Laborator nr. 3 FM2 :

Tranzistorul

- permite controlul unui curent / a unei tensiuni între 2 puncte dintr-un circuit.
- comandă în curent (tranzistor bipolar)
- comandă în tensiune (tranzistor cu efect de câmp)

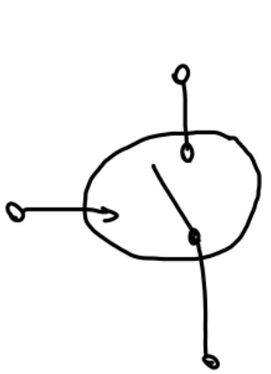
tranzistor ≡ cel mai simplu amplificator

Tranzistorul bipolar (TB, BJT)

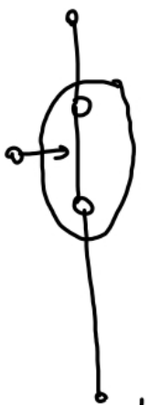
BJT = „bipolar junction transistor".

BJT: - switch controlabil electronic (blocat/saturat)
- sursă de curent controlabilă (zona activă).

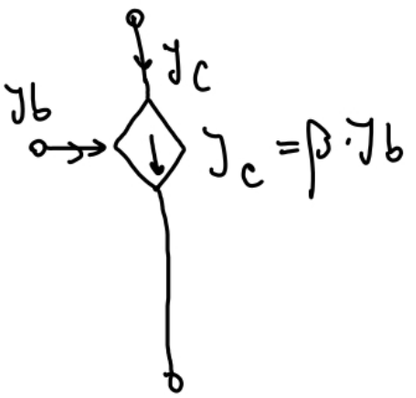
scheme echivalente



blocat

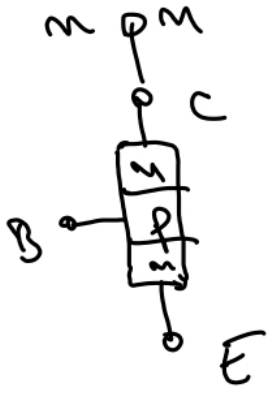


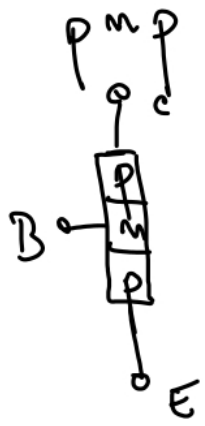
saturat

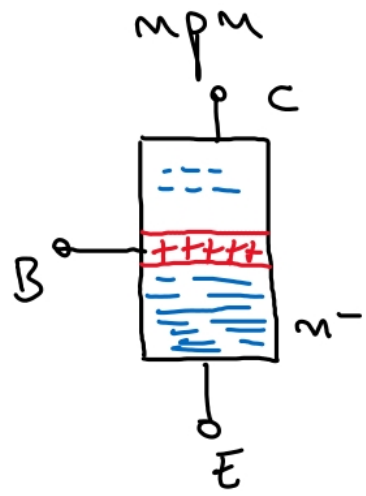


activ

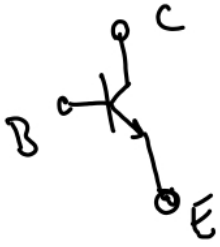
BJT → 2 joncțiuni

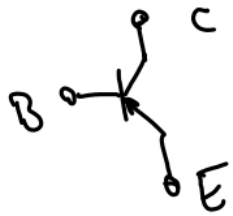




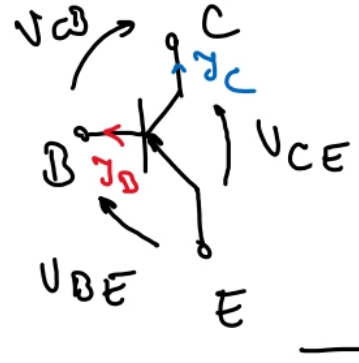


simboluri

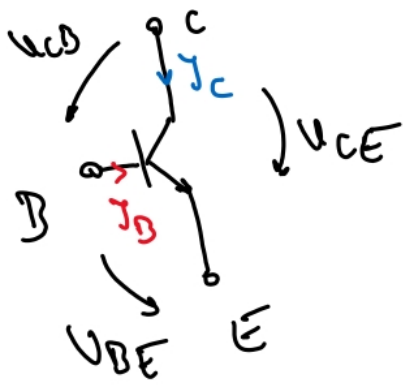




pnp



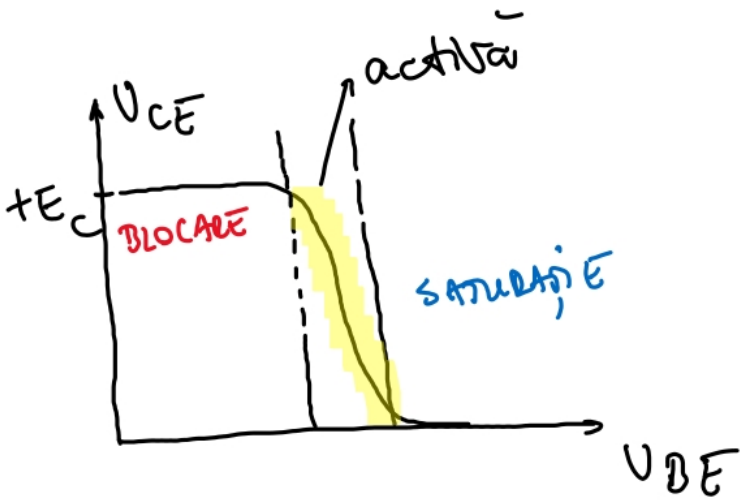
Regimuri de funcționare (npn):



