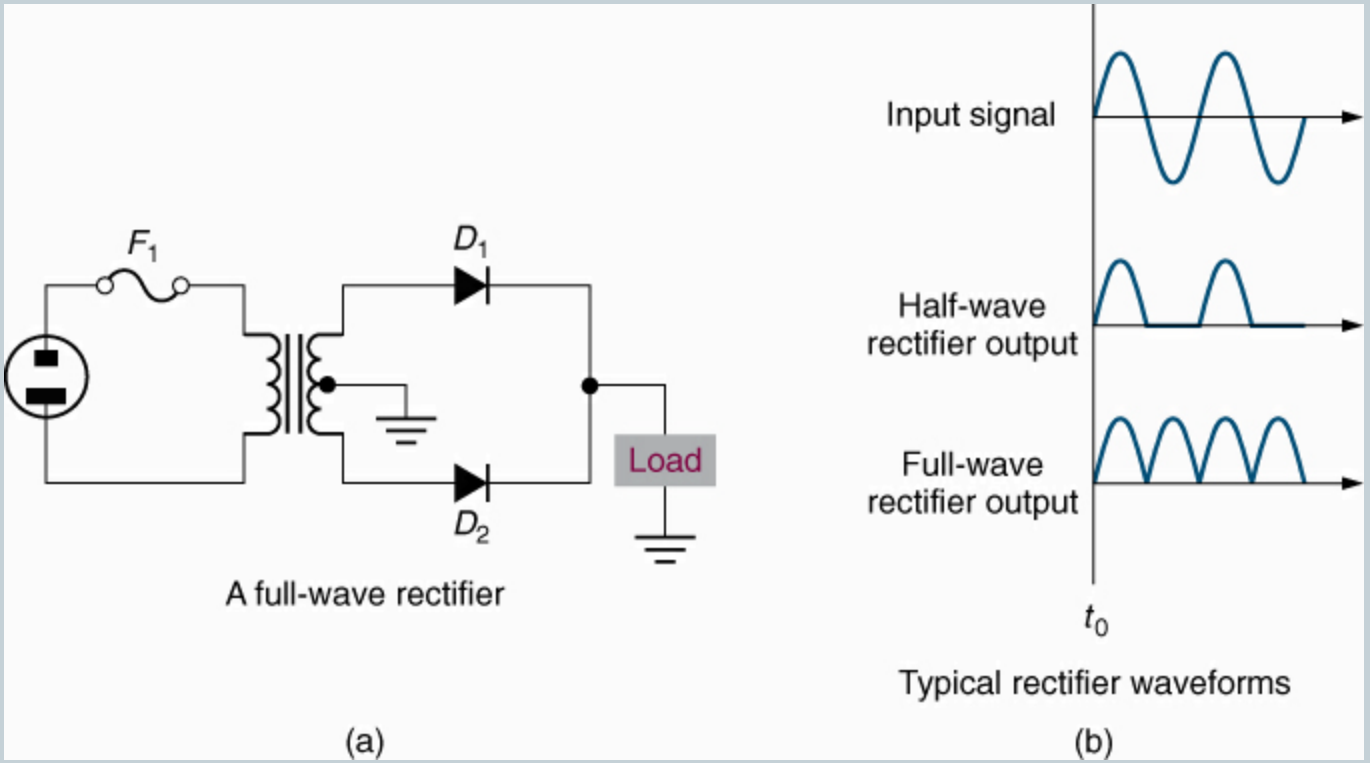
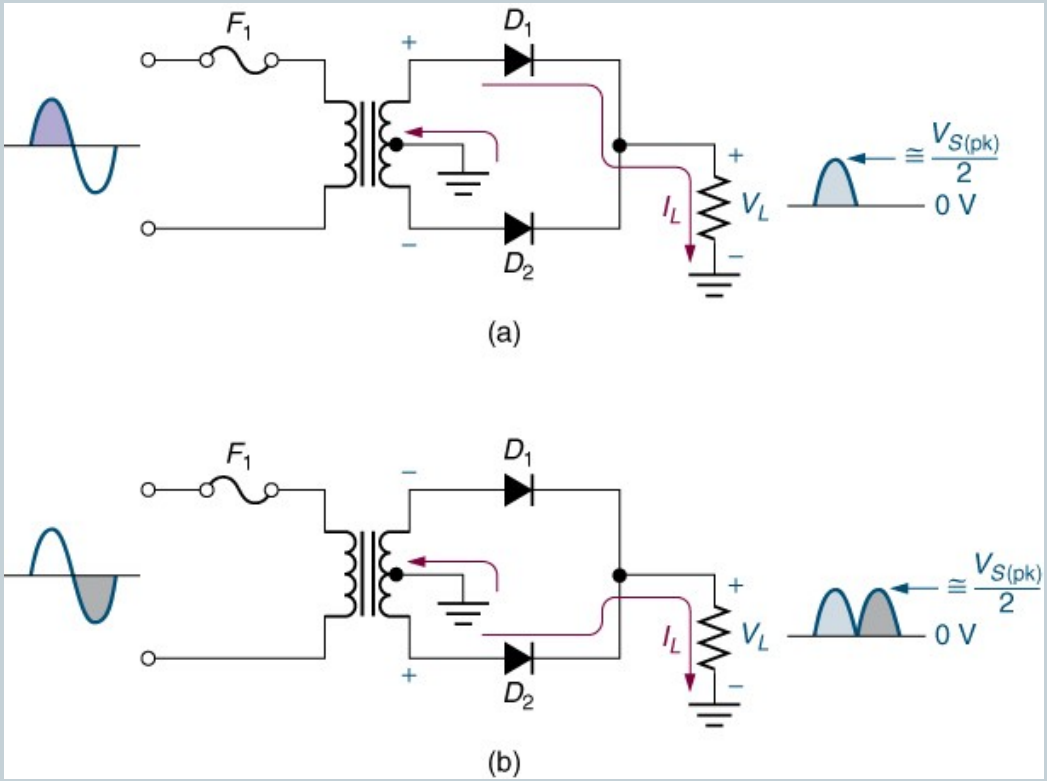
Semiconductor Diode

