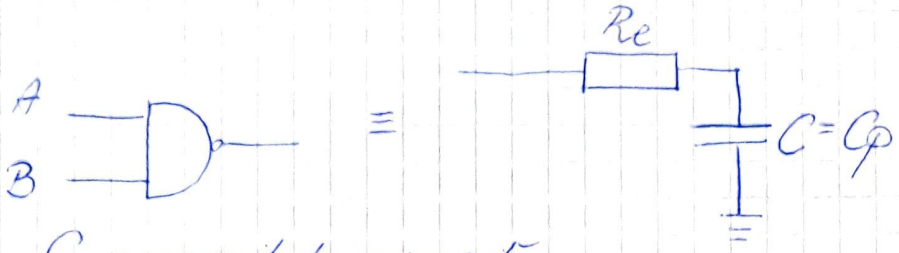
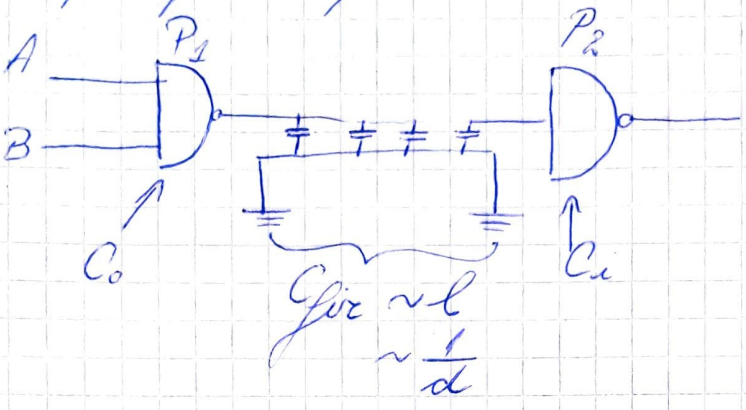
CD - curs 2



Cp = capacitate parazită



$C_p = C_o + C_{fir} + \Sigma C_i$

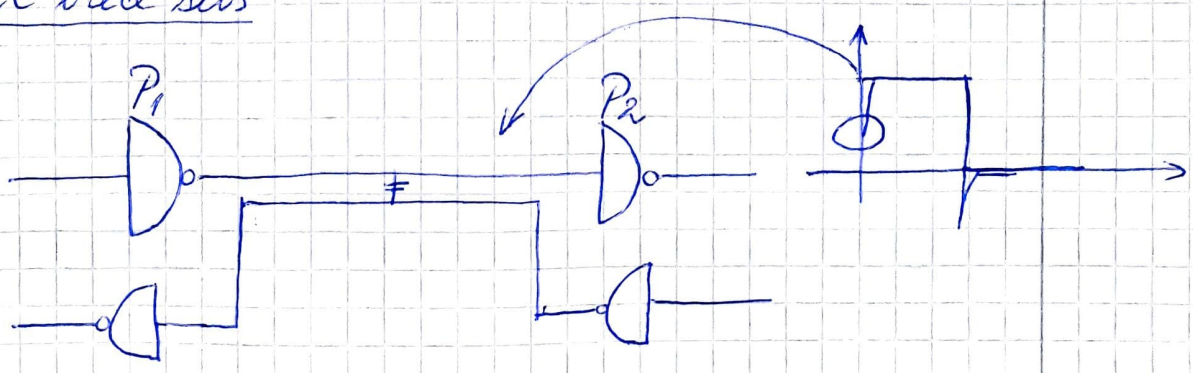
$C_o = 3 \div 5\ pF$

$C_i = 3 \div 5\ pF$

$C_{fir} = 50 \div 100\ pF/m$ → rezistența gradului de integrare

C.i. V - LSI (1 ÷ 10p)
- MSI (10 ÷ 100p)
- VSI (100 ÷ 1000p)
- VLSI (1000 ÷ 10000p)

