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10/30/17

Prelab 4: Characterization of P-N Junction and Schottky Diodes

Objective:

In this lab we will be using the X-Y operation mode of an oscilloscope and a curve tracer in order to observe and evaluate the characteristics of various diodes. We will mainly be studying the forward and reverse bias of these diodes. To begin, we will build a circuit with one voltage source (pulse generator), one resistor, one diode, and two voltmeters. One voltmeter will measure the voltage drop across the resistor and current through the diode, and the other will strictly measure the voltage across the diode. We will then vary the source voltage and measure the diode current and voltage. Next, we will measure the I-V characteristics and breakdown voltages of the different diodes provided. Lastly, we will use a flashlight to illuminate a Si PIN photodiode in reverse, zero, and forward bias conditions, and based off our observations we will determine which bias condition is the best to generate electricity.

Expected Results:

The I-V relationship of an ideal diode follows the equation:

$$I = qA\left(\frac{D_p}{L_p} P_{no} + \frac{D_n}{L_n} N_{po}\right)(e^{qV/nkT} - 1)$$
$$I = I_o(e^{qV/nkT} - 1)$$

However, this only accurately describes the diode under forward bias conditions. For reverse bias conditions we must use the equation:

$$I_{SAT} = I_o + I_{th}$$

Where I_o is the current under reverse bias and I_{th} is the current due to thermal generation.