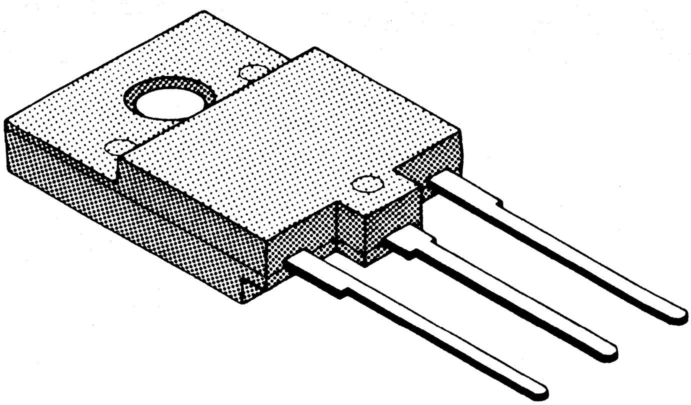
FULLY ISOLATED DISCRETE POWER DEVICES



ISOWATT218™

SGS®

Technology and Service

FULLY ISOLATED DISCRETE POWER DEVICES
ISSUED NOVEMBER 1986

INTRODUCTION

This book contains an introductory note and the datasheets of SGS devices mounted in a new fully isolated package: the ISOWATT218.
ISOWATT218 is a SGS registered trade mark.

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POWER DEVICES DATASHEETS B

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INTRODUCTION A

ALPHANUMERICAL INDEX

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2N7059	D-5	BUW42	B-39	SGSF461	C-66
BU208	B-2	BUW42A	B-39	SGSF462	C-72
BU208A	B-2	BUW42AP	B-39	SGSF463	C-78
BU208D	B-6	BUW42P	B-39	SGSF464	C-84
BU426	B-10	BUX47	B-43	SGSF465	C-91
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BU508D	B-6	BUX48C	B-56	SGSF524	C-21
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BU920P	B-14	MJ10004P	B-61	SGSF542	C-33
BU920T	B-14	MJ10005	B-61	SGSF543	C-39
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BU921P	B-14	SGSD00030	B-66	SGSF561	C-66
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BU922P	B-14	SGSD311	B-71	SGSF564	C-84
BU922T	B-14	SGSF321	C-2	SGSF565	C-91
BU931R	B-19	SGSF322	C-8	SGSI426	B-10
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SGSIF424	C-21	SGSP365	D-8		
SGSIF425	C-53	SGSP366	D-8		
SGSIF441	C-27	SGSP368	D-15		
SGSIF442	C-33	SGSP369	D-15		
SGSIF443	C-39	SGSP464	D-8		
SGSIF444	C-46	SGSP465	D-8		
SGSIF445	C-59	SGSP466	D-8		
SGSIF461	C-66	SGSP468	D-15		
SGSIF462	C-72	SGSP469	D-15		
SGSIF463	C-78	SGSP473	D-21		
SGSIF464	C-84	SGSP474	D-28		
SGSIF465	C-91	SGSP475	D-28		
SGSIP464	D-8	SGSP476	D-28		
SGSIP465	D-8	SGSP477	D-21		
SGSIP466	D-8	SGSP478	D-35		
SGSIP468	D-15	SGSP479	D-35		
SGSIP469	D-15	SGSP564	D-8		
SGSIP473	D-21	SGSP565	D-8		
SGSIP474	D-28	SGSP566	D-8		
SGSIP475	D-28	SGSP568	D-15		
SGSIP476	D-28	SGSP569	D-15		
SGSIP477	D-21	SGSP573	D-21		
SGSIP478	D-35	SGSP574	D-28		
SGSIP479	D-35	SGSP575	D-28		
SGSIT13	B-29	SGSP576	D-28		
SGSIV47	B-43	SGSP577	D-21		
SGSIV47A	B-43	SGSP578	D-35		
SGSIV48	B-49	SGSP579	D-35		
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SGSIV48C	B-56				
SGSIW32	B-34				
SGSIW32A	B-34				
SGSIW42	B-39				

PACKAGE AVAILABILITY BY DEVICE

POWER

ISOWATT218	SOT-93	TO-3	TO-220	FUNCTION	BV_{CEO} (V)	I_C (A)	pag.
SGSI426	BU426			T	375	6	B-10
SGSI426A	BU426A			T	400	6	B-10
SGSI508	BU508	BU208		T	700	8	B-2
SGSI508A	BU508A	BU208A		T	700	8	B-2
SGSI508D	BU508D	BU208D		T	700	8	B-6
SGSI920	BU920P	BU920	BU920T	D	350	10	B-14
SGSI921	BU921P	BU921	BU921T	D	400	10	B-14
SGSI922	BU922P	BU922	BU922T	D	450	10	B-14
SGSI931R	BU931RP	BU931R		D	400	15	B-19
SGSI932R	BU932RP	BU932R		D	450	15	B-19
SGSI931Z	BU931ZP	BU931Z		D	350 **	20	B-24
SGSID311	SGSD311	SGSD310		D	600	28	B-71
SGSID312	SGSD00030	SGSD00031		D	600	28	B-66
SGSID313	MJ10005P	MJ10005		D	400	20	B-61
SGSID314	MJ10004P	MJ10004		D	450	20	B-61
SGSIT13	BUT13P	BUT13		D	400	13	B-29
SGSIV47	BUV47	BUX47		T	400	9	B-43
SGSIV47A	BUV47A	BUX47A		T	450	9	B-43
SGSIV48	BUV48	BUX48		T	400	15	B-49
SGSIV48A	BUV48A	BUX48A		T	450	15	B-49
SGSIV48C	BUV48C	BUX48C		T	700	15	B-56
SGSIW32	BUW32P	BUW32		T *	350	10	B-34
SGSIW32A	BUW32AP	BUW32A		T *	400	10	B-34
SGSIW42	BUW42P	BUW42		T *	350	15	B-39
SGSIW42A	BUW42AP	BUW42A		T *	400	15	B-39

* PNP
** INTERNAL CLAMPING ZENER DIODE

PACKAGE AVAILABILITY BY DEVICE

FASTSWITCH

ISOWATT218	SOT-93	TO-3	TO-220	FUNCTION	BV_{CEO} (V)	I_C (A)	pag.
SGSIF421	SGSF421	SGSF521	SGSF321	T	400	7	C-2
SGSIF422	SGSF422	SGSF522	SGSF322	T	450	5	C-8
SGSIF423	SGSF423	SGSF523	SGSF323	T	450	5	C-14
SGSIF424	SGSF424	SGSF524	SGSF324	T	600	4	C-21
SGSIF425	SGSF425			T	600	4	C-53
SGSIF441	SGSF441	SGSF541	SGSF341	T	400	10	C-27
SGSIF442	SGSF442	SGSF542	SGSF342	T	450	8	C-33
SGSIF443	SGSF443	SGSF543	SGSF343	T	450	8	C-39
SGSIF444	SGSF444	SGSF544	SGSF344	T	600	7	C-46
SGSIF445	SGSF445			T	600	7	C-59
SGSIF461	SGSF461	SGSF561		T	400	15	C-66
SGSIF462	SGSF462	SGSF562		T	450	12	C-72
SGSIF463	SGSF463	SGSF563		T	450	12	C-78
SGSIF464	SGSF464	SGSF564		T	600	10	C-84
SGSIF465	SGSF465	SGSF565		T	600	10	C-91

POWER MOS

ISOWATT218	SOT-93	TO-3	TO-220	BV_{DSS} (V)	I_D (A)	pag.
2N7056				200	19	D-2
2N7059				500	8	D-5
SGSIP464	SGSP464	SGSP564	SGSP364	450	6	D-8
SGSIP465	SGSP465	SGSP565	SGSP365	400	6	D-8
SGSIP466	SGSP466	SGSP566	SGSP366	350	6	D-8
SGSIP468	SGSP468	SGSP568	SGSP368	550	5	D-15
SGSIP469	SGSP469	SGSP569	SGSP369	500	5	D-15
SGSIP473	SGSP473	SGSP573		250	20	D-21
SGSIP474	SGSP474	SGSP574		450	12	D-28
SGSIP475	SGSP475	SGSP575		400	12	D-28
SGSIP476	SGSP476	SGSP576		350	12	D-28
SGSIP477	SGSP477	SGSP577		200	20	D-21
SGSIP478	SGSP478	SGSP578		550	10	D-35
SGSIP479	SGSP479	SGSP579		500	10	D-35

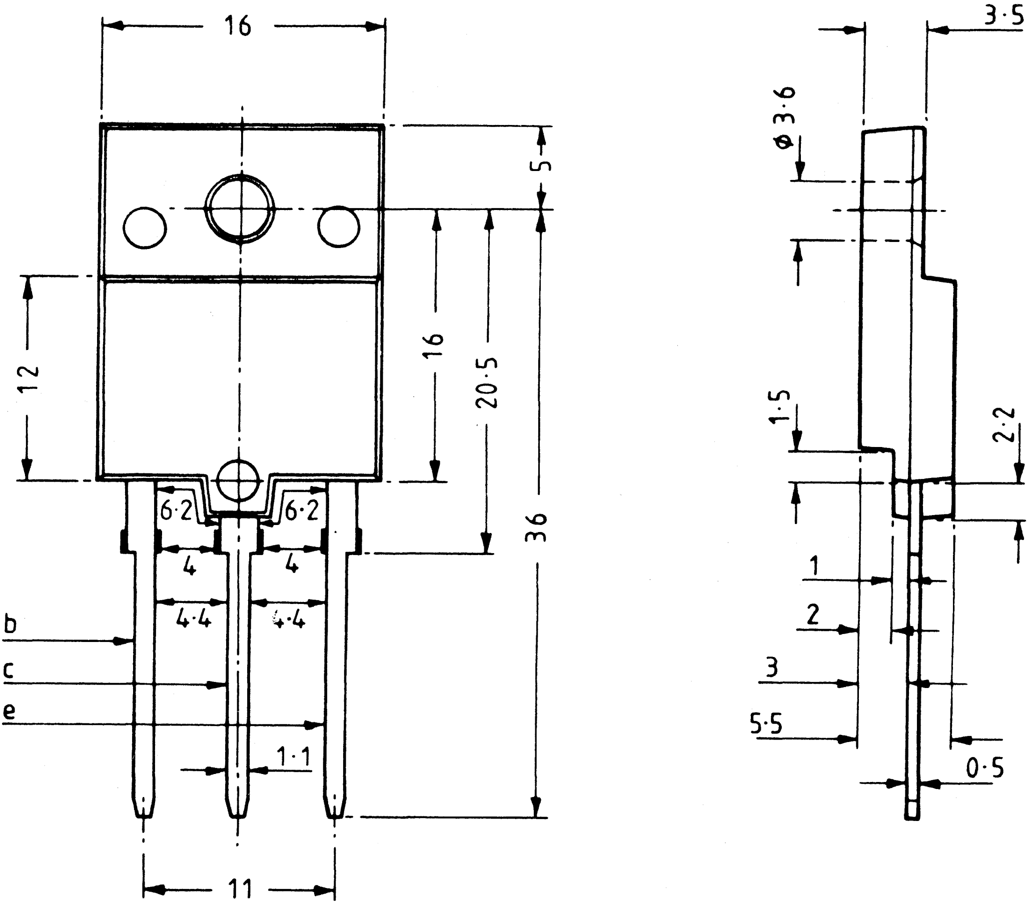
ISOWATT218 TYPES BY SEGMENT

CONSUMER	AUTOMOTIVE	INDUSTRIAL		
SGSI508	SGSI920	2N7056	SGSIF445	SGSI426
SGSI508A	SGSI921	2N7059	SGSIF461	SGSI426A
SGSI508D	SGSI922	SGSID311	SGSIF462	SGSIP477
SGSIF424	SGSI931R	SGSID312	SGSIF463	SGSIP478
SGSIF425	SGSI932R	SGSID313	SGSIF464	SGSIP479
SGSIF444	SGSI931Z	SGSID314	SGSIF465	SGSIT13
SGSIF445		SGSIF421	SGSIP464	SGSIV47
SGSIF464		SGSIF422	SGSIP465	SGSIV47A
SGSIF465		SGSIF423	SGSIP466	SGSIV48
		SGSIF424	SGSIP468	SGSIV48A
		SGSIF425	SGSIP469	SGSIV48C
		SGSIF441	SGSIP473	SGSIW32
		SGSIF442	SGSIP474	SGSIW32A
		SGSIF443	SGSIP475	SGSIW42
		SGSIF444	SGSIP476	SGSIW42A

ISOWATT218 TYPES BY APPLICATION

OFF-LINE SWITCHING MODE POWER SUPPLY		MOTOR CONTROL	AUTOMOTIVE IGNITION	DC-DC CONVERTER	COLOUR TV DEFLECTION
2N7059	SGSI426	SGSID311	SGSI920	2N7056	SGSI508A
SGSIF421	SGSI426A	SGSID312	SGSI921	SGSIP473	SGSI508D
SGSIF422	SGSIP465	SGSID313	SGSI922	SGSIP477	SGSIF424
SGSIF423	SGSIP466	SGSID314	SGSI931R		SGSIF425
SGSIF424	SGSIP468	SGSIT13	SGSI932R		SGSIF444
SGSIF441	SGSIP469	SGSIV48	SGSI931Z		SGSIF445
SGSIF442	SGSIP474	SGSIV48A			SGSIF464
SGSIF443	SGSIP475	SGSIV48C			SGSIF465
SGSIF444	SGSIP476	SGSIW32			
SGSIF461	SGSIP478	SGSIW42			
SGSIF462	SGSIP479				
SGSIF463	SGSIT13				
SGSIF464	SGSIV47				
SGSIP464	SGSIV47A				

JEDEC REGISTERED
ISOWATT218 PACKAGE



Dimensions in mm

A NEW EASY TO USE ISOLATED POWER PACKAGE

SGS has developed a new package, the ISOWATT218. This package has been designed to be produced with high volume automated equipment. It is easy to mount and fully isolated which reduces overall costs and improves reliability compared with conventional packages.

This note presents some general information on the package, the key parameters concerned with safety standards, and also examines the costs of mounting as well as thermal and electrical characteristics.

The isolation of the collector from the heatsink is achieved by molding the package with a high thermal conductivity epoxy resin. The thickness of the resin is closely controlled over the back surface of the internal copper heatspreader.

When mounted directly on to a grounded heatsink the package exceeds the creepage and clearance distances required by UL and VDE safety specifica tions. Some type of lead forming will be required so the creepage distances on the printed circuit board, to which the leads are soldered, are maintained.

Fig. 1 - The ISOWATT218

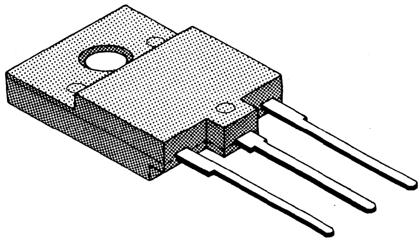
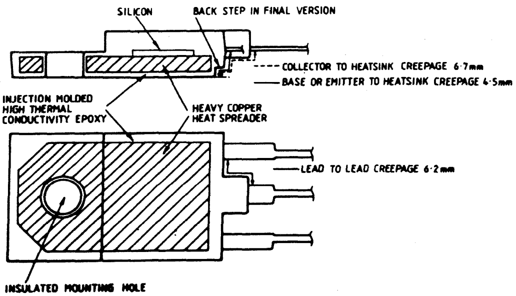


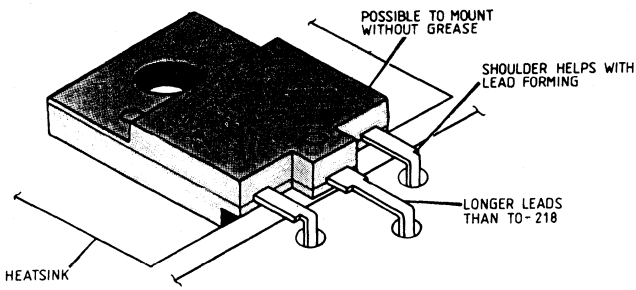
Fig. 2 - Construction of ISOWATT218



- 2.5 deg C/W JUNCTION-CASE THERMAL RESISTANCE GUARANTEED
- INSULATION > 5500v MEASURED . > 4000V GUARANTEED
- FULLY ENCAPSULATED IN RESIN
- INTERCHANGABLE WITH TO-218 AND SOT-93

SU-1305A

Fig. 3 - Mounting of the ISOWATT218 package



The requirements of VDE can be summarised as:

Isolation AC line to ground > 2500V AC for 1 minute or:

> 2750V AC for 1 second

Insulation resistance > 2MΩ at 500V DC for 1 minute

Creepage distance over the surface > 4mm (each plane surface > 1mm)

Clearance distance > 3mm

This package will respect these specifications if mounted either with a screw or clip and the collector lead is bent so that the creepage and clearance distances will be respected on the printed circuit board to which the leads will normally be connected.

COST COMPARISONS

The ISOWATT218 package saves the time and cost of mounting non isolated packages such as TO-3, SOT-93/TO-218, TO3P etc or partially isolated devices such as TO-247, TO-127 etc. It can also replace the TO-220 package which when mounted with isolating materials will have a higher thermal resistance than ISOWATT218.

The cost savings are:

1) Direct cost of materials
2) Cost of ordering, storing and issuing to assembly department the materials.
3) The time taken to mount these materials

These costs are estimated to be:

1) Silicon impegnated washer $ 0.10 (1k resale) isolating bush $ 0.02 (1k resale)
2) $ 100/1000 = $ 0.01 each up to $ 0.10 each if handled in small batches.
3) Productivity of mounting a conventional plastic power transistor on a heatsink with isolating bush isolating washer and screw is estimated at 200/hour for TO-3 style packages the figure will be much lower, while with the ISOWATT218 the productivity should be increased by 50% . If using a clip or partially isolated device the difference is probably 50/hour. At a total labour cost of $ 8/hour this saving is $ 0.04 to $ 0.08 per unit.

In large OEM quantities the material costs may be 30% of the above prices.

These add up to cost savings of $ 0.3 for a small equipment manufacturer, or for a large volume OEM $ 0.09 minimum! This could be substantially increased depending on labour costs and productivity.

There are other factors to consider such as the reliability of the isolation over the long term and the much reduced chance of failures at isolation testing of some equipment and the very high cost of rectifying these defects.

The cost estimates are direct costs, the user will have indirect costs to add which will increase the differential by a factor of 2 to 3 times.

A more expensive plastic compound is used to achieve good thermal conductivity and the molding process is more complex for the ISOWATT218 compared with SOT-93/TO-218. Consequently the price of an ISOWATT218 device is typically $ 0.1 above the equivalent SOT-93 device when purchased in high volume, rising to $ 0.25 for small quantities via distribution.

Even with this adder most users will benefit from a direct cost saving by using the SGS ISOWATT218.

THERMAL RESISTANCE OF SOT-93 (TO-218) AND ISOWATT218

The evaluation of thermal resistance is difficult for the equipment designer as no easy method of measurement is available. This task is made more difficult as power semiconductor suppliers publish thermal resistance for the junction to case which in most practical situations becomes small compared with the total impedance from junction to ambient.

Considering applications where the popular medium power plastic encapsulated devices will be used, with small to medium size heatsinks, the thermal resistance from the package case to the heatsink via any intermediate isolation becomes an important consideration. In the majority of applications of high voltage devices in off line switching power supplies, CRT deflection or motor controls some form of isolation must be employed which can vary from 800V DC up to 2500V AC (3500V DC) depending on the application environment and safety regulations which must be met.

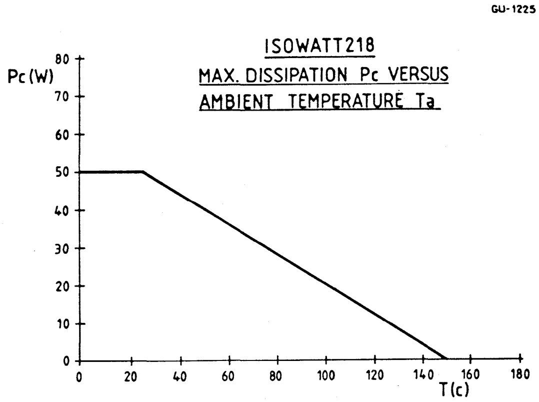
Examining this subject with various power semiconductor suppliers recommendations only adds some confusion which appears to be due to variations in test conditions and mounting torques which are not clearly specified. It should be added that the difficult nature of R_{th} measurements can easily cause a 10% uncertainty in the results.

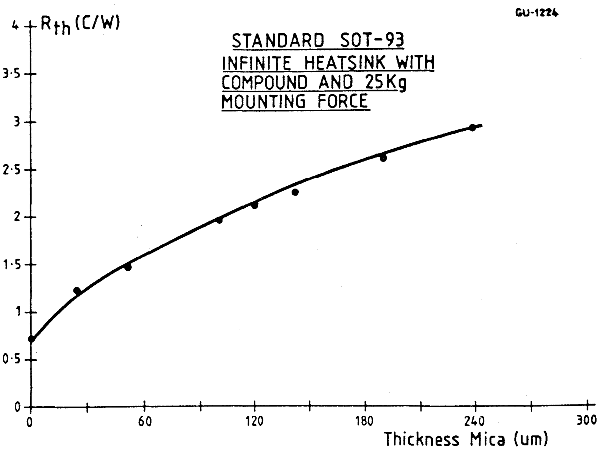
The ISOWATT218 offers many advantages over the conventional SOT-93/TO-218 package when isolation from the heatsink is required however the question is how does its thermal resistance compare in different conditions of mounting? The following notes and evaluations were made to try to offer an understanding of this and some practical advice.

R_{th} junction to case:

For devices in the conventional SOT-93 package with power ratings of 90W to 125W the thermal resistance is from 1 to 1.4°C/W, the ISOWATT218 has a maximum power dissipation rated as only 50W (2.5°C/W) with the same die as the 125W conventional device. With the 90W types the corresponding R_{th} in ISOWATT218 will be 2.9°C/W (43W).

Fig. 4





R_{th} case to heatsink:

The very best which can be achieved with direct mounting i.e. no isolation is 0.3°C/W if a thermal grease is used. However if no compound is used then this figure will range from 0.8 to 1.5 depending on the mounting method and pressure or torque applied. All this assumes that the heatsink surface is flat.

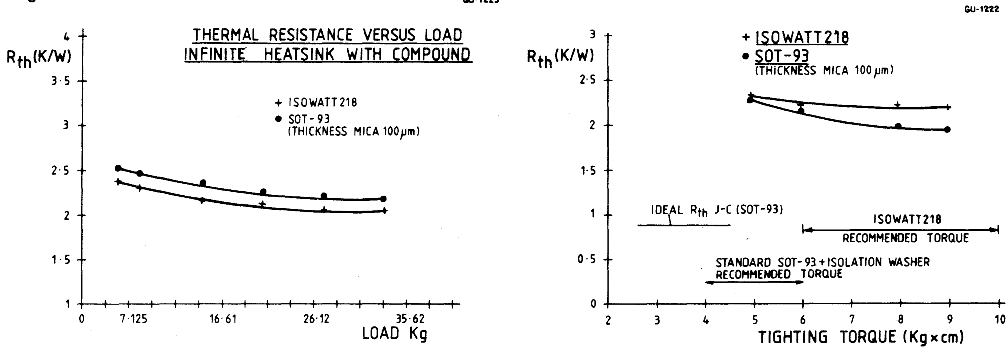
When an isolation layer is used the thermal resistance will depend on the desired insulation properties and may vary by about 1°C/W from a low voltage isolation to a high voltage case.

In the conventional packages thermal compound will be applied on both sides of the isolation layer for best heat transfer. Mounting with a screw the thermal impedance may vary by about 0.3°C/W for torque variation from 4 to 6 Kg. cm. Higher torque up to 10 Kg. cm could reduce the figure by 0.2 °C/W but is not recommended with isolating washers due to the risk of damaging them. If a clip is used over the centre of the package a force of 4Kg will give similar results to screw mounting with 4 Kg. cm while increasing the load to 20Kg will reduce the R_{th} by about 0.2°C/W, but such a load is impractical for spring clips which can be easily assembled.

For the ISOWATT218 mounted with thermal compound and using a screw the effect of torque on R_{th} is less noticable than for the conventional package as there is only one layer of compound to compress. As there is no fragile isolation layer the package may be mounted with torques of 6 to 10 Kg. cm without any risk of damage and consistent R_{th} will be achieved.

The following diagram (5) illustrates these results. The measurements were made with a device of 125W rating in the conventional package. Therefore the ideal R_{th} is about 0.8°C/W. The same die was used in the ISOWATT218 package.

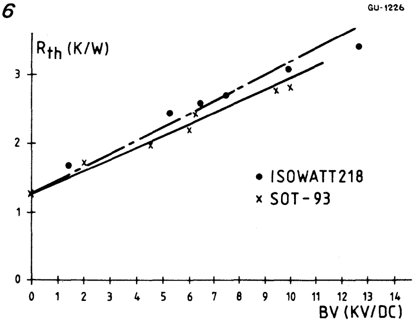
Fig. 5



Isolation voltage breakdown:

The development phase of the ISOWATT218 package required a decision to be made for the thickness of the plastic layer to be employed for the isolation. Consequently different tests were made with various plastic thickness and also with the conventional package using various mica. The breakdown voltage of the isolation was plotted against the thermal resistance and is shown in fig. 6.

Fig. 6



These results were made with thermal compound being used and are typical values - not the values which would be guaranteed. The final choice was made for a typical breakdown of 5 to 6KV DC and the ISOWATT218 is guaranteed to withstand 4KV DC which is greater than the 2750V AC for 1 second required by VDE.

Dynamic thermal impedance (Z_{th}):

Figure (7) shows the dynamic thermal impedance obtained using an infinite heatsink with very high mounting pressure (> 20Kg) and using thermal compound. For power pulses of < 0.1s the isolation and heatsink have no effect and the energy is absorbed directly in the silicon and its copper mounting.

Figure (8) shows the same tests carried out with a small heatsink and clip mounting with 5Kg force and figure (9) shows the results in free air.

If the SOT-93 is mounted with isolation but without thermal grease the overall R_{th} will be higher than the ISOWATT218 without compound as two interfaces are involved instead of only one.

Independent results state an R_{th} of 2.2 to 3°C/W for the case to heatsink of SOT-93, without compound and a mica adequate only for 1500 or 2000V peak isolation, depending on mounting pressure or torque. Adding the R_{th} of the device will result in lower overall results only if the isolation accepted is inferior and the mounting is carefully controlled.

Fig. 7

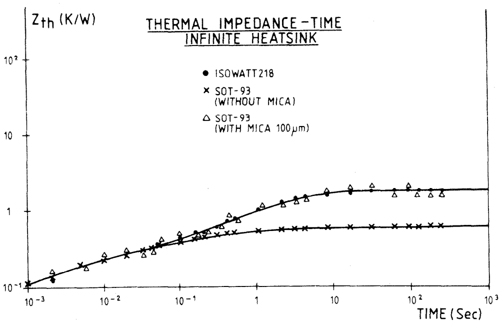


Fig. 8

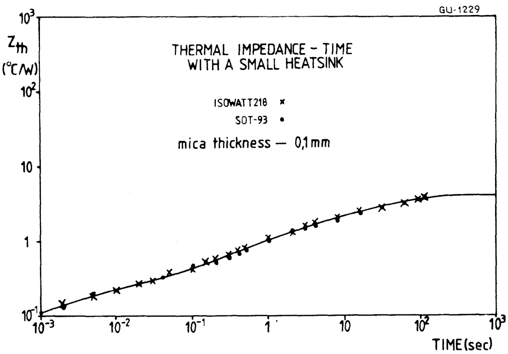
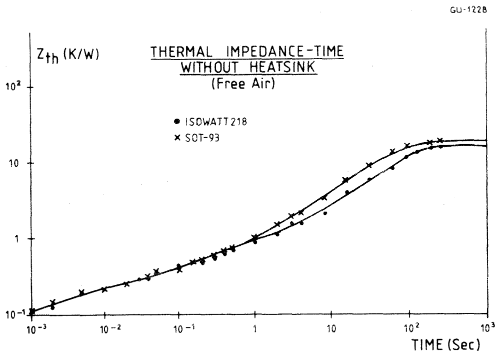


Fig. 9



CAPACITANCE FROM DEVICE COLLECTOR TO HEATSINK

In high frequency switching applications it may be important to consider the electrical capacitance which can affect RFI performance of the equipment.

A theoretical analysis of the capacitance of the ISOWATT218 which was verified by direct measurement shows the value to be typically 17pF.

CONCLUSIONS:

These tests have shown that the ISOWATT218 when mounted on a heatsink with thermal compound has an R_{th} very close to that of a conventional SOT-93/TO-218 mounted with compound and an isolation washer. When mounted with a screw the torque used is not so critical as the conventional package. Certainly even a worst case interpretation of the data indicates that any increase is negligible compared with the overall R_{th} from junction to ambient which with moderate heatsinks will be greater than 15°C/W. Any small increase is more than compensated by the convenience of the ISOWATT218 package.

From an overall cost point of view the ISOWATT218 represents a saving compared with conventional packages. The construction makes it much easier for the equipment to respect the safety standard of UL or VDE which may be required.

NOTES:

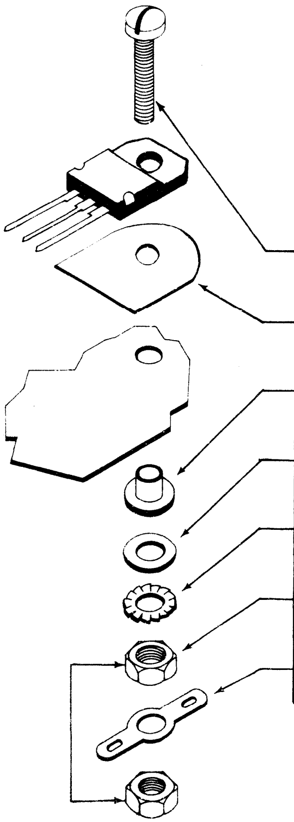
– Regulations for creepage distances and clearances in electrical equipment VDE 0110/11.72 and German Standard Dimensioning of clearances and creepage distances of electrical equipment Amendment 'b' (VDE Specification) VDE 0110b/2.79 including amendment VDE 0110a/10.75.

– Standards and Specifications for isolation taken from - VDE 0804/3.77 Telecommunications and Electronic Data Processing Equipment Class I and II, VDE 0806/8.81 Specification for safety of electrically energized office equipment, Class I.

ISOWATT218 AND SOT-93 COMPARISON

SCREW MOUNTING

SOT-93



ACCESSORY TYPE	Q.ty	ASSEMBLY NUMBER	MATERIAL	MECH. DATA Page
CHEESE HEAD SCREWS SLOTTED	1	NOT AVAILABLE FROM SGS		
MICA WASHER	1	CDA 3154	MICA	65
INSULATING BUSHES	1	CDA 3155 C	NYLON	65
WASHERS	1	NOT AVAILABLE FROM SGS		
LOCK WASHERS	1	NOT AVAILABLE FROM SGS		
HEXAGON NUTS	2	NOT AVAILABLE FROM SGS		
SOLDER LUG	1	NOT AVAILABLE FROM SGS		

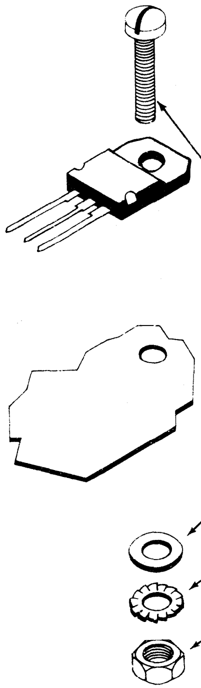
S-5668

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

ISOWATT218 AND SOT-93 COMPARISON

SCREW MOUNTING

ISOWATT218



ACCESSORY TYPE	Q.ty	ASSEMBLY NUMBER	MATERIAL	MECH. DATA Page
CHEESE HEAD SCREWS SLOTTED	1	NOT AVAILABLE FROM SGS		
WASHERS	1	NOT AVAILABLE FROM SGS		
LOCK WASHERS	1	NOT AVAILABLE FROM SGS		
HEXAGON NUTS	2	NOT AVAILABLE FROM SGS		

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

ISOWATT218 AND SOT-93 COMPARISON

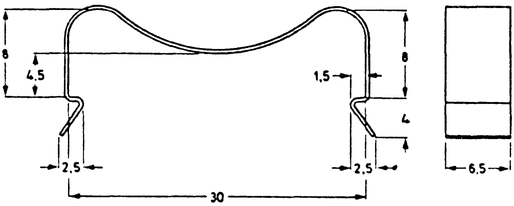
CLIP MOUNTING

for direct and insulated mounting of SOT-93 envelopes

MECHANICAL DATA

Material
CrNi steel NLN-939
thickness0.4±0.04

Dimensions in mm



SOT-93

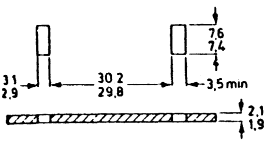


Fig. 1a Heatsink requirements

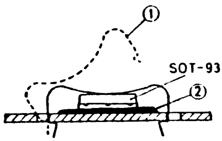


Fig. 1b Mounting
(1) = spring clip
(2) = insulator

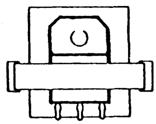


Fig. 1c Position of the device

ISOWATT218

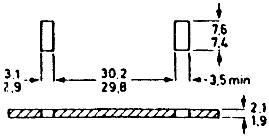


Fig. 2a Heatsink requirements

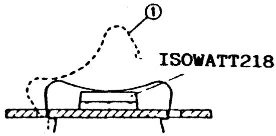


Fig 2b Mounting.
(1) = spring clip

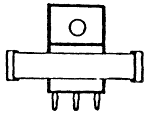


Fig. 2c Position of the device

POWER DEVICES DATASHEETS B

BU208 / BU208A
BU508 / BU508A
SGSI580 / SGSI508A

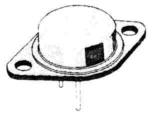
HORIZONTAL TVC DEFLECTION

- HIGH VOLTAGE
- HIGH POWER
- HIGH SWITCHING SPEED
- GOOD STABILITY

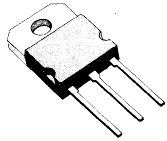
CONSUMER

- POWER SUPPLY
- TV COLOR HORIZONTAL DEFLECTION

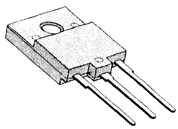
The BU208/A BU508/A and SGSI508/A are silicon multiepitaxial mesa NPN transistors.
They are respectively in Jedec TO-3 metal case, in SOT-93 plastic case and in ISOWATT218 fully isolated package.



TO-3

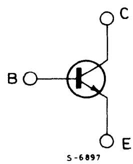


SOT-93 (TO-218)



ISOWATT218

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

V_{CES}	Collector-emitter voltage (V_{BE} = 0)		1500		V
V_{CEO}	Collector-emitter voltage (I_B = 0)		700		V
V_{EBO}	Emitter-base voltage(I_C = 0)		10		V
I_C	Collector current		8		A
I_{CM}	Collector peak current		15		A
		TO-3	**SOT-93**	**ISOWATT218**	
V_{ISO}	Isolation voltage (DC)			4000	V
P_{tot}	Total dissipation at T_c = 25°C	150	125	50	W
T_{stg}	Storage temperature	−65 to 175	−65 to 150	−65 to 150	°C
T_j	Max. operating junction temperature	175	150	150	°C

THERMAL DATA

			TO-3	SOT-93	ISOWATT218	
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1	1	2.5•	°C/W

• See notes on ISOWATT218 in this datasheet.

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

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	$V_{CE} = V_{CES}$ $V_{CE} = V_{CES}$ T_c = 125°C			1 2	mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5 V			100	μA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage	I_C = 100mA	700			V
V_{EBO}	Emitter-base voltage (I_C = 0)	I_E = 10mA	10			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 4.5 A I_B = 2 A for **BU208A/508A/SGSI508A** for **BU208/508/SGSI508**			 1 5	 V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 4.5 A I_B = 2 A			1.3	V
f_T	Transition frequency	I_C = 0.1 A V_{CE} = 5 V f = 5 MHz		7		MHz

INDUCTIVE LOAD

t_s	Storage time	I_C = 4.5A h_{FE} = 2.5 V_{CC} = 140V		7		μs
t_f	Fall time	L_C = 0.9 mH L_B = 3 μH		0.55		μs

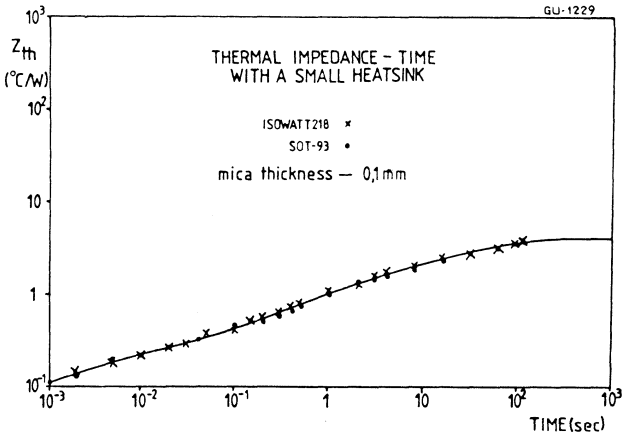
* Pulsed: Pulse duration = 300 μs, duty cycle = 1.5%

THERMAL RESISTANCE OF THE ISOWATT218

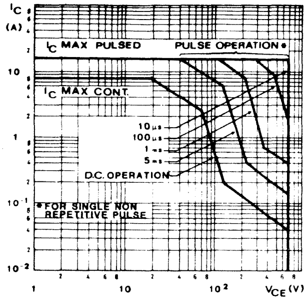
The junction to case thermal resistance of 2.5 °C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1 mm mica insulating washer, the differences are marginal. The 0.1 mm isolating washer gives 1500V to 2000V DC isolation for the SOT-93 package, SGS guarantee 4000V DC isolation for the ISOWATT 218.

The comparison in fig. 1 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The test illustrate that the ISOWATT218 has an R_{th} very close to that of conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package. The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.

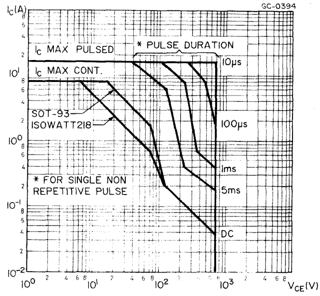
Fig. 1



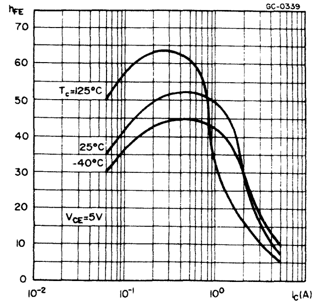
Safe operating area (TO-3)



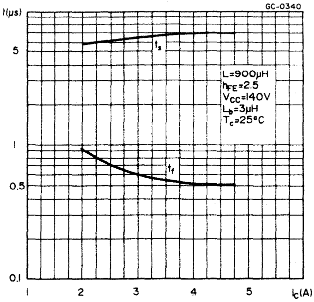
Safe operating area (SOT-93/ISOWATT218)



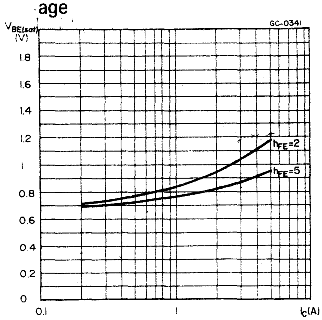
DC current gain



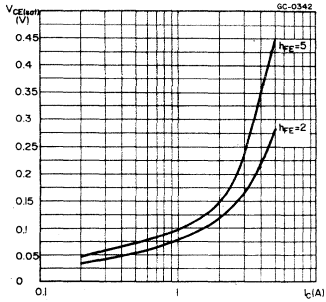
Switching time inductive load



Base-emitter saturation voltage



Collector-emitter saturation voltage



Switching time inductive load

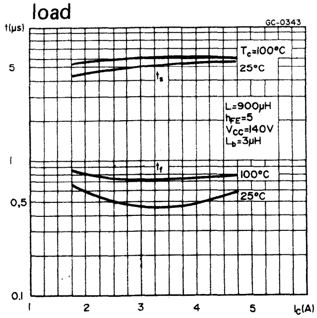
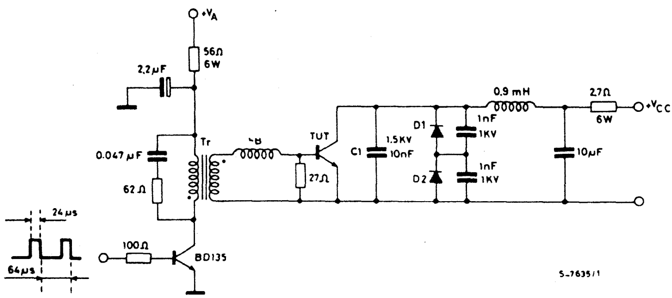


Fig. 1 - Switching times test circuit on inductive load



BU208D
BU508D
SGSI580D

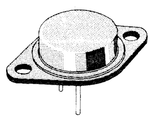
HORIZONTAL TVC DEFLECTION

- HIGH VOLTAGE
- HIGH POWER
- HIGH SWITCHING SPEED
- GOOD STABILITY

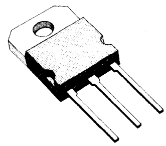
CONSUMER

- TV COLOR HORIZONTAL DEFLECTION

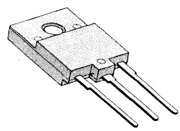
The BU208D, BU508D and SGSI508D are silicon multiepitaxial mesa NPN transistors.
They are mounted respectively in Jedec TO-3 metal case in SOT-93 plastic case and in ISOWATT218 fully isolated package.



TO-3

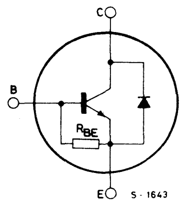


SOT-93 (TO-218)



ISOWATT218

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)		1500		V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)		700		V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		10		V
I_C	Collector current		8		A
I_{CM}	Collector peak current		15		A
		TO-3	**SOT-93**	**ISOWATT218**	
V_{ISO}	Isolation voltage (DC)			4000	V
P_{tot}	Total dissipation at $T_c = 25°C$	150	125	50	W
T_{stg}	Storage temperature	−65 to 175	−65 to 150	−65 to 150	°C
T_j	Max. operating junction temperature	175	150	150	°C

THERMAL DATA

			TO-3	SOT-93	ISOWATT218	
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1	1.2	2.5•	°C/W

• See notes on ISOWATT218 in this datasheet.

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

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	$V_{CE} = V_{CES}$ $V_{CE} = V_{CES}$ T_c = 125°C			1 2	mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5 V			300	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage	I_C = 100mA	700			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 4.5 A I_B = 2 A			1	
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 4.5 A I_B = 2 A			1.3	V
V_F	Diode forward voltage	I_F = 4 A			2	V
f_T	Transition frequency	I_C = 0.1 A V_{CE} = 5 V f = 5 MHz		7		MHz

INDUCTIVE LOAD

t_s	Storage time	I_C = 4.5A h_{FE} = 2.5 V_{CC} = 140V		7		µs
t_f	Fall time	L_C = 0.9 mH L_B = 3 µH		0.55		µs

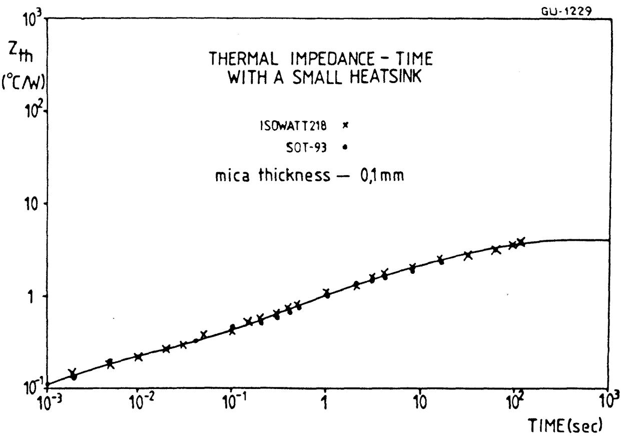
* Pulsed: Pulse duration = 300 µs, duty cycle = 1.5%

THERMAL RESISTANCE OF THE ISOWATT218

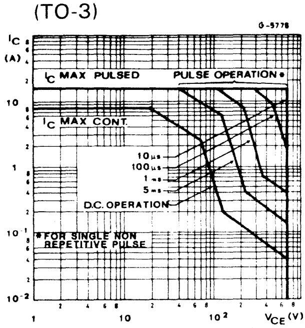
The junction to case thermal resistance of 2.5 °C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1 mm mica insulating washer, the differences are marginal. The 0.1 mm isolating washer gives 1500V to 2000V DC isolation for the SOT-93 package, SGS guarantee 4000V DC isolation for the ISOWATT 218.

The comparison in fig. 1 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The test illustrate that the ISOWATT218 has an R_{th} very close to that of conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package. The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.

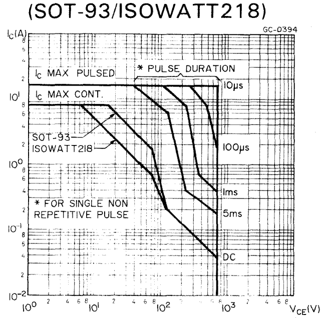
Fig. 1



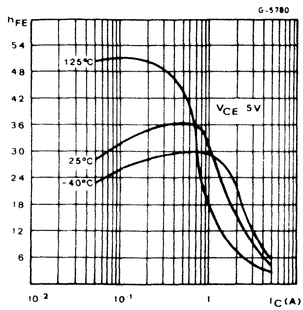
Safe operating area (TO-3)



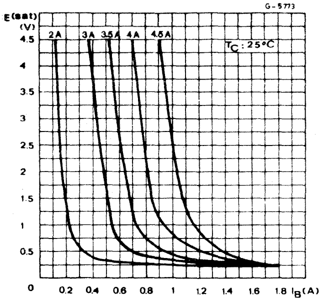
Safe operating area (SOT-93/ISOWATT218)



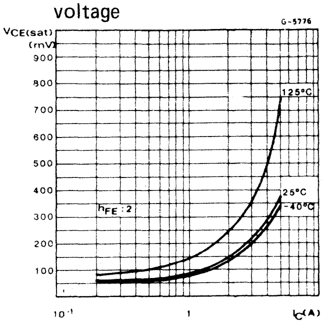
DC current gain



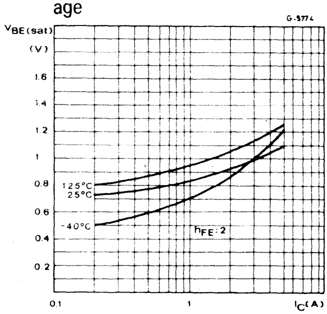
Collector saturation region



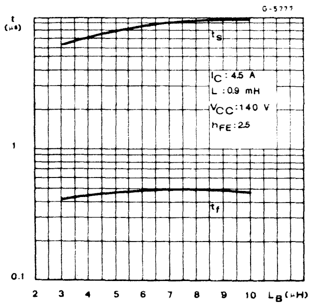
Collector emitter saturation voltage



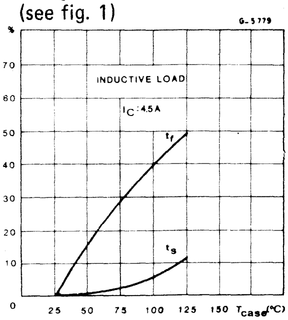
Base-emitter saturation voltage



Switching times inductive load (see fig. 1)



Switching times percentage charge vs. case temperature (see fig. 1)



Switching times inductive load (fig. 1)

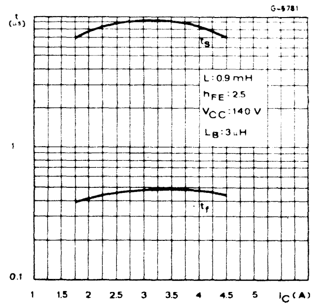
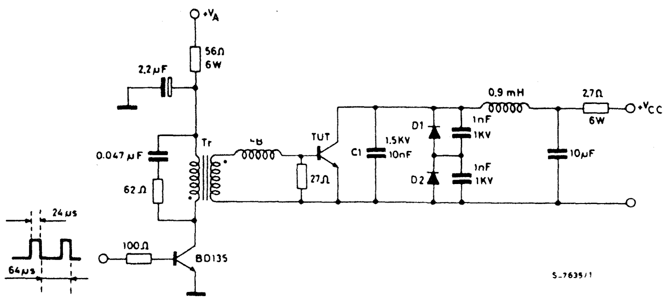


Fig. 1 - Switching times test circuit on inductive load

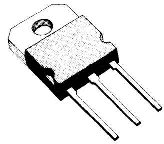


BU426 / BU426A
SGSI426 / SGSI426A

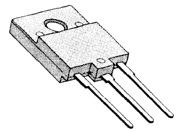
HIGH VOLTAGE POWER SWITCH

- OFF LINE SWITCHING POWER SUPPLY
- HIGH SWITCHING SPEED
- INDUSTRIAL APPLICATIONS

The BU426, BU426A, SGSI426 and SGSI426A are silicon multiepitaxial mesa NPN transistors mounted respectively in SOT-93 plastic package and ISOWATT218 fully isolated package..
They are particularly intended for switch-mode CTV supply sistems.

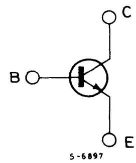


SOT-93 (TO-218)



ISOWATT218

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

ABSOLUTE MAXIMUM RATINGS	SOT-93 ISOWATT218	BU426 SGSI426		BU426A SGSI426A	
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	800		900	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	375		400	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		10		V
I_C	Collector current		6		A
I_{CM}	Collector peak current ($t_p \leq 2$ ms)		8		A
I_B	Base current		3		A
		SOT-93		ISOWATT218	
V_{ISO}	Isolation voltage (DC)			4000	V
P_{tot}	Total dissipation at $T_c \leq 25°C$	113		50	W
T_{stg}	Storage temperature	−65 to 150		−65 to 150	°C
T_j	Max. operating junction temperature	150		150	°C

THERMAL DATA

			SOT-93	ISOWATT218	
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.1	2.5•	°C/W

• See notes on ISOWATT218 in this datasheet.

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

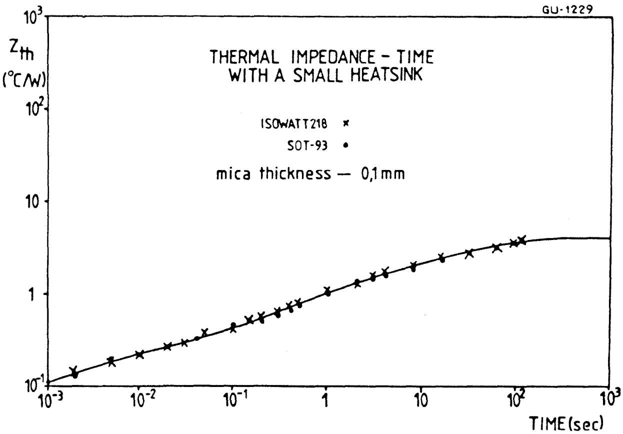
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	for **BU426/SGSI426** V_{CE} = 800 V V_{CE} = 800 V T_c = 125°C for **BU426A/SGSI426A** V_{CE} = 900 V V_{CE} = 900 V T_c = 125°C			 1 2 1 2	 mA mA mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 10 V			10	mA
$V_{CEO(sus)}$*	Collector emitter sustaining voltage	I_C = 100mA for **BU426/SGSI426** for **BU426A/SGSI426A**	 375 400			 V V
$V_{CE(sat)}$*	Collector emitter saturation voltage	I_C = 2.5 A I_B = 0.5 A I_C = 4 A I_B = 1.25 A			1.5 3	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 2.5 A I_B = 0.5 A I_C = 4 A I_B = 1.25 A			1.4 1.6	V V
h_{FE}*	DC current gain	I_C = 0.6 A V_{CE} = 5 V		30	60	
t_{on}	Turn-on time	I_C = 2.5 A V_{CC} = 250 V I_{B1} = 0.5 A		0.25	0.5	μs
t_s t_f	Storage time Fall time	I_C = 2.5 A V_{CC} = 250 V I_{B1} = 0.5 A I_{B2} = −1 A		2.5 0.2	3.5 0.5	μs μs
t_f	Fall time	I_C = 2.5 A V_{CC} = 250 V I_{B1} = 0.5 A I_{B2} = −1 A T_c = 100°C			0.75	μs

THERMAL RESISTANCE OF THE ISOWATT218

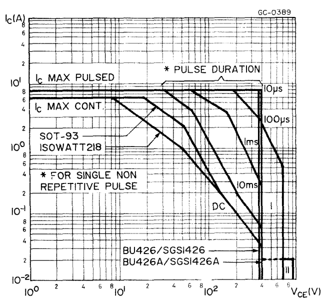
The junction to case thermal resistance of 2.5 °C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1 mm mica insulating washer, the differences are marginal. The 0.1 mm isolating washer gives 1500V to 2000V DC isolation for the SOT-93 package, SGS guarantee 4000V DC isolation for the ISOWATT 218.

The comparison in fig. 1 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The test illustrate that the ISOWATT218 has an R_{th} very close to that of conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package. The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.

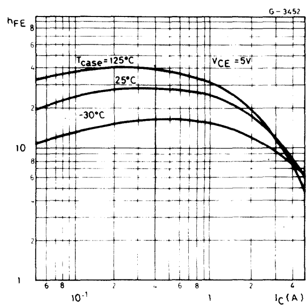
Fig. 1



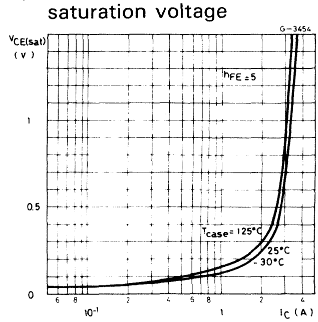
Safe operating areas



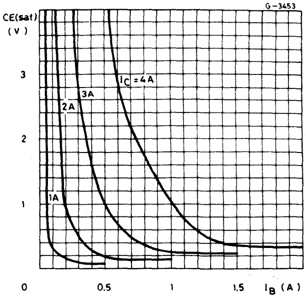
DC current gain



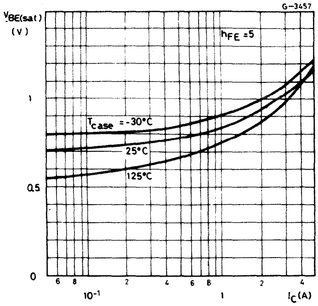
Collector-emitter saturation voltage



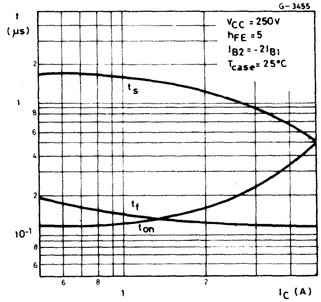
Collector-emitter saturation voltage



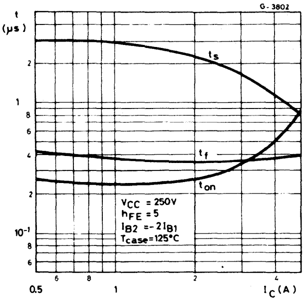
Base-emitter saturation voltage



Saturated switching characteristics



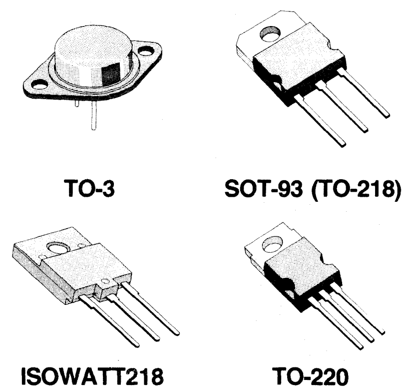
Satured switching characteristics



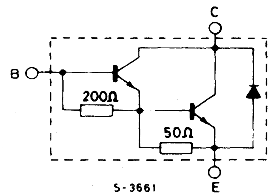
HIGH VOLTAGE POWER DISSIPATION

- HIGH VOLTAGE POWER DARLINGTON
- AUTOMOTIVE IGNITION APPLICATIONS
- HIGH CURRENT

The BU920/921/922, BU920P/921P/922P, SGSI920/921/922 and BU920T/921T/922T are silicon multiepitaxial planar NPN transistors in monolithic darlington configuration mounted respectively in Jedec TO-3 metal case, SOT-93 plastic package, ISOWATT218 fully isolated package and TO-220 plastic package.
They are particularly intended for automaive ignition applications and inverter circuits for motor control.



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

	TO-3 SOT-93 ISOWATT218 TO-220	BU920 BU920P SGSI920 BU920T		BU921 BU921P SGSI921 BU921T	BU922 BU922P SGSI922 BU922T	
V_{CES}	Collector-emitter voltage (V_{BE} = 0)	400		450	500	V
V_{CEO}	Collector-emitter voltage (I_B = 0)	350		400	450	V
V_{EBO}	Emitter-base voltage (I_C = 0)			5		V
I_C	Collector current			10		A
I_{CM}	Collector peak current			15		A
I_B	Base current			5		A
		TO-3	SOT-93	ISOWATT218	TO-220	
V_{ISO}	Isolation voltage (DC)			4000		V
P_{tot}	Total dissipation at $T_c \leq 25°C$	120	105	50	105	W
T_{stg}	Storage temperature −65 to	175	150	150	150	°C
T_j	Max. operating junction temperature	175	150	150	150	°C

THERMAL DATA

			TO-3	SOT-93	ISOWATT218	TO-220	
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.25	1.2	2.5•	1.2	°C/W

• See notes on ISOWATT218 in this datasheet.

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

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = 400 V for **920 types** V_{CE} = 450 V for **921 types** V_{CE} = 500 V for **922 types** V_{CE} = 400 V for **920 types** V_{CE} = 450 V for **921 types** V_{CE} = 500 V for **922 types** T_c = 150°C			250 250 250 0.5 0.5 0.5	μA μA μA mA mA mA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 350 V for **920 types** V_{CE} = 400 V for **921 types** V_{CE} = 450 V for **922 types**			250 250 250	μA μA μA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5 V			50	mA
$V_{CEO(sus)}$*	Collector emitter sustaining voltage	I_C = 100mA for **920 types** for **921 types** for **922 types**	350 400 450			V V V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 5 A I_B = 50mA I_C = 7 A I_B = 140mA			1.8 1.8	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 5 A I_B = 50mA I_C = 7 A I_B = 140mA			2.2 2.5	V V
V_F	Diode forward voltage	I_F = 7 A			2.5	V
	Functional tesst (see test circuit Figg.2 and 3)	for **920 types** V_{CE} = 350 V L = 7mH for **921 and 922 types** V_{CE} = 400 V L = 7mH	 7 7			 A A

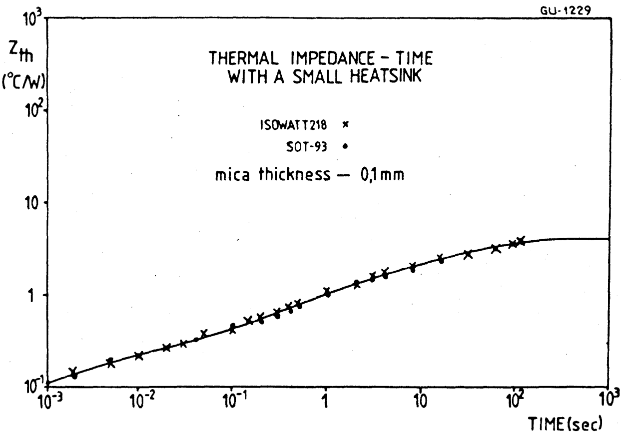
* Pulsed: Pulse duration = 300 μs, duty cycle = 1.5%

THERMAL RESISTANCE OF THE ISOWATT218

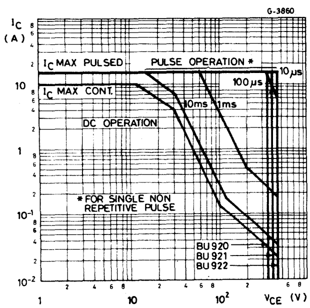
The junction to case thermal resistance of 2.5 °C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1 mm mica insulating washer, the differences are marginal. The 0.1 mm isolating washer gives 1500V to 2000V DC isolation for the SOT-93 package, SGS guarantee 4000V DC isolation for the ISOWATT 218.

The comparison in fig. 1 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The test illustrate that the ISOWATT218 has an R_{th} very close to that of conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package. The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.

