Lab Report

Name

Institutional Affiliation

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Introduction

There are several types of transistor amplifiers that are operated through the use of an AC signal input. The transmitter is normally interchanged between the negative and positive value and provides one of the ways to present the common emitter amplifier circuit so as to operate between the two main peak values. The process is referred to as the basing amplifier, and is regarded as an important design in its field. It establishes the exact functioning point of a transistor amplifier that readily receives signals and thus can reduce any form of distortion in the output signal. The common emitter amplifier refers to a three basic single-stage junction transistor which is used as a voltage amplifier. The input of the common emitter amplifier is taken from the terminal of the base, while the output is normally collected from the terminal of the collector. The terminal is common for both terminals. The purpose of the experiment was to investigate the use of the bipolar transistors as emitter followers and amplifiers. Moreover, the experiment investigated the applications of the amplifiers to circuits. This experiment was conducted in a series of steps where data and relevant information were collected for analysis. The first part investigated the emitter follower with a single supply of power and the common emitter amplifier. The second part was concerned with the investigation of the operational amplifier. This part introduced the operational amplifiers, which are an important block used in several electronic circuits. It used the operational amplifier to construct several important circuits that included the non-inverting amplifiers, inverting amplifiers, a summer and integrator.

Theory and experiment setup

The theory and experiment setup explains the processes and procedures followed to accomplish the aims and objectives of the experiment. In the theory and experiment setup, there is an explanation of how the part 1 and part 2 sections were performed. It gives details of the materials, equipment, and the measurements that were achieved in the two main parts of the experiment.

Part I Transistor 2

The part primarily consisted of exercise 1, which mainly investigated an emitter follower with a single power supply. The procedure followed to accomplish this section of the experiment was as follows:

Set up the circuit as shown in Figure 6. Even though it is not shown in the diagram, you need to connect the +12/-12 V terminals of the power supply for the op amp power. All ground connections are to be made to the ground connection of the power supply. In this circuit as well as in all subsequent circuits, the output of the function generator (VIN) is read from the oscilloscope via channel 2 and the output of the op amp is read from the oscilloscope via channel 1. Apply a sine wave of 1 kHz, 1 V peak-to-peak at the input. Record the signal at the base and the emitter (output) of the transistor. Make sure that the coupling of the oscilloscope is set to DC (direct coupling). Increase the amplitude of the sine wave until "clipping" of the output occurs. Record the output measured with an oscilloscope. Suggest a way to increase the usable range of the emitter follower, without changing the power supply. Try it on your circuit. Record the dc voltages at the base, collector, and emitter. Record the signals at the base and emitter to show the increased usable range. Measure the input resistance RIN of the emitter follower as seen by the function generator (VIN). (HINT: Insert a resistor between VIN and the 0.1 µF capacitor and measure the signal before and after the resistor. That is the method used in the last exercise of E2.) The capacitor forms a high-pass filter with the input resistors. What is the expected low frequency 3dB point? (HINT: In the case of a simple RC high-pass filter, the low frequency 3dB point is given by 3 IN 1/ (2 R C) dB f = · π). Make sure that the circuit is re-connected as shown in Fig. 2, and verify this by measuring the amplitude of the output voltage as the frequency is decreased. Record the frequency at which the amplitude decreases by a factor of 2 from the original value:

1. Connect the circuit as shown in figure 1 with RE = 990.0 +-0.1amps, R1=201.9 +-0.1Kamp and R2 = 46.69 + 0.01 Kamp, C = 115. 83-+ 0.01nF as measured;
2. Measure the voltage at the base of the collector and emitter separately with DC voltage on;
3. Apply a sine wave of I KHz. IV peak-to-peak as the input voltage;
4. Record the wavelength of Ch1 Ch 2 on the oscilloscope;
5. Increase the amplitude of the input voltage until clipping of the output waveform occurs, and record the wavelength;
6. Replace R2 with R3 = 101.20 =-0.01Kamp;
7. Measure the voltage at the collector base and emitter with only the DC voltage on;
8. Record the wavelength on the oscilloscope with the input voltage on;
9. Insets between the input voltage and the capacitor and connect Ch1 and Ch2 and the peak to peak voltage of Ch2;
10. Record the voltage differences between Ch1 and Ch2 and peak to peak voltage of Ch2.

