EJERCICIO 1

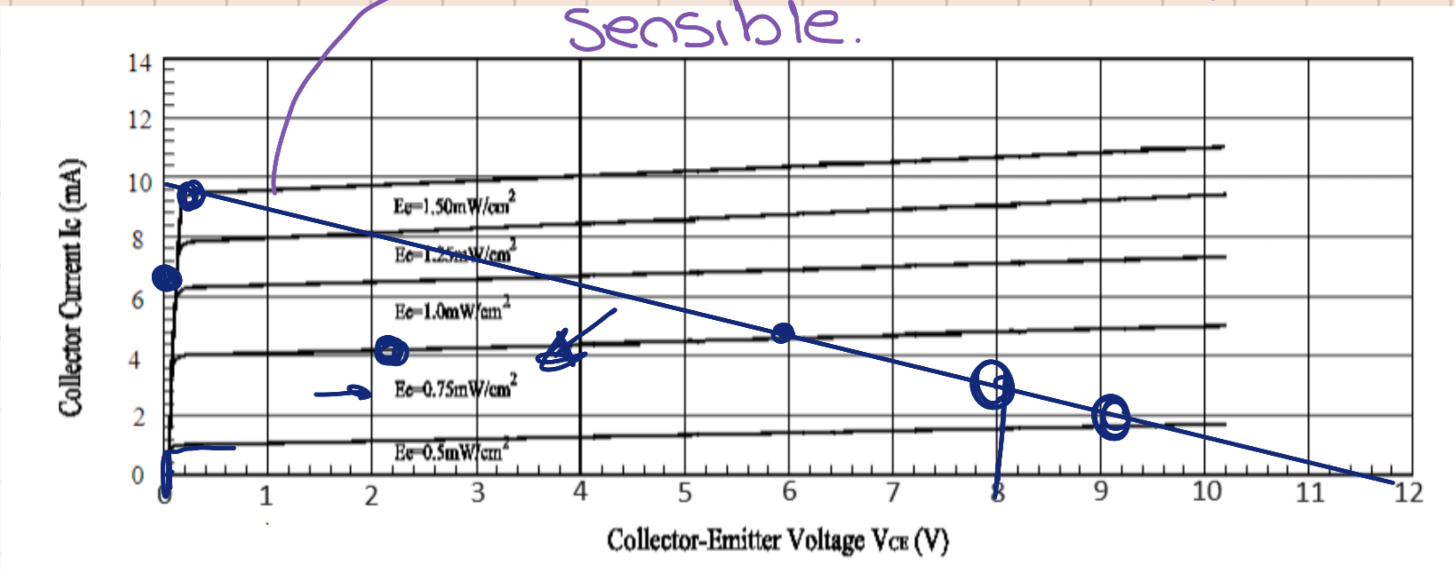
Diseñe una barrera infrarroja donde la distancia entre emisor y receptor sea de 5cm. La misma debe estar alimentada con 12V. Cuando el receptor deje de recibir la luz infrarroja se debe disparar una alarma por 2s.

$V_{CC} = 12V$

$d = 5cm$

Receptor

Cuanto menor pendiente, es mas sensible.



Ee : Irradiancia

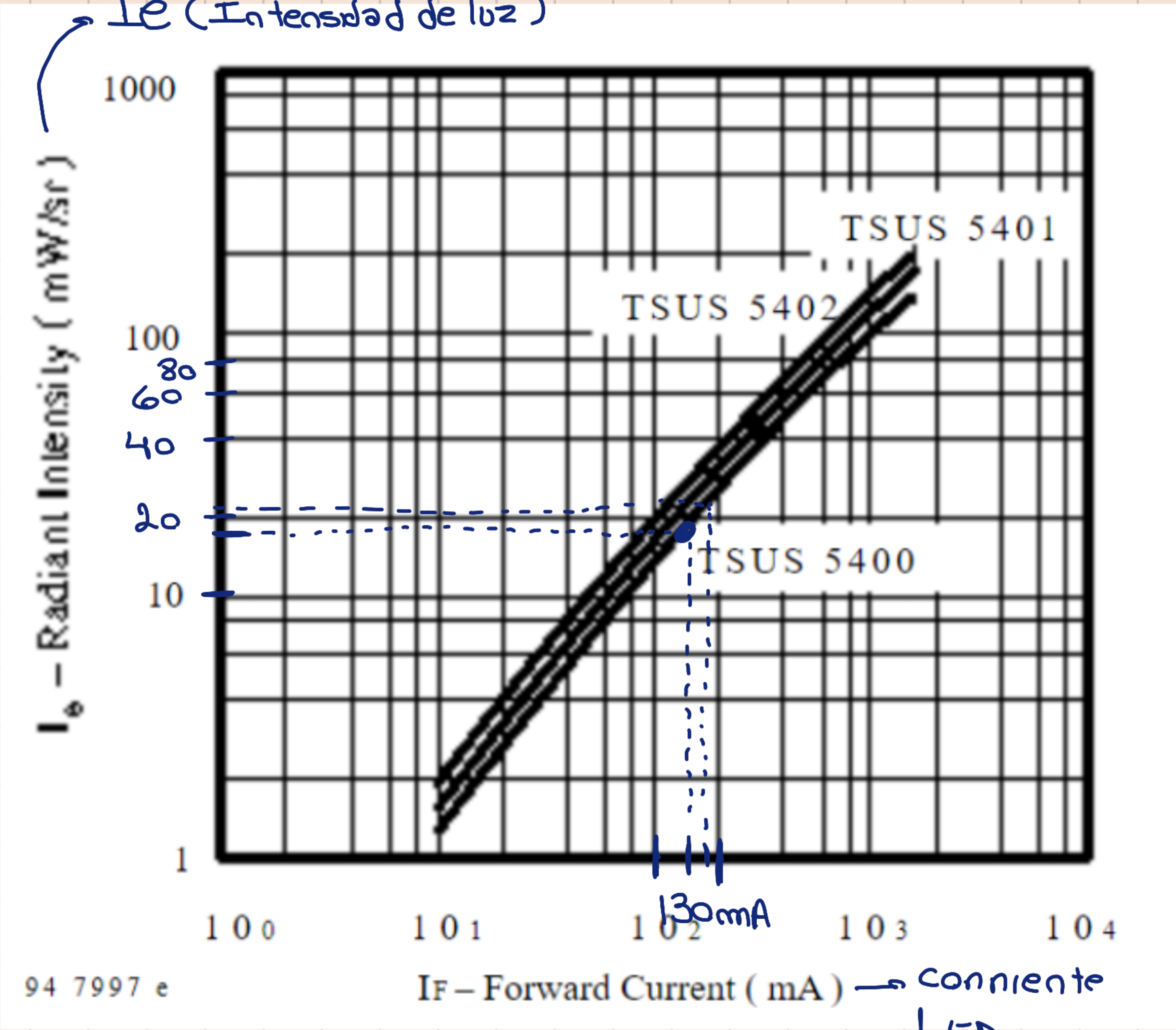
$$E_e = \frac{I_e}{d^2} = 0{,}75 \frac{mW}{cm^2}$$

$$I_e = E_e \cdot d^2 = 0{,}75 \frac{mW}{cm^2} (5cm)^2 = \boxed{18{,}75 \frac{mW}{sr}}$$

Emisor

Determinar la corriente necesaria:

Ie (Intensidad de luz)

