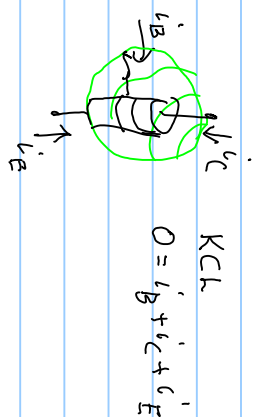
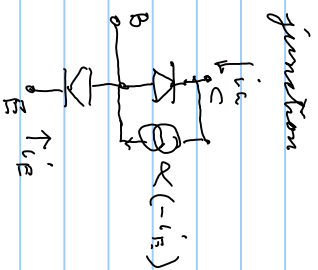


Power in $= v_D i_D$



$i_C = -\alpha i_E \Rightarrow i_E = -\frac{1}{\alpha} i_C$

$0 = i_B + i_C - \frac{1}{\alpha} i_C = i_B + \left(\frac{\alpha-1}{\alpha}\right) i_C$

$\Rightarrow i_B = \frac{\alpha}{1-\alpha} i_C = \beta i_C$

$\beta = \text{large } \alpha \approx 1$

$\beta = \alpha \text{ current gain}$

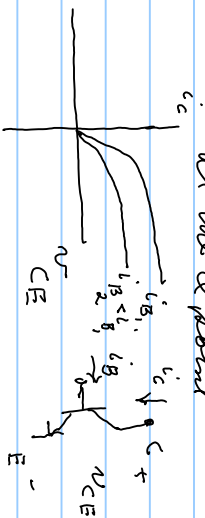
$\beta_F = \text{dc forward}$

$= \beta_F \text{ in diode}$

for our diode $i_D = I_S e^{V_D/V_T} - 1 \approx I_S e^{V_D/V_T}$ in forward region

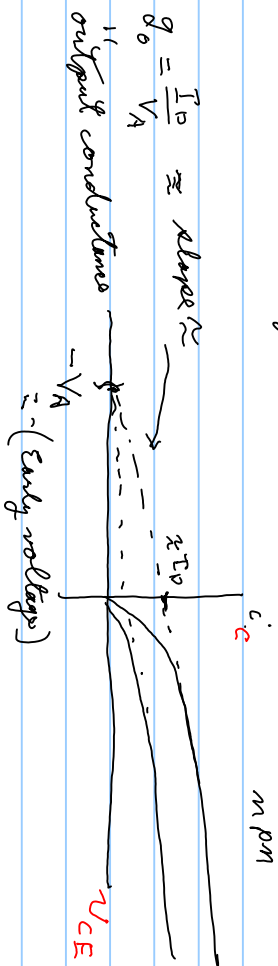
$$\left. \frac{\partial i_D}{\partial V_D} \right|_Q = \frac{I_S}{V_T} e^{V_D/V_T} = \frac{I_D}{V_T} = g_D ; V_D = V_{QD} = \frac{V_T}{I_D}$$

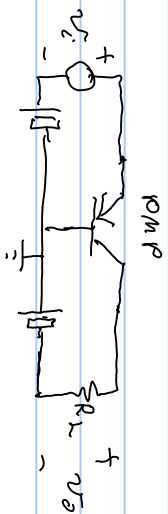
Q pt $I_D =$ bias value of diode



BJT diodes

Junction Transistors





$V_G = \frac{1}{2} V_{DD}$ ground

$V_D = V_{DD}$ output

$I_D = I_{DSS}$ current source

$V_{GS} = V_{GS} - V_{th}$ signal voltage