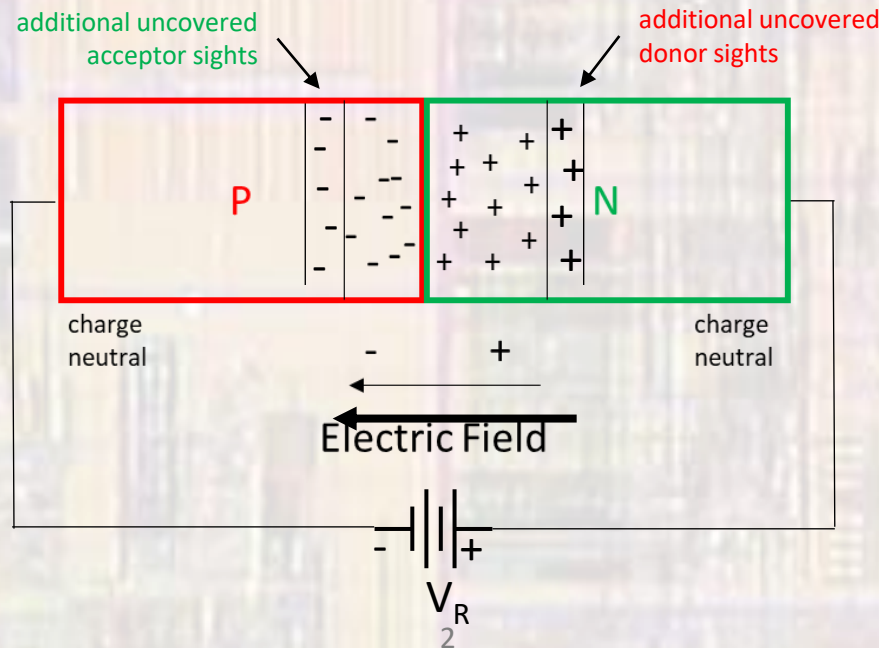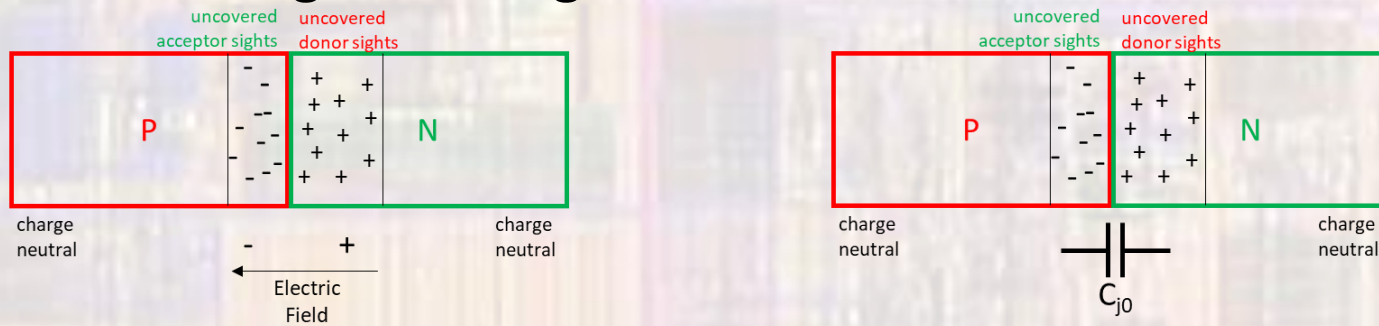# PN Junction Reverse Bias

