eletronica_basica_exerc

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October 2021

1 Equaçoes

$$I_E = I_B + I_C$$
$$\beta = \frac{I_C}{I_B}$$
$$I_C = \beta \times I_B$$
$$I_E = I_B + \beta I_B$$
$$I_E = (\beta + 1) \times I_B$$
$$V_{BE} = V_B = 0.7V$$

1.1 Base Emissor

$$V_{CC} - I_B \times R_B - V_{BE} = 0$$
$$I_B = \frac{V_{CC} - V_{BE}}{R_B}$$

1.2 Coletor Emissor

$$I_C = \beta \times I_B$$
$$V_{CE} + I_C \times R_C - V_{CC} = 0$$
$$V_{CE} = V_C = V_{CC} - I_C \times R_C$$
$$V_{BC} = V_B - V_C$$

1.3 Região de Operação

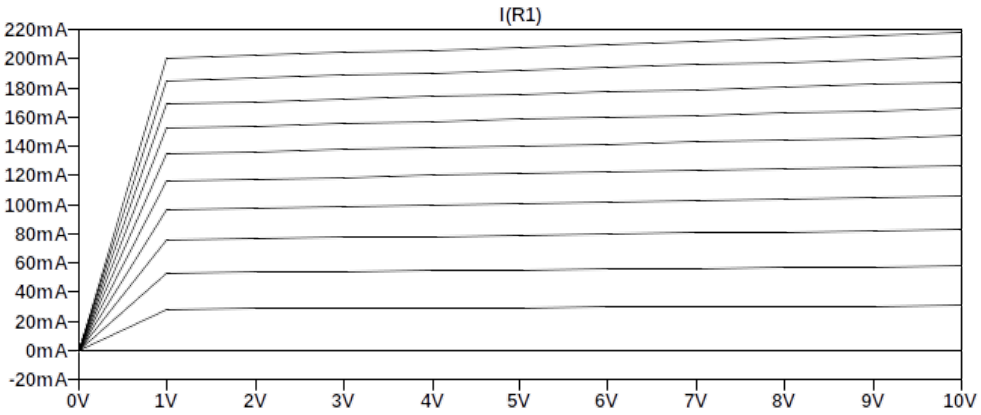


Figure 1: Eixo $Y = I_C$, eixo $X = V_{CE}$, I_B gera uma das linhas, encontrar a intecessão entre os pontos I_C e V_{CC} com a linha I_B

Para $V_{CE=0}$

$$I_C = \frac{V_{CC_{ColletorEmissor}}}{R_C}$$

Para $I_C = 0$

$$V_{CC} = V_{CE}$$

2 Primeiro Circuito

2.1 Constantes

$$V_{BE} = V_B = 0.7V$$
$$R_B = 470k$$
$$R_C = 2.7k$$
$$\beta = 90$$
$$V_{CC} = 16V$$

2.2 Base Emissor

$$I_B = \frac{V_{CC} - V_{BE}}{R_B} = \frac{16 - 0.7}{470 \times 1000} = 3.25 \times 10^{-5} = 32.5\mu A$$

2.3 Coletor Emissor

$$I_C = \beta \times I_B = 90 \times 32.5\mu A = 2925.0\mu A = 2.92mA$$

$$V_{CE} = V_C = V_{CC} - I_C \times R_C = 16 - \left(\frac{2.92}{1000}\right) \times (2.7 \times 1000) = 8.116V$$

$$V_{BC} = V_B - V_C = V_{BE} - V_{CE} = 0.7 - 8.116 = -7.416V$$

3 Segundo Circuito

3.1 Constantes

$$V_{CC} = 12V$$
$$I_C = 2mA = 0.002A$$
$$V_C = V_{CE} = 7.6V$$
$$V_E = V_{BE} = 2.4V$$
$$V_{BE} = V_B = 0.7V$$
$$B = 50$$

3.2 O que da pra calcular

3.2.1 R_C

$$V_{CE} = V_C = V_{CC} - I_C \times R_C$$
$$7.6 = 12 - 0.002 \times R_C$$
$$R_C = -\frac{V_C - V_{CC}}{I_C} = -\frac{7.6 - 12}{0.002} = 2200\Omega$$

3.2.2 I_B

$$I_C = \beta \times I_B$$
$$I_B = \frac{I_C}{\beta} = \frac{0.002}{50} = 4 \times 10^{-5} = 40\mu A$$

3.2.3 R_B

$$V_{CC} - I_B \times R_B - V_{BE} = 0$$
$$R_B = \frac{V_{CC} - V_{BE}}{I_B} = \frac{12 - 0.7}{40 \times 10^{-6}} = 282500\Omega = 282.5k\Omega$$

