**Lab - Diode Circuit Characteristics**

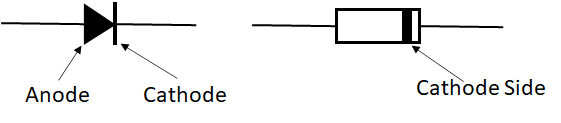
**Objectives:** After performing this experiment, you will be able to:

-Measure and plot the forward- and reverse-biased current-voltage(I-V) characteristics for a diode.

**Introduction:**

A diode is a device made out of two semiconductors materials with different electrical properties in contact with each other. It acts as an electric “one way valve” in a circuit by allowing charges to flow easily in one direction but not the other. Whenever a diode is connected to a voltage source (AC or DC) some current will flow through it. A schematic symbol of the diode is shown below where the arrowhead is called the anode and the vertical line indicates the cathode.

1. (b)



*Figure 1-a) Schematic symbol of a Diode. b) Physical appearance of diode. Line indicates cathode side.*

In this experiment, you will take data on a forward- and a reverse-biased diode and plot the I-V characteristics. You will also set up a clipper circuit made up of a diode and resistor and determine how an AC signal is modified after passing through this type of circuit.

**Equipment:**

Digital Multi-Meter (DMM), Power Supply or Powered Breadboard, Jumper Cables, Cables with alligator clips, Banana plug Cables, Function Generator, Digital Oscilloscope

Resistors: one 300 , one 1.0 M (1 x 106 

One signal diode (1N914 or equivalent)

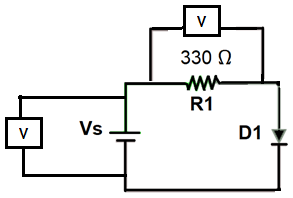
**Activity 1- Diode Characteristics (Forward Biased Diode)**

1. Use your DMM to measure and record the values of the resistors listed in Table 1. Record the data in Table 1

**Table 1**

|  |  |  |
| --- | --- | --- |
| **Resistor** | **Listed Value** | **Measured Value** |
| R1 | 300 W |  |
| R2 | 1MW or 1x106W |  |

2. When the higher electric potential of the power supply is connected to the diode’s anode terminal then the diode is said to be *forward biased*. Construct the circuit shown in Figure 2. Make sure that the cathode side of the diode is connected to the negative terminal of the power supply. Set the supply voltage, Vs, to zero volts.



*Figure 2- Forward Bias Diode Circuit[[1]](#endnote-1)*

1. Connect the DMM across the diode to monitor the forward voltage drop, VF. Slowly increase Vs to establish 0.45 V across the diode.
2. Connect the DMM across resistor R1 as shown in figure 2 to measure the voltage across the resistor, VR1, and record it in Table 2.

**Table 2**

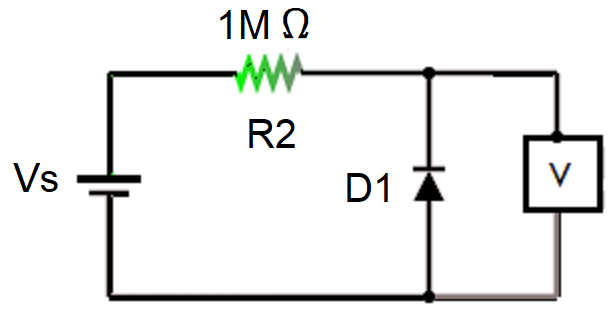
|  |  |  |
| --- | --- | --- |
| VF (Volts) | VR1 (Volts)  Measured | IF (Amps)  Computed |
| 0.45 |  |  |
| 0.50 |  |  |
| 0.55 |  |  |
| 0.60 |  |  |
| 0.65 |  |  |
| 0.70 |  |  |
| 0.75 |  |  |

1. Use Ohm's law to determine the diode’s forward current, IF. Compute IF (=VR1/R1) and enter this current in Table 2.
2. Repeat steps 3 and 4 for each forward voltage, VF, listed in Table 2.

**Activity 2- Diode Characteristics (Reverse Biased Diode)**

***Note:*** The data in this part will be accurate only if your voltmeter has a high *input* impedance.

1. Connect the circuit shown in Figure 3. In this case, the diode is reverse biased.



*Figure 3- Reverse Biased Diode Circuit*

1. Vary the voltage across the diode by setting the power supply to each voltage (*VS*) listed in Table 3. For each power supply setting, measure the voltage across the resistor (R2) and apply Ohm's law to the resistor to compute the reverse current in each case. Record the computed current, *IR,* in the table.

**Table 3**

|  |  |  |
| --- | --- | --- |
| ***VS***  **(Measured)** | ***VR2***  **(Measured)** | ***IR* (computed)** |
| 5.0V |  |  |
| 10.0V |  |  |
| 15.0V |  |  |

You should find that the voltage across the resistor, VR2, in table 3 is very small and so the voltage across the diode is approximately equal to the voltage across the voltage source (Vs) but negative since the diode is reverse biased.

1. In MS Excel plot your data so that the current (on y-axis) through diode for both the forward- and reverse-biased diode configurations is plotted against the Voltage across the diode (on x-axis).

**Question1**: In your report make sure that you briefly describe your graph. What is happening to the current through the circuit as the power supply voltage is being varied?

**Question2:** Explain how you could use an ohmmeter to identify the cathode of an unmarked diode.

1. All schematic diagrams were created with Falstad circuit simulator (https://falstad.com/circuit/) [↑](#endnote-ref-1)