

POWER MOS DEVICES

DATABOOK

3rd EDITION

JULY 1993

USE IN LIFE SUPPORT DEVICES OR SYSTEMS MUST BE EXPRESSLY AUTHORIZED

SGS-THOMSON PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF SGS-THOMSON Microelectronics. As used herein:

1. Life support devices or systems are those which (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided with the product, can be reasonably expected to result in significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can reasonably be expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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INTRODUCTION

This databook contains new and updated data sheets covering the whole range of SGS-THOMSON Power MOSFET devices for use in Industrial, Automotive, Computer, Telecommunication, Professional and Consumer electronics.

The Power MOS devices presented in this databook are made using well proven SGS-THOMSON technology.

The SGS-THOMSON Power MOSFET portfolio complements the company's wide range of devices in Power BIPOLAR, IGBT and VIPower technologies. New products are continually being produced and existing products are constantly being improved in line with our continuing efforts in research and in accordance with the market evolution.

New innovations in both silicon technology and power packaging are to be found in the data presented. A great deal of progress has been made in Power MOSFET technology in recent years. Optimized cell densities for the best device characteristics over low and high voltage ranges are used; special edge terminations for high voltage

devices have been developed; avalanche ruggedness has been designed-in. All are features to ensure cost effectiveness and reliability.

Power MOSFET packages have also improved. This includes our user friendly isolated packages: ISOWATT220, ISOWATT221, ISOWATT218 and the ISOTOP power package. Many of the standard products in these isolated packages are UL recognized.

Selection guides are provided in the following pages to facilitate rapid identification of the most suitable device for the intended use.

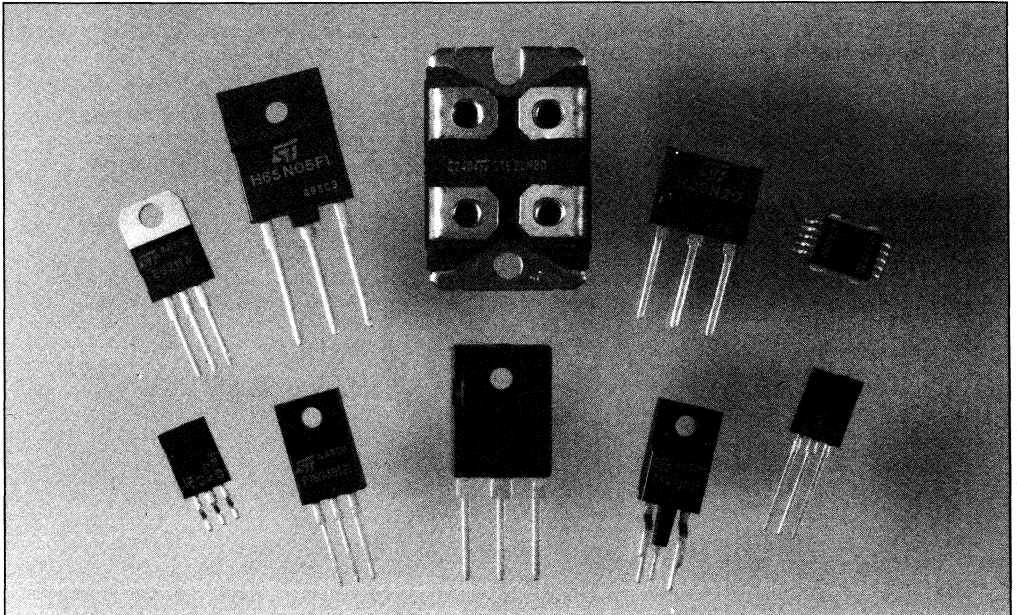
The extensive information in the datasheets makes it easy to evaluate the performance of the product within any required equipment design.

UL Recognized Devices.

ISOTOP and ISOWATT218 are already U.L. 1557 recognized. ISOWATT220 and ISOWATT221 are expected to be recognized soon.

For all the above isolated packages U.L. recognition applies with $T_j = 150\text{ }^\circ\text{C}$ max.

SGS-THOMSON Power Packages



Following its long tradition of innovative power devices, SGS-THOMSON has continued to introduce new Power MOSFET technologies and products.

This has been helped by to the company's leading and well established expertise already acquired in the bipolar transistor field.

Designed in advanced R&D centers Power MOS transistors are diffused in Catania, Italy. Dedicated MOS front-end capabilities exist in the plant for standard production as well as for advanced products.

All the technological steps involved in the fabrication of MOSFETs, from the simple diffusion to the most complex processes like metal ion implantation used for IGBTs are carefully monitored internally so that complete control of the entire process is maintained.

The front end capabilities of the plant in Catania are now reinforced with the addition of a second source diffusion line in Carrollton, Texas. This is similar to the dual capabilities of Catania and Singapore for bipolar devices.

Thanks to the long experience in all power devices SGS-THOMSON has, in its Muar and Casablanca factories, all the expertise needed for world-class packaging.

Power MOSFETs also benefiting from the company's recognized leadership in packaging.

Silicon innovation cannot be complete if appropriate housing is not provided.

SGS-THOMSON was a pioneer in the introduction of isolated ISOWATT218 and ISOWATT220. The new ISOWATT221 is the natural evolution of our package innovation in that it is an upgrade of ISOWATT220 conforming the international safety norms for clearance and creepage like the bigger ISOWATT218.

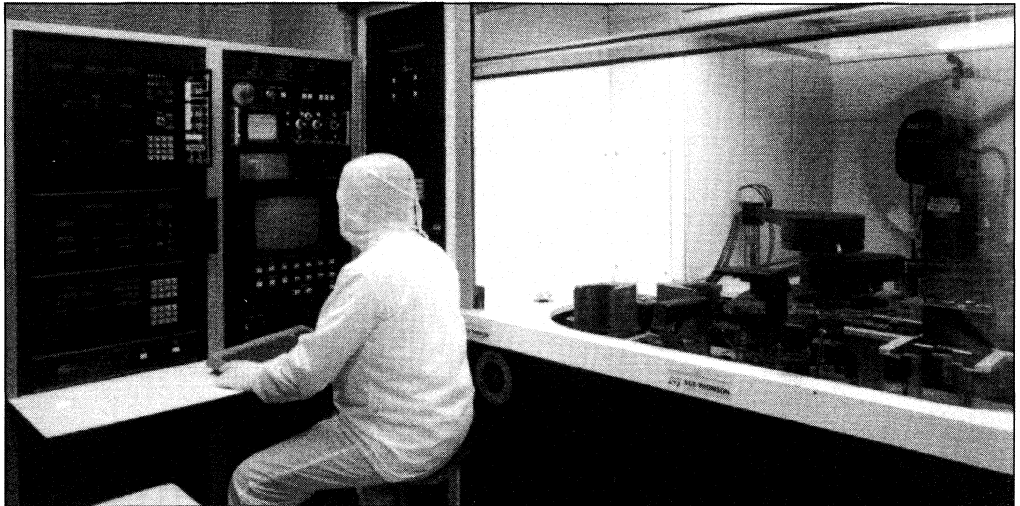
The new PowerSO-10 package, specifically developed for surface mounting applications represents a milestone in power packaging owing to its superior performance with respect to any surface mount version of TO-220. It gives real power dissipation capability, versatility and flexibility in providing the most convenient pc board layout, compatibility with most surface mount processes, and excellent reliability.

TO-247 is also available now to expand the company's already large package range while DPAK will be introduced by the end of 1993.

Other existing packages have been upgraded to guarantee 175°C maximum junction temperature at low voltage: ISOWATT220, SOT-82, and SOT-194. Even if improved versions of these packages are to be introduced in Q3 '93, the datasheets here presented already reflect this change.

Computerized SPC control is applied to all critical process steps to enable us to continually monitor and improve our product performance and quality.

Ion implantation

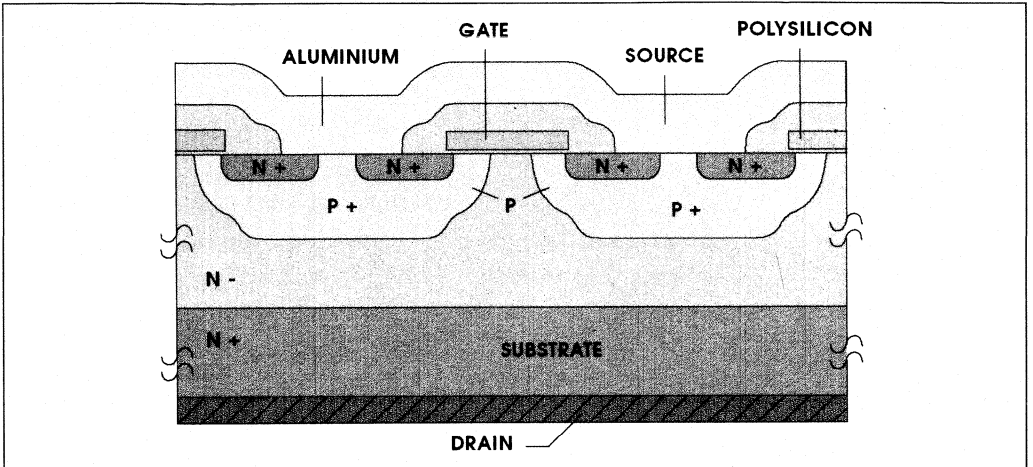


**N-CHANNEL ENHANCEMENT MODE
POWER MOS TRANSISTORS**

SGS-THOMSON series of POWER MOS transistors offers an extremely broad variety of devices covering the voltage range from 50 V to 1000 V with low on-resistance $R_{DS(on)}$ in different package and die size options.

A POWER MOS transistor is a combination of thousands of different cells connected in parallel each using a DMOS (Double Diffused MOS) structure where the channel is realized by lateral diffusion of two impurity distributions: N+ for the source and P- for the body (Fig.1).

Figure 1. POWER MOSFET Structure



This VLSI technique in fact allows shorter channel lengths to be obtained with resulting higher current capabilities. The use of polycrystalline silicon for the gate is also effective in maintaining a high stability of the threshold voltage, $V_{GS(th)}$. This basic structure is used to manufacture standard MOS devices as well as low threshold transistors.

The main advantages of SGS-THOMSON POWER MOSFETs include:

- **ULTRA FAST SWITCHING**
 - Unipolar conduction mechanism
 - Square Reverse Bias Safe Operating Area (RBSOA)
 - Very short delay time at turn-off
- **EASY DRIVE**
 - Voltage driven input
 - Low drive power requirements
 - Less component count in the drive circuit
- **POSITIVE TEMPERATURE COEFFICIENT OF $R_{DS(on)}$**
 - Easy to parallel
 - Wide Forward Bias Safe Operating Area (FBSOA)

POWER MOSFET OPERATION

The output characteristics of a POWER MOSFETs provide information about how the drain current I_D varies as a function of drain-to-source voltage V_{DS} when applied gate-to-source voltage V_{GS} is used as an additional parameter.

Fig. 2 shows the output characteristics of SGS-THOMSON STP5N80 (800V, 20Ohm). From an observation of these curves we can identify two distinct areas of operation: a) an ohmic region where on-resistance $R_{DS(on)}$ is almost constant and b) a saturation region (not to be confused with saturation in bipolar transistors) where I_D no longer varies as V_{DS} varies.

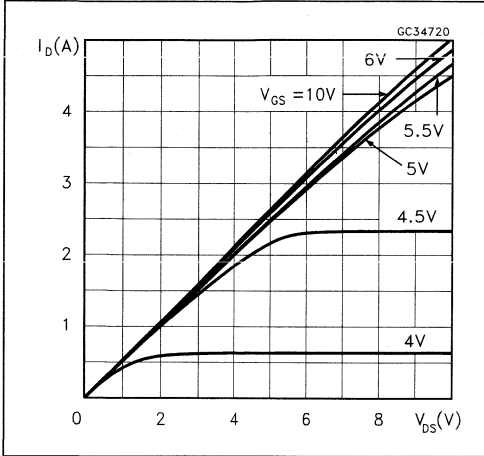
In the first region where I_D increases linearly for small values of V_{DS} we can use the following equation:

$$(1) I_D = V_{DS} / R_{DS(on)}$$

In the saturation region equation (2) holds:

$$(2) I_D = \frac{W \mu C_{ox}}{L} [V_{GS} - V_{GS(th)}]^2$$

Figure 2



where:

- $V_{GS(th)}$ = gate to source threshold voltage
- W = channel width
- L = channel length
- μ = carrier mobility in the conductive channel
- C_{ox} = gate oxide capacitance per unit area

On-resistance $R_{DS(on)}$

$R_{DS(on)}$ is defined as the overall resistance that I_D encounters when flowing from drain to source and depends on several factors.

For low voltage the dominant component of $R_{DS(on)}$ is the channel resistance. To minimize the on-resis-

tance in that range it is necessary to maximize the channel perimeter per unit area with a high packing density. At high voltage it is the resistance of the epi layer that imposes the $R_{DS(on)}$ value.

High Voltage POWER MOSFETs

In manufacturing high voltage devices, from 800 to 1000V, special care has to be taken in designing the appropriate edge termination. The goal of the edge termination is to optimize the electric field in the vicinity of silicon surface in such a manner that the electric field never reaches its critical value at which local breakdown occurs which can deteriorate the device voltage capability. Ideally, breakdown should take place in the bulk silicon.

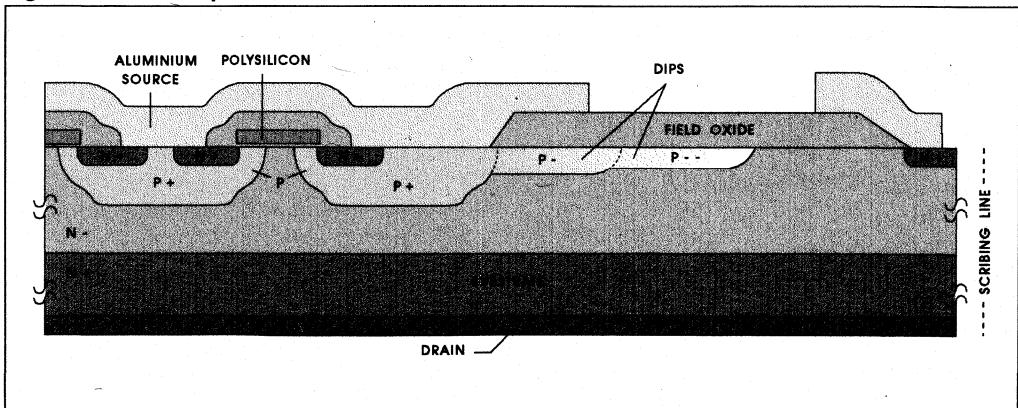
SGS-THOMSON has introduced very advanced structures for the high voltage series which on one hand improve production efficiency, while on the other translate into real benefits for the customer:

- 100% avalanche energy testing to ensure full ruggedness
- Lowest $R_{DS(on)}$ * active area
- Reduced gate charge.

All these advantages are complemented now by increased V_{GS} rating, ± 30 V instead of ± 20 V, reduced spread on $V_{GS(th)}$, lower intrinsic capacitances and very low gate charge, in the new series of high voltage devices such as STP5NA50, STP8NA50, STP3NA80, STP5NA80, etc.

These advanced devices are already available for production and some more are being introduced.

Figure 3. Double Implanted Planar Structure



Statistical Process Control (SPC) represents the use of statistical tools in the design, development, and production phases to control and minimise process variability, improve yields and quality resulting in a more efficient manufacturing and shorter cycle times. All this translates into higher quality, better service and lower costs for the customers.

Special on-line techniques include the adoption of control charts in the production areas which influence directly the process/production parameters. A control chart shows upper and/or lower control limits as well as the plot of some statistical measures for a series of samples or sub-groups. It often has a central line to detect the trend of the plotted values with respect to both control limits. The underlying idea of any control chart is to compare each successive output with the previous ones and also to compare the entire set of outputs with the target; if the process is under control, the trend of the measured output will be centered around the target.

The most popular control chart is the Stewhart chart (X, R). CUSUM (Cumulative Sum) and EWMA (Exponentially Weighted Moving Average) control charts are also used to detect small gradual drifts in process average which could not be highlighted in conventional charts.

Simplified concepts have been introduced to make the statistical tools accessible to most people; they are based on two indexes, C_p and C_{pk} process capabilities.

C_p is defined as the ratio between the specification limit range (USL-LSL) fixed by Upper Specification Limit and Lower Specification Limit, to the conventional process variability, i.e., 6σ . C_p therefore expresses how adequate the process is in meeting the specification.

C_{pk} combines the information of C_p with the measurement of the process centering around the target

and is defined as minimum value between

$$C_{pu} = \frac{(USL - AVG)}{3\sigma} \text{ and}$$

$$C_{pl} = \frac{(AVG - LSL)}{3\sigma}$$

where AVG is the process average.

From the above it follows that:

1. C_{pk} gives emphasis on the possible distribution tails which are out of the specification.
2. The definition of C_{pk} implies that the corresponding distribution be Gaussian (normal).

In some cases the normality condition on the distribution is not met, this is the case for $V_{(BR)DSS}$, so the resulting C_{pk} values could not seem appropriate.

Any device selection which cuts the distribution results in C_{pk} values falling to less than 1. Factory and market requests often lead to power discretes having some degree of selection, for example the availability of both 50V and 60V versions of the same die.

The typical C_{pk} indexes for the main electrical parameters of SGS-THOMSON Power MOSFETs are listed in the following table:

$V_{(BR)DSS}$	$R_{DS(on)}$	$V_{GS(th)}$	g_{fs}	C
> 1.3	> 1	> 4 for one lot	> 3	>3
		> 3 for total population		

N.B. These values are assuming use of the 'worst case' limits for the line and not any selected device.

It is shown essentially that the continuous drain current as specified in the datasheet by most suppliers is limited by maximum junction temperature, therefore by the device power dissipation rating P_D . Any value shown by some suppliers which does not match this functional dependence results in a tricky expedient to artificially upgrade the datasheet specification. It is also demonstrated that the only real comparison that can be made on paper is $V_{(BR)DSS(min)}$ and $R_{DS(on)(max)}$ for a similar package, therefore similar power dissipation.

The ability of Power MOSFETs to safely absorb power pulses is greater than that of bipolar transistors due to their inherent structure. In fact there is no h_{FE} effect in a MOSFET leading to secondary breakdown phenomena (resulting in current crowding and hot spots) and therefore degrading their current capability versus applied voltage like bipolar.

A more detailed comparison between the current capabilities in both MOSFETs and bipolars will elucidate the problem behind the drain current specification for a correct comprehension of their ratings.

One key parameter of bipolar transistors is the collector-emitter saturation voltage V_{CEsat} . The manufacturer guarantees that at given collector current I_{Csat} when a base current I_{Bsat} is injected, the actual collector-emitter voltage will be equal or lower than V_{CEsat} . The ratio of I_{Csat} to I_{Bsat} is referred to as forced gain. The continuous and peak collector current ratings are also specified in a datasheet based on the condition that other limits like maximum junction temperature be not exceeded. Even if these ratings can be tolerated by the transistor nevertheless their values cannot be used in practise mainly due to excessive base drive current otherwise required (lower h_{FE}) and high values of V_{CEsat} reached. For this reasons the power bipolar transistor should be operated with its nominal current below the specified I_{Csat} value.

Unlike bipolars whose current capability is limited by h_{FE} , MOSFETs base theirs on different considerations. In fact looking at the 'gain' of Power MOSFETs, namely g_{fs} , the opposite phenomenon occurs as this parameter increases as I_D increases. The only valid criterion established in the industry

on which the continuous rating of a MOSFET is based is solely thermal. This simply implies that SGS-THOMSON Power MOSFETs are capable of supplying as much current as the heat evacuation from heatsinking will permit so as to keep the junction temperature below its maximum value.

The operating drain current can therefore be calculated from the well known formula giving power dissipation across a resistor:

$$P_D = R_{DS(on)} \times I_D^2$$

with power dissipation:

$$P_D = (T_{jmax} - T_c) / R_{th(j-c)}$$

$R_{DS(on)}$ is the on-state resistance at T_{jmax} ; T_c is the case temperature and $R_{th(j-c)}$ is the maximum junction-case thermal resistance. For a worst case maximum $R_{DS(on)}$ is used. From the above

$$I_D = \sqrt{\frac{(T_{jmax} - T_c) \times R_{th(j-c)}}{R_{DS(on)}}}$$

As an example we can consider STH4N90: $R_{DS(on)}(150^\circ C) = 2.2 \times R_{DS(on)}(25^\circ C)$ from the on-resistance versus temperature plot. Substituting we get $I_D = 4.2 A$

The theoretical continuous drain current is not in practise a selection criterion for a Power MOSFETs as some competitors publicize, because in most switching applications the device is operated at duty cycles smaller than 1. In other words the MOSFET could carry a current higher than I_{Dcont} (4.2 A for STH4N90) so long as the maximum junction temperature is not exceeded. This check can easily be made using the thermal impedance curves given in the datasheets for both single pulse and repetitive pulses.

There exists however another current rating not to be exceeded, I_{DM} . For SGS-THOMSON Power MOSFETs this value is 4 times the continuous current at 25 °C, sufficiently high for any working peak currents. The dimensioning of bonding wires is chosen for their current handling capability to be well above I_{DM} . Also in most real world applications T_{case} is 25 °C; ambient temperatures are higher and heatsinks are not infinite, so continuous I_{Dmax} cannot be used.

SELECTION GUIDE: BY VOLTAGE

V _{DSS} (V)	R _{Dson} (max) (Ω)	Package	Sales Type	I _D cont (A)	P _{tot} (W)	Page
1000	0.700	ISOTOP	STE16N100	16	400	283
1000	0.770	ISOTOP	STE15N100	15	400	277
1000	2.000	TO-218	STH6N100	6	180	389
1000	2.000	ISOWATT218	STH6N100FI	3.7	70	389
1000	3.500	TO-218	STHV102	4.2	150	525
1000	3.500	ISOWATT218	STHV102FI	2.6	60	525
1000	3.500	TO-220	STP4N100	4	125	789
1000	3.500	ISOWATT220	STP4N100FI	2.2	40	789
1000	3.500	PowerSO-10	STV4N100	3.3	125	*
1000	4.000	ISOWATT221	STP4N100XI	2	35	797
1000	5.000	TO-220	STP3N100	3.5	100	749
1000	5.000	ISOWATT220	STP3N100FI	2	40	749
1000	6.000	ISOWATT221	STP3N100XI	1.6	30	757
900	1.400	TO-218	STH7N90	7.5	180	397
900	1.400	ISOWATT218	STH7N90FI	4.5	70	397
900	2.400	TO-218	STH5N90	5.3	150	377
900	2.400	ISOWATT218	STH5N90FI	3.5	60	377
900	2.400	TO-220	STP5N90	5	125	861
900	2.400	ISOWATT220	STP5N90FI	2.8	40	861
900	3.200	TO-218	STH4N90	4.2	125	369
900	3.200	ISOWATT218	STH4N90FI	2.7	55	369
900	3.500	TO-220	STP4N90	3.6	100	781
900	3.500	ISOWATT220	STP4N90FI	2.3	40	781
900	4.500	TO-220	STP3N90	3.2	100	741
900	4.500	ISOWATT220	STP3N90FI	1.9	40	741
800	0.400	ISOTOP	STE22N80	22	400	289
800	1.000	TO-218	STH9N80	9	180	413
800	1.000	ISOWATT218	STH9N80FI	5.6	70	413
800	1.200	TO-218	STH8N80	8.2	180	405
800	1.200	ISOWATT218	STH8N80FI	5.1	70	405
800	1.200	TO-247	STW8N80	8.2	180	405
800	2.000	TO-218	STHV82	5.5	150	517
800	2.000	ISOWATT218	STHV82FI	3.6	60	517
800	2.000	TO-220	STP5N80	5.5	125	841
800	2.000	ISOWATT220	STP5N80FI	3.1	40	841
800	2.400	TO-218	STH6NA80 ▲	5.8	150	385
800	2.400	ISOWATT218	STH6NA80FI ▲	3.7	60	385
800	2.400	ISOWATT221	STP5N80XI	2.6	35	853
800	2.400	TO-220	STP5NA80 ▲	4.8	125	849
800	2.400	ISOWATT220	STP5NA80FI ▲	2.7	40	849

For I_D cont definition see introductory note

▲ High switching speed and low gate charge

* Available on request

SELECTION GUIDE: BY VOLTAGE

V _{DSS} (V)	R _{Dson} (max) (Ω)	Package	Sales Type	I _{D cont} (A)	P _{tot} (W)	Page
800	2.400	PowerSO-10	STV5N80 ▲	4.8	125	*
800	3.000	TO-220	BUZ80A	3.8	100	127
800	3.000	ISOWATT220	BUZ80AFI	2.4	40	127
800	3.000	TO-218	STH4N80	4.3	125	361
800	3.000	ISOWATT218	STH4N80FI	2.8	55	361
800	3.500	ISOWATT221	STP4N80XI	2	30	773
800	3.500	PowerSO-10	STV4N80	3.8	110	*
800	4.000	TO-220	BUZ80	3.4	100	119
800	4.000	ISOWATT220	BUZ80FI	2.1	40	119
800	4.500	ISOWATT221	STP3N80XI	1.7	28	733
800	4.500	PowerSO-10	STV3N80	3.2	100	*
800	7.000	SOT-82	STK2N80	2.1	70	549
800	7.000	TO-220	STP2N80	2.4	90	701
800	7.000	ISOWATT220	STP2N80FI	1.5	35	701
600	0.150	ISOTOP	STE38N60	38	450	307
600	0.600	TO-218	STH12N60	12	180	421
600	0.600	ISOWATT218	STH12N60FI	7	70	421
600	0.600	TO-247	STW12N60	12	180	421
600	1.200	TO-220	MTP6N60	6.8	125	263
600	1.200	ISOWATT220	STP6N60FI	3.8	40	885
600	1.200	PowerSO-10	STV6N60	6.8	125	*
600	1.600	TO-220	STP5N60	5.6	100	833
600	1.600	ISOWATT220	STP5N60FI	3.4	40	833
600	2.200	TO-220	IRFBC30	4.3	100	215
600	2.200	ISOWATT220	STP3N60FI	2.7	35	717
600	2.500	TO-220	MTP3N60	3.9	100	255
600	2.500	ISOWATT220	MTP3N60FI	2.5	35	255
600	2.500	ISOWATT221	STP3N60XI	2.4	28	725
600	2.500	PowerSO-10	STV4N60	4	100	*
600	3.500	TO-220	STP2N60	2.9	70	693
600	3.500	ISOWATT220	STP2N60FI	2.2	35	693
600	8.000	SOT-82	STK2N60	1.7	50	541
550	0.120	ISOTOP	STE40N55	40	450	*
500	0.100	ISOTOP	STE47N50	47	450	319
500	0.110	ISOTOP	STE45N50	45	450	313
500	0.140	ISOTOP	STE36N50	36	410	301
500	0.200	ISOTOP	STE26N50	26	300	295
500	0.400	TO-218	IRFP450	14	180	243
500	0.400	ISOWATT218	IRFP450FI	9	70	243
500	0.400	TO-247	IRFW450	14	180	243

For I_{D cont} definition see introductory note

▲ High switching speed and low gate charge

* Available on request

V _{DSS} (V)	R _{Dson} (max) (Ω)	Package	Sales Type	I _D cont (A)	P _{tot} (W)	Page
500	0.400	TO-218	STH15N50 ▲	15	180	437
500	0.400	ISOWATT218	STH15N50FI ▲	9.3	70	437
500	0.400	TO-247	STW15N50 ▲	15	180	437
500	0.450	TO-218	STH14N50 ▲	14.1	180	429
500	0.450	ISOWATT218	STH14N50FI ▲	8.8	70	429
500	0.450	TO-247	STW14N50 ▲	14.1	180	429
500	0.850	TO-220	IRF840	8	125	207
500	0.850	ISOWATT220	IRF840FI	4.5	40	207
500	0.850	ISOWATT221	STP8N50XI	4.5	35	905
500	0.850	TO-220	STP8NA50 ▲	8	125	901
500	0.850	ISOWATT220	STP8NA50FI ▲	4.5	40	901
500	0.850	PowerSO-10	STV8NA50 ▲	8	125	*
500	1.100	TO-220	STP6N50	6	100	877
500	1.100	ISOWATT220	STP6N50FI	3.8	40	877
500	1.500	TO-220	IRF830	4.5	100	199
500	1.500	ISOWATT220	IRF830FI	3	35	199
500	1.600	TO-220	STP5NA50 ▲	5	100	829
500	1.600	ISOWATT220	STP5NA50FI ▲	3.1	35	829
500	1.600	TO-220	STP5N50	4.5	100	821
500	1.600	ISOWATT220	STP5N50FI	3	35	821
500	1.600	PowerSO-10	STV5NA50 ▲	5	100	*
500	3.000	TO-220	IRF820	3	75	193
500	3.000	ISOWATT220	IRF820FI	2.2	35	193
500	3.800	SOT-82	STK3N50	2.7	60	557
500	4.000	TO-220	IRF822	2.8	75	193
500	4.000	ISOWATT220	IRF822FI	1.9	35	193
500	4.000	ISOWATT221	STP3N50XI	1.7	25	709
500	6.000	SOT-82	STK2N50	2	50	533
450	0.400	TO-218	IRFP451	14	180	*
450	0.400	ISOWATT218	IRFP451FI	9	70	*
450	0.850	TO-220	IRF841	8	125	207
450	0.850	ISOWATT220	IRF841FI	4.5	40	207
450	1.500	TO-220	IRF831	4.5	100	199
450	1.500	ISOWATT220	IRF831FI	3	35	199
400	0.075	ISOTOP	STE50N40	50	450	325
400	0.300	TO-218	IRFP350	16	180	235
400	0.300	ISOWATT218	IRFP350FI	10	70	235
400	0.550	TO-220	IRF740	10	125	185
400	0.550	ISOWATT220	IRF740FI	5.5	40	185
400	0.550	PowerSO-10	STV10N40	10	125	*

For I_D cont definition see introductory note

▲ High switching speed and low gate charge

* Available on request

SELECTION GUIDE: BY VOLTAGE

V _{DSS} (V)	R _{Dson} (max) (Ω)	Package	Sales Type	I _D cont (A)	P _{tot} (W)	Page
400	1.000	TO-220	IRF730	5.5	100	177
400	1.000	ISOWATT220	IRF730FI	3.5	35	177
400	1.000	PowerSO-10	STV6N40	6.3	100	*
400	1.800	TO-220	IRF720	4.2	75	169
400	1.800	ISOWATT220	IRF720FI	3	35	169
400	2.100	TO-220	STP4N40	4	75	765
400	2.100	ISOWATT220	STP4N40FI	3	35	765
400	2.200	SOT-82	STK4N40	3.7	60	581
400	2.500	TO-220	BUZ76A	3.8	75	113
300	1.400	SOT-82	STK4N30	4.2	50	565
300	1.400	SOT-82	STK4N30L ■	4.2	50	565
300	1.400	TO-220	STP5N30	5	75	805
300	1.400	ISOWATT220	STP5N30FI	3	35	805
300	1.400	TO-220	STP5N30L ■	5	75	813
300	1.400	ISOWATT220	STP5N30LFI ■	3.5	35	813
250	0.110	TO-218	STH26N25	26	180	445
250	0.110	ISOWATT218	STH26N25FI	16	70	445
250	1.100	TO-220	STP6N25	6	75	869
200	0.021	ISOTOP	STE100N20	100	450	331
200	0.085	TO-218	STH33N20	33	180	453
200	0.085	ISOWATT218	STH33N20FI	20	70	453
200	0.085	TO-247	STW33N20	33	180	453
200	0.180	TO-220	IRF640	18	125	163
200	0.180	ISOWATT220	IRF640FI	10	40	163
200	0.180	TO-218	IRFP240	20	150	229
200	0.180	ISOWATT218	IRFP240FI	12	55	229
200	0.180	PowerSO-10	STV18N20	18	125	*
200	0.400	TO-220	IRF630	10	100	159
200	0.400	ISOWATT220	IRF630FI	6	35	159
200	0.400	PowerSO-10	STV10N20	10	100	*
200	0.650	TO-220	STP7N20	7	75	893
200	0.650	ISOWATT220	STP7N20FI	4.5	30	893
200	0.800	TO-220	IRF620	5	70	153
200	0.800	ISOWATT220	IRF620FI	4	30	153
200	0.700	SOT-82	STK6N20	6	60	589
100	0.007	ISOTOP	STE180N10	180	450	349
100	0.009	ISOTOP	STE150N10	150	410	337
100	0.025	TO-218	STH60N10	60	200	447
100	0.025	ISOWATT218	STH60N10FI	38	80	447
100	0.025	TO-247	STW60N10	60	200	447

For I_D cont definition see introductory note ■ Logic level * Available on request

SELECTION GUIDE: BY VOLTAGE

V _{DSS} (V)	R _{Dson} (max) (Ω)	Package	Sales Type	I _{D cont} (A)	P _{tot} (W)	Page
100	0.030	TO-218	STH55N10	55	200	469
100	0.030	ISOWATT218	STH55N10FI	34	80	469
100	0.030	TO-247	STW55N10	55	200	469
100	0.040	TO-218	STH45N10	45	180	461
100	0.040	ISOWATT218	STH45N10FI	27	65	461
100	0.040	TO-220	STP40N10	40	150	1073
100	0.040	ISOWATT220	STP40N10FI	22	45	1073
100	0.040	PowerSO-10	STV40N10	40	150	*
100	0.055	TO-218	IRFP150	40	180	223
100	0.055	ISOWATT218	IRFP150FI	23	65	223
100	0.060	TO-220	STP33N10	33	150	1025
100	0.060	ISOWATT220	STP33N10FI	18	45	1025
100	0.060	PowerSO-10	STV33N10	33	150	*
100	0.077	TO-220	IRF540	30	150	147
100	0.077	ISOWATT220	IRF540FI	16	45	147
100	0.100	TO-220	BUZ21	21	105	89
100	0.110	SOT-82	STK17N10	17	65	637
100	0.120	SOT-82	STK16N10L ■	16	65	629
100	0.120	TO-220	STP20N10	20	105	945
100	0.120	ISOWATT220	STP20N10FI	12	40	945
100	0.120	TO-220	STP20N10L ■	20	105	953
100	0.120	ISOWATT220	STP20N10LFI ■	12	40	953
100	0.140	SOT-82	STK14N10	14	65	621
100	0.140	TO-220	STP18N10	18	90	929
100	0.140	ISOWATT220	STP18N10FI	11	40	929
100	0.160	TO-220	IRF530	16	90	141
100	0.160	ISOWATT220	IRF530FI	10	40	141
100	0.250	TO-220	BUZ72A	11	70	107
100	0.270	TO-220	IRF520	10	70	135
100	0.270	ISOWATT220	IRF520FI	7	35	135
100	0.300	SOT-82	STK9N10	9	50	597
60	0.014	TO-218	STH75N06	75	200	501
60	0.014	ISOWATT218	STH75N06FI	50	80	501
60	0.014	TO-247	STW75N06	75	200	501
60	0.016	TO-220	STP60N06-16	60	150	1153
60	0.020	TO-218	STH65N06	65	180	493
60	0.020	ISOWATT218	STH65N06FI	38	65	493
60	0.020	TO-220	STP60N06	60	150	1145
60	0.020	ISOWATT220	STP60N06FI	32	45	1145
60	0.020	PowerSO-10	STV60N06	60	150	*

For I_{D cont} definition see introductory note ■ Logic level * Available on request

SELECTION GUIDE: BY VOLTAGE

V _{DSS} (V)	R _{Dson} (max) (Ω)	Package	Sales Type	I _D cont (A)	P _{tot} (W)	Page
60	0.023	TO-220	STP55N06L ■	55	150	1129
60	0.023	ISOWATT220	STP55N06LFI ■	30	45	1129
60	0.025	TO-220	STP53N06	53	150	1113
60	0.028	TO-220	STP50N06	50	150	1089
60	0.028	ISOWATT220	STP50N06FI	27	45	1089
60	0.028	TO-220	STP50N06L ■	50	200	1097
60	0.028	ISOWATT220	STP50N06LFI ■	24	40	1097
60	0.028	PowerSO-10	STV50N06	50	150	*
60	0.040	TO-220	STP36N06	36	120	1041
60	0.040	ISOWATT220	STP36N06FI	21	40	1041
60	0.040	TO-220	STP36N06L ■	36	120	1049
60	0.040	ISOWATT220	STP36N06LFI ■	21	40	1049
60	0.040	PowerSO-10	STV36N06	36	120	*
60	0.050	TO-220	STP30N06	30	105	1001
60	0.050	ISOWATT220	STP30N06FI	19	40	1001
60	0.055	SOT-82	STK23N06L ■	23	65	677
60	0.055	TO-220	STP32N06L ■	32	105	1017
60	0.055	ISOWATT220	STP32N06LFI ■	19	40	1017
60	0.065	SOT-82	STK22N06	22	65	669
60	0.065	TO-220	STP25N06	25	90	985
60	0.065	ISOWATT220	STP25N06FI	16	40	985
60	0.085	SOT-82	STK18N06	18	60	645
60	0.085	SOT-82	STK18N06L ■	18	60	653
60	0.085	TO-220	STP20N06	20	80	937
60	0.085	ISOWATT220	STP20N06FI	13	35	937
60	0.085	TO-220	STP21N06L ■	21	80	969
60	0.085	ISOWATT220	STP21N06LFI ■	14	35	969
60	0.120	SOT-82	STK14N06	14	50	613
60	0.150	TO-220	MTP3055E	14	70	271
60	0.150	ISOWATT220	MTP3055EFI	10	35	271
60	0.150	SOT-82	STK12N06L ■	12	50	605
60	0.150	SOT-82	STK3055E	12	50	685
60	0.150	TO-220	STP15N06L ■	15	70	921
60	0.150	ISOWATT220	STP15N06LFI ■	10	35	921
50	0.004	ISOTOP	STE250N05	250	450	355
50	0.006	ISOTOP	STE180N05	180	360	343
50	0.012	TO-218	STH80N05	80	200	509
50	0.012	ISOWATT218	STH80N05FI	52	70	509
50	0.012	TO-247	STW80N05	80	200	509
50	0.016	PowerSO-10	STV60N05-16	60	150	*

For I_D cont definition see introductory note

■ Logic level

* Available on request

V _{DSS} (V)	R _{Dson} (max) (Ω)	Package	Sales Type	I _D cont (A)	P _{tot} (W)	Page
50	0.020	TO-218	STH65N05	65	180	485
50	0.020	ISOWATT218	STH65N05FI	38	65	485
50	0.020	TO-220	STP60N05	60	150	1137
50	0.020	ISOWATT220	STP60N05FI	32	45	1137
50	0.020	PowerSO-10	STV60N05	60	150	*
50	0.023	TO-220	STP55N05L ■	55	150	1121
50	0.023	ISOWATT220	STP55N05LFI ■	30	45	1121
50	0.025	TO-220	STP53N05	53	150	1105
50	0.028	TO-220	IRFZ40	50	150	249
50	0.028	ISOWATT220	IRFZ40FI	27	45	249
50	0.028	TO-220	STP50N05L ■	50	200	1081
50	0.028	ISOWATT220	STP50N05LFI ■	24	40	1081
50	0.028	PowerSO-10	STV50N05	50	150	*
50	0.035	TO-220	STP40N05	40	120	1057
50	0.035	ISOWATT220	STP40N05FI	23	40	1057
50	0.035	PowerSO-10	STV40N05	40	120	*
50	0.040	TO-220	BUZ11	36	120	77
50	0.040	ISOWATT220	BUZ11FI	21	40	77
50	0.040	TO-220	STP36N05L ■	36	120	1033
50	0.040	ISOWATT220	STP36N05LFI ■	21	40	1033
50	0.050	TO-220	STP30N05	30	105	993
50	0.050	ISOWATT220	STP30N05FI	19	40	993
50	0.055	TO-220	BUZ11A	27	90	83
50	0.055	SOT-82	STK23N05L ■	23	65	677
50	0.055	TO-220	STP32N05L ■	32	105	1009
50	0.055	ISOWATT220	STP32N05LFI ■	19	40	1009
50	0.065	SOT-82	STK22N05	22	65	661
50	0.065	TO-220	STP25N05	25	90	977
50	0.065	ISOWATT220	STP25N05FI	16	40	977
50	0.070	TO-220	BUZ10	20	80	71
50	0.085	SOT-82	STK18N05	18	60	653
50	0.085	SOT-82	STK18N05L ■	18	60	653
50	0.085	TO-220	STP21N05L ■	21	80	961
50	0.085	ISOWATT220	STP21N05LFI ■	14	35	961
50	0.100	TO-220	BUZ71	18	80	95
50	0.100	ISOWATT220	BUZ71FI	12	35	95
50	0.120	TO-220	BUZ71A	13	40	101
50	0.120	ISOWATT220	BUZ71AFI	11	35	101
50	0.120	SOT-82	STK14N05	14	50	613
50	0.150	SOT-82	STK12N05L ■	12	50	605
50	0.150	TO-220	STP15N05L ■	15	70	913

For I_D cont definition see introductory note

■ Logic level

* Available on request

SELECTION GUIDE: BY PART NUMBER

Sales Type	V _{bss} (V)	R _{Dson} (max) (Ω)	Package	I _D (cont) (A)	P _{tot} (W)	Page
BUZ10	50	0.070	TO-220	20	80	71
BUZ11	50	0.040	TO-220	36	120	77
BUZ11A	50	0.055	TO-220	27	90	83
BUZ11FI	50	0.040	ISOWATT220	21	40	77
BUZ21	100	0.100	TO-220	21	105	89
BUZ71	50	0.100	TO-220	18	80	95
BUZ71A	50	0.120	TO-220	13	40	101
BUZ71AFI	50	0.120	ISOWATT220	11	35	101
BUZ71FI	50	0.100	ISOWATT220	12	35	95
BUZ72A	100	0.250	TO-220	11	70	107
BUZ76A	400	2.500	TO-220	3.8	75	113
BUZ80	800	4.000	TO-220	3.4	100	119
BUZ80A	800	3.000	TO-220	3.8	100	127
BUZ80AFI	800	3.000	ISOWATT220	2.4	40	127
BUZ80FI	800	4.000	ISOWATT220	2.1	40	119
IRF520	100	0.270	TO-220	10	70	135
IRF520FI	100	0.270	ISOWATT220	7	35	135
IRF530	100	0.160	TO-220	16	90	141
IRF530FI	100	0.160	ISOWATT220	10	40	141
IRF540	100	0.077	TO-220	30	150	147
IRF540FI	100	0.077	ISOWATT220	16	45	147
IRF620	200	0.800	TO-220	5	70	153
IRF620FI	200	0.800	ISOWATT220	4	30	153
IRF630	200	0.400	TO-220	10	100	159
IRF630FI	200	0.400	ISOWATT220	6	35	159
IRF640	200	0.180	TO-220	18	125	163
IRF640FI	200	0.180	ISOWATT220	10	40	163
IRF720	400	1.800	TO-220	4.2	75	169
IRF720FI	400	1.800	ISOWATT220	3	35	169
IRF730	400	1.000	TO-220	5.5	100	177
IRF730FI	400	1.000	ISOWATT220	3.5	35	177
IRF740	400	0.550	TO-220	10	125	185
IRF740FI	400	0.550	ISOWATT220	5.5	40	185
IRF820	500	3.000	TO-220	3	75	193
IRF820FI	500	3.000	ISOWATT220	2.2	35	193
IRF822	500	4.000	TO-220	2.8	75	193
IRF822FI	500	4.000	ISOWATT220	1.9	35	193
IRF830	500	1.500	TO-220	4.5	100	199
IRF830FI	500	1.500	ISOWATT220	3	35	199
IRF831	450	1.500	TO-220	4.5	100	199

For I_D cont definition see introductory note

SELECTION GUIDE: BY PART NUMBER

Sales Type	V _{DSS} (V)	R _{Dson} (max) (Ω)	Package	I _D (cont) (A)	P _{Tot} (W)	Page
IRF831FI	450	1.500	ISOWATT220	3	35	199
IRF840	500	0.850	TO-220	8	125	207
IRF840FI	500	0.850	ISOWATT220	4.5	40	207
IRF841	450	0.850	TO-220	8	125	207
IRF841FI	450	0.850	ISOWATT220	4.5	40	207
IRFBC30	600	2.200	TO-220	4.3	100	215
IRFP150	100	0.055	TO-218	40	180	223
IRFP150FI	100	0.055	ISOWATT218	23	65	223
IRFP240	200	0.180	TO-218	20	150	229
IRFP240FI	200	0.180	ISOWATT218	12	55	229
IRFP350	400	0.300	TO-218	16	180	235
IRFP350FI	400	0.300	ISOWATT218	10	70	235
IRFP450	500	0.400	TO-218	14	180	243
IRFP450FI	500	0.400	ISOWATT218	9	70	243
IRFP451	450	0.400	TO-218	14	180	*
IRFP451FI	450	0.400	ISOWATT218	9	70	*
IRFW450	500	0.400	TO-247	14	180	243
IRFZ40	50	0.028	TO-220	50	150	249
IRFZ40FI	50	0.028	ISOWATT220	27	45	249
MTP3N60	600	2.500	TO-220	3.9	100	255
MTP3N60FI	600	2.500	ISOWATT220	2.5	35	255
MTP6N60	600	1.200	TO-220	6.8	125	263
MTP3055E	60	0.150	TO-220	14	70	271
MTP3055EFI	60	0.150	ISOWATT220	10	35	271
STE15N100	1000	0.770	ISOTOP	15	400	277
STE16N100	1000	0.700	ISOTOP	16	400	283
STE22N80	800	0.400	ISOTOP	22	400	289
STE26N50	500	0.200	ISOTOP	26	300	295
STE36N50	500	0.140	ISOTOP	36	410	301
STE38N60	600	0.150	ISOTOP	38	450	307
STE40N55	550	0.120	ISOTOP	40	450	*
STE45N50	500	0.110	ISOTOP	45	450	313
STE47N50	500	0.100	ISOTOP	47	450	319
STE50N40	400	0.075	ISOTOP	50	450	325
STE100N20	200	0.021	ISOTOP	100	450	331
STE150N10	100	0.009	ISOTOP	150	410	337
STE180N05	50	0.006	ISOTOP	180	360	343
STE180N10	100	0.007	ISOTOP	180	450	349
STE250N05	50	0.004	ISOTOP	250	450	355
STH4N80	800	3.000	TO-218	4.3	125	361

For I_D cont definition see introductory note

* Available on request

SELECTION GUIDE: BY PART NUMBER

Sales Type	V _{DSS} (V)	R _{Dson} (max) (Ω)	Package	I _D (cont) (A)	P _{tot} (W)	Page
STH4N80FI	800	3.000	ISOWATT218	2.8	55	361
STH4N90	900	3.200	TO-218	4.2	125	369
STH4N90FI	900	3.200	ISOWATT218	2.7	55	369
STH5N90	900	2.400	TO-218	5.3	150	377
STH5N90FI	900	2.400	ISOWATT218	3.5	60	377
STH6NA80 ▲	800	2.400	TO-218	5.8	150	385
STH6NA80FI ▲	800	2.400	ISOWATT218	3.7	60	385
STH6N100	1000	2.000	TO-218	6	180	389
STH6N100FI	1000	2.000	ISOWATT218	3.7	70	389
STH7N90	900	1.400	TO-218	7.5	180	397
STH7N90FI	900	1.400	ISOWATT218	4.5	70	397
STH8N80	800	1.200	TO-218	8.2	180	405
STH8N80FI	800	1.200	ISOWATT218	5.1	70	405
STH9N80	800	1.000	TO-218	9	180	413
STH9N80FI	800	1.000	ISOWATT218	5.6	70	413
STH12N60	600	0.600	TO-218	12	180	421
STH12N60FI	600	0.600	ISOWATT218	7	70	421
STH14N50 ▲	500	0.450	TO-218	14.1	180	429
STH14N50FI ▲	500	0.450	ISOWATT218	8.8	70	429
STH15N50 ▲	500	0.400	TO-218	15	180	437
STH15N50FI ▲	500	0.400	ISOWATT218	9.3	70	437
STH26N25	250	0.110	TO-218	26	180	445
STH26N25FI	250	0.110	ISOWATT218	16	70	445
STH33N20	200	0.085	TO-218	33	180	453
STH33N20FI	200	0.085	ISOWATT218	20	70	453
STH45N10	100	0.040	TO-218	45	180	461
STH45N10FI	100	0.040	ISOWATT218	27	65	461
STH55N10	100	0.030	TO-218	55	200	469
STH55N10FI	100	0.030	ISOWATT218	34	80	469
STH60N10	100	0.025	TO-218	60	200	477
STH60N10FI	100	0.025	ISOWATT218	38	80	477
STH65N05	50	0.020	TO-218	65	180	485
STH65N05FI	50	0.020	ISOWATT218	38	65	485
STH65N06	60	0.020	TO-218	65	180	493
STH65N06FI	60	0.020	ISOWATT218	38	65	493
STH75N06	60	0.014	TO-218	75	200	501
STH75N06FI	60	0.014	ISOWATT218	50	80	501
STH80N05	50	0.012	TO-218	80	200	509
STH80N05FI	50	0.012	ISOWATT218	52	70	509
STHV82	800	2.000	TO-218	5.5	150	517

For I_D cont definition see introductory note

▲ High switching speed and low gate charge

Sales Type	V _{DSS} (V)	R _{Dson} (max) (Ω)	Package	I _D (cont) (A)	P _{tot} (W)	Page
STHV82FI	800	2.000	ISOWATT218	3.6	60	517
STHV102	1000	3.500	TO-218	4.2	150	525
STHV102FI	1000	3.500	ISOWATT218	2.6	60	525
STK2N50	500	6.000	SOT-82	2	50	533
STK2N60	600	8.000	SOT-82	1.7	50	541
STK2N80	800	7.000	SOT-82	2.1	70	549
STK3N50	500	3.800	SOT-82	2.7	60	557
STK4N30	300	1.300	SOT-82	4.2	50	565
STK4N30L ■	300	1.400	SOT-82	4.2	50	573
STK4N40	400	2.200	SOT-82	3.7	60	581
STK6N20	200	0.700	SOT-82	6	60	589
STK9N10	100	0.300	SOT-82	9	50	597
STK12N05L ■	50	0.150	SOT-82	12	50	605
STK12N06L ■	60	0.150	SOT-82	12	50	605
STK14N05	50	0.120	SOT-82	14	50	613
STK14N06	60	0.120	SOT-82	14	50	613
STK14N10	100	0.140	SOT-82	14	65	621
STK16N10L ■	100	0.120	SOT-82	16	65	629
STK17N10	100	0.110	SOT-82	17	65	637
STK18N05	50	0.085	SOT-82	18	60	645
STK18N05L ■	50	0.085	SOT-82	18	60	653
STK18N06	60	0.085	SOT-82	18	60	645
STK18N06L ■	60	0.085	SOT-82	18	60	653
STK22N05	50	0.065	SOT-82	22	65	661
STK22N06	60	0.065	SOT-82	22	65	669
STK23N05L ■	50	0.055	SOT-82	23	65	677
STK23N06L ■	60	0.055	SOT-82	23	65	677
STK3055E	60	0.150	SOT-82	12	50	685
STP2N60	600	3.500	TO-220	2.9	70	693
STP2N60FI	600	3.500	ISOWATT220	2.2	35	693
STP2N80	800	7.000	TO-220	2.4	90	701
STP2N80FI	800	7.000	ISOWATT220	1.5	35	701
STP3N50XI	500	4.000	ISOWATT221	1.7	25	709
STP3N60FI	600	2.200	ISOWATT220	2.7	35	717
STP3N60XI	600	2.500	ISOWATT221	2.4	28	725
STP3N80XI	800	4.500	ISOWATT221	1.7	28	733
STP3N90	900	4.500	TO-220	3.2	100	741
STP3N90FI	900	4.500	ISOWATT220	1.9	40	741
STP3N100	1000	5.000	TO-220	3.5	100	749
STP3N100FI	1000	5.000	ISOWATT220	2	40	749

For I_D cont definition see introductory note

■ Logic level

SELECTION GUIDE: BY PART NUMBER

Sales Type	V _{DSS} (V)	R _{Dson} (max) (Ω)	Package	I _D (cont) (A)	P _{tot} (W)	Page
STP3N100XI	1000	6.000	ISOWATT221	1.6	30	757
STP4N40	400	2.100	TO-220	4	75	765
STP4N40FI	400	2.100	ISOWATT220	3	35	765
STP4N80XI	800	3.500	ISOWATT221	2	30	773
STP4N90	900	3.500	TO-220	3.6	100	781
STP4N90FI	900	3.500	ISOWATT220	2.3	40	781
STP4N100	1000	3.500	TO-220	4	125	789
STP4N100FI	1000	3.500	ISOWATT220	2.2	40	789
STP4N100XI	1000	4.000	ISOWATT221	2	35	797
STP5N30	300	1.400	TO-220	5	75	805
STP5N30FI	300	1.400	ISOWATT220	3	35	805
STP5N30L ■	300	1.400	TO-220	5	75	813
STP5N30LFI ■	300	1.400	ISOWATT220	3.5	30	813
STP5N50	500	1.600	TO-220	4.5	100	821
STP5N50FI	500	1.600	ISOWATT220	3	35	821
STP5NA50 ▲	500	1.600	TO-220	4.5	100	829
STP5NA50FI ▲	500	1.600	ISOWATT220	3	35	829
STP5N60	600	1.600	TO-220	5.6	100	833
STP5N60FI	600	1.600	ISOWATT220	3.4	40	833
STP5N80	800	2.000	TO-220	5.5	125	841
STP5N80FI	800	2.000	ISOWATT220	3.1	40	841
STP5N80XI	800	2.400	ISOWATT221	2.6	35	853
STP5NA80 ▲	800	2.400	TO-220	4.8	125	849
STP5NA80FI ▲	800	2.400	ISOWATT220	2.7	40	849
STP5N90	900	2.400	TO-220	5	125	861
STP5N90FI	900	2.400	ISOWATT220	2.8	40	861
STP6N25	250	1.100	TO-220	5	75	869
STP6N50	500	1.100	TO-220	6	100	877
STP6N50FI	500	1.100	ISOWATT220	3.8	40	877
STP6N60FI	600	1.200	ISOWATT220	3.8	40	885
STP7N20	200	0.650	TO-220	7	75	893
STP7N20FI	200	0.650	ISOWATT220	4.5	30	893
STP8N50XI	500	0.850	ISOWATT221	4.5	35	905
STP8NA50	500	0.850	TO-220	8	125	901
STP8NA50FI	500	0.850	ISOWATT220	4.5	40	901
STP15N05L ■	50	0.150	TO-220	15	70	913
STP15N05LFI ■	50	0.150	ISOWATT220	10	35	913
STP15N06L ■	60	0.150	TO-220	15	70	921
STP15N06LFI ■	60	0.150	ISOWATT220	10	35	921
STP18N10	100	0.140	TO-220	18	90	929

For I_D cont definition see introductory note

▲ High switching speed and low gate charge

■ Logic level

SELECTION GUIDE: BY PART NUMBER

Sales Type	V _{DSS} (V)	R _{Dson} (max) (Ω)	Package	I _D (cont) (A)	P _{tot} (W)	Page
STP18N10FI	100	0.140	ISOWATT220	11	40	929
STP20N06	60	0.085	TO-220	20	80	937
STP20N06FI	60	0.085	ISOWATT220	13	35	937
STP20N10	100	0.120	TO-220	20	105	945
STP20N10FI	100	0.120	ISOWATT220	12	40	945
STP20N10L ■	100	0.120	TO-220	20	105	953
STP20N10LFI ■	100	0.120	ISOWATT220	12	40	953
STP21N05L ■	50	0.085	TO-220	21	80	961
STP21N05LFI ■	50	0.085	ISOWATT220	14	35	961
STP21N06L ■	60	0.085	TO-220	21	80	969
STP21N06LFI ■	60	0.085	ISOWATT220	14	35	969
STP25N05	50	0.065	TO-220	25	90	977
STP25N05FI	50	0.065	ISOWATT220	16	40	977
STP25N06	60	0.065	TO-220	25	90	985
STP25N06FI	60	0.065	ISOWATT220	16	40	985
STP30N05	50	0.050	TO-220	30	105	993
STP30N05FI	50	0.050	ISOWATT220	19	40	993
STP30N06	60	0.050	TO-220	30	105	1001
STP30N06FI	60	0.050	ISOWATT220	19	40	1001
STP32N05L ■	50	0.055	TO-220	32	105	1009
STP32N05LFI ■	50	0.055	ISOWATT220	19	40	1009
STP32N06L ■	60	0.055	TO-220	32	105	1017
STP32N06LFI ■	60	0.055	ISOWATT220	19	40	1017
STP33N10	100	0.060	TO-220	33	150	1025
STP33N10FI	100	0.060	ISOWATT220	18	45	1025
STP36N05L ■	50	0.040	TO-220	36	120	1033
STP36N05LFI ■	50	0.040	ISOWATT220	21	40	1033
STP36N06	60	0.040	TO-220	36	120	1041
STP36N06FI	60	0.040	ISOWATT220	21	40	1041
STP36N06L ■	60	0.040	TO-220	36	120	1049
STP36N06LFI ■	60	0.040	ISOWATT220	21	40	1049
STP40N05	50	0.035	TO-220	40	120	1057
STP40N05FI	50	0.035	ISOWATT220	23	40	1057
STP40N10	100	0.040	TO-220	40	150	1073
STP40N10FI	100	0.040	ISOWATT220	22	45	1073
STP50N05L ■	50	0.028	TO-220	50	200	1081
STP50N05LFI ■	50	0.028	ISOWATT220	24	40	1081
STP50N06	60	0.028	TO-220	50	150	1089
STP50N06FI	60	0.028	ISOWATT220	27	45	1089
STP50N06L ■	60	0.028	TO-220	50	200	1097

For I_D cont definition see introductory note

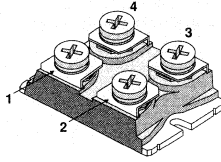
■ Logic level

SELECTION GUIDE BY – PART NUMBER

Sales Type	V _{DSS} (V)	R _{Dson} (max) (Ω)	Package	I _D (cont) (A)	P _{tot} (W)	Page
STP50N06LFI ■	60	0.028	ISOWATT220	24	40	1097
STP53N05	50	0.025	TO-220	53	150	1105
STP53N06	60	0.025	TO-220	53	150	1113
STP55N05L ■	50	0.023	TO-220	55	150	1121
STP55N05LFI ■	50	0.023	ISOWATT220	30	45	1121
STP55N06L ■	60	0.023	TO-220	55	150	1129
STP55N06LFI ■	60	0.023	ISOWATT220	30	45	1129
STP60N05	50	0.020	TO-220	60	150	1137
STP60N05FI	50	0.020	ISOWATT220	32	45	1137
STP60N06	60	0.020	TO-220	60	150	1145
STP60N06FI	60	0.020	ISOWATT220	32	45	1145
STP60N06-16	60	0.016	TO-220	60	150	1153
STV3N80	800	4.500	PowerSO-10	3.2	100	*
STV4N60	600	2.500	PowerSO-10	4	100	*
STV4N80	800	3.500	PowerSO-10	3.8	110	*
STV4N100	1000	3.500	PowerSO-10	3.3	125	*
STV5NA50 ▲	500	1.600	PowerSO-10	5	100	*
STV5NA80 ▲	800	2.400	PowerSO-10	4.6	125	*
STV6N40	400	1.000	PowerSO-10	6.3	100	*
STV6N60	600	1.200	PowerSO-10	6.8	125	*
STV8NA50 ▲	500	0.850	PowerSO-10	8	125	*
STV10N20	200	0.400	PowerSO-10	10	100	*
STV10N40	400	0.550	PowerSO-10	10	125	*
STV18N20	200	0.180	PowerSO-10	18	125	*
STV33N10	100	0.060	PowerSO-10	33	150	*
STV36N06	60	0.040	PowerSO-10	36	120	*
STV40N05	50	0.035	PowerSO-10	40	120	*
STV40N10	100	0.040	PowerSO-10	40	150	*
STV50N05	50	0.028	PowerSO-10	50	150	*
STV50N06	60	0.028	PowerSO-10	50	150	*
STV60N05	50	0.020	PowerSO-10	60	150	*
STV60N05-16	50	0.016	PowerSO-10	60	150	*
STV60N06	60	0.020	PowerSO-10	60	150	*
STW8N80	800	1.200	TO-247	8.2	180	405
STW12N60	600	0.600	TO-247	12	180	421
STW14N50	500	0.450	TO-247	14.1	180	429
STW15N50	500	0.400	TO-247	15	180	437
STW33N20	200	0.085	TO-247	33	180	453
STW55N10	100	0.030	TO-247	55	200	469
STW60N10	100	0.025	TO-247	60	200	477
STW75N06	60	0.014	TO-247	75	200	501
STW80N05	50	0.012	TO-247	80	200	509

For I_D cont definition see introductory note ▲ High switching speed and low gate charge ■ Logic level * Available on request

ISOTOP



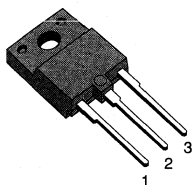
V_{DSS} (V)	R_{Dson} (max) (Ω)	Sales Type	I_D cont (A)	P_{tot} (W)	Page
1000	0.700	STE16N100	16	400	283
1000	0.770	STE15N100	15	400	277
800	0.400	STE22N80	22	400	289
600	0.150	STE38N60	38	450	307
550	0.120	STE40N55	40	450	*
500	0.100	STE47N50	47	450	319
500	0.110	STE45N50	45	450	313
500	0.140	STE36N50	36	410	301
500	0.200	STE26N50	26	300	295
400	0.075	STE50N40	50	450	325
200	0.021	STE100N20	100	450	331
100	0.007	STE180N10	180	450	349
100	0.009	STE150N10	150	410	337
50	0.004	STE250N05	250	450	355
50	0.006	STE180N05	180	360	343

For I_D cont definition see introductory note

* Available on request

SELECTION GUIDE: BY PACKAGE

ISOWATT218



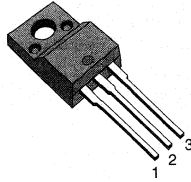
V_{DSS} (V)	R_{DSon} (max) (Ω)	Sales Type	I_D cont (A)	P_{tot} (W)	Page
1000	2.000	STH6N100FI	3.7	70	389
1000	3.500	STHV102FI	2.6	60	525
900	1.400	STH7N90FI	4.5	70	397
900	2.400	STH5N90FI	3.5	60	377
900	3.200	STH4N90FI	2.7	55	369
800	1.000	STH9N80FI	5.6	70	413
800	1.200	STH8N80FI	5.1	70	405
800	2.000	STHV82FI	3.6	60	517
800	2.400	STH5NA80FI ▲	3.5	60	849
800	3.000	STH4N80FI	2.8	55	361
600	0.600	STH12N60FI	7	70	421
500	0.400	STH15N50FI ▲	9.3	70	437
500	0.400	IRFP450FI	9	70	243
500	0.450	STH14N50FI ▲	8.8	70	429
450	0.400	IRFP451FI	9	70	*
400	0.300	IRFP350FI	10	70	235
250	0.110	STH26N25FI	16	70	445
200	0.085	STH33N20FI	20	70	453
200	0.180	IRFP240FI	12	55	163
100	0.025	STH60N10FI	38	80	447
100	0.030	STH55N10FI	34	80	469
100	0.040	STH45N10FI	27	65	461
100	0.055	IRFP150FI	23	65	223
60	0.014	STH75N06FI	50	80	501
60	0.020	STH65N06FI	38	65	493
50	0.012	STH80N05FI	52	70	509
50	0.020	STH65N05FI	38	65	485

For I_D cont definition see introductory note

▲ High switching speed and low gate charge

* Available on request

ISOWATT220



V _{DSS} (V)	R _{DSon} (max) (Ω)	Sales Type	I _{D cont} (A)	P _{tot} (W)	Page
1000	3.500	STP4N100FI	2.2	40	789
1000	5.000	STP3N100FI	2	40	749
900	2.400	STP5N90FI	2.8	40	861
900	3.500	STP4N90FI	2.3	40	781
900	4.500	STP3N90FI	1.9	40	741
800	2.000	STP5N80FI	3.1	40	841
800	2.400	STP5NA80FI ▲	2.7	40	849
800	3.000	BUZ80AFI	2.4	40	127
800	4.000	BUZ80FI	2.1	40	119
800	7.000	STP2N80FI	1.5	35	701
600	1.200	STP6N60FI	3.8	40	885
600	1.600	STP5N60FI	3.4	40	833
600	2.200	STP3N60FI	2.7	35	717
600	2.500	MTP3N60FI	2.5	35	255
600	3.500	STP2N60FI	2.2	35	693
500	0.850	IRF840FI	4.5	40	207
500	0.850	STP8NA50FI ▲	4.5	40	201
500	1.100	STP6N50FI	3.8	40	877
500	1.500	IRF830FI	3	35	199
500	1.600	STP5NA50FI ▲	3.1	35	829
500	1.600	STP5N50FI	3	35	821
500	3.000	IRF820FI	2.2	35	193
500	4.000	IRF822FI	1.9	35	193
450	0.850	IRF841FI	4.5	40	207
450	1.500	IRF831FI	3	35	199
400	0.550	IRF740FI	5.5	40	185
400	1.000	IRF730FI	3.5	35	177
400	1.800	IRF720FI	3	35	169
400	2.100	STP4N40FI	3	35	765
300	1.400	STP5N30FI	3	35	805

For I_{D cont} definition see introductory note

▲ High switching speed and low gate charge

SELECTION GUIDE: BY PACKAGE

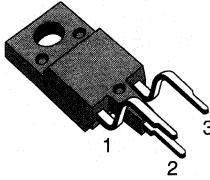
ISOWATT 220 (Cont'd)

V _{DSS} (V)	R _{Dson} (max) (Ω)	Sales Type	I _D cont (A)	P _{tot} (W)	Page
300	1.400	STP5N30LFI ■	3.5	35	813
200	0.180	IRF640FI	10	40	163
200	0.400	IRF630FI	6	35	159
200	0.650	STP7N20FI	4.5	30	893
200	0.800	IRF620FI	4	30	153
100	0.040	STP40N10FI	22	45	1073
100	0.060	STP33N10FI	18	45	1025
100	0.077	IRF540FI	16	45	147
100	0.120	STP20N10LFI ■	12	40	953
100	0.120	STP20N10FI	12	40	945
100	0.140	STP18N10FI	11	40	929
100	0.160	IRF530FI	10	40	135
100	0.270	IRF520FI	7	35	135
60	0.020	STP60N06FI	32	45	1145
60	0.023	STP55N06LFI ■	30	45	1129
60	0.028	STP50N06FI	27	45	1089
60	0.028	STP50N06LFI ■	24	40	1097
60	0.040	STP36N06FI	21	40	1041
60	0.040	STP36N06LFI ■	21	40	1049
60	0.050	STP30N06FI	19	40	1001
60	0.055	STP32N06LFI ■	19	40	1017
60	0.065	STP25N06FI	16	40	985
60	0.085	STP20N06FI	13	35	937
60	0.085	STP21N06LFI ■	14	35	969
60	0.150	STP15N06LFI ■	10	35	921
60	0.150	MTP3055EFI	10	35	271
50	0.020	STP60N05FI	32	45	1137
50	0.023	STP55N05LFI ■	30	45	1121
50	0.028	IRFZ40FI	27	45	249
50	0.028	STP50N05LFI ■	24	40	1081
50	0.035	STP40N05FI	23	40	1057
50	0.040	BUZ11FI	21	40	77
50	0.040	STP36N05LFI ■	21	40	1033
50	0.050	STP30N05FI	19	40	993
50	0.055	STP32N05LFI ■	19	40	1009
50	0.065	STP25N05FI	16	40	977
50	0.085	STP21N05LFI ■	14	35	961
50	0.100	BUZ71FI	12	35	95
50	0.120	BUZ71AFI	11	35	101
50	0.150	STP15N05LFI ■	10	35	913

For I_D cont definition see introductory note

■ Logic level

ISOWATT221

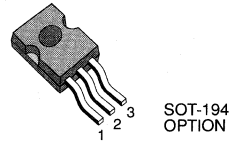
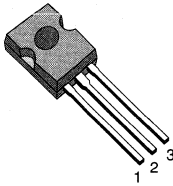


V_{DSS} (V)	R_{Dson} (max) (Ω)	Sales Type	I_D cont (A)	P_{tot} (W)	Page
1000	4.000	STP4N100XI	2	35	797
1000	6.000	STP3N100XI	1.6	30	757
800	2.400	STP5N80XI	2.6	35	853
800	3.500	STP4N80XI	2	30	773
800	4.500	STP3N80XI	1.7	28	733
600	2.500	STP3N60XI	2.4	28	725
500	0.850	STP8N50XI	4.5	35	205
500	4.000	STP3N50XI	1.7	25	709

For I_D cont definition see introductory note

SELECTION GUIDE: BY PACKAGE

SOT-82

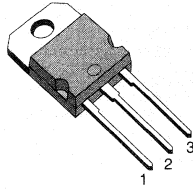


V_{DSS} (V)	R_{DSon} (max) (Ω)	Sales Type	I_D cont (A)	P_{tot} (W)	Page
800	7.000	STK2N80	2.1	70	549
600	8.000	STK2N60	1.7	50	541
500	3.800	STK3N50	2.7	60	557
500	6.000	STK2N50	2	50	533
400	2.200	STK4N40	3.7	60	581
300	1.400	STK4N30	4.2	50	565
300	1.400	STK4N30L ■	4.2	50	565
200	0.700	STK6N20	6	60	589
100	0.110	STK17N10	17	65	637
100	0.120	STK16N10L ■	16	65	629
100	0.140	STK14N10	14	65	621
100	0.300	STK9N10	9	50	597
60	0.055	STK23N06L ■	23	65	677
60	0.065	STK22N06	22	65	699
60	0.085	STK18N06	18	60	645
60	0.085	STK18N06L ■	18	60	653
60	0.120	STK14N06	14	50	613
60	0.150	STK12N06L ■	12	50	605
60	0.150	STK3055E	12	50	685
50	0.055	STK23N05L ■	23	65	677
50	0.065	STK22N05	22	65	661
50	0.085	STK18N05	18	60	653
50	0.085	STK18N05L ■	18	60	653
50	0.120	STK14N05	14	50	613
50	0.150	STK12N05L ■	12	50	605

For I_D cont definition see introductory note

■ Logic level

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V_{DSS} (V)	R_{DSon} (max) (Ω)	Sales Type	I_D cont (A)	P_{tot} (W)	Page
1000	2.000	STH6N100	6	180	389
1000	3.500	STHV102	4.2	150	525
900	1.400	STH7N90	7.5	180	397
900	2.400	STH5N90	5.3	150	377
900	3.200	STH4N90	4.2	125	369
800	1.000	STH9N80	9	180	413
800	1.200	STH8N80	8.2	180	405
800	2.000	STHV82	5.5	150	517
800	2.400	STH6NA80	5.8	150	385
800	3.000	STH4N80	4.3	125	361
600	0.600	STH12N60	12	180	421
500	0.400	STH15N50 ▲	15	180	437
500	0.400	IRFP450	14	180	*
500	0.450	STH14N50 ▲	14.1	180	429
450	0.400	IRFP451	14	180	*
400	0.300	IRFP350	16	18	235
250	0.110	STH26N25	26	180	445
200	0.085	STH33N20	33	180	453
200	0.180	IRFP240	20	150	229
100	0.025	STH60N10	60	200	447
100	0.030	STH55N10	55	200	469
100	0.040	STH45N10	45	180	461
100	0.055	IRFP150	40	180	223
60	0.014	STH75N06	75	200	501
60	0.020	STH65N06	65	180	493
50	0.012	STH80N05	80	200	509
50	0.020	STH65N05	65	180	485

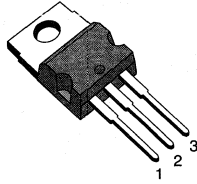
For I_D cont definition see introductory note

▲ High switching speed and low gate charge

* Available on request

SELECTION GUIDE: BY PACKAGE

TO-220



V _{DSS} (V)	R _{Dson} (max) (Ω)	Sales Type	I _{D cont} (A)	P _{tot} (W)	Page
1000	3.500	STP4N100	4	125	789
1000	5.000	STP3N100	3.5	100	749
900	2.400	STP5N90	5	125	861
900	3.500	STP4N90	3.6	100	781
900	4.500	STP3N90	3.2	100	741
800	2.000	STP5N80	5.5	125	841
800	2.400	STP5NA80 ▲	4.8	125	849
800	3.000	BUZ80A	3.8	100	127
800	4.000	BUZ80	3.4	100	119
800	7.000	STP2N80	2.4	90	701
600	1.200	MTP6N60	6.8	125	263
600	1.600	STP5N60	5.6	100	833
600	2.200	IRFBC30	4.3	100	215
600	2.500	MTP3N60	3.9	100	255
600	3.500	STP2N60	2.9	70	693
500	0.850	STP8NA50 ▲	8	125	901
500	0.850	IRF840	8	125	207
500	1.100	STP6N50	6	100	877
500	1.500	IRF830	4.5	100	199
500	1.600	STP5NA50 ▲	5	100	829
500	1.600	STP5N50	4.5	100	821
500	3.000	IRF820	3	75	193
500	4.000	IRF822	2.8	75	193
450	0.850	IRF841	8	125	207
450	1.500	IRF831	4.5	100	199
400	0.550	IRF740	10	125	185
400	1.000	IRF730	5.5	100	177
400	1.800	IRF720	4.2	75	169
400	2.100	STP4N40	4	75	765
400	2.500	BUZ76A	3.8	75	113

For I_{D cont} definition see introductory note

▲ High switching speed and low gate charge

TO-220 (Cont'd)

V _{DSS} (V)	R _{DSon} (max) (Ω)	Sales Type	I _D cont (A)	P _{tot} (W)	Page
300	1.400	STP5N30	5	75	805
300	1.400	STP5N30L ■	5	75	813
250	1.100	STP6N25	6	75	869
200	0.180	IRF640	18	125	163
200	0.400	IRF630	10	100	159
200	0.650	STP7N20	7	75	893
200	0.800	IRF620	5	70	153
100	0.040	STP40N10	40	150	1073
100	0.060	STP33N10	33	150	1025
100	0.077	IRF540	30	150	147
100	0.100	BUZ21	21	105	89
100	0.120	STP20N10	20	105	945
100	0.120	STP20N10L ■	20	105	953
100	0.140	STP18N10	18	90	929
100	0.160	IRF530	16	90	141
100	0.250	BUZ72A	11	70	107
100	0.270	IRF520	10	70	135
60	0.016	STP60N06-16	60	150	1153
60	0.020	STP60N06	60	150	1145
60	0.023	STP55N06L ■	55	150	1129
60	0.025	STP53N06	53	150	1113
60	0.028	STP50N06	50	150	1089
60	0.028	STP50N06L ■	50	200	1097
60	0.040	STP36N06L ■	36	120	1049
60	0.040	STP36N06	36	120	*
60	0.050	STP30N06	30	105	1001
60	0.055	STP32N06L ■	32	105	1017
60	0.065	STP25N06	25	90	985
60	0.085	STP20N06	20	80	937
60	0.085	STP21N06L ■	21	80	969
60	0.150	MTP3055E	14	70	271
60	0.150	STP15N06L ■	15	70	921
50	0.020	STP60N05	60	150	1137
50	0.023	STP55N05L ■	55	150	1121
50	0.025	STP53N05	53	150	1105
50	0.028	STP50N05L ■	50	200	1081
50	0.028	IRFZ40	50	150	249
50	0.035	STP40N05	40	120	1057
50	0.040	BUZ11	36	120	77
50	0.040	STP36N05L ■	36	120	1033

For I_D cont definition see introductory note

■ Logic level

* Available on request

SELECTION GUIDE: BY PACKAGE

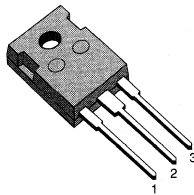
TO-220 (Cont'd)

V _{DSS} (V)	R _{Dson} (max) (Ω)	Sales Type	I _D cont (A)	P _{tot} (W)	Page
50	0.050	STP30N05	30	105	993
50	0.055	BUZ11A	27	90	83
50	0.055	STP32N05L ■	32	105	1009
50	0.065	STP25N05	25	90	977
50	0.070	BUZ10	20	80	71
50	0.085	STP21N05L ■	21	80	961
50	0.100	BUZ71	18	80	95
50	0.120	BUZ71A	13	40	101
50	0.150	STP15N05L ■	15	70	913

For I_D cont definition see introductory note

■ Logic level

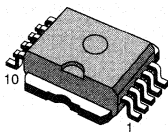
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V _{DSS} (V)	R _{Dson} (max) (Ω)	Sales Type	I _D cont (A)	P _{tot} (W)	Page
800	1.200	STW8N80	8.2	180	405
600	0.600	STW12N60	12	180	421
500	0.400	IRFW450	14	180	243
500	0.400	STW15N50	15	180	437
500	0.450	STW14N50	14.1	180	429
200	0.085	STW33N20	33	180	453
100	0.025	STW60N10	60	200	447
100	0.030	STW55N10	55	200	469
60	0.014	STW75N06	75	200	501
50	0.012	STW80N05	80	200	509

For I_D cont definition see introductory note

PowerSO-10



V_{DSS} (V)	R_{Dson} (max) (Ω)	Sales Type	I_b cont (A)	P_{tot} (W)	Page
1000	3.500	STV4N100	3.3	125	*
800	2.400	STV5NA80 ▲	4.6	125	*
800	3.500	STV4N80	3.8	110	*
800	4.500	STV3N80	3.2	100	*
600	1.200	STV6N60	6.8	125	*
600	2.500	STV4N60	4	100	*
500	0.850	STV8NA50 ▲	8	125	*
500	1.600	STV5NA50 ▲	5	100	*
400	0.550	STV10N40	10	125	*
400	1.000	STV6N40	6.3	100	*
200	0.180	STV18N20	18	125	*
200	0.400	STV10N20	10	100	*
100	0.040	STV40N10	40	150	*
100	0.060	STV33N10	33	150	*
60	0.020	STV60N06	60	150	*
60	0.028	STV50N06	50	150	*
60	0.040	STV36N06	36	120	*
50	0.016	STV60N05-16	60	150	*
50	0.020	STV60N05	60	150	*
50	0.028	STV50N05	50	150	*
50	0.035	STV40N05	40	120	*

For I_b cont definition see introductory note

▲ High switching speed and low gate charge

* Available on request

SELECTION GUIDE: LOGIC LEVEL

V _{DSS} (V)	R _{Dson(max)} (Ω)	Package	Sales Type	I _{D cont} (A)	P _{tot} (W)	Page
300	1.400	SOT-82	STK4N30L	4	50	565
300	1.400	TO-220	STP5N30L	4.5	72	813
300	1.400	ISOWATT220	STP5N30LFI	4.5	33	813
100	0.120	SOT-82	STK16N10L	16	65	629
100	0.120	TO-220	STP20N10L	20	105	953
100	0.120	ISOWATT220	STP20N10LFI	12	40	953
60	0.023	TO-220	STP55N06L	55	150	1129
60	0.023	ISOWATT220	STP55N06LFI	30	45	1129
60	0.028	TO-220	STP50N06L	50	200	1097
60	0.028	ISOWATT220	STP50N06LFI	24	40	1097
60	0.040	TO-220	STP36N06L	36	120	1049
60	0.040	ISOWATT220	STP36N06LFI	21	40	1049
60	0.055	SOT-82	STK23N06L	23	65	677
60	0.055	TO-220	STP32N06L	32	105	1017
60	0.055	ISOWATT220	STP32N06LFI	19	40	1017
60	0.085	SOT-82	STK18N06L	18	60	653
60	0.085	TO-220	STP21N06L	21	80	969
60	0.085	ISOWATT220	STP21N06LFI	14	35	969
60	0.150	SOT-82	STK12N06L	12	50	605
60	0.150	TO-220	STP15N06L	15	70	921
60	0.150	ISOWATT220	STP15N06LFI	10	35	921
50	0.023	TO-220	STP55N05L	55	150	1121
50	0.023	ISOWATT220	STP55N05LFI	30	45	1121
50	0.028	TO-220	STP50N05L	50	200	1081
50	0.028	ISOWATT220	STP50N05LFI	24	40	1081
50	0.040	TO-220	STP36N05L	36	120	1033
50	0.040	ISOWATT220	STP36N05LFI	21	40	1033
50	0.055	SOT-82	STK23N05L	23	65	677
50	0.055	TO-220	STP32N05L	32	105	1009
50	0.055	ISOWATT220	STP32N05LFI	19	40	1009
50	0.085	SOT-82	STK18N05L	18	60	653
50	0.085	TO-220	STP21N05L	21	80	961
50	0.085	ISOWATT220	STP21N05LFI	14	35	961
50	0.150	SOT-82	STK12N05L	12	50	605
50	0.150	TO-220	STP15N05L	15	70	913
50	0.150	ISOWATT220	STP15N05LFI	10	35	913

For I_{D cont} definition see introductory note

INDUSTRY STANDARD	SGS-THOMSON EQUIVALENT	SGS-THOMSON NEAREST	INDUSTRY STANDARD	SGS-THOMSON EQUIVALENT	SGS-THOMSON NEAREST
2N7054 2N7055 2N7058 2SK724 2SK725		IRFP150 STH33N20 IRFP450 STH14N50 IRFP450	APT40M75JN APT40M90JN APT801R2BN APT801R4BN APT802R4BN	STE50N40	STE50N40 STH8N80 STH8N80 STHV82
2SK727 2SK903 2SK904 2SK905 2SK906	BUZ80	STH5N90 BUZ80FI STH65N05 IRFP150	APT802R8BN APT901R3BN APT902R4BN APT902RBN APT904RBN		STH4N80 STH7N90 STH5N90 STH7N90 STH4N90
2SK949 2SK951 2SK952 2SK952-01 2SK954		IRF840FI STP2N80FI STP2N80 STP2N80 STH4N80	APT1002R4BN APT1002RBN APT1004R2BN APT1004RBN APT4030BN		STH6N100 STH6N100 STHV102 STHV102 IRFP350
2SK955 2SK956 2SK956-01 2SK960 2SK961		STHV82 STH8N80 STH8N80 STP3N90FI STP3N90	APT4540BN APT5010JN APT5012JN APT5040BN APT5050BN	STE47N50 STW15N50	IRFW450 STE45N50 STW15N50
2SK962 2SK1010-01 2SK1016-01 2SK1018-01 2SK1023	STP5N50	STH7N90 STH14N50 IRFP450 BUZ80	APT5085BN APT6015JN APT6018JN APT6060BN APT6070BN	STE38N60	STW15N50 STE38N60 STH12N60 STH12N60
2SK1023-01 2SK1024 2SK1024-01 2SK1081 2SK1081-01		BUZ80 STP3N90 STP3N90 STHV82 STHV82	APT8030JN APT8035JN APT8090BN APT10050JN BUK416-1000AE		STE22N80 STE22N80 STH9N80 STE16N100 STE15N100
2SK1082 2SK1082-01 2SK1105 2SK1384 2SK1385		STH5N90 STH5N90 STH4N80FI STHV82FI STH8N80FI	BUK416-1000BE BUK416-100AE BUK416-100BE BUK416-200AE BUK416-200BE		STE15N100 STE150N10 STE150N10 STE100N20 STE100N20
2SK1385-01 2SK1503-01 2SK1507-01 2SK1511 2SK1512		STH8N80FI IRF840 STP6N60FI STH6N100 STH7N90	BUK417-500AE BUK417-500BE BUK426-1000A BUK426-100A BUK426-100B		STE45N50 STE36N50 STHV102FI IRFP150FI IRFP150FI
2SK1547-01 2SK1548 2SK1550 APT20M40JN APT20M45JN		BUZ80FI STP3N90FI STP5N60FI STE100N20 STE100N20	BUK426-200A BUK426-200B BUK426-800A BUK426-800B BUK428-1000A	STH4N80FI STH6N100FI	IRFP240FI IRFP240FI STH4N80FI

CROSS REFERENCE

INDUSTRY STANDARD	SGS-THOMSON EQUIVALENT	SGS-THOMSON NEAREST	INDUSTRY STANDARD	SGS-THOMSON EQUIVALENT	SGS-THOMSON NEAREST
BUK428-1000B BUK428-500B BUK428-800A BUK428-800B BUK436-1000A	STHV82FI	STH6N100FI IRFP450FI STH8N80FI STHV102	BUK452-100A BUK452-100B BUK452-60A BUK452-60B BUK453-100A	BUZ72A MTP3055E IRF530	IRF520 MTP3055E
BUK436-100A BUK436-100B BUK436-200A BUK436-200B BUK436-800A	STH4N80	IRFP150 IRFP150 IRFP240 IRFP240	BUK453-100B BUK453-60A BUK453-60B BUK454-200A BUK454-200B	IRF630	IRF530 STP20N06 STP20N06 IRF630
BUK436-800B BUK437-500B BUK438-1000A BUK438-1000B BUK438-500B	STH6N100	STH4N80 STH14N50 STH6N100 STH14N50	BUK454-400B BUK454-500B BUK454-600B BUK454-800A BUK454-800B		STP4N40 IRF820 STP2N60 STP2N80 STP2N80
BUK438-800A BUK438-800B BUK439-60A BUK442-100A BUK442-100B	STHV82	STH8N80 STH75N06 IRF520FI IRF520FI	BUK455-100A BUK455-100B BUK455-200A BUK455-200B BUK455-400B	BUZ21 IRF730	IRF540 IRF640 IRF640
BUK442-60A BUK442-60B BUK443-100A BUK443-100B BUK443-60A		MTP3055EFI MTP3055EFI IRF530FI IRF530FI STP20N06FI	BUK455-500B BUK455-600B BUK455-60A BUK455-60B BUK456-1000A	IRF830 MTP3N60	STP36N06 STP36N06 STP4N100
BUK443-60B BUK444-400B BUK444-500B BUK444-600B BUK444-800A		STP20N06FI STP4N40FI IRF820 STP2N60FI STP2N80FI	BUK456-1000B BUK456-100B BUK456-200A BUK456-200B BUK456-60A	STP3N100 STP50N06	IRF540 IRF640 IRF640
BUK444-800B BUK445-100A BUK445-100B BUK445-200A BUK445-200B		STP2N80FI IRF540FI IRF540FI IRF640FI IRF640FI	BUK456-60B BUK456-800A BUK456-800B BUK457-400B BUK457-500B	BUZ80A BUZ80	STP50N06 IRF740 IRF840
BUK445-400B BUK445-500B BUK445-600B BUK445-60A BUK445-60B		IRF730FI IRF830FI STP3N60FI STP36N06 STP36N06FI	BUK457-600B BUK472-100A BUK472-100B BUK472-60A BUK472-60B	MTP6N60 MTP3055EFI	IRF520FI IRF520FI MTP3055EFI
BUK446-1000A BUK446-1000B BUK446-800A BUK446-800B BUK451-100A		STP4N100FI STP3N100FI BUZ80AFI BUZ80FI IRF520	BUK473-100A BUK473-60A BUK473-60B BUK474-400B BUK474-500B	IRF530FI	STP20N06FI STP20N06FI STP4N40FI IRF820FI

INDUSTRY STANDARD	SGS-THOMSON EQUIVALENT	SGS-THOMSON NEAREST	INDUSTRY STANDARD	SGS-THOMSON EQUIVALENT	SGS-THOMSON NEAREST
BUK474-600B BUK474-800A BUK474-800B BUK475-100A BUK475-100B	IRF540FI	STP2N60FI STP2N80FI STP2N80FI IRF540FI	BUZ12AL BUZ20 BUZ21 BUZ22 BUZ30A	BUZ21 STP33N10	STP40N05L BUZ72A IRF640
BUK475-200A BUK475-200B BUK475-400B BUK475-500B BUK475-600B	IRF730FI IRF830FI	IRF640FI IRF640FI STP3N60FI	BUZ31 BUZ32 BUZ41A BUZ42 BUZ50A	IRF630 IRF830 STP3N100	IRF640 STP5N50
BUK475-60A BUK475-60B BUK476-1000A BUK476-1000B BUK476-800A	STP3N100FI	STP36N06FI STP36N06FI STP4N100FI BUZ80AFI	BUZ50B BUZ50C BUZ60 BUZ70 BUZ70L	IRF730 MTP3055E STP15N06L	STP3N100 STP3N100
BUK542-60A BUK542-60B BUK543-60A BUK543-60B BUK545-100B		STP15N06LFI STP15N06LFI STP20N06FI STP20N06FI STP20N10LFI	BUZ71 BUZ71A BUZ71AFI BUZ71AL BUZ71FI	BUZ71 BUZ71A BUZ71AFI STP21N05L BUZ71FI	
BUK545-60A BUK552-60A BUK552-60B BUK553-60A BUK553-60B	STP15N06L	STP36N06LFI STP15N06L STP21N06L STP21N06L	BUZ71L BUZ71S2 BUZ72 BUZ72A BUZ73	STP21N05L IRF630	STP20N06 IFR530 IRF530
BUK555-100B BUK555-60A BUK556-60A BUK572-60A BUK572-60B	STP15N06LFI	STP20N10L STP36N06L STP55N06L STP15N06LFI	BUZ74 BUZ76A BUZ80 BUZ80A BUZ80AFI	IRF820 BUZ76A BUZ80 BUZ80A BUZ80AFI	STP4N40
BUK573-60A BUK573-60B BUK575-100B BUK575-60A BUZ10	BUZ10	STP32N06LFI STP21N06LFI STP20N10LFI STP36N06LFI	BUZ80FI BUZ307 BUZ308 BUZ310 BUZ311	BUZ80FI STH4N80	STH4N80 STHV102 STHV102
BUZ10A BUZ10L BUZ10S2 BUZ11 BUZ11A	BUZ71A STP25N06 STP36N06 BUZ11A	STP32N05L BUZ11 STP30N05	BUZ323 BUZ325 BUZ326 BUZ330 BUZ331	IRFP350	IRFP350 IRFP350 STH14N50 STH14N50
BUZ11AL BUZ11FI BUZ11S2 BUZ12 BUZ12A	STP32N05L BUZ11FI STP36N06 IRFZ40	 IRFZ40	BUZ332A BUZ338 BUZ339 BUZ341 BUZ345	STH15N50 STH14N50	STH12N60 STH33N20 STH55N10

CROSS REFERENCE

INDUSTRY STANDARD	SGS-THOMSON EQUIVALENT	SGS-THOMSON NEAREST	INDUSTRY STANDARD	SGS-THOMSON EQUIVALENT	SGS-THOMSON NEAREST
BUZ346 BUZ347 BUZ349 BUZ350 BUZ351		STH80N05 STH65N05 IRFP150 STH33N20 IRFP350	IRF641FI IRF642 IRF643 IRF720 IRF720FI	IRF720 IRF720FI	IRF640FI IRF640 IRF640 STP4N40
BUZ353 BUZ355 BUZ356 BUZ357 BUZ358	STHV82 STH6N100	STH14N50 STH8N80 STH6N100	IRF721 IRF722 IRF723 IRF730 IRF730FI	IRF720 IRF720 IRF720 IRF730 IRF730FI	STP4N40 STP4N40 STP4N40
IRF510 IRF511 IRF512 IRF513 IRF520	IRF520	IRF520 IRF520 IRF520 IRF520	IRF731 IRF732 IRF733 IRF740 IRF740FI	IRF740 IRF740FI	IRF730 IRF730 IRF730
IRF520FI IRF521 IRF522 IRF523 IRF530	IRF520FI IRF530	IRF520 IRF520 IRF520 STP18N10	IRF741 IRF742 IRF743 IRF820 IRF820FI	IRF820 IRF820FI	IRF740 IRF740 IRF740
IRF530FI IRF531 IRF532 IRF533 IRF540	IRF530FI IRF540	IRF530 IRF530 IRF530	IRF821 IRF822 IRF822FI IRF823 IRF830	IRF822 IRF822FI IRF830	IRF820 IRF820 IRF820
IRF540FI IRF541 IRF542 IRF543 IRF614	IRF540FI	IRF540 IRF540 IRF540 STP5N30	IRF830FI IRF831 IRF831FI IRF832 IRF833	IRF830FI IRF831 IRF831FI	IRF830 IRF830FI IRF830 IRF830
IRF620 IRF620FI IRF621 IRF622 IRF623	IRF620 IRF620FI	IRF620 IRF620 IRF620	IRF840 IRF840FI IRF841 IRF841FI IRF842	IRF840 IRF840FI IRF841 IRF841FI IRF842	IRF840 IRF840FI IRF840
IRF624 IRF630 IRF630FI IRF631 IRF632	IRF630 IRF630FI	STP5N30 IRF630 IRF630	IRF843 IRFBC20 IRFBC30 IRFBC32 IRFBC40	IRFBC30 MTP6N60	IRF840 STP2N60 MTP3N60
IRF633 IRF634 IRF640 IRF640FI IRF641	IRF640 IRF640FI	IRF630 STP5N30 IRF640	IRFBC42 IRFBE20 IRFBE22 IRFBE30 IRFBE32		STP5N60 STP2N80 STP2N80 BUZ80A BUZ80

INDUSTRY STANDARD	SGS-THOMSON EQUIVALENT	SGS-THOMSON NEAREST	INDUSTRY STANDARD	SGS-THOMSON EQUIVALENT	SGS-THOMSON NEAREST
IRFBF20 IRFBF22 IRFBF30 IRFBF32 IRFBG20		STP3N90 STP3N90 STP4N90 STP3N90 STP3N100	IRFP452 IRFP453 IRFPC50 IRFPE30 IRFPE40	STW12N60	STW14N50 IRFP450 STH12N60 STH4N80 STHV82
IRFBG22 IRFBG30 IRFBG32 IRFI530 IRFI540	IRF530FI IRF540FI	STP3N100 STP3N100 STP3N100	IRFPE42 IRFPE50 IRFPE52 IRFPF30 IRFPF40	STW8N80 STW8N80	STHV82 STH8N80 STH8N80 STH4N90 STH5N90
IRFI630 IRFI640 IRFI730 IRFI740 IRFI820	IRF630FI IRF640FI IRF730FI IRF740FI IRF820FI		IRFPF42 IRFPF50 IRFPF52 IRFPG30 IRFPG40		STH4N90 STH7N90 STH7N90 STHV102 STHV102
IRFI830 IRFI840 IRFIP044 IRFIP054 IRFIP150	IRF830FI IRF840FI STH75N06FI IRFP150FI	STH65N06FI STW75N06	IRFPG42 IRFPG50 IRFPG52 IRFS150 IRFS240	IRFP240FI	STHV102 STH6N100 STH6N100 IRFP150FI
IRFIP240 IRFIP250 IRFIP350 IRFIZ24 IRFIZ34	IRFP240FI STH33N20FI IRFP350FI	STP20N06FI STP30N06FI	IRFS242 IRFS350 IRFS450 IRFS451 IRFW450	IRFP350FI IRFP450FI IRFP451FI IRFW450	IRFP240FI
IRFIZ44 IRFP044 IRFP054 IRFP064 IRFP140		STP50N06FI STH65N06 STW75N06 STW75N06 IRFP150	IRFZ20 IRFZ22 IRFZ24 IRFZ25 IRFZ30	BUZ71 BUZ71A STP30N05	STP20N06 STP20N06
IRFP150 IRFP150 IRFP150FI IRFP240 IRFP240FI	IRFP150 IRFP150 IRFP150FI IRFP240 IRFP240FI	STW55N10	IRFZ32 IRFZ34 IRFZ35 IRFZ40 IRFZ40FI	STP30N06 STP25N06 IRFZ40 IRFZ40FI	BUZ11A
IRFP250 IRFP254 IRFP264 IRFP350 IRFP350FI	STW33N20 IRFP350 IRFP350FI	STH26N25 STH26N25	IRFZ42 IRFZ44 IRFZ45 IRFZ48 IRL530		IRFZ40 STP50N06 STP36N06 STP60N06-16 STP20N10L
IRFP448 IRFP450 IRFP450FI IRFP451 IRFP451FI	IRFP450 IRFP450FI IRFP451 IRFP451FI	STW14N50 STW15N50 STW15N50	IRLZ14 IRLZ24 IRLZ34 IRLZ44 IXT36N50	STP32N06L STP50N06L	STP15N06L STP21N06L STP36N06L STE45N50

CROSS REFERENCE

INDUSTRY STANDARD	SGS-THOMSON EQUIVALENT	SGS-THOMSON NEAREST	INDUSTRY STANDARD	SGS-THOMSON EQUIVALENT	SGS-THOMSON NEAREST
IXTH5N100 IXTH5N100A IXTH6N80 IXTH6N80A IXTH6N90		STH6N100 STH6N100 STHV82 STH8N80 STH5N90	IXTP7N50 IXTP7N50A MTA2N60E MTA4N50E MTA4N60E	IRF840 IRF830FI STP6N60FI	IRF840 STP3N60FI
IXTH6N90A IXTH10N60 IXTH10N60A IXTH10N80 IXTH11N80		STH7N90 STH12N60 STH12N60 STH9N80 STH9N80	MTA5N50E MTA6N40E MTA8N10E MTA11N10EL MTA15N06	IRF740FI	IRF840FI IRF520FI STP20N10LFI STP20N06FI
IXTH12N45 IXTH12N45A IXTH12N50 IXTH12N50A IXTH12N80		IRFP450 IRFP450 IRFP450 IRFP450 STH9N80	MTA3055E MTA30N06E MTG20N20 MTG4N100E MTG7N60E	MTP3055EFI STP50N06FI STH6N100FI	 STH33N20FI STH12N60FI
IXTH15N45 IXTH15N50A IXTH15N60 IXTN15N100 IXTN36N45	STW15N50 STW15N50	IRFP450 STH12N60 STE16N100 STE45N50	MTG9N50E MTH5N100 MTH6N100 MTH6N90 MTH7N50	IRFP450FI STH6N100	STH6N100 STH4N90 STH14N50
IXTH67N08 IXTH67N10 IXTN79N20 IXTP2N100 IXTP2N100A		STH60N10 STH60N10 STE100N20 STP3N100 STP3N100	MTH8N60 MTH8N90 MTH13N50 MTH15N20 MTH15N35	IRFP450	STH12N60 STH7N90 IRFP240 IRFP350
IXTP3N80 IXTP3N80A IXTP3N90 IXTP3N90A IXTP4N100		BUZ80 BUZ80 STP3N90 STP3N90 STP4N100	MTH15N40 MTH25N10 MTH30N20 MTH40N05 MTH40N06	IRFP350	IRFP150 STH33N20 STH65N05 STH65N06
IXTP4N100A IXTP4N45 IXTP4N45A IXTP4N50 IXTP4N50A	IRF830 IRF830 IRF830	STP4N100 IRF831 IRF831 STP5N50	MTH40N10 MTH50N05E MTP2N60E MTP2N85 MTP2N90	STP2N60	STH55N10 STH65N05 STP3N90 STP3N90
IXTP4N60 IXTP4N60A IXTP4N80 IXTP4N80A IXTP4N90	BUZ80A	MTP3N60 IRFBC30 STP5N80 STP4N90	MTP3N100E MTP3N50E MTP3N60 MTP3N60E MTP3N60FI	IRF820 MTP3N60 MTP3N60 MTP3N60FI	STP4N100
IXTP4N90A IXTP6N60 IXTP6N60A IXTP7N45 IXTP7N45A	STP5N90 STP5N60 MTP6N60 IRF840 IRF840	IRF841 IRF841	MTP4N40E MTP4N50E MTP4N80E MTP4N85 MTP4N90	IRF830 BUZ80A	STP4N40 STP4N90 STP4N90

INDUSTRY STANDARD	SGS-THOMSON EQUIVALENT	SGS-THOMSON NEAREST	INDUSTRY STANDARD	SGS-THOMSON EQUIVALENT	SGS-THOMSON NEAREST
MTP5N20 MTP5N40E MTP6N60 MTP6N60E MTP7N20	IRF730 MTP6N60 MTP6N60	IRF620 IRF620	RFH10N45 RFH10N50 RFH12N40 RFH25N20 RFH35N08		STH14N50 STH14N50 IRFP350 IRFP240 IRFP150
MTP8N20 MTP10N10E MTP10N40E MTP12N05E MTP12N10E	IRF630 BUZ72A IRF740 BUZ71A IRF530		RFH35N10 RFH45N05 RFH45N06 RFH75N05E RFP3N45	IRFP150	STH65N05 STH65N06 STH80N05 IRF820
MTP12N10EL MTP12N20 MTP15N05E MTP15N05EL MTP15N06E	BUZ71 STP15N05L	STP20N10L IRF630 MTP3055E	RFP3N50 RFP4N100 RFP6N45 RFP6N50 RFP7N40		IRF820 STP4N100 IRF830 IRF830 IRF740
MTP15N08EL MTP15N15 MTP20N06 MTP20N20E MTP25N05E	STP20N06	STP18N10 IRF640 IRF640 STP25N06	RFP8N20 RFP12N10 RFP12N10L RFP12N20 RFP14N05	BUZ71	IRF630 IRF530 STP20N10L IRF640
MTP30N05E MTP30N06EL MTP33N10E MTP36N06 MTP45N05E	STP30N05 STP33N10 STP36N06	STP36N06L IRFZ40	RFP14N05L RFP15N05 RFP15N05L RFP15N06 RFP17N06L	MTP3055E	STP15N05L BUZ71 STP15N05L STP21N06L
MTP50N05E MTP50N06E MTP50N06EL MTP3055A MTP3055E	IRFZ40 STP50N06 STP50N06L MTP3055A MTP3055E		RFP18N10 RFP22N10 RFP25N05 RFP25N05L RFP25N06	STP18N10 STP25N06	IRF540 STP30N05 STP40N05L
MTP3055EFI MTP3055EL MTW4N80E MTW6N100 MTW7N80E	MTP3055EFI STP15N06L STW8N80	STH4N80 STH6N100	RFP25N06L RFP40N10 RFP50N05 RFP50N05L RFP50N06		STP36N06L IRF520 STP60N06 STP55N05L STP60N06
MTW8N60E MTW14N50E MTW16N40E MTW22N20E MTW32N20E	STW15N50 STW33N20	STW12N60 IRFP350 IRFP240	RFP50N06L SGSIP474 SGSIP475 SGSIP476 SGSIP477		STP55N06L IRFP451FI IRFP451FI IRF740FI IRFP240FI
MTW36N10E MTW45N10E MTW54N05E RFG40N10 RFG50N05		STW55N10 STW55N10 STH80N05 IRFP150 STH65N05	SGSIP479 SGSP201 SGSP202 SGSP211 SGSP217		STH14N50 STK9N10 STK9N10 STK9N10 STK6N20

CROSS REFERENCE

INDUSTRY STANDARD	SGS-THOMSON EQUIVALENT	SGS-THOMSON NEAREST	INDUSTRY STANDARD	SGS-THOMSON EQUIVALENT	SGS-THOMSON NEAREST
SGSP219 SGSP221 SGSP222 SGSP230 SGSP231	STK14N05	STK3N50 STK14N05 STK3N50 STK3N50	SMP60N06-14 SMP60N06-18 SMW45N10 SMW60N06-18 SMW60N10	STW60N10	STP60N06-16 STP60N06-16 STH55N10 STH75N06
SGSP232 SGSP238 SGSP239 SGSP301 SGSP302		STK3N50 STK2N50 STK2N50 IRF520 IRF520	SMW70N06-14 SSH8N60 SSH15N60 SSH40N20A SSH60N10	STW75N06	STH75N06 STH12N60 STH12N60 STH33N20 STH55N10
SGSP311 SGSP312 SGSP317 SGSP319 SGSP321		IRF520 IRF520 IRF620 IRF820 MTP3055E	SSH60N10A SSM40N20 SSP3N70 SSP3N70A SSP4N45		STH60N10 STH33N20 STP2N80 BUZ80 IRF830
SGSP322 SGSP330 SGSP331 SGSP332 SGSP351		BUZ71A IRF820 STP4N40 STP4N40 IRF520	SSP4N50 SSP4N55 SSP4N60 SSP4N70 SSP4N70A	IRF830	MTP3N60 MTP3N60 BUZ80A STP5N80
SGSP358 SGSP361 SGSP362 SGSP364 SGSP367	IRF830	BUZ71A IRF530 BUZ21 IRF831 IRF630	SSP5N35 SSP5N40 SSP6N55 SSP6N60 SSP7N20	IRF730	IRF730 STP5N60 STP5N60 IRF620
SGSP368 SGSP369 SGSP381 SGSP382 SGSP471	IRF830 IRFP150	IRF830 STP25N06 STP25N05	SSP8N20 SSP10N05 SSP10N06 SSP10N08 SSP10N10		IRF630 BUZ71A MTP3055E IRF520 IRF520
SGSP472 SGSP473 SGSP474 SGSP475 SGSP477		IRFP150 IRFP240 STH14N50 STH14N50 IRFP240	SSP12N05 SSP12N06 SSP12N08 SSP12N10 STE15N100	STE15N100	BUZ71A MTP3055E IRF530 IRF530
SGSP478 SGSP479 SGSP491 SGSP492 SGSP3055	MTP3055E	STH14N50 STH14N50 STH65N06 STH65N06	STE16N100 STE22N80 STE26N50 STE36N50 STE38N60	STE16N100 STE22N80 STE26N50 STE36N50 STE38N60	
SMP20N20 SMP25N06 SMP30N10 SMP40N10 SMP50N06-25	STP33N10 STP50N06	IRF640 STP30N06 STP33N10	STE40N55 STE45N50 STE47N50 STE50N40 STE100N20	STE40N55 STE45N50 STE47N50 STE50N40 STE100N20	

CROSS REFERENCE

INDUSTRY STANDARD	SGS-THOMSON EQUIVALENT	SGS-THOMSON NEAREST	INDUSTRY STANDARD	SGS-THOMSON EQUIVALENT	SGS-THOMSON NEAREST
STE150N10 STE180N05 STE180N10 STE250N05 STH4N80	STE150N10 STE180N05 STE180N10 STE250N05 STH4N80		STH80N05FI STHV82 STHV82FI STHV102 STHV102FI	STH80N05FI STHV82 STHV82FI STHV102 STHV102FI	
STH4N80FI STH4N90 STH4N90FI STH5N100 STH5N90	STH4N80FI STH4N90 STH4N90FI STH5N90	STH6N100	STK2N50 STK2N60 STK2N80 STK3N50 STK4N30	STK2N50 STK2N60 STK2N80 STK3N50 STK4N30	
STH5N90FI STH5NA80 STH5NA80FI STH6N100 STH6N100FI	STH5N90FI STH5NA80 STH5NA80FI STH6N100 STH6N100FI		STK4N30L STK4N40 STK6N20 STK9N10 STK12N05L	STK4N30L STK4N40 STK6N20 STK9N10 STK12N05L	
STH7N90 STH7N90FI STH8N80 STH8N80FI STH9N80	STH7N90 STH7N90FI STH8N80 STH8N80FI STH9N80		STK12N06L STK14N05 STK14N06 STK14N10 STK16N10L	STK12N06L STK14N05 STK14N06 STK14N10 STK16N10L	
STH9N80FI STH12N60 STH12N60FI STH14N50 STH14N50FI	STH9N80FI STH12N60 STH12N60FI STH14N50 STH14N50FI		STK17N10 STK18N05 STK18N05L STK18N06 STK18N06L	STK17N10 STK18N05 STK18N05L STK18N06 STK18N06L	
STH15N50 STH15N50FI STH26N25 STH26N25FI STH33N20	STH15N50 STH15N50FI STH26N25 STH26N25FI STH33N20		STK22N05 STK22N06 STK23N05L STK23N06L STK3055E	STK22N05 STK22N06 STK23N05L STK23N06L STK3055E	
STH33N20FI STH45N10 STH45N10FI STH55N10 STH55N10FI	STH33N20FI STH45N10 STH45N10FI STH55N10 STH55N10FI		STLT19 STLT19FI STLT20 STLT20FI STLT29	STP15N05L STP15N05LFI STP15N06L STP15N06LFI	STP32N05L
STH60N10 STH60N10FI STH60N05 STH65N05 STH65N05FI	STH60N10 STH60N10FI STH65N05 STH65N05FI	STH65N05	STLT29FI STLT30 STLT30FI STP2N60 STP2N60FI	 STP2N60 STP2N60FI	STP32N05LFI STP32N06L STP32N06LFI
STH65N06 STH65N06FI STH75N06 STH75N06FI STH80N05	STH65N06 STH65N06FI STH75N06 STH75N06FI STH80N05		STP2N80 STP2N80FI STP3N100 STP3N100FI STP3N100XI	STP2N80 STP2N80FI STP3N100 STP3N100FI STP3N100XI	

CROSS REFERENCE

INDUSTRY STANDARD	SGS-THOMSON EQUIVALENT	SGS-THOMSON NEAREST	INDUSTRY STANDARD	SGS-THOMSON EQUIVALENT	SGS-THOMSON NEAREST
STP3N50XI STP3N60FI STP3N60XI STP3N80XI STP3N90	STP3N50XI STP3N60FI STP3N60XI STP3N80XI STP3N90		STP18N10 STP18N10FI STP19N05L STP19N06L STP20N06	STP18N10 STP18N10FI STP20N06	STP21N05L STP21N06L
STP3N90FI STP4N100 STP4N100FI STP4N100XI STP4N40	STP3N90FI STP4N100 STP4N100FI STP4N100XI STP4N40		STP20N06FI STP20N10 STP20N10FI STP20N10L STP20N10LFI	STP20N06FI STP20N10 STP20N10FI STP20N10L STP20N10LFI	
STP4N40FI STP4N80XI STP4N90 STP4N90FI STP5N30	STP4N40FI STP4N80XI STP4N90 STP4N90FI STP5N30		STP21N05L STP21N05LFI STP21N06L STP21N06LFI STP25N05	STP21N05L STP21N05LFI STP21N06L STP21N06LFI STP25N05	
STP5N30FI STP5N30L STP5N30LFI STP5N50 STP5N50FI	STP5N30FI STP5N30L STP5N30LFI STP5N50 STP5N50FI		STP25N05FI STP25N06 STP25N06FI STP30N05 STP30N05FI	STP25N05FI STP25N06 STP25N06FI STP30N05 STP30N05FI	
STP5N60 STP5N60FI STP5N80 STP5N80FI STP5N80XI	STP5N60 STP5N60FI STP5N80 STP5N80FI STP5N80XI		STP30N06 STP30N06FI STP32N05L STP32N05LFI STP32N06L	STP30N06 STP30N06FI STP32N05L STP32N05LFI STP32N06L	
STP5N90 STP5N90FI STP5NA50 STP5NA50FI STP5NA80	STP5N90 STP5N90FI STP5NA50 STP5NA50FI STP5NA80		STP32N06LFI STP33N10 STP33N10FI STP36N05L STP36N05LFI	STP32N06LFI STP33N10 STP33N10FI STP36N05L STP36N05LFI	
STP5NA80FI STP6N25 STP6N50 STP6N50FI STP6N60FI	STP5NA80FI STP6N25 STP6N50 STP6N50FI STP6N60FI		STP36N06 STP36N06FI STP36N06L STP36N06LFI STP40N05	STP36N06 STP36N06FI STP36N06L STP36N06LFI STP40N05	
STP7N20 STP7N20FI STP8N50XI STP8NA50 STP8NA50FI	STP7N20 STP7N20FI STP8N50XI STP8NA50 STP8NA50FI		STP40N05FI STP40N06L STP40N06LFI STP40N10 STP40N10FI	STP40N05FI STP36N06L STP36N06LFI STP40N10 STP40N10FI	
STP15N05L STP15N05LFI STP15N06L STP15N06LFI STP17N05L	STP15N05L STP15N05LFI STP15N06L STP15N06LFI	STP21N05L	STP45N05L STP45N05LFI STP50N05L STP50N05LFI STP50N06	STP50N05L STP50N05LFI STP50N06	STP50N05L STP50N05LFI

INDUSTRY STANDARD	SGS-THOMSON EQUIVALENT	SGS-THOMSON NEAREST	INDUSTRY STANDARD	SGS-THOMSON EQUIVALENT	SGS-THOMSON NEAREST
STP50N06FI STP50N06L STP50N06LFI STP53N05 STP53N06	STP50N06FI STP50N06L STP50N06LFI STP53N05 STP53N06		STW80N05 TSD2M450V TSD4M250V TSD4M350V TSD4M450V	STW80N05 STE36N50 STE100N20 STE50N40 STE47N50	
STP55N05L STP55N05LFI STP55N06 STP55N06FI STP55N06L	STP55N05L STP55N05LFI STP60N06 STP60N06FI STP55N06L	STP53N06 STP50N06FI	TSD5MG40V TSD14N100V TSD17N100V TSD18N80V TSD22N80V	STE16N100 STE15N100 STE15N100 STE22N80 STE22N80	
STP55N06LFI STP60N05 STP60N05FI STP60N06 STP60N06FI	STP55N06LFI STP60N05 STP60N05FI STP60N06 STP60N06FI		TSD23N50V TSD30N60V TSD33N50V TSD40N50V TSD40N55V	STE26N50 STE38N60 STE36N50 STE45N50 STE40N55	
STP60N06-16 STV3N80 STV4N60 STV4N80 STV4N100	STP60N06-16 STV3N80 STV4N60 STV4N80 STV4N100		TSD45N50V TSD90N20V TSD135N10V TSD150N10V TSD160N05V	STE45N50 STE100N20 STE150N10 STE180N10 STE180N05	
STV5N50 STV5N80 STV6N40 STV6N60 STV8N50	STV5N50 STV5N80 STV6N40 STV6N60 STV8N50		TSD180N10V TSD200N05V TSD250N05V	STE180N10 STE180N05 STE250N05	
STV10N20 STV10N40 STV18N20 STV33N10 STV36N06	STV10N20 STV10N40 STV18N20 STV33N10 STV36N06				
STV40N05 STV40N10 STV50N05 STV50N06 STV60N05	STV40N05 STV40N10 STV50N05 STV50N06 STV60N05				
STV60N05-16 STV60N06 STW8N80 STW12N60 STW14N50	STV60N05-16 STV60N06 STW8N80 STW12N60 STW14N50				
STW15N50 STW33N20 STW55N10 STW60N10 STW75N06	STW15N50 STW33N20 STW55N10 STW60N10 STW75N06				

ALPHABETICAL LIST OF SYMBOLS

C_{DB}	Parasitic capacitance between drain and body
C_{DS}	Parasitic capacitance between drain and source
C_{GD}	Parasitic capacitance between gate and drain
C_{GS}	Parasitic capacitance between gate and source
C_{iss}	Input capacitance
C_{oss}	Output capacitance
C_{rss}	Reverse transfer capacitance
D.U.T.	Device Under Test
E_{AS}	Single pulse avalanche energy
E_{AR}	Repetitive avalanche energy
I_{AR}	Avalanche current
I_D	Drain current
I_{DLM}	Drain peak current, inductive load
I_{DM}	Drain peak current
I_{DSS}	Zero gate voltage drain current
I_G	Gate current
I_{GSS}	Gate-body leakage current with drain short circuited to source
I_{RRM}	Source drain diode reverse recovery current
I_{SD}	Source-drain diode current
I_{SDM}	Source-drain diode peak current
L	Load inductance of a specified circuit
Q_g	Gate charge
Q_{gs}	Gate-source charge
Q_{gd}	Gate-drain charge
Q_{rr}	Source drain diode reverse recovery charge
PW	Pulse width
P_{tot}	Total power dissipation
$R_{DS(on)}$	Static drain-source on resistance
R_G	Generator internal resistance
R_L	Load resistance
$R_{th-jamb}$	Thermal resistance junction-to-ambient
$R_{th-j-case}$	Thermal resistance junction-case
T_l	Maximum lead temperature for soldering purpose
T_{amb}	Ambient temperature
T_{case}	Case temperature
T_j	Junction temperature
T_{stg}	Storage temperature
UIS	Unclamped inductive switching
$V_{(BR)DSS}$	Drain-source breakdown voltage with gate short circuited to source
V_{DG}	Drain-gate voltage
V_{DGR}	Drain-gate voltage with specified resistance between gate and source

V_{DS}	Drain-source voltage
$V_{DS(on)}$	Drain-source on state voltage
V_{GS}	Gate-source-voltage
$V_{GS(th)}$	Gate threshold voltage
V_I	Input voltage of a specified circuit
V_{ISO}	Insulation Withstand Voltage (DC)
V_{SD}	Source-drain diode forward on voltage
V_{clamp}	Drain clamping voltage
$(di/dt)_{on}$	Turn-on current slope
$(dv/dt)_{off}$	Turn-off voltage slope
f	Frequency
g_{fs}	Forward transconductance
t_c	Cross-over time
$t_d(off)$	Turn-off delay time
$t_d(on)$	Turn-on delay time
t_f	Fall time
t_{on}	Turn-on time
t_r	Rise time
$t_r(V_{off})$	Off-Voltage rise time
t_{rr}	Source Drain Diode Reverse Recovery time

A. DEFINITIONS OF TERMS USED

a. **Electronic device.** An electronic tube or valve, transistor or other semiconductor device. Note: This definition excludes inductors, capacitors, resistors and similar components.

b. **Characteristic.** A characteristic is an inherent and measurable property of a device. Such a property may be electrical, mechanical, thermal, hydraulic, electro-magnetic, or nuclear and can be expressed as a value for stated or recognized conditions. A characteristic may also be a set of related values, usually shown in graphical form.

c. **Bogey electronic device.** An electronic device whose characteristics have the published nominal values for the type. A bogey electronic device for any particular application can be obtained by considering only those characteristics which are directly related to the application.

d. **Rating.** A value which establishes either a limiting capability or a limiting condition for an electronic device. It is determinate for specified values of environment and operation, and may be stated in any suitable terms.

Note: Limiting conditions may be either maxima or minima.

e. **Rating system.** The set of principles upon which ratings are established and which determines their interpretation.

Note: The rating system indicates the division of responsibility between the device manufacturer and the circuit designer, with the object of ensuring that the working conditions do not exceed the ratings.

B. ABSOLUTE MAXIMUM RATING SYSTEM

Absolute maximum ratings are limiting values of operating and environmental conditions applicable to any electronic device of a specified type as defined by its published data, which should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electronic devices in the equipment. The equipment manufacturer should design so that, initially and throughout life, no absolute maximum value for the intended service is exceeded with any device under the worst probable operating condi-

tions with respect to supply voltage variation, equipment component variation, equipment control adjustment, load variations, signal variation, environmental conditions, and variation in characteristics of the device under consideration and of all other electronic devices in the equipment.

C. DESIGN - MAXIMUM RATING SYSTEM

Design-maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the electronic device under consideration.

The equipment manufacturer should design so that, initially and throughout life, no design-maximum value for the intended service is exceeded with a bogey device under the worst probable operating conditions with respect to supply-voltage variation equipment, component variation, variation in characteristics of all other devices in the equipment, equipment control adjustment, load variation, signal variation and environmental conditions.

D. DESIGN - CENTRE RATING SYSTEM

Design-centre ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under normal conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device in average applications, taking responsibility for normal changes in operating conditions due to rated supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all electronic devices.

The equipment manufacturer should design so that, initially, no design-centre value for the intended service is exceeded with a bogey electronic device in equipment operating at the stated normal supply-voltage.

The Absolute Maximum Rating System is commonly used for semiconductor devices.

PRECAUTIONS FOR PHYSICAL HANDLING OF POWER PLASTIC TRANSISTOR [TO-220, ISOWATT220, TO-218 (SOT-93), ISOWATT218, TO-126 (SOT-32), SOT-82, SOT-194]

When mounting power transistors certain precautions must be taken in operations such as bending of leads, mounting of heatsink, soldering and removal of flux residue. If these operations are not carried out correctly, the device can be damaged or reliability compromised.

1. Bending and cutting leads

The bending or cutting of the leads requires the following precautions:

- 1.1. When bending the leads they must be clamped tightly between the package and the bending point to avoid strain on the package (in particular in the area where the leads enter the resin) (fig. 1). This also applies to cutting the leads (fig. 2).
- 1.2. The leads must be bent at a minimum distance of 3 mm from the package (fig. 3a).

- 1.3. The leads should not be bent at an angle of more than 90° and they must be bent only once (fig. 3b).
- 1.4. The leads must never be bent laterally (fig. 3c).
- 1.5. Check that the tool used to cut or form the leads does not damage them or ruin their surface finish.

2. Mounting on printed circuit

During mounting operations be careful not to apply stress to the power transistor.

- 2.1. Adhere strictly to the pin spacing of the transistor to avoid forcing the leads.
- 2.2. Leave a suitable space between printed circuit and transistor, if necessary use a spacer.
- 2.3. When fixing the device to the printed circuit do not put mechanical stress on the transistor. For this purpose the device should be soldered to the printed circuit board after the transistor has been fixed to the heatsink and the heatsink to the printed circuit board.

Fig. 1 - Bending the leads

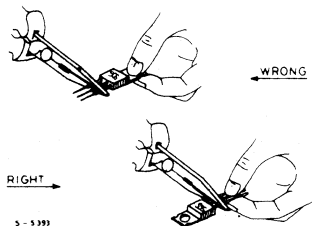


Fig. 2 - Lead forming or cutting mechanism

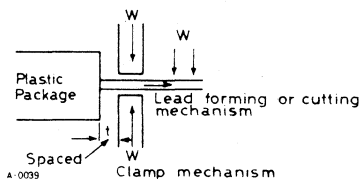
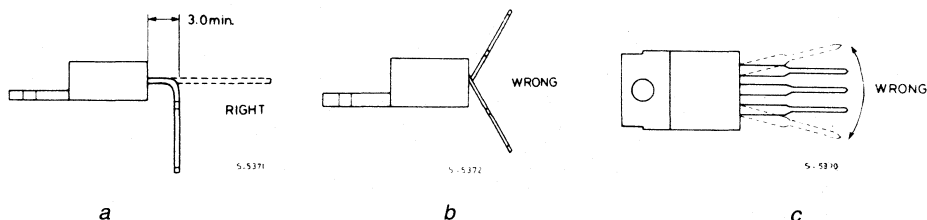


Fig. 3 - Angles for lead wire bending



3. Soldering

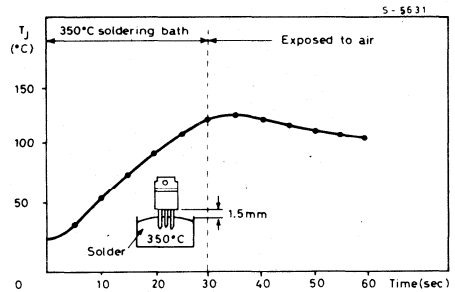
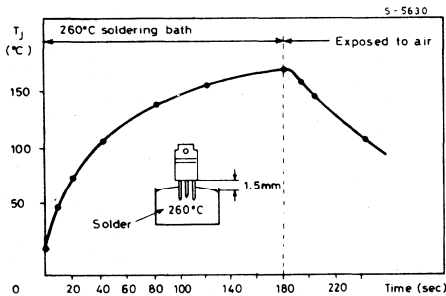
In general a transistor should never be exposed to high temperature for any length of time. It is therefore preferable to use soldering methods where the transistor is exposed to the lowest possible temperatures for a short time.

- 3.1. Tolerable conditions are 260°C for 10 sec or 350° for 3 sec. The graphs in fig. 4 give an idea of the excess junction temperature during the soldering process for a TO-220 (Ver-

sawatt). It is also important to use suitable fixes for the tin baths to avoid deterioration of the leads or of the package resin.

- 3.2. An excess of residual flux between the pins of the transistor or in contact with the resin can reduce the long-term reliability of the device. The solvent for removing excess flux must be chosen with care. The use of solvents derived from trichloroethylene is not recommended on plastic packages because the residue can cause corrosion.

Fig. 4 - Junction temperatures during soldering



4. Mounting at heatsink

To exploit best the performance of power transistor a heatsink with R_{th} suitable for the power that the transistor will dissipate must be used.

- 4.1. The plastic packages used by SGS-THOMSON for its power transistor (SOT-32, SOT-82, SOT-194, TO-220, ISOWATT220, TO-218, ISOWATT218) provide for the use of a single screw to fix the package to the heatsink. A compression spring (clip) can be sufficient as an alternative (fig. 5).

The screw should be properly tightened to en-

sure good contact between the back of the package and the heatsink but should not be too tight to avoid deformation of the copper part (tab) of the package causing breaking of the die or separation of the resin from the tab.

- 4.2. The contact R_{th} between device and heatsink can be improved by inserting a thin layer of silicone grease with fluidity sufficient to guarantee perfectly uniform distribution on the surface of the tab. The thermal resistance with and without silicone grease is given in fig. 6. An excessively thick layer or an excessive viscosity of the grease can degrade the R_{th} .

Fig. 5 - SOT-93 mounting examples

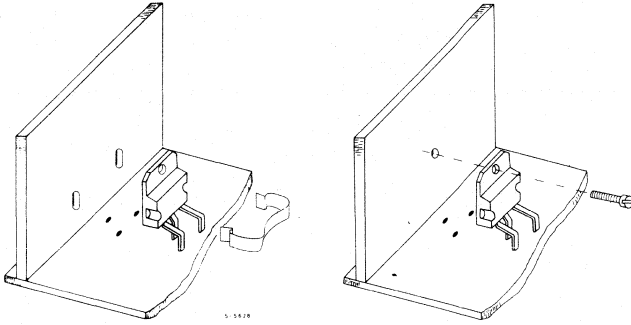
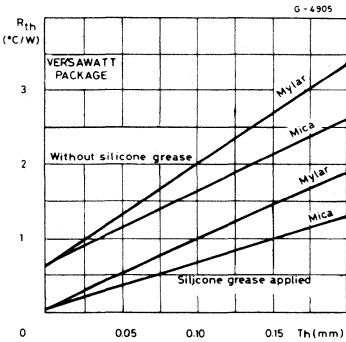


Fig. 6 - Contact thermal resistance vs. insulator thickness.

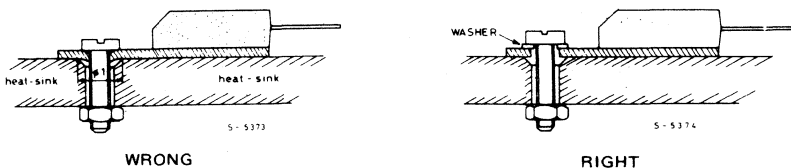


5. Heatsink problems

The most important aspect from the point of view of reliability of a power transistor is that the heatsink should be dimensioned to keep the T_j of the device as low as possible. From the mechanical point of view, however, the heatsink must be realized so that it does not damage the device.

- 5.1. The planarity of the contact surface between device and heatsink must be $< 25\mu\text{m}$ for TO-220, ISOWATT220, TO-218, ISOWATT218, TO-126 (SOT-32), SOT-82, SOT-194.

Fig. 7 - Device mounting



- 5.2. If self threading screws are used there must be an outlet for the material that is deformed during formation of the thread. The diameter $\varnothing 1$ (fig. 7) must be large enough to avoid distortion of the tab during tightening. For this purpose it may be useful to insert a washer or use of the type shown in fig. 8 where the pressure on the tab is distributed on a much larger surface. Sometimes when the hole in the heatsink is formed with a punch, around the hole or hollow there may be a ring which is lower than the heatsink surface. This is dangerous because it may lead to distortion of the tab as mentioned before.
- 5.3. A very serious problem is that of the rigidity between heatsink, device and printed circuit board. Once the device and the heatsink are mechanically connected, and the heatsink is fixed to the apparatus frame, the device and the PCB are bound together by the leads of the devices. A solution of this type is extremely dangerous.

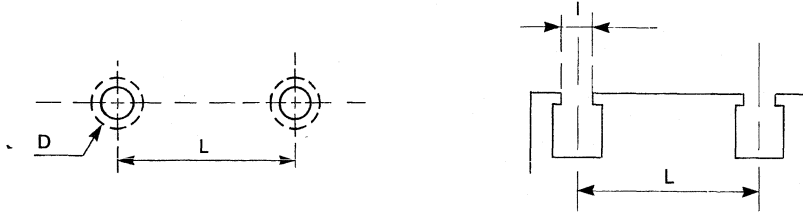
Fig. 8 - Suggested screw



ISOTOP

ISOTOP package is designed for high mechanical robustness and optimum heat removal. The basic mounting procedures are as follows.

I - MOUNTING ON HEATSINK



I1 - HEATSINK SPECIFICATION:

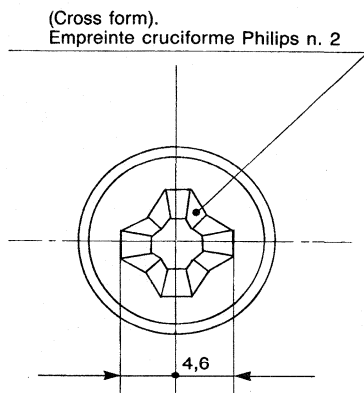
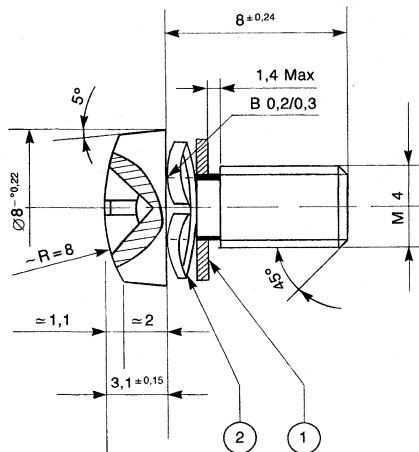
Flatness (max concavity or convexity between fixing holes)	≤ 20 microns (0.78 mils)
Surface Finish	± 1.2 microns (± 0.05 mils)
Fixing Holes	D = M4 L = 30 +3 mm (1.181 + 0.012 Inches)

I2 - MOUNTING SPECIFICATION:

Fixing Screw	M4 + lock washer
Torque	1.3 ± 0.2 N • m suggested (MAX 3.0) (7.6 \pm 1.2 LBS • Inches)
R _{th} Case/Heatsink (with thermal compound)	≤ 0.05 °C/W

II – CONNECTIONS

Screws	See Drawing
Torque	$1.3 \pm 0.2 \text{ N} \cdot \text{m}$ ($7.6 \pm 1.2 \text{ LBS} \cdot \text{Inches}$)
Twist Test	Not applicable
Contact Area (screw version)	45 mm^2
Lead Inductance	$\leq 5 \text{ nH}$

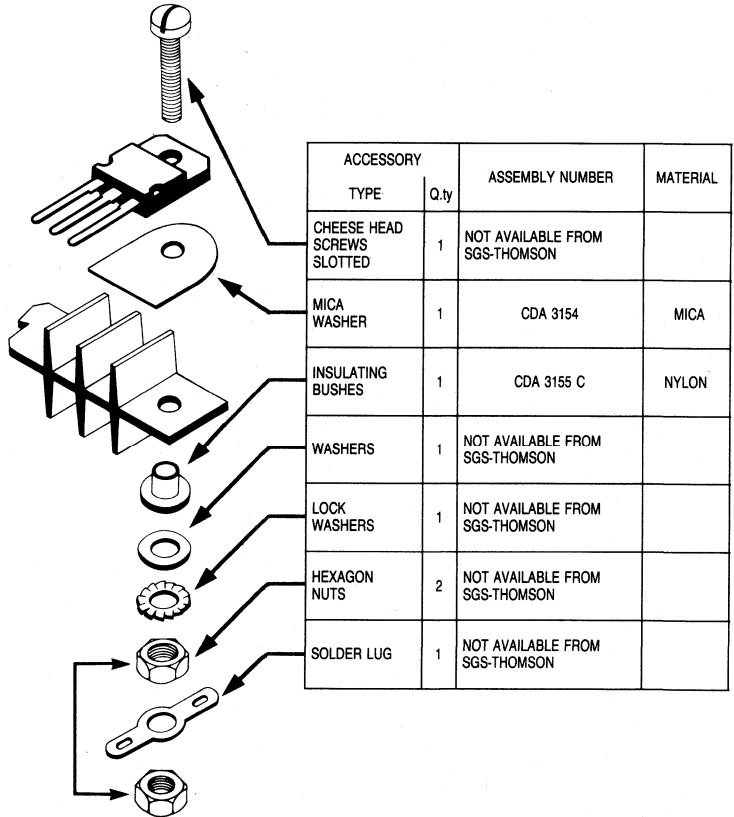


III – INSULATION

Insulation Material dice to base	Ceramic
Insulation Voltage pins to base	2500 V.RMS 1 minute
Stray capacitance	90 pF.
Creepage and Clearance Distance pins to base-heatsink	$\geq 9.5 \text{ mm}$ (0.374 Inches)
Creepage and clearance distance pin to pin	$\geq 4.5 \text{ mm}$ (0.177 Inches)
Resin: Flammability UL 94 V-O	UL Recognized
UL Qualification	File E817344

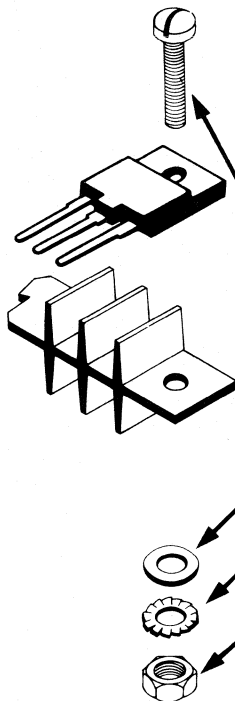
ACCESSORIES AND MOUNTING INSTRUCTIONS

TO-218 (SOT-93)



Maximum torque (applied to mounting flange)
 Recommended: 0.55 Nm
 Maximum: 1 Nm.

ISOWATT218

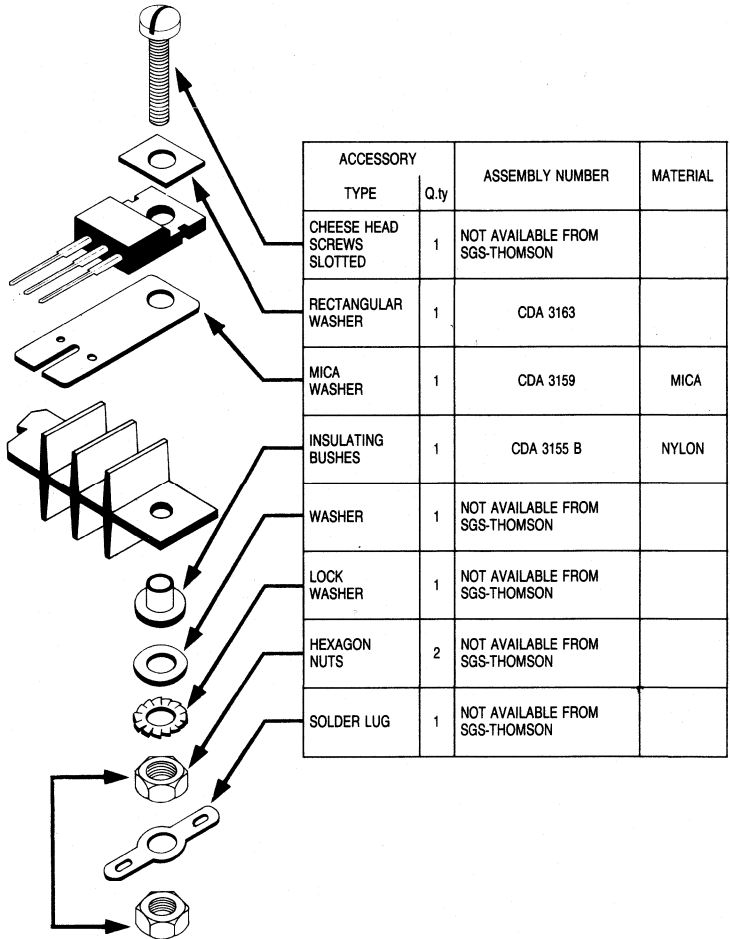


ACCESSORY		ASSEMBLY NUMBER	MATERIAL
TYPE	Q.ty		
CHEESE HEAD SCREWS SLOTTED	1	NOT AVAILABLE FROM SGS-THOMSON	
WASHERS	1	NOT AVAILABLE FROM SGS-THOMSON	
LOCK WASHERS	1	NOT AVAILABLE FROM SGS-THOMSON	
HEXAGON NUTS	1	NOT AVAILABLE FROM SGS-THOMSON	

Maximum torque (applied to mounting flange)
 Recommended: 0.55 Nm
 Maximum: 1 Nm.

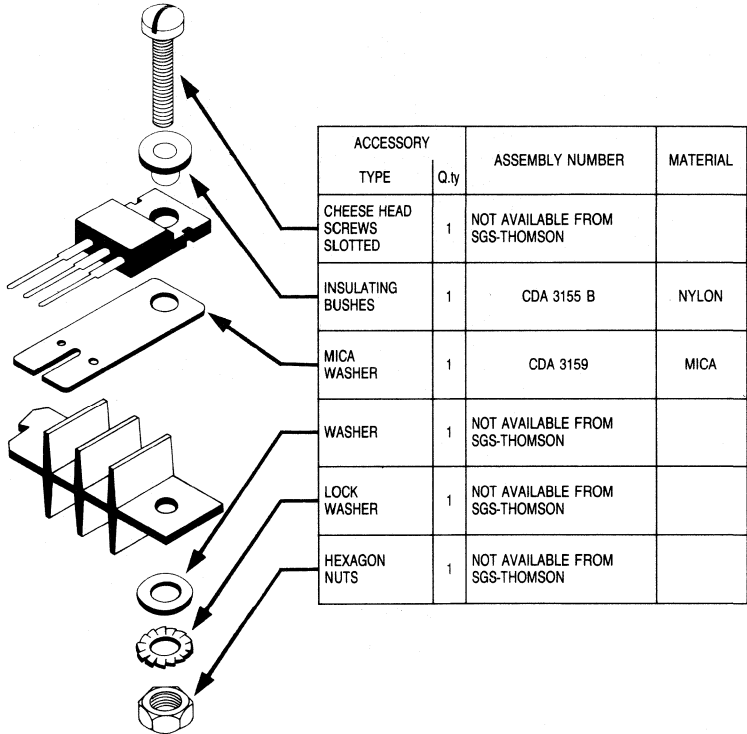
ACCESSORIES AND MOUNTING INSTRUCTIONS

TO-220



Maximum torque (applied to mounting flange)
 Recommended: 0.55 Nm
 Maximum: 0.7 Nm.

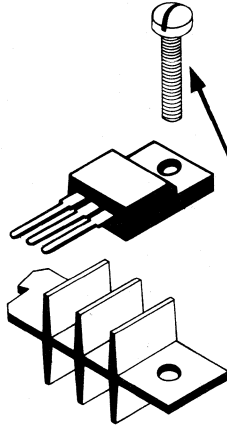
TO-220



Maximum torque (applied to mounting flange)
 Recommended: 0.55 Nm
 Maximum: 0.7 Nm.

ACCESSORIES AND MOUNTING INSTRUCTIONS

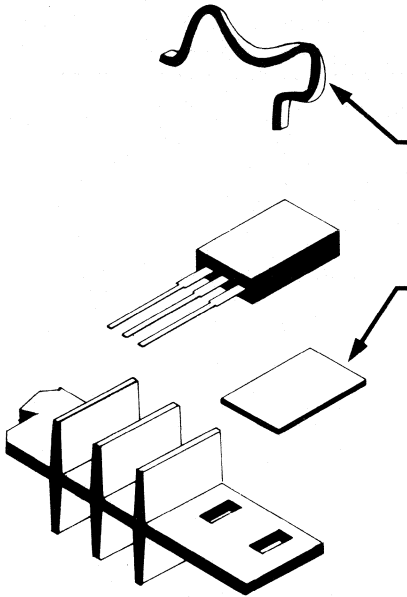
ISOWATT220, 221



ACCESSORY		Q.ty	ASSEMBLY NUMBER	MATERIAL
TYPE				
CHEESE HEAD SCREWS SLOTTED	1	1	NOT AVAILABLE FROM SGS-THOMSON	
WASHER	1	1	NOT AVAILABLE FROM SGS-THOMSON	
LOCK WASHER	1	1	NOT AVAILABLE FROM SGS-THOMSON	
HEXAGON NUTS	1	1	NOT AVAILABLE FROM SGS-THOMSON	

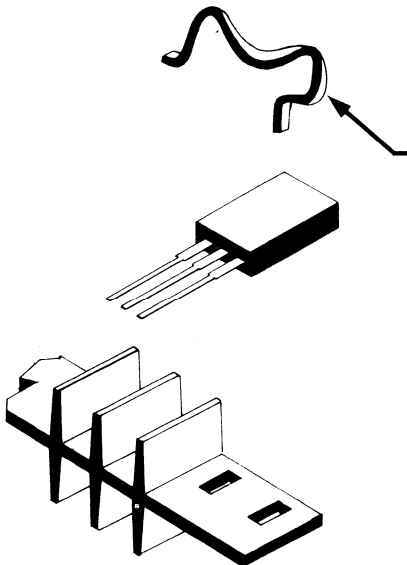
Maximum torque (applied to mounting flange)
 Recommended: 0.55 Nm
 Maximum: 0.7 Nm.

TO-126, SOT-82, SOT-194, TO-220, TO-218



ACCESSORY TYPE	Q.ty	ASSEMBLY NUMBER	MATERIAL
SPRING CLIP	1	NOT AVAILABLE FROM SGS-THOMSON	
MICA WASHER	1	TO-126 } NOT AVAILABLE FROM SOT-82 } FROM SOT-194 } SGS-THOMSON TO-220: CDA3159 TO-218: CDA3154	MICA

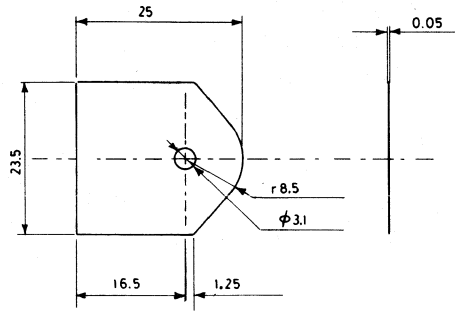
ISOWATT220, ISOWATT218



ACCESSORY TYPE	Q.ty	ASSEMBLY NUMBER	MATERIAL
SPRING CLIP	1	NOT AVAILABLE FROM SGS-THOMSON	

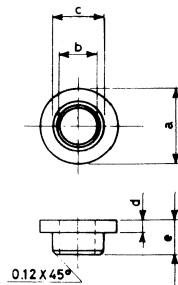
ACCESSORIES AND MOUNTING INSTRUCTIONS

CDA 3154



A-0042

CDA 3155



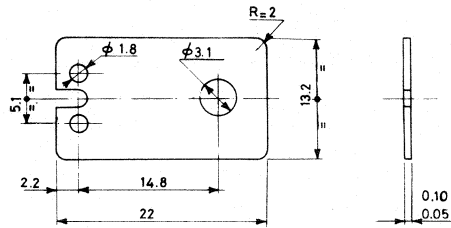
A - 0024/2

Suffix	Package	a	b	c	d	e
B	TO-220	5.30 to 5.50	3.00 to 3.10	3.83 to 3.88	0.60 to 0.65	1.70 to 1.80
C	SOT-93	6.40 to 6.60	3.00 to 3.10	4.00 to 4.05	1.3 to 1.4	2.7 to 2.9

Material: Nylon

Dimensions: mm

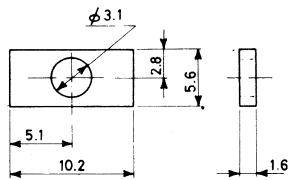
CDA 3159



A-0026/3

TYPE	MATERIAL	NOTE
CDA3159	MICA	

CDA 3163



A-0023/3

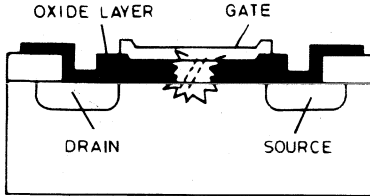
TYPE	MATERIAL	NOTE
CDA3163	Steel nickel plated	

ELECTROSTATIC DISCHARGE PROTECTION (handling precautions)

Electronic components have to be protected from the hazard of static electricity, from the manufacturing stage down to where they are utilized.

MOS devices are typically voltage and electrical field sensitive; the thin oxide layers can be destroyed by an electric field.

Fig. 1



S-6903

This happens mostly because a charged conductor, typically a person, is rapidly discharged through the device.

There will be no net charge on any portion of the MOS structure when the induced high field exceeds the breakdown voltage of the MOS capacitor we may have a self-healing break-down, degradation or catastrophic failure.

The failure hazard is not limited to the gate region but it could occur wherever two conductive areas are separated by a thin insulator.

POWER MOS devices can generally be considered less ESD sensitive than MOS I/Cs.

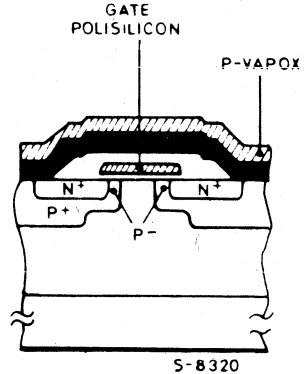
The input capacitance of a POWER MOS device is typically 10 to 200 times larger, and the gate oxide thickness is similar in size to that of the largest MOS I/Cs used.

As a result, it is common practice not to consider the ESD as dangerous for POWER MOS, but this is not always true, even though they are less sensitive than MOS I/Cs

HANDLING

SGS-THOMSON has chosen a no-compromise strategy in the MOS ESD protection. From the wafer level to the shipping of finished units, each work station and processing of the parts is guaranteed. This is achieved through total adoption of shielding and grounding media. Our final shipping of the parts is performed in antistatic tubes, bags or boxes. The suppliers greatest efforts are in vain if the end user does not provide the same level of protection and care in application.

Fig. 2



Here are the basic static control protection rules:
A - Handle all components in a static-safe work area.

B - Transport all components in static shielding containers.

To comply with the rules the following procedures must be set up.

- 1 - Static control wrist strap (from a qualified source) used and connected properly.
- 2 - Each table top must be protected with a conductive mat, properly grounded.
- 3 - Extensive use of conductive floor mats.
- 4 - Static control shoe straps, wearing typically insulating footwear, such as with crepe or thick rubber soles.
- 5 - Ionized air blowers are a necessary part of the protective system, to neutralize static charges on conductive items.
- 6 - Use only the grounded tip variety of soldering iron.
- 7 - Single components, tubes, printed circuit cards should always be contained in static shielding bags; keep our parts in the original bags up to the very last moment on the production line.
- 8 - If bigger containers (tote box) are used for in-plant transport of devices or PC boards they must be electrically conductive, like the carbon loaded ones.

- 9 - All tools, persons, testing machines, which could contact device leads must be conductive and grounded.
- 10 - Avoid using high dielectric materials (like polystyrene) for sub-assembly construction, storing and transportation.
- 11 - Follow a proper power supply sequence in testing and application. Supply voltage should be applied before and removed after input signals; insertion and removal from sockets should be done with no power applied.
- 12 - Filtration, noise suppression, slow voltage surges should be guaranteed on the supply lines.
- 13 - Any open (floating) input pin is a potential hazard to your circuit: ground or short them to V_{DD} whenever possible.

DATASHEETS

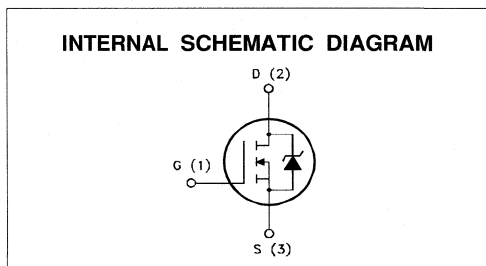
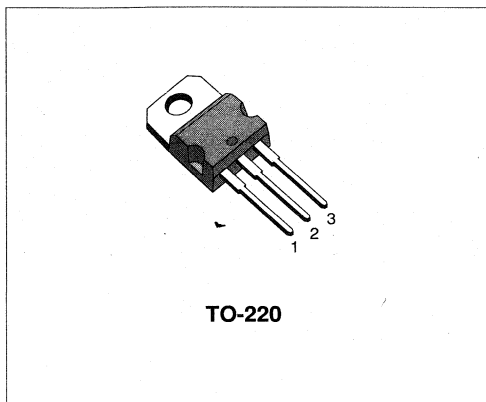
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

TYPE	V _{DSS}	R _{DS(on)}	I _D
BUZ10	50 V	< 0.07 Ω	20 A

- TYPICAL R_{DS(on)} = 0.06 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	50	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	50	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	20	A
I _{DM}	Drain Current (pulsed)	80	A
P _{tot}	Total Dissipation at T _c = 25 °C	80	W
T _{stg}	Storage Temperature	-65 to 175	°C
T _j	Max. Operating Junction Temperature	175	°C
	DIN Humidity Category (DIN 40040)	E	
	IEC Climatic Category (DIN IEC 68-1)	55/150/56	

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	1.88	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5	°C/W

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	20	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ °C}$, $I_D = I_{AR}$, $V_{DD} = 25\text{ V}$)	80	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	20	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ °C}$, pulse width limited by T_j max, $\delta < 1\%$)	14	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$	50			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating}$ $T_j = 125\text{ °C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 1\text{ mA}$	2.1	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 13\text{ A}$		0.06	0.07	Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} = 25\text{ V}$ $I_D = 13\text{ A}$	6	11		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		520	700	pF
C_{oss}	Output Capacitance			250	350	pF
C_{rss}	Reverse Transfer Capacitance			80	120	pF

SWITCHING

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 30\text{ V}$ $I_D = 3\text{ A}$ $R_{GS} = 50\text{ }\Omega$ $V_{GS} = 10\text{ V}$		45	65	ns
t_r	Rise Time			65	95	ns
$t_{d(off)}$	Turn-off Delay Time			115	160	ns
t_f	Fall Time			80	120	ns

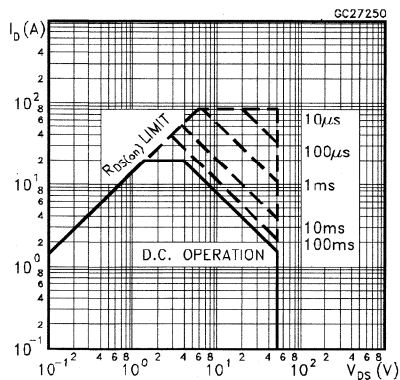
ELECTRICAL CHARACTERISTICS (continued)

SOURCE DRAIN DIODE

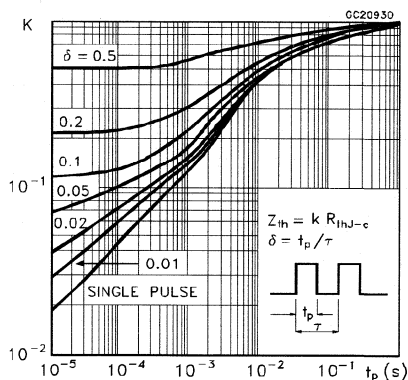
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				20	A
I_{SDM}	Source-drain Current (pulsed)				80	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 40\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 20\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 15\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		85		ns
Q_{rr}	Reverse Recovery Charge			0.13		μC

(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

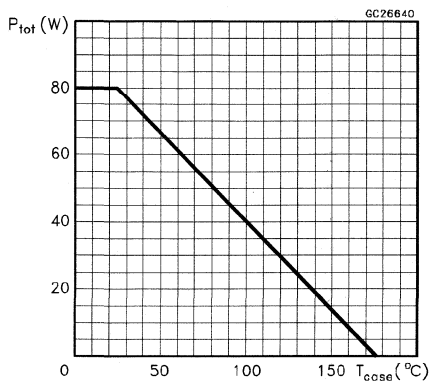
Safe Operating Area



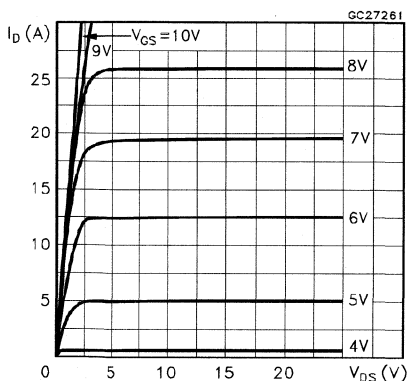
Thermal Impedance



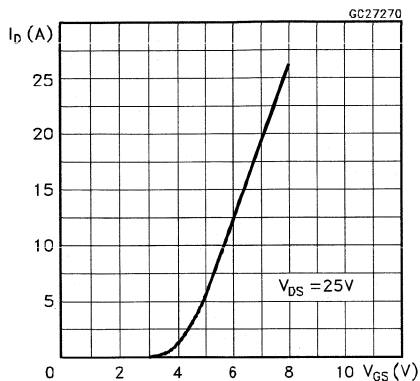
Derating Curve



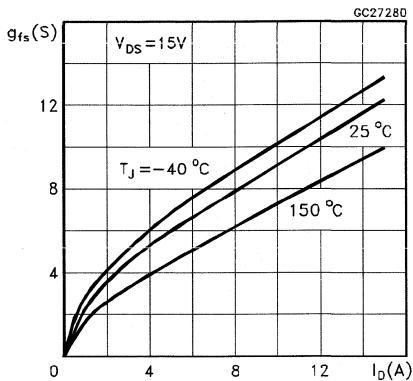
Output Characteristics



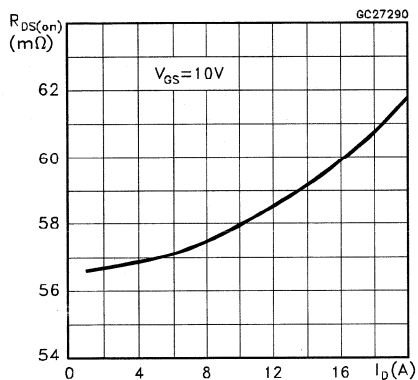
Transfer Characteristics



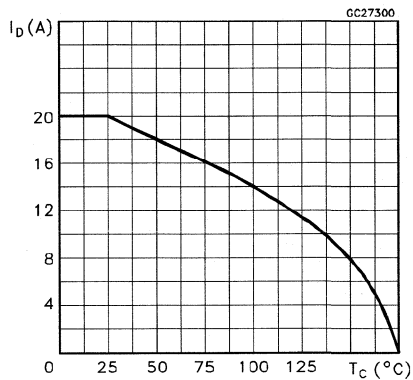
Transconductance



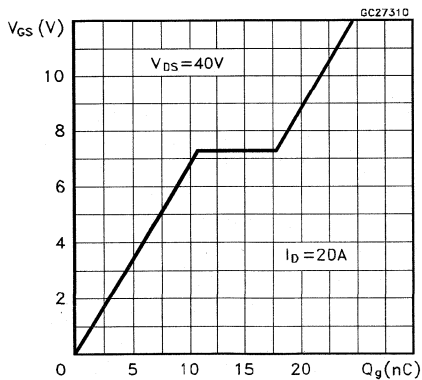
Static Drain-Source On Resistance



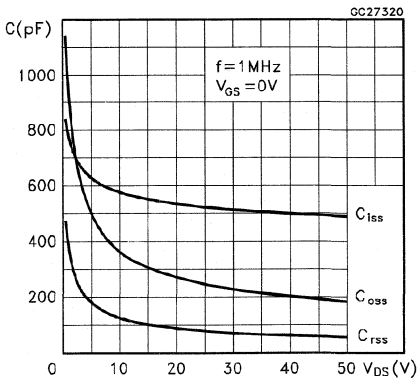
Maximum Drain Current vs Temperature



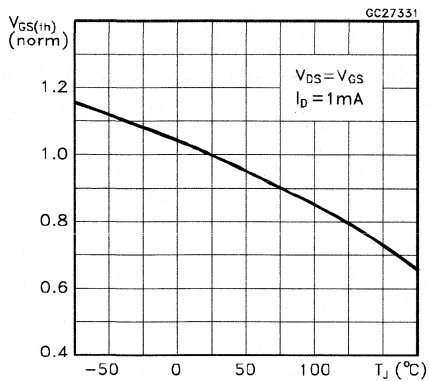
Gate Charge vs Gate-Source Voltage



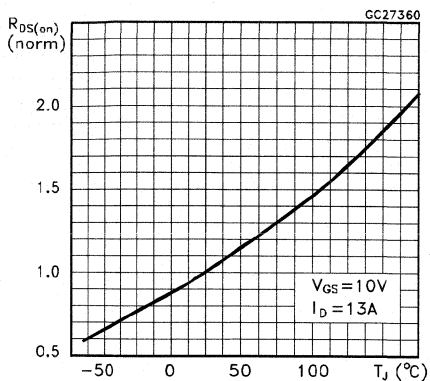
Capacitance Variation



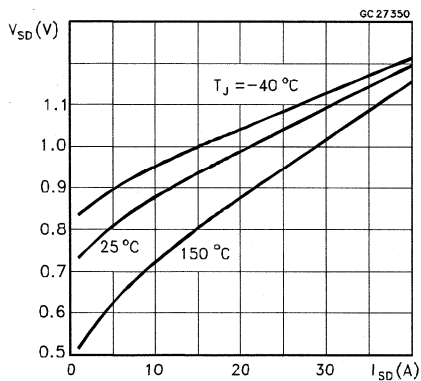
Normalized Gate Threshold Voltage vs Temperature



Normalized On Resistance vs Temperature



Source-Drain Diode Forward Characteristics



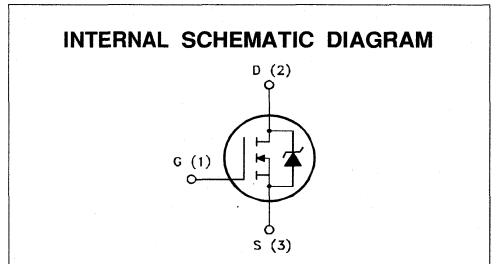
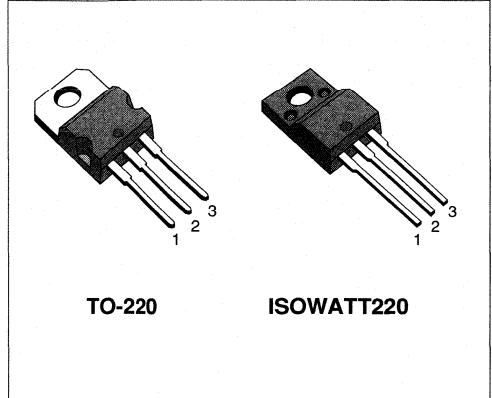
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

TYPE	V _{DSS}	R _{DS(on)}	I _D
BUZ11	50 V	< 0.04 Ω	36 A
BUZ11FI	50 V	< 0.04 Ω	21 A

- TYPICAL R_{DS(on)} = 0.03 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		BUZ11	BUZ11FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	50		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	50		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	36	21	A
I _{DM}	Drain Current (pulsed)	144	144	A
P _{tot}	Total Dissipation at T _c = 25 °C	120	40	W
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C
	DIN Humidity Category (DIN 40040)	E		
	IEC Climatic Category (DIN IEC 68-1)	55/150/56		

THERMAL DATA

			TO-220	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case	Max	1.25	3.75	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5		°C/W

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	36	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	240	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	60	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	25	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	50			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating T _j = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 1 mA	2.1	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 18 A		0.03	0.04	Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} = 15 V I _D = 18 A	10	16		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		1130	1500	pF
C _{oss}	Output Capacitance			480	650	pF
C _{rss}	Reverse Transfer Capacitance			140	200	pF

SWITCHING

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t _{d(on)}	Turn-on Time	V _{DD} = 30 V I _D = 3 A R _{GS} = 50 Ω V _{GS} = 10 V		40	60	ns
t _r	Rise Time			145	210	ns
t _{d(off)}	Turn-off Delay Time			220	320	ns
t _f	Fall Time			135	200	ns

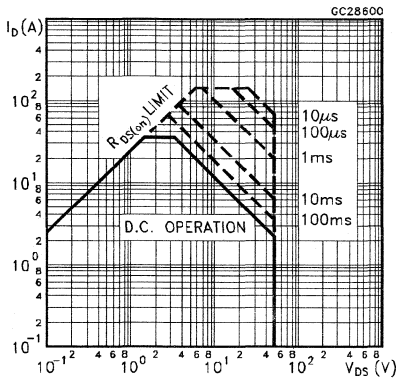
ELECTRICAL CHARACTERISTICS (continued)

SOURCE DRAIN DIODE

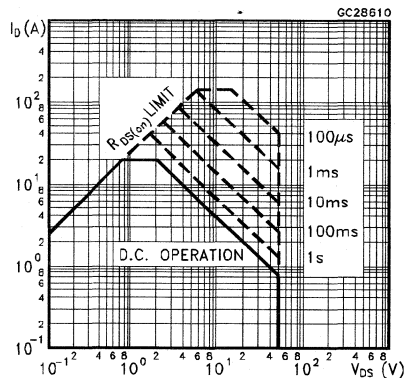
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				36	A
I_{SDM}	Source-drain Current (pulsed)				144	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 72 \text{ A}$ $V_{GS} = 0$			2.2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 36 \text{ A}$ $dI/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 30 \text{ V}$ $T_j = 150 \text{ }^\circ\text{C}$		90		ns
Q_{rr}	Reverse Recovery Charge			0.2		μC

(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

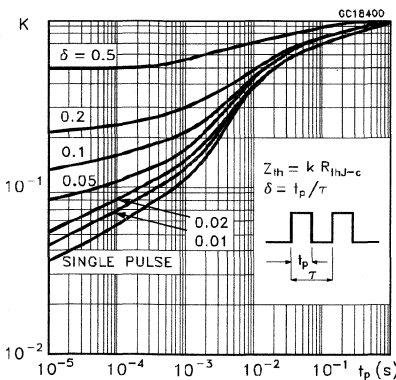
Safe Operating Area For TO-220



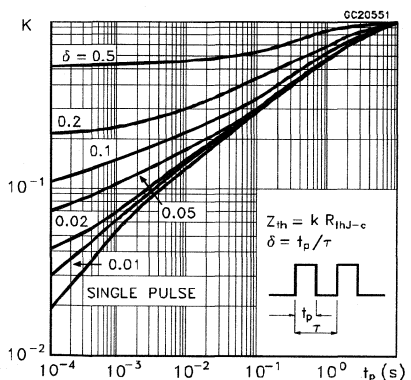
Safe Operating Area For ISOWATT220



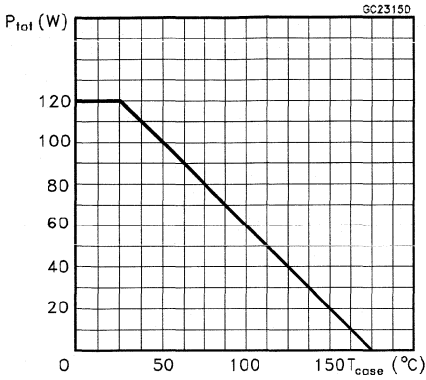
Thermal Impedance For TO-220



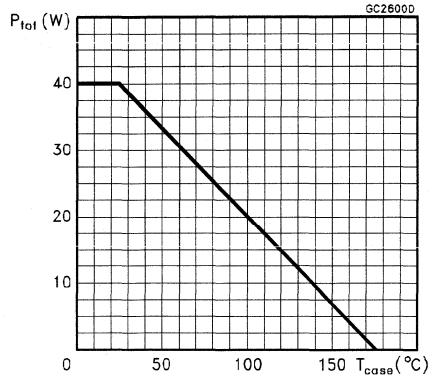
Thermal Impedance For ISOWATT220



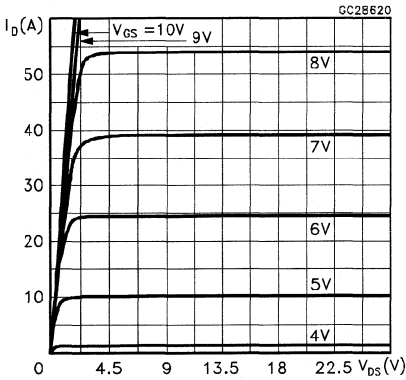
Derating Curve For TO-220



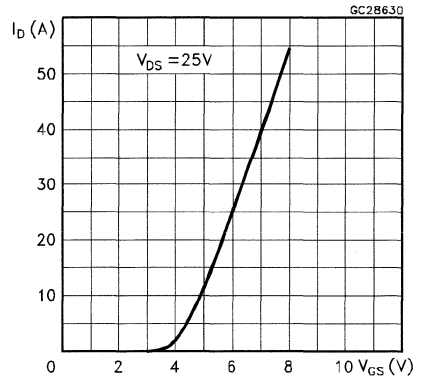
Derating Curve For ISOWATT220



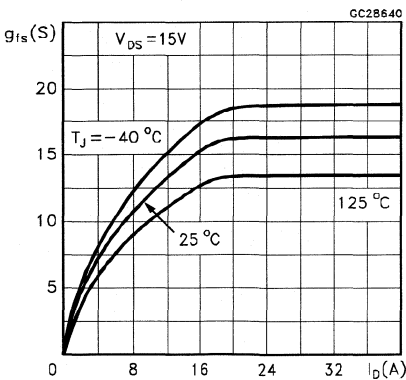
Output Characteristics



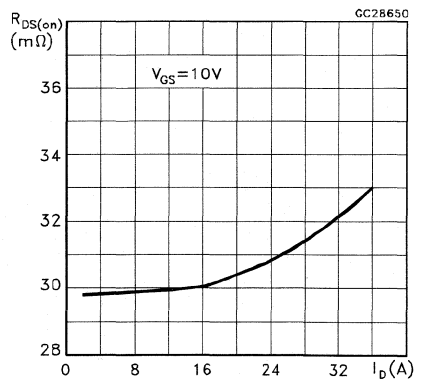
Transfer Characteristics



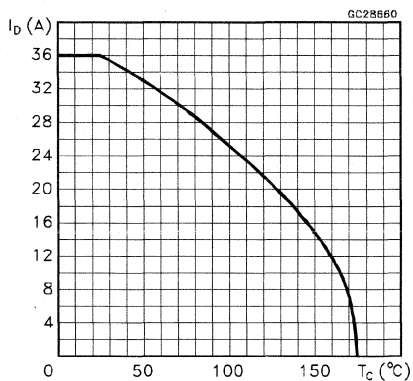
Transconductance



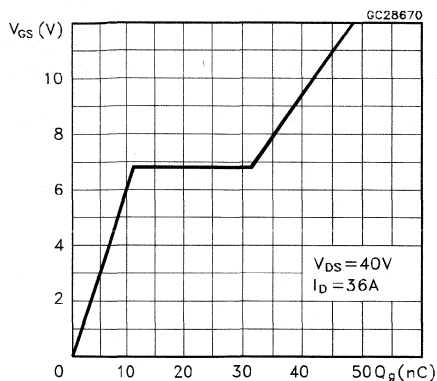
Static Drain-Source On Resistance



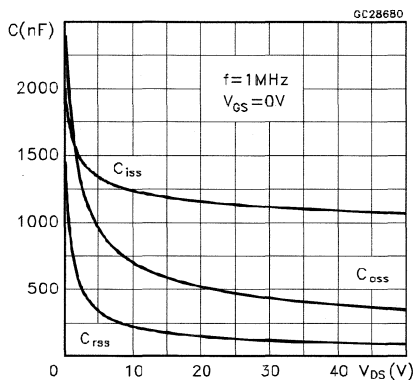
Maximum Drain Current vs Temperature



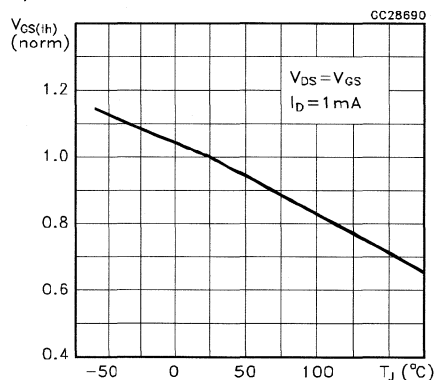
Gate Charge vs Gate-Source Voltage



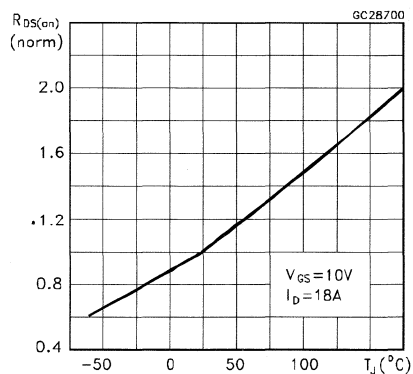
Capacitance Variation



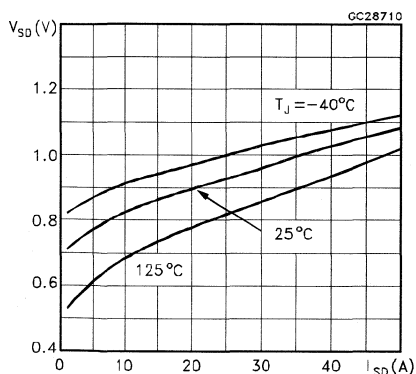
Normalized Gate Threshold Voltage vs Temperature



Normalized On Resistance vs Temperature



Source-Drain Diode Forward Characteristics



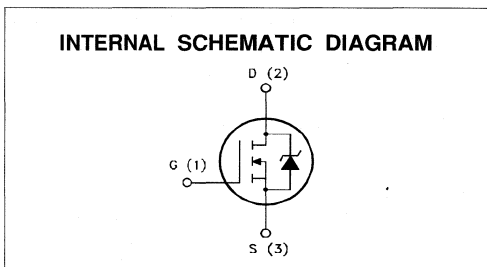
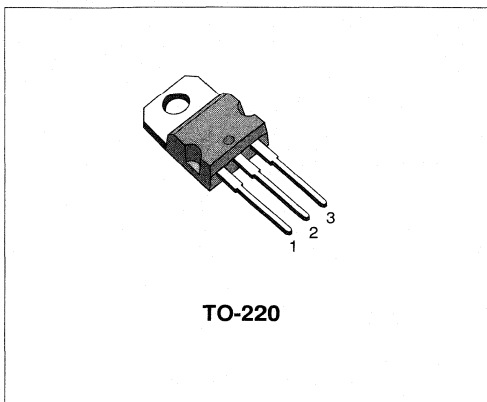
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

TYPE	V _{DSS}	R _{DS(on)}	I _D
BUZ11A	50 V	< 0.055 Ω	27 A

- TYPICAL R_{DS(on)} = 0.048 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	50	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	50	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	27	A
I _{DM}	Drain Current (pulsed)	108	A
P _{tot}	Total Dissipation at T _c = 25 °C	90	W
T _{stg}	Storage Temperature	-65 to 175	°C
T _j	Max. Operating Junction Temperature	175	°C
	DIN Humidity Category (DIN 40040)	E	
	IEC Climatic Category (DIN IEC 68-1)	55/150/56	

THERMAL DATA

R _{thj-case}	Thermal Resistance Junction-case	Max	1.67	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5	°C/W

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	27	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	140	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	35	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	19	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	50			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating T _j = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 1 mA	2.1	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10 V I _D = 15 A		0.048	0.055	Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} = 25 V I _D = 15 A	8	13		S
C _{ISS}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		700	900	pF
C _{OSS}	Output Capacitance			320	450	pF
C _{RSS}	Reverse Transfer Capacitance			90	150	pF

SWITCHING

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t _{d(on)}	Turn-on Time	V _{DD} = 30 V I _D = 3 A R _{GS} = 50 Ω V _{GS} = 10 V		30	45	ns
t _r	Rise Time			90	130	ns
t _{d(off)}	Turn-off Delay Time			210	300	ns
t _f	Fall Time			105	150	ns

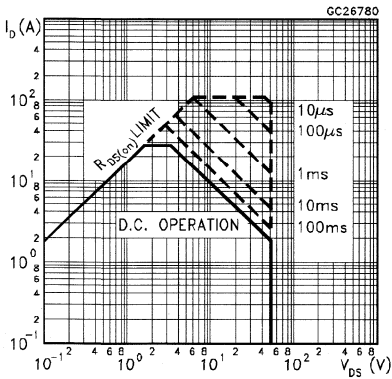
ELECTRICAL CHARACTERISTICS (continued)

SOURCE DRAIN DIODE

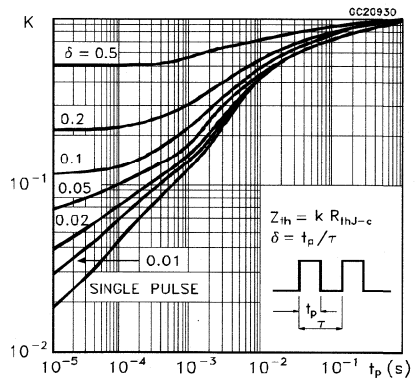
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				27	A
I_{SDM}	Source-drain Current (pulsed)				108	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 54 \text{ A}$ $V_{GS} = 0$			2.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 27 \text{ A}$ $di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 30 \text{ V}$ $T_j = 150 \text{ }^\circ\text{C}$		100		ns
Q_{rr}	Reverse Recovery Charge			0.25		μC

(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

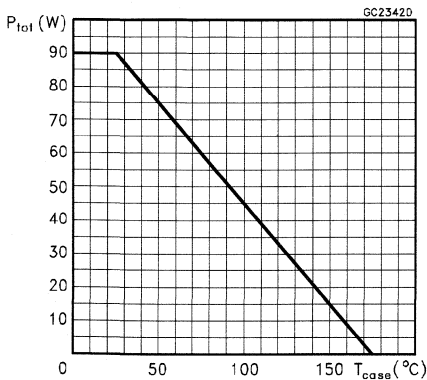
Safe Operating Area



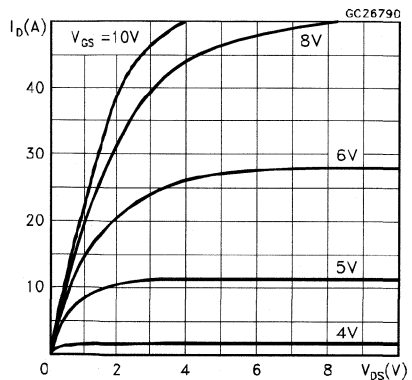
Thermal Impedance



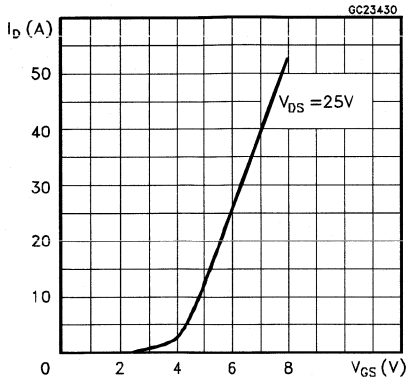
Derating Curve



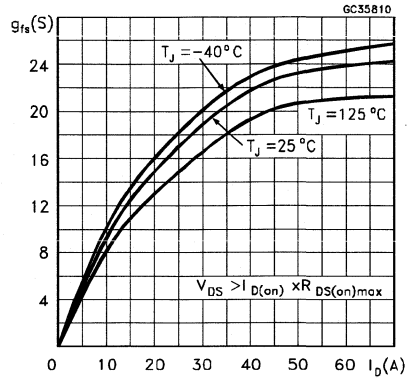
Output Characteristics



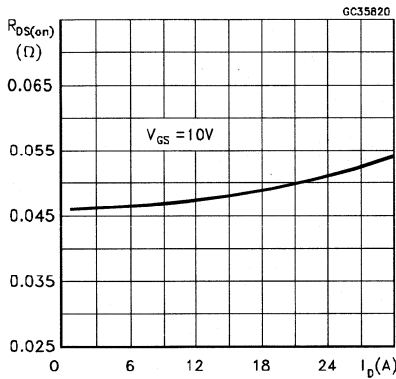
Transfer Characteristics



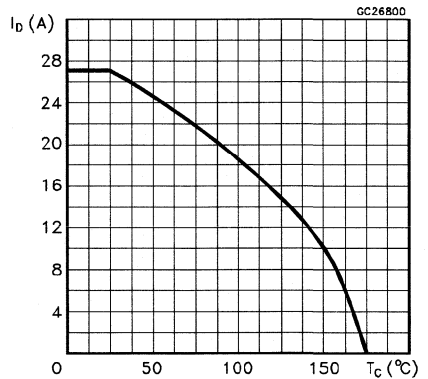
Transconductance



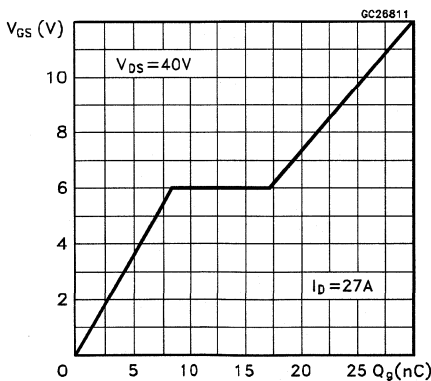
Static Drain-Source On Resistance



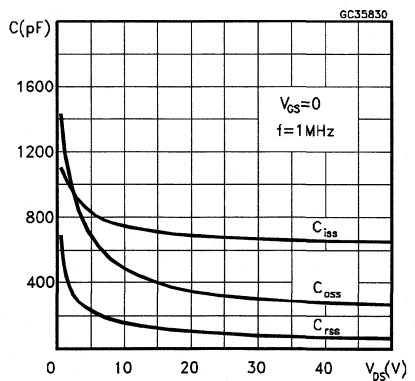
Maximum Drain Current vs Temperature



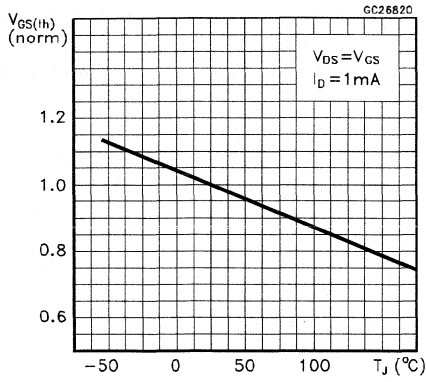
Gate Charge vs Gate-Source Voltage



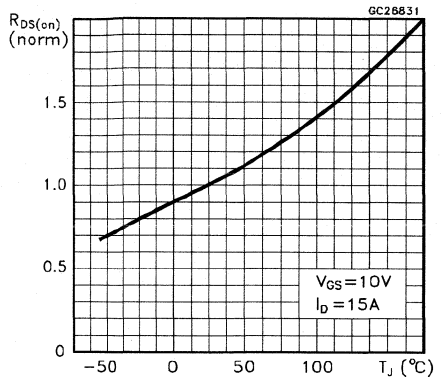
Capacitance Variation



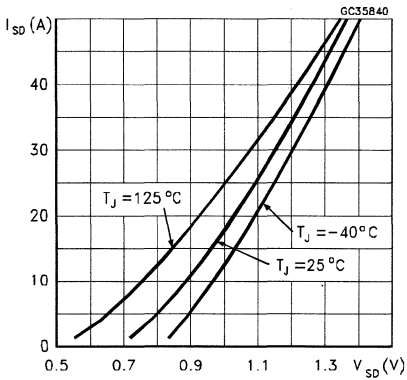
Normalized Gate Threshold Voltage vs Temperature



Normalized On Resistance vs Temperature



Source-Drain Diode Forward Characteristics



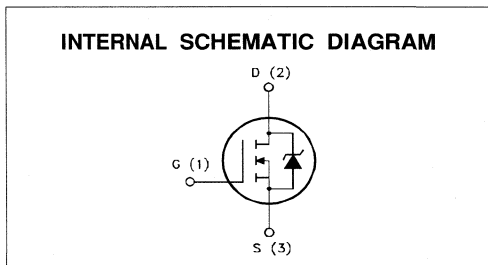
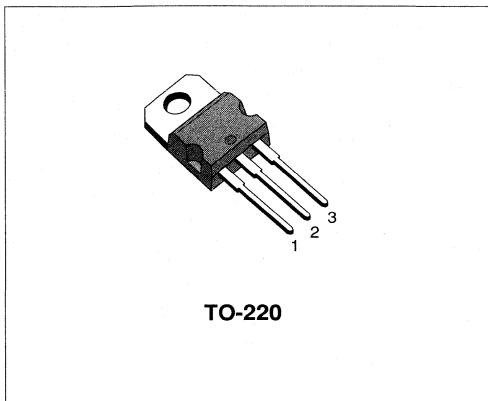
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

TYPE	V _{DSS}	R _{DS(on)}	I _D
BUZ21	100 V	< 0.1 Ω	21 A

- TYPICAL R_{DS(on)} = 0.09 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	100	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	100	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	21	A
I _{DM}	Drain Current (pulsed)	84	A
P _{tot}	Total Dissipation at T _c = 25 °C	105	W
T _{stg}	Storage Temperature	-65 to 175	°C
T _j	Max. Operating Junction Temperature	175	°C
	DIN Humidity Category (DIN 40040)	E	
	IEC Climatic Category (DIN IEC 68-1)	55/150/56	

THERMAL DATA

R _{thj-case}	Thermal Resistance Junction-case	Max	1.43	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5	°C/W

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	21	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	60	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	15	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	14	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	100			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating T _j = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 1 mA	2.1	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10 V I _D = 9 A		0.09	0.1	Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} = 15 V I _D = 9 A	4	11		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		800	1100	pF
C _{oss}	Output Capacitance			200	300	pF
C _{rss}	Reverse Transfer Capacitance			40	60	pF

SWITCHING

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t _{d(on)}	Turn-on Time	V _{DD} = 30 V I _D = 3 A R _{GS} = 50 Ω V _{GS} = 10 V		25	35	ns
t _r	Rise Time			75	110	ns
t _{d(off)}	Turn-off Delay Time			200	280	ns
t _f	Fall Time			80	120	ns

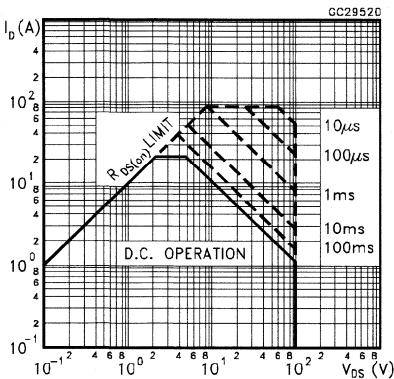
ELECTRICAL CHARACTERISTICS (continued)

SOURCE DRAIN DIODE

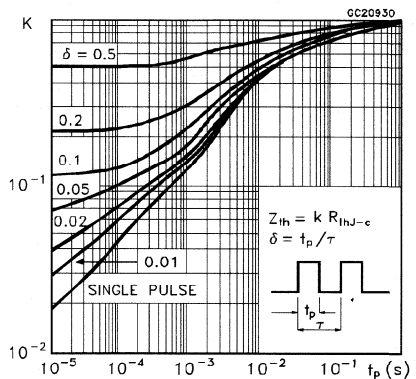
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				21	A
I_{SDM}	Source-drain Current (pulsed)				84	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 38\text{ A}$ $V_{GS} = 0$			2.1	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 19\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 20\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		125		ns
Q_{rr}	Reverse Recovery Charge			0.44		μC

(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

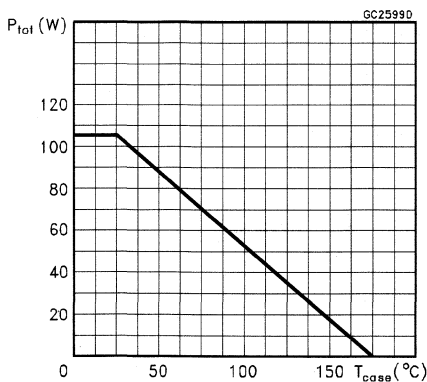
Safe Operating Area



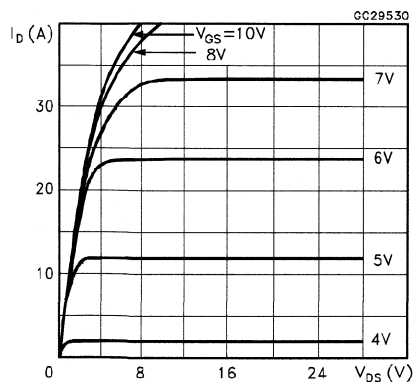
Thermal Impedance



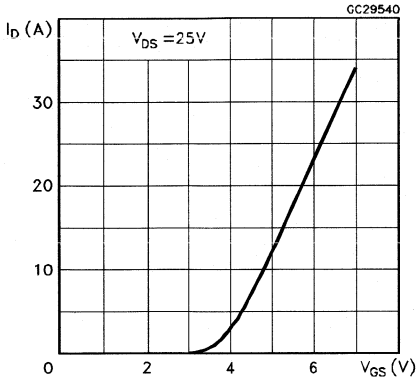
Derating Curve



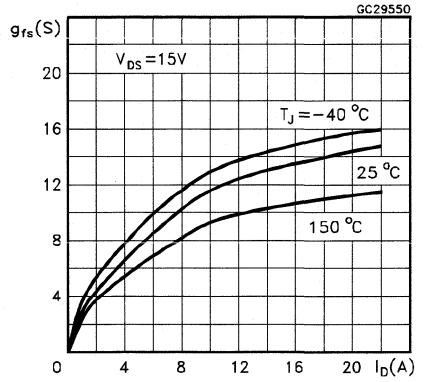
Output Characteristics



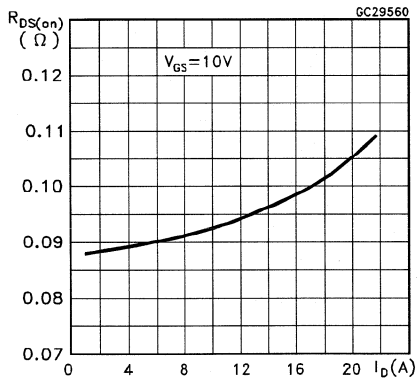
Transfer Characteristics



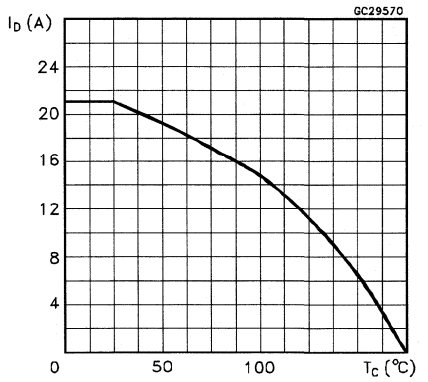
Transconductance



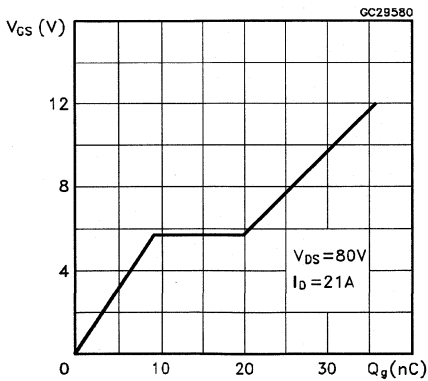
Static Drain-Source On Resistance



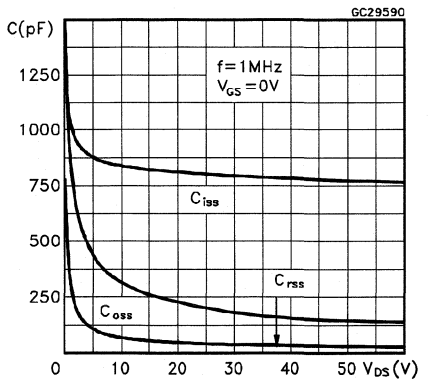
Maximum Drain Current vs Temperature



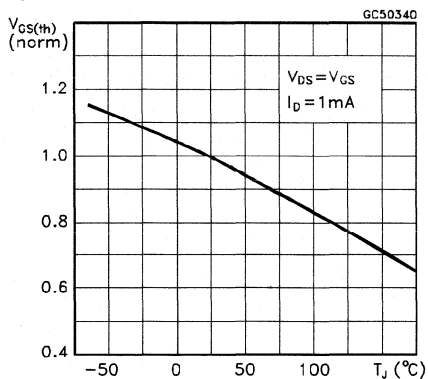
Gate Charge vs Gate-Source Voltage



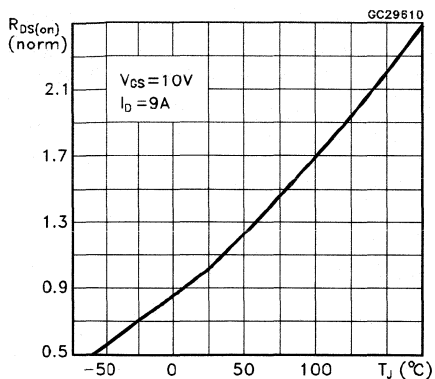
Capacitance Variation



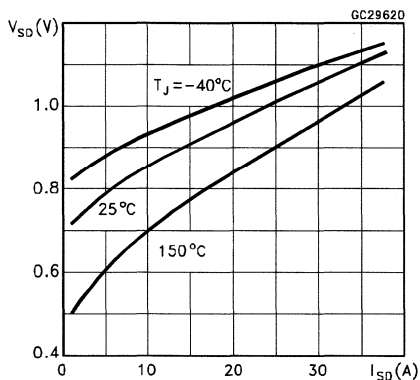
Normalized Gate Threshold Voltage vs Temperature



Normalized On Resistance vs Temperature



Source-Drain Diode Forward Characteristics



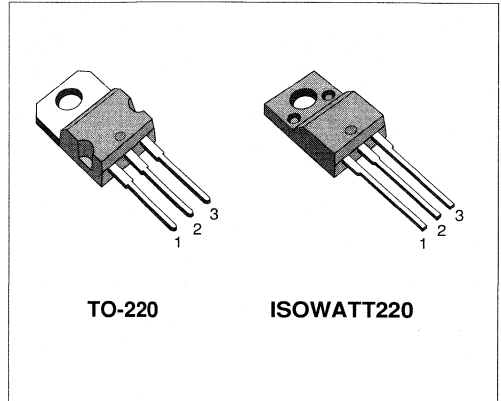
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

TYPE	V _{DS}	R _{DS(on)}	I _D
BUZ71	50 V	< 0.1 Ω	18 A
BUZ71FI	50 V	< 0.1 Ω	12 A

- TYPICAL R_{DS(on)} = 0.06 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE

APPLICATIONS

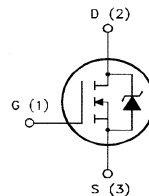
- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



TO-220

ISOWATT220

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		BUZ71	BUZ71FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	50		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	50		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	18	12	A
I _{DM}	Drain Current (pulsed)	72	72	A
P _{tot}	Total Dissipation at T _c = 25 °C	80	35	W
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C
	DIN Humidity Category (DIN 40040)	E		
	IEC Climatic Category (DIN IEC 68-1)	55/150/56		

THERMAL DATA

				TO-220	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case	Max		1.88	4.29	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max		62.5		°C/W

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	18	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	60	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	15	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	12	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	50			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating T _j = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 1 mA	2.1	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10 V I _D = 9 A		0.06	0.1	Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} = 25 V I _D = 9 A	5	8		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		520	700	pF
C _{oss}	Output Capacitance			250	350	pF
C _{rss}	Reverse Transfer Capacitance			80	120	pF

SWITCHING

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t _{d(on)}	Turn-on Time	V _{DD} = 30 V I _D = 3 A R _{GS} = 50 Ω V _{GS} = 10 V		45	65	ns
t _r	Rise Time			65	95	ns
t _{d(off)}	Turn-off Delay Time			115	160	ns
t _f	Fall Time			80	120	ns

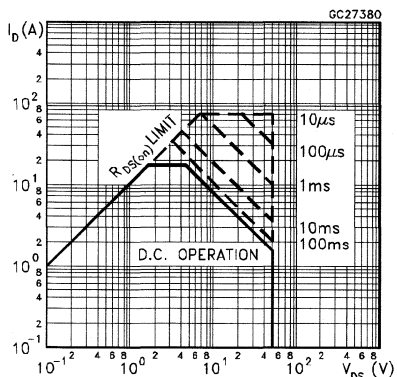
ELECTRICAL CHARACTERISTICS (continued)

SOURCE DRAIN DIODE

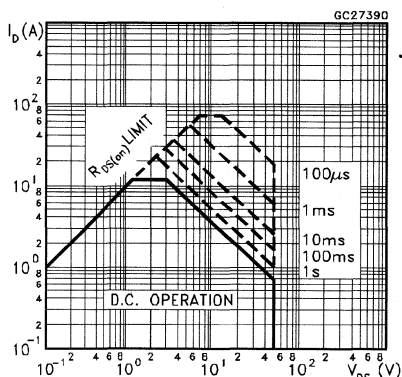
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				18	A
I_{SDM}	Source-drain Current (pulsed)				72	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 36 \text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 18 \text{ A}$ $di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 15 \text{ V}$ $T_j = 150 \text{ }^\circ\text{C}$		85		ns
Q_{rr}	Reverse Recovery Charge			0.13		μC

(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

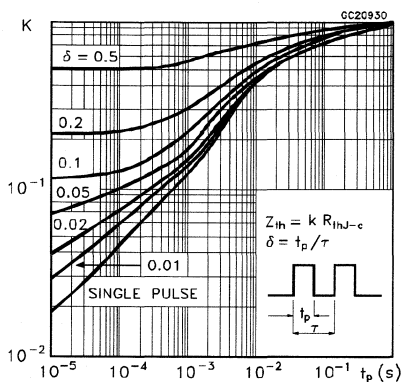
Safe Operating Area For TO-220 Package



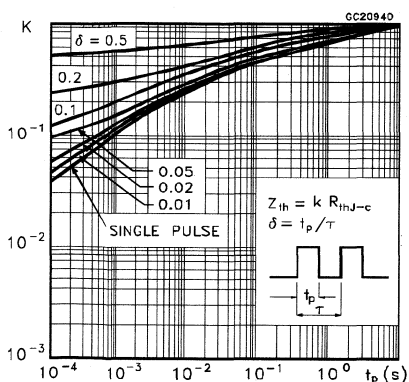
Safe Operating Area For ISOWATT220 Package



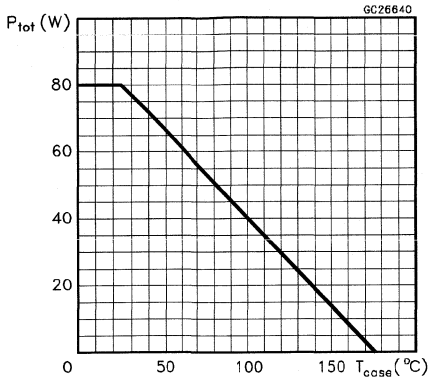
Thermal Impedance For TO-220 Package



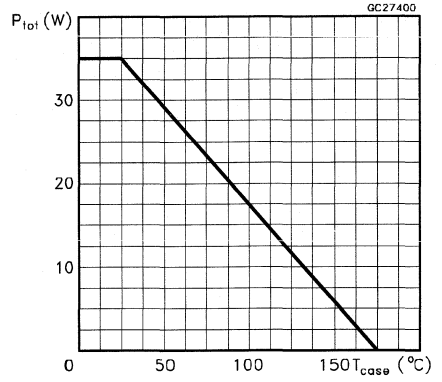
Thermal Impedance For ISOWATT220 Package



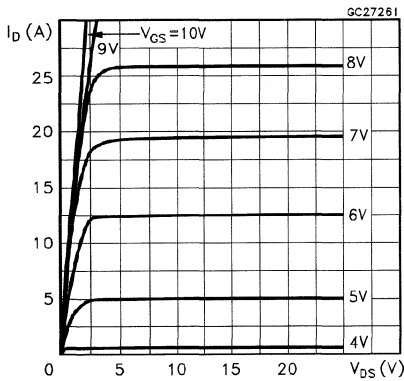
Derating Curve For TO-220 Package



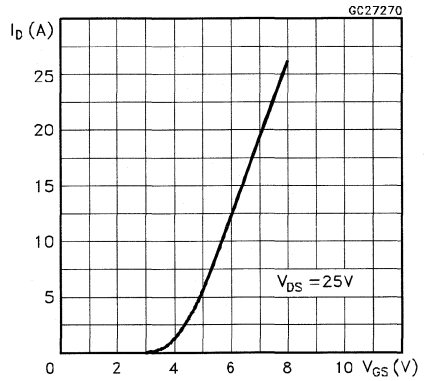
Derating Curve For ISOWATT220 Package



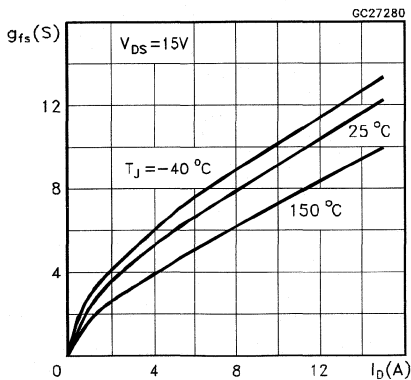
Output Characteristics



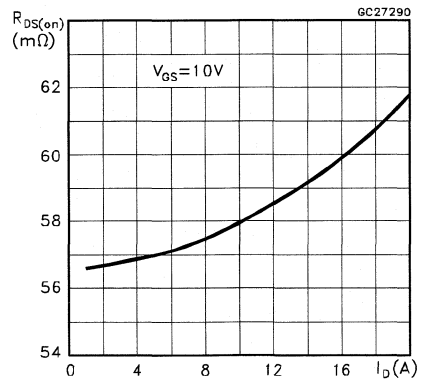
Transfer Characteristics



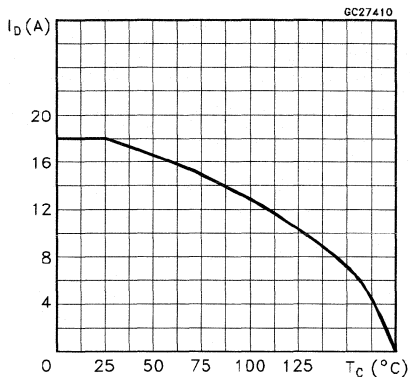
Transconductance



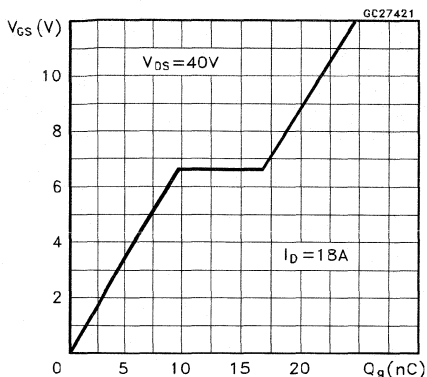
Static Drain-Source On Resistance



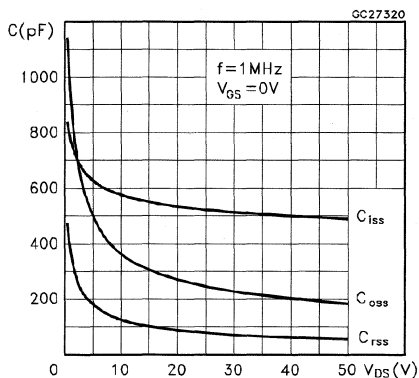
Maximum Drain Current vs Temperature



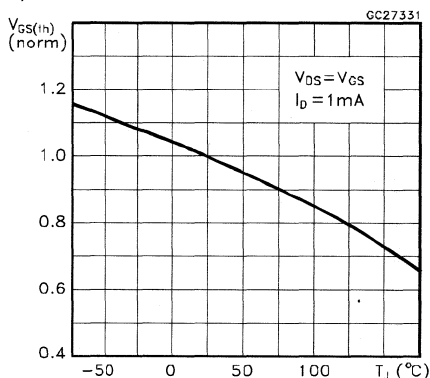
Gate Charge vs Gate-Source Voltage



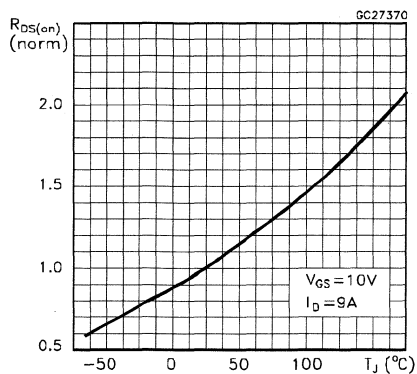
Capacitance Variation



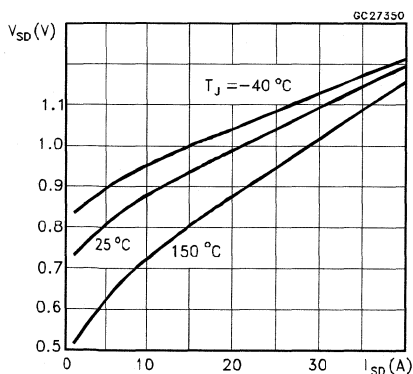
Normalized Gate Threshold Voltage vs Temperature



Normalized On Resistance vs Temperature



Source-Drain Diode Forward Characteristics



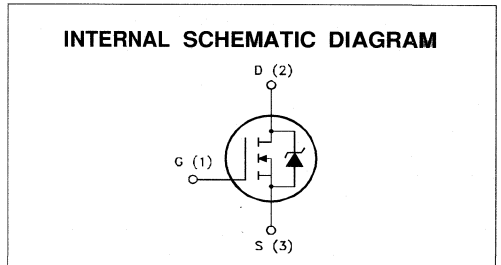
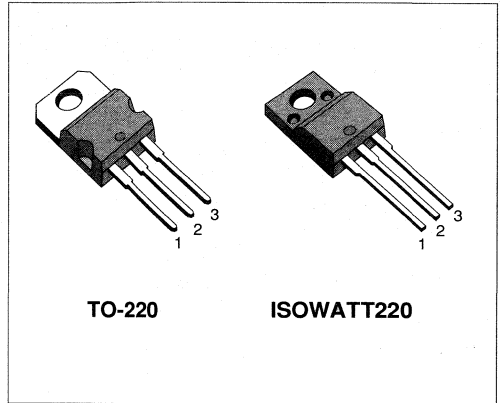
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

TYPE	V _{DSS}	R _{DS(on)}	I _D
BUZ71A	50 V	< 0.12 Ω	16 A
BUZ71AFI	50 V	< 0.12 Ω	11 A

- TYPICAL R_{DS(on)} = 0.1 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		BUZ71A	BUZ71AFI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	50		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	50		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	16	11	A
I _{DM}	Drain Current (pulsed)	64	64	A
P _{tot}	Total Dissipation at T _c = 25 °C	70	35	W
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C
	DIN Humidity Category (DIN 40040)	E		
	IEC Climatic Category (DIN IEC 68-1)	55/150/56		

THERMAL DATA

			TO-220	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case	Max	2.14	4.29	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5		°C/W

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	16	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	50	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	10	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	11	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	50			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating T _j = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 1 mA	2.1	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10 V I _D = 8 A		0.1	0.12	Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} = 25 V I _D = 8 A	3	6.5		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		330	450	pF
C _{oss}	Output Capacitance			150	250	pF
C _{rss}	Reverse Transfer Capacitance			40	60	pF

SWITCHING

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t _{d(on)}	Turn-on Time	V _{DD} = 25 V I _D = 8 A		50	70	ns
t _r	Rise Time	R _{GS} = 50 Ω V _{GS} = 10 V		100	140	ns
t _{d(off)}	Turn-off Delay Time			40	60	ns
t _f	Fall Time			45	65	ns

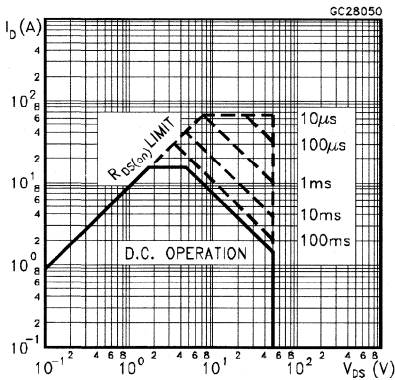
ELECTRICAL CHARACTERISTICS (continued)

SOURCE DRAIN DIODE

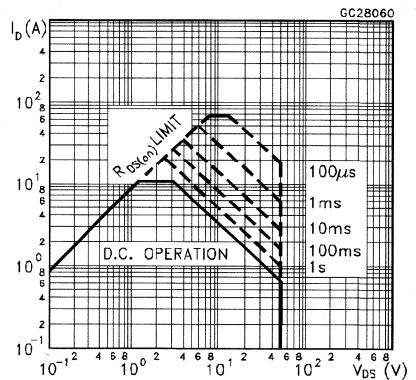
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				16	A
I_{SDM}	Source-drain Current (pulsed)				64	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 32 \text{ A}$ $V_{GS} = 0$			2.2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 16 \text{ A}$ $di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 25 \text{ V}$ $T_j = 150 \text{ }^\circ\text{C}$		70		ns
Q_{rr}	Reverse Recovery Charge			0.14		μC

(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

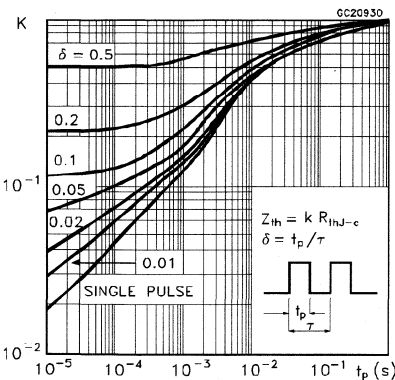
Safe Operating Area For TO-220



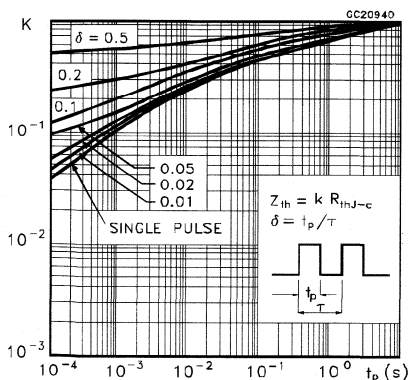
Safe Operating Area For ISOWATT220



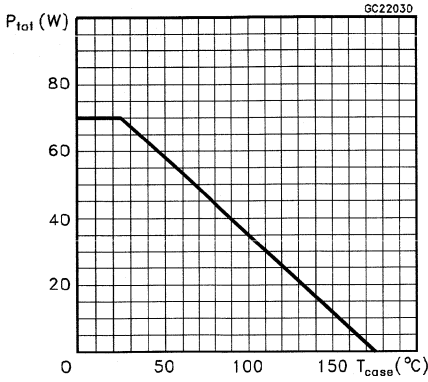
Thermal Impedance For TO-220



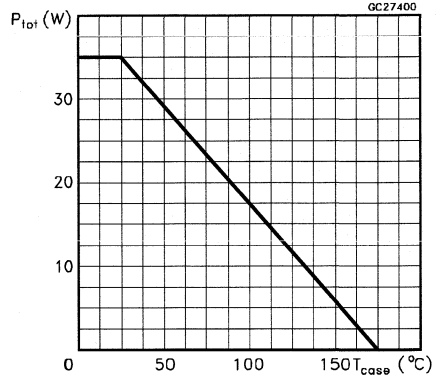
Thermal Impedance For ISOWATT220



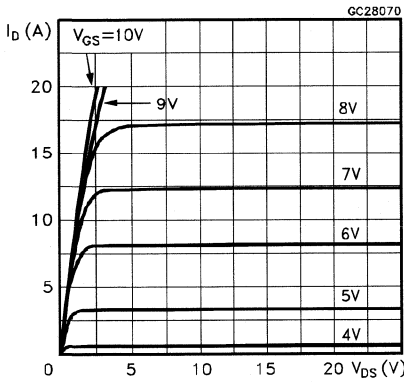
Derating Curve For TO-220



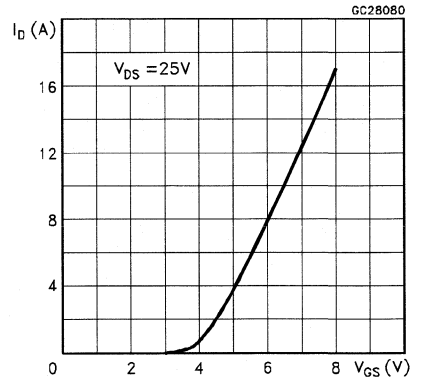
Derating Curve For ISOWATT220



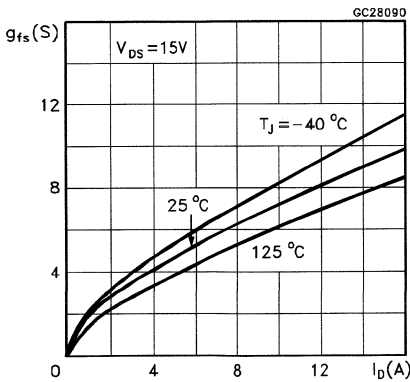
Output Characteristics



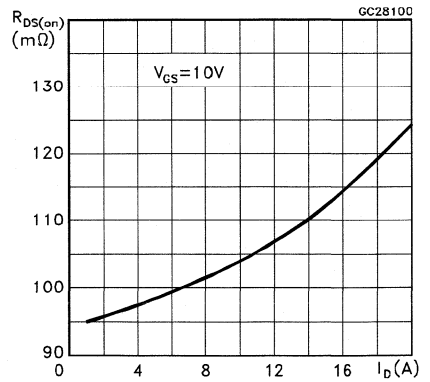
Transfer Characteristics



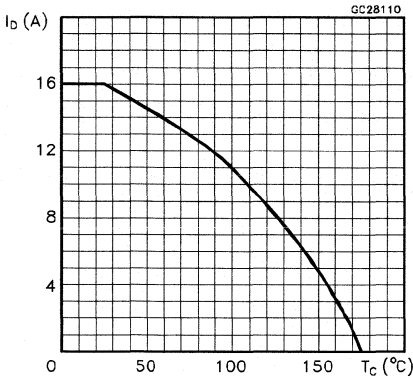
Transconductance



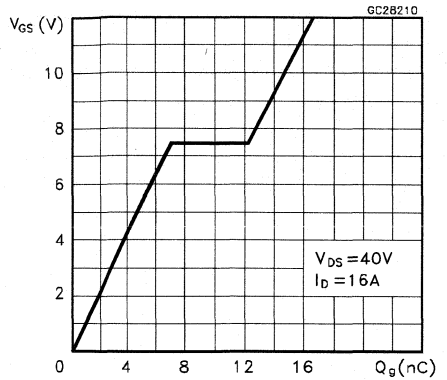
Static Drain-Source On Resistance



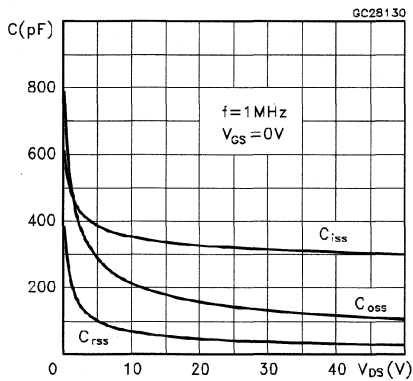
Maximum Drain Current vs Temperature



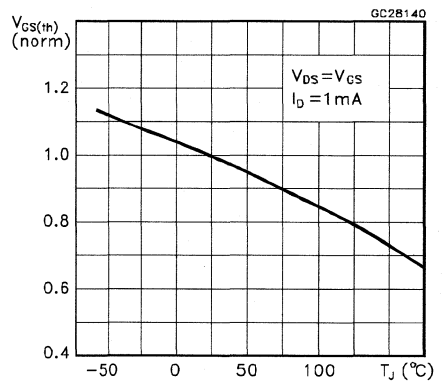
Gate Charge vs Gate-Source Voltage



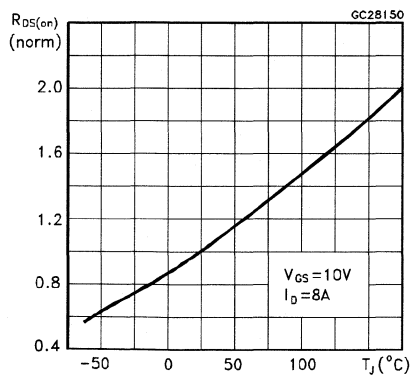
Capacitance Variation



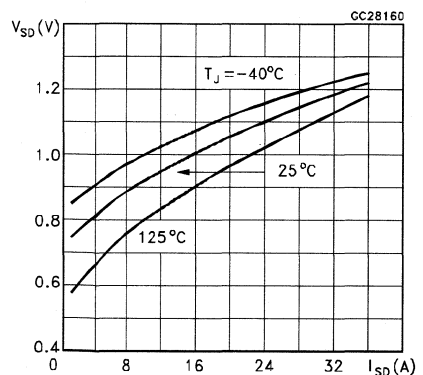
Normalized Gate Threshold Voltage vs Temperature



Normalized On Resistance vs Temperature



Source-Drain Diode Forward Characteristics



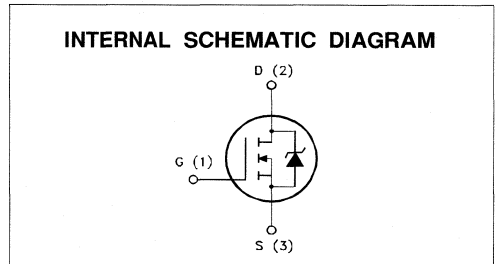
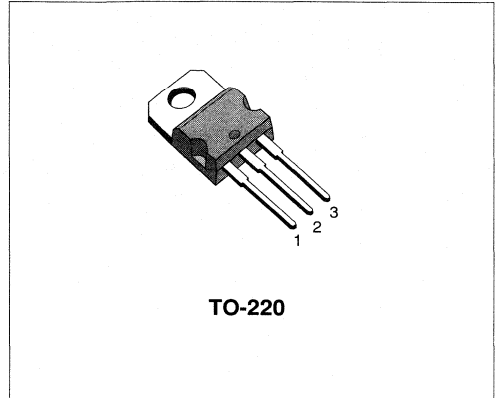
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

TYPE	V _{DSS}	R _{DS(on)}	I _D
BUZ72A	100 V	< 0.25 Ω	11 A

- TYPICAL R_{DS(on)} = 0.23 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	100	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	100	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	11	A
I _{DM}	Drain Current (pulsed)	44	A
P _{tot}	Total Dissipation at T _c = 25 °C	70	W
T _{stg}	Storage Temperature	-65 to 175	°C
T _j	Max. Operating Junction Temperature	175	°C
	DIN Humidity Category (DIN 40040)	E	
	IEC Climatic Category (DIN IEC 68-1)	55/150/56	

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	2.14	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5	°C/W

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	11	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ °C}$, $I_D = I_{AR}$, $V_{DD} = 25\text{ V}$)	36	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	9	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ °C}$, pulse width limited by T_j max, $\delta < 1\%$)	7	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$	100			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating}$ $T_j = 125\text{ °C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\text{ }\mu\text{A}$	2	2.9	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 5\text{ A}$		0.23	0.25	Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} = 25\text{ V}$ $I_D = 5\text{ A}$	2.7	4.5		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		330	450	pF
C_{oss}	Output Capacitance			90	120	pF
C_{riss}	Reverse Transfer Capacitance			25	40	pF

SWITCHING

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 50\text{ V}$ $I_D = 5.5\text{ A}$ $R_{GS} = 4.7\text{ }\Omega$ $V_{GS} = 10\text{ V}$		10	15	ns
t_r	Rise Time			50	75	ns
$t_{d(off)}$	Turn-off Delay Time			25	40	ns
t_f	Fall Time			20	30	ns

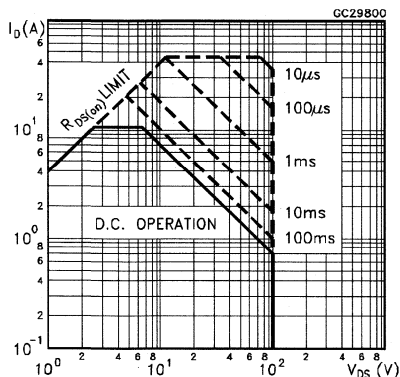
ELECTRICAL CHARACTERISTICS (continued)

SOURCE DRAIN DIODE

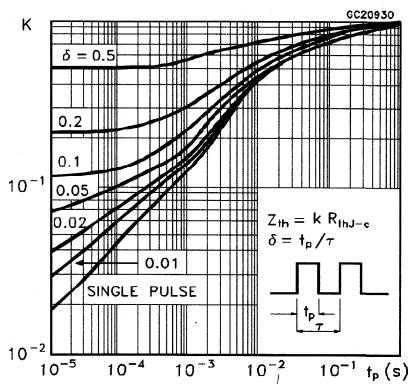
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				11	A
I_{SDM}	Source-drain Current (pulsed)				44	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 22 \text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 11 \text{ A}$ $dI/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 20 \text{ V}$ $T_j = 150 \text{ }^\circ\text{C}$		80		ns
Q_{rr}	Reverse Recovery Charge			0.22		μC

(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

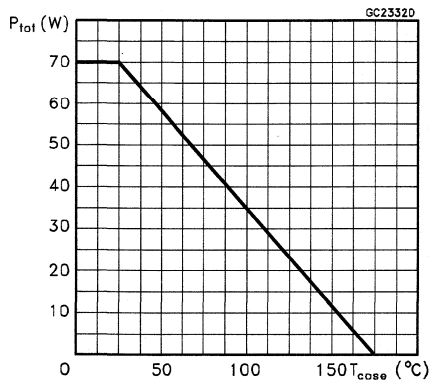
Safe Operating Area



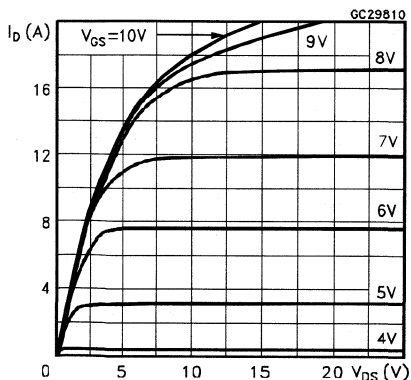
Thermal Impedance



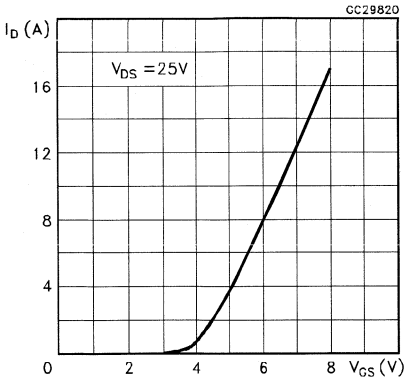
Derating Curve



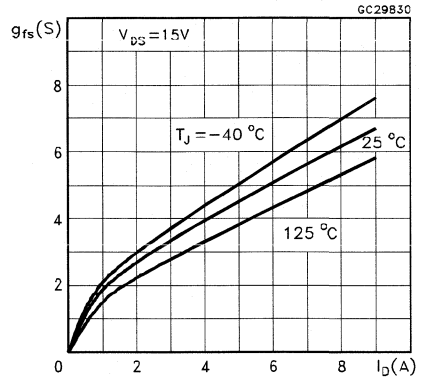
Output Characteristics



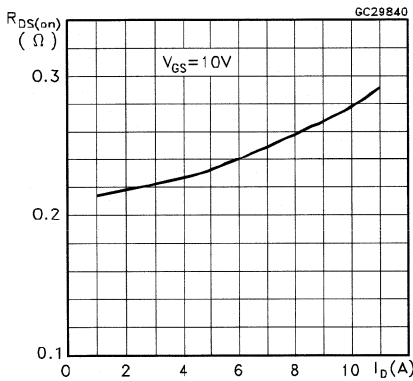
Transfer Characteristics



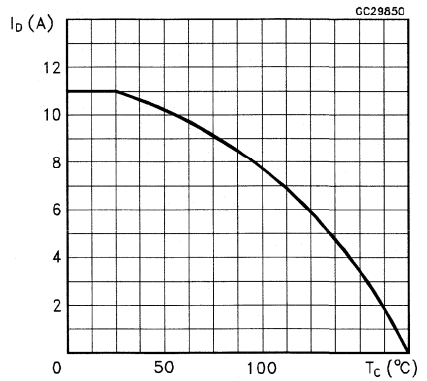
Transconductance



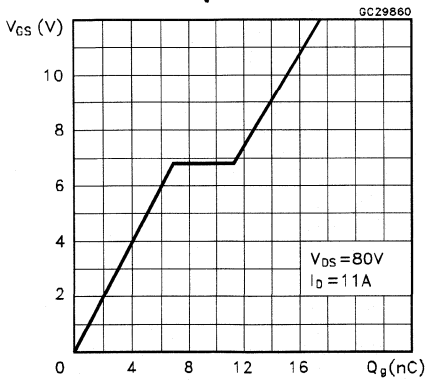
Static Drain-Source On Resistance



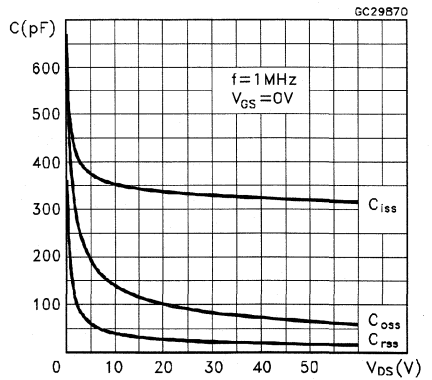
Maximum Drain Current vs Temperature



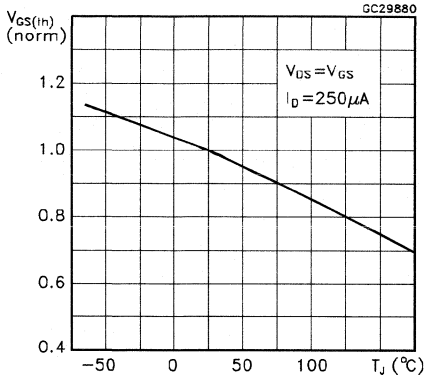
Gate Charge vs Gate-Source Voltage



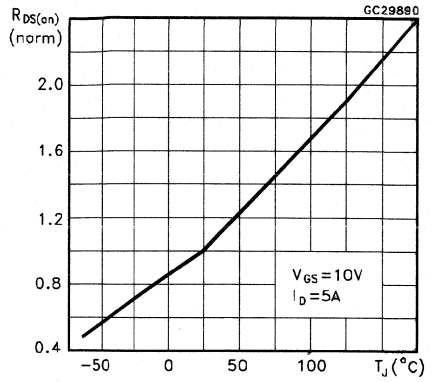
Capacitance Variation



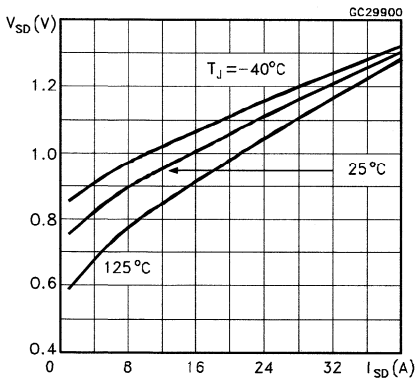
Normalized Gate Threshold Voltage vs Temperature



Normalized On Resistance vs Temperature



Source-Drain Diode Forward Characteristics



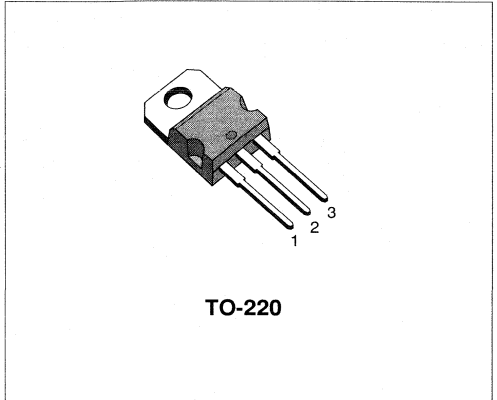
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

TYPE	V _{DSS}	R _{DS(on)}	I _D
BUZ76A	400 V	< 2.5 Ω	3.8 A

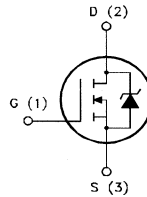
- TYPICAL R_{DS(on)} = 1.65 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	400	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	400	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 30 °C	3.8	A
I _{DM}	Drain Current (pulsed)	16	A
P _{tot}	Total Dissipation at T _c = 25 °C	75	W
T _{stg}	Storage Temperature	-65 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C
	DIN Humidity Category (DIN 40040)	E	
	IEC Climatic Category (DIN IEC 68-1)	55/150/56	

THERMAL DATA

$R_{th(j-case)}$	Thermal Resistance Junction-case	Max	3.57	°C/W
$R_{th(j-amb)}$	Thermal Resistance Junction-ambient	Max	62.5	°C/W

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	3.8	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ °C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	100	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	6.8	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ °C}$, pulse width limited by T_j max, $\delta < 1\%$)	2.3	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$	400			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating}$ $T_j = 125\text{ °C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 1\text{ mA}$	2.1	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 1.5\text{ A}$		1.65	2.5	Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} = 25\text{ V}$ $I_D = 1.5\text{ A}$	0.8	1.5		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		360	450	pF
C_{oss}	Output Capacitance			68	90	pF
C_{rss}	Reverse Transfer Capacitance			32	45	pF

SWITCHING

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 175\text{ V}$ $I_D = 2\text{ A}$ $R_{GS} = 50\text{ }\Omega$ $V_{GS} = 10\text{ V}$		25	33	ns
t_r	Rise Time			70	90	ns
$t_{d(off)}$	Turn-off Delay Time			145	190	ns
t_f	Fall Time			50	65	ns

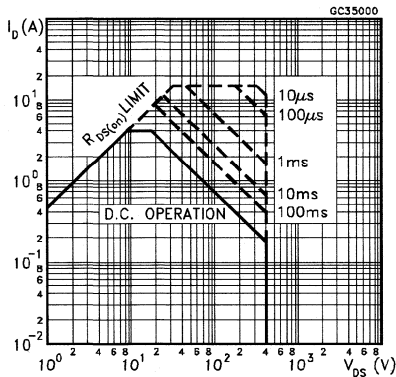
ELECTRICAL CHARACTERISTICS (continued)

SOURCE DRAIN DIODE

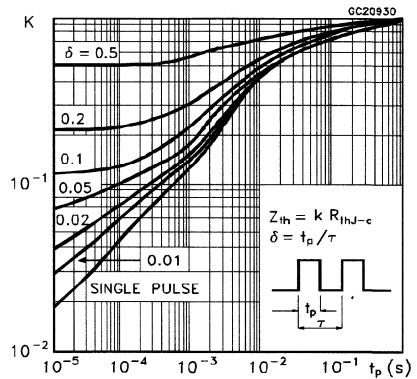
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM}	Source-drain Current Source-drain Current (pulsed)				3.8 16	A A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 5.2 \text{ A}$ $V_{GS} = 0$			1.4	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 4 \text{ A}$ $di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 100 \text{ V}$ $T_j = 150 \text{ }^\circ\text{C}$		400		ns
Q_{rr}	Reverse Recovery Charge			5.9		μC

(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

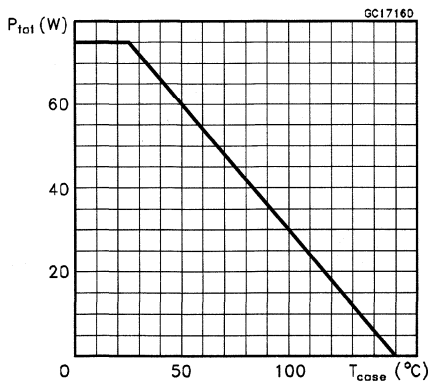
Safe Operating Area



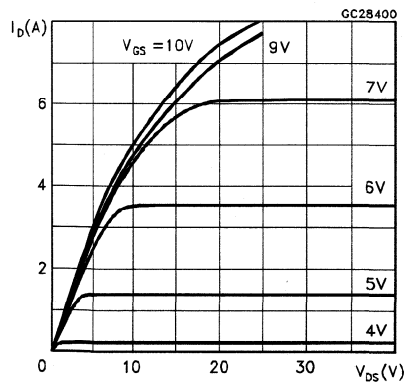
Thermal Impedance



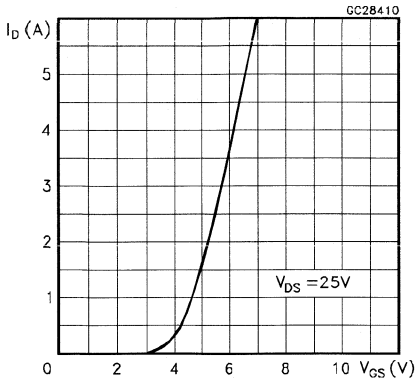
Derating Curve



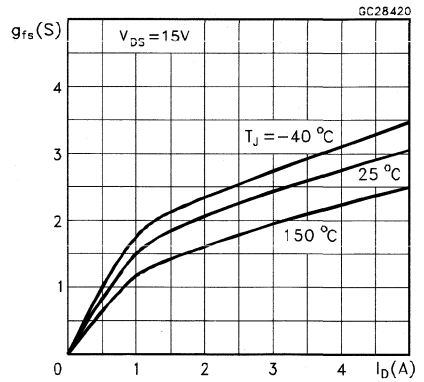
Output Characteristics



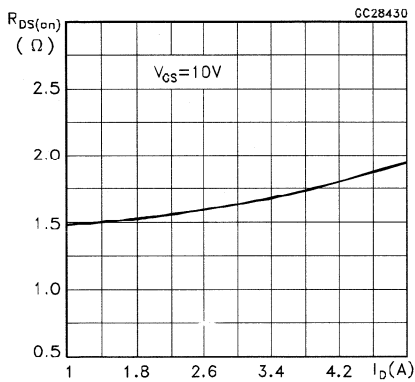
Transfer Characteristics



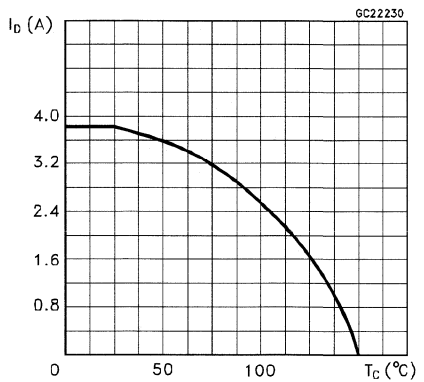
Transconductance



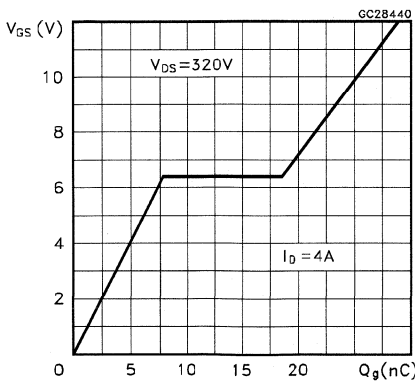
Static Drain-Source On Resistance



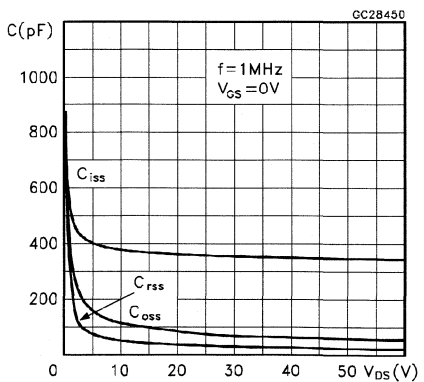
Maximum Drain Current vs Temperature



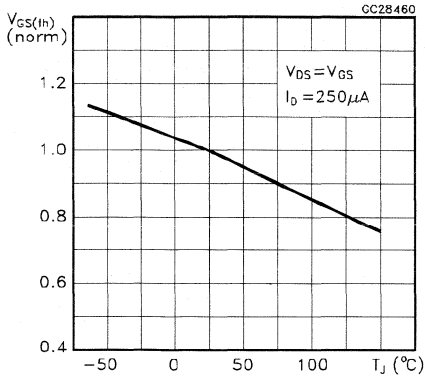
Gate Charge vs Gate-Source Voltage



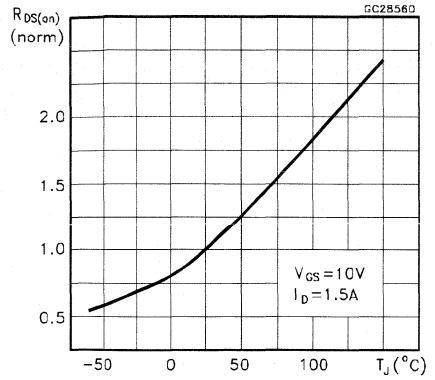
Capacitance Variation



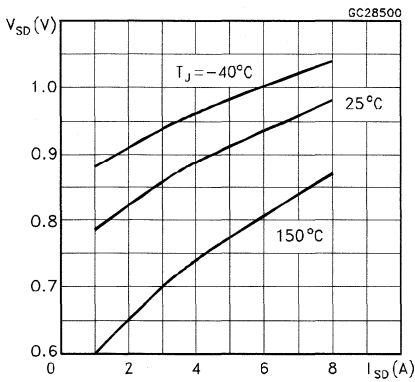
Normalized Gate Threshold Voltage vs Temperature



Normalized On Resistance vs Temperature



Source-Drain Diode Forward Characteristics



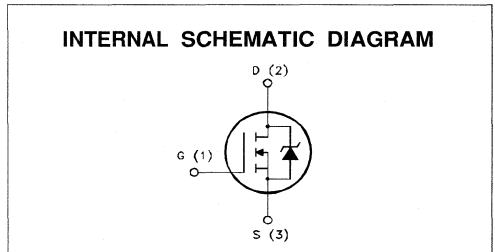
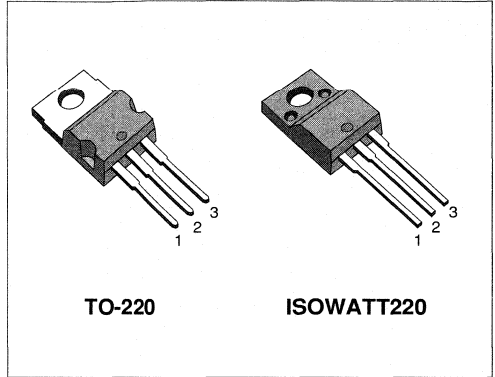
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
BUZ80	800 V	< 4 Ω	3.4 A
BUZ80FI	800 V	< 4 Ω	2.1 A

- TYPICAL R_{DS(on)} = 3.3 Ω
- AVALANCHE RUGGEDNESS TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INPUT CAPACITANCE
- LOW GATE CHARGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CONSUMER AND INDUSTRIAL LIGHTING
- DC-AC INVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLY (UPS)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		BUZ80	BUZ80FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	800		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	800		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	3.4	2.1	A
I _D	Drain Current (continuous) at T _c = 100 °C	2.1	1.3	A
I _{DM} (*)	Drain Current (pulsed)	13	13	A
P _{tot}	Total Dissipation at T _c = 25 °C	100	40	W
	Derating Factor	0.8	0.32	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case	Max	1.25	3.12	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.5		°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	3.4	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	180	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	4.8	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	2.1	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	800			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 1 mA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10 V I _D = 1.7 A V _{GS} = 10 V I _D = 1.7 A T _c = 100°C		3.3	4 8	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	3.4			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 1.7 A	1	3.5		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		650	850	pF
C _{oss}	Output Capacitance			82	105	pF
C _{rss}	Reverse Transfer Capacitance			28	40	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 30\text{ V}$ $I_D = 2.1\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)			50 110	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 640\text{ V}$ $I_D = 3\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		170		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 400\text{ V}$ $I_D = 3\text{ A}$ $V_{GS} = 10\text{ V}$		42 6 17	55	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 640\text{ V}$ $I_D = 3\text{ A}$		95	120	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		20	25	ns
t_c	Cross-over Time	(see test circuit, figure 5)		120	165	ns

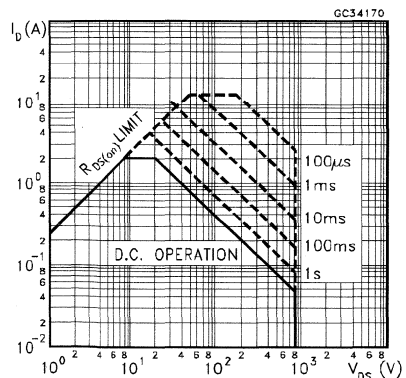
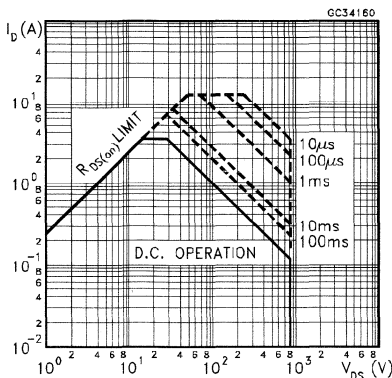
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				3.4 13	A A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 6\text{ A}$ $V_{GS} = 0$			2.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 3\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 80\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		700		ns
Q_{rr}	Reverse Recovery Charge			8.8		μ C
I_{RRM}	Reverse Recovery Current			25		A

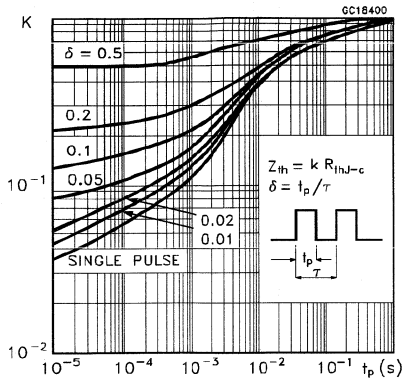
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %
 (•) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

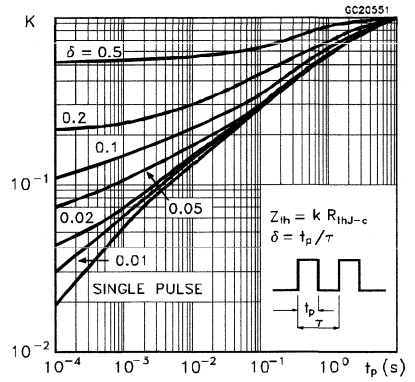
Safe Operating Areas For ISOWATT220



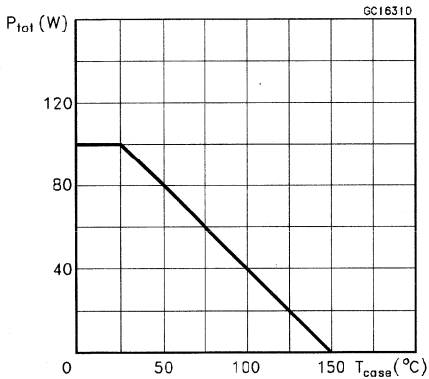
Thermal Impedance For TO-220



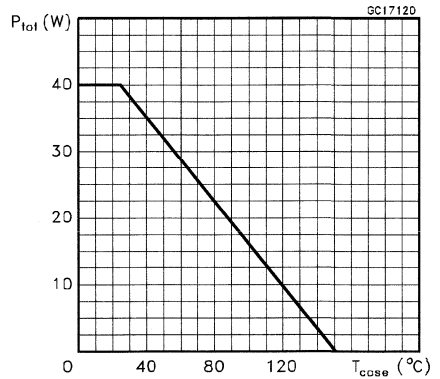
Thermal Impedance For ISOWATT220



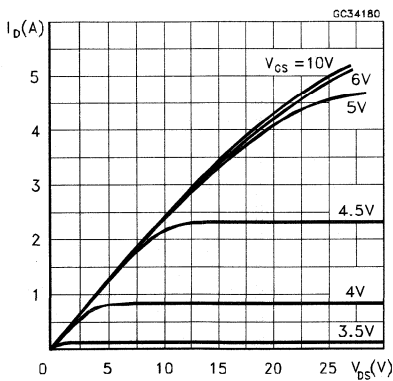
Derating Curve For TO-220



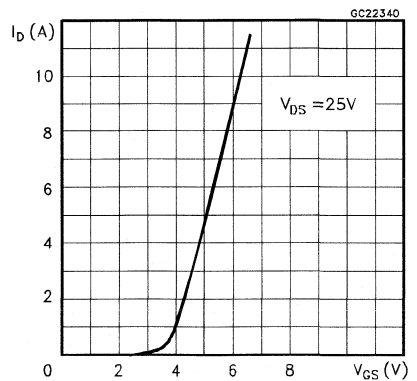
Derating Curve For ISOWATT220



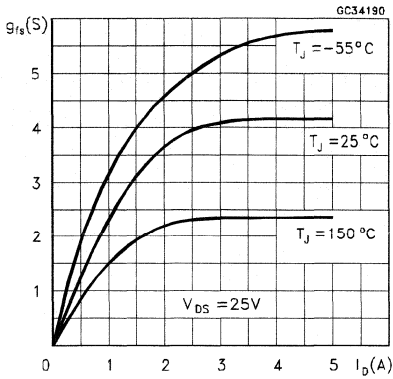
Output Characteristics



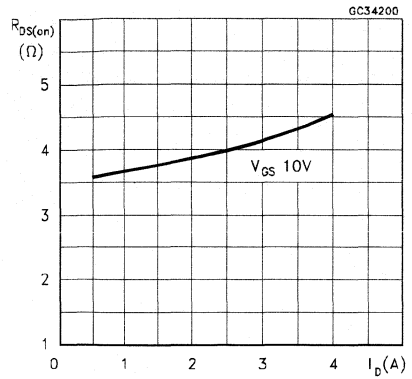
Transfer Characteristics



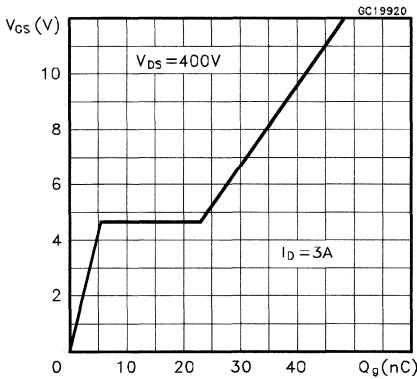
Transconductance



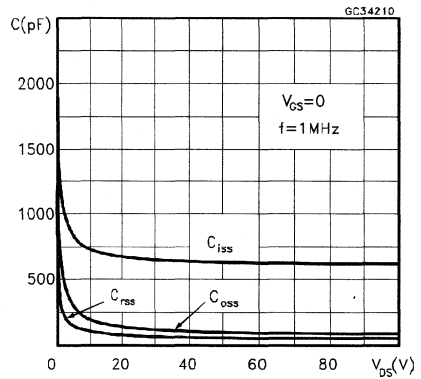
Static Drain-source On Resistance



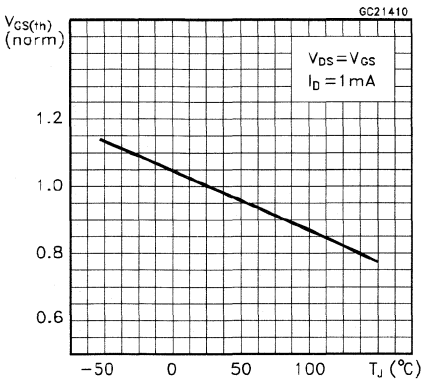
Gate Charge vs Gate-source Voltage



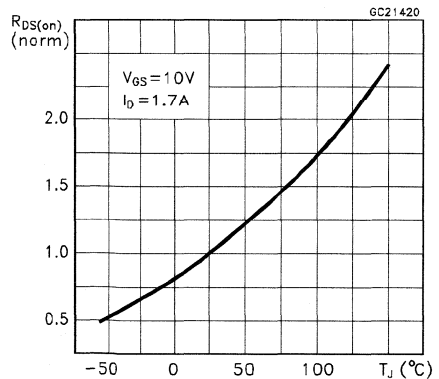
Capacitance Variations



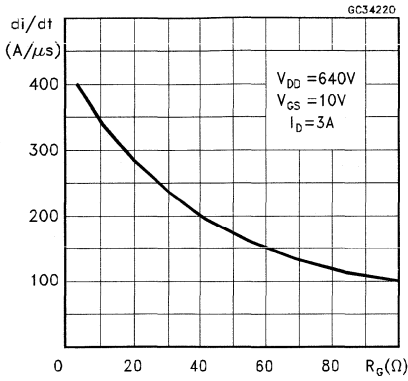
Normalized Gate Threshold Voltage vs Temperature



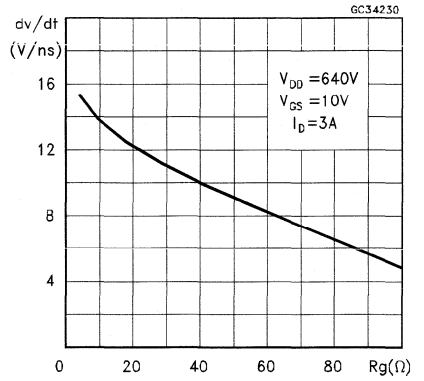
Normalized On Resistance vs Temperature



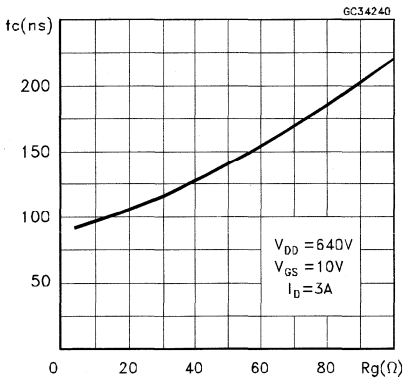
Turn-on Current Slope



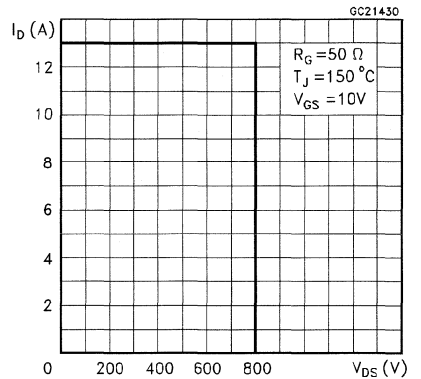
Turn-off Drain-source Voltage Slope



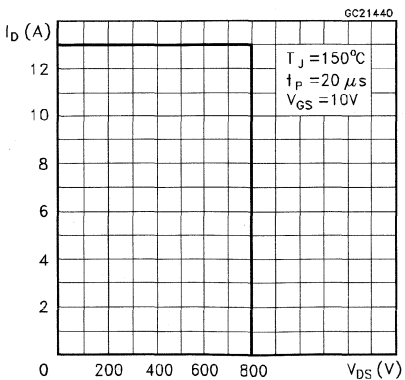
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

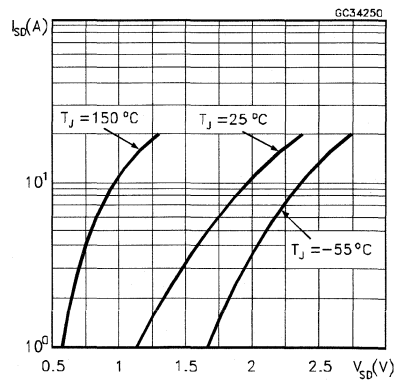


Fig. 1: Unclamped Inductive Load Test Circuits

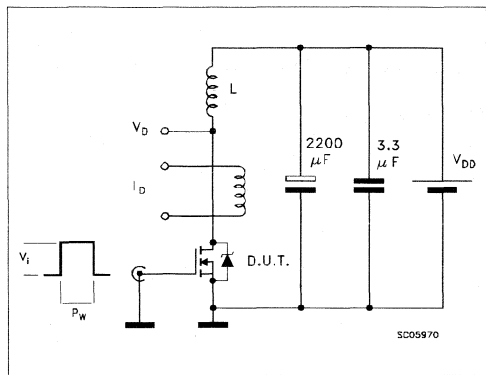


Fig. 2: Unclamped Inductive Waveforms

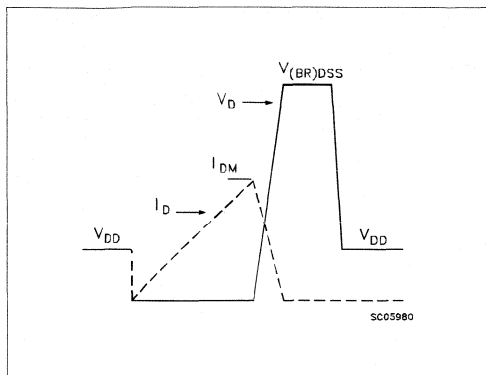


Fig. 3: Switching Times Test Circuits For Resistive Load

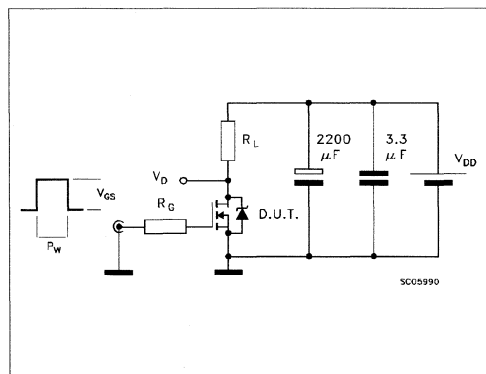


Fig. 4: Gate Charge Test Circuit

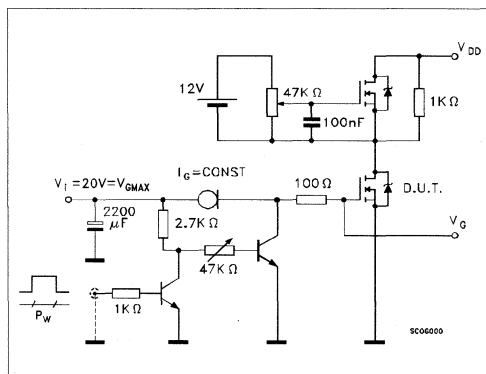
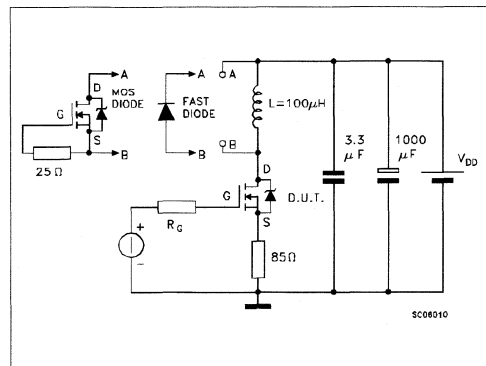


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



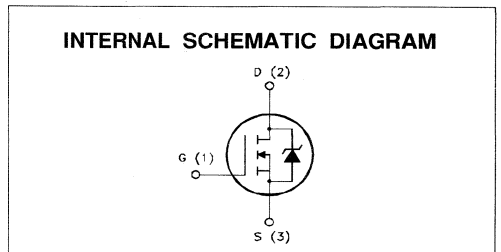
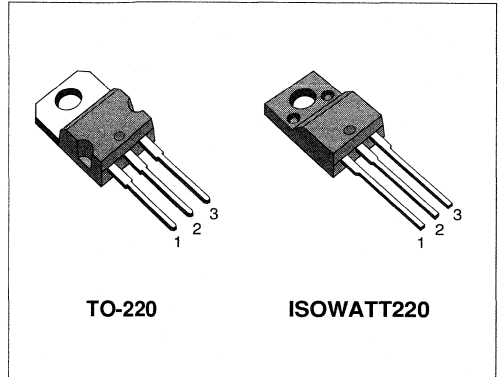
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
BUZ80A	800 V	< 3 Ω	3.8 A
BUZ80AFI	800 V	< 3 Ω	2.4 A

- TYPICAL R_{DS(on)} = 2.5 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INPUT CAPACITANCE
- LOW GATE CHARGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CONSUMER AND INDUSTRIAL LIGHTING
- DC-AC INVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLY (UPS)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		BUZ80A	BUZ80AFI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	800		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	800		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	3.8	2.4	A
I _D	Drain Current (continuous) at T _c = 100 °C	2.3	1.4	A
I _{DM} (*)	Drain Current (pulsed)	15	15	A
P _{tot}	Total Dissipation at T _c = 25 °C	100	40	W
	Derating Factor	0.8	0.32	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
$R_{thj-case}$	Thermal Resistance Junction-case	Max	1.25	3.12	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5		°C/W
$R_{thc-sink}$	Thermal Resistance Case-sink	Typ	0.5		°C/W
T_l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	3.8	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ °C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	200	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	8	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ °C}$, pulse width limited by T_j max, $\delta < 1\%$)	2.2	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$	800			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 1\text{ mA}$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 1.7\text{ A}$ $V_{GS} = 10\text{ V}$ $I_D = 1.7\text{ A}$ $T_c = 100\text{ °C}$		2.5	3 6	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	3.8			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 1.7\text{ A}$	1			S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$			1100	pF
C_{oss}	Output Capacitance				150	pF
C_{rss}	Reverse Transfer Capacitance				55	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 30\text{ V}$ $I_D = 2.3\text{ A}$		65	90	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		150	200	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 600\text{ V}$ $I_D = 3.8\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		80	110	A/ μs
Q_g	Total Gate Charge	$V_{DD} = 400\text{ V}$ $I_D = 5\text{ A}$ $V_{GS} = 10\text{ V}$		55	70	nC
Q_{gs}	Gate-Source Charge			8		nC
Q_{gd}	Gate-Drain Charge			26		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 600\text{ V}$ $I_D = 3.8\text{ A}$		110	145	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		140	190	ns
t_c	Cross-over Time	(see test circuit, figure 5)		150	200	ns

SOURCE DRAIN DIODE

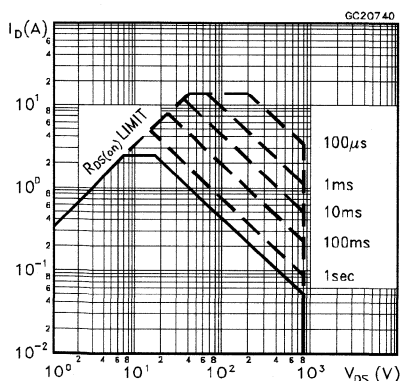
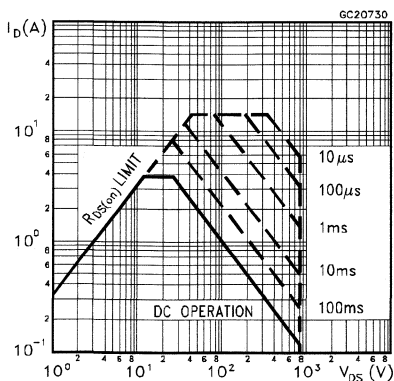
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				3.8	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				15	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 7.6\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 3.8\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_R = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		500		ns
Q_{rr}	Reverse Recovery Charge			4.3		μC
I_{RRM}	Reverse Recovery Current			17		A

(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

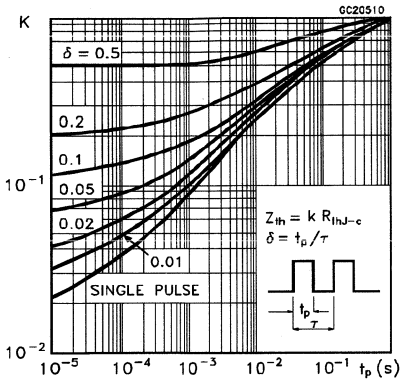
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas For TO-220 Package

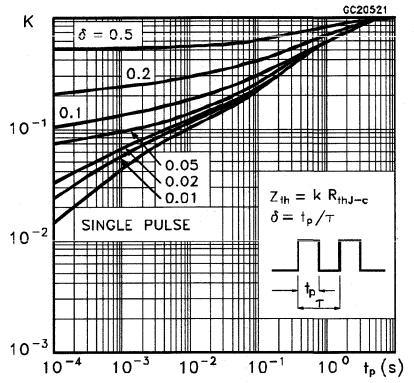
Safe Operating Areas For ISOWATT220 Package



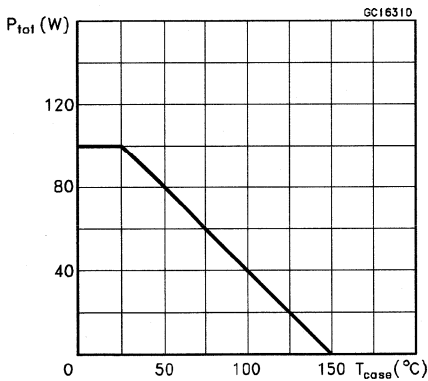
Thermal Impedance For TO-220 Package



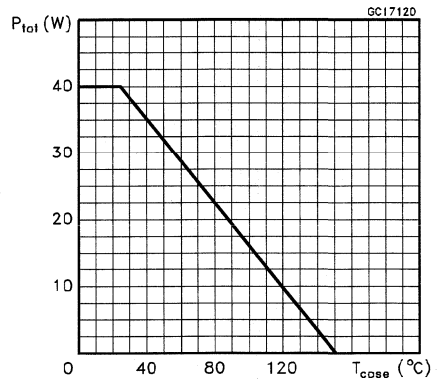
Thermal Impedance For ISOWATT220 Package



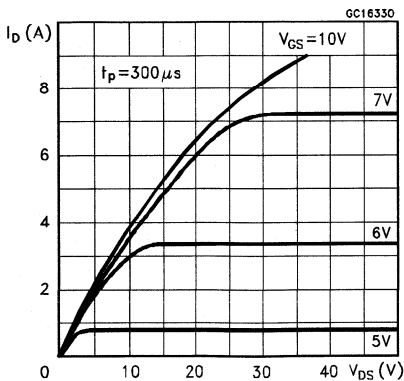
Derating Curve For TO-220 Package



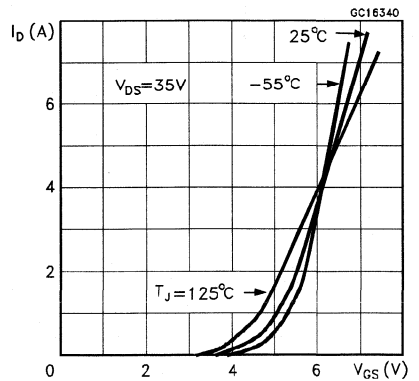
Derating Curve For ISOWATT220 Package



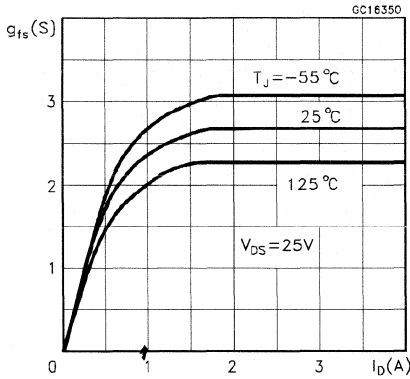
Output Characteristics



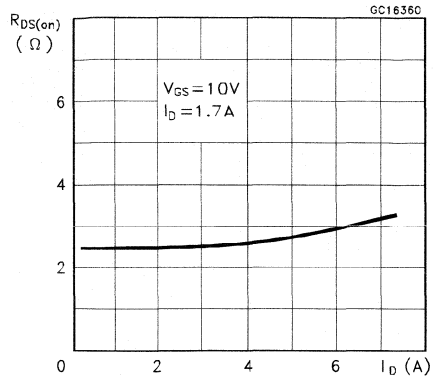
Transfer Characteristics



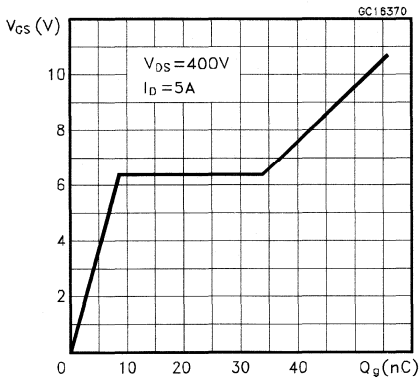
Transconductance



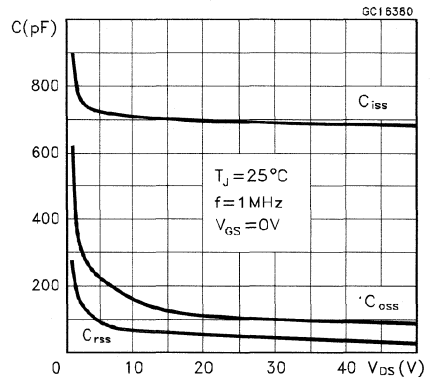
Static Drain-source On Resistance



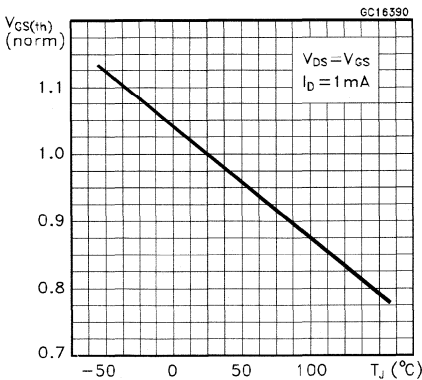
Gate Charge vs Gate-source Voltage



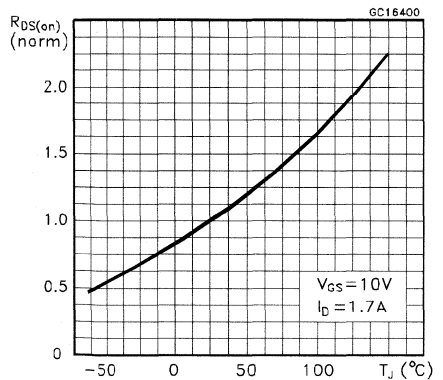
Capacitance Variations



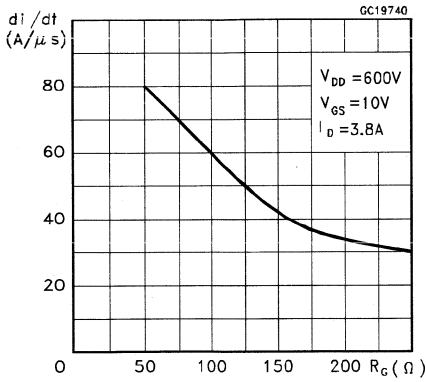
Normalized Gate Threshold Voltage vs Temperature



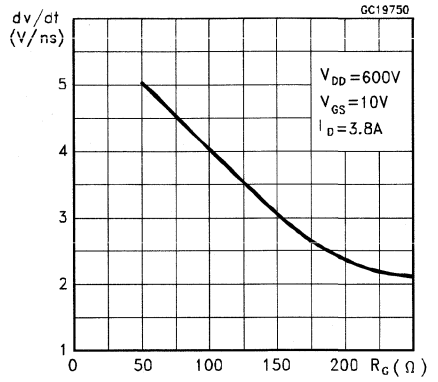
Normalized On Resistance vs Temperature



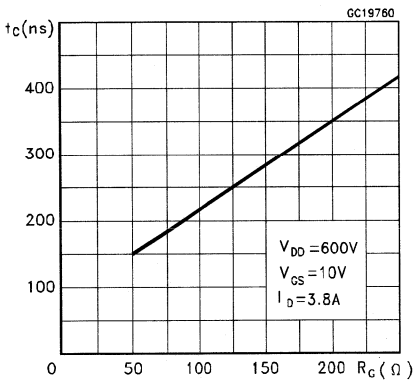
Turn-on Current Slope



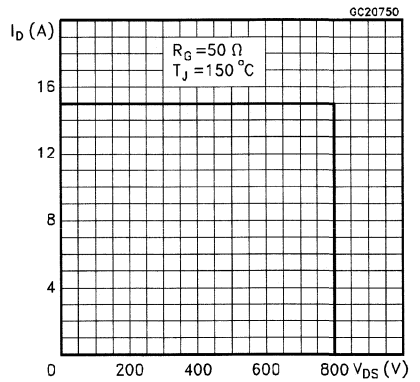
Turn-off Drain-source Voltage Slope



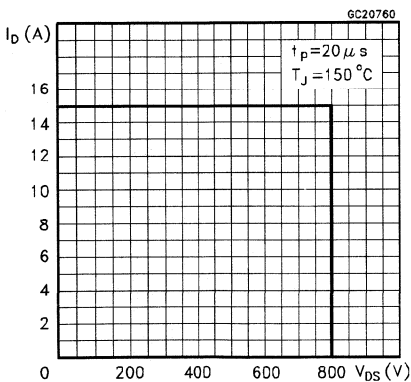
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

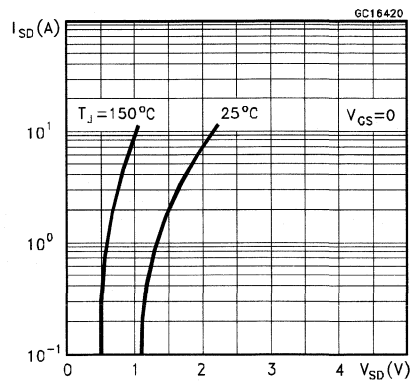


Fig. 1: Unclamped Inductive Load Test Circuits

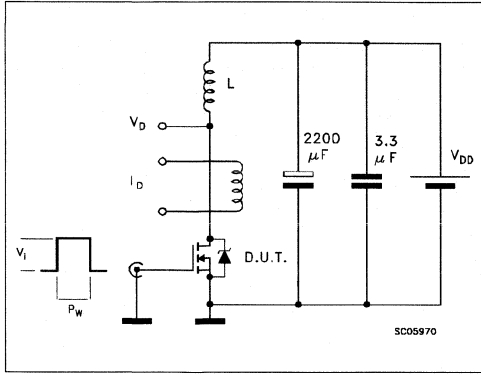


Fig. 2: Unclamped Inductive Waveforms

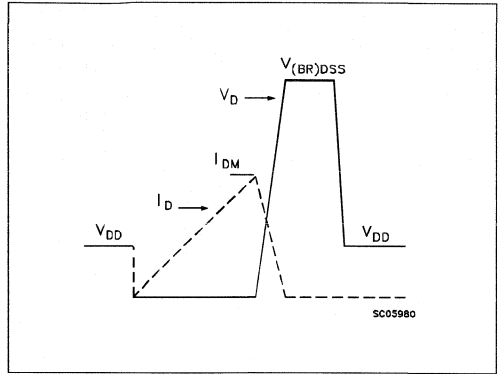


Fig. 3: Switching Times Test Circuits For Resistive Load

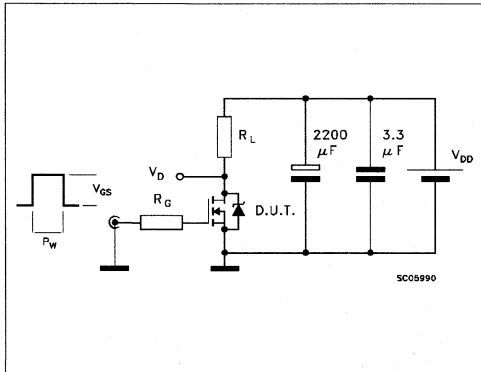


Fig. 4: Gate Charge Test Circuit

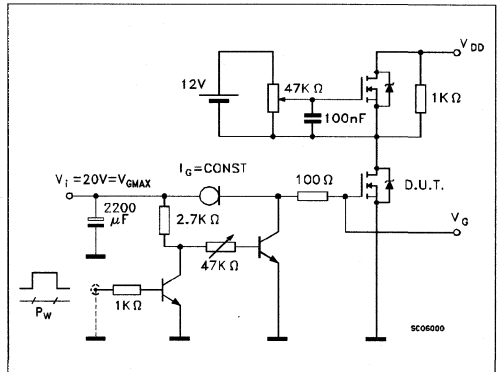
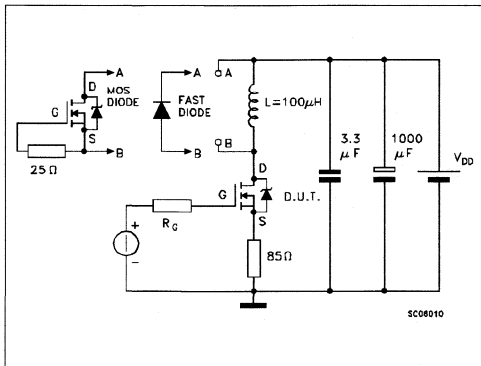


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



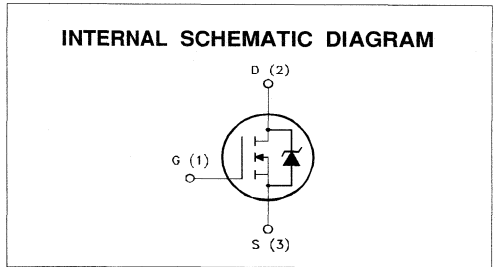
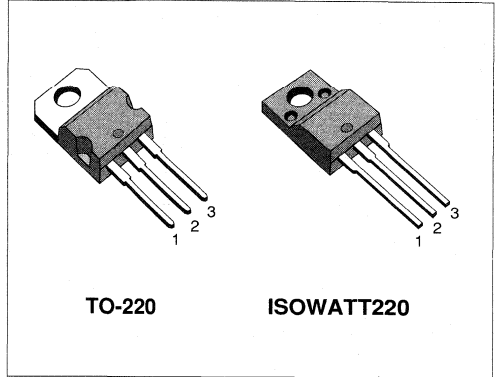
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

TYPE	V _{DSS}	R _{DS(on)}	I _D
IRF520	100 V	< 0.27 Ω	10 A
IRF520FI	100 V	< 0.27 Ω	7 A

- TYPICAL R_{DS(on)} = 0.23 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		IRF520	IRF520FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	100		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	100		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (cont.) at T _c = 25 °C	10	7	A
I _D	Drain Current (cont.) at T _c = 100 °C	7	5	A
I _{DM} (*)	Drain Current (pulsed)	40	40	A
P _{tot}	Total Dissipation at T _c = 25 °C	70	35	W
	Derating Factor	0.47	0.23	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	2000		V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case	Max	2.14	4.29	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5		°C/W
R _{thc-s}	Thermal Resistance Case-sink	Typ	0.5		°C/W
T _i	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	10	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	36	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	9	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	7	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	100			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	2.9	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 5 A		0.23	0.27	Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	10			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 5 A	2.7	4.5		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		330	450	pF
C _{oss}	Output Capacitance			90	120	pF
C _{rss}	Reverse Transfer Capacitance			25	40	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING RESISTIVE LOAD

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 50\text{ V}$ $I_D = 5\text{ A}$		10	15	ns
t_r	Rise Time	$R_{GS} = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$		50	75	ns
$t_{d(off)}$	Turn-off Delay Time	(see test circuit)		25	40	ns
t_f	Fall Time			20	30	ns
Q_g	Total Gate Charge	$I_D = 10\text{ A}$ $V_{GS} = 10\text{ V}$		15	25	nC
Q_{gs}	Gate-Source Charge	$V_{DD} = \text{Max Rating} \times 0.8$		7		nC
Q_{gd}	Gate-Drain Charge	(see test circuit)		4		nC

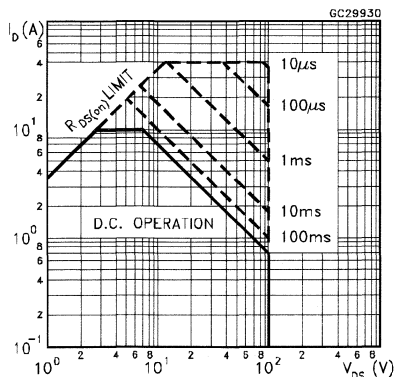
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				10	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				40	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 10\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 10\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 20\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		80		ns
Q_{rr}	Reverse Recovery Charge			0.22		μC

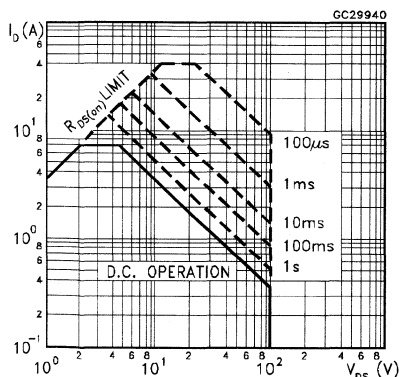
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

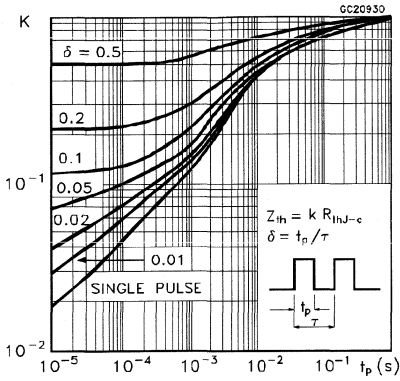
Safe Operating Area for TO-220



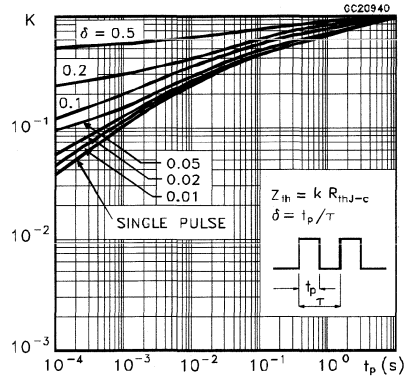
Safe Operating Area for ISOWATT220



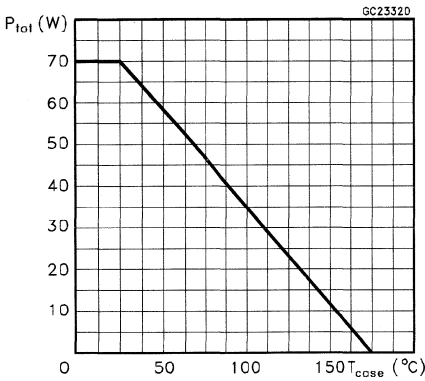
Thermal Impedance for TO-220



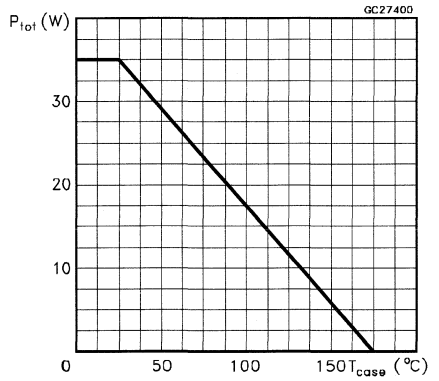
Thermal Impedance for ISOWATT220



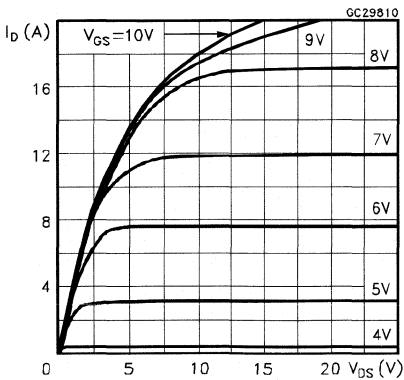
Derating Curve for TO-220



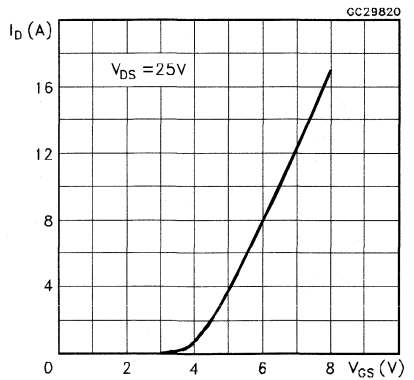
Derating Curve for ISOWATT220



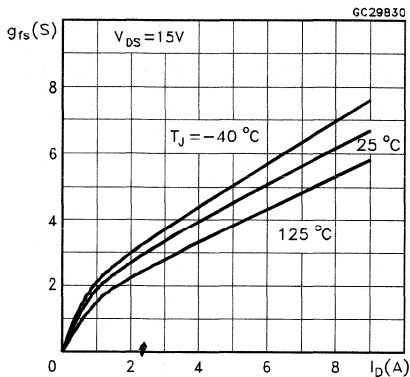
Output Characteristics



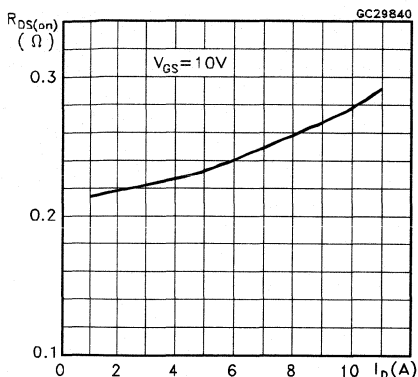
Transfer Characteristics



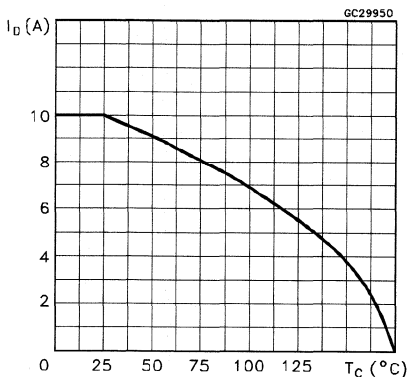
Transconductance



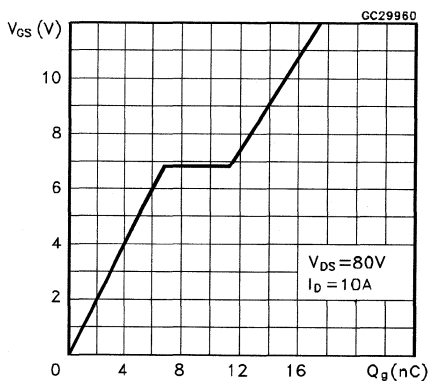
Static Drain-source On Resistance



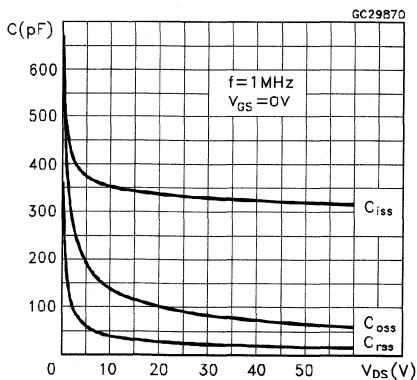
Maximum Drain Current vs Temperature



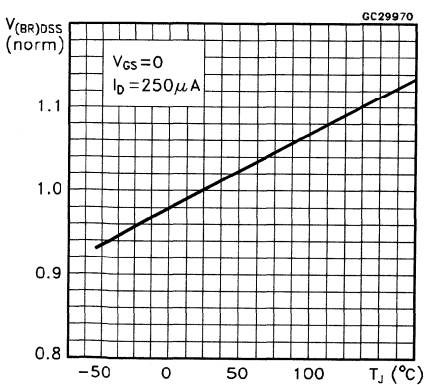
Gate Charge vs Gate-source Voltage



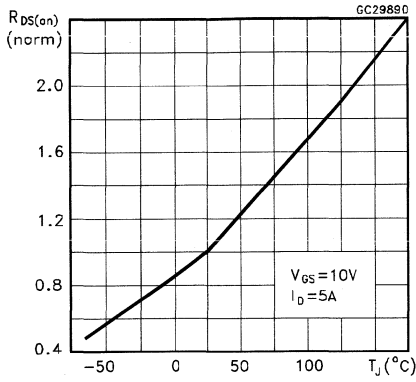
Capacitance Variations



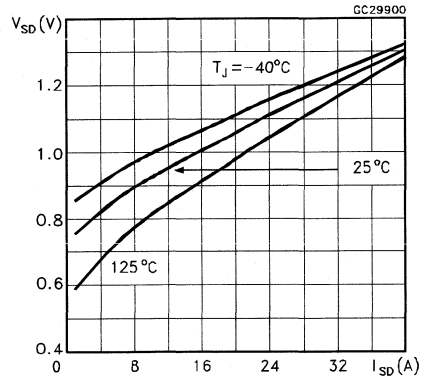
Normalized Breakdown Voltage vs Temperature



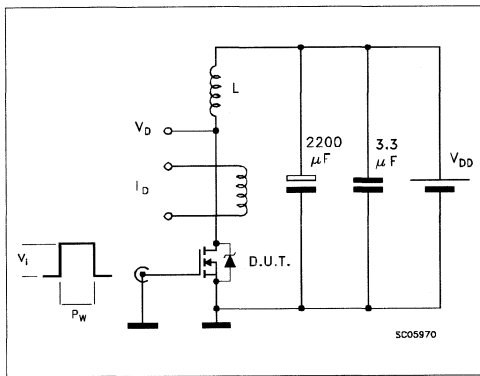
Normalized On Resistance vs Temperature



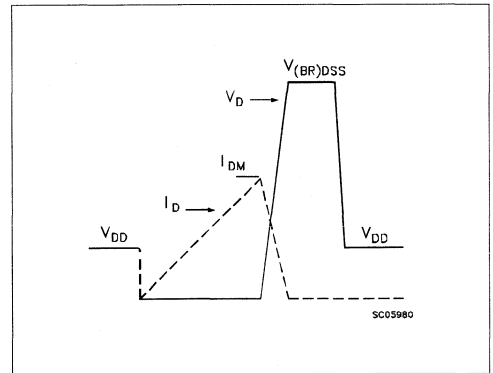
Source-drain Diode Forward Characteristics



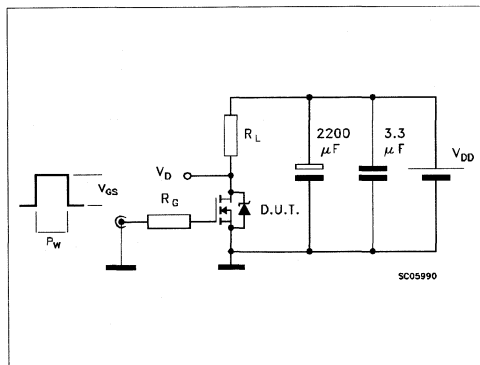
Unclamped Inductive Load Test Circuit



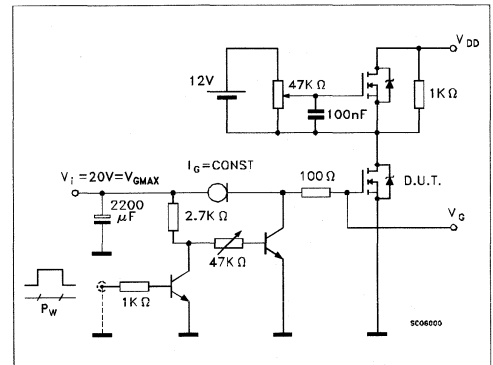
Unclamped Inductive Waveforms



Switching Time Test Circuit



Gate Charge Test Circuit



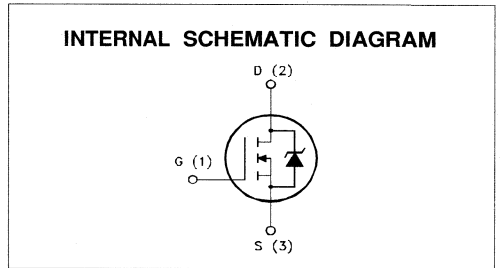
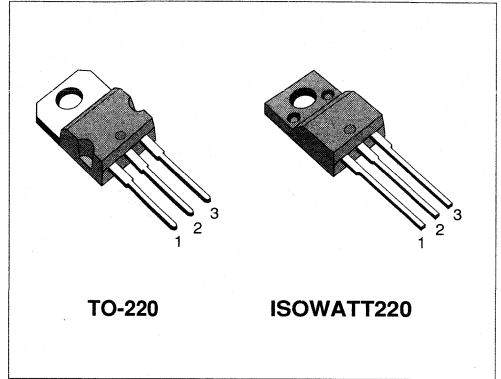
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

TYPE	V _{DSS}	R _{DS(on)}	I _D
IRF530	100 V	< 0.16 Ω	16 A
IRF530FI	100 V	< 0.16 Ω	10 A

- TYPICAL R_{DS(on)} = 0.095 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		IRF530	IRF530FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	100		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	100		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (cont.) at T _c = 25 °C	16	10	A
I _D	Drain Current (cont.) at T _c = 100 °C	11	7	A
I _{DM} (*)	Drain Current (pulsed)	64	64	A
P _{tot}	Total Dissipation at T _c = 25 °C	90	40	W
	Derating Factor	0.6	0.27	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case	Max	1.67	3.75	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5		°C/W
R _{thc-s}	Thermal Resistance Case-sink	Typ	0.5		°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	16	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	60	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	15	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	11	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	100			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	2.9	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 8 A V _{GS} = 10V I _D = 8 A T _c = 100 °C		0.095	0.16 0.32	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	16			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 8 A	4	8		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		650	900	pF
C _{oss}	Output Capacitance			180	250	pF
C _{rss}	Reverse Transfer Capacitance			40	60	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING RESISTIVE LOAD

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 36\text{ V}$ $I_D = 8\text{ A}$		20	30	ns
t_r	Rise Time	$R_G = 15\ \Omega$ $V_{GS} = 10\text{ V}$		125	180	ns
$t_{d(off)}$	Turn-off Delay Time	(see test circuit)		110	160	ns
t_f	Fall Time			65	95	ns
Q_g	Total Gate Charge	$I_D = 16\text{ A}$ $V_{GS} = 10\text{ V}$		27	40	nC
Q_{gs}	Gate-Source Charge	$V_{DD} = \text{Max Rating} \times 0.8$		9		nC
Q_{gd}	Gate-Drain Charge	(see test circuit)		11		nC

SOURCE DRAIN DIODE

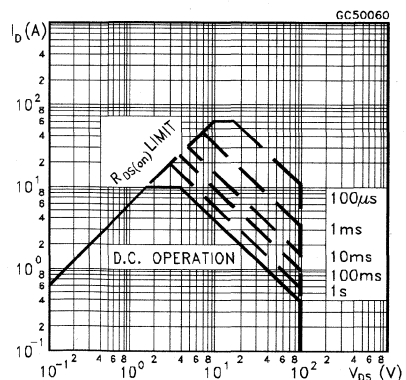
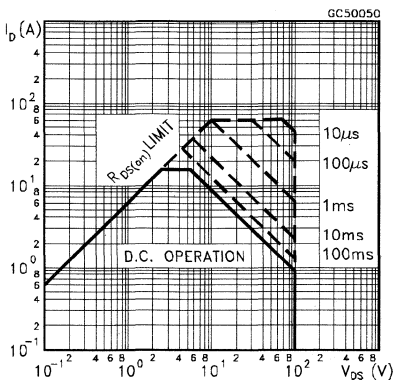
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				16	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				64	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 16\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 16\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_J = 150\text{ }^\circ\text{C}$		100		ns
Q_{rr}	Reverse Recovery Charge			0.4		μC

(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

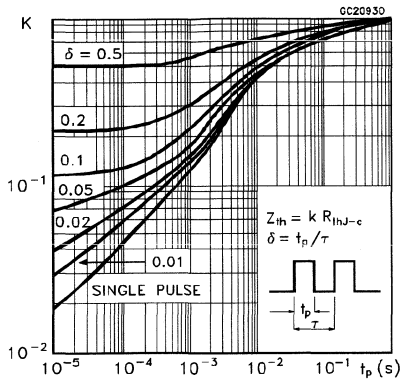
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas for TO-220

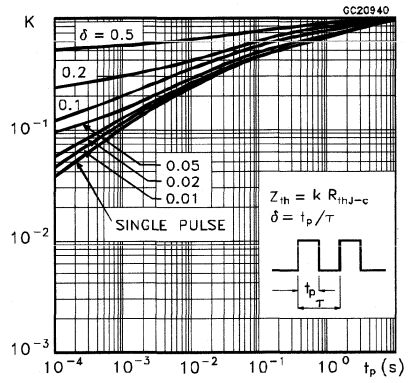
Safe Operating Areas for ISOWATT220



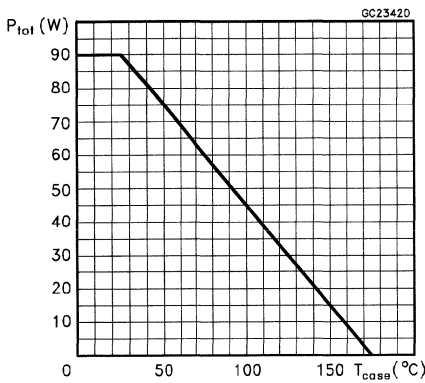
Thermal Impedance for TO-220



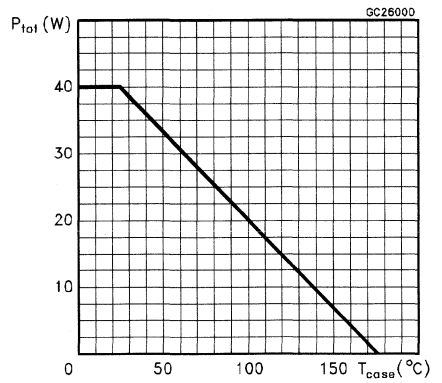
Thermal Impedance for ISOWATT220



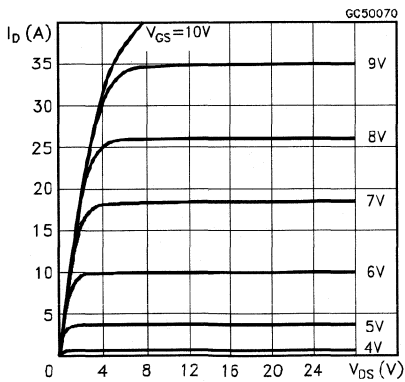
Derating Curve for TO-220



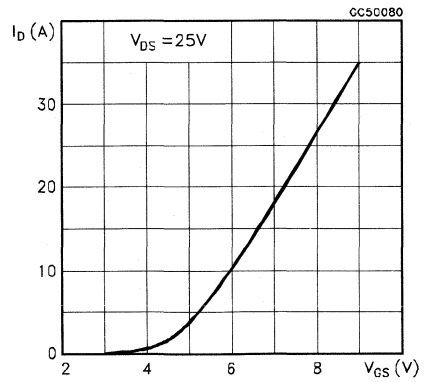
Derating Curve for ISOWATT220



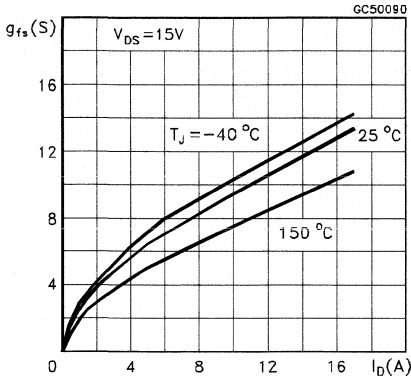
Output Characteristics



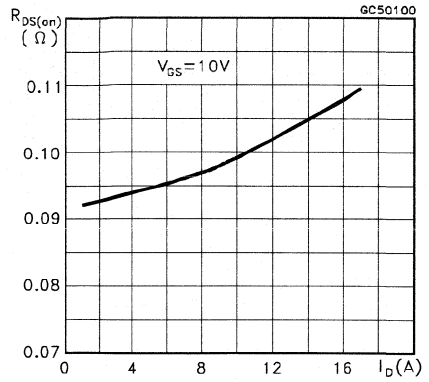
Transfer Characteristics



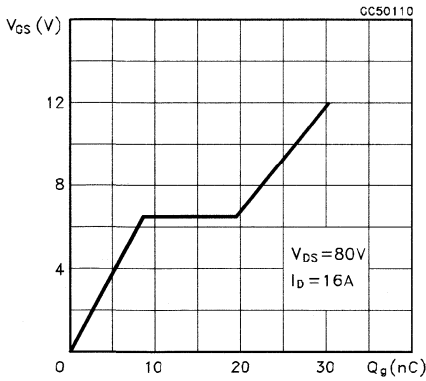
Transconductance



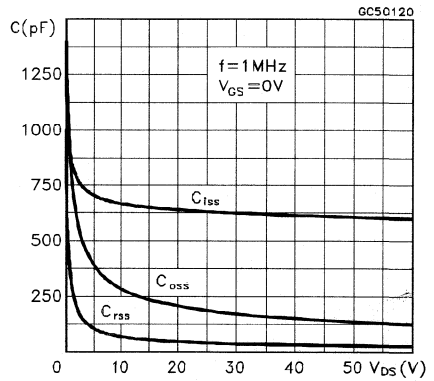
Static Drain-source On Resistance



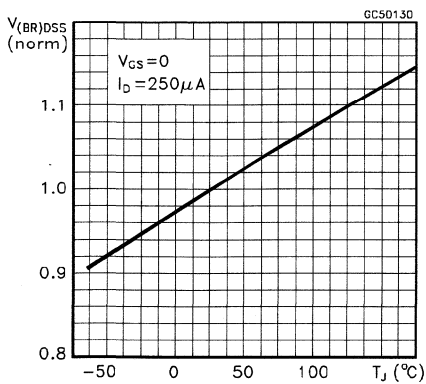
Gate Charge vs Gate-source Voltage



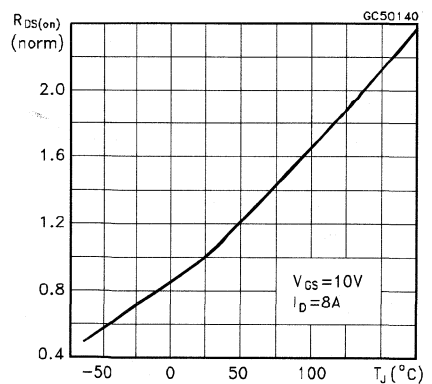
Capacitance Variations



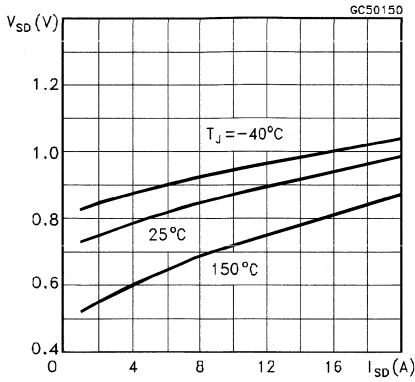
Normalized Breakdown Voltage vs Temperature



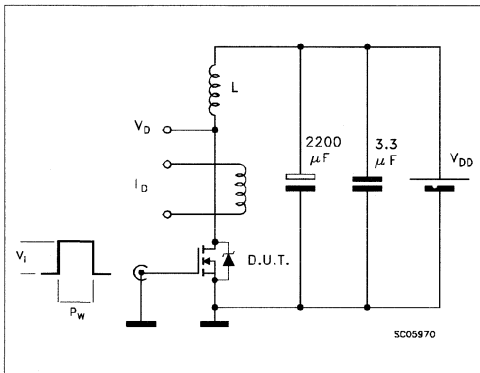
Normalized On Resistance vs Temperature



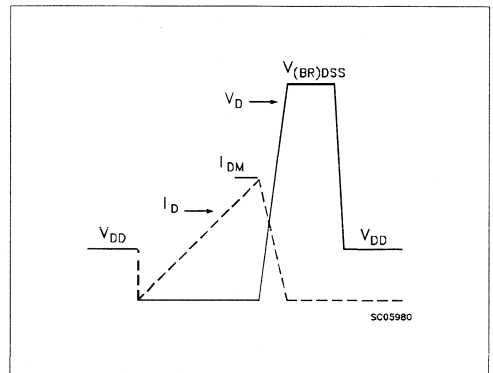
Source-drain Diode Forward Characteristics



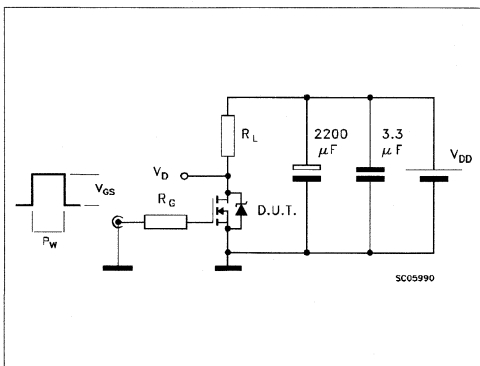
Unclamped Inductive Load Test Circuit



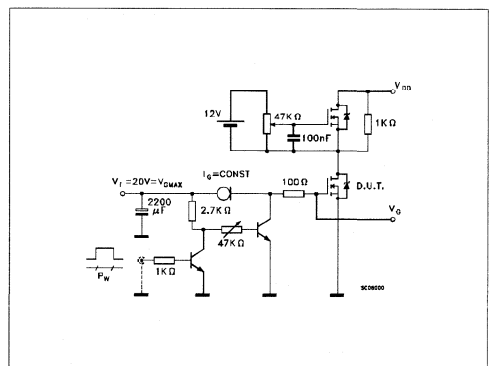
Unclamped Inductive Waveforms



Switching Time Test Circuit



Gate Charge Test Circuit



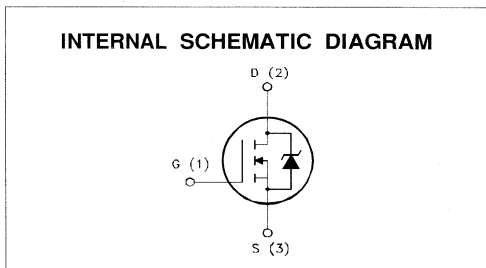
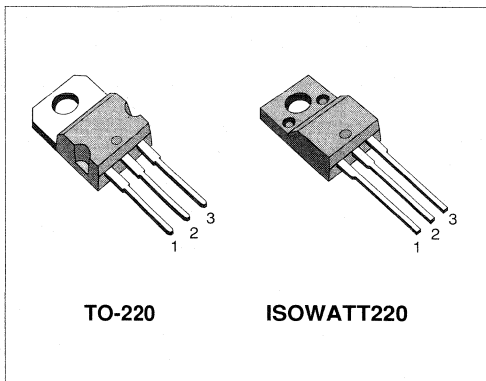
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

TYPE	V _{DSS}	R _{DS(on)}	I _D
IRF540	100 V	< 0.077 Ω	30 A
IRF540FI	100 V	< 0.077 Ω	16 A

- TYPICAL R_{DS(on)} = 0.045 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		IRF540	IRF540FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	100		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	100		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (cont.) at T _c = 25 °C	30	16	A
I _D	Drain Current (cont.) at T _c = 100 °C	21	11	A
I _{DM} (•)	Drain Current (pulsed)	120	120	A
P _{tot}	Total Dissipation at T _c = 25 °C	150	45	W
	Derating Factor	1	0.3	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(•) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case	Max	1	3.33	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5		°C/W
R _{thc-s}	Thermal Resistance Case-sink	Typ	0.5		°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	30	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	200	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	50	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	21	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	100			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	2.9	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 17 A		0.045	0.077	Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	30			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 17 A	10	18		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		1600	2100	pF
C _{oss}	Output Capacitance			460	600	pF
C _{rss}	Reverse Transfer Capacitance			140	200	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING RESISTIVE LOAD

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 50\text{ V}$ $I_D = 5\text{ A}$		55	80	ns
t_r	Rise Time	$R_i = 50\ \Omega$ $V_{GS} = 10\text{ V}$		110	160	ns
$t_{d(off)}$	Turn-off Delay Time	(see test circuit)		290	410	ns
t_f	Fall Time			125	180	ns
Q_g	Total Gate Charge	$I_D = 30\text{ A}$ $V_{GS} = 10\text{ V}$		55	80	nC
Q_{gs}	Gate-Source Charge	$V_{DD} = \text{Max Rating} \times 0.8$		11		nC
Q_{gd}	Gate-Drain Charge	(see test circuit)		26		nC

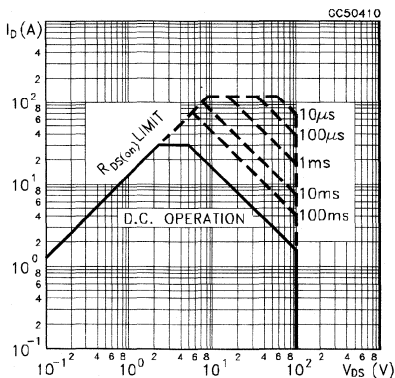
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				30	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				120	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 30\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 30\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $T_j = 150\text{ }^\circ\text{C}$ $V_{DD} = 50\text{ V}$		140		ns
Q_{rr}	Reverse Recovery Charge			0.7		μC

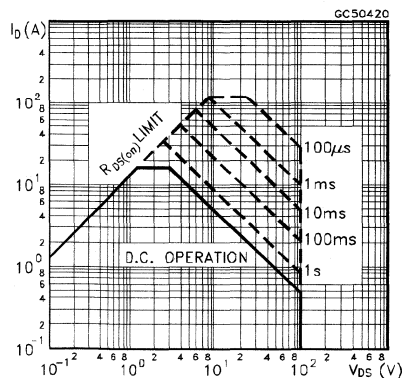
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

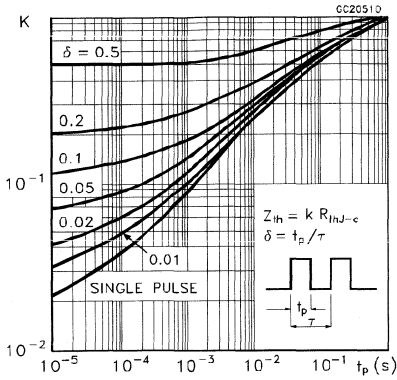
Safe Operating Area for TO-220 Package



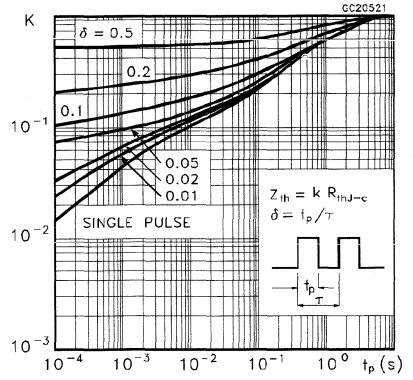
Safe Operating Area for ISOWATT220 Package



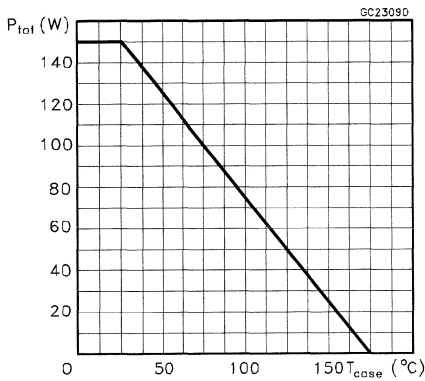
Thermal Impedance for TO-220 Package



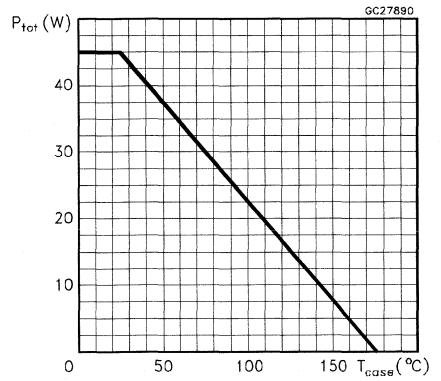
Thermal Impedance for ISOWATT220 Package



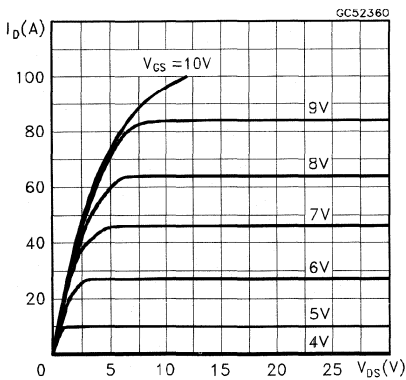
Derating Curve for TO-220 Package



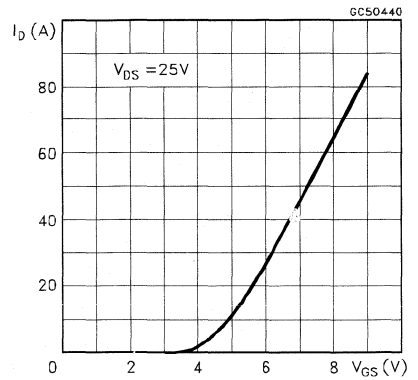
Derating Curve for ISOWATT220 Package



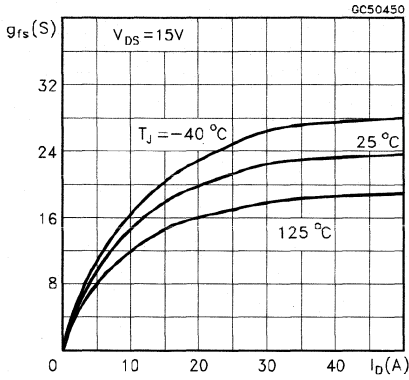
Output Characteristics



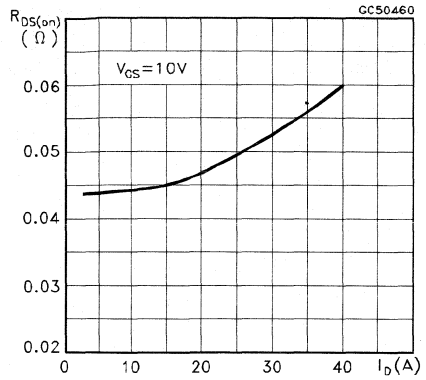
Transfer Characteristics



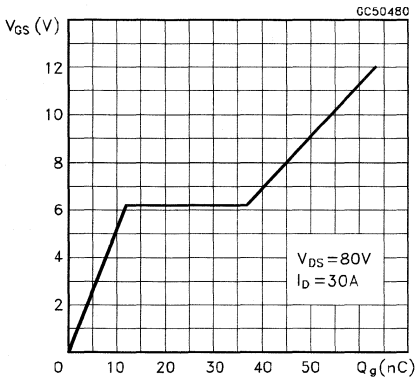
Transconductance



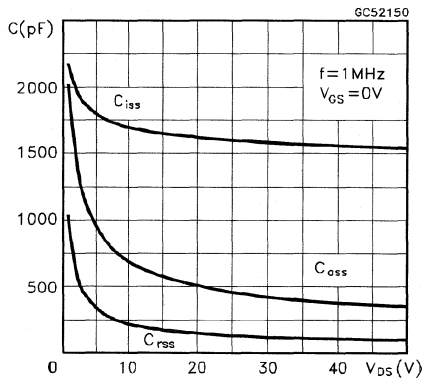
Static Drain-source On Resistance



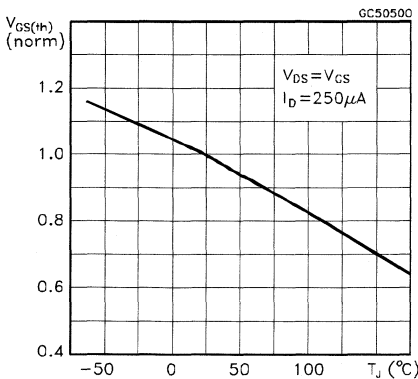
Gate Charge vs Gate-source Voltage



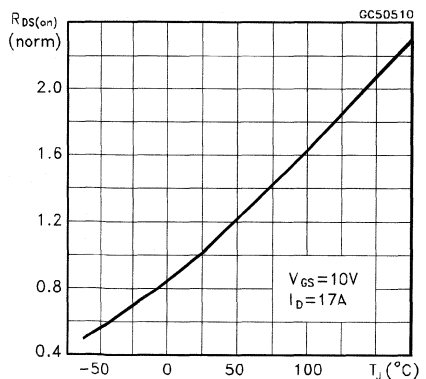
Capacitance Variations



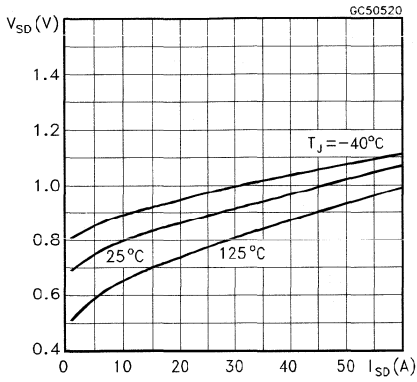
Normalized Gate Threshold Voltage vs Temperature



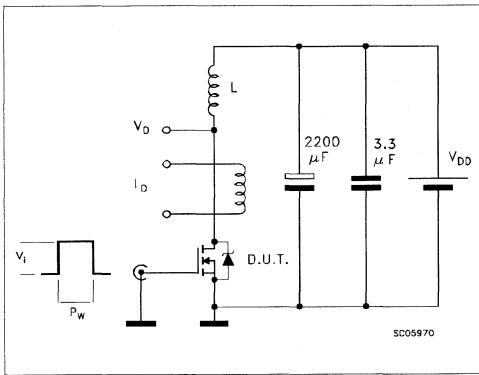
Normalized On Resistance vs Temperature



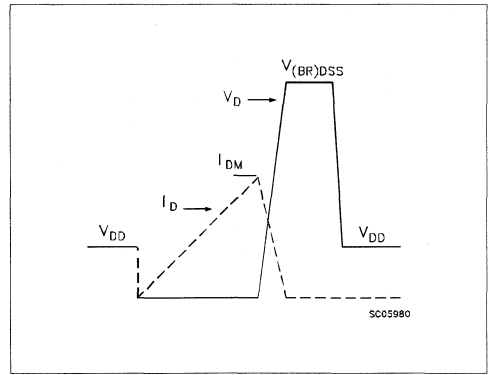
Source-drain Diode Forward Characteristics



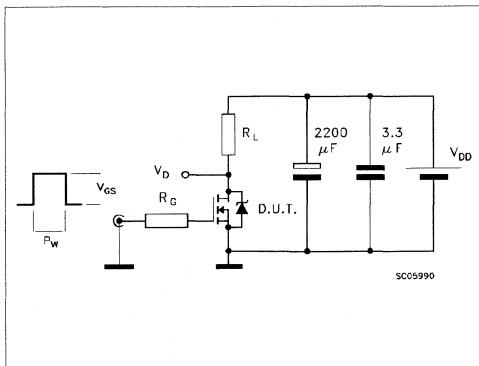
Unclamped Inductive Load Test Circuit



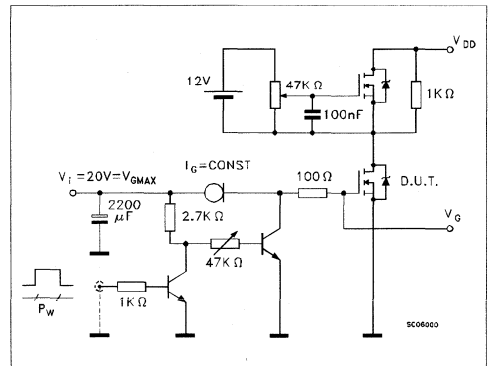
Unclamped Inductive Waveforms



Switching Time Test Circuit



Gate Charge Test Circuit



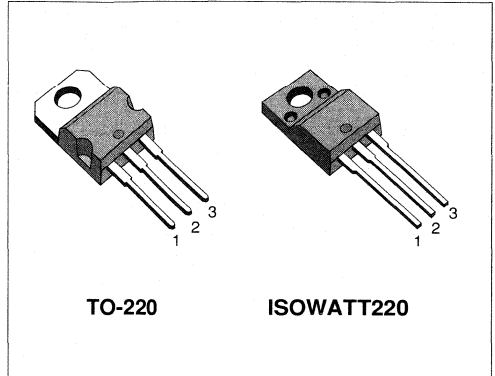
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

TYPE	V _{DSS}	R _{DS(on)}	I _D
IRF620	200 V	< 0.8 Ω	6 A
IRF620FI	200 V	< 0.8 Ω	4 A

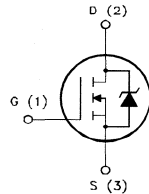
- TYPICAL R_{DS(on)} = 0.55 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- UNINTERRUPTIBLE POWER SUPPLY (UPS)
- MOTOR CONTROL, AUDIO AMPLIFIERS
- INDUSTRIAL ACTUATORS
- DC-DC & DC-AC CONVERTERS FOR TELECOM, INDUSTRIAL AND CONSUMER ENVIRONMENT



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		IRF620	IRF620FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	200		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	200		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (cont.) at T _c = 25 °C	6	4	A
I _D	Drain Current (cont.) at T _c = 100 °C	4	2	A
I _{DM} (●)	Drain Current (pulsed)	24	24	A
P _{tot}	Total Dissipation at T _c = 25 °C	70	30	W
	Derating Factor	0.56	0.24	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _J	Max. Operating Junction Temperature	150		°C

(●) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
$R_{thj-case}$	Thermal Resistance Junction-case	Max	1.79	4.17	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5		°C/W
R_{thc-s}	Thermal Resistance Case-sink	Typ	0.5		°C/W
T_l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	6	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ °C}$, $I_D = I_{AR}$, $V_{DD} = 25\text{ V}$)	20	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	5	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ °C}$, pulse width limited by T_j max, $\delta < 1\%$)	4	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\ \mu A$ $V_{GS} = 0$	200			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\ \mu A$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 3\text{ A}$		0.55	0.8	Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	6			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 3\text{ A}$	1.5	3.5		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		460	600	pF
C_{oss}	Output Capacitance			90	120	pF
C_{rss}	Reverse Transfer Capacitance			20	30	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING RESISTIVE LOAD

