

LUCRAREA 1 - CIRCUITE LINIARE

RC TRECE-JOS

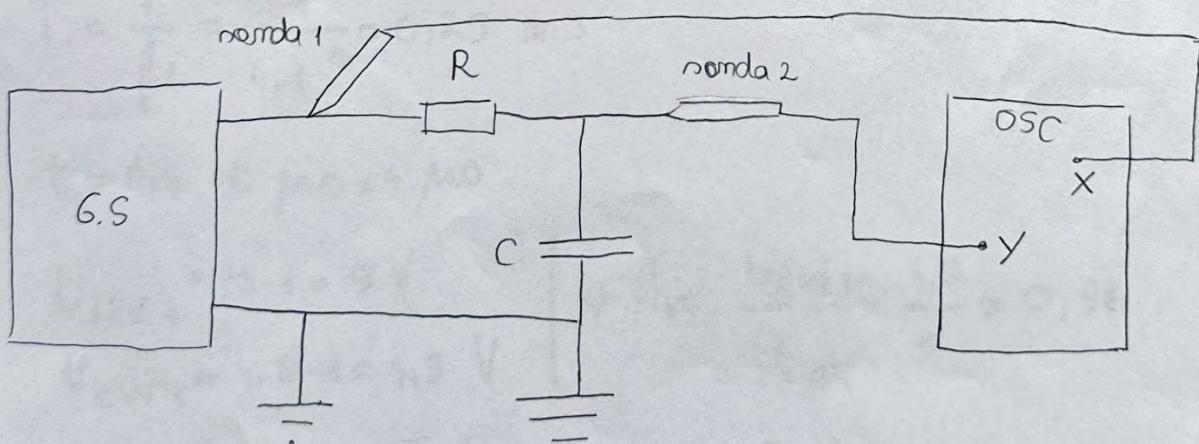
NUME: PLESA DIANA-IOANA

SEMIGRUPĂ: 2.2

Scopul lucrării

Se va studia experimental trecerea semnalelor de
diferite forme (sinusoizdale, rectangulare, exponentiale) prin
circuitele RC trece-jos.

Schema montajului



G.S. = generator de semnal

OSC = osciloscop

X, Y = intrare semnal osciloscop

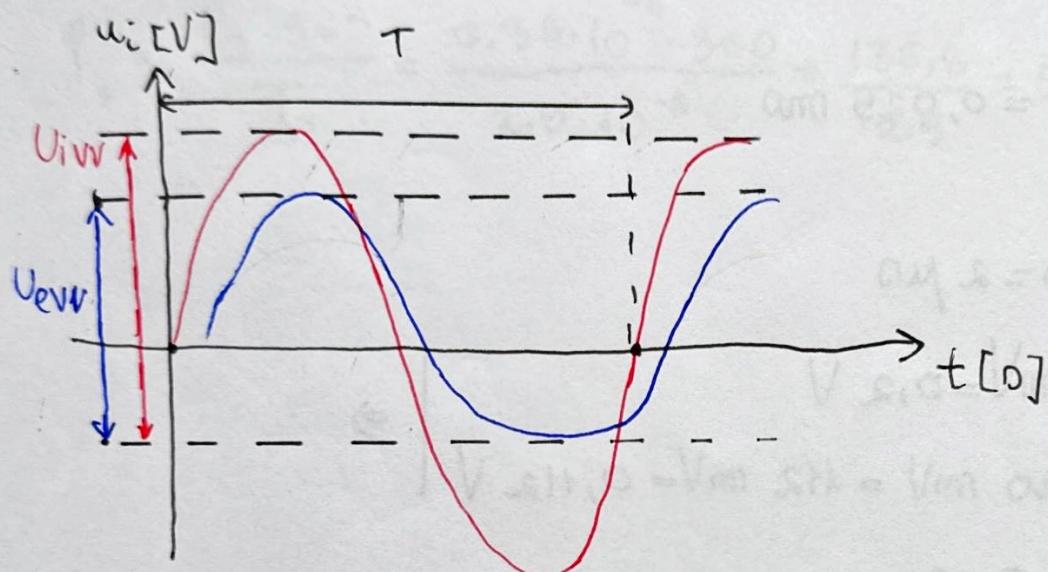
Mässuratori

$$R = 12 \text{ k}\Omega$$

$$C = 470 \text{ pF}$$

$$U = 5 \text{ V}$$

$$1. f_1 = 4 \cdot 10^3 \text{ Hz} = 4 \text{ kHz}$$



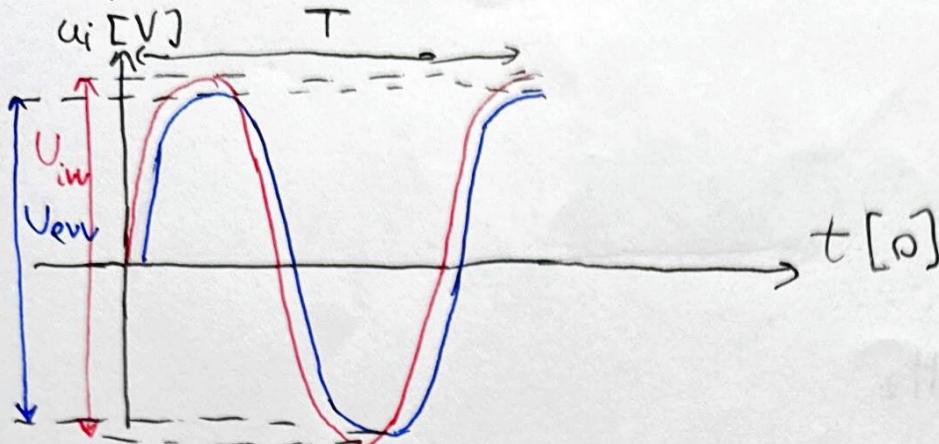
$$T_1 = \frac{1}{f_1} = \frac{1}{4 \cdot 10^3} = 0,25 \text{ ms}$$

$$t_1 = 0,4 \cdot 10 \mu\text{s} = 4 \mu\text{s}$$

$$\left. \begin{array}{l} U_{ivv1} = 5 \cdot 1 = 5 \text{ V} \\ U_{evv1} = 4,8 \cdot 1 = 4,8 \text{ V} \end{array} \right| \Rightarrow A_1 = \frac{U_{evv1}}{U_{ivv1}} = \frac{4,8}{5} = 0,96$$

$$\varphi = \frac{t_1 \cdot 360}{T_1} = \frac{4 \cdot 10^{-6} \cdot 360}{0,25 \cdot 10^{-3}} = \frac{4 \cdot 10^{-3} \cdot 360}{0,25} = \frac{4 \cdot 360}{250} = 5,76^\circ$$

$$2. f_2 = 5 \cdot 10^5 \text{ Hz} = 50 \text{ kHz}$$



$$T_2 = \frac{1}{f_2} = \frac{1}{5 \cdot 10^5} = 0,025 \text{ ms}$$

$$t_2 = 0,5 \cdot 10^{-6} = 2 \mu\text{s}$$

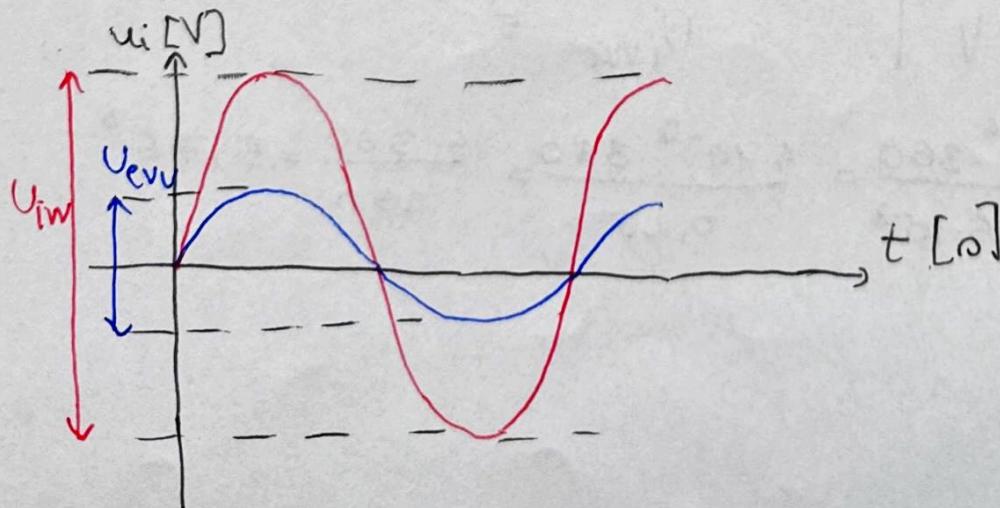
$$U_{iVV2} = 5 \cdot 50 \text{ mV} = 0,2 \text{ V}$$