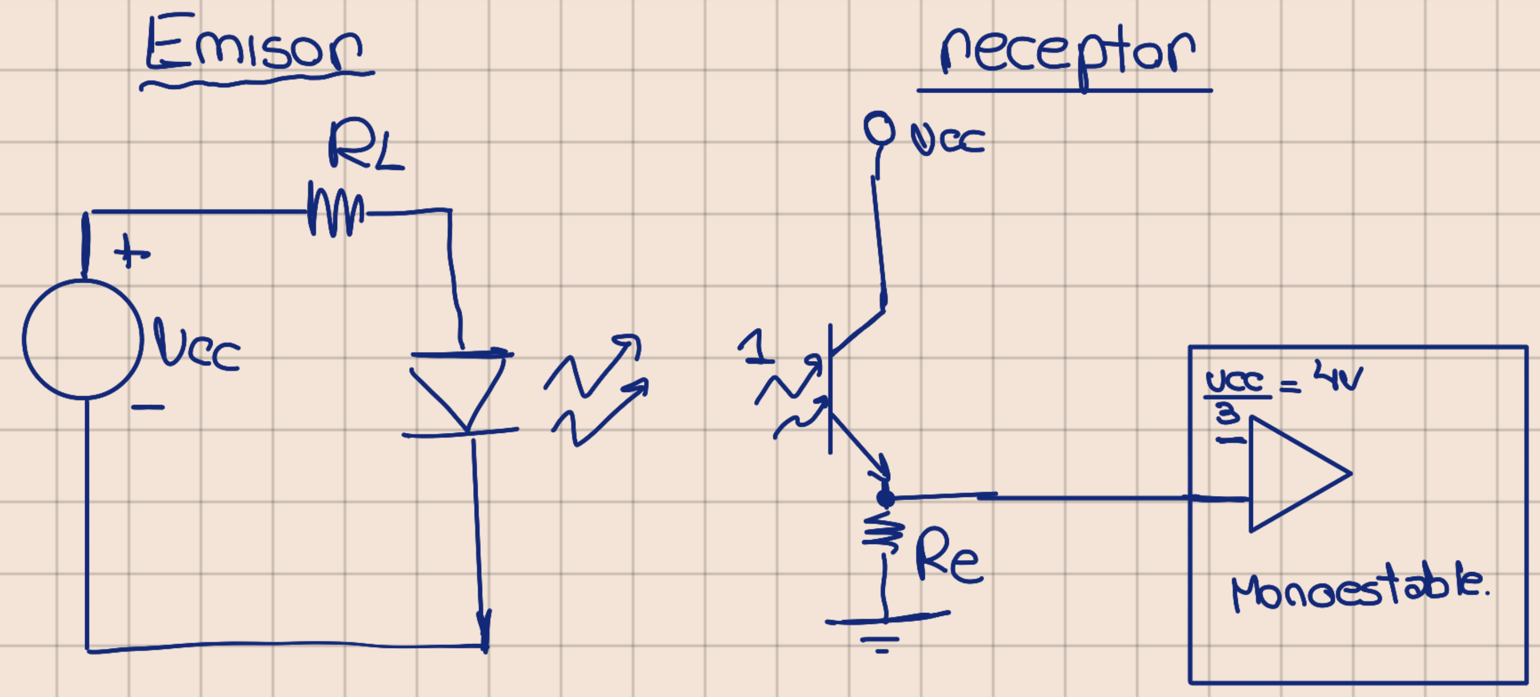


→ corriente LED

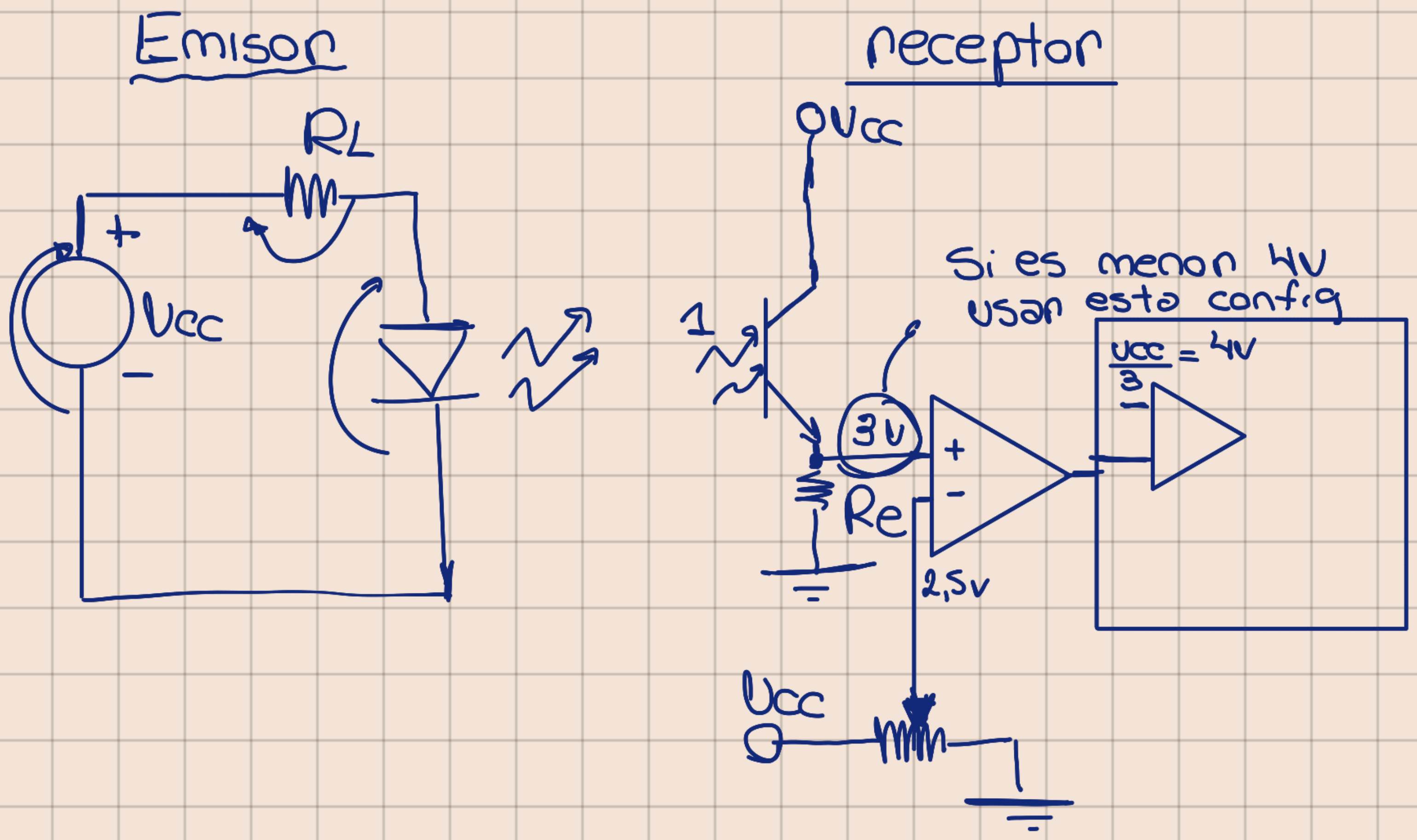
$I_{Led\,max} = 150mA \cdot 0{,}9 = 135mA$

$I_{Led} = 130mA < I_{Led\,max}$ → tomo barrera continua.

