$$I_{OH} \geq \sum I_{IH}$$

$$I_{OL} \geq \sum I_{iL}$$

④ Timpul de propagare

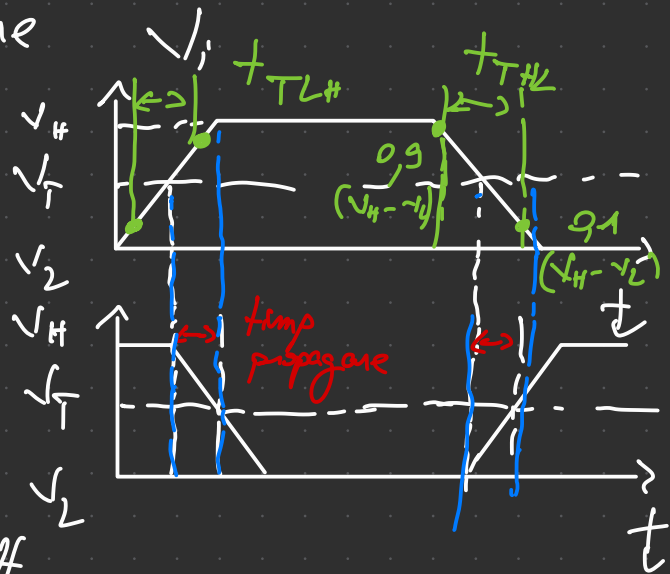$P_1$       $P_2$



→ primul $t_p$ →    $t_{PH2}$

    tranziție $H \to L$   $t_{p2H}$

→ 2 $t_p$ → tranz. $L \to H$

$$t_{pH2} \neq t_{pLH}$$

$$t_{pd} = \frac{t_{pH2} + t_{pLH}}{2}$$

timp de întârziere

$$t_{pH2} \doteq 2 \, t_{pLH}$$

$t_p H2 = \vdash\!\dashv$
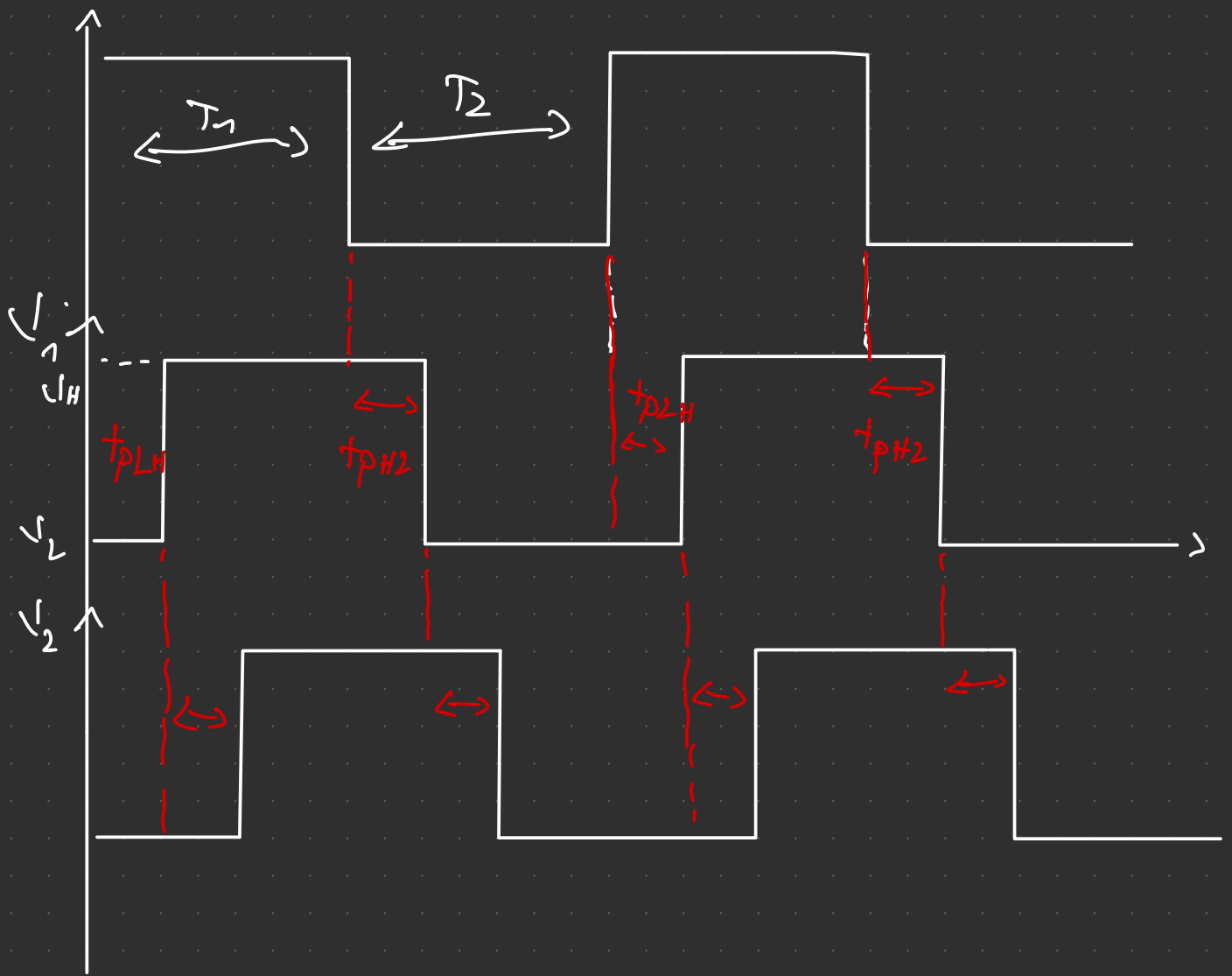
$t_{p2H} = \vdash$

