mini hifi

In contrast to the now-prevalent 'multiwatt' systems currently on the market, a design is described for a Hi-Fi stereophonic amplifier of modest specification for the price-conscious constructor. The system is built from several units that are matched to one another, but this does not preclude their use with other equipment.

The block diagram of figure 1 shows how the units are connected together to form a complete stereo amplifier. The disc preamplifier is required only with a magnetic cartridge. It is followed by the control amplifier which incorporates balance, volume and tone controls. This stage will accept inputs from high level sources such as radio and tape.

The control amplifier drives the power amplifier which will provide up to 3 watts per channel; this is sufficient for the average living room. A regulated power supply provides the H.T. for all three stages of the amplifier.

The disc preamplifier

The disc preamplifier, the circuit of which is given in figure 2 (one channel only shown), incorporates equalisation to correct the output of a magnetic cartridge according to the RIAA playback curve, and also amplifies the signal to a level sufficient to drive the control amplifier. It consists of a two-stage voltage amplifier, T4 and T5, with the RIAA feedback network R18, R19, C15 and C16 connected from the collector of T5 to the emitter of T4. DC feedback and biasing of T4 is provided by R15.

The disc preamplifier board should preferably be mounted inside the turntable itself as otherwise the capacitance of the screened lead between the cartridge and the disc preamplifier can form a resonant circuit with the self-inductance of the cartridge. If this resonance lies within the audio spectrum it may cause a peak in the frequency

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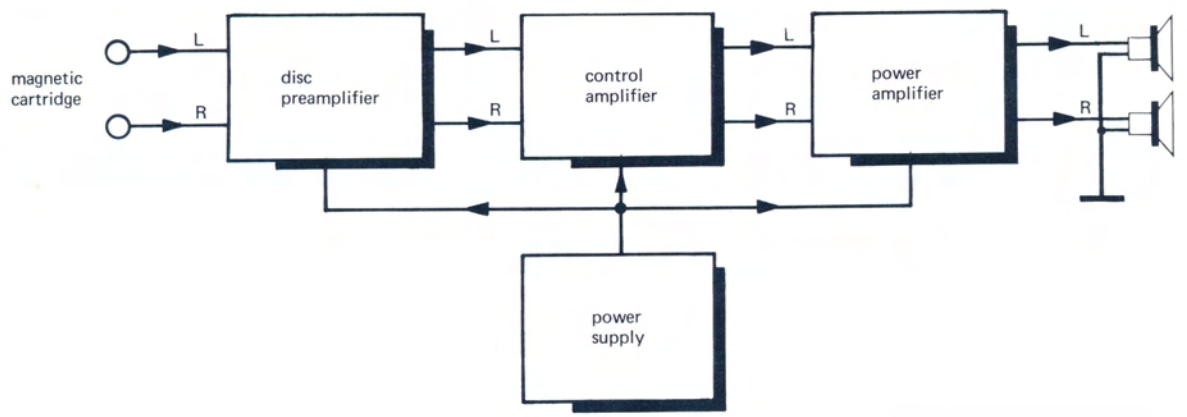