Full-wave Rectifier



Full-wave Rectifier Operation

- Diodes conduct during alternate half cycles of the input signal.
- $V_{L(pk)}$ is approximately half the value of $V_{S(pk)}$.
- The circuit produces two positive half-cycles for each input cycle.



Average Load Voltage and Current

- Average voltage (V_{ave}) – The dc equivalent of a voltage waveform.
- Average current (I_{ave}) – The dc equivalent of a current waveform.

For the output from a full-wave rectifier:

$$V_{ave} = \frac{2V_{pk}}{\pi} \qquad I_{ave} = \frac{2I_{pk}}{\pi}$$

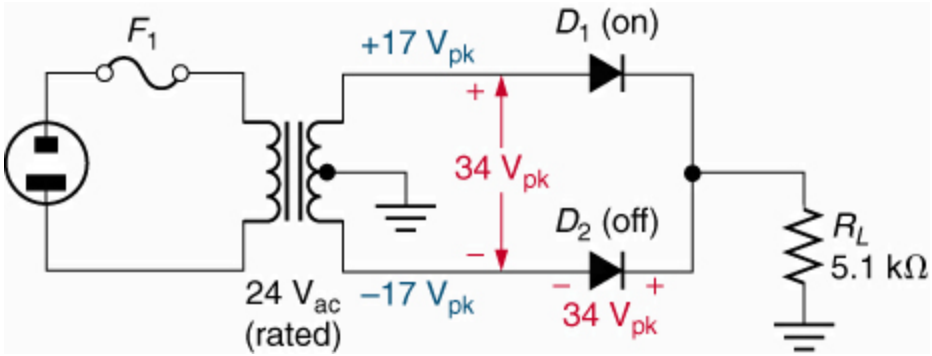
Peak Inverse Voltage (PIV)

- Peak inverse voltage (PIV) – The maximum diode reverse bias produced by a given circuit.

