Biasing Technique

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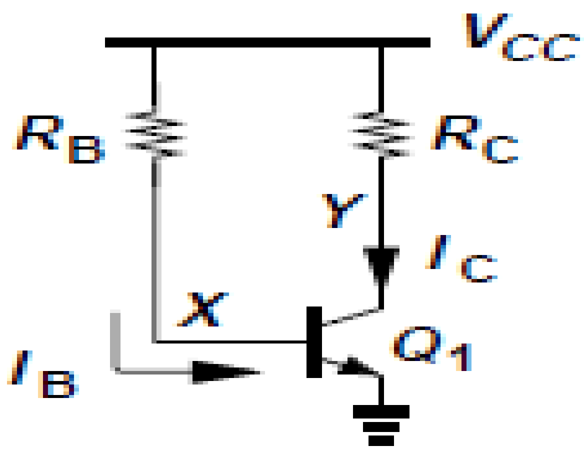
Simple Biasing



$$R_B I_B + V_{BE} = V_{CC}$$

$$I_B = \frac{V_{CC} - V_{BE}}{R_B}.$$

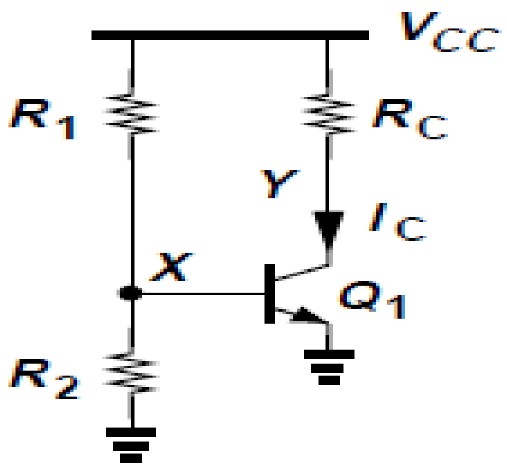
$$I_C = \beta \frac{V_{CC} - V_{BE}}{R_B},$$

$$V_{CE} = V_{CC} - R_C I_C$$
$$= V_{CC} - \beta \frac{V_{CC} - V_{BE}}{R_B} R_C.$$

$$V_{CC} - \beta \frac{V_{CC} - V_{BE}}{R_B} R_C > V_{BE}.$$

Ic is depend on B

Resistive Devider Biasing



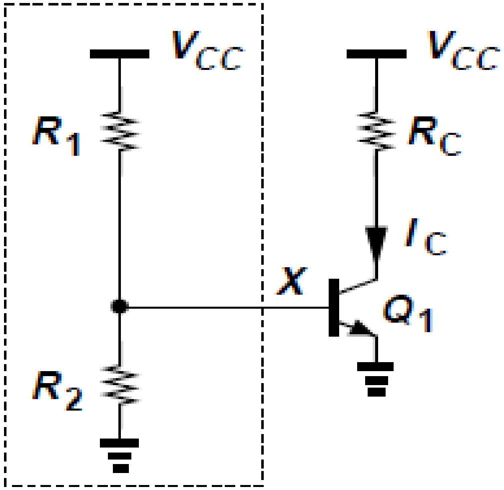
$$I_c = I_s \exp\left(\frac{V_{BE}}{V_T}\right)$$

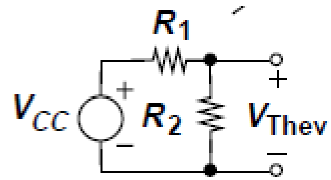
$$V_X = \frac{R_2}{R_1 + R_2} V_{CC},$$

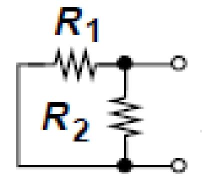
(Base-emitter Voltage)

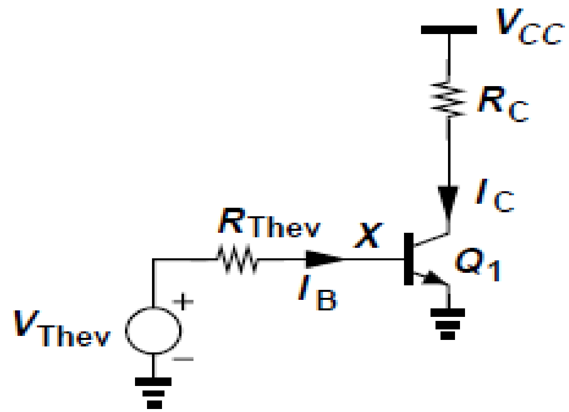
$$I_C = I_S \exp\left(\frac{R_2}{R_1 + R_2} \cdot \frac{V_{CC}}{V_T}\right),$$

