ELE 504 Lab Report 4

Akshar Maharaj

And

Vedant Khaskia

Introduction

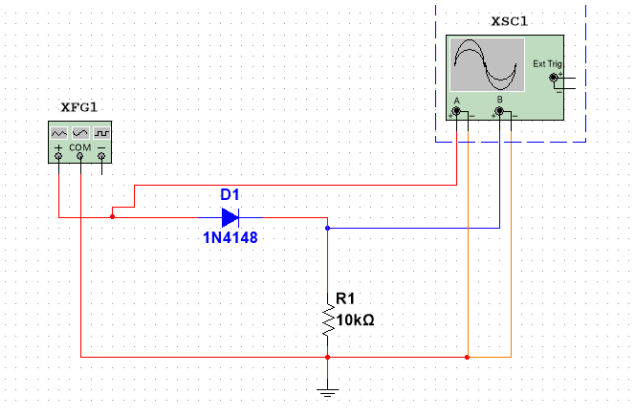
Half-wave and full-wave rectifiers can be constructed in several different ways. Rectifier circuits use the diode's ability to block current in one direction in order to create circuits that can output certain voltages given an input voltage. By combining diodes and op-amps, we can make "super diodes" that can rectify the input voltage more effectively. This lab will take a look at different rectifier circuits and the outputs they are capable of producing.

Objective

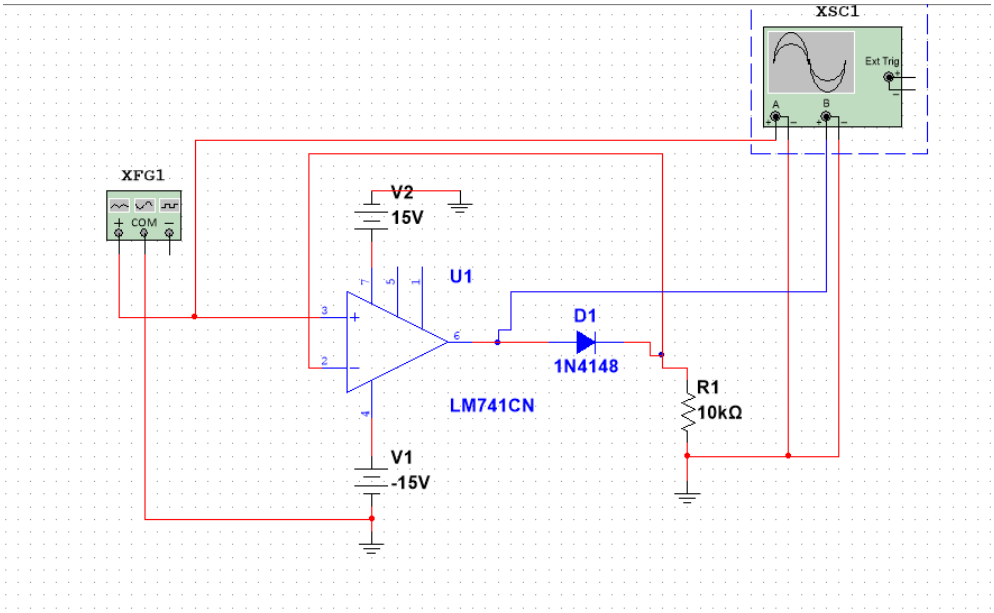
The main objective of this lab is to produce a functioning full wave rectifier circuit. Smaller objectives are to investigate the behavior of several wave rectifier circuits with the use of operational amplifiers and diodes in different configurations.

