Abu Dhabi University

Electronic Devices and Circuits

Lab Report 3
Zener Diodes and Clamping Diode Circuits

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Section 1

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Abstract

In this lab we were supposed to develop our circuit building skill to create clipping and clamping circuits using normal or zener diode.

1 Introduction

In this exercise we are going to study three applications of diodes clipper, clamper and zener. Clipping circuits are used to select a given portion of the input wave which lies above or below some reference level and used to control the reference voltage while Clamping is a process of introducing a dc level into a signal. The clamping diode can produce a negative voltage dc equal to peak value of input in the input signal. The zener diode is the diodes, which are designed to work in breakdown region. The basic function of zener diode is to maintain a specific voltage across its terminals within given limits of line or load change

2 Experiment Set-up

The Experiment Set-up included a Multisim running workstation in the lab.

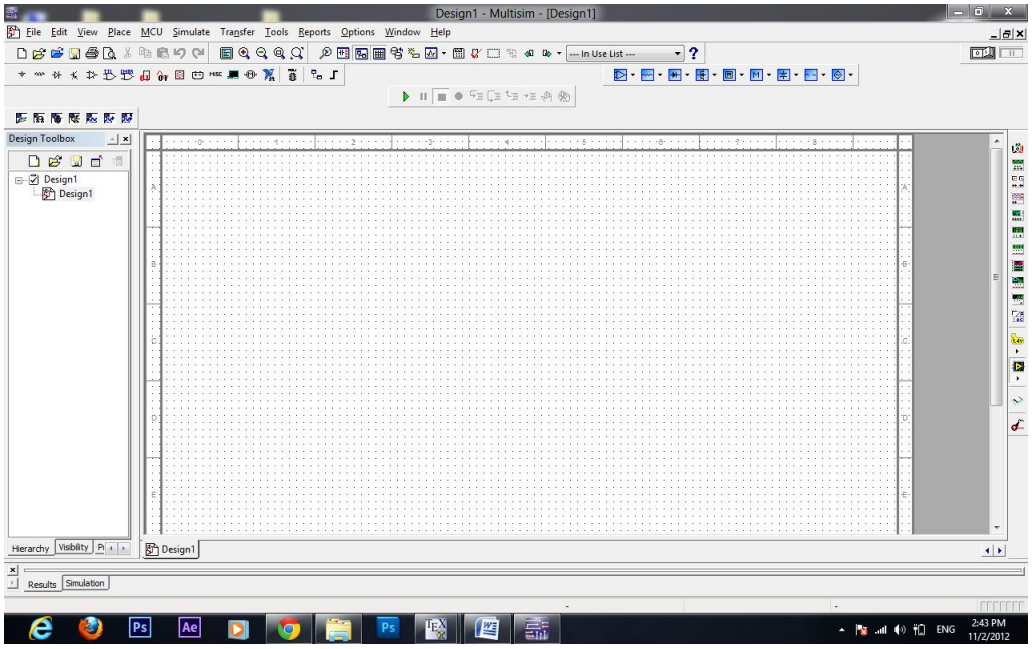

Figure 1: The experiment setup of NI Multisim

3 List of Equipment used

- Desktop Worstation.
- National Istruments Circuit Design Software Mutisim 11.

4 Procedure

4.1 Exersice 1

- Open Multisim.
- Design a diode clamping circuit for each output figure shown below.
- Verify your results assuming Silicon diodes.
- Explain design process in detail.

