

Transistorul bipolar: (TB)

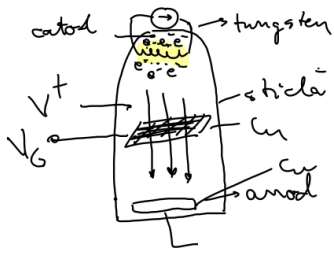
- dispozitiv semiconductor cu 3 terminale
- permite controlul unei curent folosind un alt curent (TB) sau o tensiune (TEC)

TB - transistor bipolar
 BJT - "Bipolar Junction Transistor"

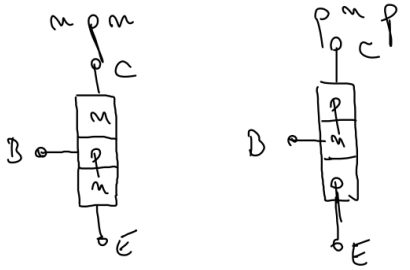
TEC - transistor cu efect de câmp
 FET - "Field-Effect Transistor"

istorie:

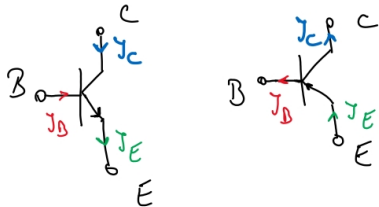
Tuburi: (controlul curentului)



tipuri de BJT



simboluri



$$I_C = \beta I_B$$

$$I_E = I_C + I_B \approx I_C$$

β - factorul de amplificare

transistorul \rightarrow cel mai simplu amplificator

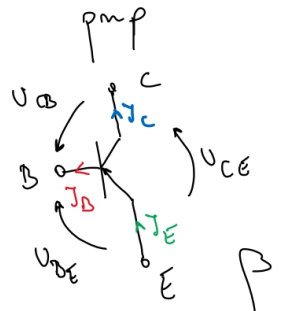
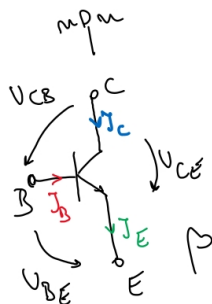
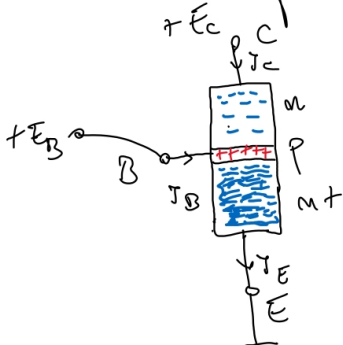
cel mai folosit: mpn

$$I_B \sim \mu A$$

$$I_C \sim mA$$

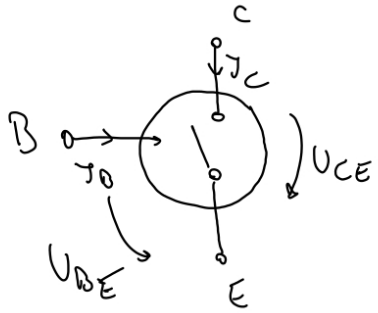
small signal ("general purpose") $\beta = 100-1000$
 putere $\beta = 2-10$

transistor mpn



Regimuri de TB:

blocat

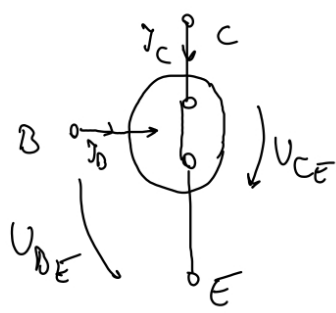


blocat

$$U_{BE} < 0.7V \Rightarrow I_B = 0 \Rightarrow I_C = 0$$

$$U_{CE} = +E_c$$

saturat

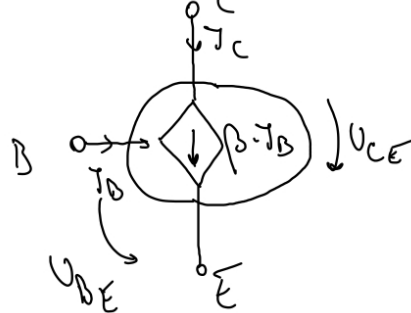


$$U_{BE} \approx 0.7V; I_B > 0$$

$$I_C \neq \beta I_B = \text{val. max.}$$

$$U_{CE} \approx 0 - 0.2V$$

activ

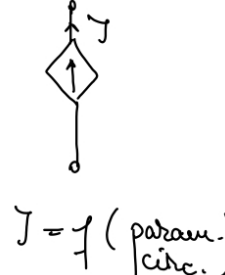
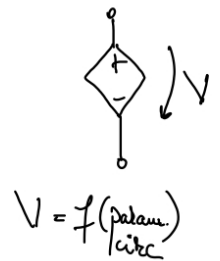


