VOLTAGE REGULATOR DESIGN - USING ZENER DIODE

The essential components in a zener voltage regulator are a limiting resistor and the zener.

The zener attempts to maintain a constant voltage (E_Z) across itself by drawing the proper amount of current. Several important specifications are necessary in order to acquire the proper diode.

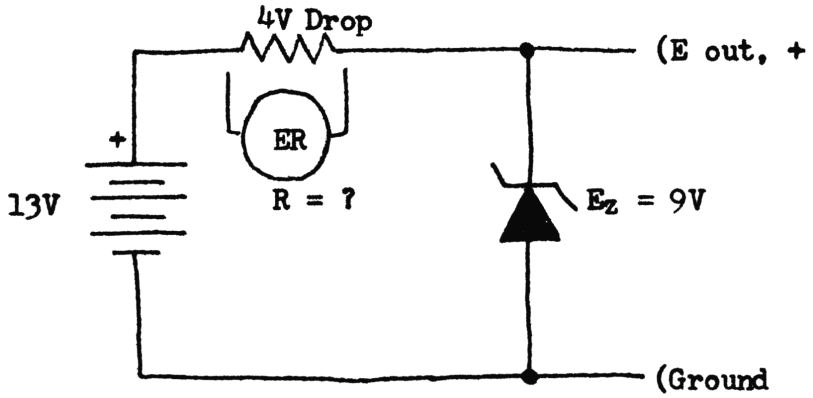
1. Choose the voltage of zener (E_Z) you require: Values range from 2.4 to 200 Volts, and current ranges from $\frac{1}{2}$ to 50 Watts.
2. Figure the power rating: $P_Z = E_Z$ (I load) (1.25). The 1.25 is a safety factor.
3. Figure maximum zener current (I_Z max.): I_Z max. $= P_Z/E_Z$ (.9). The 0.9 is the safety factor.
4. Series current limiting resistor is figured by: $R = ER/I_Z$ max. ER is the voltage drop across the resistor or Voltage input-zener voltage.
5. Power rating of resistor is: $PR = ER/I_Z$ max.

(R = Resistance; I = Current; E = Voltage; P = Power)

Example of circuit requiring a voltage of 9V at 400ma (.4A) is given below:

SPECIFICATIONS

E in = 13 Volts
E out = 9 Volts
I load max = 400ma (.4A)



The following steps are necessary to determine the required circuit value.

1. Since 9V is required output voltage, a 9V zener is used.
2. Power rating = E_Z times I_{load} times (1.25): 9V times .4Amp times 1.25 equals 4.5 Watts. A 5W zener is used as closest value above 4.5 watts.
3. I_Z max = P_Z divided by E_Z times .9: 4.5W divided by 9V times 0.9 equals .45 Amps.
4. R = ER divided by I_Z: 4V divided by .45 equals 8.88 ohms. A 9.1 ohm resistor is used as closest standard value.
5. PR = ER time I_Z max.: 4V times .45 Amps equals 1.8W. So use a 2W resistor. (Note: to be on the safe side always overrate your parts!) REMEMBER MURPHY....

So, from the above calculations the specifications of circuit are: 5W, 9V Zener Diode and 2W, 9.1 ohm resistor.....