$$U_{eVV2} = 5,6 \cdot 20 \text{ mV} = 112 \text{ mV} = 0,112 \text{ V} \quad | \Rightarrow$$

$$A_2 = \frac{U_{eVV2}}{U_{iVV1}} = \frac{0,112}{0,2} = 0,56$$

$$\varphi_2 = \frac{t_2 \cdot 360}{T_2} = \frac{2 \cdot 10^{-6} \cdot 360}{25 \cdot 10^{-6}} = \frac{720}{25} = 28,8^\circ$$

$$3. f_3 = 500 \text{ kHz}$$



$$T_3 = \frac{1}{f_3} = \frac{1}{5 \cdot 10^5} = 25 \cdot 10^{-6} \text{ s}$$

$$t_3 = 1,9 \cdot 200 \text{ ms} = 1,9 \cdot 200 \cdot 10^{-3} \text{ s} = 380 \cdot 10^{-3} \text{ s}$$

$$U_{IVV3} = 4,7 \cdot 1 \text{ V} = 4,7 \text{ V}$$

$$U_{EW3} = 0,5 \text{ V}$$

$$f_3 = \frac{t_3 \cdot 360}{T_3} = \frac{0,38 \cdot 10^{-3} \cdot 360}{2,5 \cdot 10^{-6}} = \frac{136,8}{2,5} = 54,72 \text{ Hz}$$

LUCRAREA 2 - CIRCUITE LINIARE RC TRECE-SUS

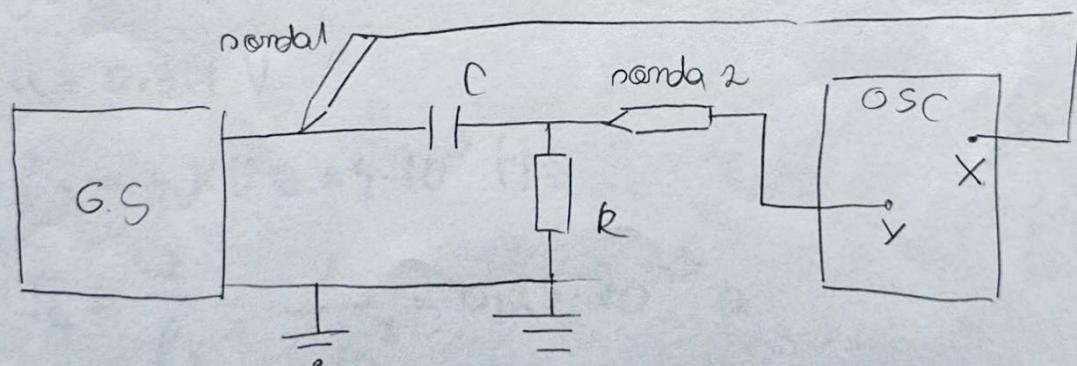
NUME: PLESĂ DIANA-IOANA

SEMIGRUPĂ : 2.2

Scopul lucrării

Se va studia experimental trecerea semnalelor de diferite forme (nunuoide, rectangulare, exponentiale) prin circuitele RC trece-sus, observându-se fenomenul de distorsiune suferit de semnalul ce se transmite prin astfel de circuit.

Schema montajului



G.S. = generator semnal

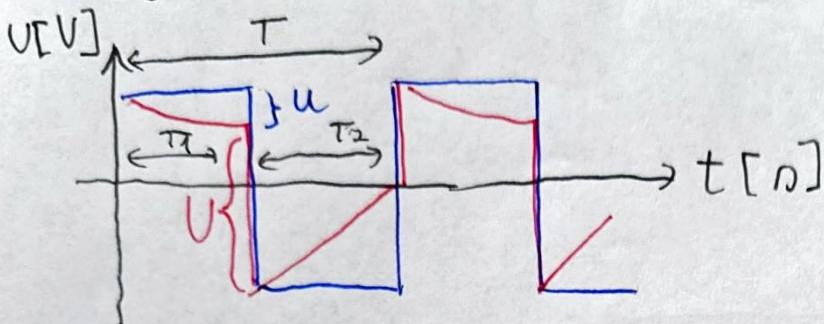
OSC = osciloscop

X, Y = intrare semne osciloscop

Māšuvarātori

a. $f_1 = 500 \text{ kHz}$ $R = 12 \text{ k}\Omega$ $C = 470 \text{ pF}$

$$t_C = 2,2 \cdot R \cdot C = 2,2 \cdot 12 \cdot 10^3 \cdot 470 \cdot 10^{-12} = 12508 \cdot 10^{-9} \text{ s}$$



$$T_1 = \frac{1}{f_1} = \frac{1}{500 \cdot 10^3} = 2,0 \cdot 10^{-6} \text{ s}$$

$$T_{11} = 2,2 \cdot 0,6 \cdot 2 \mu\Omega = 1,2 \cdot 10^{-6} \text{ s}$$

$$T_{12} = T_1 - T_{11} = 2,0 \cdot 10^{-6} - 1,2 \cdot 10^{-6} = 0,8 \cdot 10^{-6} \text{ s}$$

$$U = 5 \cdot 1 \text{ V}$$

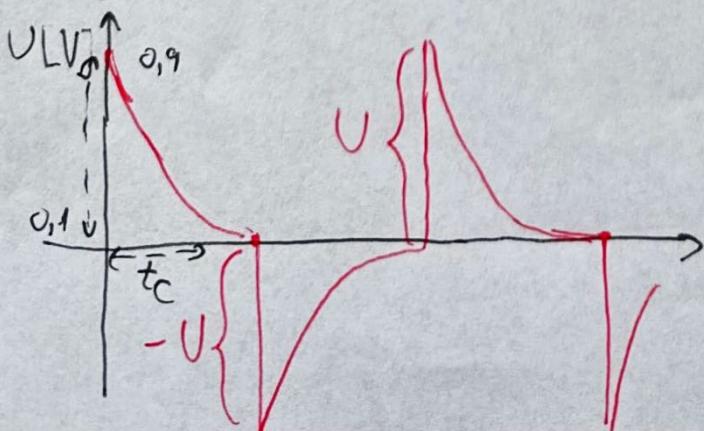
$$u = 0,5 \cdot 1 \text{ V}$$

b. $f_2 = 5 \text{ kHz} = 5 \cdot 10^3 \text{ Hz}$

$$T_2 = \frac{1}{f_2} = \frac{1}{5 \cdot 10^3} = 0,2 \cdot 10^{-3} \text{ s}$$

$$t_C = 2,2 \cdot R \cdot C = 12508 \cdot 10^{-9} \text{ s}$$

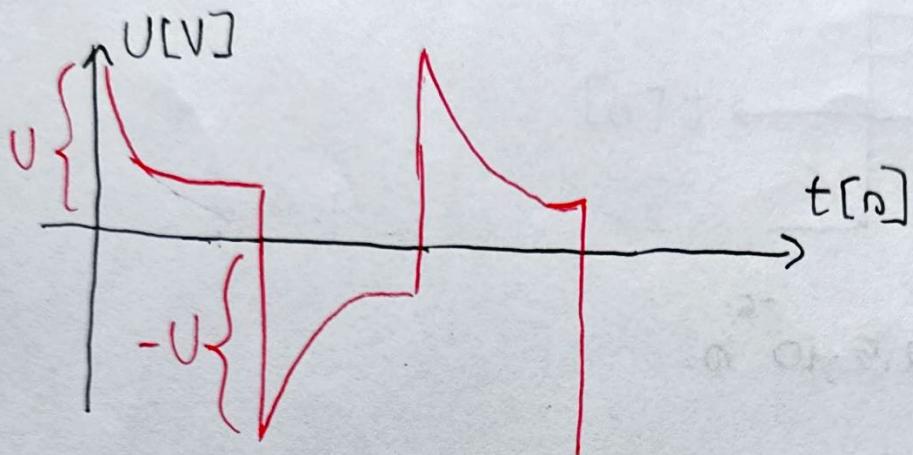
$$U = 5 \cdot 1 \text{ V} = 5 \text{ V}$$