Circuit Screenshots

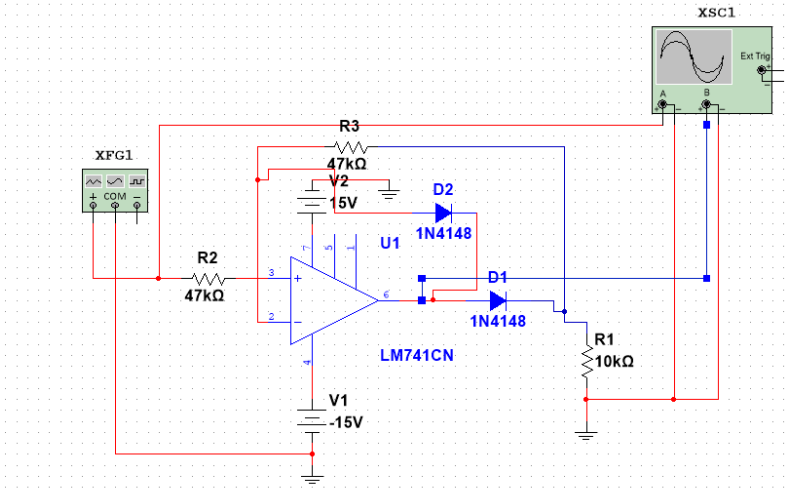
Circuit 1: Basic Rectifier



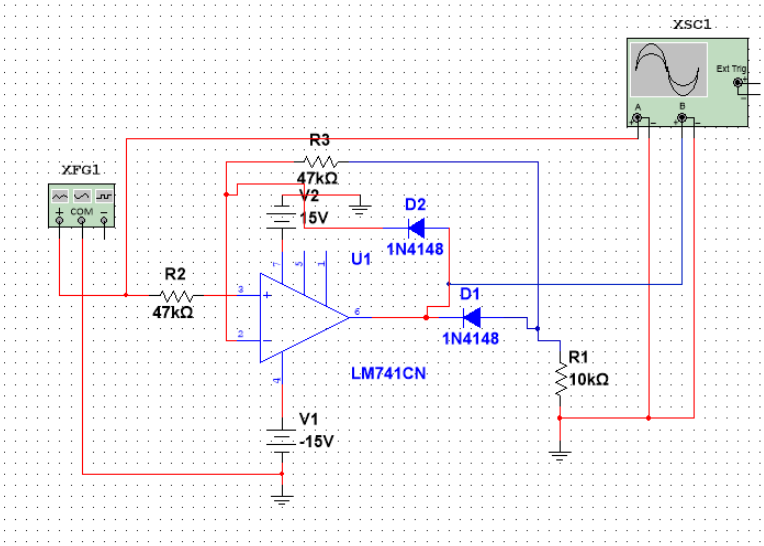
Circuit 2: Rectifier with Super Diode



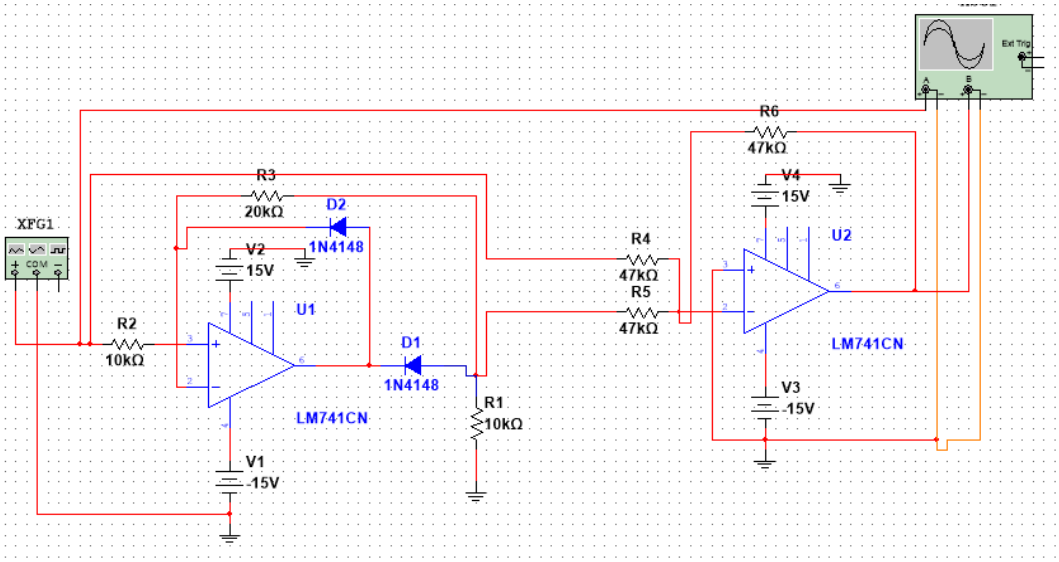
Circuit 3: Precision Half Wave Rectifier Circuit part 1



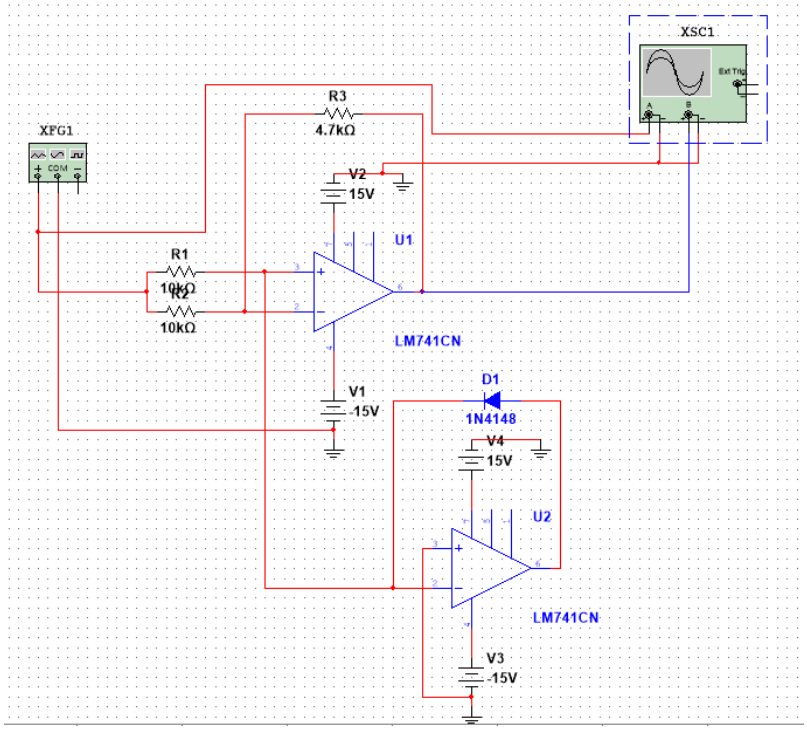
Circuit 4: Precision Half-Wave Rectifier Circuit Part 2



