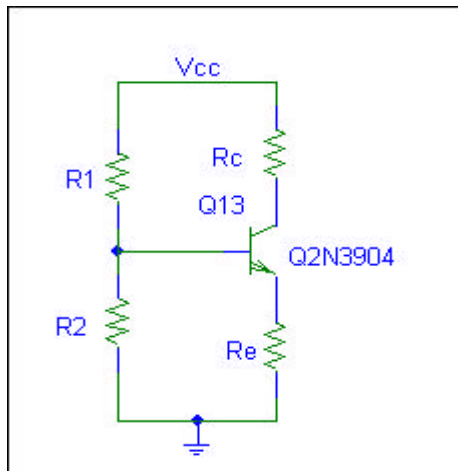


The easiest way to bias a npn BJT

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Entering these parameters for the BJT

$$h_{fe} := 150$$

$$I_c := 20 \text{ mA}$$

$$V_{ce} := 9 \text{ V}$$

$$R_4 := 50 \cdot \Omega$$

$$R_5 := 50 \cdot \Omega$$

$$V_{cc} := 12 \text{ V}$$

Assuming that

$$R_e := R_4 + R_5$$

Current (lost) going through Collector and Emitter is ignored, so $I_e := I_c$

$$\text{Voltage at R4 is: } V_e := I_e \cdot R_e \quad V_e = 2 \text{ V}$$

$$\text{Voltage drops accrossing } R_c \text{ is } V_{Rc} := V_{cc} - V_e - V_{ce}, \text{ so } R_c := \frac{V_{Rc}}{I_c}$$

$$R_c = 50 \Omega$$

Since the base voltage is 0.7 Volts higher than the emitter voltage, so base volatge is $V_b := V_e + 0.7 \cdot V$ $V_b = 2.7 \text{ V}$

$$\text{DC current gain is } h_{fe} = \frac{I_c}{I_b}, \text{ so } I_b := \frac{I_c}{h_{fe}} \quad I_b = 1.333 \cdot 10^{-4} \text{ A}$$

For biasing current going through R_1 and R_2 , we should select $I_{bias} := 10 \cdot I_b$ $I_{bias} = 1.333 \cdot 10^{-3} \text{ A}$

Voltage acrosses R_2 is V_b , and the current going through R_2 is I_{bias} , so

$$R_2 := \frac{V_b}{I_{bias}}$$

$$R_2 = 2.025 \cdot 10^3 \Omega$$

$$\text{Voltage drops through } R_1 \text{ is } V_{R1} := V_{cc} - V_b \quad V_{R1} = 9.3 \text{ V}$$

$$\text{The total current going through } R_2 \text{ is } I_{R1} := I_{bias} + I_b \quad I_{R1} = 1.467 \cdot 10^{-3} \text{ A}$$

$$\text{The value of resistor } R_1 := \frac{V_{R1}}{I_{R1}}$$

$$R_1 = 6.341 \cdot 10^3 \Omega$$

$$\text{Gain} := \frac{R_c}{R_e}$$

$$\text{Gain} = 0.5$$

$$\text{Gain}_{db} := 20 \cdot \log\left(\frac{R_c}{R_e}\right)$$

$$\text{Gain}_{db} = -6.021$$