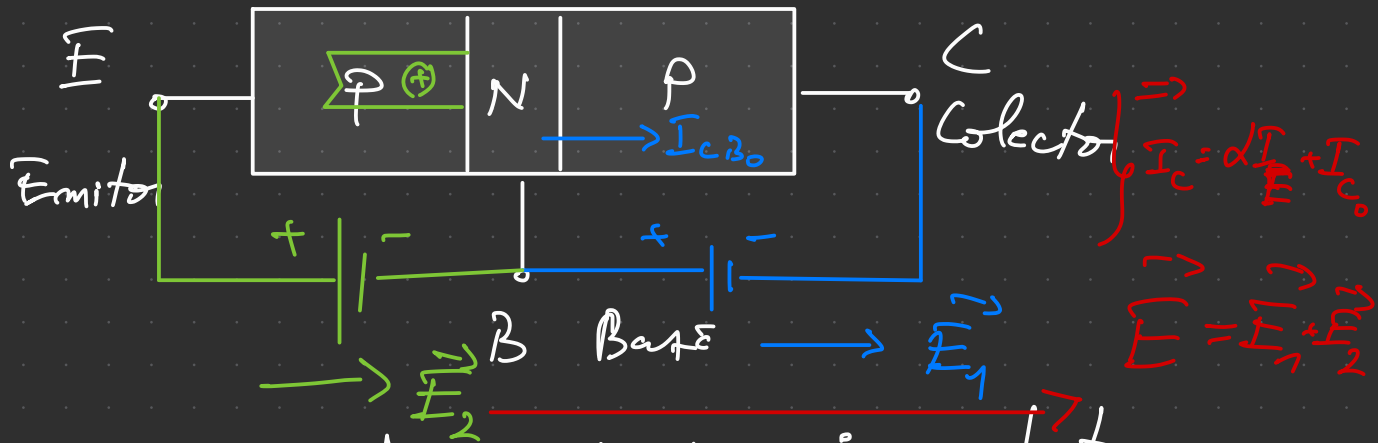


# Tranzistorul Bipolar



Emitter  $\rightarrow$  puternic dopat cu impurități  
 Colector  $\rightarrow$  slab  
 Baza  $\rightarrow$  slab ; dimensiune foarte mică

$E \rightarrow C \rightarrow$  funcționare

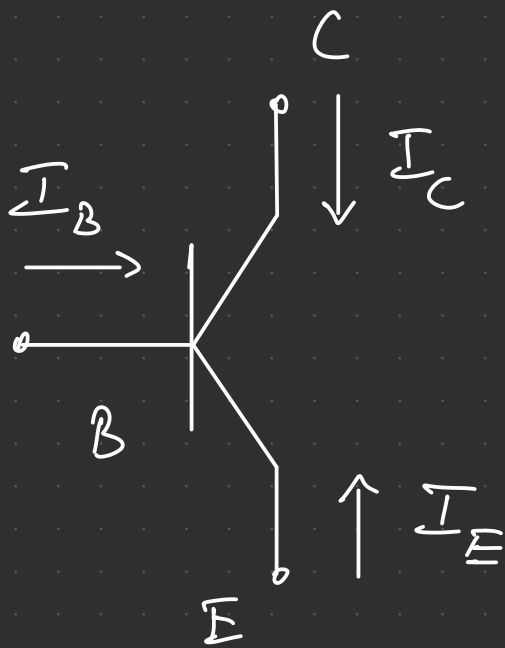
a) polarizare inversă j.c.

$I_{CBO}$   $\rightarrow$  curent colector - bază rezidual  
(sarcini minoritare din B)

