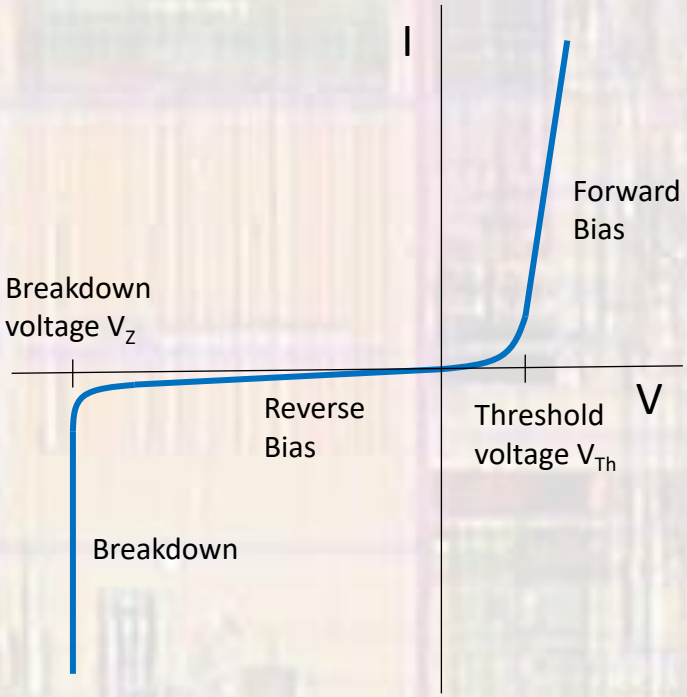
Diode Models

Last updated 3/8/23

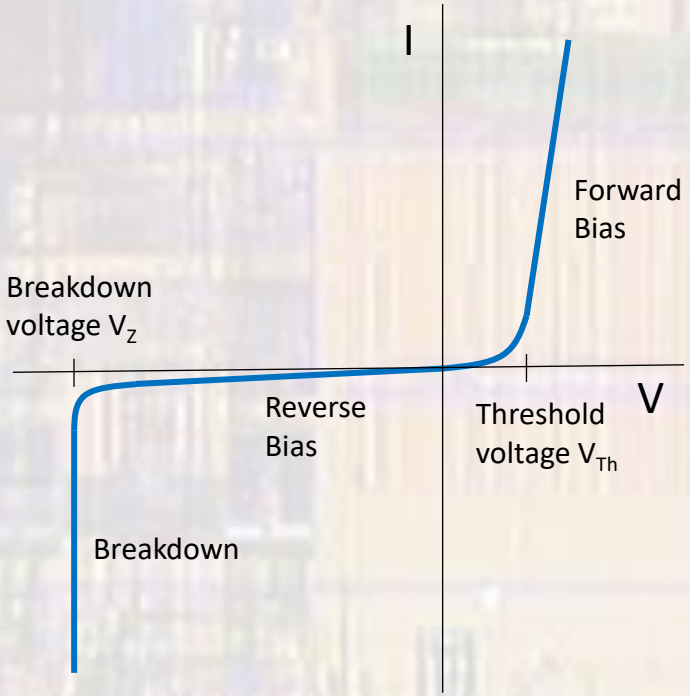
Diode Models

- Real diode behavior



Diode Models

- Real diode behavior

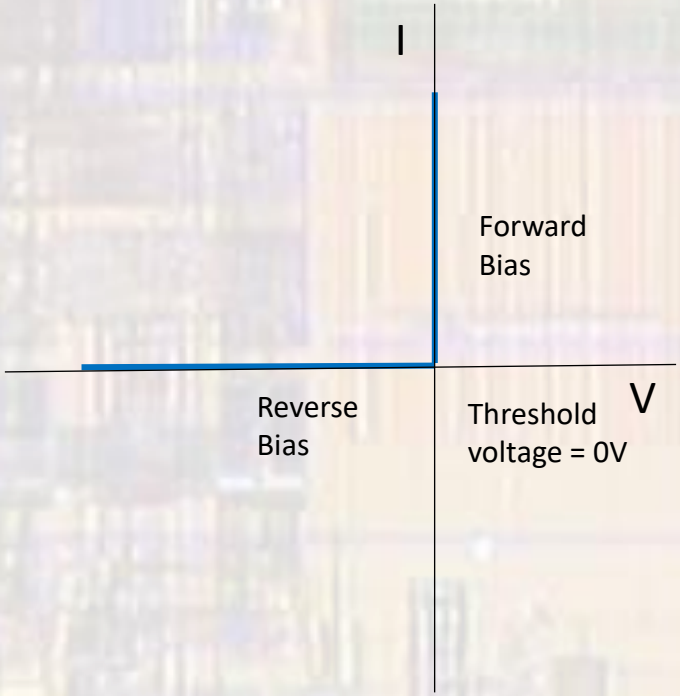


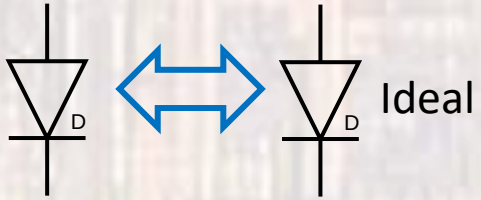
$V_D > V_Z$