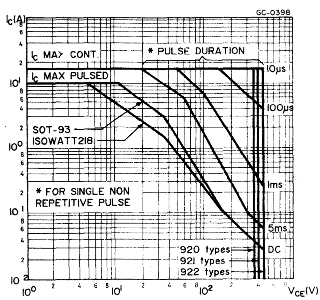
Fig. 1



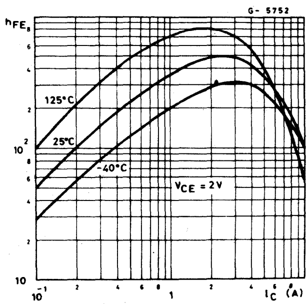
Safe operating areas



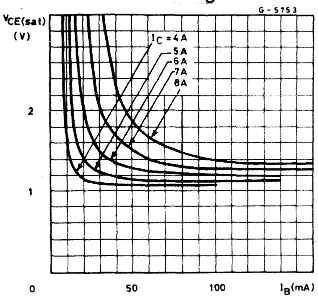
Safe operating areas



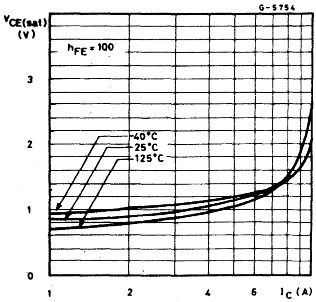
DC current gain



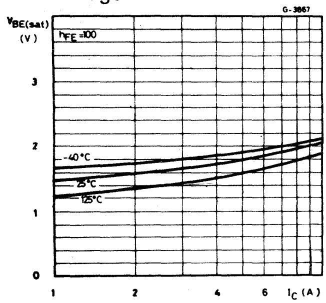
Collector-emitter saturation voltage



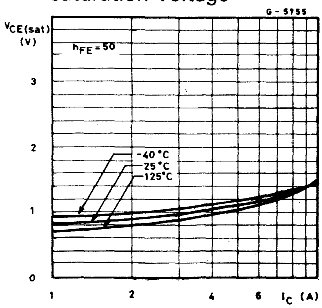
Collector-emitter saturation voltage



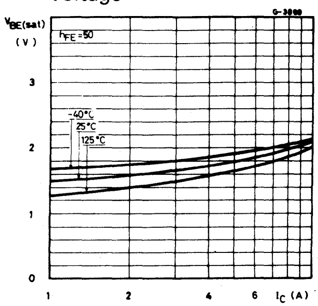
Base-emitter saturation voltage



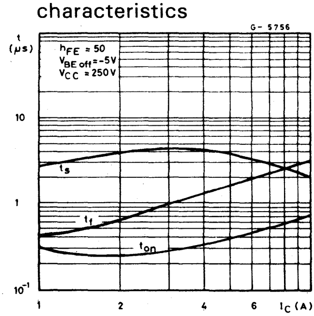
Collector-emitter saturation voltage



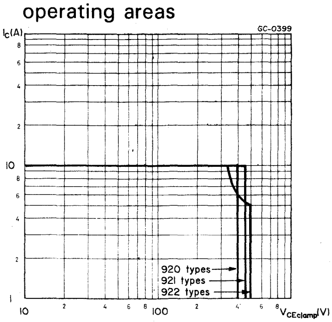
Base-emitter saturation voltage



Saturated switching characteristics



Clamped reverse bias safe operating areas



Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

$5V > |-V_{BB}| > 0V$

$I_C / I_B = 50$

$2I_{B1} > |-I_{B2}| > I_{B1}$

t_p = adjusted for nominal I_C

$R_{BB} = 1\Omega$

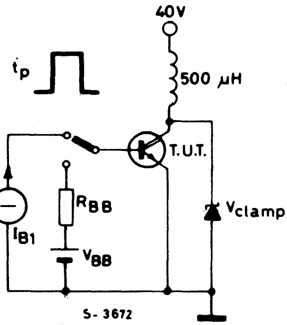


Fig. 2 — Functional test circuit

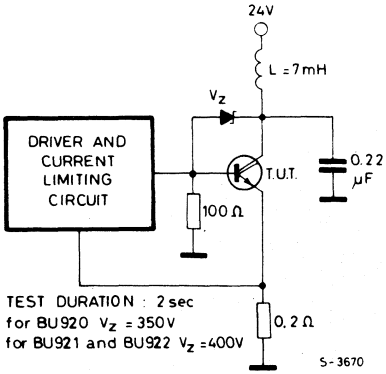
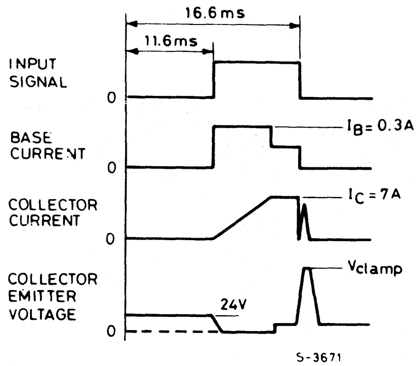


Fig. 3 — Functional test waveforms

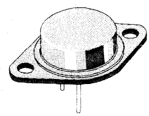


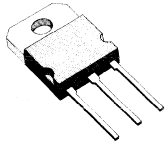
BU931R / BU932R
BU931RP /BU932RP
SGSI931R / SGSI932R

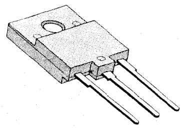
NPN POWER DARLINGTON

- AUTOMOTIVE MARKET
- HIGH PERFORMANCE ELECTRONIC IGNITION DARLINGTON
- HIGH RUGGEDNESS

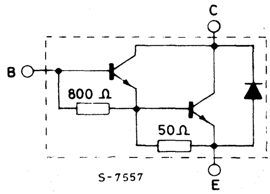
These devices are multiepitaxial biplanar NPN transistors in monolithic darlington configuration mounted in TO-3, SOT-93 and ISOWATT218 packages. They are specially intended for automotive ignition applications and invertes circuits for motor controls. Controlled performances in the linear region make them particularly suitable for car ignitions where current limiting is achieved desaturing the darlington.


TO-3


SOT-93 (TO-218)


ISOWATT218

INTERNAL SCHEMATIC DIAGRAM



S-7557

ABSOLUTE MAXIMUM RATINGS

TO-3 / SOT-93 / ISOWATT218		BU931R / BU931RP / SGSI931R		BU932R / BU932RP / SGSI932R	
V_{CES}	Collector-emitter voltage (V_{BE} = 0)	450		500	V
V_{CEO}	Collector-emitter voltage (I_{BE} = 0)	400		450	V
V_{EBO}	Emitter-base voltage (I_C = 0)		5		V
I_C	Collector current		15		A
I_{CM}	Collector peak current ($t_p \leq 10ms$)		30		A
I_B	Base current		1		A
I_{BM}	Base peak current ($t_p \leq$ 10ms)		5		A
		TO-3	**SOT-93**	**ISOWATT218**	
V_{ISO}	Isolation voltage (DC)			4000	V
P_{tot}	Total dissipation at $T_c \leq 25°C$	175	125	50	W
T_{stg}	Storage temperature	−40 to 200	−40 to 150	−40 to 150	°C
T_j	Max. operating junction temperature	200	150	150	°C

THERMAL DATA

THERMAL DATA			TO-3	SOT-93	ISOWATT218	
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1	1	2.5•	°C/W

• See notes on ISOWATT218 in this datasheet.

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

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	for **BU931R/BU931RP/SGSI931R** V_{CE} = 450 V V_{CE} = 450 V T_c = 125°C for **BU932R/BU932RP/SGSI932R** V_{CE} = 500 V V_{CE} = 500 V T_c = 125°C			 1 5 1 5	 mA mA mA mA
I_{CEO}	Collector cutoff current (I_B = 0)	for **BU931R/BU931RP/SGSI931R** V_{CE} = 400 V for **BU932R/BU932RP/SGSI932R** V_{CE} = 450 V			 1 1	 mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5 V			50	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage	I_C = 100mA for **BU931R/BU931RP/SGSI931R** for **BU932R/BU932RP/SGSI932R**	 400 450			 V V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	for **BU931R/BU931RP/SGSI931R** I_C = 7 A I_B = 70 mA I_C = 8 A I_B = 100 mA I_C = 10 A I_B = 250 mA for **BU932R/BU932RP/SGSI932R** I_C = 8 A I_B = 150 mA		 1.05 1.09 1.13 1.09	 1.6 1.8 1.8 1.8	 V V V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	for **BU932R5BU932RP/SGSI92R** I_C = 8 A I_B = 100 mA I_C = 10A I_B = 250 mA For **BU932R/BU932RP/SGSI932R** I_C = 8A I_B = 150 mA		 1.75 1.92 1.77	 2.2 2.5 2.2	 V V V
h_{FE}*	DC current gain	I_C = 5 A V_{CE} = 10 V	300			
V_F*	Diode forward voltage	I_F = 10 A		1.43	2.8	V

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

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

Parameter	Test conditions	Min.	Typ.	Max.	Unit
USE TEST (see fig. 2)	V_{CC} = 24 V V_{clamp} = 400 V L = 7mH	8			A

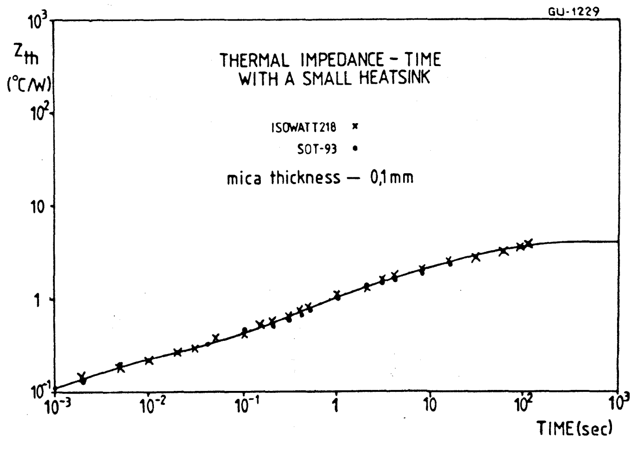
INDUCTIVE LOAD

(see fig. 3)	V_{CC} = 12 V V_{clamp} = 300 V L = 7mH				
t_s Storage time	I_C = 7 A I_B = 70mA		15		μs
t_f Fall time	V_{BE} = 0 R_{BE} = 47 Ω		0.5		μs

THERMAL RESISTANCE OF THE ISOWATT218

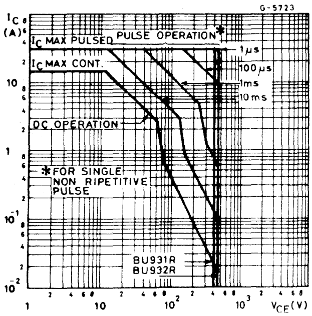
The junction to case thermal resistance of 2.5 °C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1 mm mica insulating washer, the differences are marginal. The 0.1 mm isolating washer gives 1500V to 2000V DC isolation for the SOT-93 package, SGS guarantee 4000V DC isolation for the ISOWATT 218.

The comparison in fig. 1 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The test illustrate that the ISOWATT218 has an R_{th} very close to that of conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package. The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.

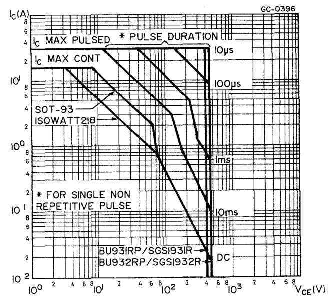


BU931R / BU932R
BU931RP / BU932RP
SGSI931R / SGSI932R

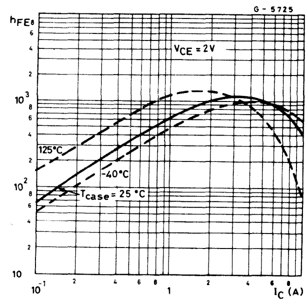
Safe operating areas



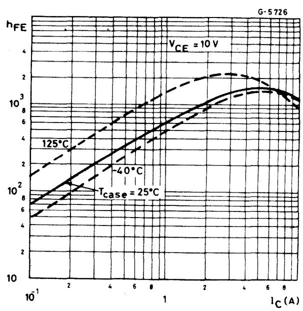
Safe operating areas



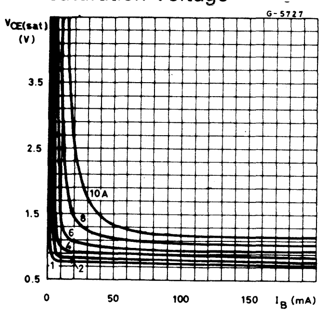
DC current gain



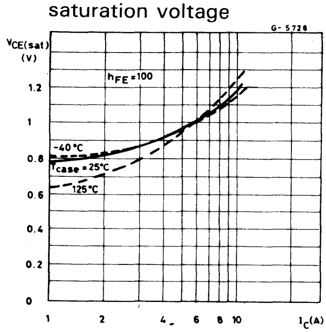
DC current gain



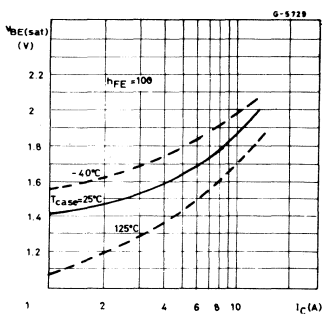
Collector-emitter saturation voltage



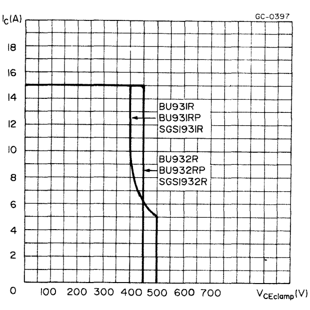
Collector-emitter saturation voltage



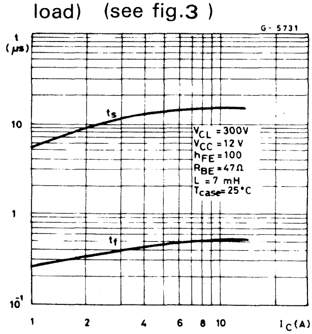
Base-emitter saturation voltage



Clamped reverse bias safe operating areas (see fig.**4**)



Saturated switching characteristics (inductive load) (see fig.**3**)



Switching times percentage variation vs. T_{case} inductive load

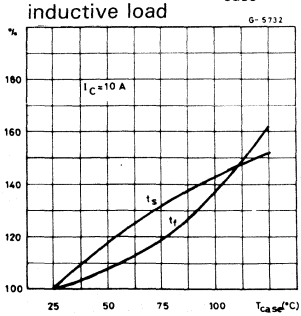


Fig. 2 – Functional test circuit

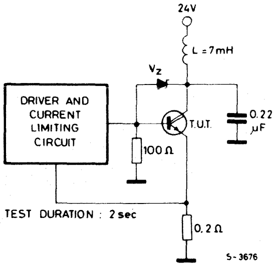


Fig. 2 – Functional test waveforms

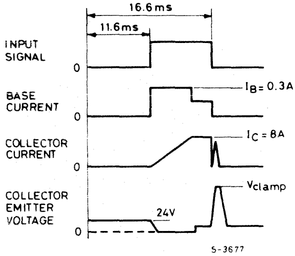


Fig. 3 – Switching times test circuit.

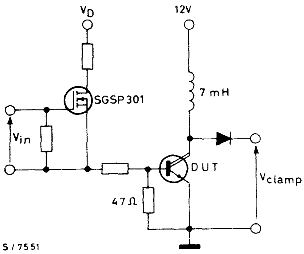
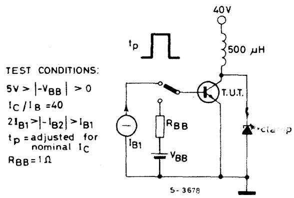


Fig. 4 – Clamped $E_{s/b}$ test circuit



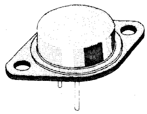
BU931Z
BU931ZP
SGSI931Z

SGS®

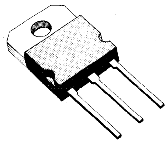
NPN POWER DARLINGTON

- HIGH RUGGEDNESS
- INTEGRATED HIGH VOLTAGE ZENER
  AUTOMOTIVE MARKET
- APPLICATION IN HIGH PERFORMANCE ELECTRONIC CAR IGNITION

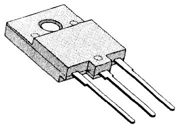
The BU931Z, BU931ZP and SGSI931Z are silicon multiepitaxial biplanar NPN transistors in monolithic darlington configuration mounted respectively in TO-3 metal case, SOT-93 plastic package and ISOWATT218 fully isolated package.



TO-3

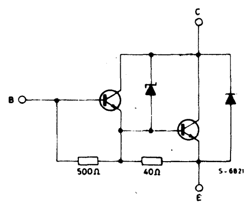


SOT-93 (TO-218)



ISOWATT218

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

		TO-3	SOT-93	ISOWATT218	
V_{CBO}	Collector-base voltage (I_E = 0)		350		V
V_{CER}	Collector-emitter voltage (R_{BE} = 100Ω)		350		V
V_{CES}	Collector-emitter voltage (V_{BE} = 0)		350		V
V_{CEO}	Collector-emitter voltage (I_B = 0)		350		V
V_{EBO}	Emitter-base voltage (I_C = 0)		5		V
I_C	Collector current		20		A
I_B	Base current		5		A
V_{ISO}	Isolation voltage (DC)			4000	V
P_{tot}	Total dissipation at $T_c \leq 25°C$	175	125	50	W
T_{stg}	Storage temperature	−40 to 200	−40 to 150	−40 to 150	°C
T_j	Max. operating junction temperature	200	150	150	°C

THERMAL DATA

			TO-3	SOT-93	ISOWATT218	
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1	1	2.5•	°C/W

• See notes on ISOWATT218 in this datasheet.

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

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CL}	Clamping current	V_{CE} = 350 either I_B = 0 or V_{BE} = 0			 250 250	 μA μA
$I_{CE\ (off)}$	Collector emitter off state current (I_B = 0)	V_{CC} = 16 V T_j = 125°C V_{BE} = 300 mV			0.5	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5 V			50	mA
V_{CL}	Clamping voltage	either I_B = 0 or V_{BE} = 0 and I_C = 100mA same T_j = 125°C	 350 350		 500 500	 V V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 7 A I_B = 70mA I_C = 8 A I_B = 100mA I_C = 10 A I_B = 150mA T_j = 125°C I_C = 7 A I_B = 70mA I_C = 8 A I_B = 100mA I_C = 10 A I_B = 150mA		1.25 1.45 1.65 1.3 1.65 1.85	1.6 1.8 2 1.8 2.1 2.4	V V V V V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 8 A I_B = 100mA I_C = 10 A I_B = 250mA			2.2 2.5	V V
$V_{BE(on)}$*	Base-emitter voltage	I_C = 5 A V_{CE} = 2 V T_j = −40°C T_j = 125°C I_C = 10 A V_{CE} = 2 V T_j = −40°C T_j = 125°C	 1.1 1.4	1.67 2 	 2.1 2.4 	V V V V V V

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

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_F*	Diode forward voltage	I_F = 10 A			2.5	V
$E_{s/b}$	Second breakdown energy unclamped	L = 10mH I_C = 10 A		500		mJ
$I_{s/b}$	Second breakdown collector current	V_{CE} = 30 t = 500ms for **BU931Z** t = 250ms for **BU931ZP** t = 250ms for **SGSI931Z**	 6 4 1.7			 A A A
	USE TEST (see fig.2)	V_{CC} = 24 V L = 7mH	8			A

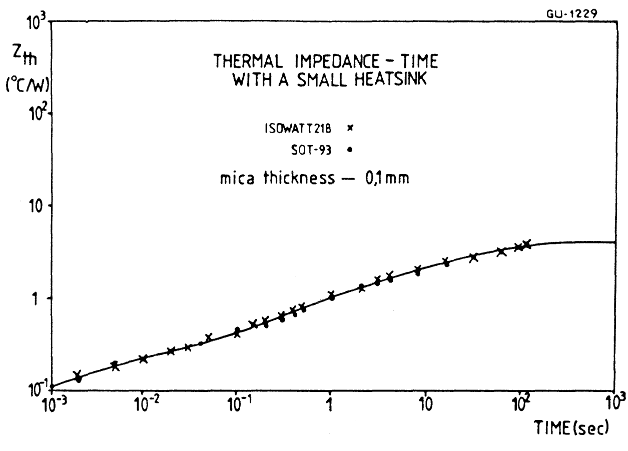
* Pulsed: Pulse duration = 300 μs, duty cycle = 1.5%

THERMAL RESISTANCE OF THE ISOWATT218

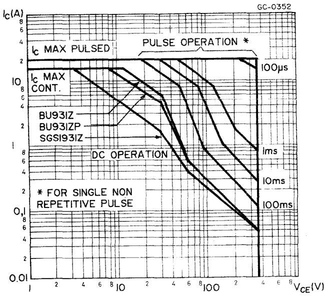
The junction to case thermal resistance of 2.5 °C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1 mm mica insulating washer, the differences are marginal. The 0.1 mm isolating washer gives 1500V to 2000V DC isolation for the SOT-93 package, SGS guarantee 4000V DC isolation for the ISOWATT 218.

The comparison in fig. 1 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The test illustrate that the ISOWATT218 has an R_{th} very close to that of conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package. The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.

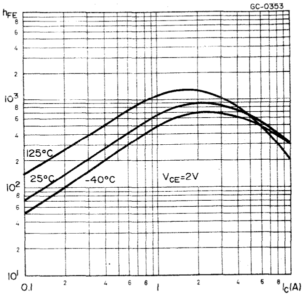
Fig. 1



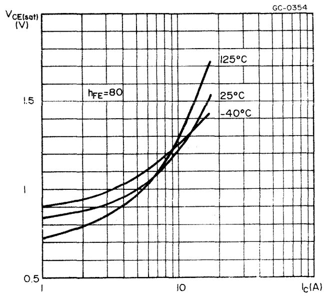
Safe operating areas



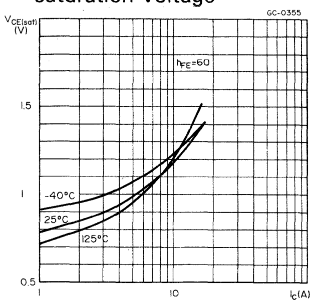
DC current gain



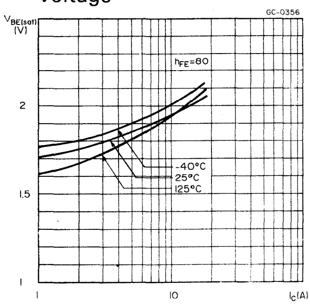
Collector-emitter saturation voltage



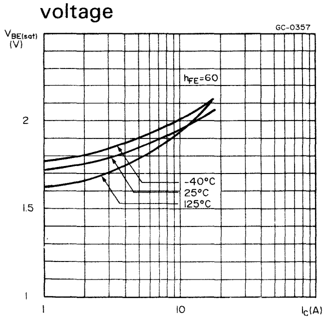
Collector-emitter saturation voltage



Base-emitter saturation voltage



Base-emitter saturation voltage



Collector-emitter saturation voltage

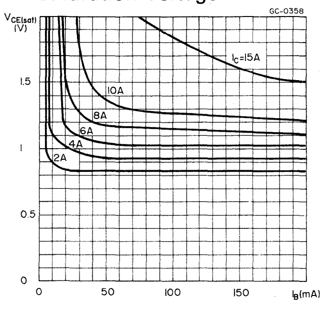


Fig. 2 — Functional test circuit

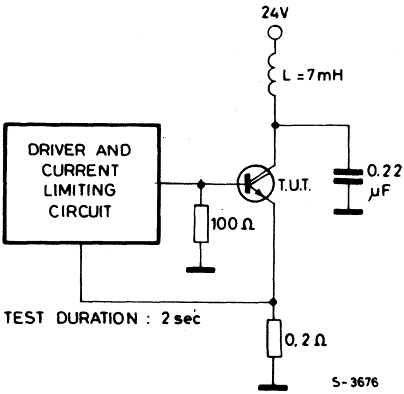
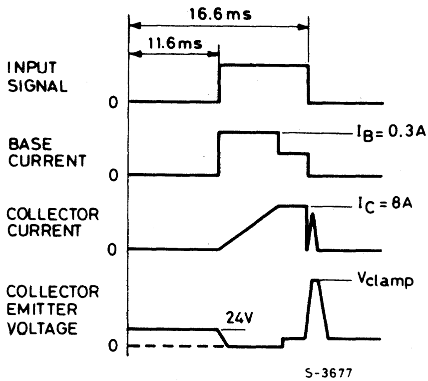


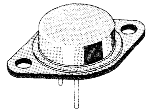
Fig. 3 — Functional test waveforms



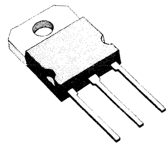
HIGH VOLTAGE POWER SWITCH

- HIGH POWER
- INTEGRATED SPEED-UP DIODE

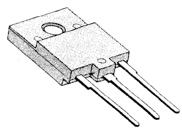
The BUT13, BUT13P and SGSIT13 are silicon multiepitaxial planar NPN transistors in monolithic darlington configuration with integrated base-emitter speed-up diode, mounted respectively in TO-3 metal case, SOT-93 plastic package and ISOWATT218 fully isolated package.
They are particularly suited for output stages in power, fast switching application.



TO-3

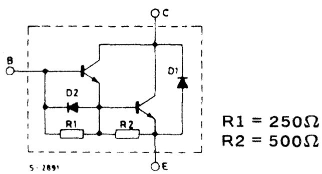


SOT-93 (TO-218)



ISOWATT218

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-emitter voltage ($I_E = 0$)		600		V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)		400		V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		10		V
I_C	Collector current		28		A
I_{CM}	Collector peak current ($t_p \leq 10ms$)		35		A
I_B	Base current		6		A
		TO-3	**SOT-93**	**ISOWATT218**	
V_{ISO}	Isolation voltage (DC)			4000	V
P_{tot}	Total dissipation at $T_c \leq 25°C$	175	125	50	W
T_{stg}	Storage temperature	−65 to 200	−65 to 150	−65 to 150	°C
T_j	Max. operating junction temperature	200	150	150	°C

11/86

THERMAL DATA

			TO-3	SOT-93	ISOWATT218	
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1	1	2.5•	°C/W

• See notes on ISOWATT218 in this datasheet.

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

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEV}	Collector cutoff current (V_{BE} = −5 V)	V_{CE} = 600 V V_{CE} = 600 V T_c = 100°C			100 2	μA mA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 400 V			1	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 2 V			20	mA
$V_{CEO(sus)}$*	Collector emitter sustaining voltage	I_C = 100mA	400			V
$V_{CE(sat)}$*	Collector emitter saturation voltage	I_C = 10 A I_B = 0.5 A I_C = 18 A I_B = 1.8 A I_C = 22 A I_B = 2.2 A I_C = 28 A I_B = 5.6 A		1.3 1.7 2 2.35	2 2.5 3 5	V V V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 10 A I_B = 0.5 A I_C = 18 A I_B = 1.8 A I_C = 22 A I_B = 2.2 A		 2.5 	2.5 3 3.3	V V V
h_{FE}*	DC current gain	I_C = 10 A V_{CE} = 5 V I_C = 18 A V_{CE} = 5 V	30 30	300 90		
V_F*	Diode forward voltage	I_F = 22 A		2.2	4	V

RESISISTIVE LOAD

t_{on} t_s t_f	Turn-on time Storage time Fall time	V_{CC} = 250 V I_C = 10 A I_{B1} = 0.5 A $V_{BE\ (off)}$ = −5 V		0.5 1.1 0.3	0.6 1.5 0.6	μs μs μs

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

INDUCTIVE LOAD

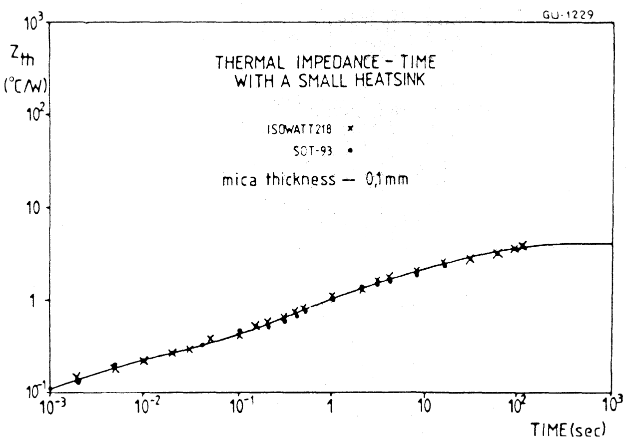
Parameter		Test conditions	Min.	Typ.	Max.	Unit
t_s	Storage time	V_{Clamp} = 250 V I_C = 10 A		1.3	2	µs
t_f	Fall time	$V_{BE\ (off)}$ = −5 V I_{B1} = 0.2 A		0.11	0.5	µs
t_c	Crossover time			0.4	0.8	µs
t_s	Storage time	V_{Clamp} = 250 V I_C = 20 A		1.4	2.6	µs
t_f	Fall time	$V_{BE\ (off)}$ = −5 V I_{B1} = 0.4 A		0.4	0.7	µs
t_c	Crossover time			0.8	1.5	µs

THERMAL RESISTANCE OF THE ISOWATT218

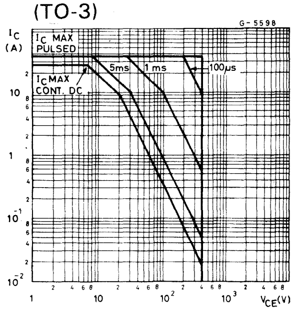
The junction to case thermal resistance of 2.5 °C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1 mm mica insulating washer, the differences are marginal. The 0.1 mm isolating washer gives 1500V to 2000V DC isolation for the SOT-93 package, SGS guarantee 4000V DC isolation for the ISOWATT 218.

The comparison in fig. 1 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The test illustrate that the ISOWATT218 has an R_{th} very close to that of conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package. The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.

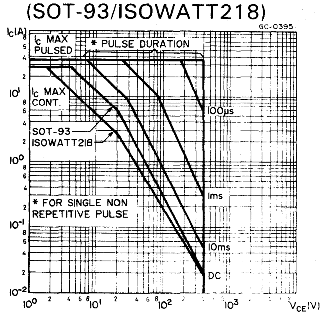
Fig. 1



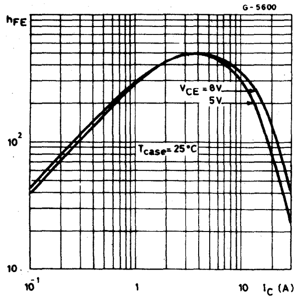
Safe operating areas (TO-3)



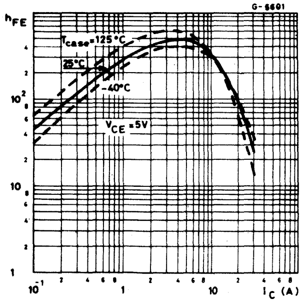
Safe operating areas (SOT-93/ISOWATT218)



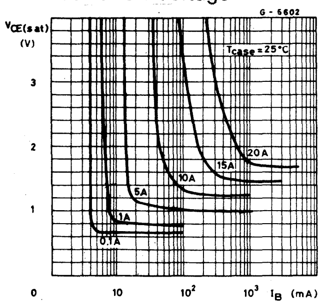
DC current gain



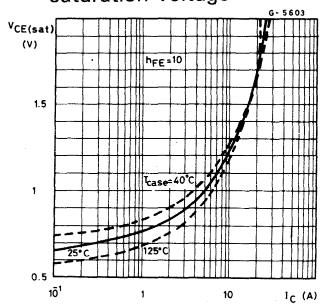
DC current gain



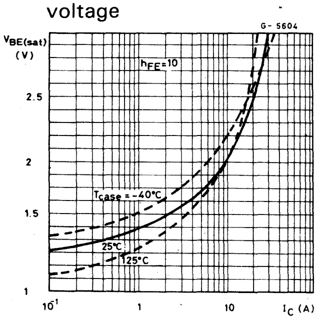
Collector-emitter saturation voltage



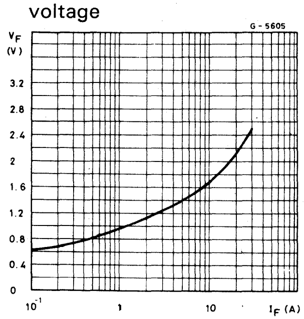
Collector-emitter saturation voltage



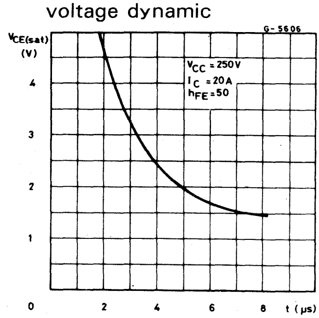
Base-emitter saturation voltage



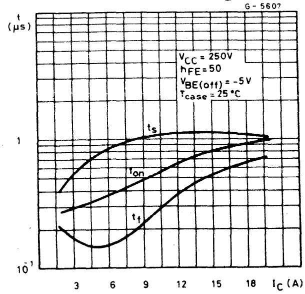
Freewheel diode forward voltage



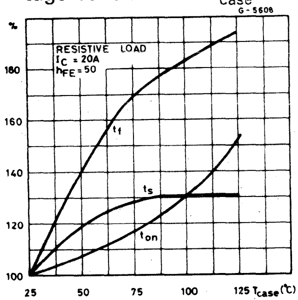
Collector-emitter saturation voltage dynamic



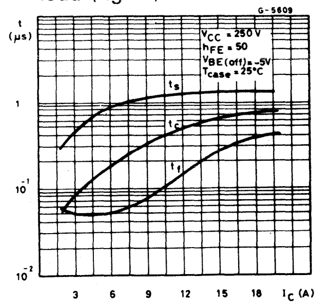
Switching times resistive load (test circuit fig. 2)



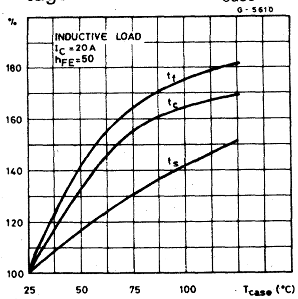
Switching times percentage variation vs. T_{case}



Switching times inductive load (fig. 2)



Switching times percentage variation vs. T_{case}



Clamped reverse bias safe operating area

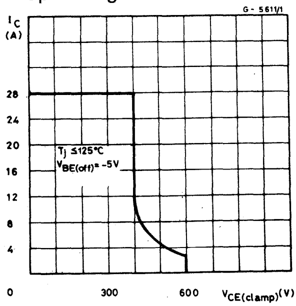
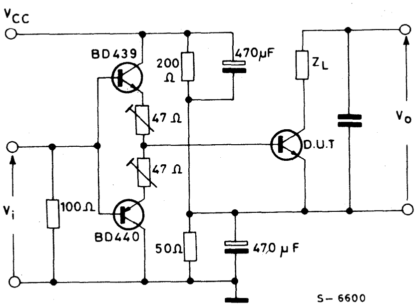


Fig. 2 - Switching times test circuit on resistive load



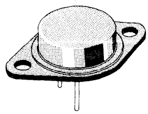
BUW32 / BUW32A
BUW32P / BUW32AP
SGSIW32 / SGSIW32A

SGS®

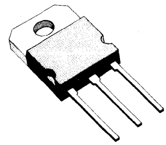
HIGH VOLTAGE POWER SWITCH

- FAST SWITCHING APPLICATIONS
- INDUSTRIAL APPLICATION

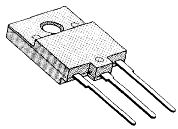
The BUW32/A, BUW32P/AP and SGSIW32/A are silicon multiepitaxial mesa PNP transistors mounted respectively in TO-3 metal case, SOT-93 plastic package and ISOWATT218 fully isolated package.



TO-3

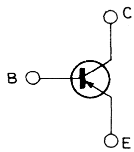


SOT-93 (TO-218)



ISOWATT218

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

	TO-3 / SOT-93 / ISOWATT218	BUW32 / BUW32P / SGSIW32		BUW32A / BUW32AP / SGSIW32A	
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	−400		−450	V
V_{CEO}	Collector-emitter voltage ($I_{BE} = 0$)	−350		−400	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	−5		−7	V
I_C	Collector current		−10		A
I_B	Base current		− 5		A
		TO-3	**SOT-93**	**ISOWATT218**	
V_{ISO}	Isolation voltage (DC)			4000	V
P_{tot}	Total dissipation at $T_c \leqslant 25°C$	125	105	50	W
T_{stg}	Storage temperature	−65 to 175	−65 to 150	−65 to 150	°C
T_j	Max. operating junction temperature	175	150	150	°C

THERMAL DATA

			TO-3	SOT-93	ISOWATT218	
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.19	1.19	2.5•	°C/W

• See notes on ISOWATT218 in this datasheet.

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

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = rated V_{CES} V_{CE} = rated V_{CES} T_c = 125°C			− 1 − 5	mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = rated V_{EBO}			− 1	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = −100mA for **BUW32/BUW32P/SGSIW32** for **BUW32A/BUW32AP/SGSIV32A**	 −350 −400			 V V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = −5 A I_B = −1.5 A			−1.5	V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C =− 5 A I_B = −1.5 A			−1.6	V
h_{FE}*	DC current gain	I_C = −1 A V_{CE} = −5 V	12			
$I_{s/b}$	Second breakdown collector current	V_{CE} = −30 V for **BUW32/A** for **BUW32P/AP** for **SGSIW32/A**	 −4.2 −3.5 −1.7			 A A A

RESISTIVE LOAD

t_{on} t_s t_f	Turn-on time Storage time Fall time	V_{CC} = −250 V I_C = −5 A I_{B1} = −I_{B2} = −1 A		0.3 0.7 0.25	0.6 1.5 0.6	μs μs μs

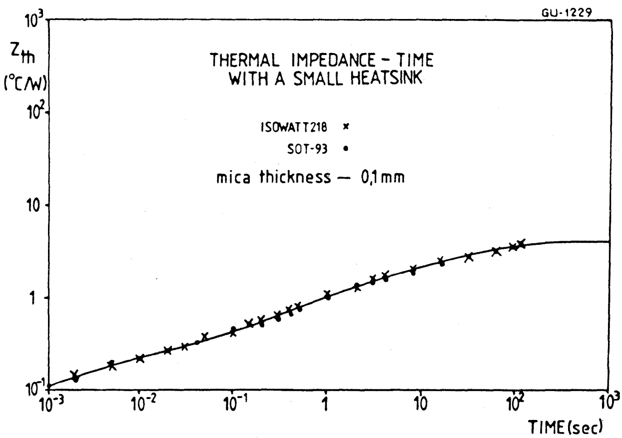
* Pulsed: Pulse duration = 300 μs, duty cycle = 1.5%

THERMAL RESISTANCE OF THE ISOWATT218

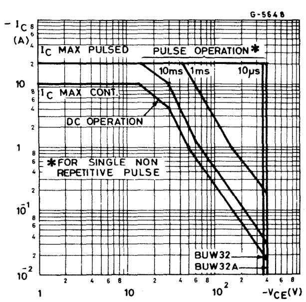
The junction to case thermal resistance of 2.5 °C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1 mm mica insulating washer, the differences are marginal. The 0.1 mm isolating washer gives 1500V to 2000V DC isolation for the SOT-93 package, SGS guarantee 4000V DC isolation for the ISOWATT 218.

The comparison in fig. 1 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The test illustrate that the ISOWATT218 has an R_{th} very close to that of conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package. The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.

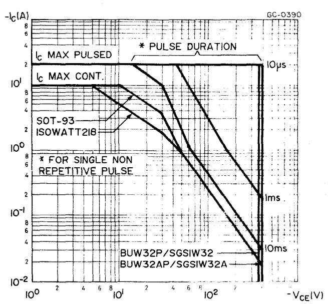
Fig. 1



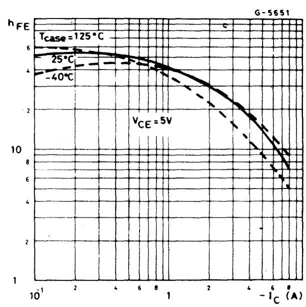
Safe operating areas



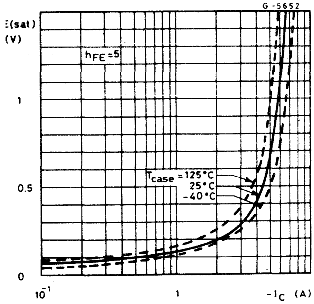
Safe operating areas



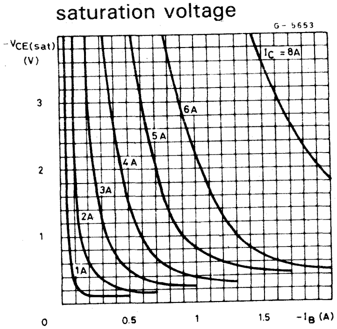
DC current gain



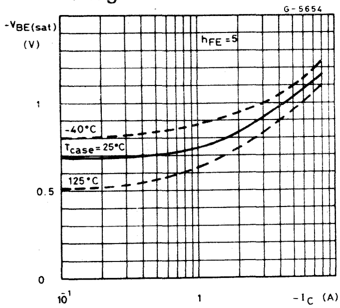
Collector-emitter saturation voltage



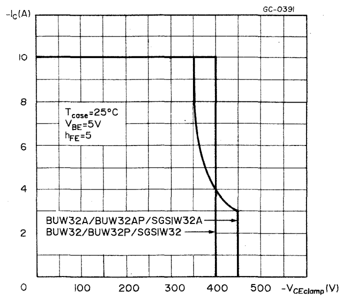
Collector-emitter saturation voltage



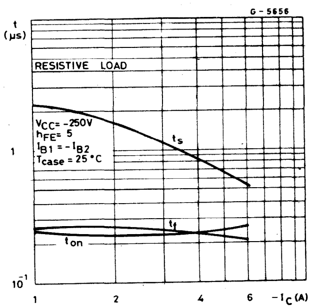
Base-emitter saturation voltage



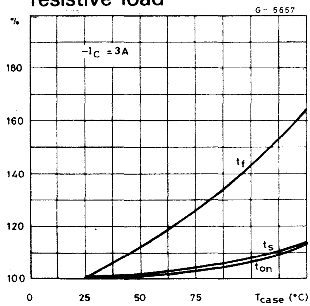
Clamped reverse bias safe operating areas



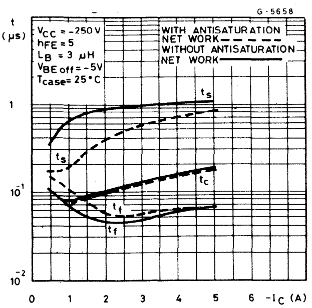
Saturated switching characteristics



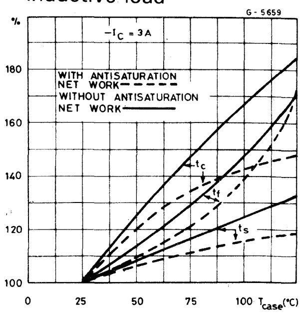
Switching times percentage variation vs. T_{case} resistive load



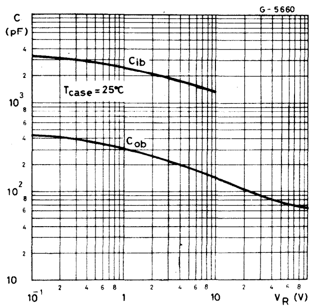
Switching times inductive load (fig. 2)



Switching times percentage variation vs. T_{case} inductive load



Capacitance variation



TEST CIRCUITS

Fig. 1

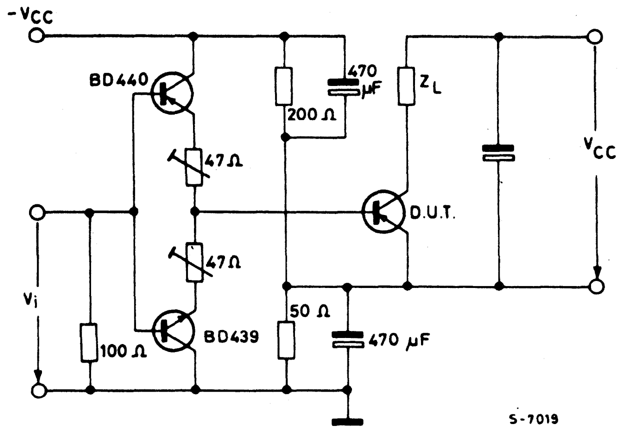
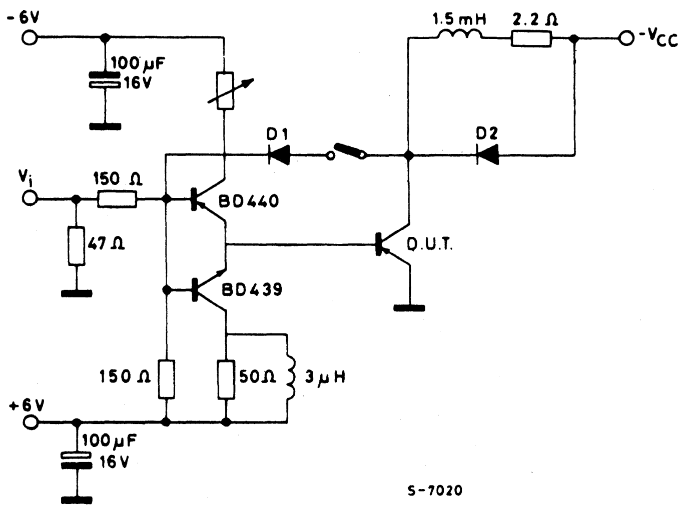


Fig. 2

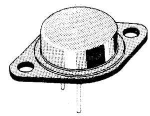


BUW42 / BUW42A
BUW42P / BUW42AP
SGSIW42 / SGSIW42A

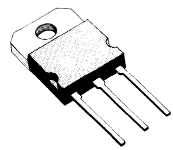
HIGH VOLTAGE POWER SWITCH

- FAST SWITCHING APPLICATIONS
- INDUSTRIAL APPLICATION

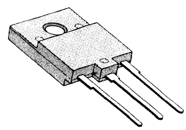
The BUW42/A, BUW42P/AP and SGSIW42/A are silicon multiepitaxial mesa PNP transistors mounted respectively in TO-3 metal case, SOT-93 plastic package and ISOWATT218 fully isolated package.



TO-3

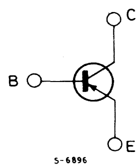


SOT-93 (TO-218)



ISOWATT218

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

	TO-3 / SOT-93 / ISOWATT218	BUW42 / BUW42P / SGSIW42		BUW42A / BUW42AP / SGSIW42A	
V_{CES}	Collector-emitter voltage (V_{BE} = 0)	−400		−450	V
V_{CEO}	Collector-emitter voltage (I_{BE} = 0)	−350		−400	V
V_{EBO}	Emitter-base voltage (I_C = 0)	−5		−7	V
I_C	Collector current		−15		A
I_{CM}	Collector peak current		−30		A
I_B	Base current		−10		A
		TO-3	**SOT-93**	**ISOWATT218**	
V_{ISO}	Isolation voltage (DC)			4000	V
P_{tot}	Total dissipation at $T_c \leq 25°C$	150	105	50	W
T_{stg}	Storage temperature	−65 to 175	−65 to 150	−65 to 150	°C
T_j	Max. operating junction temperature	175	150	150	°C

THERMAL DATA

			TO-3	SOT-93	ISOWATT218	
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1	1.2	2.5•	°C/W

• See notes on ISOWATT218 in this datasheet.

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

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = rated V_{CES}			− 1	mA
I_{EBO}	Emitter cutoff current	V_{EB} = rated V_{EBO}			− 1	mA
$V_{CEO(sus)}$*	Collector emitter sustaining voltage (I_B = 0)	I_C = 100mA for **BUW42/BUW42P/SGSIW42** for **BUW42A/BUW42AP/SGSIW42A**	 −350 −400			 V V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = −10 A I_B = −3 A			−1.5	V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = − 10 A I_B = −3 A			− 2	V
h_{FE}*	DC current gain	I_C = −3 A V_{CE} = −5 V	12		80	

RESISTIVE LOAD

t_{on} t_s t_f	Turn-on time Storage time Fall time	V_{CC} = −250 V I_C = −10 A I_{B1} = $-I_{B2}$ = −3.3 A		0.3 0.5 0.3	0.6 1.5 0.6	µs µs µs

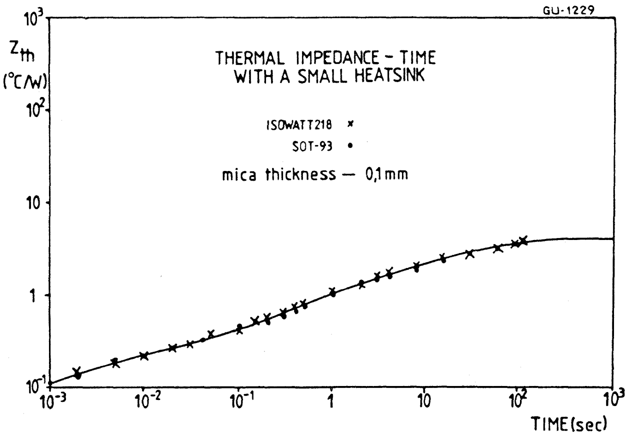
* Pulsed: Pulse duration = 300 µs, duty cycle = 1.5%

THERMAL RESISTANCE OF THE ISOWATT218

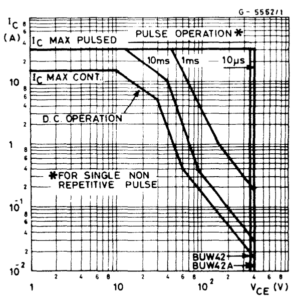
The junction to case thermal resistance of 2.5 °C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1 mm mica insulating washer, the differences are marginal. The 0.1 mm isolating washer gives 1500V to 2000V DC isolation for the SOT-93 package, SGS guarantee 4000V DC isolation for the ISOWATT 218.

The comparison in fig. 1 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The test illustrate that the ISOWATT218 has an R_{th} very close to that of conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package. The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.

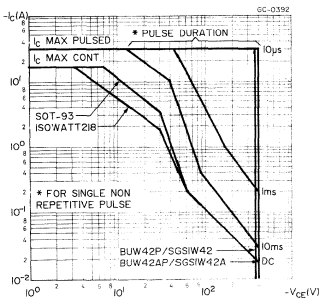
Fig. 1



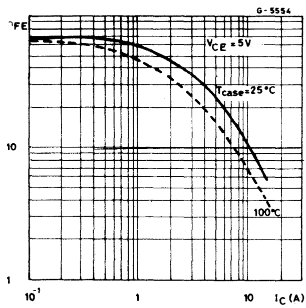
Safe operating area



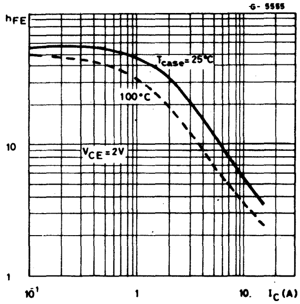
Safe operating areas



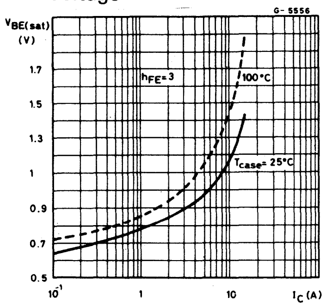
DC current gain



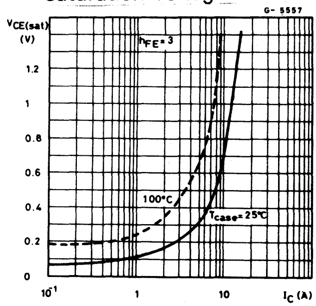
DC current gain



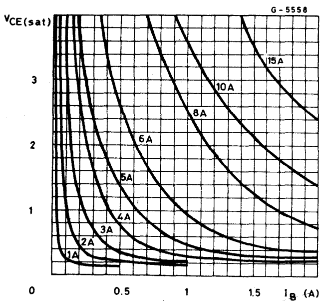
Base-emitter saturation voltage



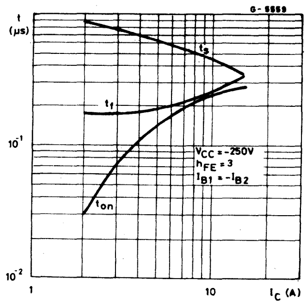
Collector-emitter saturation voltage



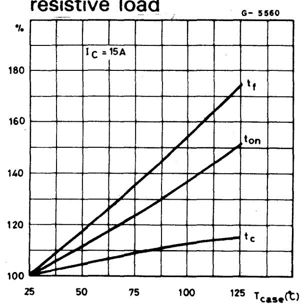
Collector-emitter saturation voltage



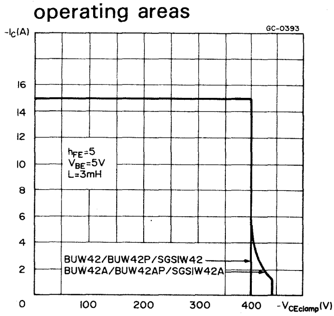
Saturated switching times resistive load



Switching times percentage variation vs. T_{case} resistive load



Clamped reverse bias safe operating areas

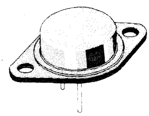


BUX47 / BUX47A
BUV47 / BUV47A
SGSIV47 / SGSIV47A

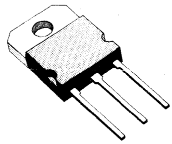
HIGH VOLTAGE POWER SWITCH

- SWITCH MODE POWER SUPPLY APPLICATIONS

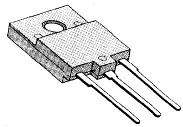
The BUX47, BUX47A, BUV47, BUV 47A, SGSIV47 and SGSIV47A are silicon multiepitaxial mesa NPN transistors mounted in respectively in TO-3 metal case, SOT-93 plastic package and ISOWATT218 fully isolated package.
They are intended for high voltage, fast switching applications.



TO-3

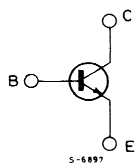


SOT-93 (TO-218)



ISOWATT218

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

TO-3 / SOT-93 / ISOWATT218		BUX47 / BUV47 / SGSIV47		BUX47A / BUV47A / SGSIV47A	
V_{CBO}	Collector-base voltage ($I_E = 0$)	850		1000	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	850		900	V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	400		450	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		7		V
I_C	Collector current		9		A
I_{CM}	Collector peak current ($t_p \leqslant 5$ ms)		15		A
I_B	Base current		8		A
I_{BM}	Base peak current ($t_p \leqslant 5$ ms)		10		A
		TO-3	**SOT-93**	**ISOWATT218**	
V_{ISO}	Isolation voltage (DC)			4000	V
P_{tot}	Total dissipation at $T_c \leqslant 25°C$	125	100	50	W
T_{stg}	Storage temperature	−65 to 175	−65 to 150	−65 to 150	°C
T_j	Max. operating junction temperature	175	150	150	°C

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THERMAL DATA

THERMAL DATA			TO-3	SOT-93	ISOWATT218	
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1	1.2	2.5•	°C/W

• See notes on ISOWATT218 in this datasheet.

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

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CER}	Collector cutoff current (R_{BE} = 10Ω)	V_{CE} = 850 V V_{CE} = 850 V T_c = 125°C			0.4 3	mA mA
I_{CEV}	Collector cutoff current (V_{BE} = −2.5 V)	V_{CE} = 850 V V_{CE} = 850 V T_c = 125°C			0.15 1.5	mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5V			1	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage	I_C = 0.2A L = 25mH for **BUV47/SGSIV47/BUX47** for **BUV47A/SGSIV47A/BUX47A**	 400 450			 V V
V_{EBO}	Emitter-base voltage (I_C = 0)	I_E = 50 mA	7		30	V
$V_{CE(sat)}$*	Collector emitter saturation voltage	for **BUV47A/SGSIV47A/BUX47A** I_C = 5 A I_B = 1 A I_C = 8 A I_B = 2.5 A for **BUV47/SGSIV47/BUX47** I_C = 6 A I_B = 1.2 A I_C = 9 A I_B = 3 A			 1.5 3 1.5 3	 V V V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	for **BUV47A/SGSIV47A/BUX47A** I_C = 5 A I_B = 1 A for **BUV47/SGSIV47/BUX47** I_C = 6 A I_B = 1.2 A			 1.6 1.6	 V V

ELECTRICAL CHARACTERISTICS (Continued)

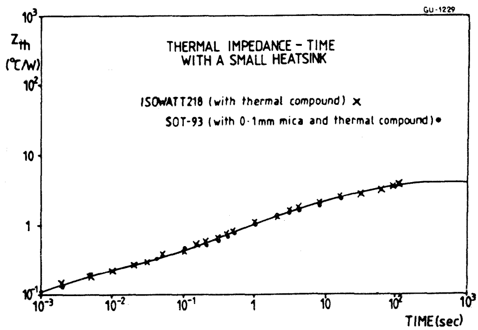
Parameter		Test conditions	Min.	Typ.	Max.	Unit
RESISTIVE LOAD (see fig. 1)						
t_{on}	Turn-on time	for **BUV47/SGSIV47/BUX47**			0.7	μs
t_s	Storage time	I_C = 6 A V_{CC} = 150 V			3	μs
t_f	Fall time	$I_{B1} = -I_{B2}$ = 1.2 A			0.8	μs
t_{on}	Turn-on time	for **BUV47A/SGSIV47A/BUX47A**			0.8	μs
t_s	Storage time	I_C = 5 A V_{CC} = 150 V			2.5	μs
t_f	Fall time	$I_{B1} = -I_{B2}$ = 1 A			0.8	μs
INDUCTIVE LOAD (see fig. 2)						
t_f	Fall time	I_C = 5 A I_{B1} = 1 A V_{BE} = 5 V V_{CC} = 300 V L = 3μH T_j = 100°C			0.5	μs

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

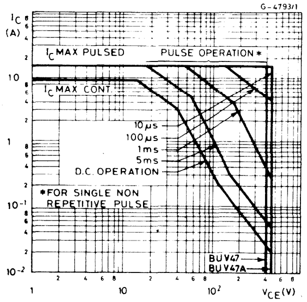
THERMAL RESISTANCE OF THE ISOWATT218

The junction to case thermal resistance of 2.5 °C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1 mm mica insulating washer, the differences are marginal. The 0.1 mm isolating washer gives 1500V to 2000V DC isolation for the SOT-93 package, SGS guarantee 4000V DC isolation for the ISOWATT 218.

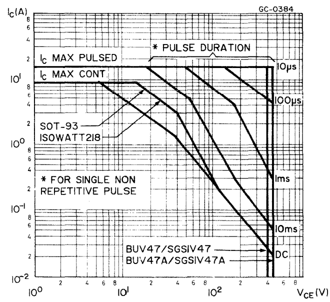
The comparison in fig. 1 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The test illustrate that the ISOWATT218 has an R_{th} very close to that of conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package. The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.



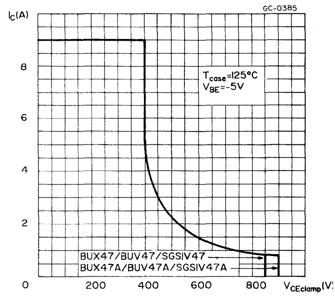
Safe operating areas



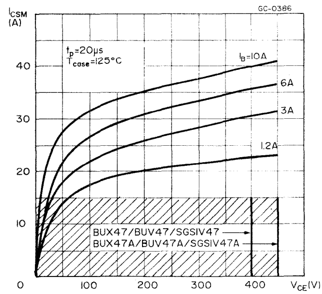
Safe operating areas



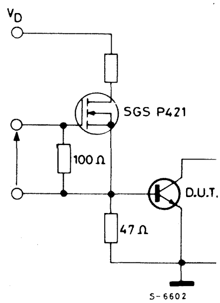
Clamped reverse biased SOA



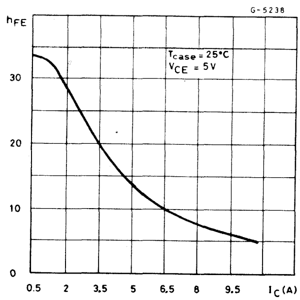
Forward biased accidental overload area



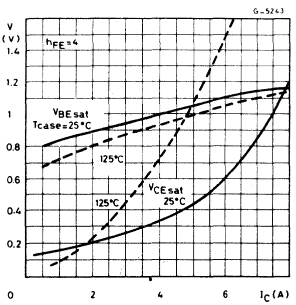
Forward biased accidental overload area test circuit.



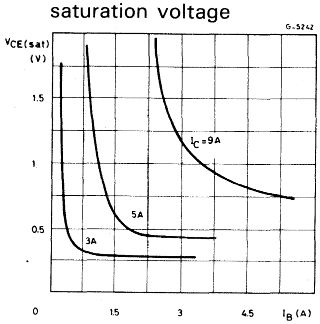
DC current gain



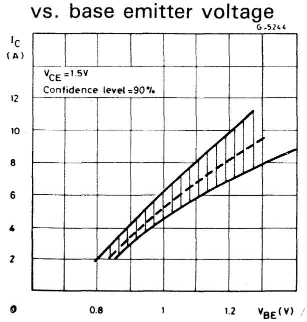
Saturation voltages



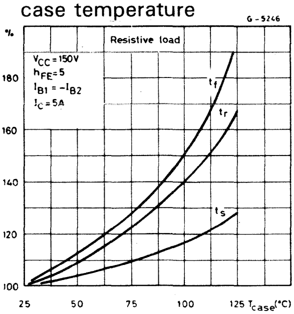
Collector-emitter saturation voltage



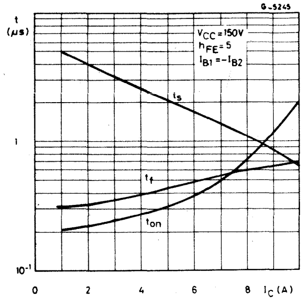
Collector current spread vs. base emitter voltage



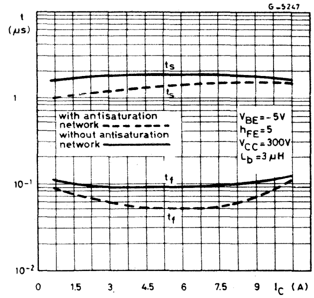
Switching times percentage variation vs. case temperature



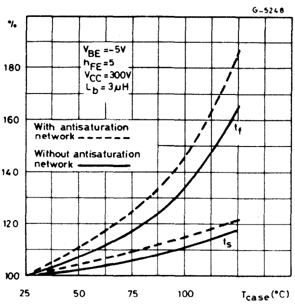
Switching times inductive load (See fig. 5)



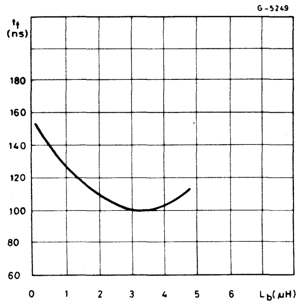
Switching times inductive load (See fig. 6)



Switching times inductive load vs. case temperature



Fall times vs. L_b (See fig. 6)



Dynamic collector-emitter saturation voltage (See fig. 3)

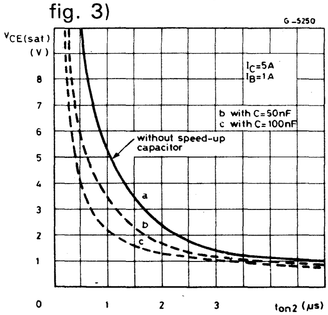


Fig. **2** Equivalent input schematic circuit at turn-on.

