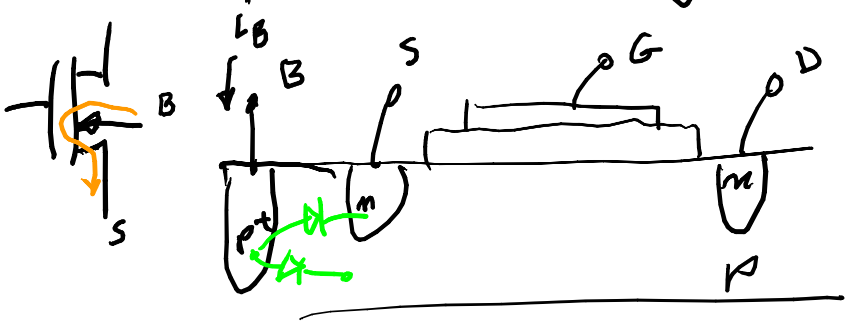
Note Title 9/6/2012

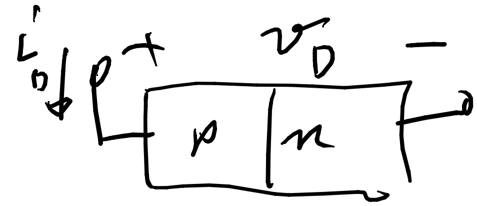
EE303
09/06/12
update 07

Parameters of interest in MOS models

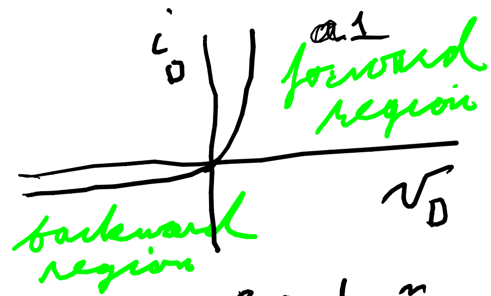
KP, W, L, λ = LAMBDA, VTO
γ = GAMMA

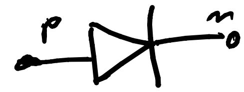
VTO = threshold VGS, B=S



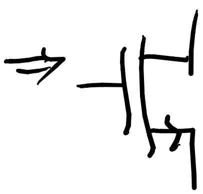


if $v_B < v_S$ these diodes are back biased only small bulk current; if $v_B = v_S$ then $i_B = 0$

