EE-202 Electronics

Chapter 4:

Diode Applications

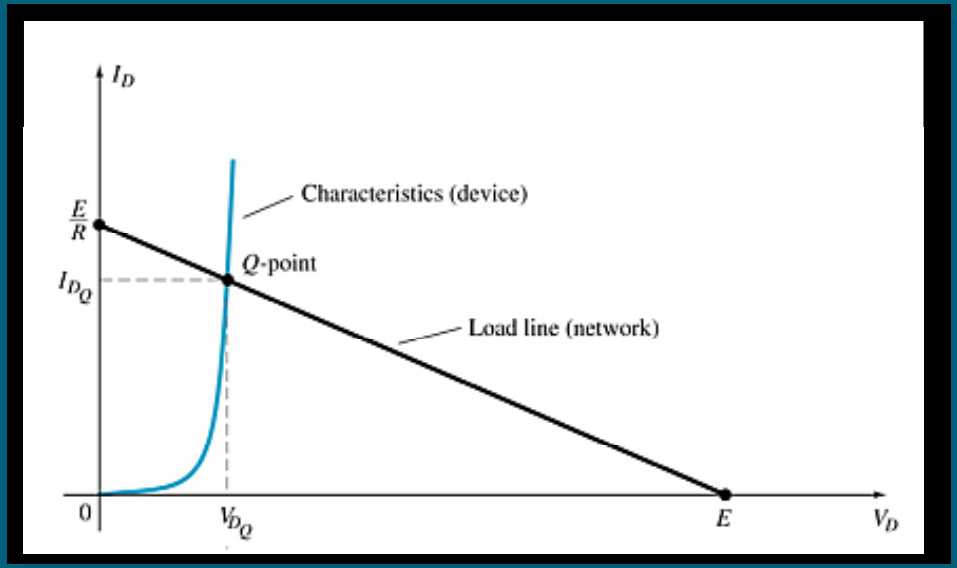
Half and Full-Wave rectifiers

Zeners

Load-Line

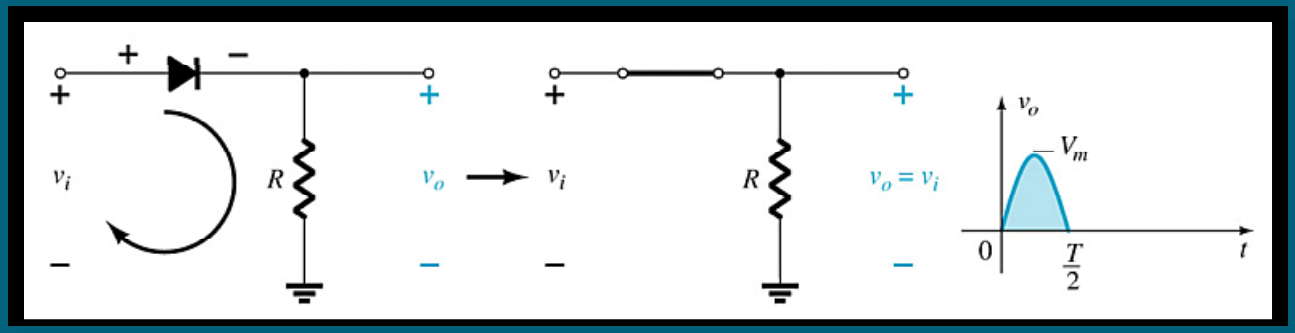
The load line shows all possible current via voltage conditions.