Circuit 5: Student Designed Precision Full-Wave Rectifier



Circuit 6: Alternate Precision Full-Wave Rectifier



Results and Tables

Figure 1: Basic Rectifier Vi and Vo Waveforms

Figure 2: Rectifier with Super Diode Vi and Vo Waveforms

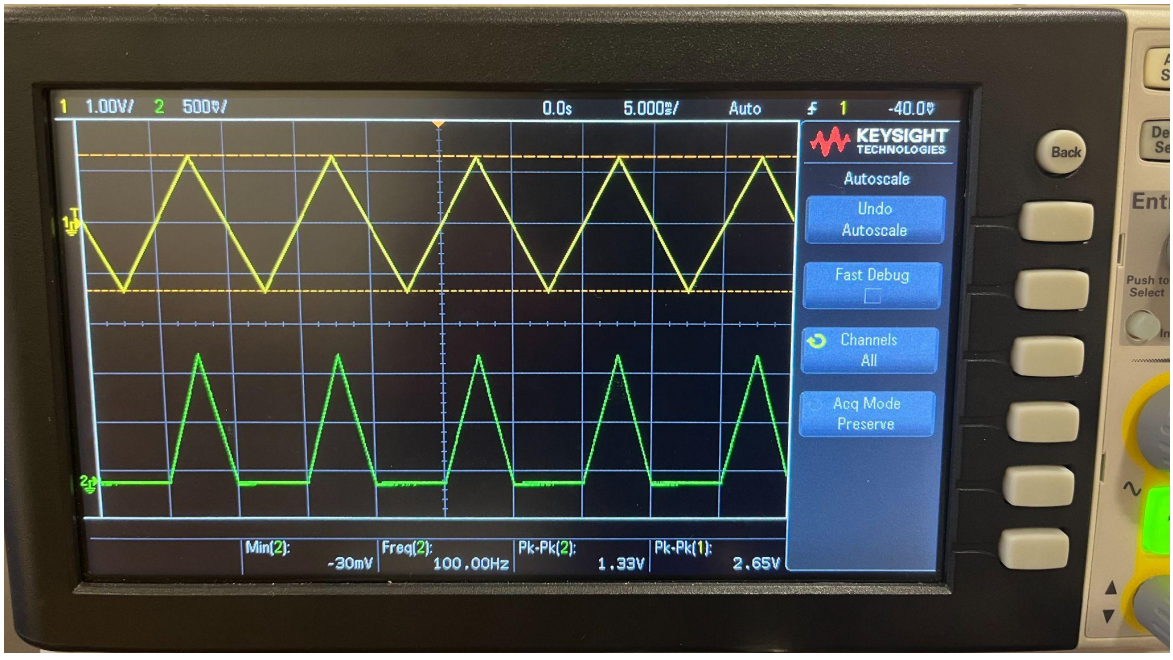


Figure 3: Rectifier with Super Diode Vi and Va Waveforms

Figure 4: Precision Half-Wave Rectifier Circuit Vi and Vo Waveforms

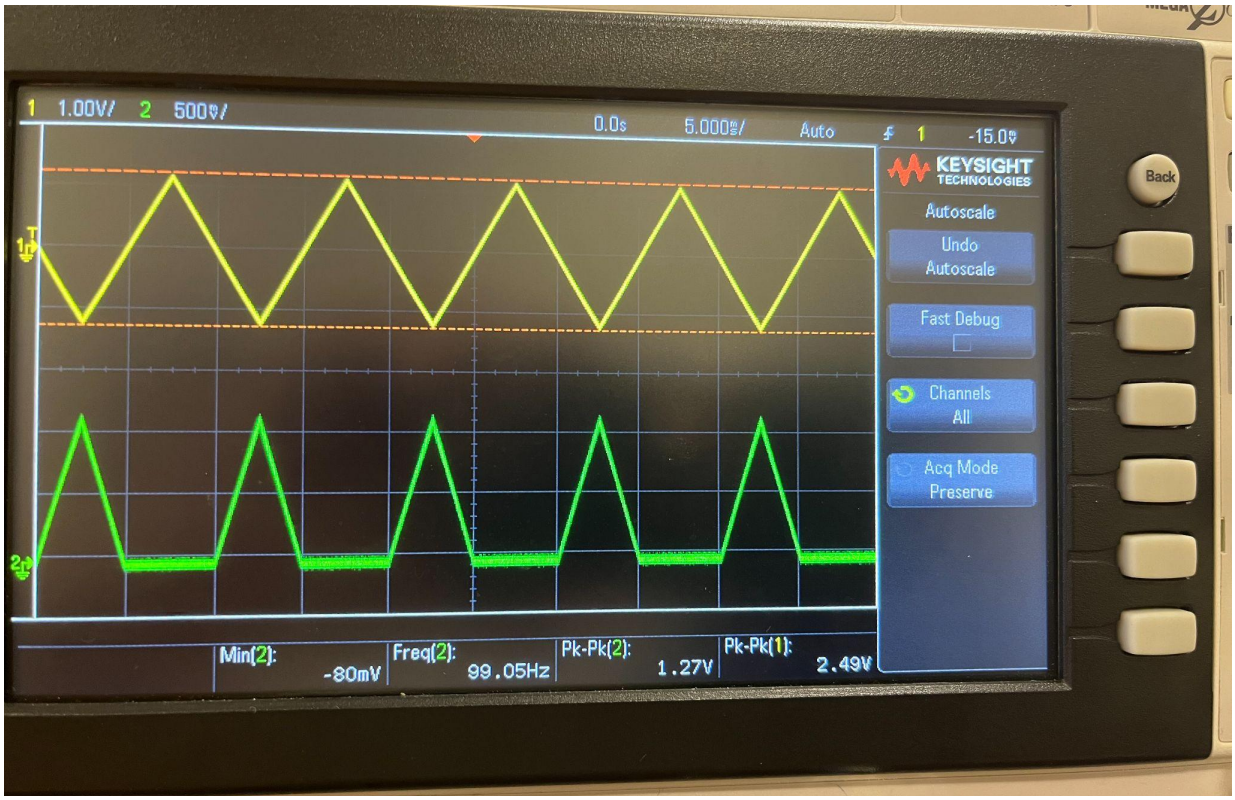


Figure 5: Precision Half-Wave Rectifier Circuit Vi and Va Waveforms