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 100\text{ V}$ $I_D = 3\text{ A}$		30	45	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		70	100	ns
$t_{d(off)}$	Turn-off Delay Time	(see test circuit)		135	190	ns
t_f	Fall Time			45	65	ns
Q_g	Total Gate Charge	$I_D = 6\text{ A}$ $V_{GS} = 10\text{ V}$		20	30	nC
Q_{gs}	Gate-Source Charge	$V_{DD} = \text{Max Rating} \times 0.8$		6		nC
Q_{gd}	Gate-Drain Charge	(see test circuit)		8		nC

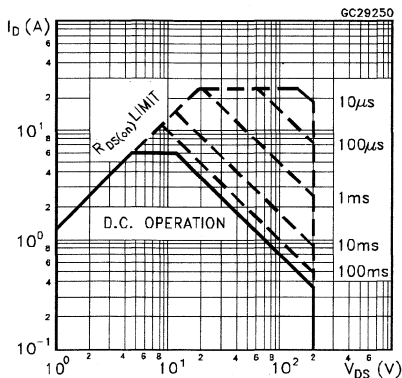
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				6	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				24	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 6\text{ A}$ $V_{GS} = 0$			1.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 6\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		170		ns
Q_{rr}	Reverse Recovery Charge			1		μC

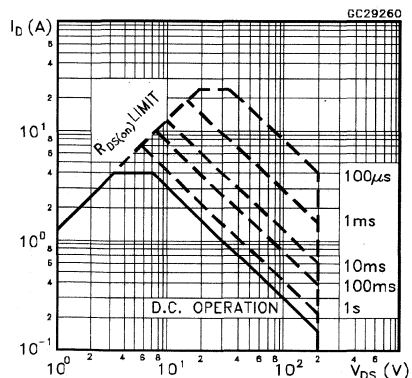
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

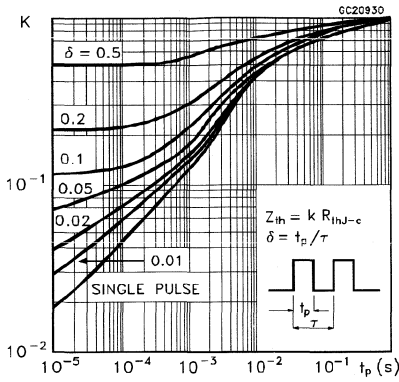
Safe Operating Area for TO-220



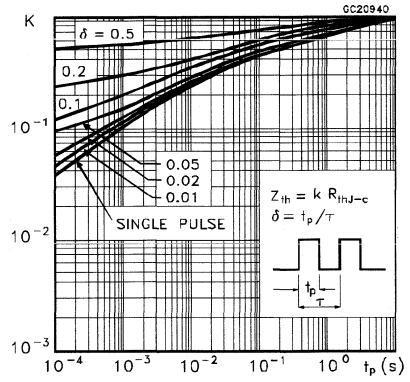
Safe Operating Area for ISOWATT220



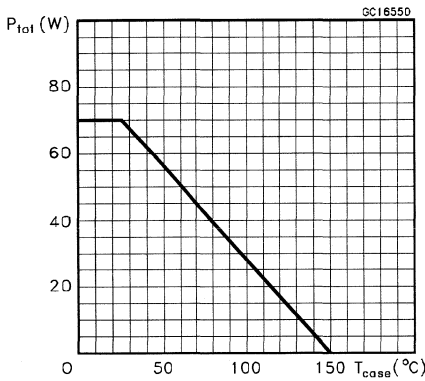
Thermal Impedance for TO-220



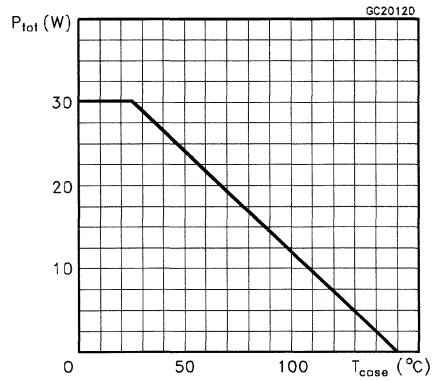
Thermal Impedance for ISOWATT220



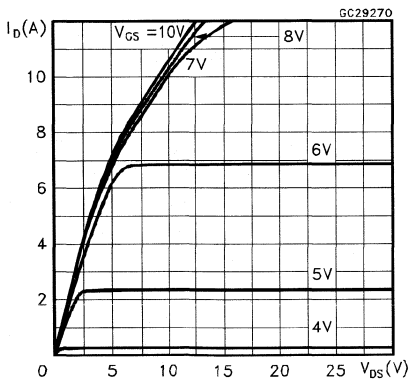
Derating Curve for TO-220



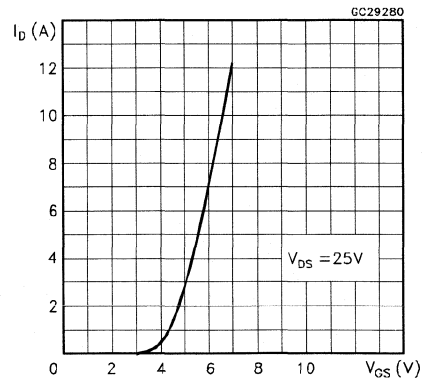
Derating Curve for ISOWATT220



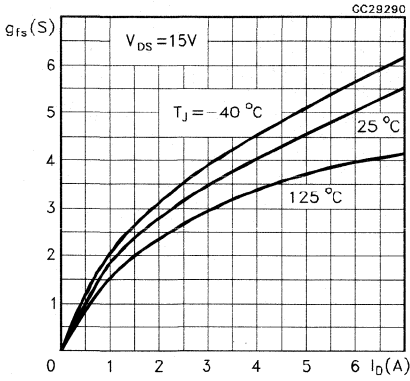
Output Characteristics



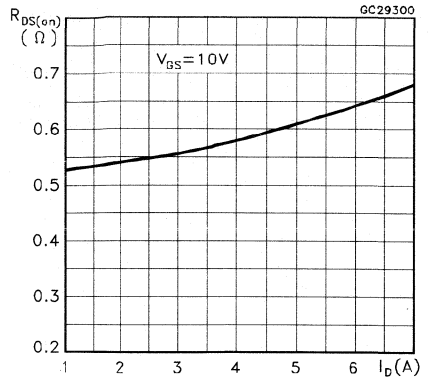
Transfer Characteristics



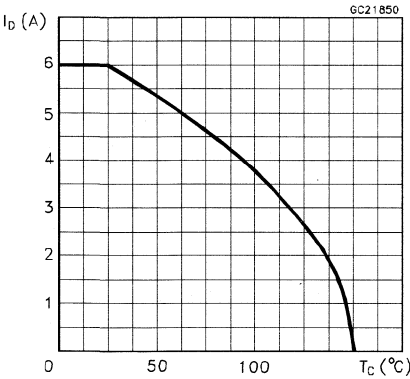
Transconductance



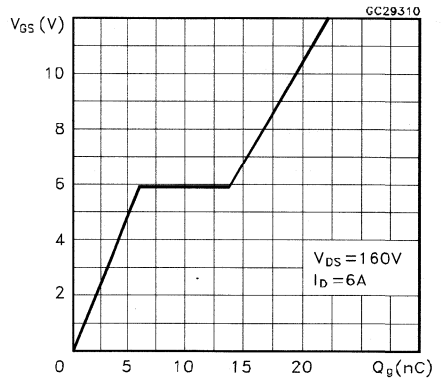
Static Drain-source On Resistance



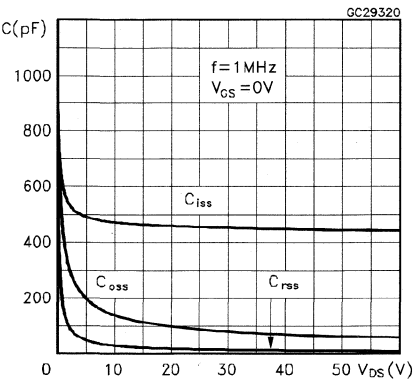
Maximum Drain Current vs Temperature



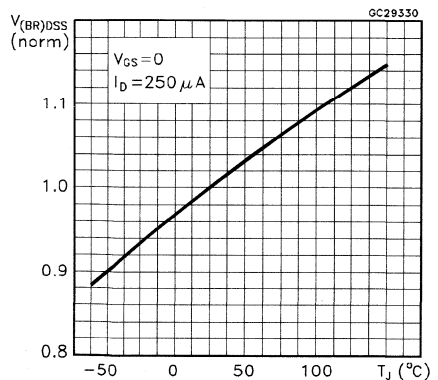
Gate Charge vs Gate-source Voltage



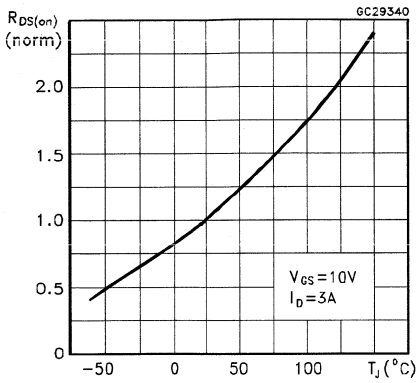
Capacitance Variations



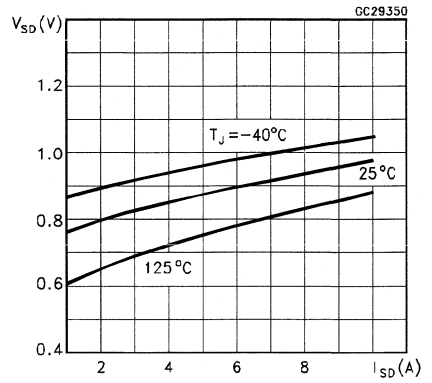
Normalized Breakdown Voltage vs Temperature



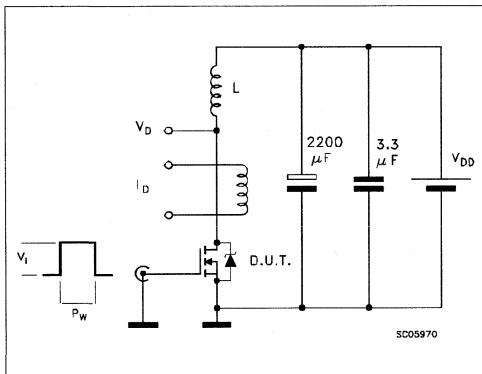
Normalized On Resistance vs Temperature



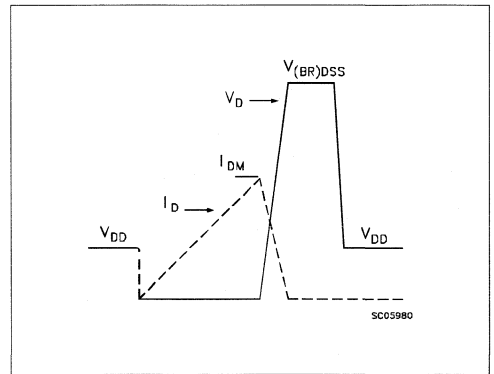
Source-drain Diode Forward Characteristics



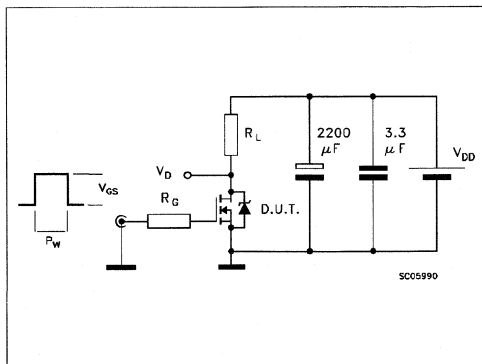
Unclamped Inductive Load Test Circuit



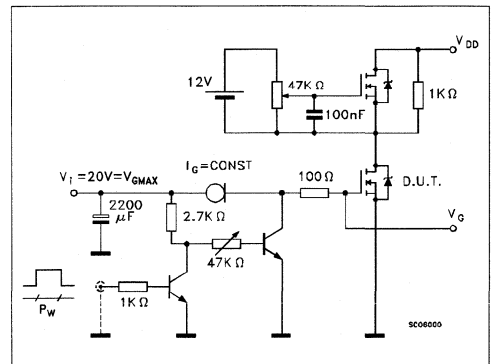
Unclamped Inductive Waveforms



Switching Time Test Circuit



Gate Charge Test Circuit



N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

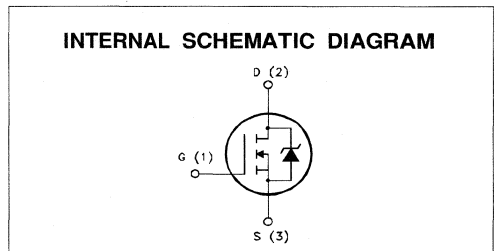
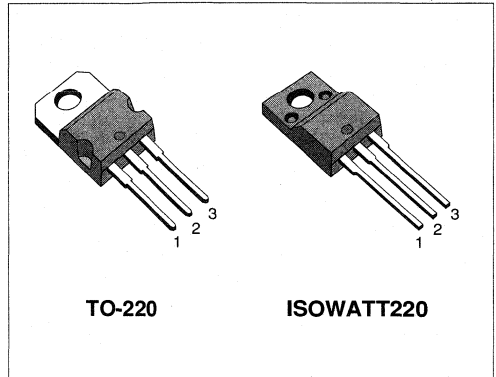
PRELIMINARY DATA

TYPE	V _{DSS}	R _{Ds(on)}	I _D
IRF630	200 V	< 0.4 Ω	10 A
IRF630FI	200 V	< 0.4 Ω	6 A

- TYPICAL R_{Ds(on)} = 0.25 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH SPEED SWITCHING
- UNINTERRUPTIBLE POWER SUPPLY (UPS)
- MOTOR CONTROL, AUDIO AMPLIFIERS
- INDUSTRIAL ACTUATORS
- DC-DC & DC-AC CONVERTERS FOR TELECOM, INDUSTRIAL AND CONSUMER ENVIRONMENT
- PARTICULARLY SUITABLE FOR ELECTRONIC FLUORESCENT LAMP BALLASTS



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		IRF630	IRF630FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	200		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	200		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	10	6	A
I _D	Drain Current (continuous) at T _c = 100 °C	6	3	A
I _{DM} (●)	Drain Current (pulsed)	40	40	A
P _{tot}	Total Dissipation at T _c = 25 °C	100	35	W
	Derating Factor	0.8	0.28	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _J	Max. Operating Junction Temperature	150		°C

(●) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case	Max	1.25	3.57	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.5		°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	10	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	60	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	15	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	6	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	200			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 5 A V _{GS} = 10V I _D = 5 A T _c = 100°C		0.25	0.4 0.8	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	10			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 5 A	3	7		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		1100	1500	pF
C _{oss}	Output Capacitance			160	250	pF
C _{rss}	Reverse Transfer Capacitance			30	50	pF

ELECTRICAL CHARACTERISTICS (continued)**SWITCHING ON**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 100\text{ V}$ $I_D = 5\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		40	60	ns
t_r	Rise Time			80	120	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 200\text{ V}$ $I_D = 10\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		250		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 200\text{ V}$ $I_D = 10\text{ A}$ $V_{GS} = 10\text{ V}$		40	60	nC
Q_{gs}	Gate-Source Charge			8		nC
Q_{gd}	Gate-Drain Charge			10		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 200\text{ V}$ $I_D = 10\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		50	80	ns
t_f	Fall Time			30	50	ns
t_c	Cross-over Time			80	130	ns

SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				10	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				40	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 10\text{ A}$ $V_{GS} = 0$			1.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 10\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		300		ns
Q_{rr}	Reverse Recovery Charge			3		μC
I_{RRM}	Reverse Recovery Current			20		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

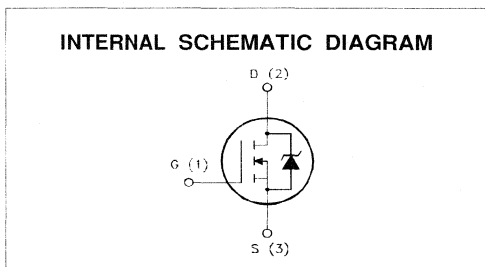
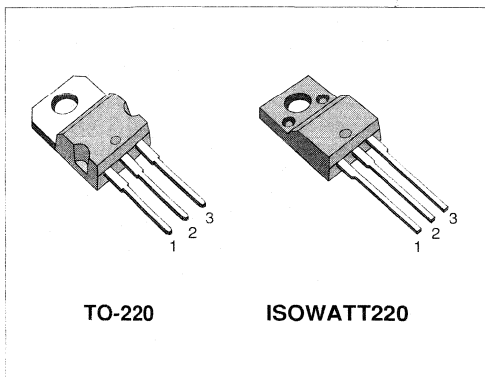
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

TYPE	V _{DSS}	R _{DS(on)}	I _D
IRF640	200 V	< 0.18 Ω	18 A
IRF640FI	200 V	< 0.18 Ω	10 A

- TYPICAL R_{DS(on)} = 0.145 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- UNINTERRUPTIBLE POWER SUPPLY (UPS)
- MOTOR CONTROL, AUDIO AMPLIFIERS
- INDUSTRIAL ACTUATORS
- DC-DC & DC-AC CONVERTERS FOR TELECOM, INDUSTRIAL AND CONSUMER ENVIRONMENT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		IRF640	IRF640FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	200		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	200		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (cont.) at T _c = 25 °C	18	10	A
I _D	Drain Current (cont.) at T _c = 100 °C	11	6	A
I _{DM} (*)	Drain Current (pulsed)	72	72	A
P _{tot}	Total Dissipation at T _c = 25 °C	125	40	W
	Derating Factor	1	0.32	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
$R_{thj-case}$	Thermal Resistance Junction-case	Max	1	3.13	$^{\circ}C/W$
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5		$^{\circ}C/W$
R_{thc-s}	Thermal Resistance Case-sink	Typ	0.5		$^{\circ}C/W$
T_l	Maximum Lead Temperature For Soldering Purpose		300		$^{\circ}C$

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	18	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25^{\circ}C$, $I_D = I_{AR}$, $V_{DD} = 25 V$)	50	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	10	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100^{\circ}C$, pulse width limited by T_j max, $\delta < 1\%$)	11	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25^{\circ}C$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250 \mu A$ $V_{GS} = 0$	200			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^{\circ}C$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20 V$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250 \mu A$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10V$ $I_D = 9 A$		0.145	0.18	Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10 V$	18			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 9 A$	6.5	13		S
C_{iss}	Input Capacitance	$V_{DS} = 25 V$ $f = 1 MHz$ $V_{GS} = 0$		1600	2100	pF
C_{oss}	Output Capacitance			270	350	pF
C_{rss}	Reverse Transfer Capacitance			50	70	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING RESISTIVE LOAD

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 100\text{ V}$ $I_D = 18\text{ A}$		20	30	ns
t_r	Rise Time	$R_G = 9.1\ \Omega$ $V_{GS} = 10\text{ V}$		75	105	ns
$t_{d(off)}$	Turn-off Delay Time	(see test circuit)		60	85	ns
t_f	Fall Time			50	70	ns
Q_g	Total Gate Charge	$I_D = 18\text{ A}$ $V_{GS} = 10\text{ V}$		57	80	nC
Q_{gs}	Gate-Source Charge	$V_{DD} = \text{Max Rating} \times 0.8$		11		nC
Q_{gd}	Gate-Drain Charge	(see test circuit)		26		nC

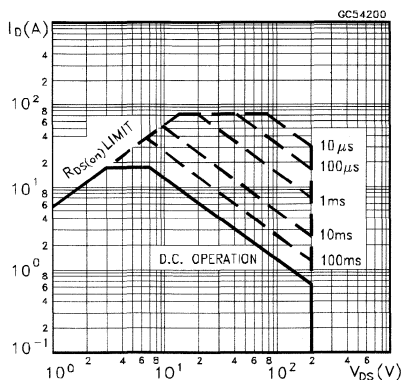
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				18	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				72	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 18\text{ A}$ $V_{GS} = 0$			1.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 18\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		300		ns
Q_{rr}	Reverse Recovery Charge			3.3		μC

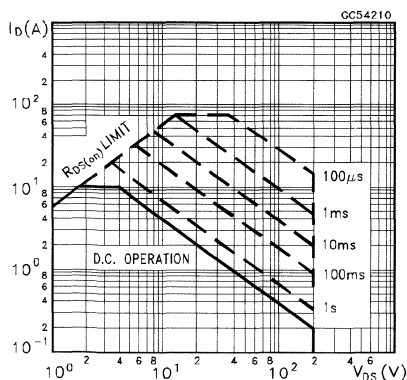
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

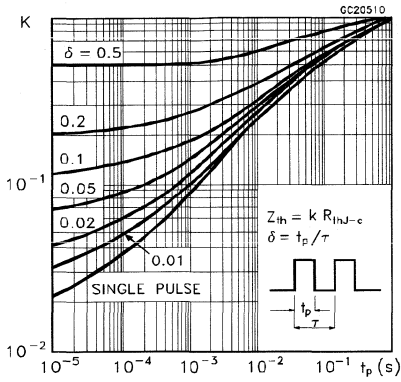
Safe Operating Area for TO-220



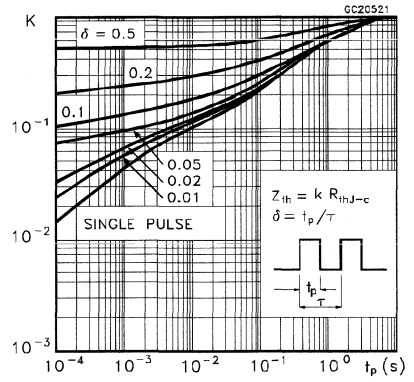
Safe Operating Area for ISOWATT220



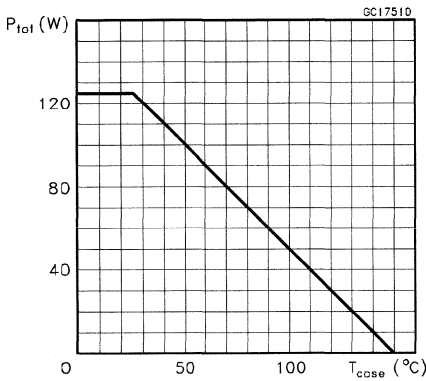
Thermal Impedance for TO-220



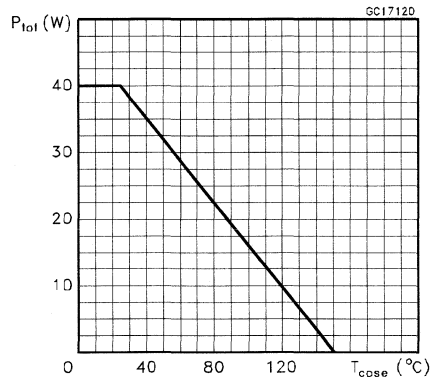
Thermal Impedance for ISOWATT220



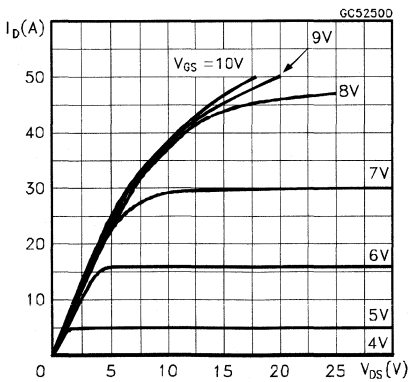
Derating Curve for TO-220



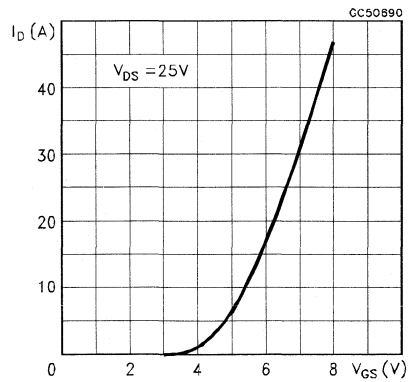
Derating Curve for ISOWATT220



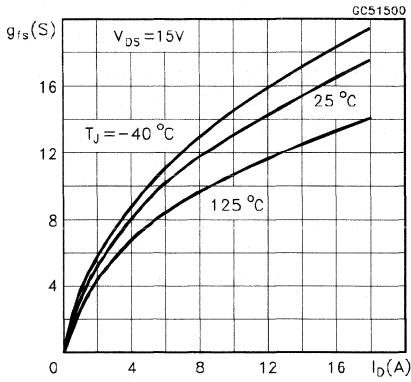
Output Characteristics



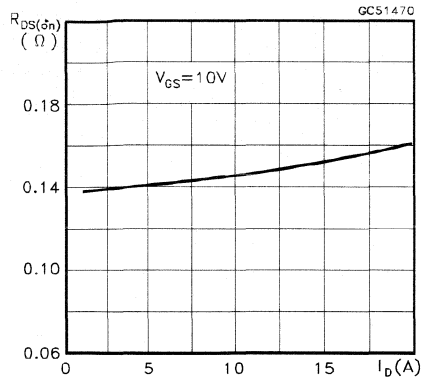
Transfer Characteristics



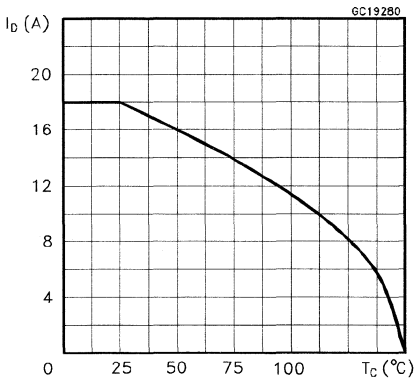
Transconductance



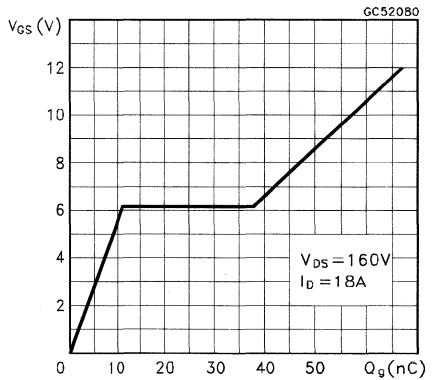
Static Drain-source On Resistance



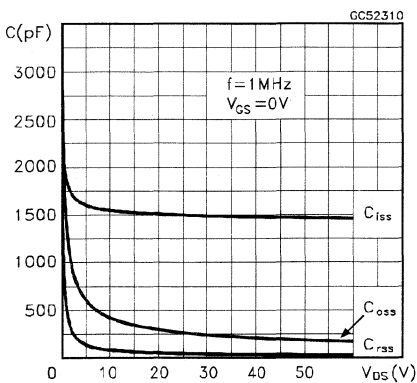
Maximum Drain Current vs Temperature



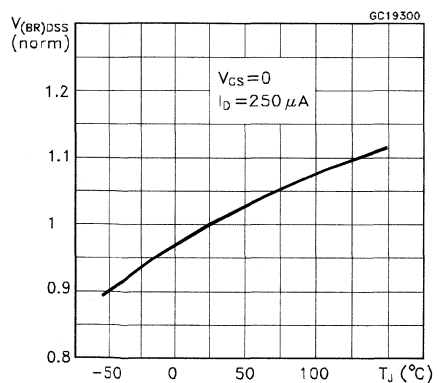
Gate Charge vs Gate-source Voltage



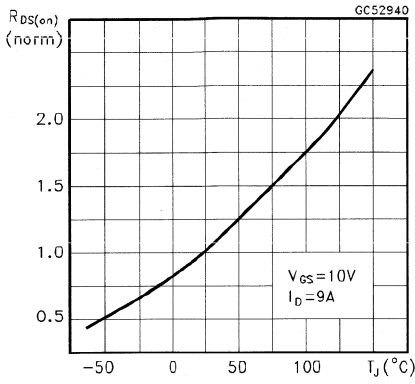
Capacitance Variations



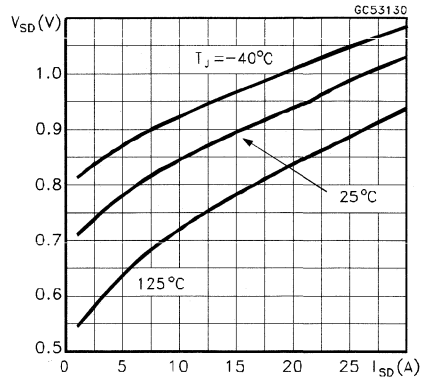
Normalized Breakdown Voltage vs Temperature



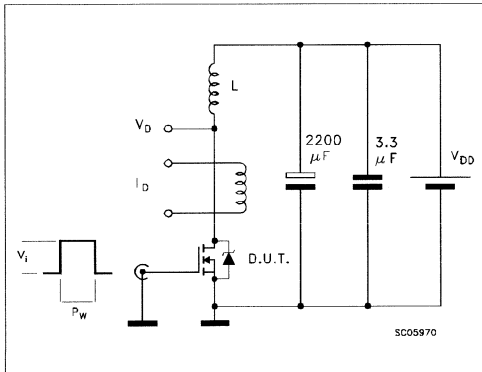
Normalized On Resistance vs Temperature



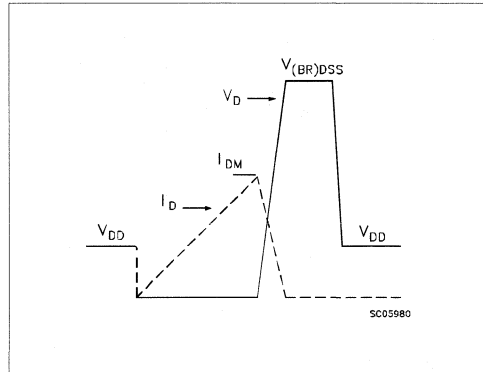
Source-drain Diode Forward Characteristics



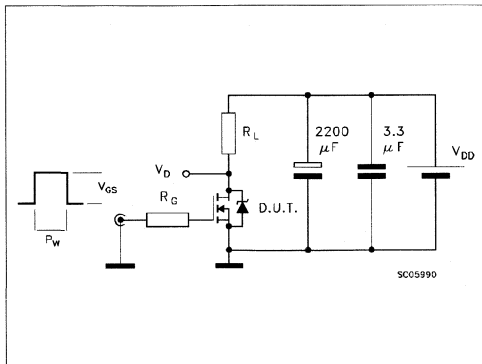
Unclamped Inductive Load Test Circuit



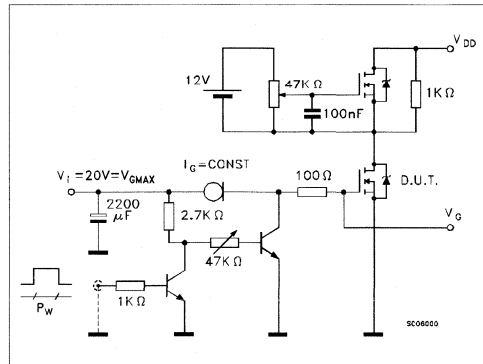
Unclamped Inductive Waveforms



Switching Time Test Circuit



Gate Charge Test Circuit



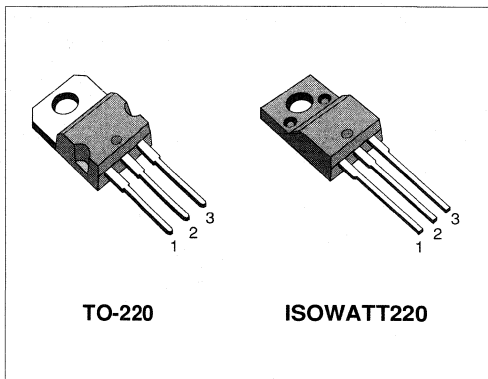
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
IRF720	400 V	< 1.8 Ω	4.2 A
IRF720FI	400 V	< 1.8 Ω	3 A

- TYPICAL R_{DS(on)} = 1.65 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

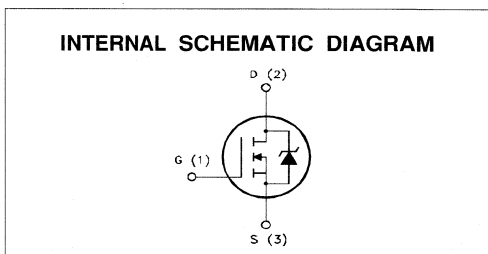
APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



TO-220

ISOWATT220



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		IRF720	IRF720FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	400		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	400		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	4.2	3	A
I _D	Drain Current (continuous) at T _c = 100 °C	2.6	1.9	A
I _{DM} (*)	Drain Current (pulsed)	16.8	16.8	A
P _{tot}	Total Dissipation at T _c = 25 °C	75	35	W
	Derating Factor	0.6	0.28	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
$R_{thj-case}$	Thermal Resistance Junction-case	Max	1.67	3.57	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5		°C/W
$R_{thc-sink}$	Thermal Resistance Case-sink	Typ	0.5		°C/W
T_l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	4.2	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ }^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	120	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	7	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ }^\circ\text{C}$, pulse width limited by T_j max, $\delta < 1\%$)	2.6	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ }^\circ\text{C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$	400			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ }^\circ\text{C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\text{ }\mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 2\text{ A}$ $V_{GS} = 10\text{ V}$ $I_D = 2\text{ A}$ $T_c = 100\text{ }^\circ\text{C}$		1.65	1.8 3.6	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	4			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 2\text{ A}$	1	2.1		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		350	450	pF
C_{oss}	Output Capacitance			68	90	pF
C_{rss}	Reverse Transfer Capacitance			32	45	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 175\text{ V}$ $I_D = 2\text{ A}$		25	33	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		70	90	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 320\text{ V}$ $I_D = 4\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		110		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 320\text{ V}$ $I_D = 4\text{ A}$ $V_{GS} = 10\text{ V}$		25	35	nC
Q_{gs}	Gate-Source Charge			7		nC
Q_{gd}	Gate-Drain Charge			11		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(off)}$	Off-voltage Rise Time	$V_{DD} = 320\text{ V}$ $I_D = 4\text{ A}$		50	65	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		28	35	ns
t_c	Cross-over Time	(see test circuit, figure 5)		75	95	ns

SOURCE DRAIN DIODE

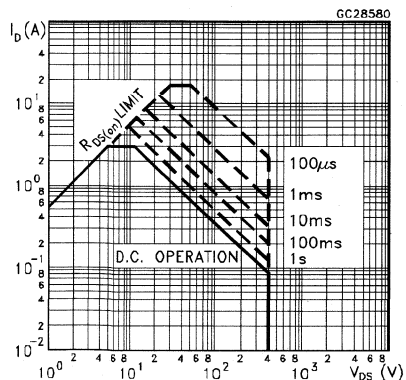
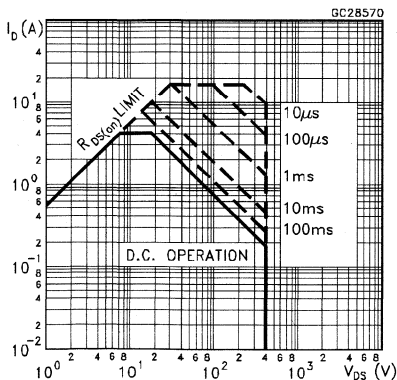
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				4	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				16	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 4\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 4\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_J = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		400		ns
Q_{rr}	Reverse Recovery Charge			5.9		μC
I_{RRM}	Reverse Recovery Current			29.5		A

(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

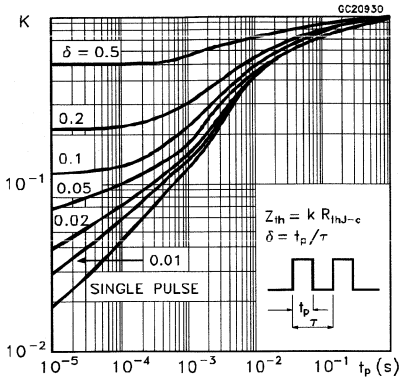
(•) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

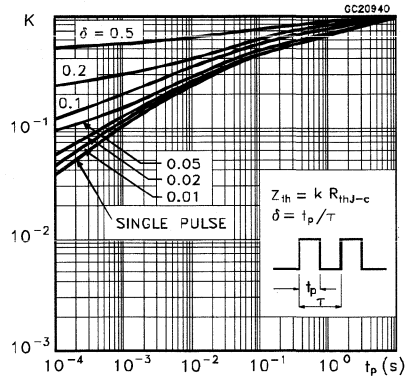
Safe Operating Areas For ISOWATT220



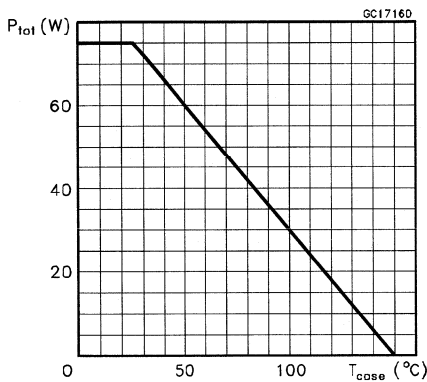
Thermal Impedance For TO-220



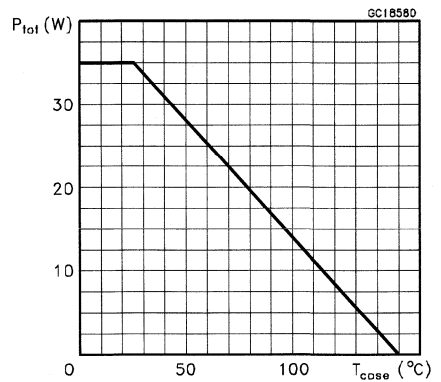
Thermal Impedance For ISOWATT220



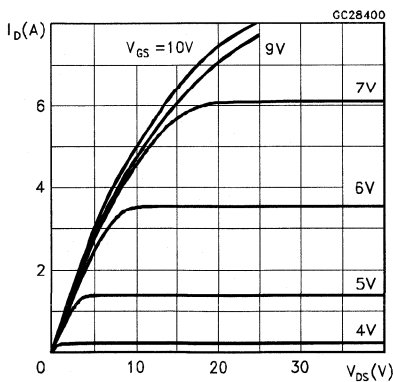
Derating Curve For TO-220



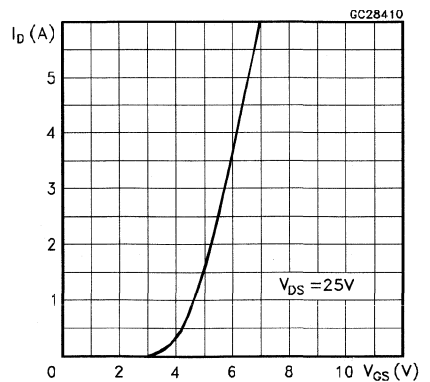
Derating Curve For ISOWATT220



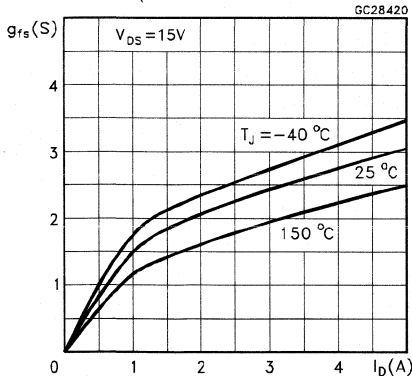
Output Characteristics



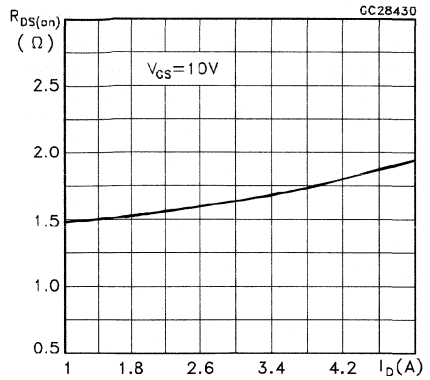
Transfer Characteristics



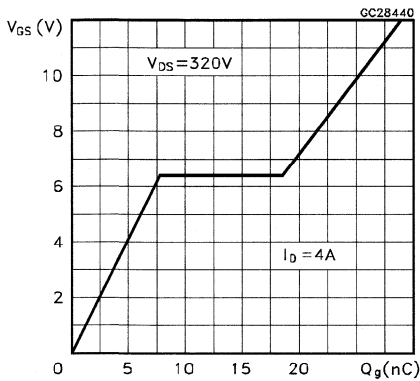
Transconductance



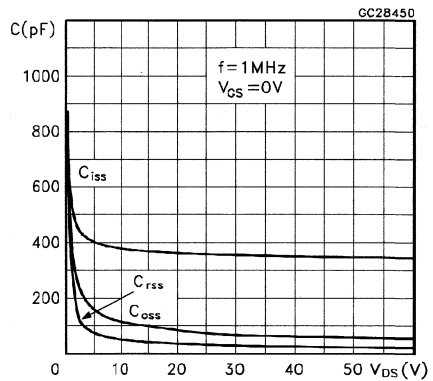
Static Drain-source On Resistance



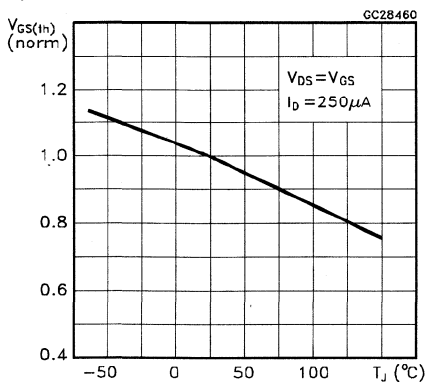
Gate Charge vs Gate-source Voltage



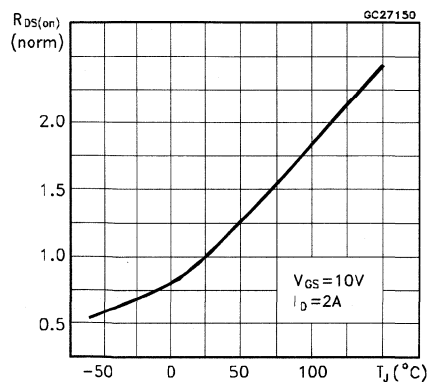
Capacitance Variations



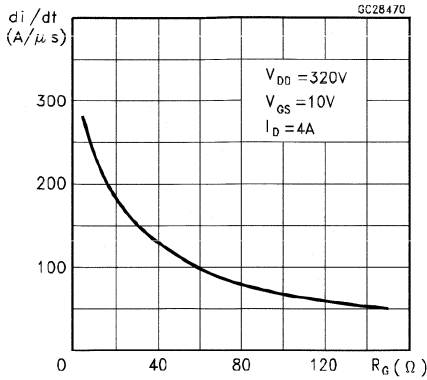
Normalized Gate Threshold Voltage vs Temperature



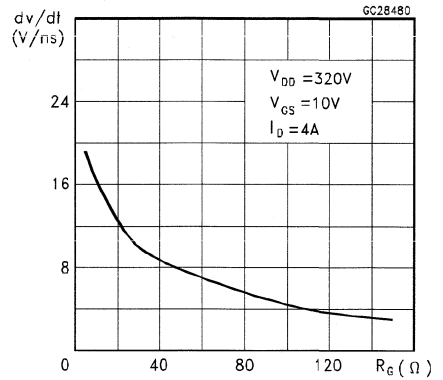
Normalized On Resistance vs Temperature



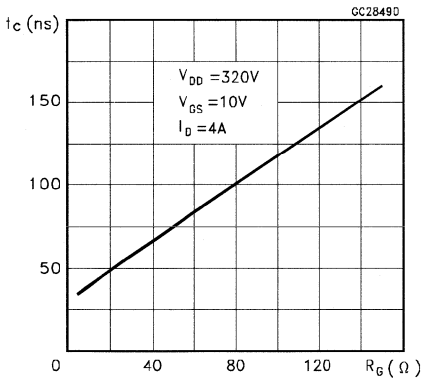
Turn-on Current Slope



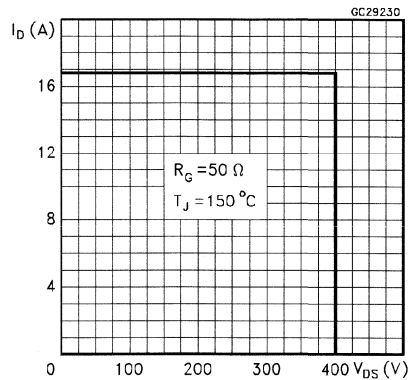
Turn-off Drain-source Voltage Slope



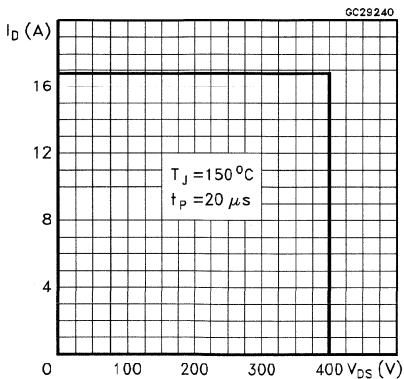
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

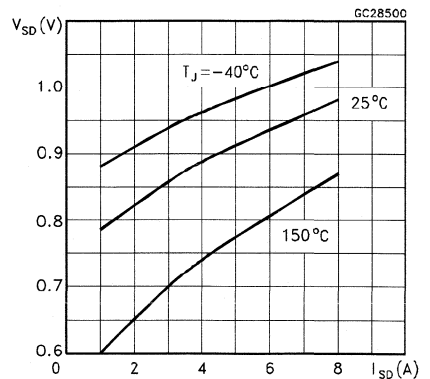


Fig. 1: Unclamped Inductive Load Test Circuits

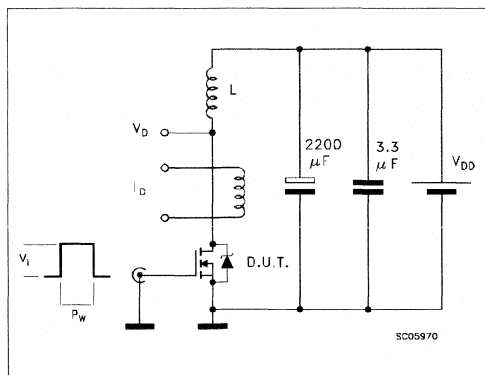


Fig. 2: Unclamped Inductive Waveforms

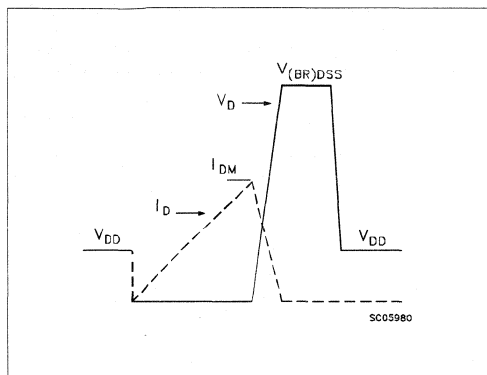


Fig. 3: Switching Times Test Circuits For Resistive Load

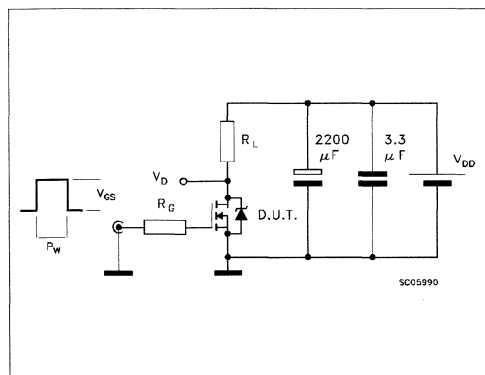


Fig. 4: Gate Charge Test Circuit

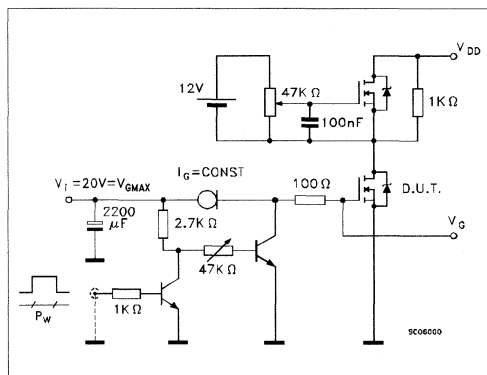
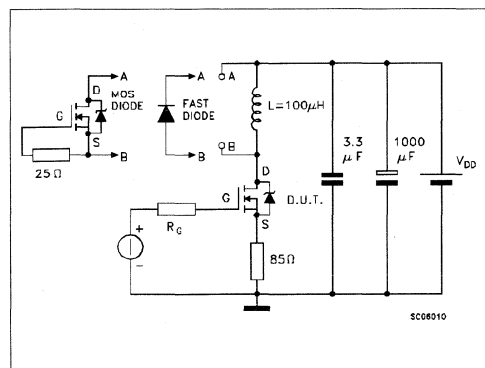


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



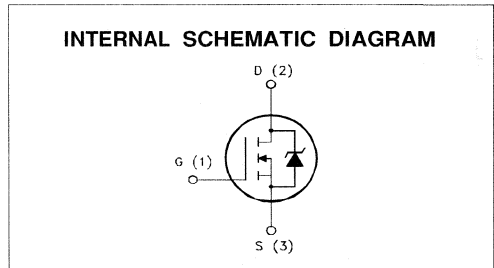
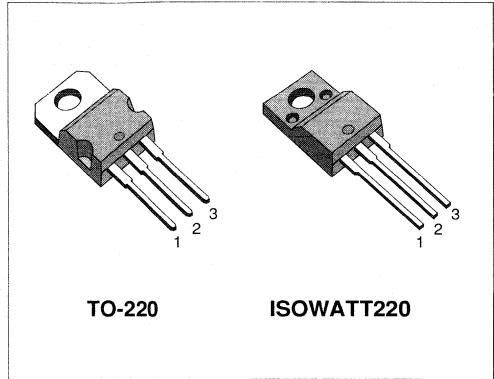
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

TYPE	V _{DSS}	R _{DS(on)}	I _D
IRF730	400 V	< 1 Ω	5.5 A
IRF730FI	400 V	< 1 Ω	3.5 A

- TYPICAL R_{DS(on)} = 0.82 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		IRF730	IRF730FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	400	400	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	400	400	V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (cont.) at T _c = 25 °C	5.5	3.5	A
I _D	Drain Current (cont.) at T _c = 100 °C	3.1	2.2	A
I _{DM} (*)	Drain Current (pulsed)	22	22	A
P _{tot}	Total Dissipation at T _c = 25 °C	100	35	W
	Derating Factor	0.8	0.32	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

		TO-220	ISOWATT220		
R _{thj-case}	Thermal Resistance Junction-case	Max	1.25	3.57	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5		°C/W
R _{thc-s}	Thermal Resistance Case-sink	Typ	0.5		°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	5.5	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	290	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	7.6	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	3.1	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	400			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 3 A		0.82	1	Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} × R _{DS(on)max} V _{GS} = 10 V	5.5			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} × R _{DS(on)max} I _D = 3 A	2.9	3.5		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		640	800	pF
C _{oss}	Output Capacitance			120	150	pF
C _{rss}	Reverse Transfer Capacitance			50	65	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING RESISTIVE LOAD

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 175\text{ V}$ $I_D = 3\text{ A}$		47	62	ns
t_r	Rise Time	$R_{GS} = 15\ \Omega$		35	45	ns
$t_{d(off)}$	Turn-off Delay Time	(see test circuit)		120	155	ns
t_f	Fall Time			30	38	ns
Q_g	Total Gate Charge	$I_D = 5.5\text{ A}$ $V_{GS} = 15\text{ V}$		44	55	nC
Q_{gs}	Gate-Source Charge	$V_{DD} = \text{Max Rating} \times 0.8$		6		nC
Q_{gd}	Gate-Drain Charge	(see test circuit)		20		nC

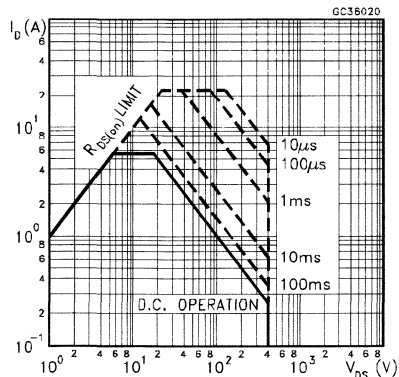
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				5.5	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				22	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 5.5\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 5.5\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		470		ns
Q_{rr}	Reverse Recovery Charge			6.3		μC

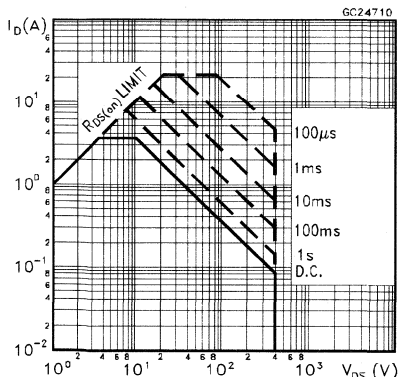
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

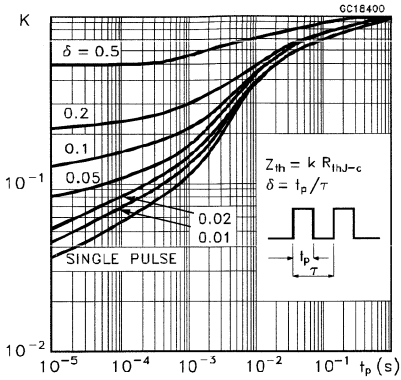
Safe Operating Area for TO-220



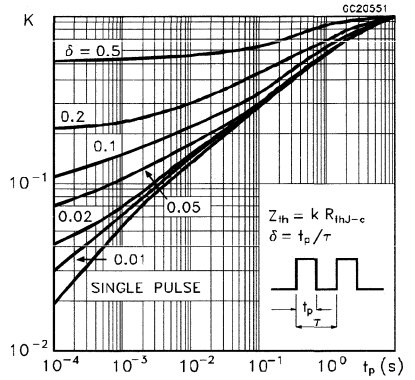
Safe Operating Area for ISOWATT220



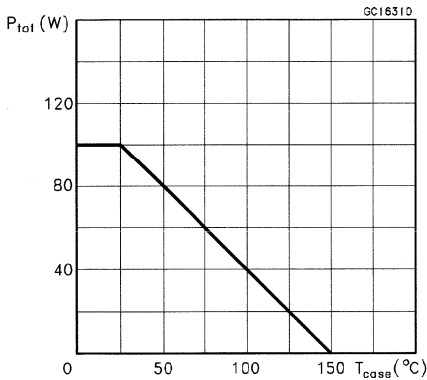
Thermal Impedance for TO-220



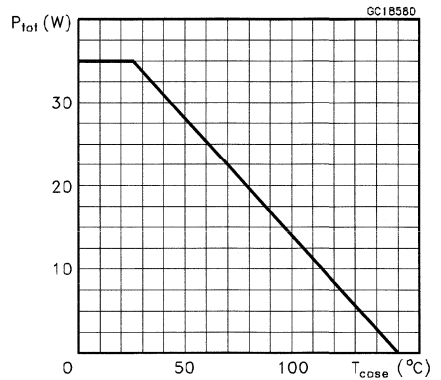
Thermal Impedance for ISOWATT220



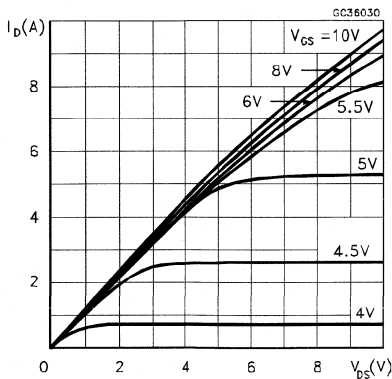
Derating Curve for TO-220



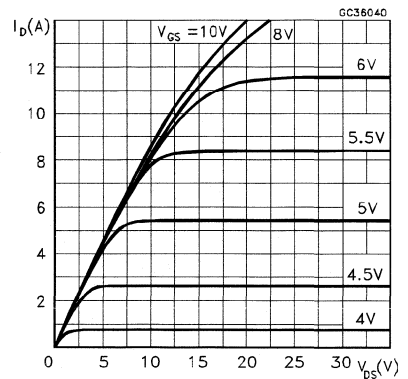
Derating Curve for ISOWATT220



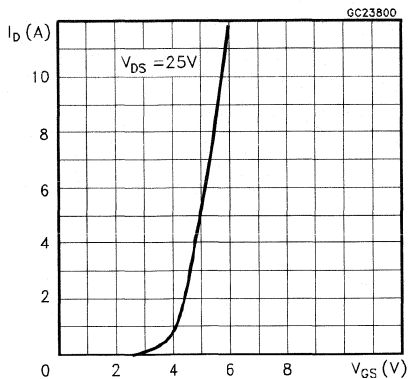
Output Characteristics



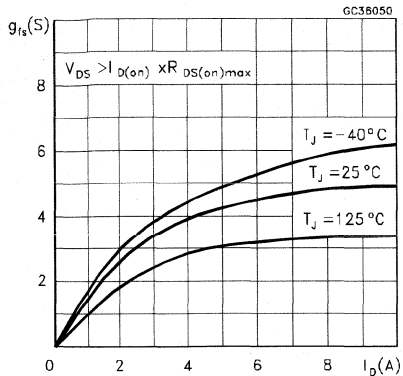
Output Characteristics



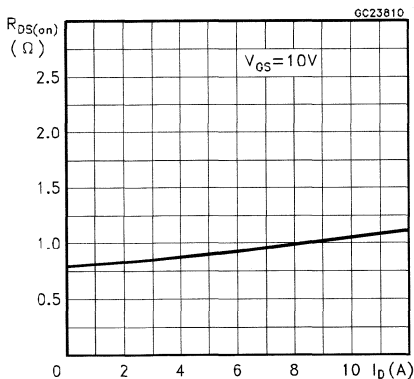
Transfer Characteristics



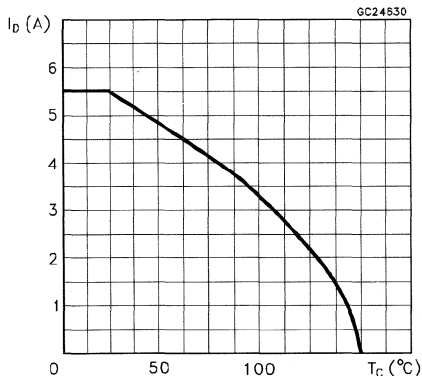
Transconductance



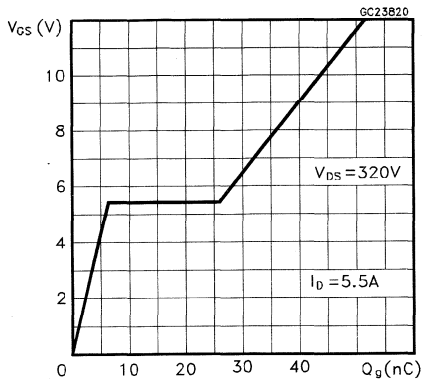
Static Drain-source On Resistance



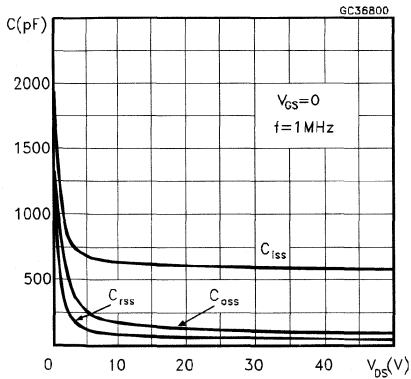
Maximum Drain Current vs Temperature



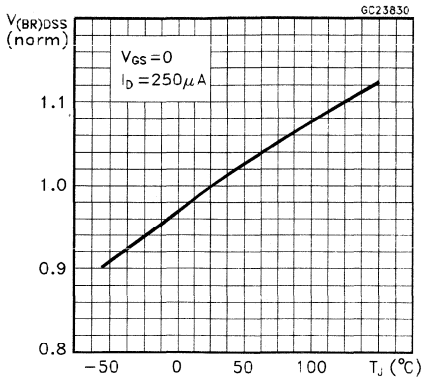
Gate Charge vs Gate-source Voltage



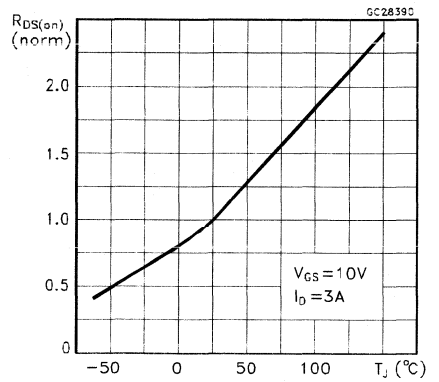
Capacitance Variations



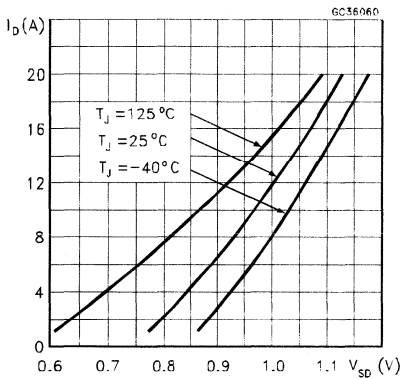
Normalized Breakdown Voltage vs Temperature



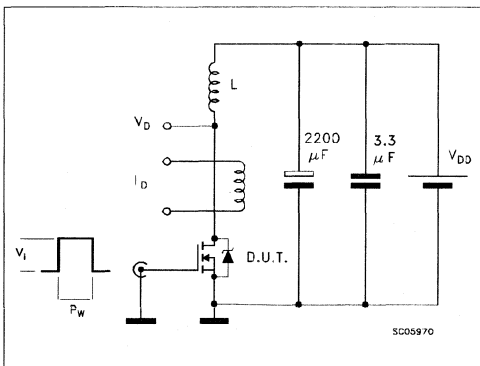
Normalized On Resistance vs Temperature



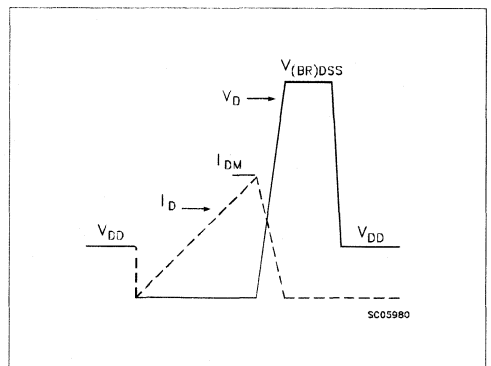
Source-drain Diode Forward Characteristics



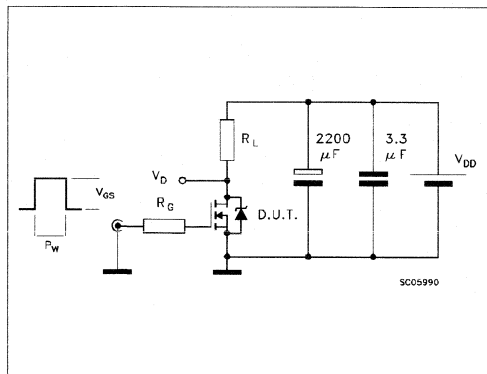
Unclamped Inductive Load Test Circuit



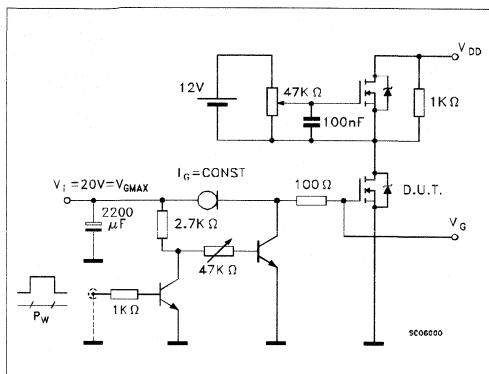
Unclamped Inductive Waveforms



Switching Time Test Circuit



Gate Charge Test Circuit



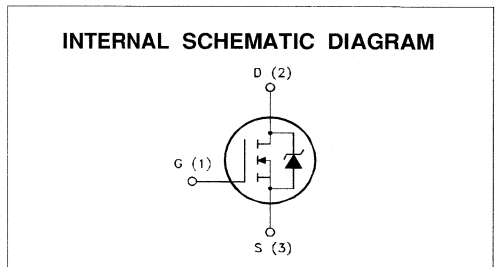
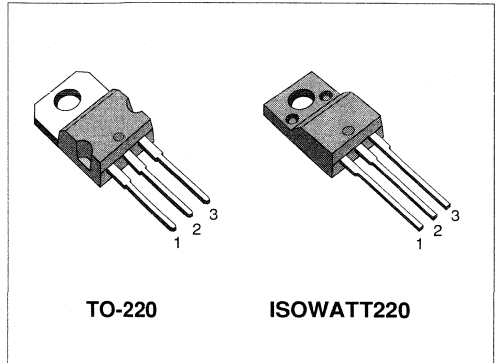
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

TYPE	V _{DSS}	R _{DS(on)}	I _D
IRF740	400 V	< 0.55 Ω	10 A
IRF740FI	400 V	< 0.55 Ω	5.5 A

- TYPICAL R_{DS(on)} = 0.42 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		IRF740	IRF740FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	400	400	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	400	400	V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (cont.) at T _c = 25 °C	10	5.5	A
I _D	Drain Current (cont.) at T _c = 100 °C	6.3	3	A
I _{DM} (*)	Drain Current (pulsed)	40	40	A
P _{tot}	Total Dissipation at T _c = 25 °C	125	40	W
	Derating Factor	1	0.32	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

		TO-220	ISOWATT220		
$R_{thj-case}$	Thermal Resistance Junction-case	Max	1	3.12	$^{\circ}\text{C}/\text{W}$
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5		$^{\circ}\text{C}/\text{W}$
R_{thc-s}	Thermal Resistance Case-sink	Typ	0.5		$^{\circ}\text{C}/\text{W}$
T_l	Maximum Lead Temperature For Soldering Purpose		300		$^{\circ}\text{C}$

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	10	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25^{\circ}\text{C}$, $I_D = I_{AR}$, $V_{DD} = 25\text{V}$)	520	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	13	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100^{\circ}\text{C}$, pulse width limited by T_j max, $\delta < 1\%$)	5.8	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25^{\circ}\text{C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\ \mu\text{A}$ $V_{GS} = 0$	400			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^{\circ}\text{C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\ \mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{V}$ $I_D = 5\text{A}$		0.42	0.55	Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{V}$	10			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 5\text{A}$	4	6		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{V}$ $f = 1\text{MHz}$ $V_{GS} = 0$		1150	1450	pF
C_{oss}	Output Capacitance			220	260	pF
C_{rss}	Reverse Transfer Capacitance			100	120	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING RESISTIVE LOAD

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 175\text{ V}$ $I_D = 5\text{ A}$ $R_i = 4.7\ \Omega$ (see test circuit)		25	32	ns
t_r	Rise Time			37	48	ns
$t_{d(off)}$	Turn-off Delay Time			120	155	ns
t_f	Fall Time			30	38	ns
Q_g	Total Gate Charge	$I_D = 10\text{ A}$ $V_{GS} = 10\text{ V}$		72	90	nC
Q_{gs}	Gate-Source Charge	$V_{DD} = \text{Max Rating} \times 0.8$		10		nC
Q_{gd}	Gate-Drain Charge	(see test circuit)		40		nC

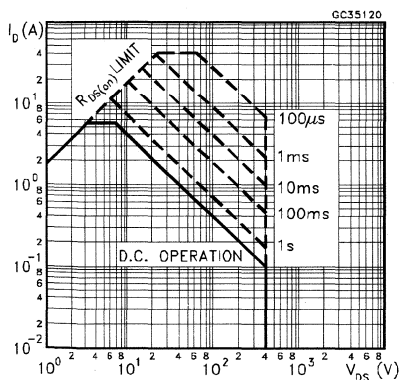
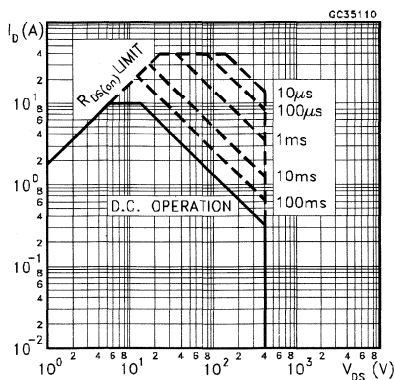
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				10	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				40	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 10\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 10\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		530		ns
Q_{rr}	Reverse Recovery Charge			7.7		μC

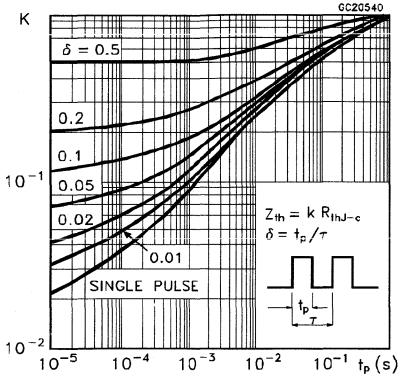
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %
 (•) Pulse width limited by safe operating area

Safe Operating Area for TO-220

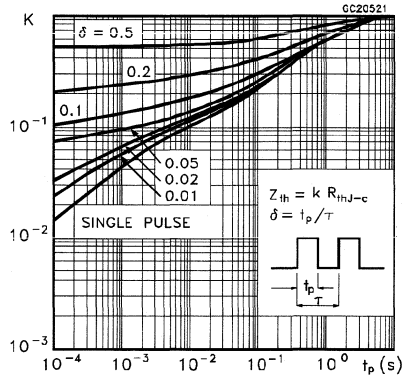
Safe Operating Area for ISOWATT220



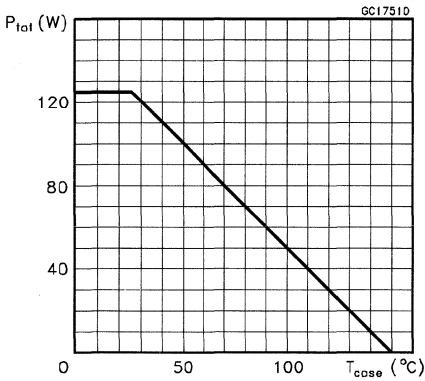
Thermal Impedance for TO-220



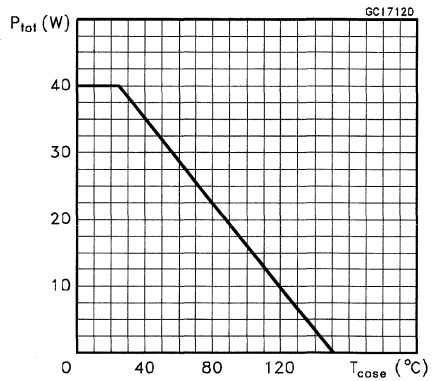
Thermal Impedance for ISOWATT220



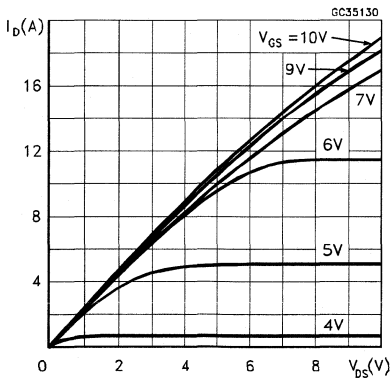
Derating Curve for TO-220



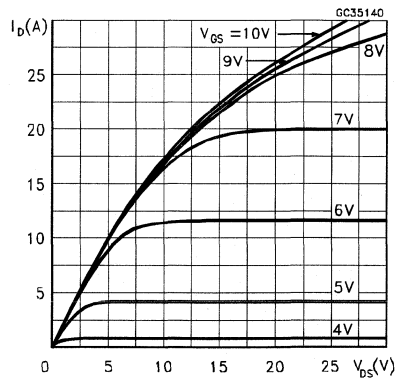
Derating Curve for ISOWATT220



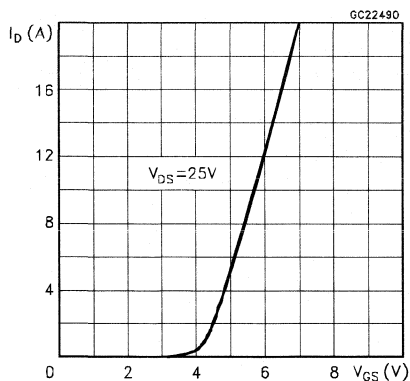
Output Characteristics



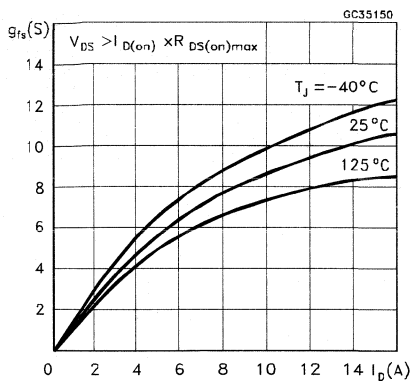
Output Characteristics



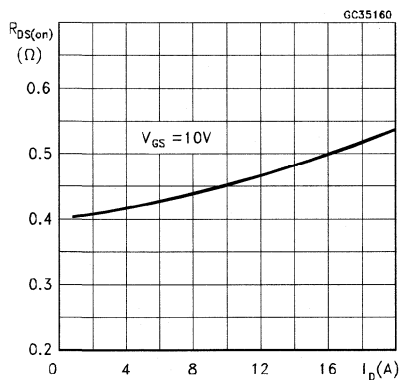
Transfer Characteristics



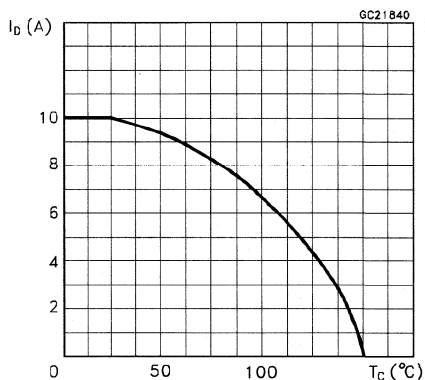
Transconductance



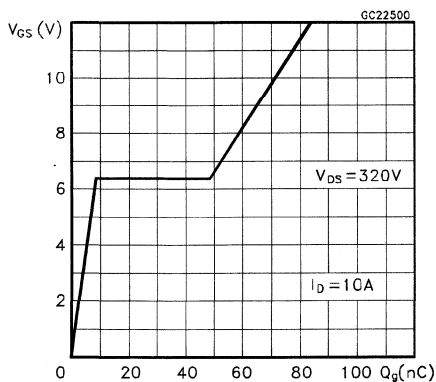
Static Drain-source On Resistance



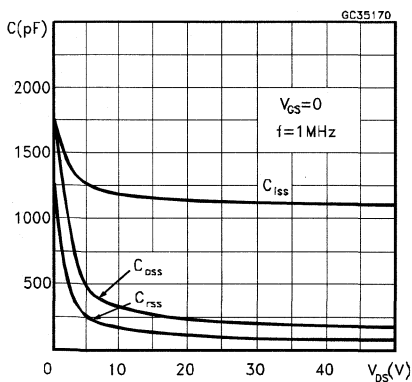
Maximum Drain Current vs Temperature



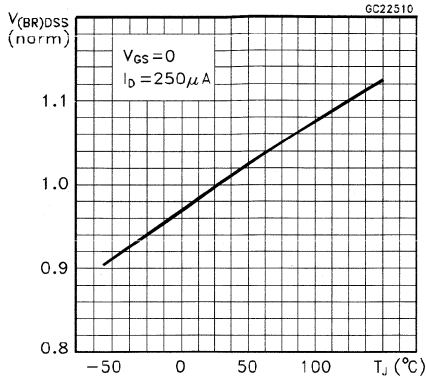
Gate Charge vs Gate-source Voltage



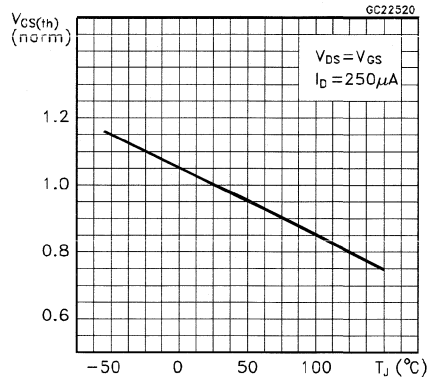
Capacitance Variations



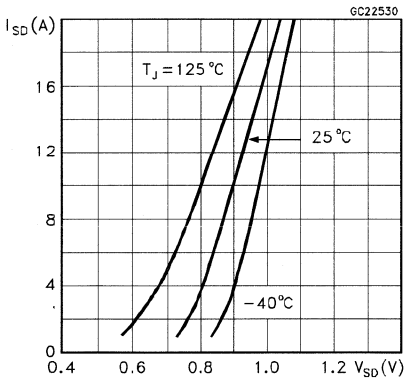
Normalized Breakdown Voltage vs Temperature



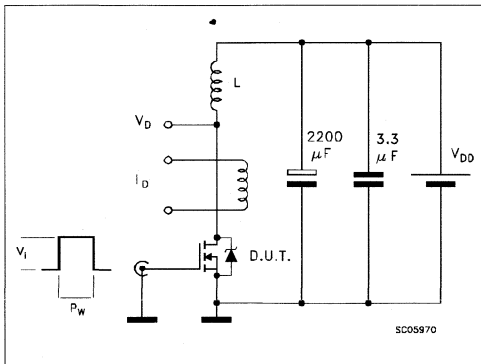
Normalized On Resistance vs Temperature



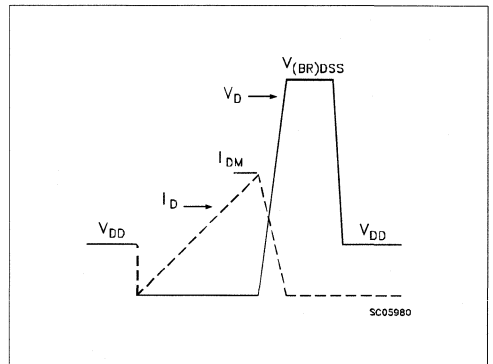
Source-drain Diode Forward Characteristics



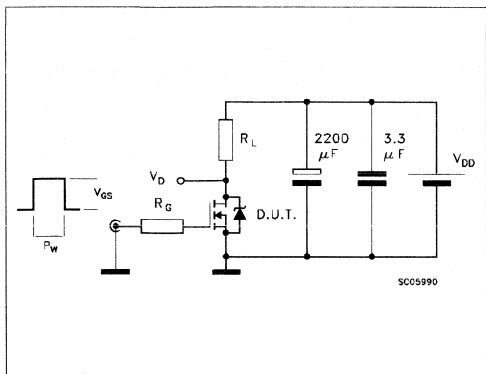
Unclamped Inductive Load Test Circuit



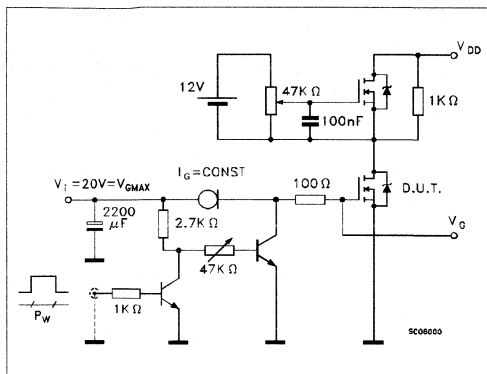
Unclamped Inductive Waveforms



Switching Time Test Circuit



Gate Charge Test Circuit



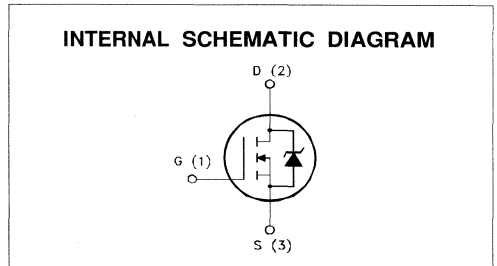
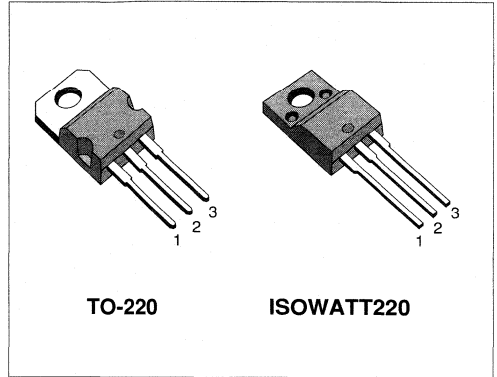
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

TYPE	V _{DSS}	R _{DS(on)}	I _D
IRF820	500 V	< 3 Ω	3 A
IRF820FI	500 V	< 3 Ω	2.2 A
IRF822	500 V	< 4 Ω	2.8 A
IRF822FI	500 V	< 4 Ω	1.9 A

- TYPICAL R_{DS(on)} = 2.5 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value				Unit
		IRF				
		820	822	820FI	822FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	500	500	500	500	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	500	500	500	500	V
V _{GS}	Gate-source Voltage	± 20				V
I _D	Drain Current (cont.) at T _c = 25 °C	3	2.8	2.2	1.9	A
I _D	Drain Current (cont.) at T _c = 100 °C	1.9	1.7	1.4	1.2	A
I _{DM} (*)	Drain Current (pulsed)	12	12	12	12	A
P _{tot}	Total Dissipation at T _c = 25 °C	75		35		W
	Derating Factor	0.6		0.28		W/°C
T _{stg}	Storage Temperature	-65 to 150				°C
T _j	Max. Operating Junction Temperature	150				°C

(*) Pulse width limited by safe operating area

THERMAL DATA

		TO-220	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case	Max 1.66	3.57	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient		62.5	°C/W
R _{thc-s}	Thermal Resistance Case-sink		0.5	°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	3	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	225	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	6	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	1.9	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	500			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 1.5 A for IRF820/820FI for IRF822/822FI		2.5 2.5	3 4	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V for IRF820/820FI for IRF822/822FI	3 2.8			A A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 1.5 A	0.8	1.93		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		350	460	pF
C _{oss}	Output Capacitance			60	80	pF
C _{rss}	Reverse Transfer Capacitance			25	35	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING RESISTIVE LOAD

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 250\text{ V}$ $I_D = 1.5\text{ A}$		35	45	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		85	110	ns
$t_{d(off)}$	Turn-off Delay Time	(see test circuit)		165	215	ns
t_f	Fall Time			60	80	ns
Q_g	Total Gate Charge	$I_D = 3\text{ A}$ $V_{GS} = 10\text{ V}$ $V_{DD} = \text{Max Rating} \times 0.8$ (see test circuit)		25 6 11	35	nC nC nC

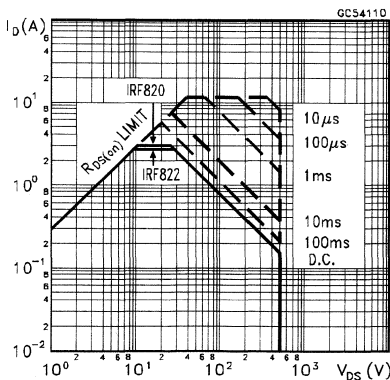
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				3	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				12	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 3\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 3\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_J = 150\text{ }^\circ\text{C}$		380		ns
Q_{rr}	Reverse Recovery Charge			3.8		μC

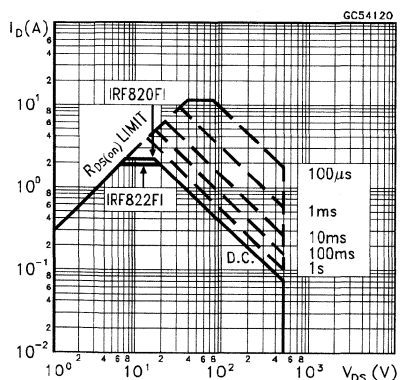
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

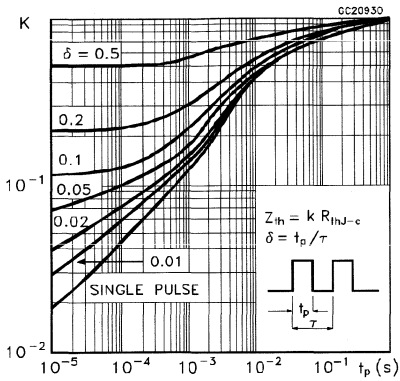
Safe Operating Area for TO-220



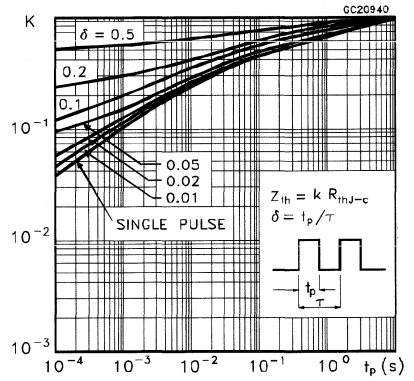
Safe Operating Area for ISOWATT220



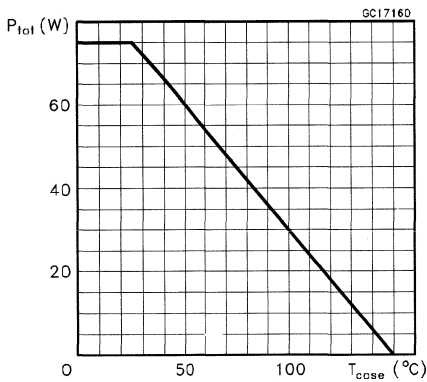
Thermal Impedance for TO-220



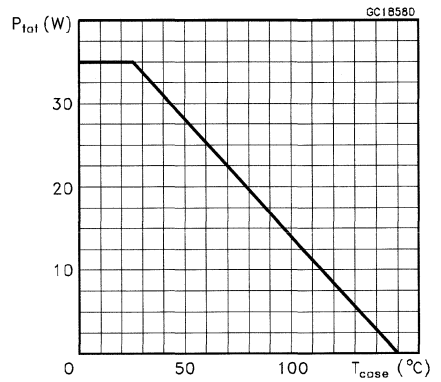
Thermal Impedance for ISOWATT220



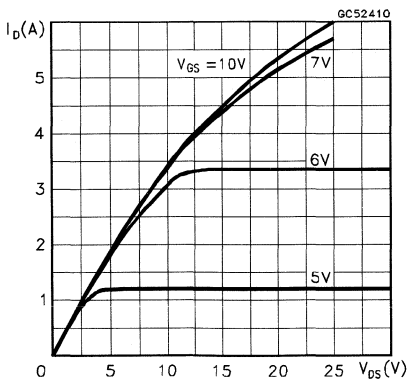
Derating Curve for TO-220



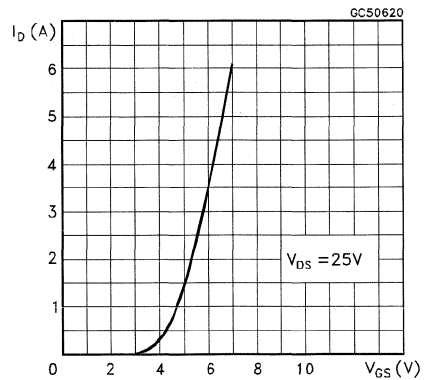
Derating Curve for ISOWATT220



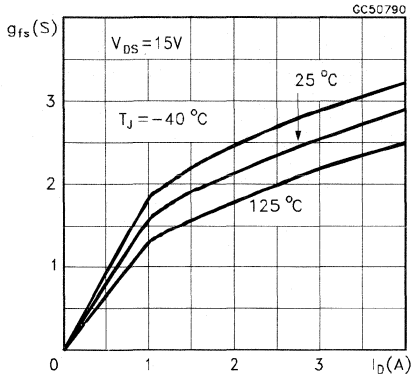
Output Characteristics



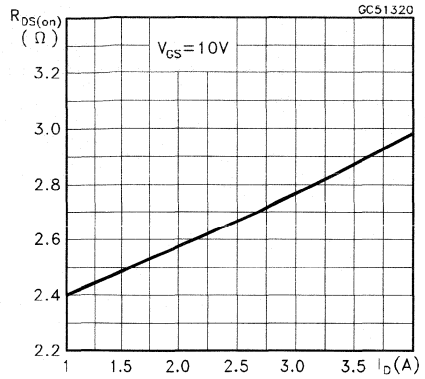
Transfer Characteristics



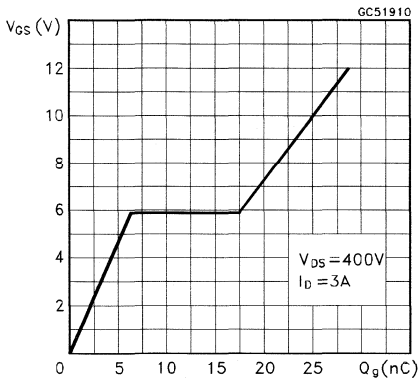
Transconductance



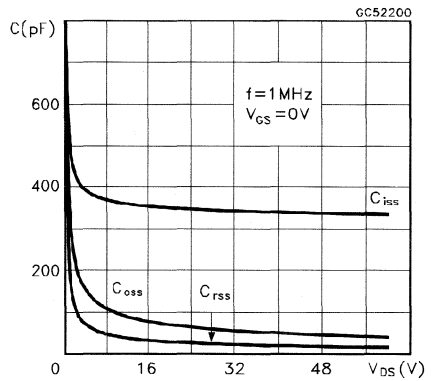
Static Drain-source On Resistance



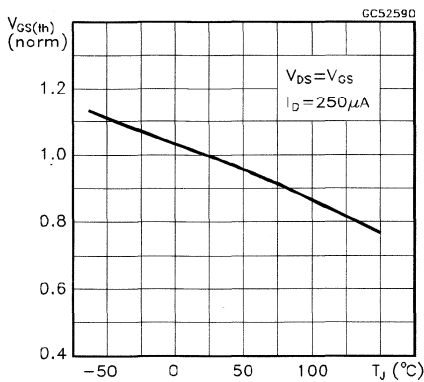
Gate Charge vs Gate-source Voltage



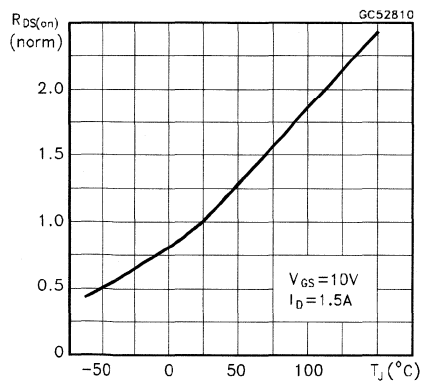
Capacitance Variations



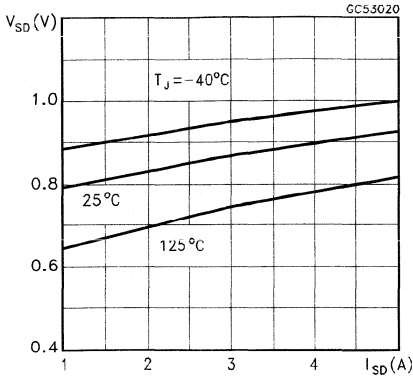
Normalized Gate Threshold Voltage vs Temperature



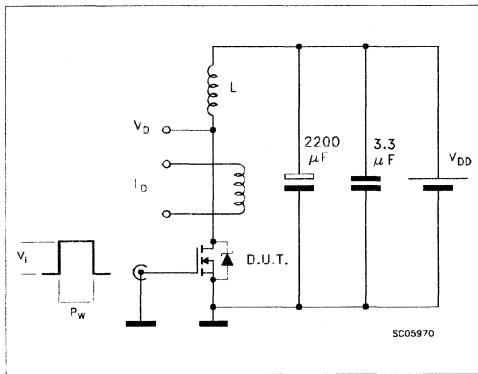
Normalized On Resistance vs Temperature



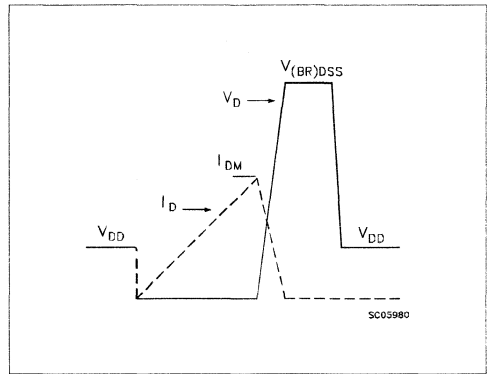
Source-drain Diode Forward Characteristics



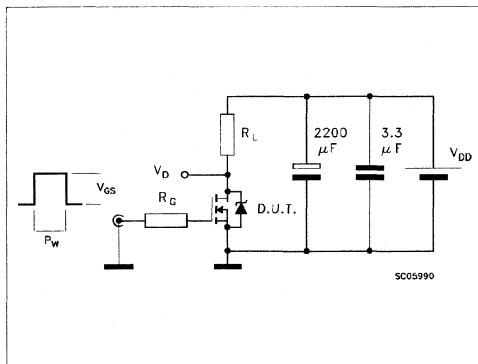
Unclamped Inductive Load Test Circuit



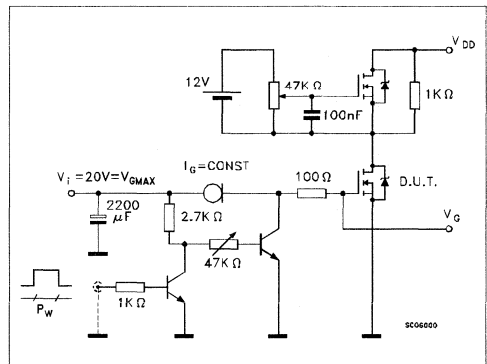
Unclamped Inductive Waveforms



Switching Time Test Circuit



Gate Charge Test Circuit



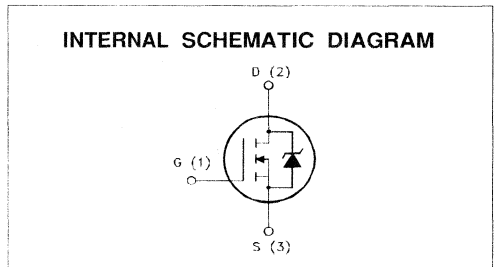
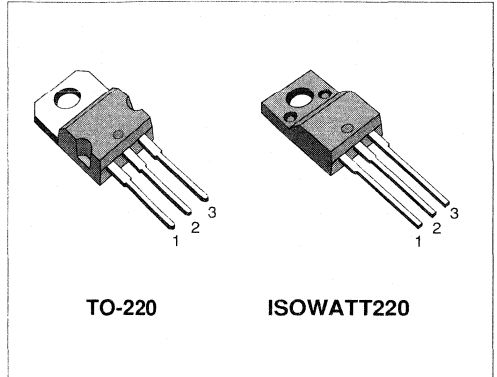
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

TYPE	V _{DSS}	R _{DS(on)}	I _D
IRF830	500 V	< 1.5 Ω	4.5 A
IRF830FI	500 V	< 1.5 Ω	3 A
IRF831	450 V	< 1.5 Ω	4.5 A
IRF831FI	450 V	< 1.5 Ω	3 A

- TYPICAL R_{DS(on)} = 1.35 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value				Unit
		IRF				
		830	831	830FI	831FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	500	450	500	450	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	500	450	500	450	V
V _{GS}	Gate-source Voltage	± 20				V
I _D	Drain Current (cont.) at T _c = 25 °C	4.5	4.5	3	3	A
I _D	Drain Current (cont.) at T _c = 100 °C	3	3	1.8	1.8	A
I _{DM} (*)	Drain Current (pulsed)	15	15	15	15	A
P _{tot}	Total Dissipation at T _c = 25 °C	100		35		W
	Derating Factor	0.8		0.28		W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—		2000		V
T _{stg}	Storage Temperature	-65 to 150				°C
T _j	Max. Operating Junction Temperature	150				°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
$R_{thj-case}$	Thermal Resistance Junction-case	Max	1.25	3.57	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5		°C/W
R_{thc-s}	Thermal Resistance Case-sink	Typ	0.5		°C/W
T_I	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	4.5	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ °C}$, $I_D = I_{AR}$, $V_{DD} = 25\text{ V}$)	280	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	7.4	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ °C}$, pulse width limited by T_j max, $\delta < 1\%$)	2.5	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$ for IRF830/830FI for IRF831/831FI	500 450			V V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\text{ }\mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 2.5\text{ A}$		1.35	1.5	Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	4.5			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 2.5\text{ A}$	2.7	3.4		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		600	800	pF
C_{oss}	Output Capacitance			100	130	pF
C_{rss}	Reverse Transfer Capacitance			40	55	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING RESISTIVE LOAD

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 225\text{ V}$ $I_D = 2.5\text{ A}$ $R_G = 15\ \Omega$ (see test circuit)		45	60	ns
t_r	Rise Time			34	42	ns
$t_{d(off)}$	Turn-off Delay Time			125	155	ns
t_f	Fall Time			39	50	ns
Q_g	Total Gate Charge	$I_D = 4.5\text{ A}$ $V_{GS} = 10\text{ V}$		42	52	nC
Q_{gs}	Gate-Source Charge	$V_{DD} = \text{Max Rating} \times 0.8$		6		nC
Q_{gd}	Gate-Drain Charge	(see test circuit)		20		nC

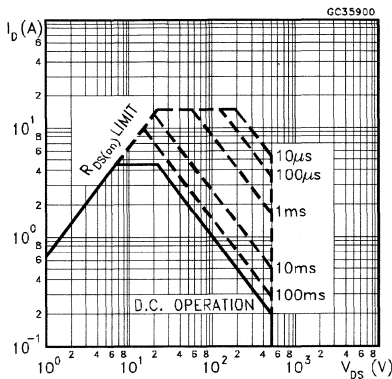
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				4.5	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				15	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 4.5\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 4.5\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		430		ns
Q_{rr}	Reverse Recovery Charge			3.8		μC

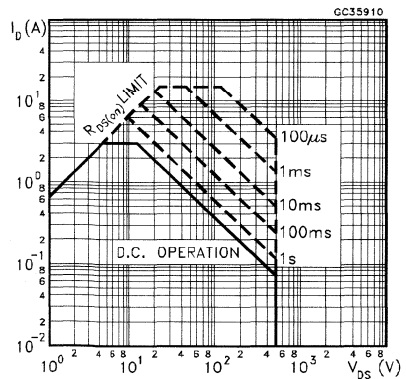
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

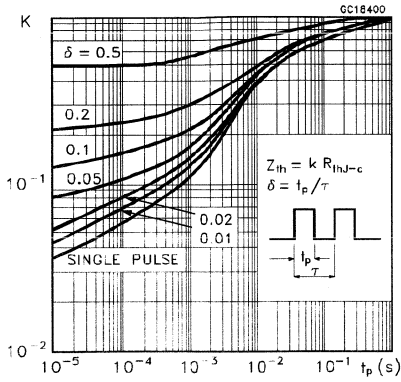
Safe Operating Area for TO-220



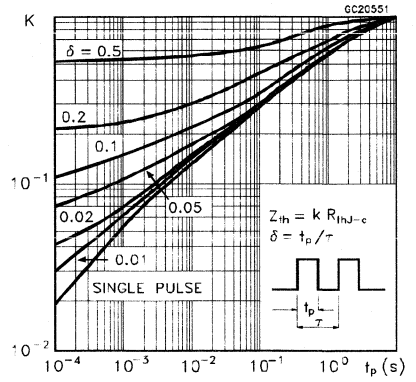
Safe Operating Area for ISOWATT220



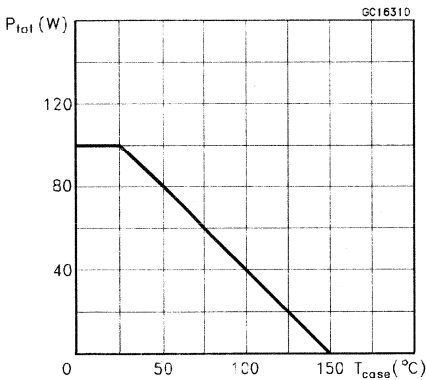
Thermal Impedance for TO-220



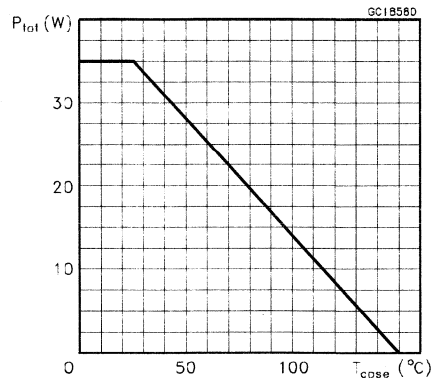
Thermal Impedance for ISOWATT220



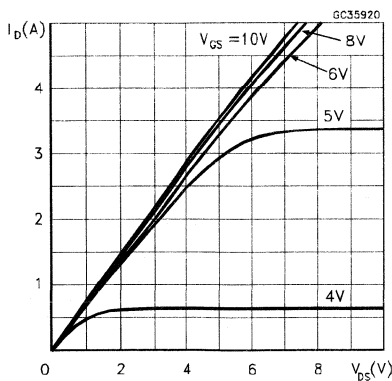
Derating Curve for TO-220



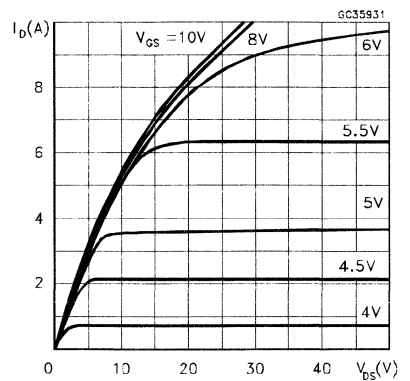
Derating Curve for ISOWATT220



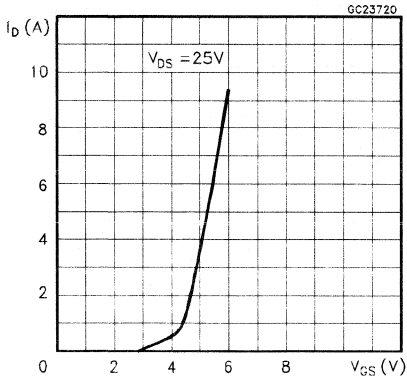
Output Characteristics



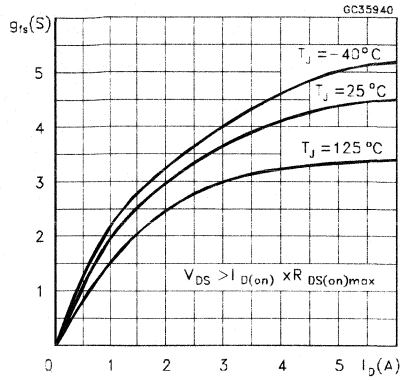
Output Characteristics



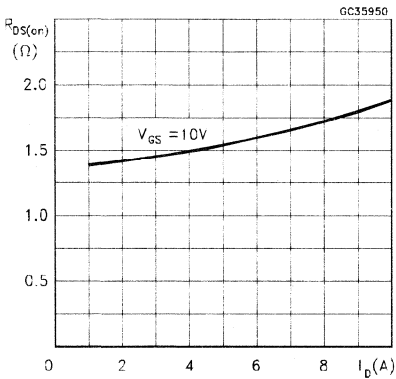
Transfer Characteristics



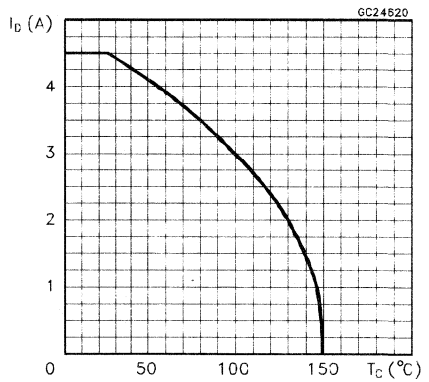
Transconductance



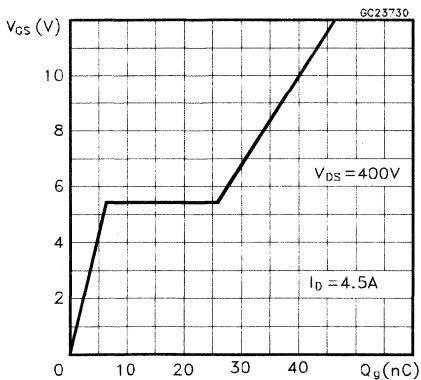
Static Drain-source On Resistance



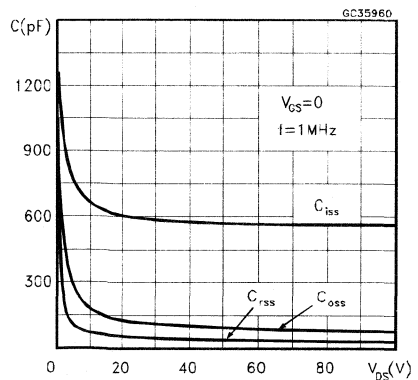
Maximum Drain Current vs Temperature



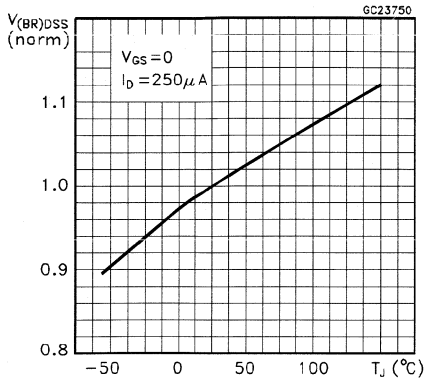
Gate Charge vs Gate-source Voltage



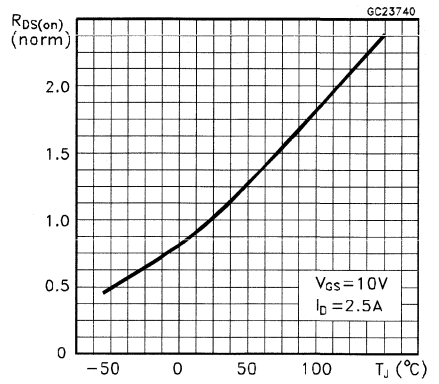
Capacitance Variations



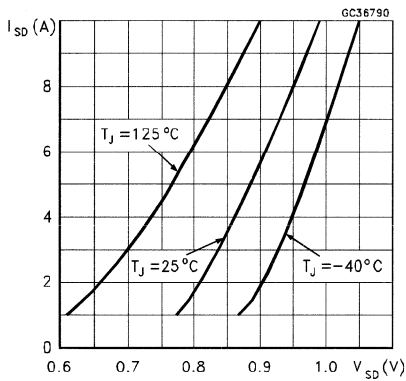
Normalized Breakdown Voltage vs Temperature



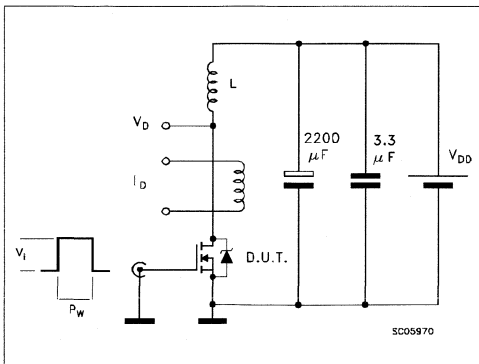
Normalized On Resistance vs Temperature



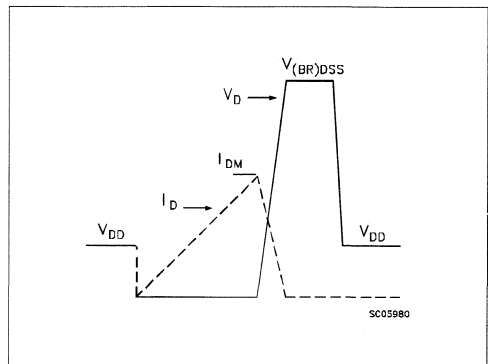
Source-drain Diode Forward Characteristics



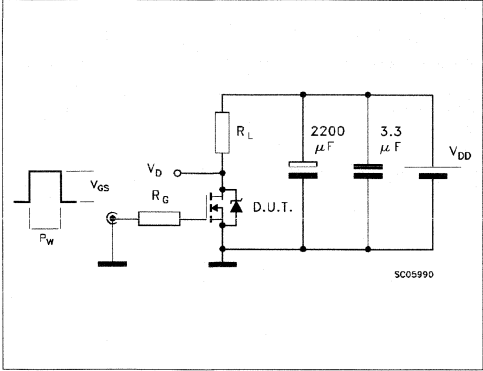
Unclamped Inductive Load Test Circuit



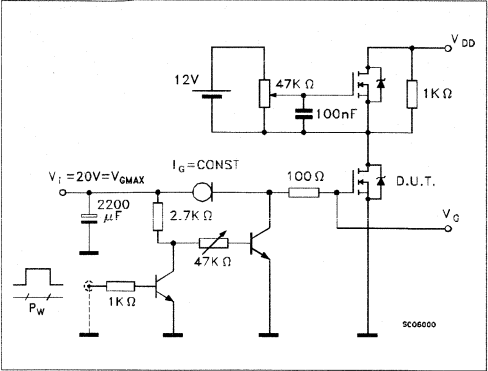
Unclamped Inductive Waveforms



Switching Time Test Circuit



Gate Charge Test Circuit



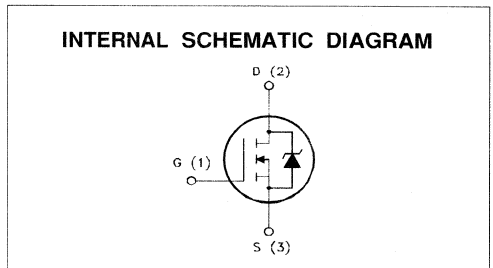
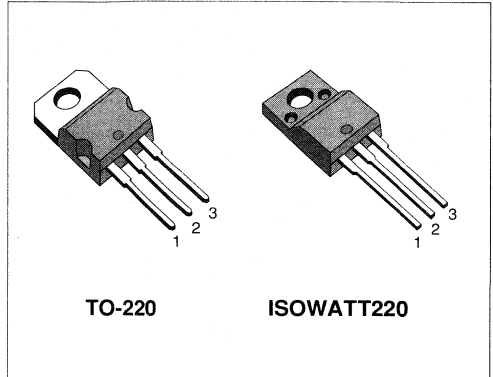
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

TYPE	V _{DSS}	R _{DS(on)}	I _D
IRF840	500 V	< 0.85 Ω	8 A
IRF840FI	500 V	< 0.85 Ω	4.5 A
IRF841	450 V	< 0.85 Ω	8 A
IRF841FI	450 V	< 0.85 Ω	4.5 A

- TYPICAL R_{DS(on)} = 0.74 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value				Unit
		IRF				
		840	841	840FI	841FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	500	450	500	450	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	500	450	500	450	V
V _{GS}	Gate-source Voltage	± 20				V
I _D	Drain Current (cont.) at T _c = 25 °C	8	8	4.5	4.5	A
I _D	Drain Current (cont.) at T _c = 100 °C	5.1	5.1	2.8	2.8	A
I _{DM} (*)	Drain Current (pulsed)	32	32	32	32	A
P _{tot}	Total Dissipation at T _c = 25 °C	125		40		W
	Derating Factor	1		0.32		W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—		2000		
T _{stg}	Storage Temperature	-65 to 150				°C
T _J	Max. Operating Junction Temperature	150				°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
$R_{thj-case}$	Thermal Resistance Junction-case	Max	1	3.12	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5		°C/W
R_{thc-s}	Thermal Resistance Case-sink	Typ	0.5		°C/W
T_l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	8	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ °C}$, $I_D = I_{AR}$, $V_{DD} = 25\text{ V}$)	510	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	13	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ °C}$, pulse width limited by T_j max, $\delta < 1\%$)	5.1	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$ for IRF840/840FI for IRF841/841FI	500 450			V V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\text{ }\mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 4.4\text{ A}$		0.74	0.85	Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	8			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 4.4\text{ A}$	4.9	6		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		1100	1500	pF
C_{oss}	Output Capacitance			190	240	pF
C_{rss}	Reverse Transfer Capacitance			80	110	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING RESISTIVE LOAD

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 200\text{ V}$ $I_D = 4\text{ A}$ $R_i = 4.7\ \Omega$ (see test circuit)		40	50	ns
t_r	Rise Time			35	43	ns
$t_{d(off)}$	Turn-off Delay Time			80	100	ns
t_f	Fall Time			20	25	ns
Q_g	Total Gate Charge	$I_D = 8\text{ A}$ $V_{GS} = 10\text{ V}$		75	95	nC
Q_{gs}	Gate-Source Charge	$V_{DD} = \text{Max Rating} \times 0.8$ (see test circuit)		9		nC
Q_{gd}	Gate-Drain Charge			39		nC

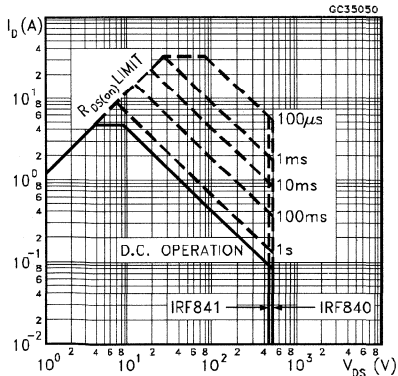
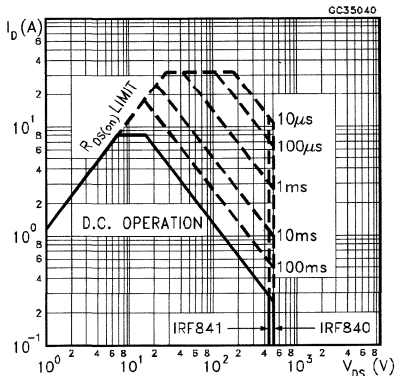
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				8	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				32	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 8\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 8\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		700		ns
Q_{rr}	Reverse Recovery Charge				12	μC

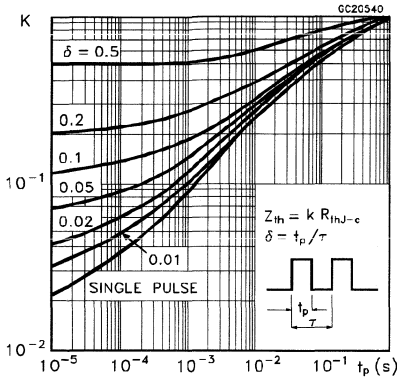
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %
 (•) Pulse width limited by safe operating area

Safe Operating Area for TO-220

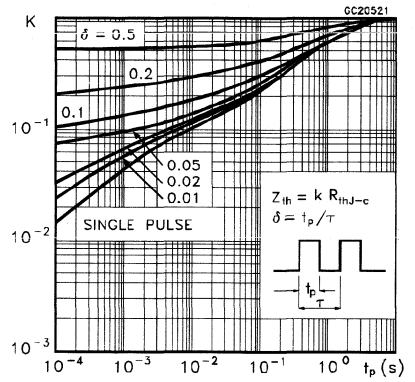
Safe Operating Area for ISOWATT220



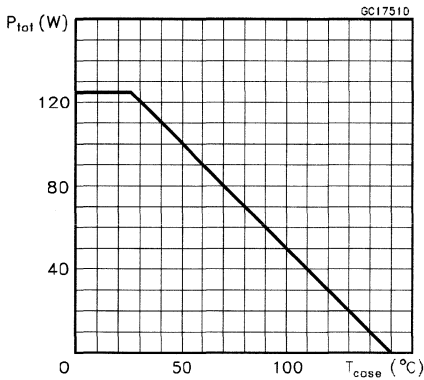
Thermal Impedance for TO-220



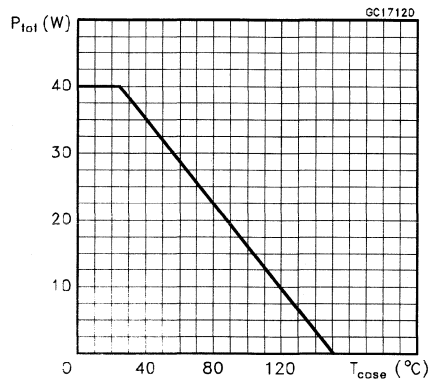
Thermal Impedance for ISOWATT220



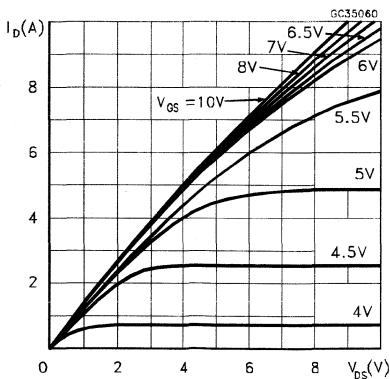
Derating Curve for TO-220



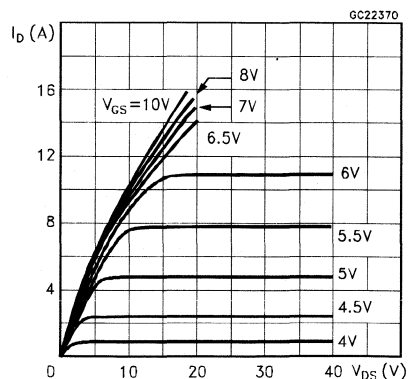
Derating Curve for ISOWATT220



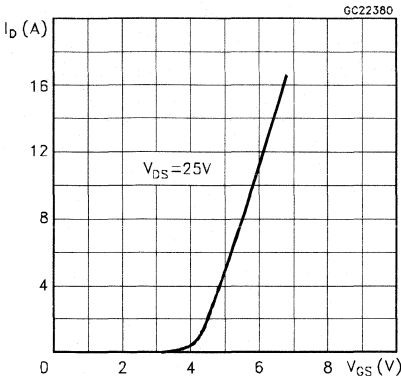
Output Characteristics



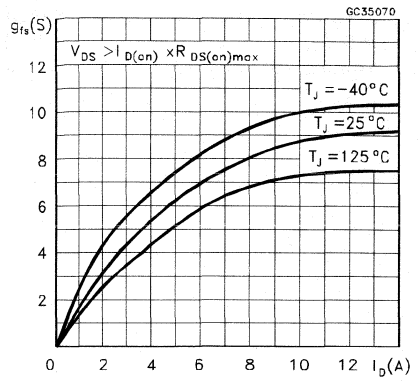
Output Characteristics



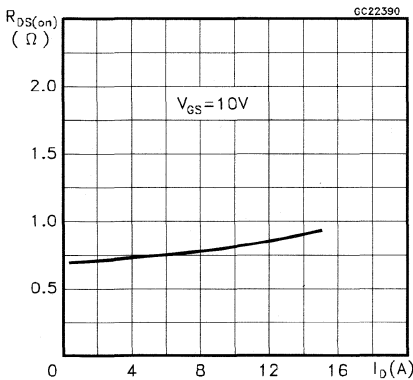
Transfer Characteristics



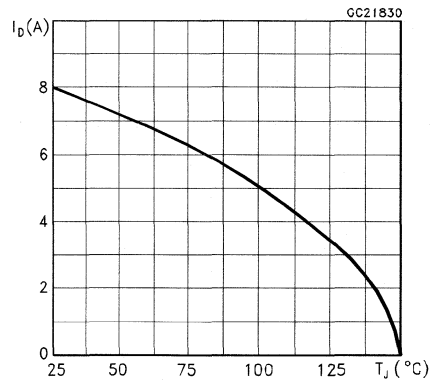
Transconductance



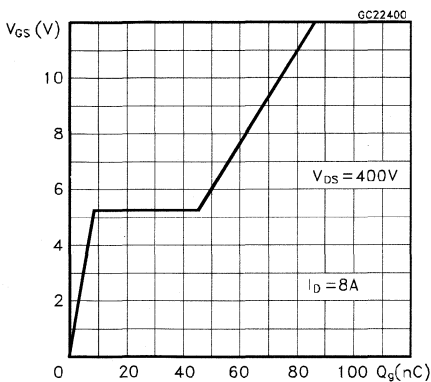
Static Drain-source On Resistance



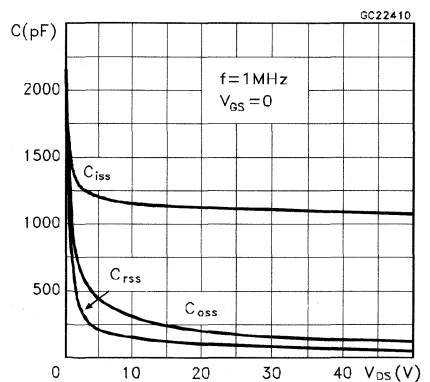
Maximum Drain Current vs Temperature



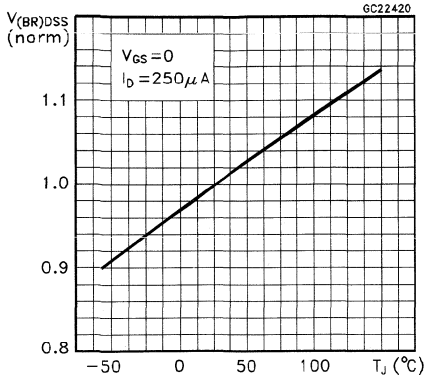
Gate Charge vs Gate-source Voltage



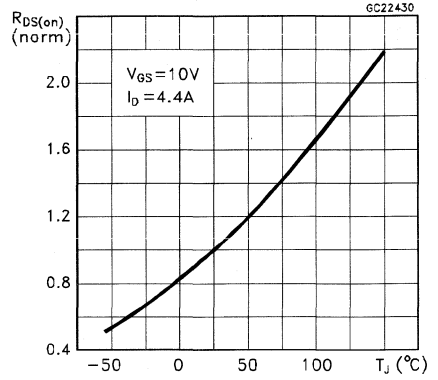
Capacitance Variations



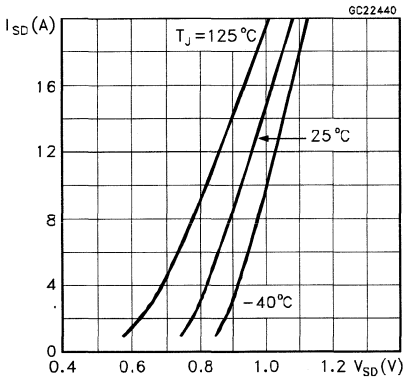
Normalized Breakdown Voltage vs Temperature



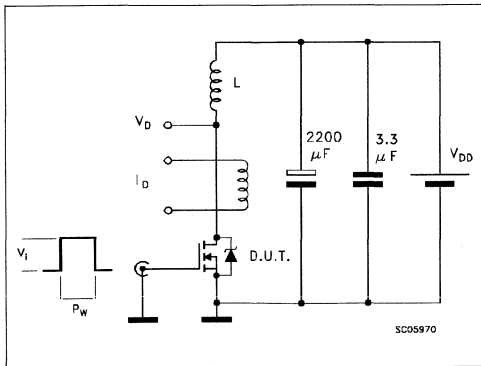
Normalized On Resistance vs Temperature



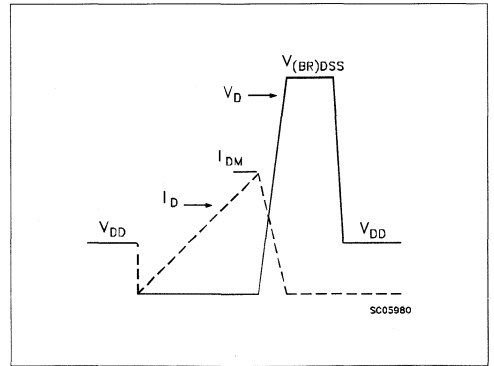
Source-drain Diode Forward Characteristics



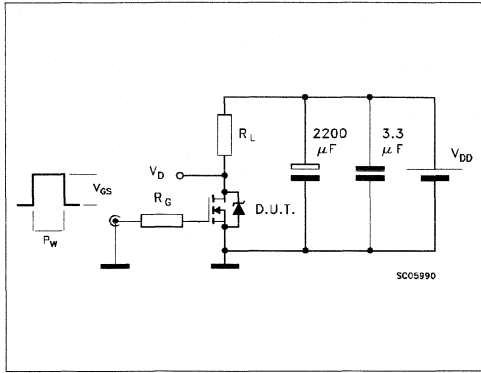
Unclamped Inductive Load Test Circuit



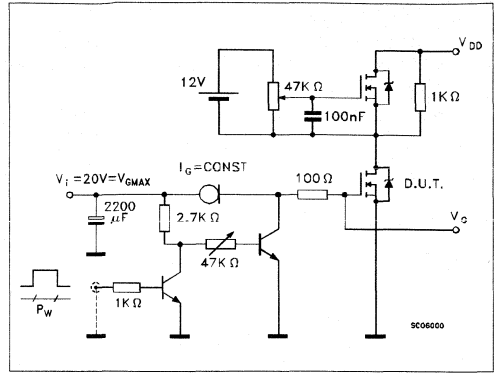
Unclamped Inductive Waveforms



Switching Time Test Circuit



Gate Charge Test Circuit



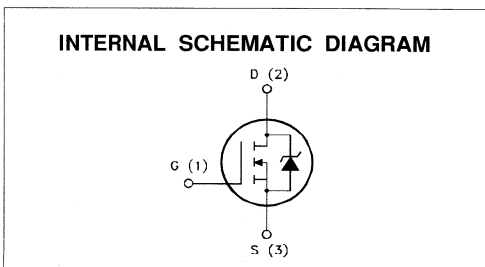
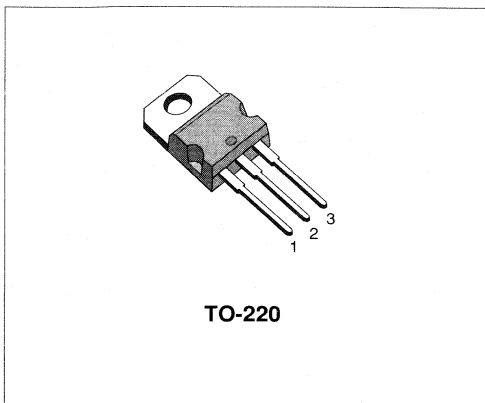
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
IRFBC30	600 V	< 2.2 Ω	4.3 A

- TYPICAL R_{DS(on)} = 2 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	600	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	600	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	4.3	A
I _D	Drain Current (continuous) at T _c = 100 °C	2.7	A
I _{DM} (●)	Drain Current (pulsed)	15	A
P _{tot}	Total Dissipation at T _c = 25 °C	100	W
	Derating Factor	0.8	W/°C
T _{stg}	Storage Temperature	-65 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C

(●) Pulse width limited by safe operating area

THERMAL DATA

R _{thj-case}	Thermal Resistance Junction-case	Max	1.25	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5	°C/W
R _{thj-amb}	Thermal Resistance Case-sink	Typ	0.5	°C/W
T _I	Maximum Lead Temperature For Soldering Purpose		300	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	4.3	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	370	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	9.8	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	2.7	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	600			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 2 A V _{GS} = 10V I _D = 2 A T _c = 100°C		2	2.2 4.4	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)} max V _{GS} = 10 V	4.3			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)} max I _D = 2 A	2.4	3		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		560	820	pF
C _{oss}	Output Capacitance			90	130	pF
C _{rss}	Reverse Transfer Capacitance			40	50	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 225\text{ V}$ $I_D = 2.5\text{ A}$		45	60	ns
t_r	Rise Time	$R_G = 15\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		33	42	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 480\text{ V}$ $I_D = 4\text{ A}$ $R_G = 15\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		200		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 480\text{ V}$ $I_D = 4\text{ A}$ $V_{GS} = 10\text{ V}$		43	55	nC
Q_{gs}	Gate-Source Charge			6		nC
Q_{gd}	Gate-Drain Charge			21		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(V_{off})}$	Off-voltage Rise Time	$V_{DD} = 480\text{ V}$ $I_D = 4\text{ A}$		35	45	ns
t_f	Fall Time	$R_G = 15\ \Omega$ $V_{GS} = 10\text{ V}$		40	55	ns
t_c	Cross-over Time	(see test circuit, figure 5)		60	75	ns

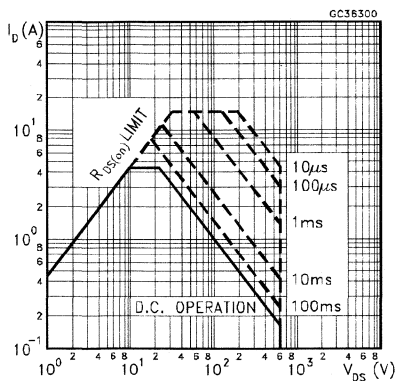
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				4.3	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				15	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 4.3\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 4\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		420		ns
Q_{rr}	Reverse Recovery Charge			3.7		μC
I_{RRM}	Reverse Recovery Current			18		A

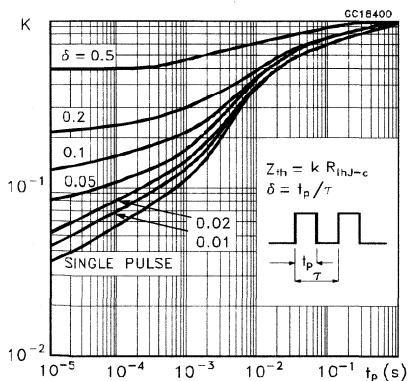
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

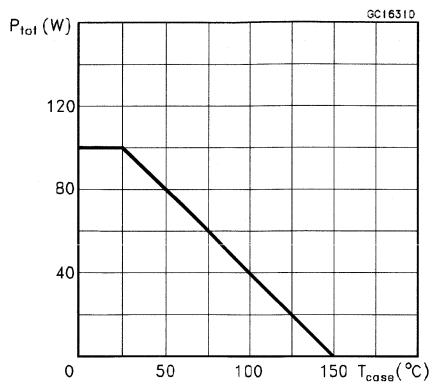
Safe Operating Area



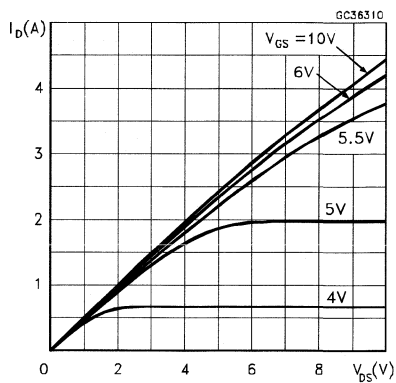
Thermal Impedance



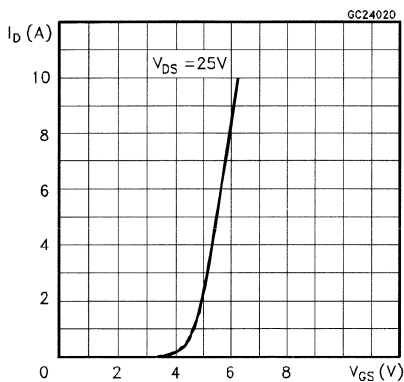
Derating Curve



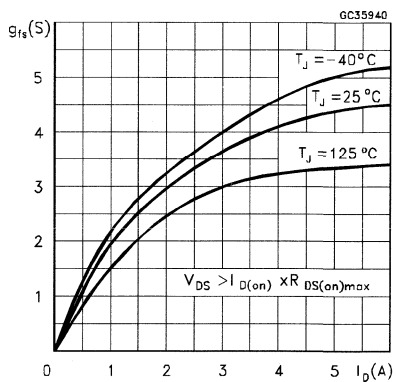
Output Characteristics



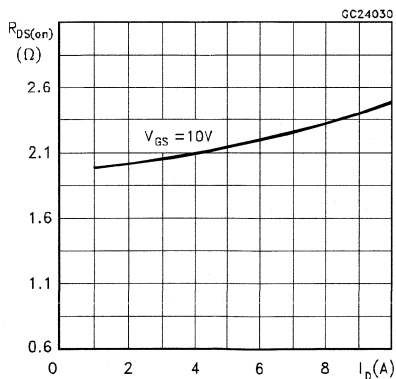
Transfer Characteristics



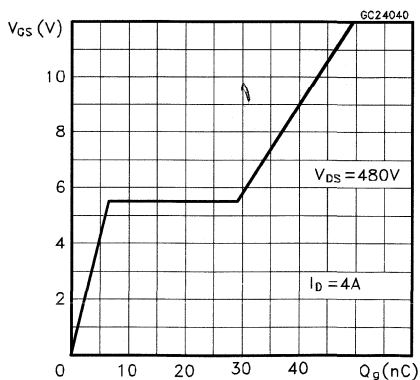
Transconductance



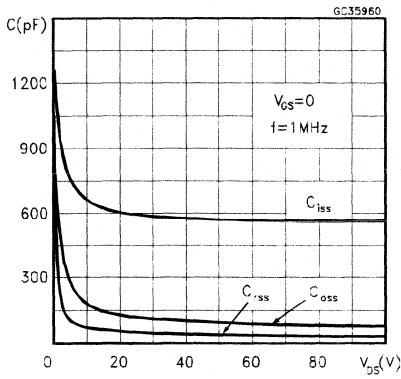
Static Drain-source On Resistance



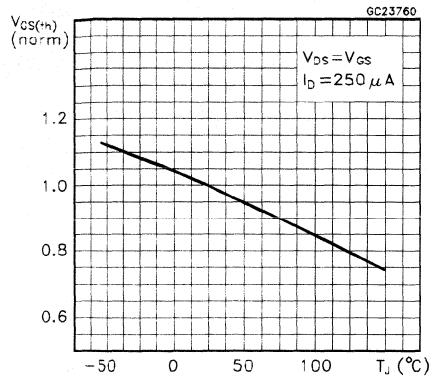
Gate Charge vs. Gate-source Voltage



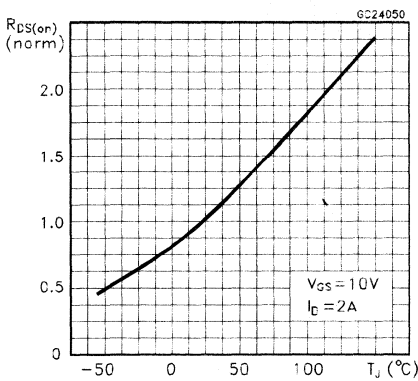
Capacitance Variations



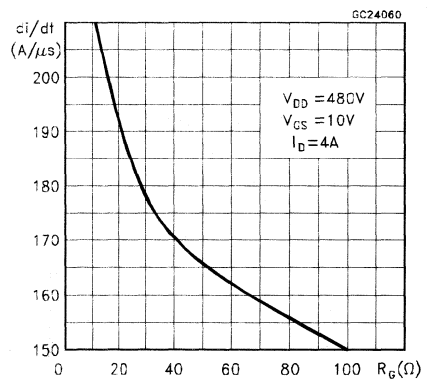
Normalized Gate Threshold Voltage vs Temperature



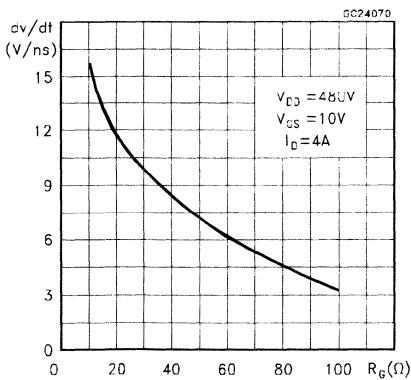
Normalized On Resistance vs Temperature



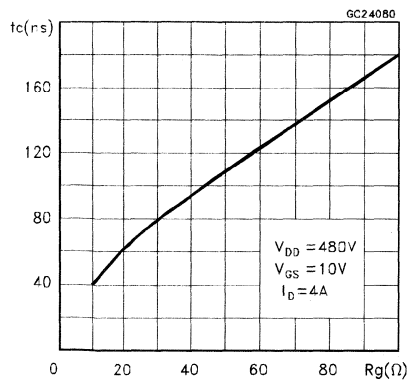
Turn-on Current Slope



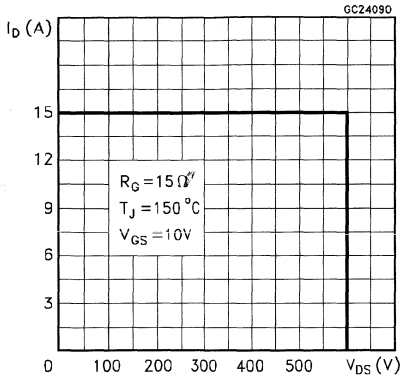
Turn-off Drain-source Voltage Slope



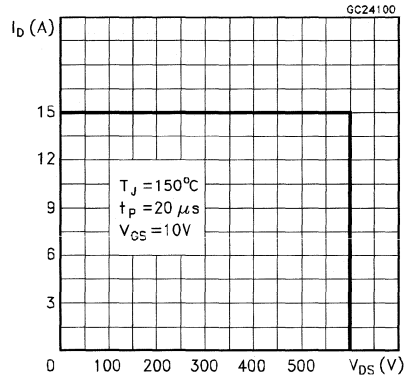
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

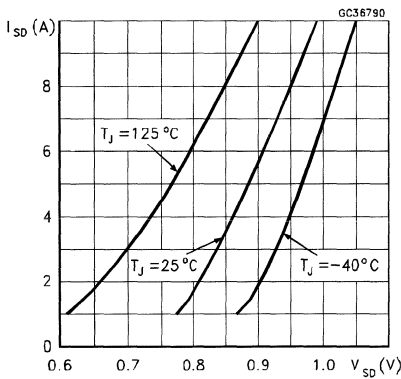


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

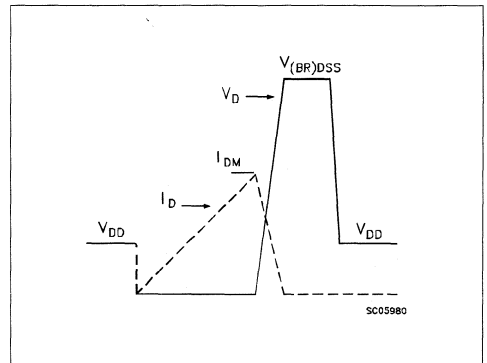
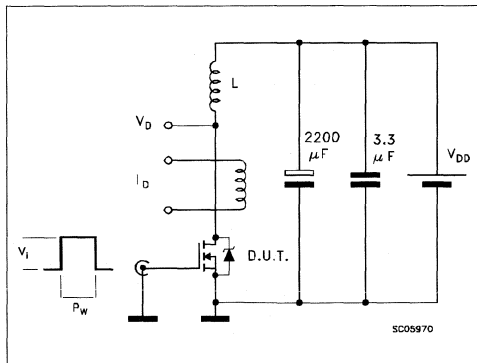


Fig. 3: Switching Times Test Circuits For Resistive Load

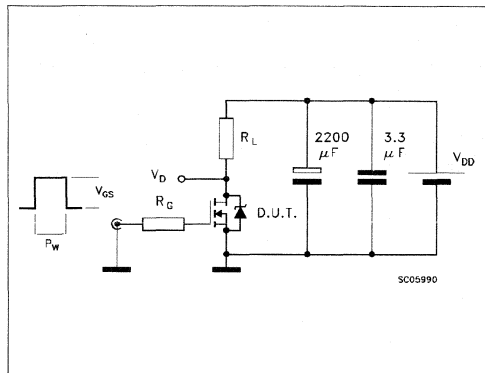


Fig. 4: Gate Charge Test Circuit

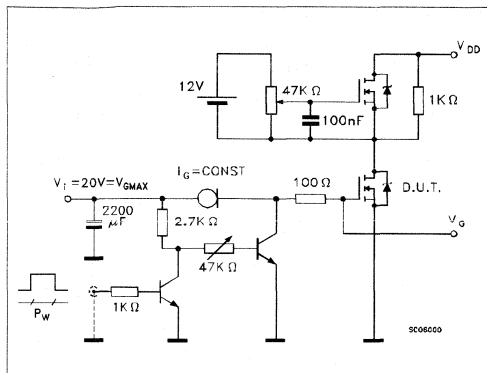
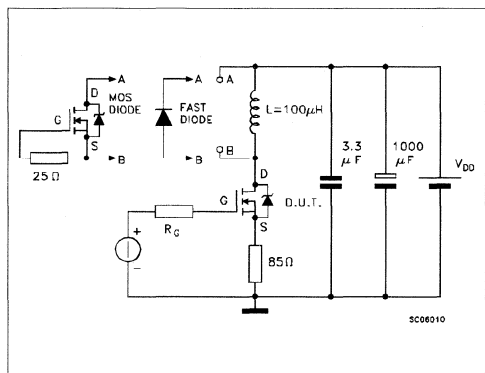


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



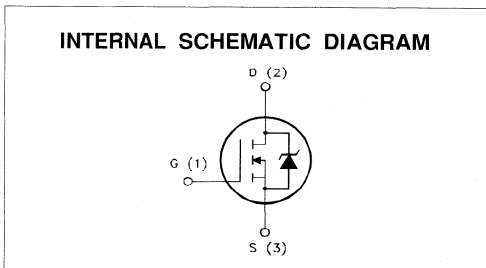
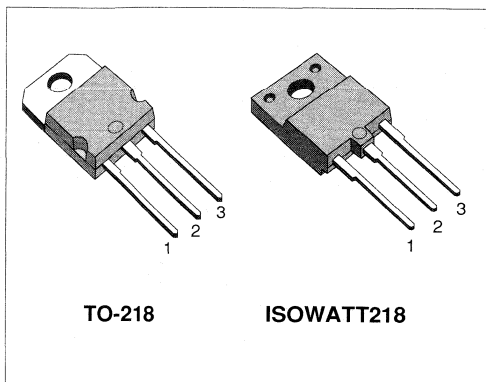
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

TYPE	V _{DSS}	R _{DS(on)}	I _D
IRFP150	100 V	< 0.055 Ω	40 A
IRFP150FI	100 V	< 0.055 Ω	23 A

- TYPICAL R_{DS(on)} = 0.035 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE FOR STANDARD PACKAGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit	
		IRFP150	IRFP150FI		
V _{DS}	Drain-source Voltage (V _{GS} = 0)	100		V	
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	100		V	
V _{GS}	Gate-source Voltage	± 20		V	
I _D	Drain Current (cont.) at T _c = 25 °C	40	23	A	
I _D	Drain Current (cont.) at T _c = 100 °C	28	14	A	
I _{DM} (*)	Drain Current (pulsed)	160	160	A	
P _{tot}	Total Dissipation at T _c = 25 °C	180	60	W	
	Derating Factor	1.2	0.48	W/°C	
V _{ISO}	Insulation Withstand Voltage (DC)	—		4000	V
T _{stg}	Storage Temperature	-65 to 175		°C	
T _j	Max. Operating Junction Temperature	175		°C	

(*) Pulse width limited by safe operating area

THERMAL DATA

		TO-218	ISOWATT218	
$R_{thj-case}$	Thermal Resistance Junction-case Max	0.83	2.08	$^{\circ}\text{C}/\text{W}$
$R_{thj-amb}$	Thermal Resistance Junction-ambient Max		30	$^{\circ}\text{C}/\text{W}$
R_{thc-s}	Thermal Resistance Case-sink Typ		0.1	$^{\circ}\text{C}/\text{W}$
T_l	Maximum Lead Temperature For Soldering Purpose		300	$^{\circ}\text{C}$

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	40	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25^{\circ}\text{C}$, $I_D = I_{AR}$, $V_{DD} = 25\text{ V}$)	210	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	50	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100^{\circ}\text{C}$, pulse width limited by T_j max, $\delta < 1\%$)	28	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25^{\circ}\text{C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\ \mu\text{A}$ $V_{GS} = 0$	100			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^{\circ}\text{C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\ \mu\text{A}$	2	2.9	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 22\text{ A}$		0.035	0.055	Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	40			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 22\text{ A}$	12	26		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		2150	2800	pF
C_{oss}	Output Capacitance			600	800	pF
C_{rss}	Reverse Transfer Capacitance			150	200	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING RESISTIVE LOAD

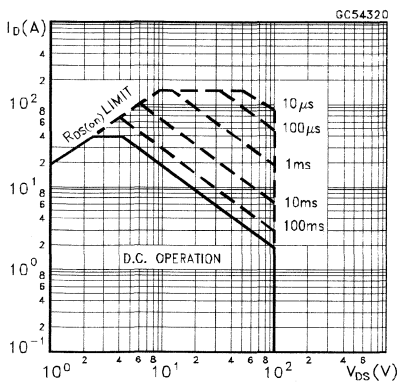
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 24\text{ V}$ $I_D = 20\text{ A}$		20	30	ns
t_r	Rise Time	$R_i = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$		130	190	ns
$t_{d(off)}$	Turn-off Delay Time	(see test circuit)		80	120	ns
t_f	Fall Time			80	120	ns
Q_g	Total Gate Charge	$I_D = 40\text{ A}$ $V_{GS} = 10\text{ V}$ $V_{DD} = \text{Max Rating} \times 0.8$ (see test circuit)		70 12 30	100	nC

SOURCE DRAIN DIODE

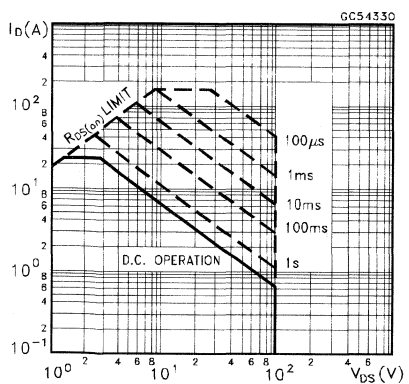
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				40	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				160	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 40\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 40\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_J = 150\text{ }^\circ\text{C}$		130		ns
Q_{rr}	Reverse Recovery Charge			0.65		μC

(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %
 (•) Pulse width limited by safe operating area

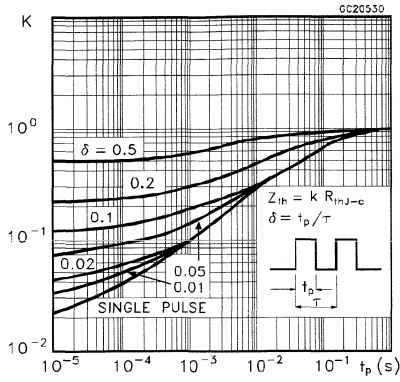
Safe Operating Area for TO-218



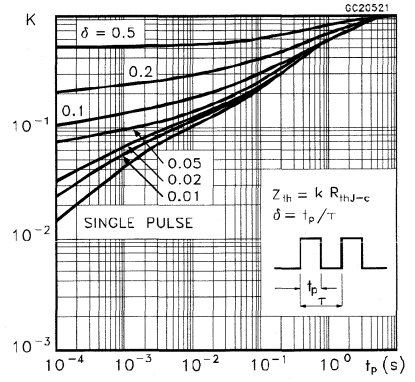
Safe Operating Area for ISOWATT218



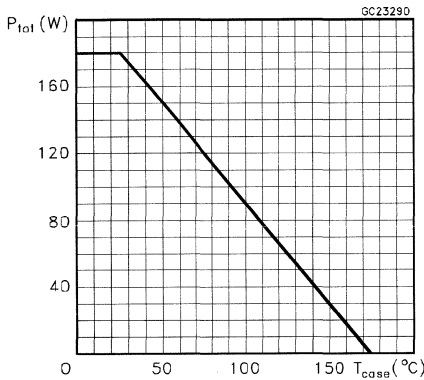
Thermal Impedance for TO-218



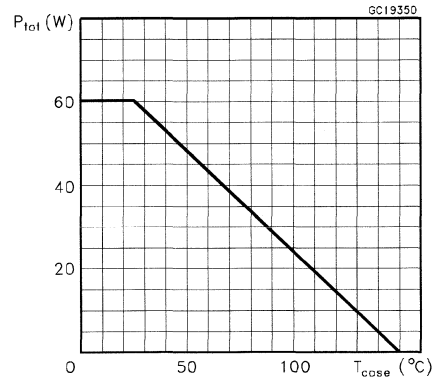
Thermal Impedance for ISOWATT218



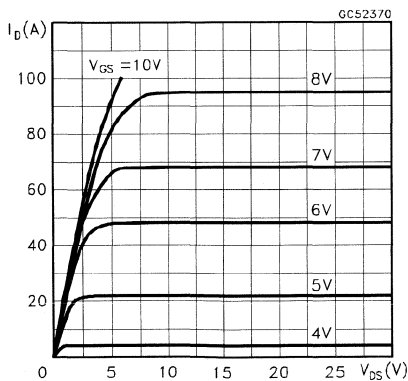
Derating Curve for TO-218



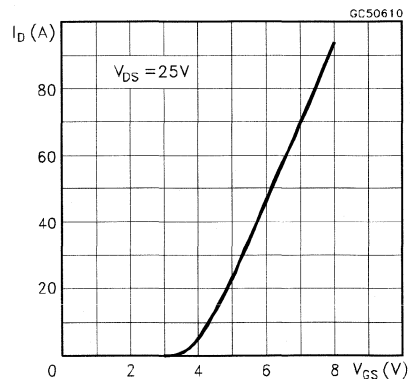
Derating Curve for ISOWATT218



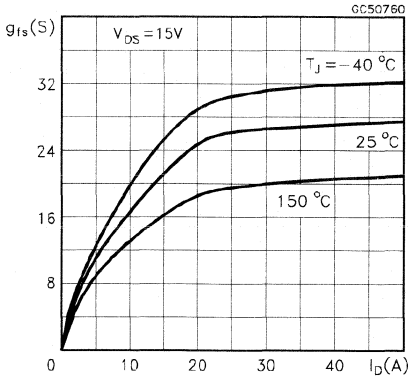
Output Characteristics



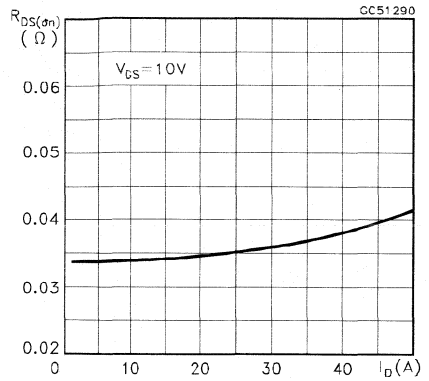
Transfer Characteristics



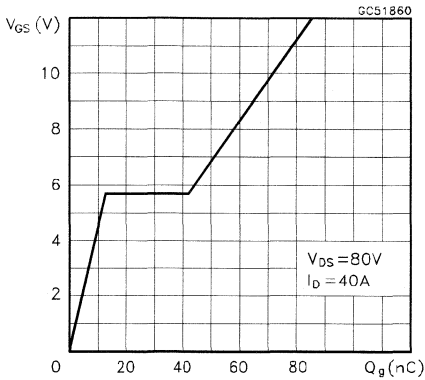
Transconductance



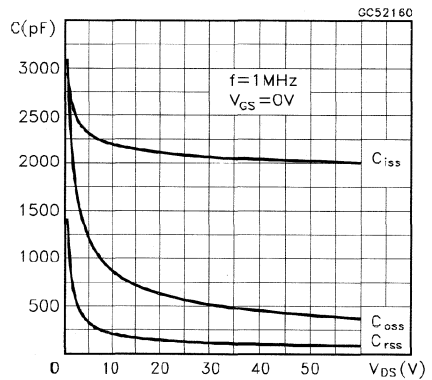
Static Drain-source On Resistance



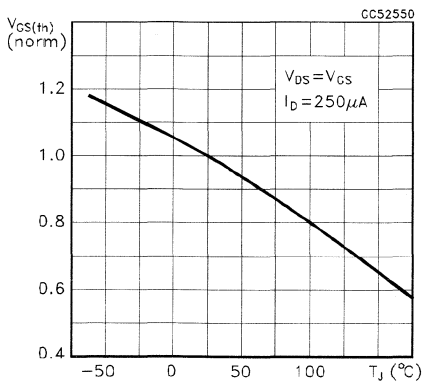
Gate Charge vs Gate-source Voltage



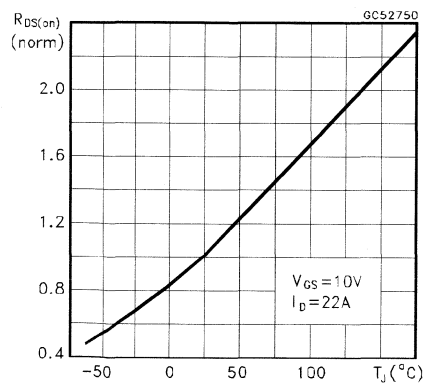
Capacitance Variations



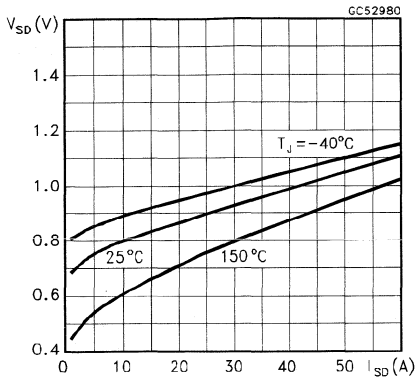
Normalized Gate Threshold Voltage vs Temperature



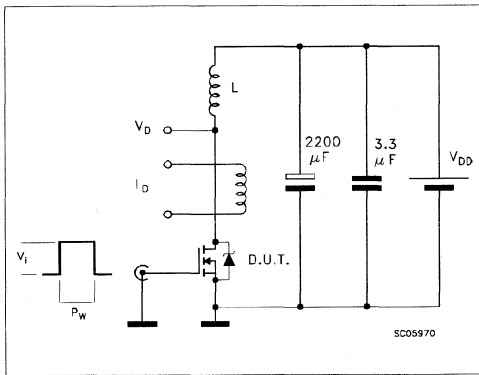
Normalized On Resistance vs Temperature



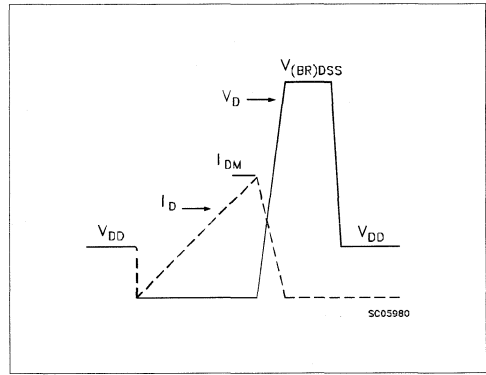
Source-drain Diode Forward Characteristics



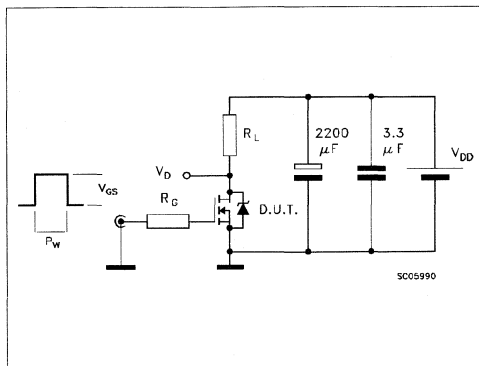
Unclamped Inductive Load Test Circuit



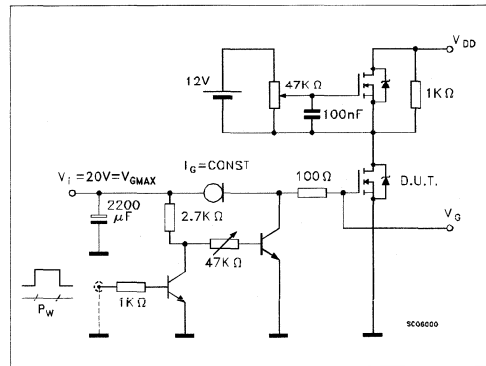
Unclamped Inductive Waveforms



Switching Time Test Circuit



Gate Charge Test Circuit



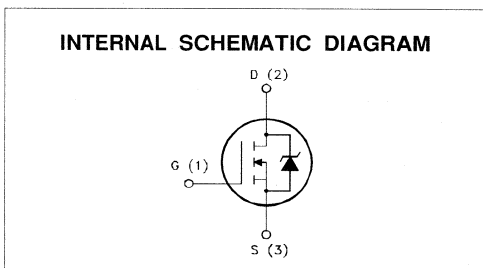
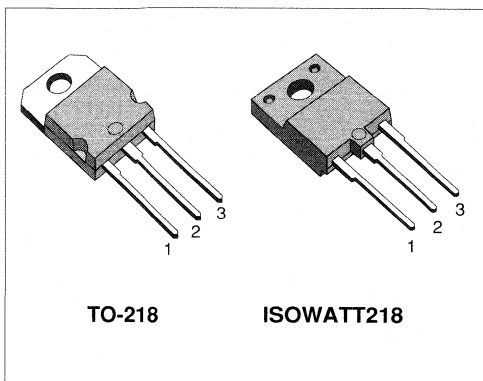
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

TYPE	V _{DSS}	R _{DS(on)}	I _D
IRFP240	200 V	< 0.18 Ω	20 A
IRFP240FI	200 V	< 0.18 Ω	12 A

- TYPICAL R_{DS(on)} = 0.145 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- UNINTERRUPTIBLE POWER SUPPLY (UPS)
- MOTOR CONTROL, AUDIO AMPLIFIERS
- INDUSTRIAL ACTUATORS
- DC-DC & DC-AC CONVERTERS FOR TELECOM, INDUSTRIAL AND CONSUMER ENVIRONMENT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		IRFP240	IRFP240FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	200		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	200		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (cont.) at T _c = 25 °C	20	12	A
I _D	Drain Current (cont.) at T _c = 100 °C	12	7	A
I _{DM} (*)	Drain Current (pulsed)	80	80	A
P _{tot}	Total Dissipation at T _c = 25 °C	150	55	W
	Derating Factor	1.2	0.44	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—		4000
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-218	ISOWATT218	
$R_{thj-case}$	Thermal Resistance Junction-case	Max	0.83	2.27	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	30		°C/W
R_{thc-s}	Thermal Resistance Case-sink	Typ	0.1		°C/W
T_l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	20	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ °C}$, $I_D = I_{AR}$, $V_{DD} = 25\text{ V}$)	50	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	10	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ °C}$, pulse width limited by T_j max, $\delta < 1\%$)	12	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$	200			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\text{ }\mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 10\text{ A}$		0.145	0.18	Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	20			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 10\text{ A}$	6.5	13		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		1600	2100	pF
C_{oss}	Output Capacitance			270	350	pF
C_{rss}	Reverse Transfer Capacitance			50	70	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING RESISTIVE LOAD

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 100\text{ V}$ $I_D = 20\text{ A}$		25	35	ns
t_r	Rise Time	$R_G = 9.1\ \Omega$ $V_{GS} = 10\text{ V}$		85	120	ns
$t_{d(off)}$	Turn-off Delay Time	(see test circuit)		65	90	ns
t_f	Fall Time			60	85	ns
Q_g	Total Gate Charge	$I_D = 20\text{ A}$ $V_{GS} = 10\text{ V}$		57	80	nC
Q_{gs}	Gate-Source Charge	$V_{DD} = \text{Max Rating} \times 0.8$		11		nC
Q_{gd}	Gate-Drain Charge	(see test circuit)		26		nC

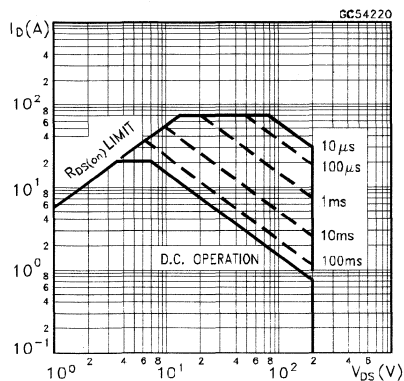
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				20	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				80	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 20\text{ A}$ $V_{GS} = 0$			1.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 20\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		310		ns
Q_{rr}	Reverse Recovery Charge			3.4		μC

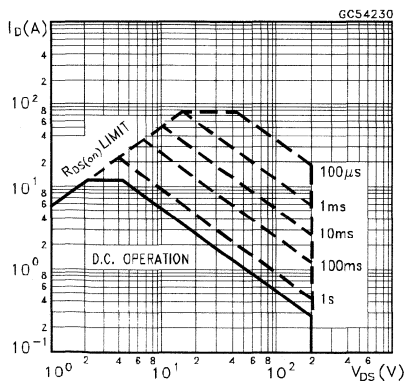
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

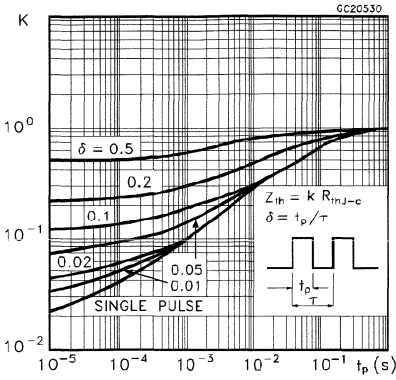
Safe Operating Area for TO-218



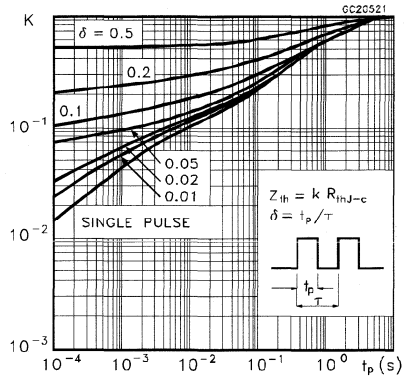
Safe Operating Area for ISOWATT218



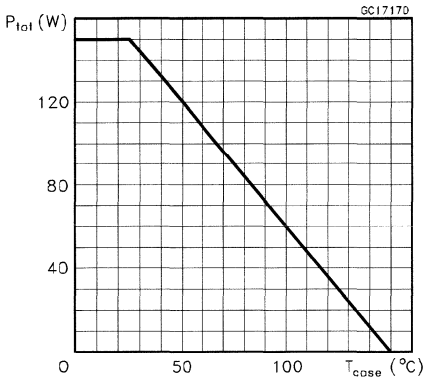
Thermal Impedance for TO-218



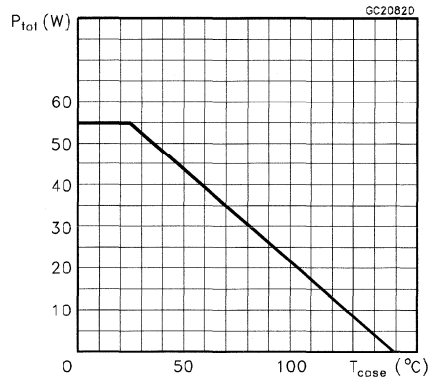
Thermal Impedance for ISOWATT218



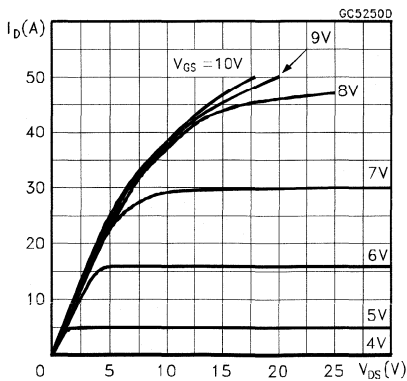
Derating Curve for TO-218



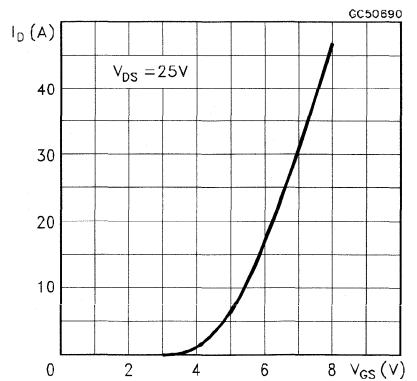
Derating Curve for ISOWATT218



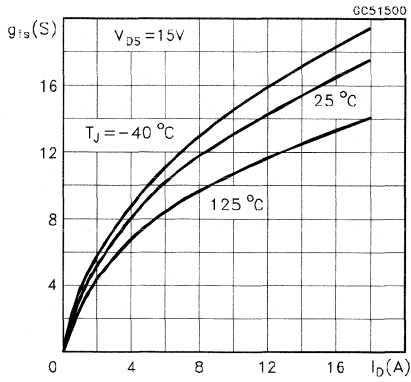
Output Characteristics



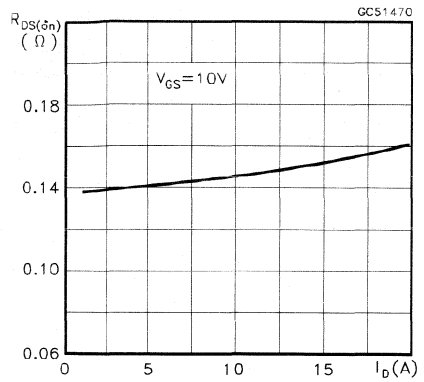
Transfer Characteristics



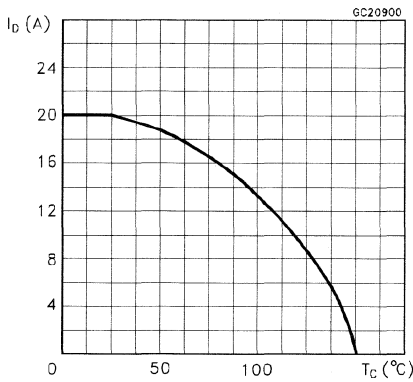
Transconductance



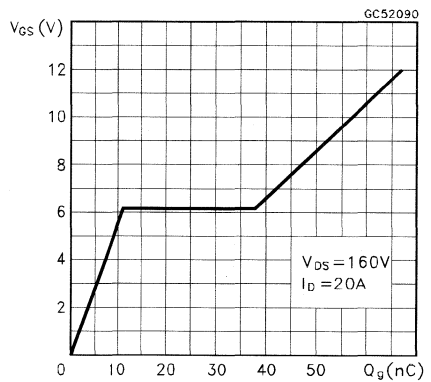
Static Drain-source On Resistance



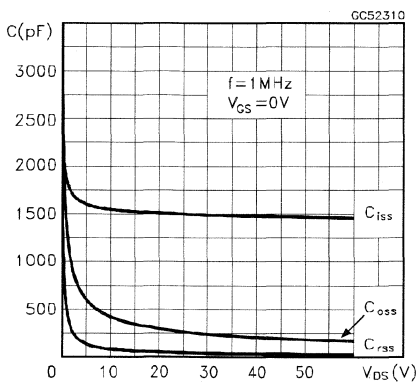
Maximum Drain Current vs Temperature



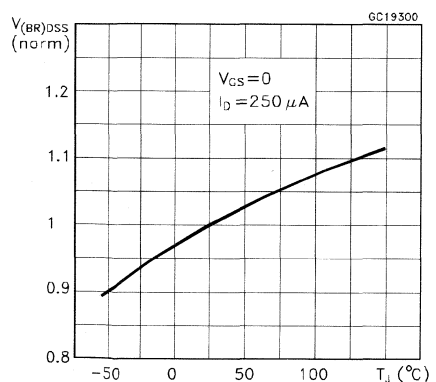
Gate Charge vs Gate-source Voltage



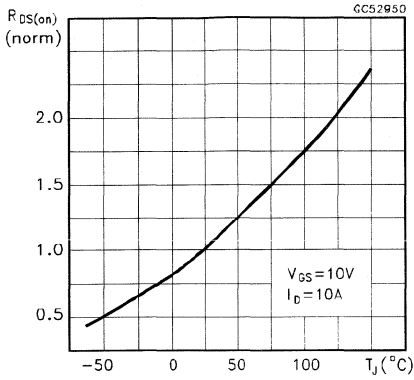
Capacitance Variations



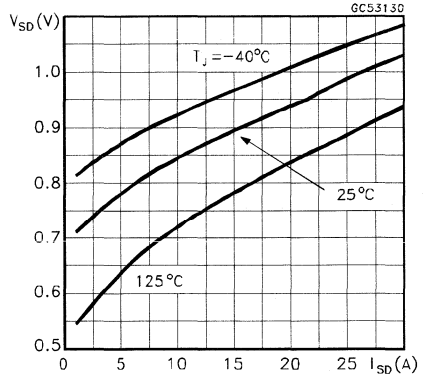
Normalized Breakdown Voltage vs Temperature



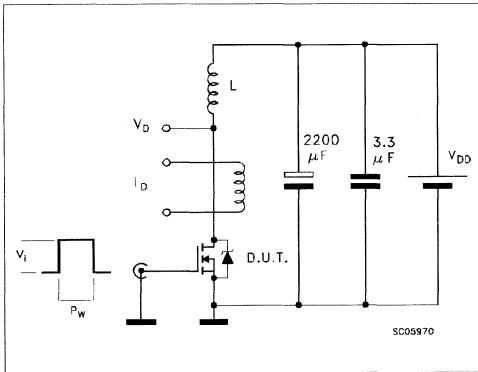
Normalized On Resistance vs Temperature



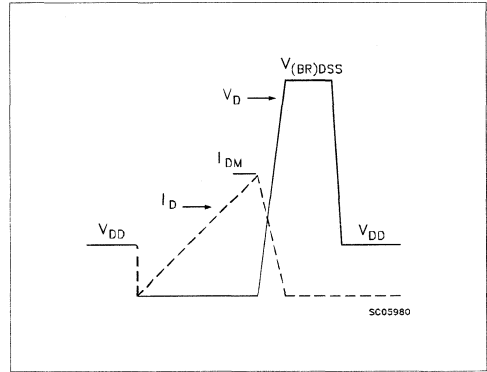
Source-drain Diode Forward Characteristics



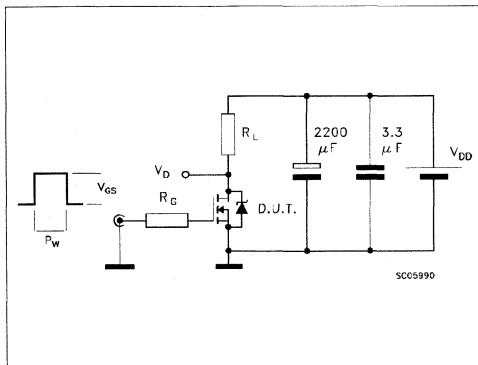
Unclamped Inductive Load Test Circuit



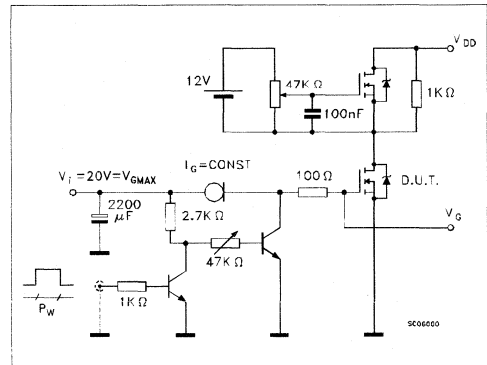
Unclamped Inductive Waveforms



Switching Time Test Circuit



Gate Charge Test Circuit



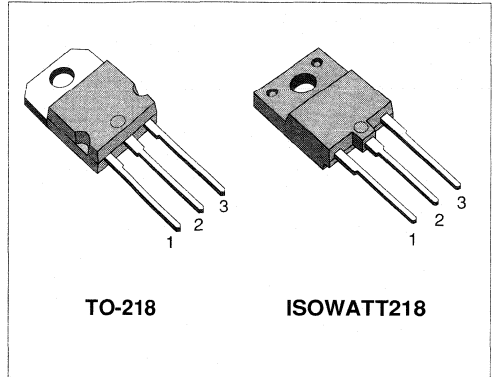
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
IRFP350	400 V	< 0.3 Ω	16 A
IRFP350FI	400 V	< 0.3 Ω	10 A

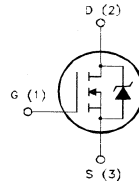
- TYPICAL R_{DS(on)} = 0.21 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		IRFP350	IRFP350FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	400		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	400		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	16	10	A
I _D	Drain Current (continuous) at T _c = 100 °C	10	7	A
I _{DM} (*)	Drain Current (pulsed)	64	64	A
P _{tot}	Total Dissipation at T _c = 25 °C	180	70	W
	Derating Factor	1.44	0.56	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	4000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _J	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

		TO-218	ISOWATT218	
$R_{thj-case}$	Thermal Resistance Junction-case Max	0.69	1.78	$^{\circ}C/W$
$R_{thj-amb}$	Thermal Resistance Junction-ambient Max		30	$^{\circ}C/W$
$R_{thc-sink}$	Thermal Resistance Case-sink Typ		0.1	$^{\circ}C/W$
T_J	Maximum Lead Temperature For Soldering Purpose		300	$^{\circ}C$

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_J max, $\delta < 1\%$)	16	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_J = 25^{\circ}C$, $I_D = I_{AR}$, $V_{DD} = 50 V$)	435	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_J max, $\delta < 1\%$)	23	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100^{\circ}C$, pulse width limited by T_J max, $\delta < 1\%$)	10	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25^{\circ}C$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250 \mu A$ $V_{GS} = 0$	400			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^{\circ}C$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20 V$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250 \mu A$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10 V$ $I_D = 8 A$ $V_{GS} = 10 V$ $I_D = 8 A$ $T_c = 100^{\circ}C$		0.21	0.3 0.6	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10 V$	16			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 8 A$	6	12		S
C_{iss}	Input Capacitance	$V_{DS} = 25 V$ $f = 1 MHz$ $V_{GS} = 0$		2200	2900	pF
C_{oss}	Output Capacitance			400	550	pF
C_{rss}	Reverse Transfer Capacitance			205	270	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 200\text{ V}$ $I_D = 8\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		25 85	35 115	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 320\text{ V}$ $I_D = 16\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		350		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 320\text{ V}$ $I_D = 16\text{ A}$ $V_{GS} = 10\text{ V}$		145 15 80	190	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$ t_f	Off-voltage Rise Time Fall Time	$V_{DD} = 320\text{ V}$ $I_D = 16\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		105 35	140 50	ns ns
t_c	Cross-over Time			150	200	ns

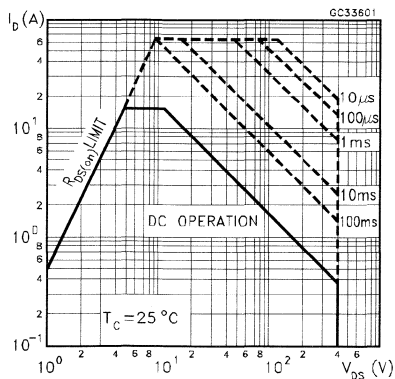
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				16 64	A A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 16\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 16\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		620		ns
Q_{rr}	Reverse Recovery Charge			10.9		μ C
I_{RRM}	Reverse Recovery Current			35		A

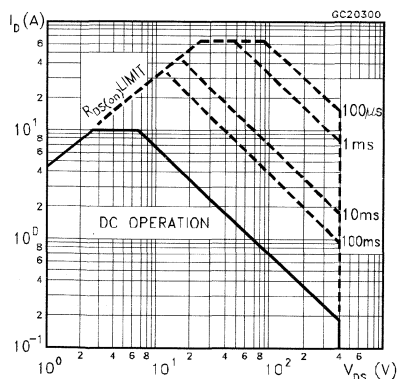
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

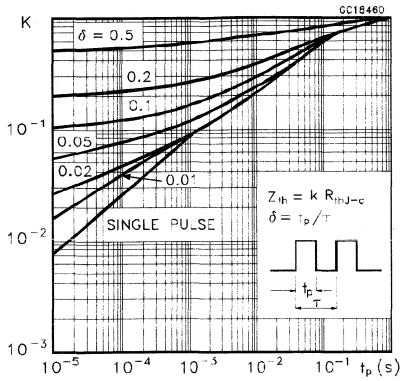
Safe Operating Areas For TO-218



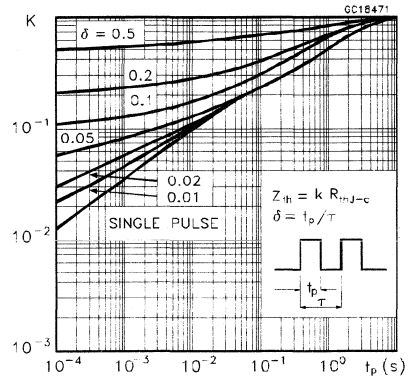
Safe Operating Areas For ISOWATT218



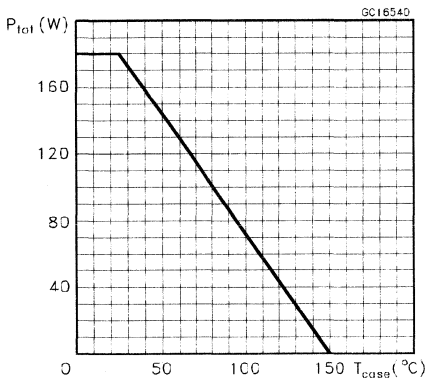
Thermal Impedance For TO-218



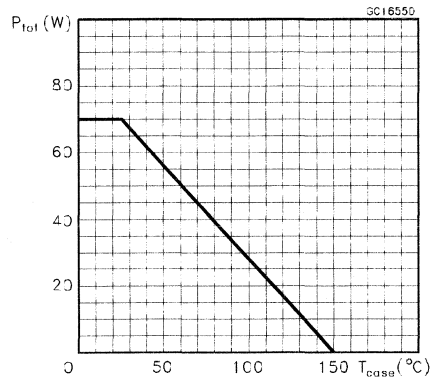
Thermal Impedance For ISOWATT218



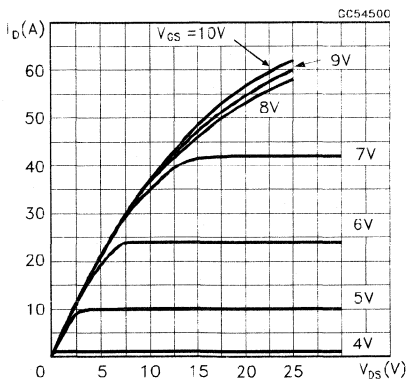
Derating Curve For TO-218



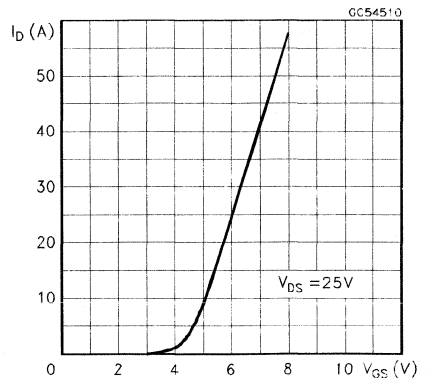
Derating Curve For ISOWATT218



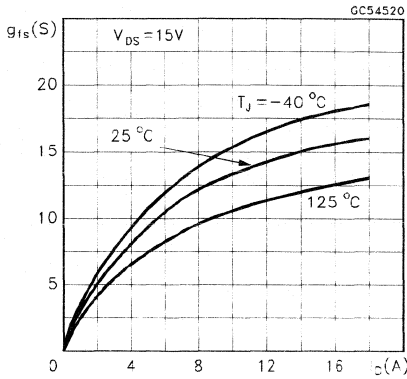
Output Characteristics



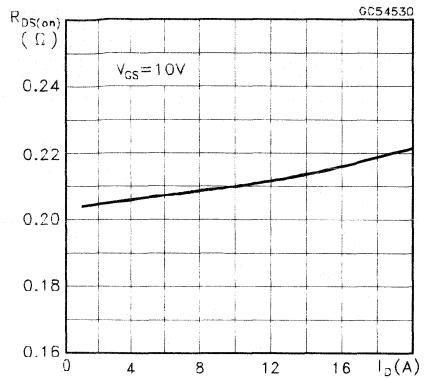
Transfer Characteristics



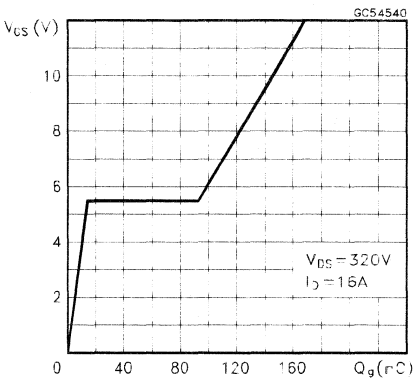
Transconductance



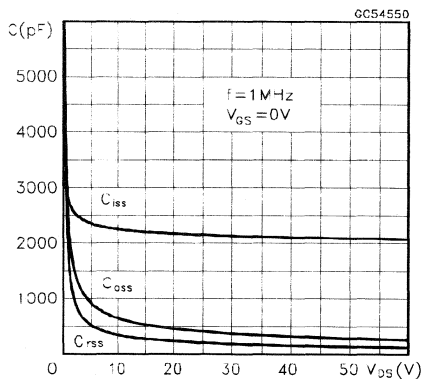
Static Drain-source On Resistance



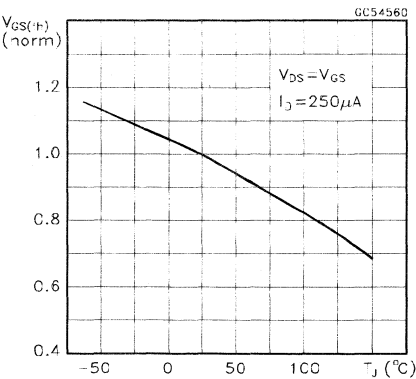
Gate Charge vs Gate-source Voltage



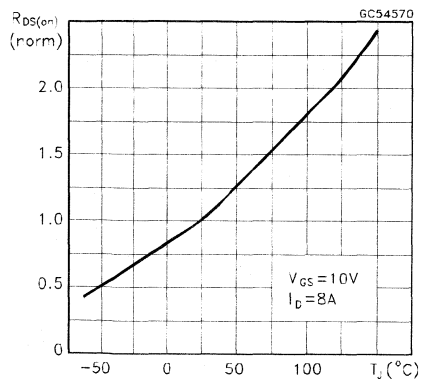
Capacitance Variations



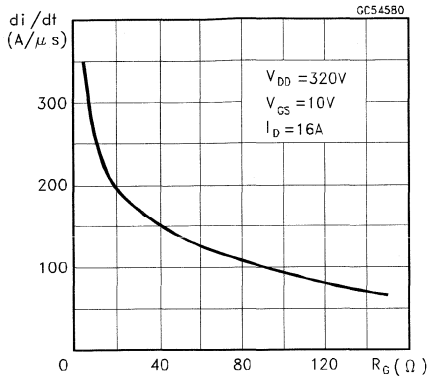
Normalized Gate Threshold Voltage vs Temperature



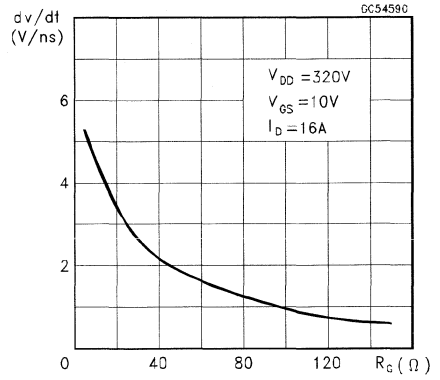
Normalized On Resistance vs Temperature



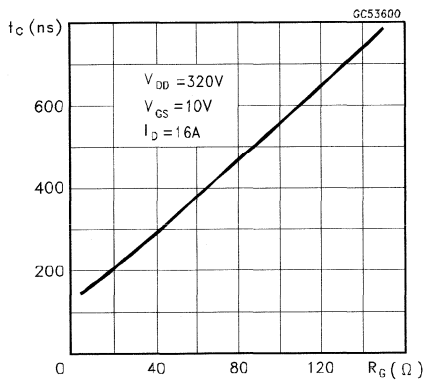
Turn-on Current Slope



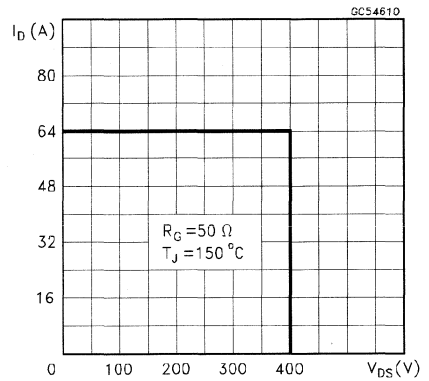
Turn-off Drain-source Voltage Slope



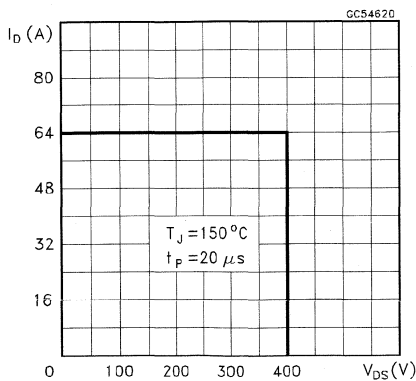
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

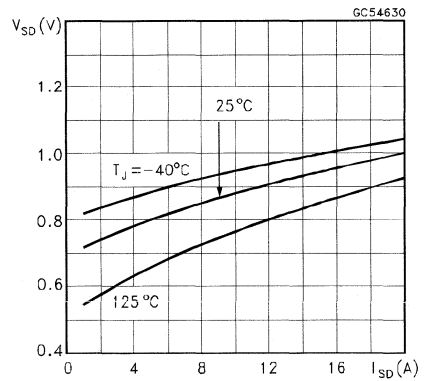


Fig. 1: Unclamped Inductive Load Test Circuits

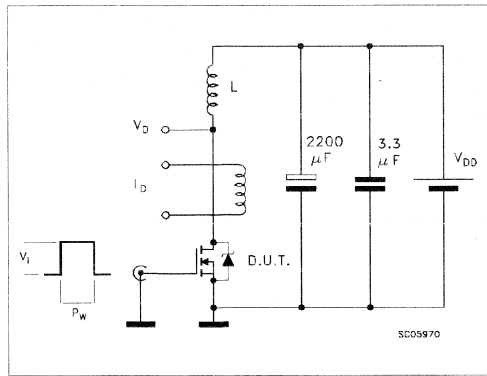


Fig. 2: Unclamped Inductive Waveforms

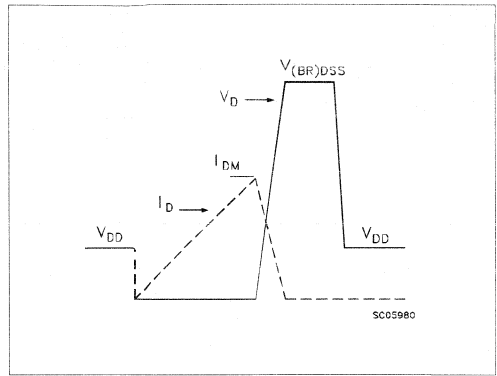


Fig. 3: Switching Times Test Circuits For Resistive Load

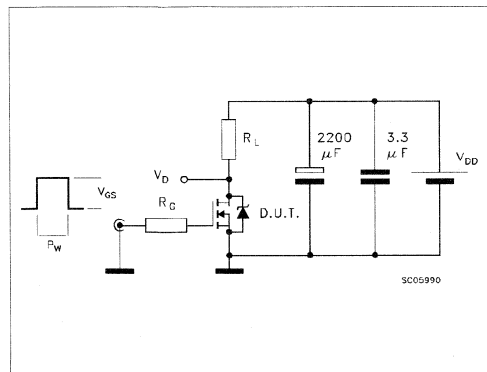


Fig. 4: Gate Charge Test Circuit

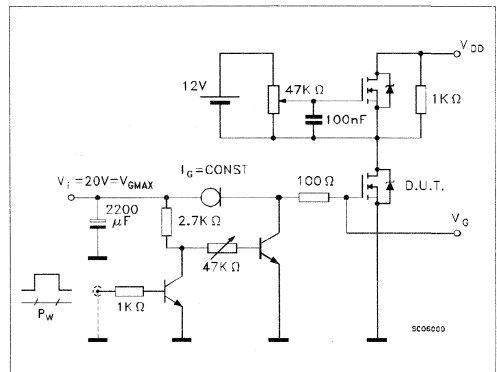
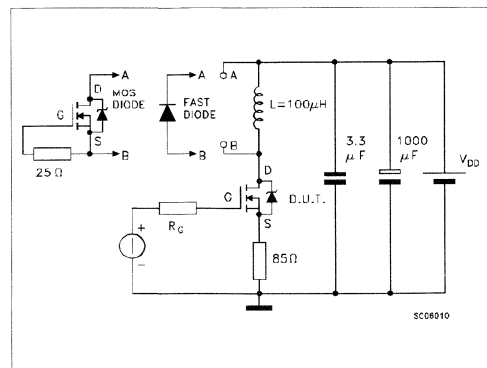


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

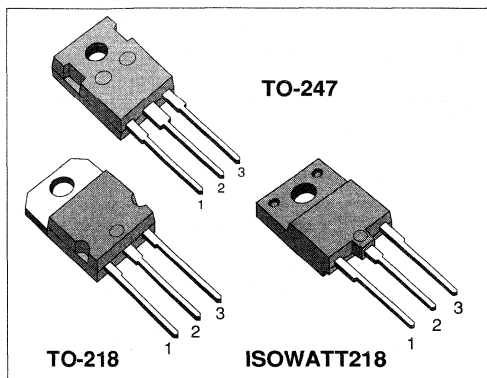
PRELIMINARY DATA

TYPE	V _{DS}	R _{DS(on)}	I _D
IRFP450	500 V	< 0.4 Ω	14 A
IRFP450FI	500 V	< 0.4 Ω	9 A
IRFW450	500 V	< 0.4 Ω	14 A

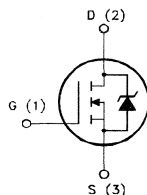
- TYPICAL R_{DS(on)} = 0.33 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		IRFP/IRFW450	IRFP450FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	500	500	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	500	500	V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (cont.) at T _c = 25 °C	14	9	A
I _D	Drain Current (cont.) at T _c = 100 °C	8.8	5.6	A
I _{DM} (●)	Drain Current (pulsed)	56	56	A
P _{tot}	Total Dissipation at T _c = 25 °C	180	70	W
	Derating Factor	1.44	0.56	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	4000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _J	Max. Operating Junction Temperature	150		°C

(●) Pulse width limited by safe operating area

THERMAL DATA

		TO-218/TO-247	ISOWATT218	
R _{thj-case}	Thermal Resistance Junction-case Max	0.69	1.78	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient Max	30		°C/W
R _{thc-s}	Thermal Resistance Case-sink Typ	0.1		°C/W
T _j	Maximum Lead Temperature For Soldering Purpose	300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	14	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	760	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	18	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	8	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	500			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10 V I _D = 7.9 A		0.33	0.4	Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	14			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 7.9 A	6	10		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		2200	3000	pF
C _{oss}	Output Capacitance			340	440	pF
C _{rss}	Reverse Transfer Capacitance			165	220	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING RESISTIVE LOAD

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 210\text{ V}$ $I_D = 7\text{ A}$ $R_i = 4.7\ \Omega$ (see test circuit)		25	35	ns
t_r	Rise Time			55	75	ns
$t_{d(off)}$	Turn-off Delay Time			170	225	ns
t_f	Fall Time			100	135	ns
Q_g	Total Gate Charge	$I_D = 13\text{ A}$ $V_{GS} = 10\text{ V}$		145	190	nC
Q_{gs}	Gate-Source Charge	$V_{DD} = \text{Max Rating} \times 0.8$		15		nC
Q_{gd}	Gate-Drain Charge	(see test circuit)		75		nC

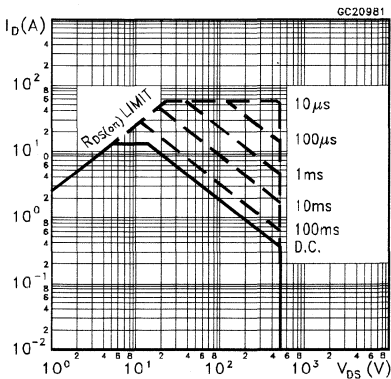
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				14	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				56	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 14\text{ A}$ $V_{GS} = 0$			1.4	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 14\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		700		ns
Q_{rr}	Reverse Recovery Charge			17		μC

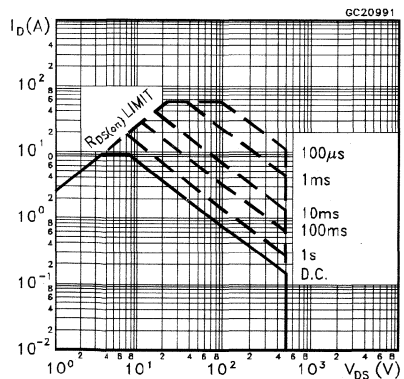
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

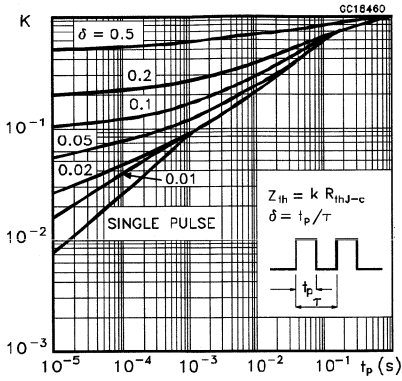
Safe Operating Area for TO-218 and TO-247



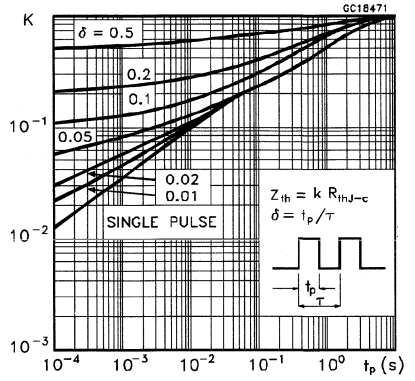
Safe Operating Area for ISOWATT218



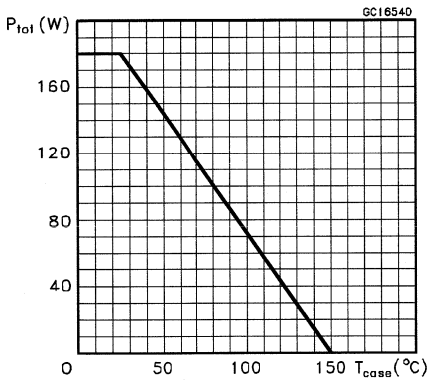
Thermal Impedance for TO-218 and TO-247



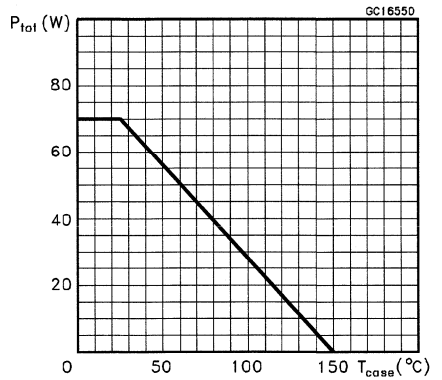
Thermal Impedance for ISOWATT218



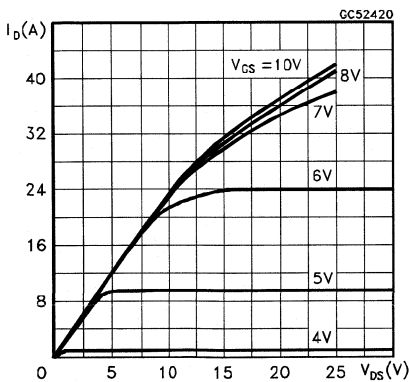
Derating Curve for TO-218 and TO-247



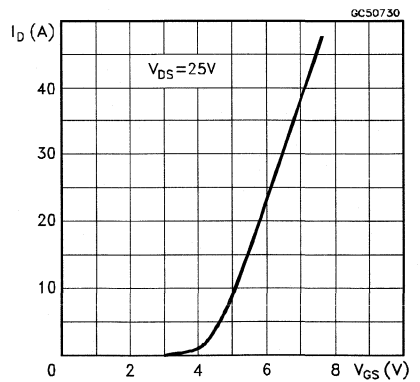
Derating Curve for ISOWATT218



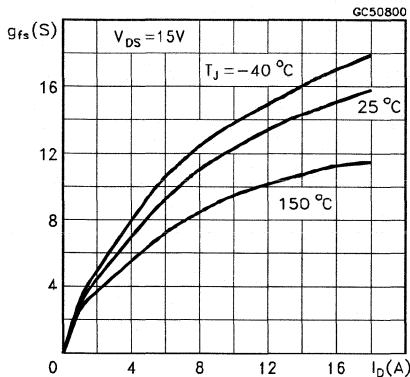
Output Characteristics



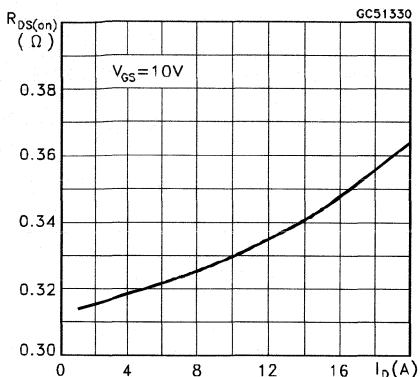
Transfer Characteristics



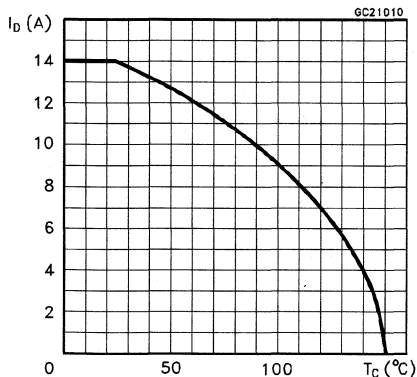
Transconductance



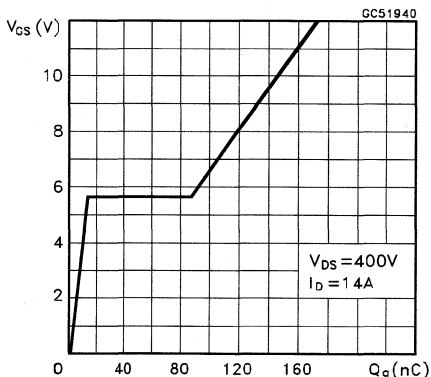
Static Drain-source On Resistance



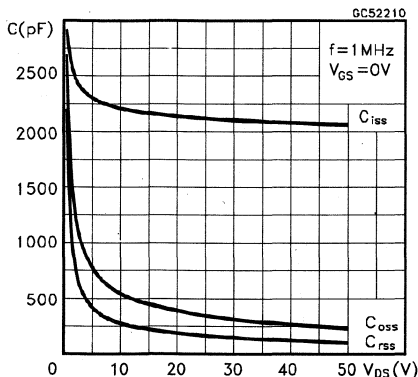
Maximum Drain Current vs Temperature



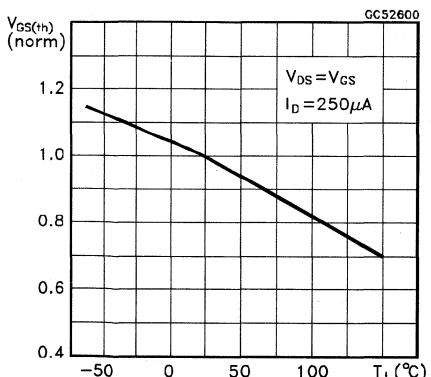
Gate Charge vs Gate-source Voltage



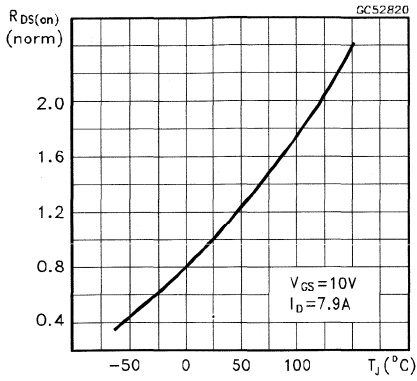
Capacitance Variations



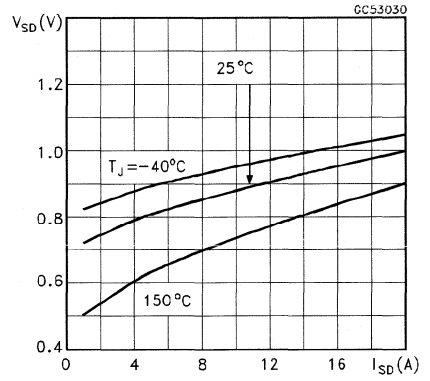
Normalized Gate Threshold Voltage vs Temperature



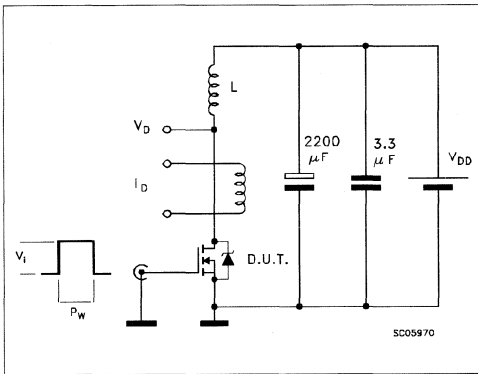
Normalized On Resistance vs Temperature



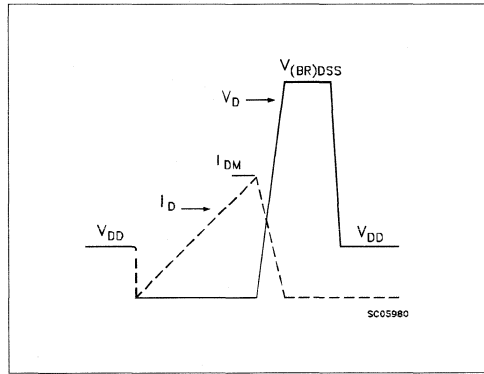
Source-drain Diode Forward Characteristics



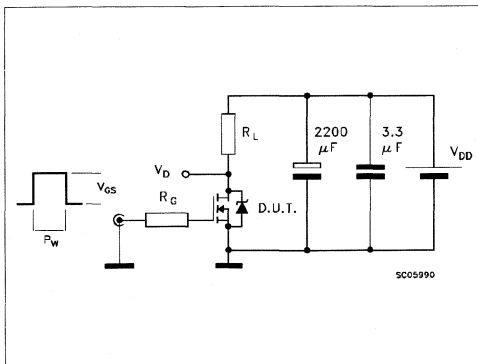
Unclamped Inductive Load Test Circuit



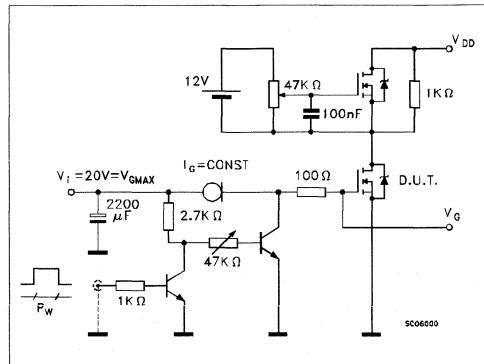
Unclamped Inductive Waveforms



Switching Time Test Circuit



Gate Charge Test Circuit



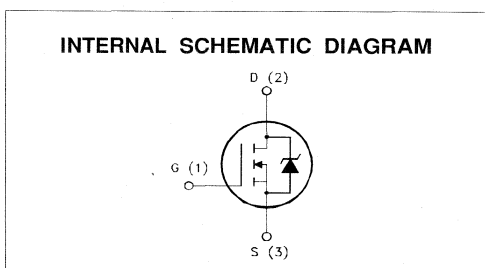
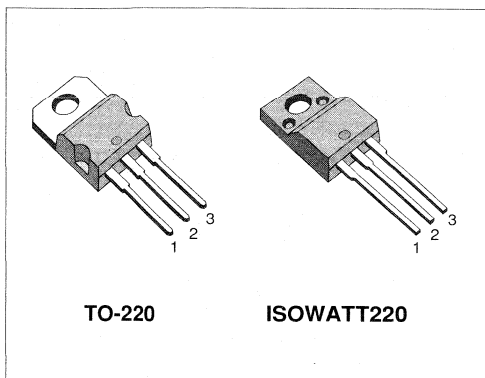
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

TYPE	V _{DS}	R _{DS(on)}	I _D
IRFZ40	50 V	< 0.028 Ω	50 A
IRFZ40FI	50 V	< 0.028 Ω	27 A

- TYPICAL R_{DS(on)} = 0.022 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		IRFZ40	IRFZ40FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	50	50	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	50	50	V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (cont.) at T _c = 25 °C	50	27	A
I _D	Drain Current (cont.) at T _c = 100 °C	35	19	A
I _{DM} (●)	Drain Current (pulsed)	200	200	A
P _{tot}	Total Dissipation at T _c = 25 °C	150	45	W
	Derating Factor	1	0.3	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(●) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
$R_{thj-case}$	Thermal Resistance Junction-case	Max	1	3.33	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5		°C/W
R_{thc-s}	Thermal Resistance Case-sink	Typ	0.5		°C/W
T_l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	50	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ °C}$, $I_D = I_{AR}$, $V_{DD} = 25\text{ V}$)	400	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	100	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ °C}$, pulse width limited by T_j max, $\delta < 1\%$)	35	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\ \mu\text{A}$ $V_{GS} = 0$	50			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\ \mu\text{A}$	2	2.9	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 29\text{ A}$		0.022	0.028	Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	50			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 29\text{ A}$	17	22		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		1700	2200	pF
C_{oss}	Output Capacitance			630	850	pF
C_{rss}	Reverse Transfer Capacitance			200	260	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING RESISTIVE LOAD

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 25\text{ V}$ $I_D = 29\text{ A}$		50	70	ns
t_r	Rise Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$		110	160	ns
$t_{d(off)}$	Turn-off Delay Time	(see test circuit)		60	90	ns
t_f	Fall Time			25	35	ns
Q_g	Total Gate Charge	$I_D = 64\text{ A}$ $V_{GS} = 10\text{ V}$		50	70	nC
Q_{gs}	Gate-Source Charge	$V_{DD} = \text{Max Rating} \times 0.8$		15		nC
Q_{gd}	Gate-Drain Charge	(see test circuit)		27		nC

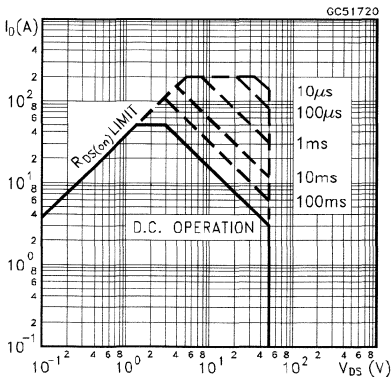
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				50	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				200	A
$V_{SD} (*)$	Forward On Voltage	$V_{GS} = 0$ $I_{SD} = 50\text{ A}$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 50\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		150		ns
Q_{rr}	Reverse Recovery Charge			0.45		μC

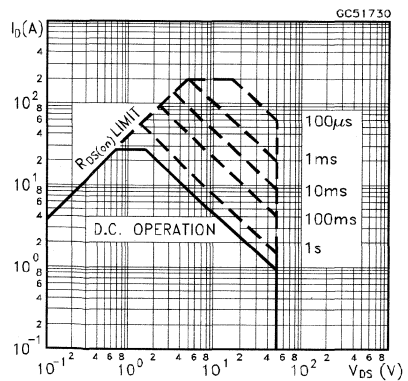
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5%

(\bullet) Pulse width limited by safe operating area

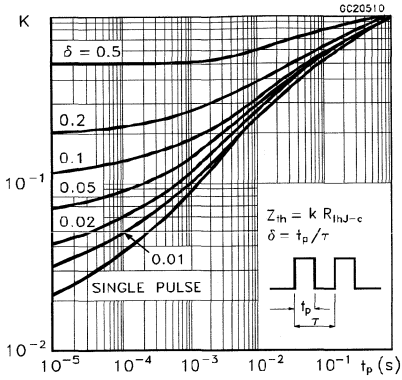
Safe Operating Area for TO-220



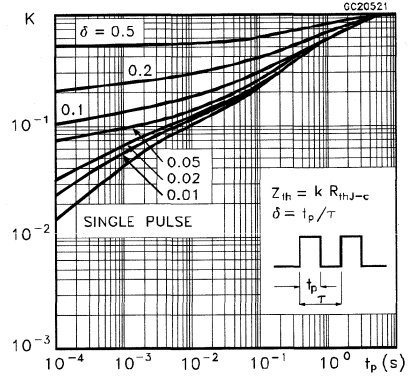
Safe Operating Area for ISOWATT220



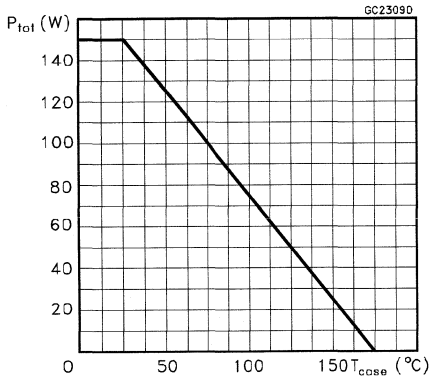
Thermal Impedance for TO-220



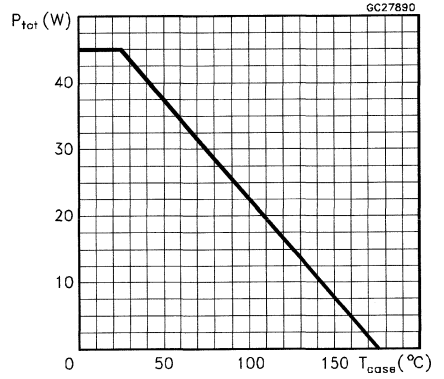
Thermal Impedance for ISOWATT220



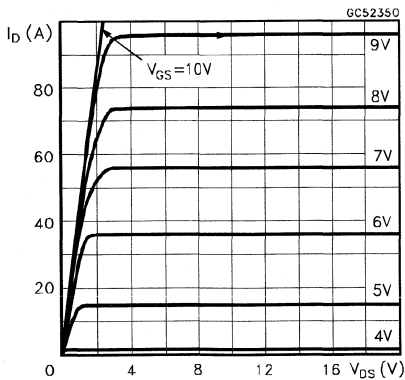
Derating Curve for TO-220



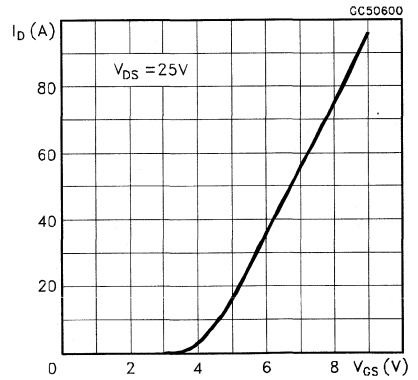
Derating Curve for ISOWATT220



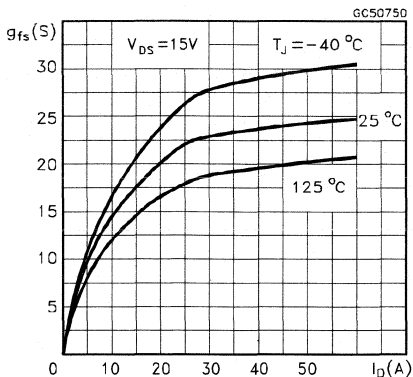
Output Characteristics



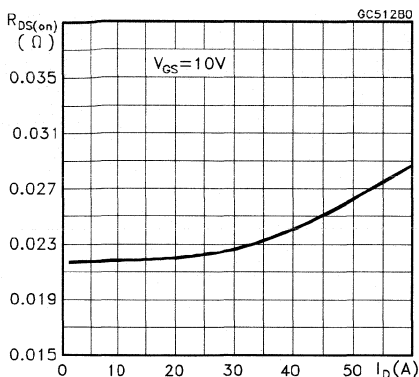
Transfer Characteristics



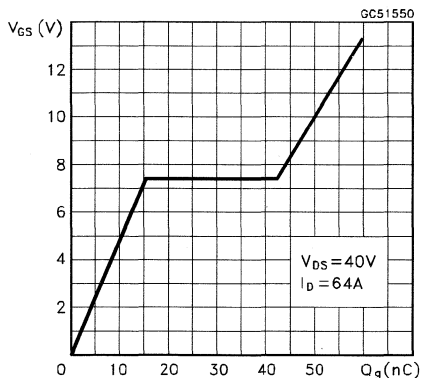
Transconductance



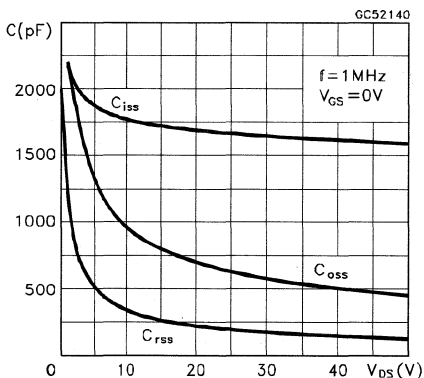
Static Drain-source On Resistance



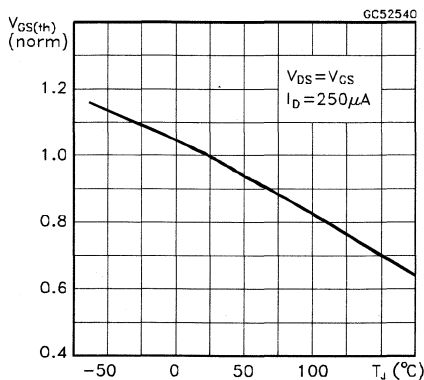
Gate Charge vs Gate-source Voltage



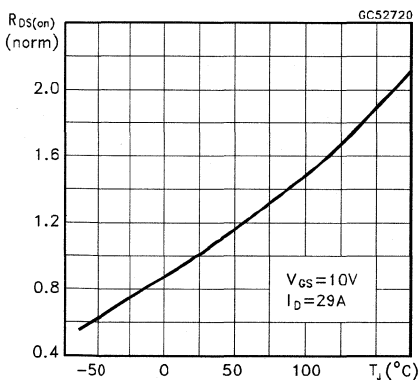
Capacitance Variations



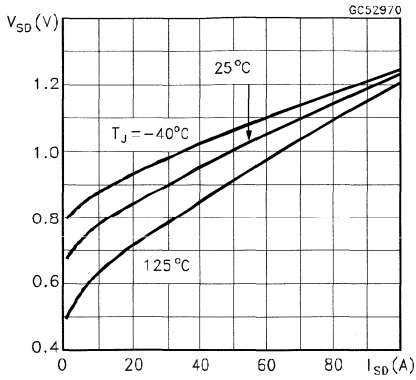
Normalized Gate Threshold Voltage vs Temperature



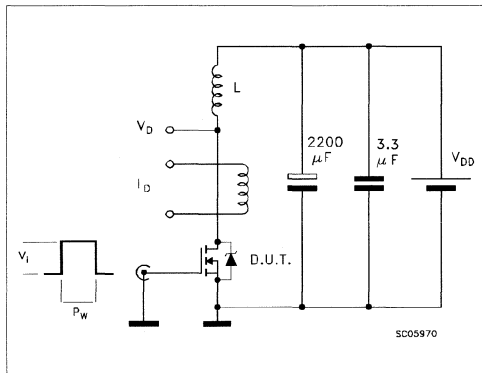
Normalized On Resistance vs Temperature



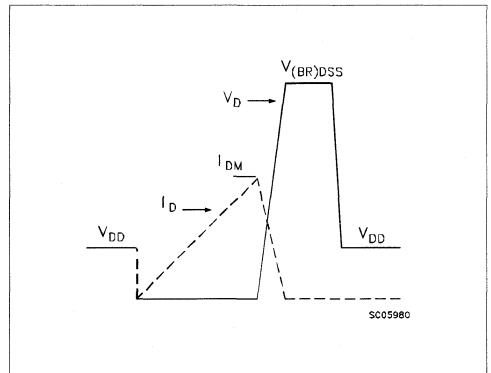
Source-drain Diode Forward Characteristics



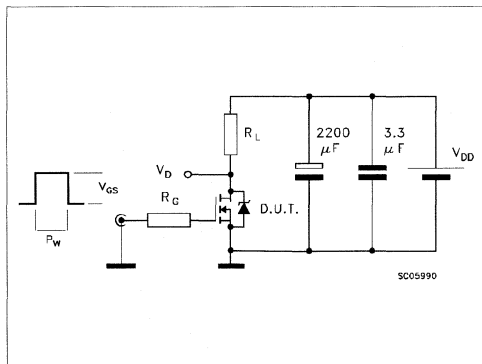
Unclamped Inductive Load Test Circuit



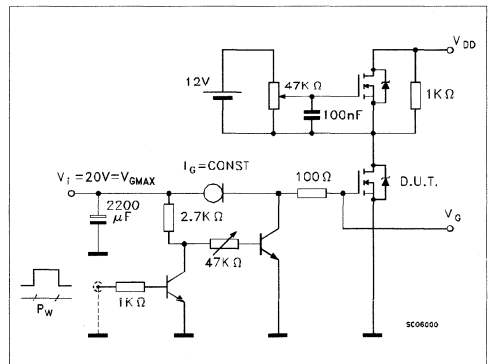
Unclamped Inductive Waveforms



Switching Time Test Circuit



Gate Charge Test Circuit



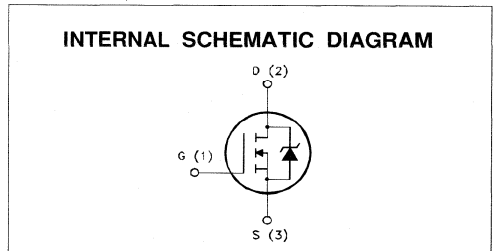
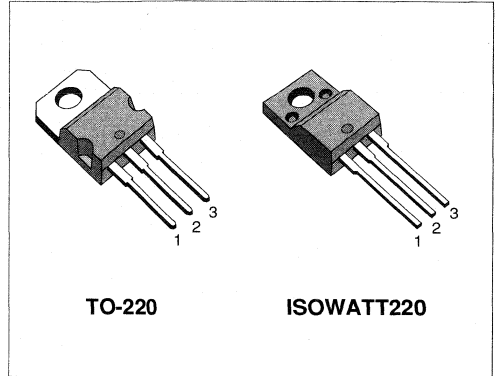
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
MTP3N60	600 V	< 2.5 Ω	3.9 A
MTP3N60FI	600 V	< 2.5 Ω	2.5 A

- TYPICAL R_{DS(on)} = 2 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		MTP3N60	MTP3N60FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	600		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	600		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	3.9	2.5	A
I _D	Drain Current (continuous) at T _c = 100 °C	2.4	1.5	A
I _{DM} (*)	Drain Current (pulsed)	14	14	A
P _{tot}	Total Dissipation at T _c = 25 °C	100	35	W
	Derating Factor	0.8	0.28	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—		2000
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

		TO-220	ISOWATT220		
$R_{thj-case}$	Thermal Resistance Junction-case	Max	1.25	3.57	$^{\circ}\text{C}/\text{W}$
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5		$^{\circ}\text{C}/\text{W}$
$R_{thc-sink}$	Thermal Resistance Case-sink	Typ	0.5		$^{\circ}\text{C}/\text{W}$
T_l	Maximum Lead Temperature For Soldering Purpose		300		$^{\circ}\text{C}$

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	3.9	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25^{\circ}\text{C}$, $I_D = I_{AR}$, $V_{DD} = 25\text{ V}$)	300	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	7.7	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100^{\circ}\text{C}$, pulse width limited by T_j max, $\delta < 1\%$)	2.4	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25^{\circ}\text{C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\ \mu\text{A}$ $V_{GS} = 0$	600			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^{\circ}\text{C}$			200 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 1\text{ mA}$	2	3	4.5	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 1.5\text{ A}$ $V_{GS} = 10\text{ V}$ $I_D = 1.5\text{ A}$ $T_c = 100^{\circ}\text{C}$		2	2.5 5	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	3.9			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 1.5\text{ A}$	1.5	2.6		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		560	800	pF
C_{oss}	Output Capacitance			90	130	pF
C_{rss}	Reverse Transfer Capacitance			40	55	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 225\text{ V}$ $I_D = 2.5\text{ A}$		45	60	ns
t_r	Rise Time	$R_G = 15\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		33	42	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 480\text{ V}$ $I_D = 4\text{ A}$ $R_G = 15\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		200		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 480\text{ V}$ $I_D = 4\text{ A}$ $V_{GS} = 10\text{ V}$		43	55	nC
Q_{gs}	Gate-Source Charge			6		nC
Q_{gd}	Gate-Drain Charge			21		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(voff)}$	Off-voltage Rise Time	$V_{DD} = 480\text{ V}$ $I_D = 4\text{ A}$		35	45	ns
t_f	Fall Time	$R_G = 15\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		40	55	ns
t_c	Cross-over Time			60	75	ns

SOURCE DRAIN DIODE

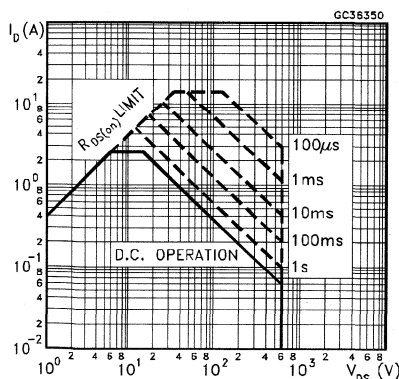
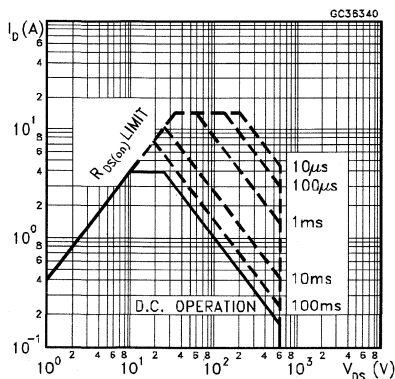
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				3.9	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				14	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 3.9\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 4\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		420		ns
Q_{rr}	Reverse Recovery Charge			3.7		μ C
I_{RRM}	Reverse Recovery Current			18		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

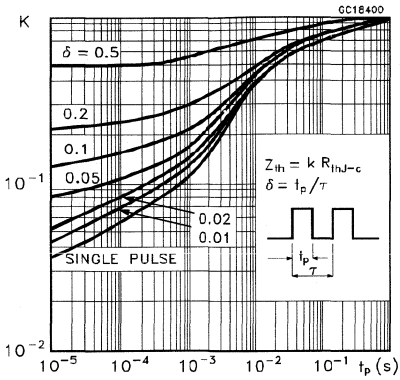
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

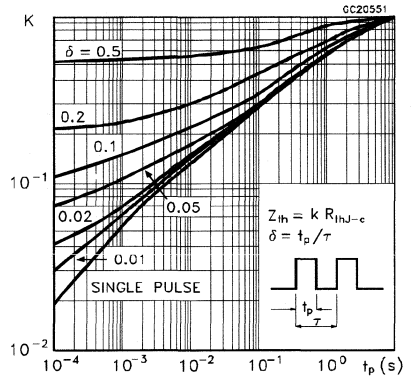
Safe Operating Areas For ISOWATT220



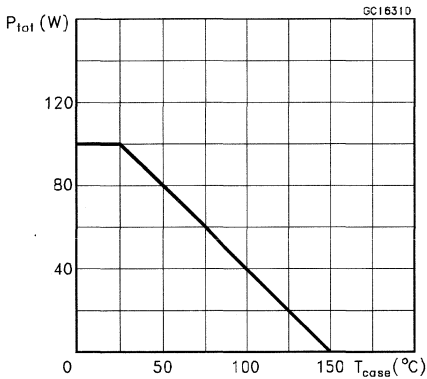
Thermal Impedance For TO-220



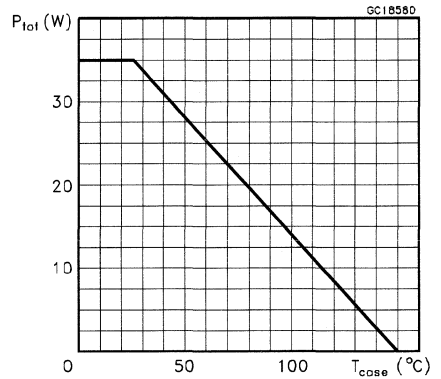
Thermal Impedance For ISOWATT220



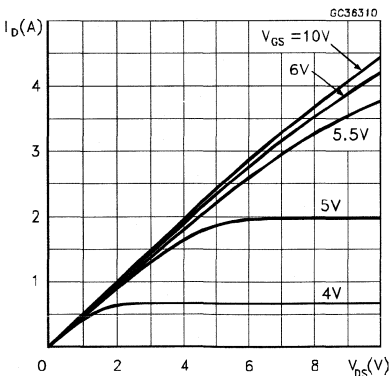
Derating Curve For TO-220



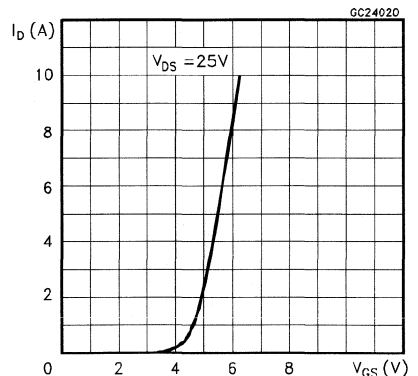
Derating Curve For ISOWATT220



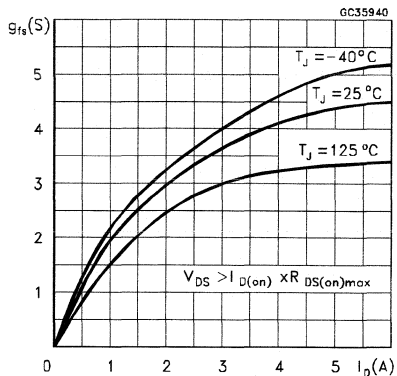
Output Characteristics



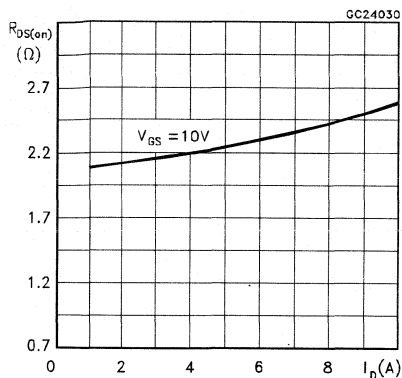
Transfer Characteristics



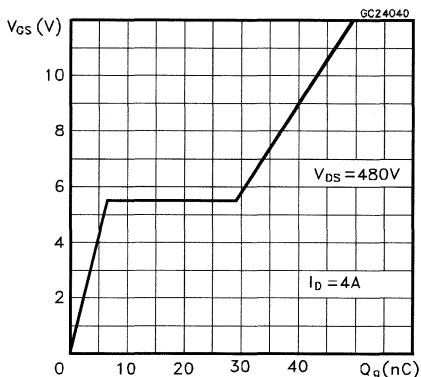
Transconductance



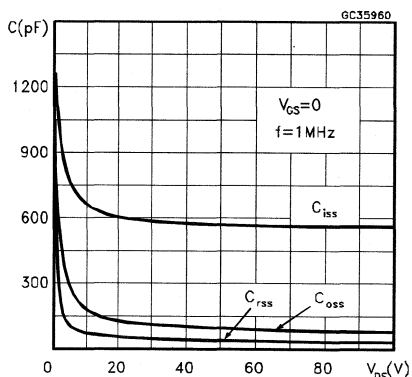
Static Drain-source On Resistance



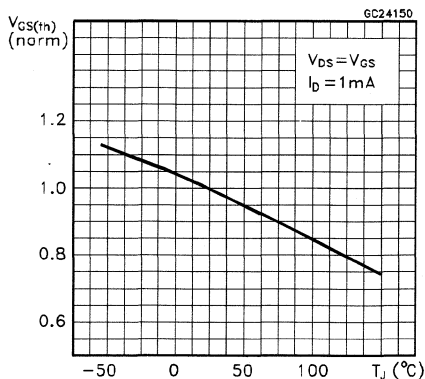
Gate Charge vs Gate-source Voltage



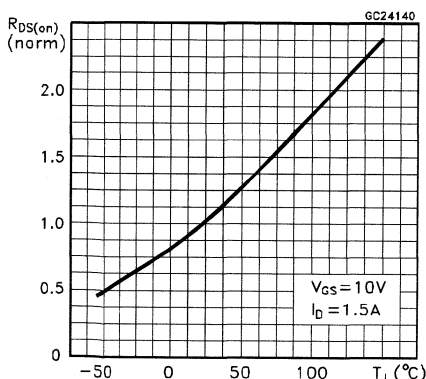
Capacitance Variations



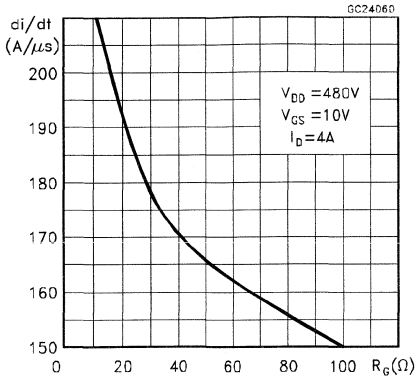
Normalized Gate Threshold Voltage vs Temperature



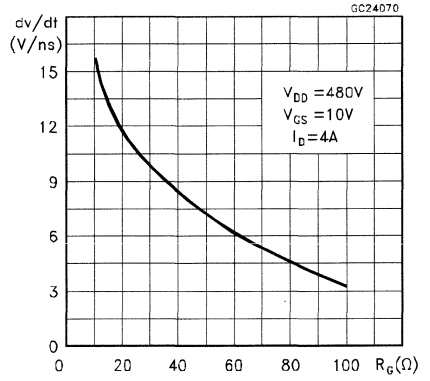
Normalized On Resistance vs Temperature



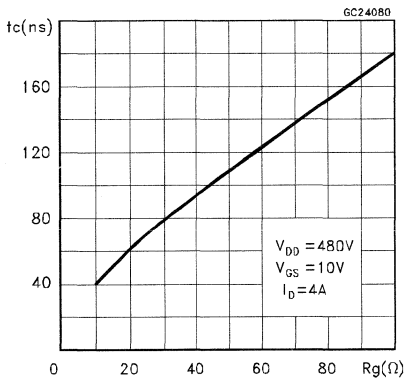
Turn-on Current Slope



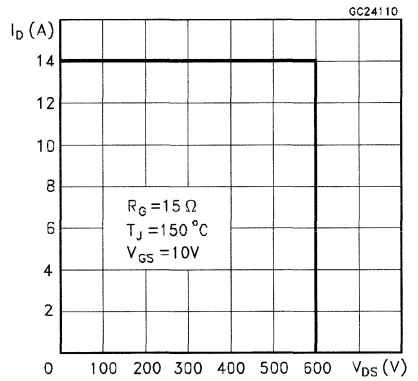
Turn-off Drain-source Voltage Slope



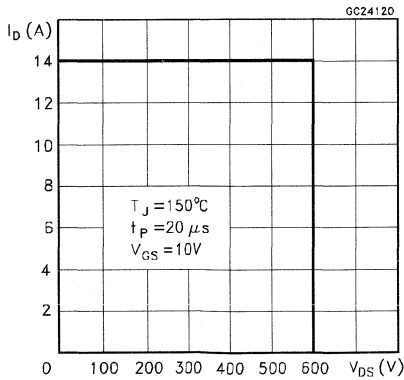
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

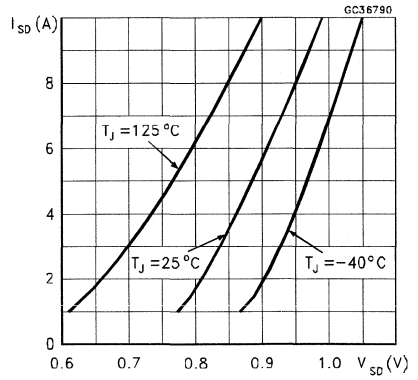


Fig. 1: Unclamped Inductive Load Test Circuits

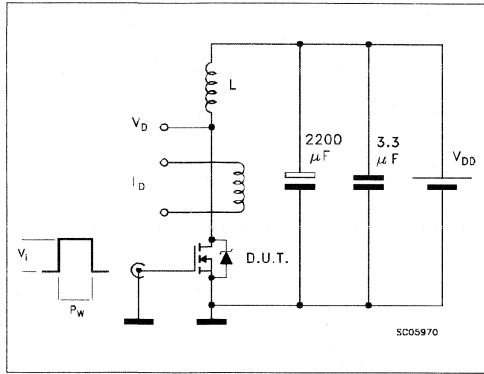


Fig. 2: Unclamped Inductive Waveforms

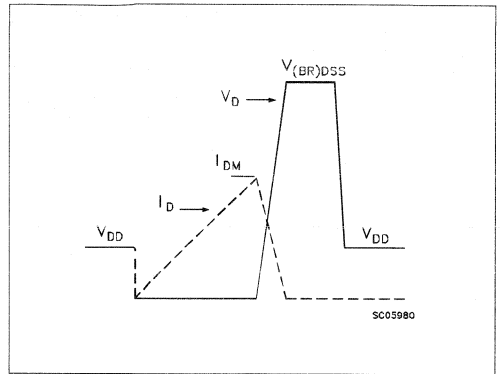


Fig. 3: Switching Times Test Circuits For Resistive Load

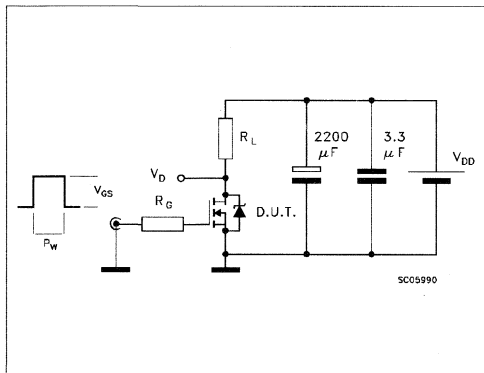


Fig. 4: Gate Charge Test Circuit

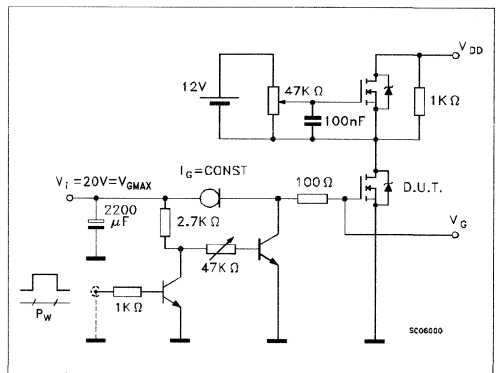
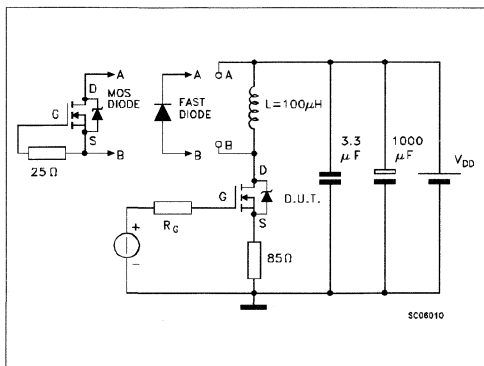


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



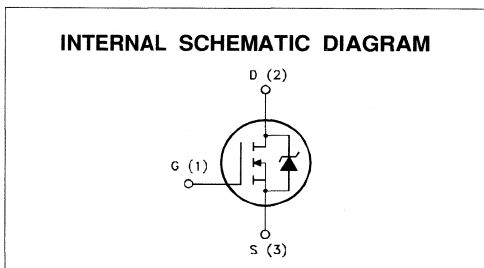
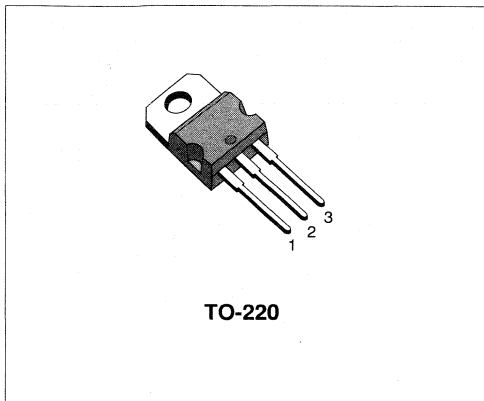
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
MTP6N60	600 V	< 1.2 Ω	6.8 A

- TYPICAL R_{DS(on)} = 1 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	600	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	600	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	6.8	A
I _D	Drain Current (continuous) at T _c = 100 °C	4.2	A
I _{DM} (*)	Drain Current (pulsed)	30	A
P _{tot}	Total Dissipation at T _c = 25 °C	125	W
	Derating Factor	1	W/°C
T _{stg}	Storage Temperature	-65 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C

(*) Pulse width limited by safe operating area

THERMAL DATA

R_{th_case}	Thermal Resistance Junction-case	Max	1	$^{\circ}\text{C}/\text{W}$
R_{th_amb}	Thermal Resistance Junction-ambient	Max	62.5	$^{\circ}\text{C}/\text{W}$
R_{th_amb}	Thermal Resistance Case-sink	Typ	0.5	$^{\circ}\text{C}/\text{W}$
T_I	Maximum Lead Temperature For Soldering Purpose		300	$^{\circ}\text{C}$

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	6.8	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25^{\circ}\text{C}$, $I_D = I_{AR}$, $V_{DD} = 25\text{ V}$)	460	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	21	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100^{\circ}\text{C}$, pulse width limited by T_j max, $\delta < 1\%$)	4.2	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25^{\circ}\text{C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\ \mu\text{A}$ $V_{GS} = 0$	600			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^{\circ}\text{C}$			200 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 1\text{ mA}$	2	3.1	4.5	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 3\text{ A}$ $V_{GS} = 10\text{ V}$ $I_D = 3\text{ A}$ $T_c = 100^{\circ}\text{C}$		1	1.2 2.4	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	6.8			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 3\text{ A}$	2	4.8		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		1150	1500	pF
C_{oss}	Output Capacitance			160	240	pF
C_{rss}	Reverse Transfer Capacitance			75	110	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 300\text{ V}$ $I_D = 3\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		50 140	65 175	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 480\text{ V}$ $I_D = 6\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		240		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 480\text{ V}$ $I_D = 6\text{ A}$ $V_{GS} = 10\text{ V}$		78 8 41	98	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(voff)}$	Off-voltage Rise Time	$V_{DD} = 480\text{ V}$ $I_D = 6\text{ A}$		100	125	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		27	34	ns
t_c	Cross-over Time	(see test circuit, figure 5)		145	180	ns

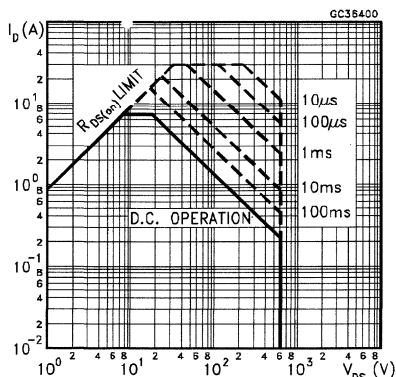
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				3.8	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				24	A
$V_{SD}(\approx)$	Forward On Voltage	$I_{SD} = 6\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 6\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		750		ns
Q_{rr}	Reverse Recovery Charge			13.5		μC
I_{RRM}	Reverse Recovery Current			38		A

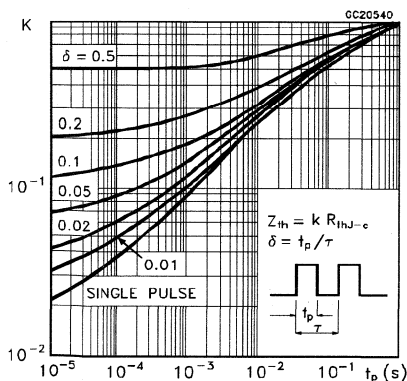
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

(•) Pulse width limited by safe operating area

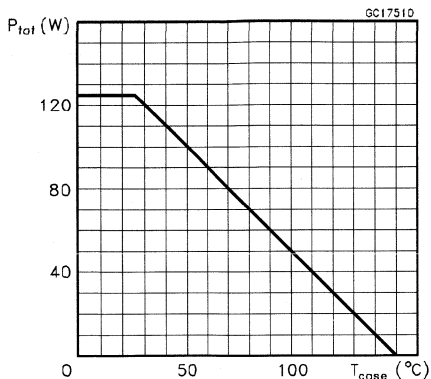
Safe Operating Area



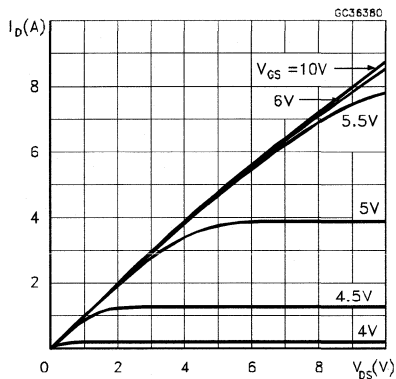
Thermal Impedance



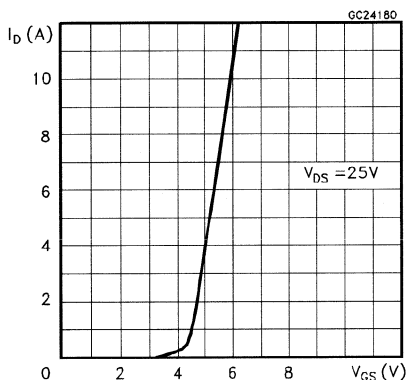
Derating Curve



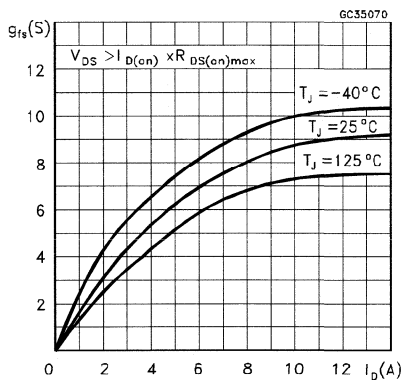
Output Characteristics



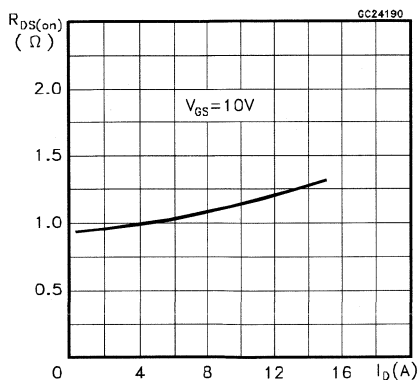
Transfer Characteristics



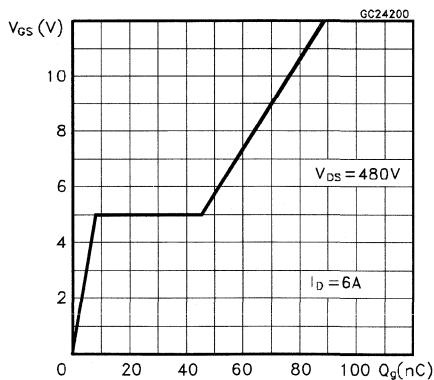
Transconductance



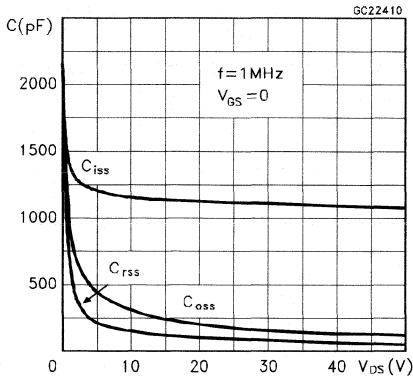
Static Drain-source On Resistance



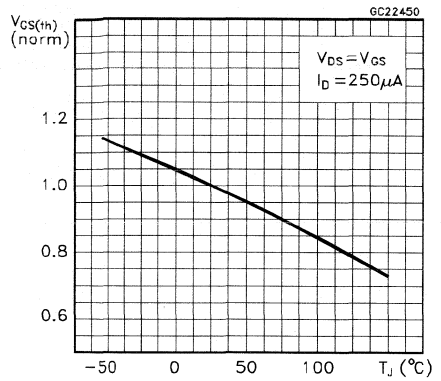
Gate Charge vs Gate-source Voltage



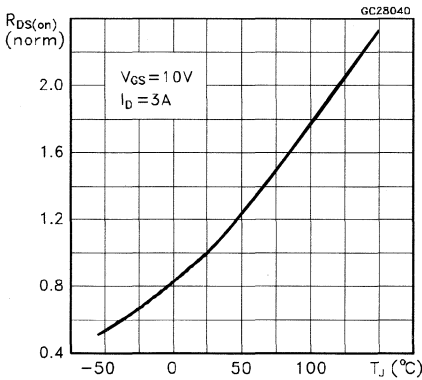
Capacitance Variations



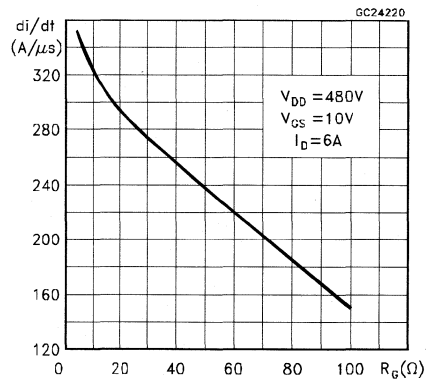
Normalized Gate Threshold Voltage vs Temperature



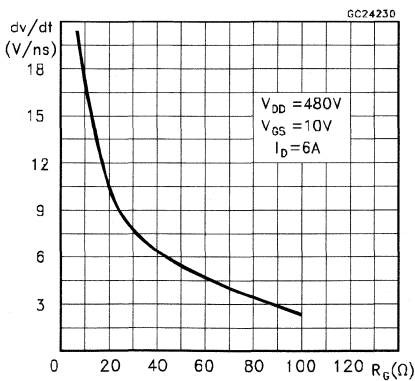
Normalized On Resistance vs Temperature



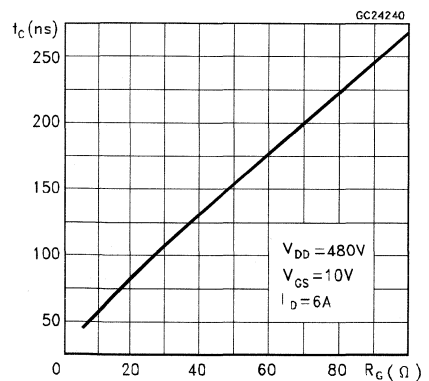
Turn-on Current Slope



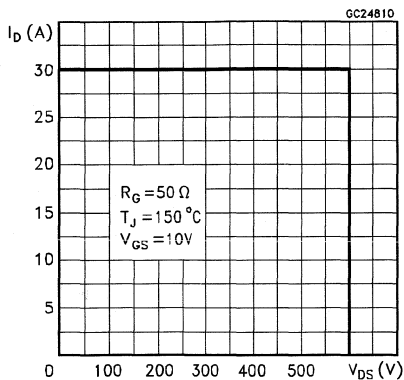
Turn-off Drain-source Voltage Slope



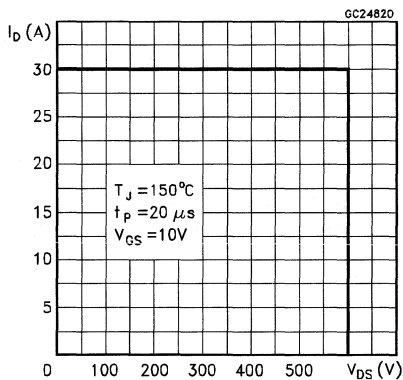
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

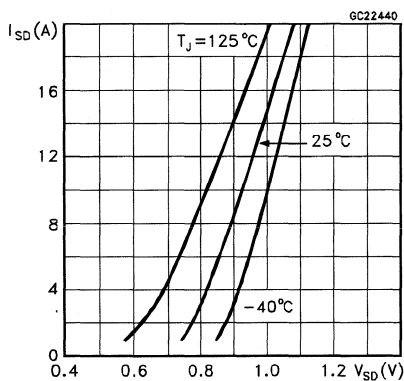


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

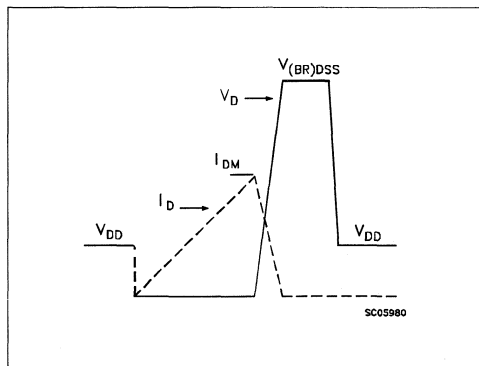
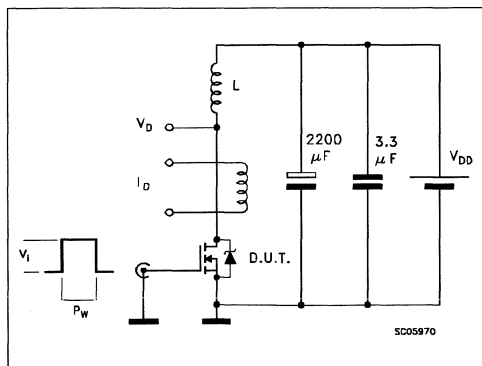


Fig. 3: Switching Times Test Circuits For Resistive Load

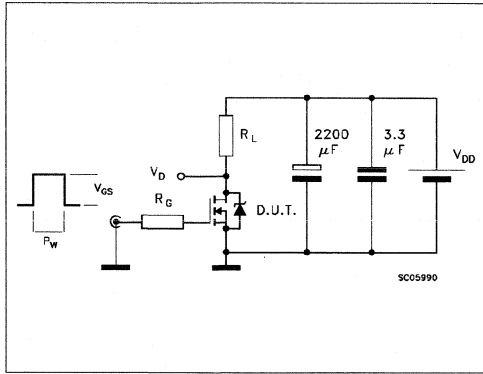


Fig. 4: Gate Charge Test Circuit

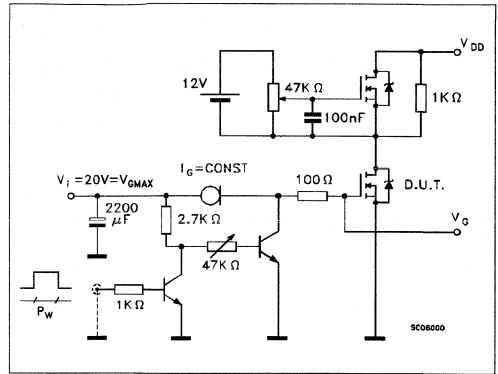
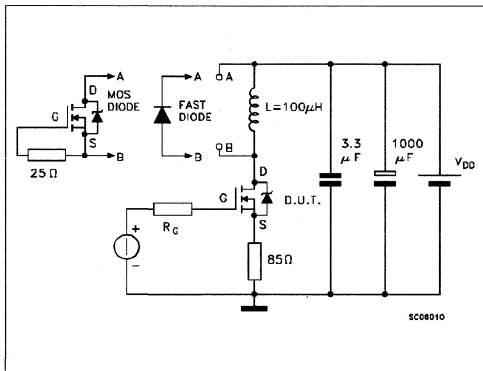


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



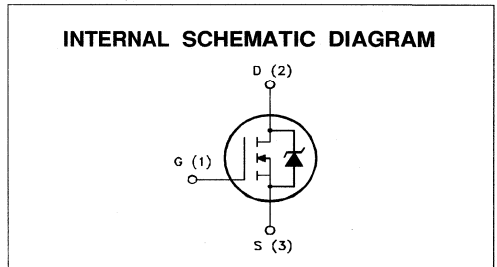
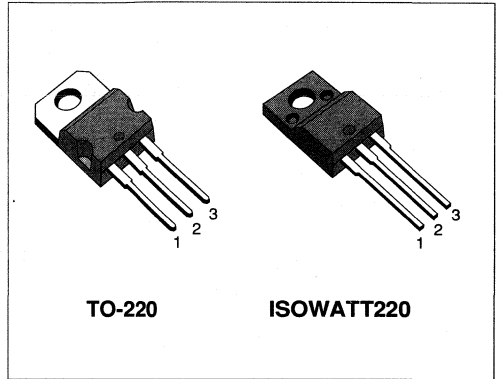
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

TYPE	V _{DSS}	R _{DS(on)}	I _D
MTP3055E	60 V	< 0.15 Ω	14 A
MTP3055EFI	60 V	< 0.15 Ω	10 A

- TYPICAL R_{DS(on)} = 0.1 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		MTP3055E	MTP3055EFI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	60		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	60		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (cont.) at T _c = 25 °C	14	10	A
I _D	Drain Current (cont.) at T _c = 100 °C	10	7	A
I _{DM} (*)	Drain Current (pulsed)	56	56	A
P _{tot}	Total Dissipation at T _c = 25 °C	70	35	W
	Derating Factor	0.47	0.23	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

		TO-220	ISOWATT220		
R _{thj-case}	Thermal Resistance Junction-case	Max	2.14	4.29	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5		°C/W
R _{thc-s}	Thermal Resistance Case-sink	Typ	0.5		°C/W
T _I	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	14	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	40	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	10	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	10	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	60			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			50 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	2.9	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 7 A		0.1	0.15	Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} × R _{DS(on)max} V _{GS} = 10 V	14			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} × R _{DS(on)max} I _D = 7 A	3	6		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		330	450	pF
C _{oss}	Output Capacitance			150	250	pF
C _{rss}	Reverse Transfer Capacitance			40	60	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING RESISTIVE LOAD

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 25\text{ V}$ $I_D = 7\text{ A}$		45	65	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		90	130	ns
$t_{d(off)}$	Turn-off Delay Time	(see test circuit)		40	60	ns
t_f	Fall Time			40	60	ns
Q_g	Total Gate Charge	$I_D = 14\text{ A}$ $V_{GS} = 10\text{ V}$		15	25	nC
Q_{gs}	Gate-Source Charge	$V_{DD} = 40\text{ V}$		7		nC
Q_{gd}	Gate-Drain Charge	(see test circuit)		5		nC

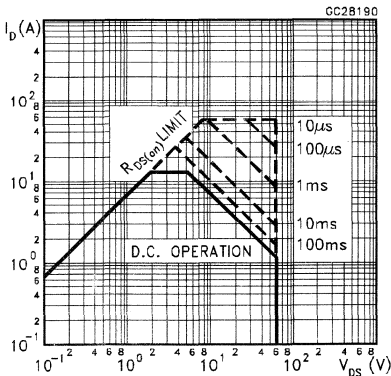
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				14	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				56	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 14\text{ A}$ $V_{GS} = 0$			1.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 14\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 25\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		60		ns
Q_{rr}	Reverse Recovery Charge			0.12		μC

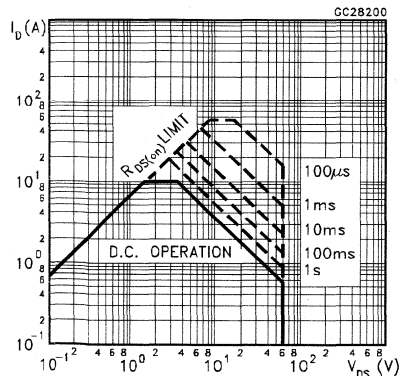
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

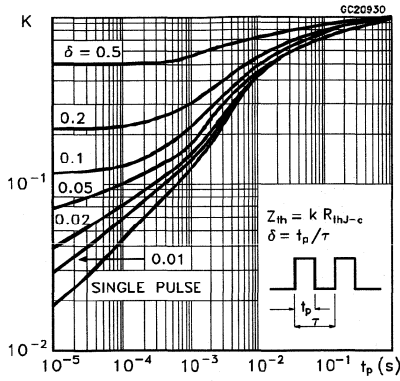
Safe Operating Area for TO-220



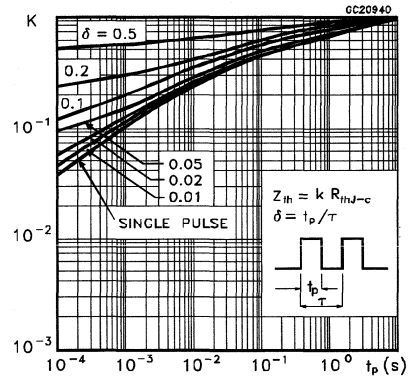
Safe Operating Area for ISOWATT220



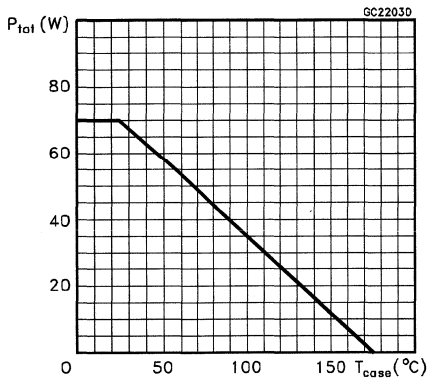
Thermal Impedance for TO-220



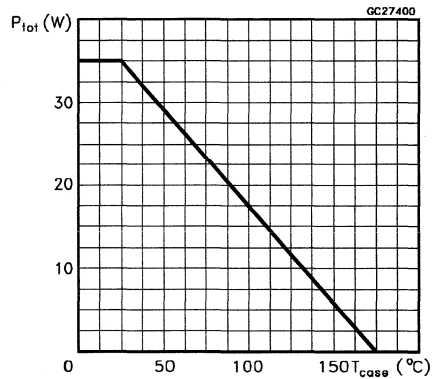
Thermal Impedance for ISOWATT220



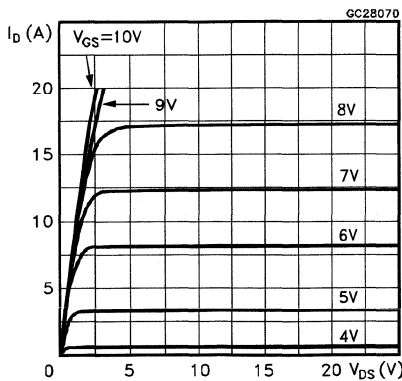
Derating Curve for TO-220



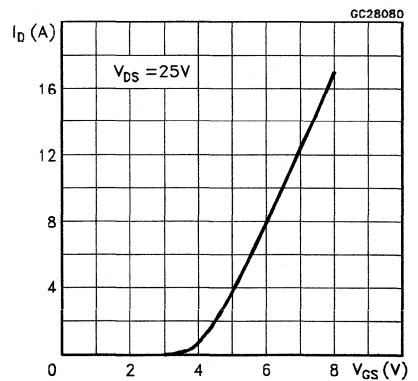
Derating Curve for ISOWATT220



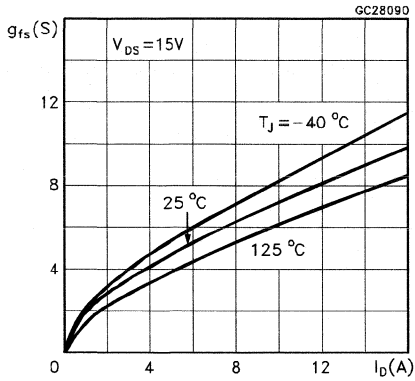
Output Characteristics



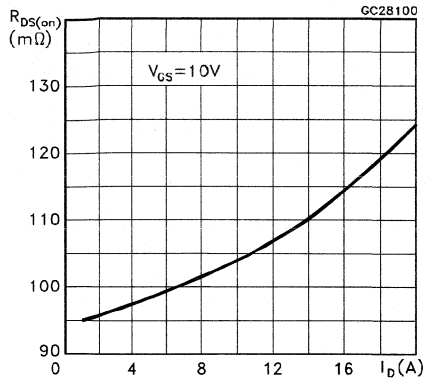
Transfer Characteristics



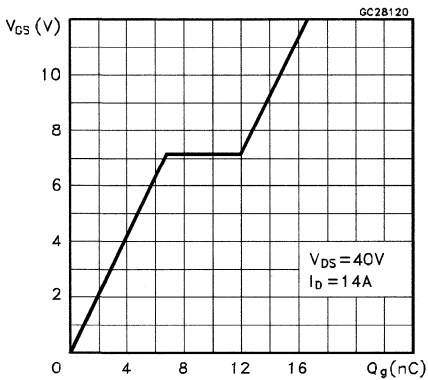
Transconductance



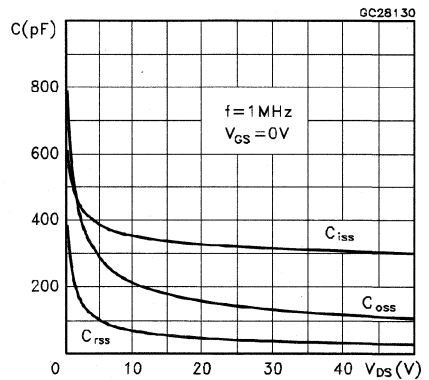
Static Drain-source On Resistance



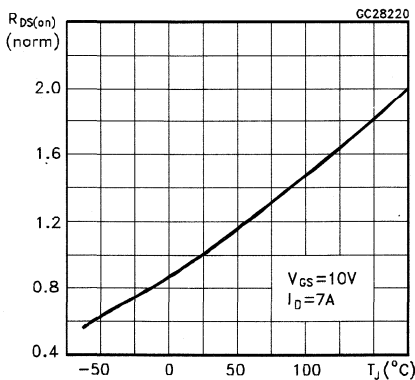
Gate Charge vs Gate-source Voltage



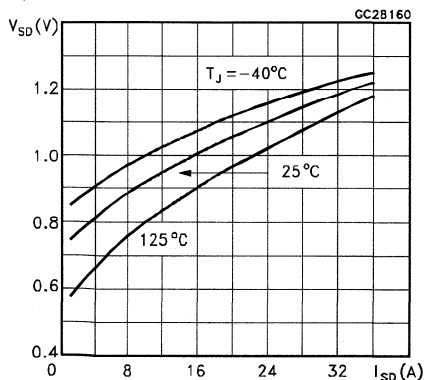
Capacitance Variations



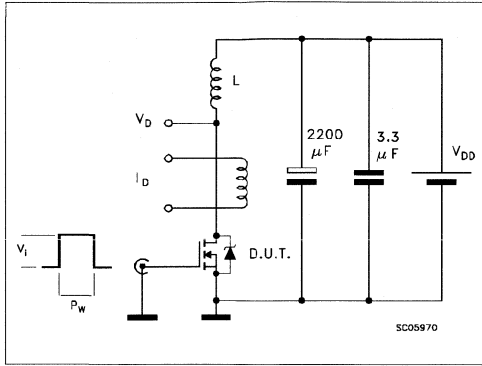
Normalized On Resistance vs Temperature



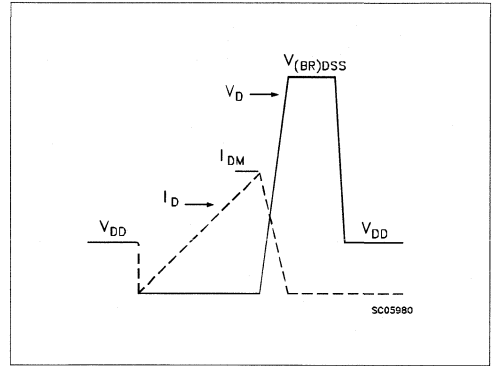
Source-drain Diode Forward Characteristics



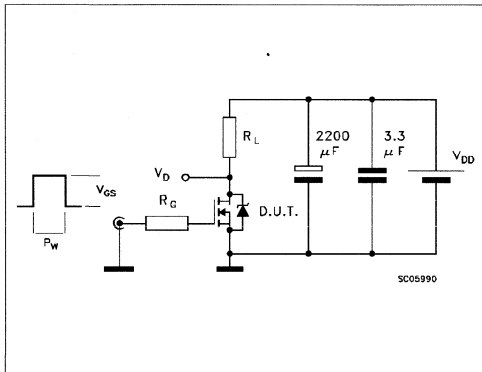
Unclamped Inductive Load Test Circuit



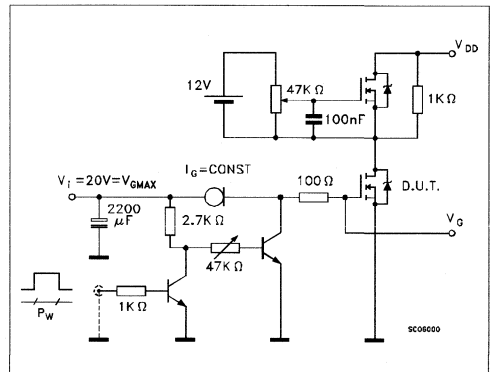
Unclamped Inductive Waveforms



Switching Time Test Circuit



Gate Charge Test Circuit



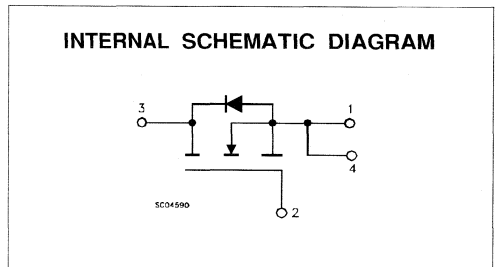
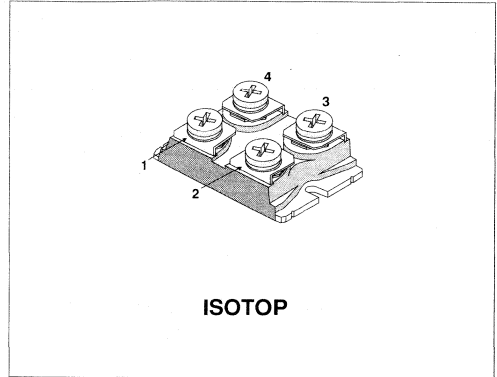
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR IN ISOTOP PACKAGE

TYPE	V _{DSS}	R _{DS(on)}	I _D
STE15N100	1000 V	< 0.77 Ω	15 A

- HIGH CURRENT POWER MODULE
- AVALANCHE RUGGED TECHNOLOGY (SEE STH6N100 FOR RATING)
- VERY LARGE SOA - LARGE PEAK POWER CAPABILITY
- EASY TO MOUNT
- SAME CURRENT CAPABILITY FOR THE TWO SOURCE TERMINALS
- EXTREMELY LOW R_{th} JUNCTION TO CASE
- VERY LOW DRAIN TO CASE CAPACITANCE
- VERY LOW INTERNAL PARASITIC INDUCTANCE (TYPICALLY < 5 nH)
- ISOLATED PACKAGE UL RECOGNIZED (FILE No E81743)

INDUSTRIAL APPLICATIONS:

- SMPS & UPS
- MOTOR CONTROL
- WELDING EQUIPMENT
- OUTPUT STAGE FOR PWM, ULTRASONIC CIRCUITS



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-Source Voltage (V _{GS} = 0)	1000	V
V _{DGR}	Drain-Gate Voltage (R _{GS} = 20 kΩ)	1000	V
V _{GS}	Gate-Source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	15	A
I _D	Drain Current (continuous) at T _c = 100 °C	9.5	A
I _{DM} (*)	Drain Current (pulsed)	60	A
P _{tot}	Total Dissipation at T _c = 25 °C	400	W
	Derating Factor	3.2	W/°C
T _{stg}	Storage Temperature	-55 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C
V _{ISO}	Insulation Withstand Voltage (AC-RMS)	2500	V

(*) Pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	0.31	°C/W
R_{thc-h}	Thermal Resistance Case-heatsink With Conductive Grease Applied	Max	0.05	°C/W

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 1\text{ mA}$ $V_{GS} = 0\text{ V}$	1000			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			500 1.5	μA mA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 300	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 1\text{ mA}$	2		4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 9\text{ A}$			0.77	Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} = 15\text{ V}$ $I_D = 9\text{ A}$	8			S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0\text{ V}$			7	nF
C_{oss}	Output Capacitance				850	pF
C_{rss}	Reverse Transfer Capacitance				250	pF

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 500\text{ V}$ $I_D = 9\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 1)		65		ns
t_r	Rise Time			78		ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 800\text{ V}$ $I_D = 15\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		570		A/ μs
Q_g	Total Gate Charge	$V_{DD} = 800\text{ V}$ $I_D = 15\text{ A}$ $V_{GS} = 10\text{ V}$		375		nC

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$	Off-voltage Rise Time	$V_{DD} = 800\text{ V}$ $I_D = 15\text{ A}$		75	95	ns
t_f	Fall Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$		18	25	ns
t_c	Cross-over Time	(see test circuit, figure 3)		105	136	ns

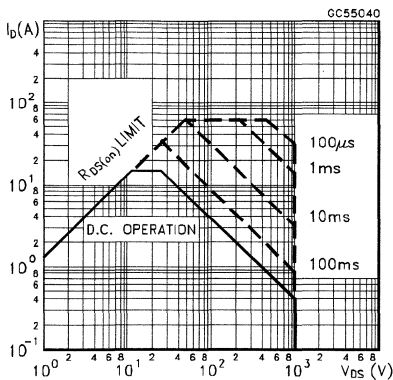
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				15	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				60	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 15\text{ A}$ $V_{GS} = 0$			2.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 15\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 3)		1150		ns
Q_{rr}	Reverse Recovery Charge			30		μC
I_{RRM}	Reverse Recovery Current			52		A

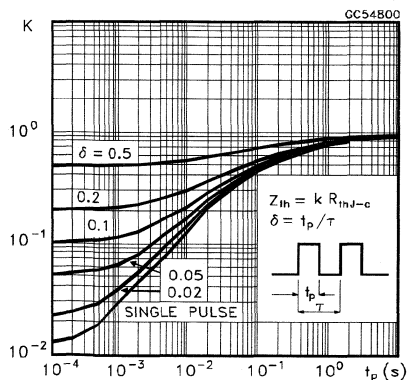
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

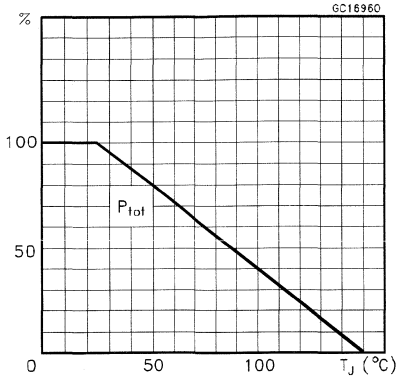
Safe Operating Area



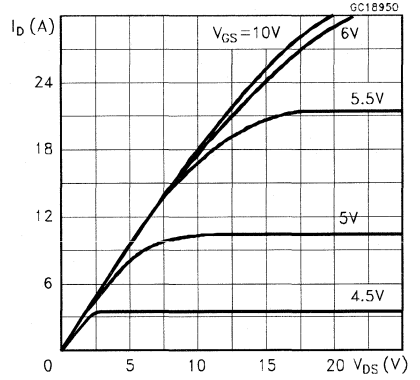
Thermal Impedance



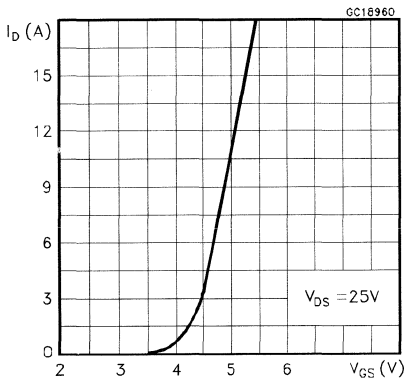
Derating Curve



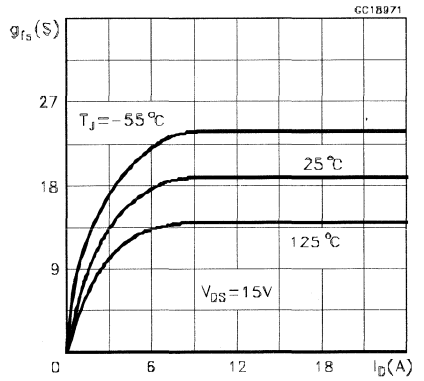
Output Characteristics



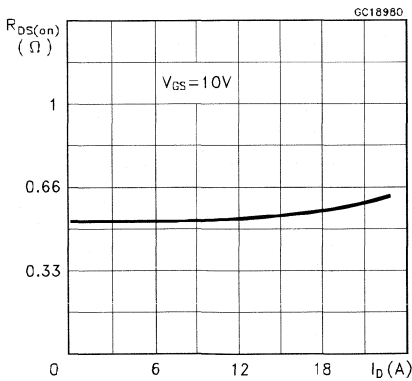
Transfer Characteristics



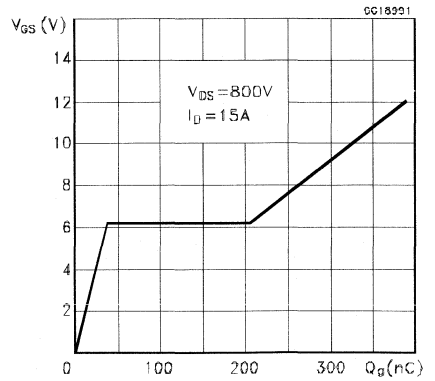
Transconductance



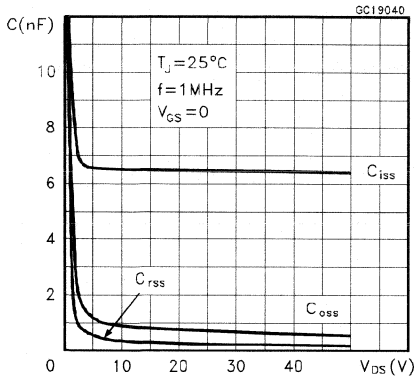
Static Drain-source On Resistance



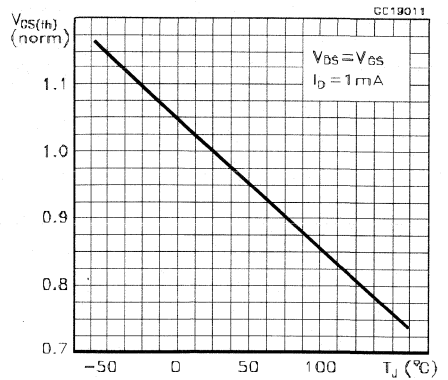
Gate Charge vs Gate-source Voltage



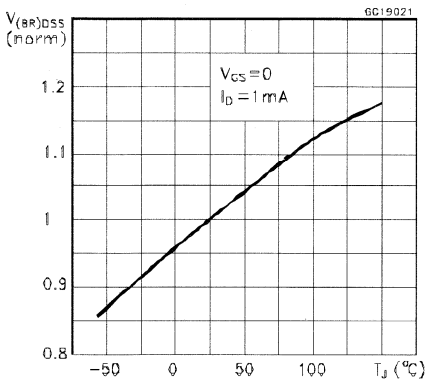
Capacitance Variations



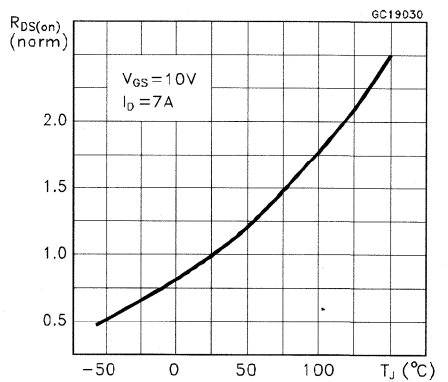
Normalized Gate Threshold Voltage vs Temperature



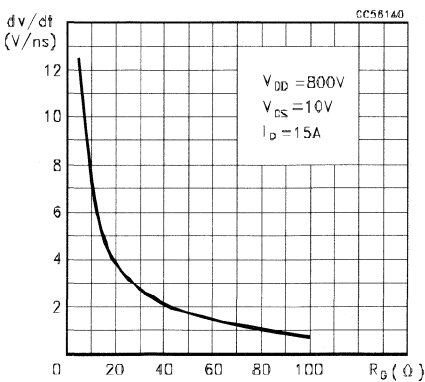
Normalized Breakdown Voltage vs Temperature



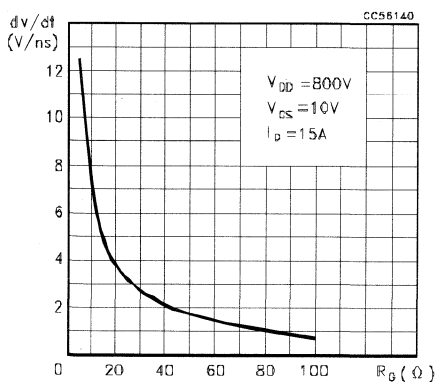
Normalized On Resistance vs Temperature



Turn-on Current Slope



Turn-off Drain-source Voltage Slope



Cross-over Time

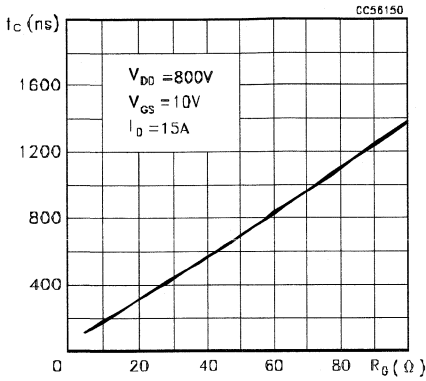


Fig. 1: Switching Times Test Circuits For Resistive Load

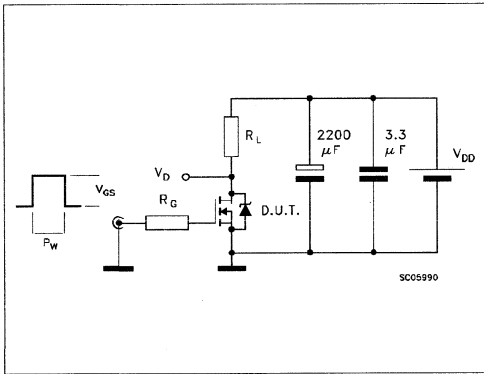
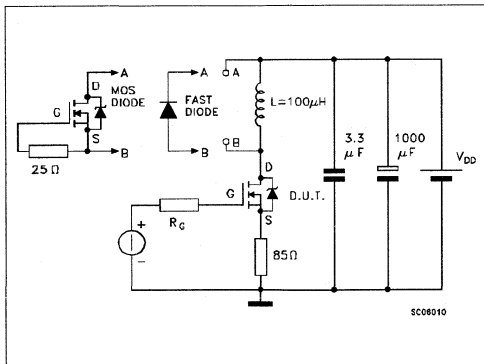


Fig. 3: Test Circuit For Inductive Load Switching And Diode Recovery Times



Source-drain Diode Forward Characteristics

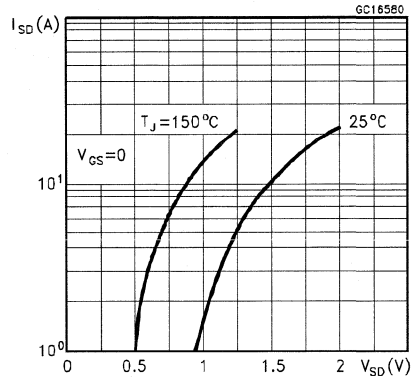
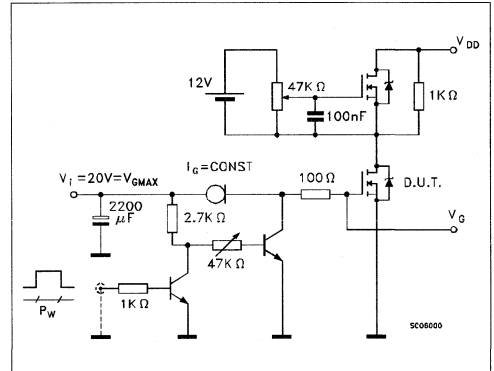


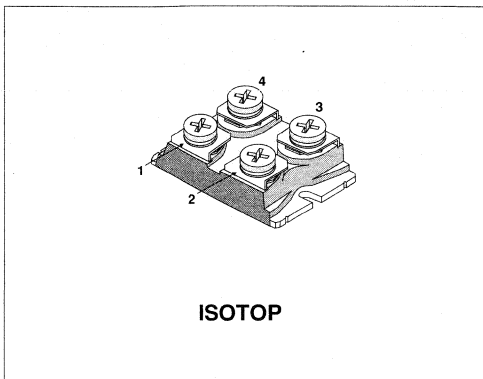
Fig. 2: Gate Charge Test Circuit



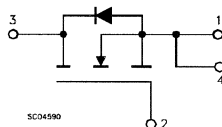
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR IN ISOTOP PACKAGE

TYPE	V _{DSS}	R _{DS(on)}	I _D
E16N100	1000 V	< 0.7 Ω	16 A

HIGH CURRENT POWER MODULE
 AVALANCHE RUGGED TECHNOLOGY
 (SEE STH6N100 FOR RATING)
 VERY LARGE SOA - LARGE PEAK POWER
 CAPABILITY
 EASY TO MOUNT
 SAME CURRENT CAPABILITY FOR THE
 TWO SOURCE TERMINALS
 EXTREMELY LOW R_{th} JUNCTION TO CASE
 VERY LOW DRAIN TO CASE CAPACITANCE
 VERY LOW INTERNAL PARASITIC
 INDUCTANCE (TYPICALLY < 5 nH)
 SOLATED PACKAGE UL RECOGNIZED
 (FILE No E81743)



INTERNAL SCHEMATIC DIAGRAM



INDUSTRIAL APPLICATIONS:

SMPS & UPS
 MOTOR CONTROL
 WELDING EQUIPMENT
 OUTPUT STAGE FOR PWM, ULTRASONIC
 CIRCUITS

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-Source Voltage (V _{GS} = 0)	1000	V
V _{DGR}	Drain-Gate Voltage (R _{GS} = 20 kΩ)	1000	V
V _{GS}	Gate-Source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	16	A
I _D	Drain Current (continuous) at T _c = 100 °C	10	A
I _{DM(•)}	Drain Current (pulsed)	64	A
P _{tot}	Total Dissipation at T _c = 25 °C	400	W
	Derating Factor	3.2	W/°C
T _{stg}	Storage Temperature	-55 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C
V _{ISO}	Insulation Withstand Voltage (AC-RMS)	2500	V

[•]pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	0.31	°C/W
R_{thc-h}	Thermal Resistance Case-heatsink With Conductive Grease Applied	Max	0.05	°C/W

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 1\text{ mA}$ $V_{GS} = 0\text{ V}$	1000			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ }^{\circ}\text{C}$			300 1.5	μA mA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 300	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 1\text{ mA}$	2		4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 9\text{ A}$			0.7	Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} = 15\text{ V}$ $I_D = 9\text{ A}$	8			S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0\text{ V}$			7	nF
C_{oss}	Output Capacitance				850	pF
C_{rss}	Reverse Transfer Capacitance				250	pF

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 500\text{ V}$ $I_D = 9\text{ A}$ $R_G = 4.7\text{ }\Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 1)		65		ns
t_r	Rise Time				78	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 800\text{ V}$ $I_D = 16\text{ A}$ $R_G = 4.7\text{ }\Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		570		A/ μs
Q_g	Total Gate Charge	$V_{DD} = 800\text{ V}$ $I_D = 16\text{ A}$ $V_{GS} = 10\text{ V}$		375		nC

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING OFF

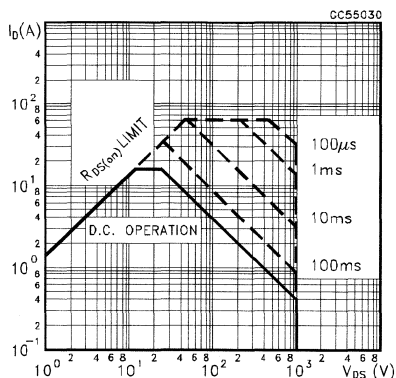
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 800\text{ V}$ $I_D = 16\text{ A}$		75	95	ns
t_f	Fall Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$		20	28	ns
t_c	Cross-over Time	(see test circuit, figure 3)		112	144	ns

SOURCE DRAIN DIODE

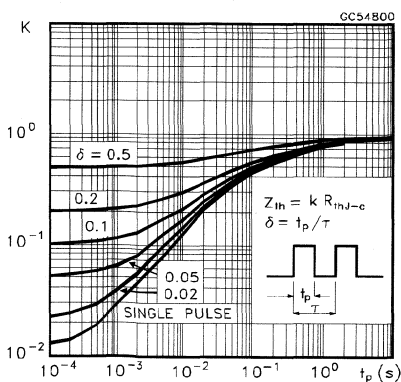
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				16	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				64	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 16\text{ A}$ $V_{GS} = 0$			2.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 16\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		1250		ns
Q_{rr}	Reverse Recovery Charge	(see test circuit, figure 3)		37		μC
I_{RRM}	Reverse Recovery Current			59		A

Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %
Pulse width limited by safe operating area

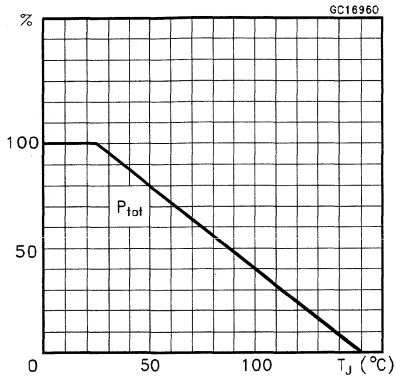
Safe Operating Area



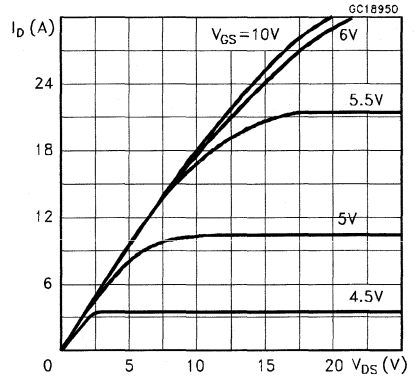
Thermal Impedance



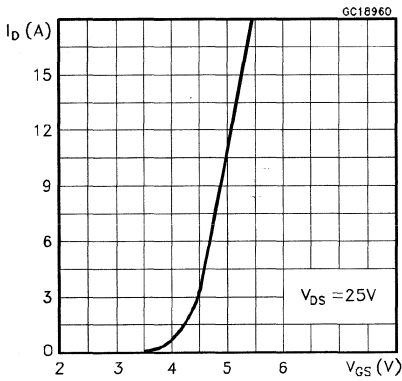
Derating Curve



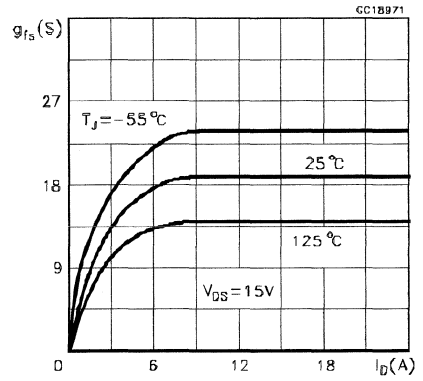
Output Characteristics



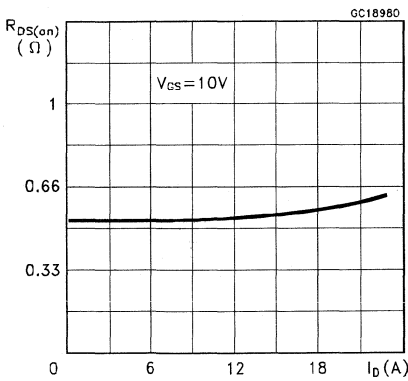
Transfer Characteristics



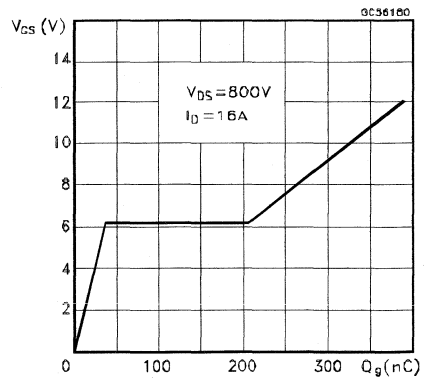
Transconductance



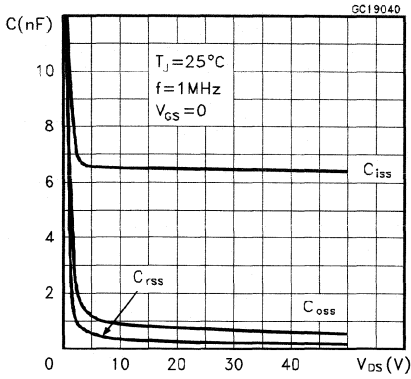
Static Drain-source On Resistance



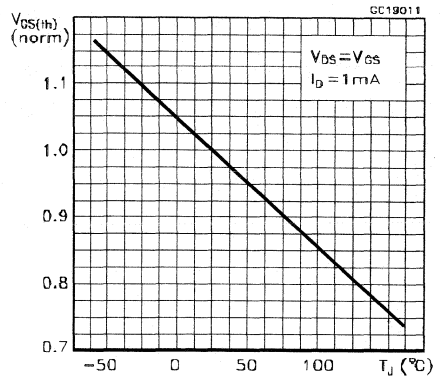
Gate Charge vs Gate-source Voltage



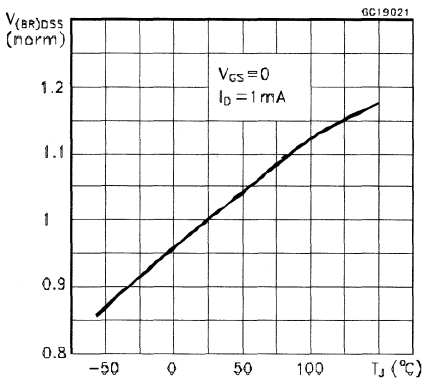
Capacitance Variations



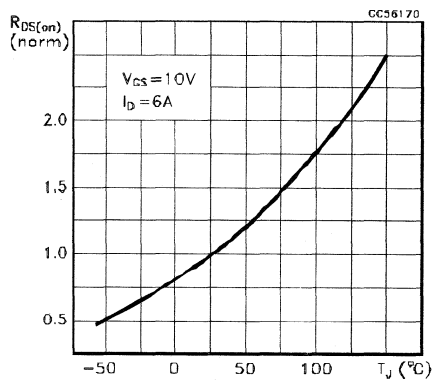
Normalized Gate Threshold Voltage vs Temperature



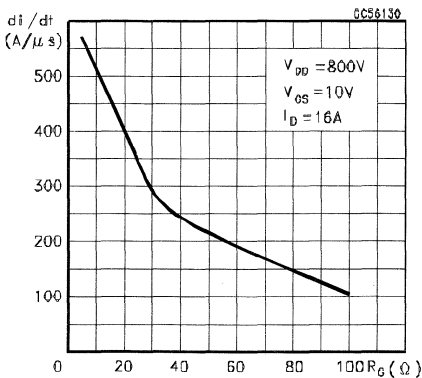
Normalized Breakdown Voltage vs Temperature



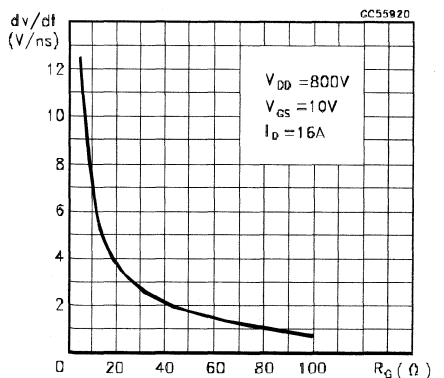
Normalized On Resistance vs Temperature



Turn-on Current Slope



Turn-off Drain-source Voltage Slope



Cross-over Time

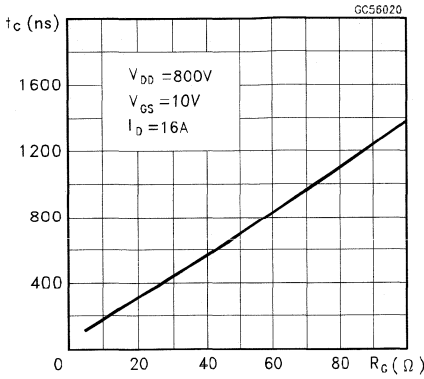


Fig. 1: Switching Times Test Circuits For Resistive Load

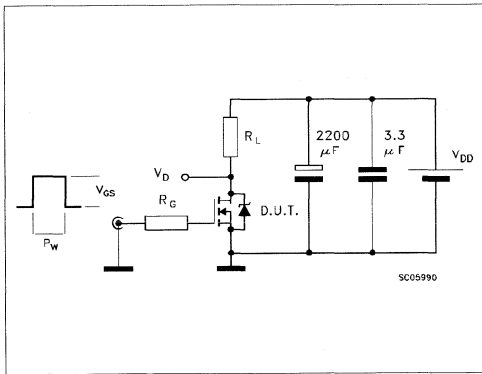
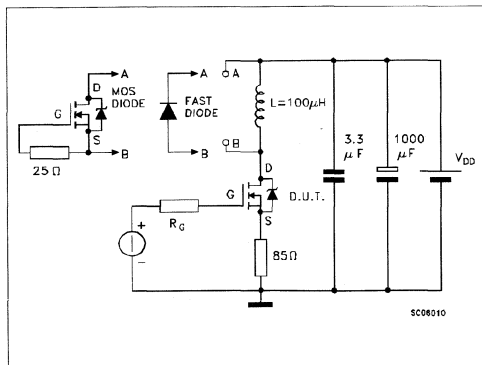


Fig. 3: Test Circuit For Inductive Load Switching And Diode Recovery Times



Source-drain Diode Forward Characteristics

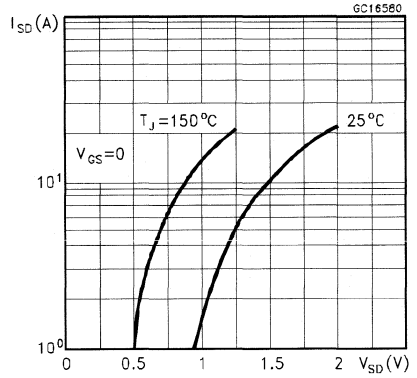
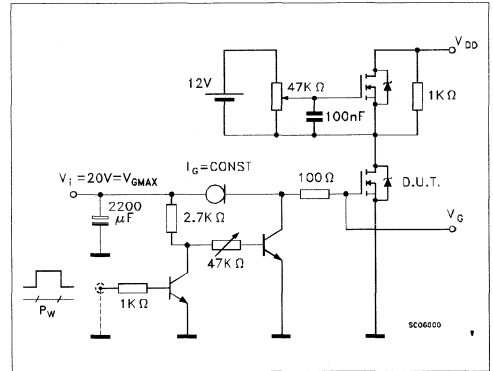


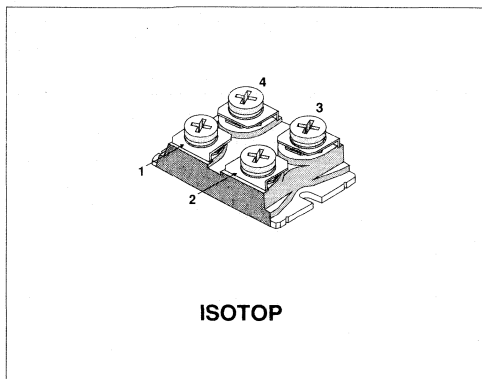
Fig. 2: Gate Charge Test Circuit



N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR IN ISOTOP PACKAGE

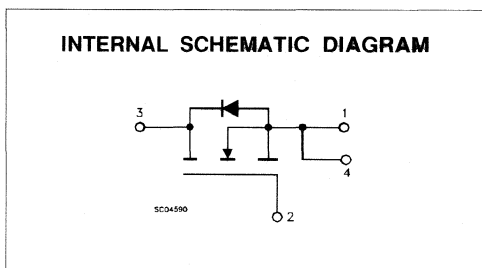
TYPE	V _{DSS}	R _{DS(on)}	I _D
TE22N80	800 V	< 0.4 Ω	22 A

HIGH CURRENT POWER MODULE
 AVALANCHE RUGGED TECHNOLOGY
 (SEE STH8N80 FOR RATING)
 VERY LARGE SOA - LARGE PEAK POWER
 CAPABILITY
 EASY TO MOUNT
 SAME CURRENT CAPABILITY FOR THE
 TWO SOURCE TERMINALS
 EXTREMELY LOW R_{th} JUNCTION TO CASE
 VERY LOW DRAIN TO CASE CAPACITANCE
 VERY LOW INTERNAL PARASITIC
 INDUCTANCE (TYPICALLY < 5 nH)
 ISOLATED PACKAGE UL RECOGNIZED
 (FILE No E81743)



INDUSTRIAL APPLICATIONS:

SMPS & UPS
 MOTOR CONTROL
 WELDING EQUIPMENT
 OUTPUT STAGE FOR PWM, ULTRASONIC
 CIRCUITS



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-Source Voltage (V _{GS} = 0)	800	V
V _{DGR}	Drain-Gate Voltage (R _{GS} = 20 kΩ)	800	V
V _{GS}	Gate-Source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	22	A
I _D	Drain Current (continuous) at T _c = 100 °C	13.5	A
I _{DM} (•)	Drain Current (pulsed)	88	A
P _{tot}	Total Dissipation at T _c = 25 °C	400	W
	Derating Factor	3.2	W/°C
T _{stg}	Storage Temperature	-55 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C
V _{ISO}	Insulation Withstand Voltage (AC-RMS)	2500	V

Pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	0.31	°C/W
R_{thc-h}	Thermal Resistance Case-heatsink With Conductive Grease Applied	Max	0.05	°C/W

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 1\text{ mA}$ $V_{GS} = 0\text{ V}$	800			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			300 1.5	μA mA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 300	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 1\text{ mA}$	2		4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 12\text{ A}$			0.4	Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} = 15\text{ V}$ $I_D = 12\text{ A}$	9			S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0\text{ V}$			8.1	nF
C_{oss}	Output Capacitance				1100	pF
C_{rss}	Reverse Transfer Capacitance				500	pF

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 400\text{ V}$ $I_D = 12\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 1)		75	100	ns
t_r	Rise Time				88	115
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 640\text{ V}$ $I_D = 22\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		660		A/ μs
Q_g	Total Gate Charge	$V_{DD} = 640\text{ V}$ $I_D = 22\text{ A}$ $V_{GS} = 10\text{ V}$		400		nC

ELECTRICAL CHARACTERISTICS (continued)

WITCHING OFF

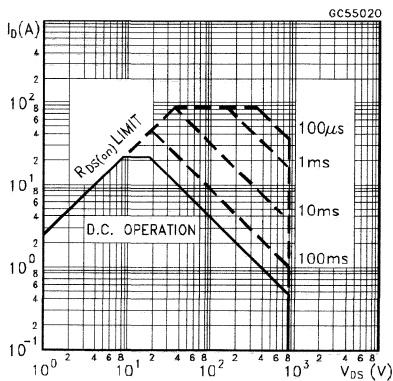
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 640\text{ V}$ $I_D = 22\text{ A}$		62	85	ns
t_f	Fall Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$		23	33	ns
t_c	Cross-over Time	(see test circuit, figure 3)		95	125	ns

SOURCE DRAIN DIODE

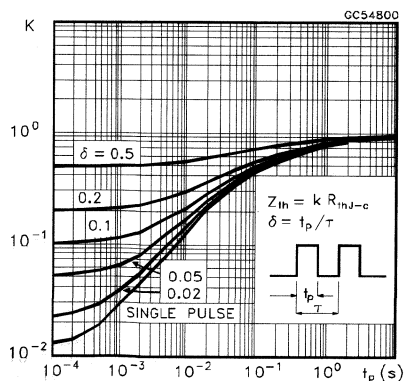
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				22	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				88	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 22\text{ A}$ $V_{GS} = 0$			2.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 22\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 3)		1400		ns
Q_{rr}	Reverse Recovery Charge			60		μC
I_{RRM}	Reverse Recovery Current			85		A

* Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %
 * Pulse width limited by safe operating area

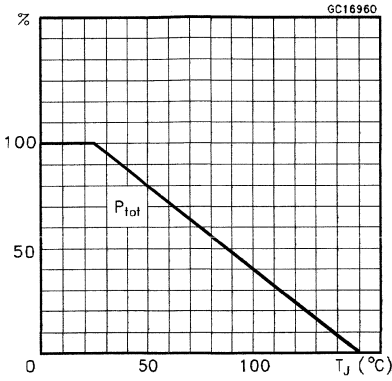
Safe Operating Area



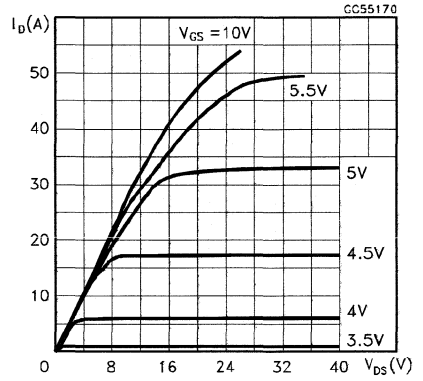
Thermal Impedance



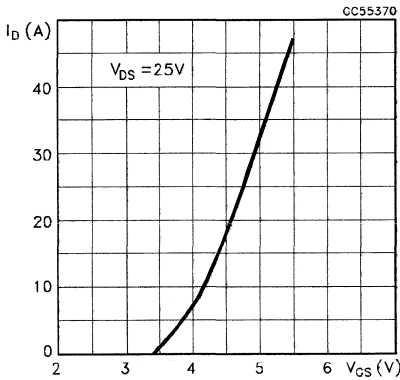
Derating Curve



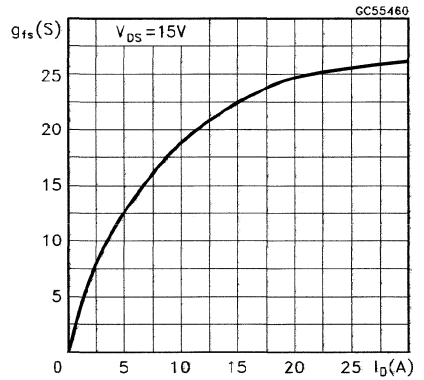
Output Characteristics



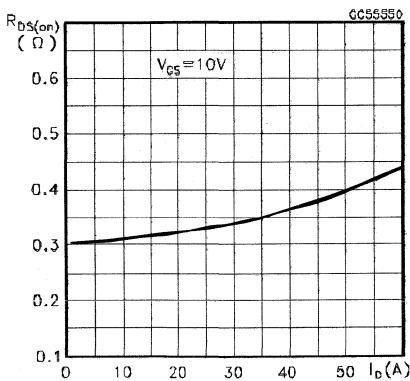
Transfer Characteristics



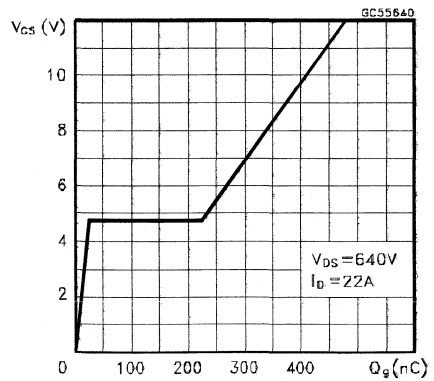
Transconductance



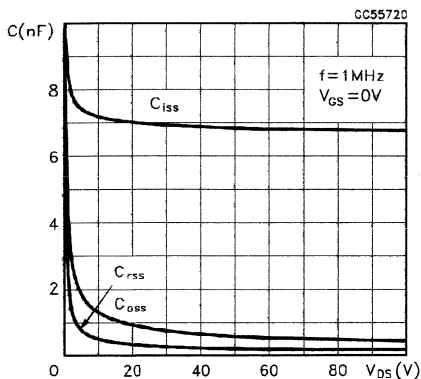
Static Drain-source On Resistance



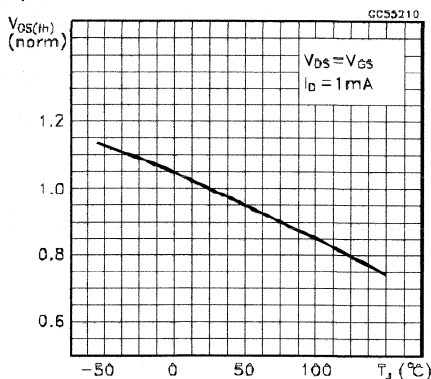
Gate Charge vs Gate-source Voltage



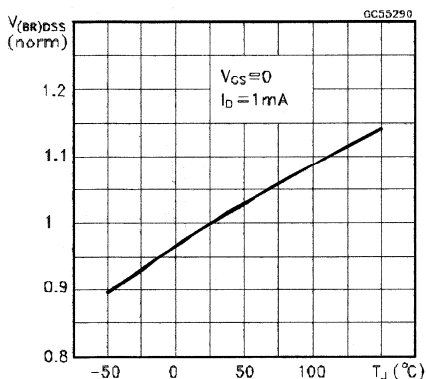
Capacitance Variations



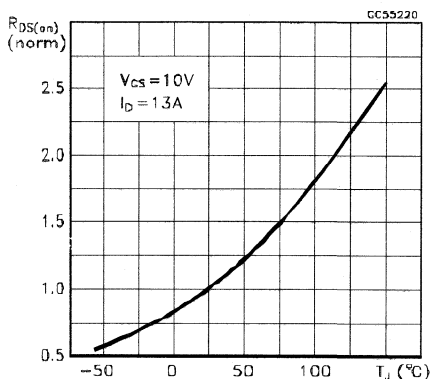
Normalized Gate Threshold Voltage vs Temperature



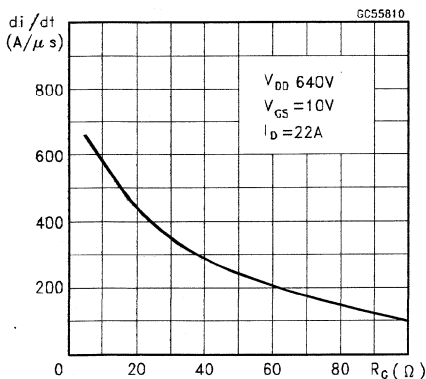
Normalized Breakdown Voltage vs Temperature



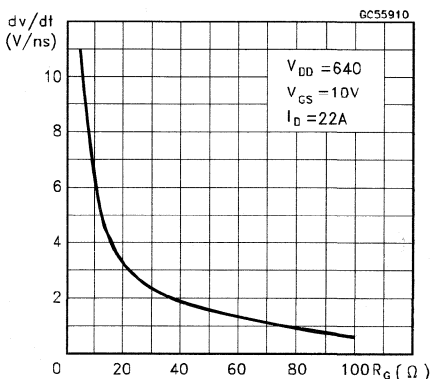
Normalized On Resistance vs Temperature



Turn-on Current Slope



Turn-off Drain-source Voltage Slope



Cross-over Time

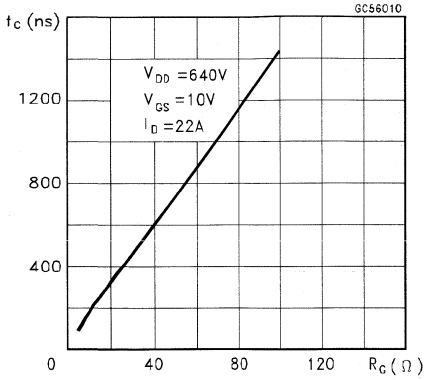


Fig. 1: Switching Times Test Circuits For Resistive Load

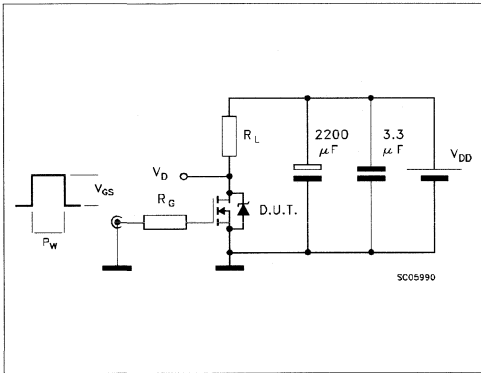
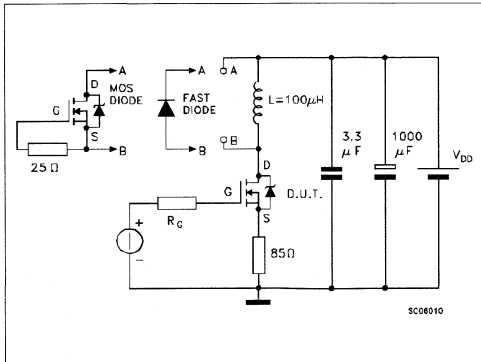


Fig. 3: Test Circuit For Inductive Load Switching And Diode Recovery Times



Source-drain Diode Forward Characteristics

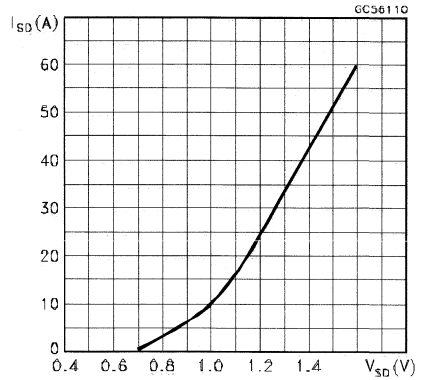
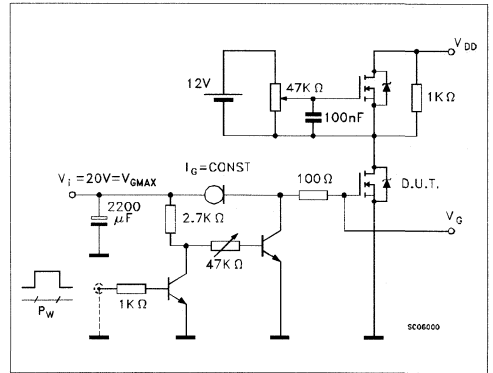


Fig. 2: Gate Charge Test Circuit



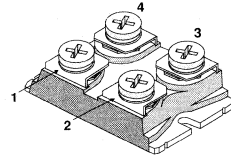
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR IN ISOTOP PACKAGE

TYPE	V _{DSS}	R _{DS(on)}	I _D
STE26N50	500 V	< 0.2 Ω	26 A

- HIGH CURRENT POWER MODULE
- AVALANCHE RUGGED TECHNOLOGY (SEE IRFP450 FOR RATING)
- VERY LARGE SOA - LARGE PEAK POWER CAPABILITY
- EASY TO MOUNT
- SAME CURRENT CAPABILITY FOR THE TWO SOURCE TERMINALS
- EXTREMELY LOW R_{th} JUNCTION TO CASE
- VERY LOW DRAIN TO CASE CAPACITANCE
- VERY LOW INTERNAL PARASITIC INDUCTANCE (TYPICALLY < 5 nH)
- ISOLATED PACKAGE UL RECOGNIZED (FILE No E81743)

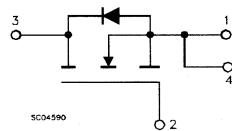
INDUSTRIAL APPLICATIONS:

- SMPS & UPS
- MOTOR CONTROL
- WELDING EQUIPMENT
- OUTPUT STAGE FOR PWM, ULTRASONIC CIRCUITS



ISOTOP

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-Source Voltage (V _{GS} = 0)	500	V
V _{DGR}	Drain-Gate Voltage (R _{GS} = 20 kΩ)	500	V
V _{GS}	Gate-Source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	26	A
I _D	Drain Current (continuous) at T _c = 100 °C	17	A
I _{DM} (*)	Drain Current (pulsed)	104	A
P _{tot}	Total Dissipation at T _c = 25 °C	300	W
	Derating Factor	2.4	W/°C
T _{stg}	Storage Temperature	-55 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C
V _{ISO}	Insulation Withstand Voltage (AC-RMS)	2500	V

(*) Pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	0.42	$^{\circ}\text{C}/\text{W}$
R_{thc-h}	Thermal Resistance Case-heatsink With Conductive Grease Applied	Max	0.05	$^{\circ}\text{C}/\text{W}$

ELECTRICAL CHARACTERISTICS ($T_{case} = 25^{\circ}\text{C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 1\text{ mA}$ $V_{GS} = 0\text{ V}$	500			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^{\circ}\text{C}$			200 1	μA mA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 200	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 1\text{ mA}$	2		4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 13\text{ A}$			0.2	Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	$V_{DS} = 15\text{ V}$ $I_D = 13\text{ A}$	12			S
C_{iss} C_{oss} C_{rss}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0\text{ V}$			6 1200 500	nF pF pF