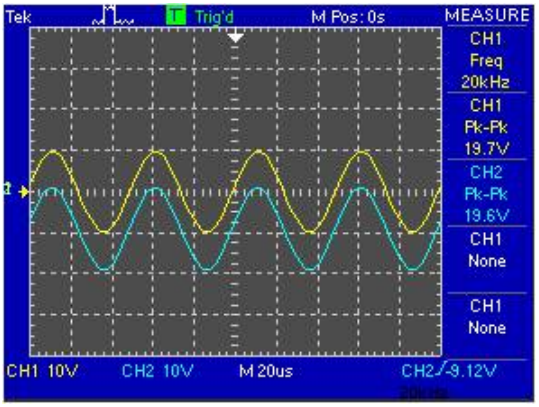

Figure 2: First clamping circuit's output

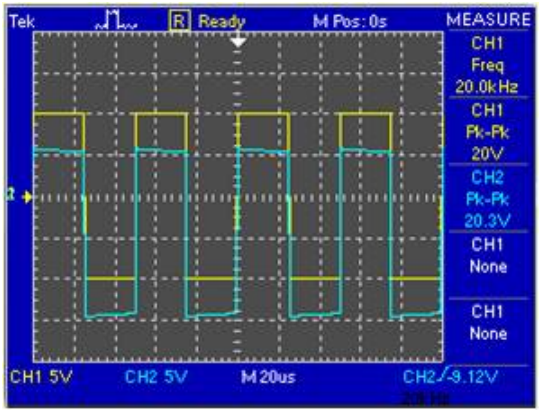

Figure 3: Second clamping circuit's output

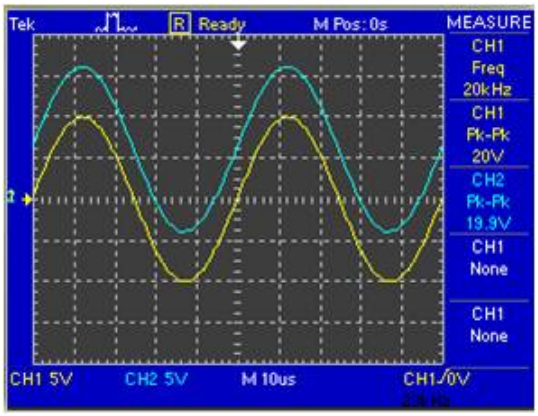

Figure 4: Third clamping circuit's output

4.2 Exercise 2

- Open Multisim.
- Design a Zener Diode clipping circuit that for each condition shown in the below table.
- Explain the design process in Detail.

Circuit No.	Function Generator Configuration	Peak Clipping values
1	Sin, 20 KHz, 20 Vpp	+V = 3V, -V = -3V
2	Sin, 20 KHz, 20 Vpp	+V = 8V, -V = -6V
3	Sin, 20 KHz, 20 Vpp	+V = 8V, -V = -12V

5 Results and Discussions

The following are circuit designs for each exercise. The Explanation is given in the caption below.