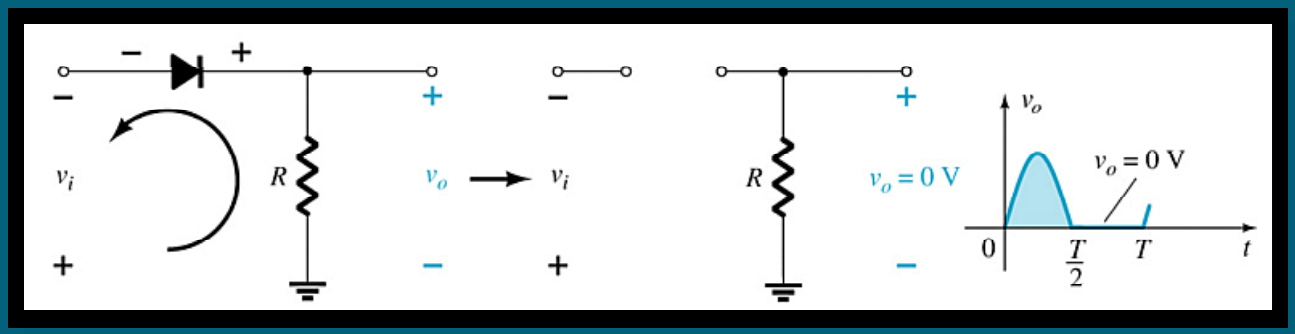
Load line and the characteristic curve intersects in the Q-point,



Half-Wave Rectification

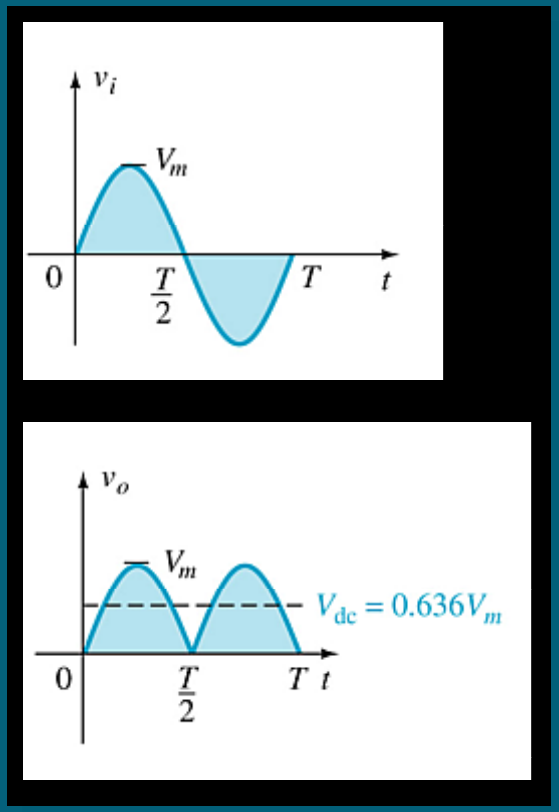
The diode conducts when forward biased.