Fie:
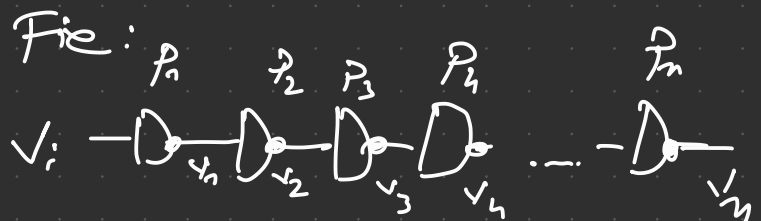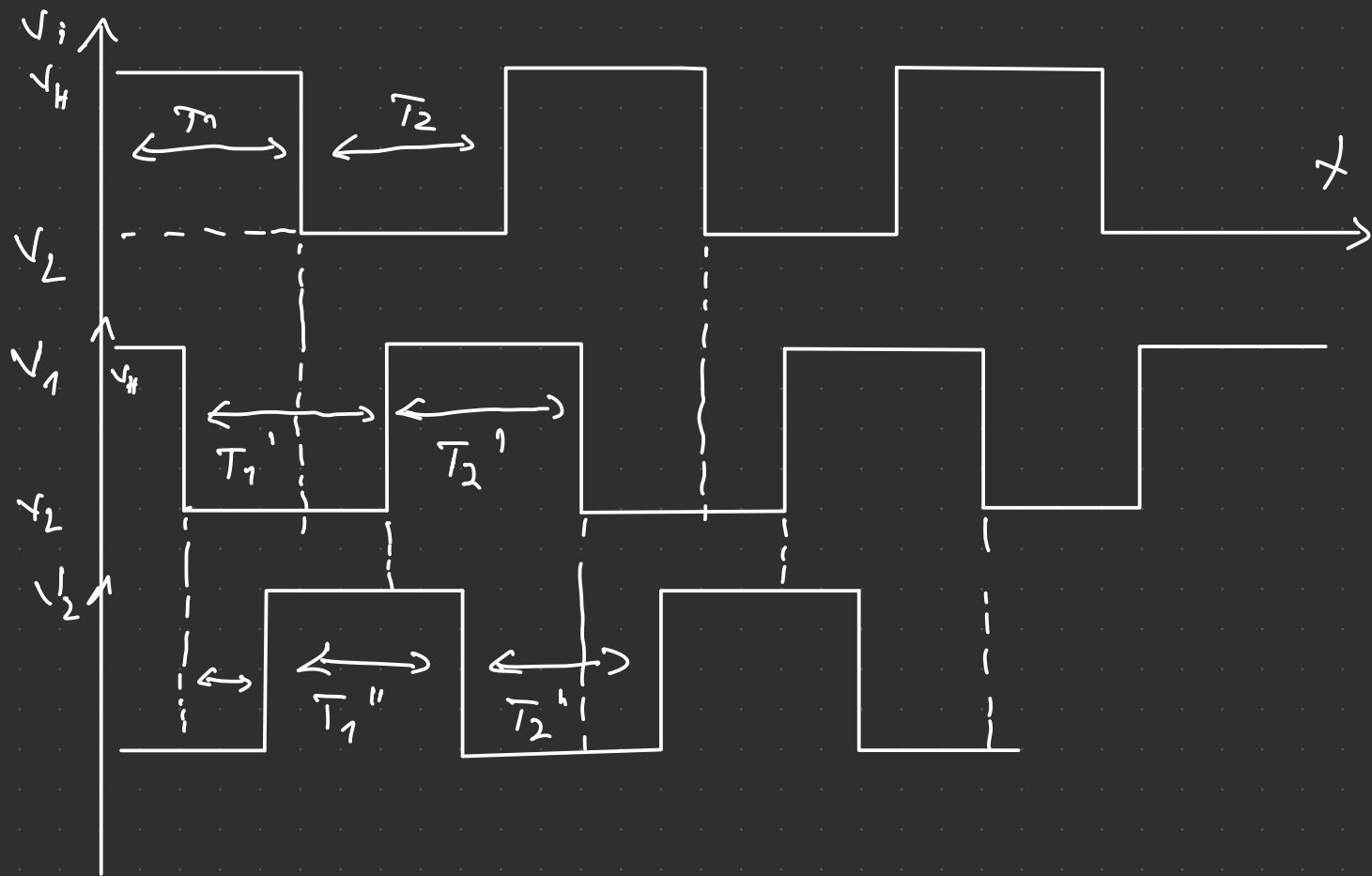
$$T_1' = T_1 - t_{pHL} + t_{pLH}$$