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 250\text{ V}$ $I_D = 13\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 1)		60 80		ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 400\text{ V}$ $I_D = 26\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		450		A/ μs
Q_g	Total Gate Charge	$V_{DD} = 400\text{ V}$ $I_D = 26\text{ A}$ $V_{GS} = 10\text{ V}$		275		nC

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 400\text{ V}$ $I_D = 26\text{ A}$		63		ns
t_f	Fall Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$		25		ns
t_c	Cross-over Time	(see test circuit, figure 3)		85		ns

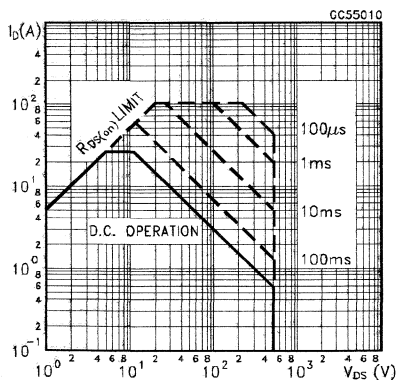
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				26	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				104	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 26\text{ A}$ $V_{GS} = 0$			1.4	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 26\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		850		ns
Q_{rr}	Reverse Recovery Charge	(see test circuit, figure 3)		23.5		μC
I_{RRM}	Reverse Recovery Current			55		A

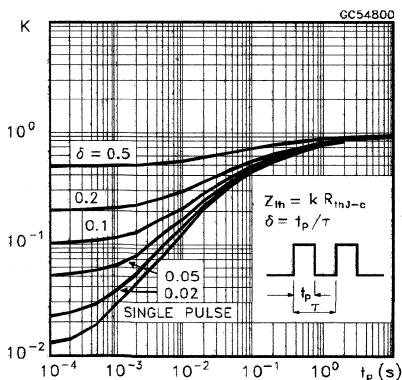
* Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

† Pulse width limited by safe operating area

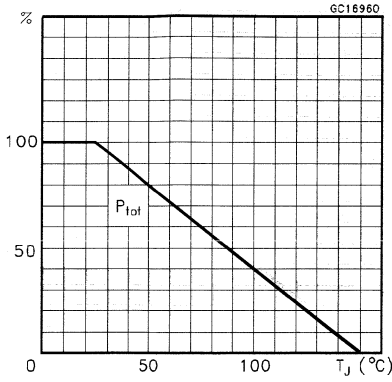
Safe Operating Area



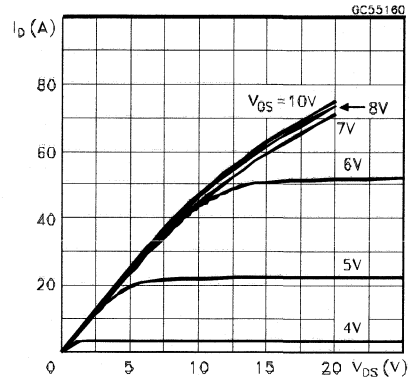
Thermal Impedance



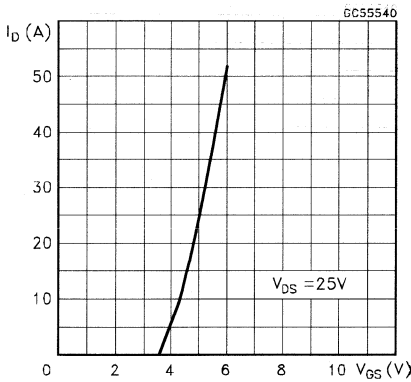
Derating Curve



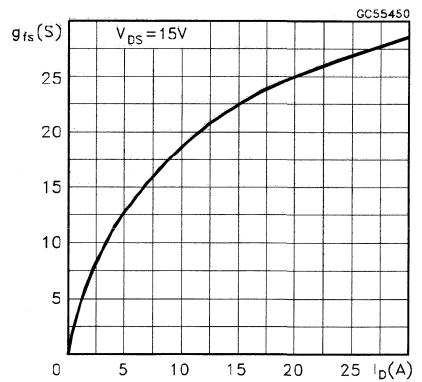
Output Characteristics



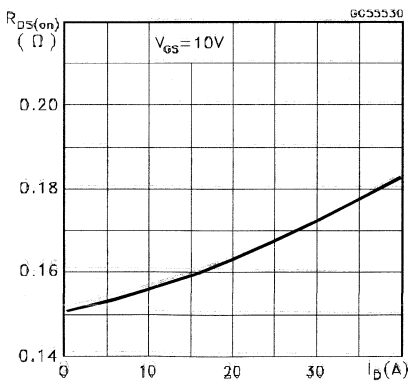
Transfer Characteristics



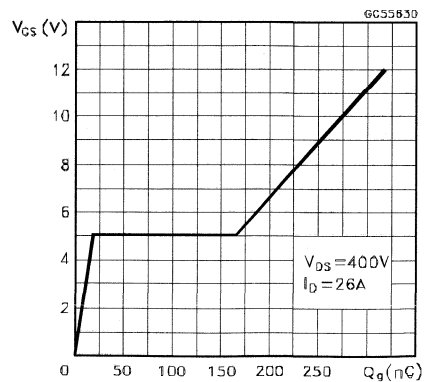
Transconductance



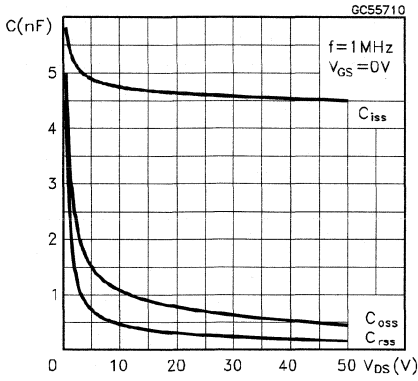
Static Drain-source On Resistance



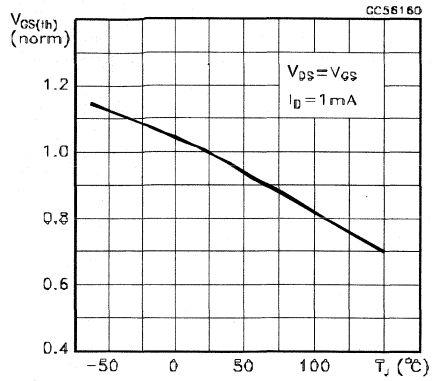
Gate Charge vs Gate-source Voltage



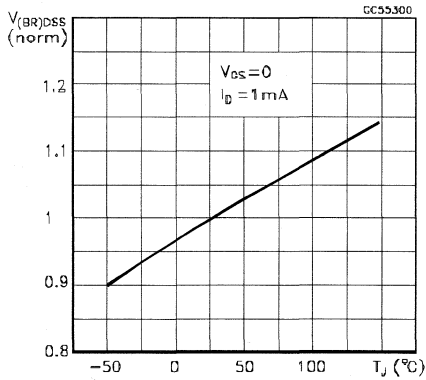
Capacitance Variations



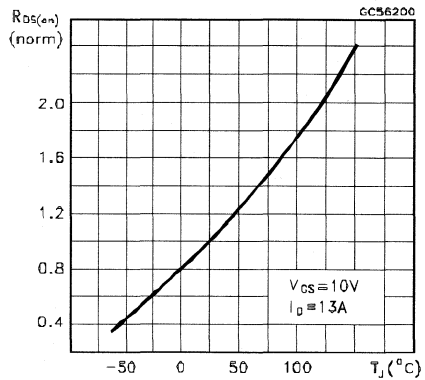
Normalized Gate Threshold Voltage vs Temperature



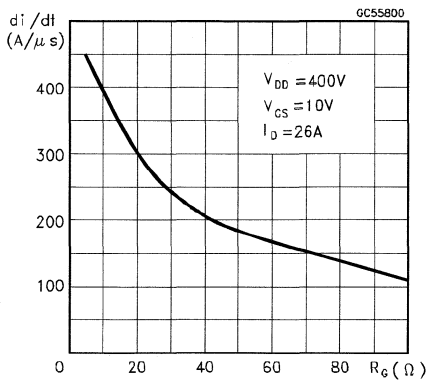
Normalized Breakdown Voltage vs Temperature



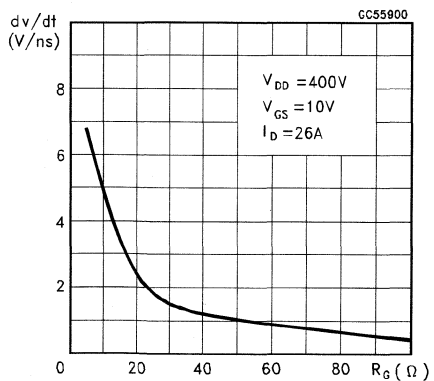
Normalized On Resistance vs Temperature



Turn-on Current Slope



Turn-off Drain-source Voltage Slope



Cross-over Time

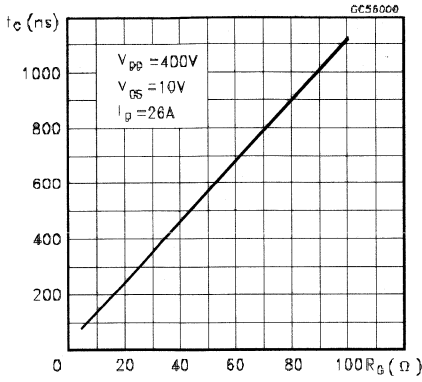


Fig. 1: Switching Times Test Circuits For Resistive Load

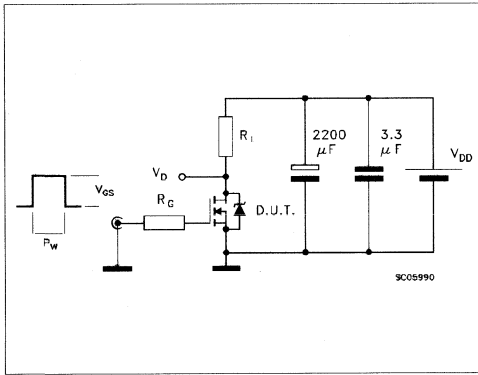
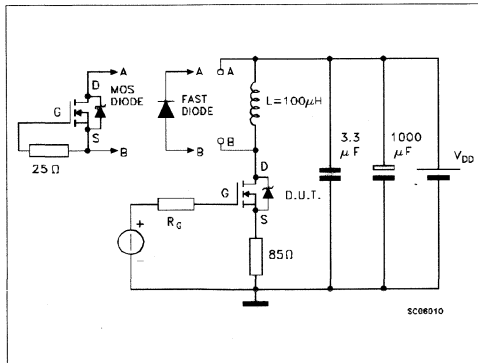


Fig. 3: Test Circuit For Inductive Load Switching And Diode Recovery Times



Source-drain Diode Forward Characteristics

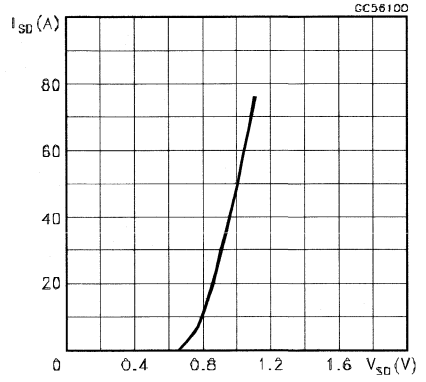
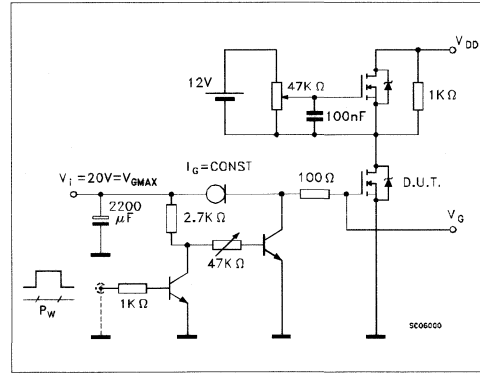


Fig. 2: Gate Charge Test Circuit



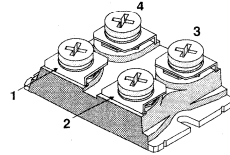
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR IN ISOTOP PACKAGE

TYPE	V _{DSS}	R _{DS(on)}	I _D
STE36N50	500 V	< 0.14 Ω	36 A

- HIGH CURRENT POWER MODULE
- AVALANCHE RUGGED TECHNOLOGY (SEE IRFP450 FOR RATING)
- VERY LARGE SOA - LARGE PEAK POWER CAPABILITY
- EASY TO MOUNT
- SAME CURRENT CAPABILITY FOR THE TWO SOURCE TERMINALS
- EXTREMELY LOW R_{th} JUNCTION TO CASE
- VERY LOW DRAIN TO CASE CAPACITANCE
- VERY LOW INTERNAL PARASITIC INDUCTANCE (TYPICALLY < 5 nH)
- ISOLATED PACKAGE UL RECOGNIZED (FILE No E81743)

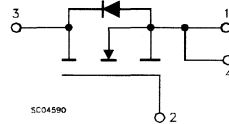
INDUSTRIAL APPLICATIONS:

- SMPS & UPS
- MOTOR CONTROL
- WELDING EQUIPMENT
- OUTPUT STAGE FOR PWM, ULTRASONIC CIRCUITS



ISOTOP

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-Source Voltage (V _{GS} = 0)	500	V
V _{DGR}	Drain-Gate Voltage (R _{GS} = 20 kΩ)	500	V
V _{GS}	Gate-Source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	36	A
I _D	Drain Current (continuous) at T _c = 100 °C	24	A
I _{DM} (●)	Drain Current (pulsed)	144	A
P _{tot}	Total Dissipation at T _c = 25 °C	410	W
	Derating Factor	3.3	W/°C
T _{stg}	Storage Temperature	-55 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C
V _{ISO}	Insulation Withstand Voltage (AC-RMS)	2500	V

(●) Pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	0.3	°C/W
R_{thc-h}	Thermal Resistance Case-heatsink With Conductive Grease Applied	Max	0.05	°C/W

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 1\text{ mA}$ $V_{GS} = 0\text{ V}$	500			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			300 1.5	μA mA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 300	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 1\text{ mA}$	2		4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 18\text{ A}$			0.14	Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} = 15\text{ V}$ $I_D = 18\text{ A}$	16			S
C_{iss} C_{oss} C_{rss}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0\text{ V}$			9 1800 750	nF pF pF

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 250\text{ V}$ $I_D = 18\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 1)		95 107		ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 400\text{ V}$ $I_D = 36\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		500		A/ μs
Q_g	Total Gate Charge	$V_{DD} = 400\text{ V}$ $I_D = 36\text{ A}$ $V_{GS} = 10\text{ V}$		410		nC

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 400\text{ V}$ $I_D = 36\text{ A}$		70		ns
t_f	Fall Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$		30		ns
t_c	Cross-over Time	(see test circuit, figure 3)		100		ns

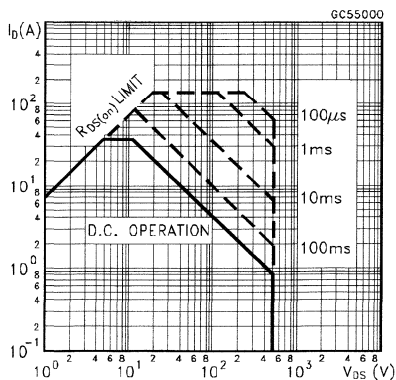
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				36	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				144	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 36\text{ A}$ $V_{GS} = 0$			1.4	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 36\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 3)		1100		ns
Q_{rr}	Reverse Recovery Charge			38.5		μC
I_{RRM}	Reverse Recovery Current			70		A

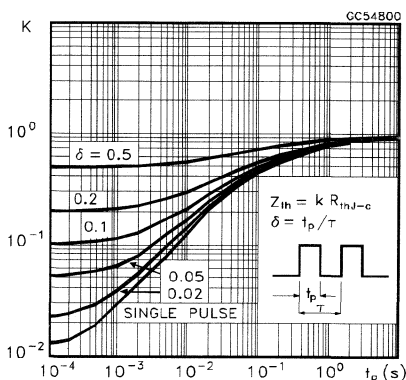
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

(•) Pulse width limited by safe operating area

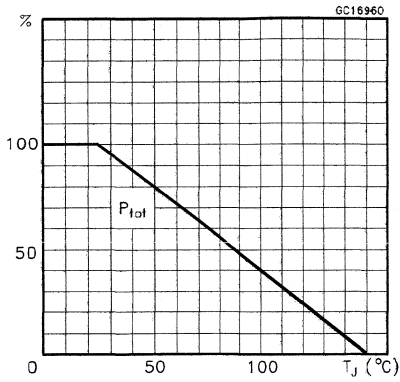
Safe Operating Area



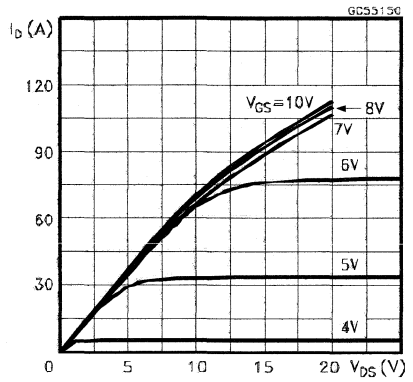
Thermal Impedance



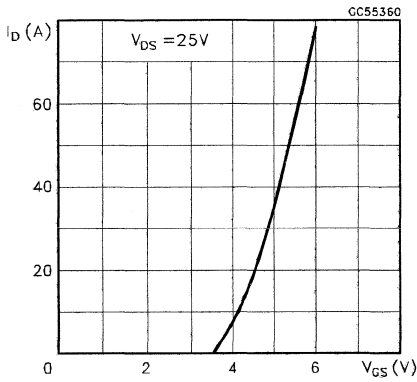
Derating Curve



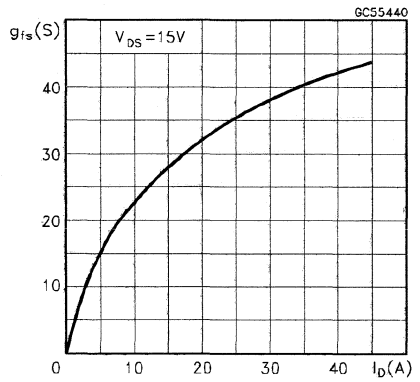
Output Characteristics



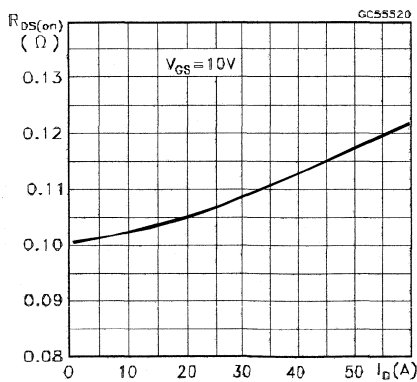
Transfer Characteristics



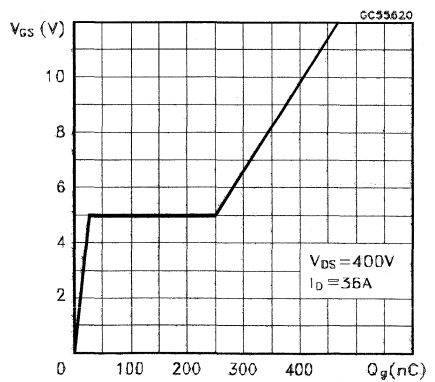
Transconductance



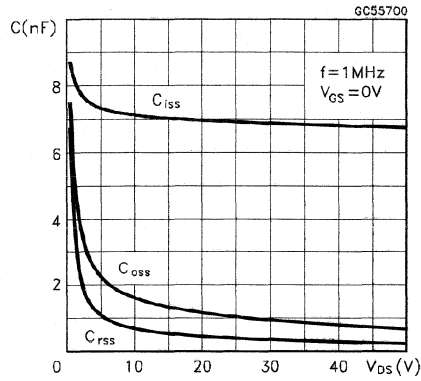
Static Drain-source On Resistance



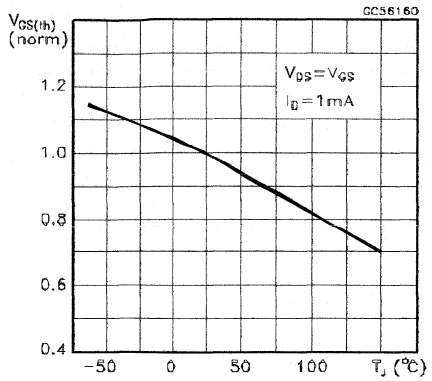
Gate Charge vs Gate-source Voltage



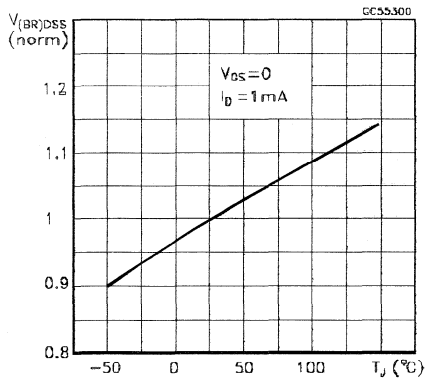
Capacitance Variations



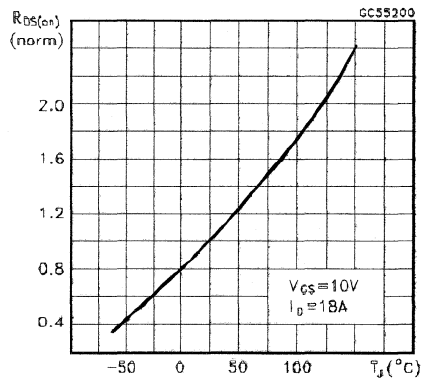
Normalized Gate Threshold Voltage vs Temperature



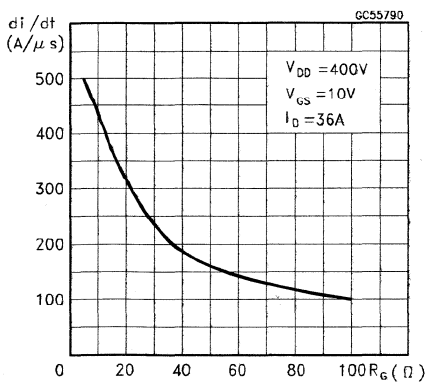
Normalized Breakdown Voltage vs Temperature



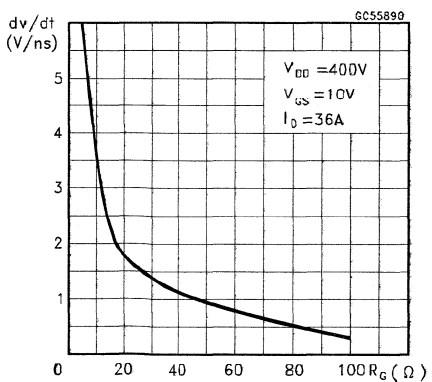
Normalized On Resistance vs Temperature



Turn-on Current Slope



Turn-off Drain-source Voltage Slope



Cross-over Time

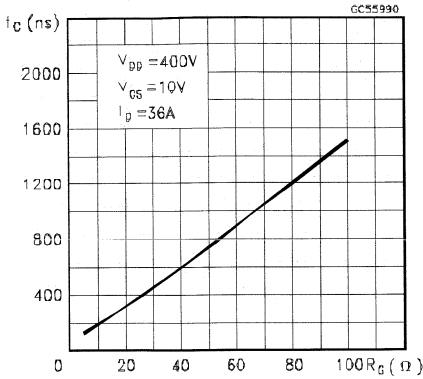
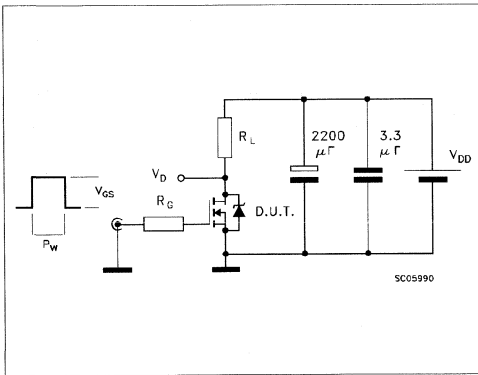


Fig. 1: Switching Times Test Circuits For Resistive Load



Source-drain Diode Forward Characteristics

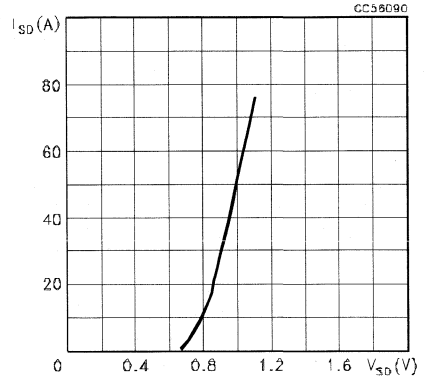


Fig. 2: Gate Charge Test Circuit

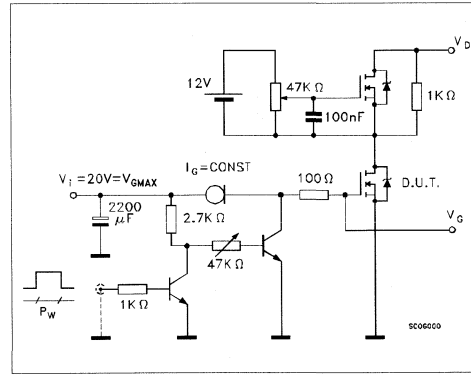
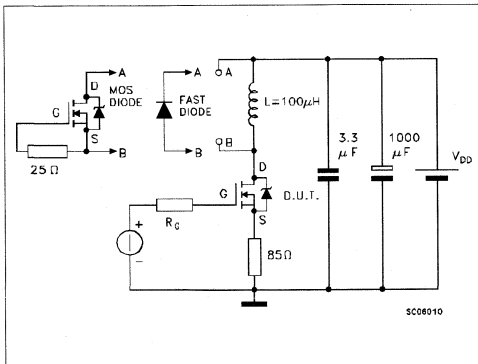


Fig. 3: Test Circuit For Inductive Load Switching And Diode Recovery Times



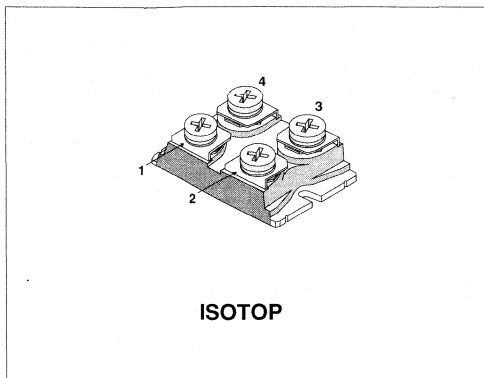
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR IN ISOTOP PACKAGE

TYPE	V _{DSS}	R _{DS(on)}	I _D
E38N60	600 V	< 0.15 Ω	38 A

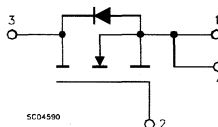
HIGH CURRENT POWER MODULE
 AVALANCHE RUGGED TECHNOLOGY
 SEE STH12N60 FOR RATING)
 VERY LARGE SOA - LARGE PEAK POWER
 CAPABILITY
 EASY TO MOUNT
 SAME CURRENT CAPABILITY FOR THE
 TWO SOURCE TERMINALS
 EXTREMELY LOW R_{th} JUNCTION TO CASE
 VERY LOW DRAIN TO CASE CAPACITANCE
 VERY LOW INTERNAL PARASITIC
 INDUCTANCE (TYPICALLY < 5 nH)
 SOLIDATED PACKAGE UL RECOGNIZED
 FILE No E81743)

INDUSTRIAL APPLICATIONS:

SMPS & UPS
 MOTOR CONTROL
 WELDING EQUIPMENT
 OUTPUT STAGE FOR PWM, ULTRASONIC
 CIRCUITS



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-Source Voltage (V _{GS} = 0)	600	V
V _{DGR}	Drain-Gate Voltage (R _{GS} = 20 kΩ)	600	V
V _{GS}	Gate-Source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	38	A
I _D	Drain Current (continuous) at T _c = 100 °C	24	A
I _{DM} (•)	Drain Current (pulsed)	152	A
P _{tot}	Total Dissipation at T _c = 25 °C	450	W
	Derating Factor	3.6	W/°C
T _{stg}	Storage Temperature	-55 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C
V _{ISO}	Insulation Withstand Voltage (AC-RMS)	2500	V

*pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	0.27	°C/W
R_{thc-h}	Thermal Resistance Case-heatsink With Conductive Grease Applied	Max	0.05	°C/W

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 1\text{ mA}$ $V_{GS} = 0\text{ V}$	600			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ }^{\circ}\text{C}$			400 2	μA mA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 400	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 1\text{ mA}$	2		4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 23\text{ A}$			0.15	Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} = 15\text{ V}$ $I_D = 23\text{ A}$	18			S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0\text{ V}$			10	nF
C_{oss}	Output Capacitance				1600	pF
C_{rss}	Reverse Transfer Capacitance				600	pF

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 300\text{ V}$ $I_D = 19\text{ A}$ $R_G = 4.7\text{ }\Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 1)		65		ns
t_r	Rise Time			200		ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 480\text{ V}$ $I_D = 38\text{ A}$ $R_G = 4.7\text{ }\Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		390		A/ μs
Q_g	Total Gate Charge	$V_{DD} = 400\text{ V}$ $I_D = 38\text{ A}$ $V_{GS} = 10\text{ V}$		460		nC

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 480\text{ V}$ $I_D = 38\text{ A}$		145		ns
t_f	Fall Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$		55		ns
t_c	Cross-over Time	(see test circuit, figure 3)		215		ns

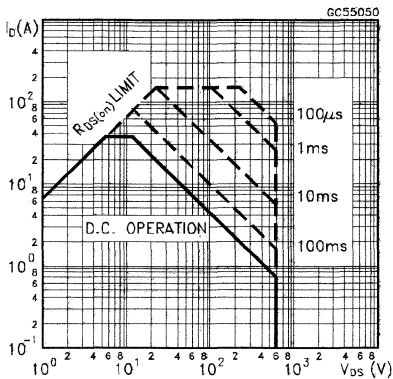
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				38	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				152	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 38\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 38\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 3)		1200		ns
Q_{rr}	Reverse Recovery Charge			43		μC
I_{RRM}	Reverse Recovery Current			76		A

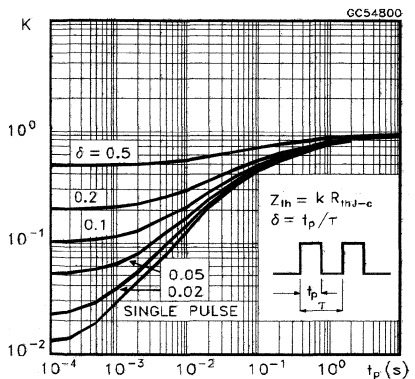
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

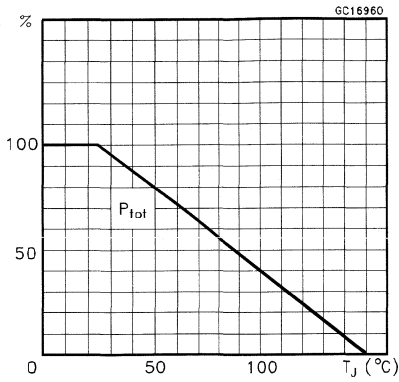
Safe Operating Area



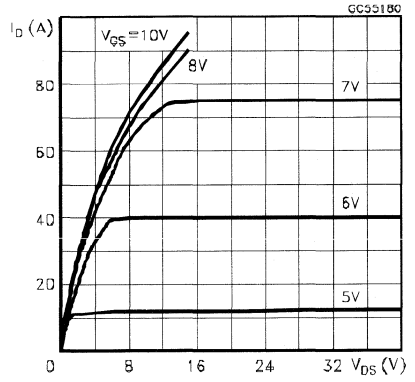
Thermal Impedance



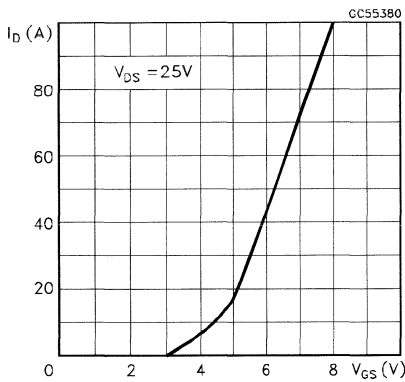
Derating Curve



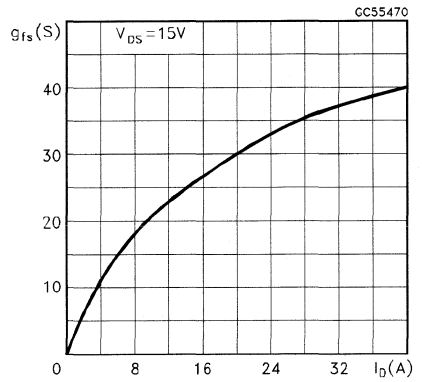
Output Characteristics



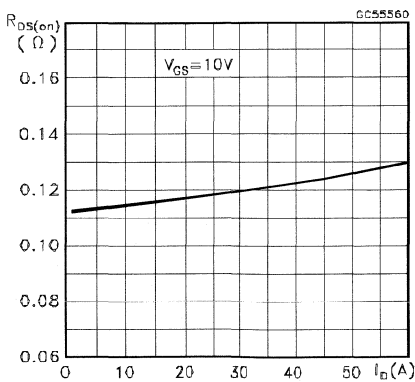
Transfer Characteristics



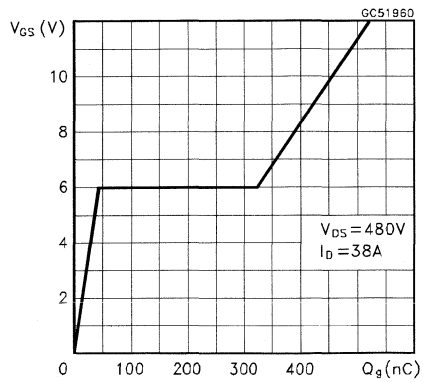
Transconductance



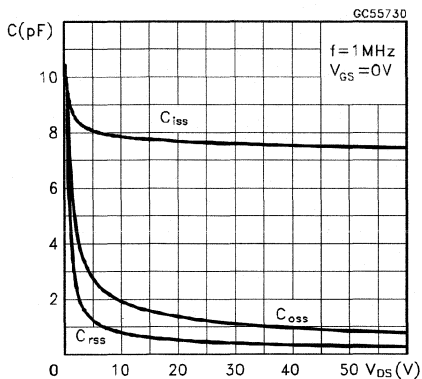
Static Drain-source On Resistance



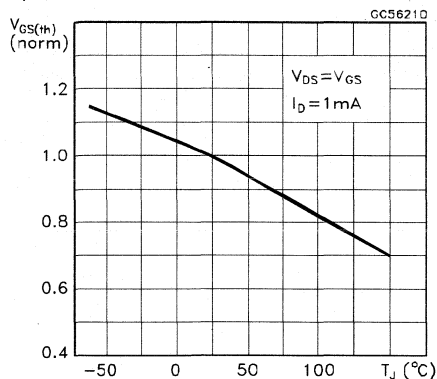
Gate Charge vs Gate-source Voltage



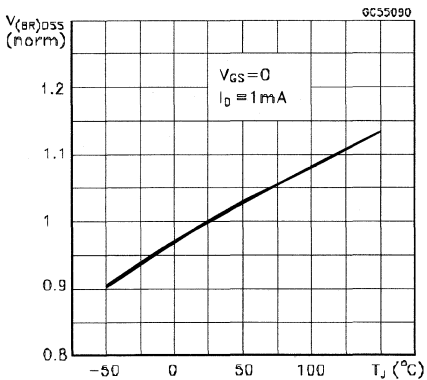
Capacitance Variations



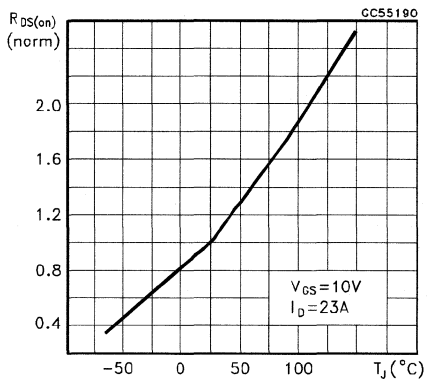
Normalized Gate Threshold Voltage vs Temperature



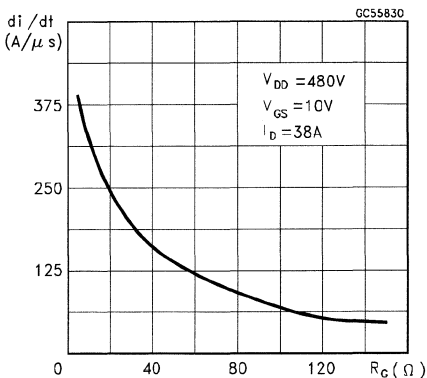
Normalized Breakdown Voltage vs Temperature



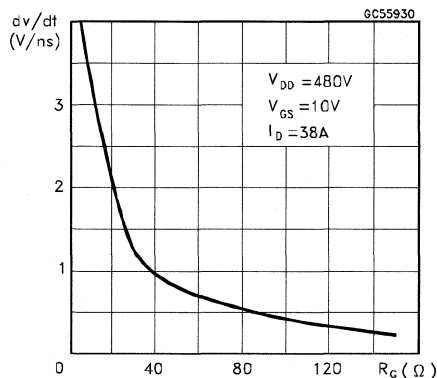
Normalized On Resistance vs Temperature



Turn-on Current Slope



Turn-off Drain-source Voltage Slope



Cross-over Time

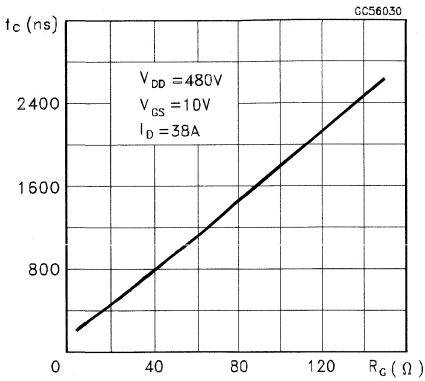


Fig. 1: Switching Times Test Circuits For Resistive Load

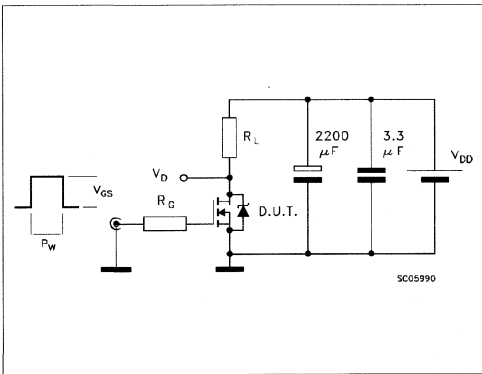
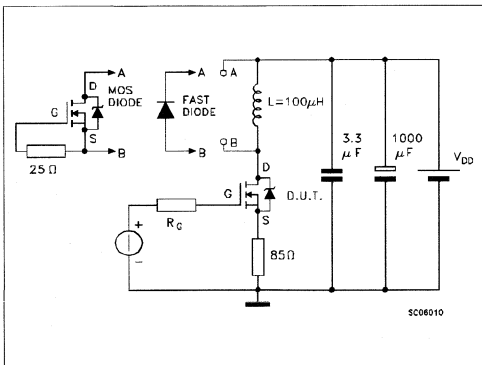


Fig. 3: Test Circuit For Inductive Load Switching And Diode Recovery Times



Source-drain Diode Forward Characteristics

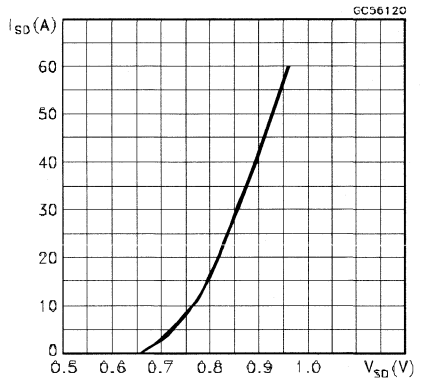
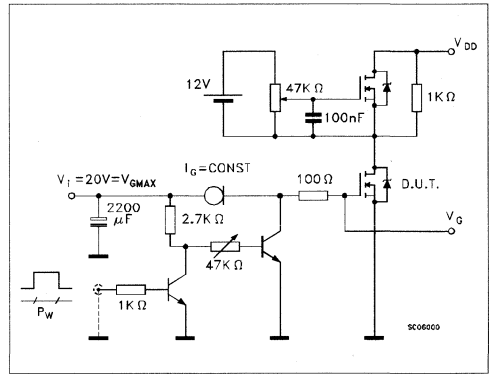


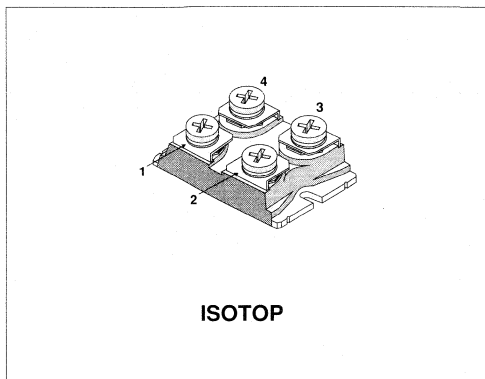
Fig. 2: Gate Charge Test Circuit



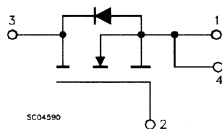
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR IN ISOTOP PACKAGE

TYPE	V _{DSS}	R _{DS(on)}	I _D
E45N50	500 V	< 0.11 Ω	45 A

HIGH CURRENT POWER MODULE
 AVALANCHE RUGGED TECHNOLOGY
 (SEE IRFP450 FOR RATING)
 VERY LARGE SOA - LARGE PEAK POWER
 CAPABILITY
 EASY TO MOUNT
 SAME CURRENT CAPABILITY FOR THE
 TWO SOURCE TERMINALS
 EXTREMELY LOW R_{th} JUNCTION TO CASE
 VERY LOW DRAIN TO CASE CAPACITANCE
 VERY LOW INTERNAL PARASITIC
 INDUCTANCE (TYPICALLY < 5 nH)
 SOLATED PACKAGE UL RECOGNIZED
 FILE No E81743)



INTERNAL SCHEMATIC DIAGRAM



INDUSTRIAL APPLICATIONS:

SMPS & UPS
 MOTOR CONTROL
 WELDING EQUIPMENT
 OUTPUT STAGE FOR PWM, ULTRASONIC
 CIRCUITS

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-Source Voltage (V _{GS} = 0)	500	V
V _{DGR}	Drain-Gate Voltage (R _{GS} = 20 kΩ)	500	V
V _{GS}	Gate-Source Voltage	± 20	V
I _D	Drain Current (continuous) at T _C = 25 °C	45	A
I _D	Drain Current (continuous) at T _C = 100 °C	28.6	A
I _{DM(●)}	Drain Current (pulsed)	180	A
P _{tot}	Total Dissipation at T _C = 25 °C	450	W
	Derating Factor	3.6	W/°C
T _{stg}	Storage Temperature	-55 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C
V _{ISO}	Insulation Withstand Voltage (AC-RMS)	2500	V

● pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	0.27	°C/W
R_{thc-h}	Thermal Resistance Case-heatsink With Conductive Grease Applied	Max	0.05	°C/W

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 1\text{ mA}$ $V_{GS} = 0\text{ V}$	500			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			400 2	μA mA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 400	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 1\text{ mA}$	2		4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 28\text{ A}$			0.11	Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	$V_{DS} = 15\text{ V}$ $I_D = 28\text{ A}$	28			S
C_{iss} C_{oss} C_{rss}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0\text{ V}$			12 2400 1000	nF pF pF

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 250\text{ V}$ $I_D = 28\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 1)		90 130		ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 400\text{ V}$ $I_D = 45\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		550		A/ μs
Q_g	Total Gate Charge	$V_{DD} = 400\text{ V}$ $I_D = 45\text{ A}$ $V_{GS} = 10\text{ V}$		550		nC

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(V_{off})}$	Off-voltage Rise Time	$V_{DD} = 400\text{ V}$ $I_D = 45\text{ A}$		120		ns
t_f	Fall Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$		55		ns
t_c	Cross-over Time	(see test circuit, figure 3)		170		ns

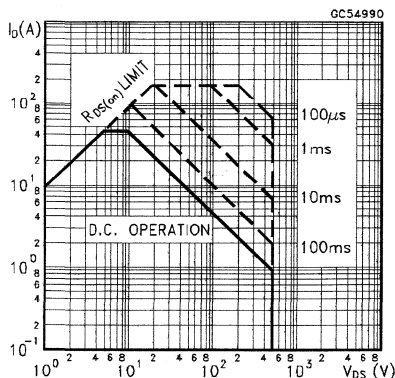
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				45	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				180	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 45\text{ A}$ $V_{GS} = 0$			1.4	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 45\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		1100		ns
Q_{rr}	Reverse Recovery Charge	(see test circuit, figure 3)		40		μC
I_{RRM}	Reverse Recovery Current			73		A

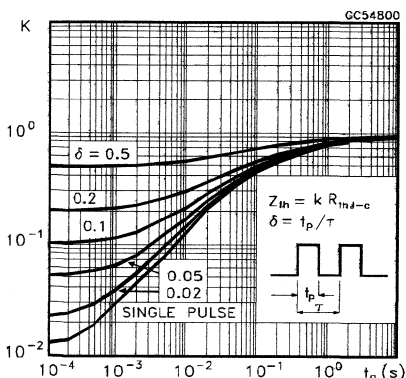
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

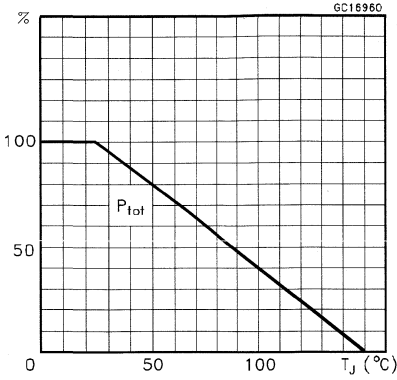
Safe Operating Area



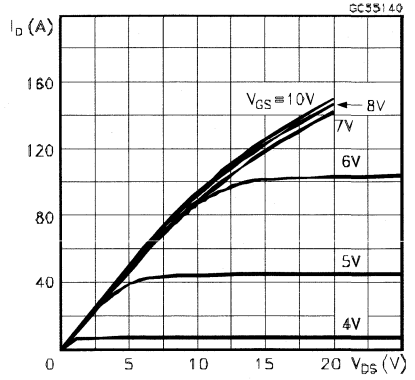
Thermal Impedance



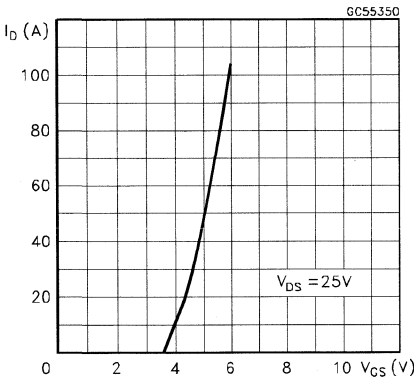
Derating Curve



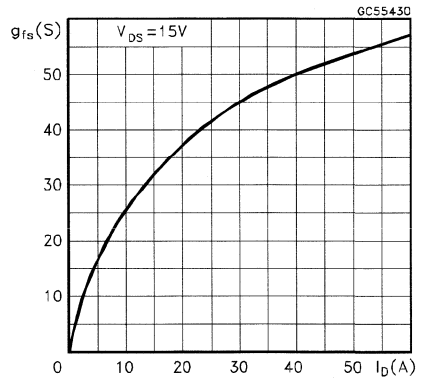
Output Characteristics



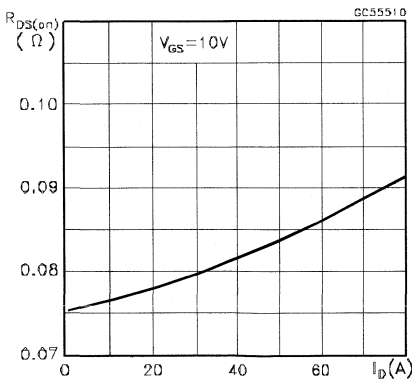
Transfer Characteristics



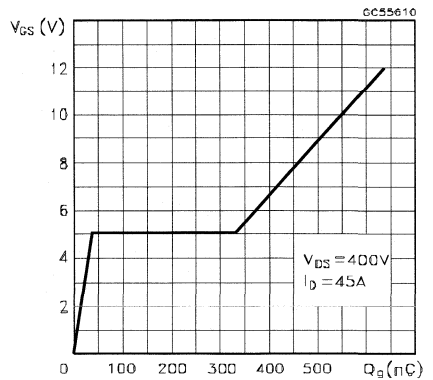
Transconductance



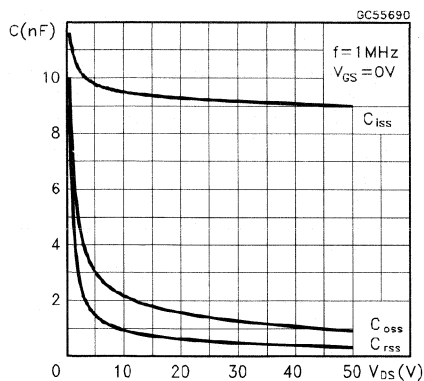
Static Drain-source On Resistance



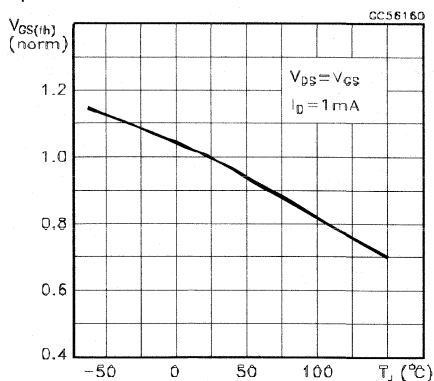
Gate Charge vs Gate-source Voltage



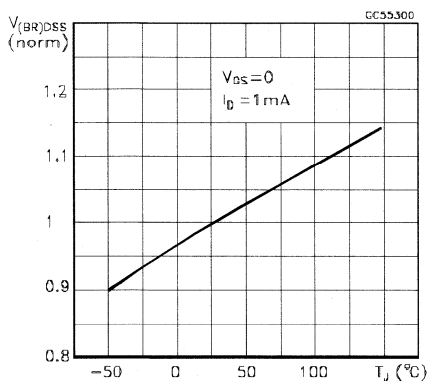
Capacitance Variations



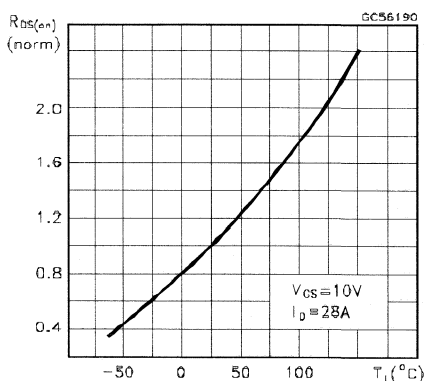
Normalized Gate Threshold Voltage vs Temperature



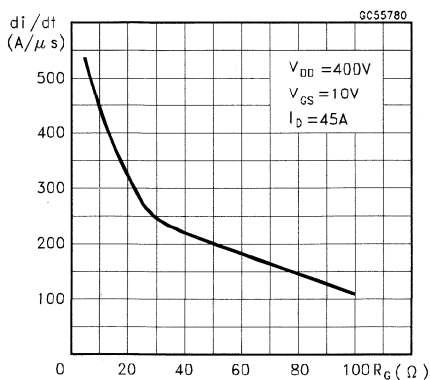
Normalized Breakdown Voltage vs Temperature



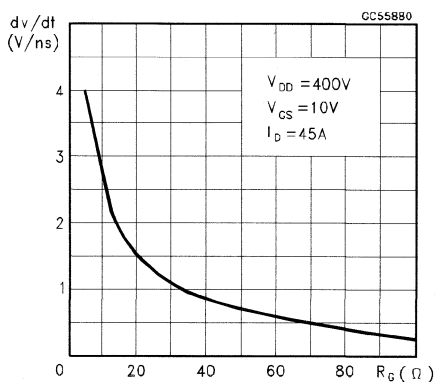
Normalized On Resistance vs Temperature



Turn-on Current Slope



Turn-off Drain-source Voltage Slope



Cross-over Time

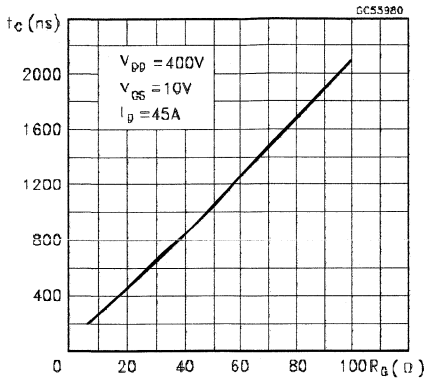
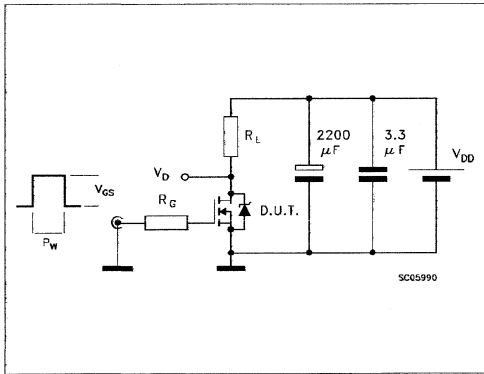


Fig. 1: Switching Times Test Circuits For Resistive Load



Source-drain Diode Forward Characteristics

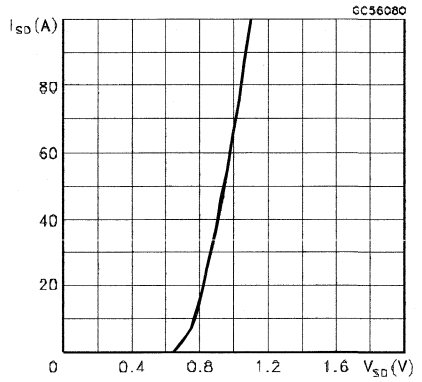


Fig. 2: Gate Charge Test Circuit

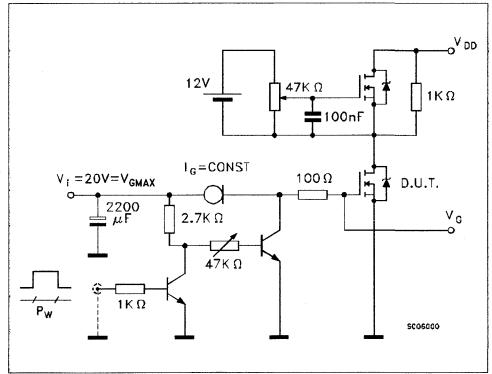
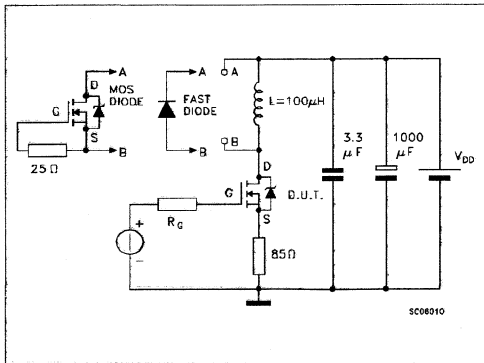


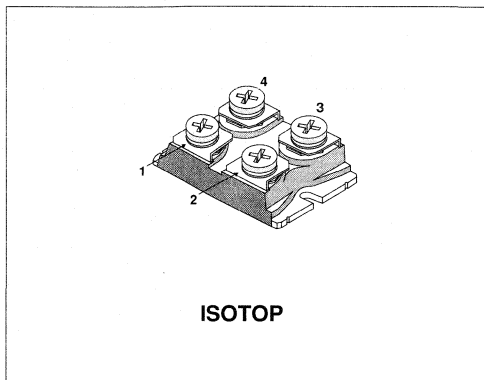
Fig. 3: Test Circuit For Inductive Load Switching And Diode Recovery Times



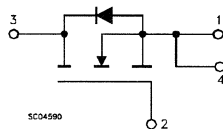
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR IN ISOTOP PACKAGE

TYPE	V _{DSS}	R _{DS(on)}	I _D
E47N50	500 V	< 0.1 Ω	47 A

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 INDUCTANCE (TYPICALLY < 5 nH)
 ISOLATED PACKAGE UL RECOGNIZED
 (FILE No E81743)



INTERNAL SCHEMATIC DIAGRAM



INDUSTRIAL APPLICATIONS:

SMPS & UPS
 MOTOR CONTROL
 WELDING EQUIPMENT
 OUTPUT STAGE FOR PWM, ULTRASONIC
 CIRCUITS

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-Source Voltage (V _{GS} = 0)	500	V
V _{DGR}	Drain-Gate Voltage (R _{GS} = 20 kΩ)	500	V
V _{GS}	Gate-Source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	47	A
I _D	Drain Current (continuous) at T _c = 100 °C	30	A
I _{DM} (*)	Drain Current (pulsed)	188	A
P _{tot}	Total Dissipation at T _c = 25 °C	450	W
	Derating Factor	3.6	W/°C
T _{stg}	Storage Temperature	-55 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C
V _{ISO}	Insulation Withstand Voltage (AC-RMS)	2500	V

*Pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	0.27	°C/W
R_{thc-h}	Thermal Resistance Case-heatsink With Conductive Grease Applied	Max	0.05	°C/W

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 1\text{ mA}$ $V_{GS} = 0\text{ V}$	500			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			400 2	μA mA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 400	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 1\text{ mA}$	2		4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 28\text{ A}$			0.1	Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} = 15\text{ V}$ $I_D = 28\text{ A}$	28			S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0\text{ V}$			12	nF
C_{oss}	Output Capacitance				2400	pF
C_{rss}	Reverse Transfer Capacitance				1000	pF

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 250\text{ V}$ $I_D = 28\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 1)		90		ns
t_r	Rise Time			130		ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 400\text{ V}$ $I_D = 45\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		550		A/ μs
Q_g	Total Gate Charge	$V_{DD} = 400\text{ V}$ $I_D = 45\text{ A}$ $V_{GS} = 10\text{ V}$		550		nC

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 400\text{ V}$ $I_D = 45\text{ A}$		120		ns
t_f	Fall Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$		55		ns
t_c	Cross-over Time	(see test circuit, figure 3)		170		ns

SOURCE DRAIN DIODE

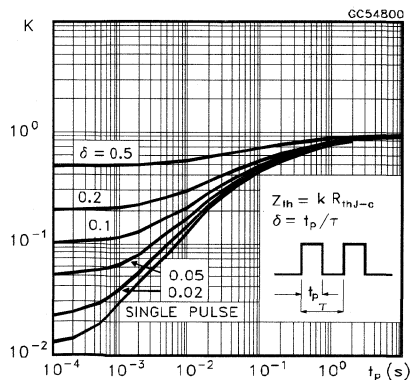
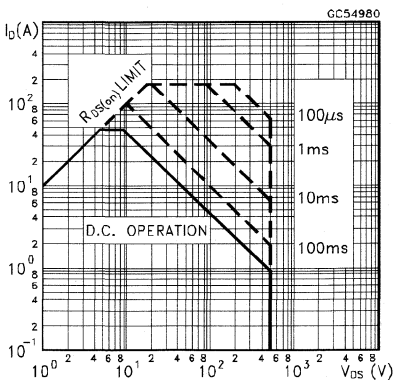
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				47	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				188	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 47\text{ A}$ $V_{GS} = 0$			1.4	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 47\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		1100		ns
Q_{rr}	Reverse Recovery Charge	(see test circuit, figure 3)		40		μC
I_{RRM}	Reverse Recovery Current			73		A

(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

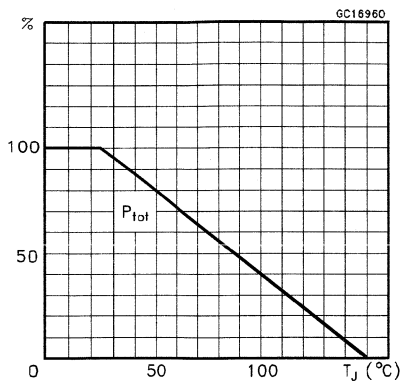
(\bullet) Pulse width limited by safe operating area

Safe Operating Area

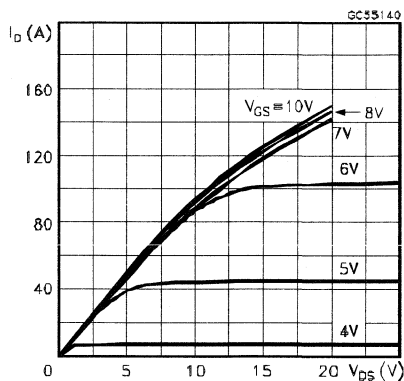
Thermal Impedance



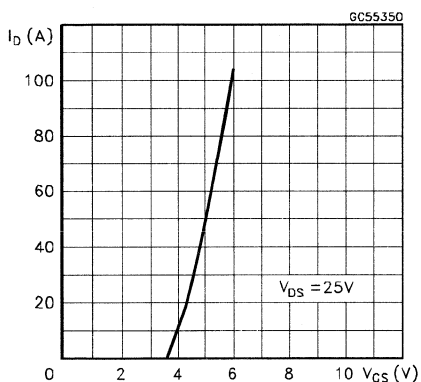
Derating Curve



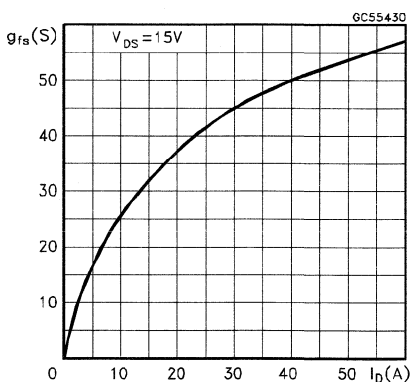
Output Characteristics



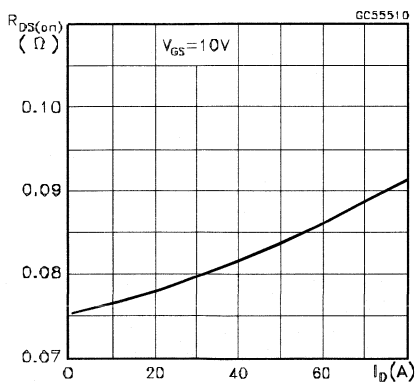
Transfer Characteristics



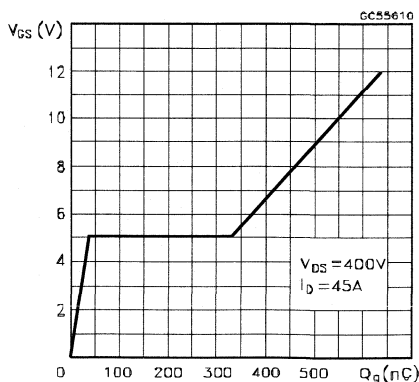
Transconductance



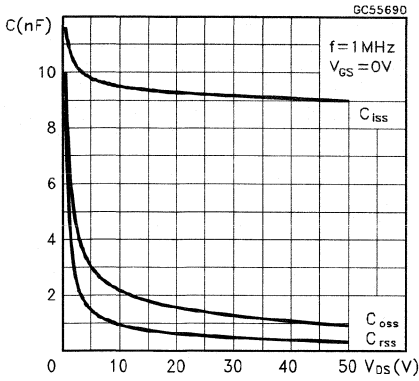
Static Drain-source On Resistance



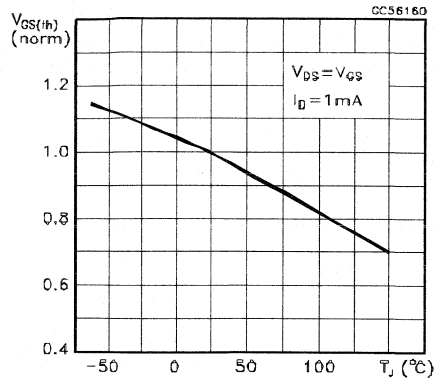
Gate Charge vs Gate-source Voltage



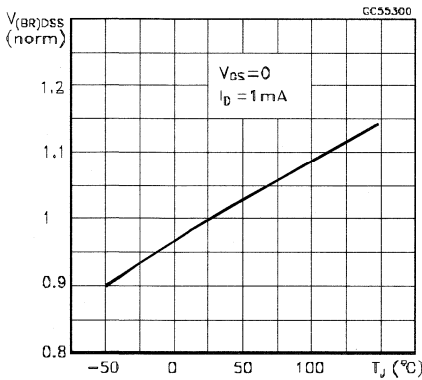
Capacitance Variations



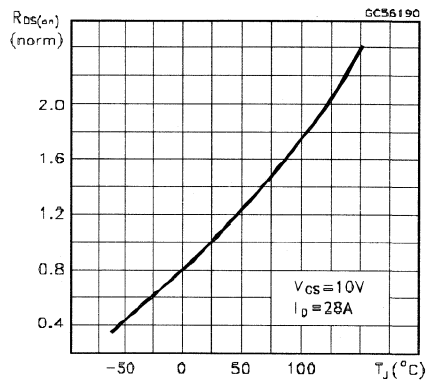
Normalized Gate Threshold Voltage vs Temperature



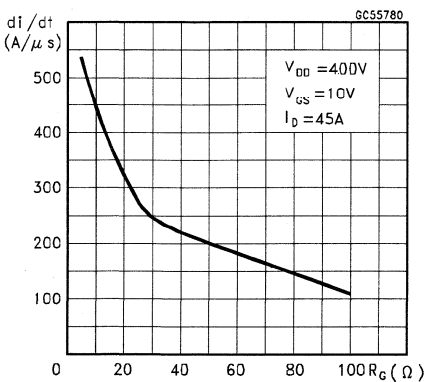
Normalized Breakdown Voltage vs Temperature



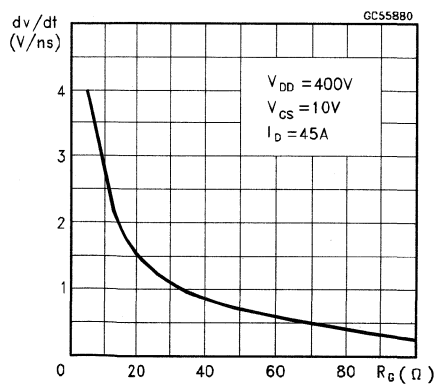
Normalized On Resistance vs Temperature



Turn-on Current Slope



Turn-off Drain-source Voltage Slope



Cross-over Time

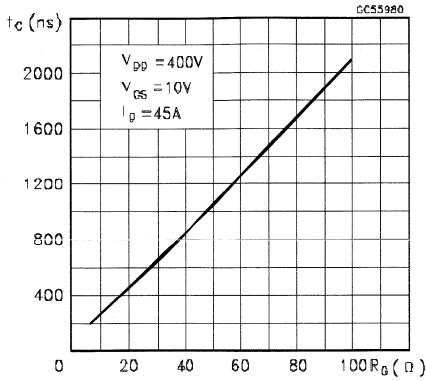
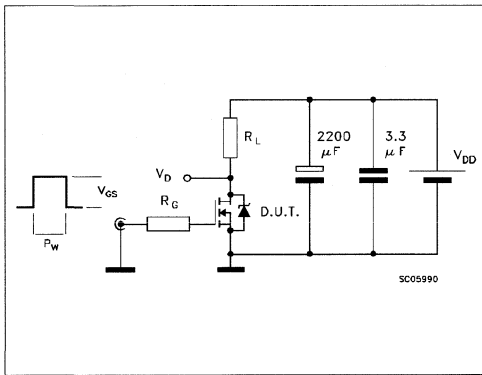


Fig. 1: Switching Times Test Circuits For Resistive Load



Source-drain Diode Forward Characteristics

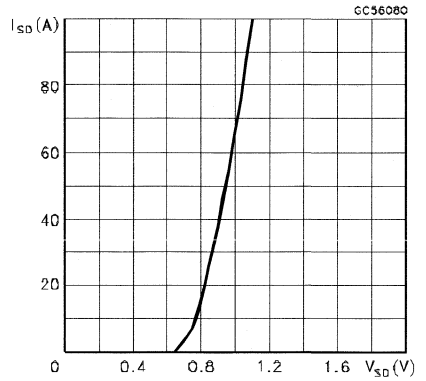


Fig. 2: Gate Charge Test Circuit

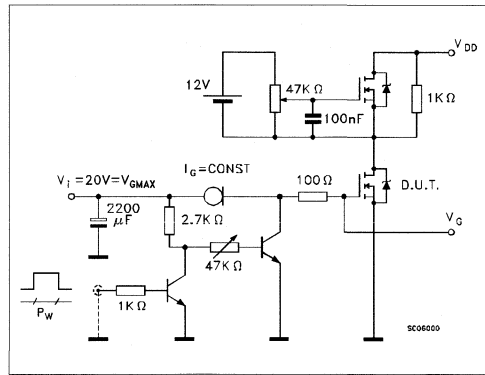
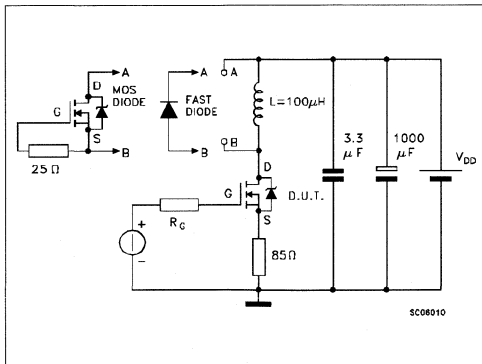


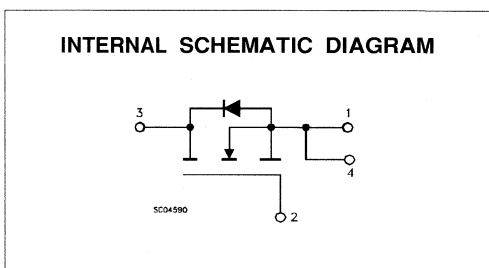
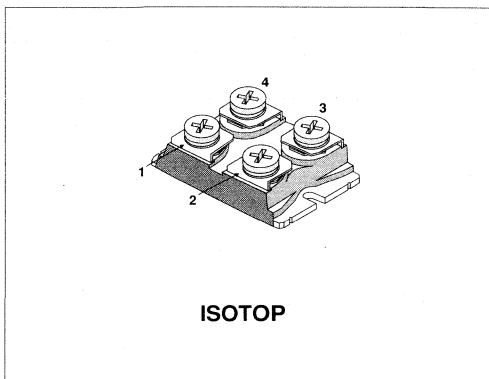
Fig. 3: Test Circuit For Inductive Load Switching And Diode Recovery Times



N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR IN ISOTOP PACKAGE

TYPE	V _{DSS}	R _{DS(on)}	I _D
STE50N40	400 V	< 0.075 Ω	50 A

- HIGH CURRENT POWER MODULE
- AVALANCHE RUGGED TECHNOLOGY (SEE IRFP350 FOR RATING)
- VERY LARGE SOA - LARGE PEAK POWER CAPABILITY
- EASY TO MOUNT
- SAME CURRENT CAPABILITY FOR THE TWO SOURCE TERMINALS
- EXTREMELY LOW R_{th} JUNCTION TO CASE
- VERY LOW DRAIN TO CASE CAPACITANCE
- VERY LOW INTERNAL PARASITIC INDUCTANCE (TYPICALLY < 5 nH)
- ISOLATED PACKAGE UL RECOGNIZED (FILE No E81743)



INDUSTRIAL APPLICATIONS:

- SMPS & UPS
- MOTOR CONTROL
- WELDING EQUIPMENT
- OUTPUT STAGE FOR PWM, ULTRASONIC CIRCUITS

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-Source Voltage (V _{GS} = 0)	400	V
V _{DGR}	Drain-Gate Voltage (R _{GS} = 20 kΩ)	400	V
V _{GS}	Gate-Source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	50	A
I _D	Drain Current (continuous) at T _c = 100 °C	34	A
I _{DM} (*)	Drain Current (pulsed)	200	A
P _{tot}	Total Dissipation at T _c = 25 °C	450	W
	Derating Factor	3.6	W/°C
T _{stg}	Storage Temperature	-55 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C
V _{ISO}	Insulation Withstand Voltage (AC-RMS)	2500	V

(*) Pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	0.27	°C/W
R_{thc-h}	Thermal Resistance Case-heatsink With Conductive Grease Applied	Max	0.05	°C/W

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 1\text{ mA}$ $V_{GS} = 0\text{ V}$	400			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			400 2	μA mA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 400	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 1\text{ mA}$	2		4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 30\text{ A}$			0.075	Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} = 15\text{ V}$ $I_D = 30\text{ A}$	28			S
C_{iss} C_{oss} C_{rss}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0\text{ V}$			12 2400 1000	nF pF pF

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 200\text{ V}$ $I_D = 30\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 1)		80 120		ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 320\text{ V}$ $I_D = 50\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		1000		A/ μs
Q_g	Total Gate Charge	$V_{DD} = 320\text{ V}$ $I_D = 50\text{ A}$ $V_{GS} = 10\text{ V}$		580		nC

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 320\text{ V}$ $I_D = 50\text{ A}$		90		ns
t_f	Fall Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$		40		ns
t_c	Cross-over Time	(see test circuit, figure 3)		135		ns

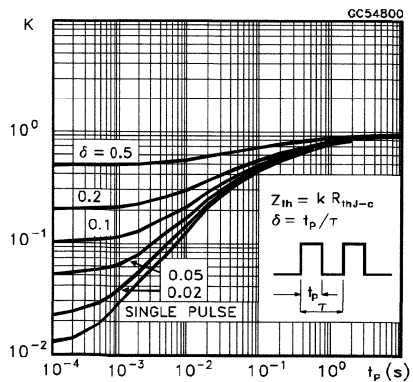
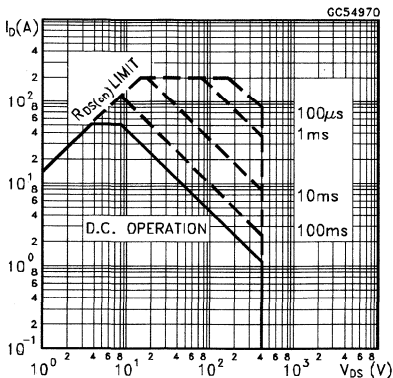
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				50	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				200	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 50\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 50\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 3)		980		ns
Q_{rr}	Reverse Recovery Charge			31.8		μC
I_{RRM}	Reverse Recovery Current			65		A

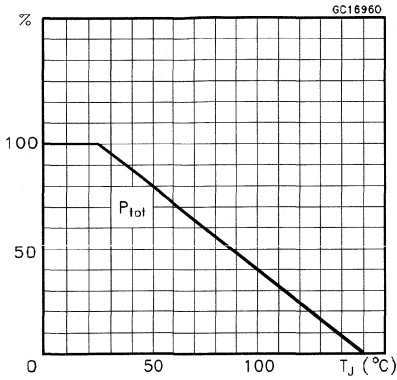
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %
 (•) Pulse width limited by safe operating area

Safe Operating Area

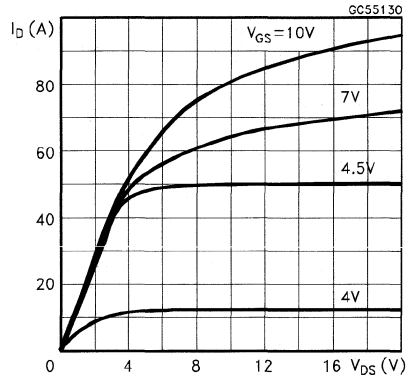
Thermal Impedance



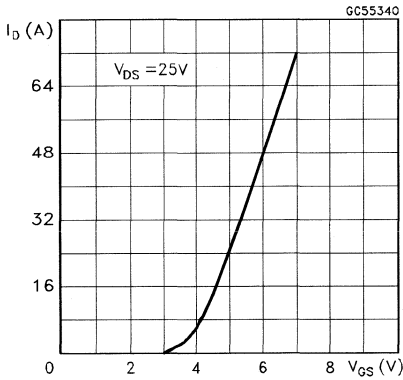
Derating Curve



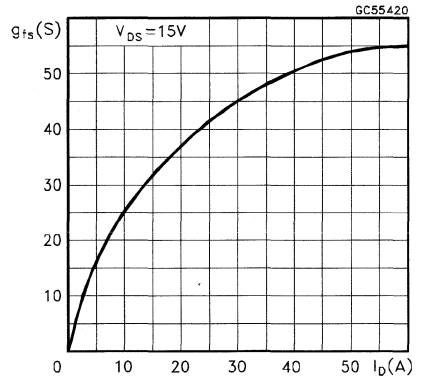
Output Characteristics



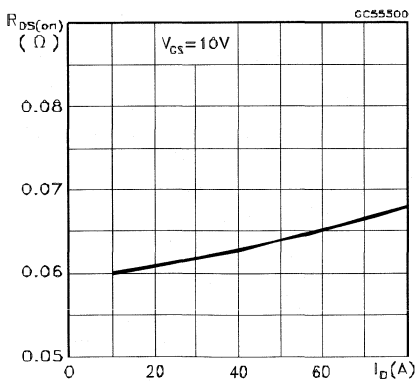
Transfer Characteristics



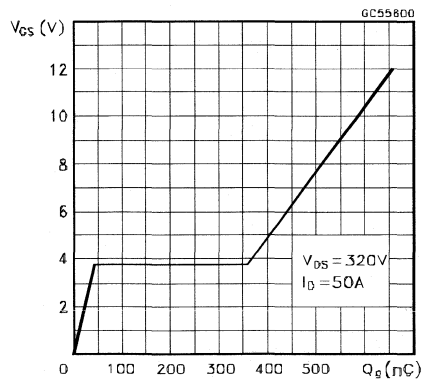
Transconductance



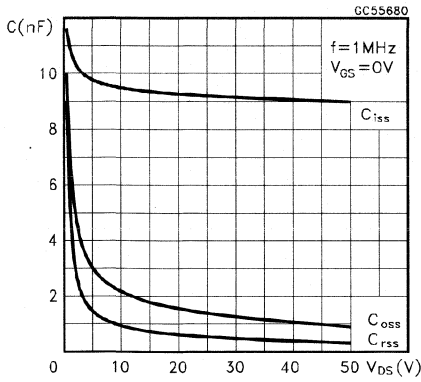
Static Drain-source On Resistance



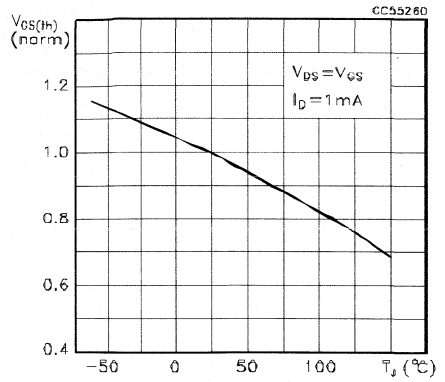
Gate Charge vs Gate-source Voltage



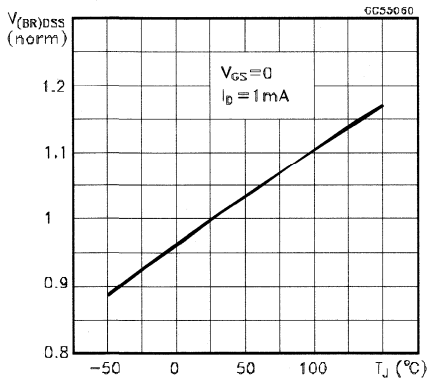
Capacitance Variations



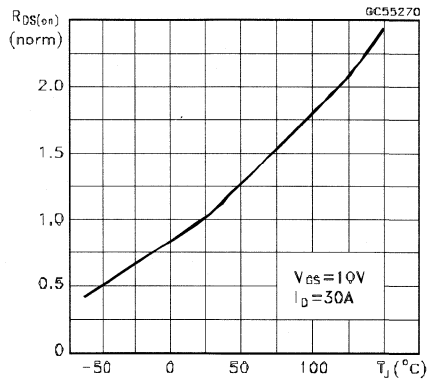
Normalized Gate Threshold Voltage vs Temperature



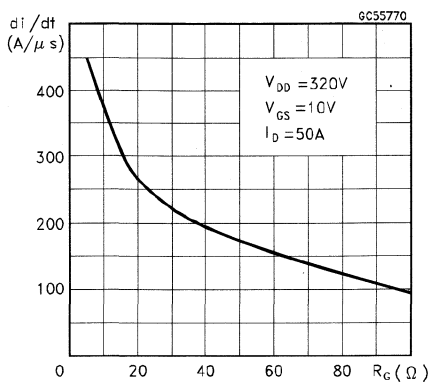
Normalized Breakdown Voltage vs Temperature



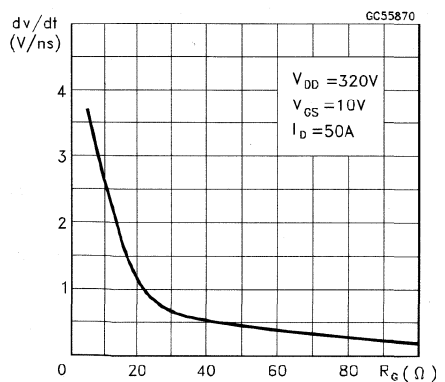
Normalized On Resistance vs Temperature



Turn-on Current Slope



Turn-off Drain-source Voltage Slope



Cross-over Time

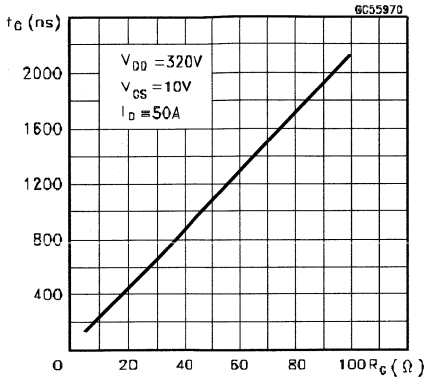
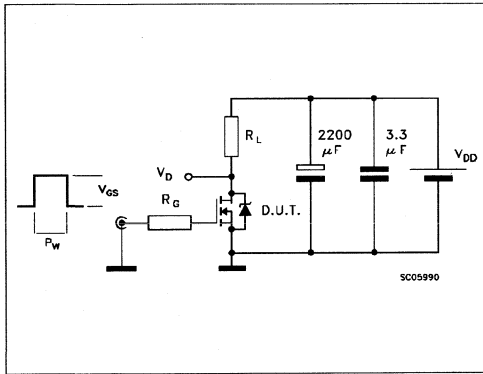


Fig. 1: Switching Times Test Circuits For Resistive Load



Source-drain Diode Forward Characteristics

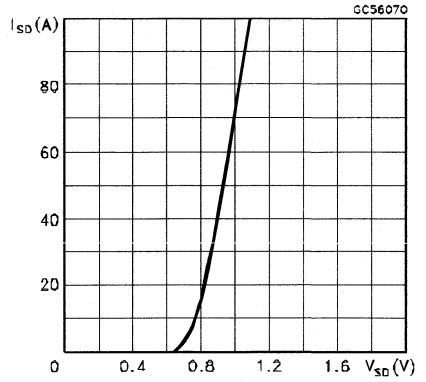


Fig. 2: Gate Charge Test Circuit

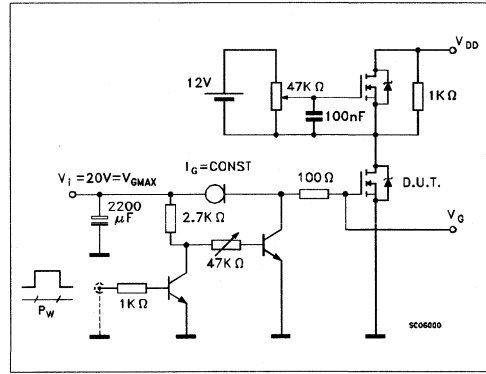
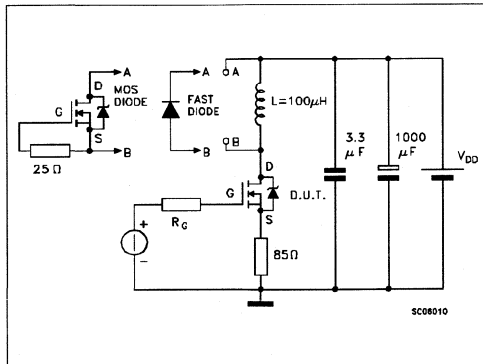


Fig. 3: Test Circuit For Inductive Load Switching And Diode Recovery Times



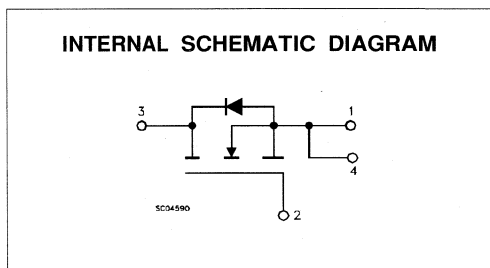
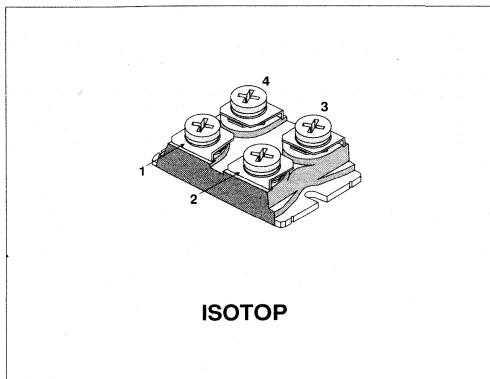
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR IN ISOTOP PACKAGE

TYPE	V _{DSS}	R _{DS(on)}	I _D
STE100N20	200 V	< 0.021 Ω	100 A

- HIGH CURRENT POWER MODULE
- AVALANCHE RUGGED TECHNOLOGY (SEE STH33N20FI FOR RATING)
- VERY LARGE SOA - LARGE PEAK POWER CAPABILITY
- EASY TO MOUNT
- SAME CURRENT CAPABILITY FOR THE TWO SOURCE TERMINALS
- EXTREMELY LOW R_{th} JUNCTION TO CASE
- VERY LOW DRAIN TO CASE CAPACITANCE
- VERY LOW INTERNAL PARASITIC INDUCTANCE (TYPICALLY < 5 nH)
- ISOLATED PACKAGE UL RECOGNIZED (FILE No E81743)

INDUSTRIAL APPLICATIONS:

- SMPS & UPS
- MOTOR CONTROL
- WELDING EQUIPMENT
- OUTPUT STAGE FOR PWM, ULTRASONIC CIRCUITS



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-Source Voltage (V _{GS} = 0)	200	V
V _{DGR}	Drain-Gate Voltage (R _{GS} = 20 kΩ)	200	V
V _{GS}	Gate-Source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	100	A
I _D	Drain Current (continuous) at T _c = 100 °C	65	A
I _{DM} (*)	Drain Current (pulsed)	400	A
P _{tot}	Total Dissipation at T _c = 25 °C	450	W
	Derating Factor	3.6	W/°C
T _{stg}	Storage Temperature	-55 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C
V _{ISO}	Insulation Withstand Voltage (AC-RMS)	2500	V

(*) Pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	0.27	$^{\circ}\text{C}/\text{W}$
R_{thc-h}	Thermal Resistance Case-heatsink With Conductive Grease Applied	Max	0.05	$^{\circ}\text{C}/\text{W}$

ELECTRICAL CHARACTERISTICS ($T_{case} = 25^{\circ}\text{C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 1\text{ mA}$ $V_{GS} = 0\text{ V}$	200			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^{\circ}\text{C}$			400 2	μA mA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 400	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 1\text{ mA}$	2		4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 60\text{ A}$			0.021	Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} = 15\text{ V}$ $I_D = 60\text{ A}$	38			S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0\text{ V}$			12	nF
C_{oss}	Output Capacitance				3200	pF
C_{rss}	Reverse Transfer Capacitance				1200	pF

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 100\text{ V}$ $I_D = 50\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 1)		75		ns
t_r	Rise Time			140		ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 160\text{ V}$ $I_D = 100\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		480		A/ μs
Q_g	Total Gate Charge	$V_{DD} = 160\text{ V}$ $I_D = 100\text{ A}$ $V_{GS} = 10\text{ V}$		505		nC

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 160\text{ V}$ $I_D = 100\text{ A}$		230		ns
t_f	Fall Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$		155		ns
t_c	Cross-over Time	(see test circuit, figure 3)		370		ns

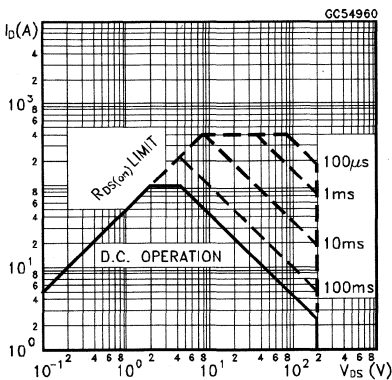
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				100	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				400	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 100\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 100\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		580		ns
Q_{rr}	Reverse Recovery Charge	(see test circuit, figure 3)		3.5		μC
I_{RRM}	Reverse Recovery Current			12		A

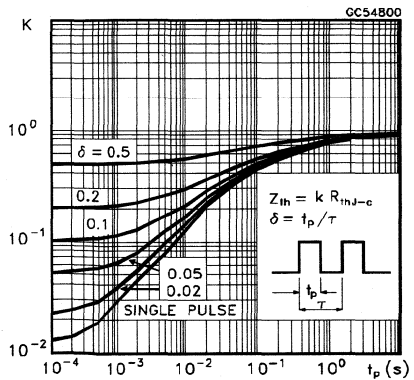
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

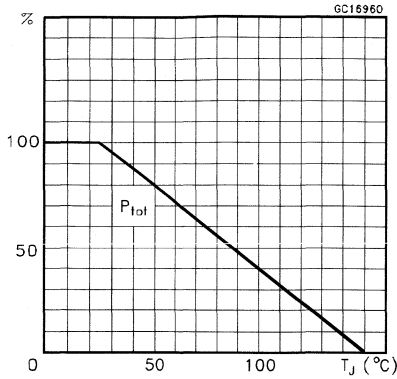
Safe Operating Area



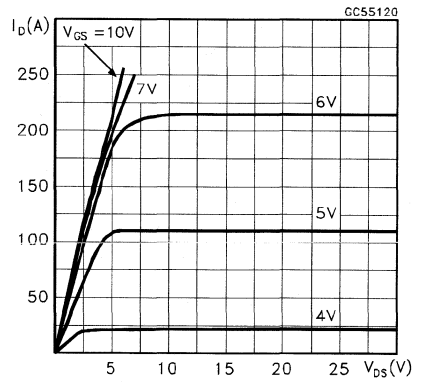
Thermal Impedance



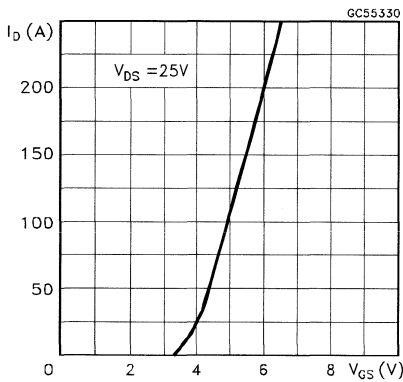
Derating Curve



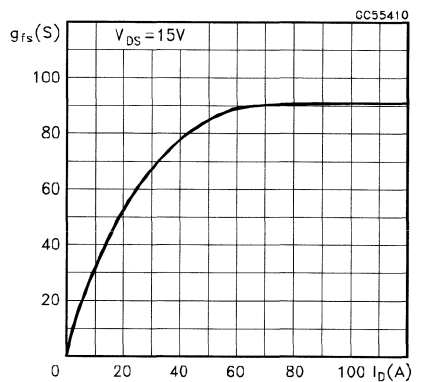
Output Characteristics



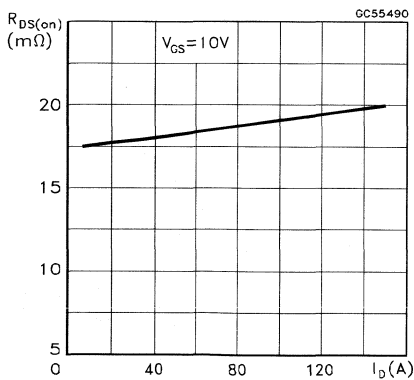
Transfer Characteristics



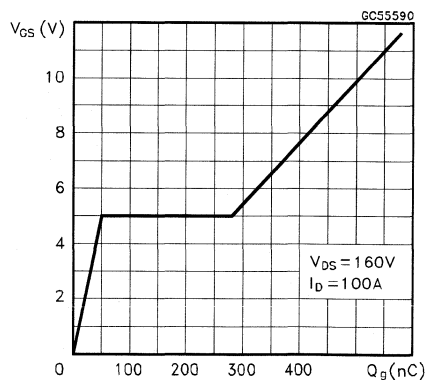
Transconductance



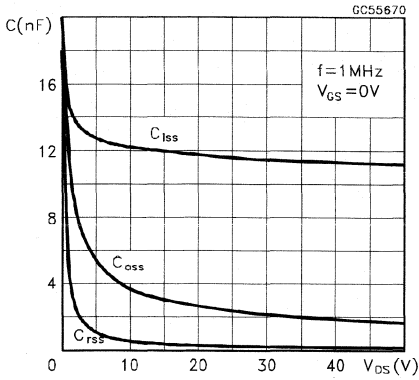
Static Drain-source On Resistance



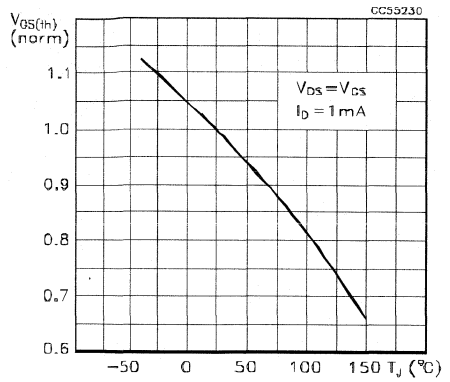
Gate Charge vs Gate-source Voltage



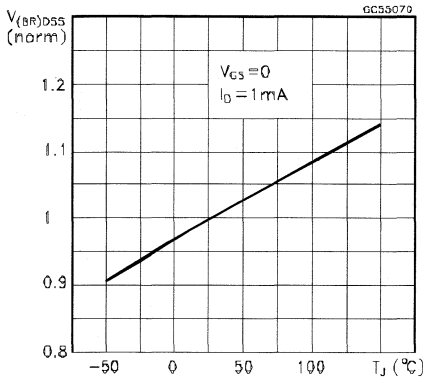
Capacitance Variations



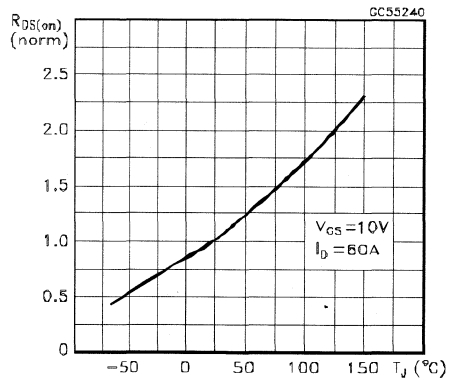
Normalized Gate Threshold Voltage vs Temperature



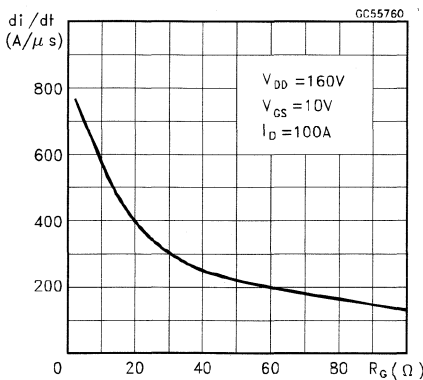
Normalized Breakdown Voltage vs Temperature



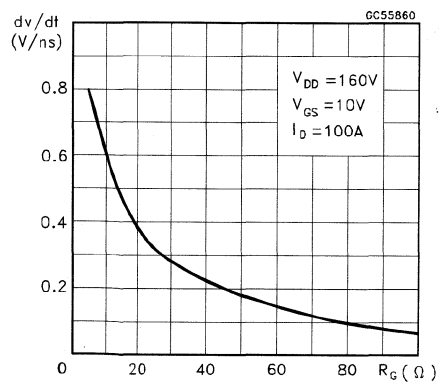
Normalized On Resistance vs Temperature



Turn-on Current Slope



Turn-off Drain-source Voltage Slope



Cross-over Time

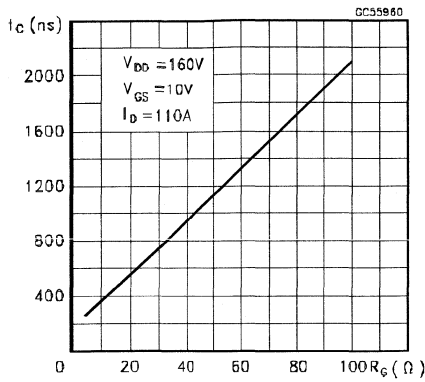
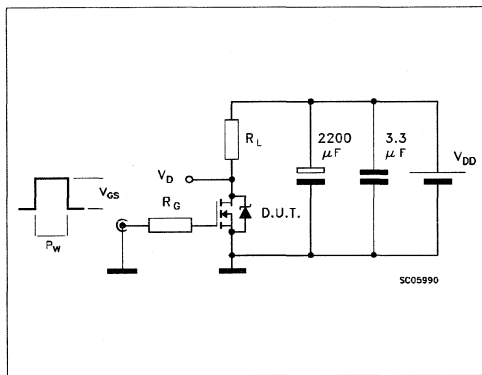


Fig. 1: Switching Times Test Circuits For Resistive Load



Source-drain Diode Forward Characteristics

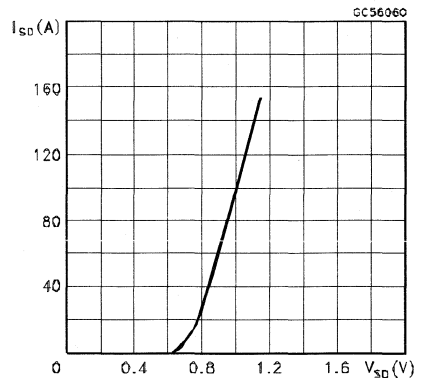


Fig. 2: Gate Charge Test Circuit

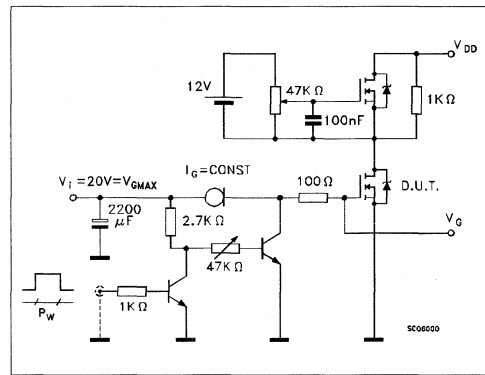
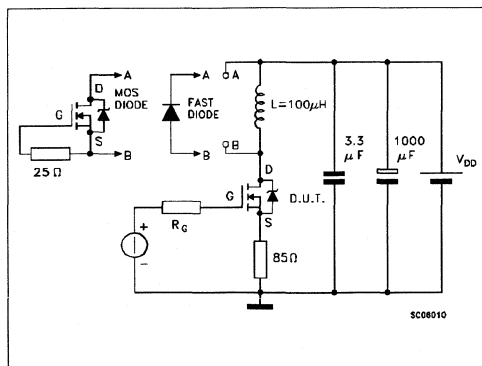


Fig. 3: Test Circuit For Inductive Load Switching And Diode Recovery Times



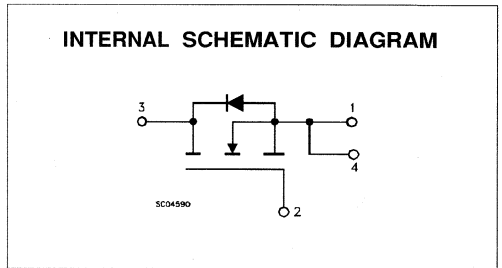
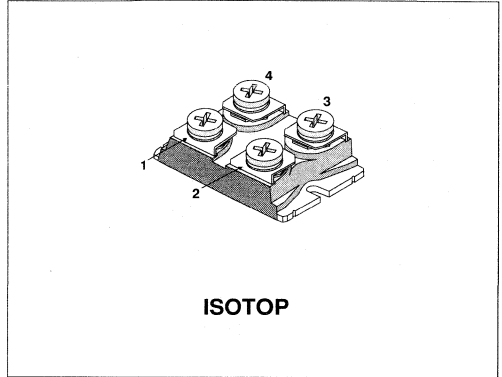
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR IN ISOTOP PACKAGE

TYPE	V _{DS}	R _{DS(on)}	I _D
STE150N10	100 V	< 0.009 Ω	150 A

- HIGH CURRENT POWER MODULE
- AVALANCHE RUGGED TECHNOLOGY (SEE STH60N10 FOR RATING)
- VERY LARGE SOA - LARGE PEAK POWER CAPABILITY
- EASY TO MOUNT
- SAME CURRENT CAPABILITY FOR THE TWO SOURCE TERMINALS
- EXTREMELY LOW R_{th} JUNCTION TO CASE
- VERY LOW DRAIN TO CASE CAPACITANCE
- VERY LOW INTERNAL PARASITIC INDUCTANCE (TYPICALLY < 5 nH)
- ISOLATED PACKAGE UL RECOGNIZED (FILE No E81743)

INDUSTRIAL APPLICATIONS:

- SMPS & UPS
- MOTOR CONTROL
- WELDING EQUIPMENT
- OUTPUT STAGE FOR PWM, ULTRASONIC CIRCUITS



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-Source Voltage (V _{GS} = 0)	100	V
V _{DGR}	Drain-Gate Voltage (R _{GS} = 20 kΩ)	100	V
V _{GS}	Gate-Source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	150	A
I _D	Drain Current (continuous) at T _c = 100 °C	100	A
I _{DM} (*)	Drain Current (pulsed)	450	A
P _{tot}	Total Dissipation at T _c = 25 °C	410	W
	Derating Factor	3.3	W/°C
T _{stg}	Storage Temperature	-55 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C
V _{ISO}	Insulation Withstand Voltage (AC-RMS)	2500	V

(*) Pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	0.3	°C/W
R_{thc-h}	Thermal Resistance Case-heatsink With Conductive Grease Applied	Max	0.05	°C/W

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 1\text{ mA}$ $V_{GS} = 0\text{ V}$	100			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			300 1.5	μA mA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 300	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 1\text{ mA}$	2		4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 90\text{ A}$			0.009	Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} = 15\text{ V}$ $I_D = 90\text{ A}$	85			S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0\text{ V}$			13.5	nF
C_{oss}	Output Capacitance				3600	pF
C_{rss}	Reverse Transfer Capacitance				900	pF

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 50\text{ V}$ $I_D = 75\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 1)		80		ns
t_r	Rise Time				140	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 80\text{ V}$ $I_D = 150\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		700		A/ μs
Q_g	Total Gate Charge	$V_{DD} = 80\text{ V}$ $I_D = 150\text{ A}$ $V_{GS} = 10\text{ V}$		320		nC

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(voff)}$	Off-voltage Rise Time	$V_{DD} = 80\text{ V}$ $I_D = 150\text{ A}$		90		ns
t_f	Fall Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$		340		ns
t_c	Cross-over Time	(see test circuit, figure 3)		400		ns

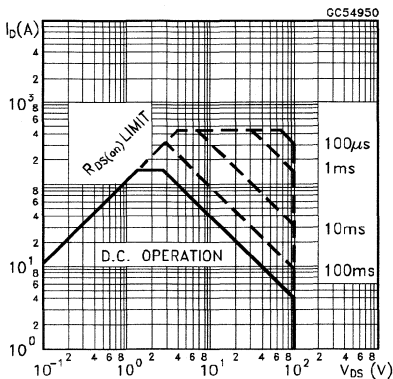
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				150	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				450	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 150\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 150\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 50\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		230		ns
Q_{rr}	Reverse Recovery Charge	(see test circuit, figure 3)		1750		μC
I_{RRM}	Reverse Recovery Current			15		A

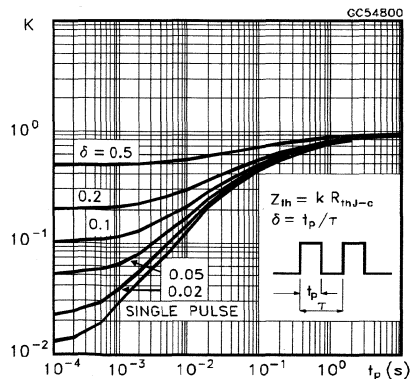
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

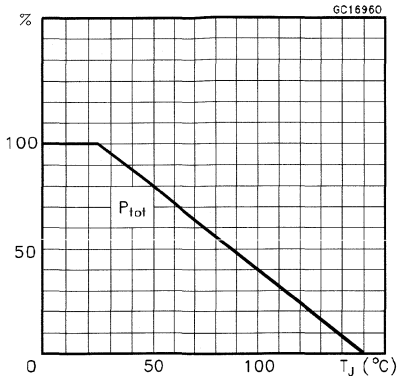
Safe Operating Area



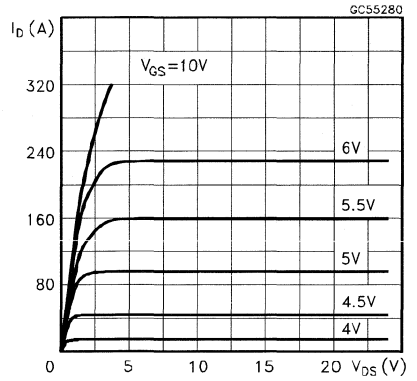
Thermal Impedance



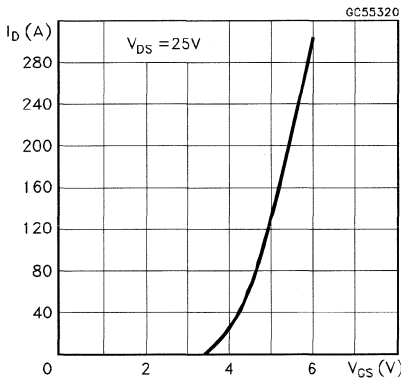
Derating Curve



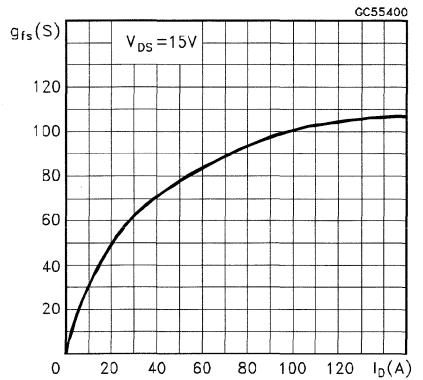
Output Characteristics



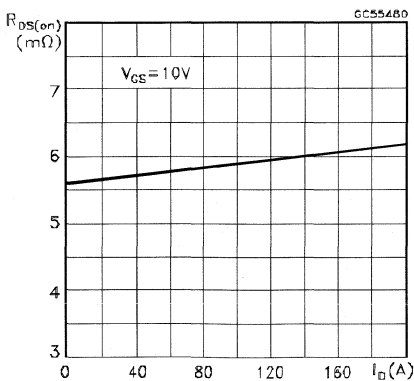
Transfer Characteristics



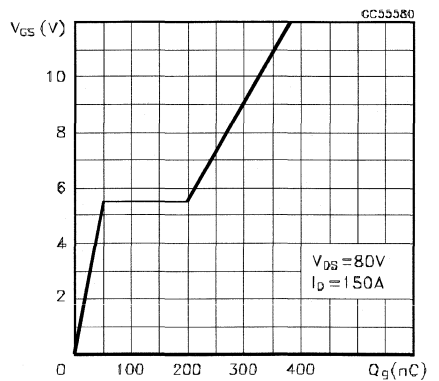
Transconductance



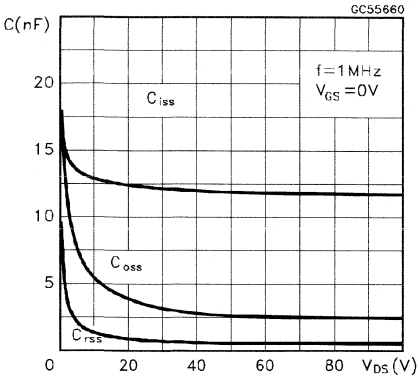
Static Drain-source On Resistance



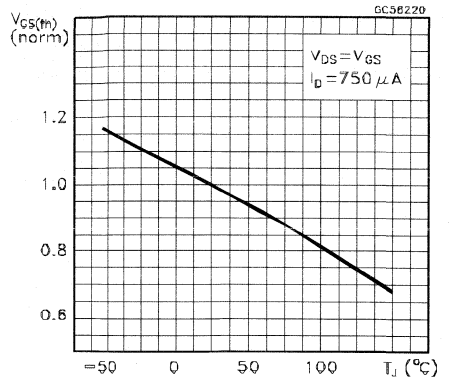
Gate Charge vs Gate-source Voltage



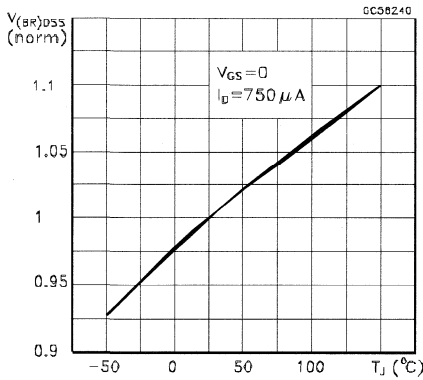
Capacitance Variations



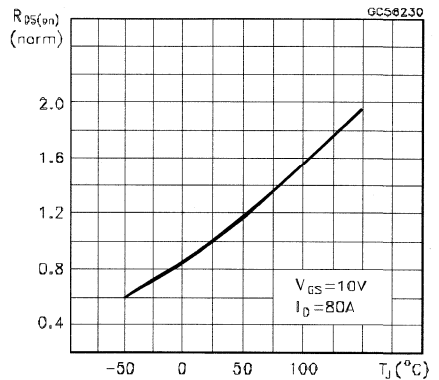
Normalized Gate Threshold Voltage vs Temperature



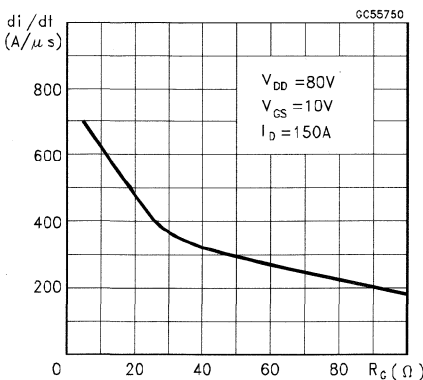
Normalized Breakdown Voltage vs Temperature



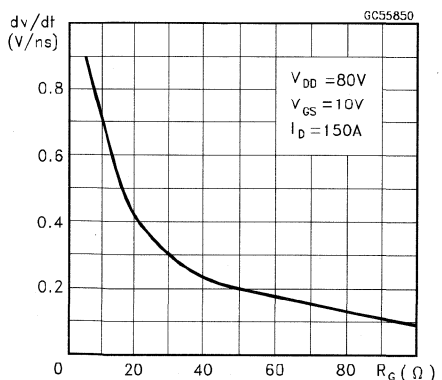
Normalized On Resistance vs Temperature



Turn-on Current Slope



Turn-off Drain-source Voltage Slope



Cross-over Time

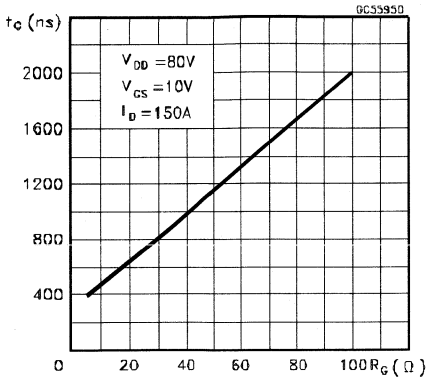
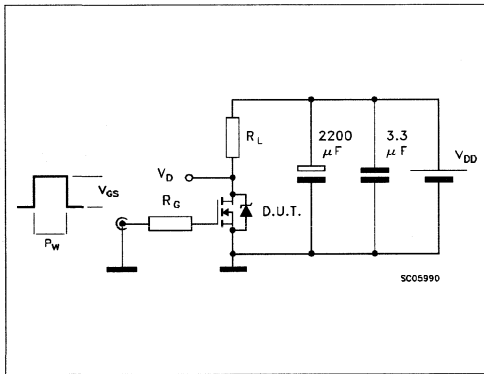


Fig. 1: Switching Times Test Circuits For Resistive Load



Source-drain Diode Forward Characteristics

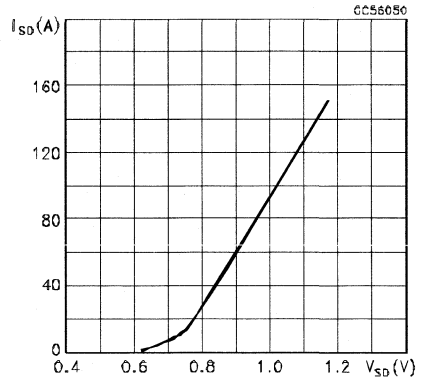


Fig. 2: Gate Charge Test Circuit

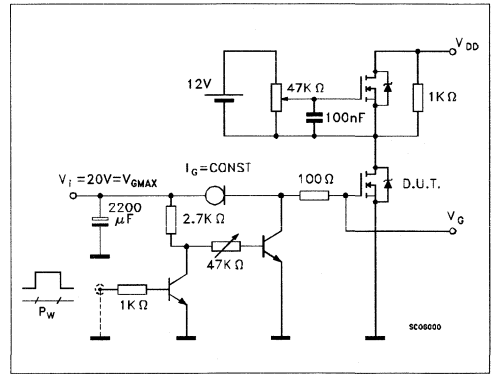
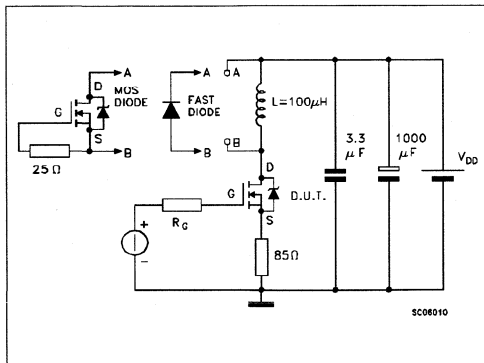


Fig. 3: Test Circuit For Inductive Load Switching And Diode Recovery Times



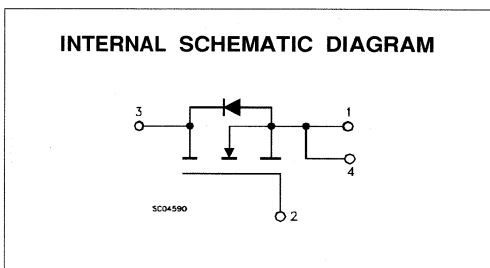
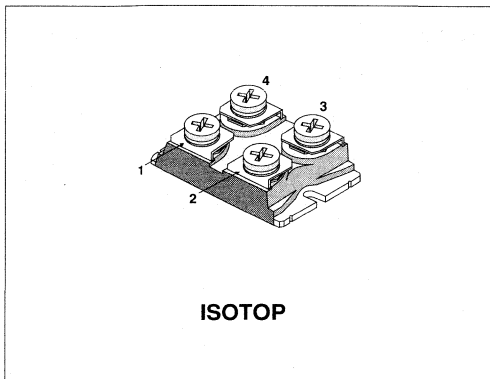
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR IN ISOTOP PACKAGE

TYPE	V _{DSS}	R _{DS(on)}	I _D
STE180N05	50 V	< 0.006 Ω	180 A

- HIGH CURRENT POWER MODULE
- AVALANCHE RUGGED TECHNOLOGY (SEE STH65N05 FOR RATING)
- VERY LARGE SOA - LARGE PEAK POWER CAPABILITY
- EASY TO MOUNT
- SAME CURRENT CAPABILITY FOR THE TWO SOURCE TERMINALS
- EXTREMELY LOW R_{th} JUNCTION TO CASE
- VERY LOW DRAIN TO CASE CAPACITANCE
- VERY LOW INTERNAL PARASITIC INDUCTANCE (TYPICALLY < 5 nH)
- ISOLATED PACKAGE UL RECOGNIZED (FILE No E81743)

INDUSTRIAL APPLICATIONS:

- SMPS & UPS
- MOTOR CONTROL
- WELDING EQUIPMENT
- OUTPUT STAGE FOR PWM, ULTRASONIC CIRCUITS



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-Source Voltage (V _{GS} = 0)	50	V
V _{DGR}	Drain-Gate Voltage (R _{GS} = 20 kΩ)	50	V
V _{GS}	Gate-Source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	180	A
I _D	Drain Current (continuous) at T _c = 100 °C	115.5	A
I _{DM} (●)	Drain Current (pulsed)	540	A
P _{tot}	Total Dissipation at T _c = 25 °C	360	W
	Derating Factor	2.9	W/°C
T _{stg}	Storage Temperature	-55 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C
V _{ISO}	Insulation Withstand Voltage (AC-RMS)	2500	V

(●) Pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	0.35	°C/W
R_{thc-h}	Thermal Resistance Case-heatsink With Conductive Grease Applied	Max	0.05	°C/W

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 1\text{ mA}$ $V_{GS} = 0\text{ V}$	50			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			400 2	μA mA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 400	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 1\text{ mA}$	2		4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 90\text{ A}$		0.004	0.006	Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} = 15\text{ V}$ $I_D = 90\text{ A}$		100		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0\text{ V}$			12	nF
C_{oss}	Output Capacitance				5200	pF
C_{rss}	Reverse Transfer Capacitance				1200	pF

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 25\text{ V}$ $I_D = 90\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 1)		55 210		ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 180\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		900		A/ μs
Q_g	Total Gate Charge	$V_{DD} = 40\text{ V}$ $I_D = 180\text{ A}$ $V_{GS} = 10\text{ V}$		270		nC

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 180\text{ A}$		40		ns
t_f	Fall Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$		315		ns
t_c	Cross-over Time	(see test circuit, figure 3)		440		ns

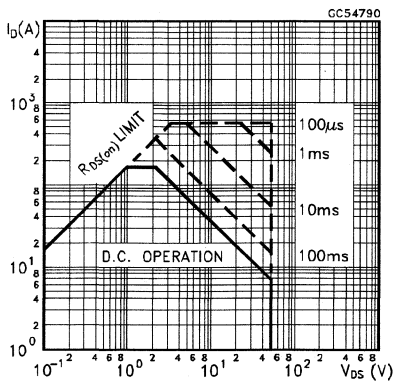
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				180	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				540	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 180\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 180\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 25\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		160		ns
Q_{rr}	Reverse Recovery Charge	(see test circuit, figure 3)		480		nC
I_{RRM}	Reverse Recovery Current			6		A

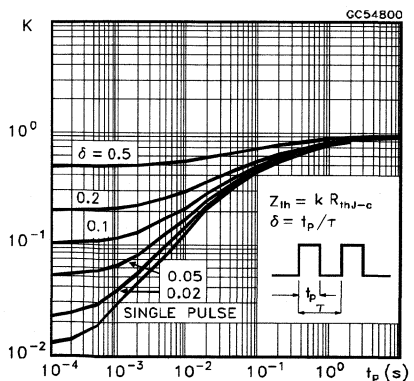
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

(•) Pulse width limited by safe operating area

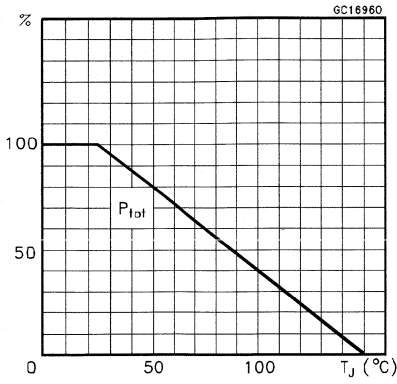
Safe Operating Area



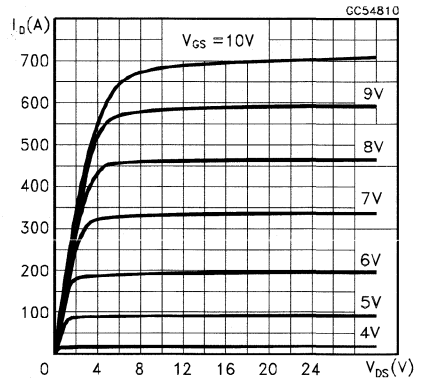
Thermal Impedance



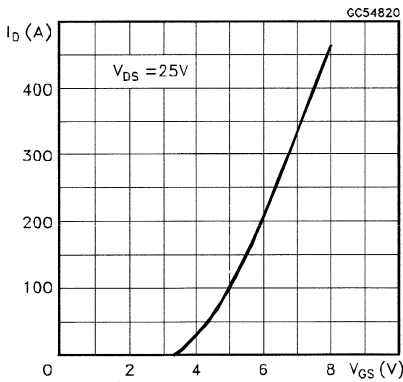
Derating Curve



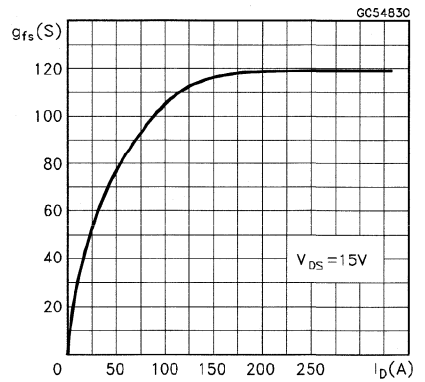
Output Characteristics



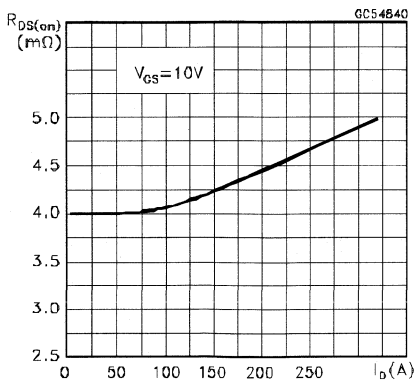
Transfer Characteristics



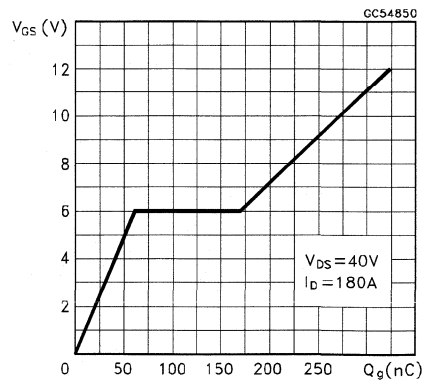
Transconductance



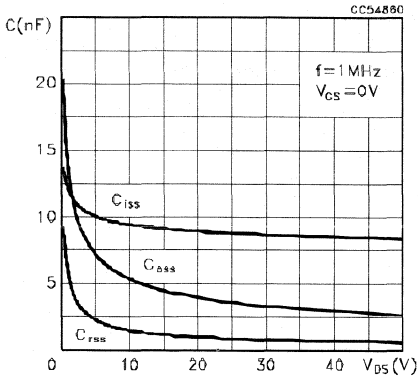
Static Drain-source On Resistance



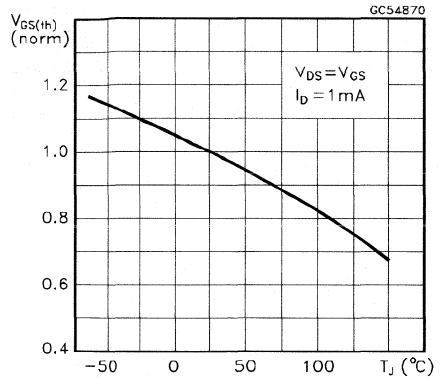
Gate Charge vs Gate-source Voltage



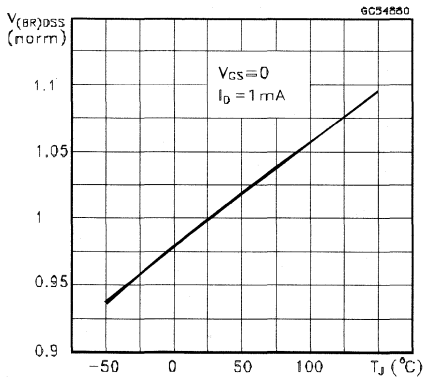
Capacitance Variations



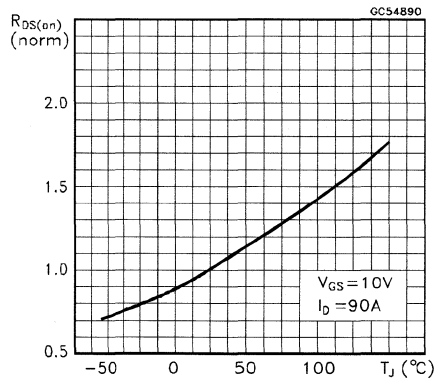
Normalized Gate Threshold Voltage vs Temperature



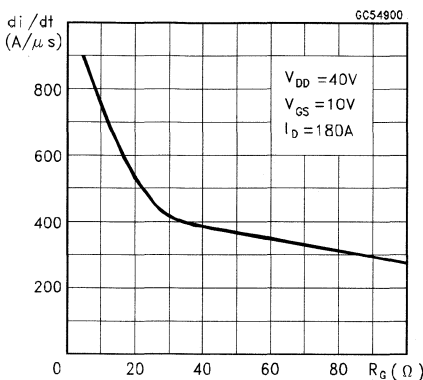
Normalized Breakdown Voltage vs Temperature



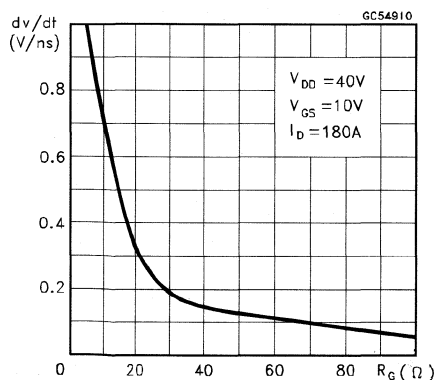
Normalized On Resistance vs Temperature



Turn-on Current Slope



Turn-off Drain-source Voltage Slope



Cross-over Time

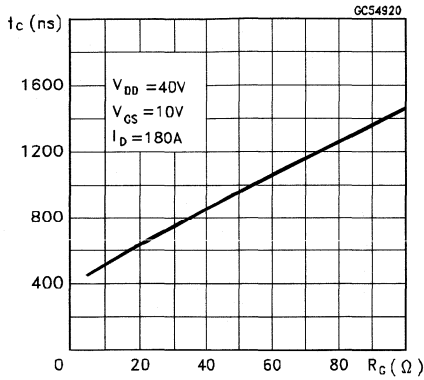
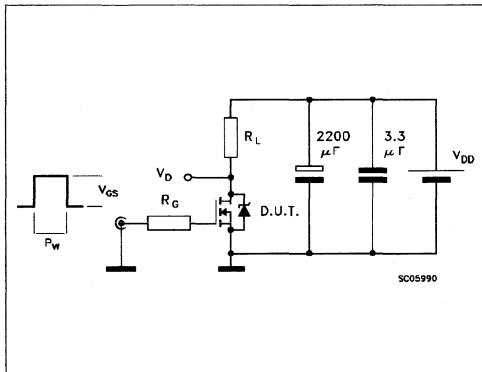


Fig. 1: Switching Times Test Circuits For Resistive Load



Source-drain Diode Forward Characteristics

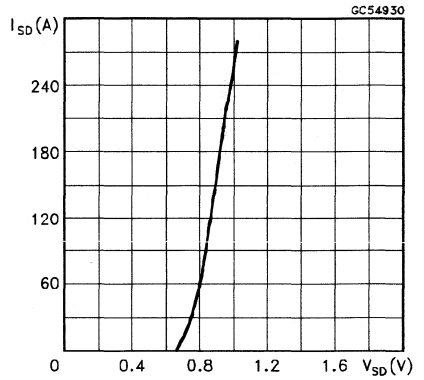


Fig. 2: Gate Charge Test Circuit

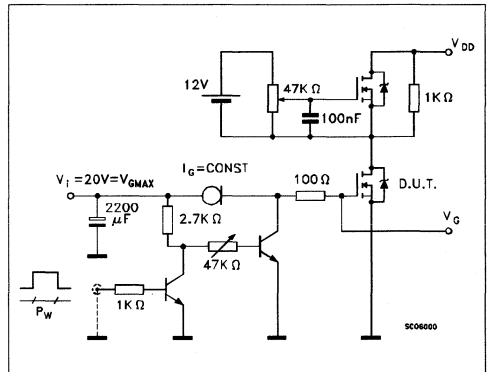
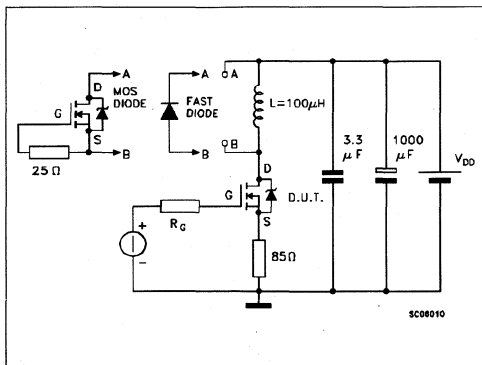


Fig. 3: Test Circuit For Inductive Load Switching And Diode Recovery Times



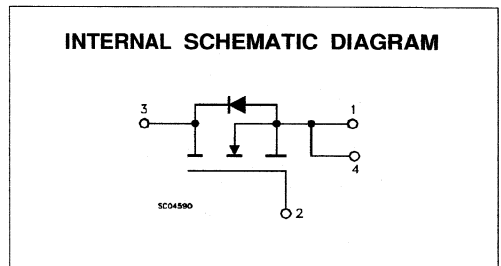
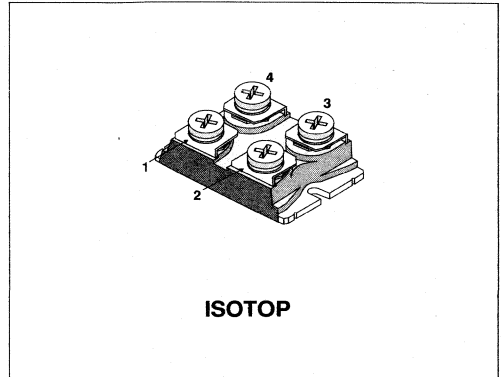
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR IN ISOTOP PACKAGE

TYPE	V _{DSS}	R _{DS(on)}	I _D
STE180N10	100 V	< 0.007 Ω	180 A

- HIGH CURRENT POWER MODULE
- AVALANCHE RUGGED TECHNOLOGY (SEE STH60N10 FOR RATING)
- VERY LARGE SOA - LARGE PEAK POWER CAPABILITY
- EASY TO MOUNT
- SAME CURRENT CAPABILITY FOR THE TWO SOURCE TERMINALS
- EXTREMELY LOW R_{th} JUNCTION TO CASE
- VERY LOW DRAIN TO CASE CAPACITANCE
- VERY LOW INTERNAL PARASITIC INDUCTANCE (TYPICALLY < 5 nH)
- ISOLATED PACKAGE UL RECOGNIZED (FILE No E81743)

INDUSTRIAL APPLICATIONS:

- SMPS & UPS
- MOTOR CONTROL
- WELDING EQUIPMENT
- OUTPUT STAGE FOR PWM, ULTRASONIC CIRCUITS



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-Source Voltage (V _{GS} = 0)	100	V
V _{DGR}	Drain-Gate Voltage (R _{GS} = 20 kΩ)	100	V
V _{GS}	Gate-Source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	180	A
I _D	Drain Current (continuous) at T _c = 100 °C	119	A
I _{DM} (*)	Drain Current (pulsed)	540	A
P _{tot}	Total Dissipation at T _c = 25 °C	450	W
	Derating Factor	3.6	W/°C
T _{stg}	Storage Temperature	-55 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C
V _{ISO}	Insulation Withstand Voltage (AC-RMS)	2500	V

(*) Pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	0.27	°C/W
R_{thc-h}	Thermal Resistance Case-heatsink With Conductive Grease Applied	Max	0.05	°C/W

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 1\text{ mA}$ $V_{GS} = 0\text{ V}$	100			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			400 2	μA mA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 400	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 1\text{ mA}$	2		4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 110\text{ A}$			0.007	Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	$V_{DS} = 15\text{ V}$ $I_D = 110\text{ A}$	100			S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0\text{ V}$			18	nF
C_{oss}	Output Capacitance				4800	pF
C_{rss}	Reverse Transfer Capacitance				1200	pF

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 50\text{ V}$ $I_D = 90\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 1)		80		ns
t_r	Rise Time			140		ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 80\text{ V}$ $I_D = 180\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		750		A/ μs
Q_g	Total Gate Charge	$V_{DD} = 80\text{ V}$ $I_D = 180\text{ A}$ $V_{GS} = 10\text{ V}$		425		nC

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$	Off-voltage Rise Time	$V_{DD} = 80\text{ V}$ $I_D = 180\text{ A}$		95		ns
t_f	Fall Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$		350		ns
t_c	Cross-over Time	(see test circuit, figure 3)		490		ns

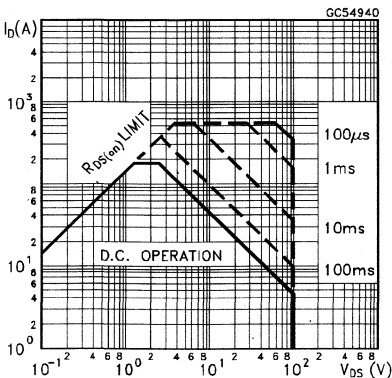
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				180	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				540	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 180\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 180\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 50\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		250		ns
Q_{rr}	Reverse Recovery Charge	(see test circuit, figure 3)		1875		μC
I_{RRM}	Reverse Recovery Current			15		A

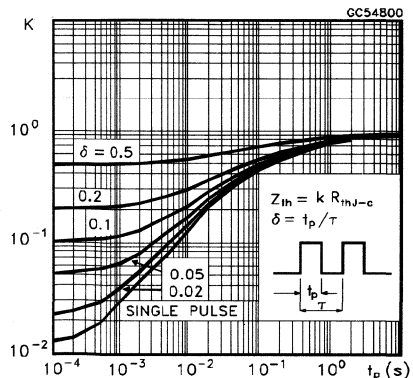
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

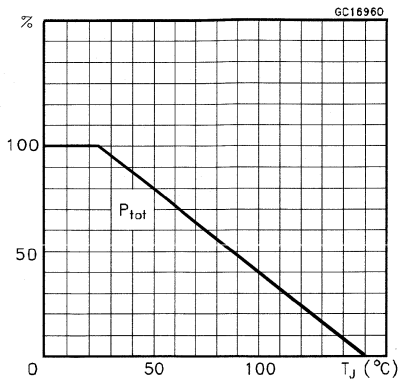
Safe Operating Area



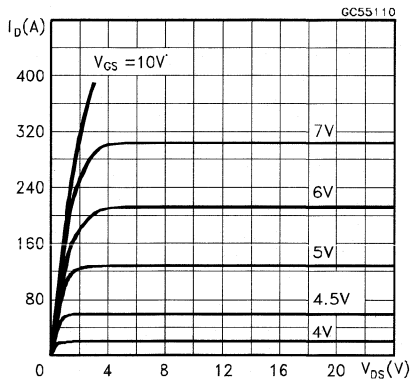
Thermal Impedance



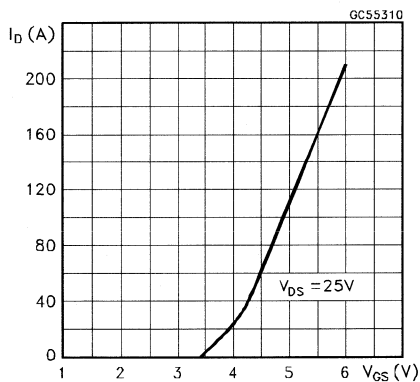
Derating Curve



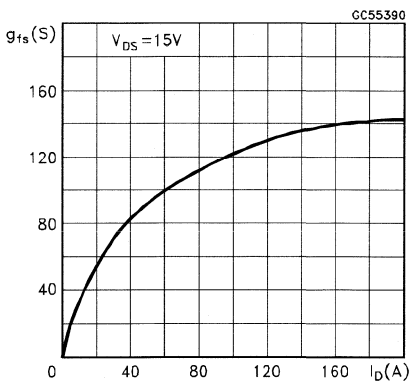
Output Characteristics



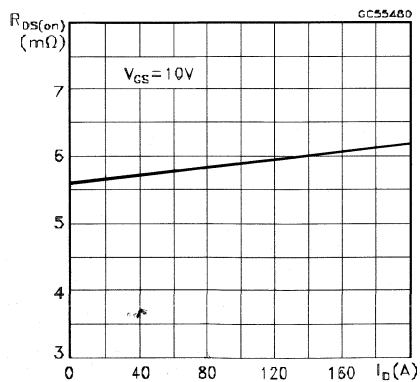
Transfer Characteristics



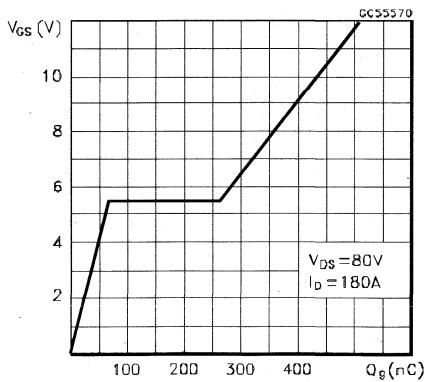
Transconductance



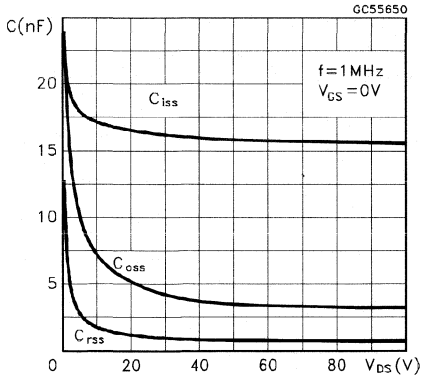
Static Drain-source On Resistance



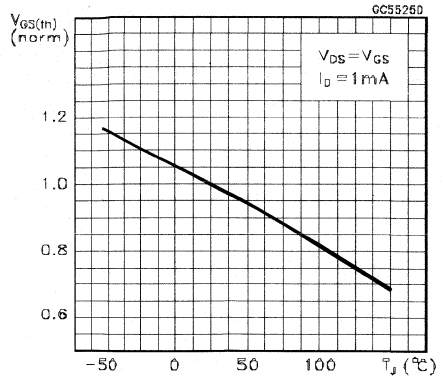
Gate Charge vs Gate-source Voltage



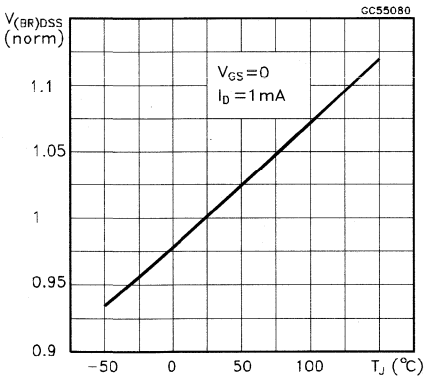
Capacitance Variations



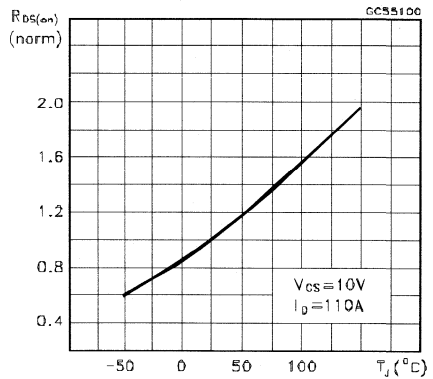
Normalized Gate Threshold Voltage vs Temperature



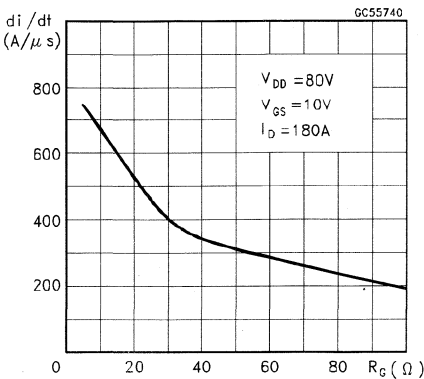
Normalized Breakdown Voltage vs Temperature



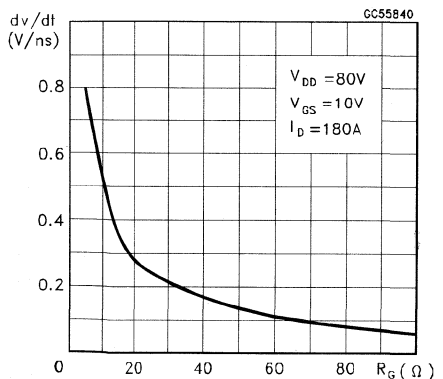
Normalized On Resistance vs Temperature



Turn-on Current Slope



Turn-off Drain-source Voltage Slope



Cross-over Time

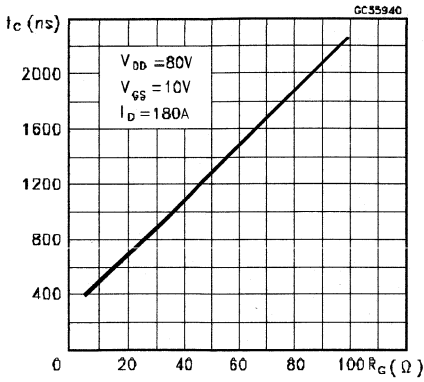
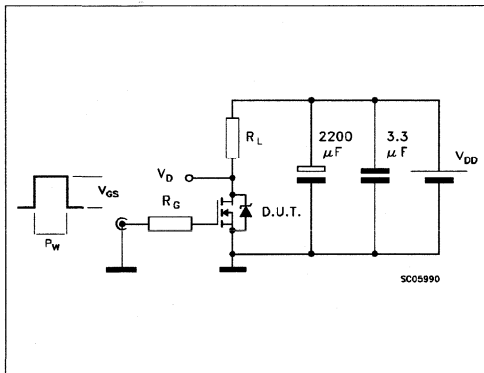


Fig. 1: Switching Times Test Circuits For Resistive Load



Source-drain Diode Forward Characteristics

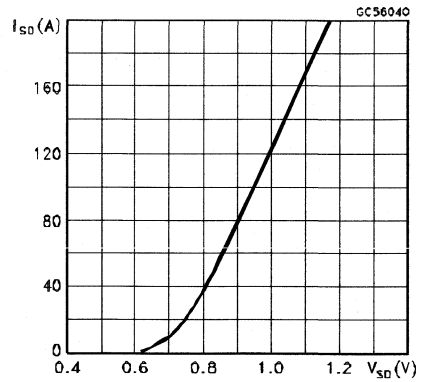


Fig. 2: Gate Charge Test Circuit

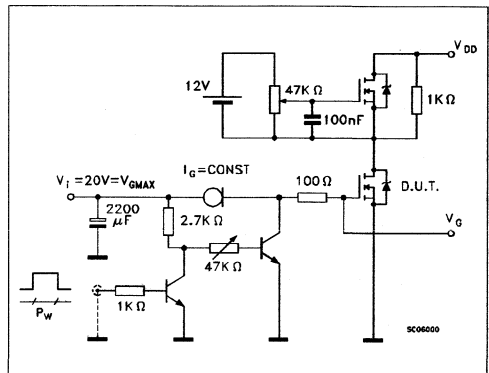
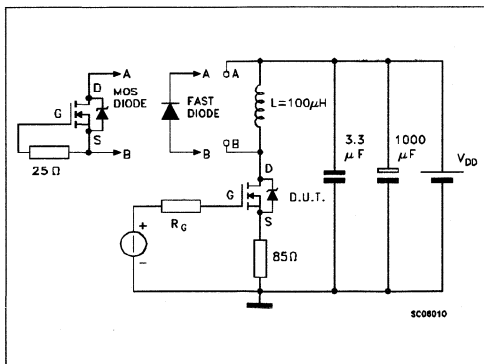


Fig. 3: Test Circuit For Inductive Load Switching And Diode Recovery Times



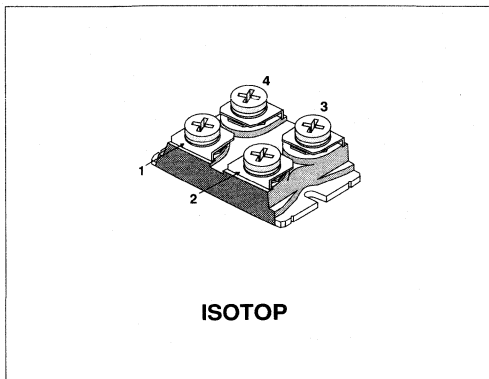
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR IN ISOTOP PACKAGE

TYPE	V _{DSS}	R _{DS(on)}	I _D
STE250N05	50 V	< 0.004 Ω	250 A

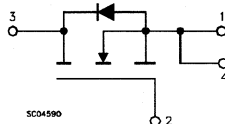
- HIGH CURRENT POWER MODULE
- AVALANCHE RUGGED TECHNOLOGY (SEE STH80N05 FOR RATING)
- VERY LARGE SOA - LARGE PEAK POWER CAPABILITY
- EASY TO MOUNT
- SAME CURRENT CAPABILITY FOR THE TWO SOURCE TERMINALS
- EXTREMELY LOW R_{th} JUNCTION TO CASE
- VERY LOW DRAIN TO CASE CAPACITANCE
- VERY LOW INTERNAL PARASITIC INDUCTANCE (TYPICALLY < 5 nH)
- ISOLATED PACKAGE UL RECOGNIZED (FILE No E81743)

INDUSTRIAL APPLICATIONS:

- SMPS & UPS
- MOTOR CONTROL
- WELDING EQUIPMENT
- OUTPUT STAGE FOR PWM, ULTRASONIC CIRCUITS



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-Source Voltage (V _{GS} = 0)	50	V
V _{DGR}	Drain-Gate Voltage (R _{GS} = 20 kΩ)	50	V
V _{GS}	Gate-Source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	250	A
I _D	Drain Current (continuous) at T _c = 100 °C	155	A
I _{DM} (*)	Drain Current (pulsed)	750	A
P _{tot}	Total Dissipation at T _c = 25 °C	450	W
	Derating Factor	3.6	W/°C
T _{stg}	Storage Temperature	-55 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C
V _{ISO}	Insulation Withstand Voltage (AC-RMS)	2500	V

(*) Pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	0.27	$^{\circ}\text{C}/\text{W}$
R_{thc-h}	Thermal Resistance Case-heatsink With Conductive Grease Applied	Max	0.05	$^{\circ}\text{C}/\text{W}$

ELECTRICAL CHARACTERISTICS ($T_{case} = 25^{\circ}\text{C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 1\text{ mA}$ $V_{GS} = 0\text{ V}$	50			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^{\circ}\text{C}$			400 2	μA mA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 400	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 1\text{ mA}$	2		4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 125\text{ A}$			0.004	Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} = 15\text{ V}$ $I_D = 125\text{ A}$	100			S
C_{iss} C_{oss} C_{rss}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0\text{ V}$			25 10000 3000	nF pF pF

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 25\text{ V}$ $I_D = 125\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 1)		95 300		ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 250\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		440		A/ μs
Q_g	Total Gate Charge	$V_{DD} = 40\text{ V}$ $I_D = 250\text{ A}$ $V_{GS} = 10\text{ V}$		475		nC

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 250\text{ A}$		140		ns
t_f	Fall Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$		745		ns
t_c	Cross-over Time	(see test circuit, figure 3)		1000		ns

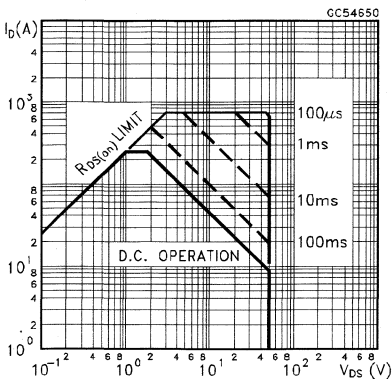
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				250	A
$I_{SDM(\bullet)}$	Source-drain Current (pulsed)				750	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 250\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 250\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 25\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		210		ns
Q_{rr}	Reverse Recovery Charge	(see test circuit, figure 3)		1.31		μC
I_{RRM}	Reverse Recovery Current			12.5		A

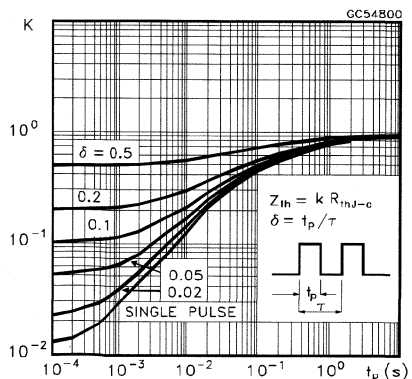
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

(•) Pulse width limited by safe operating area

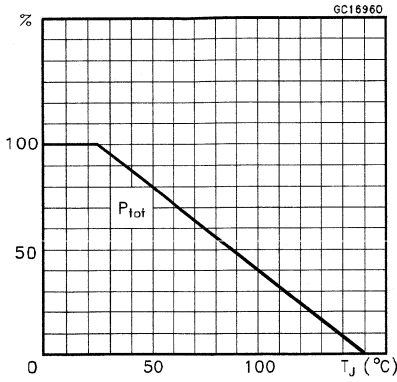
Safe Operating Area



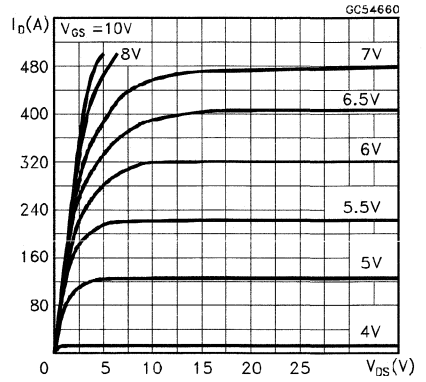
Thermal Impedance



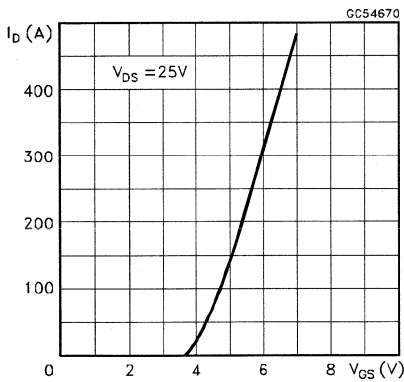
Derating Curve



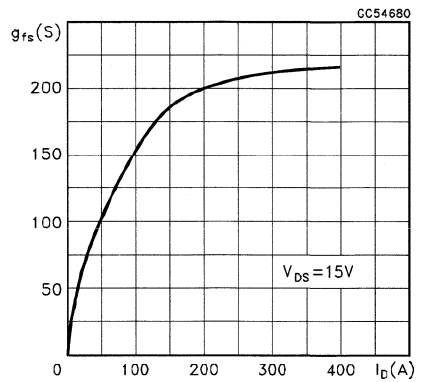
Output Characteristics



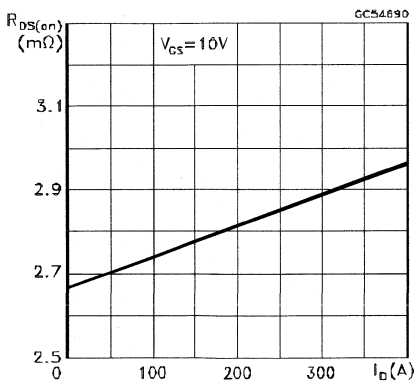
Transfer Characteristics



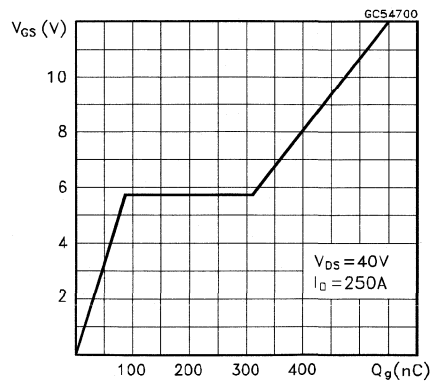
Transconductance



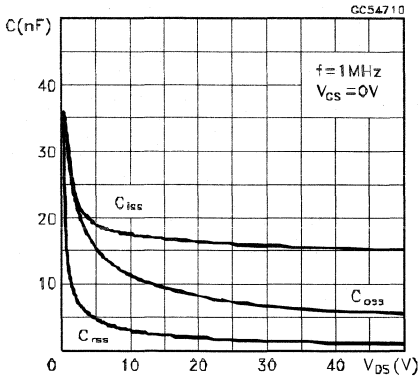
Static Drain-source On Resistance



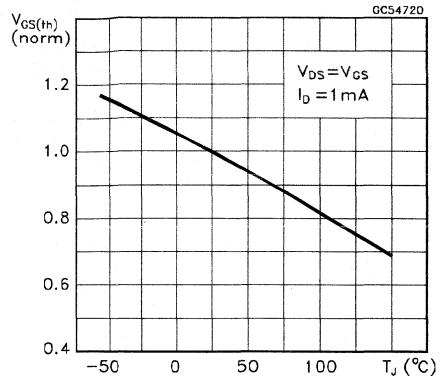
Gate Charge vs Gate-source Voltage



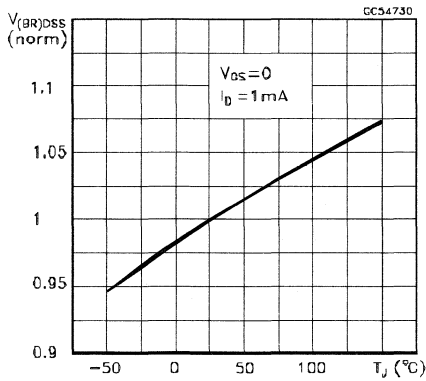
Capacitance Variations



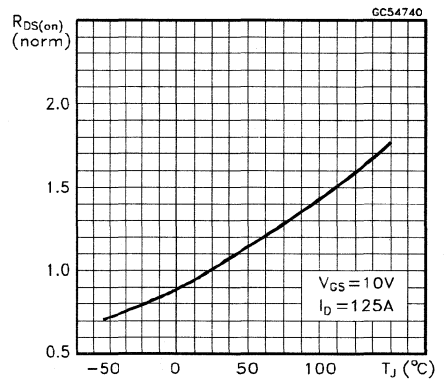
Normalized Gate Threshold Voltage vs Temperature



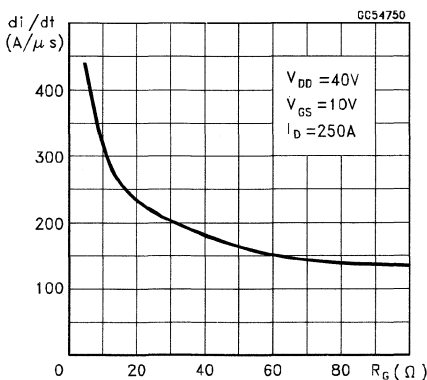
Normalized Breakdown Voltage vs Temperature



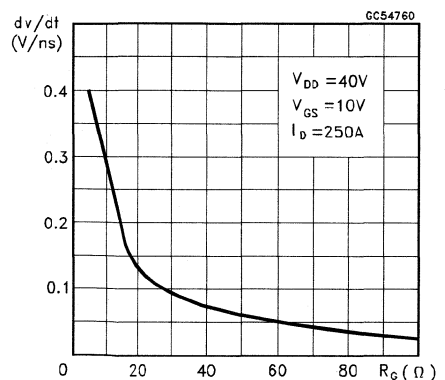
Normalized On Resistance vs Temperature



Turn-on Current Slope



Turn-off Drain-source Voltage Slope



Cross-over Time

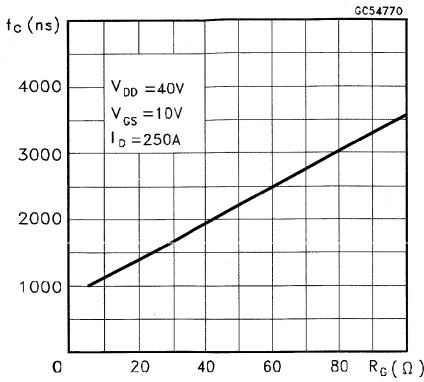
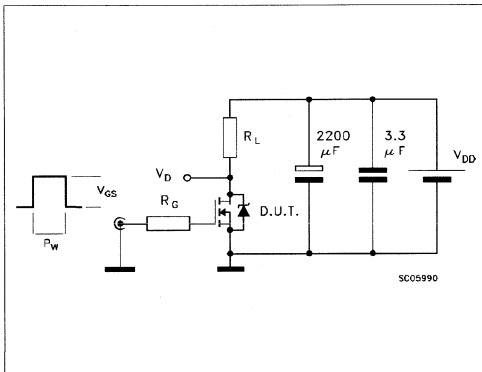


Fig. 1: Switching Times Test Circuits For Resistive Load



Source-drain Diode Forward Characteristics

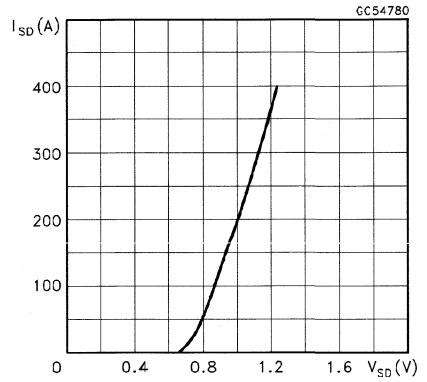


Fig. 2: Gate Charge Test Circuit

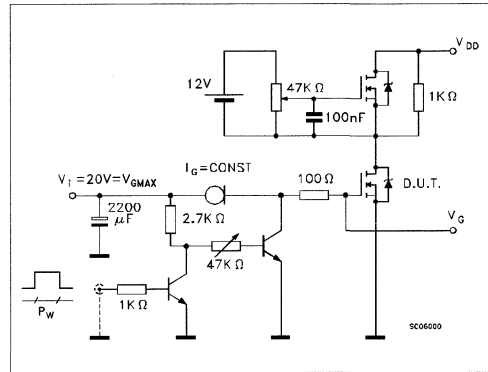
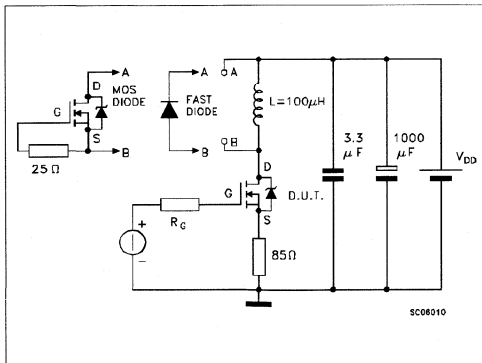


Fig. 3: Test Circuit For Inductive Load Switching And Diode Recovery Times



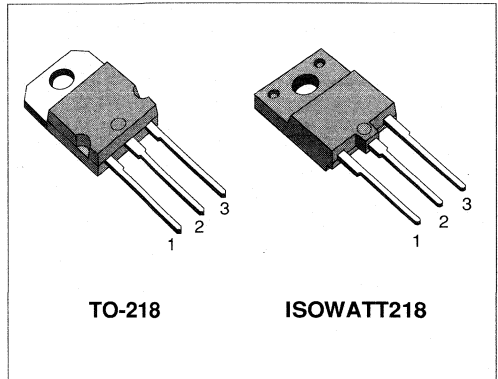
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STH4N80	800 V	< 3 Ω	4.3 A
STH4N80FI	800 V	< 3 Ω	2.8 A

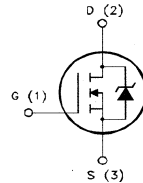
- TYPICAL R_{DS(on)} = 2.5 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INPUT CAPACITANCE
- LOW GATE CHARGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CONSUMER AND INDUSTRIAL LIGHTING
- DC-AC INVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLY (UPS)



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STH4N80	STH4N80FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	800		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	800		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	4.3	2.8	A
I _D	Drain Current (continuous) at T _c = 100 °C	2.6	1.7	A
I _{DM} (●)	Drain Current (pulsed)	16	16	A
P _{tot}	Total Dissipation at T _c = 25 °C	125	55	W
	Derating Factor	1	0.44	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	4000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(●) Pulse width limited by safe operating area

THERMAL DATA

			TO-218	ISOWATT218	
R _{thj-case}	Thermal Resistance Junction-case	Max	1	2.27	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	30		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.1		°C/W
T _I	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	4.3	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	230	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	10	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	2.6	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	800			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 1.7 A V _{GS} = 10V I _D = 1.7 A T _c = 100°C		2.5	3 6	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	4.3			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 1.7 A	1			S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0			1100	pF
C _{oss}	Output Capacitance				150	pF
C _{rss}	Reverse Transfer Capacitance				55	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 30\text{ V}$ $I_D = 2.3\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		65 150	90 200	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 600\text{ V}$ $I_D = 3.8\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		80	110	A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 400\text{ V}$ $I_D = 5\text{ A}$ $V_{GS} = 10\text{ V}$		55 8 26	70	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$ t_f	Off-voltage Rise Time Fall Time	$V_{DD} = 600\text{ V}$ $I_D = 3.8\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		110 140	145 190	ns ns
t_c	Cross-over Time	(see test circuit, figure 5)		150	200	ns

SOURCE DRAIN DIODE

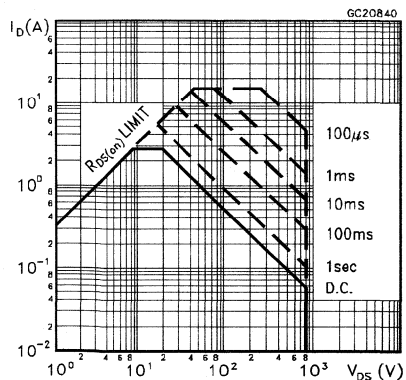
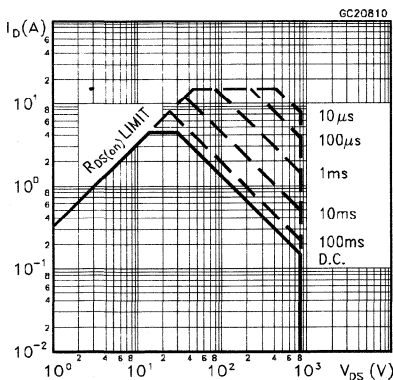
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				4.2 16	A A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 4.3\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 3.8\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_R = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		500		ns
Q_{rr}	Reverse Recovery Charge			4.3		μ C
I_{RRM}	Reverse Recovery Current			17		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

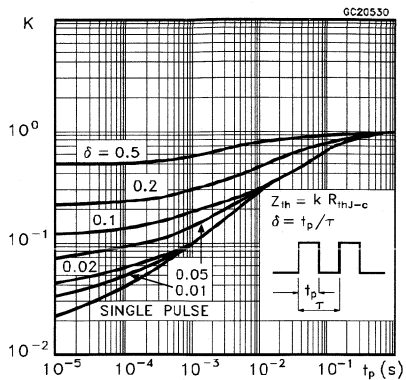
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas For TO-218

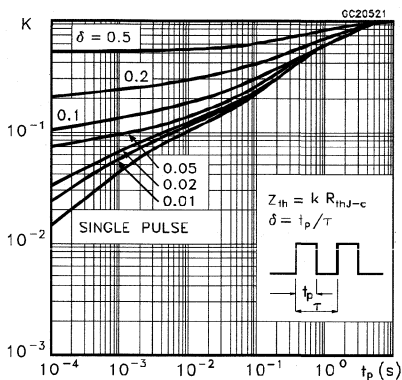
Safe Operating Areas For ISOWATT218



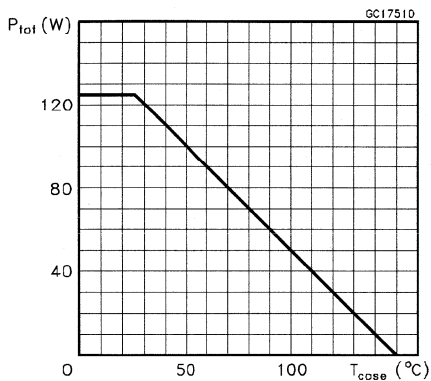
Thermal Impedance For TO-218



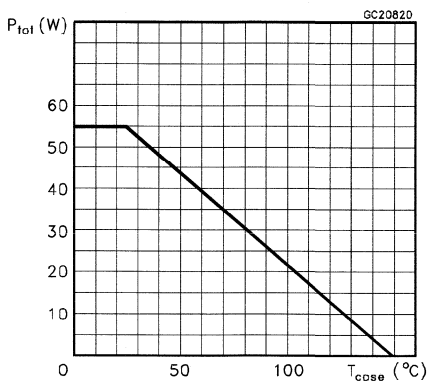
Thermal Impedance For ISOWATT218



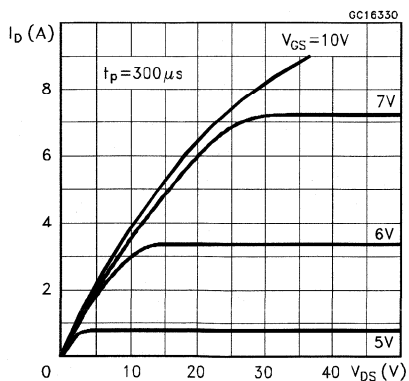
Derating Curve For TO-218



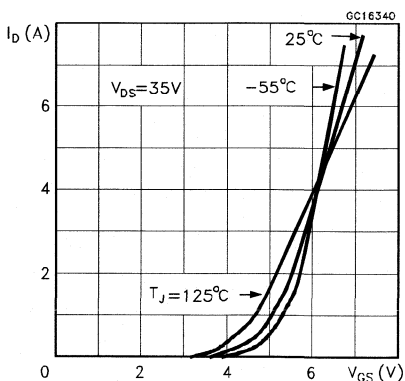
Derating Curve For ISOWATT218



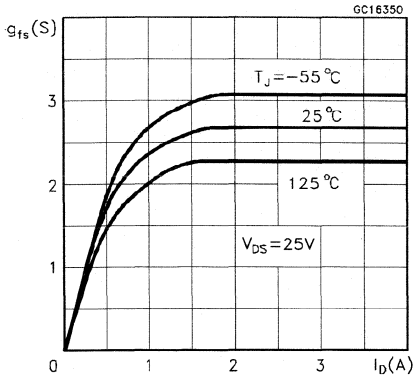
Output Characteristics



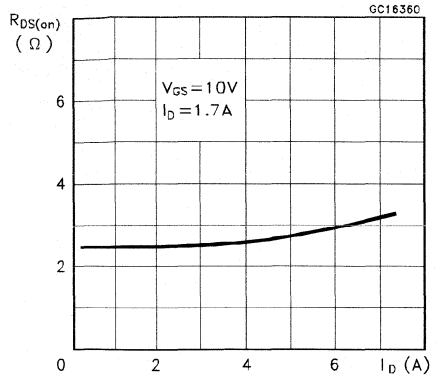
Transfer Characteristics



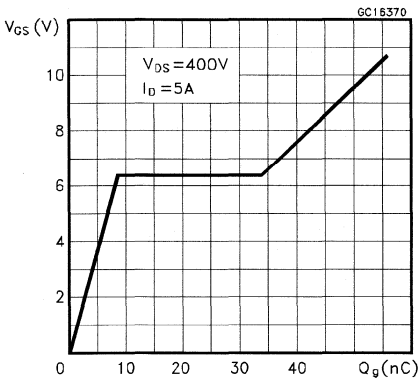
Transconductance



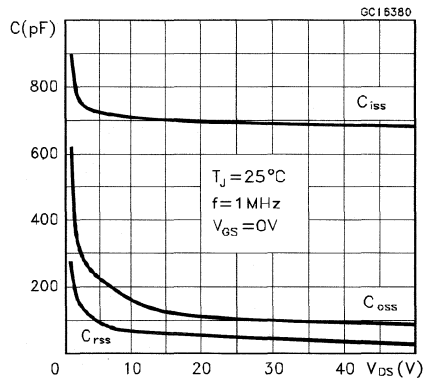
Static Drain-source On Resistance



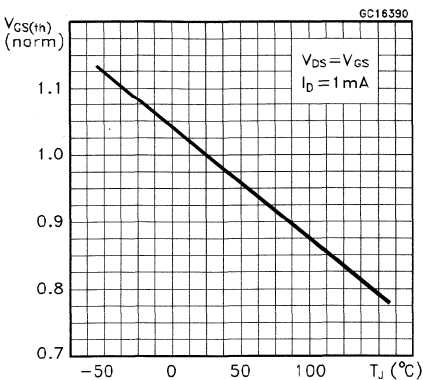
Gate Charge vs Gate-source Voltage



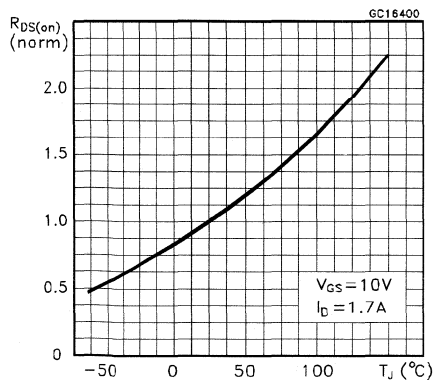
Capacitance Variations



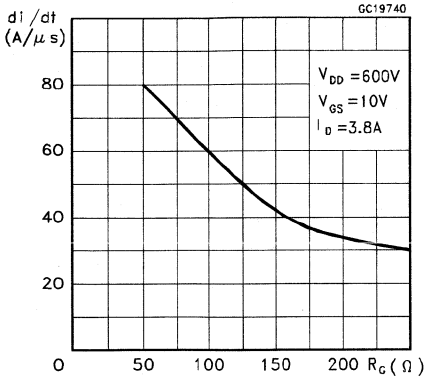
Normalized Gate Threshold Voltage vs Temperature



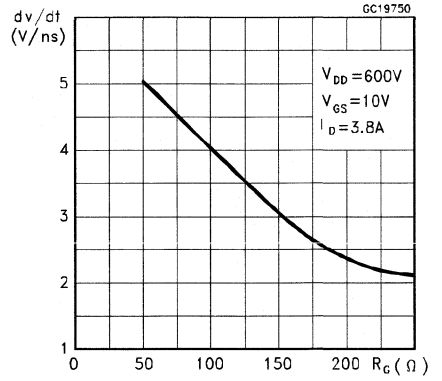
Normalized On Resistance vs Temperature



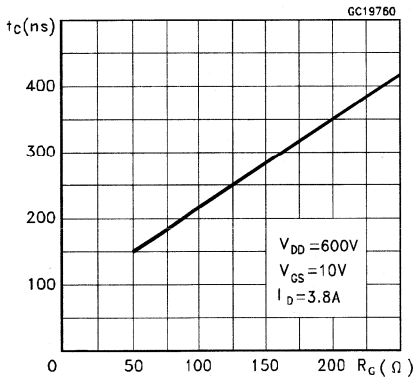
Turn-on Current Slope



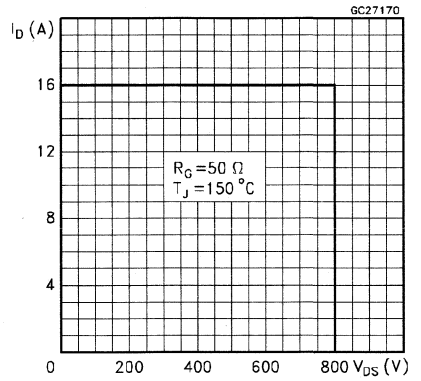
Turn-off Drain-source Voltage Slope



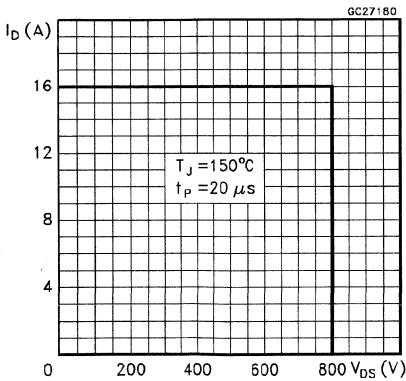
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

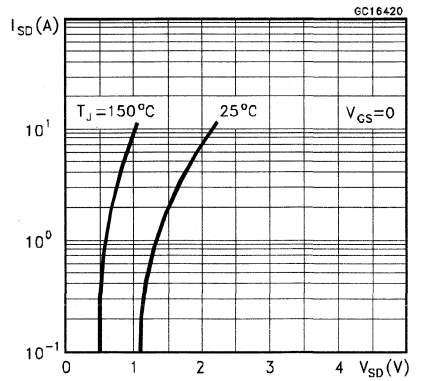


Fig. 1: Unclamped Inductive Load Test Circuits

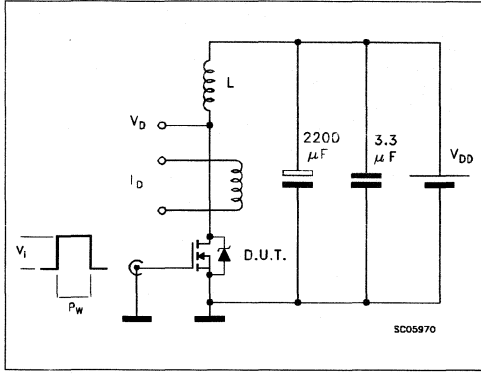


Fig. 2: Unclamped Inductive Waveforms

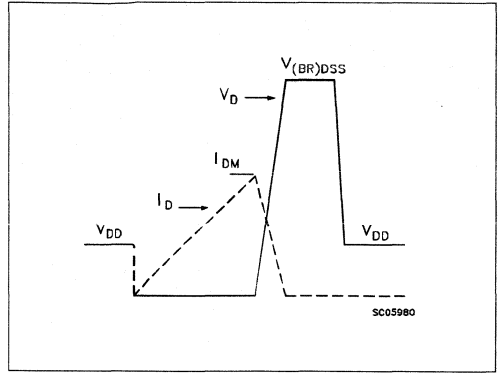


Fig. 3: Switching Times Test Circuits For Resistive Load

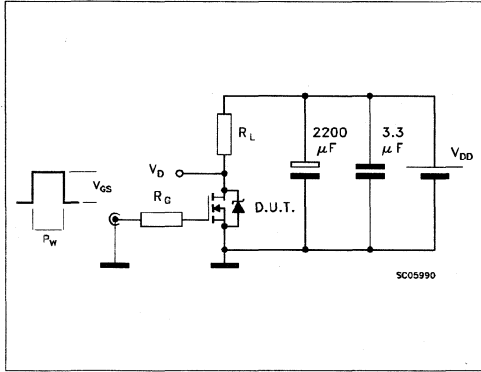


Fig. 4: Gate Charge Test Circuit

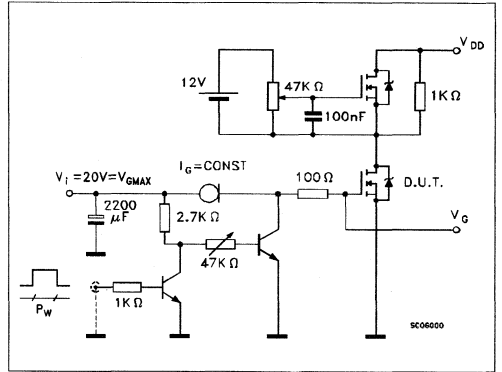
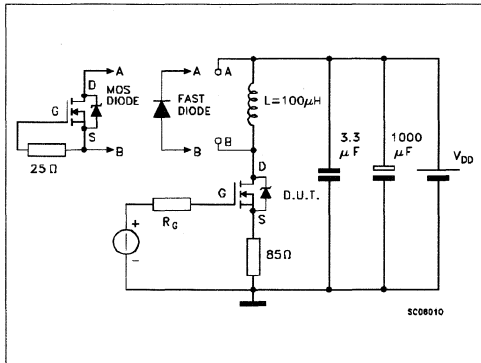


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



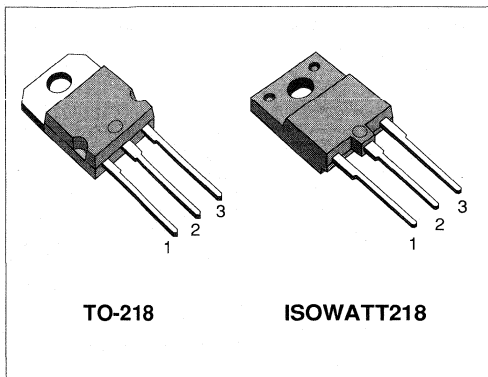
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STH4N90	900 V	< 3.2 Ω	4.2 A
STH4N90FI	900 V	< 3.2 Ω	2.7 A

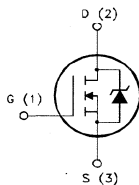
- TYPICAL R_{DS(on)} = 2.9 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INPUT CAPACITANCE
- LOW GATE CHARGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CONSUMER AND INDUSTRIAL LIGHTING
- DC-AC INVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLY (UPS)



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STH4N90	STH4N90FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	900		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	900		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	4.2	2.7	A
I _D	Drain Current (continuous) at T _c = 100 °C	2.6	1.6	A
I _{DM} (*)	Drain Current (pulsed)	16	16	A
P _{tot}	Total Dissipation at T _c = 25 °C	125	55	W
	Derating Factor	1	0.44	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	4000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-218	ISOWATT218	
R _{thj-case}	Thermal Resistance Junction-case	Max	1	2.27	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	30		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.1		°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	4.2	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	230	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	10	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	2.6	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	900			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 1.7 A V _{GS} = 10V I _D = 1.7 A T _c = 100°C		2.9	3.2 6.4	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	4.2			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 1.7 A	1			S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0			1100	pF
C _{oss}	Output Capacitance				150	pF
C _{rss}	Reverse Transfer Capacitance				55	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 30\text{ V}$ $I_D = 2.3\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		65 150	90 200	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 600\text{ V}$ $I_D = 3.8\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		80	110	A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 400\text{ V}$ $I_D = 5\text{ A}$ $V_{GS} = 10\text{ V}$		55 8 26	70	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$ t_f	Off-voltage Rise Time Fall Time	$V_{DD} = 600\text{ V}$ $I_D = 3.8\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		110 140	145 190	ns ns
t_c	Cross-over Time	(see test circuit, figure 5)		150	200	ns

SOURCE DRAIN DIODE

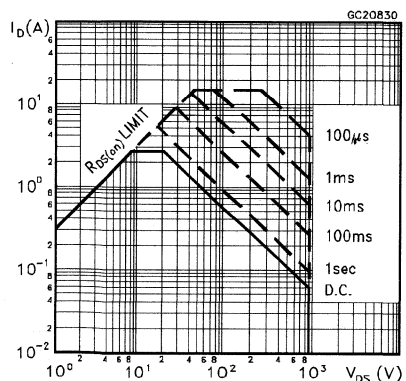
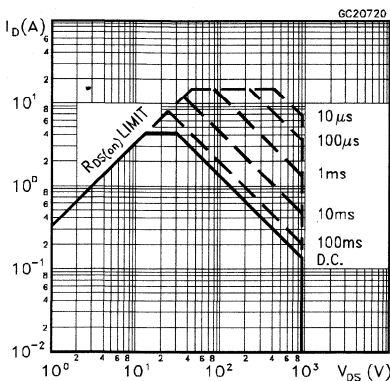
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				4.2 16	A A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 4.2\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 3.8\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_R = 100\text{ V}$ $T_J = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		500		ns
Q_{rr}	Reverse Recovery Charge			4.3		μ C
I_{RRM}	Reverse Recovery Current			17		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

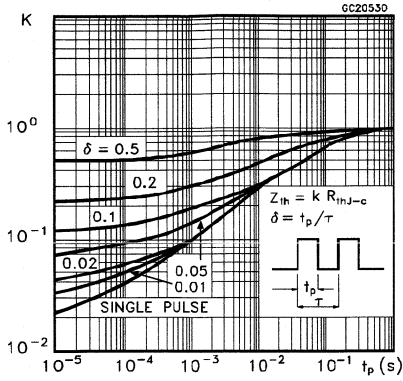
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas For TO-218

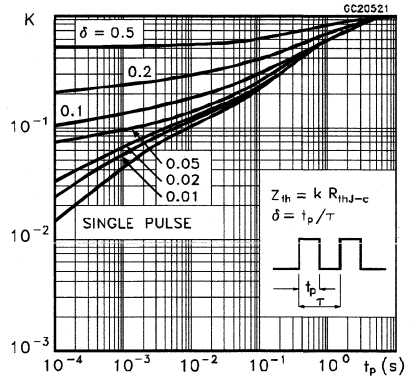
Safe Operating Areas For ISOWATT218



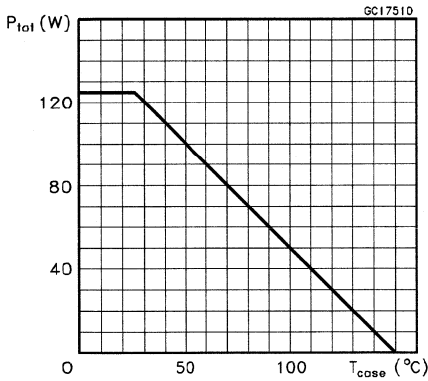
Thermal Impedance For TO-218



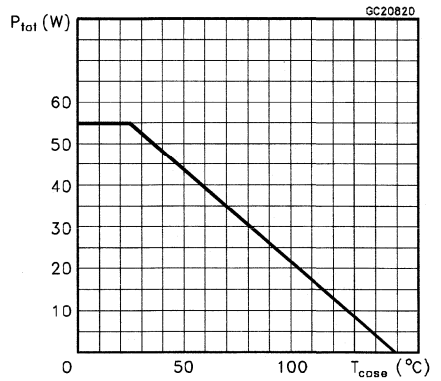
Thermal Impedance For ISOWATT218



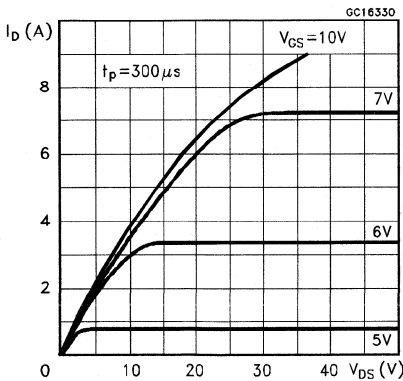
Derating Curve For TO-218



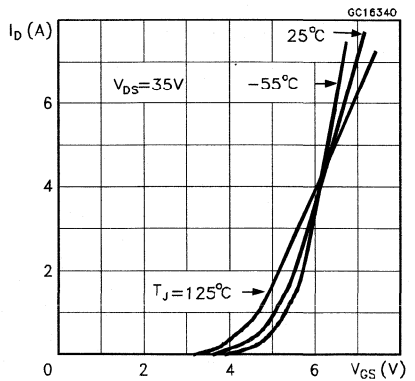
Derating Curve For ISOWATT218



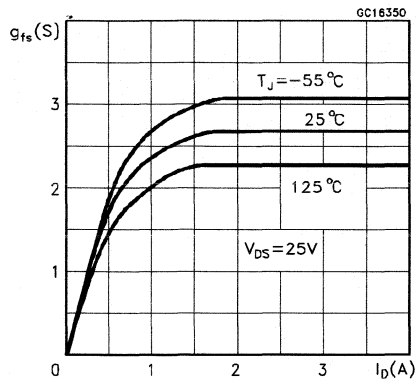
Output Characteristics



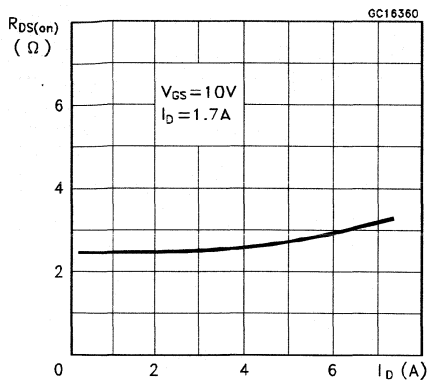
Transfer Characteristics



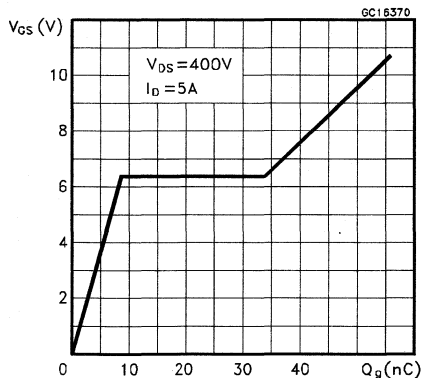
Transconductance



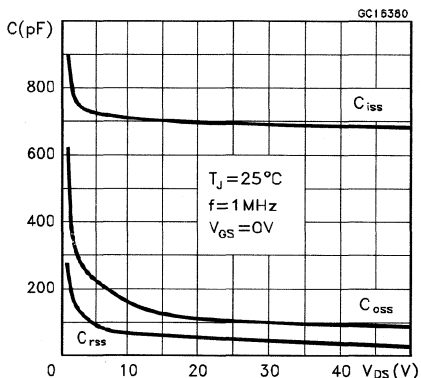
Static Drain-source On Resistance



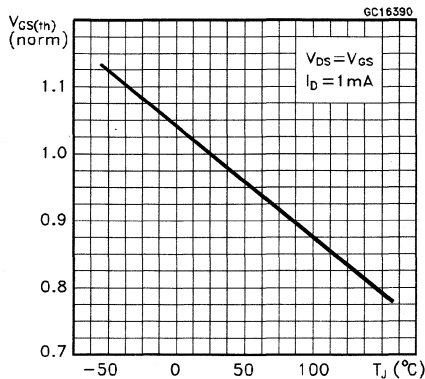
Gate Charge vs Gate-source Voltage



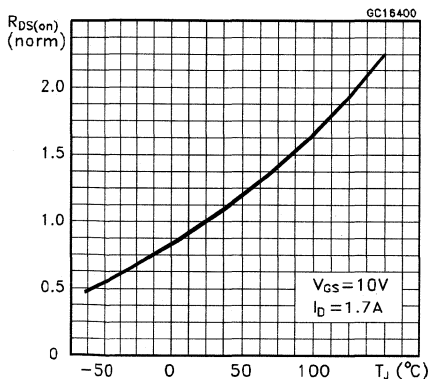
Capacitance Variations



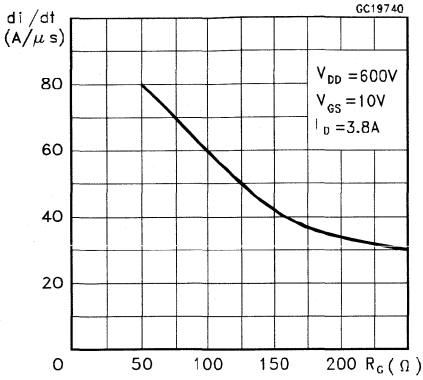
Normalized Gate Threshold Voltage vs Temperature



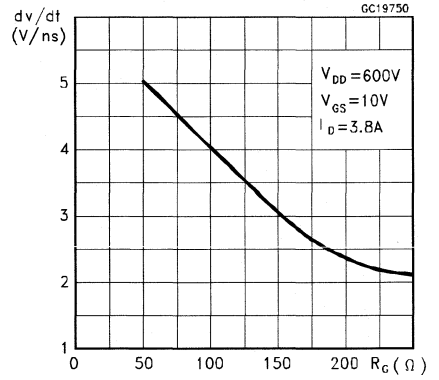
Normalized On Resistance vs Temperature



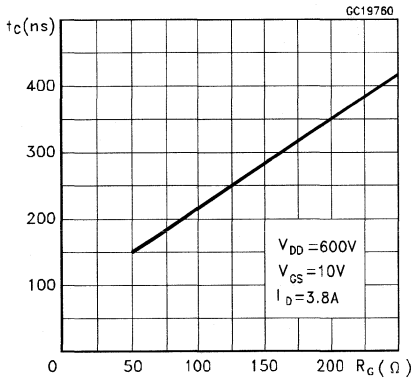
Turn-on Current Slope



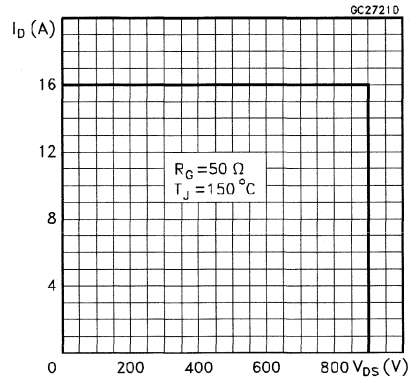
Turn-off Drain-source Voltage Slope



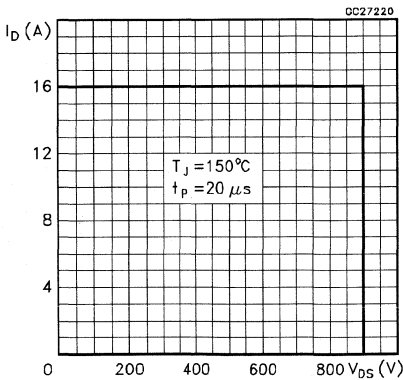
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

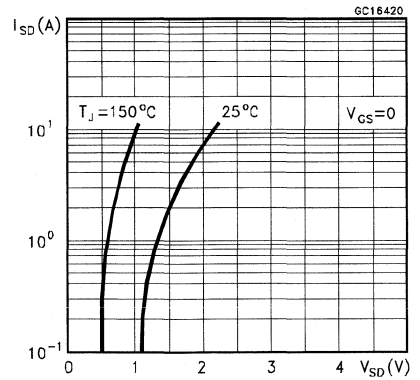


Fig. 1: Unclamped Inductive Load Test Circuits

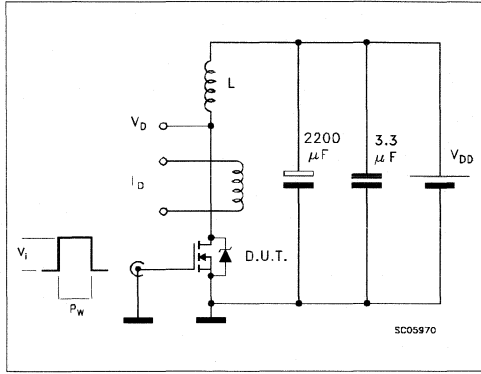


Fig. 2: Unclamped Inductive Waveforms

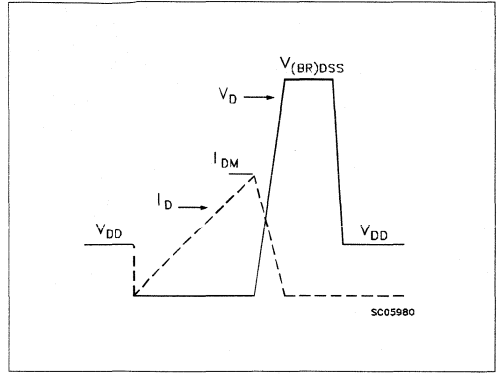


Fig. 3: Switching Times Test Circuits For Resistive Load

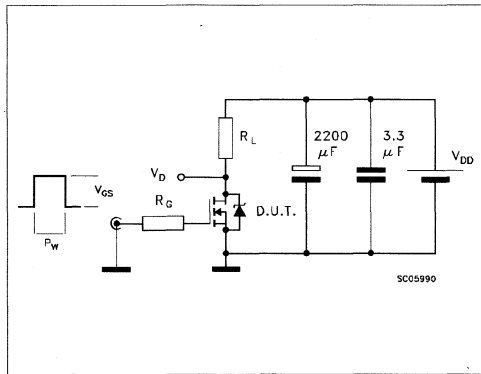


Fig. 4: Gate Charge Test Circuit

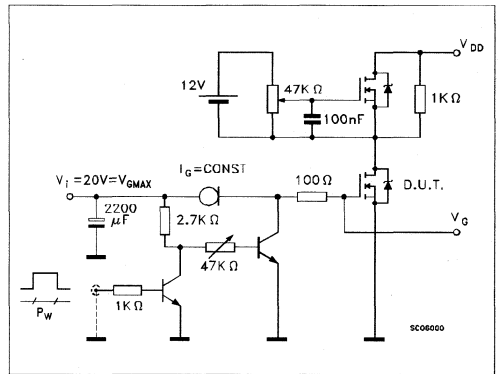
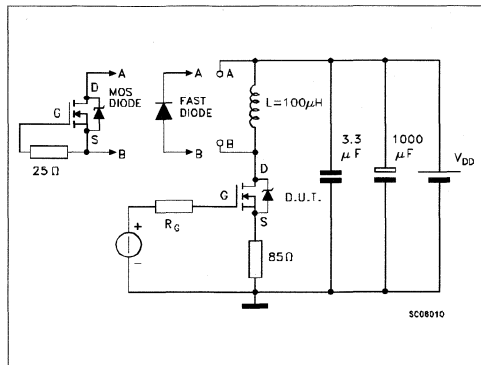


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



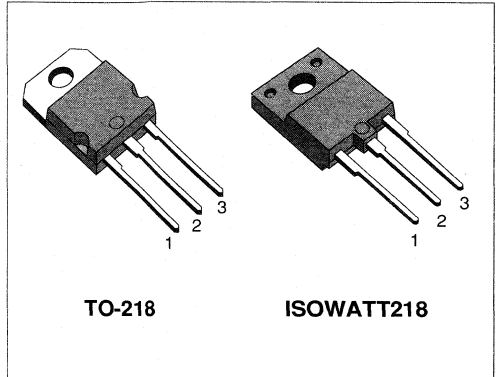
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STH5N90	900 V	< 2.4 Ω	5.3 A
STH5N90FI	900 V	< 2.4 Ω	3.5 A

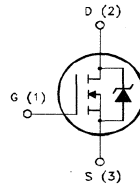
- TYPICAL R_{DS(on)} = 1.9 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INPUT CAPACITANCE
- LOW GATE CHARGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CONSUMER AND INDUSTRIAL LIGHTING
- DC-AC INVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLY (UPS)



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STH5N90	STH5N90FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	900		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	900		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	5.3	3.5	A
I _D	Drain Current (continuous) at T _c = 100 °C	3.3	2.2	A
I _{DM} (*)	Drain Current (pulsed)	20	20	A
P _{tot}	Total Dissipation at T _c = 25 °C	150	60	W
	Derating Factor	1.2	0.48	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	4000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

		TO-218	ISOWATT218		
R _{thj-case}	Thermal Resistance Junction-case	Max	0.83	2.08	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	30		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.1		°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	5.3	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	300	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	14	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	3.1	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	900			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 2.5 A V _{GS} = 10V I _D = 2.5 A T _c = 100°C		1.9	2.4 4.8	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} × R _{DS(on)max} V _{GS} = 10 V	5.3			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} × R _{DS(on)max} I _D = 2.5 A	2	4		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		1190	1450	pF
C _{oss}	Output Capacitance			165	200	pF
C _{rss}	Reverse Transfer Capacitance			70	85	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 400\text{ V}$ $I_D = 2.5\text{ A}$		50	65	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		85	105	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 640\text{ V}$ $I_D = 5.5\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		200		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 500\text{ V}$ $I_D = 6\text{ A}$ $V_{GS} = 10\text{ V}$		75	95	nC
Q_{gs}	Gate-Source Charge			9		nC
Q_{gd}	Gate-Drain Charge			33		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 640\text{ V}$ $I_D = 5.5\text{ A}$		120	150	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		30	40	ns
t_c	Cross-over Time	(see test circuit, figure 5)		160	200	ns

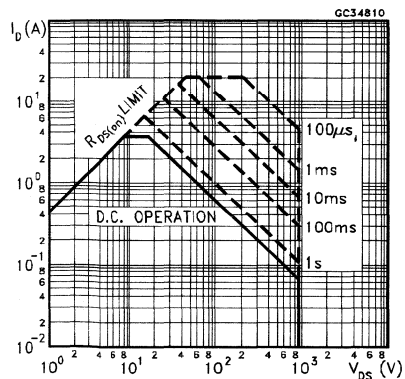
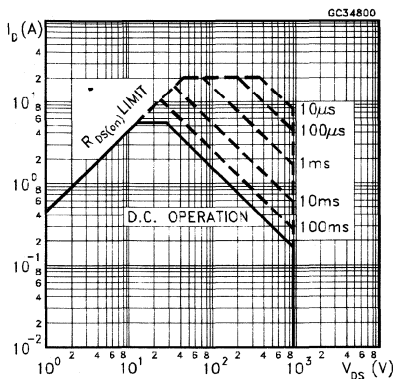
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				5.3	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				20	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 5.3\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 5.3\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 80\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		700		ns
Q_{rr}	Reverse Recovery Charge			7.7		μ C
I_{RRM}	Reverse Recovery Current			22		A

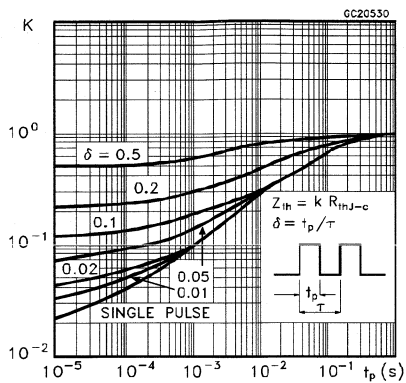
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %
 (•) Pulse width limited by safe operating area

Safe Operating Areas For TO-218

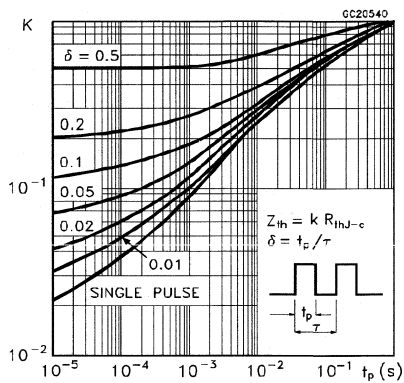
Safe Operating Areas For ISOWATT218



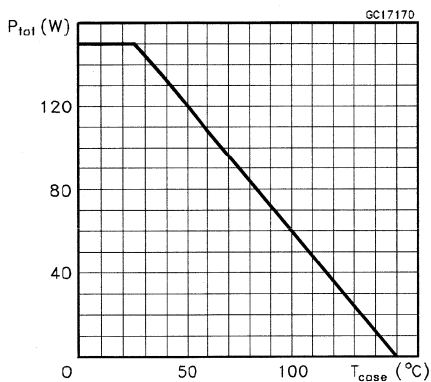
Thermal Impedance For TO-218



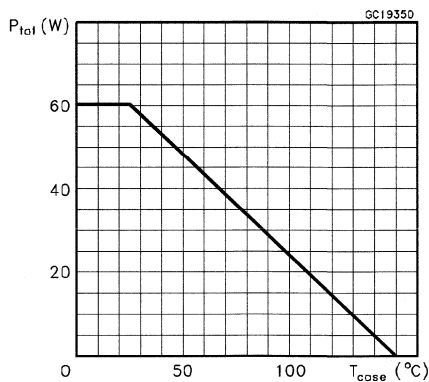
Thermal Impedance For ISOWATT218



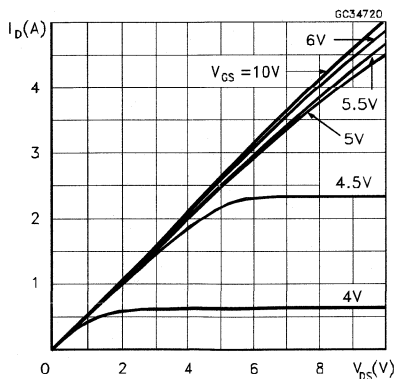
Derating Curve For TO-218



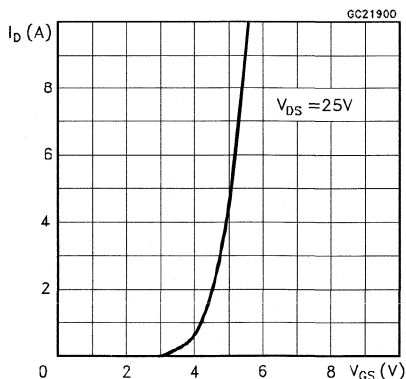
Derating Curve For ISOWATT218



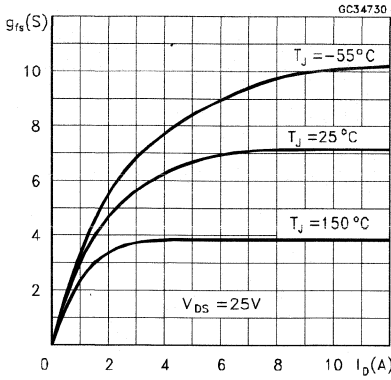
Output Characteristics



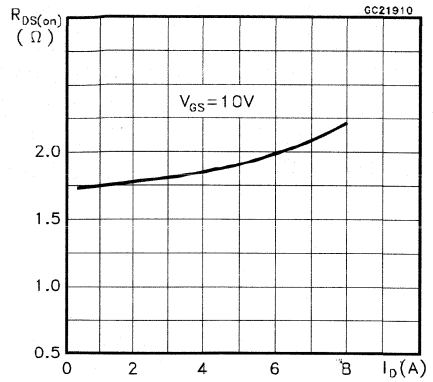
Transfer Characteristics



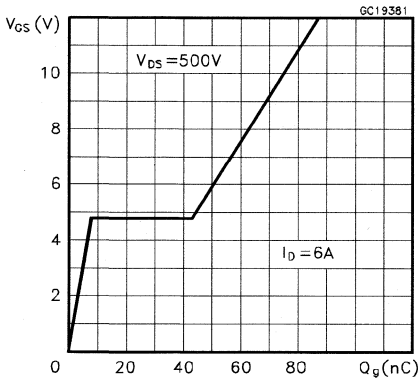
Transconductance



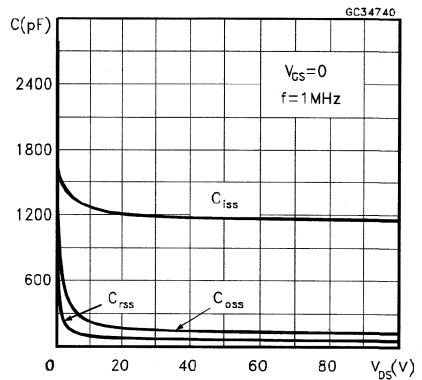
Static Drain-source On Resistance



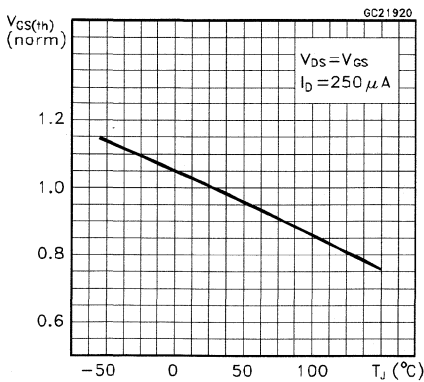
Gate Charge vs Gate-source Voltage



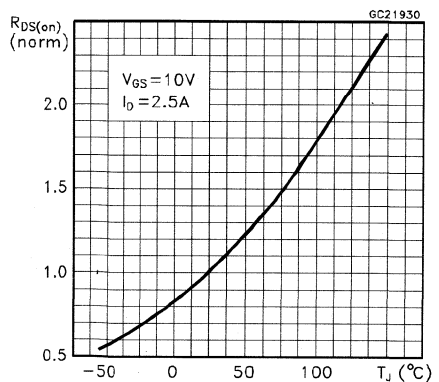
Capacitance Variations



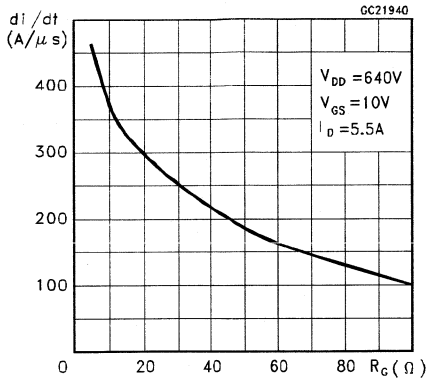
Normalized Gate Threshold Voltage vs Temperature



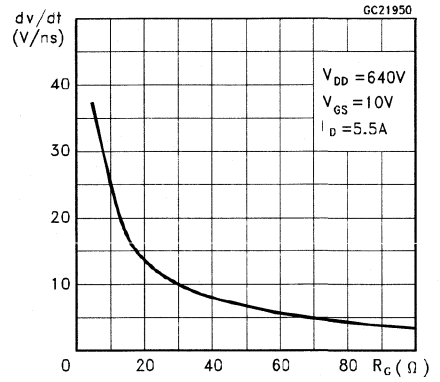
Normalized On Resistance vs Temperature



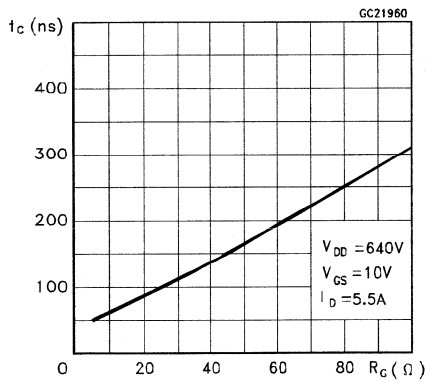
Turn-on Current Slope



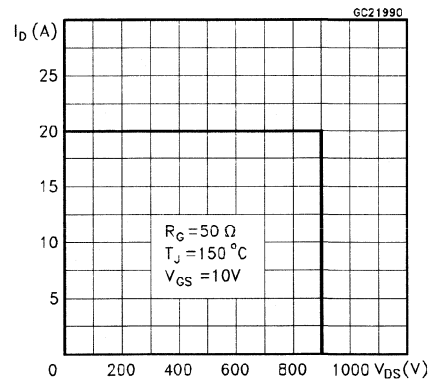
Turn-off Drain-source Voltage Slope



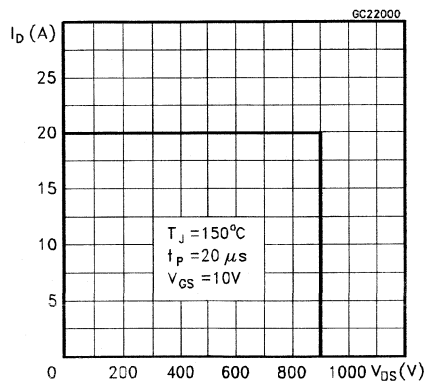
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

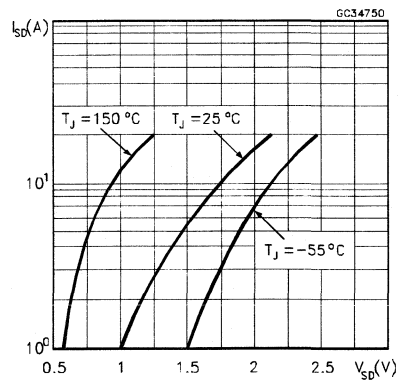


Fig. 1: Unclamped Inductive Load Test Circuits

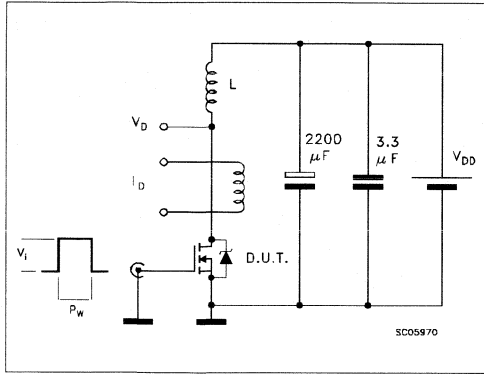


Fig. 2: Unclamped Inductive Waveforms

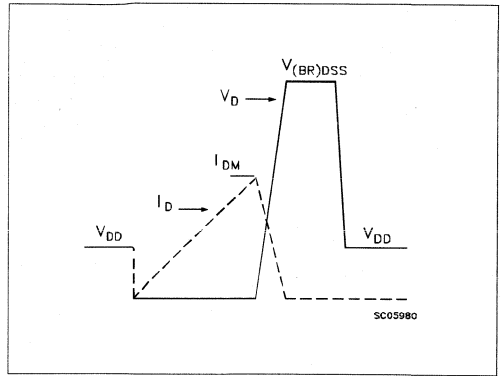


Fig. 3: Switching Times Test Circuits For Resistive Load

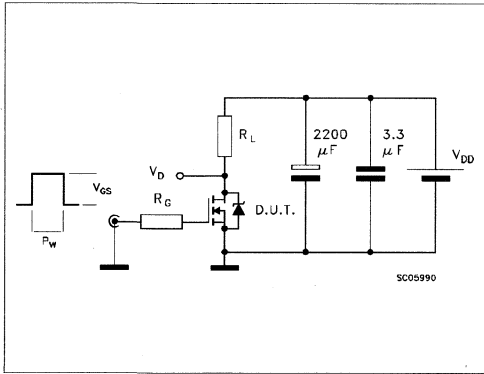


Fig. 4: Gate Charge Test Circuit

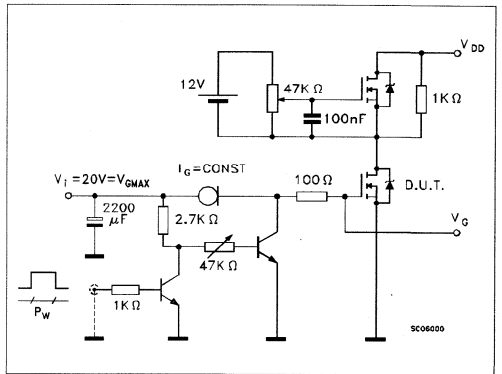
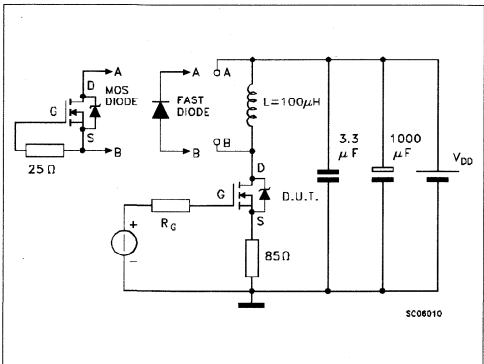


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



N - CHANNEL ENHANCEMENT MODE FAST POWER MOS TRANSISTOR

ADVANCE DATA

TYPE	V _{DSS}	R _{DS(on)}	I _D
STH6NA80	800 V	< 2.4 Ω	5.8 A
STH6NA80FI	800 V	< 2.4 Ω	3.7 A

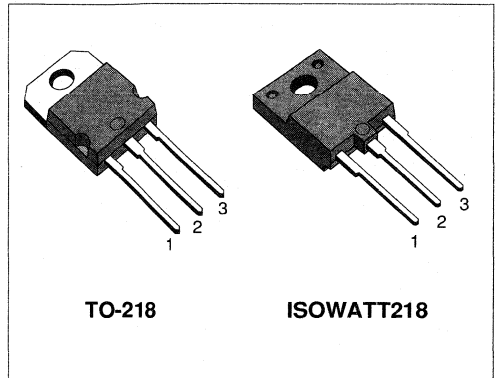
- TYPICAL R_{DS(on)} = 2 Ω
- ± 30V GATE TO SOURCE VOLTAGE RATING
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INTRINSIC CAPACITANCES
- GATE CHARGE MINIMIZED
- REDUCED THRESHOLD VOLTAGE SPREAD

DESCRIPTION

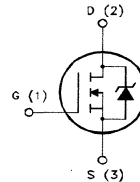
This series of POWER MOSFETS represents the most advanced high voltage technology. The optimized cell layout coupled with a new proprietary edge termination concur to give the device low R_{DS(on)} and gate charge, unequalled ruggedness and superior switching performance.

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- DC-AC CONVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLIES AND MOTOR DRIVE



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STH6NA80	STH6NA80FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	800		V
V _{DGR}	Drain-gate Voltage (R _{GS} = 20 kΩ)	800		V
V _{GS}	Gate-source Voltage	± 30		V
I _D	Drain Current (continuous) at T _c = 25 °C	5.8	3.7	A
I _D	Drain Current (continuous) at T _c = 100 °C	3.8	2.4	A
I _{DM} (*)	Drain Current (pulsed)	23	23	A
P _{tot}	Total Dissipation at T _c = 25 °C	150	60	W
	Derating Factor	1.2	0.48	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	4000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

		TO-218	ISOWATT218	
R _{thj-case}	Thermal Resistance Junction-case Max	0.83	2.08	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient Max		30	°C/W
R _{thc-sink}	Thermal Resistance Case-sink Typ		0.1	°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	5.8	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	180	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	5.4	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	3.8	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	800			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 30 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2.25	3	3.75	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 3 A V _{GS} = 10V I _D = 3 A T _c = 100°C		2	2.4 4.8	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} × R _{DS(on)max} V _{GS} = 10 V	5.8			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} × R _{DS(on)max} I _D = 3 A	3	5.5		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		1215		pF
C _{oss}	Output Capacitance			145		pF
C _{rss}	Reverse Transfer Capacitance			35		pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 400\text{ V}$ $I_D = 3\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		15 25		ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 640\text{ V}$ $I_D = 6\text{ A}$ $R_G = 47\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		200		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 640\text{ V}$ $I_D = 6\text{ A}$ $V_{GS} = 10\text{ V}$		53 7 25		nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$ t_f t_c	Off-voltage Rise Time Fall Time Cross-over Time	$V_{DD} = 640\text{ V}$ $I_D = 6\text{ A}$ $R_G = 47\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		70 25 110		ns ns ns

SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				5.8 23	A A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 6\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 6\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		800 10 40		ns μ C A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

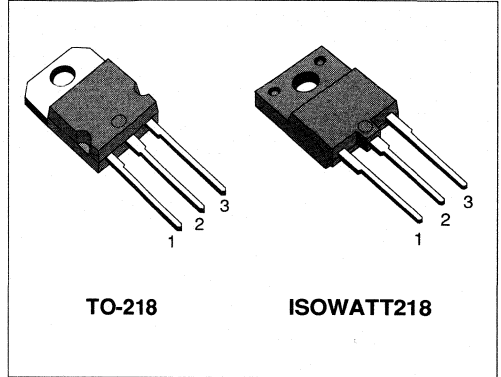
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STH6N100	1000 V	< 2 Ω	6 A
STH6N100FI	1000 V	< 2 Ω	3.7 A

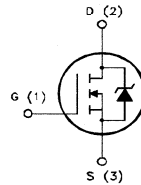
- TYPICAL R_{DS(on)} = 1.75 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INPUT CAPACITANCE
- LOW GATE CHARGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CONSUMER AND INDUSTRIAL LIGHTING
- DC-AC INVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLY (UPS)



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STH6N100	STH6N100	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	1000		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	1000		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	6	3.7	A
I _D	Drain Current (continuous) at T _c = 100 °C	3.7	2.3	A
I _{DM(•)}	Drain Current (pulsed)	24	24	A
P _{tot}	Total Dissipation at T _c = 25 °C	180	70	W
	Derating Factor	1.44	0.56	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	4000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(•) Pulse width limited by safe operating area

THERMAL DATA

			TO-218	ISOWATT218	
$R_{thj-case}$	Thermal Resistance Junction-case	Max	0.69	1.78	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	30		°C/W
$R_{thc-sink}$	Thermal Resistance Case-sink	Typ	0.1		°C/W
T_I	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	6	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ °C}$, $I_D = I_{AR}$, $V_{DD} = 25\text{ V}$)	850	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	16	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ °C}$, pulse width limited by T_j max, $\delta < 1\%$)	3.7	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$	1000			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\text{ }\mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 3\text{ A}$ $V_{GS} = 10\text{ V}$ $I_D = 3\text{ A}$ $T_c = 100\text{ °C}$		1.75	2 4	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	6			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 3\text{ A}$	4	5.5		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		2150	2800	pF
C_{oss}	Output Capacitance			260	330	pF
C_{rss}	Reverse Transfer Capacitance			105	130	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 500\text{ V}$ $I_D = 3\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		70 210	90 280	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 800\text{ V}$ $I_D = 6\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		180		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 400\text{ V}$ $I_D = 6\text{ A}$ $V_{GS} = 10\text{ V}$		125 15 55	150	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(voff)}$	Off-voltage Rise Time	$V_{DD} = 800\text{ V}$ $I_D = 6\text{ A}$		190	250	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		50	65	ns
t_c	Cross-over Time	(see test circuit, figure 5)		265	345	ns

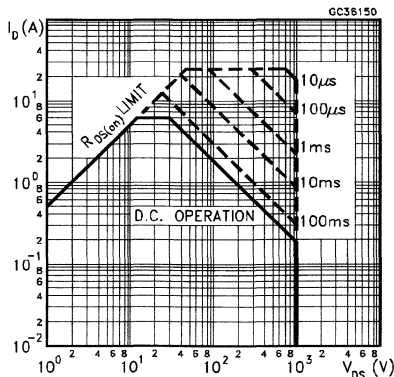
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				6 24	A A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 6\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 6\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		1100		ns
Q_{rr}	Reverse Recovery Charge			31		μ C
I_{RRM}	Reverse Recovery Current			57		A

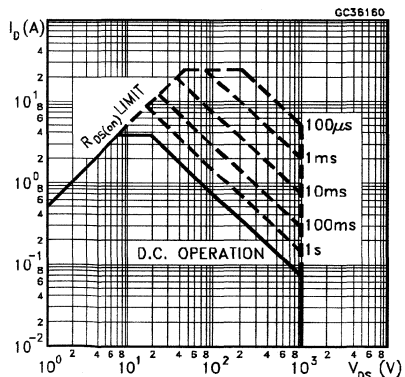
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

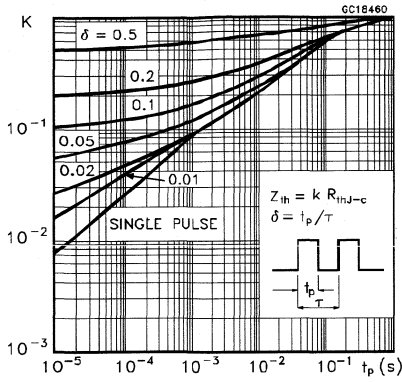
Safe Operating Areas For TO-218



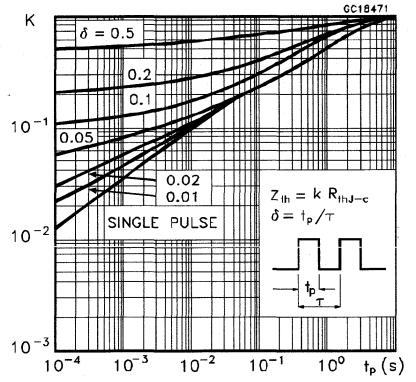
Safe Operating Areas For ISOWATT218



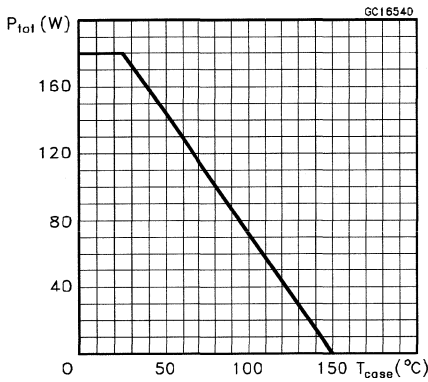
Thermal Impedance For TO-218



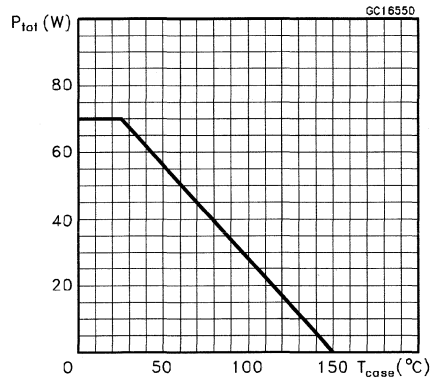
Thermal Impedance For ISOWATT218



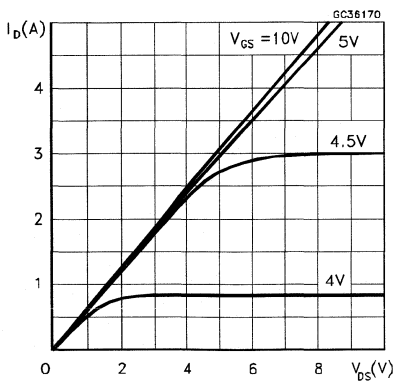
Derating Curve For TO-218



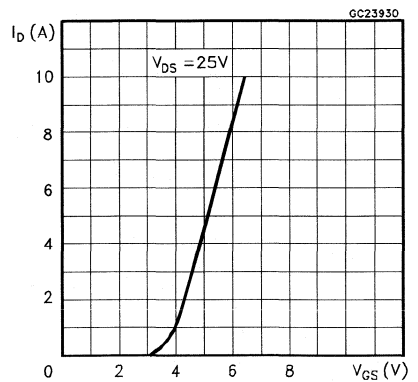
Derating Curve For ISOWATT218



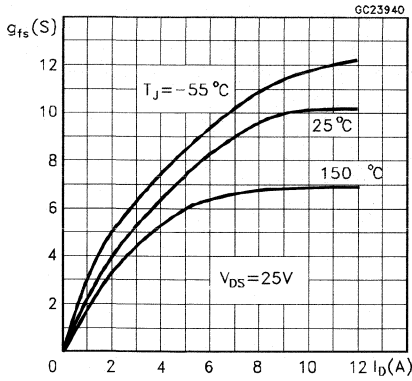
Output Characteristics



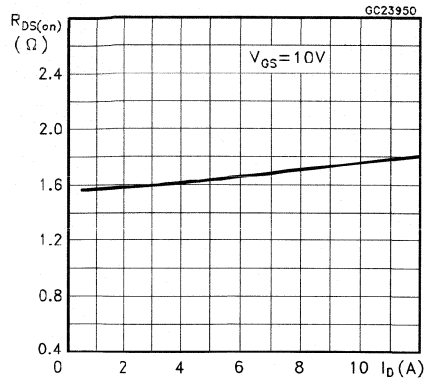
Transfer Characteristics



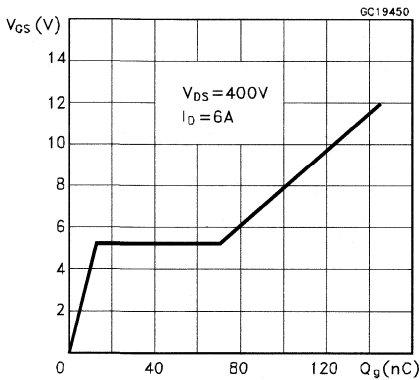
Transconductance



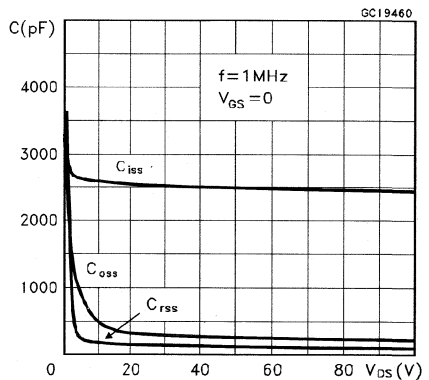
Static Drain-source On Resistance



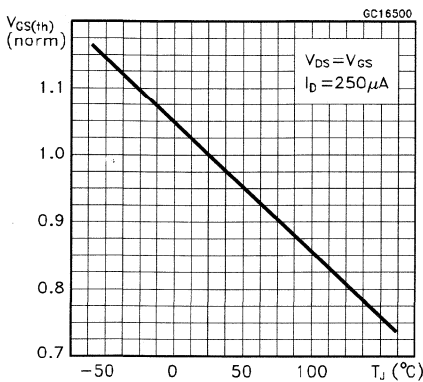
Gate Charge vs Gate-source Voltage



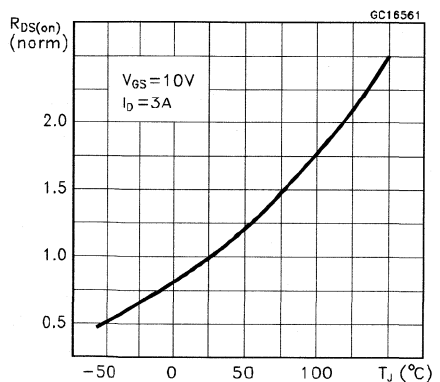
Capacitance Variations



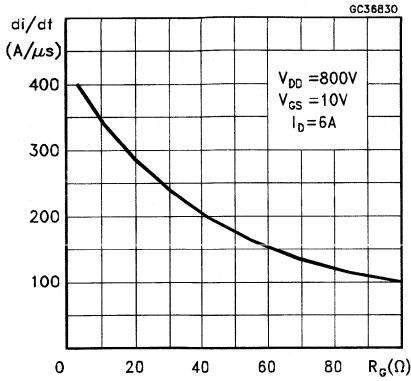
Normalized Gate Threshold Voltage vs Temperature



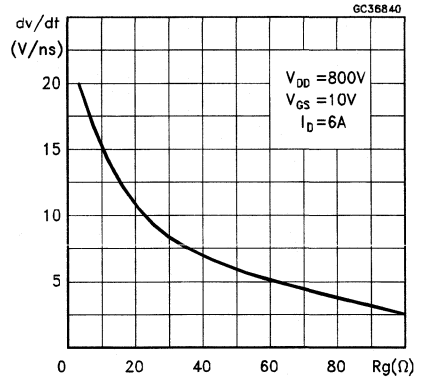
Normalized On Resistance vs Temperature



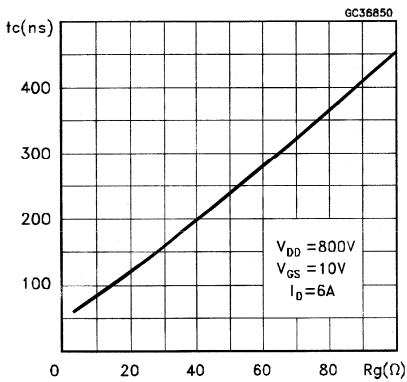
Turn-on Current Slope



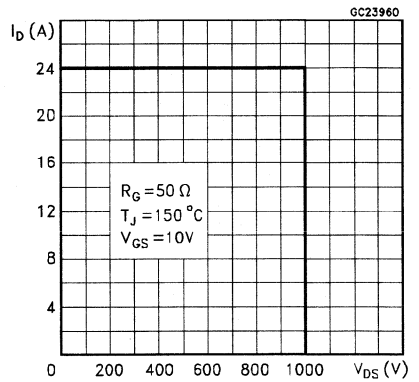
Turn-off Drain-source Voltage Slope



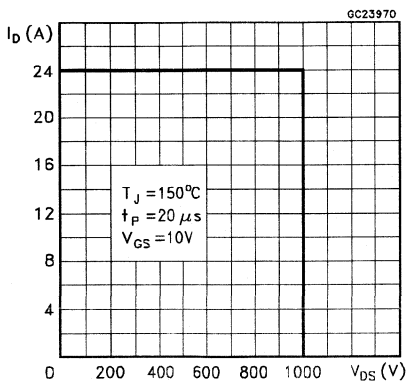
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

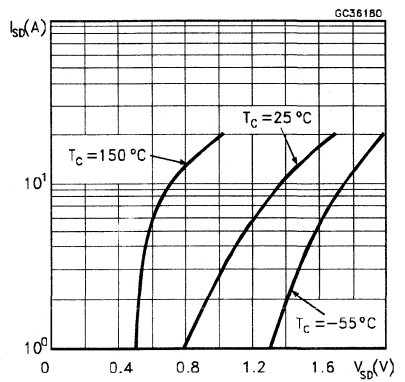


Fig. 1: Unclamped Inductive Load Test Circuits

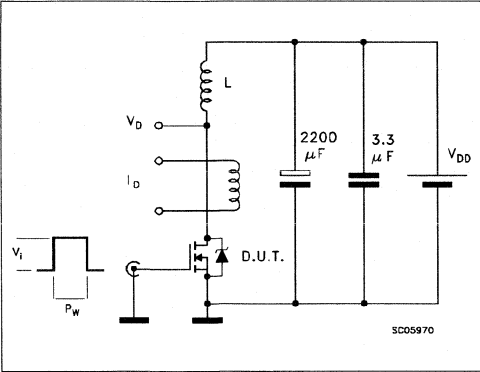


Fig. 2: Unclamped Inductive Waveforms

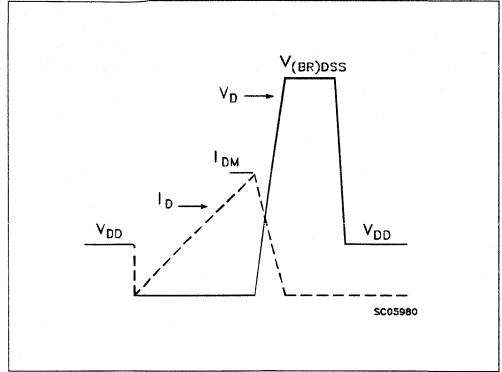


Fig. 3: Switching Times Test Circuits For Resistive Load

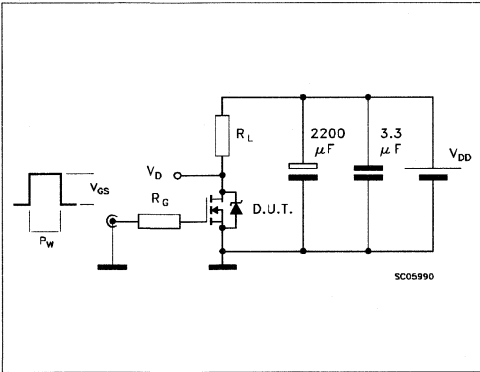


Fig. 4: Gate Charge Test Circuit

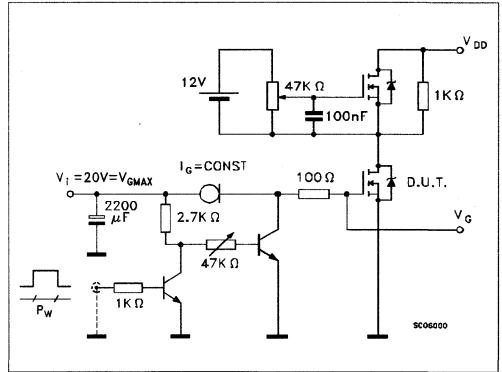
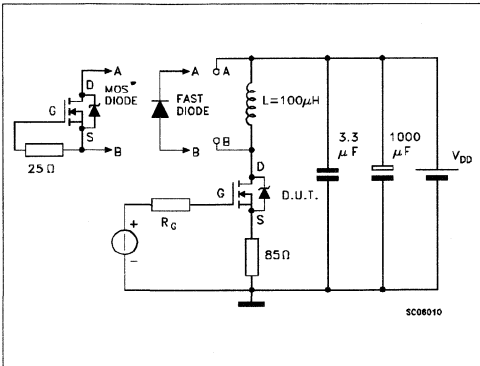


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



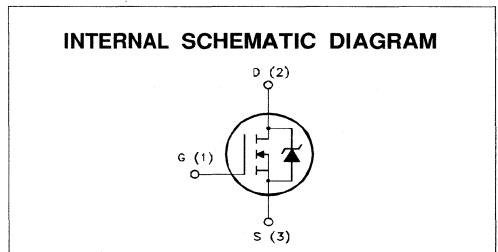
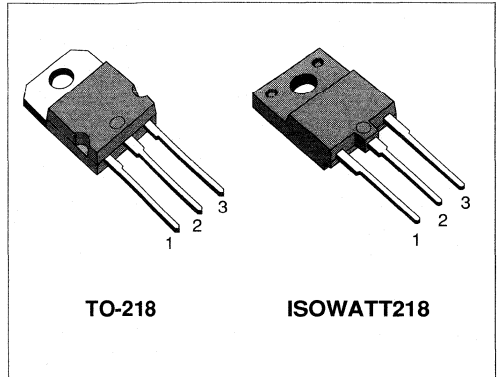
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STH7N90	900 V	< 1.4 Ω	7.5 A
STH7N90FI	900 V	< 1.4 Ω	4.5 A

- TYPICAL R_{DS(on)} = 1.05 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INPUT CAPACITANCE
- LOW GATE CHARGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CONSUMER AND INDUSTRIAL LIGHTING
- DC-AC INVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLY (UPS)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STH7N90	STH7N90FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	900		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	900		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	7.5	4.5	A
I _D	Drain Current (continuous) at T _c = 100 °C	4.7	2.8	A
I _{DM} (*)	Drain Current (pulsed)	35	35	A
P _{tot}	Total Dissipation at T _c = 25 °C	180	70	W
	Derating Factor	1.44	0.56	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	4000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _J	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-218	ISOWATT218	
R _{thj-case}	Thermal Resistance Junction-case	Max	0.69	1.78	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	30		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.1		°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	7.5	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	700	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	17	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	4	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	900			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 3.5 A V _{GS} = 10V I _D = 3.5 A T _c = 100°C		1.05	1.4 2.8	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	7.5			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 3.5 A	4	6.5		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		2100	2700	pF
C _{oss}	Output Capacitance			270	350	pF
C _{rss}	Reverse Transfer Capacitance			115	150	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 400\text{ V}$ $I_D = 4\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		90 280	120 350	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 640\text{ V}$ $I_D = 8\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		145		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 400\text{ V}$ $I_D = 8\text{ A}$ $V_{GS} = 10\text{ V}$		125 12 65	170	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$ t_f t_c	Off-voltage Rise Time Fall Time Cross-over Time	$V_{DD} = 640\text{ V}$ $I_D = 8\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		160 50 235	200 65 300	ns ns ns

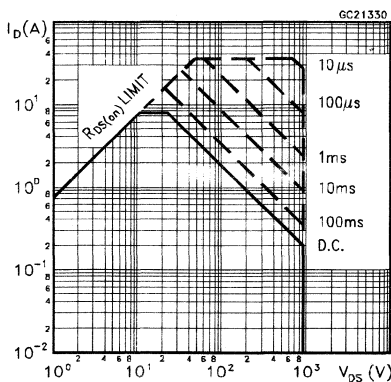
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				7.5 35	A A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 7.5\text{ A}$ $V_{GS} = 0$			2.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 7\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_R = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		900 24.8 55		ns μ C A

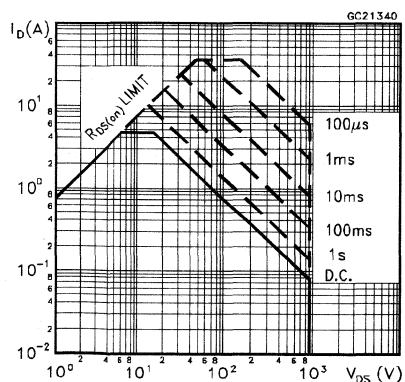
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

(•) Pulse width limited by safe operating area

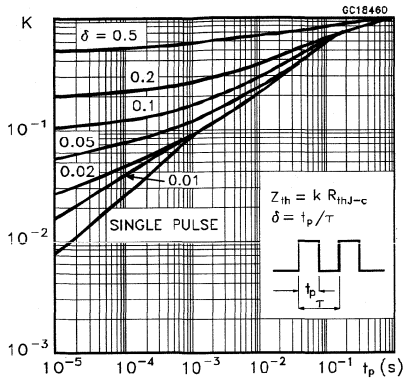
Safe Operating Areas For TO-218



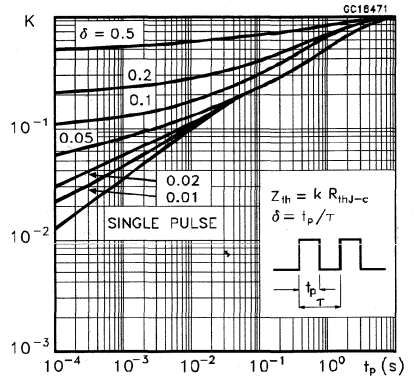
Safe Operating Areas For ISOWATT218



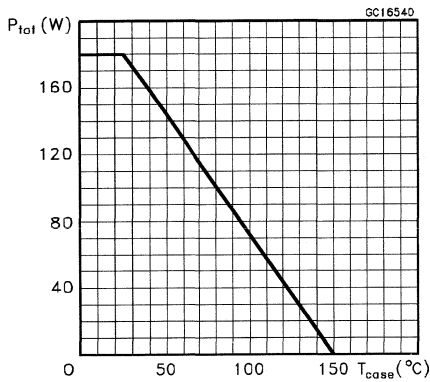
Thermal Impedance For TO-218



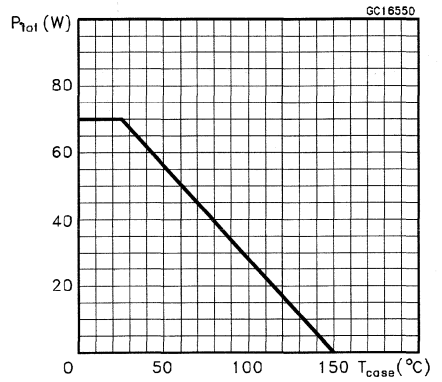
Thermal Impedance For ISOWATT218



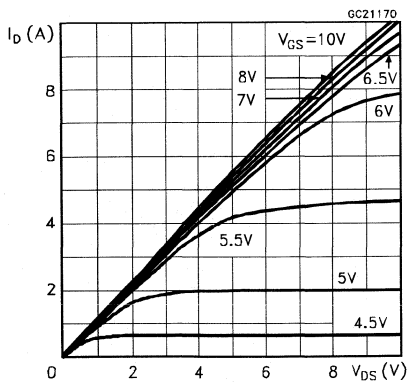
Derating Curve For TO-218



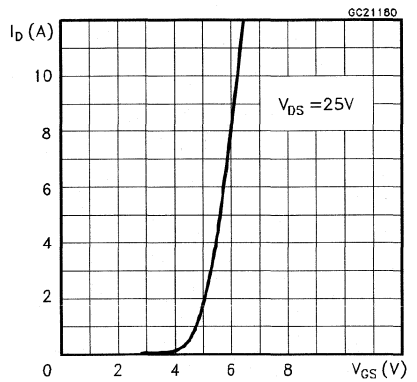
Derating Curve For ISOWATT218



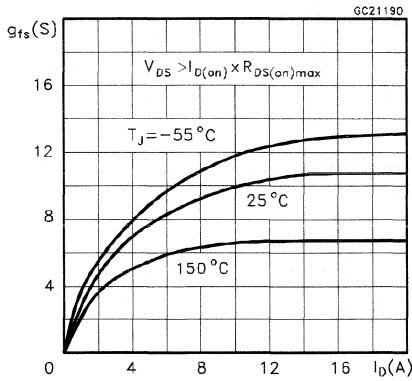
Output Characteristics



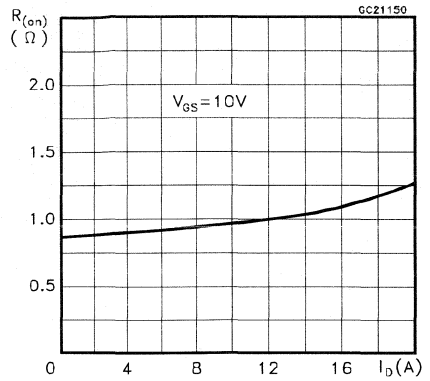
Transfer Characteristics



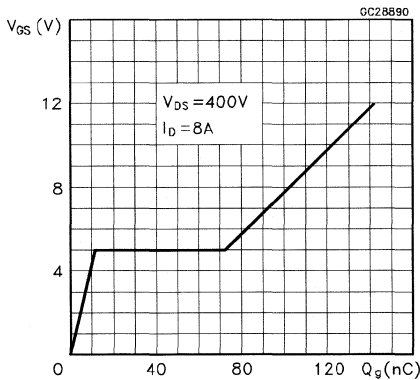
Transconductance



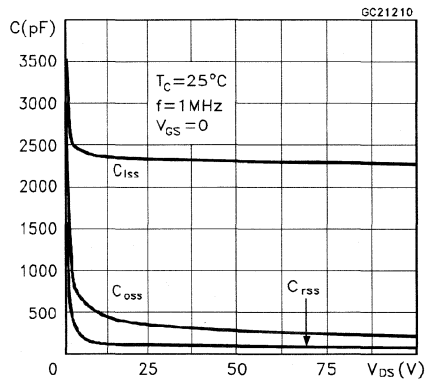
Static Drain-source On Resistance



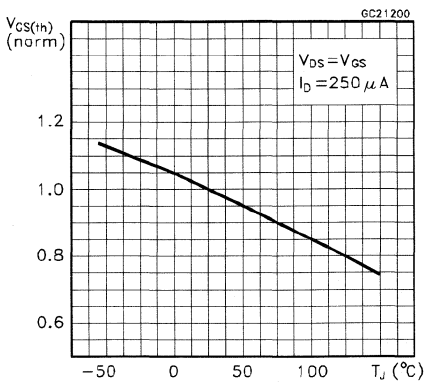
Gate Charge vs Gate-source Voltage



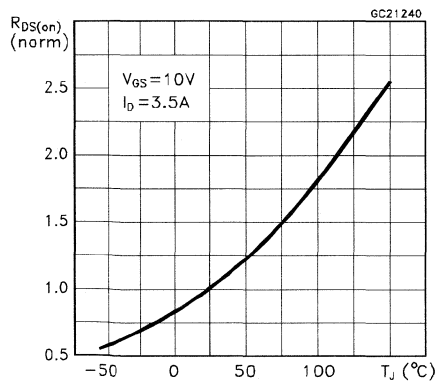
Capacitance Variations



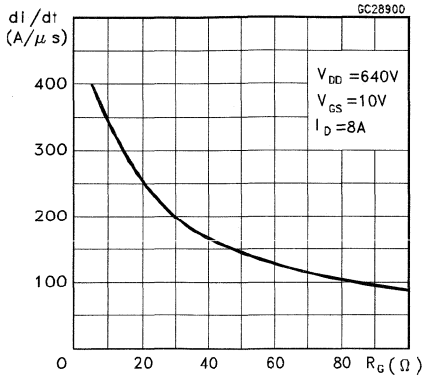
Normalized Gate Threshold Voltage vs Temperature



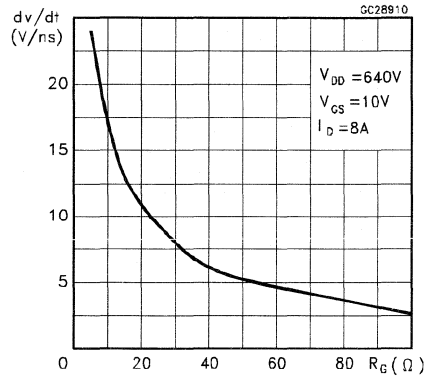
Normalized On Resistance vs Temperature



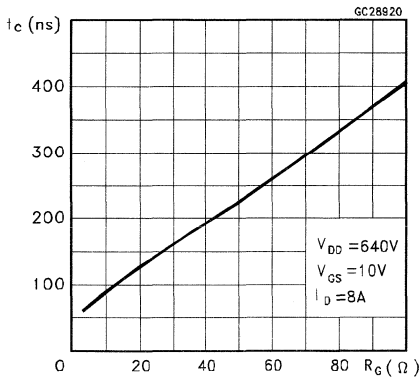
Turn-on Current Slope



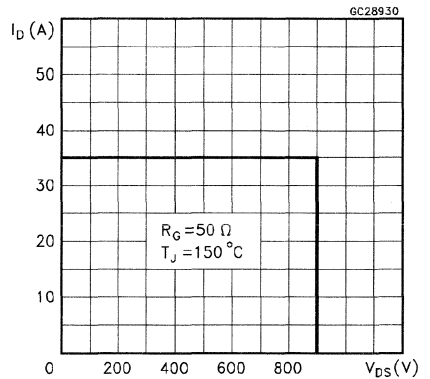
Turn-off Drain-source Voltage Slope



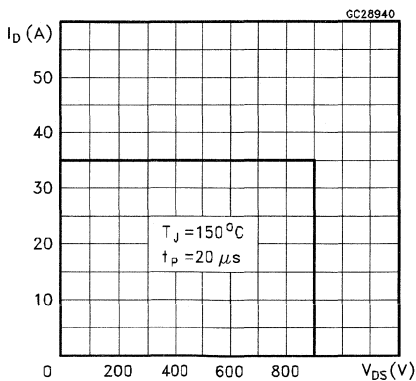
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

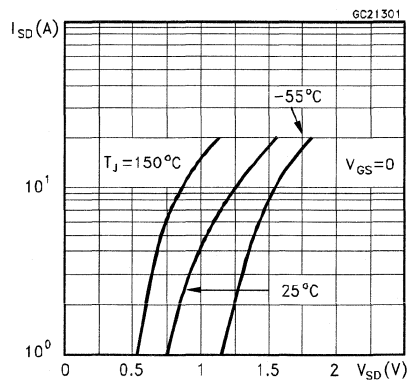


Fig. 1: Unclamped Inductive Load Test Circuits

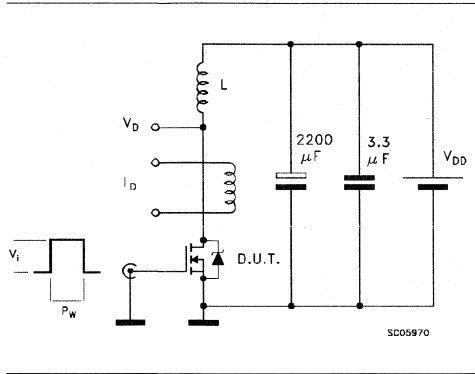


Fig. 2: Unclamped Inductive Waveforms

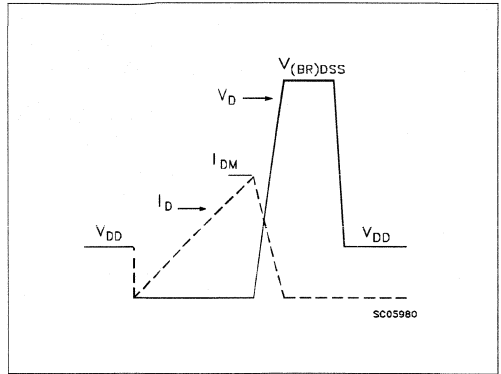


Fig. 3: Switching Times Test Circuits For resistive Load

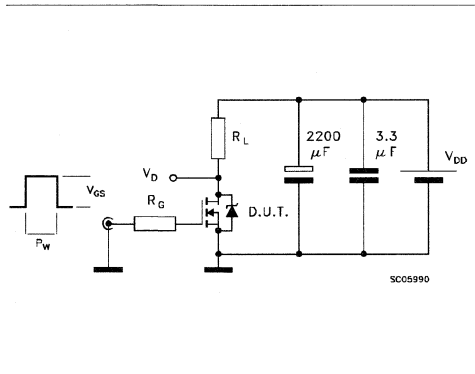


Fig. 4: Gate Charge Test Circuit

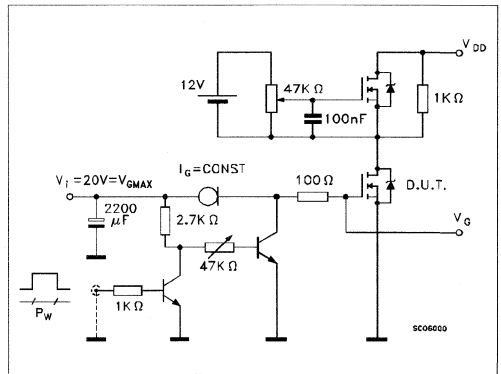
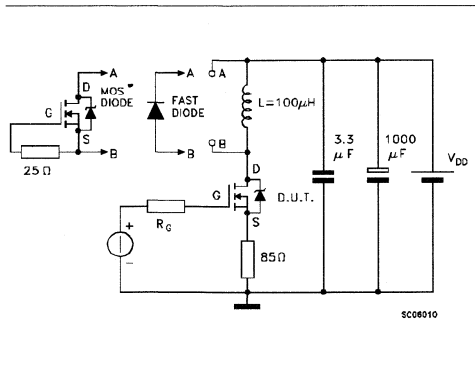


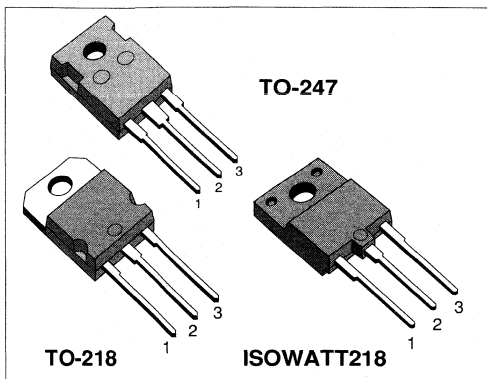
Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

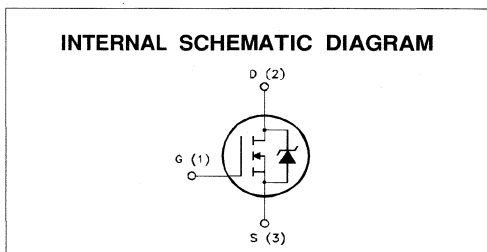
TYPE	V _{DSS}	R _{DS(on)}	I _D
STH8N80	800 V	< 1.2 Ω	8.2 A
STH8N80FI	800 V	< 1.2 Ω	5.1 A
STW8N80	800 V	< 1.2 Ω	8.2 A

TYPICAL R_{DS(on)} = 0.98 Ω
 AVALANCHE RUGGED TECHNOLOGY
 100% AVALANCHE TESTED
 REPETITIVE AVALANCHE DATA AT 100°C
 LOW INPUT CAPACITANCE
 LOW GATE CHARGE
 APPLICATION ORIENTED
 CHARACTERIZATION



APPLICATIONS

HIGH CURRENT, HIGH SPEED SWITCHING
 SWITCH MODE POWER SUPPLIES (SMPS)
 CONSUMER AND INDUSTRIAL LIGHTING
 DC-AC INVERTERS FOR WELDING
 EQUIPMENT AND UNINTERRUPTIBLE
 POWER SUPPLY (UPS)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STH/STW8N80	STH8N80FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	800		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	800		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	8.2	5.1	A
I _D	Drain Current (continuous) at T _c = 100 °C	5.1	3.2	A
I _{DM} (*)	Drain Current (pulsed)	35	35	A
P _{tot}	Total Dissipation at T _c = 25 °C	180	70	W
	Derating Factor	1.44	0.56	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	4000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _J	Max. Operating Junction Temperature	150		°C

* Pulse width limited by safe operating area

THERMAL DATA

			TO-218/TO-247	ISOWATT218	
R _{thj-case}	Thermal Resistance Junction-case	Max	0.69	1.78	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	30		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.1		°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	8.2	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	800	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	18	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	4.5	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	800			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 4 A V _{GS} = 10V I _D = 4 A T _c = 100°C		0.98	1.2 2.4	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} × R _{DS(on)max} V _{GS} = 10 V	8.2			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} × R _{DS(on)max} I _D = 4 A	4	7		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		2100	2700	pF
C _{oss}	Output Capacitance			270	350	pF
C _{rss}	Reverse Transfer Capacitance			115	150	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 400\text{ V}$ $I_D = 4\text{ A}$		90	120	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		280	350	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 640\text{ V}$ $I_D = 8\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		145		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 400\text{ V}$ $I_D = 8\text{ A}$ $V_{GS} = 10\text{ V}$		125	170	nC
Q_{gs}	Gate-Source Charge			12		nC
Q_{gd}	Gate-Drain Charge			65		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$	Off-voltage Rise Time	$V_{DD} = 640\text{ V}$ $I_D = 8\text{ A}$		160	200	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		50	65	ns
t_c	Cross-over Time	(see test circuit, figure 5)		235	300	ns

SOURCE DRAIN DIODE

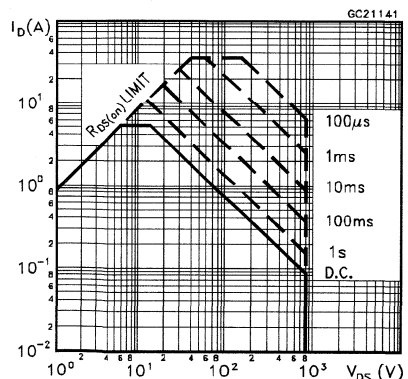
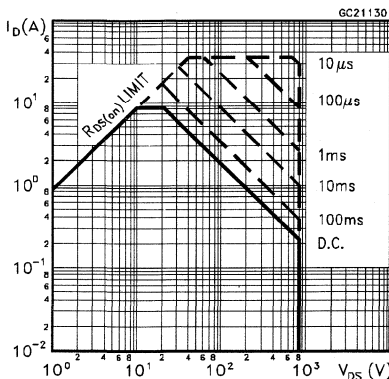
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				8.2	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				35	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 8.2\text{ A}$ $V_{GS} = 0$			2.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 8.2\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_R = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		900		ns
Q_{rr}	Reverse Recovery Charge	(see test circuit, figure 5)		24.8		μ C
I_{RRM}	Reverse Recovery Current			55		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

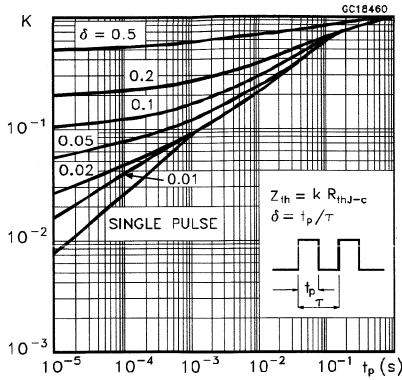
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas For TO-218 and TO-247

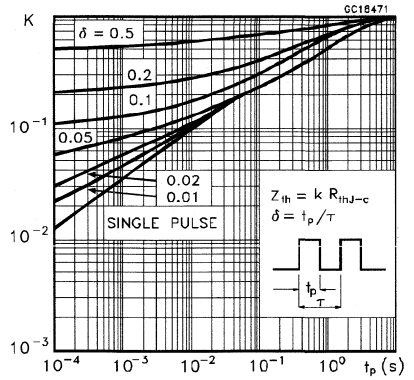
Safe Operating Areas For ISOWATT218



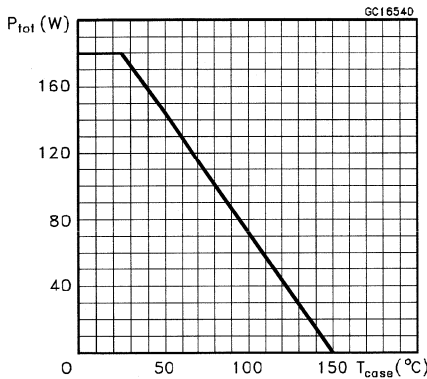
Thermal Impedance For TO-218 and TO-247



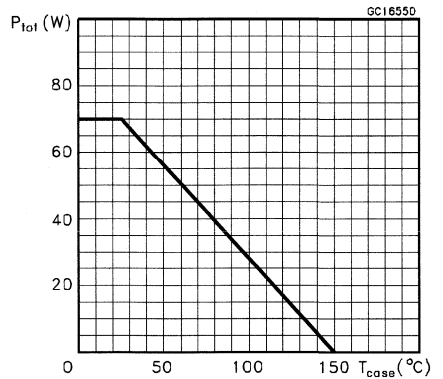
Thermal Impedance For ISOWATT218



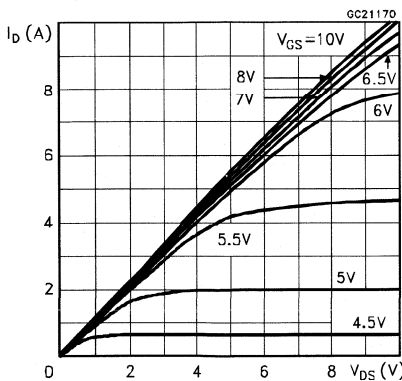
Derating Curve For TO-218 and TO-247



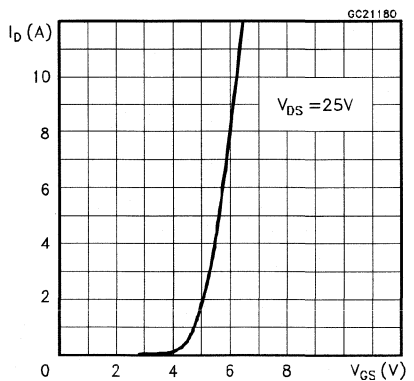
Derating Curve For ISOWATT218



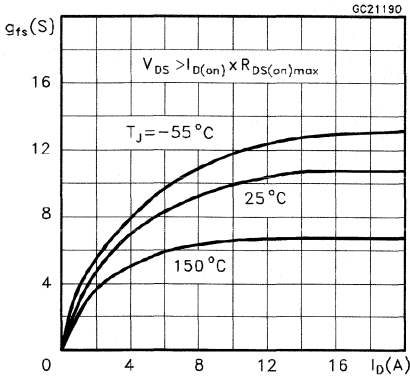
Output Characteristics



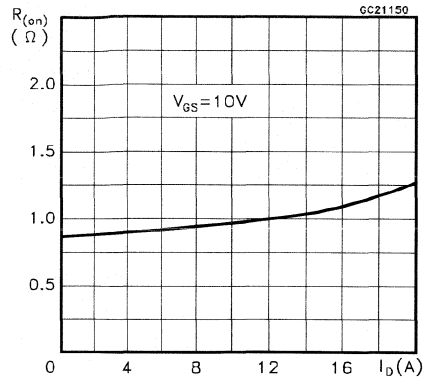
Transfer Characteristics



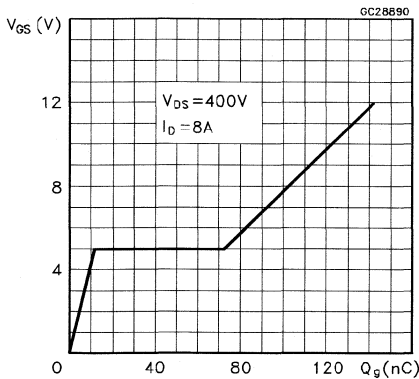
Transconductance



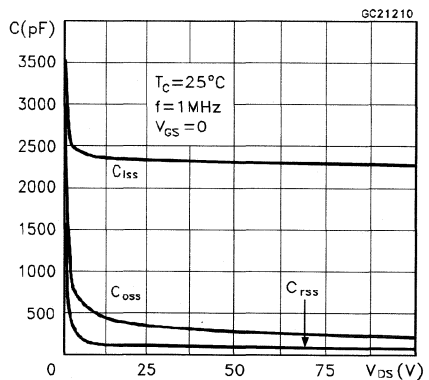
Static Drain-source On Resistance



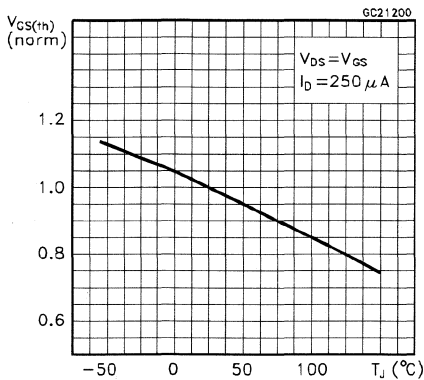
Gate Charge vs Gate-source Voltage



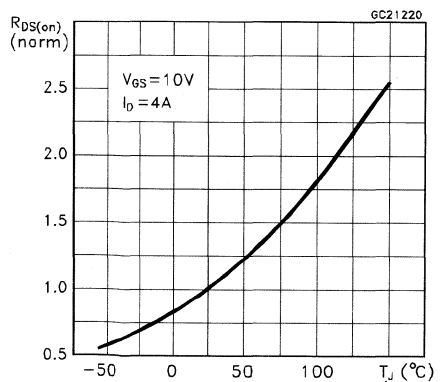
Capacitance Variations



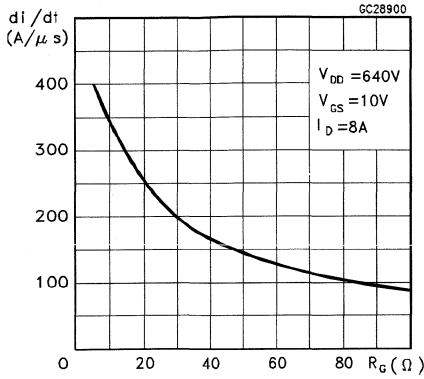
Normalized Gate Threshold Voltage vs Temperature



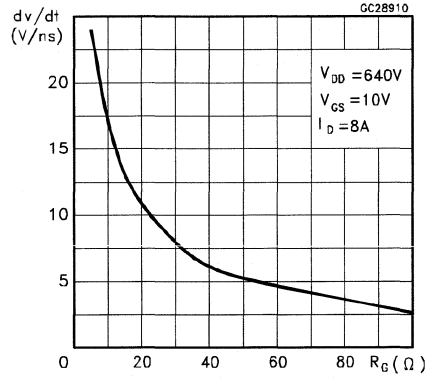
Normalized On Resistance vs Temperature



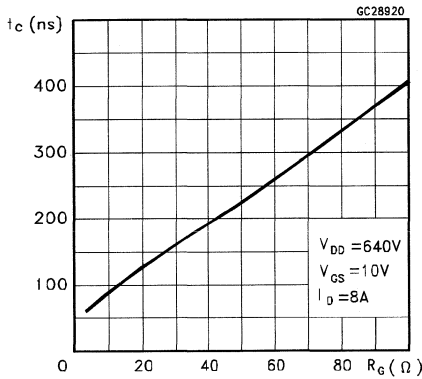
Turn-on Current Slope



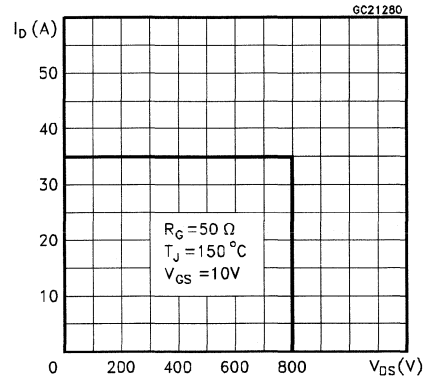
Turn-off Drain-source Voltage Slope



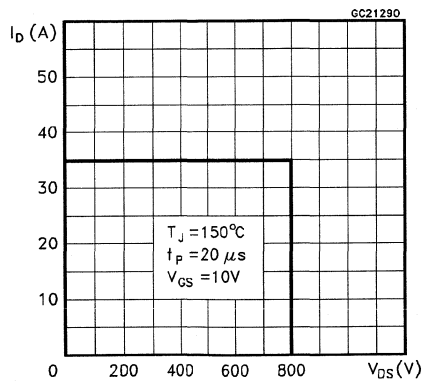
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

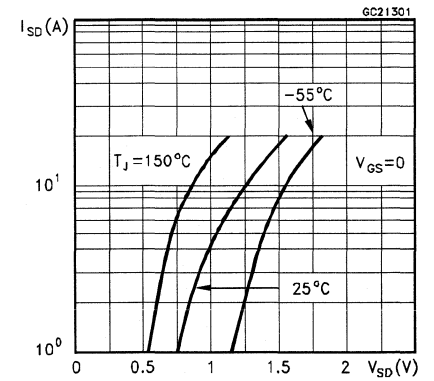


Fig. 1: Unclamped Inductive Load Test Circuits

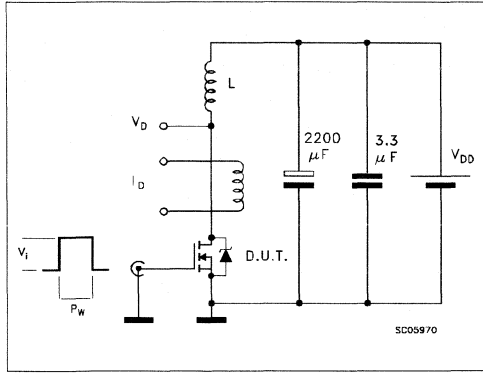


Fig. 2: Unclamped Inductive Waveforms

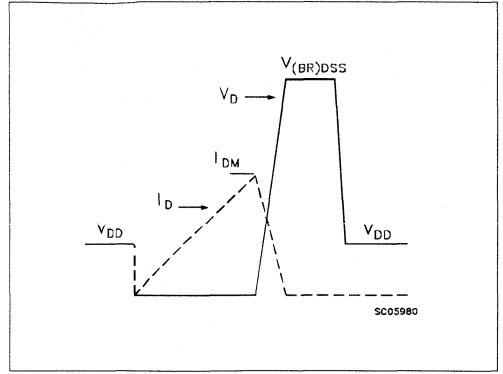


Fig. 3: Switching Times Test Circuits For Resistive Load

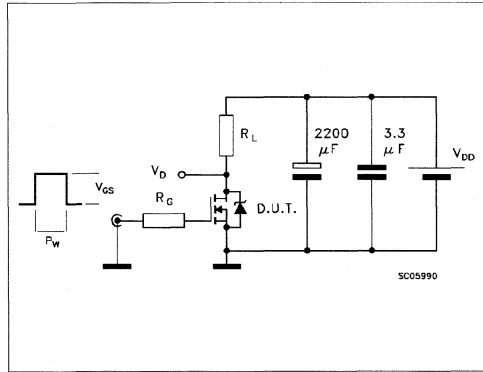


Fig. 4: Gate Charge Test Circuit

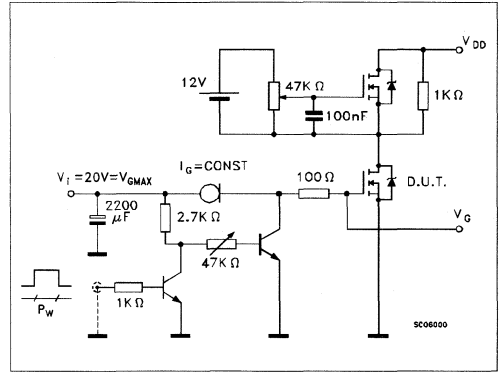
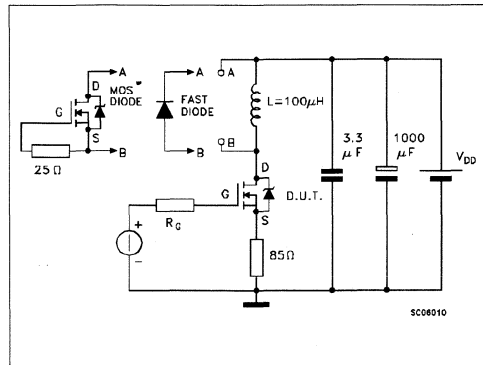


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



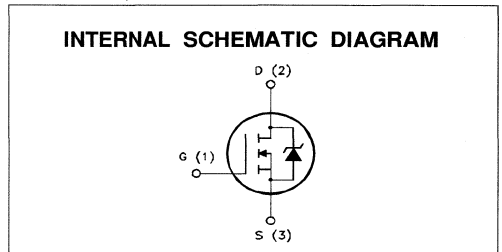
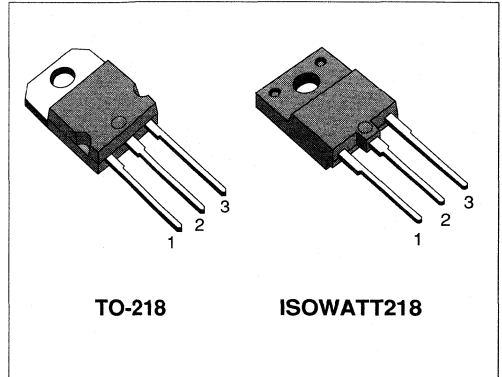
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

TYPE	V _{DSS}	R _{DS(on)}	I _D
STH9N80	800 V	< 1 Ω	9 A
STH9N80FI	800 V	< 1 Ω	5.6 A

- TYPICAL R_{DS(on)} = 0.87 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INPUT CAPACITANCE
- LOW GATE CHARGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CONSUMER AND INDUSTRIAL LIGHTING
- DC-AC INVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLY (UPS)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	VALUE		Unit
		STH9N80	STH9N80FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	800		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	800		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	9	5.6	A
I _D	Drain Current (continuous) at T _c = 100 °C	5.7	3.5	A
I _{DM} (*)	Drain Current (pulsed)	35	35	A
P _{tot}	Total Dissipation at T _c = 25 °C	180	70	W
	Derating Factor	1.44	0.56	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	4000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-218	ISOWATT218	
R _{thj-case}	Thermal Resistance Junction-case	Max	0.69	1.78	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	30		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.1		°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	9	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	1000	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	22	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	5	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	800			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 4.5 A V _{GS} = 10V I _D = 4.5 A T _c = 100°C		0.87	1 2	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	9			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 4.5 A	4	7.5		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		2100	2700	pF
C _{oss}	Output Capacitance			270	350	pF
C _{rss}	Reverse Transfer Capacitance			115	150	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 400\text{ V}$ $I_D = 4\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		90 280	120 350	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 640\text{ V}$ $I_D = 8\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		145		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 400\text{ V}$ $I_D = 8\text{ A}$ $V_{GS} = 10\text{ V}$		125 12 65	170	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 640\text{ V}$ $I_D = 8\text{ A}$		160	200	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		50	65	ns
t_c	Cross-over Time	(see test circuit, figure 5)		235	300	ns

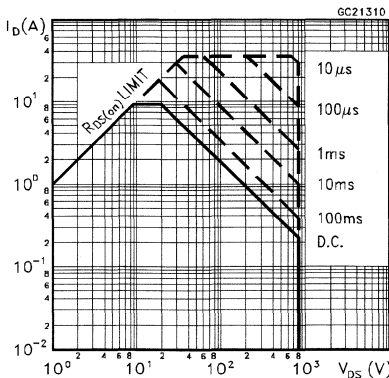
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				9	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				35	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 9\text{ A}$ $V_{GS} = 0$			2.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 9\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_R = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		900		ns
Q_{rr}	Reverse Recovery Charge			24.8		μ C
I_{RRM}	Reverse Recovery Current			55		A

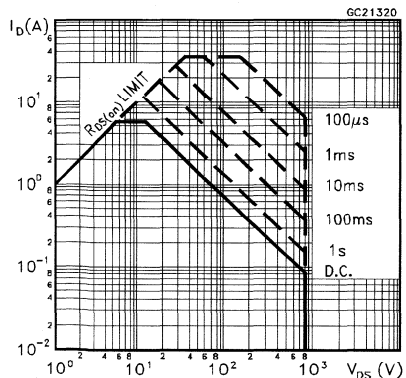
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

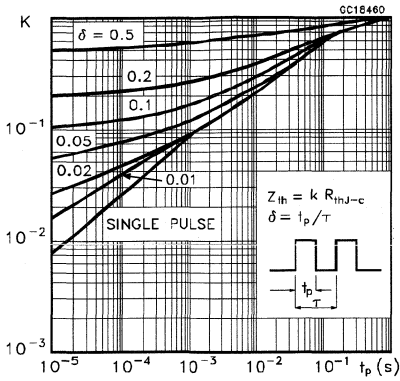
Safe Operating Areas For TO-218



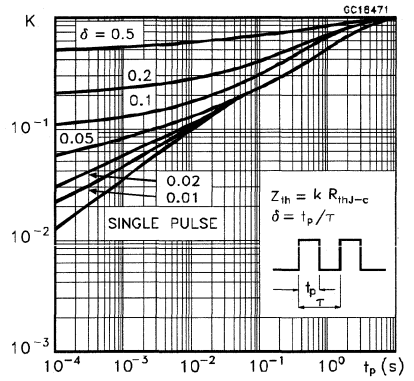
Safe Operating Areas For ISOWATT218



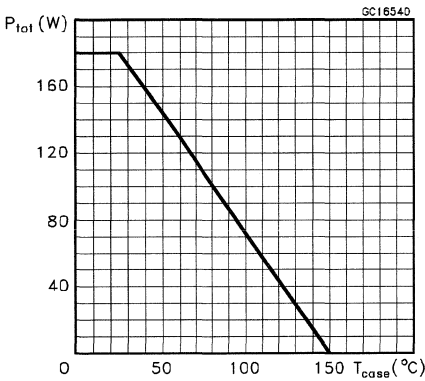
Thermal Impedance For TO-218



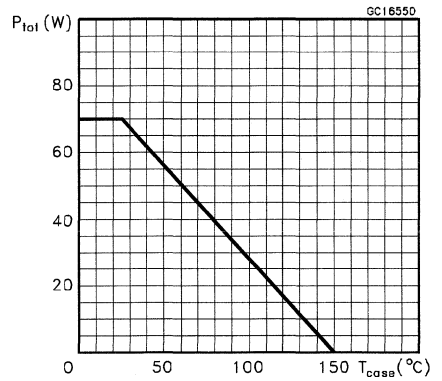
Thermal Impedance For ISOWATT218



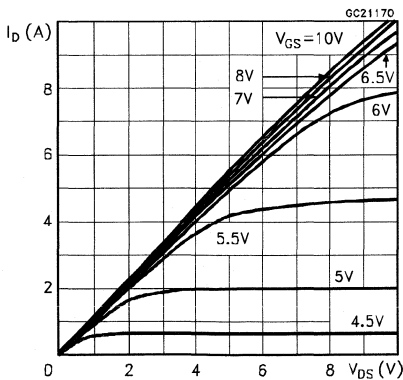
Derating Curve For TO-218



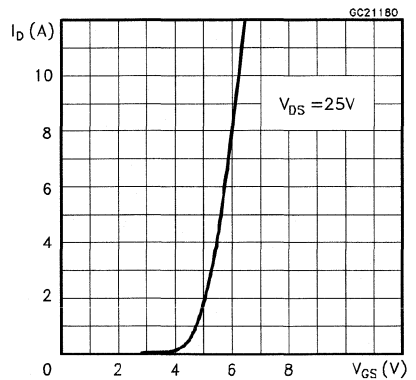
Derating Curve For ISOWATT218



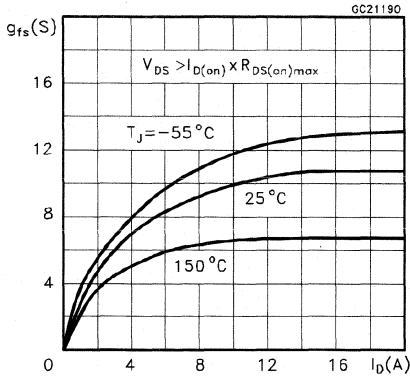
Output Characteristics



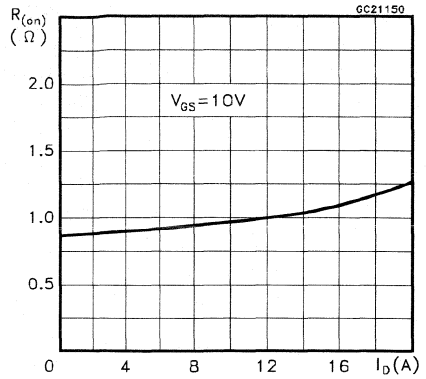
Transfer Characteristics



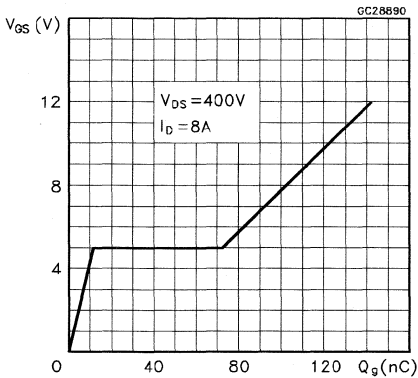
Transconductance



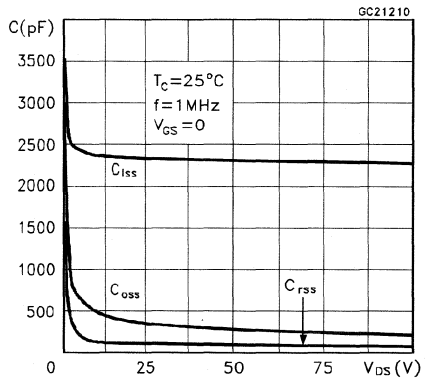
Static Drain-source On Resistance



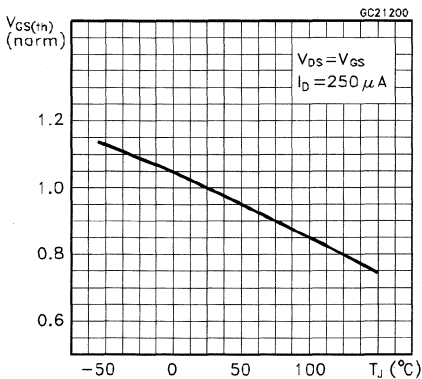
Gate Charge vs Gate-source Voltage



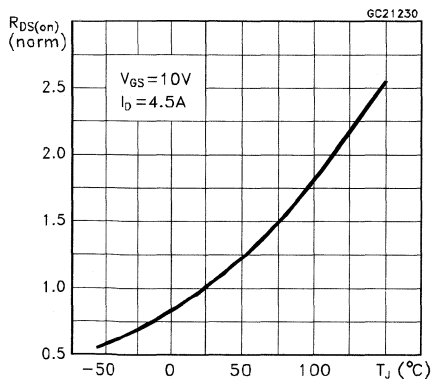
Capacitance Variations



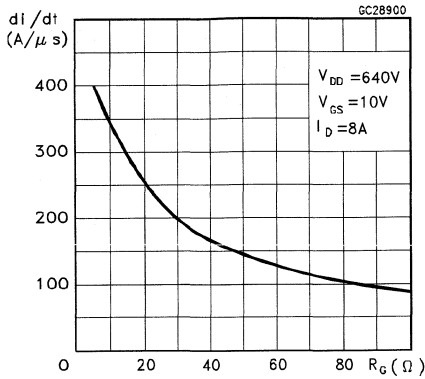
Normalized Gate Threshold Voltage vs Temperature



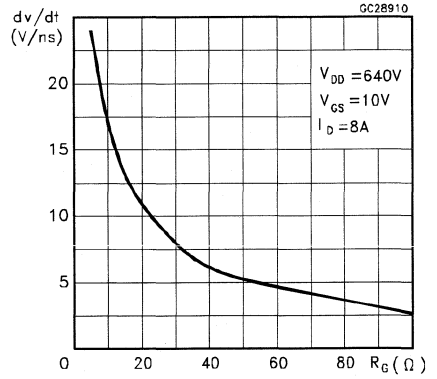
Normalized On Resistance vs Temperature



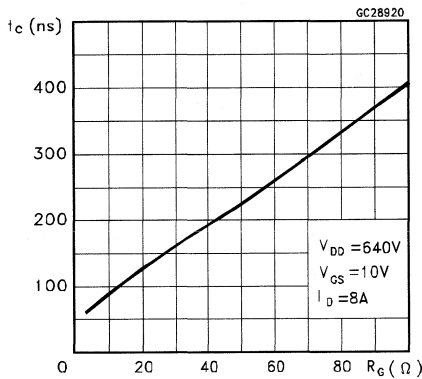
Turn-on Current Slope



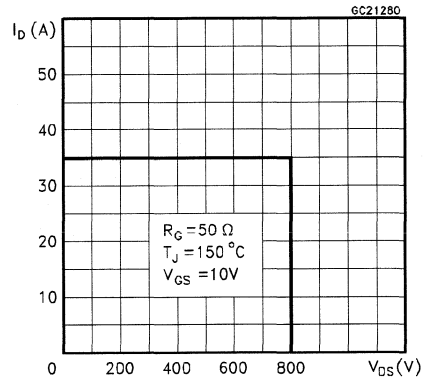
Turn-off Drain-source Voltage Slope



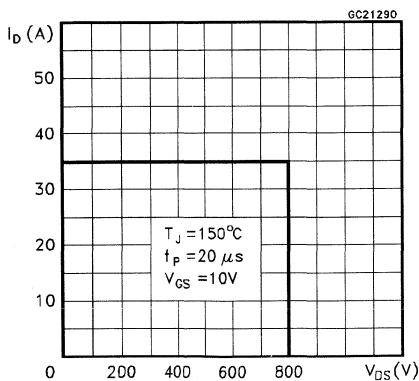
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

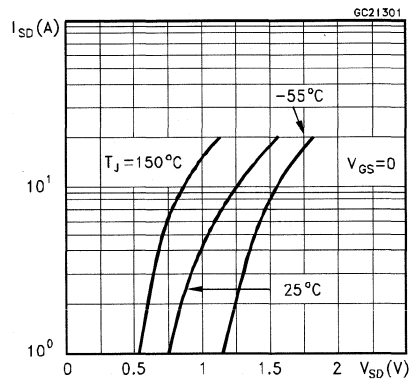


Fig. 1: Unclamped Inductive Load Test Circuits

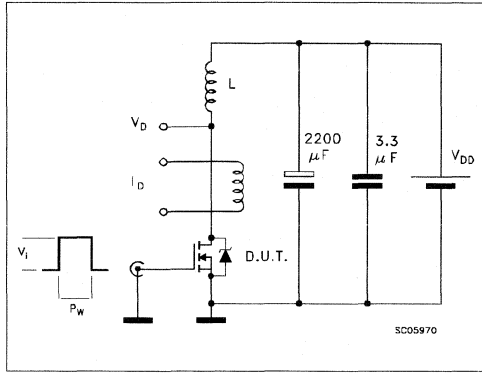


Fig. 2: Unclamped Inductive Waveforms

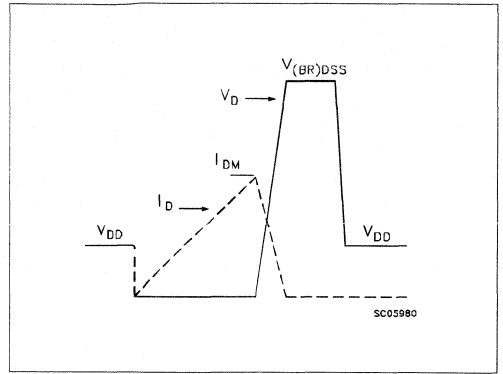


Fig. 3: Switching Times Test Circuits For Resistive Load

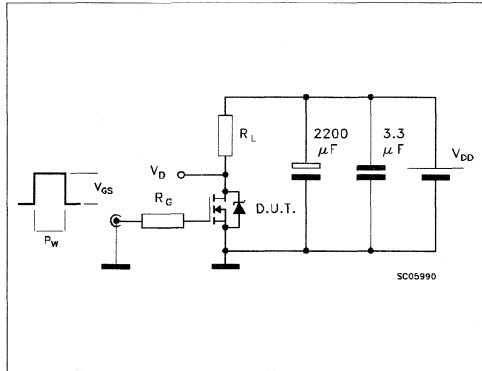


Fig. 4: Gate Charge Test Circuit

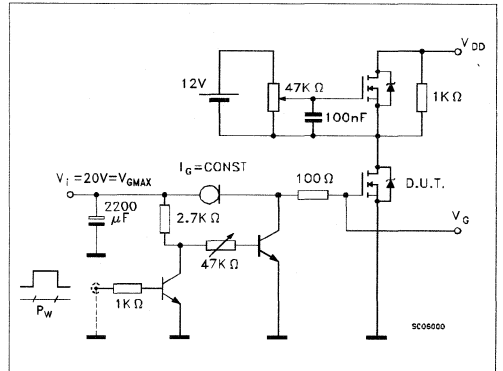
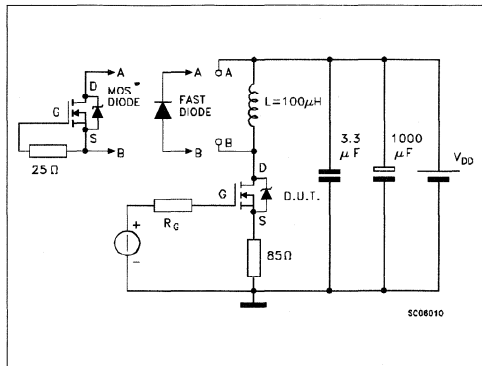


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

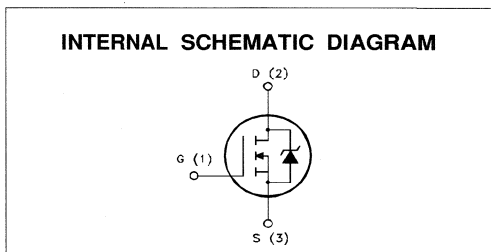
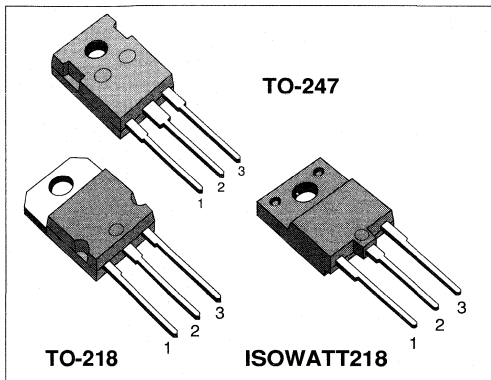
PRELIMINARY DATA

TYPE	V _{DSS}	R _{DS(on)}	I _D
STH12N60	600 V	< 0.6 Ω	12 A
STH12N60FI	600 V	< 0.6 Ω	7 A
STW12N60	600 V	< 0.6 Ω	12 A

- TYPICAL R_{DS(on)} = 0.47 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INPUT CAPACITANCE
- LOW GATE CHARGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	VALUE		Unit
		STH/STW12N60	STH12N60FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	600		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	600		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	12	7	A
I _D	Drain Current (continuous) at T _c = 100 °C	7.5	4	A
I _{DM} (*)	Drain Current (pulsed)	48	28	A
P _{tot}	Total Dissipation at T _c = 25 °C	180	70	W
	Derating Factor	1.44	0.56	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	4000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-218/TO-247	ISOWATT218	
R _{thj-case}	Thermal Resistance Junction-case	Max	0.69	1.78	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	30		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.1		°C/W
T _I	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	12	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	550	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	14	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	7.2	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	600			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 6 A V _{GS} = 10V I _D = 6 A T _c = 100°C		0.47	0.6 1.2	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	12			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 6 A	5	7.8		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		1900	2500	pF
C _{oss}	Output Capacitance			300	390	pF
C _{rss}	Reverse Transfer Capacitance			145	190	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 300\text{ V}$ $I_D = 6\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		25 85	35 115	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 480\text{ V}$ $I_D = 12\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		430		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 400\text{ V}$ $I_D = 12\text{ A}$ $V_{GS} = 10\text{ V}$		118 15 70	155	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 480\text{ V}$ $I_D = 12\text{ A}$		105	140	ns
t_f	Fall Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		35	48	ns
t_c	Cross-over Time			145	190	ns

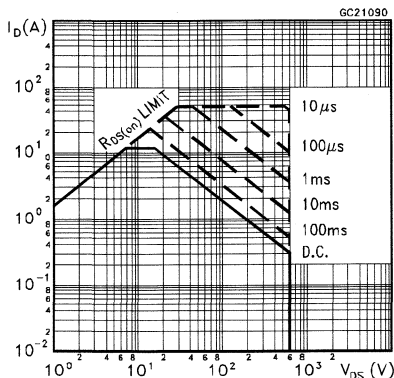
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				12	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				48	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 12\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 12\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_R = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		730		ns
Q_{rr}	Reverse Recovery Charge			15.3		μ C
I_{RRM}	Reverse Recovery Current			42		A

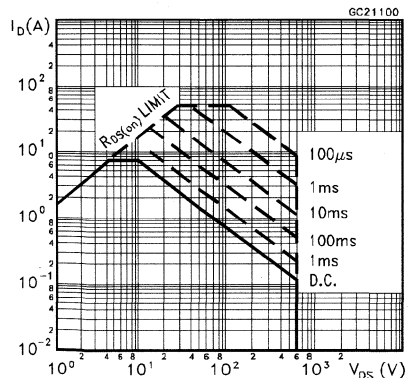
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

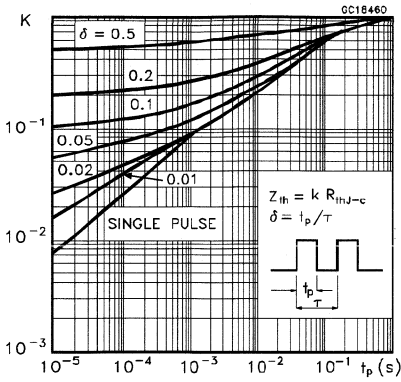
Safe Operating Areas For TO-218 and TO-247



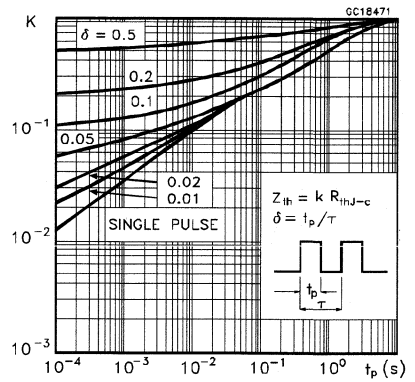
Safe Operating Areas For ISOWATT218



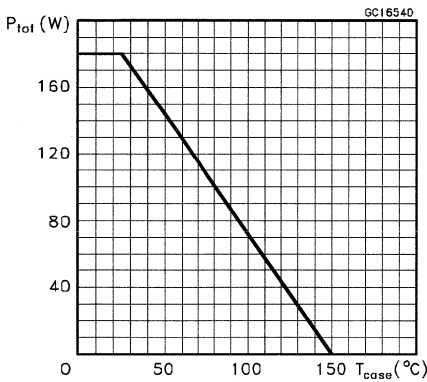
Thermal Impedance For TO-218 and TO-247



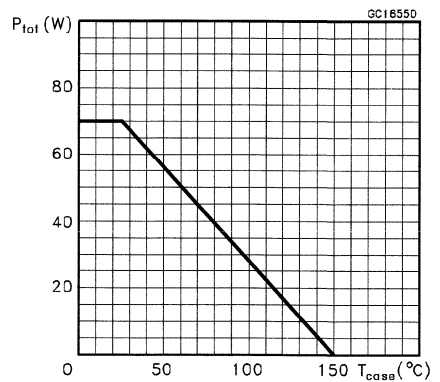
Thermal Impedance For ISOWATT218



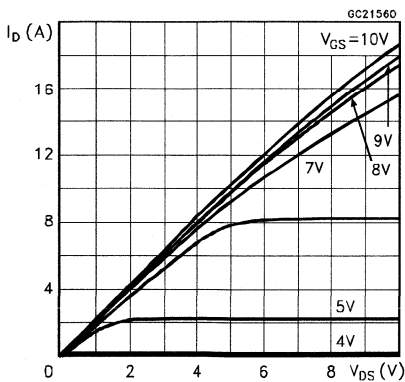
Derating Curve For TO-218 and TO-247



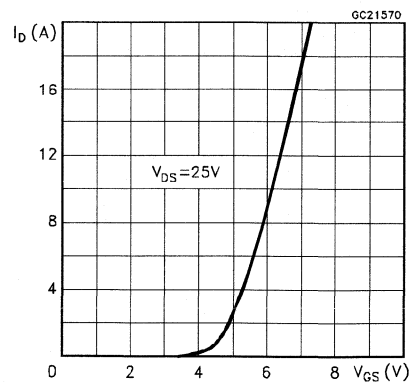
Derating Curve For ISOWATT218



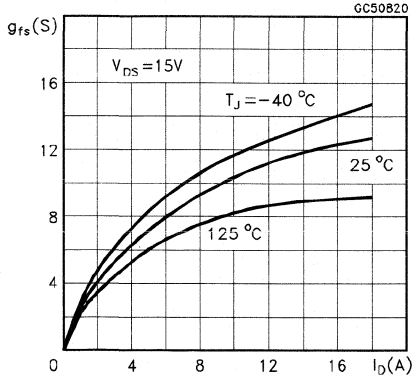
Output Characteristics



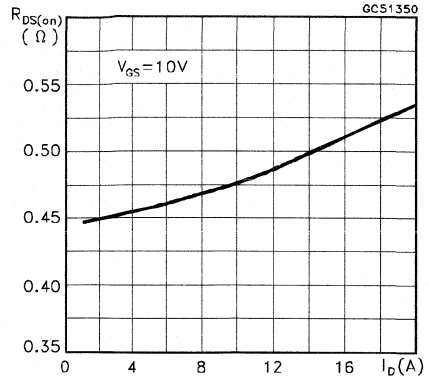
Transfer Characteristics



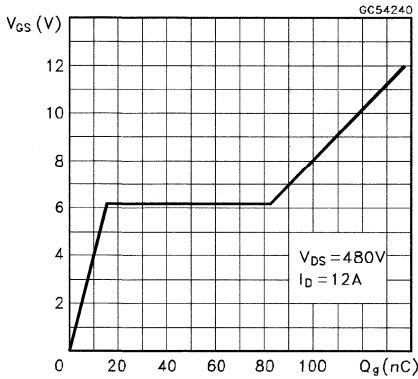
Transconductance



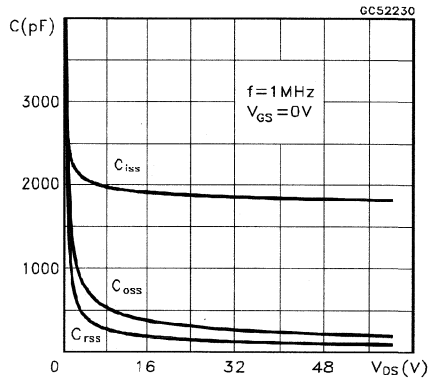
Static Drain-source On Resistance



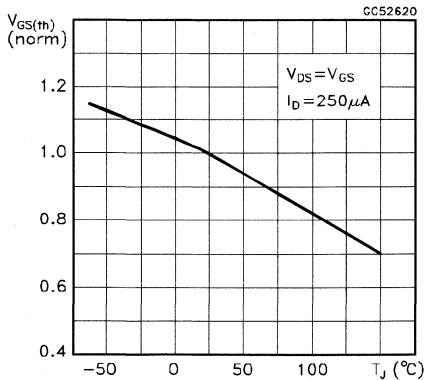
Gate Charge vs Gate-source Voltage



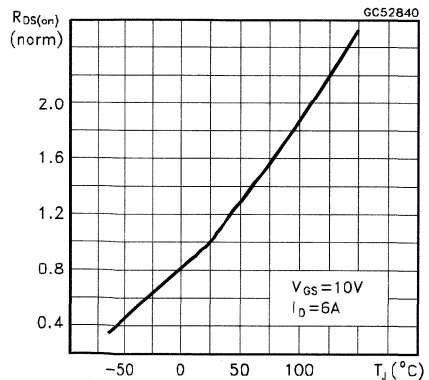
Capacitance Variations



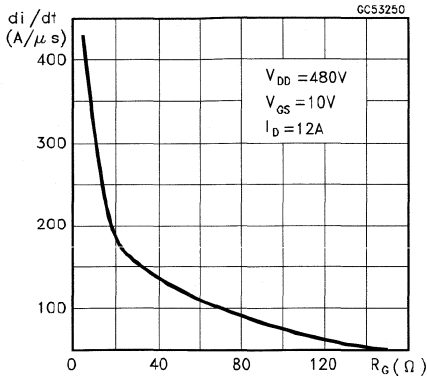
Normalized Gate Threshold Voltage vs Temperature



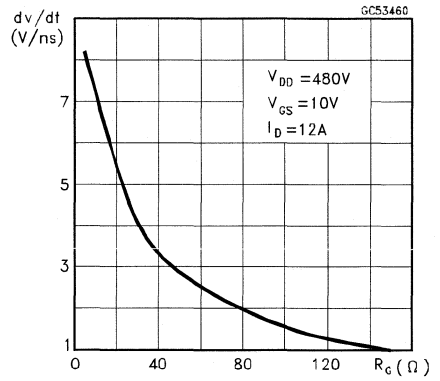
Normalized On Resistance vs Temperature



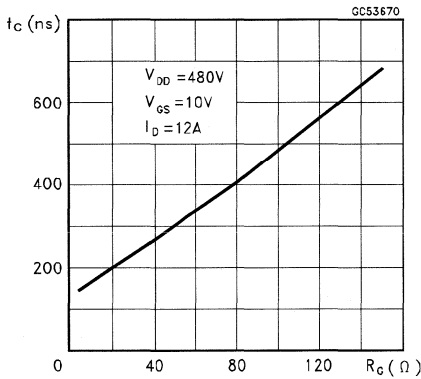
Turn-on Current Slope



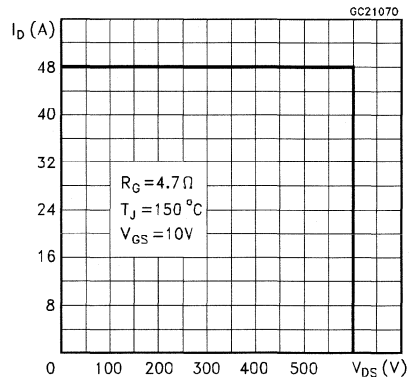
Turn-off Drain-source Voltage Slope



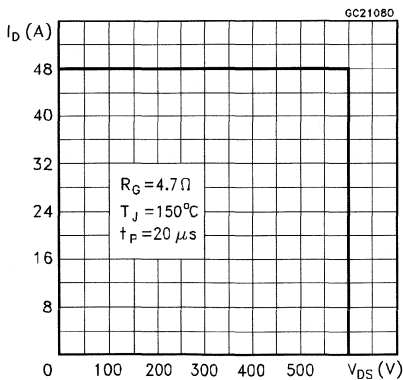
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

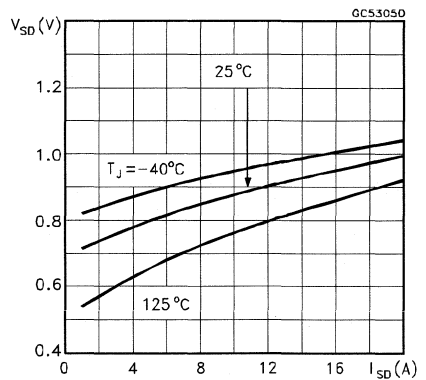


Fig. 1: Unclamped Inductive Load Test Circuits

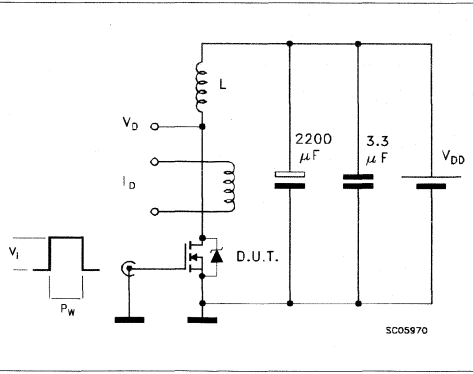


Fig. 2: Unclamped Inductive Waveforms

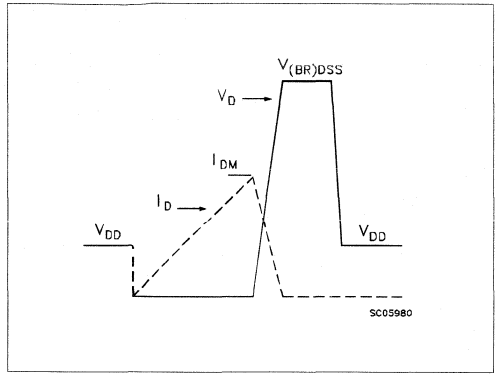


Fig. 3: Switching Times Test Circuits For Resistive Load

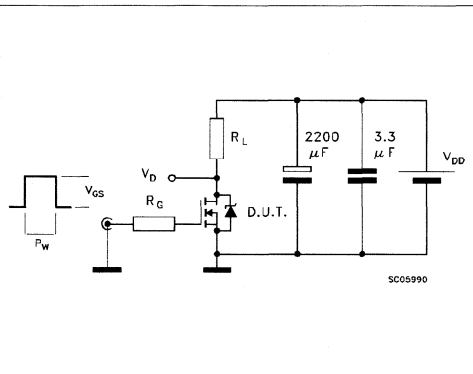


Fig. 4: Gate Charge Test Circuit

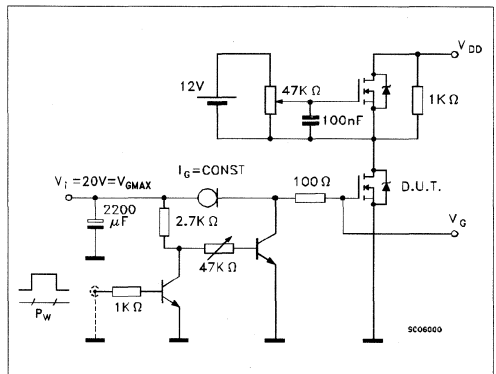
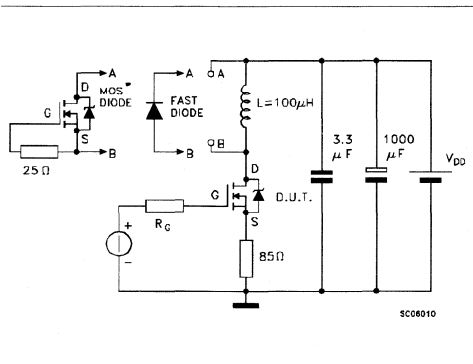


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



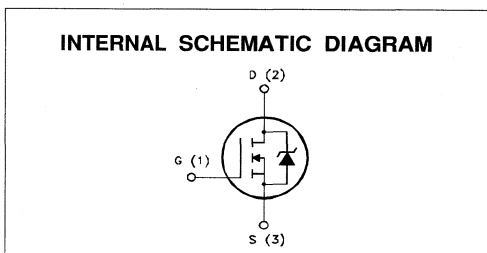
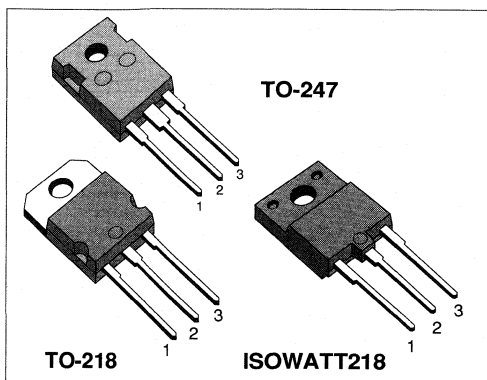
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STH14N50	500 V	< 0.45 Ω	14.1 A
STH14N50FI	500 V	< 0.45 Ω	8.8 A
STW14N50	500 V	< 0.45 Ω	14.1 A

- TYPICAL R_{DS(on)} = 0.34 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- REDUCED GATE CHARGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STH/STW14N50	STH14N50FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	500		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	500		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	14.1	8.8	A
I _D	Drain Current (continuous) at T _c = 100 °C	8.8	5.5	A
I _{DM} (*)	Drain Current (pulsed)	60	60	A
P _{tot}	Total Dissipation at T _c = 25 °C	180	70	W
	Derating Factor	1.44	0.56	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	4000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-218/TO-247	ISOWATT218	
R _{thj-case}	Thermal Resistance Junction-case	Max	0.69	1.78	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	30		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.1		°C/W
T _I	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	14.1	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	800	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	26	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	8.8	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	500			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 7.5 A V _{GS} = 10V I _D = 7.5 A T _c = 100°C		0.34	0.45 0.9	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} × R _{DS(on)max} V _{GS} = 10 V	14.1			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} × R _{DS(on)max} I _D = 7.5 A	8.5	11.2		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		2350	3000	pF
C _{oss}	Output Capacitance			340	440	pF
C _{rss}	Reverse Transfer Capacitance			75	100	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 210\text{ V}$ $I_D = 7\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		60 55	80 70	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 400\text{ V}$ $I_D = 15\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		270		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 400\text{ V}$ $I_D = 15\text{ A}$ $V_{GS} = 10\text{ V}$		90 12 48	110	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(voff)}$ t_f	Off-voltage Rise Time Fall Time	$V_{DD} = 400\text{ V}$ $I_D = 15\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$		35 45	45 60	ns ns
t_c	Cross-over Time	(see test circuit, figure 5)		65	85	ns

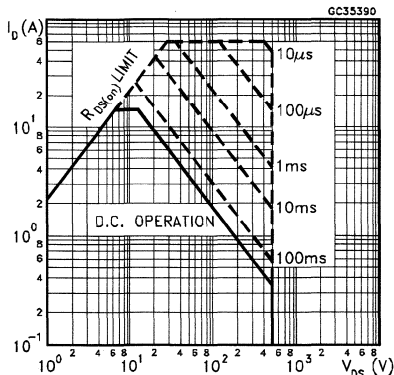
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				14.1 60	A A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 14\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 15\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		630		ns
Q_{rr}	Reverse Recovery Charge			10.7		μ C
I_{RRM}	Reverse Recovery Current			34		A

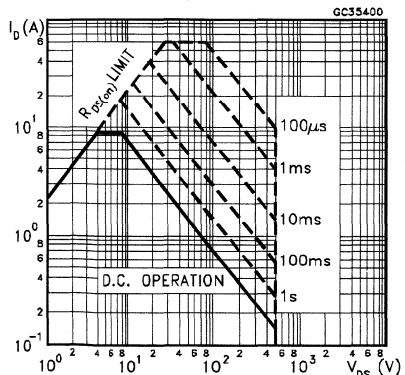
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

(•) Pulse width limited by safe operating area

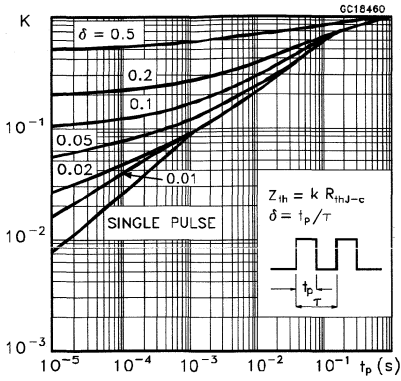
Safe Operating Areas For TO-218 and TO-247



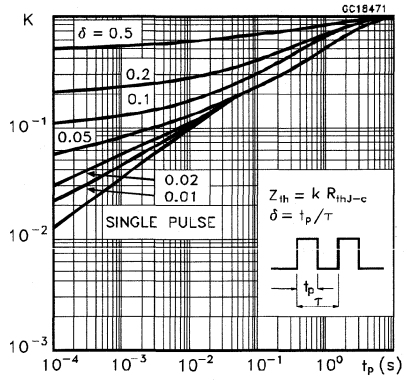
Safe Operating Areas For ISOWATT218



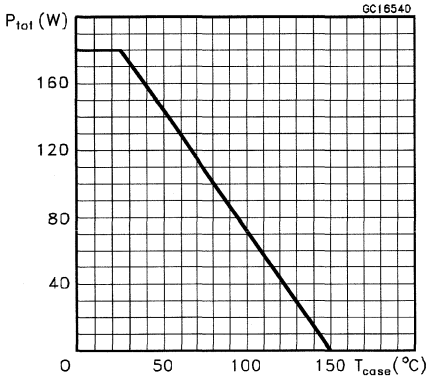
Thermal Impedance For TO218 and TO-247



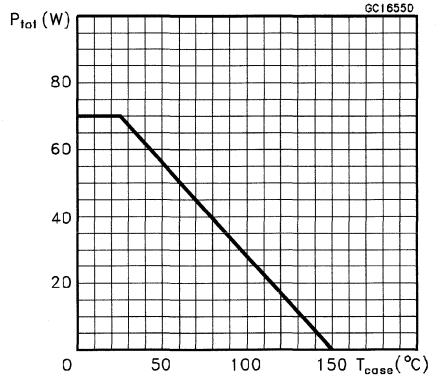
Thermal Impedance For ISOWATT218



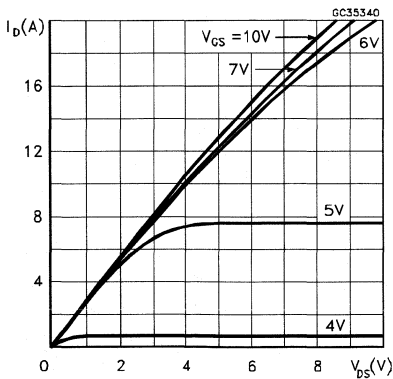
Derating Curve For TO-218 and TO-247



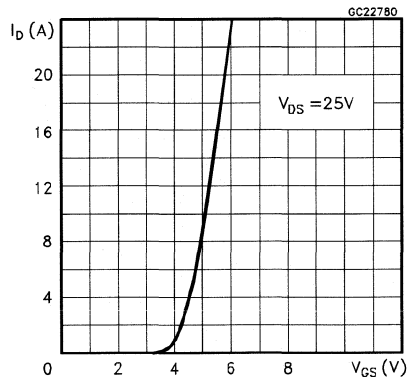
Derating Curve For ISOWATT218



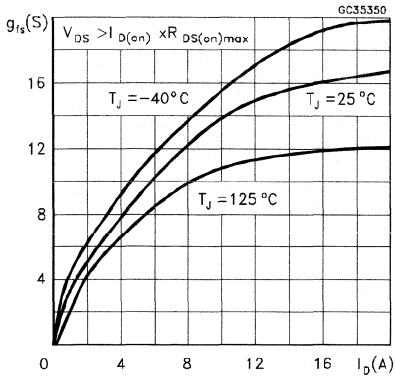
Output Characteristics



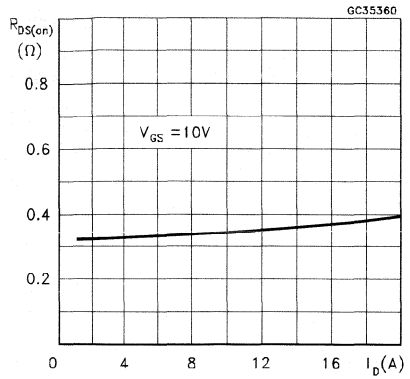
Transfer Characteristics



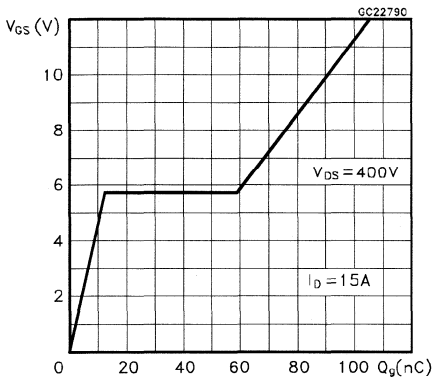
Transconductance



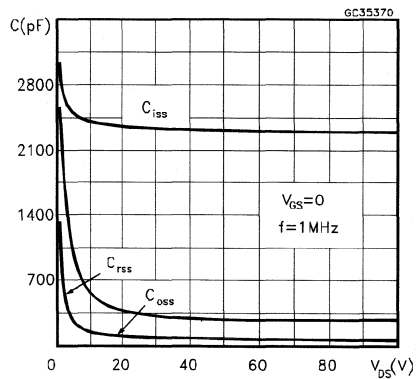
Static Drain-source On Resistance



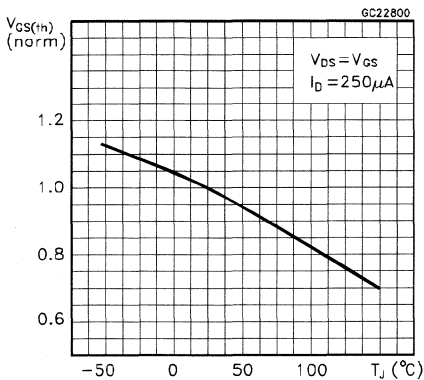
Gate Charge vs Gate-source Voltage



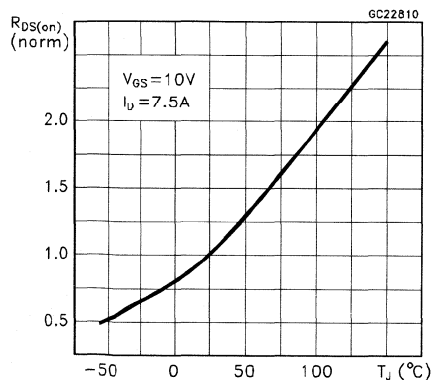
Capacitance Variations



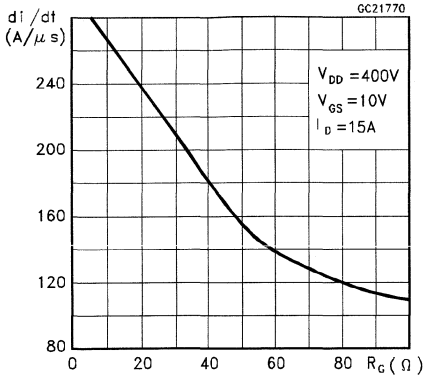
Normalized Gate Threshold Voltage vs Temperature