$$c. f_3 = 90 \text{ kHz} = 90 \cdot 10^3 \text{ Hz}$$

$$U = 1,5 \cdot 1 \text{ V} = 1,5 \text{ V}$$

$$-U = -1,5 \text{ V}$$



LUCRAREA 3 - CIRCUITE LOGICE CU DIODE, POARTA S1

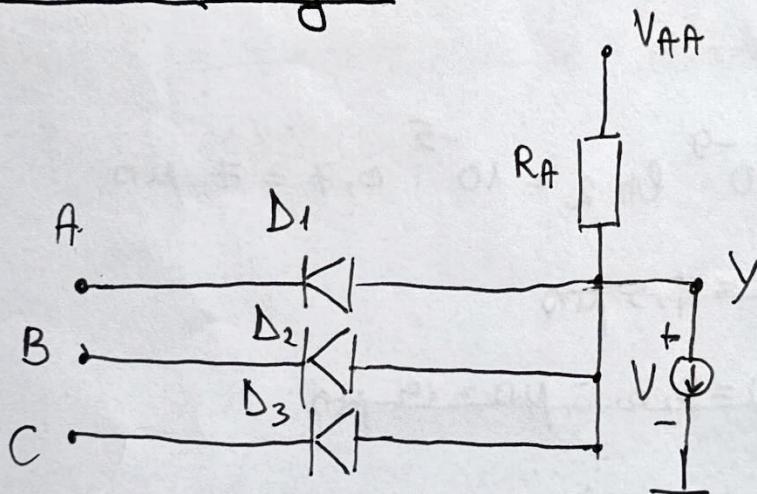
NUME: PLESA DIANA-IDANA

SEMIGRUPĂ: 2.2

Scopul lucrării

Se vor studia circuitele logice cu circuite semiconduc-toare în regim static și dinamic

Schema montajului



Măsurători

$$R = 10 \text{ k}\Omega$$

$$T_R \text{ (temp de ridicare)} = R C \cdot \ln 2$$

$$T_c \text{ (temp de coborâre)}$$

$$T \text{ (durata de repetitie a semnalului)}$$

$$t_i \text{ (durata impulsului)}$$

$$T = 10 \cdot 10 \text{ } \mu\text{s} = 100 \text{ } \mu\text{s}$$

$$t_i = 1 \cdot 10 \text{ } \mu\text{s} = 10 \text{ } \mu\text{s}$$

a. $C = 220 \text{ pF}$

$$T_R = 10 \cdot 10^3 \cdot 220 \cdot 10^{-12} \cdot \ln 2 = 220 \cdot 10^{-8} \cdot 0,7 = 154 \cdot 10^{-8} \text{ s} = 1,54 \mu\text{s}$$

$$t_C = 0,2 \cdot 1 \mu\text{s} = 0,2 \mu\text{s}$$

$$T_R (\text{mäsurat}) = 0,9 \cdot 1 = 0,9 \mu\text{s}$$

b. $C = 470 \text{ pF}$

$$T_R = 10 \cdot 10^3 \cdot 470 \cdot 10^{-12} \cdot \ln 2 = 470 \cdot 10^{-8} \cdot 0,7 = 329 \cdot 10^{-8} \text{ s} = 3,29 \mu\text{s}$$

$$t_C = 0,1 \cdot 5 \mu\text{s} = 0,5 \mu\text{s}$$

$$T_R (\text{mäsurat}) = 0,9 \cdot 5 \mu\text{s} = 4,5 \mu\text{s}$$

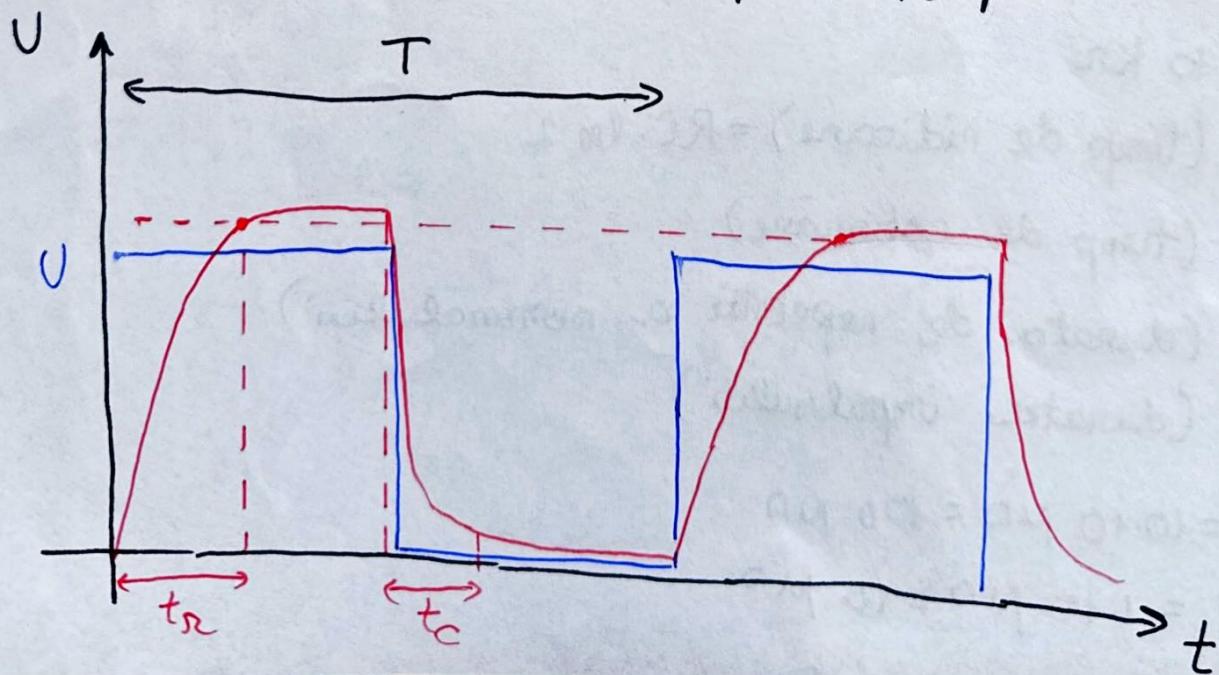
c. $C = 1 \text{ mF}$

$$T_R = 10 \cdot 10^3 \cdot 1 \cdot 10^{-9} \ln 2 = 10^{-5} \cdot 0,7 = 7 \mu\text{s}$$
 ~~$t_C = 0,3 \cdot 5 \mu\text{s} = 1,5 \mu\text{s}$~~