blocat: $V_{BE} < 0.7V$; $J_C = 0$; $V_{CE} \geq 0$
($J_B \simeq 0$)

activă: $V_{BE} \simeq 0.7V$; $J_C = \beta \cdot J_B$; $V_{CE} > 0$
($J_B > 0$) β - factor de amplificare

saturat: $V_{BE} \simeq 0.7V$; $J_C < \beta \cdot J_B$; $V_{CE} \simeq 0 - 0.2V$.



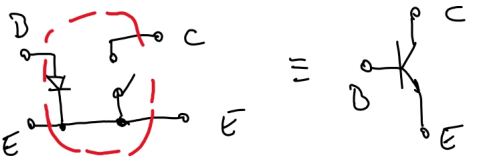
Caracteristica jonctiunii BE:

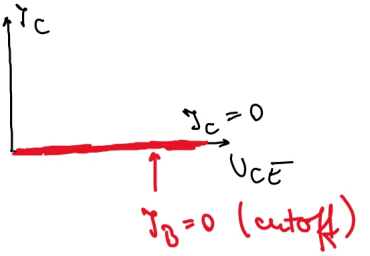
- jonctiunea BE: dioda

Caracteristica colectorului:

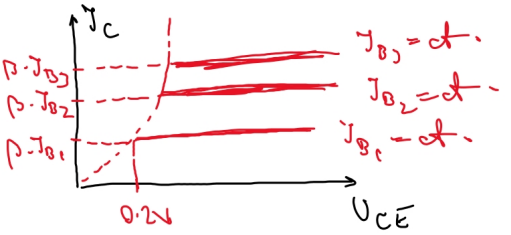
mod blocat

schemă echivalentă:

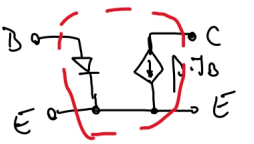




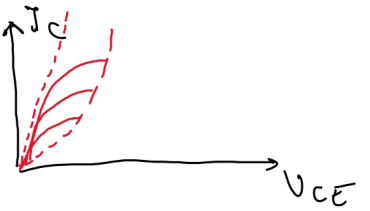
mod activ:



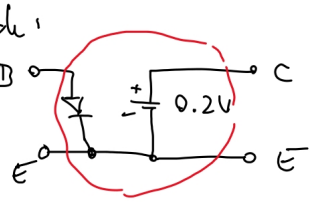
schema ech:

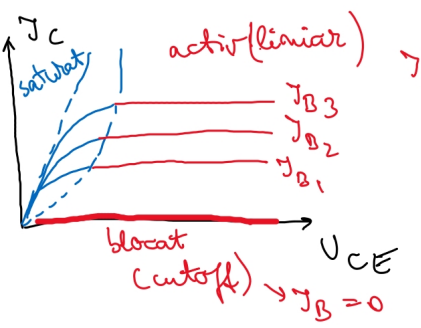


mod saturat:



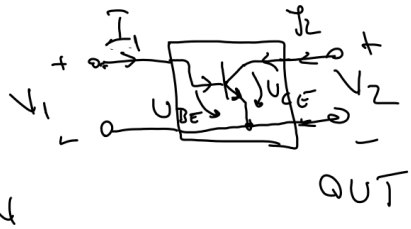
Sch. ech:





$I_{B1} < I_{B2} < I_{B3}$

Matricea hibridă:



$$\begin{pmatrix} V_1 \\ I_2 \end{pmatrix} = \begin{pmatrix} h_{11} & h_{12} \\ h_{21} & h_{22} \end{pmatrix} \begin{pmatrix} I_1 \\ V_2 \end{pmatrix}$$

$$V_1 = h_{11} I_1 + h_{12} V_2$$

$$I_2 = h_{21} I_1 + h_{22} V_2$$

definim: $h_{11} = \left.\frac{V_1}{I_1}\right|_{V_2=0}$ → Z_{in}

$$h_{12} = \left.\frac{V_1}{V_2}\right|_{I_1=0} \quad \text{adim.}$$

$$h_{21} = \left.\frac{I_2}{I_1}\right|_{V_2=0} = \beta.$$

$$h_{22} = \left.\frac{I_2}{V_2}\right|_{I_1=0} = \Omega^{-1} = S \qquad Y_{out} = \frac{1}{Z_{out}}$$

$h_{11} = h_{ie}$ (Ω)

$h_{12} = h_{re}$

$h_{22} = h_{oe}$ (S)

$h_{21} = h_{fe}$ (β)

U_{CE} (V)	U_{BE} (V)	I_B (μA)	I_C (mA)
5	0	0	0
5.001	0.594	1.06	0.159
5.004	0.632	4.09	0.696