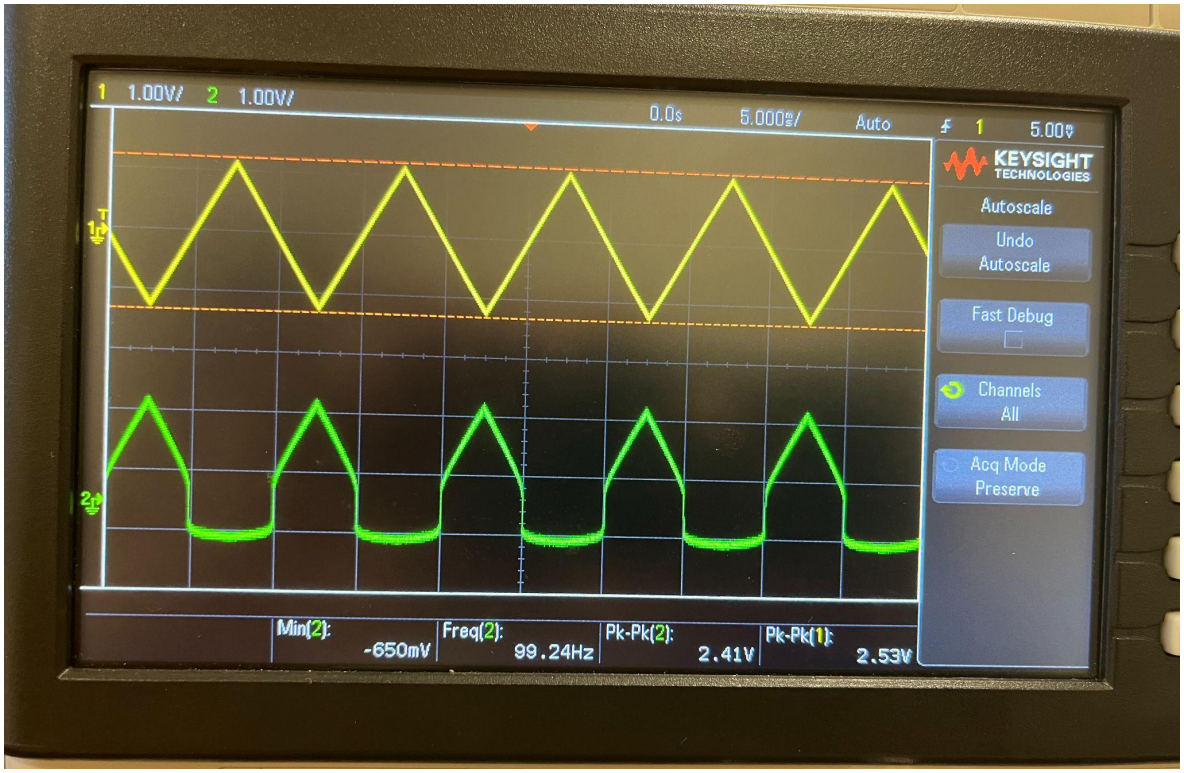


Figure 6: Precision Half-Wave Rectifier Circuit Vi and Vo Waveforms

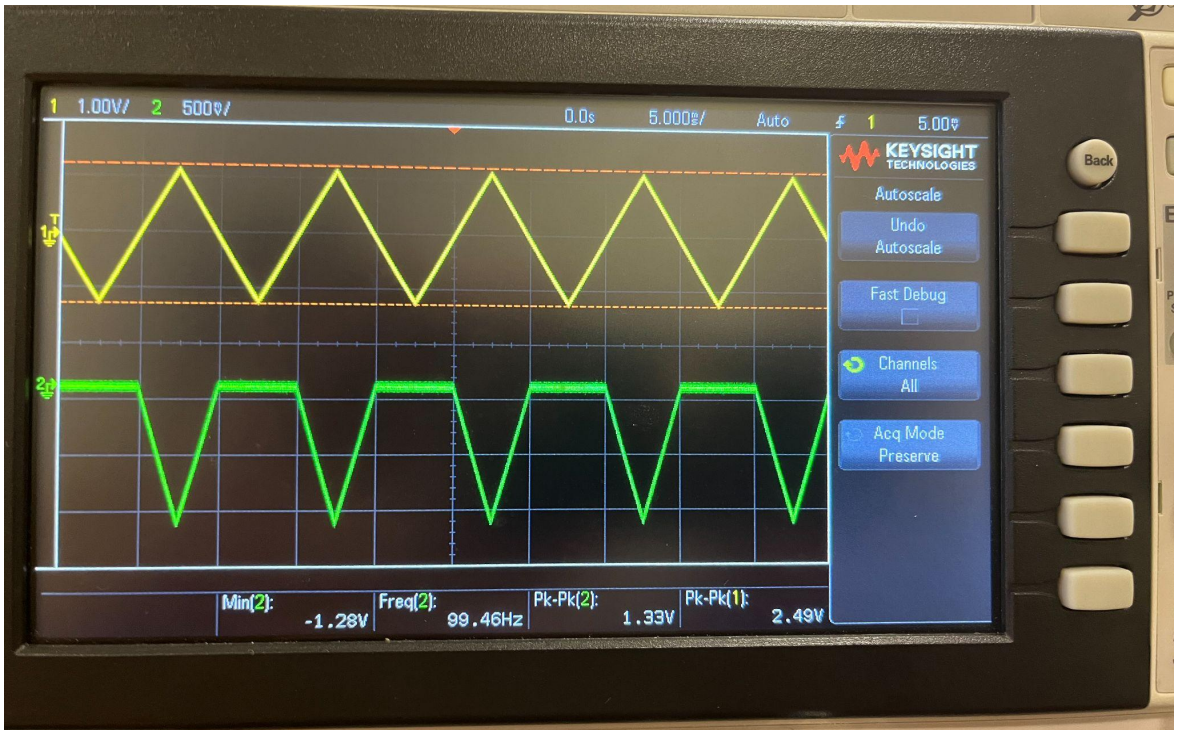


Figure 7: Precision Half-Wave Rectifier Circuit Vi and Va Waveforms

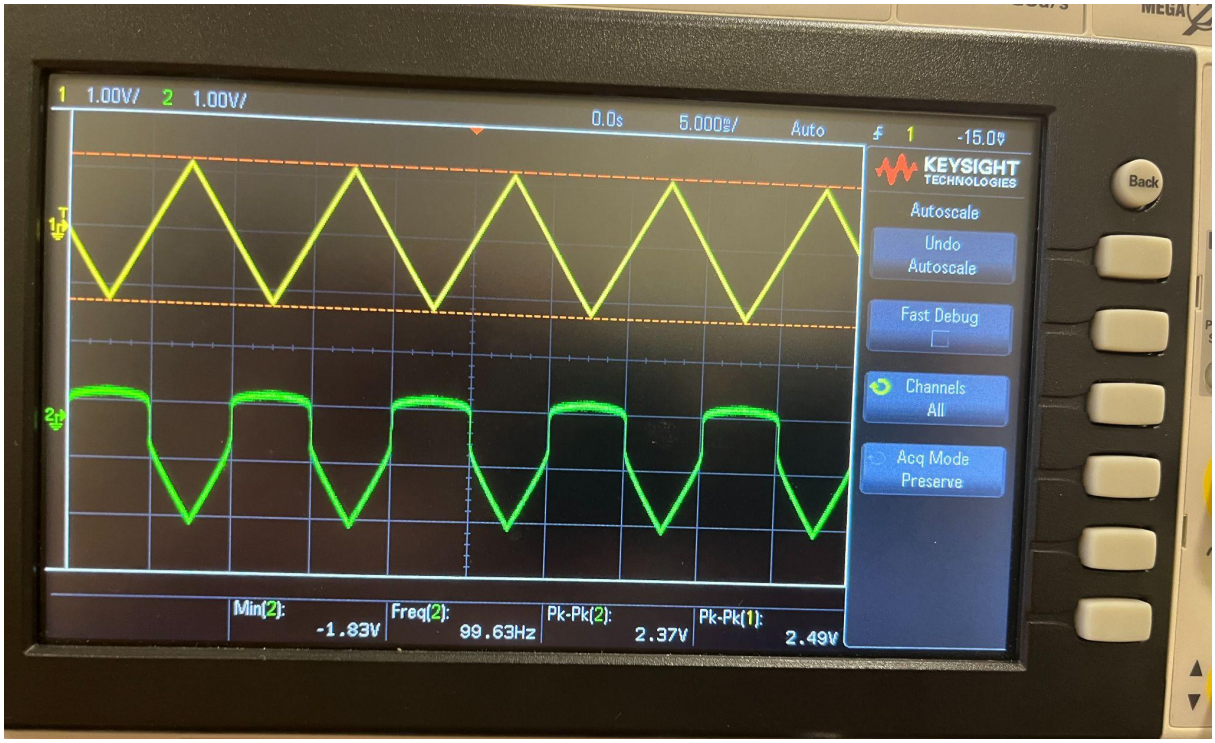


Figure 8: Transfer Function for Half Wave Rectifier

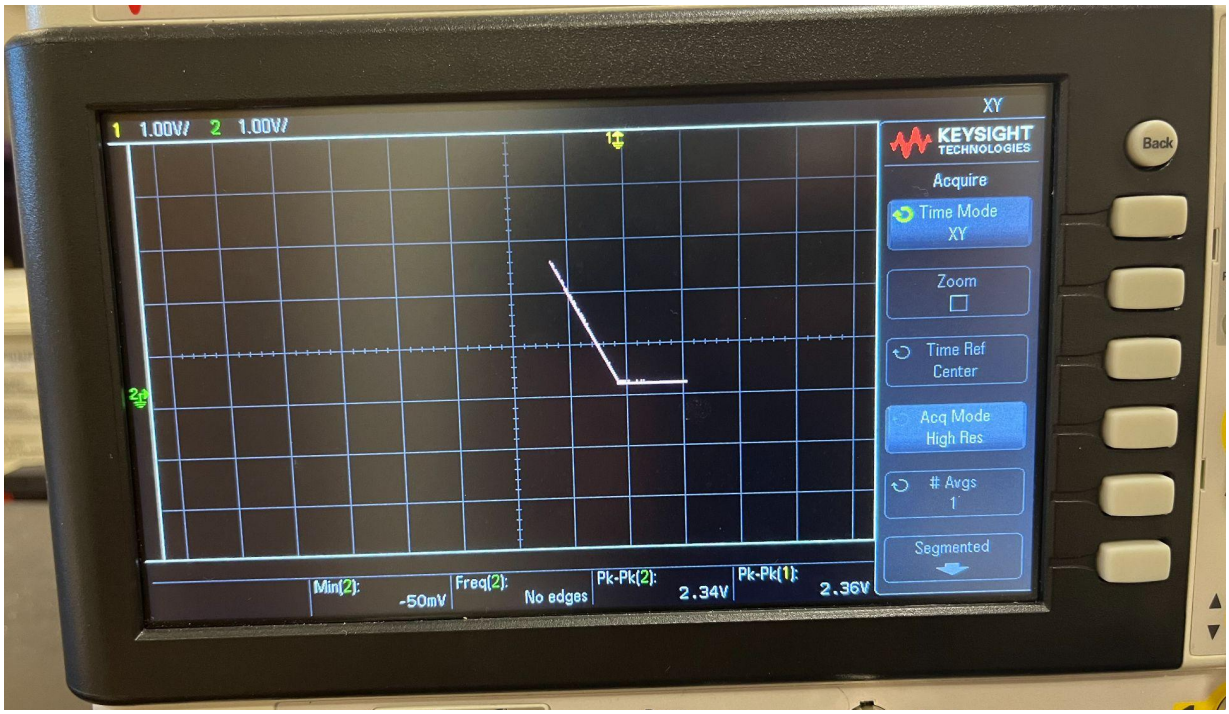


Figure 9: Transfer Function for Half Wave Rectifier

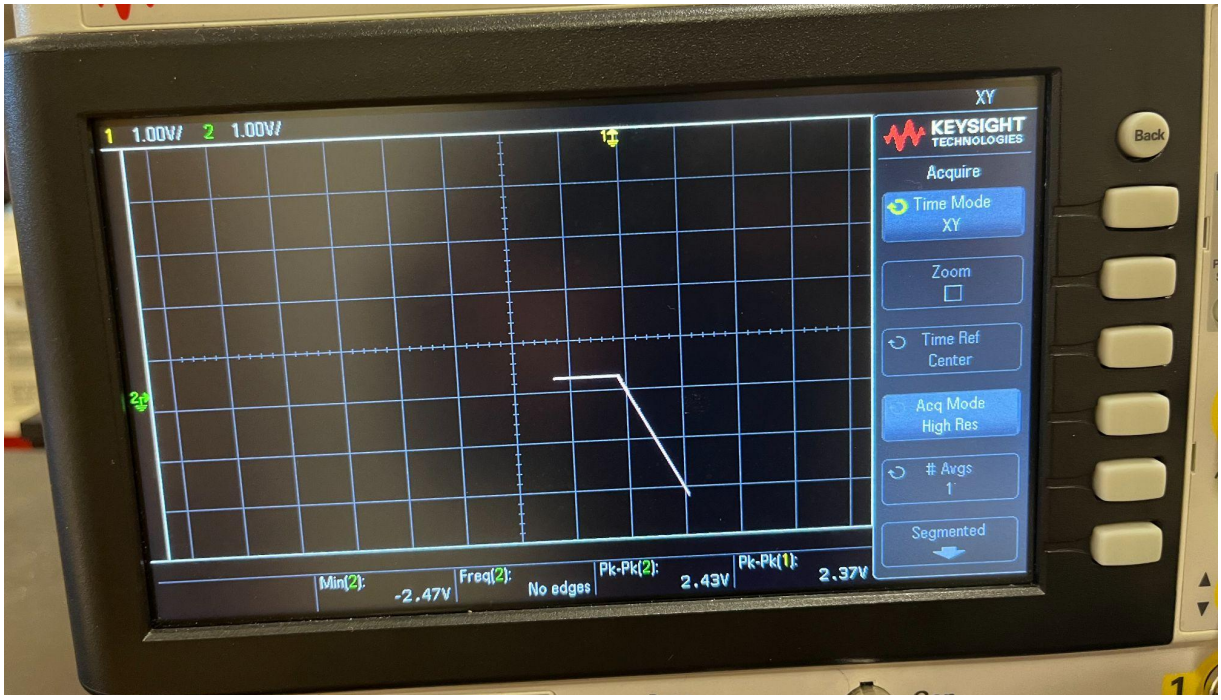


Figure 10: Student Made Precision Full Wave Rectifier Vi and Vo Waveform

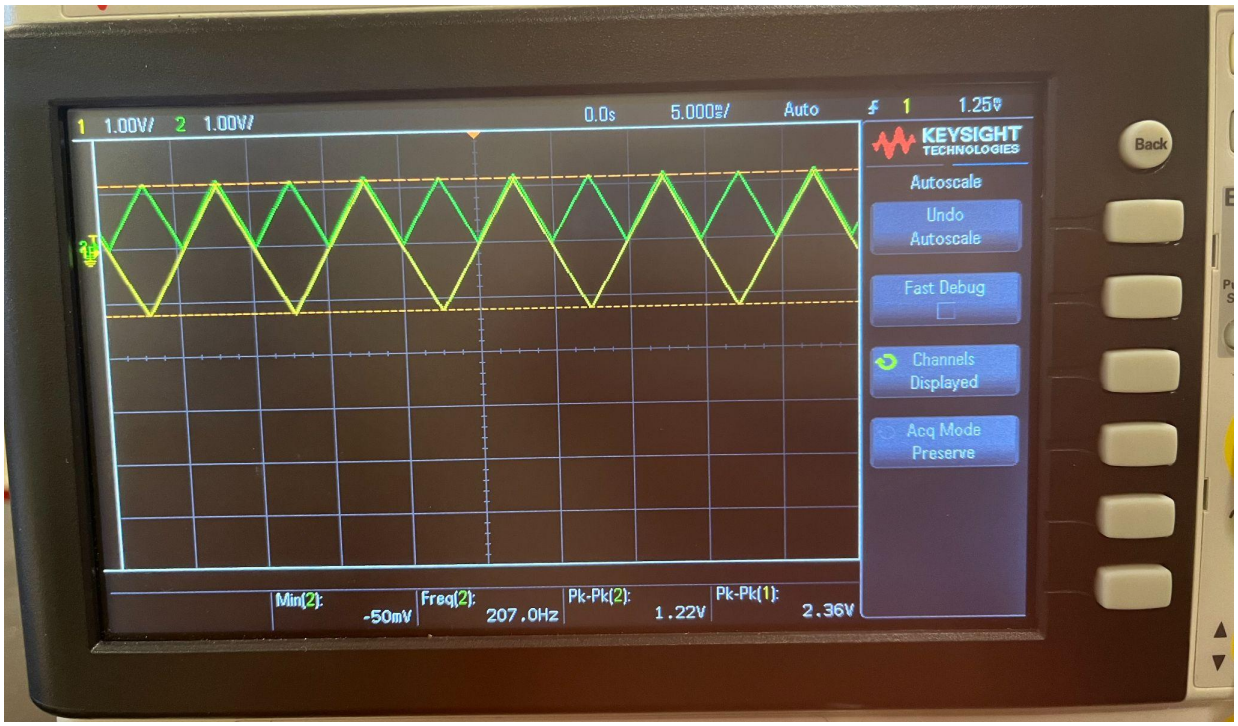