~~$T_R (\text{mäsurat}) = 3,8 \cdot 5 \mu\text{s} = 19 \mu\text{s}$~~

$$t_C = 0,3 \cdot 1 \mu\text{s} = 0,3 \mu\text{s}$$

$$T_R (\text{mäsurat}) = 0,38 \cdot 1 \mu\text{s} = 0,38 \mu\text{s}$$



LUCRAREA 5 - CIRCUITE

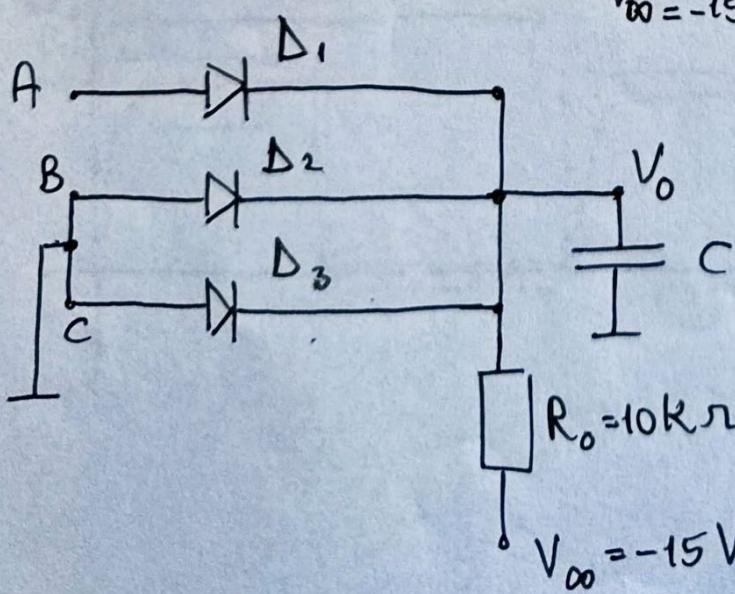
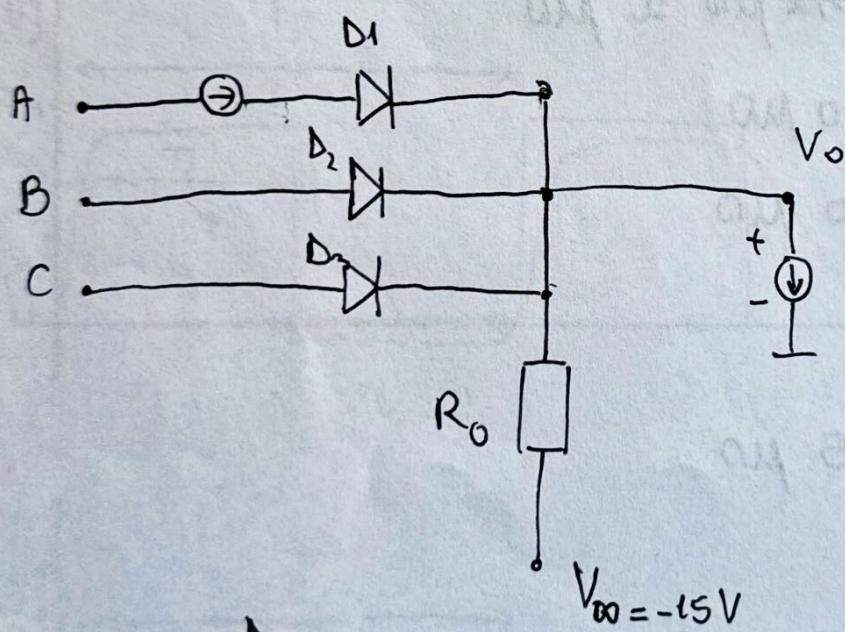
LOGICE CU DIODE, POARTA SAU

PLESA DIANA-IOANA, 2.2

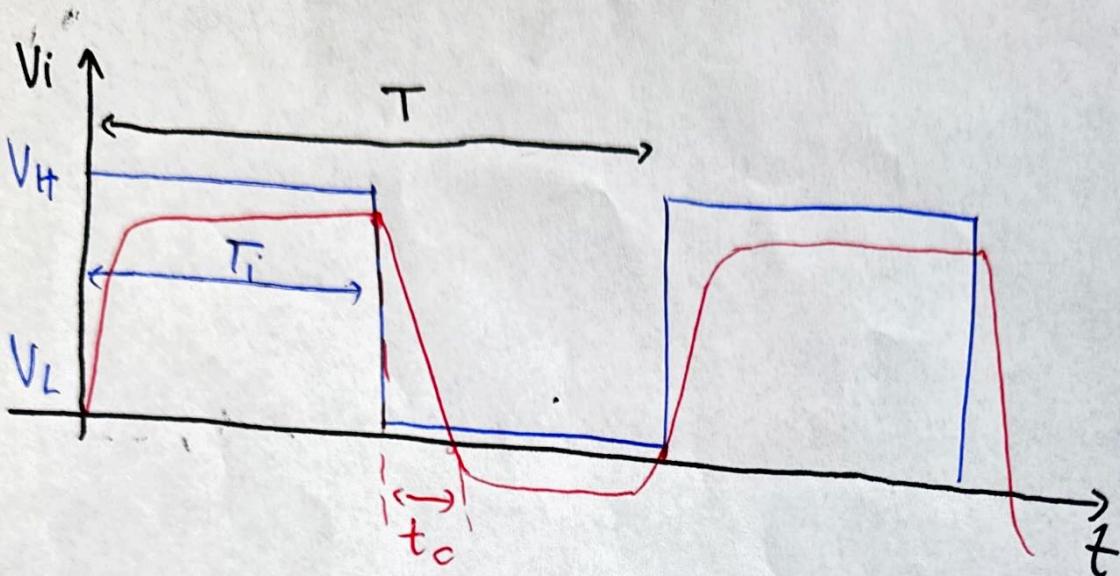
Scopul lucrării

Vor fi studiate circuitele logice cu diode semiconductoare și rezistențe, atât în regim static cât și în regim dinamic.

Schema circuitului



Mäsuratou



a. $C = 100 \text{ pF}$

$$t_c = 0,2 \cdot 10 \mu\Omega = 0,2 \mu\Omega \cdot 2 \mu\Omega$$

$$T = 5 \cdot 10 \mu\Omega = 50 \mu\Omega$$

$$t_i = 1 \cdot 10 \mu\Omega = 10 \mu\Omega$$

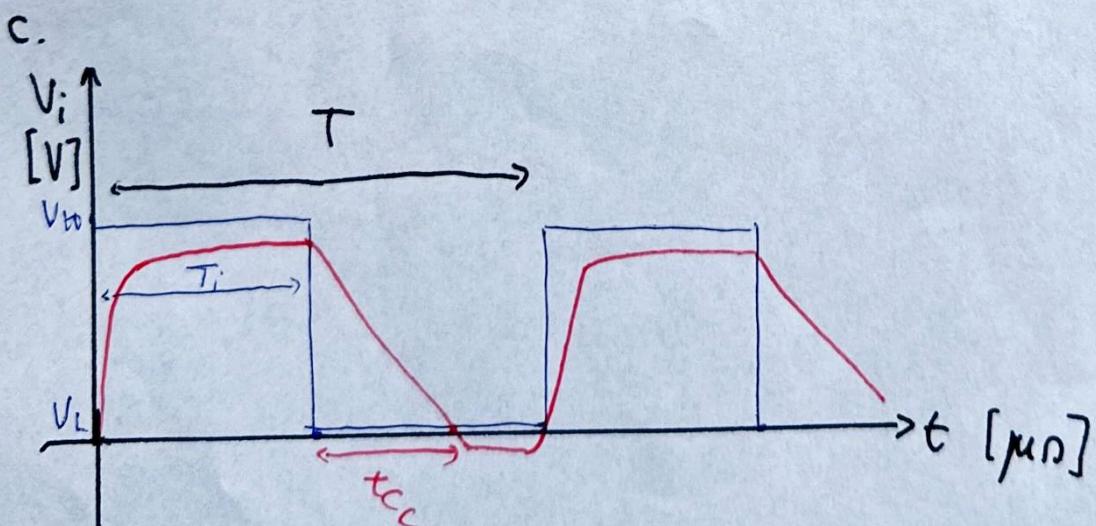
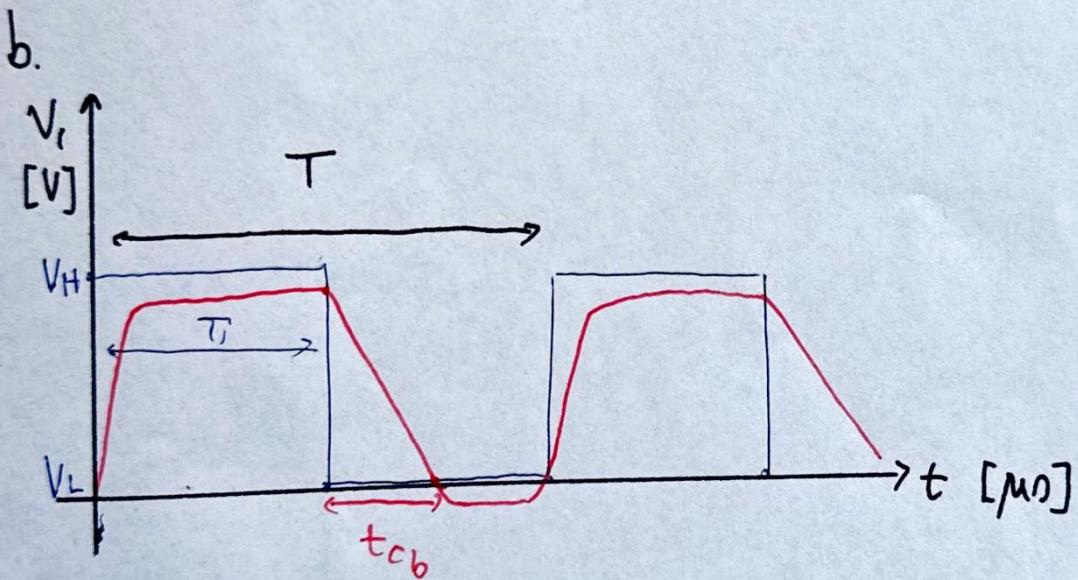
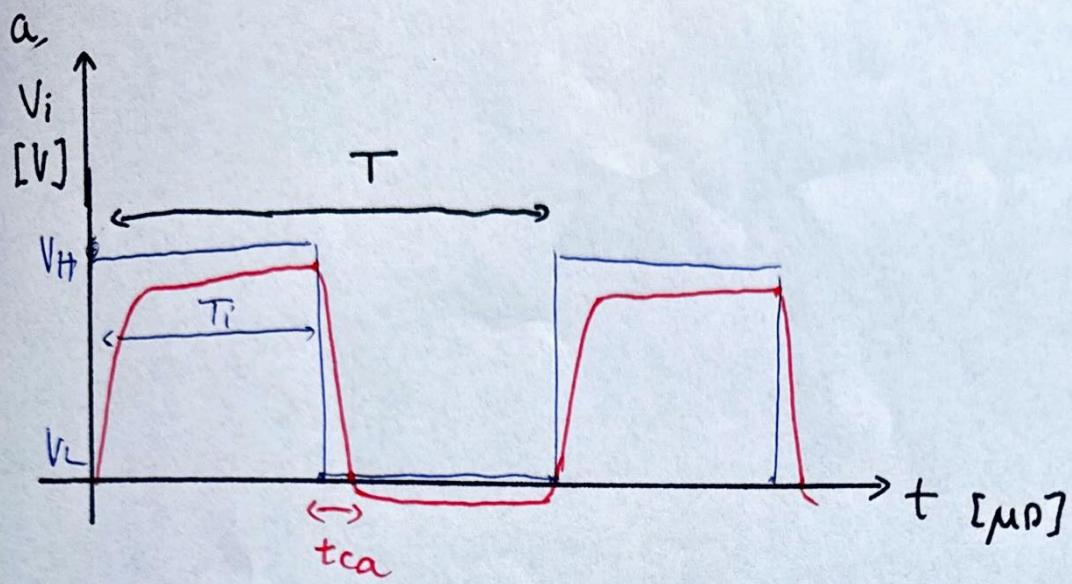
b. $C = 1 \text{ mF}$