Remove R2 and connect Chi and Ch2 to the origin position.

Decrease the input frequency until the output amplitude decreases by a factor of the square root of 2 from the original value. Record the frequency.

Part II: Operational Analysis

The second part of the experiment was concerned with the operational analysis

The steps and procedure followed in conducting the operational analysis is as follows:

1. Connect the circuit as shown in the fig 6 with R1 =993.6 +=0.1amp and R2 = 9.970 +-0.0011amp as measure and with pin 4 and 7 of the op amp connected to the -12v and +12v terminals of the power supply;

2. Apply a sine wave with a frequency of 1 KHz and a peak to peak voltage of IV as the input;

3. Turn on the power supply;

4. Observe the oscilloscope to check whether the output is a sine wave;

5. Measure the ratio of the amplitude of the output voltage and the input voltage for frequencies of 100 HZ, 1 HZ and 1KHZ and 1o KHz and 100 KHz;

6 Insert resistor R = 1015.6 +-0.1 Kamp as measured between the input and the probe of Ch2 and move E to the probe Ch2 to the other side of the resistor;

7. Measure the difference of the voltage across R and the peak voltage of Ch2 with the oscilloscope;

8. Move the probe of Chi back to the original position and record the amplitude of Ch1;

9. Remove the R and repeat the measurement;

10. Inset R3 = 110.67 amp, and R4 = 48.64 at the output separately with the other end connected to the ground. Measure the amplitude of Chi separately.

Results and Discussion

The section provides details of the part 1 and part 2 findings. The results provide the findings using charts and tables and explain the findings. The first part investigated the emitter follower with a single supply of power and the common emitter amplifier. The second part was concerned with an investigation of the operational amplifier. This part introduced the operational amplifiers, which are an important block used in several electronic circuits. It used the op amp to construct several important circuits that included the non-inverting amplifiers, inverting amplifiers, a summer and integrator.

For part 1, the following observations were made regarding the originals, base, emitter and collector. The waveform of the emitter follower with R2 is shown in the table and graph below.

Originals	Base	Emitter	Collector
DC Voltage	1,993 +-0.01	1.375 +-0.001	12.03 +-0.01

