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minireg power supply

Although it utilises only two transistors and eight other components, this simple stabilizer will supply currents up to about 4 A and is equipped with foldback current limiting.

The circuit operates as follows: ignoring R1 for a moment, current from the output of the supply flows through D1, D2, R3 and P1 to ground. Due to the forward voltage drop of D1 and D2 the emitter of T2 is always biased about 1.2 V lower than the output voltage. Should the output voltage tend to rise the emitter voltage of T2 would rise by the same amount, but since the base is fed from the potential divider P2/R4 the base voltage will rise by only $\frac{R_4}{P_2 + R_4}$ times this amount. The base-emitter voltage of T2 will thus tend to fall and T2 will draw less current from R2. The base-emitter voltage of T1 will thus fall and T1 will tend to turn off, so the output voltage of the supply will fall. Should the output voltage tend to fall the reverse will occur. The base-emitter voltage of T2 will tend to increase. T2 will turn on harder, which in turn will turn T1 on harder, and the output voltage will be restored to its original value.

The output voltage of the power supply is given by

$$V_O = (V_Z - 0.6) \cdot (\frac{R_4}{P_2} + 1)$$

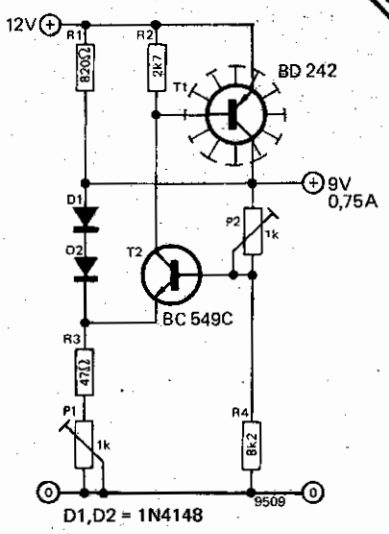
Where V_Z is the forward voltage drop of D1 plus D2.

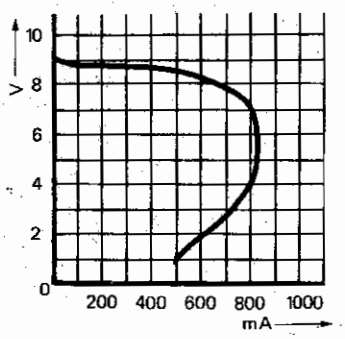
As the output current of the supply increases the current through T2 also increases as it turns on T1 harder and harder. The voltage drop across R3 and P1 will therefore increase, and the current through D1 and D2 will decrease. When the current has decreased so far that D1 and D2 are in the non-linear region of their forward transfer curve the voltage across D1 and D2 will begin to fall, and hence the output voltage will fall since the V_Z term in the above equation is decreasing. The output current will fold back as shown in the graph.

The maximum output current is given approximately by

$$I_{max} = \frac{(V_O - V_Z)\, h_{FE\ T1}}{R_3 + P_1}\ (A)$$

where $h_{FE\ T1}$ is the DC current gain of T1. With an average BD242 having a gain of about 25 the maximum output current can be adjusted from a few hundred mA to about 4 A with the component values shown.





However, using the equations given it is not difficult to redesign the power supply for other output voltages and currents.

Resistor R1 is necessary to ensure that the circuit starts up reliably. If R1 were omitted then, on switch-on, T1 would be turned off and the circuit would fail to start. R1 provides base current to T2 which ensures that the circuit starts. The value of R1 should be the largest value at which the circuit still starts reliably.

If the circuit is to be used for lower currents than that specified then a lower power device may be used for T1. For currents up to about 50 mA a TUP may be used, provided the difference between the input and output voltages is not more than two or three volts. For currents from 50 to a few hundred milliamps a medium power device such as a BC143 could be used.