

Sixties-style 40 W Audio Amplifier



By Joseph Kreutz (Germany)

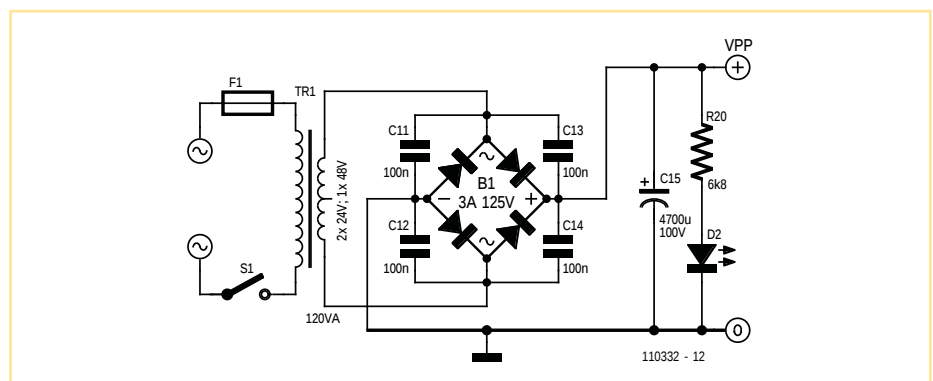
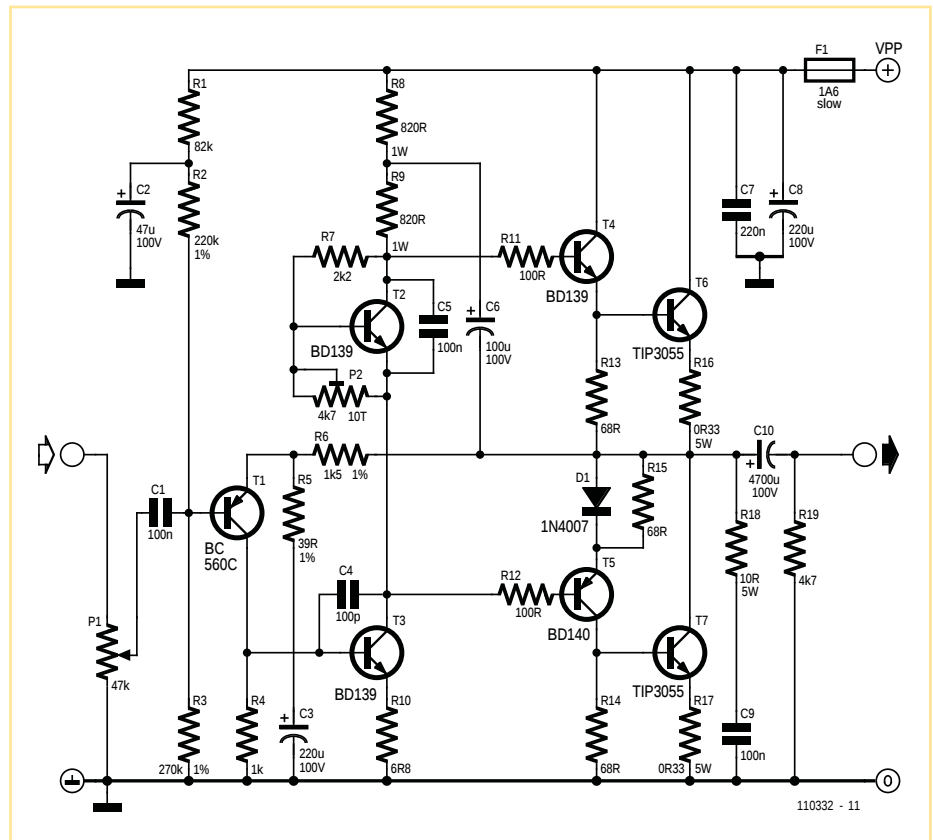
In the early 1960s RCA brought out a transistor that was to become truly legendary: the 2N3055. With a pair of these devices, you could put together an audio power amplifier that could deliver a healthy 40 W into 8 Ω . The circuit described here is fully in tune with the spirit of that era. For example, there are only seven active components in each channel, which reflects the design simplicity typical of that era (and actually a timeless quality). This 'retro' power amplifier pumps 45 W into 8 Ω with an input signal level of 0.5 V_{rms}.

It works as follows: the input signal is applied to the base of T1, while negative feedback from the output, attenuated by voltage divider R5/R6, is applied to the emitter of T1. The collector current of T1, which is proportional to the difference between the input and feedback signals, is fed to the base of T2. This transistor draws its operating current through R8 and R9 and provides voltage gain. Capacitor C6 is a bootstrap capacitor that hold the voltage across R9 nearly constant, so that the current through R9 is independent of the amplifier output signal level in the audio band.

Transistors T4–T7 form a quasi-complementary push-pull output stage. In the early 1960s, there simply wasn't any PNP transistor available that was truly complementary to the 2N3055. Designers came up with an ingenious way to get round this problem, which was to use a complementary Darlington pair consisting of a PNP driver transistor and an NPN power transistor. The schematic diagram clearly illustrates what is meant by a quasi-complementary push-pull output stage. Diode D1 provides balanced biasing for the output stage, which helps reduce distortion.

The operating point of the output stage is set and stabilized by transistor T3, which for this reason should be thermally coupled to the output transistors. The amplifier is powered from a single supply voltage at approximately 65 V, which is also 'typical sixties'. Capacitor C1, with a value of 4700 μ F, transfers the signal from the output stage to the load and provides a bit of protection for the speaker in case one of the transistors fails.