$$t_c = 0,5 \cdot 10 \mu\Omega = 5 \mu\Omega$$

c. $C = 1,5 \text{ mF}$

$$t_c = 0,6 \cdot 10 \mu\Omega = 6 \mu\Omega$$

Grafice



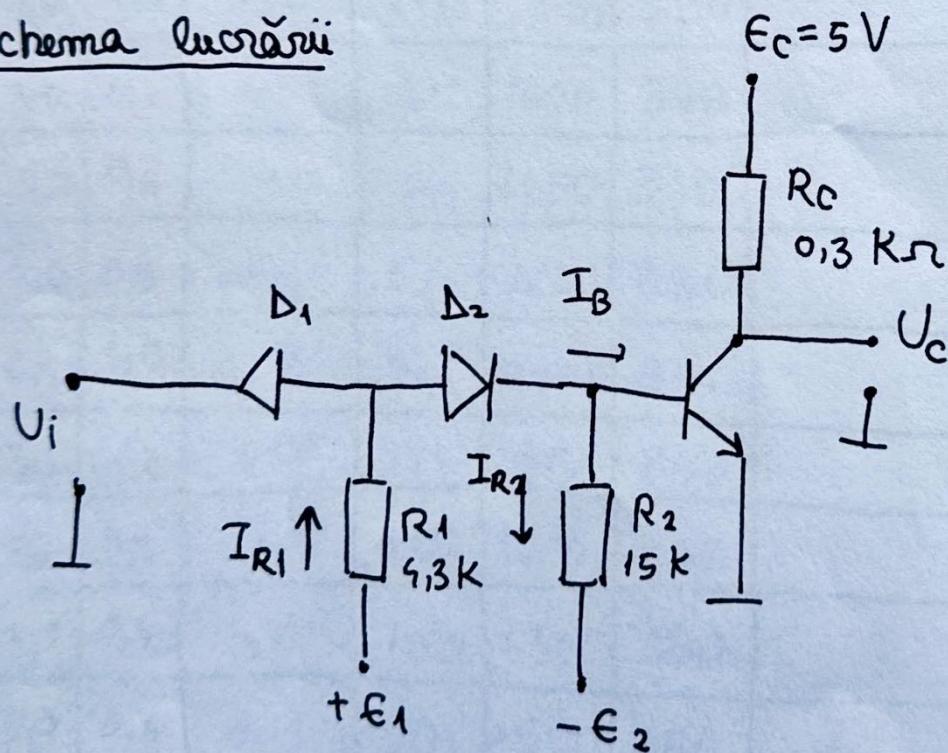
LUCRARE 5 - CARACTERISTICI DINAMICE ALE TRANZISTOARELOR BIPOLARE

PLESA DIANA-IOANA 2.2

Scopul lucrării

Se vor ridica experimental variația timpilor de comutare la transistoarele bipolare funcție de curentul de bază și se va determina dependența acestor tempi, de curentul de bază direct și invers.

Schema lucrării



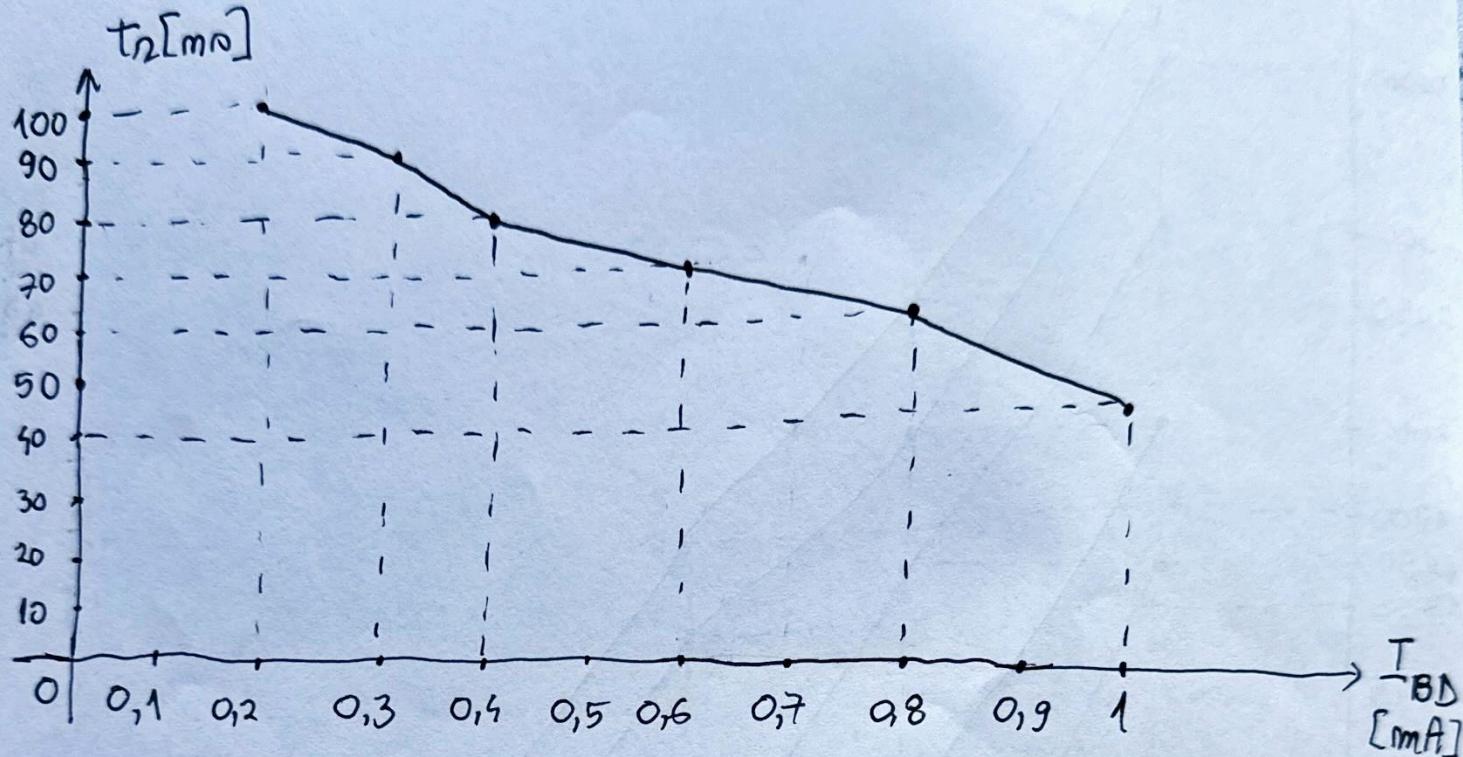
$-E_2$ V	I_{B1} mA	E_1 V	I_{BD} mA	t_i ms	t_n ms	t_s ms	t_c ms	Observati
0,75	0,05	2,8	0,2	40	100	1650	350	
		3,2	0,3	35	95	1850	420	
		3,7	0,4	26	80	2000	490	
		4,9	0,6	20	70	2300	565	
		5,4	0,8	10	60	2600	500	
		6,2	1,0	5	50	2750	505	
1,5	0,1	3	0,2	60	150	1100	430	
		3,4	0,3	50	110	1350	390	
		3,9	0,4	45	85	1600	375	
		4,7	0,6	30	70	1850	390	
		5,6	0,8	10	60	2000	380	
		6,4	1,0	5	55	2250	350	
$\frac{2,5}{3}$	0,25	3,2	0,2	60	125	900	300	
		3,7	0,3	55	110	1200	325	
		4,1	0,4	35	100	1300	350	
		4,9	0,6	25	90	1500	360	
		5,8	0,8	20	70	1750	390	
		6,7	1,0	15	55	1900	370	
3	0,2	3,4	0,2	45	150	650	280	
		3,9	0,3	40	130	950	310	
		4,3	0,4	37	120	1100	320	
		5,2	0,6	30	70	1450	310	