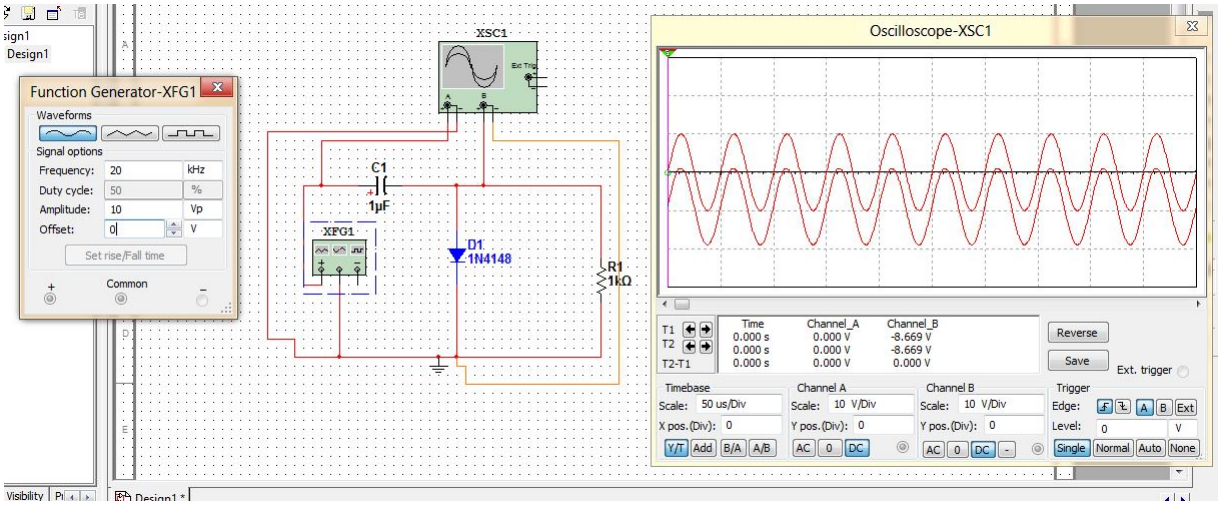

Figure 5: First clamping circuit's oscilloscope output, function generator's input, and circuit. The capacitor charges to Vpeak in the positive cycle of the sin wave and discharges in the negative cycle of the wave. Thus, In the negative cycle, the total voltage across the resistor is twice the negative Vpeak IN

