Effect of Reverse Bias B-C jn.

27/10/2014

Common Base

$$I_C = (\alpha I_E + I_{CBO})M \qquad M = \frac{1}{1-\left(\frac{V_{BC}}{V_{BR}}\right)^m}$$

$$= (\alpha I_E + I_{CBO}) \frac{1}{1-\left(\frac{V_{BC}}{V_{BR}}\right)^m}$$

$$\Rightarrow 1-\left(\frac{V_{BC}}{V_{BR}}\right)^m = \frac{\alpha I_E + I_{CBO}}{I_C}$$

$$1$$

$$V_{BC} \longrightarrow \simeq \left(1 - \frac{\alpha I_E + I_{CBO}}{I_C}\right)^{1/m} \cdot V_{BR}$$

When $I_E = 0$

$$-V_{CBO} \simeq V_{BR}$$

Common Emitter

$$I_C = (\alpha I_E + I_{CBO}) M \Rightarrow I_C = \frac{M \cdot I_{CBO}}{1 - \alpha M}$$

$I_B = 0 \Rightarrow I_C = I_E$

$\alpha < 1, \quad M > 1$

$$V_{BC} = \left(1 - \frac{\alpha(I_E) + I_{CBO}}{I_C}\right)^{1/m} V_{BR}$$

$$= \left(1 - \frac{\alpha\left(I_C + \overbrace{I_B}^{\to 0}\right)}{I_C} - \frac{I_{CBO}}{I_C}\right)^{1/m} \cdot V_{BR}$$