Figure 11: Student Made Precision Full Wave Rectifier Vi and Va Waveform

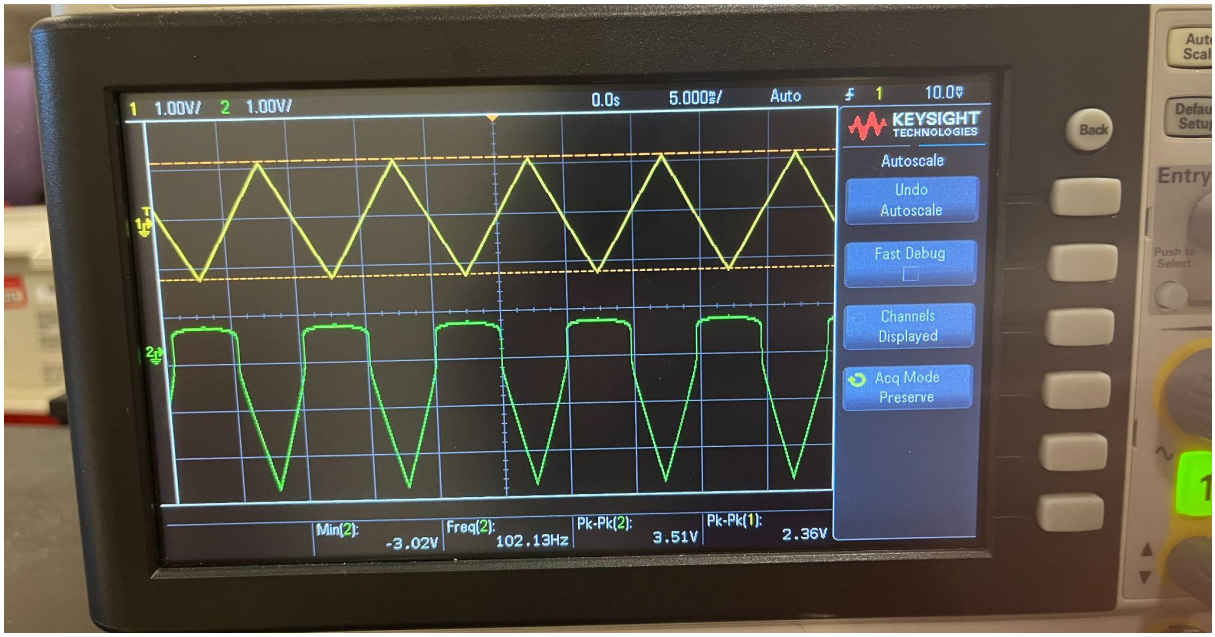


Figure 12: Transfer Function

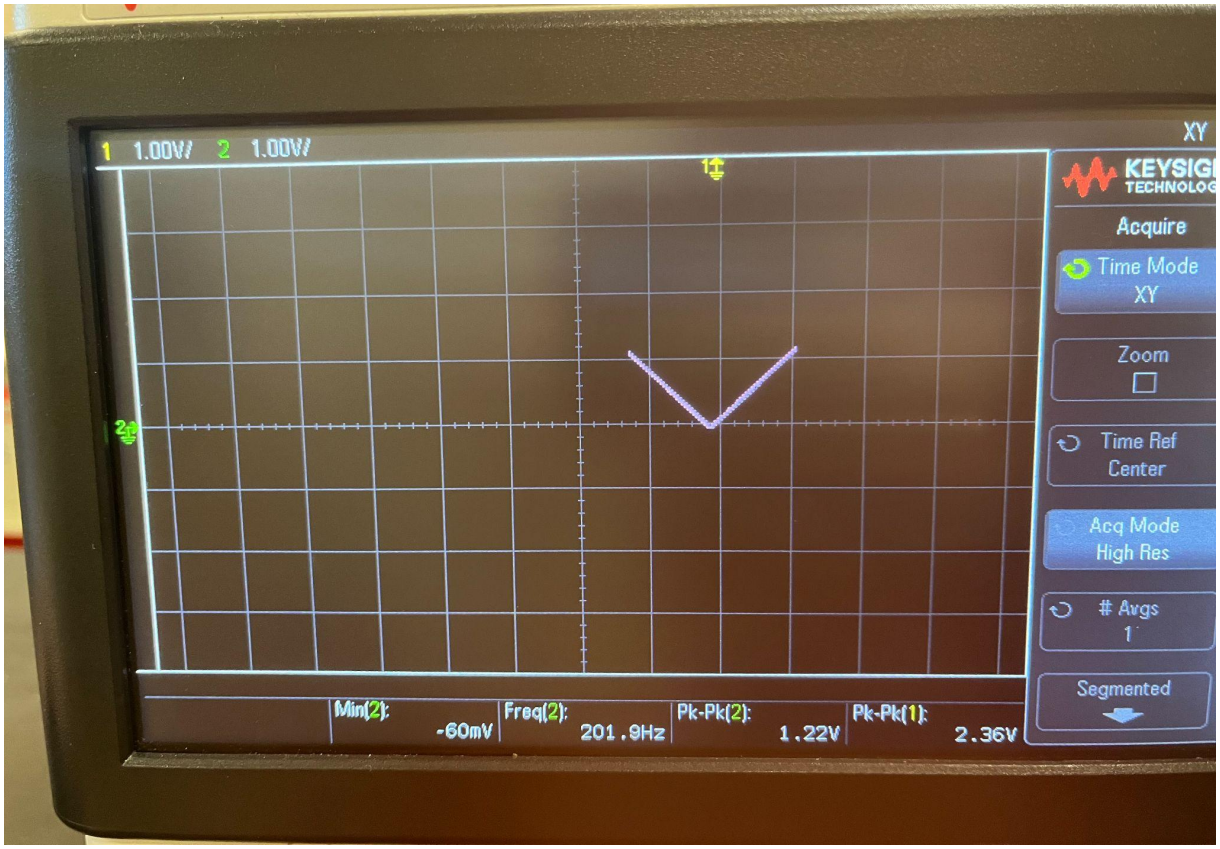


Figure 13: Alternate Precision Full Wave Rectifier Vi and Vo Waveforms

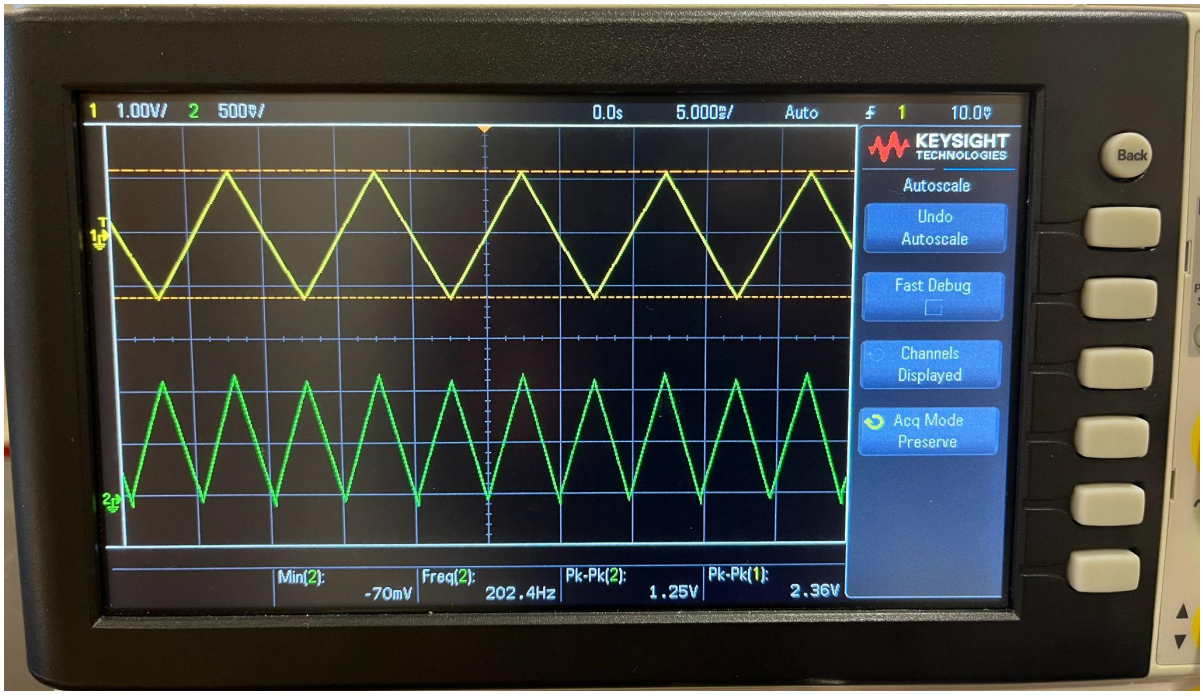


Figure 14: Alternate Precision Full Wave Rectifier Vi and Va Waveforms

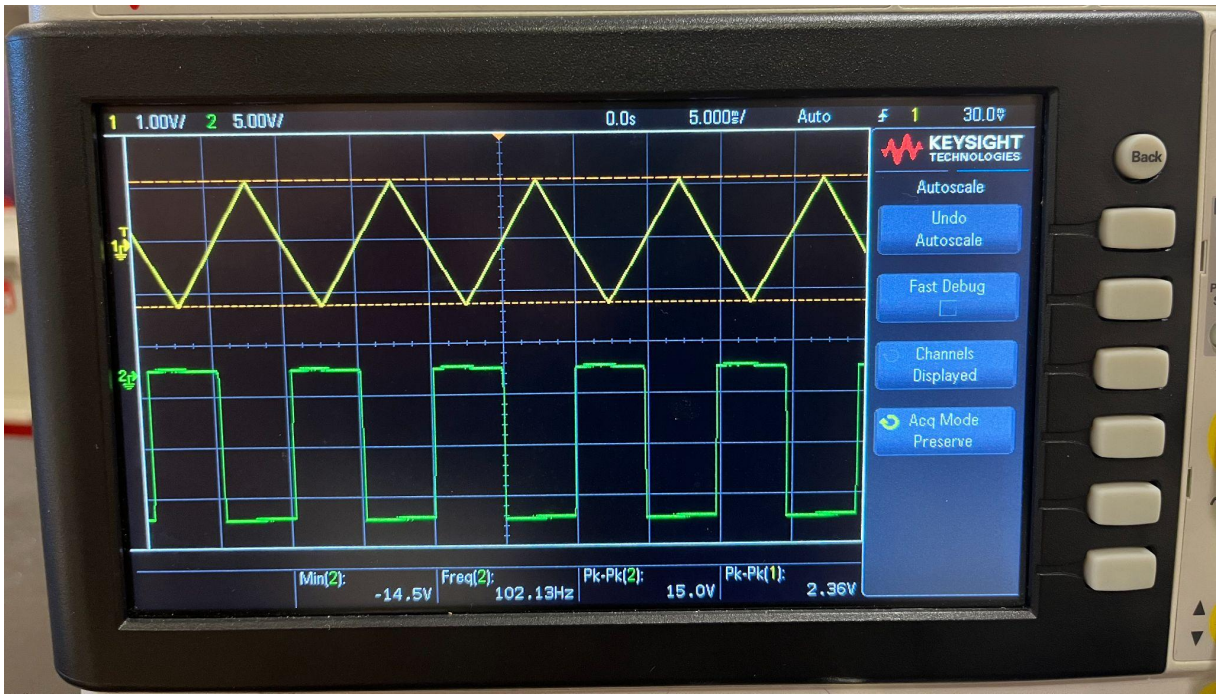
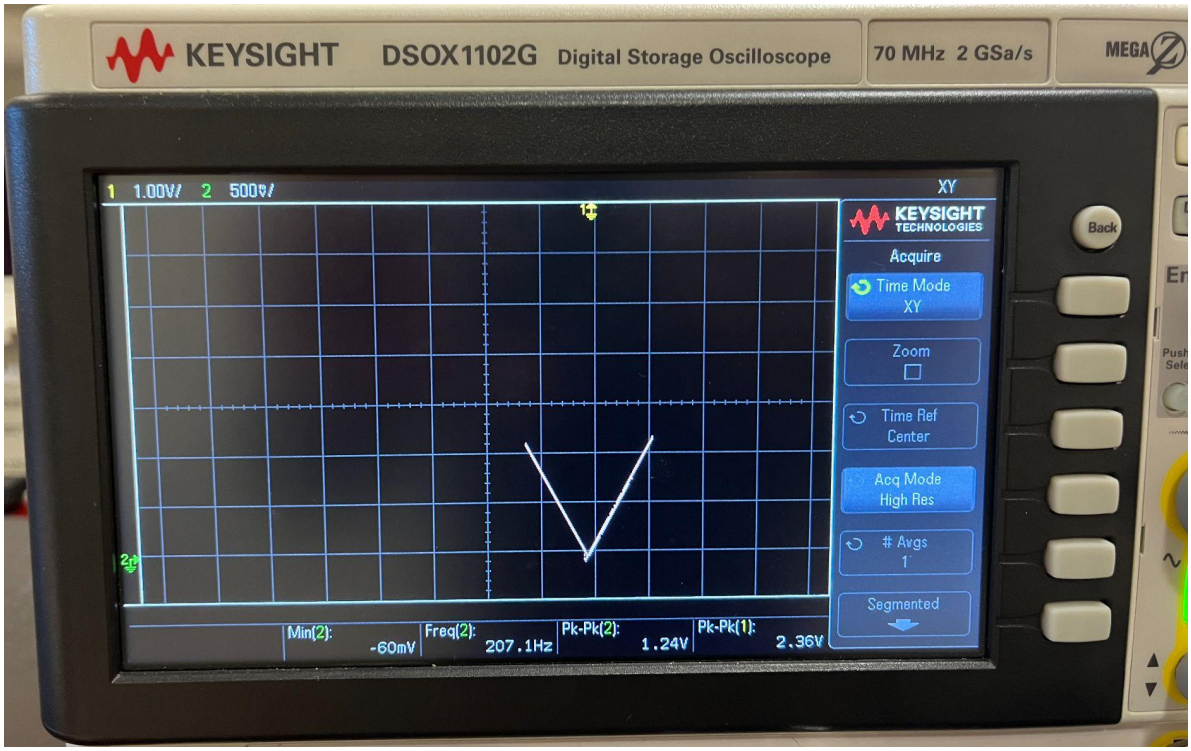


Figure 15: Transfer Function



Conclusion