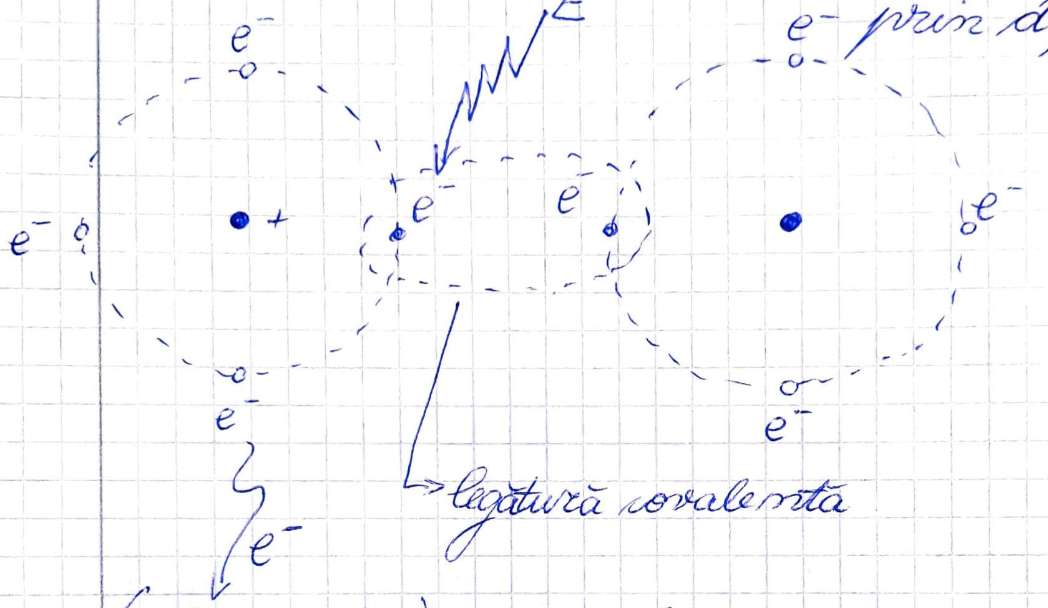
RC trece sus



Parametrii statici și dinamici ai dispozitivelor semiconductoare:
- Parametri statici
- Parametri dinamici

Dioda semiconductoare

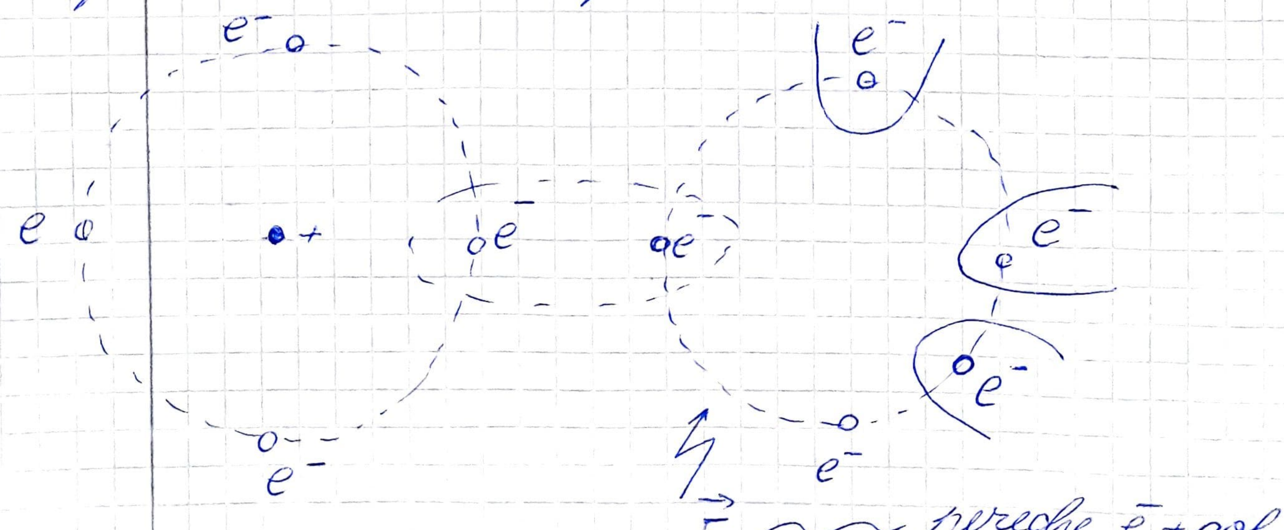
ex: Si - silicu - amestecat cu impurități prin dopare