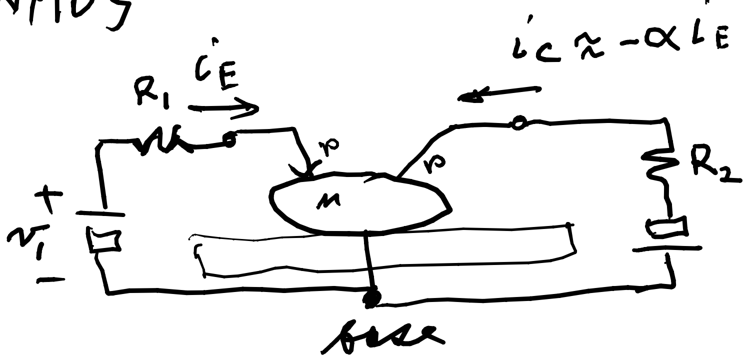




⇒

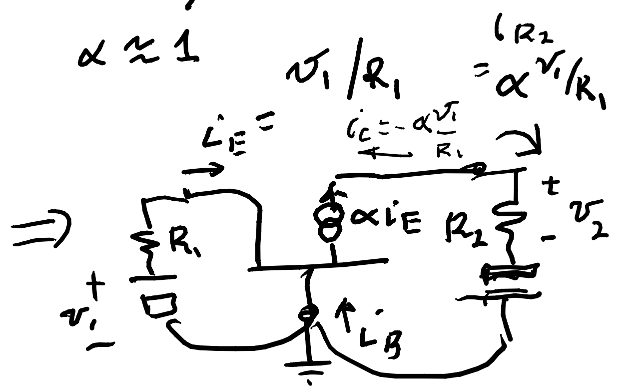


NMOS

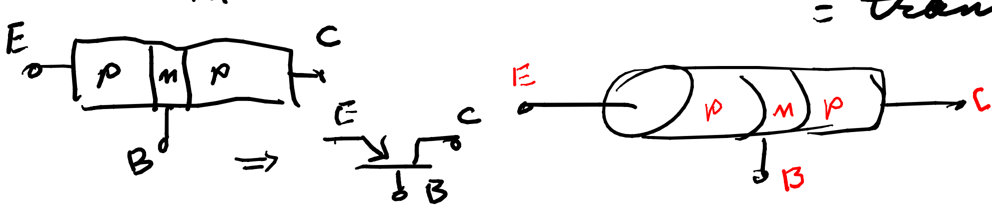


$\alpha \approx 1$

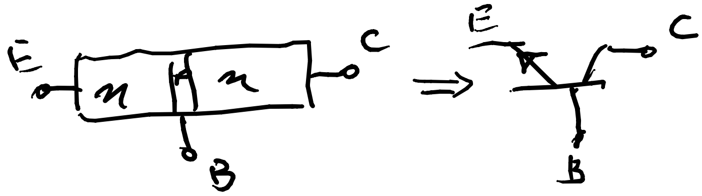
⇒



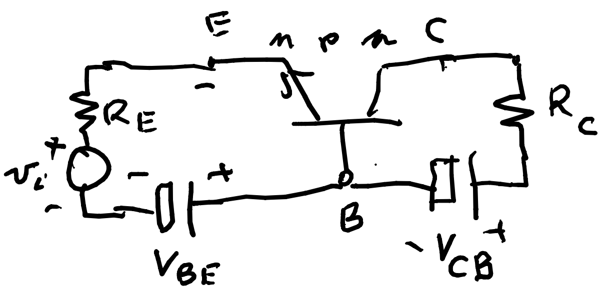
$$v_2 = \alpha \frac{v_1}{R_1} \cdot R_2 = \frac{\alpha R_2}{R_1} \cdot v_1 \Rightarrow \text{transfer resistor} = \text{transistor}$$



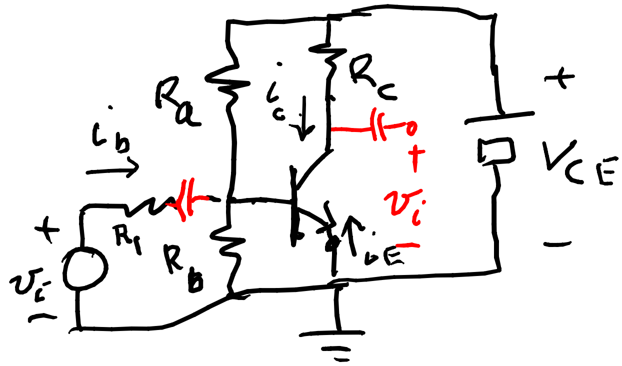
transfers small R_1 to larger R_2 gives voltage gain $v_2/v_1 = \alpha \frac{R_2}{R_1}$



voltage divider



back biases CB junction



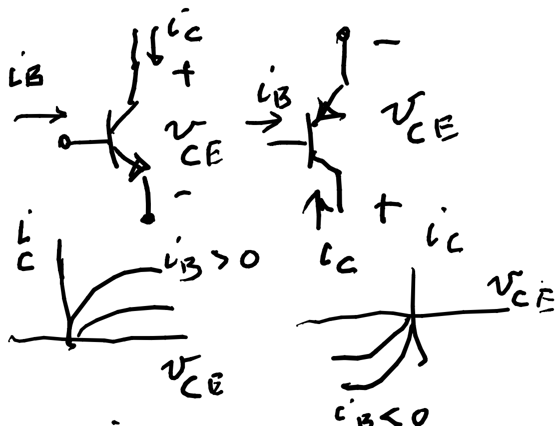
here inject i_b rather than i_E to get a large i_c

