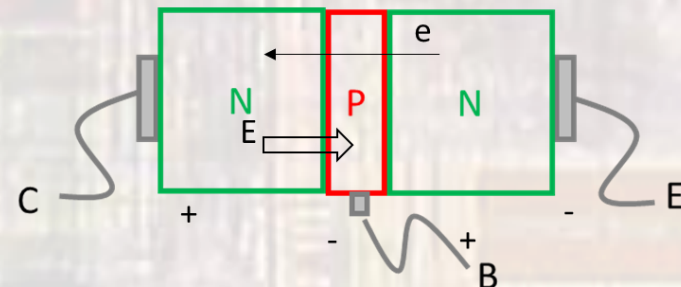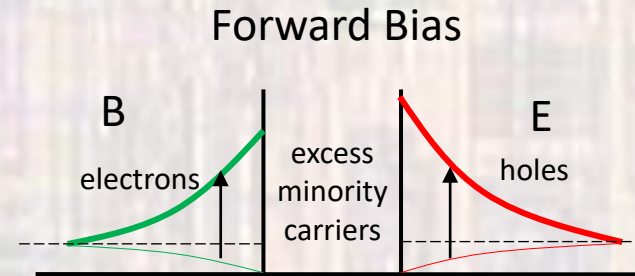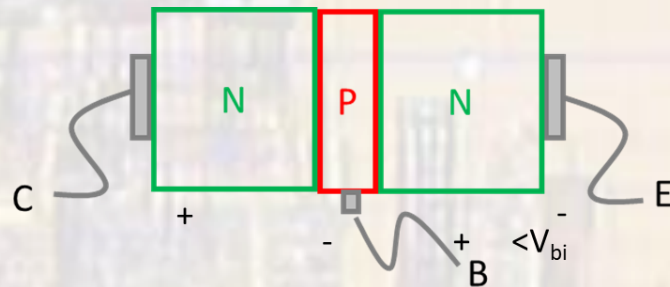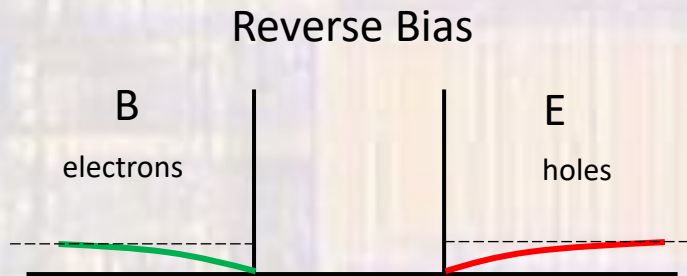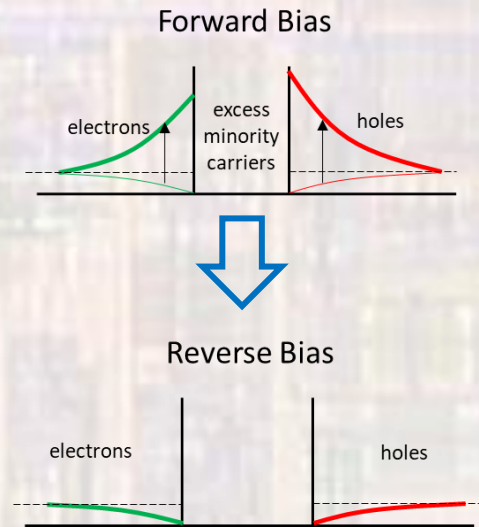# BJT Switching

Last updated 3/7/22

BJT Switching

- In forward bias(B-E), carriers are traversing the depletion region and create an excess of minority carriers in the N and P regions
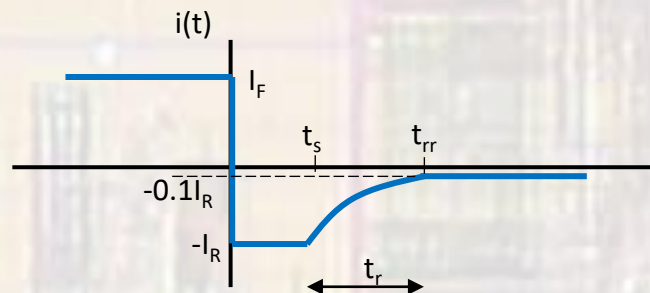
BJT Switching

- ## Switching from forward bias to reverse bias
  - Excess minority carriers must be removed
  - $\rightarrow$ reverse (negative) current flow
    - Amplitude is a function of V_F and minority carrier lifetimes
    - Storage Time – t_s
      - Time for concentrations to reach their 0V bias level
    - Recovery Time – t_r
      - Time for concentrations to reach their reverse bias level
    - Reverse Recovery Time – t_{rr}
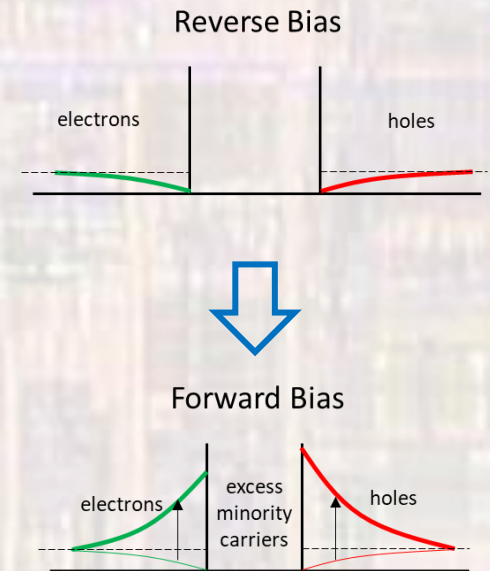   - Sum of t_s and t_r

