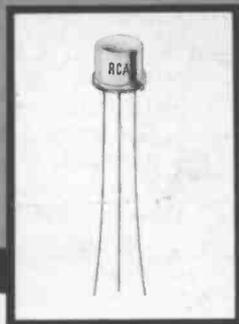




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A Power Supply for Transistor Circuits

By R. M. Mendelson, W2OK0*
RCA Electronic Components and Devices

When a radio amateur first ventures into the construction of transistor circuits, he frequently encounters a "power" roadblock. He needs a low-voltage DC power supply that can provide up to several amperes of usable current, but has available only the old high-voltage, low-current supply that he has been using for vacuum tube circuits.

The amateur need no longer be concerned with this problem. Several recently announced RCA silicon n-p-n power transistors (2N3053, 2N3054, and 2N3055) are ideally suited for construction of a small, well-regulated power supply having a continuously variable output of 5 to 25 volts at currents from milliamperes to 3 amperes. Such a supply greatly simplifies breadboard experimentation with almost any transistor circuit, and makes home-operation of mobile transistor equipment relatively easy.

Circuit Description

Figure 1 shows the schematic diagram of a conventional series-regulated power supply.

The RCA-2N3053 (Q_1) samples the output voltage and, through the RCA-2N3054 (Q_2), controls the voltage drop across the RCA-2N3055 (Q_3).

The 3.9-volt zener diode (D_5) provides a reference voltage for the emitter of the 2N3053.

Although the circuit is quite simple, regulation is very good. For example, if the output is set at 12.6 volts at zero load, a voltage drop of only 0.5 volt will occur when the load is increased to 3 amperes. When the output is set for a fixed load of 1 ampere at 12.6 volts (at a line voltage of 115 volts), the voltage change is less than 0.2 volt for a line-voltage swing from 100 to 130 volts.



Exterior view of W2OK0's power supply shows lineup (left to right, bottom) of positive, ground, and negative terminals; shorting switch; fuse and pilot light (above fuse); and line-voltage switch. Unmarked control knob between the two meters is used for setting desired voltage.

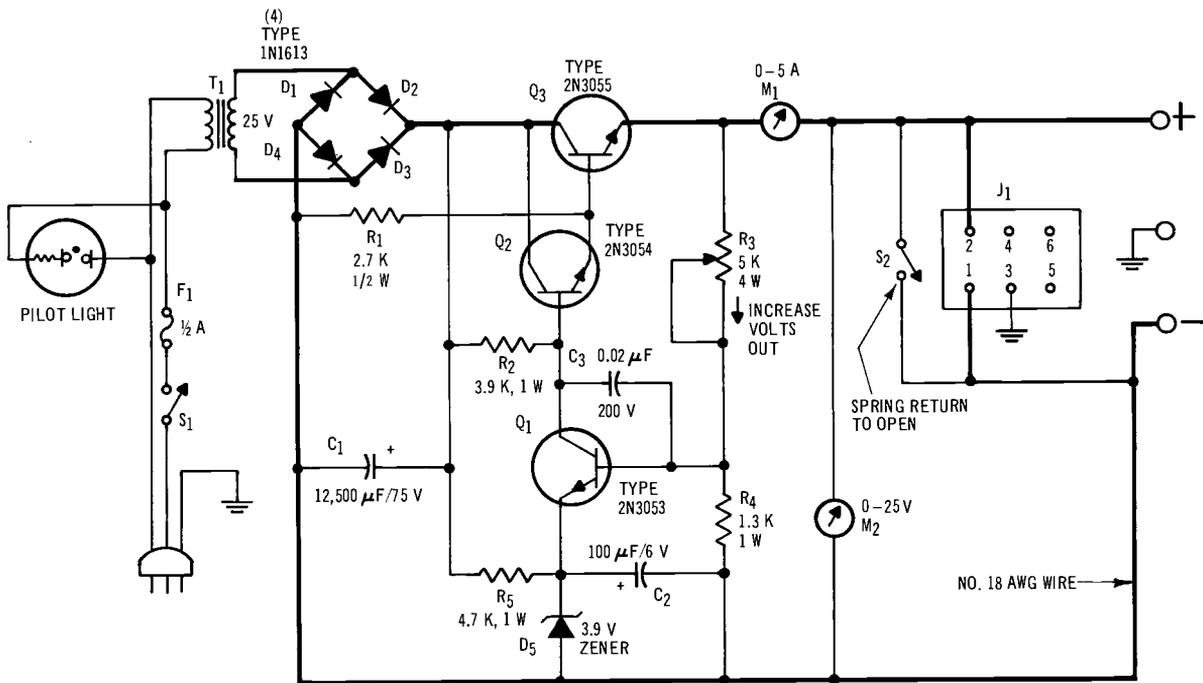
*Solid-State and Receiving Tube Division, Somerville, N. J.