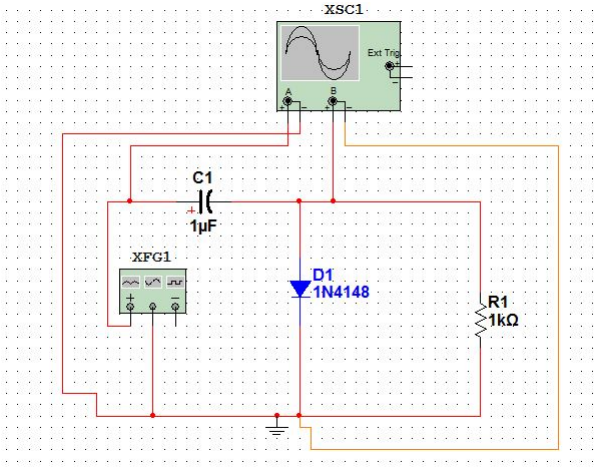

Figure 6: First clamping circuit's circuit design

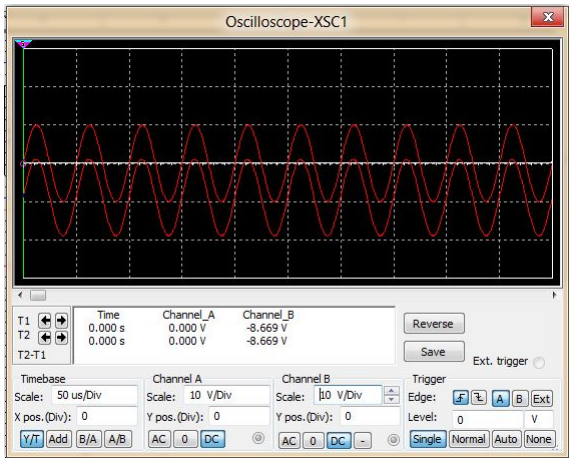

Figure 7: First clamping circuit's oscilloscope output

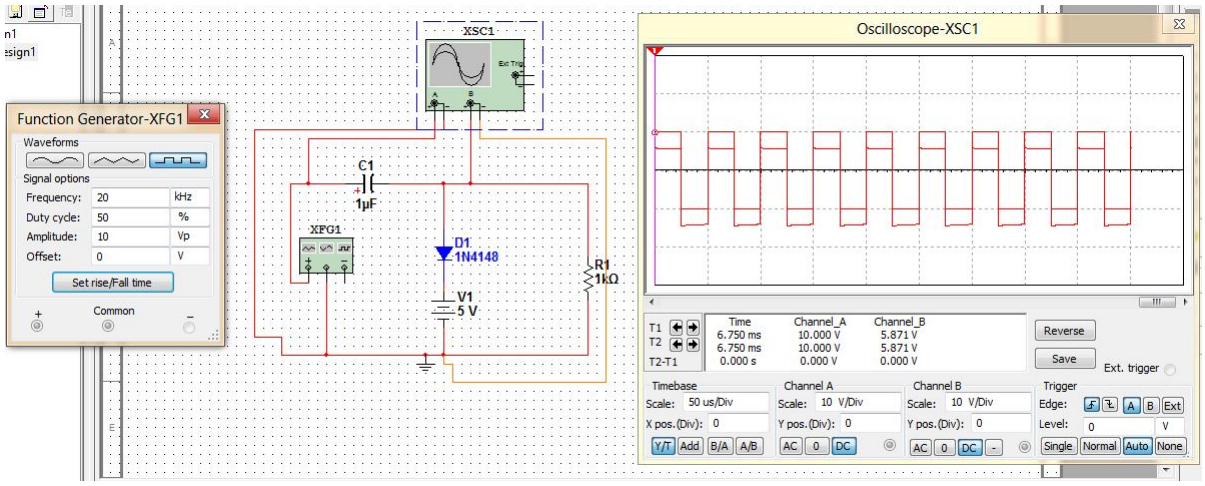

Figure 8: Second clamping circuit's oscilloscope output, function generator's input, and circuit. In the positive cycle of the square wave the diode is ON (forward biased), so the voltage across the resistor remains at constant DC 5V because it becomes in parallel with 5V DC battery. In the mean time the capacitor is charging to 5V because if we apply KVL then Voltage across capacitor = 10V - 5V = 5V. In the negative Cycle, the capacitor discharges into the circuit and the diode is Reverse bias. So the total voltage across the resistive load is 5V + 10V = 15V.

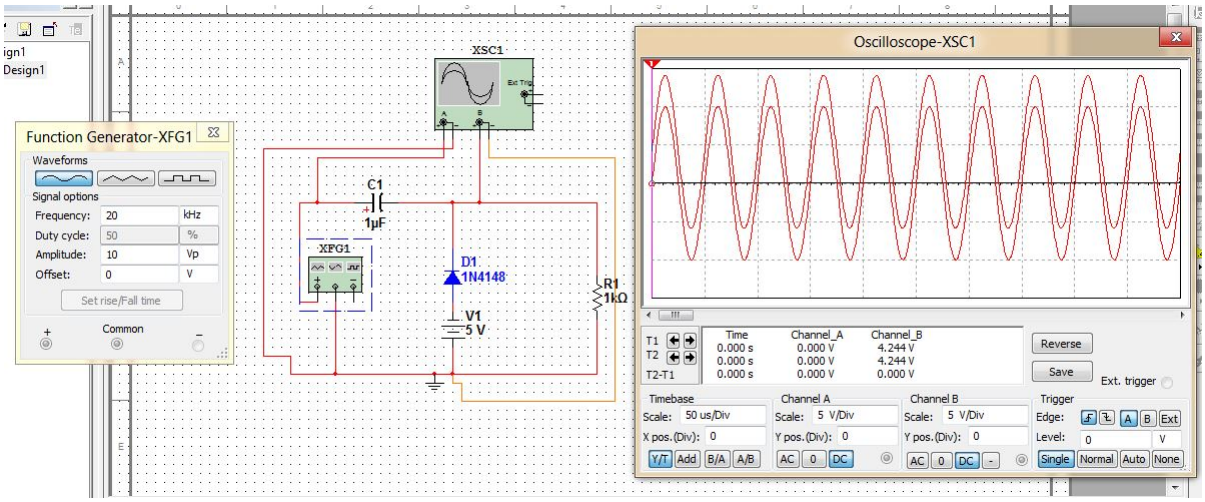

Figure 9: Third clamping circuit's oscilloscope output, function generator's input, and circuit. In the positive cycle of the sin wave the diode is OFF (reverse biased), so the voltage across the resistor is the combination of the capacitor's charged voltage and Vin from function generator. So the total Vpeak across the resistive load is 5V + 10V = 15V In the negative Cycle, the capacitor charges to 5V. and there is a constant 5V Dc voltage across the resistor because it is in parallel with the 5V battery.