Circuito :



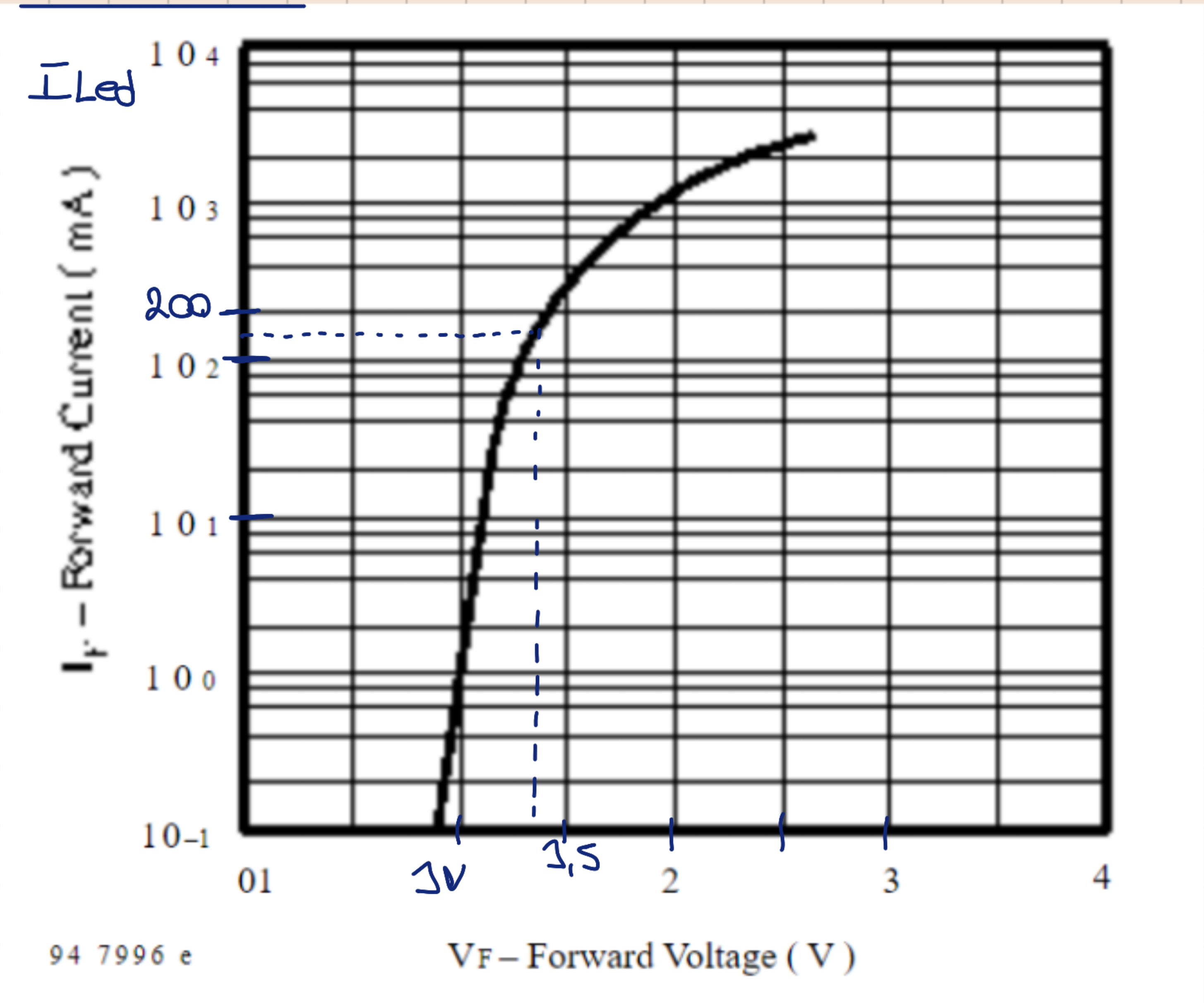
alternativa



Emisor

$V_{cc} - V_{RL} - V_{Led} = 0$

Para VLed :



$V_{Led} = 1{,}47V$

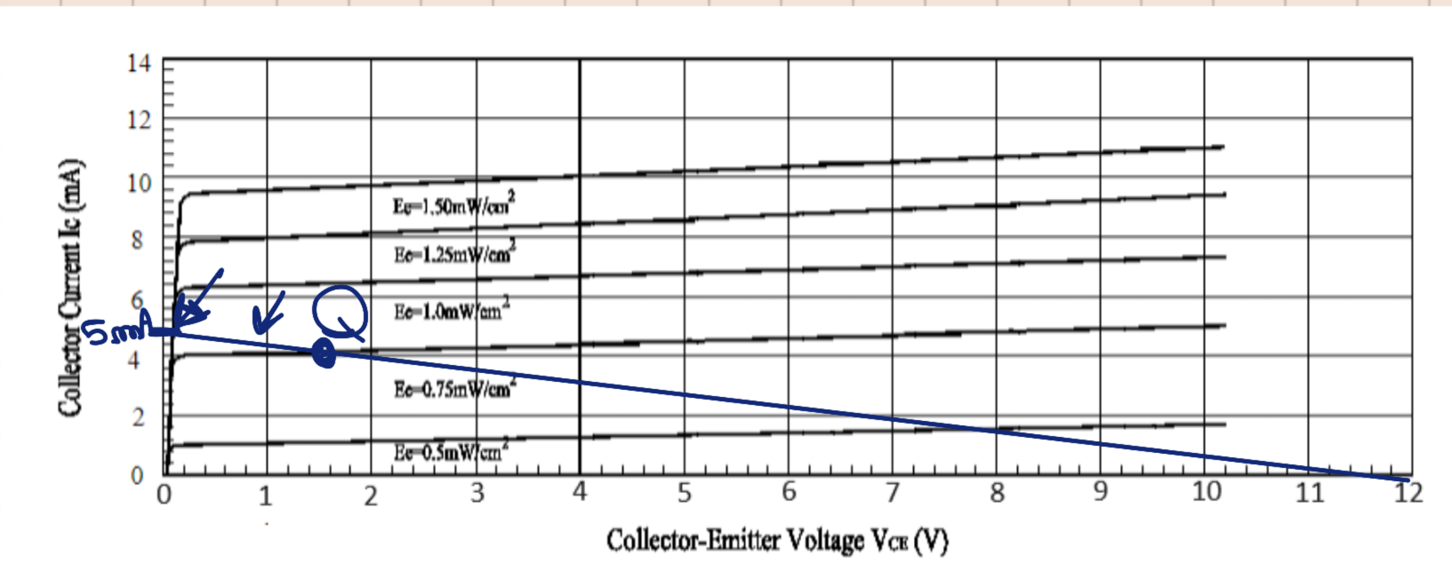
$V_{cc} - I_{Led} \cdot RL - V_{led} = 0$

$\dfrac{V_{cc} - V_{led}}{I_{Led}} = RL = 81\,\Omega \longrightarrow \boxed{RL = 82\,\Omega}$

$\boxed{I_{Led} = 128 mA}$

Receptor

Determino la RCE:



$$V_{CC} - V_{CE} - V_{RE} = 0$$

$$V_{CC} - V_{RE} = 0$$

$$\frac{V_{CC}}{I_C} = R_E. \rightarrow \text{Tomo una } I_C = 5mA$$

$$R_E = \frac{V_{CC}}{5mA} = 2400\,\Omega = \boxed{2500\,\Omega = R_E}$$

$$\boxed{I_C = 4{,}8mA}$$

EJERCICIO 2

Diseñe una barrera infrarroja pulsante donde la salida funcione de acuerdo a la siguiente tabla.

