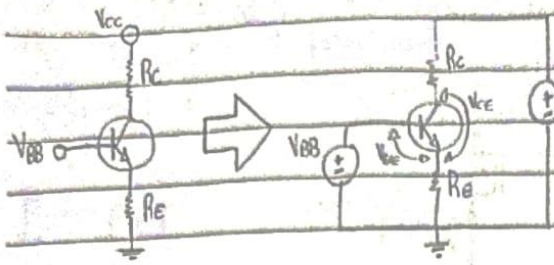
Daniel Augusto Müller

1) $V_{CC} = 12V$, $V_{BB} = 3,3V$, $R_C = 1,8k\Omega$, $R_E = 1,2k\Omega$, $\beta = 100$



$-V_{BB} + V_{BE} + R_E \cdot i_E = 0$

$i_E = (1+\beta) i_B$

$i_B = \frac{V_{BB} - V_{BE}}{R_E(1+\beta)}$ $\quad i_B = 21,45\mu A$

$i_E = 2,166mA$

$i_C = \beta \cdot i_B$

$i_C = 2,145mA$

$-V_{CC} + R_C \cdot i_C + V_{CE} + R_E \cdot i_E = 0$

$V_{CE} = V_{CC} - R_C i_C - R_E i_E$

$V_{CE} = 5,54V$

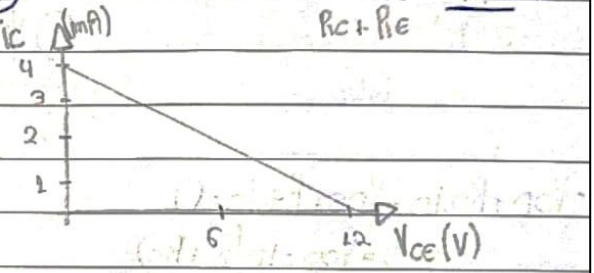
$V_C = V_{CC} - R_C \cdot i_C$ $\quad V_C = 8,139V$

$V_E = R_E \cdot i_E$ $\quad V_E = 2,599V$

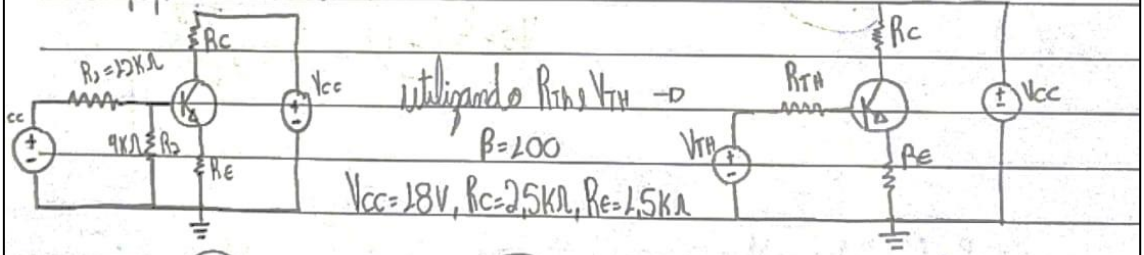
$V_{CE(corte)} = 12V$

$i_{C(SAT)} = \frac{V_{CC}}{R_C + R_E} = 4mA$

2)



Simplificando o circuito:



$R_{TH} = \frac{R_1 \cdot R_2}{R_1 + R_2} = 3k\Omega$ $\quad V_{TH} = \frac{V_{CC} \cdot R_2}{R_1 + R_2} = 4,5V$