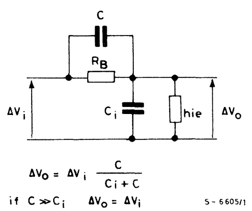


Fig. **3** $V_{CE(sat)}$ dyn. test circuit.

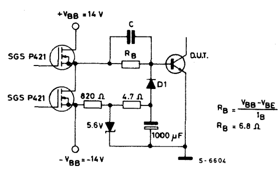


Fig. **4** Remarks to $V_{CE(sat)}$ dyn. test circuit

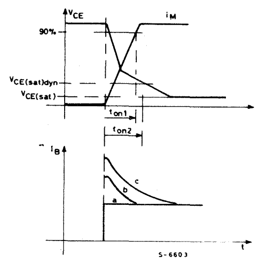


Fig. 5 - Switching times test circuit on resistive load.

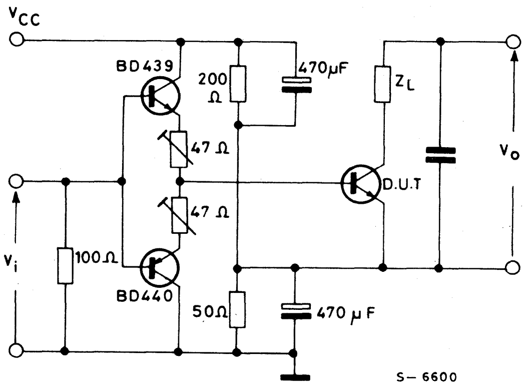
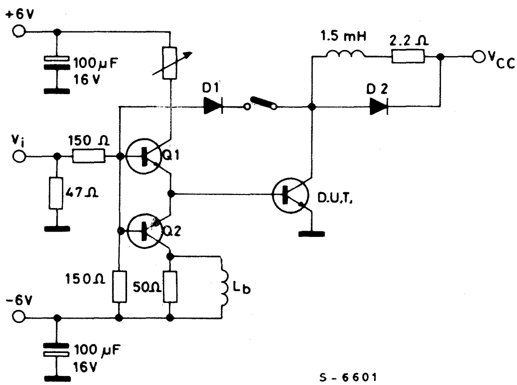


Fig. 6 - Switching times test circuit on inductive load, with and without antisaturation network



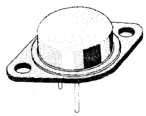
D1, D2 - Fast recovery diodes
Q1, Q2 - Transistors SGS: 2N5191, 2N5195

BUX48 / BUX48A
BUV48 / BUV48A
SGSIV48 / SGSIV48A

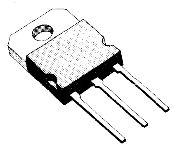
HIGH VOLTAGE POWER SWITCH

- DC, AC MOTOR CONTROL
- SWITCH MODE POWER SUPPLY

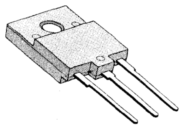
The BUX48, BUX48A, BUV48, BUV48A, SGSIV48 and SGSIV48A are multiepitaxial mesa NPN transistors mounted in respectively in TO-3 metal case, SOT-93 plastic package and ISOWATT218 fully isolated package.
They are particularly intended for switching applications directly from the 220V and 380V mains.



TO-3

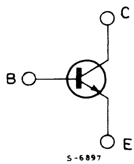


SOT-93 (TO-218)



ISOWATT218

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

TO-3 / SOT-93 / ISOWATT218		BUX48 / BUV48 / SGSIV48		BUX48A / BUV48A / SGSIV48A	
V_{CES}	Collector-emitter voltage (V_{BE} = 0)	850		1000	V
V_{CER}	Collector-emitter voltage (R_{BE} = 10Ω)	850		1000	V
V_{CEO}	Collector-emitter voltage (I_{BE} = 0)	400		450	V
V_{EBO}	Emitter-base voltage (I_C = 0)		7		V
I_C	Collector current		15		A
I_{CM}	Collector peak current I_{CP} ($t_p \leqslant$ 5 ms)		30		A
I_{CP}	Collector peak current non rep. ($t_p \leqslant$ 20 μs)		55		A
I_B	Base current		4		A
I_{BM}	Base peak current ($t_p \leqslant$ 5 ms)		20		A
		TO-3	**SOT-93**	**ISOWATT218**	
V_{ISO}	Isolation voltage (DC)			4000	V
P_{tot}	Total dissipation at $T_c \leqslant 25°C$	175	125	50	W
T_{stg}	Storage temperature	−65 to 200	−65 to 150	−65 to 150	°C
T_j	Max. operating junction temperature	200	150	150	°C

THERMAL DATA

			TO-3	SOT-93	ISOWATT218	
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1	1	2.5•	°C/W

• See notes on ISOWATT218 in this datasheet.

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

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CER}	Collector cutoff current (R_{BE} = 10Ω)	V_{CE} = rated V_{CER} V_{CE} = rated V_{CER} T_c = 125°C			500 4	μA mA
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = rated V_{CER} V_{CE} = rated V_{CER} T_c = 125°C			200 2	μA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5 V			1	mA
$V_{CEO(sus)}$*	Collector emitter sustaining voltage (I_B = 0)	I_C = 200mA L = 25mH for **BUX48/BUV48/SGSIV48** for **BUX48A/BUV48A/SGSIV48A**	 400 450			 V V
V_{EBO}	Emitttere-base voltage (I_C = 0)	I_E = 50mA	7		30	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	for **BUX48/BUV48/SGSIV48** I_C = 10 A I_B = 2 A I_C = 15 A I_B = 4 A I_C = 15 A I_B = 3 A for **BUX48A/BUV48A/SGSIV48A** I_C = 8 A I_B = 1.6 A I_C = 12 A I_B = 2.4 A			 1.5 3.5 5 1.5 5	 V V V V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	for **BUX48/BUV48/SGSIV48** I_C = 10 A I_B = 2 A for **BUX48A/BUV48A/SGSIV48A** I_C = 8 A I_B = 1.6 A			 1.6 1.6	 V V

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

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

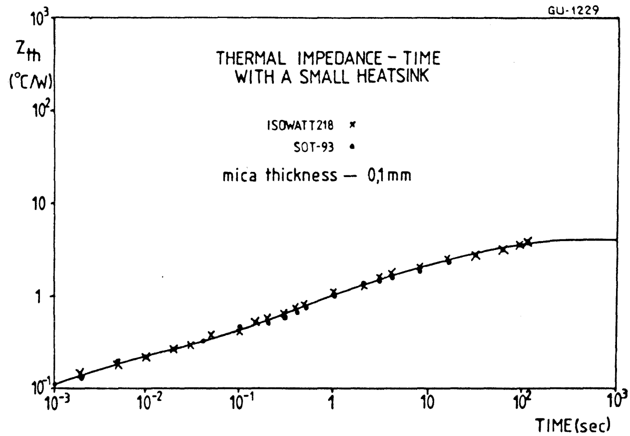
Parameter	Test conditions	Min.	Typ.	Max.	Unit
RESISTIVE LOAD					
t_{on} Turn-on time	for **BUX48/BUV48/SGSIV48** V_{CC} = 150 V I_C = 10 A I_{B1} = 2 A			1	μs
	for **BUX48A/BUV48A/SGSIV48A** V_{CC} = 150 V I_C = 8 A I_{B1} = 1.6 A			1	μs
t_s Storage time	for **BUX48/BUV48/SGSIV48** V_{CC} = 150 V I_C = 10 A $I_{B1} = -I_{B2}$ = 2 A			3	μs
	for **BUX48A/BUV48A/SGSIV48A** V_{CC} = 150 V I_C = 8 A $I_{B1} = -I_{B2}$ = 1.6 A			3	μs
t_f Fall time	for **BUX48/BUV48/SGSIV48** V_{CC} = 150 V I_C = 10 A $I_{B1} = -I_{B2}$ = 2 A			0.8	μs
	for **BUX48A/BUV48A/SGSIV48A** V_{CC} = 150 V I_C = 8 A $I_{B1} = -I_{B2}$ = 1.6 A			0.8	μs
INDUCTIVE LOAD					
t_s Storage time	for **BUX48/BUV48/SGSIV48** V_{CC} = 300 V I_C = 10A L_B = 3μH I_{B1} = 2 A V_{BE} = −5 V		2.7		μs
	same T_c = 125°C			5	μs
	for **BUX48A/BUV48A/SGSIV48A** V_{CC} = 300 V I_C = 8 A L_B = 3 μH I_{B1} = 1.6 A V_{BE} = −5 V		3		μs
	same T_c = 125°C			5	μs
t_f Fall time	for **BUX48/BUV48/SGSIV48** V_{CC} = 300 V I_C = 10 A L_B = 3μH I_{B1} = 2 A V_{BE} = −5 V		0.16		μs
	same T_c = 125°C			0.4	μs
	for **BUX48A/BUV48A/SGSIV48A** V_{CC} = 300 V I_C = 8 A L_B = 3μH I_{B1} = 1.6 A V_{BE} = −5 V		0.13		μs
	same T_c = 125°C			0.4	μs

THERMAL RESISTANCE OF THE ISOWATT218

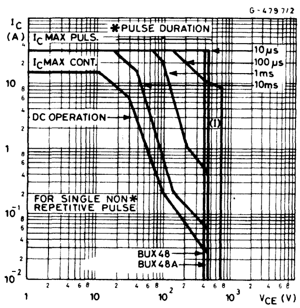
The junction to case thermal resistance of 2.5 °C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1 mm mica insulating washer, the differences are marginal. The 0.1 mm isolating washer gives 1500V to 2000V DC isolation for the SOT-93 package, SGS guarantee 4000V DC isolation for the ISOWATT 218.

The comparison in fig. 1 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The test illustrate that the ISOWATT218 has an R_{th} very close to that of conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package. The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.

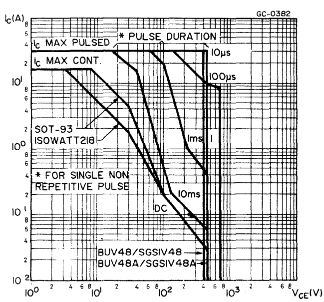
Fig. 1



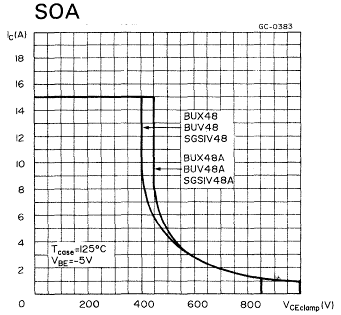
Safe operating areas



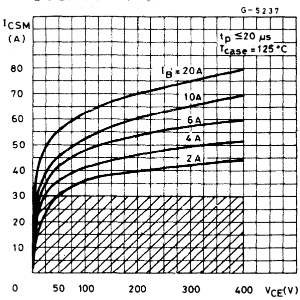
Safe operating areas



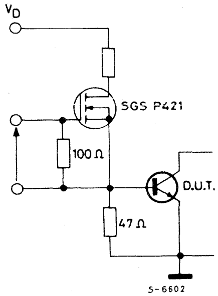
Clamped reverse biased SOA



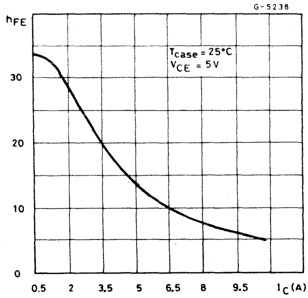
Forward biased accidental overload area



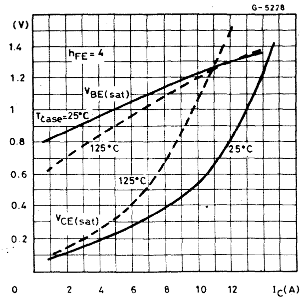
Forward biased accidental overload area test circuit.



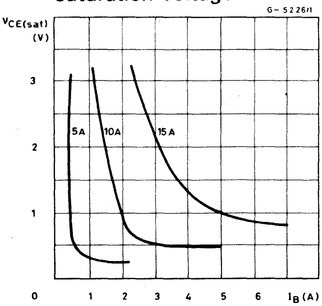
DC current gain



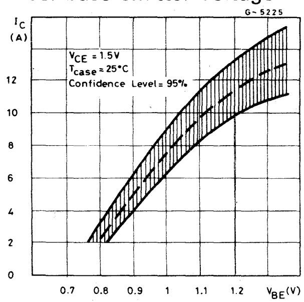
Saturation voltages



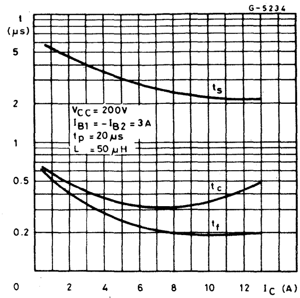
Collector-emitter saturation voltage



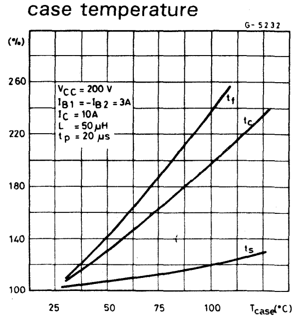
Collector current spread vs. base emitter voltage



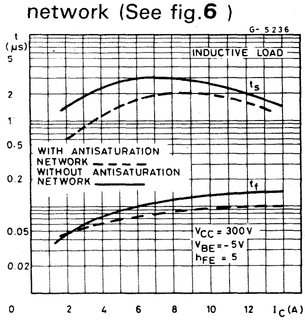
Switching times vs. collector current with I_B constant



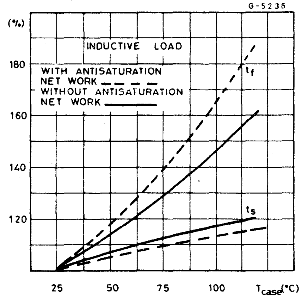
Switching times percentage variation vs. case temperature



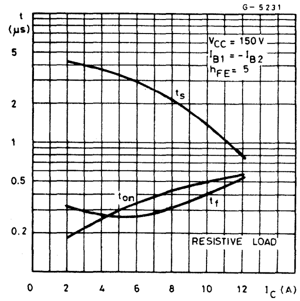
Switching times with and without antisaturation network (See fig.**6**)



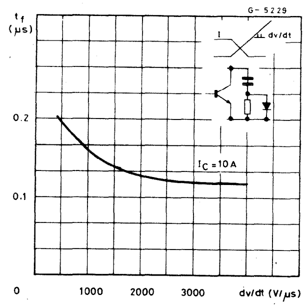
Switching times percentage vs. case temperature



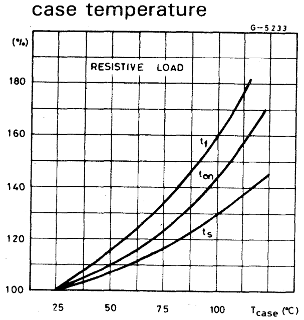
Switching times vs. collector current (See fig. 5)



Fall time vs. voltage slope (See fig. 5)



Switching times percentage variation vs. case temperature



Dynamic collector-emitter saturation voltage (See fig. 3)

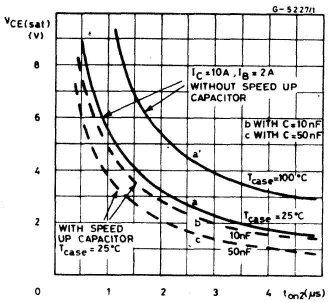
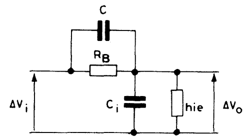


Fig. 2 - Equivalent input schematic circuit at turn-on.



$$\Delta V_o = \Delta V_i \frac{C}{C_i + C}$$

if $C \gg C_i$ $\quad \Delta V_o = \Delta V_i$

S-6605/1

Fig. 3 - $V_{CE(sat)}$ dyn. test circuit.

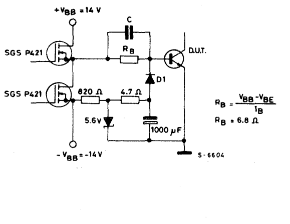


Fig. 4 Remarks to $V_{CE(sat)}$ dyn. test circuit

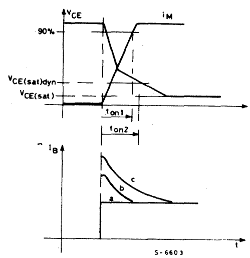


Fig. 5 - Switching times test circuit on resistive load.

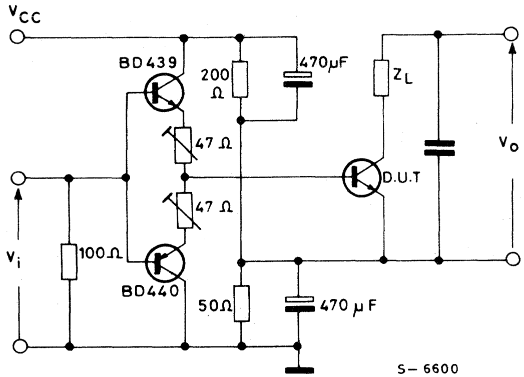
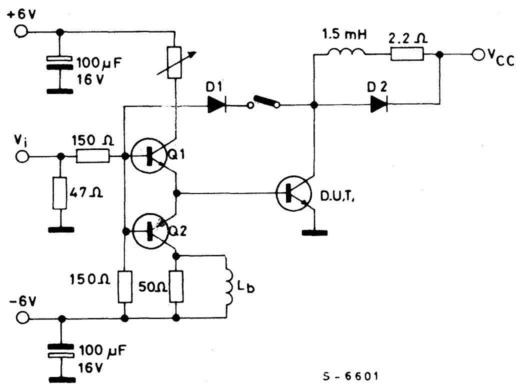


Fig.6 - Switching times test circuit on inductive load, with and without antisaturation network



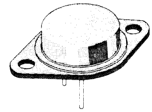
D1, D2 - Fast recovery diodes
Q1, Q2 - Transistors SGS: 2N5191, 2N5195

BUX48B / BUX48C
BUV48B / BUV48C
SGSIV48C

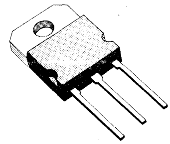
HIGH VOLTAGE POWER SWITCHING

- INDUSTRIAL APPLICATIONS

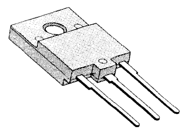
The BUX48B, BUX48C, BUV48B, BUV48C and SGSI48C are multiepitaxial mesa NPN transistors mounted respectively in TO-3 metal case SOT-93 plastic package and ISOWATT218 fully isolated package.
They are particularly intended for switching and industrial applications from single and three-phase mains.



TO-3

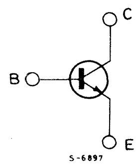


SOT-93 (TO-218)



ISOWATT218

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

	TO-3 / SOT-93 / ISOWATT218	BUX48B / BUV48B		BUX48C / BUV48C / SGSIV48C	
V_{CER}	Collector-emitter voltage (R_{BE} = 10Ω)	1200		1200	V
V_{CES}	Collector-emitter voltage (V_{BE} = 0)	1200		1200	V
V_{CEO}	Collector-emitter voltage (I_B = 0)	600		700	V
V_{EBO}	Emitter-base voltage (I_C = 0)		7		V
I_C	Collector current		15		A
I_{CM}	Collector peak current ($t_p \leqslant$ 5 ms)		30		A
I_{CP}	Collector peak current non rep. ($t_p \leqslant 20\mu s$)		55		A
I_B	Base peak current		4		A
I_{BM}	Base peak current ($t_p \leqslant$ 5 ms)		20		A
		TO-3	**SOT-93**	**ISOWATT218**	
V_{ISO}	Isolation voltage (DC)			4000	V
P_{tot}	Total dissipation at $T_c \leqslant 25°C$	175	120	50	W
T_{stg}	Storage temperature	−65 to 200	−65 to 150	−65 to 150	°C
T_j	Max. operating junction temperature	200	150	150	°C

THERMAL DATA

			TO-3	SOT-93	ISOWATT218	
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1	1	2.5•	°C/W

• See notes on ISOWATT218 in this datasheet.

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

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CER}	Collector cutoff current (R_{BE} = 10Ω)	$V_{CE} = V_{CES}$ $V_{CE} = V_{CES}$ T_c = 125°C			500 4	μA mA
I_{CES}	Collector cutoff current (V_{BE} = 0)	$V_{CE} = V_{CES}$ $V_{CE} = V_{CES}$ T_c = 125°C			500 3	μA mA
V_{CEO}	Collector cutoff current (I_B = 0)	$V_{CE} = V_{CEO}$			1	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 6 V			1	mA
$V_{CEO(sus)}$*	Collector emitter sustaining voltage (I_B = 0)	I_C = 100mA for **BUX48B/BUV48B** for **BUX48C/BUV48C/SGSIV48C**	 600 700			 V V
$V_{CER(sus)}$*	Collector emitter sustaining voltage (R_{BE} = 10 Ω)	I_C = 0.5 A V_{clamp} = 1200V L = 2mH	1200			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 6 A I_B = 1.5 A I_C = 10 A I_B = 4 A			1.5 3	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 6 A I_B = 1.5 A I_C = 10 A I_B = 4 A			1.5 2	V V

RESISTIVE LOAD

t_{on} t_s t_f	Turn-on time Storage time Fall time	V_{CC} = 250 V I_C = 6 A $I_{B1} = -I_{B2}$ = 1.5 A		0.5 1.5 0.2	1 3 0.7	μs μs μs

INDUCTIVE LOAD

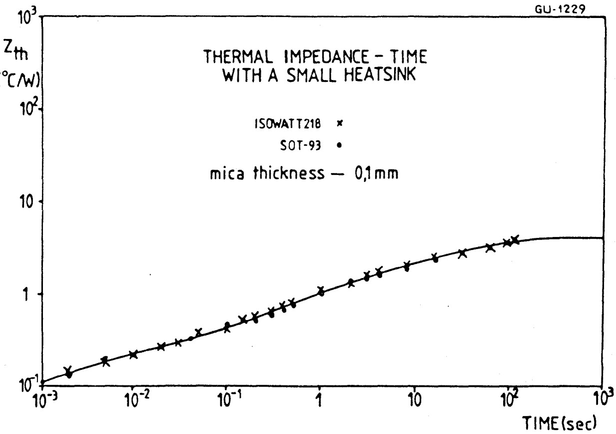
t_s t_r	Storage time Rise time	V_{CC} = 250 V I_C = 6 A $I_{B1} = -I_{B2}$ = 1.5 A		2 0.15		μs μs
t_s t_r	Storage time Rise time	V_{CC} = 250 V I_C = 6 A $I_{B1} = -I_{B2}$ = 1.5 A T_c = 125°C		3 0.33	6 0.60	μs μs

THERMAL RESISTANCE OF THE ISOWATT218

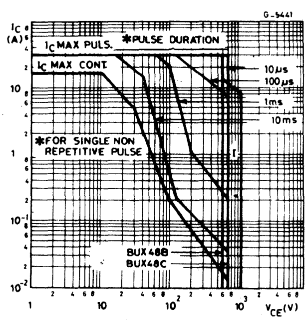
The junction to case thermal resistance of 2.5 °C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1 mm mica insulating washer, the differences are marginal. The 0.1 mm isolating washer gives 1500V to 2000V DC isolation for the SOT-93 package, SGS guarantee 4000V DC isolation for the ISOWATT 218.

The comparison in fig. 1 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The test illustrate that the ISOWATT218 has an R_{th} very close to that of conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package. The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.

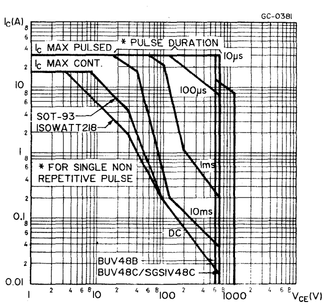
Fig. 1



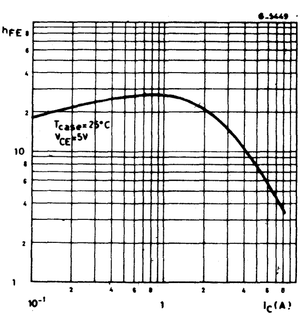
Safe operating areas



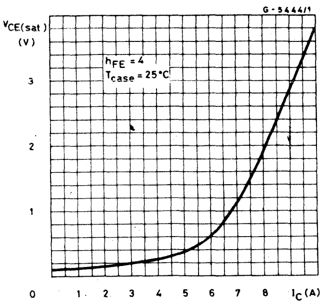
Safe operating areas



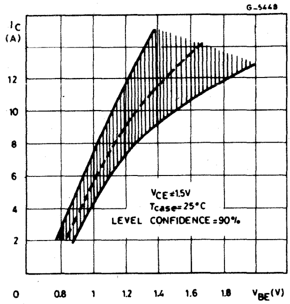
DC current gain



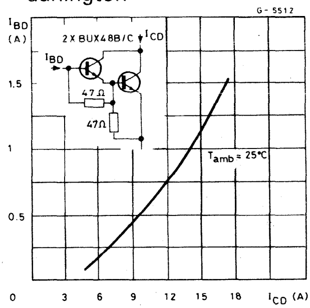
Collector-emitter saturation voltage



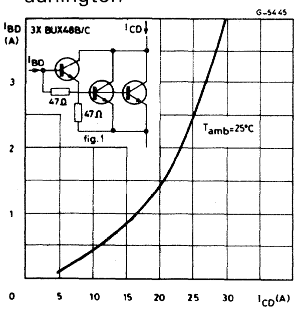
Collector current spread vs. base emitter voltage



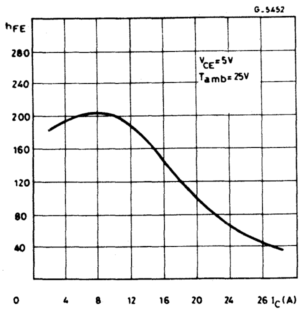
Minimum base current I_{BD} to saturate the discrete darlington



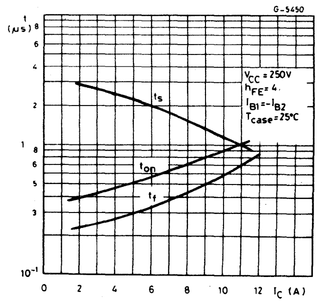
Minimum base current I_{BD} to saturate the discrete darlington



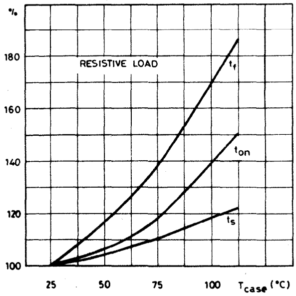
DC current gain for darlington configuration



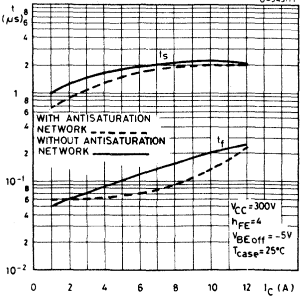
Switching times resistive load (fig. **2**)



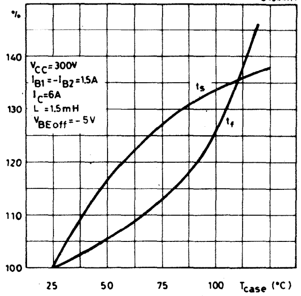
Switching times percentage variation vs. case temperature



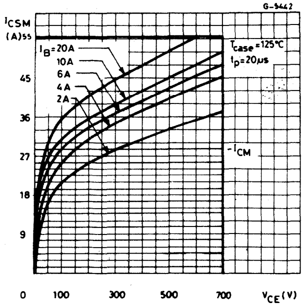
Switching times inductive load (See fig. **3**)



Switching times percentage variation vs. case temperature



Forward biased accidental overload area



Clamped reverse bias safe operating areas

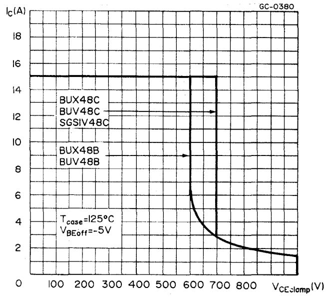


Fig. 2 - Switching times test circuit on resistive load.

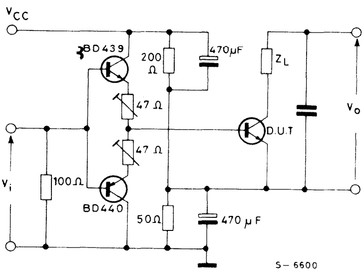
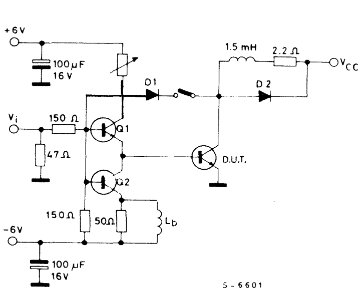


Fig.3 - Switching times test circuit on inductive load, with and without antisaturation network



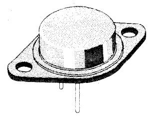
D1, D2 - Fast recovery diodes
Q1, Q2 - Transistors SGS: 2N5191, 2N5195

MJ10004/5
MJ10004P/5P
SGSID313/314

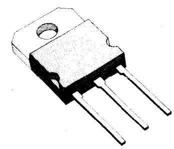
HIGH POWER FAST SWITCHING

- SPEED-UP DIODE
- MOTOR CONTROLS

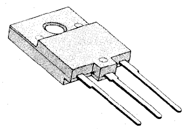
The MJ10004/5, MJ10004P/5P and SGSID313/314 are silicon epitaxial planar NPN transistors in monolithic darlington configuration with integrated speed-up diode.
They are mounted respectively in TO-3 metal case, SOT-93 plastic package and ISOWATT218 fully isolated package.
They are designed for high power, fast switching applications.



TO-3

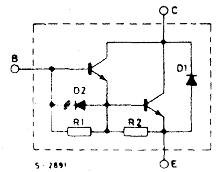


SOT-93 (TO-218)



ISOWATT218

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

	TO-3 SOT-93 ISOWATT218	MJ10004 MJ10004P SGSID313		MJ10005 MJ10005P SGSID314	
V_{CEX}	Collector-emitter voltage (V_{BE} = −1.5 V)	350		400	V
V_{CEV}	Collector-emitter voltage (V_{BE} = −5 V)	400		450	V
V_{CEO}	Collector-emitter voltage (I_B = 0)	450		500	V
V_{EBO}	Emitter-base voltage (I_C = 0)		8		V
I_C	Collector current		20		A
I_{CM}	Collector peak current		30		A
I_B	Base current		2.5		A
I_{BM}	Base peak current		5		A
		TO-3	**SOT-93**	**ISOWATT218**	
V_{ISO}	Isolation voltage (DC)			4000	V
P_{tot}	Total dissipation at $T_c \leqslant 25°C$	175	125	50	W
T_{stg}	Storage temperature	−65 to 200	−65 to 150	−65 to 150	°C
T_j	Max. operating junction temperature	200	150	150	°C

THERMAL DATA

THERMAL DATA			TO-3	SOT-93	ISOWATT218	
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1	1	2.5•	°C/W

• See notes on ISOWATT218 in this datasheet.

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

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CER}	Collector cutoff current (R_{BE} = 50ohm)	V_{CE} = rated V_{CEV} T_c = 100°C			5	μA
I_{CEV}	Collector cutoff current (V_{BE} = 1.5V)	V_{CE} = rated value V_{CE} = rated value T_c = 150°C			0.25 5	mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 2 V			175	mA
$V_{CEO(sus)}$*	Collector emitter sustaining voltage (I_B = 0)	I_C = 250mA V_{clamp} = rated V_{CEO} for **MJ10004/4P/SGSID314** for **MJ10005/5P/SGSID313**	 350 400			 V V
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage (V_{BE} = −5 V)	I_C = 2A V_{clamp} = rated V_{CEX} T_c = 100°C for **MJ10004/4P/SGSID314** for **MJ10005/5P/SGSID313** I_C = 10 A V_{clamp} = rated V_{CEX} T_c = 100°C For **MJ10004/4P/SGSID314** for **MJ10005/5P/SGSID313**	 400 450 275 325			 V V V V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 10 A I_B = 400 mA I_C = 20 A I_B = 2 A I_C = 10 A I_B = 400mA T_c = 100°C			1.9 3 2.5	V V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 10 A I_B = 400mA I_C = 10 A I_B = 400mA T_c = 100°C			2.5 2.5	V V

ELECTRICAL CHARACTERISTICS (continued)

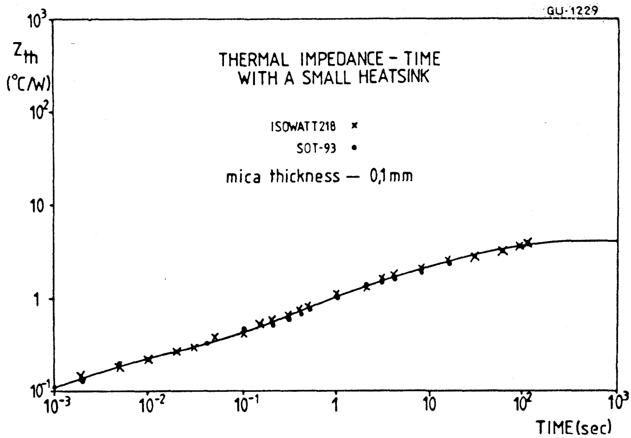
Parameter		Test conditions	Min.	Typ.	Max.	Unit
h_{FE}*	DC current gain	I_C = 5 A V_{CE} = 5 V I_C = 10 A V_{CE} = 5 V	50 40		600 400	
V_F*	Diode forward voltage	I_F = 10 A		1.8	5	V
h_{fe}	Small signal current gain	I_C = 1 A V_{CE} = 10 V f = 1 MHz	10			
C_{cbo}	Collector-base capacitance	V_{CB} = 10 V I_E = 0 f = 100 MHz	100		375	V
t_{on} t_s t_f	Turn-on time Storage time Fall time	V_{CC} = 250 V I_C = 10 A I_{B1} = $-I_{B2}$ = 400mA $V_{BE(off)}$ = 5 V t_p = 50μs duty cicle 2%		0.5 1 0.3	0.8 1.5 0.5	μs μs μs

THERMAL RESISTANCE OF THE ISOWATT218

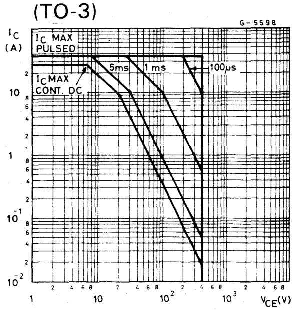
The junction to case thermal resistance of 2.5 °C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1 mm mica insulating washer, the differences are marginal. The 0.1 mm isolating washer gives 1500V to 2000V DC isolation for the SOT-93 package, SGS guarantee 4000V DC isolation for the ISOWATT 218.

The comparison in fig. 1 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The test illustrate that the ISOWATT218 has an R_{th} very close to that of conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package. The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.

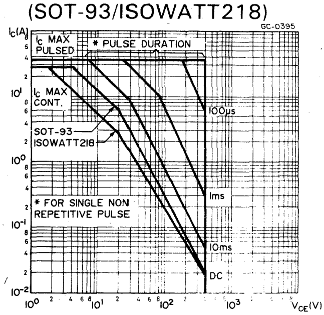
Fig. 1



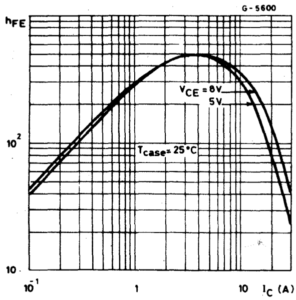
Safe operating areas (TO-3)



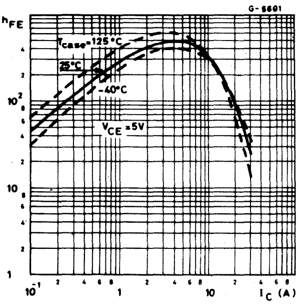
Safe operating areas (SOT-93/ISOWATT218)



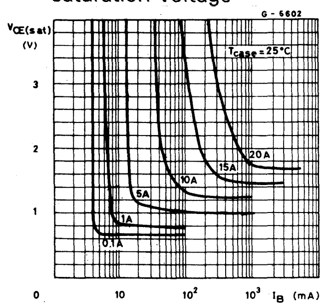
DC current gain



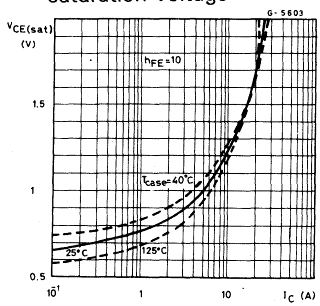
DC current gain



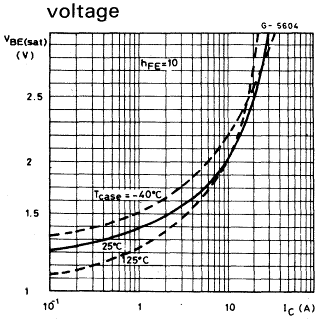
Collector-emitter saturation voltage



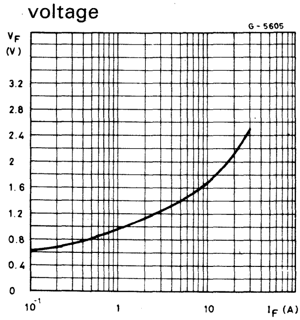
Collector-emitter saturation voltage



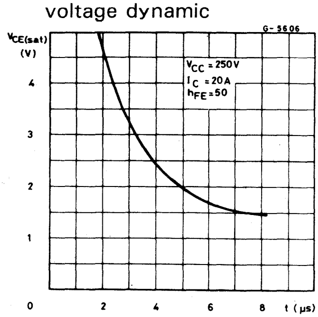
Base-emitter saturation voltage



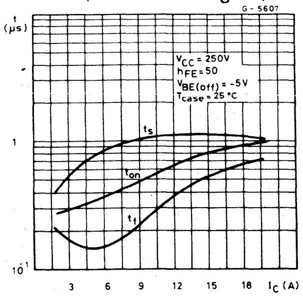
Freewheel diode forward voltage



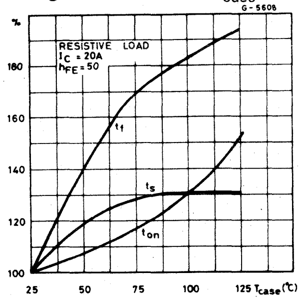
Collector-emitter saturation voltage dynamic



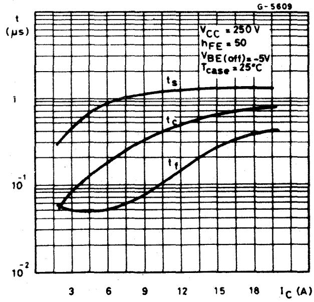
Switching times resistive load (test circuit fig. 2)



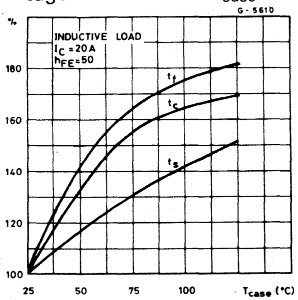
Switching times percentage variation vs. T_{case}



Switching times inductive load (fig. 2)



Switching times percentage variation vs. T_{case}



Clamped reverse bias safe operating area

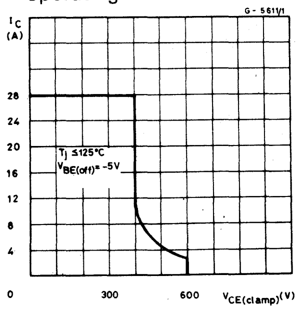
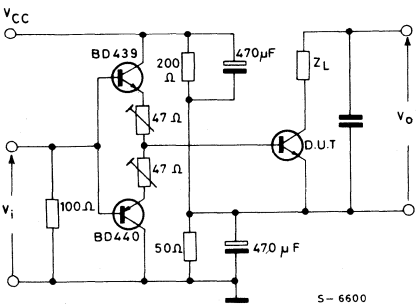


Fig. **2** - Switching times test circuit on resistive load

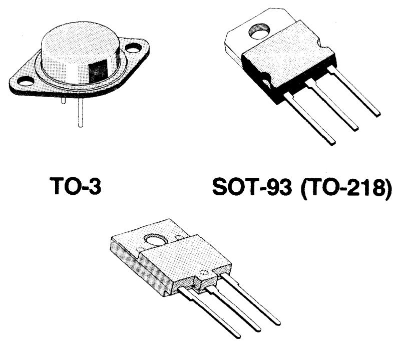


SGSD00030
SGSD00031
SGSID312

HIGH VOLTAGE, HIGH POWER, FAST SWITCHING

- INTEGRATED SPEED-UP DIODE
- MOTOR CONTROLS

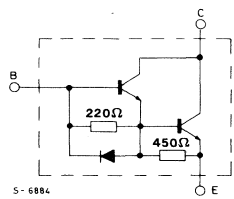
The SGSD00031, SGS00030 and SGSID312 are silicon multiepitaxial planar NPN transistors in monolithic darlington configuration with integrated speed-up diode, mounted respectively in Jedec TO-3 metal case, SOT-93 plastic package and ISOWATT218 fully isolated package.
No parasitic collector-emitter diode, so that an external fast recovery free wheeling diode can be added.
They are particulary suitable as output stage in high power, fast switching applications.



TO-3 **SOT-93 (TO-218)**

ISOWATT218

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	TO-3	SOT-93	ISOWATT218	Unit
V_{CER}	Collector-emitter voltage (R_{BE} = 50 ohm)		600		V
V_{CEO}	Collector-emitter voltage (I_B = 0)		400		V
I_C	Collector current		28		A
I_{CM}	Collector peak current ($t_p \leqslant$ 10ms)		40		A
I_B	Base current		6		A
I_{BM}	Base peak current ($t_p \leqslant$ 10ms)		12		A
		TO-3	**SOT-93**	**ISOWATT218**	
V_{ISO}	Isolation voltage (DC)			4000	V
P_{tot}	Total dissipation at $T_c \leqslant 25°C$	150	125	50	W
T_{stg}	Storage temperature	−65 to 175	−65 to 150	−65 to 150	°C
T_j	Max. operating junction temperature	175	150	150	°C

THERMAL DATA

THERMAL DATA			TO-3	SOT-93	ISOWATT218	
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1	1	2.5•	°C/W

• See notes on ISOWATT218 in this datasheet.

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

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEV}	Collector cutoff current (V_{BE} = −1.5 V)	V_{CE} = 600 V V_{CE} = 600 V T_c = 100°C			100 2	μA mA
I_{EBO}	Emitter cutoff Current (I_C = 0)	V_{EB} = 2 V			30	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage	I_C = 100mA	400			V V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 10 A I_B = 0.1 A I_C = 18 A I_B = 1.8 A			2.5 3.5	V V
h_{FE}*	DC current gain	I_C = 10 A V_{CE} = 5 V I_C = 18 A V_{CE} = 5 V	30 20			
I_{ol}	Output current overload	accidental overload switch-off current V_{clamp} = 400 V L = 100μH t_{ol} = 10 μs T_j = 125°C	28			A

RESISTIVE LOAD

t_{on} t_s t_f	Turn-on time Storage time Fall time	V_{CC} = 250 V I_C = 12 A I_{B1} = 0.1 A $V_{BE(off)}$ = −5 V			0.6 1.5 0.6	μs μs μs

INDUCTIVE LOAD

t_s t_f	Storage time Fall time	V_{CC} = 250 V I_C = 12 A I_{B1} = 0.1 A $V_{BE(off)}$ = −5 V L = 180 μH			1.5 0.5	μs μs
t_s t_f	Storage time Fall time	V_{CC} = 250 V I_C = 18 A I_{B1} = 0.1 A $V_{BE(off)}$ = −5 V L = 180 μH			1.5 0.7	μs μs

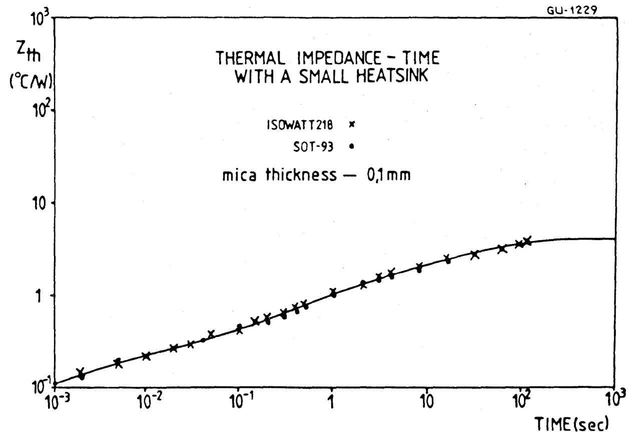
* Pulsed: Pulse duration = 300 μs, duty cycle = 1.5%

THERMAL RESISTANCE OF THE ISOWATT218

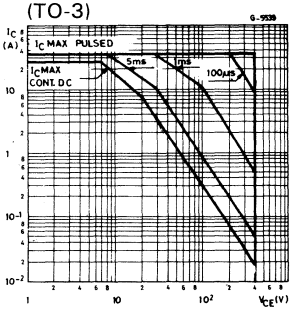
The junction to case thermal resistance of 2.5 °C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1 mm mica insulating washer, the differences are marginal. The 0.1 mm isolating washer gives 1500V to 2000V DC isolation for the SOT-93 package, SGS guarantee 4000V DC isolation for the ISOWATT 218.

The comparison in fig. 1 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The test illustrate that the ISOWATT218 has an R_{th} very close to that of conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package. The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.

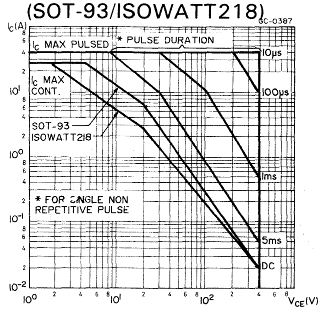
Fig. 1



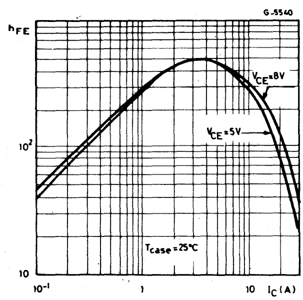
Safe operating area (TO-3)



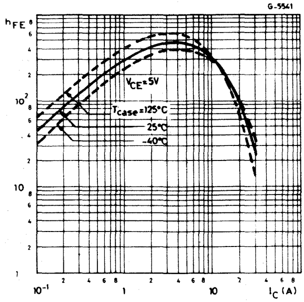
Safe operating area (SOT-93/ISOWATT218)



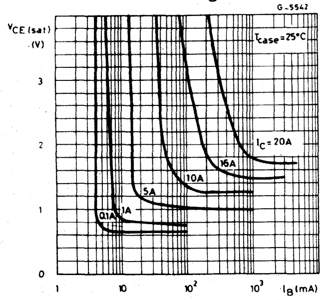
DC current gain



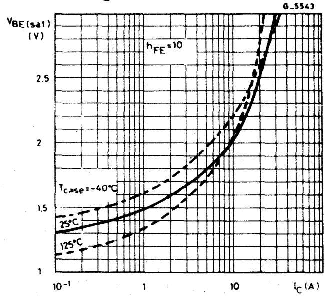
DC current gain



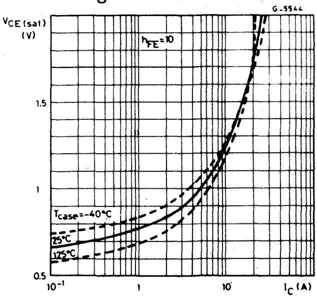
Collector-emitter saturation voltage



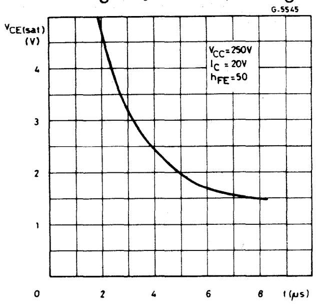
Base-emitter saturation voltage



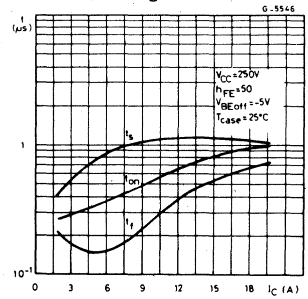
Collector emitter saturation voltage



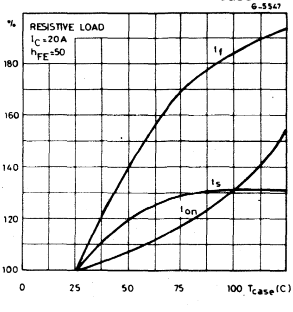
Collector-emitter saturation voltage dynamic (see fig.**2**)



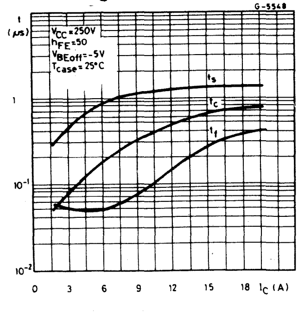
Switching times resistive load (see fig. **2**)



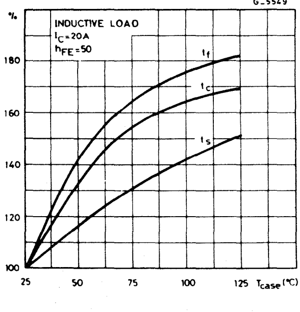
Switching times percentage variation vs. T_{case}



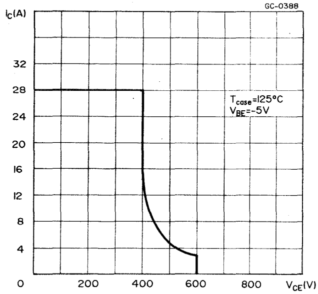
Switching times inductive load (fig. **2**)



Switching times percentage variation vs. T_{case}

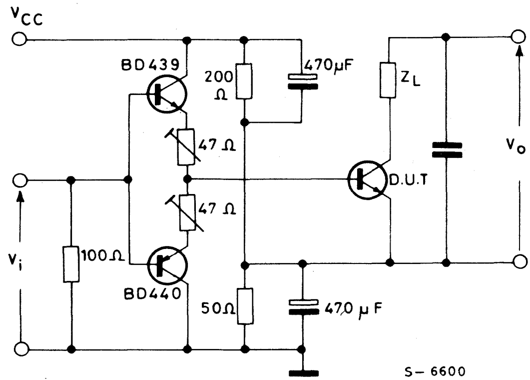


Clamped reverse bias safe operating areas



TEST CIRCUIT

Fig. 2



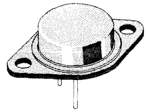
SGS®

SGSD310
SGSD311
SGSID311

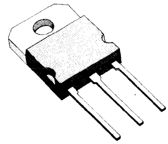
HIGH VOLTAGE, HIGH POWER, FAST SWITCHING

- INTEGRATED SPEED-UP DIODE
- MOTOR CONTROLS

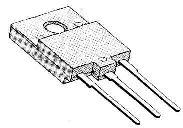
The SGSD310, SGSD311 and SGSID311 are silicon multiepitaxial planar NPN transistors in monolithic darlington configuration with integrated speed-up diode, mounted respectively in Jedec TO-3 metal case, SOT-93 plastic package and ISOWATT218 fully isolated package.
No parasitic collector-emitter diode, so that an external fast recovery free wheeling diode can be added.
They are particulary suitable as output stage in high power, fast switching applications.



TO-3

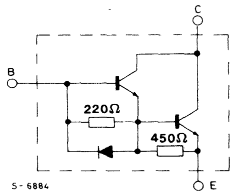


SOT-93 (TO-218)



ISOWATT218

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	TO-3	SOT-93	ISOWATT218	Unit
V_{CER}	Collector-emitter voltage (R_{BE} = 50 ohm)		600		V
V_{CEO}	Collector-emitter voltage (I_B = 0)		400		V
I_C	Collector current		28		A
I_{CM}	Collector peak current ($t_p \leq$ 10ms)		40		A
I_B	Base current		6		A
I_{BM}	Base peak current ($t_p \leq$ 10ms)		12		A
V_{ISO}	Isolation voltage (DC)			4000	V
P_{tot}	Total dissipation at $T_c \leq 25°C$	150	125	50	W
T_{stg}	Storage temperature	−65 to 175	−65 to 150	−65 to 150	°C
T_j	Max. operating junction temperature	175	150	150	°C

11/86

THERMAL DATA

			TO-3	SOT-93	ISOWATT218	
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1	1	2.5•	°C/W

• See notes on ISOWATT218 in this datasheet.

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

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEV}	Collector cutoff current (V_{BE} = −1.5 V)	V_{CE} = 600 V V_{CE} = 600 V T_c = 100°C			100 2	μA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 2 V			30	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage	I_C = 100mA	400			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 10 A I_B = 0.5 A I_C = 18 A I_B = 1.8 A I_C = 22 A I_B = 2.2 A I_C = 28 A I_B = 5.6 A			2 2.5 3 5	V V V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 10 A I_B = 0.5 A I_C = 18 A I_B = 1.8 A I_C = 22 A I_B = 2.2 A			2.5 3 3.3	V V V
h_{FE}*	DC current gain	I_C = 10 A V_{CE} = 5 V I_C = 18 A V_{CE} = 5 V	30 20			
I_{ol}	Output current overload	accidental overload switch-off current V_{clamp} = 400 V L = 100 μH t_{ol} = 10 μs T_j = 125°C	28			A

RESISTIVE LOAD

t_{on} t_s t_f	Turn-on time Storage time Fall time	V_{CC} = 250 V I_C = 10 A I_{B1} = 0.5 A $V_{BE(off)}$ = −5 V			0.6 1.5 0.6	μs μs μs

INDUCTIVE LOAD

t_s t_f	Storage time Fall time	V_{CC} = 250 V I_C = 10 A I_{B1} = 0.5 A $V_{BE(off)}$ = −5 V L = 180μH			1.5 0.5	μs μs
t_s t_f	Storage time Fall time	V_{CC} = 250 V I_C = 20 A I_{B1} = 2 A $V_{BE(off)}$ = −5 V L = 180 μH			1.5 0.7	μs μs

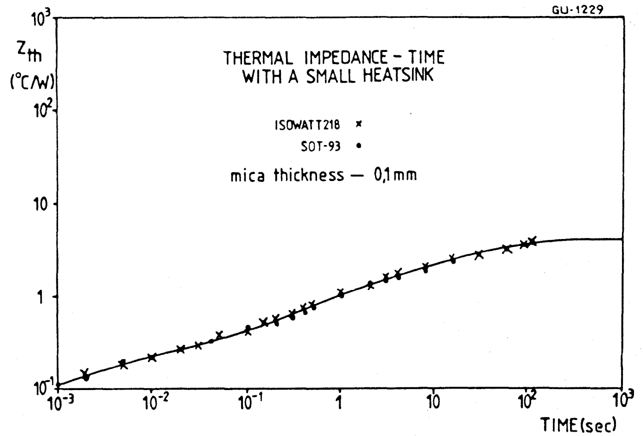
* Pulsed: Pulse duration = 300 μs, duty cycle = 1.5%

THERMAL RESISTANCE OF THE ISOWATT218

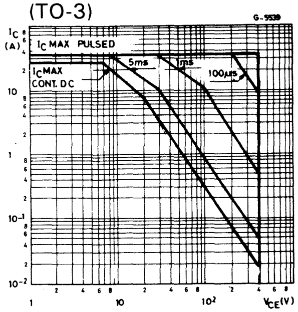
The junction to case thermal resistance of 2.5 °C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1 mm mica insulating washer, the differences are marginal. The 0.1 mm isolating washer gives 1500V to 2000V DC isolation for the SOT-93 package, SGS guarantee 4000V DC isolation for the ISOWATT 218.

The comparison in fig. 1 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The test illustrate that the ISOWATT218 has an R_{th} very close to that of conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package. The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.

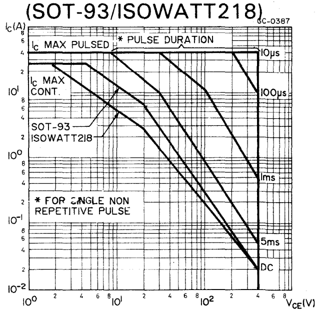
Fig. 1



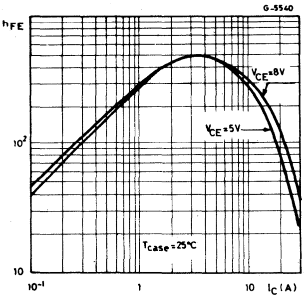
Safe operating area (TO-3)



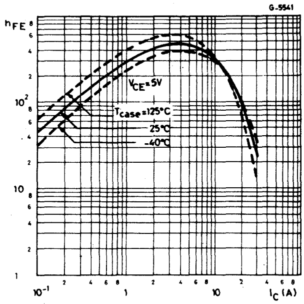
Safe operating area (SOT-93/ISOWATT218)



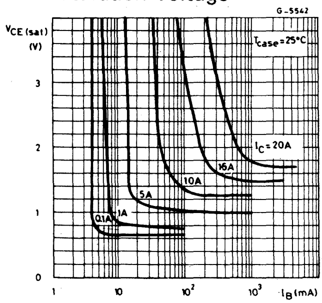
DC current gain



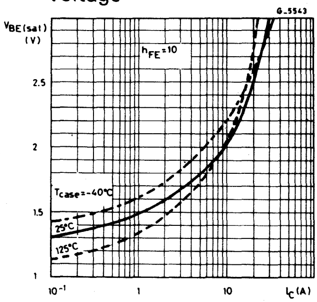
DC current gain



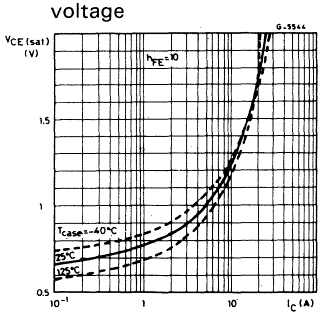
Collector-emitter saturation voltage



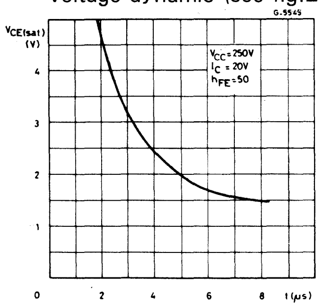
Base-emitter saturation voltage



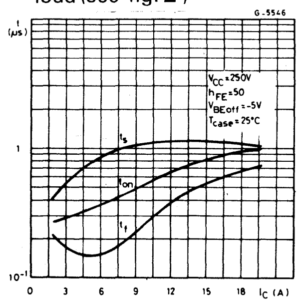
Collector emitter saturation voltage



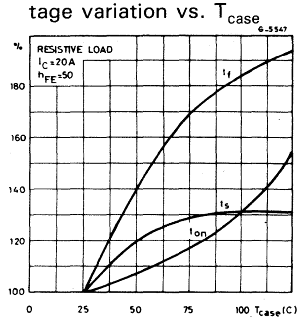
Collector-emitter saturation voltage dynamic (see fig. **2**)



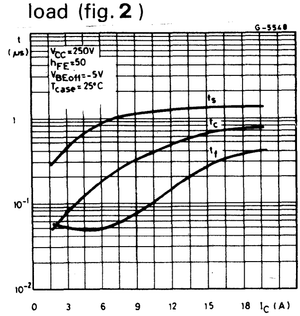
Switching times resistive load (see fig. **2**)



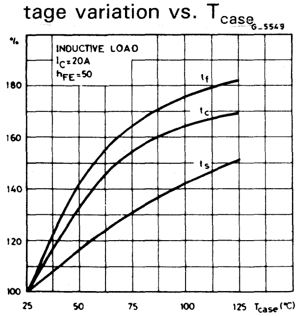
Switching times percentage variation vs. T_{case}



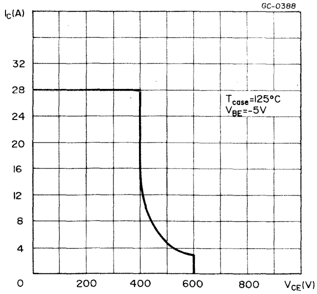
Switching times inductive load (fig. **2**)



Switching times percentage variation vs. T_{case}

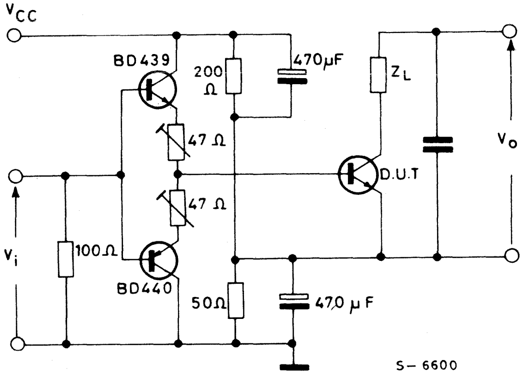


Clamped reverse bias safe operating areas



TEST CIRCUIT

Fig. 2



FASTSWITCH DEVICES DATASHEETS C

SGSF321
SGSF421
SGSIF421
SGSF521

ADVANCE DATA

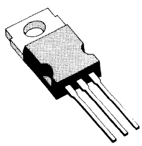
HIGH SWITCHING SPEED NPN TRANSISTORS FOR 240V OFF-LINE SWITCHING POWER SUPPLIES.

- V_{CEO} = 400V: VOLTAGE RATING TO SUIT HALF BRIDGE AND TWO TRANSISTOR FORWARD CONVERTER APPLICATIONS.
- UP TO 70KHz OPERATION WITH EASY DRIVE CIRCUITS.
- $I_{C(sat)}$ 3.5A, h_{FE} = 5: WELL SUITED FOR 250W CONVERTERS AND 2.5A, h_{FE} = 7 FOR ECONOMIC LOWER POWER APPLICATIONS.
- LOW DYNAMIC SATURATION MINIMIZES LOSSES IN HALF BRIDGE AND FORWARD CONVERTERS.
- PACKAGE CHOICE: FOUR TYPES INCLUDING ISOWATT218 TO SUIT EVERY APPLICATION.

These FASTWITCH transistors are specially designed for 240V, or 110V with input doubler, off-line switching power supply applications. FASTSWITCH transistors can operate up to 70KHz with easy drive circuits which helps to simplify designs and improve reliability, the superior switching performance of FASTSWITCH transistors reduces dissipation and consequently lowers the equipment operating temperature.