(-(e)+(gol)) pereche electron-gol

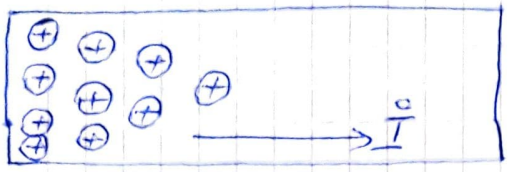
E externă (energie) poate fi: - calorică
- electro-magnetic (electric / magnetic)
- sub acțiunea radiațiilor luminoase

Dopare $10^{14 \div 20}$ + 1 imp.



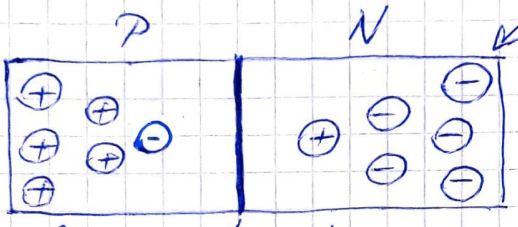
$\vec{E}$ ~ pereche $\bar{e}$ + gol

1. Prin distribuția neuniformă a sarcinilor el.



2. Prin aplicarea unui <u>câmp electric exterior</u>
↳ generat de diferență de potențial

Dioda semiconductoare

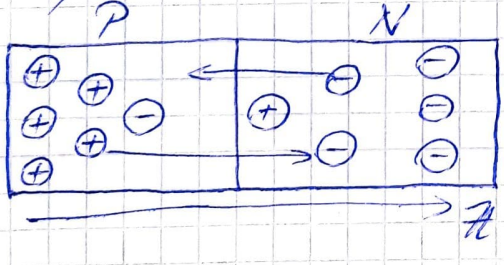


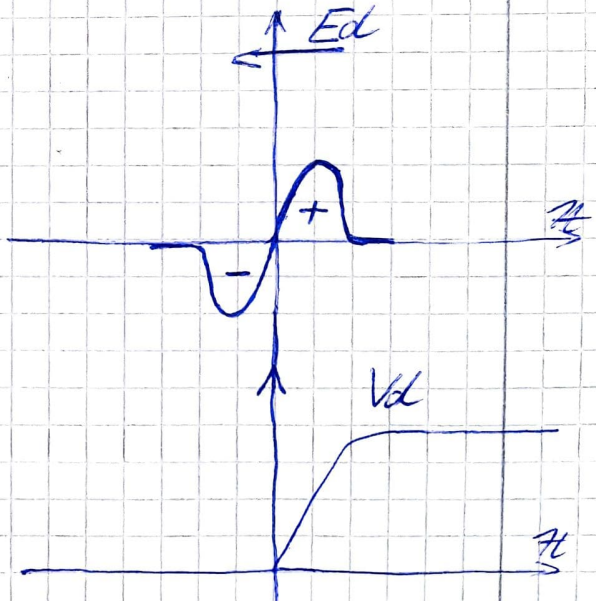
e sunt majoritare
golurile sunt minoritare

↳ joncțiune

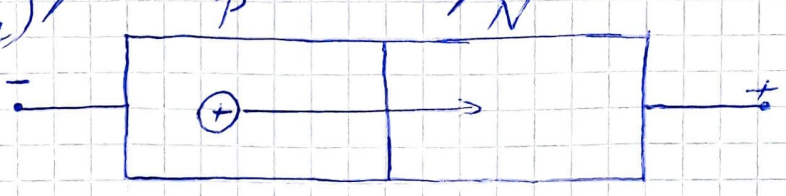
golurile sunt majoritare
e sunt sarcini minoritare

