Various BJT
Bias Configurations (H.19)

20170601

References

Based

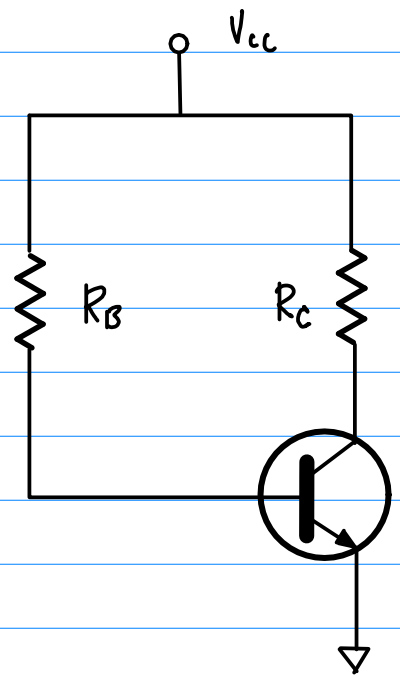
[1] Floyd, Electronic Devices 7th ed
[2] Cook,

[2] en.wikipedia.org

Robert Boylestad & Louis Nashelsky

Electronic Devices and Circuit Theory (10th ed)

Fixed Bias (Base Bias)



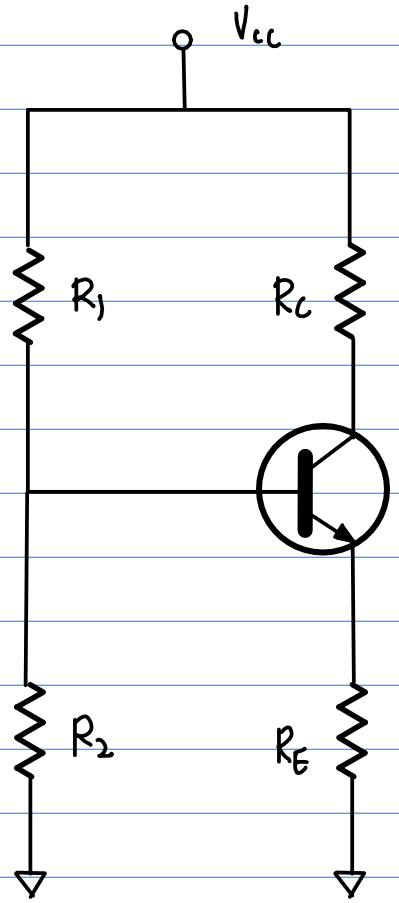
$$I_B = \frac{V_{CC} - V_{BE}}{R_B}$$

$$I_C = \beta I_B$$

$$I_E = (\beta + 1) I_B$$

$$V_{CE} = V_{CC} - I_C R_C$$

Voltage Divider Bias



Approximate: $\beta R_E \geq R_2$

$$V_B = \frac{R_2}{R_1 + R_2} V_{cc}$$

$$V_E = V_B - V_{BE}$$

$$I_E = \frac{V_E}{R_E}$$

$$I_B = \frac{I_E}{(\beta + 1)}$$

$$V_{CE} = V_{cc} - I_c (R_c + R_E)$$

Exact: $R_{TH} = R_1 \| R_2$ $E_{TH} = \frac{R_2}{R_1 + R_2} V_{cc}$

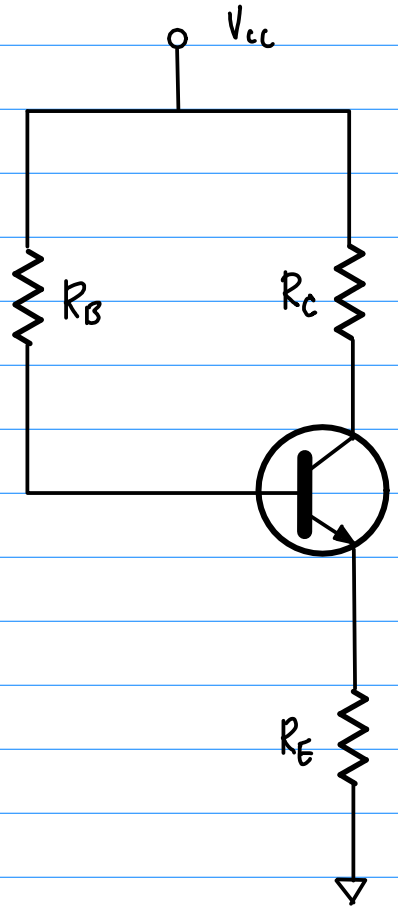
$$I_B = \frac{E_{TH} - V_{BE}}{R_{TH} + (\beta + 1) R_E}$$