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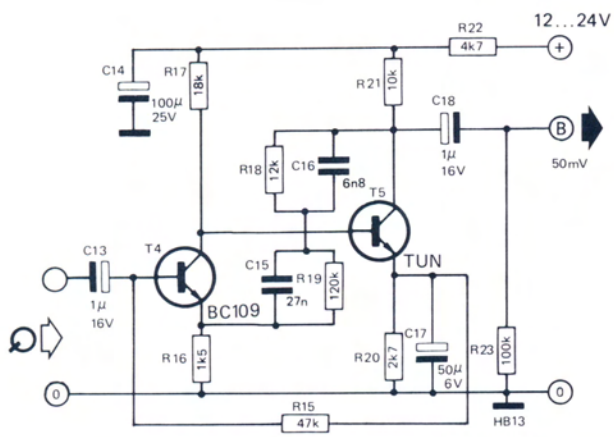
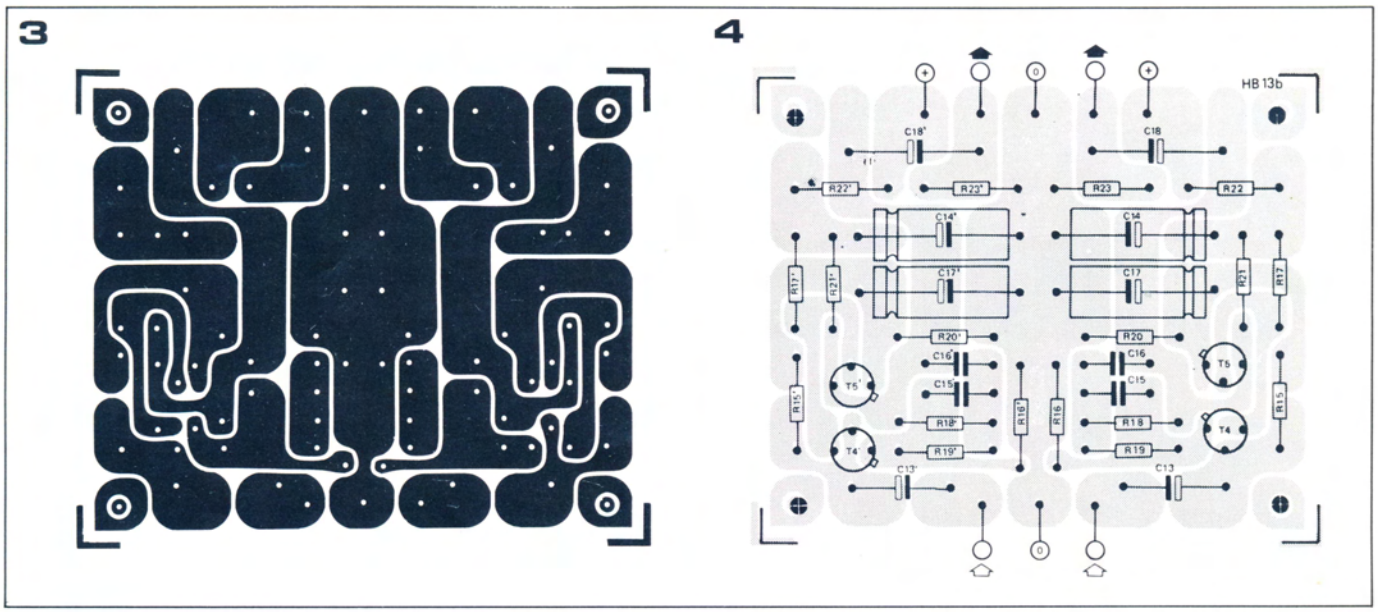
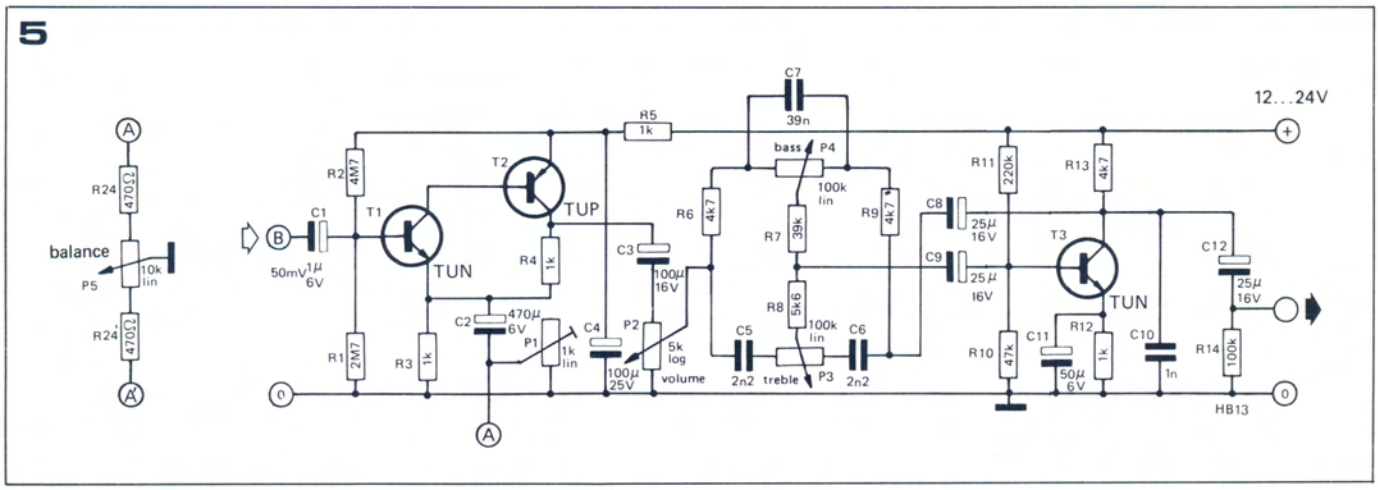


Figure 1. An economical Hi-Fi stereo amplifier built of four units. Each unit may also be used in conjunction with other equipment.

