

# TRACE ELLIOT

## SERVICE MANUAL

**DATE :** December 29, 1999  
**Product Code:** N/A  
**Model Number :** GP7 300 WATT SM SERIES

This unit has used two issues of 300 watt MOSFET power board.

The Bi-polar Bear and the 300 Mosfet Board

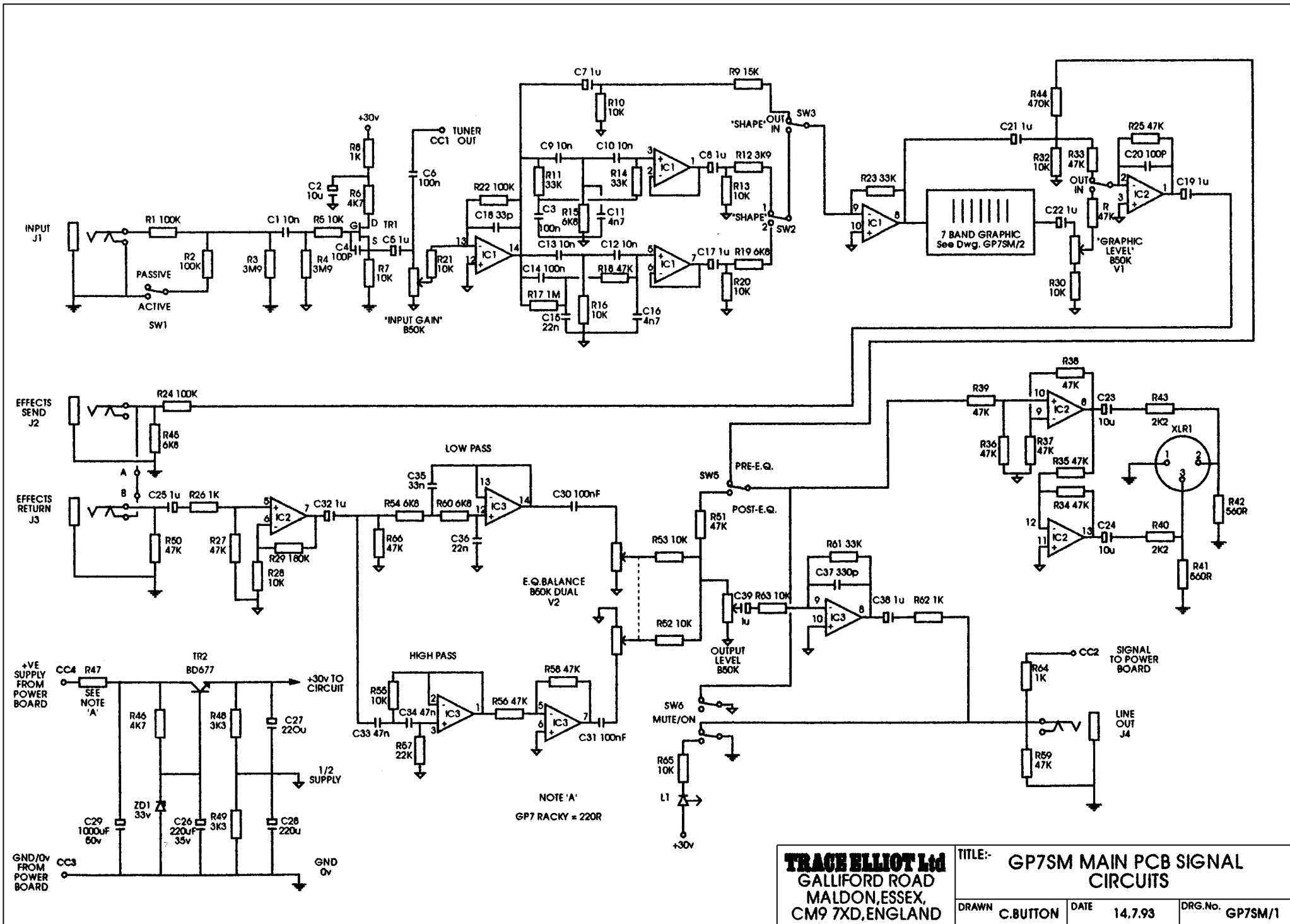
Details for both are included in this manual.

You should check which board you have in your unit before attempting any repair.

