X170994

UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE

Department of Electrical Engineering

Experiment No._____Semiconductor Diodes

INTRODUCTION

Semiconductor diodes come in a variety of types, shapes, sizes, and ratings. The different types of diodes can perform a variety of different functions. The "regular" diode has I-V characteristic curves similar to the one in Figure l. It can be used to convert AC to DC, perform digital logic, etc. The I-V characteristic curves for Zener diode looks similar to the one in Figure 2. It can be used for DC voltage regulation, waveshaping, etc. The tunnel diode has a unique I-V characteristic curve such as shown in Figure 3. A portion of its curve has a negative slope indicating negative resistance. Because of this characteristic, it is used to build ultra-high frequency oscillators.

It is very important that the maximum ratings of a diode not be exceeded. Some of these ratings are maximum peak-inverse voltage, maximum forward current (peak and continuous), and maximum wattage at which the device can operate for a particular temperature. There may be other specified maximum ratings depending on the type of diode.

The purpose of this experiment is to obtain the characteristic curves for a regular and Zener diode and to utilized the properties of the diodes to perform a number of functions.

PRELIMINARY

P-1. What is the basic feature of the diode?

P-2. Draw a circuit utilizing regular diodes that would perform full-wave rectification of an AC signal. DO NOT INCLUDE A TRANSFORMER!

Refer pg 119.(chapter 3. Diodes)
Microelectronic circuits
Adel S.Sedra , Kenneth C.Smith

P-3. Obtain the manufacturer's specifications for the diodes listed below.

1N4002 (or its equivalent)

V_{RM}(peak reverse voltage) 100

V_R (steady state reverse voltage) 100

T_A (operating ambient temperature range) 65 - 175° C

V_{FM} (Peak forward voltage) 1.6 V

V_F (average forward voltage) 0.8 V

1N5228 (or its equivalent)

operating load temperature range 65 - 200°C

V_z (regulator voltage) 3.9 V

I_R (static reverse current) 75μA

V_F (static forward voltage) 1.1V

$I_{Z\mu}$ (maximum current zener) 115μA

INSTRUCTOR'S SIGNATURE_____DATE_____

Suggested Reference

Microelectronic Circuits
Adel S.Sedra , Kenneth C.Smith
Chapter 3: Diodes

PROCEDURE

F-1. Connect the circuit of Figure 4 using a 1N4002 diode but do not connect it to the current source.

CAUTION: MAKE SURE THE OUTPUT SWITCH ON THE CURRENT SOURCE IS OFF BEFORE CONNECTING, DISCONNECTING, OR CHANGING THE CIRCUIT!

Set the Y-scale of the X-Y recorder on 50 mv/cm and the Xscale on 200 mv/cm. Use ONLY the +/- (or HI/LO) inputs to the X-Y recorder. Place the axes for the plot two centimeters right of the center of the graph paper. Place the current setting of the current source at its lowest setting (both vernier and multiplier). Set the voltage limit of the current source to no more than 10 volts. Connect the diode circuit of Figure 4 to the current source and obtain the forward-based diode I-V curve by varying the current vernier and multiplier output up to 200 mA (points may be easier to plot than a continuous curve).

F-2. Disconnect the current source from the diode circuit of Figure 4. Place the current setting of the current source at its lowest setting (both the vernier and multiplier) and set the voltage limit to 50 volts. Set the Y-scale of the X-Y recorder on 10 mv/cm and the X-scale on 5 v/cm. Connect the current source to the diode circuit of Figure 4 IN THE REVERSE DIRECTION. Obtain the reverse-biased diode I-V curve by varying the current vernier and multiplier output up to 40 volts.

F-3. Repeat F-1 above for the 1N5228 Zener diode.

F-4. Disconnect the current source from the diode circuit of Figure 4. Place the current setting of the current source at its lowest setting (both the vernier and multiplier) and set the voltage limit to 10 volts.Set the Y-scale of the X-Y recorder on 50 mv/cm and the X-scale on 0.5 v/cm. Connect the current source to the diode circuit of Figure 4 IN THE REVERSE DIRECTION. Obtain the reverse-biased diode I-V curve by varying the current vernier and multiplier output up to 100 mA.