$$I_D = I_S\left(e^{\frac{V_D}{nV_T}} - 1\right)$$

Diode Models

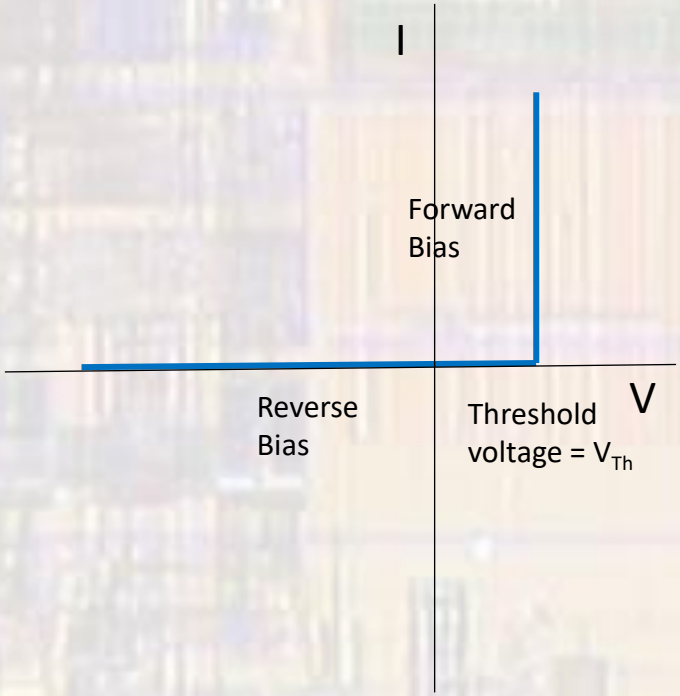
- Ideal diode models
  - Switch model

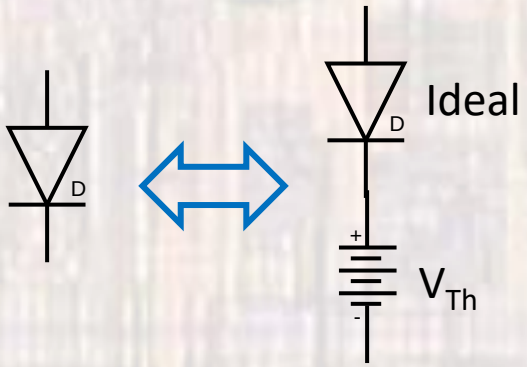




Diode Models

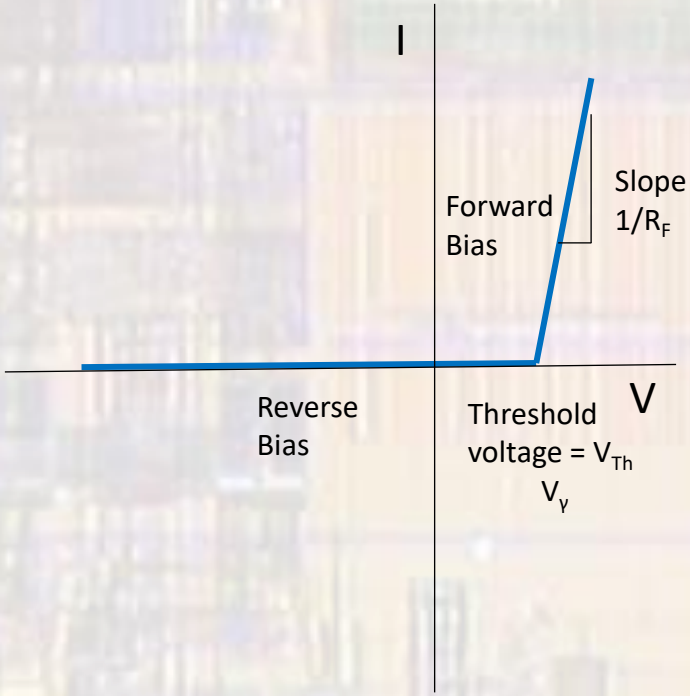
- Ideal diode models
  - Switch model with Turn-on voltage