Figure 2. The circuit of the disc preamplifier. It is designed for use with magnetic cartridges and incorporates RIAA correction.





response. Of course some cartridge manufacturers quote a recommended load capacitance and if this is so their recommendations should be adhered to. Another good reason for mounting the disc preamplifier inside the turntable is to keep it away from the hum fields of the amplifier's mains transformer. Turntable motors usually have much less stray field then the average mains transformer!

The printed circuit board for the disc preamplifier is given in figure 3 and the associated component layout in figure 4. It can be seen that the layout for the two channels is symmetrical.

The control amplifier

The circuit of one channel of the control amplifier is given in figure 5. T1 and T2 form a voltage amplifier with a high input impedance and a low output impedance. Two versions of the power amplifier are described in the following section; a 12-volt version, to give 3 watts into 4 Ω and a 17-volt version, to give 3 watts into 8 Ω. Since the output voltage of the amplifier for 3 watts into 4 Ω is 3.5 V RMS, whereas for an 8 Ω load it is 4.9 V RMS, the 17-volt version of the power amplifier requires a larger input signal, since its gain is fixed. This is accomplished by varying the gain of the control amplifier by means of P1. P1 is also used to match the gains of the two channels so that channel balance is correct with the balance control central. With P1 set to 1 k the input sensitivity when used with the 12 volt version of amplifier is about 150 mV for 3 watts into 4 Ω.

P2 is the volume control and this is followed by a standard 'Baxandall' tone control circuit which gives a range of ±12 dB on both bass and treble. The balance potentiometer P5 completes the controls. C10 is a high-frequency bypass capacitor to avoid instability. The p.c. board and component layout of the control amplifier are given in figures 6 and 7.

The power amplifier

In the circuit of figure 8 T1 and T2 form a direct-coupled voltage amplifier which controls the bias of the quasi-complementary driver/output stage T3, T5 and T4, T6. R7 and R8 are chosen so that the output devices are either just biased on or just cut off depending on the gain of the devices used. C3, C5 and R3 help to maintain stability. The input sensitivity of the amplifier is about 400 mV for 12 volt operation with a 4 Ω load, and 600 mV for 17 volt operation with an 8 Ω load. The gain

Figure 3. The layout of the p.c. board for the disc preamplifier shows the symmetrical arrangement of the two channels. (EPS HB14).

Figure 4. The component layout for the disc preamplifier board of figure 3.

Figure 5. The circuit of one channel of the control amplifier.

Figure 6. The printed circuit for the control amplifier. (EPS HB13).

Figure 7. The component layout of the control amplifier.

Parts list for figures 2 and 4:

Resistors:
R15 = 47 k
R16 = 1k5
R17 = 18 k
R18 = 12 k
R19 = 120 k
R20 = 2k7
R21 = 10 k
R22 = 4k7
R23 = 100 k

Capacitors:
C13 = 1 μ, 6 V
C14 = 100 μ, 25 V
C15 = 27 n
C16 = 6n8
C17 = 50 μ, 6 V
C18 = 1 μ, 16 V

Semiconductors:
T4 = BC 109
T5 = TUN

Parts list for figures 5 and 7:

Resistors:
R1 = 2M7
R2 = 4M7
R3,R4,R5,R12 = 1 k
R6,R9,R13 = 4k7
R7 = 39 k
R8 = 5k6
R10 = 47 k
R11 = 220 k
R14 = 100 k
R24 = 470 Ω

Capacitors:
C1 = 1 μ, 6 V tantalum
C2 = 470 μ, 6 V
C3 = 100 μ, 16 V
C4 = 100 μ, 25 V
C5,C6 = 2n2
C7 = 39 n
C8,C9,C12 = 25 μ, 16 V
C10 = 1 n
C11 = 50 μ, 6 V

Semiconductors:
T1,T3 = TUN
T2 = TUP

Miscellaneous:
P1 = preset potentiometer 1 k lin.
P2 = potentiometer 4k7 log. stereo
P3,P4 = potentiometer 100 k lin. stereo
P5 = potentiometer 10 k lin.