N° Grupo	Distancia (cm)
1	7
2	8
3	9
4	10
5	11
6	12
7	13
8	14
9	7
10	8
11	9
12	10
13	11
14	12

Todos los grupos deben accionar una alarma lumínica.
Datos de la lampara 12V/120mA

$d = 11\,cm$

$E_e = \frac{I_e}{d^2}$; yo tomo $E_e = 0{,}75\ \frac{mW}{cm^2}$

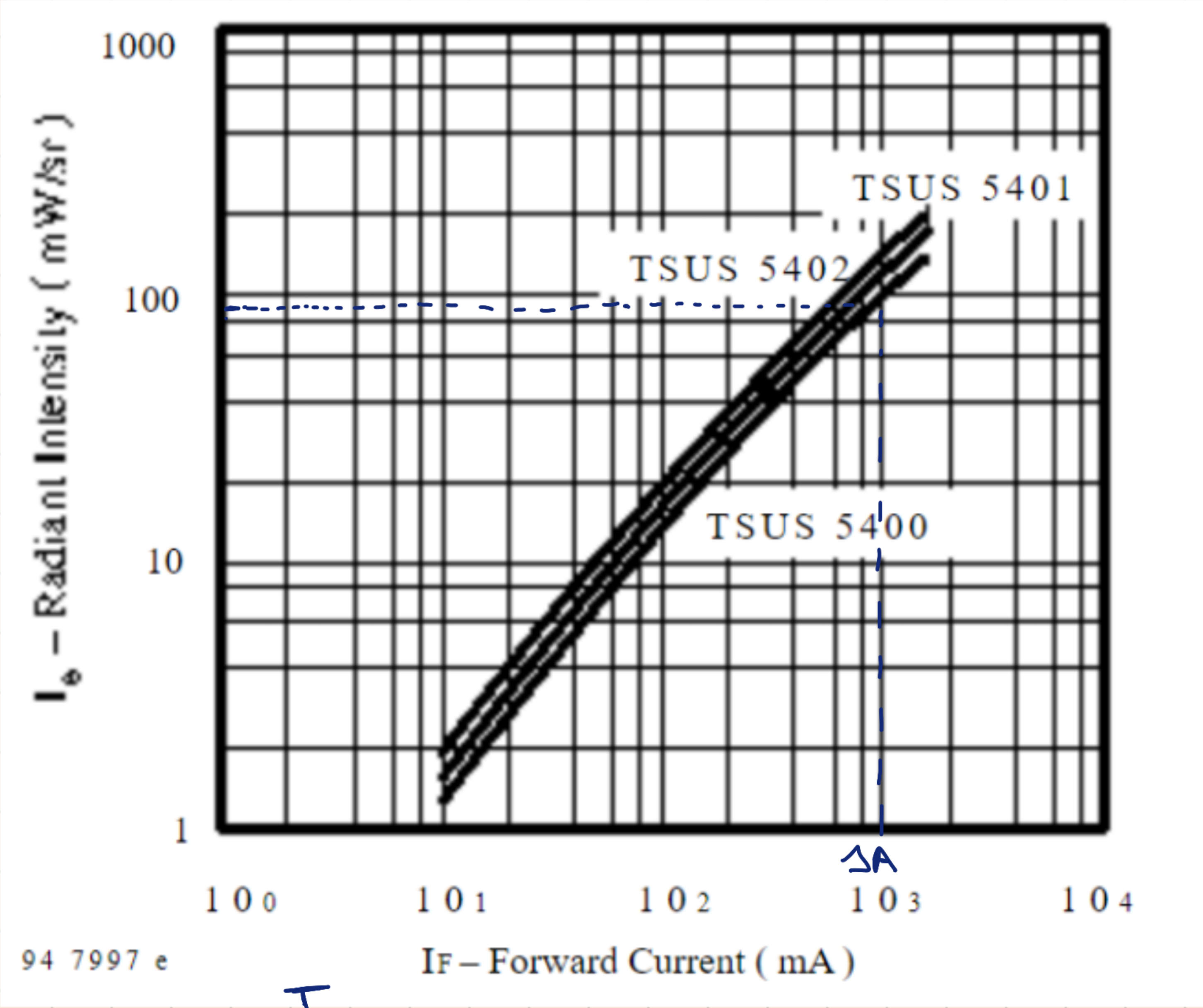
$$E_e \cdot d^2 = 0{,}75\frac{mW}{cm^2} \cdot (11\,cm)^2 = I_e$$

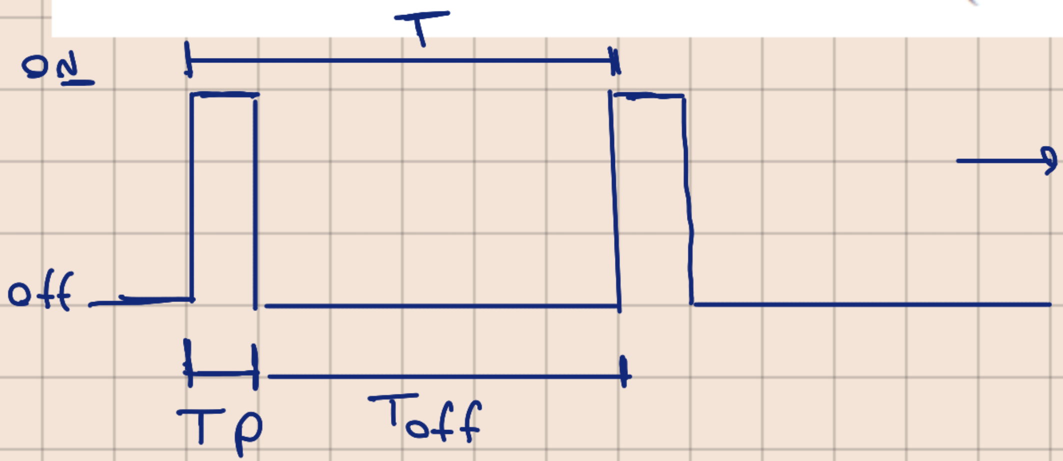
$$I_e = 90{,}75\ \frac{mW}{sr}$$

es mucho mayor $20\frac{mW}{sr}$ limites

Uso barrera pulsante.