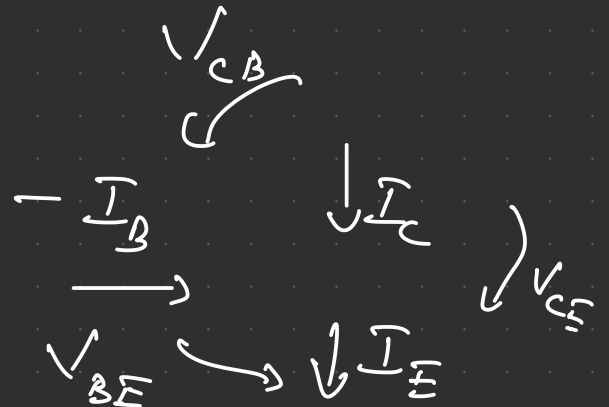
b) polarizare directă j.e

$$I_C = \alpha I_E + I_{CBO}$$

$$\alpha = 0,98 \div 0,99$$



$$I_E + I_C + I_B = 0$$

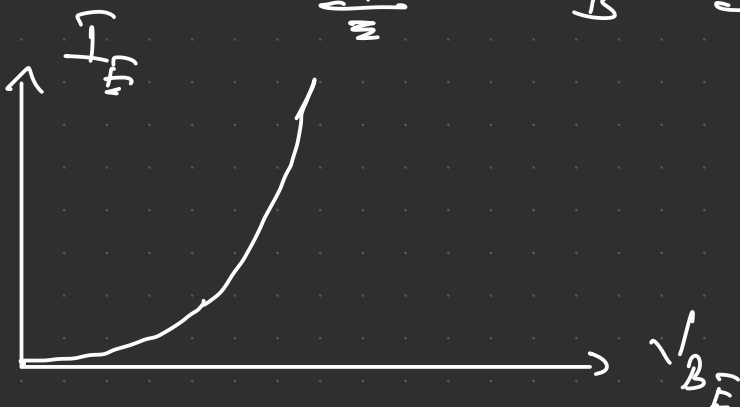
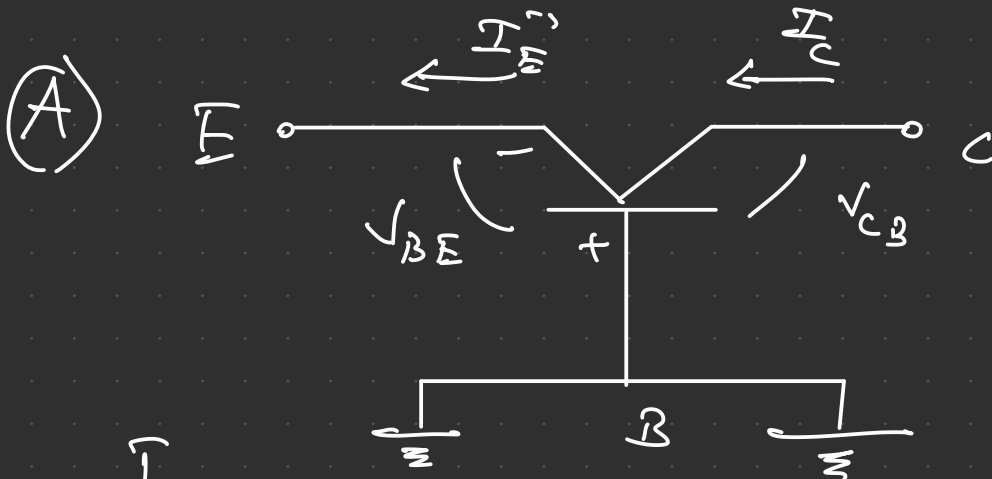
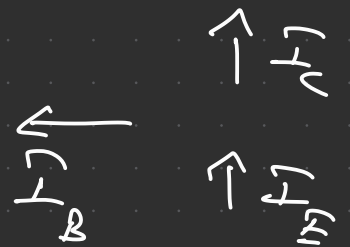