For the diode in a full-wave rectifier:

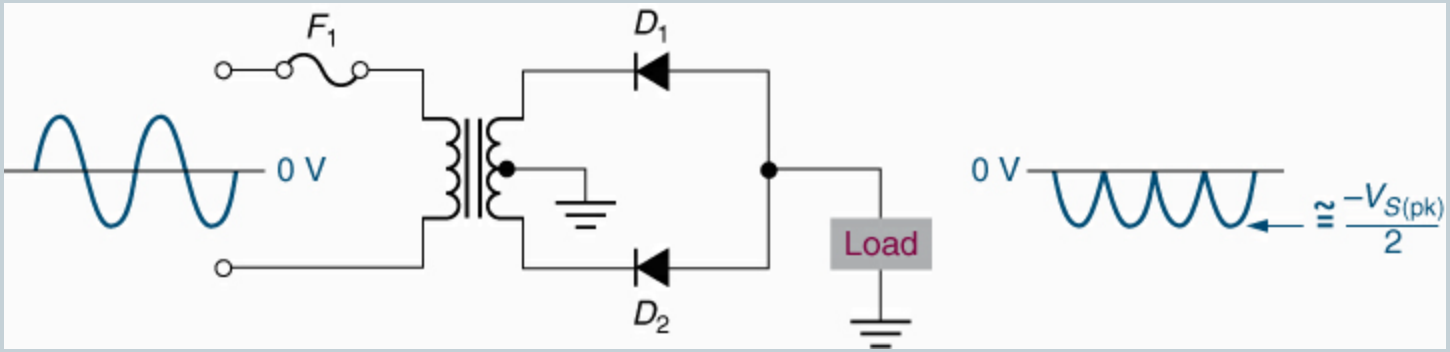
$$\text{PIV} \cong V_{S(\text{pk})}$$

$$\text{PIV} \cong 2V_{L(\text{pk})}$$



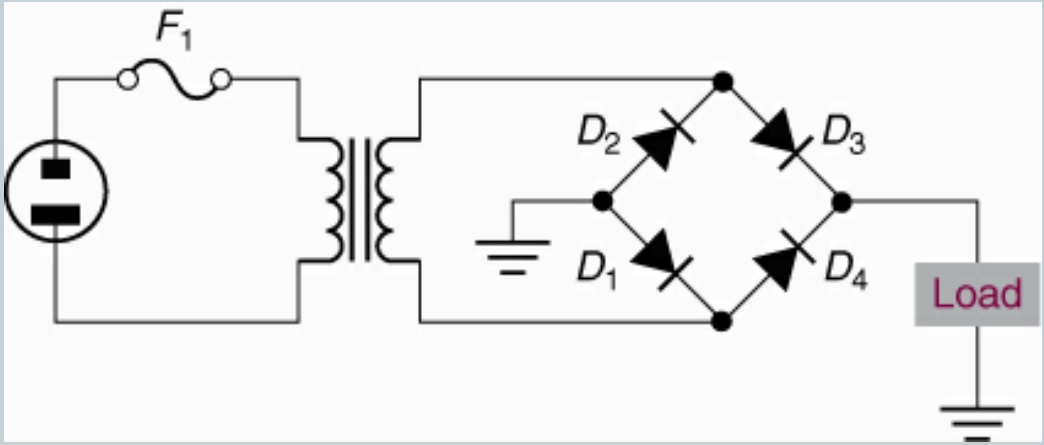
Negative Full-wave Rectifiers

- The negative full-wave rectifier converts an ac input to a series of negative pulses.



