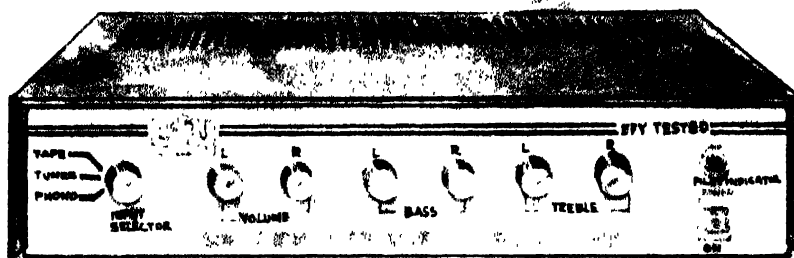


## 120W+120W Stereo Amplifier



A 120W stereo power amplifier is not so loud when the area which the amplifier must 'cover' is large, though its rating leads one to imagine the contrary. This amplifier is particularly suited to those who conduct music concerts. It is also suitable for use in auditoria. But if you already have something like a 70W + 70W amplifier, there isn't any meaning in making this amplifier. After all, there is hardly any difference between a 70W amplifier and a 120W amplifier as regards power; less than 3dB difference is barely audible. But then, it all depends on where you use it and how you use it.

This amplifier delivers an output of 120W RMS into a 4-ohm speaker. Those who wish to connect more than one speaker can do so by connecting two 8-ohm, 60W speakers or four 16-ohm, 30W speakers in parallel.

### The circuit

Transistors T1 and T2 form a differential pair and T9 forms their constant current source. The input stage is not a purely differential stage as can be seen. Transistors T3 and T4, along with T1 and T2, form a sort of cascode-differential pair. The currents at the collectors of T3 and T4 are always constant, except when the signal is present. The cascode arrangement makes it possible to use low voltage transistors at the input. This is very necessary since high voltage transistors are often short of gain. Transistor T5 acts as an emitter-follower for the collector load of T3. This transistor operates at a collector-to-emitter voltage of 5V. T6 is the class-A driver and T8 provides the constant current source. T7 acts as the  $V_{BE}$  multiplier and also compensates for

temperature changes. The output stage is made of three transistors on each side. Diodes D5 and D6 help to maintain the symmetry.

R31, C10 and C11 form the usual zobel network, to suppress spurious oscillations at the output.

The 1-ohm, 1-watt resistor (R32) and inductor L1 at the output are necessary only if any capacitive loads are likely to be used. The fuse protects the speaker from any damage due

### SPECIFICATIONS CHART

Output power (THD=0.1 per cent)	: 120W into 4-ohms load
Input sensitivity (for 120 W)	: 820 mV to 1V
Signal-to-noise ratio (at $P_o=100W$ )	: $\geq 70$ dB
Current consumption (DC)	: 1.5A, channel
Distortion at 200 mW output	: $\leq 0.1\%$

to DC appearing at the output in the event of a failure in the circuit.

The protection circuit, given in Fig. 5, is not compulsory and can be done away with, if you don't need it. Even when the output goes to  $V_{CC}$ —the saturation voltage of T12 (or  $-V_{CC}$ , i.e. the saturation voltage of T15), the power dissipation in the output transistor amounts to a mere 40W at the maximum. The output transistors can withstand 150W (max.). The maximum power dissipation in the transistors occurs when the output is halfway between 0V and  $V_{CC}$  (or  $-V_{CC}$ ). In this case, it occurs at 20V, or at 100W. The

