

BJT Amplifier Common Collector Amp (H.12)

20170603

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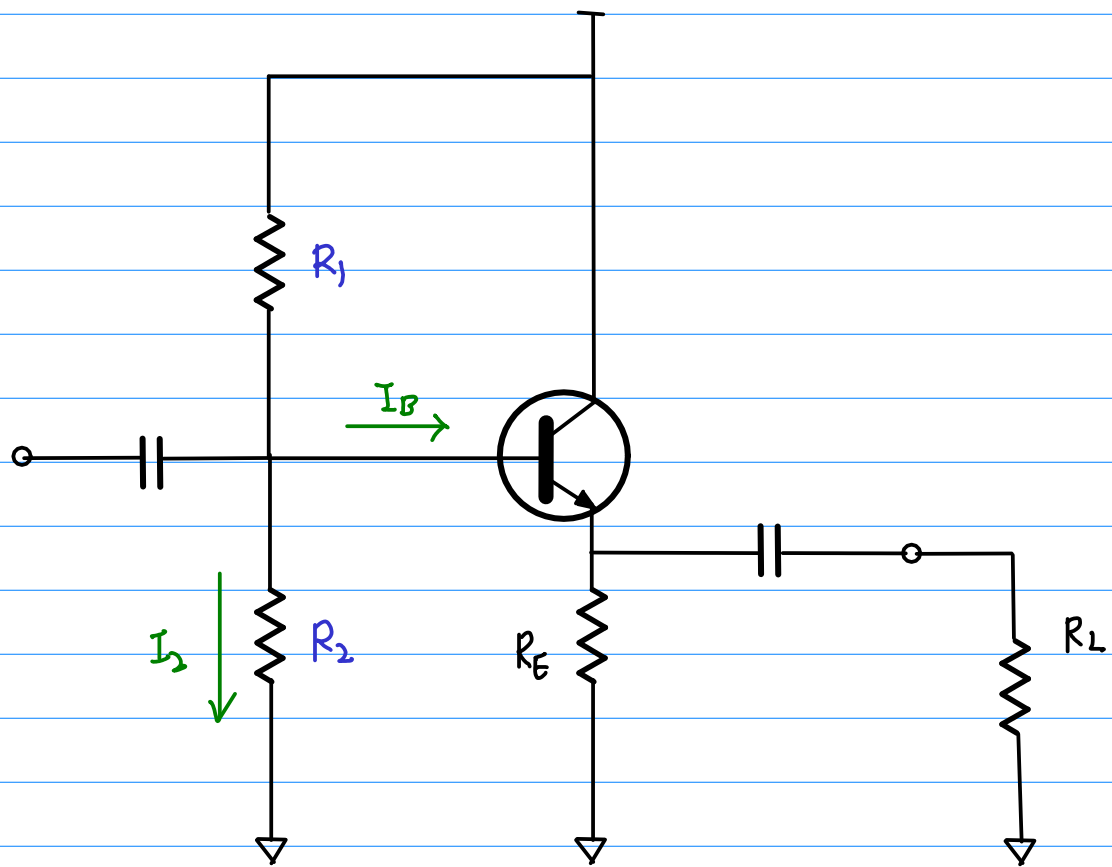
References