E3

989.9 Ohm

201.5 kOhm

46.68 kOhm

115.77 nF

101.18 kOhm

46.68 kOhm

1.967 kOhm

3.887 kOhm

Figure 1

The Waveforms of Emitter Follower with R2

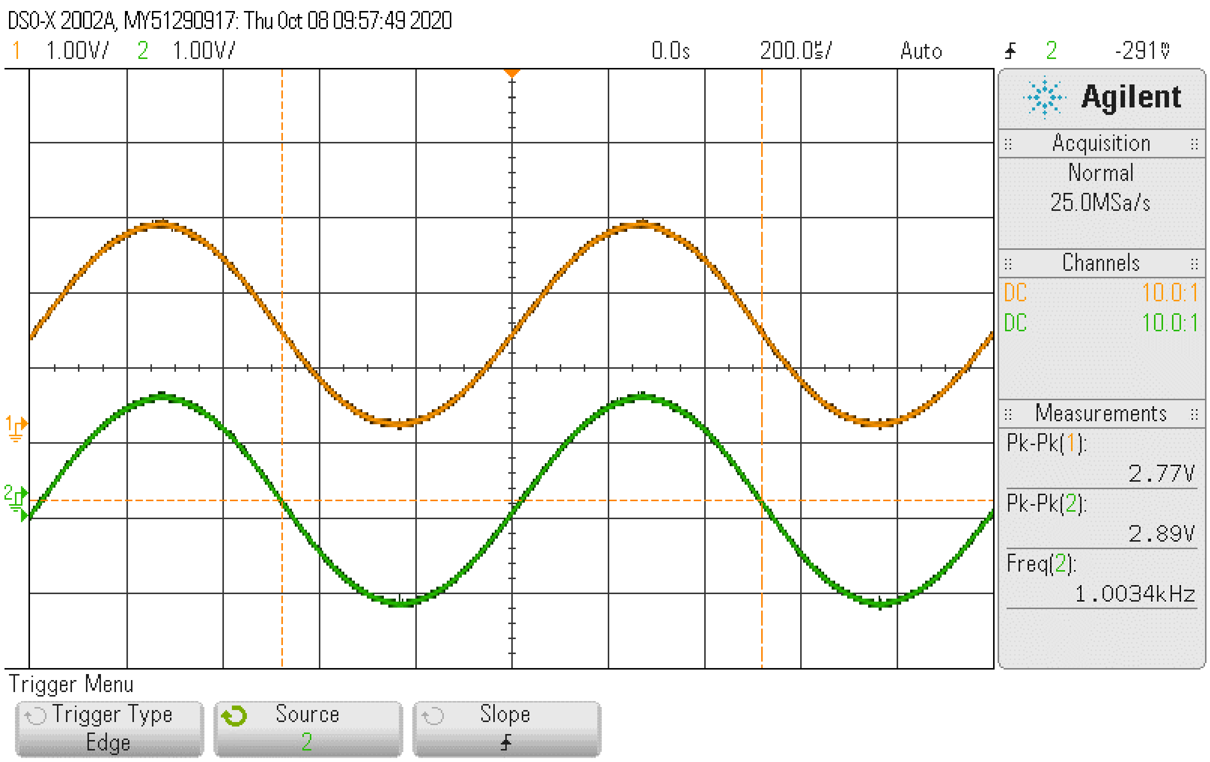

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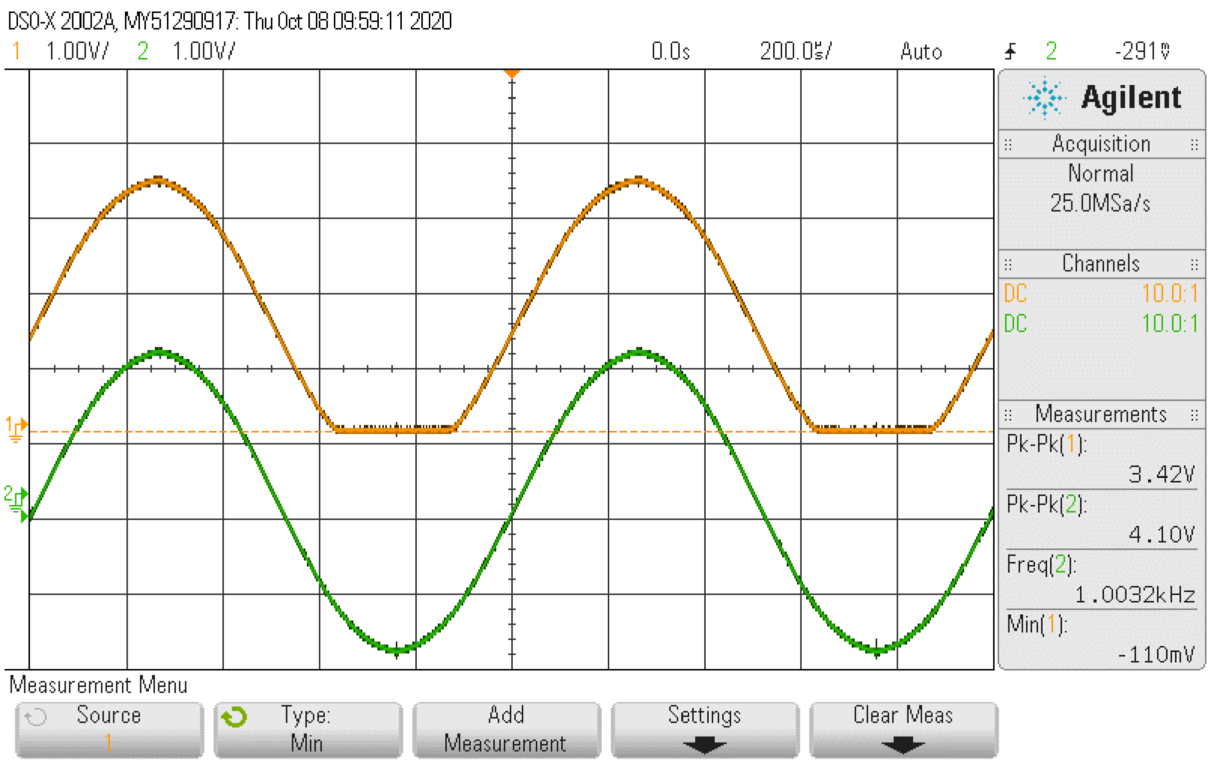
Figure 2