Difuzie

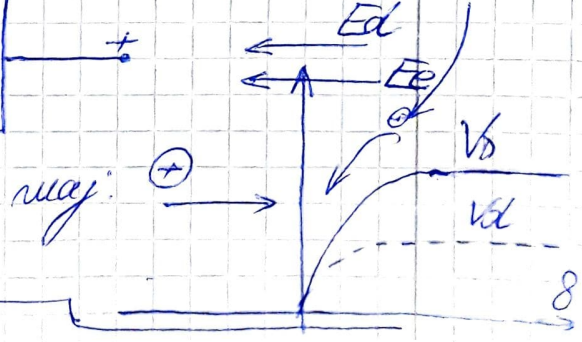




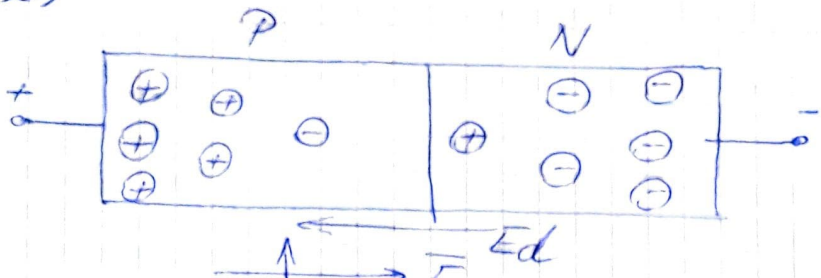
a) aplicăm un câmp electric din exterior

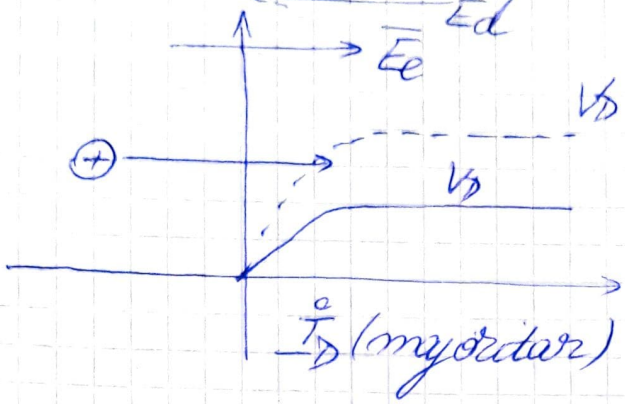


minoritare



b)





$\mathring{I}_D = \mathring{I}_0 (e^{\frac{V_D}{\eta V_T}} - 1)$

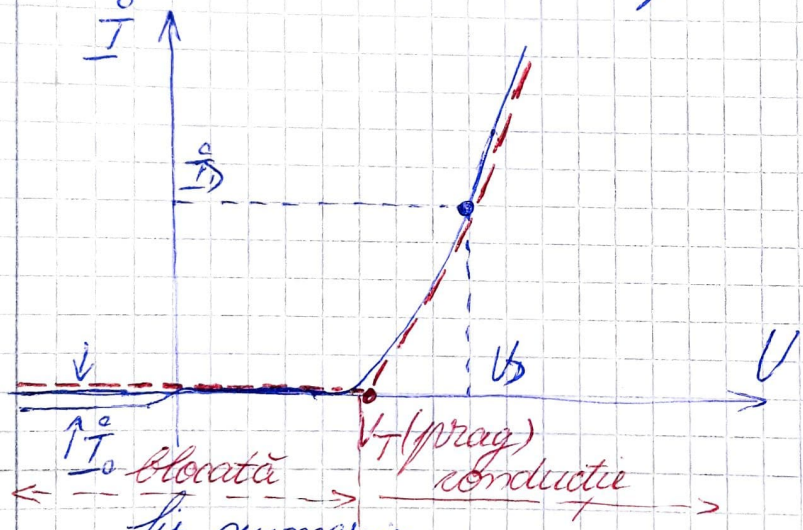
$\mathring{I}_D$ - curentul prin diodă

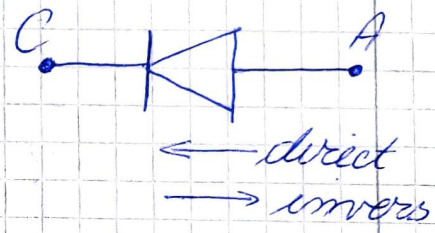
V_D - dif. de potențial la bornele diodei

η ← ~2 - Si
~1 - Ge

V_T - tens. termică (26mV la 25°)

