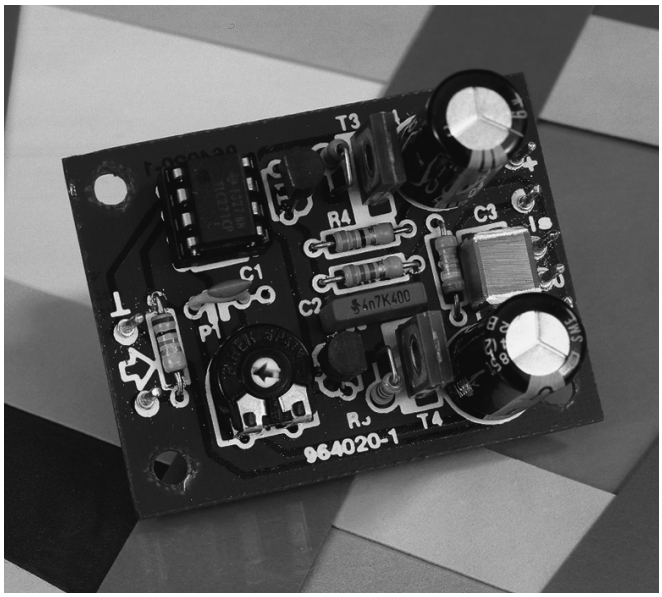
miniature power amplifier



There are quite a few applications of an audio power amplifier in which power and hi-fi characteristics are of secondary importance. If, for instance, an active loudspeaker for a portable radio receiver is needed, compact dimensions and low current drain are far more important considerations.

These properties are the prime design basis for the present mini amplifier. It continues working satisfactorily with a battery voltage down to 1.5 V. Its quiescent current drain is about 1 mA, and its efficiency is a worthwhile 70 per cent. It provides an output power of 500 mW into 8 Ω (or 800 mW into 4 Ω), has a sensitivity of 400 mV, and its distortion is never higher than 1.2 per cent.

The low current drain is obtained through a combination of a low-power op amp followed by a discrete Class-B stage. The op amp is a Type TLC271 operating in its high-current mode (pin 8 to ground). Any complications arising from the common-mode range are prevented by using the amplifier as an inverting type. The voltage amplification is set with feedback resistance P_1.

The discrete power stage consists of two complementary darlingtons, each composed of a BC and a BD transistor. Resistors R_2–R_5 limit the internal amplification. Capacitors C_1, C_2, and C_6, are compensation devices.

Boucherot network R_6-C_3 ensures amplifier stability when the load is very low or very high.

Since the output transistors have no emitter resistor, the voltage is determined solely by the knee voltage of T_3 and T_4. With a load of 4–8 Ω, these voltages are limited to 0.2–0.3 V, so that the transistors can be driven virtually up to the supply voltage. This is the reason for the atypical high efficiency of the amplifier.

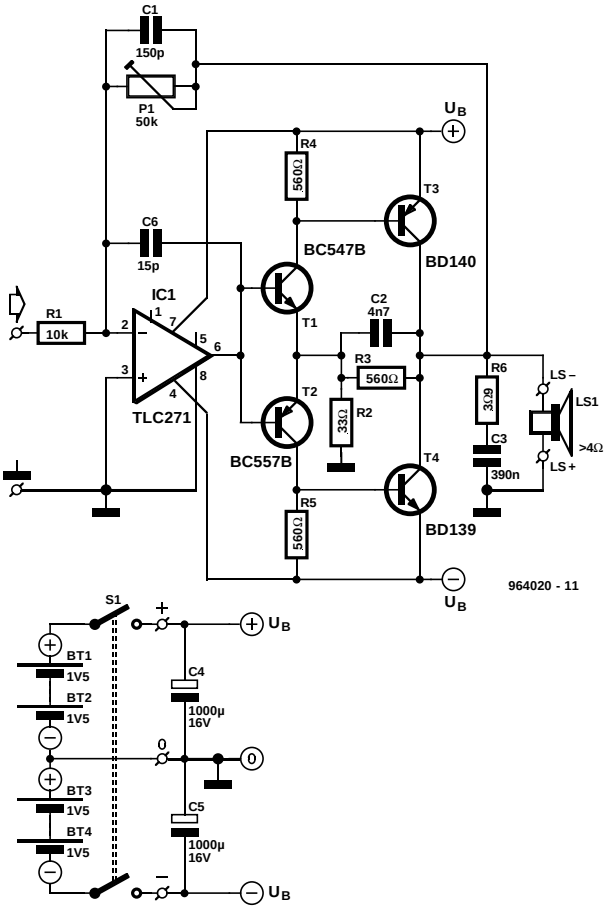
The overall bandwidth of the amplifier is limited to not less than 21 kHz at the maximum amplification of ×5.

With a 4 Ω load, the peak output current is 700 mA. A 315 mA fuse in series with the output is, therefore, a simple, but effective short-circuit protection. At maximum drive with a music signal, the average current is only 50 mA. In practice the drive will never be continuously maximum, so that the actual current drain will be much lower. A set of four penlight batteries should last about 200 hours.

The amplifier is best built on the printed-circuit shown, which, unfortunately, is not available ready made.

On a final note: since the four batteries form a symmetrical supply, on-off switch S_1 needs to be a double-pole type.

[T. Giesberts - 964020]



PARTS LIST

Resistors:
R_1 = 10 kΩ
R_2 = 33 Ω
R_3–R_5 = 560 Ω
R_6 = 3.9 Ω
P_1 = 47 kΩ preset

Capacitors:
C_1 = 150 pF
C_2 = 4.7 nF
C_3 = 390 nF
C_4, C_5 = 1000 µF, 16 V, radial
C_6 = 15 pF

Semiconductors:
T_1 = BC547B
T_2 = BC557B
T_3 = BD140
T_4 = BD139

Integrated circuit:
IC_1 = TLC271CP

Miscellaneous:
S_1 = double-pole on/off switch
Bt_1–Bt_4 = battery, 1.5 V