Based

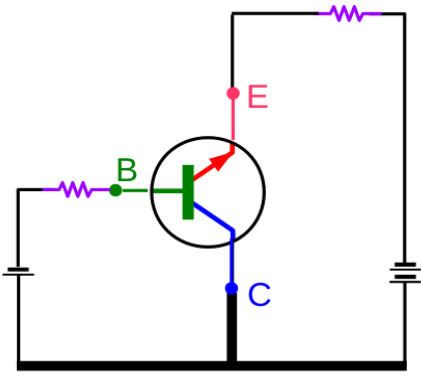
[1] Floyd, Electronic Devices 7th ed

[2] Cook,

[2] en.wikipedia.org

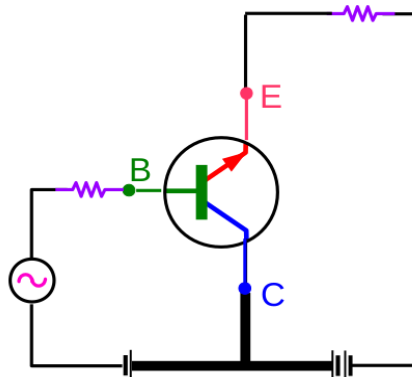


Common Collector Configuration



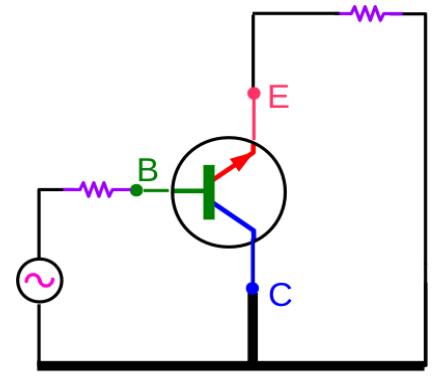
Common Collector

DC Bias



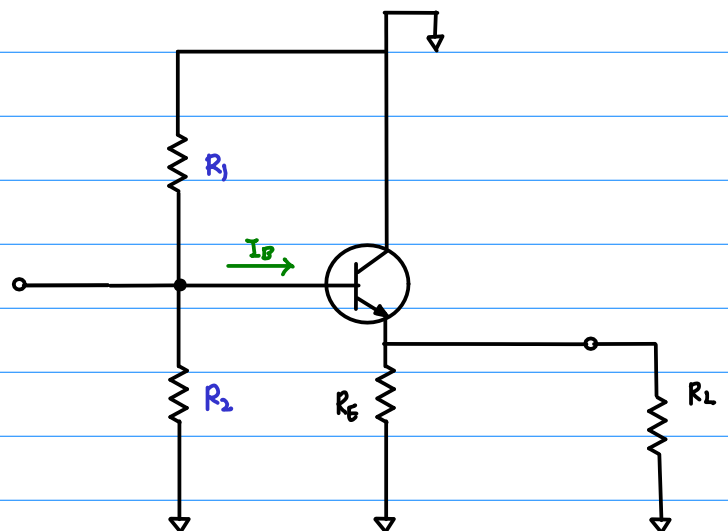
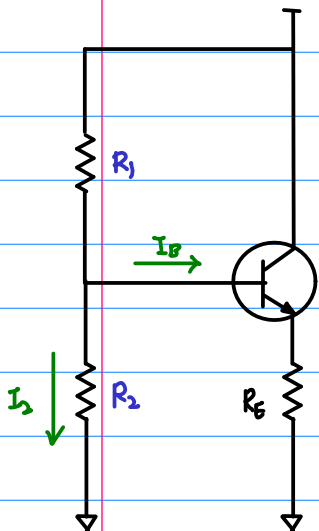
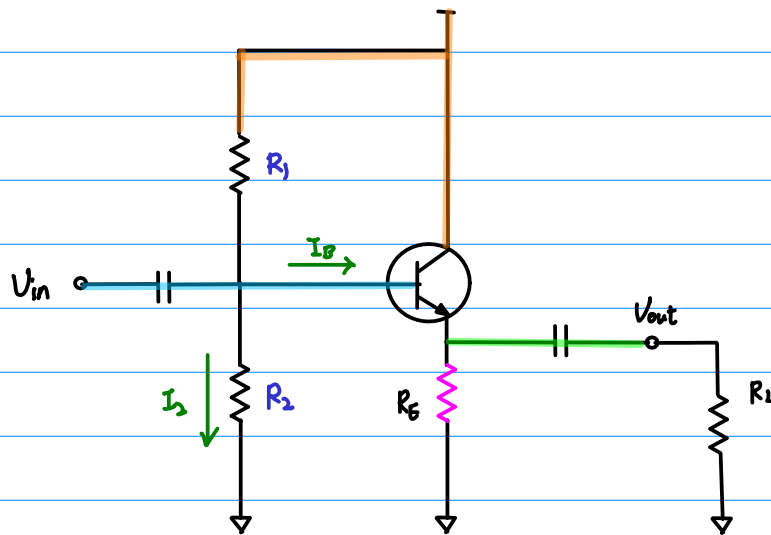
Common Collector