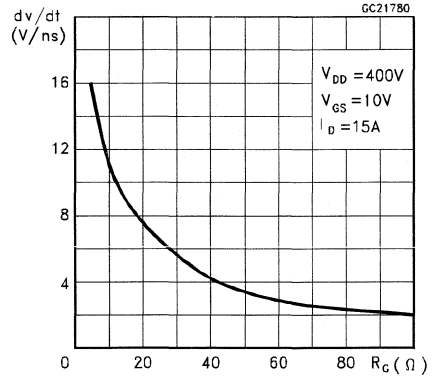
Normalized On Resistance vs Temperature



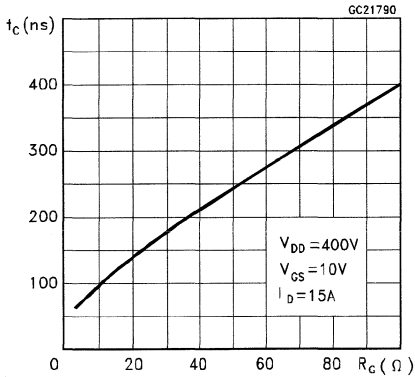
Turn-on Current Slope



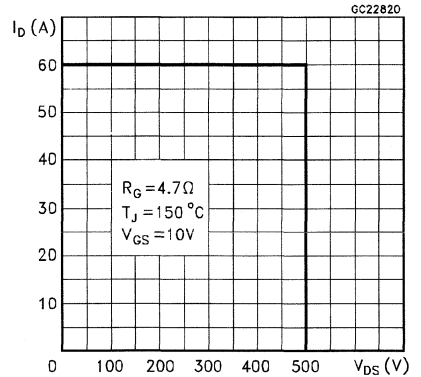
Turn-off Drain-source Voltage Slope



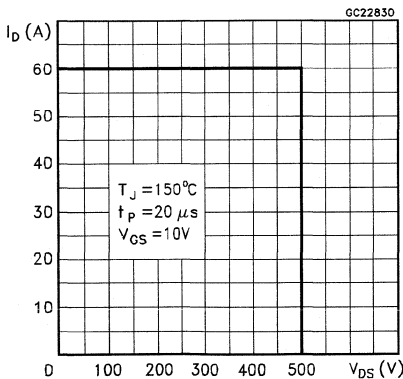
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

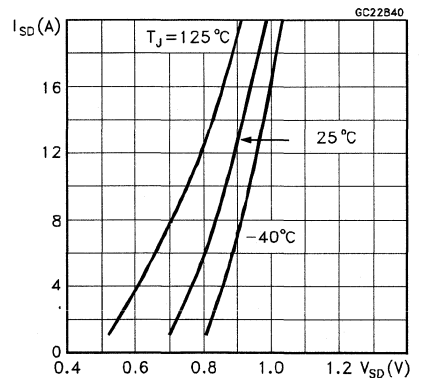


Fig. 1: Unclamped Inductive Load Test Circuits

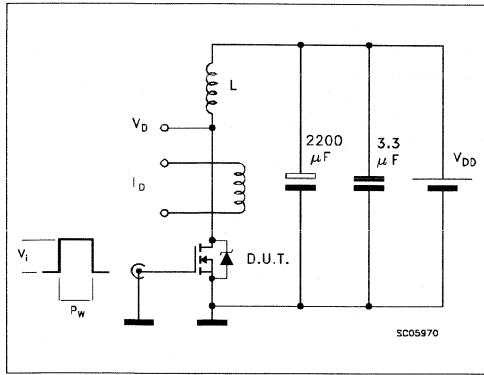


Fig. 2: Unclamped Inductive Waveforms

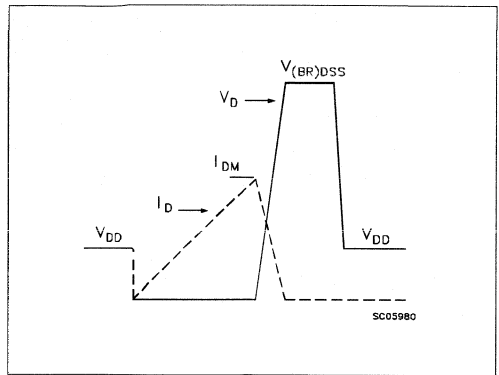


Fig. 3: Switching Times Test Circuits For Resistive Load

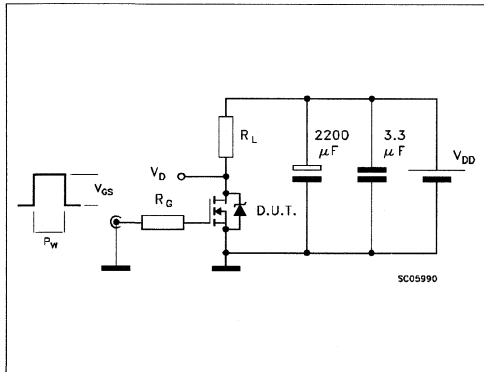


Fig. 4: Gate Charge Test Circuit

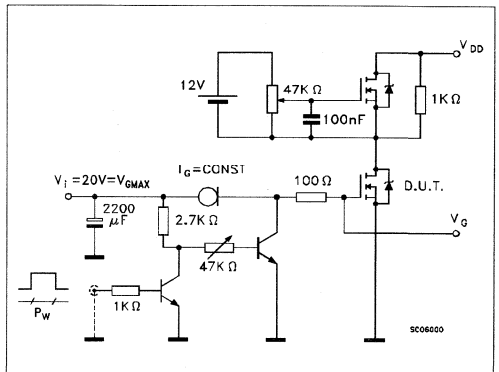
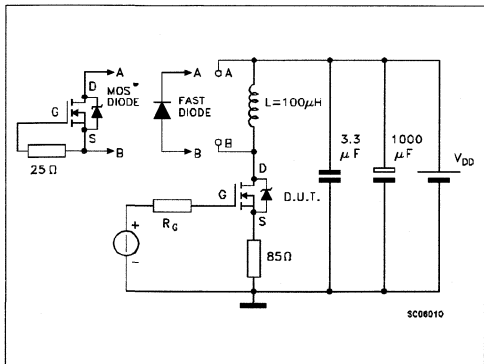


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



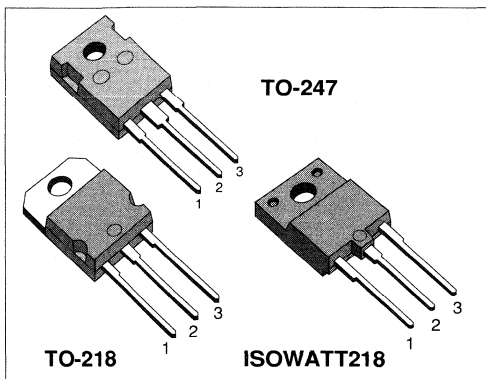
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STH15N50	500 V	< 0.4 Ω	15 A
STH15N50FI	500 V	< 0.4 Ω	9.3 A
STW15N50	500 V	< 0.4 Ω	15 A

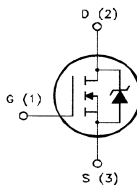
- TYPICAL R_{DS(on)} = 0.34 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- REDUCED GATE CHARGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STH/STW15N50	STH15N50FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	500		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	500		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	15	9.3	A
I _D	Drain Current (continuous) at T _c = 100 °C	9.4	5.8	A
I _{DM} (*)	Drain Current (pulsed)	60	60	A
P _{tot}	Total Dissipation at T _c = 25 °C	180	70	W
	Derating Factor	1.44	0.56	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	4000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _J	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-218/TO-247	ISOWATT218	
R _{thj-case}	Thermal Resistance Junction-case	Max	0.69	1.78	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	30		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.1		°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	15	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	900	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	30	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	9.4	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	500			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 7.5 A V _{GS} = 10V I _D = 7.5 A T _c = 100°C		0.34	0.4 0.8	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	15			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 7.5 A	8.5	11.2		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		2350	3000	pF
C _{oss}	Output Capacitance			340	440	pF
C _{rss}	Reverse Transfer Capacitance			75	100	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 210\text{ V}$ $I_D = 7\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		60 55	80 70	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 400\text{ V}$ $I_D = 15\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		270		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 400\text{ V}$ $I_D = 15\text{ A}$ $V_{GS} = 10\text{ V}$		90 12 48	110	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$	Off-voltage Rise Time	$V_{DD} = 400\text{ V}$ $I_D = 15\text{ A}$		35	45	ns
t_f	Fall Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$		45	60	ns
t_c	Cross-over Time	(see test circuit, figure 5)		65	85	ns

SOURCE DRAIN DIODE

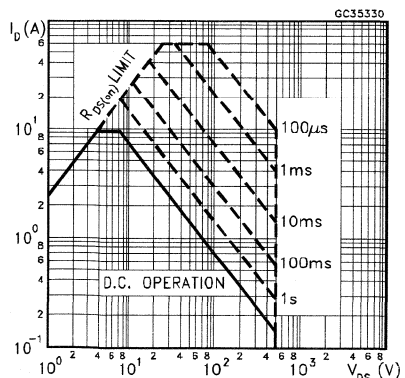
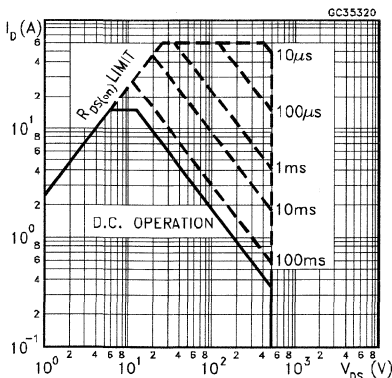
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				15 60	A A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 15\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 15\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		630		ns
Q_{rr}	Reverse Recovery Charge			10.7		μ C
I_{RRM}	Reverse Recovery Current			34		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

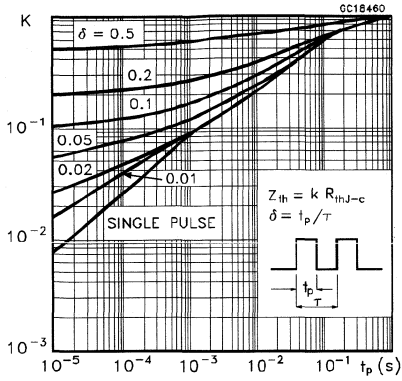
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas For TO-218 and TO-247

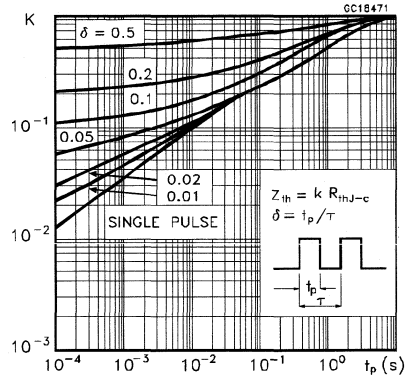
Safe Operating Areas For ISOWATT218



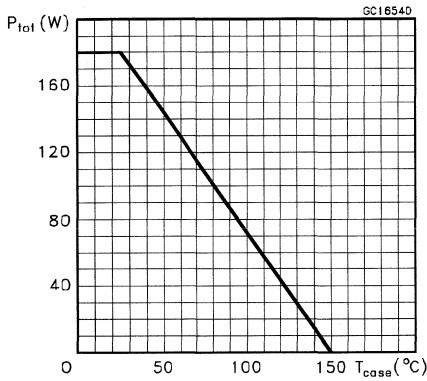
Thermal Impedance For TO-218 and TO-247



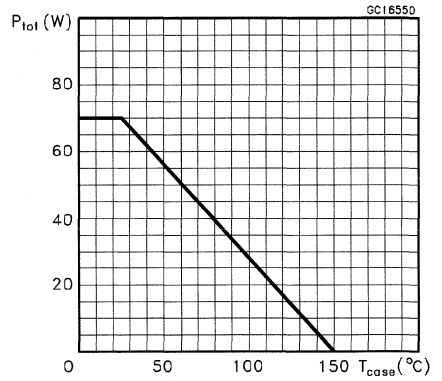
Thermal Impedance For ISOWATT218



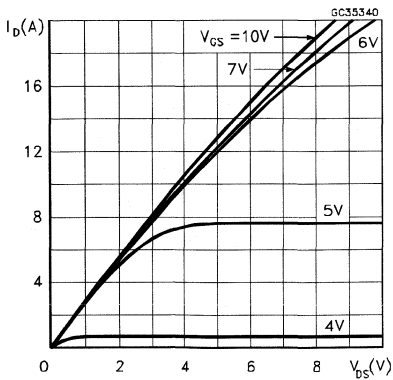
Derating Curve For TO-218 and TO-247



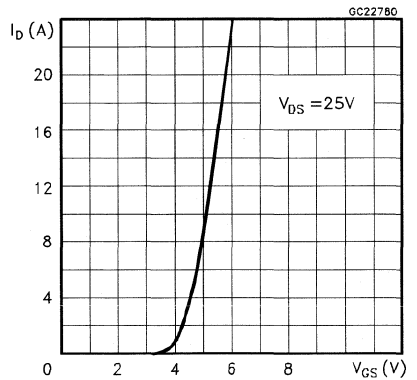
Derating Curve For ISOWATT218



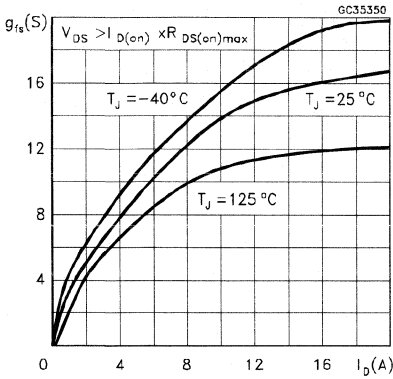
Output Characteristics



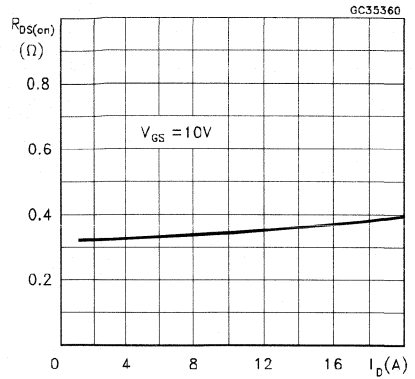
Transfer Characteristics



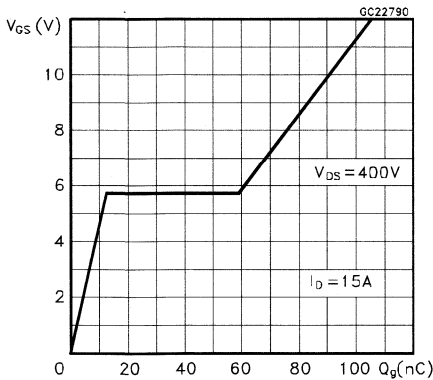
Transconductance



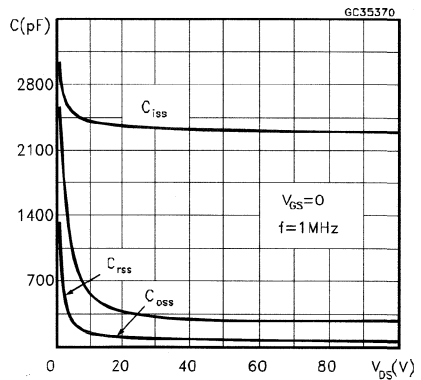
Static Drain-source On Resistance



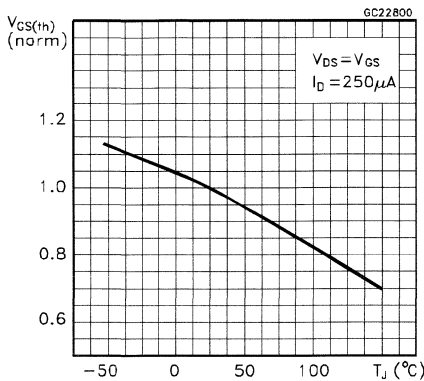
Gate Charge vs Gate-source Voltage



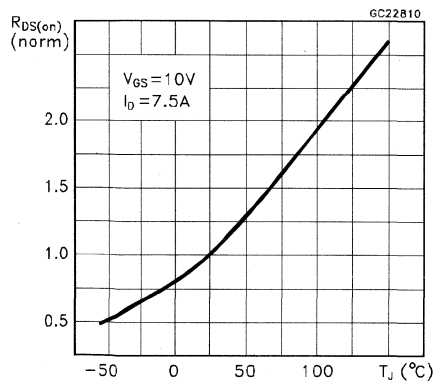
Capacitance Variations



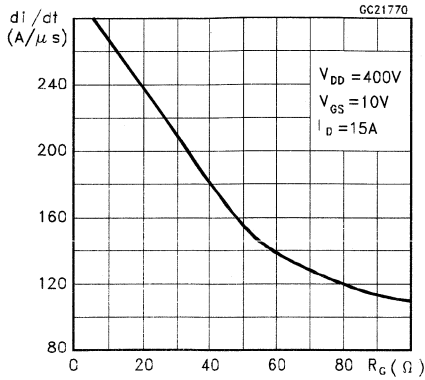
Normalized Gate Threshold Voltage vs Temperature



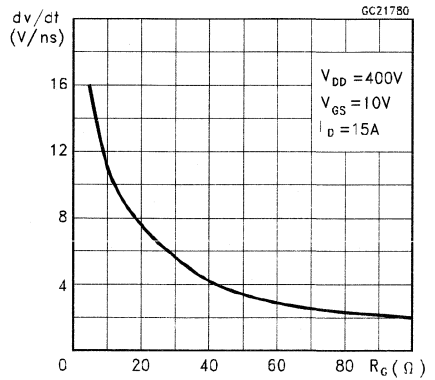
Normalized On Resistance vs Temperature



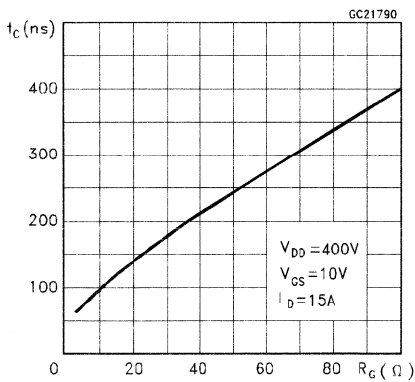
Turn-on Current Slope



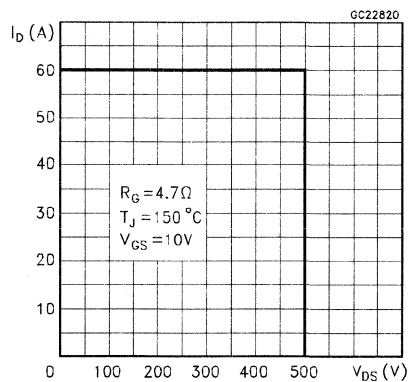
Turn-off Drain-source Voltage Slope



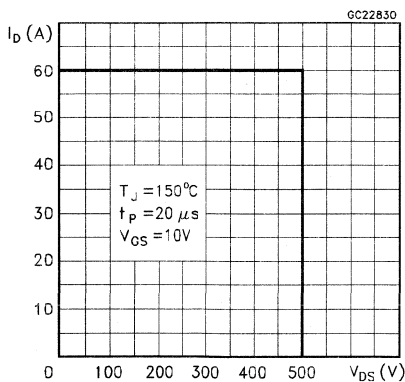
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

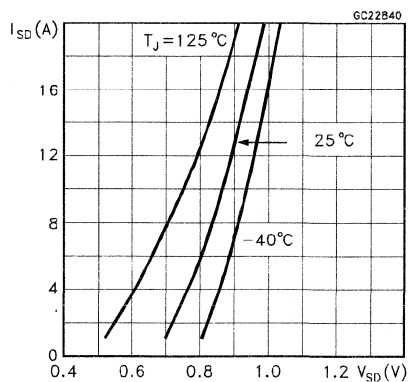


Fig. 1: Unclamped Inductive Load Test Circuits

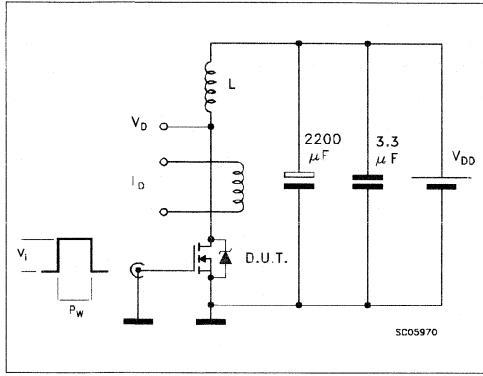


Fig. 2: Unclamped Inductive Waveforms

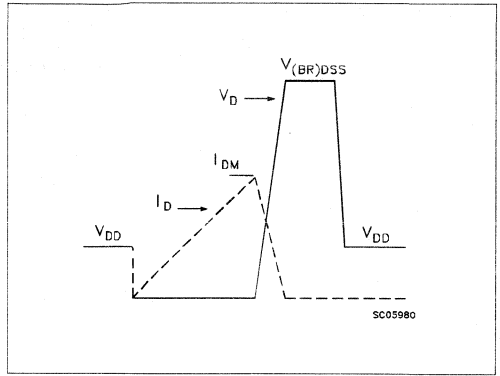


Fig. 3: Switching Times Test Circuits For Resistive Load

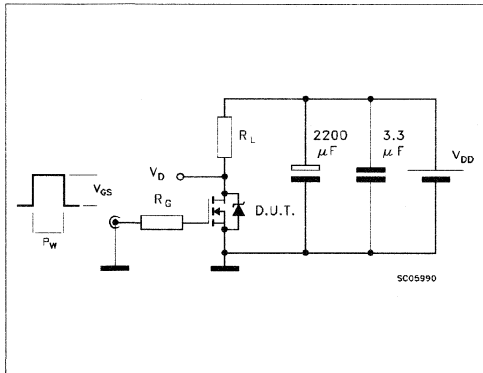


Fig. 4: Gate Charge Test Circuit

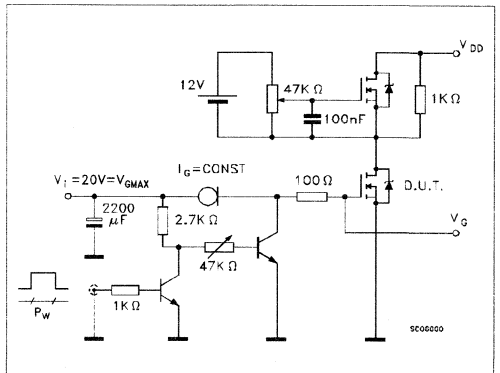
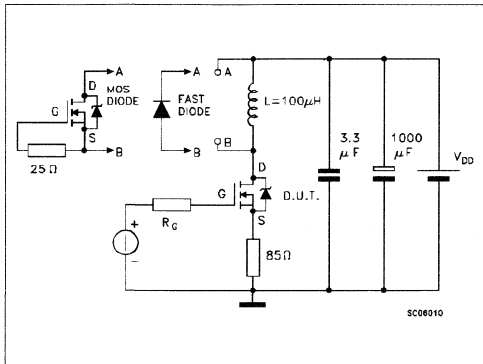


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time





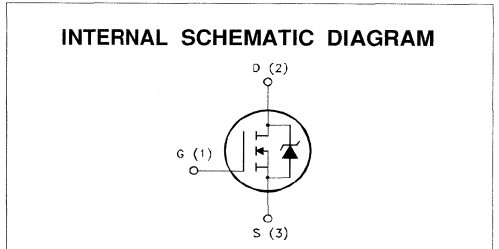
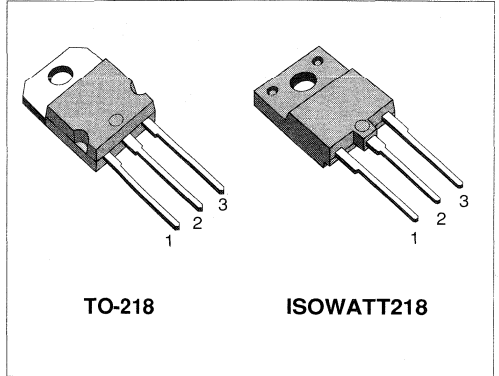
**N - CHANNEL ENHANCEMENT MODE
POWER MOS TRANSISTOR**

TYPE	V _{DSS}	R _{DS(on)}	I _D
STH26N25	250 V	< 0.11 Ω	26 A
STH26N25FI	250 V	< 0.11 Ω	16 A

- TYPICAL R_{DS(on)} = 0.085 Ω
- AVALANCHE RUGGEDNESS TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- UNINTERRUPTIBLE POWER SUPPLY (UPS)
- MOTOR CONTROL, AUDIO AMPLIFIERS
- INDUSTRIAL ACTUATORS
- DC-DC & DC-AC CONVERTERS FOR TELECOM, INDUSTRIAL AND CONSUMER ENVIRONMENT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STH26N25	STH26N25FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	250		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	250		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	26	16	A
I _D	Drain Current (continuous) at T _c = 100 °C	16	10	A
I _{DM} (*)	Drain Current (pulsed)	104	104	A
P _{tot}	Total Dissipation at T _c = 25 °C	180	70	W
	Derating Factor	1.44	0.56	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	4000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

		TO-218	ISOWATT218		
R _{thj-case}	Thermal Resistance Junction-case	Max	0.69	1.79	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	30		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.1		°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	26	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	160	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	40	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	16	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	250			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 13 A V _{GS} = 10V I _D = 13 A T _c = 100°C		0.085	0.11 0.22	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	26			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 13 A	9	18		S
C _{iSS}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		2900	3800	pF
C _{oSS}	Output Capacitance			600	800	pF
C _{rSS}	Reverse Transfer Capacitance			180	250	pF

ELECTRICAL CHARACTERISTICS (continued)
SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 125\text{ V}$ $I_D = 13\text{ A}$		25	35	ns
t_r	Rise Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		80	120	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 200\text{ V}$ $I_D = 26\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		200		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 200\text{ V}$ $I_D = 26\text{ A}$ $V_{GS} = 10\text{ V}$		125	180	nC
Q_{gs}	Gate-Source Charge			15		nC
Q_{gd}	Gate-Drain Charge			65		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(off)}$	Off-voltage Rise Time	$V_{DD} = 200\text{ V}$ $I_D = 26\text{ A}$		170	250	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		80	120	ns
t_c	Cross-over Time	(see test circuit, figure 5)		260	380	ns

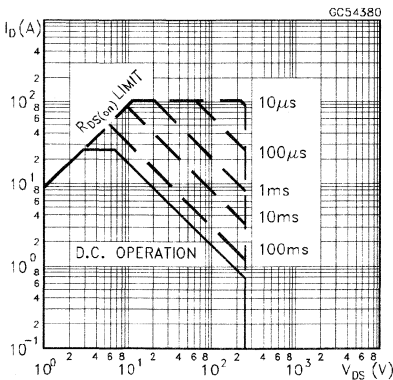
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				26	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				104	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 26\text{ A}$ $V_{GS} = 0$			1.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 26\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 50\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		400		ns
Q_{rr}	Reverse Recovery Charge	(see test circuit, figure 5)		5.2		μ C
I_{RRM}	Reverse Recovery Current			26		A

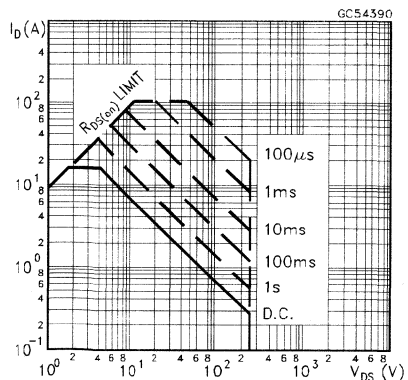
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

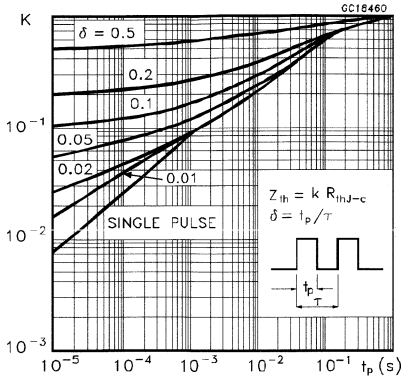
Safe Operating Areas For TO-218



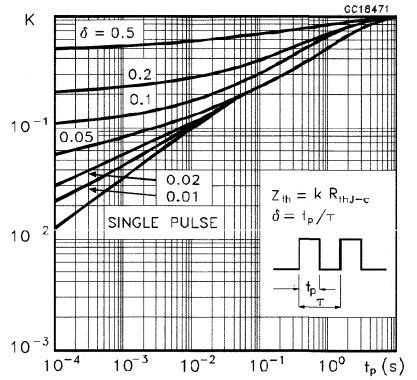
Safe Operating Areas For ISOWATT218



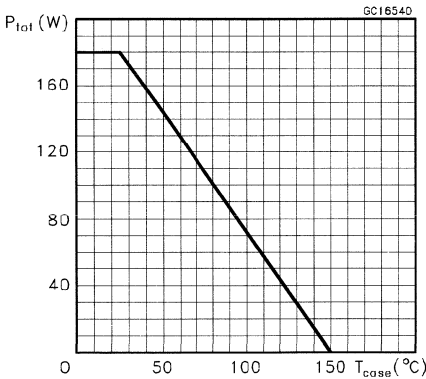
Thermal Impedance For TO-218



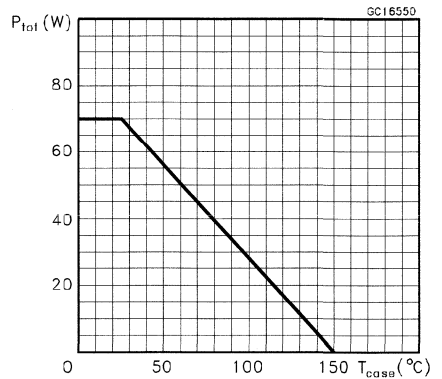
Thermal Impedance For ISOWATT218



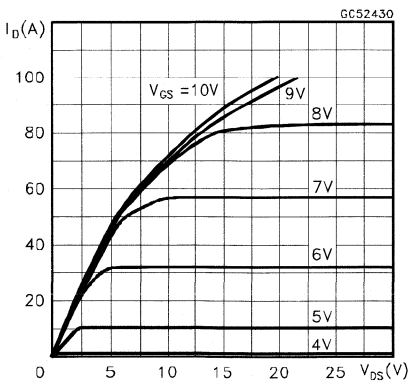
Derating Curve For TO-218



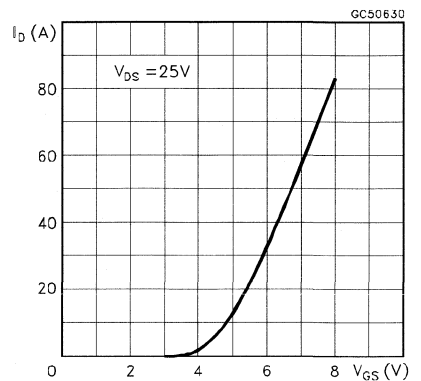
Derating Curve For ISOWATT218



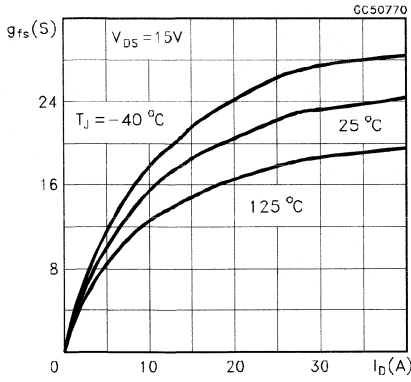
Output Characteristics



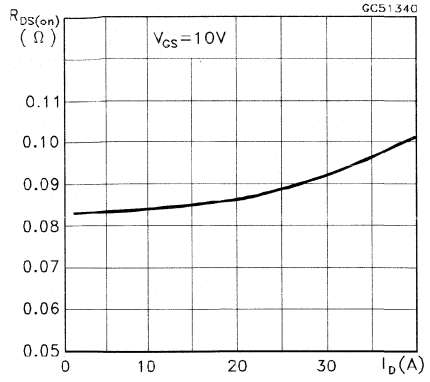
Transfer Characteristics



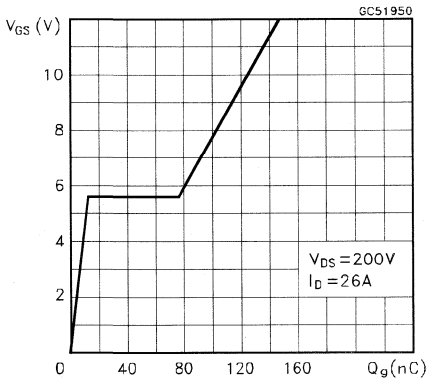
Transconductance



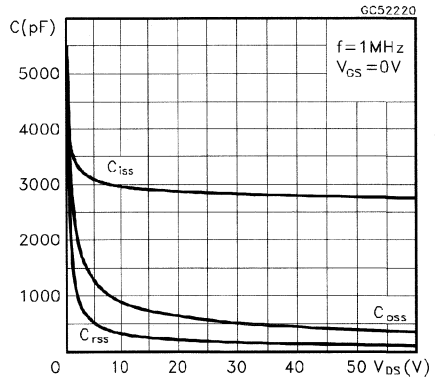
Static Drain-source On Resistance



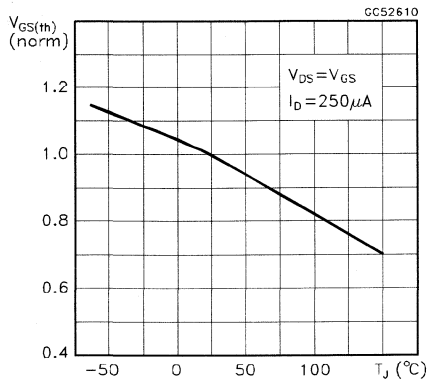
Gate Charge vs Gate-source Voltage



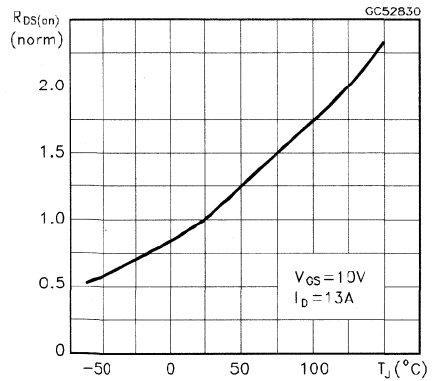
Capacitance Variations



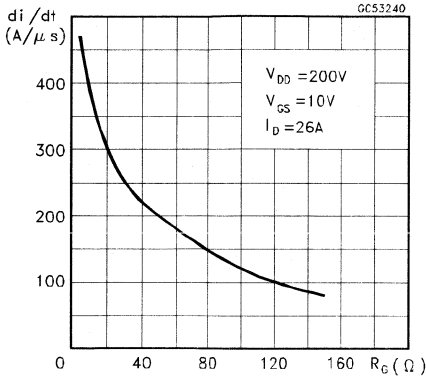
Normalized Gate Threshold Voltage vs Temperature



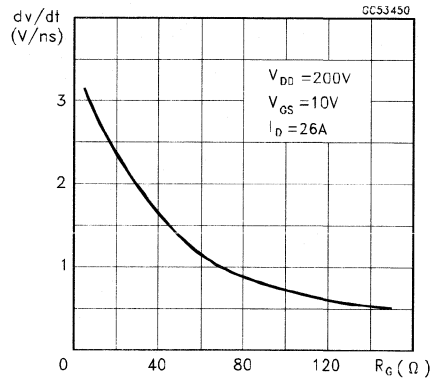
Normalized On Resistance vs Temperature



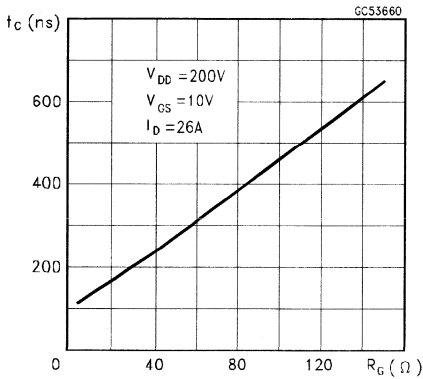
Turn-on Current Slope



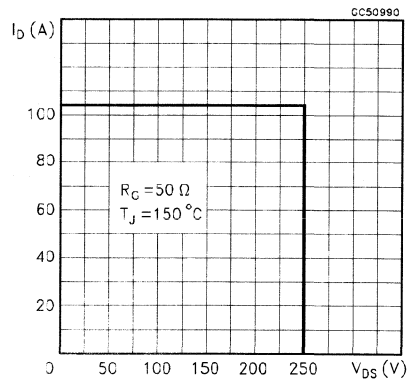
Turn-off Drain-source Voltage Slope



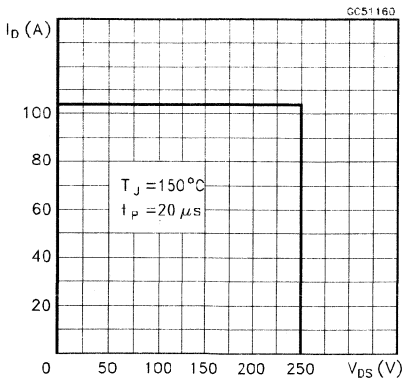
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

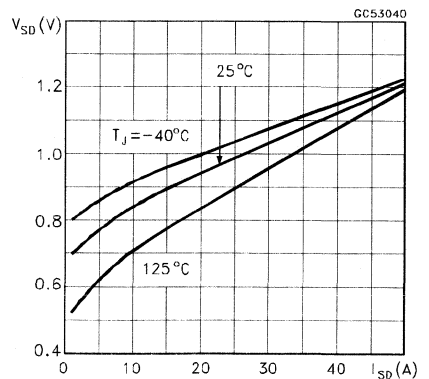


Fig. 1: Unclamped Inductive Load Test Circuits

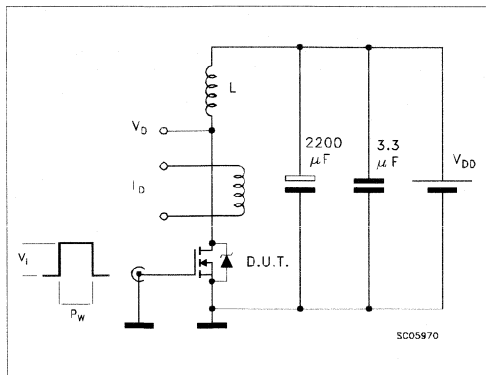


Fig. 2: Unclamped Inductive Waveforms

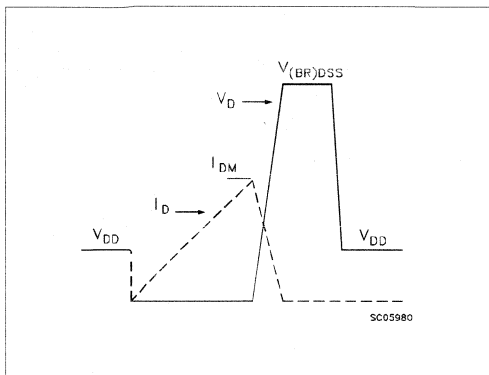


Fig. 3: Switching Times Test Circuits For Resistive Load

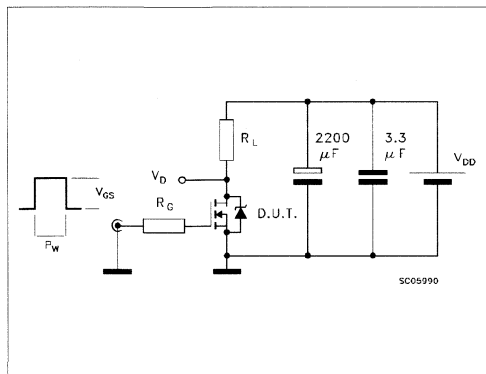


Fig. 4: Gate Charge Test Circuit

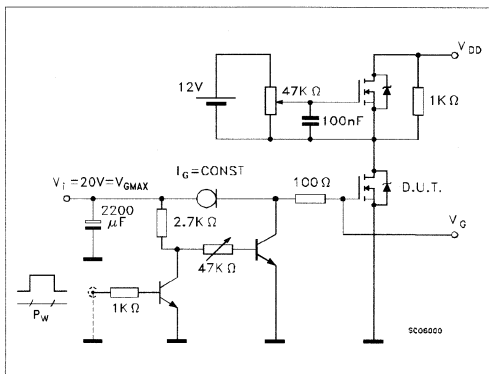
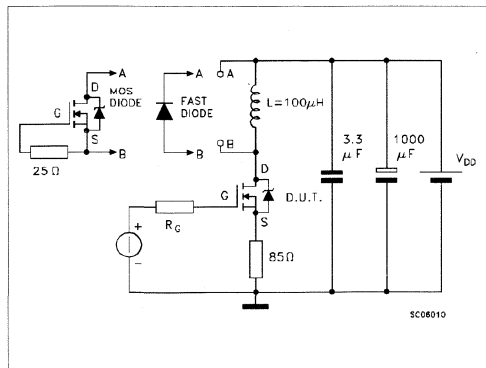


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



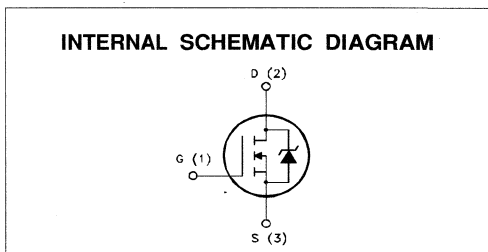
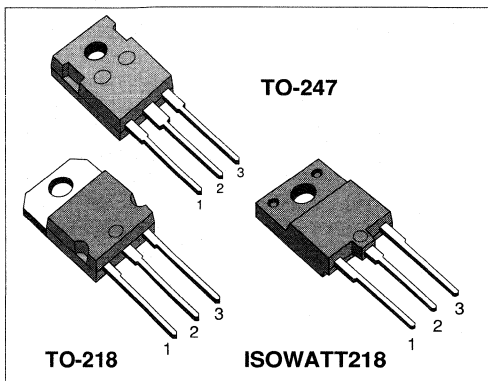
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STH33N20	200 V	< 0.085 Ω	33 A
STH33N20FI	200 V	< 0.085 Ω	20 A
STW33N20	200 V	< 0.085 Ω	33 A

- TYPICAL R_{DS(on)} = 0.073 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- UNINTERRUPTIBLE POWER SUPPLY (UPS)
- MOTOR CONTROL, AUDIO AMPLIFIERS
- INDUSTRIAL ACTUATORS
- DC-DC & DC-AC CONVERTERS FOR TELECOM, INDUSTRIAL AND CONSUMER ENVIRONMENT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STH/STW33N20	STH33N20FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	200		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	200		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	33	20	A
I _D	Drain Current (continuous) at T _c = 100 °C	20	12	A
I _{DM} (*)	Drain Current (pulsed)	132	132	A
P _{tot}	Total Dissipation at T _c = 25 °C	180	70	W
	Derating Factor	1.44	0.56	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	4000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

		TO-218/TO-247	ISOWATT218		
R _{thj-case}	Thermal Resistance Junction-case	Max	0.69	1.79	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	30		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.1		°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	33	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	150	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	40	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	20	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	200			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 16 A V _{GS} = 10V I _D = 16 A T _c = 100°C		0.073	0.085 0.170	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	33			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 16 A	10	22		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		2800	3600	pF
C _{oss}	Output Capacitance			600	800	pF
C _{rss}	Reverse Transfer Capacitance			190	250	pF

ELECTRICAL CHARACTERISTICS (continued)
SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 95\text{ V}$ $I_D = 16\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		25 65	40 95	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 160\text{ V}$ $I_D = 33\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		200		A/ μs
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 160\text{ V}$ $I_D = 33\text{ A}$ $V_{GS} = 10\text{ V}$		125 15 62	180	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$ t_f	Off-voltage Rise Time Fall Time	$V_{DD} = 160\text{ V}$ $I_D = 33\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		180 105	250 150	ns ns
t_c	Cross-over Time	(see test circuit, figure 5)		285	400	ns

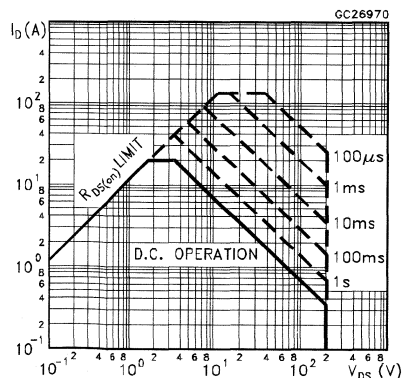
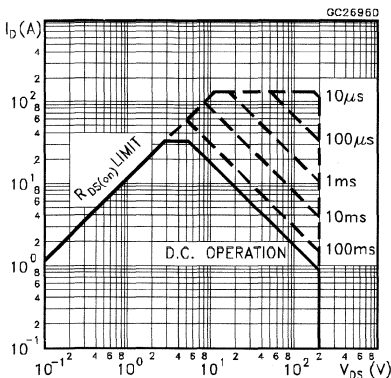
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				33 132	A A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 33\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 33\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		450		ns
Q_{rr}	Reverse Recovery Charge			5		μC
I_{RRM}	Reverse Recovery Current			22		A

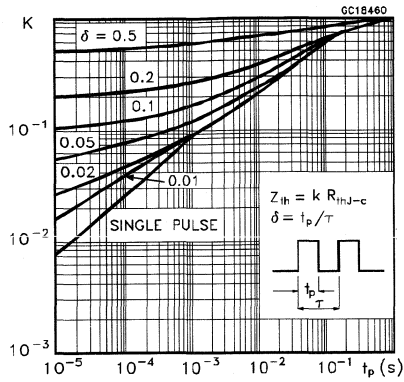
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas For TO-218 and TO-247

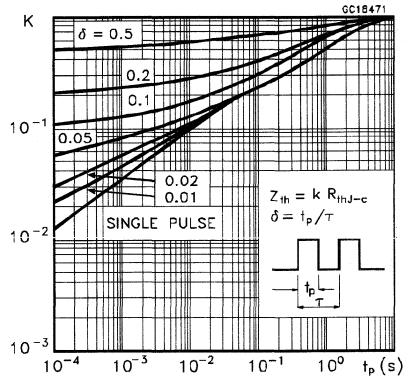
Safe Operating Areas For ISOWATT218



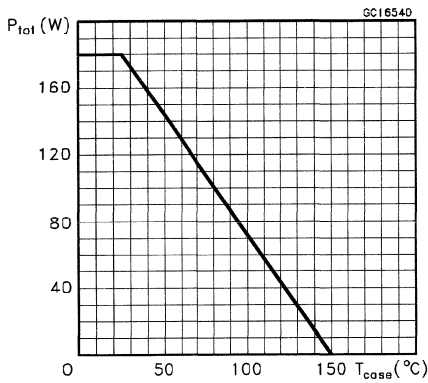
Thermal Impedance For TO-218 and TO-247



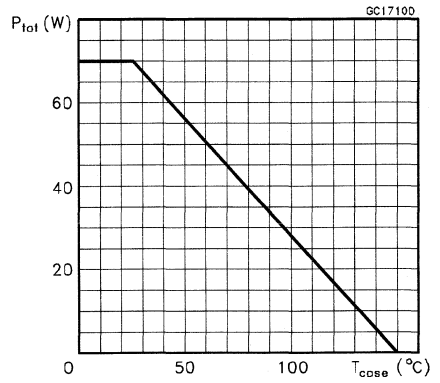
Thermal Impedance For ISOWATT218



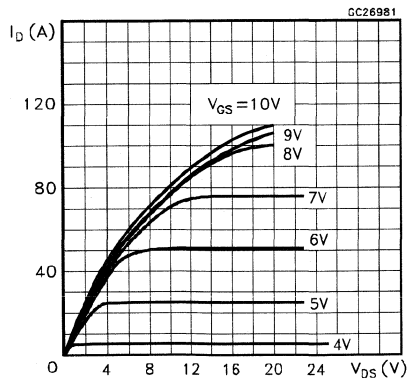
Derating Curve For TO-218 and TO-247



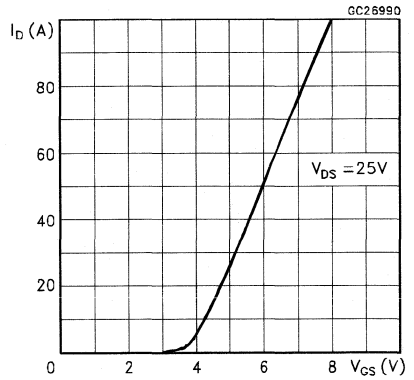
Derating Curve For ISOWATT218



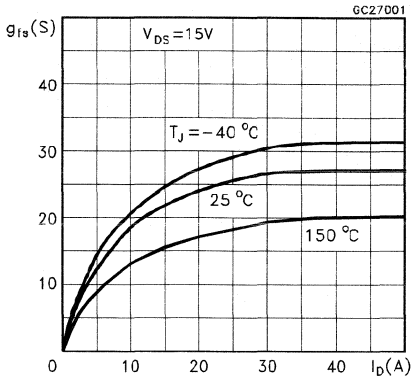
Output Characteristics



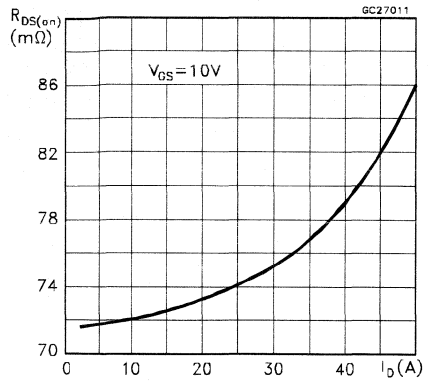
Transfer Characteristics



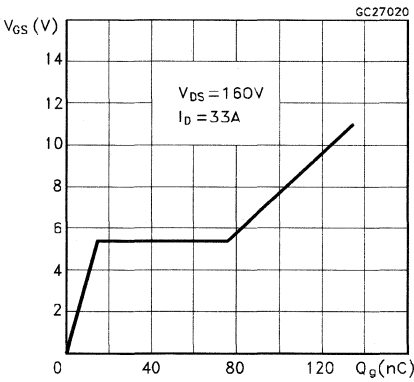
Transconductance



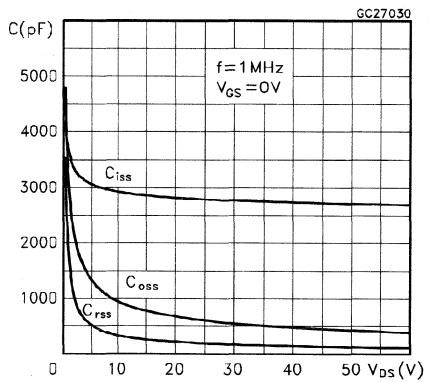
Static Drain-source On Resistance



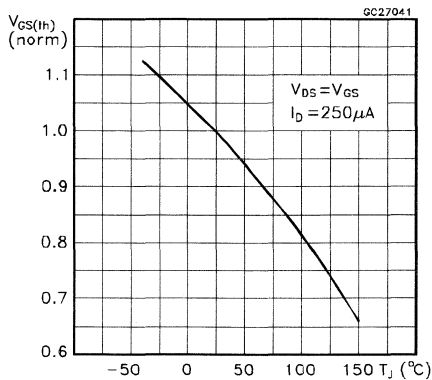
Gate Charge vs Gate-source Voltage



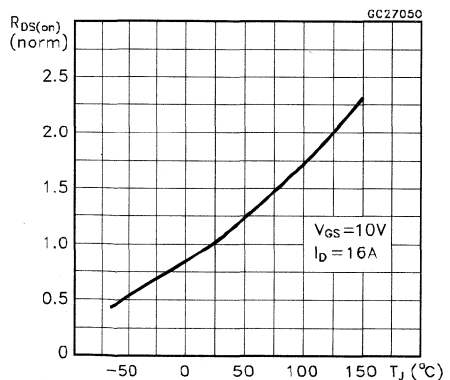
Capacitance Variations



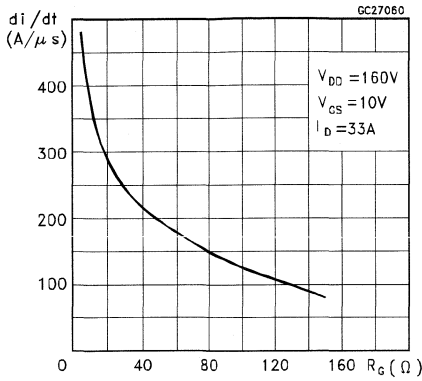
Normalized Gate Threshold Voltage vs Temperature



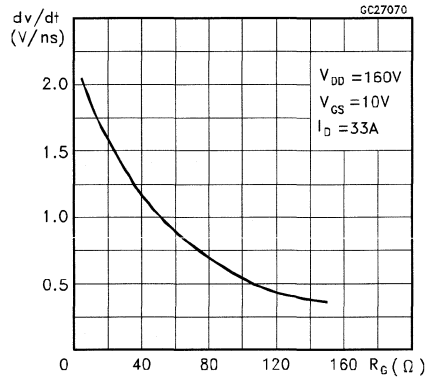
Normalized On Resistance vs Temperature



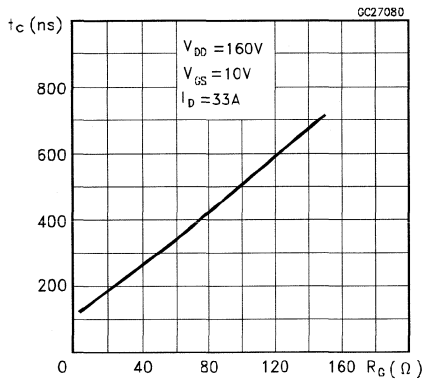
Turn-on Current Slope



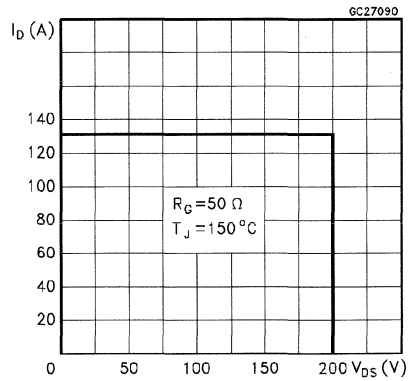
Turn-off Drain-source Voltage Slope



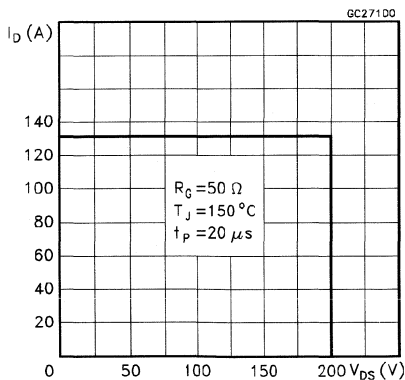
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

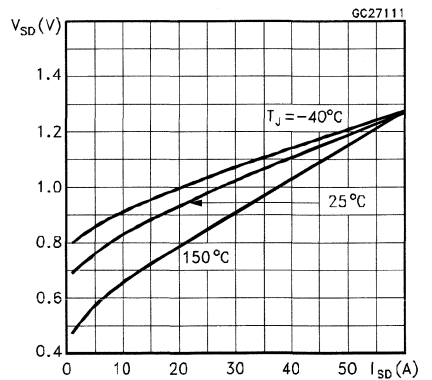


Fig. 1: Unclamped Inductive Load Test Circuits

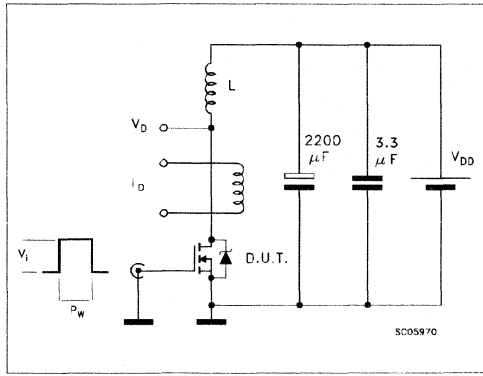


Fig. 2: Unclamped Inductive Waveforms

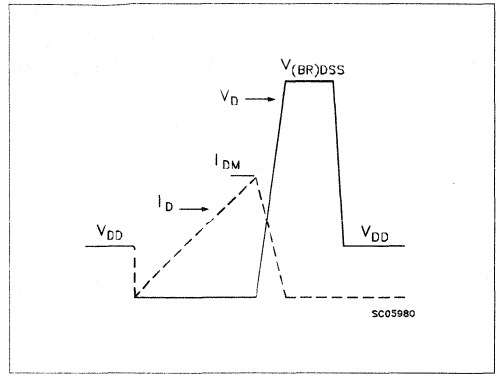


Fig. 3: Switching Times Test Circuits For Resistive Load

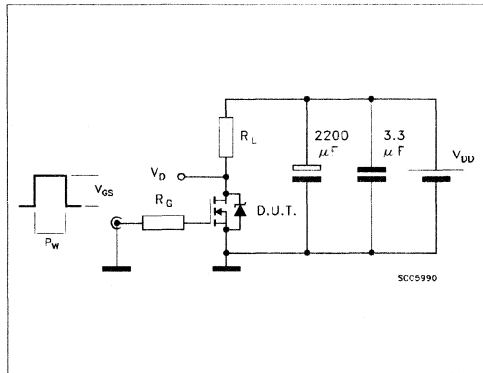


Fig. 4: Gate Charge Test Circuit

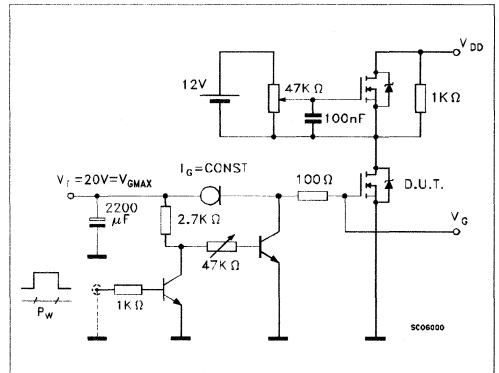
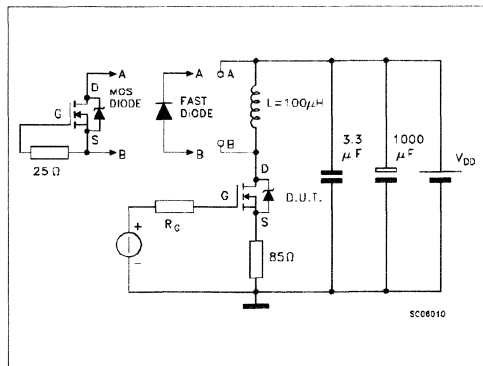


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



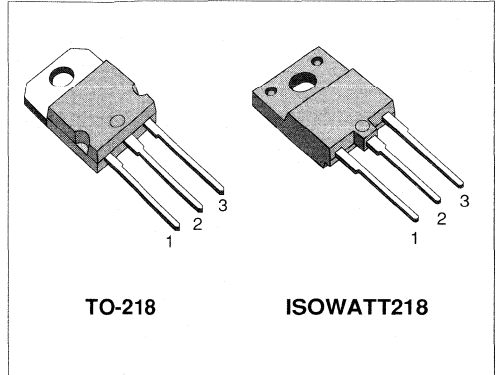
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STH45N10	100 V	< 0.04 Ω	45 A
STH45N10FI	100 V	< 0.04 Ω	27 A

- TYPICAL R_{DS(on)} = 0.035 Ω
- AVALANCHE RUGGEDNESS TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE FOR STANDARD PACKAGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

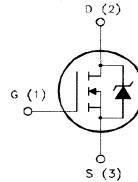
- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



TO-218

ISOWATT218

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STH45N10	STH45N10FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	100		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	100		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	45	27	A
I _D	Drain Current (continuous) at T _c = 100 °C	31	17	A
I _{DM} (•)	Drain Current (pulsed)	180	180	A
P _{tot}	Total Dissipation at T _c = 25 °C	180	60	W
	Derating Factor	1.2	0.48	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	4000	V
T _{stg}	Storage Temperature	-65 to 175	-65 to 150	°C
T _j	Max. Operating Junction Temperature	175	150	°C

(•) Pulse width limited by safe operating area

THERMAL DATA

			TO-218	ISOWATT218	
$R_{thj-case}$	Thermal Resistance Junction-case	Max	0.83	2.08	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	30		°C/W
$R_{thc-sink}$	Thermal Resistance Case-sink	Typ	0.1		°C/W
T_I	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	45	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ °C}$, $I_D = I_{AR}$, $V_{DD} = 25\text{ V}$)	240	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	60	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ °C}$, pulse width limited by T_j max, $\delta < 1\%$)	31	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$	100			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\text{ }\mu\text{A}$	2	2.9	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 22.5\text{ A}$ $V_{GS} = 10\text{ V}$ $I_D = 22.5\text{ A}$ $T_c = 100\text{ °C}$		0.035	0.04 0.08	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	45			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 22.5\text{ A}$	14	26		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		2150	2800	pF
C_{oss}	Output Capacitance			600	800	pF
C_{rss}	Reverse Transfer Capacitance			150	200	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 25\text{ V}$ $I_D = 22.5\text{ A}$		20	30	ns
t_r	Rise Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		130	190	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 80\text{ V}$ $I_D = 45\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		500		A/ μs
Q_g	Total Gate Charge	$V_{DD} = 80\text{ V}$ $I_D = 45\text{ A}$ $V_{GS} = 10\text{ V}$		70	100	nC
Q_{gs}	Gate-Source Charge			12		nC
Q_{gd}	Gate-Drain Charge			30		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 80\text{ V}$ $I_D = 45\text{ A}$		50	70	ns
t_f	Fall Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$		70	100	ns
t_c	Cross-over Time	(see test circuit, figure 5)		140	200	ns

SOURCE DRAIN DIODE

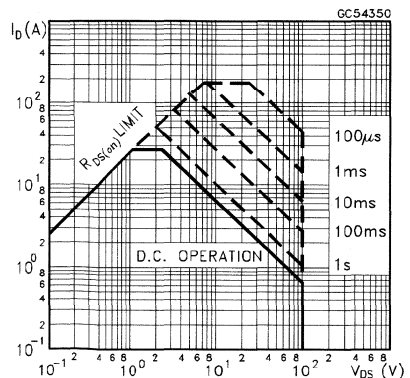
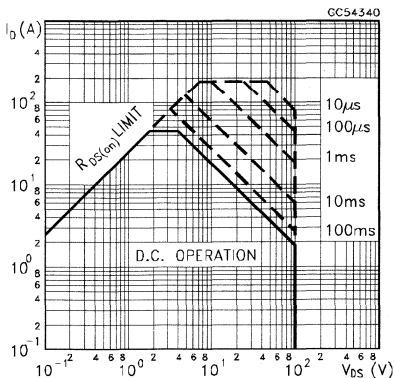
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				45	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				180	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 45\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 45\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		130		ns
Q_{rr}	Reverse Recovery Charge			0.65		μC
I_{RRM}	Reverse Recovery Current			10		A

(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

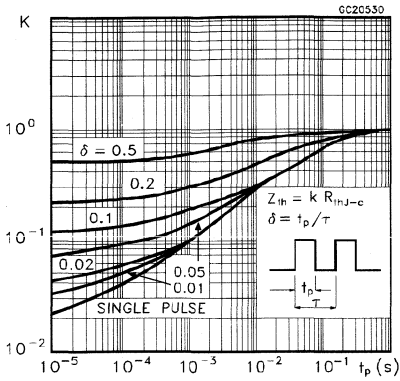
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas For TO-218

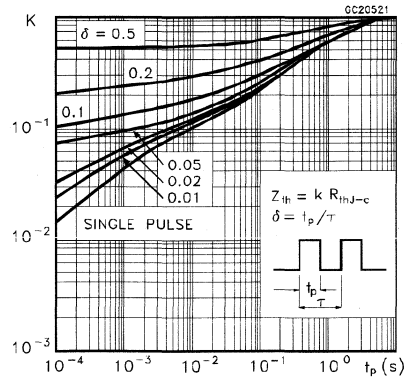
Safe Operating Areas For ISOWATT218



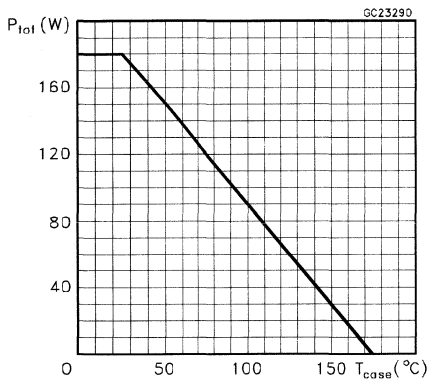
Thermal Impedance For TO-218



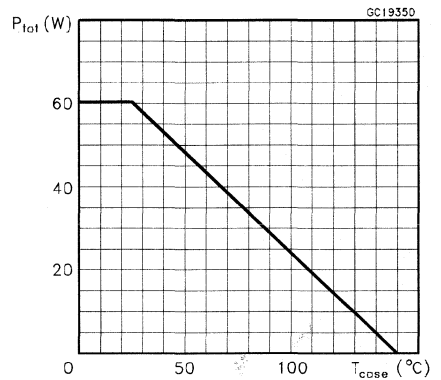
Thermal Impedance For ISOWATT218



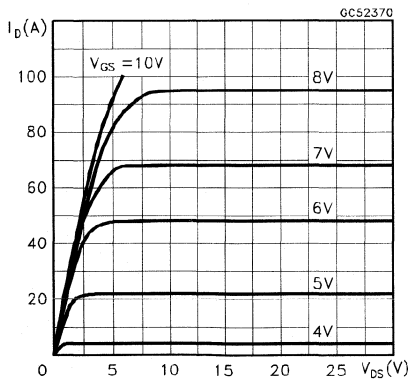
Derating Curve For TO-218



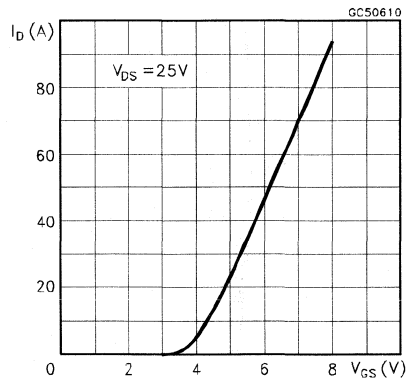
Derating Curve For ISOWATT218



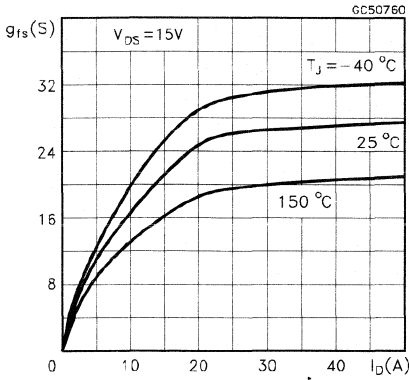
Output Characteristics



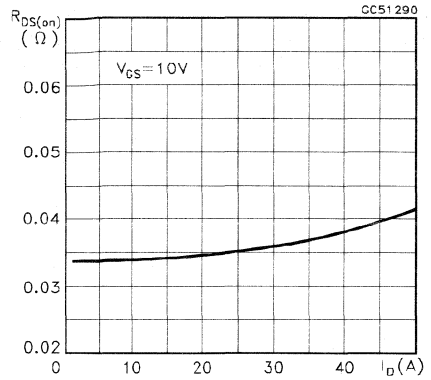
Transfer Characteristics



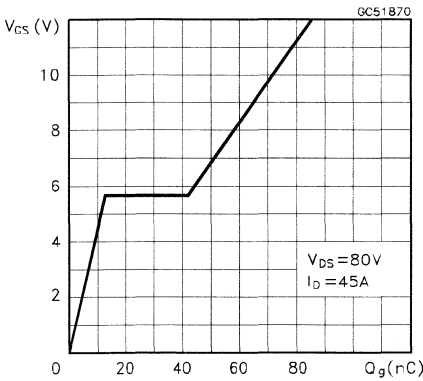
Transconductance



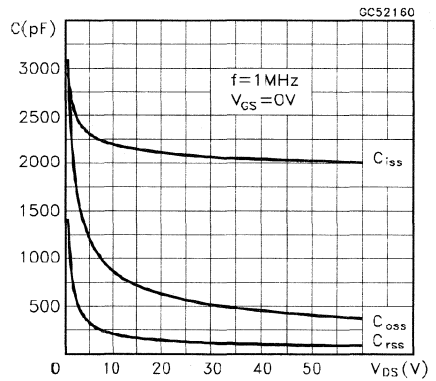
Static Drain-source On Resistance



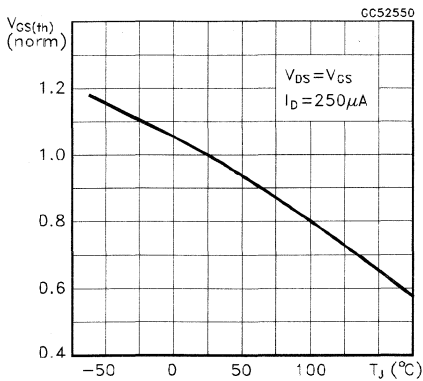
Gate Charge vs Gate-source Voltage



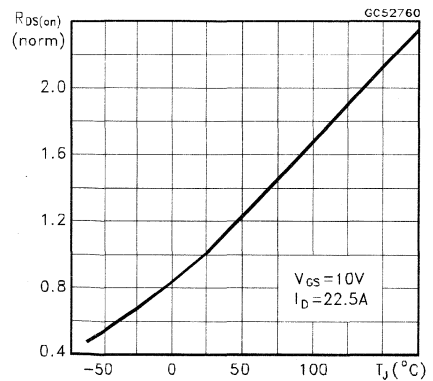
Capacitance Variations



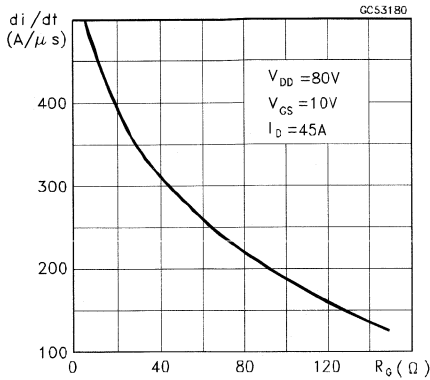
Normalized Gate Threshold Voltage vs Temperature



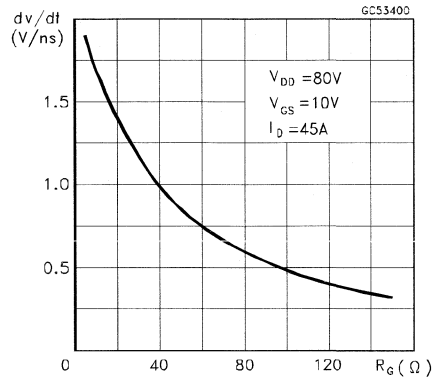
Normalized On Resistance vs Temperature



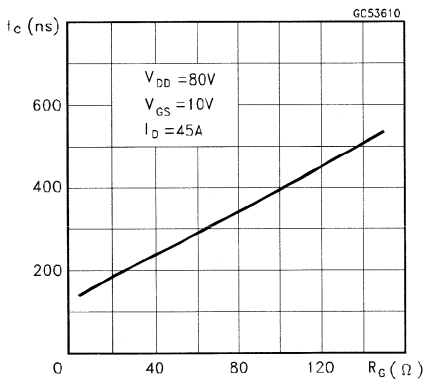
Turn-on Current Slope



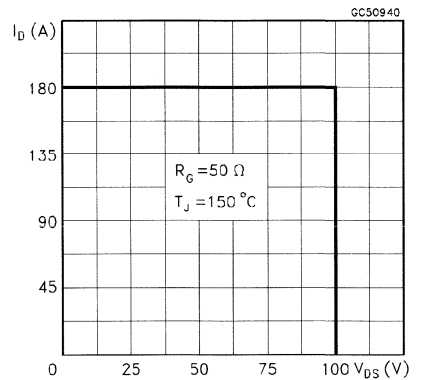
Turn-off Drain-source Voltage Slope



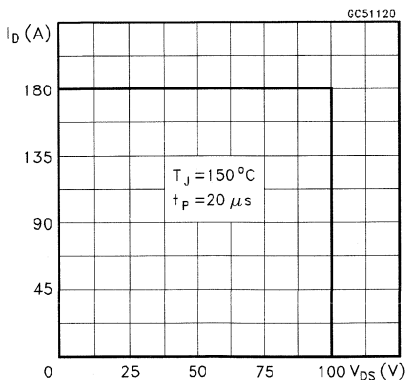
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

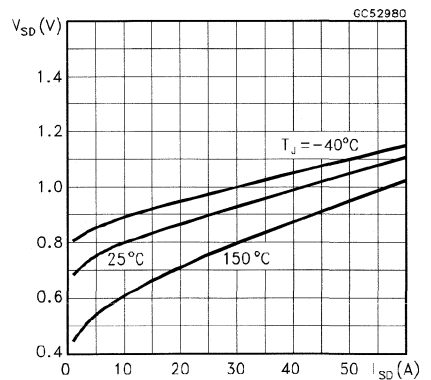


Fig. 1: Unclamped Inductive Load Test Circuits

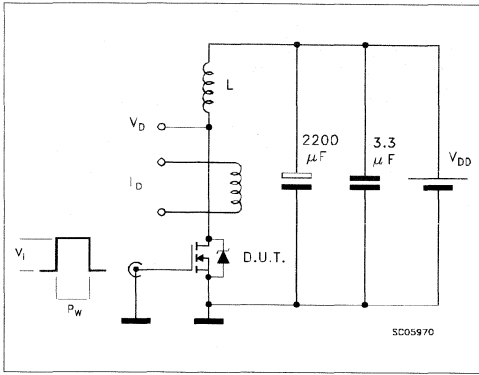


Fig. 2: Unclamped Inductive Waveforms

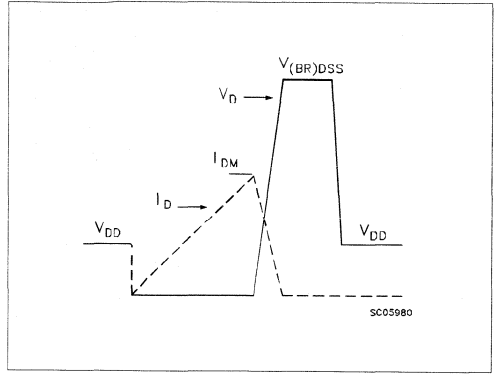


Fig. 3: Switching Times Test Circuits For Resistive Load

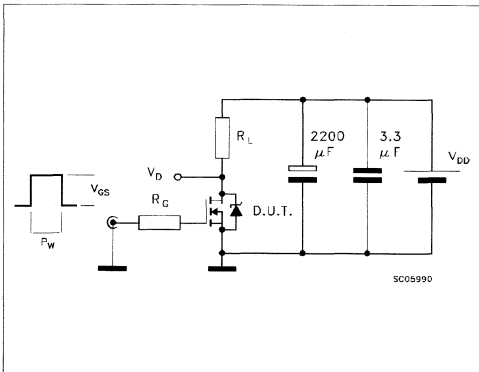


Fig. 4: Gate Charge Test Circuit

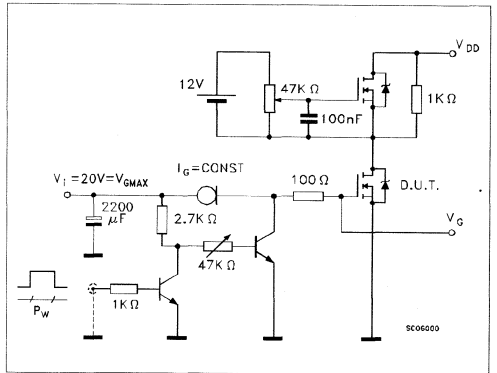
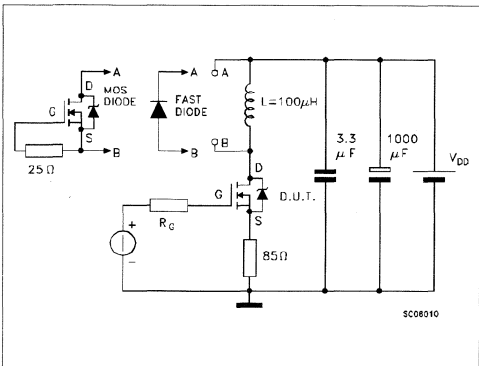


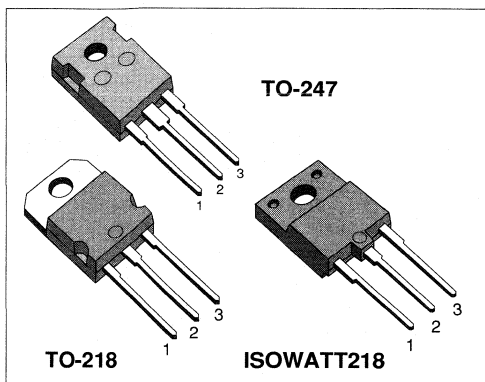
Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{bss}	R _{DS(on)}	I _D
STH55N10	100 V	< 0.030 Ω	55 A
STH55N10FI	100 V	< 0.030 Ω	33 A
STW55N10	100 V	< 0.030 Ω	55 A

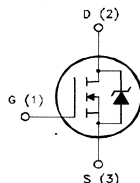
- TYPICAL R_{DS(on)} = 0.02 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- VERY HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION



APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STW/STH55N10	STH55N10FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	100		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	100		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	55	33	A
I _D	Drain Current (continuous) at T _c = 100 °C	38	20	A
I _{DM} (●)	Drain Current (pulsed)	220	220	A
P _{tot}	Total Dissipation at T _c = 25 °C	200	70	W
	Derating Factor	1.33	0.56	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	4000	V
T _{stg}	Storage Temperature	-65 to 175	-65 to 150	°C
T _j	Max. Operating Junction Temperature	175	150	°C

(●) Pulse width limited by safe operating area

THERMAL DATA

			TO-218/TO-247	ISOWATT218	
R _{thj-case}	Thermal Resistance Junction-case	Max	0.75	1.79	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	30		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.1		°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	55	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	600	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	150	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	34	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	100			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	2.9	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10 V I _D = 30 A V _{GS} = 10 V I _D = 30 A T _c = 100°C		0.02	0.03 0.06	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	55			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 30 A	25	35		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		4000	5000	pF
C _{oss}	Output Capacitance			1100	1400	pF
C _{rss}	Reverse Transfer Capacitance			250	350	pF

ELECTRICAL CHARACTERISTICS (continued)
SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 80\text{ V}$ $I_D = 30\text{ A}$		90	130	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		270	380	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 80\text{ V}$ $I_D = 55\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		270		A/ μs
Q_g	Total Gate Charge	$V_{DD} = 80\text{ V}$ $I_D = 30\text{ A}$ $V_{GS} = 10\text{ V}$		120	170	nC
Q_{gs}	Gate-Source Charge			16		nC
Q_{gd}	Gate-Drain Charge			60		nC

SWITCHING OFF

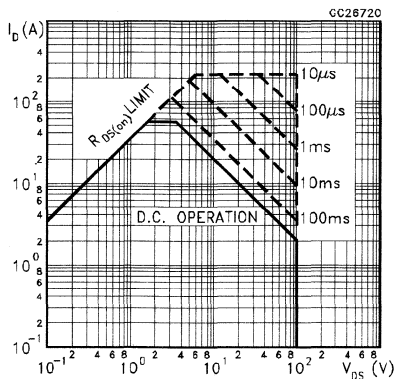
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 80\text{ V}$ $I_D = 55\text{ A}$		200	280	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		210	290	ns
t_c	Cross-over Time	(see test circuit, figure 5)		410	570	ns

SOURCE DRAIN DIODE

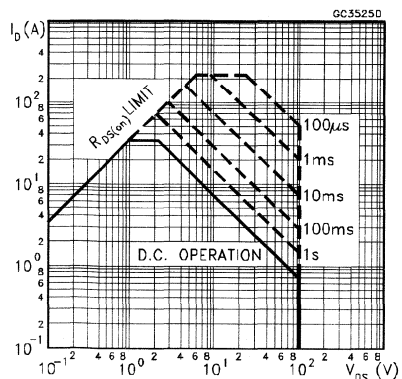
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				55	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				220	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 55\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 55\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		180		ns
Q_{rr}	Reverse Recovery Charge			1		μC
I_{RRM}	Reverse Recovery Current			11		A

(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %
(\bullet) Pulse width limited by safe operating area

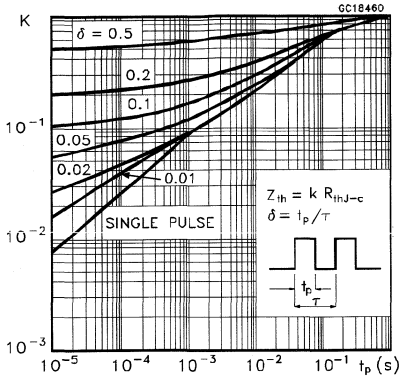
Safe Operating Areas For T0-218 and T0-247



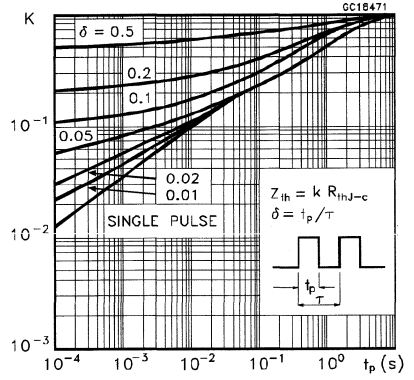
Safe Operating Areas For ISOWATT218



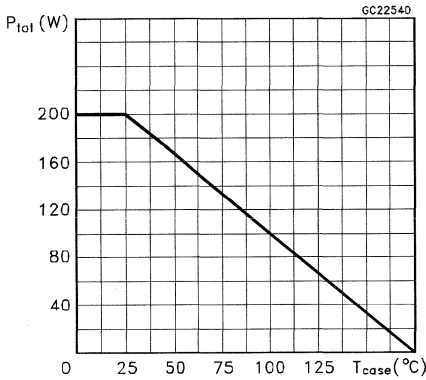
Thermal Impedance For TO-218 and TO-247



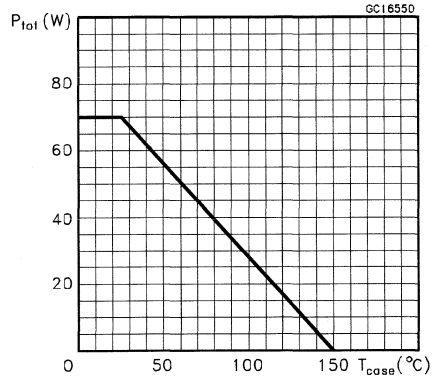
Thermal Impedance For ISOWATT218



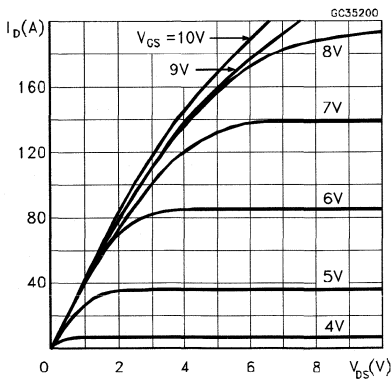
Derating Curve For TO-218 and TO-247



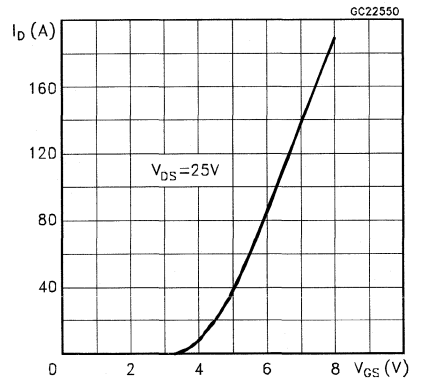
Derating Curve For ISOWATT218



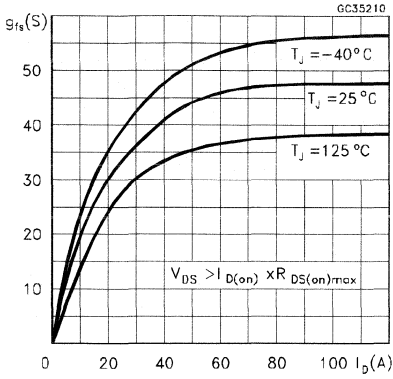
Output Characteristics



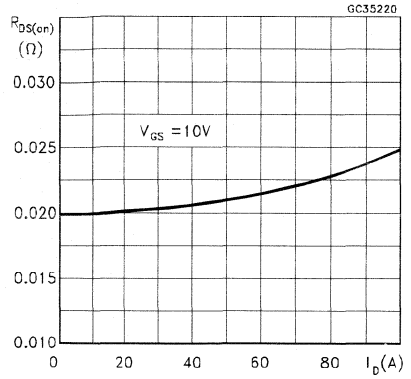
Transfer Characteristics



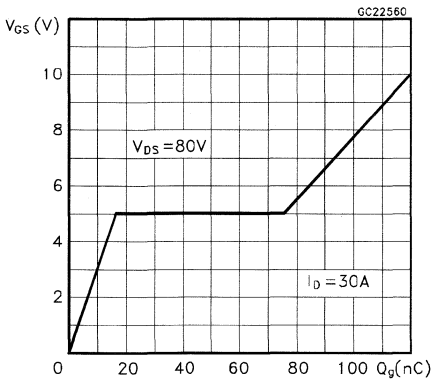
Transconductance



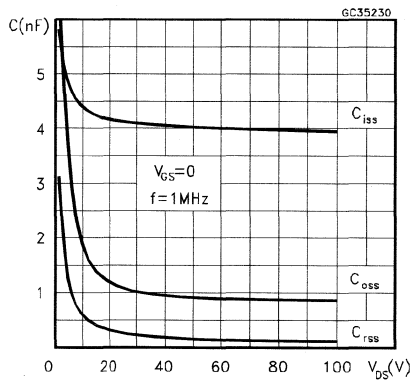
Static Drain-source On Resistance



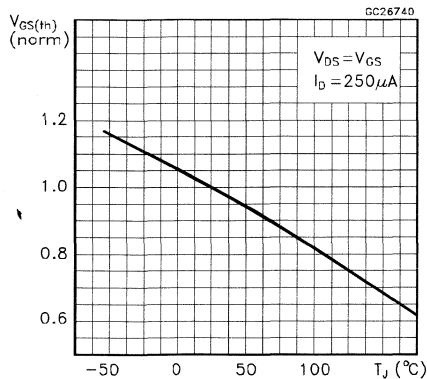
Gate Charge vs Gate-source Voltage



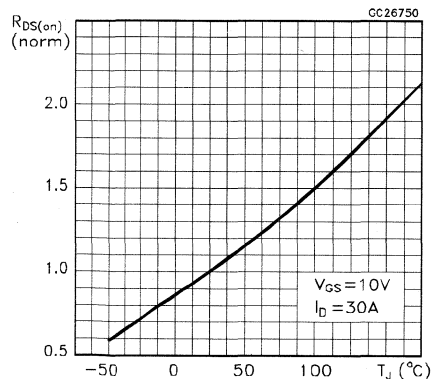
Capacitance Variations



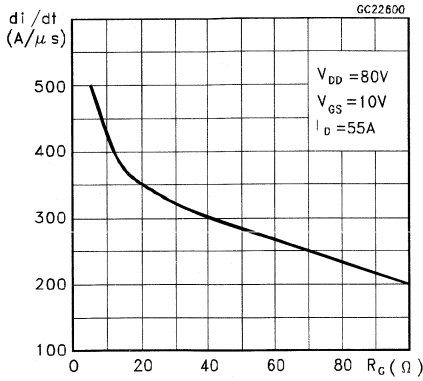
Normalized Gate Threshold Voltage vs Temperature



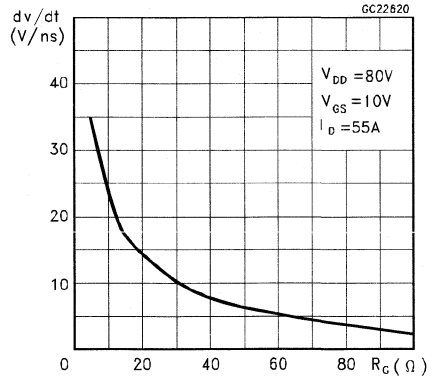
Normalized On Resistance vs Temperature



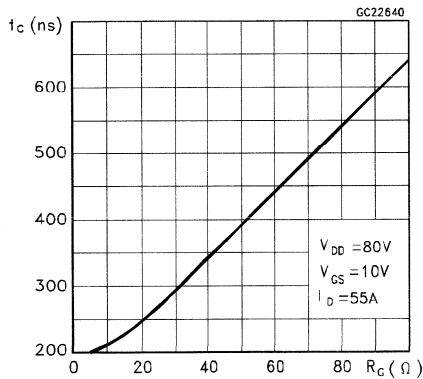
Turn-on Current Slope



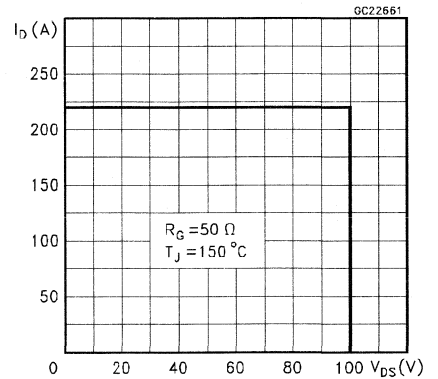
Turn-off Drain-source Voltage Slope



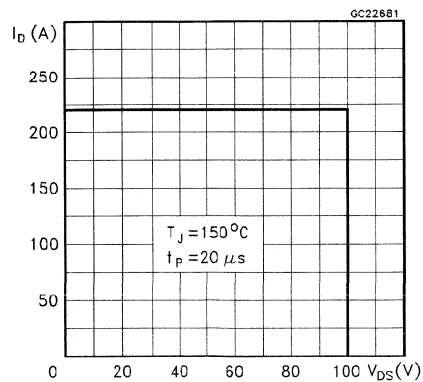
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

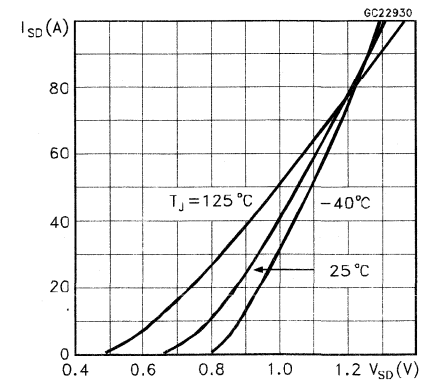


Fig. 1: Unclamped Inductive Load Test Circuits

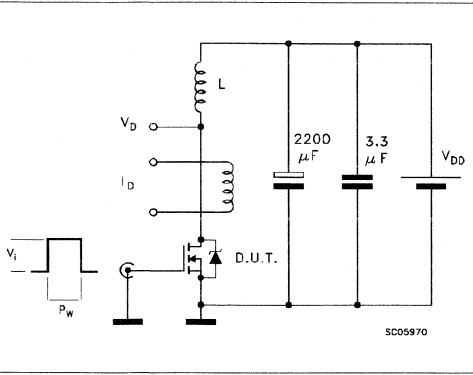


Fig. 2: Unclamped Inductive Waveforms

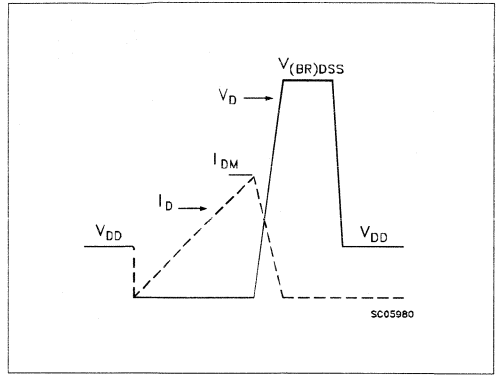


Fig. 3: Switching Times Test Circuits For Resistive Load

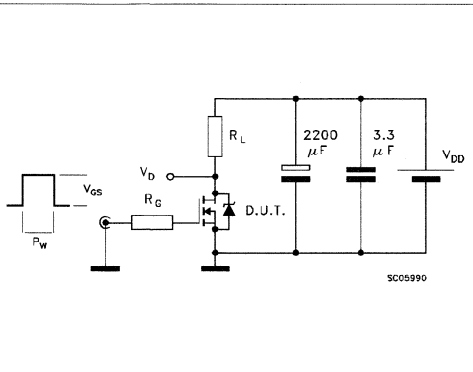


Fig. 4: Gate Charge Test Circuit

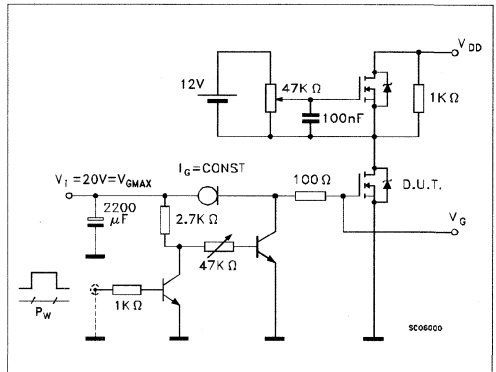
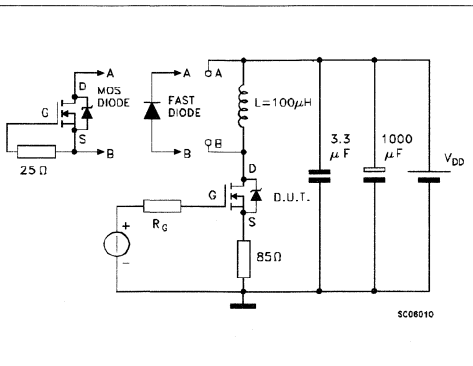


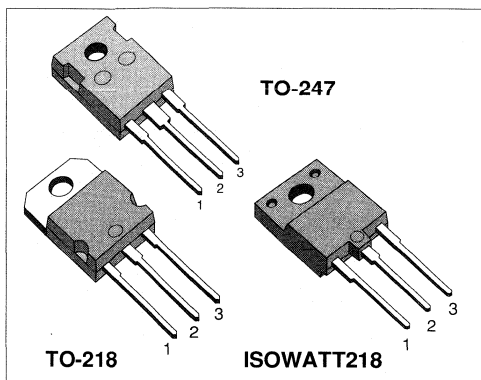
Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STH60N10	100 V	< 0.025 Ω	60 A
STH60N10FI	100 V	< 0.025 Ω	36 A
STW60N10	100 V	< 0.025 Ω	60 A

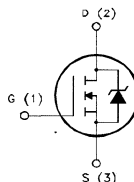
- TYPICAL R_{DS(on)} = 0.02 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- VERY HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION



APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STH/STW60N10	STH60N10FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	100		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	100		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	60	36	A
I _D	Drain Current (continuous) at T _c = 100 °C	42	22	A
I _{DM} (*)	Drain Current (pulsed)	240	240	A
P _{tot}	Total Dissipation at T _c = 25 °C	200	70	W
	Derating Factor	1.33	0.56	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	4000		V
T _{stg}	Storage Temperature	-65 to 175	-65 to 150	°C
T _j	Max. Operating Junction Temperature	175	150	°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-218/TO-247	ISOWATT218	
R _{thj-case}	Thermal Resistance Junction-case	Max	0.75	1.79	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	30		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.1		°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AH}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	60	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	720	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	180	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	37	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	100			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	2.9	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10 V I _D = 30 A V _{GS} = 10 V I _D = 30 A T _c = 100°C		0.02	0.025 0.05	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	60			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 30 A	25	35		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		4000	5000	pF
C _{oss}	Output Capacitance			1100	1400	pF
C _{rss}	Reverse Transfer Capacitance			250	350	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 80\text{ V}$ $I_D = 30\text{ A}$		90	130	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		270	380	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 80\text{ V}$ $I_D = 60\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		270		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 80\text{ V}$ $I_D = 30\text{ A}$ $V_{GS} = 10\text{ V}$		120	170	nC
Q_{gs}	Gate-Source Charge			16		nC
Q_{gd}	Gate-Drain Charge			60		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{rr}(V_{off})$	Off-voltage Rise Time	$V_{DD} = 80\text{ V}$ $I_D = 60\text{ A}$		200	280	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		210	290	ns
t_c	Cross-over Time	(see test circuit, figure 5)		410	570	ns

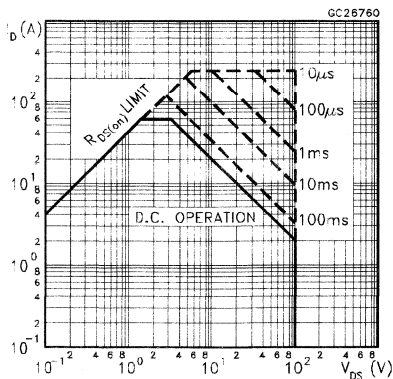
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				60	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				240	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 60\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 60\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		180		ns
Q_{rr}	Reverse Recovery Charge			1		μ C
I_{RRM}	Reverse Recovery Current			11		A

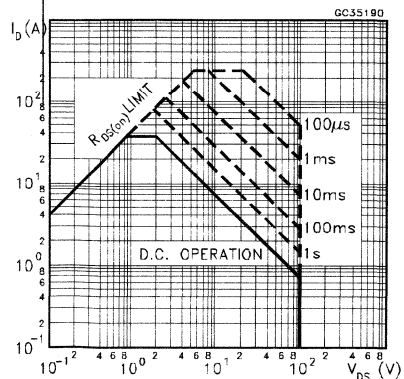
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

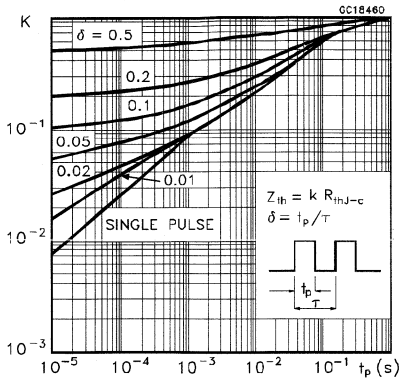
Safe Operating Areas For TO-218 and TO-247



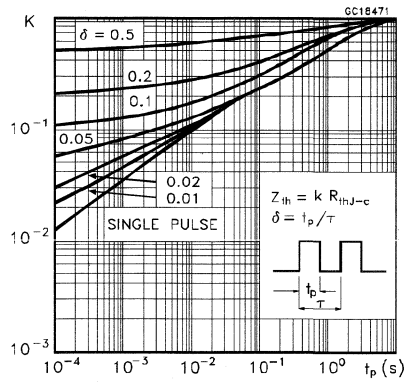
Safe Operating Areas For ISOWATT218



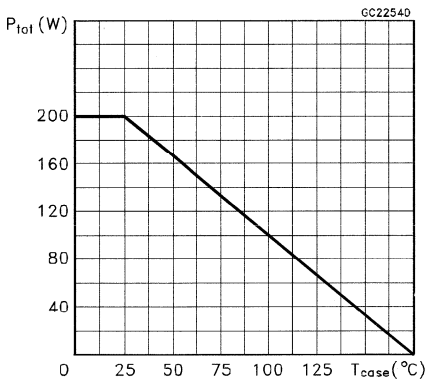
Thermal Impedance For TO-218 and TO-247



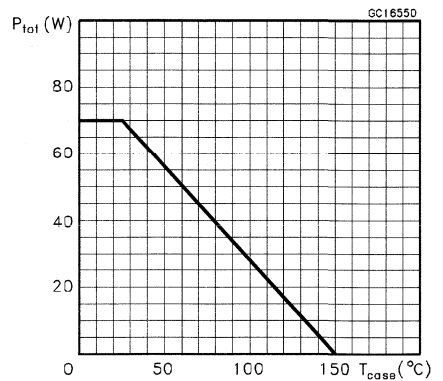
Thermal Impedance For ISOWATT218



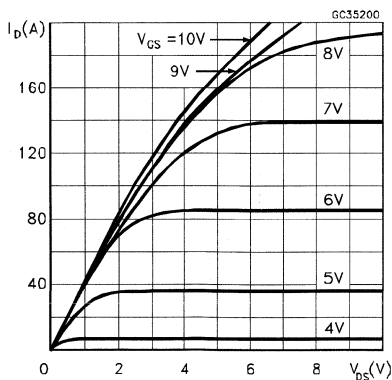
Derating Curve For TO-218 and TO-247



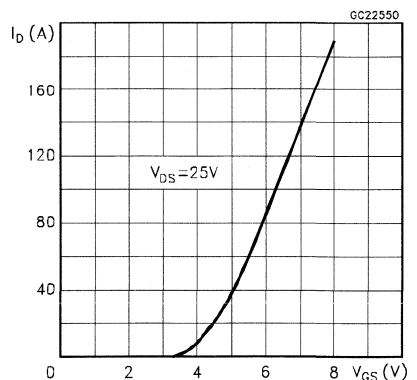
Derating Curve For ISOWATT218



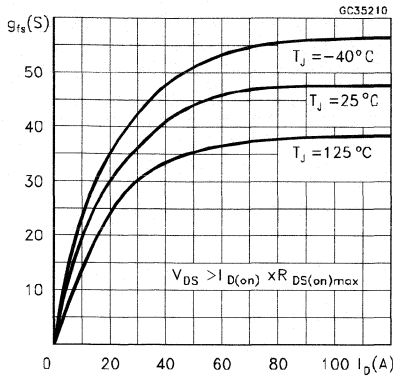
Output Characteristics



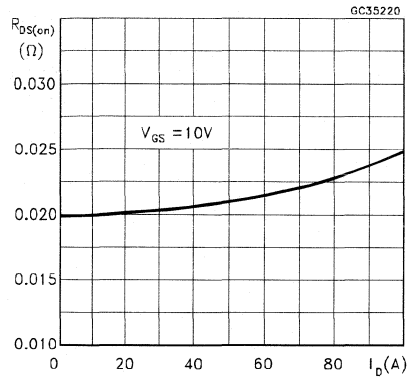
Transfer Characteristics



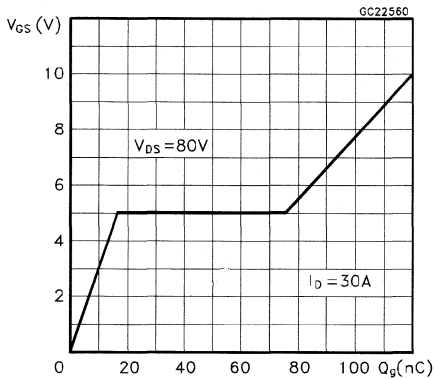
Transconductance



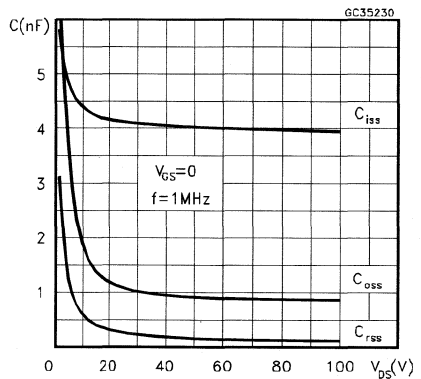
Static Drain-source On Resistance



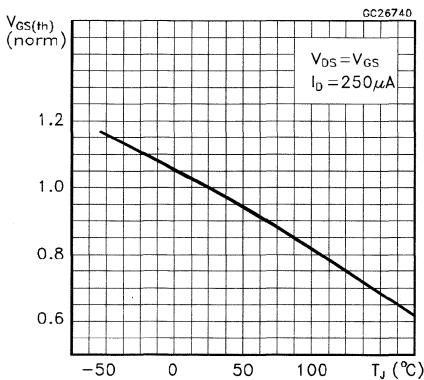
Gate Charge vs Gate-source Voltage



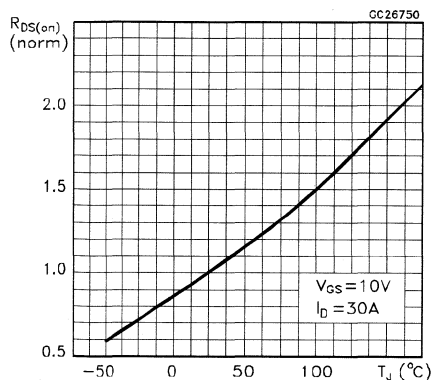
Capacitance Variations



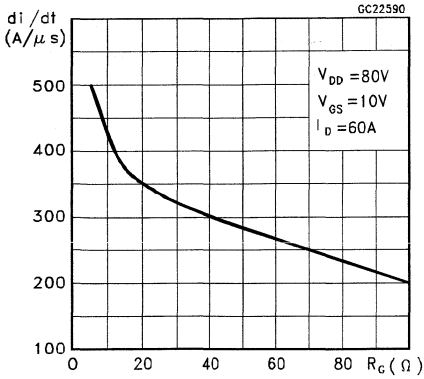
Normalized Gate Threshold Voltage vs Temperature



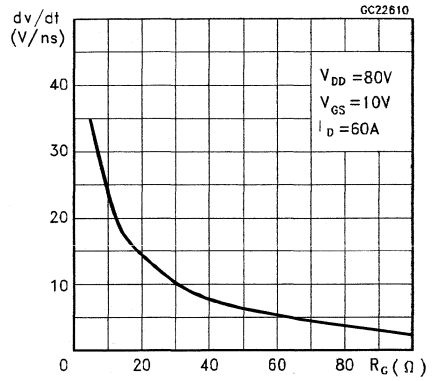
Normalized On Resistance vs Temperature



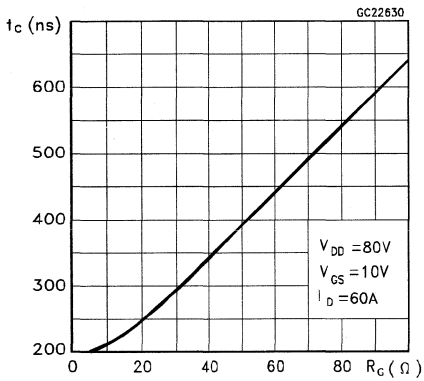
Turn-on Current Slope



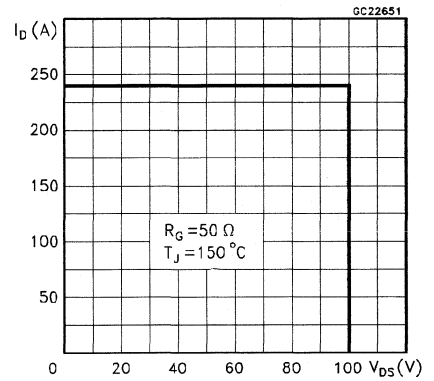
Turn-off Drain-source Voltage Slope



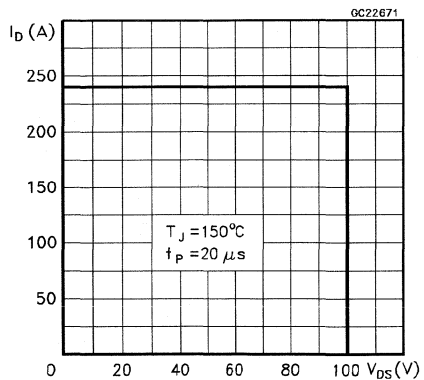
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

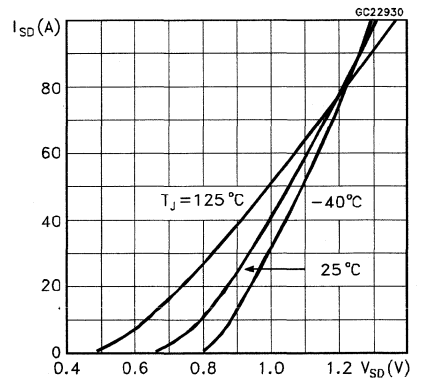


Fig. 1: Unclamped Inductive Load Test Circuits

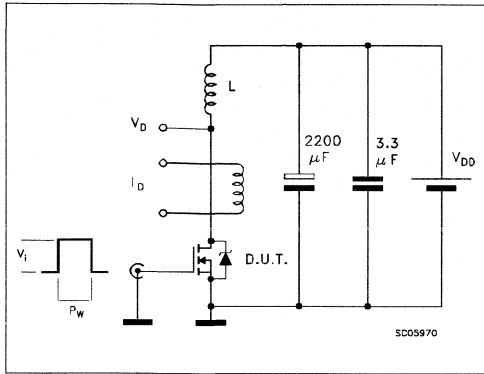


Fig. 2: Unclamped Inductive Waveforms

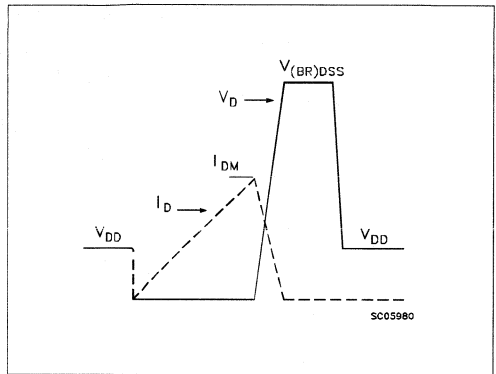


Fig. 3: Switching Times Test Circuits For Resistive Load

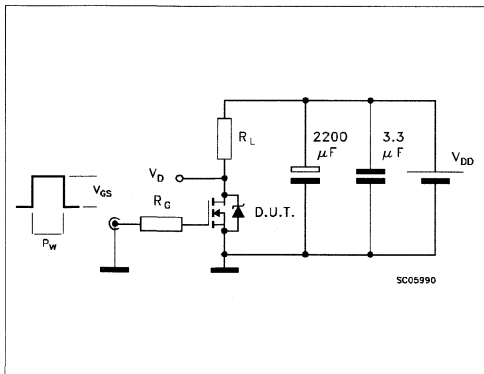


Fig. 4: Gate Charge Test Circuit

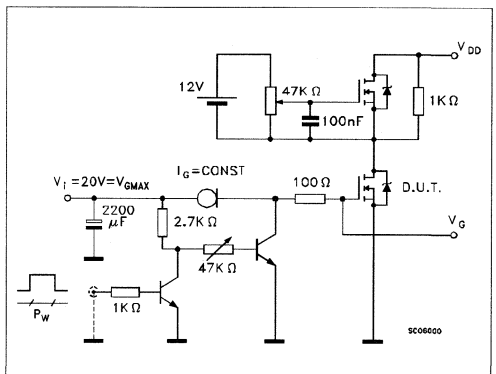
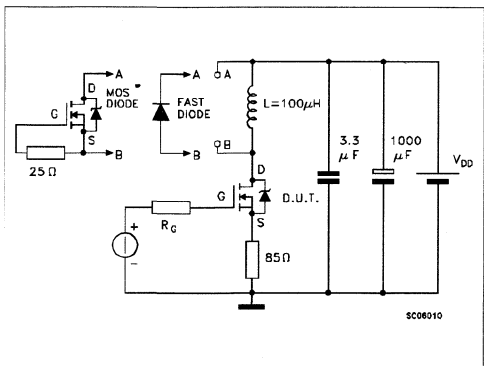


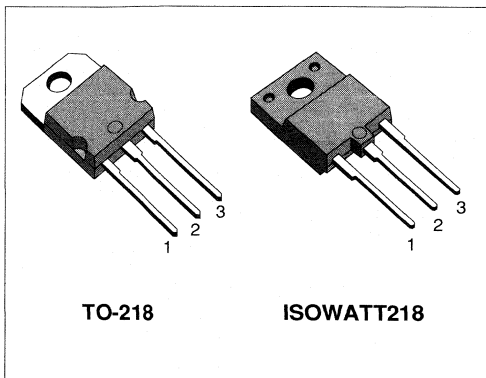
Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

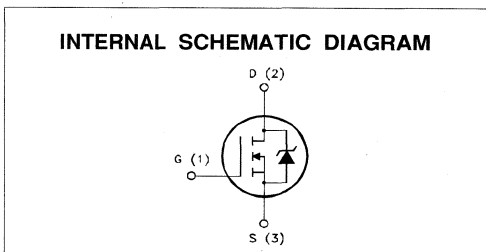
TYPE	V _{DSS}	R _{DS(on)}	I _D
STH65N05	50 V	< 0.02 Ω	65 A
STH65N05FI	50 V	< 0.02 Ω	37 A

- TYPICAL R_{DS(on)} = 0.017 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- VERY LOW R_{DS(on)}
- APPLICATION ORIENTED CHARACTERIZATION



APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STH65N05	STH65N05FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	50		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	50		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	65	37	A
I _D	Drain Current (continuous) at T _c = 100 °C	45	23	A
I _{DM} (*)	Drain Current (pulsed)	260	260	A
P _{tot}	Total Dissipation at T _c = 25 °C	180	60	W
	Derating Factor	1.2	0.48	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	4000	V
T _{stg}	Storage Temperature	-65 to 175	-65 to 150	°C
T _J	Max. Operating Junction Temperature	175	150	°C

*) Pulse width limited by safe operating area

THERMAL DATA

			TO-218	ISOWATT218	
R _{thj-case}	Thermal Resistance Junction-case	Max	0.83	2.08	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	30		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.1		°C/W
T _j	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	65	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	800	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	200	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	41	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	50			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	2.9	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 32.5 A V _{GS} = 10V I _D = 32.5 A T _c = 100°C		0.017	0.02 0.04	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} × R _{DS(on)max} V _{GS} = 10 V	65			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} × R _{DS(on)max} I _D = 32.5 A	18	29		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		2200	2900	pF
C _{oss}	Output Capacitance			950	1300	pF
C _{rss}	Reverse Transfer Capacitance			250	350	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 65\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		70 550	100 750	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 65\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		185		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 40\text{ V}$ $I_D = 65\text{ A}$ $V_{GS} = 10\text{ V}$		68 15 27	95	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 65\text{ A}$		170	240	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		200	280	ns
t_c	Cross-over Time			380	530	ns

SOURCE DRAIN DIODE

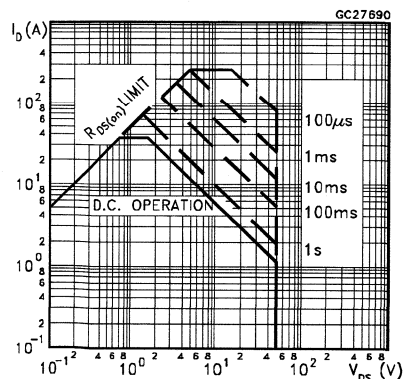
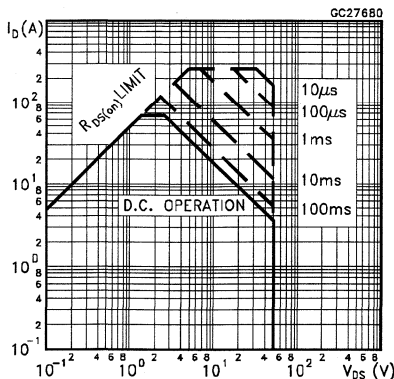
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				65 260	A A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 65\text{ A}$ $V_{GS} = 0$			1.7	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 65\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 25\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		120		ns
Q_{rr}	Reverse Recovery Charge			0.27		μ C
I_{RRM}	Reverse Recovery Current			4.5		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

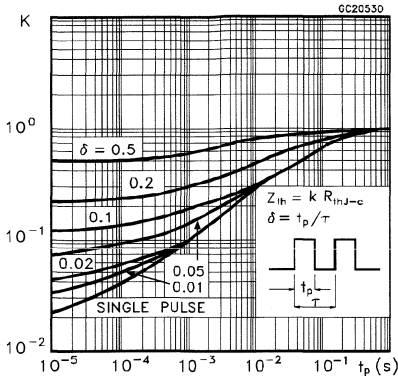
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas For TO-218

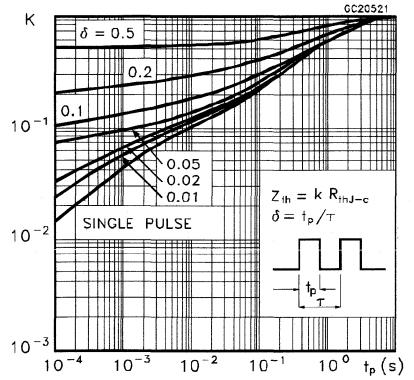
Safe Operating Areas For ISOWATT218



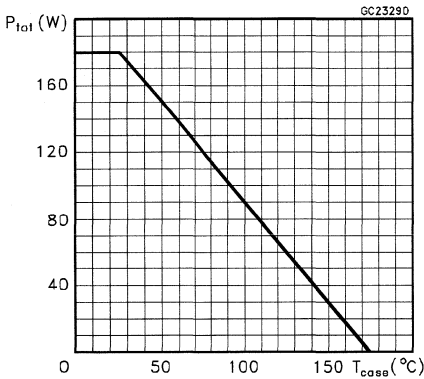
Thermal Impedance For TO-218



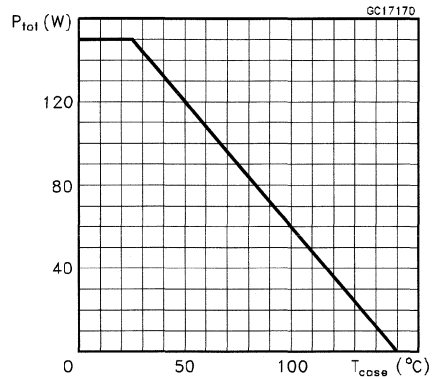
Thermal Impedance For ISOWATT218



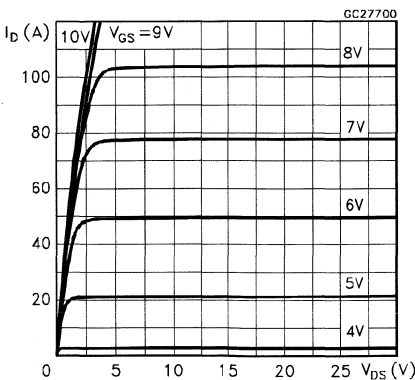
Derating Curve For TO-218



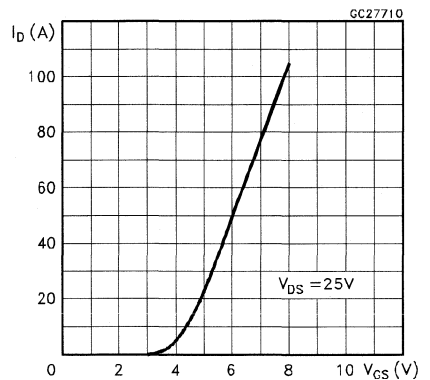
Derating Curve For ISOWATT218



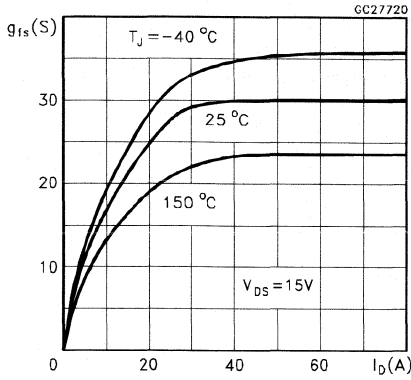
Output Characteristics



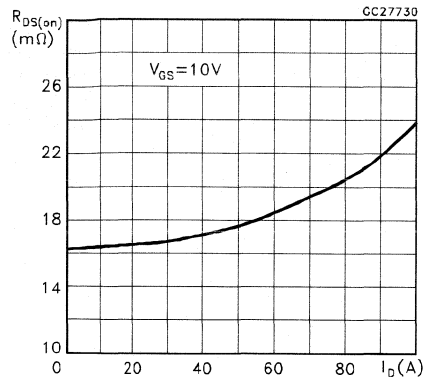
Transfer Characteristics



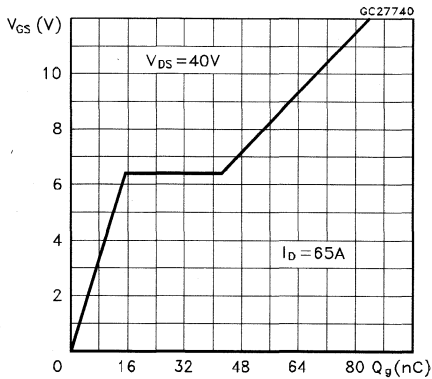
Transconductance



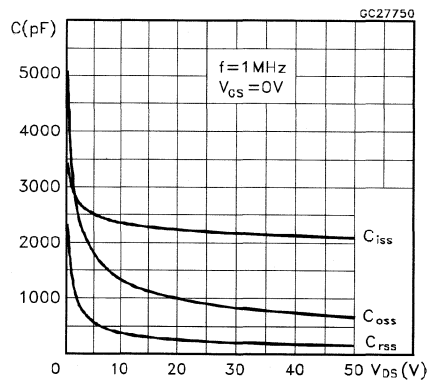
Static Drain-source On Resistance



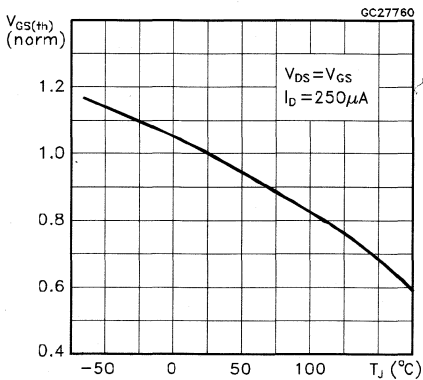
Gate Charge vs Gate-source Voltage



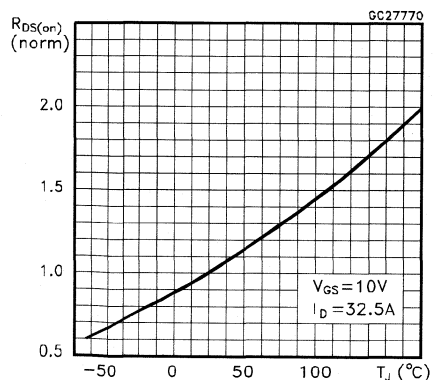
Capacitance Variations



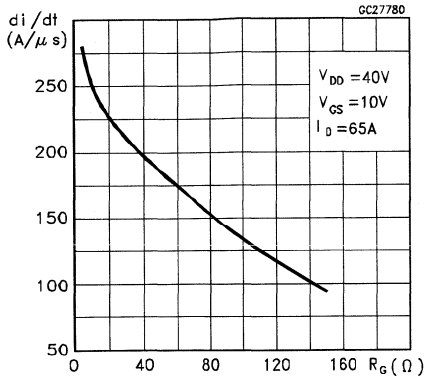
Normalized Gate Threshold Voltage vs Temperature



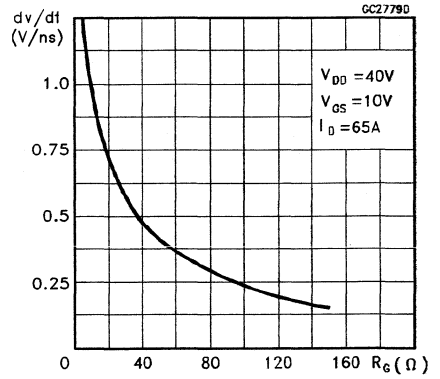
Normalized On Resistance vs Temperature



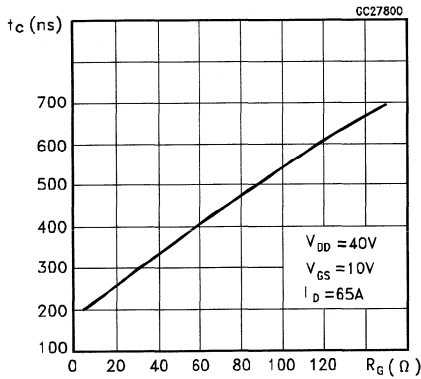
Turn-on Current Slope



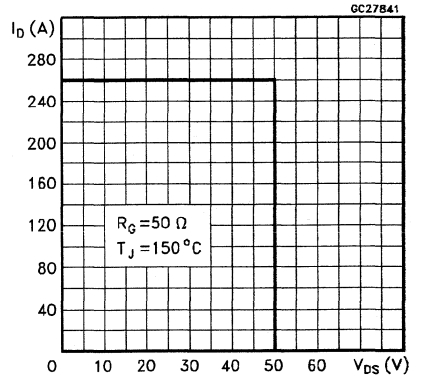
Turn-off Drain-source Voltage Slope



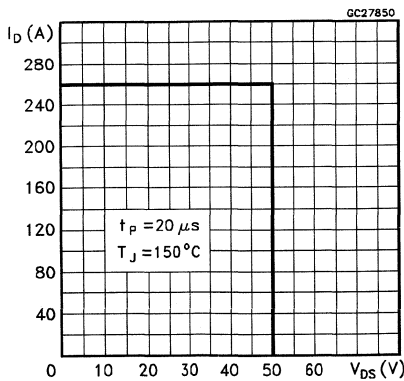
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

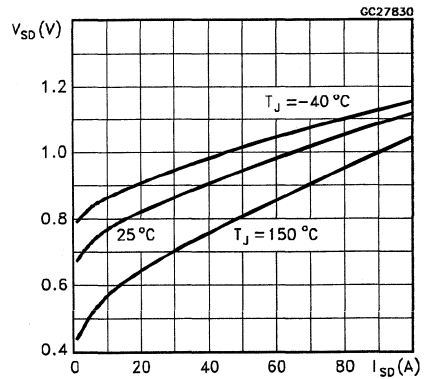


Fig. 1: Unclamped Inductive Load Test Circuits

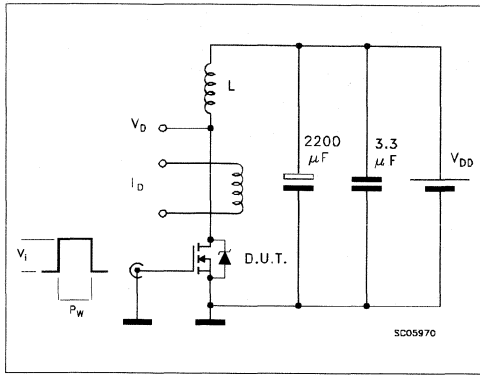


Fig. 2: Unclamped Inductive Waveforms

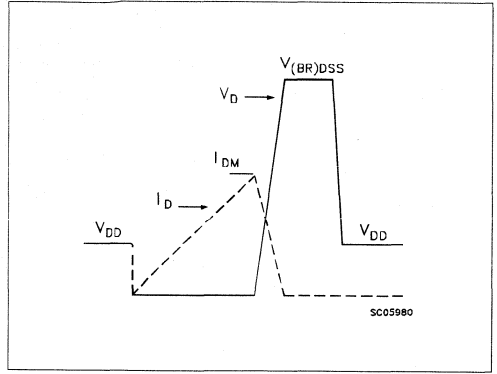


Fig. 3: Switching Times Test Circuits For Resistive Load

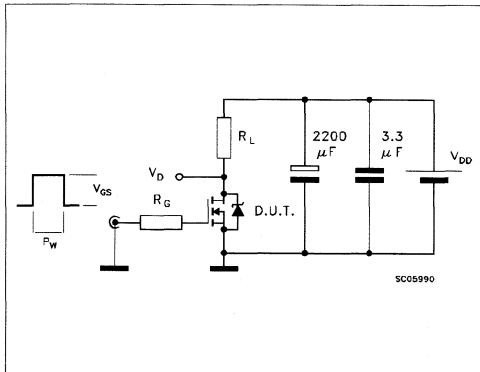


Fig. 4: Gate Charge Test Circuit

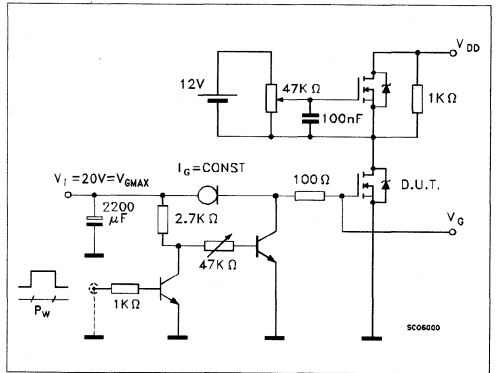
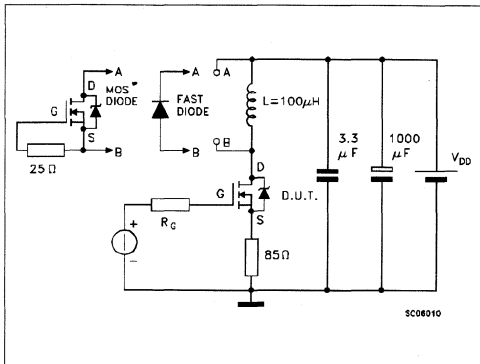


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



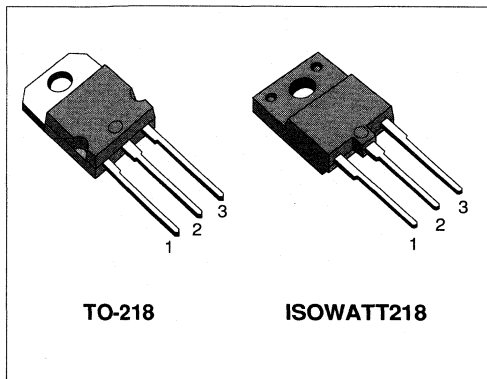
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{bss}	R _{DS(on)}	I _D
STH65N06	60 V	< 0.02 Ω	65 A
STH65N06FI	60 V	< 0.02 Ω	37 A

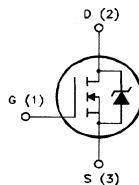
- TYPICAL R_{DS(on)} = 0.017 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- VERY LOW R_{DS(on)}
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STH65N06	STH65N06FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	60		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	60		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	65	37	A
I _D	Drain Current (continuous) at T _c = 100 °C	45	23	A
I _{DM} (*)	Drain Current (pulsed)	260	260	A
P _{tot}	Total Dissipation at T _c = 25 °C	180	60	W
	Derating Factor	1.2	0.48	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—		4000 V
T _{stg}	Storage Temperature	-65 to 175	-65 to 150	°C
T _J	Max. Operating Junction Temperature	175	150	°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-218	ISOWATT218	
R _{thj-case}	Thermal Resistance Junction-case	Max	0.83	2.08	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	30		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.1		°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	65	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	720	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	180	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	41	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	60			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	2.9	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 32.5 A V _{GS} = 10V I _D = 32.5 A T _c = 100°C		0.017	0.02 0.04	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	65			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 32.5 A	18	29		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		2200	2900	pF
C _{oss}	Output Capacitance			950	1300	pF
C _{rss}	Reverse Transfer Capacitance			250	350	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 65\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		70 550	100 750	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 65\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		185		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 40\text{ V}$ $I_D = 65\text{ A}$ $V_{GS} = 10\text{ V}$		68 15 27	95	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(off)}$ t_f t_c	Off-voltage Rise Time Fall Time Cross-over Time	$V_{DD} = 40\text{ V}$ $I_D = 65\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		170 200 380	240 280 530	ns ns ns

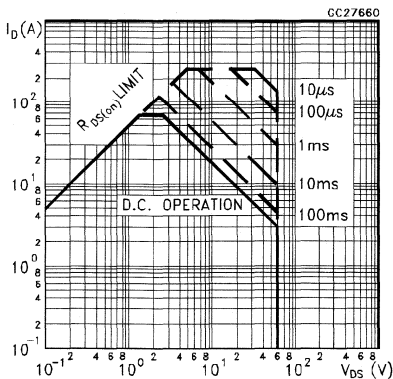
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				65 260	A A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 65\text{ A}$ $V_{GS} = 0$			1.7	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 65\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 25\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		120 0.27 4.5		ns μ C A

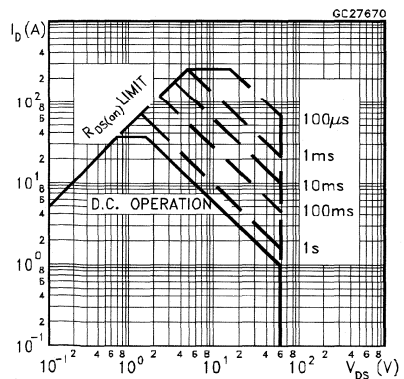
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

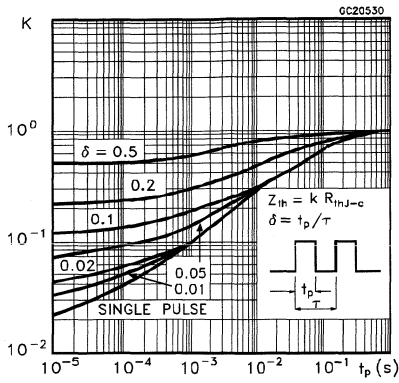
Safe Operating Areas For TO-218



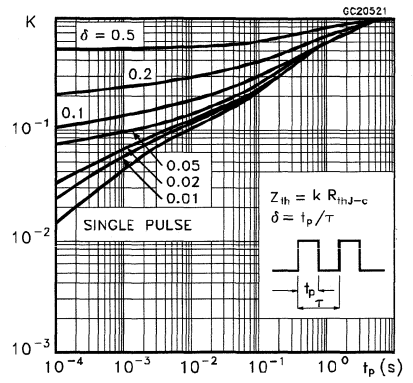
Safe Operating Areas For ISOWATT218



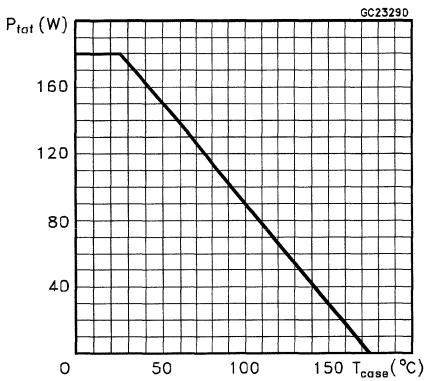
Thermal Impedance For TO-218



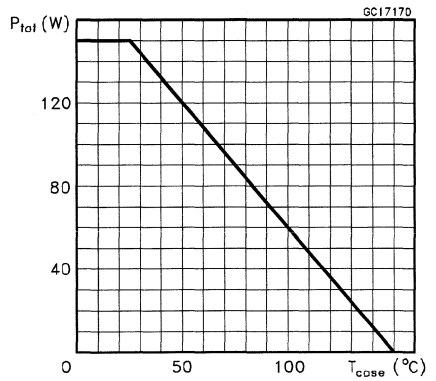
Thermal Impedance For ISOWATT218



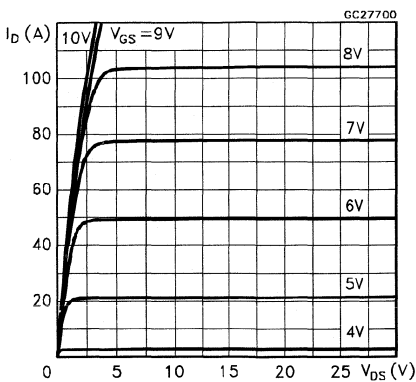
Derating Curve For TO-218



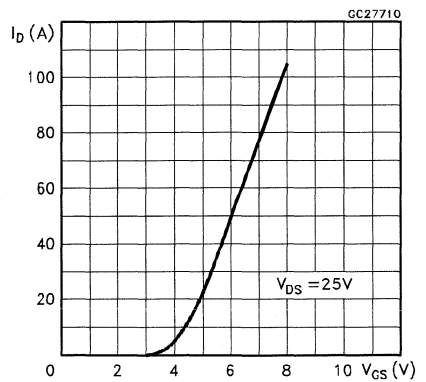
Derating Curve For ISOWATT218



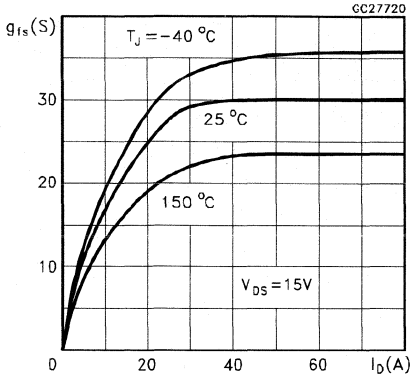
Output Characteristics



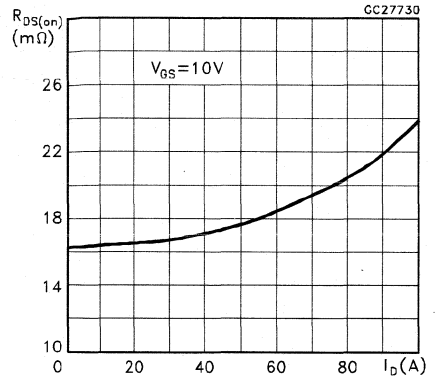
Transfer Characteristics



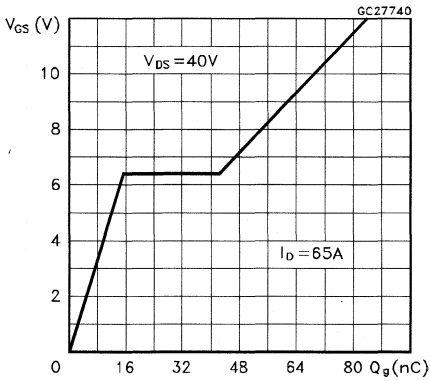
Transconductance



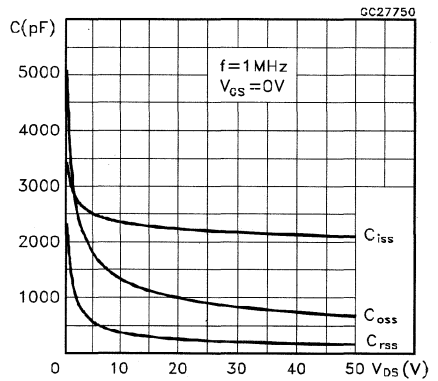
Static Drain-source On Resistance



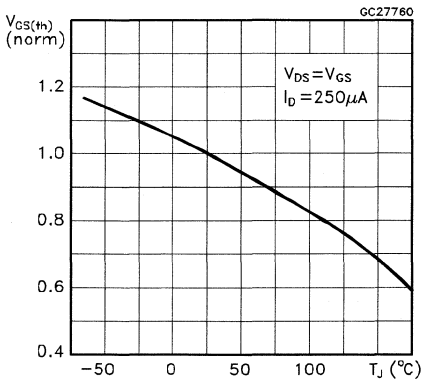
Gate Charge vs Gate-source Voltage



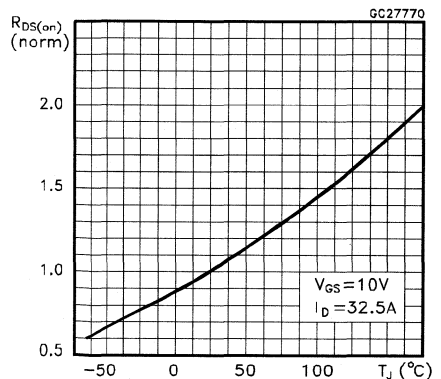
Capacitance Variations



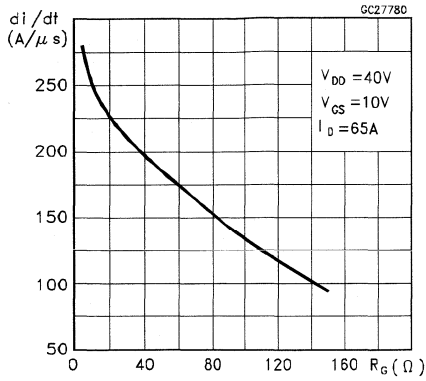
Normalized Gate Threshold Voltage vs Temperature



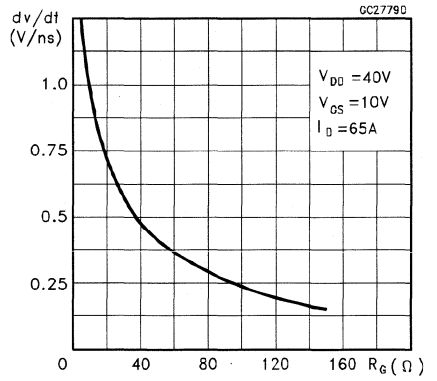
Normalized On Resistance vs Temperature



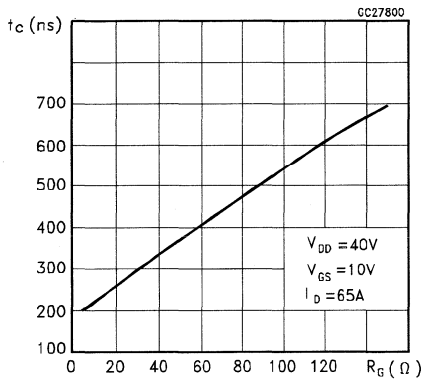
Turn-on Current Slope



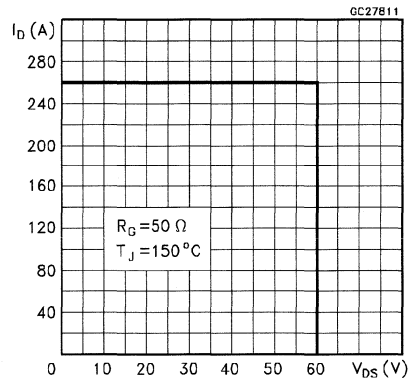
Turn-off Drain-source Voltage Slope



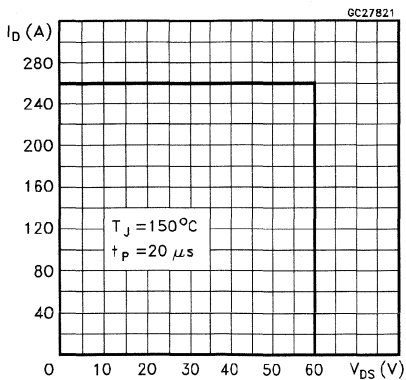
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

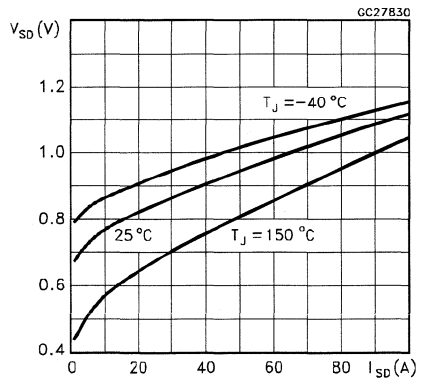


Fig. 1: Unclamped Inductive Load Test Circuits

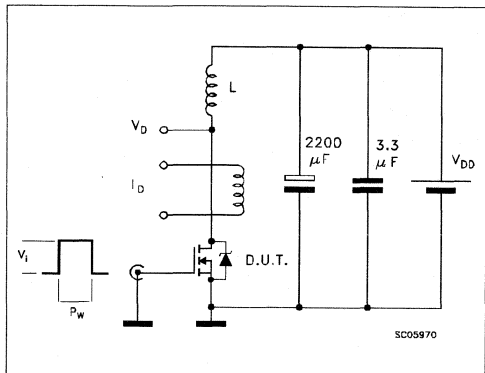


Fig. 2: Unclamped Inductive Waveforms

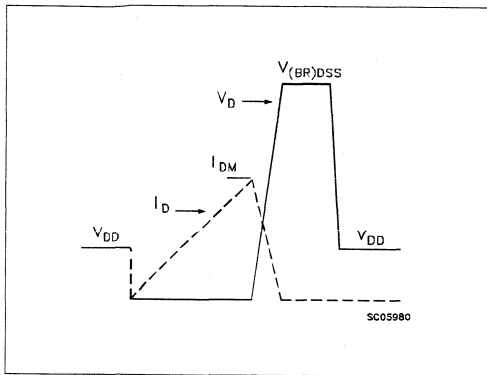


Fig. 3: Switching Times Test Circuits For Resistive Load

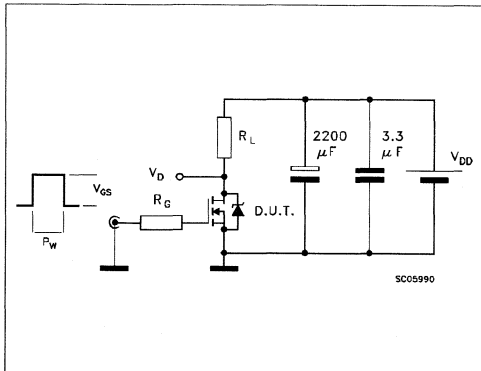


Fig. 4: Gate Charge Test Circuit

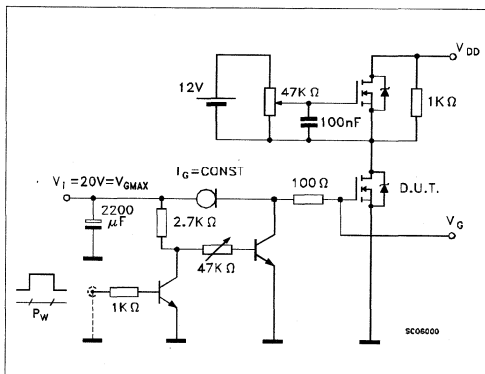
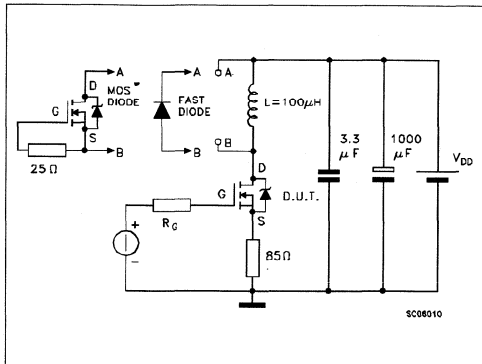


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



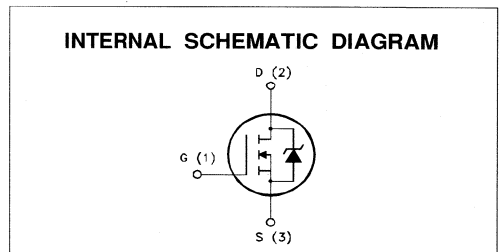
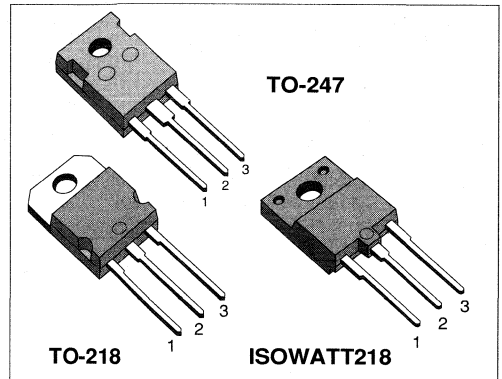
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STH75N06	60 V	< 0.014 Ω	75 A
STH75N06FI	60 V	< 0.014 Ω	48 A
STH75N06	60 V	< 0.014 Ω	75 A

- TYPICAL R_{DS(on)} = 0.011 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- VERY HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit	
		STW/STH75N06	STH75N06FI		
V _{DS}	Drain-source Voltage (V _{GS} = 0)	60		V	
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	60		V	
V _{GS}	Gate-source Voltage	± 20		V	
I _D	Drain Current (continuous) at T _c = 25 °C	75	48	A	
I _D	Drain Current (continuous) at T _c = 100 °C	53	30	A	
I _{DM} (*)	Drain Current (pulsed)	300	300	A	
P _{tot}	Total Dissipation at T _c = 25 °C	200	70	W	
	Derating Factor	1.33	0.56	W/°C	
V _{ISO}	Insulation Withstand Voltage (DC)	—		4000	V
T _{stg}	Storage Temperature	-65 to 175	-65 to 150	°C	
T _j	Max. Operating Junction Temperature	175	150	°C	

(*) Pulse width limited by safe operating area

THERMAL DATA

		TO-218/TO-247	ISOWATT218		
R _{thj-case}	Thermal Resistance Junction-case	Max	0.75	1.79	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	30		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.1		°C/W
T _I	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	70	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	900	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	200	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	45	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	60			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	2.9	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 40 A V _{GS} = 10V I _D = 40 A T _c = 100°C		0.011	0.014 0.028	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	75			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 40 A	25	45		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		4000	5200	pF
C _{oss}	Output Capacitance			1800	2300	pF
C _{rss}	Reverse Transfer Capacitance			500	650	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 25\text{ V}$ $I_D = 40\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		190 900	270 1300	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 75\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		150		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 25\text{ V}$ $I_D = 40\text{ A}$ $V_{GS} = 10\text{ V}$		130 27 48	180	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 75\text{ A}$		400	550	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		300	420	ns
t_c	Cross-over Time			650	900	ns

SOURCE DRAIN DIODE

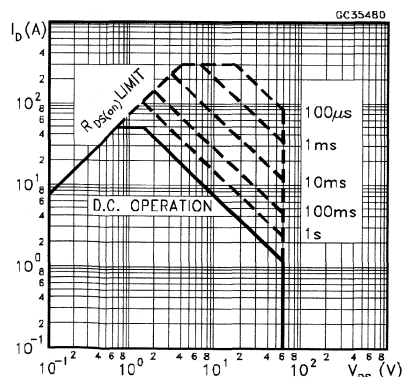
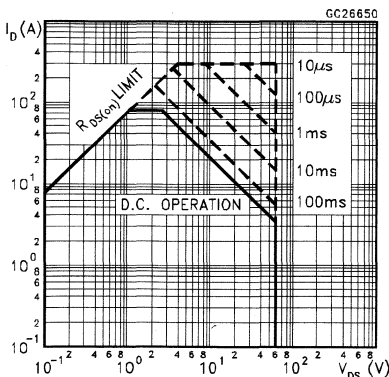
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				75	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				300	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 75\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 75\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 35\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		130		ns
Q_{rr}	Reverse Recovery Charge			0.45		μ C
I_{RRM}	Reverse Recovery Current			7		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

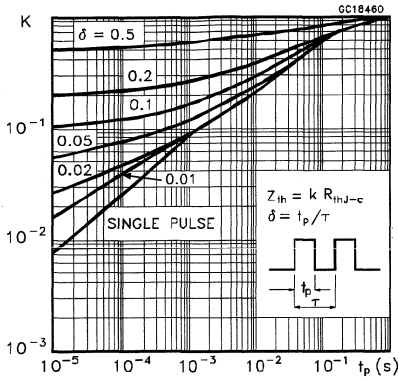
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas For TO-218 and TO-247

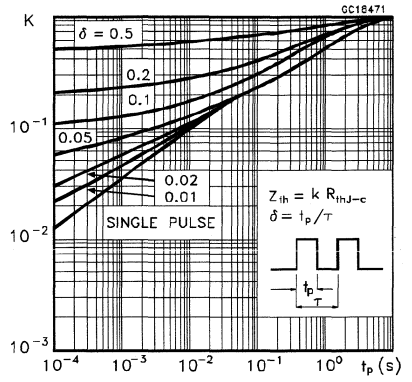
Safe Operating Areas For ISOWATT218



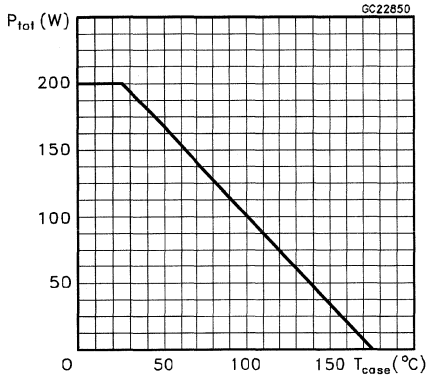
Thermal Impedance For TO-218 and TO-247



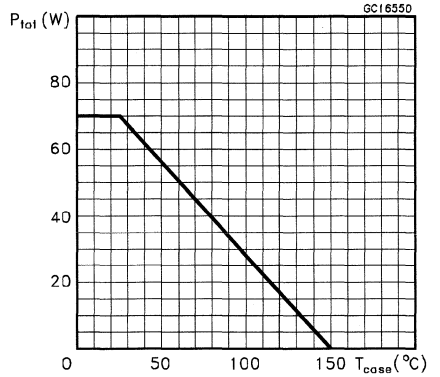
Thermal Impedance For ISOWATT218



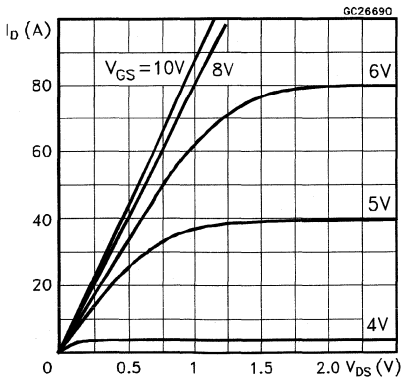
Derating Curve For TO-218 and TO-247



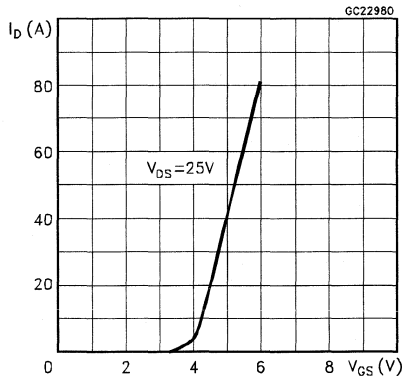
Derating Curve For ISOWATT218



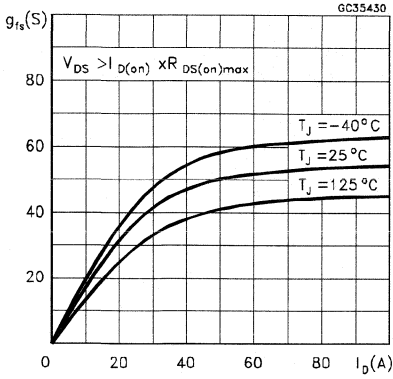
Output Characteristics



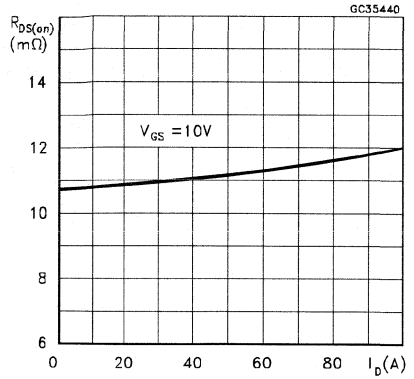
Transfer Characteristics



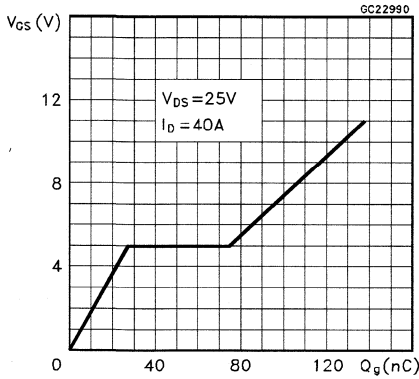
Transconductance



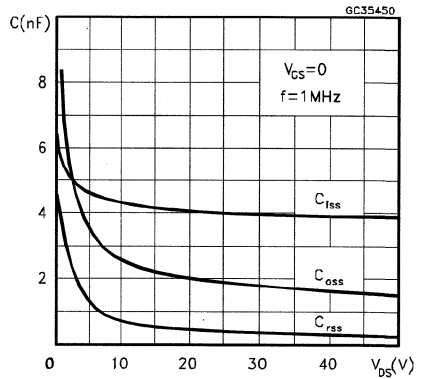
Static Drain-source On Resistance



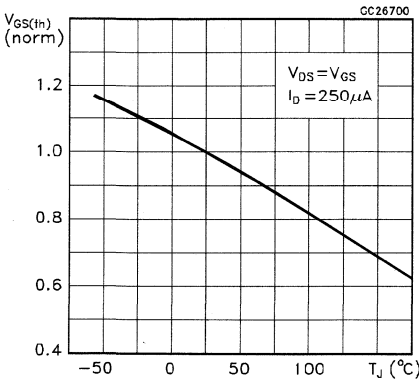
Gate Charge vs Gate-source Voltage



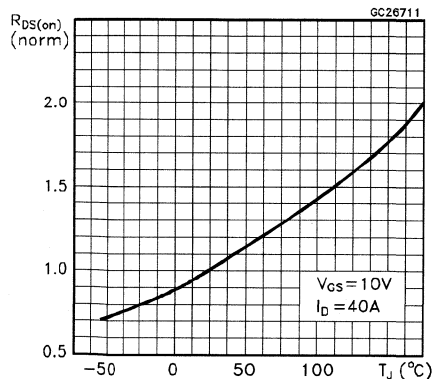
Capacitance Variations



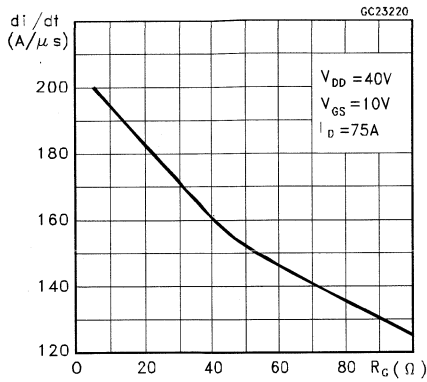
Normalized Gate Threshold Voltage vs Temperature



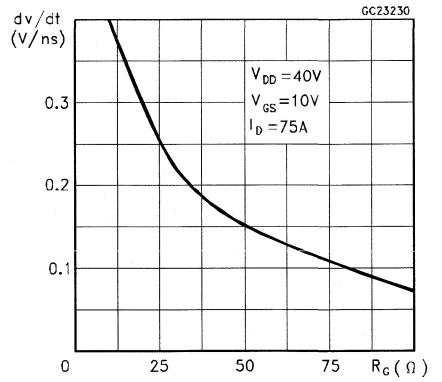
Normalized On Resistance vs Temperature



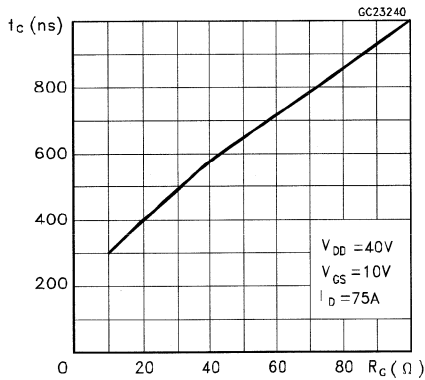
Turn-on Current Slope



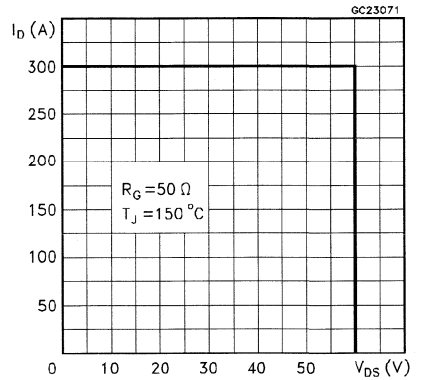
Turn-off Drain-source Voltage Slope



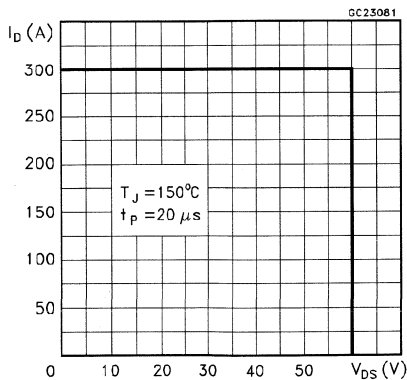
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

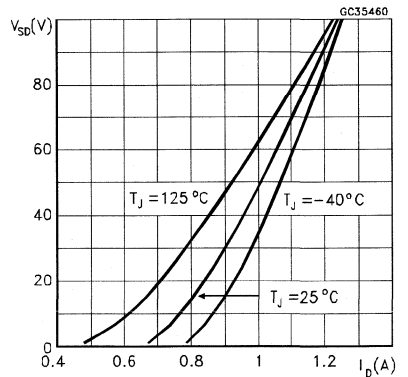


Fig. 1: Unclamped Inductive Load Test Circuits

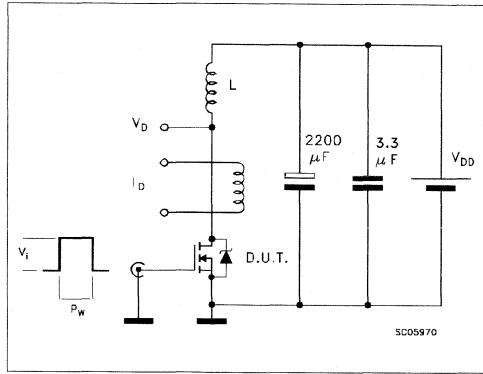


Fig. 2: Unclamped Inductive Waveforms

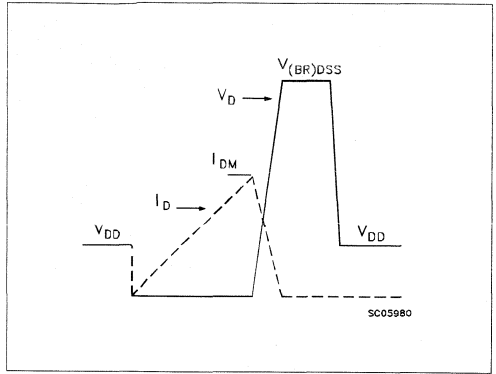


Fig. 3: Switching Times Test Circuits For Resistive Load

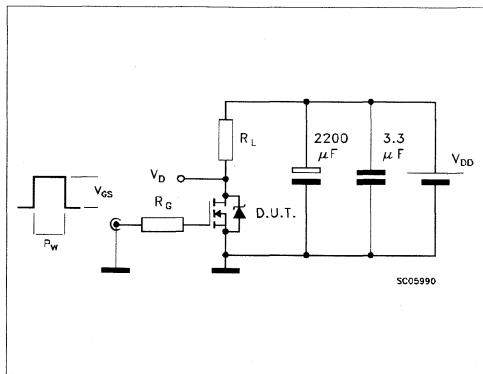


Fig. 4: Gate Charge Test Circuit

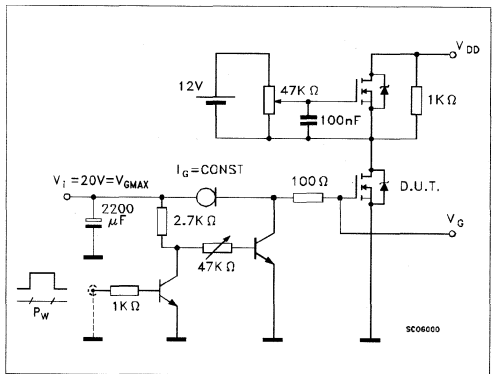
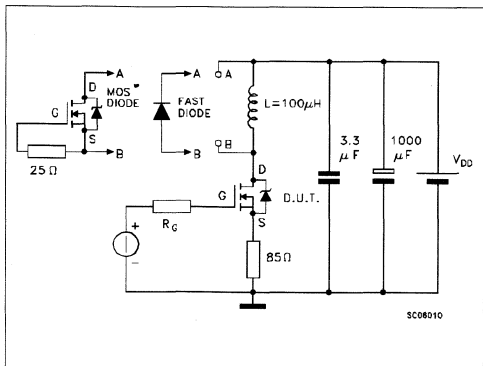


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



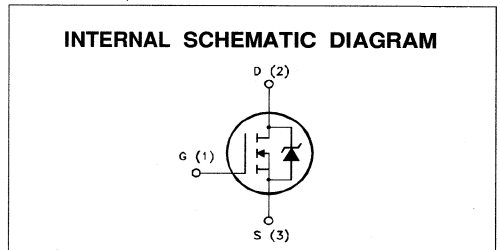
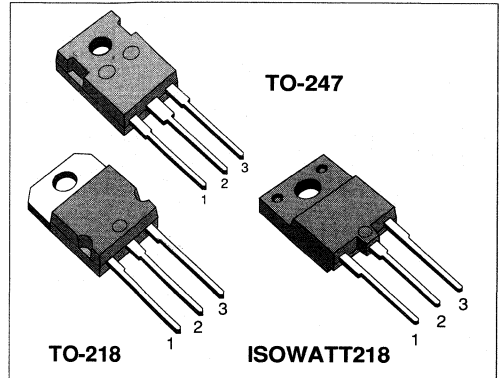
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STH80N05	50 V	< 0.012 Ω	80 A
STH80N05FI	50 V	< 0.012 Ω	52 A
STW80N05	50 V	< 0.012 Ω	80 A

- TYPICAL R_{DS(on)} = 0.011 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- VERY HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit	
		STW/STH80N05	STH80N05FI		
V _{DS}	Drain-source Voltage (V _{GS} = 0)	50		V	
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	50		V	
V _{GS}	Gate-source Voltage	± 20		V	
I _D	Drain Current (continuous) at T _c = 25 °C	80	52	A	
I _D	Drain Current (continuous) at T _c = 100 °C	56	32	A	
I _{DM} (*)	Drain Current (pulsed)	320	320	A	
P _{tot}	Total Dissipation at T _c = 25 °C	200	70	W	
	Derating Factor	1.33	0.56	W/°C	
V _{ISO}	Insulation Withstand Voltage (DC)	—		4000	V
T _{stg}	Storage Temperature	-65 to 175	-65 to 150	°C	
T _j	Max. Operating Junction Temperature	175	150	°C	

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-218/TO-247	ISOWATT218	
R _{thj-case}	Thermal Resistance Junction-case	Max	0.75	1.79	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	30		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.1		°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	70	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	900	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	200	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	45	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	50			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	2.9	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 40 A V _{GS} = 10V I _D = 40 A T _c = 100°C		0.011	0.012 0.024	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	80			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 40 A	25	45		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		4000	5200	pF
C _{oss}	Output Capacitance			1800	2300	pF
C _{rss}	Reverse Transfer Capacitance			500	650	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 25\text{ V}$ $I_D = 40\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		190 900	270 1300	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 80\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		150		A/ μs
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 25\text{ V}$ $I_D = 40\text{ A}$ $V_{GS} = 10\text{ V}$		130 27 48	180	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(off)}$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 80\text{ A}$		450	600	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		350	480	ns
t_c	Cross-over Time			700	950	ns

SOURCE DRAIN DIODE

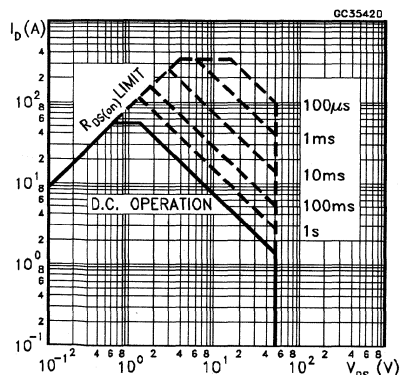
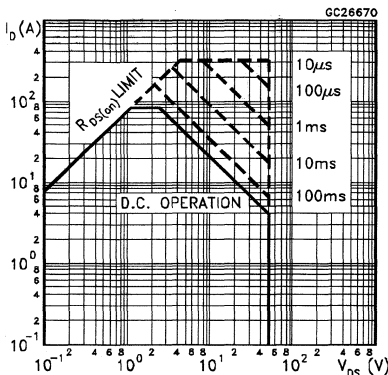
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				80 320	A A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 80\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 80\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 35\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		130		ns
Q_{rr}	Reverse Recovery Charge			0.45		μC
I_{RRM}	Reverse Recovery Current			7		A

(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

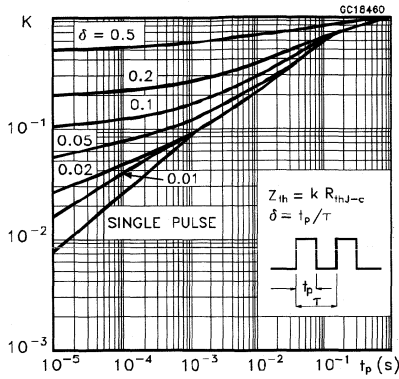
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas For TO-218 and TO-247

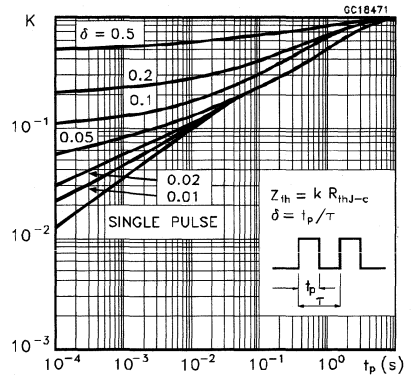
Safe Operating Areas For ISOWATT218



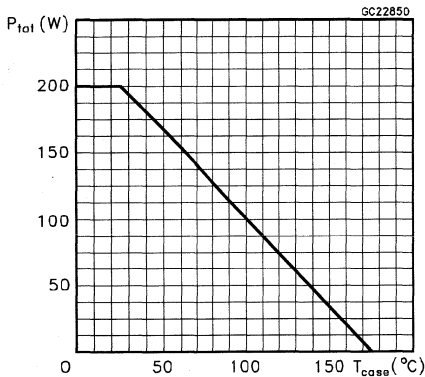
Thermal Impedance For TO-218 and TO-247



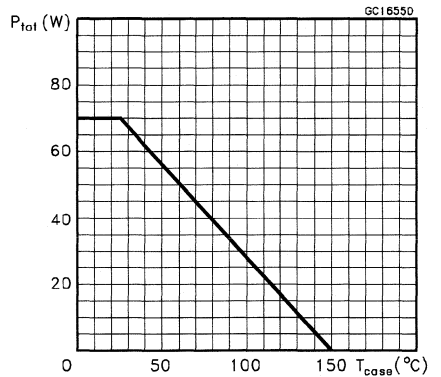
Thermal Impedance For ISOWATT218



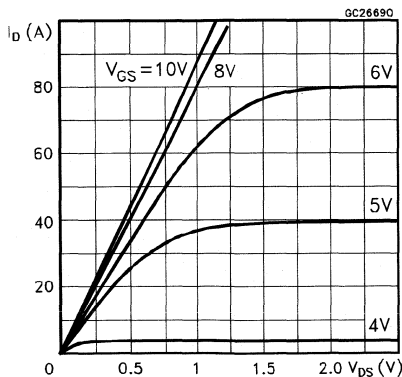
Derating Curve For TO-218 and TO-247



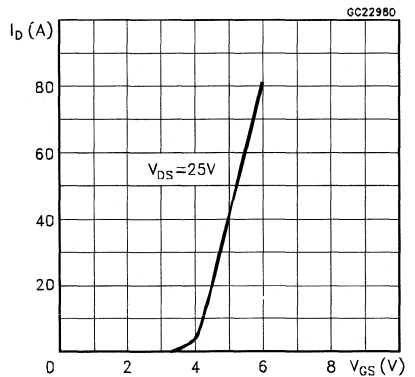
Derating Curve For ISOWATT218



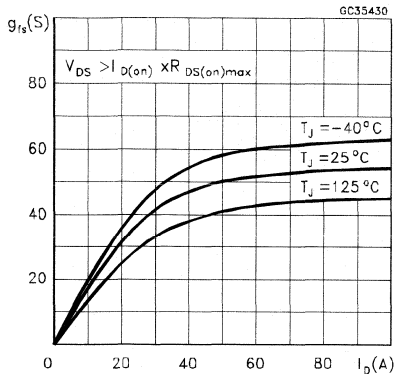
Output Characteristics



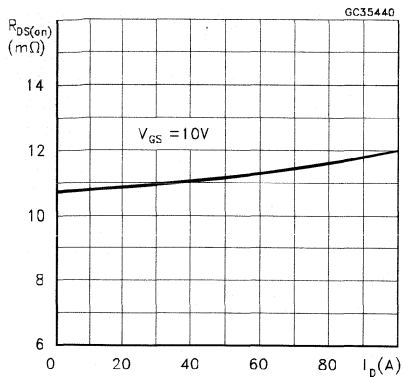
Transfer Characteristics



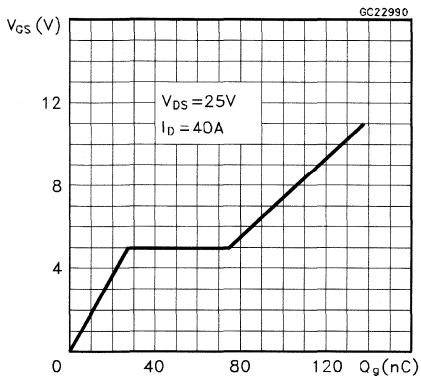
Transconductance



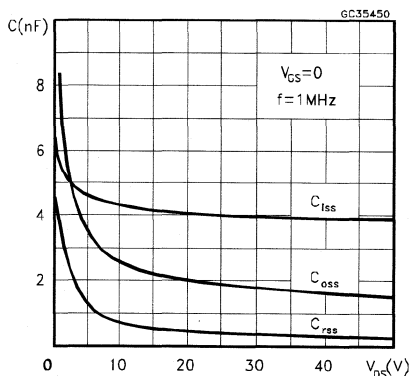
Static Drain-source On Resistance



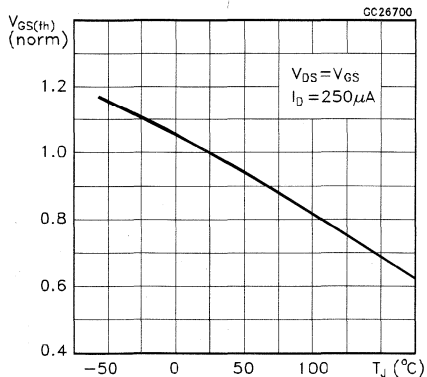
Gate Charge vs Gate-source Voltage



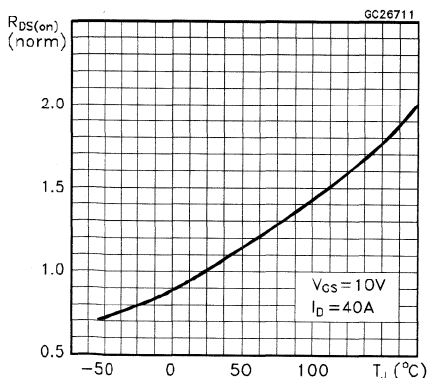
Capacitance Variations



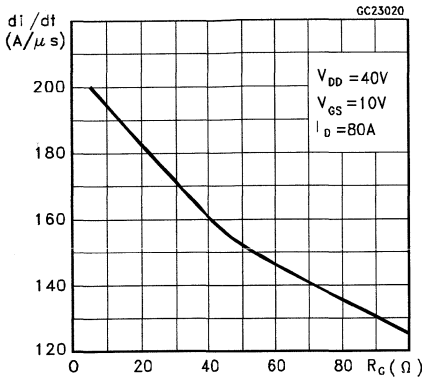
Normalized Gate Threshold Voltage vs Temperature



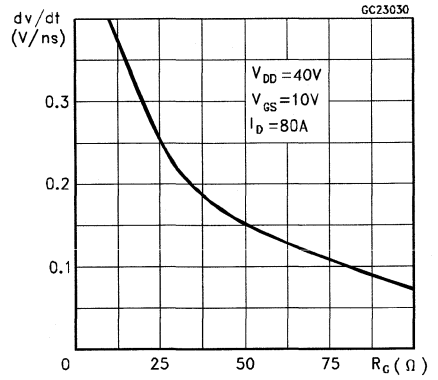
Normalized On Resistance vs Temperature



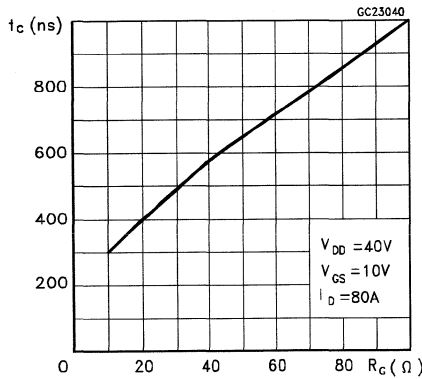
Turn-on Current Slope



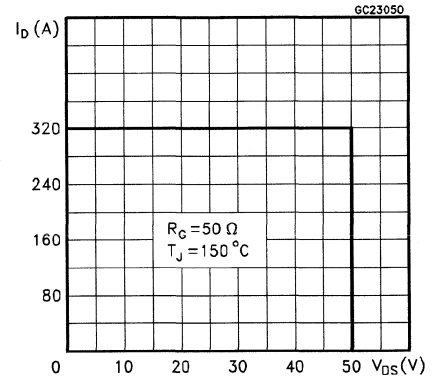
Turn-off Drain-source Voltage Slope



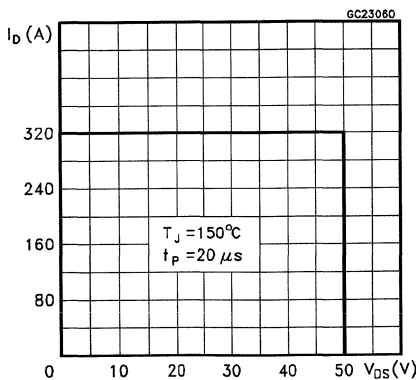
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

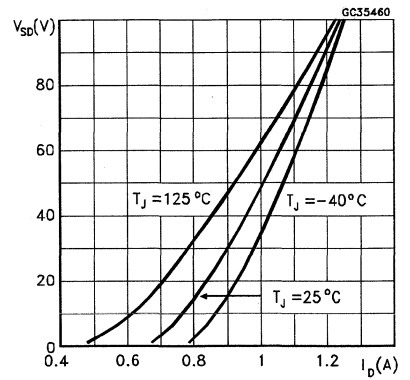


Fig. 1: Unclamped Inductive Load Test Circuits

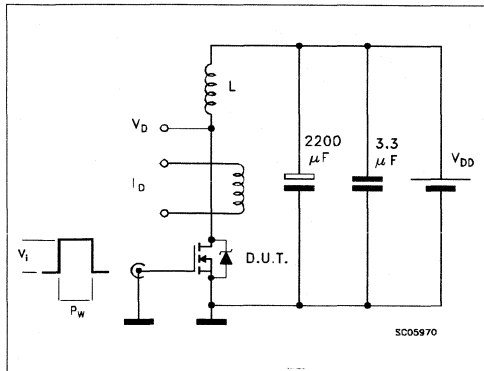


Fig. 2: Unclamped Inductive Waveforms

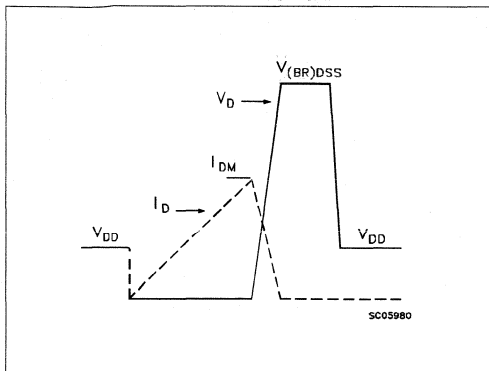


Fig. 3: Switching Times Test Circuits For Resistive Load

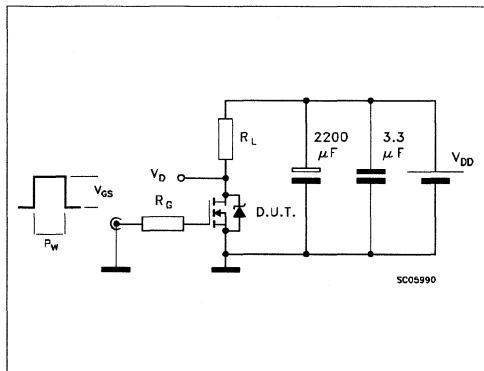


Fig. 4: Gate Charge Test Circuit

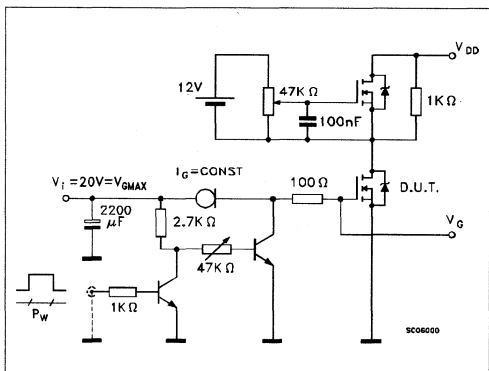
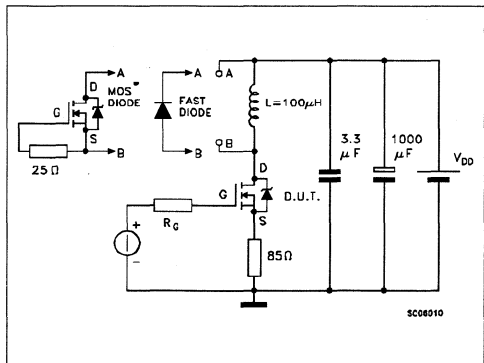


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



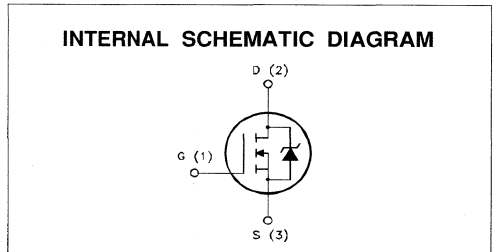
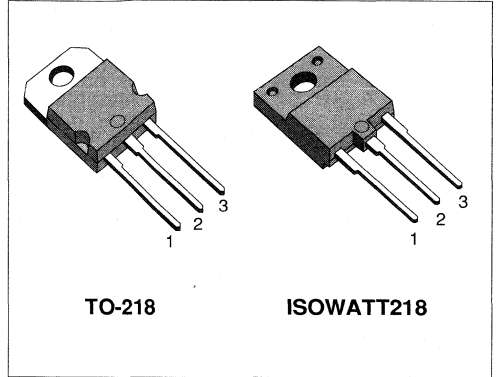
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STHV82	800 V	< 2 Ω	5.5 A
STHV82FI	800 V	< 2 Ω	3.6 A

- TYPICAL R_{DS(on)} = 1.65 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INPUT CAPACITANCE
- LOW GATE CHARGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CONSUMER AND INDUSTRIAL LIGHTING
- DC-AC INVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLY (UPS)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STHV82	STHV82FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	800		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	800		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	5.5	3.6	A
I _D	Drain Current (continuous) at T _c = 100 °C	3.4	2.3	A
I _{DM} (*)	Drain Current (pulsed)	20	20	A
P _{tot}	Total Dissipation at T _c = 25 °C	150	60	W
	Derating Factor	1.2	0.48	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	4000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _J	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-218	ISOWATT218	
R _{thj-case}	Thermal Resistance Junction-case	Max	0.83	2.08	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	30		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.1		°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	5.5	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	320	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	16	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	3.2	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	800			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 2.5A V _{GS} = 10V I _D = 2.5 A T _c = 100°C		1.65	2 4	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	5.5			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 2.5 A	2	4		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		1190	1450	pF
C _{oss}	Output Capacitance			165	200	pF
C _{rss}	Reverse Transfer Capacitance			70	85	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 400\text{ V}$ $I_D = 2.5\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		50 85	65 105	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 640\text{ V}$ $I_D = 5.5\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		200		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 500\text{ V}$ $I_D = 6\text{ A}$ $V_{GS} = 10\text{ V}$		75 9 33	95	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(voff)$ t_f	Off-voltage Rise Time Fall Time	$V_{DD} = 640\text{ V}$ $I_D = 5.5\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		120 30	150 40	ns ns
t_c	Cross-over Time	(see test circuit, figure 5)		160	200	ns

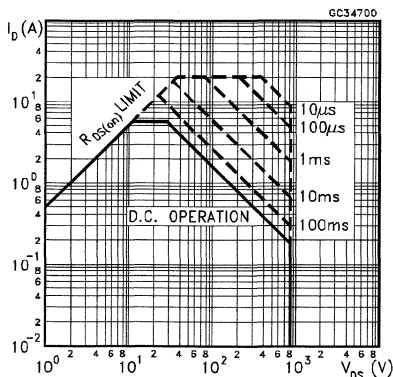
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				5.5 20	A A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 5.5\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 5.5\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 80\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		700		ns
Q_{rr}	Reverse Recovery Charge			7.7		μ C
I_{RRM}	Reverse Recovery Current			22		A

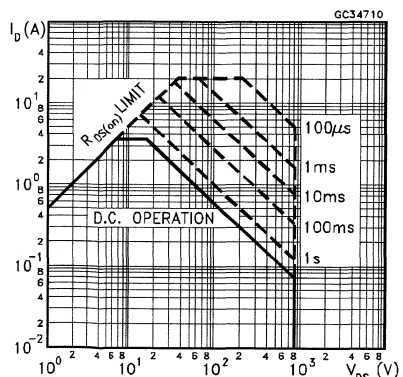
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

(•) Pulse width limited by safe operating area

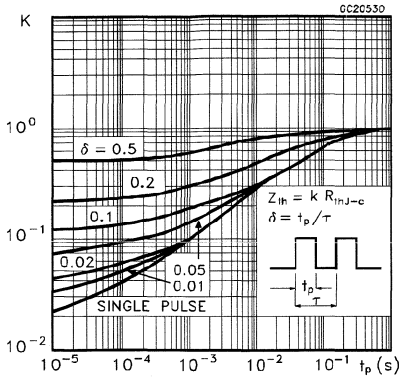
Safe Operating Areas For TO-218



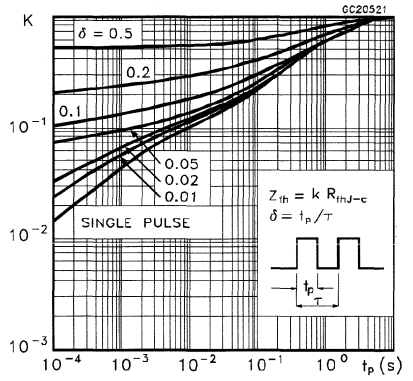
Safe Operating Areas For ISOWATT218



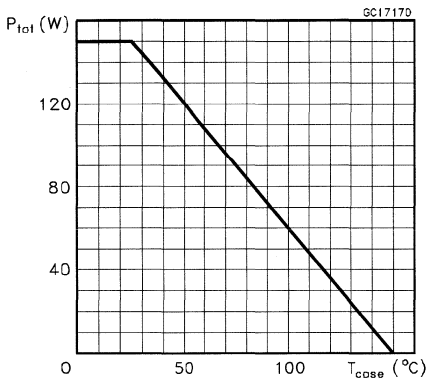
Thermal Impedance For TO-218



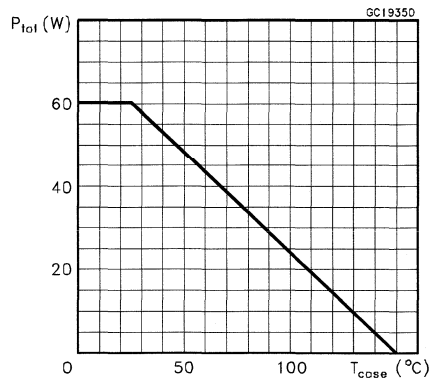
Thermal Impedance For ISOWATT218



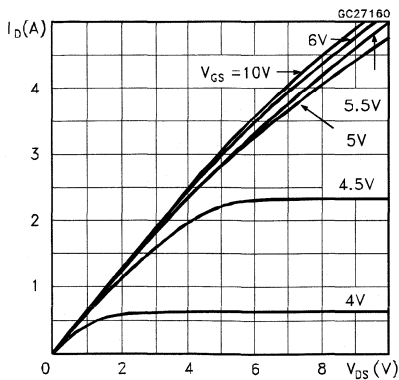
Derating Curve For TO-218



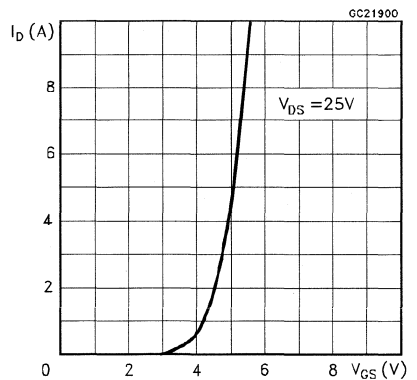
Derating Curve For ISOWATT218



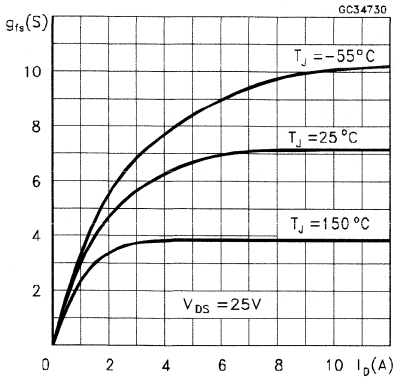
Output Characteristics



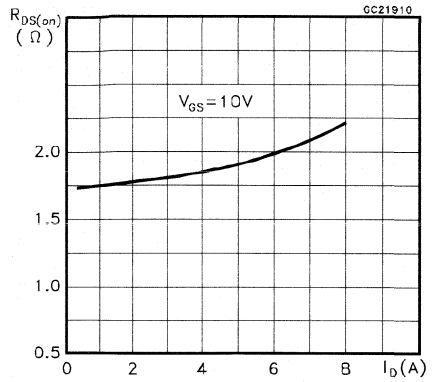
Transfer Characteristics



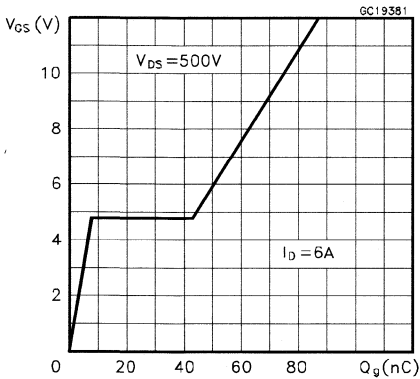
Transconductance



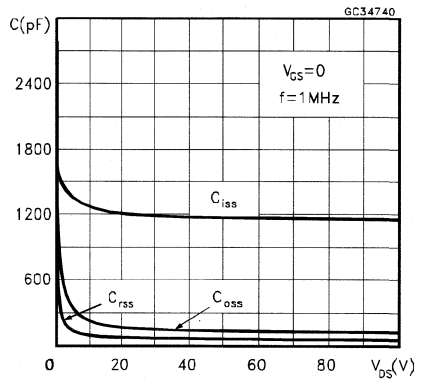
Static Drain-source On Resistance



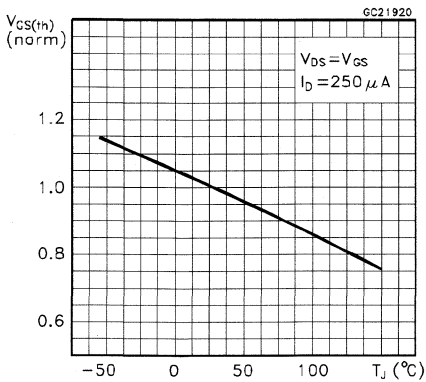
Gate Charge vs Gate-source Voltage



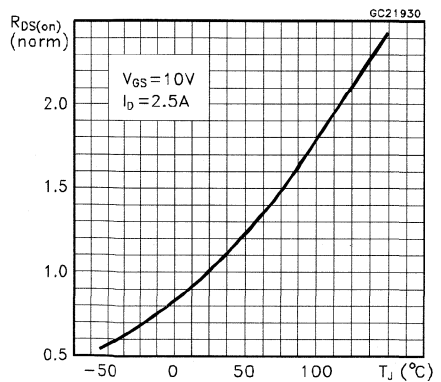
Capacitance Variations



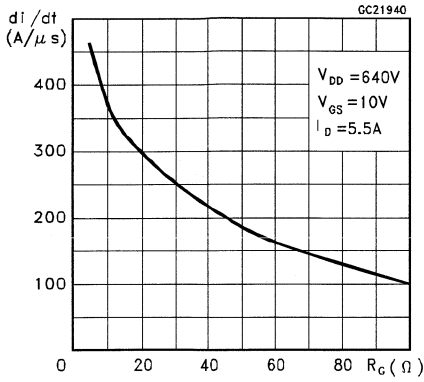
Normalized Gate Threshold Voltage vs Temperature



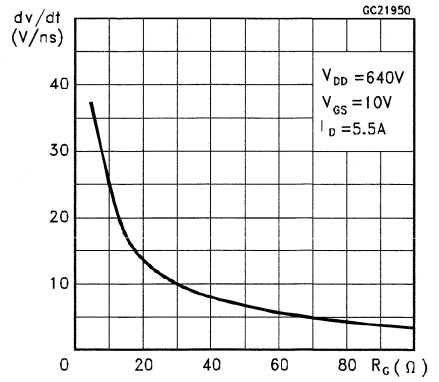
Normalized On Resistance vs Temperature



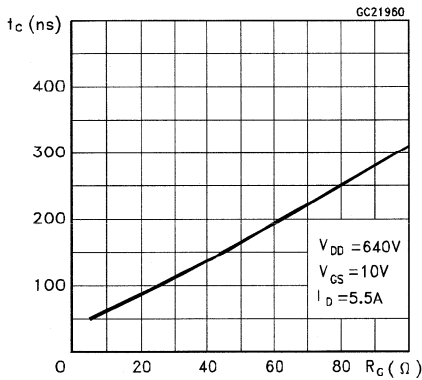
Turn-on Current Slope



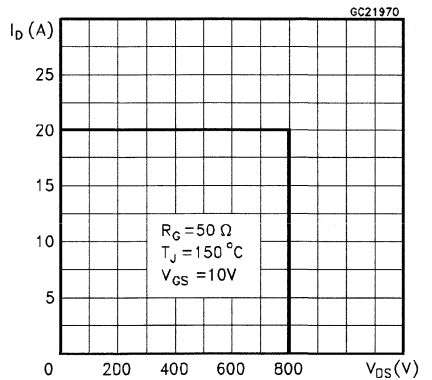
Turn-off Drain-source Voltage Slope



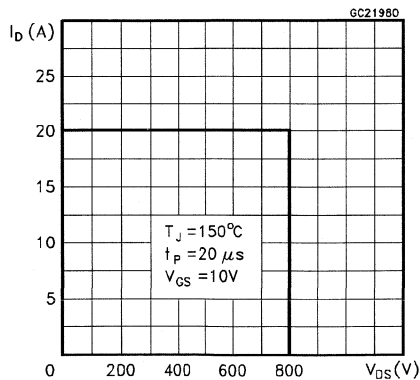
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

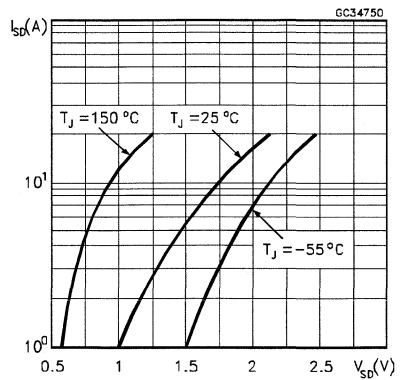


Fig. 1: Unclamped Inductive Load Test Circuits

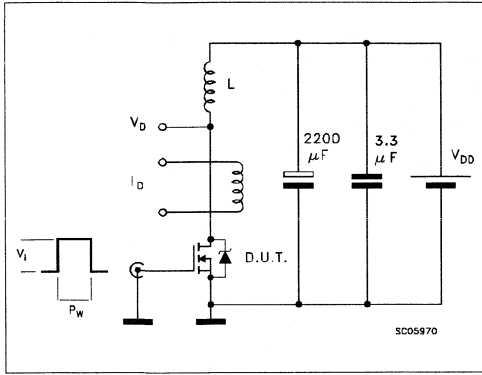


Fig. 2: Unclamped Inductive Waveforms

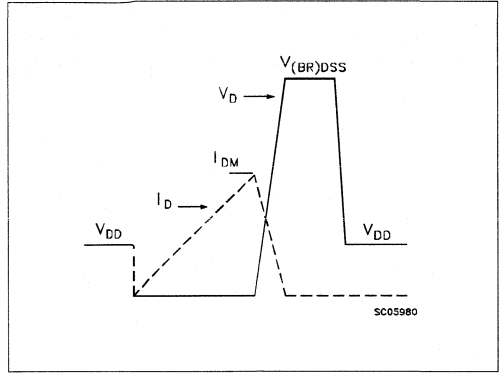


Fig. 3: Switching Times Test Circuits For Resistive Load

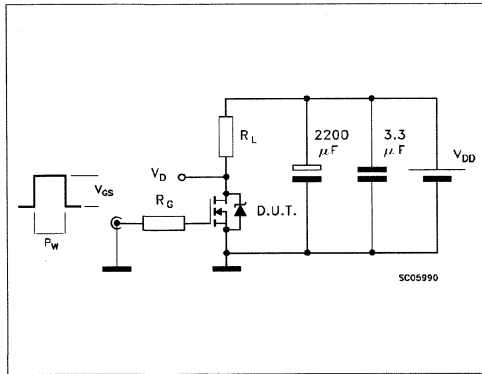


Fig. 4: Gate Charge Test Circuit

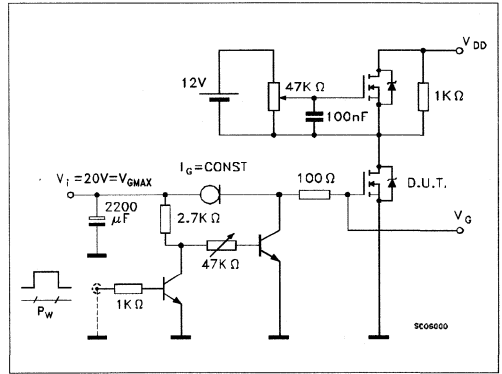
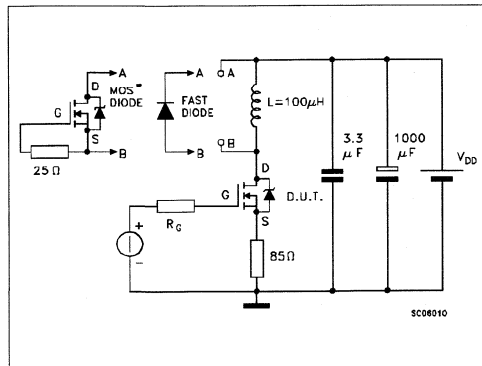


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



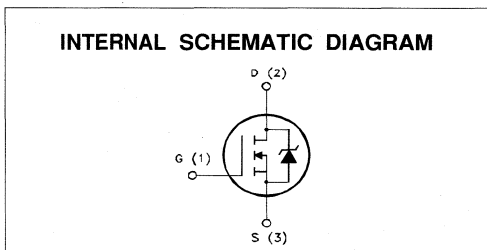
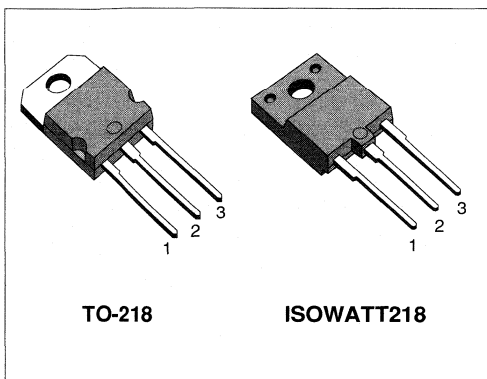
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STHV102	1000 V	< 3.5 Ω	4.2 A
STHV102FI	1000 V	< 3.5 Ω	2.6 A

- TYPICAL R_{DS(on)} = 3.1 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INPUT CAPACITANCE
- LOW GATE CHARGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CONSUMER AND INDUSTRIAL LIGHTING
- DC-AC INVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLY (UPS)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STHV102	STHV102FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	1000		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	1000		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	4.2	2.6	A
I _D	Drain Current (continuous) at T _c = 100 °C	2.6	1.6	A
I _{DM} (*)	Drain Current (pulsed)	16	16	A
P _{tot}	Total Dissipation at T _c = 25 °C	150	60	W
	Derating Factor	1.2	0.48	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	4000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-218	ISOWATT218	
R _{thj-case}	Thermal Resistance Junction-case	Max	0.83	2.08	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	30		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.1		°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	4.2	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	180	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	9.2	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	2.5	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	1000			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 2 A V _{GS} = 10V I _D = 2 A T _c = 100°C		3.1	3.5 7	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	4.2			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 2 A	2	4		S
C _{iSS}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		1230	1500	pF
C _{oSS}	Output Capacitance			165	200	pF
C _{rSS}	Reverse Transfer Capacitance			70	85	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 800\text{ V}$ $I_D = 2\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		36 130	45 165	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 800\text{ V}$ $I_D = 4\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		180		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 800\text{ V}$ $I_D = 4\text{ A}$ $V_{GS} = 10\text{ V}$		80 8 40	100	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$ t_f	Off-voltage Rise Time Fall Time	$V_{DD} = 800\text{ V}$ $I_D = 4\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		100 25	125 32	ns ns
t_c	Cross-over Time	(see test circuit, figure 5)		155	190	ns

SOURCE DRAIN DIODE

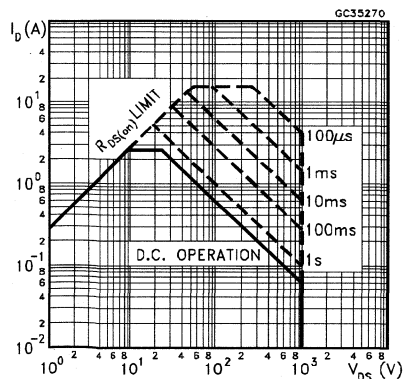
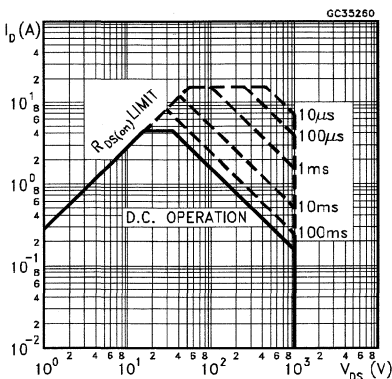
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				4.2 16	A A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 4.2\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 4.2\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		1200		ns
Q_{rr}	Reverse Recovery Charge			30		μ C
I_{RRM}	Reverse Recovery Current			50		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

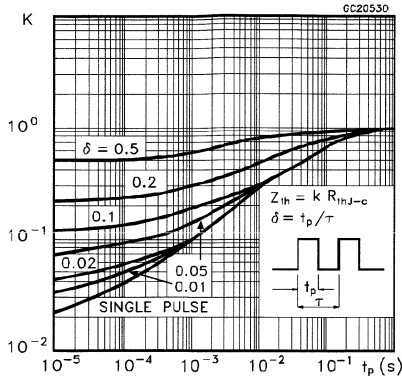
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas For TO-218

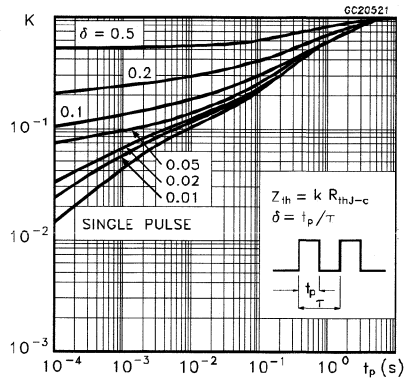
Safe Operating Areas For ISOWATT218



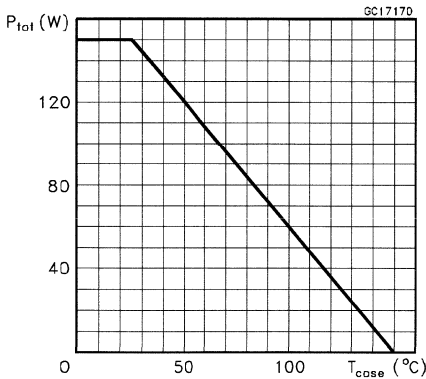
Thermal Impedance For TO-218



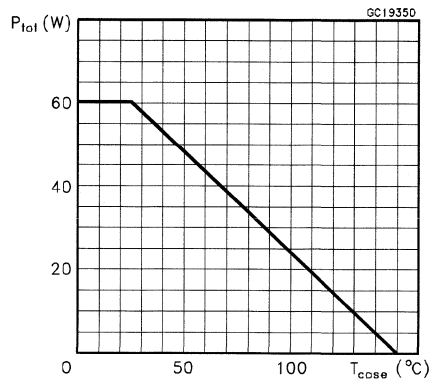
Thermal Impedance For ISOWATT218



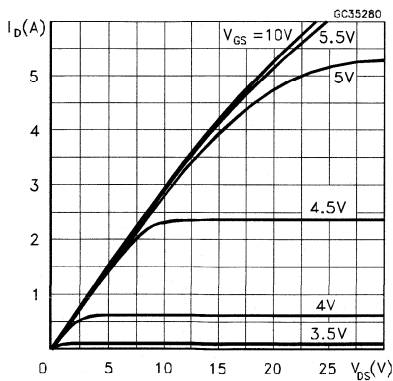
Derating Curve For TO-218



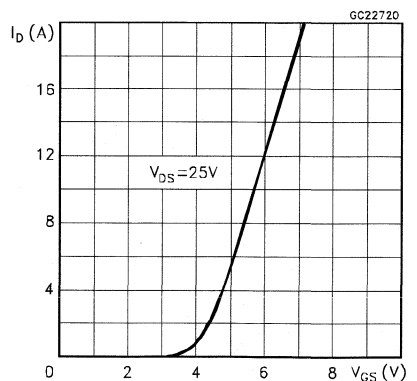
Derating Curve For ISOWATT218



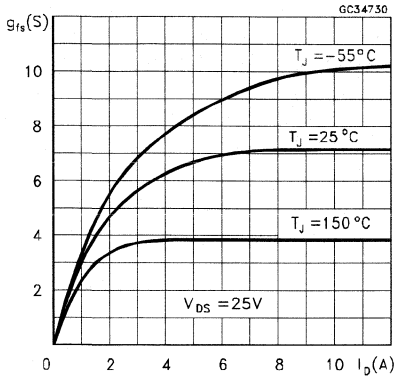
Output Characteristics



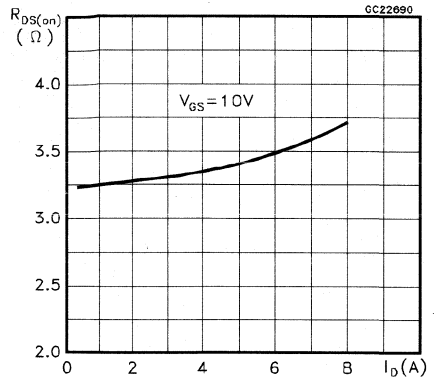
Transfer Characteristics



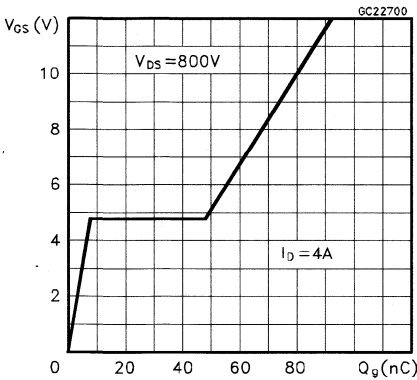
Transconductance



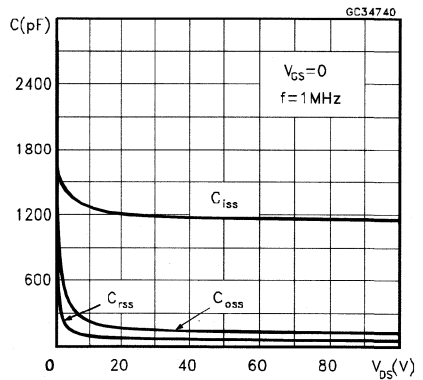
Static Drain-source On Resistance



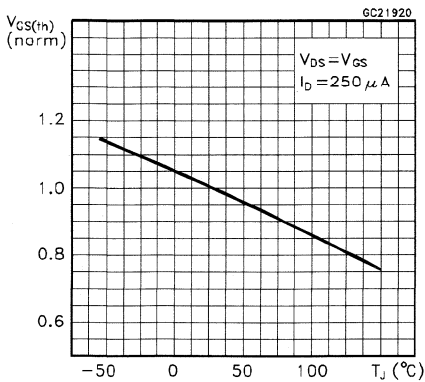
Gate Charge vs Gate-source Voltage



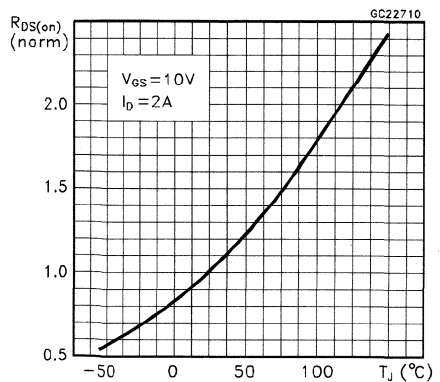
Capacitance Variations



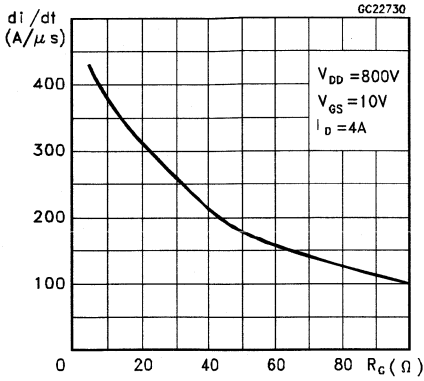
Normalized Gate Threshold Voltage vs Temperature



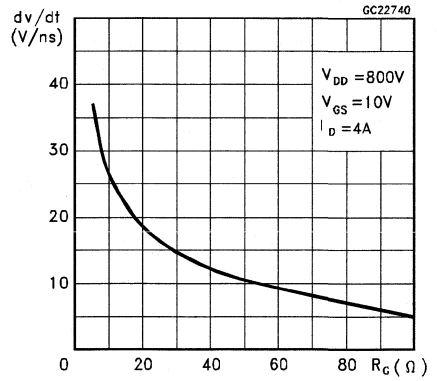
Normalized On Resistance vs Temperature



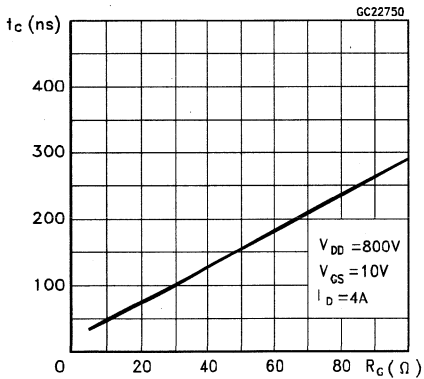
Turn-on Current Slope



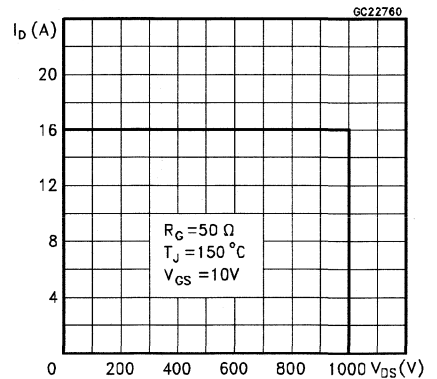
Turn-off Drain-source Voltage Slope



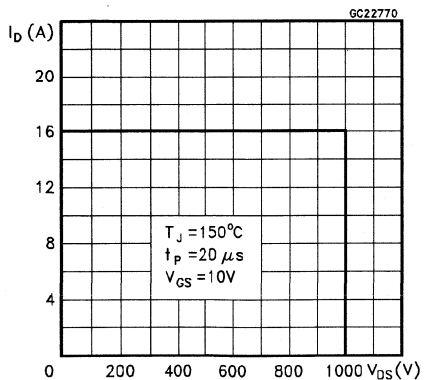
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

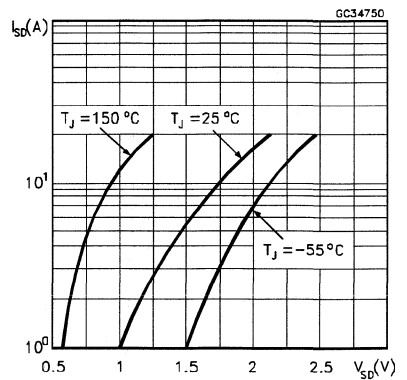


Fig. 1: Unclamped Inductive Load Test Circuits

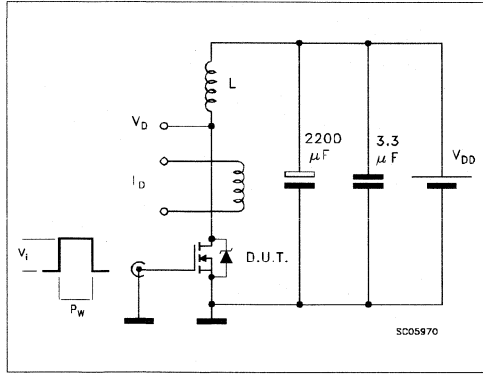


Fig. 2: Unclamped Inductive Waveforms

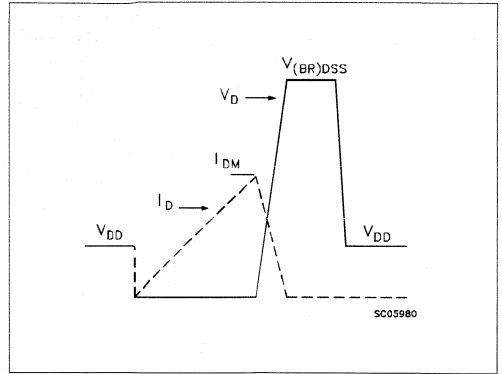


Fig. 3: Switching Times Test Circuits For Resistive Load

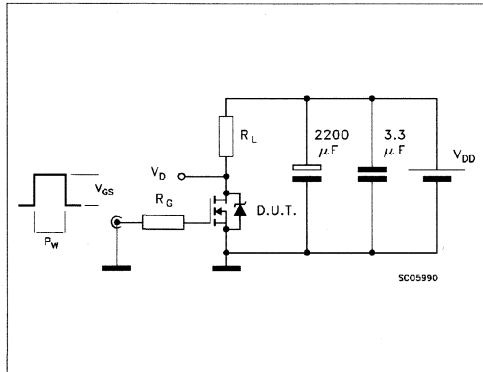


Fig. 4: Gate Charge Test Circuit

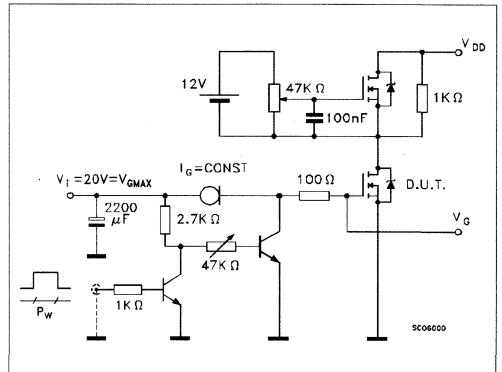
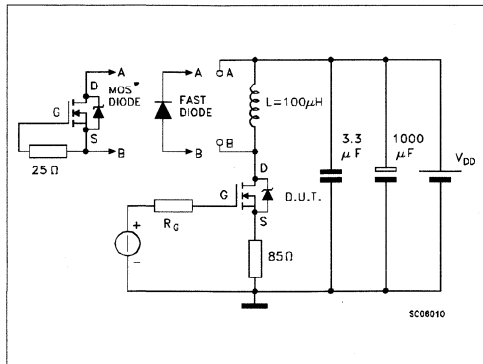


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



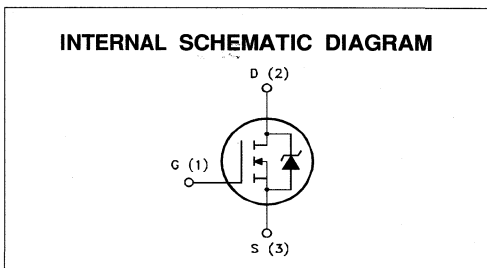
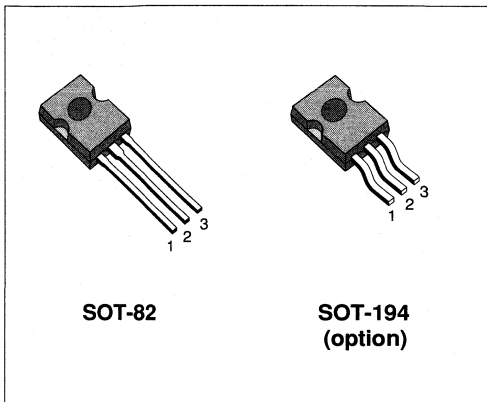
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STK2N50	500 V	< 6 Ω	2 A

- TYPICAL R_{DS(on)} = 4.6 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	500	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	500	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	2	A
I _D	Drain Current (continuous) at T _c = 100 °C	1.25	A
I _{DM} (*)	Drain Current (pulsed)	8	A
P _{tot}	Total Dissipation at T _c = 25 °C	50	W
	Derating Factor	0.4	W/°C
T _{stg}	Storage Temperature	-65 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C

(*) Pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	2.5	$^{\circ}C/W$
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	80	$^{\circ}C/W$
$R_{thj-amb}$	Thermal Resistance Case-sink	Typ	0.7	$^{\circ}C/W$
T_I	Maximum Lead Temperature For Soldering Purpose		275	$^{\circ}C$

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	2	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25^{\circ}C$, $I_D = I_{AR}$, $V_{DD} = 50$ V)	20	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	1.5	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100^{\circ}C$, pulse width limited by T_j max, $\delta < 1\%$)	1.2	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25^{\circ}C$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250 \mu A$ $V_{GS} = 0$	500			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^{\circ}C$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20$ V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250 \mu A$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10$ V $I_D = 1$ A $V_{GS} = 10$ V $I_D = 1$ A $T_c = 100^{\circ}C$		4.6	6 12	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10$ V	2			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 1$ A	0.65	1		S
C_{iss}	Input Capacitance	$V_{DS} = 25$ V $f = 1$ MHz $V_{GS} = 0$		200	270	pF
C_{oss}	Output Capacitance			35	50	pF
C_{rss}	Reverse Transfer Capacitance			12	18	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 200\text{ V}$ $I_D = 1\text{ A}$		35	48	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		85	115	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 400\text{ V}$ $I_D = 2\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		28		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 400\text{ V}$ $I_D = 2\text{ A}$ $V_{GS} = 10\text{ V}$		18	25	nC
Q_{GS}	Gate-Source Charge			5		nC
Q_{GD}	Gate-Drain Charge			8		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$	Off-voltage Rise Time	$V_{DD} = 400\text{ V}$ $I_D = 2\text{ A}$		28	40	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		15	25	ns
t_c	Cross-over Time	(see test circuit, figure 5)		45	60	ns

SOURCE DRAIN DIODE

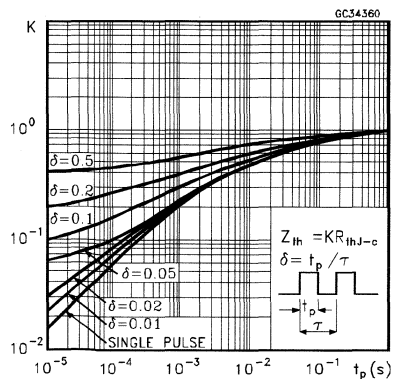
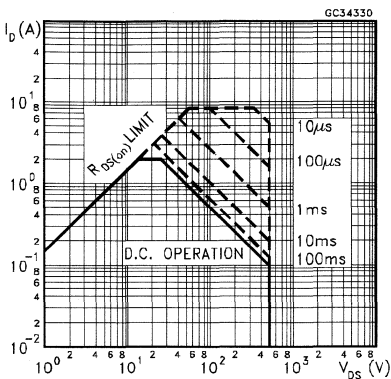
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				2	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				8	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 2\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 2\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		330		ns
Q_{rr}	Reverse Recovery Charge	(see test circuit, figure 5)		3.5		μ C
I_{RRM}	Reverse Recovery Current			15		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

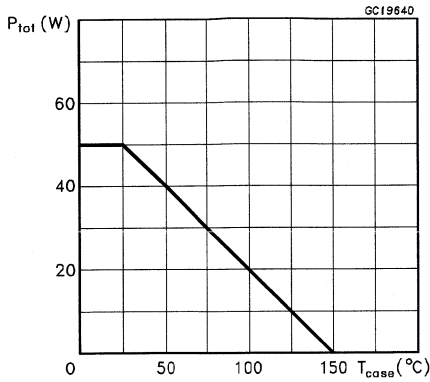
(\bullet) Pulse width limited by safe operating area

Safe Operating Area

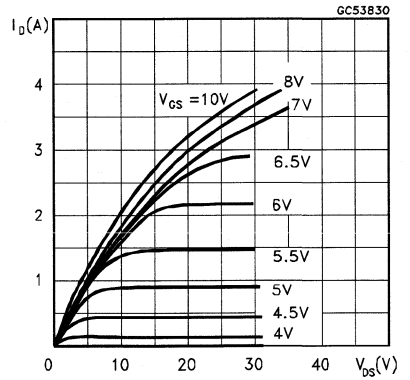
Thermal Impedance



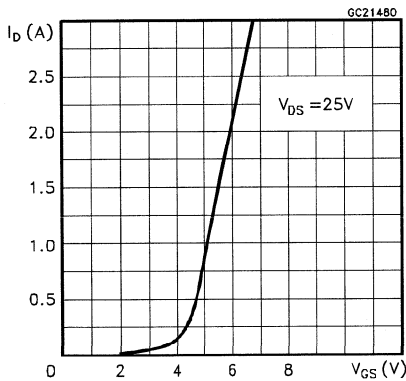
Derating Curve



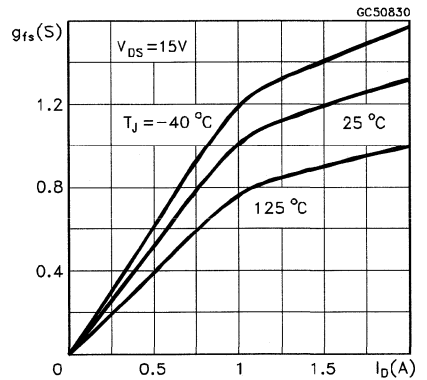
Output Characteristics



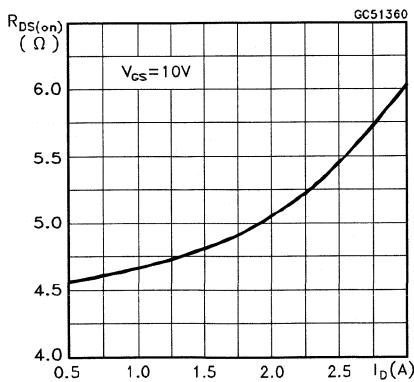
Transfer Characteristics



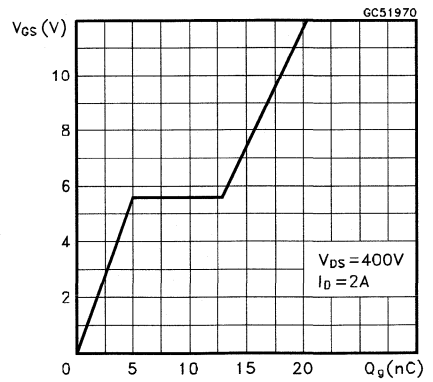
Transconductance



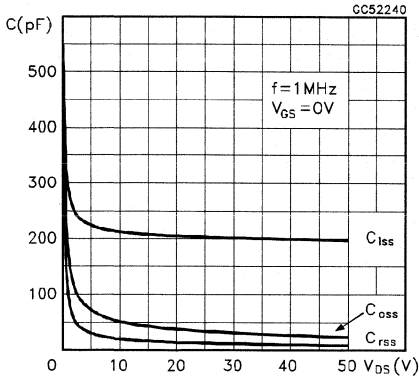
Static Drain-source On Resistance



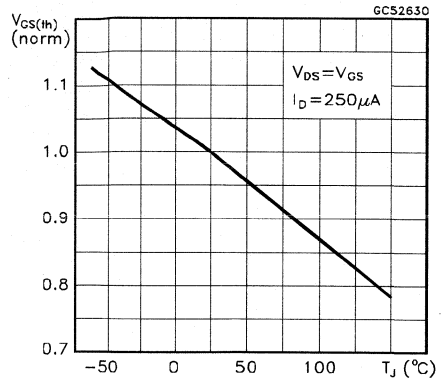
Gate Charge vs Gate-source Voltage



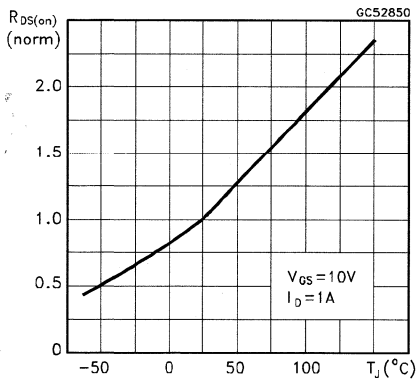
Capacitance Variations



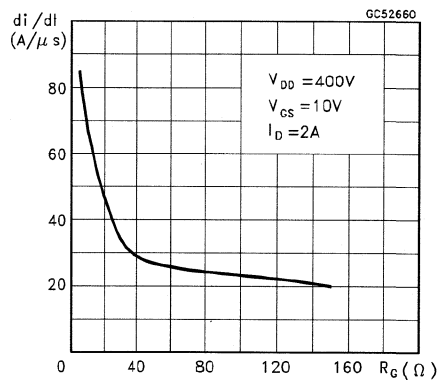
Normalized Gate Threshold Voltage vs Temperature



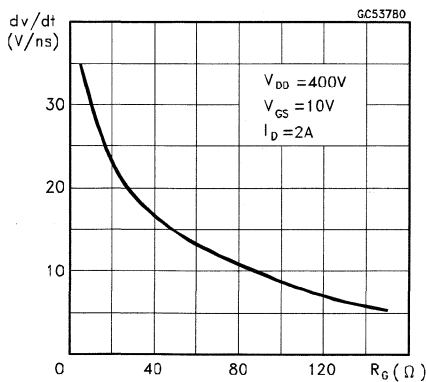
Normalized On Resistance vs Temperature



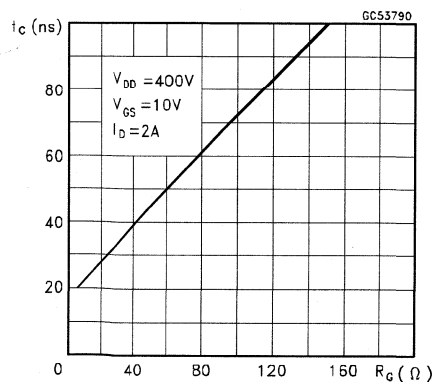
Turn-on Current Slope



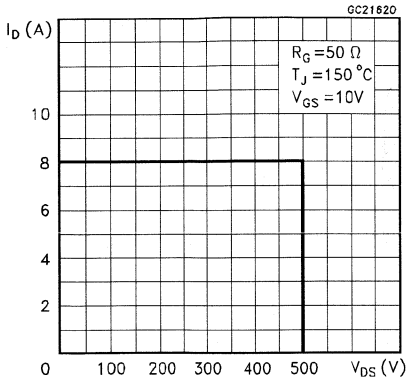
Turn-off Drain-source Voltage Slope



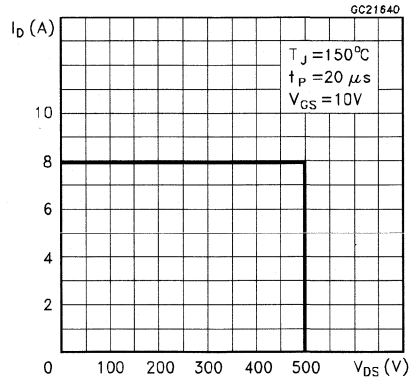
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

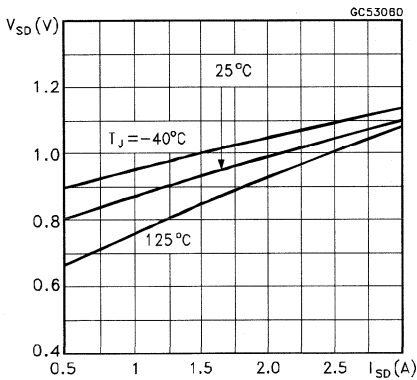


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

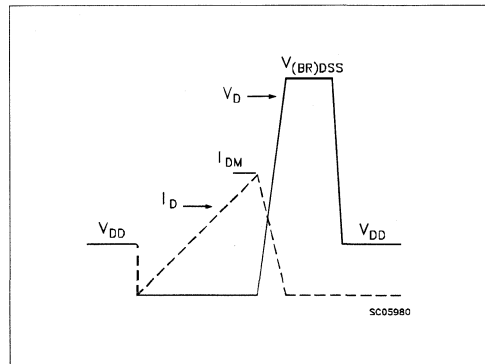
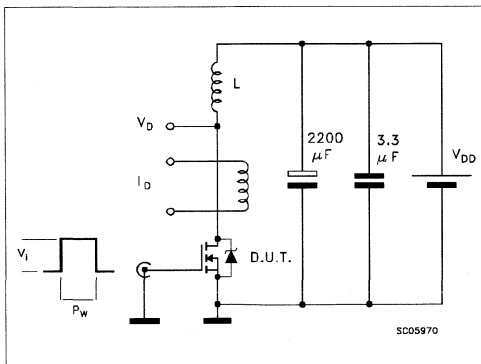


Fig. 3: Switching Times Test Circuits For Resistive Load

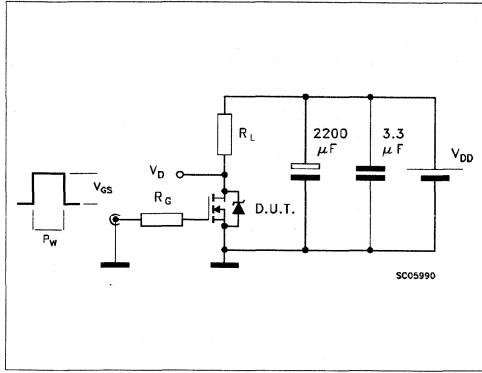


Fig. 4: Gate Charge Test Circuit

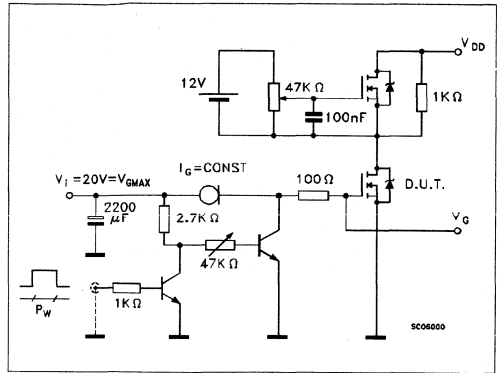
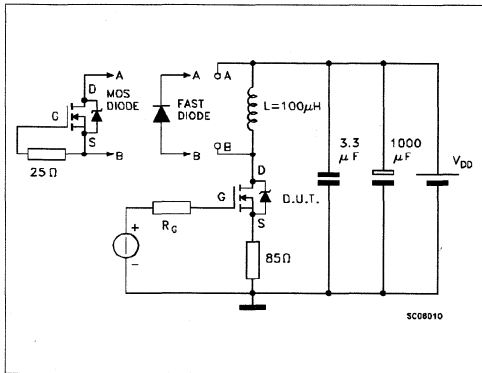


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



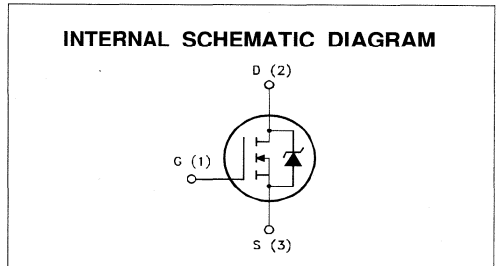
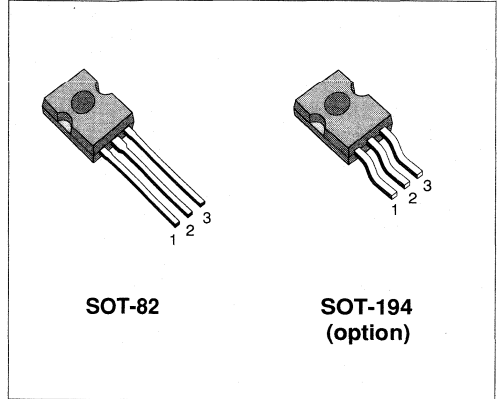
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STK2N60	600 V	< 8 Ω	1.7 A

- TYPICAL R_{DS(on)} = 5.7 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	600	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	600	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	1.7	A
I _D	Drain Current (continuous) at T _c = 100 °C	1.1	A
I _{DM} (*)	Drain Current (pulsed)	6.8	A
P _{tot}	Total Dissipation at T _c = 25 °C	50	W
	Derating Factor	0.4	W/°C
T _{stg}	Storage Temperature	-65 to 150	°C
T _J	Max. Operating Junction Temperature	150	°C

(*) Pulse width limited by safe operating area

THERMAL DATA

R _{thj-case}	Thermal Resistance Junction-case	Max	2.5	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	80	°C/W
R _{thj-amb}	Thermal Resistance Case-sink	Typ	0.7	°C/W
T _j	Maximum Lead Temperature For Soldering Purpose		275	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	1.7	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	15	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	1.2	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	1.1	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	600			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 1 A V _{GS} = 10V I _D = 1 A T _c = 100°C		5.7	8 16	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} × R _{DS(on)max} V _{GS} = 10 V	1.7			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} × R _{DS(on)max} I _D = 1 A	0.65	1		S
C _{iss} C _{oss} C _{rss}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		200 35 12	270 50 18	pF pF pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 200\text{ V}$ $I_D = 1\text{ A}$		35	48	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		85	115	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 400\text{ V}$ $I_D = 2\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		28		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 400\text{ V}$ $I_D = 2\text{ A}$ $V_{GS} = 10\text{ V}$		18	25	nC
Q_{gs}	Gate-Source Charge			5		nC
Q_{gd}	Gate-Drain Charge			8		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 400\text{ V}$ $I_D = 2\text{ A}$		28	40	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		15	25	ns
t_c	Cross-over Time	(see test circuit, figure 5)		45	60	ns

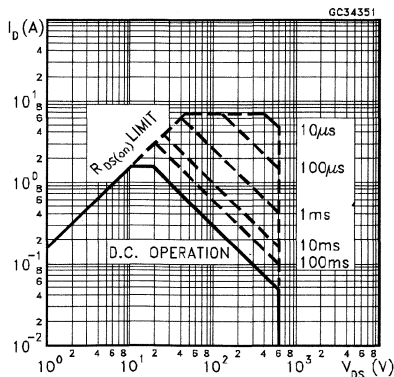
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				1.7	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				6.8	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 1.7\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 2\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		330		ns
Q_{rr}	Reverse Recovery Charge			3.6		μC
I_{RRM}	Reverse Recovery Current			15		A

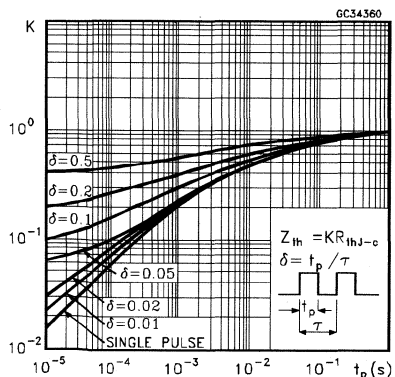
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

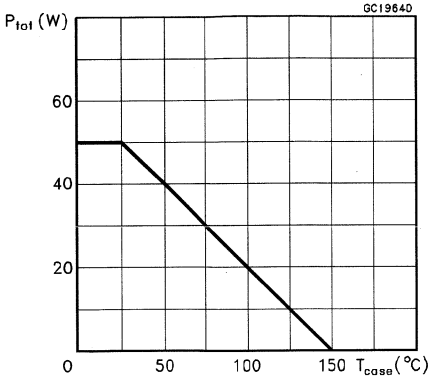
Safe Operating Area



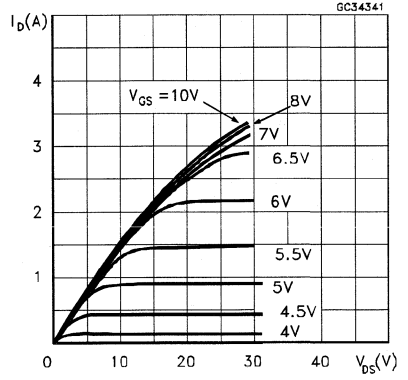
Thermal Impedance



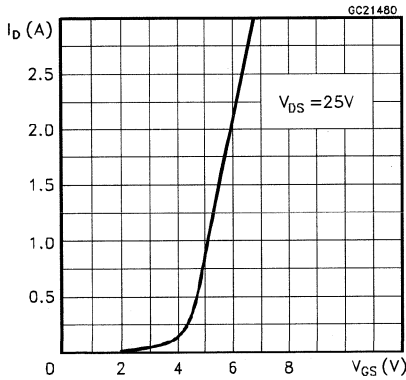
Derating Curve



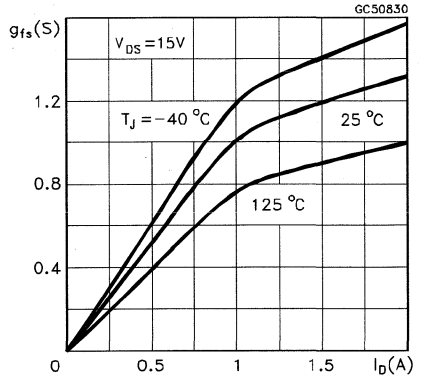
Output Characteristics



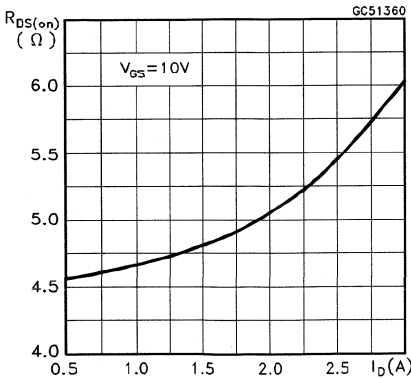
Transfer Characteristics



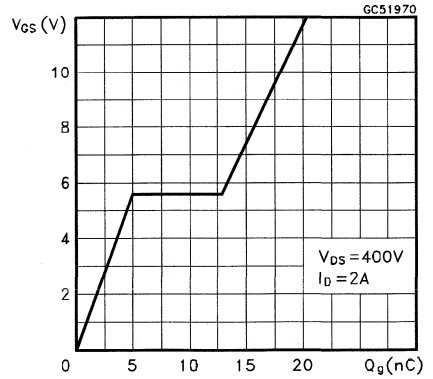
Transconductance



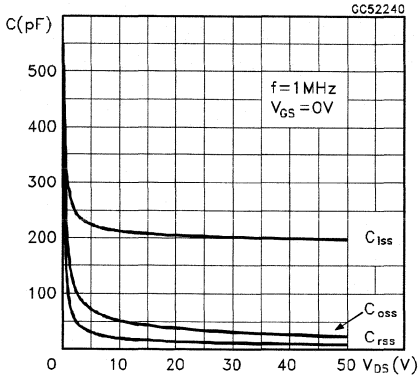
Static Drain-source On Resistance



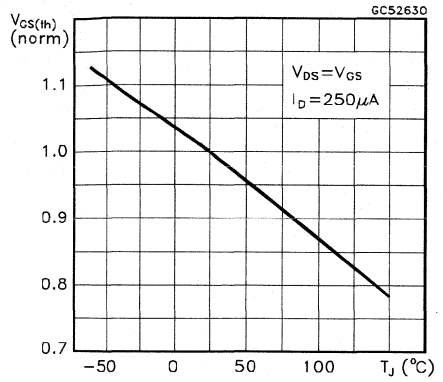
Gate Charge vs Gate-source Voltage



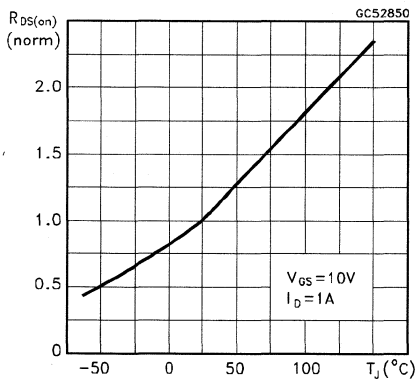
Capacitance Variations



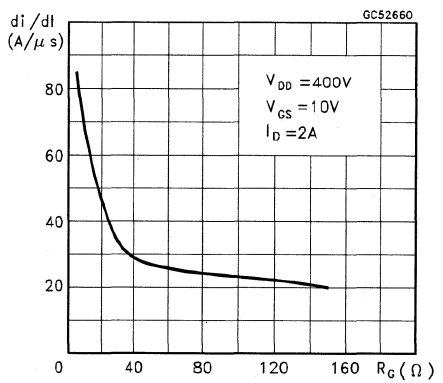
Normalized Gate Threshold Voltage vs Temperature



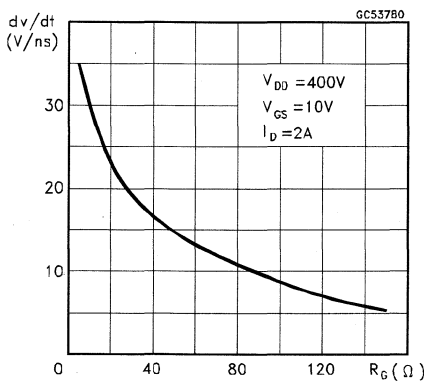
Normalized On Resistance vs Temperature



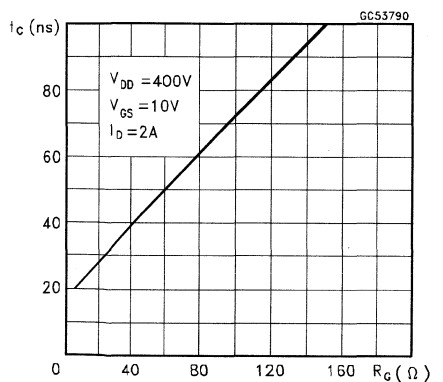
Turn-on Current Slope



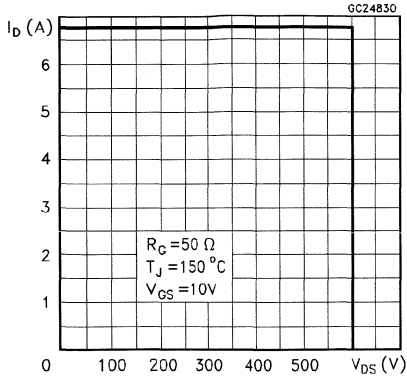
Turn-off Drain-source Voltage Slope



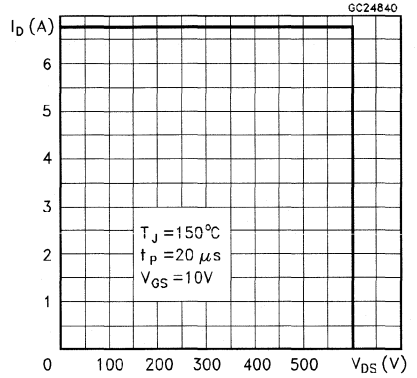
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

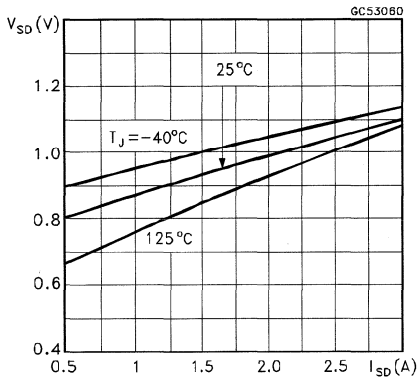


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

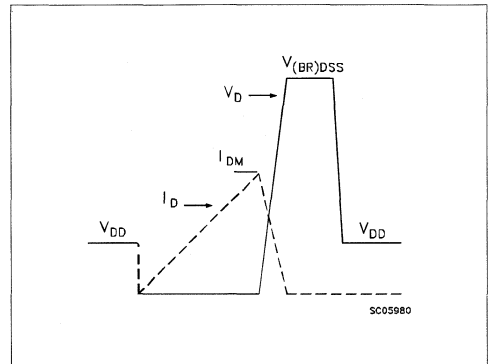
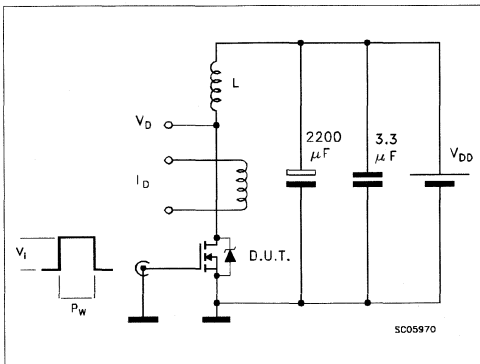


Fig. 3: Switching Times Test Circuits For Resistive Load

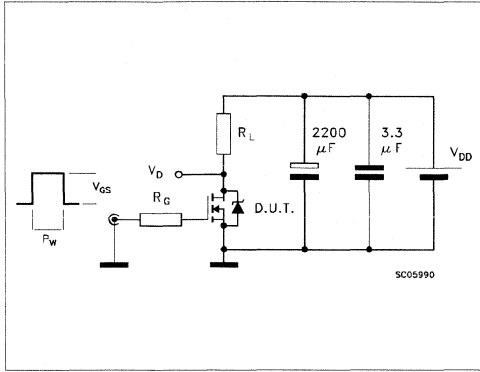


Fig. 4: Gate Charge Test Circuit

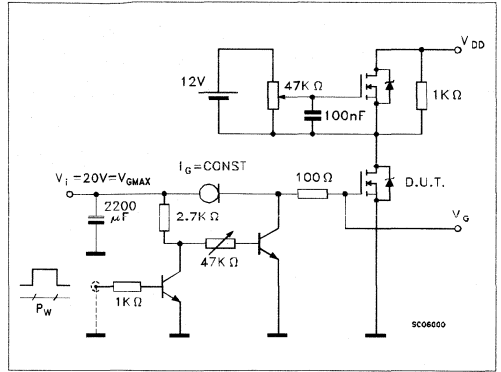
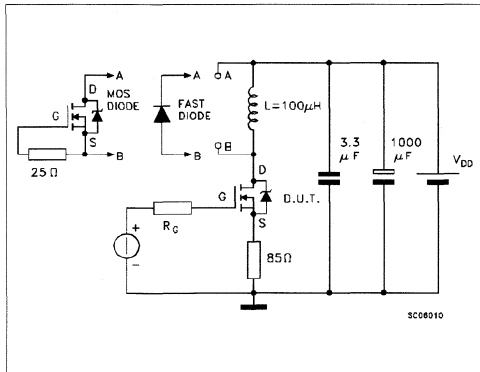


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



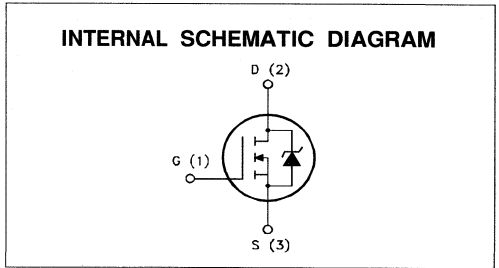
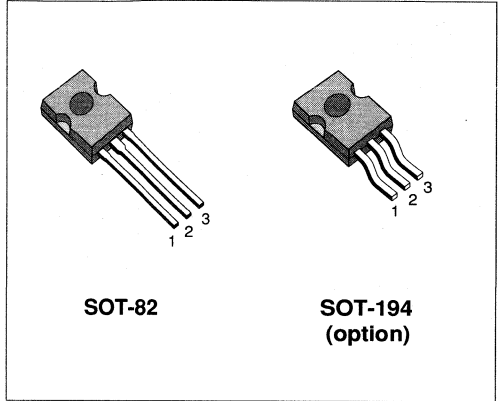
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STK2N80	800 V	< 7 Ω	2.1 A

- TYPICAL R_{DS(on)} = 5 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INPUT CAPACITANCE
- LOW GATE CHARGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CONSUMER AND INDUSTRIAL LIGHTING



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	800	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	800	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	2.1	A
I _D	Drain Current (continuous) at T _c = 100 °C	1.3	A
I _{DM} (*)	Drain Current (pulsed)	9.6	A
P _{tot}	Total Dissipation at T _c = 25 °C	70	W
	Derating Factor	0.56	W/°C
T _{stg}	Storage Temperature	-65 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C

(*) Pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	1.78	$^{\circ}C/W$
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	80	$^{\circ}C/W$
$R_{thj-amb}$	Thermal Resistance Case-sink	Typ	0.7	$^{\circ}C/W$
T_l	Maximum Lead Temperature For Soldering Purpose		275	$^{\circ}C$

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	2.1	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25^{\circ}C$, $I_D = I_{AR}$, $V_{DD} = 25 V$)	80	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	2.8	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100^{\circ}C$, pulse width limited by T_j max, $\delta < 1\%$)	1.3	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25^{\circ}C$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250 \mu A$ $V_{GS} = 0$	800			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^{\circ}C$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20 V$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250 \mu A$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10V$ $I_D = 1 A$ $V_{GS} = 10V$ $I_D = 1 A$ $T_c = 100^{\circ}C$		5	7 14	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10 V$	2.1			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 1 A$	1.2	1.9		S
C_{iss}	Input Capacitance	$V_{DS} = 25 V$ $f = 1 MHz$ $V_{GS} = 0$		460	600	pF
C_{oss}	Output Capacitance			55	70	pF
C_{rss}	Reverse Transfer Capacitance			22	30	pF

ELECTRICAL CHARACTERISTICS (continued)
SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 400\text{ V}$ $I_D = 1.5\text{ A}$		38	50	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		42	57	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 640\text{ V}$ $I_D = 2\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		160		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 640\text{ V}$ $I_D = 2\text{ A}$ $V_{GS} = 10\text{ V}$		31	40	nC
Q_{gs}	Gate-Source Charge			6		nC
Q_{gd}	Gate-Drain Charge			14		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$	Off-voltage Rise Time	$V_{DD} = 640\text{ V}$ $I_D = 2\text{ A}$		70	90	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		25	32	ns
t_c	Cross-over Time	(see test circuit, figure 5)		108	140	ns

SOURCE DRAIN DIODE

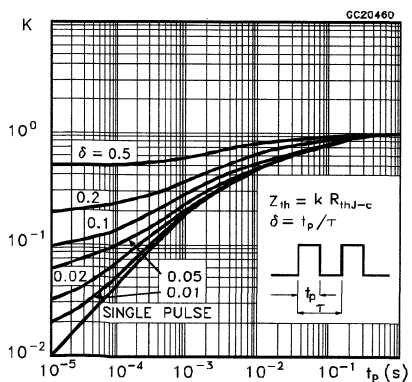
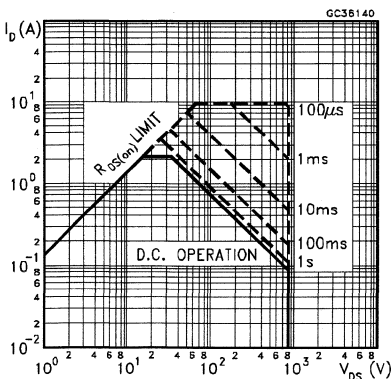
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				2.1	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				9.6	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 2.1\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 2\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		920		ns
Q_{rr}	Reverse Recovery Charge			18.4		μC
I_{RRM}	Reverse Recovery Current			40		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

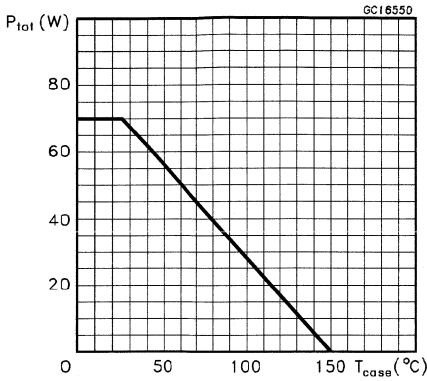
(•) Pulse width limited by safe operating area

Safe Operating Area

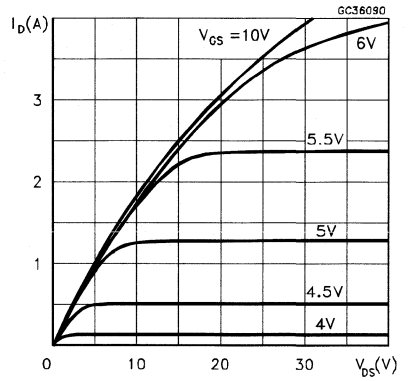
Thermal Impedance



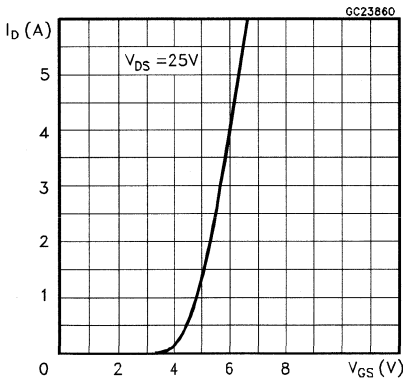
Derating Curve



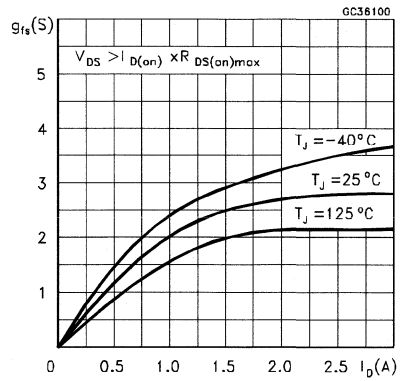
Output Characteristics



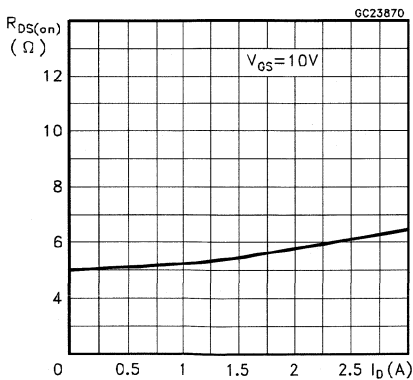
Transfer Characteristics



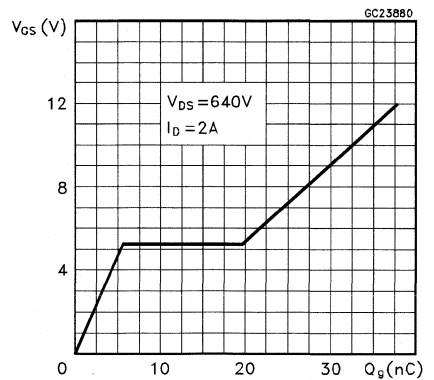
Transconductance



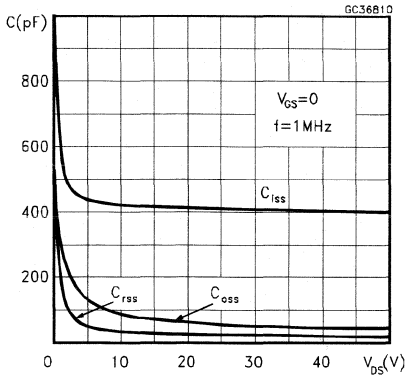
Static Drain-source On Resistance



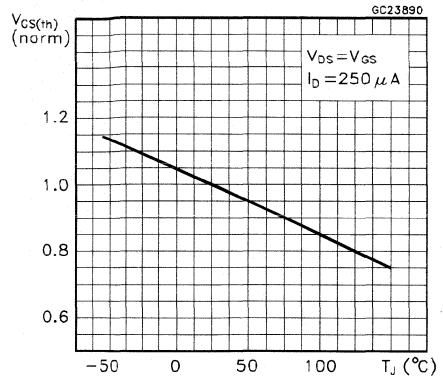
Gate Charge vs Gate-source Voltage



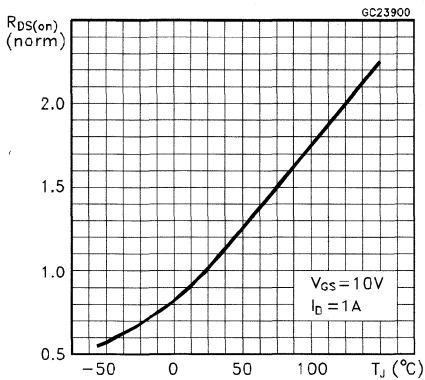
Capacitance Variations



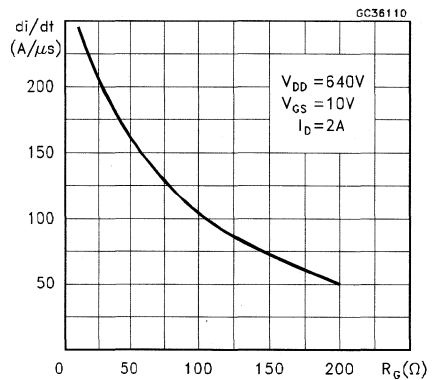
Normalized Gate Threshold Voltage vs Temperature



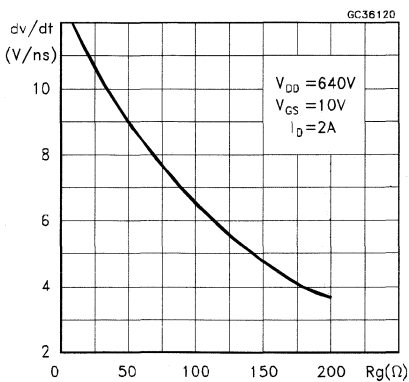
Normalized On Resistance vs Temperature



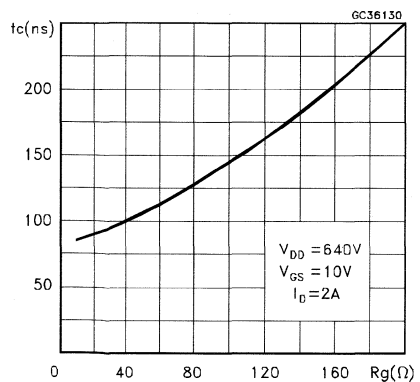
Turn-on Current Slope



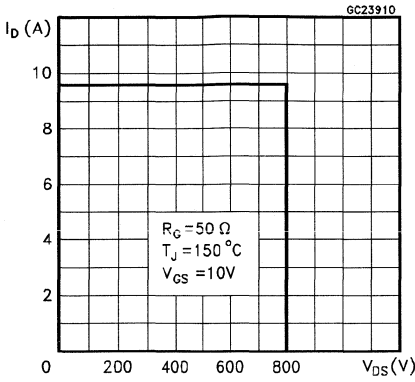
Turn-off Drain-source Voltage Slope



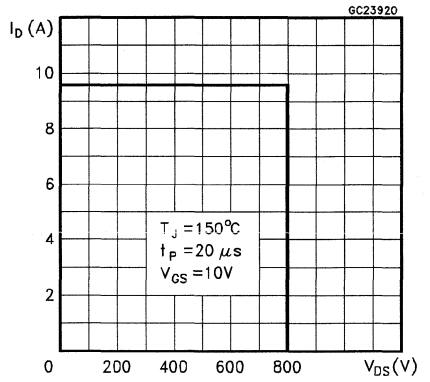
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

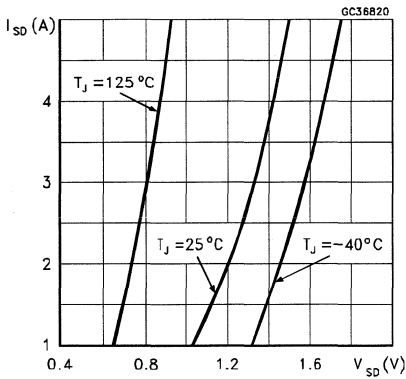


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

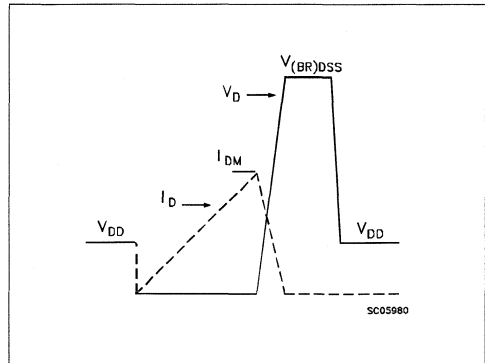
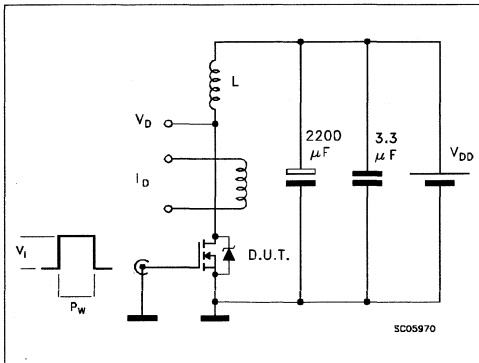


Fig. 3: Switching Times Test Circuits For Resistive Load

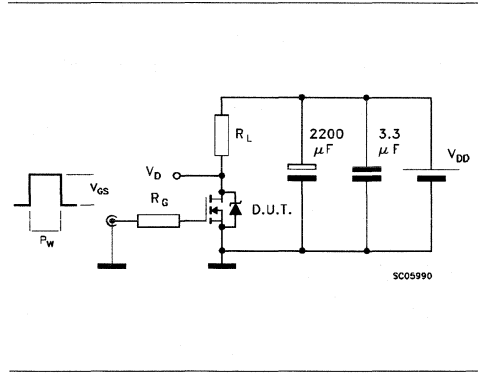


Fig. 4: Gate Charge Test Circuit

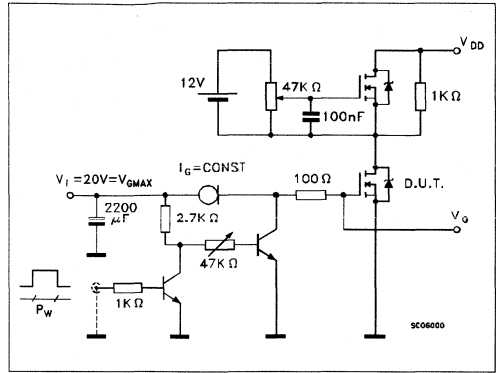
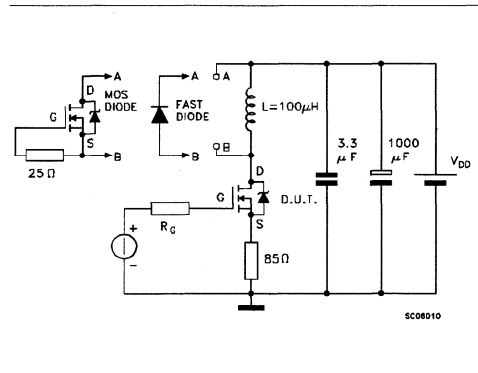


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



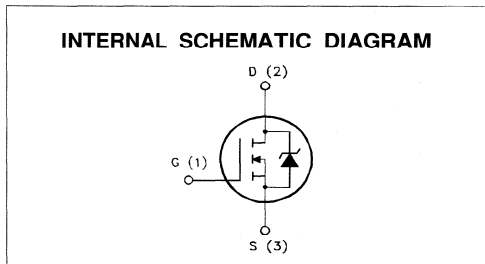
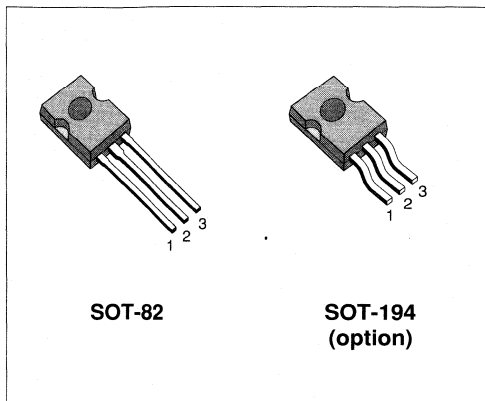
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STK3N50	500 V	< 3.8 Ω	2.7 A

- TYPICAL R_{DS(on)} = 2.5 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	500	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	500	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	2.7	A
I _D	Drain Current (continuous) at T _c = 100 °C	1.7	A
I _{DM} (*)	Drain Current (pulsed)	12	A
P _{tot}	Total Dissipation at T _c = 25 °C	60	W
	Derating Factor	0.48	W/°C
T _{stg}	Storage Temperature	-65 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C

* Pulse width limited by safe operating area

THERMAL DATA

R _{thj-case}	Thermal Resistance Junction-case	Max	2.08	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	80	°C/W
R _{thj-amb}	Thermal Resistance Case-sink	Typ	0.7	°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		275	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current (repetitive or not-repetitive, T _j = 25 °C)	2.8	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	200	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	5	mJ
I _{AR}	Avalanche Current (repetitive or not-repetitive, T _j = 100 °C)	1.6	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	500			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 1.5 A V _{GS} = 10V I _D = 1.5 A T _c = 100°C		2.5	3.8 7.6	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	2.7			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs}	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 1.5 A	0.8	1.93		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		350	460	pF
C _{oss}	Output Capacitance			60	80	pF
C _{rss}	Reverse Transfer Capacitance			25	35	pF

ELECTRICAL CHARACTERISTICS (continued)
SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 250\text{ V}$ $I_D = 1.5\text{ A}$		35	45	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		85	110	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 400\text{ V}$ $I_D = 3\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		120		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 400\text{ V}$ $I_D = 3\text{ A}$ $V_{GS} = 10\text{ V}$		25	35	nC
Q_{gs}	Gate-Source Charge			6		nC
Q_{gd}	Gate-Drain Charge			11		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(voff)}$	Off-voltage Rise Time	$V_{DD} = 400\text{ V}$ $I_D = 3\text{ A}$		50	65	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		20	30	ns
t_c	Cross-over Time	(see test circuit, figure 5)		80	105	ns

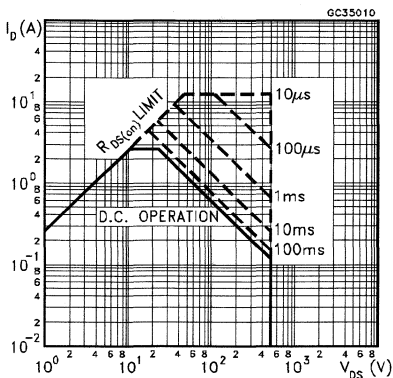
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				2.8	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				12	A
V_{SD}	Forward On Voltage	$I_{SD} = 2.8\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 2.8\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		380		ns
Q_{rr}	Reverse Recovery Charge			3.8		μ C
I_{RRM}	Reverse Recovery Current			20		A

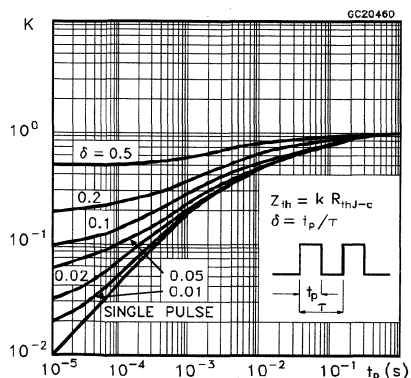
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5%

(\bullet) Pulse width limited by safe operating area

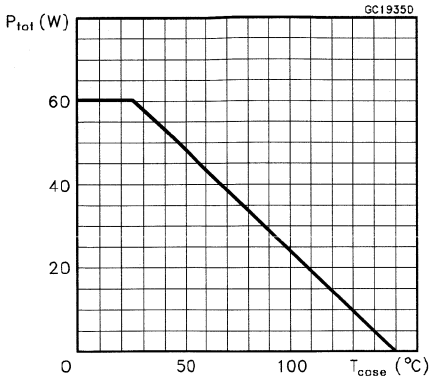
Safe Operating Area



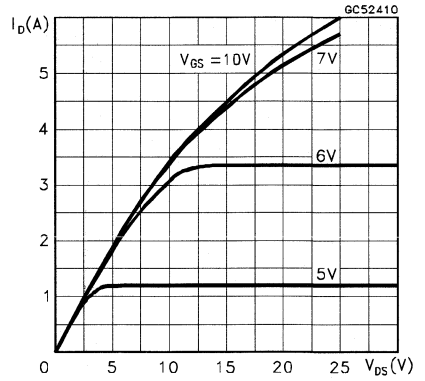
Thermal Impedance



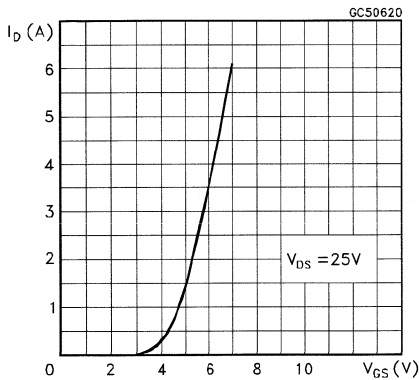
Derating Curve



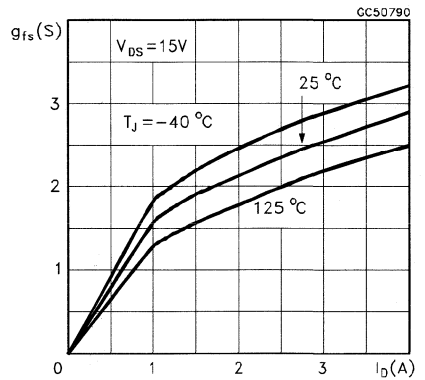
Output Characteristics



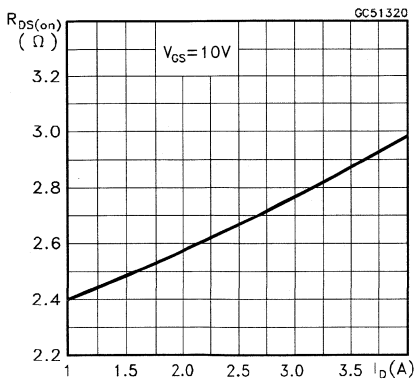
Transfer Characteristics



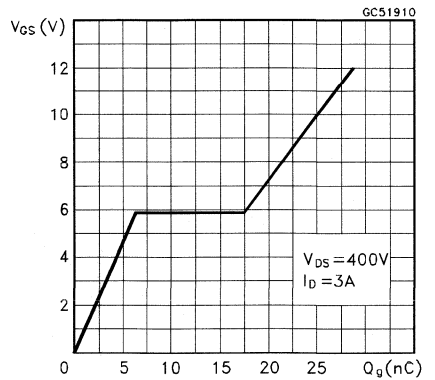
Transconductance



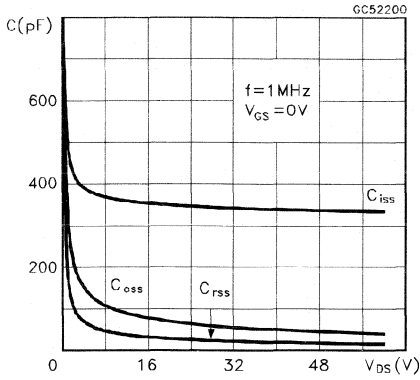
Static Drain-source On Resistance



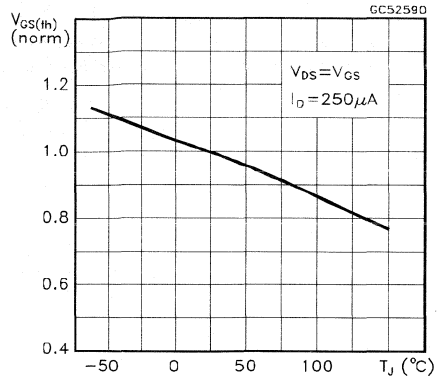
Gate Charge vs Gate-source Voltage



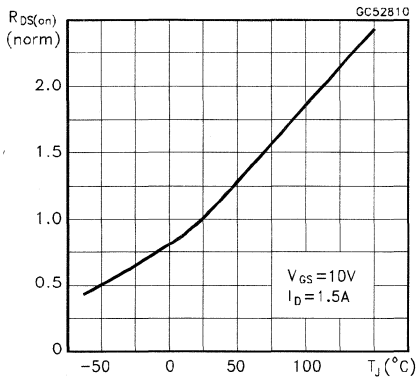
Capacitance Variations



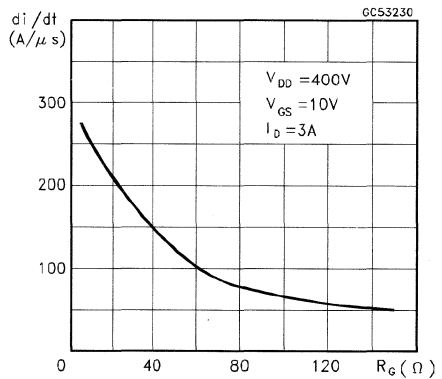
Normalized Gate Threshold Voltage vs Temperature



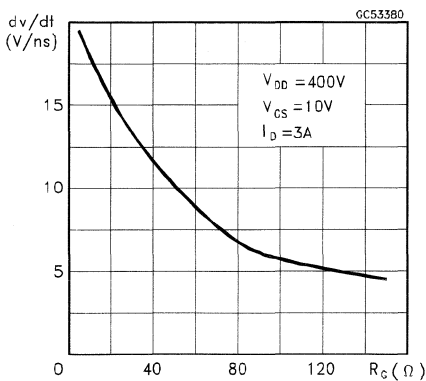
Normalized On Resistance vs Temperature



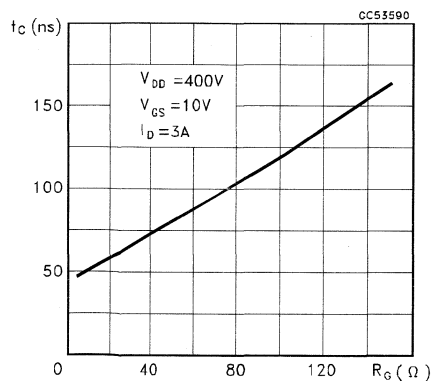
Turn-on Current Slope



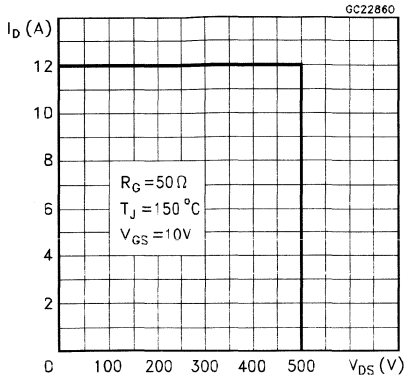
Turn-off Drain-source Voltage Slope



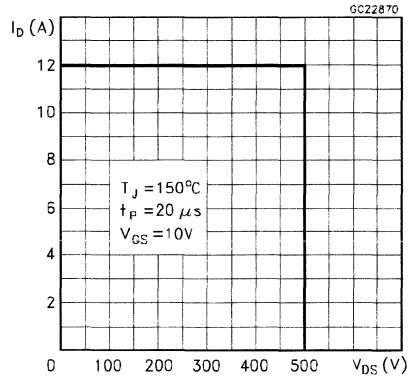
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

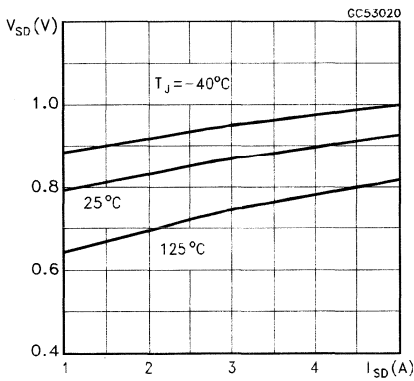


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

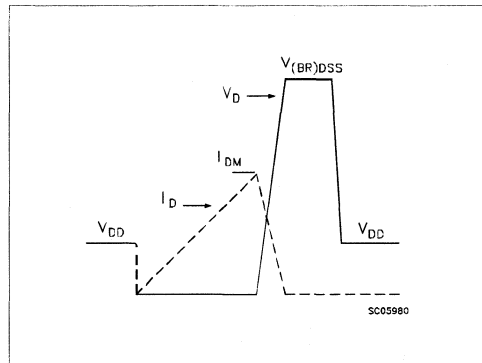
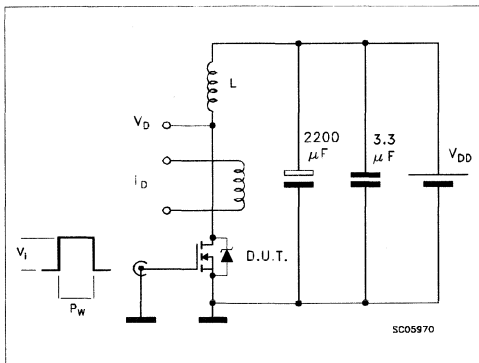


Fig. 3: Switching Times Test Circuits For Resistive Load

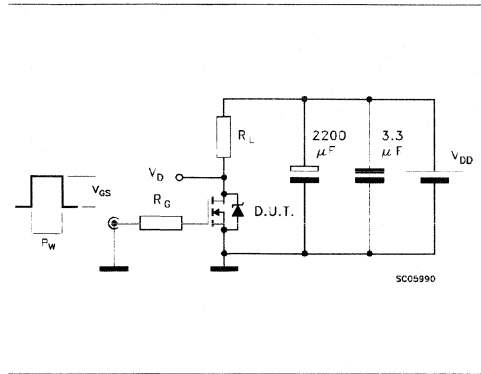


Fig. 4: Gate Charge Test Circuit

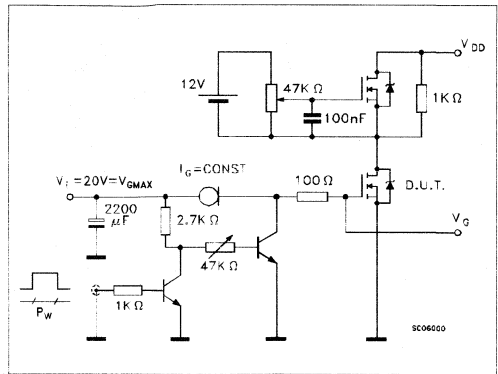
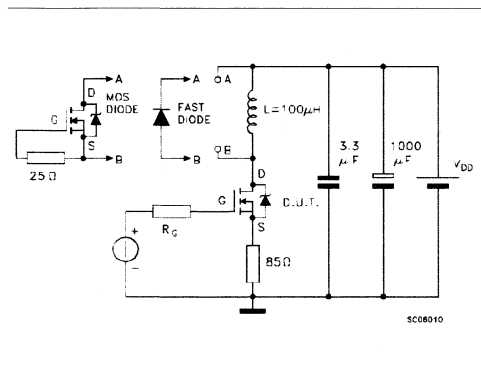


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



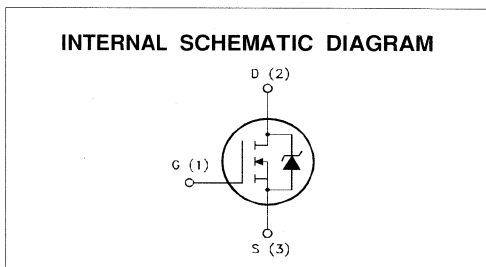
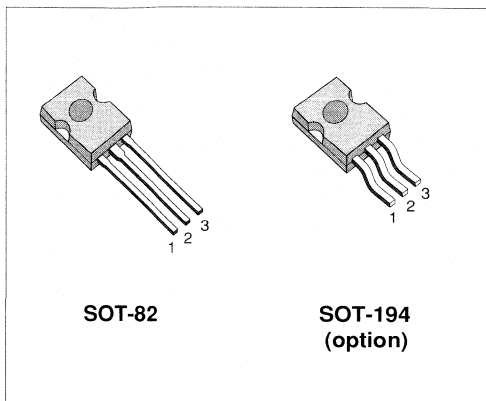
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STK4N30	300 V	< 1.4 Ω	4.2 A

- TYPICAL R_{DS(on)} = 1.2 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH SPEED SWITCHING
- UNINTERRUPTIBLE POWER SUPPLY (UPS)
- MOTOR CONTROL, AUDIO AMPLIFIERS
- INDUSTRIAL ACTUATORS
- DC-DC & DC-AC CONVERTERS FOR TELECOM, INDUSTRIAL AND CONSUMER ENVIRONMENT
- PARTICULARLY SUITABLE FOR ELECTRONIC FLUORESCENT LAMP BALLASTS



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	300	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	300	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	4.2	A
I _D	Drain Current (continuous) at T _c = 100 °C	2.6	A
I _{DM} (*)	Drain Current (pulsed)	16	A
P _{tot}	Total Dissipation at T _c = 25 °C	60	W
	Derating Factor	0.48	W/°C
T _{stg}	Storage Temperature	-65 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C

(*) Pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	2.08	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	80	°C/W
$R_{thj-amb}$	Thermal Resistance Case-sink	Typ	0.7	°C/W
T_l	Maximum Lead Temperature For Soldering Purpose		275	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	4.2	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ °C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	32	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	1	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ °C}$, pulse width limited by T_j max, $\delta < 1\%$)	2.6	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$	300			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\text{ }\mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 2\text{ A}$ $V_{GS} = 10\text{ V}$ $I_D = 2\text{ A}$ $T_c = 100\text{ °C}$		1.2	1.4 1.8	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	4			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 2\text{ A}$	1.5	2.3		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		500	700	pF
C_{oss}	Output Capacitance			80	110	pF
C_{rss}	Reverse Transfer Capacitance			16	25	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 150\text{ V}$ $I_D = 2\text{ A}$		45	60	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		30	40	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 240\text{ V}$ $I_D = 4\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		330		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 240\text{ V}$ $I_D = 4\text{ A}$ $V_{GS} = 10\text{ V}$		20	30	nC
Q_{gs}	Gate-Source Charge			6		nC
Q_{gd}	Gate-Drain Charge			8		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 240\text{ V}$ $I_D = 4\text{ A}$		35	50	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		20	30	ns
t_c	Cross-over Time	(see test circuit, figure 5)		60	80	ns

SOURCE DRAIN DIODE

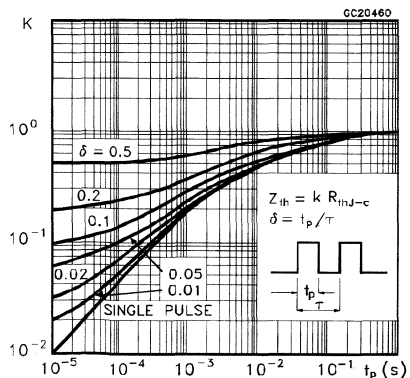
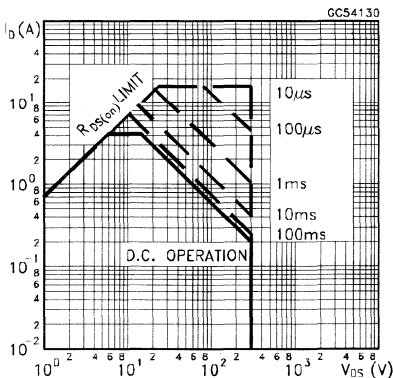
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				4	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				16	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 4\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 4\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		300		ns
Q_{rr}	Reverse Recovery Charge	(see test circuit, figure 5)		1.7		μ C
I_{RRM}	Reverse Recovery Current			13		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

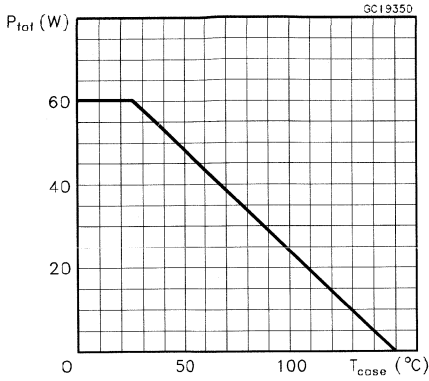
(\bullet) Pulse width limited by safe operating area

Safe Operating Area

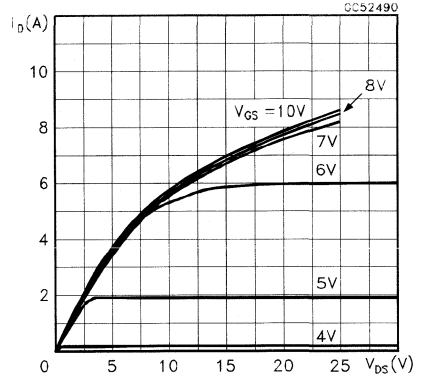
Thermal Impedance



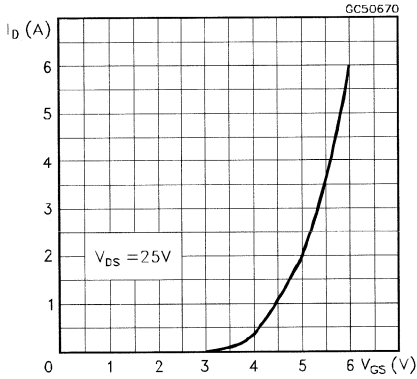
Derating Curve



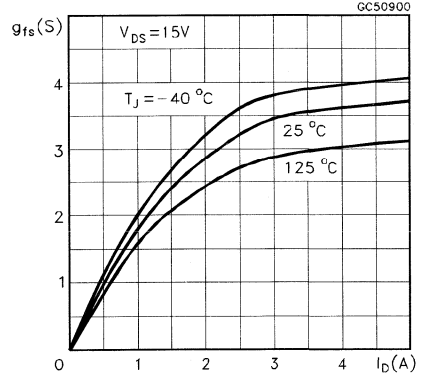
Output Characteristics



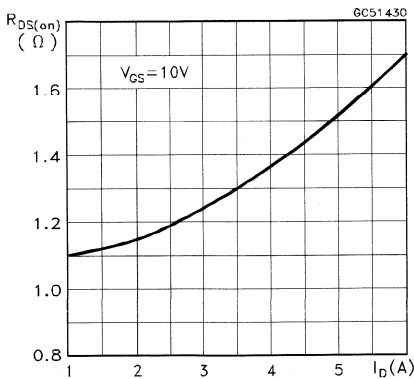
Transfer Characteristics



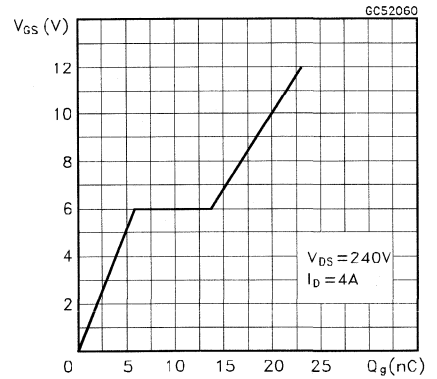
Transconductance



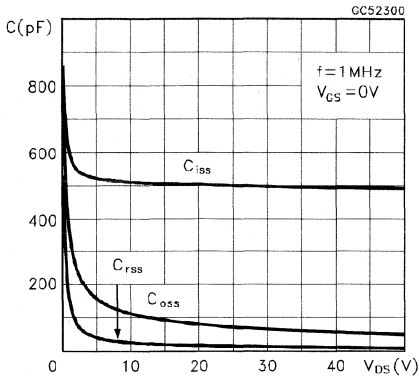
Static Drain-source On Resistance



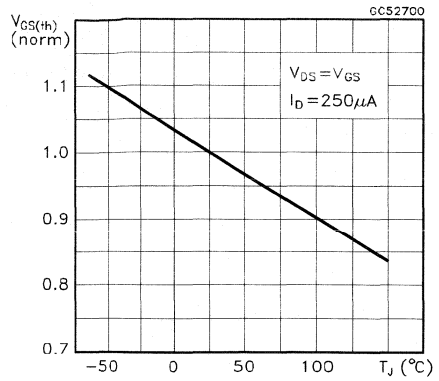
Gate Charge vs Gate-source Voltage



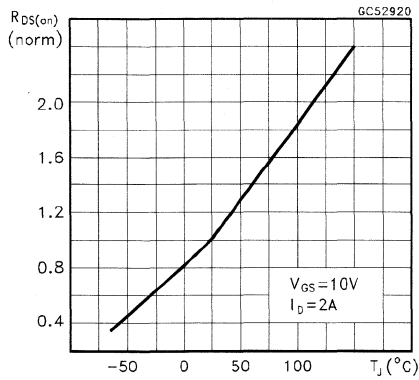
Capacitance Variations



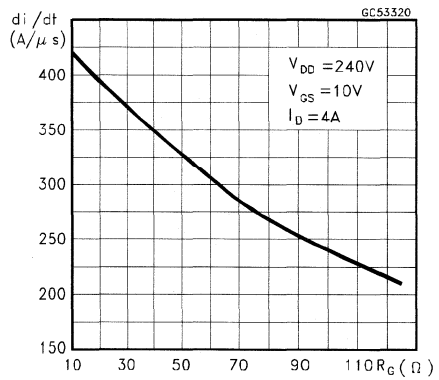
Normalized Gate Threshold Voltage vs Temperature



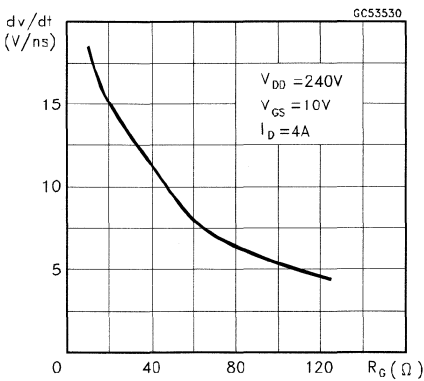
Normalized On Resistance vs Temperature



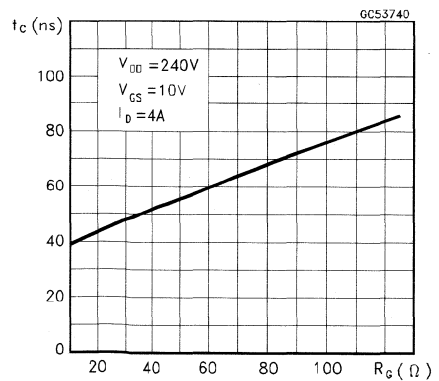
Turn-on Current Slope



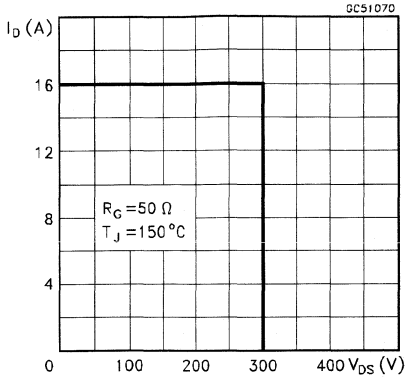
Turn-off Drain-source Voltage Slope



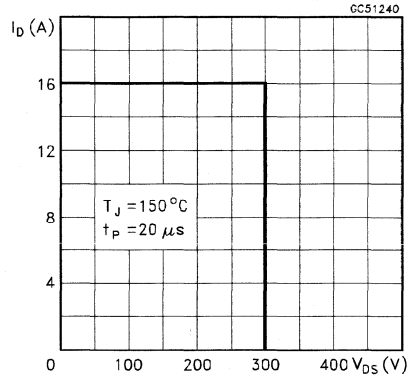
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

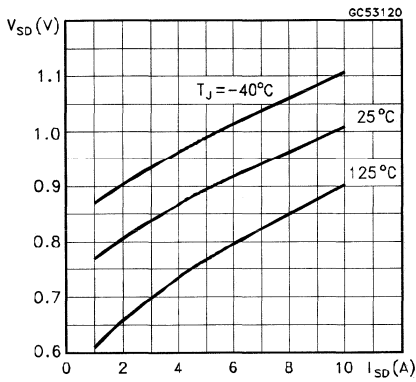


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

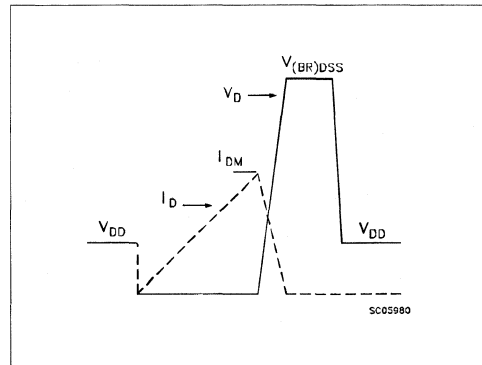
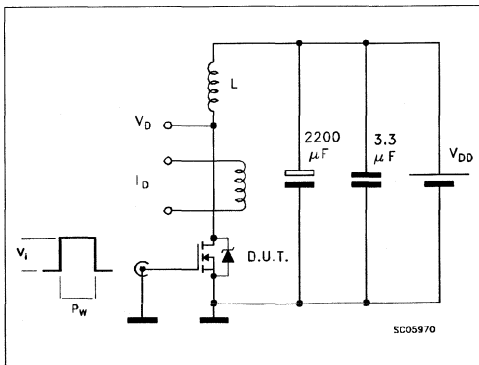


Fig. 3: Switching Times Test Circuits For Resistive Load

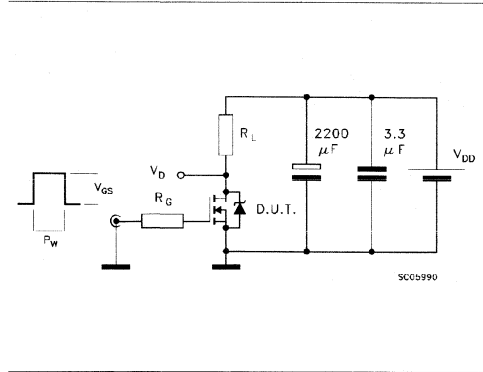


Fig. 4: Gate Charge Test Circuit

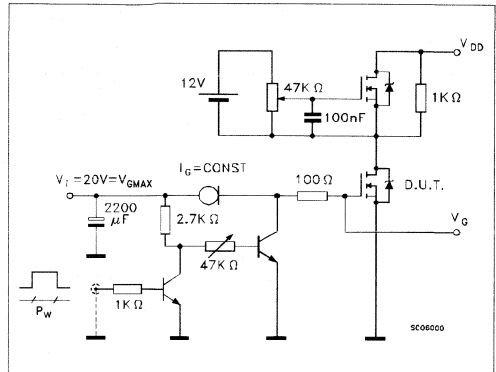
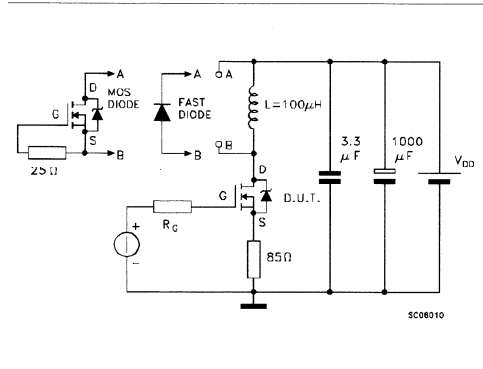


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



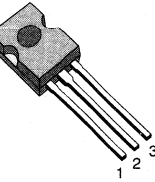
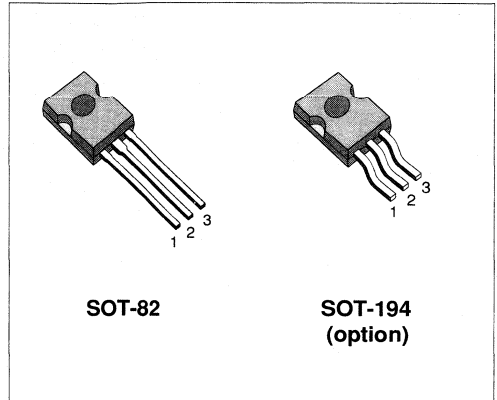
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DS}	R _{DS(on)}	I _D
STK4N30L	300 V	< 1.4 Ω	4.2 A

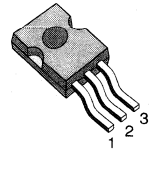
- TYPICAL R_{DS(on)} = 1.25 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

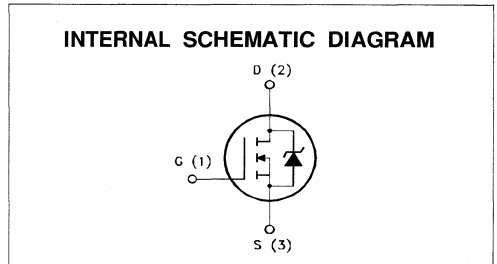
- HIGH SPEED SWITCHING
- UNINTERRUPTIBLE POWER SUPPLY (UPS)
- MOTOR CONTROL, AUDIO AMPLIFIERS
- INDUSTRIAL ACTUATORS
- DC-DC & DC-AC CONVERTERS FOR TELECOM, INDUSTRIAL AND CONSUMER ENVIRONMENT
- PARTICULARLY SUITABLE FOR ELECTRONIC FLUORESCENT LAMP BALLASTS



SOT-82



SOT-194
(option)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	300	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	300	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	4.2	A
I _D	Drain Current (continuous) at T _c = 100 °C	2.6	A
I _{DM} (*)	Drain Current (pulsed)	16	A
P _{tot}	Total Dissipation at T _c = 25 °C	60	W
	Derating Factor	0.48	W/°C
T _{stg}	Storage Temperature	-65 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C

(*) Pulse width limited by safe operating area

THERMAL DATA

R _{thj-case}	Thermal Resistance Junction-case	Max	2.08	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	80	°C/W
R _{thj-amb}	Thermal Resistance Case-sink	Typ	0.7	°C/W
T _J	Maximum Lead Temperature For Soldering Purpose		275	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _J max, δ < 1%)	4.2	A
E _{AS}	Single Pulse Avalanche Energy (starting T _J = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	32	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _J max, δ < 1%)	1	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _J max, δ < 1%)	2.6	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	300			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	1	1.6	2.5	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 5 V I _D = 2.5 A V _{GS} = 5 V I _D = 2.5 A T _c = 100°C		1.25	1.4 1.8	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	4			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 2.5 A	2	5		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		580	780	pF
C _{oss}	Output Capacitance			75	120	pF
C _{rss}	Reverse Transfer Capacitance			14	25	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 150\text{ V}$ $I_D = 2\text{ A}$		70	90	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 3)		165	215	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 240\text{ V}$ $I_D = 4\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 5)		115		A/ μs
Q_g	Total Gate Charge	$V_{DD} = 240\text{ V}$ $I_D = 4\text{ A}$ $V_{GS} = 5\text{ V}$		16	22	nC
Q_{gs}	Gate-Source Charge			5		nC
Q_{gd}	Gate-Drain Charge			7		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 240\text{ V}$ $I_D = 4\text{ A}$		60	80	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$		50	65	ns
t_c	Cross-over Time	(see test circuit, figure 5)		120	160	ns

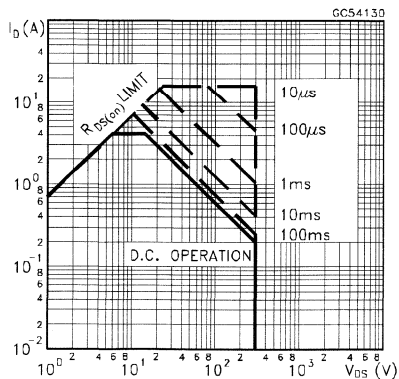
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				5	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				20	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 5\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 5\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		360		ns
Q_{rr}	Reverse Recovery Charge			2.4		μC
I_{RRM}	Reverse Recovery Current			13		A

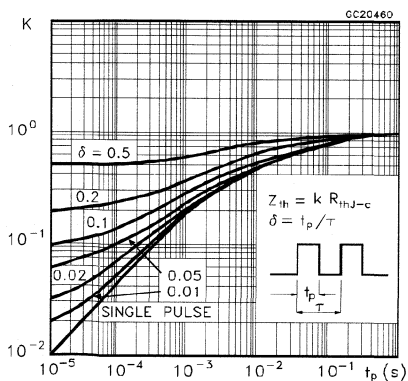
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

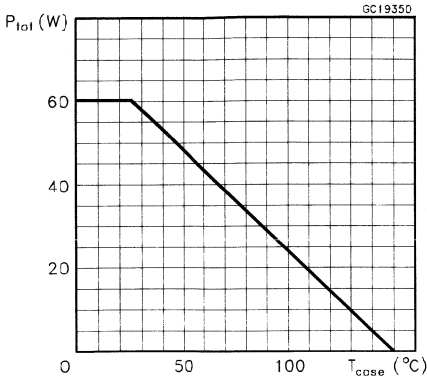
Safe Operating Area



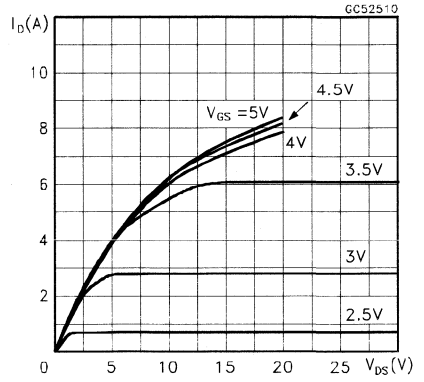
Thermal Impedance



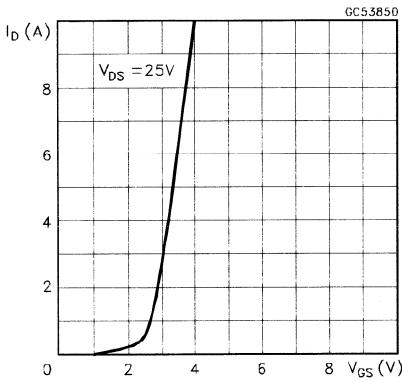
Derating Curve



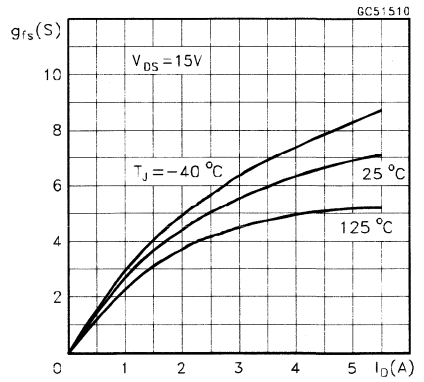
Output Characteristics



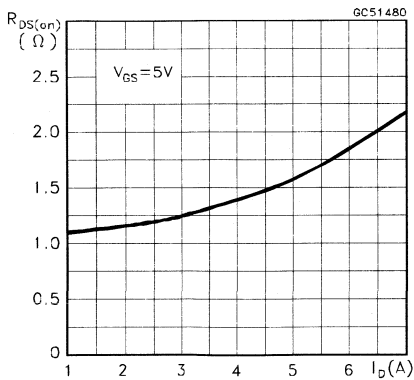
Transfer Characteristics



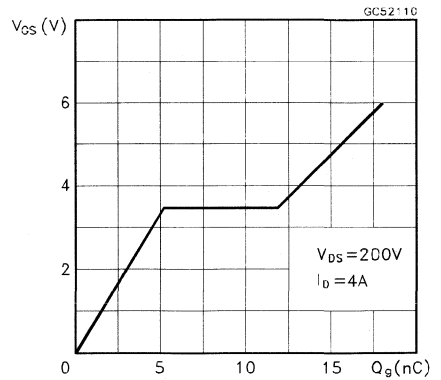
Transconductance



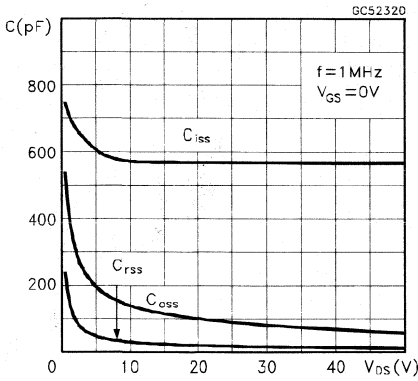
Static Drain-source On Resistance



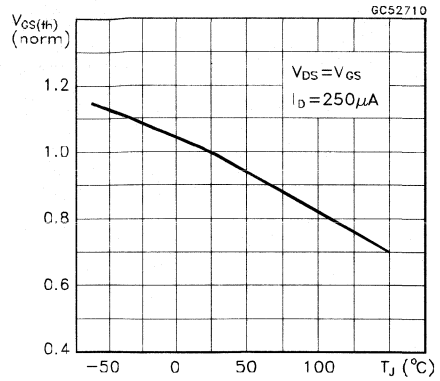
Gate Charge vs Gate-source Voltage



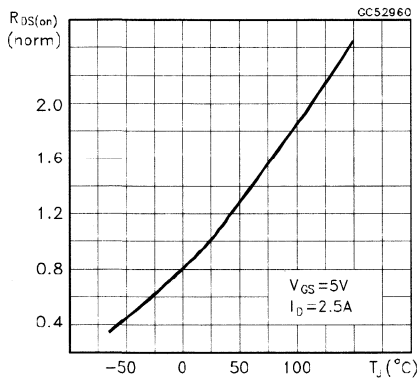
Capacitance Variations



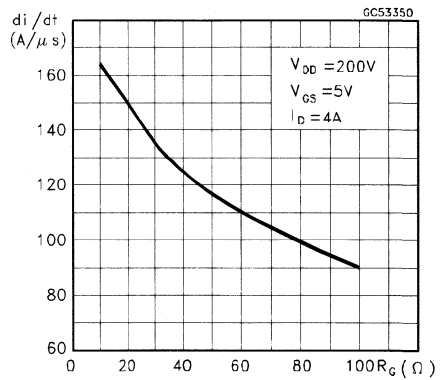
Normalized Gate Threshold Voltage vs Temperature



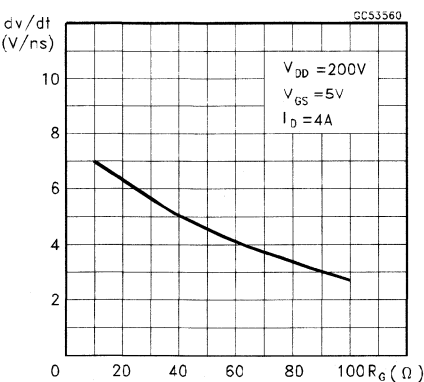
Normalized On Resistance vs Temperature



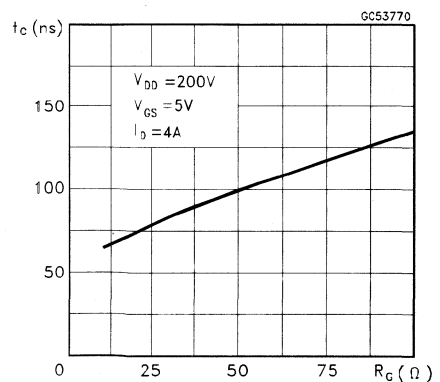
Turn-on Current Slope



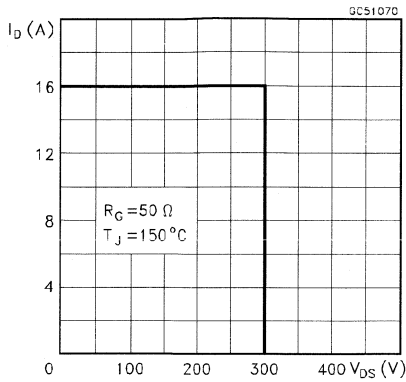
Turn-off Drain-source Voltage Slope



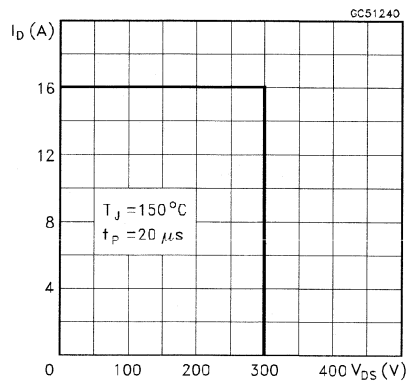
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

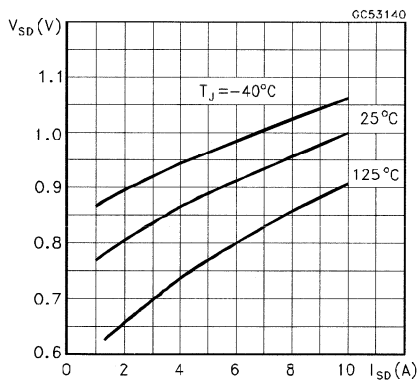


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

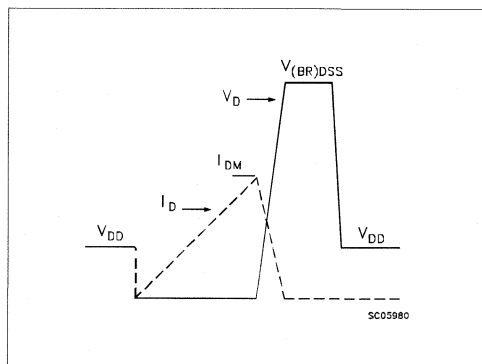
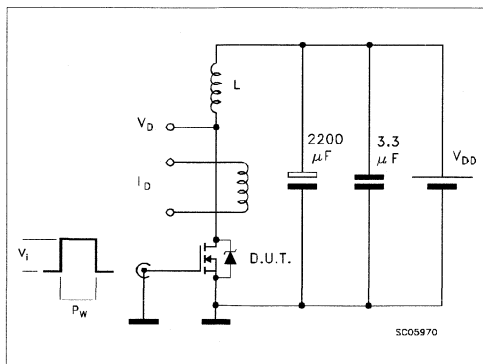


Fig. 3: Switching Times Test Circuits For Resistive Load

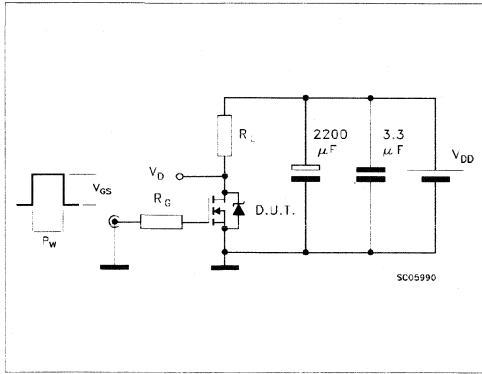


Fig. 4: Gate Charge Test Circuit

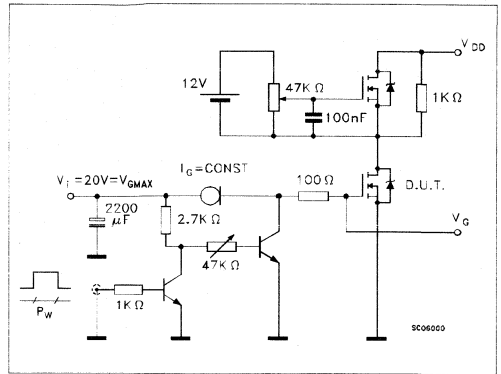
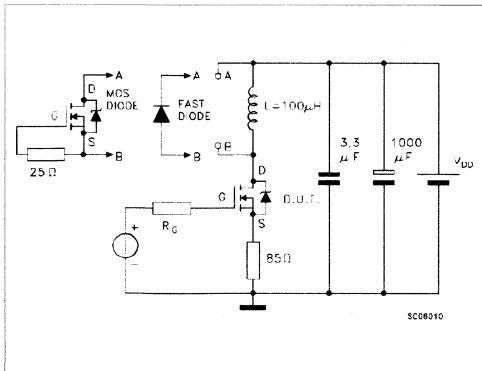


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



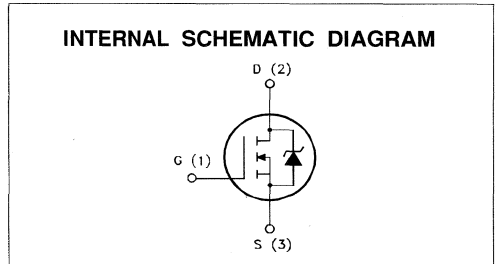
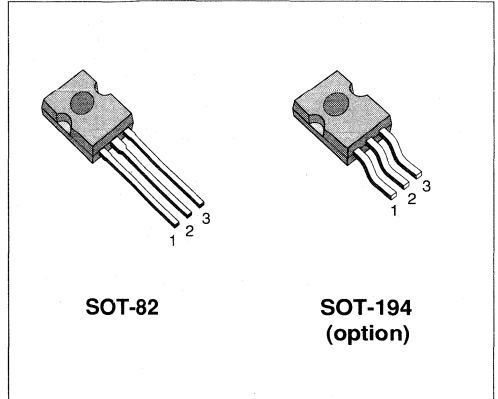
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STK4N40	400 V	< 2.2 Ω	3.7 A