Forward Bias

electrons   excess minority carriers   holes

Reverse Bias

electrons   holes

Turn Off

$i(t)$

I_F

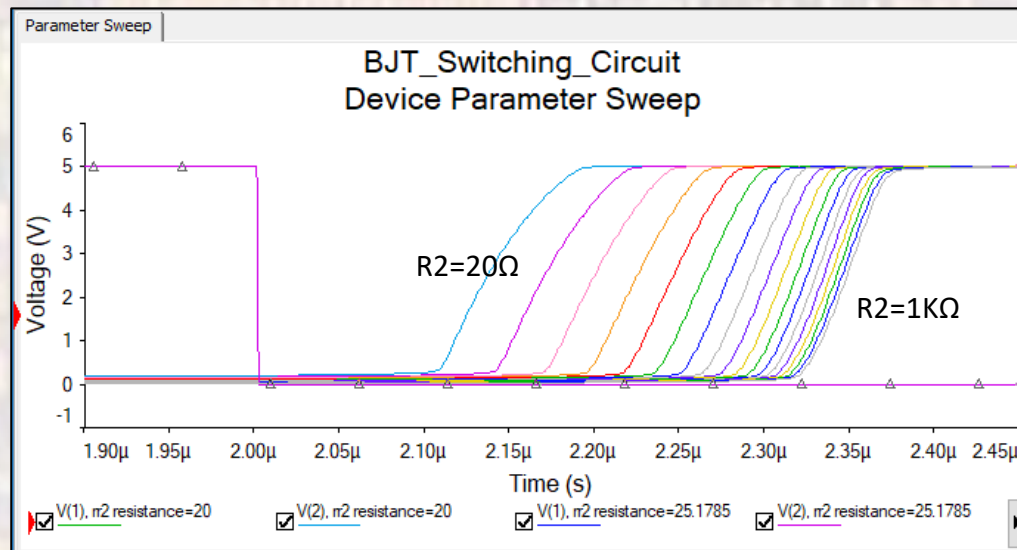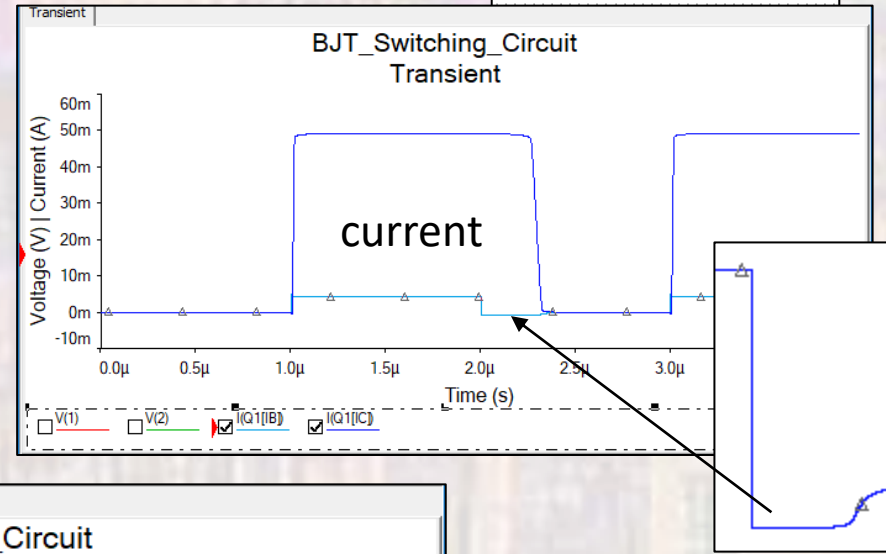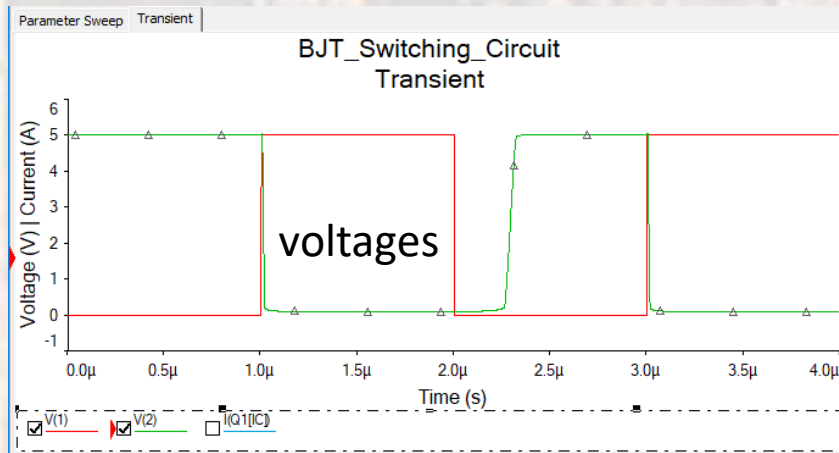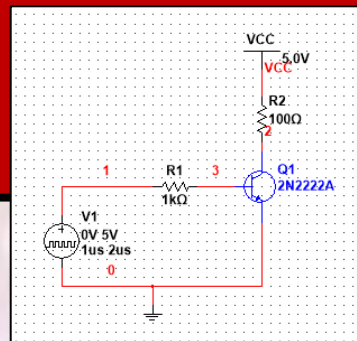t_s t_{rr}

$-0.1I_R$

$-I_R$

t_r

BJT Switching

- Switching from reverse bias to forward bias
  - No excess minority carriers to be removed
  - → No storage time
    - Fast transitions

Reverse Bias

electrons   holes

Forward Bias

electrons   excess minority carriers   holes

BJT Switching

- Simulation Example

voltages

current

R2 swept from
20Ω to 1K Ω

R2=20Ω

R2=1KΩ

The larger R2
the deeper Q1
goes into saturation
→
longer base recovery
times