

# Experiment: 1

## Current-Voltage Characteristics of Diode

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**Abstract**—The first week's experiment consisted of three primary parts. In the first part, we aim to analyze the Current-Voltage characteristics of normal Diode by using a AC signal (triangular wave) as input and the output Current voltage (By using XY curve plotting) on DSO. Our second aim was to analyze the Current -Voltage characteristics of Zener diode using same triangular AC input wave and We see the output on DSO.

### I. INTRODUCTION

#### A. Diode

The fundamental property of a Diode is that it allows the current to flow in only one direction. Diode is a simple Device that is either closed (non-conducting) or open (conducting). In forward bias diode acts as short circuit and in reverse bias it behaves like open circuit.

#### B. Zener Diode

Zener diode is specially designed to operate in reverse Break-down region. In forward bias it acts as a normal diode and in reverse bias it has a particular voltage called breakdown voltage, beyond that current increases suddenly.

### II. APPARATUS REQUIRED

#### A. Digital Storage Oscilloscope (DSO)-1

Agilent Technologies DSO1052B (50MHz, 1GSa/s)

#### B. DFunction Generator-1

scientific SM5070 (3 MHz)

#### C. Bread Board

#### D. Oscilloscopic Probes with BNC Connector-3

One-X probe

#### E. Zener Diode-1

#### F. Resistor-1

#### G. diode-1

#### H. Some copper wire to have connection between circuit.

### III. PROCEDURE

#### A. For Normal Diode

1) We connected circuit on Bread-board (Diode and Resistor in series):

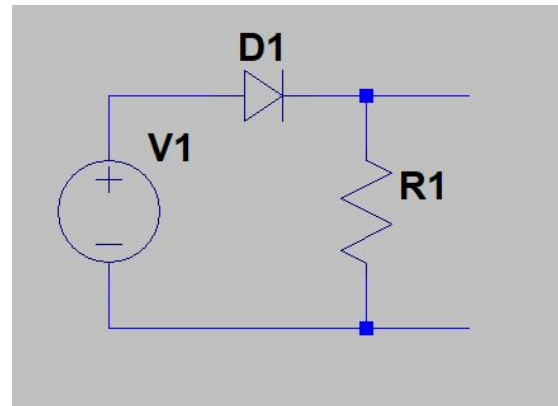


Fig. 1. Diode Circuit.

2) We applied a Tri-Angular wave on circuit as input voltage.:

3) The plot of input voltage and output voltage obtained on DSO by using BNC prob. :

4) We got the peak voltage of each of the each wave(sorry : we don't capture the picture that is having peak voltage showing in the DSO for this graph.):

5) We obtain the current-Voltage characteristics by press Horiz button and then selecting the X-Y mode instead of X-T or Y-T mode.:

### B. For Zener Diode

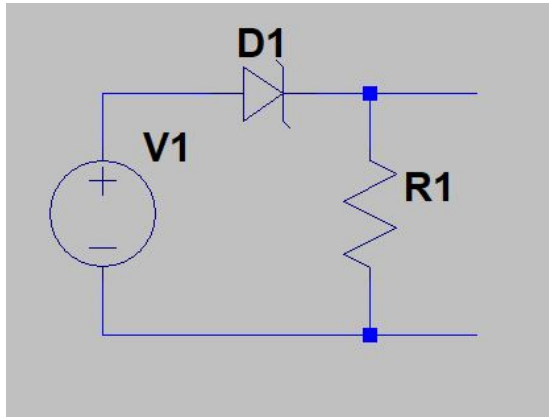


Fig. 2. Zener Diode Circuit.

1) We repeat same procedure for Zener Diode. And circuit was made by using zener diode and resistor in series on Bread-Board.:

## IV. EXPERIMENTAL RESULTS AND DISCUSSION

### A. For Normal Diode

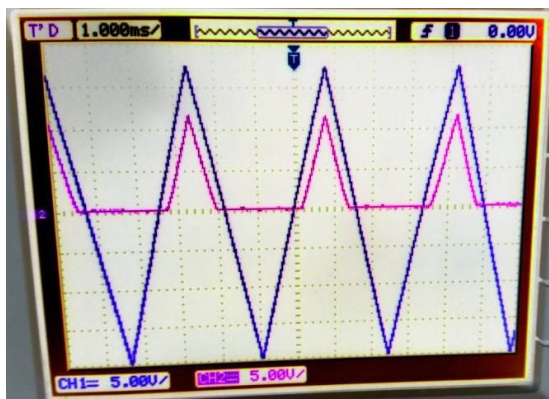


Fig. 3. Input and Output Voltage (Output is across Resistor)(V-T Curve).