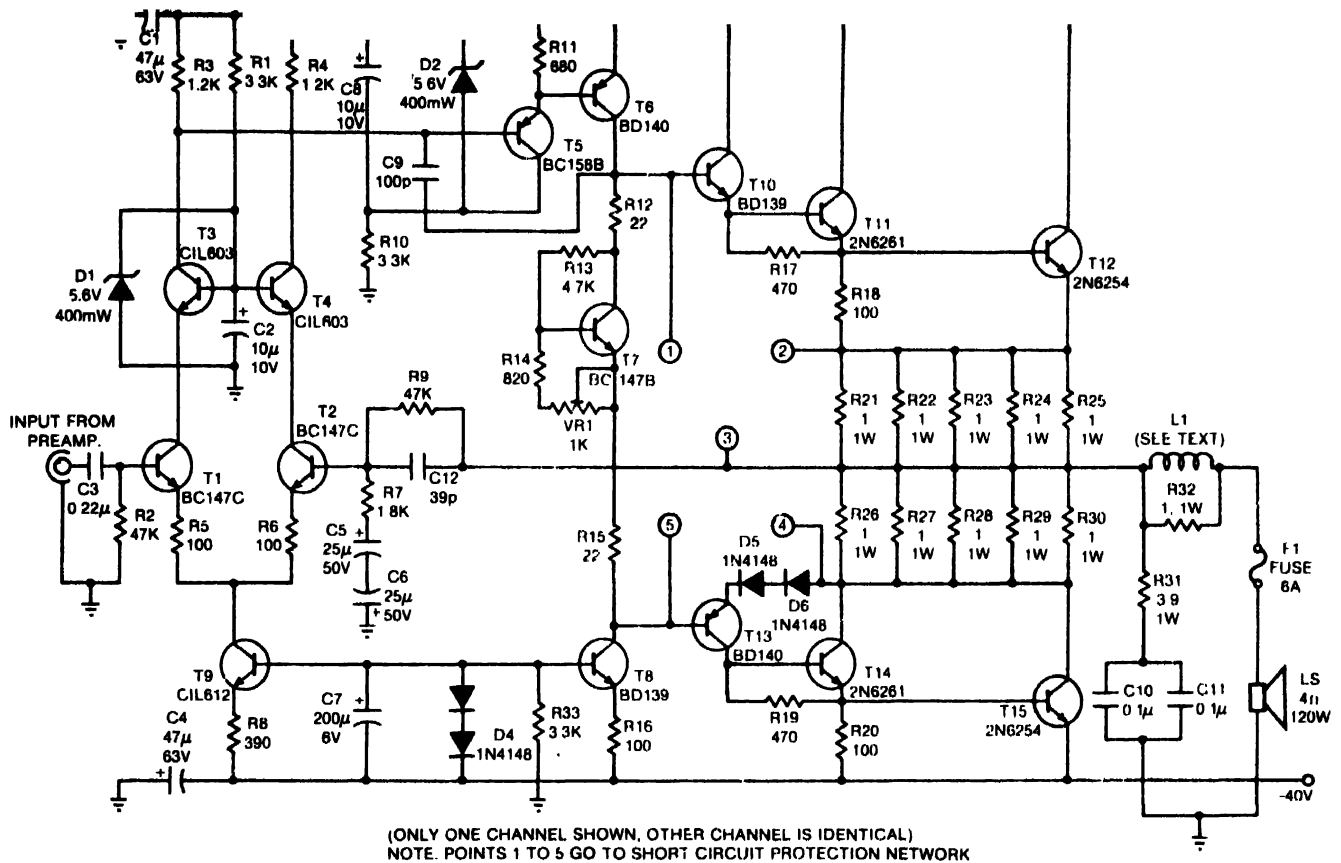


Fig. 1: Circuit diagram for 120W + 120W stereo amplifier.

### PARTS LIST

#### Semiconductors:

T1, T2	-- BC147C npn AF transistor
T3, T4	-- CIL603 npn AF transistor
T5	-- BC158B pnp AF transistor
T6, T13	-- BD140 pnp low-power transistor
T7, T16	-- BC147B npn AF transistor
T8, T10	-- BD139 npn low-power transistor
T9	-- CIL612 npn transistor
T11, T14	-- 2N6261 npn driver transistor
T12, T15	-- 2N6254 npn power transistor
T17	-- BC157 pnp transistor
D1, D2	-- 5.6V, 400mW zener diode
D3-D6	-- 1N4148 silicon switching diode
D7-D10	-- 2SM15, 15-amp rectifier diode

#### Resistors (all 1/4 watt, ±5% carbon, unless stated otherwise):

R1, R10, R33	-- 3.3-kilohm, 1/2 watt carbon
R2, R9	-- 47-kilohm
R3, R4	-- 1.2-kilohm
R5, R6, R16, R18,	
R20	-- 100-ohm
R7	-- 1.8-kilohm
R11	-- 680-ohm
R8	-- 390-ohm
R12, R15	-- 22-ohm
R13	-- 4.7-kilohm
R14	-- 820-ohm

R17, R19	470-ohm
R21-R30, R32	1-ohm, 1W carbon
R31	3.9-ohm, 1W carbon
R34, R37	2-kilohm
R35, R36	1-kilohm