The Bi-polar board is marked PC00026

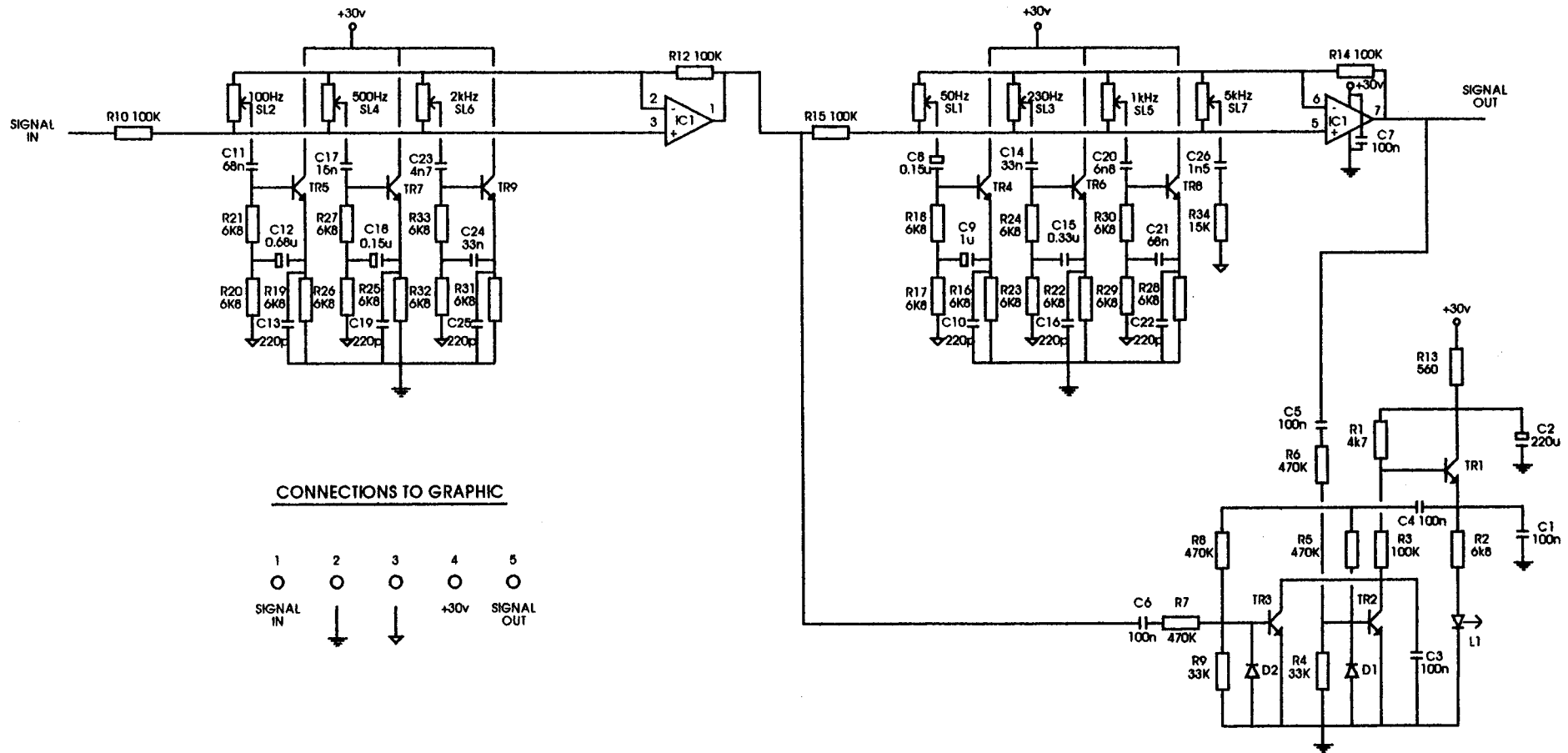
The MOSFET board is marked PC00083

Issued by:  
**Trace Elliot Limited**  
**Blackwater Trading Estate**  
**The Causeway**  
**Maldon**  
**Essex**  
**England**  
**CM4 4GG**



**TRACHELLIOT Ltd**  
 GALLIFORD ROAD  
 MALDON, ESSEX,  
 CM9 7XD, ENGLAND

TITLE:- GP7SM MAIN PCB SIGNAL CIRCUITS	
DRAWN C.BUTTON	DATE 14.7.93
DRG.No. GP7SM/1	



**TRACE ELLIOT Ltd**  
 GALLIFORD ROAD  
 MALDON, ESSEX,  
 CM9 7XD, ENGLAND

TITLE:- GP7SM GRAPHIC E.Q. &  
 OVERLOAD DISPLAY

DRAWN C.BUTTON

DATE 16.7.93

DRG.No. GP7SM/2

# PARTS LIST FOR GP7 SM MAIN PCB

Description	Part Code	Qty	Where Used
<b>RESISTORS</b>			
ZERO OHM LINK	72-RC-ZERO	17	
100K ¼ WATT	72-RM100K	4	R1 R2 R22 R24
3.9M ¼ WATT	72-RM3M9	2	R3 R4
10K ¼ WATT	72-RM10K	15	R5 R7 R10 R13 R16 R20 R21 R28 R30 R32 R52 R53 R55 R63 R65
4.7K ¼ WATT	72-RM4K7	1	R46
1K ¼ WATT	72-RM1K	4	R8 R26 R62 R64
15K ¼ WATT	72-RM15K	1	R9
33K ¼ WATT	72-RM33K	4	R11 R14 R23 R61
3.9K ¼ WATT	72-RM3K9	2	R12 R6
6.8K ¼ WATT	72-RM6K8	5	R15 R19 R45 R54 R60
1M ¼ WATT	72-RM1M	1	R17
47K ¼ WATT	72-RM47K	17	R18 R25 R27 R31 R33 R35-39 R50 R51 R56 R58 R59 R66 R34
180K ¼ WATT	72-RM180K	1	R29
2.2K ¼ WATT	72-RM2K2	2	R40 R43
560R ¼ WATT	72-RM560R	2	R41 R42
470K ¼ WATT	72-RM470K	1	R44
22K ¼ WATT	72-RM22K	1	R57
3K3 ¼ WATT	72-RM3K3	2	R48 R49
330R 4 WATT	72-RWW330R-4W	1	R47
<b>CAPACITORS</b>			
4.7nF 100V POLY	72-C4N7-100VP	2	C11 C16
10nF 100V POLY	72-C10N-100VP	5	C1 C9 C10 C12 C13
22nF 100V POLY	72-C22N-100VP	2	C15 C36
33nF 100V POLY	72-C33N-100VP	1	C35
47nF 100V POLY	72-C47N-100VP	2	C33 C34
100nF 100V POLY	72-C100N-100VP	5	C3 C6 C14 C30 C31
33pF 100V CER/DISC	72-C33P-100VCD	1	C18
100pF 100V CER/DISC	72-C100P-VCD2	2	C4 C20
330pF 100V CER/DISC	72-C330P-100VCD2	1	C37
1µF 35V TANT	72-C1-35VT	11	C5 C7 C8 C17 C19 C21 C22 C25 C32 C38 C39
10µF 63V RADIAL	72-C10-63VER	3	C2 C23 C24

