BANGLADESH UNIVERSITY OF BUSINESS AND TECHNOLOGY

Lab Report on

Study of half wave rectifier circuit

Lab Report No: 3

Course Code: EEE 212

Course Title: Electronic devices and circuits lab

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Experiment no: 3

Experiment Name: Study of half wave rectifier circuit.

Objective:

To calculate the DC output voltages of half-wave rectifiers.

Apparatus:

a) Oscilloscope
b) Function generator
c) Breadboard
d) Diode
e) Resistor
f) Multimeter
g) Scope probes

Theory:

The conversion of AC into DC is called Rectification. Electronic devices can convert AC power into DC power with high efficiency. During the positive half cycle, the diode is forward biased and it conducts and hence a current flow through the load resistor. During the negative half cycle, the diode is reverse biased and it is equivalent to an open circuit, hence the current through the load resistance is zero. Thus the diode conducts only for one half cycle and results in half wave rectification. The input and output voltage waveform may be analytically written as:

$$V_{in} = V_p \sin wt$$

$$V_{out} = V_{pl} \sin wt$$

and

$$V_{out} = 0$$

Where

$$V_{pl} = V_p - V_T$$

The output DC voltage of an ideal half wave rectifier for a sinusoidal input voltage is:

$$\mathrm{Vp} = \frac{\mathrm{Vp}}{\sqrt{2}}$$

$$\mathrm{Vo(dc)} = \frac{\mathrm{Vp}}{\sqrt{2}}$$

$$\mathrm{Vdc} = \frac{\mathrm{Vp}}{\pi}$$

Where:
Vdc, Vav - the DC or average output voltage,
Vp, the peak value of the phase input voltages,
Vrms, the root-mean-square value of output voltage.

<u>Circuit Diagram:</u>

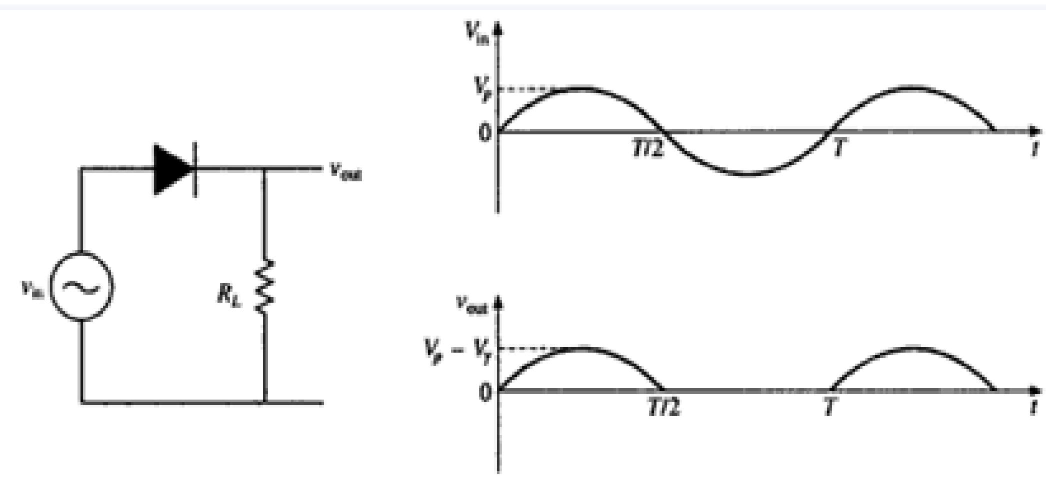

Fig: Circuit diagram, input and output signal

Figures:

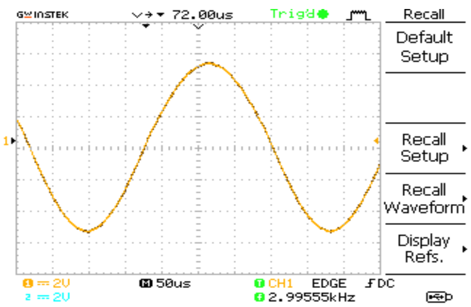

Fig1: Input Signal

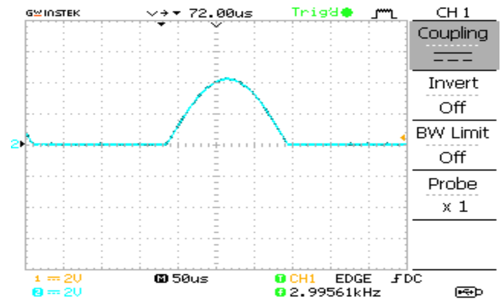

Fig2: Output Signal

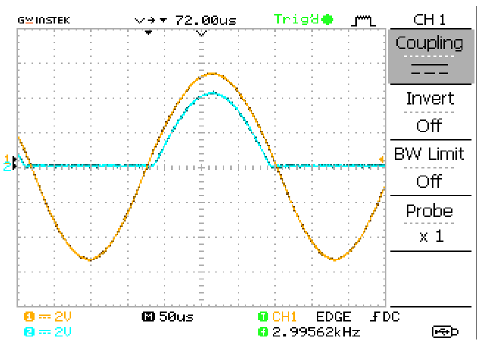

Fig3: Input and Output Signal-1

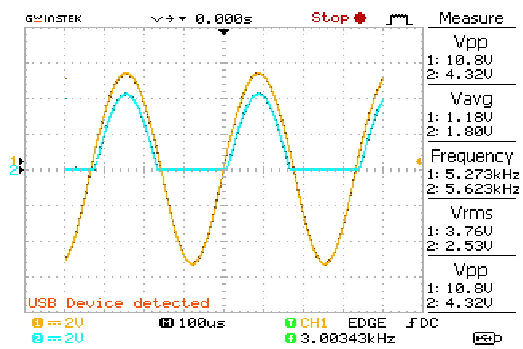

Fig4: Input and Output Signal -2

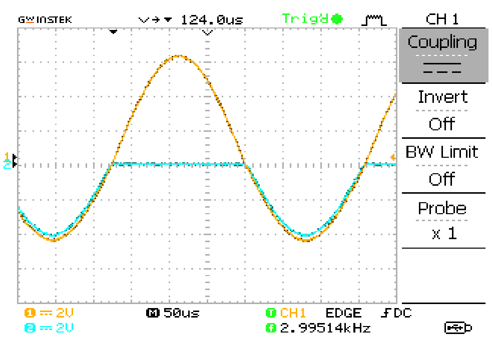

Fig5: Input signal and output signal-3

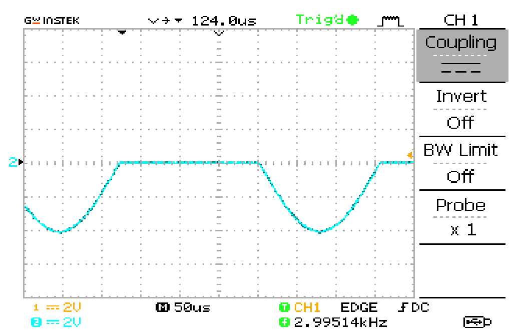

Fig6: Output Signal (negative cycle)-1

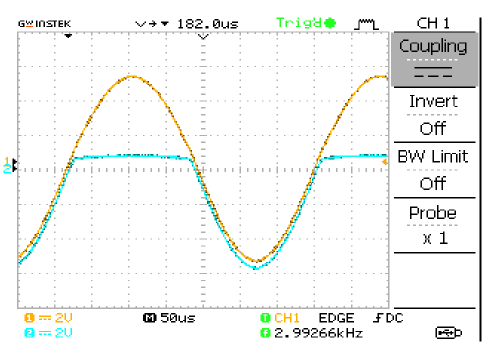

Fig7: : Input signal and output signal- 4

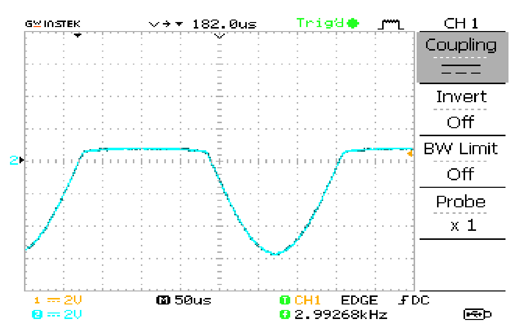

Fig8: Output Signal (negative cycle)- 2

Calculation:

For input:

Peak value, V_{in} = 2.7 × .2 = 5.4 V

Rms = 3.73

Time = 6.8 × 50 = 340 μs

Frequency, $f_i = \frac{1}{T} = \frac{1}{340 \times 10^{-6}}$ Hz = 2.94 KHz

For output:

Peak value, V_{out} = 2.1 × 2 = 4.2 V

Rms = $\frac{Vp}{2}$ = 2.1V

Time = 6.8 × 50 = 340 μs

Frequency, $f_o = \frac{1}{T} = \frac{1}{340 \times 10^{-6}}$ Hz = 2.94 KHz

Vdc = $\frac{Vp}{\pi} = \frac{4.2}{\pi}$ = 1.34 V

So, the difference of peak value = $V_i - V_o$ = 5.4 – 4.2 = 1.2 V (voltage drop in diode)

Conclusion:

In this experiment we got to know how to build a half wave rectifier. For building we must choose a diode that can safely withstand the current the circuit will have to provide, and also the reverse bias voltage that will be applied to it. Diodes are rated for maximum average forward current, which, since the diode conducts only half the time (positive-going half-cycles only), is roughly 1/2(*V*av/*RL*), where *V*av is the average voltage and *RL* is the load resistance. We also observe the waveform on the oscilloscope for this experiment. The half-wave rectifier is used most often in low-power applications because of their major disadvantages being. The output amplitude is less than the input amplitude, there is no output during the negative half cycle so half the power is wasted and the output is pulsed DC resulting in excessive ripple.