#### Capacitors:

C1, C4	47μF, 63V electrolytic
C2, C8	10μF, 10V electrolytic
C3	0.22μF, 100V ceramic
C5, C6	25μF, 50V electrolytic
C7	200μF, 6V electrolytic
C9	100pF styroflex
C10, C11	0.1μF, 100V ceramic disc
C12	39pF styroflex
C13, C14	0.01μF, ceramic disc
C15, C16	10000μF, 100V electrolytic

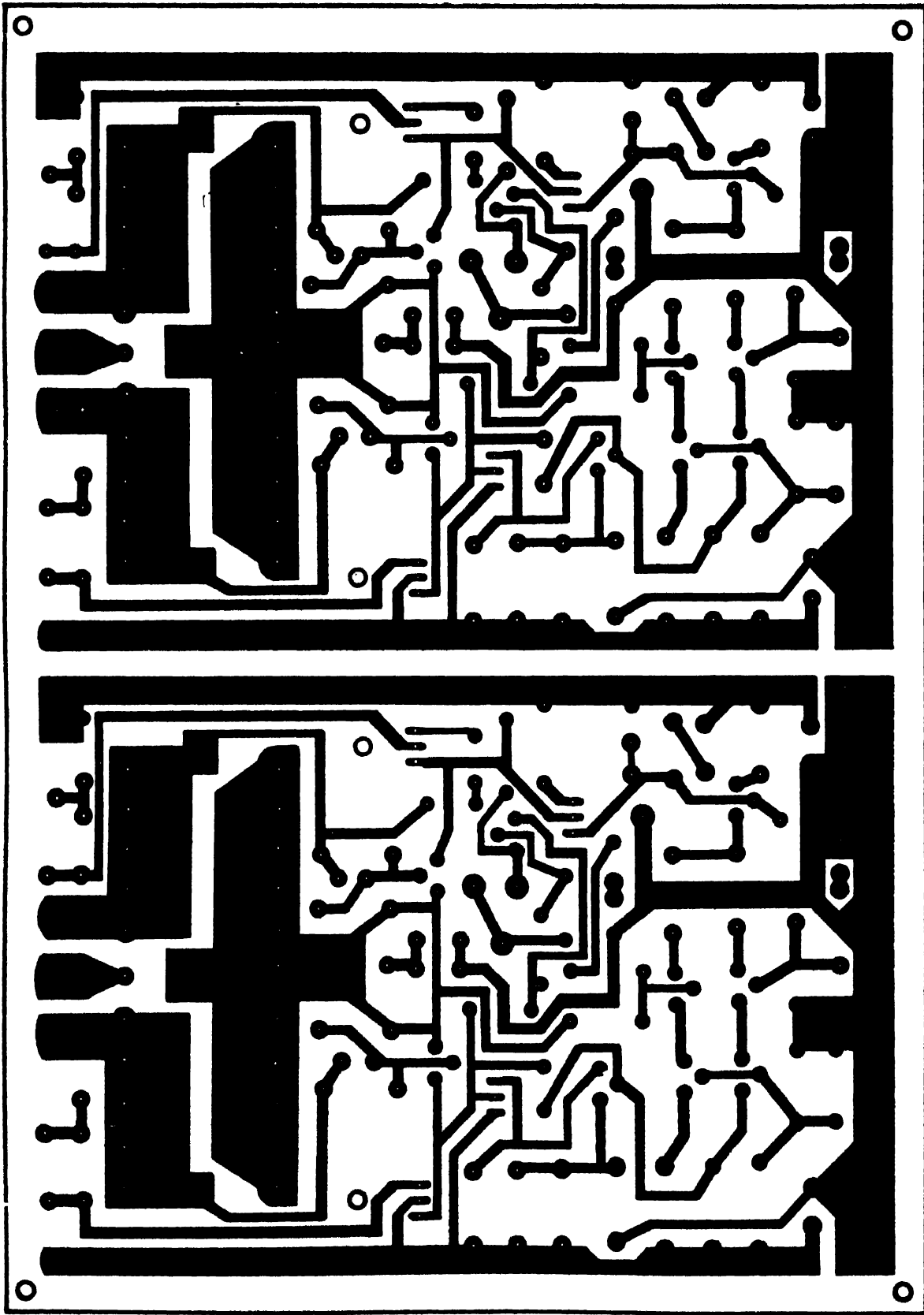
#### Miscellaneous:

LS	Loudspeaker (see text)
L1	See text
X1	33V-0-33V, 10-amp secondary transformer
S1	SPDT switch
F1	6-amp fuse with holder
F2	1-amp fuse with holder
	PCB, heatsink, coaxial cable, capacitor clamps, hardware, BNC plug/socket, enclosure, mains lead etc.

dissipation in the output transistor is then 100W. The transistor can, of course, withstand this.