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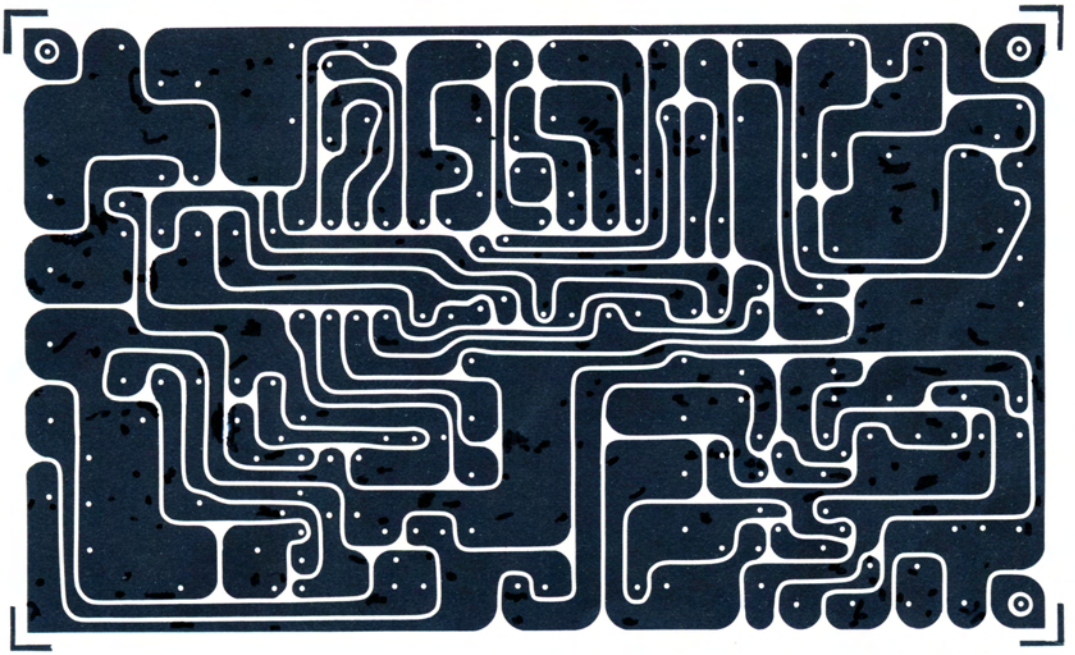

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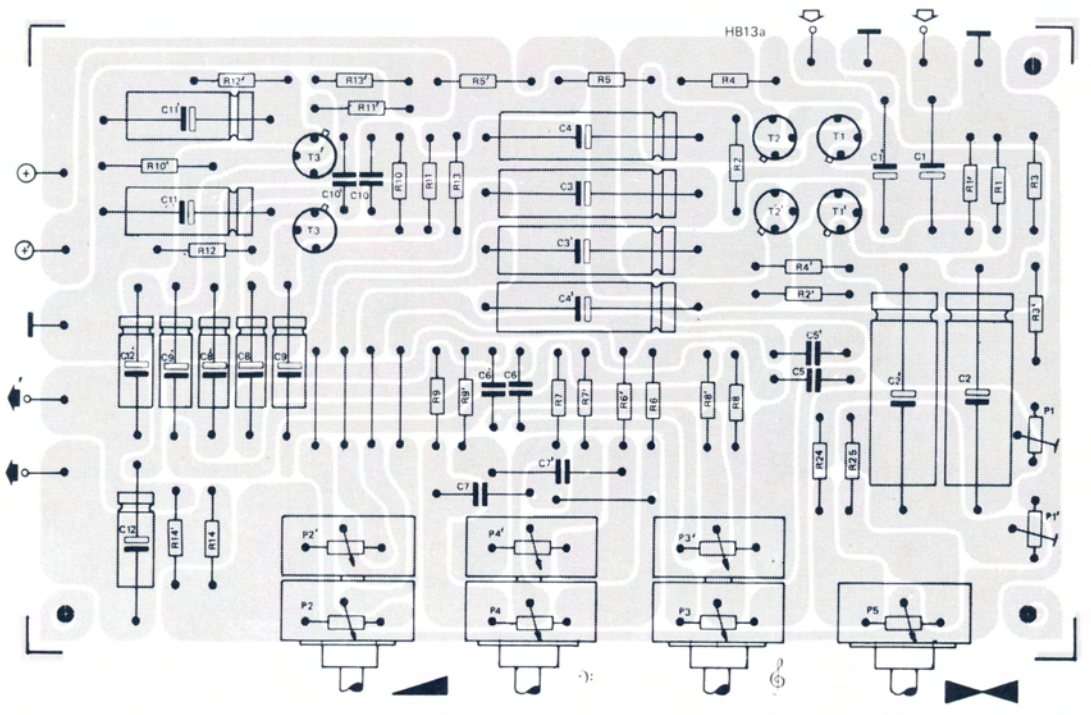

