

# CHAPTER

3

## Diodes

This laboratory exercise we will introduce you to a very useful non-linear electrical device: the diode. Diodes and other nonlinear elements are extremely important components of electronic circuits forming the basis for operations such as radio signal detection. In this Lab session we will give you a brief exposure to this interesting nonlinear element. We will use the power supply and the DMM to measure the I-V curves of several important 2 terminal devices: the resistor, the diode, the Zener diode, and the Light Emitting Diode (LED).



### Background

The general method for measuring an I-V curve is to apply a voltage to the device under test and to measure the current that flows. Note, it is also possible to take the reverse approach and apply a current and measure the voltage. In this lab we will use the DMM to measure the current flowing through the device under test (DUT). We will then adjust the power supply voltage until a specified current flows. Then we can determine a single point on the I-V curve by measuring the power supply voltage. Because the power supply can destroy the components we will use in this lab, you should place a 1K resistor in series with the DUT to limit the maximum current flow as shown in Fig. 3.1. To make simultaneous measurement of voltage and current easier, you should borrow a second DMM from an adjacent Lab bench. Of course, you should in turn



2. Next, repeat the steps in part 1 for a 1N4148 diode. There should be six of these in your lab kit. The diode is described in more detail in Chapter 1. The physical shape of the diode is illustrated in Fig. 3.2. The black band goes to the N side of the diode. Install the diode as the DUT with the band toward the bottom and the side without the band toward the top where the resistor and the power supply are connected. Since we know that the diode will not conduct current in the negative direction, it will not be possible to adjust the +20V section of the power supply to achieve large negative current flows. To avoid damaging the diode, do not apply more than +12V with the 20V supply. If the desired current cannot be achieved even after you have turned the voltage up to a full +12V, just make a measurement of the actual voltage across the DUT and the current flowing through it.

+1mA	-1mA
+2mA	-2mA
+3mA	-3mA
+4mA	-4mA
+5mA	-5mA

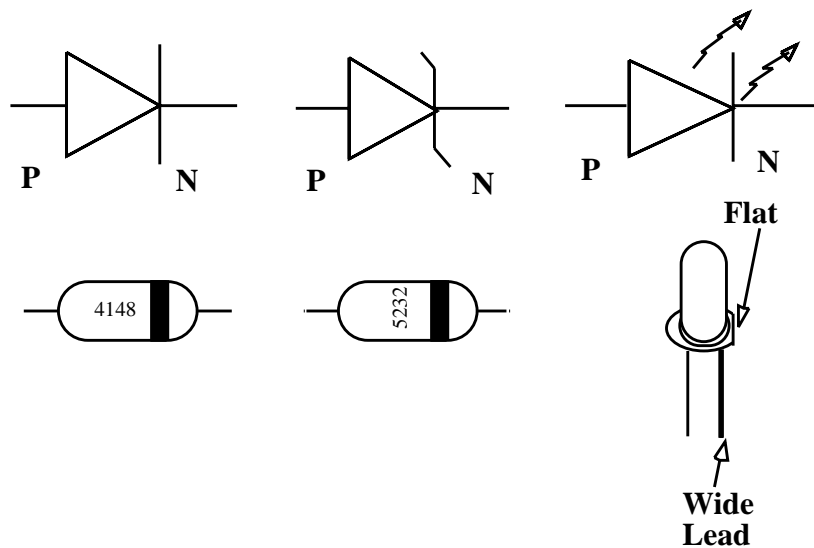
3. Next, repeat the steps in part 1 for a 1N5232B Zener diode. There is only one of these in your lab kit. The diode is described in more detail in Chapter 1. The physical shape of the diode is illustrated in Fig. 3.2. As before, the black band goes to the N side of the diode. Install the diode as the DUT with the band toward the bottom and the side without the band toward the top where the power supply is connected. To avoid damaging the diode, do not apply more than +12V with the 20V supply. Note, with the Zener diode the desired current can be reached in both polarities.

+1mA	-1mA
+2mA	-2mA
+3mA	-3mA
+4mA	-4mA
+5mA	-5mA

4. Finally, repeat the steps in part 1 for an LED. An LED is simply a diode which turns on with between 1V and 2V of forward voltage. The LED is made of materials that emit light when current flows. The physical shape of the diode is illustrated in Fig. 3.2. The flat side of the diode goes to the N side of the diode. Install the diode as the DUT with the flat toward the bottom and the side with-

out the flat toward the top where the power supply is connected. To avoid damaging the diode, do not apply more than +12V with the 20V supply. When the desired current cannot be achieved even after you have turned the voltage up to a full +12V, just make a measurement of the actual voltage across the DUT and the current flowing through it. (Just write Lights Up or Not)

- |      |      |
|------|------|
| +1mA | -1mA |
| +2mA | -2mA |
| +3mA | -3mA |
| +4mA | -4mA |
| +5mA | -5mA |



**Figure 3.2** Schematic symbol (top) and physical shape (bottom) of various diodes from robot kit: 1N4148 signal diode, IN523 5.7V Zener diode, and a Red LED.