- TYPICAL R_{DS(on)} = 1.65 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	400	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	400	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	3.7	A
I _D	Drain Current (continuous) at T _c = 100 °C	2.3	A
I _{DM} (*)	Drain Current (pulsed)	16	A
P _{tot}	Total Dissipation at T _c = 25 °C	60	W
	Derating Factor	0.48	W/°C
T _{stg}	Storage Temperature	-65 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C

(*) Pulse width limited by safe operating area

THERMAL DATA

R _{thj-case}	Thermal Resistance Junction-case	Max	2.08	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	80	°C/W
R _{thj-amb}	Thermal Resistance Case-sink	Typ	0.7	°C/W
T _I	Maximum Lead Temperature For Soldering Purpose		275	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _I max, δ < 1%)	3.7	A
E _{AS}	Single Pulse Avalanche Energy (starting T _I = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	95	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _I max, δ < 1%)	6.7	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _I max, δ < 1%)	2.3	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	400			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 2 A V _{GS} = 10V I _D = 2 A T _c = 100°C		1.65	2.2 4.4	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	3.7			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 2 A	1	2.1		S
C _{ISS}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		350	450	pF
C _{OSS}	Output Capacitance			68	90	pF
C _{RSS}	Reverse Transfer Capacitance			32	45	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 175\text{ V}$ $I_D = 2\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		25	33	ns
t_r	Rise Time			70	90	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 320\text{ V}$ $I_D = 4\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		110		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 320\text{ V}$ $I_D = 4\text{ A}$ $V_{GS} = 10\text{ V}$		25	35	nC
Q_{gs}	Gate-Source Charge			7		nC
Q_{gd}	Gate-Drain Charge			11		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(voff)}$	Off-voltage Rise Time	$V_{DD} = 320\text{ V}$ $I_D = 4\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		50	65	ns
t_f	Fall Time			28	35	ns
t_c	Cross-over Time			75	95	ns

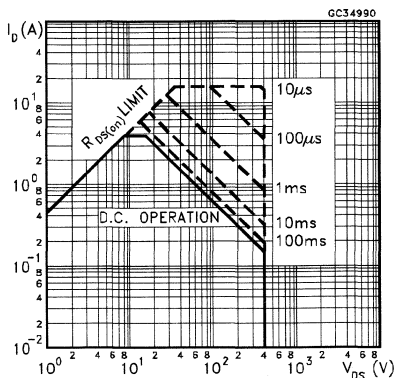
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				3.7	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				16	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 3.7\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 3.7\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		400		ns
Q_{rr}	Reverse Recovery Charge			5.9		μC
I_{RRM}	Reverse Recovery Current			29.5		A

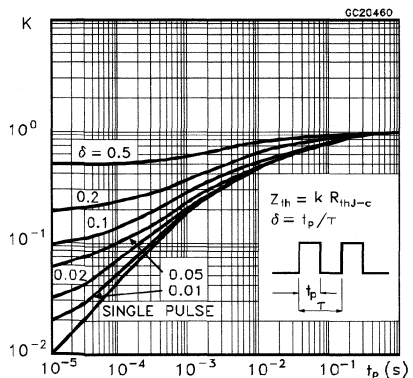
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

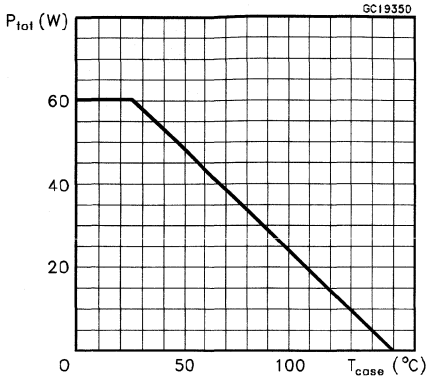
Safe Operating Area



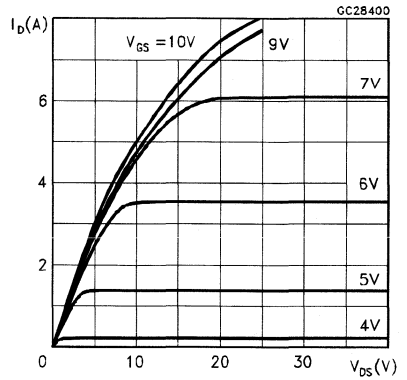
Thermal Impedance



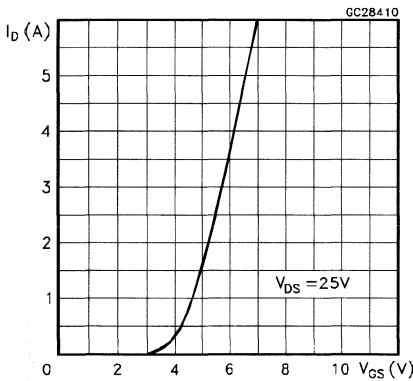
Derating Curve



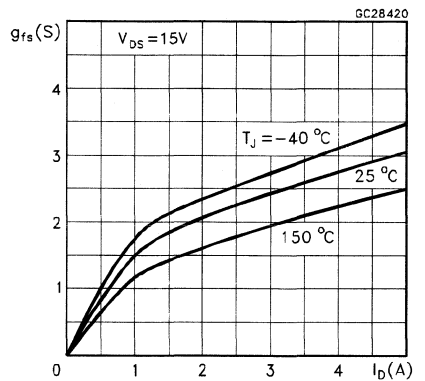
Output Characteristics



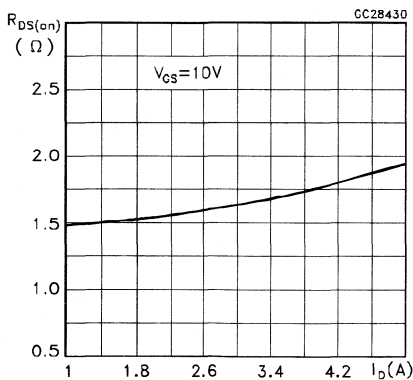
Transfer Characteristics



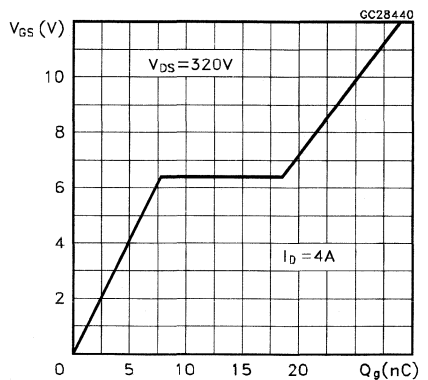
Transconductance



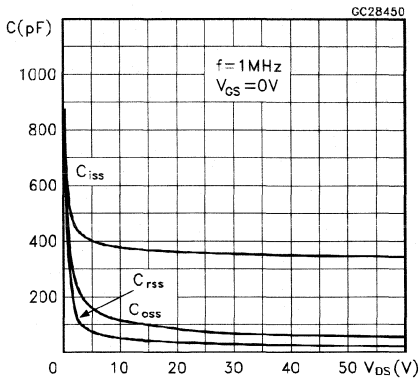
Static Drain-source On Resistance



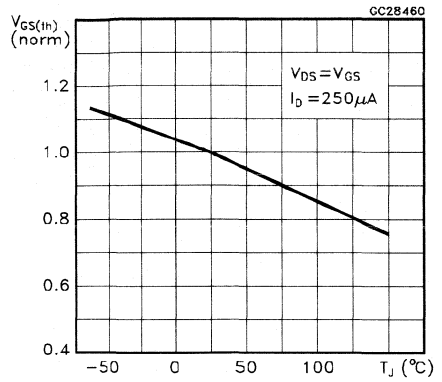
Gate Charge vs Gate-source Voltage



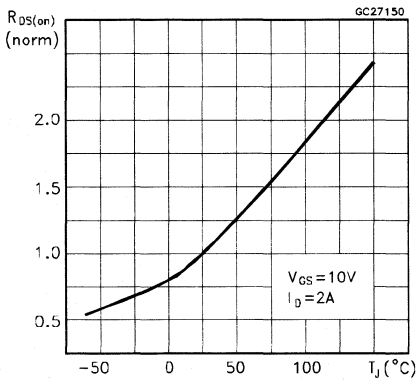
Capacitance Variations



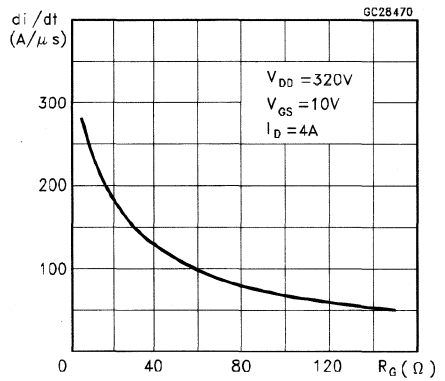
Normalized Gate Threshold Voltage vs Temperature



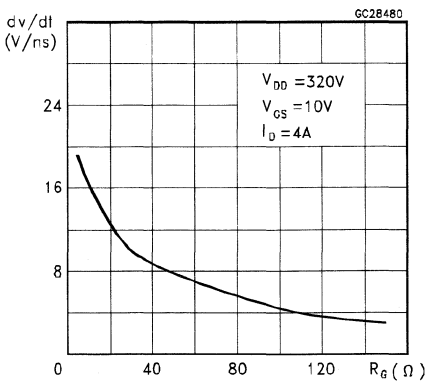
Normalized On Resistance vs Temperature



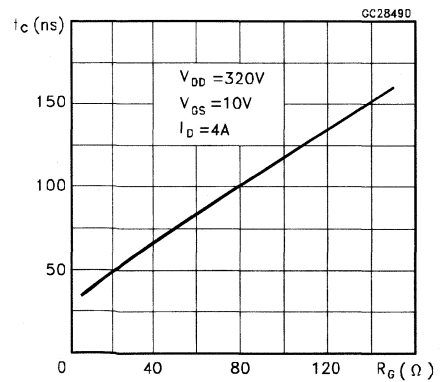
Turn-on Current Slope



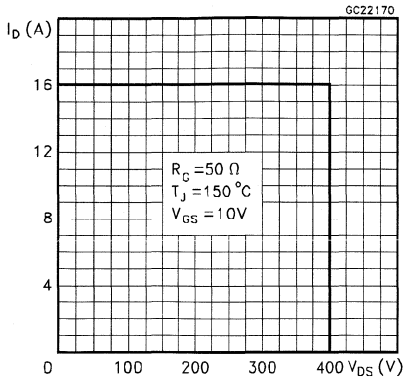
Turn-off Drain-source Voltage Slope



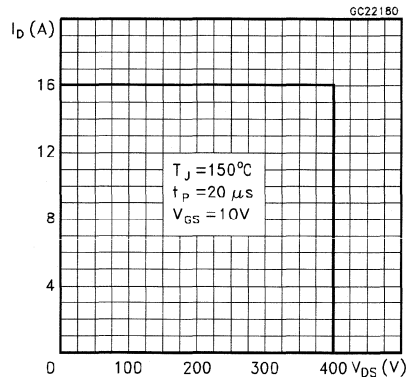
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

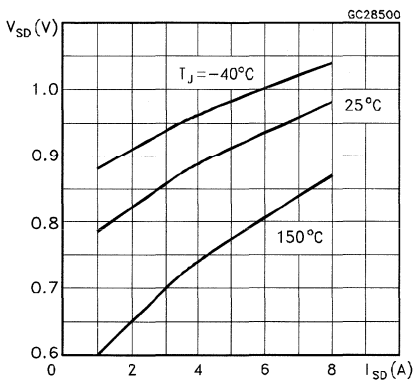


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

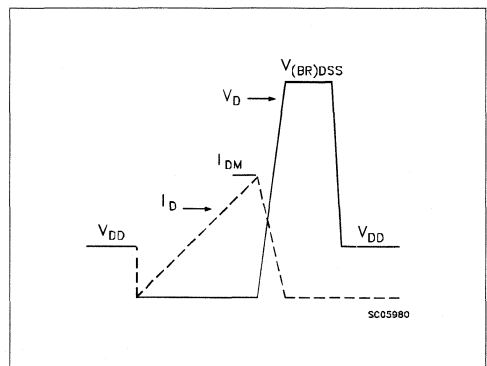
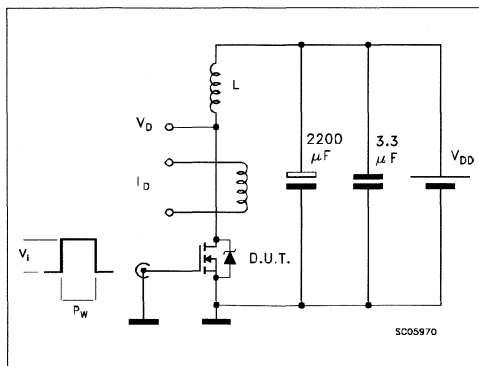


Fig. 3: Switching Times Test Circuits For Resistive Load

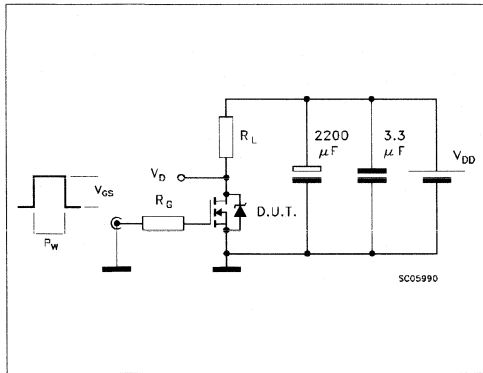


Fig. 4: Gate Charge Test Circuit

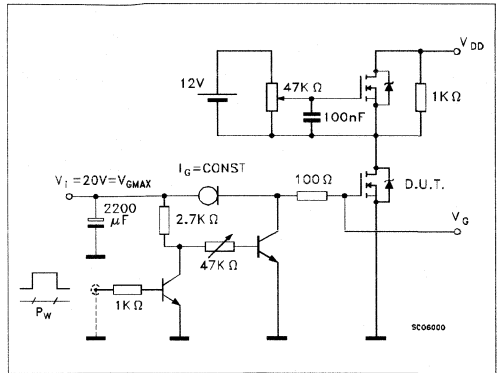
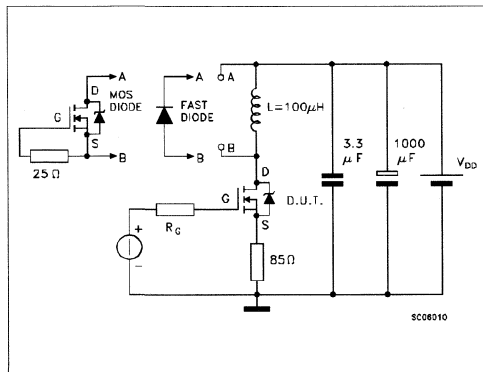


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



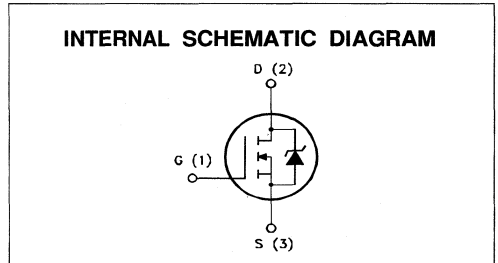
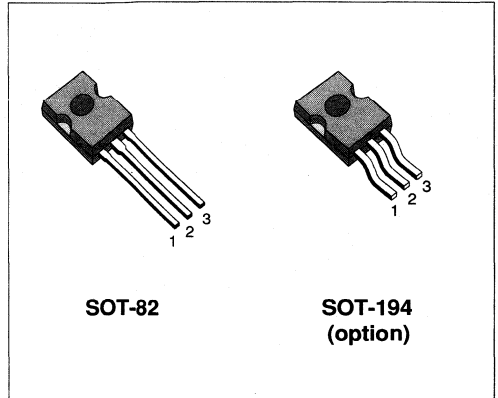
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STK6N20	200 V	< 0.7 Ω	6 A

- TYPICAL R_{DS(on)} = 0.55 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- UNINTERRUPTIBLE POWER SUPPLY (UPS)
- MOTOR CONTROL, AUDIO AMPLIFIERS
- INDUSTRIAL ACTUATORS
- DC-DC & DC-AC CONVERTERS FOR TELECOM, INDUSTRIAL AND CONSUMER ENVIRONMENT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	200	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	200	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	6	A
I _D	Drain Current (continuous) at T _c = 100 °C	4	A
I _{DM} (*)	Drain Current (pulsed)	24	A
P _{tot}	Total Dissipation at T _c = 25 °C	55	W
	Derating Factor	0.44	W/°C
T _{stg}	Storage Temperature	-65 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C

(*) Pulse width limited by safe operating area

THERMAL DATA

R _{thj-case}	Thermal Resistance Junction-case	Max	2.27	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	80	°C/W
R _{thj-amb}	Thermal Resistance Case-sink	Typ	0.7	°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		275	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	6	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	20	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	5	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	4	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	200			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 3 A V _{GS} = 10V I _D = 3 A T _c = 100°C		0.55	0.7 1.4	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} × R _{DS(on)max} V _{GS} = 10 V	6			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} × R _{DS(on)max} I _D = 3 A	1.5	3.5		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		460	600	pF
C _{oss}	Output Capacitance			90	120	pF
C _{rss}	Reverse Transfer Capacitance			20	30	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 100\text{ V}$ $I_D = 3\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		30 70	45 100	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 160\text{ V}$ $I_D = 6\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		155		A/ μs
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 160\text{ V}$ $I_D = 6\text{ A}$ $V_{GS} = 10\text{ V}$		20 6 8	30	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$ t_f	Off-voltage Rise Time Fall Time	$V_{DD} = 160\text{ V}$ $I_D = 6\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		40 25	60 35	ns ns
t_c	Cross-over Time	(see test circuit, figure 5)		65	95	ns

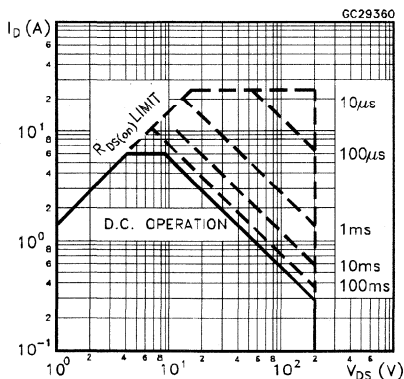
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				6 24	A A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 6\text{ A}$ $V_{GS} = 0$			1.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 6\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		170		ns
Q_{rr}	Reverse Recovery Charge			1		μC
I_{RRM}	Reverse Recovery Current			12		A

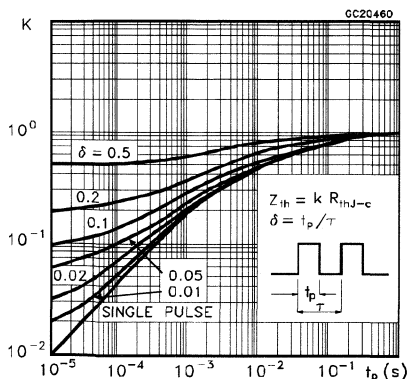
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

(•) Pulse width limited by safe operating area

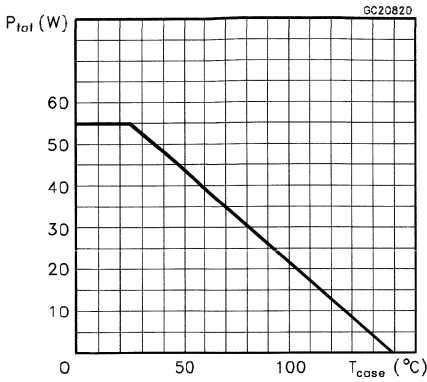
Safe Operating Area



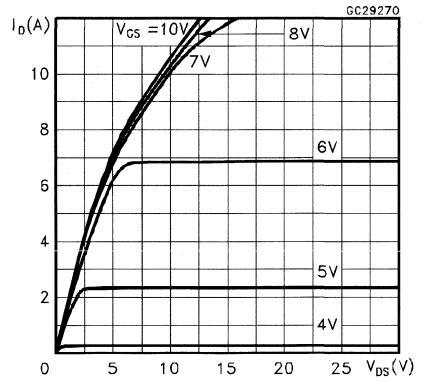
Thermal Impedance



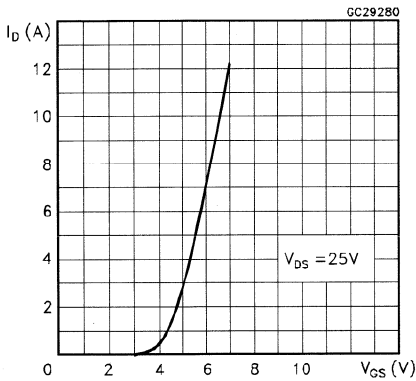
Derating Curve



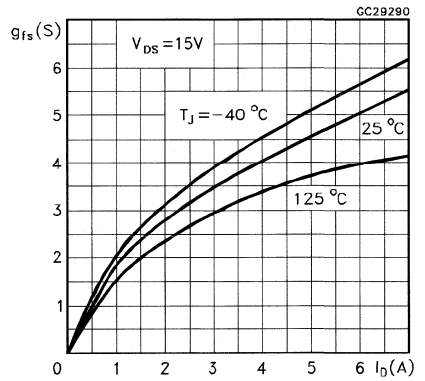
Output Characteristics



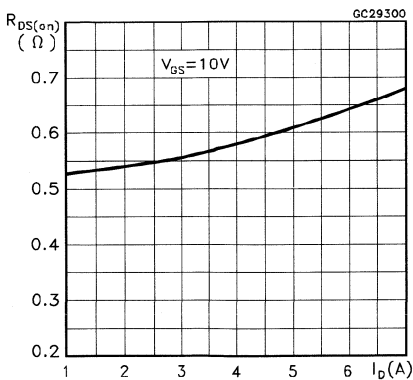
Transfer Characteristics



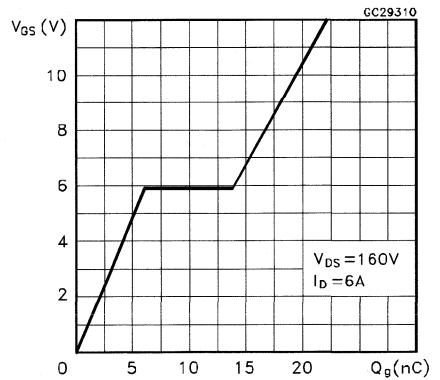
Transconductance



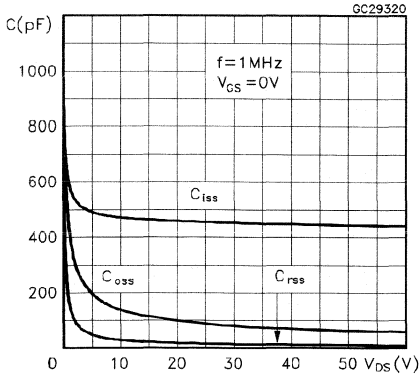
Static Drain-source On Resistance



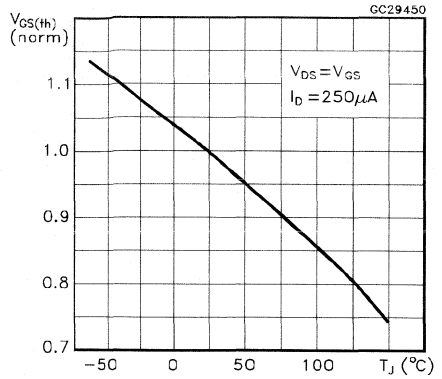
Gate Charge vs Gate-source Voltage



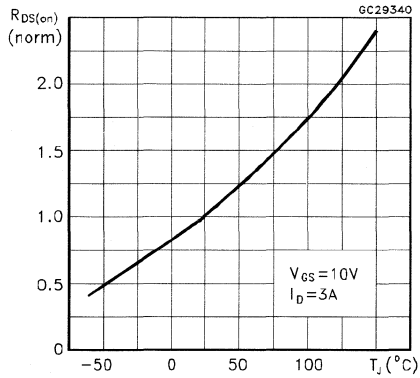
Capacitance Variations



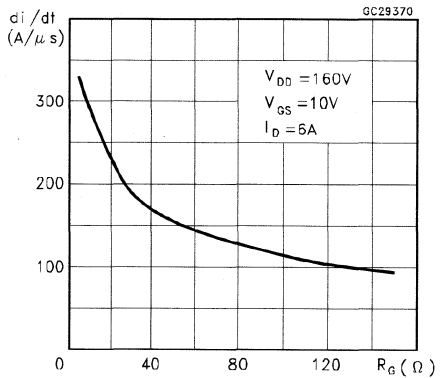
Normalized Gate Threshold Voltage vs Temperature



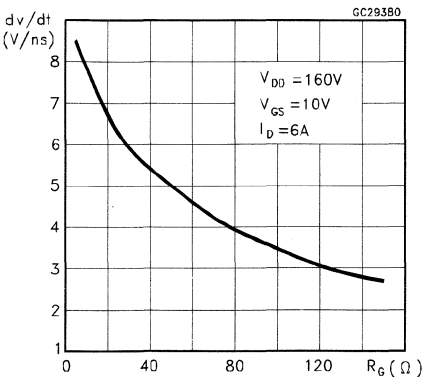
Normalized On Resistance vs Temperature



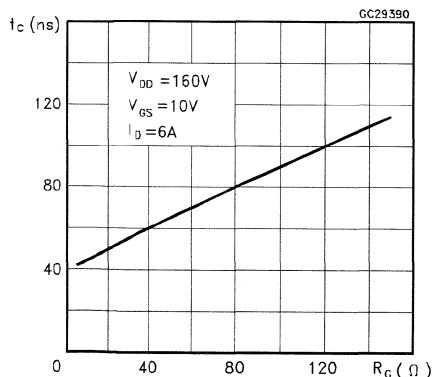
Turn-on Current Slope



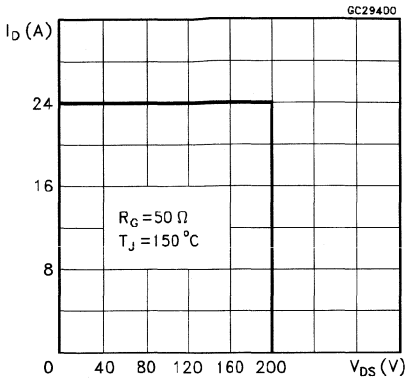
Turn-off Drain-source Voltage Slope



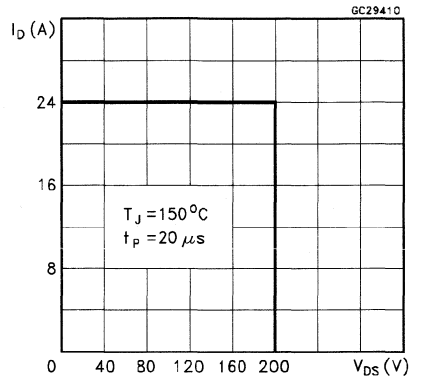
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

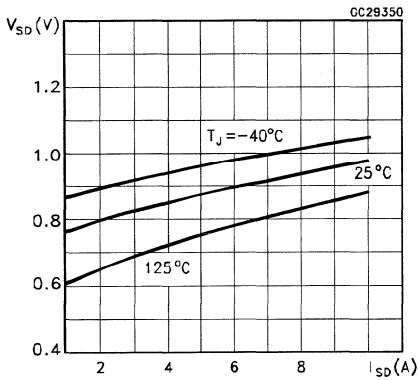


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

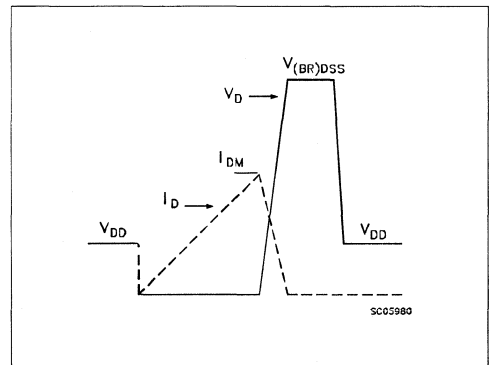
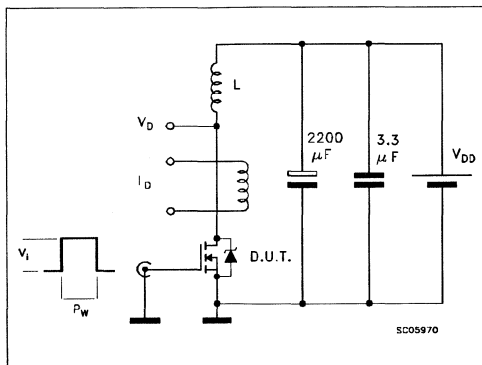


Fig. 3: Switching Times Test Circuits For Resistive Load

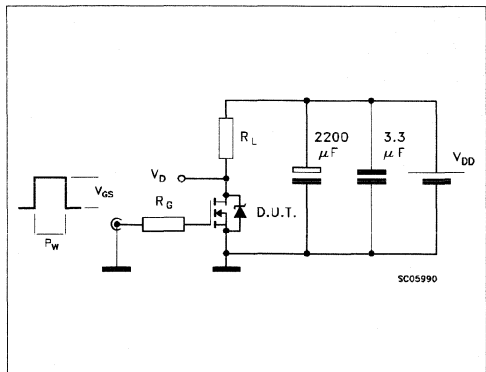


Fig. 4: Gate Charge Test Circuit

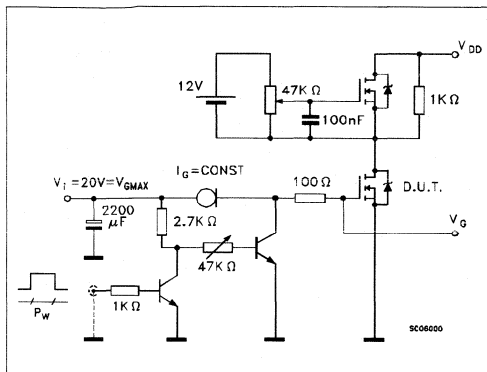
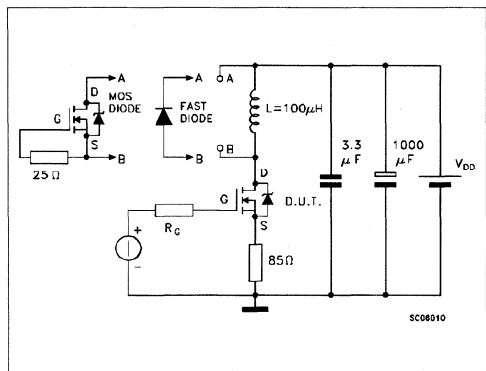


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



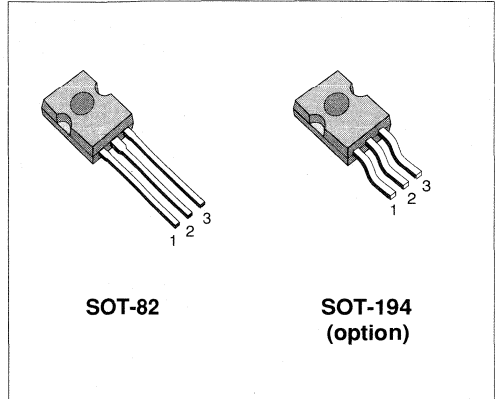
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STK9N10	100 V	< 0.3 Ω	9 A

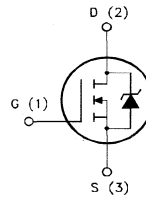
- TYPICAL R_{DS(on)} = 0.23 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	100	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	100	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	9	A
I _D	Drain Current (continuous) at T _c = 100 °C	6	A
I _{DM} (*)	Drain Current (pulsed)	36	A
P _{tot}	Total Dissipation at T _c = 25 °C	50	W
	Derating Factor	0.33	W/°C
T _{stg}	Storage Temperature	-65 to 175	°C
T _j	Max. Operating Junction Temperature	175	°C

(*) Pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	3.0	$^{\circ}C/W$
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	80	$^{\circ}C/W$
$R_{thj-amb}$	Thermal Resistance Case-sink	Typ	0.7	$^{\circ}C/W$
T_I	Maximum Lead Temperature For Soldering Purpose		275	$^{\circ}C$

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	9	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25^{\circ}C$, $I_D = I_{AR}$, $V_{DD} = 25 V$)	30	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	7	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100^{\circ}C$, pulse width limited by T_j max, $\delta < 1\%$)	6	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25^{\circ}C$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250 \mu A$ $V_{GS} = 0$	100			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^{\circ}C$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20 V$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250 \mu A$	2	2.9	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10V$ $I_D = 4.5 A$ $V_{GS} = 10V$ $I_D = 4.5 A$ $T_c = 100^{\circ}C$		0.23	0.3 0.6	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10 V$	9			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 4.5 A$	2	4		S
C_{iss}	Input Capacitance	$V_{DS} = 25 V$ $f = 1 MHz$ $V_{GS} = 0$		330	450	pF
C_{oss}	Output Capacitance			90	120	pF
C_{rss}	Reverse Transfer Capacitance			25	40	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 50\text{ V}$ $I_D = 4.5\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		10 50	15 75	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 80\text{ V}$ $I_D = 9\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		440		A/ μ s
Q_g Q_{Gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 80\text{ V}$ $I_D = 9\text{ A}$ $V_{GS} = 10\text{ V}$		15 7 4	25	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(off)}$ t_f	Off-voltage Rise Time Fall Time	$V_{DD} = 80\text{ V}$ $I_D = 9\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$		15 25	25 35	ns ns
t_c	Cross-over Time	(see test circuit, figure 5)		50	70	ns

SOURCE DRAIN DIODE

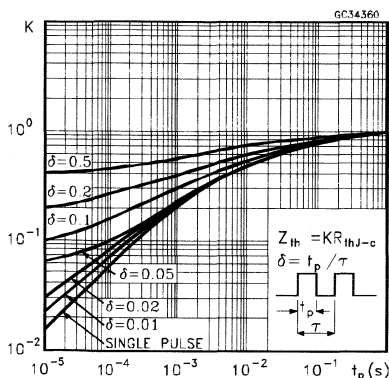
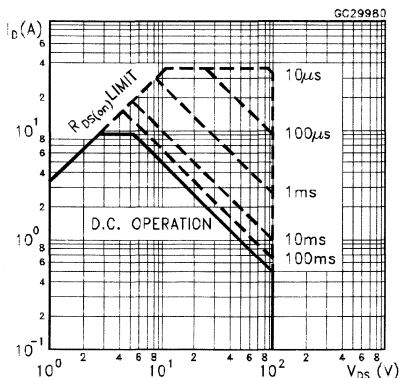
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				9 36	A A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 9\text{ A}$ $V_{GS} = 0$			1.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 9\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 20\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		80		ns
Q_{rr}	Reverse Recovery Charge			0.2		μC
I_{RRM}	Reverse Recovery Current			5		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

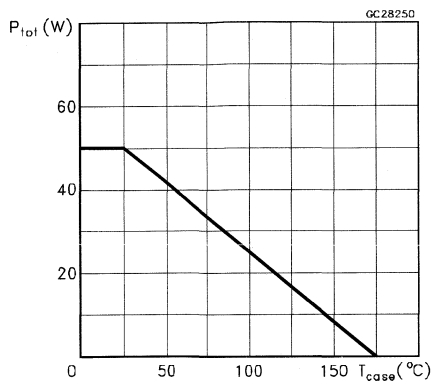
(•) Pulse width limited by safe operating area

Safe Operating Area

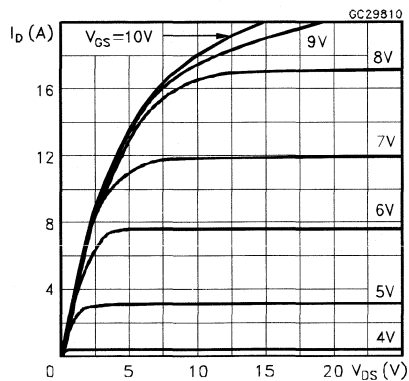
Thermal Impedance



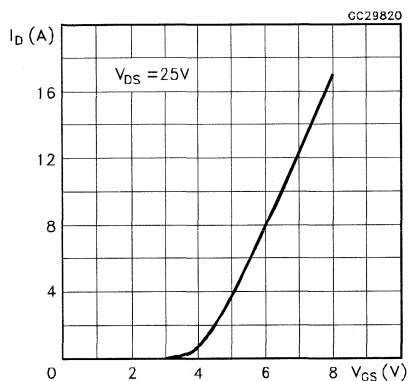
Derating Curve



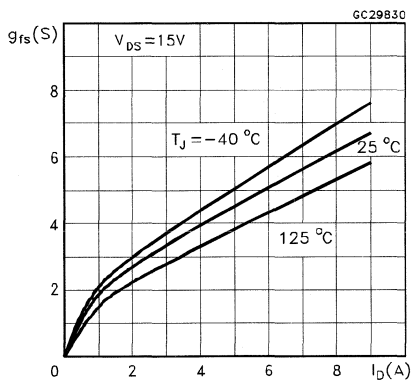
Output Characteristics



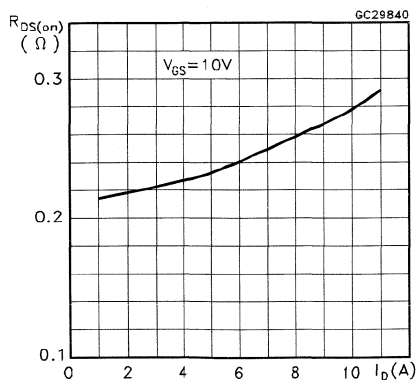
Transfer Characteristics



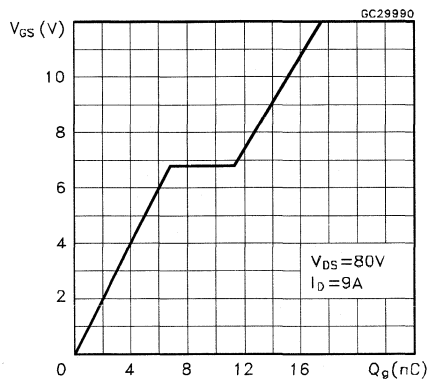
Transconductance



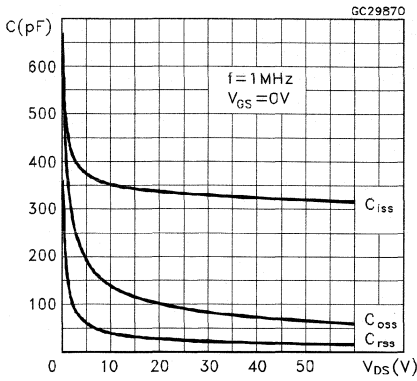
Static Drain-source On Resistance



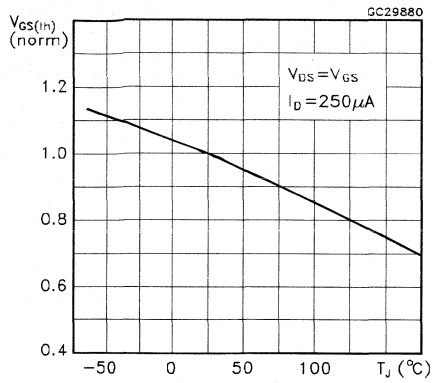
Gate Charge vs Gate-source Voltage



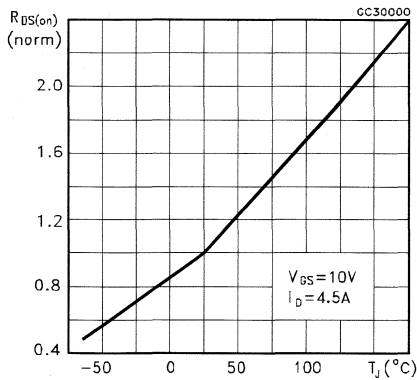
Capacitance Variations



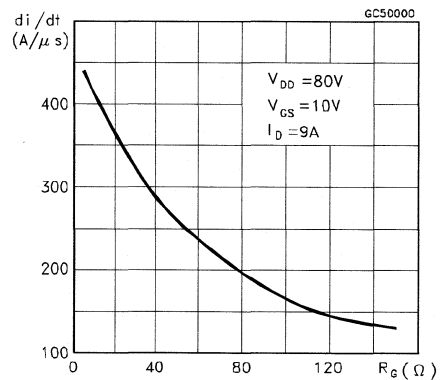
Normalized Gate Threshold Voltage vs Temperature



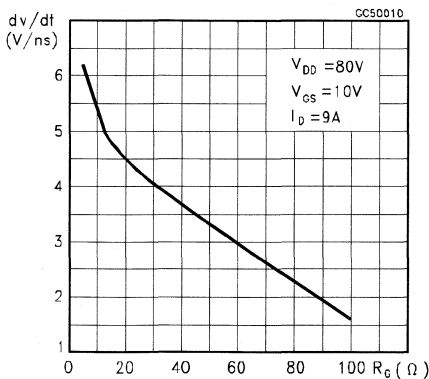
Normalized On Resistance vs Temperature



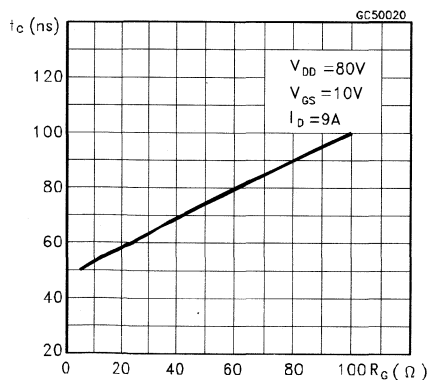
Turn-on Current Slope



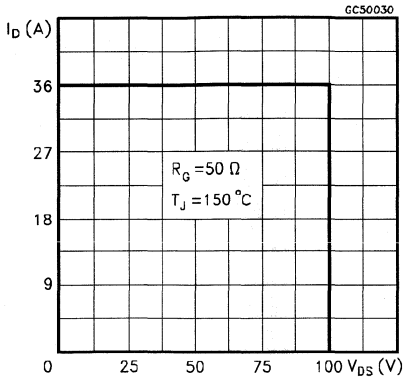
Turn-off Drain-source Voltage Slope



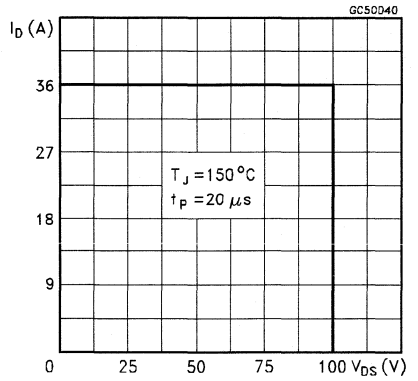
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

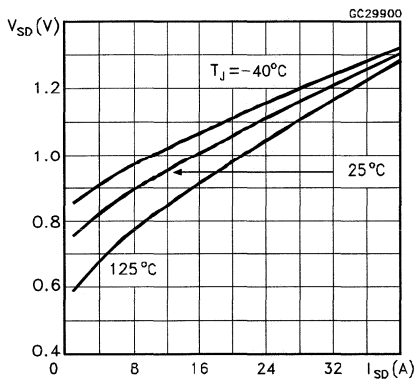


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

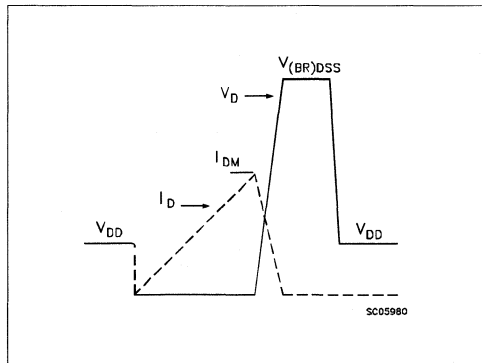
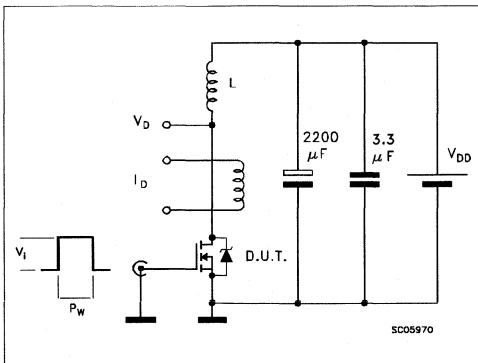


Fig. 3: Switching Times Test Circuits For Resistive Load

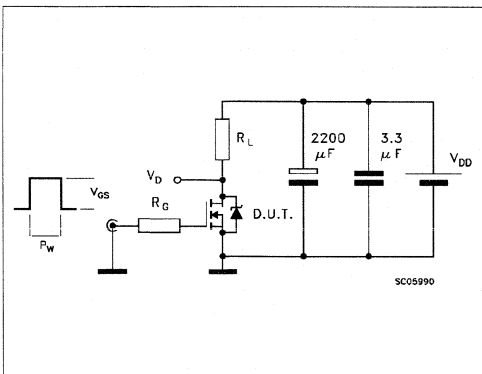


Fig. 4: Gate Charge Test Circuit

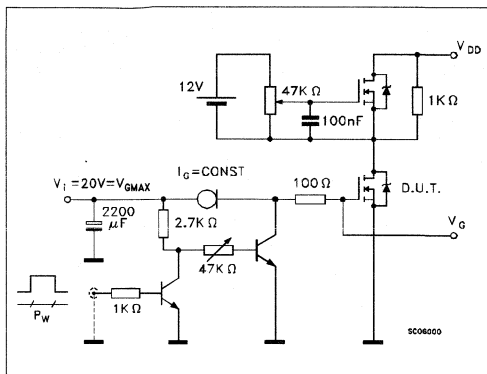
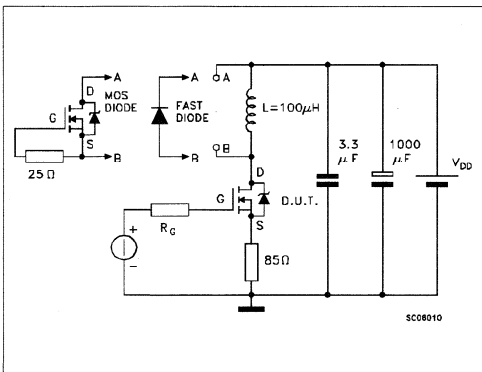


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



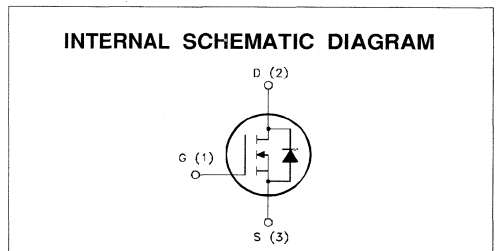
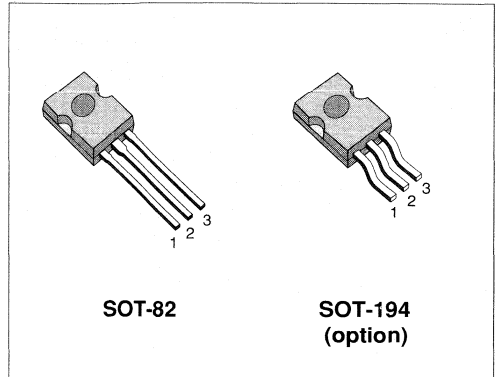
N - CHANNEL ENHANCEMENT MODE LOW THRESHOLD POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STK12N05L	50 V	< 0.15 Ω	12 A
STK12N06L	60 V	< 0.15 Ω	12 A

- TYPICAL R_{DS(on)} = 0.115 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- LOGIC LEVEL COMPATIBLE INPUT
- 175°C OPERATING TEMPERATURE FOR STANDARD PACKAGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STK12N05L	STK12N06L	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	50	60	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	50	60	V
V _{GS}	Gate-source Voltage	± 15		V
I _D	Drain Current (continuous) at T _C = 25 °C	12		A
I _D	Drain Current (continuous) at T _C = 100 °C	8		A
I _{DM} (•)	Drain Current (pulsed)	48		A
P _{tot}	Total Dissipation at T _C = 25 °C	50		W
	Derating Factor	0.33		W/°C
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(•) Pulse width limited by safe operating area

THERMAL DATA

R _{thj-case}	Thermal Resistance Junction-case	Max	3	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	80	°C/W
R _{thj-amb}	Thermal Resistance Case-sink	Typ	0.7	°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		275	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	12	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	30	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	7	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	8	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0 for STK12N05L for STK12N06L	50 60			V V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 15 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	1	1.6	2.5	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 5 V I _D = 6 A V _{GS} = 5 V I _D = 6 A T _c = 100 °C		0.115	0.15 0.3	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	15			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 6 A	4	8		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		350	500	pF
C _{oss}	Output Capacitance			150	200	pF
C _{rss}	Reverse Transfer Capacitance			50	80	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 25\text{ V}$ $I_D = 6\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 3)		55 180	80 260	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 12\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 5)		120		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 40\text{ V}$ $I_D = 12\text{ A}$ $V_{GS} = 5\text{ V}$		12 6 4	18	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$ t_f t_c	Off-voltage Rise Time Fall Time Cross-over Time	$V_{DD} = 40\text{ V}$ $I_D = 12\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 5)		40 60 110	60 90 160	ns ns ns

SOURCE DRAIN DIODE

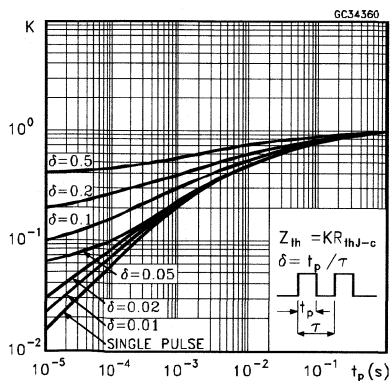
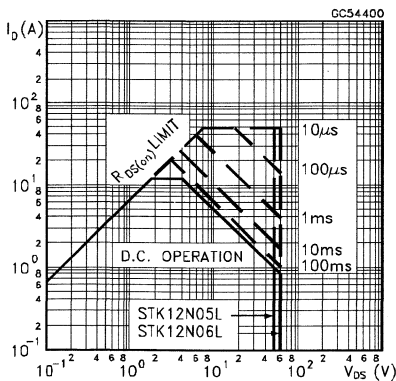
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				12 48	A A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 12\text{ A}$ $V_{GS} = 0$			1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 12\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 25\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		75 0.15 4		ns μ C A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

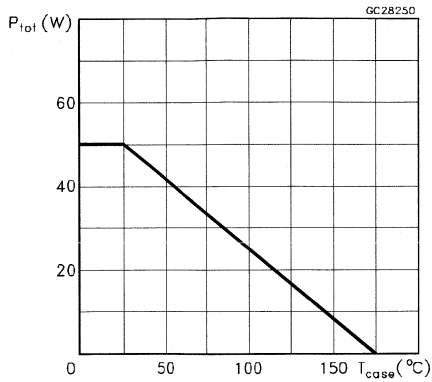
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas

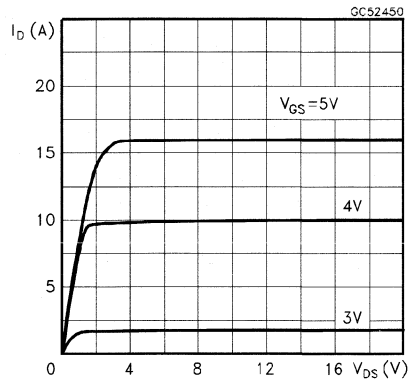
Thermal Impedance



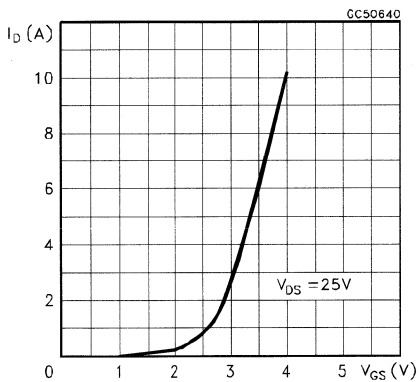
Derating Curve



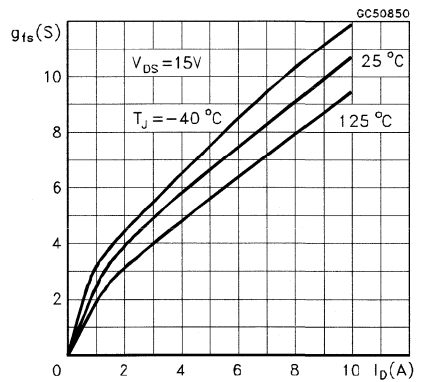
Output Characteristics



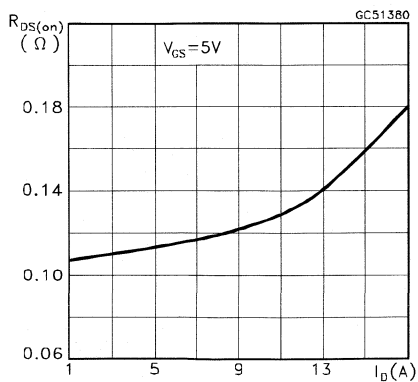
Transfer Characteristics



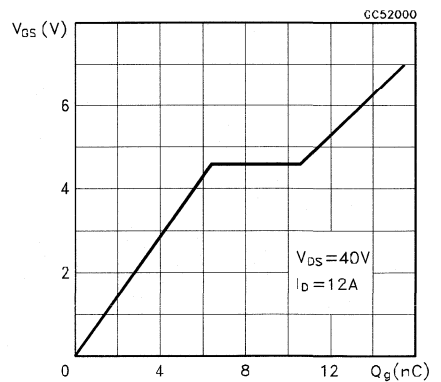
Transconductance



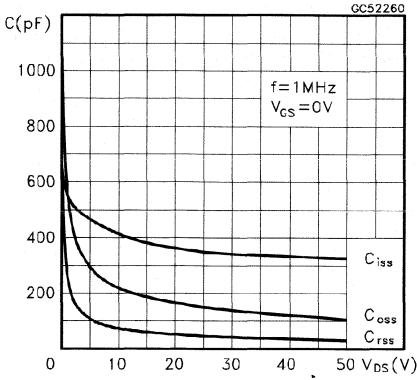
Static Drain-source On Resistance



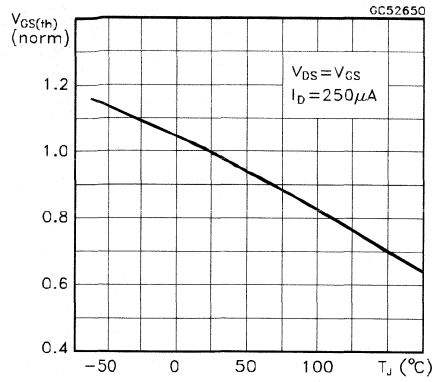
Gate Charge vs Gate-source Voltage



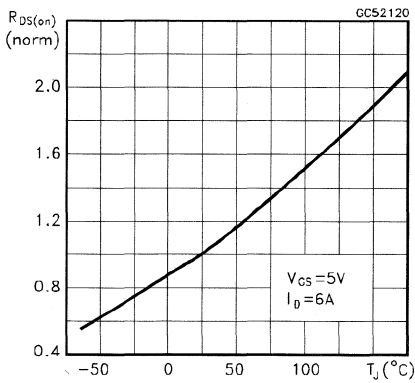
Capacitance Variations



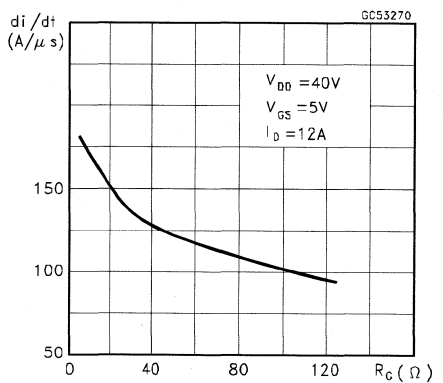
Normalized Gate Threshold Voltage vs Temperature



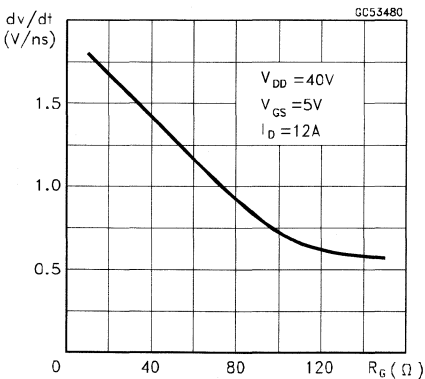
Normalized On Resistance vs Temperature



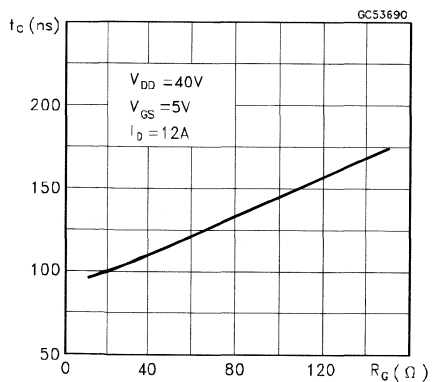
Turn-on Current Slope



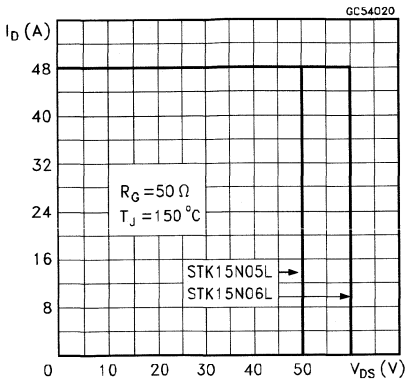
Turn-off Drain-source Voltage Slope



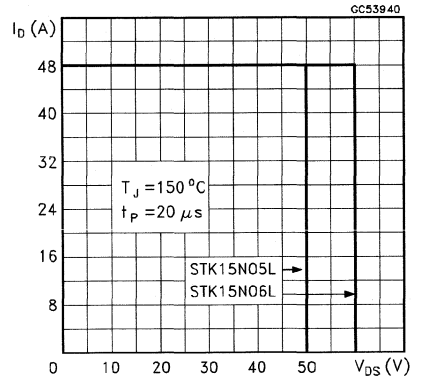
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

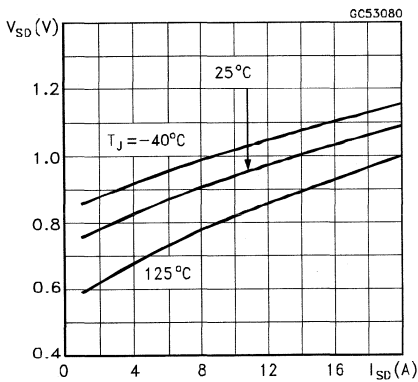


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

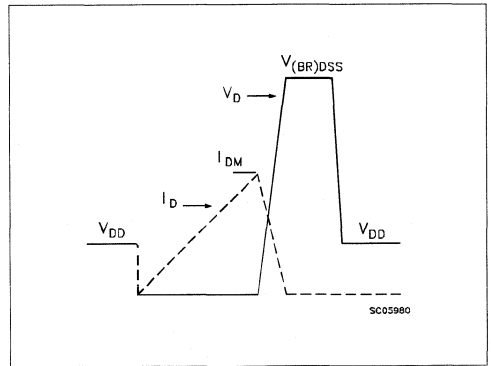
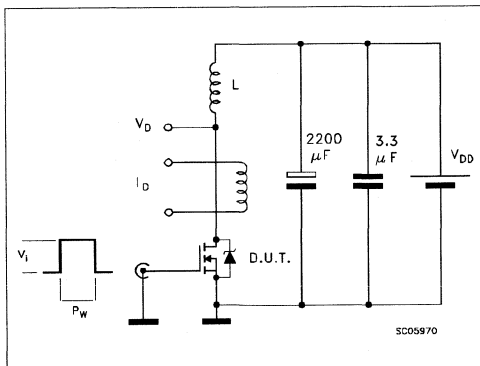


Fig. 3: Switching Times Test Circuits For Resistive Load

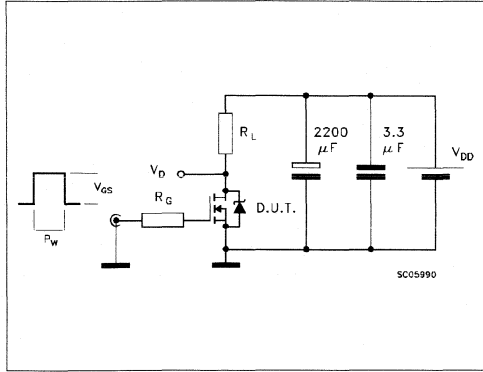


Fig. 4: Gate Charge Test Circuit

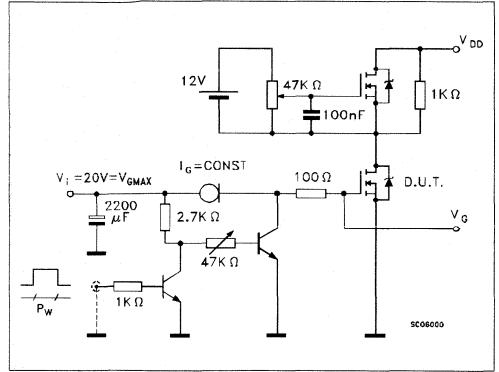
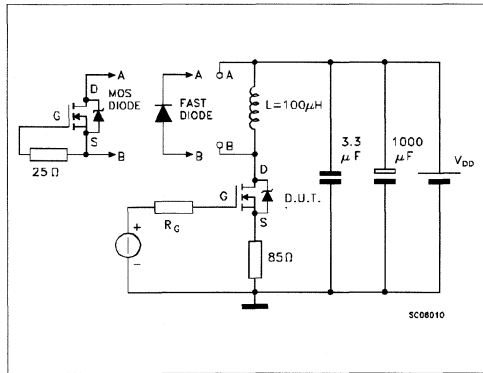


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

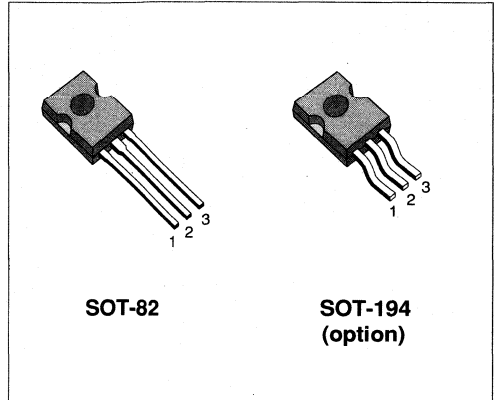
PRELIMINARY DATA

TYPE	V _{DSS}	R _{DS(on)}	I _D
STK14N05	50 V	< 0.12 Ω	14 A
STK14N06	60 V	< 0.12 Ω	14 A

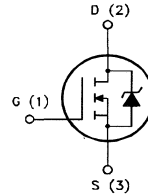
- TYPICAL R_{DS(on)} = 0.1 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STK14N05	STK14N06	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	50	60	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	50	60	V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	14		A
I _D	Drain Current (continuous) at T _c = 100 °C	10		A
I _{DM} (*)	Drain Current (pulsed)	56		A
P _{tot}	Total Dissipation at T _c = 25 °C	50		W
	Derating Factor	0.33		W/°C
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	3.0	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	80	°C/W
$R_{thc-sink}$	Thermal Resistance Case-sink	Typ	0.7	°C/W
T_I	Maximum Lead Temperature For Soldering Purpose		275	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	14	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ }^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 25\text{ V}$)	40	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	10	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ }^\circ\text{C}$, pulse width limited by T_j max, $\delta < 1\%$)	10	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ }^\circ\text{C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$ for STK14N05 for STK14N06	50 60			V V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ }^\circ\text{C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\text{ }\mu\text{A}$	2	2.9	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 7\text{ A}$ $V_{GS} = 10\text{ V}$ $I_D = 7\text{ A}$ $T_c = 100\text{ }^\circ\text{C}$		0.1	0.12 0.24	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	14			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 7\text{ A}$	3	6		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		330	450	pF
C_{oss}	Output Capacitance			150	250	pF
C_{rss}	Reverse Transfer Capacitance			40	60	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 25\text{ V}$ $I_D = 7\text{ A}$		45	65	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit figure)		90	130	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 14\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit figure)		210		A/ μs
Q_g	Total Gate Charge	$V_{DD} = 40\text{ V}$ $I_D = 14\text{ A}$ $V_{GS} = 10\text{ V}$		15	25	nC
Q_{gs}	Gate-Source Charge			7		nC
Q_{gd}	Gate-Drain Charge			5		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(voff)}$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 14\text{ A}$		35	50	ns
t_f	Fall Time	$R_{GS} = 50\ \Omega$ $V_{GS} = 10\text{ V}$		45	65	ns
t_c	Cross-over Time	(see test circuit figure)		85	120	ns

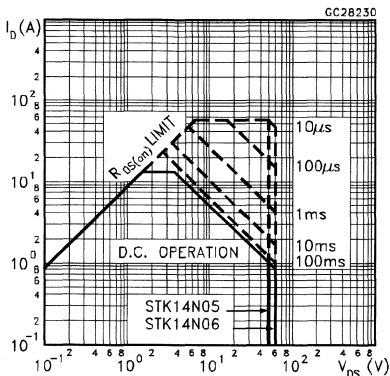
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				14	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				56	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 14\text{ A}$ $V_{GS} = 0$			1.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 14\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 25\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		60		ns
Q_{rr}	Reverse Recovery Charge			0.12		μC
I_{RRM}	Reverse Recovery Current			4		A

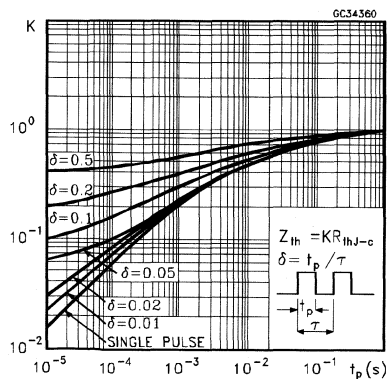
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

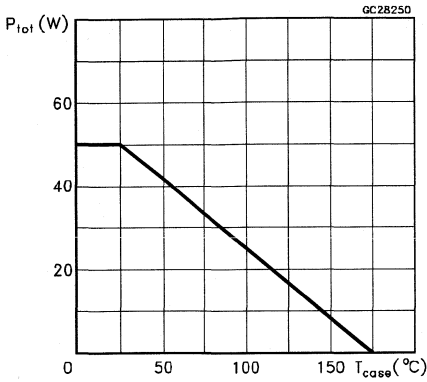
Safe Operating Area



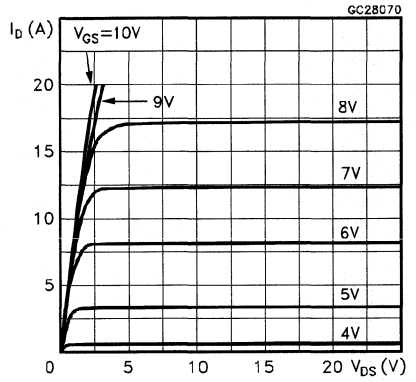
Thermal Impedance



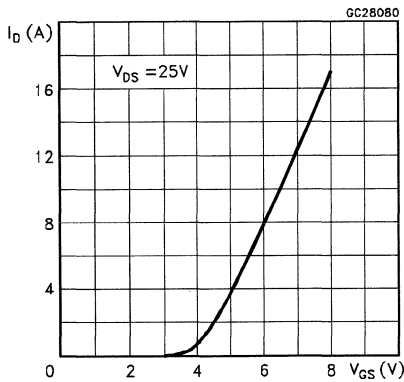
Derating Curve



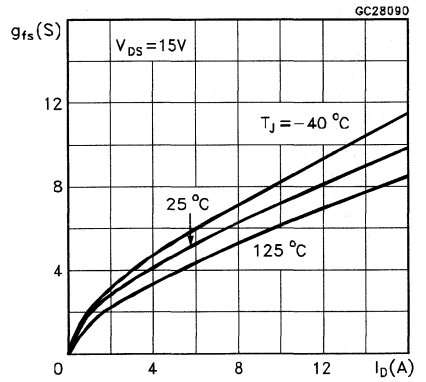
Output Characteristics



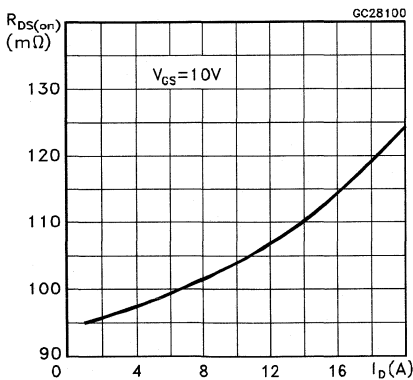
Transfer Characteristics



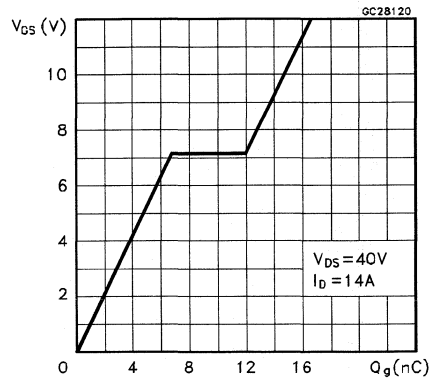
Transconductance



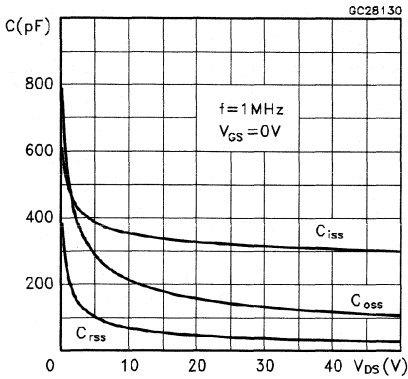
Static Drain-source On Resistance



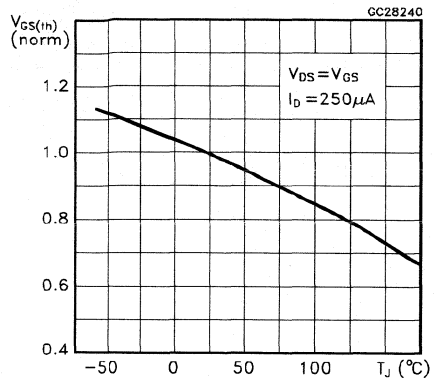
Gate Charge vs Gate-source Voltage



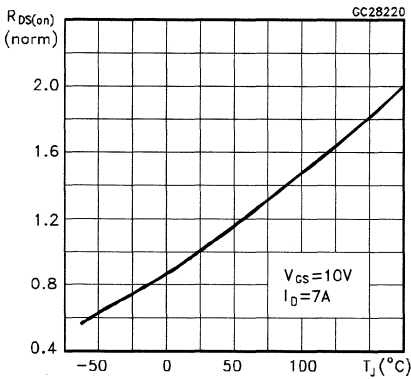
Capacitance Variations



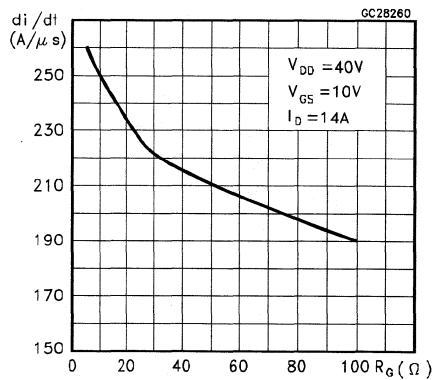
Normalized Gate Threshold Voltage vs Temperature



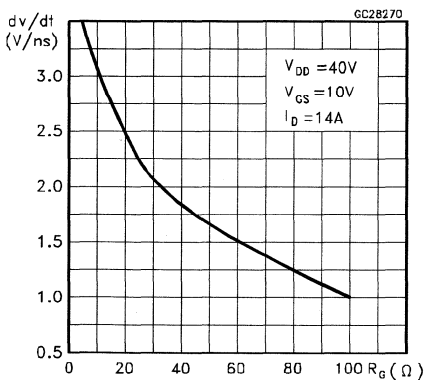
Normalized On Resistance vs Temperature



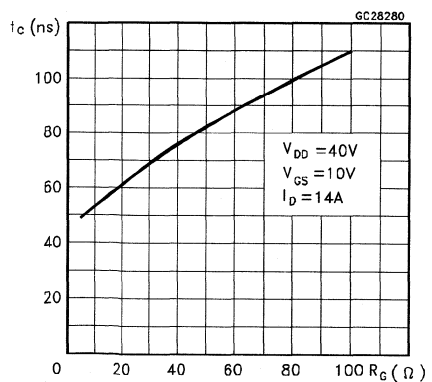
Turn-on Current Slope



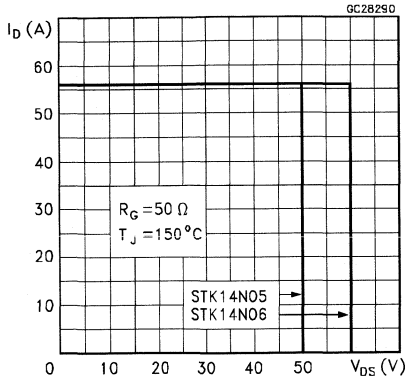
Turn-off Drain-source Voltage Slope



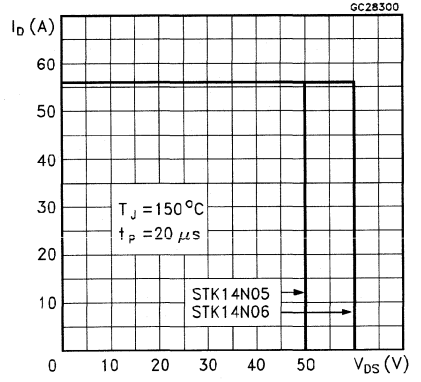
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

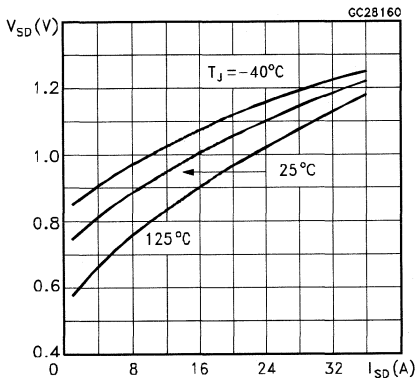


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

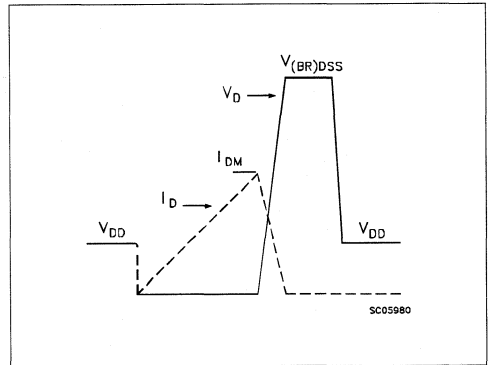
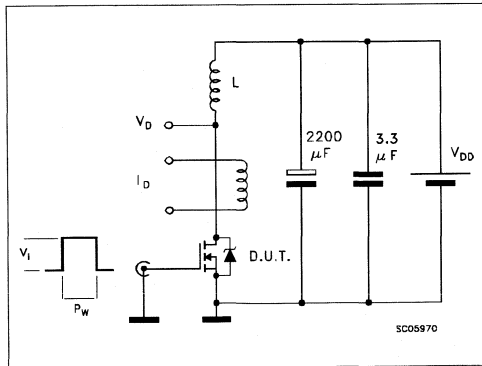


Fig. 3: Switching Times Test Circuits For Resistive Load

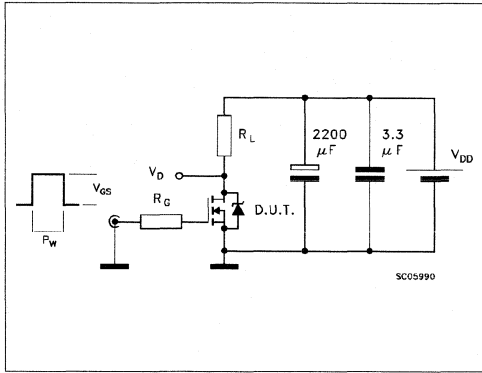


Fig. 4: Gate Charge Test Circuit

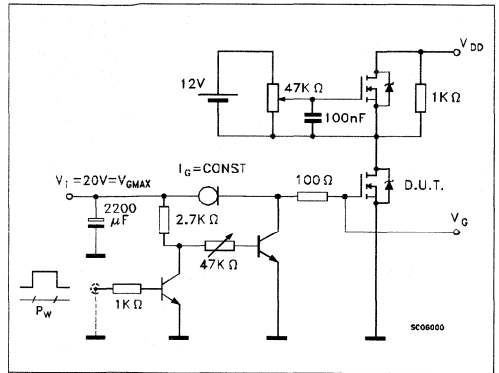
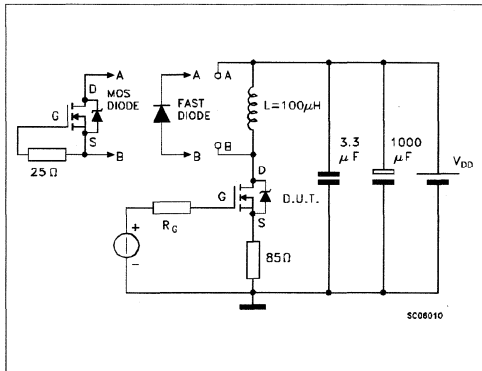


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



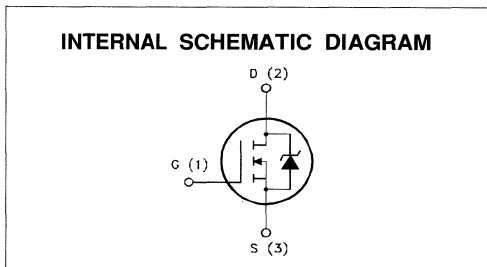
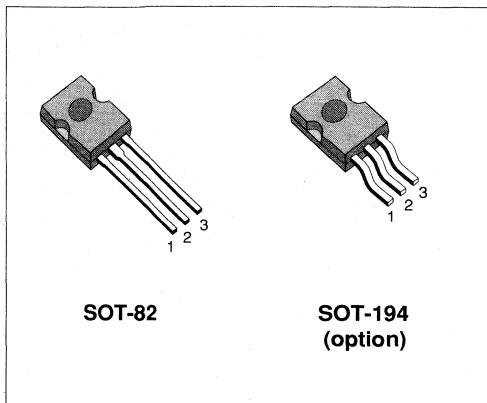
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STK14N10	100 V	< 0.14 Ω	14 A

- TYPICAL R_{DS(on)} = 0.095 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	100	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	100	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	14	A
I _D	Drain Current (continuous) at T _c = 100 °C	9	A
I _{DM} (*)	Drain Current (pulsed)	56	A
P _{tot}	Total Dissipation at T _c = 25 °C	65	W
	Derating Factor	0.43	W/°C
T _{stg}	Storage Temperature	-65 to 175	°C
T _j	Max. Operating Junction Temperature	175	°C

(*) Pulse width limited by safe operating area

THERMAL DATA

R _{thj-case}	Thermal Resistance Junction-case	Max	2.31	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	80	°C/W
R _{thj-amb}	Thermal Resistance Case-sink	Typ	0.7	°C/W
T _j	Maximum Lead Temperature For Soldering Purpose		275	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	14	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	60	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	15	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	9	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	100			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	2.9	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 7 A V _{GS} = 10V I _D = 7 A T _c = 100°C		0.095	0.14 0.28	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	14			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 7 A	4	8		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		650	900	pF
C _{oss}	Output Capacitance			180	250	pF
C _{rss}	Reverse Transfer Capacitance			40	60	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 36\text{ V}$ $I_D = 7\text{ A}$		20	30	ns
t_r	Rise Time	$R_G = 15\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		120	170	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 80\text{ V}$ $I_D = 14\text{ A}$ $R_G = 15\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		180		A/ μs
Q_g	Total Gate Charge	$V_{DD} = 80\text{ V}$ $I_D = 14\text{ A}$ $V_{GS} = 10\text{ V}$		27	40	nC
Q_{gs}	Gate-Source Charge			8		nC
Q_{gd}	Gate-Drain Charge			11		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 80\text{ V}$ $I_D = 14\text{ A}$		50	70	ns
t_f	Fall Time	$R_G = 15\ \Omega$ $V_{GS} = 10\text{ V}$		40	60	ns
t_c	Cross-over Time	(see test circuit, figure 5)		90	130	ns

SOURCE DRAIN DIODE

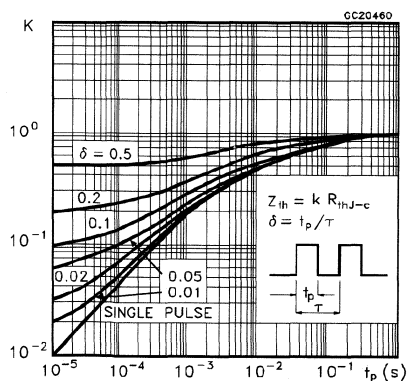
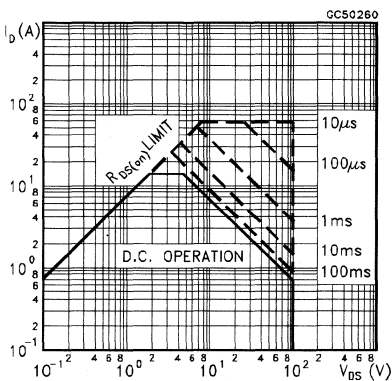
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				14	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				56	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 14\text{ A}$ $V_{GS} = 0$			1.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 14\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		100		ns
Q_{rr}	Reverse Recovery Charge			0.35		μC
I_{RRM}	Reverse Recovery Current			7		A

(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

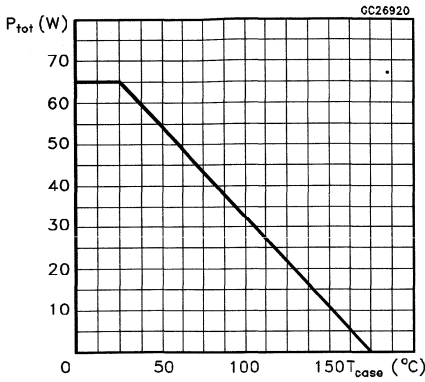
(•) Pulse width limited by safe operating area

Safe Operating Areas

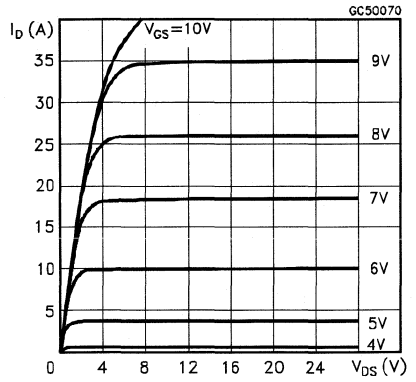
Thermal Impedance



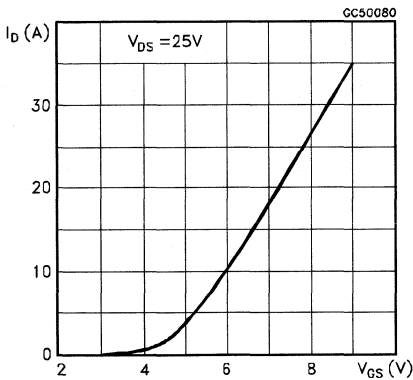
Derating Curve



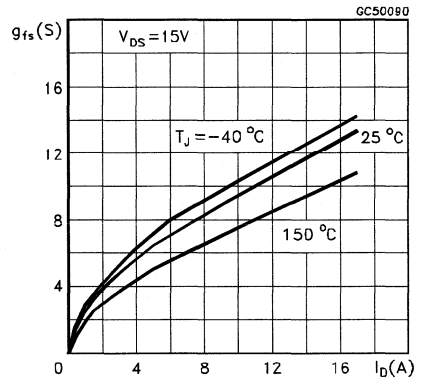
Output Characteristics



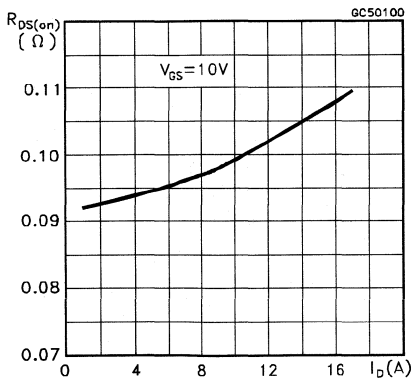
Transfer Characteristics



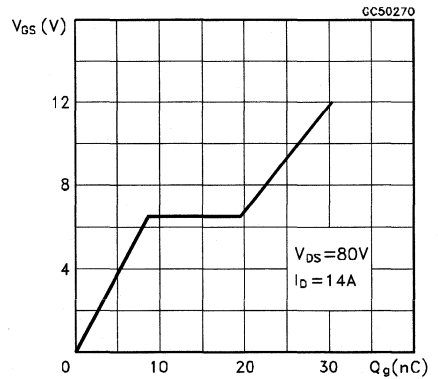
Transconductance



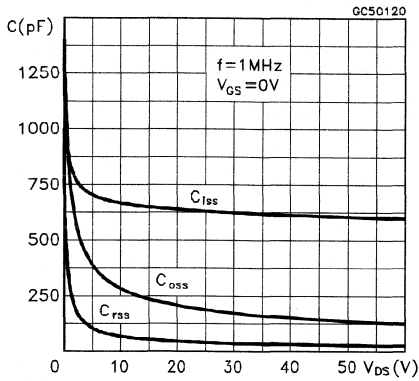
Static Drain-source On Resistance



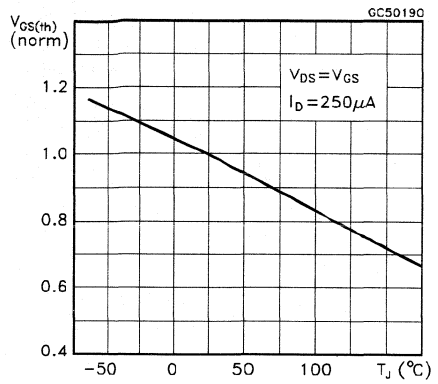
Gate Charge vs Gate-source Voltage



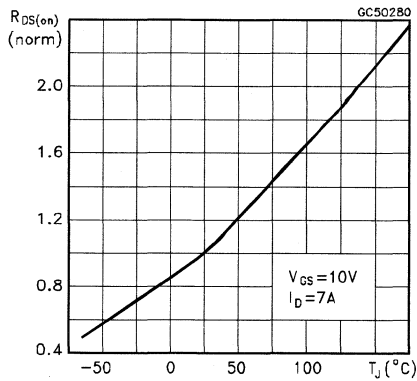
Capacitance Variations



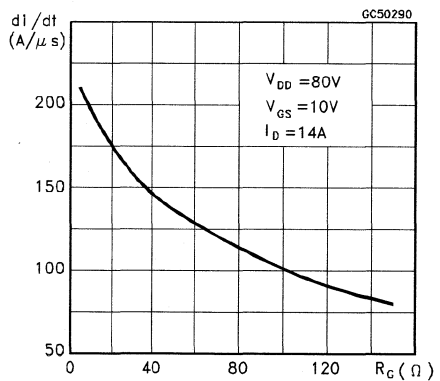
Normalized Gate Threshold Voltage vs Temperature



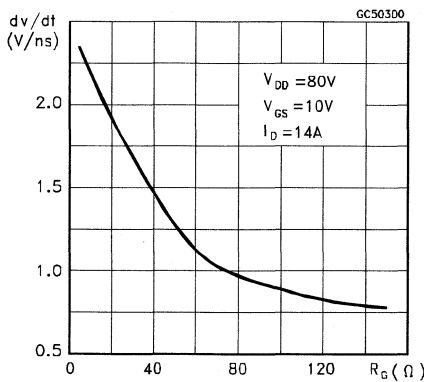
Normalized On Resistance vs Temperature



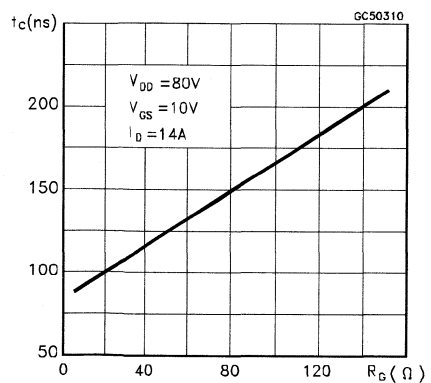
Turn-on Current Slope



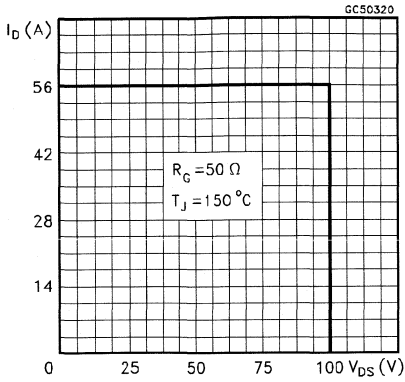
Turn-off Drain-source Voltage Slope



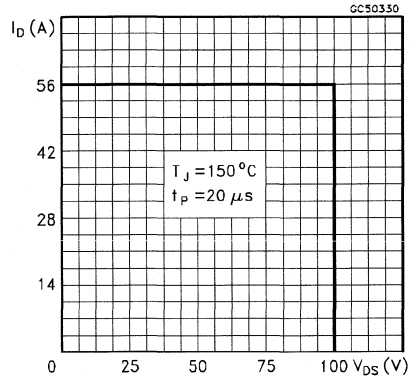
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

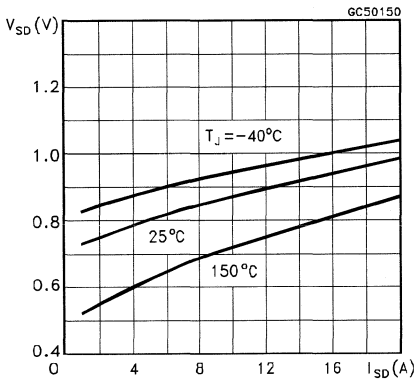


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

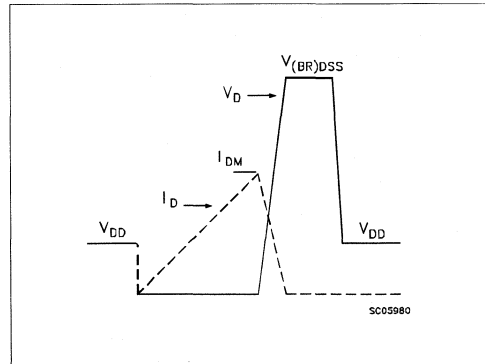
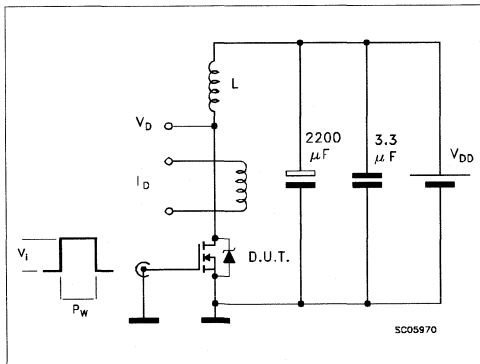


Fig. 3: Switching Times Test Circuits For Resistive Load

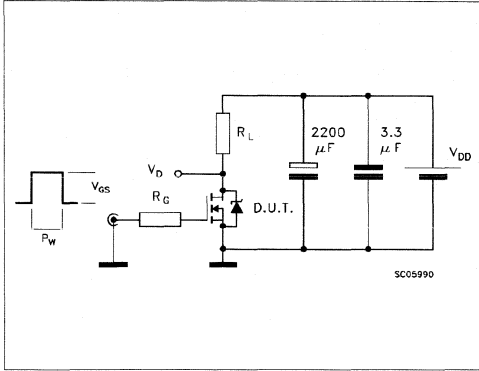


Fig. 4: Gate Charge Test Circuit

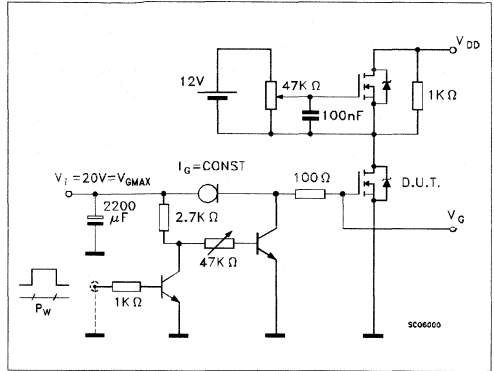
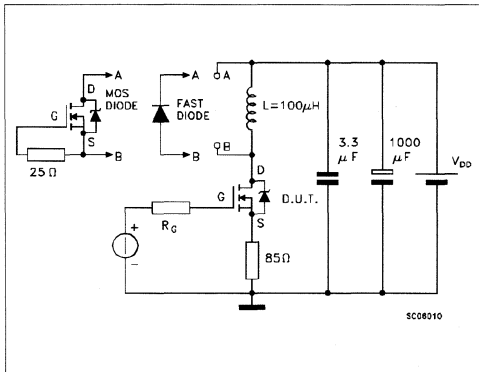


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



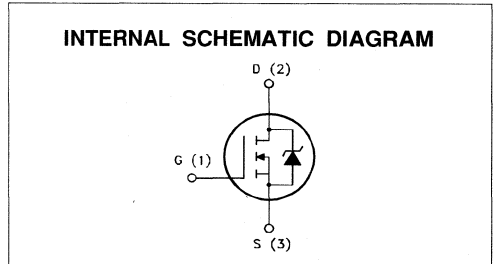
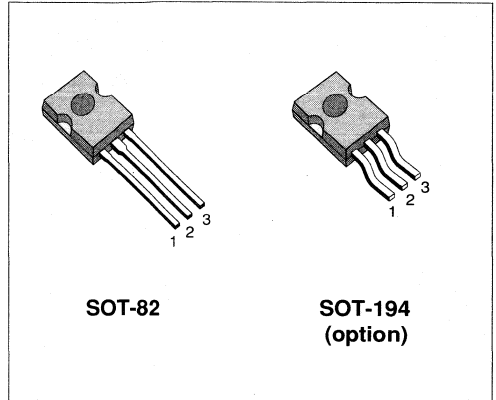
N - CHANNEL ENHANCEMENT MODE LOW THRESHOLD POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STK16N10L	100 V	< 0.12 Ω	16 A

- TYPICAL R_{DS(on)} = 0.09 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- LOGIC LEVEL COMPATIBLE INPUT
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	100	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	100	V
V _{GS}	Gate-source Voltage	± 15	V
I _D	Drain Current (continuous) at T _c = 25 °C	16	A
I _D	Drain Current (continuous) at T _c = 100 °C	11	A
I _{DM} (*)	Drain Current (pulsed)	64	A
P _{tot}	Total Dissipation at T _c = 25 °C	65	W
	Derating Factor	0.43	W/°C
T _{stg}	Storage Temperature	-65 to 175	°C
T _j	Max. Operating Junction Temperature	175	°C

(*) Pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	2.31	$^{\circ}C/W$
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	80	$^{\circ}C/W$
$R_{thc-sink}$	Thermal Resistance Case-sink	Typ	0.7	$^{\circ}C/W$
T_I	Maximum Lead Temperature For Soldering Purpose		275	$^{\circ}C$

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	16	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25^{\circ}C$, $I_D = I_{AR}$, $V_{DD} = 25 V$)	40	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	10	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100^{\circ}C$, pulse width limited by T_j max, $\delta < 1\%$)	11	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25^{\circ}C$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250 \mu A$ $V_{GS} = 0$	100			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^{\circ}C$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 15 V$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250 \mu A$	1	1.6	2.5	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 5 V$ $I_D = 8 A$ $V_{GS} = 5 V$ $I_D = 8 A$ $T_c = 100^{\circ}C$		0.09	0.12 0.24	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10 V$	16			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 8 A$	7	14		S
C_{iss}	Input Capacitance	$V_{DS} = 25 V$ $f = 1 MHz$ $V_{GS} = 0$		1200	1500	pF
C_{oss}	Output Capacitance			250	350	pF
C_{rss}	Reverse Transfer Capacitance			60	90	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING RESISTIVE LOAD

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 30\text{ V}$ $I_D = 8\text{ A}$		50	70	ns
t_r	Rise Time	$R_{GS} = 25\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 3)		95	130	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 80\text{ V}$ $I_D = 16\text{ A}$ $R_{GS} = 25\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 5)		170		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 80\text{ V}$ $I_D = 16\text{ A}$ $V_{GS} = 5\text{ V}$		22	30	nC
Q_{gs}	Gate-Source Charge			6		nC
Q_{gd}	Gate-Drain Charge			11		nC

SWITCHING INDUCTIVE LOAD

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(voff)}$	Off-voltage Rise Time	$V_{DD} = 80\text{ V}$ $I_D = 16\text{ A}$		55	80	ns
t_f	Fall Time	$R_{GS} = 25\ \Omega$ $V_{GS} = 5\text{ V}$		55	80	ns
t_c	Cross-over Time	(see test circuit, figure 5)		110	160	ns

SOURCE DRAIN DIODE

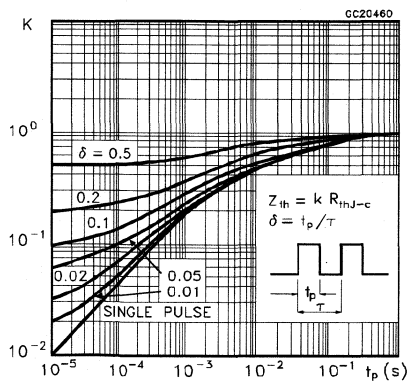
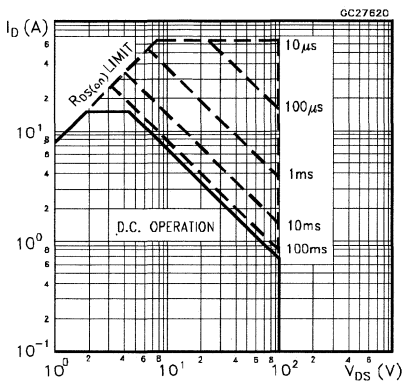
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				16	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				64	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 16\text{ A}$ $V_{GS} = 0$			1.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 16\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 50\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		120		ns
Q_{rr}	Reverse Recovery Charge			0.4		μC
I_{RRM}	Reverse Recovery Current			7		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

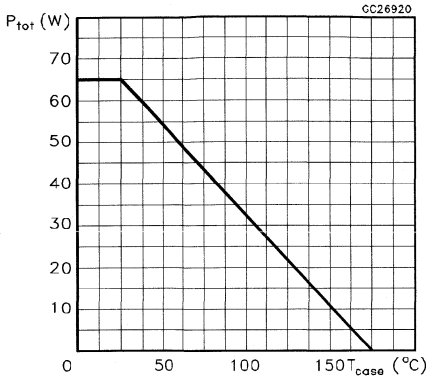
(•) Pulse width limited by safe operating area

Safe Operating Area

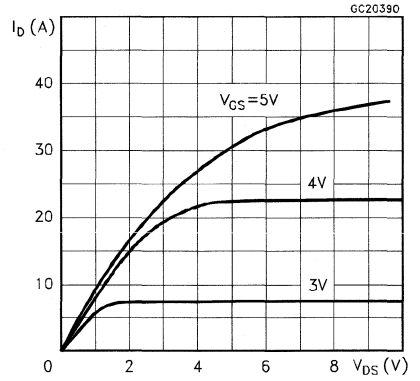
Thermal Impedance



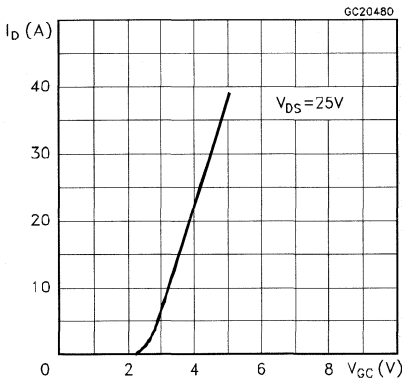
Derating Curve



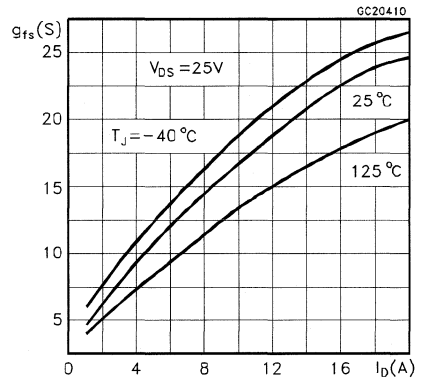
Output Characteristics



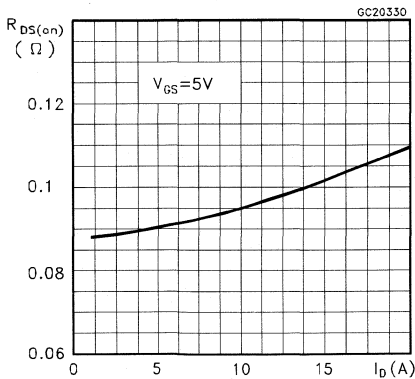
Transfer Characteristics



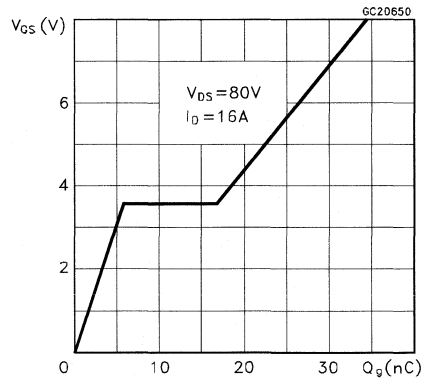
Transconductance



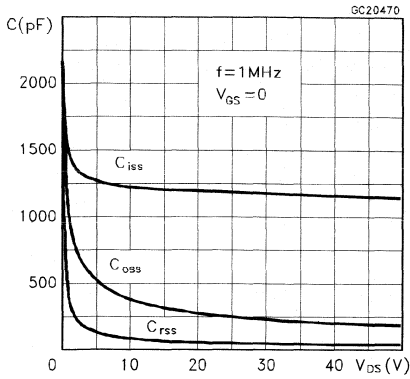
Static Drain-source On Resistance



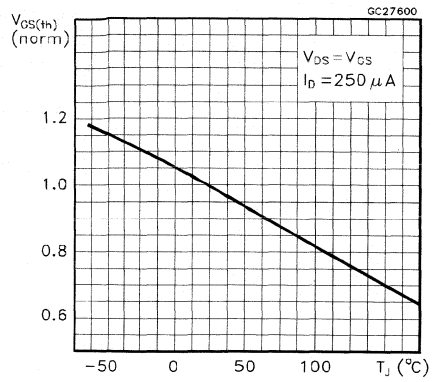
Gate Charge vs Gate-source Voltage



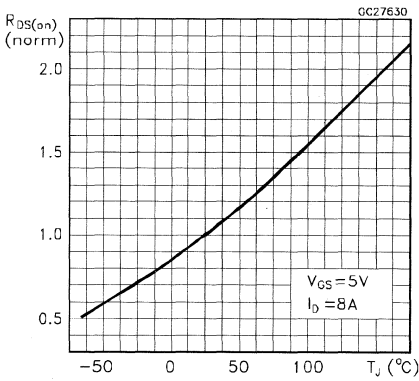
Capacitance Variations



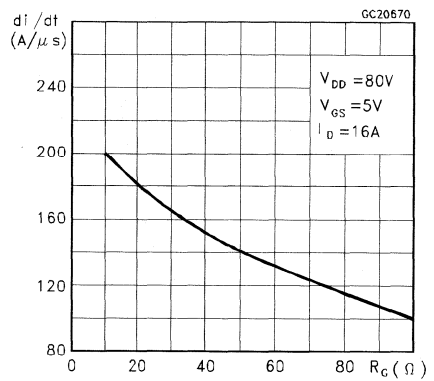
Normalized Gate Threshold Voltage vs Temperature



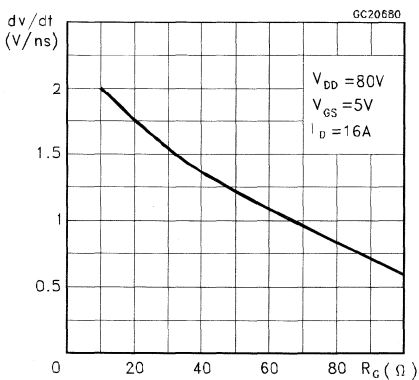
Normalized On Resistance vs Temperature



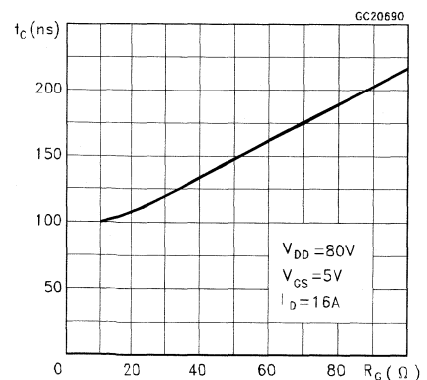
Turn-on Current Slope



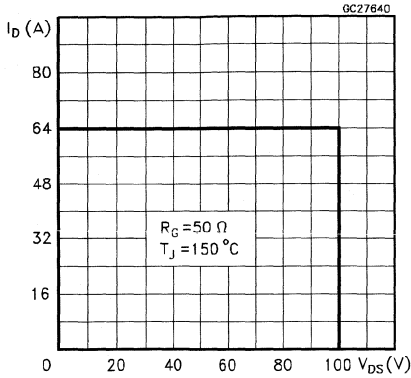
Turn-off Drain-source Voltage Slope



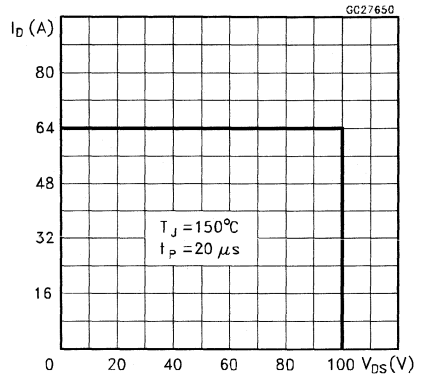
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

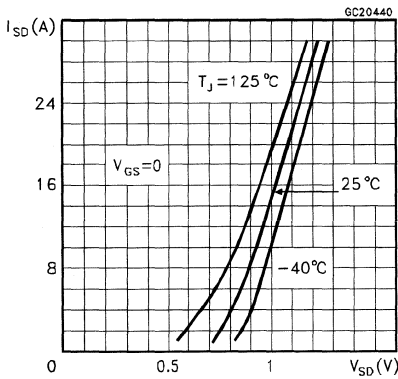


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

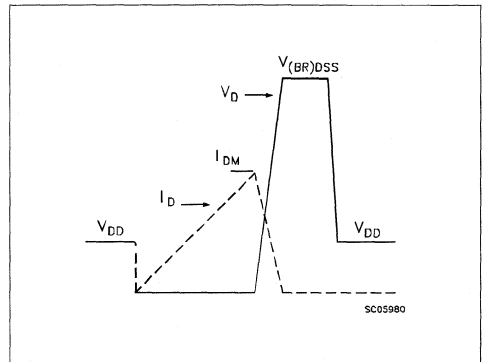
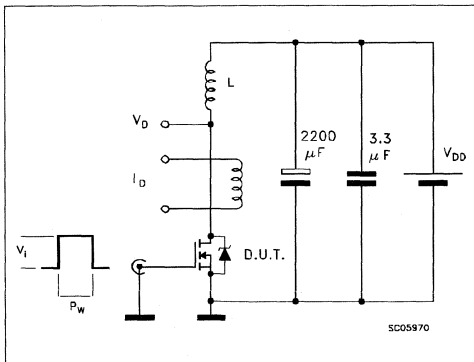


Fig. 3: Switching Times Test Circuits For Resistive Load

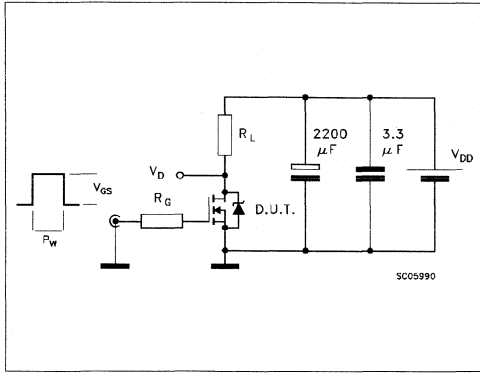


Fig. 4: Gate Charge Test Circuit

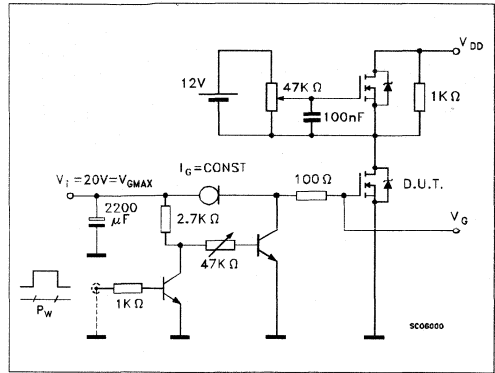
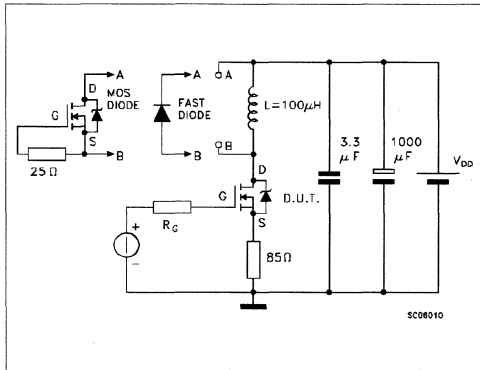


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



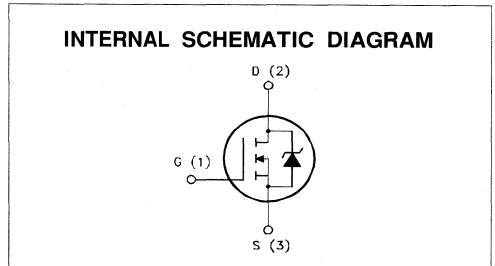
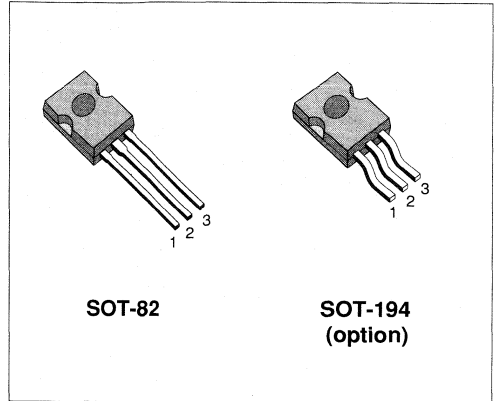
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STK17N10	100 V	< 0.11 Ω	17 A

- TYPICAL R_{DS(on)} = 0.09 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	100	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	100	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	17	A
I _D	Drain Current (continuous) at T _c = 100 °C	12	A
I _{DM} (*)	Drain Current (pulsed)	68	A
P _{tot}	Total Dissipation at T _c = 25 °C	65	W
	Derating Factor	0.43	W/°C
T _{stg}	Storage Temperature	-65 to 175	°C
T _j	Max. Operating Junction Temperature	175	°C

(*) Pulse width limited by safe operating area

THERMAL DATA

R _{thj-case}	Thermal Resistance Junction-case	Max	2.31	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	80	°C/W
R _{thj-amb}	Thermal Resistance Case-sink	Typ	0.7	°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		275	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	17	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	60	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	15	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	12	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	100			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	2.9	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 8.5 A V _{GS} = 10V I _D = 8.5 A T _c = 100°C		0.09	0.11 0.22	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	17			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 8.5 A	5	10		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		800	1100	pF
C _{oss}	Output Capacitance			200	300	pF
C _{rss}	Reverse Transfer Capacitance			40	60	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 30\text{ V}$ $I_D = 3\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		25 75	35 110	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 80\text{ V}$ $I_D = 17\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		300		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 80\text{ V}$ $I_D = 17\text{ A}$ $V_{GS} = 10\text{ V}$		30 9 11	45	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(voff)}$ t_f	Off-voltage Rise Time Fall Time	$V_{DD} = 80\text{ V}$ $I_D = 17\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		65 50	90 70	ns ns
t_c	Cross-over Time	(see test circuit, figure 5)		125	175	ns

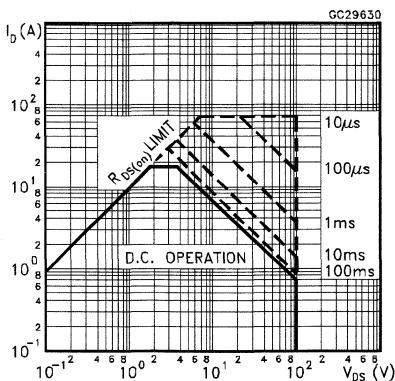
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				17 68	A A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 17\text{ A}$ $V_{GS} = 0$			1.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 17\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 20\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		125		ns
Q_{rr}	Reverse Recovery Charge			0.44		μ C
I_{RRM}	Reverse Recovery Current			7		A

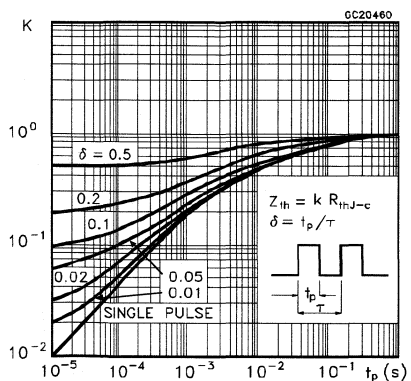
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

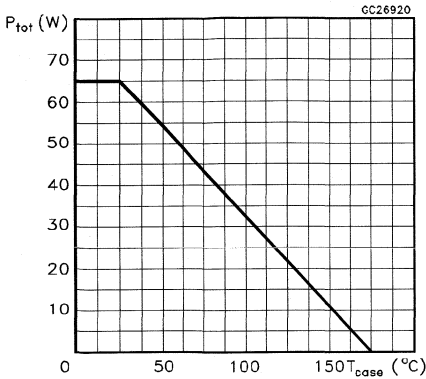
Safe Operating Areas



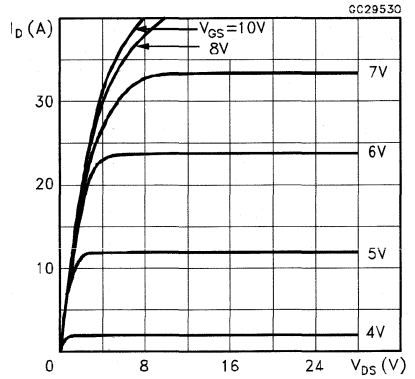
Thermal Impedance



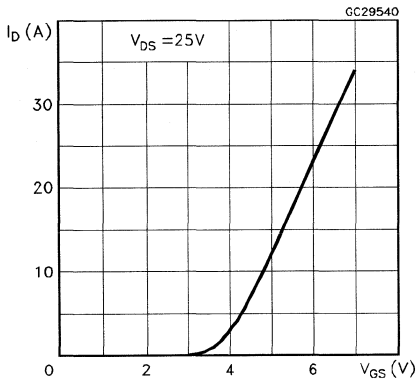
Derating Curve



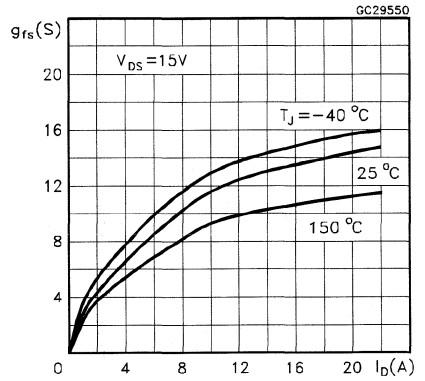
Output Characteristics



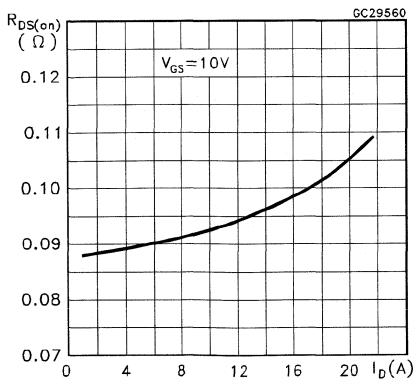
Transfer Characteristics



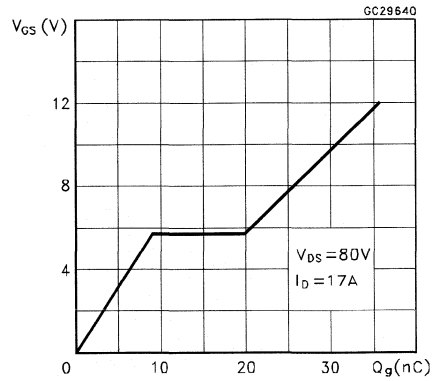
Transconductance



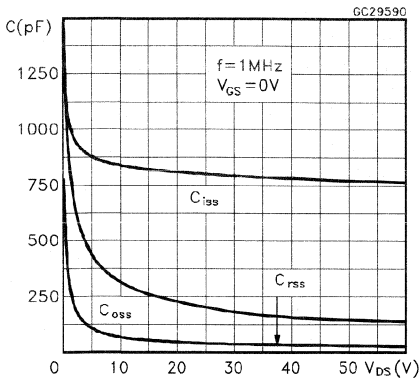
Static Drain-source On Resistance



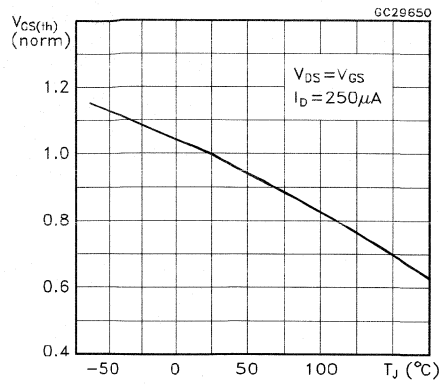
Gate Charge vs Gate-source Voltage



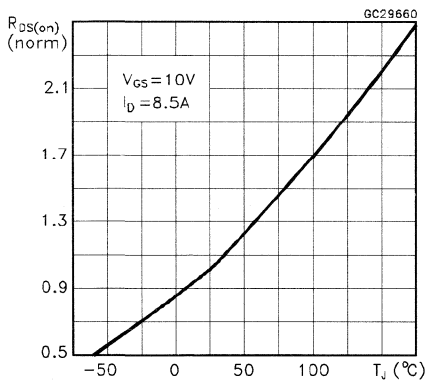
Capacitance Variations



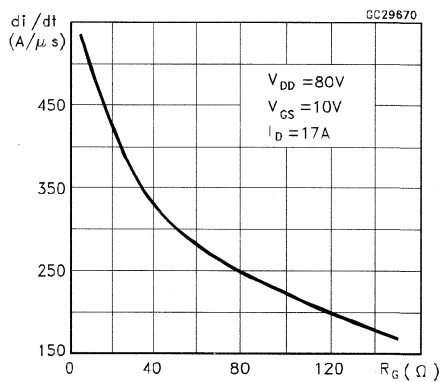
Normalized Gate Threshold Voltage vs Temperature



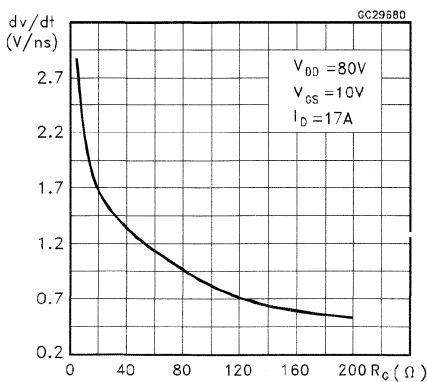
Normalized On Resistance vs Temperature



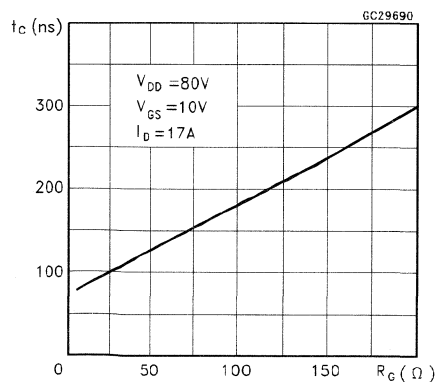
Turn-on Current Slope



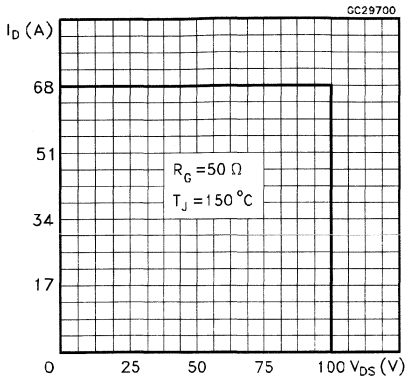
Turn-off Drain-source Voltage Slope



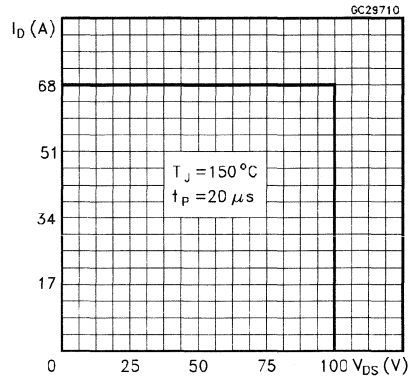
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

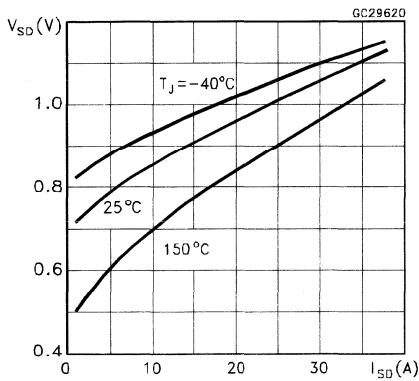


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

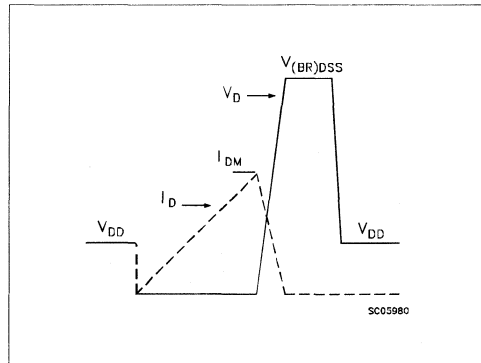
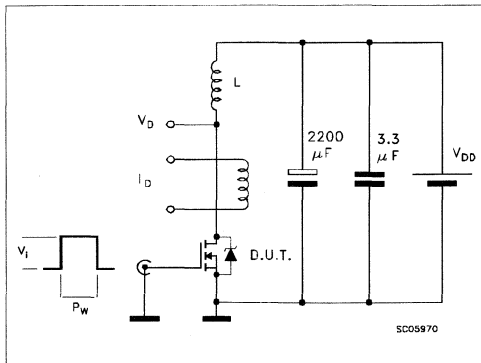


Fig. 3: Switching Times Test Circuits For Resistive Load

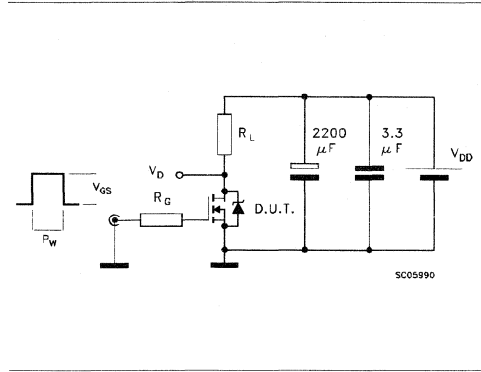


Fig. 4: Gate Charge Test Circuit

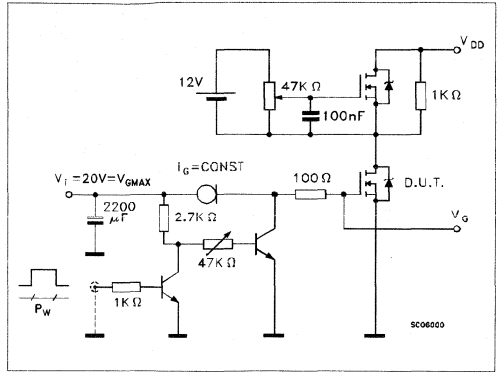
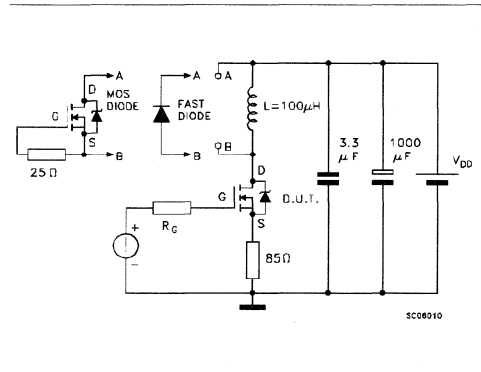


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



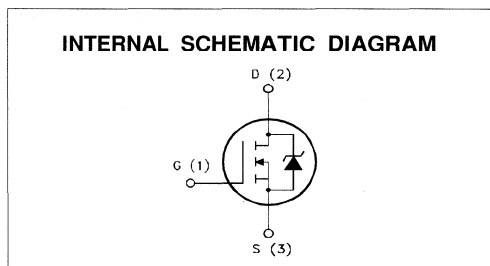
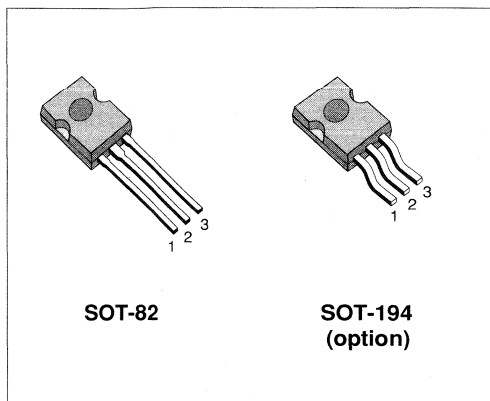
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STK18N05	50 V	< 0.085 Ω	18 A
STK18N06	60 V	< 0.085 Ω	18 A

- TYPICAL R_{DS(on)} = 0.06 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STK18N05	STK18N06	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	50	60	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	50	60	V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	18		A
I _D	Drain Current (continuous) at T _c = 100 °C	12		A
I _{DM} (*)	Drain Current (pulsed)	72		A
P _{tot}	Total Dissipation at T _c = 25 °C	60		W
	Derating Factor	0.4		W/°C
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	2.5	$^{\circ}C/W$
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	80	$^{\circ}C/W$
$R_{thc-sink}$	Thermal Resistance Case-sink	Typ	0.7	$^{\circ}C/W$
T_I	Maximum Lead Temperature For Soldering Purpose		275	$^{\circ}C$

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	18	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25^{\circ}C$, $I_D = I_{AR}$, $V_{DD} = 25 V$)	60	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	15	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100^{\circ}C$, pulse width limited by T_j max, $\delta < 1\%$)	12	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25^{\circ}C$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250 \mu A$ $V_{GS} = 0$ for STK18N05 for STK18N06	50 60			V V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^{\circ}C$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20 V$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250 \mu A$	2	2.9	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10 V$ $I_D = 9 A$ $V_{GS} = 10 V$ $I_D = 9 A$ $T_c = 100^{\circ}C$		0.06	0.085 0.17	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10 V$	18			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 9 A$	5	8		S
C_{iss}	Input Capacitance	$V_{DS} = 25 V$ $f = 1 MHz$ $V_{GS} = 0$		520	700	pF
C_{oss}	Output Capacitance			250	350	pF
C_{rss}	Reverse Transfer Capacitance			80	120	pF

ELECTRICAL CHARACTERISTICS (continued)
SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 30\text{ V}$ $I_D = 3\text{ A}$		45	65	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit figure)		65	95	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 18\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit figure)		240		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 40\text{ V}$ $I_D = 18\text{ A}$ $V_{GS} = 10\text{ V}$		22	30	nC
Q_{gs}	Gate-Source Charge			10		nC
Q_{gd}	Gate-Drain Charge			7		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 18\text{ A}$		80	120	ns
t_f	Fall Time	$R_{GS} = 50\ \Omega$ $V_{GS} = 10\text{ V}$		60	90	ns
t_c	Cross-over Time	(see test circuit figure)		140	210	ns

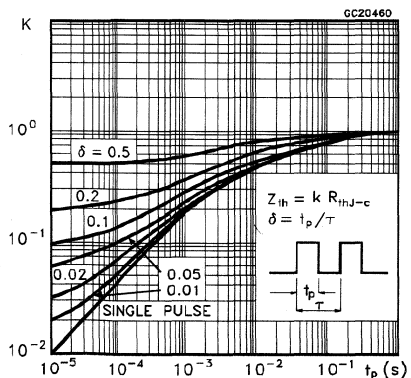
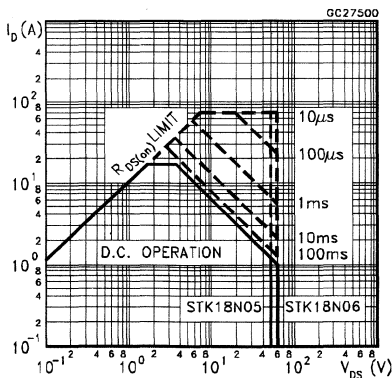
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				18	A
$I_{SDM(\bullet)}$	Source-drain Current (pulsed)				72	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 18\text{ A}$ $V_{GS} = 0$			1.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 18\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 15\text{ V}$ $T_J = 150\text{ }^\circ\text{C}$		85		ns
Q_{rr}	Reverse Recovery Charge			0.13		μC
I_{RRM}	Reverse Recovery Current			3		A

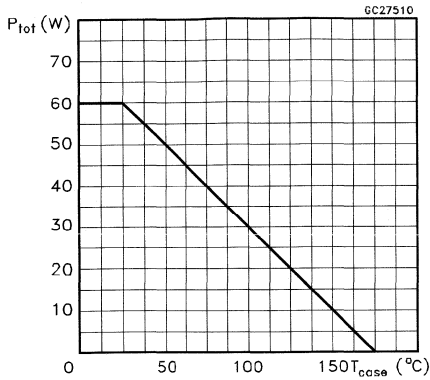
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %
 (•) Pulse width limited by safe operating area

Safe Operating Area

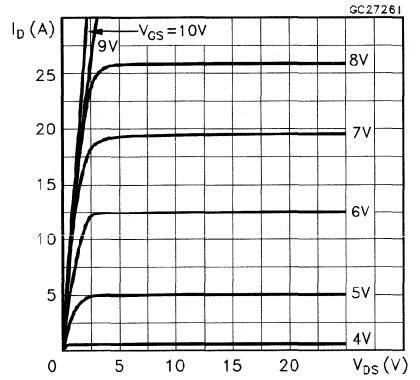
Thermal Impedance



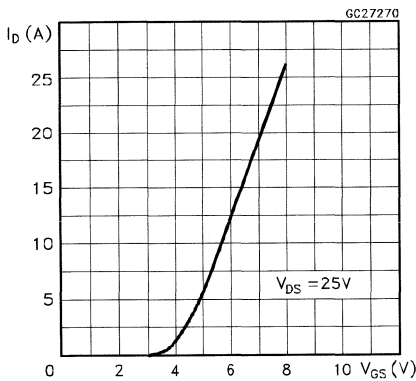
Derating Curve



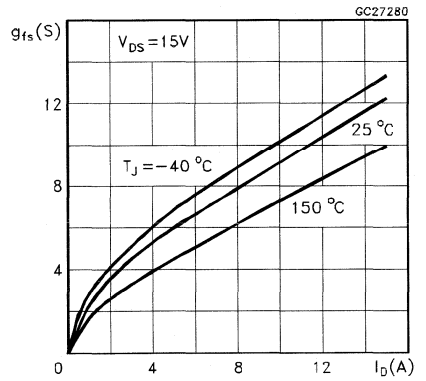
Output Characteristics



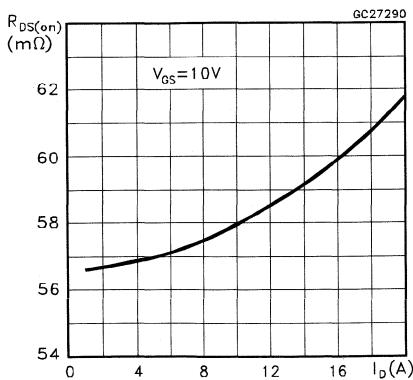
Transfer Characteristics



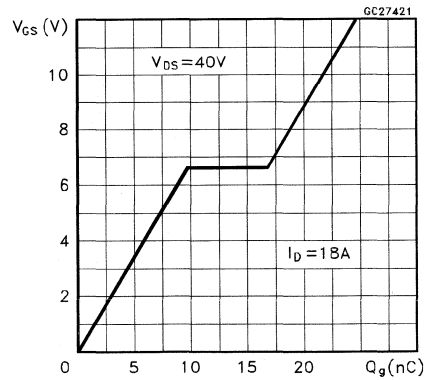
Transconductance



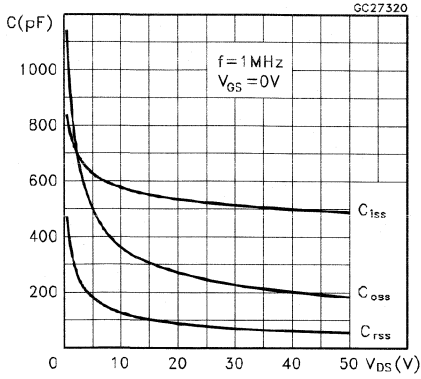
Static Drain-source On Resistance



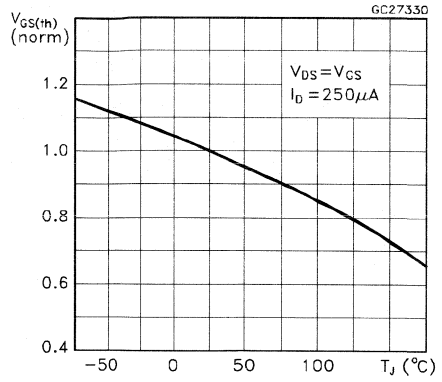
Gate Charge vs Gate-source Voltage



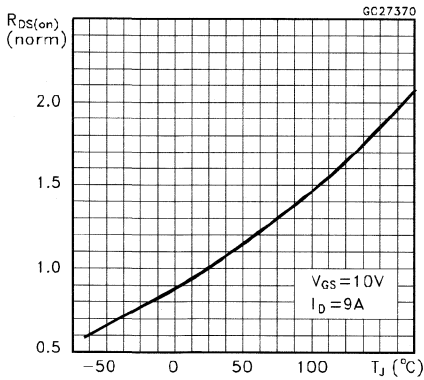
Capacitance Variations



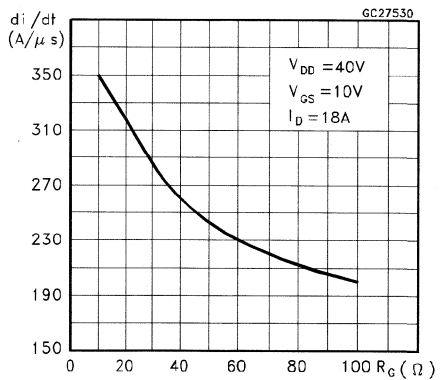
Normalized Gate Threshold Voltage vs Temperature



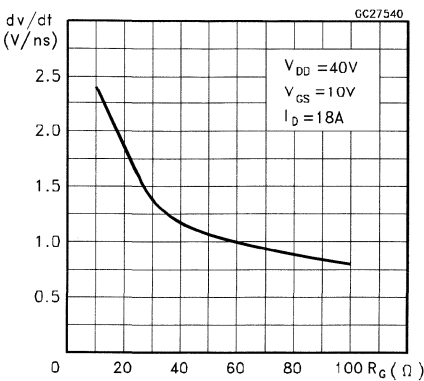
Normalized On Resistance vs Temperature



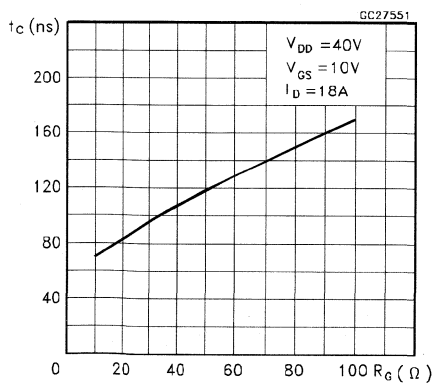
Turn-on Current Slope



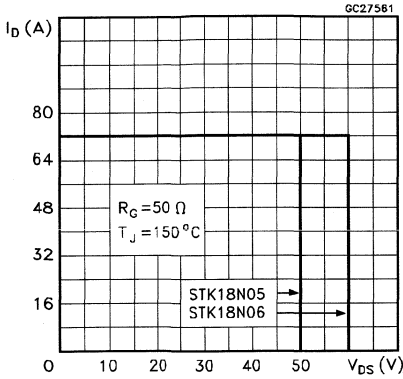
Turn-off Drain-source Voltage Slope



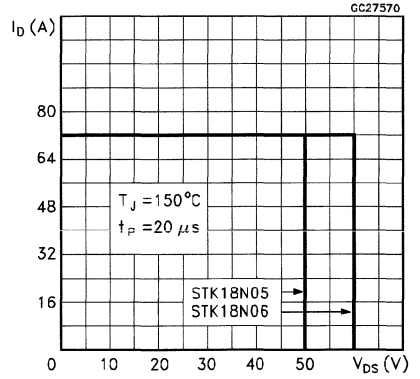
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

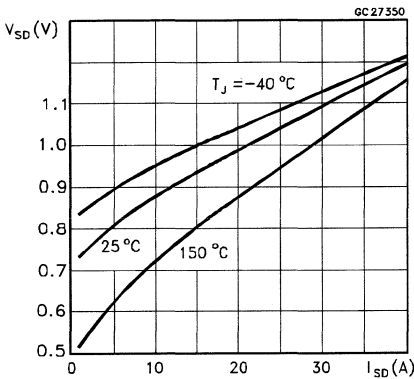


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

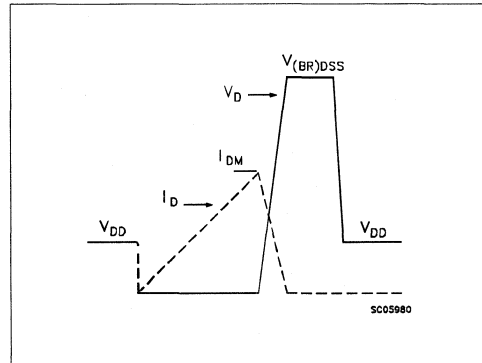
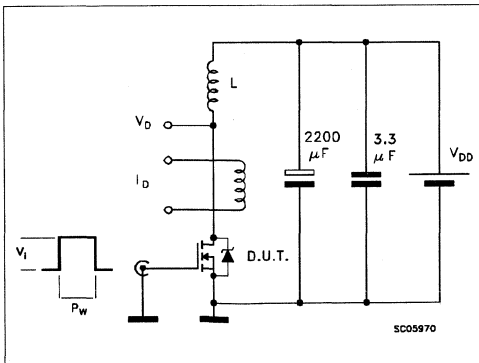


Fig. 3: Switching Times Test Circuits For Resistive Load

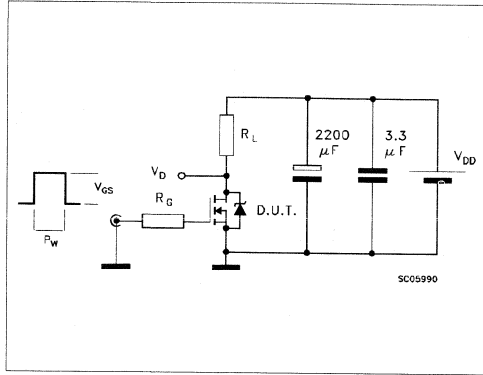


Fig. 4: Gate Charge Test Circuit

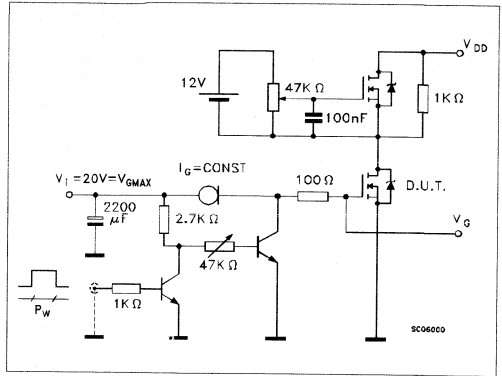
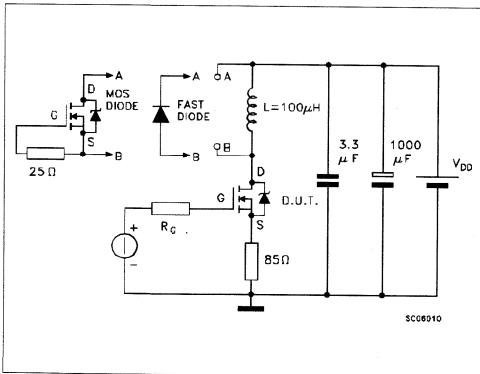


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



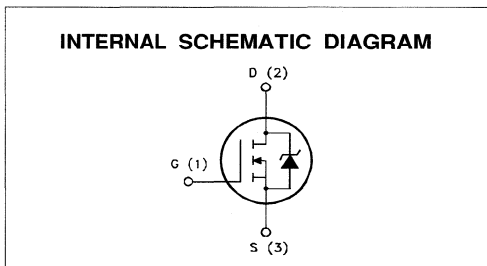
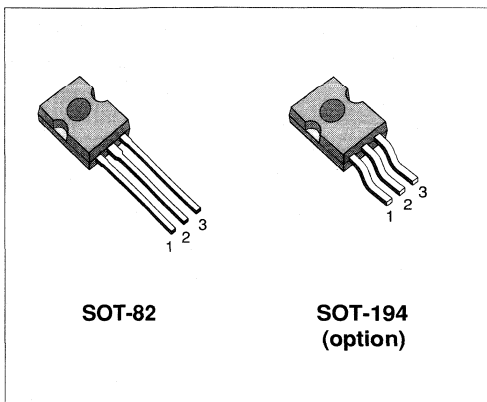
N - CHANNEL ENHANCEMENT MODE LOW THRESHOLD POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STK18N05L	50 V	< 0.085 Ω	18 A
STK18N06L	60 V	< 0.085 Ω	18 A

- TYPICAL R_{DS(on)} = 0.065 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- LOGIC LEVEL COMPATIBLE INPUT
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STK18N05L	STK18N06L	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	50	60	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	50	60	V
V _{GS}	Gate-source Voltage	± 15		V
I _D	Drain Current (continuous) at T _c = 25 °C	18		A
I _D	Drain Current (continuous) at T _c = 100 °C	12		A
I _{DM} (*)	Drain Current (pulsed)	72		A
P _{tot}	Total Dissipation at T _c = 25 °C	60		W
	Derating Factor	0.4		W/°C
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	2.5	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	80	°C/W
$R_{thc-sink}$	Thermal Resistance Case-sink	Typ	0.7	°C/W
T_l	Maximum Lead Temperature For Soldering Purpose		275	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	18	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ °C}$, $I_D = I_{AR}$, $V_{DD} = 25\text{ V}$)	60	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	15	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ °C}$, pulse width limited by T_j max, $\delta < 1\%$)	12	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$ for STK18N05L for STK18N06L	50 60			V V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 15\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\text{ }\mu\text{A}$	1	1.6	2.5	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 5\text{ V}$ $I_D = 9\text{ A}$ $V_{GS} = 5\text{ V}$ $I_D = 9\text{ A}$ $T_c = 100\text{ °C}$		0.065	0.085 0.17	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	18			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 9\text{ A}$	5	13		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		700	1000	pF
C_{oss}	Output Capacitance			250	350	pF
C_{rss}	Reverse Transfer Capacitance			70	100	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING RESISTIVE LOAD

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 30\text{ V}$ $I_D = 9\text{ A}$		60	90	ns
t_r	Rise Time	$R_{GS} = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 3)		360	520	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 18\text{ A}$ $R_{GS} = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 5)		130		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 40\text{ V}$ $I_D = 18\text{ A}$ $V_{GS} = 5\text{ V}$		18	26	nC
Q_{GS}	Gate-Source Charge			6		nC
Q_{gd}	Gate-Drain Charge			10		nC

SWITCHING INDUCTIVE LOAD

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(v_{off})$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 18\text{ A}$		70	100	ns
t_f	Fall Time	$R_{GS} = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 5)		100	150	ns
t_c	Cross-over Time			180	260	ns

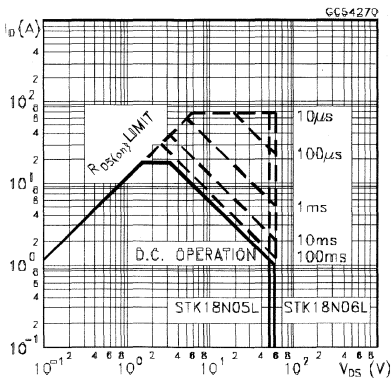
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				18	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				72	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 18\text{ A}$ $V_{GS} = 0$			1.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 18\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		65		ns
Q_{rr}	Reverse Recovery Charge			0.13		μ C
I_{RRM}	Reverse Recovery Current			4		A

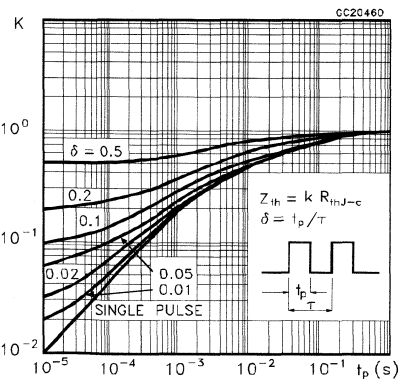
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

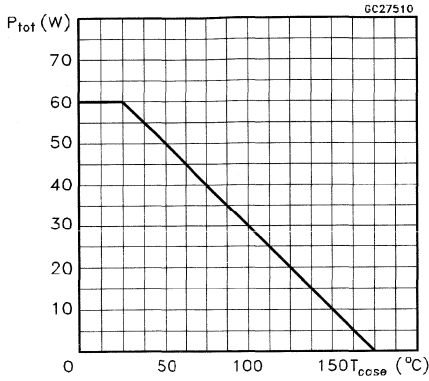
Safe Operating Area



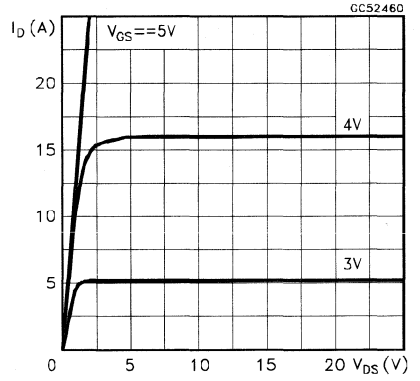
Thermal Impedance



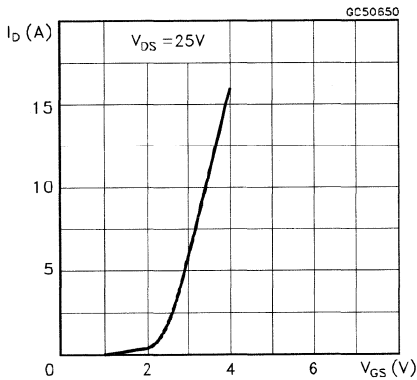
Derating Curve



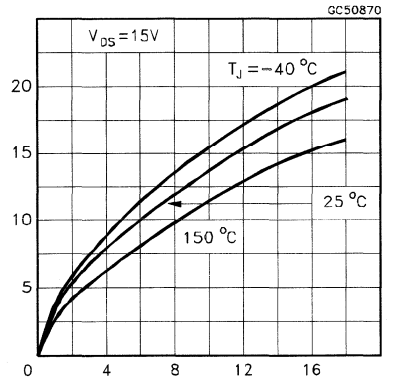
Output Characteristics



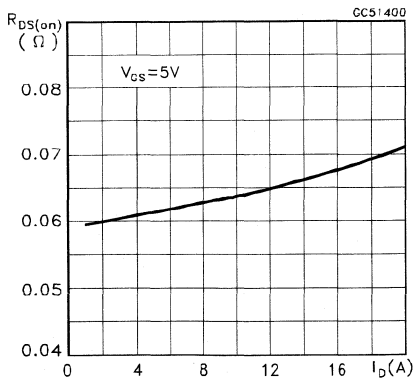
Transfer Characteristics



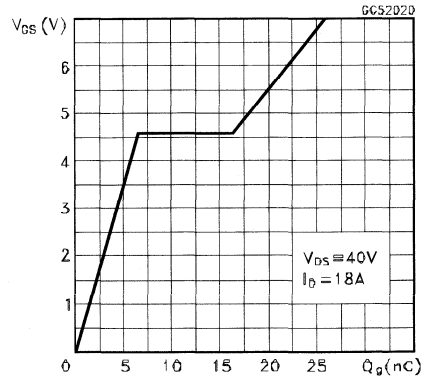
Transconductance



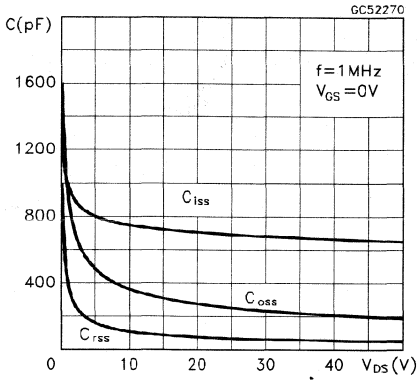
Static Drain-source On Resistance



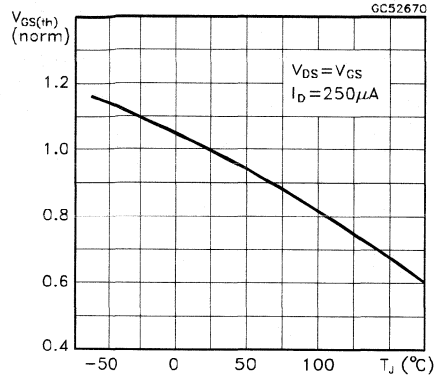
Gate Charge vs Gate-source Voltage



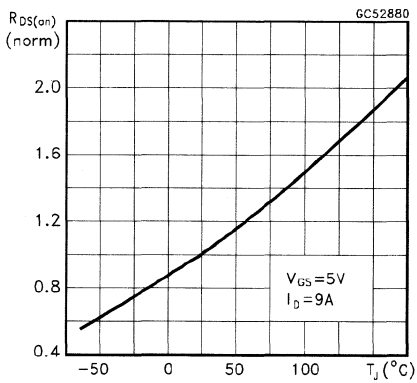
Capacitance Variations



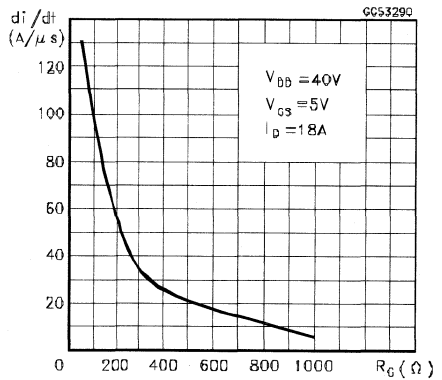
Normalized Gate Threshold Voltage vs Temperature



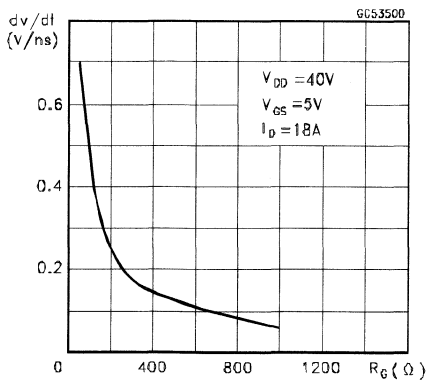
Normalized On Resistance vs Temperature



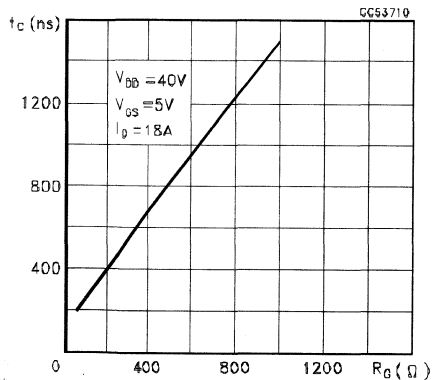
Turn-on Current Slope



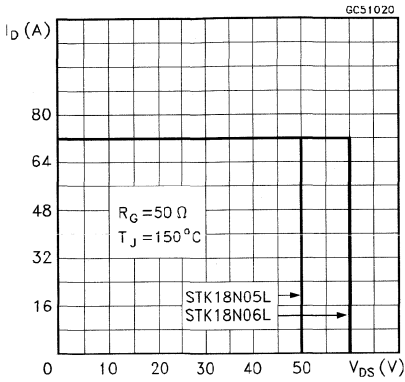
Turn-off Drain-source Voltage Slope



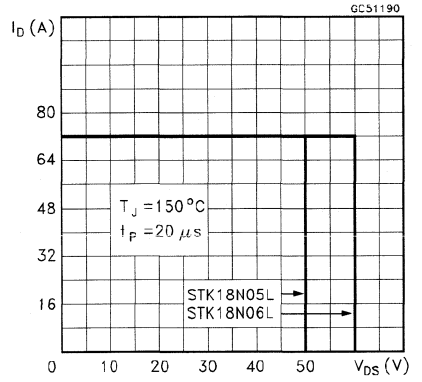
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

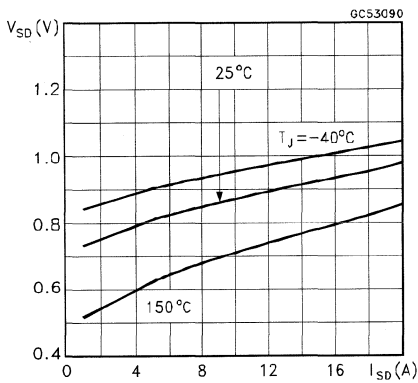


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

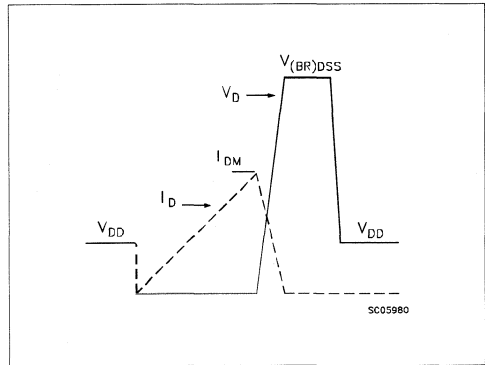
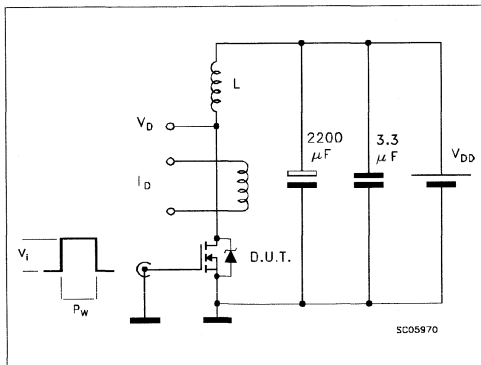


Fig. 3: Switching Times Test Circuits For Resistive Load

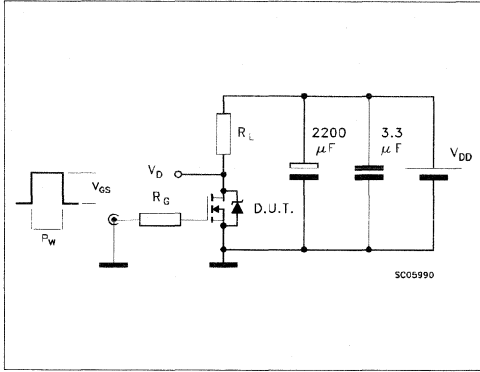


Fig. 4: Gate Charge Test Circuit

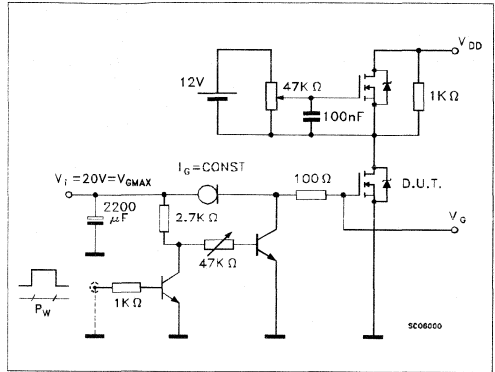
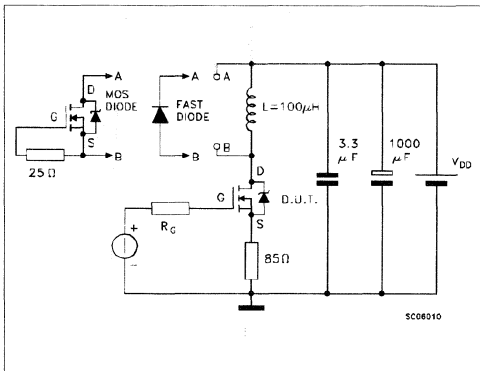


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



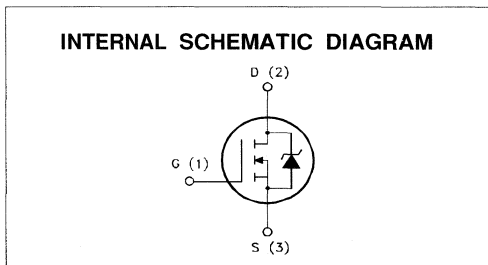
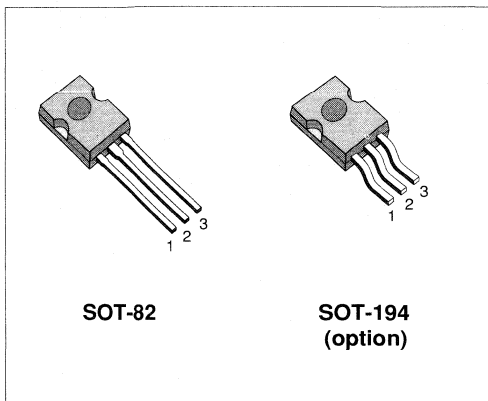
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DS}	R _{DS(on)}	I _D
STK22N05	50 V	< 0.065 Ω	22 A

- TYPICAL R_{DS(on)} = 0.048 Ω
- AVALANCHE RUGGEDNESS TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	50	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	50	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	22	A
I _D	Drain Current (continuous) at T _c = 100 °C	15	A
I _{DM} (*)	Drain Current (pulsed)	88	A
P _{tot}	Total Dissipation at T _c = 25 °C	65	W
	Derating Factor	0.43	W/°C
T _{stg}	Storage Temperature	-65 to 175	°C
T _j	Max. Operating Junction Temperature	175	°C

(*) Pulse width limited by safe operating area

THERMAL DATA

R _{thj-case}	Thermal Resistance Junction-case	Max	2.31	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	80	°C/W
R _{thj-amb}	Thermal Resistance Case-sink	Typ	0.7	°C/W
T _i	Maximum Lead Temperature For Soldering Purpose		275	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	22	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	100	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	25	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	15	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	50			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	2.9	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 11 A V _{GS} = 10V I _D = 11 A T _c = 100°C		0.048	0.065 0.13	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	22			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 11 A	6	10		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		700	900	pF
C _{oss}	Output Capacitance			320	450	pF
C _{rss}	Reverse Transfer Capacitance			90	150	pF

ELECTRICAL CHARACTERISTICS (continued)
SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 30\text{ V}$ $I_D = 3\text{ A}$		30	45	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		90	130	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 22\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		230		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 40\text{ V}$ $I_D = 22\text{ A}$ $V_{GS} = 10\text{ V}$		26	40	nC
Q_{gs}	Gate-Source Charge			8		nC
Q_{gd}	Gate-Drain Charge			9		nC

SWITCHING OFF

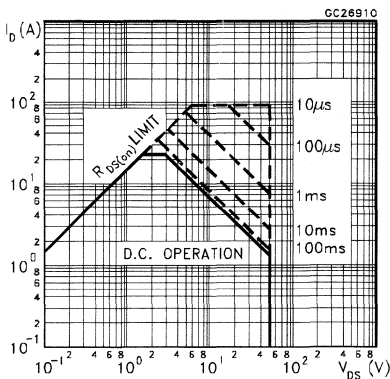
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 22\text{ A}$		80	120	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		80	120	ns
t_c	Cross-over Time			170	250	ns

SOURCE DRAIN DIODE

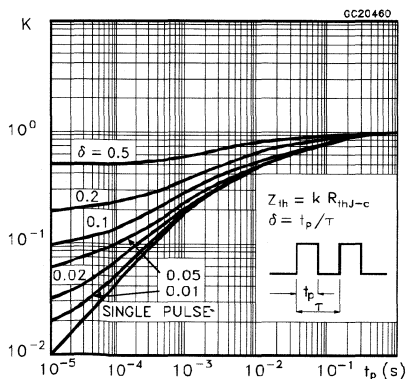
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				22	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				88	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 22\text{ A}$ $V_{GS} = 0$			1.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 22\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		80		ns
Q_{rr}	Reverse Recovery Charge			0.22		μ C
I_{RRM}	Reverse Recovery Current			5.5		A

(\ast) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %
 (\bullet) Pulse width limited by safe operating area

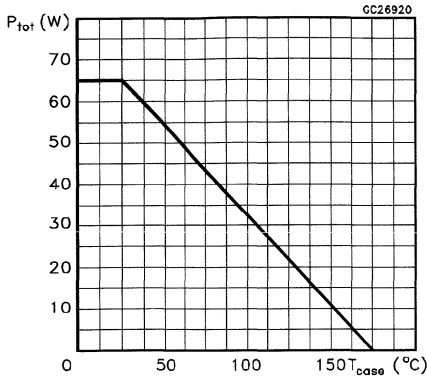
Safe Operating Area



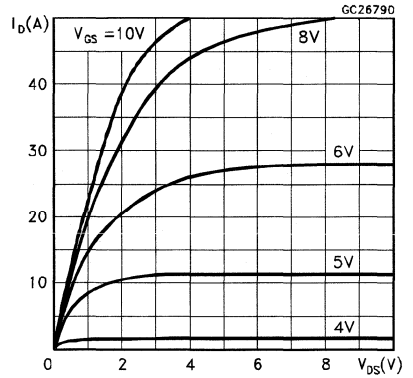
Thermal Impedance



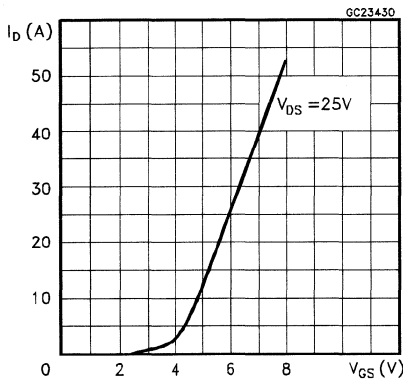
Derating Curve



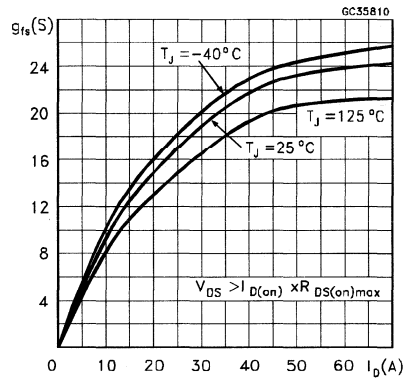
Output Characteristics



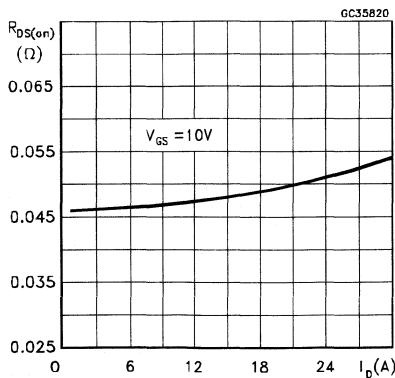
Transfer Characteristics



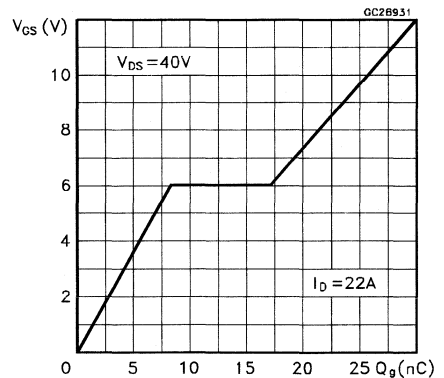
Transconductance



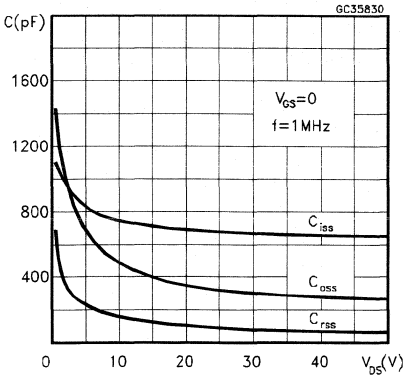
Static Drain-source On Resistance



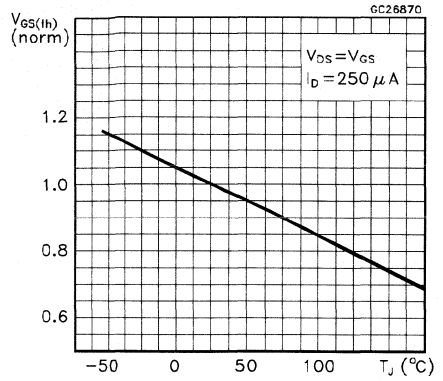
Gate Charge vs Gate-source Voltage



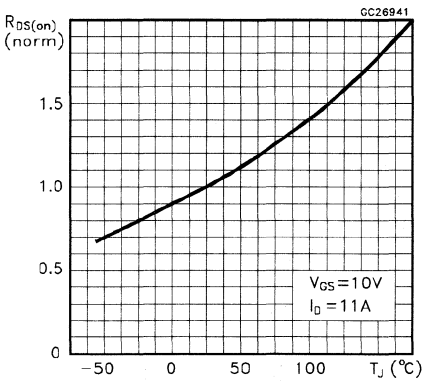
Capacitance Variations



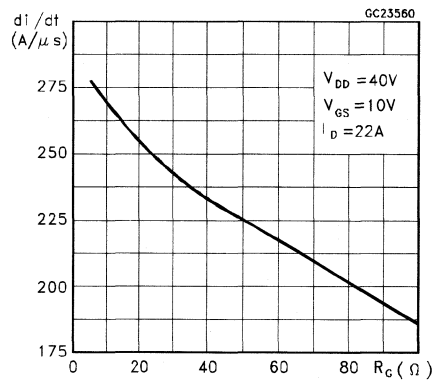
Normalized Gate Threshold Voltage vs Temperature



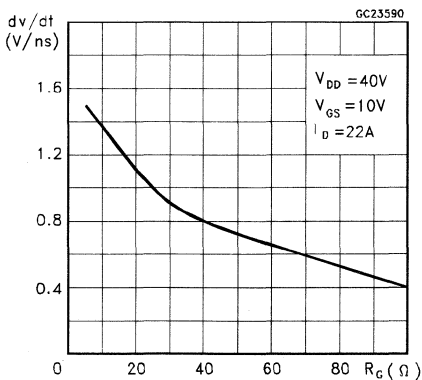
Normalized On Resistance vs Temperature



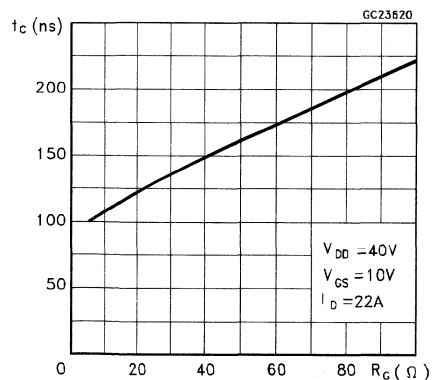
Turn-on Current Slope



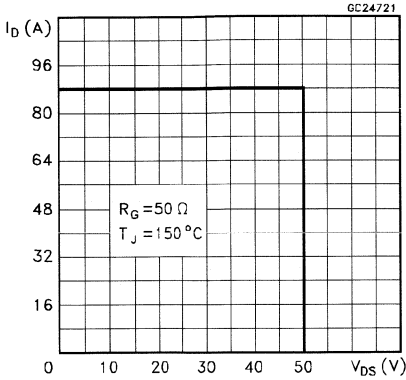
Turn-off Drain-source Voltage Slope



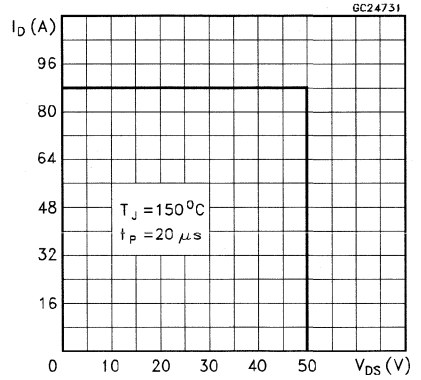
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

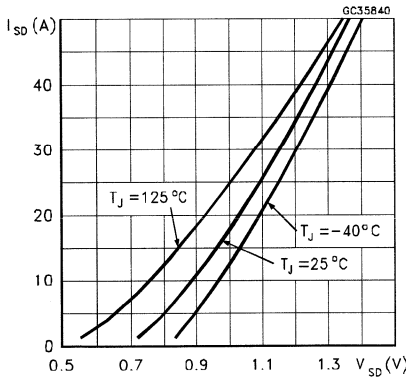


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

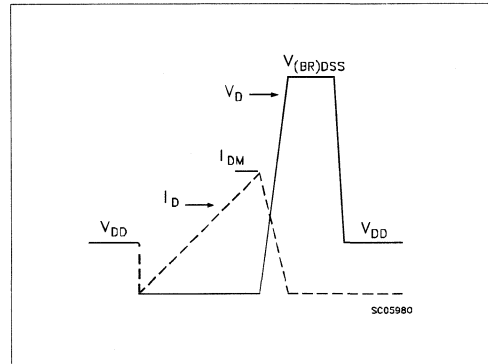
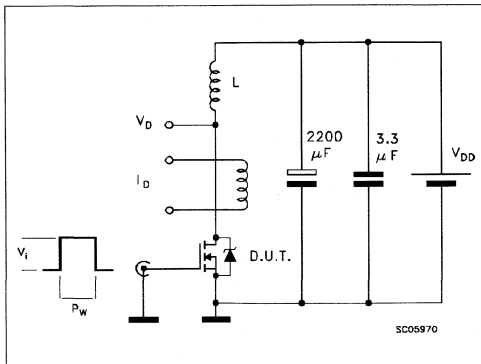


Fig. 3: Switching Times Test Circuits For Resistive Load

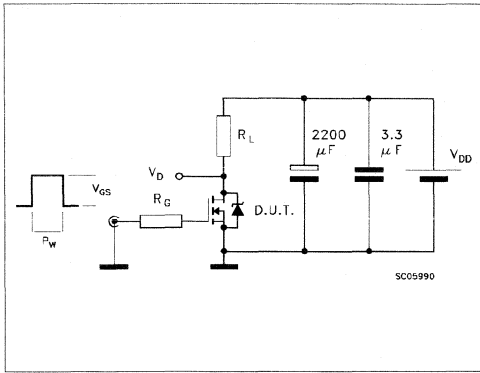


Fig. 4: Gate Charge Test Circuit

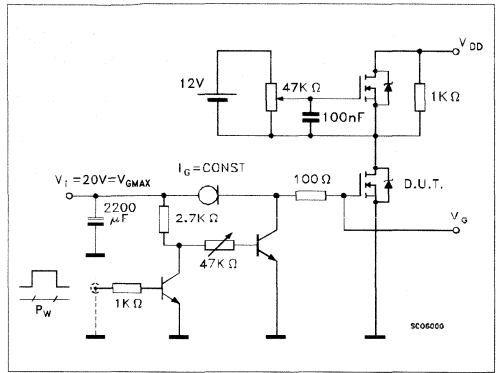
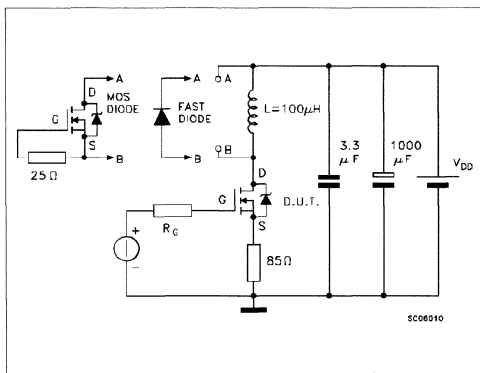


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



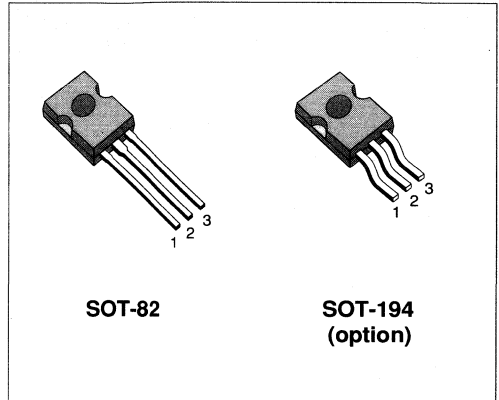
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STK22N06	60 V	< 0.065 Ω	22 A

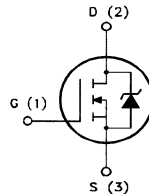
- TYPICAL R_{DS(on)} = 0.048 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	60	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	60	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	22	A
I _D	Drain Current (continuous) at T _c = 100 °C	15	A
I _{DM} (*)	Drain Current (pulsed)	88	A
P _{tot}	Total Dissipation at T _c = 25 °C	65	W
	Derating Factor	0.43	W/°C
T _{stg}	Storage Temperature	-65 to 175	°C
T _j	Max. Operating Junction Temperature	175	°C

(*) Pulse width limited by safe operating area

THERMAL DATA

R _{thj-case}	Thermal Resistance Junction-case	Max	2.31	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	80	°C/W
R _{thj-amb}	Thermal Resistance Case-sink	Typ	0.7	°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		275	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	22	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	100	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	25	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	15	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	60			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	2.9	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 11 A V _{GS} = 10V I _D = 11 A T _c = 100°C		0.048	0.065 0.13	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	22			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 11 A	6	10		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		700	900	pF
C _{oss}	Output Capacitance			320	450	pF
C _{rss}	Reverse Transfer Capacitance			90	150	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 30\text{ V}$ $I_D = 3\text{ A}$		30	45	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		90	130	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 22\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		230		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 40\text{ V}$ $I_D = 22\text{ A}$ $V_{GS} = 10\text{ V}$		26	40	nC
Q_{gs}	Gate-Source Charge			8		nC
Q_{gd}	Gate-Drain Charge			9		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 22\text{ A}$		80	120	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		80	120	ns
t_c	Cross-over Time	(see test circuit, figure 5)		170	250	ns

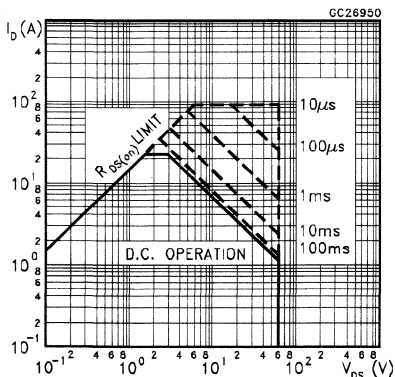
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				22	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				88	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 22\text{ A}$ $V_{GS} = 0$			1.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 22\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		80		ns
Q_{rr}	Reverse Recovery Charge			0.22		μ C
I_{RRM}	Reverse Recovery Current			5.5		A

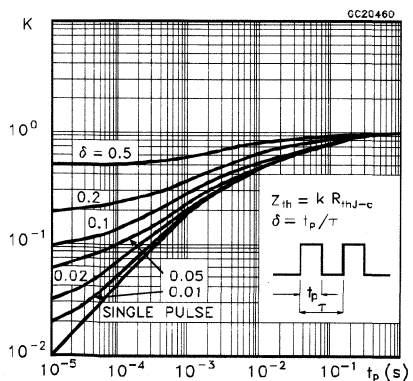
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

(•) Pulse width limited by safe operating area

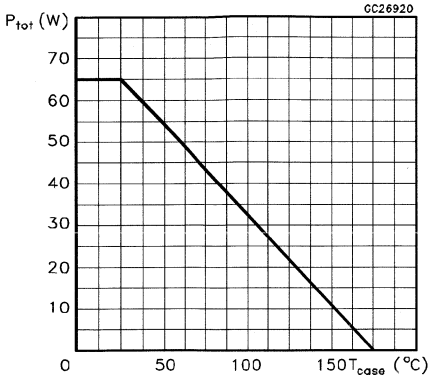
Safe Operating Area



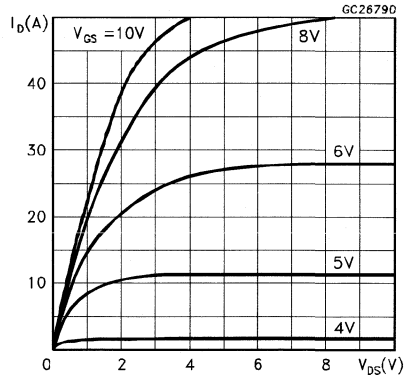
Thermal Impedance



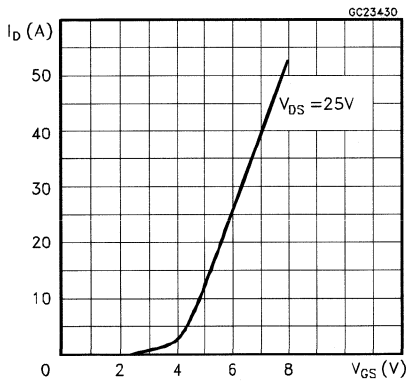
Derating Curve



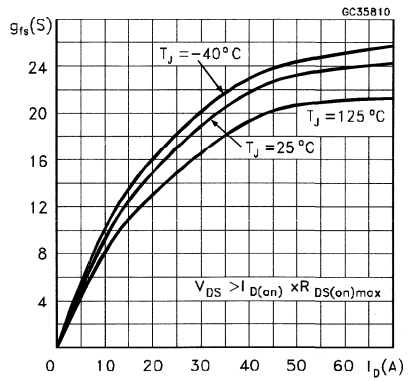
Output Characteristics



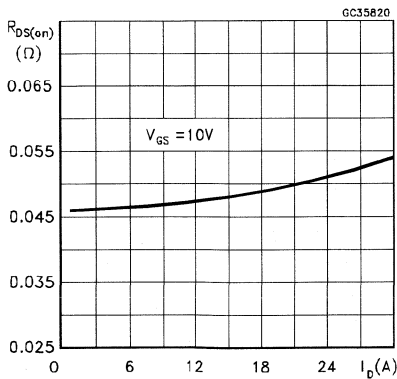
Transfer Characteristics



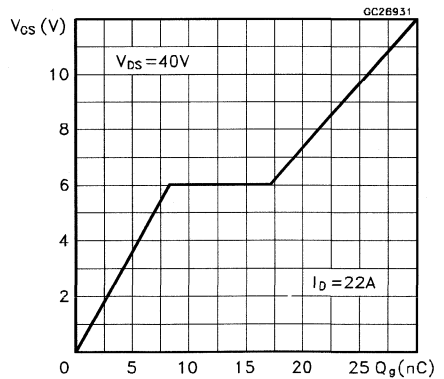
Transconductance



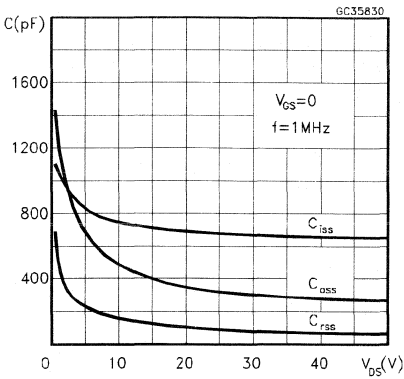
Static Drain-source On Resistance



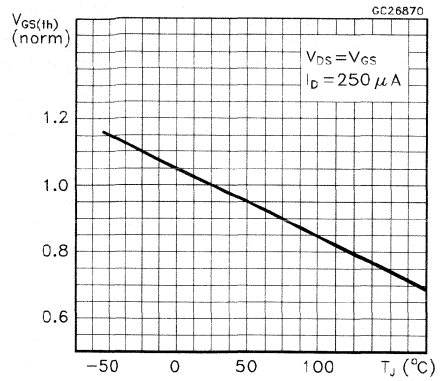
Gate Charge vs Gate-source Voltage



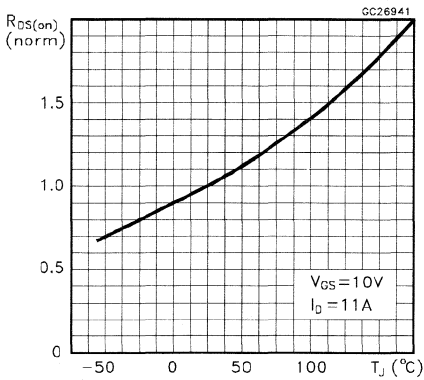
Capacitance Variations



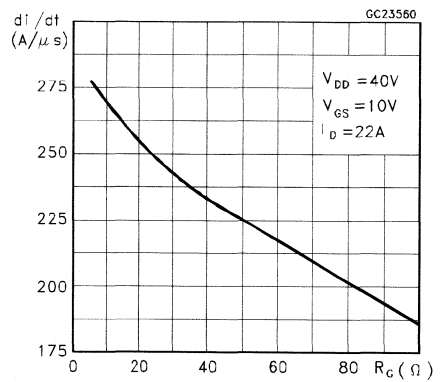
Normalized Gate Threshold Voltage vs Temperature



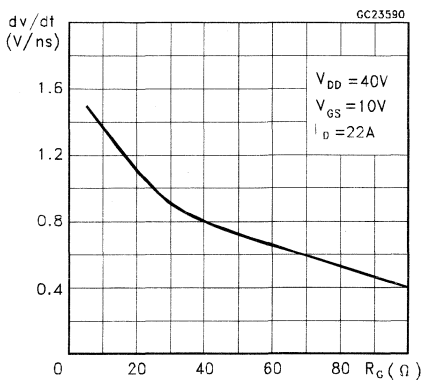
Normalized On Resistance vs Temperature



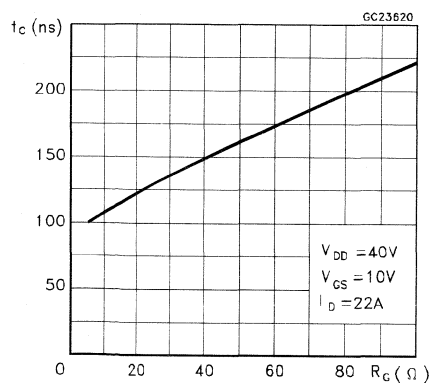
Turn-on Current Slope



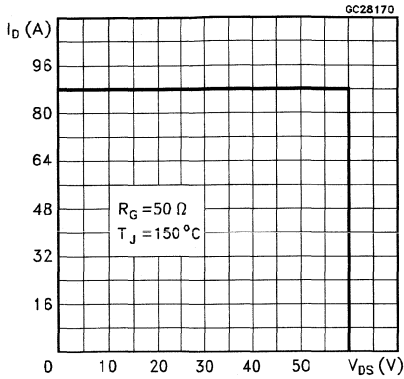
Turn-off Drain-source Voltage Slope



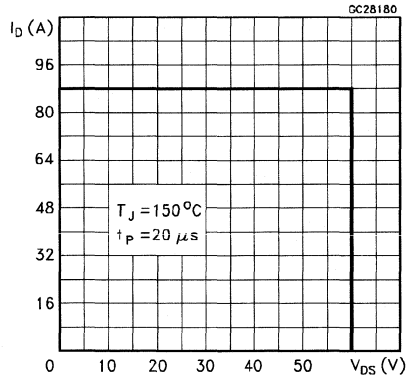
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

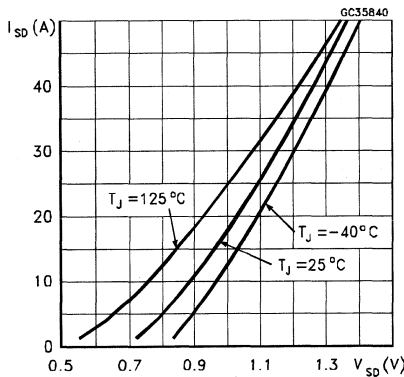


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

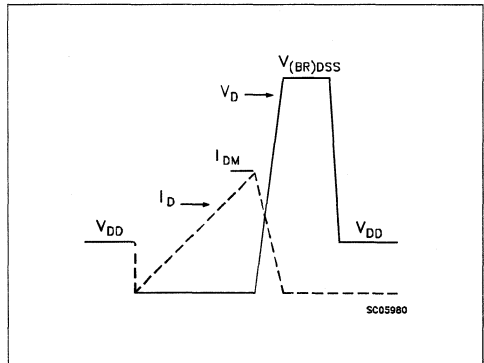
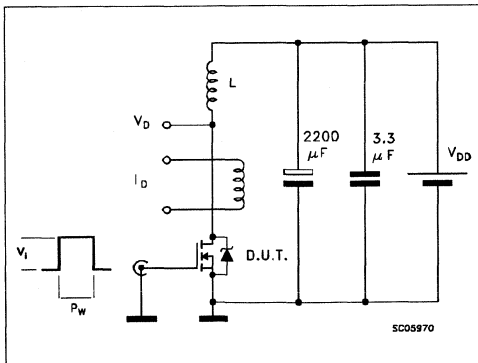


Fig. 3: Switching Times Test Circuits For Resistive Load

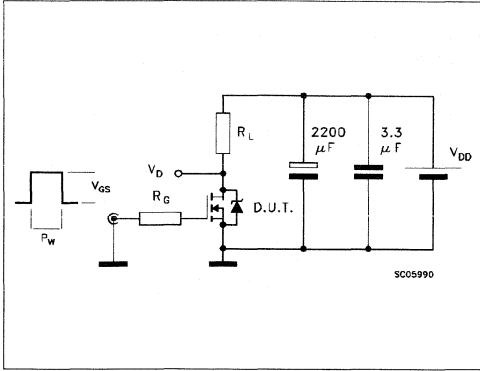


Fig. 4: Gate Charge Test Circuit

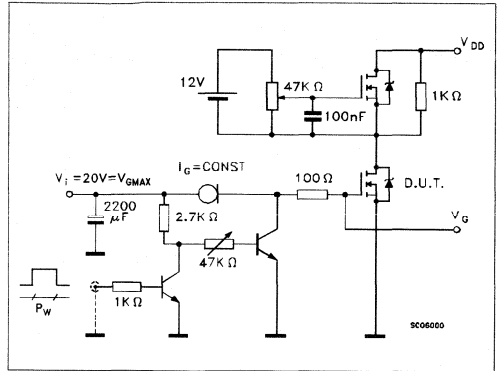
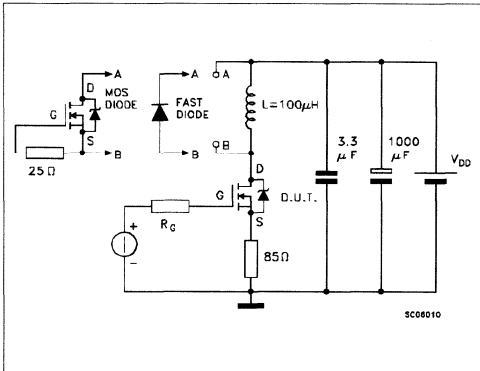


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



N - CHANNEL ENHANCEMENT MODE LOW THRESHOLD POWER MOS TRANSISTOR

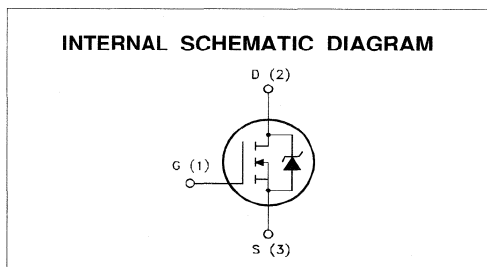
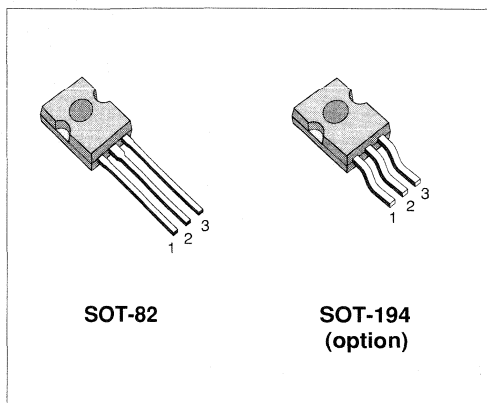
PRELIMINARY DATA

TYPE	V _{DSS}	R _{DS(on)}	I _D
STK23N05L	50 V	< 0.055 Ω	23 A
STK23N06L	60 V	< 0.055 Ω	23 A

- TYPICAL R_{DS(on)} = 0.044 Ω
- AVALANCHE RUGGEDNESS TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- LOGIC LEVEL COMPATIBLE INPUT
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STK23N05L	STK23N06L	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	50	60	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	50	60	V
V _{GS}	Gate-source Voltage	± 15		V
I _D	Drain Current (continuous) at T _c = 25 °C	23		A
I _D	Drain Current (continuous) at T _c = 100 °C	16		A
I _{DM} (*)	Drain Current (pulsed)	92		A
P _{tot}	Total Dissipation at T _c = 25 °C	65		W
	Derating Factor	0.43		W/°C
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

R _{thj-case}	Thermal Resistance Junction-case	Max	2.31	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	80	°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.7	°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		275	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	23	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	90	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	20	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	16	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0 for STK23N05L for STK23N06L	50 60			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 15 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	1	1.6	2.5	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 5 V I _D = 11.5 A V _{GS} = 5 V I _D = 11.5 A T _c = 100 °C		0.044	0.055 0.11	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	23			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 11.5 A	9	19		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		980	1300	pF
C _{oss}	Output Capacitance			320	450	pF
C _{rss}	Reverse Transfer Capacitance			80	110	pF

ELECTRICAL CHARACTERISTICS (continued)
SWITCHING RESISTIVE LOAD

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 25\text{ V}$ $I_D = 11.5\text{ A}$		45	65	ns
t_r	Rise Time	$R_{GS} = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 3)		380	550	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 23\text{ A}$ $R_{GS} = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 5)		130		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 40\text{ V}$ $I_D = 23\text{ A}$ $V_{GS} = 5\text{ V}$		25	35	nC
Q_{gs}	Gate-Source Charge			8		nC
Q_{gd}	Gate-Drain Charge			12		nC

SWITCHING INDUCTIVE LOAD

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 23\text{ A}$		80	120	ns
t_f	Fall Time	$R_{GS} = 50\ \Omega$ $V_{GS} = 5\text{ V}$		130	190	ns
t_c	Cross-over Time	(see test circuit, figure 5)		230	330	ns

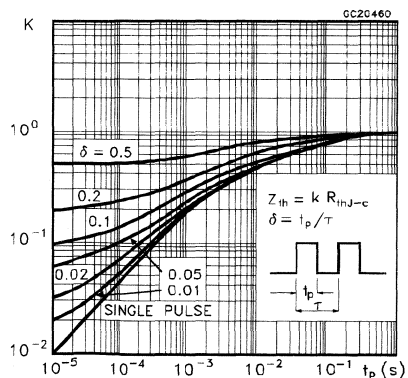
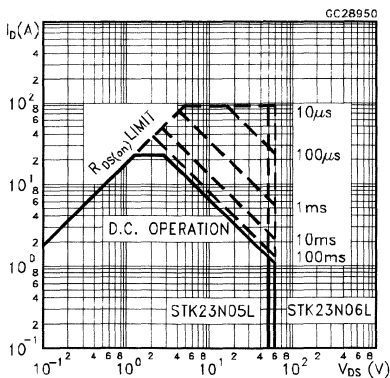
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				23	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				92	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 23\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 23\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 25\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		100		ns
Q_{rr}	Reverse Recovery Charge			0.2		μ C
I_{RRM}	Reverse Recovery Current			4		A

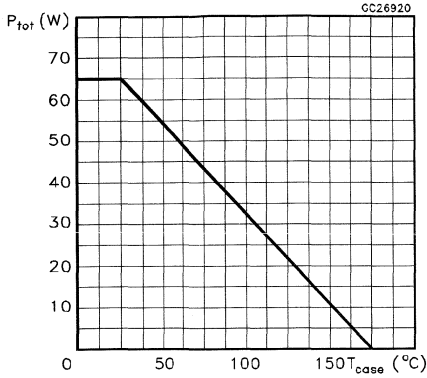
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %
 (•) Pulse width limited by safe operating area

Safe Operating Area

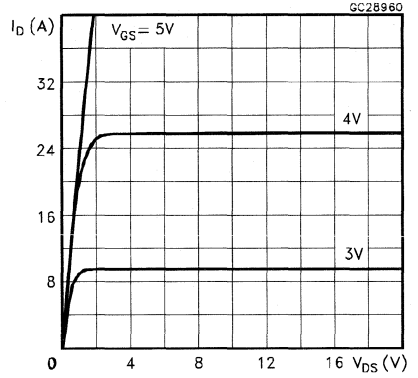
Thermal Impedance



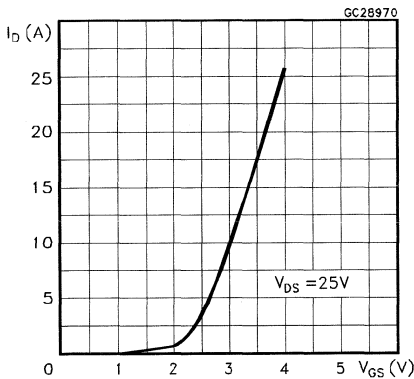
Derating Curve



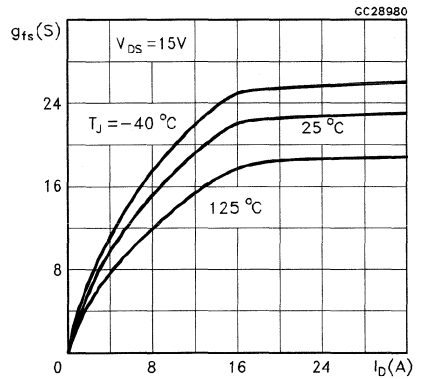
Output Characteristics



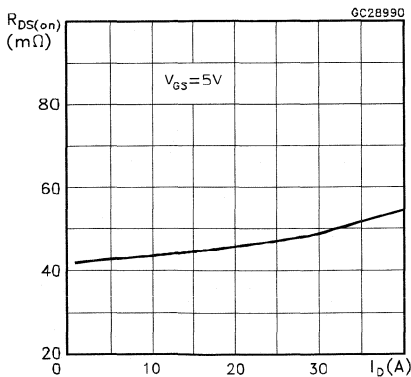
Transfer Characteristics



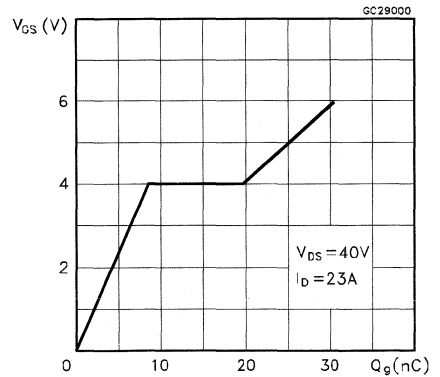
Transconductance



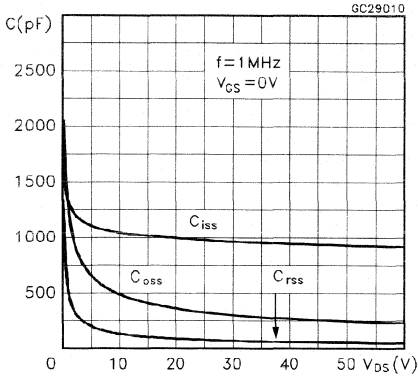
Static Drain-source On Resistance



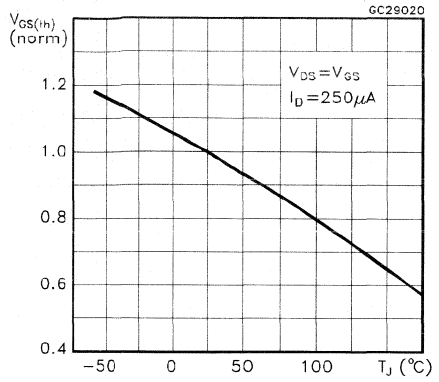
Gate Charge vs Gate-source Voltage



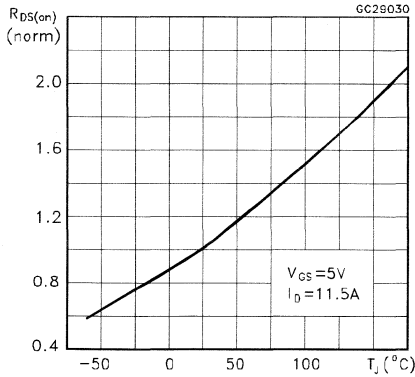
Capacitance Variations



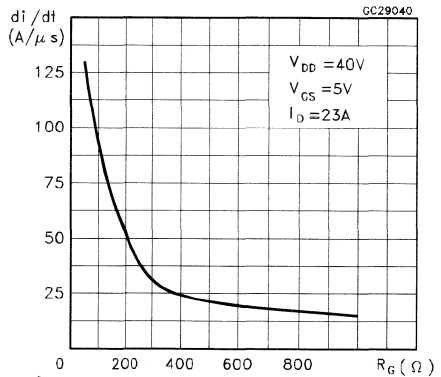
Normalized Gate Threshold Voltage vs Temperature



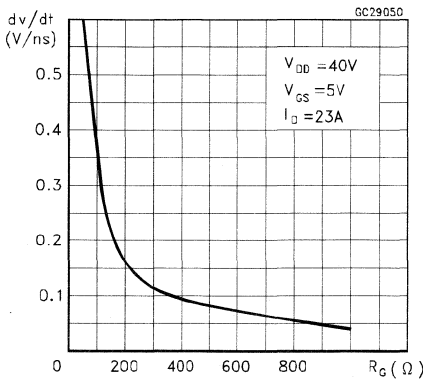
Normalized On Resistance vs Temperature



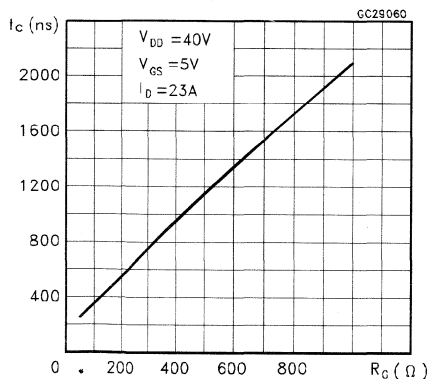
Turn-on Current Slope



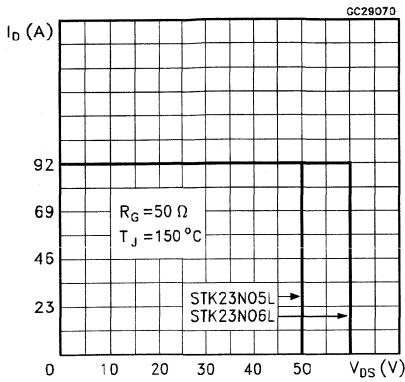
Turn-off Drain-source Voltage Slope



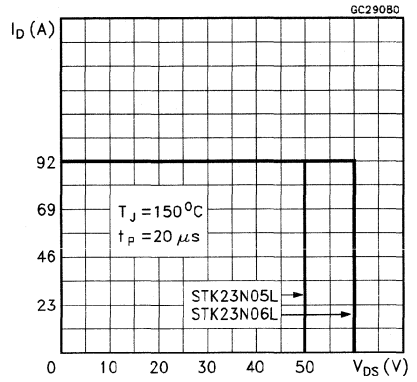
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

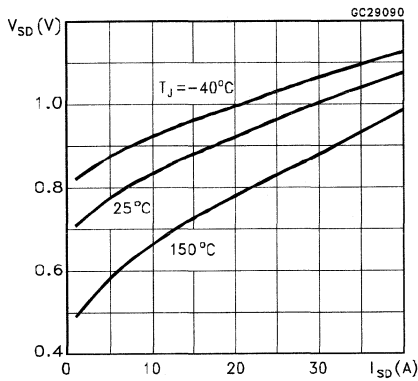


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

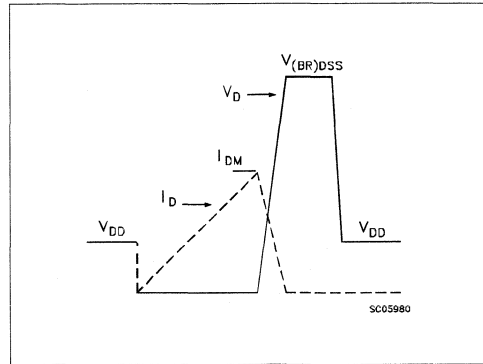
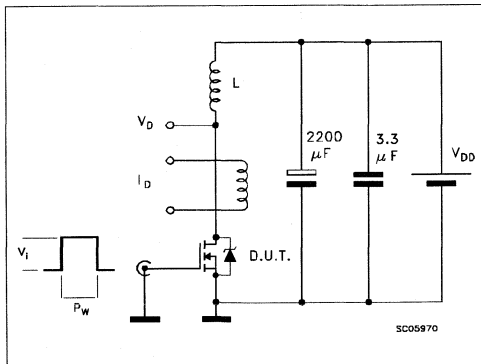


Fig. 3: Switching Times Test Circuits For Resistive Load

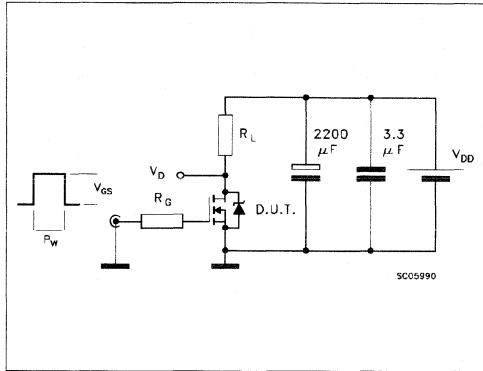


Fig. 4: Gate Charge Test Circuit

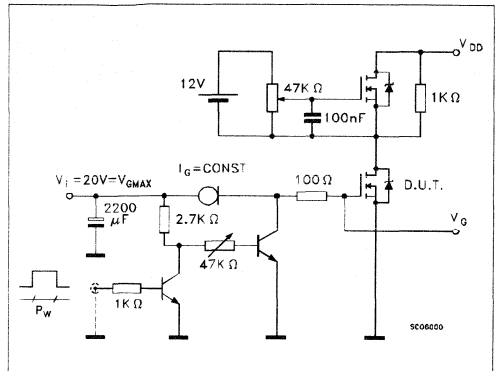
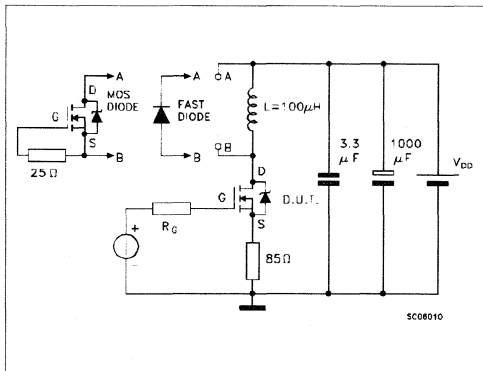


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



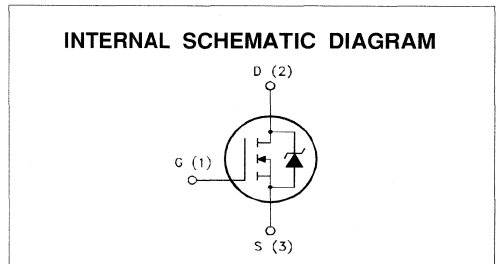
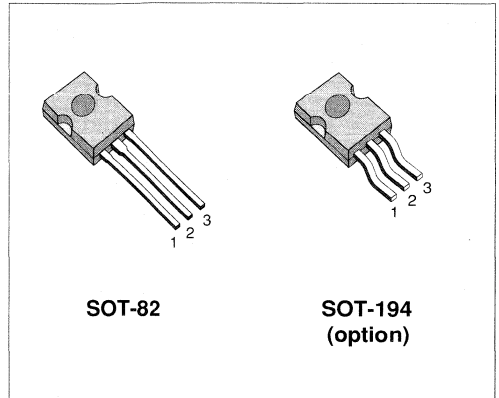
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STK3055E	60 V	< 0.15 Ω	12 A

- TYPICAL R_{DS(on)} = 0.1 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	60	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	60	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	12	A
I _D	Drain Current (continuous) at T _c = 100 °C	8	A
I _{DM} (*)	Drain Current (pulsed)	48	A
P _{tot}	Total Dissipation at T _c = 25 °C	50	W
	Derating Factor	0.33	W/°C
T _{stg}	Storage Temperature	-65 to 175	°C
T _j	Max. Operating Junction Temperature	175	°C

(*) Pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	3.0	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	80	°C/W
R_{thc-s}	Thermal Resistance Case-sink	Typ	0.7	°C/W
T_j	Maximum Lead Temperature For Soldering Purpose		275	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	12	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ °C}$, $I_D = I_{AR}$, $V_{DD} = 25\text{ V}$)	30	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	7	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ °C}$, pulse width limited by T_j max, $\delta < 1\%$)	8	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$	60			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\text{ }\mu\text{A}$	2	2.9	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 6\text{ A}$ $V_{GS} = 10\text{ V}$ $I_D = 6\text{ A}$ $T_c = 100\text{ °C}$		0.1	0.15 0.3	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	12			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 6\text{ A}$	3	5		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		330	450	pF
C_{oss}	Output Capacitance			150	250	pF
C_{rss}	Reverse Transfer Capacitance			40	60	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 25\text{ V}$ $I_D = 6\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		40 80	60 120	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 12\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		210		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 40\text{ V}$ $I_D = 12\text{ A}$ $V_{GS} = 10\text{ V}$		15 7 5	25	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(off)}$ t_f	Off-voltage Rise Time Fall Time	$V_{DD} = 40\text{ V}$ $I_D = 12\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		30 40	45 60	ns ns
t_c	Cross-over Time	(see test circuit, figure 5)		80	120	ns

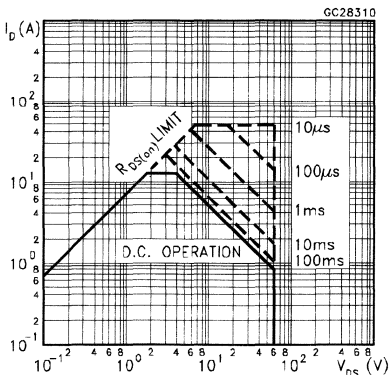
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				12 48	A A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 12\text{ A}$ $V_{GS} = 0$			1.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 12\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 25\text{ V}$ $T_J = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		60		ns
Q_{rr}	Reverse Recovery Charge			0.12		μ C
I_{RRM}	Reverse Recovery Current			4		A

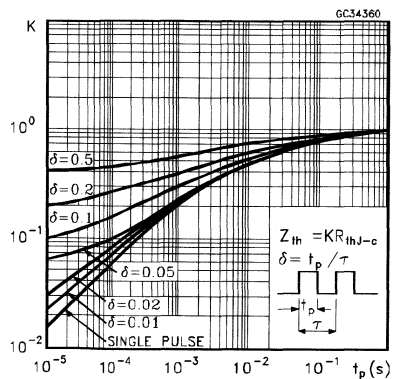
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

(•) Pulse width limited by safe operating area

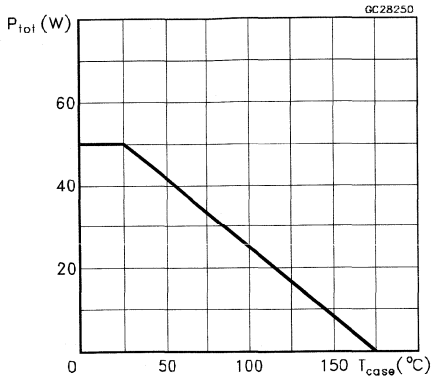
Safe Operating Area



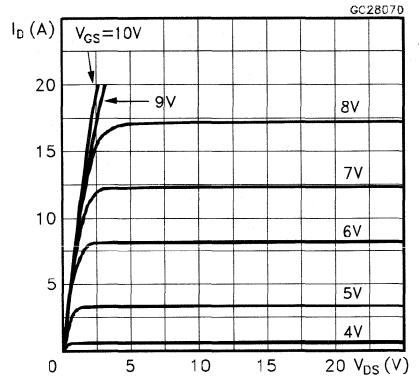
Thermal Impedance



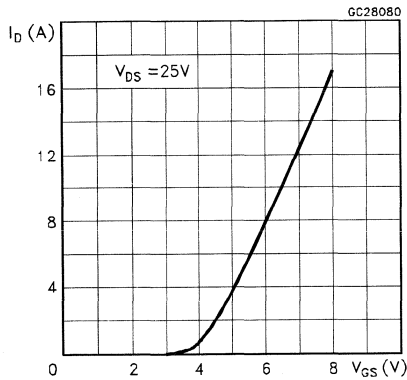
Derating Curve



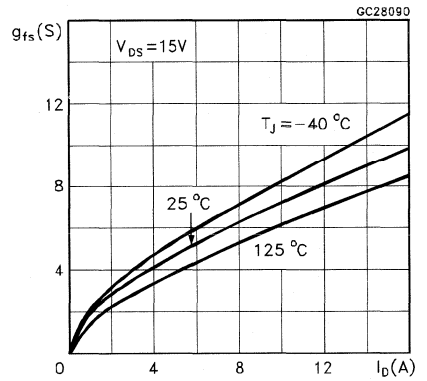
Output Characteristics



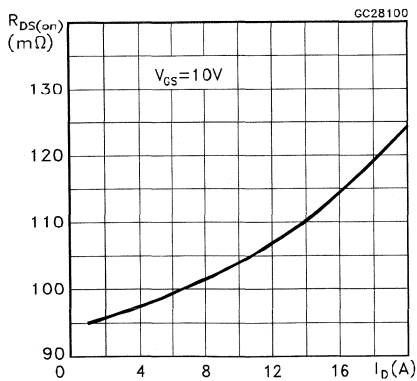
Transfer Characteristics



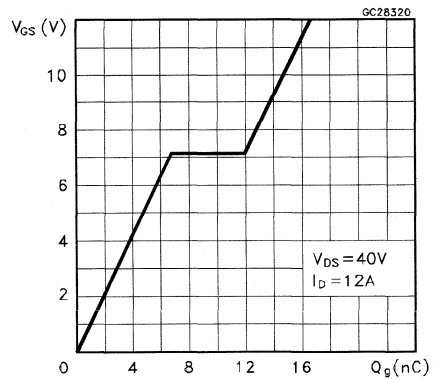
Transconductance



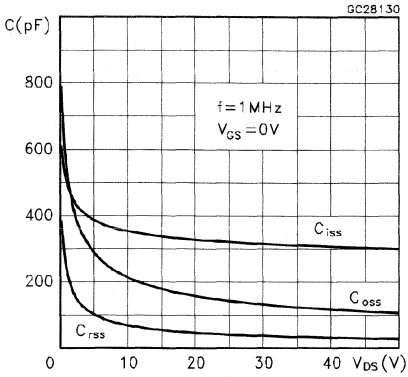
Static Drain-source On Resistance



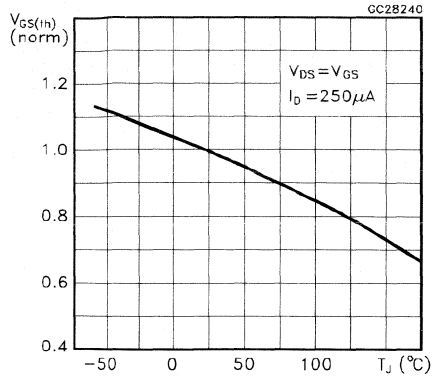
Gate Charge vs Gate-source Voltage



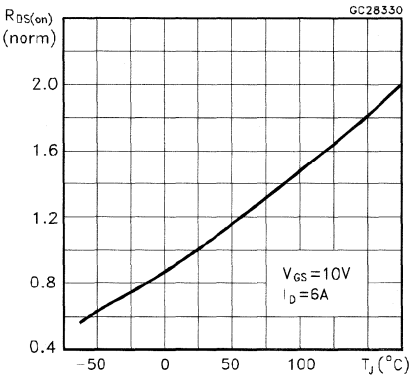
Capacitance Variations



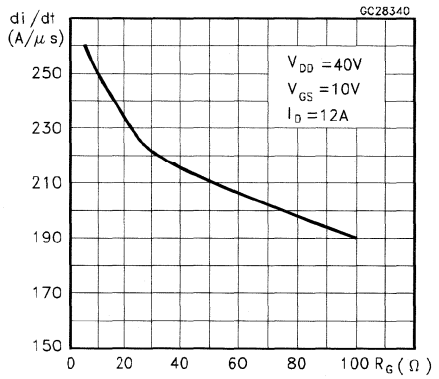
Normalized Gate Threshold Voltage vs Temperature



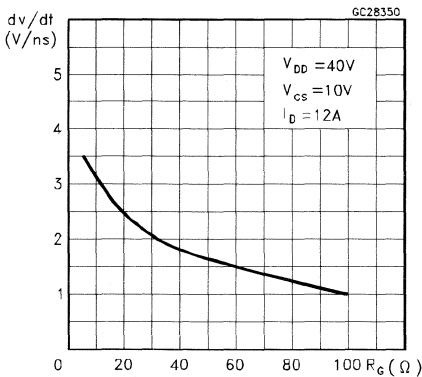
Normalized On Resistance vs Temperature



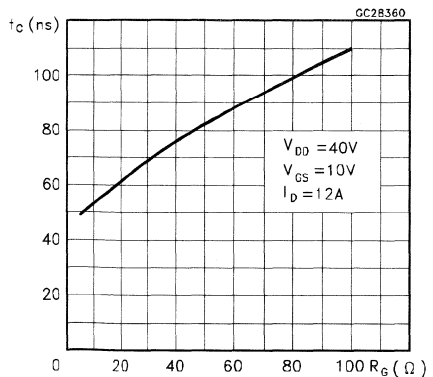
Turn-on Current Slope



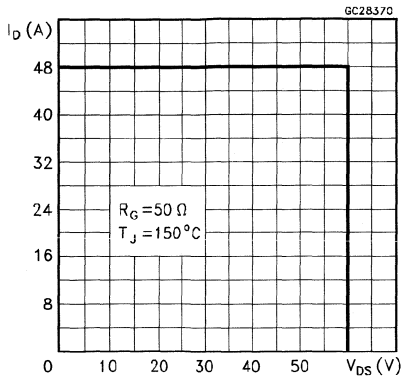
Turn-off Drain-source Voltage Slope



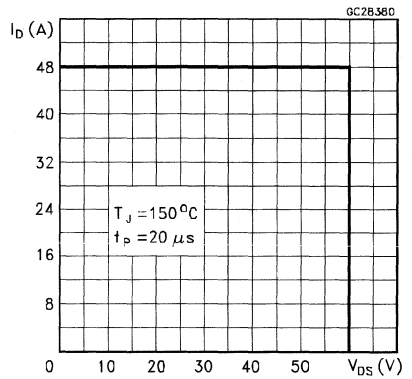
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

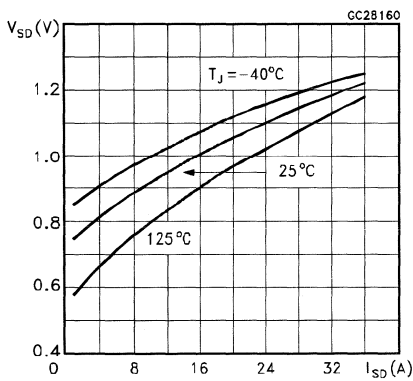


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

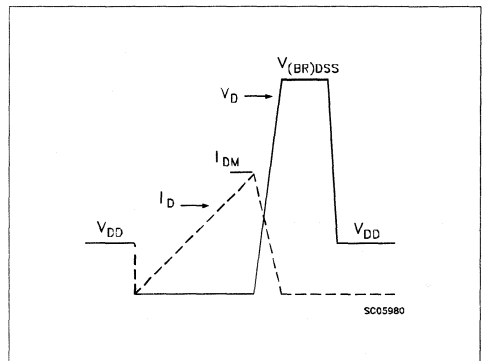
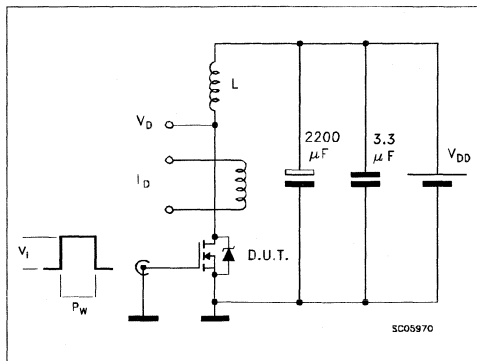


Fig. 3: Switching Times Test Circuits For Resistive Load

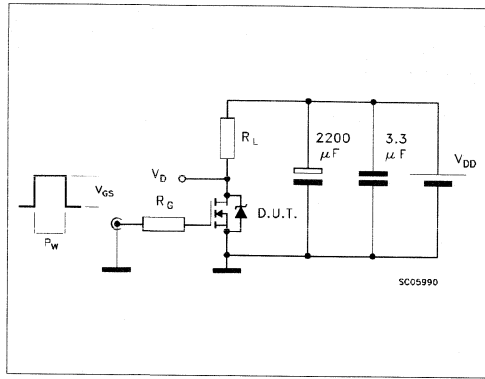


Fig. 4: Gate Charge Test Circuit

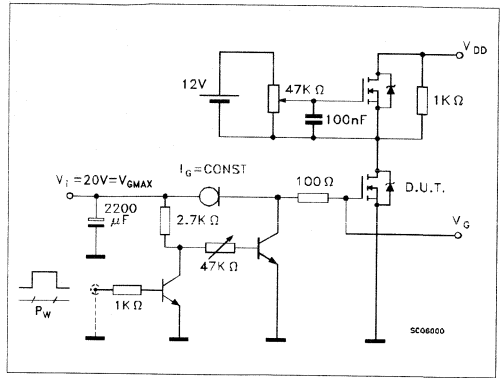
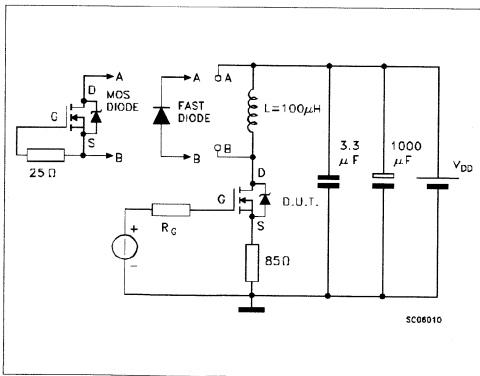


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



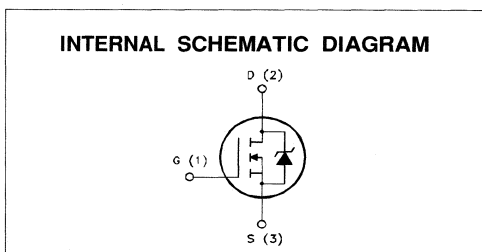
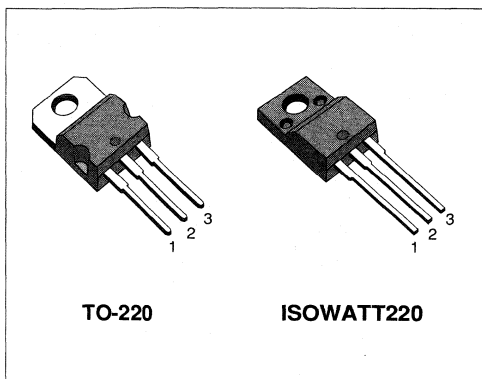
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DS}	R _{DS(on)}	I _D
STP2N60	600 V	< 3.5 Ω	2.9 A
STP2N60FI	600 V	< 3.5 Ω	2.2 A

- TYPICAL R_{DS(on)} = 3.2 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP2N60	STP2N60FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	600		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	600		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	2.9	2.2	A
I _D	Drain Current (continuous) at T _c = 100 °C	1.7	1.3	A
I _{DM} (*)	Drain Current (pulsed)	11	11	A
P _{tot}	Total Dissipation at T _c = 25 °C	70	35	W
	Derating Factor	0.56	0.28	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
$R_{thj-case}$	Thermal Resistance Junction-case	Max	1.78	3.57	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5		°C/W
$R_{thc-sink}$	Thermal Resistance Case-sink	Typ	0.5		°C/W
T_j	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	2.9	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ }^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	105	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	3.5	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ }^\circ\text{C}$, pulse width limited by T_j max, $\delta < 1\%$)	1.7	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ }^\circ\text{C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$	600			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ }^\circ\text{C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\text{ }\mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 1.5\text{ A}$ $V_{GS} = 10\text{ V}$ $I_D = 1.5\text{ A}$ $T_c = 100\text{ }^\circ\text{C}$		3.2	3.5 7	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	2.9			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 1.5\text{ A}$	1	2.4		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		450	600	pF
C_{oss}	Output Capacitance			62	85	pF
C_{rss}	Reverse Transfer Capacitance			23	35	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 35\text{ V}$ $I_D = 2\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		25 110	40 150	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 480\text{ V}$ $I_D = 2.9\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		75		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 480\text{ V}$ $I_D = 2.9\text{ A}$ $V_{GS} = 10\text{ V}$		33 7 13	45	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 480\text{ V}$ $I_D = 2.9\text{ A}$		70	95	ns
t_f	Fall Time	$V_{DD} = 480\text{ V}$ $I_D = 2.9\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		20	30	ns
t_c	Cross-over Time	(see test circuit, figure 5)		100	130	ns

SOURCE DRAIN DIODE

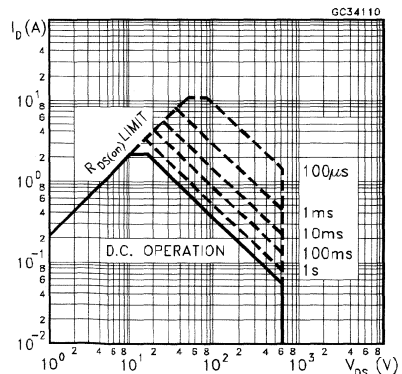
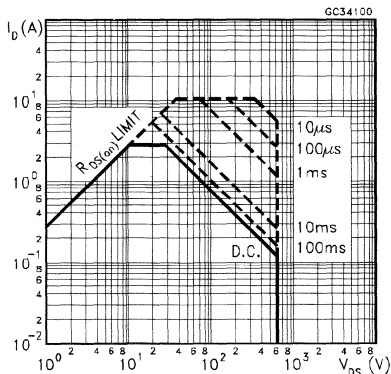
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				2.9	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				11	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 2.9\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 2.9\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 80\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		500		ns
Q_{rr}	Reverse Recovery Charge			7		μ C
I_{RRM}	Reverse Recovery Current			28		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

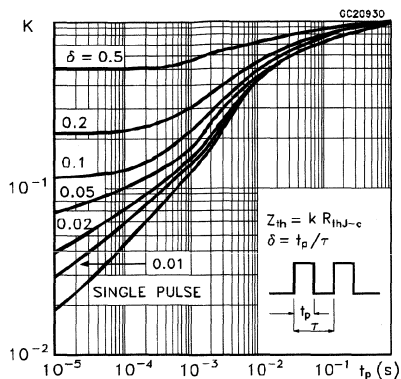
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

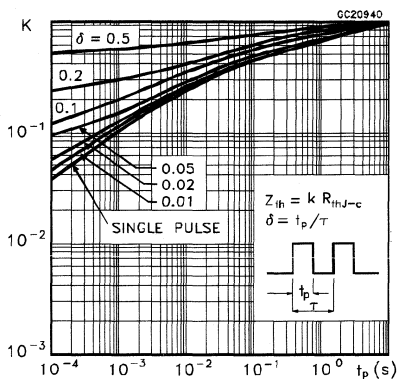
Safe Operating Areas For ISOWATT220



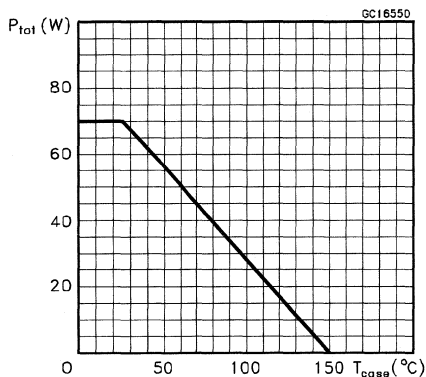
Thermal Impedance For TO-220



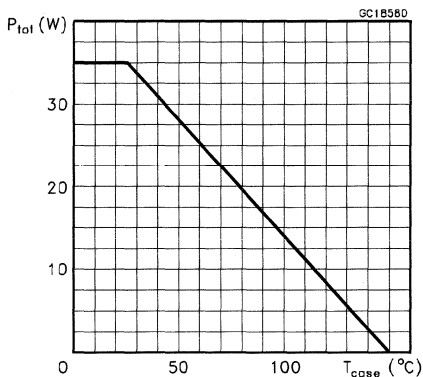
Thermal Impedance For ISOWATT220



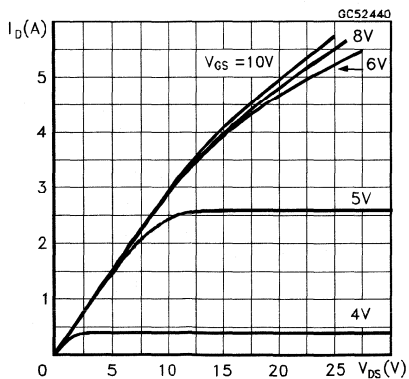
Derating Curve For TO-220



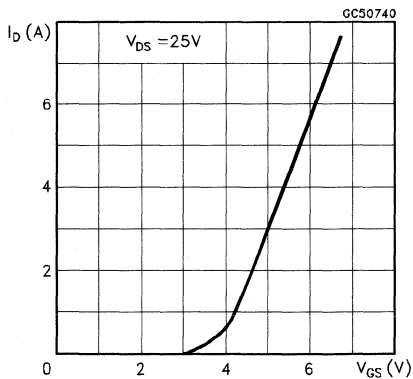
Derating Curve For ISOWATT220



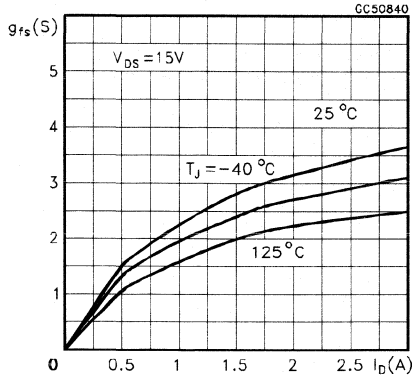
Output Characteristics



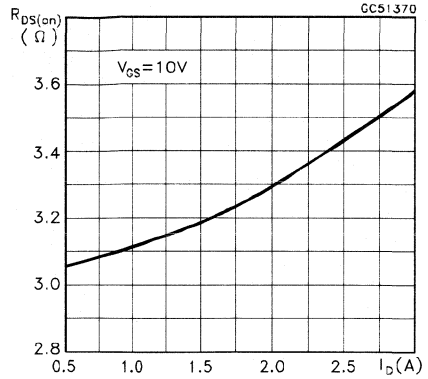
Transfer Characteristics



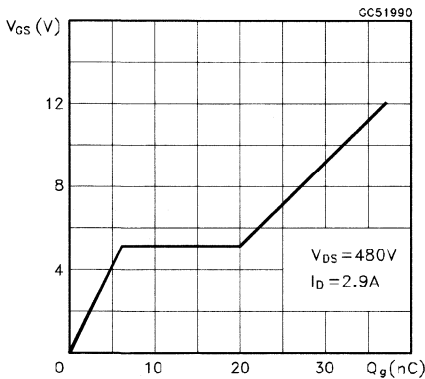
Transconductance



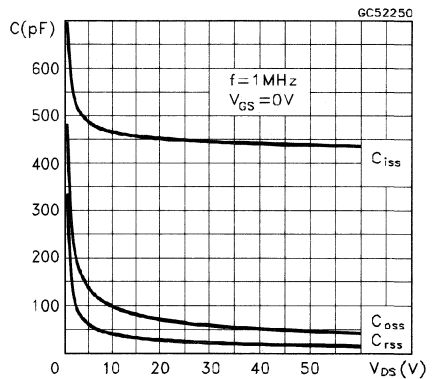
Static Drain-source On Resistance



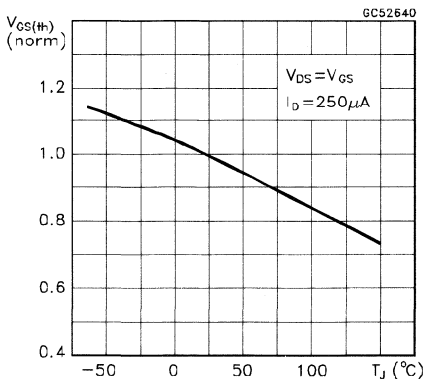
Gate Charge vs Gate-source Voltage



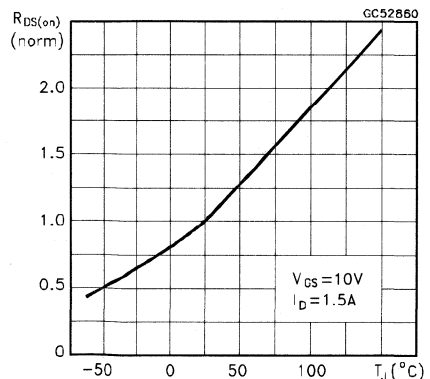
Capacitance Variations



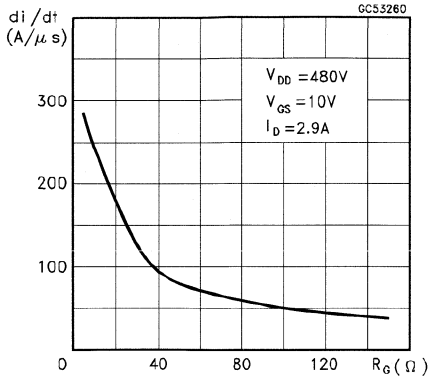
Normalized Gate Threshold Voltage vs Temperature



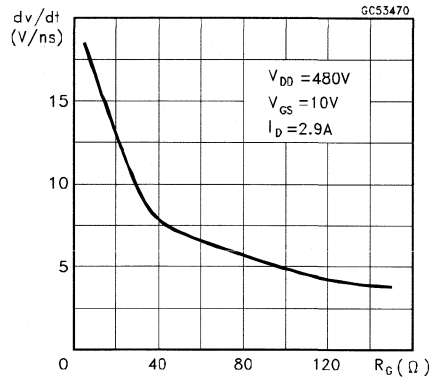
Normalized On Resistance vs Temperature



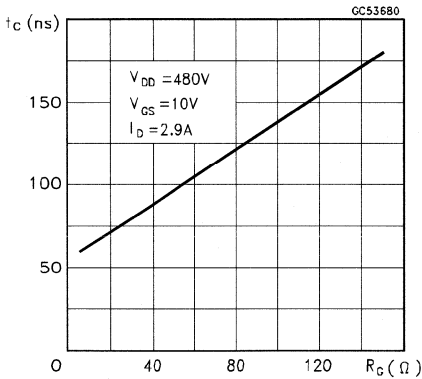
Turn-on Current Slope



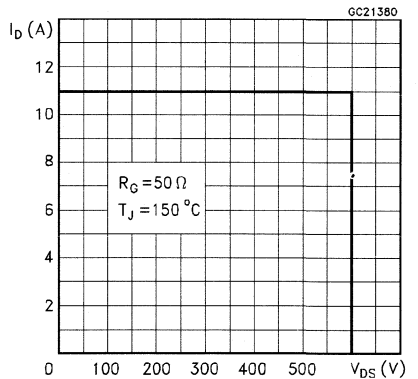
Turn-off Drain-source Voltage Slope



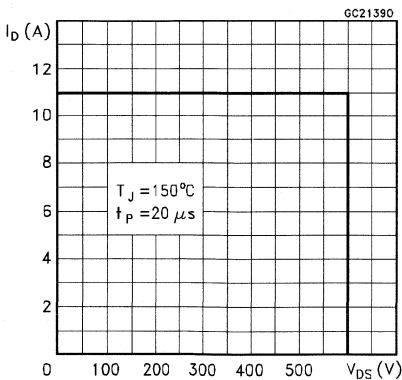
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

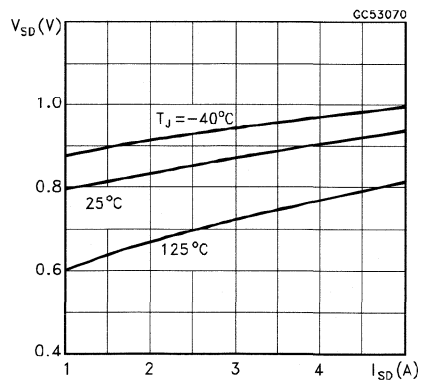


Fig. 1: Unclamped Inductive Load Test Circuits

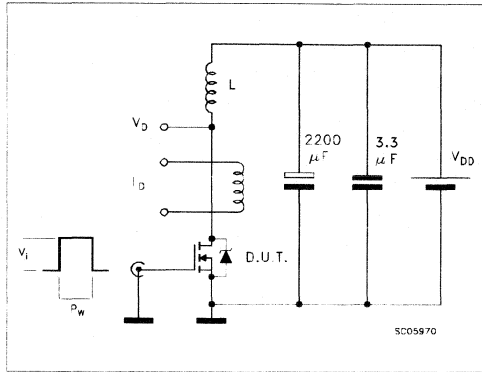


Fig. 2: Unclamped Inductive Waveforms

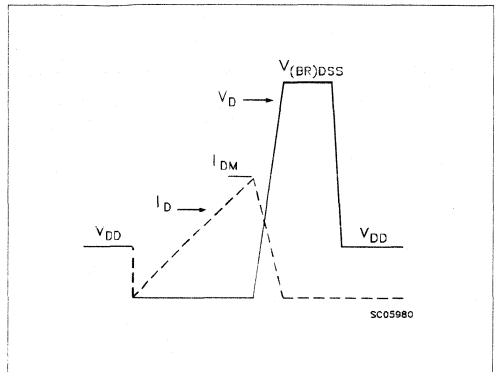


Fig. 3: Switching Times Test Circuits For Resistive Load

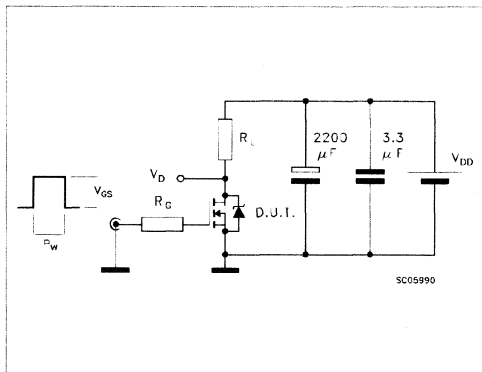


Fig. 4: Gate Charge Test Circuit

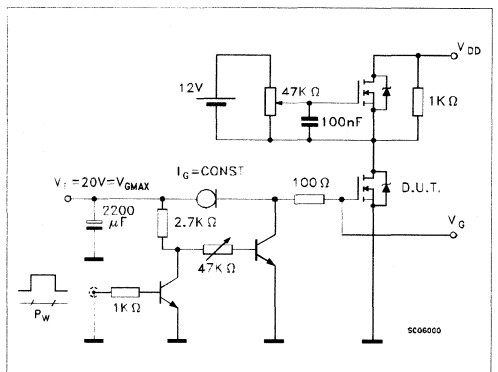
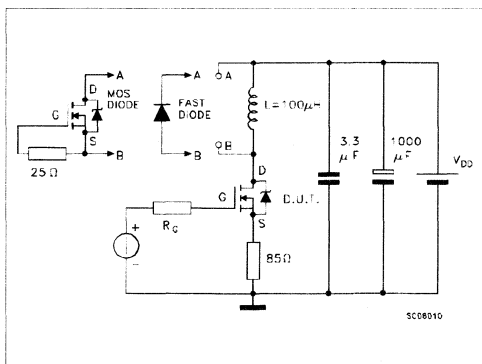


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



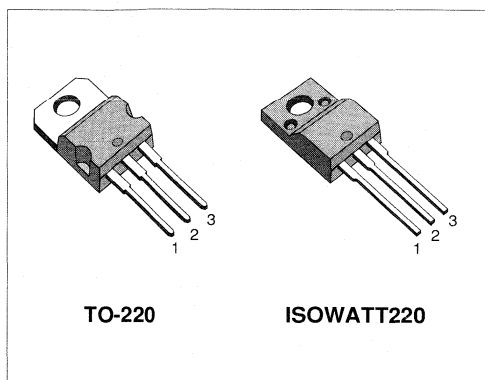
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP2N80	800 V	< 7 Ω	2.4 A
STP2N80FI	800 V	< 7 Ω	1.5 A

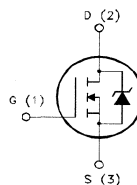
- TYPICAL R_{DS(on)} = 5 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INPUT CAPACITANCE
- LOW GATE CHARGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CONSUMER AND INDUSTRIAL LIGHTING



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP2N80	STP2N80FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	800		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	800		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	2.4	1.5	A
I _D	Drain Current (continuous) at T _c = 100 °C	1.5	0.95	A
I _{DM} (•)	Drain Current (pulsed)	9.6	9.6	A
P _{tot}	Total Dissipation at T _c = 25 °C	90	35	W
	Derating Factor	0.72	0.28	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _J	Max. Operating Junction Temperature	150		°C

(•) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case	Max	1.38	3.57	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.5		°C/W
T _j	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	2.4	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	85	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	3	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	1.5	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	800			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 1 A V _{GS} = 10V I _D = 1 A T _c = 100°C		5	7 14	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	2.4			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 1 A	1.2	1.9		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		460	600	pF
C _{oss}	Output Capacitance			55	70	pF
C _{rss}	Reverse Transfer Capacitance			22	30	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 400\text{ V}$ $I_D = 1.5\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		38 42	50 57	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 640\text{ V}$ $I_D = 2\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		160		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 640\text{ V}$ $I_D = 2\text{ A}$ $V_{GS} = 10\text{ V}$		31 6 14	40	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(off)}$	Off-voltage Rise Time	$V_{DD} = 640\text{ V}$ $I_D = 2\text{ A}$		70	90	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		25	32	ns
t_c	Cross-over Time			108	140	ns

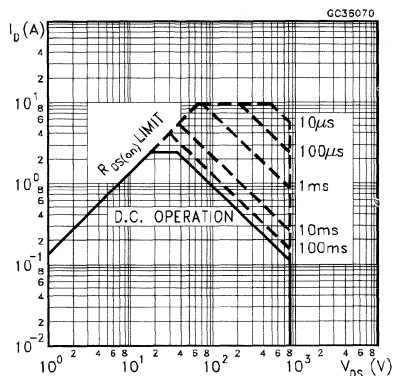
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				2.4	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				9.6	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 2.4\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 2\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_J = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		920		ns
Q_{rr}	Reverse Recovery Charge			18.4		μ C
I_{RRM}	Reverse Recovery Current			40		A

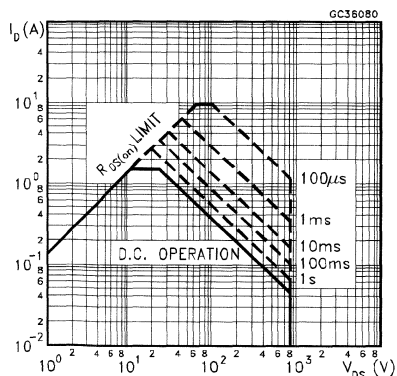
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

(•) Pulse width limited by safe operating area

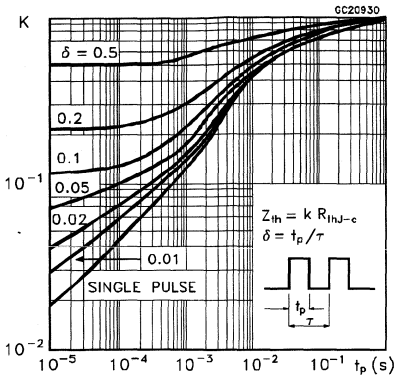
Safe Operating Areas For TO-220



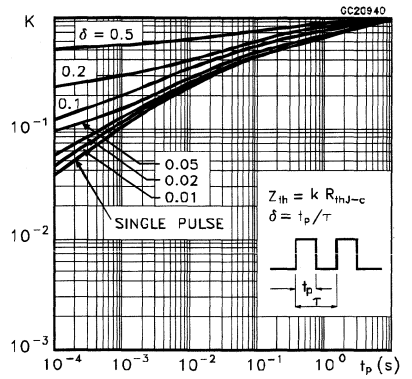
Safe Operating Areas For ISOWATT220



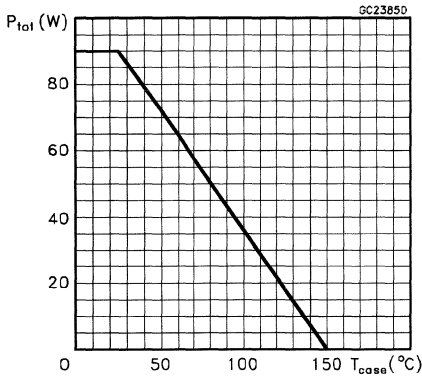
Thermal Impedance For TO-220



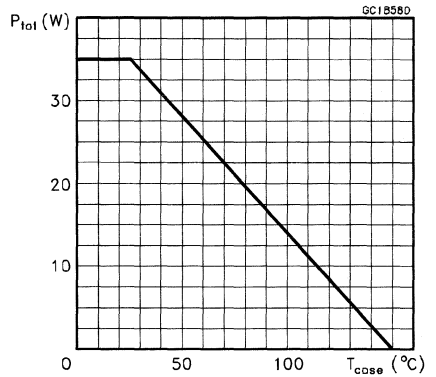
Thermal Impedance For ISOWATT220



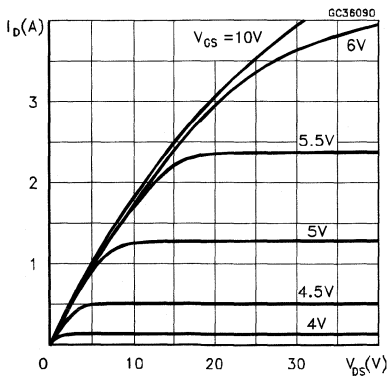
Derating Curve For TO-220



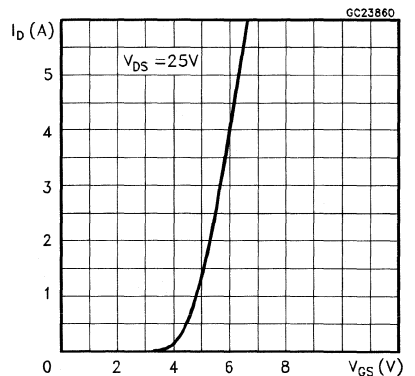
Derating Curve For ISOWATT220



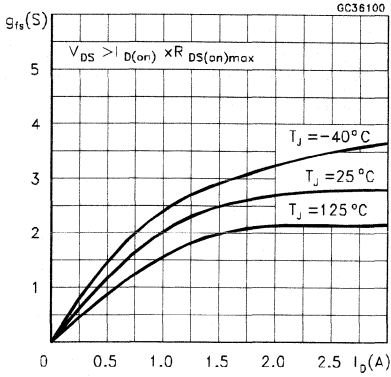
Output Characteristics



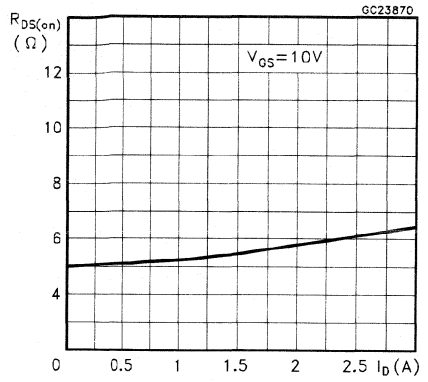
Transfer Characteristics



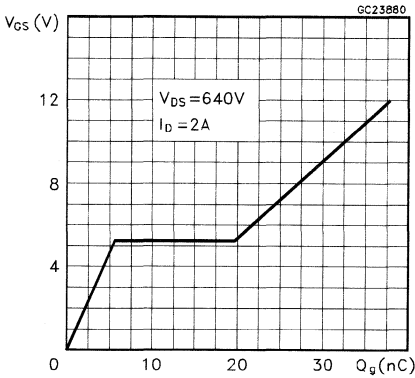
Transconductance



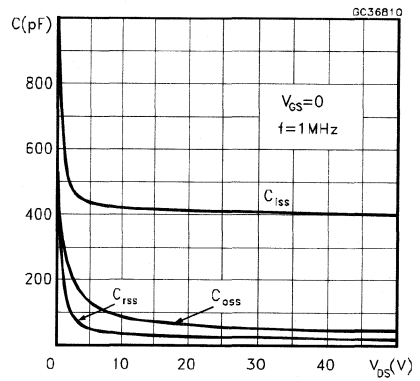
Static Drain-source On Resistance



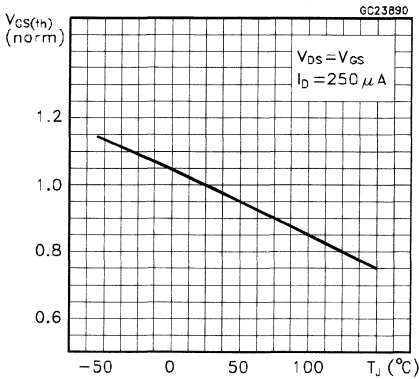
Gate Charge vs Gate-source Voltage



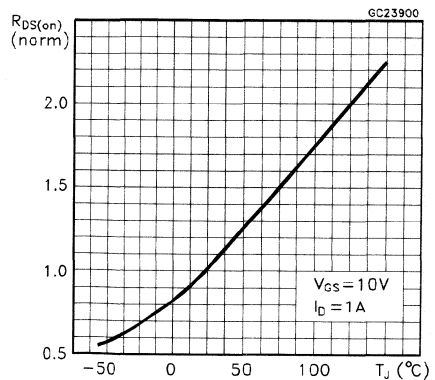
Capacitance Variations



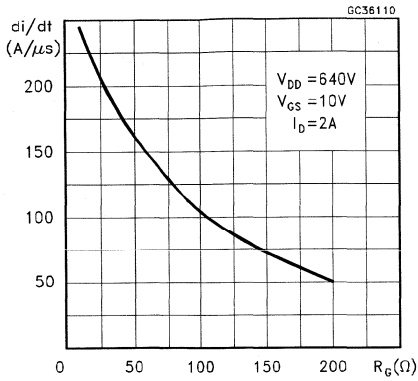
Normalized Gate Threshold Voltage vs Temperature



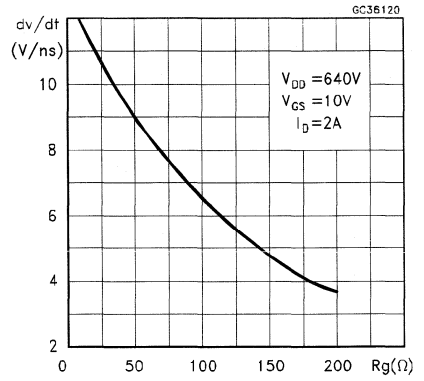
Normalized On Resistance vs Temperature



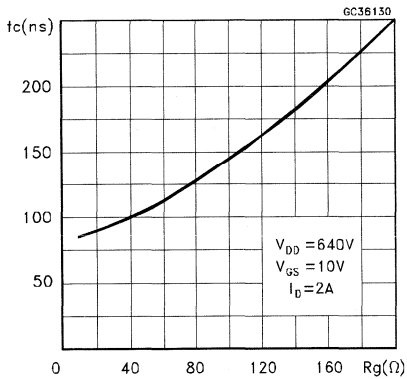
Turn-on Current Slope



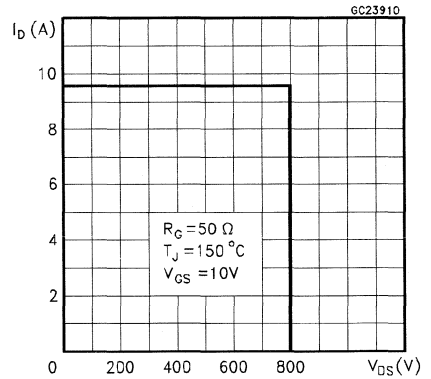
Turn-off Drain-source Voltage Slope



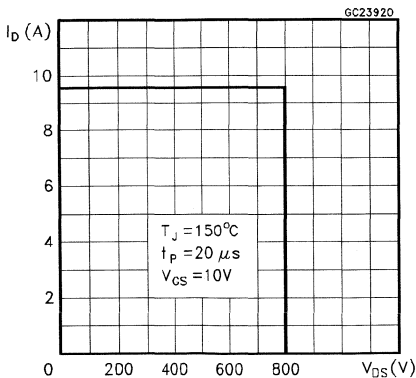
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

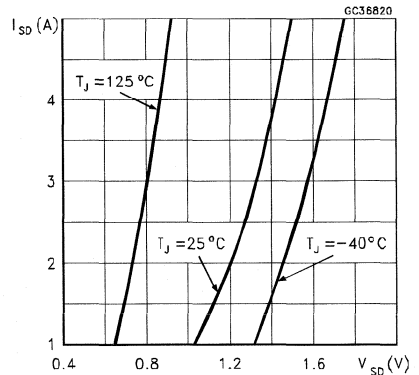


Fig. 1: Unclamped Inductive Load Test Circuits

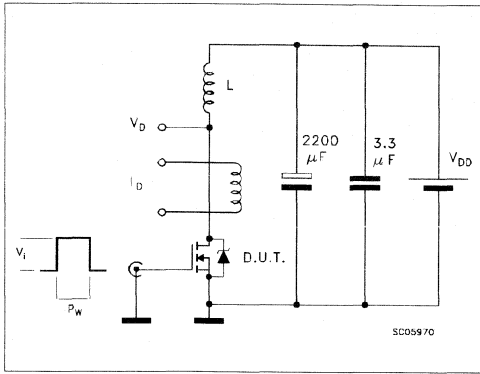


Fig. 2: Unclamped Inductive Waveforms

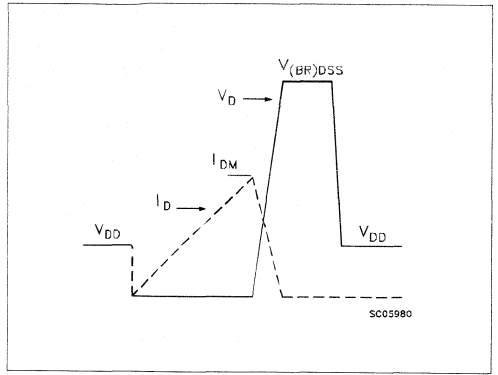


Fig. 3: Switching Times Test Circuits For Resistive Load

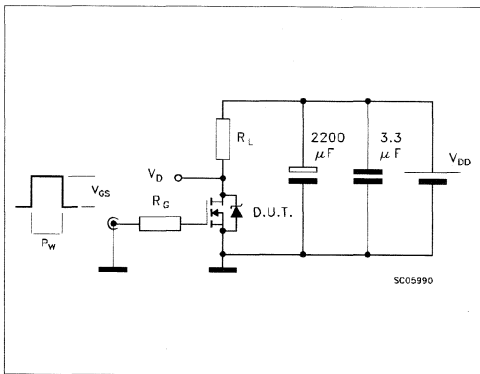


Fig. 4: Gate Charge Test Circuit

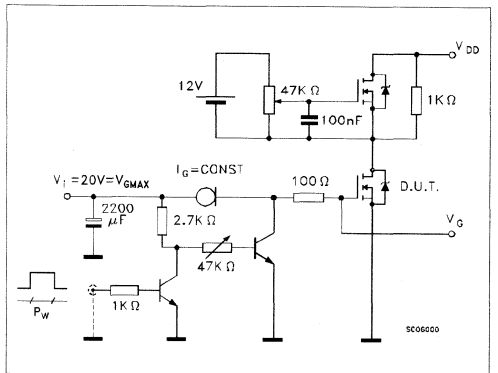
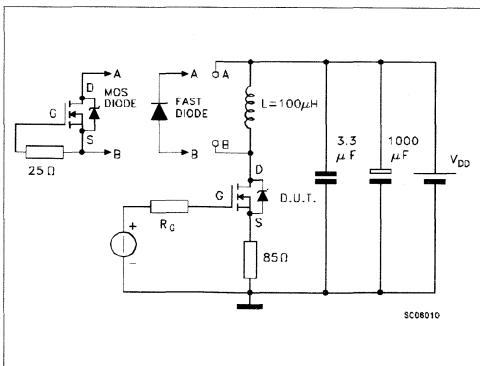


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



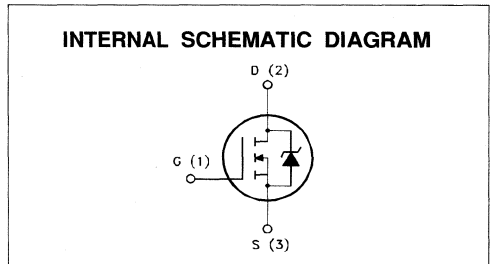
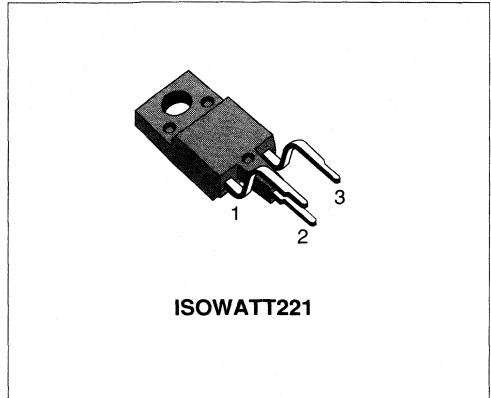
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP3N50XI	500 V	< 4 Ω	1.7 A

- TYPICAL R_{DS(on)} = 2.5 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	500	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	500	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	1.7	A
I _D	Drain Current (continuous) at T _c = 100 °C	1.1	A
I _{DM} (*)	Drain Current (pulsed)	6.8	A
P _{tot}	Total Dissipation at T _c = 25 °C	25	W
	Derating Factor	0.2	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	4000	V
T _{stg}	Storage Temperature	-65 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C

(*) Pulse width limited by safe operating area

THERMAL DATA

R _{thj-case}	Thermal Resistance Junction-case	Max	5	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	60	°C/W
R _{thj-amb}	Thermal Resistance Case-sink	Typ	0.5	°C/W
T _J	Maximum Lead Temperature For Soldering Purpose		300	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _J max, δ < 1%)	2.7	A
E _{AS}	Single Pulse Avalanche Energy (starting T _J = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	200	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _J max, δ < 1%)	5	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _J max, δ < 1%)	1.6	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	500			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 1.5 A V _{GS} = 10V I _D = 1.5 A T _c = 100°C		2.5	4 8	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	1.7			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 1.5 A	0.8	1.93		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		350	460	pF
C _{oss}	Output Capacitance			60	80	pF
C _{rss}	Reverse Transfer Capacitance			25	35	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 250\text{ V}$ $I_D = 1.5\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		35 85	45 110	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 400\text{ V}$ $I_D = 3\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		120		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 400\text{ V}$ $I_D = 3\text{ A}$ $V_{GS} = 10\text{ V}$		25 6 11	35	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$ t_f	Off-voltage Rise Time Fall Time	$V_{DD} = 400\text{ V}$ $I_D = 3\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		50 20	65 30	ns ns
t_c	Cross-over Time	(see test circuit, figure 5)		80	105	ns

SOURCE DRAIN DIODE

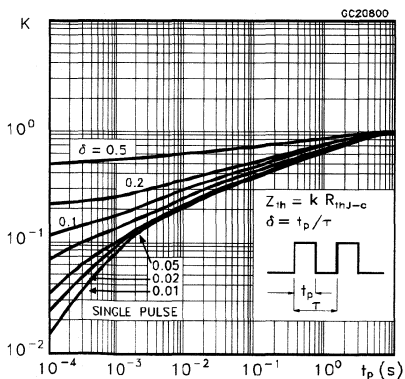
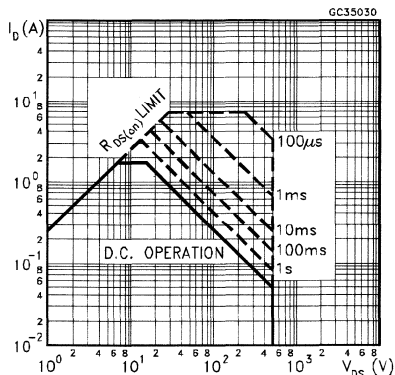
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				1.7 6.8	A A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 1.7\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr} t_f	Reverse Recovery Time Reverse Recovery Charge	$I_{SD} = 2.8\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		380		ns μ C
I_{RRM}	Reverse Recovery Current			20		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

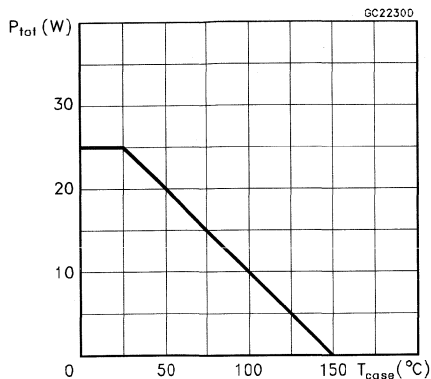
(\bullet) Pulse width limited by safe operating area

Safe Operating Area

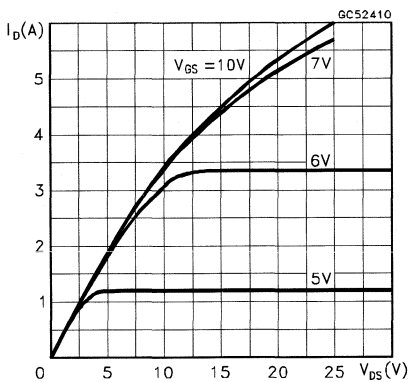
Thermal Impedance



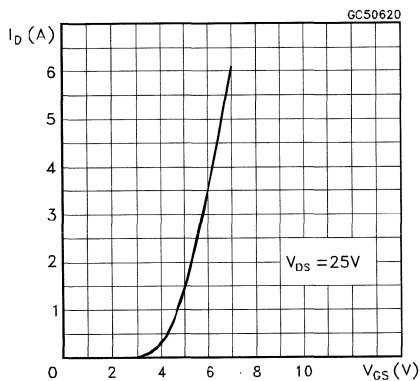
Derating Curve



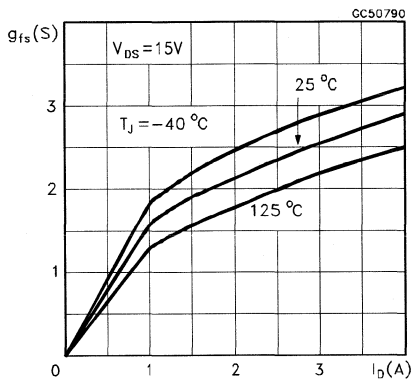
Output Characteristics



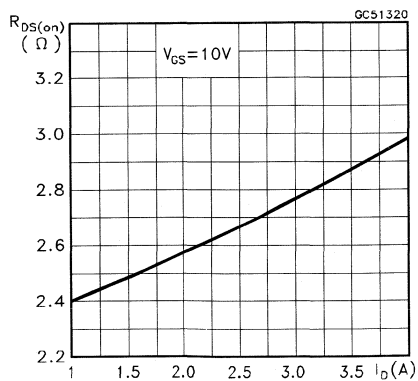
Transfer Characteristics



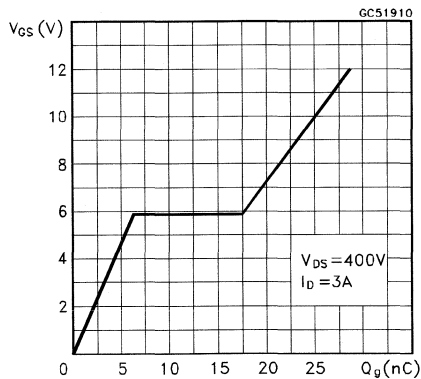
Transconductance



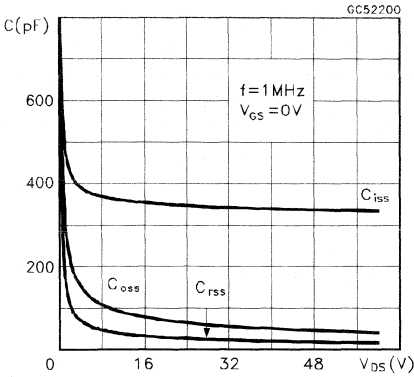
Static Drain-source On Resistance



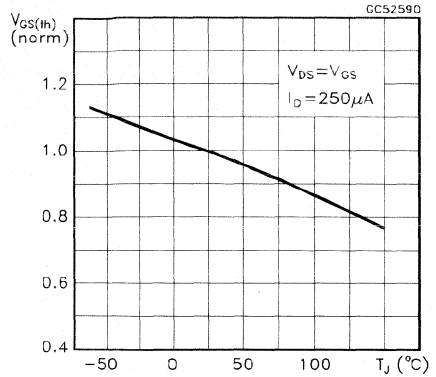
Gate Charge vs Gate-source Voltage



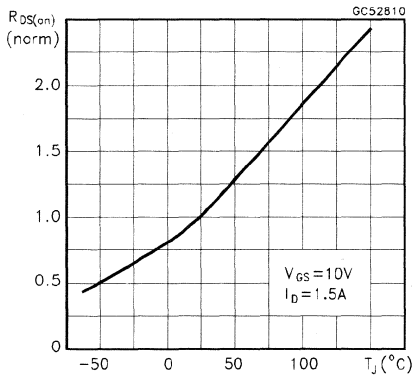
Capacitance Variations



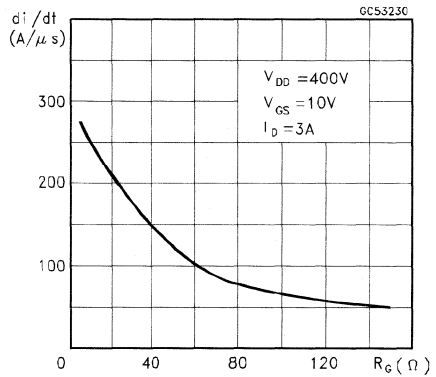
Normalized Gate Threshold Voltage vs Temperature



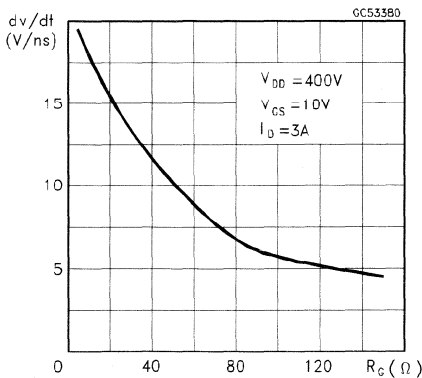
Normalized On Resistance vs Temperature



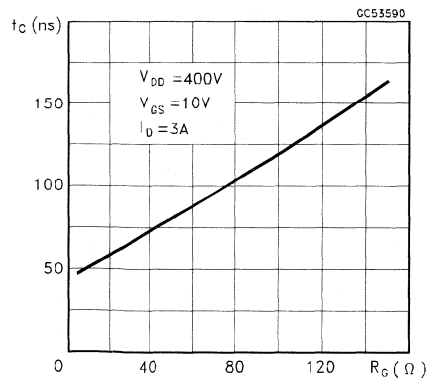
Turn-on Current Slope



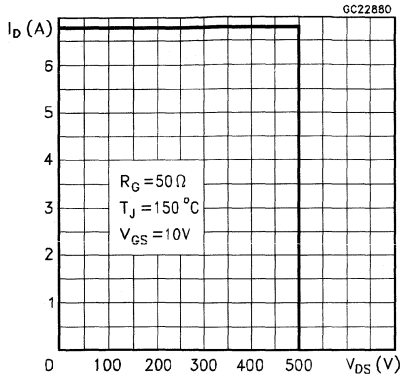
Turn-off Drain-source Voltage Slope



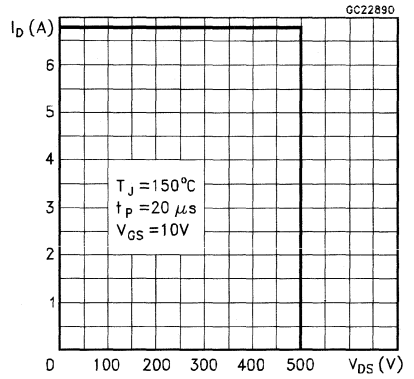
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

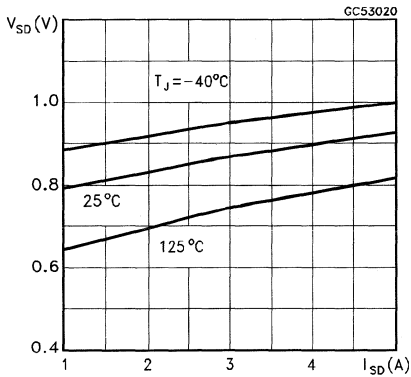


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

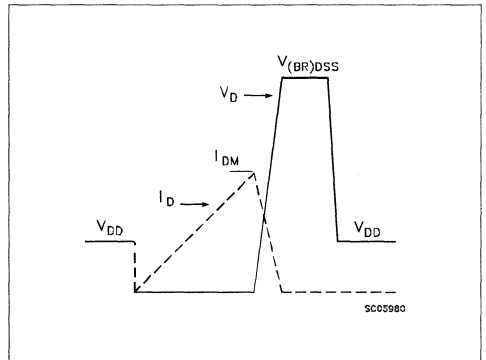
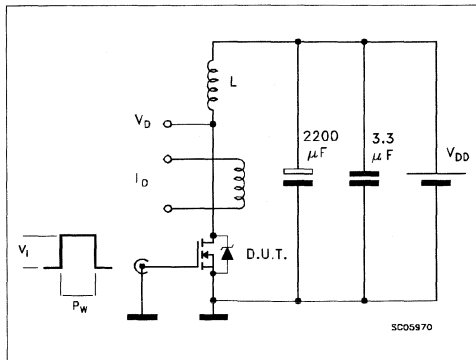


Fig. 3: Switching Times Test Circuits For Resistive Load

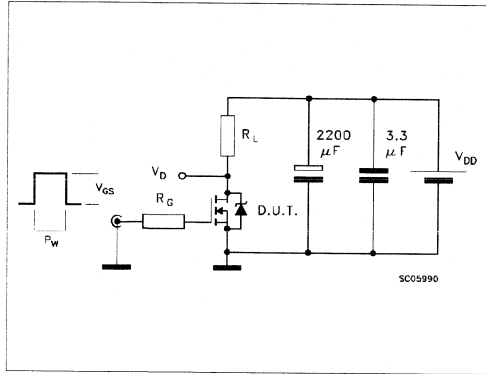


Fig. 4: Gate Charge Test Circuit

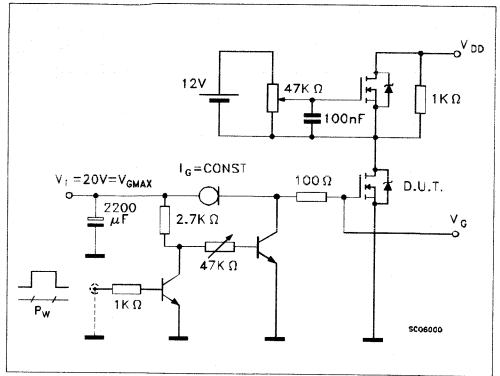
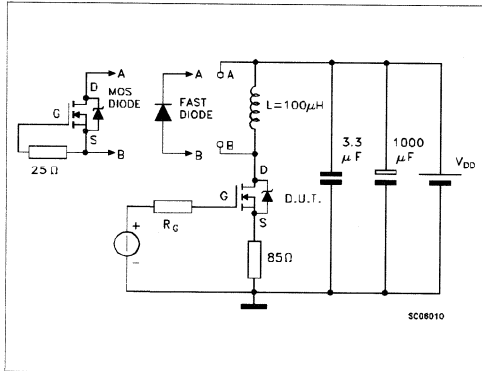


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



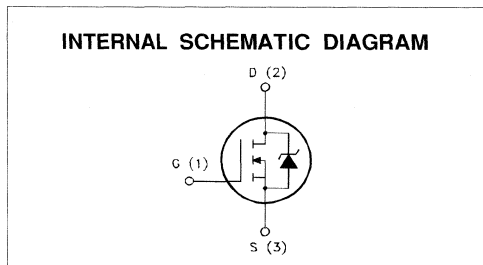
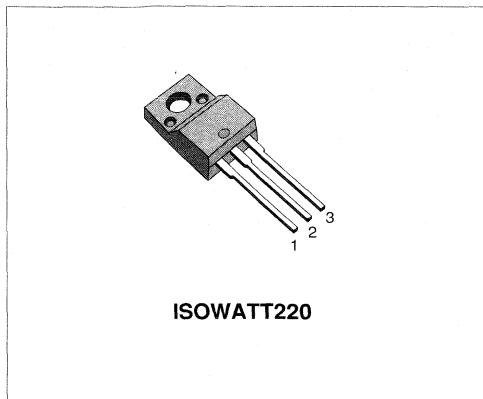
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{bss}	R _{DS(on)}	I _D
STP3N60FI	600 V	< 2.2 Ω	2.7 A

- TYPICAL R_{DS(on)} = 2 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	600	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	600	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	2.7	A
I _D	Drain Current (continuous) at T _c = 100 °C	1.7	A
I _{DM} (*)	Drain Current (pulsed)	14	A
P _{tot}	Total Dissipation at T _c = 25 °C	35	W
	Derating Factor	0.28	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	2000	V
T _{stg}	Storage Temperature	-65 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C

(*) Pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	3.57	$^{\circ}\text{C}/\text{W}$
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5	$^{\circ}\text{C}/\text{W}$
$R_{thj-amb}$	Thermal Resistance Case-sink	Typ	0.5	$^{\circ}\text{C}/\text{W}$
T_l	Maximum Lead Temperature For Soldering Purpose		300	$^{\circ}\text{C}$

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	4.3	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25^{\circ}\text{C}$, $I_D = I_{AR}$, $V_{DD} = 25\text{ V}$)	370	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	9.8	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100^{\circ}\text{C}$, pulse width limited by T_j max, $\delta < 1\%$)	2.7	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25^{\circ}\text{C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\ \mu\text{A}$ $V_{GS} = 0$	600			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^{\circ}\text{C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\ \mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 1.5\text{ A}$ $V_{GS} = 10\text{ V}$ $I_D = 1.5\text{ A}$ $T_c = 100^{\circ}\text{C}$		2	2.2 4.4	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	3			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 1.5\text{ A}$	1.5	2.6		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		560	800	pF
C_{oss}	Output Capacitance			90	130	pF
C_{rss}	Reverse Transfer Capacitance			40	50	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 225\text{ V}$ $I_D = 2.5\text{ A}$ $R_G = 15\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		45 33	60 42	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 480\text{ V}$ $I_D = 4\text{ A}$ $R_G = 15\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		200		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 480\text{ V}$ $I_D = 4\text{ A}$ $V_{GS} = 10\text{ V}$		43 6 21	55	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 480\text{ V}$ $I_D = 4\text{ A}$		35	45	ns
t_f	Fall Time	$R_G = 15\ \Omega$ $V_{GS} = 10\text{ V}$		40	55	ns
t_c	Cross-over Time	(see test circuit, figure 5)		60	75	ns

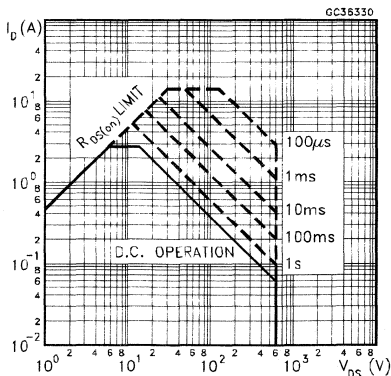
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				2.7 14	A A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 3\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 4\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		420		ns
Q_{rr}	Reverse Recovery Charge			3.7		μ C
I_{RRM}	Reverse Recovery Current			18		A

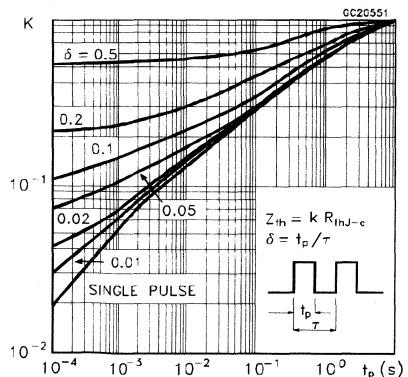
(*) Pulsed; Pulse duration = 300 μ s, duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

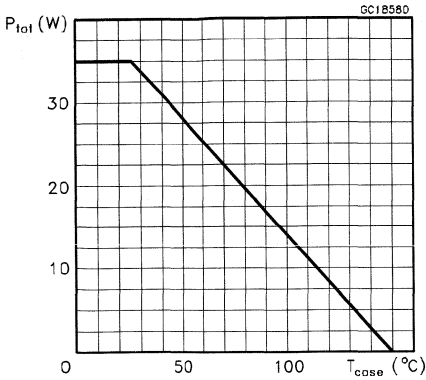
Safe Operating Area



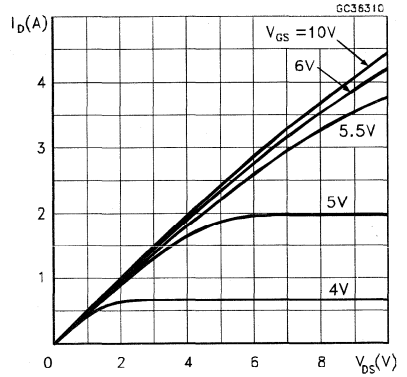
Thermal Impedance



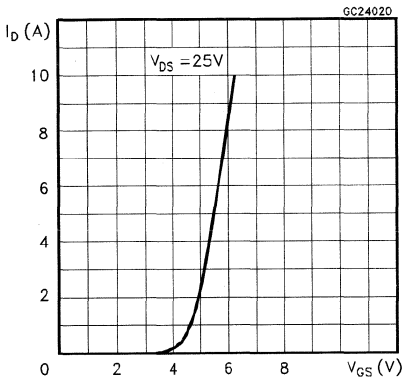
Derating Curve



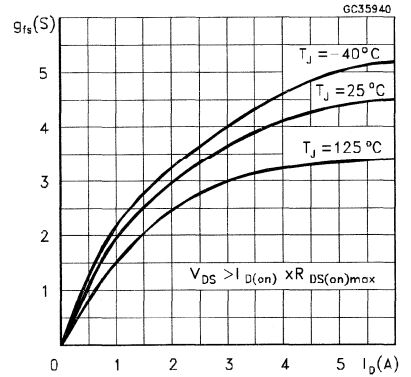
Output Characteristics



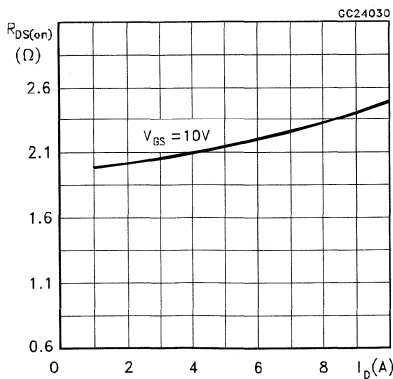
Transfer Characteristics



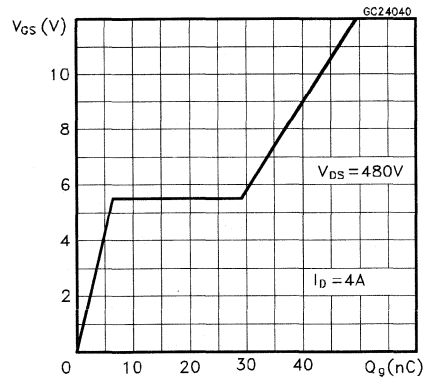
Transconductance



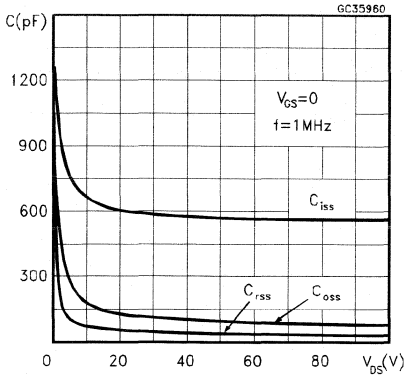
Static Drain-source On Resistance



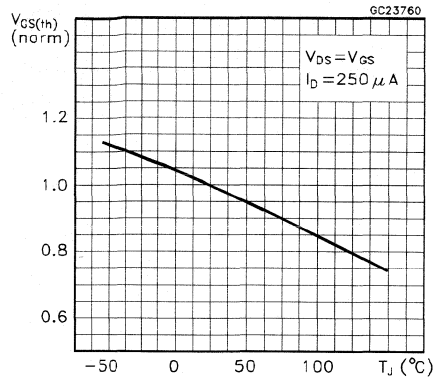
Gate Charge vs Gate-source Voltage



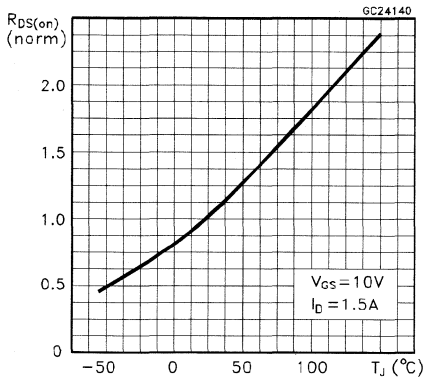
Capacitance Variations



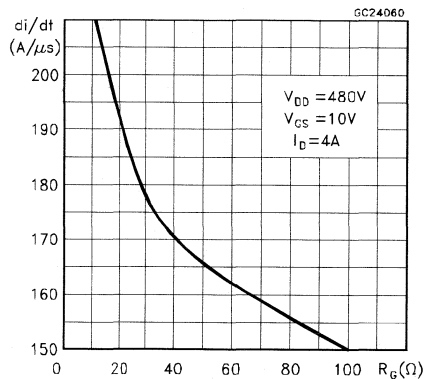
Normalized Gate Threshold Voltage vs Temperature



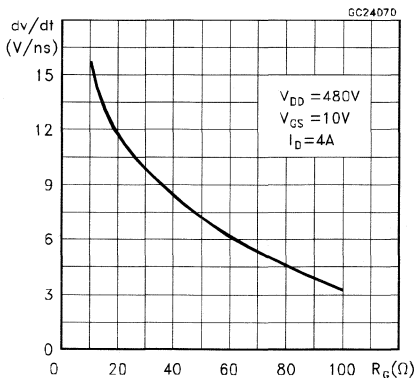
Normalized On Resistance vs Temperature



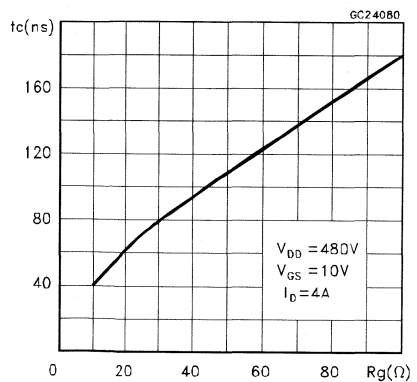
Turn-on Current Slope



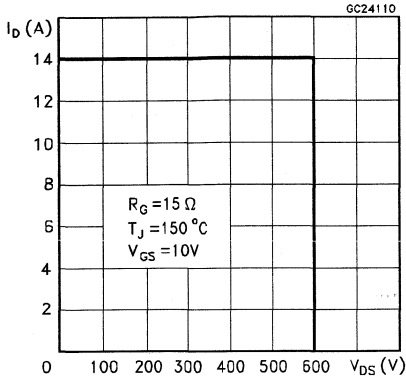
Turn-off Drain-source Voltage Slope



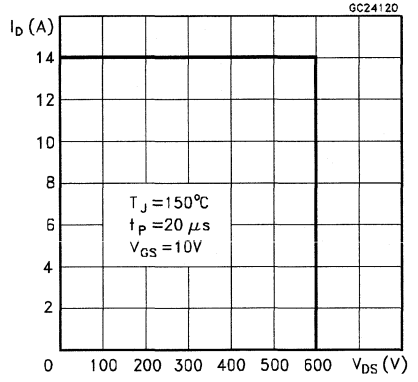
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

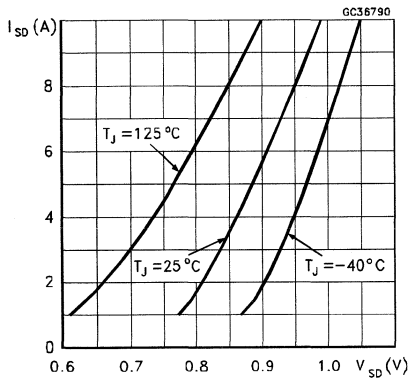


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

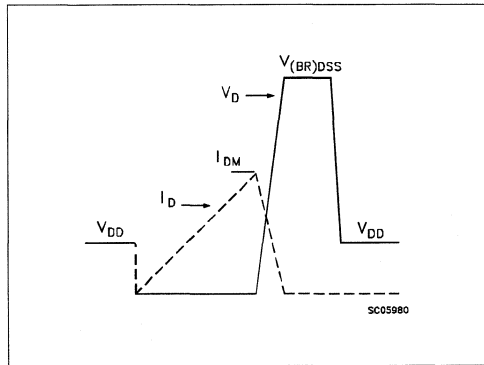
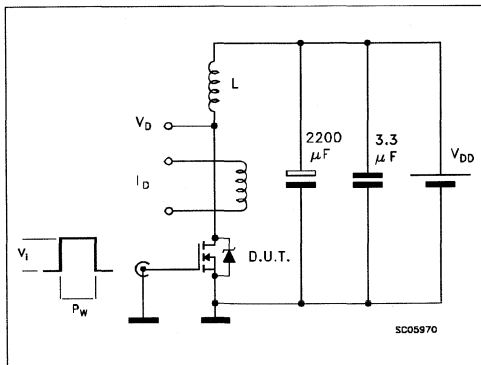


Fig. 3: Switching Times Test Circuits For Resistive Load

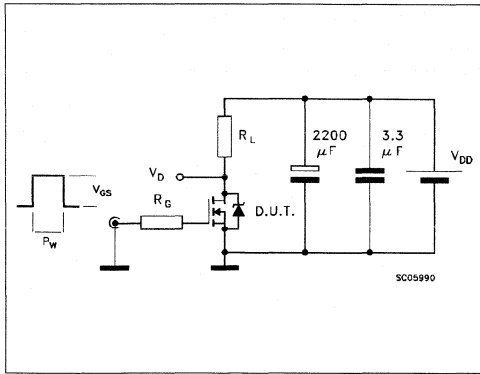


Fig. 4: Gate Charge Test Circuit

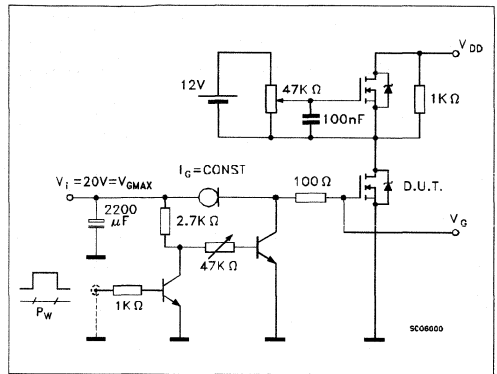
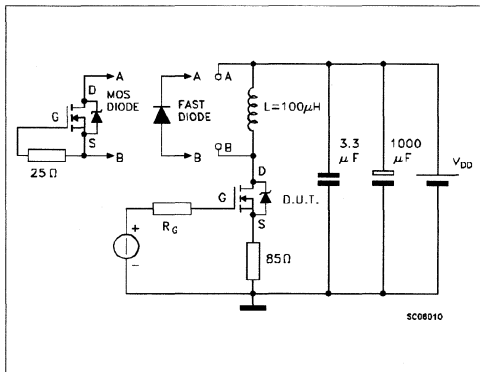


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



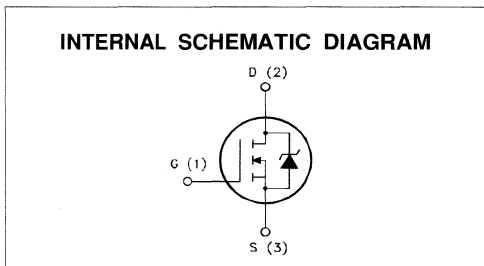
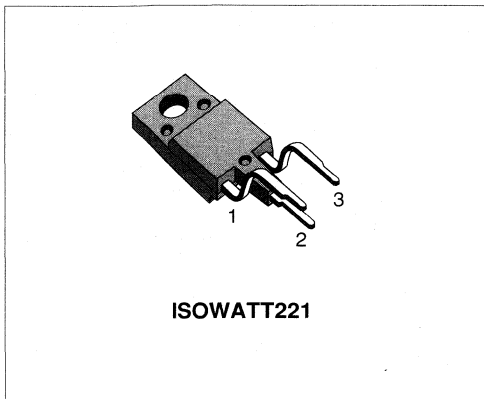
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP3N60XI	600 V	< 2.5 Ω	2.4 A

- TYPICAL R_{DS(on)} = 2 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	600	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	600	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	2.4	A
I _D	Drain Current (continuous) at T _c = 100 °C	1.6	A
I _{DM} (*)	Drain Current (pulsed)	9.6	A
P _{tot}	Total Dissipation at T _c = 25 °C	28	W
	Derating Factor	0.22	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	4000	V
T _{stg}	Storage Temperature	-65 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C

(*) Pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	4.46	$^{\circ}C/W$
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	60	$^{\circ}C/W$
$R_{thj-amb}$	Thermal Resistance Case-sink	Typ	0.5	$^{\circ}C/W$
T_l	Maximum Lead Temperature For Soldering Purpose		300	$^{\circ}C$

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	3	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25^{\circ}C$, $I_D = I_{AR}$, $V_{DD} = 50$ V)	180	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	3.5	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100^{\circ}C$, pulse width limited by T_j max, $\delta < 1\%$)	1.6	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25^{\circ}C$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250 \mu A$ $V_{GS} = 0$	600			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^{\circ}C$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20$ V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250 \mu A$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10$ V $I_D = 1.5$ A $V_{GS} = 10$ V $I_D = 1.5$ A $T_c = 100^{\circ}C$		2	2.5 5	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10$ V	2.4			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 1.5$ A	1.5	2.6		S
C_{iss}	Input Capacitance	$V_{DS} = 25$ V $f = 1$ MHz $V_{GS} = 0$		560	800	pF
C_{oss}	Output Capacitance			90	130	pF
C_{rss}	Reverse Transfer Capacitance			40	50	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 225\text{ V}$ $I_D = 2.5\text{ A}$ $R_G = 15\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		45 33	60 42	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 480\text{ V}$ $I_D = 4\text{ A}$ $R_G = 15\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		200		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 400\text{ V}$ $I_D = 4\text{ A}$ $V_{GS} = 10\text{ V}$		43 6 21	55	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$ t_f t_c	Off-voltage Rise Time Fall Time Cross-over Time	$V_{DD} = 480\text{ V}$ $I_D = 4\text{ A}$ $R_G = 15\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		35 40 60	45 55 75	ns ns ns

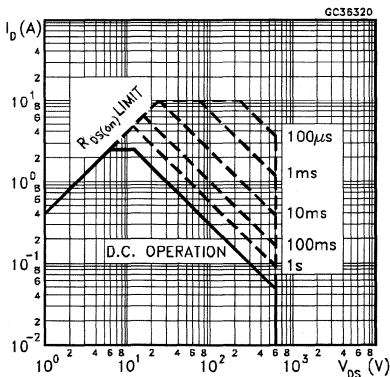
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				2.4 9.6	A A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 2.4\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 4\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_R = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		420		ns
Q_{rr}	Reverse Recovery Charge			3.7		μ C
I_{RRM}	Reverse Recovery Current			18		A

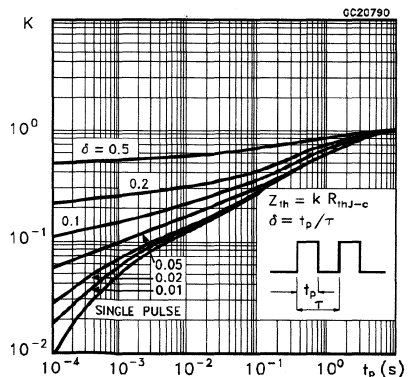
(*) Pulsed; Pulse duration = 300 μ s, duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

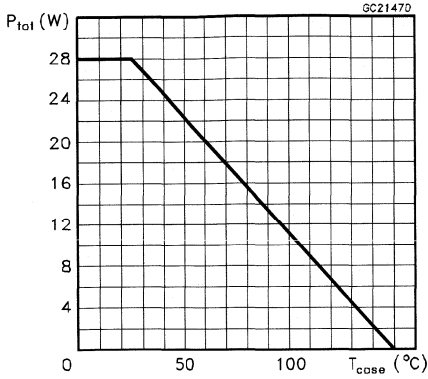
Safe Operating Area



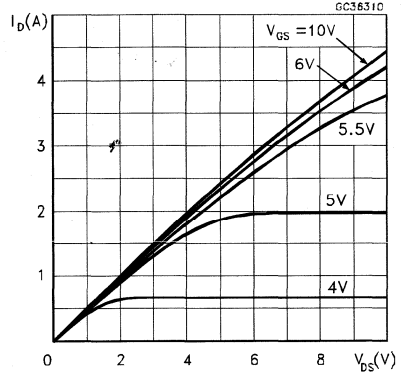
Thermal Impedance



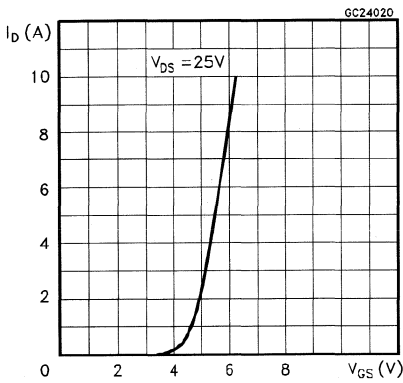
Derating Curve



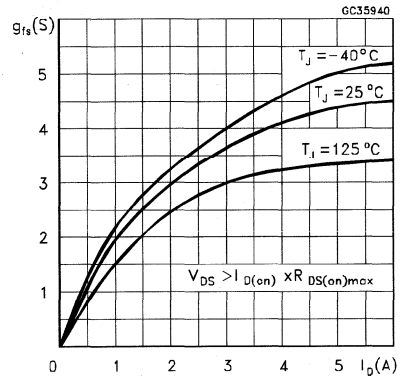
Output Characteristics



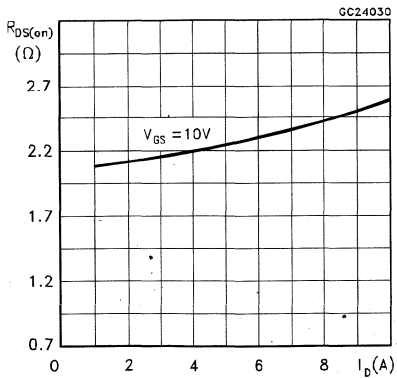
Transfer Characteristics



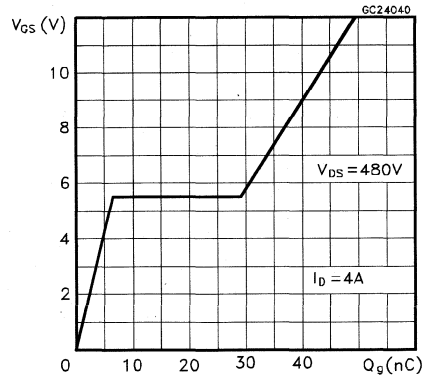
Transconductance



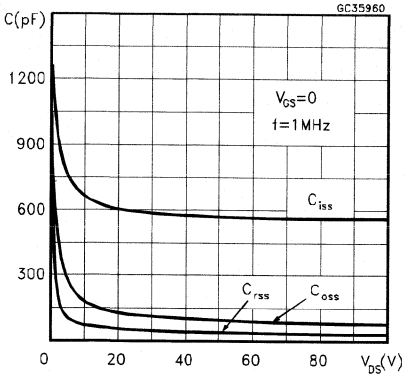
Static Drain-source On Resistance



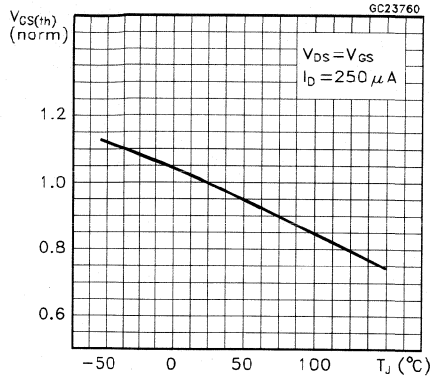
Gate Charge vs Gate-source Voltage



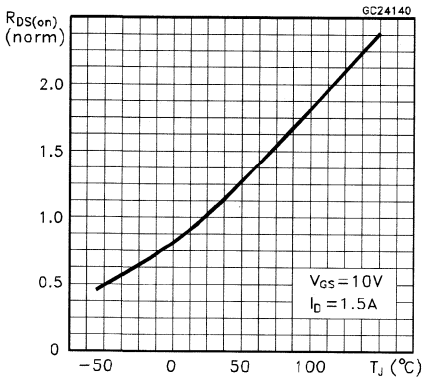
Capacitance Variations



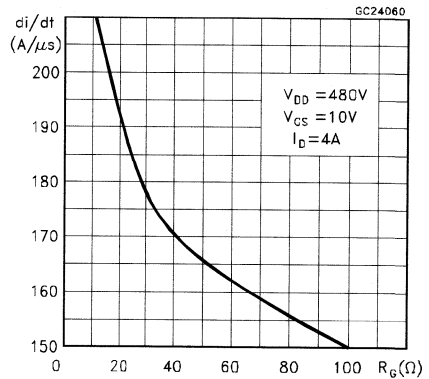
Normalized Gate Threshold Voltage vs Temperature



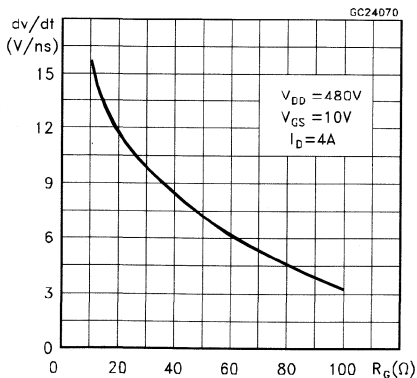
Normalized On Resistance vs Temperature



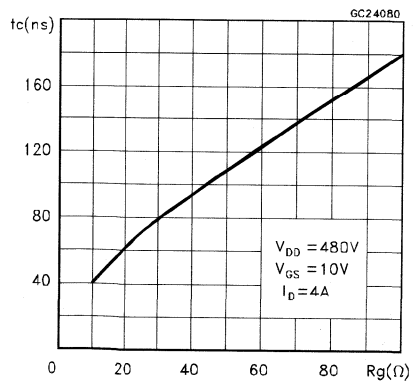
Turn-on Current Slope



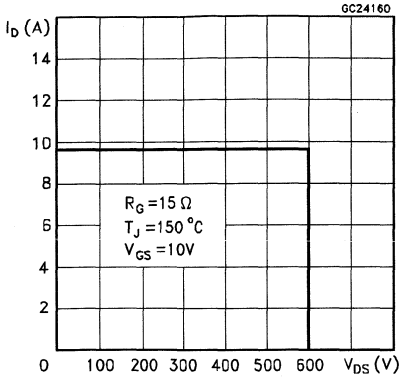
Turn-off Drain-source Voltage Slope



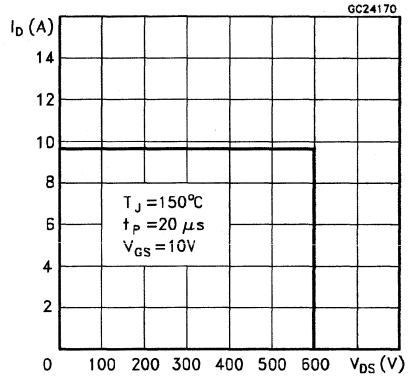
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

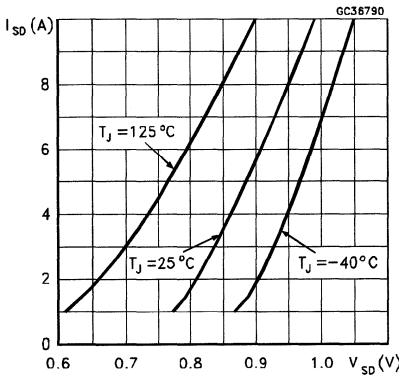


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

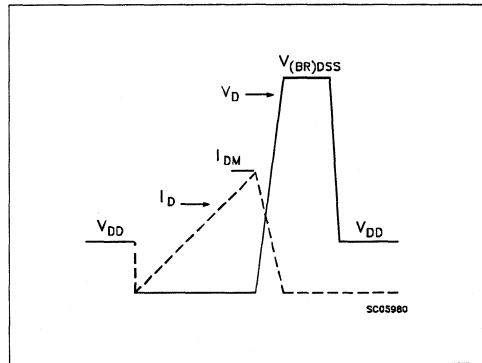
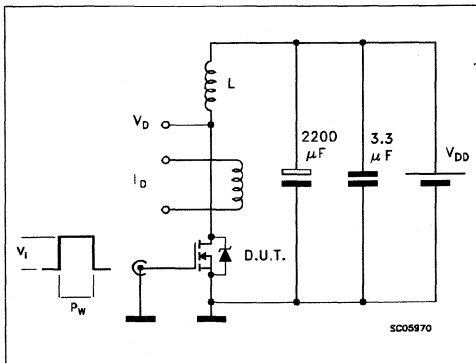


Fig. 3: Switching Times Test Circuits For Resistive Load

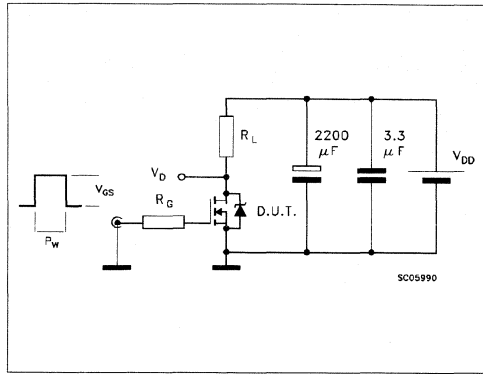


Fig. 4: Gate Charge Test Circuit

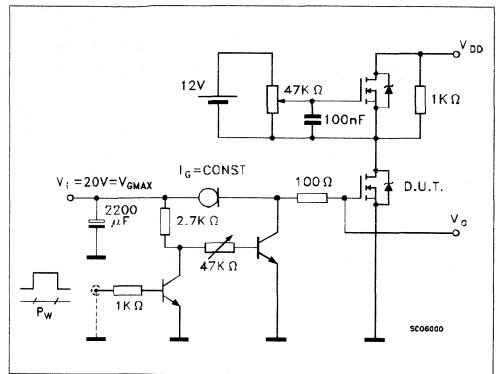
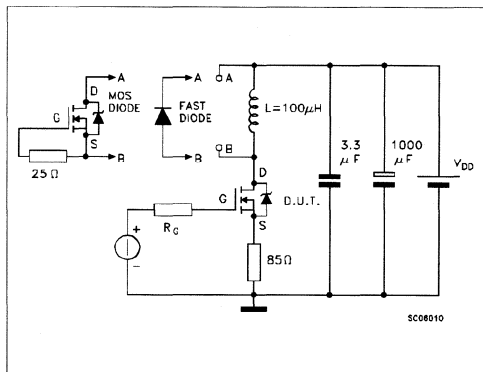


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



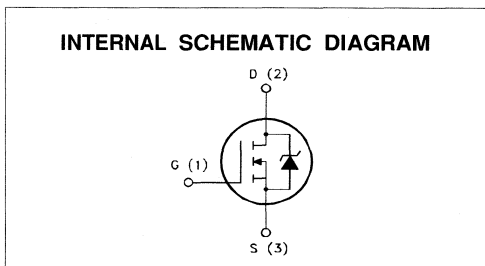
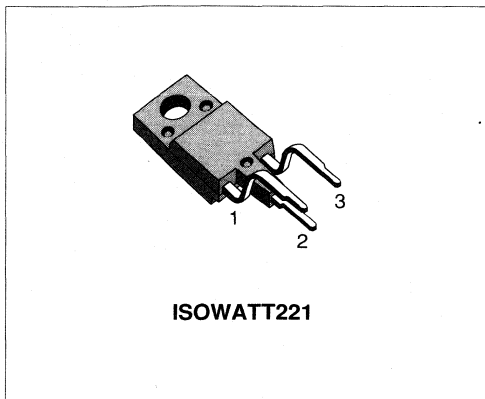
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP3N80XI	800 V	< 4.5 Ω	1.7 A

- TYPICAL R_{DS(on)} = 3.9 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INPUT CAPACITANCE
- LOW GATE CHARGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CONSUMER AND INDUSTRIAL LIGHTING
- DC-AC INVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLY (UPS)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	800	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	800	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	1.7	A
I _D	Drain Current (continuous) at T _c = 100 °C	1.1	A
I _{DM} (*)	Drain Current (pulsed)	6.8	A
P _{tot}	Total Dissipation at T _c = 25 °C	28	W
	Derating Factor	0.22	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	4000	V
T _{stg}	Storage Temperature	-65 to 150	°C

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	4.46	$^{\circ}\text{C}/\text{W}$
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	60	$^{\circ}\text{C}/\text{W}$
$R_{thj-amb}$	Thermal Resistance Case-sink	Typ	0.5	$^{\circ}\text{C}/\text{W}$
T_I	Maximum Lead Temperature For Soldering Purpose		300	$^{\circ}\text{C}$

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	3.2	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25^{\circ}\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	160	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	4.2	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100^{\circ}\text{C}$, pulse width limited by T_j max, $\delta < 1\%$)	2	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25^{\circ}\text{C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\ \mu\text{A}$ $V_{GS} = 0$	800			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^{\circ}\text{C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\ \mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 1.7\text{ A}$ $V_{GS} = 10\text{ V}$ $I_D = 1.7\text{ A}$ $T_c = 100^{\circ}\text{C}$		3.9	4.5 9	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	1.7			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 1.7\text{ A}$	1	3.5		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		650	850	pF
C_{oss}	Output Capacitance			82	105	pF
C_{rss}	Reverse Transfer Capacitance			28	40	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 30\text{ V}$ $I_D = 2.1\text{ A}$		40	50	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		90	115	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 640\text{ V}$ $I_D = 3\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		170		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 400\text{ V}$ $I_D = 3\text{ A}$ $V_{GS} = 10\text{ V}$		42	55	nC
Q_{gs}	Gate-Source Charge			6		nC
Q_{gd}	Gate-Drain Charge			17		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 640\text{ V}$ $I_D = 3\text{ A}$		95	120	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		20	25	ns
t_c	Cross-over Time	(see test circuit, figure 5)		120	150	ns

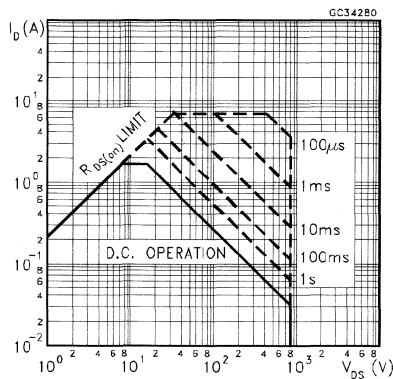
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				1.7	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				6.8	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 1.7\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 3\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 80\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		700		ns
Q_{rr}	Reverse Recovery Charge			8.8		μC
I_{RRM}	Reverse Recovery Current			25		A

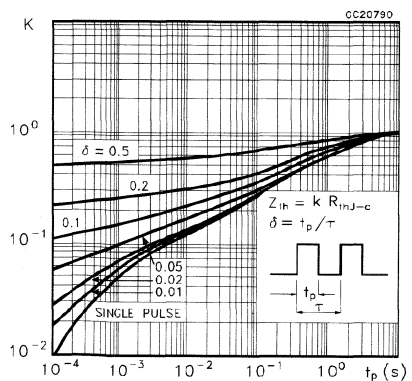
(\ast) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

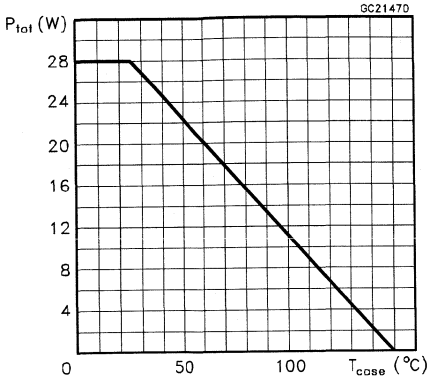
Safe Operating Area



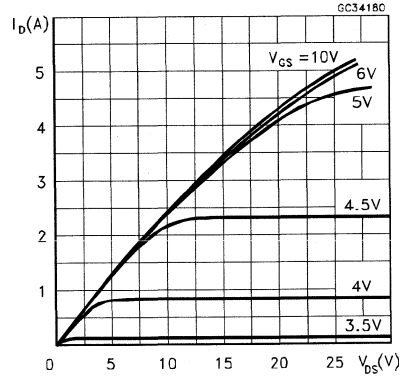
Thermal Impedance



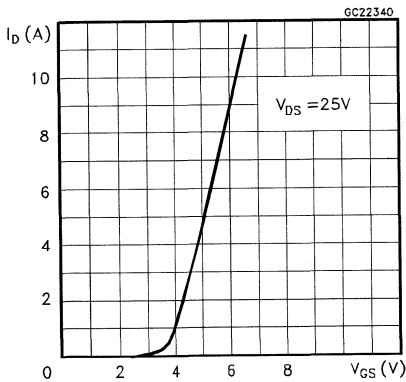
Derating Curve



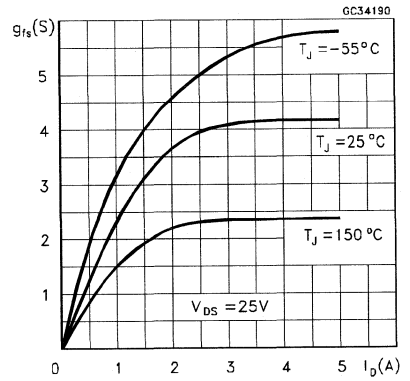
Output Characteristics



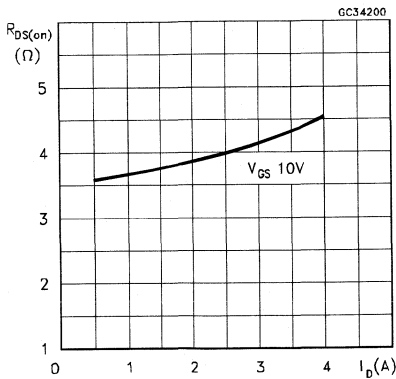
Transfer Characteristics



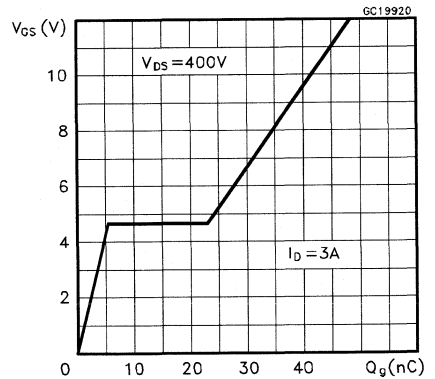
Transconductance



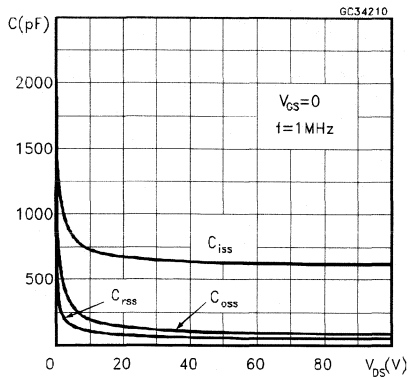
Static Drain-source On Resistance



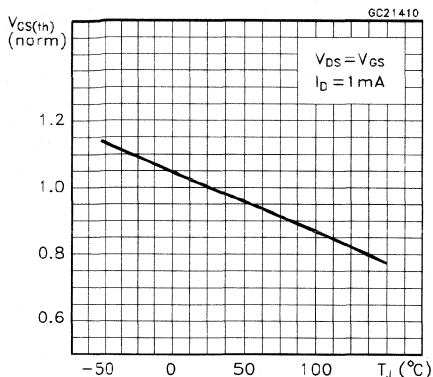
Gate Charge vs Gate-source Voltage



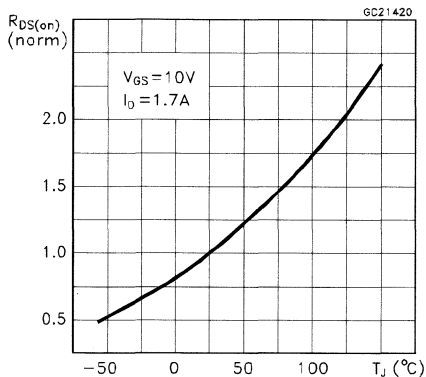
Capacitance Variations



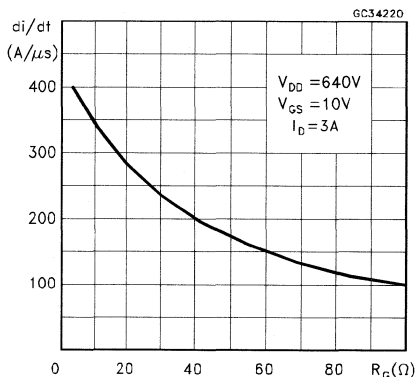
Normalized Gate Threshold Voltage vs Temperature