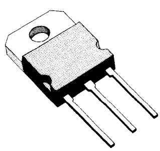
The $I_{C(sat)}$ is 3.5A with a gain of 5 so these FASTSWITCH transistors can be used in half bridge and two transistor forward converters up to 250W. FASTSWITCH transistors are available in the ISOWATT218 fully isolated package which conforms to the creepage distance and isolation requirements of VDE, IEC, and UL specifications.

SGSF321



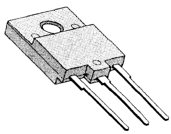
TO-220

SGSF421



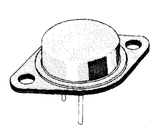
SOT-93 (TO-218)

SGSIF421



ISOWATT218

SGSF521



TO-3

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	SGSF321	SGSF421	SGSIF421	SGSF521	Unit
V_{CES}	Collector-emitter voltage (V_{BE} = 0)	700				V
V_{CEO}	Collector-emitter voltage (I_B = 0)	400				V
V_{EBO}	Emitter-base voltage (I_C = 0)	7				V
I_C	Collector current	5				A
I_{CM}	Collector peak current (t_p < 5ms)	10				A
I_B	Base current	3				A
I_{BM}	Base peak current (t_p < 5ms)	6				A
P_{tot}	Total dissipation at T_c < 25°C	85	100	41.5	95	W
T_{stg}	Storage temperature −65 to	150	150	150	175	°C
T_j	Junction temperature	150	150	150	175	°C

This is advanced information on a new product now in development or undergoing evaluation. Details are subject to change without notice.

THERMAL DATA

			SGSF321	SGSF421	SGSIF421	SGSF521
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max.	1.47	1.25	3.0 •	1.58 °C/W

• See notes on ISOWATT 218 in this datasheet.

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

Parameter		Test Condition		Min.	Typ.	Max.	Unit.
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = 700V				200	μA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 380V V_{CE} = 400V				200 2	μA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 6V				1	mA
$V_{CEO(sus)}$ *	Collector emitter sustaining voltage	I_C = 0.1A		400			V
$V_{CE(sat)}$ *	Collector-emitter saturation voltage	I_C = 3.5A I_C = 2.5A	I_B = 0.7A I_B = 0.35A			1.5 1.5	V V
$V_{BE(sat)}$ *	Base-emitter saturation voltage	I_C = 3.5A I_C = 2.5A	I_B = 0.7A I_B = 0.35A			1.5 1.5	V V

RESISTIVE LOAD

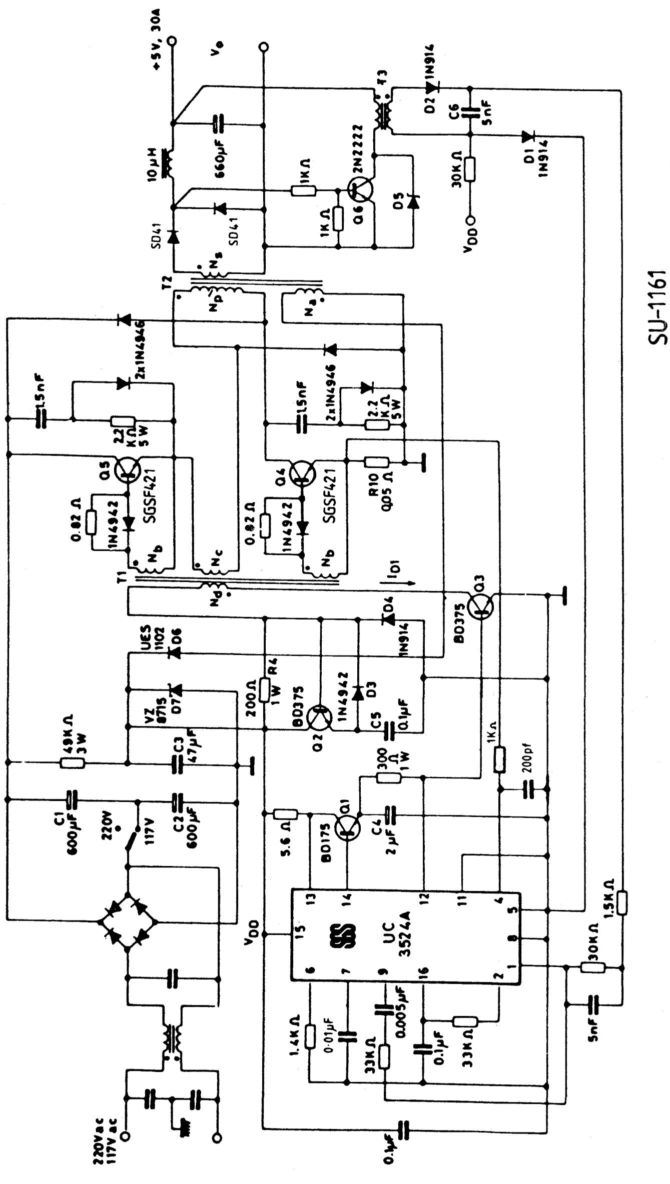
t_{on} t_s t_f	Turn-on time Storage time Fall time	I_C = 3.5A I_{B1} = 0.7A I_{B2} = 0.7A	V_{CC} = 150V		0.6 1.5 0.25	1.0 2.5 0.5	μs μs μs
t_{on} t_s t_f	Turn-on time Storage time Fall time	I_C = 3.5A I_{B1} = 0.7A I_{B2} = 1.4A	V_{CC} = 150V		0.50 0.70 0.08	1.0 1.5 0.25	μs μs μs

INDUCTIVE LOAD

t_s t_f	Storage time Fall time	I_C = 3.5A L = 200 μH h_{FE} = 5	V_{CC} = 150V $V_{BE(off)}$ = −5V T_c = 25°C		0.60 0.07	1.20 0.14	μs μs
t_s t_f	Storage time Fall time	I_C = 3.5A L = 200μH h_{FE} = 5	V_{CC} = 150V $V_{BE(off)}$ = −5V T_c = 100°C		0.70 0.08	1.50 0.22	μs μs

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

Fig. 1 – 150W two transistor forward converter using the SGS UC3524A



THERMAL RESISTANCE OF THE ISOWATT218

The junction to case thermal resistance of 3.0°C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1mm mica insulating washer, the differences are marginal. The 0.1mm isolating washer gives 1500V to 2000VDC isolation for the SOT-93 package, SGS guarantee 4000VDC isolation for the ISOWATT218.

The comparison in fig. 2 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The tests illustrate that the ISOWATT218 has an R_{th} very close to that of a conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package.

The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.

Fig. 2

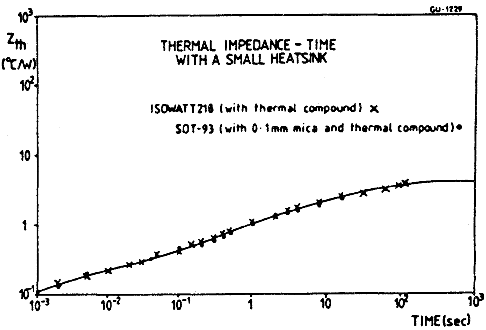


Fig. 3 - $V_{CE\ (sat)}$ Dynamic

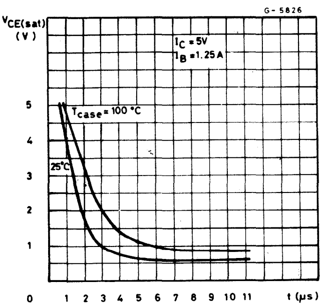


Fig. 4 - Capacitance

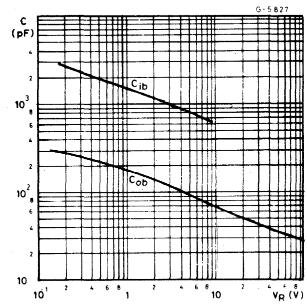


Fig. 5 - Reverse bias safe operating area

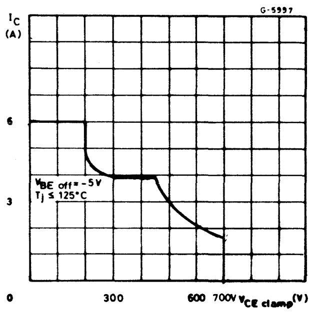


Fig. 6 - DC current gain

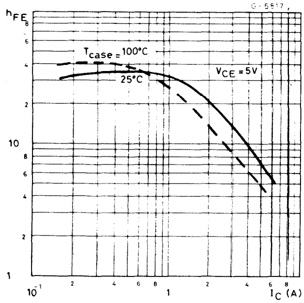


Fig. 7 - Collector-emitter saturation voltage

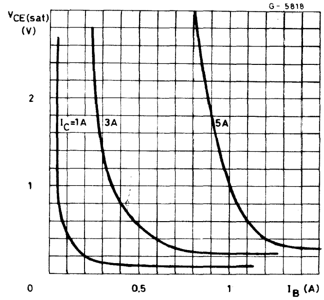


Fig. 8 - Collector-emitter saturation voltage

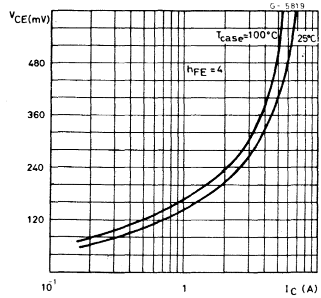


Fig. 9 - Base-emitter saturation voltage

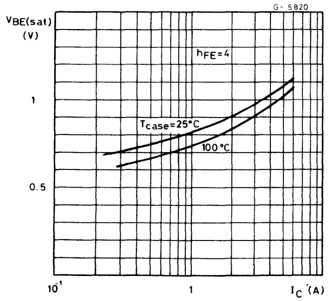


Fig. 10 - Collector current spread vs. base emitter voltage

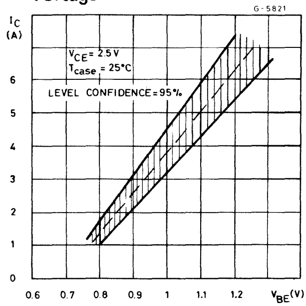


Fig. 11 - Resistive load switching times

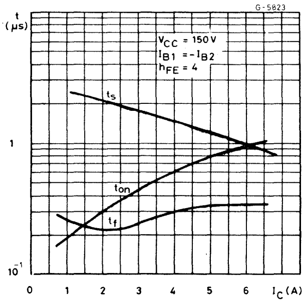


Fig. 12 - Inductive load switching times

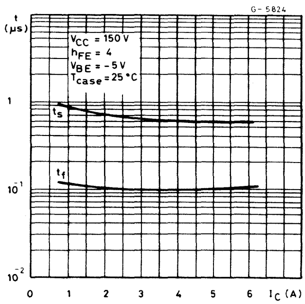


Fig. 13 - Switching times percentage variation vs. case temperature

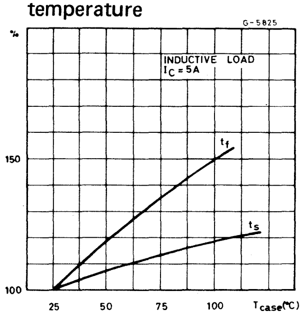


Fig. 14 - Internal schematic diagram

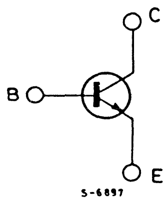
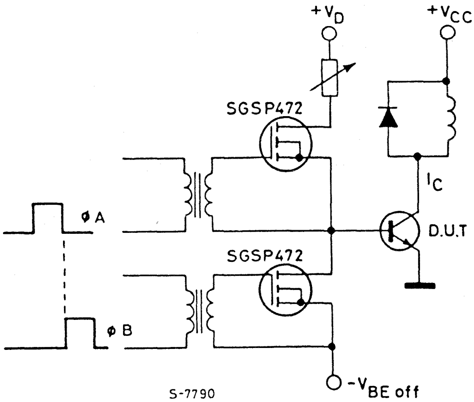


Fig. 15 - Switching times test circuit



$V_{CC} = 150V$
$L = 0.2mH$
$\phi_A =$ pulse width must be adjusted to obtain desired I_C value
$\phi_B =$ pulse width equal to ϕ_A pulse duration

SGSF322
SGSF422
SGSIF422
SGSF522

ADVANCE DATA

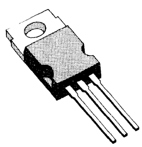
HIGH VOLTAGE NPN TRANSISTORS FOR 240V OFF-LINE SWITCHING POWER SUPPLIES.

- V_{CES} = 850V: HIGH VOLTAGE RATING FOR SINGLE TRANSISTOR APPLICATIONS WITH PEAK VOLTAGE LIMITING.
- UP TO 70KHz OPERATION WITH EASY DRIVE CIRCUITS.
- $I_{C(sat)}$ 3.0A, h_{FE} = 5: WELL SUITED FOR 120W FLYBACK AND 240W FORWARD CONVERTERS AND 2.0A, h_{FE} = 6.5 FOR ECONOMIC LOWER POWER APPLICATIONS.
- LOW DYNAMIC SATURATION MINIMIZES LOSSES IN FORWARD CONVERTERS.
- PACKAGE CHOICE: FOUR TYPES INCLUDING ISOWATT218 TO SUIT EVERY APPLICATION.

These FASTWITCH transistors are specially designed for 240V, or 110V with input doubler, off-line switching power supply applications where the normal high voltage peaks associated with single transistor converters are limited by a transformer clamp winding or overvoltage snubbing.

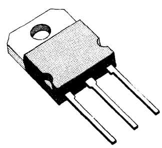
The $I_{C(sat)}$ is 3A with a gain of 5 so these FASTSWITCH transistors can be used in flyback converters up to 120W and forward converters up to 240W. The superior switching performance of FASTSWITCH transistors reduces dissipation and consequently lowers the equipment operating temperature. FASTSWITCH transistors are available in the ISOWATT218 fully isolated package which conforms to the creepage distance and isolation requirements of VDE, IEC, and UL specifications.

SGSF322



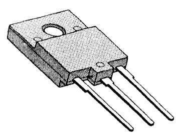
TO-220

SGSF422



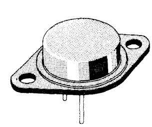
SOT-93 (TO-218)

SGSIF422



ISOWATT218

SGSF522



TO-3

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	SGSF322	SGSF422	SGSIF422	SGSF522	Unit
V_{CES}	Collector-emitter voltage (V_{BE} = 0)		850			V
V_{CEO}	Collector-emitter voltage (I_B = 0)		450			V
V_{EBO}	Emitter-base voltage (I_C = 0)		7			V
I_C	Collector current		5			A
I_{CM}	Collector peak current (t_p < 5ms)		10			A
I_B	Base current		3			A
I_{BM}	Base peak current (t_p < 5ms)		6			A
P_{tot}	Total dissipation at T_c < 25°C	85	100	41.5	95	W
T_{stg}	Storage temperature −65 to	150	150	150	175	°C
T_j	Junction temperature	150	150	150	175	°C

This is advanced information on a new product now in development or undergoing evaluation. Details are subject to change without notice.

THERMAL DATA

			SGSF322	SGSF422	SGSIF422	SGSF522
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max.	1.47	1.25	3.0 •	1.58 °C/W

• See notes on ISOWATT 218 in this datasheet.

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

Parameter		Test Condition	Min.	Typ.	Max.	Unit.
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = 850V			200	μA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 380V V_{CE} = 450V			200 2	μA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 6V			1	mA
$V_{CEO(sus)}$*	Collector emitter sustaining voltage	I_C = 0.1A	450			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 3.0A I_B = 0.6A I_C = 2.0A I_B = 0.3A			1.5 1.5	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 3.0A I_B = 0.6A I_C = 2.0A I_B = 0.3A			1.5 1.5	V V

RESISTIVE LOAD

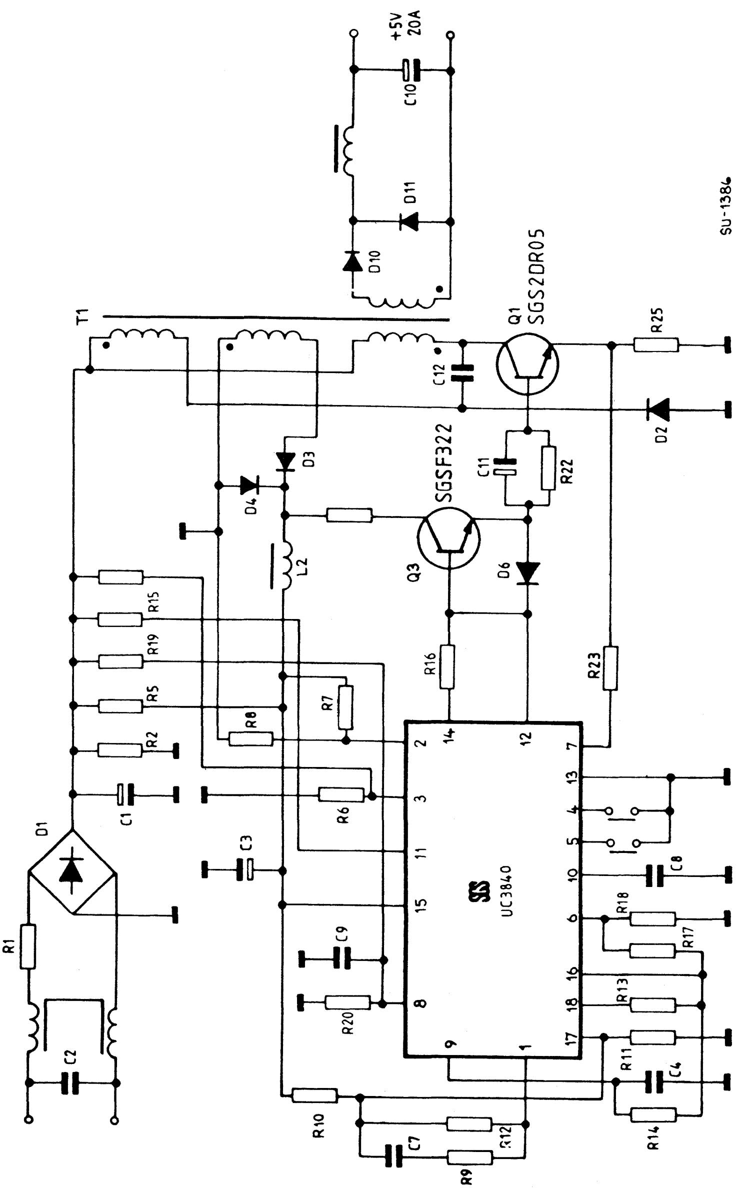
t_{on} t_s t_f	Turn-on time Storage time Fall time	I_C = 3.0A V_{CC} = 150V I_{B1} = 0.6A I_{B2} = 0.6A		0.60 1.50 0.25	1.0 2.5 0.5	μs μs μs
t_{on} t_s t_f	Turn-on time Storage time Fall time	I_C = 3.2A V_{CC} = 150V I_{B1} = 0.6A I_{B2} = 1.2A		0.50 0.70 0.08	1.0 1.5 0.25	μs μs μs

INDUCTIVE LOAD

t_s t_f	Storage time Fall time	I_C = 3.0A V_{CC} = 150V L = 200 μH $V_{BE(off)}$ = −5V h_{FE} = 5 T_c = 25°C		0.60 0.07	1.20 0.14	μs μs
t_s t_f	Storage time Fall time	I_C = 3.0A V_{CC} = 150V L = 200μH $V_{BE(off)}$ = −5V h_{FE} = 5 T_c = 100°C		0.70 0.08	1.5 0.22	μs μs

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

Fig. 1 - 100W forward converter using the SGS control circuit UC3840



THERMAL RESISTANCE OF THE ISOWATT218

The junction to case thermal resistance of 3.0°C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1mm mica insulating washer, the differences are marginal. The 0.1mm isolating washer gives 1500V to 2000VDC isolation for the SOT-93 package, SGS guarantee 4000VDC isolation for the ISOWATT218.

The comparison in fig. 2 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The tests illustrate that the ISOWATT218 has an R_{th} very close to that of a conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package.

The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.

Fig. 2

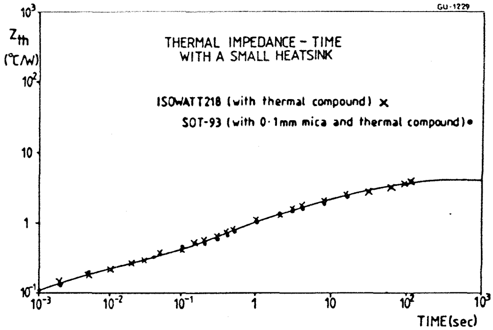


Fig. 3 - $V_{CE\ (sat)}$ Dynamic

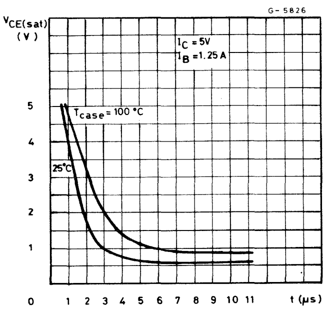


Fig. 4 - Capacitance

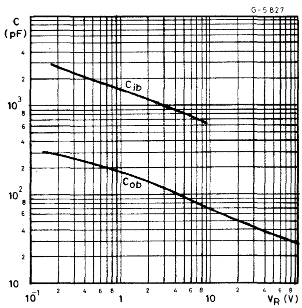


Fig. 5 - Reverse bias safe operating area

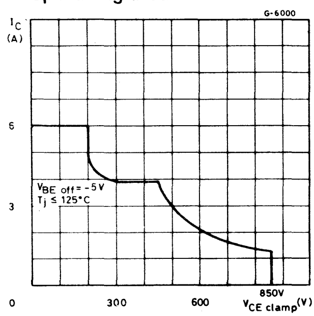


Fig. 6 - Collector current spread vs. base emitter voltage

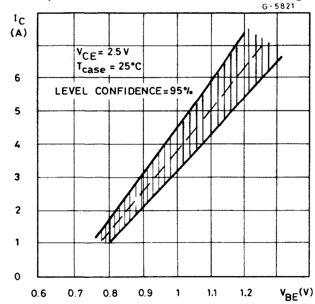


Fig. 7 - Resistive load switching times

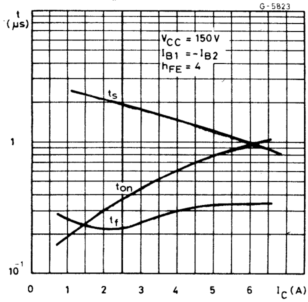


Fig. 8 - Inductive load switching times

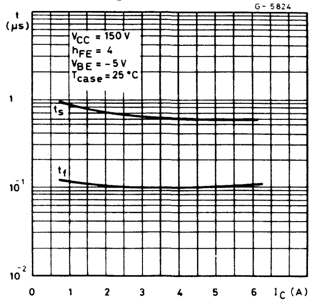


Fig. 9 - Switching times percentage variation vs. case temperature

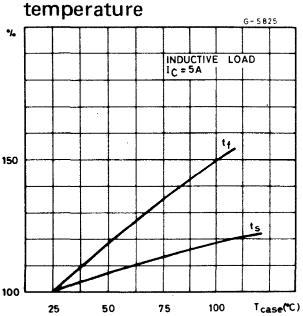


Fig. 10 - DC current gain

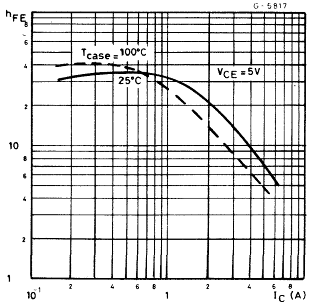


Fig. 11 - Collector-emitter saturation voltage

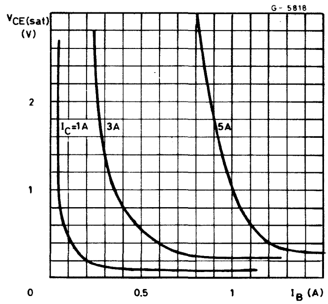


Fig. 12 - Collector-emitter saturation voltage

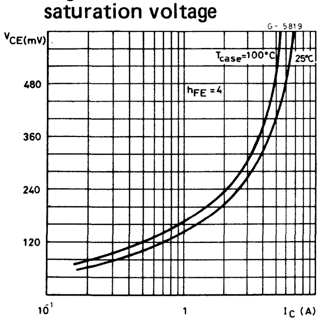


Fig. 13 - Base emitter saturation voltage

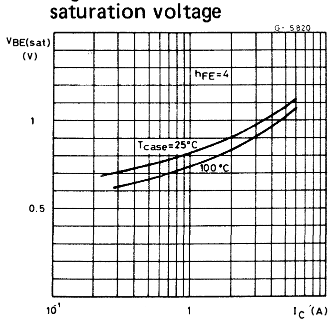


Fig. 14 - Internal schematic diagram

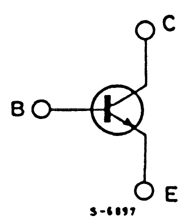
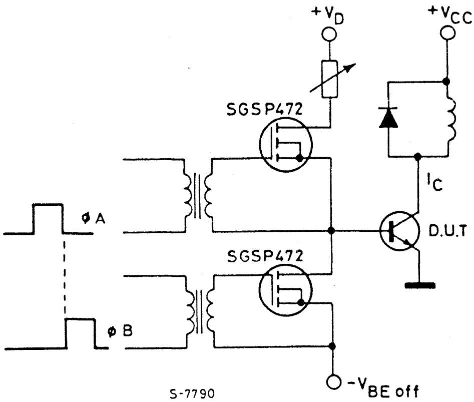


Fig. 15 - Switching times test circuit



$V_{CC} = 150V$
$L = 0.2mH$
ϕ_A = pulse width must be adjusted to obtain desired I_C value
ϕ_B = pulse width equal to ϕ_A pulse duration

SGSF323
SGSF423
SGSIF423
SGSF523

ADVANCE DATA

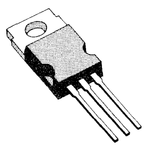
HIGH VOLTAGE NPN TRANSISTORS FOR 240V OFF-LINE SWITCHING POWER SUPPLIES.

- V_{CES} = 1000V: HIGH VOLTAGE RATING FOR SINGLE TRANSISTOR FLYBACK AND FORWARD CONVERTER APPLICATIONS.
- UP TO 70KHz OPERATION WITH EASY DRIVE CIRCUITS.
- $I_{C(sat)}$ 2.5A, h_{FE} = 5: WELL SUITED FOR 100W FORWARD CONVERTERS AND 1.75A, h_{FE} = 7 FOR ECONOMIC LOWER POWER APPLICATIONS.
- LOW DYNAMIC SATURATION MINIMIZES LOSSES IN FORWARD CONVERTERS.
- PACKAGE CHOICE: FOUR TYPES INCLUDING ISOWATT218 TO SUIT EVERY APPLICATION.

These FASTWITCH transistors are specially designed for 240V, or 110V with input doubler, off-line switching power supply applications. The 1000V blocking voltage allows these FASTSWITCH transistors to be used in single transistor converters without a costly overvoltage snubbing network.

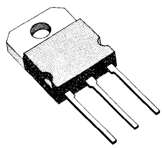
The $I_{C(sat)}$ is 2.5A with a gain of 5 so these FASTSWITCH transistors can be used in flyback converters up to 100W and forward converters up to 200W. The superior switching performance of FASTSWITCH transistors reduces dissipation and consequently lowers the equipment operating temperature. FASTSWITCH transistors are available in the ISOWATT218 fully isolated package which conforms to the creepage distance and isolation requirements of VDE, IEC, and UL specifications.

SGSF323



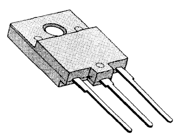
TO-220

SGSF423



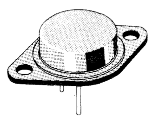
SOT-93 (TO-218)

SGSIF423



ISOWATT218

SGSF523



TO-3

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	SGSF323	SGSF423	SGSIF423	SGSF523	Unit
V_{CES}	Collector-emitter voltage (V_{BE} = 0)		1000			V
V_{CEO}	Collector-emitter voltage (I_B = 0)		450			V
V_{EBO}	Emitter-base voltage (I_C = 0)		7			V
I_C	Collector current		5			A
I_{CM}	Collector peak current (t_p < 5ms)		10			A
I_B	Base current		3			A
I_{BM}	Base peak current (t_p < 5ms)		6			A
P_{tot}	Total dissipation at T_c < 25°C	85	100	41.5	95	W
T_{stg}	Storage temperature −65 to	150	150	150	175	°C
T_j	Junction temperature	150	150	150	175	°C

This is advanced information on a new product now in development or undergoing evaluation. Details are subject to change without notice.

THERMAL DATA

			SGSF323	SGSF423	SGSIF423	SGSF523
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max.	1.47	1.25	3.0 •	1.58 °C/W

• See notes on ISOWATT 218 in this datasheet

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

Parameter		Test Condition	Min.	Typ.	Max.	Unit.
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = 1000V			200	μA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 380V V_{CE} = 450V			200 2	μA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 6V			1	mA
$V_{CEO(sus)}$*	Collector emitter sustaining voltage	I_C = 0.1A	450			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 2.5A I_B = 0.5A I_C = 1.75A I_B = 0.25A			1.5 1.5	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 2.5A I_B = 0.5A I_C = 1.75A I_B = 0.25A			1.5 1.5	V V

RESISTIVE LOAD

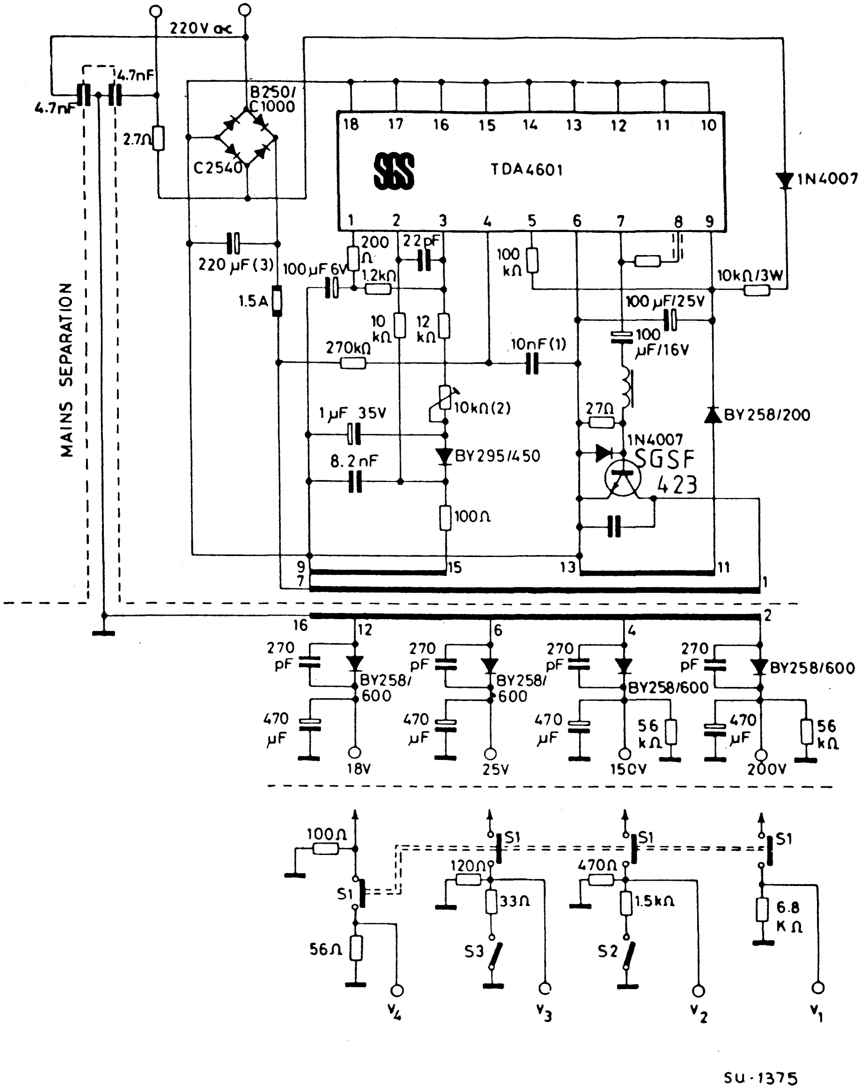
t_{on} t_s t_f	Turn-on time Storage time Fall time	I_C = 2.5A V_{CC} = 150V I_{B1} = 0.5A I_{B2} = 0.5A		0.66 1.65 0.27	1.1 2.7 0.55	μs μs μs
t_{on} t_s t_f	Turn-on time Storage time Fall time	I_C = 2.5A V_{CC} = 150V I_{B1} = 0.5A I_{B2} = 1.0A		0.55 0.80 0.08	1.1 1.7 0.27	μs μs μs

INDUCTIVE LOAD

t_s t_f	Storage time Fall time	I_C = 2.5A V_{CC} = 150V L = 200 μH $V_{BE(off)}$ = −5V h_{FE} = 5 T_c = 25°C		0.66 0.07	1.3 0.14	μs μs
t_s t_f	Storage time Fall time	I_C = 2.5A V_{CC} = 150V L = 200μH $V_{BE(off)}$ = −5V h_{FE} = 5 T_c = 100°C		0.77 0.09	1.7 0.25	μs μs

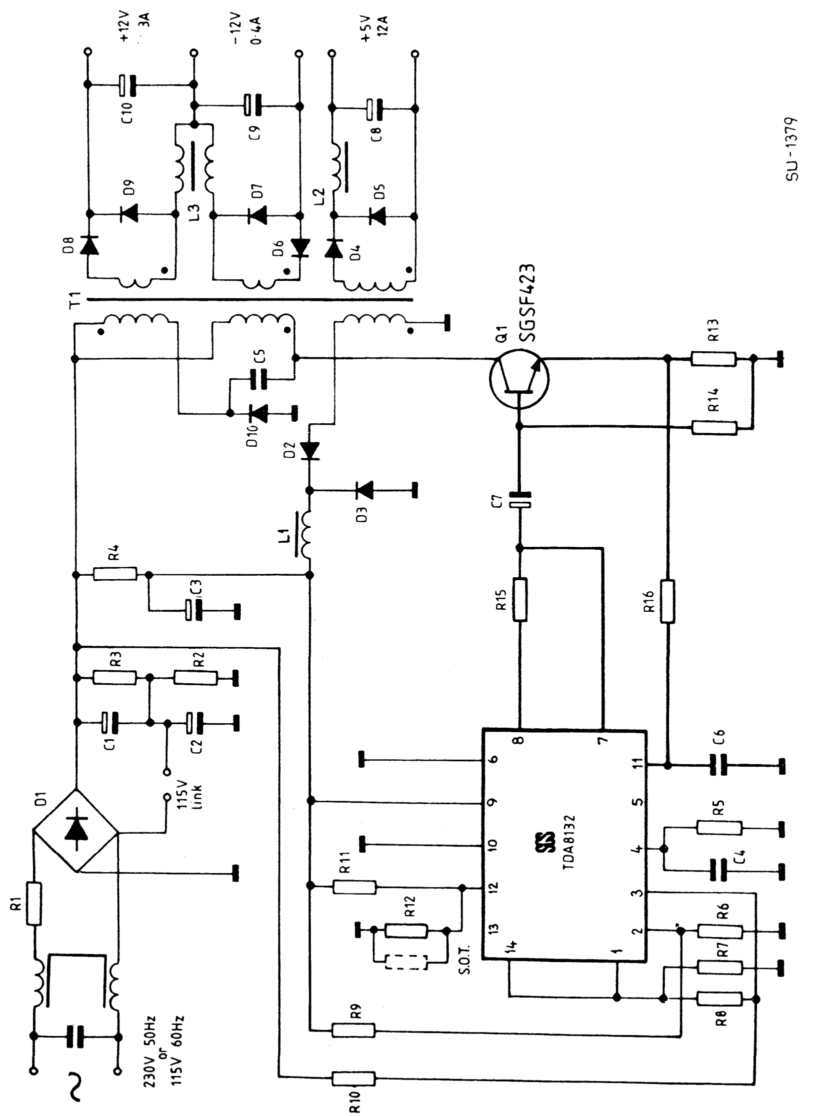
* Pulsed: Pulse duration = 300 μs, duty cycle = 1.5%

Fig. 1 – 50W flyback converter using the SGS control circuit TDA4601



1) C limits the maximum collector current of the SGSF423 at overshooting permissible output power.
2) Adjustment of secondary voltage.
3) Must be discharged before IC change.

Fig. 2 - 100W forward converter using the SGS control circuit TDA8132



THERMAL RESISTANCE OF THE ISOWATT218

The junction to case thermal resistance of 3.0°C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1 mm mica insulating washer, the differences are marginal. The 0.1 mm isolating washer gives 1500V to 2000 VDC isolation for the SOT-93 package, SGS guarantee 4000 VDC isolation for the ISOWATT218.
The comparison in fig. 3 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The tests illustrate that the ISOWATT218 has an R_{th} very close to that of a conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package.

The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.

Fig. 3

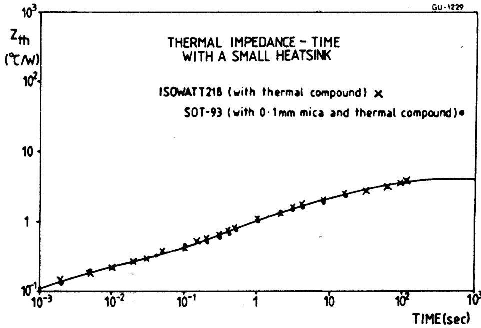


Fig. 4 - $V_{CE(sat)}$ dynamic

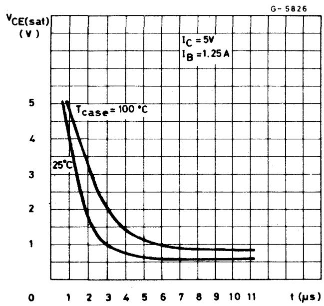


Fig. 5 - Capacitance

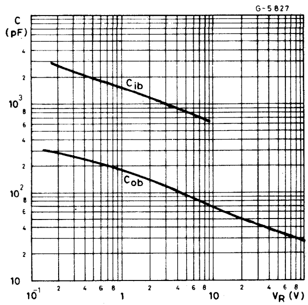


Fig. 6 - Reverse bias safe operating area

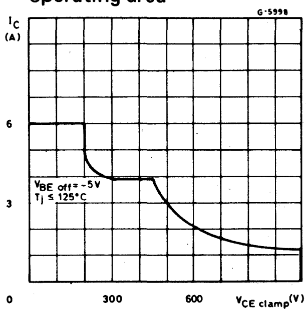


Fig. 7 - DC current gain

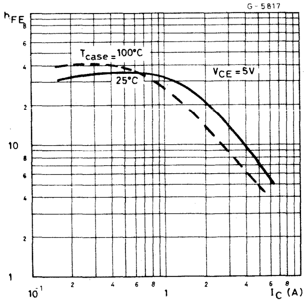


Fig. 8 - Collector-emitter saturation voltage

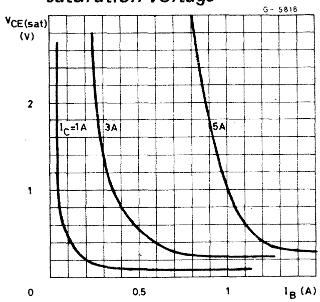


Fig. 9 - Collector-emitter saturation voltage

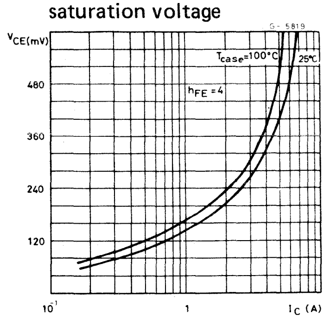


Fig. 10 - Base-emitter saturation voltage

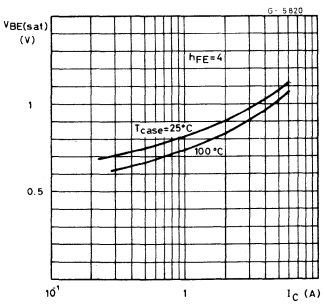


Fig. 11 - Collector current spread vs. base emitter voltage

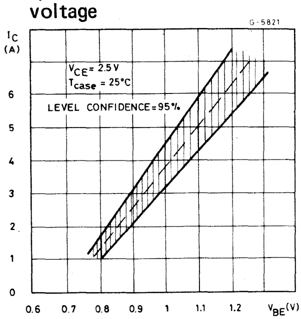


Fig. 12 - Resistive load switching times

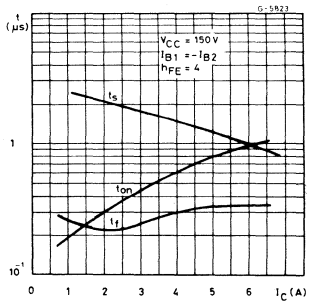


Fig. 13 - Inductive load switching times

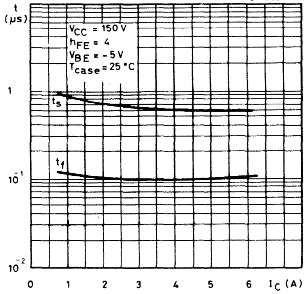


Fig. 14 - Switching times percentage variation vs. case temperature

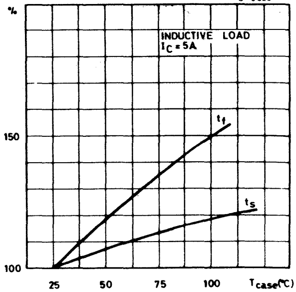


Fig. 15 - Internal schematic diagram

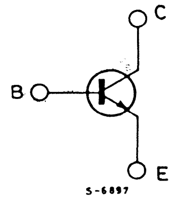
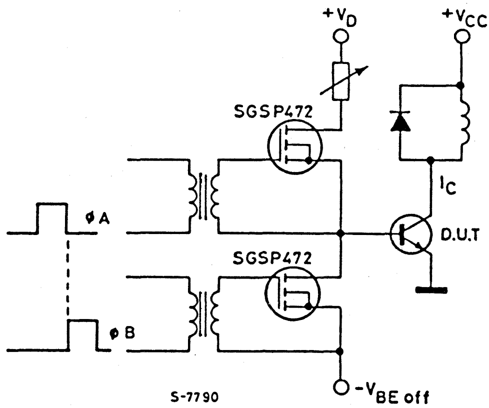


Fig. 16 - Switching times test circuit



$V_{CC} = 150V$
$L = 0.2mH$
ϕ_A = pulse width must be adjusted to obtain desired I_C value
ϕ_B = pulse width equal to ϕ_A pulse duration

SGSF324
SGSF424
SGSIF424
SGSF524

ADVANCE DATA

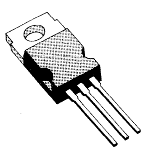
HIGH VOLTAGE NPN TRANSISTORS FOR 240V OFF-LINE SWITCHING POWER SUPPLIES AND 90° COLOUR CRT DEFLECTION.

- V_{CES} = 1200V: HIGH VOLTAGE RATING FOR DEFLECTION AND SINGLE TRANSISTOR CONVERTER APPLICATIONS.
- UP TO 50KHz OPERATION WITH EASY DRIVE CIRCUITS.
- $I_{C(sat)}$ 1.75A, h_{FE} = 5: WELL SUITED FOR 65W FLYBACK AND 125W FORWARD CONVERTERS AND 1.25A, h_{FE} = 7 FOR ECONOMIC LOWER POWER APPLICATIONS.
- LOW DYNAMIC SATURATION WHICH MINIMIZES LOSSES IN FORWARD CONVERTERS.
- PACKAGE CHOICE: FOUR TYPES INCLUDING ISOWATT218 TO SUIT EVERY APPLICATION.

These FASTWITCH transistors are specially designed for 240V, or 110V with input doubler, off-line switching power supply and small screen colour CRT deflection applications. The 1200V rating needed for deflection circuits is also a benefit to forward and flyback converters because costly overvoltage snubbers can be avoided.

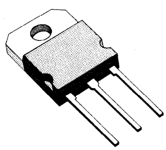
The $I_{C(sat)}$ is 1.75A with a gain of 5 so these FASTSWITCH transistors can be used in flyback converters up to 65W and forward converters up to 125W. The superior switching performance of FASTSWITCH transistors reduces dissipation and consequently lowers the equipment operating temperature. FASTSWITCH transistors are available in the ISOWATT218 fully isolated package which conforms to the creepage distance and isolation requirements of VDE, IEC, and UL specifications.

SGSF324



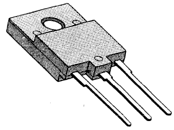
TO-220

SGSF424



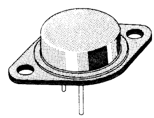
SOT-93 (TO-218)

SGSIF424



ISOWATT218

SGSF524



TO-3

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	SGSF324	SGSF424	SGSIF424	SGSF524	Unit
V_{CES}	Collector-emitter voltage (V_{BE} = 0)	1200				V
V_{CEO}	Collector-emitter voltage (I_B = 0)	600				V
V_{EBO}	Emitter-base voltage (I_C = 0)	7				V
I_C	Collector current	4				A
I_{CM}	Collector peak current (t_p < 5ms)	8				A
I_B	Base current	3				A
I_{BM}	Base peak current (t_p < 5ms)	6				A
P_{tot}	Total dissipation at T_c < 25°C	85	100	41.5	95	W
T_{stg}	Storage temperature −65 to	150	150	150	175	°C
T_j	Junction temperature	150	150	150	175	°C

This is advanced information on a new product now in development or undergoing evaluation. Details are subject to change without notice.

11/86

THERMAL DATA

			SGSF324	SGSF424	SGSIF424	SGSF524
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max.	1.47	1.25	3.0•	1.58 °C/W

• See notes on ISOWATT218 in this datasheet

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

	Parameter	Test Condition	Min.	Typ.	Max.	Unit.
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = 1200V			200	μA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 380V V_{CE} = 600V			200 2	μA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 6V			1	mA
$V_{CEO(sus)}$*	Collector emitter sustaining voltage	I_C = 0.1A	600			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 1.75A I_B = 0.35A I_C = 1.25A I_B = 0.18A			1.5 1.5	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 1.75A I_B = 0.35A I_C = 1.25A I_B = 0.18A			1.5 1.5	V V

RESISTIVE LOAD

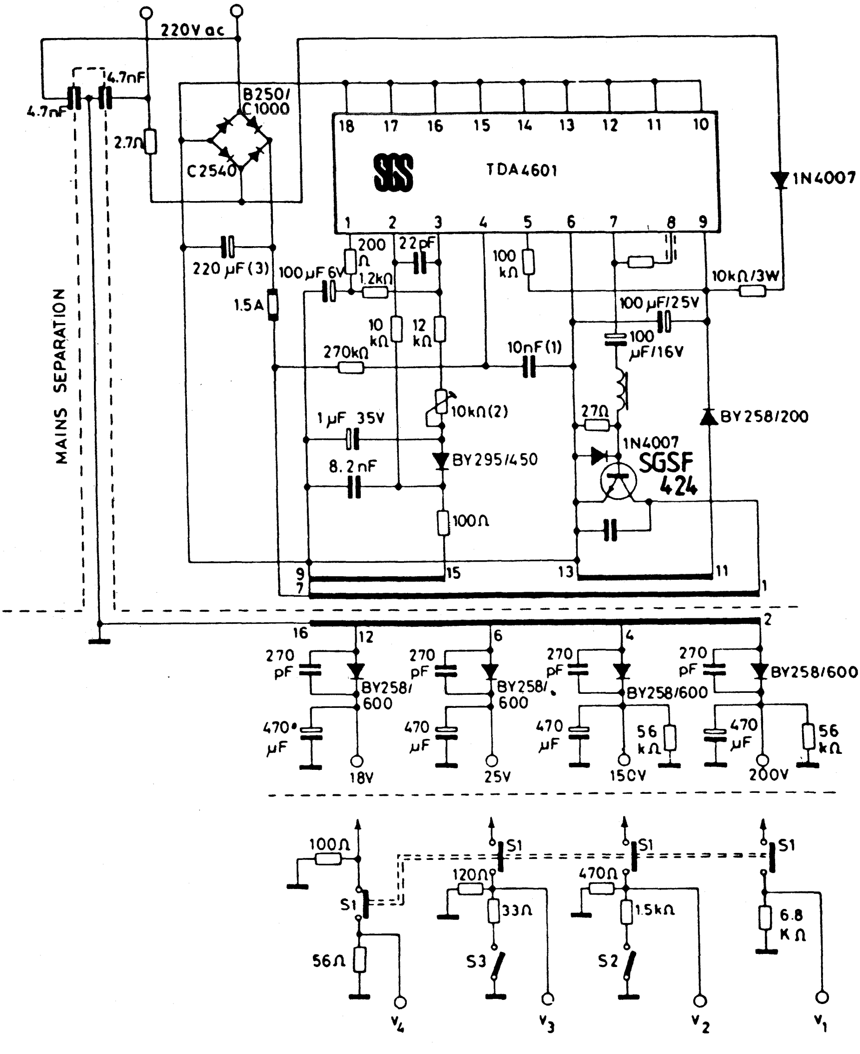
t_{on} t_s t_f	Turn-on time Storage time Fall time	I_C = 1.75A V_{CC} = 250V I_{B1} = 0.35A I_{B2} = 0.35A		0.72 1.80 0.30		μs μs μs
t_{on} t_s t_f	Turn-on time Storage time Fall time	I_C = 1.75A V_{CC} = 250V I_{B1} = 0.35A I_{B2} = 0.7A		0.60 0.84 0.10		μs μs μs

INDUCTIVE LOAD

t_s t_f	Storage time Fall time	I_C= 1.75A V_{CL} = 200V L = 200 μH $V_{BE(off)}$ = −5V h_{FE} = 5 T_c = 25°C		0.72 0.08		μs μs
t_s t_f	Storage time Fall time	I_C = 1.75A V_{CL} = 200V L = 200μH $V_{BE(off)}$ = −5V h_{FE} = 5 T_c = 100°C		0.84 0.10		μs μs

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

Fig. 1 - 50W flyback converter using the SGS control circuit TDA4601



1) C limits the maximum collector current of the SGSF424 at overshooting permissible output power.
2) Adjustment of secondary voltage.
3) Must be discharged before IC change.

Fig. 2 - 50W flyback converter using the SGS control circuit UC3842

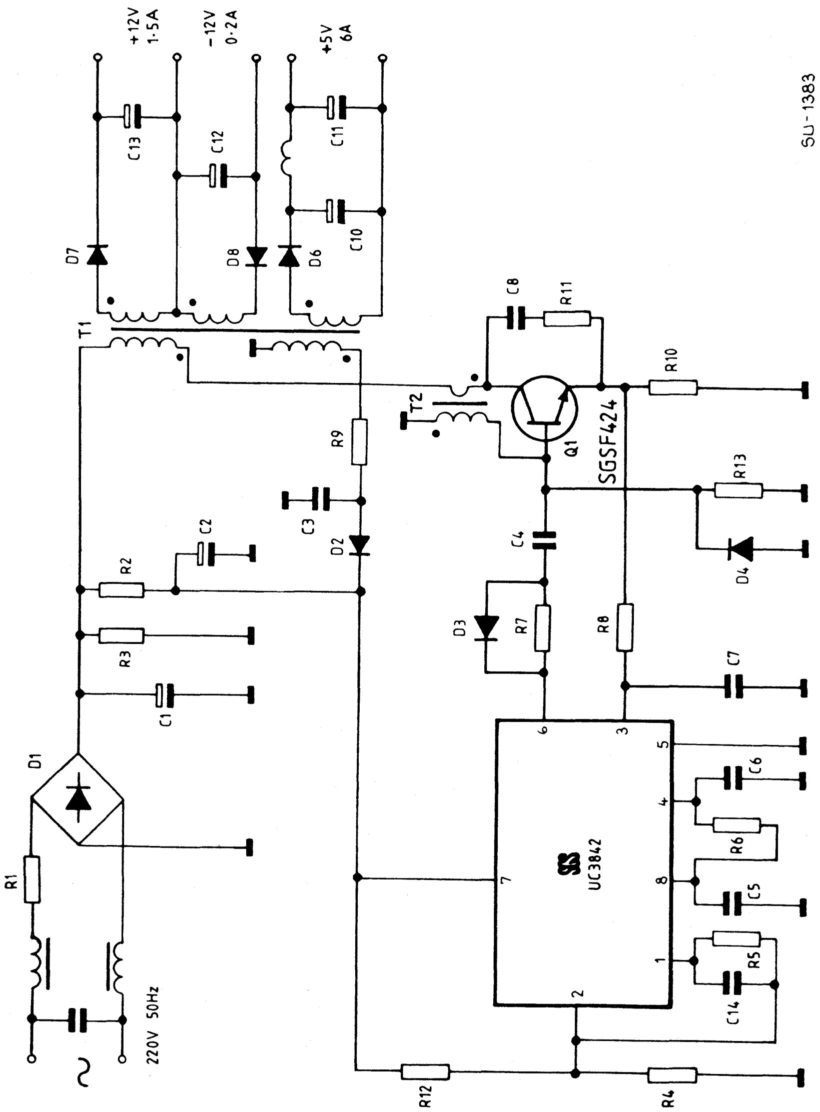
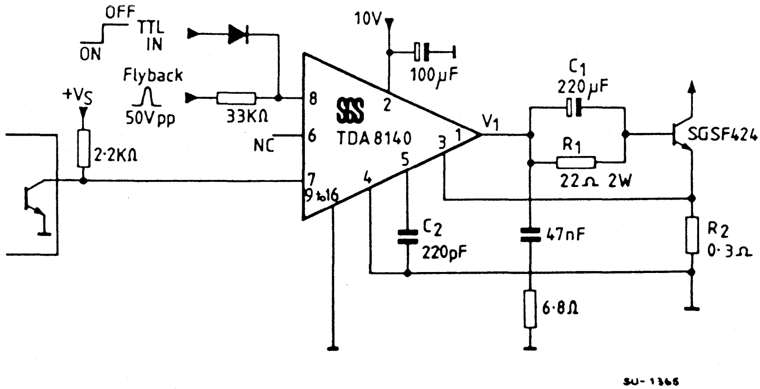


Fig. 3 - Typical colour CRT deflection with the SGS TDA8140



THERMAL RESISTANCE OF THE ISOWATT218

The junction to case thermal resistance of 3.0°C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1 mm mica insulating washer, the differences are marginal. The 0.1mm isolating washer gives 1500V to 2000 VDC isolation for the SOT-93 package, SGS guarantee 4000 VDC isolation for the ISOWATT218.

The comparison in fig. 4 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The tests illustrate that the ISOWATT218 has an R_{th} very close to that of a conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package.

The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.

Fig. 4

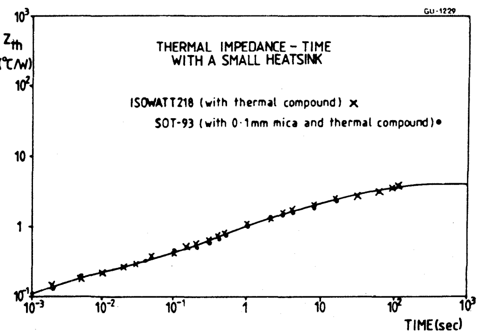


Fig. 5 - Internal schematic diagram

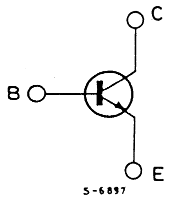
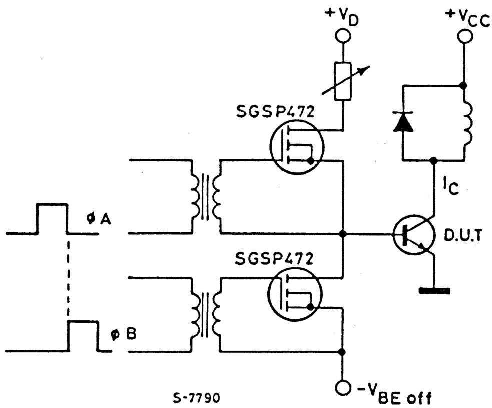


Fig. 6 - Switching times test circuit



V_{CC}= 150V
L = 0.2mH

ϕ_A = pulse width must be adjusted to obtain desired I_C value
ϕ_B = pulse width equal to ϕ_A pulse duration

SGSF341
SGSF441
SGSIF441
SGSF541

ADVANCE DATA

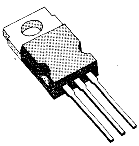
HIGH SWITCHING SPEED NPN TRANSISTORS FOR 240V OFF-LINE SWITCHING POWER SUPPLIES.

- V_{CEO} = 400V: TO SUIT TWO TRANSISTOR FORWARD AND BRIDGE CONVERTER APPLICATIONS.
- UP TO 70KHz OPERATION WITH EASY DRIVE CIRCUITS.
- $I_{C(sat)}$ 6A, h_{FE} = 5: WELL SUITED FOR 450W FORWARD AND HALF BRIDGE OR 900W FULL BRIDGE CONVERTERS AND 4A, h_{FE} = 6.5 FOR ECONOMIC LOWER POWER APPLICATIONS.
- LOW DYNAMIC SATURATION MINIMIZES LOSSES.
- PACKAGE CHOICE: FOUR TYPES INCLUDING ISOWATT218 TO SUIT EVERY APPLICATION.

These FASTWITCH transistors are specially designed for 240V, or 110V with input doubler, off-line switching power supply applications. FASTSWITCH transistors can operate up to 70KHz with easy drive circuits which helps to simplify designs and improve reliability, the superior switching performance of FASTSWITCH transistors reduces dissipation and consequently lowers the equipment operating temperature.

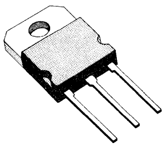
The $I_{C(sat)}$ is 6A with a gain of 5 so these FASTSWITCH transistors can be used in forward and half bridge designs up to 450W or full bridge converters up to 900W. FASTSWITCH transistors are available in the ISOWATT218 fully isolated package which conforms to the creepage distance and isolation requirements of VDE, IEC, and UL specifications.

SGSF341



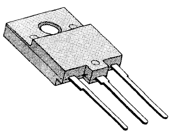
TO-220

SGSF441



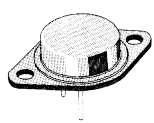
SOT-93 (TO-218)

SGSIF441



ISOWATT218

SGSF541



TO-3

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	SGSF341	SGSF441	SGSIF441	SGSF541	Unit
V_{CES}	Collector-emitter voltage (V_{BE} = 0)	700				V
V_{CEO}	Collector-emitter voltage (I_B = 0)	400				V
V_{EBO}	Emitter-base voltage (I_C = 0)	7				V
I_C	Collector current	10				A
I_{CM}	Collector peak current (t_p < 5ms)	15				A
I_B	Base current	6				A
I_{BM}	Base peak current (t_p < 5ms)	10				A
P_{tot}	Total dissipation at T_c < 25°C	95	115	44	105	W
T_{stg}	Storage temperature −65 to	150	150	150	175	°C
T_j	Junction temperature	150	150	150	175	°C

This is advanced information on a new product now in development or undergoing evaluation. Details are subject to change without notice.

THERMAL DATA

			SGSF341	SGSF441	SGSIF441	SGSF541
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max.	1.31	1.09	2.84•	1.43 °C/W

• See notess on ISOWATT218 in this datasheet

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

Parameter		Test Condition		Min.	Typ.	Max.	Unit.
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = 700V				200	μA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 380V V_{CE} = 400V				200 2	μA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 6V				1	mA
$V_{CEO(sus)}$ *	Collector emitter sustaining voltage	I_C = 0.1A		400			V
$V_{CE(sat)}$ *	Collector-emitter saturation voltage	I_C = 6A I_C = 4A	I_B = 1.2A I_B = 0.6A			1.5 1.5	V V
$V_{BE(sat)}$ *	Base-emitter saturation voltage	I_C = 6A I_C = 4A	I_B = 1.2A I_B = 0.6A			1.5 1.5	V V

RESISTIVE LOAD

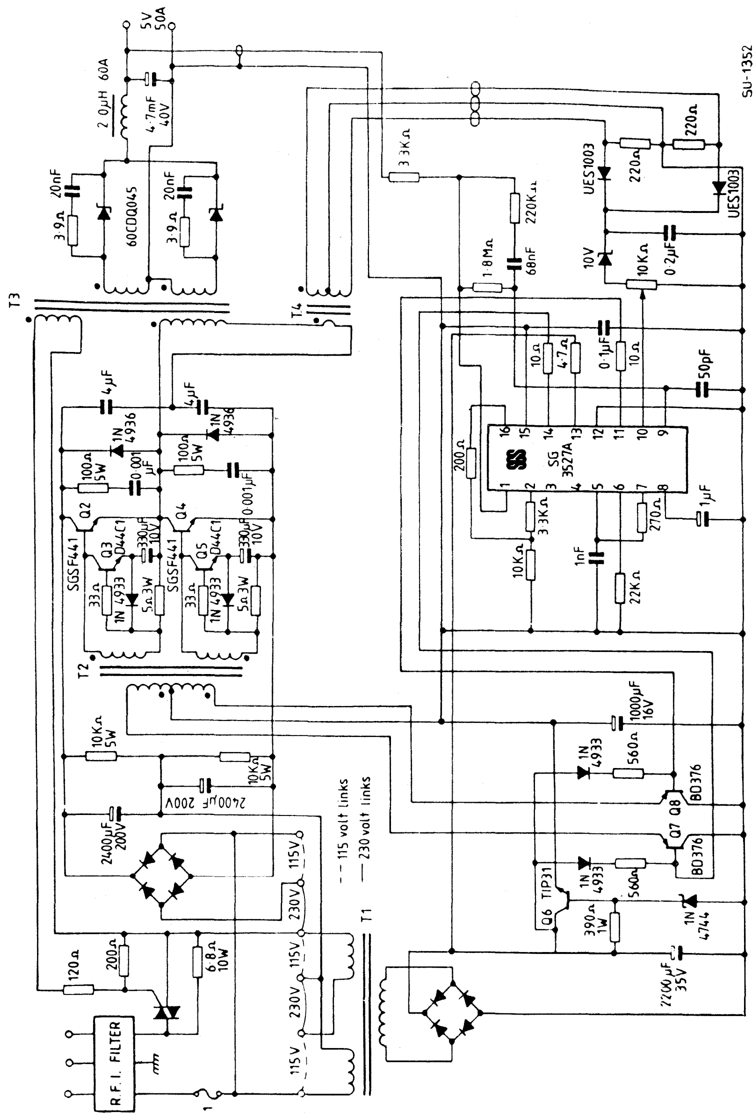
t_{on} t_s t_f	Turn-on time Storage time Fall time	I_C = 6A I_{B1} = 1.2A I_{B2} = 1.2A	V_{CC} = 150V		0.3 1.7 0.2	0.8 3 0.4	μs μs μs
t_{on} t_s t_f	Turn-on time Storage time Fall time	I_C = 6A I_{B1} = 1.2A I_{B2} = 2.4A	V_{CC} = 150V		0.3 1.0 0.1	0.8 2.0 0.25	μs μs μs

INDUCTIVE LOAD

t_s t_f	Storage time Fall time	I_C = 6A L = 200 μH h_{FE} = 5	V_{CC} = 150V $V_{BE(off)}$ = −5V T_c = 25°C		0.7 0.05	1.2 0.12	μs μs
t_s t_f	Storage time Fall time	I_C = 6A L = 200μH h_{FE} = 5	V_{CC} = 150V $V_{BE(off)}$ = −5V T_c = 100°C		0.8 0.09	1.5 0.24	μs μs

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

Fig. 1 - 250W half bridge converter using the SGS control circuit SG3527A



THERMAL RESISTANCE OF THE ISOWATT218

The junction to case thermal resistance of 2.84°C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1mm mica insulating washer, the differences are marginal. The 0.1mm isolating washer gives 1500V to 2000 VDC isolation for the SOT-93 package, SGS guarantee 4000 VDC isolation for the ISOWATT218.
The comparison in fig. 2 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The tests illustrate that the ISOWATT218 has an R_{th} very close to that of a conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package. The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.