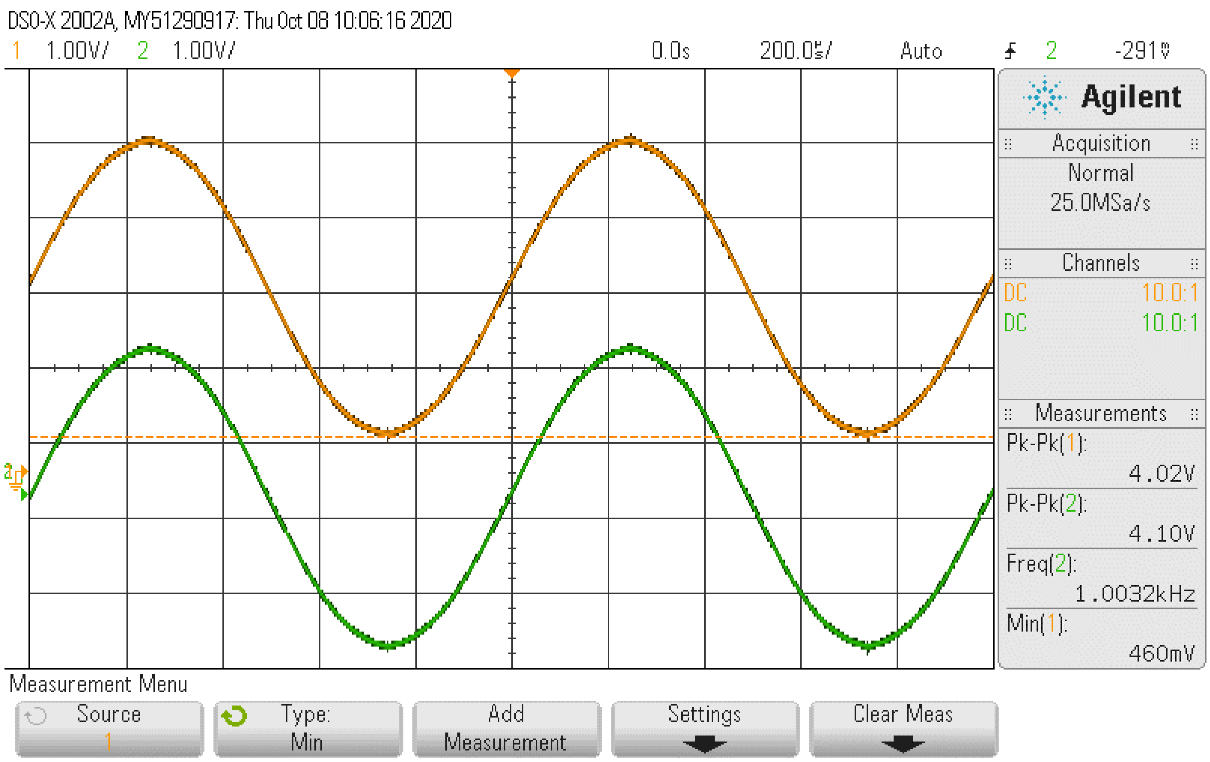


Waveforms of the emitter follower with R2 were also determined given the values shown in the table below.

With R3	Base	Emitter	Collector
DC Voltage	3.16	2.53	12.02

Figure 3

The waveforms of the emitter follower with R2.