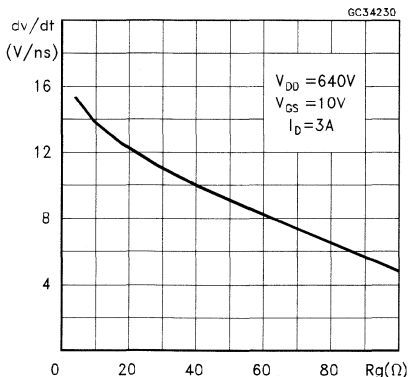
Normalized On Resistance vs Temperature



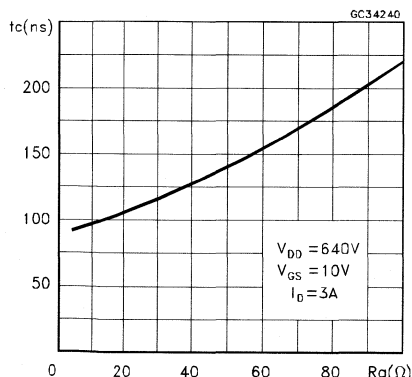
Turn-on Current Slope



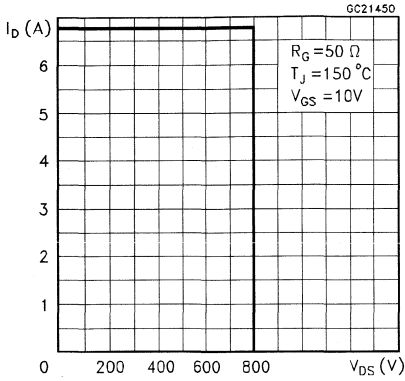
Turn-off Drain-source Voltage Slope



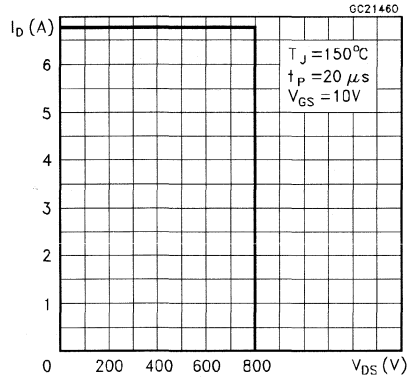
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

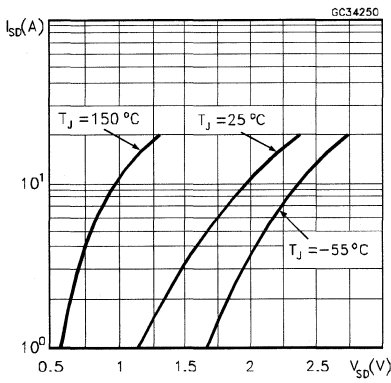


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

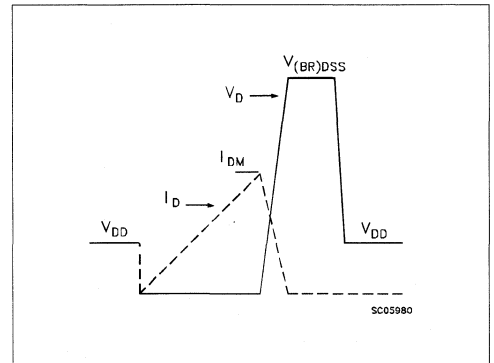
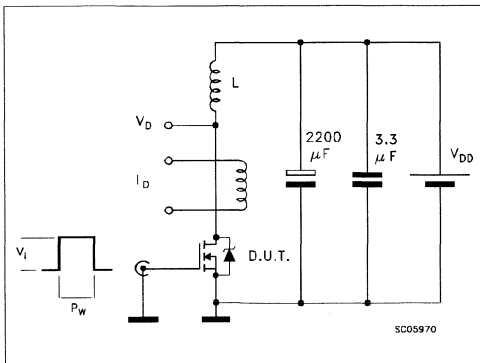


Fig. 3: Switching Times Test Circuits For Resistive Load

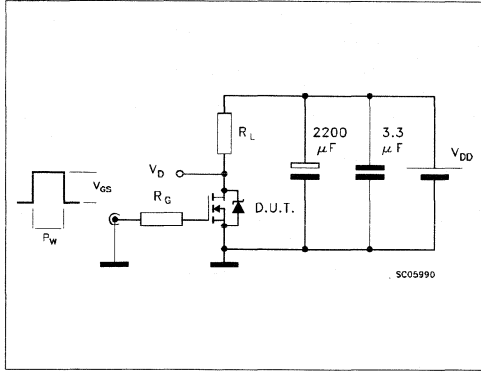


Fig. 4: Gate Charge Test Circuit

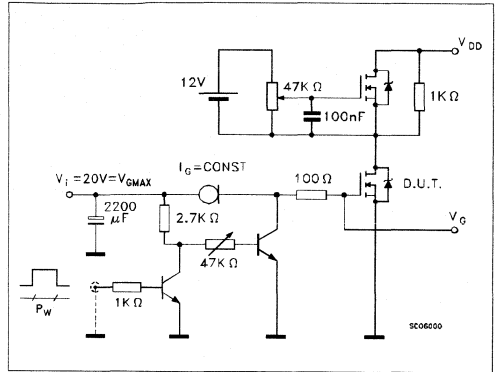
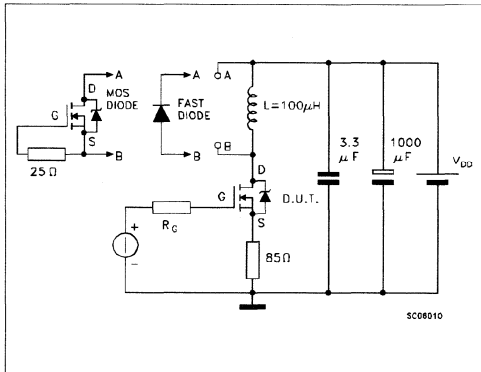


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



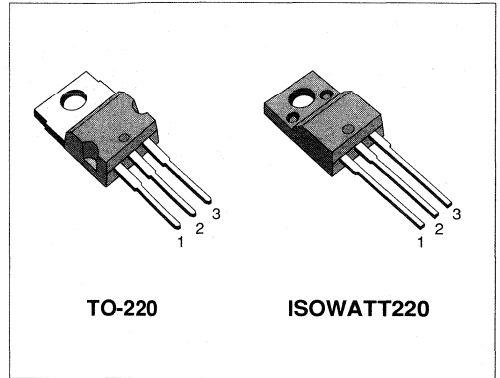
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP3N90	900 V	< 4.5 Ω	3.2 A
STP3N90FI	900 V	< 4.5 Ω	1.9 A

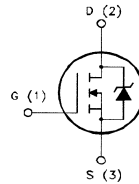
- TYPICAL R_{DS(on)} = 3.9 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INPUT CAPACITANCE
- LOW GATE CHARGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CONSUMER AND INDUSTRIAL LIGHTING
- DC-AC INVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLY (UPS)



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP3N90	STP3N90FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	900		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	900		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	3.2	1.9	A
I _D	Drain Current (continuous) at T _c = 100 °C	2	1.2	A
I _{DM} (*)	Drain Current (pulsed)	13	13	A
P _{tot}	Total Dissipation at T _c = 25 °C	100	40	W
	Derating Factor	0.8	0.32	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
$R_{thj-case}$	Thermal Resistance Junction-case	Max	1.25	3.12	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5		°C/W
$R_{thc-sink}$	Thermal Resistance Case-sink	Typ	0.5		°C/W
T_j	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	3.2	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ °C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	160	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	4.2	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ °C}$, pulse width limited by T_j max, $\delta < 1\%$)	2	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$	900			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\text{ }\mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 1.7\text{ A}$ $V_{GS} = 10\text{ V}$ $I_D = 1.7\text{ A}$ $T_c = 100\text{ °C}$		3.9	4.5 9	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	3.2			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 1.7\text{ A}$	1	3.5		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		650	850	pF
C_{oss}	Output Capacitance			82	105	pF
C_{rss}	Reverse Transfer Capacitance			28	40	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 30\text{ V}$ $I_D = 2.1\text{ A}$			50	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)			110	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 640\text{ V}$ $I_D = 3\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		170		A/ μs
Q_g	Total Gate Charge	$V_{DD} = 400\text{ V}$ $I_D = 3\text{ A}$ $V_{GS} = 10\text{ V}$		42	55	nC
Q_{gs}	Gate-Source Charge			6		nC
Q_{gd}	Gate-Drain Charge			17		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 640\text{ V}$ $I_D = 3\text{ A}$		95	120	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		20	25	ns
t_c	Cross-over Time	(see test circuit, figure 5)		120	165	ns

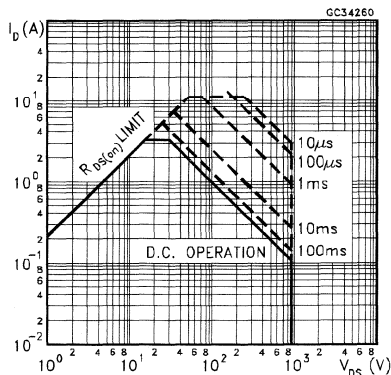
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				3.2	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				13	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 3.2\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 3\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 80\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		700		ns
Q_{rr}	Reverse Recovery Charge			8.8		μC
I_{RRM}	Reverse Recovery Current			25		A

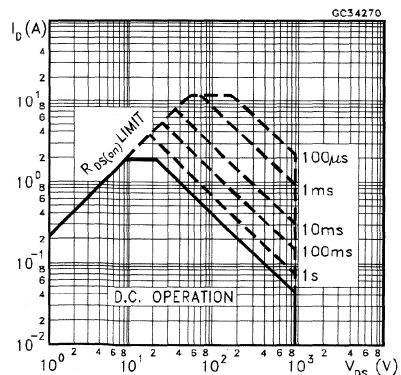
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

(•) Pulse width limited by safe operating area

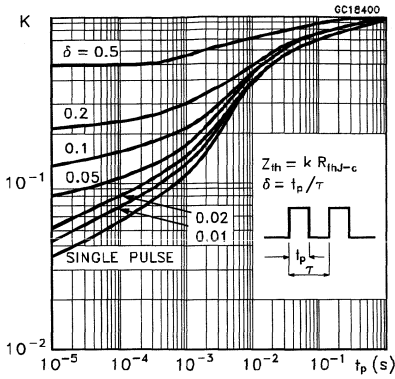
Safe Operating Areas For TO220



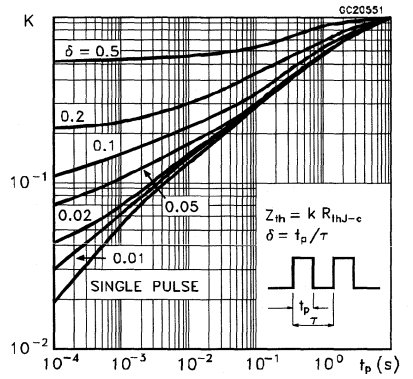
Safe Operating Areas For ISOWATT220



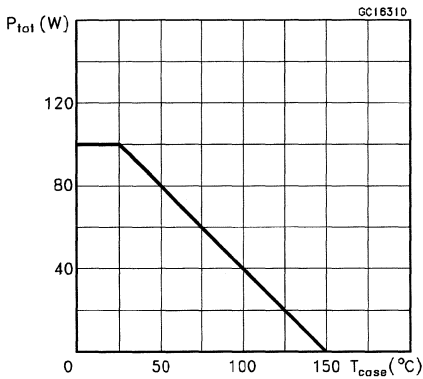
Thermal Impedance For TO-220



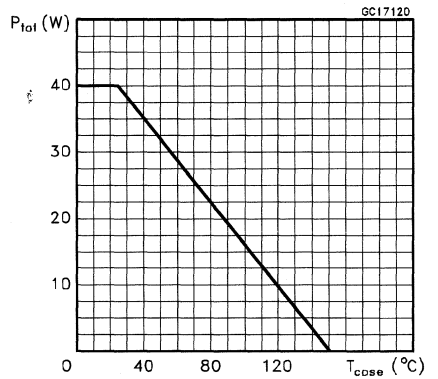
Thermal Impedance For ISOWATT220



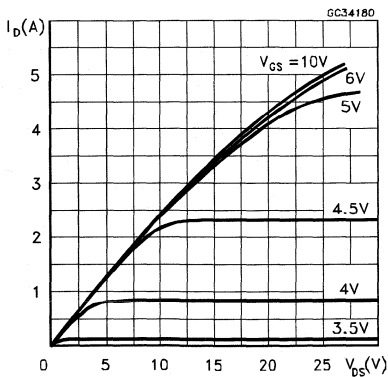
Derating Curve For TO-220



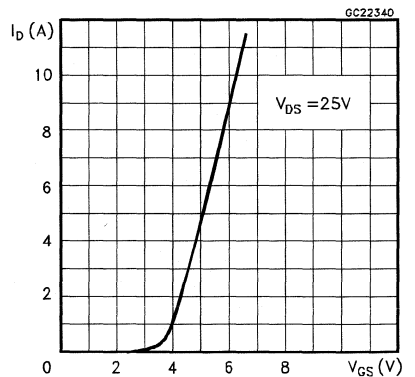
Derating Curve For ISOWATT220



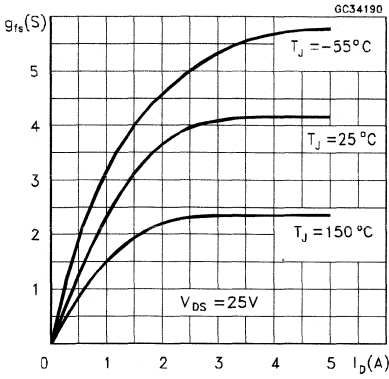
Output Characteristics



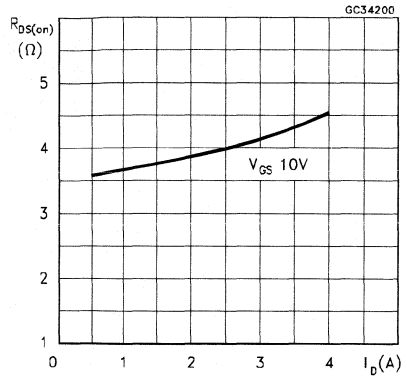
Transfer Characteristics



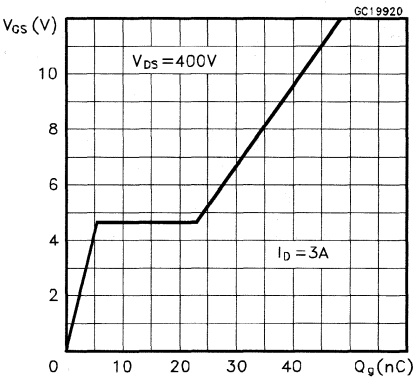
Transconductance



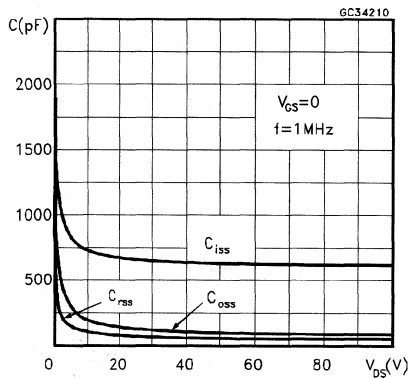
Static Drain-source On Resistance



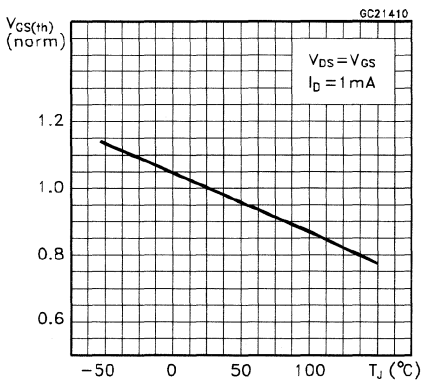
Gate Charge vs Gate-source Voltage



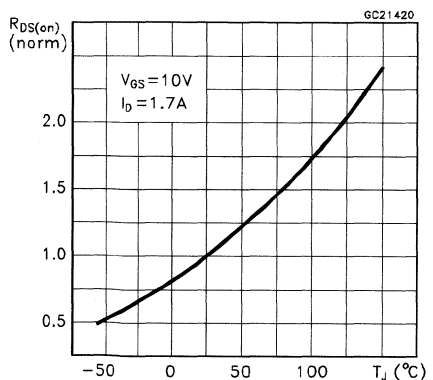
Capacitance Variations



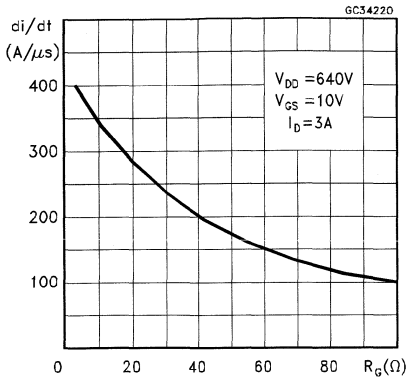
Normalized Gate Threshold Voltage vs Temperature



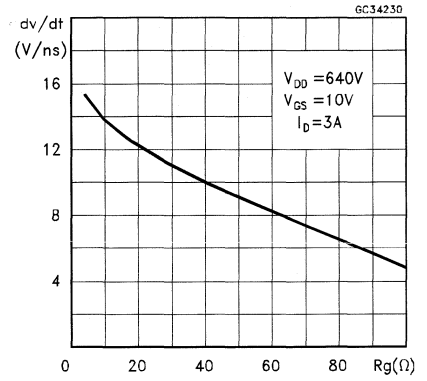
Normalized On Resistance vs Temperature



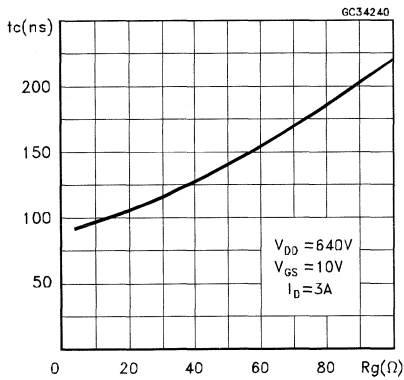
Turn-on Current Slope



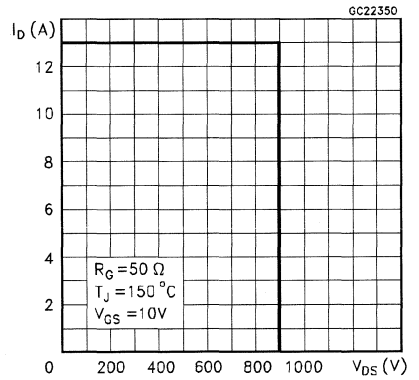
Turn-off Drain-source Voltage Slope



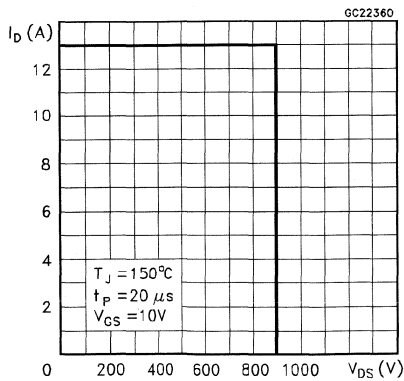
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

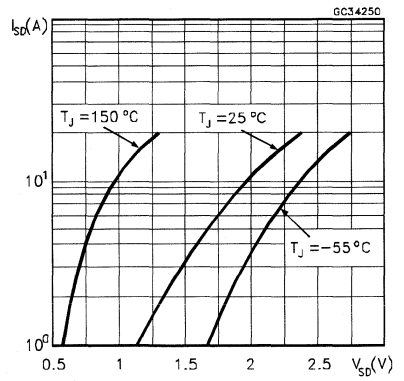


Fig. 1: Unclamped Inductive Load Test Circuits

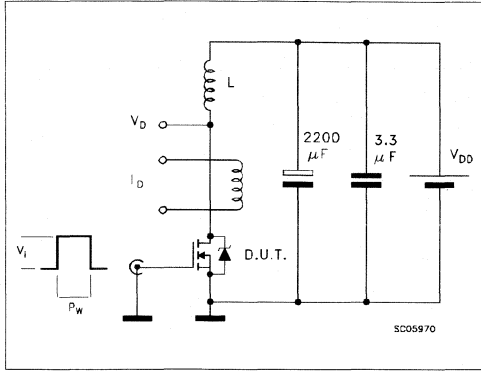


Fig. 2: Unclamped Inductive Waveforms

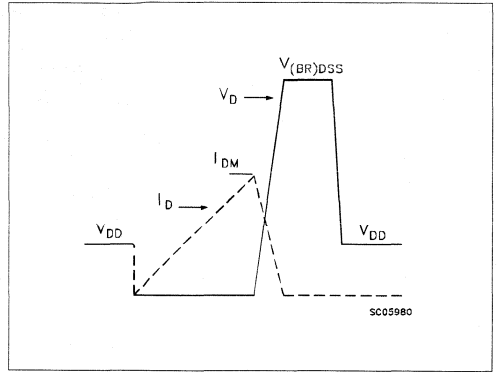


Fig. 3: Switching Times Test Circuits For Resistive Load

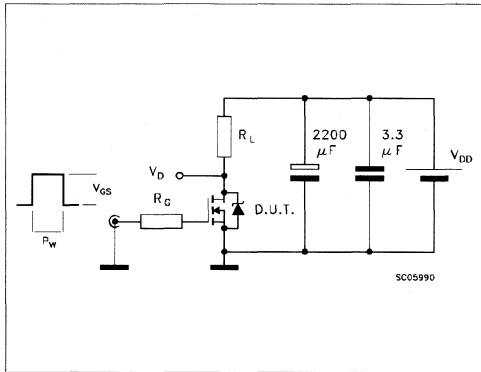


Fig. 4: Gate Charge Test Circuit

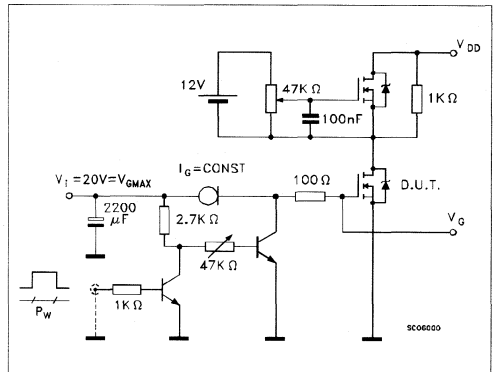
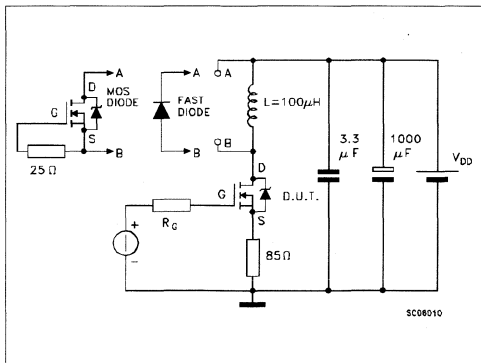


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



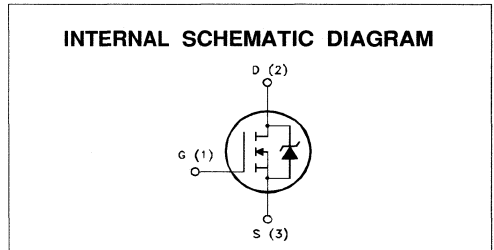
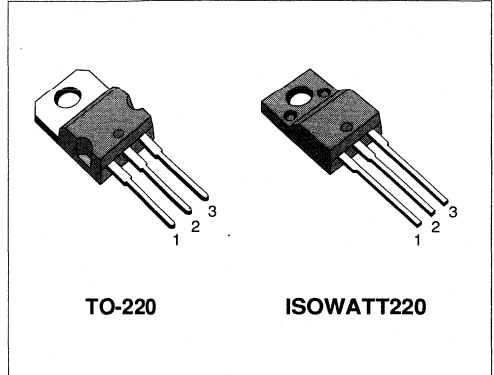
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP3N100	1000 V	< 5 Ω	3.5 A
STP3N100FI	1000 V	< 5 Ω	2 A

- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INPUT CAPACITANCE
- LOW GATE CHARGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CONSUMER AND INDUSTRIAL LIGHTING
- DC-AC INVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLY (UPS)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP3N100	STP3N100FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	1000		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	1000		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	3.5	2	A
I _D	Drain Current (continuous) at T _c = 100 °C	2	1.2	A
I _{DM} (*)	Drain Current (pulsed)	14	14	A
P _{tot}	Total Dissipation at T _c = 25 °C	100	40	W
	Derating Factor	0.8	0.32	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _J	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case	Max	1.25	3.12	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max		62.5	°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ		0.5	°C/W
T _l	Maximum Lead Temperature For Soldering Purpose			300	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current (repetitive or not-repetitive, T _j = 25 °C)	3.5	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	130	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	6	mJ
I _{AR}	Avalanche Current (repetitive or not-repetitive, T _j = 100 °C)	2	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	1000			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 1.5 A V _{GS} = 10V I _D = 1.5 A T _c = 100°C			5 10	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} × R _{DS(on)max} V _{GS} = 10 V	3.5			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs}	Forward Transconductance	V _{DS} > I _{D(on)} × R _{DS(on)max} I _D = 1.5 A	1	1.8		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		750	950	pF
C _{oss}	Output Capacitance			80	110	pF
C _{rss}	Reverse Transfer Capacitance			25	40	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 400\text{ V}$ $I_D = 1.8\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		70 70	90 90	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 600\text{ V}$ $I_D = 3.5\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		100		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 400\text{ V}$ $I_D = 3.5\text{ A}$ $V_{GS} = 10\text{ V}$		48 7 24	60	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(v_{off})$ t_f	Off-voltage Rise Time Fall Time	$V_{DD} = 600\text{ V}$ $I_D = 3.5\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		90 60	115 75	ns ns
t_c	Cross-over Time	(see test circuit, figure 5)		130	165	ns

SOURCE DRAIN DIODE

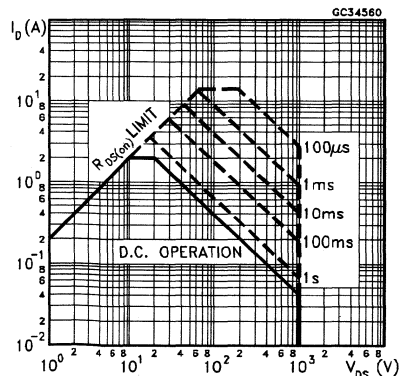
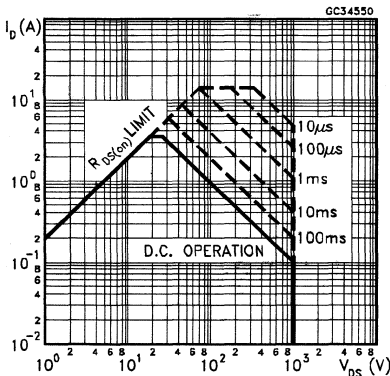
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				3.5 14	A A
V_{SD}	Forward On Voltage	$I_{SD} = 3.5\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 3.5\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		900		ns
Q_{rr}	Reverse Recovery Charge			10		μ C
I_{RRM}	Reverse Recovery Current			23		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

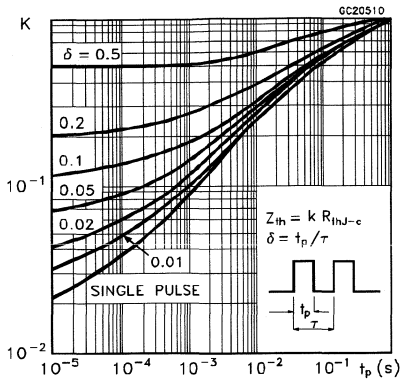
(•) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

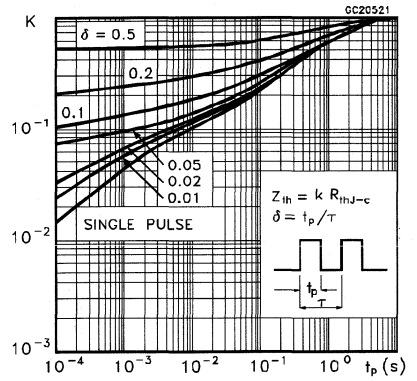
Safe Operating Areas For ISOWATT220



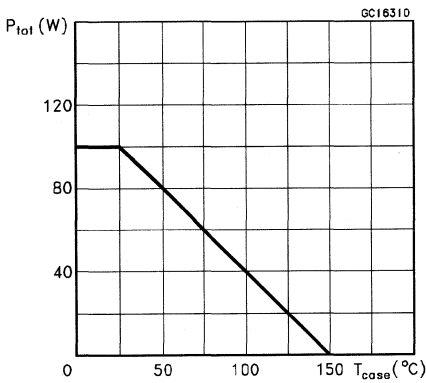
Thermal Impedance For TO-220



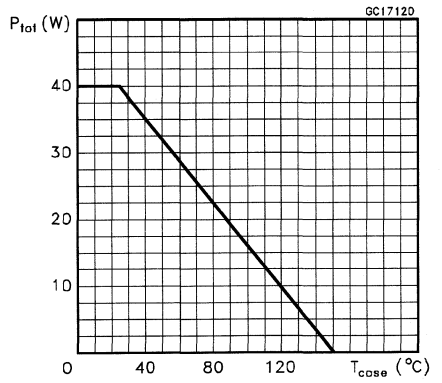
Thermal Impedance For ISOWATT220



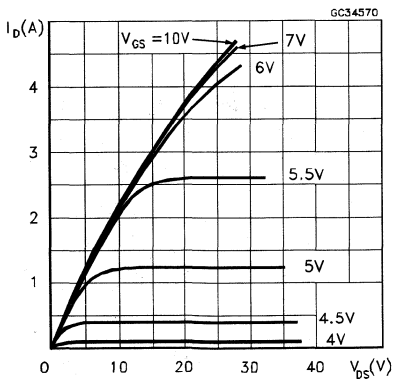
Derating Curve For TO-220



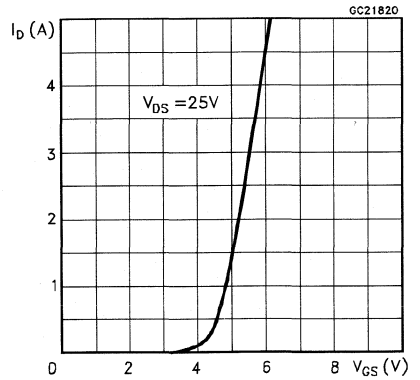
Derating Curve For ISOWATT220



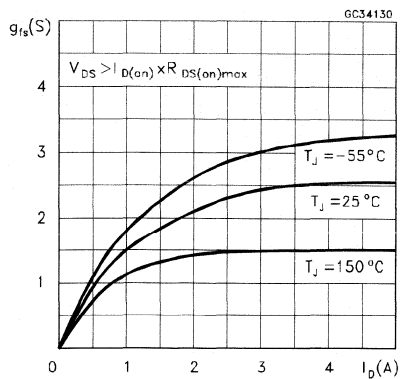
Output Characteristics



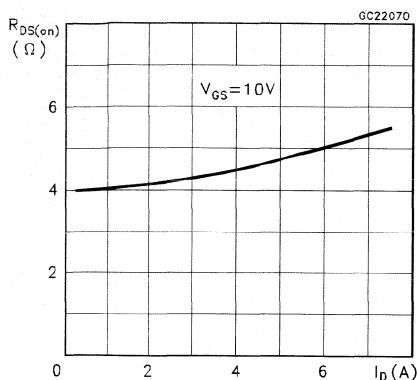
Transfer Characteristics



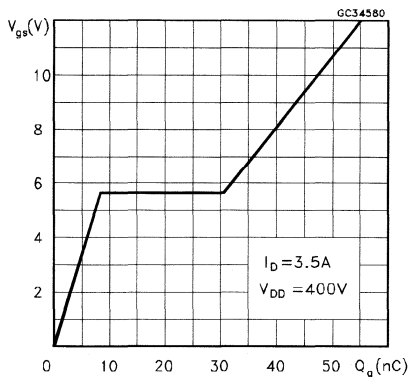
Transconductance



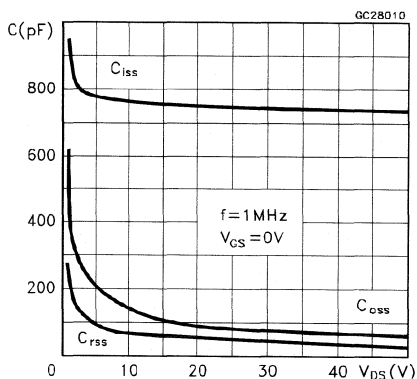
Static Drain-source On Resistance



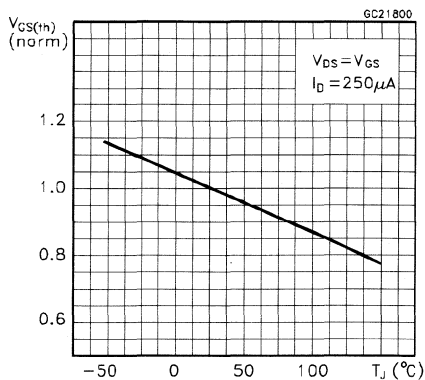
Gate Charge vs Gate-source Voltage



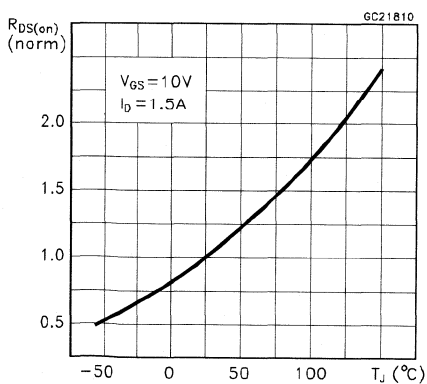
Capacitance Variations



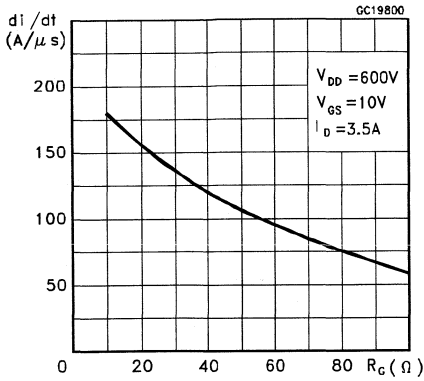
Normalized Gate Threshold Voltage vs Temperature



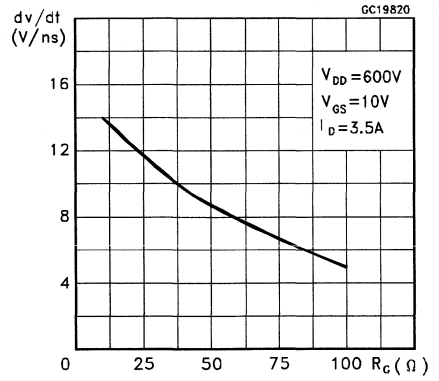
Normalized On Resistance vs Temperature



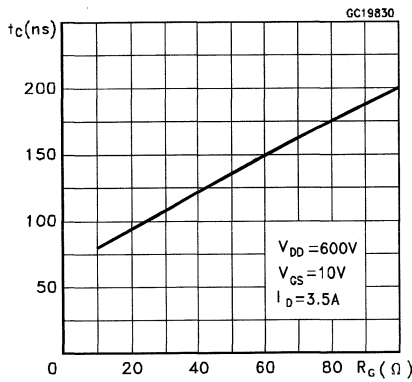
Turn-on Current Slope



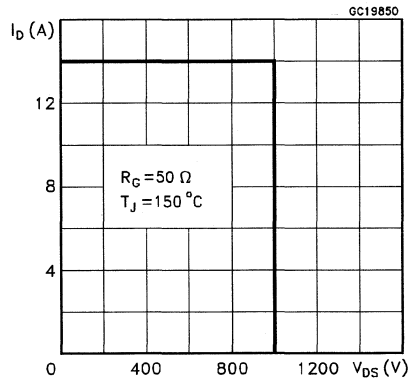
Turn-off Drain-source Voltage Slope



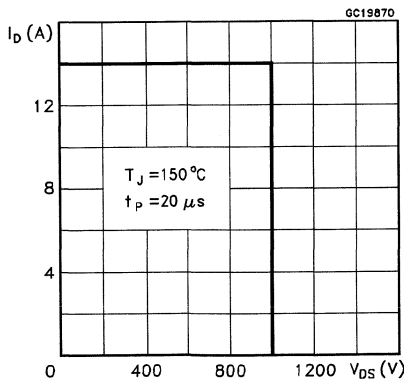
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

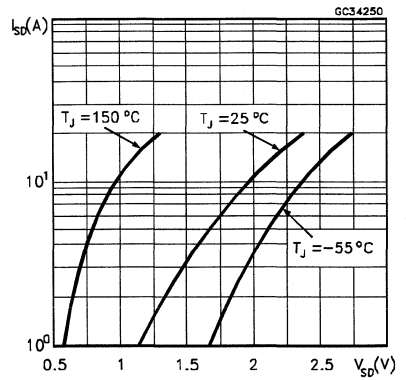


Fig. 1: Unclamped Inductive Load Test Circuits

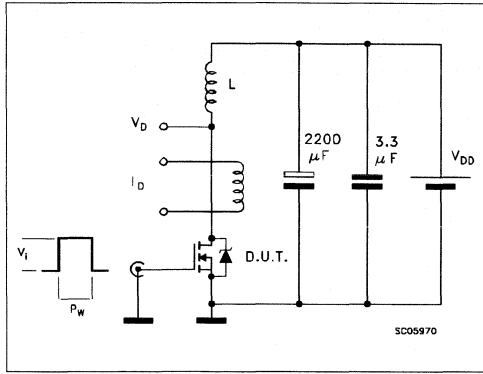


Fig. 2: Unclamped Inductive Waveforms

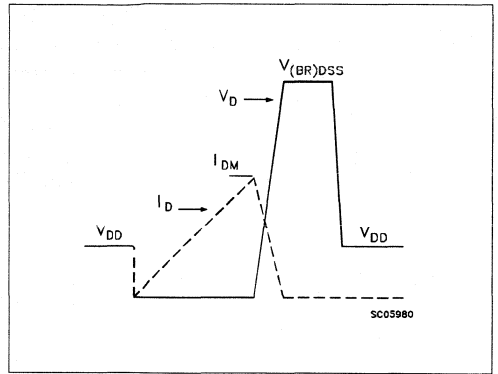


Fig. 3: Switching Times Test Circuits For Resistive Load

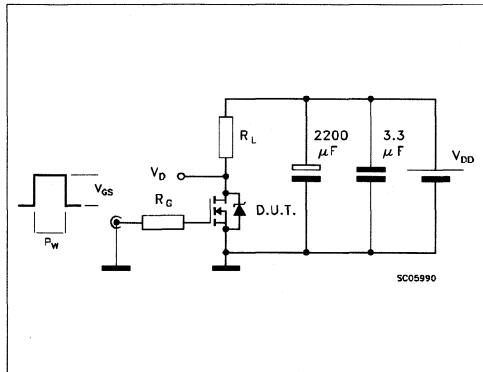


Fig. 4: Gate Charge Test Circuit

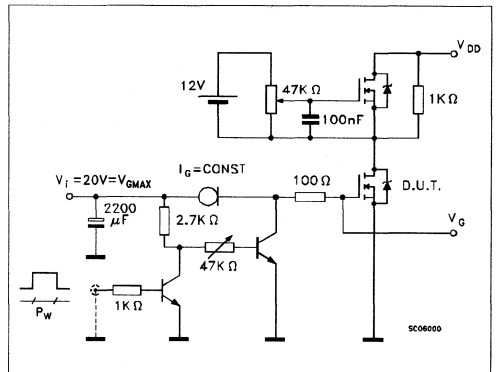
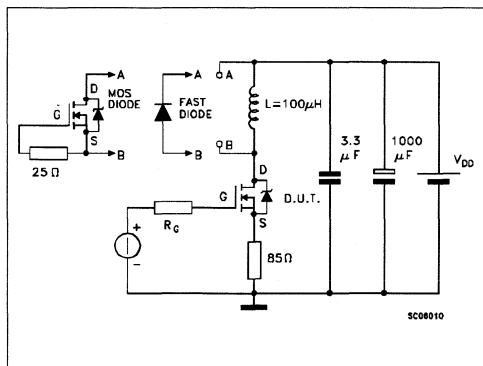


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



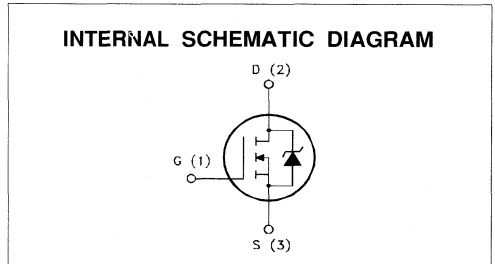
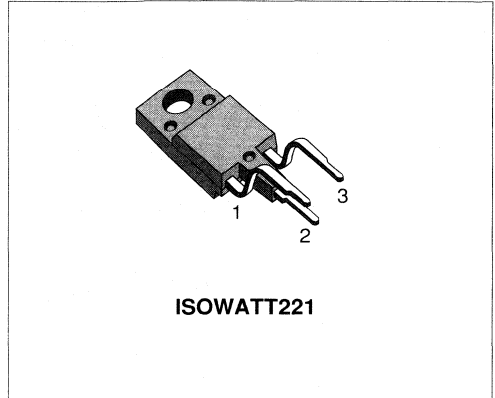
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP3N100XI	1000 V	< 6 Ω	1.6 A

- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INPUT CAPACITANCE
- LOW GATE CHARGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CONSUMER AND INDUSTRIAL LIGHTING
- DC-AC INVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLY (UPS)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	1000	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	1000	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	1.6	A
I _D	Drain Current (continuous) at T _c = 100 °C	1	A
I _{DM} (*)	Drain Current (pulsed)	6.4	A
P _{tot}	Total Dissipation at T _c = 25 °C	30	W
	Derating Factor	0.24	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	4000	V
T _{stg}	Storage Temperature	-65 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C

(*) Pulse width limited by safe operating area

THERMAL DATA

R _{thj-case}	Thermal Resistance Junction-case	Max	4.16	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	60	°C/W
R _{thj-amb}	Thermal Resistance Case-sink	Typ	0.5	°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	3	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	100	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	4.5	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	1.8	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	1000			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 1.5 A V _{GS} = 10V I _D = 1.5 A T _c = 100°C			6 12	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	1.6			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 1.5 A	1	1.8		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		750	950	pF
C _{oss}	Output Capacitance			80	110	pF
C _{rss}	Reverse Transfer Capacitance			25	40	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 400\text{ V}$ $I_D = 1.8\text{ A}$		70	90	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		70	90	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 600\text{ V}$ $I_D = 3.5\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		100		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 400\text{ V}$ $I_D = 3.5\text{ A}$ $V_{GS} = 10\text{ V}$		48	60	nC
Q_{gs}	Gate-Source Charge			7		nC
Q_{gd}	Gate-Drain Charge			24		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 600\text{ V}$ $I_D = 3.5\text{ A}$		90	115	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		60	75	ns
t_c	Cross-over Time	(see test circuit, figure 5)		130	165	ns

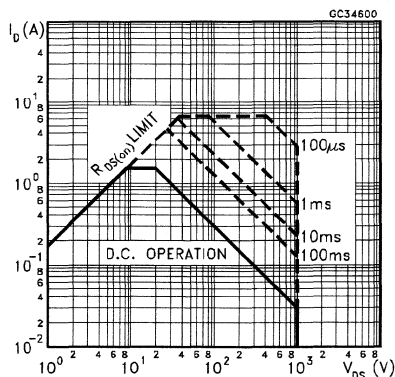
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				1.6	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				6.4	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 1.6\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 3.5\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		900		ns
Q_{rr}	Reverse Recovery Charge			10		μ C
I_{RRM}	Reverse Recovery Current			23		A

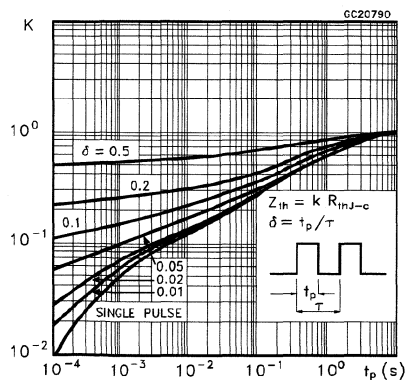
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

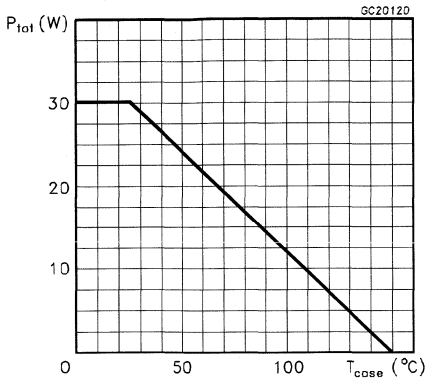
Safe Operating Area



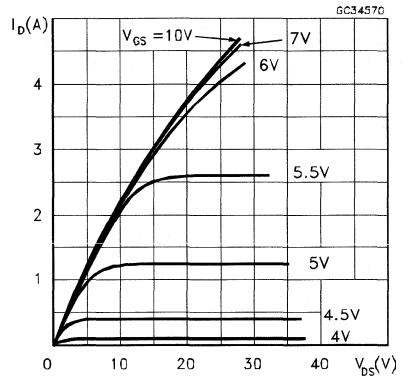
Thermal Impedance



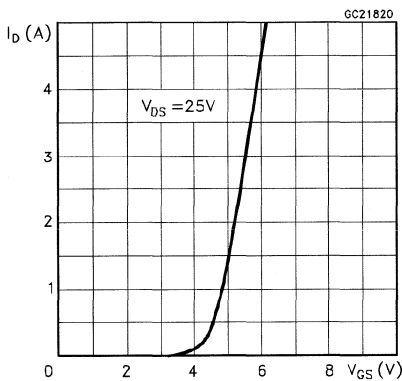
Derating Curve



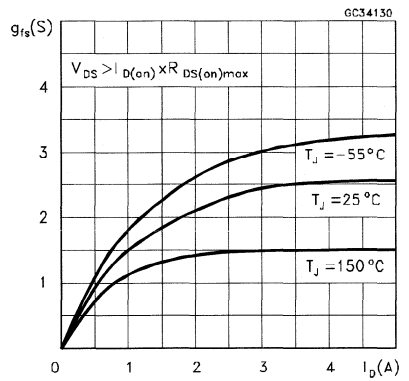
Output Characteristics



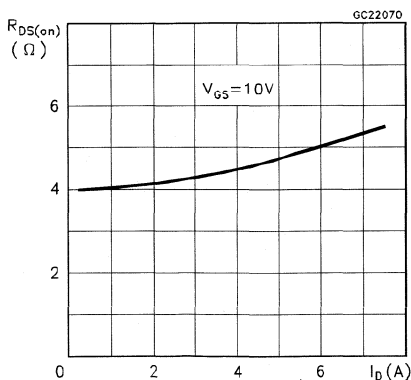
Transfer Characteristics



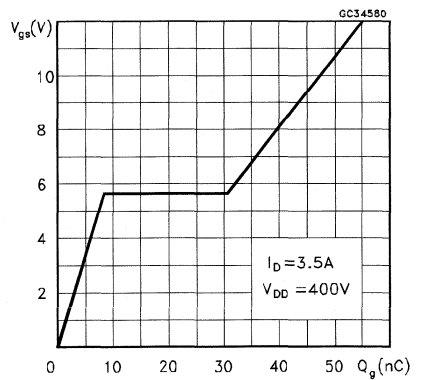
Transconductance



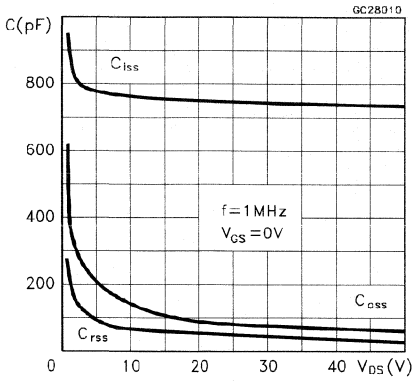
Static Drain-source On Resistance



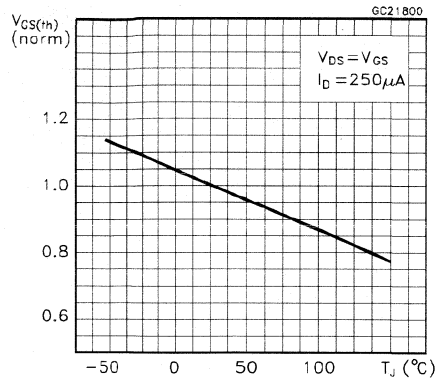
Gate Charge vs Gate-source Voltage



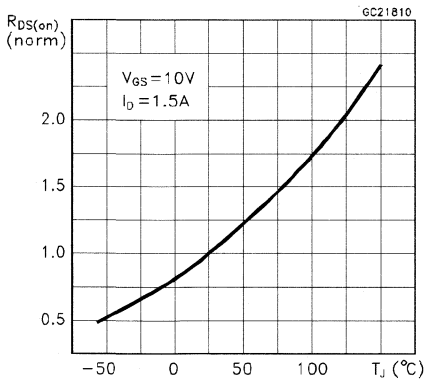
Capacitance Variations



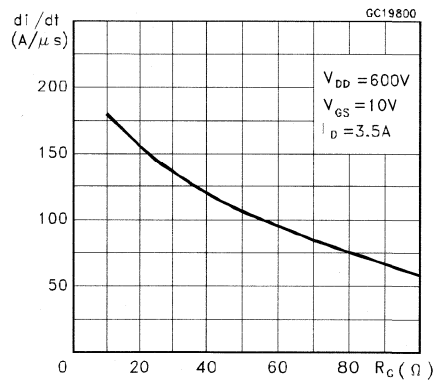
Normalized Gate Threshold Voltage vs Temperature



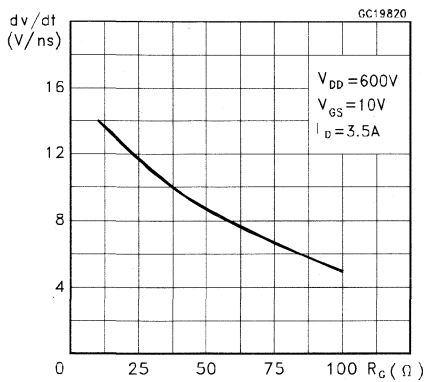
Normalized On Resistance vs Temperature



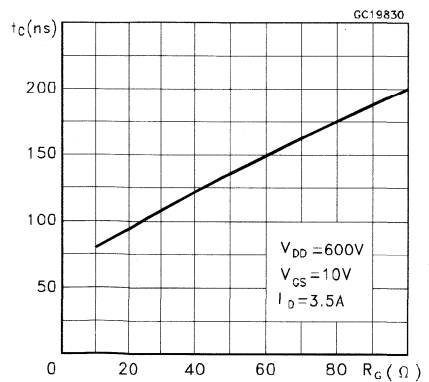
Turn-on Current Slope



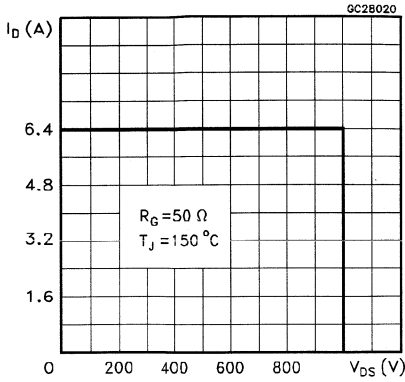
Turn-off Drain-source Voltage Slope



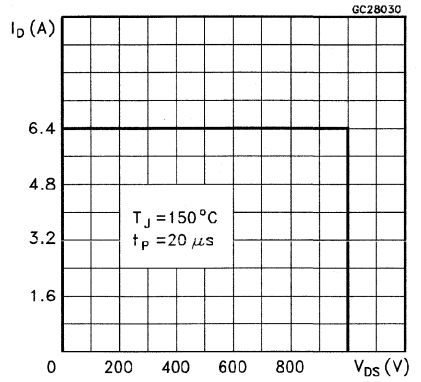
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

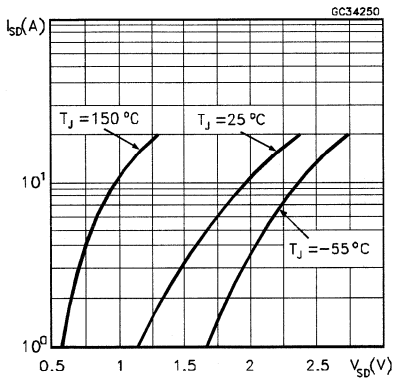


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

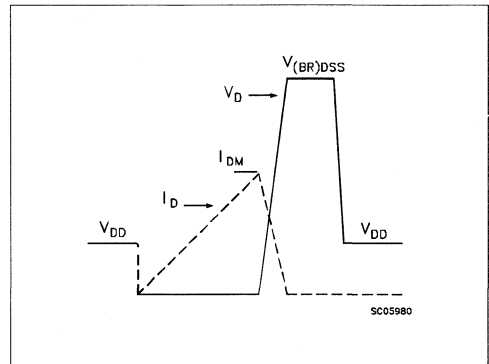
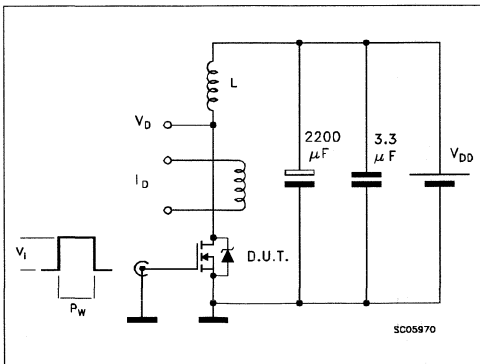


Fig. 3: Switching Times Test Circuits For Resistive Load

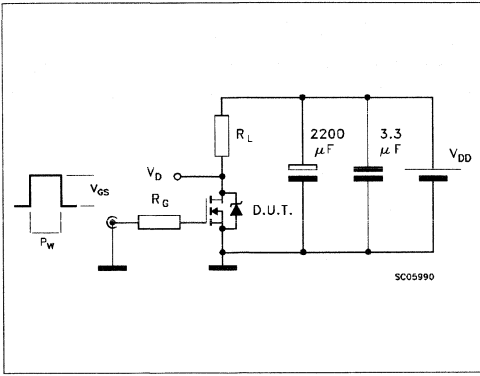


Fig. 4: Gate Charge Test Circuit

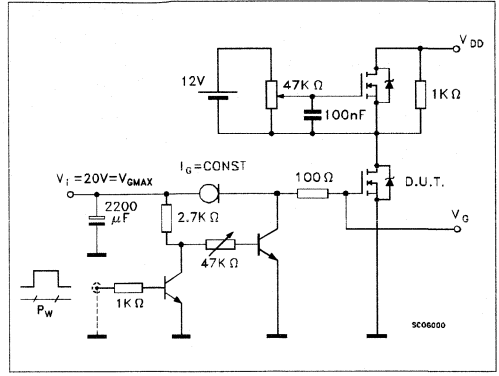
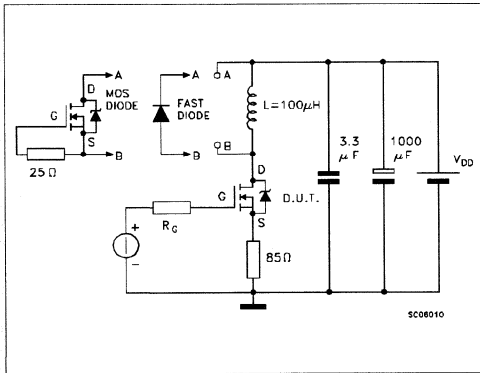


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



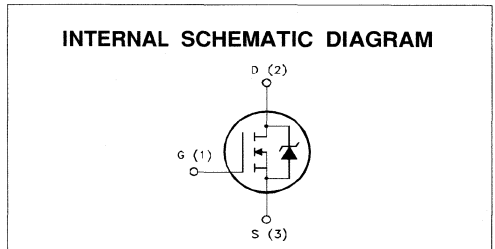
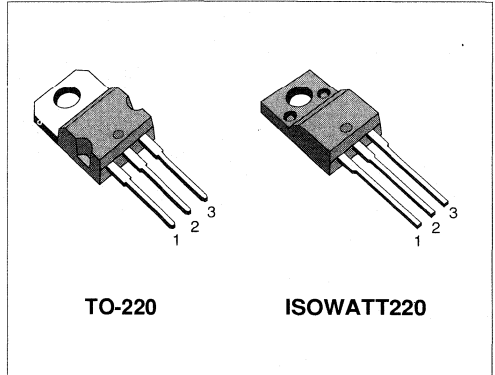
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DS}	R _{DS(on)}	I _D
STP4N40	400 V	< 2.1 Ω	4 A
STP4N40FI	400 V	< 2.1 Ω	3 A

- TYPICAL R_{DS(on)} = 1.65 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP4N40	STP4N40FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	400		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	400		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	4	3	A
I _D	Drain Current (continuous) at T _c = 100 °C	2.5	1.9	A
I _{DM} (*)	Drain Current (pulsed)	16	16	A
P _{tot}	Total Dissipation at T _c = 25 °C	75	35	W
	Derating Factor	0.6	0.28	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

		TO-220	ISOWATT220	
$R_{thj-case}$	Thermal Resistance Junction-case Max	1.67	3.57	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient Max	62.5		°C/W
$R_{thc-sink}$	Thermal Resistance Case-sink Typ	0.5		°C/W
T_l	Maximum Lead Temperature For Soldering Purpose	300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	4	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ °C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	110	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	7	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ °C}$, pulse width limited by T_j max, $\delta < 1\%$)	2.5	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$	400			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\text{ }\mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 2\text{ A}$ $V_{GS} = 10\text{ V}$ $I_D = 2\text{ A}$ $T_c = 100\text{ °C}$		1.65	2.1 4.2	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	4			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 2\text{ A}$	1	2.1		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		350	450	pF
C_{oss}	Output Capacitance			68	90	pF
C_{rss}	Reverse Transfer Capacitance			32	45	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 175\text{ V}$ $I_D = 2\text{ A}$		25	33	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		70	90	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 320\text{ V}$ $I_D = 4\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		110		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 320\text{ V}$ $I_D = 4\text{ A}$ $V_{GS} = 10\text{ V}$		25	35	nC
Q_{gs}	Gate-Source Charge			7		nC
Q_{gd}	Gate-Drain Charge			11		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(voff)}$	Off-voltage Rise Time	$V_{DD} = 320\text{ V}$ $I_D = 4\text{ A}$		50	65	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		28	35	ns
t_c	Cross-over Time	(see test circuit, figure 5)		75	95	ns

SOURCE DRAIN DIODE

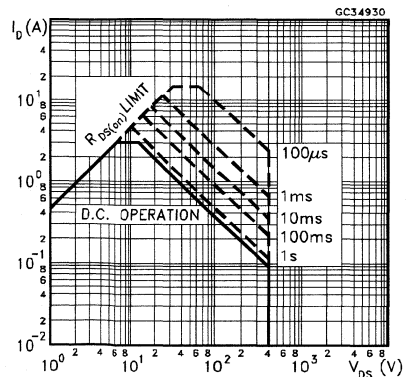
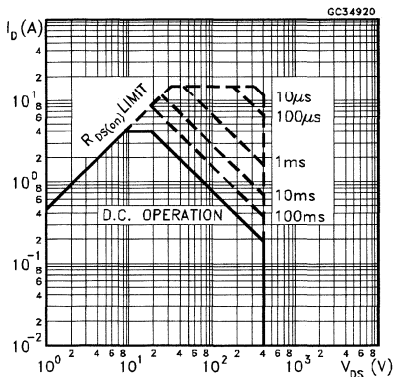
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				4	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				16	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 4\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 4\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		400		ns
Q_{rr}	Reverse Recovery Charge			5.9		μ C
I_{RRM}	Reverse Recovery Current			29.5		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

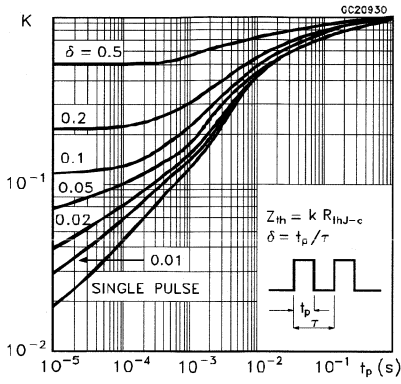
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

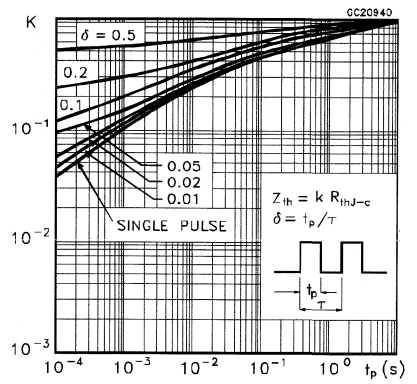
Safe Operating Areas For ISOWATT220



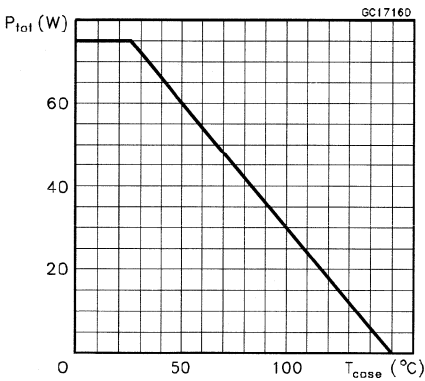
Thermal Impedance For TO-220



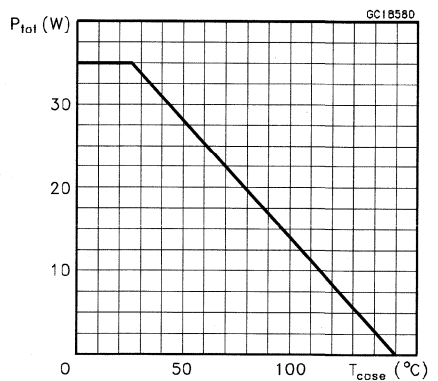
Thermal Impedance For ISOWATT220



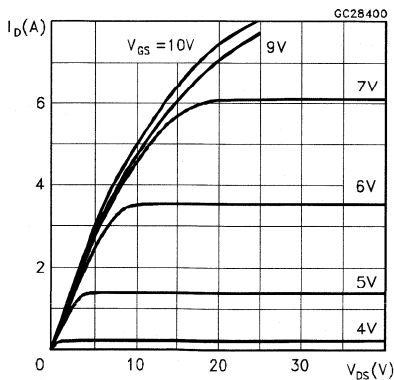
Derating Curve For TO-220



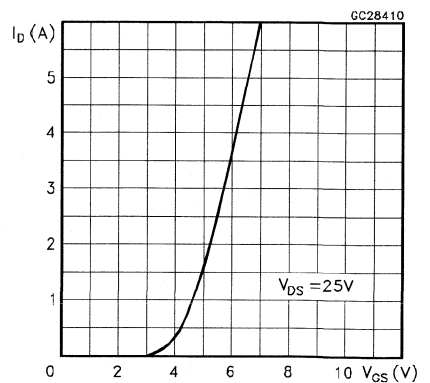
Derating Curve For ISOWATT220



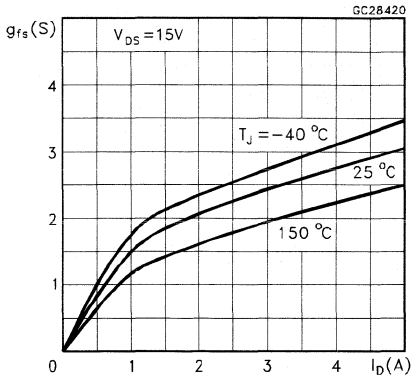
Output Characteristics



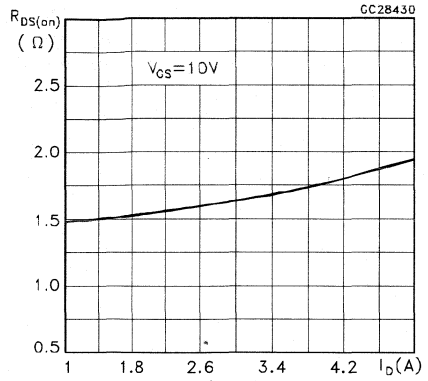
Transfer Characteristics



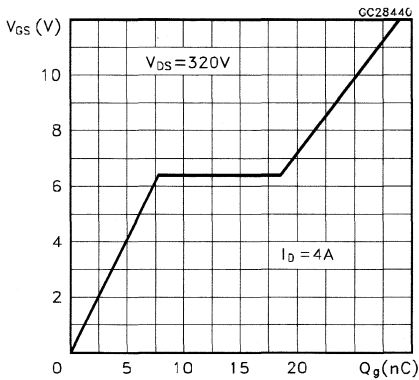
Transconductance



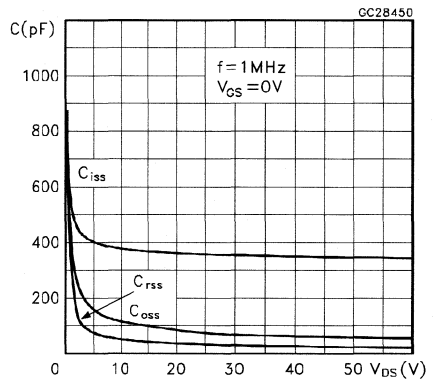
Static Drain-source On Resistance



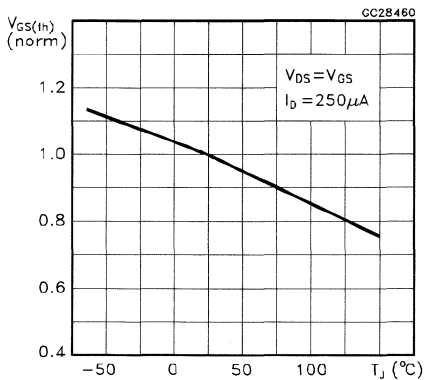
Gate Charge vs Gate-source Voltage



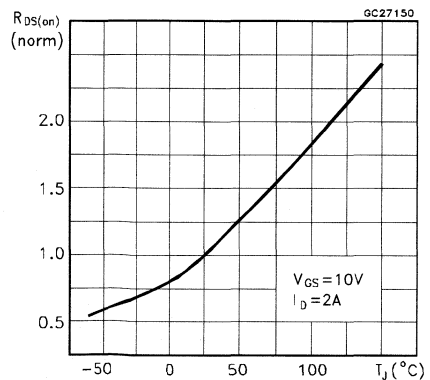
Capacitance Variations



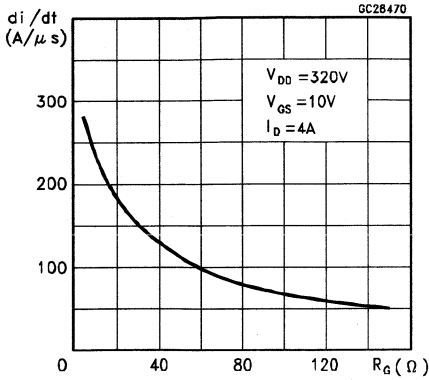
Normalized Gate Threshold Voltage vs Temperature



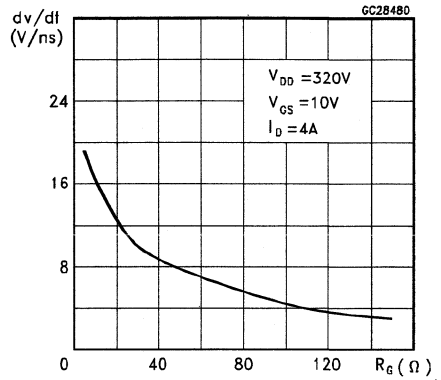
Normalized On Resistance vs Temperature



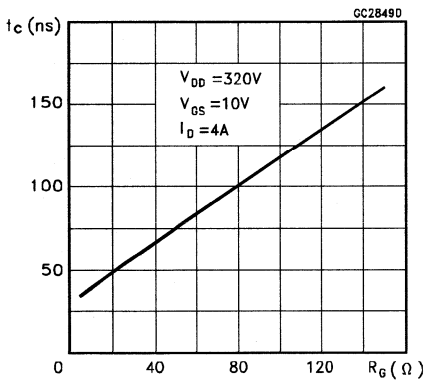
Turn-on Current Slope



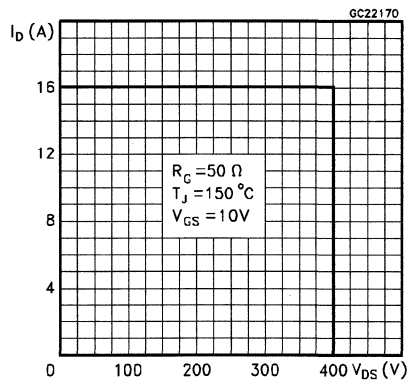
Turn-off Drain-source Voltage Slope



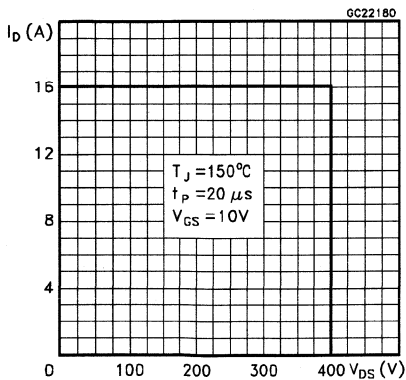
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

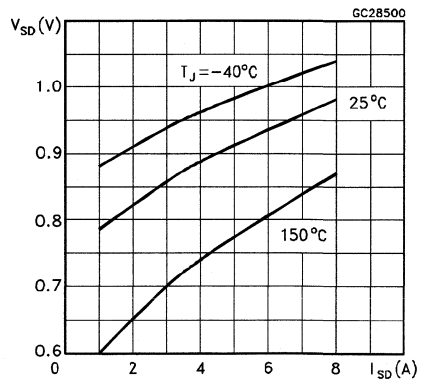


Fig. 1: Unclamped Inductive Load Test Circuits

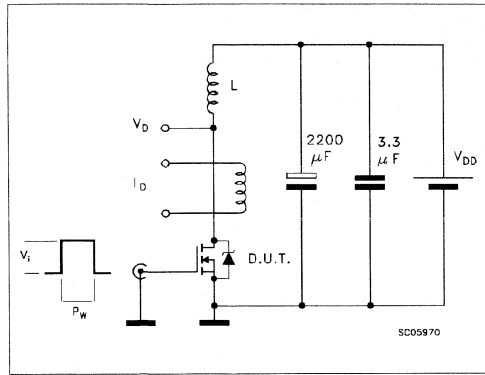


Fig. 2: Unclamped Inductive Waveforms

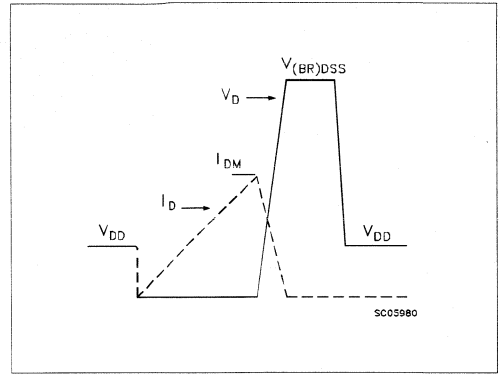


Fig. 3: Switching Times Test Circuits For Resistive Load

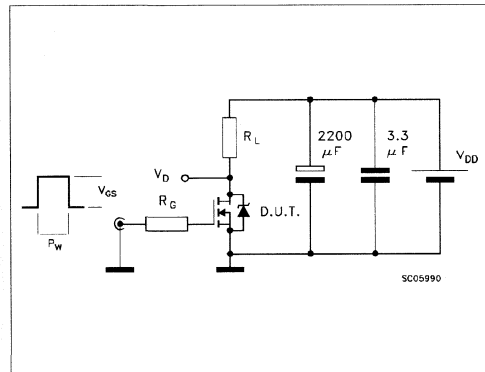


Fig. 4: Gate Charge Test Circuit

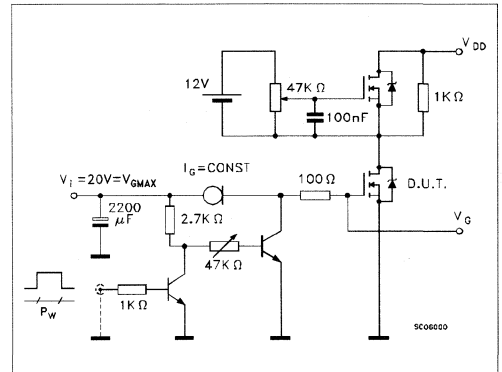
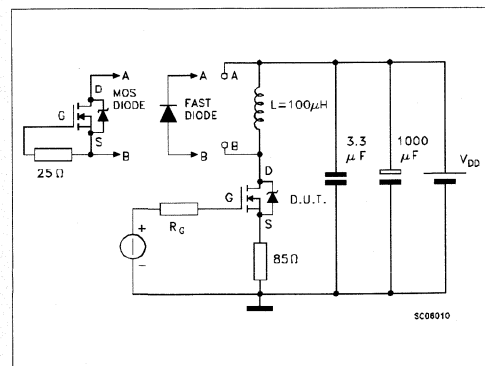


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



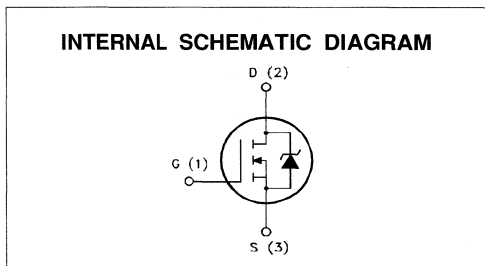
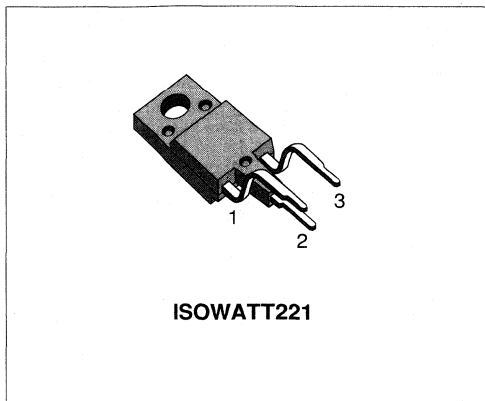
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP4N80XI	800 V	< 3.5 Ω	2 A

- TYPICAL R_{DS(on)} = 2.9 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INPUT CAPACITANCE
- LOW GATE CHARGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CONSUMER AND INDUSTRIAL LIGHTING
- DC-AC INVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLY (UPS)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	800	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	800	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	2	A
I _D	Drain Current (continuous) at T _c = 100 °C	1.3	A
I _{DM} (*)	Drain Current (pulsed)	8	A
P _{tot}	Total Dissipation at T _c = 25 °C	30	W
	Derating Factor	0.24	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	4000	V
T _{stg}	Storage Temperature	-65 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C

(*) Pulse width limited by safe operating area

THERMAL DATA

R _{thj-case}	Thermal Resistance Junction-case	Max	4.16	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	60	°C/W
R _{thj-amb}	Thermal Resistance Case-sink	Typ	0.5	°C/W
T _I	Maximum Lead Temperature For Soldering Purpose		300	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	4	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	210	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	5	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	1.8	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	800			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 1.7 A V _{GS} = 10V I _D = 1.7 A T _c = 100°C		2.9	3.5 7	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	2			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 1.7 A	1			S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0			1100	pF
C _{oss}	Output Capacitance				150	pF
C _{rss}	Reverse Transfer Capacitance				55	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 30\text{ V}$ $I_D = 2.3\text{ A}$		65	90	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		150	200	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 600\text{ V}$ $I_D = 3.8\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		80	110	A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 400\text{ V}$ $I_D = 5\text{ A}$ $V_{GS} = 10\text{ V}$		55	70	nC
Q_{gs}	Gate-Source Charge			8		nC
Q_{gd}	Gate-Drain Charge			26		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$	Off-voltage Rise Time	$V_{DD} = 600\text{ V}$ $I_D = 3.8\text{ A}$		110	145	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		140	190	ns
t_c	Cross-over Time	(see test circuit, figure 5)		150	200	ns

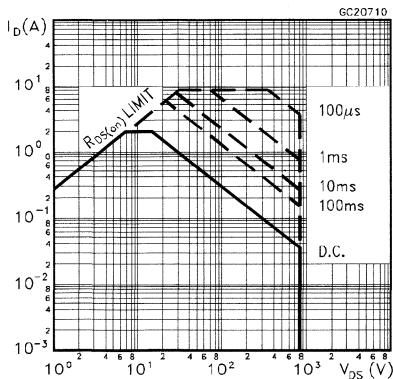
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				2	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				8	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 2\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 3.8\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		500		ns
Q_{rr}	Reverse Recovery Charge			4.3		μ C
I_{RRM}	Reverse Recovery Current			17		A

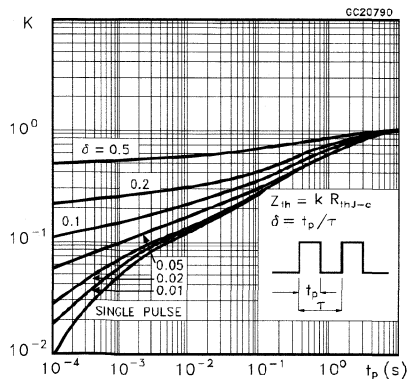
(*) Pulsed: Pulse duration $\bar{t} = 300\ \mu\text{s}$, duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

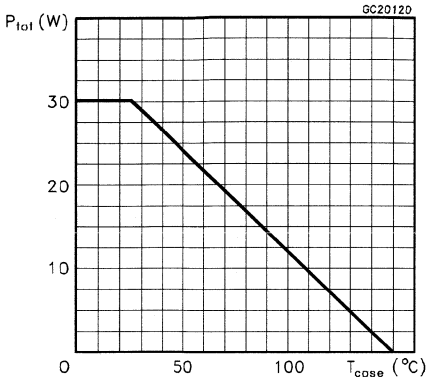
Safe Operating Area



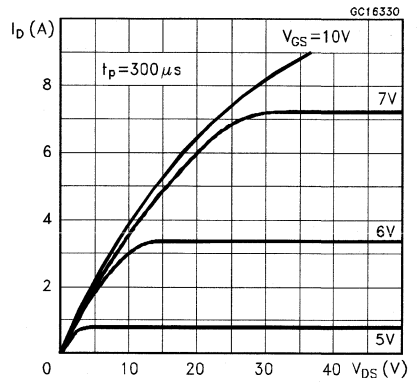
Thermal Impedance



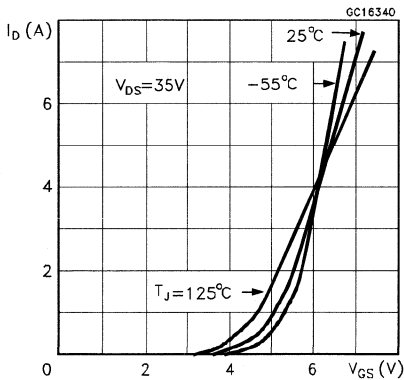
Derating Curve



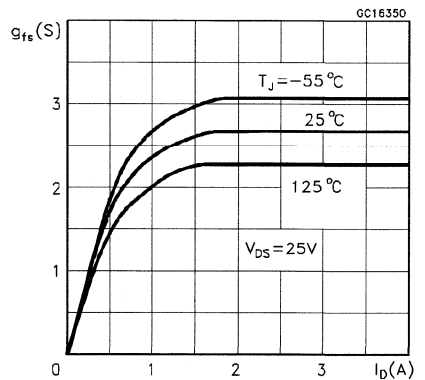
Output Characteristics



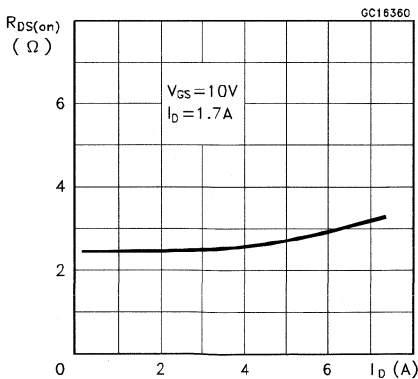
Transfer Characteristics



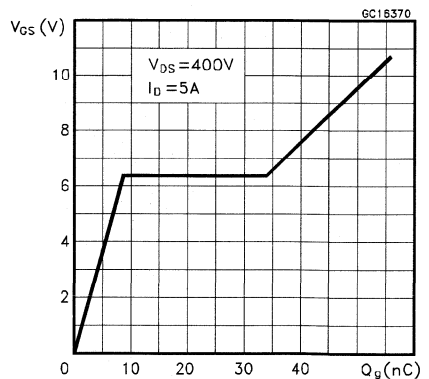
Transconductance



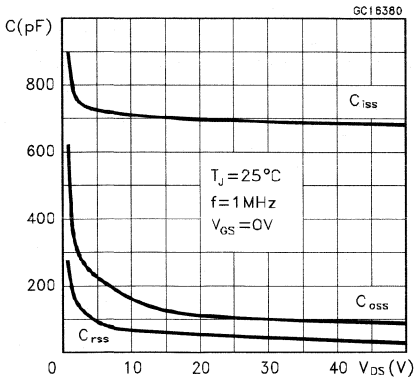
Static Drain-source On Resistance



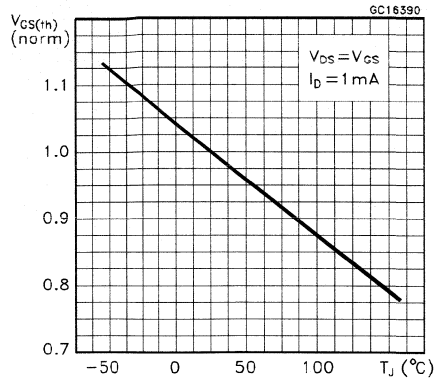
Gate Charge vs Gate-source Voltage



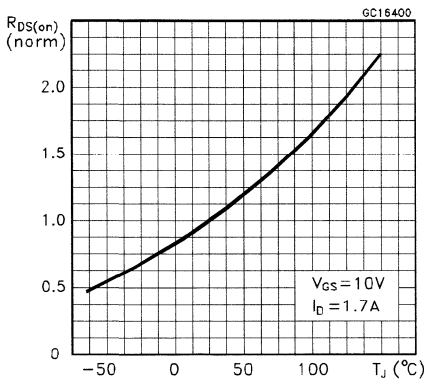
Capacitance Variations



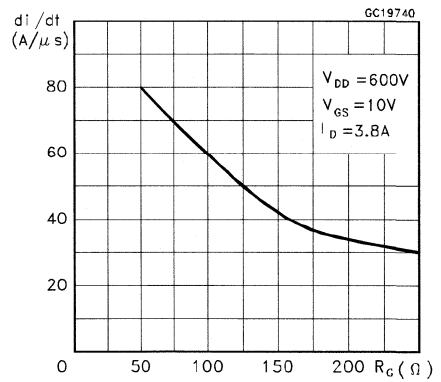
Normalized Gate Threshold Voltage vs Temperature



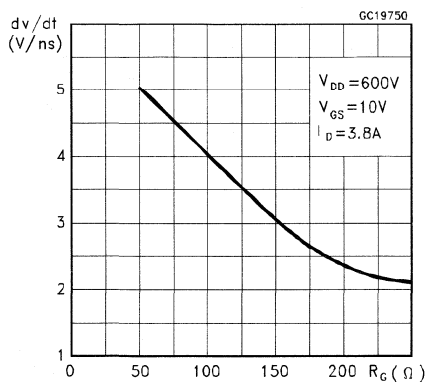
Normalized On Resistance vs Temperature



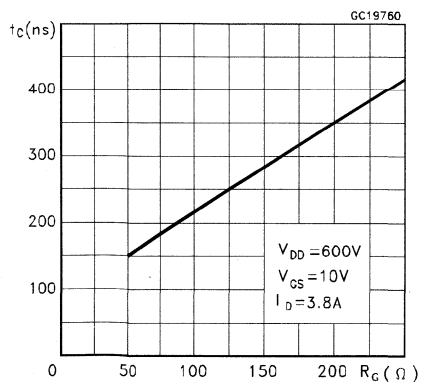
Turn-on Current Slope



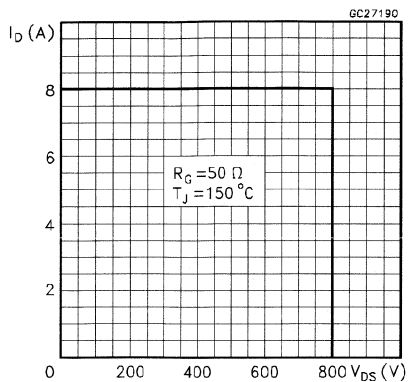
Turn-off Drain-source Voltage Slope



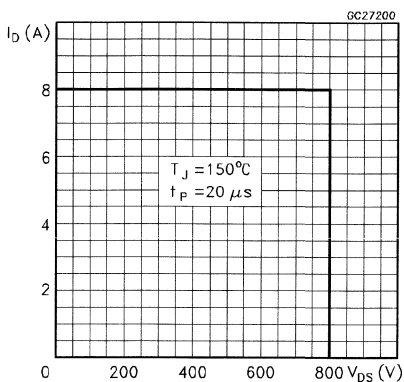
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

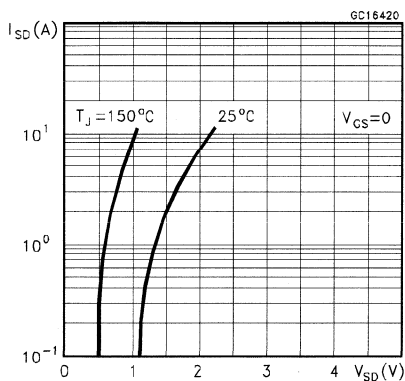


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

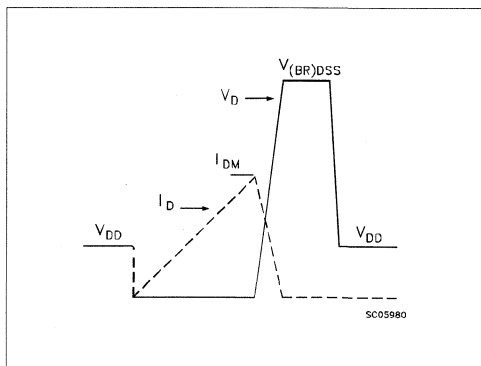
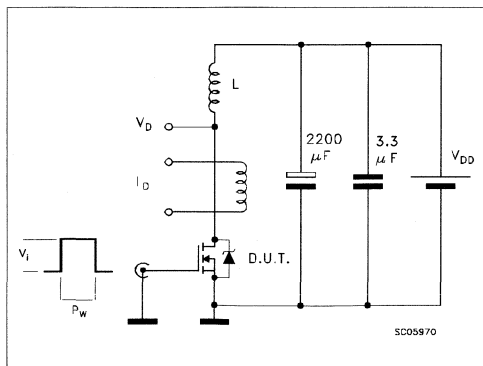


Fig. 3: Switching Times Test Circuits For Resistive Load

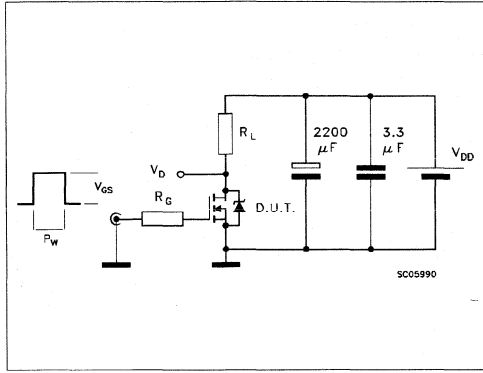


Fig. 4: Gate Charge Test Circuit

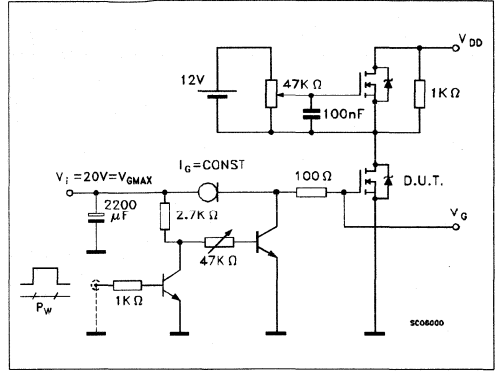
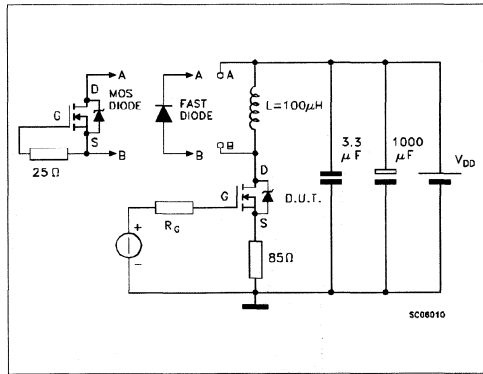


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



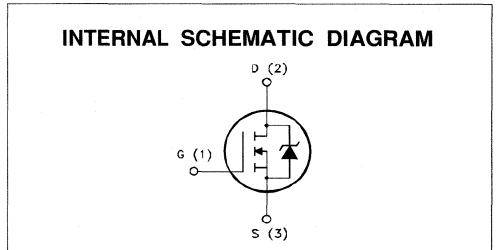
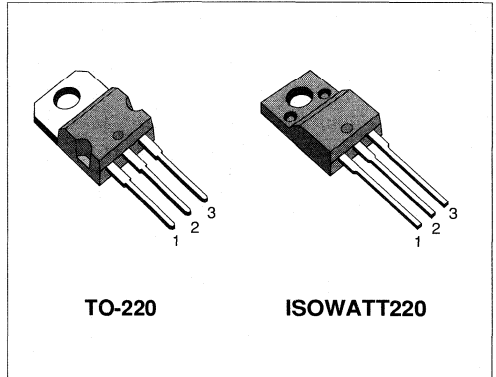
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP4N90	900 V	< 3.5 Ω	3.6 A
STP4N90FI	900 V	< 3.5 Ω	2.3 A

- TYPICAL R_{DS(on)} = 2.9 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INPUT CAPACITANCE
- LOW GATE CHARGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CONSUMER AND INDUSTRIAL LIGHTING
- DC-AC INVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLY (UPS)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP4N90	STP4N90FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	900		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	900		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	3.6	2.3	A
I _D	Drain Current (continuous) at T _c = 100 °C	2.2	1.3	A
I _{DM} (*)	Drain Current (pulsed)	15	15	A
P _{tot}	Total Dissipation at T _c = 25 °C	100	40	W
	Derating Factor	0.8	0.32	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case	Max	1.25	3.12	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.5		°C/W
T _I	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current (repetitive or not-repetitive, T _j = 25 °C)	3.6	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	190	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	8	mJ
I _{AR}	Avalanche Current (repetitive or not-repetitive, T _j = 100 °C)	2.2	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	900			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 1.7 A V _{GS} = 10V I _D = 1.7 A T _c = 100°C		2.9	3.5 7	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	3.6			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs}	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 1.7 A	1			S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0			1100	pF
C _{oss}	Output Capacitance				150	pF
C _{rss}	Reverse Transfer Capacitance				55	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 30\text{ V}$ $I_D = 2.3\text{ A}$		65	90	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		150	200	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 600\text{ V}$ $I_D = 3.8\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		80	110	A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 400\text{ V}$ $I_D = 5\text{ A}$ $V_{GS} = 10\text{ V}$		55	70	nC
Q_{gs}	Gate-Source Charge			8		nC
Q_{gd}	Gate-Drain Charge			26		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$	Off-voltage Rise Time	$V_{DD} = 600\text{ V}$ $I_D = 3.8\text{ A}$		110	145	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		140	190	ns
t_c	Cross-over Time	(see test circuit, figure 5)		150	200	ns

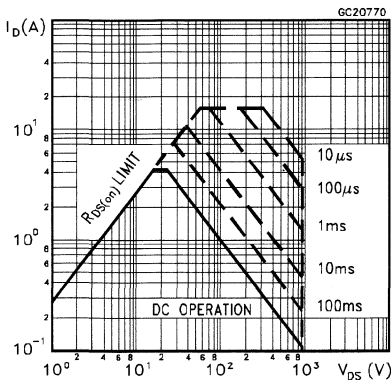
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				3.6	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				16	A
V_{SD}	Forward On Voltage	$I_{SD} = 3.6\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 3.6\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_R = 100\text{ V}$		500		ns
Q_{rr}	Reverse Recovery Charge	(see test circuit, figure 5)		4.3		μ C
I_{RRM}	Reverse Recovery Current			17		A

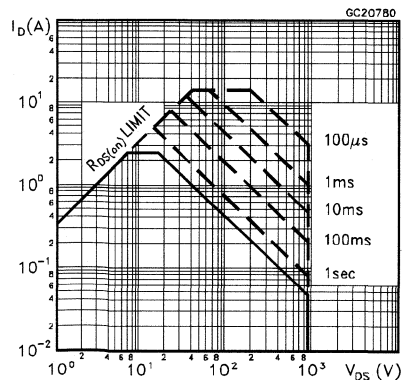
(*) Pulsed: Pulse duration $\bar{t} = 300\ \mu\text{s}$, duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

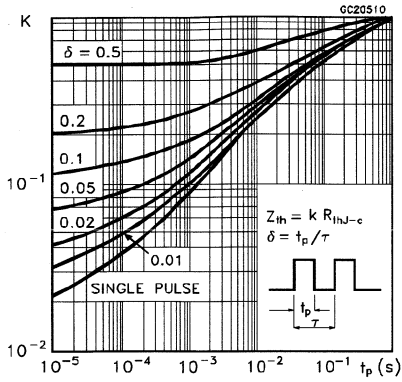
Safe Operating Areas For TO-220



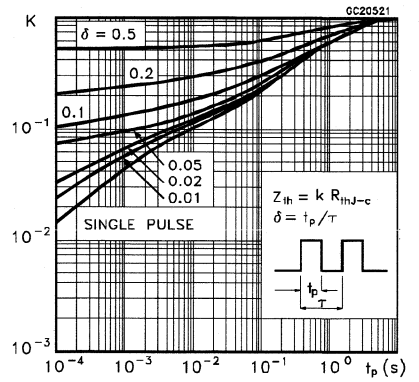
Safe Operating Areas For ISOWATT220



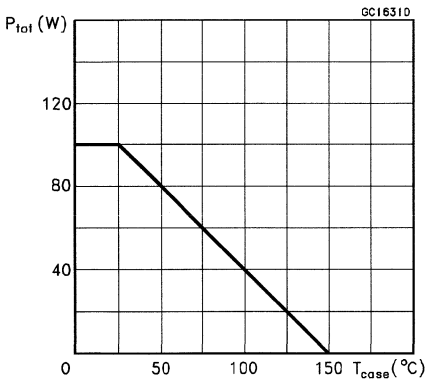
Thermal Impedance For TO-220



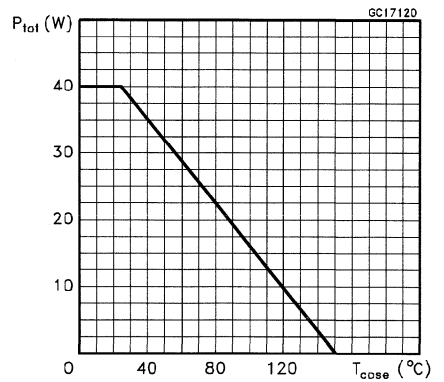
Thermal Impedance For ISOWATT220



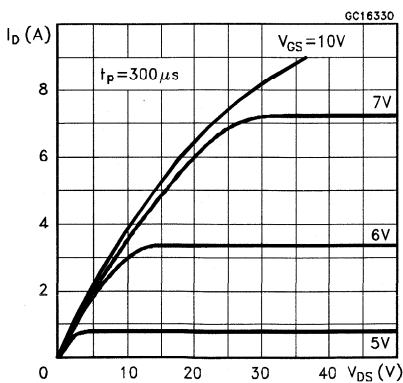
Derating Curve For TO-220



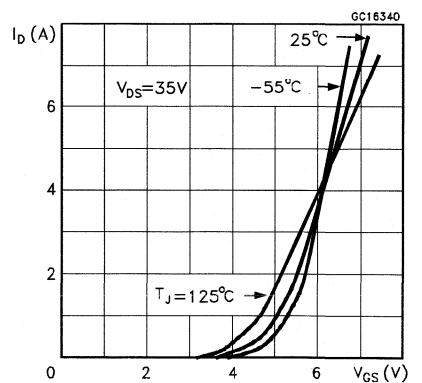
Derating Curve For ISOWATT220



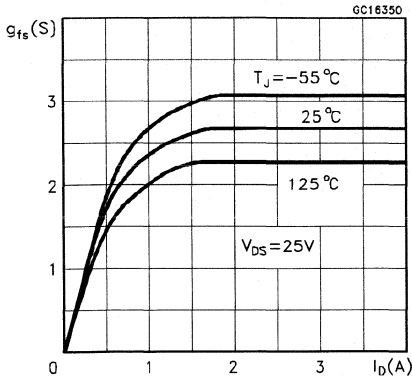
Output Characteristics



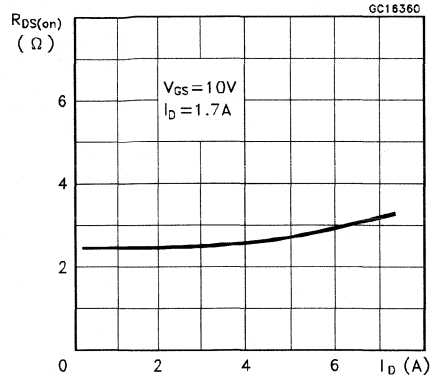
Transfer Characteristics



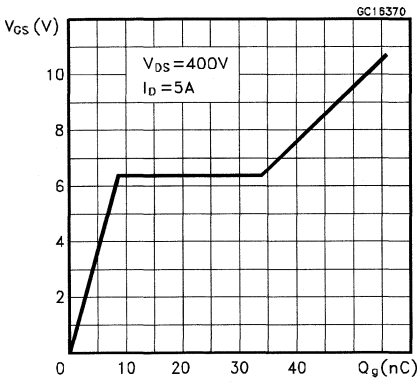
Transconductance



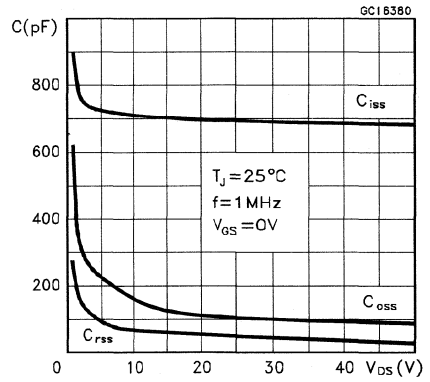
Static Drain-source On Resistance



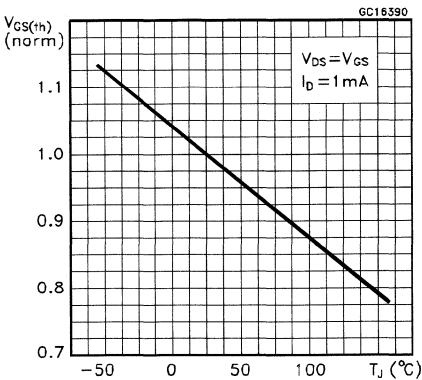
Gate Charge vs Gate-source Voltage



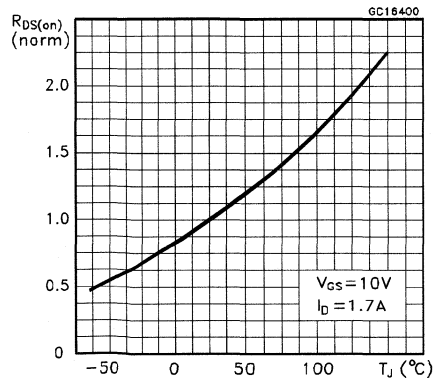
Capacitance Variations



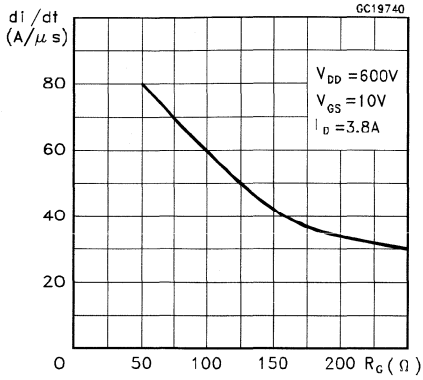
Normalized Gate Threshold Voltage vs Temperature



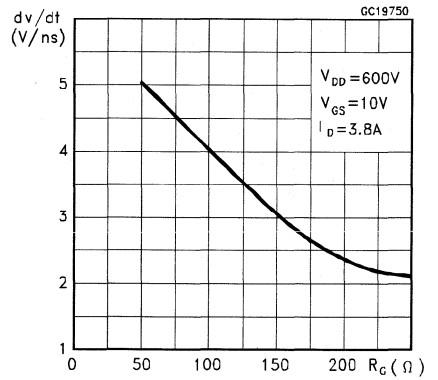
Normalized On Resistance vs Temperature



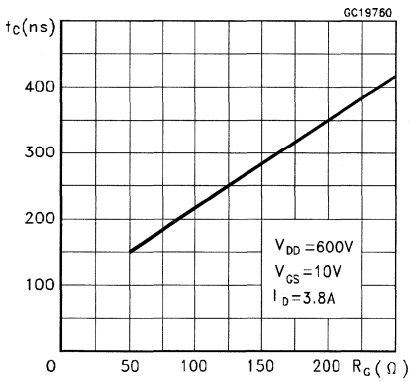
Turn-on Current Slope



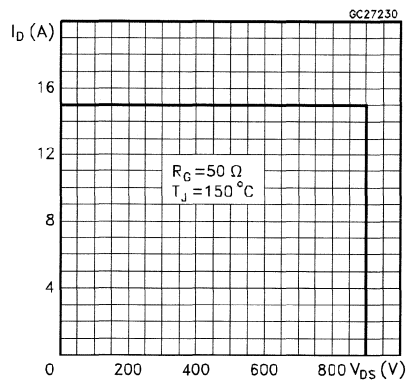
Turn-off Drain-source Voltage Slope



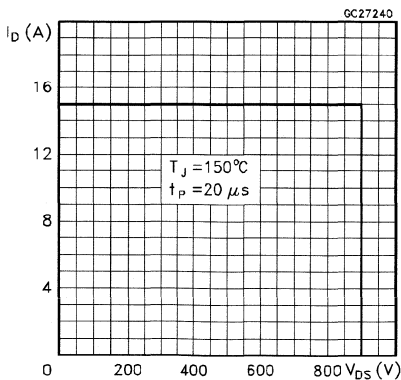
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

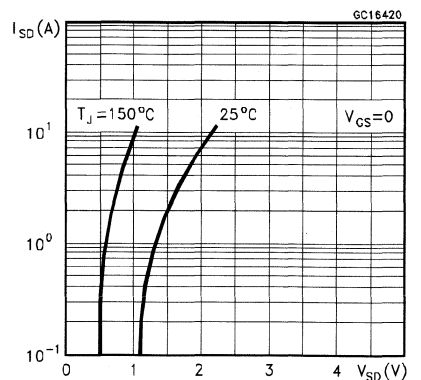


Fig. 1: Unclamped Inductive Load Test Circuits

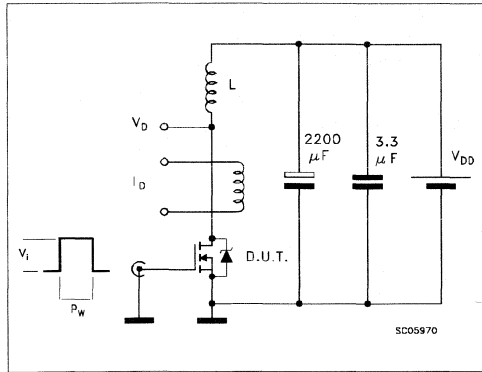


Fig. 2: Unclamped Inductive Waveforms

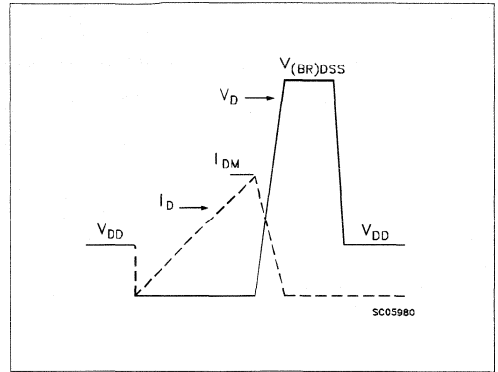


Fig. 3: Switching Times Test Circuits For Resistive Load

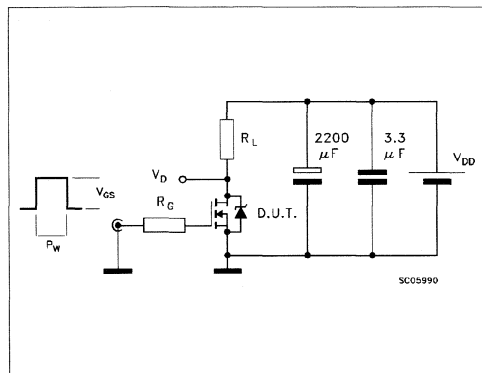


Fig. 4: Gate Charge Test Circuit

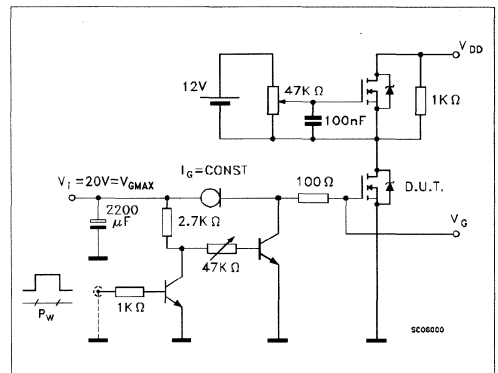
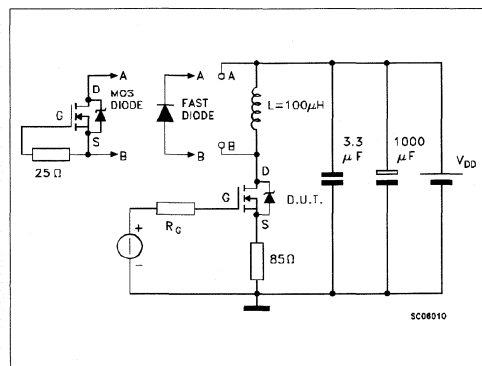


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



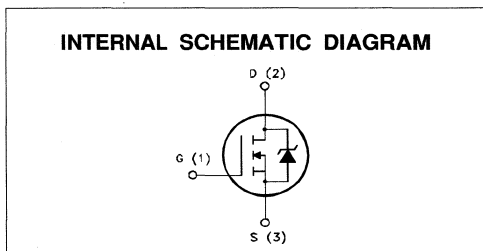
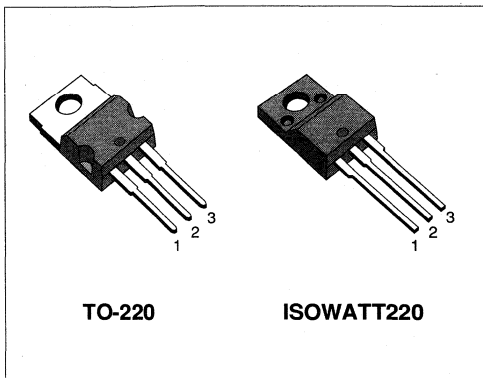
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP4N100	1000 V	< 3.5 Ω	4 A
STP4N100FI	1000 V	< 3.5 Ω	2.2 A

- TYPICAL R_{DS(on)} = 3.1 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INPUT CAPACITANCE
- LOW GATE CHARGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CONSUMER AND INDUSTRIAL LIGHTING
- DC-AC INVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLY (UPS)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP4N100	STP4N100FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	1000		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	1000		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	4	2.2	A
I _D	Drain Current (continuous) at T _c = 100 °C	2.5	1.4	A
I _{DM} (*)	Drain Current (pulsed)	16	16	A
P _{tot}	Total Dissipation at T _c = 25 °C	125	40	W
	Derating Factor	1	0.32	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
$R_{thj-case}$	Thermal Resistance Junction-case	Max	1	3.12	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5		°C/W
$R_{thc-sink}$	Thermal Resistance Case-sink	Typ	0.5		°C/W
T_l	Maximum Lead Temperature For Soldering Purpose			300	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	4	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ °C}$, $I_D = I_{AR}$, $V_{DD} = 25\text{ V}$)	160	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	8.3	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ °C}$, pulse width limited by T_j max, $\delta < 1\%$)	2.5	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$	1000			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\text{ }\mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 2\text{ A}$ $V_{GS} = 10\text{ V}$ $I_D = 2\text{ A}$ $T_c = 100\text{ °C}$		3.1	3.5 7	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	4			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 2\text{ A}$	2	4		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		1230	1500	pF
C_{oss}	Output Capacitance			165	200	pF
C_{rss}	Reverse Transfer Capacitance			70	85	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 800\text{ V}$ $I_D = 2\text{ A}$		36	45	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		30	165	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 800\text{ V}$ $I_D = 4\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		180		A/ μ s
Q_G	Total Gate Charge	$V_{DD} = 800\text{ V}$ $I_D = 4\text{ A}$ $V_{GS} = 10\text{ V}$		80	100	nC
Q_{GS}	Gate-Source Charge			8		nC
Q_{GD}	Gate-Drain Charge			40		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(voff)}$	Off-voltage Rise Time	$V_{DD} = 800\text{ V}$ $I_D = 4\text{ A}$		100	125	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		25	32	ns
t_c	Cross-over Time	(see test circuit, figure 5)		155	190	ns

SOURCE DRAIN DIODE

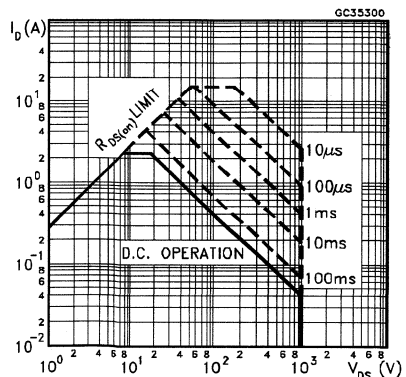
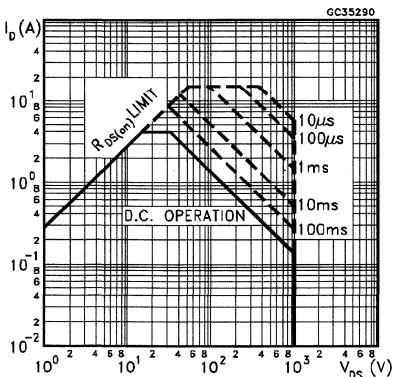
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				4	A
$I_{SDM(*)}$	Source-drain Current (pulsed)				16	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 4\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 4\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_J = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		1200		ns
Q_{rr}	Reverse Recovery Charge			30		μ C
I_{RRM}	Reverse Recovery Current			50		A

(*) Pulsed: Pulse duration $\tau = 300\ \mu\text{s}$, duty cycle 1.5%

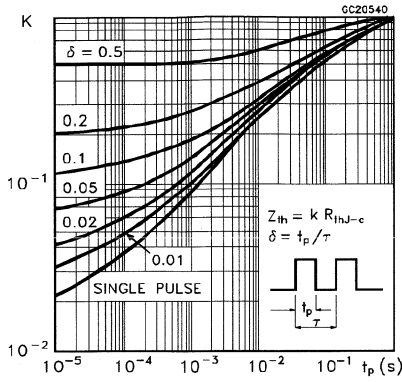
(•) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

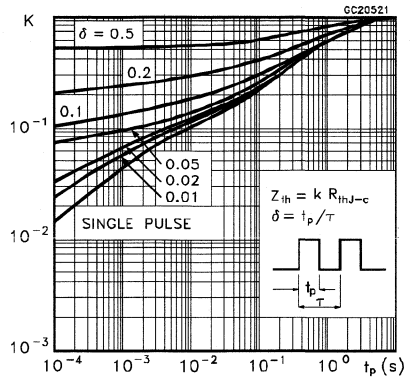
Safe Operating Areas For ISOWATT220



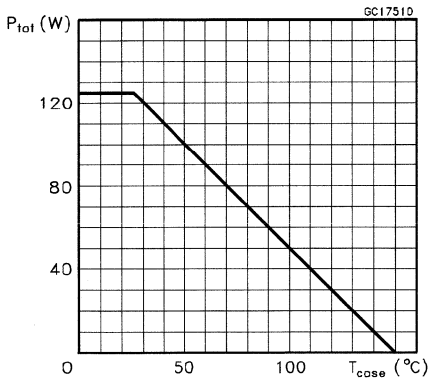
Thermal Impedance For TO-220



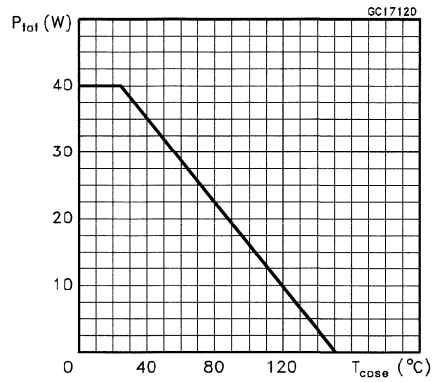
Thermal Impedance For ISOWATT220



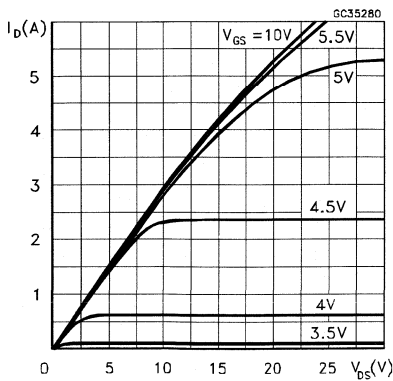
Derating Curve For TO-220



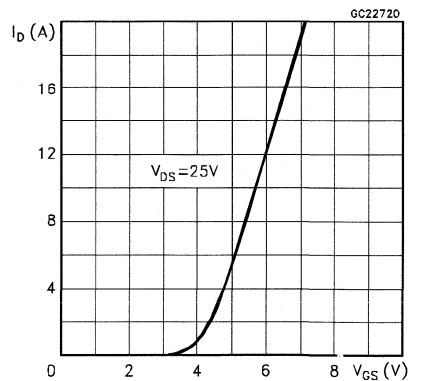
Derating Curve For ISOWATT220



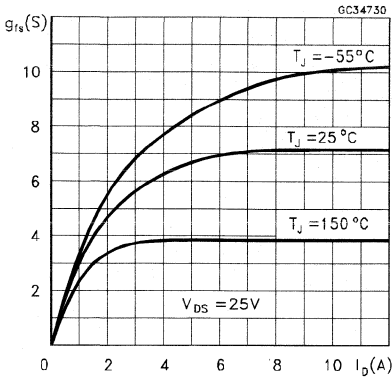
Output Characteristics



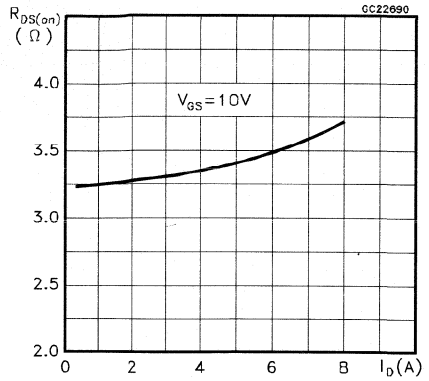
Transfer Characteristics



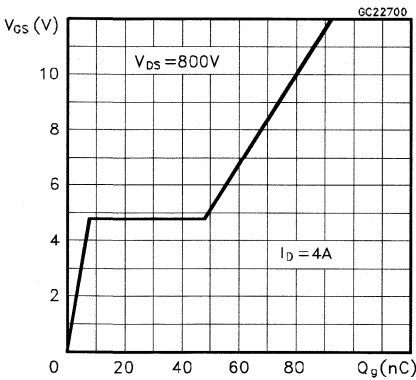
Transconductance



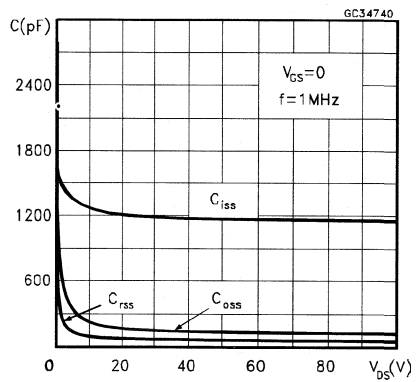
Static Drain-source On Resistance



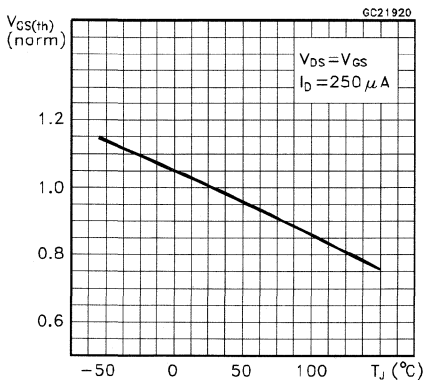
Gate Charge vs Gate-source Voltage



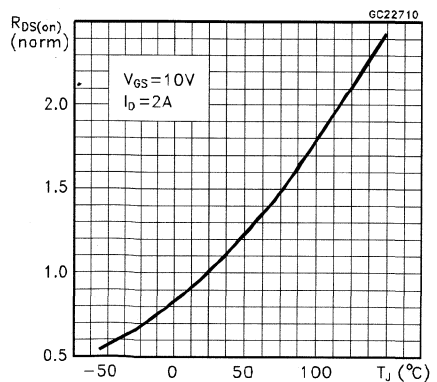
Capacitance Variations



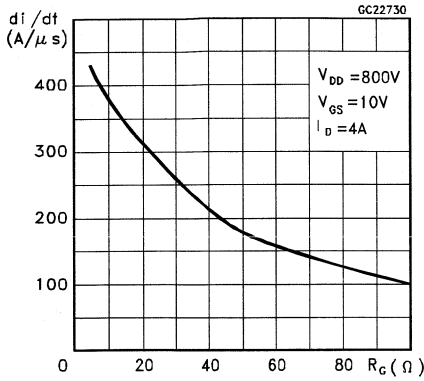
Normalized Gate Threshold Voltage vs Temperature



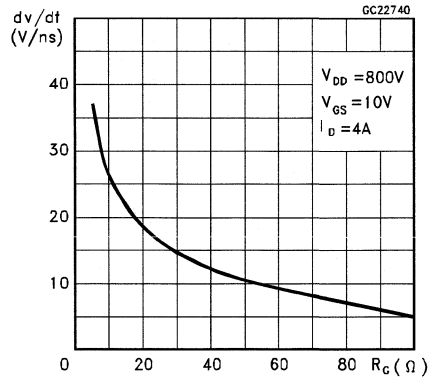
Normalized On Resistance vs Temperature



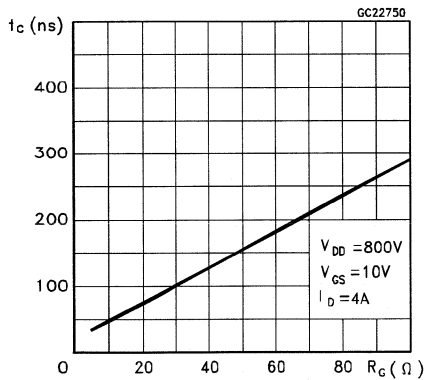
Turn-on Current Slope



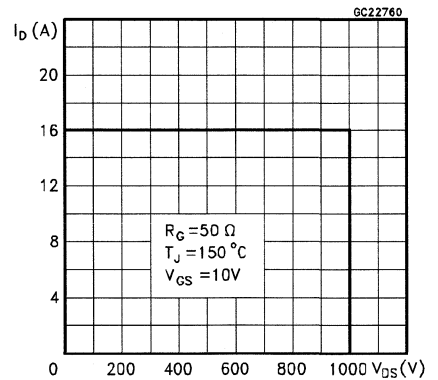
Turn-off Drain-source Voltage Slope



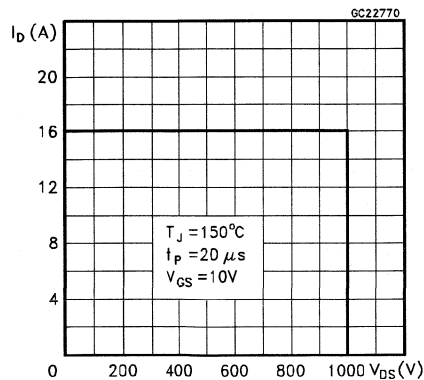
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

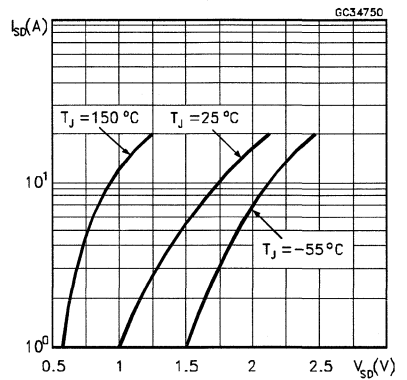


Fig. 1: Unclamped Inductive Load Test Circuits

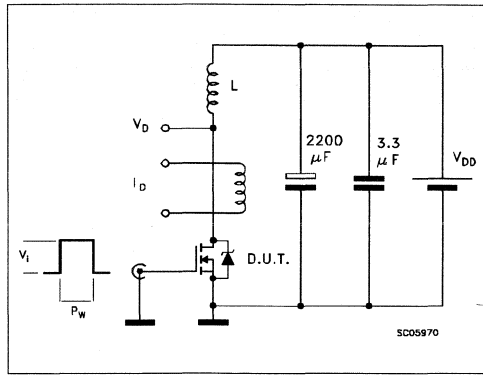


Fig. 2: Unclamped Inductive Waveforms

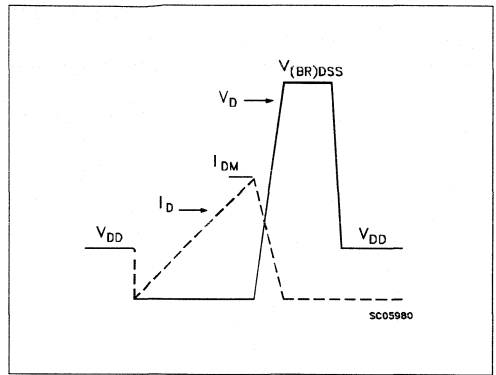


Fig. 3: Switching Times Test Circuits For Resistive Load

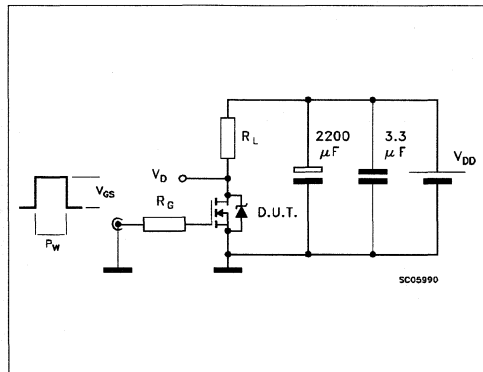


Fig. 4: Gate Charge Test Circuit

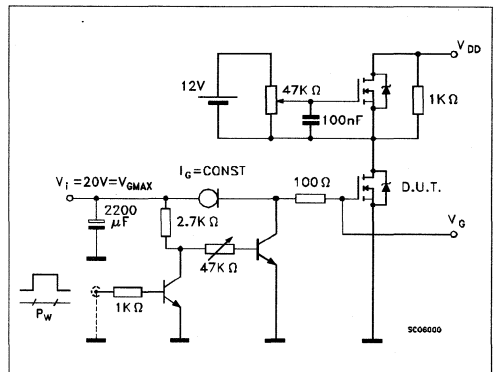
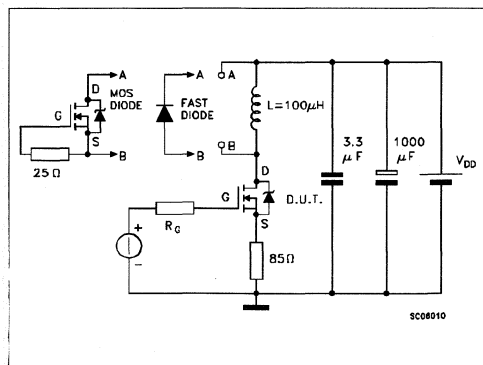


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



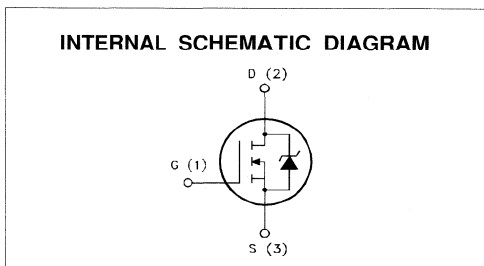
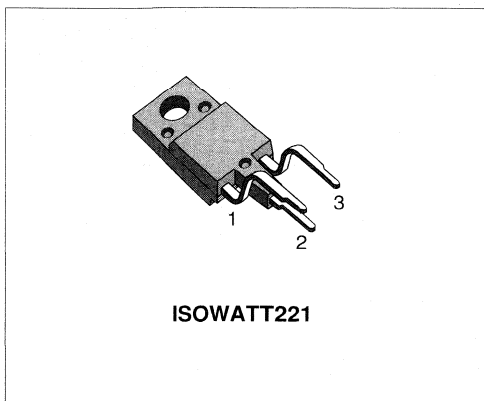
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP4N100XI	1000 V	< 4 Ω	2 A

- TYPICAL R_{DS(on)} = 3.1 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INPUT CAPACITANCE
- LOW GATE CHARGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CONSUMER AND INDUSTRIAL LIGHTING
- DC-AC INVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLY (UPS)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	1000	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	1000	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	2	A
I _D	Drain Current (continuous) at T _c = 100 °C	1.3	A
I _{DM} (*)	Drain Current (pulsed)	8	A
P _{tot}	Total Dissipation at T _c = 25 °C	35	W
	Derating Factor	0.28	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	4000	V
T _{stg}	Storage Temperature	-65 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C

(*) Pulse width limited by safe operating area

THERMAL DATA

R _{thj-case}	Thermal Resistance Junction-case	Max	3.57	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	60	°C/W
R _{thj-amb}	Thermal Resistance Case-sink	Typ	0.5	°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	4	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	160	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	8.3	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	2.5	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	1000			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 2 A V _{GS} = 10V I _D = 2 A T _c = 100°C		3.1	4 8	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} × R _{DS(on)max} V _{GS} = 10 V	2			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} × R _{DS(on)max} I _D = 2 A	2	4		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		1230	1500	pF
C _{oss}	Output Capacitance			165	200	pF
C _{rss}	Reverse Transfer Capacitance			70	85	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 800\text{ V}$ $I_D = 2\text{ A}$		36	45	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		130	165	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 800\text{ V}$ $I_D = 4\text{ A}$ $R_G = 15\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		180		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 800\text{ V}$ $I_D = 4\text{ A}$ $V_{GS} = 10\text{ V}$		80	100	nC
Q_{gs}	Gate-Source Charge			8		nC
Q_{gd}	Gate-Drain Charge			40		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(voff)}$	Off-voltage Rise Time	$V_{DD} = 800\text{ V}$ $I_D = 4\text{ A}$		100	125	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		25	32	ns
t_c	Cross-over Time	(see test circuit, figure 5)		155	190	ns

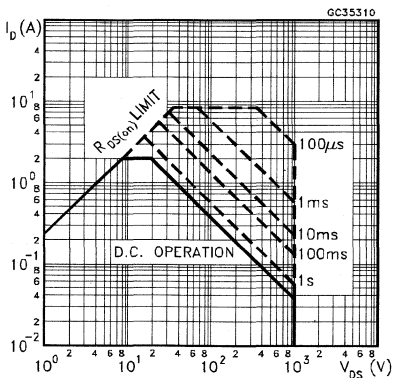
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				2	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				8	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 2\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 4\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		1200		ns
Q_{rr}	Reverse Recovery Charge			30		μ C
I_{RRM}	Reverse Recovery Current			50		A

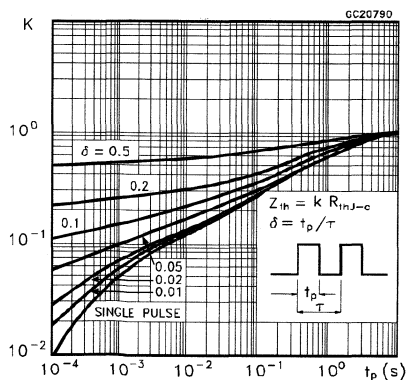
(*) Pulsed: Pulse duration $\tau = 300\ \mu\text{s}$, duty cycle 1.5%

(•) Pulse width limited by safe operating area

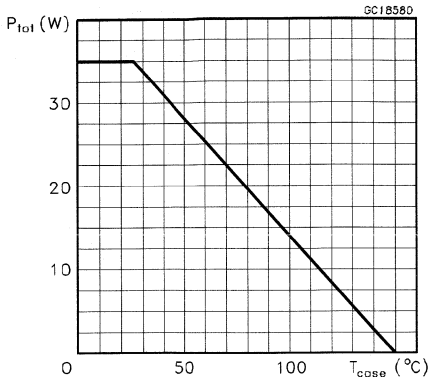
Safe Operating Area



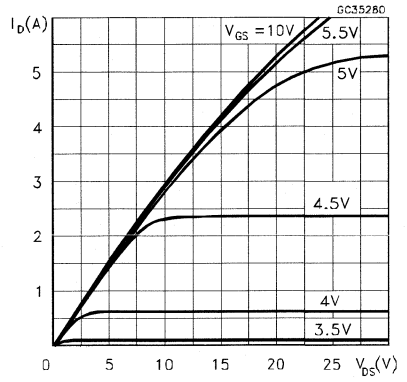
Thermal Impedance



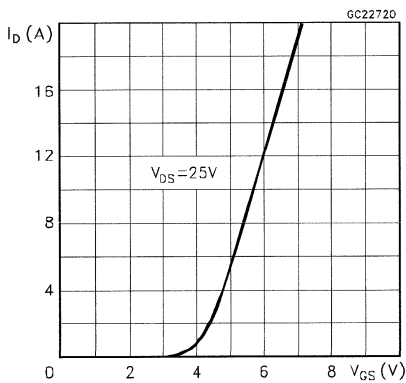
Derating Curve



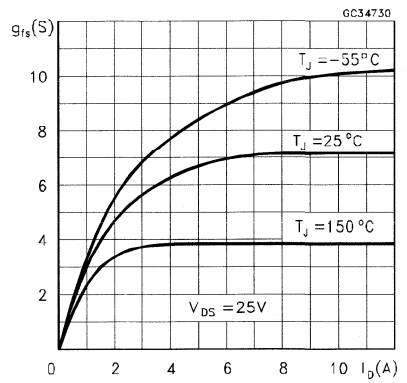
Output Characteristics



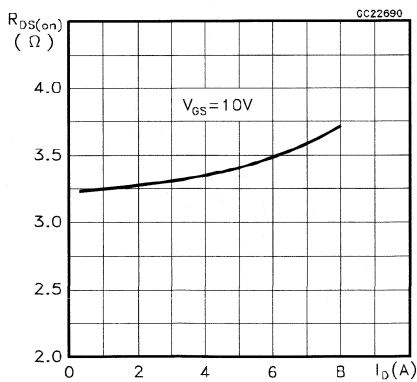
Transfer Characteristics



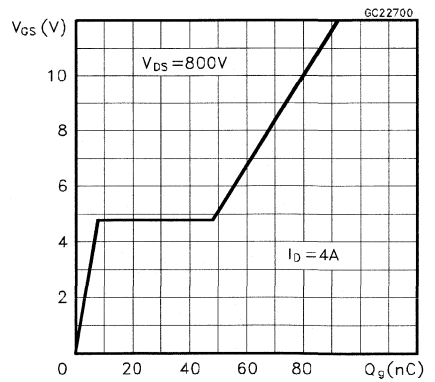
Transconductance



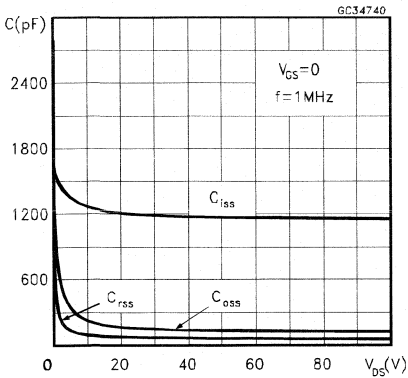
Static Drain-source On Resistance



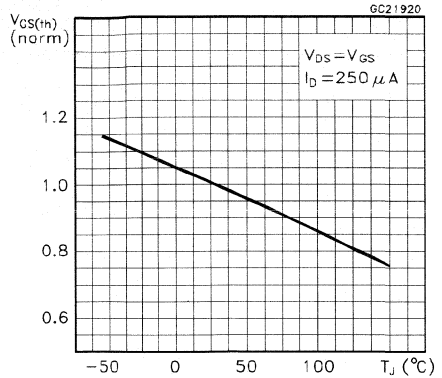
Gate Charge vs Gate-source Voltage



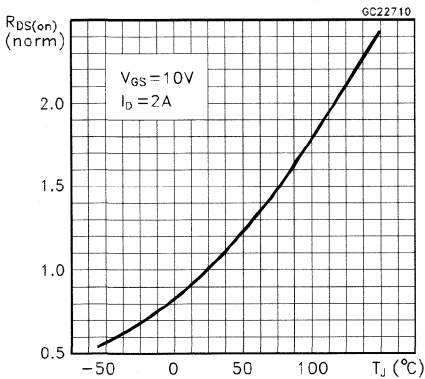
Capacitance Variations



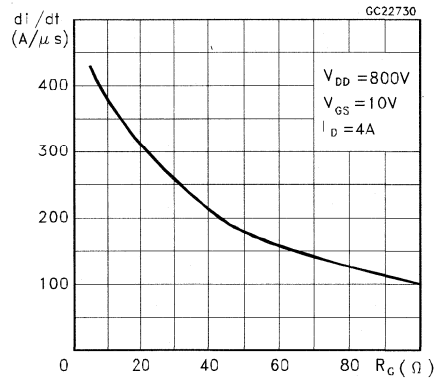
Normalized Gate Threshold Voltage vs Temperature



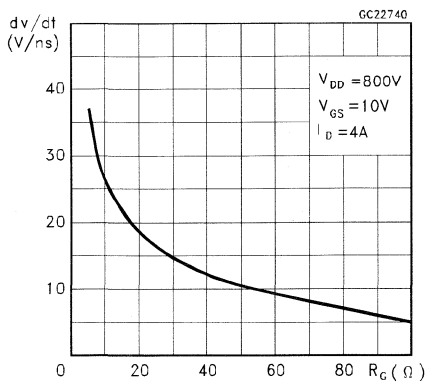
Normalized On Resistance vs Temperature



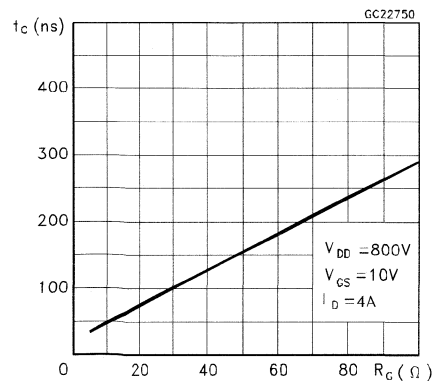
Turn-on Current Slope



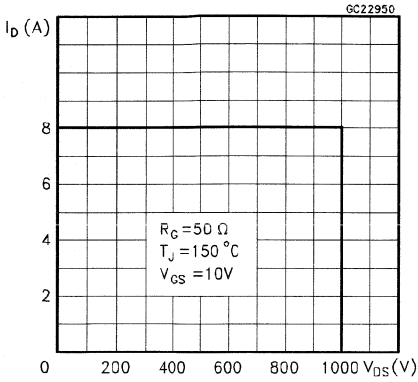
Turn-off Drain-source Voltage Slope



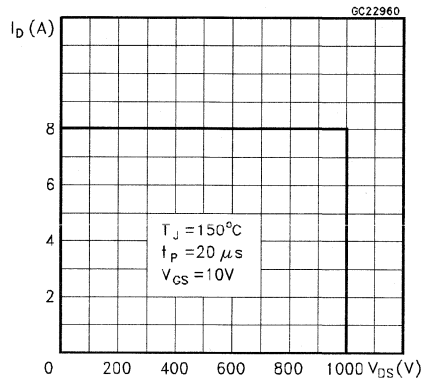
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

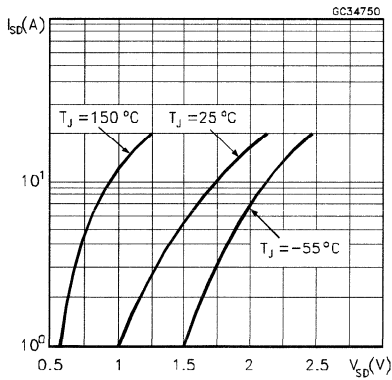


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

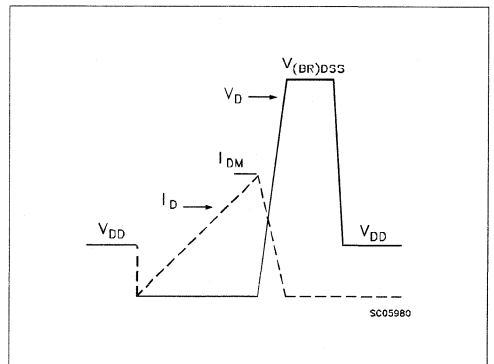
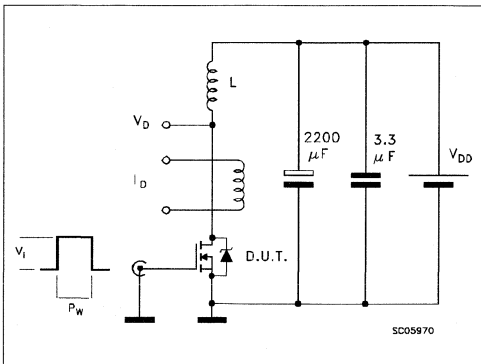


Fig. 3: Switching Times Test Circuits For Resistive Load

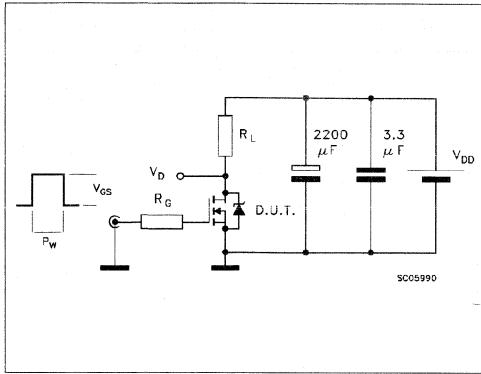


Fig. 4: Gate Charge Test Circuit

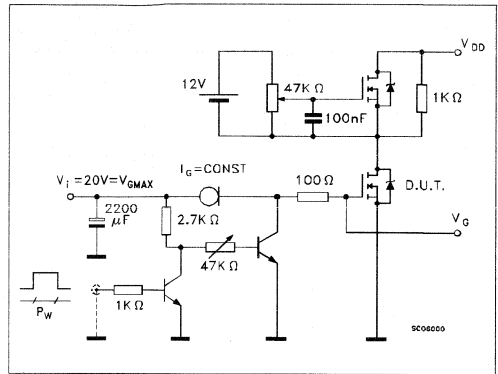
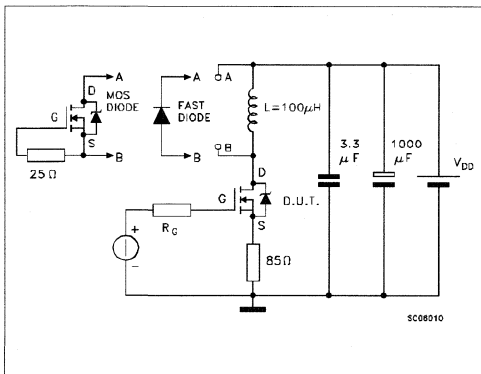


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



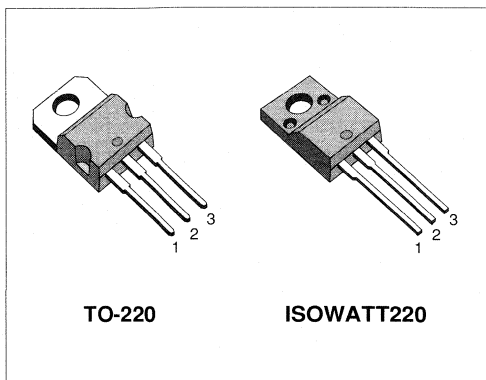
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP5N30	300 V	< 1.4 Ω	5 A
STP5N30FI	300 V	< 1.4 Ω	3.5 A

- TYPICAL R_{DS(on)} = 1.2 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

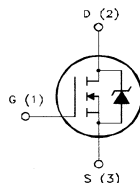
- HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT
- PARTICULARLY SUITABLE FOR ELECTRONIC FLUORESCENT LAMP BALLASTS



TO-220

ISOWATT220

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP5N30	STP5N30FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	300		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	300		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	5	3.5	A
I _D	Drain Current (continuous) at T _c = 100 °C	3.2	2.2	A
I _{DM(●)}	Drain Current (pulsed)	20	20	A
P _{tot}	Total Dissipation at T _c = 25 °C	75	35	W
	Derating Factor	0.6	0.28	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(●) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
$R_{thj-case}$	Thermal Resistance Junction-case	Max	1.67	3.57	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5		°C/W
$R_{thc-sink}$	Thermal Resistance Case-sink	Typ	0.5		°C/W
T_l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	5	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ °C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	50	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	1.5	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ °C}$, pulse width limited by T_j max, $\delta < 1\%$)	3.2	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$	300			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\text{ }\mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 2.5\text{ A}$ $V_{GS} = 10\text{ V}$ $I_D = 2.5\text{ A}$ $T_c = 100\text{ °C}$		1.2	1.4 2.8	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	5			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 2.5\text{ A}$	2	3.1		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		500	700	pF
C_{oss}	Output Capacitance			80	110	pF
C_{rss}	Reverse Transfer Capacitance			16	25	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 150\text{ V}$ $I_D = 2.5\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		45 30	60 40	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 240\text{ V}$ $I_D = 5\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		330		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 240\text{ V}$ $I_D = 5\text{ A}$ $V_{GS} = 10\text{ V}$		20 6 8	30	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$ t_f	Off-voltage Rise Time Fall Time	$V_{DD} = 240\text{ V}$ $I_D = 5\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		35 20	50 30	ns ns
t_c	Cross-over Time	(see test circuit, figure 5)		60	80	ns

SOURCE DRAIN DIODE

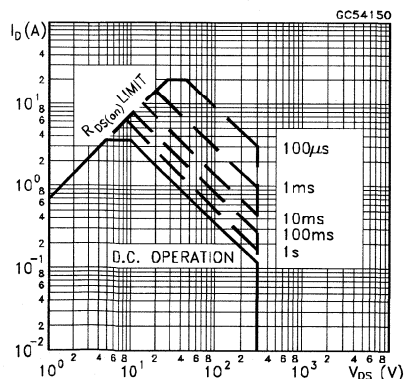
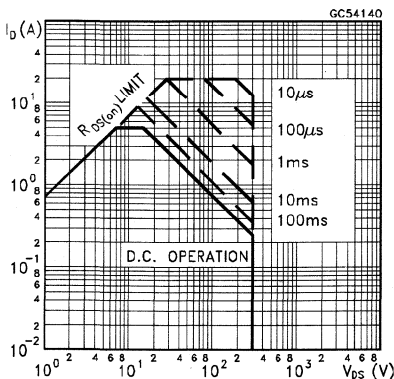
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				5 20	A A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 5\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 5\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_J = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		300		ns
Q_{rr}	Reverse Recovery Charge			1.7		μ C
I_{RRM}	Reverse Recovery Current			13		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

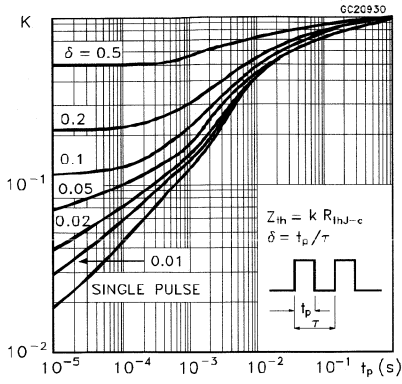
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

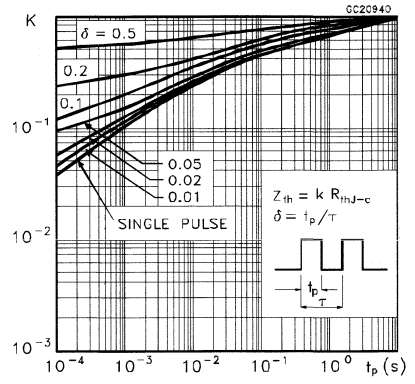
Safe Operating Areas For ISOWATT220



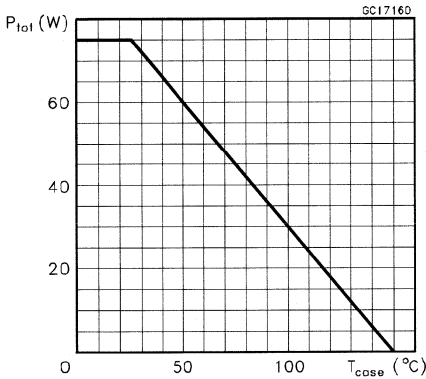
Thermal Impedance For TO-220



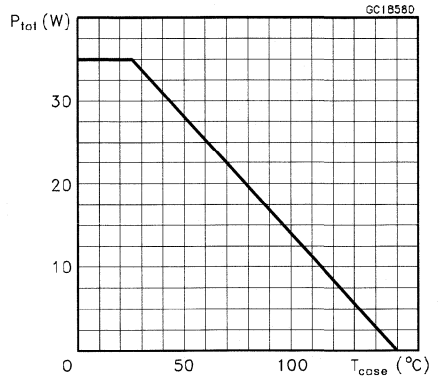
Thermal Impedance For ISOWATT220



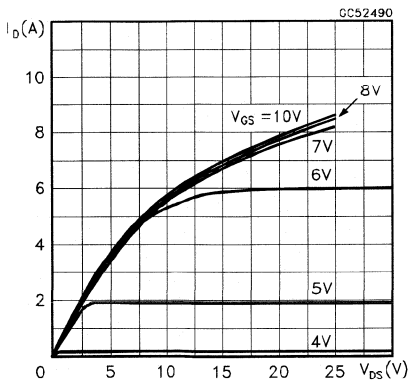
Derating Curve For TO-220



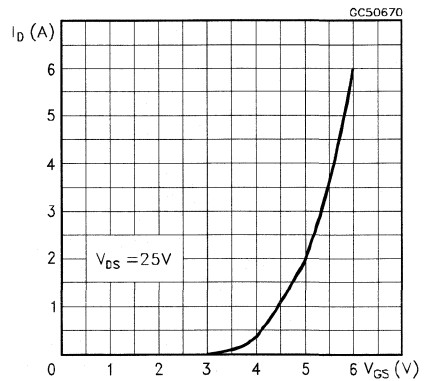
Derating Curve For ISOWATT220



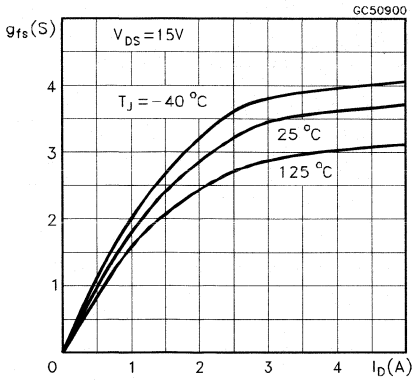
Output Characteristics



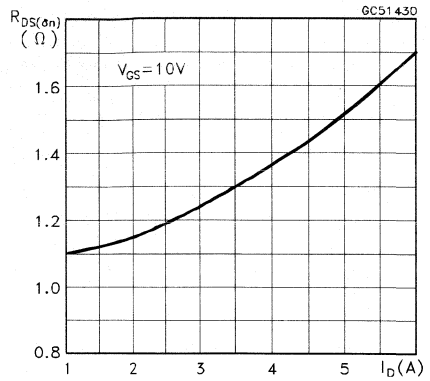
Transfer Characteristics



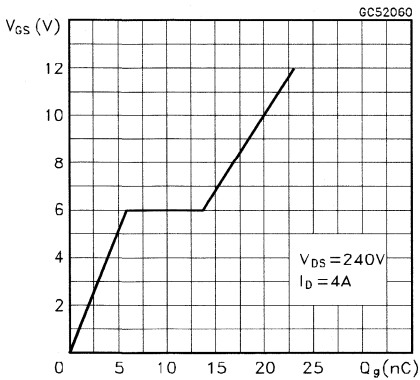
Transconductance



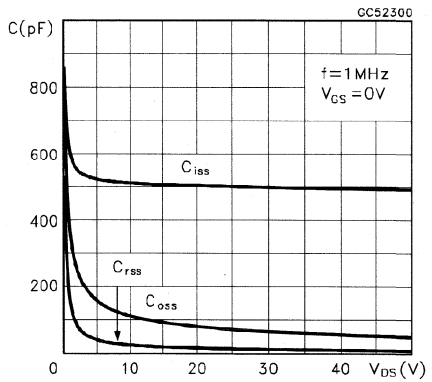
Static Drain-source On Resistance



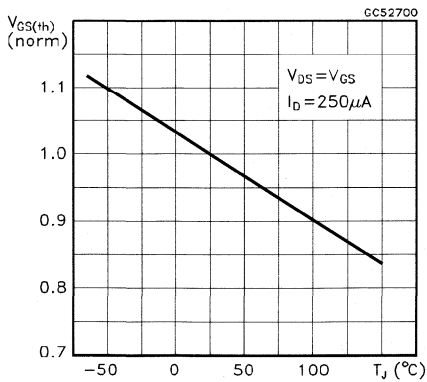
Gate Charge vs Gate-source Voltage



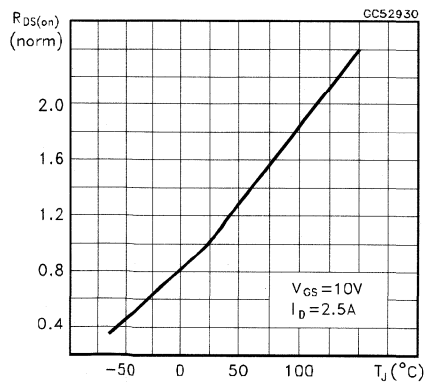
Capacitance Variations



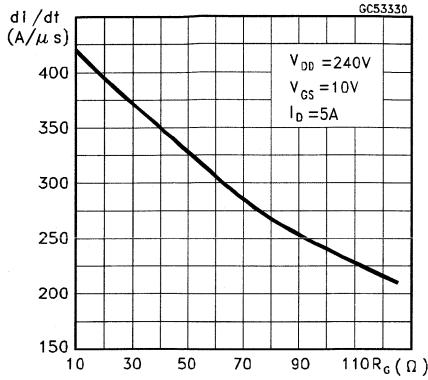
Normalized Gate Threshold Voltage vs Temperature



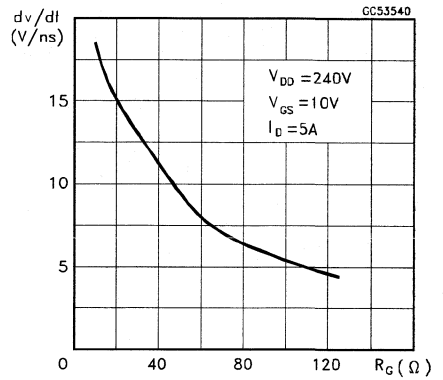
Normalized On Resistance vs Temperature



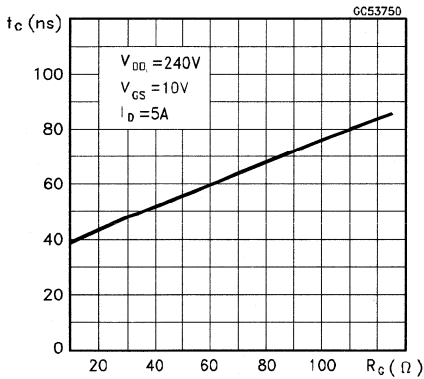
Turn-on Current Slope



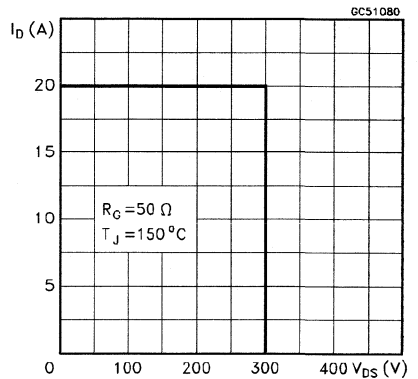
Turn-off Drain-source Voltage Slope



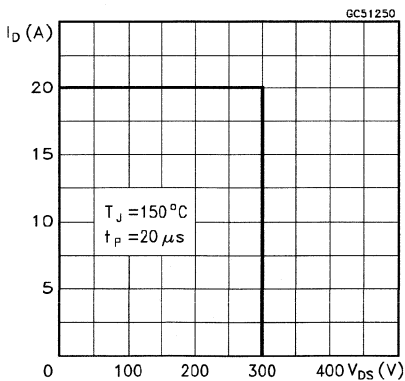
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

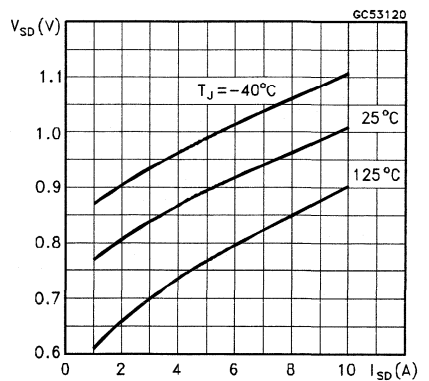


Fig. 1: Unclamped Inductive Load Test Circuits

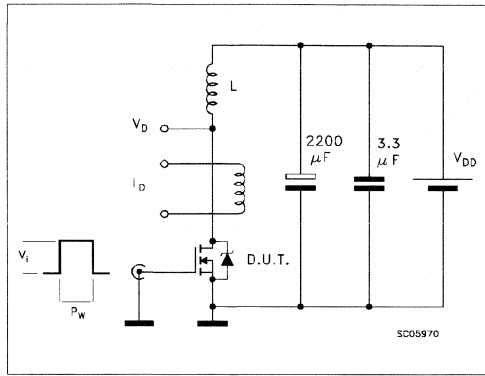


Fig. 2: Unclamped Inductive Waveforms

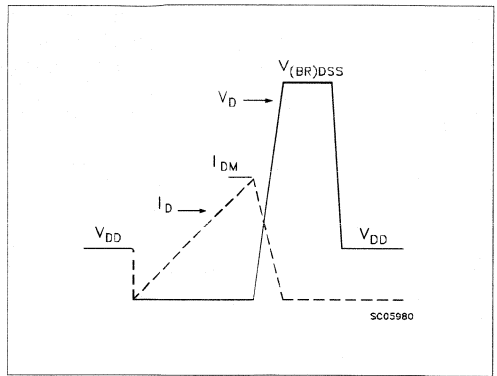


Fig. 3: Switching Times Test Circuits For Resistive Load

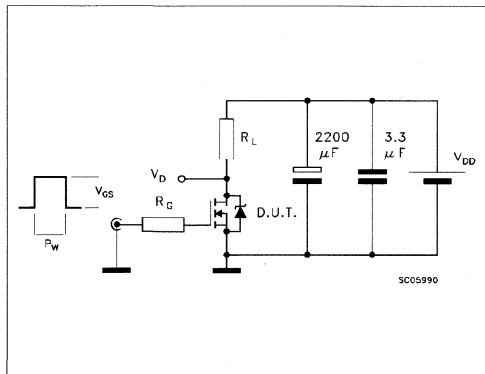


Fig. 4: Gate Charge Test Circuit

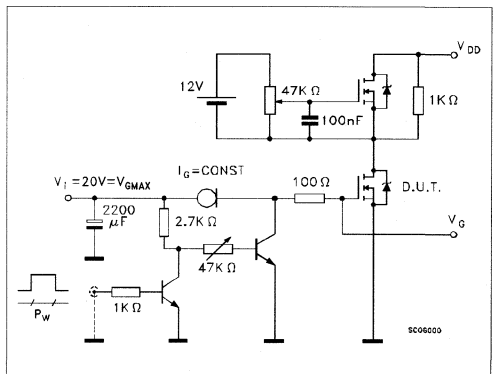
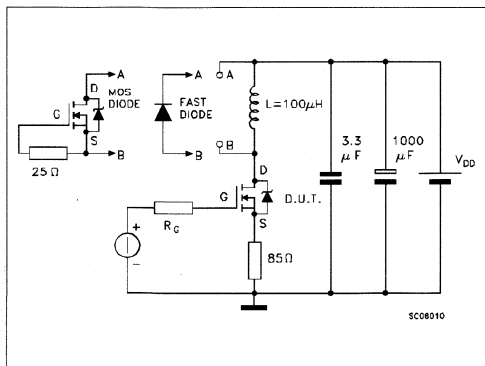


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



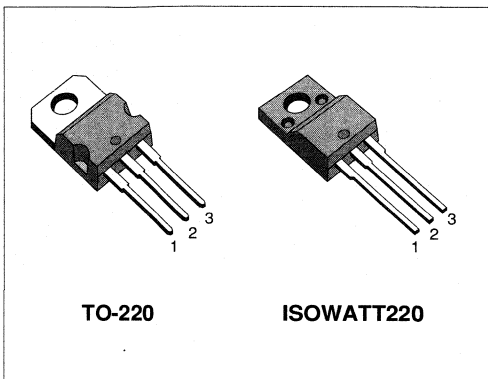
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP5N30L	300 V	< 1.4 Ω	5 A
STP5N30LFI	300 V	< 1.4 Ω	3.5 A

- TYPICAL R_{DS(on)} = 1.25 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

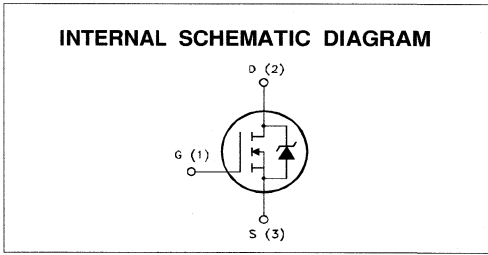
APPLICATIONS

- HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT
- PARTICULARLY SUITABLE FOR ELECTRONIC FLUORESCENT LAMP BALLASTS



TO-220

ISOWATT220



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP5N30L	STP5N30LFI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	300		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	300		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	5	3.5	A
I _D	Drain Current (continuous) at T _c = 100 °C	3.2	2.2	A
I _{DM} (*)	Drain Current (pulsed)	20	20	A
P _{tot}	Total Dissipation at T _c = 25 °C	75	35	W
	Derating Factor	0.6	0.28	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
$R_{thj-case}$	Thermal Resistance Junction-case	Max	1.67	3.57	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5		°C/W
$R_{thc-sink}$	Thermal Resistance Case-sink	Typ	0.5		°C/W
T_l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	5	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ }^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	50	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	1.5	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ }^\circ\text{C}$, pulse width limited by T_j max, $\delta < 1\%$)	3.2	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ }^\circ\text{C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$	300			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ }^\circ\text{C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\text{ }\mu\text{A}$	1	1.6	2.5	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 5\text{ V}$ $I_D = 2.5\text{ A}$ $V_{GS} = 5\text{ V}$ $I_D = 2.5\text{ A}$ $T_c = 100\text{ }^\circ\text{C}$		1.25	1.4 2.8	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	5			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 2.5\text{ A}$	2	5		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		580	780	pF
C_{oss}	Output Capacitance			75	110	pF
C_{rss}	Reverse Transfer Capacitance			14	25	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 150\text{ V}$ $I_D = 2.5\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 3)		70 165	90 215	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 240\text{ V}$ $I_D = 5\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 5)		115		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 240\text{ V}$ $I_D = 5\text{ A}$ $V_{GS} = 5\text{ V}$		16 5 7	22	nC nC nC

SWITCHING OFF

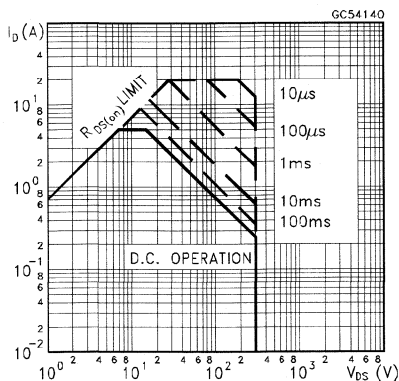
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$ t_f t_c	Off-voltage Rise Time Fall Time Cross-over Time	$V_{DD} = 240\text{ V}$ $I_D = 5\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 5)		60 50 120	80 65 160	ns ns ns

SOURCE DRAIN DIODE

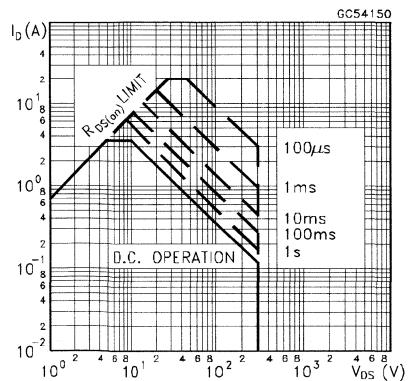
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				5 20	A A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 5\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 5\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		360		ns
Q_{rr}	Reverse Recovery Charge			2.4		μ C
I_{RRM}	Reverse Recovery Current			13		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %
 (•) Pulse width limited by safe operating area

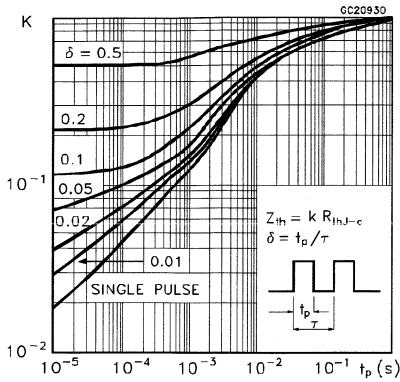
Safe Operating Areas For TO-220



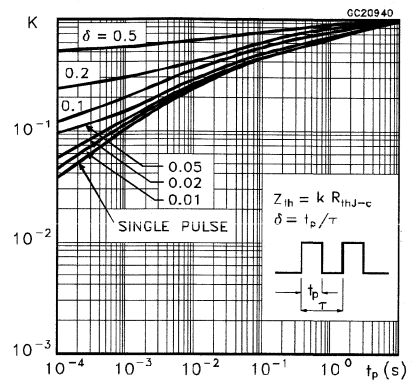
Safe Operating Areas For ISOWATT220



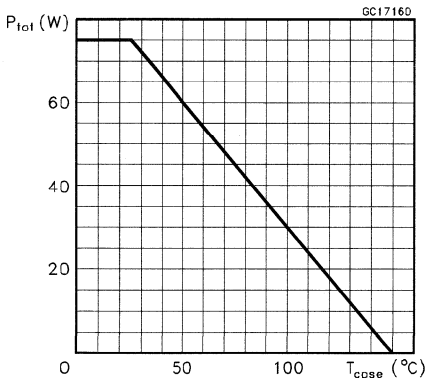
Thermal Impedance For TO-220



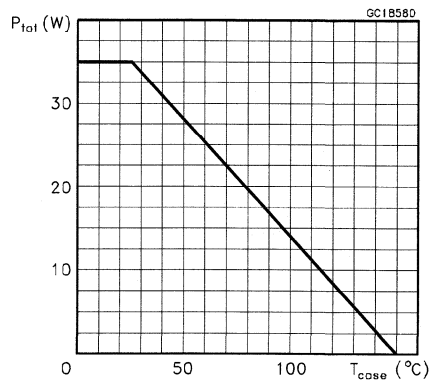
Thermal Impedance For ISOWATT220



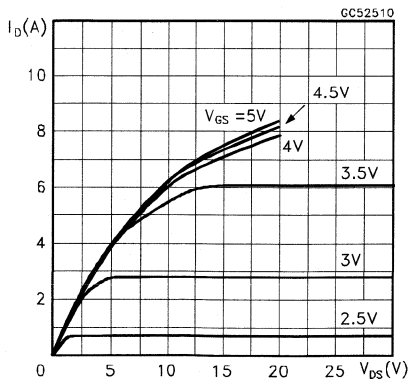
Derating Curve For TO-220



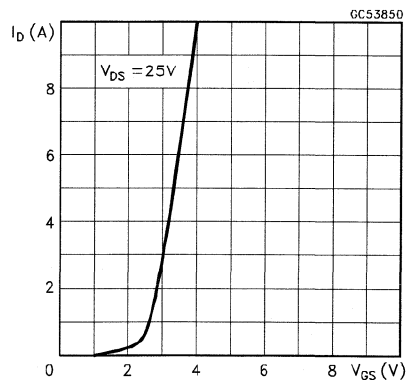
Derating Curve For ISOWATT220



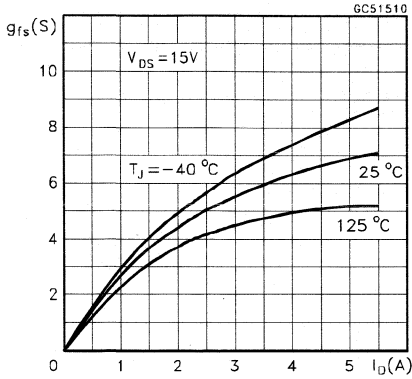
Output Characteristics



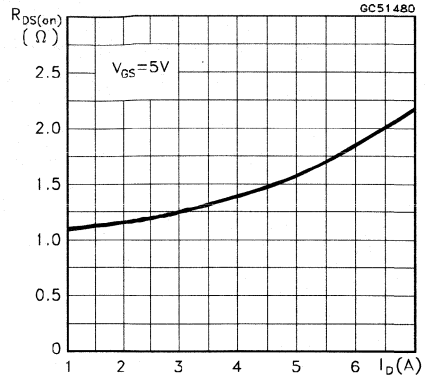
Transfer Characteristics



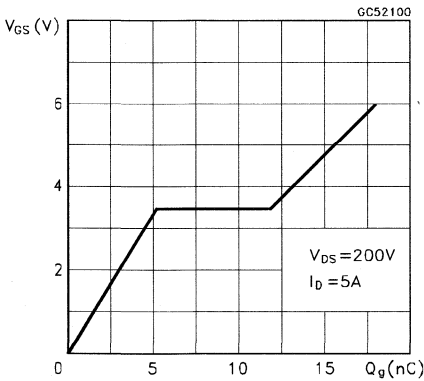
Transconductance



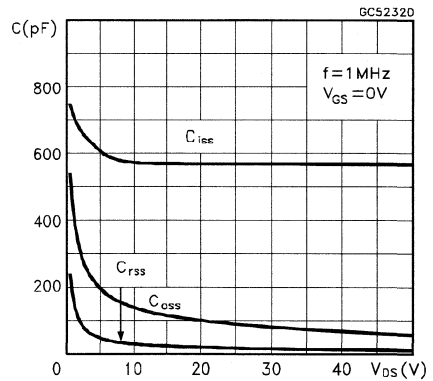
Static Drain-source On Resistance



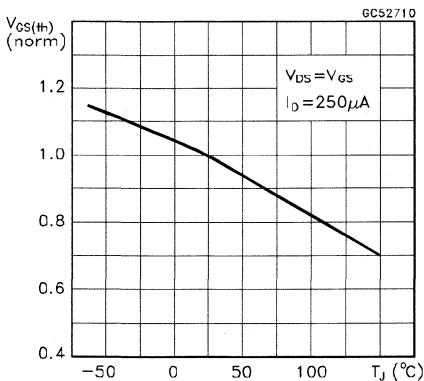
Gate Charge vs Gate-source Voltage



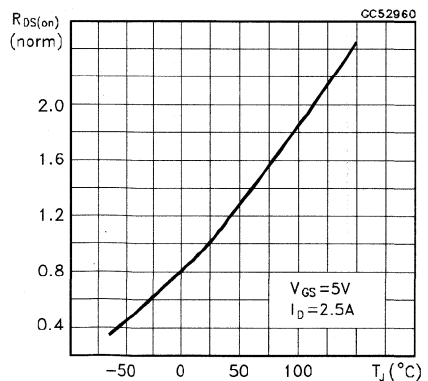
Capacitance Variations



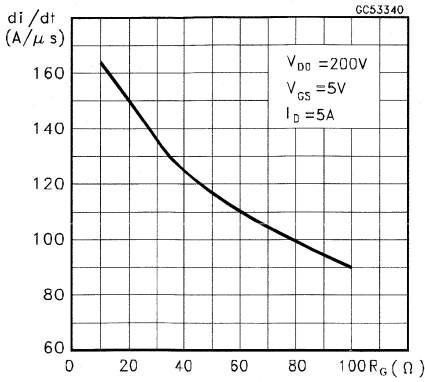
Normalized Gate Threshold Voltage vs Temperature



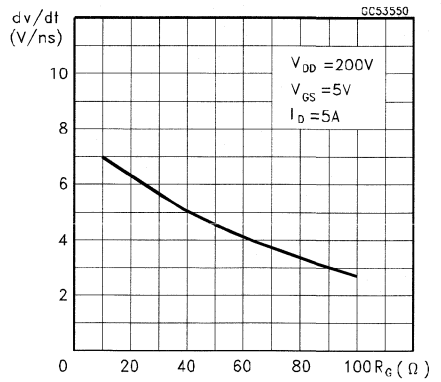
Normalized On Resistance vs Temperature



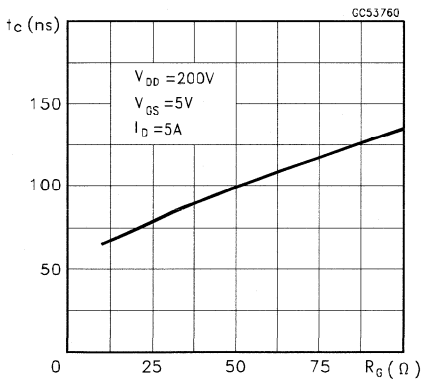
Turn-on Current Slope



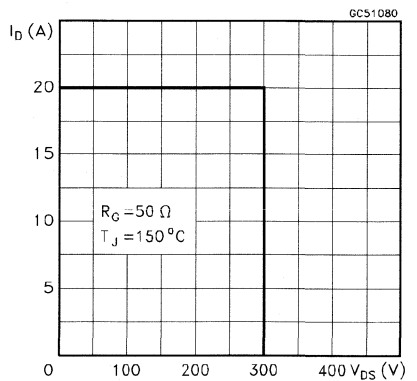
Turn-off Drain-source Voltage Slope



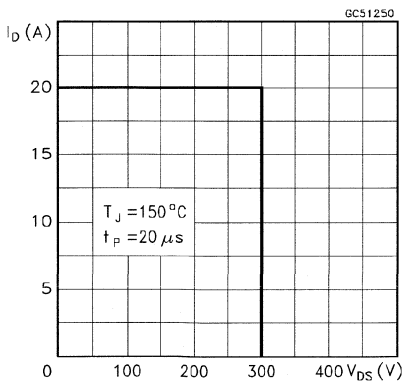
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

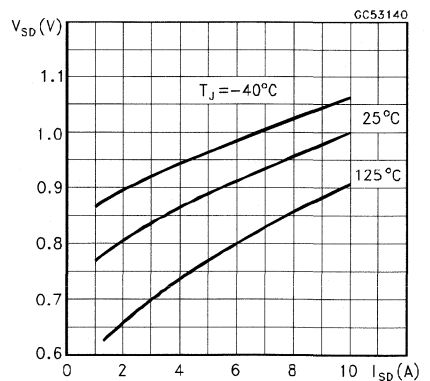


Fig. 1: Unclamped Inductive Load Test Circuits

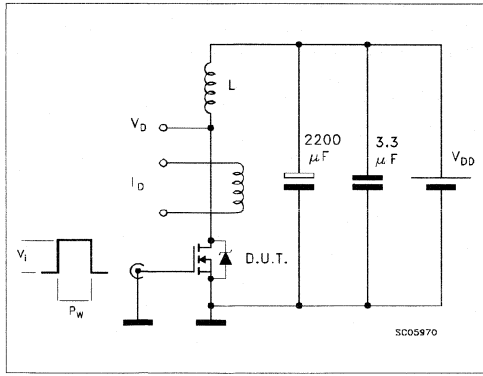


Fig. 2: Unclamped Inductive Waveforms

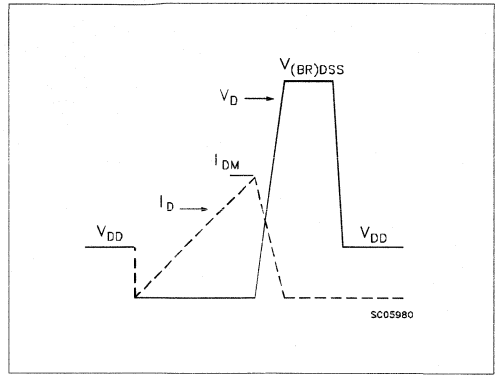


Fig. 3: Switching Times Test Circuits For Resistive Load

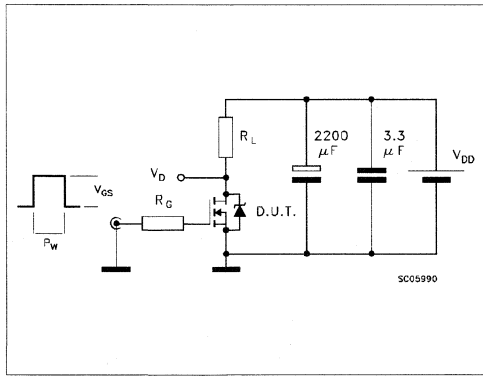


Fig. 4: Gate Charge Test Circuit

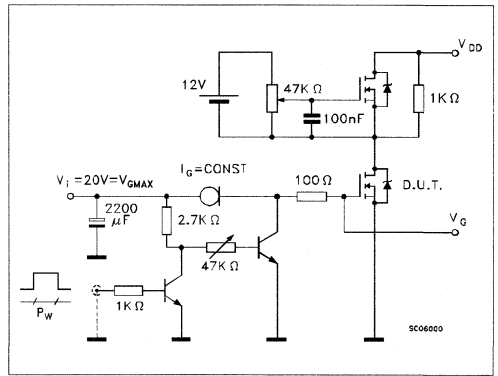
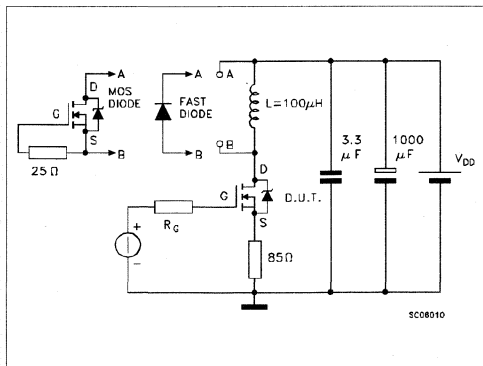


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



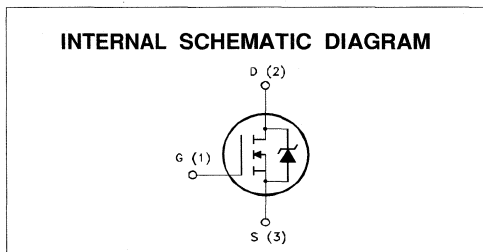
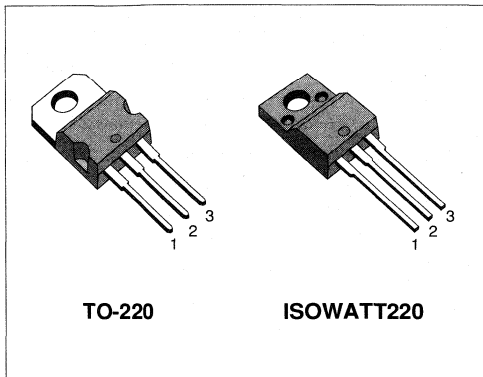
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP5N50	500 V	< 1.6 Ω	4.5 A
STP5N50FI	500 V	< 1.6 Ω	3 A

- TYPICAL R_{DS(on)} = 1.4 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP5N50	STP5N50FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	500		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	500		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	4.5	3	A
I _D	Drain Current (continuous) at T _c = 100 °C	3	1.8	A
I _{DM} (*)	Drain Current (pulsed)	15	15	A
P _{tot}	Total Dissipation at T _c = 25 °C	100	35	W
	Derating Factor	0.8	0.28	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-200	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case	Max	1.25	3.57	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.5		°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	4.5	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	280	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	7.4	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	2.5	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	500			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 2.5 A V _{GS} = 10V I _D = 2.5 A T _c = 100°C		1.4	1.6 3.2	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	4.5			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 2.5 A	2.7	3.4		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		600	800	pF
C _{oss}	Output Capacitance			100	130	pF
C _{rss}	Reverse Transfer Capacitance			40	55	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 225\text{ V}$ $I_D = 2.5\text{ A}$ $R_G = 15\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		45 34	60 42	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 400\text{ V}$ $I_D = 4.5\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		170		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 400\text{ V}$ $I_D = 4.5\text{ A}$ $V_{GS} = 10\text{ V}$		42 6 20	52	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(off)}$ t_f t_c	Off-voltage Rise Time Fall Time Cross-over Time	$V_{DD} = 400\text{ V}$ $I_D = 4.5\text{ A}$ $R_G = 15\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		35 45 60	45 55 75	ns ns ns

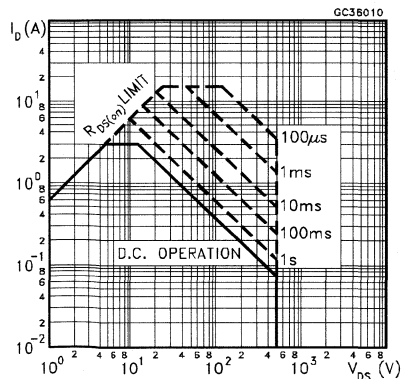
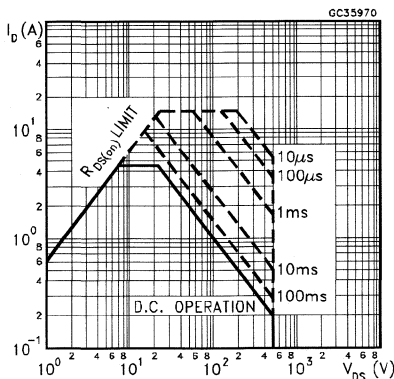
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				4.5 15	A A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 4.5\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 4.5\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		430 3.8 17.5		ns μ C A

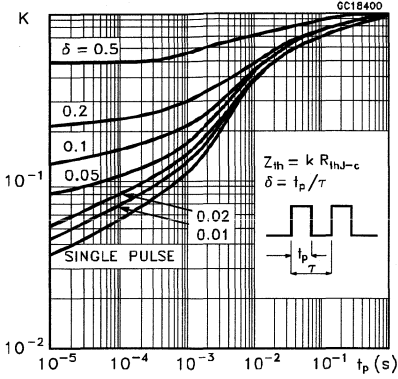
(*) Pulsed: Pulse duration $\bar{t} = 300\ \mu\text{s}$, duty cycle 1.5 %
 (•) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

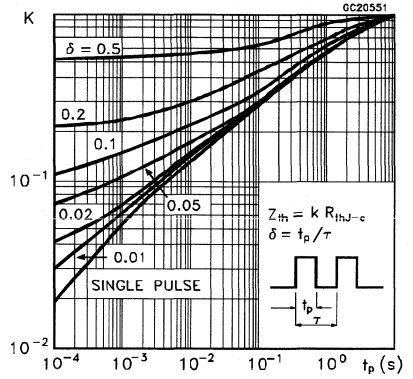
Safe Operating Areas For ISOWATT220



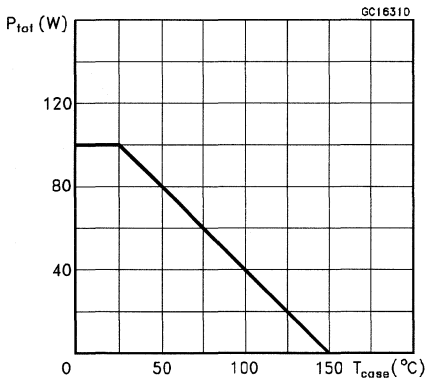
Thermal Impedance For TO-220



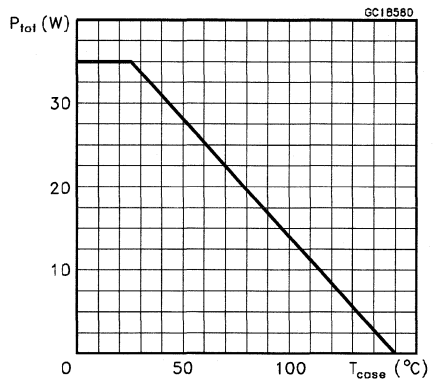
Thermal Impedance For ISOWATT220



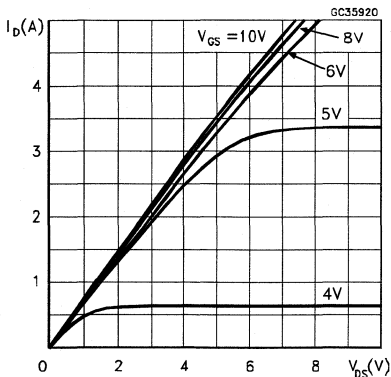
Derating Curve For TO-220



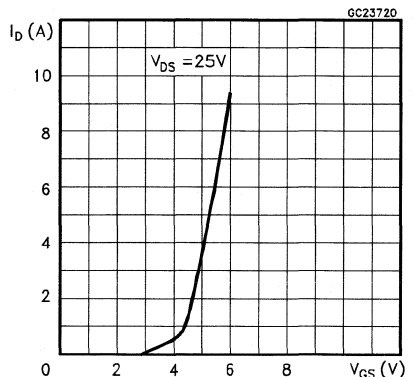
Derating Curve For ISOWATT220



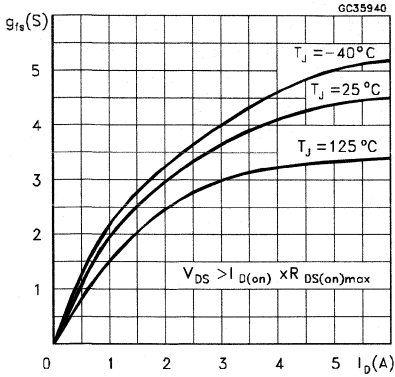
Output Characteristics



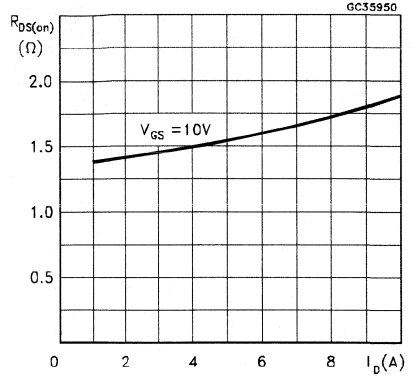
Transfer Characteristics



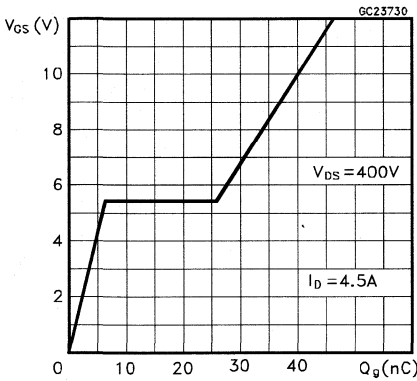
Transconductance



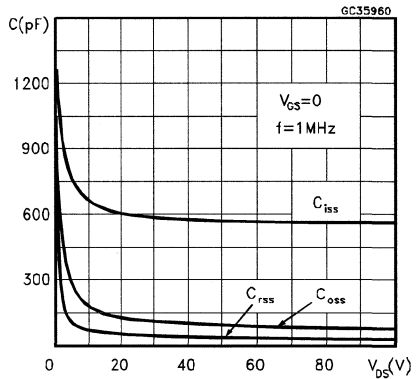
Static Drain-source On Resistance



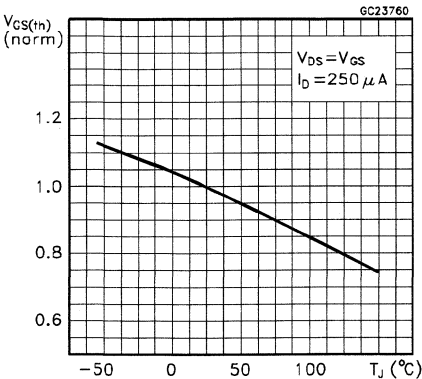
Gate Charge vs Gate-source Voltage



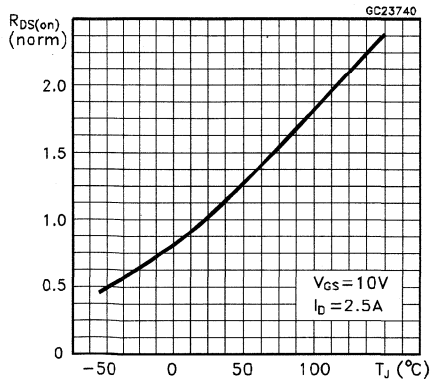
Capacitance Variations



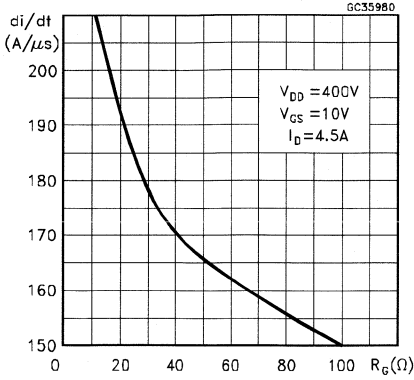
Normalized Gate Threshold Voltage vs Temperature



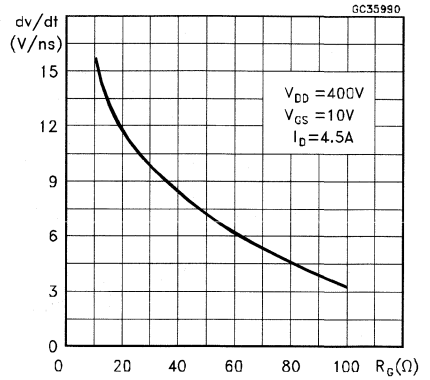
Normalized On Resistance vs Temperature



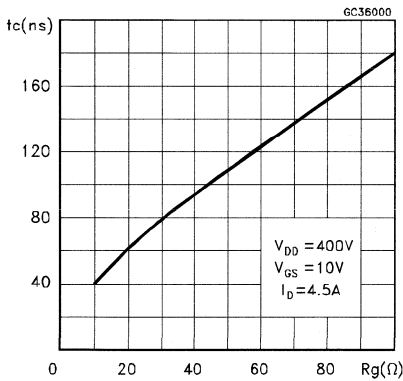
Turn-on Current Slope



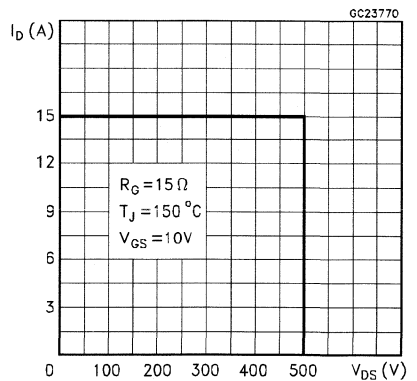
Turn-off Drain-source Voltage Slope



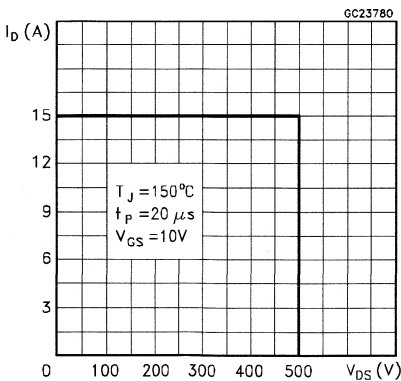
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

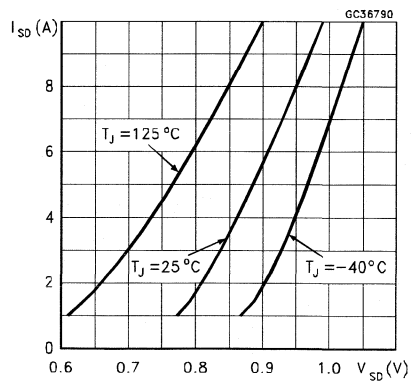


Fig. 1: Unclamped Inductive Load Test Circuits

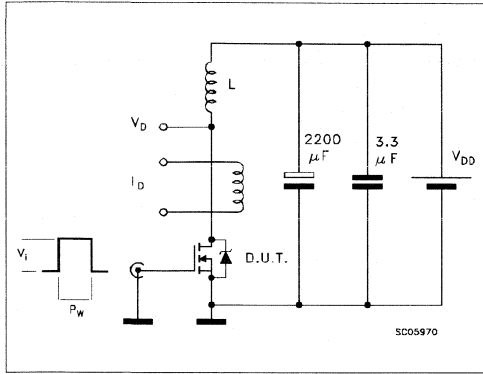


Fig. 2: Unclamped Inductive Waveforms

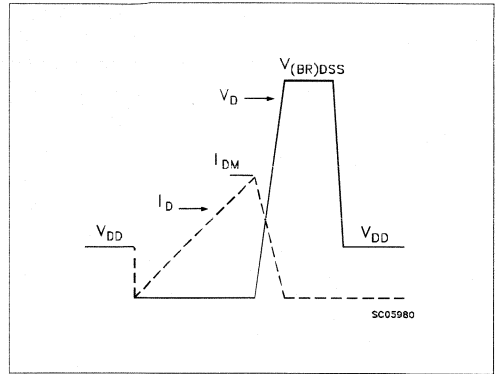


Fig. 3: Switching Times Test Circuits For Resistive Load

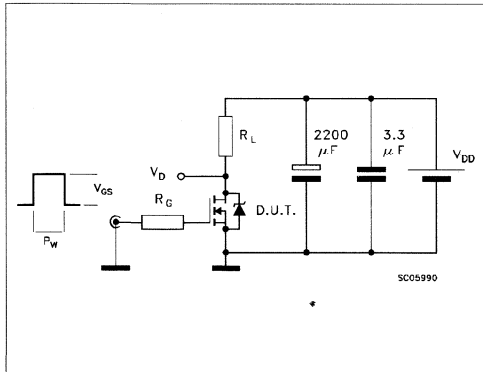


Fig. 4: Gate Charge Test Circuit

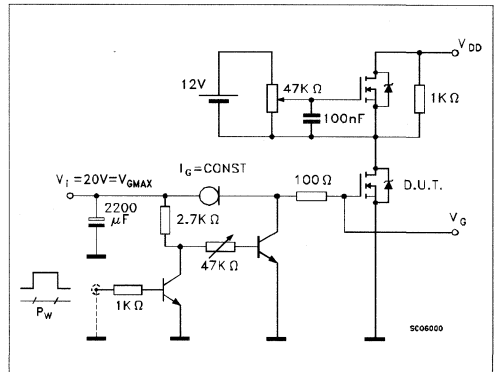
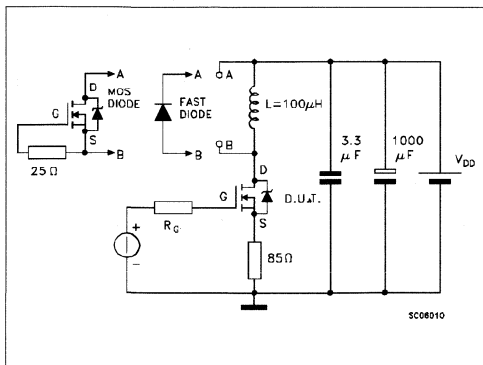


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



N - CHANNEL ENHANCEMENT MODE FAST POWER MOS TRANSISTOR

ADVANCE DATA

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP5NA50	500 V	< 1.6 Ω	5 A
STP5NA50FI	500 V	< 1.6 Ω	3.1 A

- TYPICAL R_{DS(on)} = 1.2 Ω
- ± 30V GATE TO SOURCE VOLTAGE RATING
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INTRINSIC CAPACITANCES
- GATE CHARGE MINIMIZED
- REDUCED THRESHOLD VOLTAGE SPREAD

DESCRIPTION

This series of POWER MOSFETS represents the most advanced high voltage technology. The optimized cell layout coupled with a new proprietary edge termination concur to give the device low R_{DS(on)} and gate charge, unequalled ruggedness and superior switching performance.

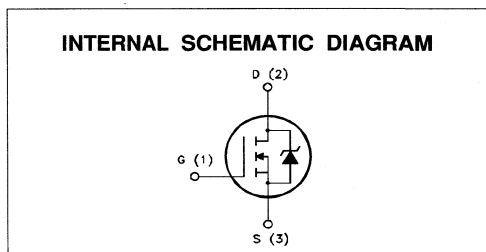
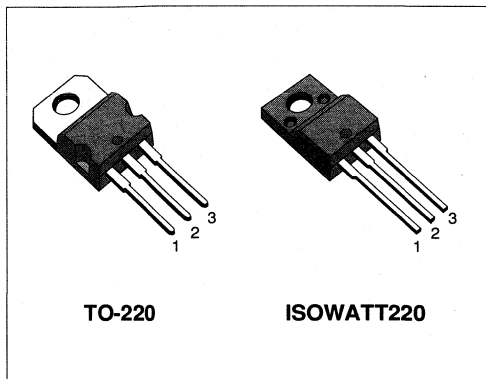
APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- DC-AC CONVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLIES AND MOTOR DRIVE

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP5NA50	STP5NA50FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	500		V
V _{DGR}	Drain-gate Voltage (R _{GS} = 20 kΩ)	500		V
V _{GS}	Gate-source Voltage	± 30		V
I _D	Drain Current (continuous) at T _c = 25 °C	5	3.1	A
I _D	Drain Current (continuous) at T _c = 100 °C	3.3	2.1	A
I _{DM} (*)	Drain Current (pulsed)	20	20	A
P _{tot}	Total Dissipation at T _c = 25 °C	100	35	W
	Derating Factor	0.8	0.28	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area



THERMAL DATA

			TO-220	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case	Max	1.25	3.57	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.5		°C/W
T _j	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	5	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	140	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	4.2	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	2.1	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	400			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 30 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2.25	3	3.75	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 2.5 A V _{GS} = 10V I _D = 2.5 A T _c = 100°C		1.2	1.6 3.2	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} × R _{DS(on)max} V _{GS} = 10 V	5			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} × R _{DS(on)max} I _D = 2.5 A	2.7	4		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		700		pF
C _{oss}	Output Capacitance			115		pF
C _{rss}	Reverse Transfer Capacitance			30		pF

ELECTRICAL CHARACTERISTICS (continued)**SWITCHING ON**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 250\text{ V}$ $I_D = 2.5\text{ A}$ $R_G = 15\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		15 45		ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 250\text{ V}$ $I_D = 5\text{ A}$ $R_G = 47\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		400		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 400\text{ V}$ $I_D = 5\text{ A}$ $V_{GS} = 10\text{ V}$		32 6 14		nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(voff)}$ t_f t_c	Off-voltage Rise Time Fall Time Cross-over Time	$V_{DD} = 400\text{ V}$ $I_D = 5\text{ A}$ $R_G = 15\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		15 12 30		ns ns ns

SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				5 20	A A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 5\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 5\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 50\text{ V}$ $T_J = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		380 3.4 18		ns μ C A

(*) Pulsed: Pulse duration² = 300 μ s, duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

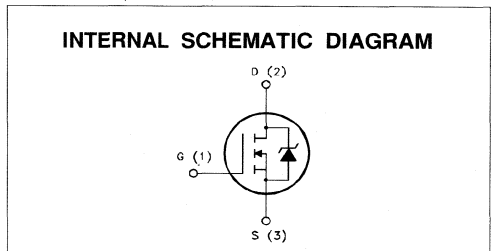
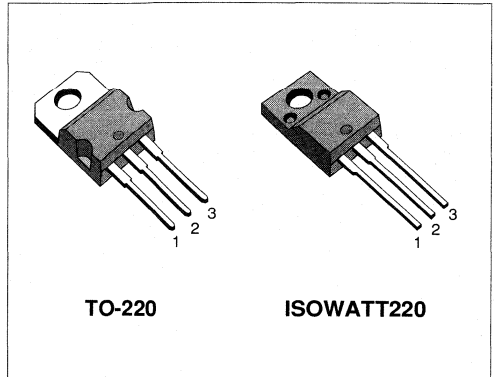
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP5N60	600 V	< 1.6 Ω	5.6 A
STP5N60FI	600 V	< 1.6 Ω	3.2 A

- TYPICAL R_{DS(on)} = 1.33 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP5N60	STP5N60FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	600		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	600		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _C = 25 °C	5.6	3.2	A
I _D	Drain Current (continuous) at T _C = 100 °C	3.5	2	A
I _{DM} (*)	Drain Current (pulsed)	20	20	A
P _{tot}	Total Dissipation at T _C = 25 °C	100	40	W
	Derating Factor	1	0.32	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
$R_{thj-case}$	Thermal Resistance Junction-case	Max	1	3.12	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5		°C/W
$R_{thc-sink}$	Thermal Resistance Case-sink	Typ	0.5		°C/W
T_l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	5.6	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ °C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	350	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	15	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ °C}$, pulse width limited by T_j max, $\delta < 1\%$)	3.5	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$	600			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\text{ }\mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 2.5\text{ A}$ $V_{GS} = 10\text{ V}$ $I_D = 2.5\text{ A}$ $T_c = 100\text{ °C}$		1.33	1.5 3	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	5.6			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 2.5\text{ A}$	1.5	3.4		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		720	1000	pF
C_{oss}	Output Capacitance			120	170	pF
C_{rss}	Reverse Transfer Capacitance			50	70	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 300\text{ V}$ $I_D = 2.5\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		55 150	75 200	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 480\text{ V}$ $I_D = 5\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		115		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 480\text{ V}$ $I_D = 5\text{ A}$ $V_{GS} = 10\text{ V}$		46 8 25	65	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$	Off-voltage Rise Time	$V_{DD} = 480\text{ V}$ $I_D = 5\text{ A}$		80	105	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		25	35	ns
t_c	Cross-over Time	(see test circuit, figure 5)		120	160	ns

SOURCE DRAIN DIODE

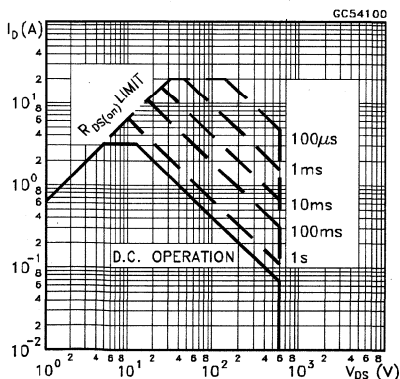
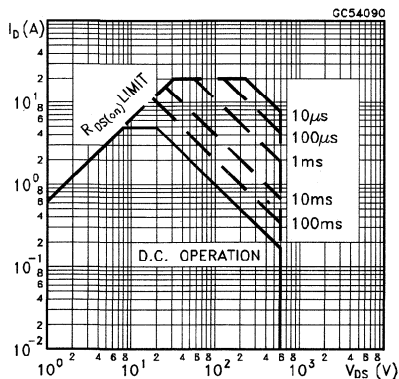
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				5.6 20	A A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 5.9\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 6\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		525		ns
Q_{rr}	Reverse Recovery Charge			5.8		μ C
I_{RRM}	Reverse Recovery Current			22		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

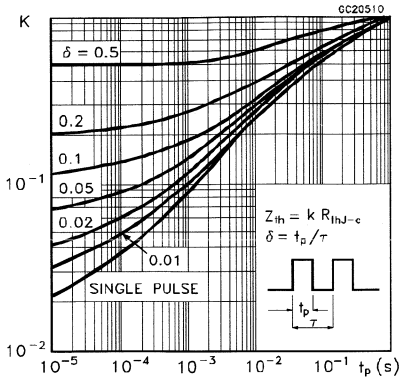
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

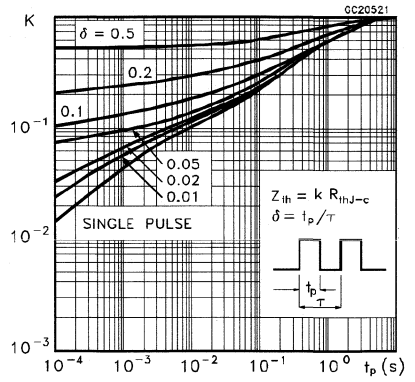
Safe Operating Areas For ISOWATT220



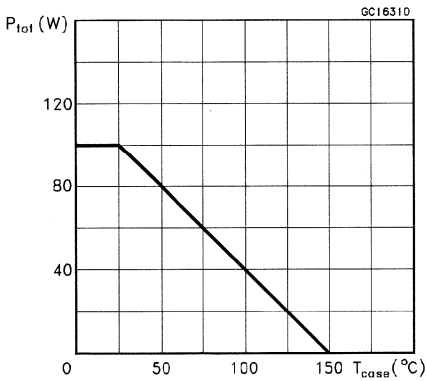
Thermal Impedance For TO-220



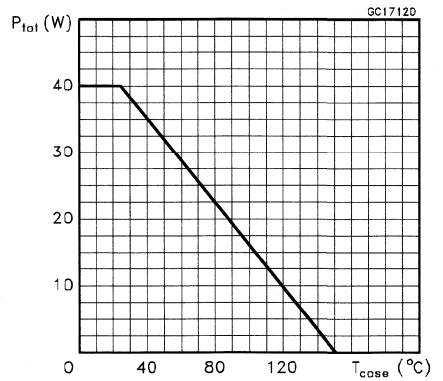
Thermal Impedance For ISOWATT220



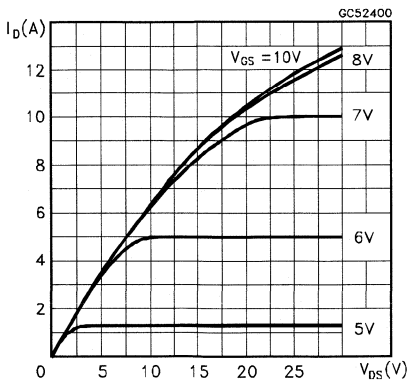
Derating Curve For TO-220



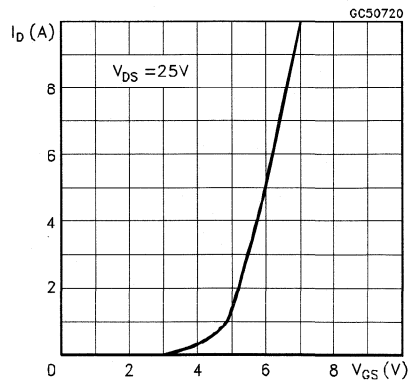
Derating Curve For ISOWATT220



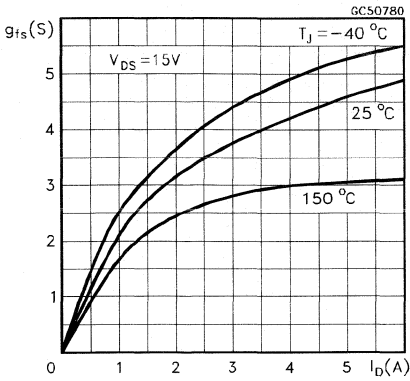
Output Characteristics



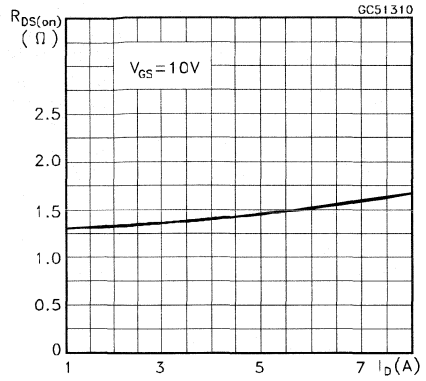
Transfer Characteristics



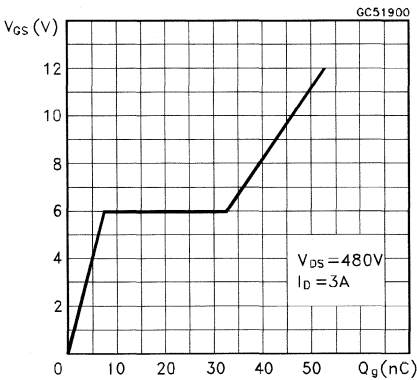
Transconductance



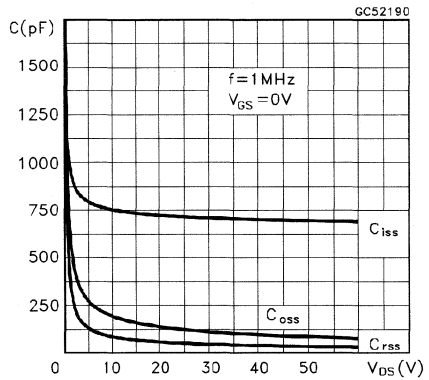
Static Drain-source On Resistance



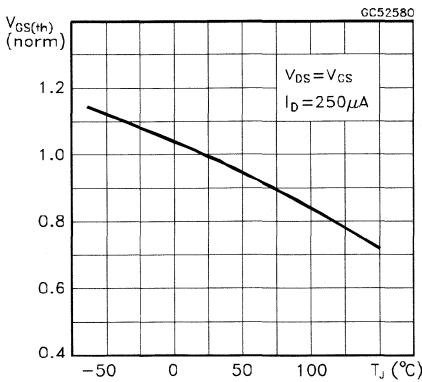
Gate Charge vs Gate-source Voltage



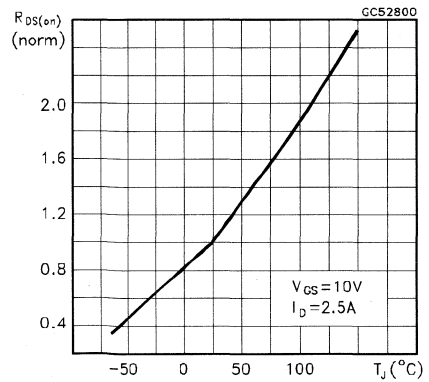
Capacitance Variations



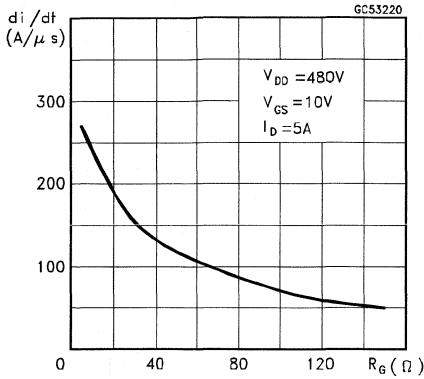
Normalized Gate Threshold Voltage vs Temperature



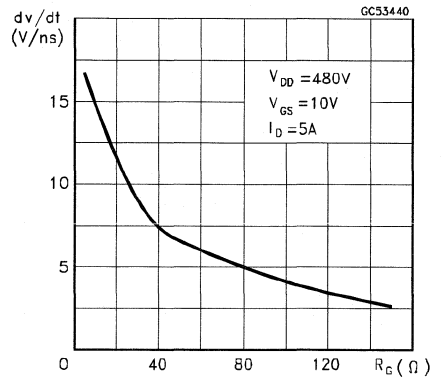
Normalized On Resistance vs Temperature



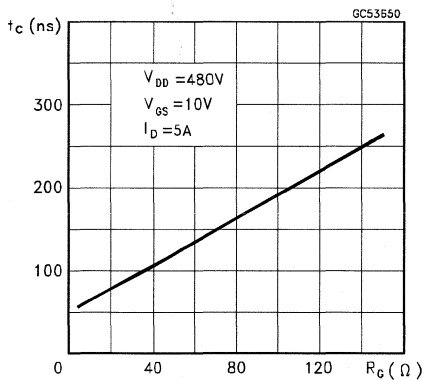
Turn-on Current Slope



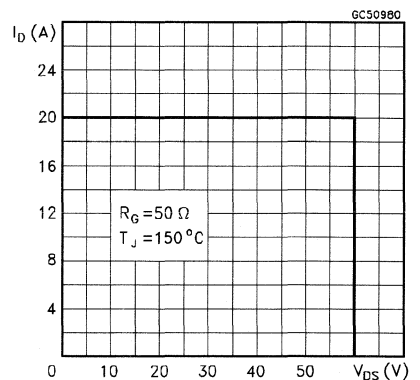
Turn-off Drain-source Voltage Slope



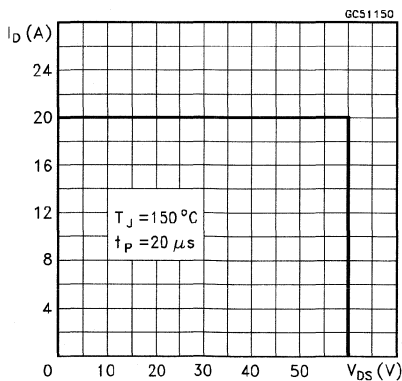
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

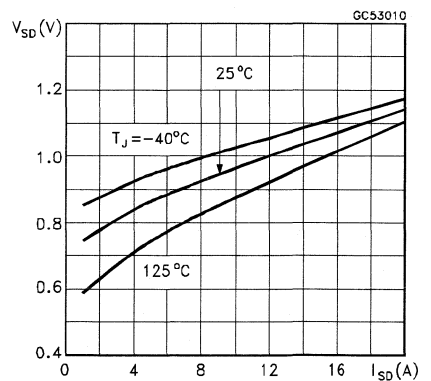


Fig. 1: Unclamped Inductive Load Test Circuits

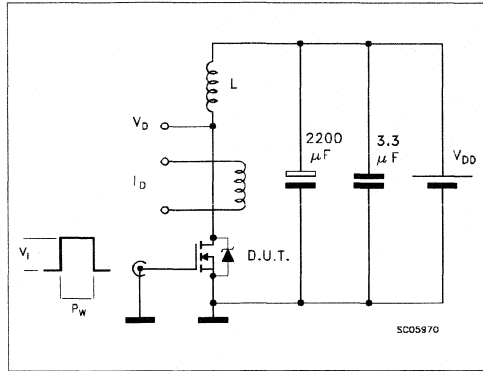


Fig. 2: Unclamped Inductive Waveforms

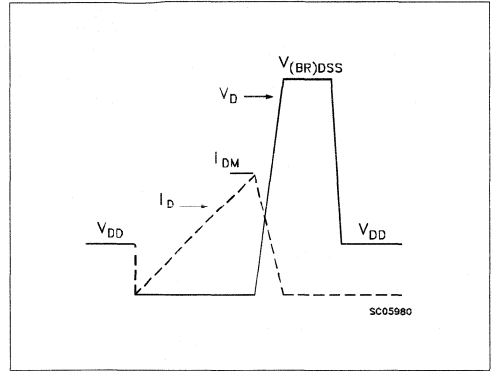


Fig. 3: Switching Times Test Circuits For Resistive Load

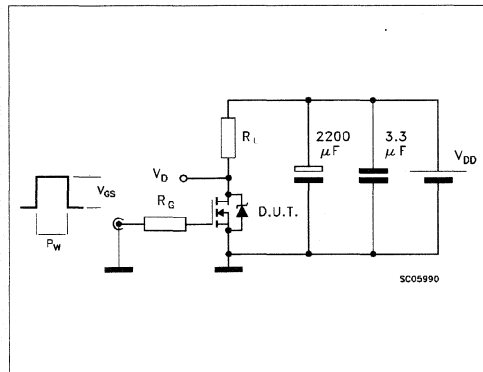


Fig. 4: Gate Charge Test Circuit

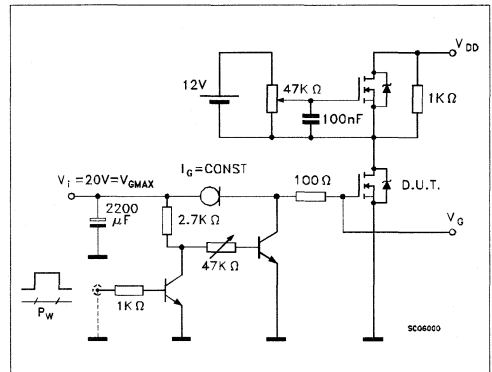
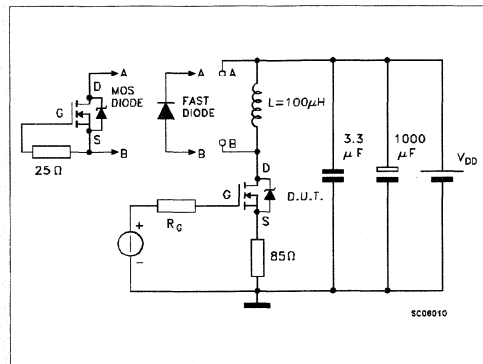


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



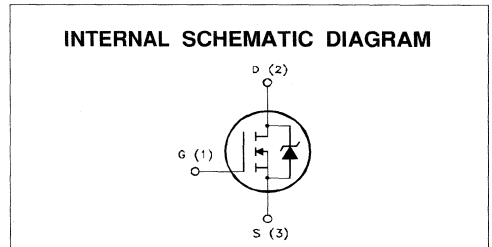
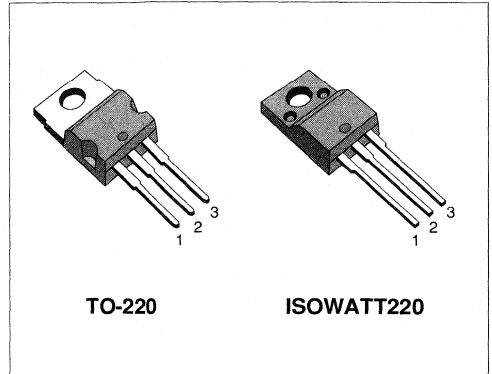
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP5N80	800 V	< 2 Ω	5.5 A
STP5N80FI	800 V	< 2 Ω	3.1 A

- TYPICAL R_{DS(on)} = 1.65 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INPUT CAPACITANCE
- LOW GATE CHARGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CONSUMER AND INDUSTRIAL LIGHTING
- DC-AC INVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLY (UPS)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP5N80	STP5N80FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	800		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	800		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	5.5	3.1	A
I _D	Drain Current (continuous) at T _c = 100 °C	3.4	2	A
I _{DM} (*)	Drain Current (pulsed)	20	20	A
P _{tot}	Total Dissipation at T _c = 25 °C	125	40	W
	Derating Factor	1	0.32	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

		TO-220	ISOWATT220		
R _{thj-case}	Thermal Resistance Junction-case	Max	1	3.12	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.5		°C/W
T _I	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	5.5	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	320	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	16	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	3.2	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	800			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 2.5 A V _{GS} = 10V I _D = 2.5 A T _c = 100 °C		1.65	2 4	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	5			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 2.5 A	2	4		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		1190	1450	pF
C _{oss}	Output Capacitance			165	200	pF
C _{rss}	Reverse Transfer Capacitance			70	85	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 400\text{ V}$ $I_D = 2.5\text{ A}$		50	65	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		85	105	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 640\text{ V}$ $I_D = 5.5\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		200		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 500\text{ V}$ $I_D = 6\text{ A}$ $V_{GS} = 10\text{ V}$		75	95	nC
Q_{gs}	Gate-Source Charge			9		nC
Q_{gd}	Gate-Drain Charge			33		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(voff)}$	Off-voltage Rise Time	$V_{DD} = 640\text{ V}$ $I_D = 5.5\text{ A}$		120	150	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		30	40	ns
t_c	Cross-over Time	(see test circuit, figure 5)		160	200	ns

SOURCE DRAIN DIODE

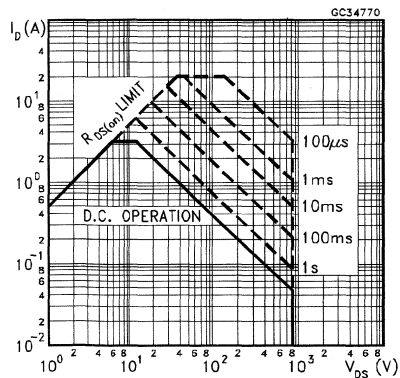
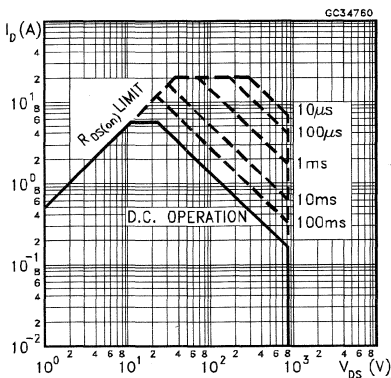
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				5.5	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				20	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 5.5\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 5.5\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 80\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		700		ns
Q_{rr}	Reverse Recovery Charge			7.7		μ C
I_{RRM}	Reverse Recovery Current			22		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

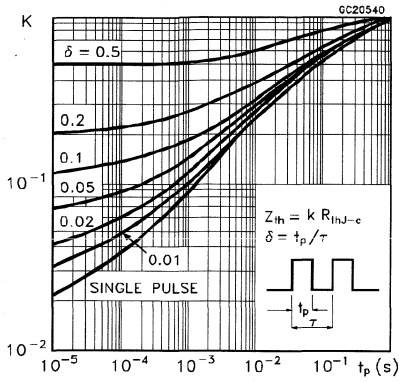
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

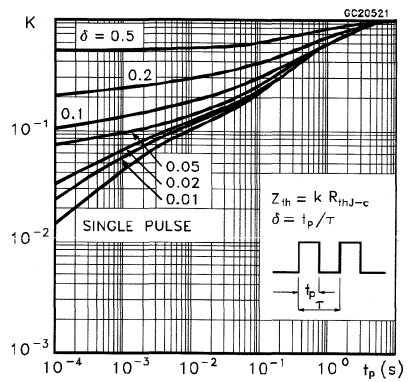
Safe Operating Areas For ISOWATT220



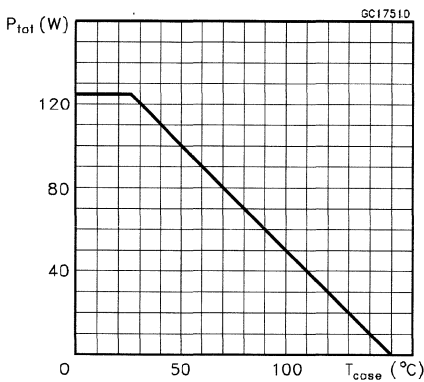
Thermal Impedance For TO-220



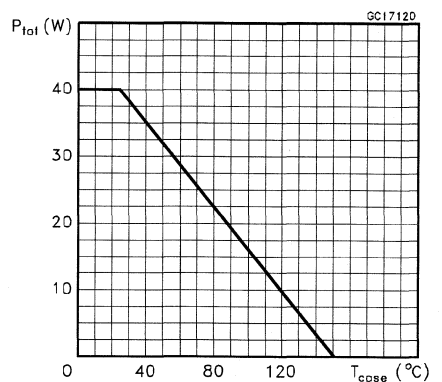
Thermal Impedance For ISOWATT220



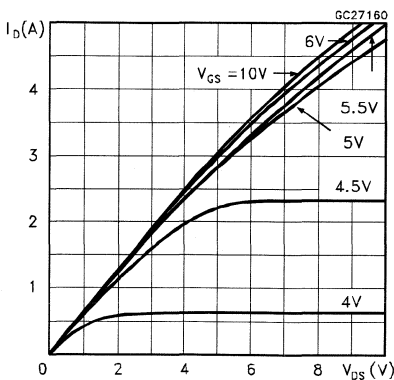
Derating Curve For TO-220



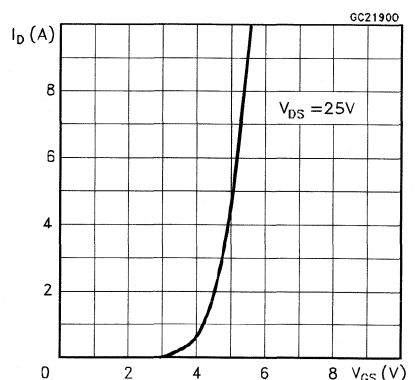
Derating Curve For ISOWATT220



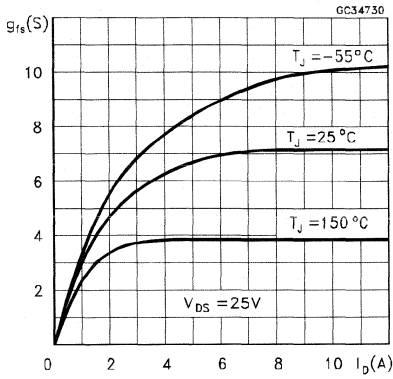
Output Characteristics



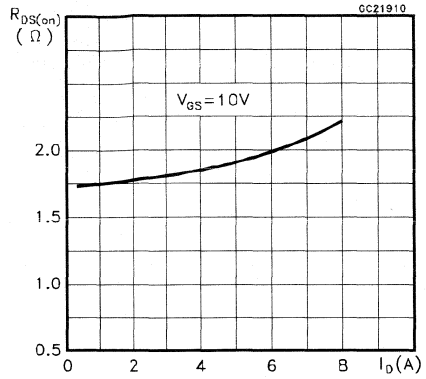
Transfer Characteristics



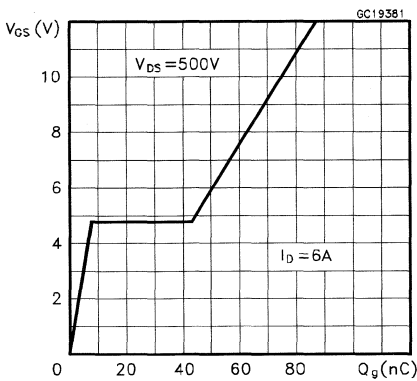
Transconductance



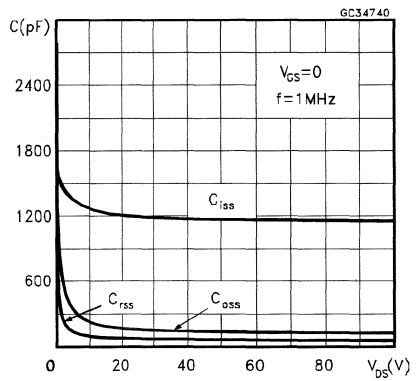
Static Drain-source On Resistance



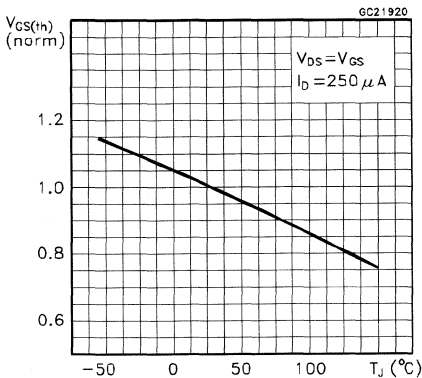
Gate Charge vs Gate-source Voltage



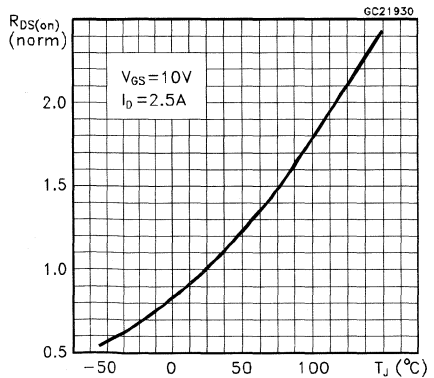
Capacitance Variations



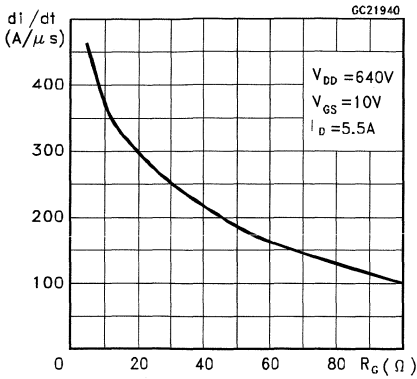
Normalized Gate Threshold Voltage vs Temperature



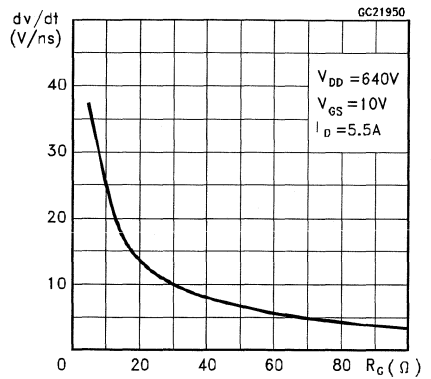
Normalized On Resistance vs Temperature



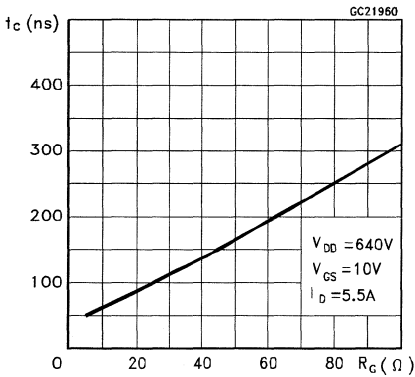
Turn-on Current Slope



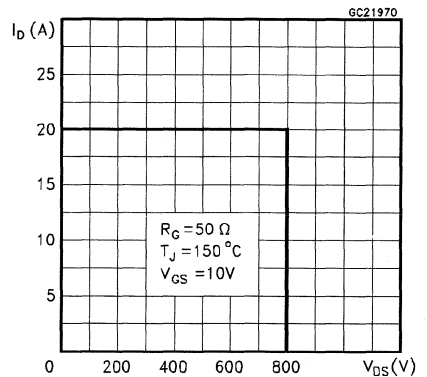
Turn-off Drain-source Voltage Slope



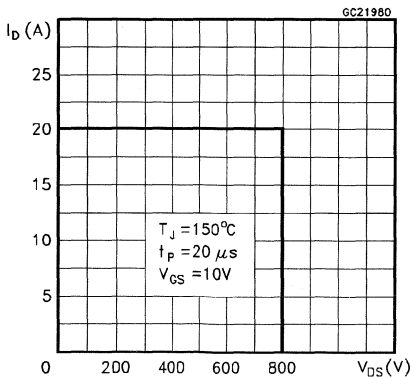
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

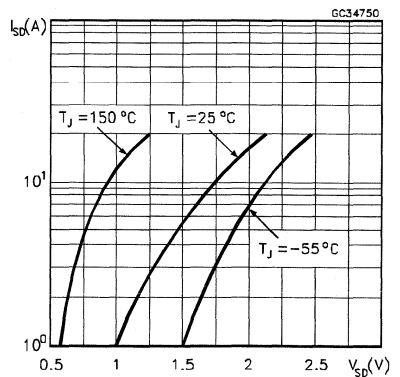


Fig. 1: Unclamped Inductive Load Test Circuits

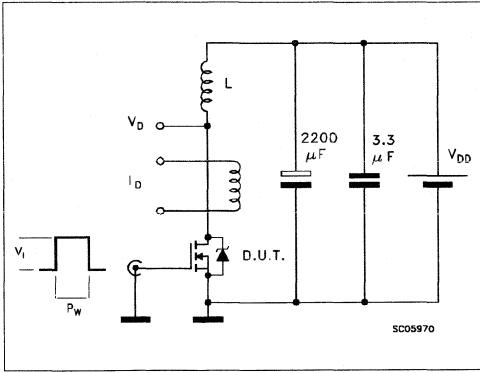


Fig. 2: Unclamped Inductive Waveforms

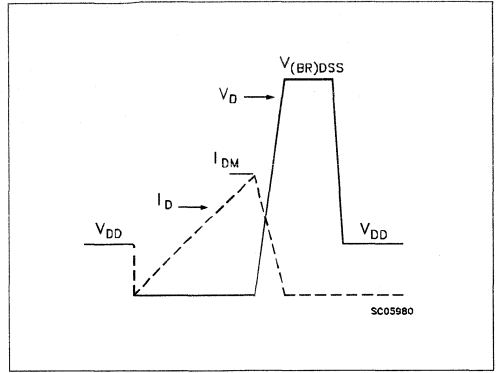


Fig. 3: Switching Times Test Circuits For Resistive Load

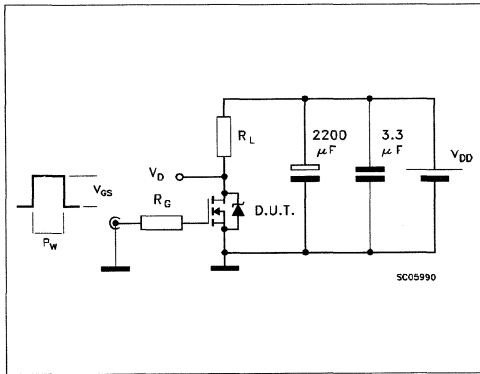


Fig. 4: Gate Charge Test Circuit

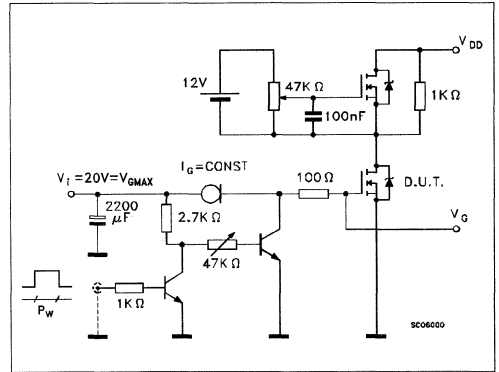
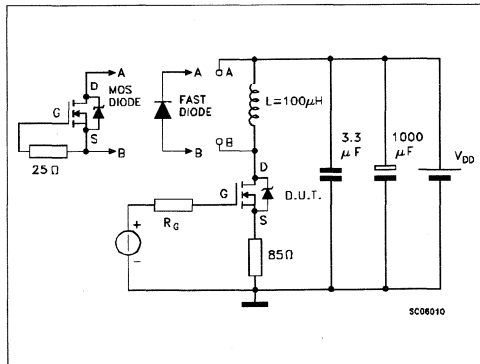


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



N - CHANNEL ENHANCEMENT MODE FAST POWER MOS TRANSISTOR

ADVANCE DATA

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP5NA80	800 V	< 2.4 Ω	4.8 A
STP5NA80FI	800 V	< 2.4 Ω	2.7 A

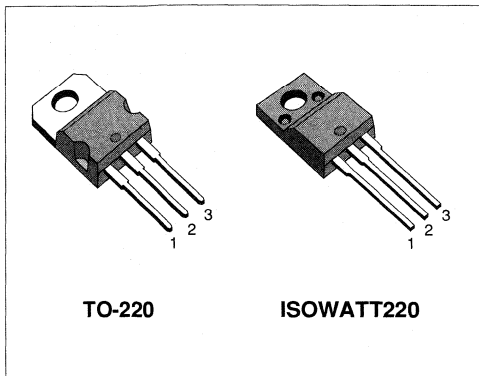
- TYPICAL R_{DS(on)} = 2 Ω
- ± 30V GATE TO SOURCE VOLTAGE RATING
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INTRINSIC CAPACITANCES
- GATE CHARGE MINIMIZED
- REDUCED THRESHOLD VOLTAGE SPREAD

DESCRIPTION

This series of POWER MOSFETS represents the most advanced high voltage technology. The optimized cell layout coupled with a new proprietary edge termination concur to give the device low R_{DS(on)} and gate charge, unequalled ruggedness and superior switching performance.

APPLICATIONS

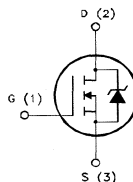
- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- DC-AC CONVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLIES AND MOTOR DRIVE



TO-220

ISOWATT220

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP5NA80	STP5NA80FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	800		V
V _{DGR}	Drain-gate Voltage (R _{GS} = 20 kΩ)	800		V
V _{GS}	Gate-source Voltage	± 30		V
I _D	Drain Current (continuous) at T _c = 25 °C	4.8	2.7	A
I _D	Drain Current (continuous) at T _c = 100 °C	3.2	1.8	A
I _{DM} (*)	Drain Current (pulsed)	19	19	A
P _{tot}	Total Dissipation at T _c = 25 °C	125	40	W
	Derating Factor	1	0.32	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

		TO-220	ISOWATT220	
$R_{thj-case}$	Thermal Resistance Junction-case Max	1	3.12	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient Max	62.5		°C/W
$R_{thc-sink}$	Thermal Resistance Case-sink Typ	0.5		°C/W
T_l	Maximum Lead Temperature For Soldering Purpose	300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	4.8	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ }^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	125	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	3.7	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ }^\circ\text{C}$, pulse width limited by T_j max, $\delta < 1\%$)	3.2	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ }^\circ\text{C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$	800			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ }^\circ\text{C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 30\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\text{ }\mu\text{A}$	2.25	3	3.75	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 2.5\text{ A}$ $V_{GS} = 10\text{ V}$ $I_D = 2.5\text{ A}$ $T_c = 100\text{ }^\circ\text{C}$		2	2.4 4.8	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	4.8			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 2.5\text{ A}$	2.7	5		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		1215		pF
C_{oss}	Output Capacitance			145		pF
C_{rss}	Reverse Transfer Capacitance			35		pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 400\text{ V}$ $I_D = 2.5\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		15 25		ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 640\text{ V}$ $I_D = 5\text{ A}$ $R_G = 47\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		200		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 640\text{ V}$ $I_D = 5\text{ A}$ $V_{GS} = 10\text{ V}$		53 7 25		nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$ t_f t_c	Off-voltage Rise Time Fall Time Cross-over Time	$V_{DD} = 640\text{ V}$ $I_D = 5\text{ A}$ $R_G = 47\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		70 25 110		ns ns ns

SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				4.8 19	A A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 5\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 5\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		800 16 40		ns μ C A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

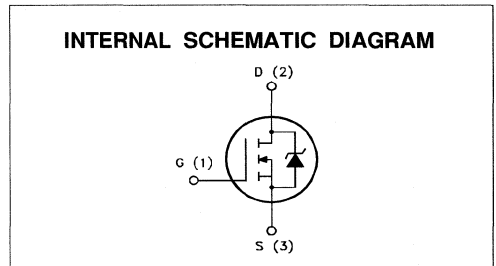
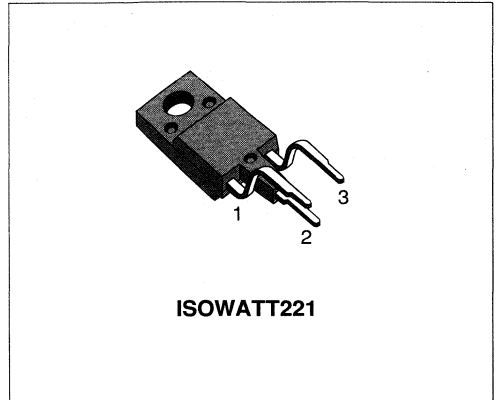
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP5N80XI	800 V	< 2.4 Ω	2.6 A

- TYPICAL R_{DS(on)} = 1.9 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INPUT CAPACITANCE
- LOW GATE CHARGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CONSUMER AND INDUSTRIAL LIGHTING
- DC-AC INVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLY (UPS)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	800	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	800	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	2.6	A
I _D	Drain Current (continuous) at T _c = 100 °C	1.7	A
I _{DM} (*)	Drain Current (pulsed)	11	A
P _{tot}	Total Dissipation at T _c = 25 °C	35	W
	Derating Factor	0.28	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	4000	V
T _{stg}	Storage Temperature	-65 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C

(*) Pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	3.57	$^{\circ}C/W$
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	60	$^{\circ}C/W$
$R_{thj-amb}$	Thermal Resistance Case-sink	Typ	0.5	$^{\circ}C/W$
T_l	Maximum Lead Temperature For Soldering Purpose		300	$^{\circ}C$

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	5	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25^{\circ}C$, $I_D = I_{AR}$, $V_{DD} = 50 V$)	270	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	13	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100^{\circ}C$, pulse width limited by T_j max, $\delta < 1\%$)	3	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25^{\circ}C$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250 \mu A$ $V_{GS} = 0$	800			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^{\circ}C$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20 V$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250 \mu A$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10V$ $I_D = 2.5 A$ $V_{GS} = 10V$ $I_D = 2.5 A$ $T_c = 100^{\circ}C$		1.9	2.4 4.8	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10 V$	2.6			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 2.5 A$	2	4		S
C_{iss}	Input Capacitance	$V_{DS} = 25 V$ $f = 1 MHz$ $V_{GS} = 0$		1190	1450	pF
C_{oss}	Output Capacitance			165	200	pF
C_{rss}	Reverse Transfer Capacitance			70	85	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 400\text{ V}$ $I_D = 2.5\text{ A}$		50	65	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		85	105	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 640\text{ V}$ $I_D = 5.5\text{ A}$ $R_G = 15\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		200		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 500\text{ V}$ $I_D = 6\text{ A}$ $V_{GS} = 10\text{ V}$		75	95	nC
Q_{gs}	Gate-Source Charge			9		nC
Q_{gd}	Gate-Drain Charge			33		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 640\text{ V}$ $I_D = 5.5\text{ A}$		120	150	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		30	40	ns
t_c	Cross-over Time	(see test circuit, figure 5)		160	200	ns

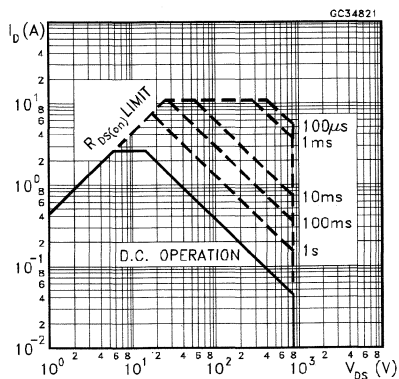
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				2.6	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				11	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 2.6\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 2.6\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 80\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		700		ns
Q_{rr}	Reverse Recovery Charge			7.7		μC
I_{RRM}	Reverse Recovery Current			22		A

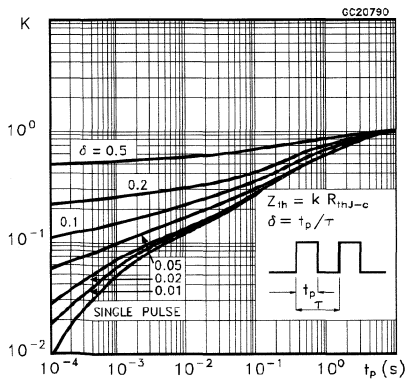
(*) Pulsed: Pulse duration $t_p = 300\ \mu\text{s}$, duty cycle 1.5 %

(•) Pulse width limited by safe operating area

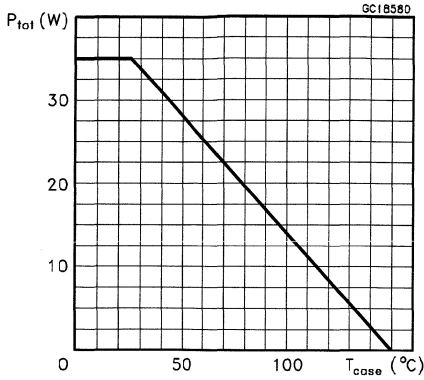
Safe Operating Area



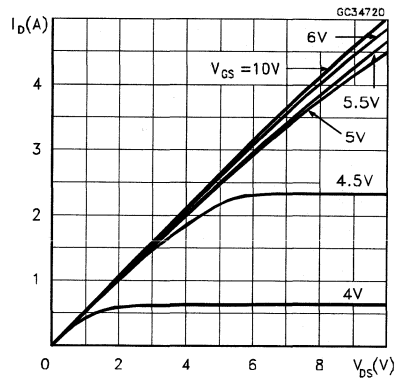
Thermal Impedance



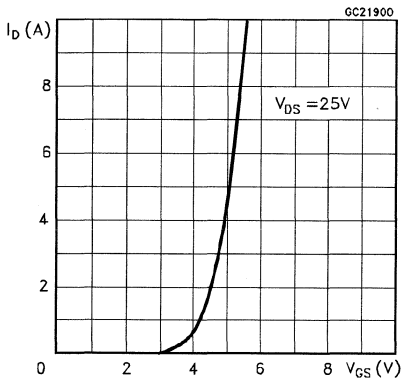
Derating Curve



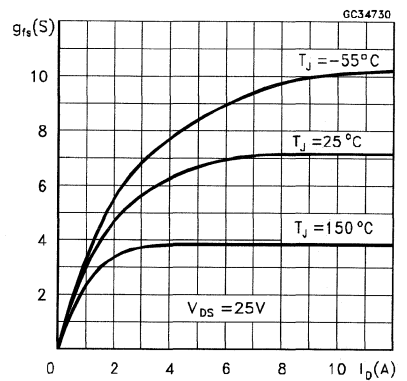
Output Characteristics



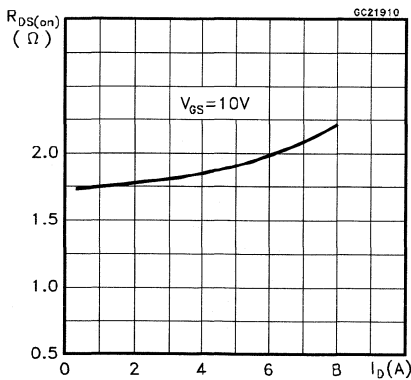
Transfer Characteristics



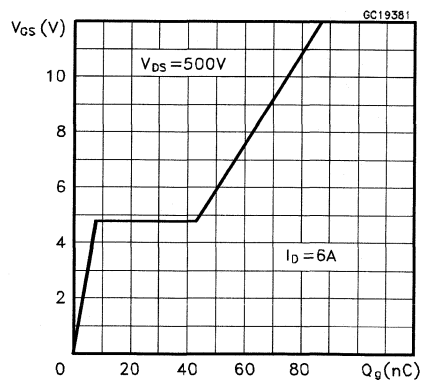
Transconductance



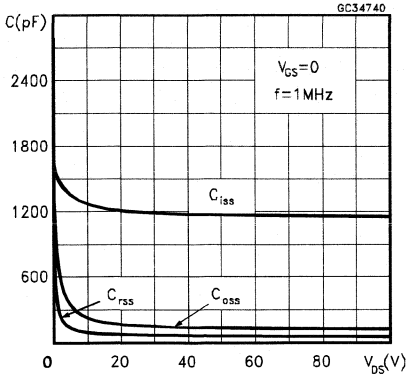
Static Drain-source On Resistance



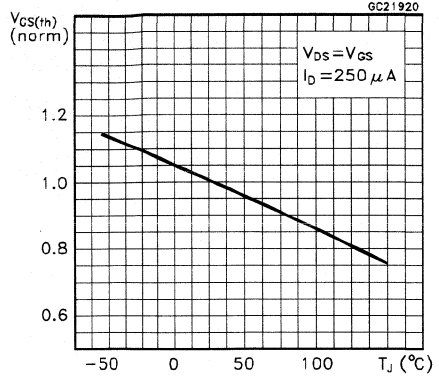
Gate Charge vs Gate-source Voltage



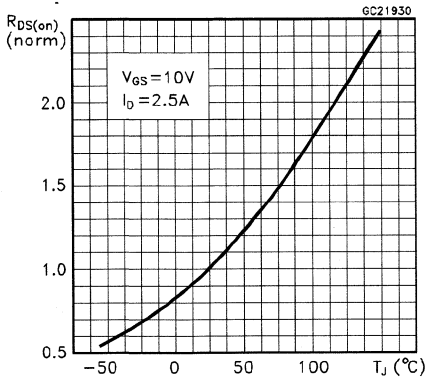
Capacitance Variations



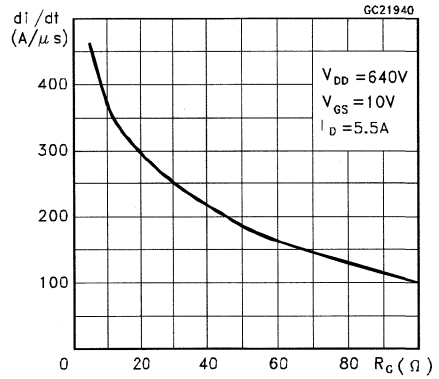
Normalized Gate Threshold Voltage vs Temperature



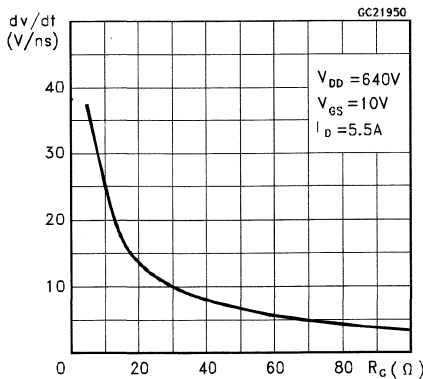
Normalized On Resistance vs Temperature



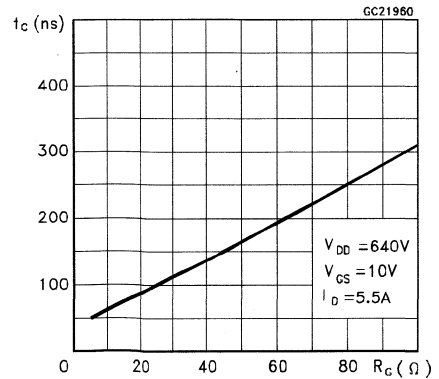
Turn-on Current Slope



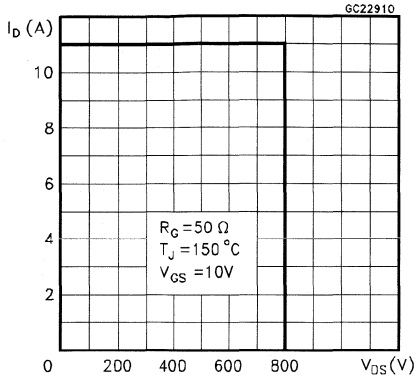
Turn-off Drain-source Voltage Slope



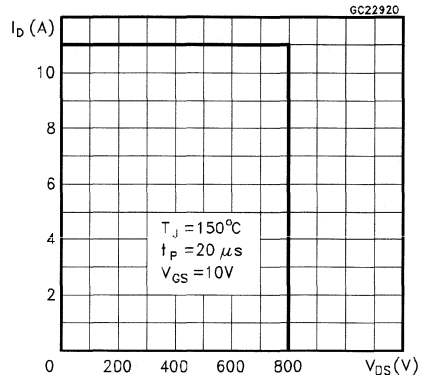
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

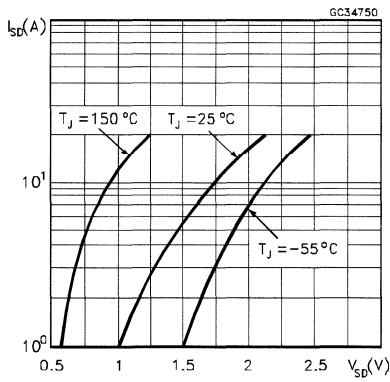


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

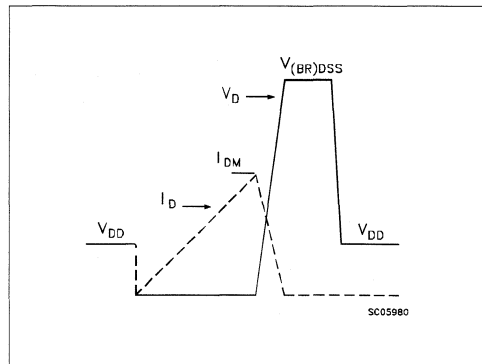
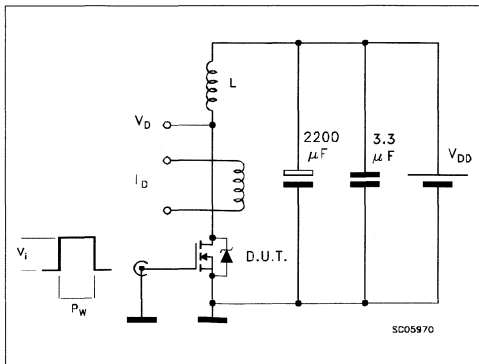


Fig. 3: Switching Times Test Circuits For Resistive Load

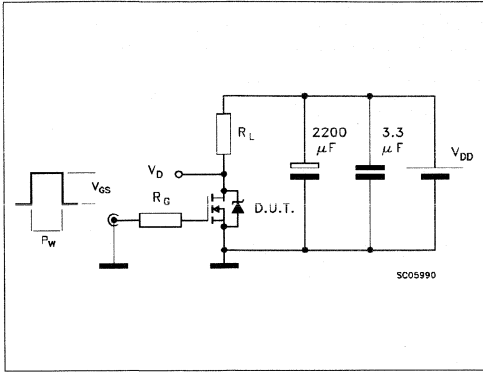


Fig. 4: Gate Charge Test Circuit

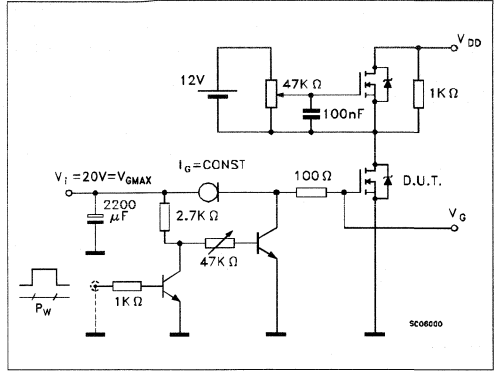
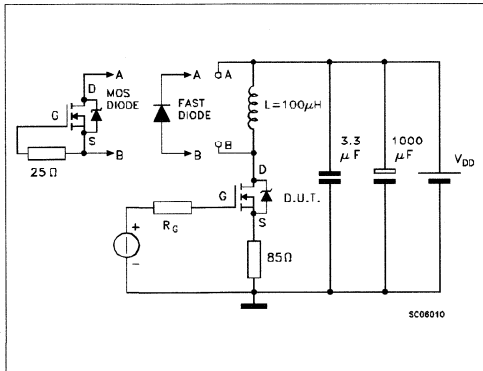


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



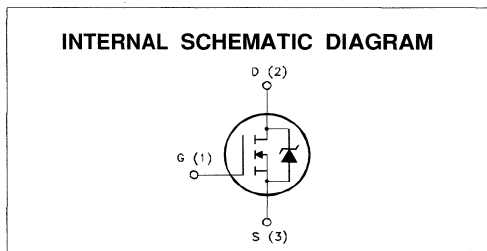
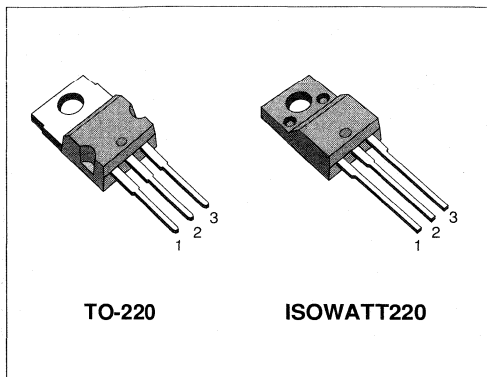
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP5N90	900 V	< 2.4 Ω	5 A
STP5N90FI	900 V	< 2.4 Ω	2.8 A

- TYPICAL R_{DS(on)} = 1.9 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INPUT CAPACITANCE
- LOW GATE CHARGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CONSUMER AND INDUSTRIAL LIGHTING
- DC-AC INVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLY (UPS)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP5N90	STP5N90FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	900		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	900		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	5	2.8	A
I _D	Drain Current (continuous) at T _c = 100 °C	3	1.7	A
I _{DM} (*)	Drain Current (pulsed)	20	20	A
P _{tot}	Total Dissipation at T _c = 25 °C	125	40	W
	Derating Factor	1	0.32	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

		TO-220	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case Max	1	3.12	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient Max		62.5	°C/W
R _{thc-sink}	Thermal Resistance Case-sink Typ		0.5	°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	5	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	270	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	13	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	3	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	900			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 2.5 A V _{GS} = 10V I _D = 2.5 A T _c = 100°C		1.9	2.4 4.8	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} × R _{DS(on)max} V _{GS} = 10 V	5			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} × R _{DS(on)max} I _D = 2.5 A	2	4		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		1190	1450	pF
C _{oss}	Output Capacitance			165	200	pF
C _{rss}	Reverse Transfer Capacitance			70	85	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 400\text{ V}$ $I_D = 2.5\text{ A}$		50	65	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		85	105	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 640\text{ V}$ $I_D = 5.5\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		200		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 500\text{ V}$ $I_D = 6\text{ A}$ $V_{GS} = 10\text{ V}$		75	95	nC
Q_{gs}	Gate-Source Charge			9		nC
Q_{gd}	Gate-Drain Charge			33		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$	Off-voltage Rise Time	$V_{DD} = 640\text{ V}$ $I_D = 5.5\text{ A}$		120	150	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		30	40	ns
t_c	Cross-over Time	(see test circuit, figure 5)		160	200	ns

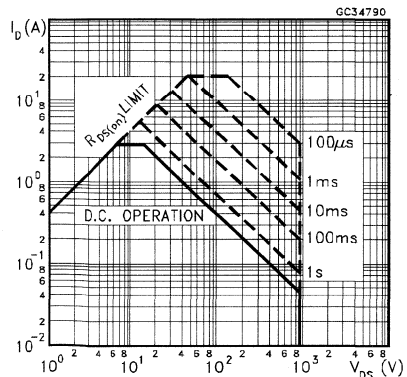
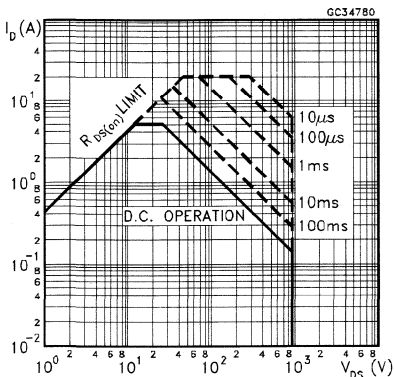
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				5	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				20	A
V_{SD}	Forward On Voltage	$I_{SD} = 5\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 5\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 80\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		700		ns
Q_{rr}	Reverse Recovery Charge			7.7		μC
I_{RRM}	Reverse Recovery Current			22		A

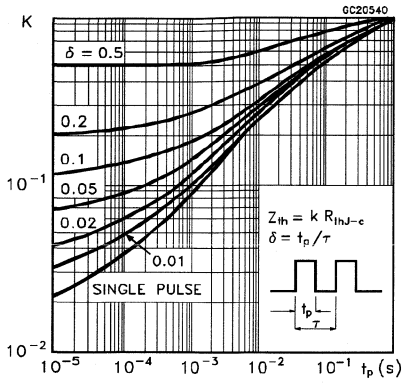
(*) Pulsed: Pulse duration $\bar{t} = 300\ \mu\text{s}$, duty cycle 1.5 %
 (•) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

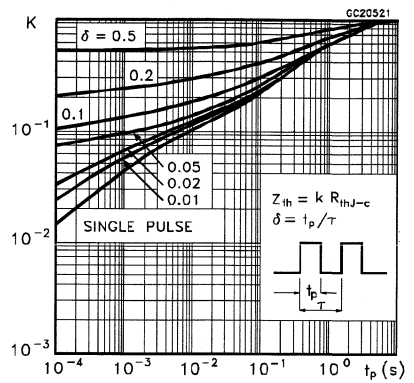
Safe Operating Areas For ISOWATT220



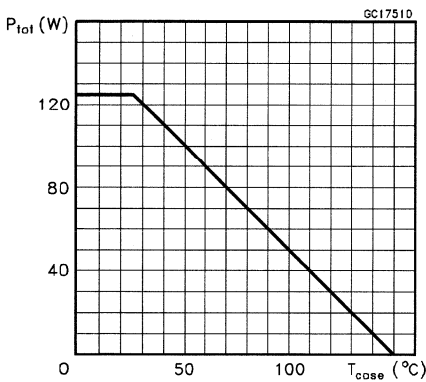
Thermal Impedance For TO-220



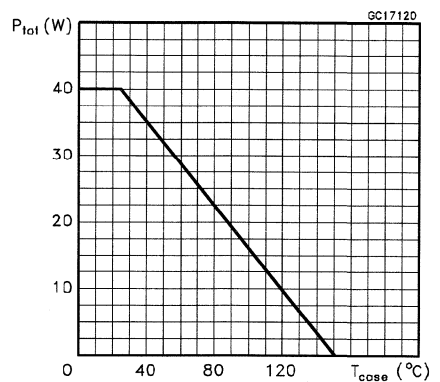
Thermal Impedance For ISOWATT220



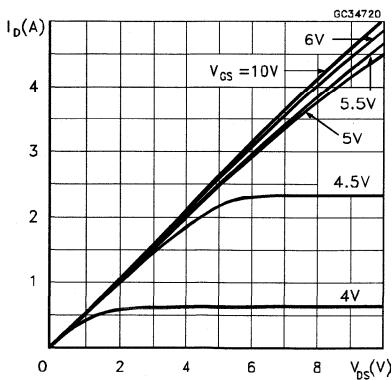
Derating Curve For TO-220



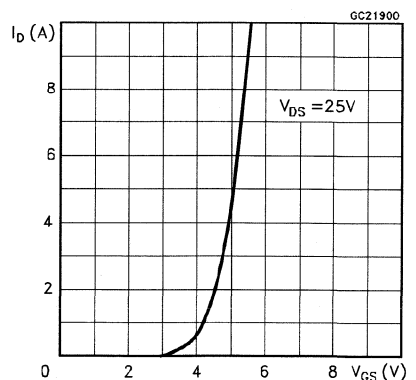
Derating Curve For ISOWATT220



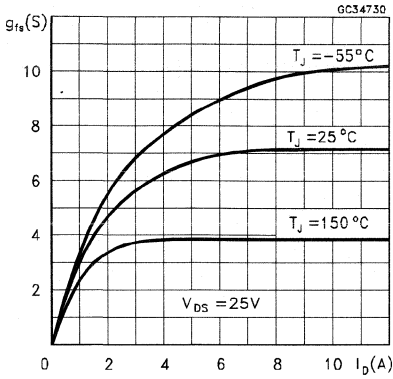
Output Characteristics



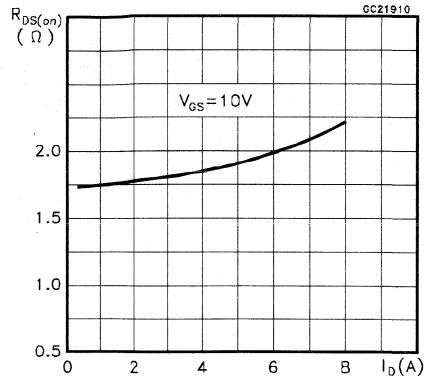
Transfer Characteristics



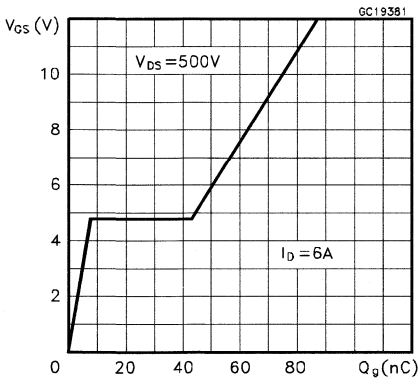
Transconductance



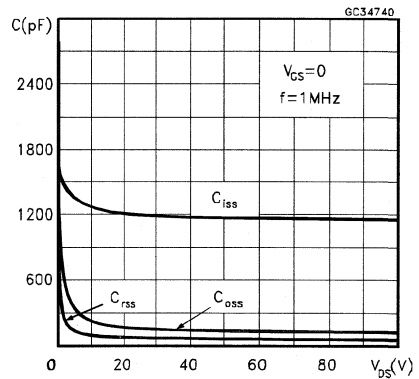
Static Drain-source On Resistance



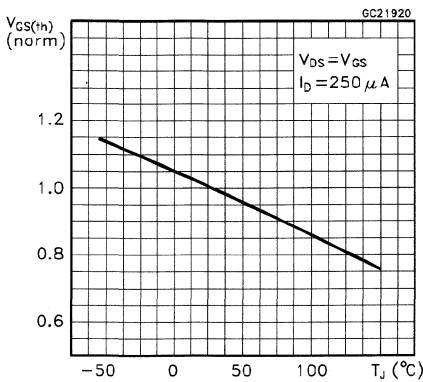
Gate Charge vs Gate-source Voltage



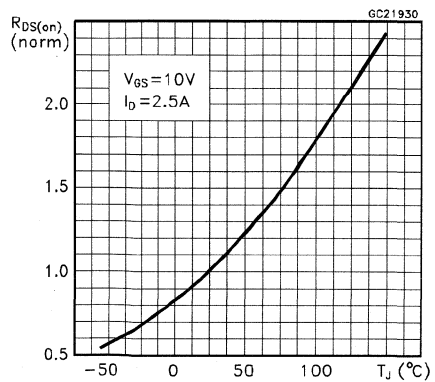
Capacitance Variations



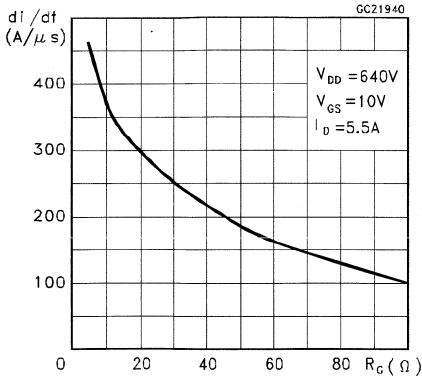
Normalized Gate Threshold Voltage vs Temperature



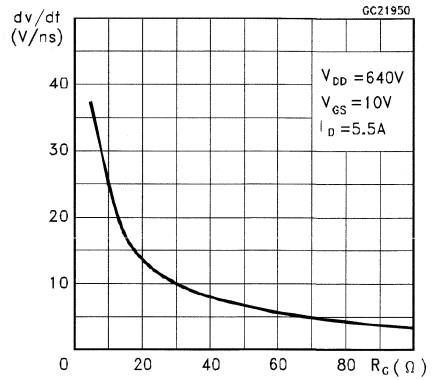
Normalized On Resistance vs Temperature



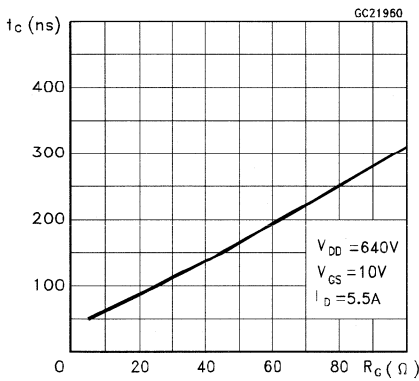
Turn-on Current Slope



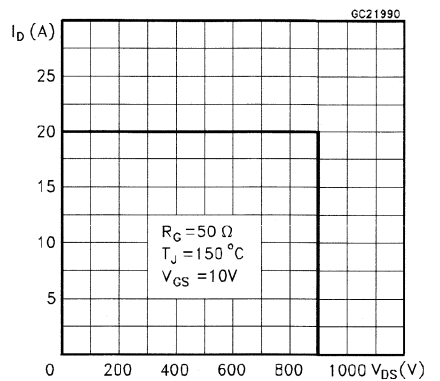
Turn-off Drain-source Voltage Slope



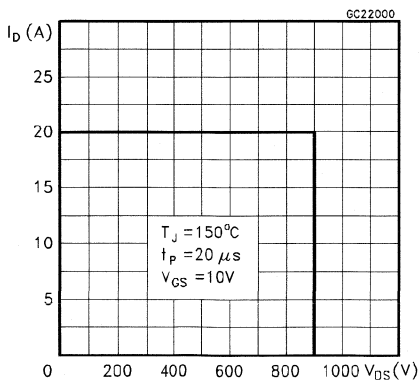
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

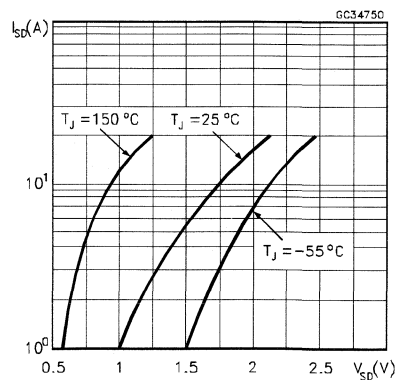


Fig. 1: Unclamped Inductive Load Test Circuits

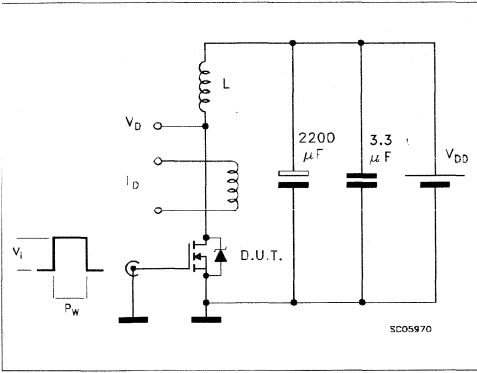


Fig. 2: Unclamped Inductive Waveforms

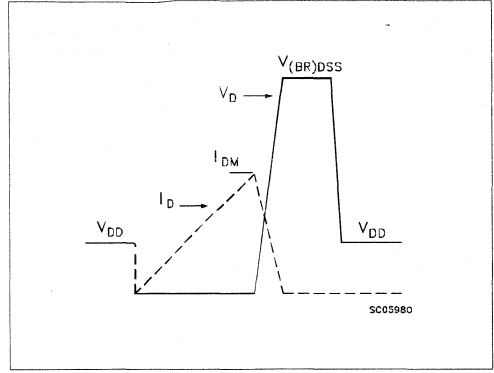


Fig. 3: Switching Times Test Circuits For Resistive Load

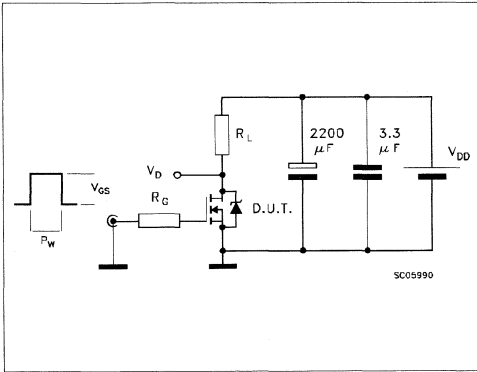


Fig. 4: Gate Charge Test Circuit

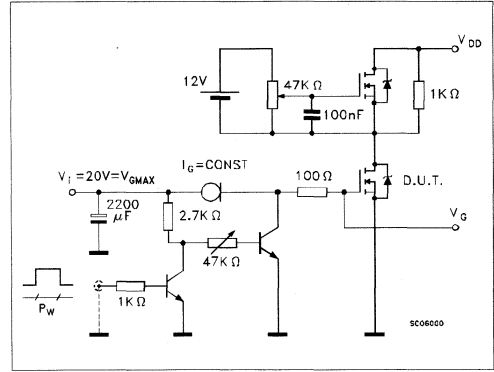
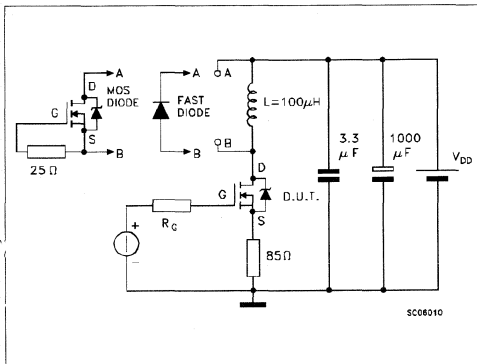


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

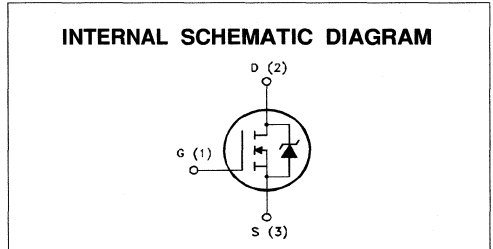
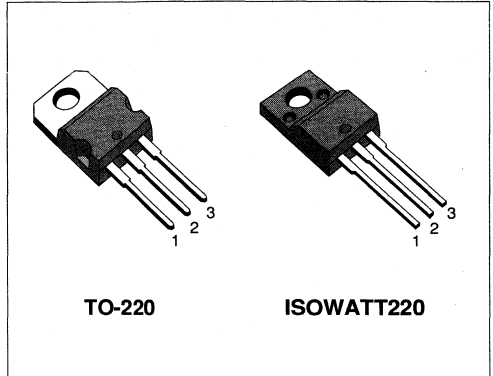
PRELIMINARY DATA

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP6N25	250 V	< 1 Ω	6 A
STP6N25FI	250 V	< 1 Ω	4 A

- TYPICAL R_{DS(on)} = 0.7 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH SPEED SWITCHING
- UNINTERRUPTIBLE POWER SUPPLY (UPS)
- MOTOR CONTROL, AUDIO AMPLIFIERS
- INDUSTRIAL ACTUATORS
- DC-DC & DC-AC CONVERTERS FOR TELECOM, INDUSTRIAL AND CONSUMER ENVIRONMENT
- PARTICULARLY SUITABLE FOR ELECTRONIC FLUORESCENT LAMP BALLASTS



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP6N25	STP6N25FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	250		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	250		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	6	4	A
I _D	Drain Current (continuous) at T _c = 100 °C	4	2.6	A
I _{DM} (*)	Drain Current (pulsed)	24	24	A
P _{tot}	Total Dissipation at T _c = 25 °C	70	35	W
	Derating Factor	0.56	0.28	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	2000		
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

		TO-220	ISOWATT220		
R _{thj-case}	Thermal Resistance Junction-case	Max	1.79	3.57	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.5		°C/W
T _I	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	6	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	40	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	10	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	4	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	250			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 3 A V _{GS} = 10V I _D = 3 A T _c = 100°C		0.7	1 2	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	6			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 3 A	1.5	3.5		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		500	700	pF
C _{oss}	Output Capacitance			85	120	pF
C _{rss}	Reverse Transfer Capacitance			15	30	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 125\text{ V}$ $I_D = 3\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		35 70	50 100	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 200\text{ V}$ $I_D = 6\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		220		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 200\text{ V}$ $I_D = 6\text{ A}$ $V_{GS} = 10\text{ V}$		20 6 7	30	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$ t_f t_c	Off-voltage Rise Time Fall Time Cross-over Time	$V_{DD} = 200\text{ V}$ $I_D = 6\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		40 25 70	60 35 100	ns ns ns

SOURCE DRAIN DIODE

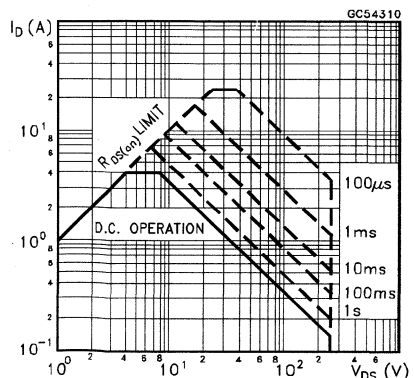
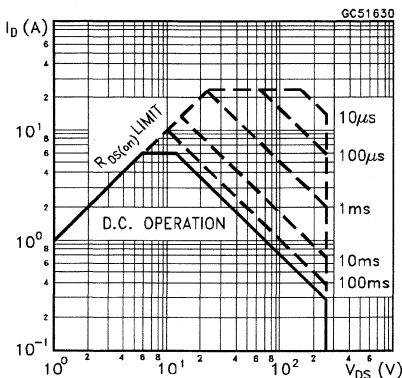
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				6 24	A A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 6\text{ A}$ $V_{GS} = 0$			1.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 6\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_J = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		180		ns
Q_{rr}	Reverse Recovery Charge			1.1		μ C
I_{RRM}	Reverse Recovery Current			12		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

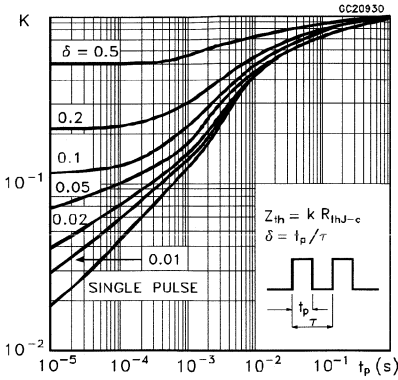
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

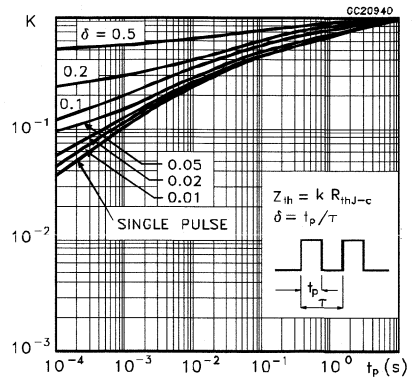
Safe Operating Areas For ISOWATT220



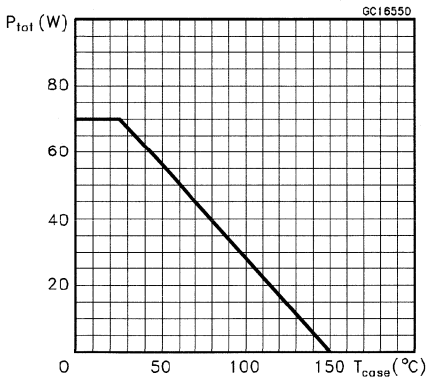
Thermal Impedance For TO-220



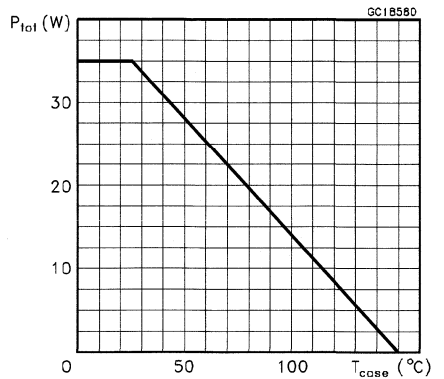
Thermal Impedance For ISOWATT220



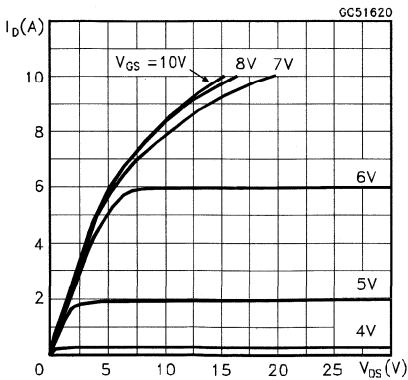
Derating Curve For TO-220



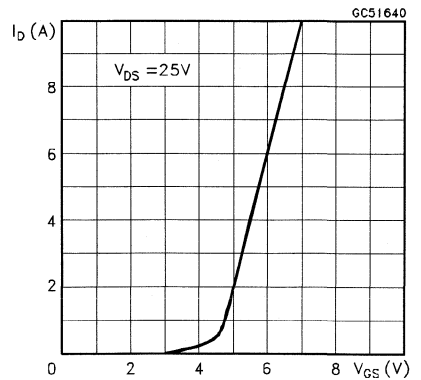
Derating Curve For ISOWATT220



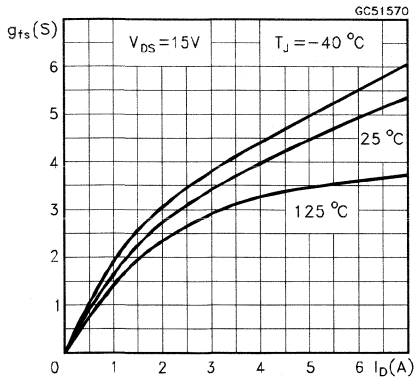
Output Characteristics



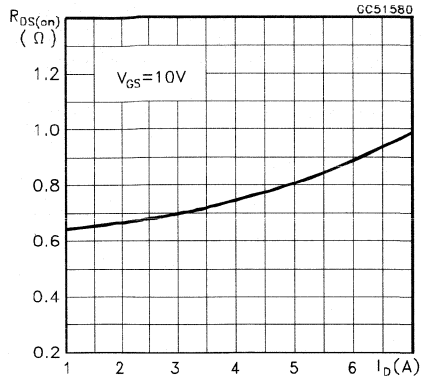
Transfer Characteristics



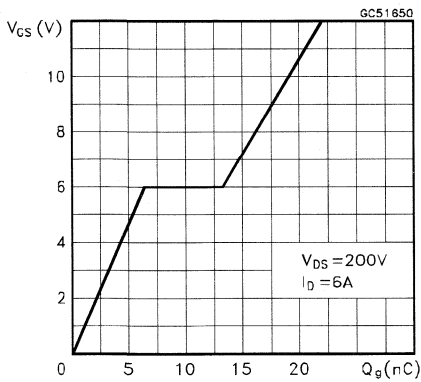
Transconductance



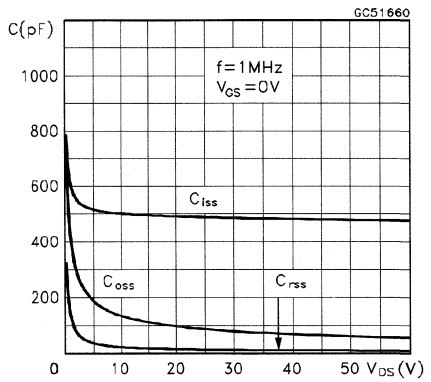
Static Drain-source On Resistance



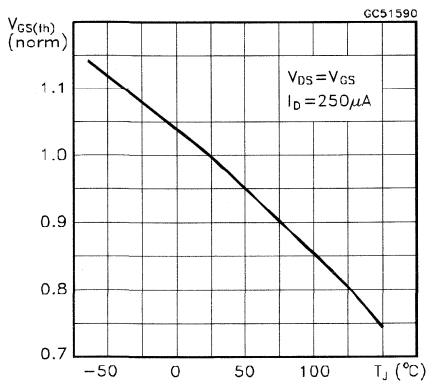
Gate Charge vs Gate-source Voltage



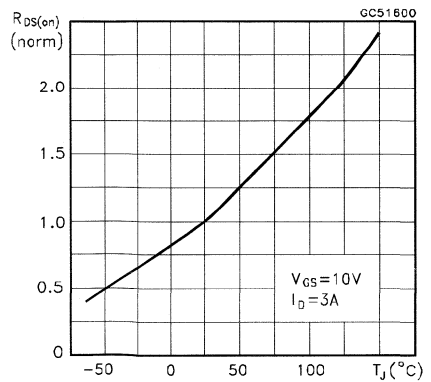
Capacitance Variations



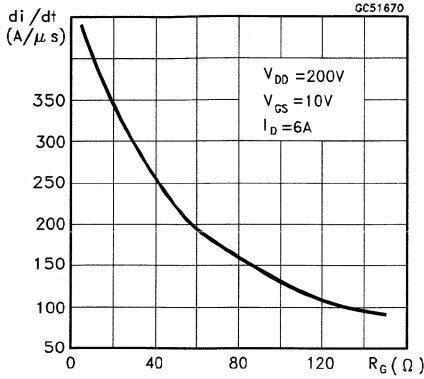
Normalized Gate Threshold Voltage vs Temperature



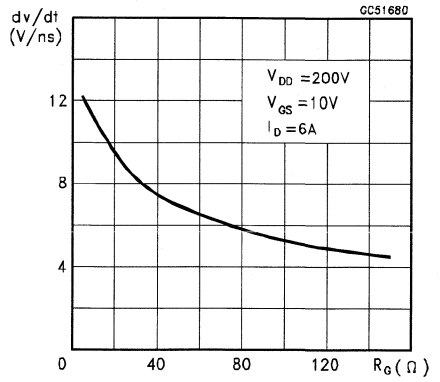
Normalized On Resistance vs Temperature



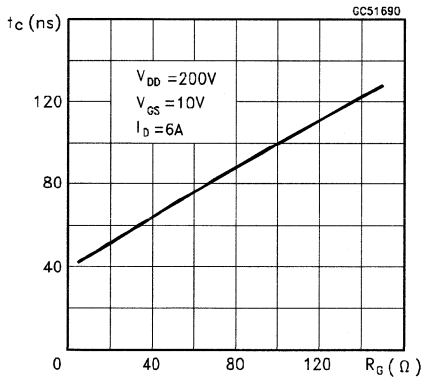
Turn-on Current Slope



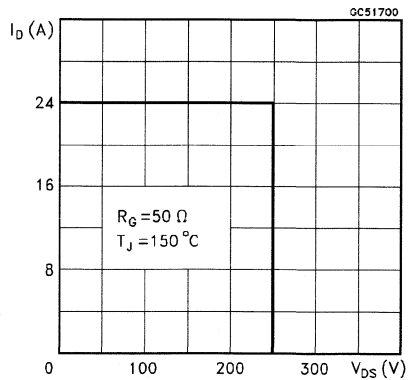
Turn-off Drain-source Voltage Slope



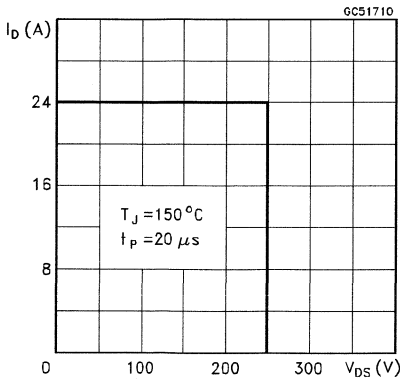
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

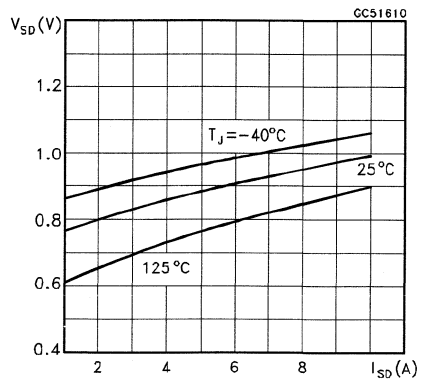


Fig. 1: Unclamped Inductive Load Test Circuits

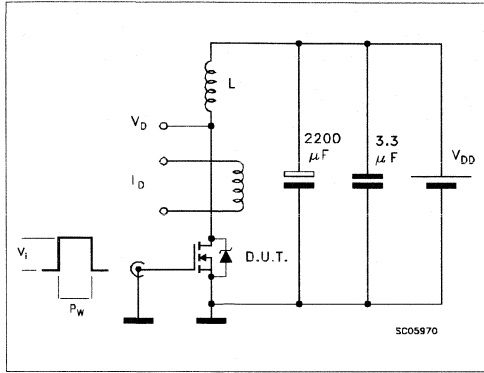


Fig. 2: Unclamped Inductive Waveforms

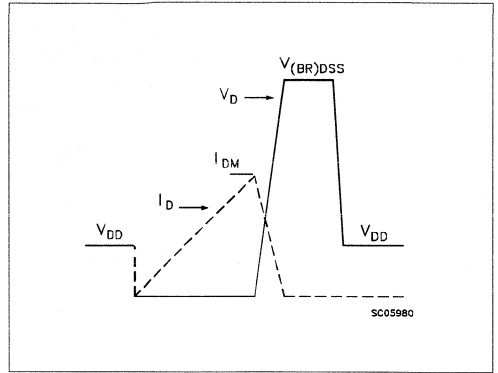


Fig. 3: Switching Times Test Circuits For Resistive Load

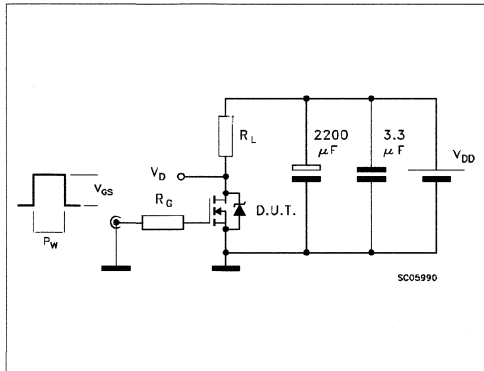


Fig. 4: Gate Charge Test Circuit

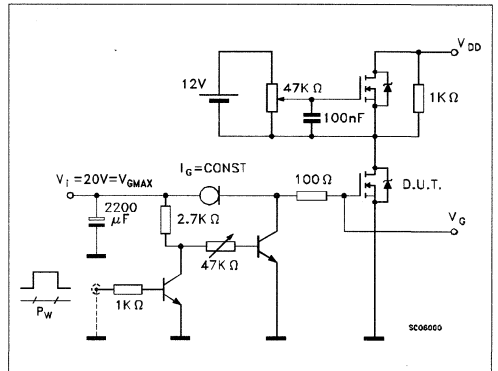
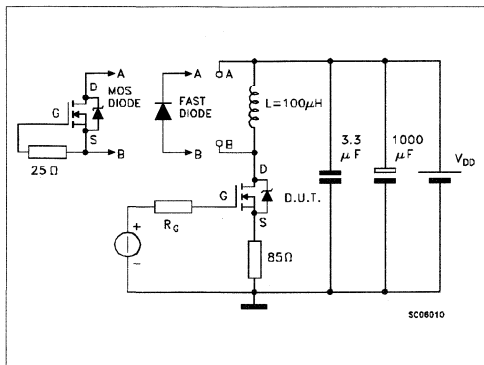


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



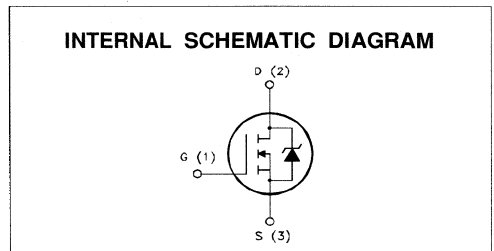
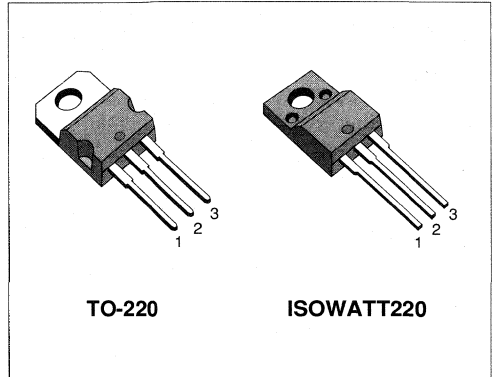
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP6N50	500 V	< 1.1 Ω	6 A
STP6N50FI	500 V	< 1.1 Ω	3.8 A

- TYPICAL R_{DS(on)} = 0.93 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP6N50	STP6N50FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	500		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	500		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	6	3.8	A
I _D	Drain Current (continuous) at T _c = 100 °C	3.8	2.4	A
I _{DM} (*)	Drain Current (pulsed)	24	24	A
P _{tot}	Total Dissipation at T _c = 25 °C	100	40	W
	Derating Factor	0.8	0.32	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-200	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case	Max	1.25	3.12	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.5		°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	6	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	300	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	7	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	3.8	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	500			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 3 A V _{GS} = 10V I _D = 3 A T _c = 100°C		0.93	1.1 2.2	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} × R _{DS(on)max} V _{GS} = 10 V	6			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} × R _{DS(on)max} I _D = 3 A	2.5	4.5		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		800	1100	pF
C _{oss}	Output Capacitance			140	190	pF
C _{rss}	Reverse Transfer Capacitance			60	80	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 250\text{ V}$ $I_D = 3\text{ A}$		40	55	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		110	150	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 400\text{ V}$ $I_D = 6\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		85		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 400\text{ V}$ $I_D = 6\text{ A}$ $V_{GS} = 10\text{ V}$		55	75	nC
Q_{gs}	Gate-Source Charge			9		nC
Q_{gd}	Gate-Drain Charge			26		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 400\text{ V}$ $I_D = 6\text{ A}$		115	160	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		35	50	ns
t_c	Cross-over Time	(see test circuit, figure 5)		165	220	ns

SOURCE DRAIN DIODE

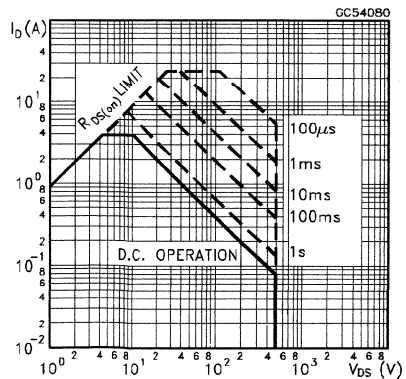
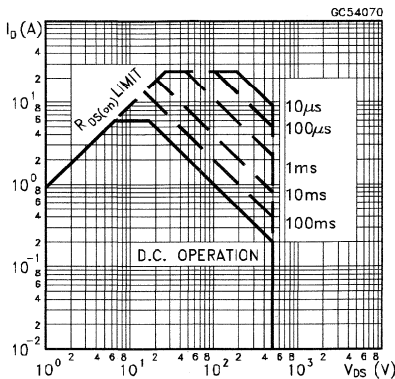
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				6	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				24	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 6\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 6\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		550		ns
Q_{rr}	Reverse Recovery Charge	(see test circuit, figure 5)		6.9		μC
I_{RRM}	Reverse Recovery Current			25		A

*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

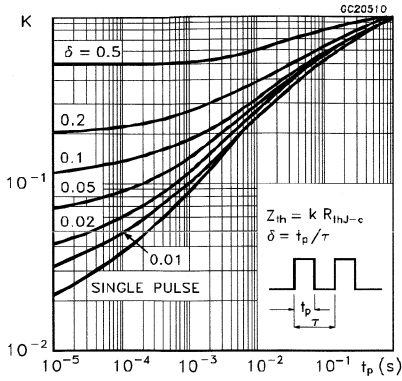
•) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

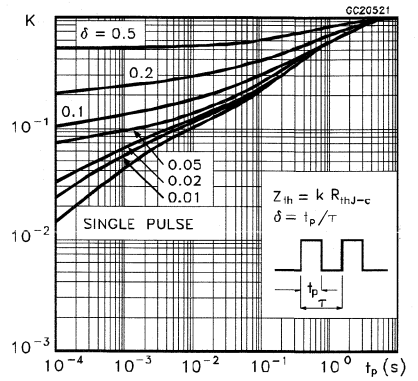
Safe Operating Areas For ISOWATT220



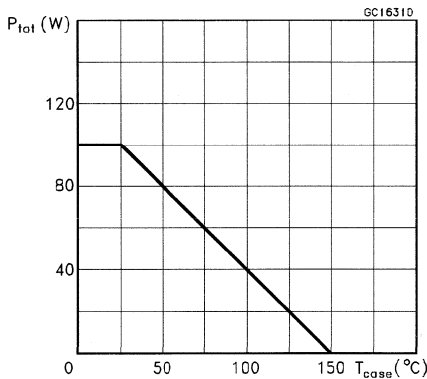
Thermal Impedance For TO-220



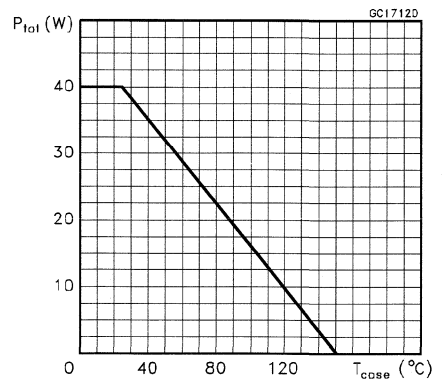
Thermal Impedance For ISOWATT220



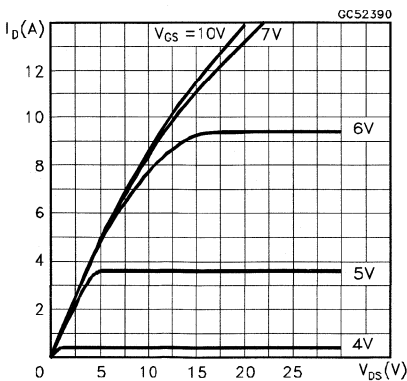
Derating Curve For TO-220



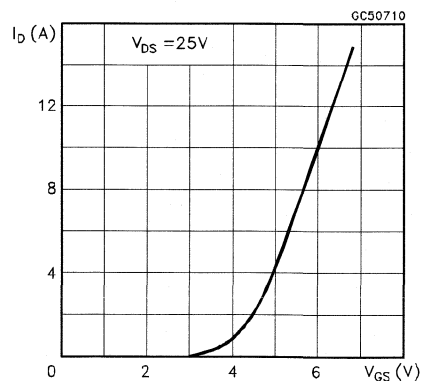
Derating Curve For ISOWATT220



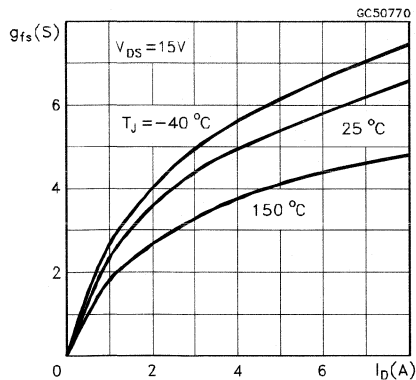
Output Characteristics



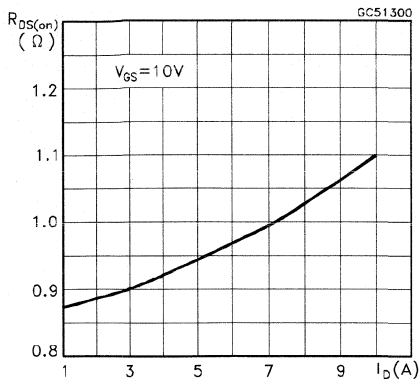
Transfer Characteristics



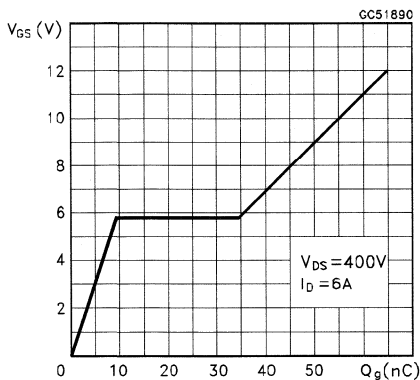
Transconductance



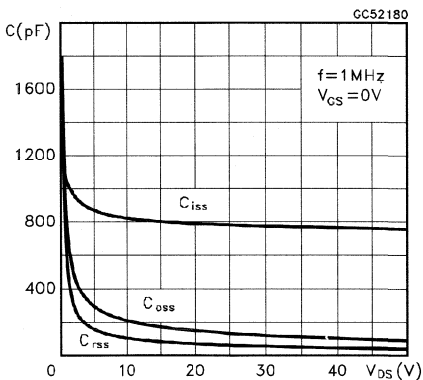
Static Drain-source On Resistance



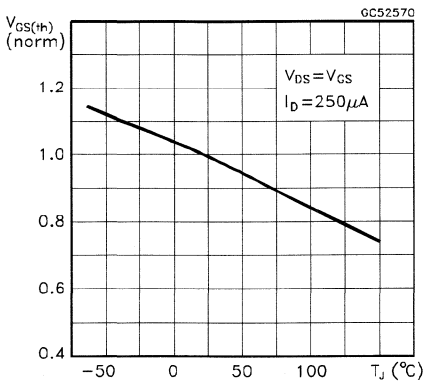
Gate Charge vs Gate-source Voltage



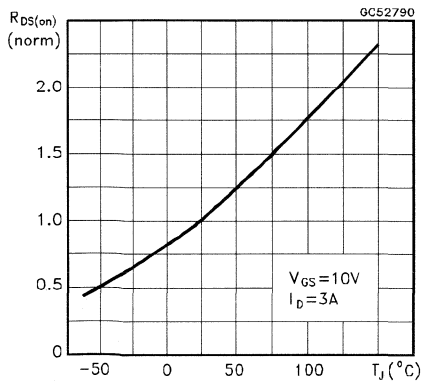
Capacitance Variations



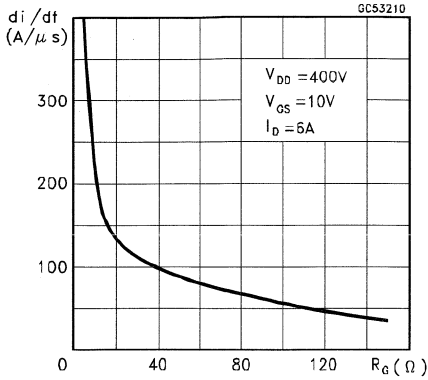
Normalized Gate Threshold Voltage vs Temperature



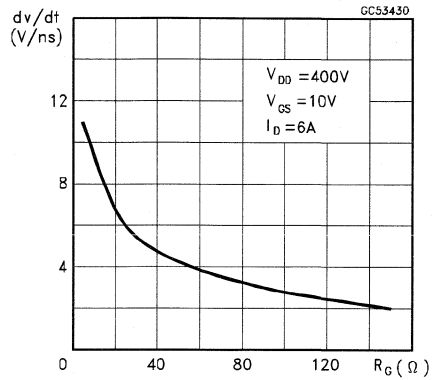
Normalized On Resistance vs Temperature



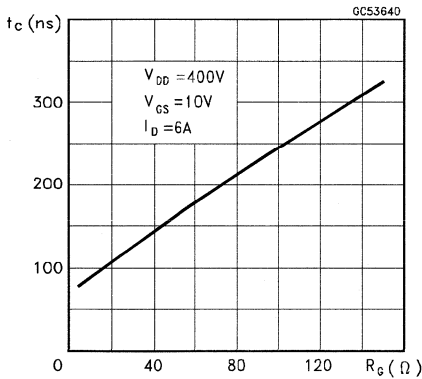
Turn-on Current Slope



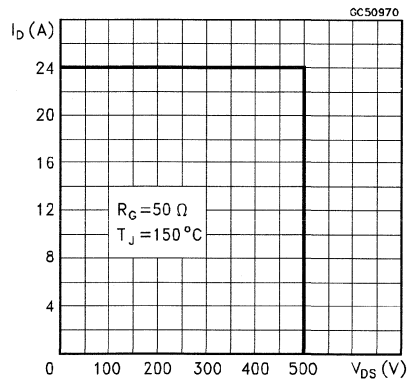
Turn-off Drain-source Voltage Slope



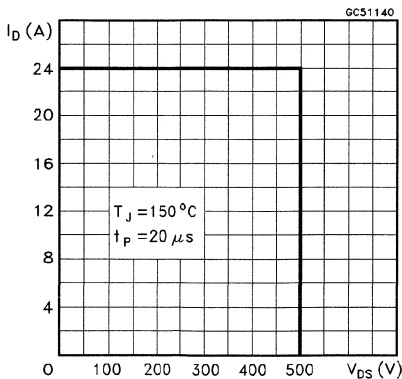
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

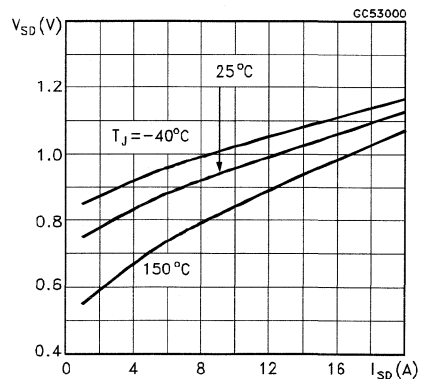


Fig. 1: Unclamped Inductive Load Test Circuits

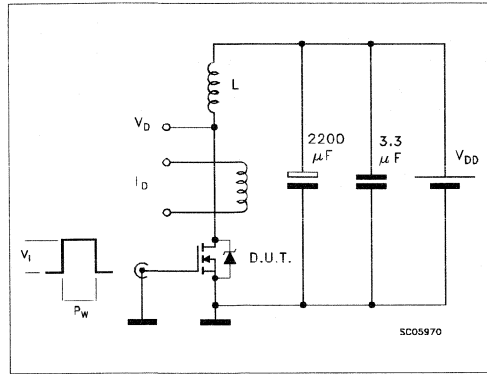


Fig. 2: Unclamped Inductive Waveforms

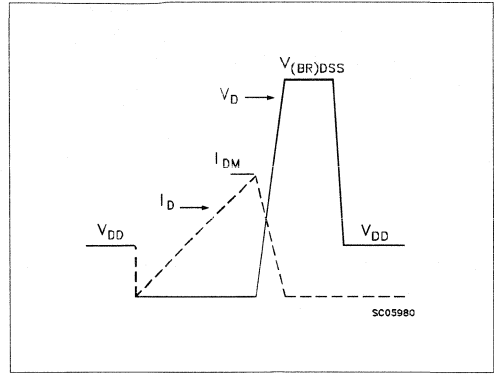


Fig. 3: Switching Times Test Circuits For Resistive Load

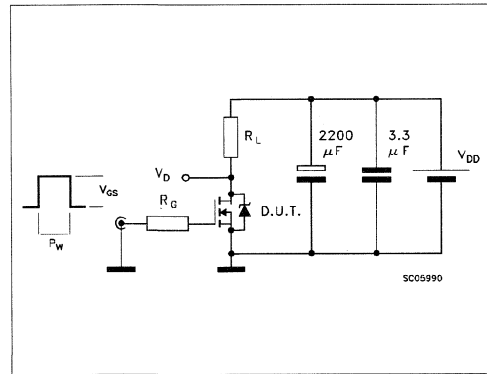


Fig. 4: Gate Charge Test Circuit

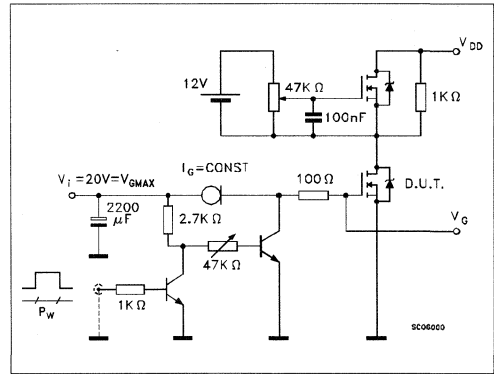
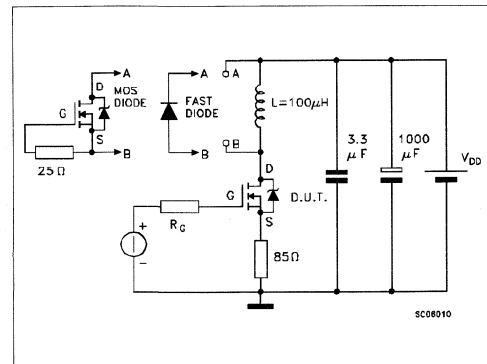


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



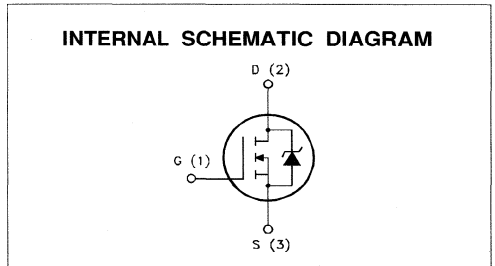
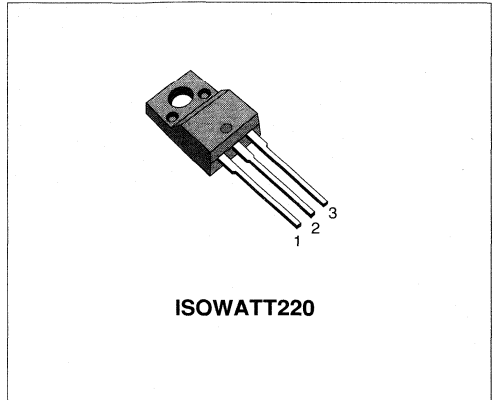
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP6N60FI	600 V	< 1.2 Ω	3.8 A

- TYPICAL R_{DS(on)} = 1 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	600	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	600	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	3.8	A
I _D	Drain Current (continuous) at T _c = 100 °C	2.4	A
I _{DM} (*)	Drain Current (pulsed)	24	A
P _{tot}	Total Dissipation at T _c = 25 °C	40	W
	Derating Factor	0.32	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	2000	V
T _{stg}	Storage Temperature	-65 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C

(*) Pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	3.12	$^{\circ}C/W$
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5	$^{\circ}C/W$
$R_{thj-amb}$	Thermal Resistance Case-sink	Typ	0.5	$^{\circ}C/W$
T_l	Maximum Lead Temperature For Soldering Purpose		300	$^{\circ}C$

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	6	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25^{\circ}C$, $I_D = I_{AR}$, $V_{DD} = 25$ V)	370	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	17	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100^{\circ}C$, pulse width limited by T_j max, $\delta < 1\%$)	3.7	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25^{\circ}C$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250 \mu A$ $V_{GS} = 0$	600			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^{\circ}C$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20$ V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250 \mu A$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10$ V $I_D = 3$ A $V_{GS} = 10$ V $I_D = 3$ A $T_c = 100^{\circ}C$		1	1.2 2.4	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10$ V	6			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 3$ A	2	4.8		S
C_{iss}	Input Capacitance	$V_{DS} = 25$ V $f = 1$ MHz $V_{GS} = 0$		1150	1500	pF
C_{oss}	Output Capacitance			160	240	pF
C_{rss}	Reverse Transfer Capacitance			75	110	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 300\text{ V}$ $I_D = 3\text{ A}$		50	65	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		140	175	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 480\text{ V}$ $I_D = 6\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		240		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 480\text{ V}$ $I_D = 6\text{ A}$ $V_{GS} = 10\text{ V}$		78	98	nC
Q_{gs}	Gate-Source Charge			8		nC
Q_{gd}	Gate-Drain Charge			41		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(voff)}$	Off-voltage Rise Time	$V_{DD} = 480\text{ V}$ $I_D = 6\text{ A}$		100	125	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		27	34	ns
t_c	Cross-over Time	(see test circuit, figure 5)		145	180	ns

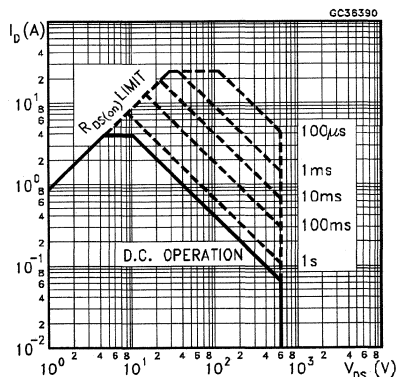
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				3.8	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				24	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 6\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 6\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		750		ns
Q_{rr}	Reverse Recovery Charge			13.5		μ C
I_{RRM}	Reverse Recovery Current			38		A

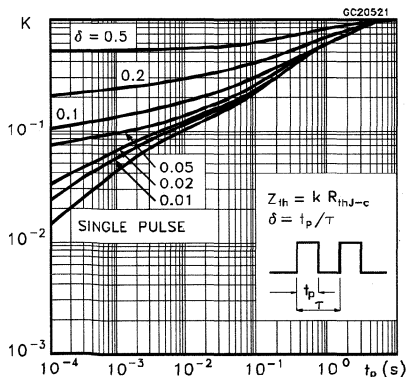
(*) Pulsed: Pulse duration $\bar{t} = 300\ \mu\text{s}$, duty cycle 1.5 %

(•) Pulse width limited by safe operating area

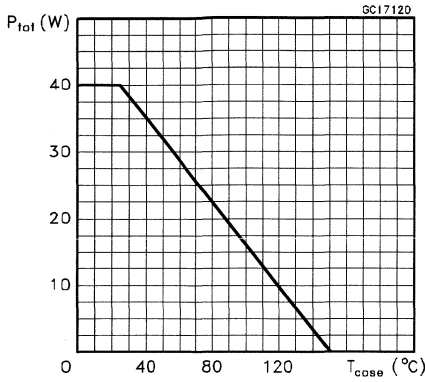
Safe Operating Area



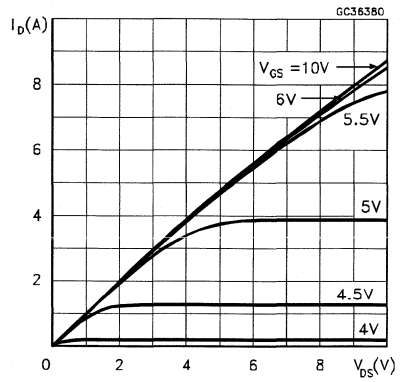
Thermal Impedance



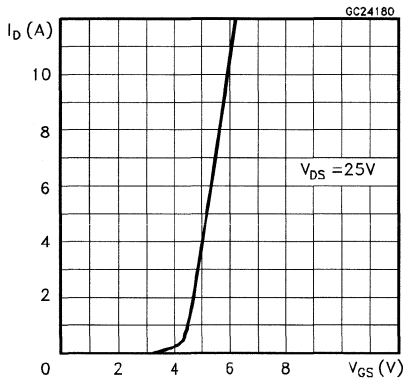
Derating Curve



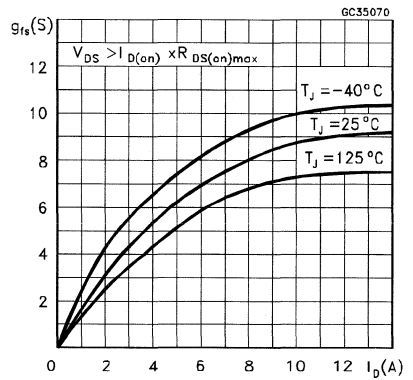
Output Characteristics



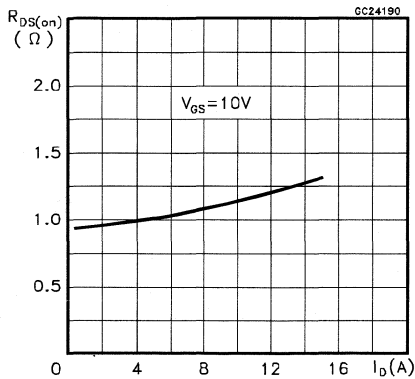
Transfer Characteristics



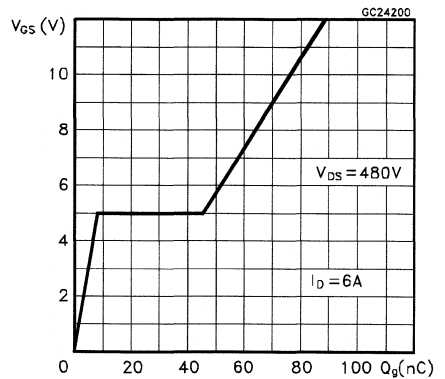
Transconductance



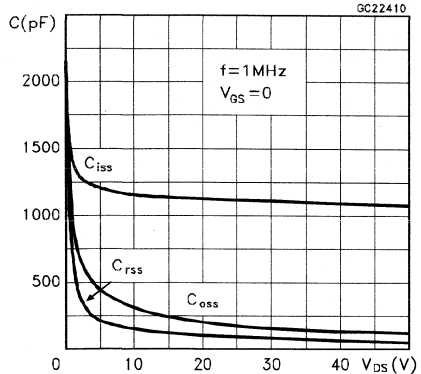
Static Drain-source On Resistance



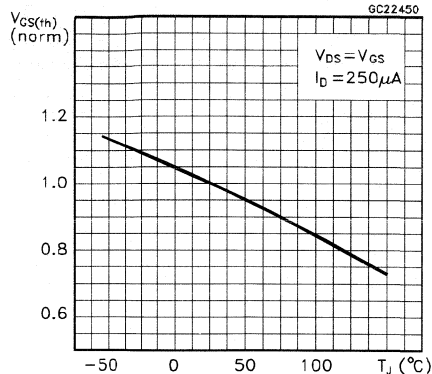
Gate Charge vs Gate-source Voltage



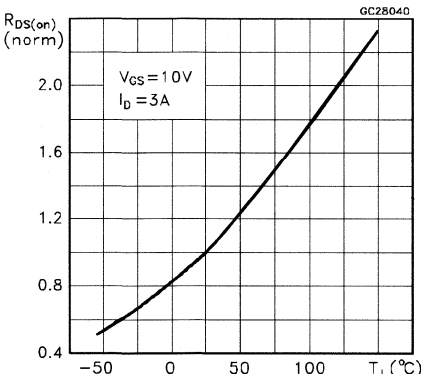
Capacitance Variations



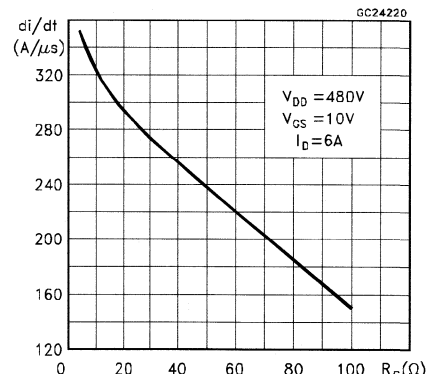
Normalized Gate Threshold Voltage vs Temperature



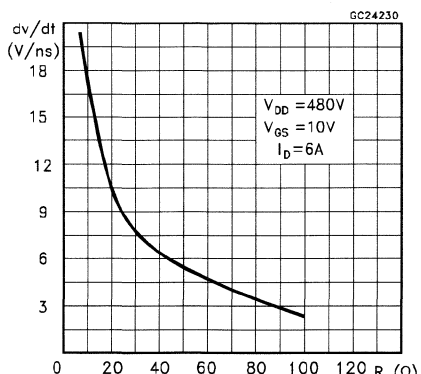
Normalized On Resistance vs Temperature



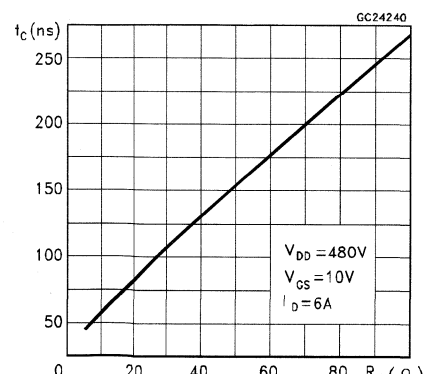
Turn-on Current Slope



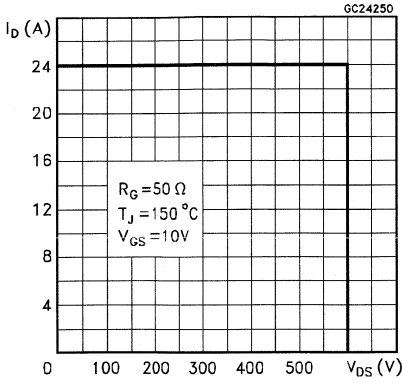
Turn-off Drain-source Voltage Slope



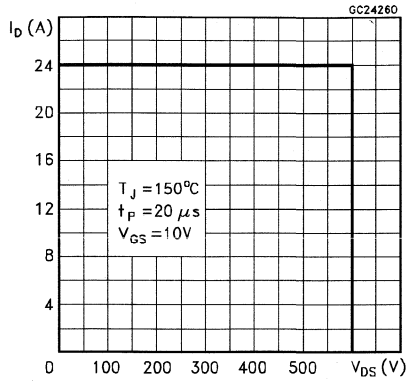
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

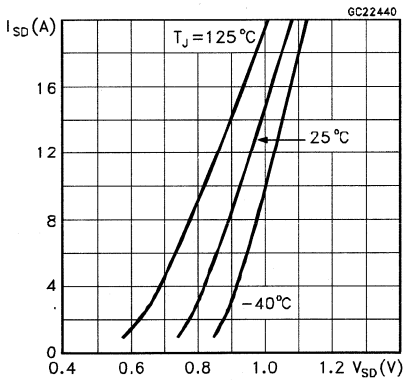


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

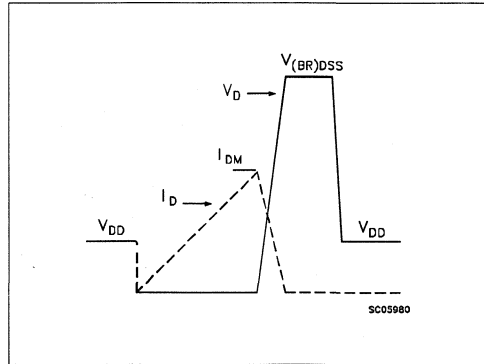
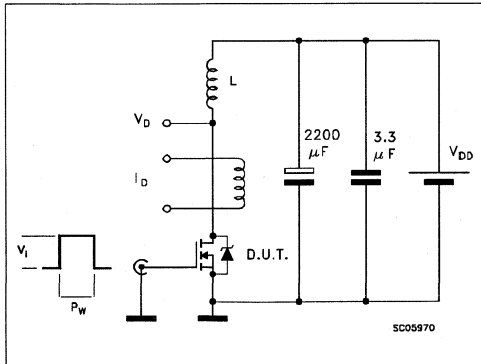


Fig. 3: Switching Times Test Circuits For Resistive Load

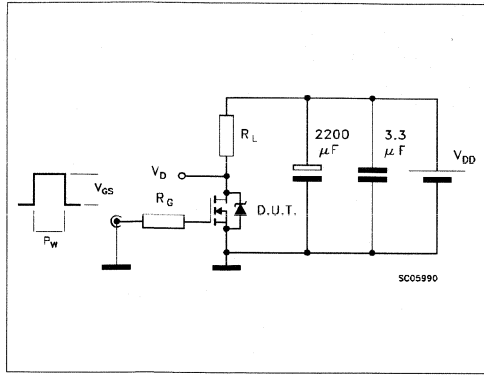


Fig. 4: Gate Charge Test Circuit

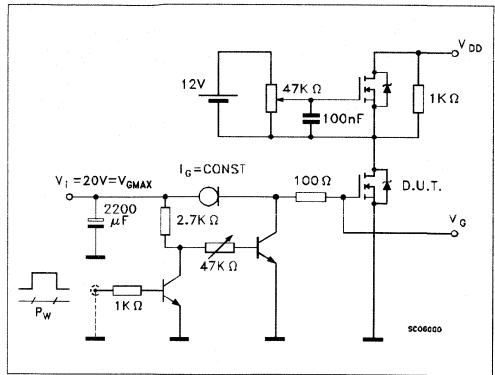
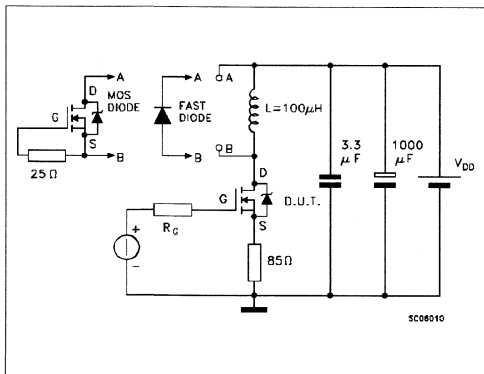


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



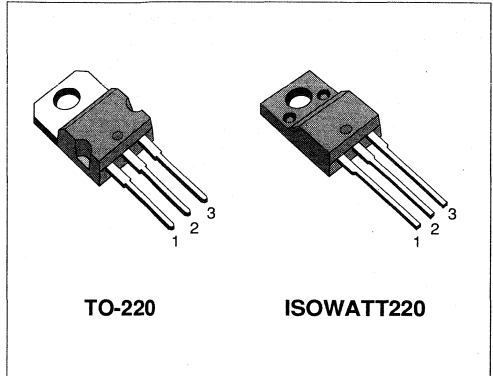
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP7N20	200 V	< 0.65 Ω	7 A
STP7N20FI	200 V	< 0.65 Ω	4 A

- TYPICAL R_{DS(on)} = 0.55 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

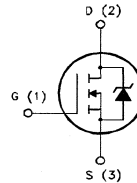
- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



TO-220

ISOWATT220

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP7N20	STP7N20FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	200		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	200		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	7	4	A
I _D	Drain Current (continuous) at T _c = 100 °C	4	2	A
I _{DM} (*)	Drain Current (pulsed)	28	28	A
P _{tot}	Total Dissipation at T _c = 25 °C	70	30	W
	Derating Factor	0.56	0.24	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case	Max	1.79	4.17	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5		°C/W
R _{thc-s}	Thermal Resistance Case-sink	Typ	0.5		°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	7	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	30	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	7	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	4	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	200			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 3.5 A V _{GS} = 10V I _D = 3.5 A T _c = 100°C		0.55	065 1.3	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} × R _{DS(on)max} V _{GS} = 10 V	7			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} × R _{DS(on)max} I _D = 3.5 A	1.8	3.8		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		460	600	pF
C _{oss}	Output Capacitance			90	120	pF
C _{rss}	Reverse Transfer Capacitance			20	30	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 100\text{ V}$ $I_D = 3.5\text{ A}$		30	45	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		70	100	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 160\text{ V}$ $I_D = 7\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		155		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 160\text{ V}$ $I_D = 7\text{ A}$ $V_{GS} = 10\text{ V}$		20	30	nC
Q_{gs}	Gate-Source Charge			6		nC
Q_{gd}	Gate-Drain Charge			8		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(V_{off})}$	Off-voltage Rise Time	$V_{DD} = 160\text{ V}$ $I_D = 7\text{ A}$		40	60	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		30	45	ns
t_c	Cross-over Time	(see test circuit, figure 5)		70	105	ns

SOURCE DRAIN DIODE

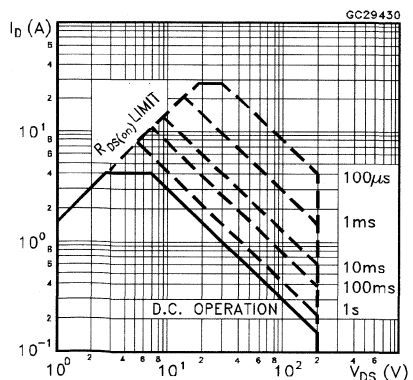
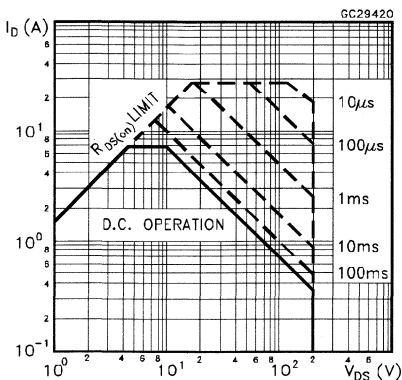
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				7	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				28	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 7\text{ A}$ $V_{GS} = 0$			1.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 7\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		170		ns
Q_{rr}	Reverse Recovery Charge			1		μ C
I_{RRM}	Reverse Recovery Current			12		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

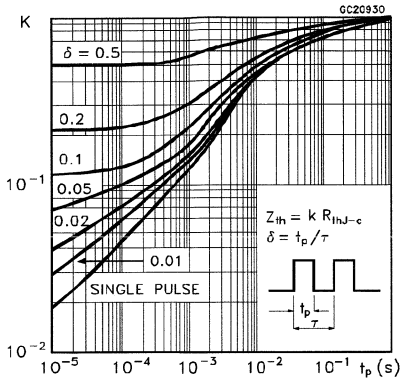
(•) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

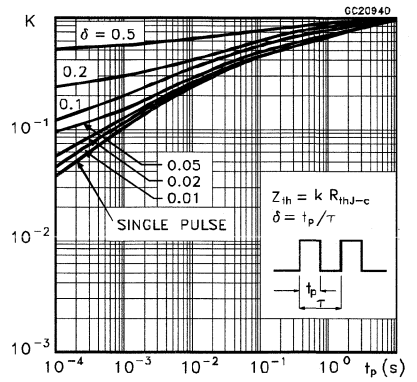
Safe Operating Areas For ISOWATT220



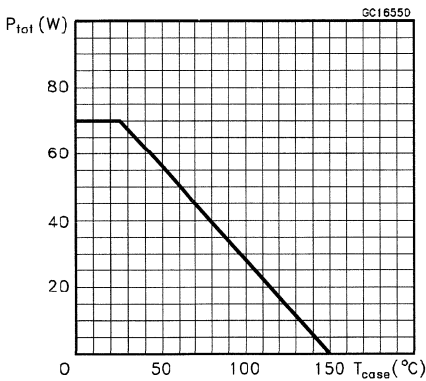
Thermal Impedance For TO-220



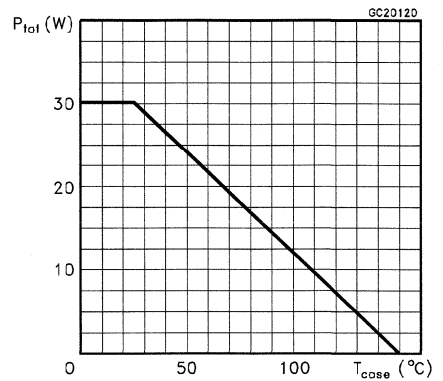
Thermal Impedance For ISOWATT220



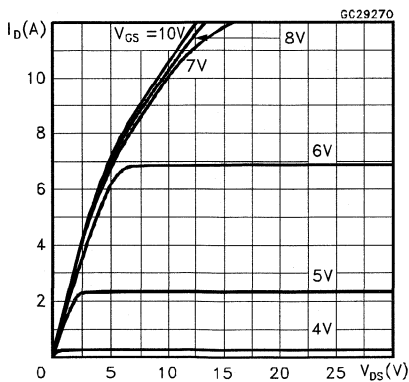
Derating Curve For TO-220



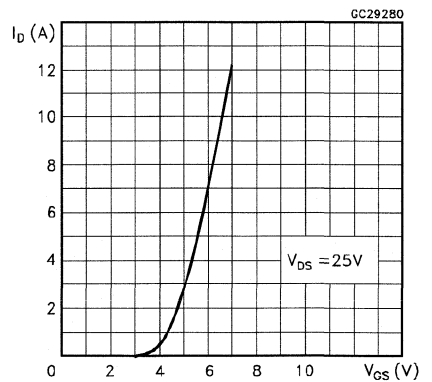
Derating Curve For ISOWATT220



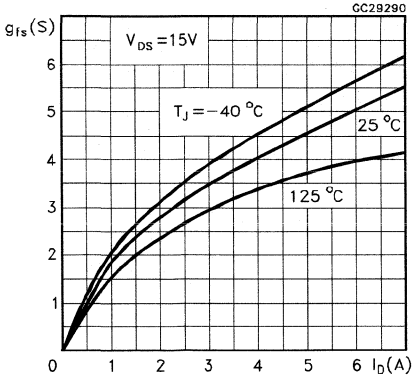
Output Characteristics



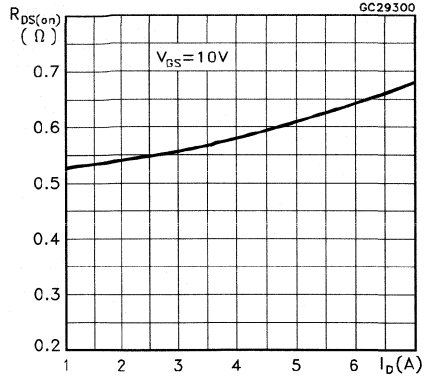
Transfer Characteristics



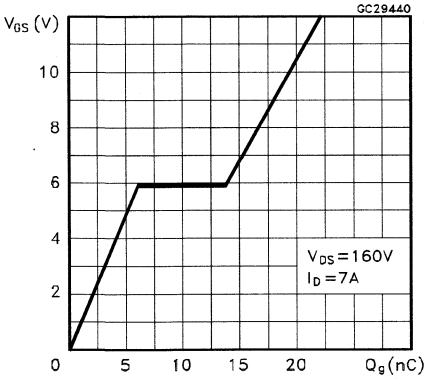
Transconductance



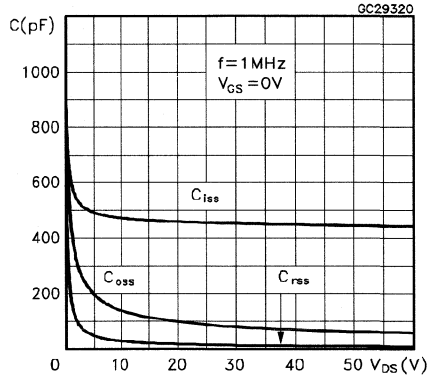
Static Drain-source On Resistance



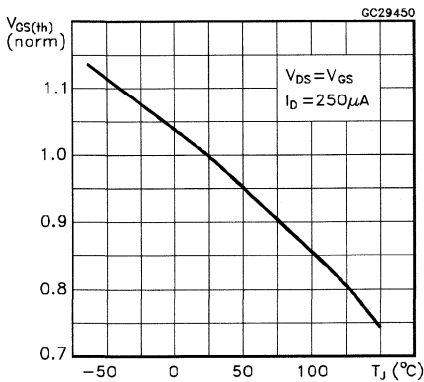
Gate Charge vs Gate-source Voltage



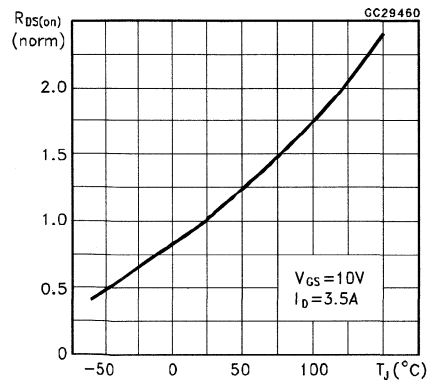
Capacitance Variations



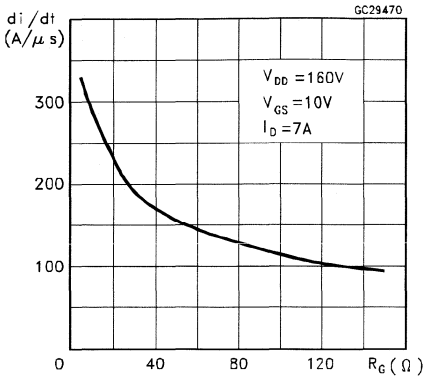
Normalized Gate Threshold Voltage vs Temperature



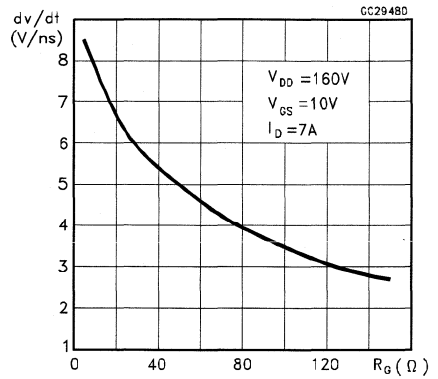
Normalized On Resistance vs Temperature



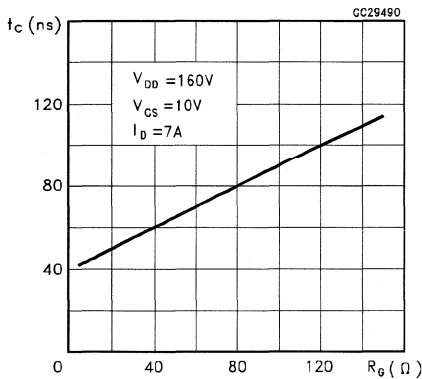
Turn-on Current Slope



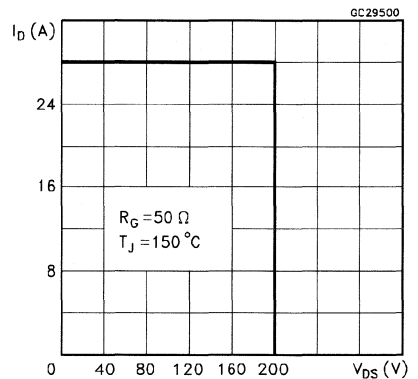
Turn-off Drain-source Voltage Slope



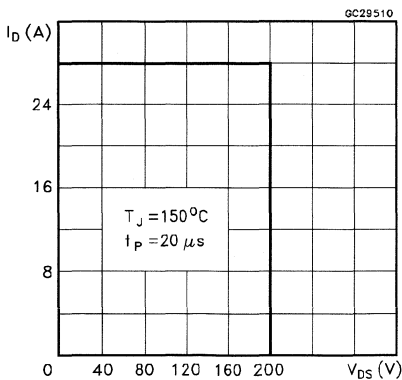
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

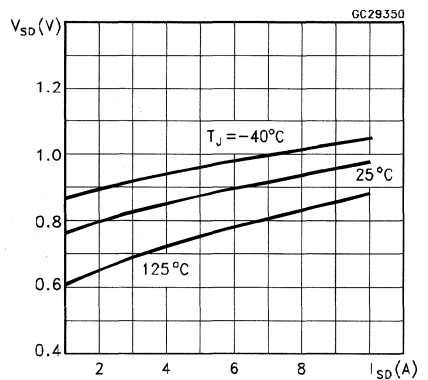


Fig. 1: Unclamped Inductive Load Test Circuits

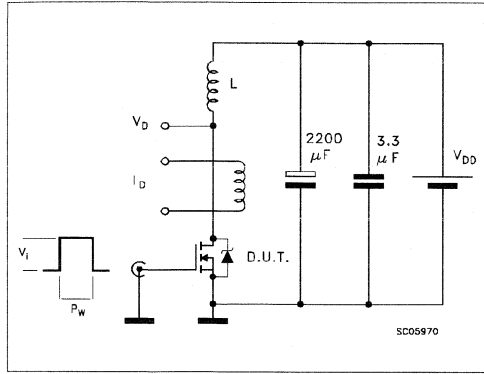


Fig. 2: Unclamped Inductive Waveforms

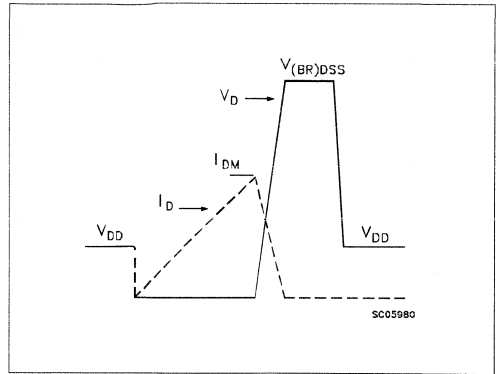


Fig. 3: Switching Times Test Circuits For Resistive Load

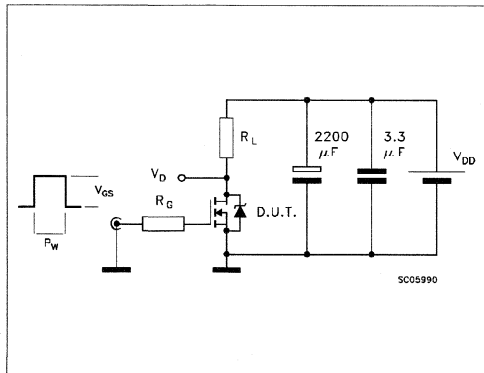


Fig. 4: Gate Charge Test Circuit

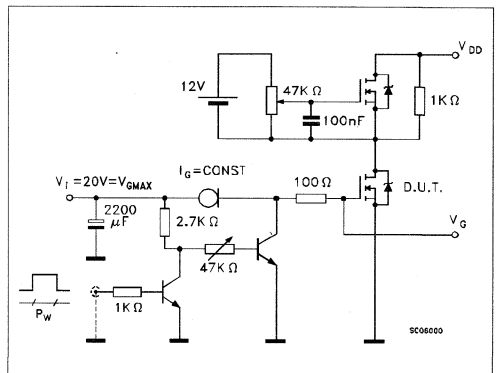
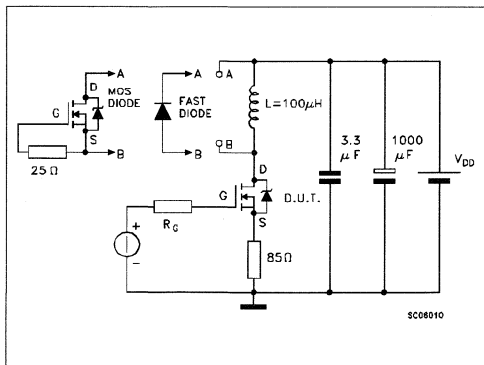


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



N - CHANNEL ENHANCEMENT MODE FAST POWER MOS TRANSISTOR

ADVANCE DATA

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP8NA50	500 V	< 0.85 Ω	8 A
STP8NA50FI	500 V	< 0.85 Ω	4.5 A

- TYPICAL R_{DS(on)} = 0.68 Ω
- ± 30V GATE TO SOURCE VOLTAGE RATING
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INTRINSIC CAPACITANCES
- GATE CHARGE MINIMIZED
- REDUCED THRESHOLD VOLTAGE SPREAD

DESCRIPTION

This series of POWER MOSFETS represents the most advanced high voltage technology. The optimized cell layout coupled with a new proprietary edge termination concur to give the device low R_{DS(on)} and gate charge, unequalled ruggedness and superior switching performance.