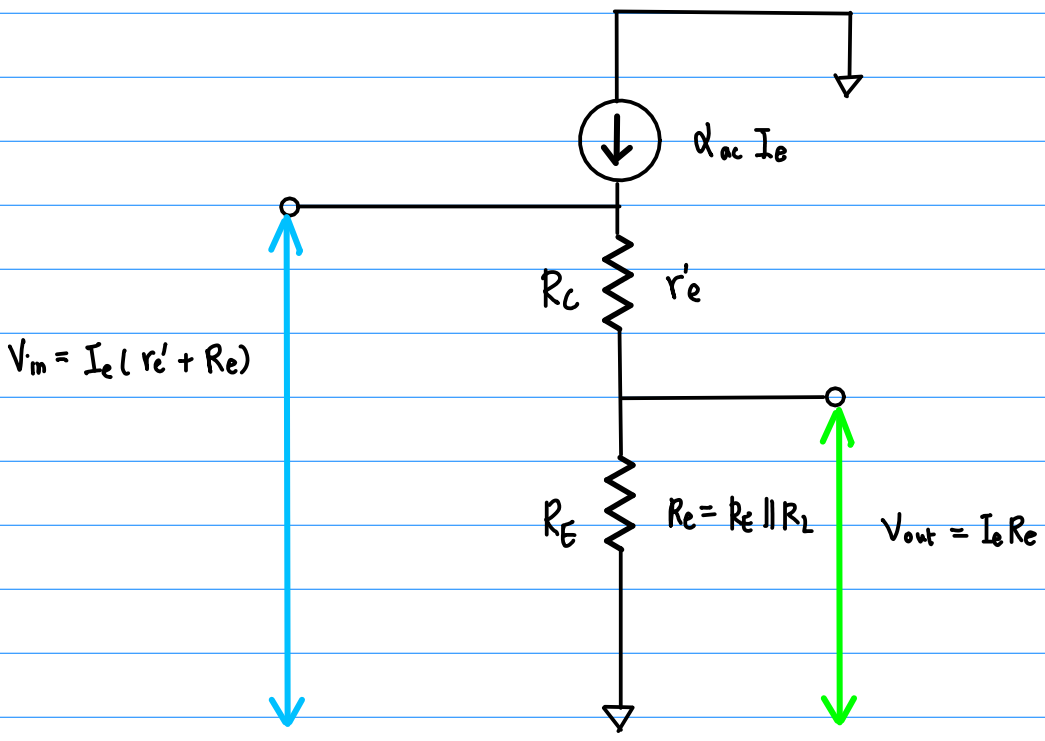
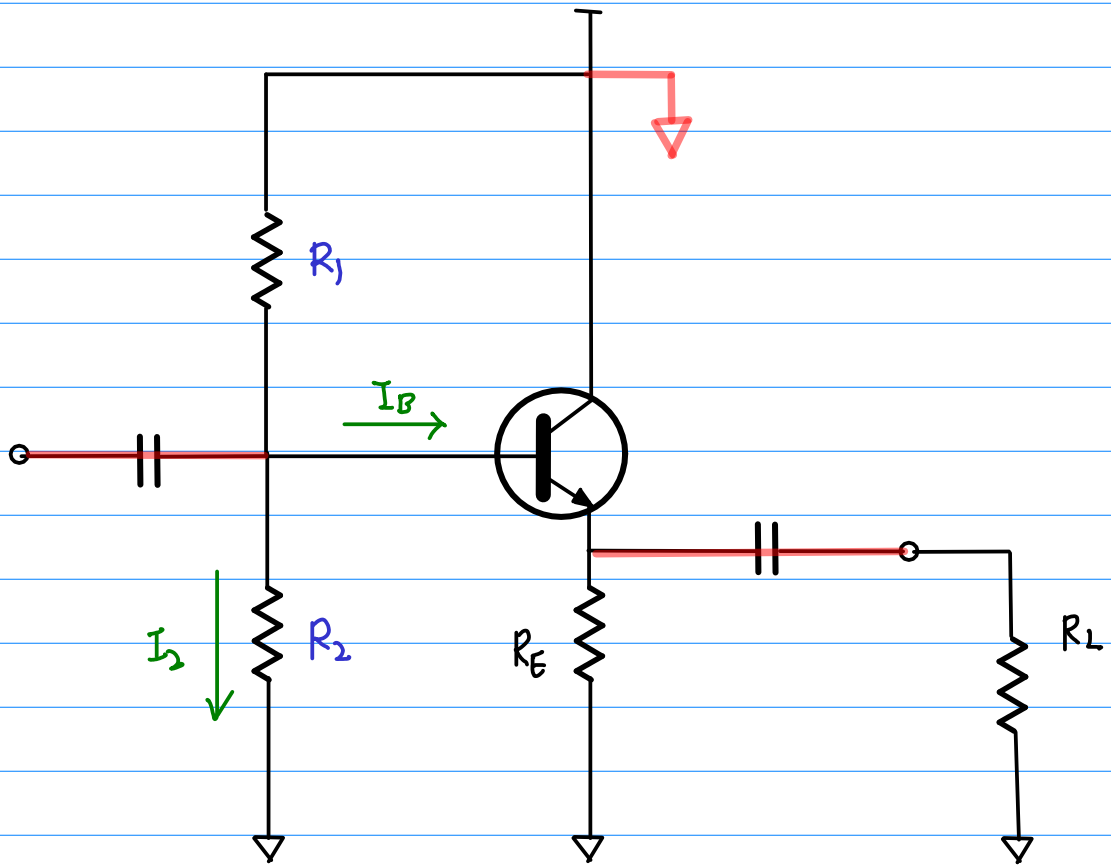
DC Bias + AC Signal