REPORT (should include at least the following)

R-1. Describe what function the diode is performing in each of the circuits of Figures 5 through 10.

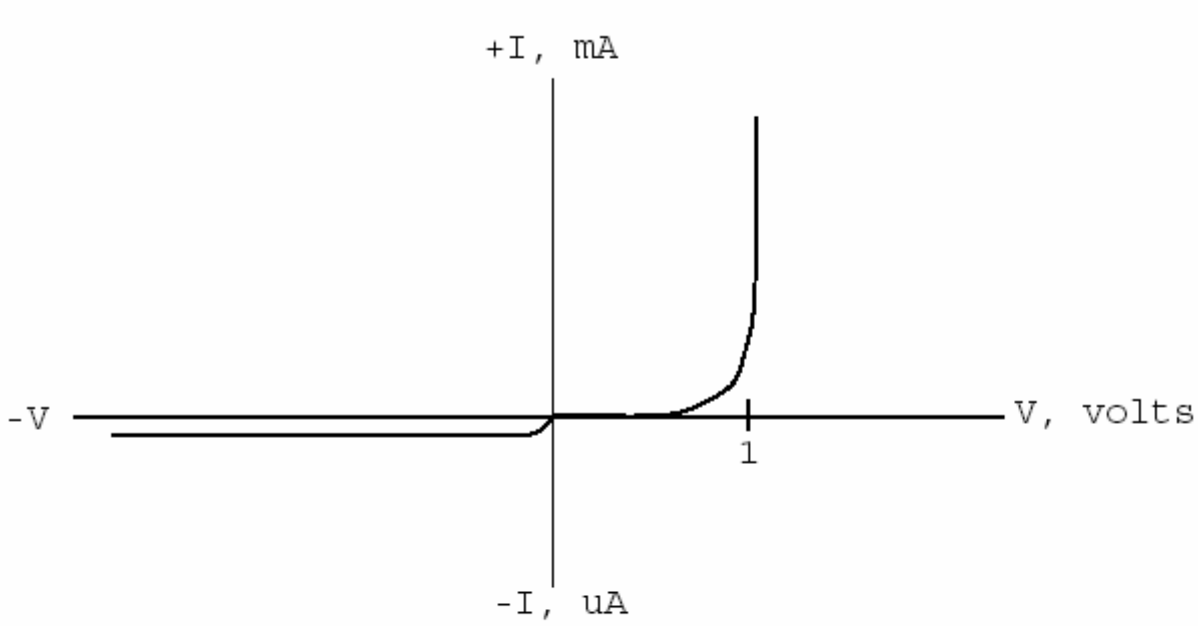

Figure 1. Regular Diode Characteristics

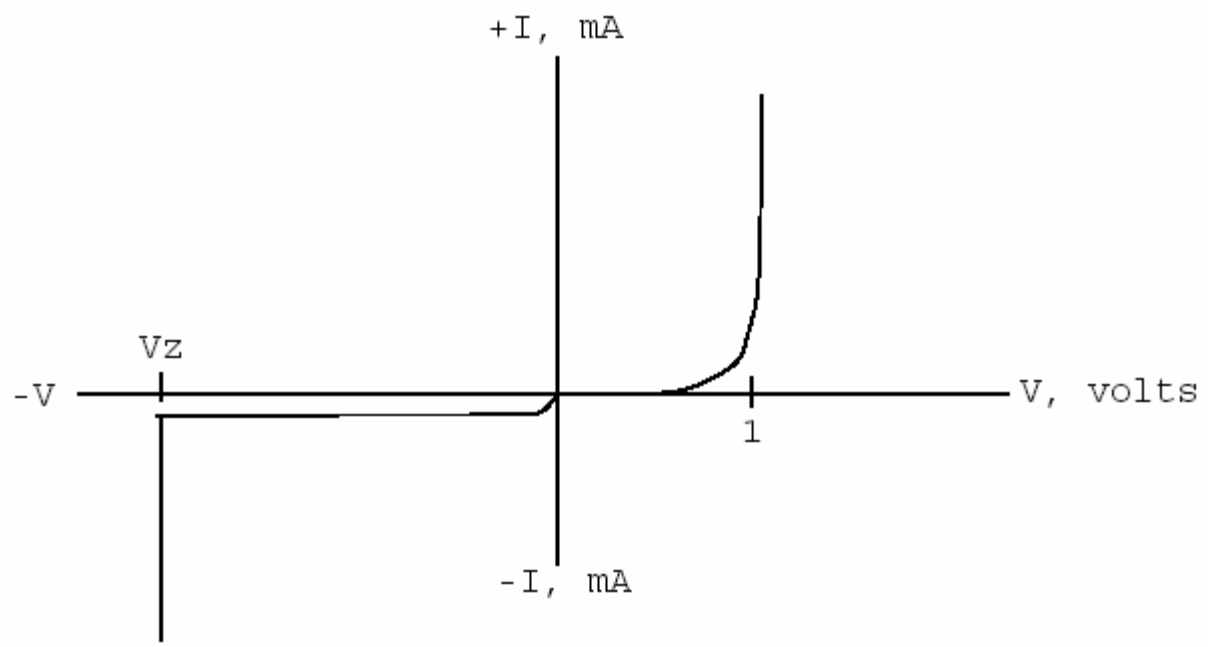

Figure 2. Zener Diode Characteristics