$$U_{BE} \approx 0.7V; I_B > 0$$

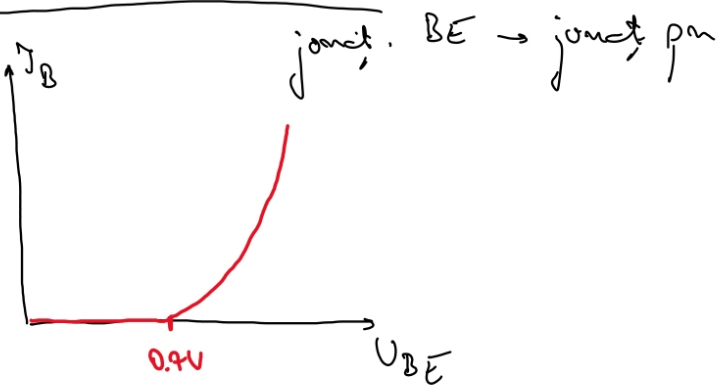
$$I_C = \beta \cdot I_B \text{ - dep. liniară}$$

$$U_{CE} > 0$$

subse dependente
surse de tensiune

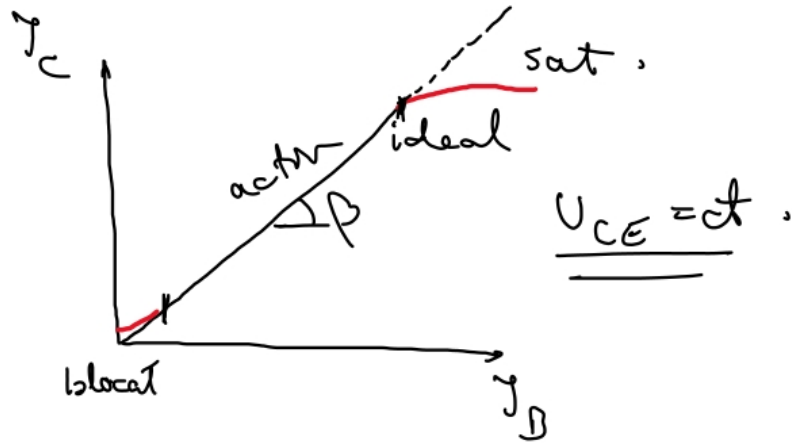


Caracteristica bazei:

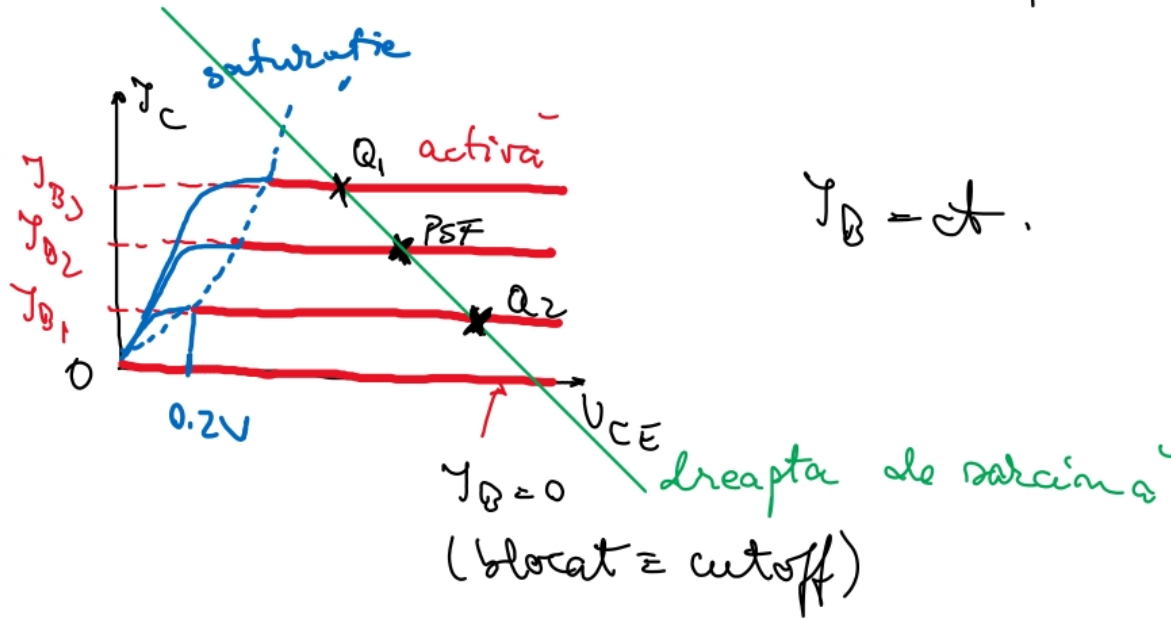


Caracteristicile colectoarei → cele 3 regiuni

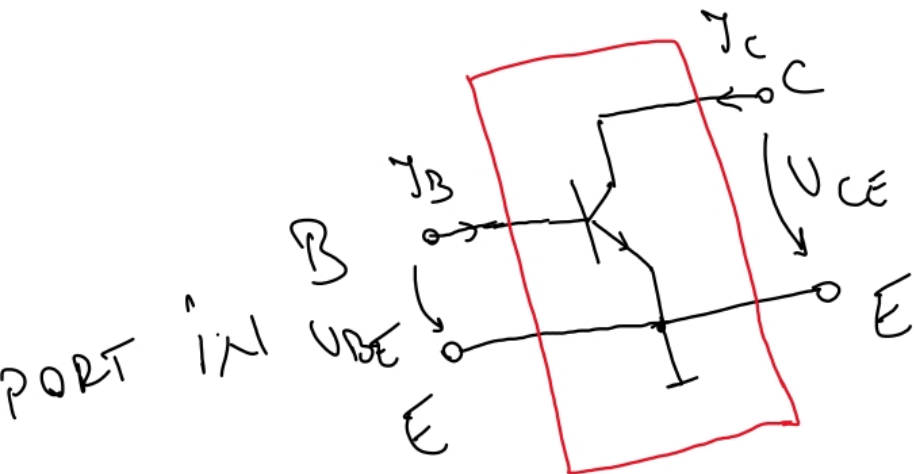
ce param V_{BE}, V_{CE}, I_B, I_C



⇒ param. hibridi h_{ij}



$I_B = ct.$



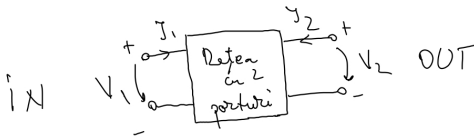
PORT OUT

→ cuadripol

||
rețea cu 2 porturi



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

$$h_{11} = \left. \frac{V_1}{I_1} \right|_{V_2=0} = Z_{in} (\Omega) = h_{ie}$$

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

$$h_{21} = \left. \frac{I_2}{I_1} \right|_{V_2=0} = \beta (\text{adim}) = h_{fe}$$

$$h_{22} = \left. \frac{I_2}{V_2} \right|_{I_1=0} = Y_{out} = \frac{1}{Z_{out}} (S) = h_{oe}$$

| $U_{CE} (V)$ | $U_{BE} (V)$ | $I_B (\mu A)$ | $I_C (mA)$ |
|--------------|--------------|---------------|------------|
| 5 | 0 | 0 | 0 |
| 5 | 0.210 | 0 | 0 |
| ; | ; | ; | ; |
| 4.998 | 0.553 | 0.270 | 0.032 |
| ; | ; | ; | ; |
| 5 | 0.600 | 1.302 | 0.200 |
| ; | ; | ; | ; |
| 5.003 | 0.633 | 4.367 | 0.757 |
| ; | ; | ; | ; |
| 4.999 | 0.658 | 11.019 | 1.971 |

$$E_B = 5V; U_{CE} = 5V$$

↓

coord. PSF:

$$U_{BE} = 693.8 \text{ mV}$$

$$I_B = 43.062 \mu A$$

$$U_{CE} = 5V$$

$$I_C = 7.78 \text{ mA}$$