The use of an output coupling capacitor is eliminated by

using a symmetrical power supply. To connect this amplifier to a crossover network, be sure that the capacitors in it are non-polarised.



**Fig. 2: PCB layout for 120W + 120W stereo amplifier.**

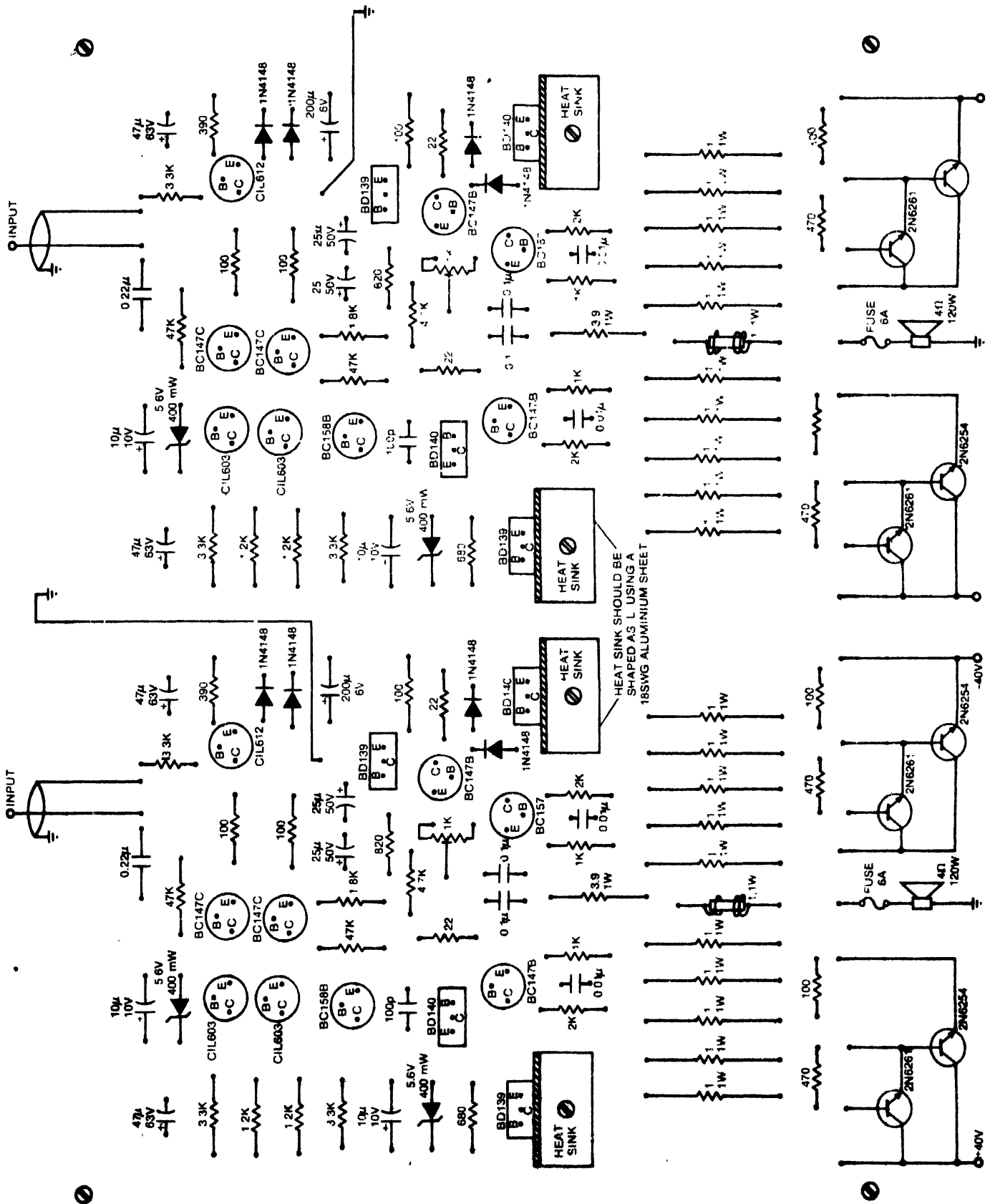


Fig. 3: Components layout for 120W + 120W stereo amplifier.