$$T_1'' = T_1 - t_{pLH} + t_{pHL} = T_1$$

$$T_2'' = T_2$$

$$T_1' = T_1 - t_{PLH} + t_{PHL}$$

$$T_1'' = T_1' - t_{PLH} + t_{PHL}$$

$$T_1^{(n)} = T_1 - n\left(t_{PLH} - t_{PHL}\right)$$
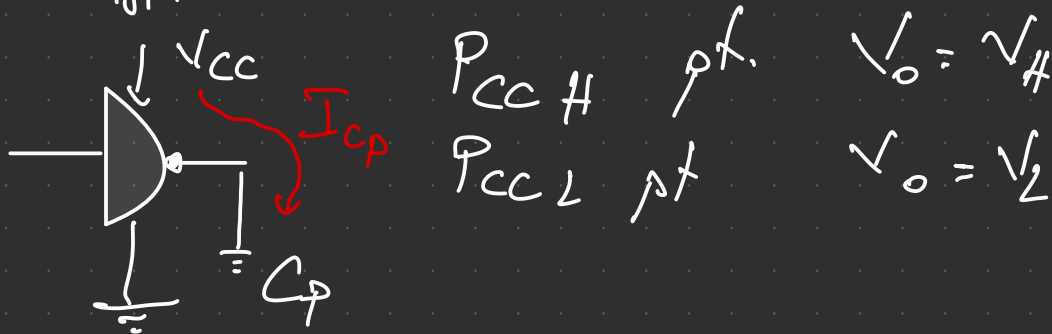
ex. $t_{PLH} = 15\ ns$

$t_{PHL} = 20\ ns$

$T_1 = T_2 = 100\ ns$ → se cere ca după câte porti semnalul dispare?

$$N = \frac{T_1}{t_{pH2} - t_{pLH}} = \frac{100}{20-10} = \underline{\underline{10}}$$

---

⑤ Puterea consumată

$$P_{tot} = P_{cc} + P_D + P_{DS}$$

$V_{cc}$
putere
statică

puterea
dinamică

dinamică
suplimentară



$P_{CC\,H}$ pt. $V_o = V_H$

$P_{CC\,L}$ pt. $V_o = V_2$

$$P_{cc} = \frac{I_{CC\,L} + I_{CC\,H}}{2} \cdot V_{cc}$$

$$C_p = \sum C_i + C_o + C_{fin.}$$
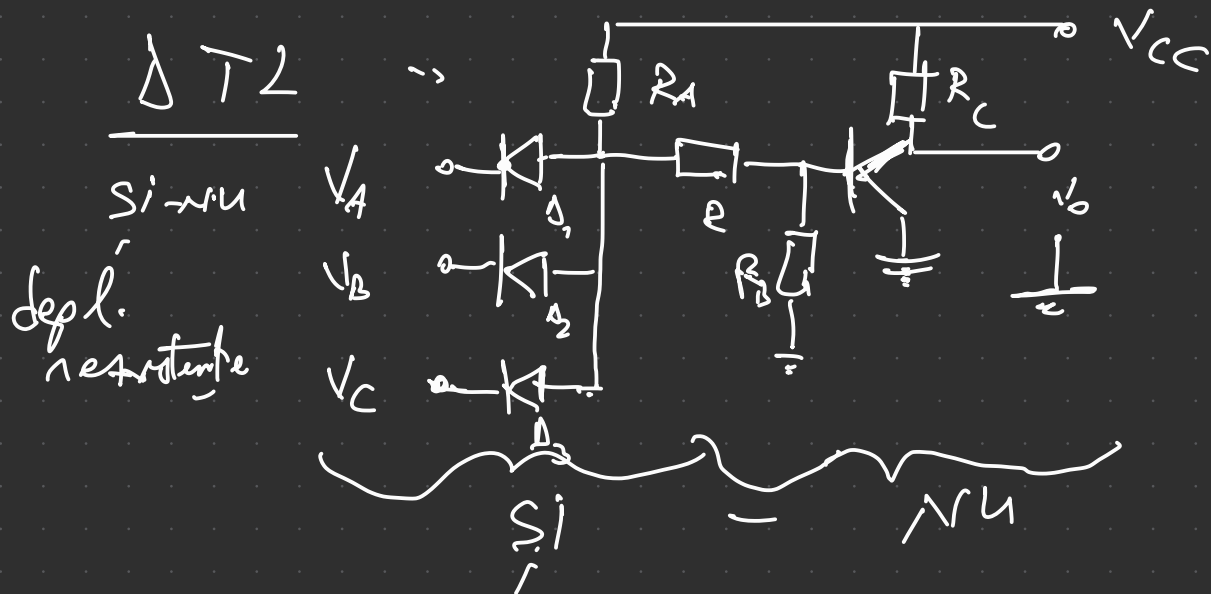
$$P_D = I_{Cp} \cdot V_{cc} = \frac{C_p V_{cc}^2}{T}$$