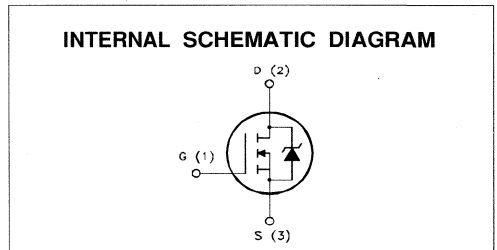
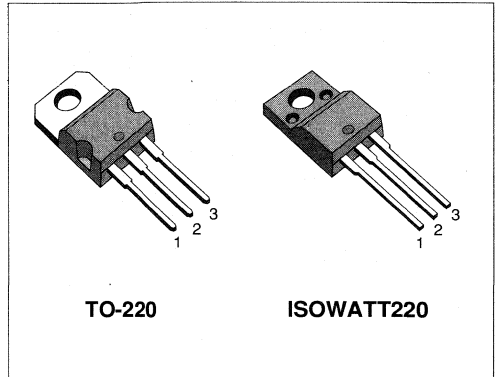
APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- DC-AC CONVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLIES AND MOTOR DRIVE

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP8NA50	STP8NA50FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	500		V
V _{DGR}	Drain-gate Voltage (R _{GS} = 20 kΩ)	500		V
V _{GS}	Gate-source Voltage	± 30		V
I _D	Drain Current (continuous) at T _c = 25 °C	8	4.5	A
I _D	Drain Current (continuous) at T _c = 100 °C	5.3	3	A
I _{DM} (*)	Drain Current (pulsed)	32	32	A
P _{tot}	Total Dissipation at T _c = 25 °C	125	40	W
	Derating Factor	1	0.32	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	2000		V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(*) Pulse width limited by safe operating area



THERMAL DATA

		TO-220	ISOWATT220		
$R_{thj-case}$	Thermal Resistance Junction-case	Max	1	3.12	$^{\circ}\text{C}/\text{W}$
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5		$^{\circ}\text{C}/\text{W}$
$R_{thc-sink}$	Thermal Resistance Case-sink	Typ	0.5		$^{\circ}\text{C}/\text{W}$
T_l	Maximum Lead Temperature For Soldering Purpose		300		$^{\circ}\text{C}$

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	8	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25^{\circ}\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{V}$)	350	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	11	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100^{\circ}\text{C}$, pulse width limited by T_j max, $\delta < 1\%$)	5.3	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25^{\circ}\text{C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\ \mu\text{A}$ $V_{GS} = 0$	500			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^{\circ}\text{C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 30\text{V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\ \mu\text{A}$	2.25	3	3.75	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{V}$ $I_D = 4\text{A}$ $V_{GS} = 10\text{V}$ $I_D = 4\text{A}$ $T_c = 100^{\circ}\text{C}$		0.68	0.85 1.7	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{V}$	8			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 4\text{A}$	4.5	6.8		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{V}$ $f = 1\text{MHz}$ $V_{GS} = 0$		1200		pF
C_{oss}	Output Capacitance			190		pF
C_{rss}	Reverse Transfer Capacitance			55		pF

ELECTRICAL CHARACTERISTICS (continued)**SWITCHING ON**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 250\text{ V}$ $I_D = 4\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		18		ns
t_r	Rise Time			26		ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 400\text{ V}$ $I_D = 8\text{ A}$ $R_G = 47\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		240		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 400\text{ V}$ $I_D = 8\text{ A}$ $V_{GS} = 10\text{ V}$		53		nC
Q_{gs}	Gate-Source Charge			8		nC
Q_{gd}	Gate-Drain Charge			25		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 400\text{ V}$ $I_D = 8\text{ A}$ $R_G = 47\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		75		ns
t_f	Fall Time			25		ns
t_c	Cross-over Time			115		ns

SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				8	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				32	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 8\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 8\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 50\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		440		ns
Q_{rr}	Reverse Recovery Charge			5.5		μ C
I_{RRM}	Reverse Recovery Current			25		A

(*) Pulsed: Pulse duration $\tau_p = 300\ \mu\text{s}$, duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

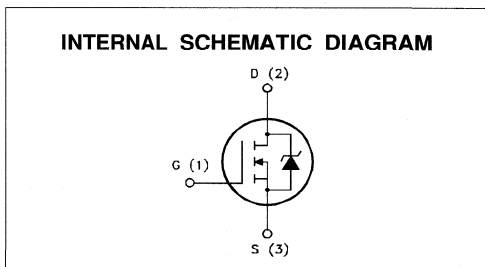
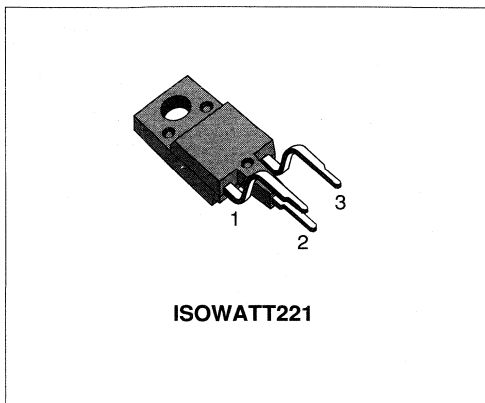
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP8N50XI	500 V	< 0.85 Ω	4.5 A

- TYPICAL R_{DS(on)} = 0.74 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INPUT CAPACITANCE
- LOW GATE CHARGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	500	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	500	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	4.5	A
I _D	Drain Current (continuous) at T _c = 100 °C	3	A
I _{DM} (•)	Drain Current (pulsed)	18	A
P _{tot}	Total Dissipation at T _c = 25 °C	35	W
	Derating Factor	0.28	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	4000	V
T _{stg}	Storage Temperature	-65 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C

(•) Pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	3.57	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	60	°C/W
$R_{thj-amb}$	Thermal Resistance Case-sink	Typ	0.5	°C/W
T_I	Maximum Lead Temperature For Soldering Purpose		300	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	4.5	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ °C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	160	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	6	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ °C}$, pulse width limited by T_j max, $\delta < 1\%$)	3	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$	500			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\text{ }\mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 4\text{ A}$ $V_{GS} = 10\text{ V}$ $I_D = 4\text{ A}$ $T_c = 100\text{ °C}$		0.74	0.85 1.7	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	4.5			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 4\text{ A}$	4	6		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		1100	1500	pF
C_{oss}	Output Capacitance			190	240	pF
C_{rss}	Reverse Transfer Capacitance			80	110	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 200\text{ V}$ $I_D = 4\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		40 35	50 43	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 400\text{ V}$ $I_D = 8\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		240		A/ μ s
Q_G Q_{GS} Q_{GD}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 400\text{ V}$ $I_D = 8\text{ A}$ $V_{GS} = 10\text{ V}$		75 9 39	95	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(voff)}$ t_f t_c	Off-voltage Rise Time Fall Time Cross-over Time	$V_{DD} = 400\text{ V}$ $I_D = 8\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		25 25 40	32 32 50	ns ns ns

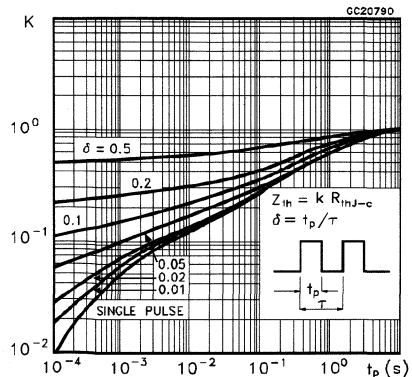
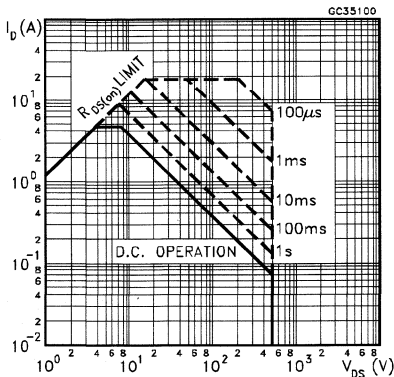
50SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				4.5 18	A A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 4.5\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 8\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_J = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		700		ns
Q_{rr}	Reverse Recovery Charge			12		μ C
I_{RRM}	Reverse Recovery Current			35		A

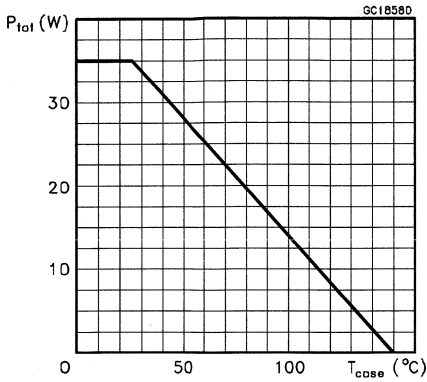
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %
 (•) Pulse width limited by safe operating area

Safe Operating Area

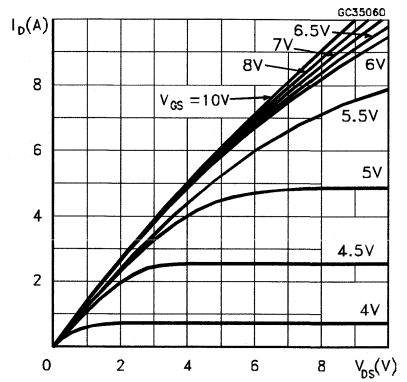
Thermal Impedance



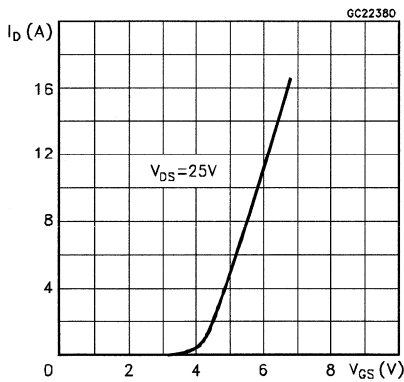
Derating Curve



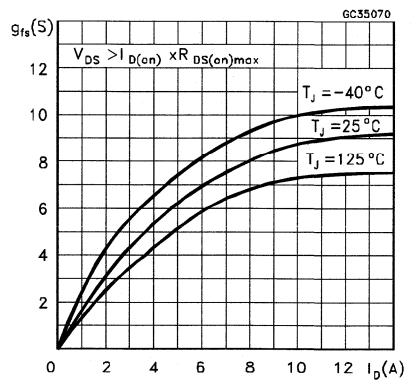
Output Characteristics



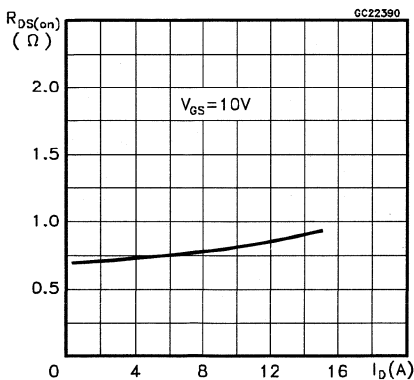
Transfer Characteristics



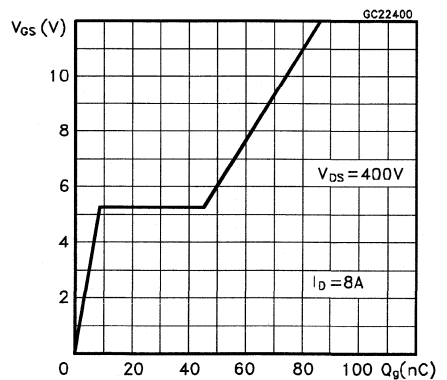
Transconductance



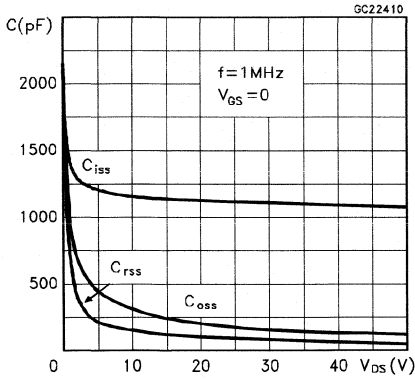
Static Drain-source On Resistance



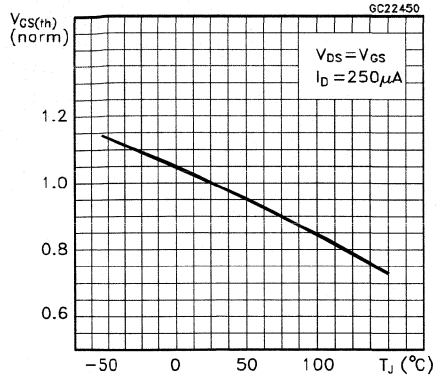
Gate Charge vs Gate-source Voltage



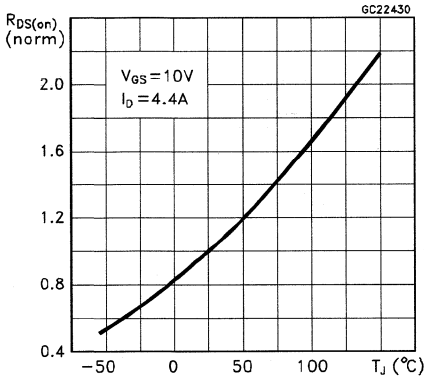
Capacitance Variations



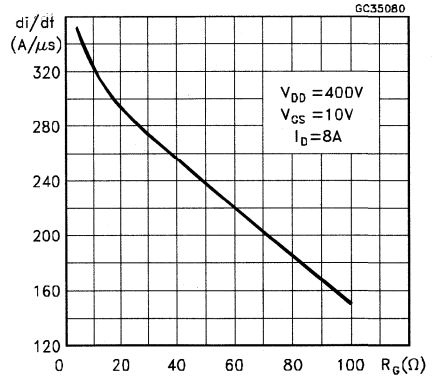
Normalized Gate Threshold Voltage vs Temperature



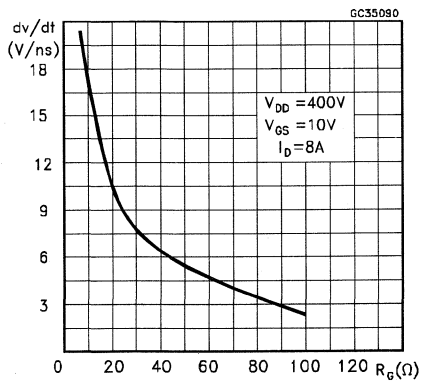
Normalized On Resistance vs Temperature



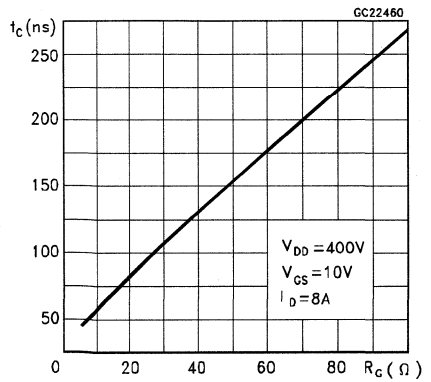
Turn-on Current Slope



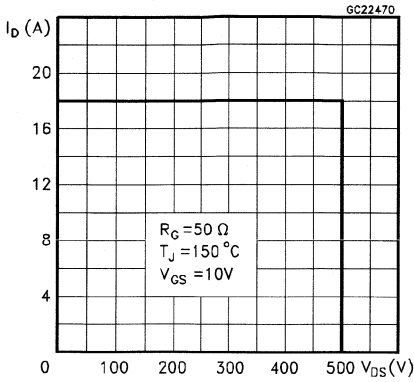
Turn-off Drain-source Voltage Slope



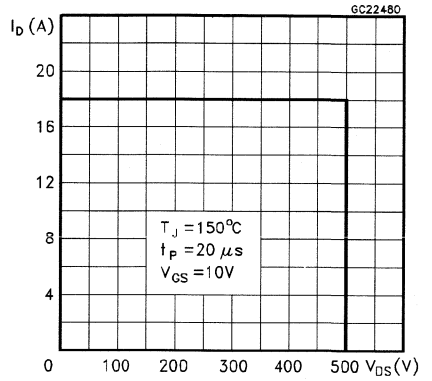
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

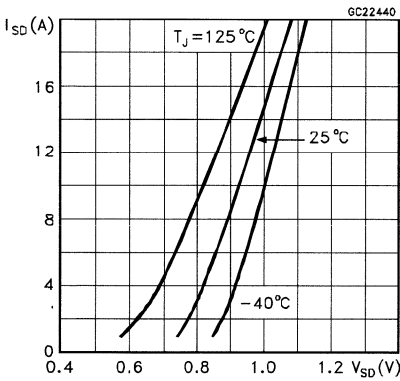


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

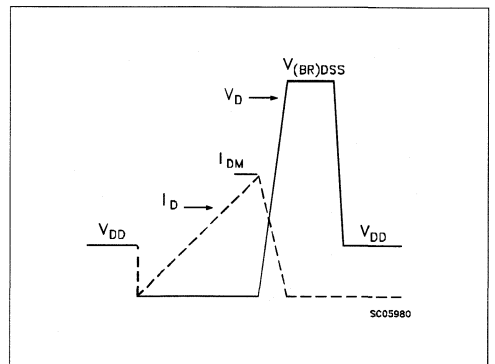
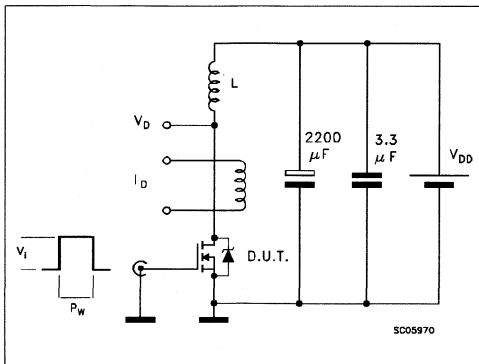


Fig. 3: Switching Times Test Circuits For Resistive Load

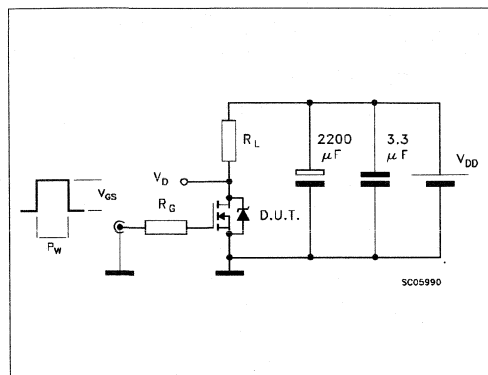


Fig. 4: Gate Charge Test Circuit

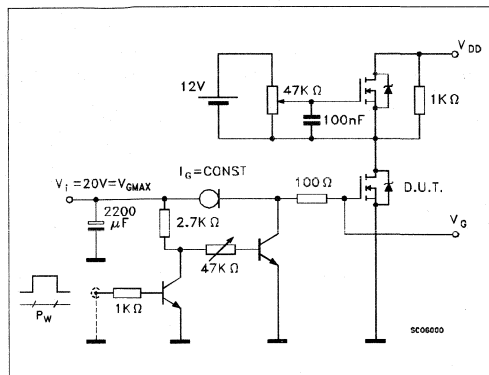
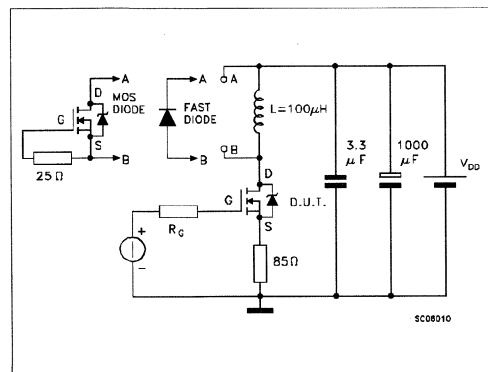


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



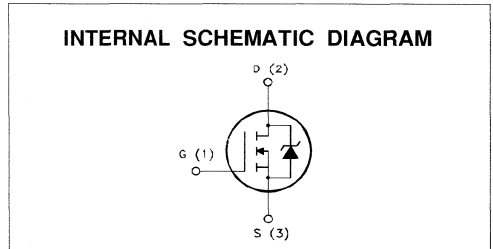
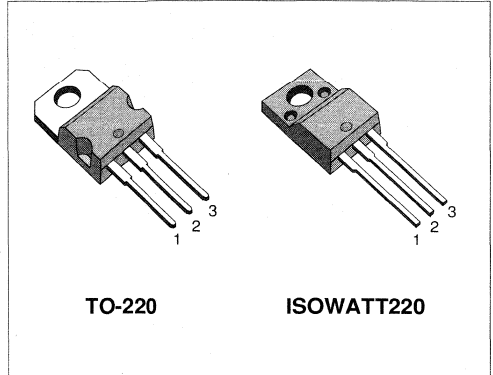
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP15N05L	50 V	< 0.15 Ω	15 A
STP15N05LFI	50 V	< 0.15 Ω	10 A

- TYPICAL R_{DS(on)} = 0.115 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- LOGIC LEVEL COMPATIBLE INPUT
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP15N05L	STP15N05LFI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	50		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	50		V
V _{GS}	Gate-source Voltage	± 15		V
I _D	Drain Current (continuous) at T _c = 25 °C	15	10	A
I _D	Drain Current (continuous) at T _c = 100 °C	10	7	A
I _{DM} (*)	Drain Current (pulsed)	60	60	A
P _{tot}	Total Dissipation at T _c = 25 °C	70	35	W
	Derating Factor	0.47	0.23	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

		TO-220	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case Max	2.14	4.29	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient Max	62.5		°C/W
R _{thc-sink}	Thermal Resistance Case-sink Typ	0.5		°C/W
T _l	Maximum Lead Temperature For Soldering Purpose	300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	15	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	45	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	10	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	10	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	50			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 15 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	1	1.6	2.5	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 5 V I _D = 7.5 A V _{GS} = 5 V I _D = 7.5 A T _c = 100°C		0.115	0.15 0.3	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	15			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 7.5 A	5	9		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		350	500	pF
C _{oss}	Output Capacitance			150	200	pF
C _{rss}	Reverse Transfer Capacitance			50	80	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 25\text{ V}$ $I_D = 7.5\text{ A}$		60	90	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 3)		190	270	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 15\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 5)		120		A/ μs
Q_g	Total Gate Charge	$V_{DD} = 40\text{ V}$ $I_D = 15\text{ A}$ $V_{GS} = 5\text{ V}$		12	18	nC
Q_{gs}	Gate-Source Charge			7		nC
Q_{gd}	Gate-Drain Charge			4		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 15\text{ A}$		40	60	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$		60	90	ns
t_c	Cross-over Time	(see test circuit, figure 5)		110	160	ns

SOURCE DRAIN DIODE

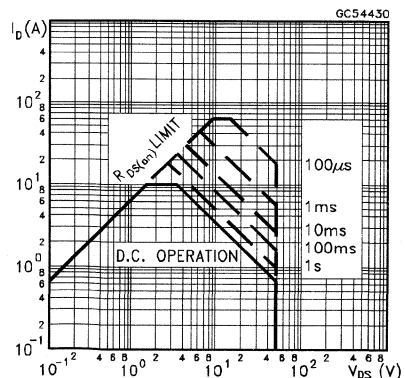
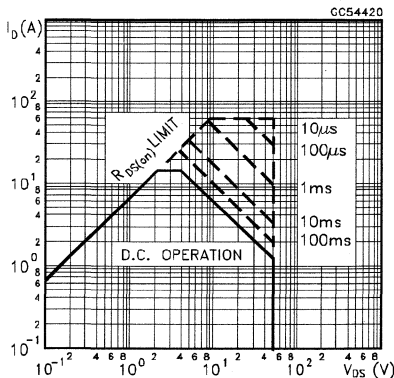
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				15	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				60	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 15\text{ A}$ $V_{GS} = 0$			1.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 15\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 25\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		80		ns
Q_{rr}	Reverse Recovery Charge			0.18		μC
I_{RRM}	Reverse Recovery Current			4.5		A

(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

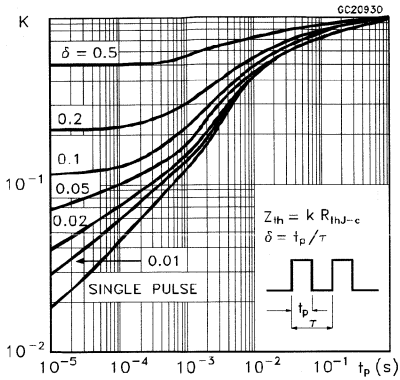
(•) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

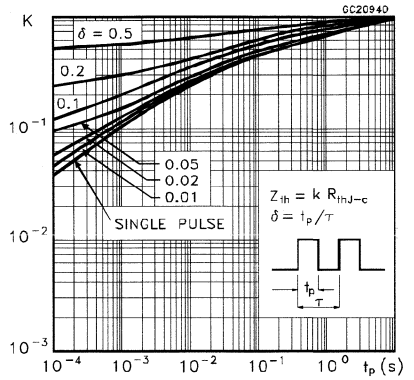
Safe Operating Areas For ISOWATT220



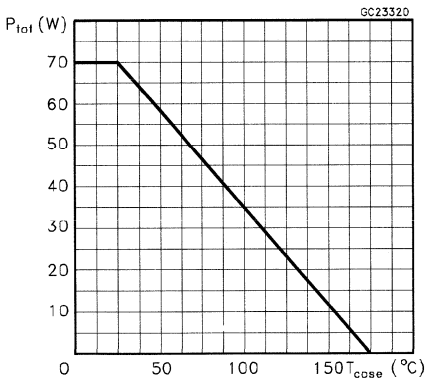
Thermal Impedance For TO-220



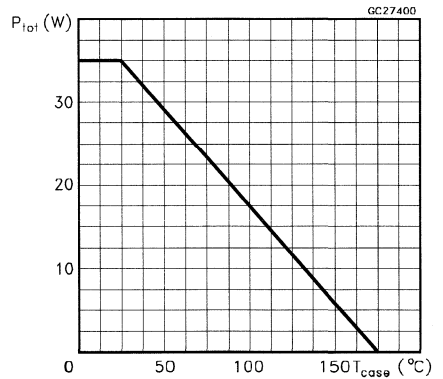
Thermal Impedance For ISOWATT220



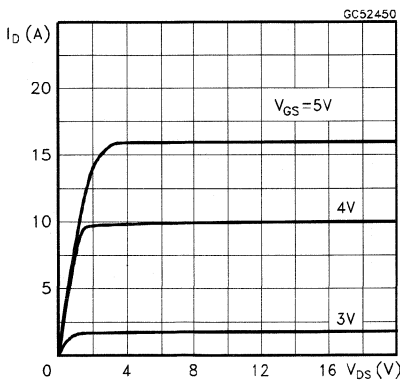
Derating Curve For TO-220



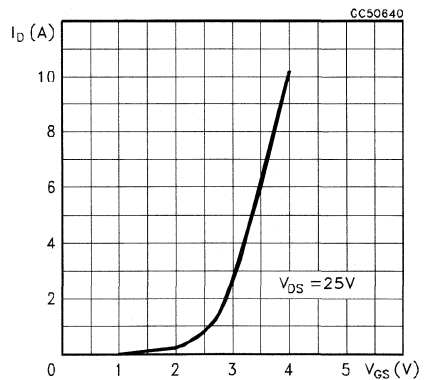
Derating Curve For ISOWATT220



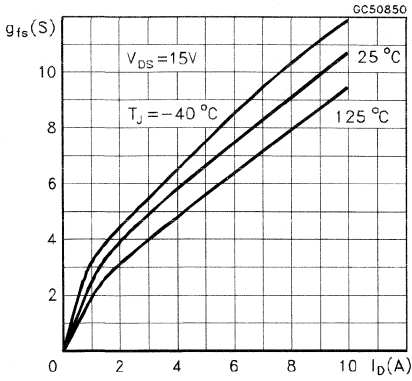
Output Characteristics



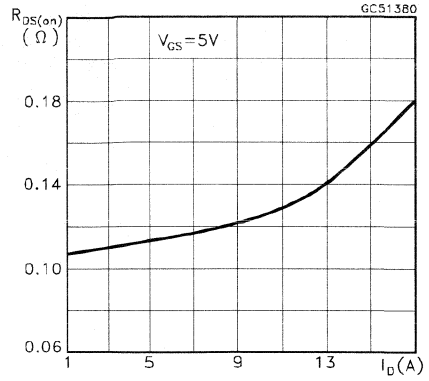
Transfer Characteristics



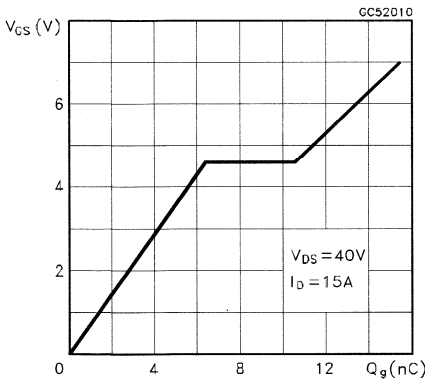
Transconductance



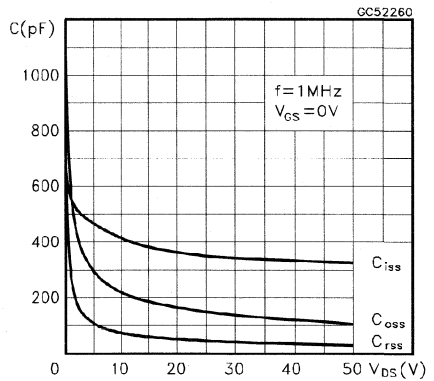
Static Drain-source On Resistance



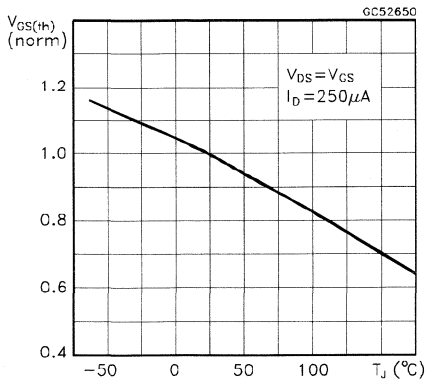
Gate Charge vs Gate-source Voltage



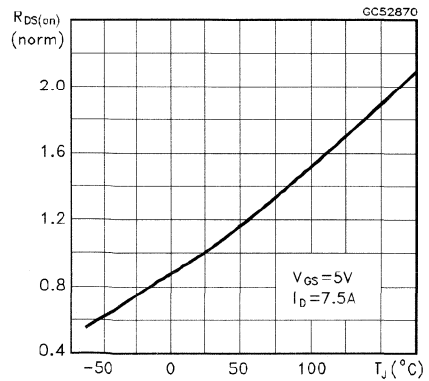
Capacitance Variations



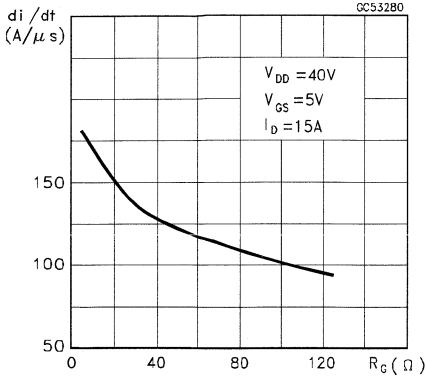
Normalized Gate Threshold Voltage vs Temperature



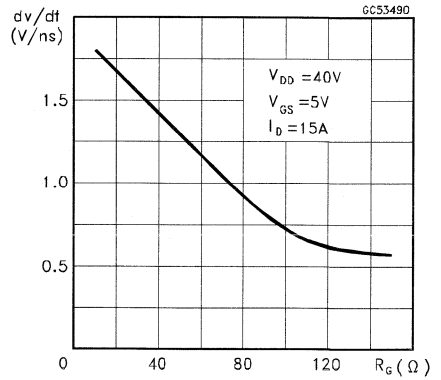
Normalized On Resistance vs Temperature



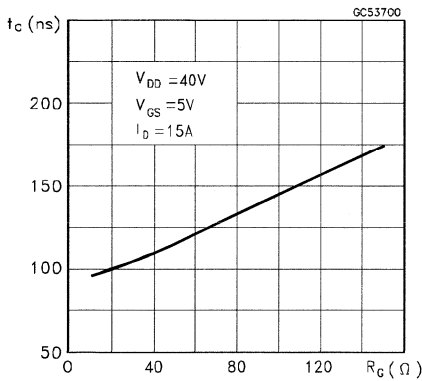
Turn-on Current Slope



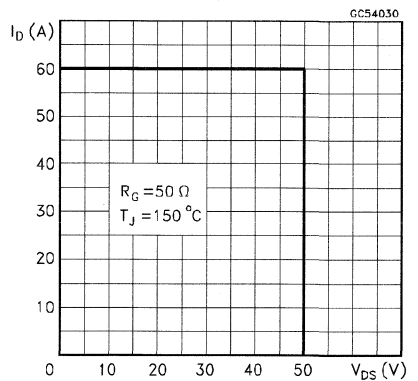
Turn-off Drain-source Voltage Slope



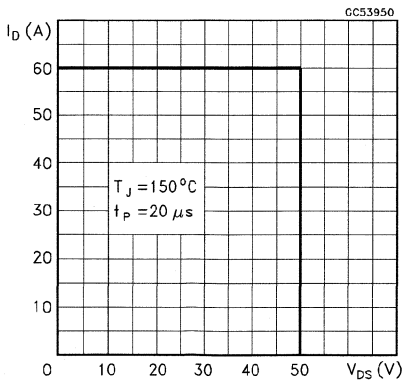
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

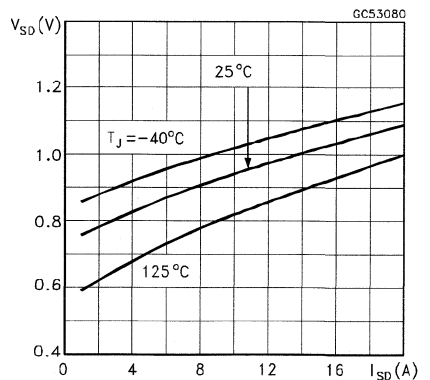


Fig. 1: Unclamped Inductive Load Test Circuits

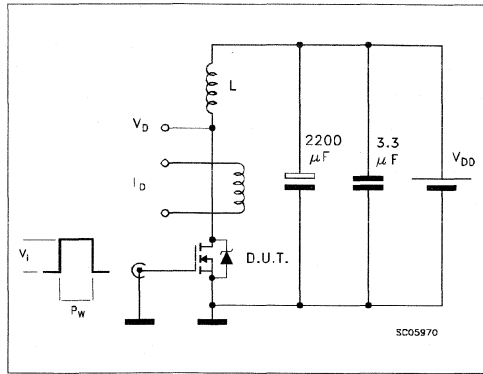


Fig. 2: Unclamped Inductive Waveforms

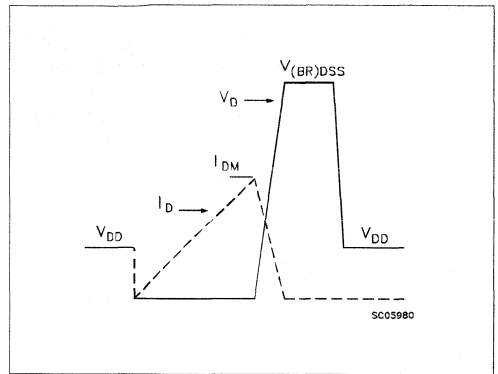


Fig. 3: Switching Times Test Circuits For Resistive Load

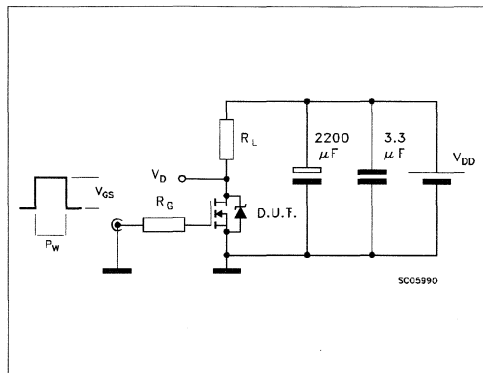


Fig. 4: Gate Charge Test Circuit

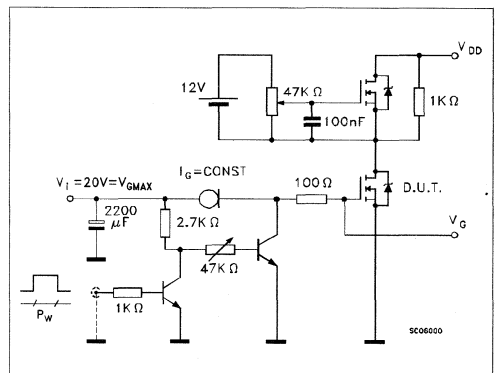
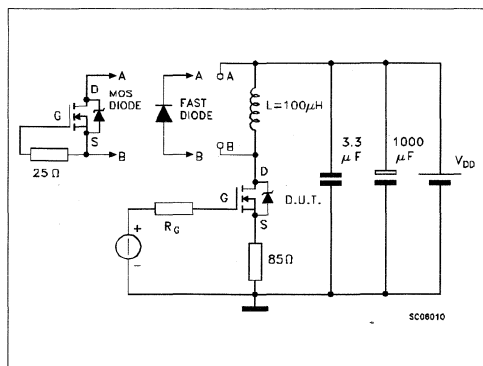


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



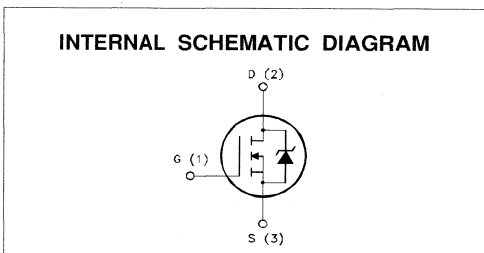
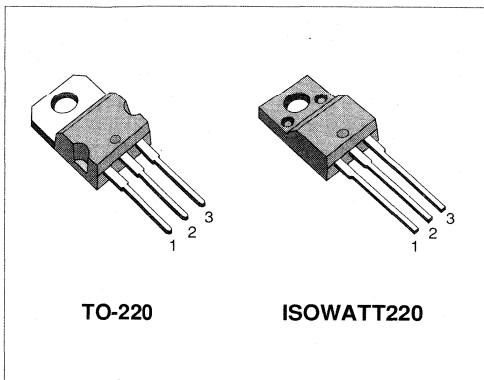
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP15N06L	60 V	< 0.15 Ω	15 A
STP15N06LFI	60 V	< 0.15 Ω	10 A

- TYPICAL R_{DS(on)} = 0.115 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- LOGIC LEVEL COMPATIBLE INPUT
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP15N06L	STP15N06LFI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	60		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	60		V
V _{GS}	Gate-source Voltage	± 15		V
I _D	Drain Current (continuous) at T _c = 25 °C	15	10	A
I _D	Drain Current (continuous) at T _c = 100 °C	10	7	A
I _{DM} (*)	Drain Current (pulsed)	60	60	A
P _{tot}	Total Dissipation at T _c = 25 °C	70	35	W
	Derating Factor	0.47	0.23	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

		TO-220	ISOWATT220		
R _{thj-case}	Thermal Resistance Junction-case	Max	2.14	4.29	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.5		°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	15	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	40	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	10	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	10	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	60			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 15 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	1	1.6	2.5	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 5 V I _D = 7.5 A V _{GS} = 5 V I _D = 7.5 A T _c = 100 °C		0.115	0.15 0.3	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} × R _{DS(on)max} V _{GS} = 10 V	15			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} × R _{DS(on)max} I _D = 7.5 A	5	9		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		350	500	pF
C _{oss}	Output Capacitance			150	200	pF
C _{rss}	Reverse Transfer Capacitance			50	80	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 25\text{ V}$ $I_D = 7.5\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 3)		60 190	90 270	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 15\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 5)		120		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 40\text{ V}$ $I_D = 15\text{ A}$ $V_{GS} = 5\text{ V}$		12 7 4	18	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 15\text{ A}$		40	60	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$		60	90	ns
t_c	Cross-over Time	(see test circuit, figure 5)		110	160	ns

SOURCE DRAIN DIODE

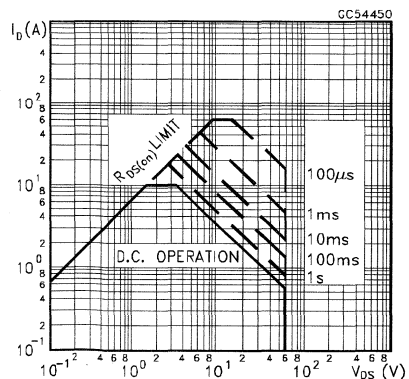
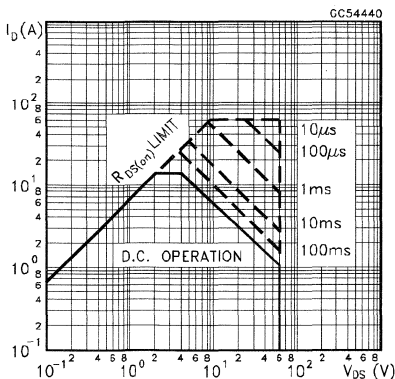
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				15 60	A A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 15\text{ A}$ $V_{GS} = 0$			1.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 15\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 25\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		80		ns
Q_{rr}	Reverse Recovery Charge			0.18		μ C
I_{RRM}	Reverse Recovery Current			4.5		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

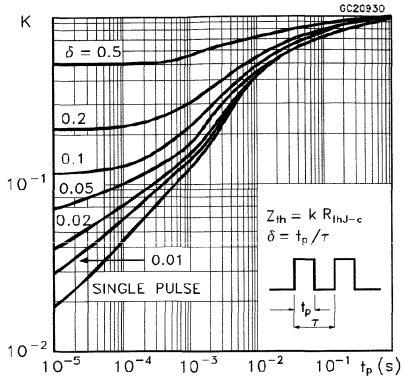
(•) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

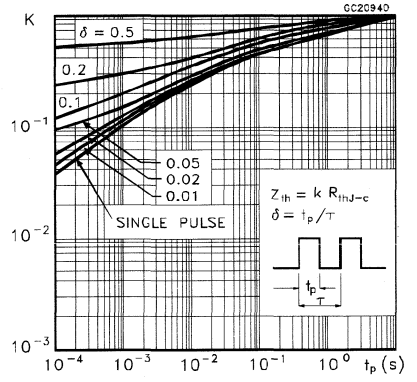
Safe Operating Areas For ISOWATT220



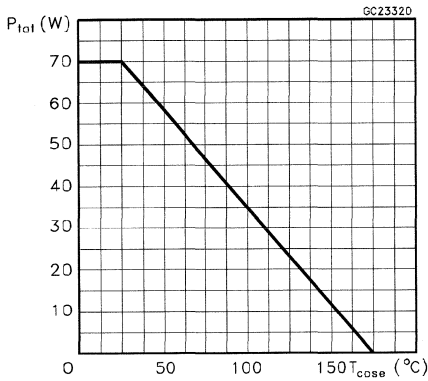
Thermal Impedance For TO-220



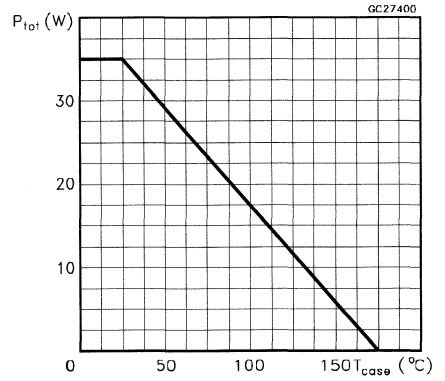
Thermal Impedance For ISOWATT220



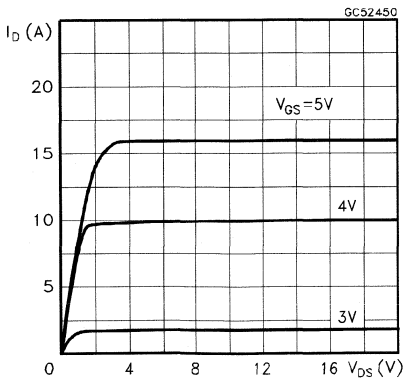
Derating Curve For TO-220



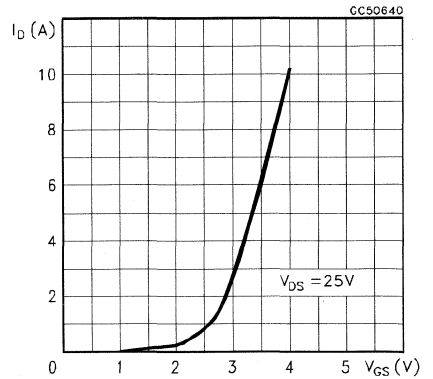
Derating Curve For ISOWATT220



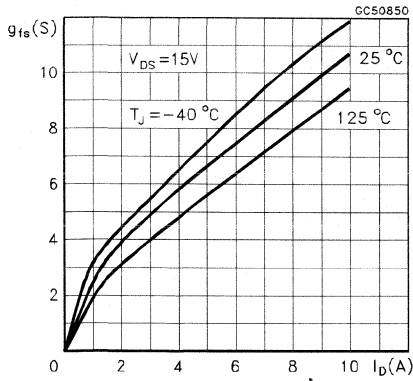
Output Characteristics



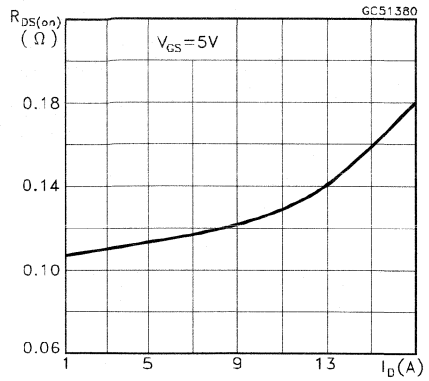
Transfer Characteristics



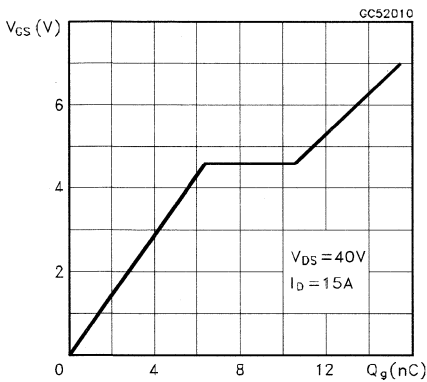
Transconductance



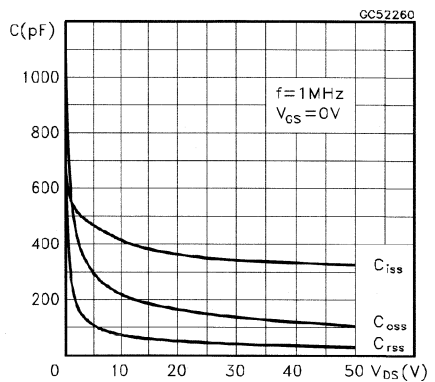
Static Drain-source On Resistance



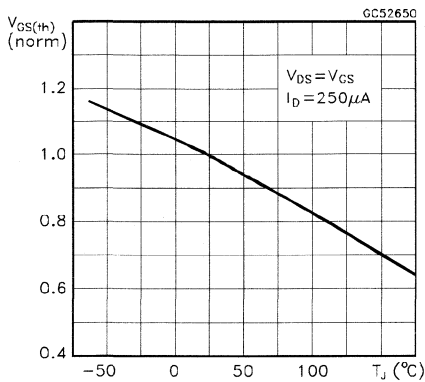
Gate Charge vs Gate-source Voltage



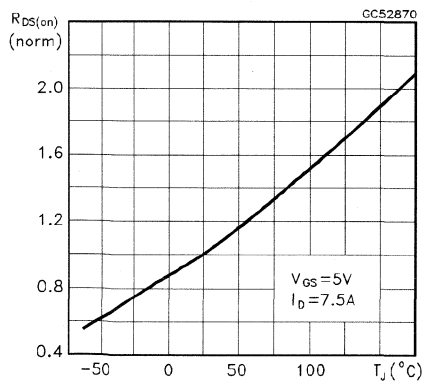
Capacitance Variations



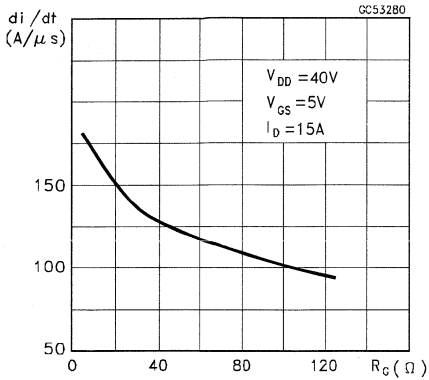
Normalized Gate Threshold Voltage vs Temperature



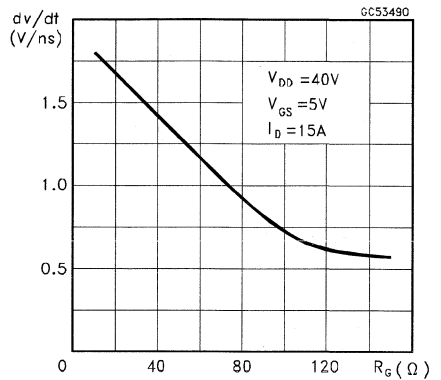
Normalized On Resistance vs Temperature



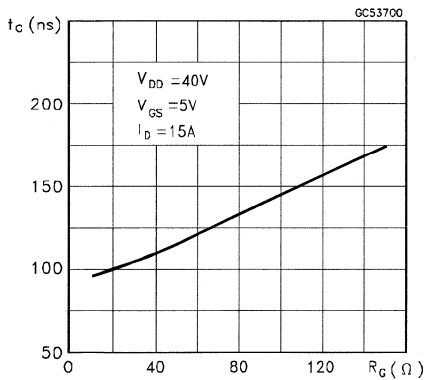
Turn-on Current Slope



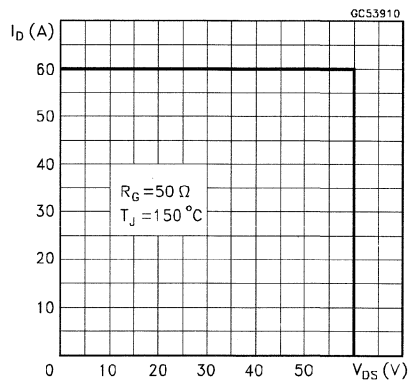
Turn-off Drain-source Voltage Slope



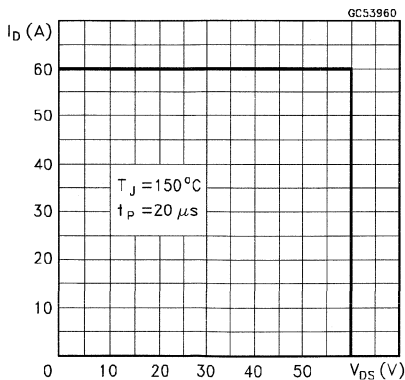
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

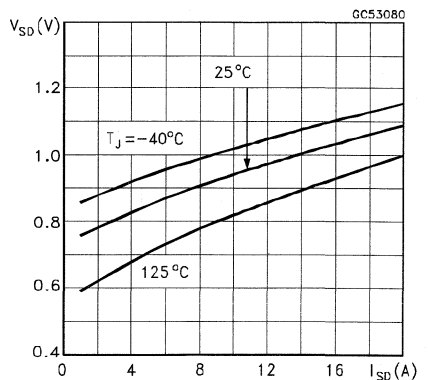


Fig. 1: Unclamped Inductive Load Test Circuits

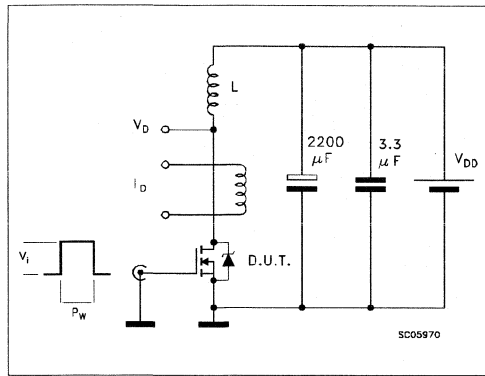


Fig. 2: Unclamped Inductive Waveforms

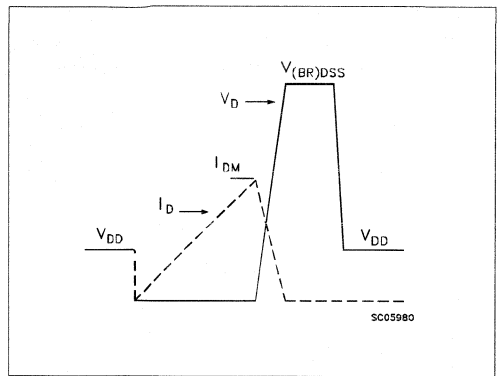


Fig. 3: Switching Times Test Circuits For Resistive Load

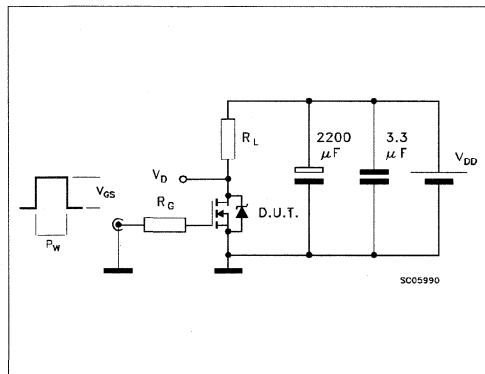


Fig. 4: Gate Charge Test Circuit

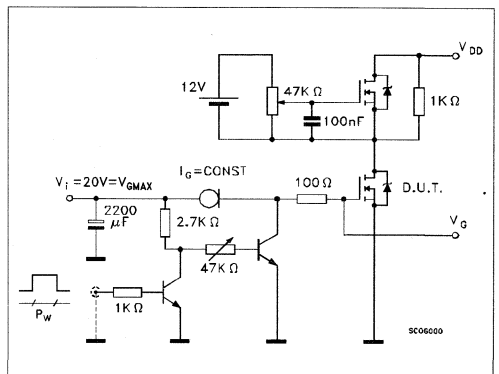
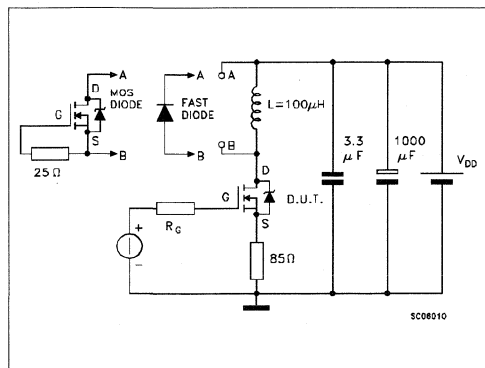


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



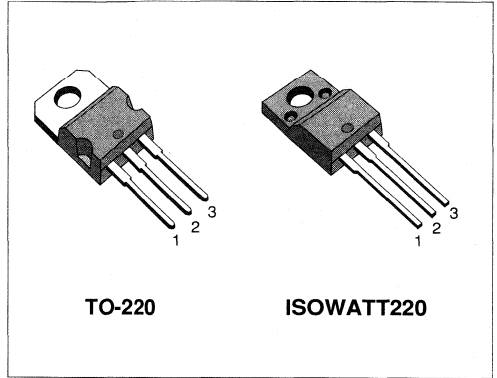
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP18N10	100 V	< 0.14 Ω	18 A
STP18N10FI	100 V	< 0.14 Ω	11 A

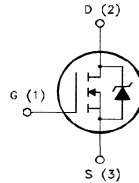
- TYPICAL R_{DS(on)} = 0.095 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP18N10	STP18N10FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	100		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	100		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	18	11	A
I _D	Drain Current (continuous) at T _c = 100 °C	12	7	A
I _{DM} (*)	Drain Current (pulsed)	72	72	A
P _{tot}	Total Dissipation at T _c = 25 °C	90	40	W
	Derating Factor	0.6	0.27	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case	Max	1.67	3.75	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max		62.5	°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ		0.5	°C/W
T _J	Maximum Lead Temperature For Soldering Purpose			300	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _J max, δ < 1%)	18	A
E _{AS}	Single Pulse Avalanche Energy (starting T _J = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	80	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _J max, δ < 1%)	20	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _J max, δ < 1%)	12	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	100			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	2.9	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 9 A V _{GS} = 10V I _D = 9 A T _c = 100°C		0.095	0.14 0.28	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	18			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 9 A	5	9		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		650	900	pF
C _{oss}	Output Capacitance			180	250	pF
C _{rss}	Reverse Transfer Capacitance			40	60	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 36\text{ V}$ $I_D = 9\text{ A}$		20	30	ns
t_r	Rise Time	$R_G = 15\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		130	185	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 80\text{ V}$ $I_D = 18\text{ A}$ $R_G = 15\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		180		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 80\text{ V}$ $I_D = 18\text{ A}$ $V_{GS} = 10\text{ V}$		27	40	nC
Q_{gs}	Gate-Source Charge			9		nC
Q_{gd}	Gate-Drain Charge			11		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(voff)}$	Off-voltage Rise Time	$V_{DD} = 80\text{ V}$ $I_D = 18\text{ A}$		55	80	ns
t_f	Fall Time	$R_G = 15\ \Omega$ $V_{GS} = 10\text{ V}$		45	65	ns
t_c	Cross-over Time	(see test circuit, figure 5)		100	145	ns

SOURCE DRAIN DIODE

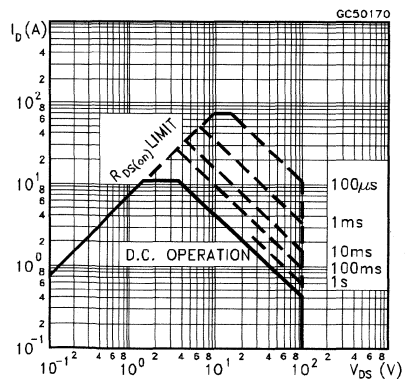
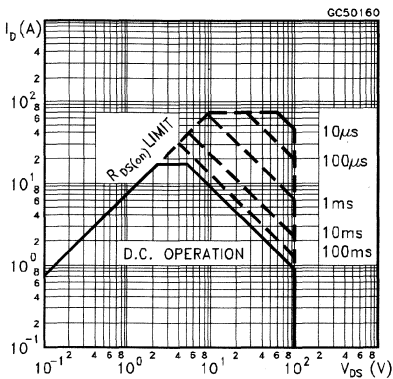
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				18	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				72	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 18\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 18\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		100		ns
Q_{rr}	Reverse Recovery Charge			0.4		μC
I_{RRM}	Reverse Recovery Current			8		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

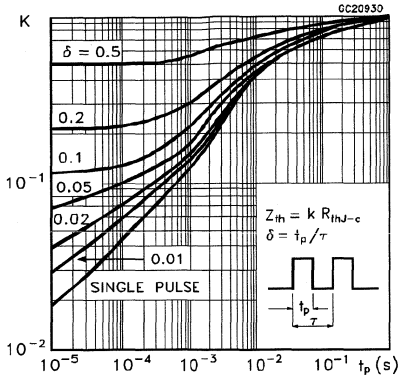
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

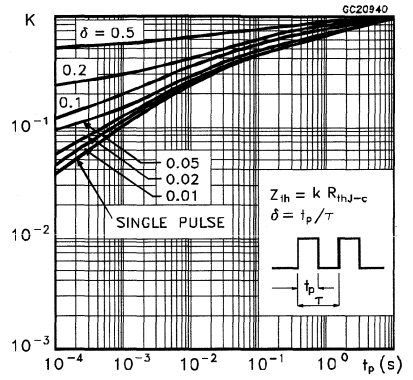
Safe Operating Areas For ISOWATT220



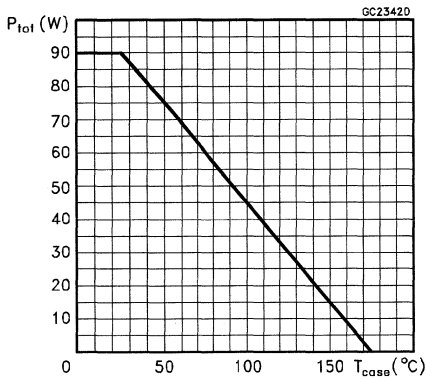
Thermal Impedance For TO-220



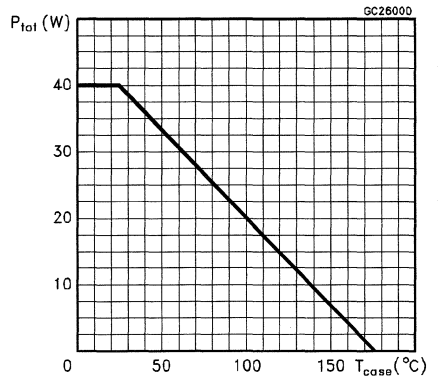
Thermal Impedance For ISOWATT220



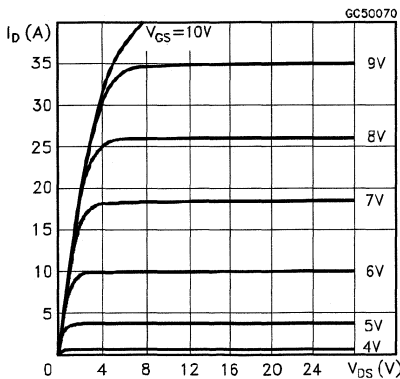
Derating Curve For TO-220



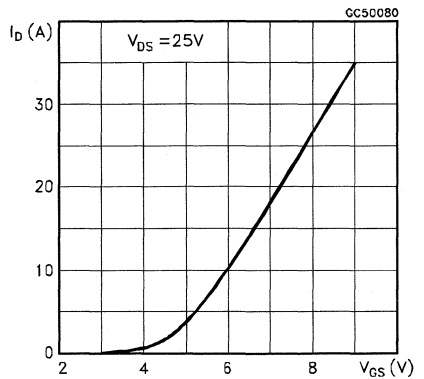
Derating Curve For ISOWATT220



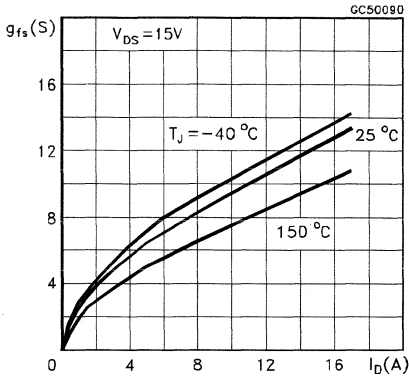
Output Characteristics



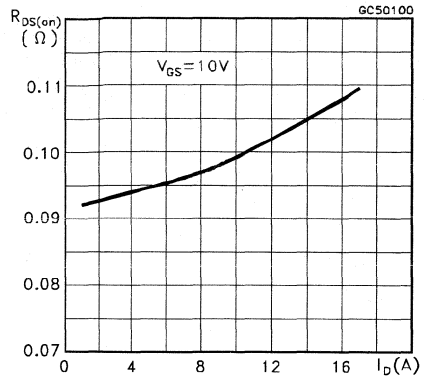
Transfer Characteristics



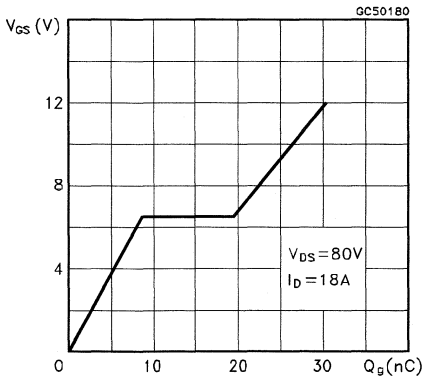
Transconductance



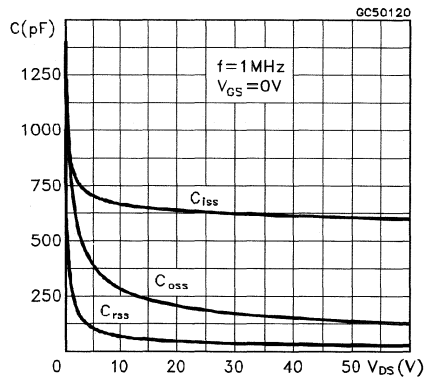
Static Drain-source On Resistance



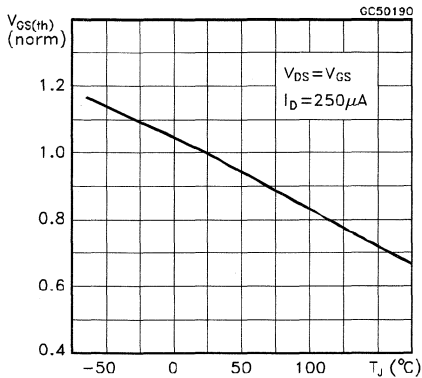
Gate Charge vs Gate-source Voltage



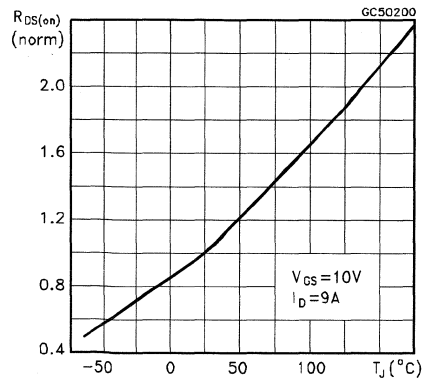
Capacitance Variations



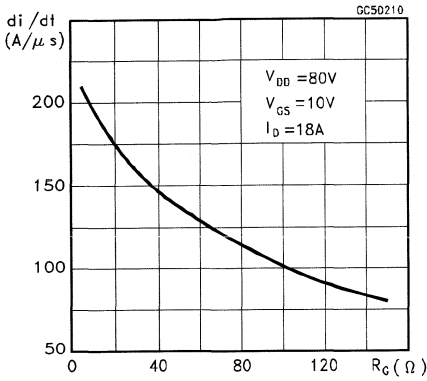
Normalized Gate Threshold Voltage vs Temperature



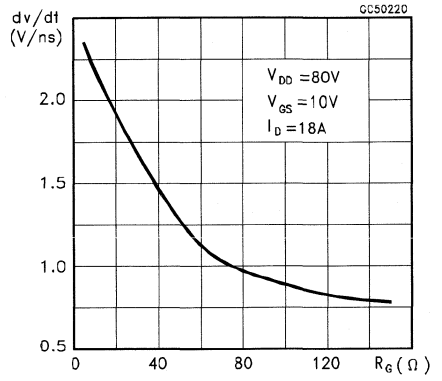
Normalized On Resistance vs Temperature



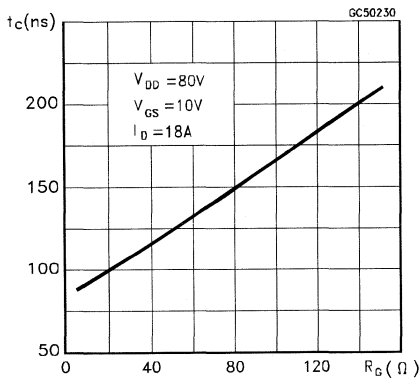
Turn-on Current Slope



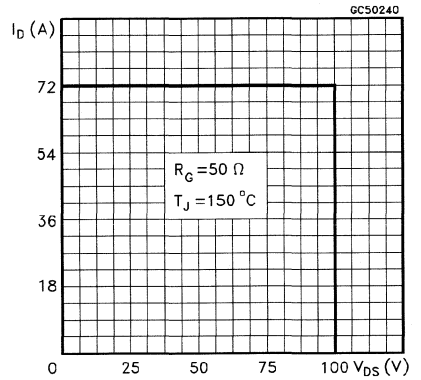
Turn-off Drain-source Voltage Slope



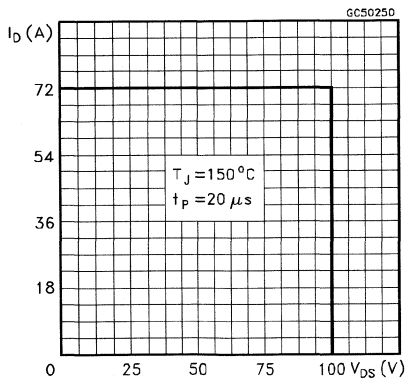
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

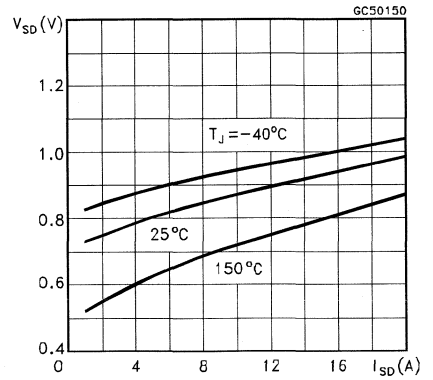


Fig. 1: Unclamped Inductive Load Test Circuits

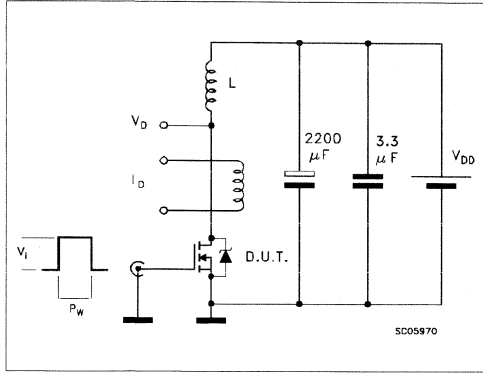


Fig. 2: Unclamped Inductive Waveforms

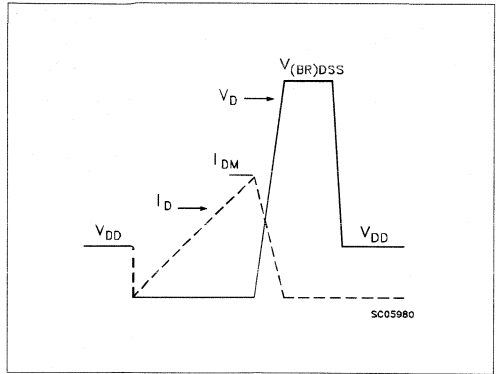


Fig. 3: Switching Times Test Circuits For Resistive Load

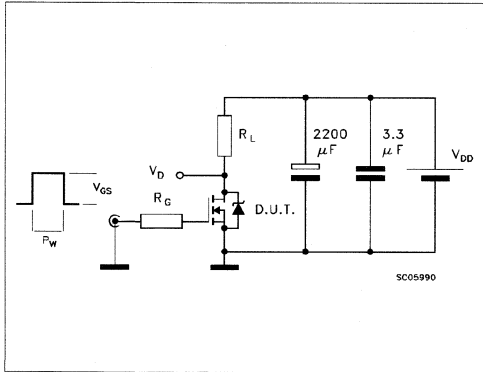


Fig. 4: Gate Charge Test Circuit

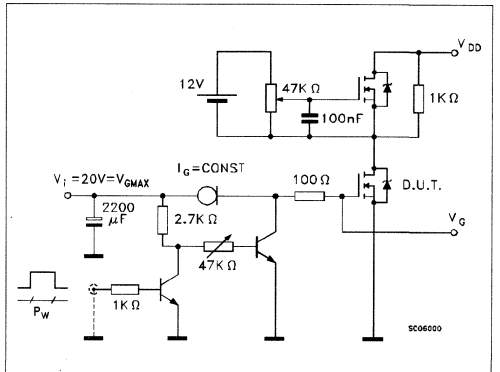
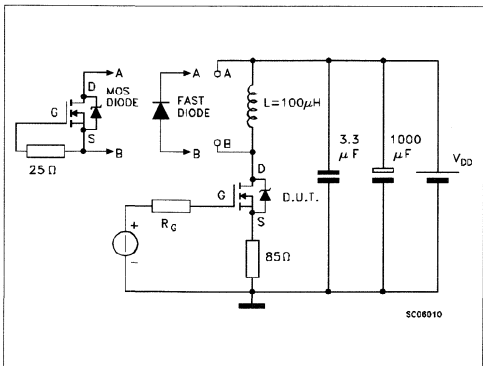


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



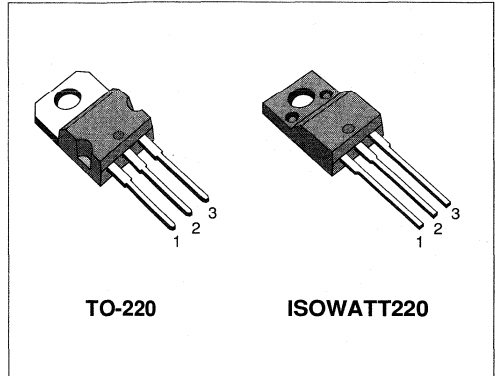
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP20N06	60 V	< 0.085 Ω	20 A
STP20N06FI	60 V	< 0.085 Ω	13 A

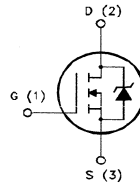
- TYPICAL R_{DS(on)} = 0.06 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP20N06	STP20N06FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	60		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	60		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	20	13	A
I _D	Drain Current (continuous) at T _c = 100 °C	14	9	A
I _{DM} (*)	Drain Current (pulsed)	80	80	A
P _{tot}	Total Dissipation at T _c = 25 °C	80	35	W
	Derating Factor	0.53	0.23	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

		TO-220	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case Max	1.88	4.29	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient Max	62.5		°C/W
R _{thc-sink}	Thermal Resistance Case-sink Typ	0.5		°C/W
T _I	Maximum Lead Temperature For Soldering Purpose	300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	20	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	80	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	20	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	14	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	60			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	2.9	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 10 A V _{GS} = 10V I _D = 10 A T _c = 100°C		0.06	0.085 0.17	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} × R _{DS(on)max} V _{GS} = 10 V	20			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} × R _{DS(on)max} I _D = 10 A	6	9		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		520	700	pF
C _{oss}	Output Capacitance			250	350	pF
C _{rss}	Reverse Transfer Capacitance			80	120	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 30\text{ V}$ $I_D = 3\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		45 65	65 95	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 20\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		240		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 40\text{ V}$ $I_D = 20\text{ A}$ $V_{GS} = 10\text{ V}$		22 11 7	30	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(v_{off})$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 20\text{ A}$		80	120	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		60	90	ns
t_c	Cross-over Time			140	210	ns

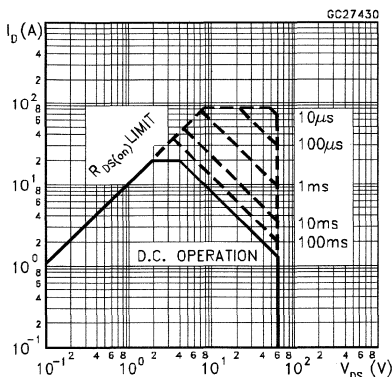
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				20 80	A A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 20\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 20\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 15\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		85		ns
Q_{rr}	Reverse Recovery Charge			0.13		μC
I_{RRM}	Reverse Recovery Current			3		A

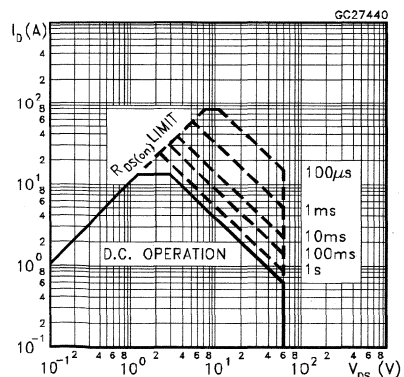
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

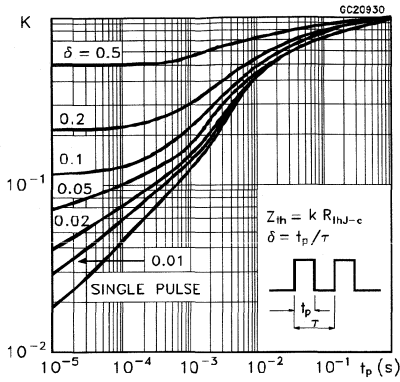
Safe Operating Areas For TO-220



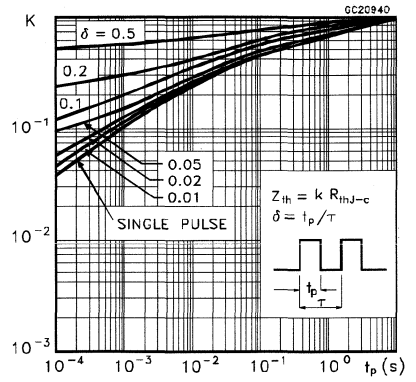
Safe Operating Areas For ISOWATT220



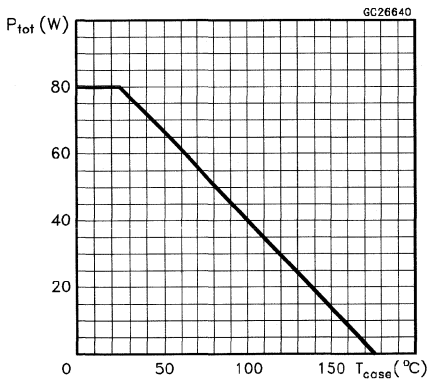
Thermal Impedance For TO-220



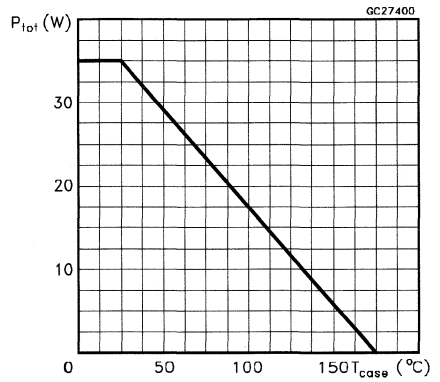
Thermal Impedance For ISOWATT220



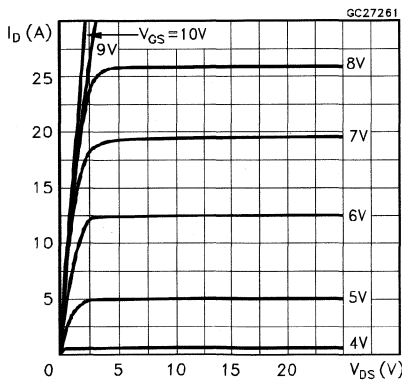
Derating Curve For TO-220



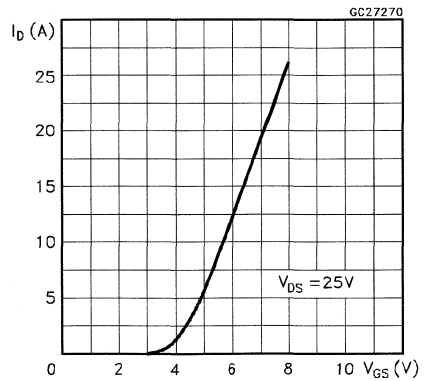
Derating Curve For ISOWATT220



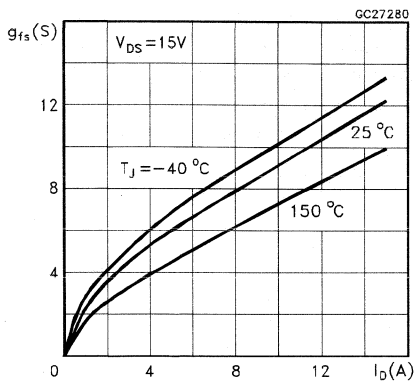
Output Characteristics



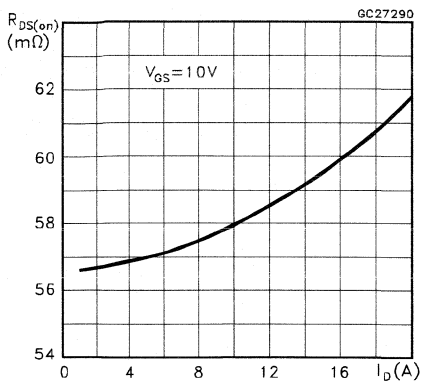
Transfer Characteristics



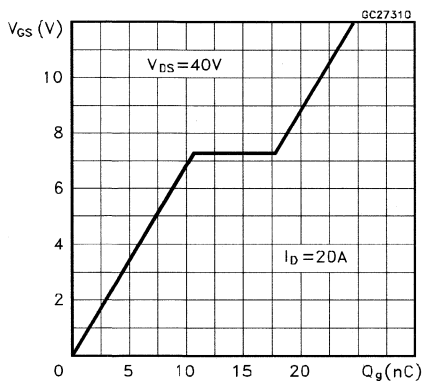
Transconductance



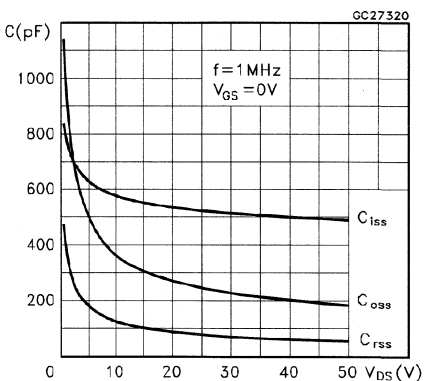
Static Drain-source On Resistance



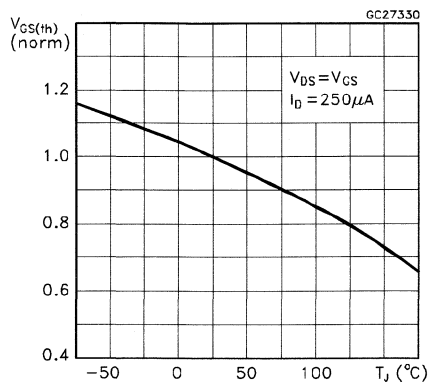
Gate Charge vs Gate-source Voltage



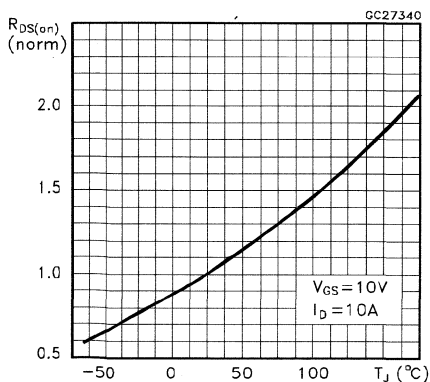
Capacitance Variations



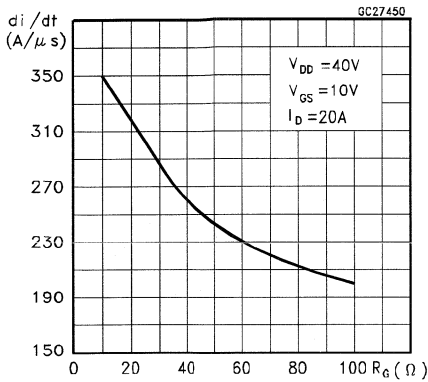
Normalized Gate Threshold Voltage vs Temperature



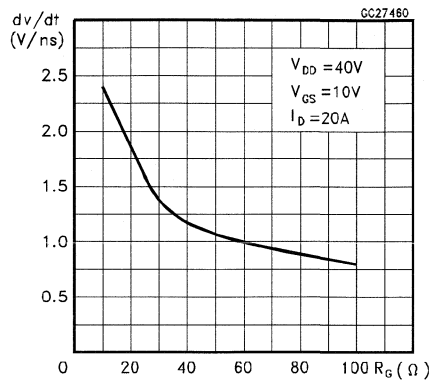
Normalized On Resistance vs Temperature



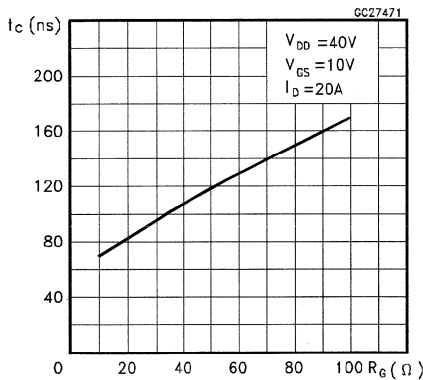
Turn-on Current Slope



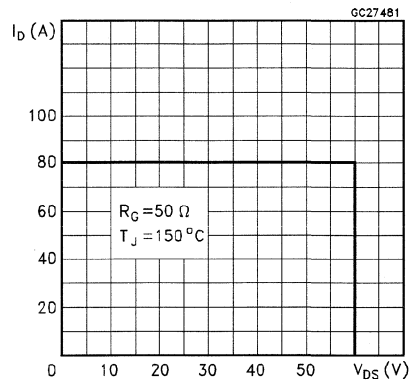
Turn-off Drain-source Voltage Slope



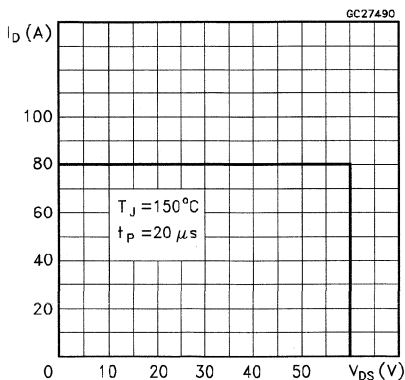
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

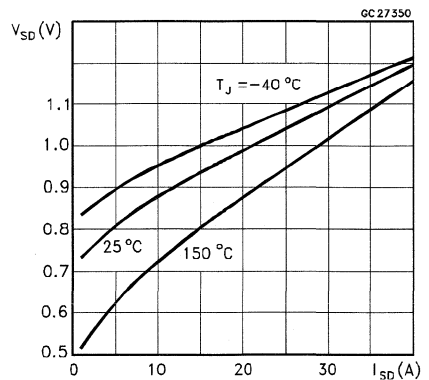


Fig. 1: Unclamped Inductive Load Test Circuits

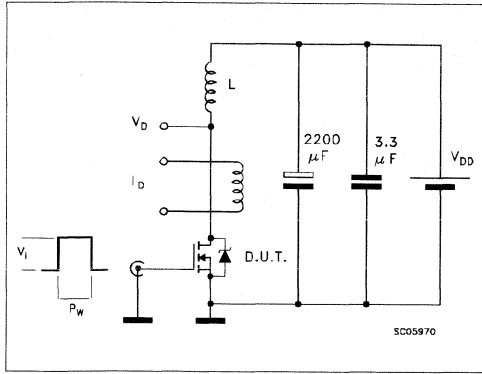


Fig. 2: Unclamped Inductive Waveforms

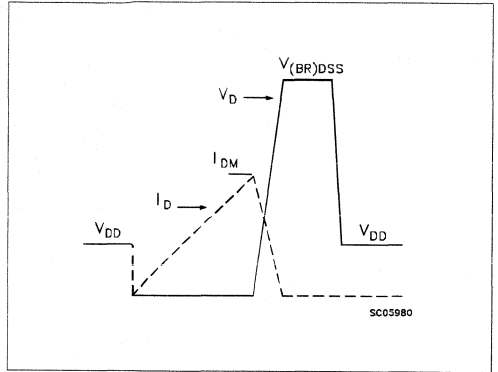


Fig. 3: Switching Times Test Circuits For Resistive Load

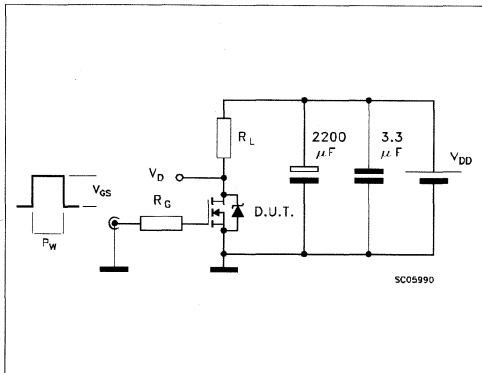


Fig. 4: Gate Charge Test Circuit

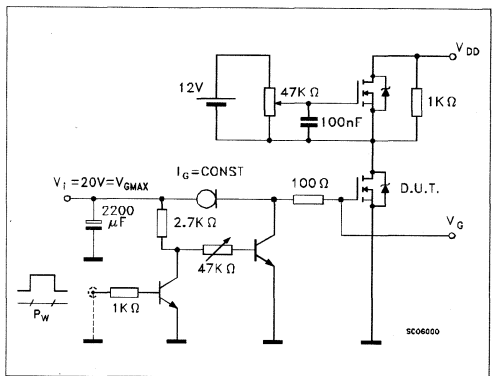
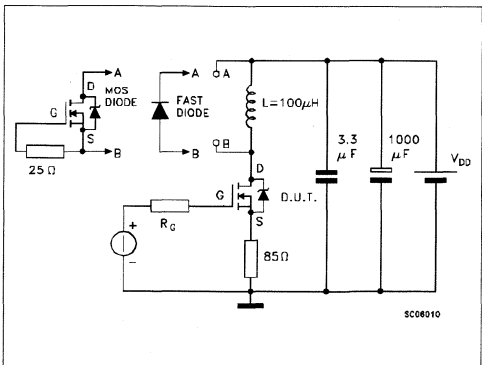


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



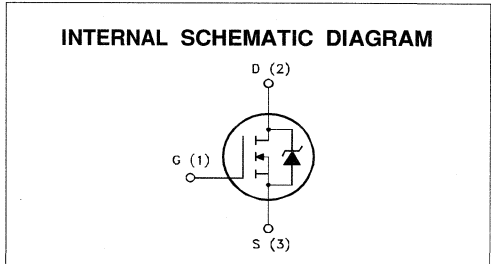
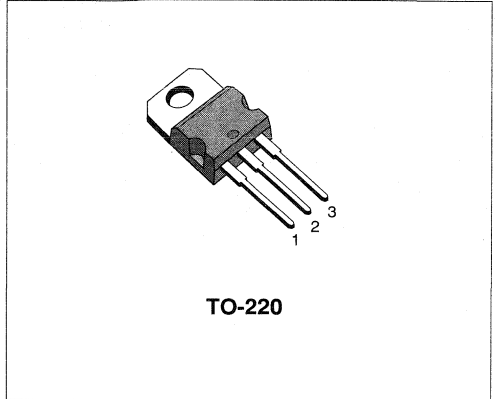
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP20N10	100 V	< 0.12 Ω	20 A

- TYPICAL R_{DS(on)} = 0.09 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	100	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	100	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	20	A
I _D	Drain Current (continuous) at T _c = 100 °C	14	A
I _{DM} (*)	Drain Current (pulsed)	80	A
P _{tot}	Total Dissipation at T _c = 25 °C	105	W
	Derating Factor	0.7	W/°C
T _{stg}	Storage Temperature	-65 to 175	°C
T _j	Max. Operating Junction Temperature	175	°C

(*) Pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	1.43	$^{\circ}C/W$
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5	$^{\circ}C/W$
$R_{thj-amb}$	Thermal Resistance Case-sink	Typ	0.5	$^{\circ}C/W$
T_l	Maximum Lead Temperature For Soldering Purpose		300	$^{\circ}C$

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	20	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25^{\circ}C$, $I_D = I_{AR}$, $V_{DD} = 25 V$)	60	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	15	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100^{\circ}C$, pulse width limited by T_j max, $\delta < 1\%$)	14	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25^{\circ}C$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250 \mu A$ $V_{GS} = 0$	100			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^{\circ}C$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20 V$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250 \mu A$	2	2.9	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10V$ $I_D = 10 A$ $V_{GS} = 10V$ $I_D = 10 A$ $T_c = 100^{\circ}C$		0.09	0.12 0.24	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10 V$	20			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 10 A$	7	12		S
C_{iss}	Input Capacitance	$V_{DS} = 25 V$ $f = 1 MHz$ $V_{GS} = 0$		800	1100	pF
C_{oss}	Output Capacitance			200	300	pF
C_{rss}	Reverse Transfer Capacitance			40	60	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 30\text{ V}$ $I_D = 3\text{ A}$		25	35	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		75	110	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 80\text{ V}$ $I_D = 20\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		300		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 80\text{ V}$ $I_D = 20\text{ A}$ $V_{GS} = 10\text{ V}$		30	45	nC
Q_{gs}	Gate-Source Charge			9		nC
Q_{gd}	Gate-Drain Charge			11		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(voff)}$	Off-voltage Rise Time	$V_{DD} = 80\text{ V}$ $I_D = 20\text{ A}$		70	100	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		55	80	ns
t_c	Cross-over Time	(see test circuit, figure 5)		130	185	ns

SOURCE DRAIN DIODE

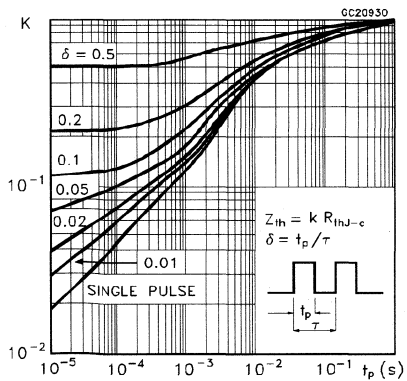
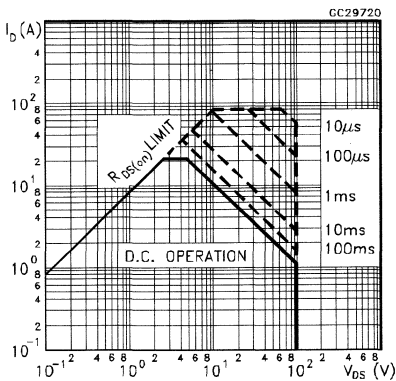
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				20	A
$I_{SDM(*)}$	Source-drain Current (pulsed)				80	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 20\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 20\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 20\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		125		ns
Q_{rr}	Reverse Recovery Charge			0.44		μ C
I_{RRM}	Reverse Recovery Current			7		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

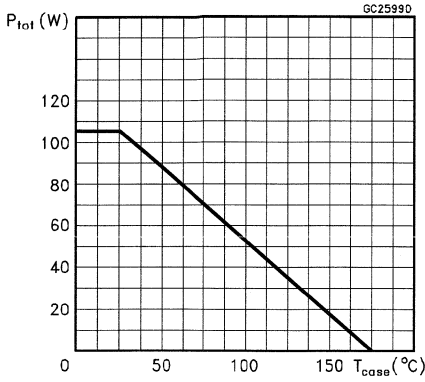
(•) Pulse width limited by safe operating area

Safe Operating Areas

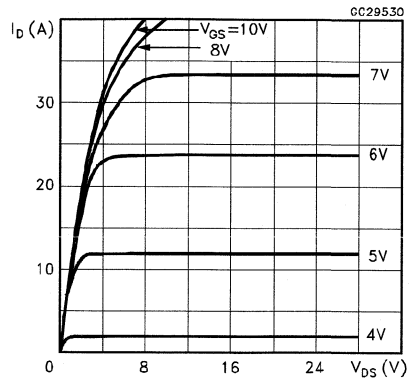
Thermal Impedance



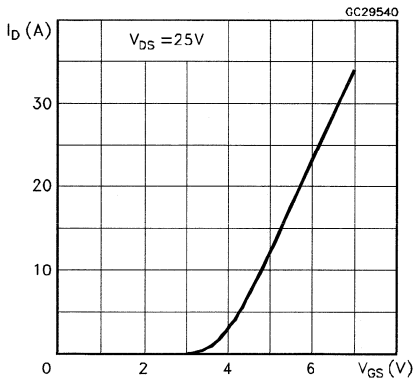
Derating Curve



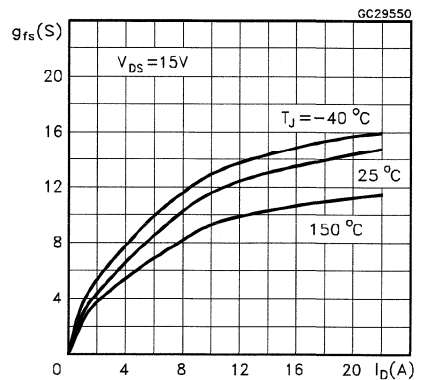
Output Characteristics



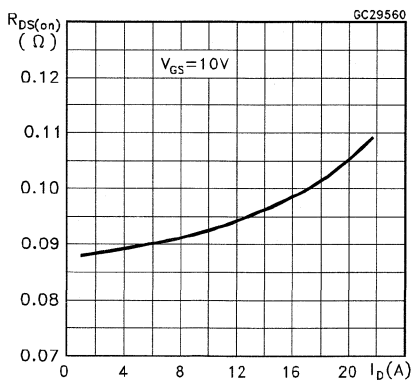
Transfer Characteristics



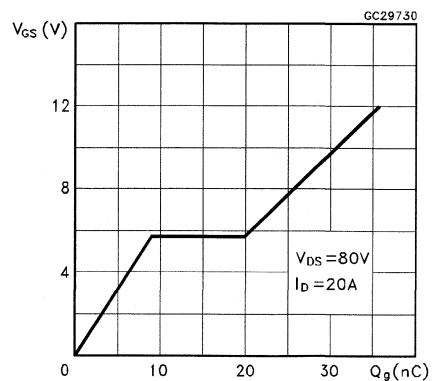
Transconductance



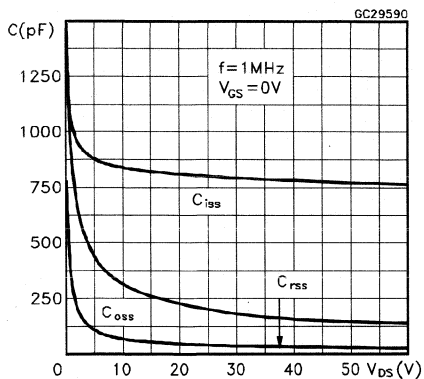
Static Drain-source On Resistance



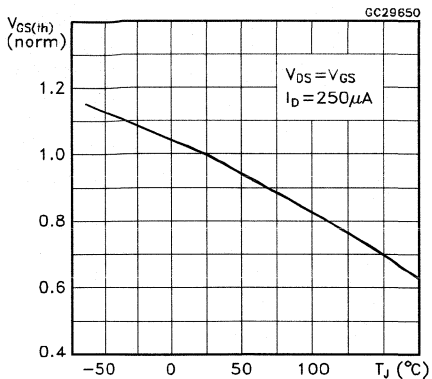
Gate Charge vs Gate-source Voltage



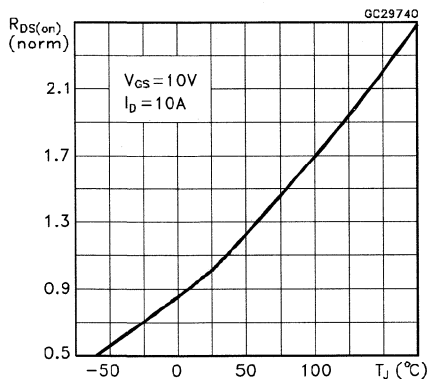
Capacitance Variations



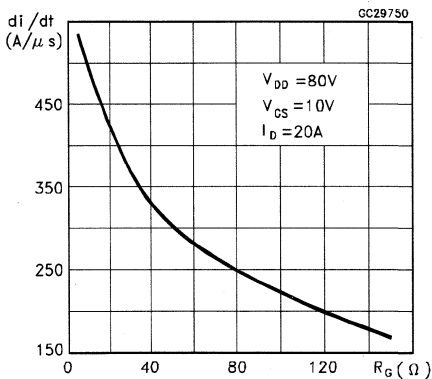
Normalized Gate Threshold Voltage vs Temperature



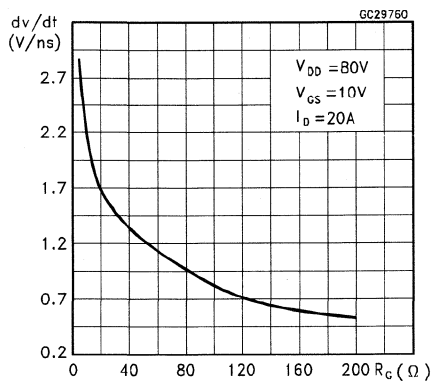
Normalized On Resistance vs Temperature



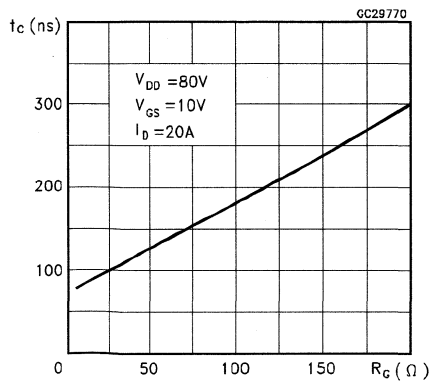
Turn-on Current Slope



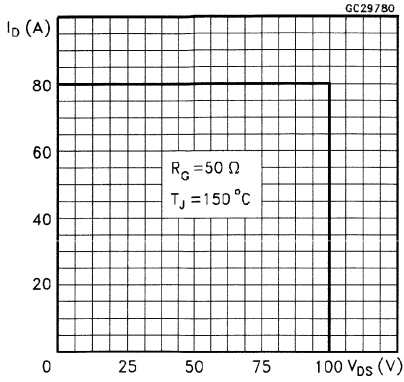
Turn-off Drain-source Voltage Slope



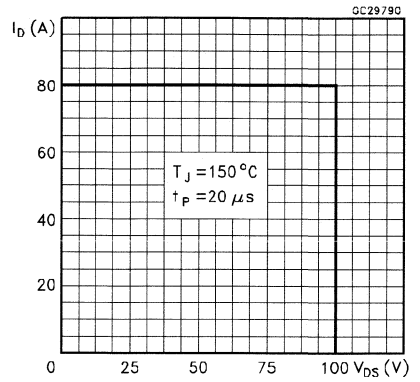
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

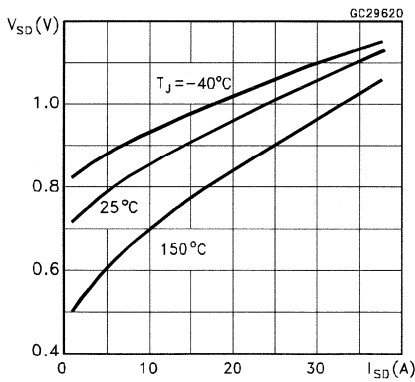


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

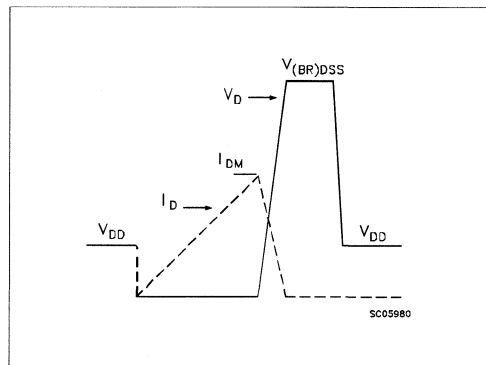
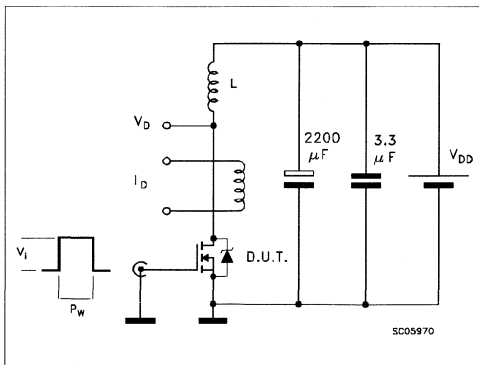


Fig. 3: Switching Times Test Circuits For Resistive Load

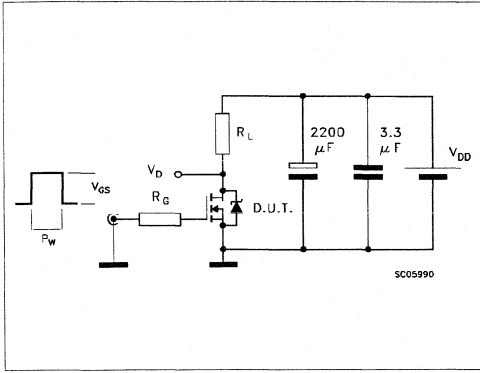


Fig. 4: Gate Charge Test Circuit

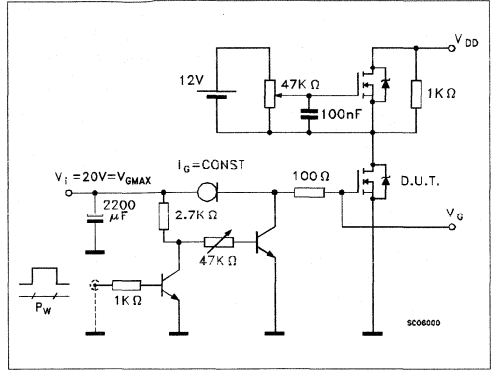
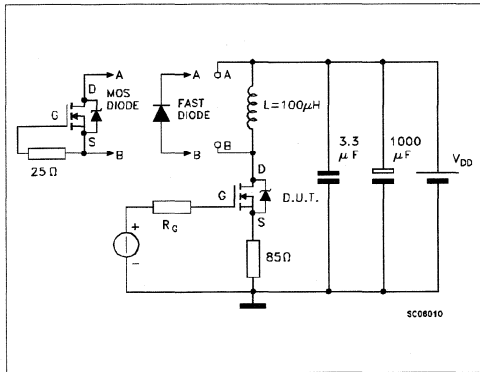


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



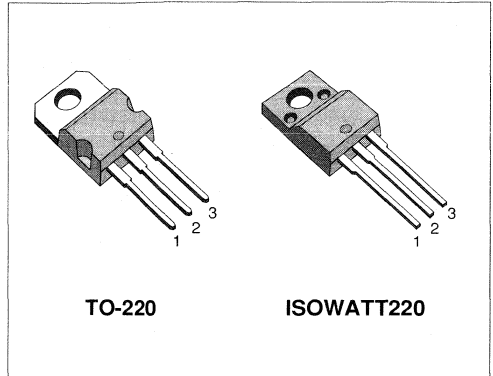
N - CHANNEL ENHANCEMENT MODE LOW THRESHOLD POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP20N10L	100 V	< 0.12 Ω	20 A
STP20N10LFI	100 V	< 0.12 Ω	12 A

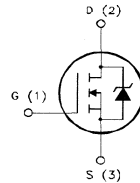
- TYPICAL R_{DS(on)} = 0.09 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- LOGIC LEVEL COMPATIBLE INPUT
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP20N10L	STP20N10LFI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	100		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	100		V
V _{GS}	Gate-source Voltage	± 15		V
I _D	Drain Current (continuous) at T _c = 25 °C	20	12	A
I _D	Drain Current (continuous) at T _c = 100 °C	14	8	A
I _{DM} (•)	Drain Current (pulsed)	80	80	A
P _{tot}	Total Dissipation at T _c = 25 °C	105	40	W
	Derating Factor	0.7	0.27	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(•) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case	Max	1.43	3.75	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.5		°C/W
T _j	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	20	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	120	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	30	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	14	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	100			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 15 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	1	1.6	2.5	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 5 V I _D = 10 A V _{GS} = 5 V I _D = 10 A T _c = 100 °C		0.09	0.12 0.24	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	20			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 10 A	10	16		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		1200	1500	pF
C _{oss}	Output Capacitance			250	350	pF
C _{rss}	Reverse Transfer Capacitance			60	90	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 30\text{ V}$ $I_D = 10\text{ A}$		50	70	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 3)		140	200	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 80\text{ V}$ $I_D = 20\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 5)		140		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 80\text{ V}$ $I_D = 20\text{ A}$ $V_{GS} = 5\text{ V}$		22	30	nC
Q_{gs}	Gate-Source Charge			6		nC
Q_{gd}	Gate-Drain Charge			12		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 80\text{ V}$ $I_D = 20\text{ A}$		80	110	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$		80	110	ns
t_c	Cross-over Time	(see test circuit, figure 5)		160	220	ns

SOURCE DRAIN DIODE

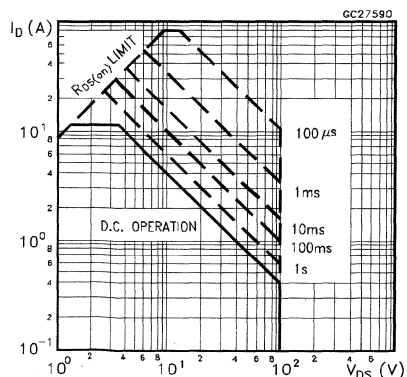
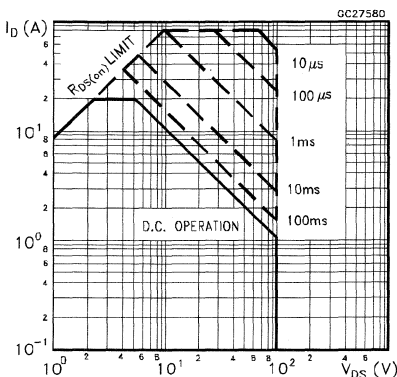
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				20	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				80	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 20\text{ A}$ $V_{GS} = 0$			1.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 20\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 50\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		130		ns
Q_{rr}	Reverse Recovery Charge			0.4		μC
I_{RRM}	Reverse Recovery Current			6		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

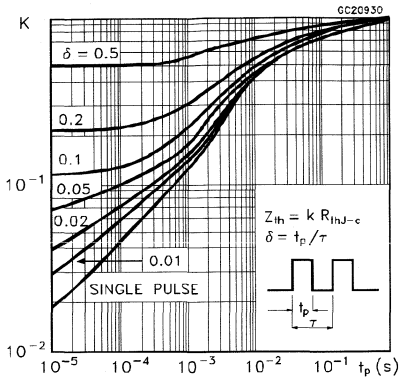
(•) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

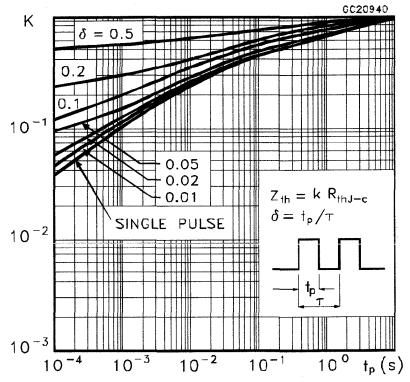
Safe Operating Areas For ISOWATT220



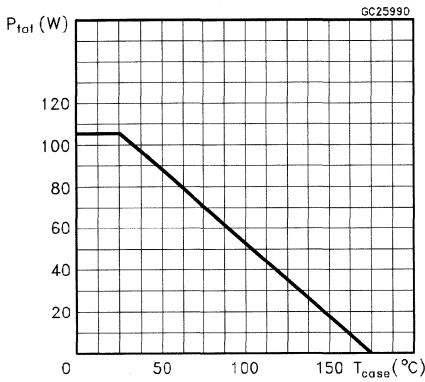
Thermal Impedance For TO-220



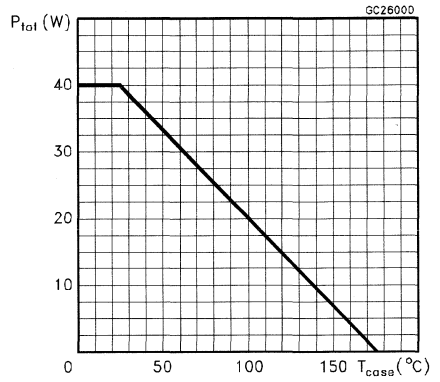
Thermal Impedance For ISOWATT220



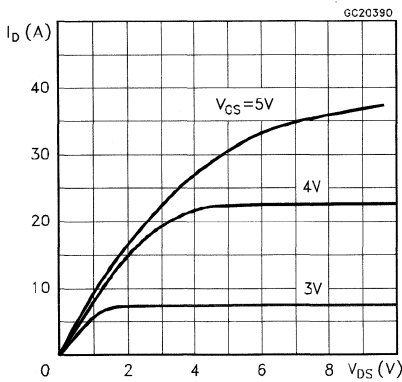
Derating Curve For TO-220



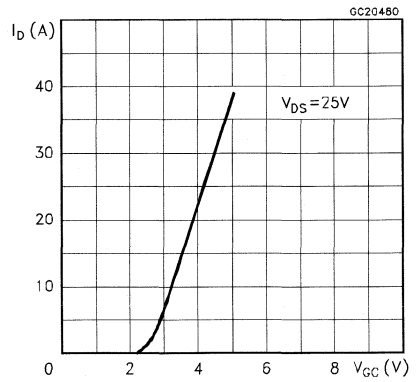
Derating Curve For ISOWATT220



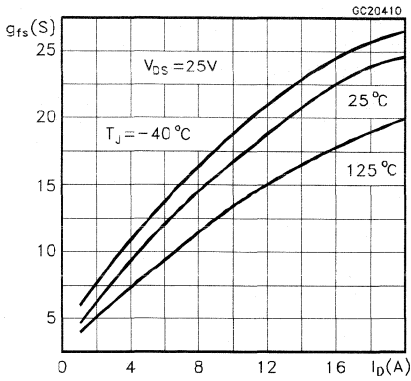
Output Characteristics



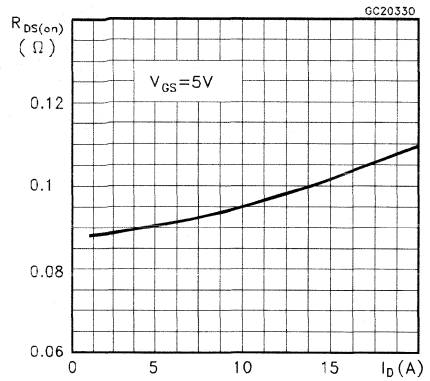
Transfer Characteristics



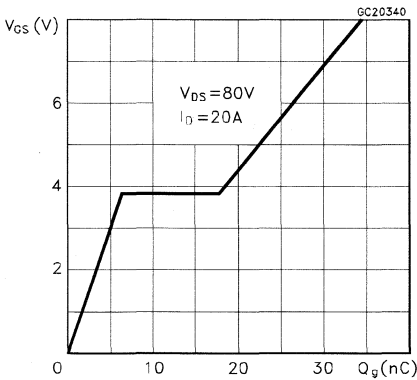
Transconductance



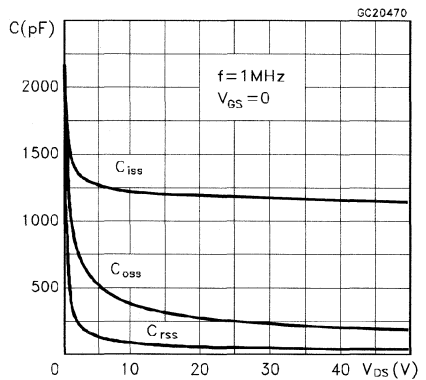
Static Drain-source On Resistance



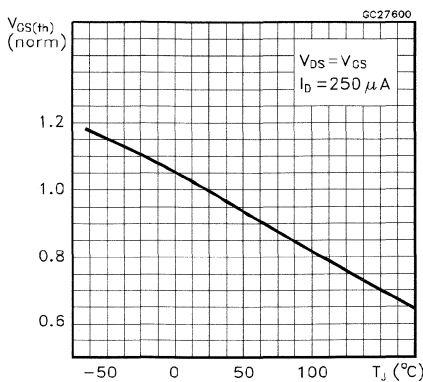
Gate Charge vs Gate-source Voltage



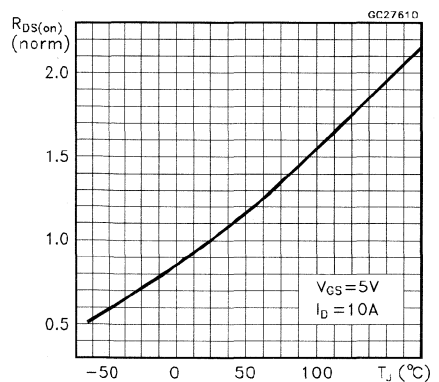
Capacitance Variations



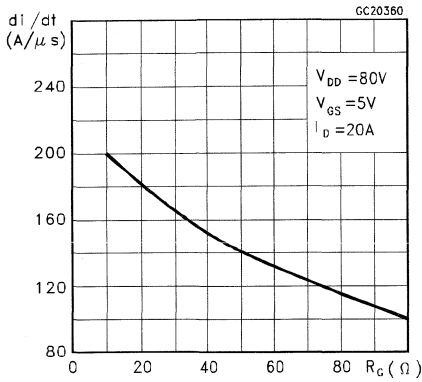
Normalized Gate Threshold Voltage vs Temperature



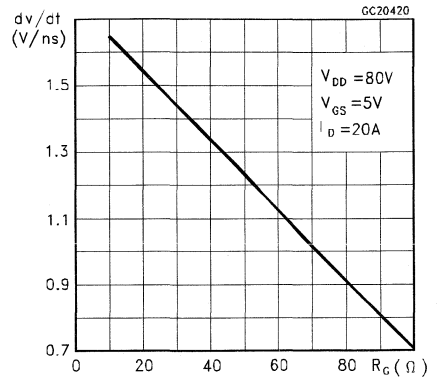
Normalized On Resistance vs Temperature



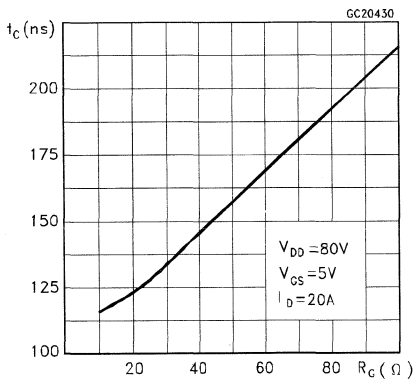
Turn-on Current Slope



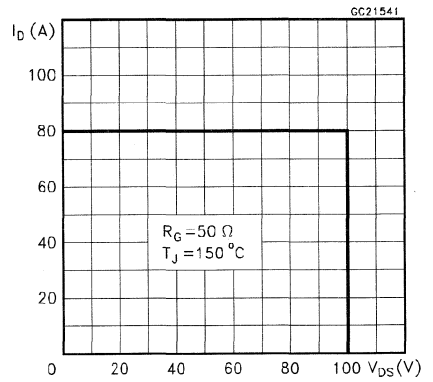
Turn-off Drain-source Voltage Slope



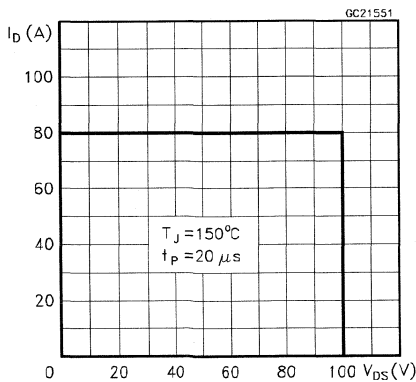
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

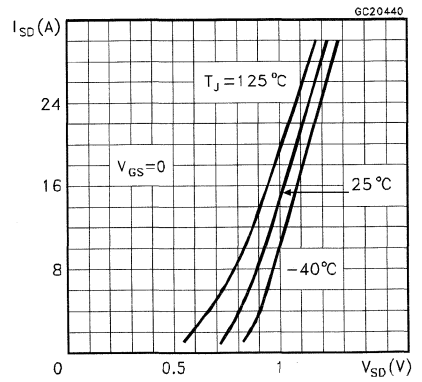


Fig. 1: Unclamped Inductive Load Test Circuits

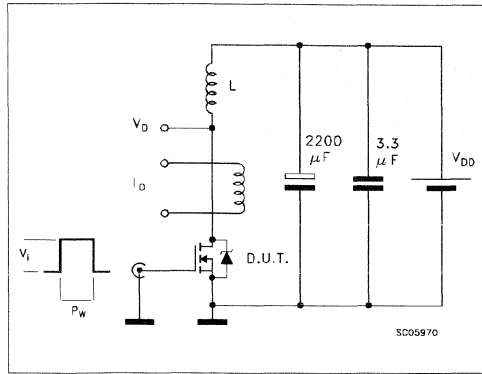


Fig. 2: Unclamped Inductive Waveforms

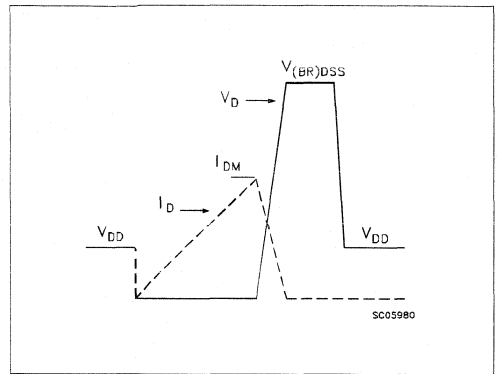


Fig. 3: Switching Times Test Circuits For Resistive Load

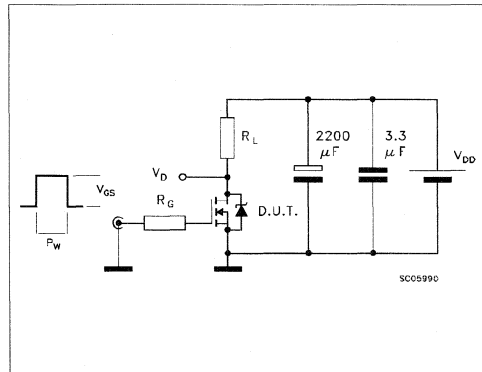


Fig. 4: Gate Charge Test Circuit

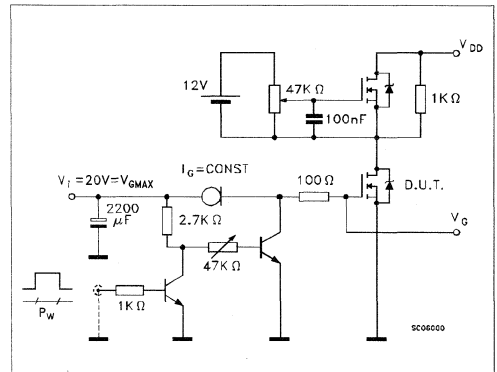
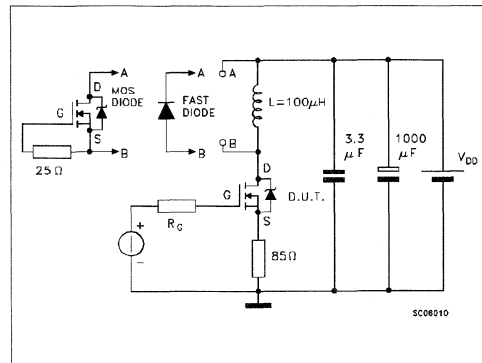


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



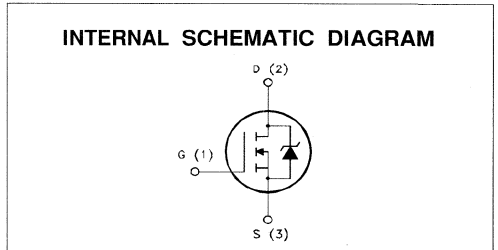
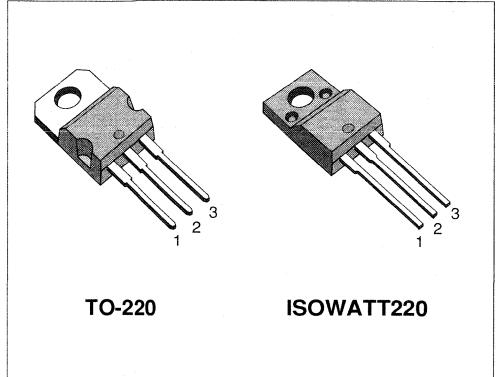
N - CHANNEL ENHANCEMENT MODE LOW THRESHOLD POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP21N05L	50 V	< 0.085 Ω	21 A
STP21N05LFI	50 V	< 0.085 Ω	14 A

- TYPICAL R_{DS(on)} = 0.065 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- LOGIC LEVEL COMPATIBLE INPUT
- 175 °C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP21N05L	STP21N05LFI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	50		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	50		V
V _{GS}	Gate-source Voltage	± 15		V
I _D	Drain Current (continuous) at T _c = 25 °C	21	14	A
I _D	Drain Current (continuous) at T _c = 100 °C	14	9	A
I _{DM} (*)	Drain Current (pulsed)	84	84	A
P _{tot}	Total Dissipation at T _c = 25 °C	80	35	W
	Derating Factor	0.53	0.23	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _J	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

		TO-220	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case Max	1.88	4.29	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient Max	62.5		°C/W
R _{thc-sink}	Thermal Resistance Case-sink Typ	0.5		°C/W
T _l	Maximum Lead Temperature For Soldering Purpose	300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	21	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	80	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	20	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	14	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	50			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 15 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	1	1.6	2.5	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 5 V I _D = 10.5 A V _{GS} = 5 V I _D = 10.5 A T _c = 100 °C		0.065	0.085 0.17	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)} max V _{GS} = 10 V	21			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)} max I _D = 10.5 A	6	15		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		700	1000	pF
C _{oss}	Output Capacitance			250	350	pF
C _{rss}	Reverse Transfer Capacitance			70	100	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 30\text{ V}$ $I_D = 10.5\text{ A}$		65	95	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 3)		370	530	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 21\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 5)		130		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 40\text{ V}$ $I_D = 21\text{ A}$ $V_{GS} = 5\text{ V}$		18	26	nC
Q_{gs}	Gate-Source Charge			6		nC
Q_{gd}	Gate-Drain Charge			10		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(voff)}$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 21\text{ A}$		70	100	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$		100	150	ns
t_c	Cross-over Time	(see test circuit, figure 5)		180	260	ns

SOURCE DRAIN DIODE

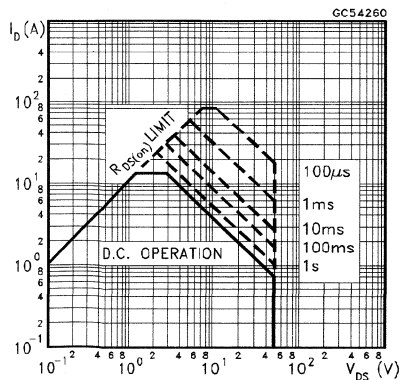
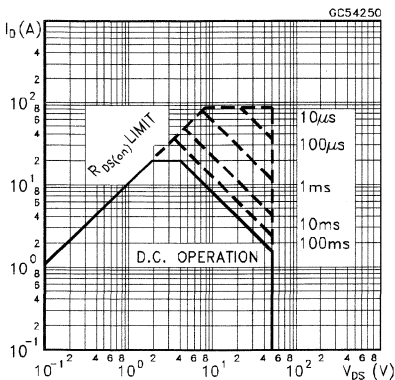
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				21	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				84	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 21\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 21\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		65		ns
Q_{rr}	Reverse Recovery Charge			0.13		μC
I_{RRM}	Reverse Recovery Current			4		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

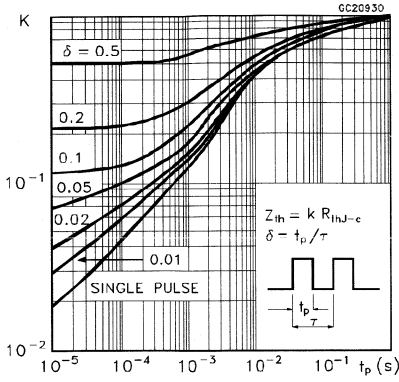
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas

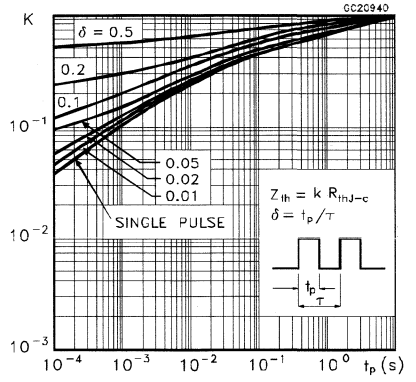
Safe Operating Areas



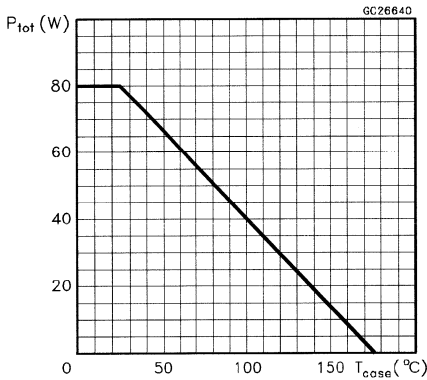
Thermal Impedance For TO-220



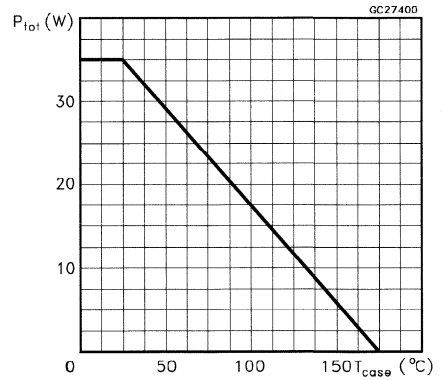
Thermal Impedance For ISOWATT220



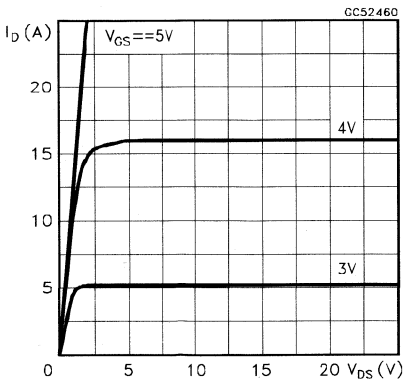
Derating Curve For TO-220



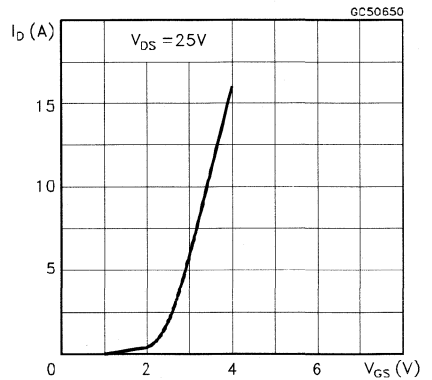
Derating Curve For ISOWATT220



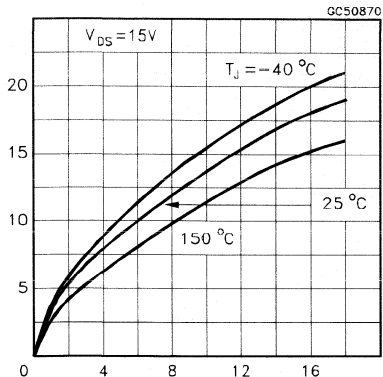
Output Characteristics



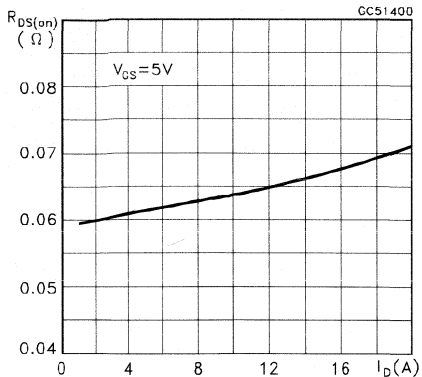
Transfer Characteristics



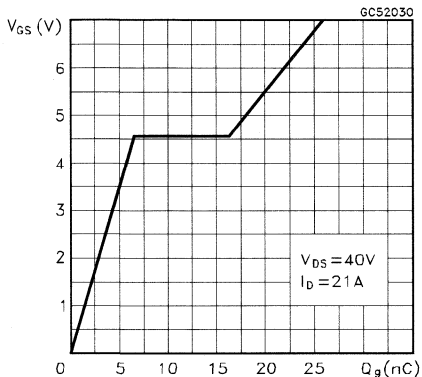
Transconductance



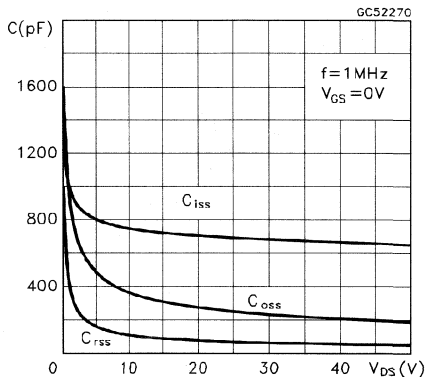
Static Drain-source On Resistance



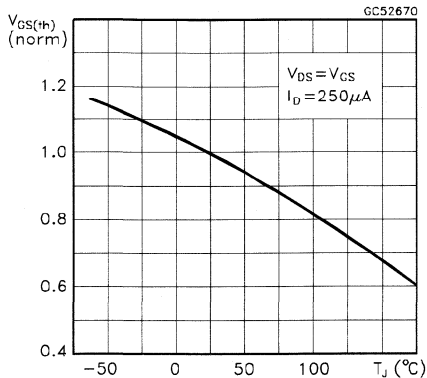
Gate Charge vs Gate-source Voltage



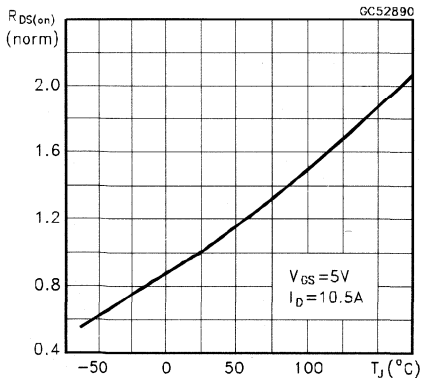
Capacitance Variations



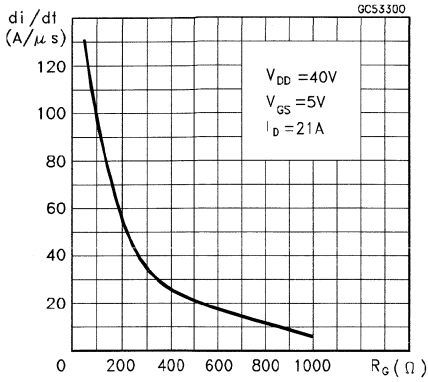
Normalized Gate Threshold Voltage vs Temperature



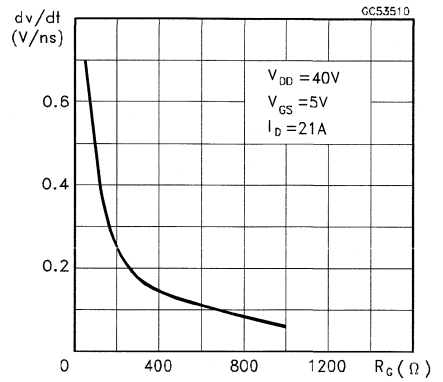
Normalized On Resistance vs Temperature



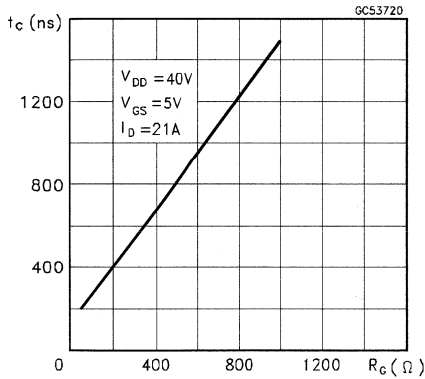
Turn-on Current Slope



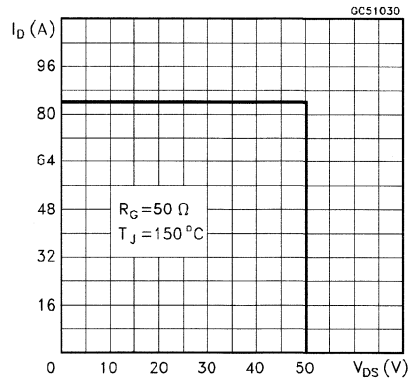
Turn-off Drain-source Voltage Slope



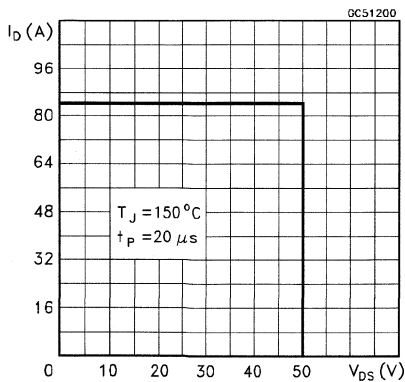
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

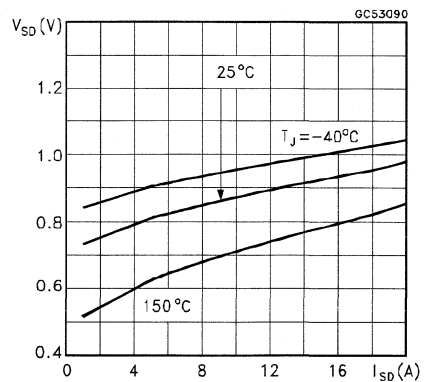


Fig. 1: Unclamped Inductive Load Test Circuits

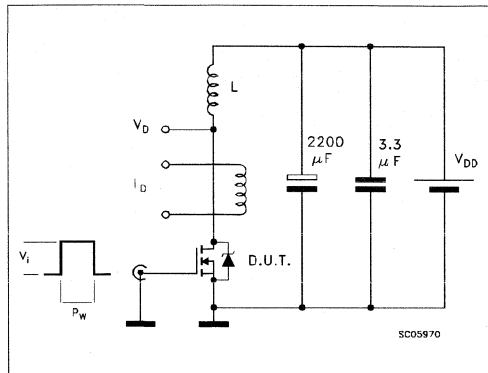


Fig. 2: Unclamped Inductive Waveforms

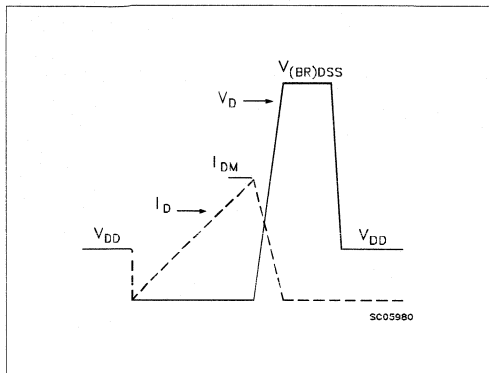


Fig. 3: Switching Times Test Circuits For Resistive Load

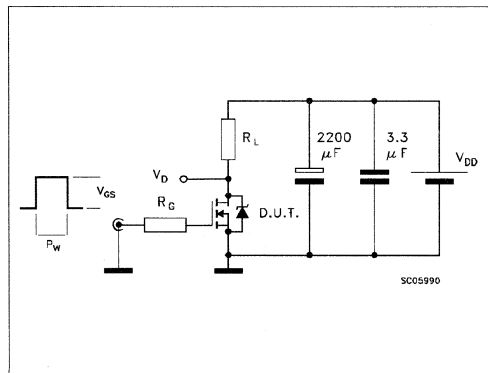


Fig. 4: Gate Charge Test Circuit

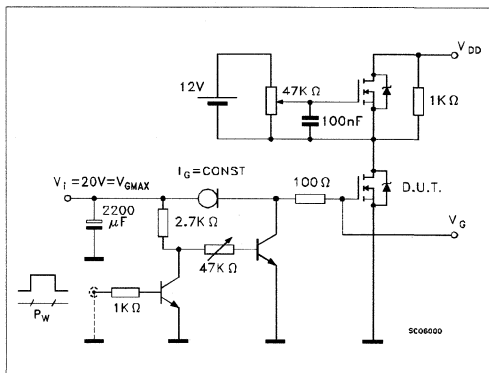
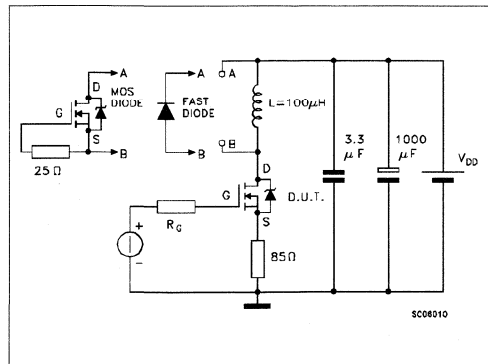


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



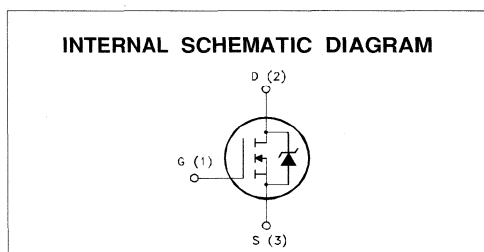
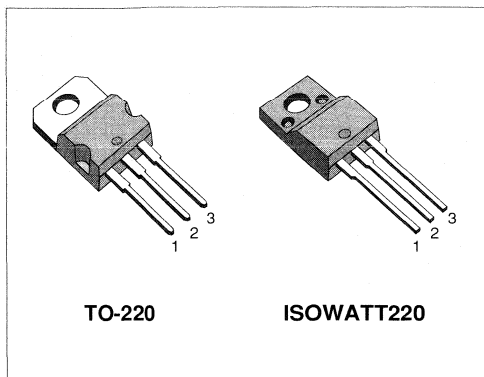
N - CHANNEL ENHANCEMENT MODE LOW THRESHOLD POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP21N06L	60 V	< 0.085 Ω	21 A
STP21N06LFI	60 V	< 0.085 Ω	14 A

- TYPICAL R_{DS(on)} = 0.065 Ω
- AVALANCHE RUGGED TESTED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- LOGIC LEVEL COMPATIBLE INPUT
- 175 °C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit	
		STP21N06L	STP21N06LFI		
V _{DS}	Drain-source Voltage (V _{GS} = 0)	60		V	
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	60		V	
V _{GS}	Gate-source Voltage	± 15		V	
I _D	Drain Current (continuous) at T _c = 25 °C	21	14	A	
I _D	Drain Current (continuous) at T _c = 100 °C	14	9	A	
I _{DM} (*)	Drain Current (pulsed)	84	84	A	
P _{tot}	Total Dissipation at T _c = 25 °C	80	35	W	
	Derating Factor	0.53	0.23	W/°C	
V _{ISO}	Insulation Withstand Voltage (DC)	—		2000	V
T _{stg}	Storage Temperature	-65 to 175		°C	
T _j	Max. Operating Junction Temperature	175		°C	

(*) Pulse width limited by safe operating area

THERMAL DATA

		TO-220	ISOWATT220		
R _{thj-case}	Thermal Resistance Junction-case	Max	1.88	4.29	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.5		°C/W
T _I	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	21	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	80	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	20	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	14	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	60			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 15 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	1	1.6	2.5	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 5 V I _D = 10.5 A V _{GS} = 5 V I _D = 10.5 A T _c = 100 °C		0.065	0.085 0.17	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	21			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 10.5 A	6	15		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		700	1000	pF
C _{oss}	Output Capacitance			250	350	pF
C _{rss}	Reverse Transfer Capacitance			70	100	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 30\text{ V}$ $I_D = 10.5\text{ A}$		65	95	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 3)		370	530	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 21\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 5)		130		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 40\text{ V}$ $I_D = 21\text{ A}$ $V_{GS} = 5\text{ V}$		18	26	nC
Q_{gs}	Gate-Source Charge			6		nC
Q_{gd}	Gate-Drain Charge			10		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 21\text{ A}$		70	100	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$		100	150	ns
t_c	Cross-over Time	(see test circuit, figure 5)		180	260	ns

SOURCE DRAIN DIODE

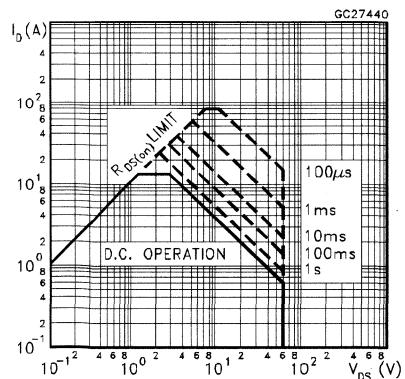
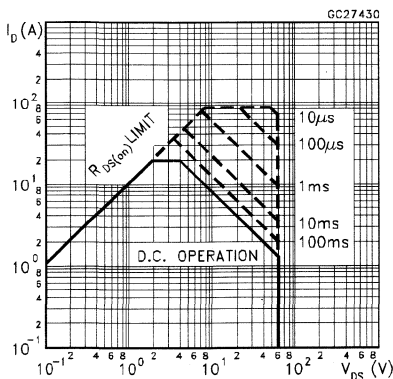
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				21	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				84	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 21\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 21\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		65		ns
Q_{rr}	Reverse Recovery Charge	(see test circuit, figure 5)		0.13		μ C
I_{RRM}	Reverse Recovery Current			4		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

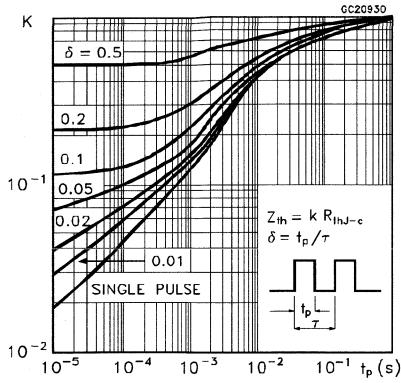
(•) Pulse width limited by safe operating area

Safe Operating Areas

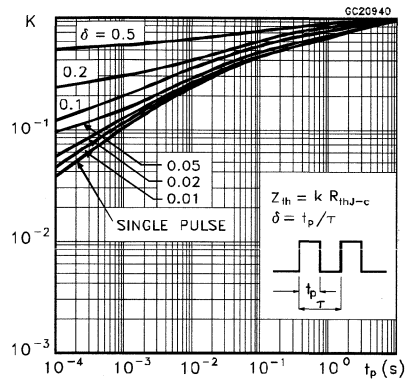
Safe Operating Areas



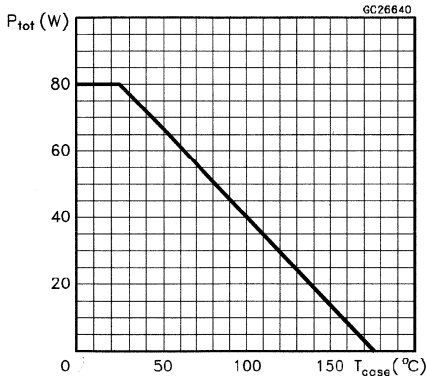
Thermal Impedance For TO-220



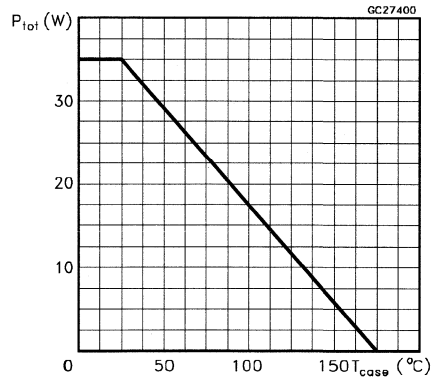
Thermal Impedance For ISOWATT220



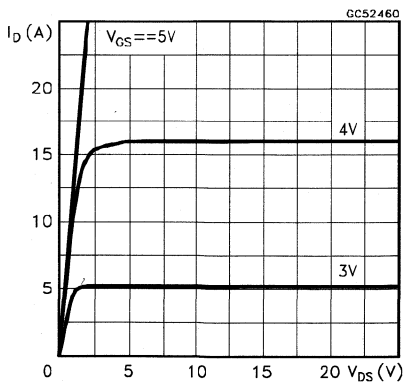
Derating Curve For TO-220



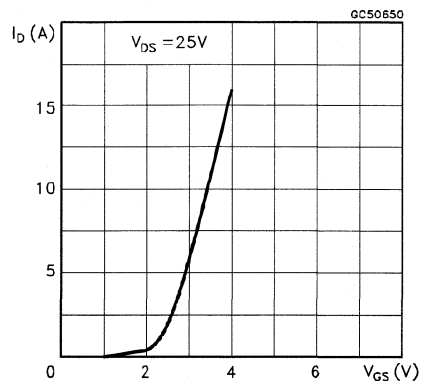
Derating Curve For ISOWATT220



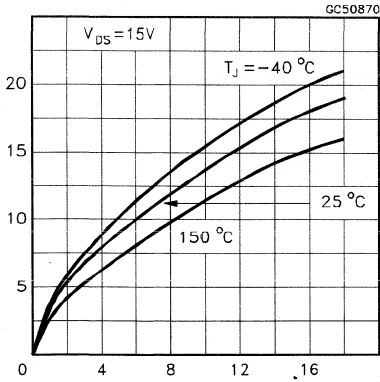
Output Characteristics



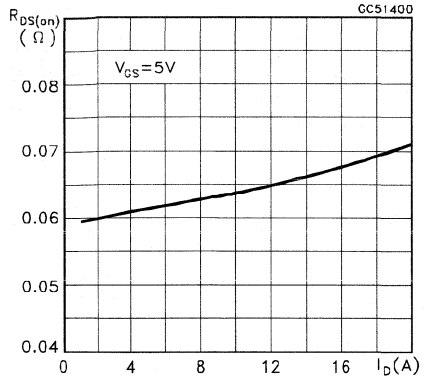
Transfer Characteristics



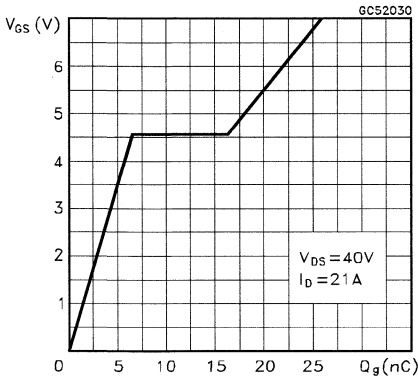
Transconductance



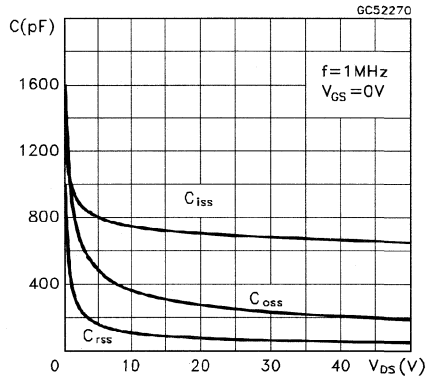
Static Drain-source On Resistance



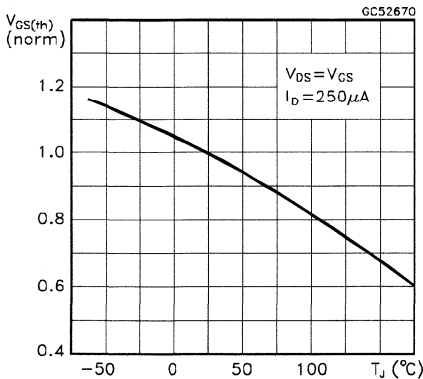
Gate Charge vs Gate-source Voltage



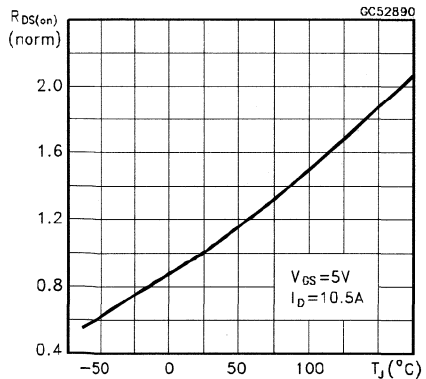
Capacitance Variations



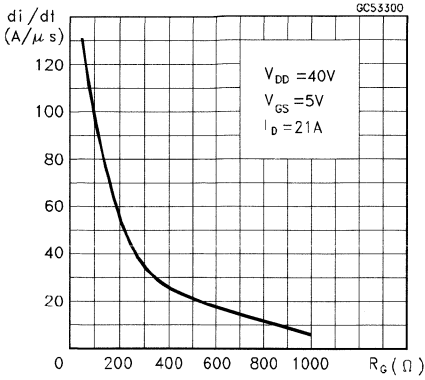
Normalized Gate Threshold Voltage vs Temperature



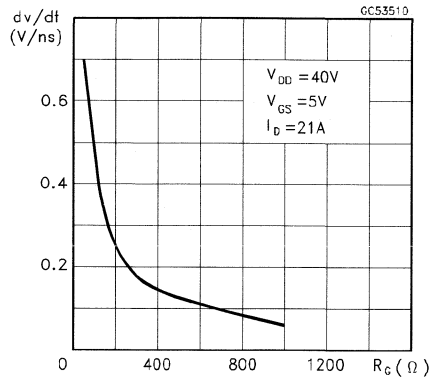
Normalized On Resistance vs Temperature



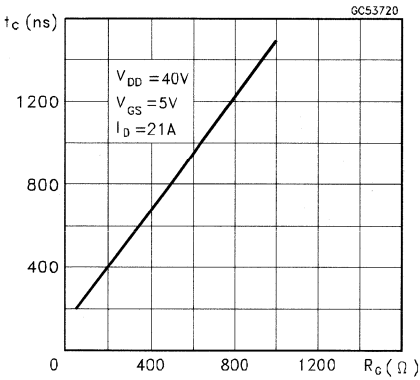
Turn-on Current Slope



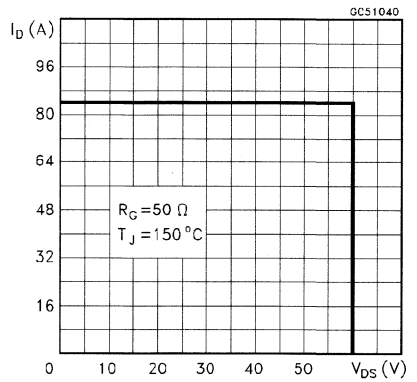
Turn-off Drain-source Voltage Slope



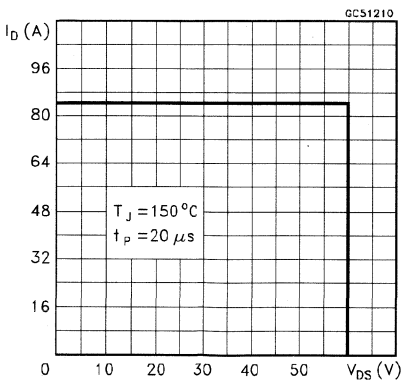
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

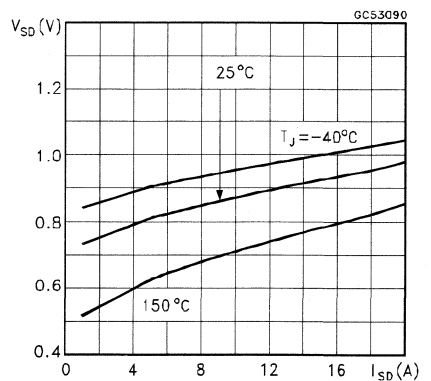


Fig. 1: Unclamped Inductive Load Test Circuits

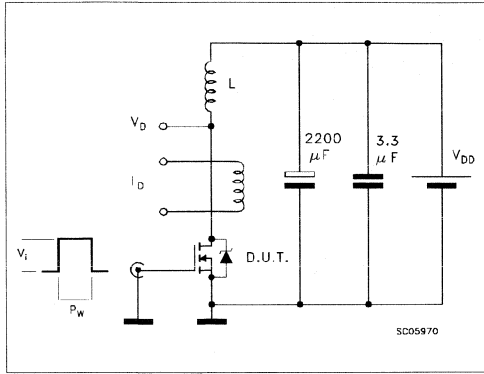


Fig. 2: Unclamped Inductive Waveforms

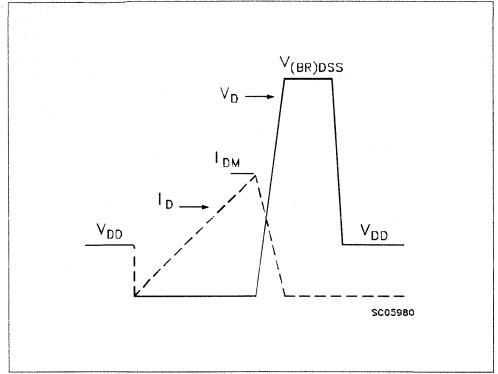


Fig. 3: Switching Times Test Circuits For Resistive Load

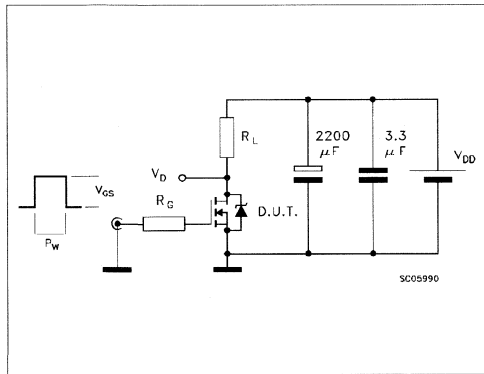


Fig. 4: Gate Charge Test Circuit

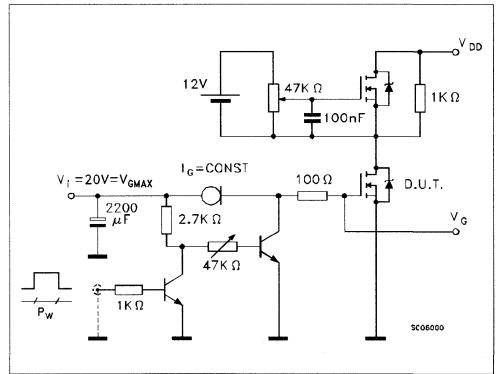
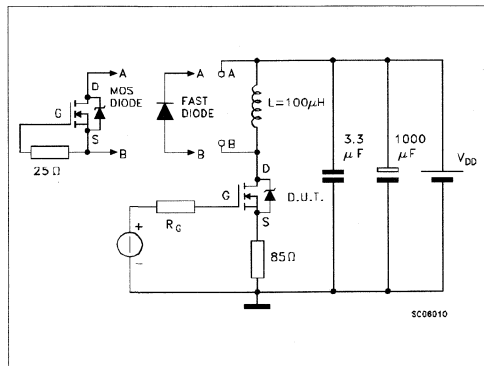


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



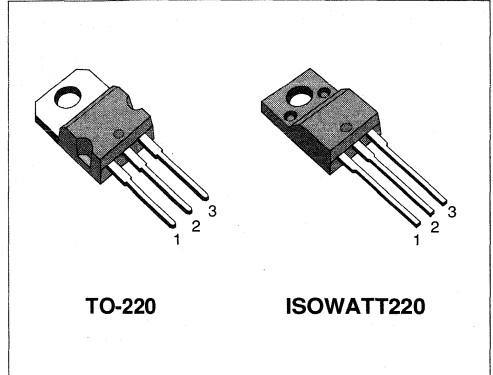
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP25N05	50 V	< 0.065 Ω	25 A
STP25N05FI	50 V	< 0.065 Ω	16 A

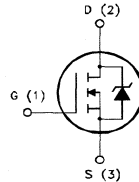
- TYPICAL R_{DS(on)} = 0.048 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP25N05	STP25N05FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	50		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	50		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	25	16	A
I _D	Drain Current (continuous) at T _c = 100 °C	17	11	A
I _{DM} (*)	Drain Current (pulsed)	100	100	A
P _{tot}	Total Dissipation at T _c = 25 °C	90	40	W
	Derating Factor	0.6	0.27	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
$R_{thj-case}$	Thermal Resistance Junction-case	Max	1.67	3.75	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5		°C/W
$R_{thc-sink}$	Thermal Resistance Case-sink	Typ	0.5		°C/W
T_I	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	25	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ }^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 25\text{ V}$)	120	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	30	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ }^\circ\text{C}$, pulse width limited by T_j max, $\delta < 1\%$)	17	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ }^\circ\text{C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$	50			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ }^\circ\text{C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\text{ }\mu\text{A}$	2	2.9	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 12.5\text{ A}$ $V_{GS} = 10\text{ V}$ $I_D = 12.5\text{ A}$ $T_c = 100\text{ }^\circ\text{C}$		0.048	0.065 0.13	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	25			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 12.5\text{ A}$	7	11		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		700	900	pF
C_{oss}	Output Capacitance			320	450	pF
C_{rss}	Reverse Transfer Capacitance			90	150	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 30\text{ V}$ $I_D = 3\text{ A}$		30	45	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		90	130	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 25\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		230		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 40\text{ V}$ $I_D = 25\text{ A}$ $V_{GS} = 10\text{ V}$		26	40	nC
Q_{gs}	Gate-Source Charge			8		nC
Q_{gd}	Gate-Drain Charge			9		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 25\text{ A}$		80	120	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		80	120	ns
t_c	Cross-over Time	(see test circuit, figure 5)		170	250	ns

SOURCE DRAIN DIODE

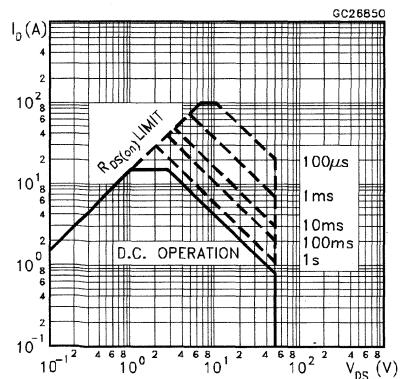
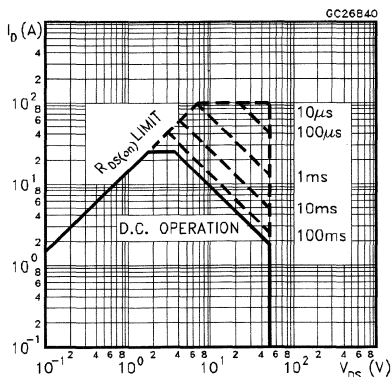
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				25	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				100	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 25\text{ A}$ $V_{GS} = 0$			1.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 25\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		80		ns
Q_{rr}	Reverse Recovery Charge			0.22		μ C
I_{RRM}	Reverse Recovery Current			5.5		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

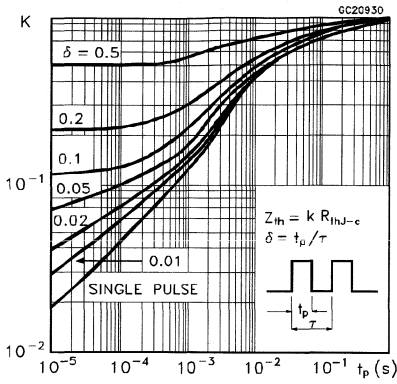
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

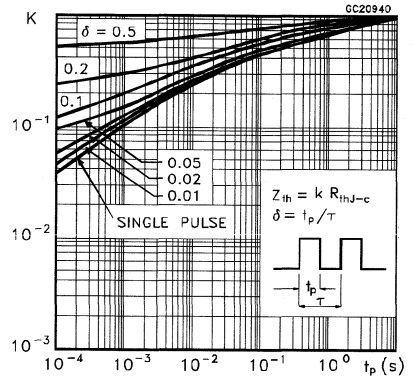
Safe Operating Areas For ISOWATT220



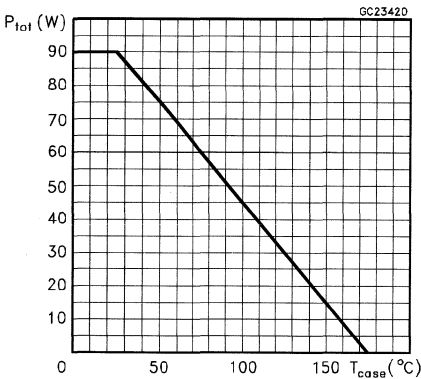
Thermal Impedance For TO-220



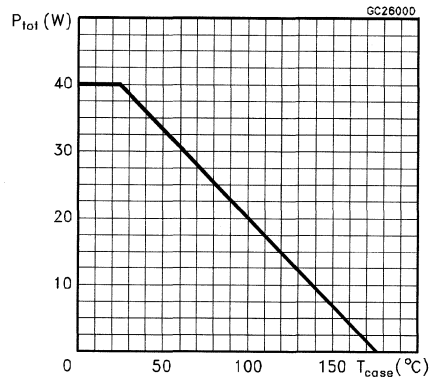
Thermal Impedance For ISOWATT220



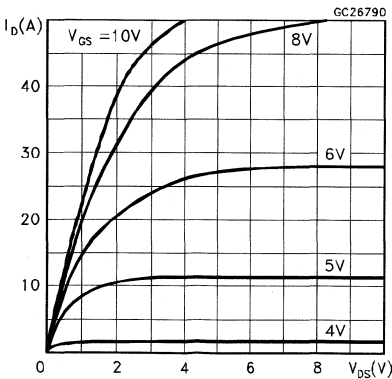
Derating Curve For TO-220



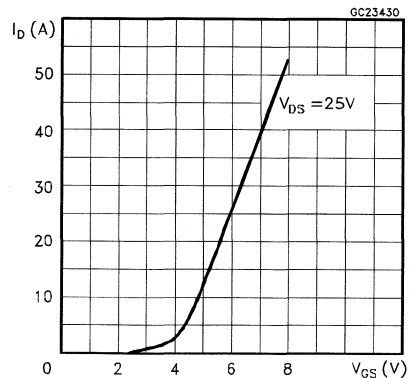
Derating Curve For ISOWATT220



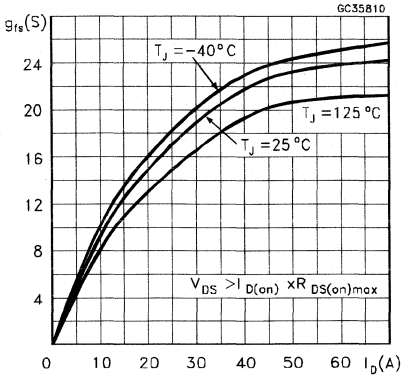
Output Characteristics



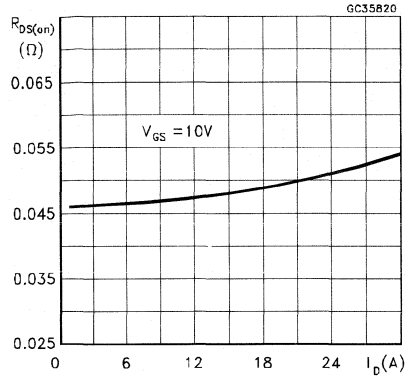
Transfer Characteristics



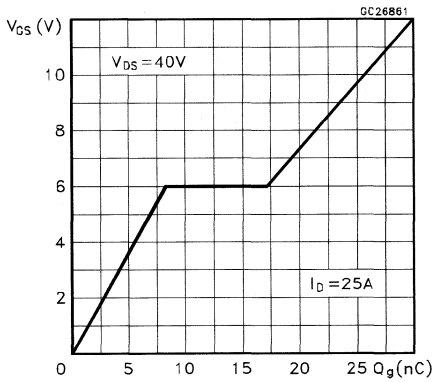
Transconductance



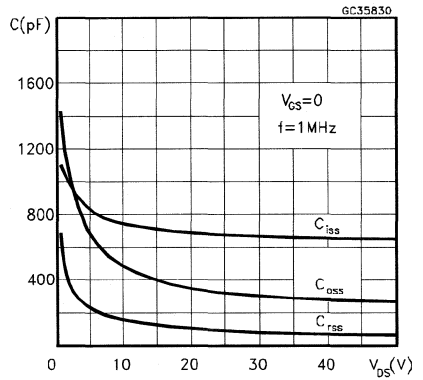
Static Drain-source On Resistance



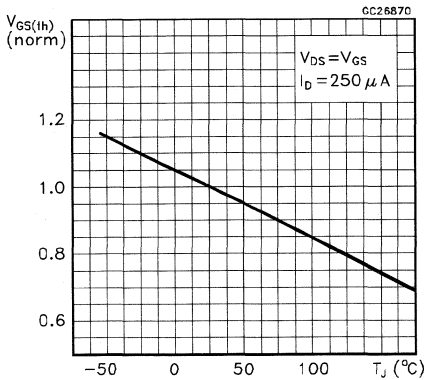
Gate Charge vs Gate-source Voltage



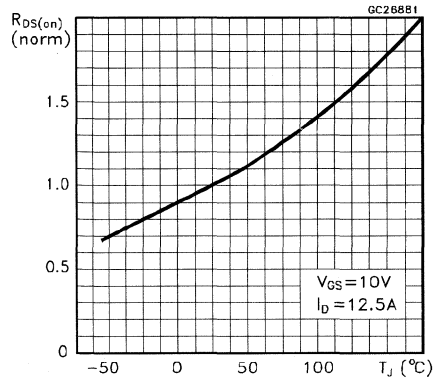
Capacitance Variations



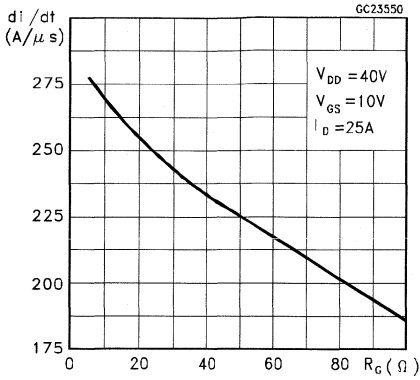
Normalized Gate Threshold Voltage vs Temperature



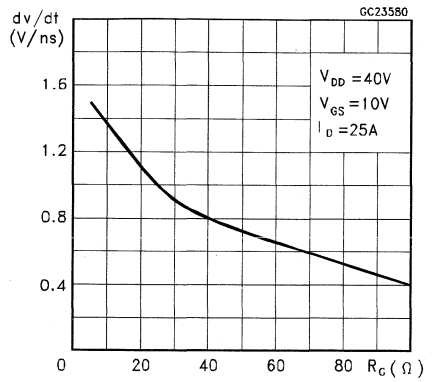
Normalized On Resistance vs Temperature



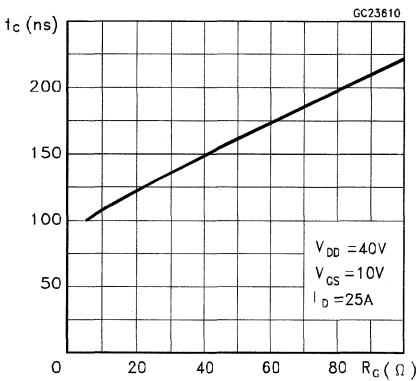
Turn-on Current Slope



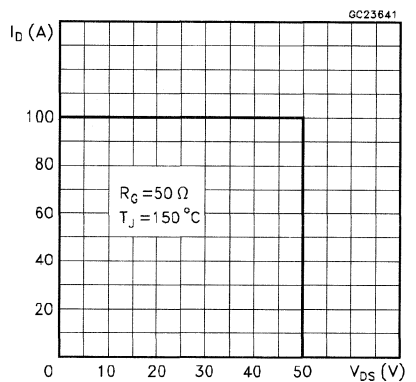
Turn-off Drain-source Voltage Slope



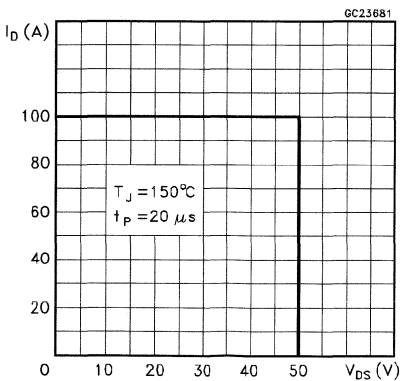
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

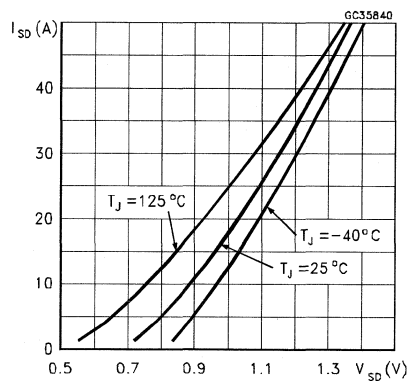


Fig. 1: Unclamped Inductive Load Test Circuits

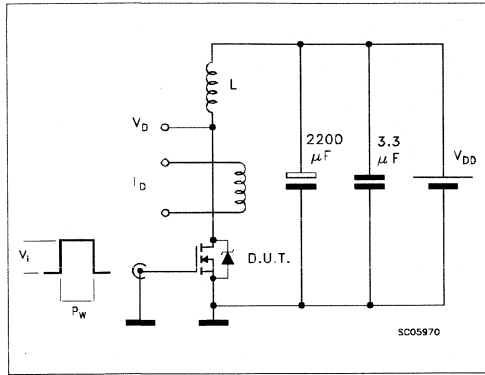


Fig. 2: Unclamped Inductive Waveforms

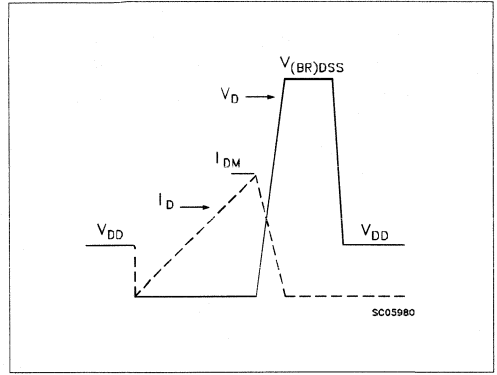


Fig. 3: Switching Times Test Circuits For Resistive Load

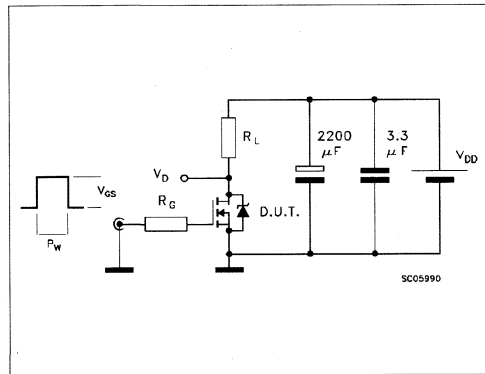


Fig. 4: Gate Charge Test Circuit

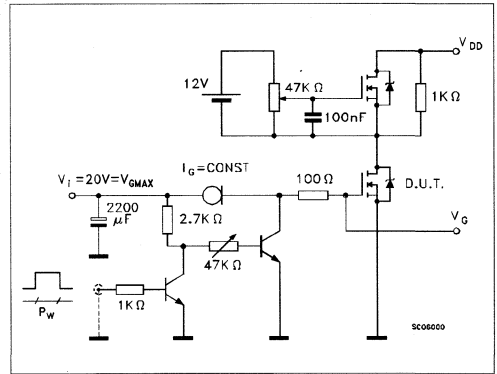
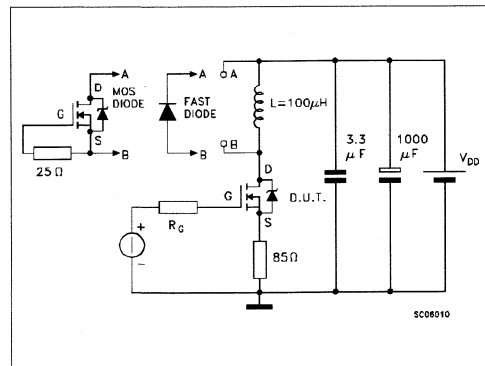


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



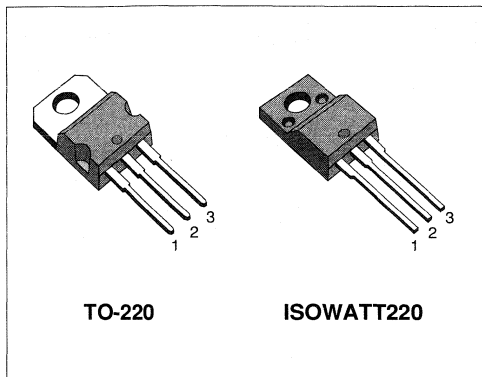
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP25N06	60 V	< 0.065 Ω	25 A
STP25N06FI	60 V	< 0.065 Ω	16 A

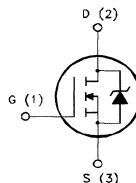
- TYPICAL R_{DS(on)} = 0.048 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP25N06	STP25N06FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	60		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	60		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	25	16	A
I _D	Drain Current (continuous) at T _c = 100 °C	17	11	A
I _{DM} (*)	Drain Current (pulsed)	100	100	A
P _{tot}	Total Dissipation at T _c = 25 °C	90	40	W
	Derating Factor	0.6	0.27	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case	Max	1.57	3.75	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.5		°C/W
T _i	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	25	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	100	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	25	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	17	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	60			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	2.9	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 12.5 A V _{GS} = 10V I _D = 12.5 A T _c = 100°C		0.048	0.065 0.13	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	25			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 12.5 A	7	11		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		700	900	pF
C _{oss}	Output Capacitance			320	450	pF
C _{rss}	Reverse Transfer Capacitance			90	150	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 30\text{ V}$ $I_D = 3\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		30 90	45 130	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 25\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		230		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 40\text{ V}$ $I_D = 25\text{ A}$ $V_{GS} = 10\text{ V}$		26 8 9	40	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(off)}$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 25\text{ A}$		80	120	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		80	120	ns
t_c	Cross-over Time			170	250	ns

SOURCE DRAIN DIODE

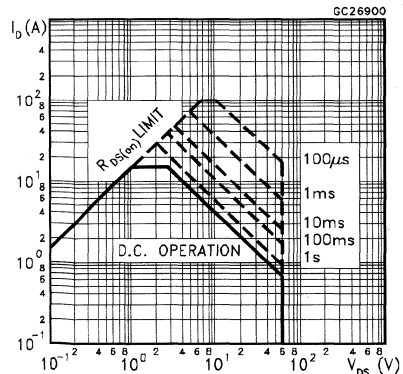
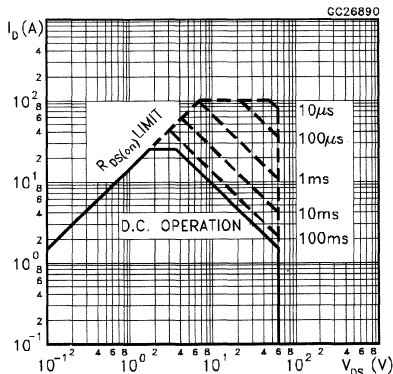
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				25 100	A A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 25\text{ A}$ $V_{GS} = 0$			1.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 25\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_J = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		80		ns
Q_{rr}	Reverse Recovery Charge			0.22		μC
I_{RRM}	Reverse Recovery Current			5.5		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

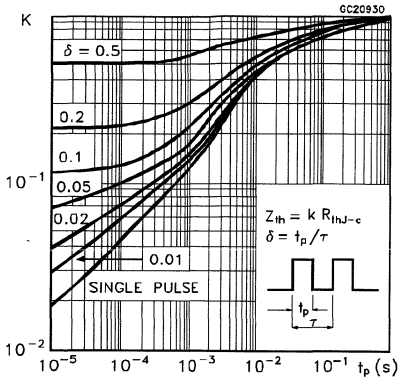
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

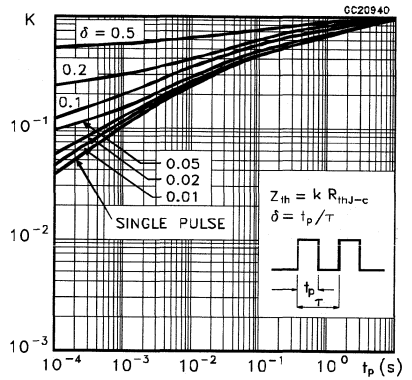
Safe Operating Areas For ISOWATT220



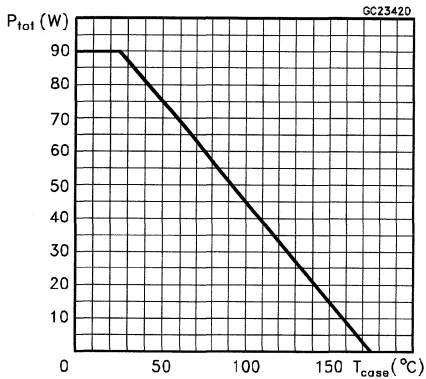
Thermal Impedance For TO-220



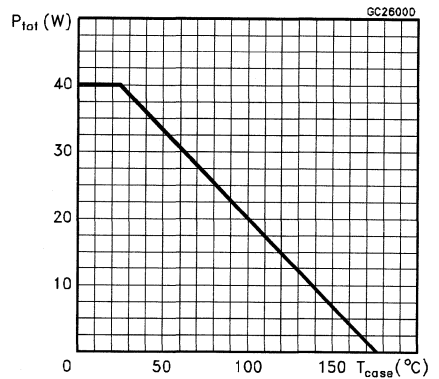
Thermal Impedance For ISOWATT220



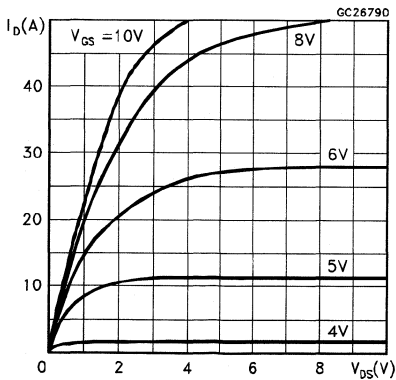
Derating Curve For TO-220



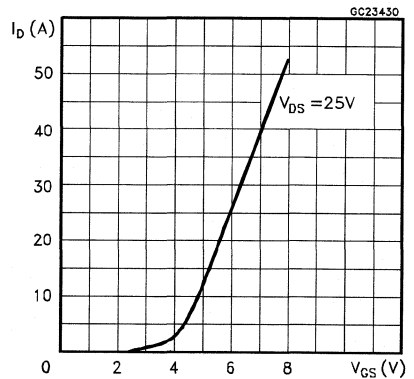
Derating Curve For ISOWATT220



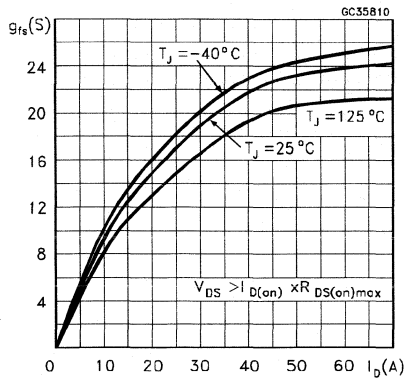
Output Characteristics



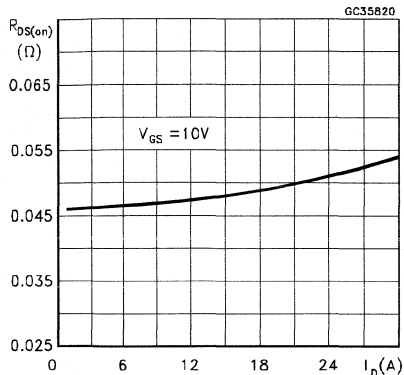
Transfer Characteristics



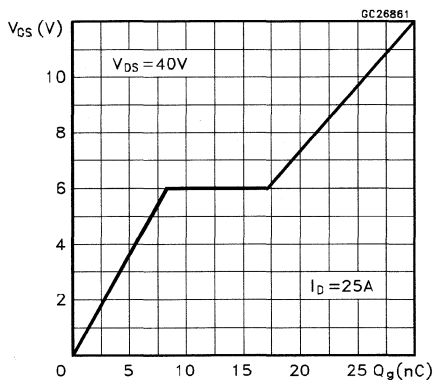
Transconductance



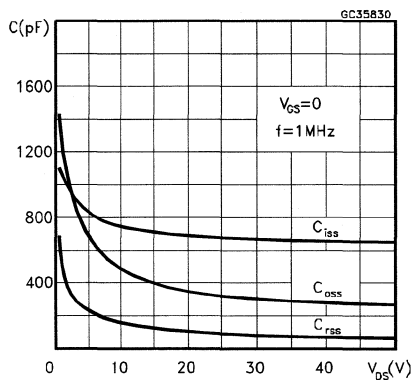
Static Drain-source On Resistance



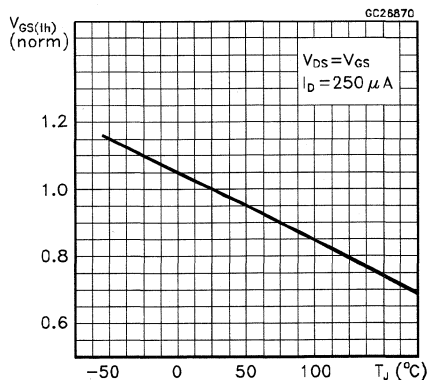
Gate Charge vs Gate-source Voltage



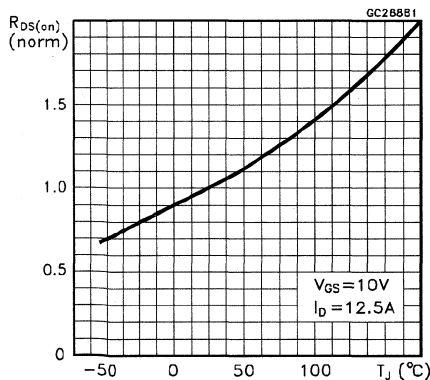
Capacitance Variations



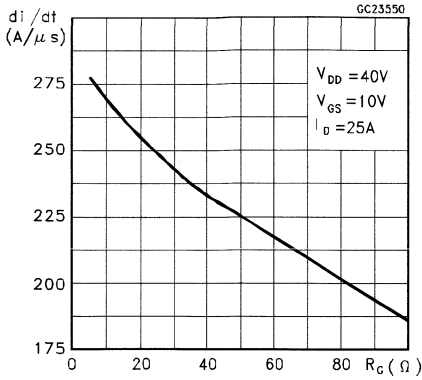
Normalized Gate Threshold Voltage vs Temperature



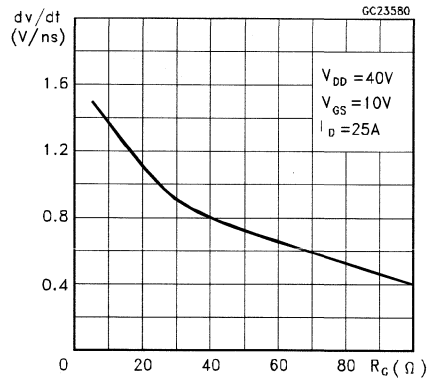
Normalized On Resistance vs Temperature



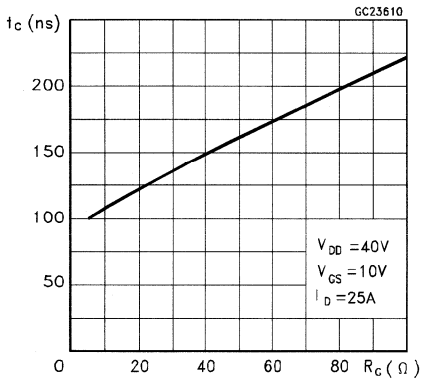
Turn-on Current Slope



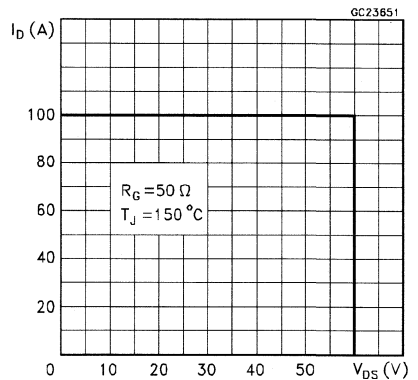
Turn-off Drain-source Voltage Slope



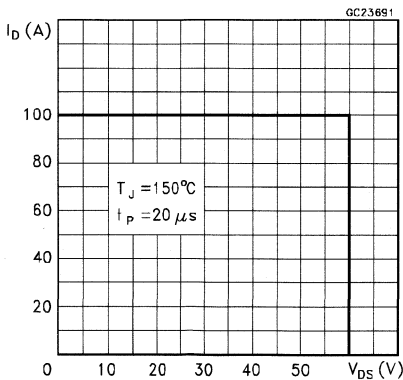
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

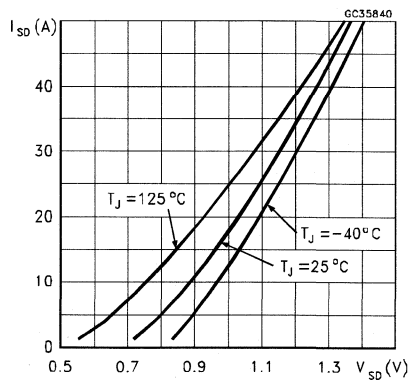


Fig. 1: Unclamped Inductive Load Test Circuits

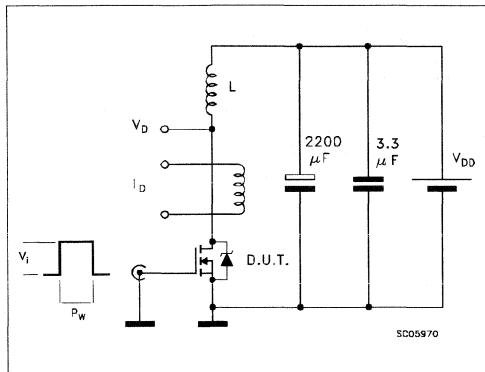


Fig. 2: Unclamped Inductive Waveforms

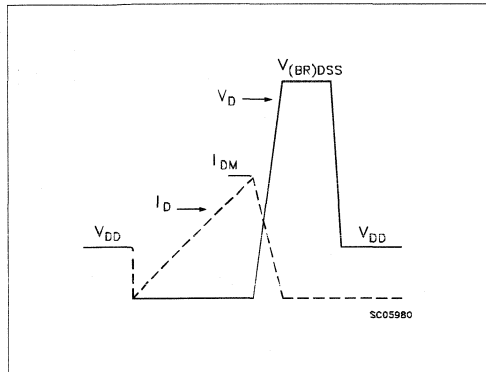


Fig. 3: Switching Times Test Circuits For Resistive Load

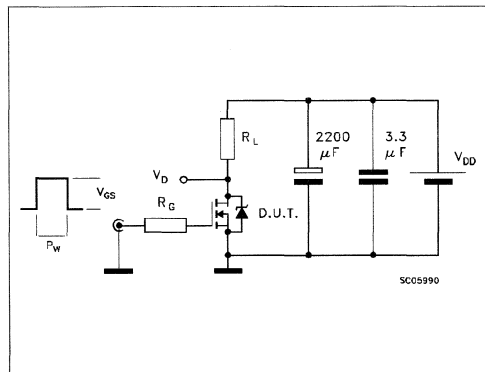


Fig. 4: Gate Charge Test Circuit

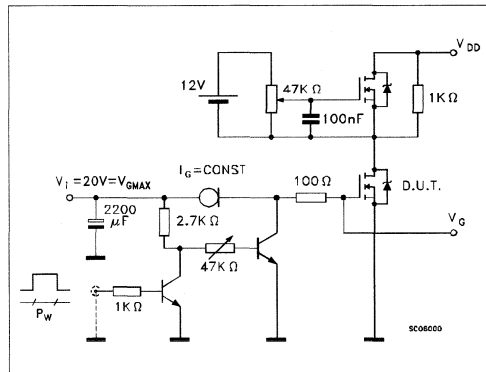
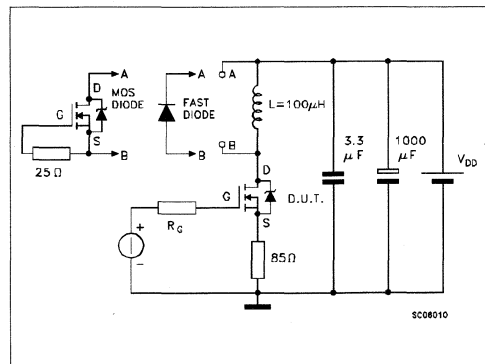


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



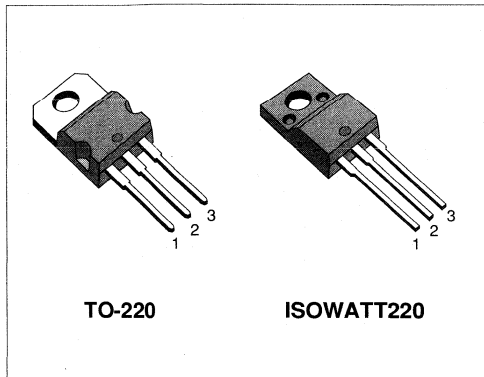
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DS}	R _{DS(on)}	I _D
STP30N05	50 V	< 0.05 Ω	30 A
STP30N05FI	50 V	< 0.05 Ω	19 A

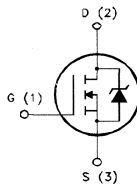
- TYPICAL R_{DS(on)} = 0.045 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP30N05	STP30N05FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	50		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	50		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	30	19	A
I _D	Drain Current (continuous) at T _c = 100 °C	21	13	A
I _{DM} (*)	Drain Current (pulsed)	120	120	A
P _{tot}	Total Dissipation at T _c = 25 °C	105	40	W
	Derating Factor	0.7	0.27	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

		TO-220	ISOWATT220		
$R_{thj-case}$	Thermal Resistance Junction-case	Max	1.43	3.75	$^{\circ}\text{C}/\text{W}$
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5		$^{\circ}\text{C}/\text{W}$
$R_{thc-sink}$	Thermal Resistance Case-sink	Typ	0.5		$^{\circ}\text{C}/\text{W}$
T_I	Maximum Lead Temperature For Soldering Purpose		300		$^{\circ}\text{C}$

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	30	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25^{\circ}\text{C}$, $I_D = I_{AR}$, $V_{DD} = 25\text{V}$)	180	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	45	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100^{\circ}\text{C}$, pulse width limited by T_j max, $\delta < 1\%$)	21	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25^{\circ}\text{C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\ \mu\text{A}$ $V_{GS} = 0$	50			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^{\circ}\text{C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\ \mu\text{A}$	2	2.9	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{V}$ $I_D = 15\text{A}$ $V_{GS} = 10\text{V}$ $I_D = 15\text{A}$ $T_c = 100^{\circ}\text{C}$		0.045	0.05 0.1	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{V}$	30			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 15\text{A}$	8	12		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{V}$ $f = 1\text{MHz}$ $V_{GS} = 0$		950	1250	pF
C_{oss}	Output Capacitance			420	600	pF
C_{rss}	Reverse Transfer Capacitance			110	200	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 30\text{ V}$ $I_D = 30\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		50 190	70 270	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 30\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		190		A/ μs
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 40\text{ V}$ $I_D = 30\text{ A}$ $V_{GS} = 10\text{ V}$		30 11 14	45	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(v_{off})$ t_f t_c	Off-voltage Rise Time Fall Time Cross-over Time	$V_{DD} = 40\text{ V}$ $I_D = 30\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		120 75 180	170 100 250	ns ns ns

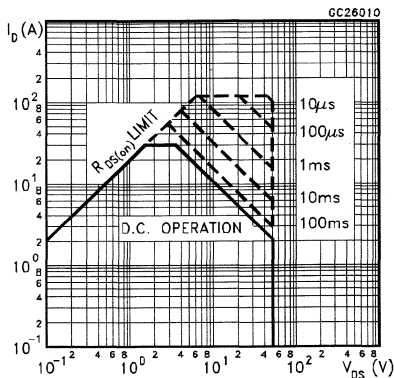
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				30 120	A A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 30\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 30\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		85 0.25 6		ns μC A

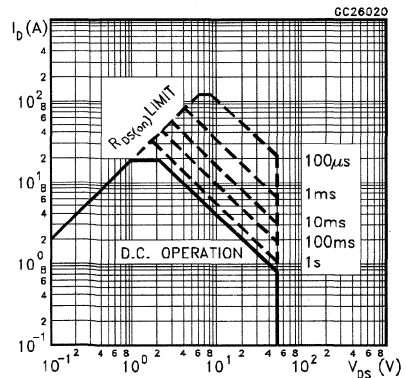
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

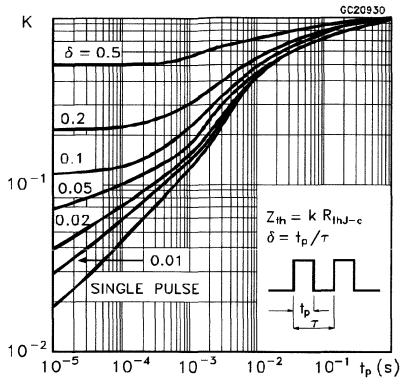
Safe Operating Areas For TO-220



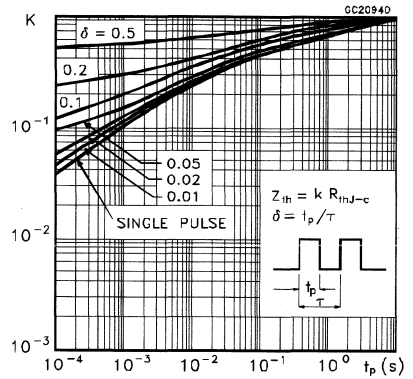
Safe Operating Areas For ISOWATT220



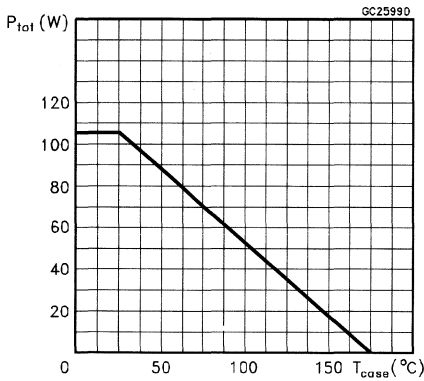
Thermal Impedance For TO-220



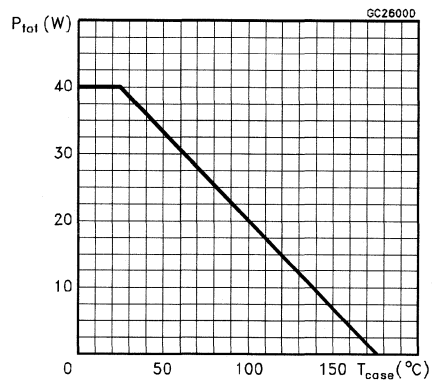
Thermal Impedance For ISOWATT220



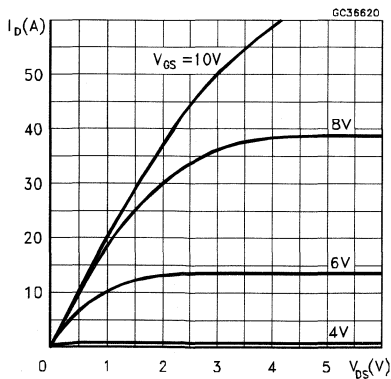
Derating Curve For TO-220



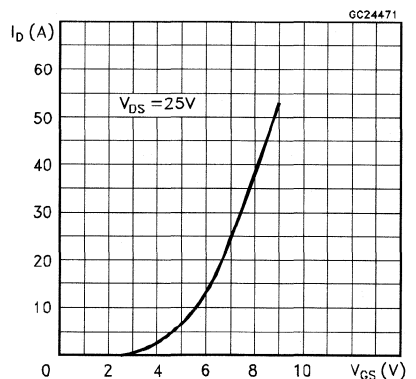
Derating Curve For ISOWATT220



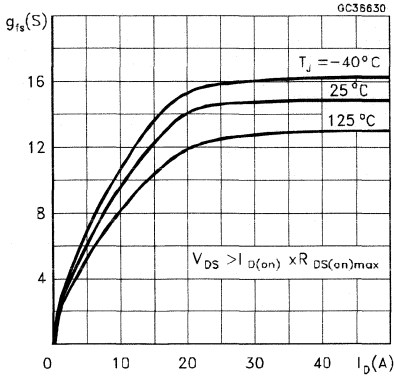
Output Characteristics



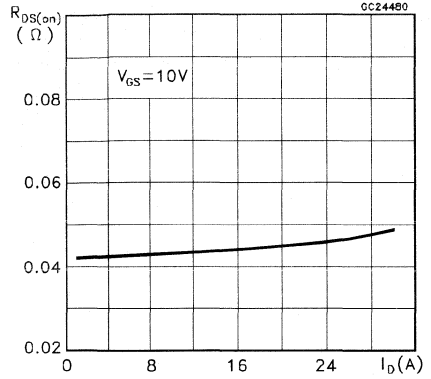
Transfer Characteristics



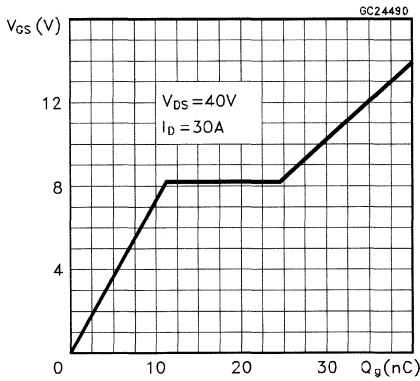
Transconductance



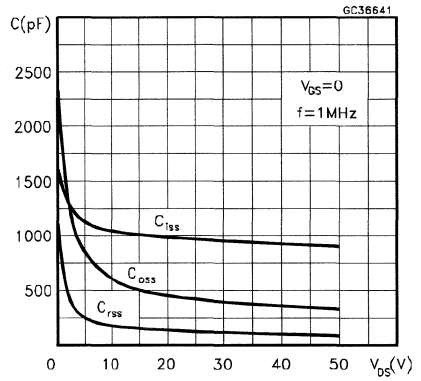
Static Drain-source On Resistance



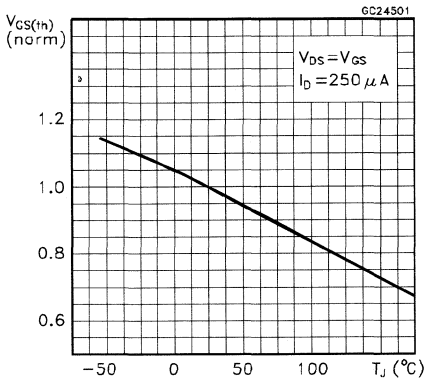
Gate Charge vs Gate-source Voltage



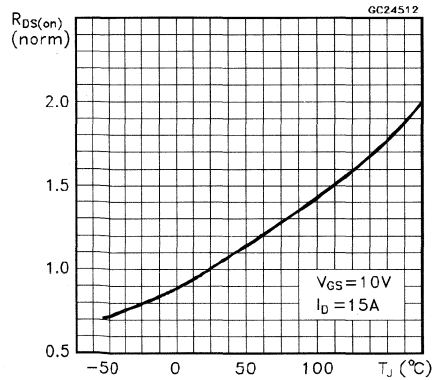
Capacitance Variations



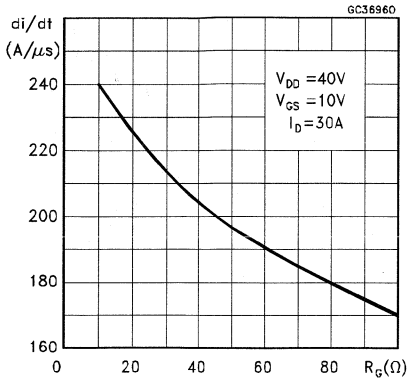
Normalized Gate Threshold Voltage vs Temperature



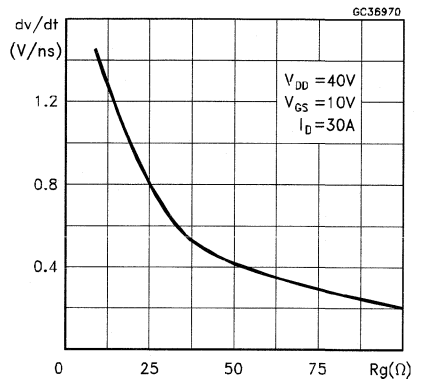
Normalized On Resistance vs Temperature



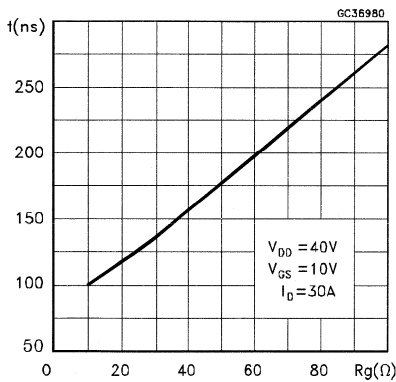
Turn-on Current Slope



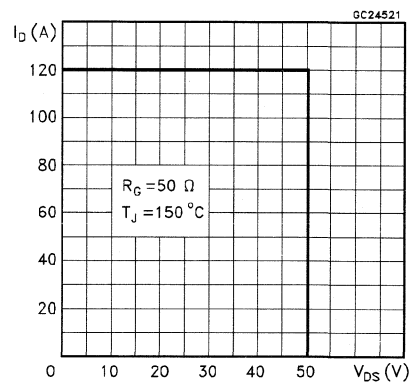
Turn-off Drain-source Voltage Slope



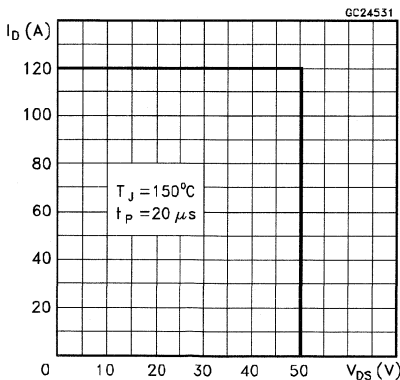
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

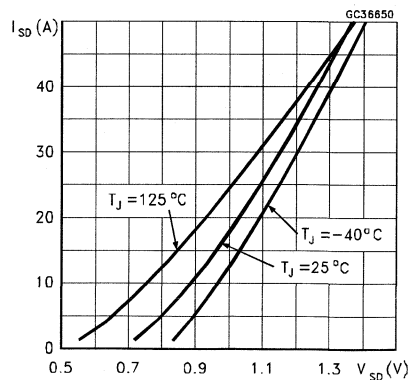


Fig. 1: Unclamped Inductive Load Test Circuits

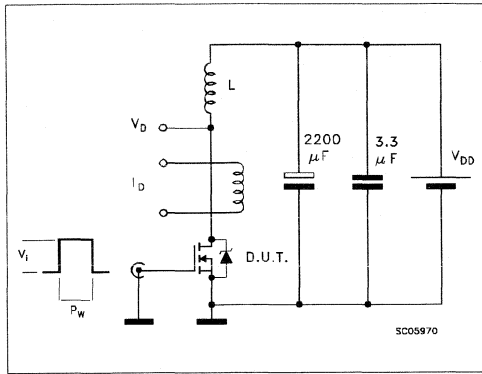


Fig. 2: Unclamped Inductive Waveforms

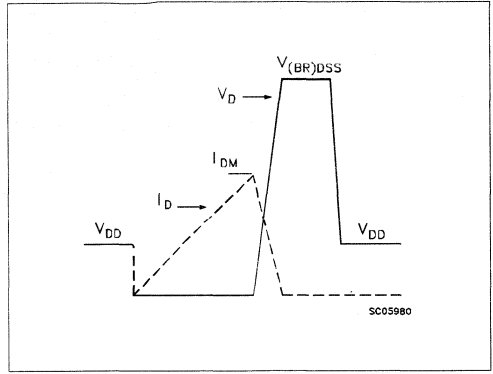


Fig. 3: Switching Times Test Circuits For Resistive Load

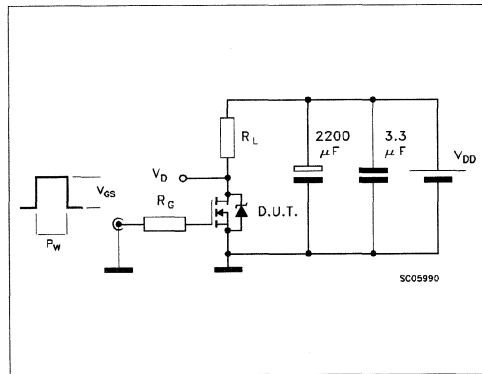


Fig. 4: Gate Charge Test Circuit

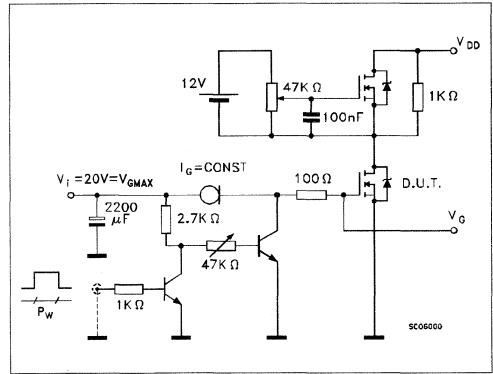
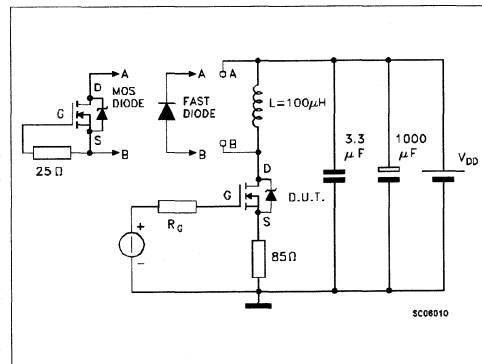


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



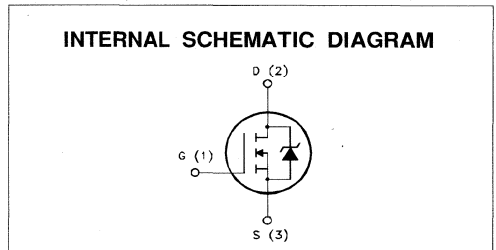
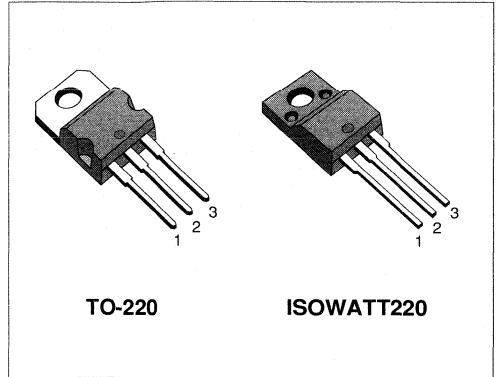
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{Ds(on)}	I _D
STP30N06	60 V	< 0.05 Ω	30 A
STP30N06FI	60 V	< 0.05 Ω	19 A

- TYPICAL R_{Ds(on)} = 0.045 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP30N06	STP30N06FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	60		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	60		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	30	19	A
I _D	Drain Current (continuous) at T _c = 100 °C	21	13	A
I _{DM} (*)	Drain Current (pulsed)	120	120	A
P _{tot}	Total Dissipation at T _c = 25 °C	105	40	W
	Derating Factor	0.7	0.27	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case	Max	1.43	3.57	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.5		°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	30	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	160	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	40	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	21	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	60			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	2.9	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 15 A V _{GS} = 10V I _D = 15 A T _c = 100°C		0.045	0.05 0.1	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} × R _{DS(on)max} V _{GS} = 10 V	30			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} × R _{DS(on)max} I _D = 15 A	8	12		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		950	1250	pF
C _{oss}	Output Capacitance			420	600	pF
C _{rss}	Reverse Transfer Capacitance			110	200	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 30\text{ V}$ $I_D = 30\text{ A}$		50	70	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		190	270	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 30\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		190		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 40\text{ V}$ $I_D = 30\text{ A}$ $V_{GS} = 10\text{ V}$		30	45	nC
Q_{gs}	Gate-Source Charge			11		nC
Q_{gd}	Gate-Drain Charge			14		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 30\text{ A}$		120	170	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		75	100	ns
t_c	Cross-over Time	(see test circuit, figure 5)		180	250	ns

SOURCE DRAIN DIODE

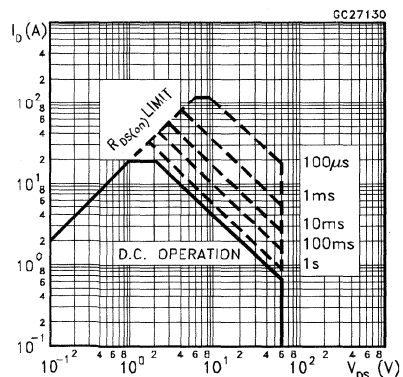
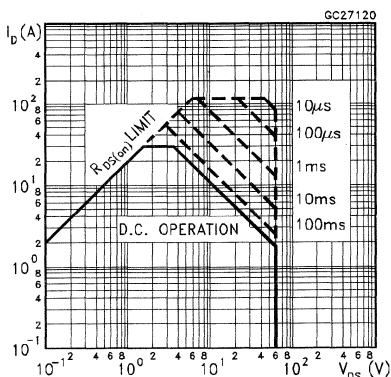
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				30	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				120	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 30\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 30\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		85		ns
Q_{rr}	Reverse Recovery Charge			0.25		μ C
I_{RRM}	Reverse Recovery Current			6		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

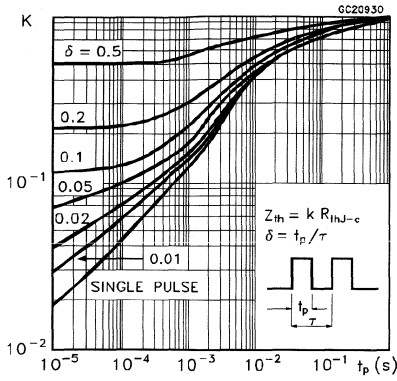
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

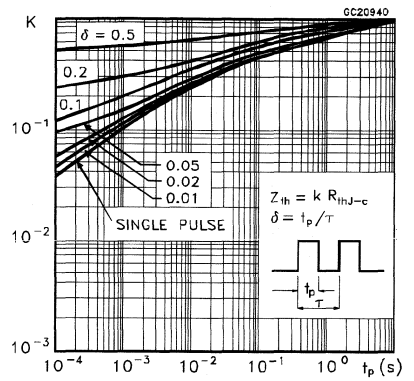
Safe Operating Areas For ISOWATT220



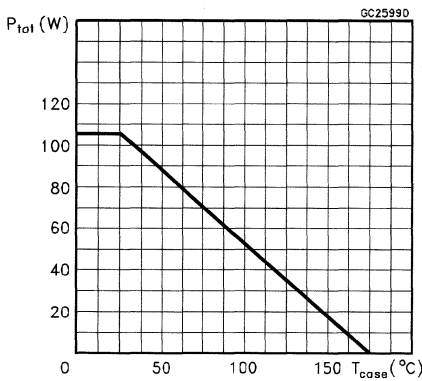
Thermal Impedance For TO-220



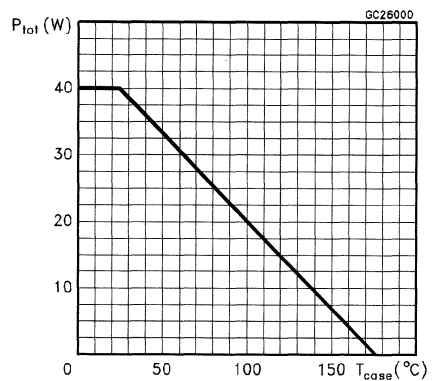
Thermal Impedance For ISOWATT220



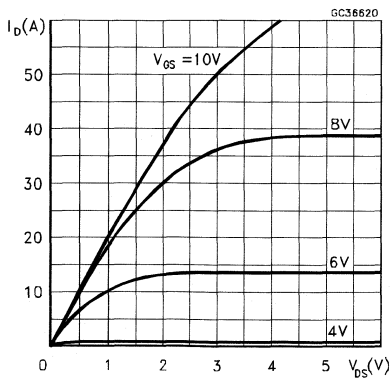
Derating Curve For TO-220



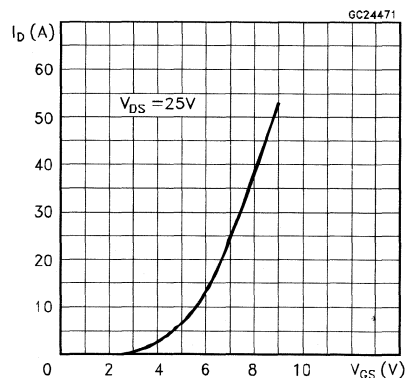
Derating Curve For ISOWATT220



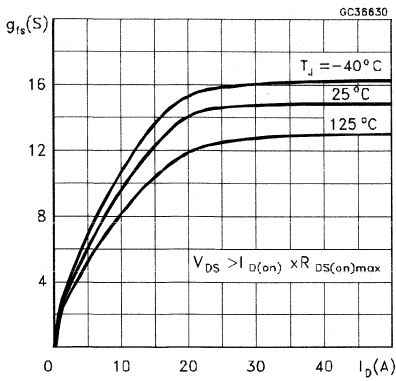
Output Characteristics



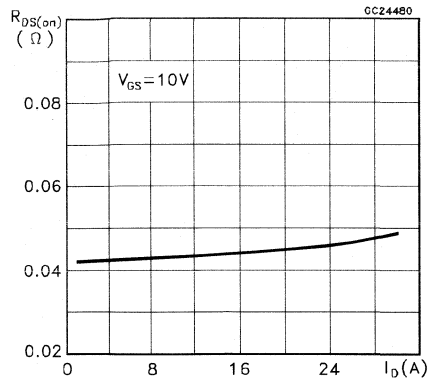
Transfer Characteristics



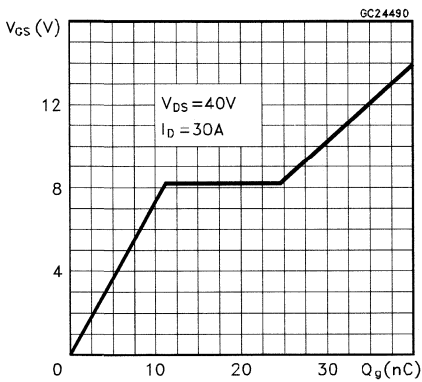
Transconductance



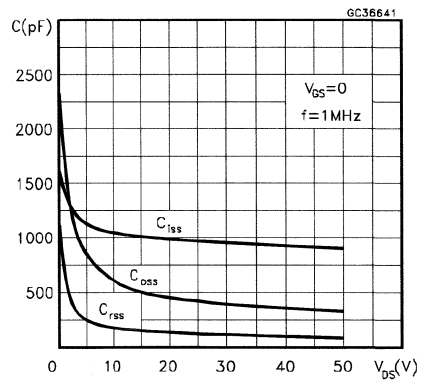
Static Drain-source On Resistance



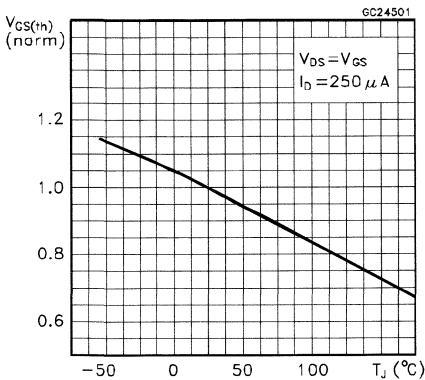
Gate Charge vs Gate-source Voltage



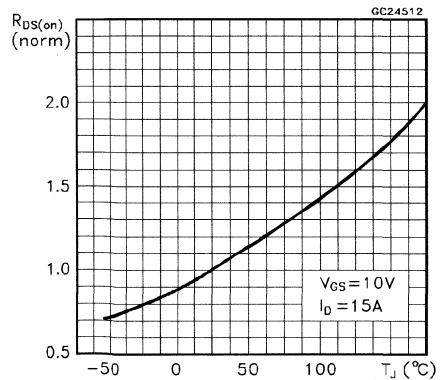
Capacitance Variations



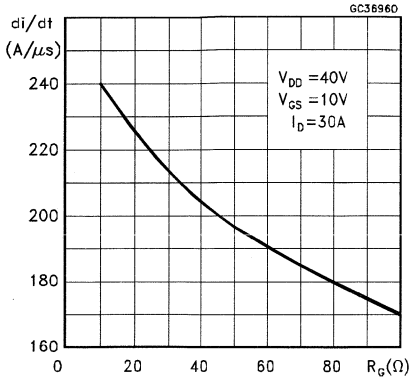
Normalized Gate Threshold Voltage vs Temperature



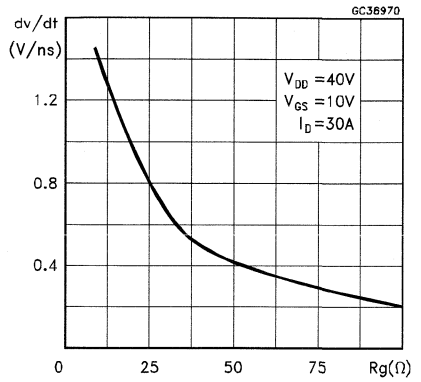
Normalized On Resistance vs Temperature



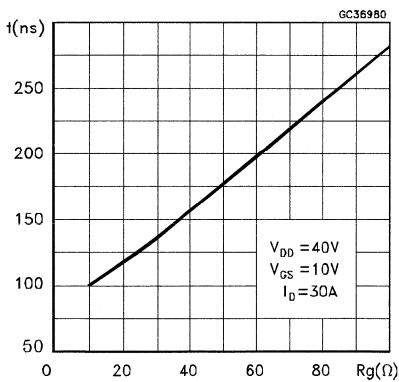
Turn-on Current Slope



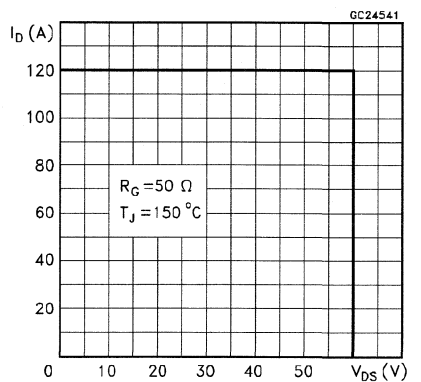
Turn-off Drain-source Voltage Slope



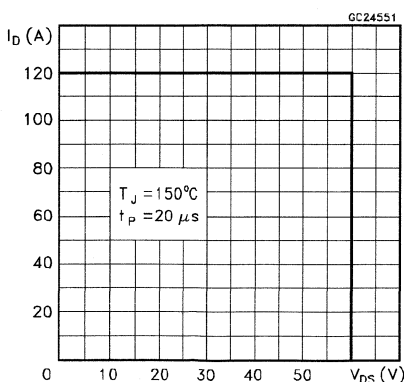
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

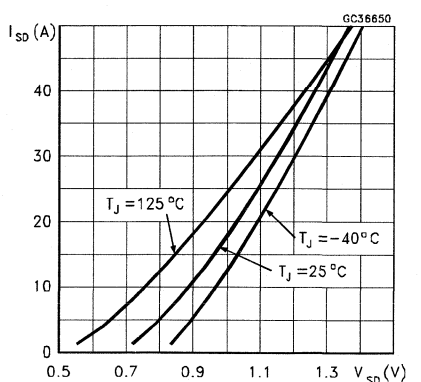


Fig. 1: Unclamped Inductive Load Test Circuits

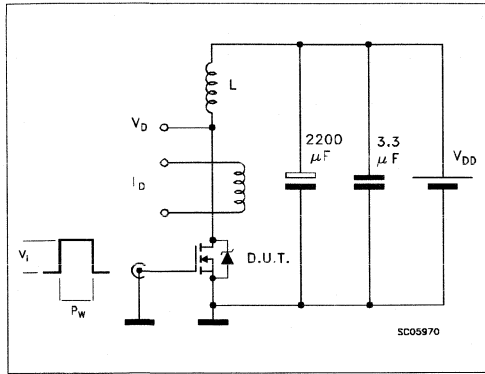


Fig. 2: Unclamped Inductive Waveforms

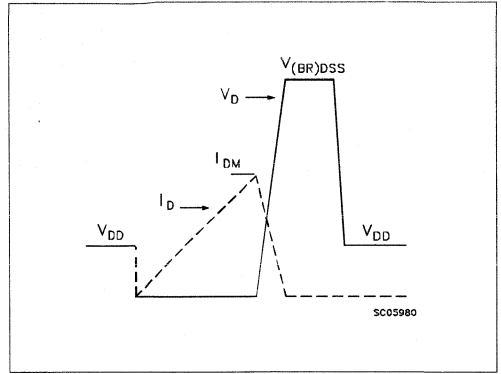


Fig. 3: Switching Times Test Circuits For Resistive Load

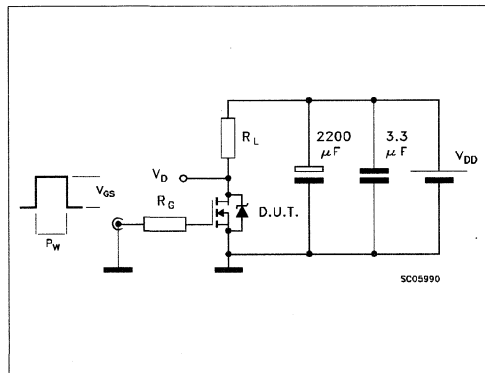


Fig. 4: Gate Charge Test Circuit

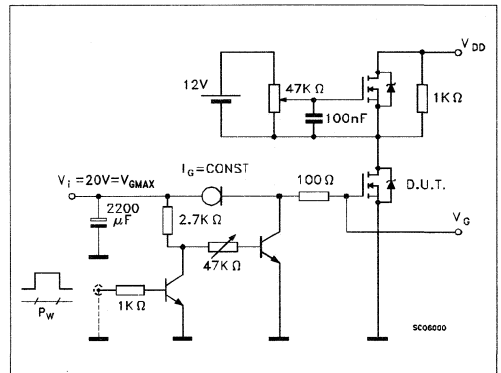
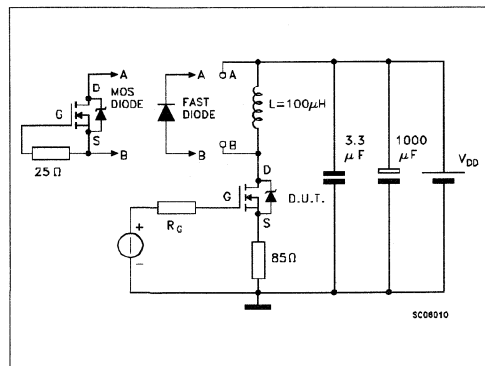


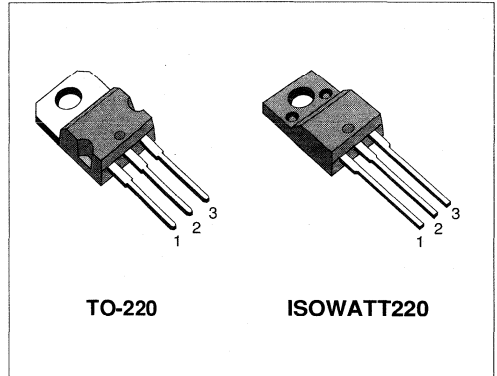
Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP32N05L	50 V	< 0.055 Ω	32 A
STP32N05LFI	50 V	< 0.055 Ω	19 A

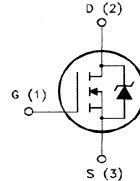
- TYPICAL R_{DS(on)} = 0.045 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- LOGIC LEVEL COMPATIBLE INPUT
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION



APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP32N05L	STP32N05LFI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	50		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	50		V
V _{GS}	Gate-source Voltage	± 15		V
I _D	Drain Current (continuous) at T _c = 25 °C	32	19	A
I _D	Drain Current (continuous) at T _c = 100 °C	22	13	A
I _{DM} (*)	Drain Current (pulsed)	128	128	A
P _{tot}	Total Dissipation at T _c = 25 °C	105	40	W
	Derating Factor	0.7	0.27	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case	Max	1.43	3.75	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.5		°C/W
T _j	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	32	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	200	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	50	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	22	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	50			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 15 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	1	1.6	2.5	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 5 V I _D = 16 A V _{GS} = 5 V I _D = 16 A T _c = 100°C		0.045	0.055 0.11	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	32			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 16 A	10	22		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		980	1300	pF
C _{oss}	Output Capacitance			320	450	pF
C _{rss}	Reverse Transfer Capacitance			80	110	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 25\text{ V}$ $I_D = 16\text{ A}$		60	90	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 3)		430	630	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 32\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 5)		130		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 40\text{ V}$ $I_D = 32\text{ A}$ $V_{GS} = 5\text{ V}$		25	35	nC
Q_{gs}	Gate-Source Charge			9		nC
Q_{gd}	Gate-Drain Charge			12		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 32\text{ A}$		90	130	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$		140	200	ns
t_c	Cross-over Time	(see test circuit, figure 5)		250	350	ns

SOURCE DRAIN DIODE

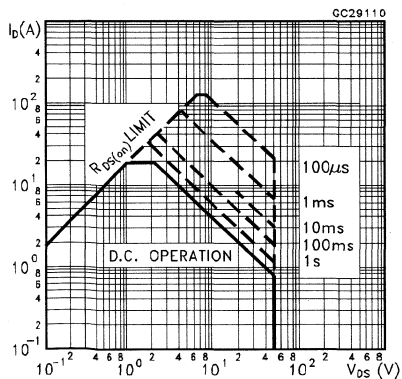
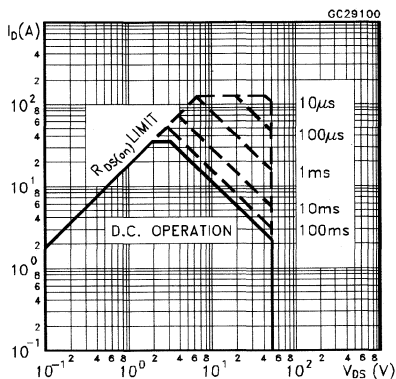
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				32	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				128	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 32\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 32\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 25\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		100		ns
Q_{rr}	Reverse Recovery Charge			0.2		μC
I_{RRM}	Reverse Recovery Current			4		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

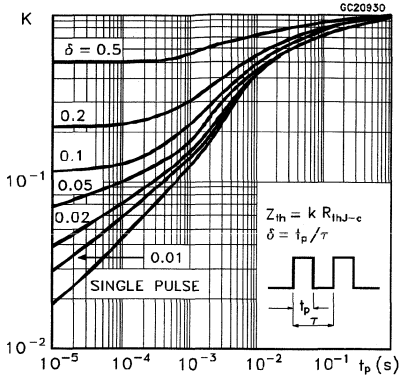
(•) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

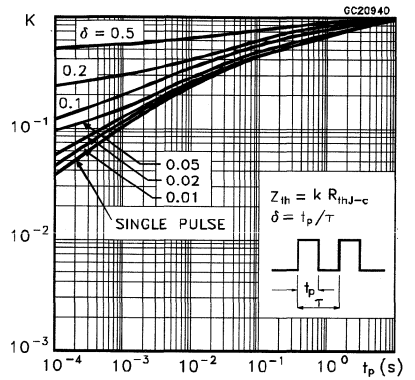
Safe Operating Areas For ISOWATT220



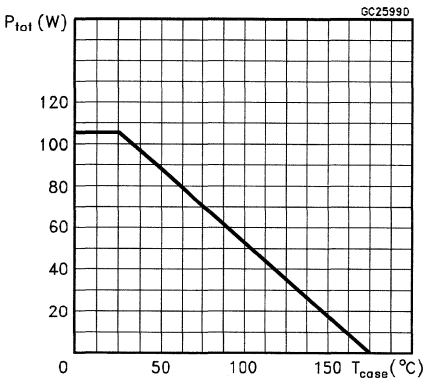
Thermal Impedance For TO-220



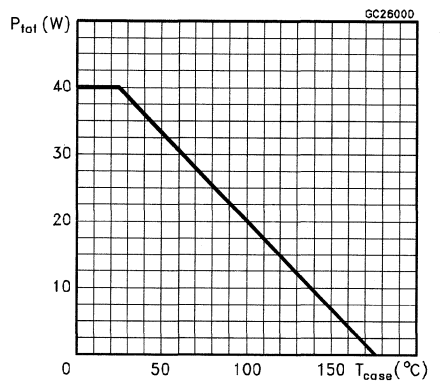
Thermal Impedance For ISOWATT220



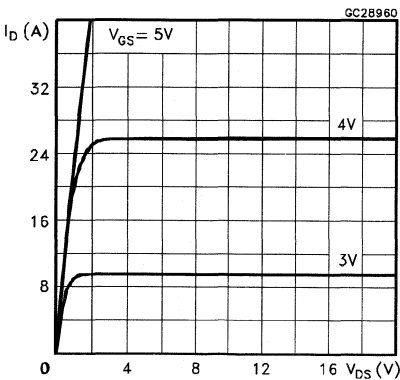
Derating Curve For TO-220



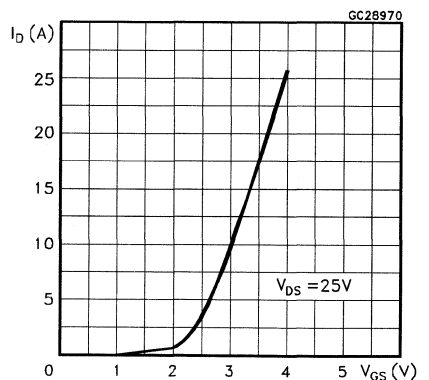
Derating Curve For ISOWATT220



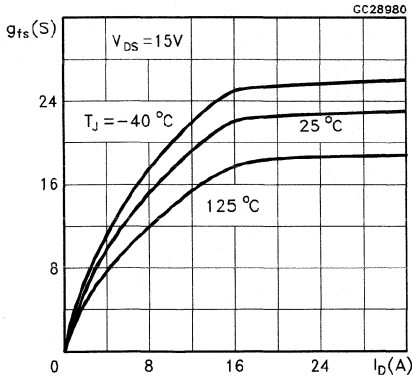
Output Characteristics



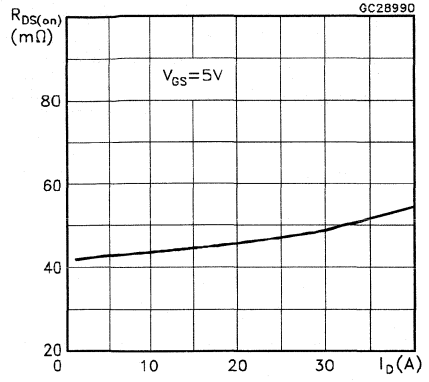
Transfer Characteristics



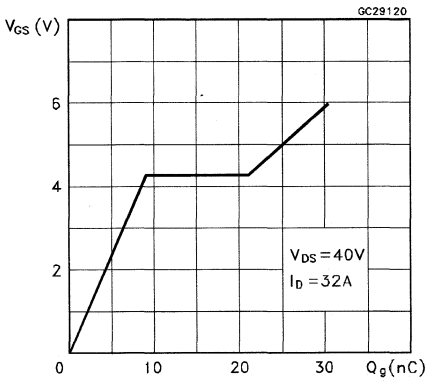
Transconductance



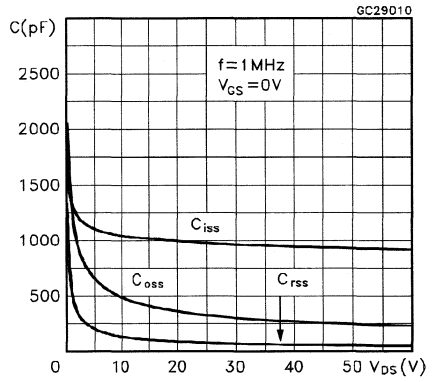
Static Drain-source On Resistance



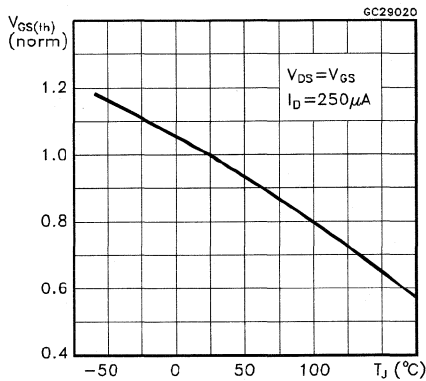
Gate Charge vs Gate-source Voltage



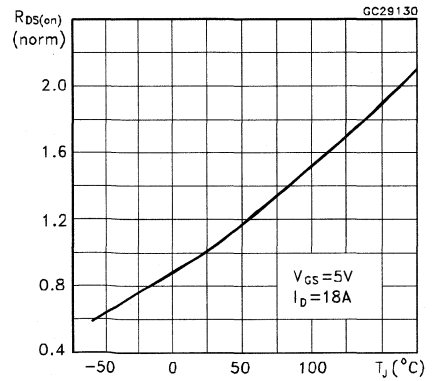
Capacitance Variations



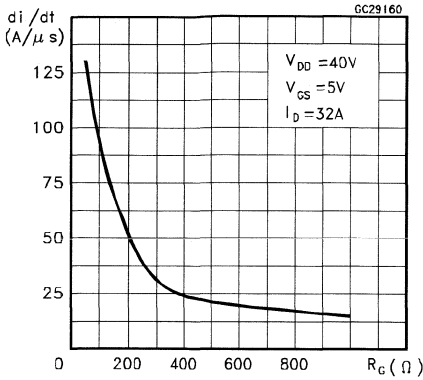
Normalized Gate Threshold Voltage vs Temperature



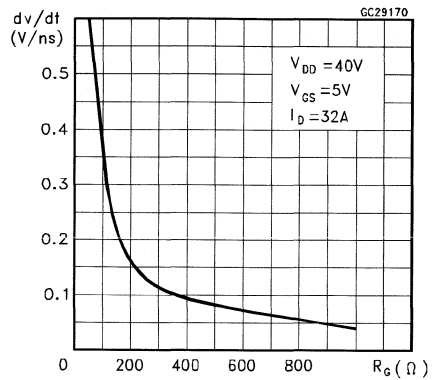
Normalized On Resistance vs Temperature



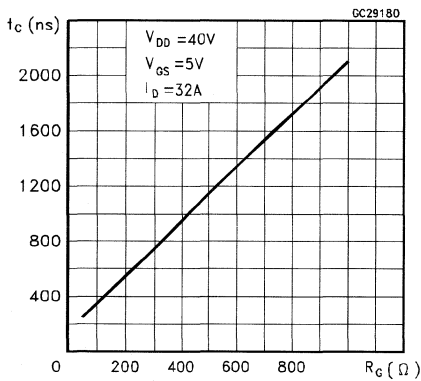
Turn-on Current Slope



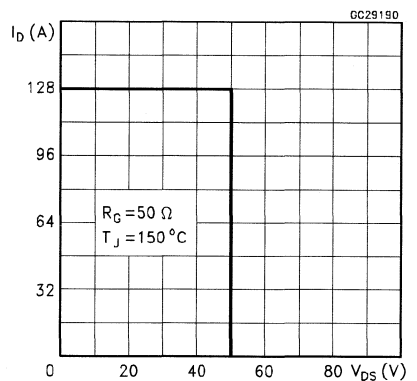
Turn-off Drain-source Voltage Slope



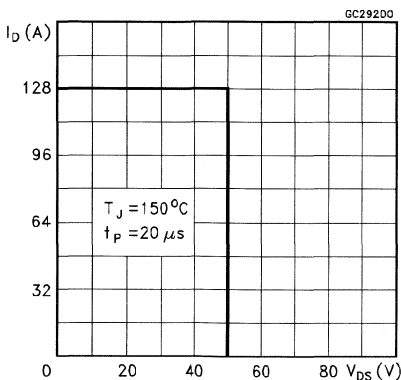
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

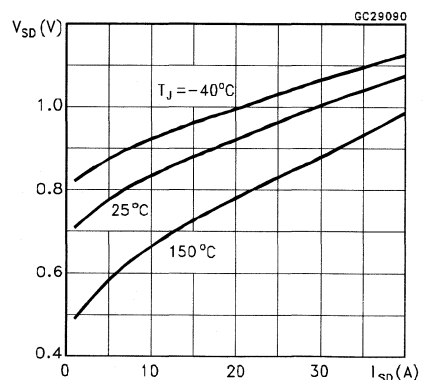


Fig. 1: Unclamped Inductive Load Test Circuits

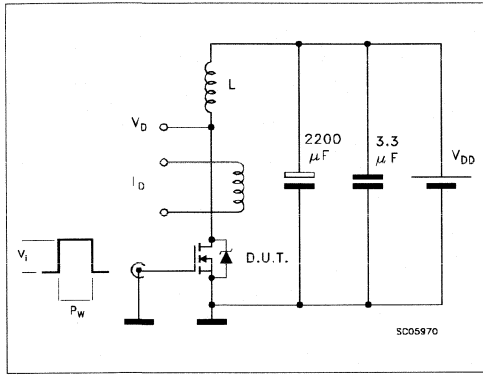


Fig. 2: Unclamped Inductive Waveforms

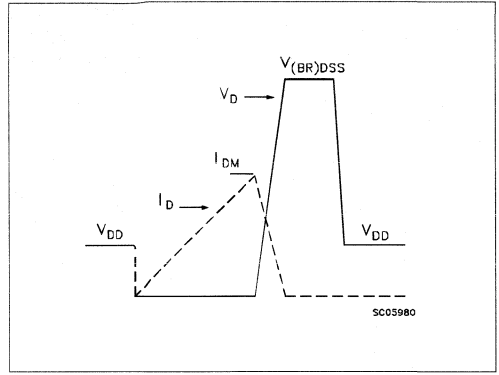


Fig. 3: Switching Times Test Circuits For Resistive Load

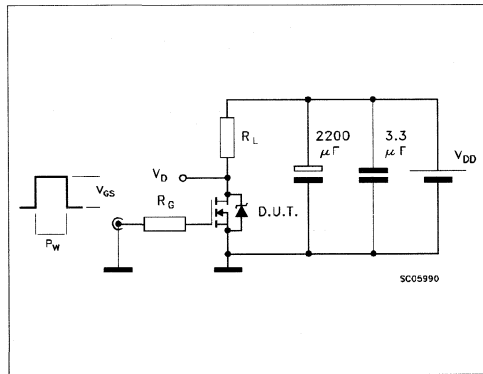


Fig. 4: Gate Charge Test Circuit

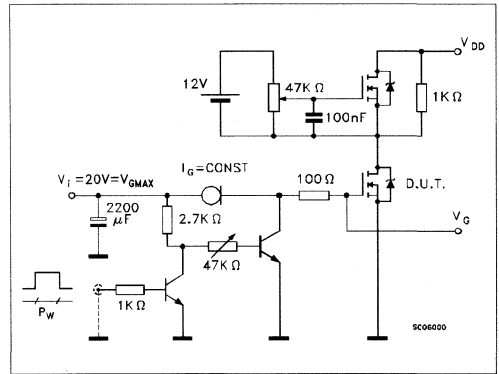
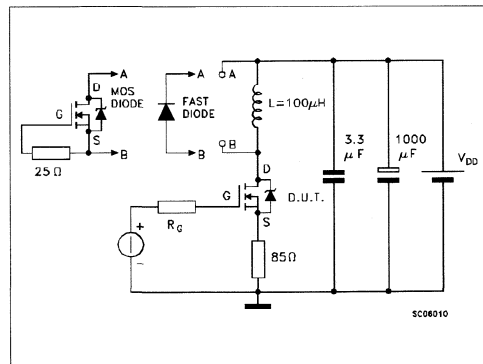


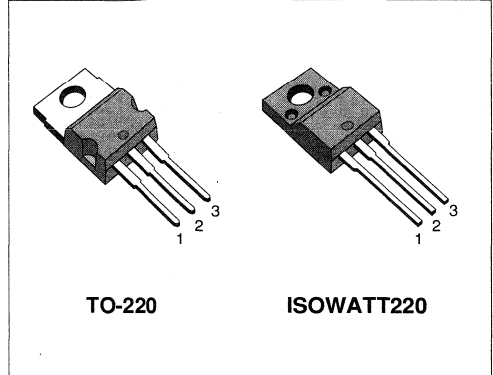
Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP32N06L	60 V	< 0.055 Ω	32 A
STP32N06LFI	60 V	< 0.055 Ω	19 A

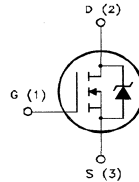
- TYPICAL R_{DS(on)} = 0.045 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- LOGIC LEVEL COMPATIBLE INPUT
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION



APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP32N06L	STP32N06LFI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	60		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	60		V
V _{GS}	Gate-source Voltage	± 15		V
I _D	Drain Current (continuous) at T _c = 25 °C	32	19	A
I _D	Drain Current (continuous) at T _c = 100 °C	22	13	A
I _{DM} (*)	Drain Current (pulsed)	128	128	A
P _{tot}	Total Dissipation at T _c = 25 °C	105	40	W
	Derating Factor	0.7	0.27	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case	Max	1.43	3.75	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.5		°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	32	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	180	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	45	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	22	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	60			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 15 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	1	1.6	2.5	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 5 V I _D = 16 A V _{GS} = 5 V I _D = 16 A T _c = 100°C		0.045	0.055 0.11	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	32			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 16 A	10	22		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		980	1300	pF
C _{oss}	Output Capacitance			320	450	pF
C _{rss}	Reverse Transfer Capacitance			80	110	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 25\text{ V}$ $I_D = 16\text{ A}$		60	90	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 3)		430	630	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 32\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 5)		130		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 40\text{ V}$ $I_D = 32\text{ A}$ $V_{GS} = 5\text{ V}$		25	35	nC
Q_{gs}	Gate-Source Charge			9		nC
Q_{gd}	Gate-Drain Charge			12		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 32\text{ A}$		90	130	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$		140	200	ns
t_c	Cross-over Time	(see test circuit, figure 5)		250	350	ns

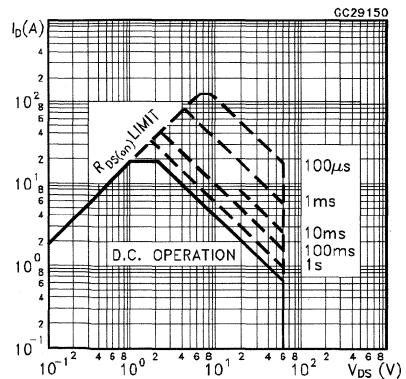
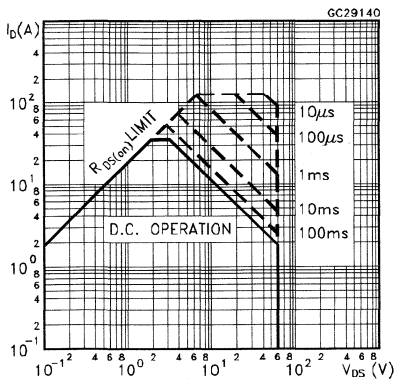
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				32	A
$I_{SDM}(\ast)$	Source-drain Current (pulsed)				128	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 32\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 32\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 25\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		100		ns
Q_{rr}	Reverse Recovery Charge			0.2		μC
I_{RRM}	Reverse Recovery Current			4		A

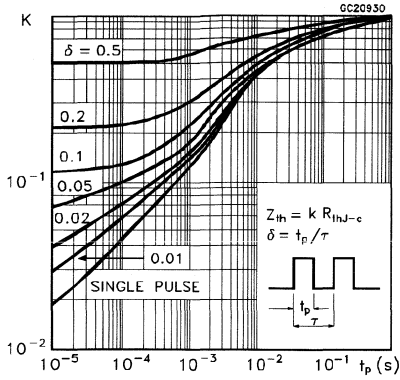
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %
 (**) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

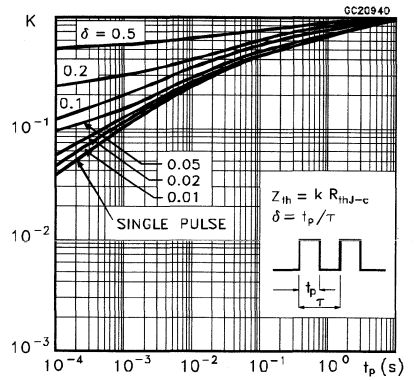
Safe Operating Areas For ISOWATT220



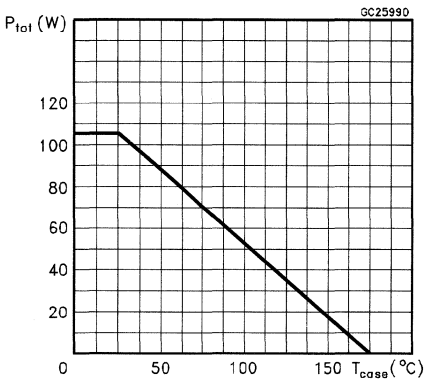
Thermal Impedance For TO-220



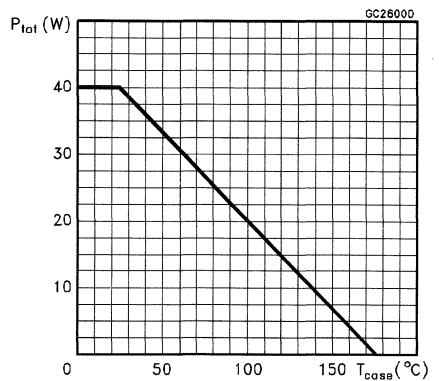
Thermal Impedance For ISOWATT220



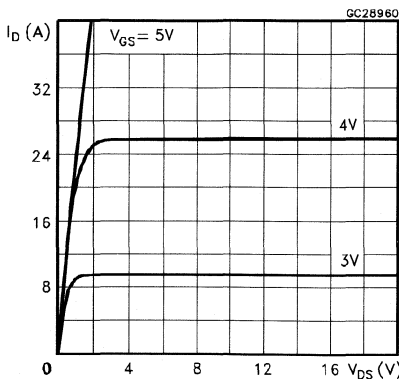
Derating Curve For TO-220



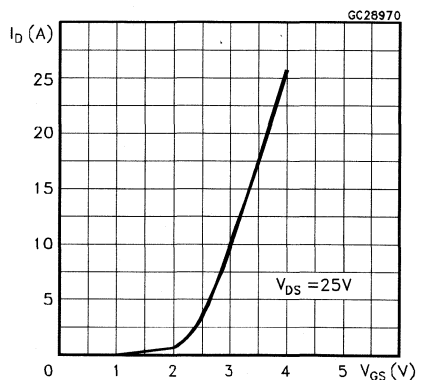
Derating Curve For ISOWATT220



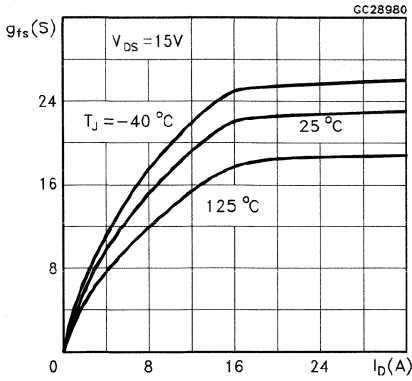
Output Characteristics



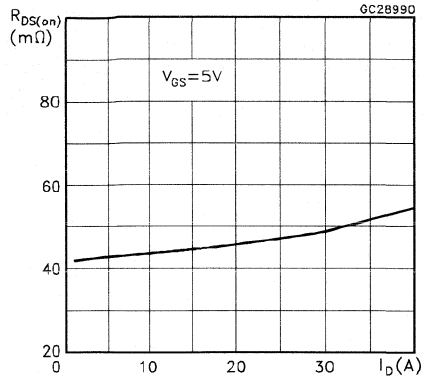
Transfer Characteristics



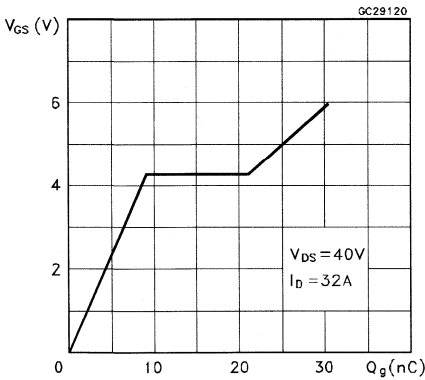
Transconductance



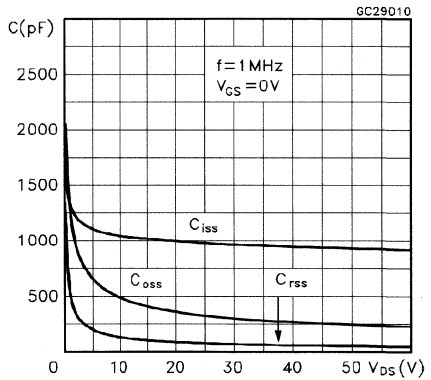
Static Drain-source On Resistance



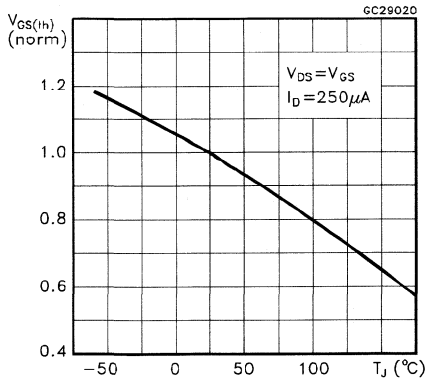
Gate Charge vs Gate-source Voltage



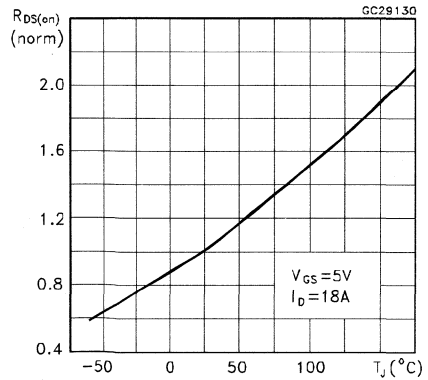
Capacitance Variations



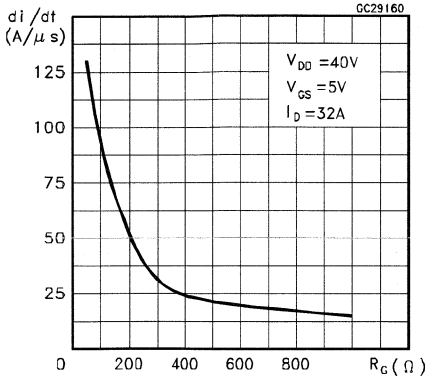
Normalized Gate Threshold Voltage vs Temperature



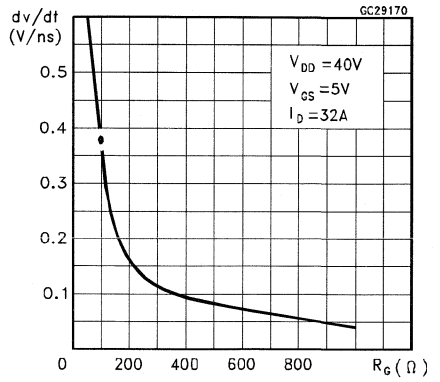
Normalized On Resistance vs Temperature



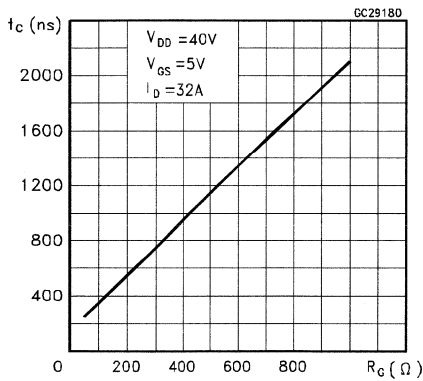
Turn-on Current Slope



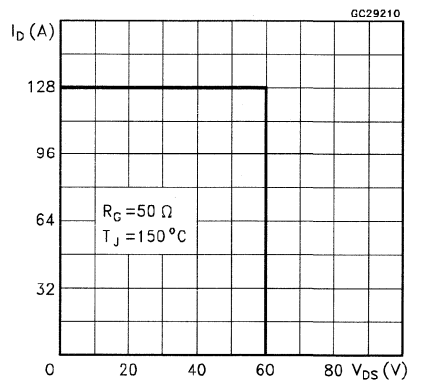
Turn-off Drain-source Voltage Slope



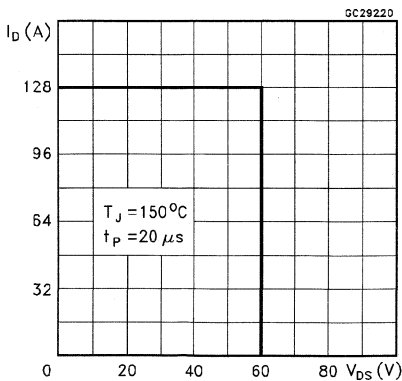
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

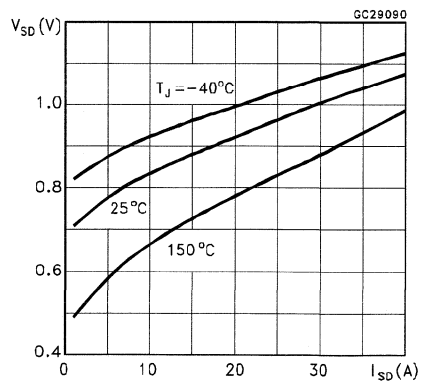


Fig. 1: Unclamped Inductive Load Test Circuits

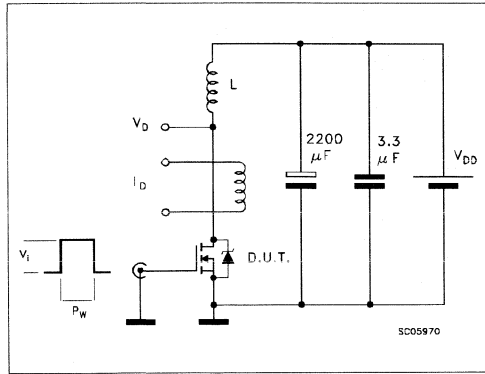


Fig. 2: Unclamped Inductive Waveforms

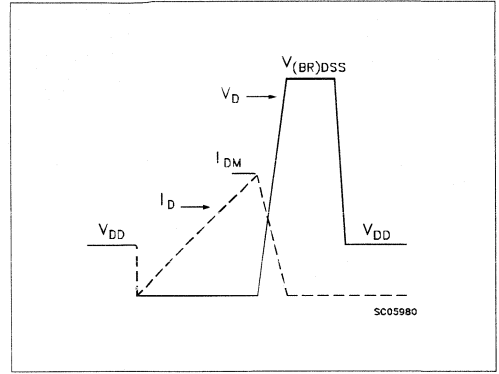


Fig. 3: Switching Times Test Circuits For Resistive Load

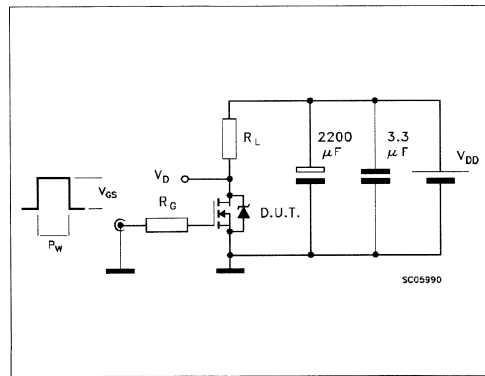


Fig. 4: Gate Charge Test Circuit

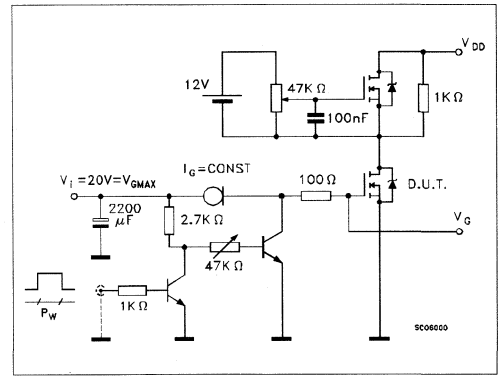
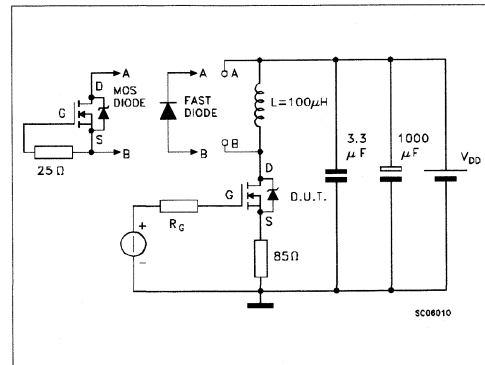


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



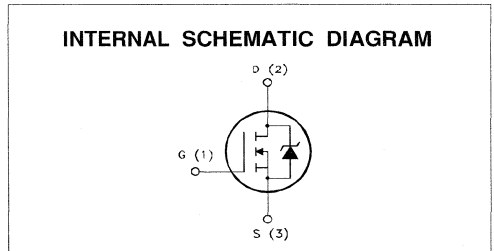
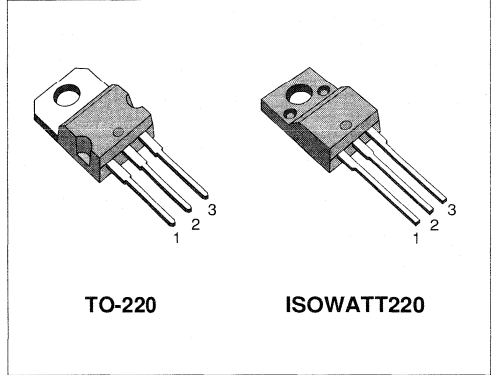
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP33N10	100 V	< 0.06 Ω	33 A
STP33N10FI	100 V	< 0.06 Ω	18 A

- TYPICAL R_{DS(on)} = 0.045 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
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- HIGH CURRENT, HIGH SPEED SWITCHING
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- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP33N10	STP33N10FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	100		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	100		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	33	18	A
I _D	Drain Current (continuous) at T _c = 100 °C	23	12	A
I _{DM} (*)	Drain Current (pulsed)	132	132	A
P _{tot}	Total Dissipation at T _c = 25 °C	150	45	W
	Derating Factor	1	0.3	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

		TO-220	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case Max	1	3.33	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient Max		62.5	°C/W
R _{thc-sink}	Thermal Resistance Case-sink Typ		0.5	°C/W
T _I	Maximum Lead Temperature For Soldering Purpose		300	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	33	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	240	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	60	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	23	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	100			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	2.9	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 17 A V _{GS} = 10V I _D = 17 A T _c = 100°C		0.045	0.06 0.12	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	33			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 17 A	10	18		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		1600	2100	pF
C _{oss}	Output Capacitance			460	600	pF
C _{rss}	Reverse Transfer Capacitance			140	200	pF

ELECTRICAL CHARACTERISTICS (continued)
SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 50\text{ V}$ $I_D = 5\text{ A}$		55	80	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		110	160	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 80\text{ V}$ $I_D = 33\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		300		A/ μs
Q_g	Total Gate Charge	$V_{DD} = 80\text{ V}$ $I_D = 33\text{ A}$ $V_{GS} = 10\text{ V}$		55	80	nC
Q_{gs}	Gate-Source Charge			11		nC
Q_{gd}	Gate-Drain Charge			26		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$	Off-voltage Rise Time	$V_{DD} = 80\text{ V}$ $I_D = 33\text{ A}$		110	160	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		85	120	ns
t_c	Cross-over Time	(see test circuit, figure 5)		200	290	ns

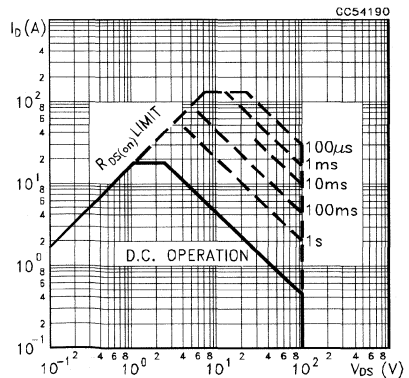
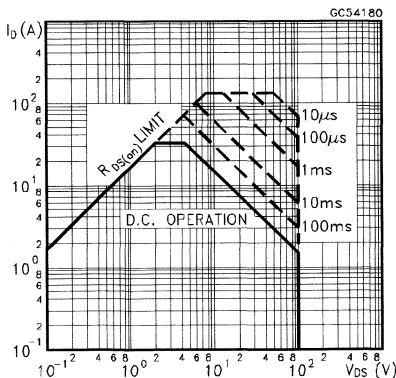
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				33	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				132	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 33\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 33\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 50\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		140		ns
Q_{rr}	Reverse Recovery Charge	(see test circuit, figure 5)		0.7		μC
I_{RRM}	Reverse Recovery Current			10		A

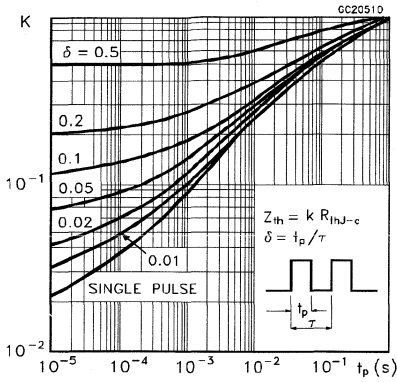
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

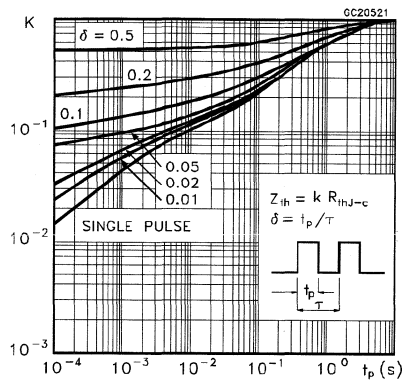
Safe Operating Areas For ISOWATT220



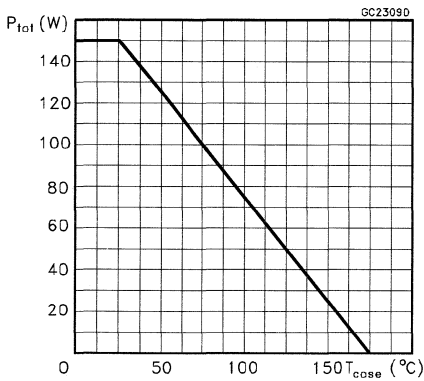
Thermal Impedance For TO-220



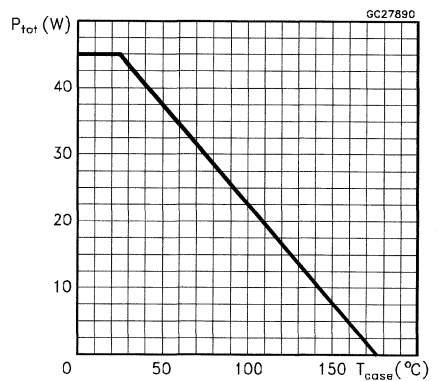
Thermal Impedance For ISOWATT220



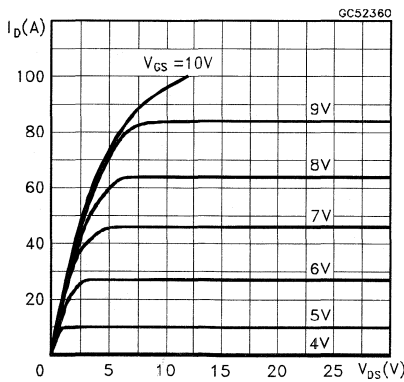
Derating Curve For TO-220



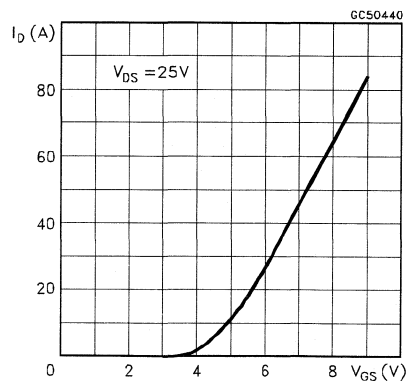
Derating Curve For ISOWATT220



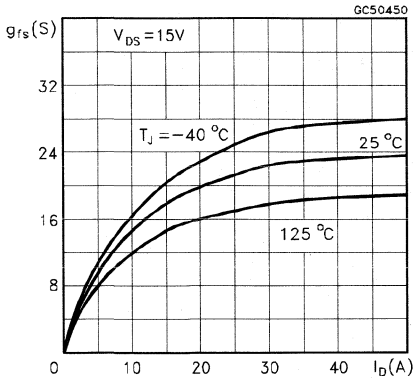
Output Characteristics



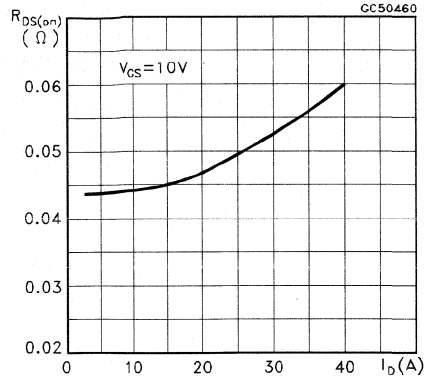
Transfer Characteristics



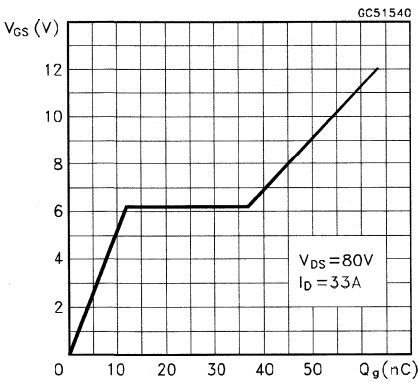
Transconductance



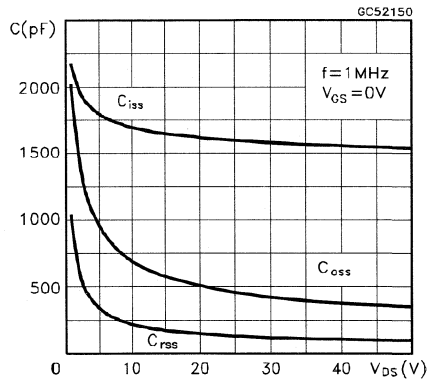
Static Drain-source On Resistance



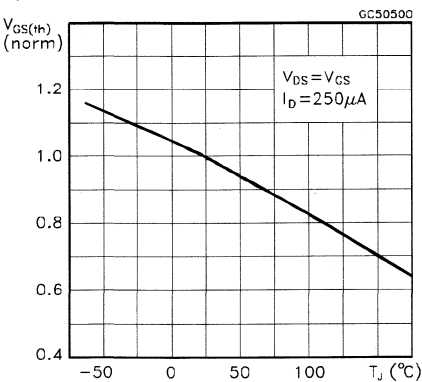
Gate Charge vs Gate-source Voltage



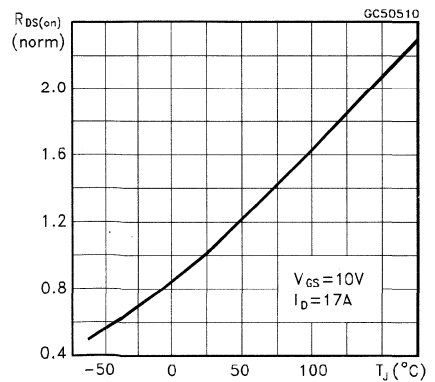
Capacitance Variations



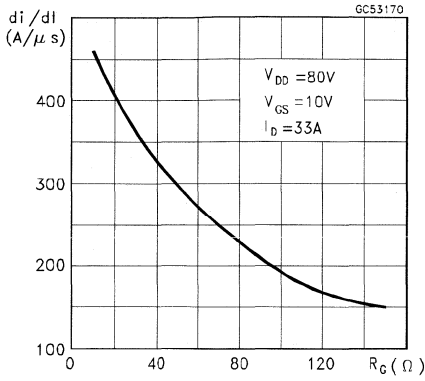
Normalized Gate Threshold Voltage vs Temperature



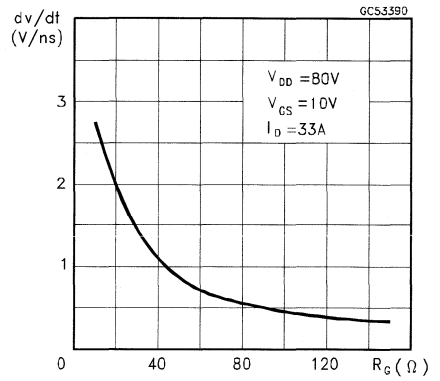
Normalized On Resistance vs Temperature



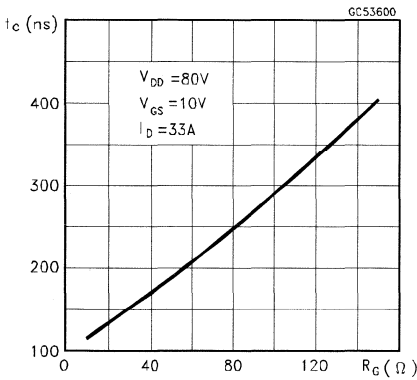
Turn-on Current Slope



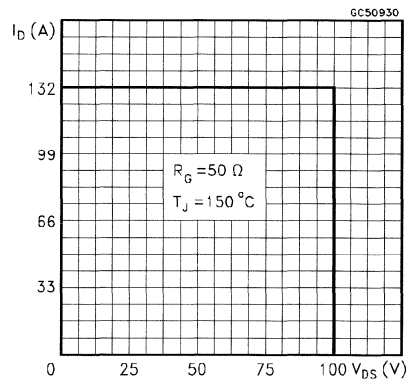
Turn-off Drain-source Voltage Slope



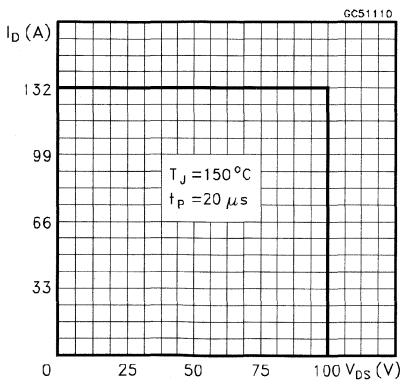
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

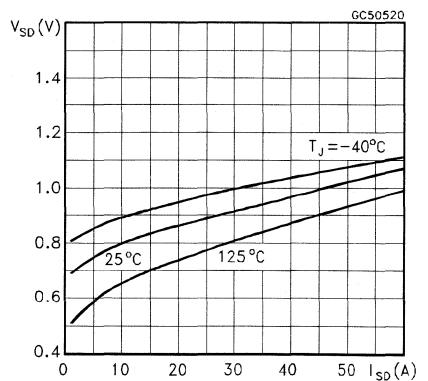


Fig. 1: Unclamped Inductive Load Test Circuits

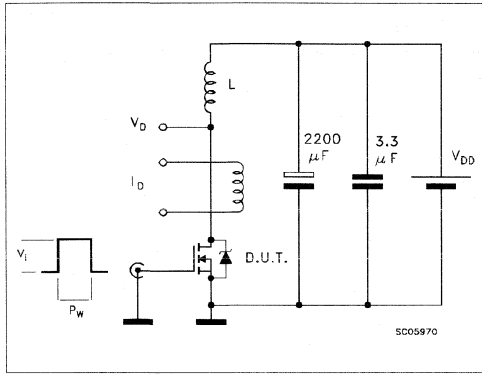


Fig. 2: Unclamped Inductive Waveforms

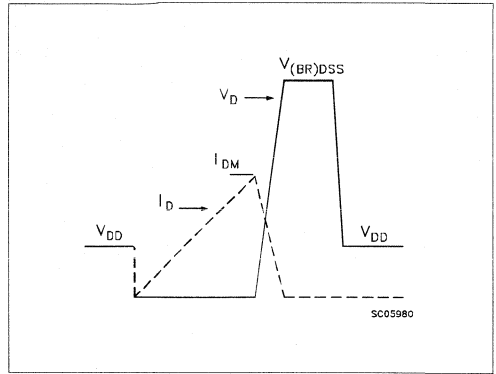


Fig. 3: Switching Times Test Circuits For Resistive Load

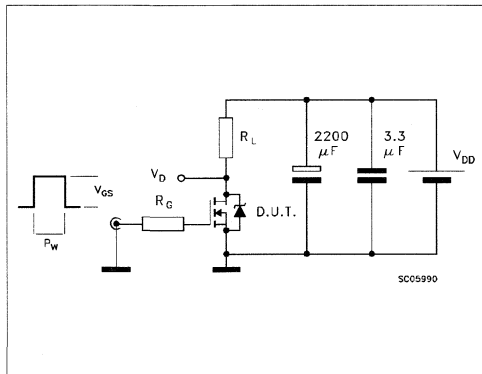


Fig. 4: Gate Charge Test Circuit

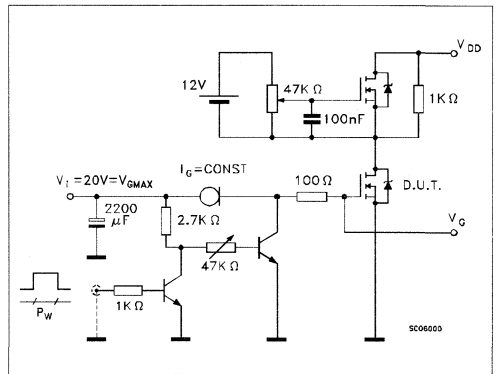
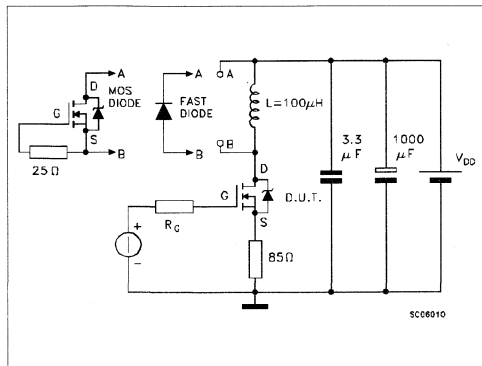


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



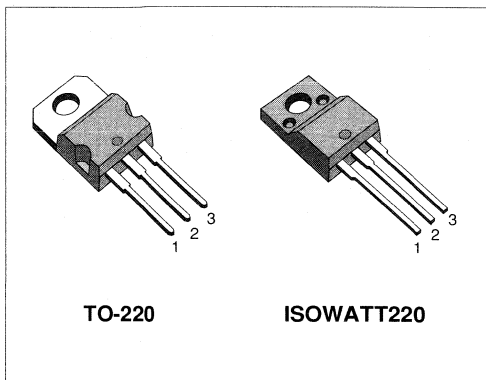
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP36N05L	50 V	< 0.04 Ω	36 A
STP36N05LFI	50 V	< 0.04 Ω	21 A

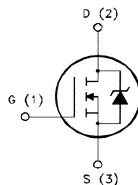
- TYPICAL R_{DS(on)} = 0.033 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- LOGIC LEVEL COMPATIBLE INPUT
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP36N05L	STP36N05LFI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	50		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	50		V
V _{GS}	Gate-source Voltage	± 15		V
I _D	Drain Current (continuous) at T _c = 25 °C	36	21	A
I _D	Drain Current (continuous) at T _c = 100 °C	25	14	A
I _{DM} (•)	Drain Current (pulsed)	144	144	A
P _{tot}	Total Dissipation at T _c = 25 °C	120	40	W
	Derating Factor	0.8	0.27	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(•) Pulse width limited by safe operating area

THERMAL DATA

		TO-220	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case Max	1.25	3.75	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient Max		62.5	°C/W
R _{thc-sink}	Thermal Resistance Case-sink Typ		0.5	°C/W
T _I	Maximum Lead Temperature For Soldering Purpose		300	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	36	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	240	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	60	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	25	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	50			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 15 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	1	1.6	2.5	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 5 V I _D = 18 A V _{GS} = 5 V I _D = 18 A T _c = 100 °C		0.033	0.04 0.08	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} × R _{DS(on)max} V _{GS} = 10 V	36			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} × R _{DS(on)max} I _D = 18 A	12	24		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		1350	1800	pF
C _{oss}	Output Capacitance			450	600	pF
C _{rss}	Reverse Transfer Capacitance			130	200	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 25\text{ V}$ $I_D = 18\text{ A}$		90	130	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 3)		550	800	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 36\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 5)		85		A/ μs
Q_g	Total Gate Charge	$V_{DD} = 40\text{ V}$ $I_D = 36\text{ A}$ $V_{GS} = 5\text{ V}$		35	50	nC
Q_{gs}	Gate-Source Charge			11		nC
Q_{gd}	Gate-Drain Charge			19		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 36\text{ A}$		110	160	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$		180	260	ns
t_c	Cross-over Time	(see test circuit, figure 5)		310	450	ns

SOURCE DRAIN DIODE

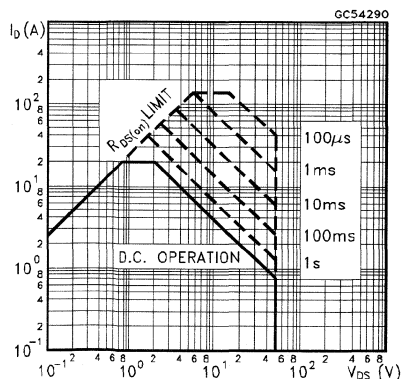
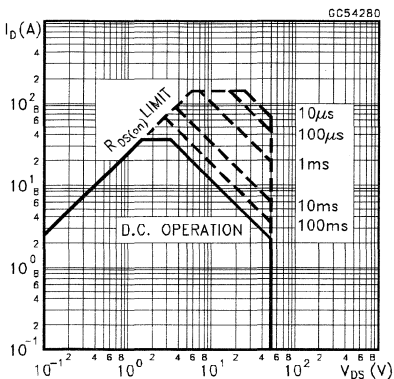
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				36	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				144	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 36\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 36\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		100		ns
Q_{rr}	Reverse Recovery Charge			0.27		μC
I_{RRM}	Reverse Recovery Current			5.5		A

(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

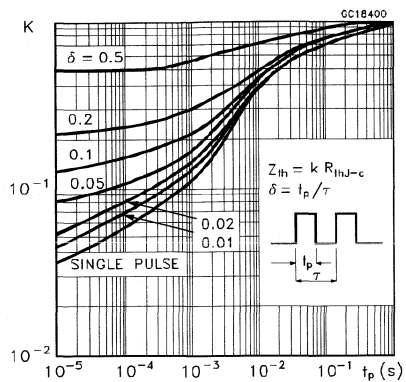
(•) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

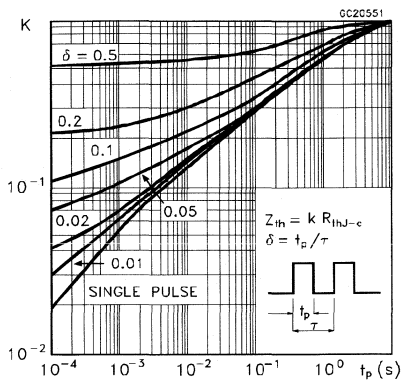
Safe Operating Areas For ISOWATT220



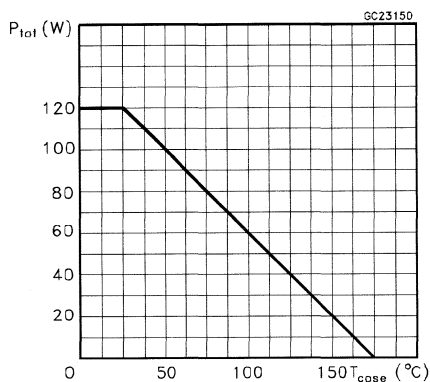
Thermal Impedance For TO-220



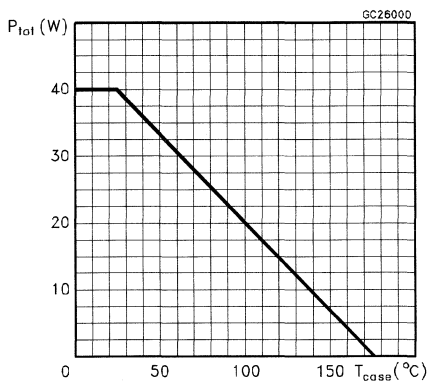
Thermal Impedance For ISOWATT220



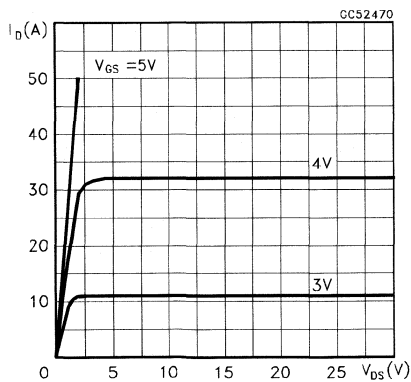
Derating Curve For TO-220



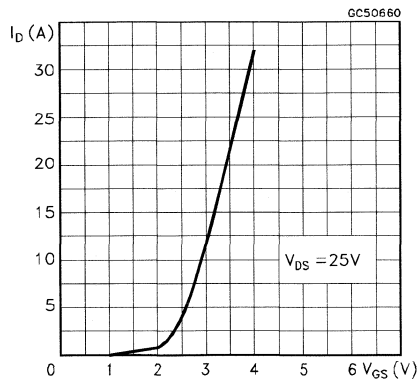
Derating Curve For ISOWATT220



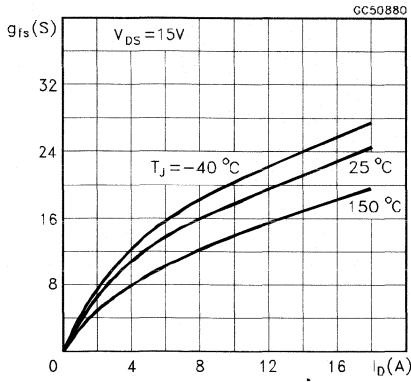
Output Characteristics



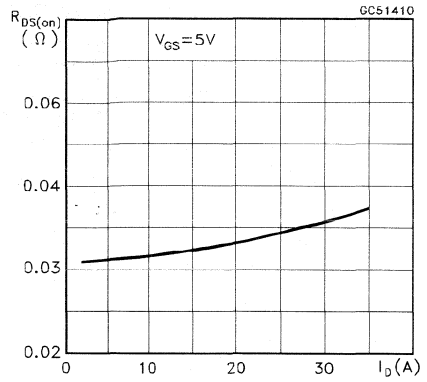
Transfer Characteristics



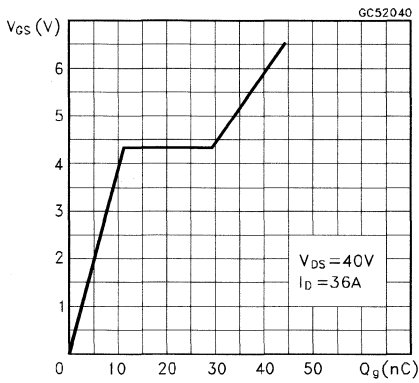
Transconductance



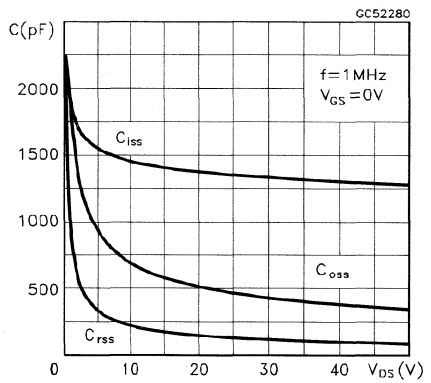
Static Drain-source On Resistance



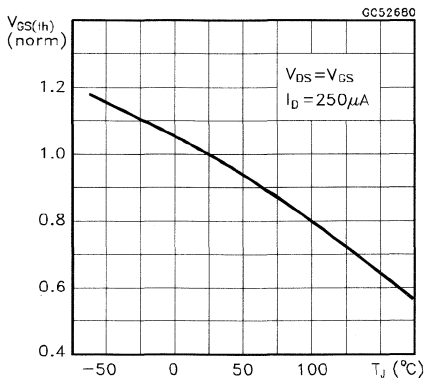
Gate Charge vs Gate-source Voltage



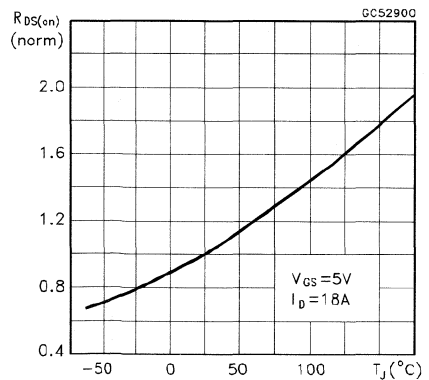
Capacitance Variations



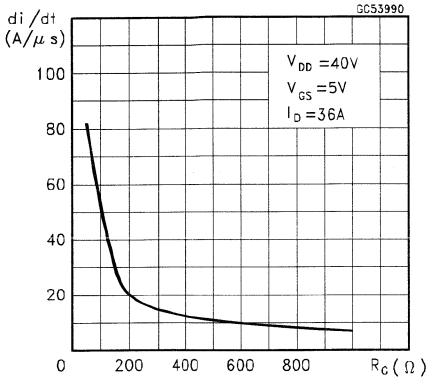
Normalized Gate Threshold Voltage vs Temperature