$-V_{TH} + R_{TH} i_B + V_{BE} + R_E(\beta+1) i_B = 0$

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

$i_B = 24,595\mu A$

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$i_B = 24{,}595\,\mu A$

$i_C = 2{,}46\,mA$

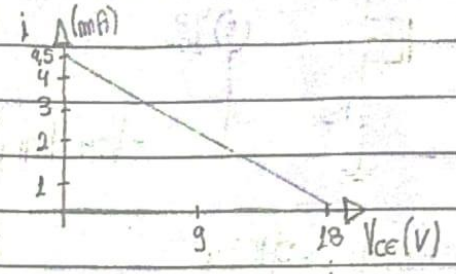
$i_E = 2{,}48\,mA$

$-V_{CC} + R_C.i_C + V_{CE} + R_E.i_E = 0$

$V_{CE} = V_{CC} - R_C.i_C + R_E.i_E$

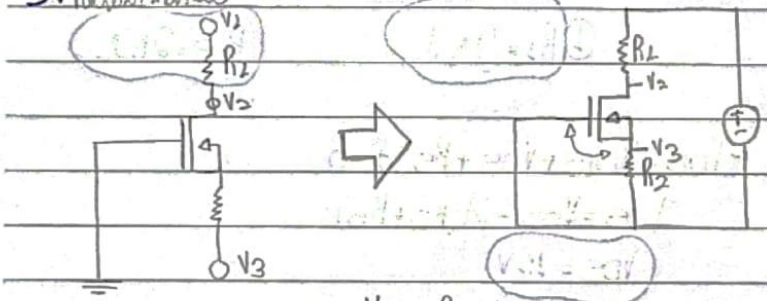
$V_{CE} = 1{,}82\,V$

$V_{CE(corte)} = 18\,V$



$i_{C(SAT)} = \frac{V_{CC}}{R_C + R_E} = 4{,}5\,mA$

3) Redesenhando



$V_1 = 14V$

$R_1 = 2{,}2K\Omega$

$R_2 = 1{,}2K\Omega$

$i_{dss} = 6mA$

$V_p = -6V$

$V_{GS} + R_2.i_d = 0$

$V_{GS} = 1{,}2K\,i_d$ $\quad V_{GS} = 1{,}2K \cdot 2{,}17m = -2{,}387V$

$i_d = i_{dss}\left(1 - \frac{V_{GS}}{V_p}\right)^2$ $\quad i_d = 6m\left(1 - \frac{1{,}2K\,i_d}{+6}\right)^2 = 6m\left(1 - \frac{2{,}2K\,i_d}{6} + \frac{(1{,}2K\,i_d)^2}{6^2}\right)$

$i_d = 6m - 2{,}2i_d + 201{,}667 + i_d^2$

$201{,}667\,i_d^2 - 3{,}2i_d + 6m = 0$ $\quad i_d' = 13{,}7mA$

$i_d'' = 2{,}17mA$ ← utilizar o menor

$V_2 + R_1.i_d - V_1 = 0$

$V_2 = V_1 - R_1.i_d$ $\quad V_2 = 9{,}226V$

$V_3 = R_2.i_d$ $\quad V_3 = 2{,}387V$

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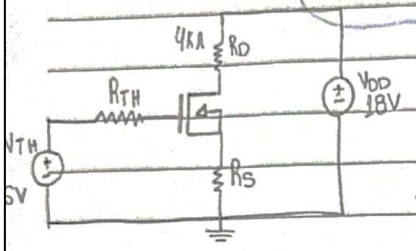
41 Redesenhando e utilizando V_{TH}/R_{TH} $\quad id = K(V_{GS} - V_T)^2$



Considerando o ponto de operação do gráfico em $V_{GS} = 4V$ e $i_D = 1mA$

$$-V_{TH} + R_{TH} \cdot i_G + V_{GS} + R_S \cdot id = 0$$

$$K = \frac{id(ON)}{(V_{GS(ON)} - V_T)^2} = 5{,}102\,u$$

Quando $id = 0$

$V_{TH} = V_{G(S)} = 6V$

$$V_{TH} = \frac{V_{DD} \cdot R_2}{R_1 + R_2}$$

$$① \; R_1 = \left(\frac{V_{DD} - 1}{V_{TH}}\right) R_2$$

① $R_1 = 2M\Omega$

Quando $V_{GS} = 0$

$$R_S = \frac{V_{TH}}{id} \quad id = 3mA$$

$R_S = 2K\Omega$

$$-V_{DD} + R_D i_D + V_{DS} + R_S \cdot id = 0$$

$$V_{DS} = V_{DD} - id(R_D + R_S)$$

$V_{DS} = 12V$

$$V_D = V_{DD} - R_D \cdot i_D$$

$V_D = 14V$

$$V_S = R_S \cdot id$$

$V_S = 2V$