Emisor

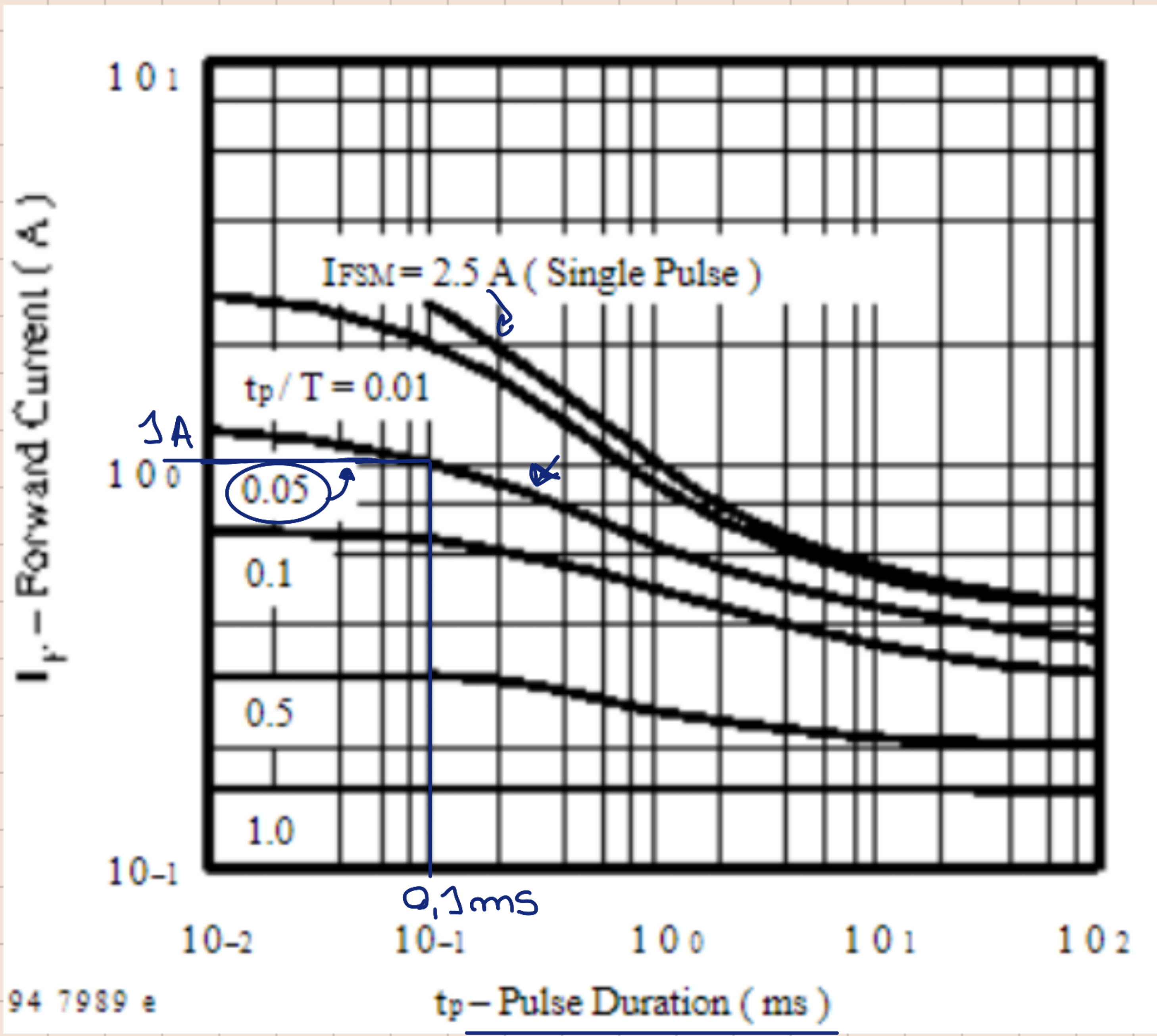




→ Trabajo en forma pulsada

$$D = \frac{T_p}{T} \longrightarrow$$ ¿de donde saco esto?

Se obtiene de hoja de datos.



$T_p = 0{,}1\,ms$

$D = 5\,\% = \frac{T_p}{T} \cdot 100\% \Rightarrow D = 0{,}05$

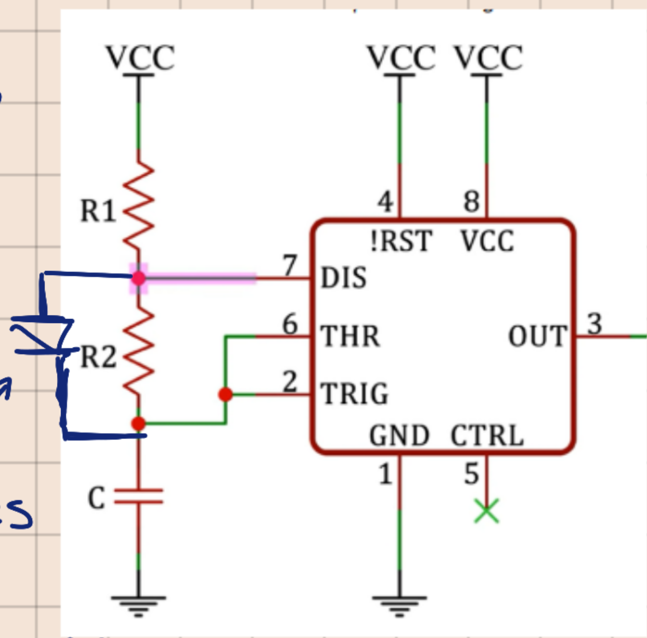
$T_p = 0{,}693 \cdot R_1 \cdot C$

$T_{off} = 0{,}693 \cdot R_2 \cdot C$

$\boxed{C = 100\,nf}$

$T_p = 0{,}1\,ms$

$T_{off} = T - T_p$



esto es porque $T_p < T_{off}$

$$T_{off} = \frac{T_p}{D} - T_p = 2ms - 0,1ms = 1,9ms$$

$$T_p \Rightarrow 0,1ms = 0,693 \cdot R_1 \cdot 100nf$$

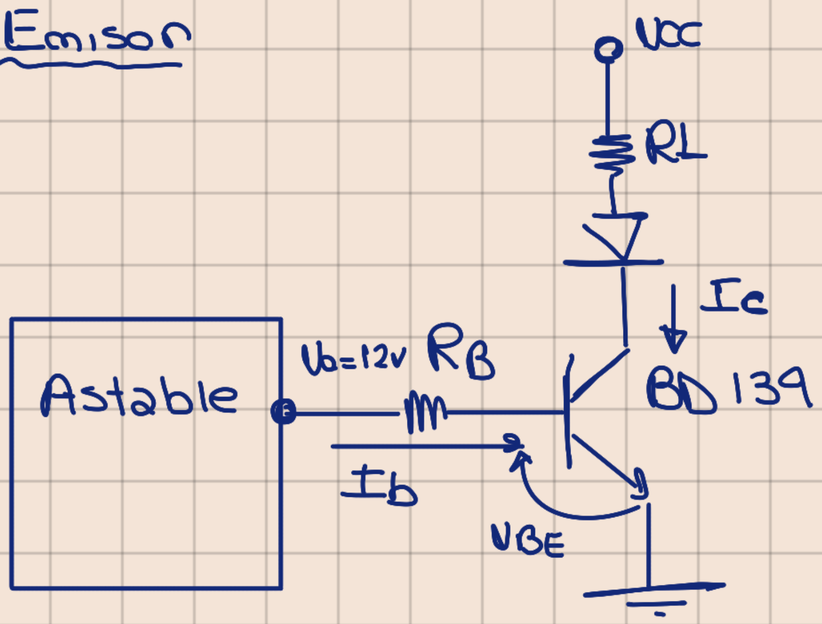
$$R_1 = \frac{0,1 ms}{0,693 \cdot 100nf} = 1,44 k\Omega \Rightarrow R_1 = 1k5\Omega$$

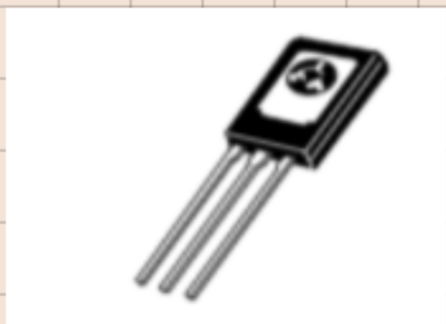
$$T_{off} \Rightarrow 1,9ms = 0,693 \cdot R_2 \cdot 100nf$$

$$R_2 = \frac{1,9ms}{0,693 \cdot 100nf} = 27,417 k\Omega \Rightarrow R_2 = 27k\Omega$$

$$\left.\begin{array}{l} T_{off} = 1,87 ms \\ T_p = 0,103 ms \end{array}\right\} \begin{array}{l} T = 1,973 ms \\ D = \frac{T_p}{T} = 0,052 \equiv 5,2\% \end{array}$$

Emisor





CASE 77–08
TO–225AA TYPE

$$H_{FE} = 30 \rightarrow I_b \cdot H_{fe} = I_c$$

$$\frac{12v - V_{BE}}{I_b} = R_b; \quad I_b = \frac{I_c}{h_{fe}} = \frac{1}{30} = 33mA$$

$$\frac{12v - 0{,}7v}{33mA} = Rb = 342\ \Omega \longrightarrow Rb = 330\ \Omega$$

MAXIMUM RATINGS

Rating	Symbol	Type	Value	Unit
Collector–Emitter Voltage	V_{CEO}	BD 135 BD 137 BD 139	45 60 80	Vdc
Collector–Base Voltage	V_{CBO}	BD 135 BD 137 BD 139	45 60 100	Vdc
Emitter–Base Voltage	V_{EBO}		5	Vdc
Collector Current	I_C		1.5	Adc
Base Current	I_B		0.5	Adc
Total Device Dissipation @ T_A = 25°C Derate above 25°C	P_D		1.25 10	Watts mW/°C
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D		12.5 100	Watt mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}		–55 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	θ_{JC}	10	°C/W
Thermal Resistance, Junction to Ambient	θ_{JA}	100	°C/W

Soporta la Ic.