a) NPN

$$\rightarrow I_E = I_C + I_B$$

b) PNP

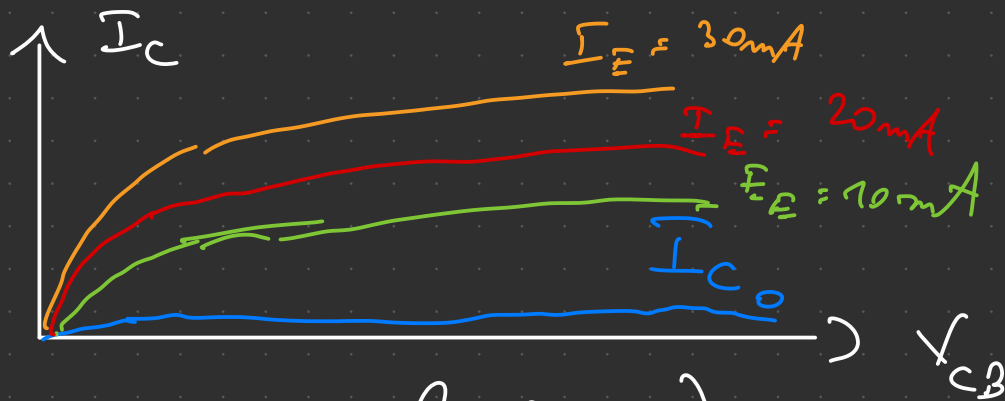
$$\rightarrow I_E = I_C + I_B$$



Characteristice  
Volt - Amper

$$I_E = f(V_{BE})$$

(caracteristică de intrare a tranzistorului)



$$I_C = f(V_{CB})$$

$$\frac{I_C}{I_B} = \beta \rightarrow \text{factor de amplificare}$$

$$\frac{I_C}{I_E} = \alpha$$

$|_{\text{pt } V_{BC} = 0}$

## Relatii fundamentale

$$(1) \quad I_C = \alpha I_E + I_{C0}$$

$$(2) \quad I_E = I_C + I_B$$

$$(3) \quad \alpha = \frac{\beta}{1 + \beta}$$

$$(4) \quad \beta = \frac{\alpha}{1 - \alpha}$$

$$\frac{I_C}{I_C} = 1 + \frac{I_B}{I_C} \rightarrow \frac{1}{\alpha} = 1 + \frac{1}{\beta}$$

$$(1) \quad I_E = f(V_{BE})$$

c. intr. (BC)

$$(2) \quad I_C = f(V_{CB})$$

c. iesire (BC)

$$(3) \quad I_B = f(V_{BE})$$

c. intr. (EC)

$$(4) \quad I_C = f(V_{CE})$$

c. iesire (EC)

$\rightarrow$  generarea curentului de colector

# Regimul de funcționare

dispozitiv cu 2 joncțiuni:

$I_E$   $I_C$  (polarizate direct și invers)  $\rightarrow$  4 regimuri fct.

a) pol. inv. inv.  $\rightarrow$  regim blocat  
 $\rightarrow$  comutator deschis  $I_C = I_{C0} [\mu A \div 10 nA]$

$$I_C = \min, I_{CE} = \max$$

b) pol. direct inv.  $\rightarrow$  regim normal

- (A) repetor pe emitor (BC)  
 $I_C \approx \alpha I_E \approx I_E$
- (B) amplificator (EC)  
 $I_C = \beta I_B$

$$\beta \gg 1$$

c) pol. direct direct  $\rightarrow$  saturat  
 $\rightarrow$  se comportă ca o rezistență  $\rightarrow$

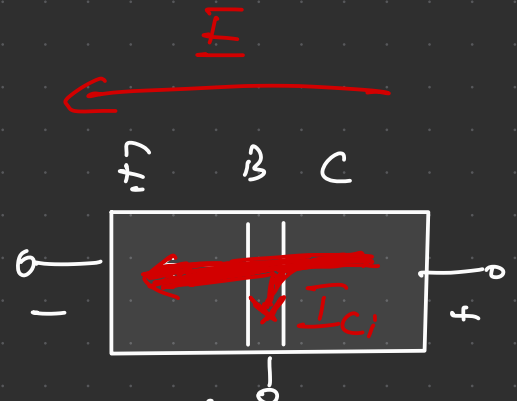
$$\begin{cases} V_{CEs} \approx 0,1 V \text{ (constantă } \rightarrow \text{ min-limit)} \\ I_C = I_{Cs} \text{ (max-limit)} \\ V_{BE} = V_{BES} (\sim 0,7 V) \end{cases}$$

→ face ca tranzistorul să lucreze ca un comutator închis

$$I_C = \max$$

$$V_{CE} = \min$$

$$R_{CE} = \min$$



d) pol. inversă directă

→ colecatorul schimbă rolul cu emitorul

$$I_{E_i} = \alpha_i \cdot I_{C_i} + I_{C_0} \quad \alpha_i = 0,4 \div 0,5$$

→ regim invers, tranzistor → atenuator de curent