Caracteristica Volt-Amper





Sis. numerice

Comutare { $\mathring{I}$ mare; R mică „1"
$\mathring{I}$ mic; R mare „0"

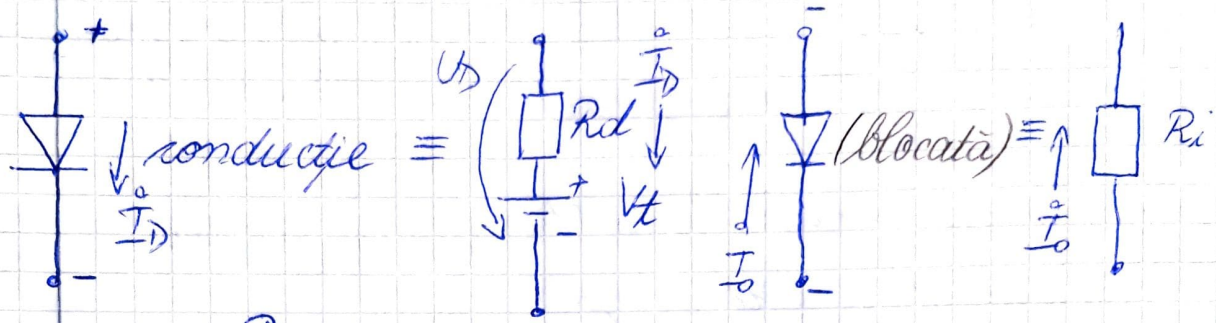
k

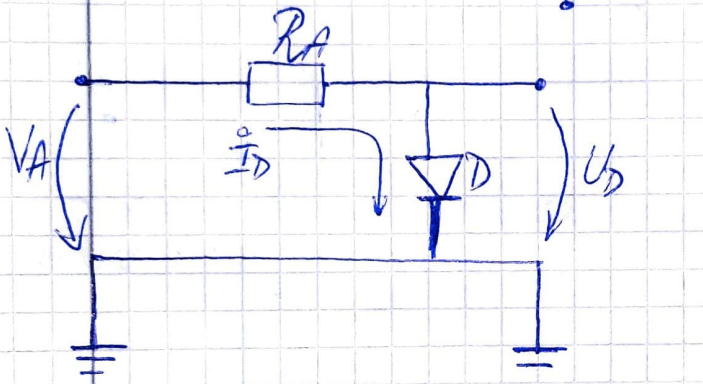
{ închis; $\mathring{I}$ mare; R mică „1"
deschis; $\mathring{I}$ mic; R mare „0"

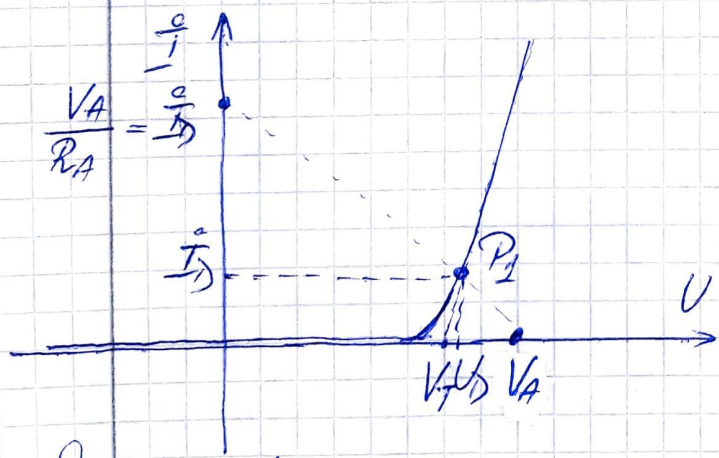
Dioda semiconductoare { conducție (polarizat direct)
$\mathring{I}$ mare; R mică → „1"
blocată (polarizare inversă)
A(-)
C(+)
$\mathring{I}$ mic; R mare → „0"

Diode de comutație - folosite în circuite numerice

- V_γ (prag) $\simeq 0{,}6 \div 0{,}65\,V$
- $\overset{\circ}{I}_o$ (rezidual de saturație) $\simeq 10 \div 20\,nA$
- R_d (directă) $= \dfrac{V_D}{\overset{\circ}{I}_D}$
- R_i (inversă) $\simeq 10 \div 20\,M\Omega$
- $\overset{\circ}{I}_D \simeq 1 \div 20\,mA$