$V_{CEsat} = 0{,}5V$

$I_C = 1A$

$V_{Led} = 2v$ (de curva)

$V_{CC} = 12V$

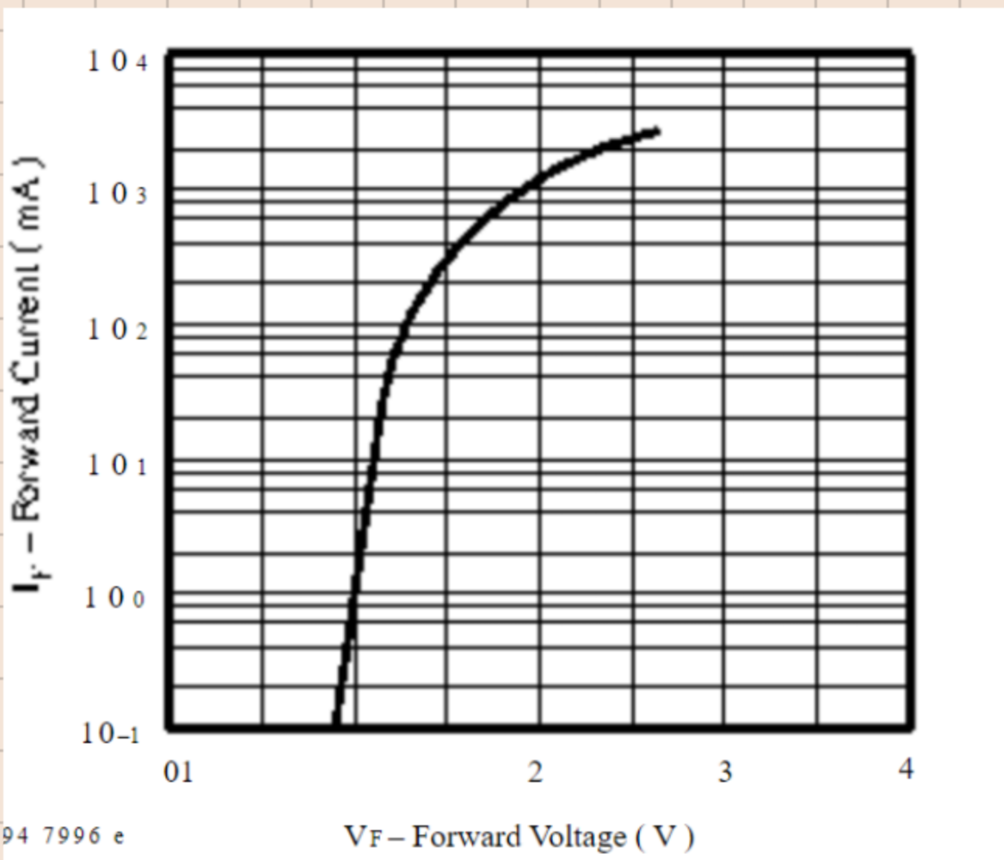
$$\frac{V_{CC} - V_{Led} - V_{CE}}{I_C} = RL$$

$RL = 9{,}5\ \Omega$

$RL = 10\ \Omega$

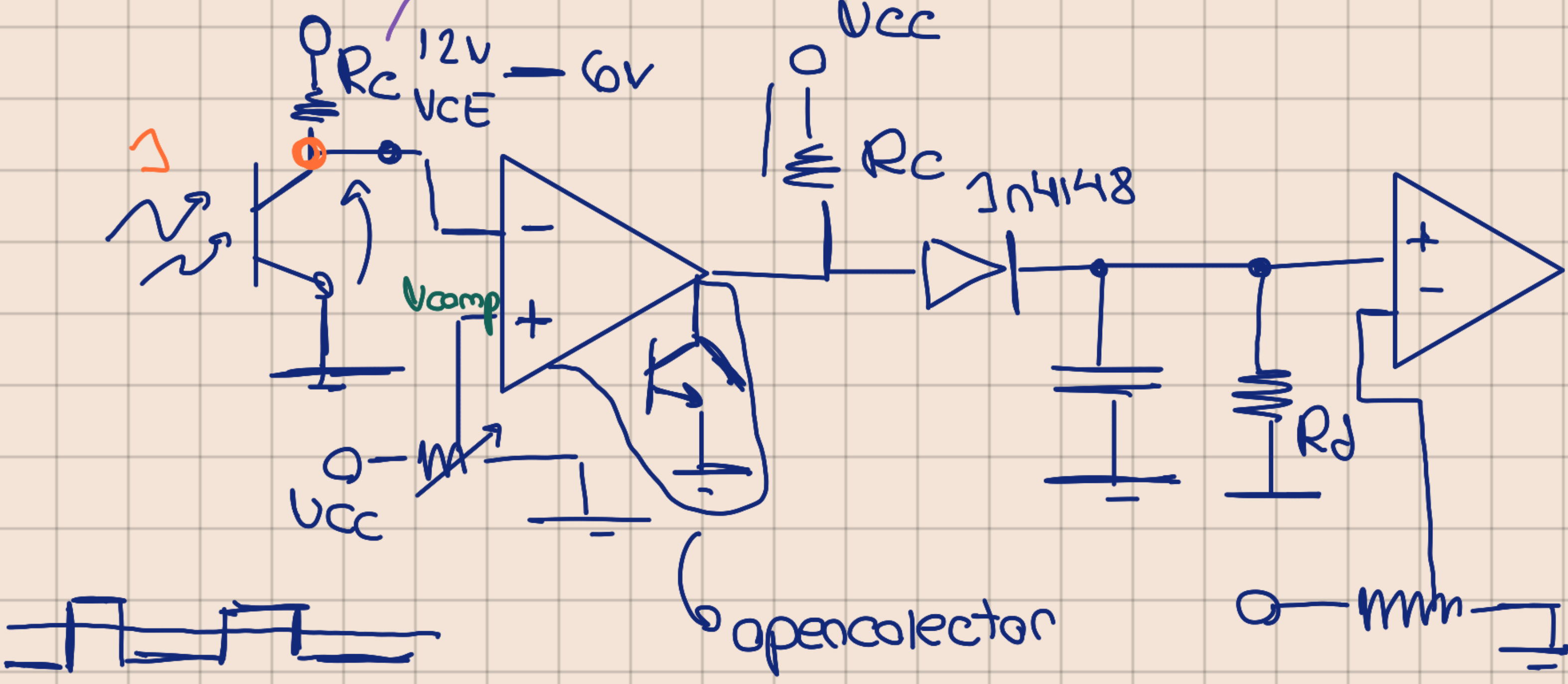
$I_{led} = 950mA$

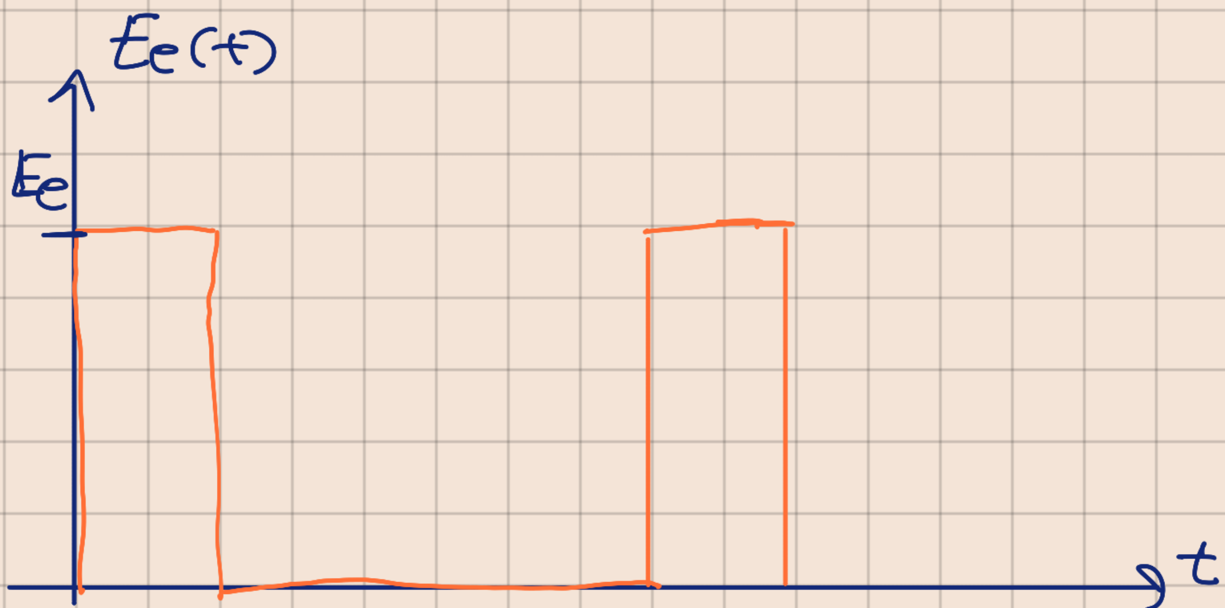
Curva de tension del led. (determino Vled)