Last updated 2/10/22
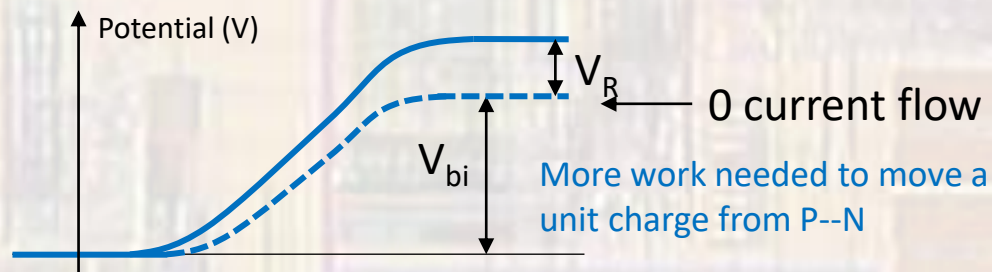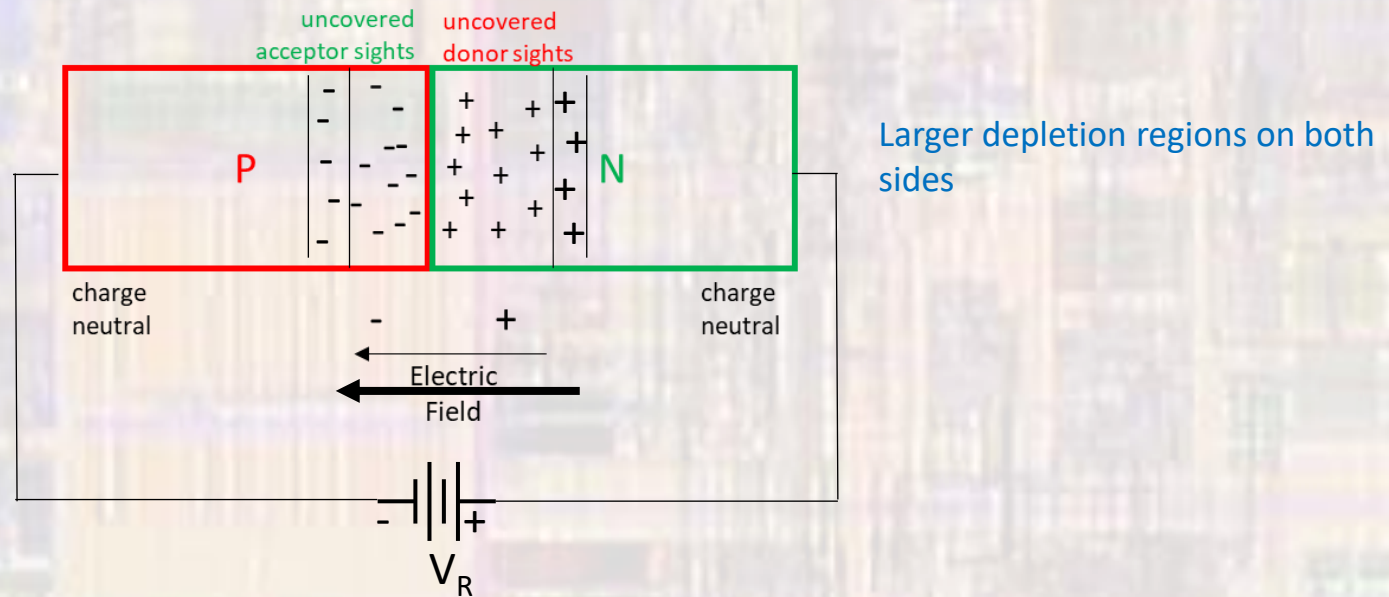
- Reverse bias
  - N side at a higher voltage than the P side

PN Junction – Reverse Bias

- Reverse Bias
  - N side at a higher voltage than the P side

uncovered acceptor sights

uncovered donor sights

P

N

Larger depletion regions on both sides

charge neutral

charge neutral

Electric Field

V_R

Potential (V)