(when the base current is negligible)









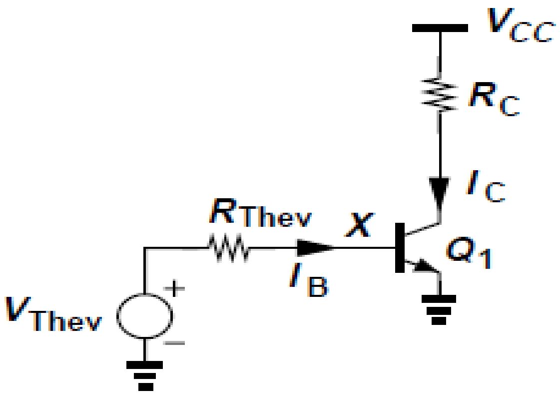
$$V_{Thev} = \frac{R_2}{R_1 + R_2} V_{CC}.$$

$$R_{Thev} = R_1 || R_2.$$

$$V_X = V_{Thev} - I_B R_{Thev}$$

$$I_C = I_S \exp \frac{V_{Thev} - I_B R_{Thev}}{V_T}.$$

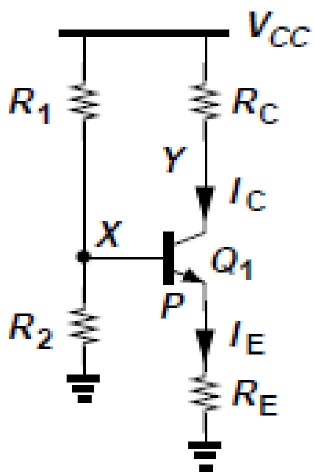
$$I_B = \left(V_{Thev} - V_T \ln \frac{I_C}{I_S} \right) \cdot \frac{1}{R_{Thev}},$$

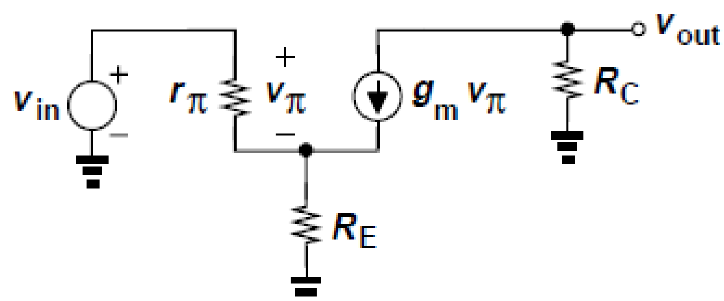


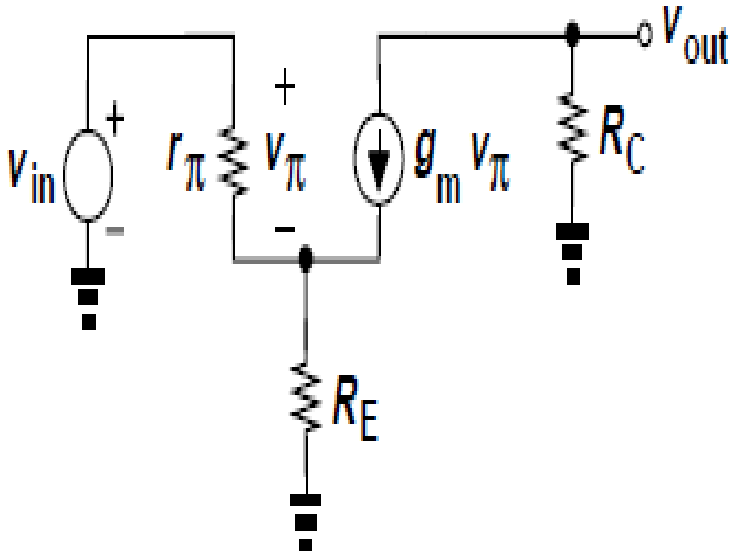
V_{CC} increase 5% V_{BE} increase 5%

V_{BE} = 800 mv ΔV_{BE} = 40 mv

$$I_c \text{ increase } \exp\frac{40mV}{26mV} = 4.65$$







$$V_{IN} = V_\pi + V_E$$

$$\frac{V_{IN} - V_{RE}}{r_\pi} + g_m V_\pi = \frac{V_E}{R_E}$$

$$\frac{V_E}{V_{IN}} = \frac{R_E}{\frac{1}{g_m} + R_E}$$

$$V_E \approx V_{IN} \left(\frac{1}{g_m} \ll R_E \right)$$

Thank you