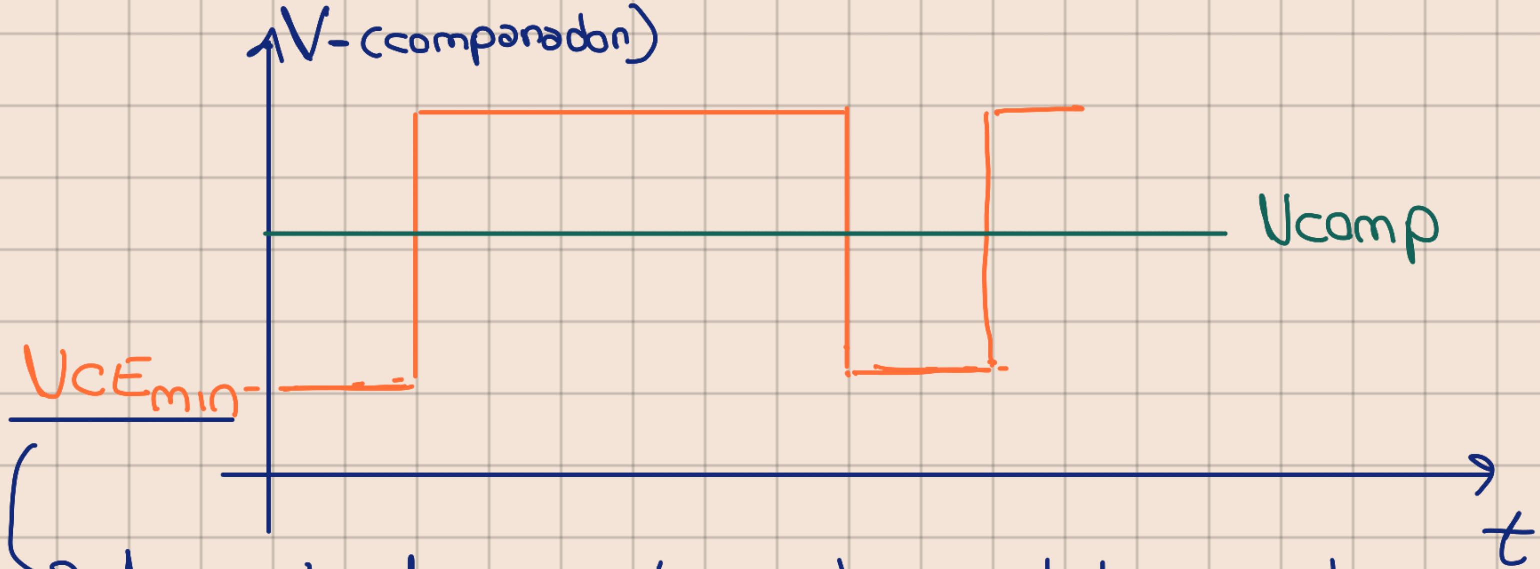


Receptor

→ determina la sensibilidad

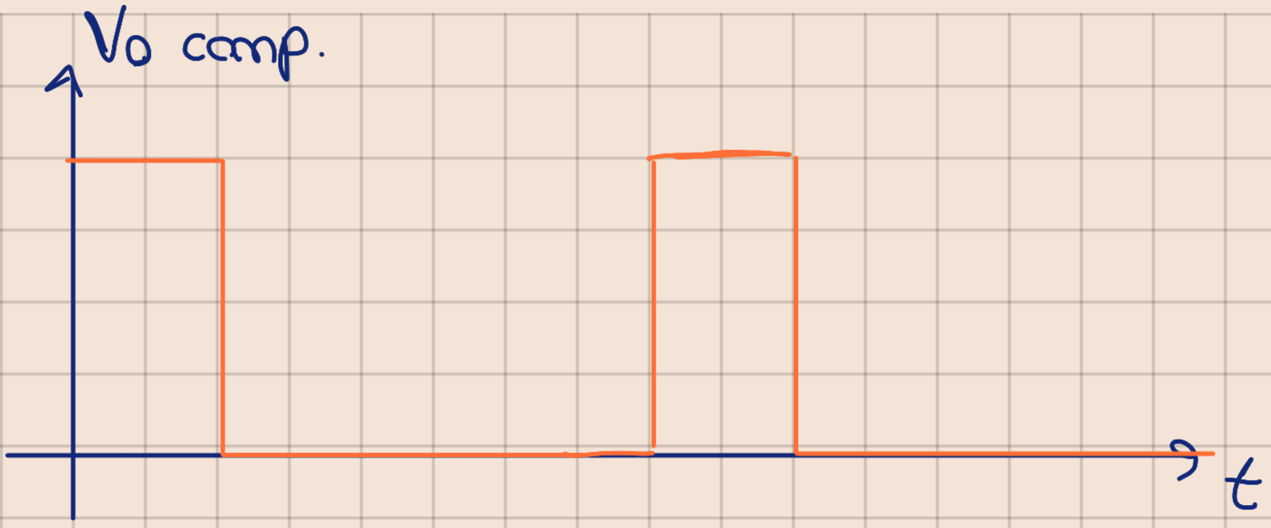




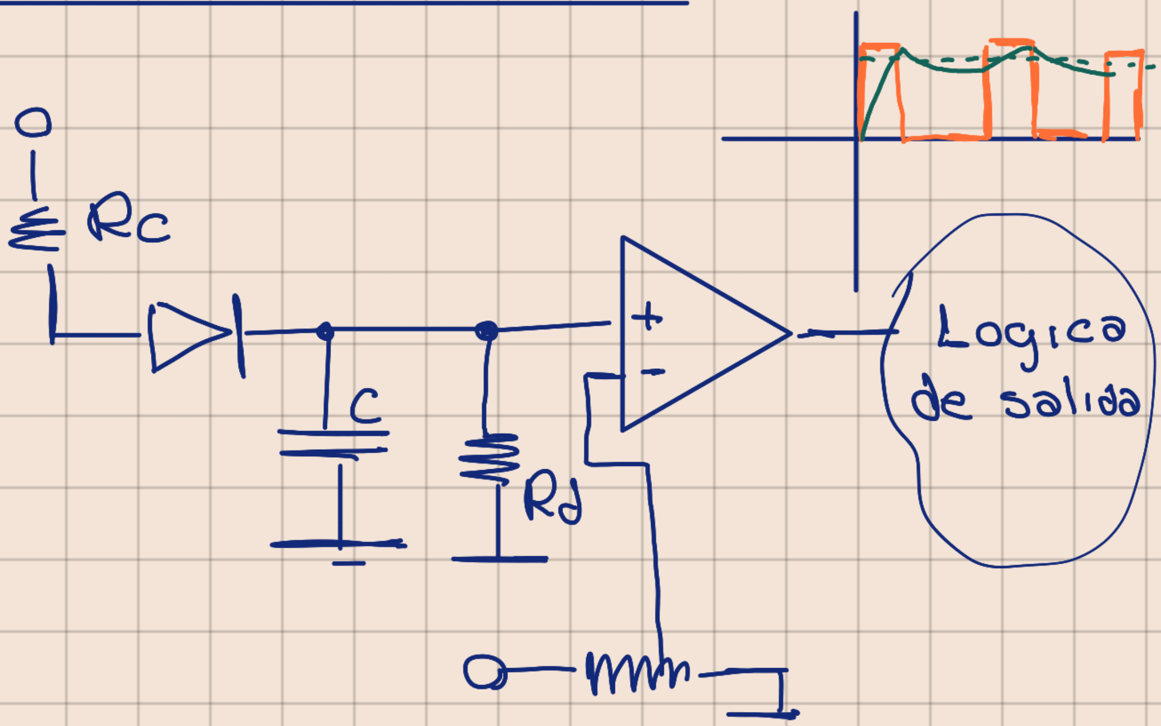


depende de cuanto sature el transistor.