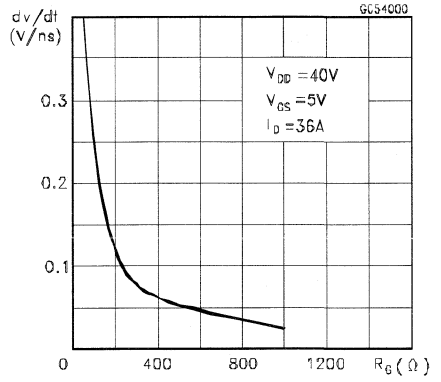
Normalized On Resistance vs Temperature



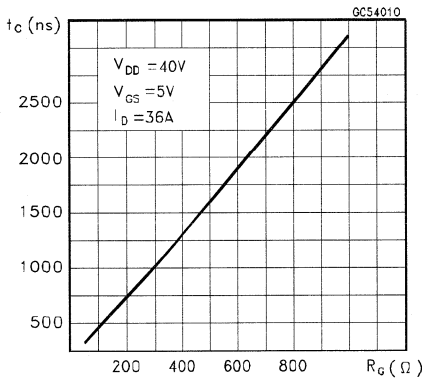
Turn-on Current Slope



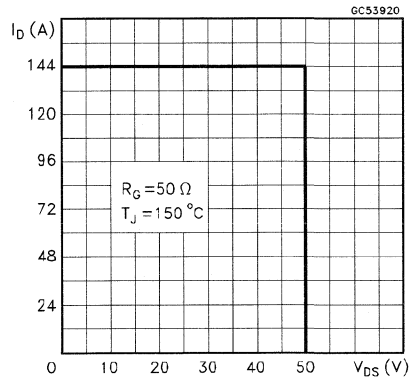
Turn-off Drain-source Voltage Slope



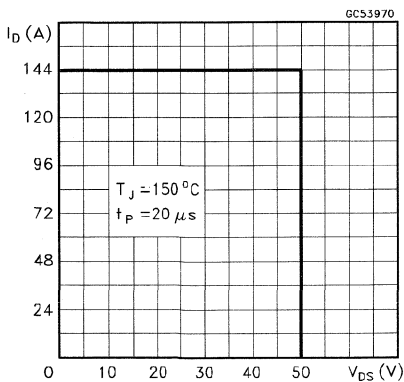
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

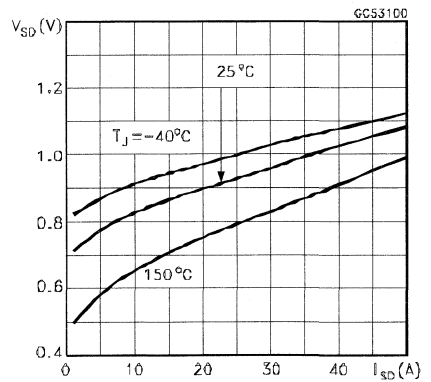


Fig. 1: Unclamped Inductive Load Test Circuits

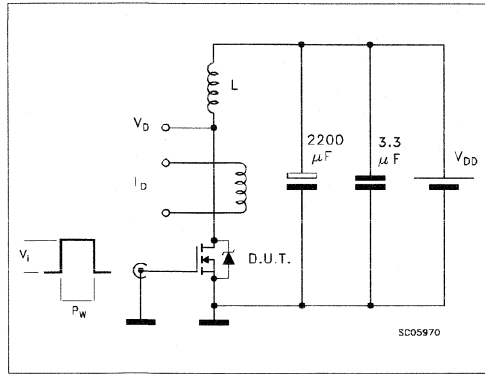


Fig. 2: Unclamped Inductive Waveforms

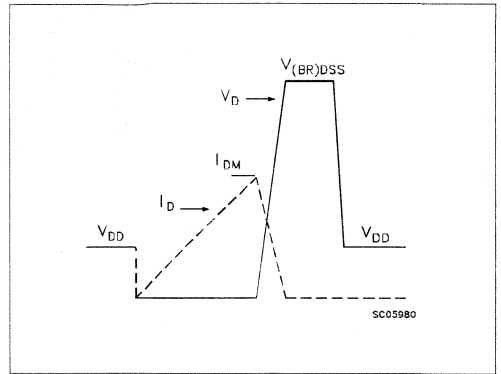


Fig. 3: Switching Times Test Circuits For Resistive Load

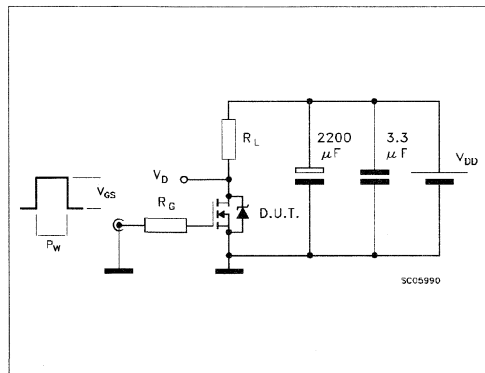


Fig. 4: Gate Charge Test Circuit

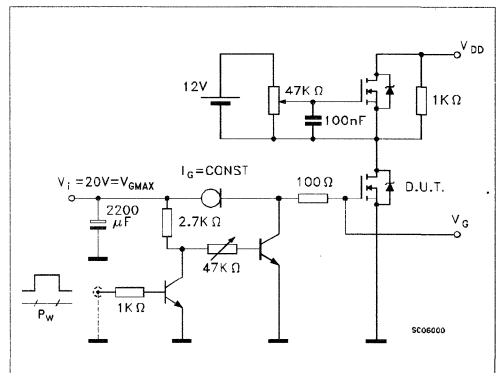
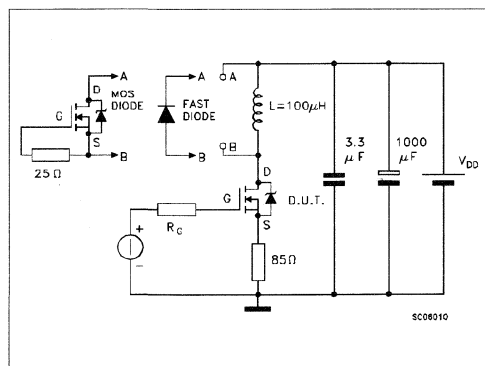


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



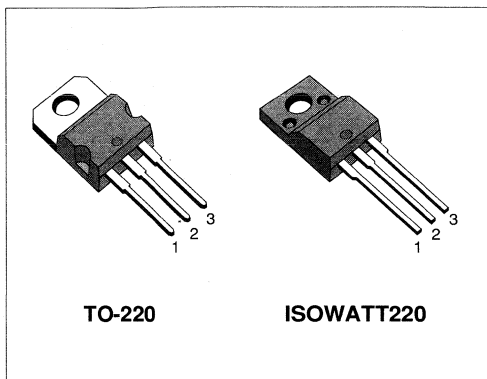
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP36N06	60 V	< 0.04 Ω	36 A
STP36N06FI	60 V	< 0.04 Ω	21 A

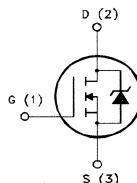
- TYPICAL R_{DS(on)} = 0.03 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP36N06	STP36N06FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	60		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	60		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	36	21	A
I _D	Drain Current (continuous) at T _c = 100 °C	25	14	A
I _{DM} (*)	Drain Current (pulsed)	144	144	A
P _{tot}	Total Dissipation at T _c = 25 °C	120	40	W
	Derating Factor	0.8	0.27	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

		TO-220	ISOWATT220		
$R_{thj-case}$	Thermal Resistance Junction-case	Max	1.25	3.75	$^{\circ}\text{C}/\text{W}$
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5		$^{\circ}\text{C}/\text{W}$
$R_{thc-sink}$	Thermal Resistance Case-sink	Typ	0.5		$^{\circ}\text{C}/\text{W}$
T_l	Maximum Lead Temperature For Soldering Purpose		300		$^{\circ}\text{C}$

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	36	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25^{\circ}\text{C}$, $I_D = I_{AR}$, $V_{DD} = 25\text{ V}$)	240	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	60	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100^{\circ}\text{C}$, pulse width limited by T_j max, $\delta < 1\%$)	25	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25^{\circ}\text{C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\ \mu\text{A}$ $V_{GS} = 0$	60			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^{\circ}\text{C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\ \mu\text{A}$	2	2.9	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 18\text{ A}$ $V_{GS} = 10\text{ V}$ $I_D = 18\text{ A}$ $T_c = 100^{\circ}\text{C}$		0.03	0.04 0.08	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	36			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 18\text{ A}$	12	16		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		1130	1500	pF
C_{oss}	Output Capacitance			480	650	pF
C_{rss}	Reverse Transfer Capacitance			140	200	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 25\text{ V}$ $I_D = 18\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		45 280	65 400	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 36\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		200		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 40\text{ V}$ $I_D = 36\text{ A}$ $V_{GS} = 10\text{ V}$		42 11 21	60	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$ t_f	Off-voltage Rise Time Fall Time	$V_{DD} = 40\text{ V}$ $I_D = 36\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		110 105	160 150	ns ns
t_c	Cross-over Time			220	310	ns

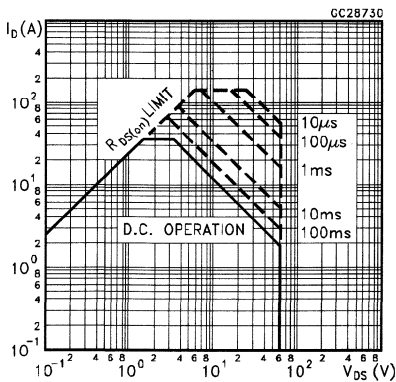
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				36 144	A A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 36\text{ A}$ $V_{GS} = 0$			1.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 36\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		90		ns
Q_{rr}	Reverse Recovery Charge			0.2		μ C
I_{RRM}	Reverse Recovery Current			4.5		A

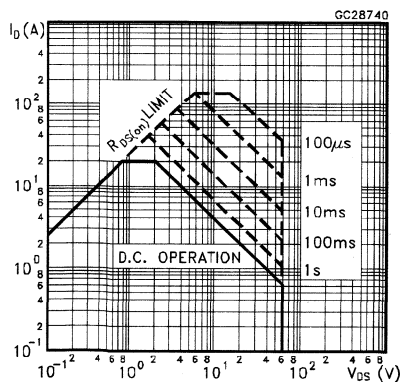
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

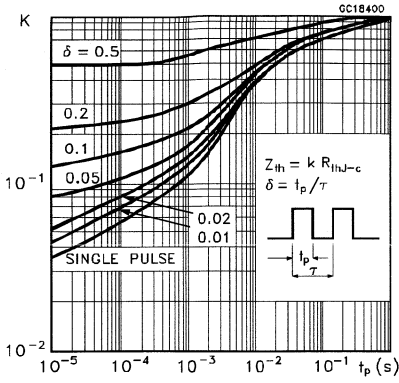
Safe Operating Areas For TO-220



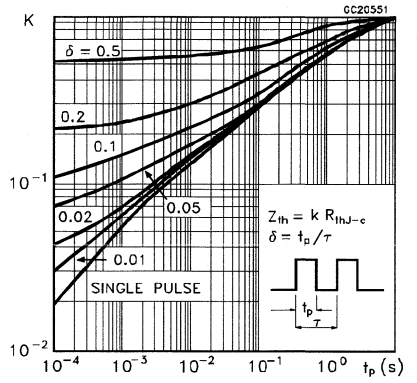
Safe Operating Areas For ISOWATT220



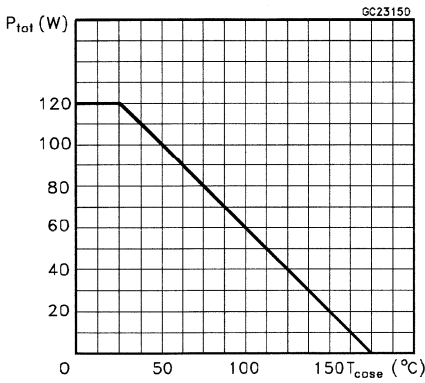
Thermal Impedance For TO-220



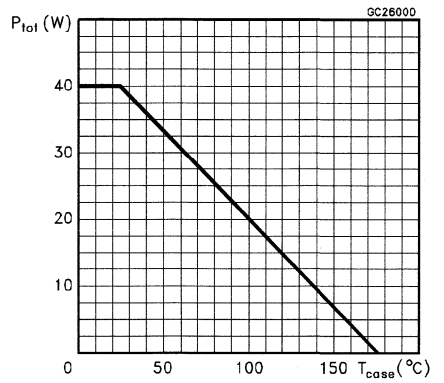
Thermal Impedance For ISOWATT220



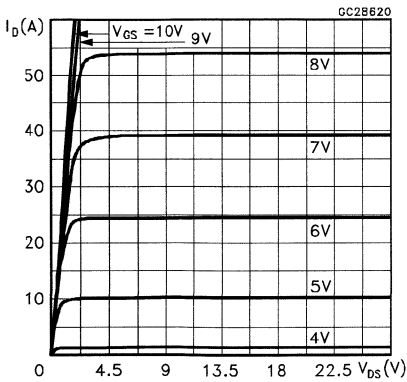
Derating Curve For TO-220



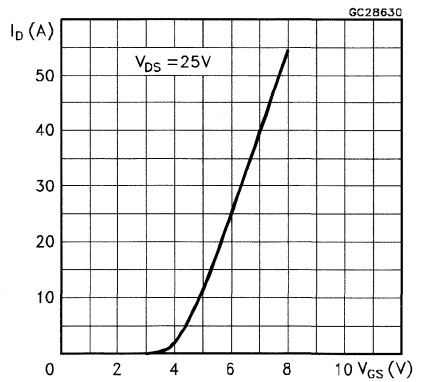
Derating Curve For ISOWATT220



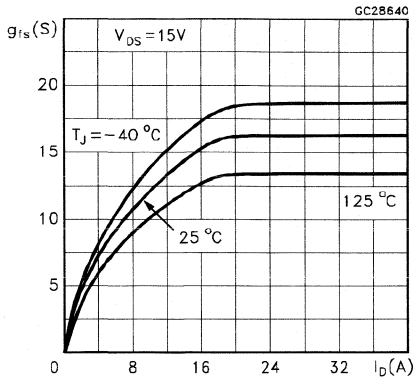
Output Characteristics



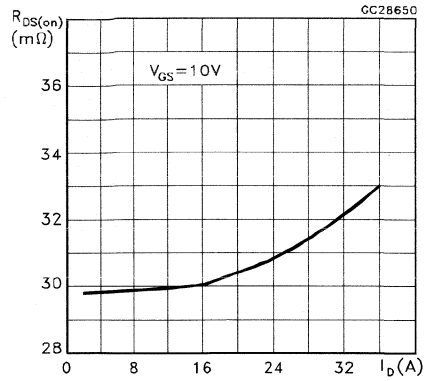
Transfer Characteristics



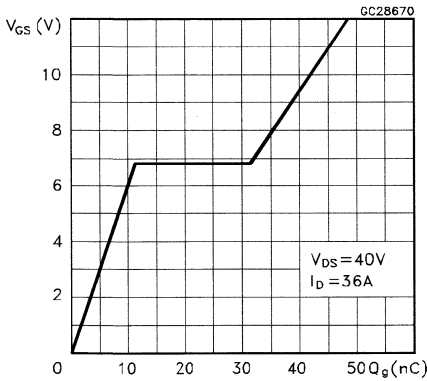
Transconductance



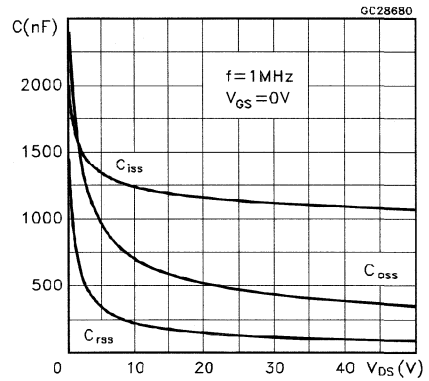
Static Drain-source On Resistance



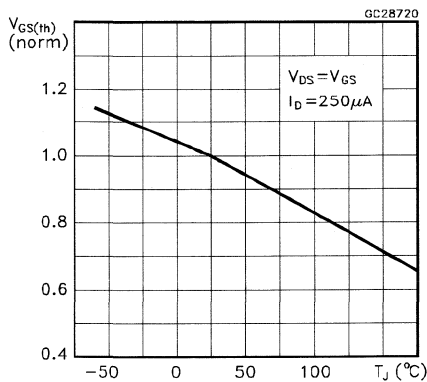
Gate Charge vs Gate-source Voltage



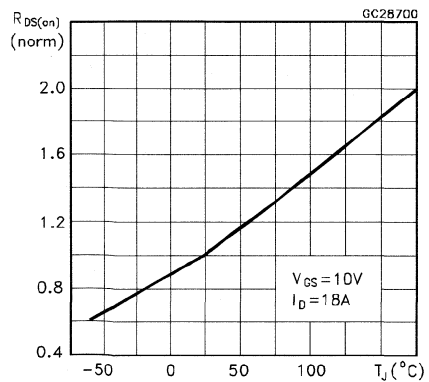
Capacitance Variations



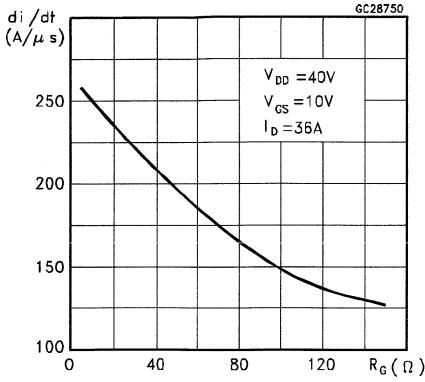
Normalized Gate Threshold Voltage vs Temperature



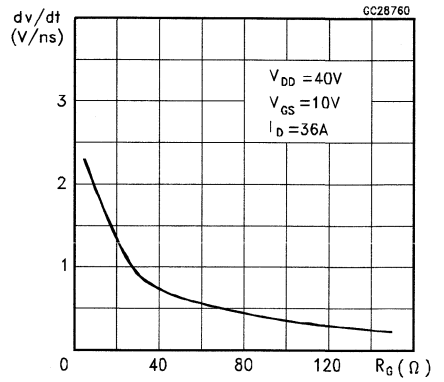
Normalized On Resistance vs Temperature



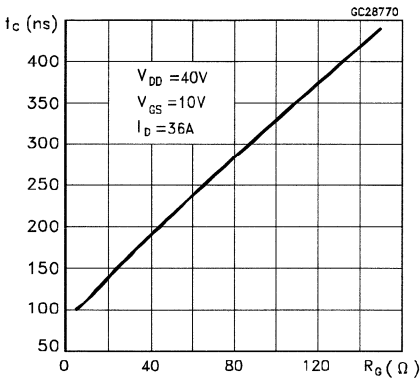
Turn-on Current Slope



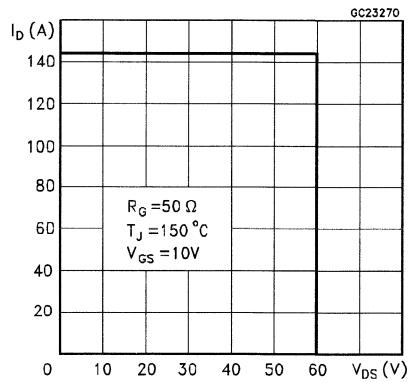
Turn-off Drain-source Voltage Slope



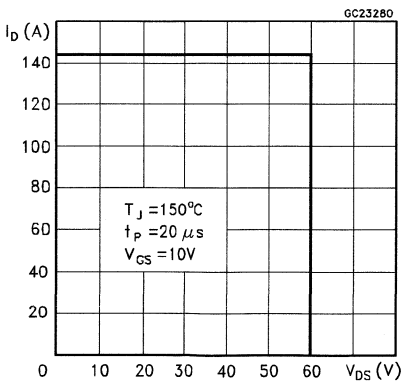
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

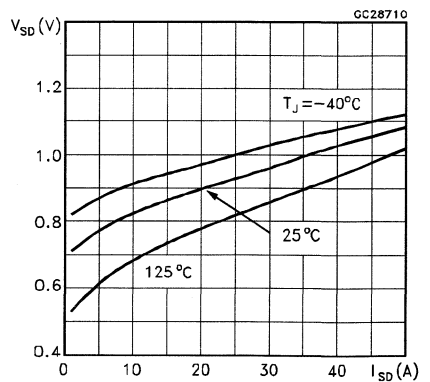


Fig. 1: Unclamped Inductive Load Test Circuits

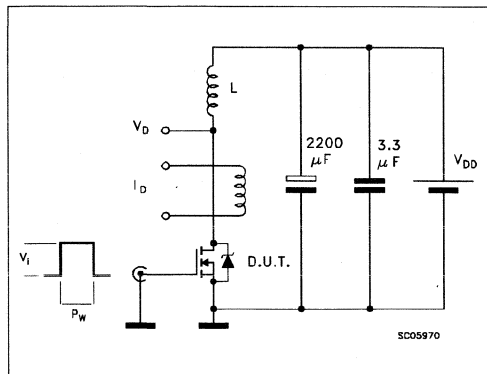


Fig. 2: Unclamped Inductive Waveforms

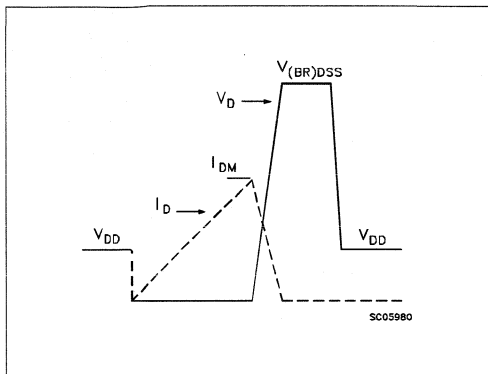


Fig. 3: Switching Times Test Circuits For Resistive Load

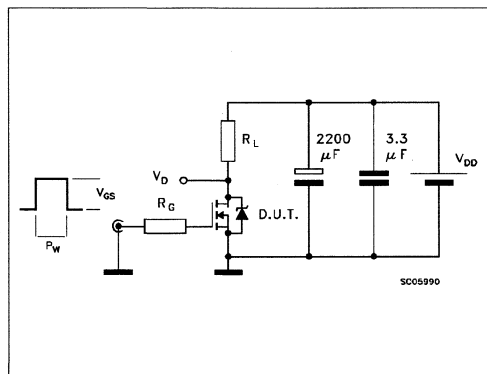


Fig. 4: Gate Charge Test Circuit

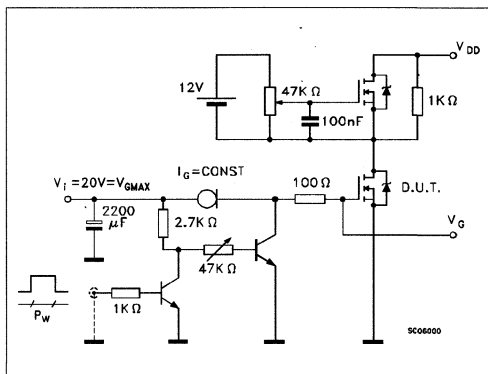
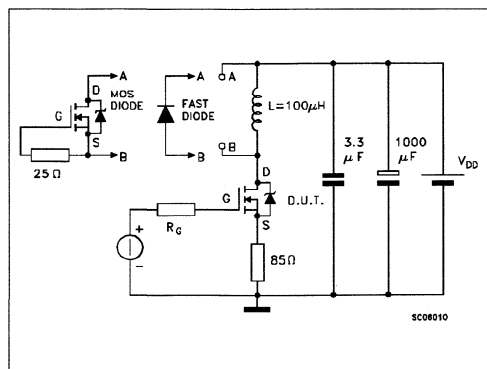


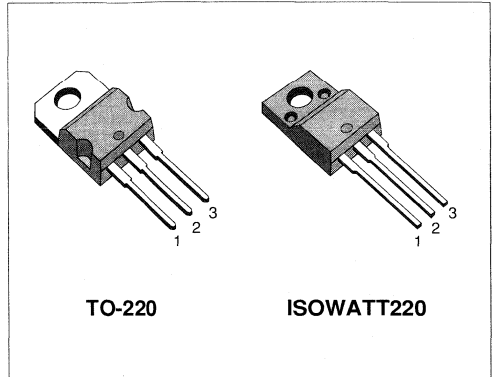
Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP36N05L	60 V	< 0.04 Ω	36 A
STP36N05LFI	60 V	< 0.04 Ω	21 A

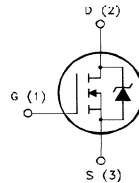
- TYPICAL R_{DS(on)} = 0.033 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- LOGIC LEVEL COMPATIBLE INPUT
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION



APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP36N06L	STP36N06LFI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	60		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	60		V
V _{GS}	Gate-source Voltage	± 15		V
I _D	Drain Current (continuous) at T _c = 25 °C	36	21	A
I _D	Drain Current (continuous) at T _c = 100 °C	25	14	A
I _{DM} (*)	Drain Current (pulsed)	144	144	A
P _{tot}	Total Dissipation at T _c = 25 °C	120	40	W
	Derating Factor	0.8	0.27	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

		TO-220	ISOWATT220	
$R_{thj-case}$	Thermal Resistance Junction-case Max	1.25	3.75	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient Max		62.5	°C/W
$R_{thc-sink}$	Thermal Resistance Case-sink Typ		0.5	°C/W
T_l	Maximum Lead Temperature For Soldering Purpose		300	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	36	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ °C}$, $I_D = I_{AR}$, $V_{DD} = 25\text{ V}$)	240	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	60	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ °C}$, pulse width limited by T_j max, $\delta < 1\%$)	25	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$	60			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 15\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\text{ }\mu\text{A}$	1	1.6	2.5	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 5\text{ V}$ $I_D = 18\text{ A}$ $V_{GS} = 5\text{ V}$ $I_D = 18\text{ A}$ $T_c = 100\text{ °C}$		0.033	0.04 0.08	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	36			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 18\text{ A}$	12	24		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		1350	1800	pF
C_{oss}	Output Capacitance			450	600	pF
C_{rss}	Reverse Transfer Capacitance			130	200	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 25\text{ V}$ $I_D = 18\text{ A}$		90	130	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 3)		550	800	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 36\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 5)		85		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 40\text{ V}$ $I_D = 36\text{ A}$ $V_{GS} = 5\text{ V}$		35	50	nC
Q_{gs}	Gate-Source Charge			11		nC
Q_{gd}	Gate-Drain Charge			19		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 36\text{ A}$		110	160	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$		180	260	ns
t_c	Cross-over Time	(see test circuit, figure 5)		310	450	ns

SOURCE DRAIN DIODE

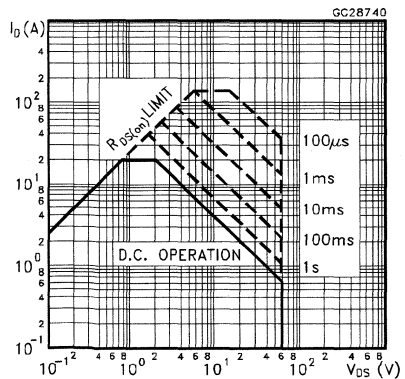
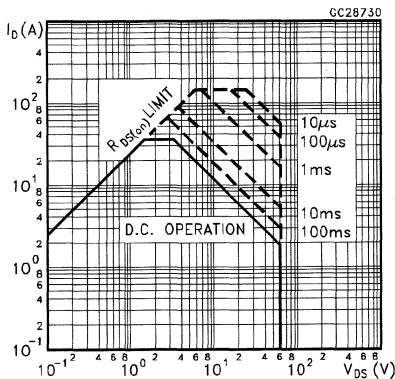
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				36	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				144	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 36\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 36\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_J = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		100		ns
Q_{rr}	Reverse Recovery Charge			0.27		μC
I_{RRM}	Reverse Recovery Current			5.5		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

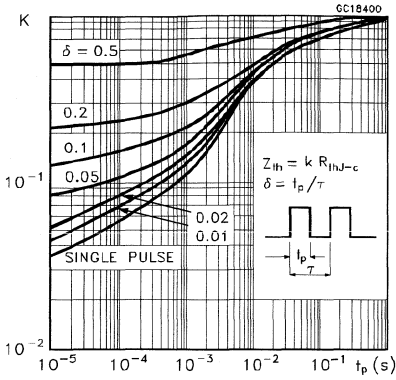
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

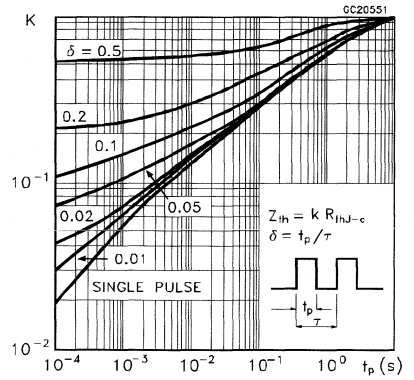
Safe Operating Areas For ISOWATT220



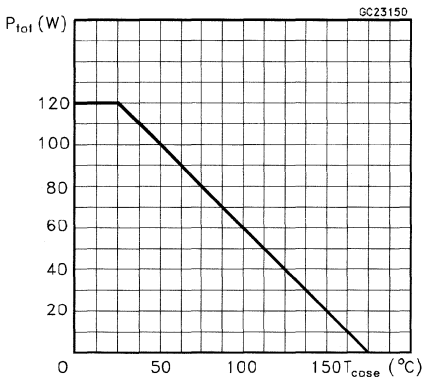
Thermal Impedance For TO-220



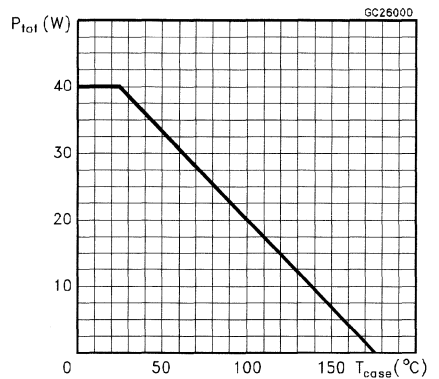
Thermal Impedance For ISOWATT220



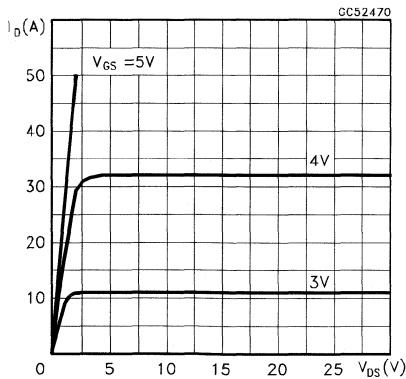
Derating Curve For TO-220



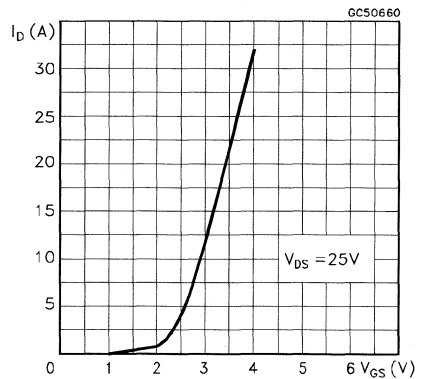
Derating Curve For ISOWATT220



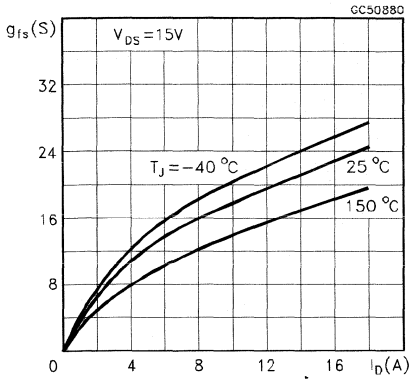
Output Characteristics



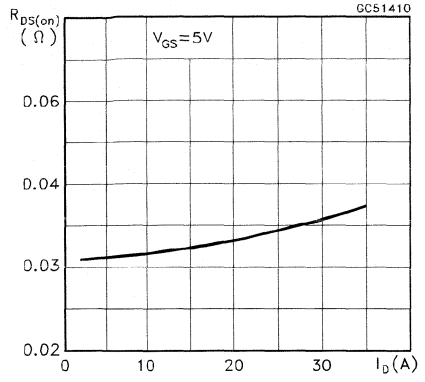
Transfer Characteristics



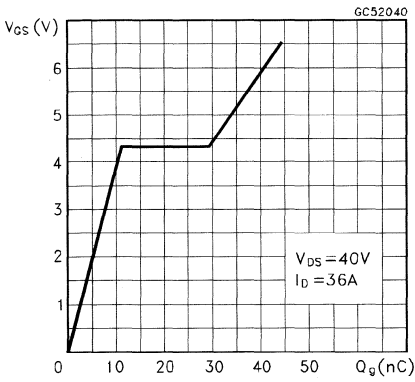
Transconductance



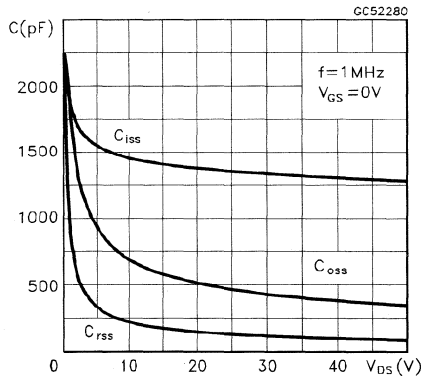
Static Drain-source On Resistance



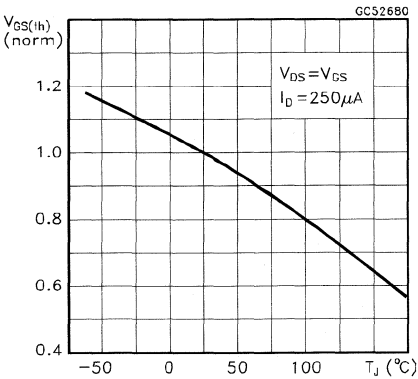
Gate Charge vs Gate-source Voltage



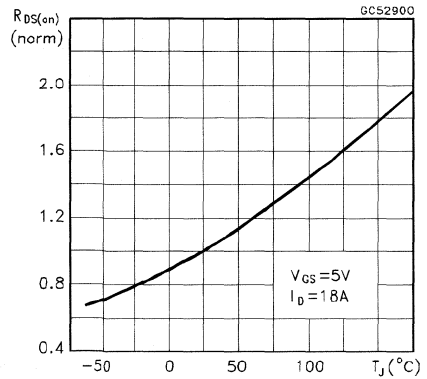
Capacitance Variations



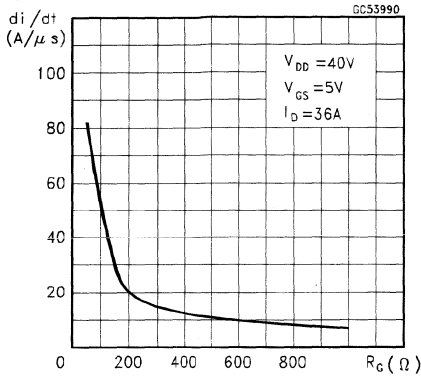
Normalized Gate Threshold Voltage vs Temperature



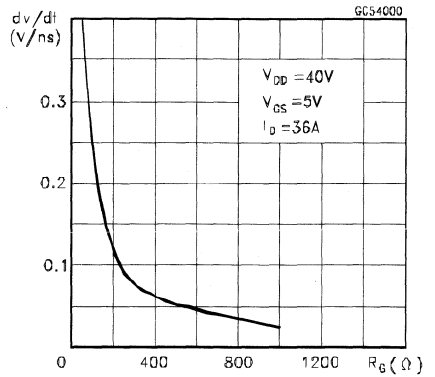
Normalized On Resistance vs Temperature



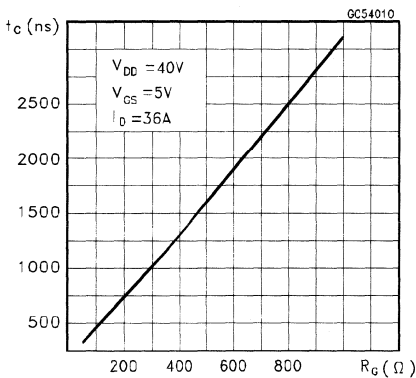
Turn-on Current Slope



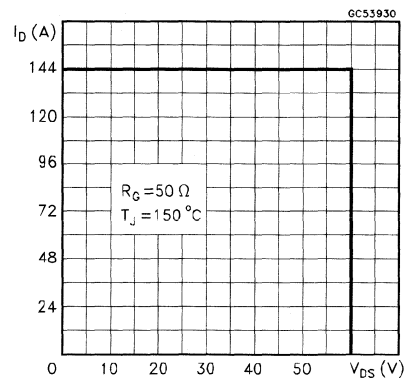
Turn-off Drain-source Voltage Slope



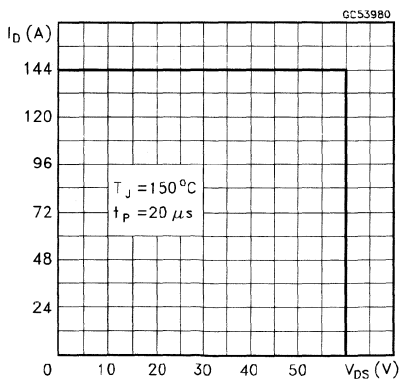
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

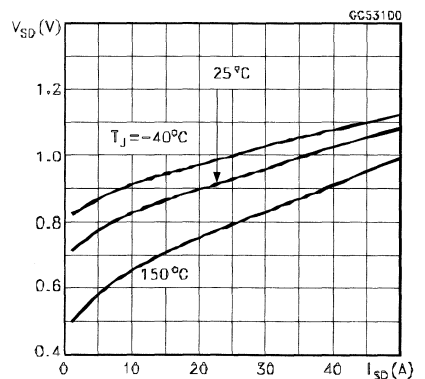


Fig. 1: Unclamped Inductive Load Test Circuits

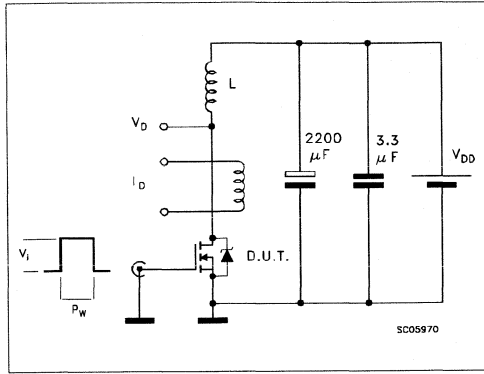


Fig. 2: Unclamped Inductive Waveforms

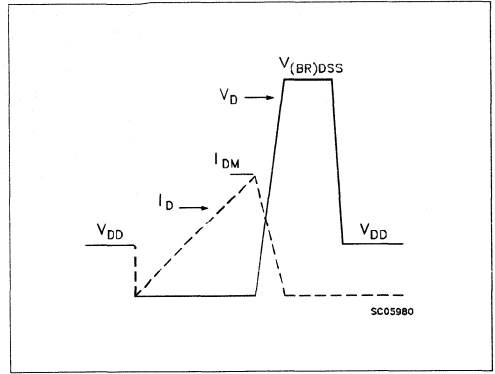


Fig. 3: Switching Times Test Circuits For Resistive Load

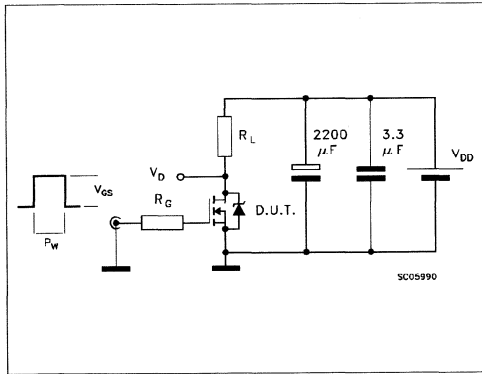


Fig. 4: Gate Charge Test Circuit

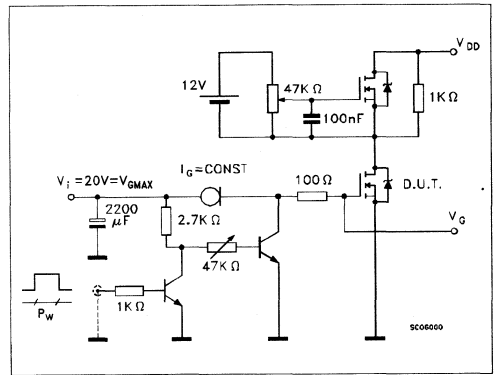
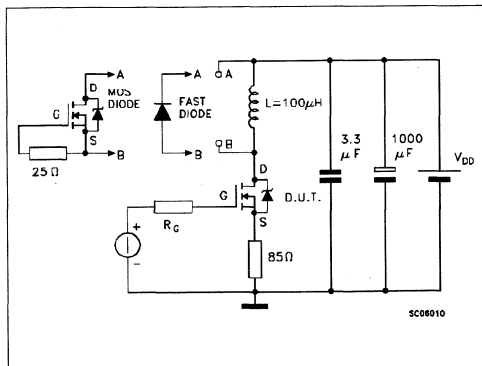


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



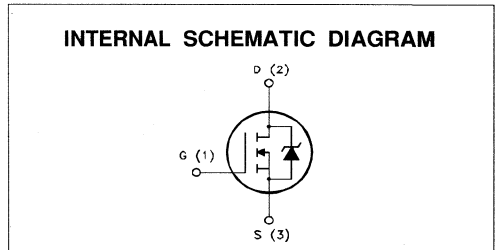
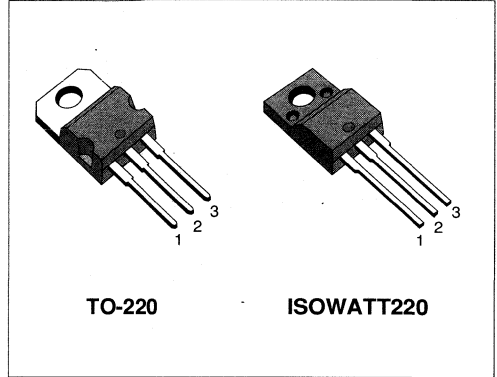
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP40N05	50 V	< 0.035 Ω	40 A
STP40N05FI	50 V	< 0.035 Ω	23 A

- TYPICAL R_{DS(on)} = 0.03 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP40N05	STP40N05FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	50		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	50		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	40	23	A
I _D	Drain Current (continuous) at T _c = 100 °C	28	16	A
I _{DM} (*)	Drain Current (pulsed)	160	160	A
P _{tot}	Total Dissipation at T _c = 25 °C	120	40	W
	Derating Factor	0.8	0.27	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
$R_{thj-case}$	Thermal Resistance Junction-case	Max	1.25	3.75	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5		°C/W
$R_{thc-sink}$	Thermal Resistance Case-sink	Typ	0.5		°C/W
T_l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	40	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ °C}$, $I_D = I_{AR}$, $V_{DD} = 25\text{ V}$)	300	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	75	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ °C}$, pulse width limited by T_j max, $\delta < 1\%$)	28	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$	50			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\text{ }\mu\text{A}$	2	2.9	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 20\text{ A}$ $V_{GS} = 10\text{ V}$ $I_D = 20\text{ A}$ $T_c = 100\text{ °C}$		0.03	0.035 0.07	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	40			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 20\text{ A}$	13	16		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		1130	1500	pF
C_{oss}	Output Capacitance			480	650	pF
C_{rss}	Reverse Transfer Capacitance			140	200	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 25\text{ V}$ $I_D = 20\text{ A}$		50	70	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		290	410	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 40\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		200		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 40\text{ V}$ $I_D = 40\text{ A}$ $V_{GS} = 10\text{ V}$		42	60	nC
Q_{gs}	Gate-Source Charge			11		nC
Q_{gd}	Gate-Drain Charge			21		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 40\text{ A}$		110	160	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		110	160	ns
t_c	Cross-over Time	(see test circuit, figure 5)		230	330	ns

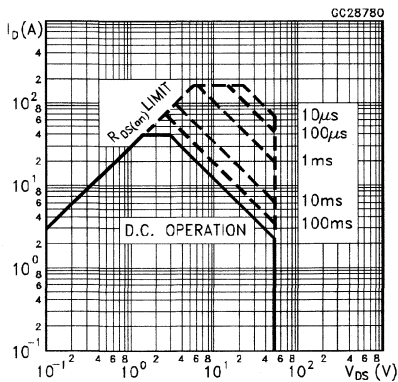
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				40	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				160	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 40\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 40\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		90		ns
Q_{rr}	Reverse Recovery Charge			0.2		μ C
I_{RRM}	Reverse Recovery Current			4.5		A

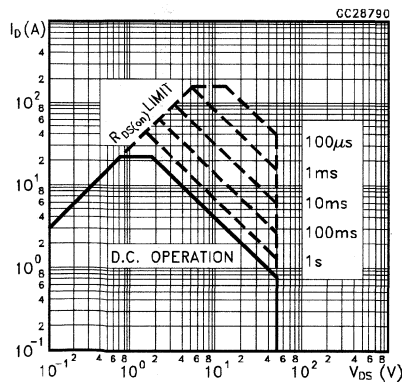
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

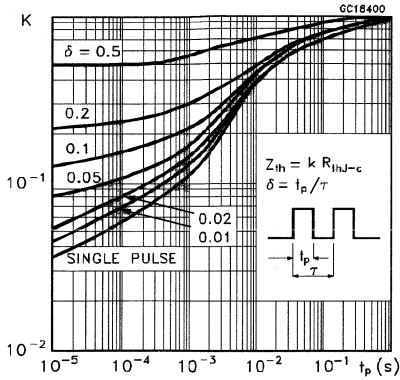
Safe Operating Areas For TO-220



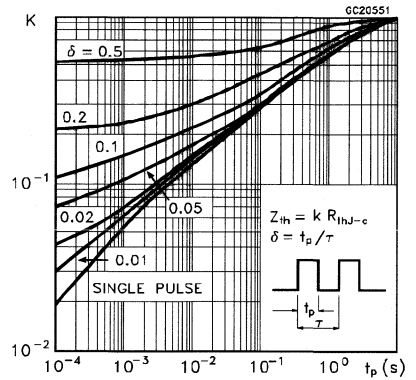
Safe Operating Areas For ISOWATT220



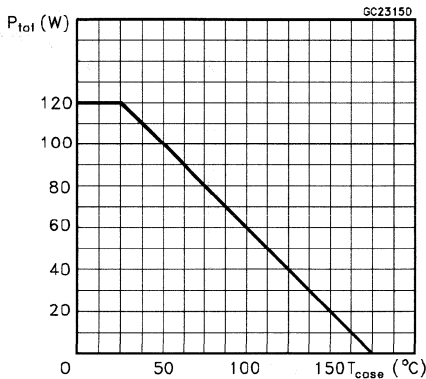
Thermal Impedance For TO-220



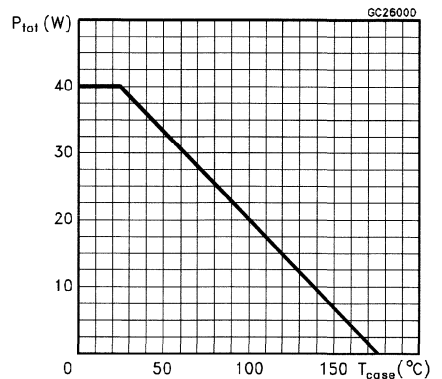
Thermal Impedance For ISOWATT220



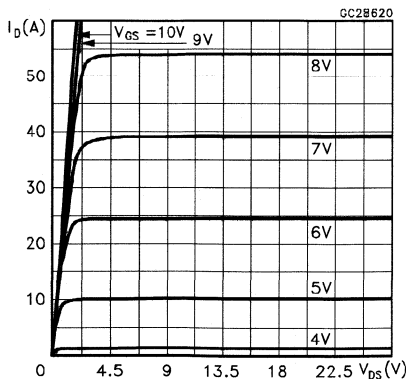
Derating Curve For TO-220



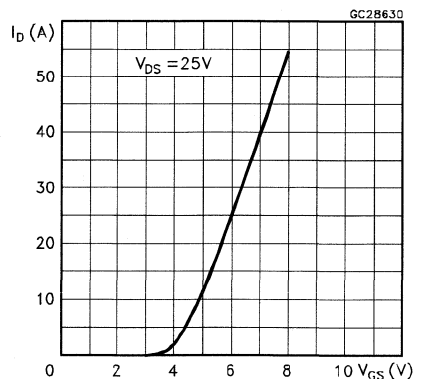
Derating Curve For ISOWATT220



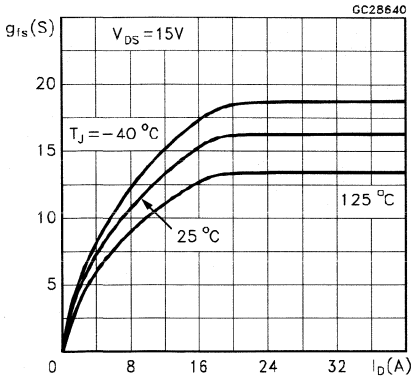
Output Characteristics



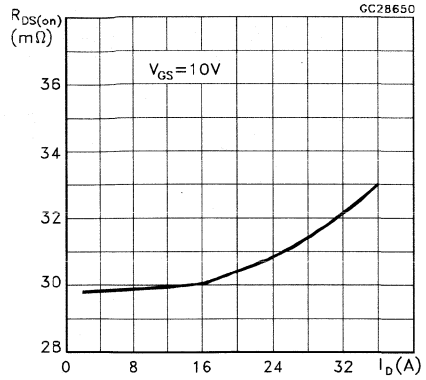
Transfer Characteristics



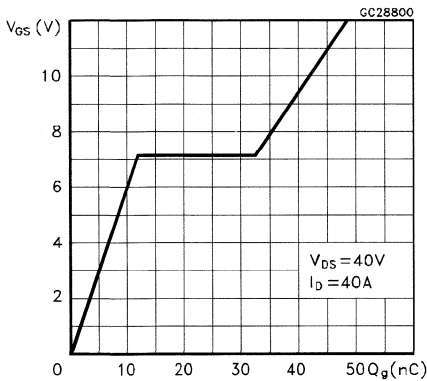
Transconductance



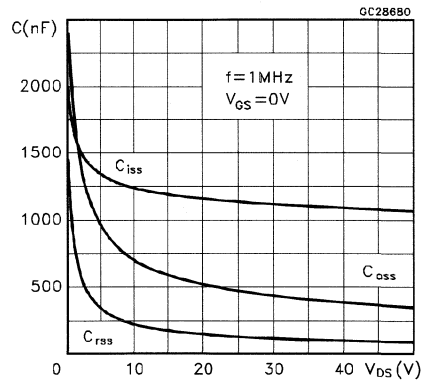
Static Drain-source On Resistance



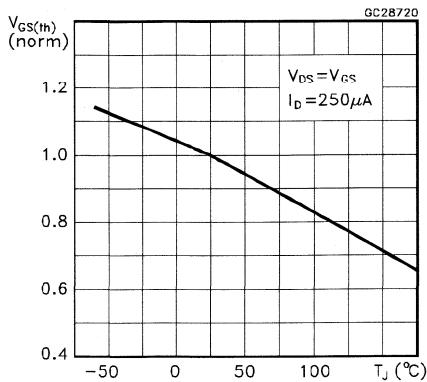
Gate Charge vs Gate-source Voltage



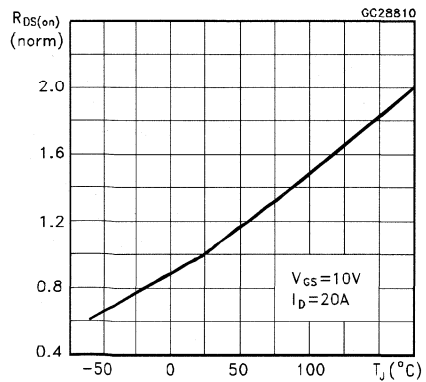
Capacitance Variations



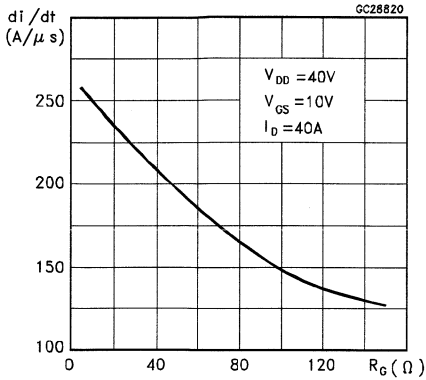
Normalized Gate Threshold Voltage vs Temperature



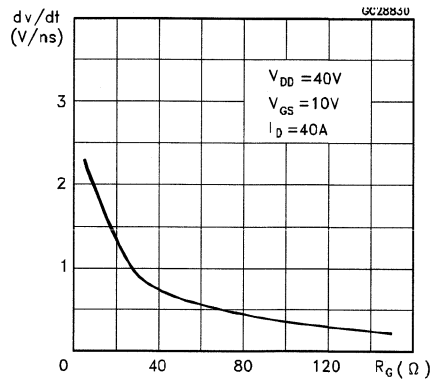
Normalized On Resistance vs Temperature



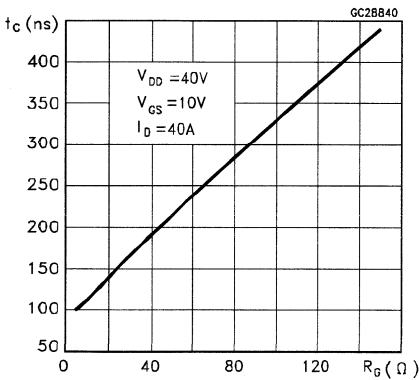
Turn-on Current Slope



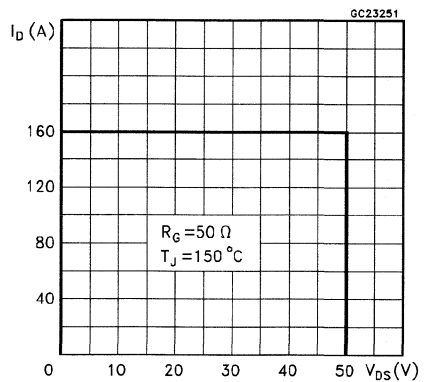
Turn-off Drain-source Voltage Slope



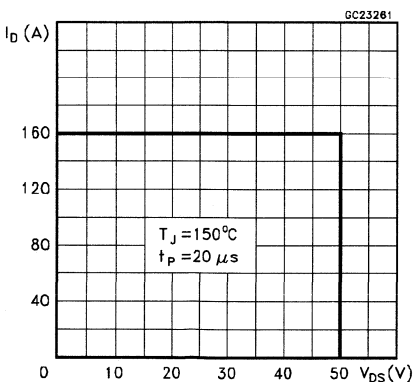
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

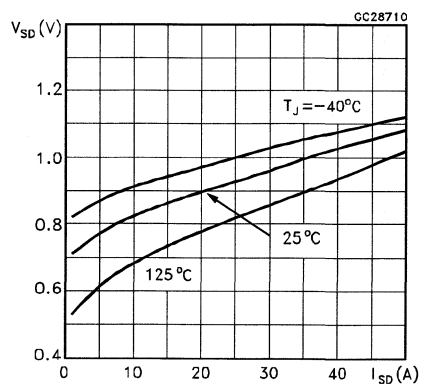


Fig. 1: Unclamped Inductive Load Test Circuits

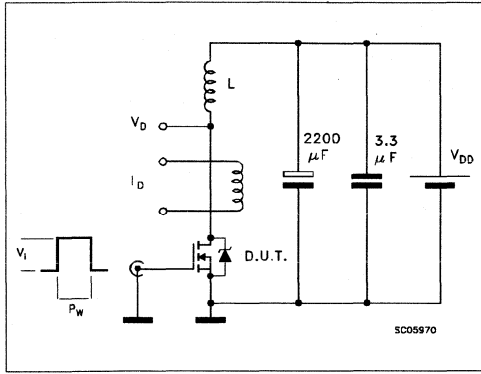


Fig. 2: Unclamped Inductive Waveforms

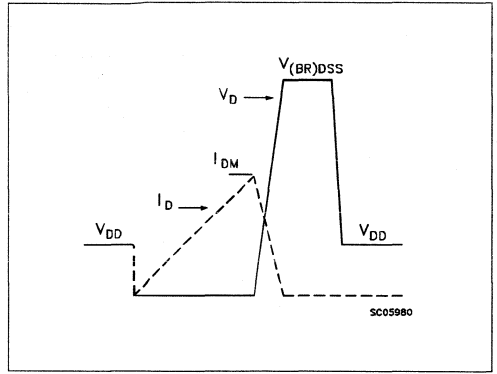


Fig. 3: Switching Times Test Circuits For Resistive Load

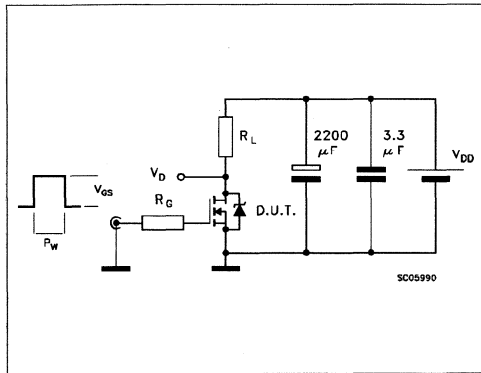


Fig. 4: Gate Charge Test Circuit

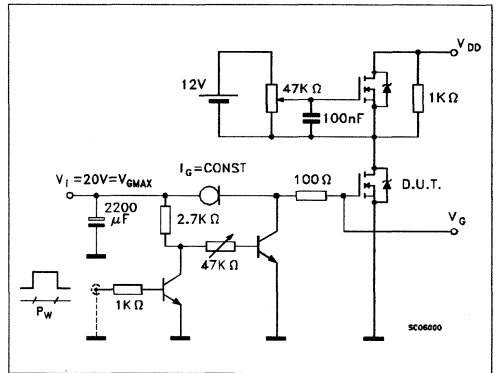
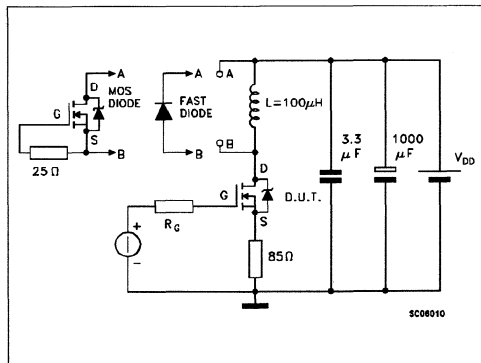


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



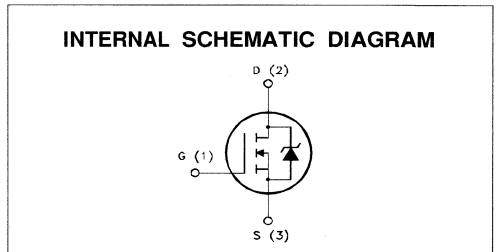
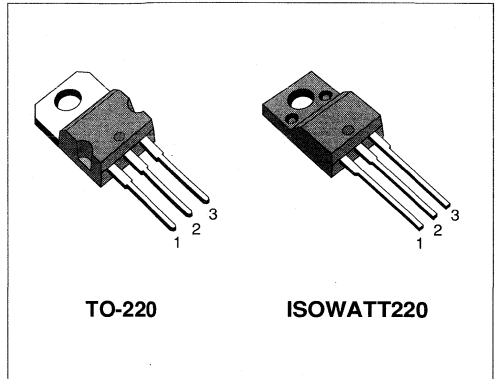
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP40N06	60 V	< 0.035 Ω	40 A
STP40N06FI	60 V	< 0.035 Ω	23 A

- TYPICAL R_{DS(on)} = 0.03 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP40N06	STP40N06FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	60		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	60		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	40	23	A
I _D	Drain Current (continuous) at T _c = 100 °C	28	16	A
I _{DM} (*)	Drain Current (pulsed)	160	160	A
P _{tot}	Total Dissipation at T _c = 25 °C	120	40	W
	Derating Factor	0.8	0.27	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
$R_{thj-case}$	Thermal Resistance Junction-case	Max	1.25	3.75	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5		°C/W
$R_{thc-sink}$	Thermal Resistance Case-sink	Typ	0.5		°C/W
T_l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	40	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ °C}$, $I_D = I_{AR}$, $V_{DD} = 25\text{ V}$)	300	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	75	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ °C}$, pulse width limited by T_j max, $\delta < 1\%$)	28	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$	60			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\text{ }\mu\text{A}$	2	2.9	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 20\text{ A}$ $V_{GS} = 10\text{ V}$ $I_D = 20\text{ A}$ $T_c = 100\text{ °C}$		0.03	0.035 0.07	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	40			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 20\text{ A}$	13	16		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		1130	1500	pF
C_{oss}	Output Capacitance			480	650	pF
C_{rss}	Reverse Transfer Capacitance			140	200	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 25\text{ V}$ $I_D = 20\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		50 290	70 410	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 40\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		200		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 40\text{ V}$ $I_D = 40\text{ A}$ $V_{GS} = 10\text{ V}$		42 11 21	60	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 40\text{ A}$		110	160	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		110	160	ns
t_c	Cross-over Time	(see test circuit, figure 5)		230	330	ns

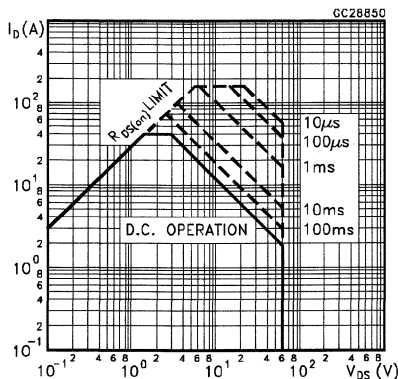
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				40 160	A A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 40\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 40\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		90		ns
Q_{rr}	Reverse Recovery Charge			0.2		μ C
I_{RRM}	Reverse Recovery Current			4.5		A

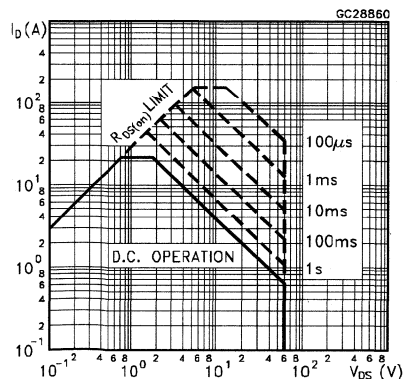
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

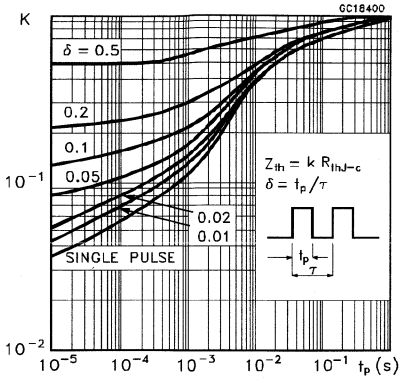
Safe Operating Areas For TO-220



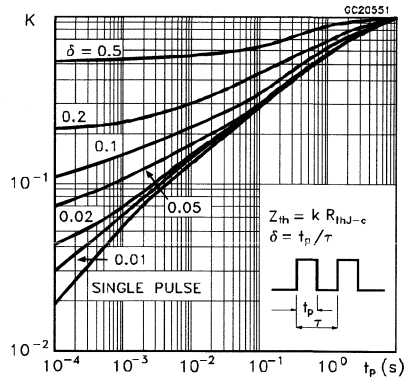
Safe Operating Areas For ISOWATT220



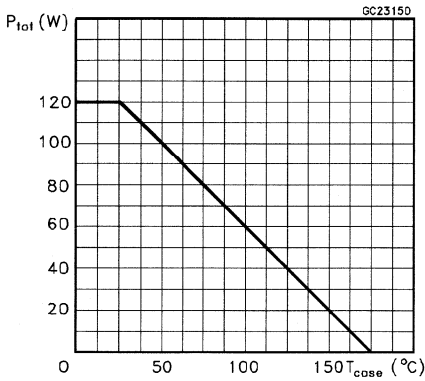
Thermal Impedance For TO-220



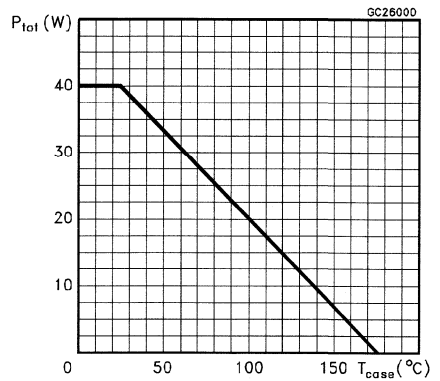
Thermal Impedance For ISOWATT220



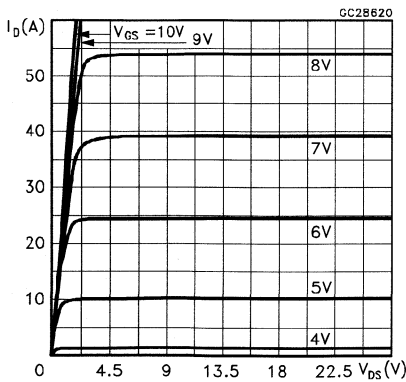
Derating Curve For TO-220



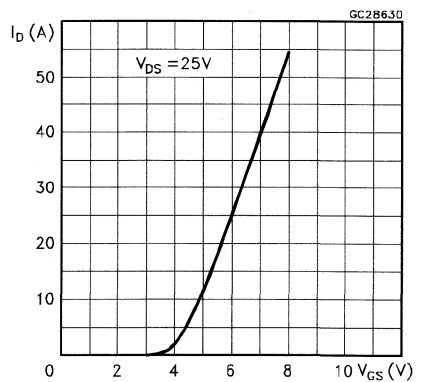
Derating Curve For ISOWATT220



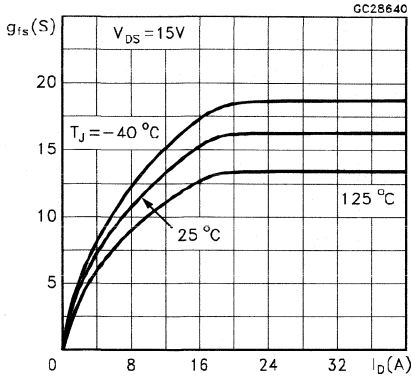
Output Characteristics



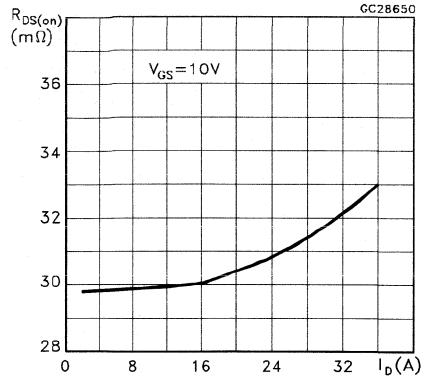
Transfer Characteristics



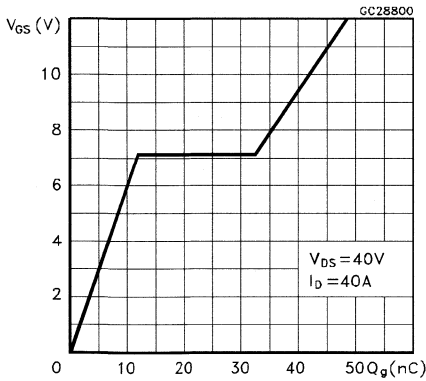
Transconductance



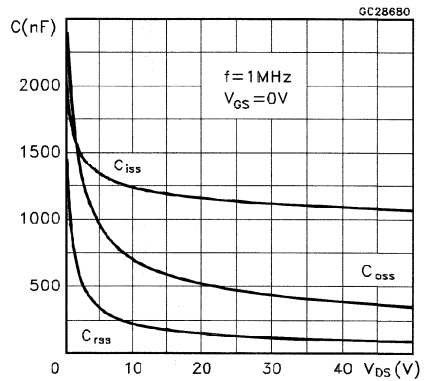
Static Drain-source On Resistance



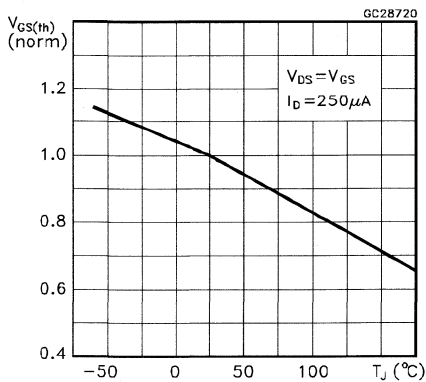
Gate Charge vs Gate-source Voltage



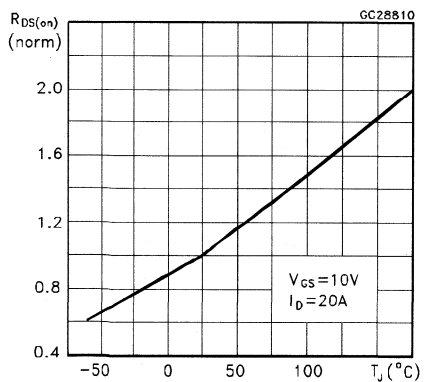
Capacitance Variations



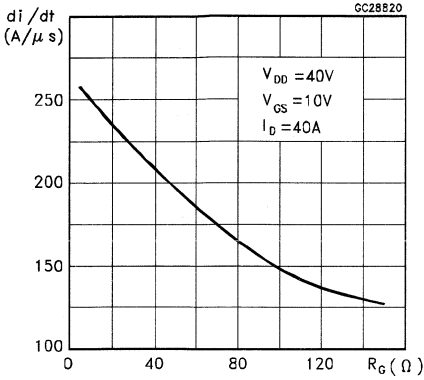
Normalized Gate Threshold Voltage vs Temperature



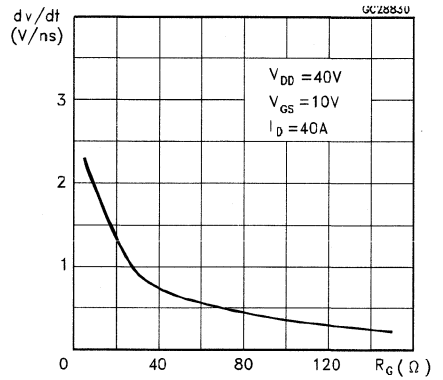
Normalized On Resistance vs Temperature



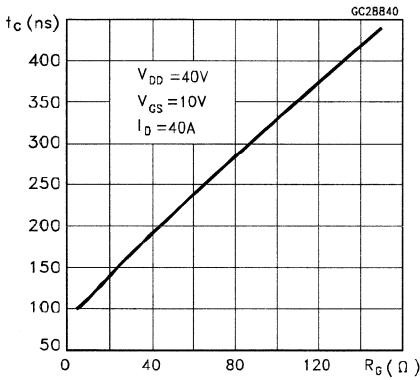
Turn-on Current Slope



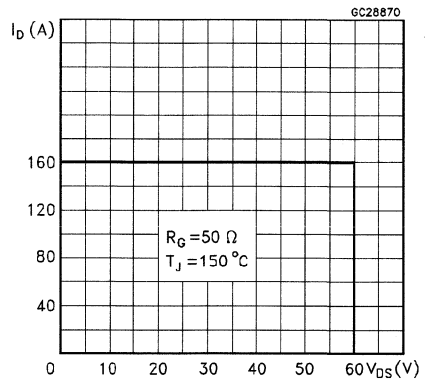
Turn-off Drain-source Voltage Slope



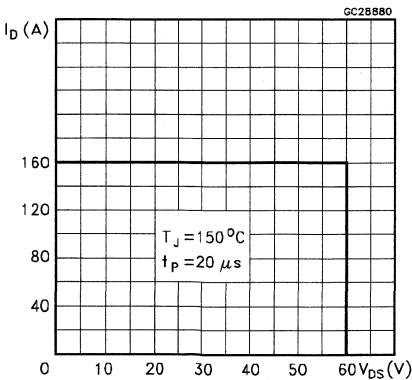
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

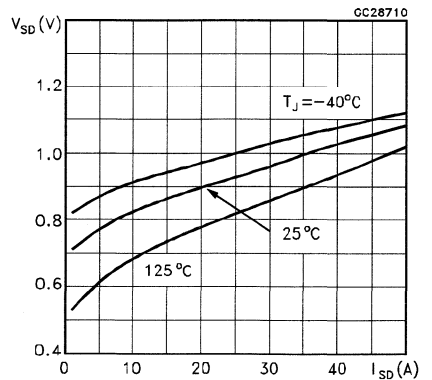


Fig. 1: Unclamped Inductive Load Test Circuits

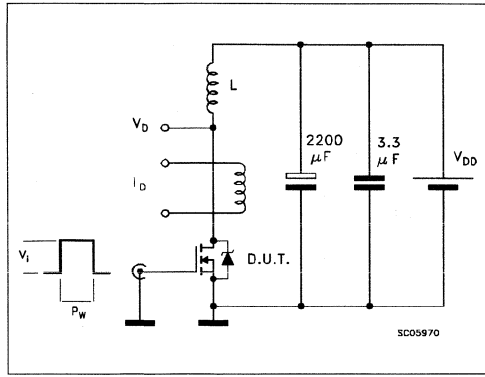


Fig. 2: Unclamped Inductive Waveforms

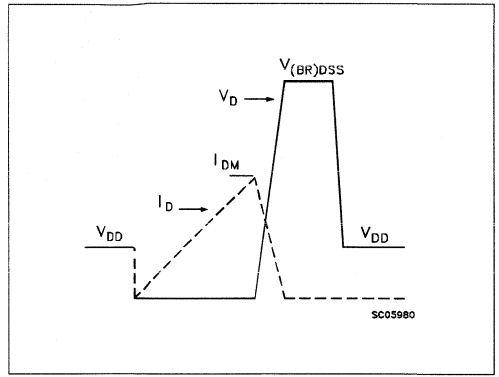


Fig. 3: Switching Times Test Circuits For Resistive Load

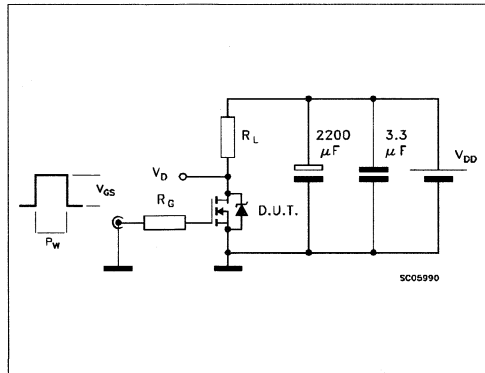


Fig. 4: Gate Charge Test Circuit

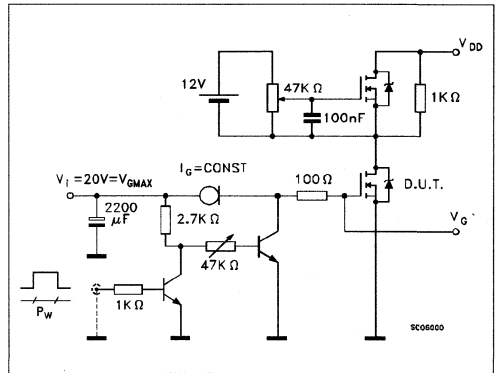
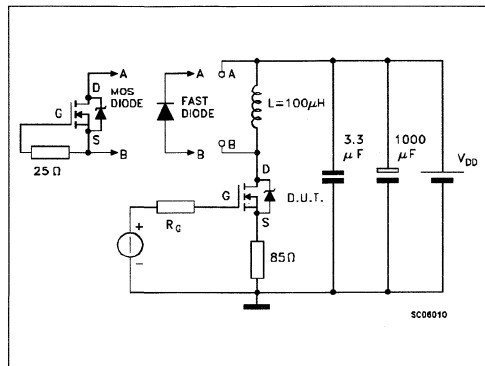


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



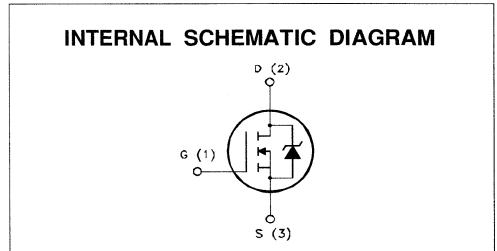
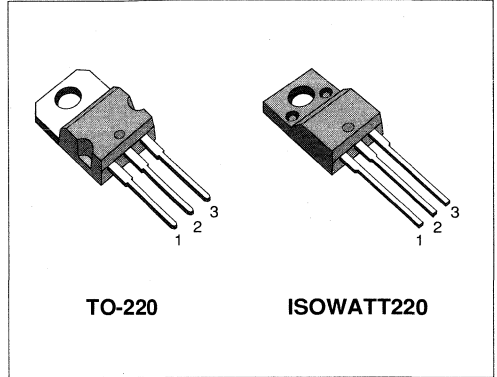
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP40N10	100 V	< 0.04 Ω	40 A
STP40N10FI	100 V	< 0.04 Ω	22 A

- TYPICAL R_{DS(on)} = 0.035 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP40N10	STP40N10FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	100		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	100		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	40	22	A
I _D	Drain Current (continuous) at T _c = 100 °C	28	15	A
I _{DM} (*)	Drain Current (pulsed)	160	160	A
P _{tot}	Total Dissipation at T _c = 25 °C	150	45	W
	Derating Factor	1	0.3	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
$R_{thj-case}$	Thermal Resistance Junction-case	Max	1	3.33	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5		°C/W
$R_{thc-sink}$	Thermal Resistance Case-sink	Typ	0.5		°C/W
T_l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	40	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 25\text{ V}$)	210	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	50	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100^\circ\text{C}$, pulse width limited by T_j max, $\delta < 1\%$)	28	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25^\circ\text{C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\ \mu\text{A}$ $V_{GS} = 0$	100			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^\circ\text{C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\ \mu\text{A}$	2	2.9	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 20\text{ A}$ $V_{GS} = 10\text{ V}$ $I_D = 20\text{ A}$ $T_c = 100^\circ\text{C}$		0.035	0.04 0.08	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	40			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 20\text{ A}$	14	25		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		2150	2800	pF
C_{oss}	Output Capacitance			600	800	pF
C_{rss}	Reverse Transfer Capacitance			150	200	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 80\text{ V}$ $I_D = 20\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		20 130	30 190	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 80\text{ V}$ $I_D = 40\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		500		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 80\text{ V}$ $I_D = 40\text{ A}$ $V_{GS} = 10\text{ V}$		70 12 30	100	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(off)}$ t_f	Off-voltage Rise Time Fall Time	$V_{DD} = 80\text{ V}$ $I_D = 40\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$		50 70	70 100	ns ns
t_c	Cross-over Time	(see test circuit, figure 5)		140	200	ns

SOURCE DRAIN DIODE

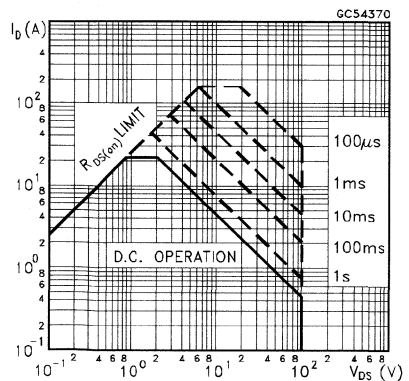
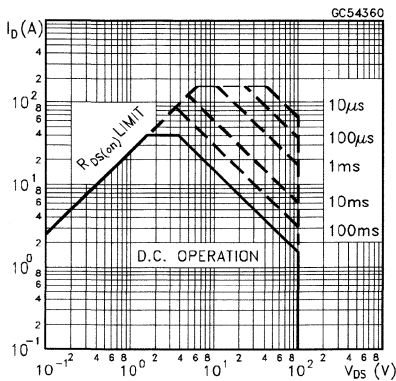
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				40 160	A A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 40\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 40\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		130		ns
Q_{rr}	Reverse Recovery Charge			0.65		μ C
I_{RRM}	Reverse Recovery Current			10		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

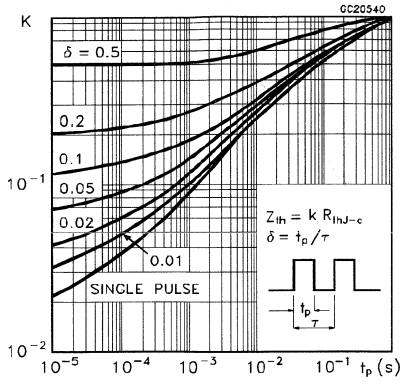
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

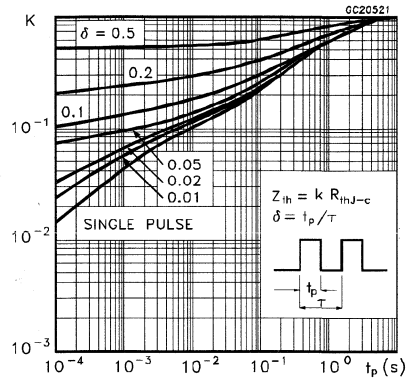
Safe Operating Areas For ISOWATT220



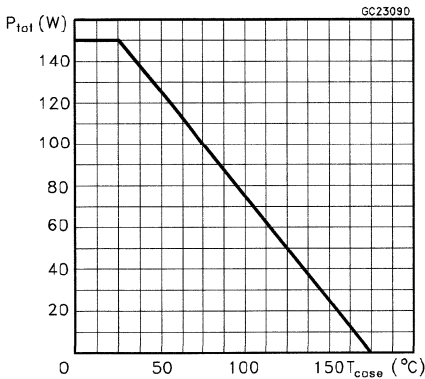
Thermal Impedance For TO-220



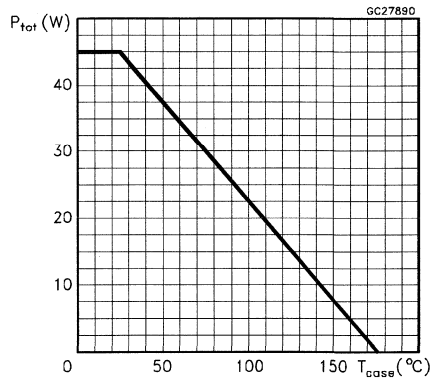
Thermal Impedance For ISOWATT220



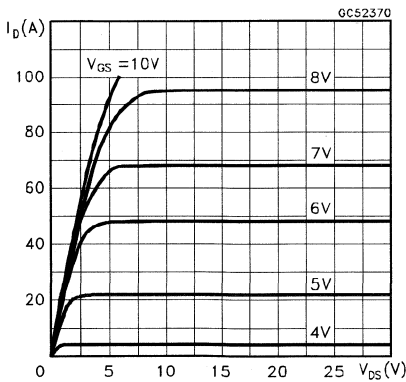
Derating Curve For TO-220



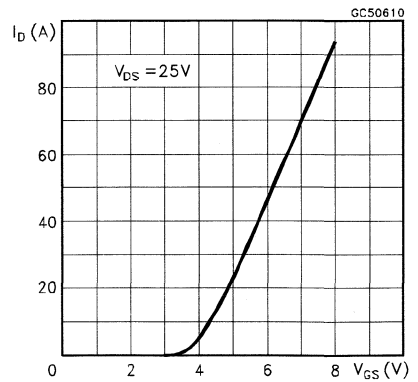
Derating Curve For ISOWATT220



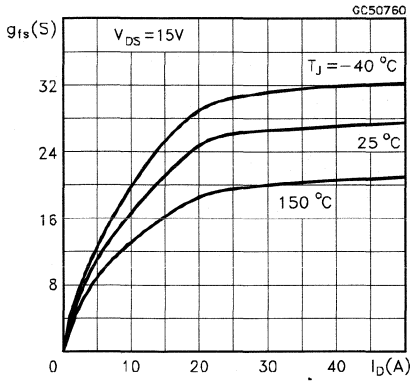
Output Characteristics



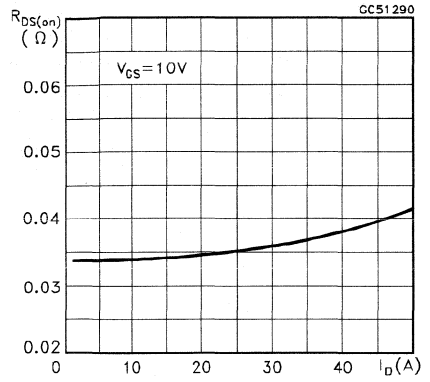
Transfer Characteristics



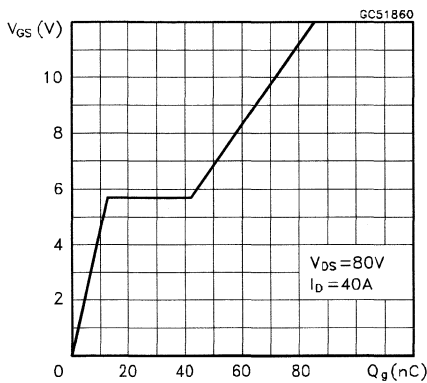
Transconductance



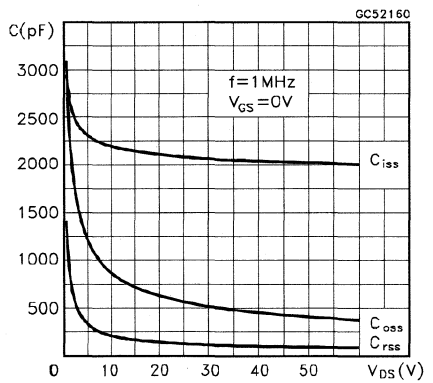
Static Drain-source On Resistance



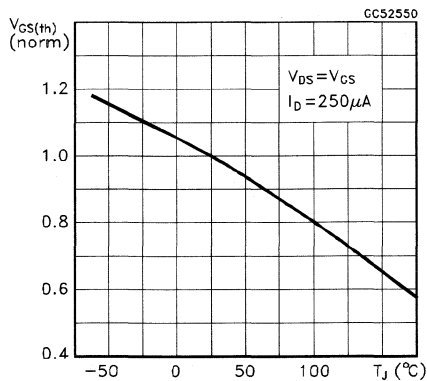
Gate Charge vs Gate-source Voltage



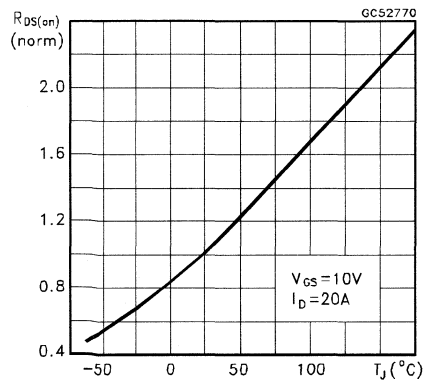
Capacitance Variations



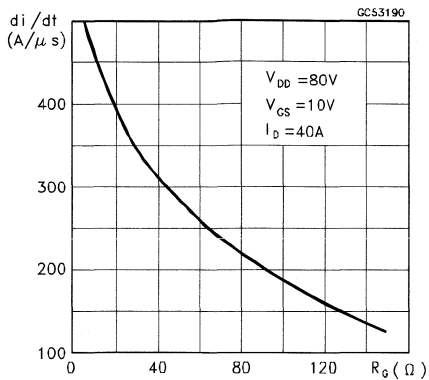
Normalized Gate Threshold Voltage vs Temperature



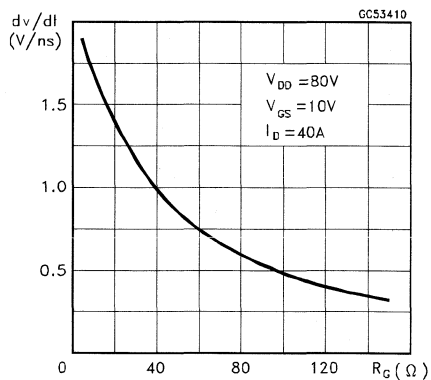
Normalized On Resistance vs Temperature



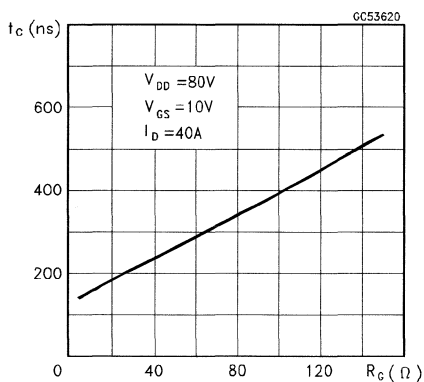
Turn-on Current Slope



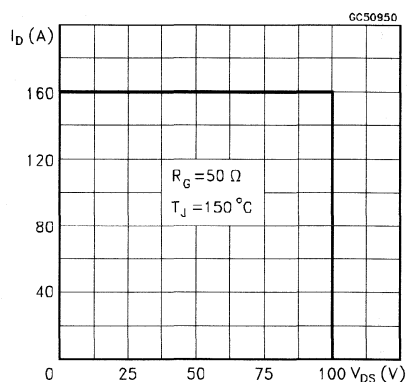
Turn-off Drain-source Voltage Slope



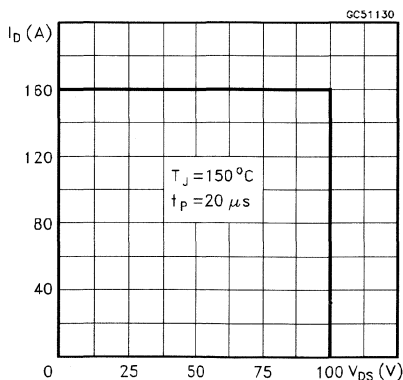
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

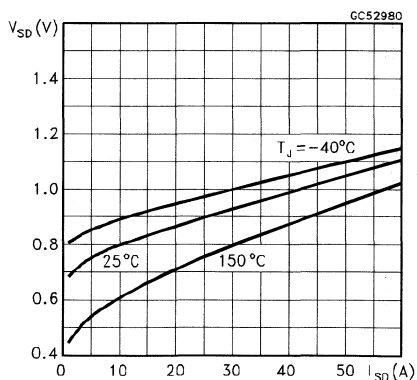


Fig. 1: Unclamped Inductive Load Test Circuits

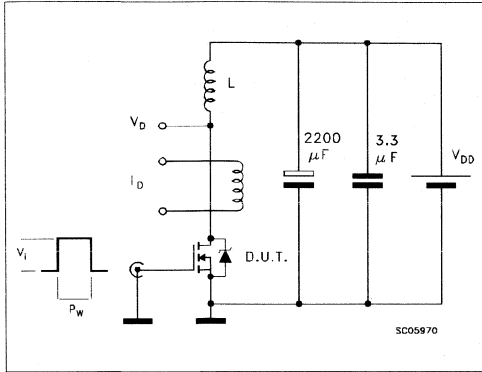


Fig. 2: Unclamped Inductive Waveforms

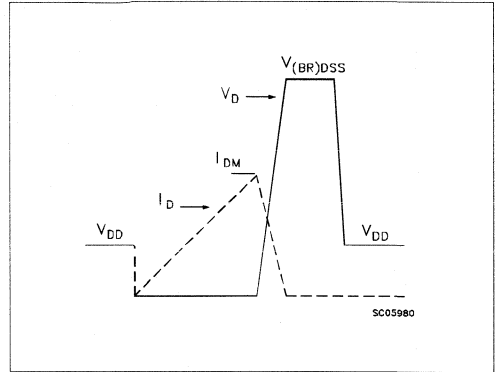


Fig. 3: Switching Times Test Circuits For Resistive Load

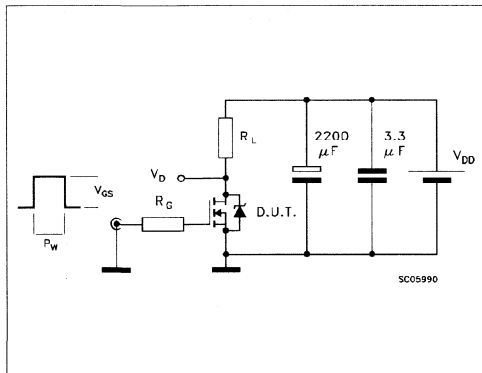


Fig. 4: Gate Charge Test Circuit

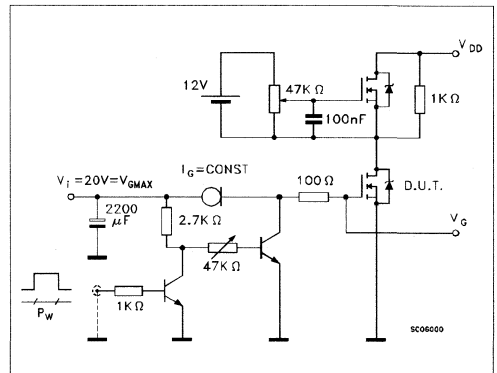
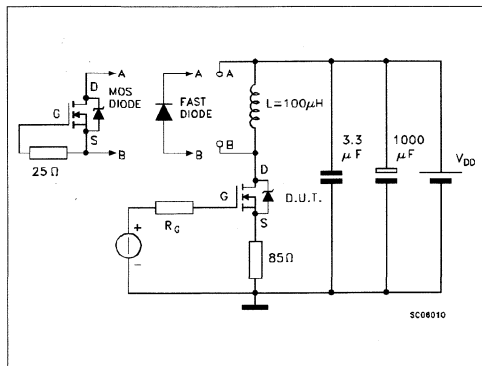


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time





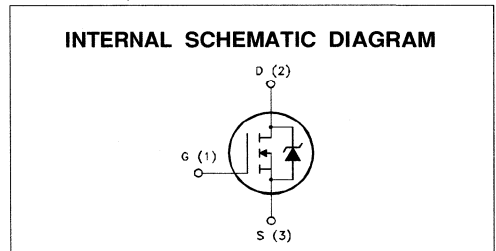
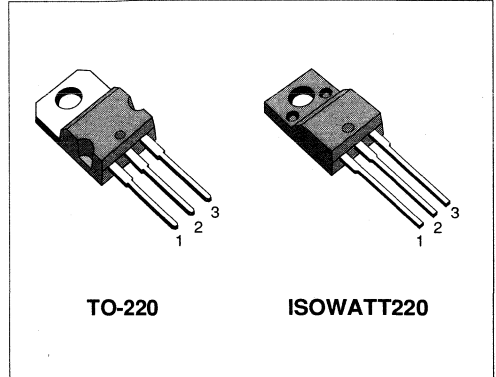
**N - CHANNEL ENHANCEMENT MODE
LOW THRESHOLD POWER MOS TRANSISTOR**

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP50N05L	50 V	< 0.028 Ω	50 A
STP50N05LFI	50 V	< 0.028 Ω	27 A

- TYPICAL R_{DS(on)} = 0.024 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- LOGIC LEVEL COMPATIBLE INPUT
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP50N05L	STP50N05LFI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	50		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	50		V
V _{GS}	Gate-source Voltage	± 15		V
I _D	Drain Current (continuous) at T _c = 25 °C	50	27	A
I _D	Drain Current (continuous) at T _c = 100 °C	35	19	A
I _{DM} (*)	Drain Current (pulsed)	200	200	A
P _{tot}	Total Dissipation at T _c = 25 °C	150	45	W
	Derating Factor	1	0.3	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

		TO-220	ISOWATT220		
R _{thj-case}	Thermal Resistance Junction-case	Max	1	3.33	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max		62.5	°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ		0.5	°C/W
T _l	Maximum Lead Temperature For Soldering Purpose			300	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	50	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	400	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	100	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	35	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	50			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 15 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	1	1.6	2.5	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 5 V I _D = 25 A V _{GS} = 5 V I _D = 25 A T _c = 100 °C		0.024	0.028 0.056	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} × R _{DS(on)max} V _{GS} = 10 V	50			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} × R _{DS(on)max} I _D = 25 A	17	31		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		2000	2600	pF
C _{oss}	Output Capacitance			660	900	pF
C _{rss}	Reverse Transfer Capacitance			160	220	pF

ELECTRICAL CHARACTERISTICS (continued)
SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 25\text{ V}$ $I_D = 25\text{ A}$		95	140	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 3)		550	800	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 50\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 5)		100		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 80\text{ V}$ $I_D = 50\text{ A}$ $V_{GS} = 5\text{ V}$		42	60	nC
Q_{gs}	Gate-Source Charge			11		nC
Q_{gd}	Gate-Drain Charge			25		nC

SWITCHING OFF

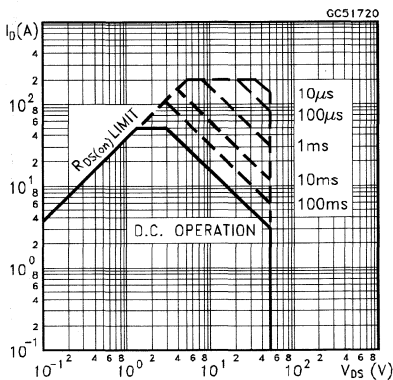
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 50\text{ A}$		145	210	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$		215	310	ns
t_c	Cross-over Time	(see test circuit, figure 5)		380	550	ns

SOURCE DRAIN DIODE

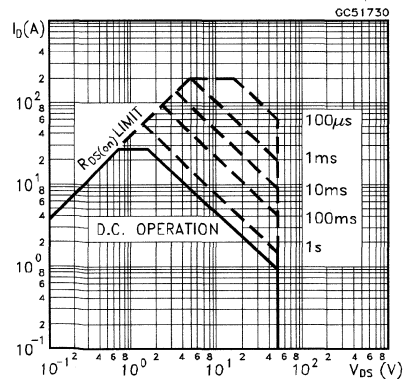
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				50	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				200	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 50\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 50\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_J = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		110		ns
Q_{rr}	Reverse Recovery Charge			0.27		μC
I_{RRM}	Reverse Recovery Current			5		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %
(\bullet) Pulse width limited by safe operating area

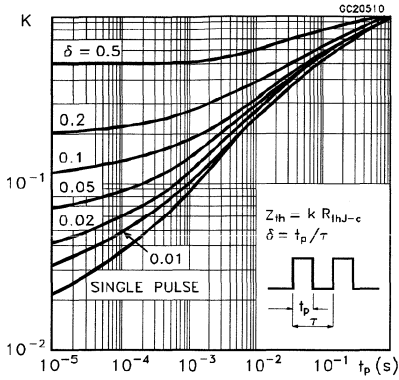
Safe Operating Areas For TO-220



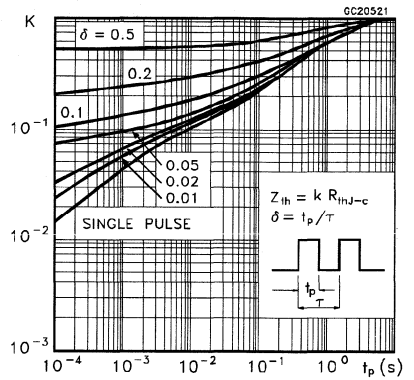
Safe Operating Areas For ISOWATT220



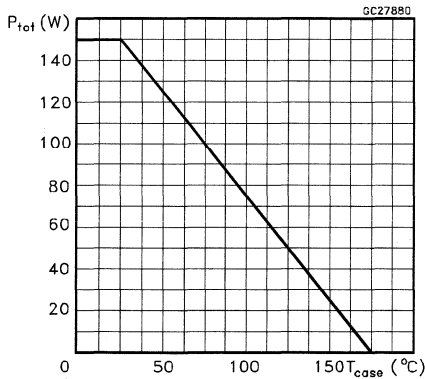
Thermal Impedance For TO-220



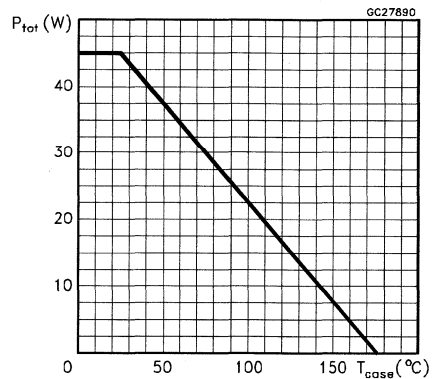
Thermal Impedance For ISOWATT220



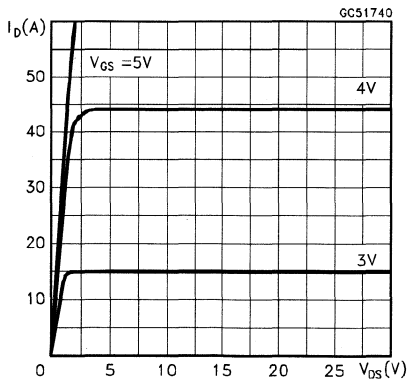
Derating Curve For TO-220



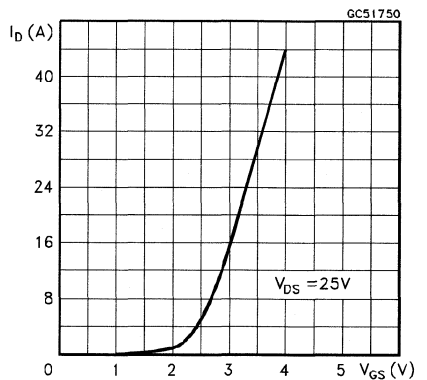
Derating Curve For ISOWATT220



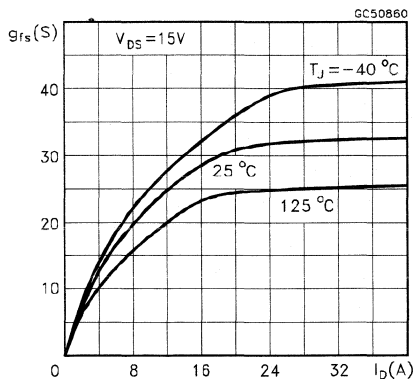
Output Characteristics



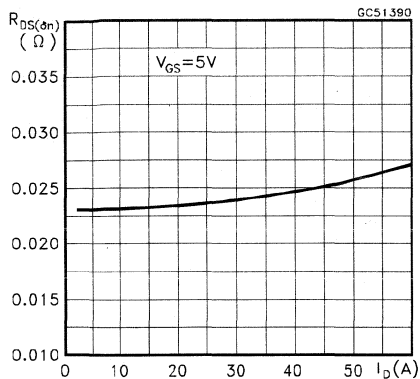
Transfer Characteristics



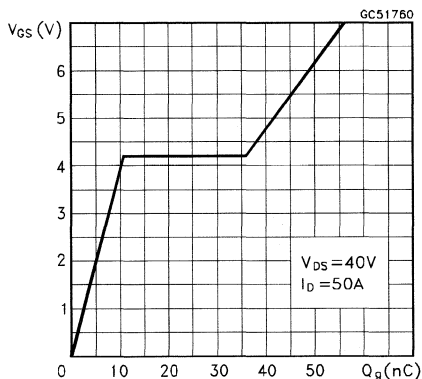
Transconductance



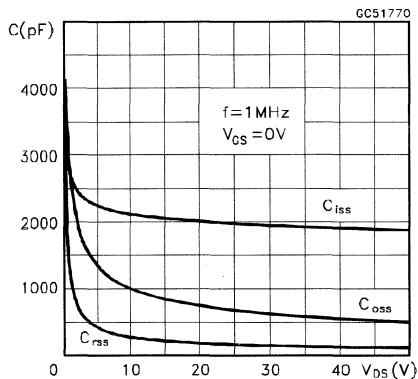
Static Drain-source On Resistance



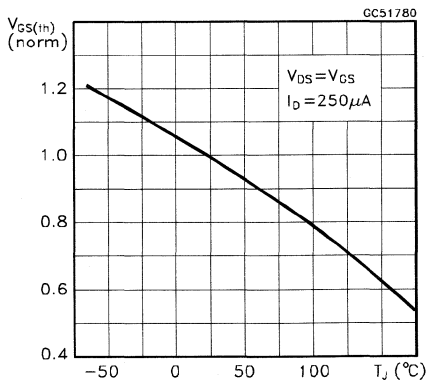
Gate Charge vs Gate-source Voltage



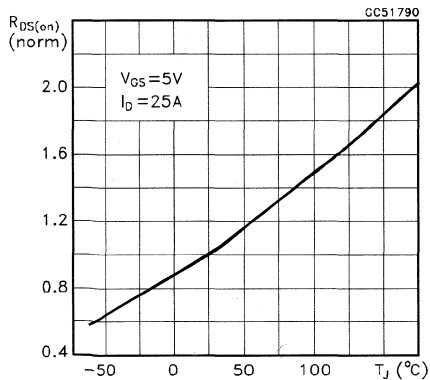
Capacitance Variations



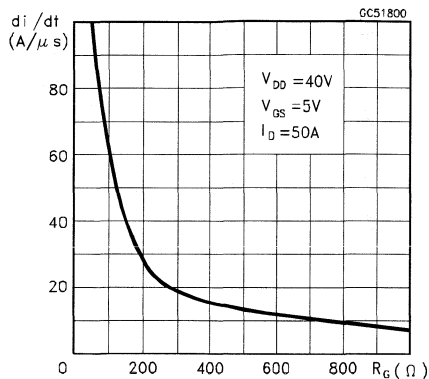
Normalized Gate Threshold Voltage vs Temperature



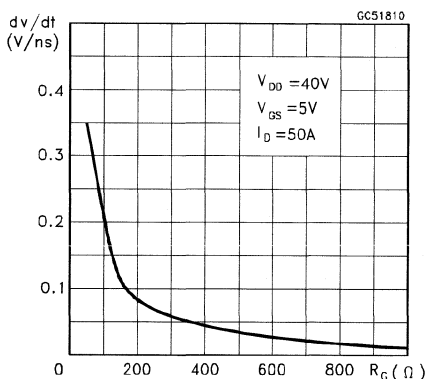
Normalized On Resistance vs Temperature



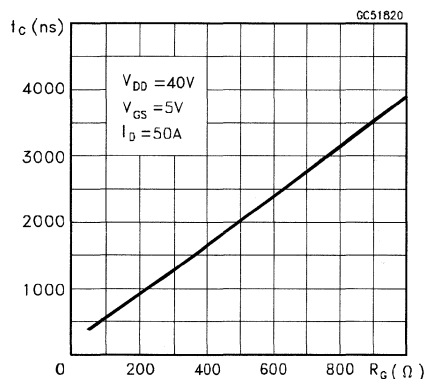
Turn-on Current Slope



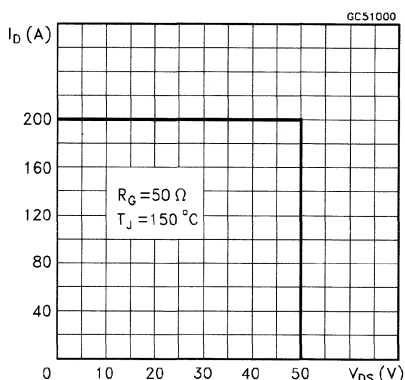
Turn-off Drain-source Voltage Slope



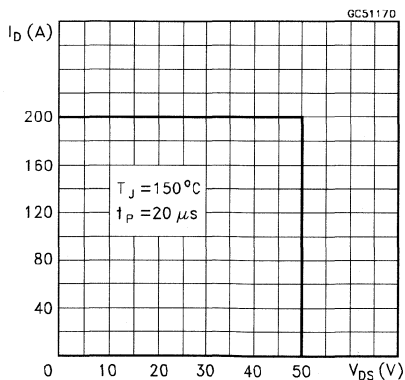
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

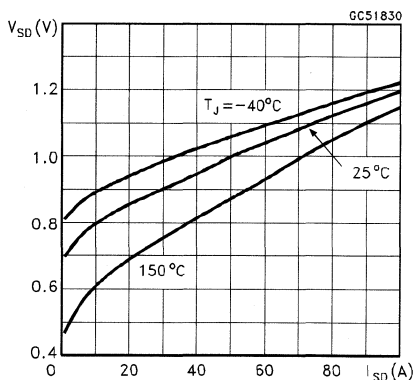


Fig. 1: Unclamped Inductive Load Test Circuits

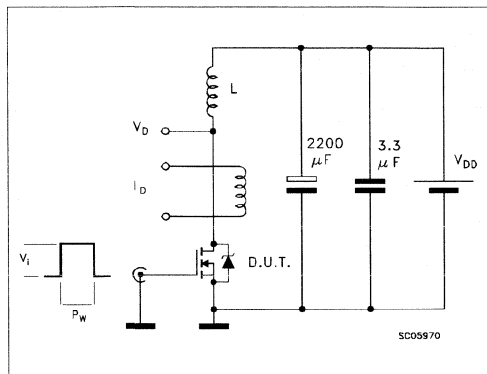


Fig. 2: Unclamped Inductive Waveforms

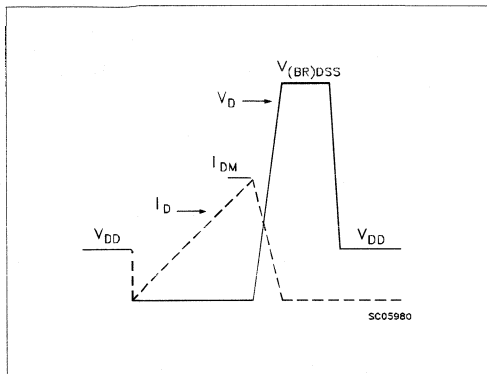


Fig. 3: Switching Times Test Circuits For Resistive Load

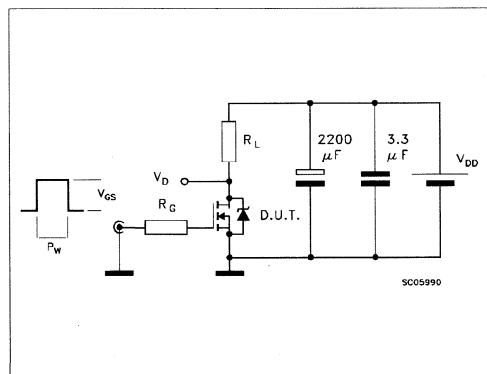


Fig. 4: Gate Charge Test Circuit

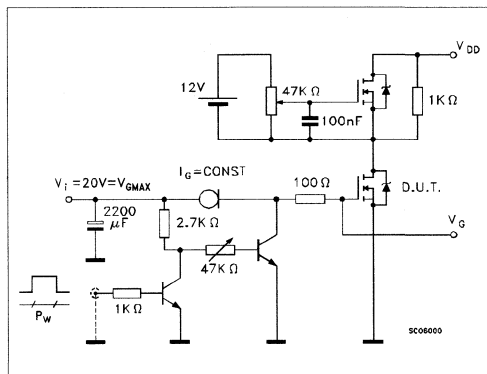
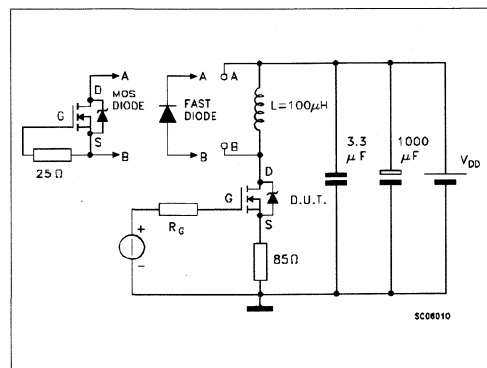


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



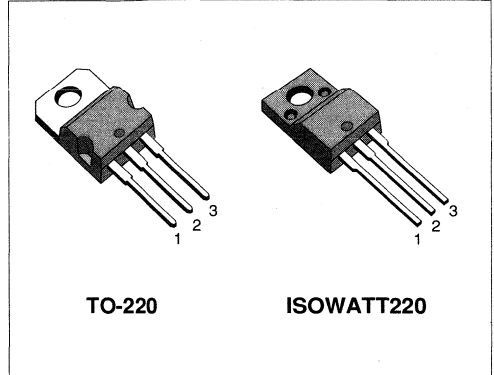
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{Ds(on)}	I _D
STP50N06	60 V	< 0.028 Ω	50 A
STP50N06FI	60 V	< 0.028 Ω	27 A

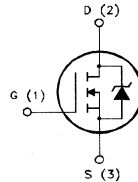
- TYPICAL R_{Ds(on)} = 0.022 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP50N06	STP50N06FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	60		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	60		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	50	27	A
I _D	Drain Current (continuous) at T _c = 100 °C	35	19	A
I _{DM} (*)	Drain Current (pulsed)	200	200	A
P _{tot}	Total Dissipation at T _c = 25 °C	150	45	W
	Derating Factor	1	0.3	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
$R_{thj-case}$	Thermal Resistance Junction-case	Max	1	3.33	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5		°C/W
$R_{thc-sink}$	Thermal Resistance Case-sink	Typ	0.5		°C/W
T_l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	50	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ }^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 25\text{ V}$)	400	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	100	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ }^\circ\text{C}$, pulse width limited by T_j max, $\delta < 1\%$)	35	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ }^\circ\text{C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$	60			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ }^\circ\text{C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\text{ }\mu\text{A}$	2	2.9	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 25\text{ A}$ $V_{GS} = 10\text{ V}$ $I_D = 25\text{ A}$ $T_c = 100\text{ }^\circ\text{C}$		0.022	0.028 0.056	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	50			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 25\text{ A}$	17	22		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		1700	2200	pF
C_{oss}	Output Capacitance			630	850	pF
C_{rss}	Reverse Transfer Capacitance			200	260	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 25\text{ V}$ $I_D = 25\text{ A}$		50	70	ns
t_r	Rise Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		110	160	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 50\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		460		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 40\text{ V}$ $I_D = 50\text{ A}$ $V_{GS} = 10\text{ V}$		50	70	nC
Q_{gs}	Gate-Source Charge			14		nC
Q_{gd}	Gate-Drain Charge			25		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(off)}$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 50\text{ A}$		55	80	ns
t_f	Fall Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$		50	70	ns
t_c	Cross-over Time	(see test circuit, figure 5)		110	160	ns

SOURCE DRAIN DIODE

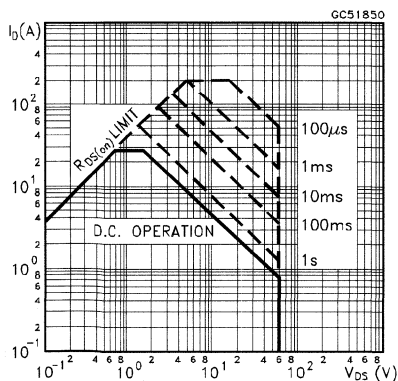
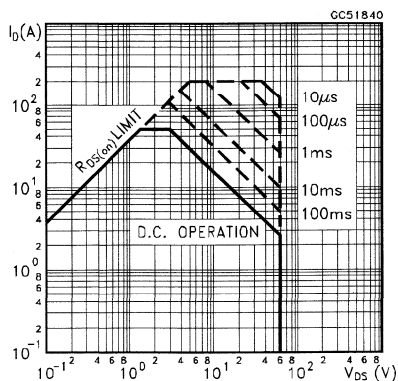
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				50	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				200	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 50\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 50\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		150		ns
Q_{rr}	Reverse Recovery Charge			0.45		μ C
I_{RRM}	Reverse Recovery Current			6		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

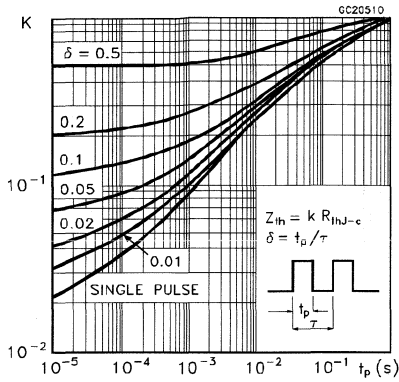
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

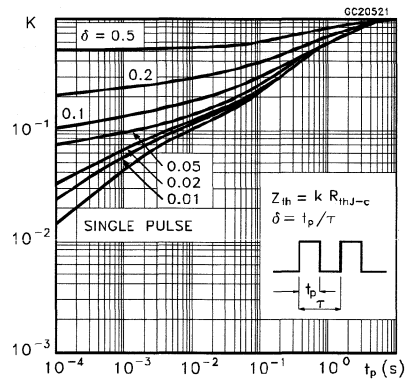
Safe Operating Areas For ISOWATT220



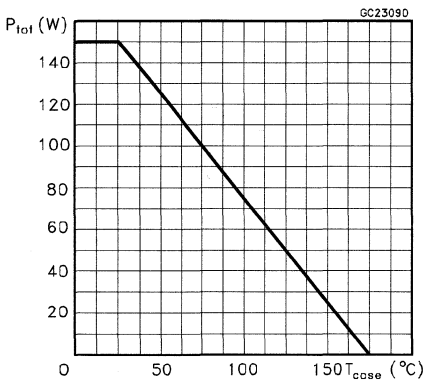
Thermal Impedance For TO-220



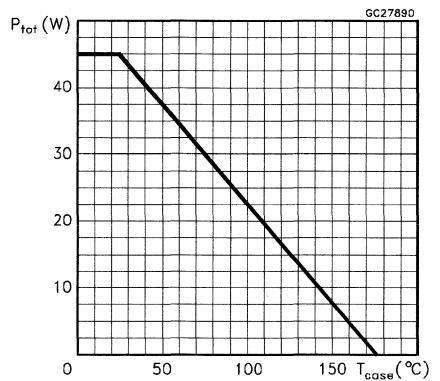
Thermal Impedance For ISOWATT220



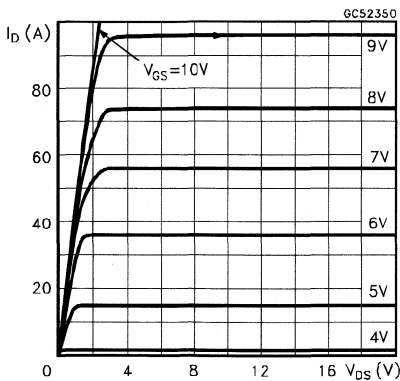
Derating Curve For TO-220



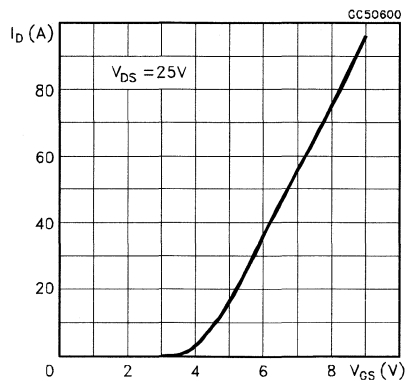
Derating Curve For ISOWATT220



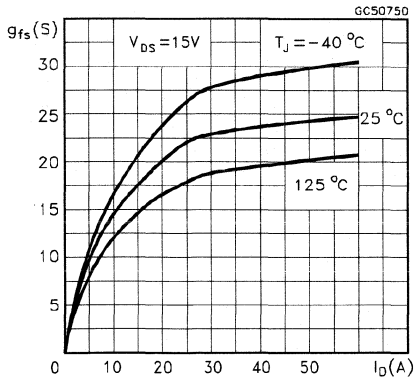
Output Characteristics



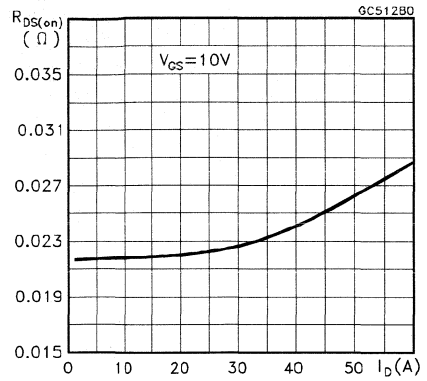
Transfer Characteristics



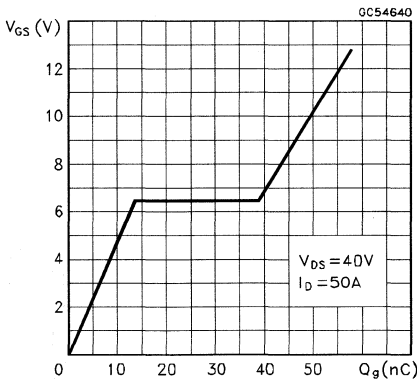
Transconductance



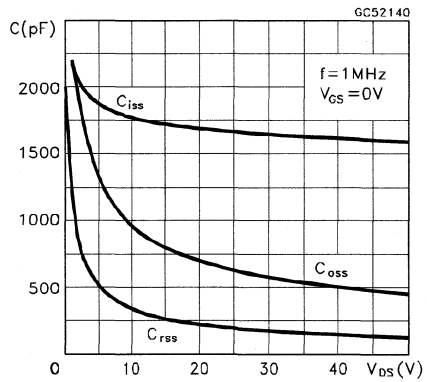
Static Drain-source On Resistance



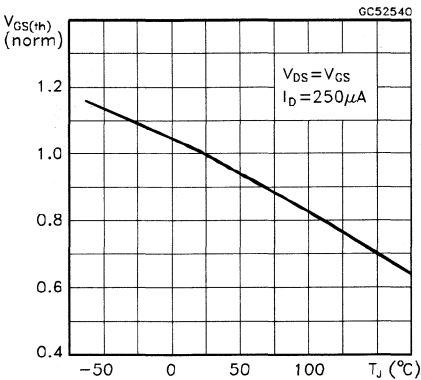
Gate Charge vs Gate-source Voltage



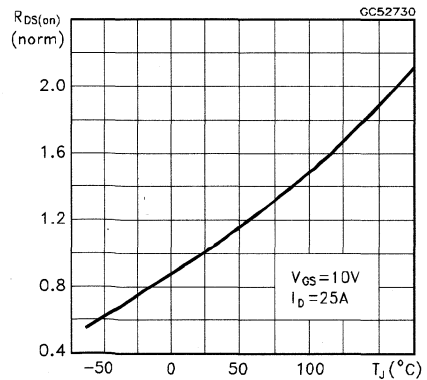
Capacitance Variations



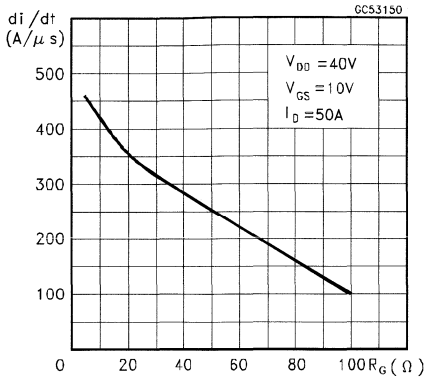
Normalized Gate Threshold Voltage vs Temperature



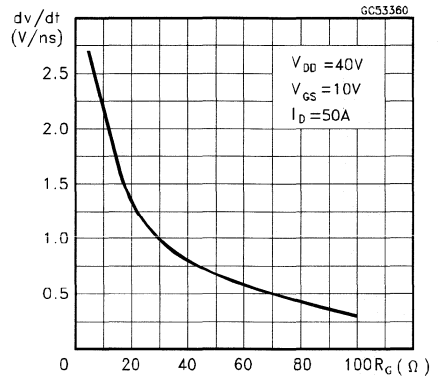
Normalized On Resistance vs Temperature



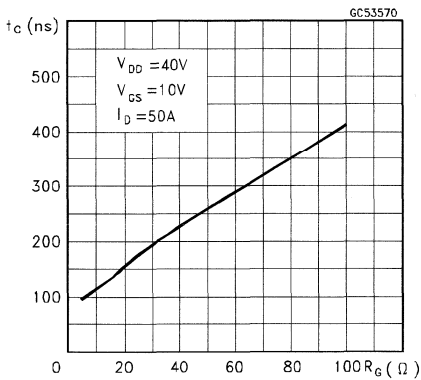
Turn-on Current Slope



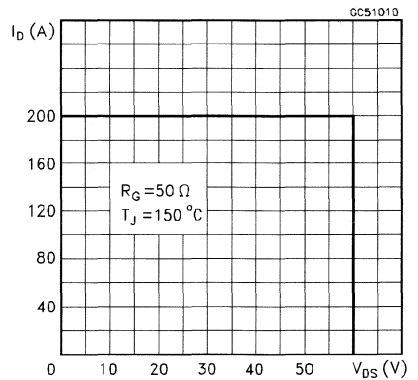
Turn-off Drain-source Voltage Slope



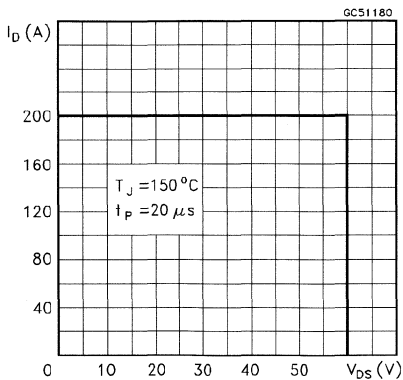
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

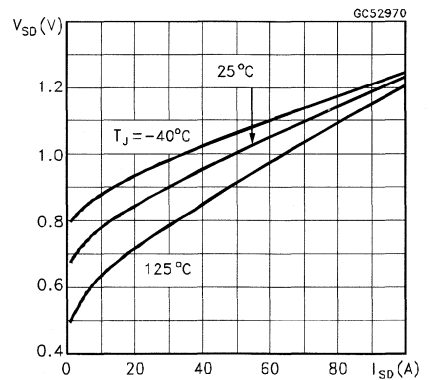


Fig. 1: Unclamped Inductive Load Test Circuits

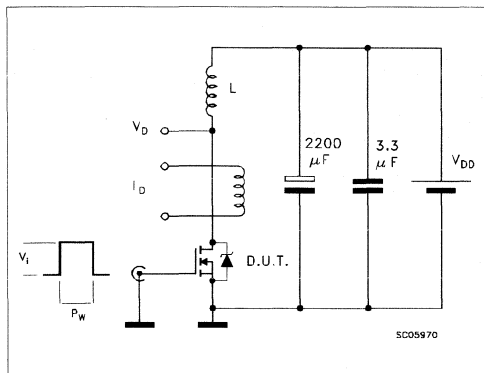


Fig. 2: Unclamped Inductive Waveforms

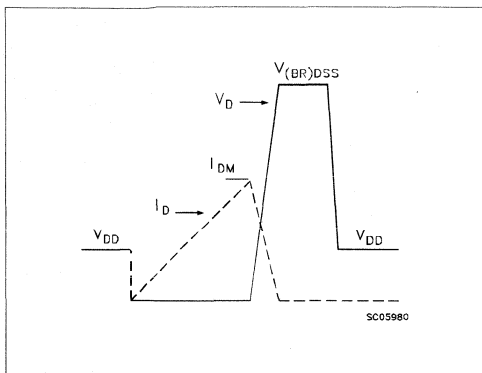


Fig. 3: Switching Times Test Circuits For Resistive Load

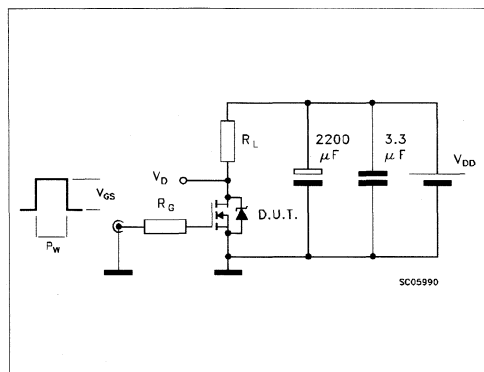


Fig. 4: Gate Charge Test Circuit

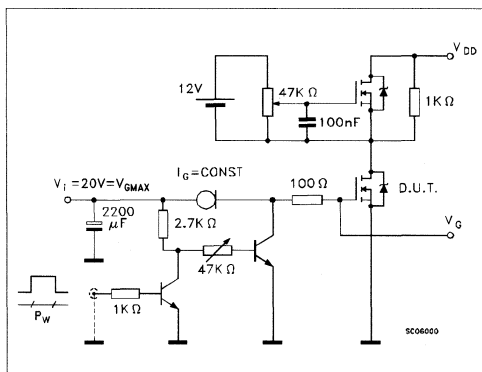
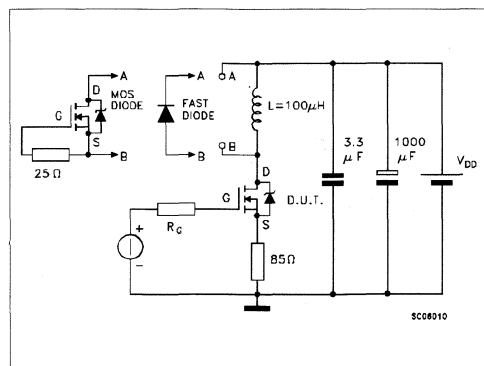


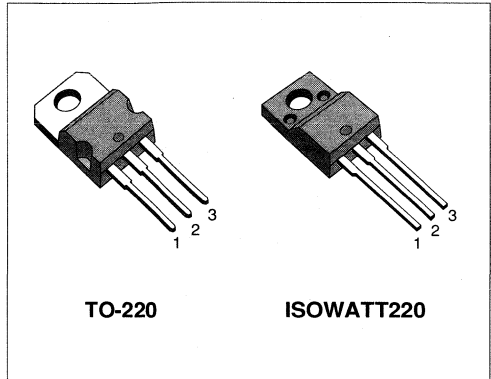
Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



**N - CHANNEL ENHANCEMENT MODE
LOW THRESHOLD POWER MOS TRANSISTOR**

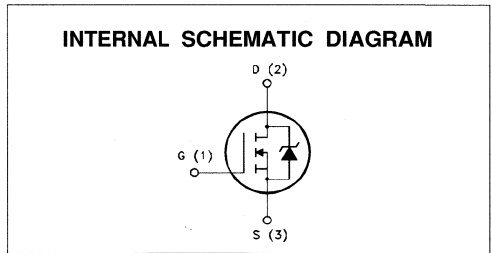
TYPE	V _{DSS}	R _{DS(on)}	I _D
STP50N06L	60 V	< 0.028 Ω	50 A
STP50N06LFI	60 V	< 0.028 Ω	27 A

- TYPICAL R_{DS(on)} = 0.024 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- LOGIC LEVEL COMPATIBLE INPUT
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION



APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP50N06L	STP50N06LFI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	60		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	60		V
V _{GS}	Gate-source Voltage	± 15		V
I _D	Drain Current (continuous) at T _c = 25 °C	50	27	A
I _D	Drain Current (continuous) at T _c = 100 °C	35	19	A
I _{DM} (*)	Drain Current (pulsed)	200	200	A
P _{tot}	Total Dissipation at T _c = 25 °C	150	45	W
	Derating Factor	1	0.3	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case	Max	1	3.33	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.5		°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _J max, δ < 1%)	50	A
E _{AS}	Single Pulse Avalanche Energy (starting T _J = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	400	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _J max, δ < 1%)	100	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _J max, δ < 1%)	35	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	60			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 15 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	1	1.6	2.5	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 5 V I _D = 25 A V _{GS} = 5 V I _D = 25 A T _c = 100 °C		0.024	0.028 0.056	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} × R _{DS(on)max} V _{GS} = 10 V	50			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} × R _{DS(on)max} I _D = 25 A	17	31		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		2000	2600	pF
C _{oss}	Output Capacitance			660	900	pF
C _{rss}	Reverse Transfer Capacitance			160	220	pF

ELECTRICAL CHARACTERISTICS (continued)
SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 25\text{ V}$ $I_D = 25\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 3)		95	140	ns
t_r	Rise Time			550	800	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 50\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 5)		100		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 80\text{ V}$ $I_D = 50\text{ A}$ $V_{GS} = 5\text{ V}$		42	60	nC
Q_{gs}	Gate-Source Charge			11		nC
Q_{gd}	Gate-Drain Charge			25		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 50\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 5)		145	210	ns
t_f	Fall Time			215	310	ns
t_c	Cross-over Time			380	550	ns

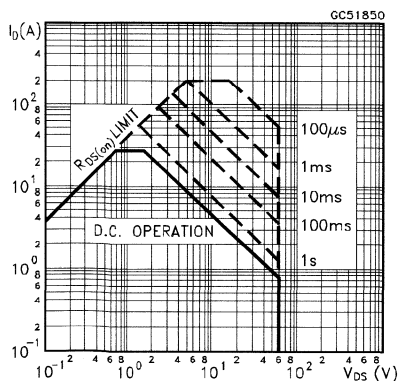
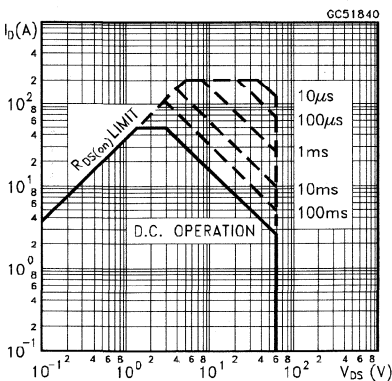
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				50	A
$I_{SDM(\bullet)}$	Source-drain Current (pulsed)				200	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 50\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 50\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		110		ns
Q_{rr}	Reverse Recovery Charge			0.27		μC
I_{RRM}	Reverse Recovery Current			5		A

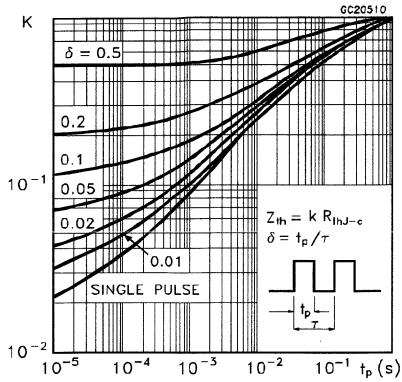
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %
 (•) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

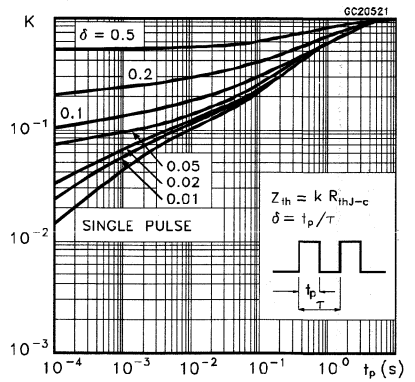
Safe Operating Areas For ISOWATT220



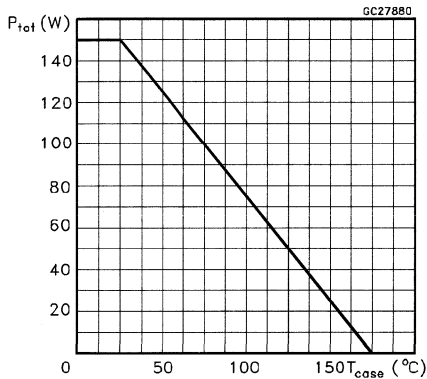
Thermal Impedance For TO-220



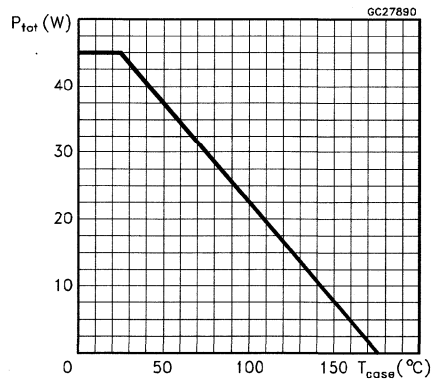
Thermal Impedance For ISOWATT220



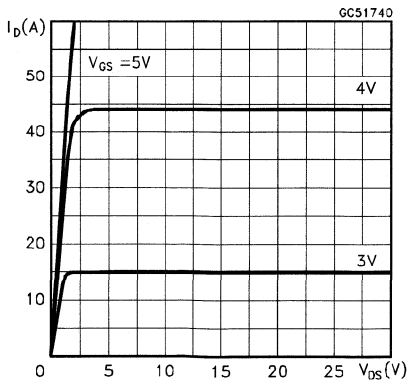
Derating Curve For TO-220



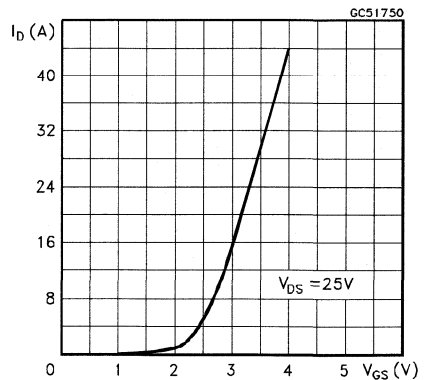
Derating Curve For ISOWATT220



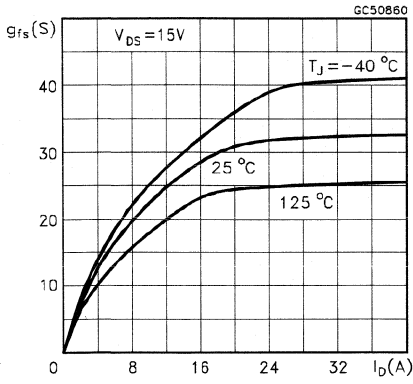
Output Characteristics



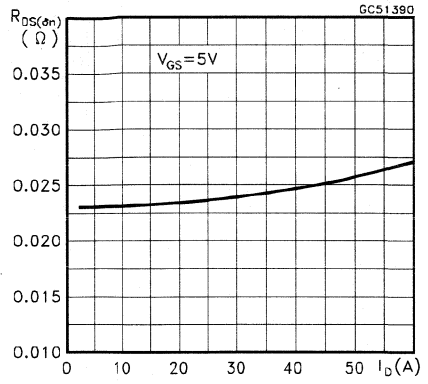
Transfer Characteristics



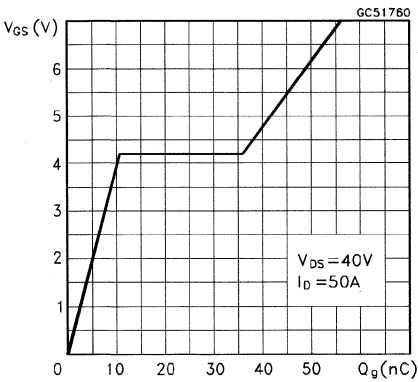
Transconductance



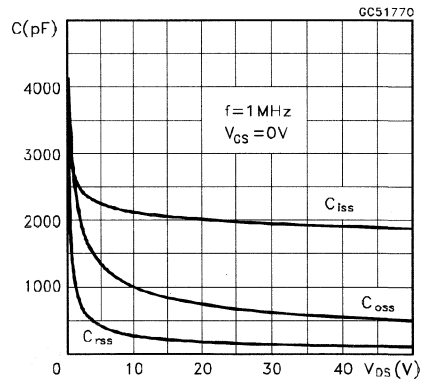
Static Drain-source On Resistance



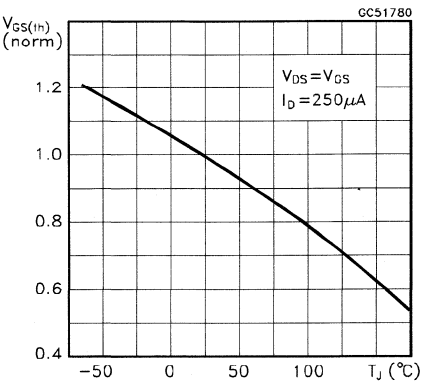
Gate Charge vs Gate-source Voltage



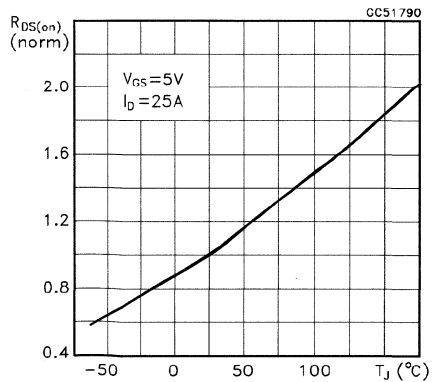
Capacitance Variations



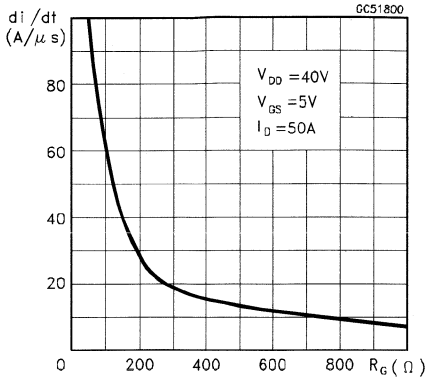
Normalized Gate Threshold Voltage vs Temperature



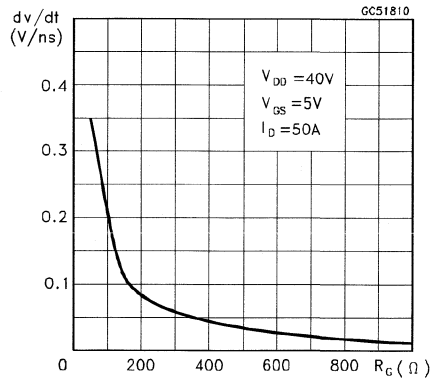
Normalized On Resistance vs Temperature



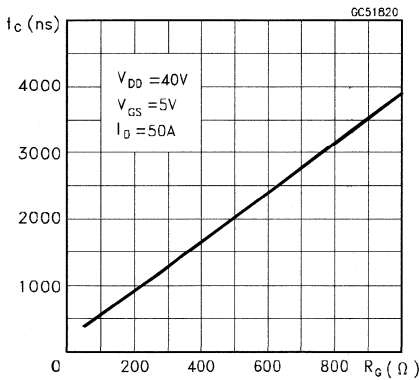
Turn-on Current Slope



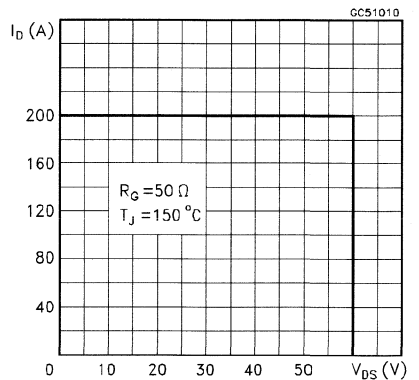
Turn-off Drain-source Voltage Slope



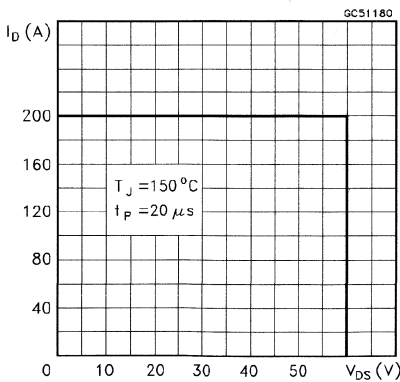
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

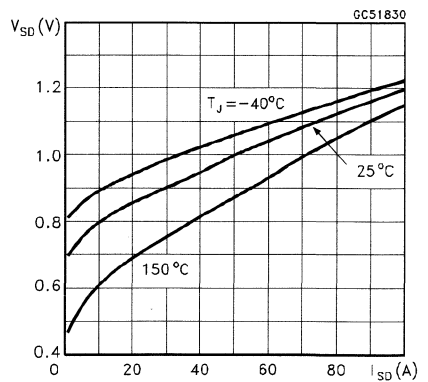


Fig. 1: Unclamped Inductive Load Test Circuits

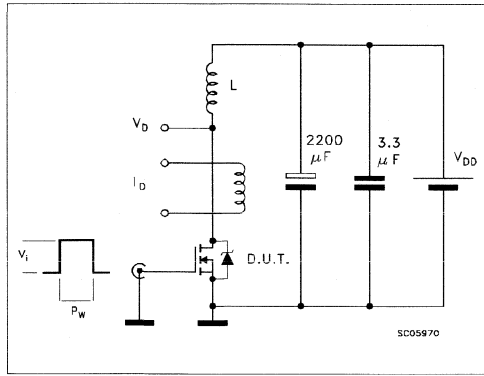


Fig. 2: Unclamped Inductive Waveforms

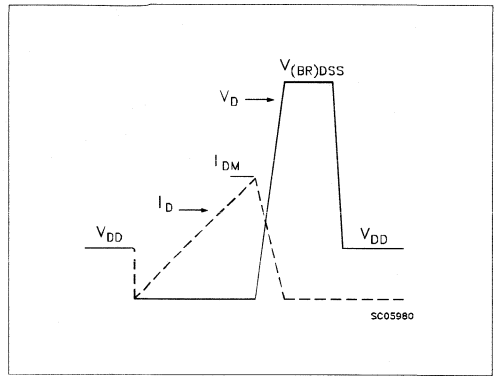


Fig. 3: Switching Times Test Circuits For Resistive Load

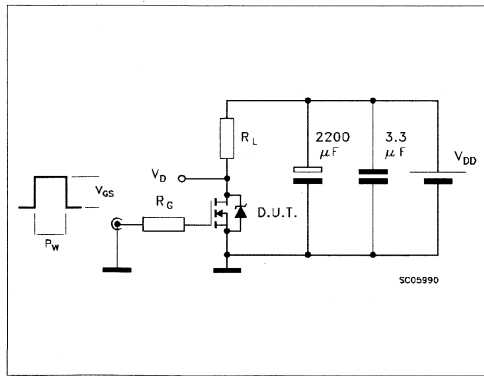


Fig. 4: Gate Charge Test Circuit

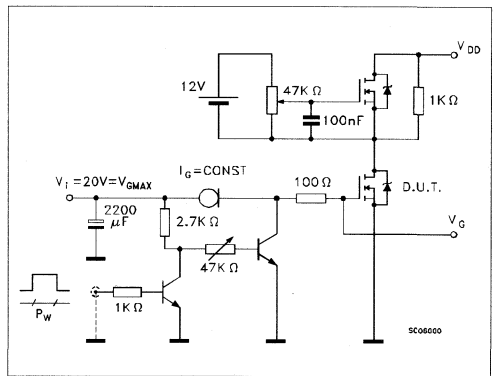
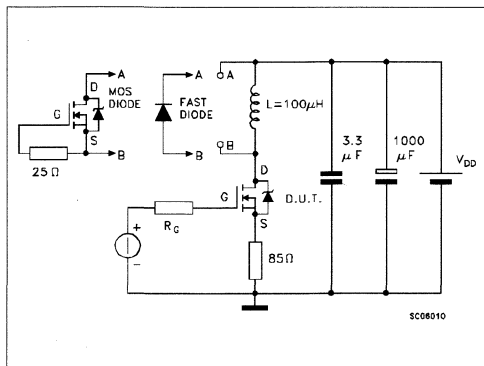


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



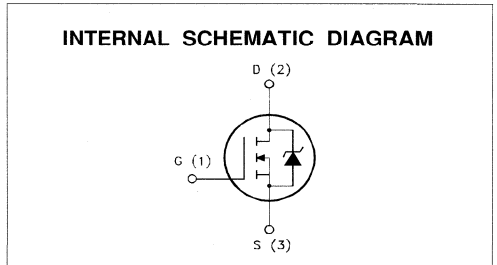
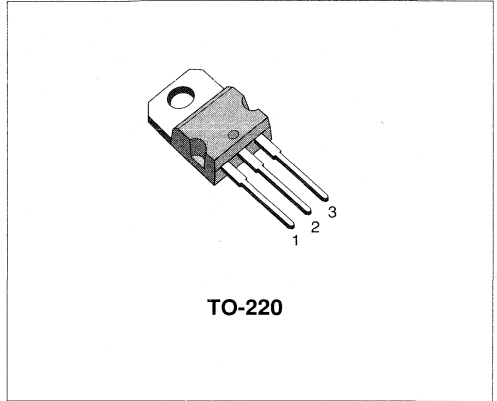
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP53N05	50 V	< 0.025 Ω	53 A

- TYPICAL R_{DS(on)} = 0.022 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	50	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	50	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	53	A
I _D	Drain Current (continuous) at T _c = 100 °C	37	A
I _{DM} (•)	Drain Current (pulsed)	212	A
P _{tot}	Total Dissipation at T _c = 25 °C	150	W
	Derating Factor	1	W/°C
T _{stg}	Storage Temperature	-65 to 175	°C
T _j	Max. Operating Junction Temperature	175	°C

(•) Pulse width limited by safe operating area

THERMAL DATA

R _{thj-case}	Thermal Resistance Junction-case	Max	1	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5	°C/W
R _{th-amb}	Thermal Resistance Case-sink	Typ	0.5	°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	53	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	450	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	110	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	37	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	50			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	2.9	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V I _D = 26.5 A V _{GS} = 10V I _D = 26.5 A T _c = 100°C		0.022	0.025 0.05	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	53			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 26.5 A	17	22		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		1700	2200	pF
C _{oss}	Output Capacitance			630	850	pF
C _{rss}	Reverse Transfer Capacitance			200	260	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 25\text{ V}$ $I_D = 26.5\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		50 110	70 160	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 53\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		460		A/ μs
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 40\text{ V}$ $I_D = 53\text{ A}$ $V_{GS} = 10\text{ V}$		50 14 25	70	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$ t_f t_c	Off-voltage Rise Time Fall Time Cross-over Time	$V_{DD} = 40\text{ V}$ $I_D = 53\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		55 50 110	80 70 160	ns ns ns

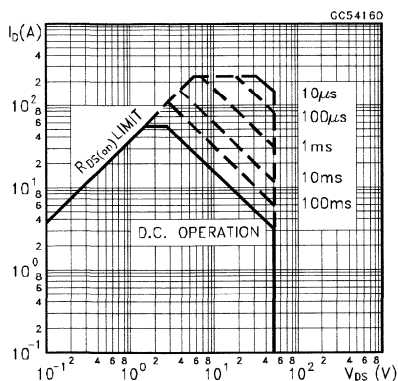
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				53 212	A A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 53\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 53\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		150		ns
Q_{rr}	Reverse Recovery Charge			0.45		μC
I_{RRM}	Reverse Recovery Current			6		A

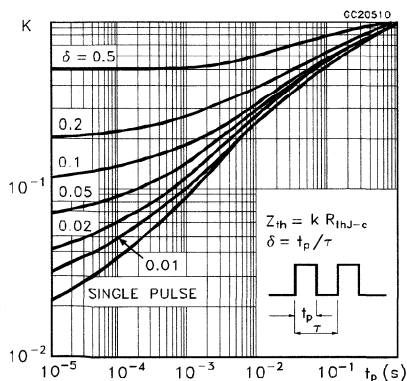
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

(•) Pulse width limited by safe operating area

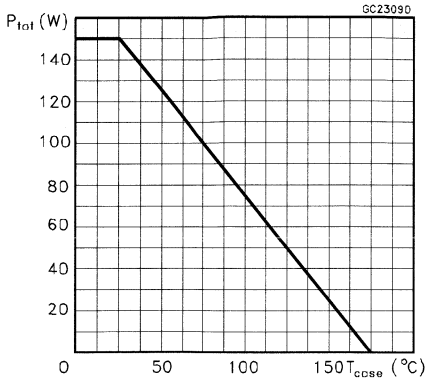
Safe Operating Areas



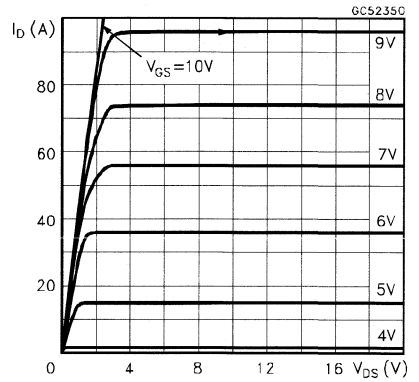
Thermal Impedance



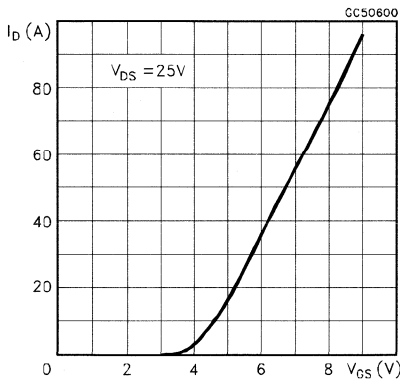
Derating Curve



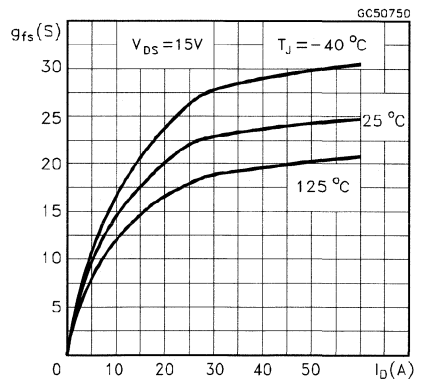
Output Characteristics



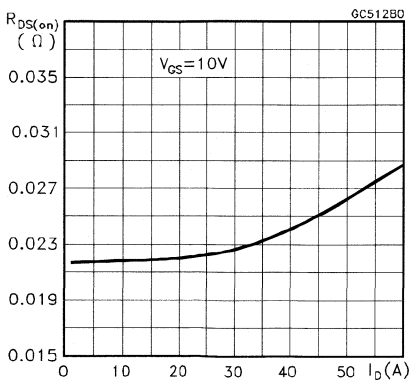
Transfer Characteristics



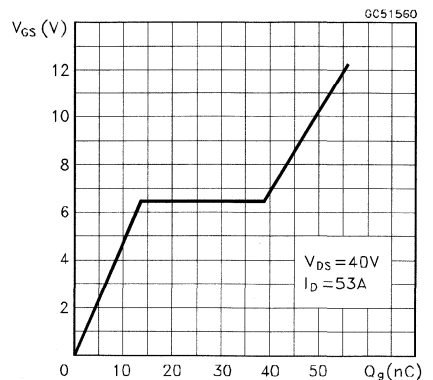
Transconductance



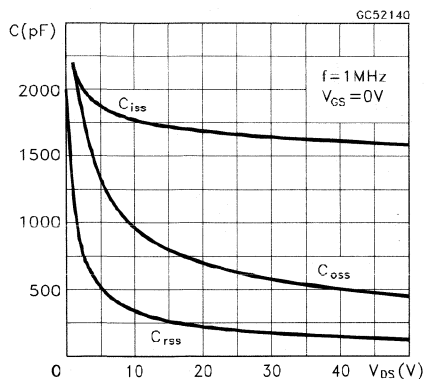
Static Drain-source On Resistance



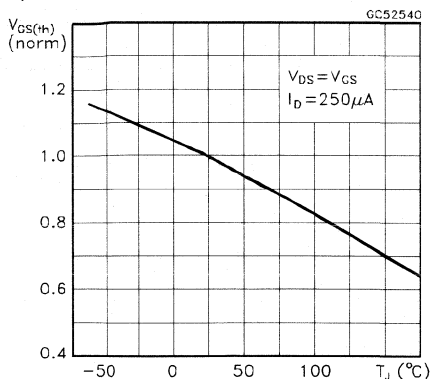
Gate Charge vs Gate-source Voltage



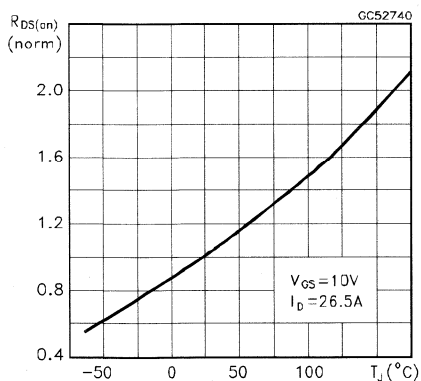
Capacitance Variations



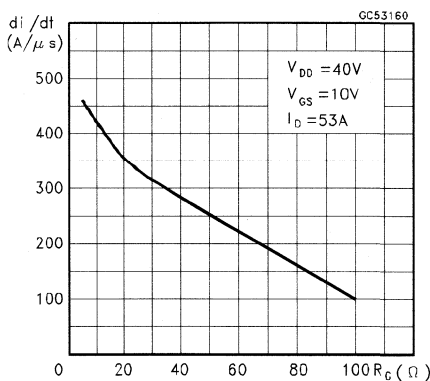
Normalized Gate Threshold Voltage vs Temperature



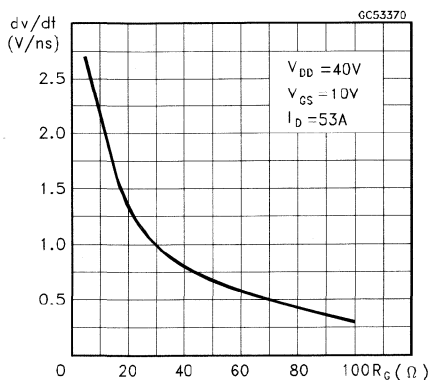
Normalized On Resistance vs Temperature



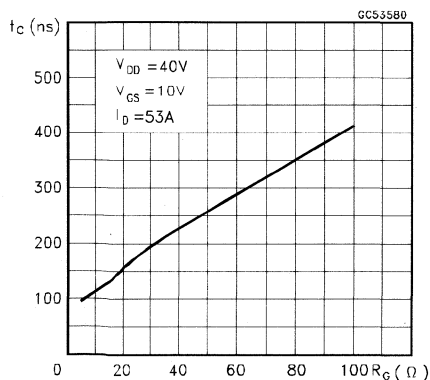
Turn-on Current Slope



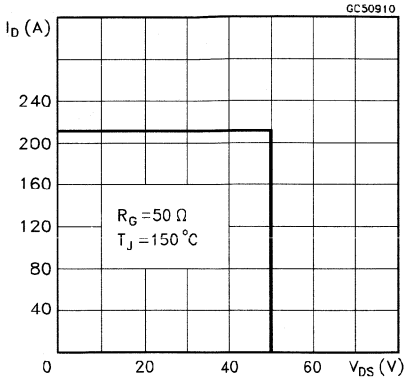
Turn-off Drain-source Voltage Slope



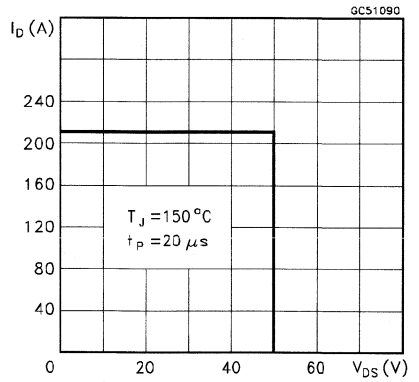
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

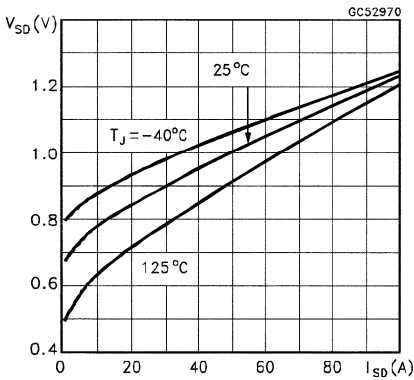


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

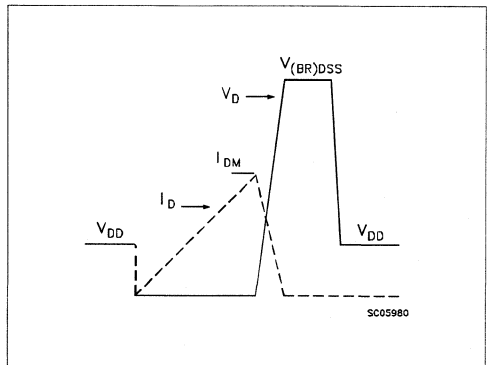
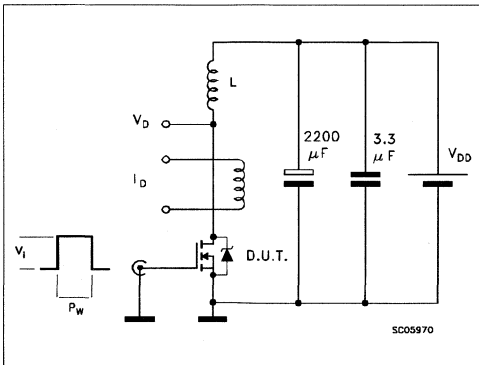


Fig. 3: Switching Times Test Circuits For Resistive Load

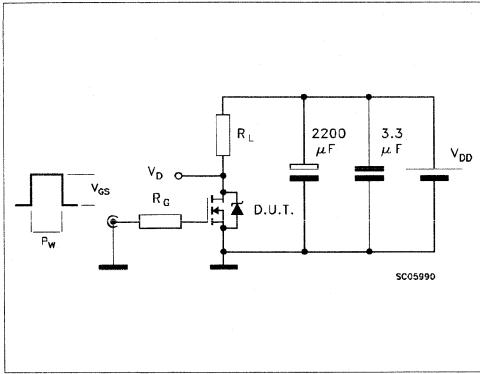


Fig. 4: Gate Charge Test Circuit

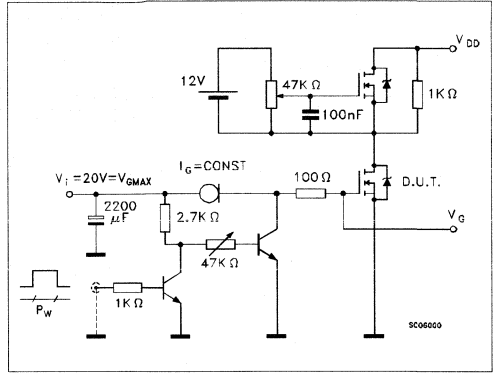
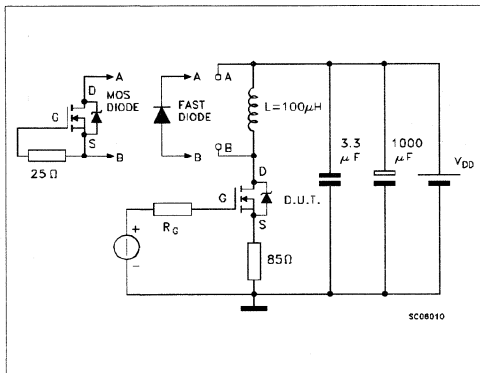


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



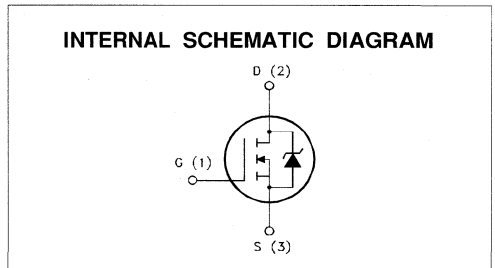
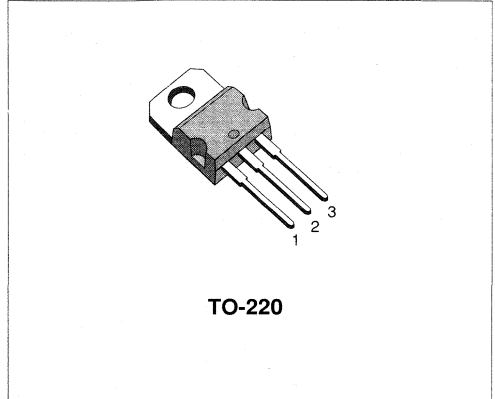
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP53N06	60 V	< 0.025 Ω	53 A

- TYPICAL R_{DS(on)} = 0.022 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	60	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	60	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	53	A
I _D	Drain Current (continuous) at T _c = 100 °C	37	A
I _{DM} (•)	Drain Current (pulsed)	212	A
P _{tot}	Total Dissipation at T _c = 25 °C	150	W
	Derating Factor	1	W/°C
T _{stg}	Storage Temperature	-65 to 175	°C
T _j	Max. Operating Junction Temperature	175	°C

(•) Pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	1	$^{\circ}C/W$
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5	$^{\circ}C/W$
$R_{thj-amb}$	Thermal Resistance Case-sink	Typ	0.5	$^{\circ}C/W$
T_I	Maximum Lead Temperature For Soldering Purpose		300	$^{\circ}C$

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	53	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25^{\circ}C$, $I_D = I_{AR}$, $V_{DD} = 25 V$)	450	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	110	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100^{\circ}C$, pulse width limited by T_j max, $\delta < 1\%$)	37	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25^{\circ}C$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250 \mu A$ $V_{GS} = 0$	60			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^{\circ}C$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20 V$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250 \mu A$	2	2.9	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10V$ $I_D = 26.5 A$ $V_{GS} = 10V$ $I_D = 26.5 A$ $T_c = 100^{\circ}C$		0.022	0.025 0.05	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10 V$	53			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 26.5 A$	17	22		S
C_{iss}	Input Capacitance	$V_{DS} = 25 V$ $f = 1 MHz$ $V_{GS} = 0$		1700	2200	pF
C_{oss}	Output Capacitance			630	850	pF
C_{rss}	Reverse Transfer Capacitance			200	260	pF

ELECTRICAL CHARACTERISTICS (continued)
SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 25\text{ V}$ $I_D = 26.5\text{ A}$		50	70	ns
t_r	Rise Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		110	160	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 53\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		460		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 40\text{ V}$ $I_D = 53\text{ A}$ $V_{GS} = 10\text{ V}$		50	70	nC
Q_{gs}	Gate-Source Charge			14		nC
Q_{gd}	Gate-Drain Charge			25		nC

SWITCHING OFF

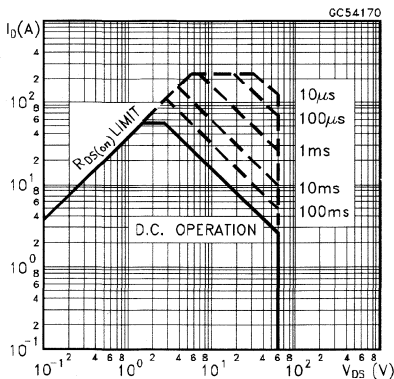
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 53\text{ A}$		55	80	ns
t_f	Fall Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$		50	70	ns
t_c	Cross-over Time	(see test circuit, figure 5)		110	160	ns

SOURCE DRAIN DIODE

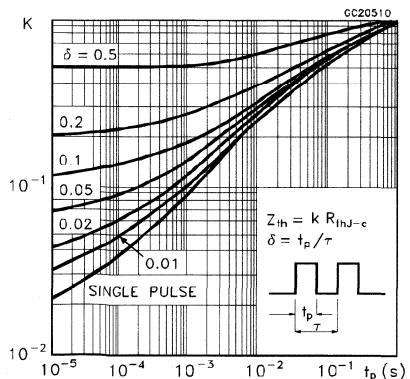
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				53	A
$I_{SDM(\bullet)}$	Source-drain Current (pulsed)				212	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 53\text{ A}$ $V_{GS} = 0$			2	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 53\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		150		ns
Q_{rr}	Reverse Recovery Charge	(see test circuit, figure 5)		0.45		μC
I_{RRM}	Reverse Recovery Current			6		A

(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %
 (•) Pulse width limited by safe operating area

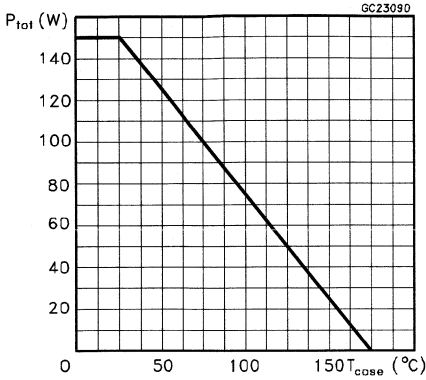
Safe Operating Areas



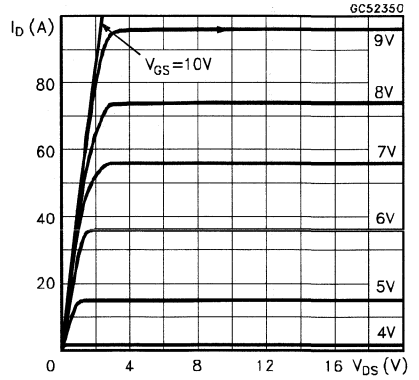
Thermal Impedance



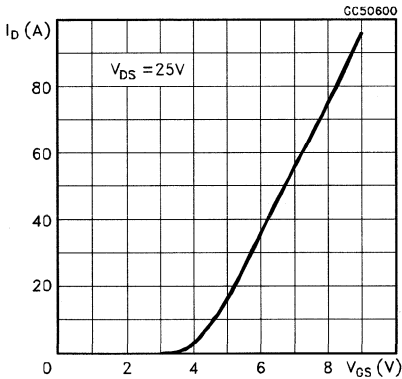
Derating Curve



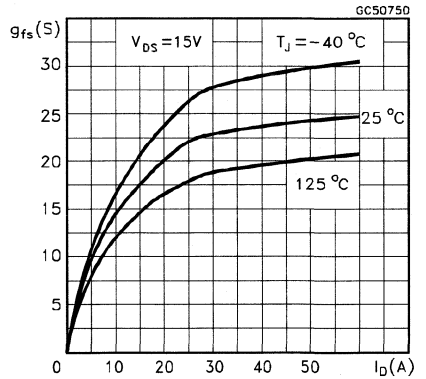
Output Characteristics



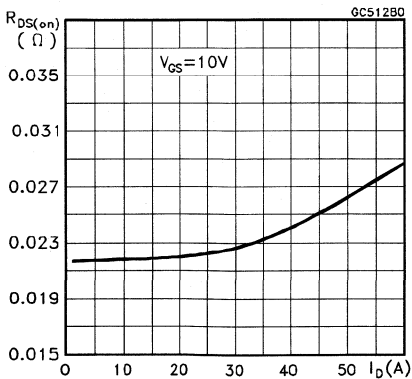
Transfer Characteristics



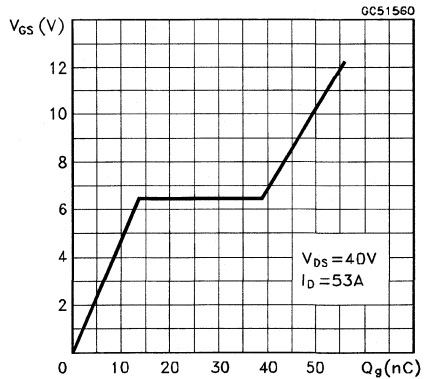
Transconductance



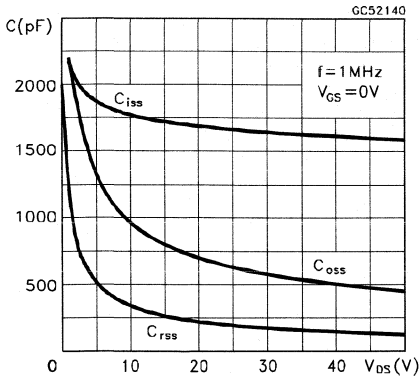
Static Drain-source On Resistance



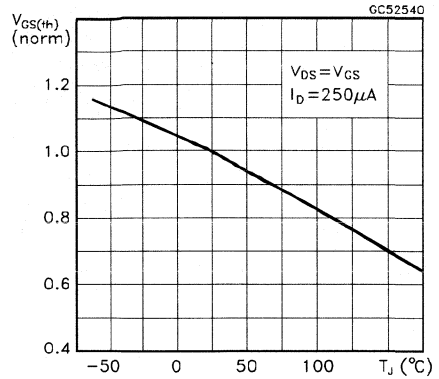
Gate Charge vs Gate-source Voltage



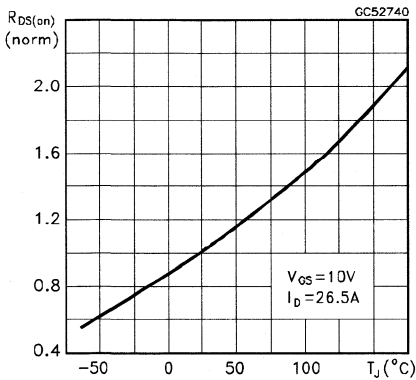
Capacitance Variations



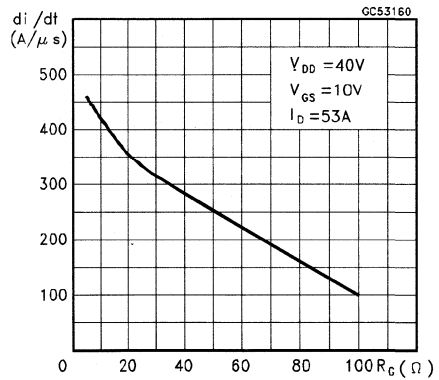
Normalized Gate Threshold Voltage vs Temperature



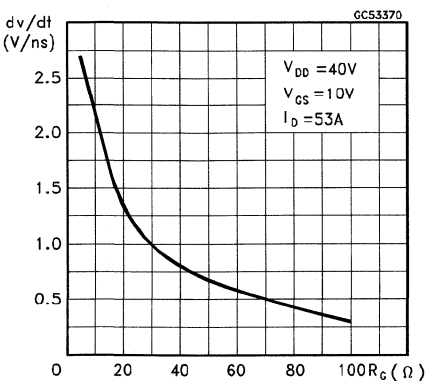
Normalized On Resistance vs Temperature



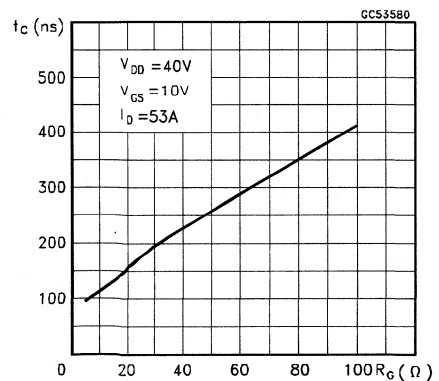
Turn-on Current Slope



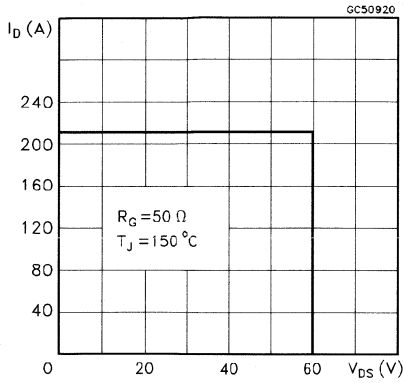
Turn-off Drain-source Voltage Slope



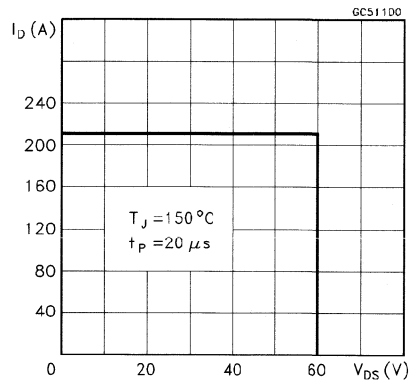
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

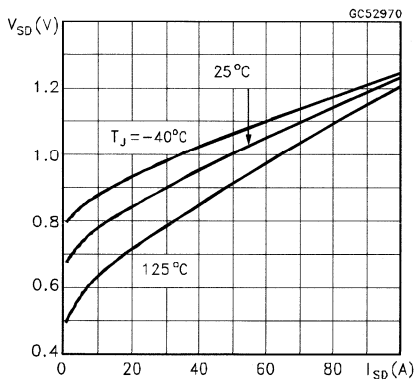


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

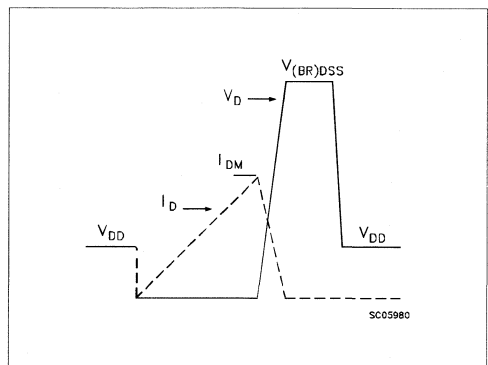
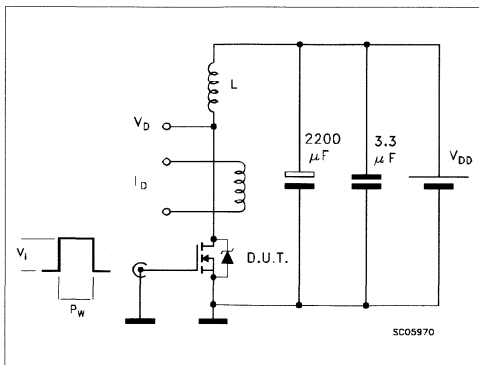


Fig. 3: Switching Times Test Circuits For Resistive Load

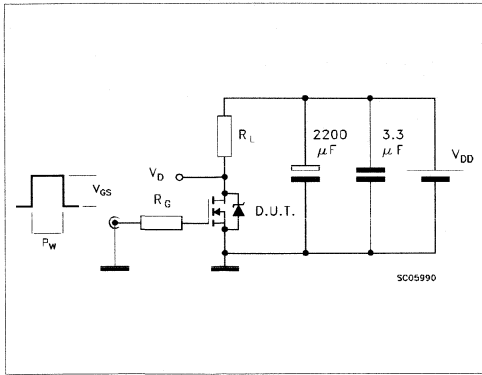


Fig. 4: Gate Charge Test Circuit

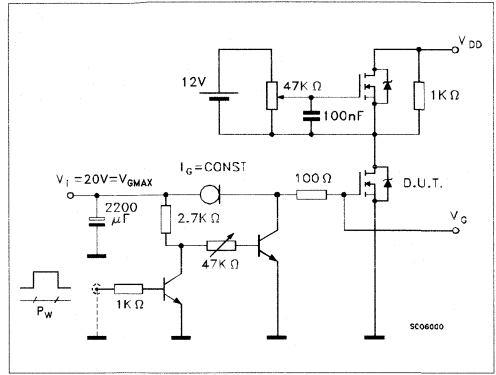
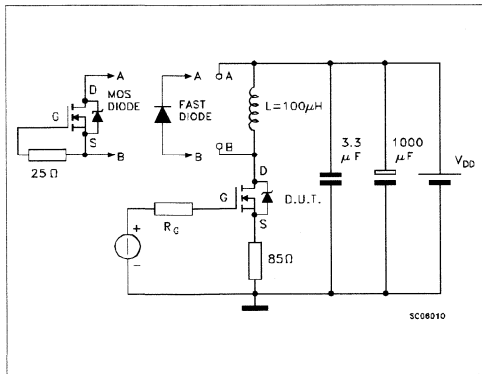


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



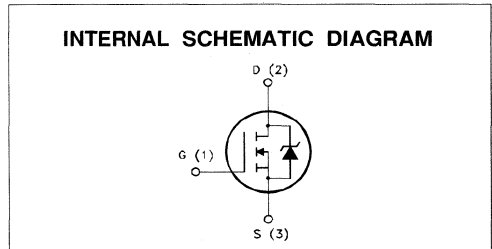
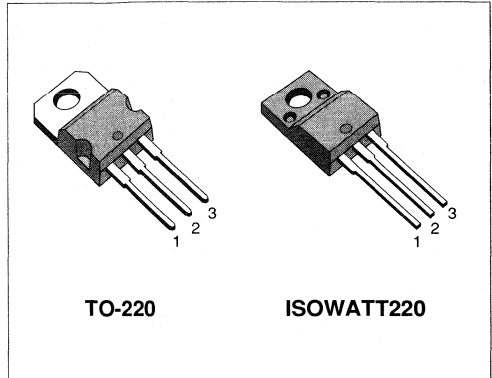
N - CHANNEL ENHANCEMENT MODE LOW THRESHOLD POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP55N05L	50 V	< 0.023 Ω	55 A
STP55N05LFI	50 V	< 0.023 Ω	30 A

- TYPICAL R_{DS(on)} = 0.02 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- LOGIC LEVEL COMPATIBLE INPUT
- 175°C OPERATING TEMPERATURE FOR STANDARD PACKAGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit	
		STP55N05L	STP55N05LFI		
V _{DS}	Drain-source Voltage (V _{GS} = 0)	50		V	
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	50		V	
V _{GS}	Gate-source Voltage	± 15		V	
I _D	Drain Current (continuous) at T _c = 25 °C	55	30	A	
I _D	Drain Current (continuous) at T _c = 100 °C	38	21	A	
I _{DM} (*)	Drain Current (pulsed)	220	220	A	
P _{tot}	Total Dissipation at T _c = 25 °C	150	45	W	
	Derating Factor	1	0.3	W/°C	
V _{ISO}	Insulation Withstand Voltage (DC)	—		2000	V
T _{stg}	Storage Temperature	-65 to 175		°C	
T _j	Max. Operating Junction Temperature	175		°C	

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case	Max	1	3.33	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max		62.5	°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ		0.5	°C/W
T _l	Maximum Lead Temperature For Soldering Purpose			300	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	55	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	500	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	120	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	38	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	50			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 15 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	1	1.6	2.5	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 5 V I _D = 27.5 A V _{GS} = 5 V I _D = 27.5 A T _c = 100 °C		0.02	0.023 0.046	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} × R _{DS(on)max} V _{GS} = 10 V	55			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} × R _{DS(on)max} I _D = 27.5 A	20	39		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		2700	3600	pF
C _{oss}	Output Capacitance			850	1200	pF
C _{rss}	Reverse Transfer Capacitance			180	250	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 25\text{ V}$ $I_D = 27.5\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 3)		150 950	220 1400	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 55\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 5)		110		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 40\text{ V}$ $I_D = 55\text{ A}$ $V_{GS} = 5\text{ V}$		55 12 28	80	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(off)}$ t_f	Off-voltage Rise Time Fall Time	$V_{DD} = 40\text{ V}$ $I_D = 55\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 5)		185 250	270 350	ns ns
t_c	Cross-over Time	(see test circuit, figure 5)		500	700	ns

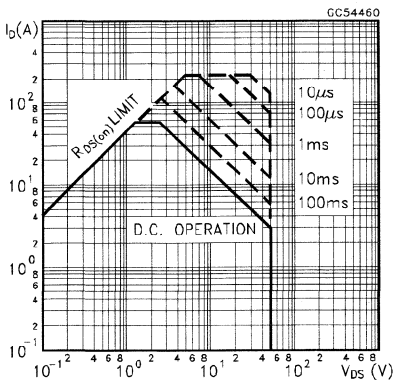
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				55 220	A A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 55\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 55\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		120		ns
Q_{rr}	Reverse Recovery Charge			0.3		μ C
I_{RRM}	Reverse Recovery Current			5		A

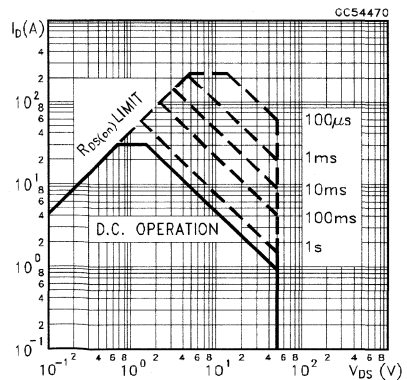
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

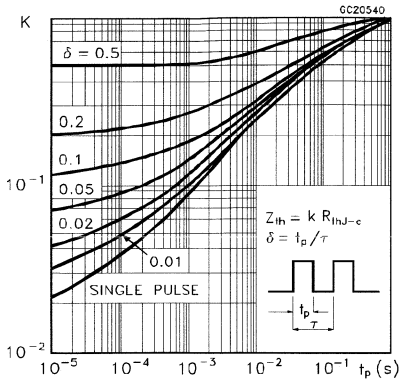
Safe Operating Areas For TO-220



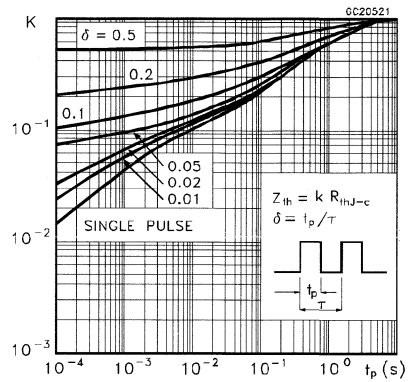
Safe Operating Areas For ISOWATT220



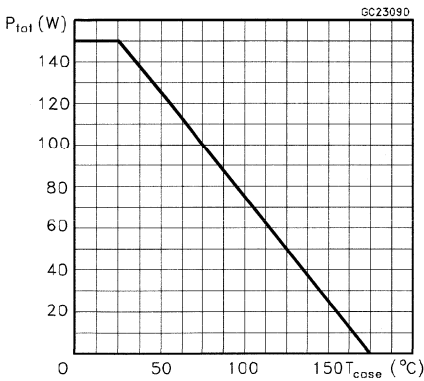
Thermal Impedance For TO-220



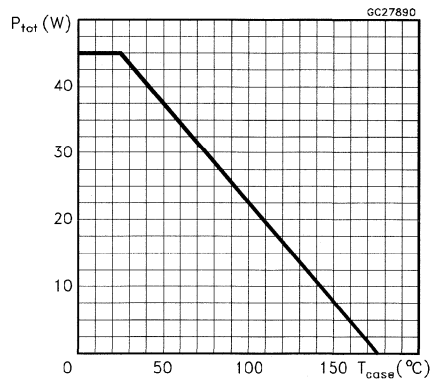
Thermal Impedance For ISOWATT220



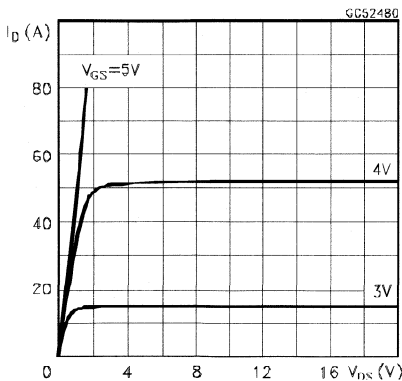
Derating Curve For TO-220



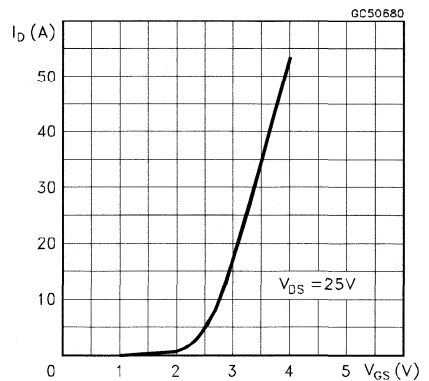
Derating Curve For ISOWATT220



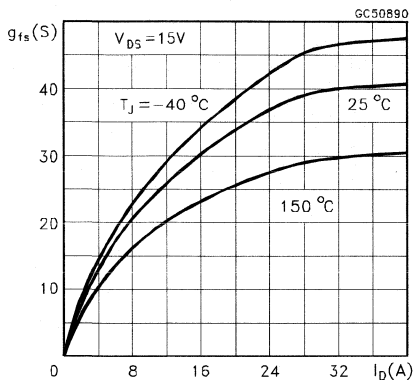
Output Characteristics



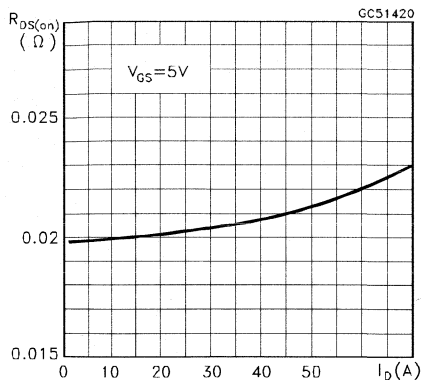
Transfer Characteristics



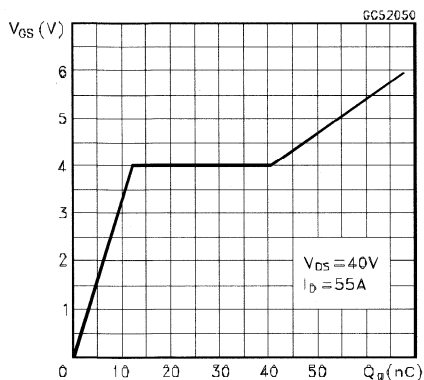
Transconductance



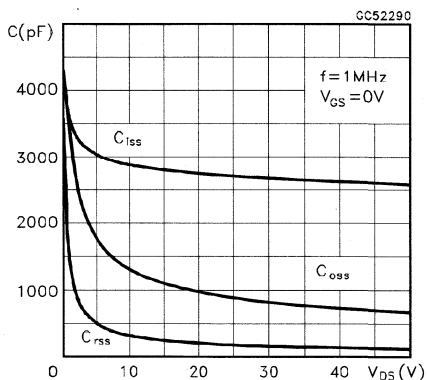
Static Drain-source On Resistance



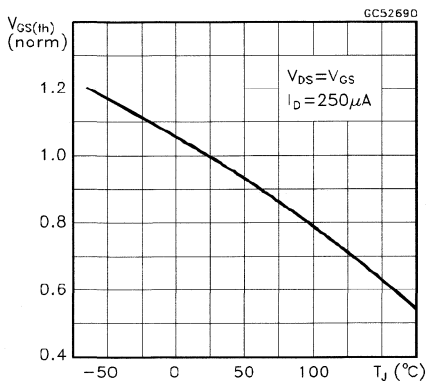
Gate Charge vs Gate-source Voltage



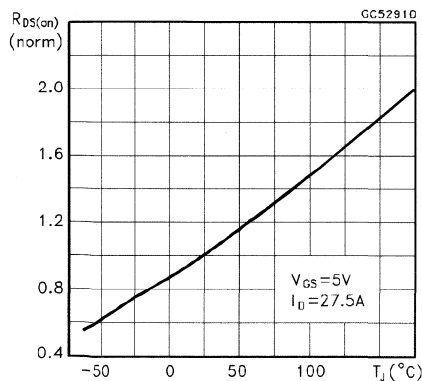
Capacitance Variations



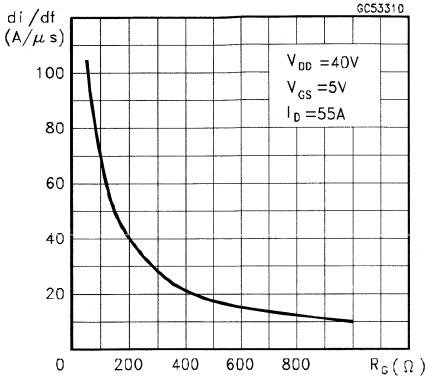
Normalized Gate Threshold Voltage vs Temperature



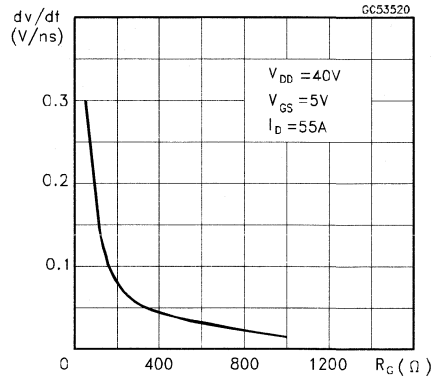
Normalized On Resistance vs Temperature



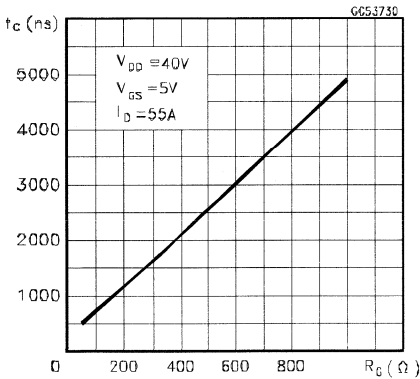
Turn-on Current Slope



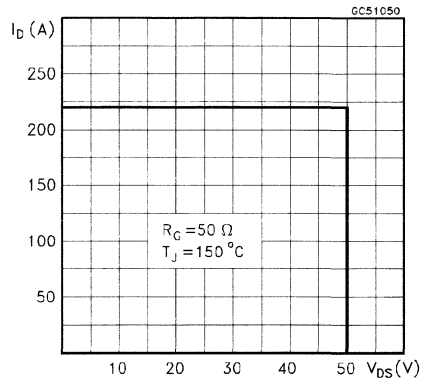
Turn-off Drain-source Voltage Slope



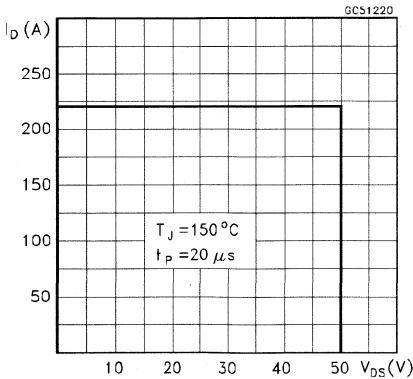
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

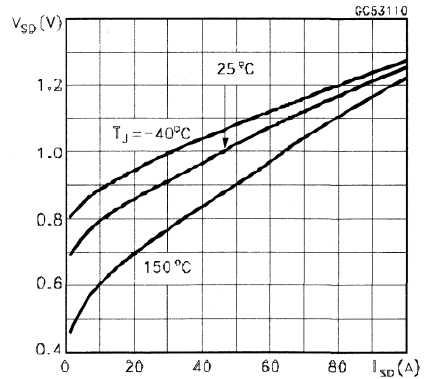


Fig. 1: Unclamped Inductive Load Test Circuits

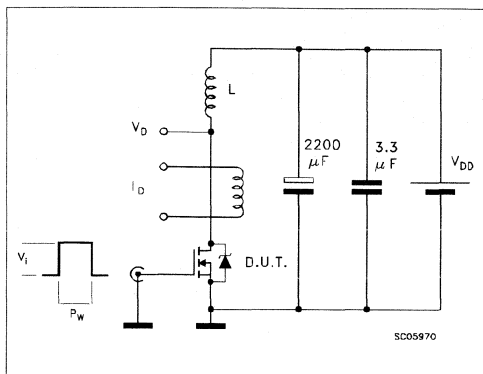


Fig. 2: Unclamped Inductive Waveforms

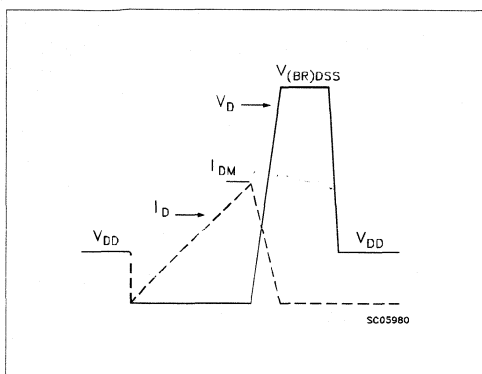


Fig. 3: Switching Times Test Circuits For Resistive Load

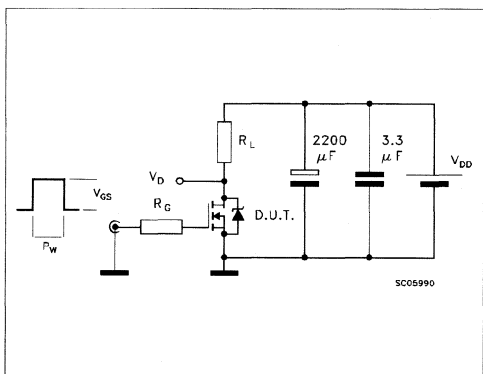


Fig. 4: Gate Charge Test Circuit

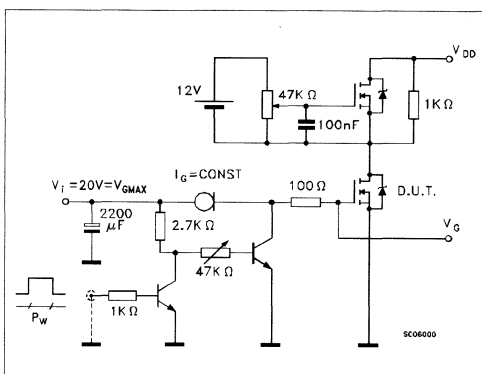
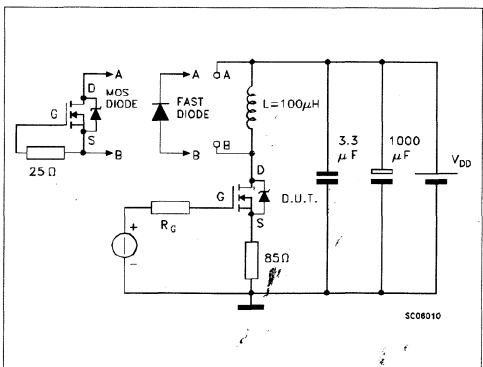


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



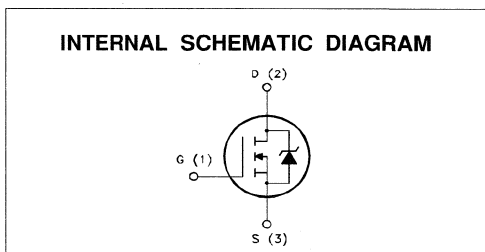
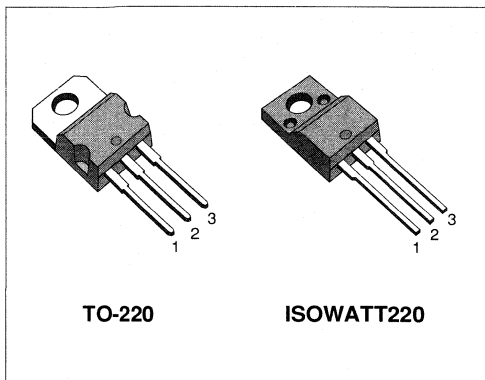
N - CHANNEL ENHANCEMENT MODE LOW THRESHOLD POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP55N06L	60 V	< 0.023 Ω	55 A
STP55N06LFI	60 V	< 0.023 Ω	30 A

- TYPICAL R_{DS(on)} = 0.02 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- LOGIC LEVEL COMPATIBLE INPUT
- 175°C OPERATING TEMPERATURE FOR STANDARD PACKAGE
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP55N06L	STP55N06LFI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	60		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	60		V
V _{GS}	Gate-source Voltage	± 15		V
I _D	Drain Current (continuous) at T _c = 25 °C	55	30	A
I _D	Drain Current (continuous) at T _c = 100 °C	38	21	A
I _{DM} (*)	Drain Current (pulsed)	220	220	A
P _{tot}	Total Dissipation at T _c = 25 °C	150	45	W
	Derating Factor	1	0.3	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

		TO-220	ISOWATT220		
$R_{thj-case}$	Thermal Resistance Junction-case	Max	1	3.33	$^{\circ}\text{C}/\text{W}$
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5		$^{\circ}\text{C}/\text{W}$
$R_{thc-sink}$	Thermal Resistance Case-sink	Typ	0.5		$^{\circ}\text{C}/\text{W}$
T_l	Maximum Lead Temperature For Soldering Purpose		300		$^{\circ}\text{C}$

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	55	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25^{\circ}\text{C}$, $I_D = I_{AR}$, $V_{DD} = 25\text{V}$)	500	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	120	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100^{\circ}\text{C}$, pulse width limited by T_j max, $\delta < 1\%$)	38	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25^{\circ}\text{C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\ \mu\text{A}$ $V_{GS} = 0$	60			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^{\circ}\text{C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 15\text{V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\ \mu\text{A}$	1	1.6	2.5	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 5\text{V}$ $I_D = 27.5\text{A}$ $V_{GS} = 5\text{V}$ $I_D = 27.5\text{A}$ $T_c = 100^{\circ}\text{C}$		0.02	0.023 0.046	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{V}$	55			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 27.5\text{A}$	20	39		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{V}$ $f = 1\text{MHz}$ $V_{GS} = 0$		2700	3600	pF
C_{oss}	Output Capacitance			850	1200	pF
C_{rss}	Reverse Transfer Capacitance			180	250	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 25\text{ V}$ $I_D = 27.5\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 3)		150 950	220 1400	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 55\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 5)		110		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 40\text{ V}$ $I_D = 55\text{ A}$ $V_{GS} = 5\text{ V}$		55 12 28	80	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(off)}$ t_f t_c	Off-voltage Rise Time Fall Time Cross-over Time	$V_{DD} = 40\text{ V}$ $I_D = 55\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 5)		185 250 500	270 350 700	ns ns ns

SOURCE DRAIN DIODE

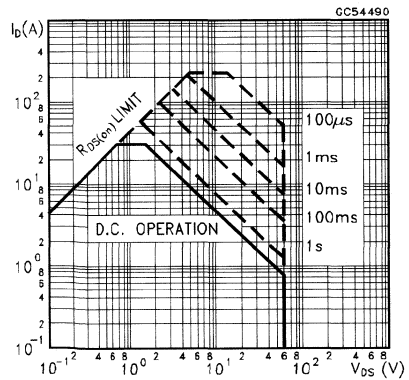
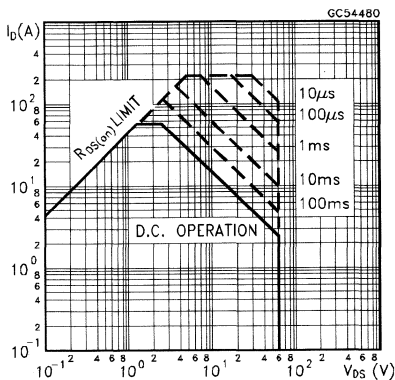
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				55 220	A A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 55\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 55\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		120 0.3 5		ns μ C A

(\ast) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

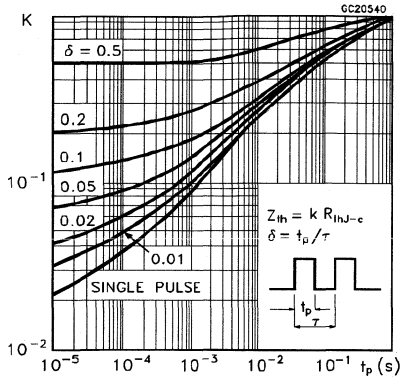
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas For TO-220

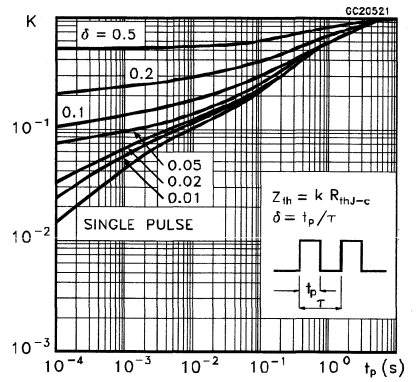
Safe Operating Areas For ISOWATT220



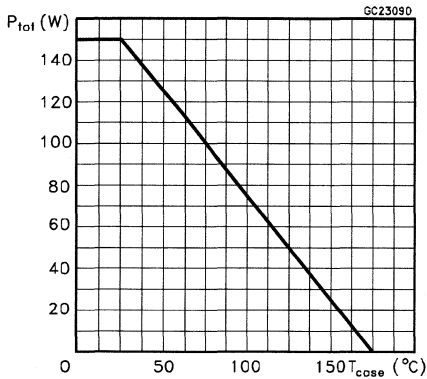
Thermal Impedance For TO-220



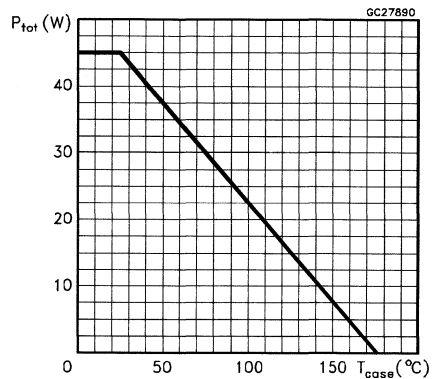
Thermal Impedance For ISOWATT220



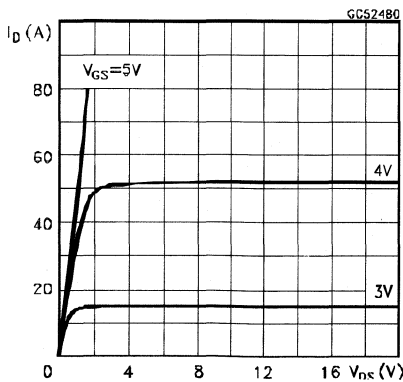
Derating Curve For TO-220



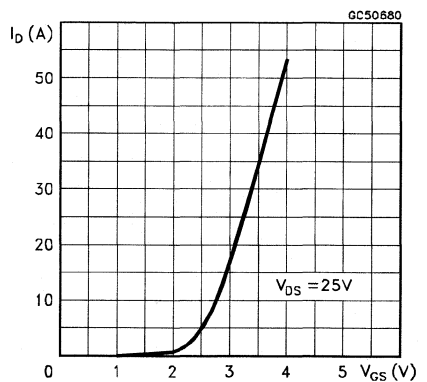
Derating Curve For ISOWATT220



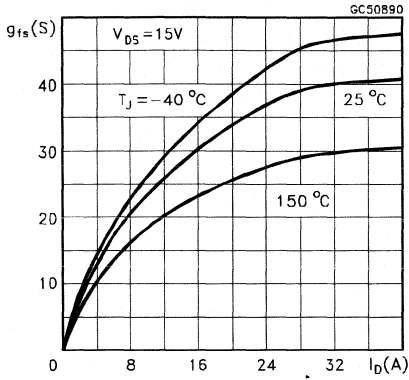
Output Characteristics



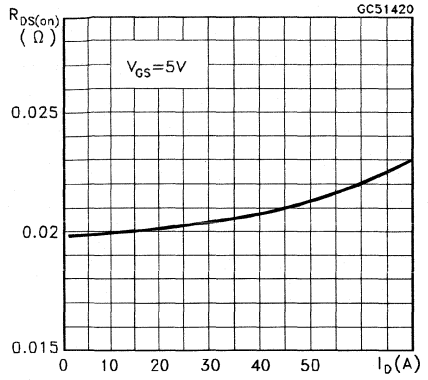
Transfer Characteristics



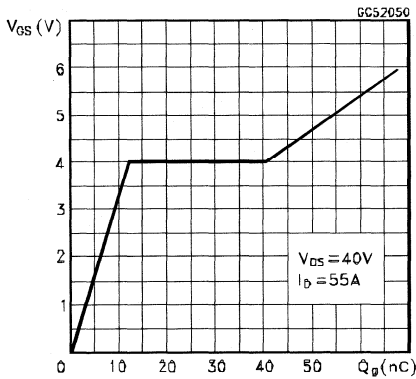
Transconductance



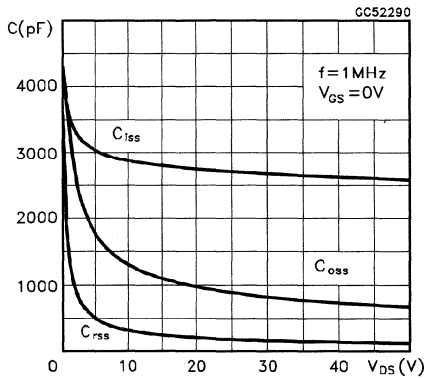
Static Drain-source On Resistance



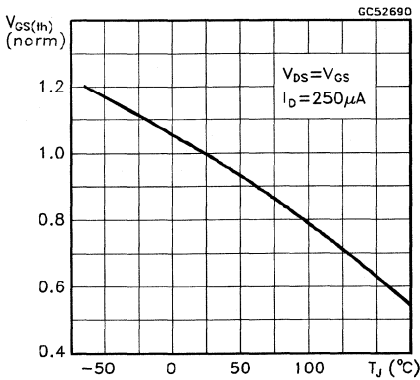
Gate Charge vs Gate-source Voltage



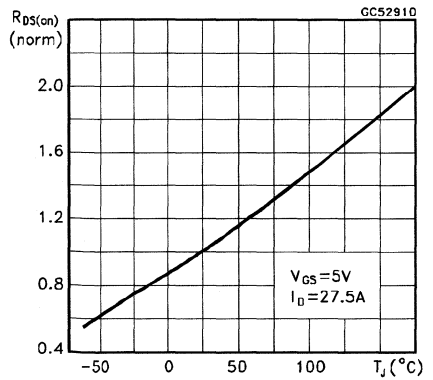
Capacitance Variations



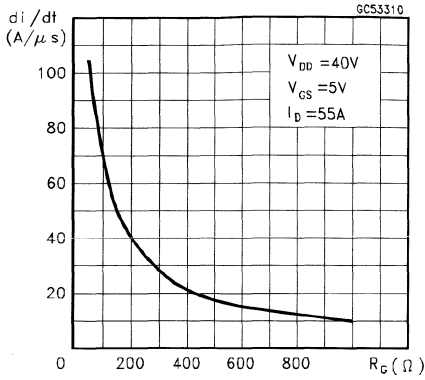
Normalized Gate Threshold Voltage vs Temperature



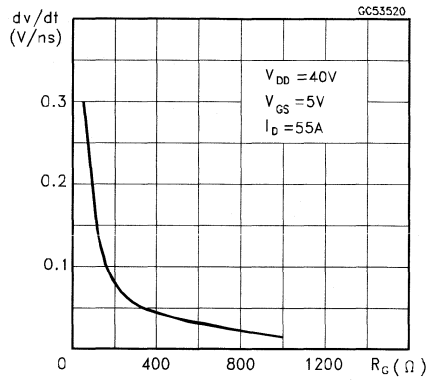
Normalized On Resistance vs Temperature



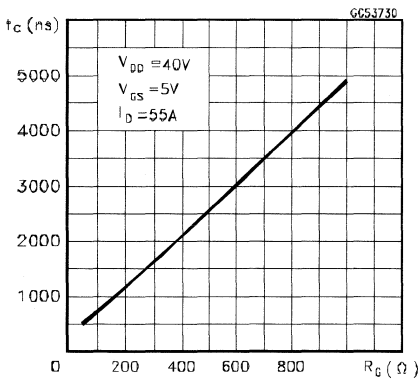
Turn-on Current Slope



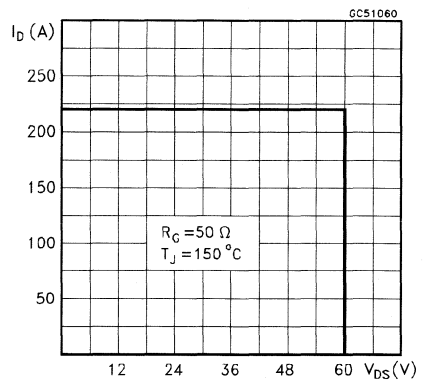
Turn-off Drain-source Voltage Slope



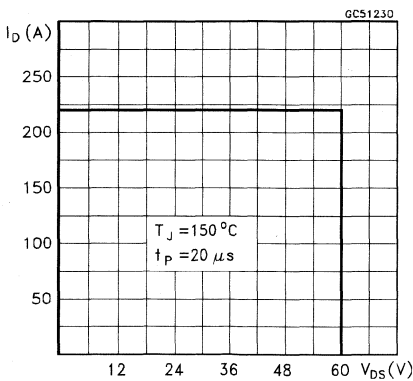
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

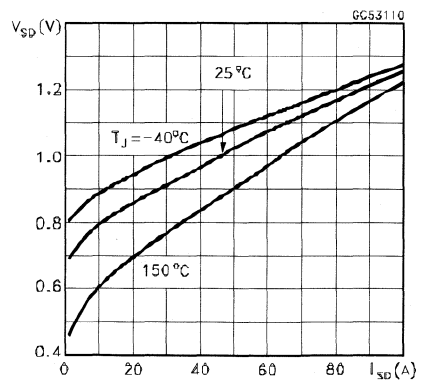


Fig. 1: Unclamped Inductive Load Test Circuits

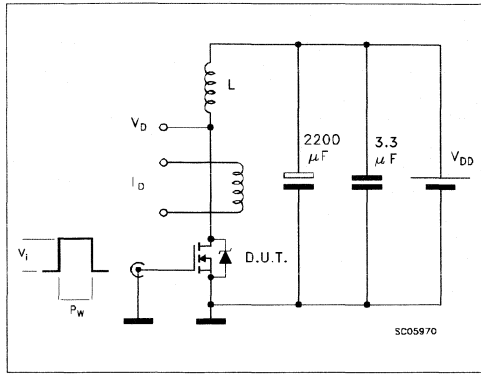


Fig. 2: Unclamped Inductive Waveforms

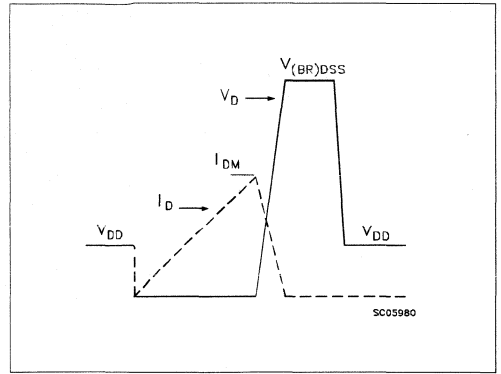


Fig. 3: Switching Times Test Circuits For Resistive Load

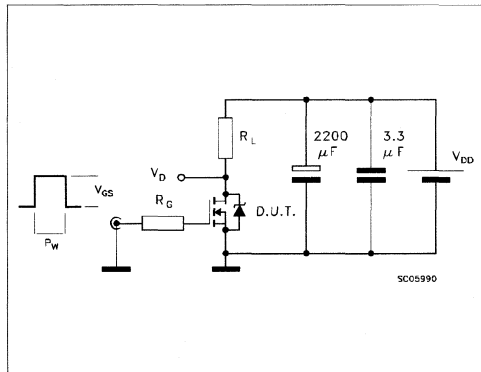


Fig. 4: Gate Charge Test Circuit

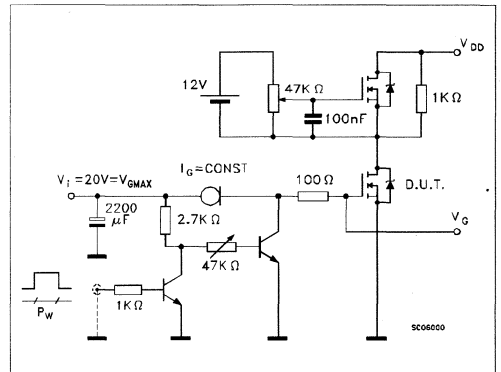
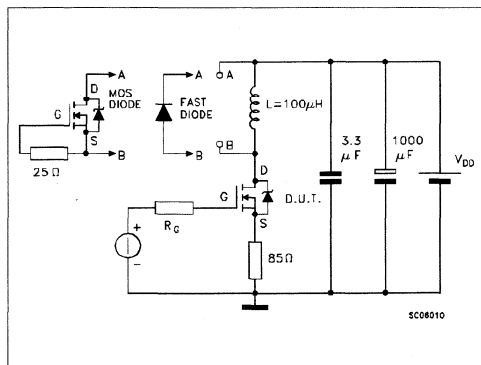


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



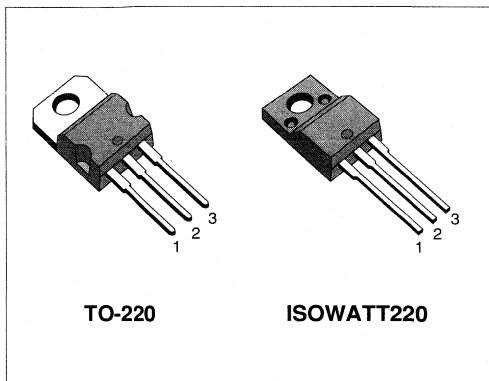
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP60N05	50 V	< 0.02 Ω	60 A
STP60N05FI	50 V	< 0.02 Ω	32 A

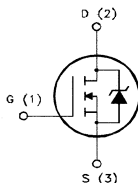
- TYPICAL R_{DS(on)} = 0.017 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- VERY LOW R_{DS(on)}
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP60N05	STP60N05FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	50		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	50		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	60	32	A
I _D	Drain Current (continuous) at T _c = 100 °C	42	22	A
I _{DM} (*)	Drain Current (pulsed)	240	240	A
P _{tot}	Total Dissipation at T _c = 25 °C	150	45	W
	Derating Factor	1	0.3	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
$R_{thj-case}$	Thermal Resistance Junction-case	Max	1	3.33	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5		°C/W
$R_{thc-sink}$	Thermal Resistance Case-sink	Typ	0.5		°C/W
T_j	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	60	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\text{ °C}$, $I_D = I_{AR}$, $V_{DD} = 25\text{ V}$)	700	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	170	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\text{ °C}$, pulse width limited by T_j max, $\delta < 1\%$)	42	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$	50			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\text{ }\mu\text{A}$	2	2.9	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 30\text{ A}$ $V_{GS} = 10\text{ V}$ $I_D = 30\text{ A}$ $T_c = 100\text{ °C}$		0.017	0.02 0.04	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	60			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 30\text{ A}$	16	29		S
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$		2200	2900	pF
C_{oss}	Output Capacitance			950	1300	pF
C_{rss}	Reverse Transfer Capacitance			250	350	pF

ELECTRICAL CHARACTERISTICS (continued)**SWITCHING ON**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 40\text{ V}$ $I_D = 60\text{ A}$		65	90	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		500	700	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 60\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		185		A/ μs
Q_g	Total Gate Charge	$V_{DD} = 40\text{ V}$ $I_D = 60\text{ A}$ $V_{GS} = 10\text{ V}$		68	95	nC
Q_{gs}	Gate-Source Charge			15		nC
Q_{gd}	Gate-Drain Charge			27		nC

SWITCHING OFF

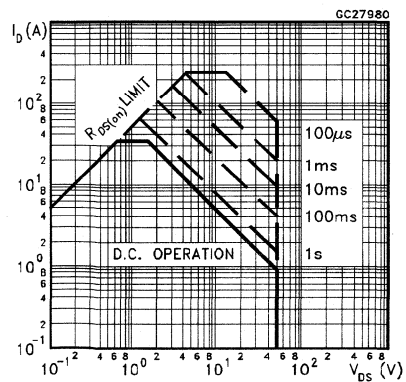
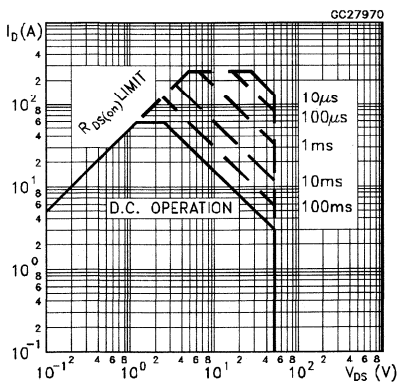
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 60\text{ A}$		160	220	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		190	270	ns
t_c	Cross-over Time	(see test circuit, figure 5)		370	520	ns

SOURCE DRAIN DIODE

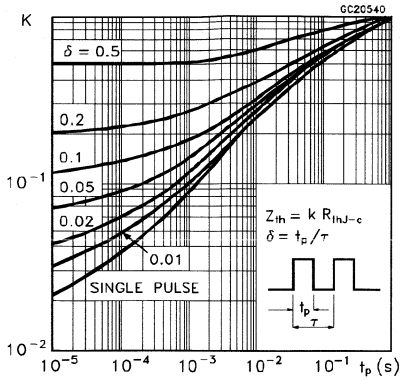
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				60	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				240	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 60\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 60\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 25\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		120		ns
Q_{rr}	Reverse Recovery Charge			0.27		μC
I_{RRM}	Reverse Recovery Current			4.5		A

(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

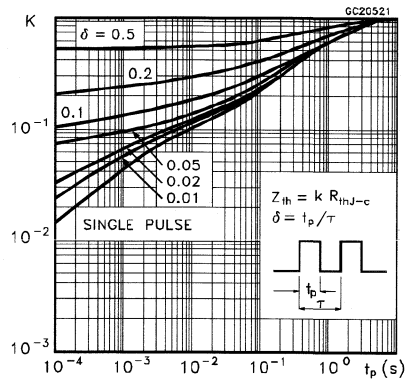
(\bullet) Pulse width limited by safe operating area

Safe Operating Areas for TO-220**Safe Operating Areas for ISOWATT220**

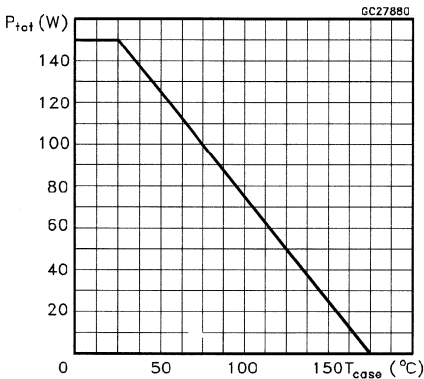
Thermal Impedance For TO-220



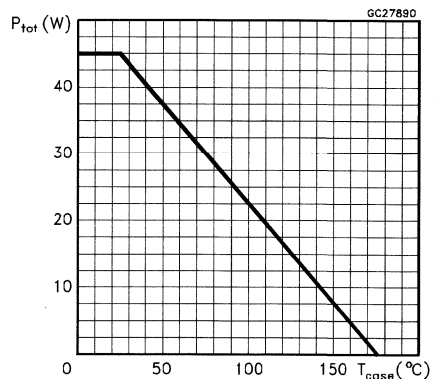
Thermal Impedance For ISOWATT220



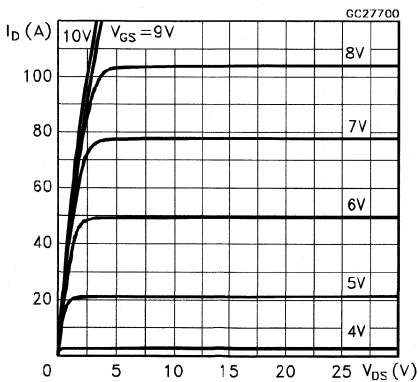
Derating Curve For TO-220



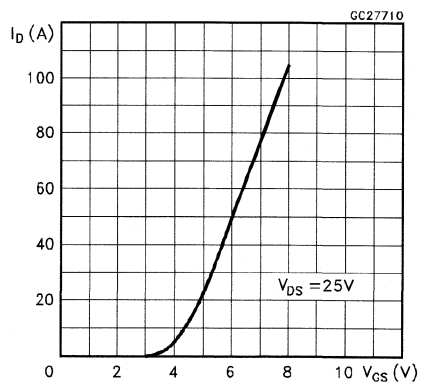
Derating Curve For ISOWATT220



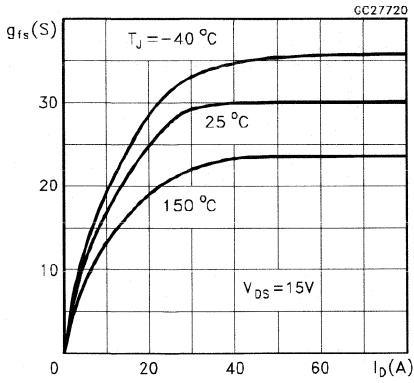
Output Characteristics



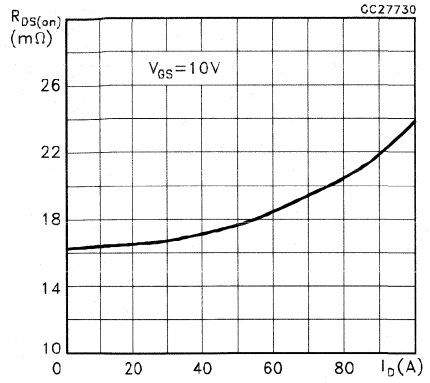
Transfer Characteristics



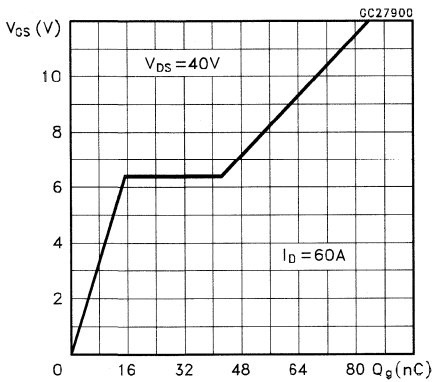
Transconductance



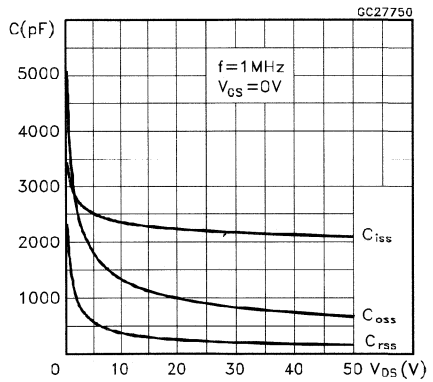
Static Drain-source On Resistance



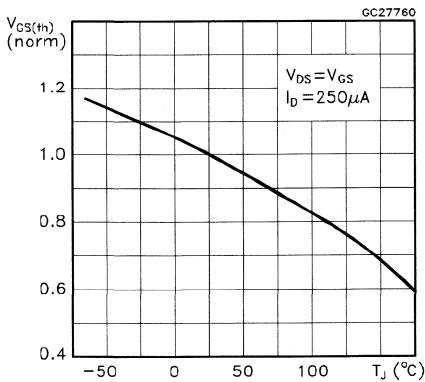
Gate Charge vs Gate-source Voltage



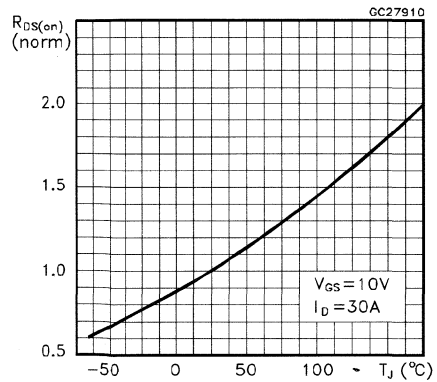
Capacitance Variations



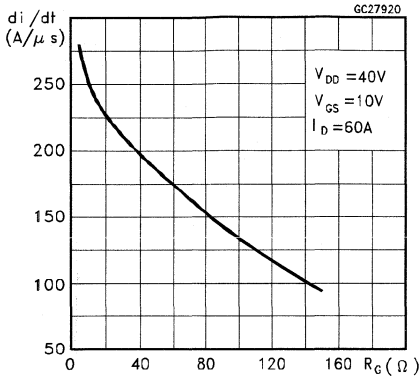
Normalized Gate Threshold Voltage vs Temperature



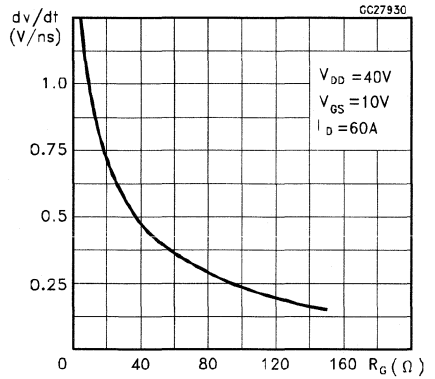
Normalized On Resistance vs Temperature



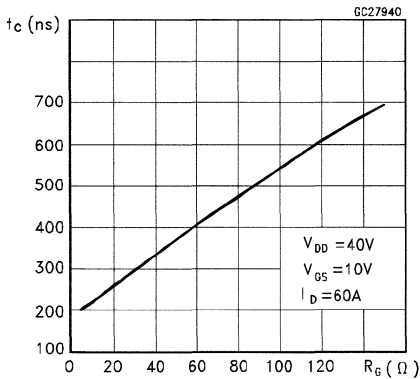
Turn-on Current Slope



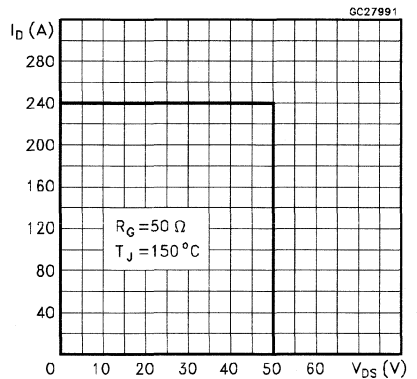
Turn-off Drain-source Voltage Slope



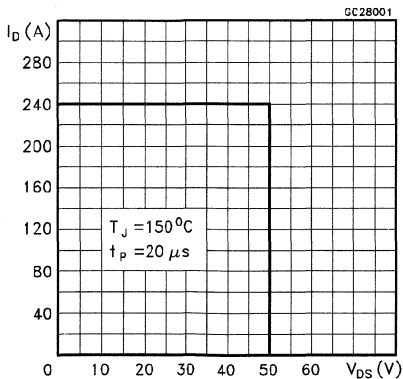
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

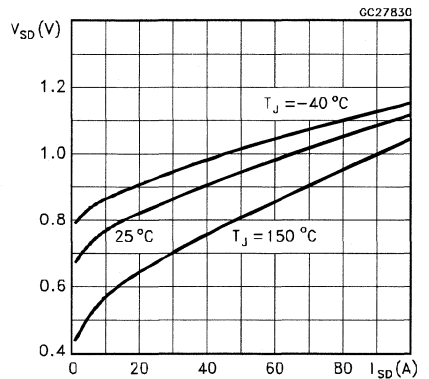


Fig. 1: Unclamped Inductive Load Test Circuits

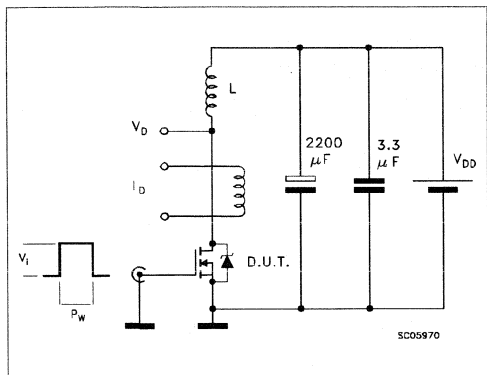


Fig. 2: Unclamped Inductive Waveforms

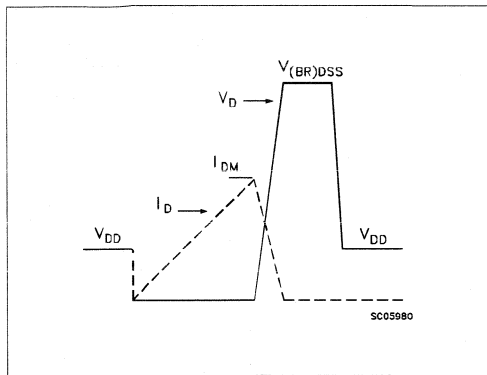


Fig. 3: Switching Times Test Circuits For Resistive Load

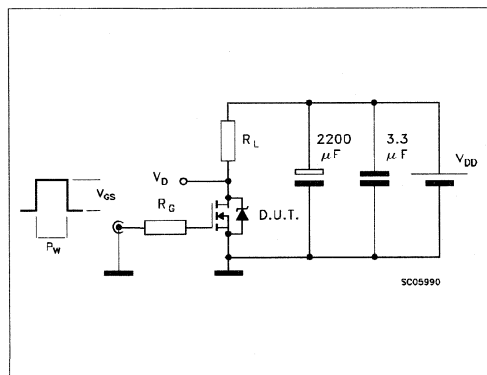


Fig. 4: Gate Charge Test Circuit

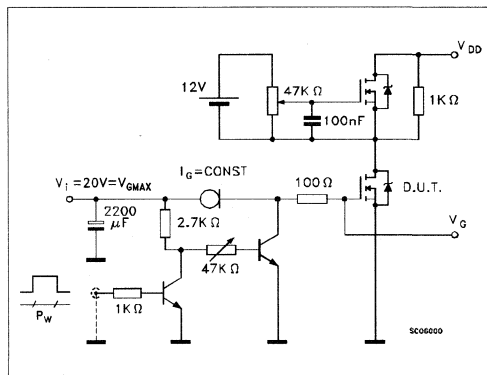
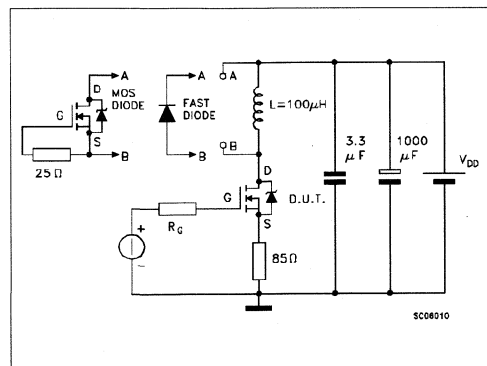


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



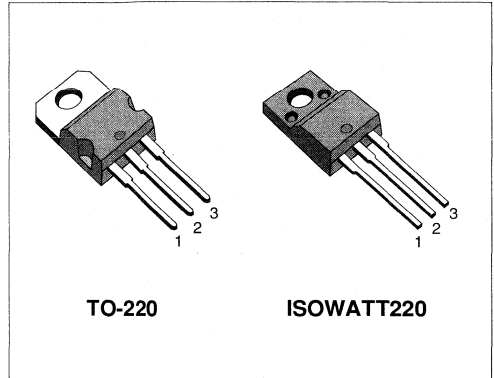
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP60N06	60 V	< 0.02 Ω	60 A
STP60N06FI	60 V	< 0.02 Ω	32 A

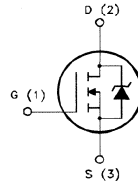
- TYPICAL R_{DS(on)} = 0.017 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- VERY LOW R_{DS(on)}
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP60N06	STP60N06FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	60		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	60		V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	60	32	A
I _D	Drain Current (continuous) at T _c = 100 °C	42	22	A
I _{DM} (*)	Drain Current (pulsed)	240	240	A
P _{tot}	Total Dissipation at T _c = 25 °C	150	45	W
	Derating Factor	1	0.3	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

			TO-220	ISOWATT220	
R _{thj-case}	Thermal Resistance Junction-case	Max	1	3.33	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ	0.5		°C/W
T _l	Maximum Lead Temperature For Soldering Purpose		300		°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	60	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	600	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	150	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	42	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0	60			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	2.9	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10 V I _D = 30 A V _{GS} = 10 V I _D = 30 A T _c = 100°C		0.017	0.02 0.04	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} × R _{DS(on)max} V _{GS} = 10 V	60			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} × R _{DS(on)max} I _D = 30 A	16	29		S
C _{iss}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		2200	2900	pF
C _{oss}	Output Capacitance			950	1300	pF
C _{rss}	Reverse Transfer Capacitance			250	350	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 40\text{ V}$ $I_D = 60\text{ A}$		65	90	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		500	700	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 60\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		185		A/ μs
Q_g	Total Gate Charge	$V_{DD} = 40\text{ V}$ $I_D = 60\text{ A}$ $V_{GS} = 10\text{ V}$		68	95	nC
Q_{gs}	Gate-Source Charge			15		nC
Q_{gd}	Gate-Drain Charge			27		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 60\text{ A}$		160	220	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$		190	270	ns
t_c	Cross-over Time	(see test circuit, figure 5)		370	520	ns

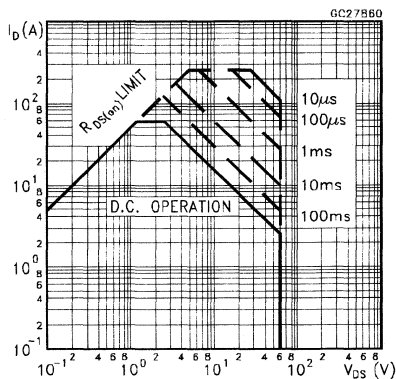
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				60	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				240	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 60\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 60\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 25\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		120		ns
Q_{rr}	Reverse Recovery Charge			0.27		μC
I_{RRM}	Reverse Recovery Current			4.5		A

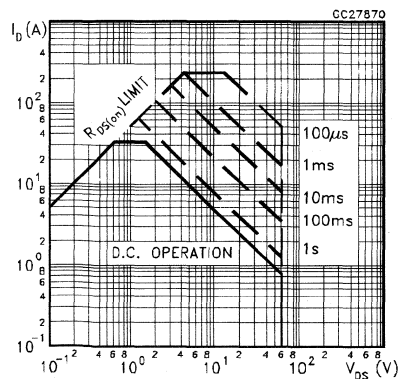
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

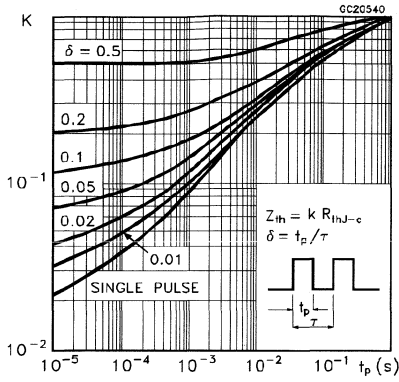
Safe Operating Areas For TO-220



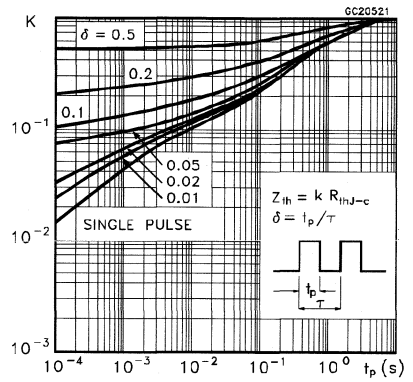
Safe Operating Areas For ISOWATT220



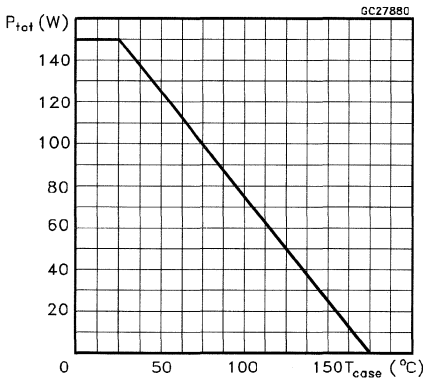
Thermal Impedance For TO-220



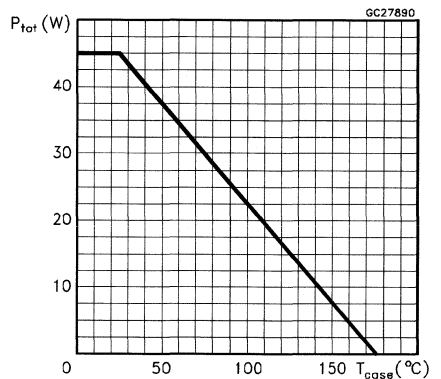
Thermal Impedance For ISOWATT220



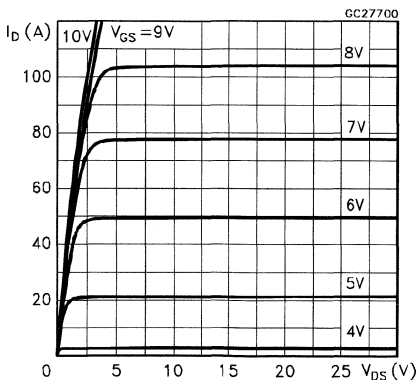
Derating Curve For TO-220



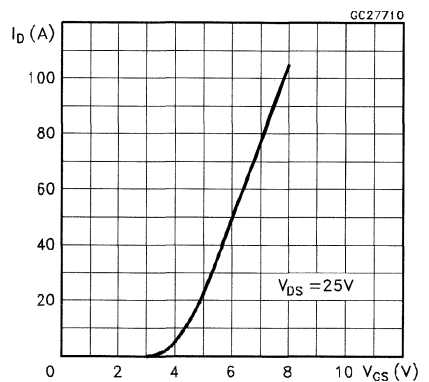
Derating Curve For ISOWATT220



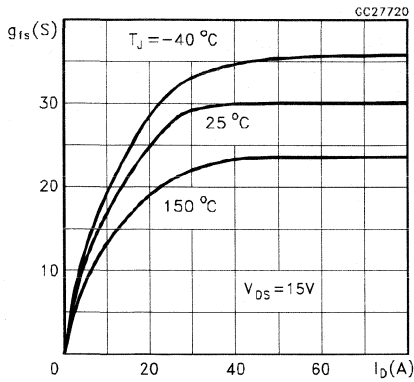
Output Characteristics



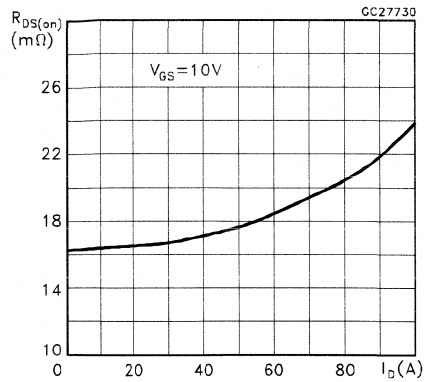
Transfer Characteristics



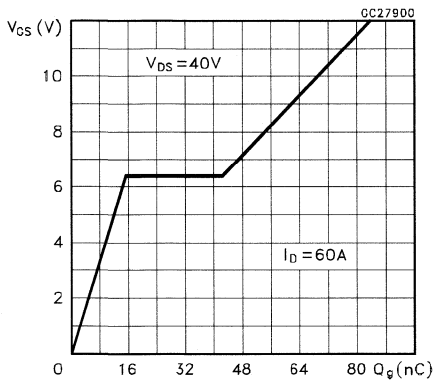
Transconductance



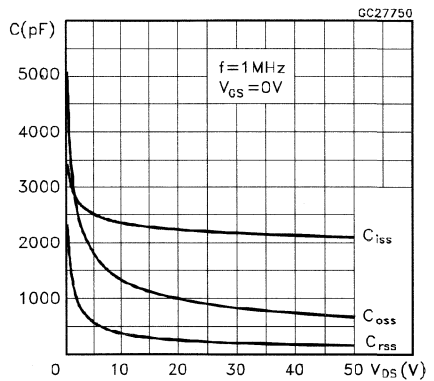
Static Drain-source On Resistance



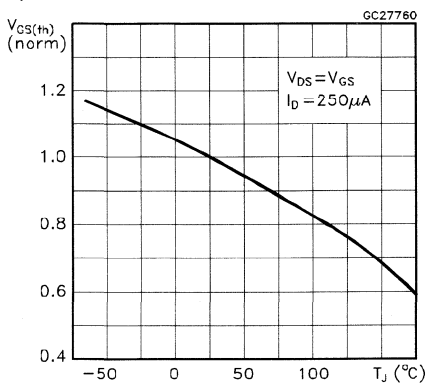
Gate Charge vs Gate-source Voltage



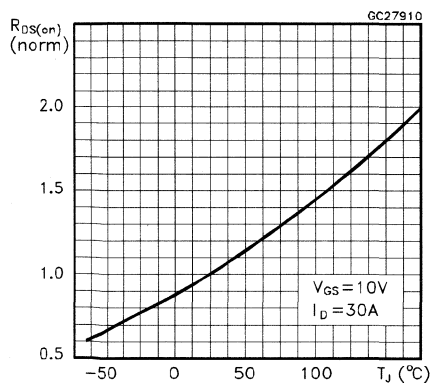
Capacitance Variations



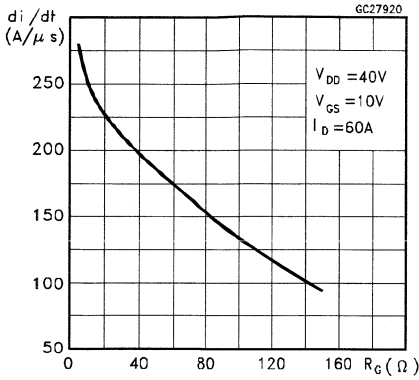
Normalized Gate Threshold Voltage vs Temperature



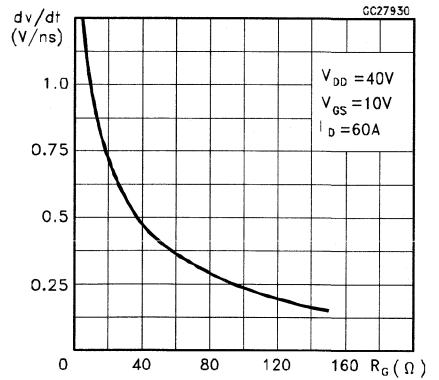
Normalized On Resistance vs Temperature



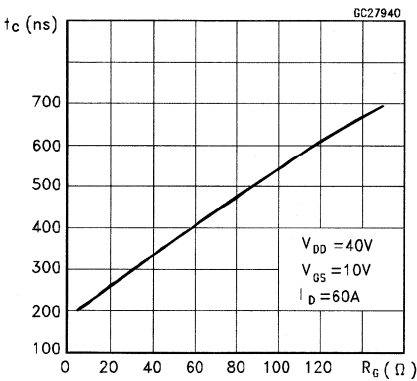
Turn-on Current Slope



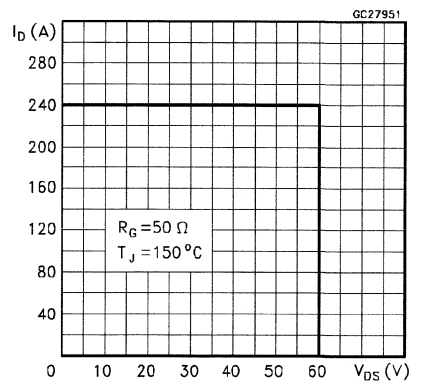
Turn-off Drain-source Voltage Slope



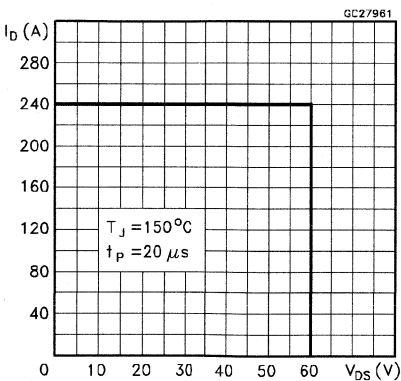
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

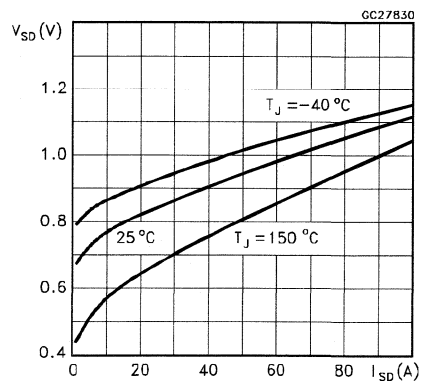


Fig. 1: Unclamped Inductive Load Test Circuits

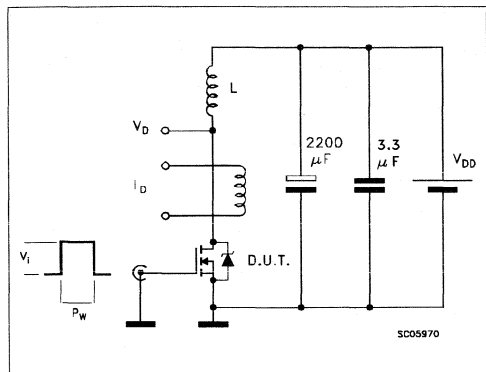


Fig. 2: Unclamped Inductive Waveforms

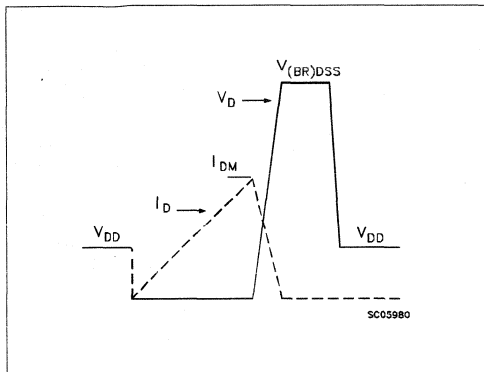


Fig. 3: Switching Times Test Circuits For Resistive Load

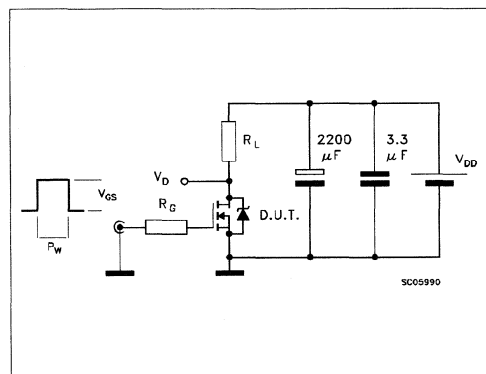


Fig. 4: Gate Charge Test Circuit

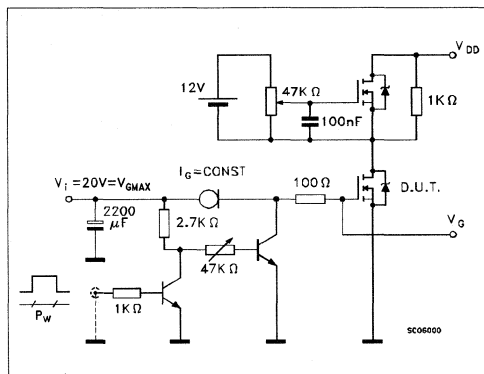
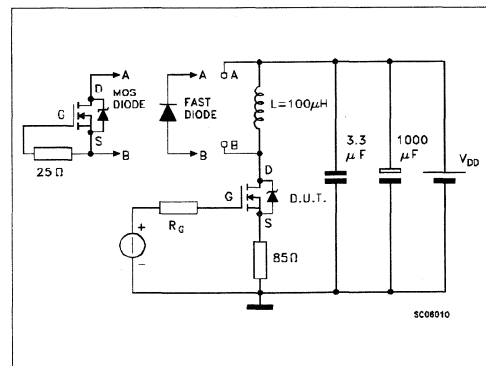


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



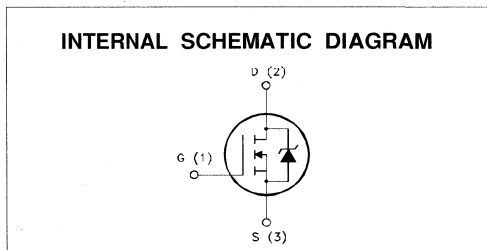
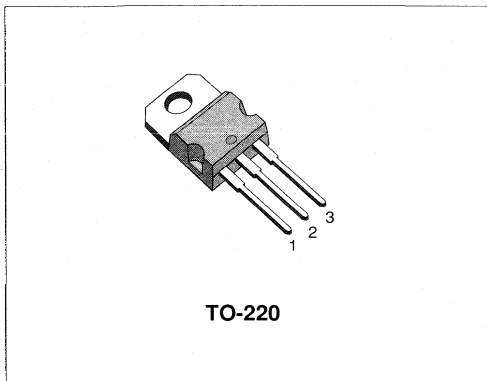
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STP60N05-16	50 V	< 0.016 Ω	60 A
STP60N06-16	60 V	< 0.016 Ω	60 A

- TYPICAL R_{DS(on)} = 0.013 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- VERY HIGH CURRENT CAPABILITY
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP60N05-16	STP60N06-16	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	50	60	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	50	60	V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	60		A
I _D	Drain Current (continuous) at T _c = 100 °C	42		A
I _{DM} (*)	Drain Current (pulsed)	240		A
P _{tot}	Total Dissipation at T _c = 25 °C	150		W
	Derating Factor	1		W/°C
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(*) Pulse width limited by safe operating area

THERMAL DATA

R _{thj-case}	Thermal Resistance Junction-case	Max	1	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	62.5	°C/W
R _{thj-amb}	Thermal Resistance Case-sink	Typ	0.5	°C/W
T _i	Maximum Lead Temperature For Soldering Purpose		300	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	60	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 25 V)	600	mJ
E _{AR}	Repetitive Avalanche Energy (pulse width limited by T _j max, δ < 1%)	150	mJ
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (T _c = 100 °C, pulse width limited by T _j max, δ < 1%)	42	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source Breakdown Voltage	I _D = 250 μA V _{GS} = 0 for STP60N05-16 for STP60N06-16	50 60			V V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating x 0.8 T _c = 125 °C			250 1000	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} I _D = 250 μA	2	2.9	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10 V I _D = 30 A V _{GS} = 10 V I _D = 30 A T _c = 100°C		0.013	0.016 0.032	Ω Ω
I _{D(on)}	On State Drain Current	V _{DS} > I _{D(on)} x R _{DS(on)max} V _{GS} = 10 V	60			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (*)	Forward Transconductance	V _{DS} > I _{D(on)} x R _{DS(on)max} I _D = 30 A	20	40		S
C _{iSS}	Input Capacitance	V _{DS} = 25 V f = 1 MHz V _{GS} = 0		2900	3800	pF
C _{oSS}	Output Capacitance			900	1200	pF
C _{rSS}	Reverse Transfer Capacitance			230	300	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 30\text{ V}$ $I_D = 30\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		75 370	105 520	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 60\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		190		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 40\text{ V}$ $I_D = 60\text{ A}$ $V_{GS} = 10\text{ V}$		105 18 44	150	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$	Off-voltage Rise Time	$V_{DD} = 40\text{ V}$ $I_D = 60\text{ A}$		185	260	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		250	350	ns
t_c	Cross-over Time			480	680	ns

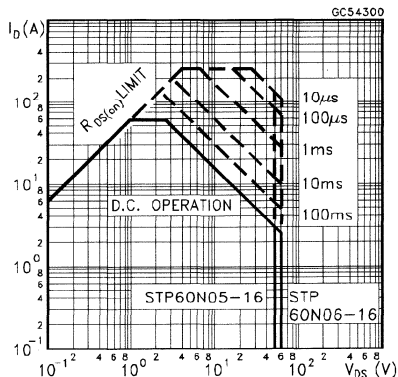
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				60 240	A A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 60\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 60\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		120		ns
Q_{rr}	Reverse Recovery Charge			0.36		μC
I_{RRM}	Reverse Recovery Current			6		A

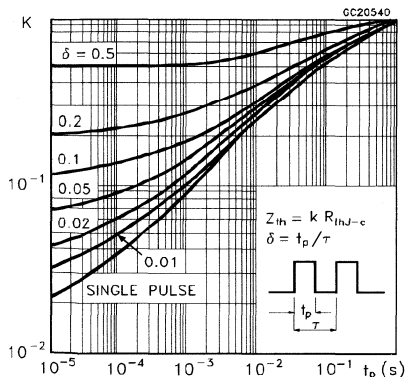
(*) Pulsed: Pulse duration = 300 μ s, duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

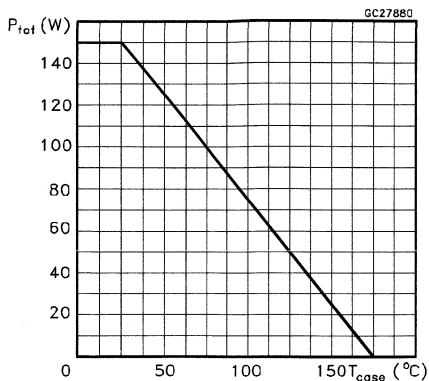
Safe Operating Areas



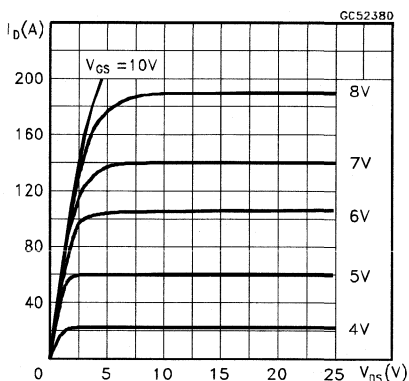
Thermal Impedance



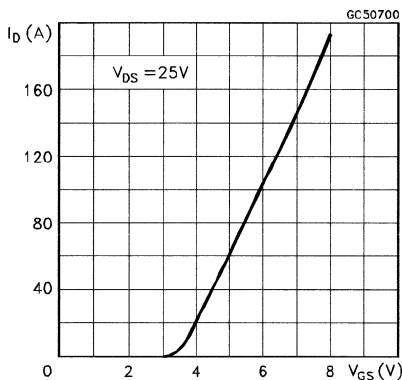
Derating Curve



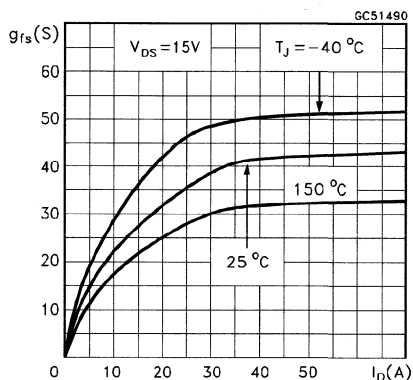
Output Characteristics



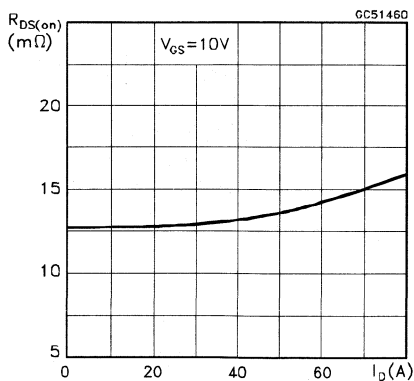
Transfer Characteristics



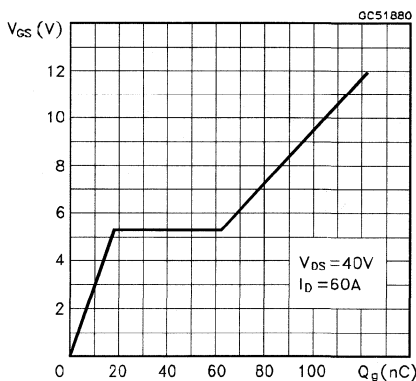
Transconductance



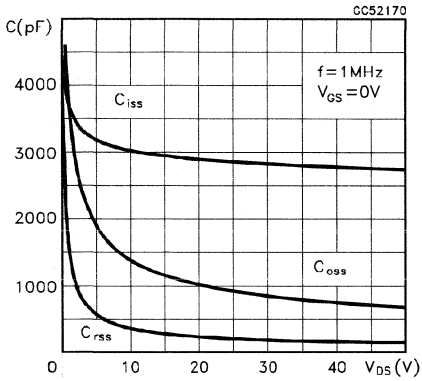
Static Drain-source On Resistance



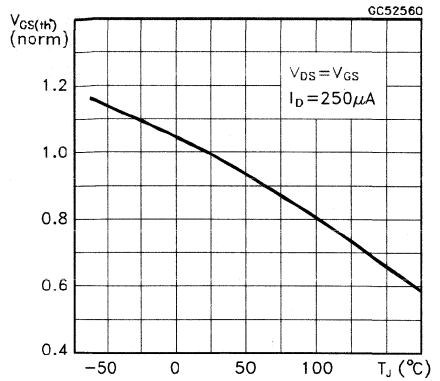
Gate Charge vs Gate-source Voltage



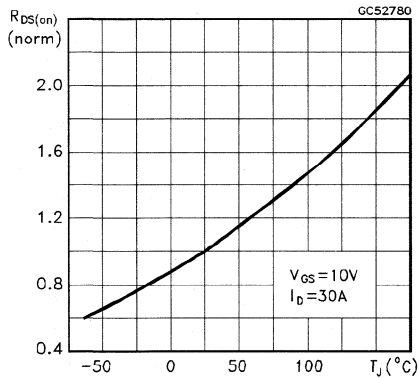
Capacitance Variations



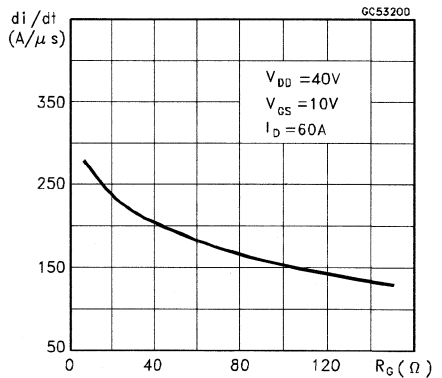
Normalized Gate Threshold Voltage vs Temperature



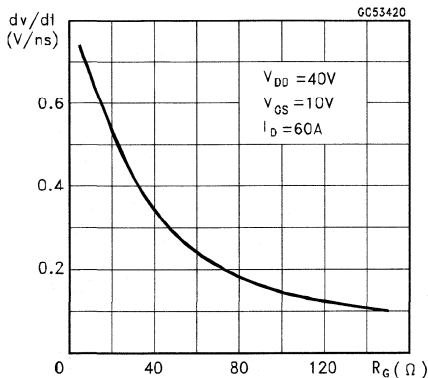
Normalized On Resistance vs Temperature



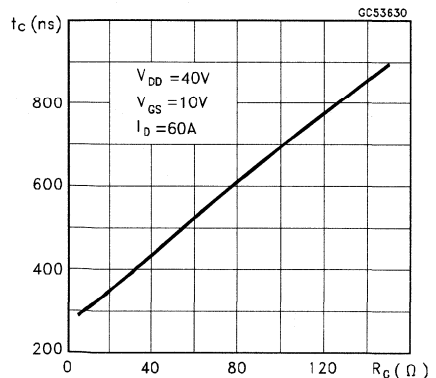
Turn-on Current Slope



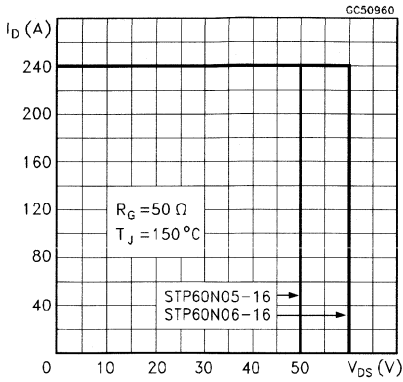
Turn-off Drain-source Voltage Slope



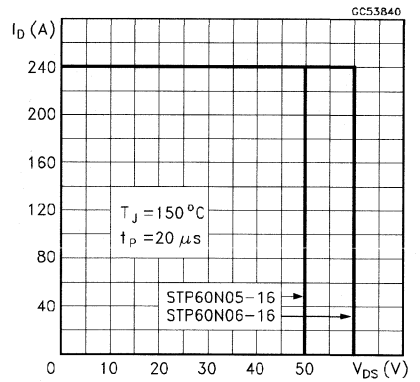
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

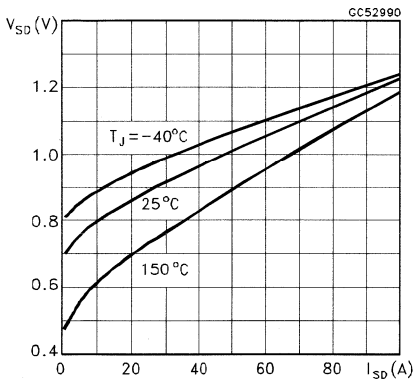


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

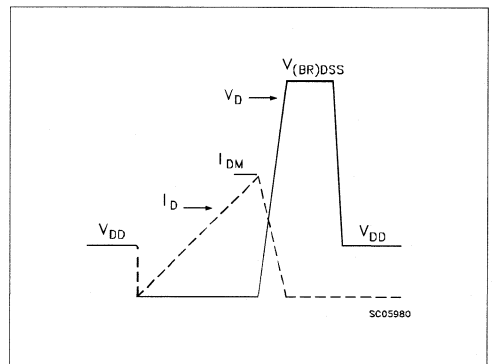
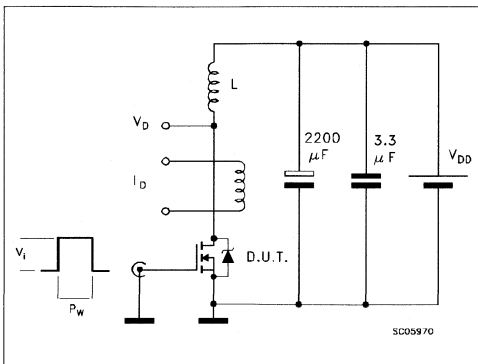


Fig. 3: Switching Times Test Circuits For Resistive Load

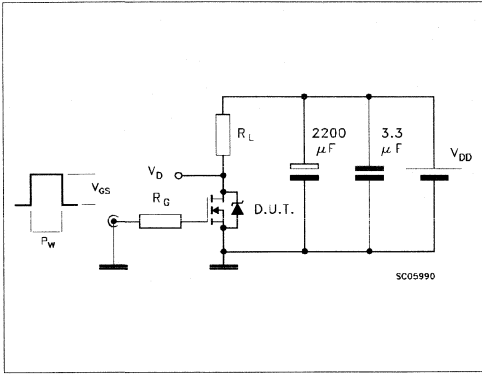


Fig. 4: Gate Charge Test Circuit

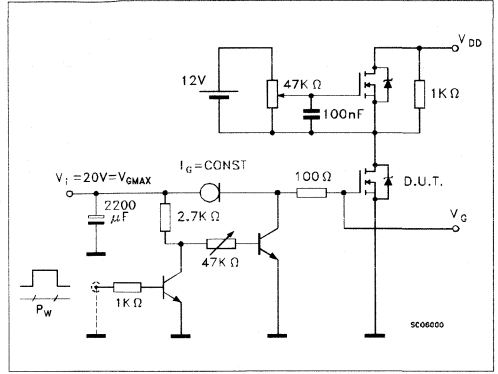
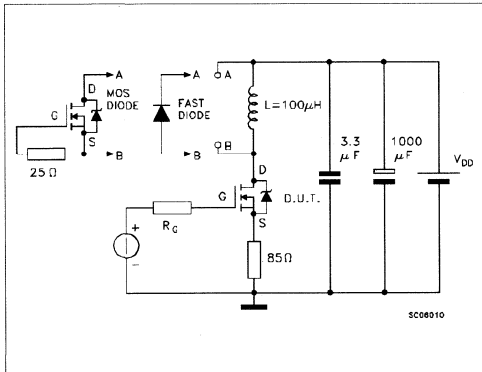


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



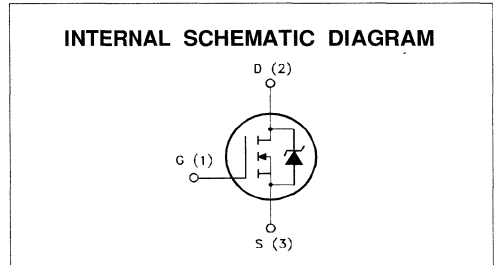
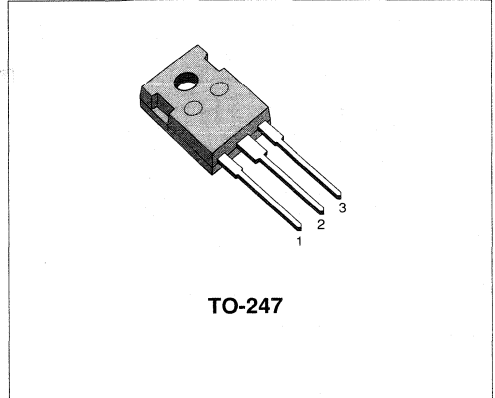
N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STW16N40	400 V	< 0.3 Ω	16 A

- TYPICAL R_{DS(on)} = 0.21 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source Voltage (V _{GS} = 0)	400	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	400	V
V _{GS}	Gate-source Voltage	± 20	V
I _D	Drain Current (continuous) at T _c = 25 °C	16	A
I _D	Drain Current (continuous) at T _c = 100 °C	10	A
I _{DM} (*)	Drain Current (pulsed)	64	A
P _{tot}	Total Dissipation at T _c = 25 °C	180	W
	Derating Factor	1.44	W/°C
T _{stg}	Storage Temperature	-65 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C

(*) Pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	0.69	$^{\circ}C/W$
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	30	$^{\circ}C/W$
$R_{thj-amb}$	Thermal Resistance Case-sink	Typ	0.1	$^{\circ}C/W$
T_j	Maximum Lead Temperature For Soldering Purpose		300	$^{\circ}C$

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	16	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25^{\circ}C$, $I_D = I_{AR}$, $V_{DD} = 50$ V)	435	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	23	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100^{\circ}C$, pulse width limited by T_j max, $\delta < 1\%$)	10	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25^{\circ}C$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250 \mu A$ $V_{GS} = 0$	400			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^{\circ}C$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20$ V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250 \mu A$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10$ V $I_D = 8$ A $V_{GS} = 10$ V $I_D = 8$ A $T_c = 100^{\circ}C$		0.21	0.3 0.6	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10$ V	16			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 8$ A	6	12		S
C_{iss}	Input Capacitance	$V_{DS} = 25$ V $f = 1$ MHz $V_{GS} = 0$		2200	2900	pF
C_{oss}	Output Capacitance			400	550	pF
C_{rss}	Reverse Transfer Capacitance			205	270	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 200\text{ V}$ $I_D = 8\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		25 85	35 115	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 320\text{ V}$ $I_D = 16\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		350		A/ μs
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 320\text{ V}$ $I_D = 16\text{ A}$ $V_{GS} = 10\text{ V}$		145 15 80	190	nC nC nC

SWITCHING OFF

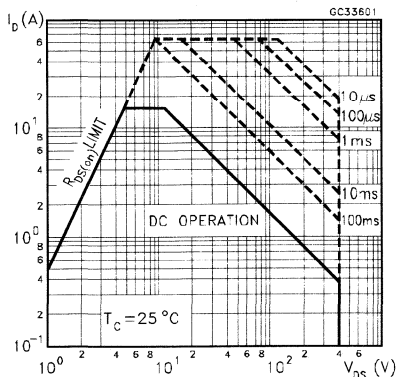
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(v_{off})$ t_f	Off-voltage Rise Time Fall Time	$V_{DD} = 320\text{ V}$ $I_D = 16\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		105 35	140 50	ns ns
t_c	Cross-over Time	(see test circuit, figure 5)		150	200	ns

SOURCE DRAIN DIODE

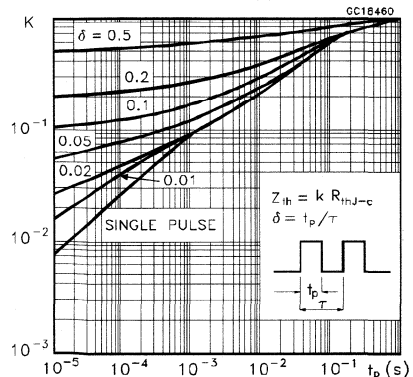
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				16 64	A A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 16\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 16\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_J = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		620		ns
Q_{rr}	Reverse Recovery Charge			10.9		μC
I_{RRM}	Reverse Recovery Current			35		A

(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %
 (•) Pulse width limited by safe operating area

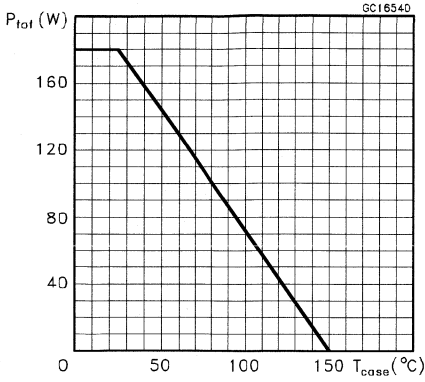
Safe Operating Areas



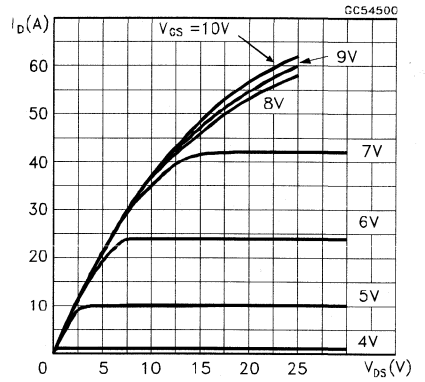
Thermal Impedance



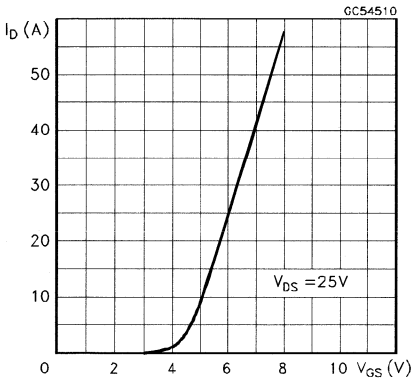
Derating Curve



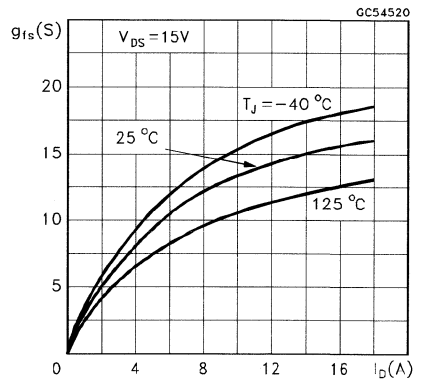
Output Characteristics



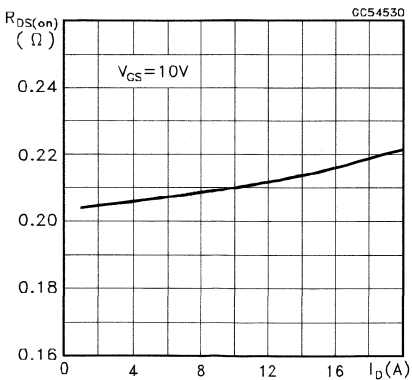
Transfer Characteristics



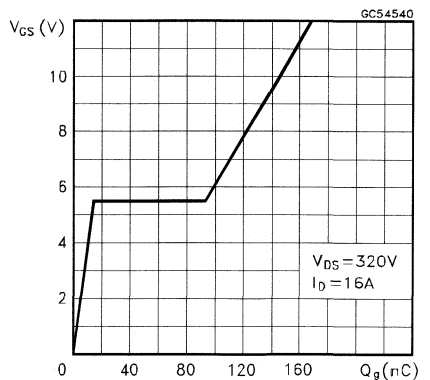
Transconductance



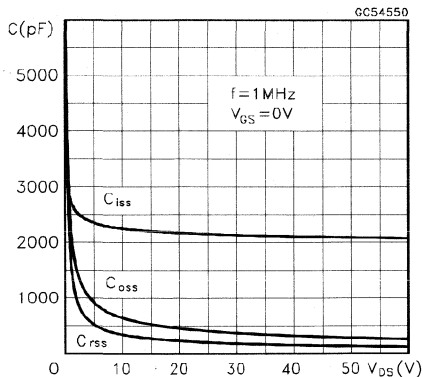
Static Drain-source On Resistance



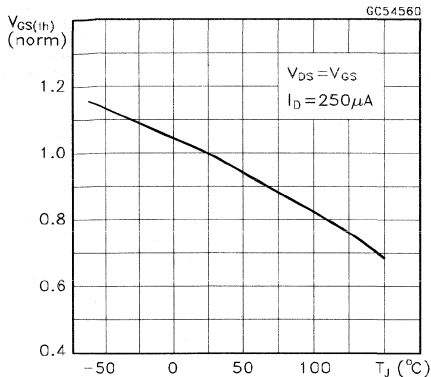
Gate Charge vs Gate-source Voltage



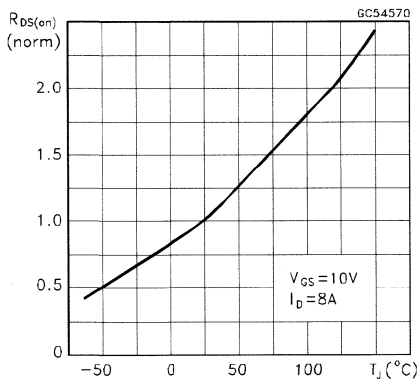
Capacitance Variations



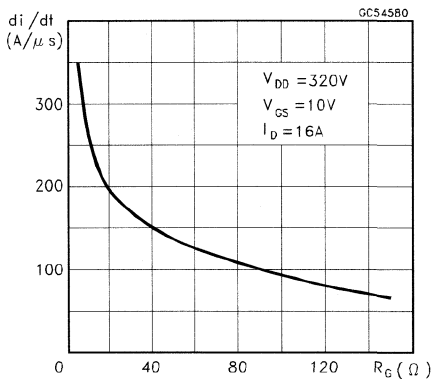
Normalized Gate Threshold Voltage vs Temperature



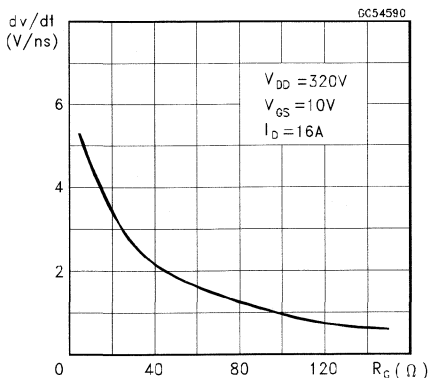
Normalized On Resistance vs Temperature



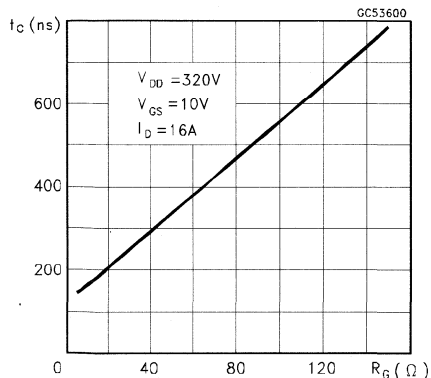
Turn-on Current Slope



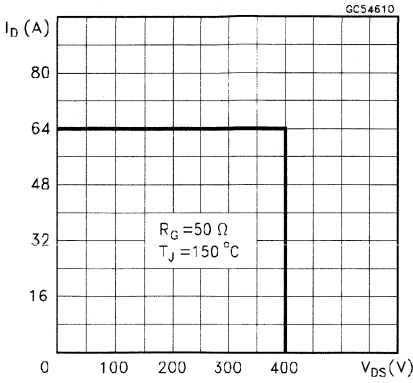
Turn-off Drain-source Voltage Slope



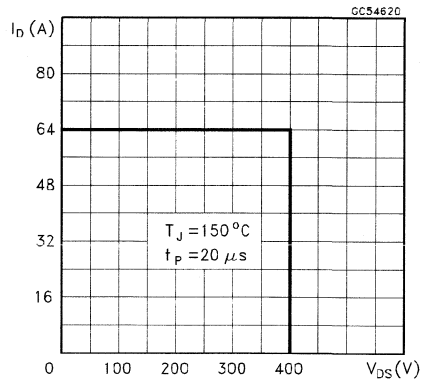
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

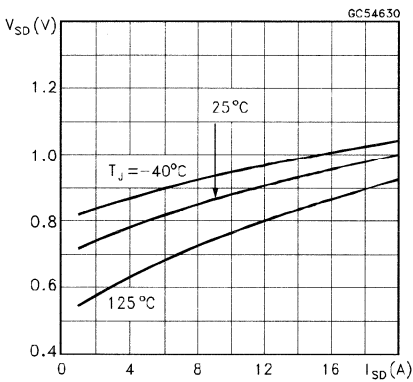
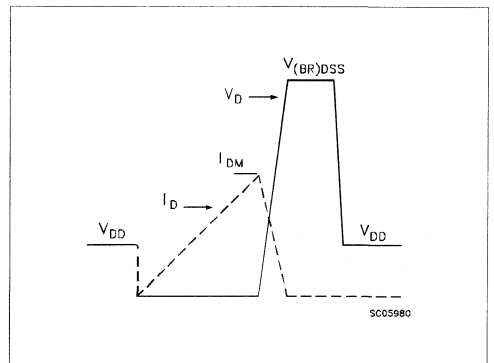
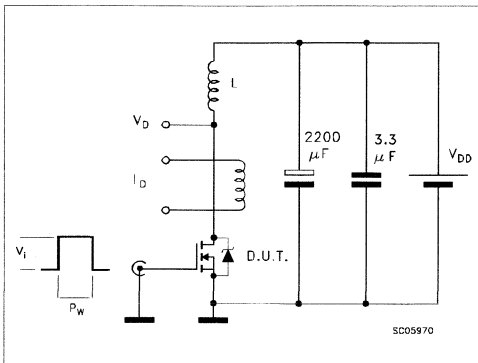


Fig. 1: Unclamped Inductive Load Test Circuits

Fig. 2: Unclamped Inductive Waveforms

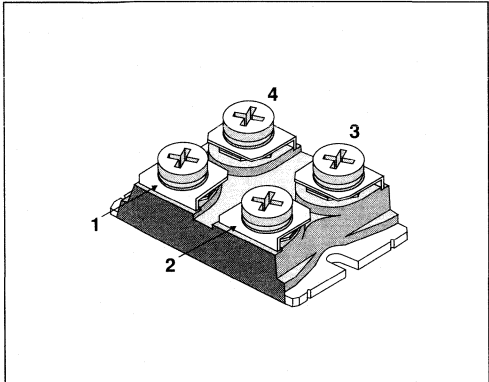


PACKAGES

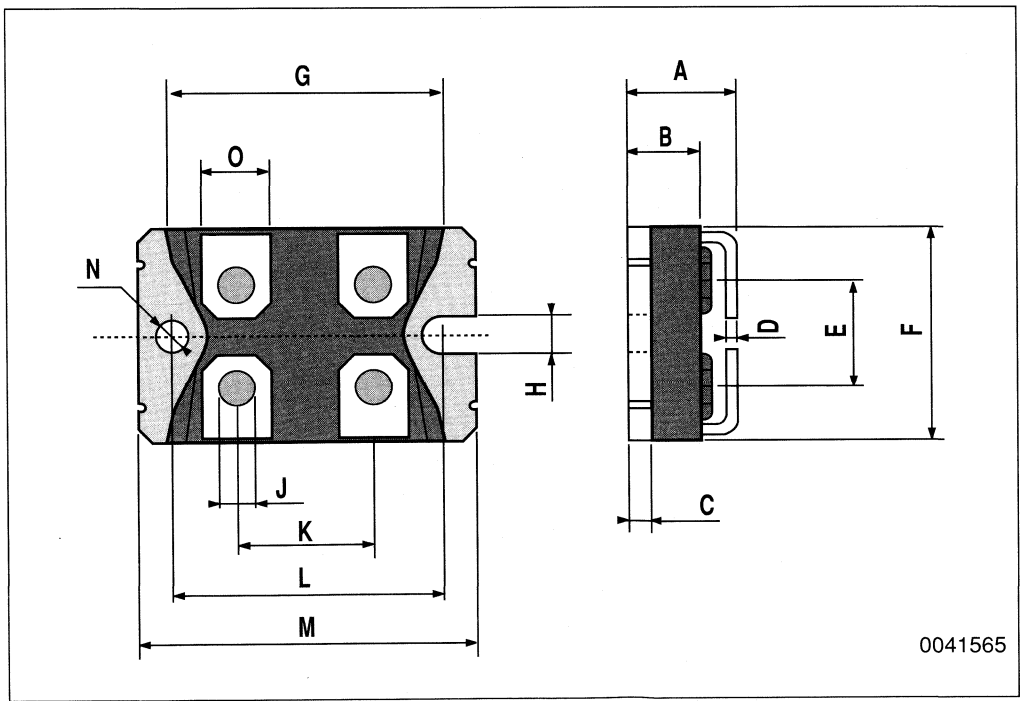
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	11.8		12.2	0.466		0.480
B	8.9		9.1	0.350		0.358
C	1.95		2.05	0.076		0.080
D	0.75		0.85	0.029		0.033
E	12.6		12.8	0.496		0.503
F	25.15		25.5	0.990		1.003
G	31.5		31.7	1.240		1.248
H	4			0.157		
J	4.1		4.3	0.161		0.169
K	14.9		15.1	0.586		0.594
L	30.1		30.3	1.185		1.193
M	37.8		38.2	1.488		1.503
N	4			0.157		
O	7.8		8.2	0.307		0.322
P	5.5			0.216		



OUTLINE AND MECHANICAL DATA



ISOTOP

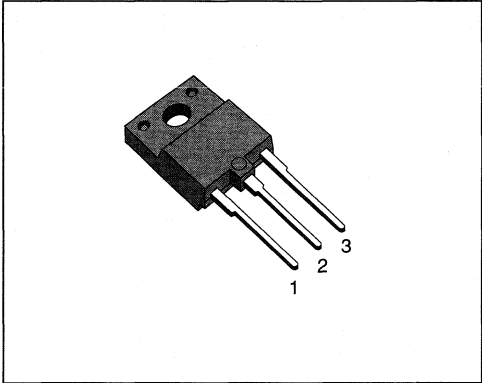


0041565

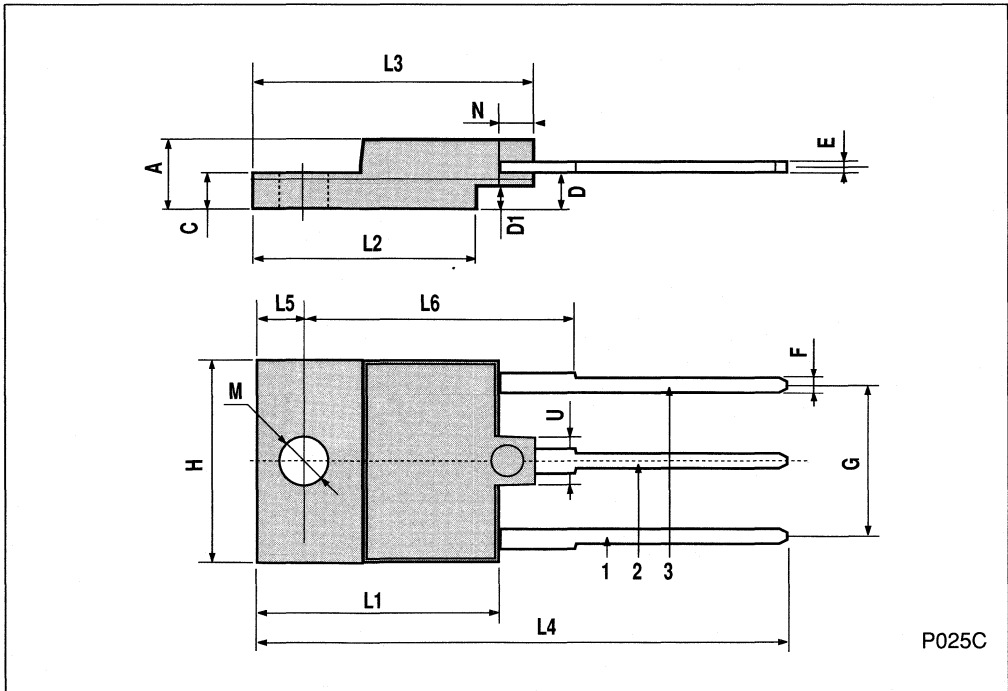
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	5.35		5.65	0.210		0.222
C	3.3		3.8	0.130		0.149
D	2.9		3.1	0.114		0.122
D1	1.88		2.08	0.074		0.081
E	0.45		1	0.017		0.039
F	1.05		1.25	0.041		0.049
G	10.8		11.2	0.425		0.441
H	15.8		16.2	0.622		0.637
L1	20.8		21.2	0.818		0.834
L2	19.1		19.9	0.752		0.783
L3	22.8		23.6	0.897		0.929
L4	40.5		42.5	1.594		1.673
L5	4.85		5.25	0.190		0.206
L6	20.25		20.75	0.797		0.817
M	3.5		3.7	0.137		0.145
N	2.1		2.3	0.082		0.090
U		4.6			0.181	



OUTLINE AND MECHANICAL DATA



ISOWATT218

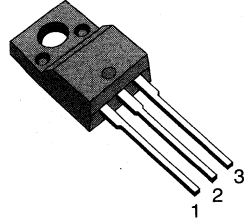


P025C

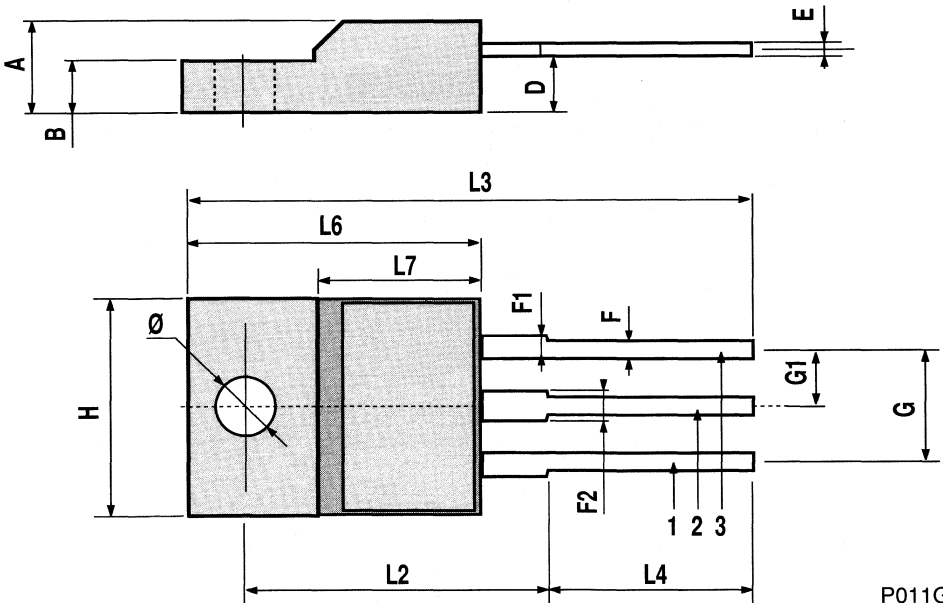
DIM.	mm			Inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
B	2.5		2.7	0.098		0.106
D	2.5		2.75	0.098		0.108
E	0.4		0.7	0.015		0.027
F	0.75		1	0.030		0.039
F1	1.15		1.7	0.045		0.067
F2	1.15		1.7	0.045		0.067
G	4.95		5.2	0.195		0.204
G1	2.4		2.7	0.094		0.106
H	10		10.4	0.393		0.409
L2		16			0.630	
L3	28.6		30.6	1.126		1.204
L6	15.9		16.4	0.626		0.645
L7	9		9.3	0.354		3.66
∅	3		3.2	0.118		0.126

ST **SGS-THOMSON**
MICROELECTRONICS

**OUTLINE AND
MECHANICAL DATA**



ISOWATT220

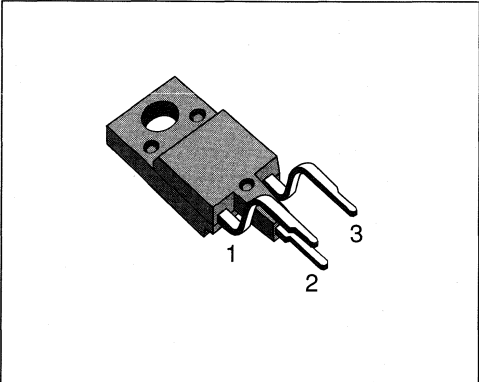


P011G

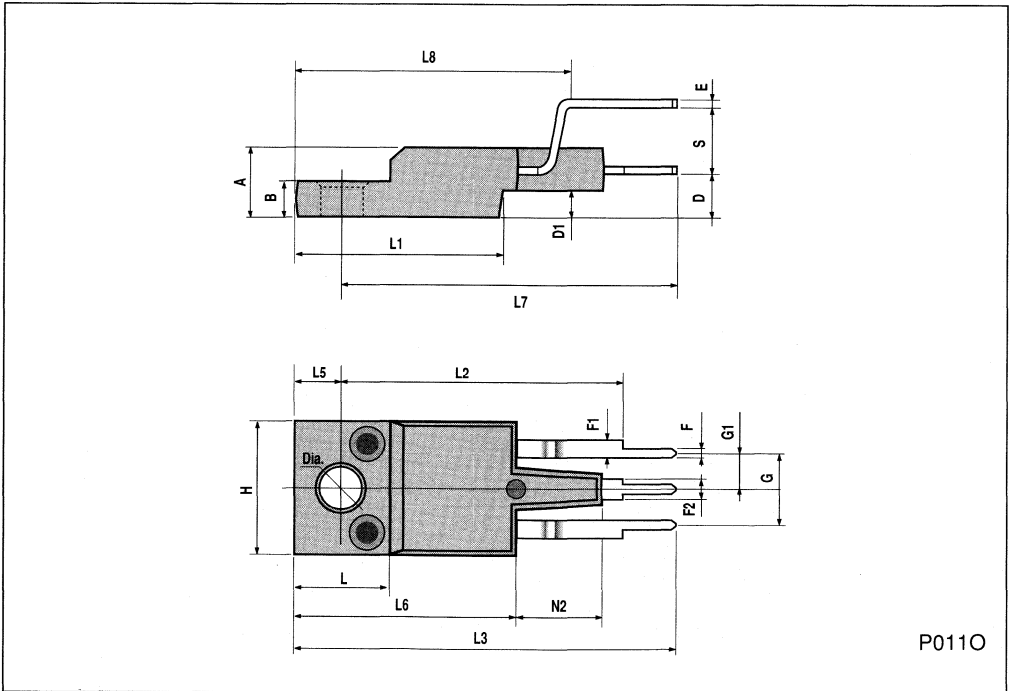
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	5.13		5.33	0.202		0.210
B	2.63		2.83	0.103		0.111
D	3.05		3.35	0.120		0.132
D1	1.90		2.10	0.074		0.082
E	0.50		0.70	0.019		0.027
F	0.70		1.00	0.027		0.039
F1	1.25		1.50	0.049		0.059
F2	1.25		1.50	0.049		0.059
G	5.00		5.20	0.196		0.204
G1	2.50		2.60	0.098		0.102
H	10.00		10.40	0.393		0.409
L	6.80		7.10	0.267		0.279
L1	14.70		15.10	0.578		0.594
L2		20.20			0.795	
L3	26.60		28.60	1.047		1.126
L5	3.30		3.40	0.130		0.134
L6	15.90		16.30	0.626		0.641
L7	23.20		25.20	0.913		0.992
L8		19.80			0.779	
N2		6.00			0.236	
DIA.	3.00		3.20	0.118		0.126
S	4.88		5.28	0.192		0.207



OUTLINE AND MECHANICAL DATA



ISOWATT221

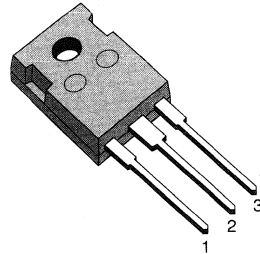


P0110

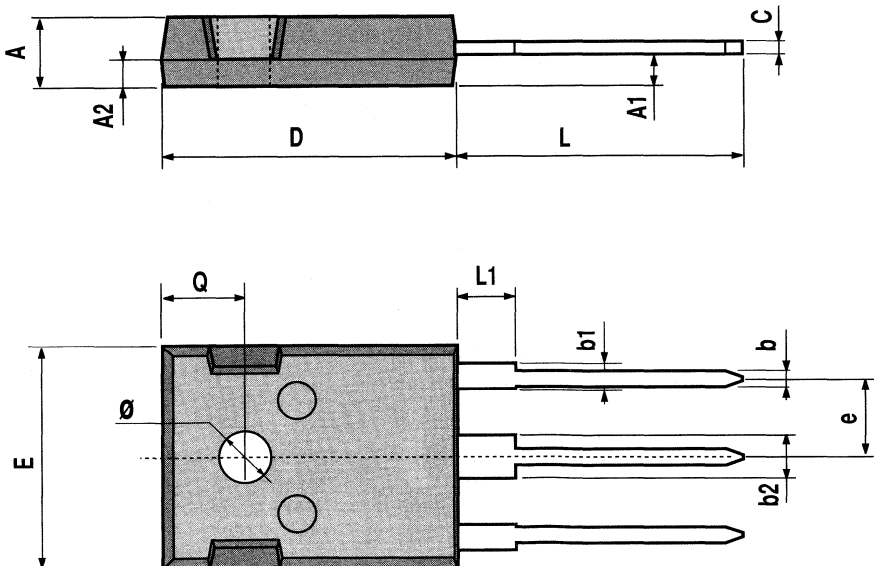
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.7		5.3	0.185		0.208
A1			2.87			0.113
A2	1.5		2.5	0.059		0.098
b	1		1.4	0.039		0.055
b1			2.25			0.088
b2	3.05		3.43	0.120		0.135
C	0.4		0.8	0.015		0.031
D	20.4		21.18	0.803		0.833
e	5.43		5.47	0.213		0.215
E	15.3		15.95	0.602		0.628
L	15.57			0.613		
L1	3.7		4.3	0.145		0.169
Q	5.3		5.84	0.208		0.230
ØP	3.5		3.71	0.137		0.146



OUTLINE AND MECHANICAL DATA



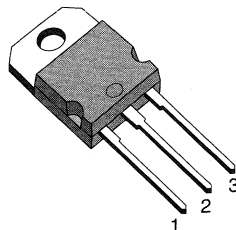
TO-247



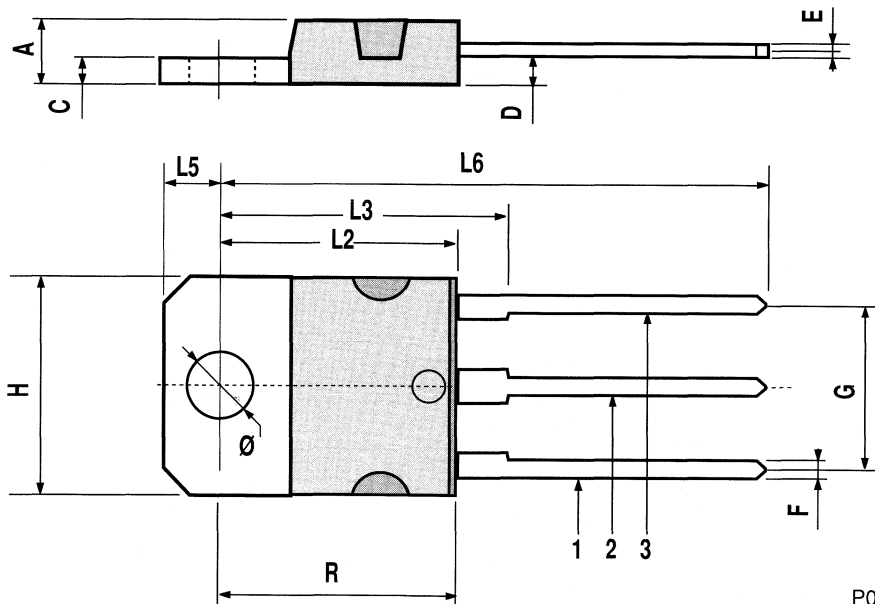
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.7		4.9	0.185		0.193
C	1.9		2.1	0.075		0.082
D		2.5			0.098	
E	0.5		0.78	0.019		0.030
F	1.1		1.3	0.043		0.051
G	10.8		11.1	0.425		0.437
H	14.7		15.2	0.578		0.598
L2	-		16.2	-		0.637
L3		18			0.708	
L5	3.95		4.15	0.155		0.163
L6		31			1.220	
R	-		12.2	-		0.480
Ø	4		4.1	0.157		0.161



OUTLINE AND MECHANICAL DATA



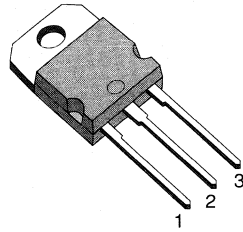
TO-218 (SOT-93)



P025A

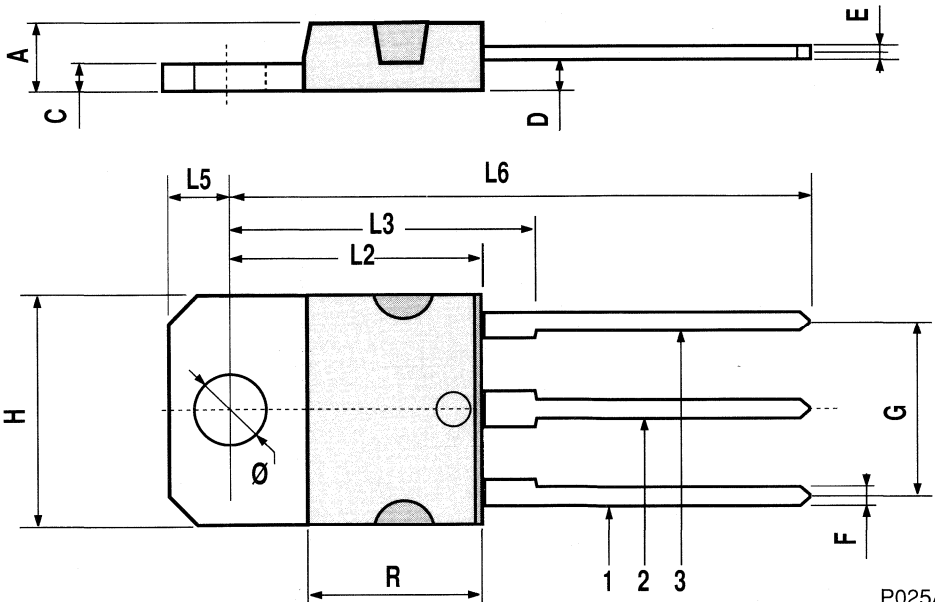
Phasing out during 1993 (see next page)

OUTLINE AND MECHANICAL DATA



TO-218 (SOT-93) (new version)

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.7		4.9	0.185		0.193
C	1.17		1.37	0.046		0.054
D		2.5			0.098	
E	0.5		0.78	0.019		0.030
F	1.1		1.3	0.043		0.051
G	10.8		11.1	0.425		0.437
H	14.7		15.2	0.578		0.598
L2	-		16.2	-		0.637
L3		18			0.708	
L5	3.95		4.15	0.155		0.163
L6		31			1.220	
R	-		12.2	-		0.480
∅	4		4.1	0.157		0.161



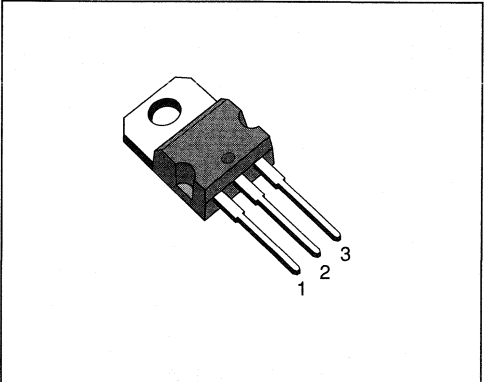
P025A

Introduction starting Q3 1993

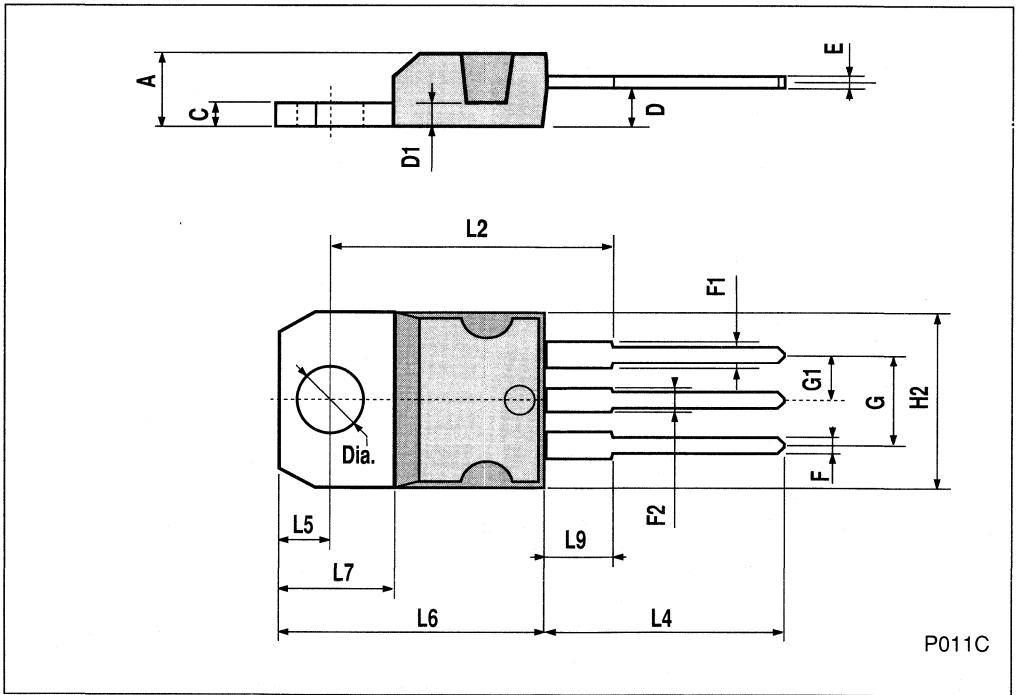
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
C	1.23		1.32	0.048		0.051
D	2.40		2.72	0.094		0.107
D1		1.27			0.050	
E	0.49		0.70	0.019		0.027
F	0.61		0.88	0.024		0.034
F1	1.14		1.70	0.044		0.067
F2	1.14		1.70	0.044		0.067
G	4.95		5.15	0.194		0.203
G1	2.4		2.7	0.094		0.106
H2	10.0		10.40	0.393		0.409
L2		16.4			0.645	
L4	13.0		14.0	0.511		0.551
L5	2.65		2.95	0.104		0.116
L6	15.2		15.9	0.598		0.625
L7	6.2		6.6	0.244		0.260
L9	3.5		4.2	0.137		0.165
DIA.	3.75		3.85	0.147		0.151



OUTLINE AND MECHANICAL DATA



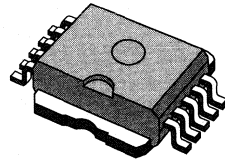
TO-220 (DSG)



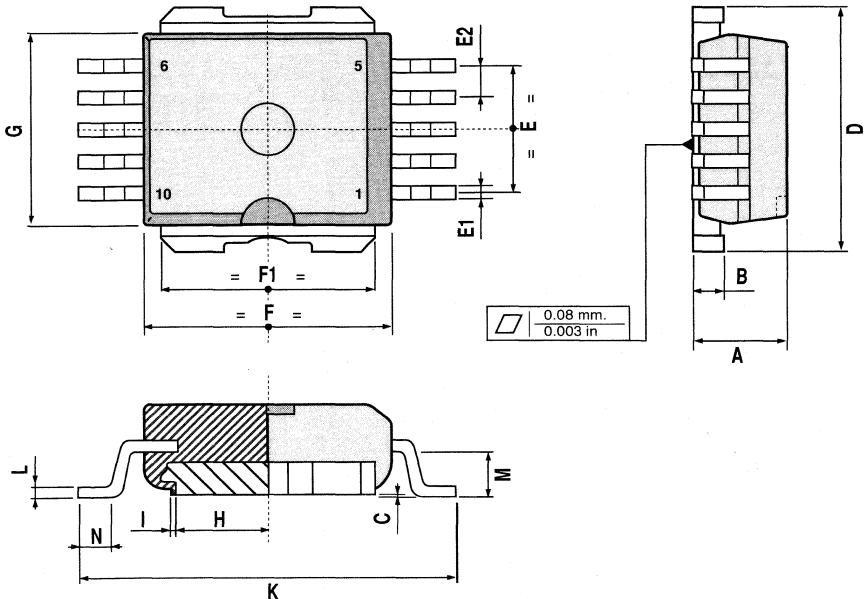
P011C

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	3.45	3.5	3.55	0.135	0.137	0.140
B		1.28	1.30		0.050	0.051
C			0.15			0.006
D	9.40	9.50	9.60	0.370	0.374	0.378
E	4.98	5.08	5.48	0.196	0.200	0.216
E1	0.40	0.45	0.60	0.016	0.018	0.024
E2	1.17	1.27	1.37	0.046	0.050	0.054
F	9.30	9.40	9.50	0.366	0.370	0.374
F1	7.95	8.00	8.15	0.313	0.315	0.321
G	7.40	7.50	7.60	0.291	0.295	0.299
H	6.80	6.90	7.00	0.267	0.417	0.421
I		0.10			0.004	
K	13.80	14.10	14.40	0.543	0.555	0.567
L		0.40	0.50		0.016	0.020
M	1.60	1.67	1.80	0.063	0.066	0.071
N	0.60	0.08	1.00	0.024	0.031	0.039

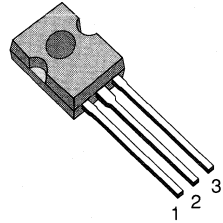
OUTLINE AND MECHANICAL DATA



PowerSO-10

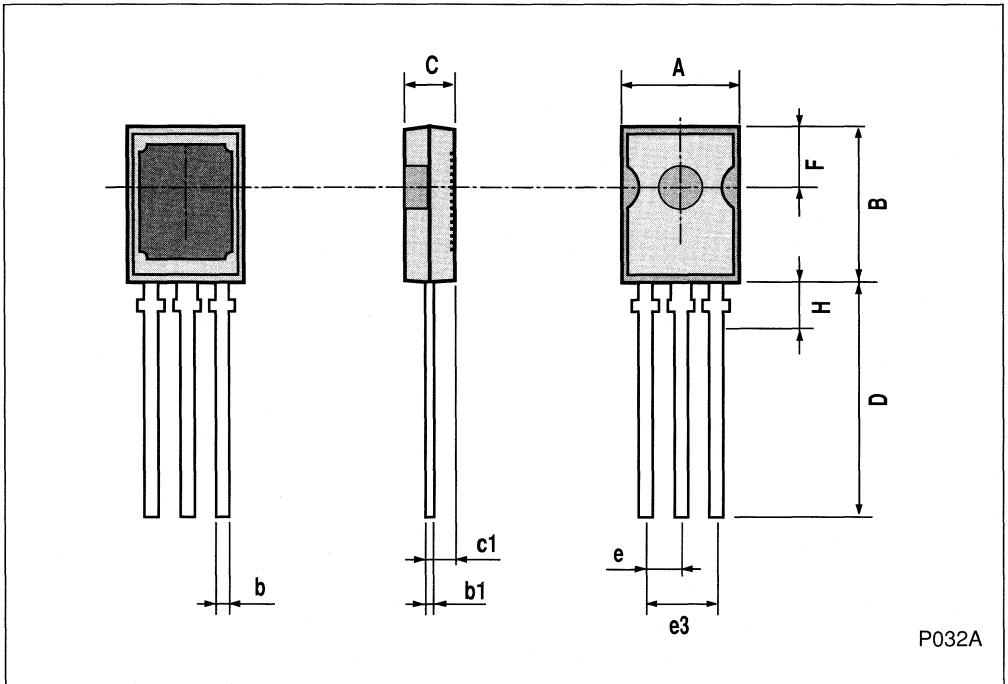


OUTLINE AND MECHANICAL DATA



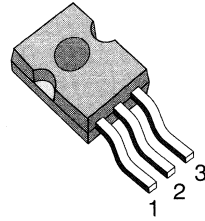
SOT-82

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	7.4		7.8	0.291		0.307
B	10.5		11.3	0.413		0.445
b	0.7		0.9	0.028		0.035
b1	0.49		0.75	0.019		0.030
C	2.4		2.7	0.04		0.106
c1		1.2			0.047	
D		15.7			0.618	
e		2.2			0.087	
e3		4.4			0.173	
F		3.8			0.150	
H			2.54		0.100	



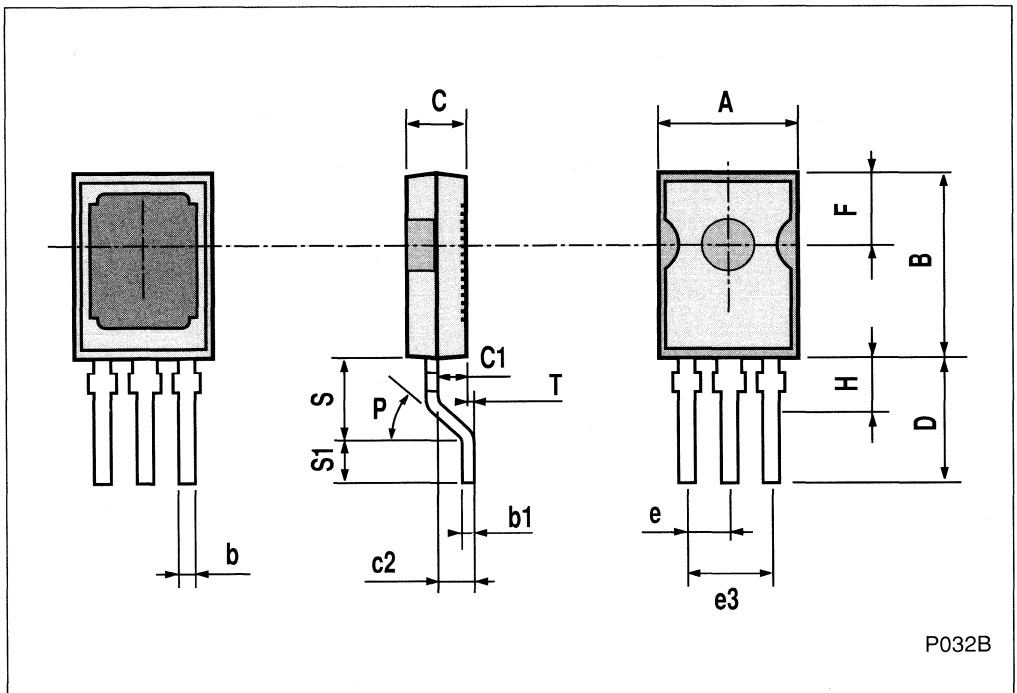
P032A

OUTLINE AND MECHANICAL DATA



SOT-194

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	7.4		7.8	0.291		0.307
B	10.5		11.3	0.413		0.445
b	0.7		0.9	0.028		0.035
b1	0.49		0.75	0.019		0.030
C	2.4		2.7	0.094		0.106
c1		1.2			0.047	
c2		1.3			0.051	
D		6			0.236	
e		2.2			0.087	
e3		4.4			0.173	
F		3.8			0.150	
H			2.54			0.100
P	45° (typ.)					
S		4			0.157	
S1		2			0.079	
T		0.1			0.004	



P032B

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