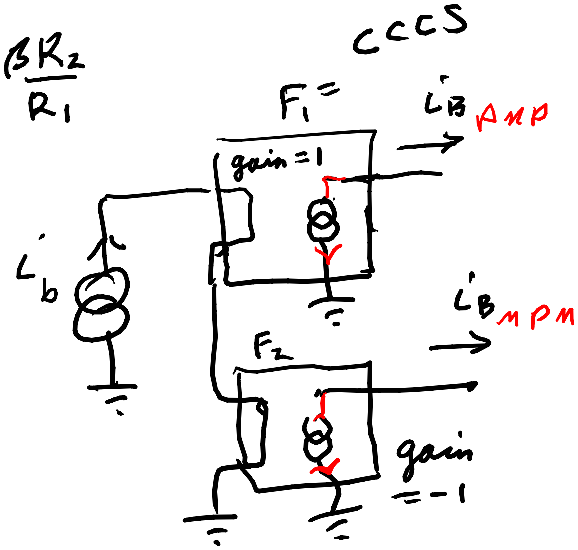
$$i_C + i_B + i_E = 0 \qquad i_B = -i_C - i_E = -i_C - \left(-\frac{1}{\alpha} i_C\right) = \frac{1-\alpha}{\alpha} \cdot i_C$$

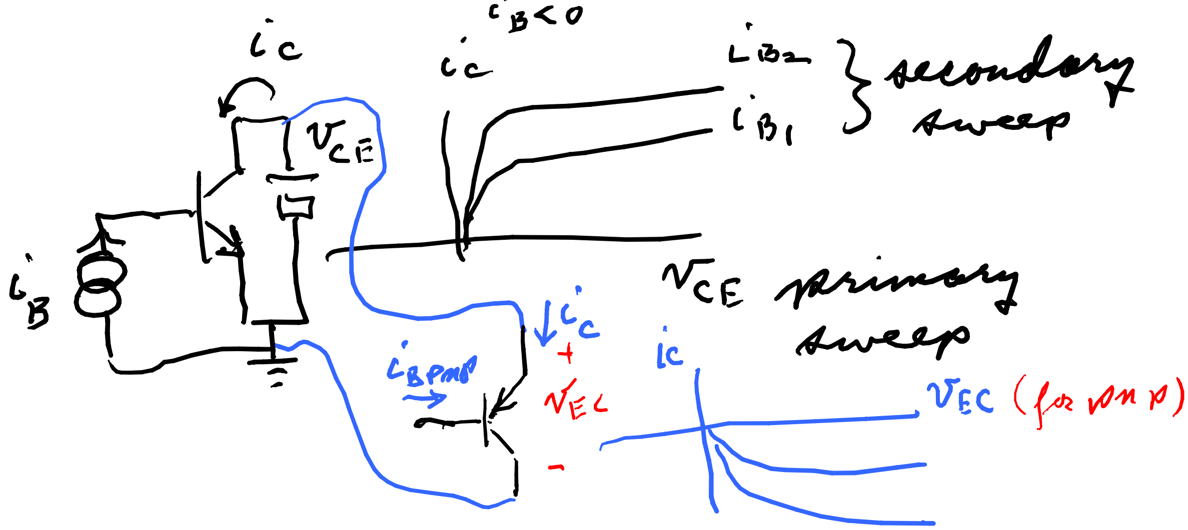
$$\Rightarrow i_C = \frac{\alpha}{1-\alpha} \cdot i_B = \beta \cdot i_B$$

$$\beta R_2 \cdot i_B = R_2 i_c = v_2 \qquad \Rightarrow \qquad \frac{v_2}{v_1} = \frac{\beta R_2}{R_1}$$

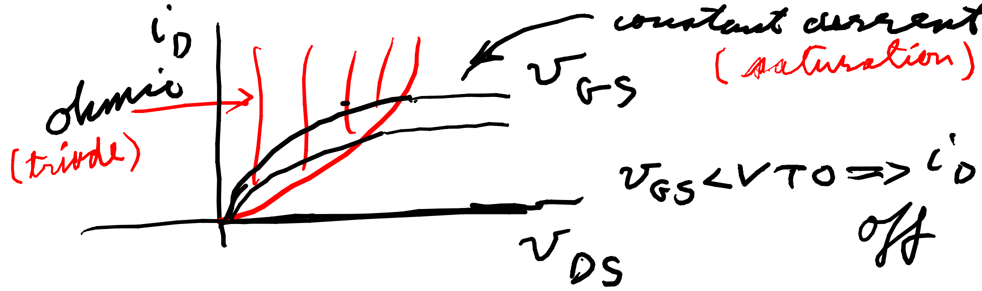
$$i_B = v_1 / R_1$$







NMOS



$v_{GS} < VTO \Rightarrow i_D = 0$

off