$-E_2$ V	I_{B1} mA	E_1 V	I_{BD} mA	t_i nS	t_r nS	t_s nS	t_c nS	Observatü
		6,0	0,9	25	65	1550	300	
		6,9	1,0	21	50	1650	305	
3,75	0,25	3,7	0,2	39	140	655	320	
		4,1	0,3	35	130	800	300	
		4,5	0,4	30	120	925	305	
		5,4	0,6	25	90	1200	315	
		6,2	0,8	20	70	1350	290	
		7,1	1,0	15	50	1450	330	

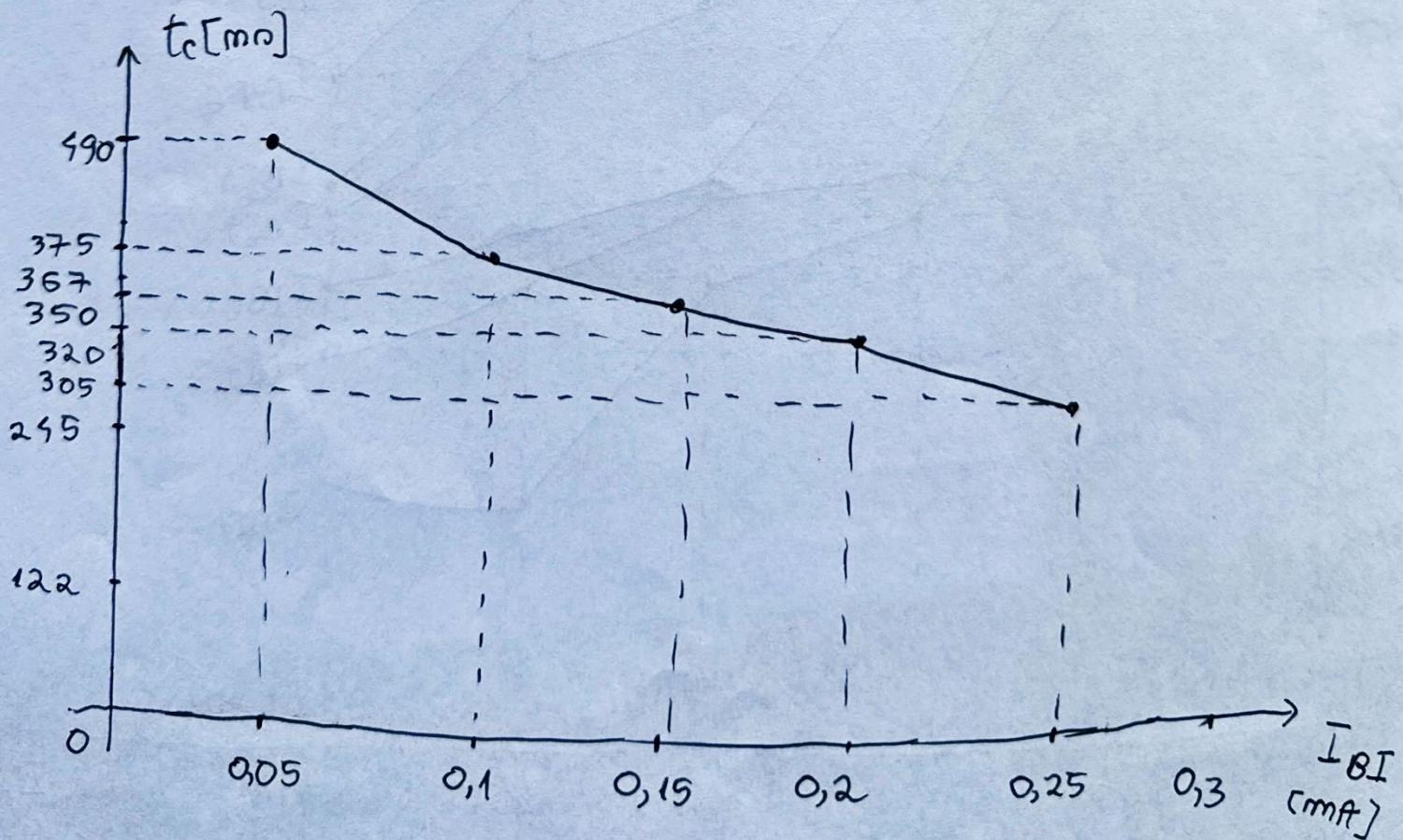
Grafice

Timp de ridicare (t_r)