Fig. 2

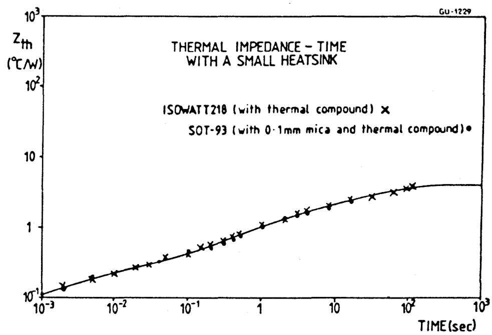


Fig. 3 - Base-emitter saturation voltage

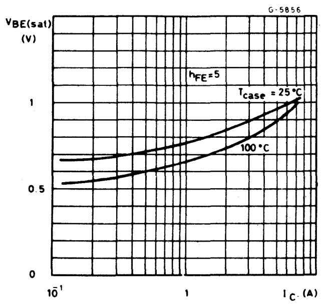


Fig. 4 - Collector current spread vs. base emitter voltage

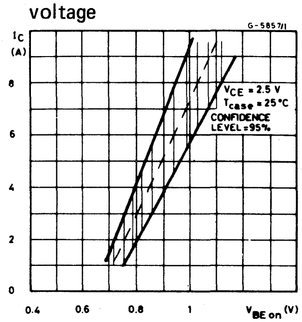


Fig. 5 - Reverse biased safe operating area

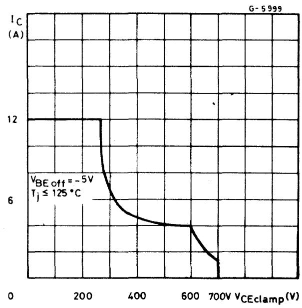


Fig. 6 - Resistive load switching times

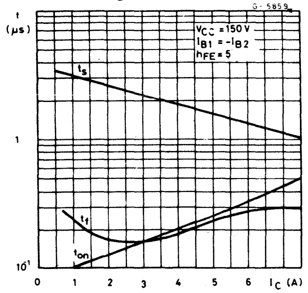


Fig. 7 - DC current gain

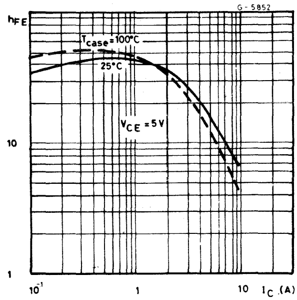


Fig. 8 - DC current gain

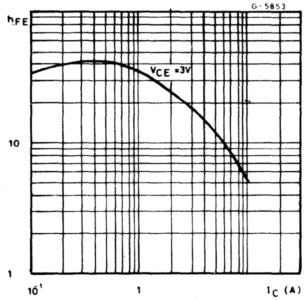


Fig. 9 - Collector-emitter saturation voltage

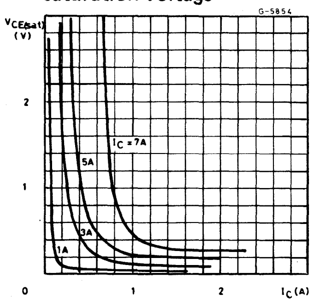


Fig. 10 - Collector-emitter saturation voltage

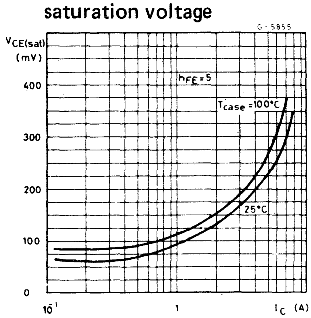


Fig. 11 - Inductive load switching times

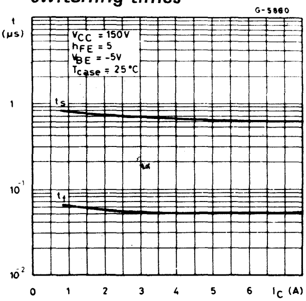


Fig. 12 - Switching times percentage variation vs. case temperature

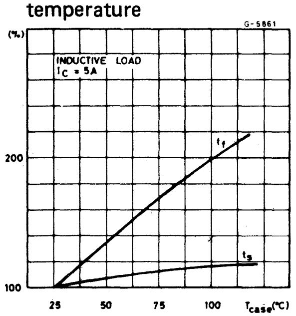


Fig. 13 - $V_{CE(sat)}$ dynamic

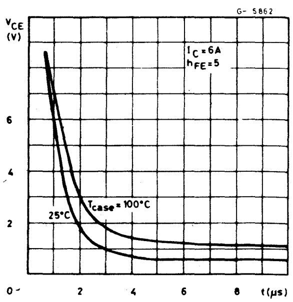


Fig. 14 - Capacitance

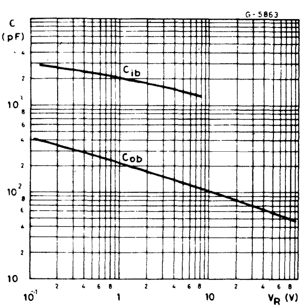


Fig. 15 - Internal schematic diagram

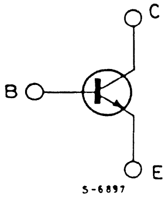
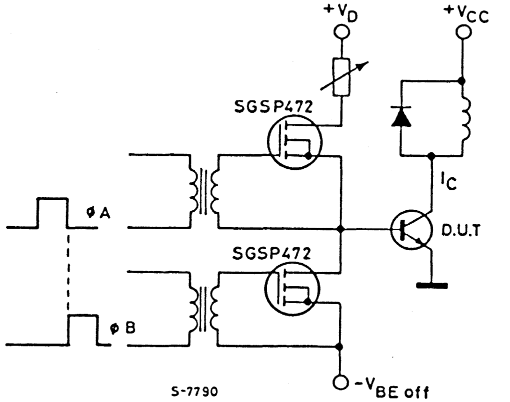


Fig. 16 - Switching times test circuit



V_{CC} = 150V
L = 0.2 mH

ϕ_A = pulse width must be adjusted to obtain desired I_C value
ϕ_B = pulse width equal to ϕ_A pulse duration

SGS®

SGSF342
SGSF442
SGSIF442
SGSF542

ADVANCE DATA

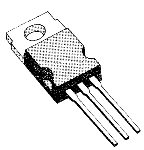
HIGH VOLTAGE NPN TRANSISTORS FOR 240V OFF-LINE SWITCHING POWER SUPPLIES.

- V_{CES} = 850V: HIGH VOLTAGE RATING FOR SINGLE TRANSISTOR APPLICATIONS WITH PEAK VOLTAGE LIMITING.
- UP TO 70KHz OPERATION WITH EASY DRIVE CIRCUITS.
- $I_{C(sat)}$ 5A, h_{FE} = 5: WELL SUITED FOR 200W FLYBACK AND 400W FORWARD CONVERTERS. AND 3.5A, h_{FE} = 7 FOR ECONOMIC LOWER POWER APPLICATIONS.
- LOW DYNAMIC SATURATION MINIMIZES LOSSES IN FORWARD CONVERTERS.
- PACKAGE CHOICE: FOUR TYPES INCLUDING ISOWATT218 TO SUIT EVERY APPLICATION.

These FASTWITCH transistors are specially designed for 240V, or 110V with input doubler, off-line switching power supply applications where the normal high voltage peaks associated with single transistor converters are limited by a transformer clamp winding or overvoltage snubbing.

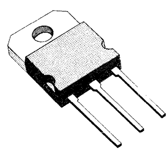
The $I_{C(sat)}$ is 5A with a gain of 5 so these FASTSWITCH transistors can be used in flyback converters up to 200W and forward converters up to 400W. The superior switching performance of FASTSWITCH transistors reduces dissipation and consequently lowers the equipment operating temperature. FASTSWITCH transistors are available in the ISOWATT218 fully isolated package which conforms to the creepage distance and isolation requirements of VDE, IEC, and UL specifications.

SGSF342



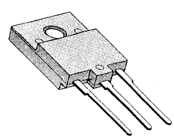
TO-220

SGSF442



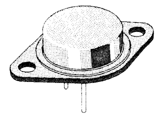
SOT-93 (TO-218)

SGSIF442



ISOWATT218

SGSF542



TO-3

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	SGSF342	SGSF442	SGSIF442	SGSF542	Unit
V_{CES}	Collector-emitter voltage (V_{BE} = 0)	850				V
V_{CEO}	Collector-emitter voltage (I_B = 0)	450				V
V_{EBO}	Emitter-base voltage (I_C = 0)	7				V
I_C	Collector current	8				A
I_{CM}	Collector peak current (t_p < 5ms)	15				A
I_B	Base current	5				A
I_{BM}	Base peak current (t_p < 5ms)	8				A
P_{tot}	Total dissipation at T_c < 25°C	95	115	44	105	W
T_{stg}	Storage temperature −65 to	150	150	150	175	°C
T_j	Junction temperature	150	150	150	175	°C

This is advanced information on a new product now in development or undergoing evaluation. Details are subject to change without notice.

THERMAL DATA

			SGSF342	SGSF442	SGSIF442	SGSF542
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max.	1.31	1.09	2.84•	1.43 °C/W

• See notes on ISOWATT218 in this datasheet

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

Parameter		Test Condition		Min.	Typ.	Max.	Unit.
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = 850V				200	µA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 380V V_{CE} = 450V				200 2	µA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 6V				1	mA
$V_{CEO(sus)}$*	Collector emitter sustaining voltage	I_C = 0.1A		450			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 5.0A I_C = 3.5A	I_B = 1.0A I_B = 0.5A			1.5 1.5	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 5.0A I_C = 3.5A	I_B = 1.0A I_B = 0.5A			1.5 1.5	V V

RESISTIVE LOAD

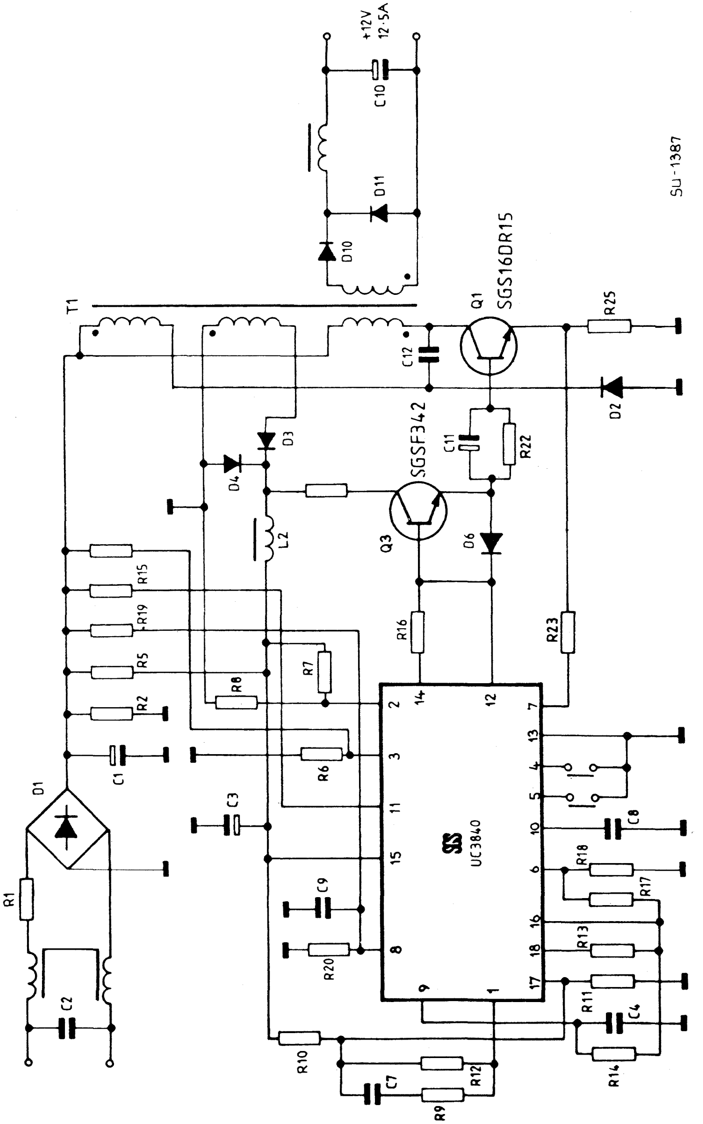
t_{on} t_s t_f	Turn-on time Storage time Fall time	I_C = 5.0A I_{B1} = 1.0A I_{B2} = 1.0A	V_{CC} = 150V		0.30 1.70 0.20	0.8 3.0 0.4	µs µs µs
t_{on} t_s t_f	Turn-on time Storage time Fall time	I_C = 5.0A I_{B1} = 1.0A I_{B2} = 2.0A	V_{CC} = 150V		0.30 1.0 0.10	0.8 2.0 0.25	µs µs µs

INDUCTIVE LOAD

t_s t_f	Storage time Fall time	I_C= 5.0A L = 200 µH h_{FE} = 5	V_{CC} = 150V $V_{BE(off)}$ = −5V T_c = 25°C		0.70 0.05	1.20 0.12	µs µs
t_s t_f	Storage time Fall time	I_C = 5.0A L = 200µH h_{FE} = 5	V_{CC} = 150V $V_{BE(off)}$ = −5V T_c = 100°C		0.80 0.09	1.5 0.24	µs µs

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

Fig. 1 - 150W forward converter using the SGS control circuit UC3840



THERMAL RESISTANCE OF THE ISOWATT218

The junction to case thermal resistance of 2.84°C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (SOT-218) package with a 0.1mm mica insulating washer, the differences are marginal. The 0.1mm isolating washer gives 1500V to 2000 VDC isolation for the SOT-93 package, SGS guarantee 4000 VDC isolation for the ISOWATT218.
The comparison in fig. 2 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The tests illustrate that the ISOWATT218 has an R_{th} very close to that of a conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package. The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.

Fig. 2

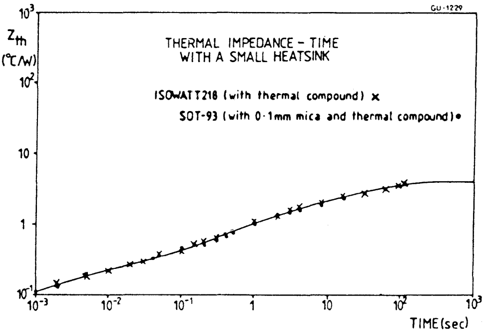


Fig. 3 - Base-emitter saturation voltage

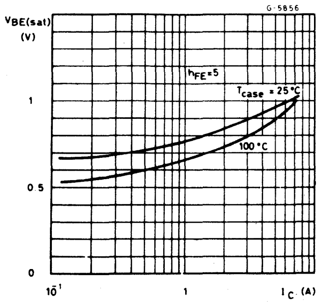


Fig. 4 - Collector current spread vs. base-emitter voltage

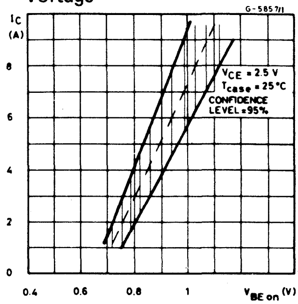


Fig. 5 - Reverse biased safe operating area

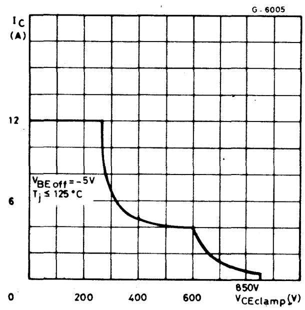


Fig. 6 - Resistive load switching times

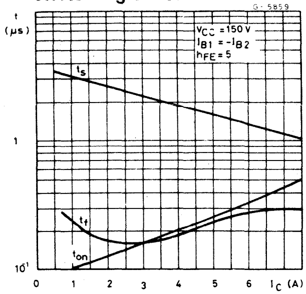


Fig. 7 - DC current gain

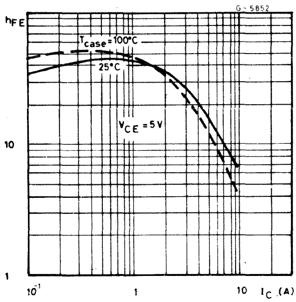


Fig. 8 - DC current gain

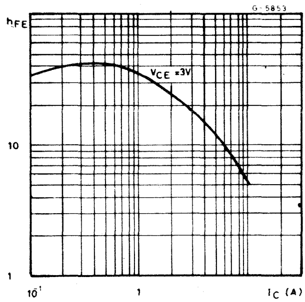


Fig. 9 - Collector-emitter saturation voltage

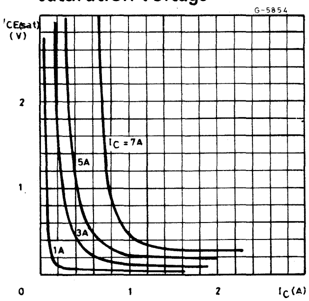


Fig. 10 - Collector-emitter saturation voltage

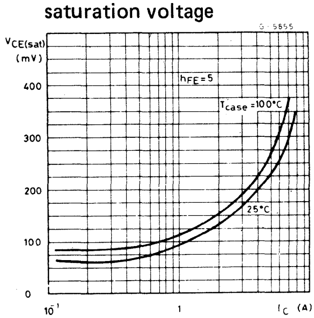


Fig. 11 - Inductive load switching times

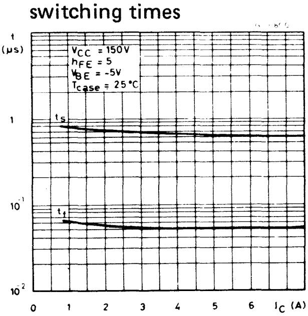


Fig. 12 - Switching times percentage variation vs. case temperature

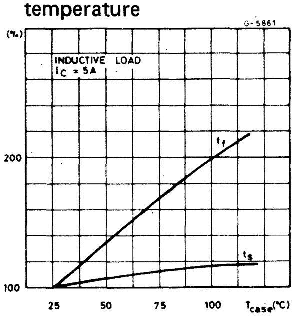


Fig. 13 - $V_{CE(sat)}$ dynamic

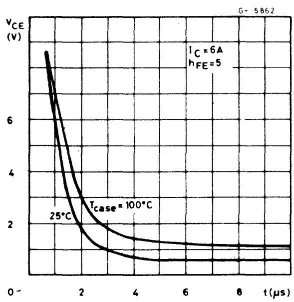


Fig. 14 - Capacitance

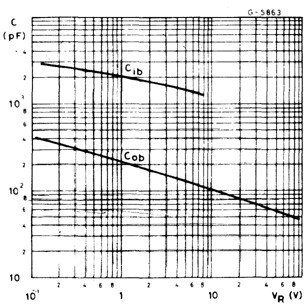


Fig. 15 - Internal schematic diagram

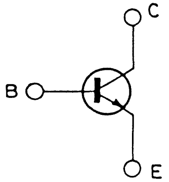
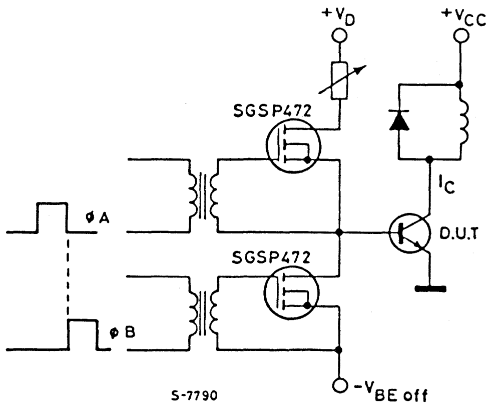


Fig. 16 - Switching times test circuit



$V_{CC} = 150V$
L = 0.2 mH

ϕ_A = pulse width must be adjusted to obtain desired I_C value
ϕ_B = pulse width equal to ϕ_A pulse duration

SGS®

SGSF343
SGSF443
SGSIF443
SGSF543

ADVANCE DATA

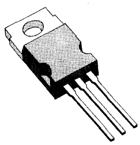
HIGH VOLTAGE NPN TRANSISTORS FOR 240V OFF-LINE SWITCHING POWER SUPPLIES.

- V_{CES} = 1000V: HIGH VOLTAGE RATING FOR SINGLE TRANSISTOR FLYBACK AND FORWARD CONVERTER APPLICATIONS.
- UP TO 70KHz OPERATION WITH EASY DRIVE CIRCUITS.
- $I_{C(sat)}$ 4.5A, h_{FE} = 5: WELL SUITED FOR 175W FLYBACK AND 350W FORWARD CONVERTERS AND 3A, h_{FE} = 6.5 FOR ECONOMIC LOWER POWER APPLICATIONS.
- LOW DYNAMIC SATURATION MINIMIZES LOSSES IN FORWARD CONVERTERS.
- PACKAGE CHOICE: FOUR TYPES INCLUDING ISOWATT218 TO SUIT EVERY APPLICATION.

These FASTWITCH transistors are specially designed for 240V, or 110V with input doubler, off-line switching power supply applications. The 1000V blocking voltage allows these FASTSWITCH transistors to be used in single transistor converters without a costly overvoltage snubbing network.

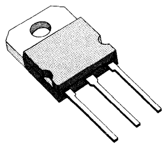
The $I_{C(sat)}$ is 4.5A with a gain of 5 so these FASTSWITCH transistors can be used in flyback converters up to 175W and forward converters up to 350W. The superior switching performance of FASTSWITCH transistors reduces dissipation and consequently lowers the equipment operating temperature. FASTSWITCH transistors are available in the ISOWATT218 fully isolated package which conforms to the creepage distance and isolation requirements of VDE, IEC, and UL specifications.

SGSF343



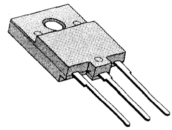
TO-220

SGSF443



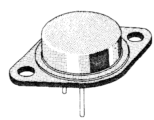
SOT-93 (TO-218)

SGSIF443



ISOWATT218

SGSF543



TO-3

ABSOLUTE MAXIMUM RATINGS

<table>
<tr><th></th><th></th><th>SGSF343</th><th>SGSF443</th><th>SGSIF443</th><th>SGSF543</th><th></th></tr>
<tr><td>V_{CES}</td><td>Collector-emitter voltage (V_{BE} = 0)</td><td colspan="4">1000</td><td>V</td></tr>
<tr><td>V_{CEO}</td><td>Collector-emitter voltage (I_B = 0)</td><td colspan="4">450</td><td>V</td></tr>
<tr><td>V_{EBO}</td><td>Emitter-base voltage (I_C = 0)</td><td colspan="4">7</td><td>V</td></tr>
<tr><td>I_C</td><td>Collector current</td><td colspan="4">8</td><td>A</td></tr>
<tr><td>I_{CM}</td><td>Collector peak current (t_p < 5ms)</td><td colspan="4">15</td><td>A</td></tr>
<tr><td>I_B</td><td>Base current</td><td colspan="4">5</td><td>A</td></tr>
<tr><td>I_{BM}</td><td>Base peak current (t_p < 5ms)</td><td colspan="4">8</td><td>A</td></tr>
<tr><td>P_{tot}</td><td>Total dissipation at T_c < 25°C</td><td>95</td><td>115</td><td>44</td><td>105</td><td>W</td></tr>
<tr><td>T_{stg}</td><td>Storage temperature −65 to</td><td>150</td><td>150</td><td>150</td><td>175</td><td>°C</td></tr>
<tr><td>T_j</td><td>Junction temperature</td><td>150</td><td>150</td><td>150</td><td>175</td><td>°C</td></tr>
</table>

This is advanced information on a new product now in development or undergoing evaluation. Details are subject to change without notice.

THERMAL DATA

			SGSF343	SGSF443	SGSIF443	SGSF543
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max.	1.31	1.09	2.84 •	1.43 °C/W

• See notes on ISOWATT218 in this datasheet

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

Parameter		Test Condition	Min.	Typ.	Max.	Unit.
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = 1000V			200	μA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 380V V_{CE} = 450V			200 2	μA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 6V			1	mA
$V_{CEO(sus)}$*	Collector emitter sustaining voltage	I_C = 0.1A	450			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 4.5A I_B = 0.9A I_C = 3.0A I_B = 0.45A			1.5 1.5	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 4.5A I_B = 0.9A I_C = 3.0A I_B = 0.45A			1.5 1.5	V V

RESISTIVE LOAD

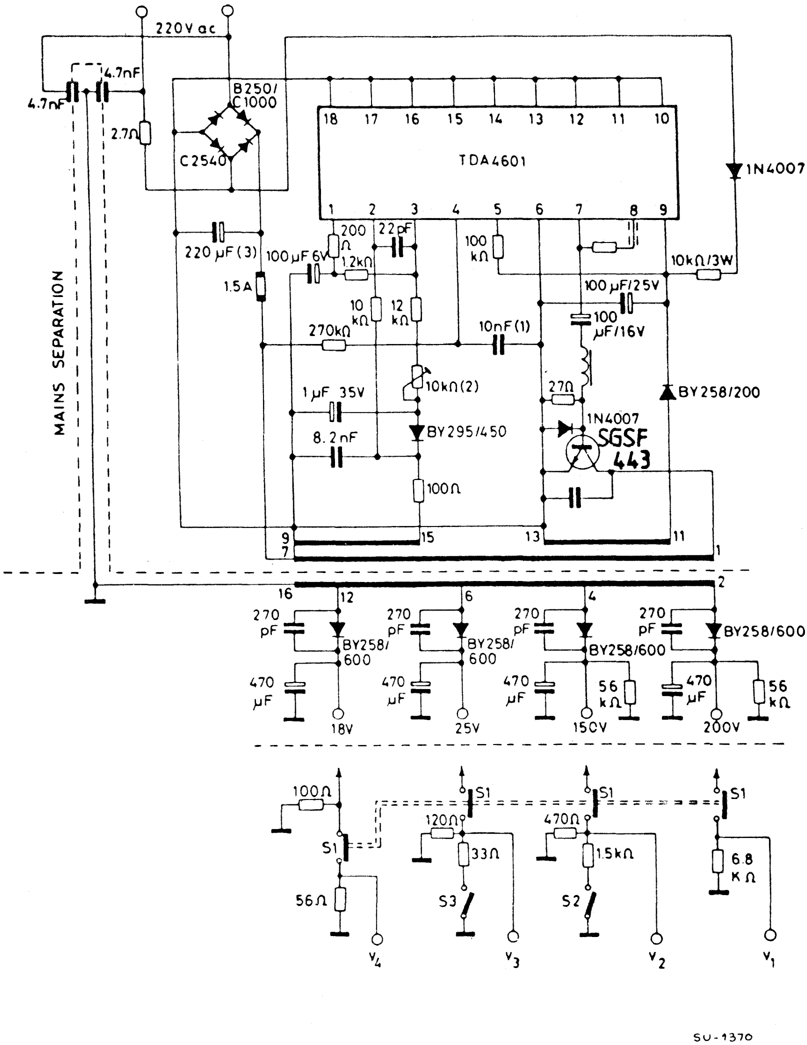
Parameter		Test Condition	Min.	Typ.	Max.	Unit.
t_{on} t_s t_f	Turn-on time Storage time Fall time	I_C = 4.5A V_{CC} = 150V I_{B1} = 0.9A I_{B2} = 0.9A		0.33 1.85 0.22	0.9 3.3 0.5	μs μs μs
t_{on} t_s t_f	Turn-on time Storage time Fall time	I_C = 4.5A V_{CC} = 150V I_{B1} = 0.9A I_{B2} = 1.8A		0.33 1.1 0.11	0.9 2.2 0.3	μs μs μs

INDUCTIVE LOAD

Parameter		Test Condition	Min.	Typ.	Max.	Unit.
t_s t_f	Storage time Fall time	I_C = 4.5A V_{CC} = 150V L = 200 μH $V_{BE(off)}$ = −5V h_{FE} = 5 T_c = 25°C		0.77 0.06	1.35 0.15	μs μs
t_s t_f	Storage time Fall time	I_C = 4.5A V_{CC} = 150V L = 200μH $V_{BE(off)}$ = −5V h_{FE} = 5 T_c = 100°C		0.88 0.10	1.7 0.27	μs μs

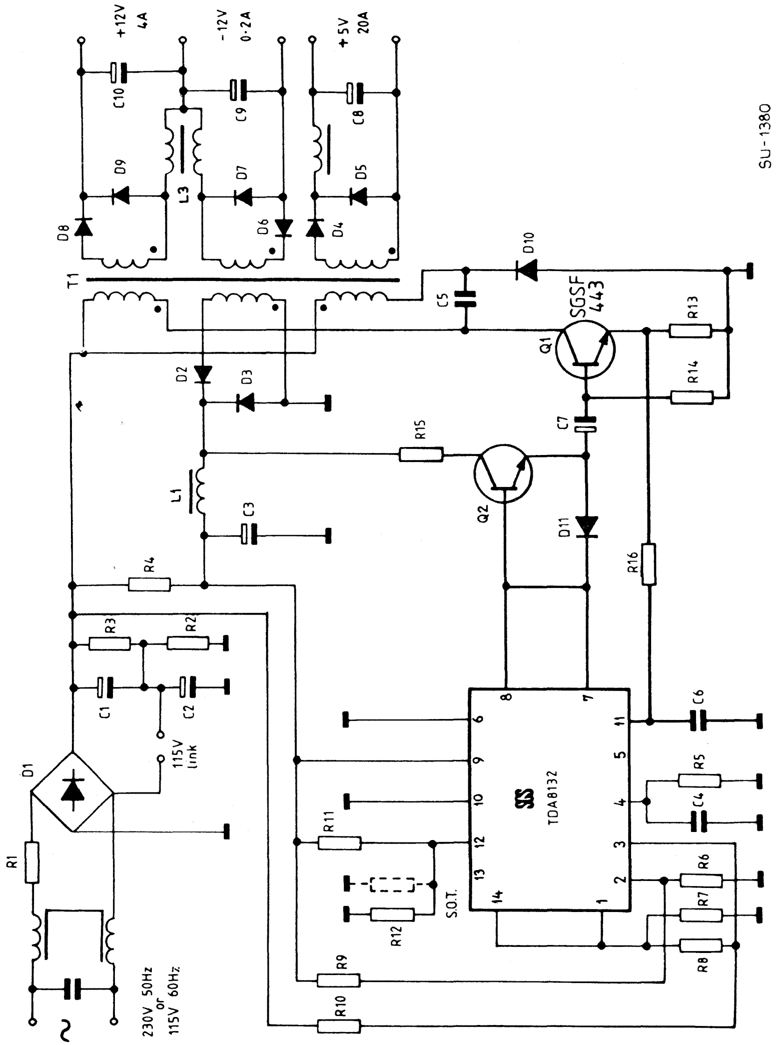
* Pulsed: Pulse duration = 300 μs, duty cycle = 1.5%

Fig. 1 – 100W flyback converter using the SGS control circuit TDA4601



1) C limits maximum collector current of the SGSF443 at overshooting permissible output power.
2) Adjustment of secondary voltage.
3) Must be discharged before IC change.

Fig. 2 - 150W forward converter using the SGS control circuit TDA8132



THERMAL RESISTANCE OF THE ISOWATT218

The junction to case thermal resistance of 2.84°C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1mm mica insulating washer, the differences are marginal. The 0.1mm isolating washer gives 1500V to 2000 VDC isolation for the SOT-93 package, SGS guarantee 4000 VDC isolation for the ISOWATT218.
The comparison in fig. 3 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The tests illustrate that the ISOWATT218 has an R_{th} very close to that of a conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package. The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.

Fig. 3

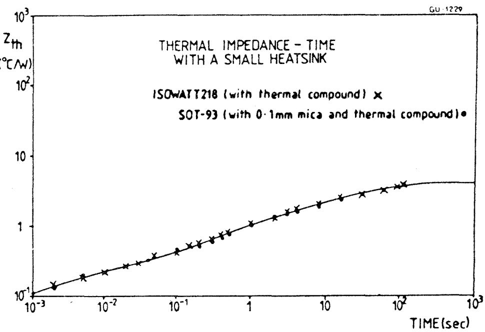


Fig. 4 - Base-emitter saturation voltage

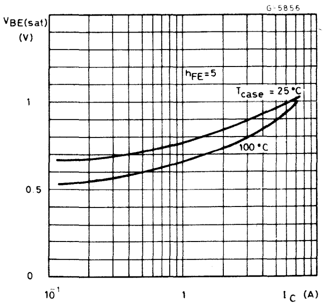


Fig. 5 - Collector current spread vs. base-emitter voltage

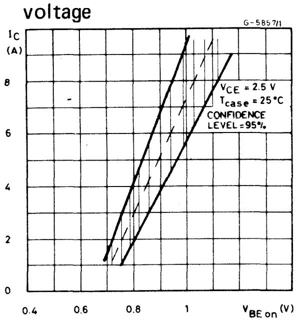


Fig. 6 - Reverse biased safe operating area

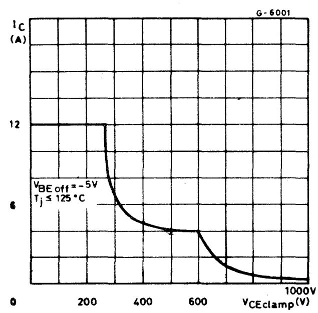


Fig. 7 - Resistive load switching times

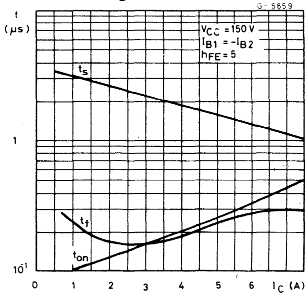


Fig. 8 - DC current gain

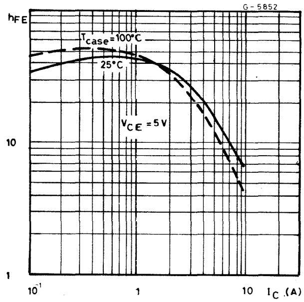


Fig. 9 - DC current gain

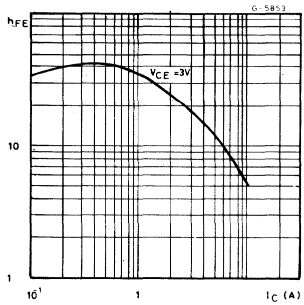


Fig. 10 - Collector-emitter saturation voltage

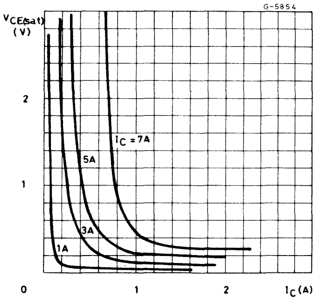


Fig. 11 - Collector-emitter saturation voltage

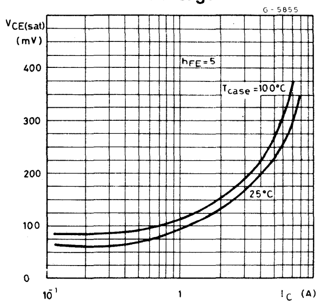


Fig. 12 - Inductive load switching times

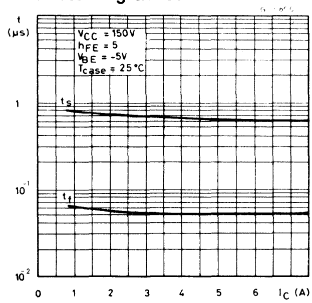


Fig. 13 - Switching times percentage variation vs. case temperature

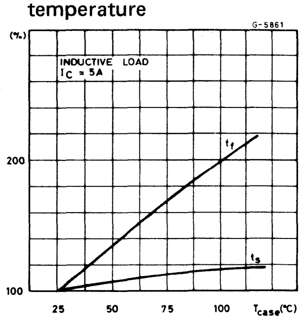


Fig. 14 - $V_{CE(sat)}$ dynamic

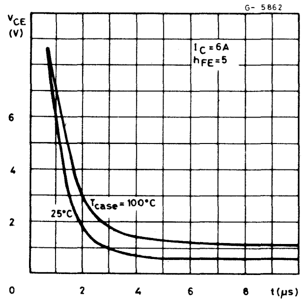


Fig. 15 - Capacitance

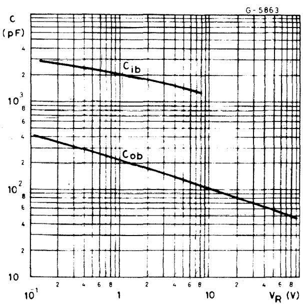


Fig. 16 - Internal schematic diagram

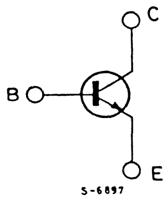
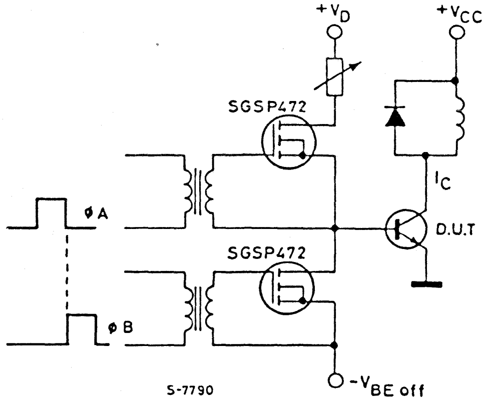


Fig. 17 - Switching times test circuit



V_{CC}= 150V
L = 0.2 mH

ϕ_A = pulse width must be adjusted to obtain desired I_C value
ϕ_B = pulse width equal to ϕ_A pulse duration

SGSF344
SGSF444
SGSIF444
SGSF544

ADVANCE DATA

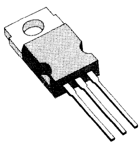
HIGH VOLTAGE NPN TRANSISTORS FOR 240V OFF-LINE SWITCHING POWER SUPPLIES AND 90° COLOUR CRT DEFLECTION.

- V_{CES} = 1200V: HIGH VOLTAGE RATING FOR DEFLECTION AND SINGLE TRANSISTOR CONVERTER APPLICATIONS.
- UP TO 50KHz OPERATION WITH EASY DRIVE CIRCUITS.
- $I_{C(sat)}$ 3.5A, h_{FE} = 5: WELL SUITED FOR 125W FLYBACK AND 250W FORWARD CONVERTERS AND 2.5A, h_{FE} = 7A FOR ECONOMIC LOWER POWER APPLICATIONS.
- LOW DYNAMIC SATURATION WHICH MINIMIZES LOSSES IN FORWARD CONVERTERS.
- PACKAGE CHOICE: FOUR TYPES INCLUDING ISOWATT218 TO SUIT EVERY APPLICATION.

These FASTWITCH transistors are specially designed for 240V, or 110V with input doubler, off-line switching power supply and colour CRT deflection applications. The 1200V rating needed for deflection circuits is also a benefit to forward and flyback converters because costly overvoltage snubbers can be avoided.

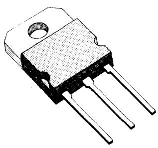
The $I_{C(sat)}$ is 3.5A with a gain of 5 so these FASTSWITCH transistors can be used in flyback converters up to 125W and forward converters up to 250W. The superior switching performance of FASTSWITCH transistors reduces dissipation and consequently lowers the equipment operating temperature. FASTSWITCH transistors are available in the ISOWATT218 fully isolated package which conforms to the creepage distance and isolation requirements of VDE, IEC, and UL specifications.

SGSF344



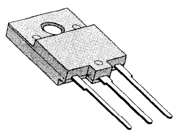
TO-220

SGSF444



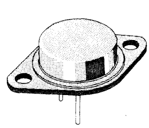
SOT-93 (TO-218)

SGSIF444



ISOWATT218

SGSF544



TO-3

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	SGSF344	SGSF444	SGSIF444	SGSF544	Unit
V_{CES}	Collector-emitter voltage (V_{BE} = 0)	1200				V
V_{CEO}	Collector-emitter voltage (I_B = 0)	600				V
V_{EBO}	Emitter-base voltage (I_C = 0)	7				V
I_C	Collector current	7				A
I_{CM}	Collector peak current (t_p < 5ms)	12				A
I_B	Base current	5				A
I_{BM}	Base peak current (t_p < 5ms)	8				A
P_{tot}	Total dissipation at T_c < 25°C	95	115	44	105	W
T_{stg}	Storage temperature −65 to	150	150	150	175	°C
T_j	Junction temperature	150	150	150	175	°C

This is advanced information on a new product now in development or undergoing evaluation. Details are subject to change without notice.

THERMAL DATA

			SGSF344	SGSF444	SGSIF444	SGSF544
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max.	1.31	1.09	2.84•	1.43 °C/W

• See notes on ISOWATT218 in this datasheet.

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

Parameter		Test Condition	Min.	Typ.	Max.	Unit.
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = 1200V			200	μA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 380V V_{CE} = 600V			200 2	μA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 6V			1	mA
$V_{CEO(sus)}$*	Collector emitter sustaining voltage	I_C = 0.1A	600			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 3.5A I_B = 0.7A I_C = 2.5A I_B = 0.35A			1.5 1.5	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 3.5A I_B = 0.7A I_C = 2.5A I_B = 0.35A			1.5 1.5	V V

RESISTIVE LOAD

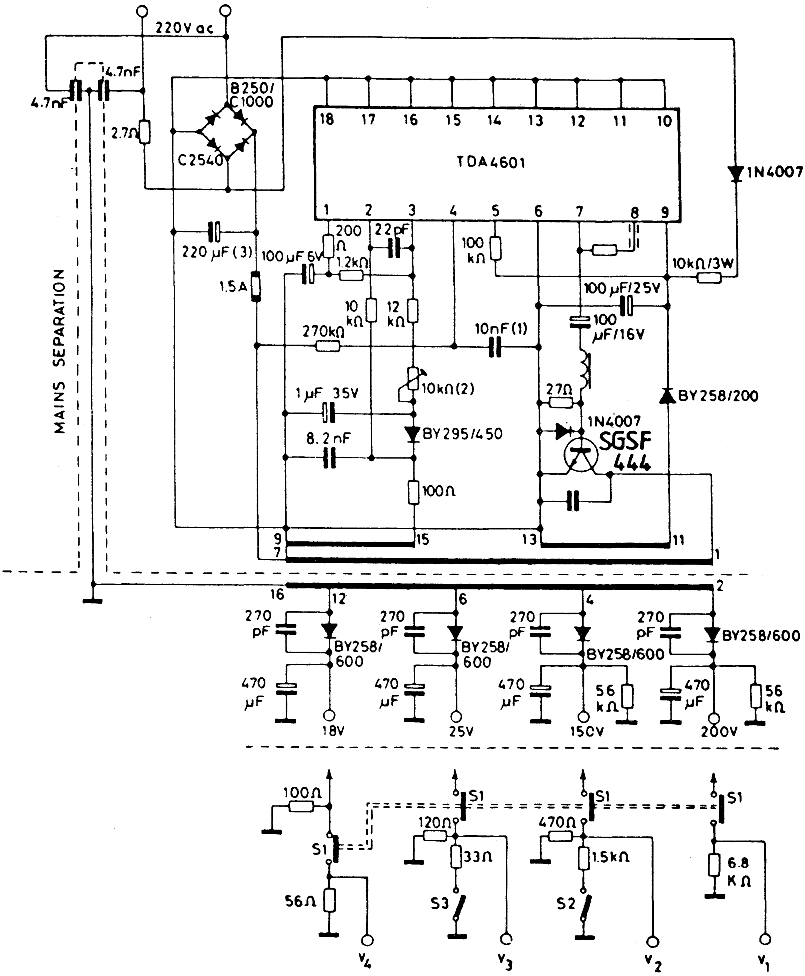
t_{on} t_s t_f	Turn-on time Storage time Fall time	I_C = 3.5A V_{CC} = 250V I_{B1} = 0.7A I_{B2} = 0.7A		0.42 2.40 0.29		μs μs μs
t_{on} t_s t_f	Turn-on time Storage time Fall time	I_C = 3.5A V_{CC} = 250V I_{B1} = 0.7A I_{B2} = 1.4A		0.42 1.45 0.15		μs μs μs

INDUCTIVE LOAD

t_s t_f	Storage time Fall time	I_C= 3.5A V_{CL} = 200V L = 200 μH $V_{BE(off)}$ = −5V h_{FE} = 5 T_c = 25°C		1.00 0.07		μs μs
t_s t_f	Storage time Fall time	I_C = 3.5A V_{CL} = 200V L = 200μH $V_{BE(off)}$ = −5V h_{FE} = 5 T_c = 100°C		1.00 0.11		μs μs

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

Fig. 1 - 100W flyback converter using the SGS control circuit TDA4601



SU-1371

1) C limits the maximum collector current of the SGSF444 at overshooting permissible output power.
2) Adjustment of secondary voltage.
3) Must be discharged before IC change.

Fig. 2 - 125W flyback converter using the SGS control circuit TDA8130

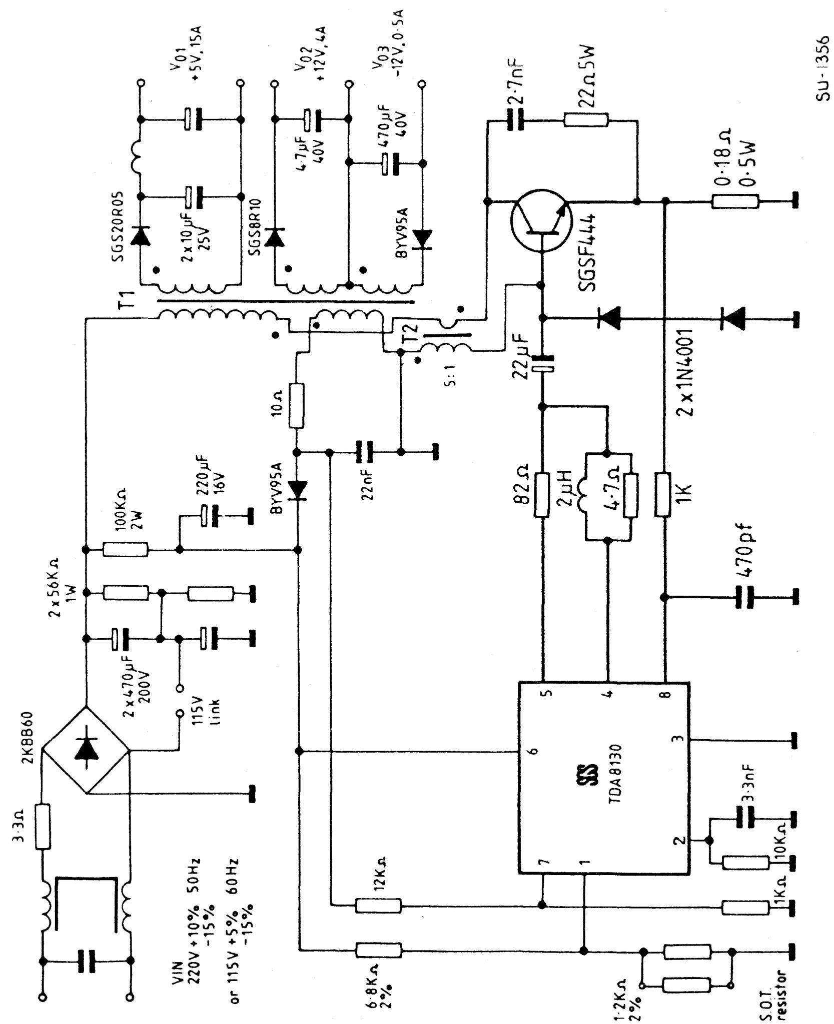
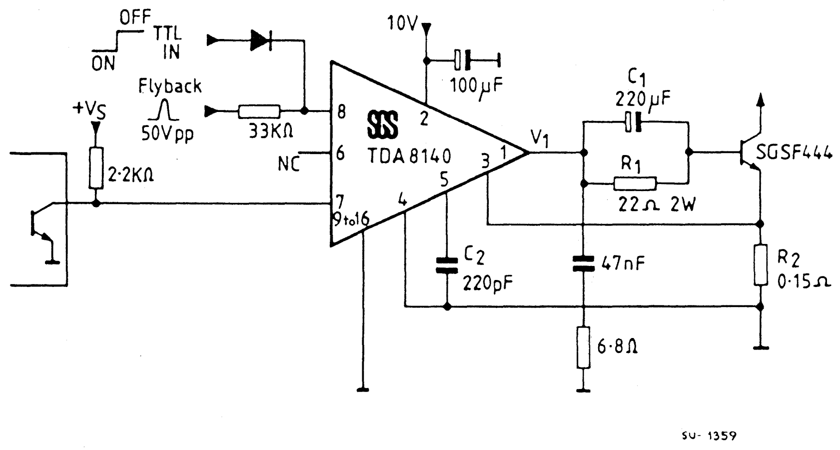


Fig. 3 – Typical colour TV deflection using the SGS TDA8140 controller



THERMAL RESISTANCE OF THE ISOWATT218

The junction to case thermal resistance of 2.84°C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1mm mica insulating washer, the differences are marginal. The 0.1mm isolating washer gives 1500V to 2000 VDC isolation for the SOT-93 package, SGS guarantee 4000 VDC isolation for the ISOWATT218.

The comparison in fig. 4 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The tests illustrate that the ISOWATT218 has an R_{th} very close to that of a conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package. The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.

Fig. 4

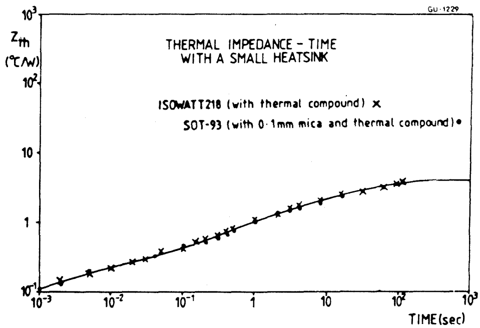


Fig. 5 - Reverse bias safe operating area

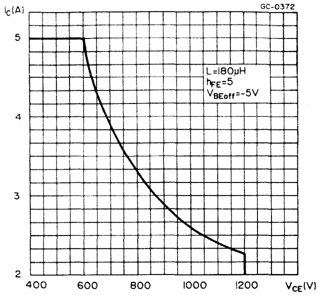


Fig. 6 - Collector-emitter saturation voltage vs. base current

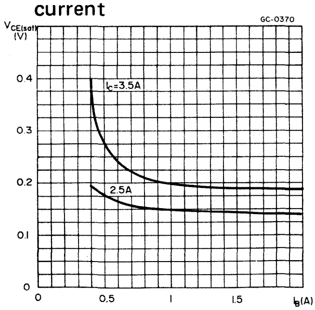


Fig. 7 - Base-emitter saturation voltage vs. base current

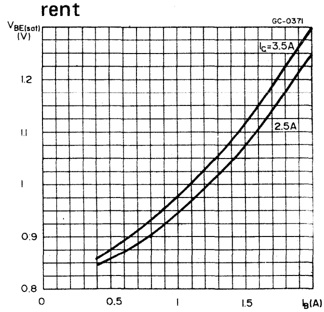


Fig. 8 - Collector-emitter saturation voltage

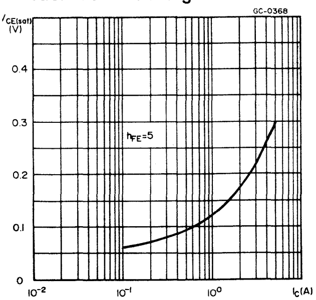


Fig. 9 - Base-emitter saturation voltage

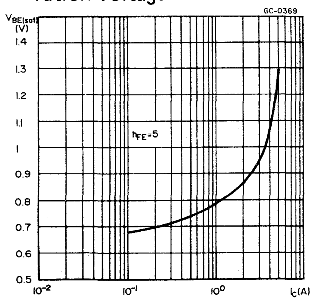


Fig. 10 - DC current gain

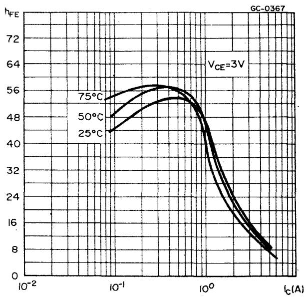


Fig. 11 - Resistive load switching times

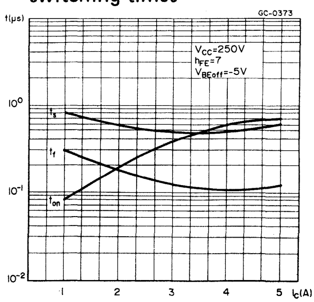


Fig. 12 - Resistive load switching times

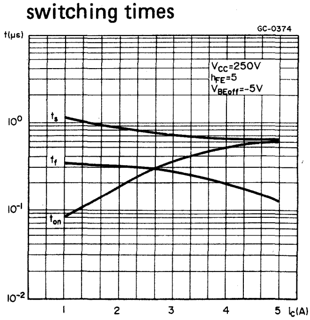


Fig. 13 - Inductive load switching times

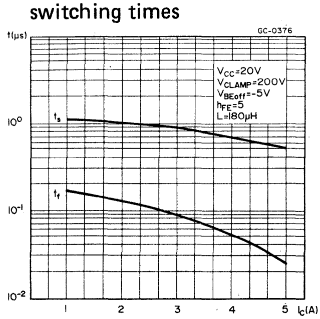


Fig. 14 - Inductive load switching times

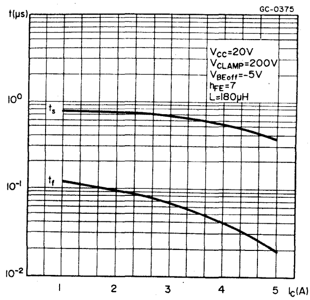


Fig. 15 - Internal schematic diagram

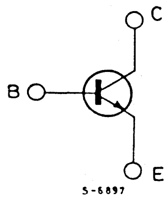
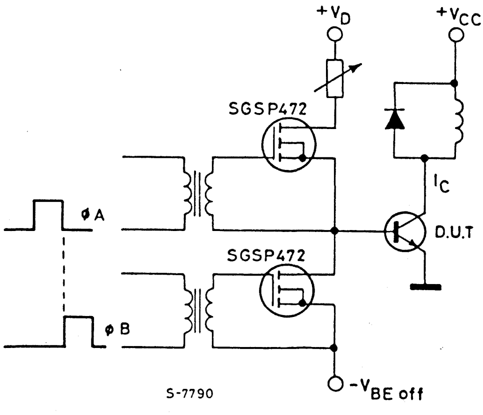


Fig. 16 - Switching times test circuit



V_{CC}= 150V
L = 0.2 mH

ϕ_A = pulse width must be adjusted to obtain desired I_C value
ϕ_B = pulse width equal to ϕ_A pulse duration

SGS®

SGSF425
SGSIF425

ADVANCE DATA

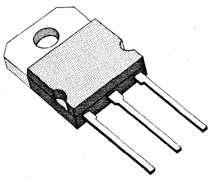
HIGH VOLTAGE NPN TRANSISTORS FOR 240 V OFF-LINE SWITCHING POWER SUPPLIES AND 90° COLOUR CRT DEFLECTION.

- V_{CES} = 1300V: HIGH VOLTAGE RATING FOR DEFLECTION AND SINGLE TRANSISTOR CONVERTER APPLICATIONS.
- UP TO 50KHz OPERATION WITH EASY DRIVE CIRCUITS.
- $I_{C(sat)}$ 1.25A, h_{FE} = 5: WELL SUITED FOR 50W FLYBACK AND 100W FORWARD CONVERTERS AND 1A, h_{FE} = 7 FOR ECONOMIC LOWER POWER APPLICATIONS.
- VERY FAST SWITCHING SPEED: IDEAL FOR COLOUR TV AND HIGH RESOLUTION MONITORS.
- PACKAGE CHOICE: TWO TYPES SOT-93 (TO-218) AND ISOWATT218

These FASTWITCH transistors are specially designed for 240V, or 110V with input doubler, off-line switching power supply and colour CRT deflection applications. The 1300V rating needed for deflection circuits is also a benefit to forward and flyback converters because costly over voltage snubbers can be avoided.

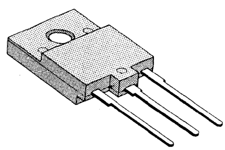
The $I_{C(sat)}$ is 1.25A with a gain of 5 so these FASTSWITCH transistors can be used in flyback converters up to 50W and forward converters up to 100W. The superior switching performance of FASTSWITCH transistors reduces dissipation and consequently lowers the equipment operating temperature. FASTSWITCH transistors are available in the ISOWATT218 fully isolated package which conforms to the creepage distance and isolation requirements of VDE, IEC and UL specifications.

SGSF425



SOT-93 (TO-218)

SGSIF425



ISOWATT218

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	SGSF425	SGSIF425	Unit
V_{CES}	Collector-emitter voltage (V_{BE} = 0)	1300		V
V_{CEO}	Collector-emitter voltage (I_B = 0)	600		V
V_{EBO}	Emitter-base voltage (I_C = 0)	7		V
I_C	Collector current	4		A
I_{CM}	Collector peak current (t_p < 5ms)	8		A
I_B	Base current	3		A
I_{BM}	Base peak current (t_p < 5ms)	6		A
P_{tot}	Total dissipation at T_c < 25°C	100	41.5	W
T_{stg}	Storage temperature	−65 to 150		°C
T_j	Junction temperature	150		°C

This ia advanced information on a new product now in development or undergoing evaluation. Details are subject to change without notice.

THERMAL DATA

			SGSF425	SGSIF425	
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max.	1.25	3.0 •	°C/W

•See notes on ISOWATT218 in this datasheet

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

Parameter		Test Condition	Min.	Typ.	Max.	Unit.
I_{CES}	Collector cutoff current (V_{EB} = 0)	V_{CE} = 1300V			200	μA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 380V V_{CE} = 600V			200 2	μA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 6V			1	mA
$V_{CEO(sus)}$*	Collector emitter sustaining voltage	I_C = 0.1A	600			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 1.25A I_B = 0.25A I_C = 1A I_B = 0.15A			1.5 1.5	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 1.25A I_B = 0.25A I_C = 1A I_B = 0.15A			1.5 1.5	V V

RESISTIVE LOAD

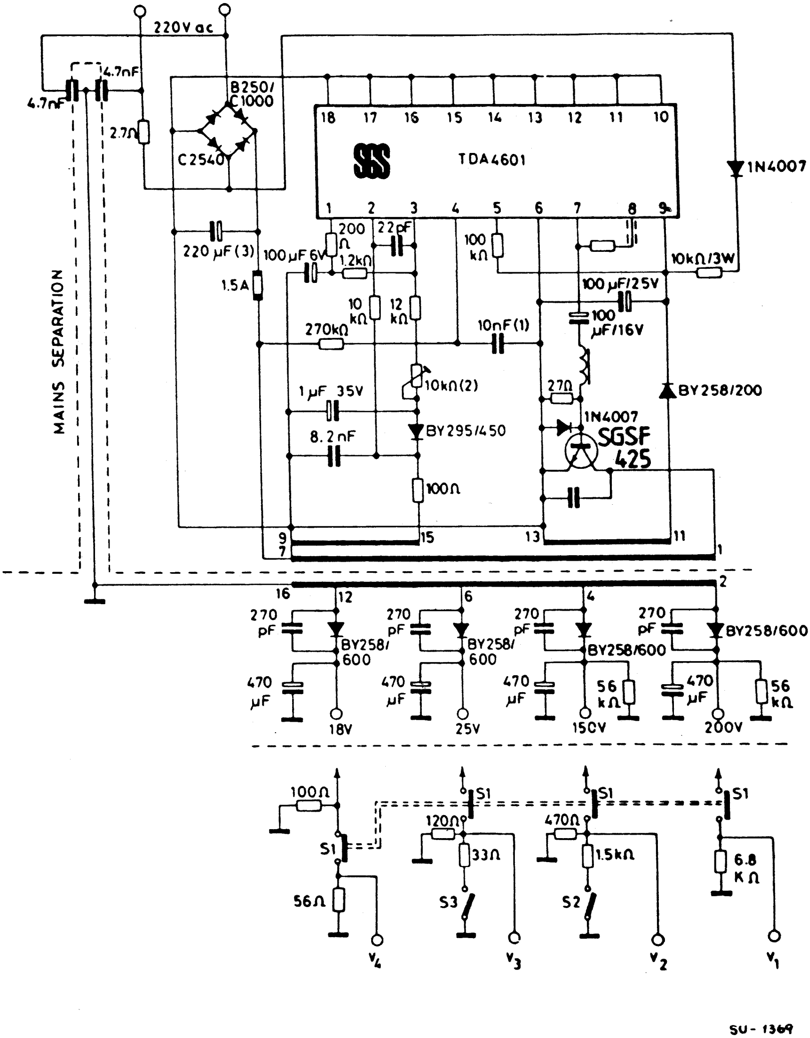
t_{on} t_s t_f	Turn-on time Storage time Fall time	I_C = 1.25A V_{CC} = 250V I_{B1} = 0.25A I_{B2} = 0.25A		0.72 1.80 0.30		μs μs μs
t_{on} t_s t_f	Turn-on time Storage time Fall time	I_C = 1.25A V_{CC} = 250V I_{B1} = 0.25A I_{B2} = 0.5A		0.60 0.84 0.10		μs μs μs

INDUCTIVE LOAD

t_s t_f	Storage time Fall time	I_C = 1.25A V_{CL} = 200V L = 200μH $V_{BE(off)}$ = −5V h_{FE} = 5 T_c = 25°C		1.00 0.12		μs μs
t_s t_f	Storage time Fall time	I_C = 1.25A V_{CL} = 200V L = 200μH $V_{BE(off)}$ = −5V h_{FE} = 5 T_c = 100°C		1.00 0.20		μs μs

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

Fig. 1 - 50W flyback converter using the SGS controller TDA4601



1) C limits the maximum collector current of the SGSF425 at overshooting permissible output power.
2) Adjustment of secondary voltage.
3) Must be discharged before IC change.