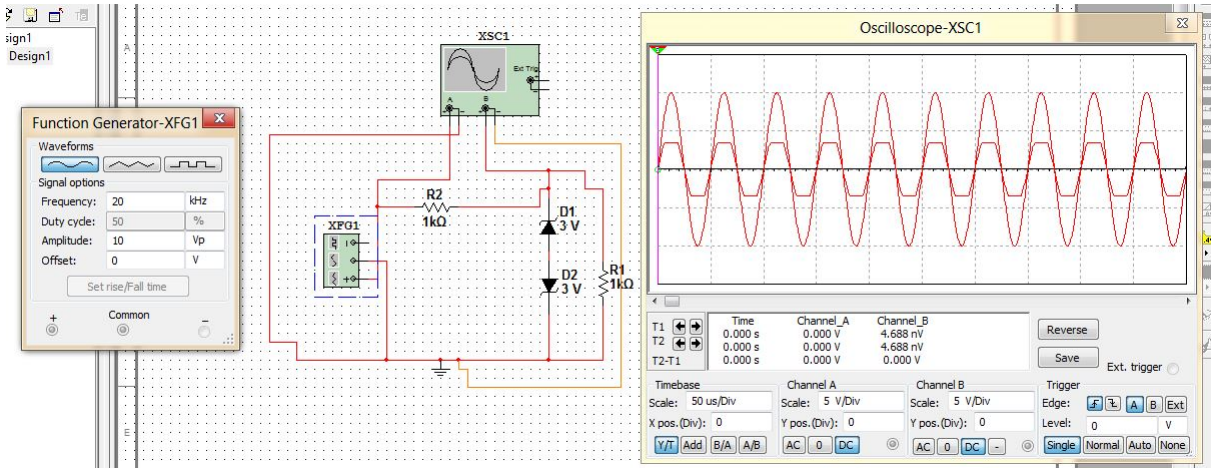

Figure 10: First clipping circuit's oscilloscope output, function generator's input, and circuit. In the positive cycle, one of the diode is forward biased so it allows all the current to pass through it but the other one is reversely biased thus creating a potential difference and stops the current to pass through it until the potential increases more than 3V. In which case the zener diode breaks down and there is almost zero potential difference across the zener diodes. In the negative cycle, one of the diode is forward biased so it allows all the current to pass through it but the other one is reversely biased thus creating a potential difference and stops the current to pass through it until the potential increases more than 3V. In which case the zener diode breaks down and there is almost zero potential difference across the zener diodes.

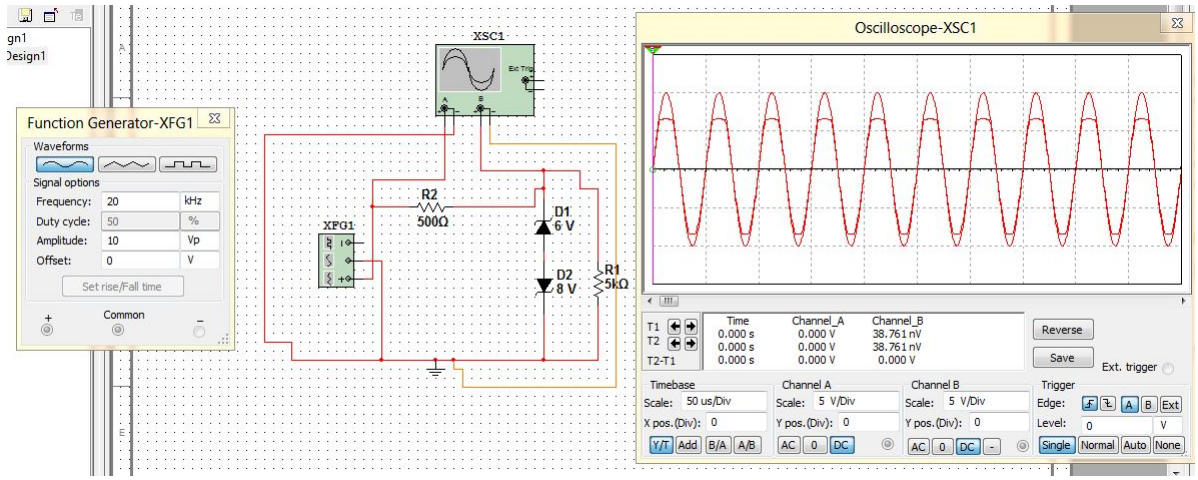

Figure 11: Second clipping circuit's oscilloscope output, function generator's input, and circuit. In the positive cycle, one of the diode is forward biased so it allows all the current to pass through it but the other one is reversely biased thus creating a potential difference and stops the current to pass through it until the potential increases more than 6V. In which case the zener diode breaks down and there is almost zero potential difference across the zener diodes. In the negative cycle, one of the diode is forward biased so it allows all the current to pass through it but the other one is reversely biased thus creating a potential difference and stops the current to pass through it until the potential increases more than 8V. In which case the zener diode breaks down and there is almost zero potential difference across the zener diodes.