3.2.4 I_E

$$I_E = I_B + I_C = 4 \times 10^{-5} + 0.002 = 0.00204A$$

3.2.5 R_C

$$R_C = \frac{V_E}{I_E} = \frac{2.4}{0.00204} = 1176.47\Omega$$

4 Terceiro Circuito

4.1 Constantes

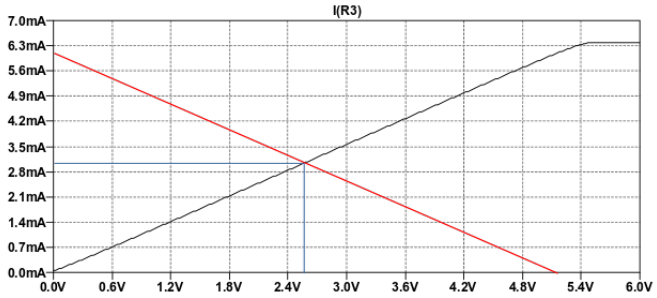
$$V_{CC_{coletor}} = 5V$$
$$V_{CC_{base}} = V_I = 5V|3V|0V$$
$$R_C = 820\Omega$$
$$R_B = 68k\Omega$$
$$\beta = 100$$
$$V_{BE} = V_B = 0.7V$$

4.2 $V_I = 5V$

$$I_B = \frac{V_{CC} - V_{BE}}{R_B} = \frac{5 - 0.7}{68 \times 1000} = 6.32 \times 10^{-5} = 63.23\mu A$$

$$I_C = \frac{V_{CC_{ColletorEmissor}}}{R_C} = \frac{5}{820} = 0.0061A = 6.1mA$$

$$V_{CC} = V_{CE} = 5V$$



Reta de carga para esse transistor (aproximado)

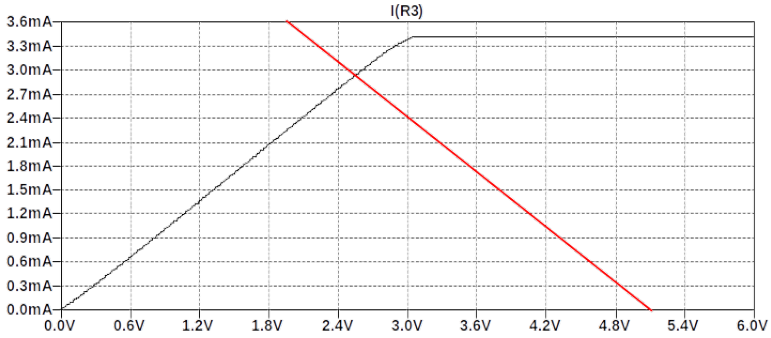
$$I_Q \approx 3mA$$
$$V_Q \approx 2.5V$$

4.3 $V_I = 3V$

$$I_B = \frac{V_{CC} - V_{BE}}{R_B} = \frac{3 - 0.7}{68 \times 1000} = 3.38 \times 10^{-5} = 33.82\mu A$$

$$I_C = \frac{V_{CC_{ColletorEmissor}}}{R_C} = \frac{5}{820} = 0.0061A = 6.1mA$$

$$V_{CC} = V_{CE} = 5V$$



Reta de carga para esse transistor (aproximado)

$$I_Q \approx 2.8mA$$

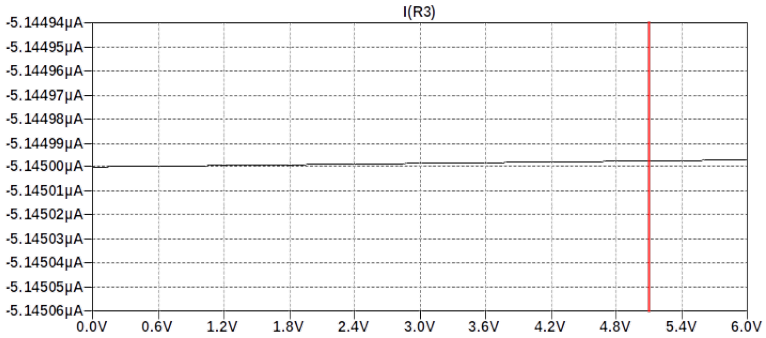
$$V_Q \approx 2.5V$$

4.4 $V_I = 0V$

$$I_B = \frac{V_{CC} - V_{BE}}{R_B} = \frac{0 - 0.7}{68 \times 1000} = -1.029 \times 10^{-5} = -10.29\mu A$$

$$I_C = \frac{V_{CC_{ColletorEmissor}}}{R_C} = \frac{5}{820} = 0.0061A = 6.1mA$$

$$V_{CC} = V_{CE} = 5V$$



Reta de carga para esse transistor (aproximado)

$$I_Q \approx -5.1499\mu A$$

$$V_Q \approx 5V$$