1) Because of Built-in-voltage the output voltage in forward bias is less than the input voltage And in reverse bias output voltage is zero(Across the resistance)Because diode is behave like open circuit.:

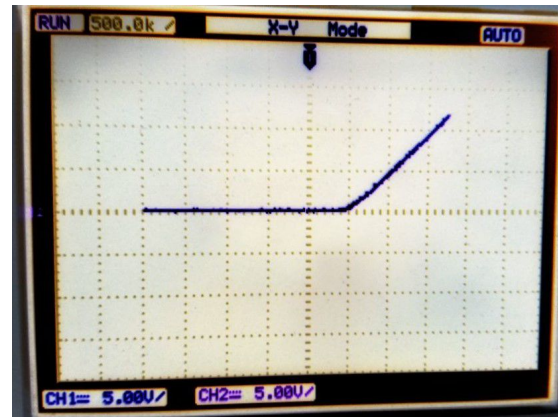


Fig. 4. Current Voltage characteristics.(Current on Y-axis and Voltage on X-axis)

2) The point at which this this sudden increase takes place the sudden increase takes place in I-V characteristics graph is called "Knee Point" :

### B. For Zener Diode

1) Zener Diode is behaving as a normal diode in forward bias.:

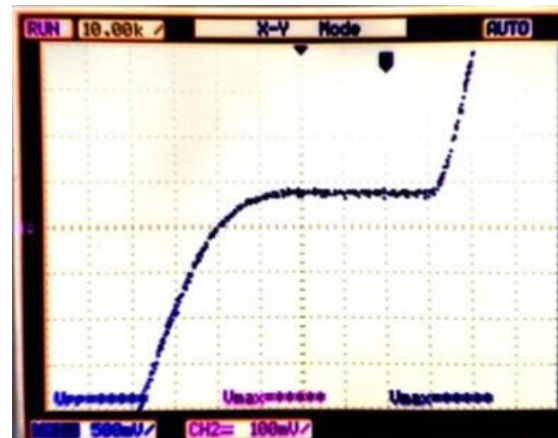


Fig. 5. Zener Diode Current Voltage characteristics.(Current on Y-axis and Voltage on X-axis)

2) Beyond a certain Breakdown voltage current flows through Zener Diode:

## V. CALCULATION

For Diode,  
 $V_{bi} = 0.98 - 0.41V$   
 $V_{bi} = 0.57V$

Hence in piece wise linear model Diode can be replace by a resistor and a voltage source(Considering characteristics in only forward bias).

The voltage source would be equal to the built-in voltage.

So,  $V = 0.57V$

The value of resistor can be calculated by using two point on graph and thus, calculating inverse of slop of the graph.

For example suppose two point are for (650,160) and

(832,312).

Hence R will be:

$$R = \frac{832 - 650}{312 - 160} \Omega = 1.197 \Omega$$

(1)

So diode can be replaced with a DC voltage source and ther resistance.

#### VI. PRECAUTION

- A. Before using the prob cross check that probe con-figuration selected in DSO is the same as the probe using in the circuit (usually 1-X probe).*
- B. Do not allow the crocodile clips to touch each other.*
- C. Don't let touch your hand while measuring the resistor, it will give wrong result or measurement.*
- D. Select the DC coupling in DSO.*
- E. Excess of current may damage the diode.*

#### VII. CONCLUSION

It is concluded that We can use a simple Diode wherever we have to allow current to flow only in one direction. And for zener diode we get concluded that after the breakdown voltage only current changes and the voltage doesn't change so we can use it as a voltage regulator.

#### REFERENCES

- [1] Lecture Slides of Dr. Kunal Ghosh (Assistant Professor,IIT Mandi) and Instructions of Dr. Hitesh shirmali (Assistant Professor,IIT Mandi).
- [2] Previous year's report and guidance of Aanand Ramrakhyani. *and various report of various groups*. [<https://insite.iitmandi.ac.in/moodle/>]. IC 161P course, 2017.
- [3] Wikipedia,  
[https://en.wikipedia.org/wiki/Zener\\_diode](https://en.wikipedia.org/wiki/Zener_diode)  
<https://en.wikipedia.org/wiki/Diode>