The Change in Voltage = 2.01-+ 0.0IV and Change in VB= 2.17 +-0.01V

RZn = 50.41+- 0.01k amp

Waveforms = 25.4 +- 0.1Hz

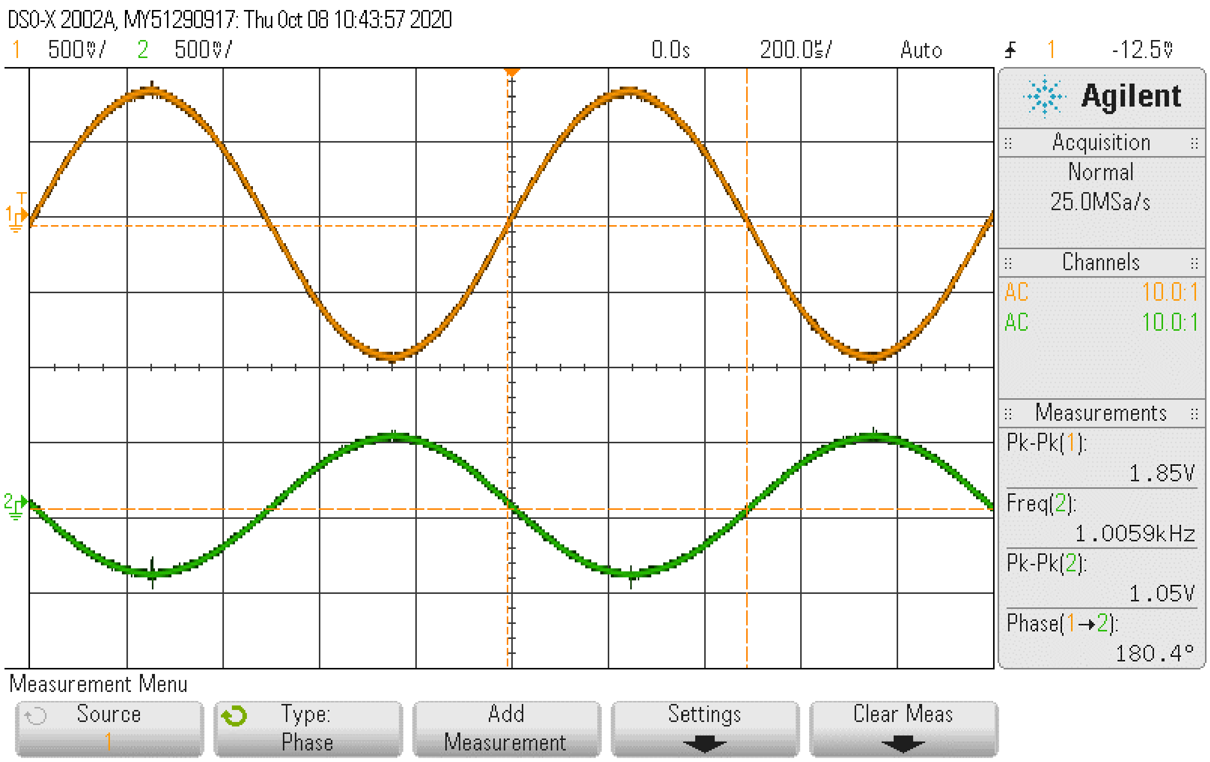
Wavelength of the Common Emitter

The result of the wavelength of the common emitter is as shown in the table below.

	Base	Emitter	Collector
DC Voltage	1.990 +- 0.001	1.370 +-0.001	9.31 +0.01

Figure 4

The waveform of the common emitter amplifier with AC coupling Vp-p for R4 = 3.62+- 0.01 V