After conducting the lab, several conclusions can be drawn about each circuit. Firstly, the basic half-wave rectifier (Circuit 1) was capable of rectifying the input, however, the output cut out 500mV from the input voltage due to the voltage drop-off across the diode. This was similar to the prelab analysis, however 700mV was cut out in the prelab analysis instead of 500mV. Secondly, the super diode half-wave rectifier (Circuit 2) was successful in producing the positive half of the input waveform at the output without cutting out part of the input like in Circuit 1. This was also seen in the prelab analysis where both the input and output voltage had the same max value of 1.3V(peak). The precision rectifier in Circuit 3 was observed to invert the input voltage at the output when the input was less than 0. Similarly, the precision rectifier in Circuit 4 was also observed to invert the input voltage at the output when the input was greater than 0. Both precision rectifiers were also successful in producing the transfer functions that were derived in the prelab. The full-wave rectifier in Circuit 5 was able to combine a modified version of the precision rectifier in Circuit 4 and an inverting summer circuit to fully rectify the input voltage. The observed output was equal to the input when the input was greater than 0 and inverted the input when the input was less than 0. Circuit 6 was an alternative to Circuit 5 and was also successful in fully rectifying the input voltage at the output. Overall, every circuit was able to successfully produce the desired output and transfer function that was derived in the prelab analysis.