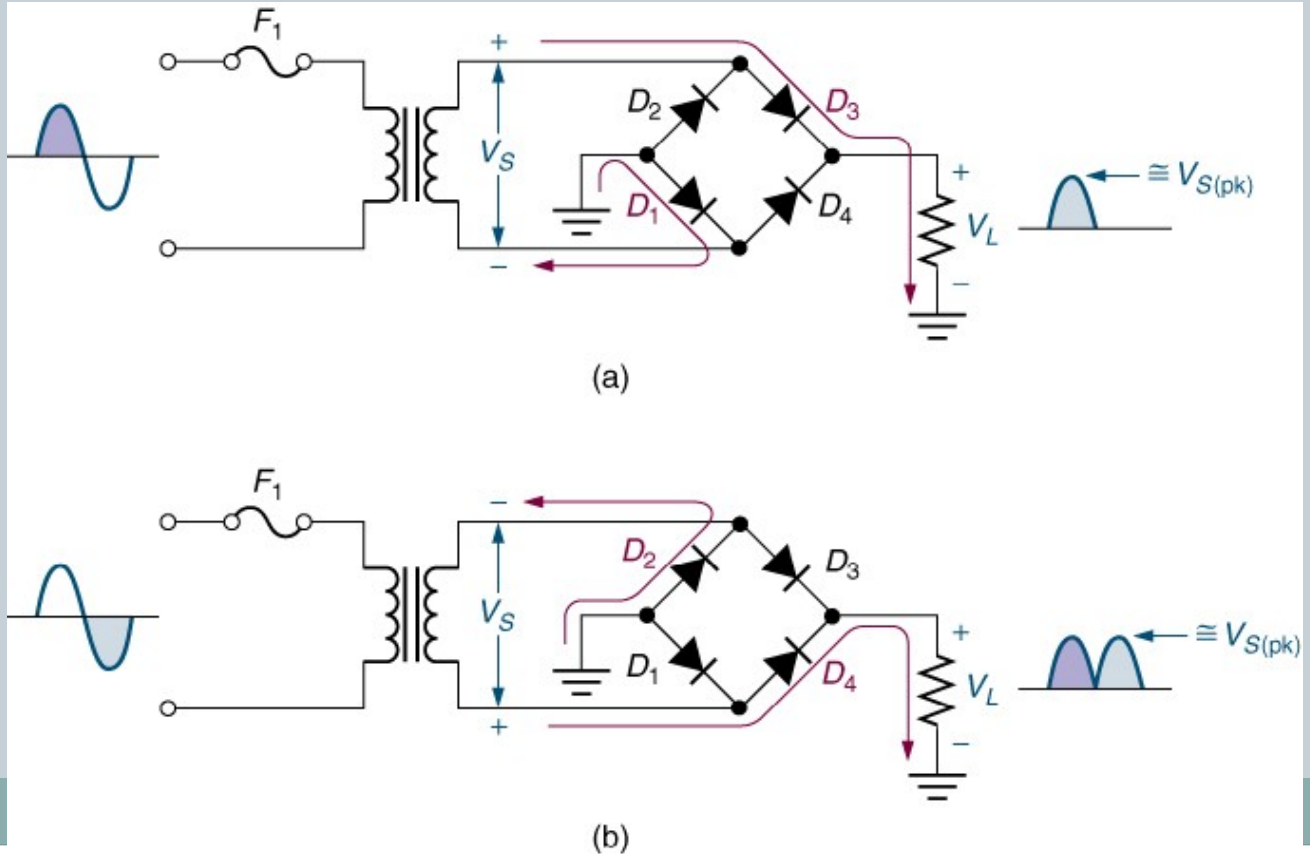
Full-Wave Bridge Rectifiers

- The most commonly used because:
  - It does not require the use of a center-tapped transformer.
  - It can be coupled directly to the ac power line.
  - It produces a higher dc output than a comparable full-wave center-tapped rectifier.



Bridge Rectifier Operation

- Conduction alternates between two diode pairs.



Calculating load voltage and current relationships

$$V_{L(\text{pk})} = V_{S(\text{pk})} - 1.4\ \text{V}$$

$$V_{\text{ave}} = \frac{2V_{L(\text{pk})}}{\pi}$$

$$I_{\text{ave}} = \frac{V_{\text{ave}}}{R_L}$$

$$\text{PIV} = V_{\text{S(pk)}} - 0.7\ \text{V}$$