The amplifier does not have output current limiting. Although this is not a critical shortcoming, a certain amount of caution is advisable. The only protection in this regard is provided by a slow-acting 1.6-A fuse in the supply



Performance figures with an 8.2 Ω resistive load (indicative values)

THD	0.08%; third harmonic at 1400 Hz; output level 3 V
Bandwidth	29 Hz (–3 dB) to over 100 kHz (–0.5 dB) at an output level of 3 V _{rms} –3 dB at 100 kHz referred to 18 V at 1.0 kHz
Maximum output voltage	19.5 V at the saturation threshold

line, which is intended to limit the damage if anything goes wrong.

The power supply consists of a transformer, a bridge rectifier, four small capacitors and a 4700 μ F electrolytic capacitor. This is enough to power a two-channel stereo amplifier. The LED is a power-on indicator and is intended to

be fitted on the front panel.

Assembling the circuit is very straightforward. Transistors T3, T4 and T5 should be fitted with heat sinks suitable for a TO126 package and with a thermal resistance less than 20 K/W. Transistors T2, T6 and T7 should all be fitted on a single heat sink with a thermal

resistance of 2 K/W or less, using insulating washers and thermal paste.

Before applying power to the circuit for the first time, set P2 to its maximum value, temporarily replace the fuse with a 47 Ω , 5 W resistor, and connect a voltmeter across R17. Then switch on the power.

The voltmeter should indicate 0 V. Now carefully adjust P2 until the voltmeter reads 15 mV, which corresponds to a quiescent current of 50 mA. Then switch off the power and

install the fuse in place of the power resistor. After this, check the voltage across R17 again (with the power on) and if necessary adjust it to 15 mV.

This is fun DIY project, cheap and unpretentious. Nevertheless, the sound quality of this amplifier is respectable. The distortion level gives no grounds for complaint. Of course, it's not a figure with an incredible number of zeros after the decimal point, but the idea here is to brush up on sixties technology.

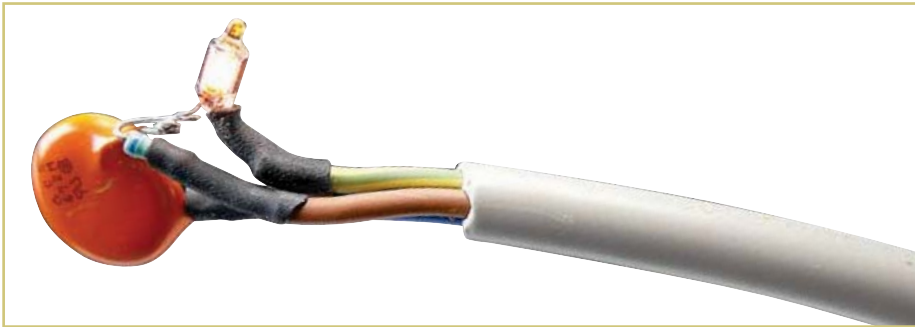
The author has designed two PCB layouts: one for the amplifier and one for the power supply. The layouts can be downloaded from [1] in PDF, Gerber and/or Easy-PC CAD format.

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Internet Link

[1] www.elektor.com/110332

Belgian Earth Fault Detector

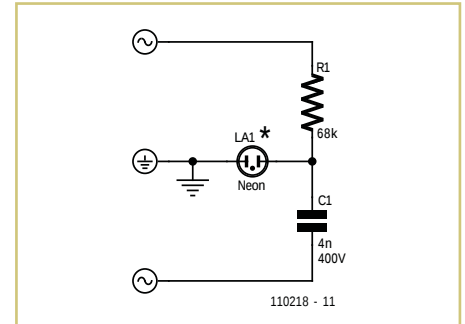


By Marc Mertz (Belgium)

Having been affected by earth fault accidents, the author put together this little circuit. It consists of just three elements: the neon with its original resistor — for example, salvaged from the switch on an AC power bar — and a small capacitor (class Y) salvaged from the electronics of a low-consumption lamp. A larger capacitance makes the neon glow brighter. All this for no money at all. The neon lights only when

there is an efficient Earth present. This works well at the author's home, with Live or Neutral either way round. In the Elektor laboratory based in The Netherlands, some concerns were expressed as described in the June 2011 issue [1], as the circuit was sensitive to the relative positions of the Live and Neutral. So the Earth fault detector can also be used as a Phase detector, but probably in Belgium only.

The whole thing can easily be incorporated



into a power socket; the author used a small transparent cover to protect the neon.

(110218)

Note. As opposed to the UK and the US, some AC power outlets in Belgium — and all in The Netherlands — are not polarized, i.e. AC power plugs (both earthed and non-earthed) can be inserted either way around.

Internet link

[1] www.elektor.com/110396

Wire Loop Game

By Andreas Binner (Germany)

In the 'Wire Loop Game', a test of dexterity, the player has to pass a metal hoop along a twisted piece of wire without letting the hoop touch the wire. Usually all the associated electronics does is ring a bell to indicate when the player has lost. The version described here has a few extra features to make things a bit more

exciting, adding a time limit to the game and a ticking sound during play.

Two 555 timer ICs are used to provide these functions. IC1 is configured as a monostable which controls the time allowed for the game, adjustable using potentiometer P1. IC2 is a multivibrator to provide the ticking and

the continuous buzz that indicates when the player has touched the wire with the hoop.

When the monostable is in its steady state, the output of IC1 (pin 3) is low. T1 acts as an inverter, and D2 is thus forward biased. R8 and R4 are therefore effectively in parallel, with the result that IC2 produces a low