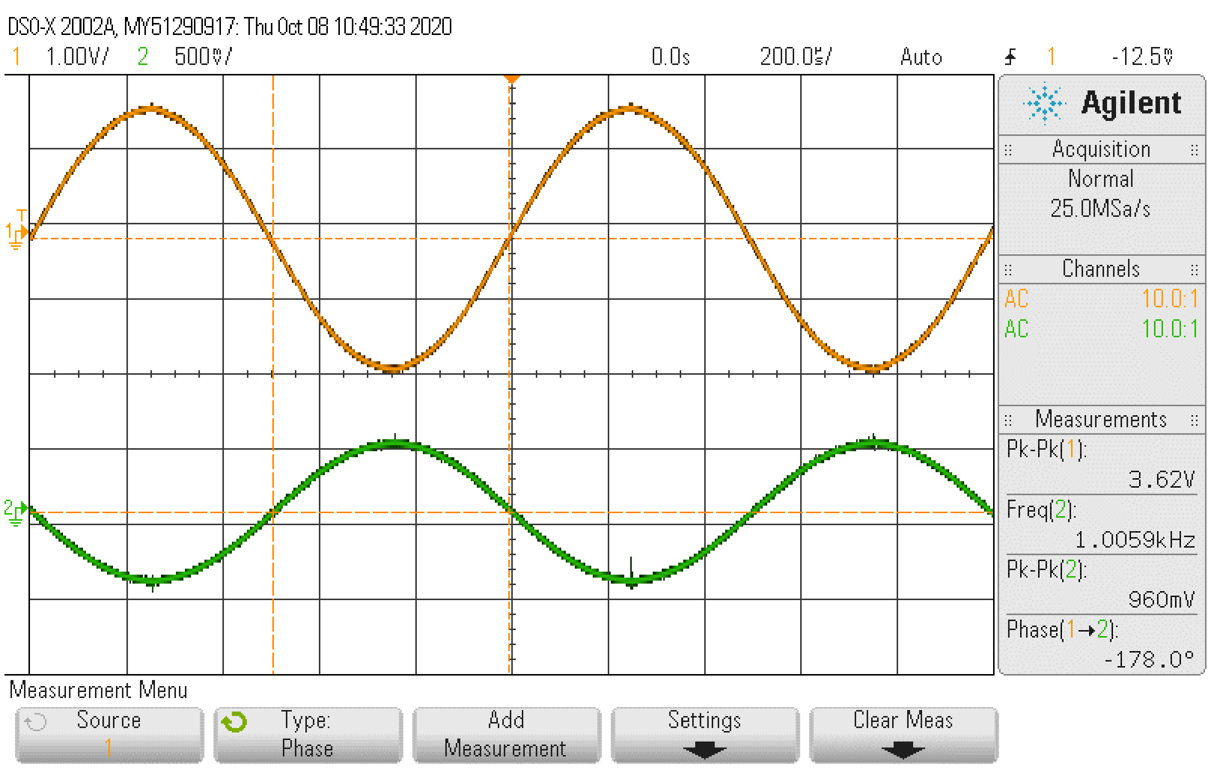
Result of Part 2 Experiment

The result of part 2 of the experiment is shown in the table below, which compares the frequency and voltage.