$$I_C = \beta I_B$$

$$I_E = (\beta + 1) I_B$$

$$V_{CE} = V_{cc} - I_C (R_C + R_E)$$

Emitter Bias (Emitter Feedback Bias)



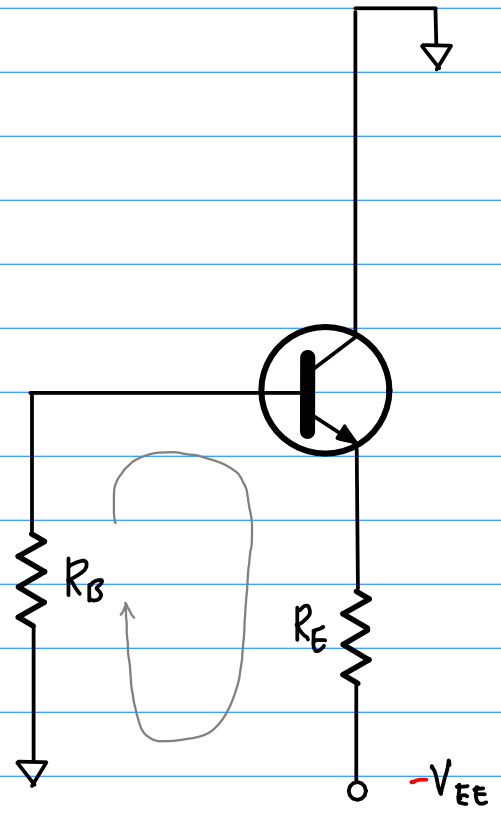
$$I_B = \frac{V_{cc} - V_{BE}}{R_B + (\beta+1) R_E}$$

$$I_c = \beta I_B$$

$$I_E = (\beta+1) I_B$$

$$V_{CE} = V_{cc} - I_c (R_c + R_E)$$

Emitter Follower



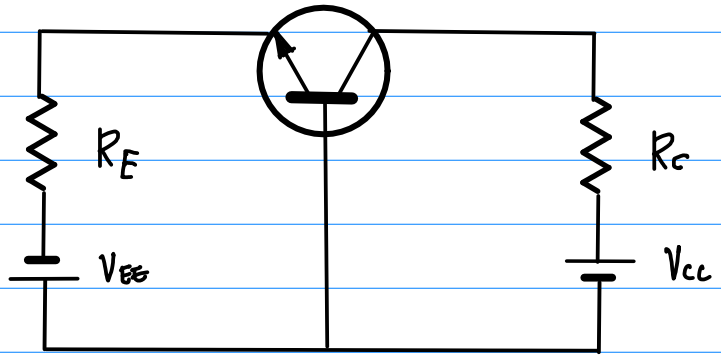
$$I_B = \frac{V_{EE} - V_{BE}}{R_B + (\beta+1) R_E}$$