Common Collector

AC Signal





A_v

$$V_{out} = I_e R_e$$

$$V_{in} = I_e (r_e' + R_c)$$

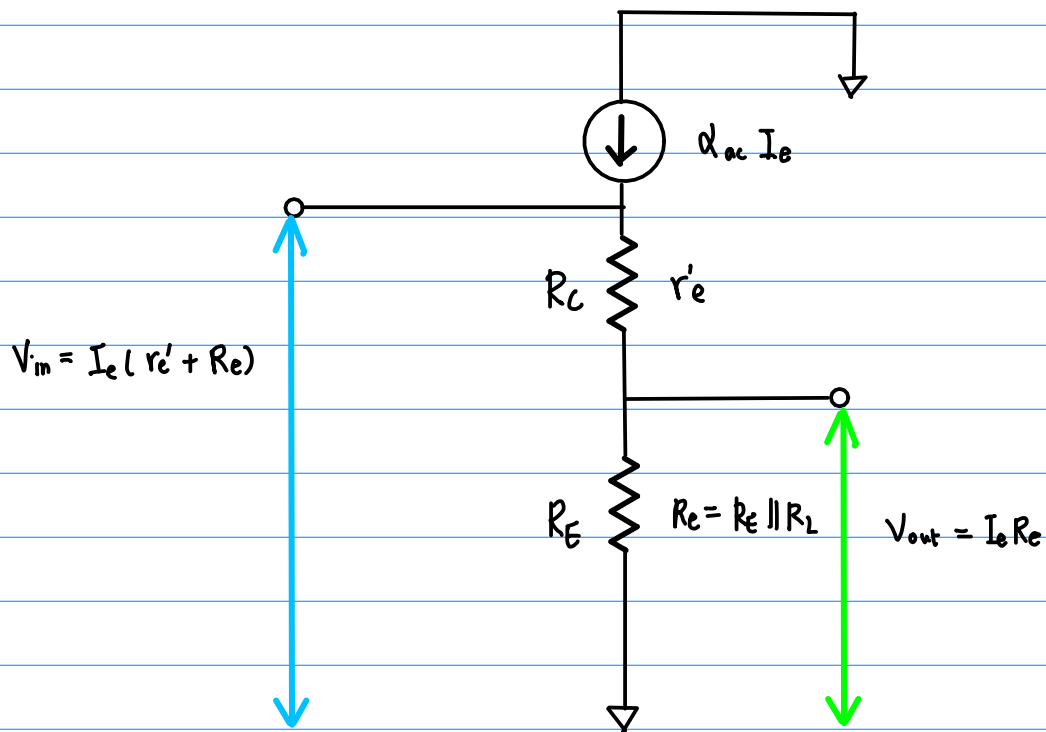
$$A_v = \frac{I_e R_e}{I_e (r_e' + R_c)} = \frac{R_e}{(r_e' + R_c)}$$

$$R_e = R_E \parallel R_L$$

$$R_e = R_E \quad \text{no load}$$

$A_v < 1$ always

if $R_c \gg r_e' \Rightarrow A_v = 1$



Z_i

$$R_{in(base)} = \frac{V_{in}}{I_{in}} = \frac{V_b}{I_b} = \frac{I_e(r_e' + R_e)}{I_b} = \frac{\beta I_b (r_e' + R_e)}{I_b}$$

$$R_{in(base)} = \beta (r_e' + R_e)$$

$$R_e \gg r_e'$$

$$R_{in(base)} = \beta R_e$$

$$R_{in(total)} = R_1 \parallel R_2 \parallel R_{in(base)} = R_1 \parallel R_2 \parallel \beta R_e$$

