Half Wave and Peak Rectifier Circuits

Materials:

- 2 Series Mixed Series Oscilloscope (MSO)
- Arbitrary/Function Generator (AFG): AFG1000 or internal 2 Series MSO AFG
- Resistor (1)
- Capacitor (1)
- General purpose diode (1)
- Breadboard
- Jumper wires

Procedure:

Task 1: Building a Half Wave Rectifier

R = 1 kΩ Diode (D) PN: 1N4936

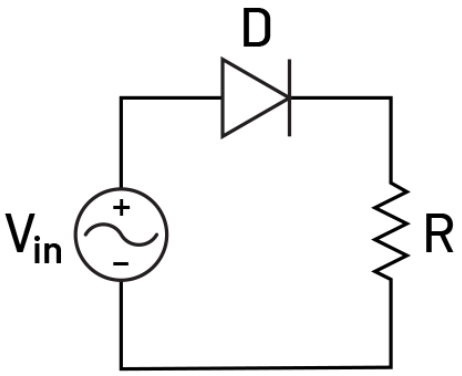

Figure 1. Half wave rectifier circuit.

1. Build the half wave rectifier circuit shown in Figure 1. using the corresponding resistor value. When placing the diode, make sure the polarity of the diode matches the schematic in Figure 1.

2. Configure the output of either the internal AFG on the 2 Series MSO or an external AFG like the AFG1000 to output a 1 kHz sinewave with amplitude of 2 Vpp. Connect this input to the circuit (V_{in}). Connect the channel 1 probe to the input of the circuit and the channel 2 probe to the voltage across the resistor.

3. Observe the input and output waveforms on the 2 Series MSO by selecting channel 1 and 2 to appear on the screen. Adjust the vertical scale to around 500 mV/div and the horizontal scale to see a few periods of the waveforms. Record characteristics of the output wave form. What is the amplitude difference between the input and output waveforms? What is the expected voltage drop across the diode when the input waveform is positive and when it is negative? The goal of a rectifying circuit is to convert AC to DC, is the current output waveform a suitable DC source? Why or why not?

Task 2: Building a Peak Half Wave Rectifier

R = 1 kΩ C = 10 uF Diode (D) PN: 1N4936

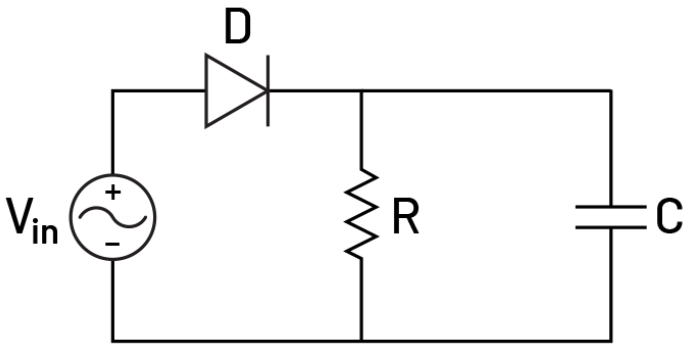

Figure 2. Peak half wave rectifier circuit.

1. Build the peak half wave rectifier circuit shown in Figure 2. using the corresponding resistor and capacitor value. When placing the diode, make sure the polarity of the diode matches the schematic in Figure 2.

2. Configure the output of either the internal AFG on the 2 Series MSO or an external AFG like the AFG1000 to output a 5 kHz sinewave with amplitude of 2 Vpp. Connect this input to the circuit (V_{in}). Connect the channel 1 probe to the input of the circuit and the channel 2 probe to the voltage across the resistor and capacitor.

3. Observe the input and output waveforms on the 2 Series MSO by selecting channel 1 and 2 to appear on the screen. Adjust the vertical scale to around 500 mV/div and the horizontal scale to see a few periods of the waveforms. Observe both the input and output waveforms. Is the input waveform distorted? Is the output waveform a constant DC signal?

4. If the input waveform is being distorted, adjust the frequency to find the frequency where the input waveform is not distorted and the output waveform has a small ripple voltage. The ripple voltage is the difference between the maximum output waveform value and the minimum. Use the cursors to measure the ripple voltage for three different input frequencies and record them in Table 1. Which frequency has the lowest ripple voltage with little input distortion?

Test Frequency	Ripple Voltage	Input Waveform Distortion

Table 1. Observed peak rectifier characteristics.

Instructor's Notes:

Figure 3. Expected waveforms from Task 1.

Figure 4. Expected waveforms from Task 2. V_{ripple} = 217 mV, Frequency = 1 kHz.

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