

DIODE AS A FULL-WAVE RECTIFIER

RAVITEJ UPPU

1. AIM

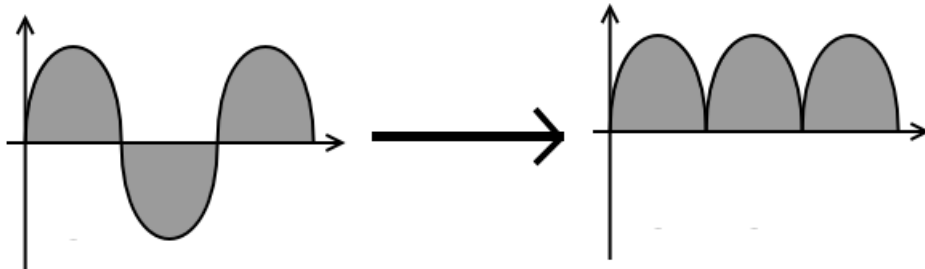
To observe and measure the output waveforms of a full-wave rectifier.

2. THEORY

DC voltage and current are required for electronic devices, hence, is necessary to convert AC into DC by a process called rectification. A single rectifier diode serves as a half-wave rectifier, in which only one alternation of the AC waveform is applied to the load. When two rectifier diodes are used, we have full wave rectification. A full-wave rectifier converts the whole of the input waveform to one of constant polarity (positive or negative) at its output by reversing the negative (or positive) portions of the alternating current waveform. The positive (or negative) portions thus combine with the reversed negative (or positive) portions to produce an entirely positive (or negative) voltage/current waveform.

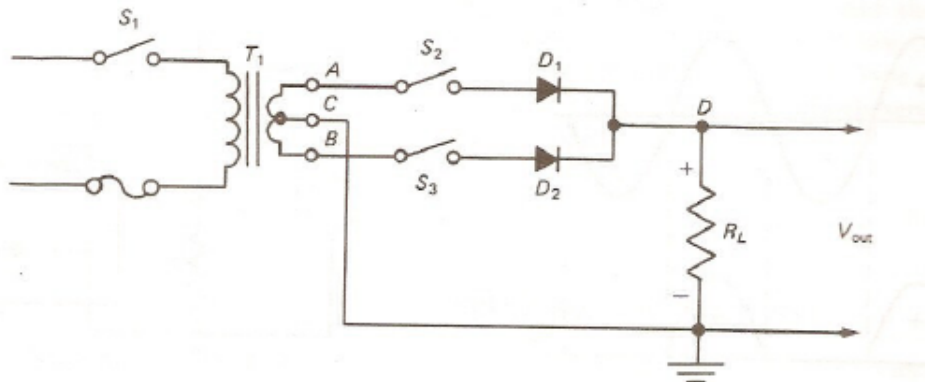
For single-phase AC, if the transformer is center-tapped, then two diodes back-to-back (i.e. anodes-to-anode or cathode-to-cathode) form a full-wave rectifier. Each rectifier, when conducting, is not a perfect switch. It exhibits some internal resistance. Because of this resistance, there is some voltage loss across each diode. Whether the secondary winding of the transformer feeding the rectifiers is a voltage step-up step-down winding depends on the requirement of the electronic device for which the power supplied is intended. When transformers are used for power-rectifier circuits, the resistance of the secondary windings is low to reduce power losses in the output.

If the input wave form is like the first image, then the next image shows the output wave form.



3. PROCEDURE

We need to complete the following circuit consisting of two identical diodes, a transformer, switches, a load resistance and oscilloscope to observe the waveforms.



I did this with two different diodes BY127 and 6A4MIC. Closing both the switches gives a full-wave rectifier circuit, closing any leads to a half-wave rectifier. WE note the peak to peak Voltage out and RMS value of the same and check the relation between RMS value and peak to peak value. There are losses in the circuit and also the signal from the transformer has lot of noise with no well defined peak. This noise can be reduced by using a filter in the circuit to get better looking curves.

4. OBSERVATIONS AND RESULTS

4.1. Diode BY127.

- V_{in} RMS = 26.35V
- V_{out} RMS = 5.79V with the waveform as in the first figure
- V_{out} peak-to-peak = 7.2V
- V RMS across the first diode =14.03V
- V RMS across the second diode =14.07V
- V_{out} peak-to-peak for half-wave (i.e one of switches is open) =7.2V with only one-section of wave rectified.

4.2. Diode 6A4MIC.

- V_{in} RMS = 26.35V
- V_{out} RMS = 5.75V with the waveform as in the first figure
- V_{out} peak-to-peak = 7.4V
- V RMS across the first diode =14.08V
- V RMS across the second diode =14.10V
- V_{out} peak-to-peak for half-wave (i.e one of switches is open) =7.6V with only one-section of wave rectified.
- The output waveform is much more sharper (clearer) with this diode than the BY127.