Fig. 2 - 50W flyback converter using the SGS UC3842 controller

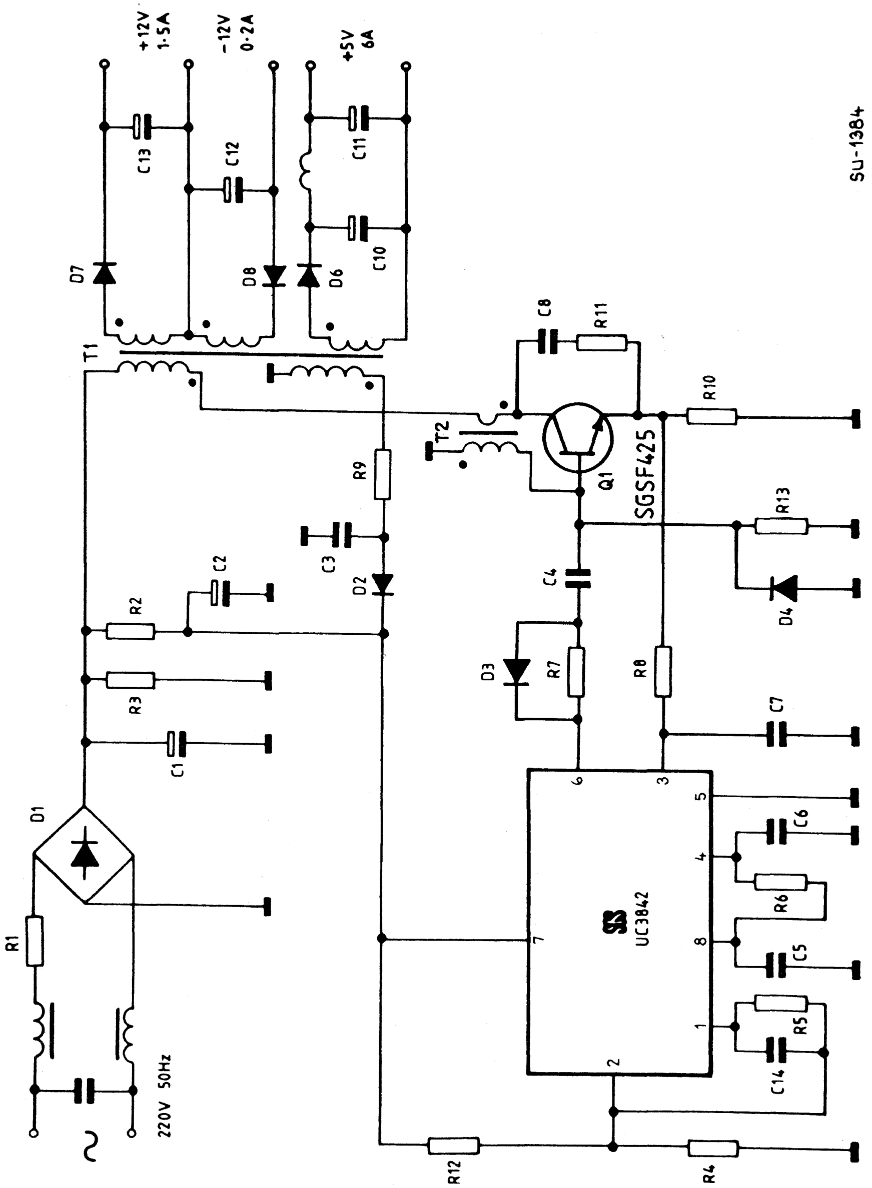
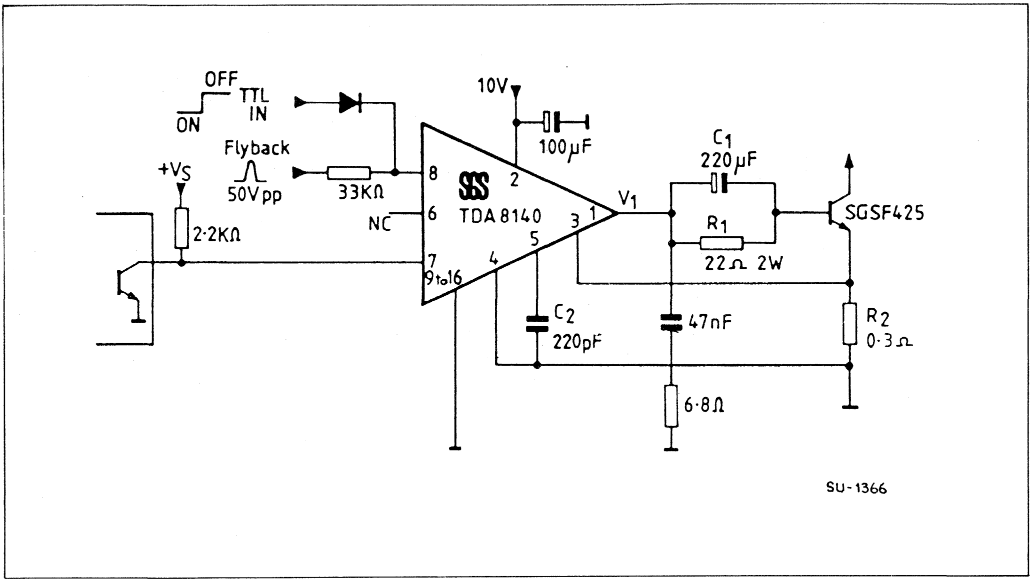


Fig. 3 - Typical colour CRT deflection using the SGS TDA8140



THERMAL RESISTANCE OF THE ISOWATT218

The junction to case thermal resistance of 3.0°C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1mm mica insulating washer, the differences are marginal. The 0.1mm isolating washer gives 1500V to 2000 VDC isolation for the SOT-93 package, SGS guarantee 4000 VDC isolation for the ISOWATT218.
The comparison in fig. 4 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The tests illustrate that the ISOWATT218 has an R_{th} very close to that of a conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package. The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.

Fig. 4

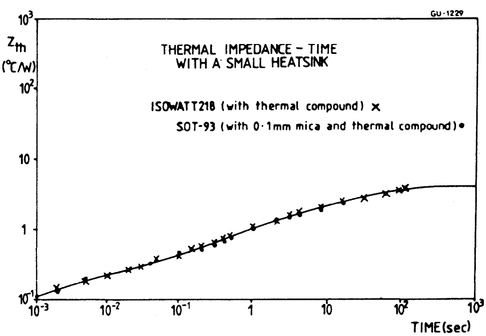


Fig. 5 - Internal schematic diagram

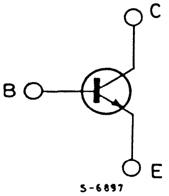
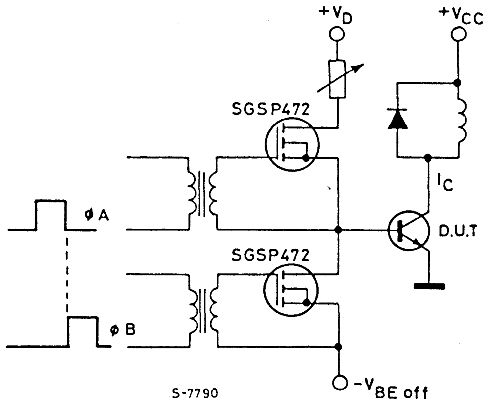


Fig. 6 - Switching times test circuit



V_{CC} = 150V
L = 0.2mH

ϕ_A = pulse width must be adjusted to obtain desired I_C value
ϕ_B = pulse width equal to ϕ_A pulse duration

SGS®

SGSF445
SGSIF445

ADVANCE DATA

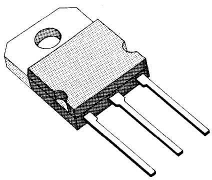
HIGH VOLTAGE NPN TRANSISTORS FOR 240 V OFF-LINE SWITCHING POWER SUPPLIES AND 90° COLOUR CRT DEFLECTION.

- V_{CES} = 1300V: HIGH VOLTAGE RATING FOR DEFLECTION AND SINGLE TRANSISTOR CONVERTER APPLICATIONS.
- UP TO 50KHz OPERATION WITH EASY DRIVE CIRCUITS.
- $I_{C(sat)}$ 3A, h_{FE} = 5: WELL SUITED FOR 110W FLYBACK AND 220W FORWARD CONVERTERS AND 2A, h_{FE} = 7 FOR ECONOMIC LOWER POWER APPLICATIONS.
- VERY FAST SWITCHING SPEED: IDEAL FOR COLOUR TV AND HIGH RESOLUTION MONITORS.
- PACKAGE CHOICE: TWO TYPES SOT-93 (TO-218) AND ISOWATT218

These FASTWITCH transistors are specially designed for 240V, or 110V with input doubler, off-line switching power supply and colour CRT deflection applications. The 1300V rating needed for deflection circuits is also a benefit to forward and flyback converters because costly over voltage snubbers can be avoided.

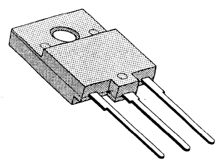
The $I_{C(sat)}$ is 3A with a gain of 5 so these FASTSWITCH transistors can be used in flyback converters up to 110W and forward converters up to 220W. The superior switching performance of FASTSWITCH transistors reduces dissipation and consequently lowers the equipment operating temperature. FASTSWITCH transistors are available in the ISOWATT218 fully isolated package which conforms to the creepage requirements of VDE, IEC and UL specifications.

SGSF445



SOT-93 (TO-218)

SGSIF445



ISOWATT218

ABSOLUTE MAXIMUM RATINGS

<table>
<tr><th></th><th></th><th>SGSF445</th><th>SGSIF445</th><th></th></tr>
<tr><td>V_{CES}</td><td>Collector-emitter voltage (V_{BE} = 0)</td><td colspan="2">1300</td><td>V</td></tr>
<tr><td>V_{CEO}</td><td>Collector-emitter voltage (I_B = 0)</td><td colspan="2">600</td><td>V</td></tr>
<tr><td>V_{EBO}</td><td>Emitter-base voltage (I_C = 0)</td><td colspan="2">7</td><td>V</td></tr>
<tr><td>I_C</td><td>Collector current</td><td colspan="2">7</td><td>A</td></tr>
<tr><td>I_{CM}</td><td>Collector peak current (t_p < 5ms)</td><td colspan="2">12</td><td>A</td></tr>
<tr><td>I_B</td><td>Base current</td><td colspan="2">5</td><td>A</td></tr>
<tr><td>I_{BM}</td><td>Base peak current (t_p < 5ms)</td><td colspan="2">8</td><td>A</td></tr>
<tr><td>P_{tot}</td><td>Total dissipation at T_c < 25°C</td><td>115</td><td>44</td><td>W</td></tr>
<tr><td>T_{stg}</td><td>Storage temperature</td><td colspan="2">−65 to 150</td><td>°C</td></tr>
<tr><td>T_j</td><td>Junction temperature</td><td colspan="2">150</td><td>°C</td></tr>
</table>

This is advanced information on a new product now in development or undergoing evaluation. Details are subject to change without notice.

THERMAL DATA

			SGSF445	SGSIF445	
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max.	1.09	2.84 •	°C/W

• See notes on ISOWATT218 in this datasheet

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

Parameter		Test Condition	Min.	Typ.	Max.	Unit.
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = 1300V			200	μA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 380V V_{CE} = 600V			200 2	μA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 6V			1	mA
$V_{CEO(sus)}$*	Collector emitter sustaining voltage	I_C = 0.1A	600			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 3A I_B = 0.6A I_C = 2A I_B = 0.3A			1.5 1.5	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 3A I_B = 0.6A I_C = 2A I_B = 0.3A			1.5 1.5	V V

RESISTIVE LOAD

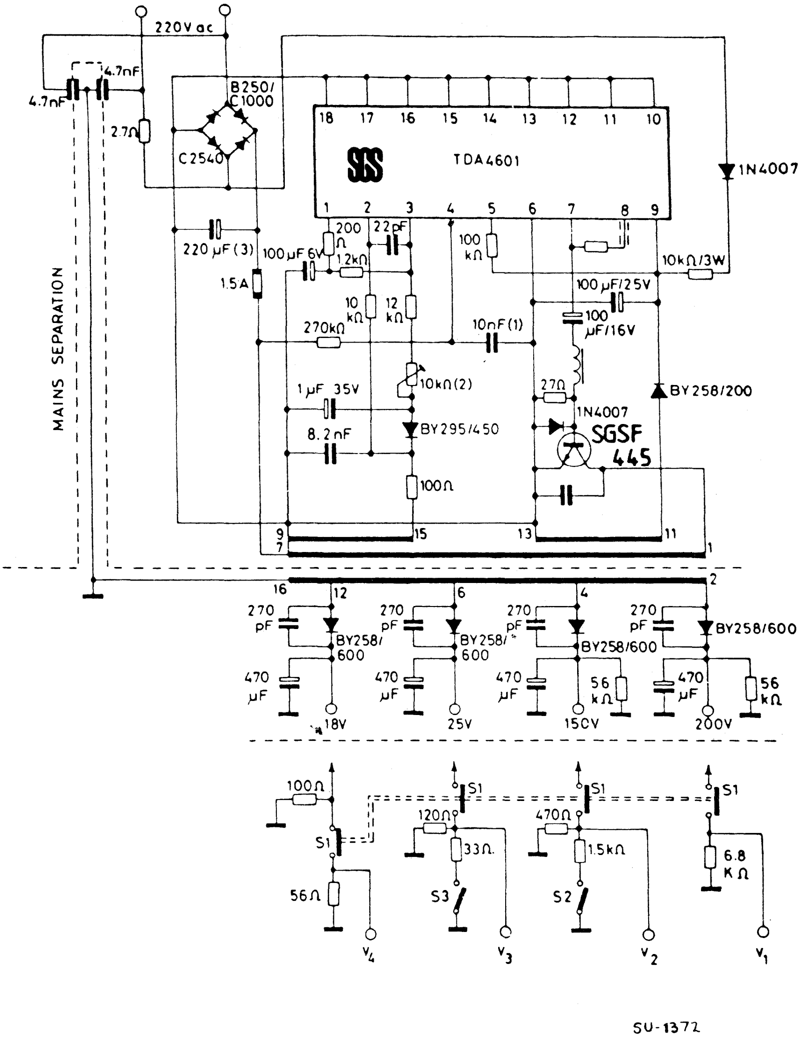
t_{on} t_s t_f	Turn-on time Storage time Fall time	I_C = 3A V_{CC} = 250V I_{B1} = 0.6A I_{B2} = 0.6A		0.42 2.40 0.29		μs μs μs
t_{on} t_s t_f	Turn-on time Storage time Fall time	I_C = 3A V_{CC} = 250V I_{B1} = 0.6A I_{B2} = 1.2A		0.42 1.45 0.15		μs μs μs

INDUCTIVE LOAD

t_s t_f	Storage time Fall time	I_C = 3A V_{CL} = 200V L = 200μH $V_{BE(off)}$ = −5V h_{FE} = 5 T_c = 25°C		1.00 0.07		μs μs
t_s t_f	Storage time Fall time	I_C = 3A V_{CL} = 200V L = 200μH $V_{BE(off)}$ = −5V h_{FE} = 5 T_c = 100°C		1.00 0.11		μs μs

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

Fig. 1 - 100W flyback converter using the SGS controller TDA4601



1) C limits the maximum collector current of the SGSF445 at overshooting permissible output power.
2) Adjustment of secondary voltage.
3) Must be discharged before IC change.

Fig. 2 – 125W flyback converter using the SGS TDA8130 controller

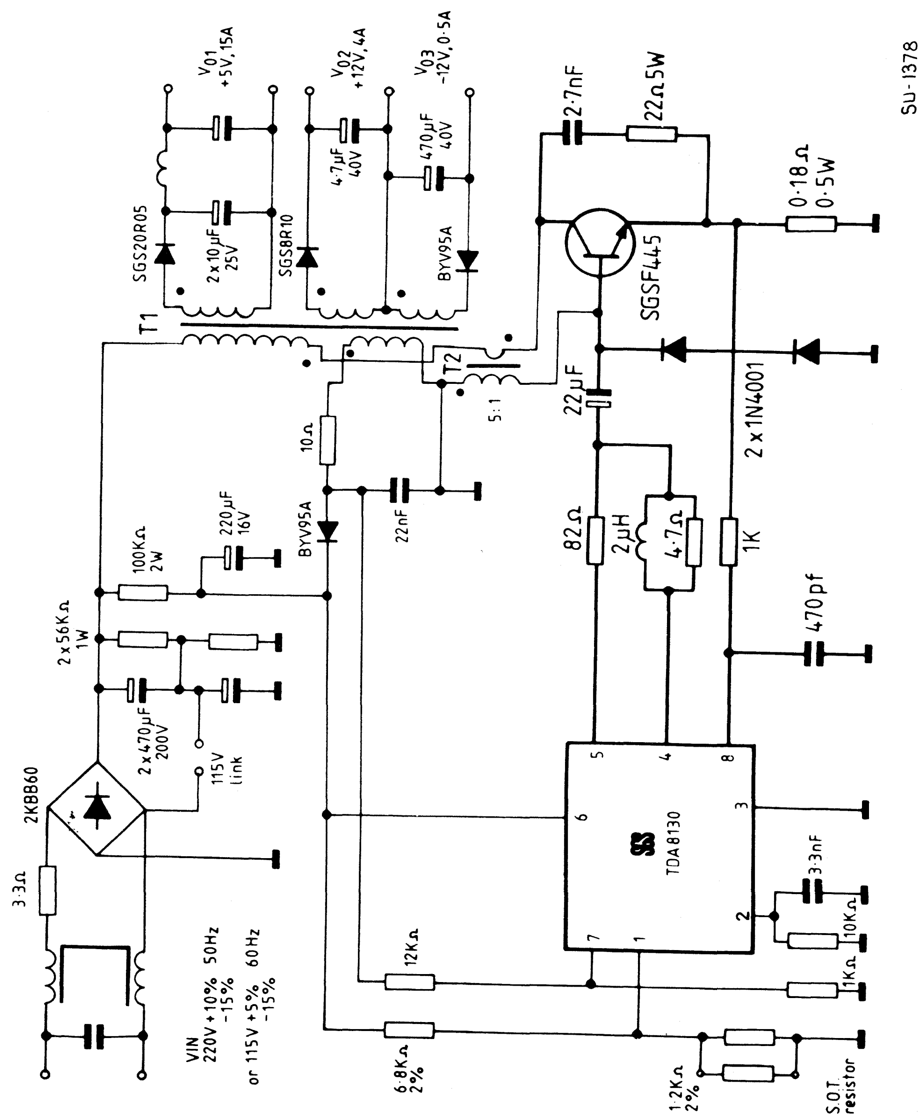
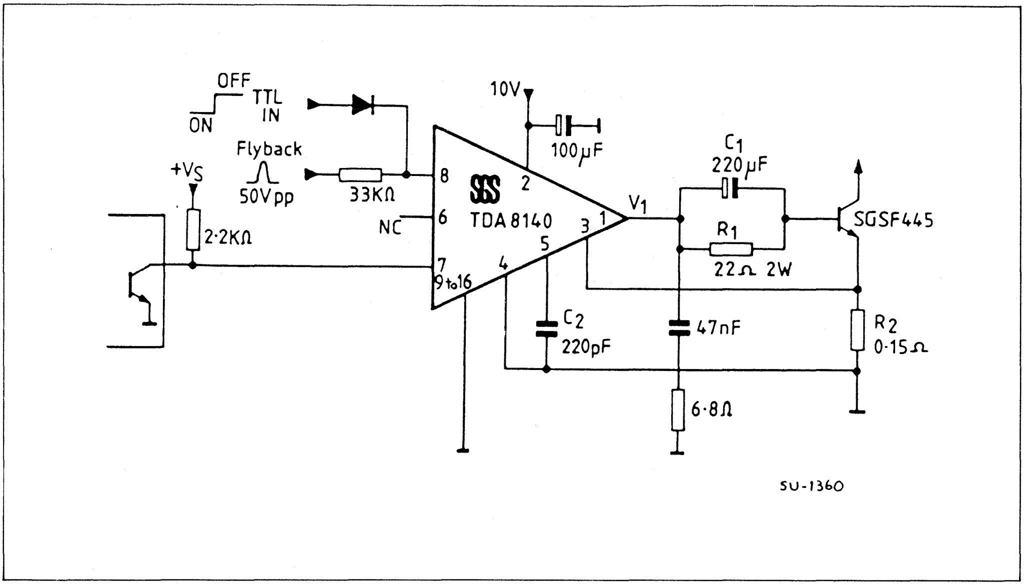


Fig. 3 - Typical colour CRT deflection using the SGS TDA8140



THERMAL RESISTANCE OF THE ISOWATT218

The junction to case thermal resistance of 2.84°C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1mm mica insulating washer, the differences are marginal. The 0.1mm isolating washer gives 1500V to 2000 VDC isolation for the SOT-93 package, SGS guarantee 4000 VDC isolation for the ISOWATT218.
The comparison in fig. 4 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The tests illustrate that the ISOWATT218 has an R_{th} very close to that of a conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package. The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.

Fig. 4

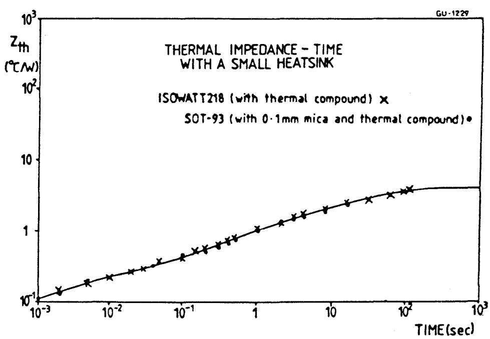


Fig. 5 - Reverse bias safe operating area

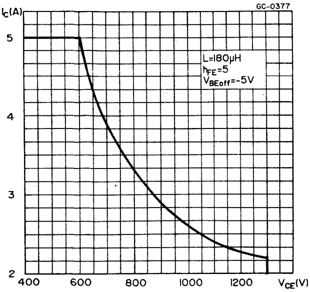


Fig. 6 - Collector-emitter saturation voltage vs. base current

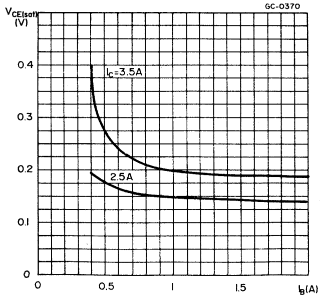


Fig. 7 - Base-emitter saturation voltage vs. base current

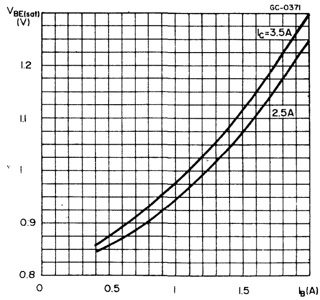


Fig. 8 - Collector-emitter saturation voltage

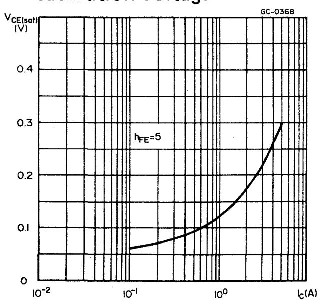


Fig. 9 - Base-emitter saturation voltage

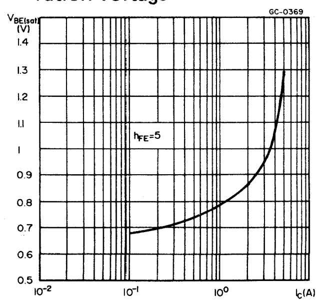


Fig. 10 - DC current gain

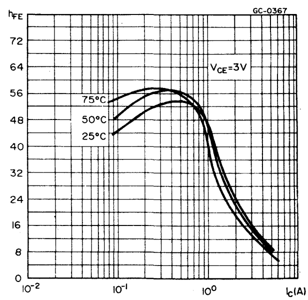


Fig. 11 - Resistive load switching times

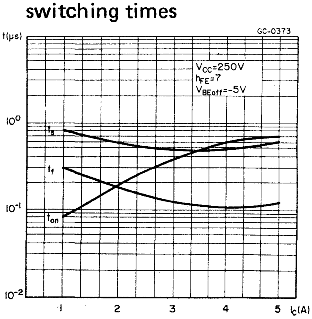


Fig. 12 - Resistive load switching times

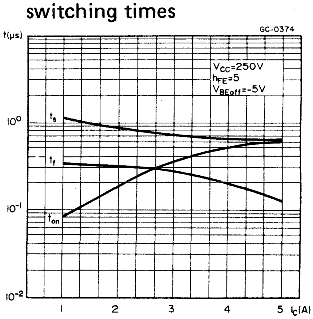


Fig. 13 - Inductive load switching times

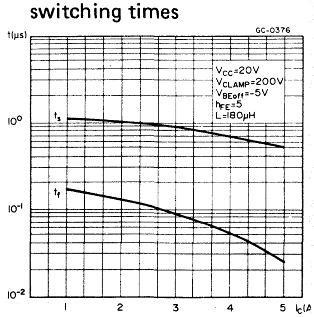


Fig. 14 - Inductive load switching times

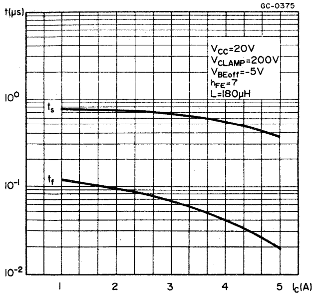


Fig. 15 - Internal schematic diagram

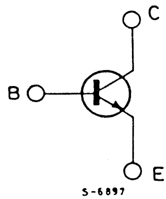
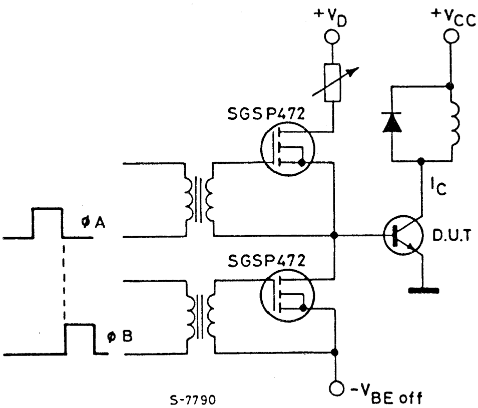


Fig. 16 - Switching times test circuit



V_{CC}= 150V
L = 0.2mH

ϕ_A = pulse width must be adjusted to obtain desired I_C value
ϕ_B = pulse width equal to ϕ_A pulse duration

SGSF461
SGSIF461
SGSF561

ADVANCE DATA

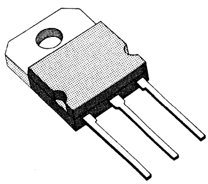
HIGH SWITCHING SPEED NPN TRANSISTORS FOR 240V OFF-LINE SWITCHING POWER SUPPLIES.

- V_{CEO} = 400V: VOLTAGE RATING TO SUIT HALF AND FULL BRIDGE CONVERTER APPLICATIONS
- UP TO 70KHz OPERATION WITH EASY DRIVE CIRCUITS
- $I_{C(sat)}$ 10A, h_{FE} = 5; WELL SUITED FOR 750W HALF BRIDGE AND 1500W FULL BRIDGE CONVERTERS, AND 5.5A, h_{FE} = 6.5A FOR ECONOMIC LOWER POWER APPLICATIONS
- LOW DYNAMIC SATURATION MINIMIZES LOSSES IN HALF AND FULL BRIDGE CONVERTERS
- PACKAGE CHOICE: THREE TYPES INCLUDING ISOWATT218 TO SUIT EVERY APPLICATION

These FASTWITCH transistors are specially designed for 240V, or 110V with input doubler, off-line switching power supply applications. FASTSWITCH transistors can operate up to 70KHz with easy drive circuits which helps to simplify designs and improve reliability, the superior switching performance of FASTSWITCH transistors reduces dissipation and consequently lowers the equipment operating temperature.

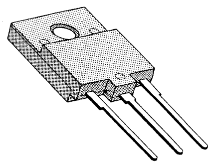
The $I_{C(sat)}$ is 10A with a gain of 5 so these FASTSWITCH transistors can be used in half bridge designs up to 750W and full bridge converters up to 1500W. FASTSWITCH transistors are available in the ISOWATT218 fully isolated package which conforms to the creepage distance and isolation requirements of VDE, IEC, and UL specifications.

SGSF461



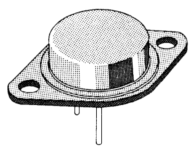
SOT-93 (TO-218)

SGSIF461



ISOWATT218

SGSF561



TO-3

ABSOLUTE MAXIMUM RATINGS

		SGSF461	SGSIF461	SGSF561	
V_{CES}	Collector-emitter voltage (V_{BE} = 0)		700		V
V_{CEO}	Collector-emitter voltage (I_B = 0)		400		V
V_{EBO}	Emitter-base voltage (I_C = 0)		7		V
I_C	Collector current		15		A
I_{CM}	Collector peak current (t_p < 5ms)		25		A
I_B	Base current		8		A
I_{BM}	Base peak current (t_p < 5ms)		15		A
P_{tot}	Total dissipation at T_c < 25°C	165	50	140	W
T_{stg}	Storage temperature—65 to	150	150	175	°C
T_j	Junction temperature	150	150	175	°C

This is advanced information on a new product now in development or undergoing evaluation. Details are subject to change without notice.

THERMAL DATA

			SGSF461	SGSIF461	SGSF561	
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max.	0.76	2.5•	1.07	°C/W

• See notes on ISOWATT218 in this datasheet

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

Parameter		Test Condition	Min.	Typ.	Max.	Unit.
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = 700V			200	μA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 380V V_{CE} = 400V			200 2	μA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 6V			1	mA
$V_{CEO(sus)}$*	Collector emitter sustaining voltage	I_C = 0.1A	400			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 10A I_B = 2A I_C = 5.5A I_B = 0.8A			1.5 1.5	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 10A I_B = 2A I_C = 5.5A I_B = 0.8A			1.5 1.5	V V

RESISTIVE LOAD

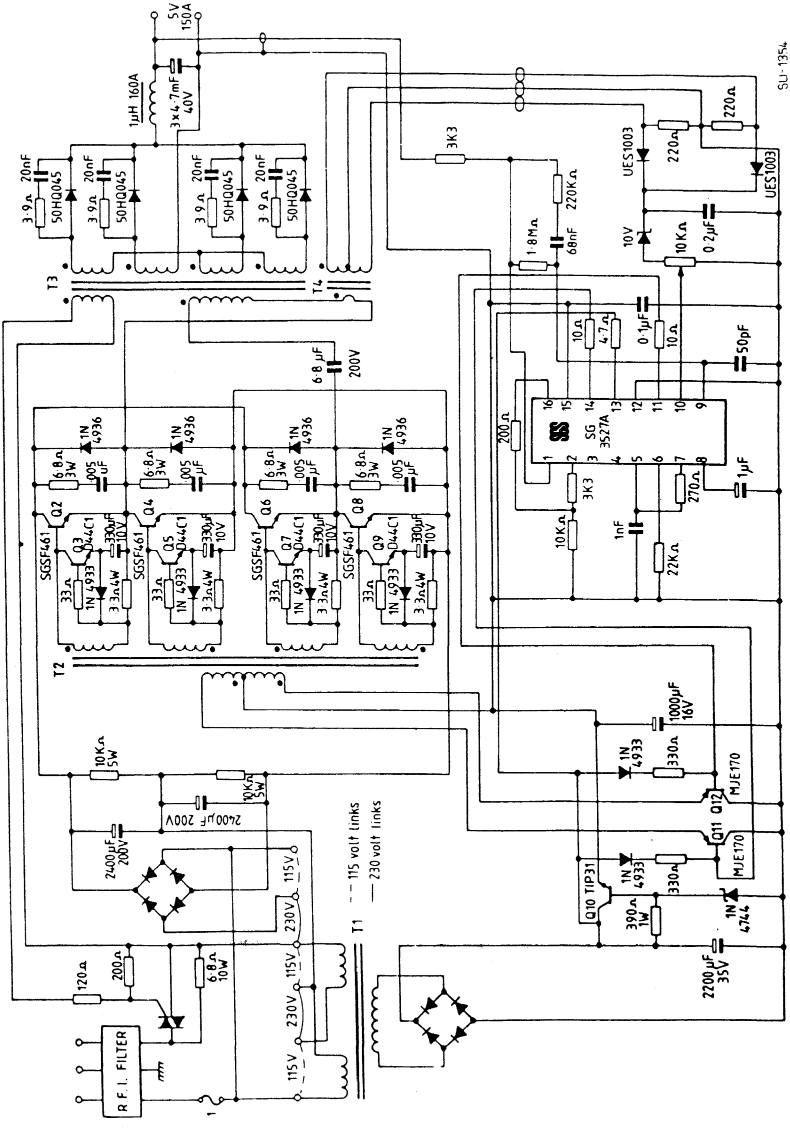
t_{on} t_s t_f	Turn-on time Storage time Fall time	I_C = 10A V_{CC} = 150V I_{B1} = 2A I_{B2} = 2A		0.6 1.1 0.25	1.0 2.2 0.5	μs μs μs
t_{on} t_s t_f	Turn-on time Storage time Fall time	I_C = 10A V_{CC} = 150V I_{B1} = 2A I_{B2} = 4A		0.50 1.0 0.15	1.0 2.0 0.30	μs μs μs

INDUCTIVE LOAD

t_s t_f	Storage time Fall time	I_C = 10A V_{CC} = 150V L = 200 μH $V_{BE(off)}$ = −5V h_{FE} = 5 T_c = 25°C		0.7 0.04	1.2 0.1	μs μs
t_s t_f	Storage time Fall time	I_C = 10A V_{CC} = 150V L = 200μH $V_{BE(off)}$ = −5V h_{FE} = 5 T_c = 100°C		0.9 0.08	1.5 0.2	μs μs

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

Fig. 1 - 750W full bridge converter using the SGS control circuit SGS control circuit SG3527A



THERMAL RESISTANCE OF THE ISOWATT218

The junction to case thermal resistance of 2.5°C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1mm mica insulating washer, the differences are marginal. The 0.1 mm isolating washer gives 1500V to 2000 VDC isolation for the SOT-93 package, SGS guarantee 4000 VDC isolation for the ISOWATT 218.

The comparison in fig. 2 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The tests illustrate that the ISOWATT218 has an R_{th} very close to that of a conventional SOT-93 (SOT-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package. The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.

Fig. 2

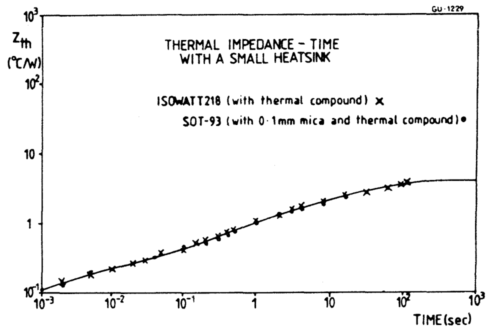


Fig. 3 - Base-emitter saturation voltage

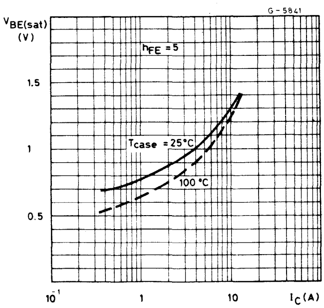


Fig. 4 - Collector current spread vs. base emitter voltage

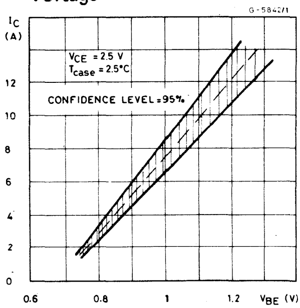


Fig. 5 - Reverse bias safe operating area

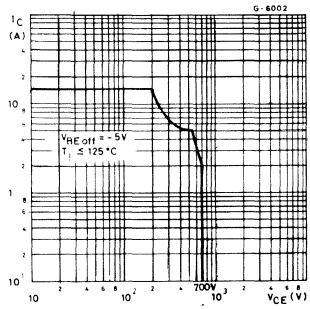


Fig. 6 - Resistive load switching times

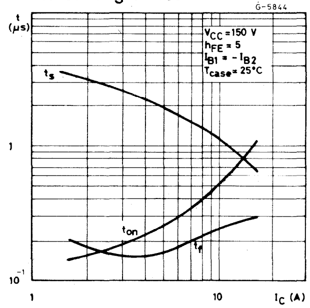


Fig. 7 - DC current gain

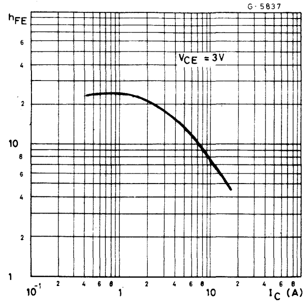


Fig. 8 - DC current gain

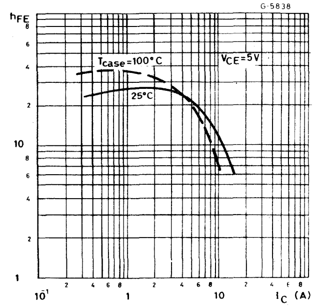


Fig. 9 - Collector-emitter saturation voltage

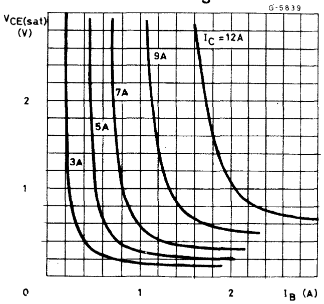


Fig. 10 - Collector-emitter saturation voltage

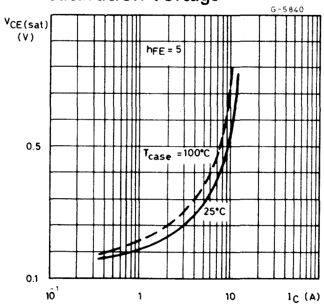


Fig. 11 - Inductive load switching times

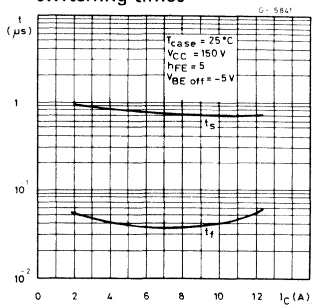


Fig. 12 - Switching times percentage variation vs. case temperature

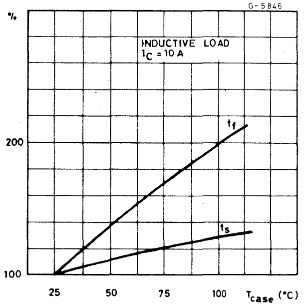


Fig. 13 - $V_{CE(sat)}$ dynamic

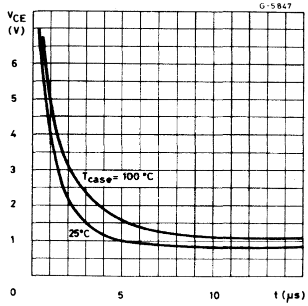


Fig. 14 - Capacitance

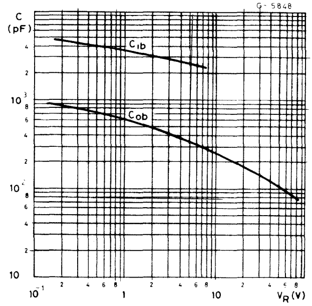


Fig. 15 - Internal schematic diagram

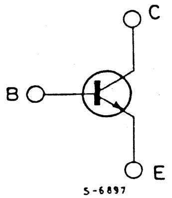
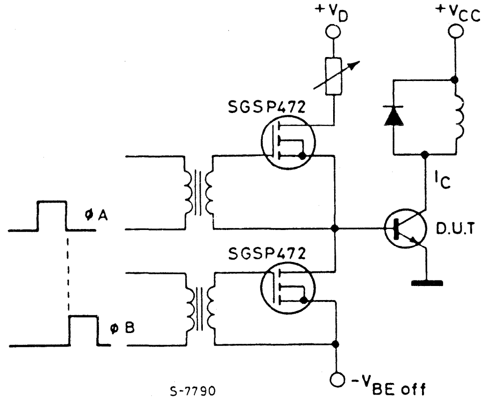


Fig. 16 - Switching times test circuit



V_{CC} = 150V
L = 0.2mH

ϕ_A = pulse width must be adjusted to obtain desired I_C value
ϕ_B = pulse width equal to ϕ_A pulse duration

SGSF462
SGSIF462
SGSF562

ADVANCE DATA

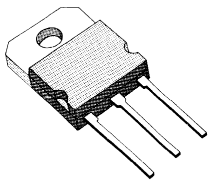
HIGH VOLTAGE NPN TRANSISTORS FOR 240 V OFF-LINE SWITCHING POWER SUPPLIES.

- V_{CES} = 850V: HIGH VOLTAGE RATING FOR SINGLE TRANSISTOR APPLICATIONS WITH PEAK VOLTAGE LIMITING.
- UP TO 70KHz OPERATION WITH EASY DRIVE CIRCUITS.
- $I_{C(sat)}$ 8.5A, h_{FE} = 5: WELL SUITED FOR 325W FLYBACK AND 650W FORWARD CONVERTERS OR 5A, h_{FE} = 7 FOR LOWER POWER APPLICATIONS.
- LOW DYNAMIC SATURATION MINIMIZES LOSSES IN FORWARD CONVERTERS.
- PACKAGE CHOICE: THREE TYPES INCLUDING ISOWATT218 TO SUIT EVERY APPLICATION.

These FASTWITCH transistors are specially designed for 240V, or 110V with input doubler, off-line switching power supply applications where the normal high voltage peaks associated with single transistor converters are limited by a transformer clamp winding or overvoltage snubbing.

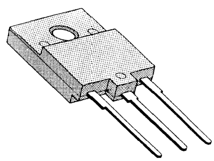
The $I_{C(sat)}$ is 8.5A with a gain of 5 so these FASTSWITCH transistors can be used in flyback converters up to 325W and forward converters up to 650W. The superior switching performance of FASTSWITCH transistors reduces dissipation and consequently lowers the equipment operating temperature. FASTSWITCH transistors are available in the ISOWATT218 fully isolated package which conforms to the creepage distance and isolation requirements of VDE, IEC, and UL specifications.

SGSF462



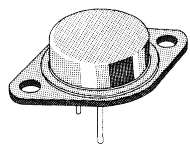
SOT-93 (TO-218)

SGSIF462



ISOWATT218

SGSF562



TO-3

ABSOLUTE MAXIMUM RATINGS

		SGSF462	SGSIF462	SGSF562	
V_{CES}	Collector-emitter voltage (V_{BE} = 0)		850		V
V_{CEO}	Collector-emitter voltage (I_B = 0)		450		V
V_{EBO}	Emitter-base voltage (I_C = 0)		7		V
I_C	Collector current		12		A
I_{CM}	Collector peak current (t_p < 5ms)		20		A
I_B	Base current		7		A
I_{BM}	Base peak current (t_p < 5ms)		12		A
P_{tot}	Total dissipation at T_c < 25°C	165	50	140	W
T_{stg}	Storage temperature −65 to	150	150	175	°C
T_j	Junction temperature	150	150	175	°C

This is advanced information on a new product now in development or undergoing evaluation. Details are subject to change without notice.

THERMAL DATA

			SGSF462	SGSIF462	SGSF562
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max.	0.76	2.5 •	1.07 °C/W

• See notes on ISOWATT218 in this datasheet

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

Parameter		Test Condition	Min.	Typ.	Max.	Unit.
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = 850V			200	μA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 380V V_{CE} = 450V			200 2	μA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 6V			1	mA
$V_{CEO(sus)}$ *	Collector emitter sustaining voltage	I_C = 0.1A	450			V
$V_{CE(sat)}$ *	Collector-emitter saturation voltage	I_C = 8.5A I_B = 1.7A I_C = 5A I_B = 0.7A			1.5 1.5	V V
$V_{BE(sat)}$ *	Base-emitter saturation voltage	I_C = 8.5A I_B = 1.7A I_C = 5A I_B = 0.7A			1.5 1.5	V V

RESISTIVE LOAD

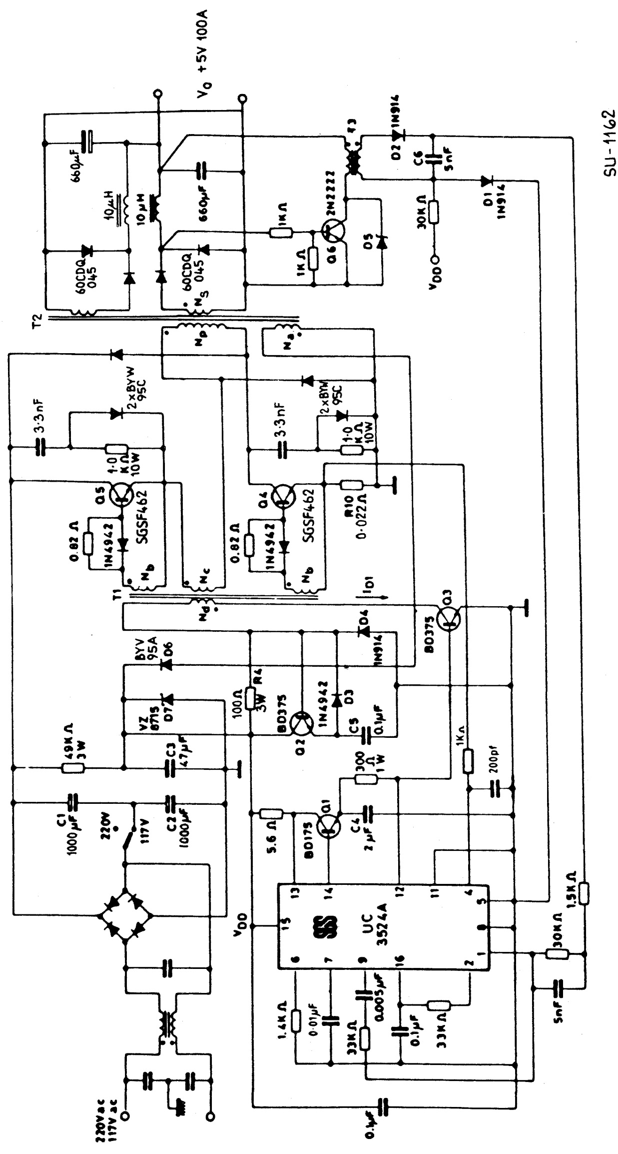
t_{on} t_s t_f	Turn-on time Storage time Fall time	I_C = 8.5A V_{CC} = 275V I_{B1} = 1.7A I_{B2} = 1.7A		0.6 1.1 0.25	1.0 2.2 0.5	μs μs μs
t_{on} t_s t_f	Turn-on time Storage time Fall time	I_C = 8.5A V_{CC} = 275V I_{B1} = 1.7A I_{B2} = 3.4A		0.5 1.0 0.15	1.0 2.0 0.3	μs μs μs

INDUCTIVE LOAD

t_s t_f	Storage time Fall time	I_C=8.5A V_{CC} = 250V L = 200 μH $V_{BE(off)}$ = −5V h_{FE} = 5 T_c = 25°C		0.7 0.04	1.2 0.1	μs μs
t_s t_f	Storage time Fall time	I_C = 8.5A V_{CC} = 250V L = 200μH $V_{BE(off)}$ = −5V h_{FE} = 5 T_c = 100°C		0.9 0.08	1.5 0.2	μs μs

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

Fig. 1 – Two transistor forward converter using the SGS controller circuit UC3524A



THERMAL RESISTANCE OF THE ISOWATT218

The junction to case thermal resistance of 2.5°C/W for the ISOWATT218 package may seem quite high at first glance, but if compared to a conventional SOT-93 (TO-218) package with a 0.1mm mica insulating washer, the differences are marginal. The 0.1mm isolating washer gives 1500V to 2000 VDC isolation for the SOT-93 package, SGS guarantee 4000 VDC isolation for the ISOWATT218.
The comparison in fig. 2 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The tests illustrate that the ISOWATT218 has an R_{th} very close to that of a conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package. The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.

Fig. 2

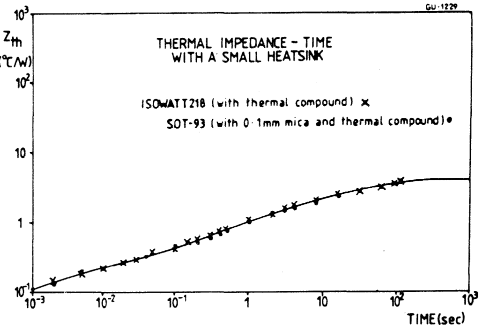


Fig. 3 - Base-emitter saturation voltage

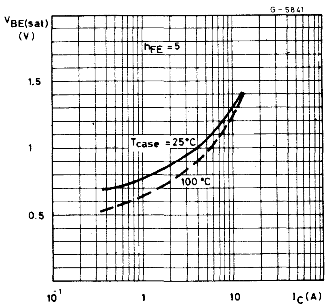


Fig. 4 - Collector current spread vs. base emitter voltage

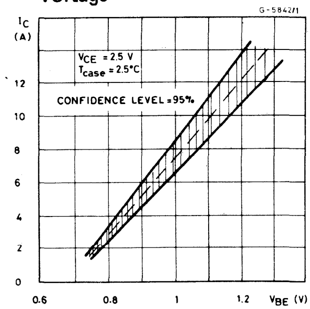


Fig. 5 - Reverse bias safe operating area

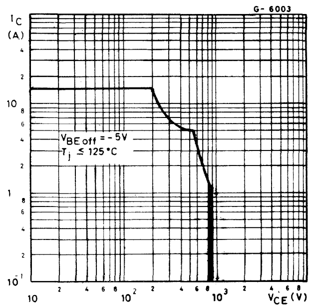


Fig. 6 - Resistive load switching times

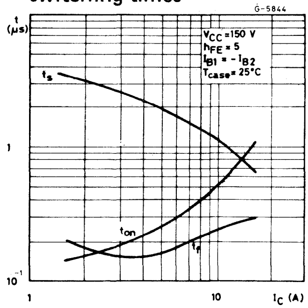


Fig. 7 - DC current gain

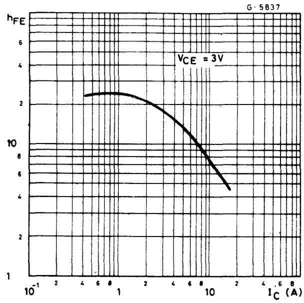


Fig. 8 - DC current gain

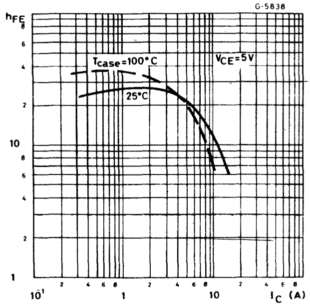


Fig. 9 - Collector-emitter saturation voltage

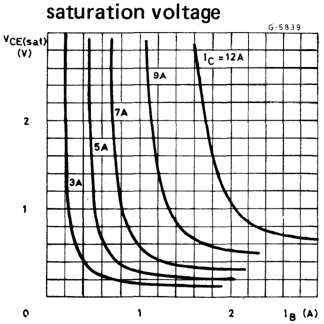


Fig. 10 - Collector-emitter saturation voltage

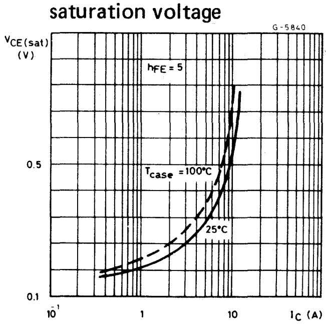


Fig. 11 - Inductive load switching times

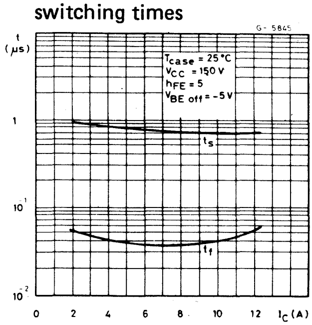


Fig. 12 - Switching times percentage variation vs. case temperature

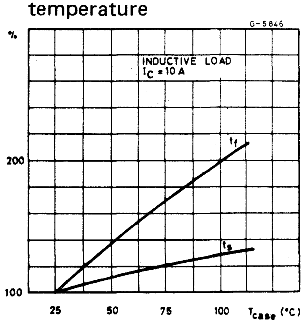


Fig. 13 - $V_{CE(sat)}$ dynamic

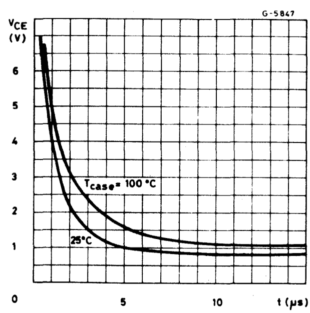


Fig. 14 - Capacitance

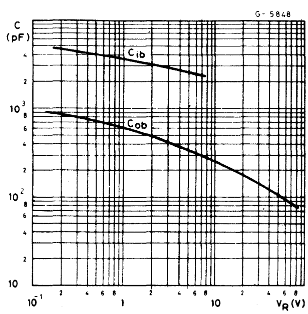


Fig. 15 - Internal schematic diagram

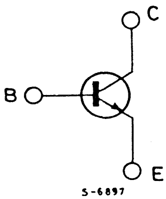
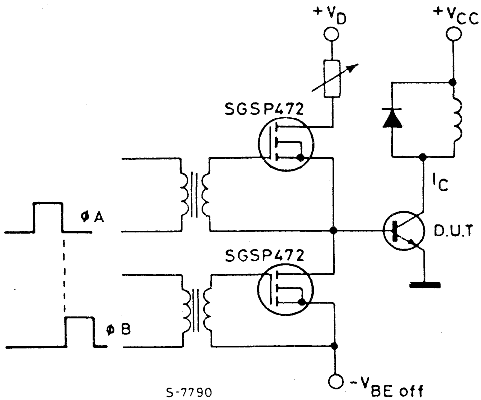


Fig. 16 - Switching times test circuit



V_{CC} = 150V
L = 0.2mH

ϕ_A = pulse width must be adjusted to obtain desired I_C value
ϕ_B = pulse width equal to ϕ_A pulse duration

SGSF463
SGSIF463
SGSF563

ADVANCE DATA

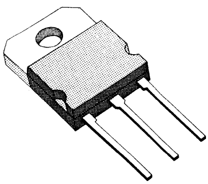
HIGH VOLTAGE NPN TRANSISTORS FOR 240 V OFF-LINE SWITCHING POWER SUPPLIES.

- V_{CES} = 1000V: HIGH VOLTAGE RATING FOR SINGLE TRANSISTOR FLYBACK AND FORWARD CONVERTER APPLICATIONS.
- UP TO 70KHz OPERATION WITH EASY DRIVE CIRCUITS.
- $I_{C(sat)}$ 7A, h_{FE} = 5: WELL SUITED FOR HIGH POWER FLYBACK AND FORWARD CONVERTERS OR 4A, h_{FE} = 6.5 FOR LOWER POWER APPLICATIONS.
- LOW DYNAMIC SATURATION WHICH MINIMEZES LOSSES IN FORWARD CONVERTERS.
- PACKAGE CHOICE: THREE TYPES INCLUDING ISOWATT218 TO SUIT EVERY APPLICATION.

These FASTWITCH transistors are specially designed for 240V, or 110V with input doubler, off-line switching power supply applications. The 1000V blocking voltage allows these FASTSWITCH transistors to be used in single transistor converters without an expensive overvoltage snubbing network.

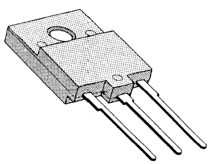
The $I_{C(sat)}$ is 7A with a gain of 5 so these FASTSWITCH transistors can be used in high power flyback and forward converter applications. The superior switching performance of FASTSWITCH transistors reduces dissipation and consequently lowers the equipment operating temperature. FASTSWITCH transistors are available in the ISOWATT218 fully isolated package which conforms to the creepage distance and isolation requirements of VDE, IEC, and UL specifications.

SGSF463



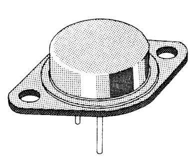
SOT-93 (TO-218)

SGSIF463



ISOWATT218

SGSF563



TO-3

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	SGSF463	SGSIF463	SGSF563	Unit
V_{CES}	Collector-emitter voltage (V_{BE} = 0)		1000		V
V_{CEO}	Collector-emitter voltage (I_B = 0)		450		V
V_{EBO}	Emitter-base voltage (I_C = 0)		7		V
I_C	Collector current		12		A
I_{CM}	Collector peak current (t_p < 5ms)		20		A
I_B	Base current		7		A
I_{BM}	Base peak current (t_p < 5ms)		12		A
P_{tot}	Total dissipation at T_c < 25°C	165	50	140	W
T_{stg}	Storage temperature −65 to	150	150	175	°C
T_j	Junction temperature	150	150	175	°C

This is advanced information on a new product now in development or undergoing evaluation. Details are subject to change without notice.

THERMAL DATA

			SGSF463	SGSIF463	SGSF563	
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max.	0.76	2.5•	1.07	°C/W

• See notes on ISOWATT218 in this datasheet.

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

Parameter		Test Condition	Min.	Typ.	Max.	Unit.
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = 1000V			200	µA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 380V V_{CE} = 450V			200 2	µA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 6V			1	mA
$V_{CEO(sus)}$*	Collector emitter sustaining voltage	I_C = 0.1A	450			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 7.0A I_B = 1.4A I_C = 4.0A I_B = 0.6A			1.5 1.5	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 7.0A I_B = 1.4A I_C = 4.0A I_B = 0.6A			1.5 1.5	V V

RESISTIVE LOAD

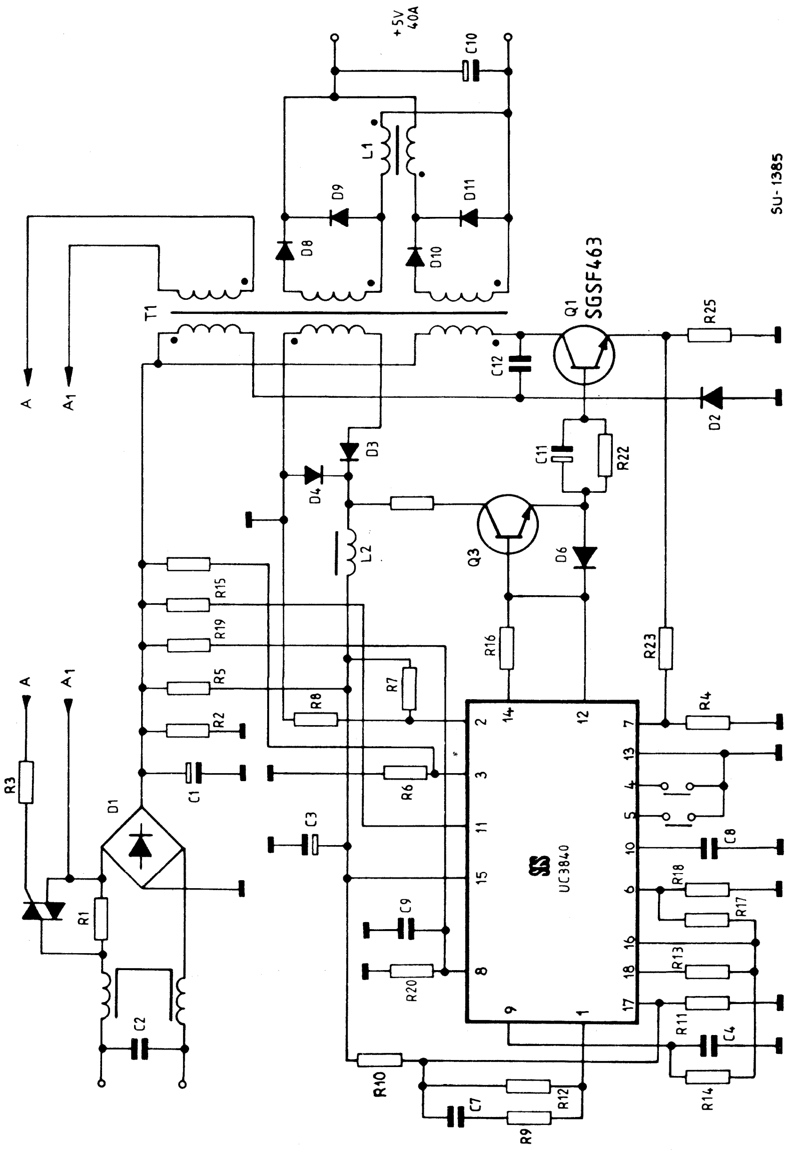
t_{on} t_s t_f	Turn-on time Storage time Fall time	I_C = 7.0A V_{CC} = 275V I_{B1} = 1.4A I_{B2} = 1.4A		0.66 1.21 0.28	1.1 2.41 0.55	µs µs µs
t_{on} t_s t_f	Turn-on time Storage time Fall time	I_C = 7.0A V_{CC} = 275V I_{B1} = 1.4A I_{B2} = 2.8A		0.55 1.1 0.18	1.1 2.2 0.33	µs µs µs

INDUCTIVE LOAD

t_s t_f	Storage time Fall time	I_C = 7.0A V_{CC} = 250V L = 200 µH $V_{BE(off)}$ = −5V h_{FE} = 5 T_c = 25°C		0.77 0.05	1.32 0.11	µs µs
t_s t_f	Storage time Fall time	I_C = 7.0A V_{CC} = 250V L = 200µH $V_{BE(off)}$ = −5V h_{FE} = 5 T_c = 100°C		0.99 0.09	1.65 0.22	µs µs

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

Fig. 1 - 200W forward converter using the SGS controller UC3840



ΓHERMAL RESISTANCE OF THE SOWATT218

Γhe junction to case thermal resistance of 2.5°C/W or the ISOWATT218 package may seem quite ligh at first glance, but if compared to a conven-ional SOT-93 (TO-218) package with a 0.1mm nica insulating washer, the differences are mar-jinal. The 0.1mm isolating washer gives 1500V o 2000 VDC isolation for the SOT-93 package, ;GS guarantee 4000 VDC isolation for the SOWATT218.