$$V_{BC} \simeq -V_{CE}$$

$$-V_{CEO} = \left(1 - \alpha\right)^{1/m} V_{BR}$$

$$= \frac{1}{(1+\beta)^{1/m}} V_{BR}$$

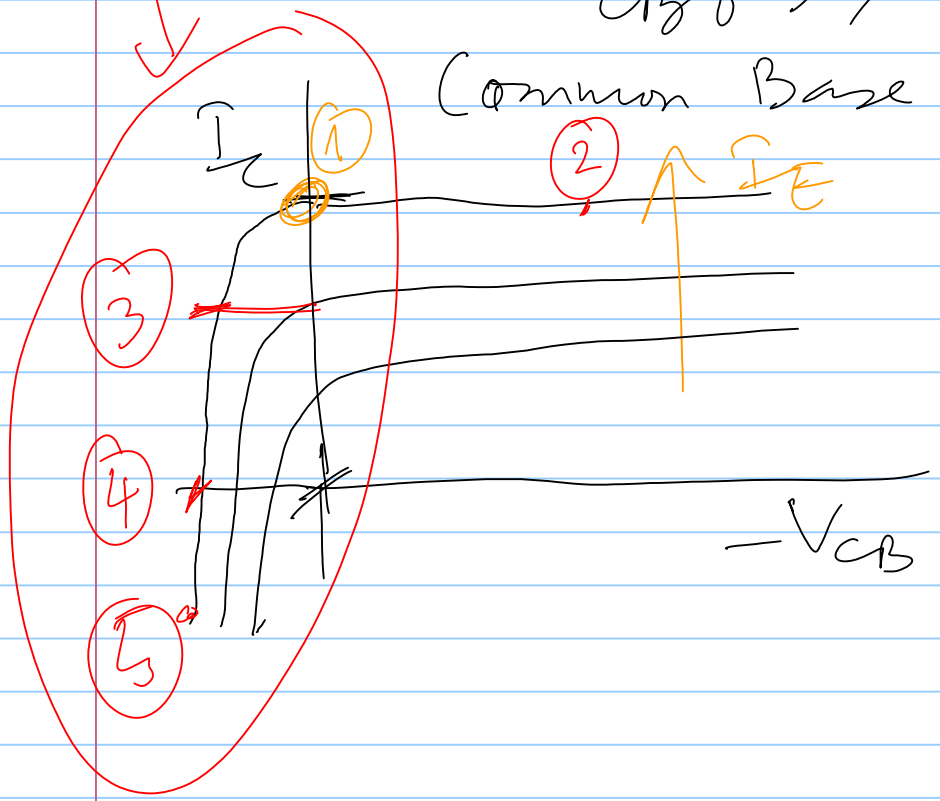
$$\beta = \frac{\alpha}{1-\alpha}$$

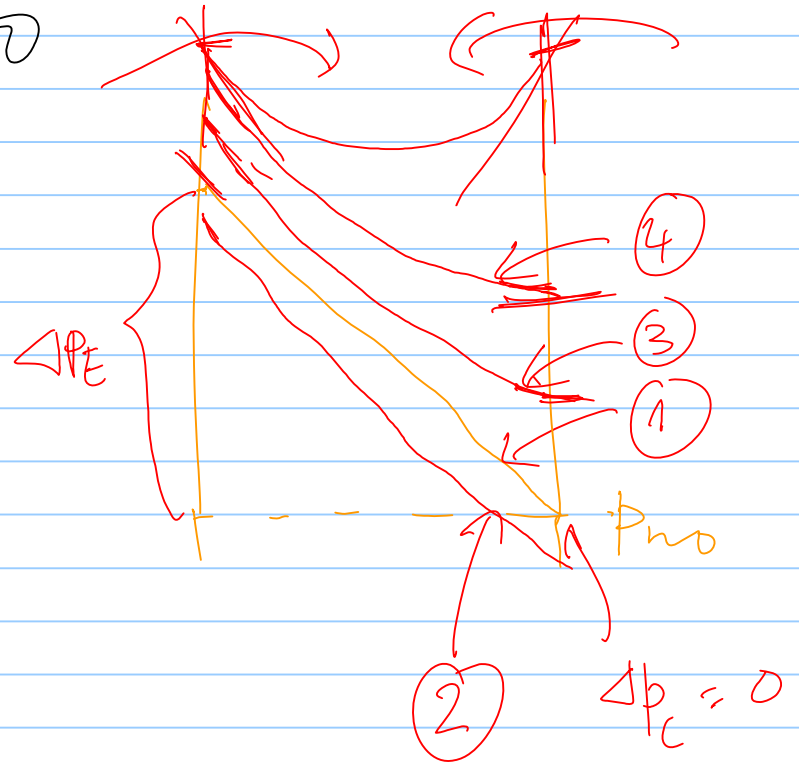
$$\alpha = \frac{\beta}{1+\beta}$$