Construction

The layout of the power-supply circuit is not critical. As an aid to the builder, however, a typical chassis layout is pictured in Figures 2 and 3.

Builders of the power supply are given two important reminders:

First, a wire at least No. 18 AWG in size should be used for those sections of the circuit that carry the 3-ampere current. These sections are represented by heavy lines on



C₁ — 12,500 μ F, 75 volts, electrolytic (Mallory CG1252U75G1 or equiv.)

C₂ — 100 μ F, 6 volts (Sprague TE 1102 or equiv.)

C₃ — 0.02 μ F, 200 volts (Sprague 2TM-S20 or equiv.)

D₁, D₂, D₃, D₄ — Diodes, RCA 1N1613

D₅ — Zener diode, 3.9 volt, 1 watt (International Rectifier Company Z1100 or equiv.)

F₁ — 0.5 ampere, slow-blow type

J₁ — Socket, 6 pin (Cinch-Jones S306AB or equiv.)

M₁ — Meter, 0-5 amperes (Simpson 1227C or equiv.)

M₂ — Meter, 0-25 volts (Simpson 1227C or equiv.)

Q₁ — Transistor, RCA-2N3053

Q₂ — Transistor, RCA-2N3054

Q₃ — Transistor, RCA-2N3055

R₁ — 2,700 ohms, 1/2 watt

R₂ — 3,900 ohms, 1 watt

R₃ — Potentiometer, 5,000 ohms, 4 watts, wirewound (Mallory M5MPK or equiv.)

R₄ — 1,300 ohms, 1 watt

R₅ — 4,700 ohms, 1 watt

S₁ — SPST, toggle (Cutler-Hammer 7580K6 or equiv.)

S₂ — SPST, toggle, spring-return to open (Cutler-Hammer 7506K3 or equiv.)

T₁ — Transformer, 25 volts, 2 amperes (Stancor P8357 or equiv.)

Miscellaneous — Cabinet (Bud Futura MD1960 or equiv.); Chassis, 7 by 9 by 2 inches (Bud CB40 or equiv.); 1 Transistor Socket (Cinch-Jones 2TS-4 or equiv.); 1 Heat Sink (Lafayette Radio 30G-1020 or equiv.); 3 Binding Posts (H. H. Smith 257 or equiv.); 1 Pilot Light with built-in resistor (Dialco 249-7841-933 or equiv.); 1 Fuse Post, 3AG (Littelfuse 342004 or equiv.)

Figure 1: Schematic diagram and Parts List of W2OKO's power supply for transistor circuits. Heavy lines in schematic show sections of circuit that carry 3-ampere current. Wire used for these sections should be No. 18 AWG in size.

the Figure-1 schematic diagram. Wire of the same size is also desirable for leads to external circuits.

Second, an adequate heat sink should be employed in the mounting of the high-current transistors and the rectifier diodes. The heat sink used by the author (see Figure-1 Parts List) has proved ideal, and performs best when vertically mounted and isolated from other components.