$$I_C = \beta I_B$$

$$I_E = (\beta + 1) I_B$$

$$V_{CE} = V_{EE} - I_E R_E$$

Common Base



$$I_E = \frac{V_{EE} - V_{BE}}{R_E}$$

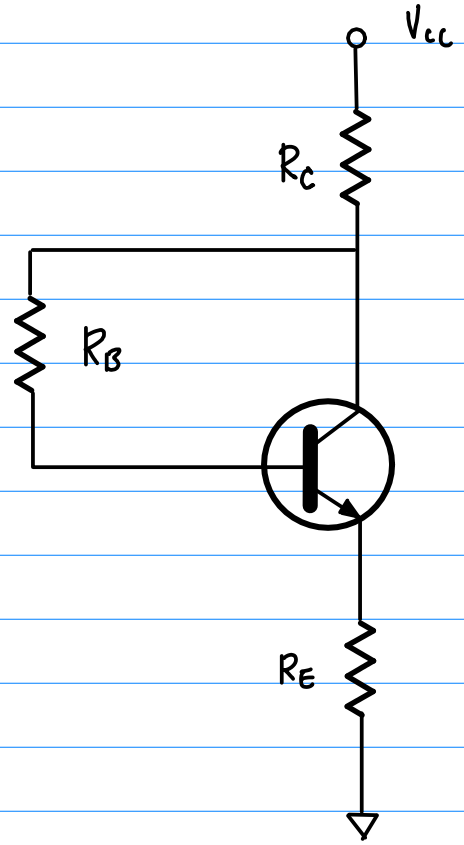
$$I_B = \frac{I_E}{\beta + 1}$$

$$I_C = \beta I_B$$

$$V_{CE} = V_{CC} + V_{EE} - I_E (R_C + R_E)$$

$$V_{CB} = V_{CC} - I_C R_C$$

Collector Feedback



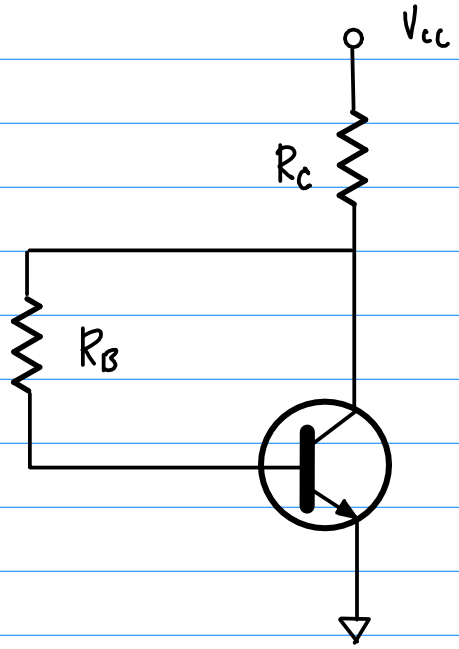
$$I_B = \frac{V_{CC} - V_{BE}}{R_B + \beta(R_C + R_E)}$$

$$I_C = \beta I_B$$

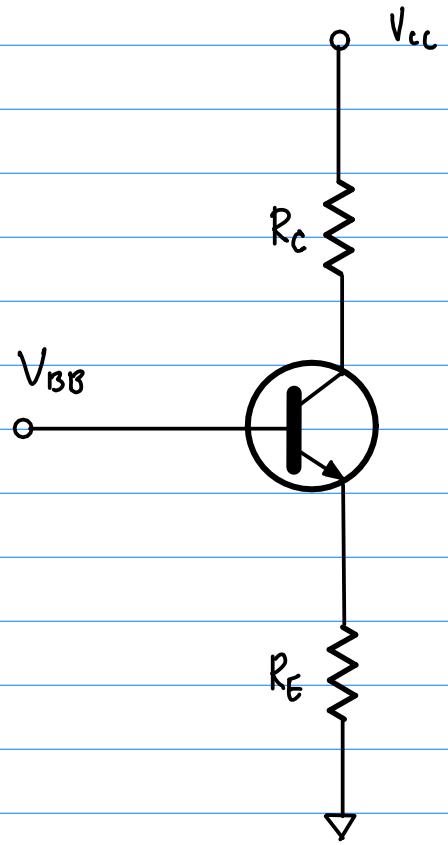
$$I_E = (\beta + 1) I_B$$

$$V_{CE} = V_{CC} - I_C(R_C + R_E)$$

Collector-Emitter Feedback



Emitter Bias



Two Supply Emitter Bias