A_i

$$I_{in} = \frac{V_{in}}{R_{in(total)}}$$

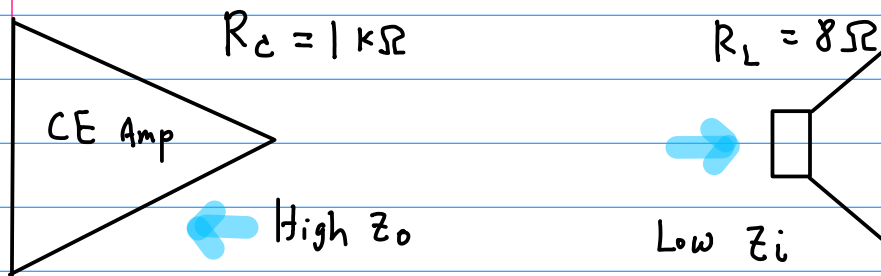
$$A_i = \frac{I_e}{I_{in}}$$

$$R_1, R_2 \gg R_{in(base)}$$

$$R_1 \parallel R_2 \gg \beta R_e$$

$$A_i = \frac{I_e}{I_{in}} = \beta$$

Driving Low Resistance Load



$$R_c = R_c \parallel R_L = 1000 \parallel 8 = 7.94 \Omega$$

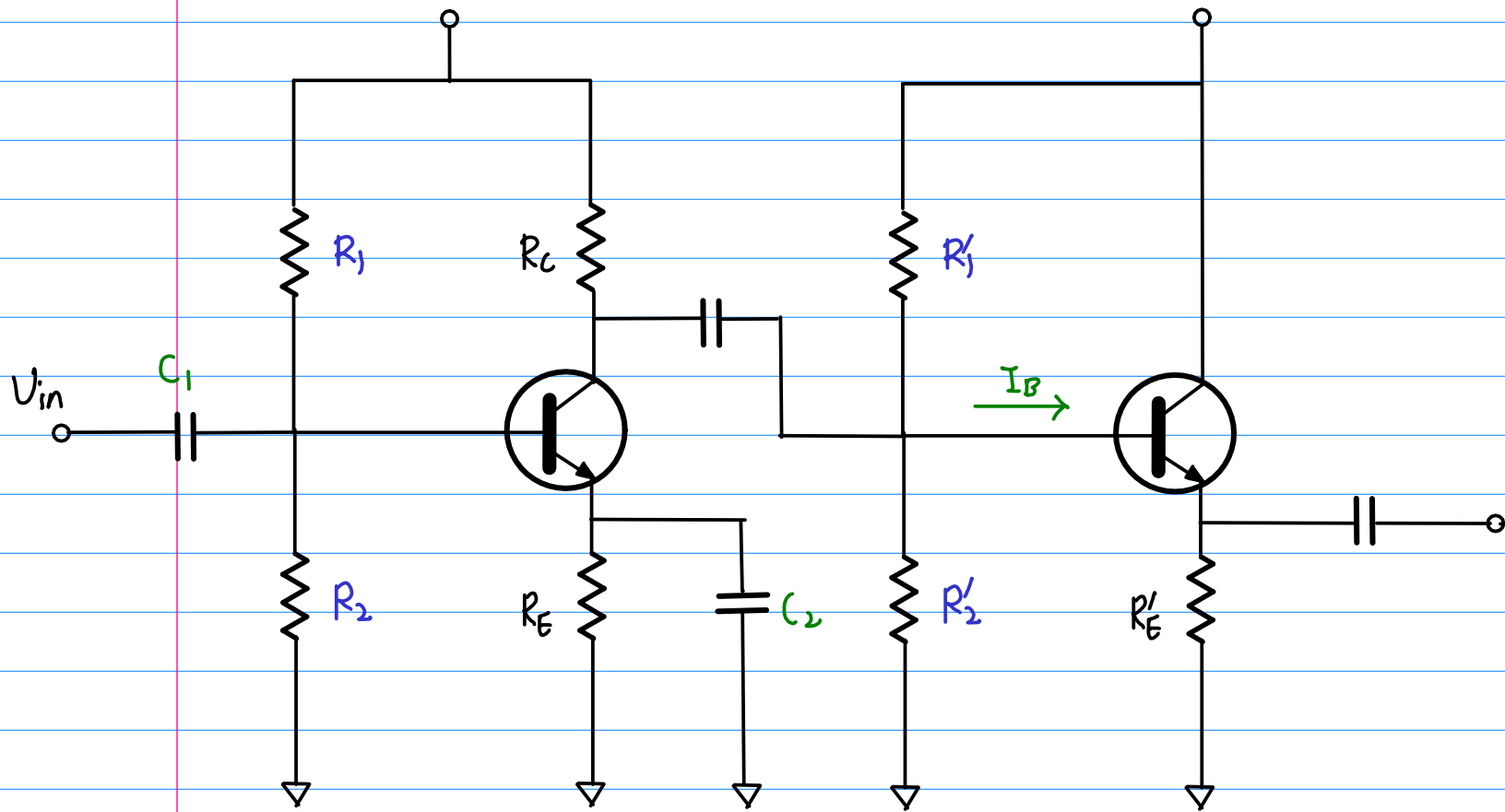
$$A_v = \frac{R_c}{r_{e'}} = \frac{1000}{5} = 200 \quad \text{without load}$$