Dreapta de sarcină

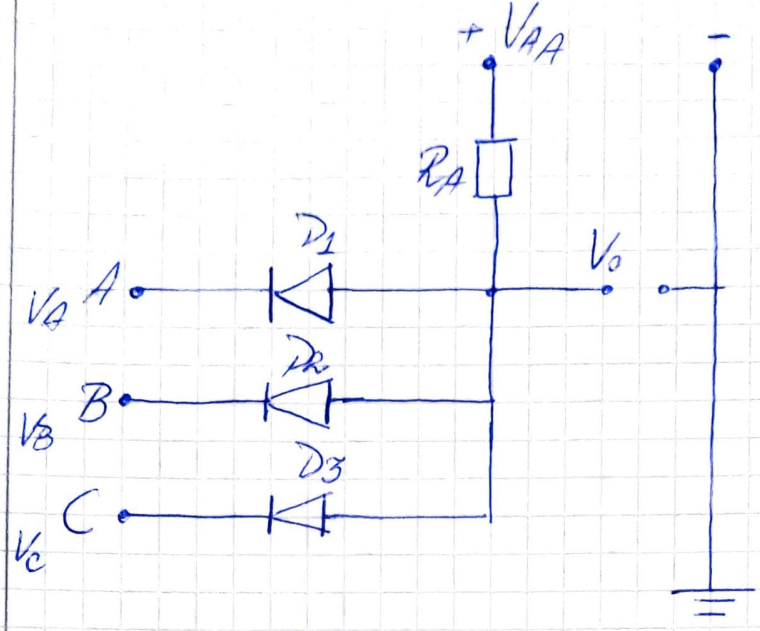
$V_A = R_A \cdot \overset{\circ}{I}_D + V_D$

a) pt. $V_D = 0 \rightarrow \overset{\circ}{I}_D = \dfrac{V_A}{R_A}$

b) pt. $\overset{\circ}{I}_D = 0 \rightarrow V_D = V_A$

V_A (int) să se modifice prin proiectare

Poarta ȘI cu diode (3 intrări)



$V_{AA} > V_H > V_L$

ex: $V_{AA} = 15V$

$V_H = 5V$

$V_L = 0V$

$2^3 = 8$

a) $V_A = V_B = V_C = V_L$

D_1, D_2, D_3 conducție

$V_0 = V_L + V_T$ și dacă V_T neglijabilă, $V_0 \simeq V_L$

↳ cădere de prag

b) $V_A = V_B = V_C = V_H$

D_1, D_2, D_3 conducție

$V_0 = V_H + V_T$ și dacă V_T neglijabilă

$V_0 \simeq V_H$

c) $V_A = V_L$; $V_B = V_C = V_H$

$V_B = V_2$; $V_A = V_C = V_H$

$V_C = V_L$; $V_A = V_B = V_H$

$V_A = V_B = V_2$; $V_C = V_H$

} 6 combinații

D_1 cond. → $V_0 = V_A = V_L + V_T \simeq V_T$

D_2, D_3 bl. $V_H = 1$ logic $V_L = 0$ logic

V_A	V_B	V_C	V_D
V_L	V_L	V_L	V_L
V_L	V_L	V_H	V_L
V_L	V_H	V_L	V_L
V_L	V_H	V_H	V_L
V_H	V_L	V_L	V_L
V_H	V_L	V_H	V_L
V_H	V_H	V_L	V_L
V_H	V_H	V_H	V_H

V_A	V_B	V_C	V_D
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

$F = A \cdot B \cdot C$ (S_i)

Dimensionare (proiectarea circuitului ȘI cu diode)

m. c. c. m. d

- R (± toleranță)
- D (variații ale $\frac{\Delta}{T} = f(U)$)
- V_{AA} (tens. de alimentare ± toleranțe)
- circuitul funcționează la temperaturi diferite
- $\frac{\Delta}{T_0} \sim T°(C)$
- încărcare diferită