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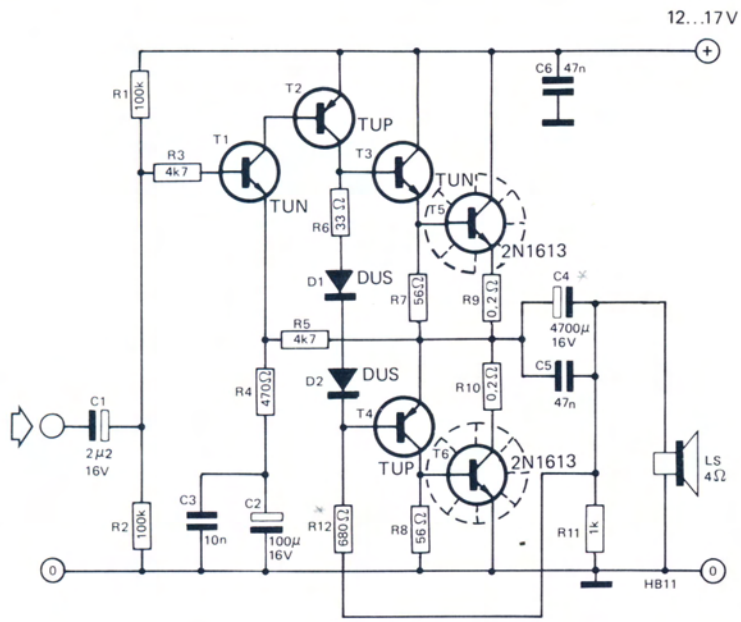

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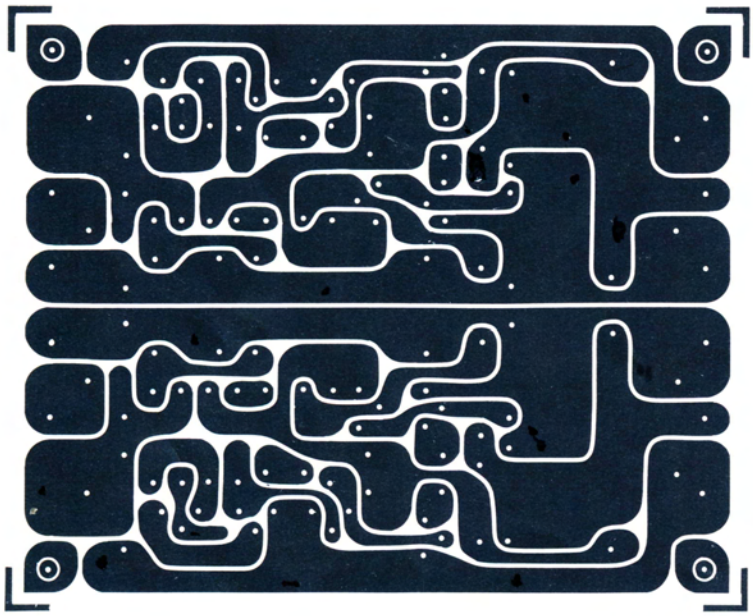

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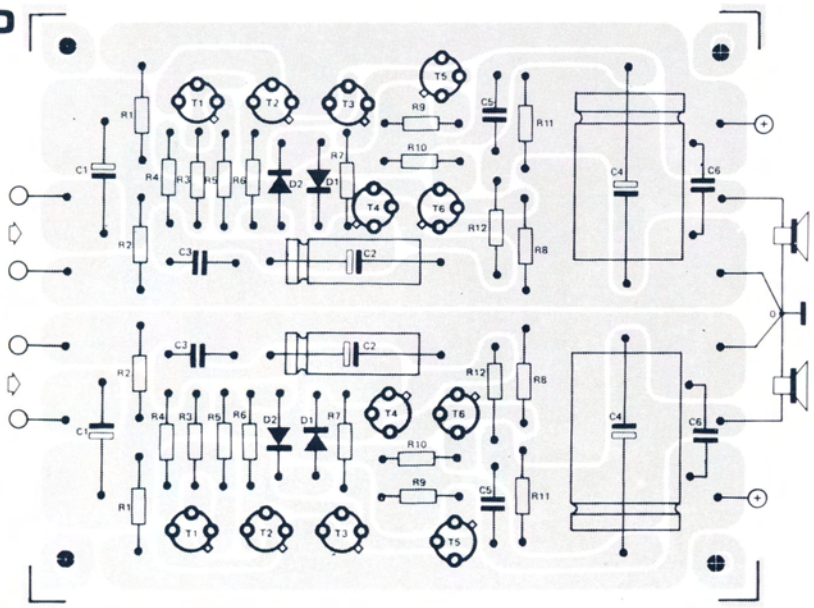