NOTE: C12 (39P) SHOULD BE CONNECTED FROM TRACK SIDE IN PARALLEL OF R9 (47K)

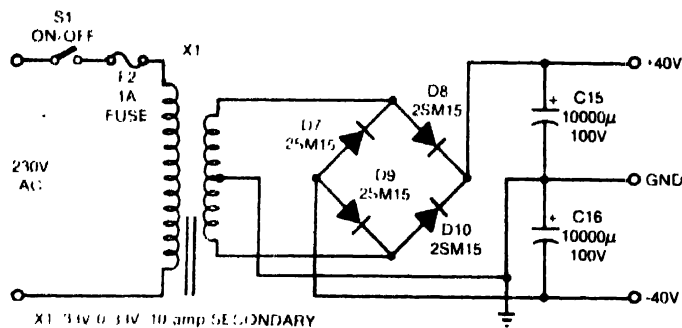


Fig. 4: Suggested power supply for the circuit.

#### Details of the Power Supply Components

Components	Mono	Stereo
Fuse (F2)	1A	2A
Capacitors C15 and C16	5000µF	10000µF
Diodes D7 to D10		
Current (PIV $\geq$ 200V)	6A	12A
<b>Transformer</b>		
Secondary Current	5A	10A
Core Size	Longue Width 6.25 cm Stack height: 5cm	Longue Width 7.5 cm Stack height 7.5 cm
No. of turns in Primary SWG	4601 23 SWG	2561 20 SWG
Secondary/SWG	661+661 17 SWG	371+371 15 SWG

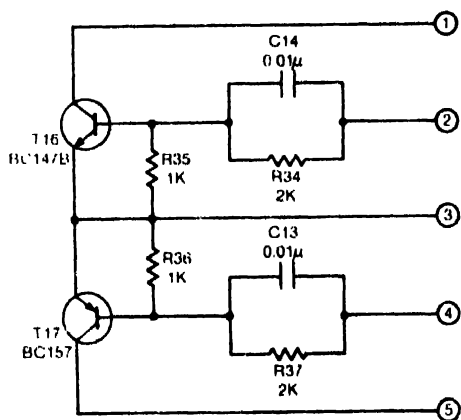


Fig. 5: Short circuit protection network.

#### Construction

The wiring should pose no problem if the PCB whose pattern is shown in Fig. 2 is used. When soldering components, solder all the resistors, except R21-R30, first. Then solder the capacitors and finally the transistors and the resistors R21-R30. There is no specific reason for this sequence. It is just that low-profile components should be mounted first. It will be easier to solder them in this sequence.

If soldering all the resistors R21 to R30 side by side poses any problem, first solder three resistors on each side and then solder the other two on top of them, on each side.

Transistors T11 and T12 can be mounted on the same heat-sink. The same goes for T14 and T15. The heatsinks must be of 1.2°C/W type. Use of silicon grease is advisable. The heatsinks for T6 and T8 are made by bending 1.2mm thick, 3cm x 2cm pieces of aluminium in 'L' shape. The longer arm of the 'L' should be screwed to the transistor and the shorter to the PCB. Only then should the transistors be soldered.

The fuse that is connected in series with the speaker can be fixed at the back panel of the amplifier. These fuses must be of quick blow type. All wiring must be made with 18SWG tinned wire or flexible wires that can carry currents up to 6A. Use separate power supply wires for each channel and separate speaker return leads.

#### Adjustments

After checking the wiring, turn VR1 clockwise fully or set to maximum resistance. Now connect a voltmeter, capable of reading millivolts, across the resistors R21-R25. Switch on the amplifier and adjust VR1 so that the meter shows 6 to 10 mV.

This is the only adjustment required. Connect a tape recorder or a tuner through a suitable preamplifier and tone control amplifier to enjoy the music.

**Note:** A suitable preamplifier designed and developed at EFY lab to go with this power amplifier will be published in the next issue to enable a complete hi-fi stereo amplifier system.

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