Frequency	1000Hz	1KHz	10KHz`	100KHz
Vr/Vzn	10.2 +-0.1	10.4 +-0.1	21.8 +10.1	

Change in V = 160 +-

Figure 5



E3

101.42 kOhm

1018.5kOhm

12.25 nF

19.75 kOhm

4.578 kOhm

9.967 kOhm

Figure 1

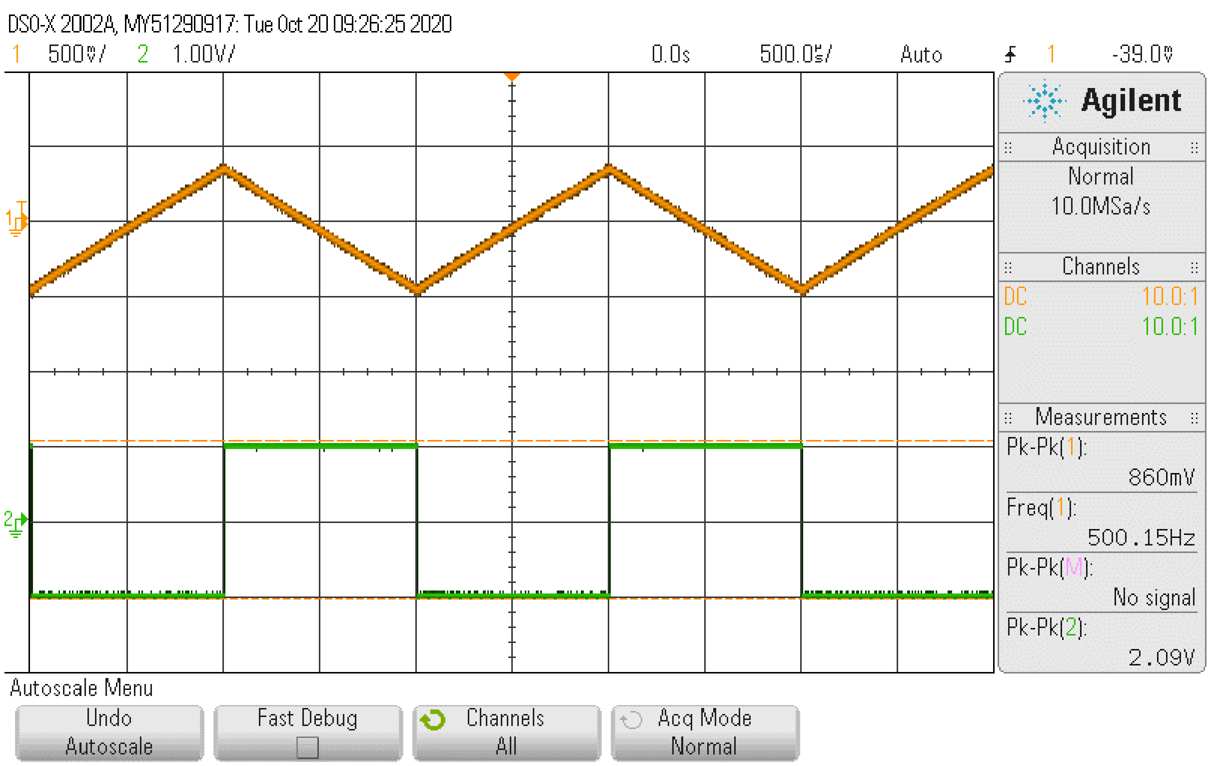


Figure 2

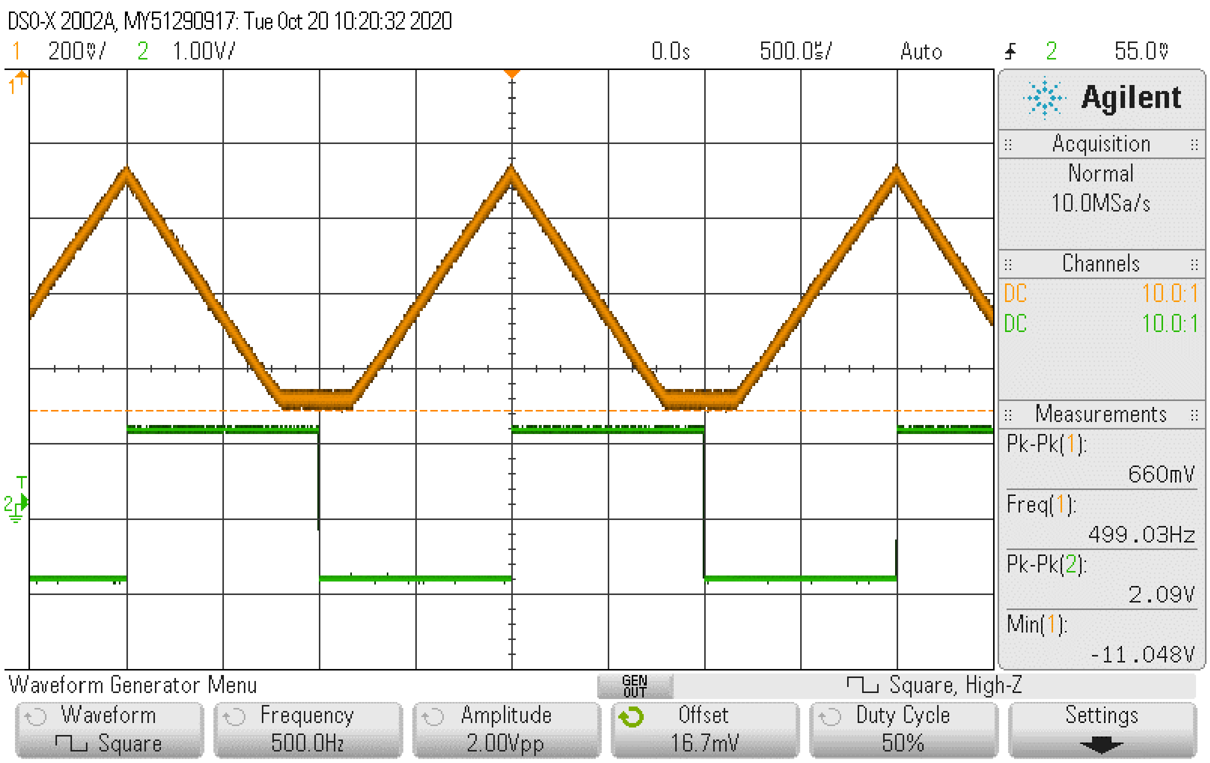
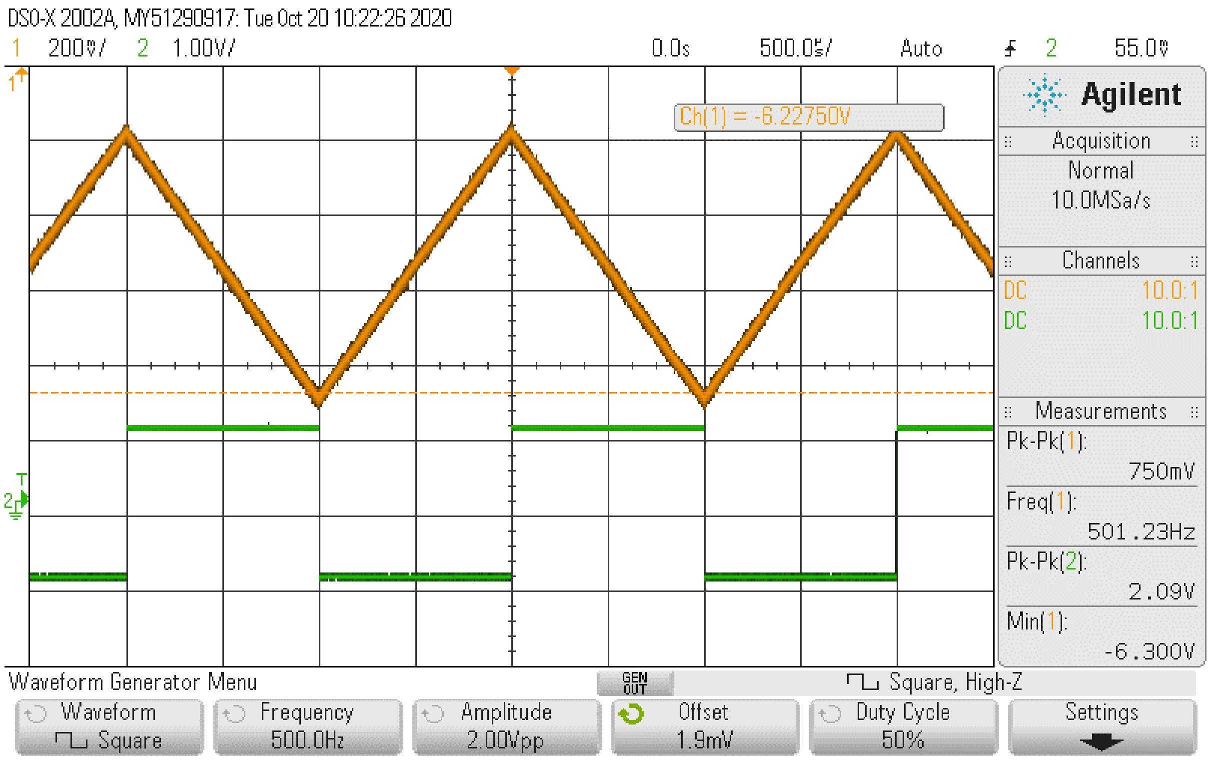

