Laborator 3 electronică I:

Porți logice cu tranzistori:

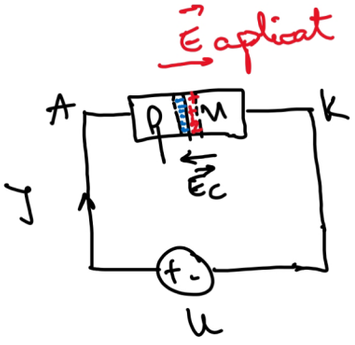
- porți logice cu TB (BJT) → bipolar junction transistor
- porți logice de tip CMOS → tranzistori cu efect de câmp de tip MOS (MOSFET) Field-effect transistor

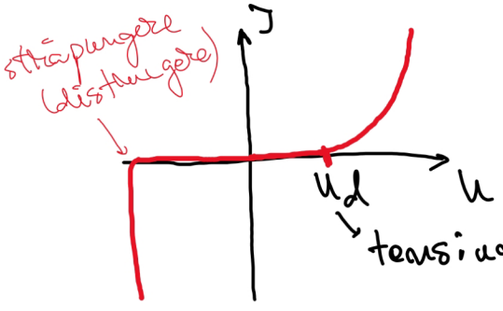
Joncțiunea p-n:

semiconductor p - dopat cu elemente acceptoare
goluri ca purtători majoritari

Si nedopat - concentrații egale de electroni și goluri

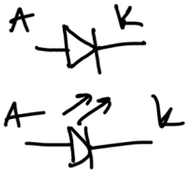
semiconductor n - dopat cu elemente donoare
electroni ca purtători majoritari



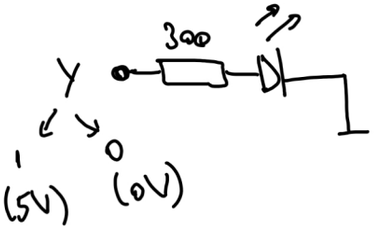


U_d → tensiune de deschidere ($\simeq 0.7V$)

Diode semiconductoare LED



1 logic LED ON
0 logic LED OFF



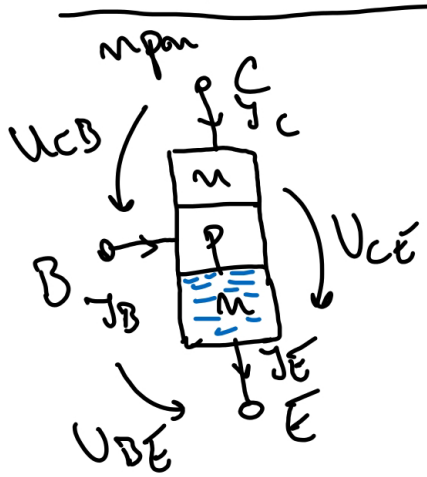
Tranzistorul bipolar (TB, BJT) ;

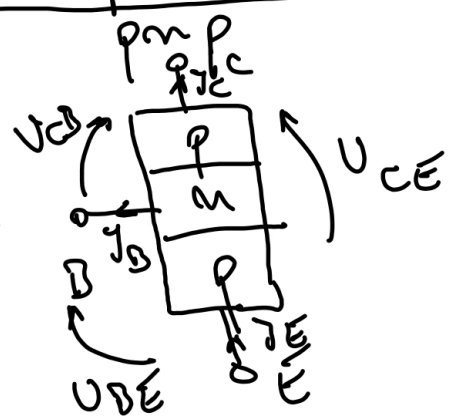
dispozitiv controlat în curent

controlăm I_C prin I_B

↓ mA ↓ μA

(small signal).

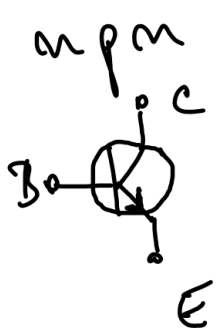


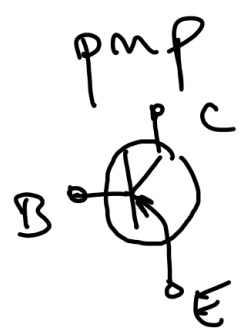


$I_E \simeq I_C$

$I_C \simeq \beta \cdot I_B$

$\beta = 10 - 1000$





Regimuri de funcționare ale TB:

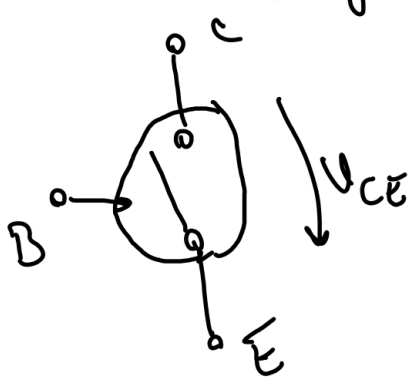
BLOCAT

$I_B = 0$

$U_{BE} < 0.7V$ (Ud)