$$t_r \sim \frac{1}{I_{BD}}$$

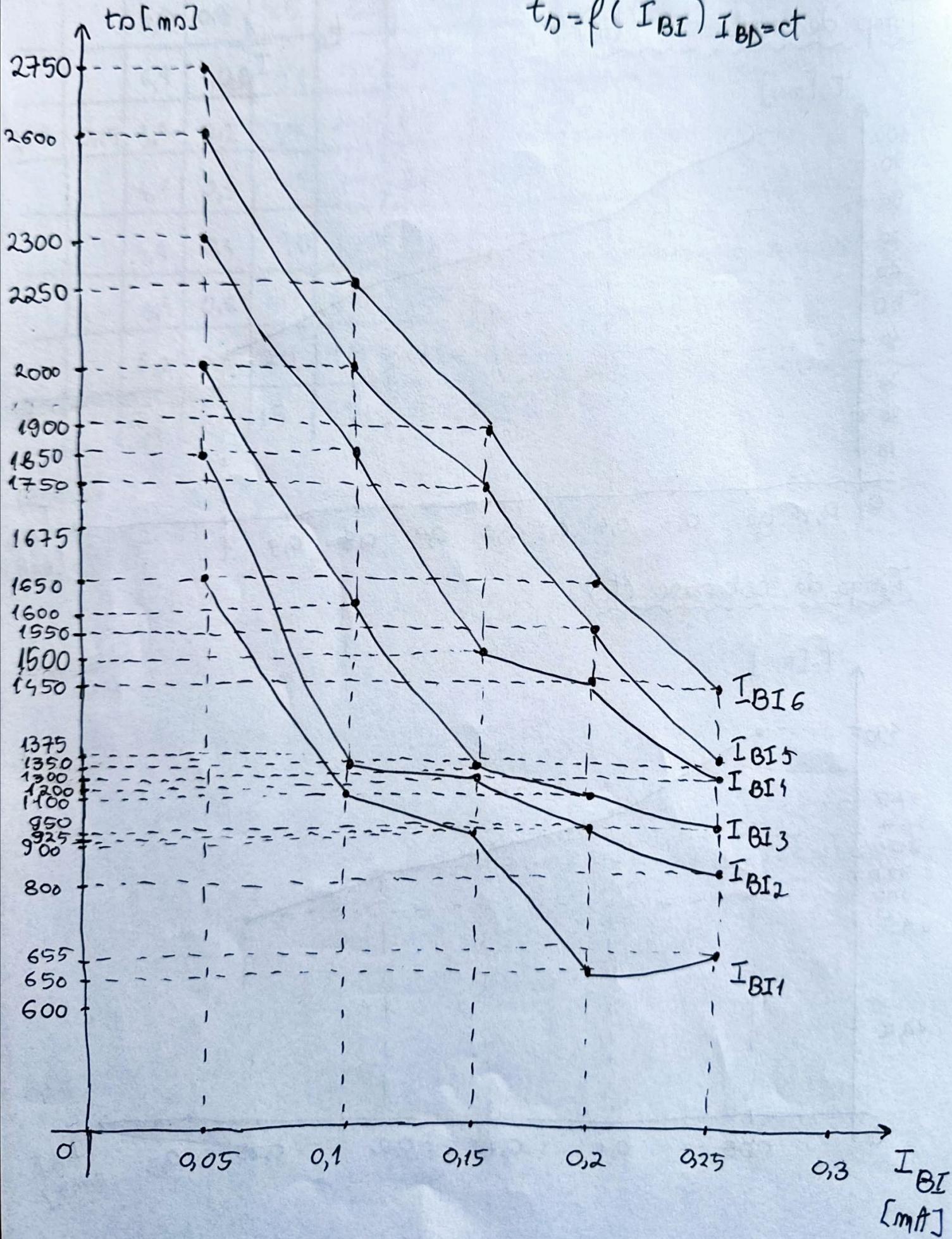


Timp de coborâre (t_c)



Timp de saturatie

$$t_D = f(I_{BI}) \quad I_{BD} = ct$$



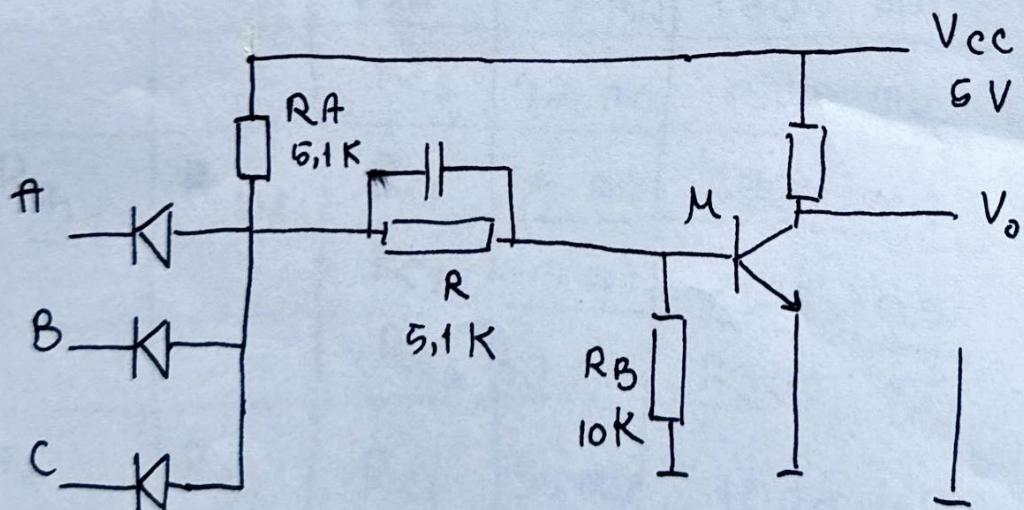
LUCRAREA 6 - CIRCUITE LOGICE
CU DIODE SI TRANZISTOARE. POARTA
SI-NU CU DEPLASARE DE NIVEL
PRIN REZISTENTE