DSO-X 2002A, MY51290917: Tue Oct 20 10:20:32 2020
1 200mV/ 2 1.00V/
0.0s 500.0us/ Auto
2 55.0mV
Agilent
Acquisition
Normal
10.0MSa/s
Channels
DC 10.0:1
DC 10.0:1
Measurements
Pk-Pk(1):
660mV
Freq(1):
499.03Hz
Pk-Pk(2):
2.09V
Min(1):
-11.048V
Waveform Generator Menu
GEN OUT
Square, High-Z
Waveform
Square
Frequency
500.0Hz
Amplitude
2.00Vpp
Offset
16.7mV
Duty Cycle
50%
Settings

Figure 3



Conclusion

Where A is the open-loop voltage gain of the amplifier, v+ is the non-inverting input voltage and v- is the inverting input voltage. Both v+ and v- are node voltages with respect to the ground. Typically, the open-loop voltage gain A is in the order of 105 - 106. A resistor is placed between the output node and the inverting input to provide feedback and adjust amplification. When an op-amp circuit behaves linearly, the op-amp adjusts its output current such that the voltage difference between the two inputs is nearly zero. v v − + = (2) Another important feature of the op-amp is that its input resistance is very large and may be taken as infinite in many applications. The most common type of op-amp is LM741, which has an input resistance of 2 MΩ. This is large enough to be considered infinite in most applications. Because of the high input resistance, only a very small current flows into either input of an op-amp. In practical op-amp circuits, the current flowing into either of the inputs is usually in the order of µA.