$I_C = 0$

$U_{CE} \simeq E_C$ (1 logic)



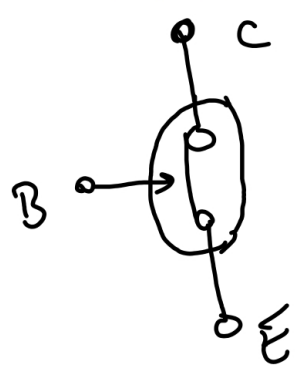
SATURAT

I_B - mare

$I_C = max < \beta I_B$

$U_{BE} \simeq 0.7V$

$U_{CE} = 0 - 0.2V$ (0 logic)
(f. mic)



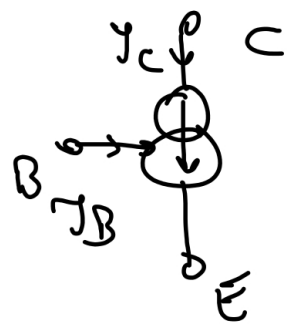
ACTIV

$U_{CE} > 0$

$U_{BE} \simeq 0.7V$

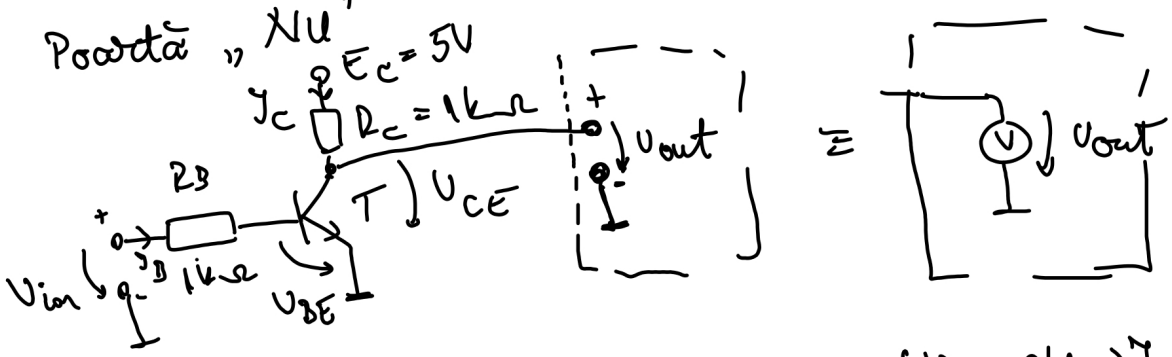
I_B - mici mic mici mare

$I_C = \beta \cdot I_B$



Porți logice elementare cu TB:

Poarta „NU"



$\equiv$

U_{in}	U_{out}	Stare T
0V	5V	Blocat
5V	0V	saturat

$U_{in} = 0V \Rightarrow I_B = 0,\ U_{BE} = 0$

T blocat

$I_C = 0 \Rightarrow U_{out} = 5V$

$U_{in} = 5V \Rightarrow I_B$ finit

$U_{BE} \cong 0.7V$

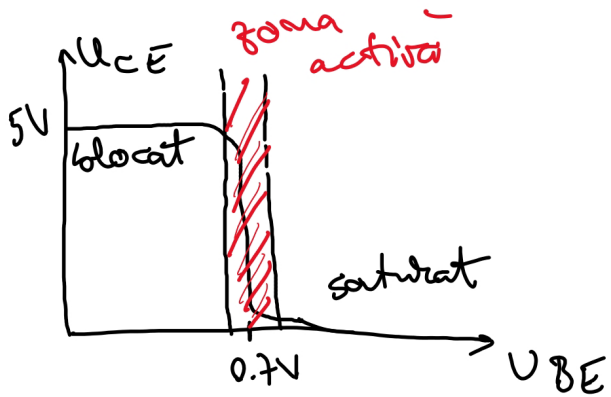
T saturat

I_C - max

$U_{out} \cong 0$

IN	OUT
0	1
1	0

$\Rightarrow$ „NOT" („NU")



TTL

IN:

0: 0 - 0.8V

1: 2 - 5V

OUT:

0: 0 - 0.5V

1: 2.7 - 5V

$V_{alim} - 4.9 - 5.25V$

Tranzistorul cu efect de câmp de tip MOS:

MOSFET cu canal indus. (enhancement mode).

CMOS V_{DD} - 5 - 18V

IN:

0: 0 - 1.5V

1: 3.5 - 5V

OUT:

0: 0 - 0.05V

1: 4.95 - 5V