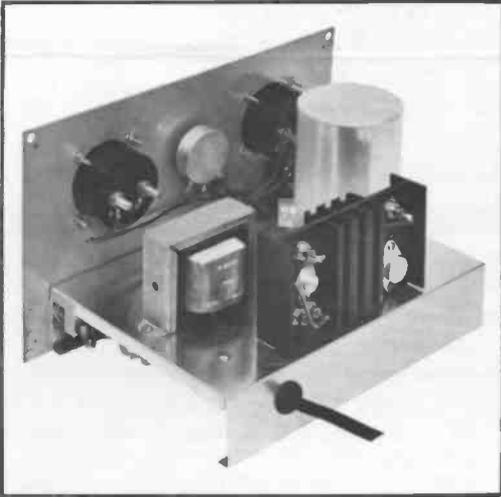


Figure 2: Rear view of W2OKO's power supply shows layout arrangement of four power diodes and 2N3054 and 2N3055 transistors on heat sink. Builders are advised to leave sufficient room around heat sink for air circulation.

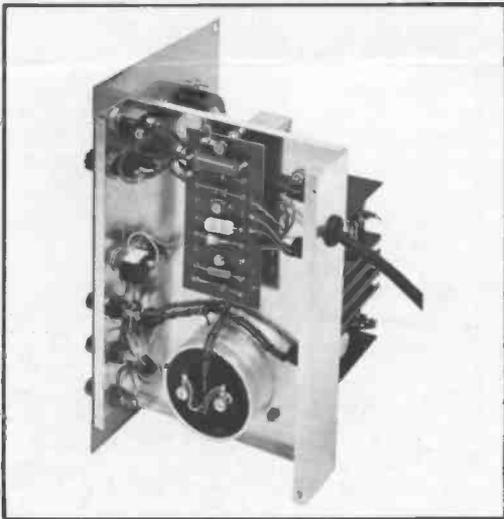


Figure 3: Bottom view of power supply shows how 2N3053 transistor is mounted on terminal board together with all the small components of the circuit.

Because the collectors of the 2N3054 (Q_2) and 2N3055 (Q_3), and the cathode studs of the rectifier diodes, D_2 and D_3 , have one electrical point in common, all these devices may be bolted directly to the heat sink without insulation — provided the heat sink is electrically insulated from the chassis. Such insulation is easily achieved by drilling and tapping two holes in the bottom edge of the heat sink and then installing fiber shoulder



Figure 4: Closeup of left side of heat sink shows how it is insulated from the chassis by fiber shoulder washer (arrow). Note how hexagonal mica insulator is placed under diode, D_1 , shown at top. The same arrangement should be used in mounting diode, D_4 , on the right side of the heat sink.

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washers (see Figure 4 for illustration).

Exact positioning of components on the heat sink is not important, but holes around the emitter and base pins must provide ample clearance. Wires can be soldered directly to these pins with the aid of a small pencil-type iron. The remaining two diodes (D_1 and D_4) may also be mounted on the heat sink, but must be insulated from it by the mica spacers supplied with the diodes. Although this entire assembly is above ground potential, it receives only the low voltage from the transformer secondary.

The shorting switch across the output terminals must be of the spring-return (back to "open" position) type in order to avoid damage to the power-supply unit.

Operation

Properly constructed, the power supply should have a range of approximately 5 to 25 volts. Use of an adequate heat sink should permit a full current of 3 amperes to be drawn continuously.

Because the 2N3055 (Q_3) acts as a series resistor, lower output voltages increase the voltage drop across this transistor. The greater the voltage drop, the greater the heat dissipation at Q_3 . If lower output voltages are desired, the operator must be especially mind-

ful of the fact that current should not exceed 3 amperes.

The shorting switch (S_2) is used when the power supply is connected to an experimental circuit and voltage must be removed from the circuit in order to make a change. Although line voltage is removed by turning off the main switch (S_1), discharge of the filter capacitor (C_1) may require up to several minutes. Use of S_2 accomplishes this discharge almost instantaneously.

If S_2 is accidentally closed while the power is still on, the power supply saturates at approximately 5 amperes; however, no damage occurs unless the switch is kept closed for many seconds.

Conclusion

With this handy, well-regulated power supply available on the work bench, the radio amateur can try out almost any transistor circuit "at the flick of a switch," and need no longer engage in time-consuming battery hunts as a prelude to breadboard experimentation.

Easy to construct and operate, the W20KO unit employs three well-established RCA transistor types which provide the amateur with stable, reliable performance over a long service life.