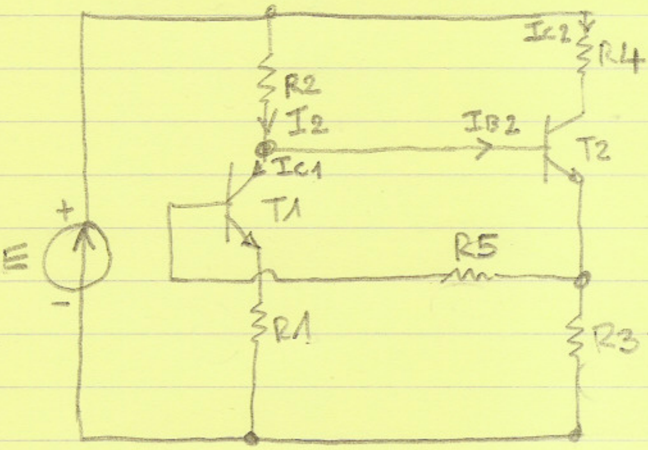
HULK28

Polarisation de transistors



$E = 12V$

$\beta = 100$

$V_{BE} = 0{,}6V$

$R1 = 1K\Omega$

$R2 = 8{,}2K\Omega$

$R3 = 3{,}3K\Omega$

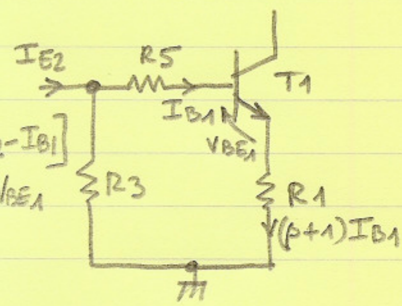
$R4 = 4{,}7K\Omega$

$R5 = 180K\Omega$

→ Calculer les coordonnées du point de repos de T1 et T2

$$\begin{cases} I_{C2} = \beta I_{B2} \\ I_{B2} = I_2 - I_{C1} \\ I_{C1} = \beta I_{B1} \end{cases} \Rightarrow I_{C2} = \beta(I_2 - \beta I_{B1})$$

Calcul de I_2 et I_{B1}

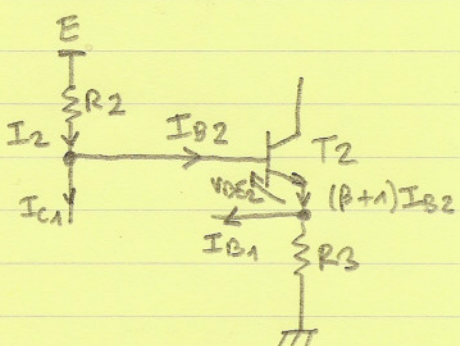


$$V_{BE1} + (\beta+1)R_1 I_{B1} = -R_5 \cdot I_{B1} + R_3\left[(\beta+1)I_{B2} - I_{B1}\right]$$

$$I_{B1}\left[(\beta+1)R1 + R5 + R3\right] = R3\ \frac{\beta+1}{\beta} \cdot I_{C2} - V_{BE1}$$

on pose : $R = (\beta+1)R1 + R5 + R3$

$$\Rightarrow I_{B1} = \frac{\beta+1}{\beta} \cdot \frac{R3}{R} \cdot I_{C2} - \frac{V_{BE1}}{R}$$



$$E = R2 I_2 + V_{BE2} + R3\left(\frac{\beta+1}{\beta} \cdot I_{C2} - I_{B1}\right)$$

$$\Rightarrow R2 I_2 = E - V_{BE2} - \frac{\beta+1}{\beta} R3 I_{C2} + \frac{R3^2(\beta+1)}{R \cdot \beta} \cdot I_{C2} - \frac{R3}{R} V_{BE1}$$

Soit $I_2 = \dfrac{E - V_{BE2}}{R2} - \dfrac{R3}{RR2} V_{BE1} + \dfrac{\beta+1}{\beta} \cdot \dfrac{R3}{R2}\left(\dfrac{R3}{R} - 1\right) I_{C2}$

d'où $I_{C2} = \beta \dfrac{\dfrac{E - V_{BE2}}{R2} + \dfrac{V_{BE1}}{R}\left(\beta - \dfrac{R3}{R2}\right)}{1 + (\beta+1)\dfrac{R3}{R2}\left(1 - \dfrac{R3}{R} + \beta\dfrac{R2}{R}\right)}$

avec $R = (\beta+1)R1 + R5 + R3$

Application numérique :

on prend $\beta >> 1$ $\quad \dfrac{R3}{R2} = 0{,}402 << \beta \quad \Rightarrow R \simeq \beta R1 + R5 + R3 = 283{,}3 K\Omega$

$$I_{C2} \simeq \beta \frac{\dfrac{E - V_{BE}}{R2} + \dfrac{V_{BE}}{R} \cdot \beta}{1 + \beta\dfrac{R3}{R2}\left(1 + \beta\dfrac{R2}{R}\right)} = \boxed{1{,}02 mA}$$

et $I_{B1} \simeq \dfrac{R3}{R} I_{C2} - \dfrac{V_{BE}}{R} = \boxed{9{,}76 \mu A}$

et $I_{B2} = \boxed{10{,}2 \mu A}$

$\boxed{I_{C1} = 976 \mu A}$