$$A_v = \frac{R_c}{r_{e'}} = \frac{7.94}{5} = 1.59 \quad \text{with } 8 \Omega \text{ load}$$

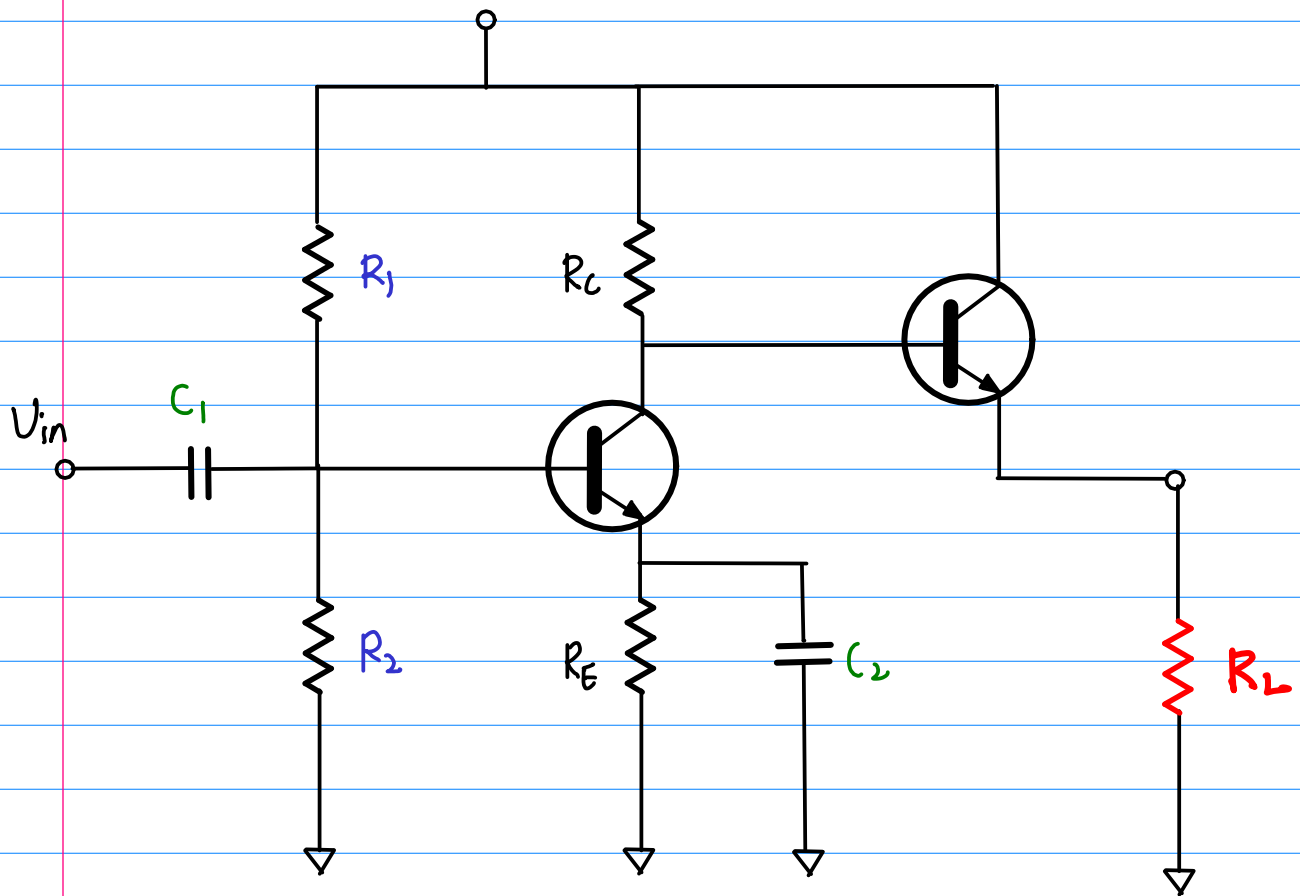
Darlington pair
interface (buffer)

