Diode I-V Characteristics

Objectives: To measure the DC I-V Characteristics of diodes.

Background: Semiconductor devices generally exhibit highly nonlinear I-V characteristics. This means that a small change in the applied voltage could cause a large change in device current. Conversely, in certain situations, a small change in the current being forced through the device may result in a large change in the voltage across the device. Due to such rapid variations, special circuits may be required to make measurements with good resolution. In the case of a diode under forward bias, the current rises exponentially with the applied voltage and the circuit shown in Fig.1 can be used effectively for the measurements.

Experiment:

1) Wire up the circuit as shown in Fig.1 (be very careful with the transistor terminals!) and test it when the "Device under Test" (DUT) is a simple resistor, say, 1kΩ. Make sure that by changing the potentiometer settings, you are able to change the current through the DUT. The values of R1 (resistance between upper terminal and variable terminal of the potentiometer) and R2 (resistance between variable terminal and lower portion of the potentiometer) need to be suitably chosen. Measure the voltage across the DUT and confirm it varies linearly with the current. Check also that V_{BE} of the transistor is in the range of 0.6-0.8V. If it is not, there is something seriously wrong.

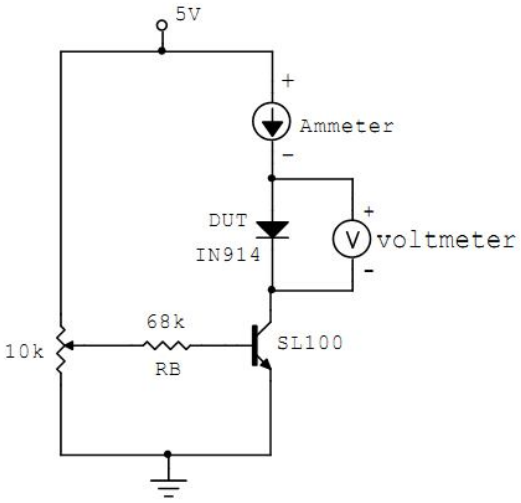

Figure 1

2) Replace the DUT by a Silicon diode (1N914). For currents ranging from about 0.1μA to 20mA, measure the voltage across the diode. Make sure that the diode is connected in the "forward bias" configuration.
3) Now use a Germanium transistor AC127 as a diode. Repeat the above measurement.
4) Devise a suitable circuit and measure the "reverse bias" I-V characteristics of the Silicon and Germanium diodes. (Fig.2)

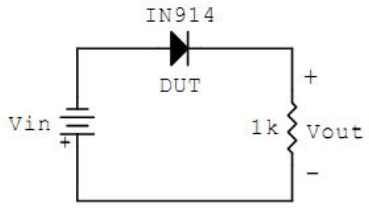

Figure 2