

Purpose

In this lab you will observe the forward voltage drop of the diode as a function of current for two diodes. In addition you will learn how to use the function generator, both oscilloscope channels simultaneously, and use the cursors.

Equipment

1. Function Generator (FG)
2. Oscilloscope

Materials

1. 100 Ω Resistor *b10 b10 b10 ← 98-23-2*
2. 330 Ω Resistor *010 010 010 ← 327-59-2*
3. 1N4002 Diode
4. Red Light Emitting Diode (LED) (Provided in Lab)

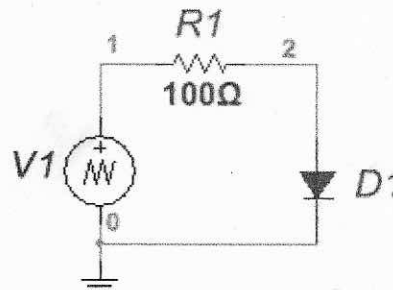
Procedure

1. Directly connect the Function Generator to channel 1 of the oscilloscope and configure it to provide a Sawtooth Wave with the following parameters:

Settings:

- a. A Maximum Voltage of +4V
- b. A Minimum Voltage of -1V
- c. A Frequency of 100Hz

To do this start by selecting the 'Wave Gen' button, WAVE = RAMP, FREQ = 100 Hz, AMPLITUDE = 5.0V, Offset \cong 1.50V, SYMMETRY (Duty Cycle) = 100%



2. Measure and record resistor values. Once the Function Generator is properly configured, construct the circuit as shown on the previous page. Remember that when the Function Generator is used the red clip is the positive terminal and the black clip is the negative terminal. At this time use the 1N4002 Silicon Diode as D. [Note that for the 1N4002 the lead closest to the white band is cathode and corresponds to the line seen with the diode in circuit diagrams. For glass cased diodes (such as the Zener) the band is black. Just remember that the lead closest to the band is the cathode.] Connect channel 1 of the oscilloscope to node 1 on the circuit diagram and channel 2 to node 2. Connect the black alligator clip from the oscilloscope probes to node 0 of the circuit.
3. Adjust the oscilloscope settings until you have a good view of one to two cycle(s) of the two resulting waveforms. Once this is done press SINGLE on the scope to have it take

one "reading" to make it easier to look at. (Make sure channel 1 and channel 2 are both set to 2V/div.) Use the cursors (see below) to probe the wave and take measurements of the voltages that you see on both waveforms. Take measurements of both at the following points: $V_1 = -1V, 0V, +1V, +2V, +V_{max}$

To utilize the cursor feature, select the 'Cursors' button, MODE = TRACK WAVEFORM, X1 SOURCE = 1, X2 SOURCE = 2. First set CURSORS = X1 and move the cross hairs to -1V, then set CURSORS = X2 and move the cross hairs until they align with X1 ($\Delta X = 0.00$ s), then set CURSORS = X1X2 LINKED. Then you will be able to measure V_1 and V_D simultaneously at the points requested above. Record the measured values of V_1 and V_D in a table and the calculated forward current, I_F (see table example below).

4. Disconnect the FG and probes from the circuit and replace the 1N4002 diode with the red LED and the 100Ω for the 330Ω resistor. Note: The cathode end of the LED is indicated with a flat edge on the plastic casing and a shorter leg. Turn the FG back on and repeat step 3.

Submittal: Lab Cover Sheet, Title Page, DATA, and DISCUSSION

Provide a table that contains each pair of voltage measurements that you took (the source and diode voltages). For each pair calculate the current flowing in the circuit at that time. Discuss your observations of the data and talk briefly about the differences between the 1N4002 and the LED. Nothing you submit should be hand-written.

This lab submittal will consist of **two circuits**, **one table** (including measured and calculated data), any **general equations (or sample equations)** used to calculate any data in the table, and a **'DISCUSSION'** section. Find (and submit) the **datasheet of the LED, Kingbright WP7113SRD/E and the 1N4002 diode**, and include in your discussion the expected forward current and voltage of each diode from the datasheet compared to measured results.

Example Table:

V_1	V_1	V_D	I_F	V_1	V_{LED}	I_F
-1	-1.01	-1.04	0.3	-1.01	-1.08	0.21
0	0.64	0.37	0.4	0.73	0.07	2
+1	1.01	0.637	3.73	1.00	1.05	-0.15
2	2.00	0.637	13.63	2.02	1.48	1.63
MAX	2.81	0.647	21.63	2.89	1.54	4.09

$$I_F = \frac{V_1 - V_D}{R}$$

diode
 resistor 100Ω

LED
 resistor 330Ω

2.8
 0.647 mV
 2.2