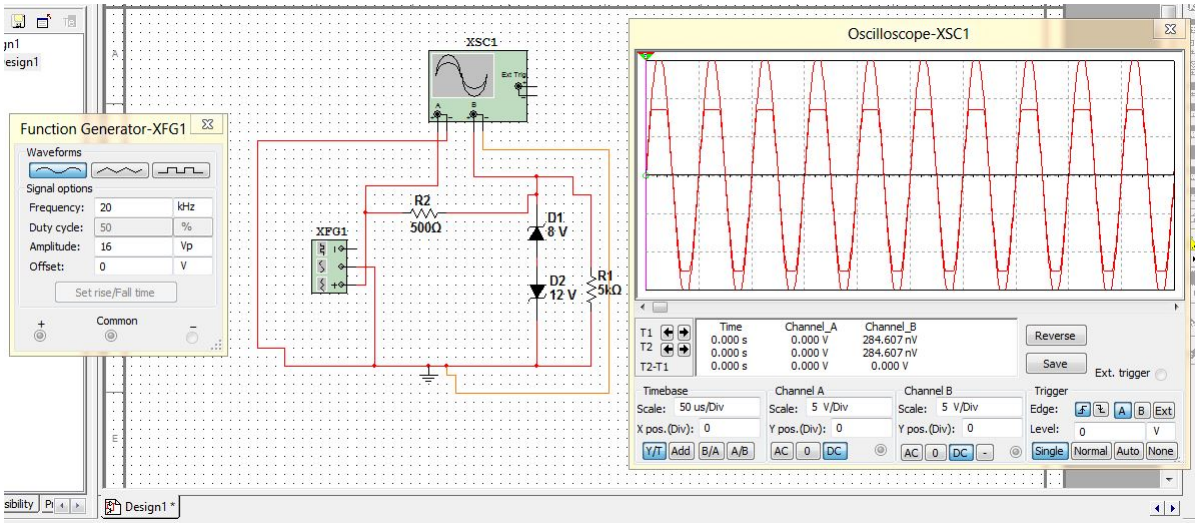

Figure 12: Third clipping circuit's oscilloscope output, function generator's input, and circuit. In the positive cycle, one of the diode is forward biased so it allows all the current to pass through it but the other one is reversely biased thus creating a potential difference and stops the current to pass through it until the potential increases more than 8V. In which case the zener diode breaks down and there is almost zero potential difference across the zener diodes. In the negative cycle, one of the diode is forward biased so it allows all the current to pass through it but the other one is reversely biased thus creating a potential difference and stops the current to pass through it until the potential increases more than 12V. In which case the zener diode breaks down and there is almost zero potential difference across the zener diodes

6 Conclusion

- Clamping circuits are used to protect the range of input signal.
- The polarity of the diode determine which peak will be clamped.
- Zener diode act as a voltage regulator that pass highly current when the source was to high and vice versa
- Zener diode are designed to work on the reverse mode

7 Team Dynamics

Report/Member	Weight/Grade	Obaidullah	Salem	Hezam
Abstract	20%	65%	15%	15%
Introduction	10%	0%	50%	50%
Procedure Part 1	10%	100%	0%	0%
Procedure Part 2	10%	0%	100%	0%
Procedure Part 3	10%	0%	0%	100%
Results Part 1	10%	100%	0%	0%
Results Part 2	10%	0%	100%	0%
Results Part 3	10%	0%	0%	100%
Conclusion	10%	0%	50%	50%
Claimed Contribution		**33%**	**33%**	**33%**
Contribution Validation Penalty		**0%**	**0%**	**0%**
Overall Contribution		**33%**	**33%**	**33%**
Overall Grade with Quality	**100%**	**100.0%**	**100.0%**	**100.0%**