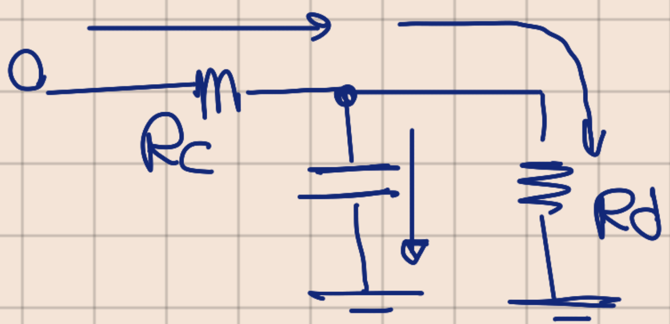
Se puede hacer lo mismo saliendo por emisor.



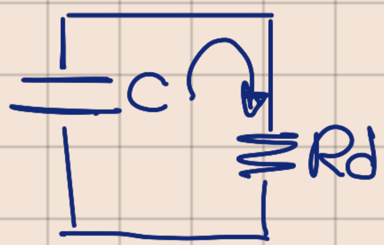
Circuito de linealizacion



Carga



Descarga



$$\boxed{\tau_c << \tau_d}$$

$$\tau_c = (R_c // R_d) . C$$

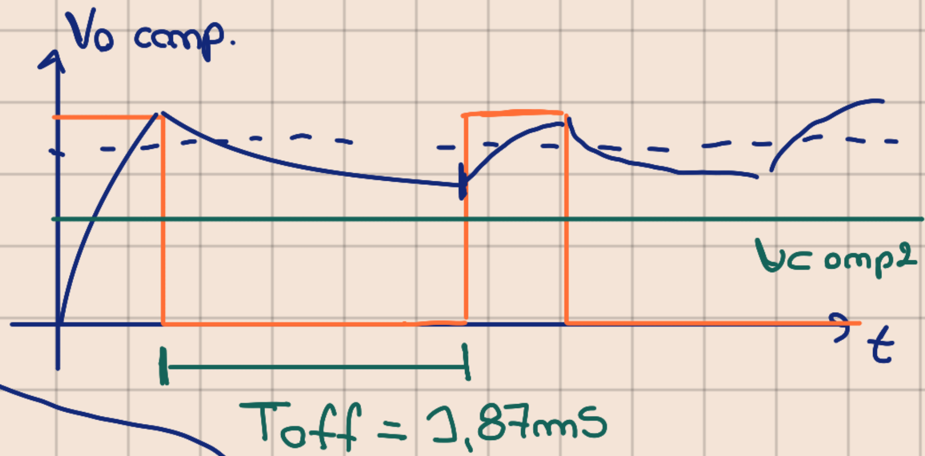
$$\tau_d = R_d . C$$

$R_c // R_d < R_d$

$R_c < R_d \longrightarrow R_c // R_d \cong R_c$

$\tau_c \cong R_c \cdot C$

$\tau_d = R_d \cdot C$



$\frac{5\tau_d}{100} = T_{off}$

aseguramos que no se descargue

Condicion de diseño para determinar τ_d

$\tau_d = \frac{100 \cdot T_{off}}{5}$

$\tau_d = 20\, T_{off} = 37,4\, mS$

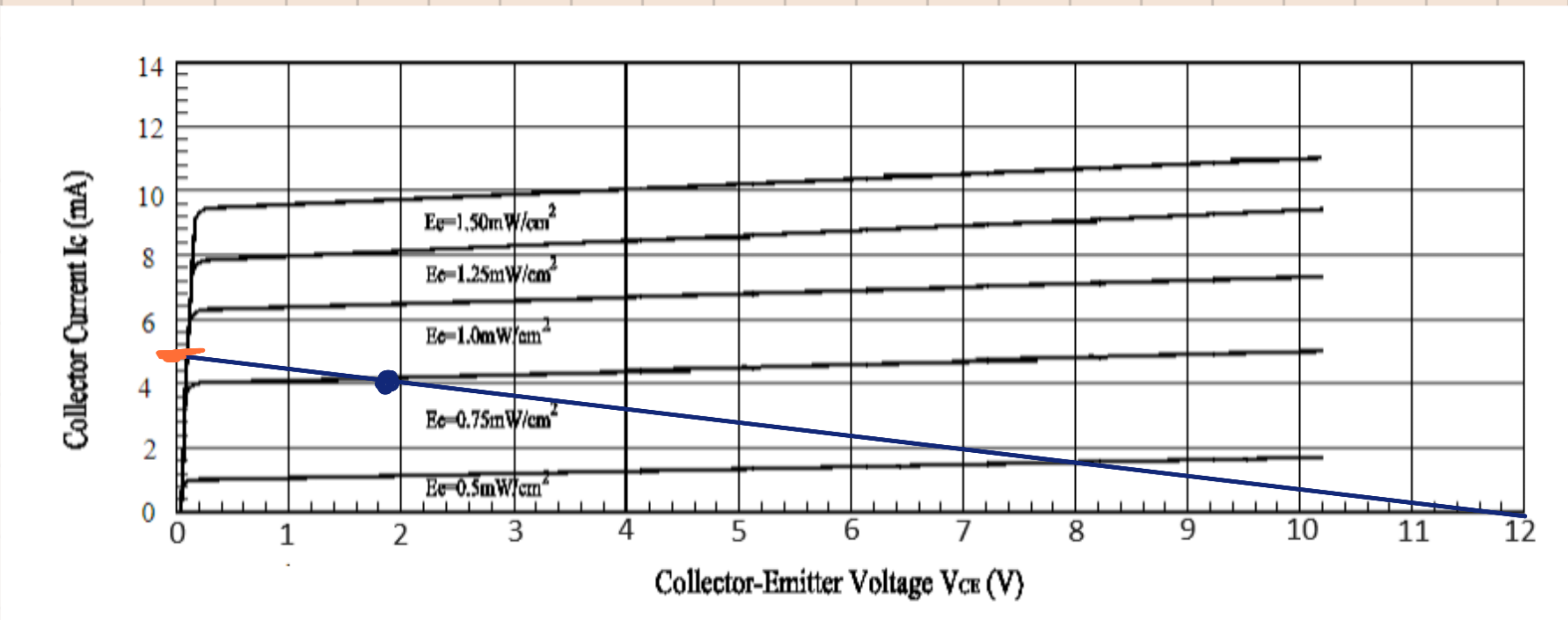
$\tau_d = 37,4\, mS$

$R_d \cdot C = 37\, mS \longrightarrow C = 1\, \mu f$

$R_d = \frac{37\, mS}{C} = 37\, k\Omega$

$\tau_c \cdot 100 < \tau_d \longrightarrow \tau_c = 0,37\, mS$

$R_c = \frac{\tau_c}{C} = 370\, \Omega$



$I_C = 5\,mA$

$$\frac{V_{CC} - \cancel{V_{CE}}^{\,0}}{I_C} = R_C = 2400\,\Omega$$