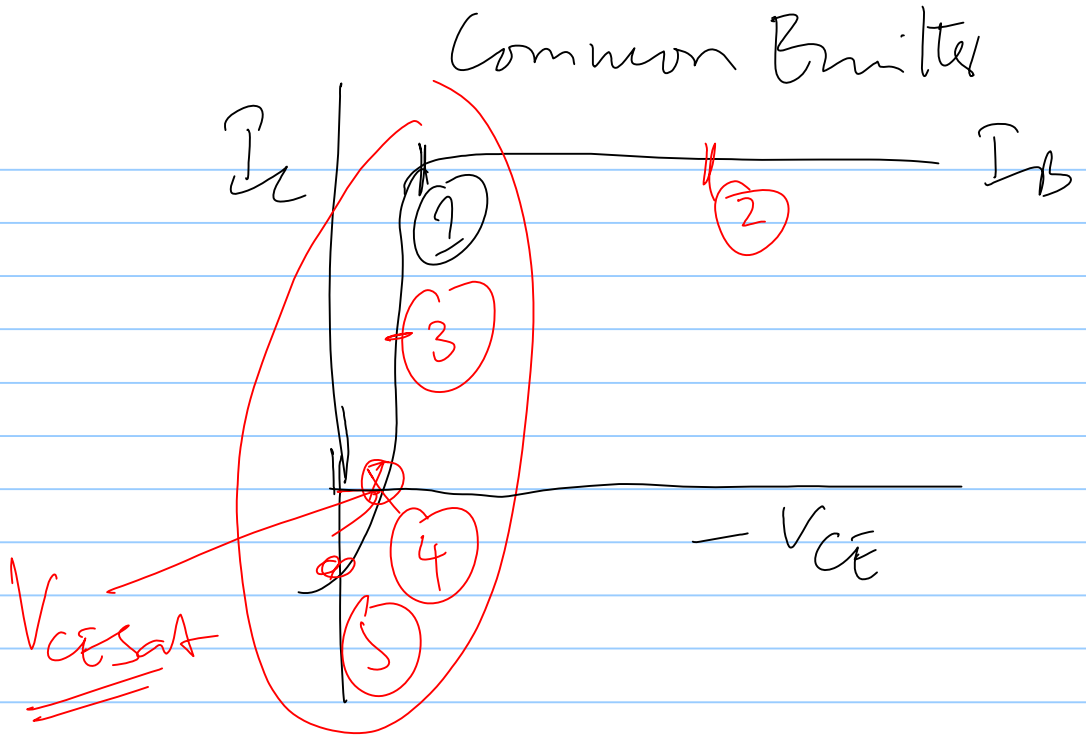
Saturation

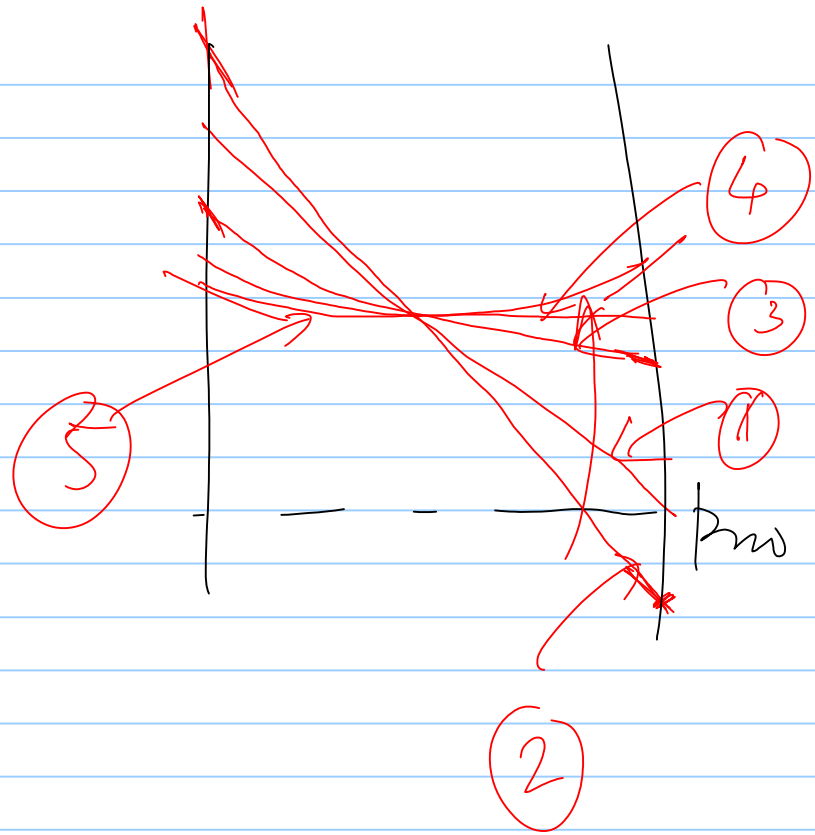
$-V_{CB0} >> -V_{CE0}$

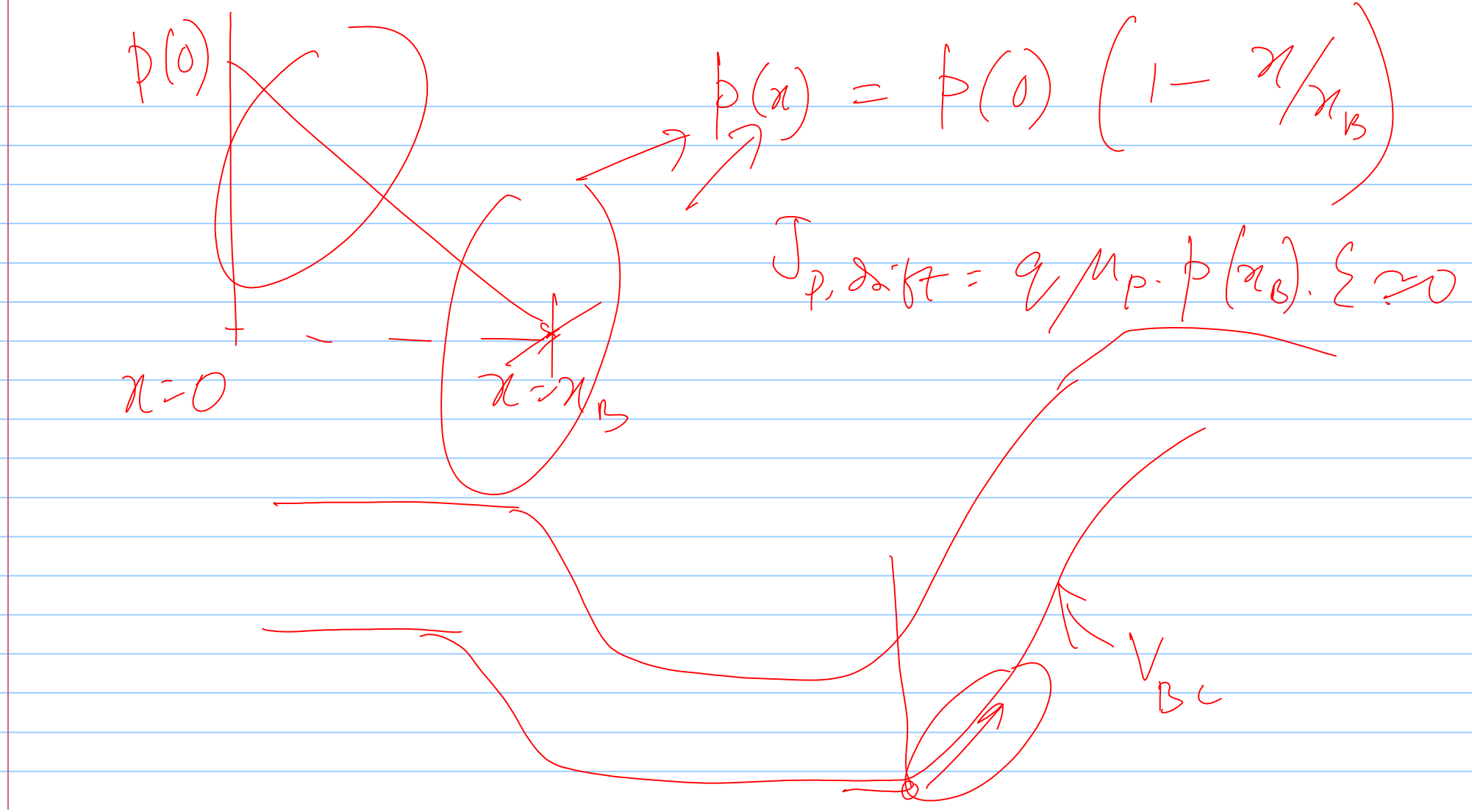
Common Base



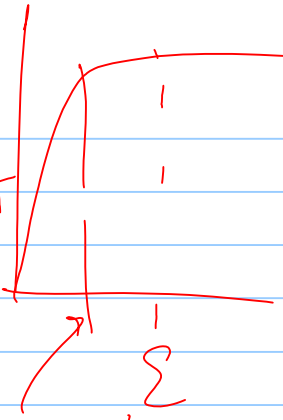



Common Emitter
I_C
I_B
$-V_{CE}$
$V_{CE(sat)}$
1
2
3
4
5


4
3
1
5
2


p(0)
p(x) = p(0) (1 − x/x_B)
J_p,drift = q/μ_p · p(x_B) · ξ ≈ 0
x = 0
x = x_B
V_BC

If $\mathcal{E}$ is high $\rightarrow v_{drift} = v_{sat}$



$J_C = \beta q v_{sat}$

$\Rightarrow \beta = \dfrac{J_C}{q v_{sat}}$

$\dfrac{I_C}{I_B} = \beta$