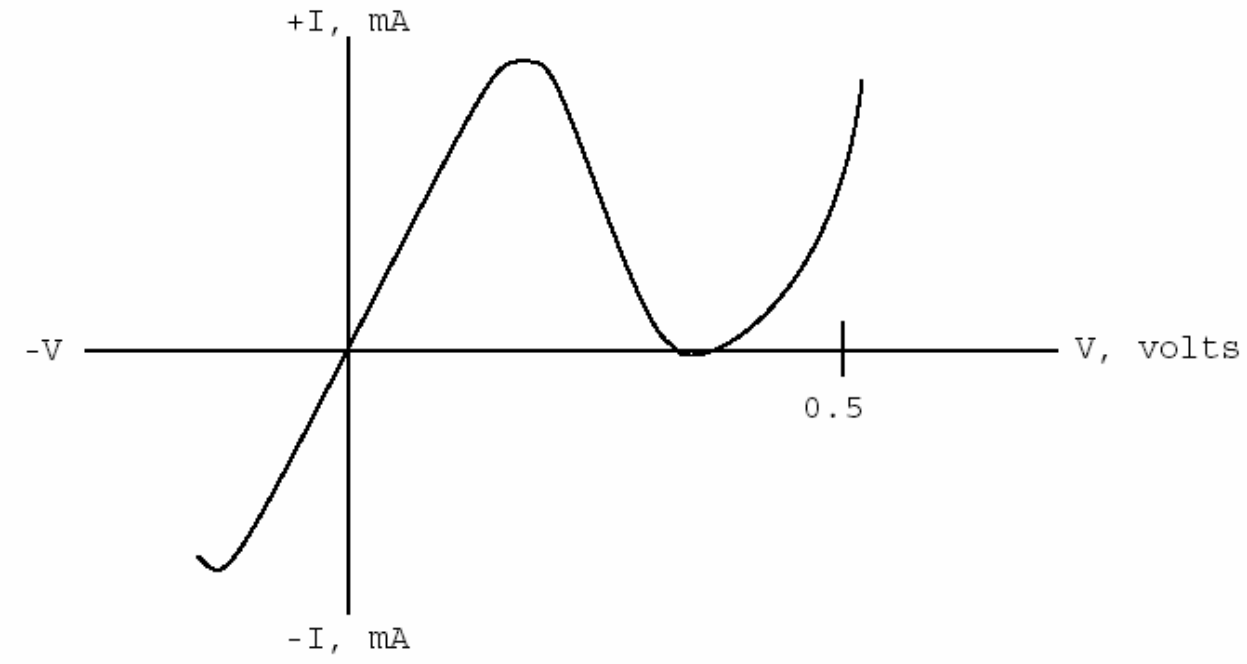

Figure 3. Tunnel Diode Characteristics

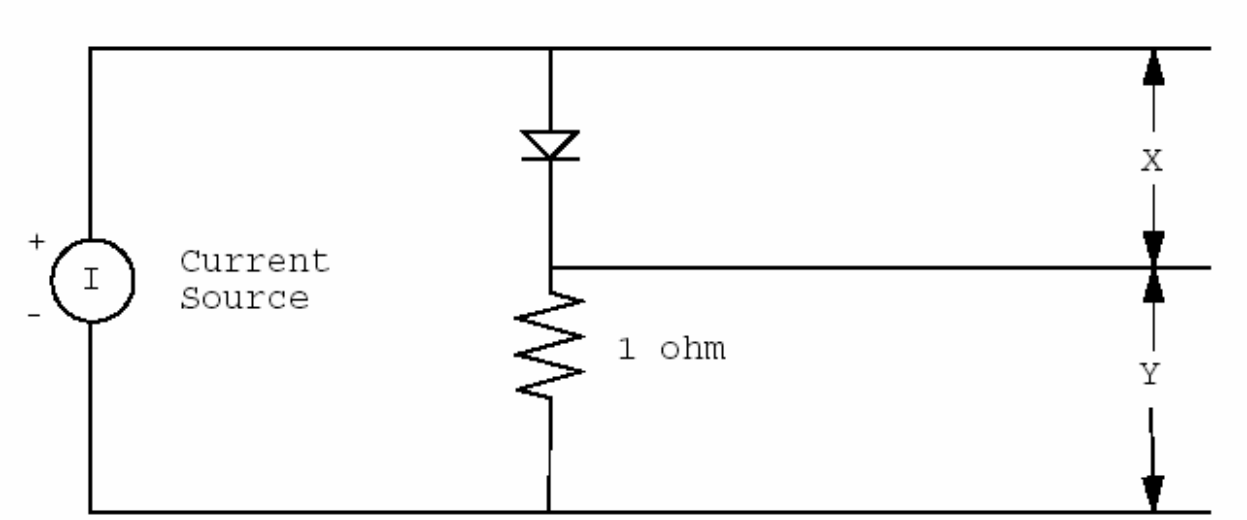

Figure 4.

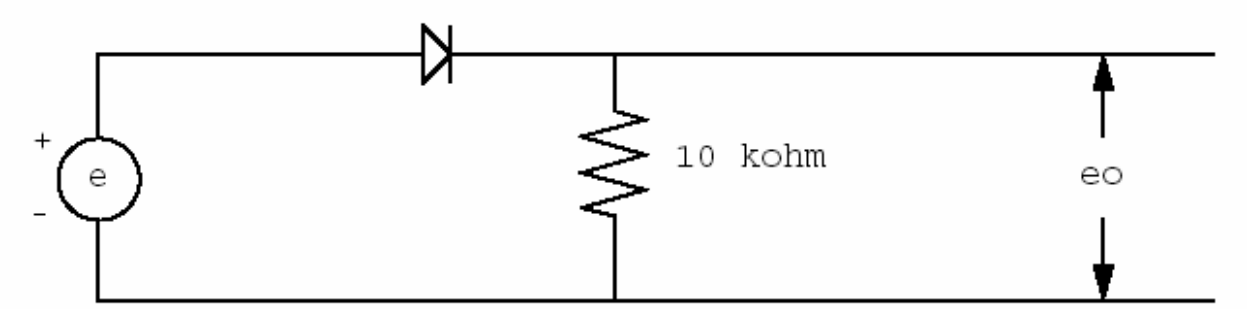

Figure 5.