Γhe comparison in fig. 2 shows the dynamic :hermal resistance of both devices mounted ısing a thermal compound. The tests illustrate :hat the ISOWATT218 has an R_{th} very close to :hat of a conventional SOT-93 (TO-218) and ıny small increase is more than compensated for ›y the convenience of the ISOWATT218 package.

The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.

Fig. 2

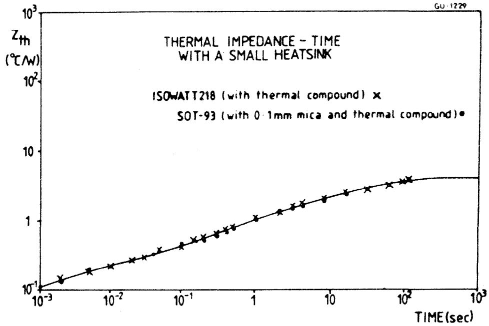


Fig. 3 - Base-emitter saturation voltage

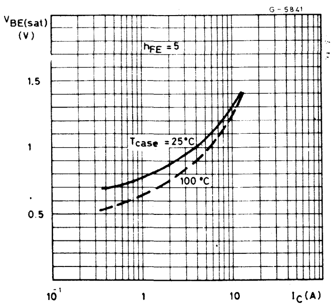


Fig. 4 - Collector current spread vs. base emitter voltage

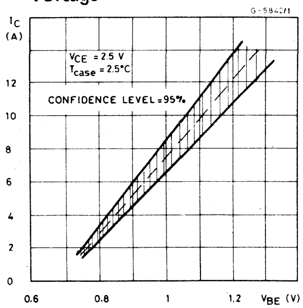


Fig. 5 - Reverse bias safe operating area

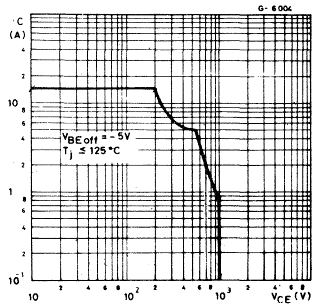


Fig. 6 - Resistive load switching times

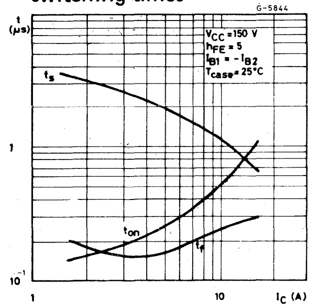


Fig. 7 - DC current gain

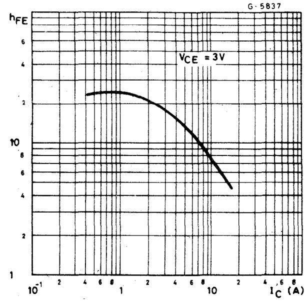


Fig. 8 - DC current gain

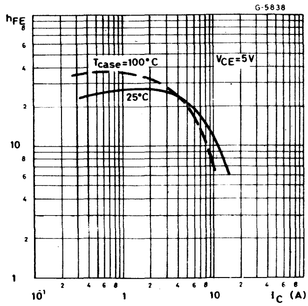


Fig. 9 - Collector-emitter saturation voltage

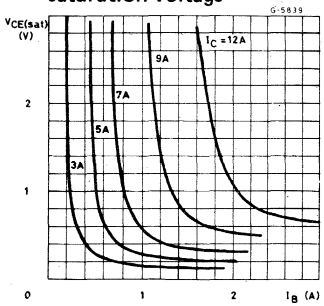


Fig. 10 - Collector-emitter saturation voltage

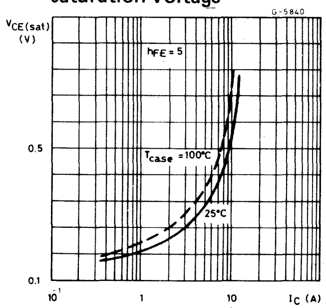


Fig. 11 - Inductive load switching times

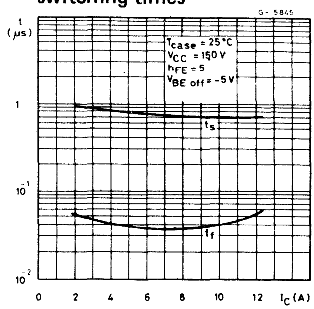


Fig. 12 - Switching times percentage variation vs. case temperature

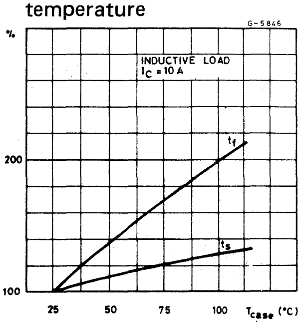


Fig. 13 - $V_{CE(sat)}$ dynamic

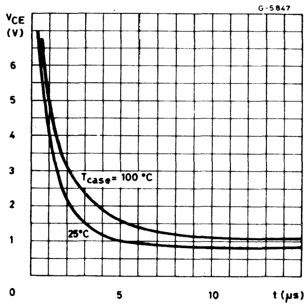


Fig. 14 - Capacitance

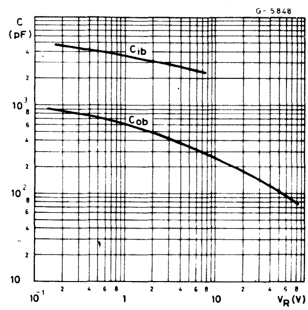


Fig. 15 - Internal schematic diagram

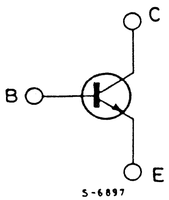
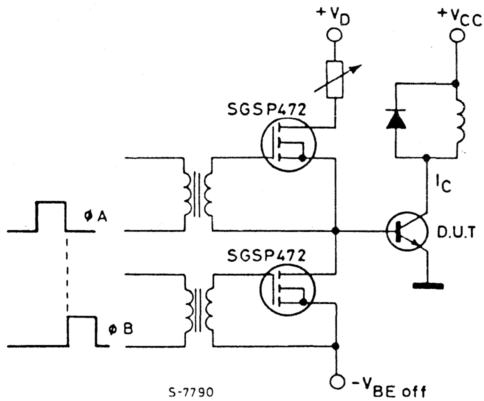


Fig. 16 - Switching times test circuit



V_{CC} = 150V
L = 0.2mH

ϕ_A = pulse width must be adjusted to obtain desired I_C value
ϕ_B = pulse width equal to ϕ_A pulse duration

SGSF464
SGSIF464
SGSF564

ADVANCE DATA

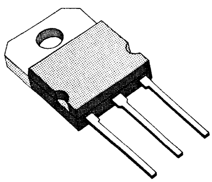
HIGH VOLTAGE NPN TRANSISTORS FOR 240 V OFF-LINE SWITCHING POWER SUPPLIES AND 90° COLOUR CRT DEFLECTION.

- V_{CES} = 1200V: HIGH VOLTAGE RATING FOR DEFLECTION AND SINGLE TRANSISTOR CONVERTER APPLICATIONS.
- UP TO 50KHz OPERATION WITH EASY DRIVE CIRCUITS.
- $I_{C(sat)}$ 6A, h_{FE} = 5: WELL SUITED FOR 225W FLYBACK AND 450W FORWARD CONVERTERS AND 3.5A, h_{FE} = 7 FOR LOWER POWER APPLICATIONS.
- LOW DYNAMIC SATURATION MINIMIZES LOSSES IN FORWARD CONVERTERS.
- PACKAGE CHOICE: THREE TYPES INCLUDING ISOWATT218 TO SUIT EVERY APPLICATION.

These FASTSWITCH transistor are specially designed for 240V, or 110V with input doubler, off-line switching power supply and colour CRT deflection applications. The 1200V rating needed for deflection circuits is also a benefit to forward and flyback converters because costly over voltage snubbers can be omitted.

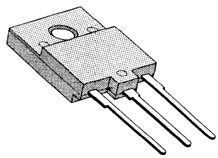
The $I_{C(sat)}$ is 6A with a gain of 5 so these FASTSWITCH transistors can be used in flyback converters up to 225W and forward converters up to 450W. The superior switching performance of FASTSWITCH transistors reduces dissipation and consequently lowers the equipment operating temperature. FASTSWITCH transistors are available in the ISOWATT218 fully isolated package which conforms to the creepage distance and isolation requirements of VDE, IEC and UL specifications.

SGSF464



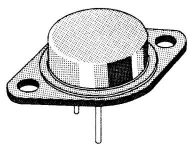
SOT-93 (TO-218)

SGSF464



ISOWATT218

SGSF564



TO-3

ABSOLUTE MAXIMUM RATINGS

		SGSF464	SGSIF464	SGSF564	
V_{CES}	Collector-emitter voltage (V_{BE} = 0)		1200		V
V_{CEO}	Collector-emitter voltage (I_B = 0)		600		V
V_{EBO}	Emitter-base voltage (I_C = 0)		7		V
I_C	Collector current		10		A
I_{CM}	Collector peak current (t_p < 5ms)		15		A
I_B	Base current		7		A
I_{BM}	Base peak current (t_p < 5ms)		12		A
P_{tot}	Total dissipation at T_c < 25°C	165	50	140	W
T_{stg}	Storage temperature −65 to	150	150	175	°C
T_j	Junction temperature	150	150	175	°C

This is advanced information on a new product now in development or undergoing evaluation. Details are subject to change without notice.

THERMAL DATA

			SGSF464	SGSF464	SGSF564	
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max.	0.76	2.5*	1.07	°C/W

*See notes on ISOWATT 218 in this datasheet

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

Parameter		Test Condition	Min.	Typ.	Max.	Unit.
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = 1200V			200	μA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 380V V_{CE} = 600V			200 2	μA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 6V			1	mA
$V_{CEO(sus)}$*	Collector emitter sustaining voltage	I_C = 0.1A	600			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 6A I_B = 1.2A I_C = 3.5A I_B = 0.5A			1.5 1.5	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 6A I_B = 1.2A I_C = 3.5A I_B = 0.5A			1.5 1.5	V V

RESISTIVE LOAD

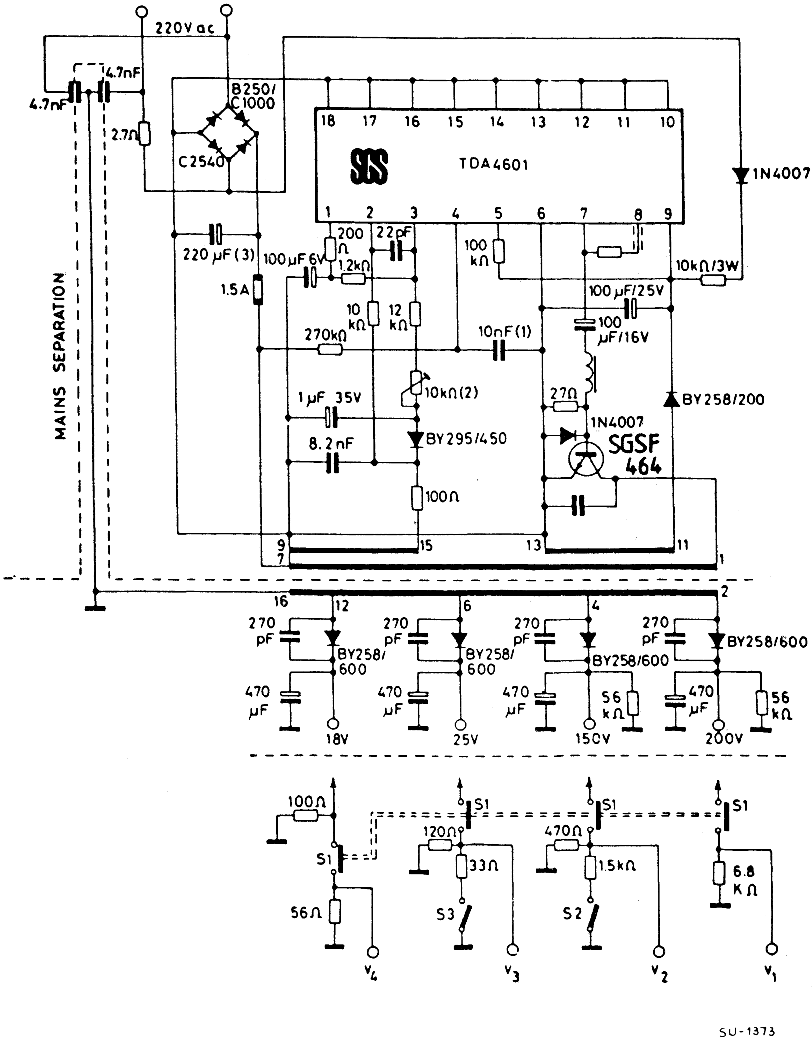
t_{on} t_s t_f	Turn-on time Storage time Fall time	I_C = 6A V_{CC} = 275V I_{B1} = 1.2A I_{B2} = 2.4A		0.4 1.7 125	1.2 3.0 400	μs μs ns

INDUCTIVE LOAD

t_{on}	Turn-on time	I_C = 6A V_{CC} = 250V L = 180μH h_{FE} = 5 T_c = 25°C		220	500	ns
t_s t_f	Storage time Fall time	I_C = 6A V_{CC} = 250V L = 900 μH $V_{BE(off)}$ = −5V h_{FE} = 5 T_c = 100°C		2.0 85	3.5 350	μs ns

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

Fig. 1 - 150W flyback converter using the SGS control circuit TDA4601



1) C limits the maximum collector current of the SGSF464 at overshooting permissible output power.
2) Adjustment of secondary voltage.
3) Must be discharged before IC change.

Fig. 2 - 200W flyback converter using the SGS control circuit TDA8132

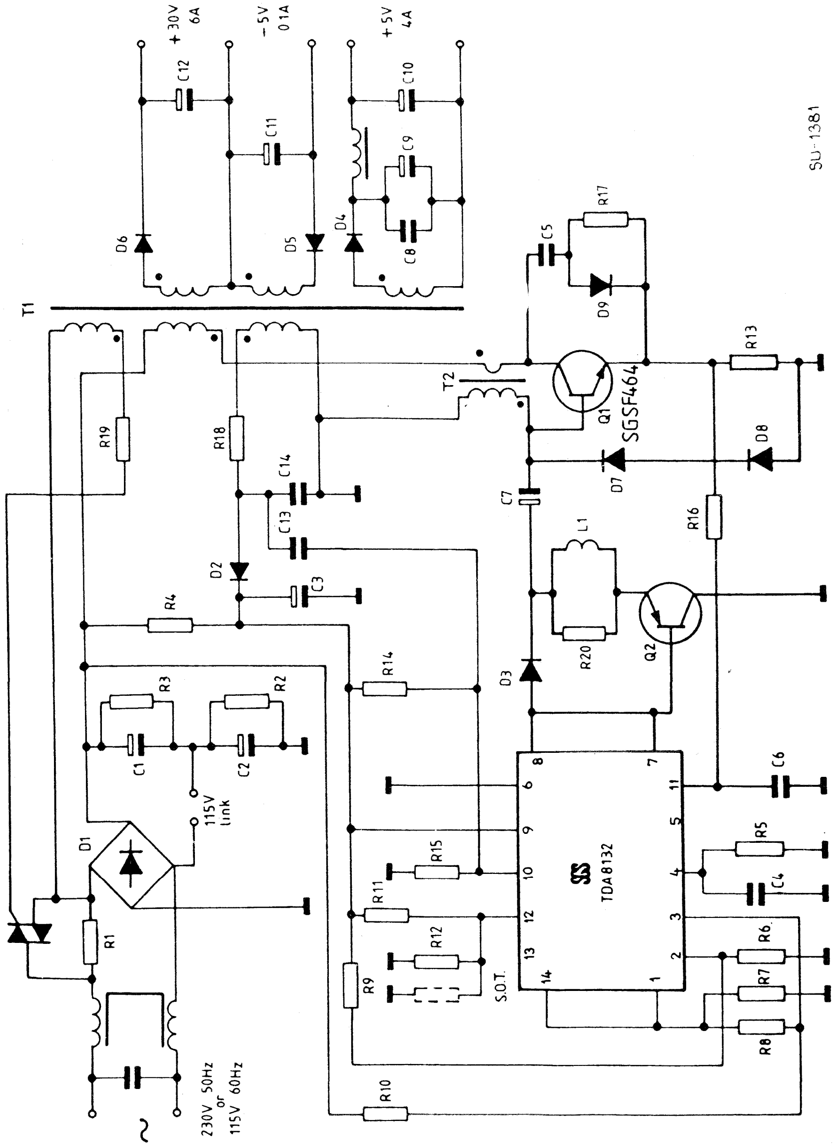
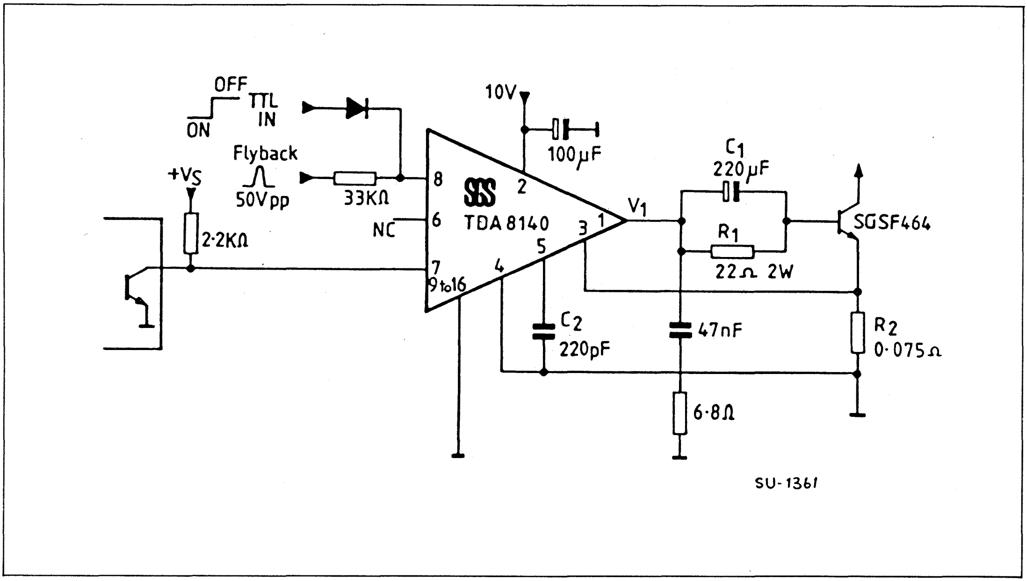


Fig. 3 - Typical colour CRT deflection using the SGS TDA8140



THERMAL RESISTANCE OF THE ISOWATT218

The junction to case thermal resistance of 2.5°C/W for the ISOWATT218 package may seem quite high at first glance, but if compared to a conventional SOT-93 (TO-218) package with a 0.1mm mica insulating washer, the differences are marginal. The 0.1mm isolating washer gives 1500V to 2000 VDC isolation for the SOT-93 package, SGS guarantee 4000 VDC isolation for the ISOWATT218.

The comparison in fig. 4 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The tests illustrate that the ISOWATT218 has an R_{th} very close to that of a conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package.

The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.

Fig. 4

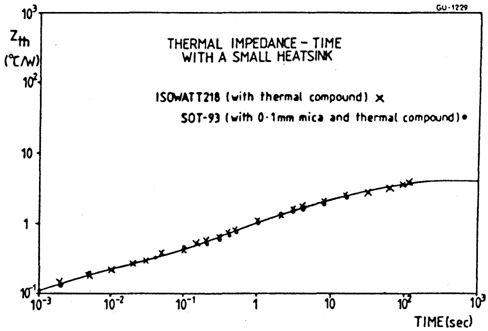


Fig. 5 - Reverse bias safe operating area

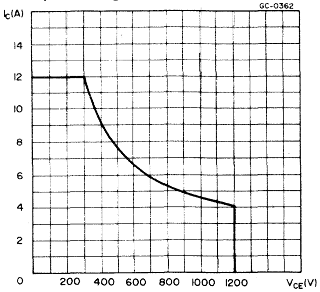


Fig. 6 - Collector-emitter saturation voltage

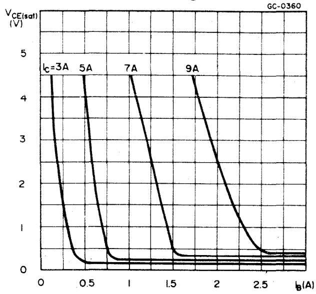


Fig. 7 - Base-emitter saturation voltage

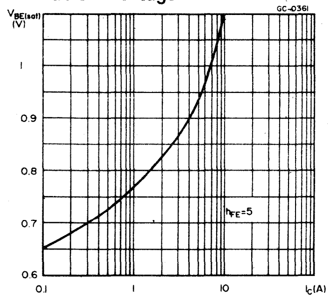


Fig. 8 - DC current gain

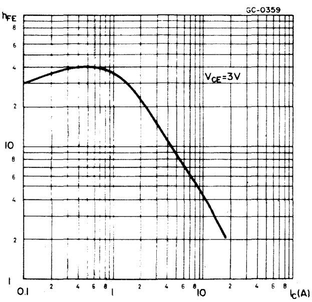


Fig. 9 - DC current gain

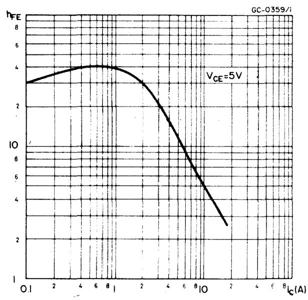


Fig. 10 - Resistive load switching times

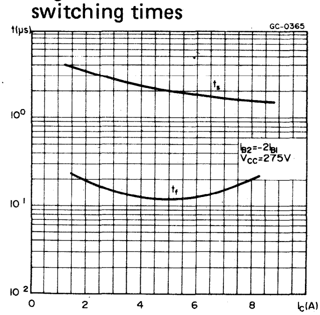


Fig. 11 - Inductive load switching times

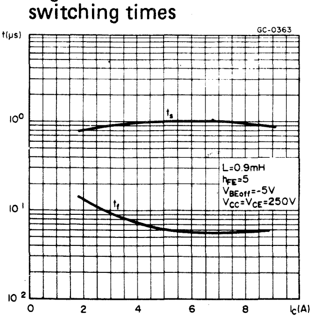


Fig. 12 - Inductive load switching times

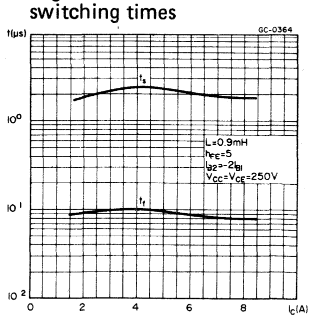


Fig. 13 - Internal schematic diagram

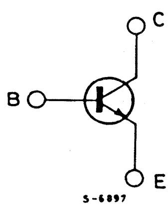
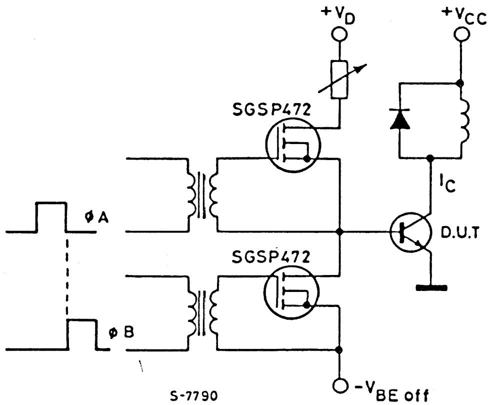


Fig. 14 - Switching times test circuit



V_{CC} = 150V
L = 0.2 mH

ϕ_A = pulse width must be adjusted to obtain desired I_C value
ϕ_B = pulse width equal to ϕ_A pulse duration

SGS®

SGSF465
SGSIF465
SGSF565

ADVANCE DATA

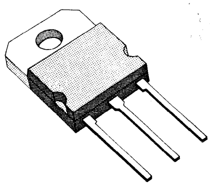
HIGH VOLTAGE NPN TRANSISTORS FOR 240 V OFF-LINE SWITCHING POWER SUPPLIES AND 90° COLOUR CRT DEFLECTION.

- V_{CES} = 1300V: HIGH VOLTAGE RATING FOR DEFLECTION AND SINGLE TRANSISTOR CONVERTER APPLICATIONS.
- UP TO 50KHz OPERATION WITH EASY DRIVE CIRCUITS.
- $I_{C(sat)}$ 5.0A, h_{FE} = 5: WELL SUITED FOR 200W FLYBACK AND 400W FORWARD CONVERTERS AND 3.0A, h_{FE} = 6.5 FOR LOWER POWER APPLICATIONS.
- LOW DYNAMIC SATURATION WHICH MINIMEZES LOSSES IN FORWARD CONVERTERS..
- PACKAGE CHOICE: THREE TYPES INCLUDING ISOWATT218 TO SUIT EVERY APPLICATION.

These FASTWITCH transistors are specially designed for 240V, or 110V with input doubler, off-line switching power supply and colour CRT deflection applications. The 1300V rating needed for deflection circuits is also a benefit to forward and flyback converters because costly over voltage snubbers can be avoided.

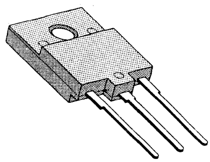
The $I_{C(sat)}$ is 5.0A with a gain of 5 so these FASTSWITCH transistors can be used in flyback converters up 200W and forward converters up 400W. The superior switching performance of FASTSWITCH transistors reduces dissipation and consequently lowers the equipment operating temperature. FASTSWITCH transistors are available in the ISOWATT218 fully isolated package which conforms to the creepage distance and isolation requirements of VDE, IEC, and UL specifications.

SGSF465



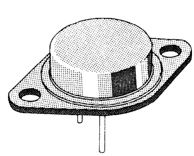
SOT-93 (TO-218)

SGSIF465



ISOWATT218

SGSF565



TO-3

ABSOLUTE MAXIMUM RATINGS

		SGSF465	SGSIF465	SGSF565	
V_{CES}	Collector-emitter voltage (V_{BE} = 0)		1300		V
V_{CEO}	Collector-emitter voltage (I_B = 0)		600		V
V_{EBO}	Emitter-base voltage (I_C = 0)		7		V
I_C	Collector current		10		A
I_{CM}	Collector peak current (t_p < 5ms)		15		A
I_B	Base current		7		A
I_{BM}	Base peak current (t_p < 5ms)		12		A
P_{tot}	Total dissipation at T_c < 25°C	165	50	140	W
T_{stg}	Storage temperature −65 to	150	150	175	°C
T_j	Junction temperature	150	150	175	°C

This is advanced information on a new product now in development or undergoing evaluation. Details are subject to change without notice.

THERMAL DATA

			SGSF465	SGSIF465	SGSF565	
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max.	0.76	2.5•	1.07	°C/W

• See notes on ISOWATT218 in this datasheet.

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

Parameter		Test Condition	Min.	Typ.	Max.	Unit.
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = 1300V			200	μA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 380V V_{CE} = 600V			200 2	μA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 6V			1	mA
$V_{CEO(sus)}$*	Collector emitter sustaining voltage	I_C = 0.1A	600			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 5.0A I_B = 1.0A I_C = 3.0A I_B = 0.4A			1.5 1.5	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 5.0A I_B = 1.0A I_C = 3.0A I_B = 0.4A			1.5 1.5	V V

RESISTIVE LOAD

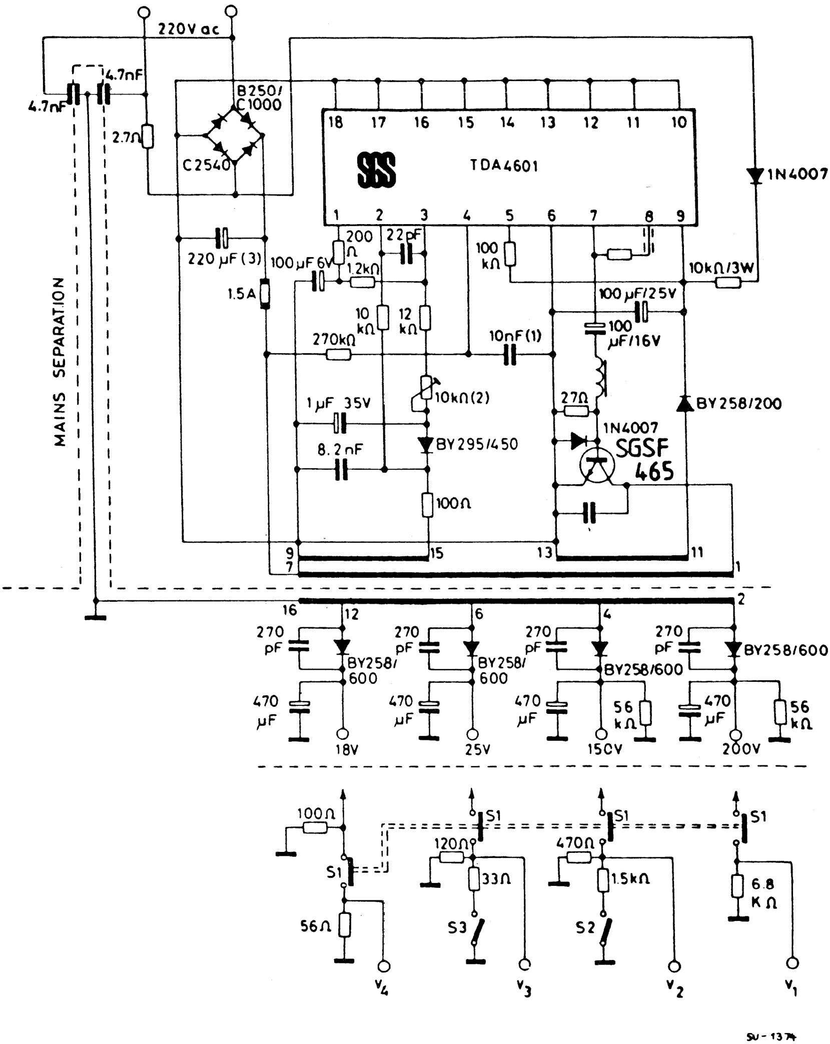
t_{on} t_s t_f	Turn-on time Storage time Fall time	I_C = 5.0A V_{CC} = 275V I_{B1} = 1.0A I_{B2} = 2.0A		0.40 1.70 125	1.2 3.0 400	μs μs ns

INDUCTIVE LOAD

t_{on}	Turn-on time	I_C = 5A V_{CC} = 250V L = 180μH h_{FE} = 5 T_c = 25°C		220	500	ns
t_s t_f	Storage time Fall time	I_C=5A V_{CC} = 250V L = 900 μH $V_{BE(off)}$ = −5V h_{FE} = 5 T_c = 100°C		2.0 85	3.5 350	μs ns

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

Fig. 1 - 150W flyback converter using the SGS control circuit TDA4601



1) C limits the maximum collector current of the SGSF465 at overshooting permissible output power.
2) Adjustment of secondary voltage.
3) Must be discharged before IC charge.

Fig. 2 - 200W flyback converter using the SGS TDA8132 controller

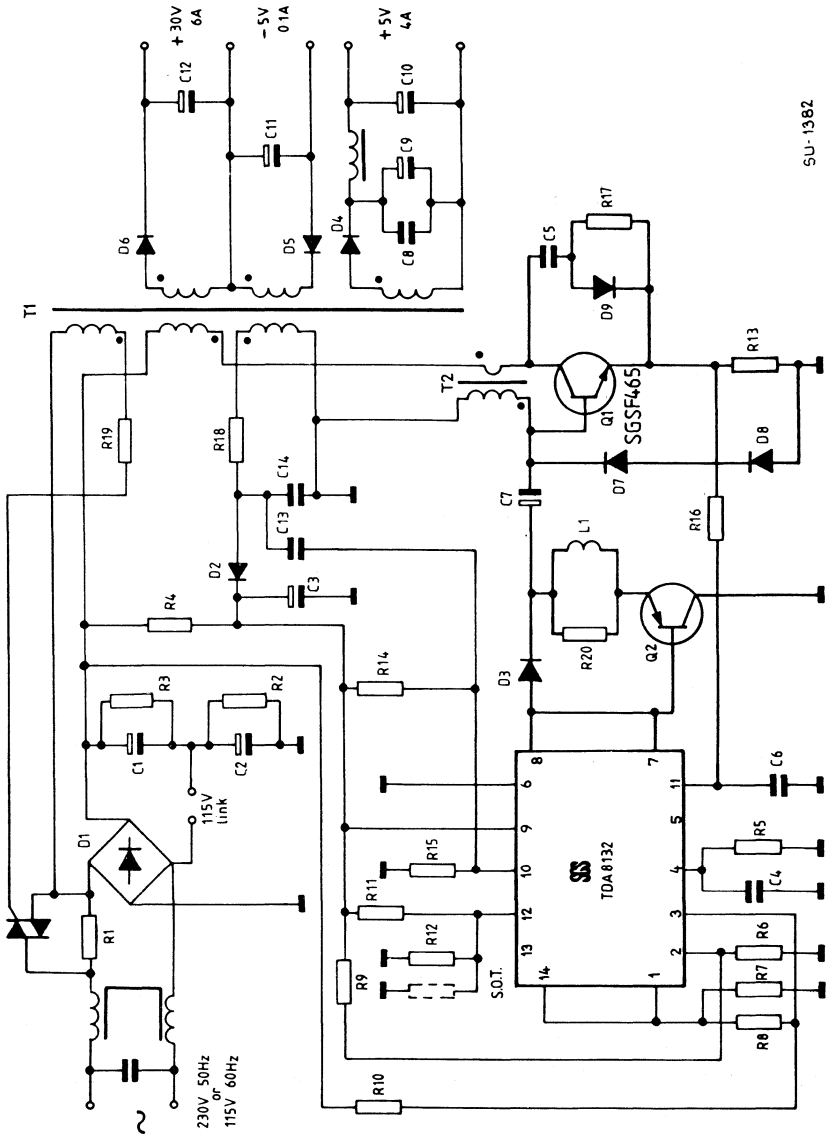
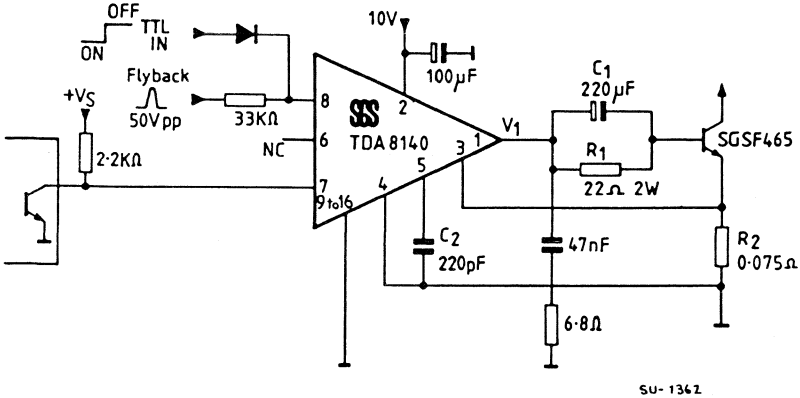


Fig. 3 - Typical colour CRT deflection using the SGS TDA8140



THERMAL RESISTANCE OF THE ISOWATT218

The junction to case thermal resistance of 2.5°C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1mm mica insulating washer, the differences are marginal. The 0.1mm isolating washer gives 1500V to 2000 VDC isolation for the SOT-93 package, SGS guarantee 4000 VDC isolation for the ISOWATT218.
The comparison in fig. 4 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The tests illustrate that the ISOWATT218 has an R_{th} very close to that of a conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package.

The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.

Fig. 4

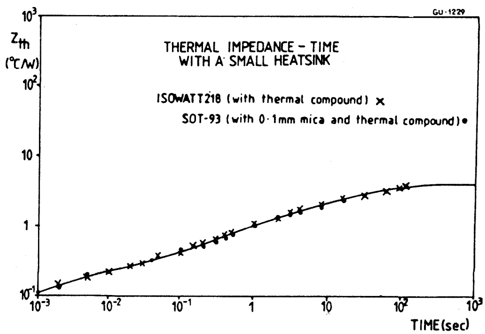


Fig. 5 - Reverse bias safe operating area

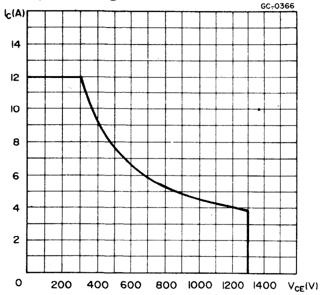


Fig. 6 - Collector-emitter saturation voltage

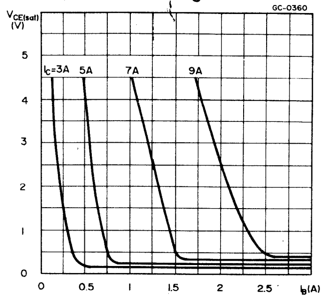


Fig. 7 - Base-emitter saturation voltage

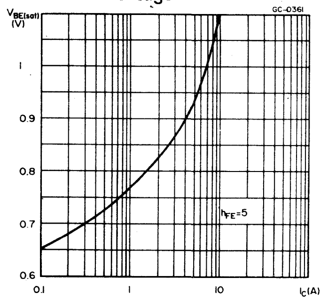


Fig. 8 - DC current gain

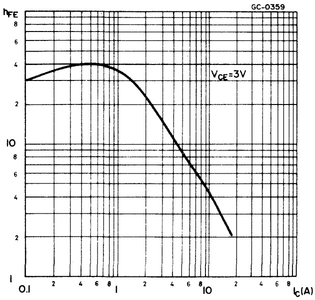


Fig. 9 - DC current gain

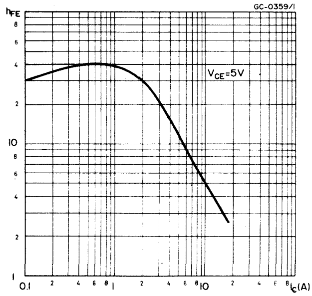


Fig. 10 - Resistive load switching times

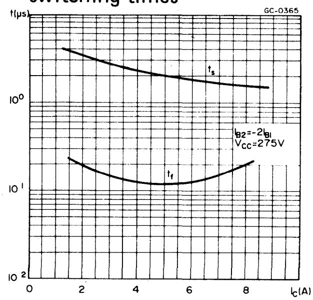


Fig. 11 - Inductive load switching times

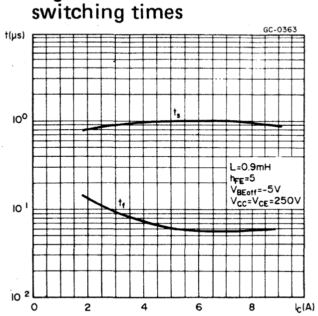


Fig. 12 - Inductive load switching times

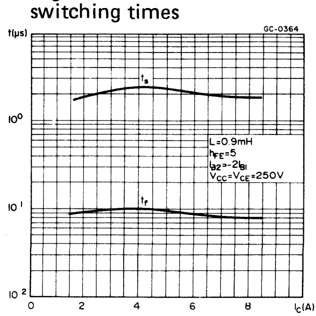


Fig. 13 - Internal schematic diagram

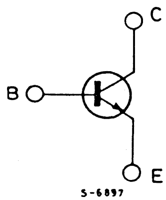
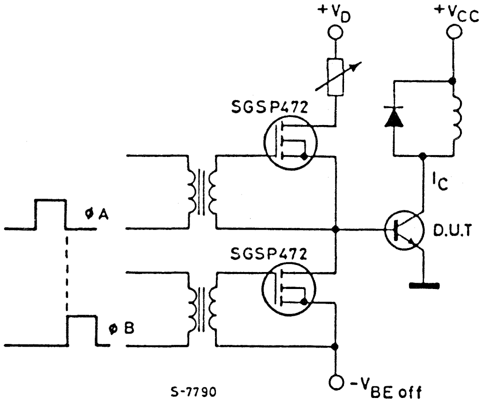


Fig. 14 - Switching times test circuit



V_{CC}= 150V
L = 0.2mH

ϕ_A = pulse width must be adjusted to obtain desired I_C value
ϕ_B = pulse width equal to ϕ_A pulse duration

POWER MOS DEVICES DATASHEETS D

2N7056

ADVANCE DATA

HIGH SPEED SWITCHING APPLICATIONS

V_{DSS}	$R_{DS\ (on)}$	I_D
200V	0.100Ω	19A

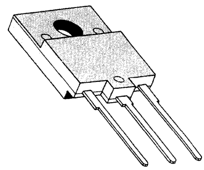
- FULLY ISOLATED PACKAGE
- 200 VOLTS - FOR SMPS UPS AND DC/DC CONVERTERS
- ULTRA FAST SWITCHING
- EASY DRIVE - REDUCES EQUIPMENT SIZE AND COST

INDUSTRIAL APPLICATIONS:

- DC/DC CONVERTERS
- MOTOR CONTROLS
- ROBOTICS

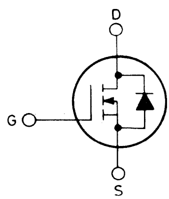
N-Channel enhancement mode POWER MOS field effect transistors. Easy drive, very fast switching times and simple mounting make these POWER MOS transistors ideal for high speed switching applications in a wide range of equipment.

The ISOWATT218 package requires only simple single hole mounting and provides isolation to 2500V ac, 4000V dc. and meets with the creepage distance requirements of VDE, IEC, and UL specifications. The package thermal characteristics are optimised to provide the best isolation with excellent thermal coupling.



ISOWATT218

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

V_{DS}	Drain-source voltage (V_{GS} = 0)	200	V
V_{DGR}	Drain-gate voltage (R_{GS} = 1 MΩ)	200	V
I_D	Drain current (continuous) T_c = 25°C	±19	A
	T_c = 100°C	±12	A
I_{DM}(•)	Drain current (pulsed)	±120	A
V_{GS}	Gate-source voltage	±40	V
P_{tot}	Total dissipation at $T_c \leq 25$°C	70	W
	Total dissipation at T_c = 100°C	28	W
Junction to case - linear derating factor		0.56	W/°C
Junction to ambient - linear derating factor		0.029	W/°C
T_{stg}	Storage temperature	−55 to 150	°C
T_j	Max. operating junction temperature	150	°C
Lead Temperature - 1/16" from case for 10s		300	°C

(•) Pulse width limited by safe operating area.

This is advanced information on a new product in development or undergoing evaluation. Details are subject to change without notice.

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max.	1.80°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient		35°C/W

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

Parameter		Test conditions	Min.	Typ.	Max.	Unit
OFF						
$V_{(BR)\ DSS}$	Drain-source breakdown voltage	I_D = 250 μA V_{GS} = 0V	200			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = Max Rating V_{DS} = Max Rating × 0.8 T_{case} = 125°C			250 1000	μA μA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = +20V (forward) V_{GS} = −20V (reverse)			100 −100	nA nA
ON*						
$V_{GS\ (th)}$	Gate threshold voltage	V_{DS} = V_{GS} I_D = 1.0 mA	2		4	V
$V_{DS(on)}$	Drain-source voltage	V_{GS} = 10V I_D = 16A		1.12	1.60	V
$R_{DS\ (on)}$	Static drain-source on-resistance	V_{GS} = 10V I_D = 16A V_{GS} = 10 V I_D = 9A T_{case} = 125°C		0.07 0.12	0.10 0.175	Ω Ω
DYNAMIC						
g_{fs}	Forward transconductance	$V_{DS} \geq 2 \times V_{DS(on)}$ I_D = 16A	8.0	12		mho
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 25V f = 1 MHz V_{GS} = 0		2400 600 250	3300 1200 600	pF pF pF
$C_{D\text{-}HS}$	Drain-Heatsink capacitance	$V_{D\text{-}HS}$ = 25V f = 1MHz		19		pF

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions	Min.	Typ.	Max.	Unit.
SWITCHING						
$t_{d\ (on)}$	Turn-on time	V_{DD} = 750V I_D = 16A		25	35	ns
tr	Rise time	V_{gen} = 10V R_g = 5Ω		60	100	ns
$t_{d(off)}$	Turn off delay time	R_i = 4.5Ω		85	125	ns
t_f	Fall time			38	100	ns
SOURCE DRAIN DIODE						
I_{SD}	Source-Drain current				19	A
		T_c = 100°C			12	A
I_{SDM} (•)	Source-Drain current (pulsed)				120	A
V_{SD}*	Forward on voltage	V_{GS} = 0 I_{SD} = 28A		1.6	2.0	V
t_{rr}	Reverse recovery	I_{SD} = 19A di/dt = 100A/μs		150	400	ns

* Pulsed: Pulse duration = 300μs, duty cycle 2%
(•) Pulse width limited by safe operating area

2N7059

HIGH SPEED SWITCHING APPLICATIONS

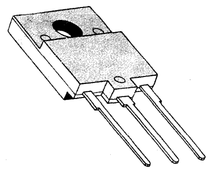
V_{DSS}	$R_{DS\ (on)}$	I_D
500V	0.45Ω	8A

- FULLY ISOLATED PACKAGE
- HIGH VOLTAGE - FOR OFF-LINE SMPS
- HIGH CURRENT - 8A FOR UP TO 1200W SMPS
- ULTRA FAST SWITCHING - FOR OPERATION AT ⩾ 100KHz
- EASY DRIVE - REDUCES EQUIPMENT SIZE AND COST

INDUSTRIAL APPLICATIONS:

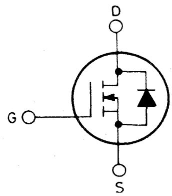
- SWITCHING MODE POWER SUPPLIES
- MOTOR CONTROLS

N-Channel enhancement mode POWER MOS field effect transistors. Easy drive, very fast switching times and simple mounting make these POWER MOS transistors ideal for high speed switching applications in a wide range of equipment.
The ISOWATT218 package requires only simple single hole mounting and provides isolation to 2500V ac, 4000V dc. and meets with the creepage distance requirements of VDE, IEC, and UL specifications. The package thermal characteristics are optimised to provide the best isolation with excellent thermal coupling.



ISOWATT218

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

V_{DS}	Drain-source voltage (V_{GS} = 0)	500	V
V_{DGR}	Drain-gate voltage (R_{GS} = 1 MΩ)	500	V
I_D	Drain current (continuous) T_c = 25°C	±8	A
	T_c = 100°C	±5	A
I_{DM}(•)	Drain current (pulsed)	±52	A
V_{GS}	Gate-source voltage	±40	V
P_{tot}	Total dissipation at T_c ⩽25°C	70	W
	Total dissipation at T_c = 100°C	28	W
Junction to case - linear derating factor		0.56	W/°C
Junction to ambient - linear derating factor		0.029	W/°C
T_{stg}	Storage temperature	−55 to 150	°C
T_j	Max. operating junction temperature	150	°C
Lead Temperature - 1/16″ from case for 10s		300	°C

(•) Pulse width limited by safe operating area.
This is advanced information on a new product in development or undergoing evaluation. Details are subject to change without notice.

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max.	1.80°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient		35°C/W

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

Parameter		Test conditions	Min.	Typ.	Max.	Unit
OFF						
$V_{(BR)\ DSS}$	Drain-source breakdown voltage	I_D = 250 μA V_{GS} = 0V	500			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = Max Rating V_{DS} = Max Rating × 0.8 T_{case} = 125°C			250 1000	μA μA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = +20V (forward) V_{GS} = −20V (reverse)			100 −100	nA nA
ON*						
$V_{GS\ (th)}$	Gate threshold voltage	V_{DS} = V_{GS} I_D = 1.0 mA	2		4	V
$V_{DS(on)}$	Drain-source voltage	V_{GS} = 10V I_D = 7A		2.66	3.15	V
$R_{DS\ (on)}$	Static drain-source on-resistance	V_{GS} = 10V I_D = 7A V_{GS} = 10V I_D = 4A T_{case} = 125°C		0.38 0.72	0.45 0.86	Ω Ω
DYNAMIC						
g_{fs}	Forward transconductance	$V_{DS} \geq 2 \times V_{DS(on)}$ I_D = 7A I_D = 16A	6.0	7.2		mho
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 25V f = 1 MHz V_{GS} = 0		2600 280 40	3300 700 300	pF pF pF
$C_{D\text{-}HS}$	Drain Heatsink capacitance	$V_{D\text{-}HS}$ = 25V f = 1MHz		19		pF

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions	Min.	Typ.	Max.	Unit.
SWITCHING						
$t_{d\,(on)}$	Turn-on time	V_{DD} = 210V I_D = 7A		25	40	ns
tr	Rise time	V_{gen} = 10V R_g = 5Ω		25	50	ns
$t_{d(off)}$	Turn off delay time	R_i = 30Ω		75	150	ns
t_f	Fall time			31	70	ns
SOURCE DRAIN DIODE						
I_{SD}	Source-Drain current				8	A
		T_c = 100°C			5	A
I_{SDM} (•)	Source-Drain current (pulsed)				52	A
V_{SD}*	Forward on voltage	V_{GS} = 0 I_{SD} = 12A		1.2	1.5	V
t_{rr}	Reverse recovery	I_{SD} = 8A di/dt = 100A/μs		400	600	ns

* Pulsed: Pulse duration = 300μs, duty cycle 2%
(•) Pulse width limited by safe operating area

SGSP364/P365/P366
SGSP464/P465/P466
SGSIP464/P465/IP466
SGSP564/P565/P566

HIGH SPEED SWITCHING APPLICATIONS

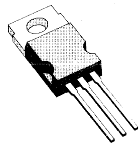
V_{DSS}	$R_{DS\ (on)}$	I_D
350/400 V	1 Ω	6 A
450 V	1.5 Ω	6 A

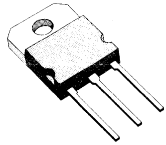
- HIGH VOLTAGE - FOR ELECTRONIC LAMP BALLAST
- ULTRA FAST SWITCHING
- EASY DRIVE - REDUCES COST AND SIZE

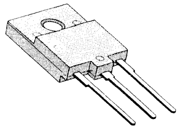
INDUSTRIAL APPLICATIONS:

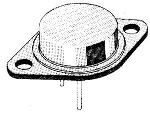
- ELECTRONIC LAMP BALLAST
- DC SWITCH

N-Channel enhancement mode POWERMOS field effect transistors. Easy drive and very fast switching times make these POWERMOS transistors ideal for high speed switching applications.
Applications include DC switch, costant current source, ultrasonic equipment and electronic ballast for fluorescent lamps.
The package range for this device includes the isolated case ISOWATT218. This provides isolation to 2500V ac, 4000V dc and the creepage distance requirement of VDE, IEC and UL specifications.

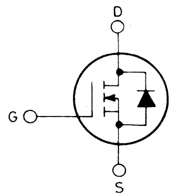

TO-220


SOT-93 (TO-218)


ISOWATT218


TO-3

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

	TO-220 / SOT-93 / ISOWATT218 / TO-3	SGSP364 / SGSP464 / SGSIP464 / SGSP564	SGSP365 / SGSP465 / SGSIP465 / SGSP565	SGSP366 / SGSP466 / SGSIP466 / SGSP566	
V_{DS}	Drain-source voltage (V_{GS} = 0)	450	400	350	V
V_{DGR}	Drain-gate voltage (R_{GS} = 20KΩ)	450	400	350	V
V_{GS}	Gate-source voltage		± 20		V
I_D	Drain current (continuous) T_c = 25°C		6		A
	at T_c = 100°C		4		A
I_{DM}(•)	Drain current (pulsed)		24		A
I_{DLM}	Drain inductive current, clamped		24		A

		TO-220	SOT-93	ISOWATT218	TO-3	
V_{ISO}	Isolation voltage (DC)			4000		V
P_{tot}	Total dissipation at T_{case} = 25°C	100	125	50	125	W
	Derating factor	0.8	1	0.4	1	W/°C
T_{stg}	Storage temperature			−55 to 150		°C
T_j	Max. operating junction temperature			150		°C

(•) Pulse width limited by safe operating area.

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THERMAL DATA

			TO-220	SOT-93	ISOWATT218	TO-3
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.25	1	2.5•	1° °C/W
T_L	Maximum lead temperature for soldering purpose				275	°C

• See notes on ISOWATT218 in this datasheet.

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

Parameter	Test conditions	Min.	Typ.	Max.	Unit
OFF					
$V_{(BR)\ DSS}$ Drain-source breakdown voltage	I_D = 250 μA V_{GS} = 0				
	for **SGSP364/P464/IP464/P564**	450			V
	for **SGSP365/P465/IP465/P565**	400			V
	for **SGSP366/P466/IP466/P566**	350			V
I_{DSS} Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = Max Rating			250	μA
I_{GSS} Gate-body leakage current (V_{DS} = 0)	V_{GS} = ±20V			100	nA
ON*					
$V_{GS\ (th)}$ Gate threshold voltage	V_{DS} = V_{GS} I_D = 250 μA	2		4	V
$V_{DS(on)}$ Drain-source voltage	V_{GS} = 10V I_D = 3A				
	for **SGSP364/P464/IP464/P564**			4.5	V
	for **SGSP365/P465/IP465/P565**			3	V
	for **SGSP366/P466/IP466/P566**			3	V
	V_{GS} = 10V I_D = 6A				
	for **SGSP364/P464/IP464/P564**			10	V
	for **SGSP365/P465/IP465/P565**			6.7	V
	for **SGSP366/P466/IP466/P566**			6.7	V
	V_{GS} = 10V I_D = 3A T_c = 100°C				
	for **SGSP364/P464/IP464/P564**			9	V
	for **SGSP365/P465/IP465/P565**			6	V
	for **SGSP366/P466/IP466/P566**			6	V
$R_{DS\ (on)}$ Static drain-source on-resistance	V_{GS} = 10V I_D = 3A				
	for **SGSP364/P464/IP464/P564**			1.5	Ω
	for **SGSP365/P465/IP465/P565**			1	Ω
	for **SGSP366/P466/IP466/P566**			1	Ω

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions	Min.	Typ.	Max.	Unit.
DYNAMIC						
g_{fs}	Forward transconductance	V_{DS} = 25V I_D = 3A	3			mho
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 25V f = 1 MHz V_{GS} = 0		780 150 100	1000 200 130	pF pF pF
$C_{D\text{-}HS}$	Drain-Heatsink capacitance	$V_{D\text{-}HS}$ = 25V f = 1 MHz		19	23	pF
SWITCHING						
$t_{d(on)}$ t_r $t_{d(off)}$ t_f	Turn-on time Rise time Turn off delay time Fall time	V_{CC} = 250V I_D = 3A V_i = 10V R_i = 10Ω (see test circuit)		30 30 100 50		ns ns ns ns
SOURCE DRAIN DIODE						
I_{SD} I_{SDM} (•)	Source-Drain current Source-Drain current (pulsed)				6 24	A A
V_{SD}	Forward on voltage	I_{SD} = 6A V_{GS} = 0			1.2	V
t_{on} t_{rr}	Turn-on time Reverse recovery time	I_{SD} = 6A V_{GS} = 0 di/dt = 25A/μs		250 350		ns ns

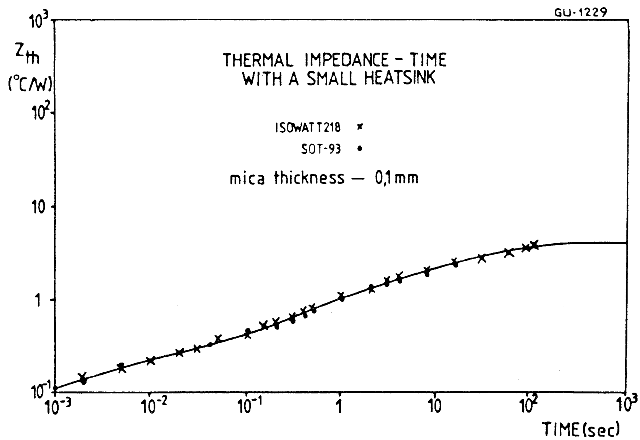
* Pulsed: Pulse duration = 300μs, duty cycle 1.5%
(•) Pulse width limited by safe operating area

THERMAL RESISTANCE OF THE ISOWATT218

The junction to case thermal resistance of 2.5 °C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1 mm mica insulating washer, the differences are marginal. The 0.1 mm isolating washer gives 1500V to 2000V DC isolation for the SOT-93 package, SGS guarantee 4000V DC isolation for the ISOWATT 218.

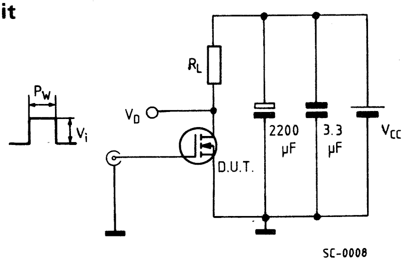
The comparison in fig. 1 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The test illustrate that the ISOWATT218 has an R_{th} very close to that of conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package. The drain to heatsink capacitance of the ISOWATT218 is typically 19pF.