V_R

0 current flow

V_{bi}

More work needed to move a unit charge from P--N

PN Junction – Reverse Bias

- Reverse Bias
  - The reversed bias shifts the energy bands relative to the P and N side
    - No impact on the drift current
    - Reduces the number of carriers that have sufficient energy to diffuse
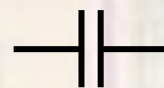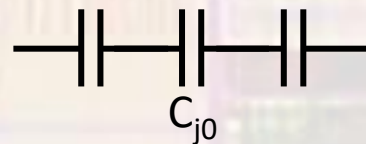
$I_D \approx 0$

drift   diffusion

$$V_{bi} + VR = -\frac{1}{q}\Delta E$$

diffusion   drift

$J_{p\text{-diff}} \downarrow \quad < \quad J_{p\text{-drift}}$ $J_{n\text{-diff}} \downarrow \quad < \quad J_{n\text{-drift}}$
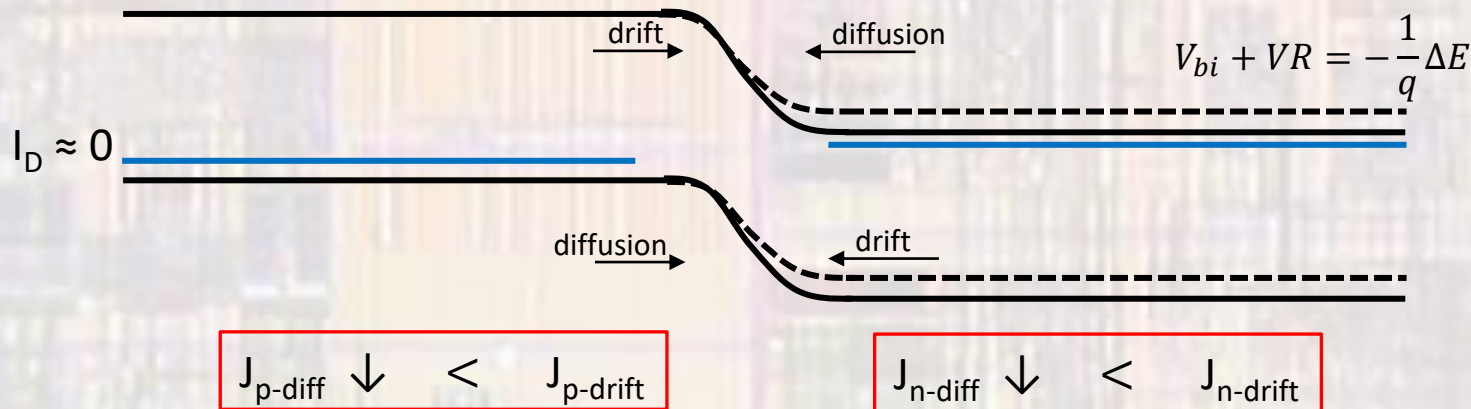
  - Resulting net current is small and negative (N → P)
    - additional reverse bias leads to small changes in a small number – essentially flat

- Reverse Bias – Junction Capacitance
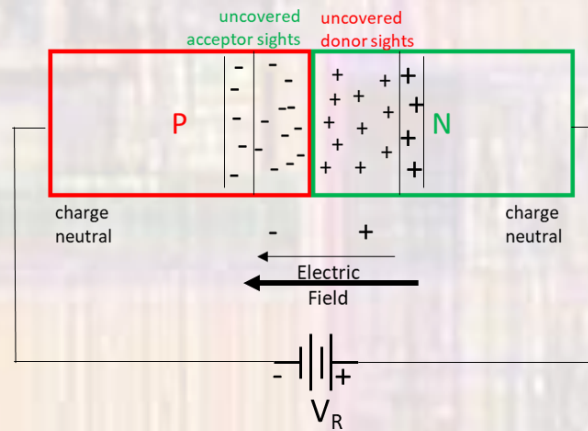
additional depletion region (W) → reduced capacitance

C_{j0}

Note: this is a Majority Carrier phenomena and can be very fast → small capacitance

$$C_j = C_{j0}\left(1 - \frac{V_A}{V_{bi}}\right)^{-1/2}$$

$V_A = -V_R$