

Name _____
Date _____
Instructor _____

EXPERIMENT

4

Half-Wave and Full-Wave Rectification

OBJECTIVE

To calculate, draw, and measure the DC output voltages of half-wave and full-wave rectifier circuits.

EQUIPMENT REQUIRED

Instruments

Oscilloscope
DMM

Components

Resistors

(2) 2.2-k Ω
(1) 3.3-k Ω

Diodes

(4) Silicon

Supplies

Function generator

Miscellaneous

12.6-V Center-tapped transformer with fused line cord

EQUIPMENT ISSUED

Item	Laboratory serial no.
Oscilloscope	
DMM	
Function generator	

RÉSUMÉ OF THEORY

The primary function of half-wave and full-wave rectification systems is to establish a DC level from a sinusoidal input signal that has zero average (DC) level.

The half-wave voltage signal of Fig. 4.1 normally established by a network with a single diode has an average or equivalent DC voltage level equal to 31.8% of the peak voltage V_m .

That is,

$$V_{dc} = 0.318V_{\text{peak}} \text{ volts} \quad (4.1)$$

half-wave

The full-wave rectified signal of Fig. 4.2 has twice the average or DC level of the half-wave signal, or 63.6% of the peak value V_m .

That is,

$$V_{dc} = 0.636V_{\text{peak}} \text{ volts} \quad (4.2)$$

full-wave

For large sinusoidal inputs ($V_m \gg V_T$) the forward-biased transition voltage of a diode can be ignored. However, for situations when the peak value of the sinusoidal signal is not that much greater than V_T , V_T can have a noticeable effect on V_{DC} .

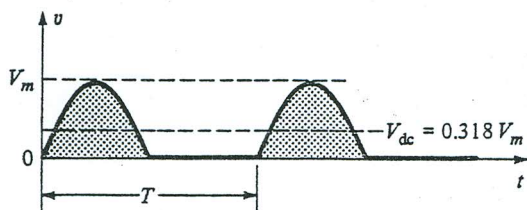


Figure 4-1

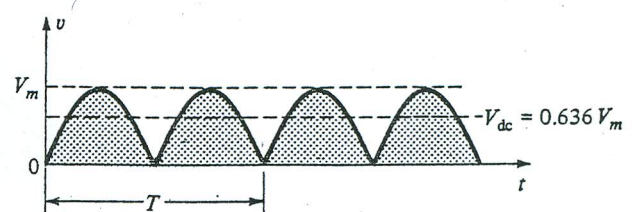


Figure 4-2 Full-wave rectified signal.

In rectification systems the peak inverse voltage (PIV) or Zener breakdown voltage parameter must be considered carefully. The PIV voltage is the maximum reverse-bias voltage that a diode can handle before entering the Zener breakdown region. For typical single-diode half-wave rectification systems, the required PIV level is equal to the peak value of the applied sinusoidal signal. For the four-diode full-wave bridge rectification system, the required PIV level is again the peak value, but for a two-diode center-tapped configuration, it is twice the peak value of the applied signal.