220 $\mu$ F 25V RADIAL	72-C220-35VER	2	C26 C28
10 $\mu$ F 35V AXIAL	72-C10-35VEA	1	This is to be fitted in place of the link above C15 and C16. Fitted the same way round as the rest of the radials, + at the top.
<b>SEMI-CONDUCTORS</b>			
TL074 OP-AMP	72-IC-TL074	3	IC1,2,3
J112 FET	72-FET-J-112	1	TR1
33V ZENER DIODE	72-D-BZX55C33V	1	ZD1
BD677	72-TBD677	1	TR2
HEATSINK FOR BD677	71-HS-TEG	1	TR2
<b>SOCKETS</b>			
3 WAY HEADER	72-HEAD-3W-2	1	CB
4 WAY HEADER	72-HEAD-4W	1	CC
5 WAY HEADER	72-HEAD-5W	1	CA
JACK SOCKETS	72-SKT-JCKBNBG	4	J1 J2 J3 J4
<b>POTS / SWITCHES</b>			
50K DUAL GANG PCB	73-POT-50K-DG	1	V2
50K PCB MOUNT POT	73-POT-50KB	1	V1
50K POTS FLYING	C00-POT-50KB	2	INPUT / OUTPUT
LATCHING PUSH SWITCH	73-SW-F2UEE	6	SW1-6
<b>OTHERS</b>			
RED LED	72-LED-RED-TEG	1	LED 1