Figure 8. The output amplifier, which will deliver 3 watts into 4 Ω with a 12 volt supply and 3 watts into 8 Ω with a 17 volt supply. The different values for R12 and C4 are given in the table.

Figure 9. The printed circuit for the power amplifier is also symmetrical. It may be cut in half for mono applications if desired.

Figure 10. Component layout for the power amplifier p.c. board. (EPS HB11).

Figure 11. The circuit of the simple stabilised supply. The values of R1 and Z1 depend on the supply voltage required.

Figure 12. Board and component layout for the power supply. (EPS HB12).

Parts list for figures 8 and 10:

Resistors:
R1,R2 = 100 k
R3,R5 = 4k7
R4 = 470 Ω
R6 = 33 Ω
R7,R8 = 56 Ω
R9,R10 = 0,2 Ω
R11 = 1 k
R12 = see table

Capacitors:
C1 = 2,2 μ, 16 V
C2 = 100 μ, 16 V
C3 = 10 n
C4 = see table
C5,C6 = 47 n

Semiconductors:
T1,T3 = TUN
T2,T4 = TUP
T5,T6 = 2N1613
D1,D2 = DUS
2 TO5 heatsinks for T5 and T6

	12 V	17 V
R12	680 Ω	1 k
C4	4700 μ	2200 μ
LS	4 Ω	8 Ω

may be increased by reducing R4 but this is not recommended as instability may occur and in any case the overall gain of the system may be altered by adjusting P1 on the control amplifier board. The printed circuit for the power amplifier is given in figure 9 and the component layout in figure 10.

Supply

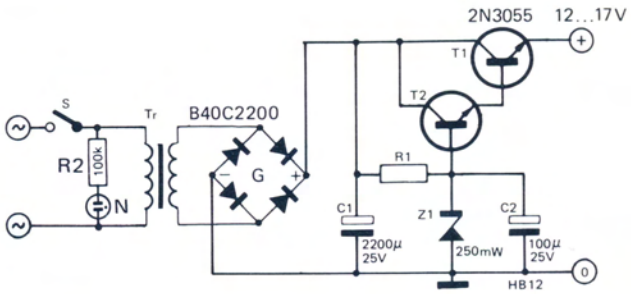
The regulated power supply is very simple, as can be seen from figure 11. T1 and T2 form a Darlington pair acting as a compound emitter-follower with a reference voltage provided by Z1. Z1 is chosen as a 13 or 18 volt zener for a 12 or 17 volt supply respectively. Since T2 dissipates only a small amount of power a heatsink is not required.
Figure 12 shows the board and component layout of the power supply. The component values for both versions are given in the table of figure 11.

Layout

The following layout precautions should be noted when assembling the completed board onto a chassis:

1. Loudspeaker common must be connected directly to the power supply common and should be kept well away from the boards.
2. Separate leads must be run from the supply to the supply points on each board.
3. Outputs of any board should be kept well away from inputs of other boards (except of course where the output of a stage is connected to the input of the succeeding stage).
4. Care should be taken to avoid earth loops. Each section of the amplifier should have only one connection to supply common.

11



Parts list for figures 11 and 12:

Resistor:
R1 = see table
R2 = 100 k

Capacitors:
C1 = 2200 µ, 25 V
C2 = 100 µ, 25 V

Semiconductors:
T1 = 2N3055
T2 = see table

Transformer:
Tr1 = 2 A sec. see table

Miscellaneous:
G = B40C2200 40 V 2.2 A bridge rec.
or 4 x 1N4001
Z1 = zener diode, 250 mW, see table
N = neon
S = switch on/off

	12 V	17 V
R1	270 Ω	680 Ω
Z1	13 V	18 V
T2	TUN	BC 107
Tr	12 V ~	18 V ~

12