high output resistance & low resistance load

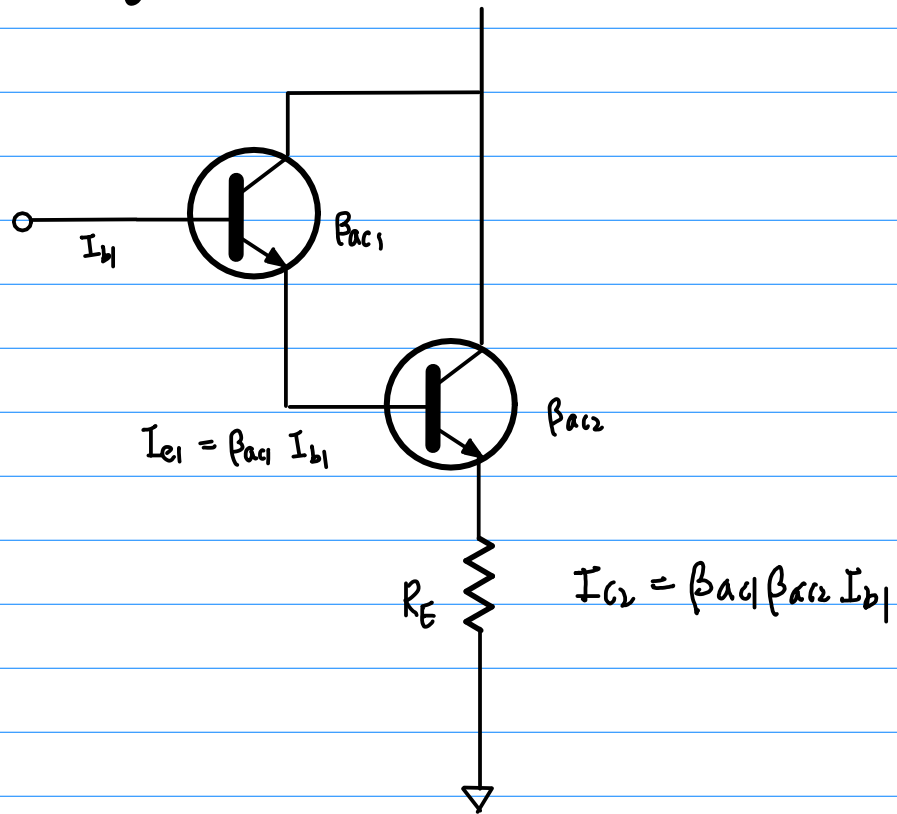
CE + CC



Direct Coupled Output Stage



The Darlington Pair



$$\beta_{ac} = \beta_{ac1} \cdot \beta_{ac2}$$

★ $R_{in} = \beta_{ac1} \beta_{ac2} R_E \rightarrow$ high input resistance