**Rik Daniels**  
**February 24, 1997**

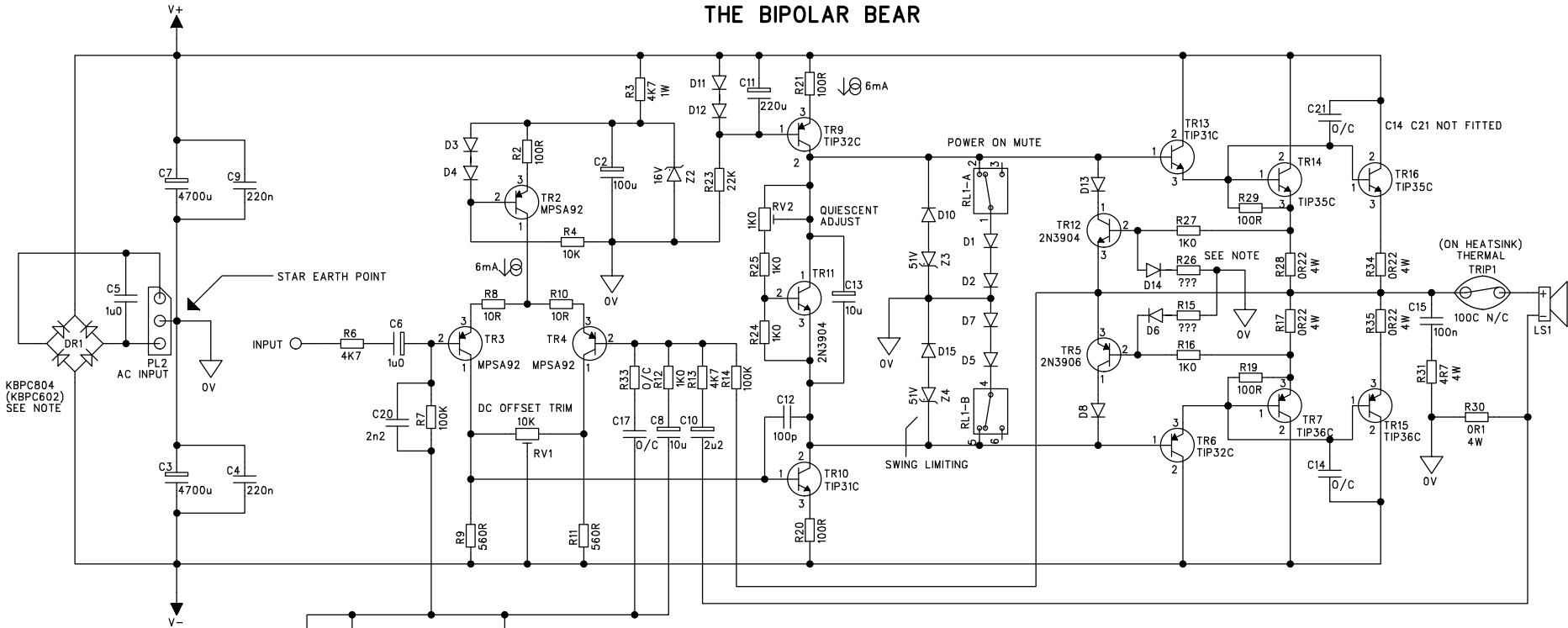
## PARTS LIST FOR GP7SM FRONT BOARD

Description	Part Code	Qty	Where Used
<b>RESISTORS</b>			
ZERO OHM LINK	72-RCZERO	3	
100K ¼ WATT	72-RM100K	5	R3 R10 R12 R14 R15
15K ¼ WATT	72-RM15K	1	R34
33K ¼ WATT	72-RM33K	2	R4 R9
470K ¼ WATT	72-RM470K	4	R5 R6 R7 R8
4K7 ¼ WATT	72-RM4K7	1	R1
560R ¼ WATT	72-RM560R	1	R13
6K8 ¼ WATT	72-RM6K8	19	R2 R16-33
<b>CAPACITORS</b>			
0.15µF 35V TANT	72-C0.15-35VT	2	C8 C18
0.33µF 35V TANT	72-C0.33-35VT	1	C15
0.68µF 35V TANT	72-C0.68-35VT	1	C12
1µF 35V TANT	72-C1-35VT	1	C9
100nF 100V POLY	72-C100N-100VP	6	C1 C3-7
15nF 100V POLY	72-C15N-100VP	1	C17
1n5 100V POLY	72-C1N5-100VP	1	C26
220µF 35V RADIAL	72-C220-35VER	1	C2
220pF 100V POLY	72-C220P-100VCD2	6	C10 C13 C16 C19 C22 C25
33nF 100V POLY	72-C33N-100VP	2	C14 C24
4n7 100V POLY	72-C4N7-100VP	1	C23
68nF 100V POLY	72-C68N-100VP	2	C11 C21
6n8 100V POLY	72-C6N8-100VP	1	C20
<b>SEMI-CONDUCTORS</b>			
IN4148 DIODE	72-D-IN4148	2	D1 D2
TL072 OP-AMP	72-IC-TL072	1	IC1
RED LED	72-LED-RED	1	L1
BC212L TRANSISTOR	72-TBC212L	1	TR1
BC549C TRANSISTOR	72-TBC549C	8	TR2-9
<b>OTHERS</b>			
PLASTIC SPACER	71-SPA-LED-TEG2	1	L1
5 WAY JUMPER LINK	72-LK-5W100MM	1	CA
SLIDER POTS	73-SLIDER-B100KC	7	SL1-7

**Rik Daniels**  
**February 24, 1997**

ISSUE CHANGE NOTE DATE	ISSUE CHANGE NOTE DATE	ISSUE CHANGE NOTE DATE
ISSUE CHANGE NOTE DATE	ISSUE CHANGE NOTE DATE	ISSUE CHANGE NOTE DATE

## THE BIPOLAR BEAR



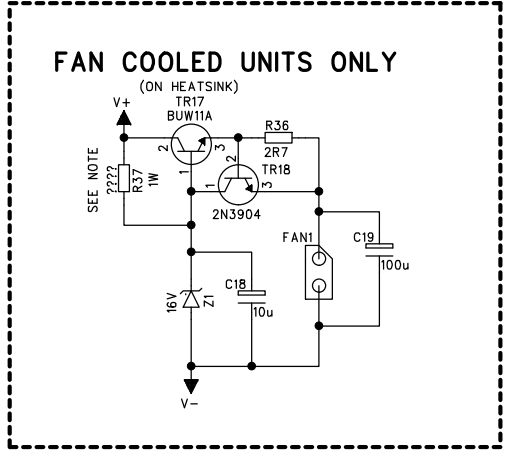
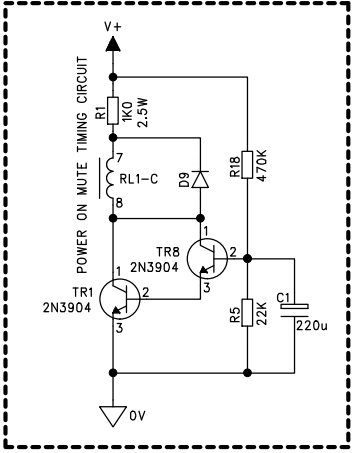
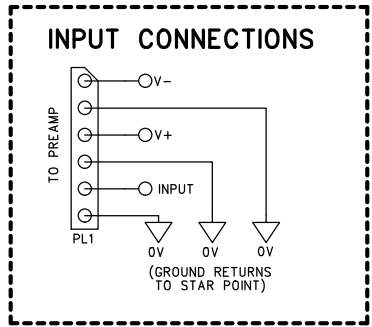
DECOUPLING TO CHASSIS

