# Full Wave Rectifiers Theory and Circuit Operation

Full-wave rectifiers are used for various electronic applications. Full-wave rectifiers are the most commonly used devices for the dc power supplies.

A full-wave rectifier is as same as the half-wave rectifier circuit, but the difference is a full wave rectifier allows unidirectional current through the load during the entire sinusoidal cycle (as opposed to only half the cycle in the half-wave). In other words, for both the positive and negative half cycles of the input sinusoidal wave, the full wave rectifier conducts current through the load resistance. This will leads to a constant dc voltage through out the input wave (sinusoidal wave).
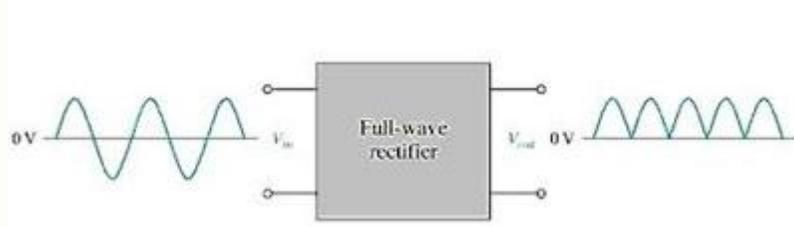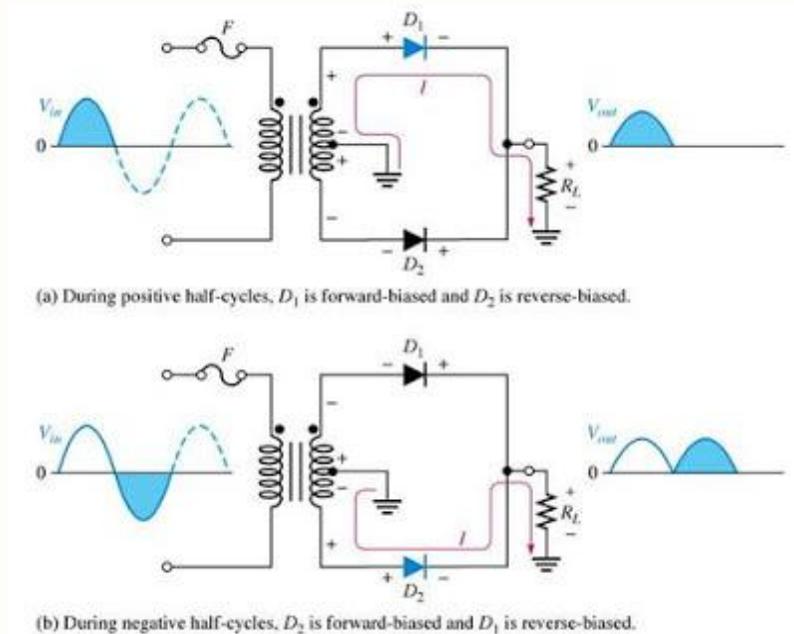

Average value of output of the full wave rectifier becomes twice that of the half wave rectifier output:

$$V_A = 2V_{pi}/\pi$$

Full wave rectifiers are of two types:

i) Center-tapped Full-Wave Rectifier:

To the secondary of a center-tapped transformer, two diodes connected.
Between the center tap and each secondary half of Vin is shows up.
Only one of the diodes is forward biased, at any point in time.
A continuous conduction of current through load will flows due to this.

(a) During positive half-cycles, D_1 is forward-biased and D_2 is reverse-biased.

(b) During negative half-cycles, D_2 is forward-biased and D_1 is reverse-biased.

The peak inverse voltage (PIV) across then diode D2 is:

$$PIV = (V_{pi(sec)}/2 - 0.7) - (-V_{pi(sec)}/2)$$
$$= (V_{pi(sec)}/2 + V_{pi(sec)}/2 - 0.7)$$
$$= V_{pi(sec)} - 0.7$$
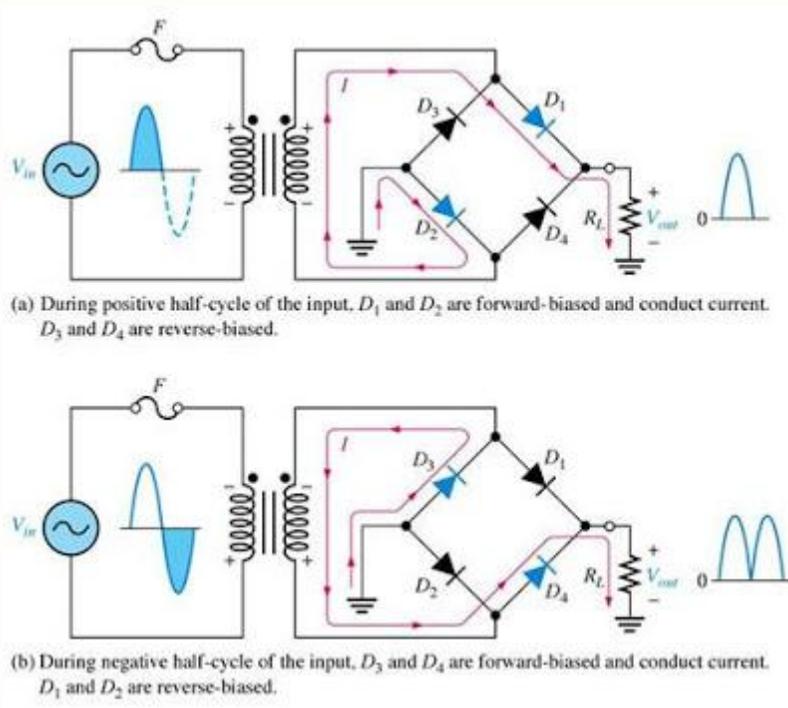
Since we know that,

$$V_{pi(out)} = V_{pi(sec)}/2 - 0.7, \text{ we get:}$$
$$V_{pi(sec)} = 2V_{p(out)} + 1.4$$

SO the PIV across each diode will be:

$$PIV = 2V_{pi(out)} + 0.7 \text{ V}$$

ii) Bridge Full-Wave Rectifier:

(a) During positive half-cycle of the input, D_1 and D_2 are forward-biased and conduct current. D_3 and D_4 are reverse-biased.

(b) During negative half-cycle of the input, D_3 and D_4 are forward-biased and conduct current. D_1 and D_2 are reverse-biased.

The diodes D1 and D2 are forward biased during the positive half cycle of the input.
The diodes D3 and D4 are the conducing diodes during the negative half cycle of the input.
The output voltage can be written as:
The PIV is a lot smaller, we can use a full bridge rectifier than a center-tap:

$$PIV = V_{pi(out)} + 0.7 \text{ Volts}$$

Source:

http://www.electronicsandcommunications.com/2013/04/full-wave-rectifiers-theory-and-circuit.html