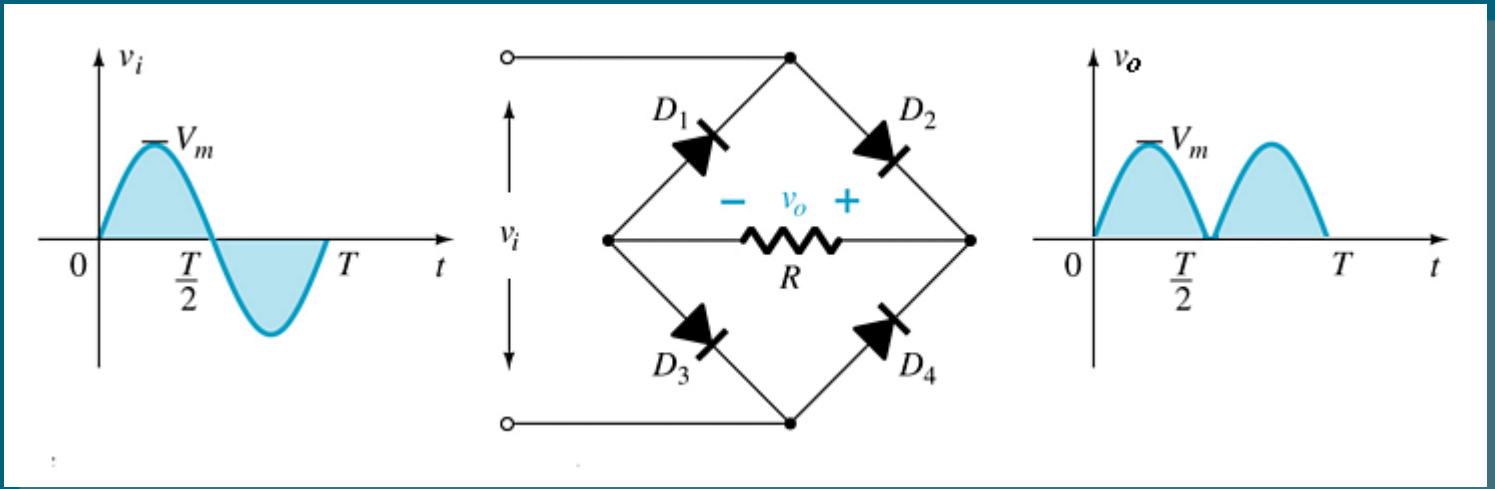
Full-Wave Rectification

Full-wave rectification produces a greater DC output:



- **Half-wave: $V_{dc} = 0.318V_m$**
- **Full-wave: $V_{dc} = 0.636V_m$**

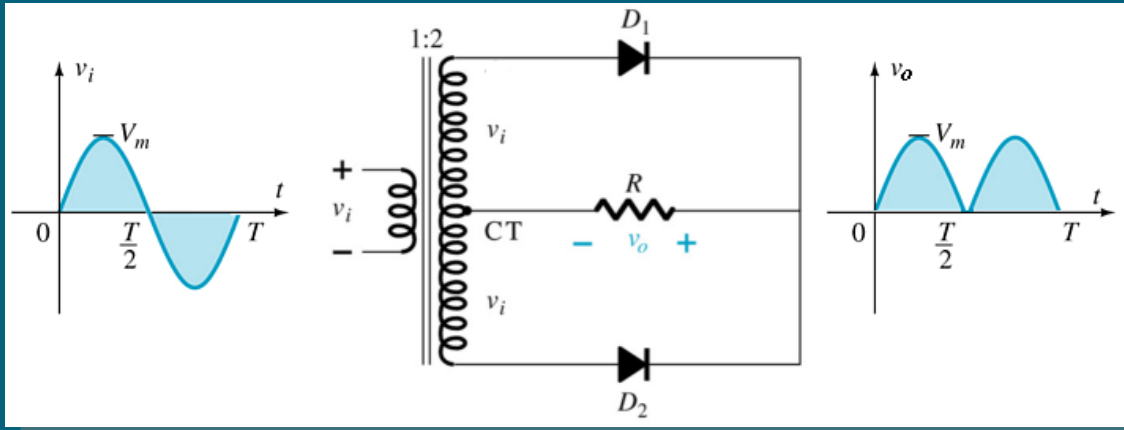
Full-Wave Rectification



Bridge Rectifier

- **Four diodes are required**
- **V_{DC} = 0.636 Vm**

Full-Wave Rectification



Center-Tapped Transformer Rectifier

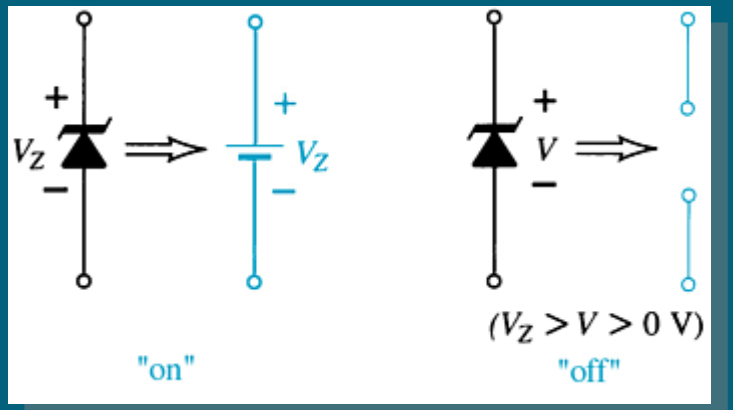
Requires

- **Two diodes**
- **Center-tapped transformer**

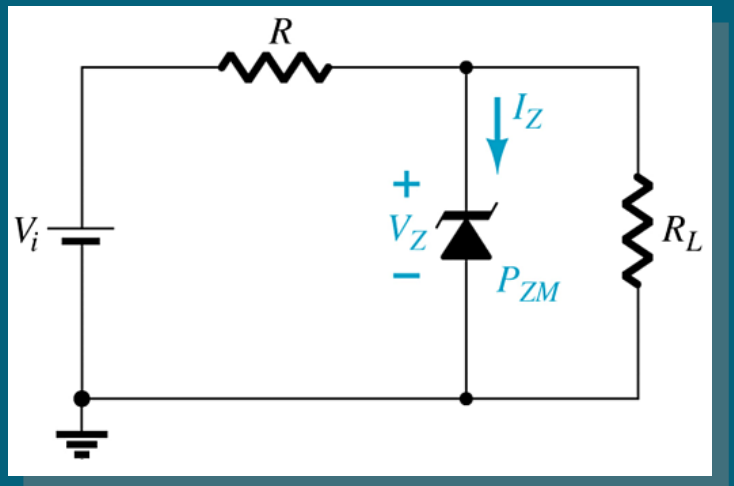
$$V_{DC} = 0.636(V_m)$$

Zener Diodes

The Zener is a diode operated in reverse bias at the Zener Voltage (V_z).



- When $V_i \geq V_z$
  - The Zener is on
  - Voltage across the Zener is V_z
  - Zener current: $I_Z = I_R - I_{RL}$
  - The Zener Power: $P_Z = V_Z I_Z$
- When $V_i < V_z$
  - The Zener is off
  - The Zener acts as an open circuit

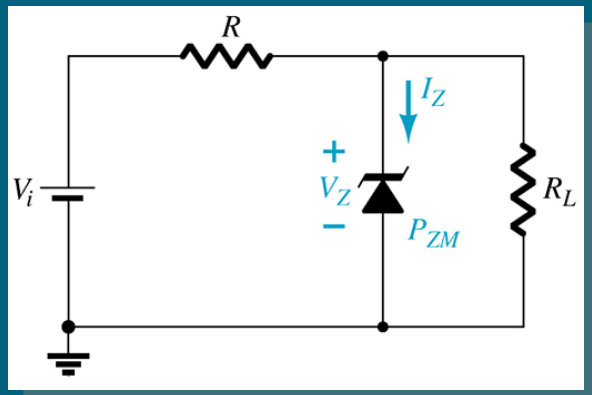


Zener Resistor Values

If R is too large, the Zener diode cannot conduct.

The minimum current is given by:

$$I_{Lmin} = I_R - I_{ZK}$$



The *maximum* value of resistance is:

$$R_{Lmax} = \frac{V_Z}{I_{Lmin}}$$

If R is too small, maximum current for the circuit :

$$I_{Lmax} = \frac{V_L}{R_L} = \frac{V_Z}{R_{Lmin}}$$

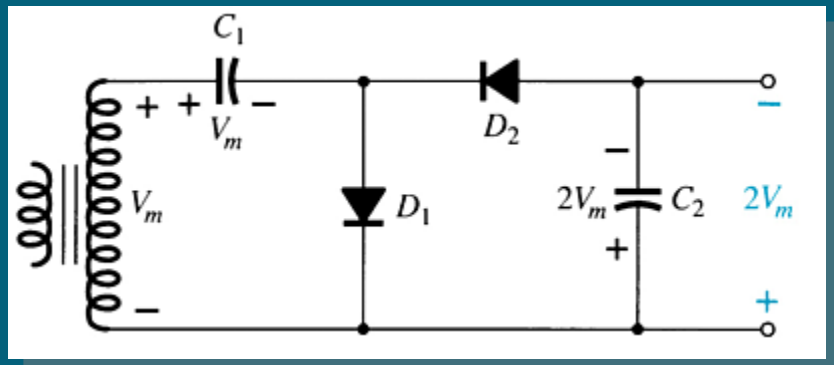
The *minimum* value of resistance is:

$$R_{Lmin} = \frac{RV_Z}{V_i - V_Z}$$

Voltage-Multiplier Circuits

- Voltage Doubler
- Voltage Tripler
- Voltage Quadrupler

Voltage Doubler



Output of the half-wave voltage doubler's:

$$V_{out} = V_{C2} = 2V_m$$

V_m = peak secondary voltage of the transformer