**NB:**  
 TR15 TR16 R34 R35 NOT FITTED FOR 150W  
 R30 R13 C10 SET OUTPUT DAMPING FACTOR  
 R33 C17 ARE FOR PRESENCE LIFT (IF REQD)  
 R7 = R14 ALWAYS  
 R15 & R26 = 10K FOR 150W  
 R15 & R26 = 27K FOR 300W  
 R37 = 10K / 1W FOR 150W  
 R37 = 22K / 1W FOR 300W  
 DR1 = KBPC602 FOR 150W  
 DR1 = KBPC804 FOR 300W  
 D1 D2 D5 D7 D10 D15 = 1N4007  
 D9 = 16V ZENER  
 ALL OTHER DIODES 1N4148

OUTPUT DEVICES:  
 TIP35C / TIP36C FOR 150W  
 2SC4468 / 2SA1695 FOR 300W



COMPONENTS USED ARE OF AN APPROVED TYPE AND MUST BE REPLACED ACCORDINGLY



TITLE PROJECT DRAWING No ISSUE DATE DRAWN BY  
 POWER AMP. MODULE 150/290W BASS UNITS CD00019 9 22/3/1996 J B RECKLESS  
**TRACE ELLIOT**  
 TRACE ELLIOT LIMITED  
 MALDON ESSEX CM9 7XD  
 ENGLAND  
 TEL (01621) 851851  
 FAX (01621) 851932

# **BIPOLAR BEAR - PC00026**

## **CIRCUIT DESCRIPTION**

The Bipolar Bear is a general purpose bipolar junction transistor power amplifier PCB that has been designed for use in bass, lead guitar and acoustic amplifiers. It is fairly straightforward in design, and includes voltage and current feedback so that the frequency response and output damping factor can be adjusted to suit each particular application. The damping factor is a measure of how much the output amplitude varies as the load impedance is changed. A high damping factor means that the output voltage remains constant regardless of load impedance; a low damping factor means that the load impedance plays a major part in the overall output amplitude.

The unit has been designed for use in amplifiers of up to 300 watts rms output. For power output of up to 150 watts, one pair of output transistors is used; for greater power output a second pair of devices is required.

### **INPUT STAGE**

TR3 and TR4 form a 'long tail pair' - their purpose is to compare the input signal with the output voltage and current, and produce a 'difference' signal that is used to drive the following stage. TR2, in conjunction with D3, D4, R2 and R4, provides a 'constant current source' that maintains a current of approximately 6mA into the emitters of TR3 and TR4. The purpose of R3, C2 and Z2 is to 'decouple' the supply voltage ripple, so as to minimise the 100Hz 'hum' into the rest of the amplifier.

The collector load resistor of TR3 and TR4 - R9, can be 'balanced' using preset RV1 so that any differences in gain between the two transistors can be tuned out to give an overall zero DC offset in the output.

Capacitor C20 (across R7) sets the high frequency rolloff of the input stage. C6 (in series with R7) sets the low frequency rolloff of the input stage.

### **VOLTAGE AMPLIFICATION STAGE**

Transistor TR10 is the main voltage amplification stage of the amplifier. It takes the small signal swing from the long tail pair and amplifies it to the full amplitude of the power amplifier output stage. Capacitor C12 is known as the



'compensation capacitor' - its purpose is to prevent the amplifier from becoming unstable at high frequencies.

TR9, in conjunction with R21, D11, D12, R23 and C11, is a 'constant current source' load for the collector of TR10. It ensures that as the collector of TR10 swings from rail to rail, there is always sufficient current to drive the following stages of the amp.

The purpose of TR11 is to control the quiescent or 'bias' current of the output stage. When a bipolar junction transistor becomes hot (i.e. when power is being dissipated) the current through the device increases for a given applied bias voltage. TR11 is mounted on the heatsink and thermally coupled to the output transistors. Its temperature tracks those of the output devices and it therefore keeps the bias current (almost) constant as temperature varies.

Preset RV2 can be used to adjust the bias voltage so that any crossover distortion can be accurately trimmed out. **This is far more important in bipolar power amps than their MOSFET equivalent.**

## **DRIVER STAGE**

The purpose of driver transistors TR13 and TR6 is to increase the current available to drive the base junction of the output transistors - they are emitter followers.

## **OUTPUT STAGE**

Transistors TR14, TR16, TR7 and TR15 are also emitter followers - they pass the voltage from the driver stage through to the output and dissipate most of the heat in the amplifier.

Emitter resistors R17, R28, R34 and R35 are to ensure that each transistor shares an equal part of the current output, and to provide stable biasing in conjunction with TR11.

## **ZOBEL NETWORK**

C15 and R31 ensure that the amplifier 'sees' a suitable load at high frequencies, as many loudspeaker systems act as an 'open circuit' at very high frequencies.

## **VOLTAGE FEEDBACK**

R14, R12 and C8 comprise the voltage feedback of the amplifier. These components set the overall gain and improve consistency from one amp to another.

## **CURRENT FEEDBACK**

R30, R13 and C10 comprise the current feedback of the amplifier. These components determine the overall damping factor of the amplifier.

## **SHORT CIRCUIT PROTECTION**

Transistors TR12 and TR5 play no part during normal amplification. Their purpose is to protect the output transistors from a possible short circuit. A high positive current will produce a voltage across R28 which, when the current reaches a certain amount, will 'turn on' TR12 and short out the base drive to TR13.

Under normal conditions, most of the current that would turn on TR12 is shorted to ground via D14 and R26. However, when the output is shorted out, there is no voltage across D14, so all the current flows into TR12.