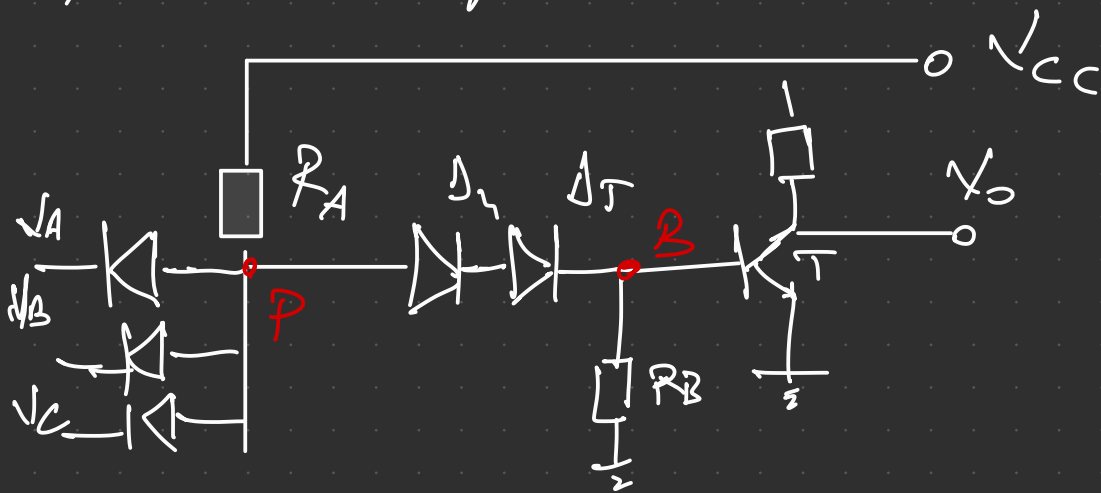$$i_{Cp} = C_p \frac{dU}{dt} = C_p F \, V_{cc}^2$$

$C_p = 50 pF$
$V_{cc} = 5^v$
$F = 1 MHz$

$P_D = 50 \cdot 10^{-12} \cdot 10^6 \cdot 25 = 1,25 \, mW$

$\underline{\Delta T2}$

Sinu

depl.
rezistenta

$V_A$
$V_B$
$V_C$



$Si \quad \overline{\quad} \quad NU$

$Si \quad NU \quad depl. \quad cu \quad diode$



$V_P > V_{CC}$

$V_P = V_{D_h} + V_{D_s} + V_{BE} \sim 2,25 V$

$V_A = V_B = V_C = V_H = V_{CC}$

a) Tranzistorul T se blocheaza $\rightarrow$ $V_P = 2,25$

$\rightarrow V_o = V_{CE_S} = 0,1 V = V_L$

b) $V_{A...} = V_L$ (cel putin o dioda $\begin{array}{c} d_1, d_2, d_3 \\ cond. \end{array}$)

$V_P = V_L + V_A = 0,1 + 0,75 = 0,85$

p.t. a deschide $D_{h,s} \xrightarrow{V_{BE}} T_{bl} \rightarrow V_H$

Pt. a conduce cele 3 jonctiuni

$(\partial_4, \partial_5, j_{BE})$ avem nevoie $\mathcal{F}_M$

$V_p = V_{D4T} + V_{D4T} + V_{BE}^{\Gamma}$

$= 0{,}6\Gamma + 0{,}65 + 0{,}65 = 1{,}95\,v$

$TSl \rightarrow V_o = V_{CC} = V\cancel{H}$

---

$\rightarrow$ | T T L |



$V_A$
$V_B$

$T_1 \rightarrow$ multiemitor