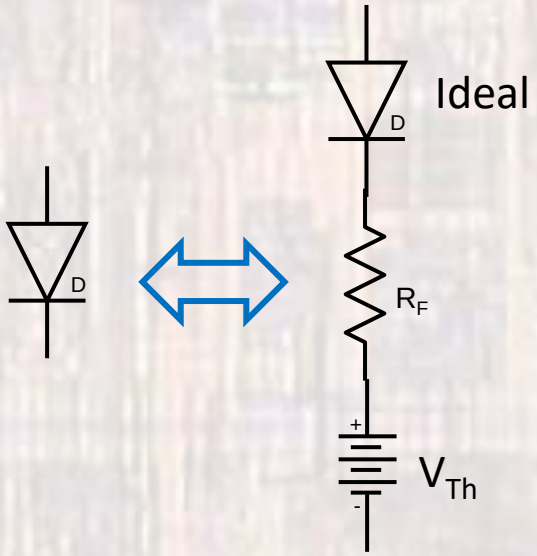




Diode Models

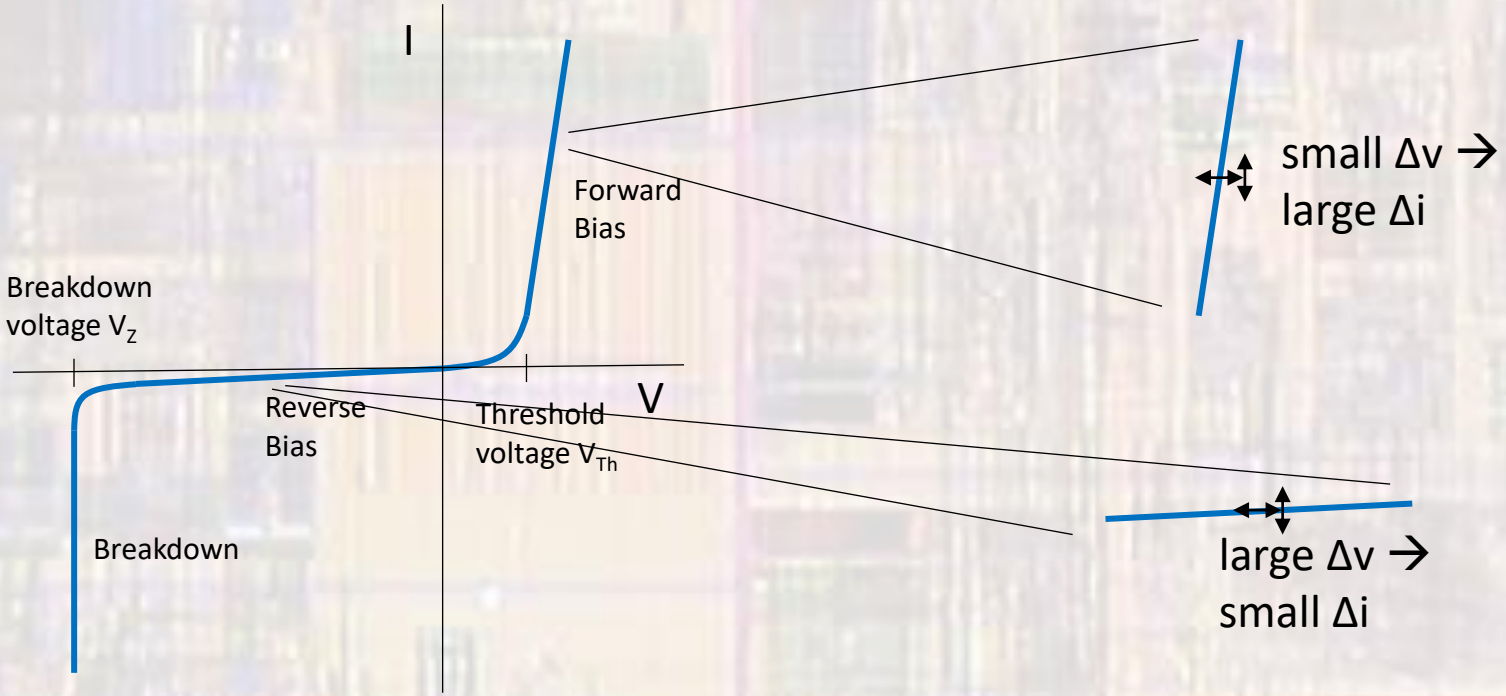
- Ideal diode models
  - Piecewise Linear model





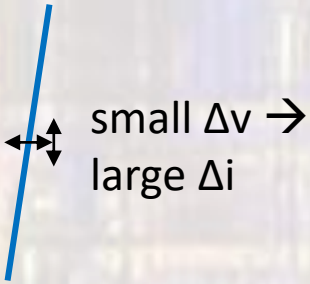
Diode Models

- Small Signal Model
  - Consider the I-V characteristics constant



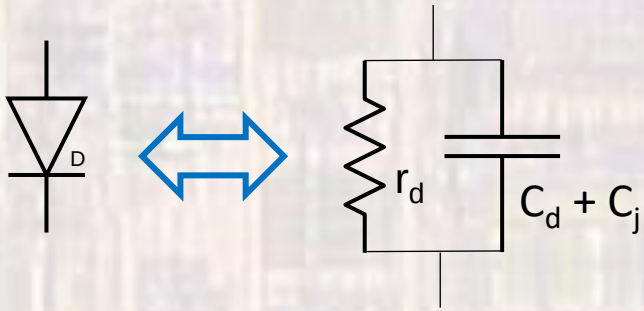
Diode Models

- Small Signal Model



small Δv → large Δi

I_D – DC current
V_D – DC voltage
i_d – small signal current
v_d – small signal voltage



large Δv → small Δi

$$i_d = \left(\frac{I_D}{V_T}\right) v_d = \left(\frac{1}{r_d}\right) v_d$$

$$r_d = \left(\frac{V_T}{I_D}\right)$$

C_j – Junction Capacitance
C_d – Diffusion Capacitance

C_j – dominant in reverse bias
C_d – dominant in forward bias