This method of short circuit protection is known as 'foldback current limiting' - the maximum current allowed into a normal load is higher than the maximum current allowed into a short circuit.

Transistor TR5 and its associated components provide similar protection for output transistors TR7 and TR15.

## **POWER ON MUTE**

The purpose of relay RL1 and its associated components is to limit the swing of the output stage while the amp is powering up or down, and thus prevent any large 'bangs' being sent into the loudspeaker.

Transistors TR1 and TR8 in conjunction with R18 and C1 set the timing constant for the power on / off muting.

## **SWING LIMITING**

Zener diodes Z3 and Z4 in conjunction with diodes D10 and D15 limit the maximum output swing, to prevent the output transistors from over-volting when the amp is used 'off load'.

## **FAN DRIVE CIRCUIT**

Transistor TR17 passes current to the cooling fan, whilst dropping the voltage from the rails to a more appropriate 12 - 16Vdc. Zener Z1 and resistor R37 set the fan voltage. Transistor TR18 and resistor R36 act to limit the maximum current into the fan - this prevents the destruction of TR17 should the fan become short circuit, or be forced to stop.

Jonny Reckless, 6 December 1995

**PARTS LIST FOR 300W BASS AMP  
USING PC00026 ISSUE 7  
Please label the pcb '300W BASS'**

Description	Part Code	Qty	Where Used
DIODE 1N4007	72-D-1N4007	14	D1.....D8 D10....D15
ZENER DIODE 16 VOLT	72-D-BZY88C16V	3	Z1 Z2 D9
ZENER DIODE 51 VOLT	72-D-BZY88C51V	2	Z3 Z4
ZERO OHM LINKS	72-RCZERO	14	
RES 1/4W 2R7	72-RM2R7	1	R36
RES 1/4W 10R	72-RM10R	2	R8 R10
RES 1/4W 100R	72-RM100R	4	R2 R9 R20 R21
RES 1/4W 220R	72-RM220R	2	R19 R29
RES 1/4W 1K0	72-RM1K	5	R12 R16 R24 R25 R27
RES 1/4W 4K7	72-RM4K7	2	R6 R13
RES 1 WATT 4K7	72-RM4K7-1WATT	1	R3
RES 1/4W 10K	72-RM10K	2	R4 R32
RES 1 WATT 22K	72-RM22K-1WATT	1	R37
RES 1/4W 22K	72-RM22K	2	R5 R23
RES 1/4W 27K	72-RM27K	2	R15 R26
RES 1/4W 100K	72-RM100K	2	R7 R14
RES 1/4W 470K	72-RM470K	1	R18
CAP RADIAL 1u0 63V	72-C1-63VER	1	C6
CAP RADIAL 2u2 63V	72-C2.2-63VER	1	C10
CAP RADIAL 10u 63V	72-C10-63VER	5	C8 C13 C18 C22 C23
CAP RADIAL 100u 16V	72-C100-16VER	2	C2 C19
CAP RADIAL 220u 25V	72-C220-25VER	2	C1 C11
CAP CERAMIC 100p 100V	72-C100P-100VCD	1	C12
CAP BOX POLY 2n2 100V	72-C2N2-100VP	1	C20
CAP BOX POLY 100n 100V	72-C100N-100VP	2	C15 C16
CAP BOX POLY 220n 250V	72-C220N-250VP	2	C4 C9
CAP BOX POLY 1uF 250V	72-C1-250VP	1	C5
TRANSISTOR MPSA92	72-TMPSA92	3	TR2 TR3 TR4
TRANSISTOR 2N3904	72-T2N3904	5	TR1 TR8 TR11 TR12 TR18
TRANSISTOR 2N3906	72-T2N3906	1	TR5
TRANSISTOR TIP31C	72-TIP31C	2	TR10 TR13
TRANSISTOR TIP32C	72-TIP32C	2	TR6 TR9

PRESET 1K0	72-PRESET-1K	2	RV1 RV2
RELAY 47W/6 12V DPCO	73-RELAY-47W	1	RL1
PCB TERMINAL 2 WAY	73-TERM-PCB-2WAY	1	FAN OUTPUT
HEADER 6 WAY 0.1"	72-HEAD-6W-2	1	PL1
HEADER 3 WAY 0.2"	72-HEAD-3W-3	1	PL2
HEADER 2 WAY 0.2"	72-HEAD-2W-2	1	LS1
RES W/W 0R22 4W	72-RWW0R22-4W	4	R17 R28 R34 R35
RES W/W 4R7 4W	72-RWW4R7-4W	1	R31
RES W/W 0R1 4W	72-RWW0R1-4W	1	R30
RES W/W 1K0 2.5W	72-RWW1K-2.5W	1	R1
CAP 4700u 80V SNAP IN	73-CAP-470080V	2	C3 C7
RECTIFIER KBPC804	73-BRIDGE-3	1	DR1 (fit to heatsink)
HEATSINK FINNED	71-HS-TEG	1	fit to DR1
TRANSISTOR 2SC4468	72-T2SC4468	2	TR14 TR16
TRANSISTOR 2SA1695	72-T2SA1695	2	TR7 TR15
TRANSISTOR BUW11A	72-TBUW11A	1	TR17
HEATSINK KR70	74-HS-KR70-1	2	fit to output devices
TRANSISTOR CLIP	74-HS-KR70-CLIP1	5	fit to output devices
THERMAL TRIP 100C	73-SWT-THERM-2	1	fit to heatsink, wire to TRIP1
FIXINGS:	71-SCR-M3X8PP/TT	10	for heatsinks and trip
	71-SCR-M3X16PP	1	for KBPC602
	71-NUT-M3ZINC	1	for KBPC602
	71-WAS-M3AZINC	1	for KBPC602
	71-WAS-M3SCOIL	1	for KBPC602
	71-WAS-M3NYL	8	for heatsinks under PCB

## **Important Notice**

To make the bi-polar 300 watt bass board reliable the following guidelines must be adhered to.