Fig. 1

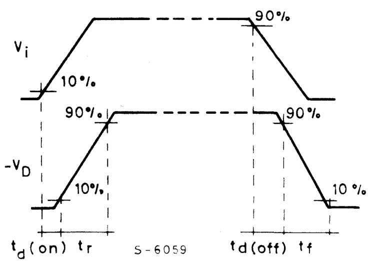


SWITCHING TIMES RESISTIVE LOAD

Test circuit



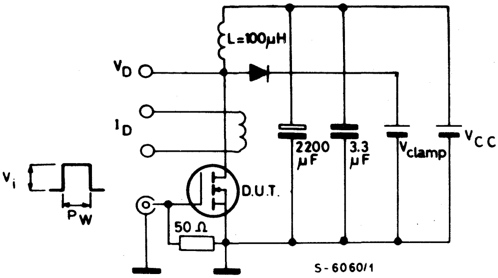
Waveforms



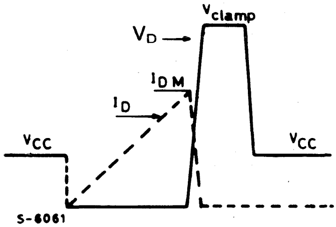
Pulse width ⩽ 100 µs
Duty cycle ⩽ 2%
V_i = 10V

CLAMPED INDUCTIVE LOAD

Test circuit

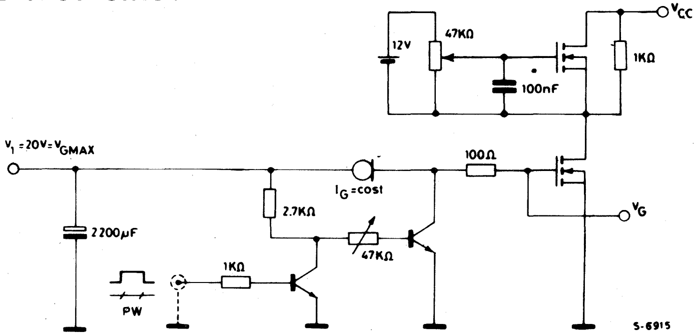


Waveforms



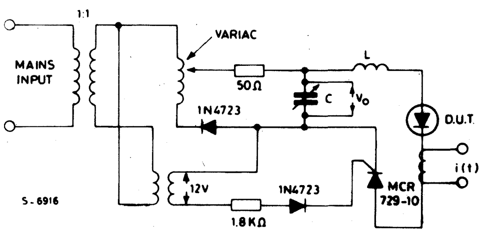
V_i = 12V
Pulse width: adjusted to obtain specified I_{DM}, V_{clamp} = 0.75 $V_{(BR)\ DSS}$

GATE CHARGE TEST CIRCUIT



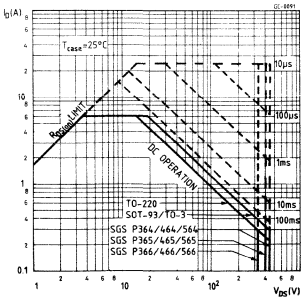
PW adjusted to obtain required V_G

DIODE BODY-DRAIN t_{rr} MEASUREMENT

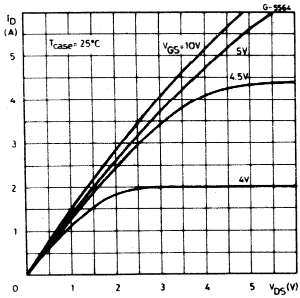


Jedec test circuit

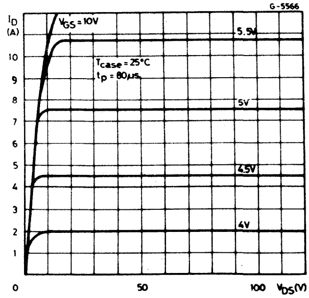
Safe operating areas



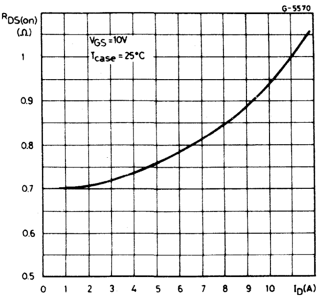
Output characteristics



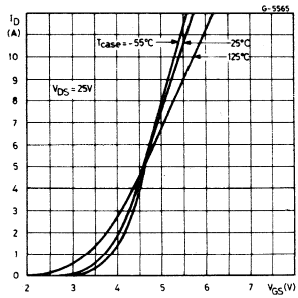
Output characteristics



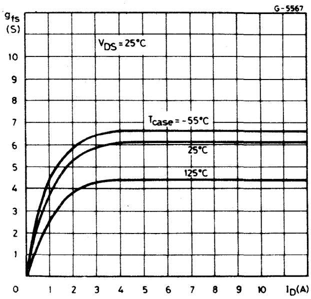
Static drain-cource on resistance



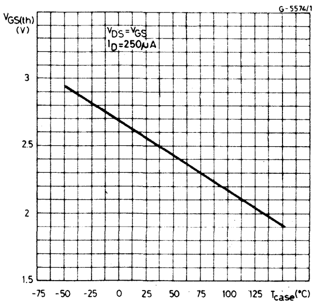
Transfer characteristics



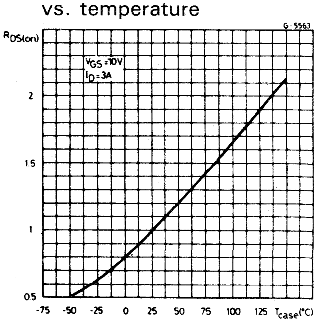
Transconductance



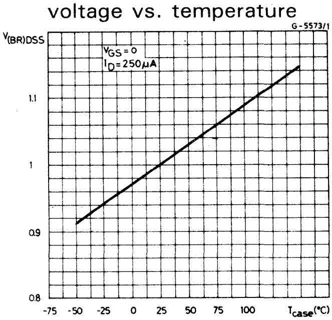
Gate threshold voltage vs. temperature



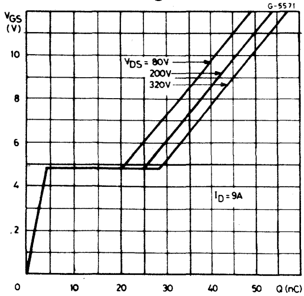
Normalized on resistance vs. temperature



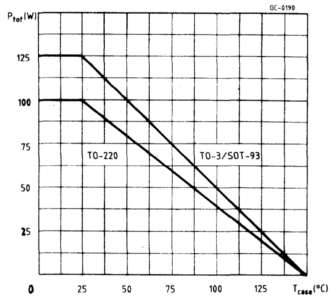
Normalized breakdown voltage vs. temperature



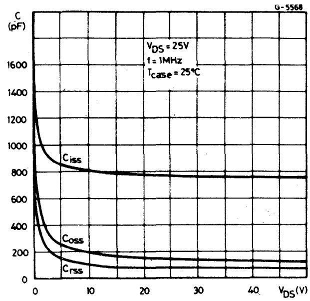
Gate charge vs. gate-source voltage



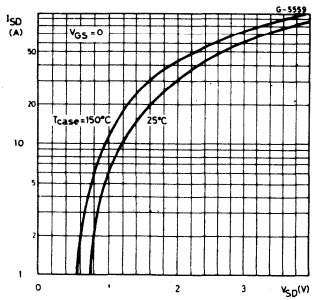
Derating curve



Capacitance variation



Source-drain diode forward characteristics



SGSP368/369
SGSP468/469
SGSIP468/469
SGSP568/569

HIGH SPEED SWITCHING APPLICATIONS

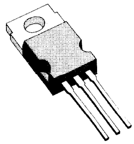
V_{DSS}	$R_{DS\ (on)}$	I_D
500V	1.5 Ω	5A
550V	2.5 Ω	5A

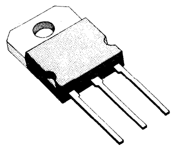
- HIGH VOLTAGE - FOR ELECTRONIC LAMP BALLAST AND SMPS
- ULTRA FAST SWITCHING - UP TO 200KHz OPERATIONS
- EASY DRIVE - REDUCES COST AND SIZE

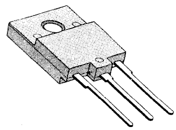
INDUSTRIAL APPLICATIONS:

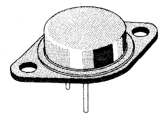
- SMPS
- ELECTRONIC LAMP BALLAST
- DC SWITCH

N-Channel enhancement mode POWER MOS field effect transistors. Easy drive and very fast switching times make these POWER MOS transistors ideal for high speed switching applications.
Applications include DC switch, constant current source, ultrasonic equipment electronic ripple control and electronic ballast for fluorescent lamps. The package range for this devices includes the isolated case ISOWATT218. This provides isolation to 2500V ac, 4000V dc and the creepage distance requirement of VDE, IEC, and UL specifications.

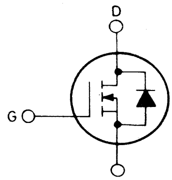

TO-220


SOT-93 (TO-218)


ISOWATT218


TO-3

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

TO-220 SOT-93 ISOWATT218 TO-3		SGSP368 SGSP468 SGSIP468 SGSP568	SGSP369 SGSP469 SGSIP469 SGSP569	
V_{DS}	Drain-source voltage (V_{GS} = 0)	550	500	V
V_{DGR}	Drain-gate voltage (R_{GS} = 20KΩ)	550	500	V
V_{GS}	Gate-source voltage	± 20		V
I_D	Drain current (continuous) T_c = 25°C	5		A
	at T_c = 100°C	3.2		A
I_{DM}(•)	Drain current (pulsed)	20		A
I_{DLM}	Drain inductive current, clamped	20		A

		TO-220	SOT-93	ISOWATT218	TO-3	
V_{ISO}	Isolation voltage (DC)			4000		V
P_{tot}	Total dissipation at T_{case} = 25°C	100	125	50	125	W
	Derating factor	0.8	1	0.4	1	W/°C
T_{stg}	Storage temperature			−55 to 150		°C
T_j	Max. operating junction temperature			150		°C

(•) Pulse width limited by safe operating area.

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THERMAL DATA

			TO-220	SOT-93	ISOWATT218	TO-3	
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.25	1	2.5•	1°	°C/W
T_L	Maximum lead temperature for soldering purpose				275		°C

• See notes on ISOWATT218 in this datasheet.

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

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
OFF						
$V_{(BR)\ DSS}$	Drain-source breakdown voltage	I_D = 250 µA V_{GS} = 0 for **SGSP368/P468/IP468/P568** for **SGSP369/0469/IP469/P569**	 550 500			 V V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = Max Rating			250	µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ±20V			100	nA
ON*						
$V_{GS\ (th)}$	Gate threshold voltage	V_{DS} = V_{GS} I_D = 250 µA	2		4	V
$V_{DS(on)}$	Drain-source voltage	V_{GS} = 10V I_D = 2.5A for **SGSP368/P468/IP468/P568** for **SGSP369/P469/IP469/P569**			 6.25 3.75	 V V
$R_{DS\ (on)}$	Static drain-source on-resistance	V_{GS} = 10V I_D = 2.5A for **SGSP368/P468/IP468/P568** for **SGSP369/P469/IP469/P569**			 2.5 1.5	 Ω Ω
DYNAMIC						
g_{fs}	Forward transconductance	V_{DS} = 25V I_D = 2.5A	3			mho
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 25V f = 1 MHz V_{GS} = 0		780 150 80	1000 190 100	pF pF pF
$C_{D\text{-}HS}$	Drain-Heatsink capacitance	$V_{D\text{-}HS}$ = 25 V f = 1 MHz		19	23	pF

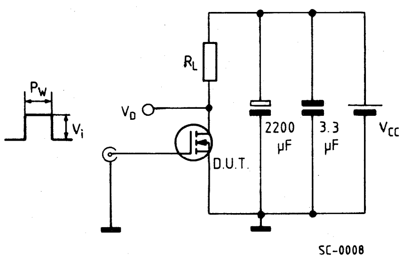
ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions	Min.	Typ.	Max.	Unit.
SWITCHING						
$t_{d\ (on)}$	Turn-on time	$V_{CC}=250V$ $I_D=2.5A$		30		ns
t_r	Rise time	$V_i = 10V$ $R_i = 10\Omega$		15		ns
$t_{d(off)}$	Turn off delay time	(see test circuit)		80		ns
t_f	Fall time			40		ns
SOURCE DRAIN DIODE						
I_{SD}	Source-Drain current				5	A
I_{SDM} (•)	Source-Drain current (pulsed)				20	A
V_{SD}	Forward on voltage	$I_{SD} = 5A$ $V_{GS} = 0$			1.15	V
t_{on}	Turn-on time	$I_{SD} = 5A$ $V_{GS} = 0$		85		ns
t_{rr}	Reverse recovery time	di/dt = 150A/μs		320		ns

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

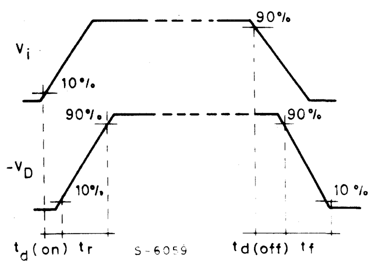
SWITCHING TIMES RESISTIVE LOAD

Test circuit



Pulse width ⩽ 100 μs
Duty cycle ⩽ 2%
$V_i = 10V$

Waveforms

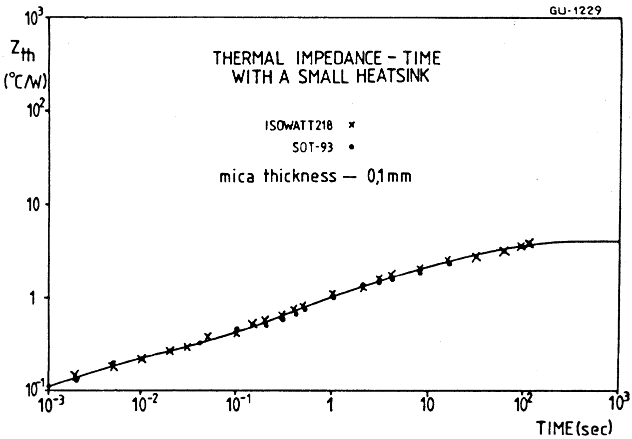


THERMAL RESISTANCE OF THE ISOWATT218

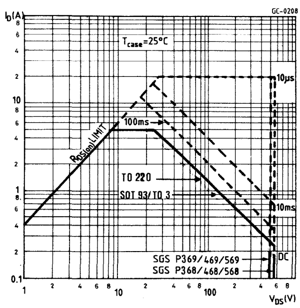
The junction to case thermal resistance of 2.5 °C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1 mm mica insulating washer, the differences are marginal. The 0.1 mm isolating washer gives 1500V to 2000V DC isolation for the SOT-93 package, SGS guarantee 4000V DC isolation for the ISOWATT 218.

The comparison in fig. 1 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The test illustrate that the ISOWATT218 has an R_{th} very close to that of conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package. The drain to heatsink capacitance of the ISOWATT218 is typically 19pF.

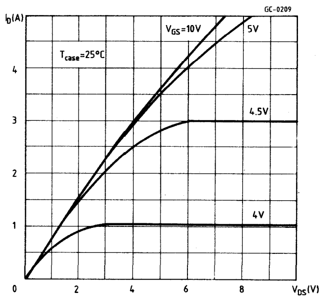
Fig. 3



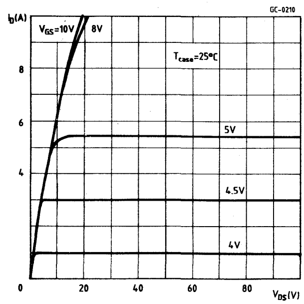
Safe operating areas



Output characteristics.

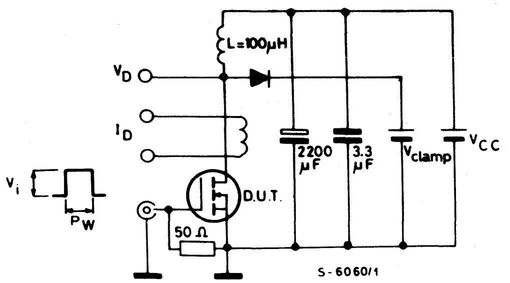


Output characteristics.

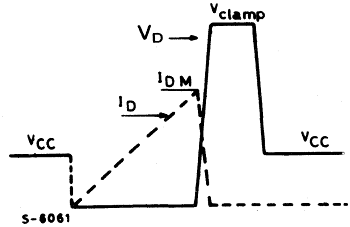


CLAMPED INDUCTIVE LOAD

Test circuit

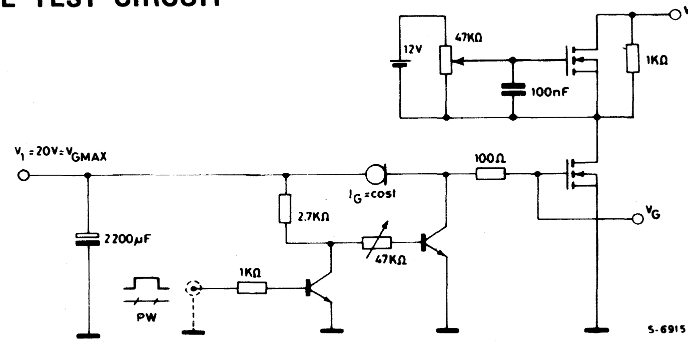


Waveforms



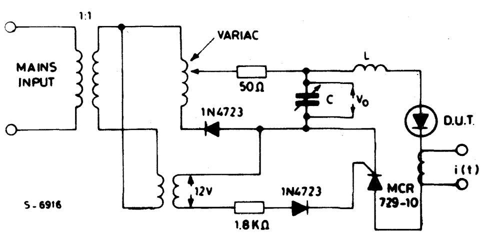
V_i = 12V
Pulse width: adjusted to obtain specified I_{DM}, V_{clamp} = 0.75 $V_{(BR)\ DSS}$

GATE CHARGE TEST CIRCUIT



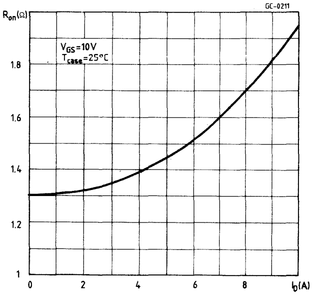
PW adjusted to obtain required V_G

DIODE BODY-DRAIN t_{rr} MEASUREMENT

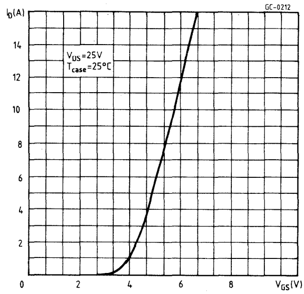


Jedec test circuit

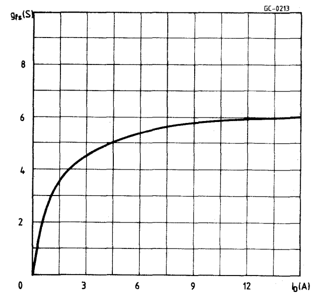
Static drain-source on resistance.



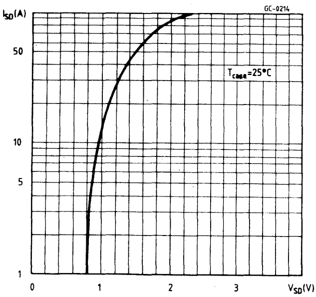
Transfer characteristic.



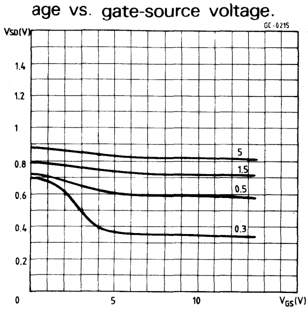
Transconductance.



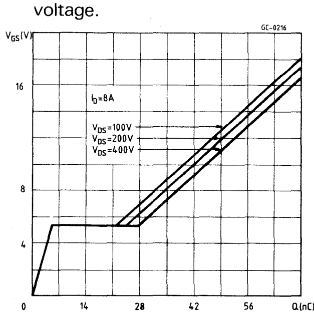
Source-drain diode forward characteristic.



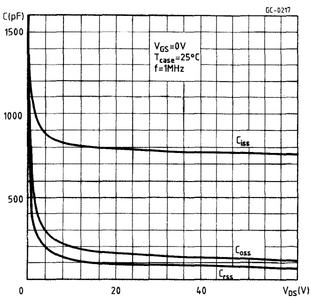
Source-drain diode forward volt age vs. gate-source voltage.



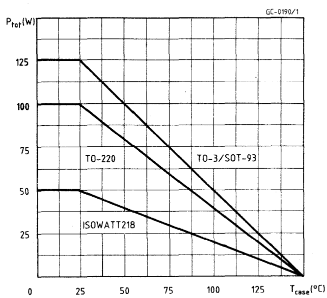
Gate charge vs. gate to source voltage.



Capacitances variation.



Derating curves.



SGSP473/P477
SGSIP473/IP477
SGSP573/P577

HIGH SPEED SWITCHING APPLICATIONS

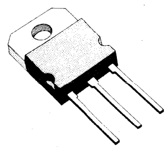
V_{DSS}	$R_{DS\ (on)}$	I_D
200 V	0.17 Ω	20 A
250 V	0.22 Ω	20 A

- 200 - 250V - FOR TELECOMS APPLICATIONS
- HIGH CURRENT - FOR PLUSED LASER DRIVES
- ULTRA FAST SWITCHING
- EASY DRIVE - REDUCES COST AND SIZE

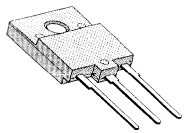
INDUSTRIAL APPLICATIONS:

- SWITCHING MODE POWER SUPPLY
- MOTOR CONTROL FOR ROBOTICS

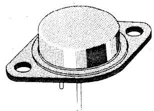
N-Channel enhancement mode POWERMOS field effect transistors. Easy drive and fast switching times make these POWERMOS transistors ideal for high speed switching applications.
Typical applications include electronics, laser diode drivers, UPS, SMPS, DC/DC, DC switch for telecoms and electronic vehicle drivers.
The package range for this device includes the isolated case ISOWATT218. This provides isolation to 2500V ac, 4000V dc and the creepage requirements of VDE, IEC and UL specifications.



SOT-93 (TO-218)

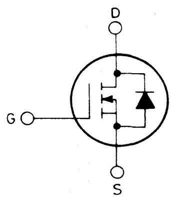


ISOWATT218



TO-3

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

	SOT-93 / ISOWATT218 / TO-3	SGSP473 / SGSIP473 / SGSP573		SGSP477 / SGSIP477 / SGSP577	
V_{DS}	Drain-source voltage (V_{GS} = 0)	250		200	V
V_{DGR}	Drain-gate voltage (R_{GS} = 20KΩ)	250		200	V
V_{GS}	Gate-source voltage		± 20		V
I_D	Drain current (continuous) T_c = 25°C		20		A
	at T_c = 100°C		13		A
I_{DM}(•)	Drain current (pulsed)		80		A
I_{DLM}	Drain inductive current, clamped		80		A
		SOT-93	ISOWATT218	TO-3	
V_{ISO}	Isolation voltage (DC)		4000		V
P_{tot}	Total dissipation at T_{case} = 25°C	150	50	150	W
	Derating factor	1.2	0.4	1.2	W/°C
T_{stg}	Storage temperature		−55 to 150		°C
T_j	Max. operating junction temperature		150		°C

(•) Pulse width limited by safe operating area.

THERMAL DATA

			SOT-93	ISOWATT218	TO-3	
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	0.84	2.5•	0.84	°C/W
T_L	Maximum lead temperature for soldering purpose			275		°C

• See notes on ISOWATT218 in this datasheet.

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

Parameter		Test conditions	Min.	Typ.	Max.	Unit
OFF						
$V_{(BR)\ DSS}$	Drain-source breakdown voltage	I_D = 250 μA V_{GS} = 0				
		for **SGSP473/IP4743/P573**	250			V
		for **SGSP477/IP477/P577**	200			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = Max Rating			250	μA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ±20V			100	nA
ON*						
$V_{GS\ (th)}$	Gate threshold voltage	V_{DS} = V_{GS} I_D = 250 μA	2		4	V
$V_{DS(on)}$	Drain-source voltage	V_{GS} = 10V I_D = 10A				
		for **SGSP473/IP473/P573**			2.2	V
		for **SGSP477/IP477/P577**			1.7	V
		V_{GS} = 10V I_D = 20A				
		for **SGSP473/IP473/P573**			4.7	V
		for **SGSP477/IP477/P577**			3.6	V
		V_{GS} = 10V I_D = 10A T_c = 100°C				
		for **SGSP473/IP473/P573**			4.4	V
		for **SGSP477/IP477/P577**			3.4	V
$R_{DS\ (on)}$	Static drain-source on-resistance	V_{GS} = 10V I_D = 10A				
		for **SGSP473/IP473/P573**			0.22	Ω
		for **SGSP477/IP477/P577**			0.17	Ω

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions	Min.	Typ.	Max.	Unit.
DYNAMIC						
g_{fs}	Forward transconductance	V_{DS} = 25V I_D = 10A	8			mho
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 25V f = 1 MHz V_{GS} = 0		1900 450 200	2200 550 260	pF pF pF
C_{D-HS}	Drain-Heatsink capacitance	V_{D-HS} = 25V f = 1 MHz		19	23	pF
SWITCHING						
$t_{d(on)}$ t_r $t_{d(off)}$ t_f	Turn-on time Rise time Turn off delay time Fall time	V_{CC} = 75V I_D = 10A V_i = 10V R_i = 10Ω (see test circuit)		30 25 90 20		ns ns ns ns
SOURCE DRAIN DIODE						
I_{SD} I_{SDM} (•)	Source-Drain current Source-Drain current (pulsed)				20 80	A A
V_{SD}	Forward on voltage	I_{SD} = 20A V_{GS} = 0			1.3	V
t_{on} t_{rr}	Turn-on time Reverse recovery time	I_{SD} = 18A V_{GS} = 0 di/dt = 100Aμs		300 300		ns ns

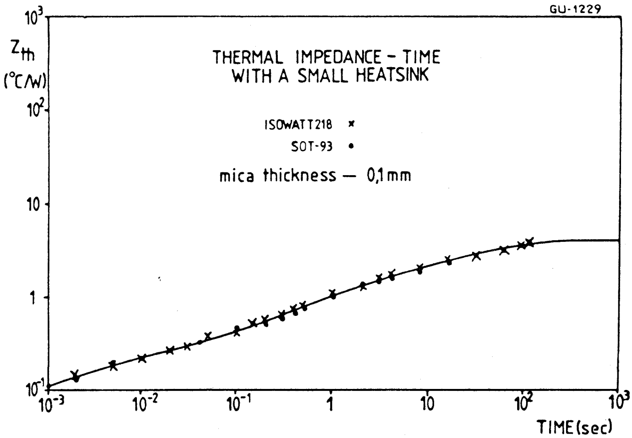
* Pulsed: Pulse duration = 300 μs, duty cycle 1.5%
(•) Pulse width limited by safe operating area

THERMAL RESISTANCE OF THE ISOWATT218

The junction to case thermal resistance of 2.5 °C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1 mm mica insulating washer, the differences are marginal. The 0.1 mm isolating washer gives 1500V to 2000V DC isolation for the SOT-93 package, SGS guarantee 4000V DC isolation for the ISOWATT 218.

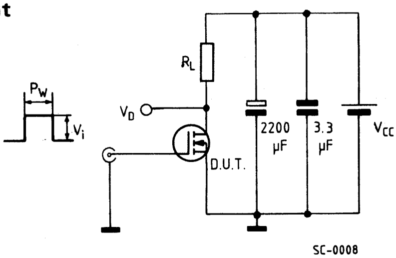
The comparison in fig. 1 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The test illustrate that the ISOWATT218 has an R_{th} very close to that of conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package. The drain to heatsink capacitance of the ISOWATT218 is typically 19pF.

Fig. 1



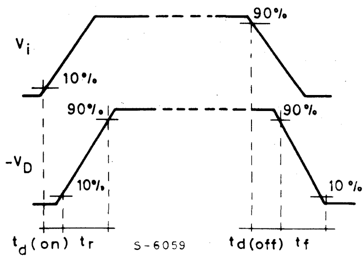
SWITCHING TIMES RESISTIVE LOAD

Test circuit



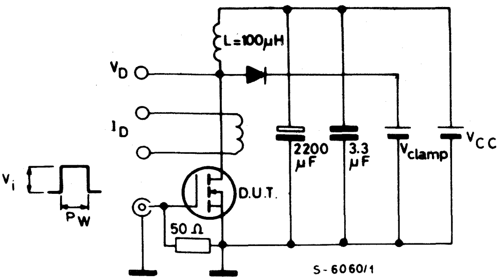
Pulse width ≤ 100 μs
Duty cycle ≤ 2%
$V_i = 10V$

Waveforms

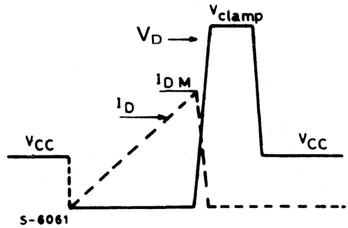


CLAMPED INDUCTIVE LOAD

Test circuit

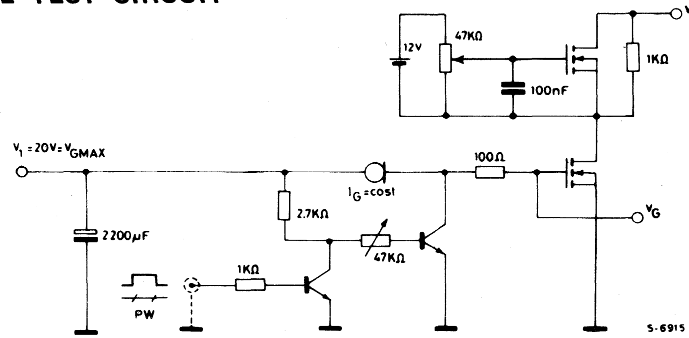


Waveforms



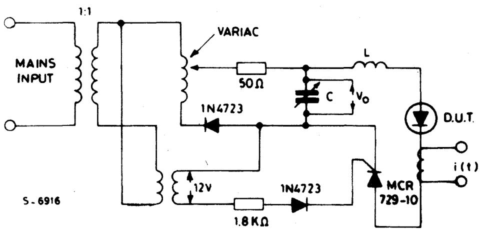
V_i = 12V
Pulse width: adjusted to obtain specified I_{DM}, V_{clamp} = 0.75 $V_{(BR)\ DSS}$

GATE CHARGE TEST CIRCUIT



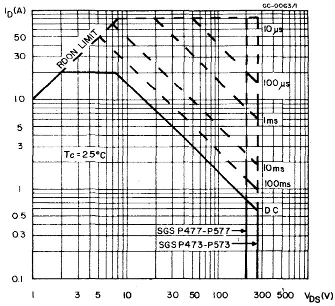
PW adjusted to obtain required V_G

DIODE BODY-DRAIN t_{rr} MEASUREMENT

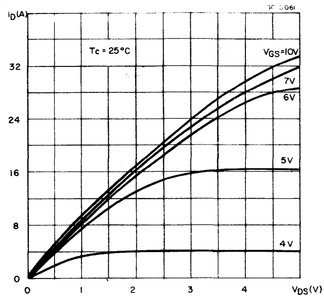


Jedec test circuit

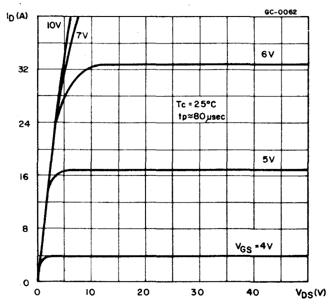
Safe operating areas



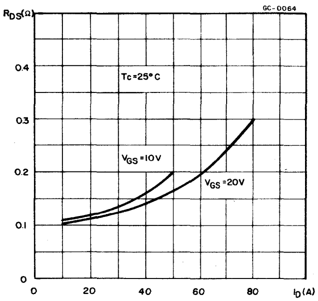
Output characcteristics



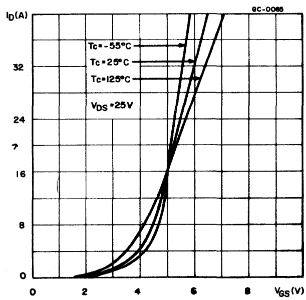
Output characteristics



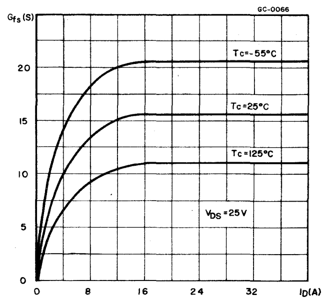
Static drain-source on resistance



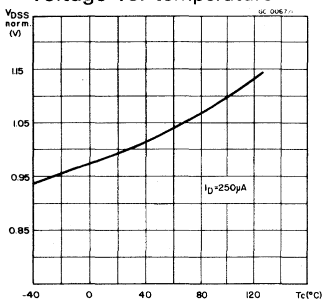
Transfer characteristics



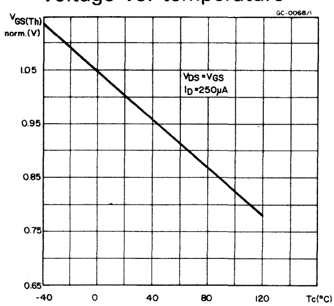
Transconductance



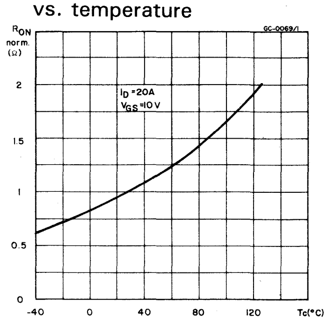
Normalized breakdown voltage vs. temperature



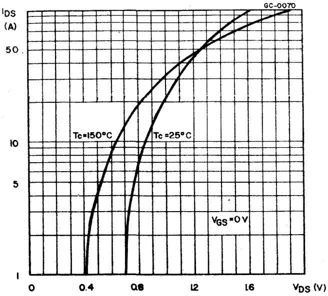
Normalized gate thereshold voltage vs. temperature



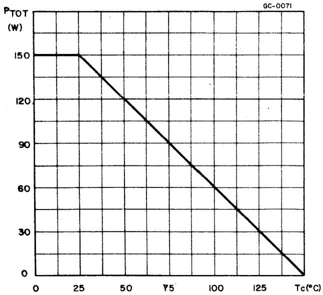
Normalized on resistance vs. temperature



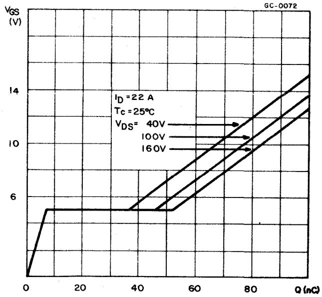
Source-drain diode forward characteristics



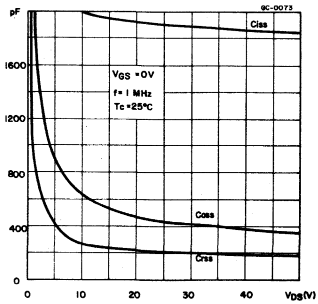
Derating curve



Gate charge vs. gate-source voltage



Capacitance variation



SGSP474/P475/476
SGSIP474/IP475/IP476
SGSP574/P575/P576

HIGH SPEED SWITCHING APPLICATIONS

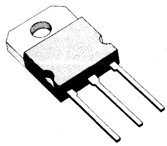
V_{DSS}	$R_{DS\ (on)}$	I_D
350/400 V	0.55 Ω	12 A
450 V	0.7 Ω	12 A

- HIGH VOLTAGE - FOR OFF-LINE SMPS
- HIGH CURRENT - FOR UP TO 350W
- ULTRA FAST SWITCHING - FOR OPERATION AT ⩾100KHz
- EASY DRIVE - REDUCES SIZE AND COST

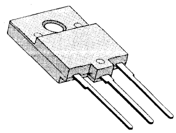
INDUSTRIAL APPLICATIONS:

- SWITCHING MODE POWER SUPPLIES
- MOTOR CONTROLS

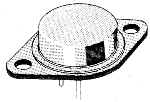
N-Channel enhancement mode POWERMOS field effect transistors. Fast switching and easy drive make these POWERMOS transistors ideal for high voltage switching applications.
These applications include electronic welders, switched mode power supplies and sonar equipment. The package range for this devices includes the isolated case ISOWATT218. This provides isolation to 2500V ac, 4000V dc and the creepeage distance requirement of VDE, IEC and UL specifications.



SOT-93 (TO-218)

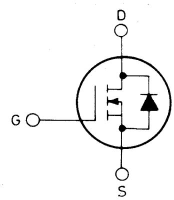


ISOWATT218



TO-3

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

	SOT-93 / ISOWATT218 / TO-3	SGSP474 / SGSIP474 / SGSP574	SGSP475 / SGSIP475 / SGSP575	SGSP476 / SGSIP476 / SGSP576	
V_{DS}	Drain-source voltage (V_{GS} = 0)	450	400	350	V
V_{DGR}	Drain-gate voltage (R_{GS} = 20KΩ)	450	400	350	V
V_{GS}	Gate-source voltage		± 20		V
I_D	Drain current (continuous) T_c = 25°C		12		A
	at T_c = 100°C		7.6		A
I_{DM}(•)	Drain current (pulsed)		48		A
I_{DLM}	Drain inductive current, clamped		48		A
		SOT-93	ISOWATT218	TO-3	
V_{ISO}	Isolation voltage (DC)		4000		V
P_{tot}	Total dissipation at T_{case} = 25°C	150	50	150	W
	Derating factor	1.2	0.4	1.2	W/°C
T_{stg}	Storage temperature		−55 to 150		°C
T_j	Max. operating junction temperature		150		°C

(•) Pulse width limited by safe operating area.

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THERMAL DATA

			SOT-93	ISOWATT218	TO-3	
$R_{th\ j-case}$	Thermal resistance junction-case	max	0.83	2.5•	0.83	°C/W
T_L	Maximum lead temperature for soldering purpose			275		°C

• See notes on ISOWATT218 in this datasheet.

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

Parameter		Test conditions	Min.	Typ.	Max.	Unit
OFF						
$V_{(BR)\ DSS}$	Drain-source breakdown voltage	I_D = 250 μA V_{GS} = 0				
		for **SGSP474/IP474/P574**	450			V
		for **SGSP475/IP475/P575**	400			V
		for **SGSP476/IP476/P576**	350			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = Max Rating			250	μA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ±20V			100	nA
ON*						
$V_{GS\ (th)}$	Gate threshold voltage	V_{DS} = V_{GS} I_D = 250 μA	2		4	V
$V_{DS(on)}$	Drain-source voltage	V_{GS} = 10V I_D = 6A				
		for **SGSP474/IP474/P574**			4.2	V
		for **SGSP475/IP475/P575**			3.3	V
		for **SGSP476/IP476/P576**			3.3	V
		V_{GS} = 10V I_D = 12A				
		for **SGSP474/IP474/P574**			9.3	V
		for **SGSP475/IP475/P575**			7.1	V
		for **SGSP476/IP476/P576**			7.1	V
		V_{GS} = 10V I_D = 6A T_c = 100°C				
		for **SGSP474/IP474/P574**			8.4	V
		for **SGSP475/IP475/P575**			6.6	V
		for **SGSP476/IP476/P576**			6.6	V
$R_{DS\ (on)}$	Static drain-source on-resistance	V_{GS} = 10V I_D = 6A				
		for **SGSP474/IP474/P574**			0.70	Ω
		for **SGSP475/IP475/P575**			0.55	Ω
		for **SGSP476/IP476P576**			0.55	Ω

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions	Min.	Typ.	Max.	Unit.
DYNAMIC						
g_{fs}	Forward transconductance	V_{DS} = 25V I_D = 6A	6			mho
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 25V f= 1 MHz V_{GS} = 0		1600 300 200	2100 390 260	pF pF pF
C_{D-HS}	Drain-Heatsink capacitance	V_{D-HS} = 25V f = 1 MHz		19	23	pF
SWITCHING						
$t_{d(on)}$ t_r $t_{d(off)}$ t_f	Turn-on time Rise time Turn off delay time Fall time	V_{CC}= 100V I_D= 6A V_i = 10V R_i = 4.7Ω (see test circuit)		20 25 70 20		ns ns ns ns
SOURCE DRAIN DIODE						
I_{SD} I_{SDM} (•)	Source-Drain current Source-Drain current (pulsed)				12 48	A A
V_{SD}	Forward on voltage	I_{SD} = 12A V_{GS} = 0			1.2	V
t_{on} t_{rr}	Turn-on time Reverse recovery time	I_{SD} = 12A V_{GS} = 0 di/dt = 25A μs		700 800		ns ns

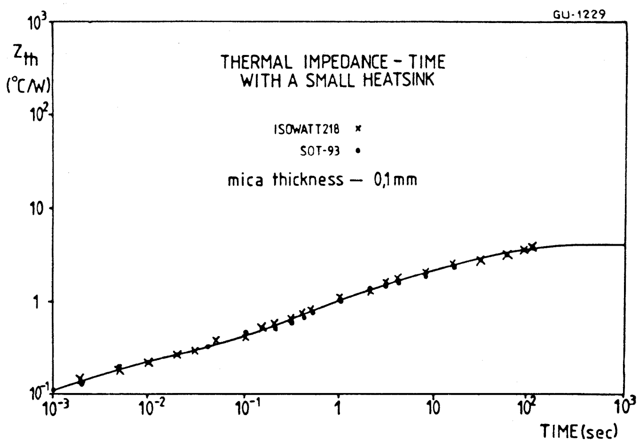
* Pulsed: Pulse duration = 300 μs, duty cycle 1.5%
(•) Pulse width limited by safe operating area

THERMAL RESISTANCE OF THE ISOWATT218

The junction to case thermal resistance of 2.5 °C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1 mm mica insulating washer, the differences are marginal. The 0.1 mm isolating washer gives 1500V to 2000V DC isolation for the SOT-93 package, SGS guarantee 4000V DC isolation for the ISOWATT 218.

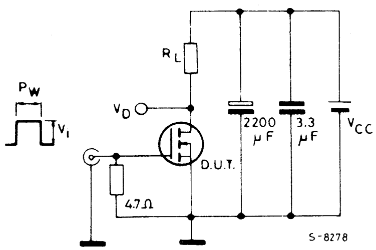
The comparison in fig. 1 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The test illustrate that the ISOWATT218 has an R_{th} very close to that of conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT218 package. The drain to heatsink capacitance of the ISOWATT218 is typically 19pF.

Fig. 1



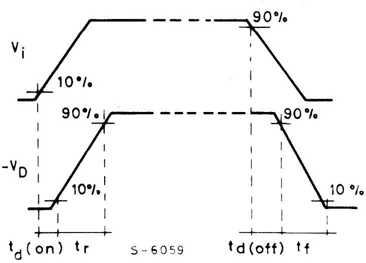
SWITCHING TIMES RESISTIVE LOAD

Test circuit



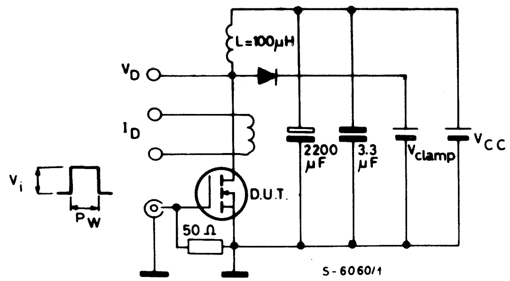
Pulse width $\leqslant$ 100 μs
Duty cycle $\leqslant$ 2%
V_i = 10V

Waveforms

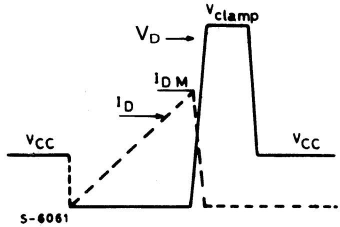


CLAMPED INDUCTIVE LOAD

Test circuit

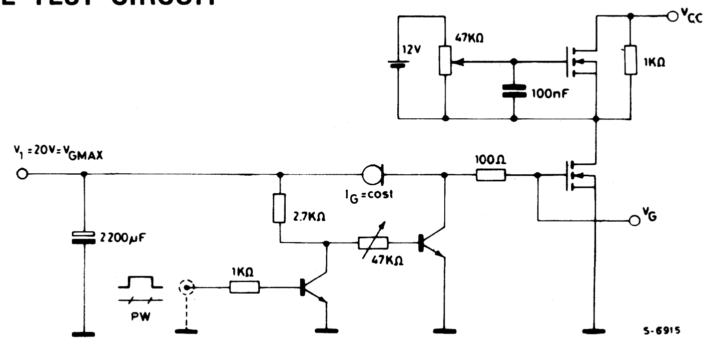


Waveforms



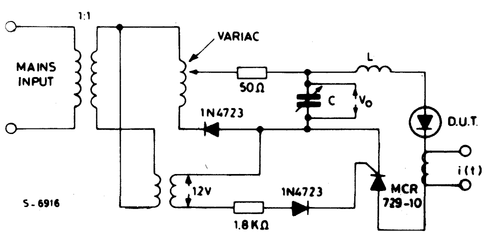
$V_i = 12V$
Pulse width: adjusted to obtain specified I_{DM}, $V_{clamp} = 0.75\ V_{(BR)\ DSS}$

GATE CHARGE TEST CIRCUIT



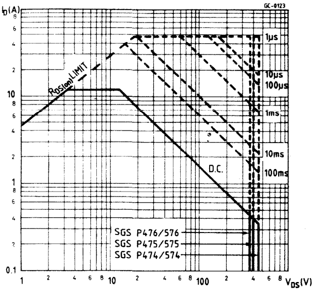
PW adjusted to obtain required V_G

DIODE BODY-DRAIN t_{rr} MEASUREMENT

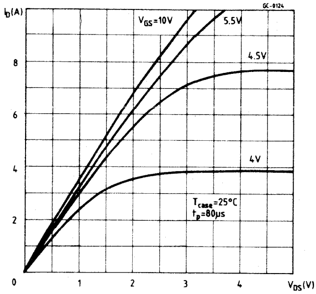


Jedec test circuit

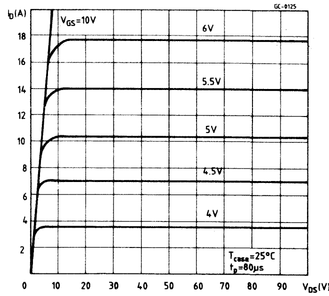
Safe operating areas



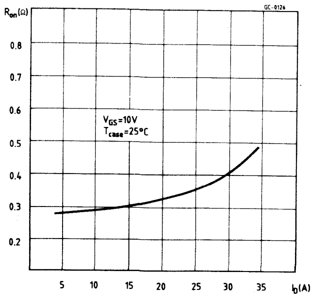
Output characteristics



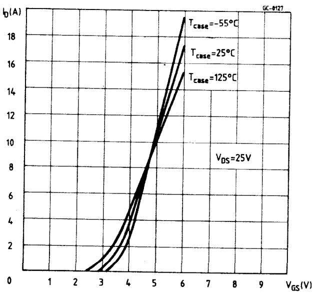
Output characteristics



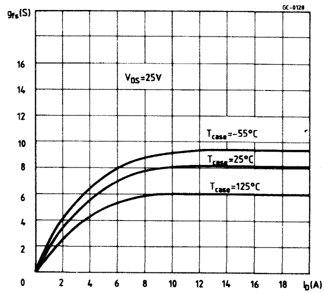
Static drain-source on resistance



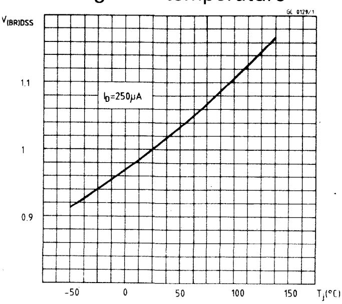
Transfer characteristics



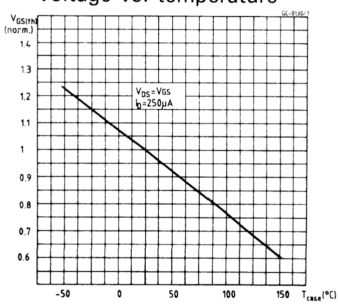
Transconductance



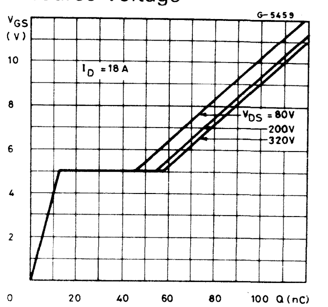
Normalized breakdown voltage vs. temperature



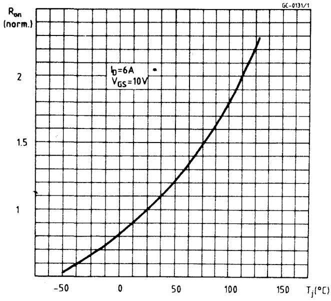
Normalized gate thereshold voltage vs. temperature



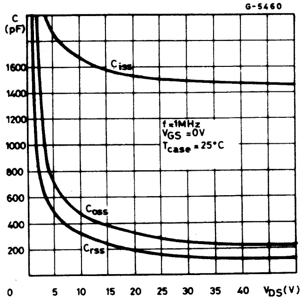
Gate charge vs. gate to source voltage



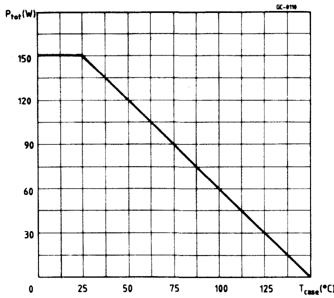
Normalized on resistance vs. temperature



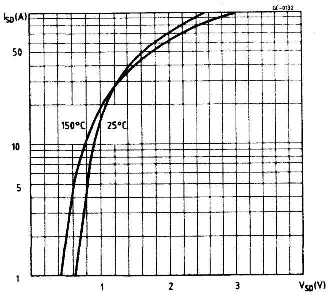
Capacitance variation



Derating curves



Source-drain diode forward characteristics



SGSP478/479
SGSIP478/479
SGSP578/579

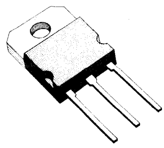
HIGH SPEED SWITCHING APPLICATIONS

V_{DSS}	$R_{DS\,(on)}$	I_D
500V	0.7 Ω	10A
550V	1 Ω	10A

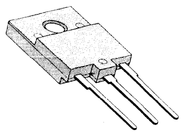
- HIGH VOLTAGE - 500 FOR OFF-LINE SMPS
- HIGH CURRENT - 10A FOR UP 350W SMPS
- ULTRA FAST SWITCHING - FOR OPERATION AT ≥100KHz
- EASY DRIVE - REDUCES COST AND SIZE

INDUSTRIAL APPLICATION:

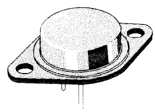
- SWITCHING MODE POWER SUPPLIES
- MOTOR CONTROL



SOT-93 (TO-218)



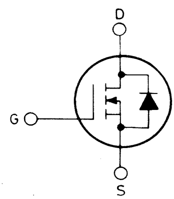
ISOWATT218



TO-3

N-Channel enhancement mode POWER MOS field effect transistors. Easy drive and very fast switching times make these POWER MOS transistors ideal for high speed switching applications.
Typical applications include switched mode power supplies, uninteruptable power supplies and motor speed control.
The package range for this devices includes the isolated case ISOWATT218. This provides isolation to 2500V ac, 4000V dc and the creepage distance requirement of VDE, IEC, and UL specifications.

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

	SOT-93 / ISOWATT218 / TO-3	SGSP478 / SGSIP478 / SGSP578	SGSP479 / SGSIP479 / SGSP579	
V_{DS}	Drain-source voltage (V_{GS} = 0)	550	500	V
V_{DGR}	Drain-gate voltage (R_{GS} = 20KΩ)	550	500	V
V_{GS}	Gate-source voltage	± 20		V
I_D	Drain current (continuous) T_c = 25°C	10		A
	at T_c = 100°C	6.3		A
I_{DM}(•)	Drain current (pulsed)	40		A
I_{DLM}	Drain inductive current, clamped	40		A

		SOT-93	ISOWATT218	TO-3	
V_{ISO}	Isolation voltage (DC)		4000		V
P_{tot}	Total dissipation at T_{case} = 25°C	150	50	150	W
	Derating factor	1.2	0.4	1.2	W/°C
T_{stg}	Storage temperature		−55 to 150		°C
T_j	Max. operating junction temperature		150		°C

(•) Pulse width limited by safe operating area.

THERMAL DATA

			SOT-93	ISOWATT218	TO-3	
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	0.83	2.5•	0.83	°C/W
T_L	Maximum lead temperature for soldering purpose			275		°C

• See notes on ISOWATT218 in this datasheet.

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

Parameter		Test conditions	Min.	Typ.	Max.	Unit
OFF						
$V_{(BR)\ DSS}$	Drain-source breakdown voltage	I_D = 250 μA V_{GS} = 0 for **SGSP478/IP478/P578** for **SGSP/479/IP479/P579**	 550 500			 V V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = Max Rating			250	μA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ±20V			100	nA
ON*						
$V_{GS\ (th)}$	Gate threshold voltage	V_{DS} = V_{GS} I_D = 250 μA	2		4	V
$V_{DS(on)}$	Drain-source voltage	V_{GS} = 10V I_D = 5A for **SGSP478/IP478/P578** for **SGSP479/IP479/P579**			 5 3.5	 V V
$R_{DS\ (on)}$	Static drain-source on-resistance	V_{GS} = 10V I_D = 5A for **SGSP478/IP478/P578** for **SGSP479/IP479/P579**			 1 0.7	 Ω Ω
DYNAMIC						
g_{fs}	Forward transconductance	V_{DS} = 25V I_D = 5A	5			mho
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 25V f = 1 MHz V_{GS} = 0		1600 230 140	1900 280 170	pF pF pF
$C_{D\text{-}HS}$	Drain-Heatsink capacitance	$V_{D\text{-}HS}$ = 25 V f = 1 MHz		19	23	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING

Parameter		Test conditions	Min.	Typ.	Max.	Unit.
$t_{d\ (on)}$	Turn-on time	$V_{CC} = 250V$ $I_D = 5A$		25		ns
t_r	Rise time	$V_i = 10V$ $R_i = 10\Omega$		30		ns
$t_{d(off)}$	Turn off delay time	(see test circuit)		80		ns
t_f	Fall time			20		ns

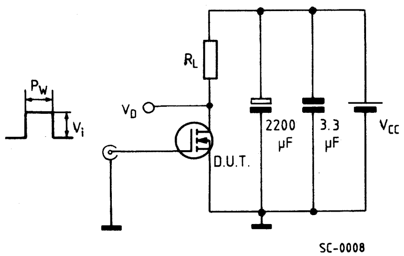
SOURCE DRAIN DIODE

Parameter		Test conditions	Min.	Typ.	Max.	Unit.
I_{SD}	Source-Drain current				10	A
I_{SDM} (•)	Source-Drain current (pulsed)				40	A
V_{SD}	Forward on voltage	$I_{SD} = 10A$ $V_{GS} = 0$			1.15	V
t_{on}	Turn-on time	$I_{SD} = 10A$ $V_{GS} = 0$		75		ns
t_{rr}	Reverse recovery time	$di/dt = 100A/\mu s$		500		ns

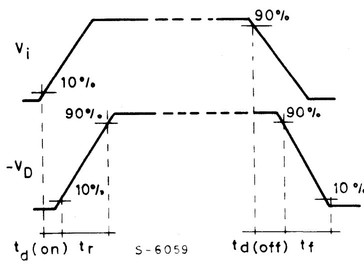
* Pulsed: Pulse duration = 300/µs, duty cycle 1.5%
(•) Pulse width limited by safe operating area

SWITCHING TIMES RESISTIVE LOAD

Test circuit



Waveforms



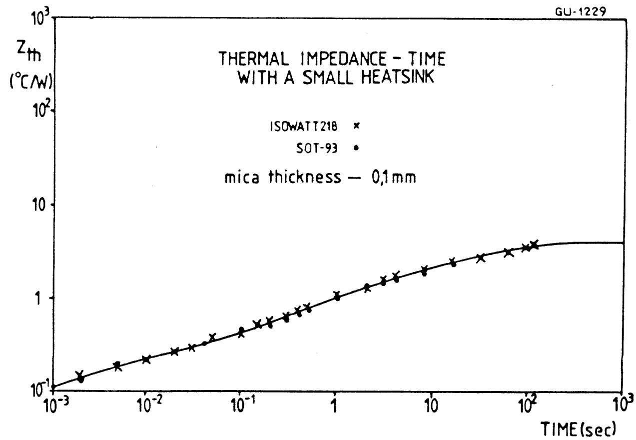
Pulse width ⩽ 100 µs
Duty cycle ⩽ 2%
$V_i = 10V$

THERMAL RESISTANCE OF THE ISOWATT218

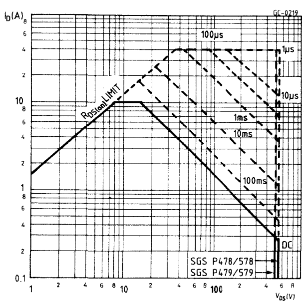
The junction to case thermal resistance of 2.5 C/W for the ISOWATT218 package may seem quite high at first glance but if compared to a conventional SOT-93 (TO-218) package with a 0.1 mm mica insulating washer, the differences are marginal. The 0.1 mm isolating washer gives 1500V to 2000V DC isolation for the SOT-93 package, SGS guarantee 4000V DC isolation for the ISOWATT 218.

The comparison in fig. 4 shows the dynamic thermal resistance of both devices mounted using a thermal compound. The test illustrate that the ISOWATT218 has an R_{th} very close to that of conventional SOT-93 (TO-218) and any small increase is more than compensated for by the convenience of the ISOWATT 218 package. The collector to heatsink capacitance of the ISOWATT218 is typically 17pF.

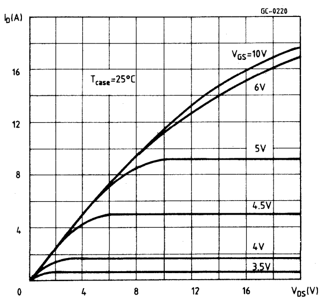
Fig. 3



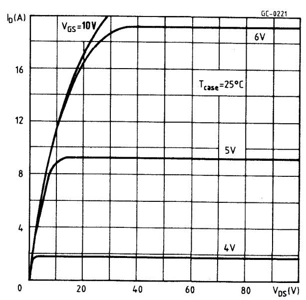
Safe operating areas



Output characteristics.

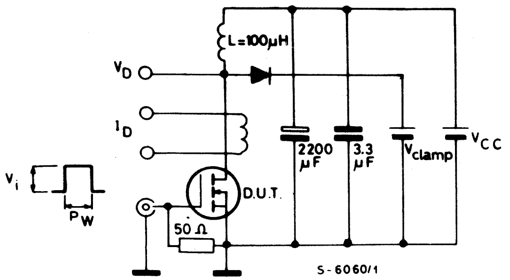


Output characteristics.

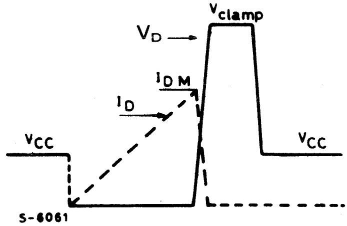


CLAMPED INDUCTIVE LOAD

Test circuit



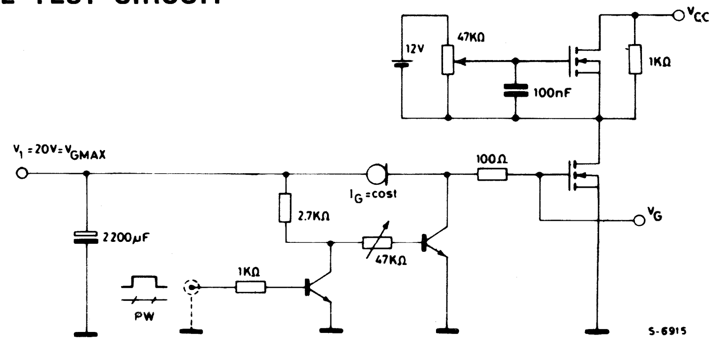
Waveforms



$V_i = 12V$

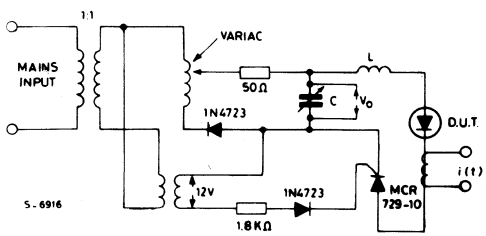
Pulse width: adjusted to obtain specified I_{DM}, $V_{clamp} = 0.75\ V_{(BR)\ DSS}$

GATE CHARGE TEST CIRCUIT



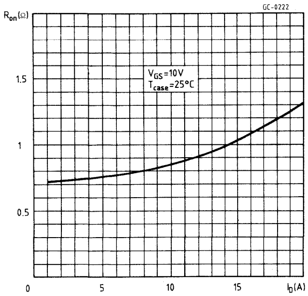
PW adjusted to obtain required V_G

DIODE BODY-DRAIN t_{rr} MEASUREMENT

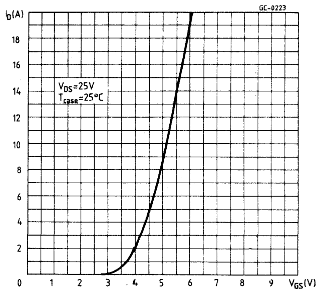


Jedec test circuit

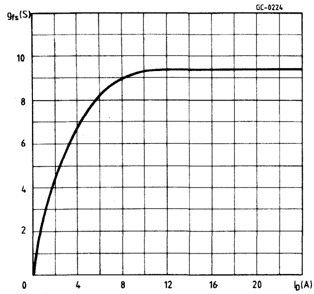
Static drain-source on resistance.



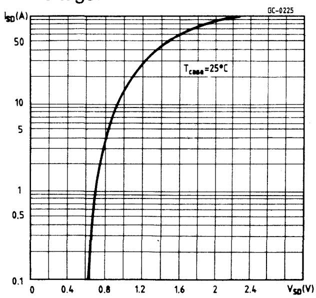
Transfer characteristic.



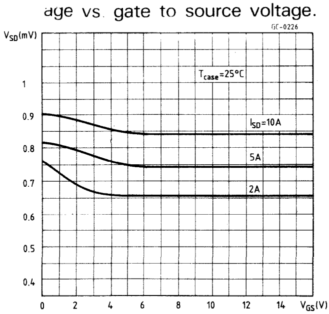
Transconductance.



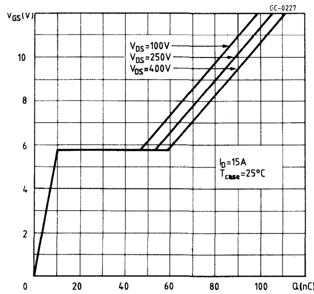
Source-drain diode forward voltage.



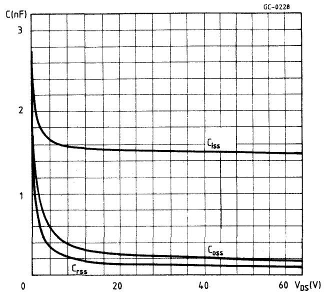
Source-drain diode forward voltage vs. gate to source voltage.



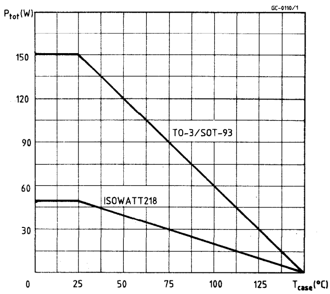
Gate charge vs. gate to source voltage.



Capacitances variation.

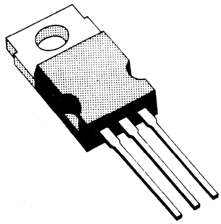


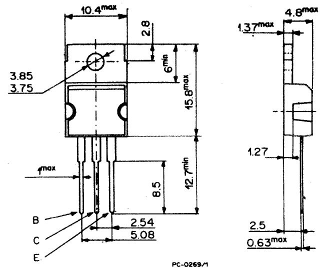
Derating curve.



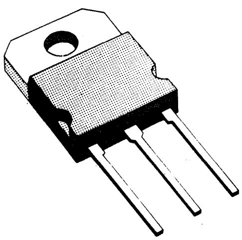
PACKAGES

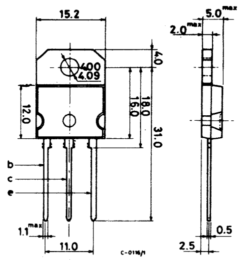
TO-220



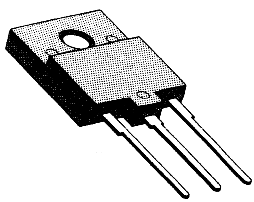


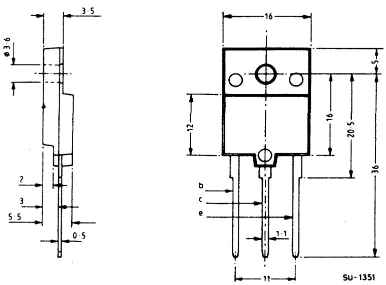
SOT-93 (TO-218)



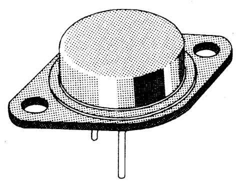


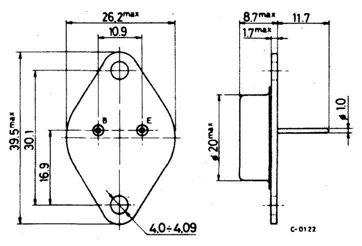
ISOWATT218





TO-3





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