When a board need to be serviced it is advisable to replace both the Output Transistors and TIP31 and TIP32. Also it is advisable to replace TR11 which is situated under the rear of the heatsink.

The Output device should only be T2SC4468 and T2SA1695's  
The Drivers should be of the same manufacturer as each other to ensure stability.

And TR11 is a T2N3904 as listed on the parts list.

TR11 need to be completely covered in Heat Transfer Compound (HTC)  
This is to ensure that it keeps the unit biased correctly even when the unit gets hot. If TR11 is not covered then the fan can cool this component down and give the board a fault reading of temperature and provide and inappropriate bias.

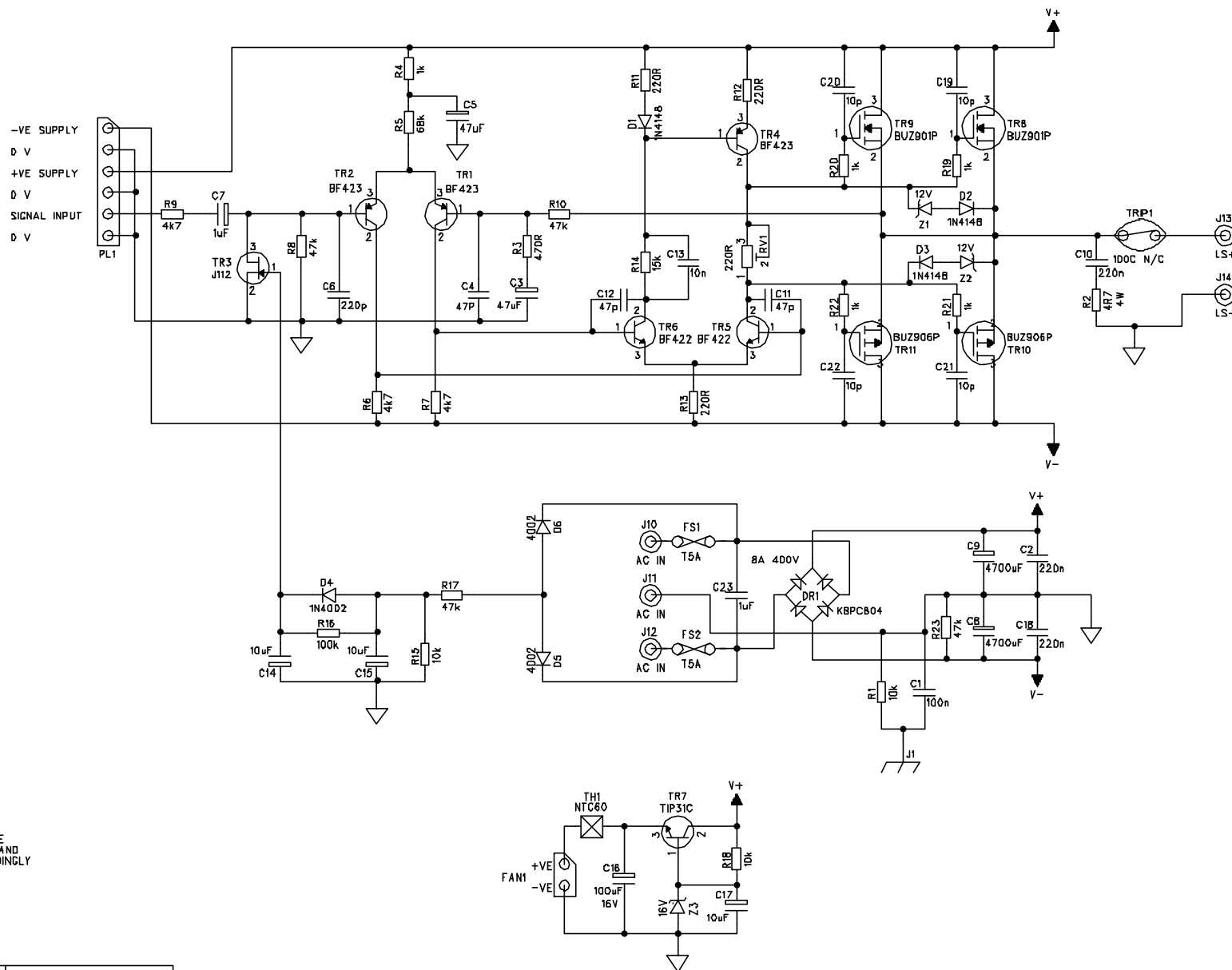
When adjusting the bias on the scope, make sure that the crossover distortion is just not visible. Too far beyond this point will over bias the unit.

Use a Shake-proof washer under the pcb earth point to ensure a permanent connection and prevent crackling noises in the future.

Paul Mathews

Jan 2000-01-25

ISSUE CHANGE NOTE DATE	ISSUE CHANGE NOTE DATE	ISSUE CHANGE NOTE DATE
ISSUE CHANGE NOTE DATE	ISSUE CHANGE NOTE DATE	ISSUE CHANGE NOTE DATE



  
 COMPONENTS USED ARE  
 OF AN APPROVED TYPE AND  
 MUST BE REPLACED ACCORDINGLY

PCB - PC0082

TITLE 300 WATT MOSFET OUTPUT  
 PROJECT BIPOLAR BEAR REPLACEMENT  
 DRAWING No CD0086  
 ISSUE 4  
 DATE 6/5/99  
 DRAWN BY CLIVE BUTTON

**TRACE ELLIOT**  
 TRACE ELLIOT LIMITED  
 WALDON ESSEX CM9 7GG  
 ENGLAND  
 TEL (01621) 855266  
 FAX (01621) 851975

# C11-MOD-K300Bx4.

**PARTS LIST FOR 300 WATT MOSFET BASS POWER STAGE  
PC00082x3-C BUTTON-21/7/97 UP-ISSUED-8/1/98 A EWEN.  
UP-ISSUE 5/2/98 R18 TO 1WATT. ISSUE 4 REFERENCE TO CD0086X4**

Description	Part Code	Qty	Where Used
ZENER1, 12V	72-D-BZX55C12V	2	Z1-2
ZENER1, 16V	72-D-BZX55C16V	1	Z3
DIODE1, 1N4002	72-D-1N4002	3	D4-6
DIODE1, 1N4148	72-D-1N4148	3	D1-3
R-1watt 10K	72-RM10K-1WATT	1	R18
R1/4W, 100k	72-RM100K	1	R16
R1/4W, 10k	72-RM10K	3	R1 R15
R1/4W, 15k	72-RM15K	1	R14
R1/4W, 1k	72-RM1K	5	R4 R19-22
R1/4W, 220R	72-RM220R	3	R11-13
R1/4W, 470R	72-RM470R	1	R3
R1/4W, 47k	72-RM47K	3	R8 R10 R17
R1/4W, 4k7	72-RM4K7	3	R6-7 R9
R1/4W, 68k	72-RM68K	1	R5
R4W, 4R7	72-RWW4R7-4W	1	R2
	There is no R23 on the PCB		R23
PRESET, 220R	72-PRESET-220R	1	RV1
ZERO OHM LINK	72-RCZERO	19	
CAPCER, 10p	72-C10P-500VCD	4	C19-22
CAPCER, 47p	72-C47P-100VCD2	3	C4 C11-12
CAPCER, 220p	72-C220P-100VCD	1	C6
CAPP1, 10n	72-C10N-100VP	1	C13
CAPP1, 100n	72-C100N-100VP	1	C1
BF422	72-TBF422	2	TR5-6
BF423	72-TBF423	3	TR1-2 TR4
J112	72-FET-J-112	1	TR3
CAPE2, 1uF	72-C1-63VER	1	C7
CAPE2, 10uF	72-C10-63VER	3	C15 C17 C14
CAPE2, 47uF	72-C47-63VER	2	C3 C5
CAPE2, 100uF	72-C100-16VER	1	C16
CAPP5, 220n	72-C220N-250VP	3	C2 C10 C18
CAPP6, 1uF	72-C1-250VP	1	C23
PCB TERMINAL 2 WAY	73-TERM-PCB-2WAY	1	FAN1
HEADER 2 WAY 0.2"	72-HEAD-2W-2	1	LS1



HEADER 3 WAY 0.2"	72-HEAD-3W-3	1	PL2
HEADER 6 WAY 0.1"	72-HEAD-6W-2	1	PL1
PCBFUSECLIP, 20MM FUSE T5A	72-FUS-HLD-PCB-4 72-FUS-5AT	4 1	FS1-2 FS1-2
CAPE6,4700uF 80V	72-CAP-470080V	2	C8-9
SB104	72-BRIDGE-4	1	DR1
BUZ901P	72-MOS-BUZ901P	2	TR8-9
BUZ906P	72-MOS-BUZ906P	2	TR10-11
TRANSISTOR CLIP	71-HS-KR70-CLIP1	4	fit to output devices
THERMISTOR	72-THERMISTER-4 Mount against heatsink with plenty of thermal compound between the thermistor and the heatsink.	1	TH1
TIP31C	72-TIP31C (or 72-TSM2178)	1	TR7
SMALL HEATSINK	71-HS-CLO5-45	1	FIT TO TR7 WITH THERMAL COMPOUND
BRIDGE HEATSINK	71-HS-TEG	1	FOR BRIDGE RECT
LARGE HEATSINK	71-HS-KR180	1	FOR OUTPUT DEVICES
TRIP,100C N/C	73-SWT-THERM-2	1	FIT TO HEATSINK WIRE TO TRIP1
FIXINGS	71-SCR-M3X8PP/TT	7	FOR HEATSINK & TRIP