PLESA DIANA-IOANA 2.2

SCOPUL LUCRARII

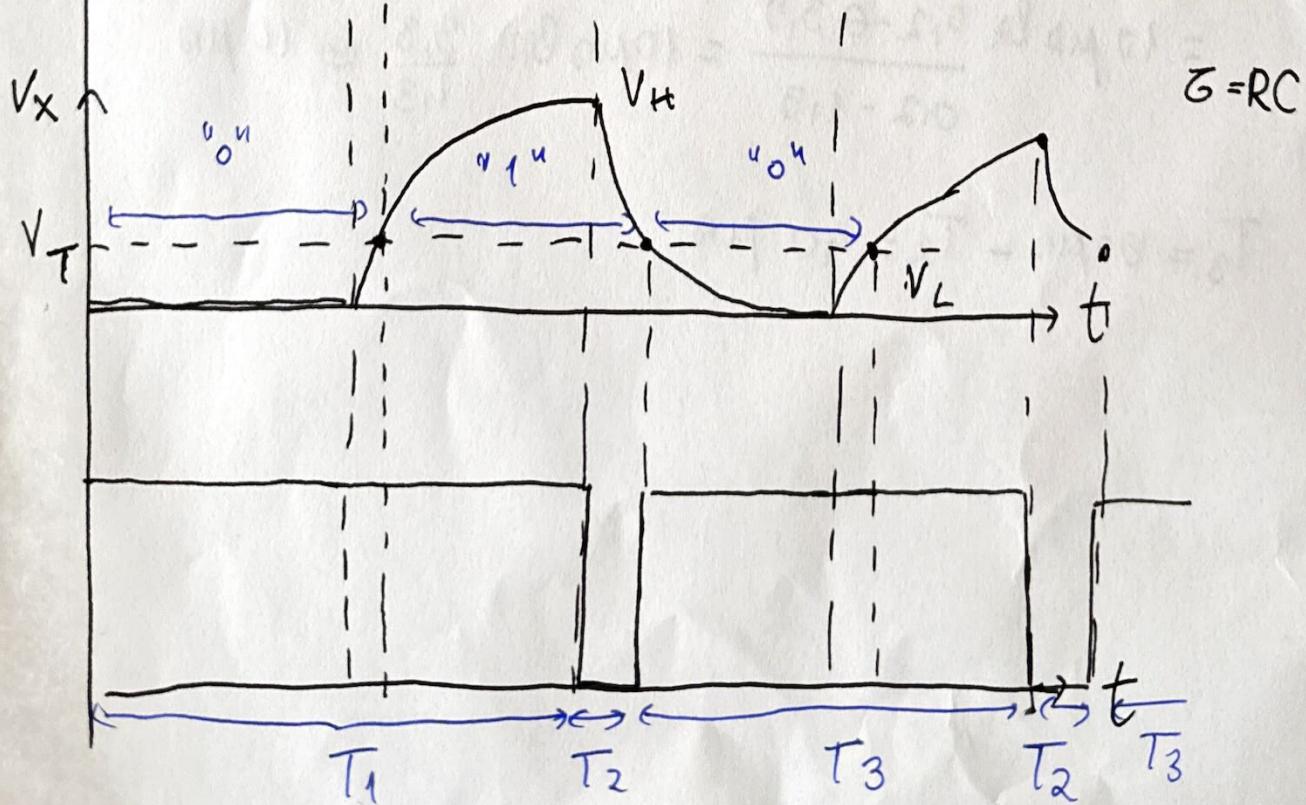
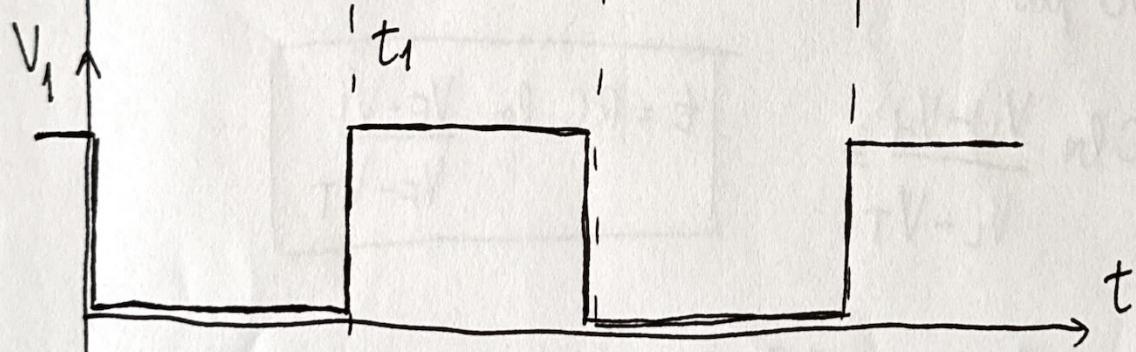
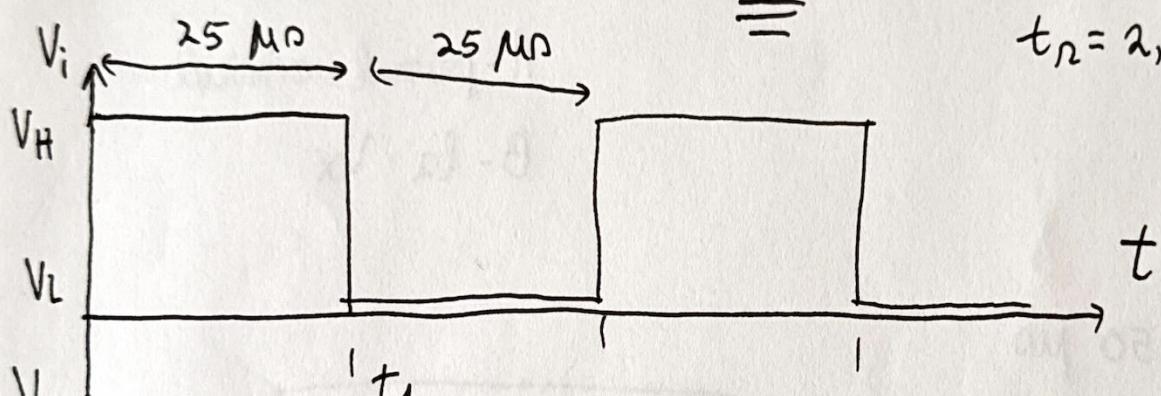
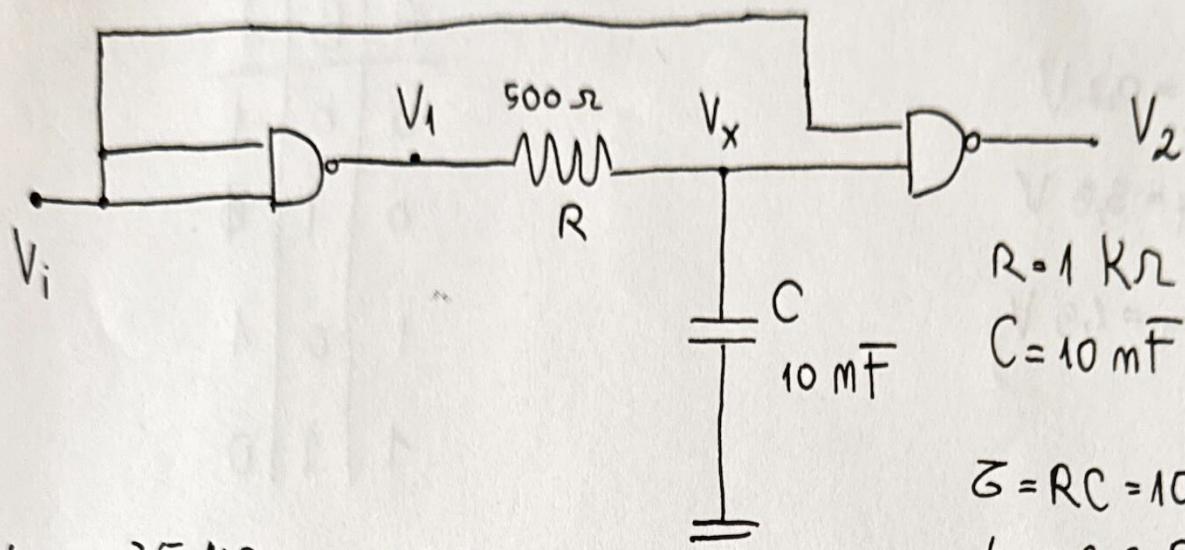
Se va realiza un circuit ȘI-NU cu componente discrete cu deplasare de nivel prin rezistente. Pe circuitul realizat se vor măsura parametrii statici și dinamici ai acestuia.

SCHEMA MONTAJULUI



R_A	R_B	R_C	t_{db}	t_{be}
R_{A1}	R_{B1}	R_{C1}	55 m Ω	1700 m Ω
		R_{C2}	40 m Ω	2000 m Ω
		R_{C3}	38 m Ω	2100 m Ω
R_{A1}	R_{B2}	R_{C1}	55 m Ω	950 m Ω
		R_{C2}	58 m Ω	1050 m Ω
		R_{C3}	58 m Ω	1250 m Ω
R_{A1}	R_{B3}	R_{C1}	50 m Ω	1200 m Ω
		R_{C2}	55 m Ω	1300 m Ω
		R_{C3}	52 m Ω	1500 m Ω
R_{A2}	R_{B1}	R_{C1}	45 m Ω	1900 m Ω
		R_{C2}	40 m Ω	2100 m Ω
		R_{C3}	40 m Ω	2300 m Ω
R_{A2}	R_{B2}	R_{C1}	55 m Ω	1000 m Ω
		R_{C2}	58 m Ω	1200 m Ω
		R_{C3}	52 m Ω	1500 m Ω
R_{A2}	R_{B3}	R_{C1}	52 m Ω	1300 m Ω
		R_{C2}	42 m Ω	1500 m Ω
		R_{C3}	40 m Ω	1600 m Ω

R_A	R_B	R_C	t_{db}	t_{bl}
R_{A_3}	R_{B_1}	R_{C_1}	58 mΩ	1250 mΩ
		R_{C_2}	50 mΩ	1500 mΩ
		R_{C_3}	50 mΩ	1600 mΩ
R_{A_3}	R_{B_2}	R_{C_1}	62 mΩ	450 mΩ
		R_{C_2}	50 mΩ	650 mΩ
		R_{C_3}	50 mΩ	900 mΩ
R_{A_3}	R_{B_3}	R_{C_1}	56 mΩ	700 mΩ
		R_{C_2}	48 mΩ	900 mΩ
		R_{C_3}	44 mΩ	1000 mΩ



Pt TTL

$$V_L = 0,2 \text{ V}$$

$$V_H = 3,5 \text{ V}$$

$$V_T = 1,5 \text{ V}$$

A	B	F
0	0	1
0	1	0
1	0	1
1	1	0

A - primul semnal

B - la V_X

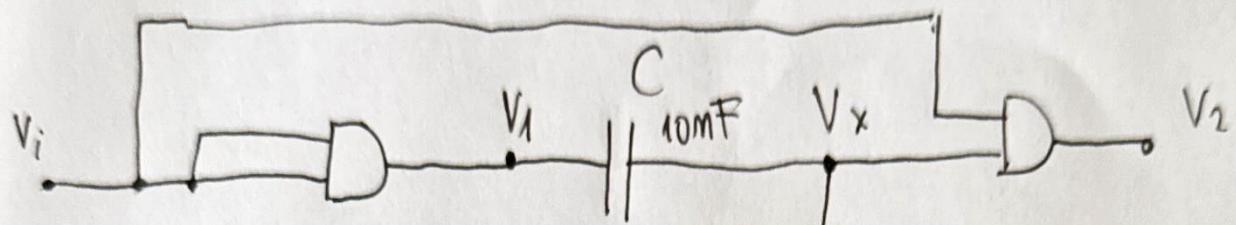
$$T_1 = 50 \mu\text{s}$$

$$T_2 = RC \ln \frac{V_L - V_H}{V_L - V_T} =$$

$$t = RC \ln \frac{V_F - V_i}{V_F - V_T}$$

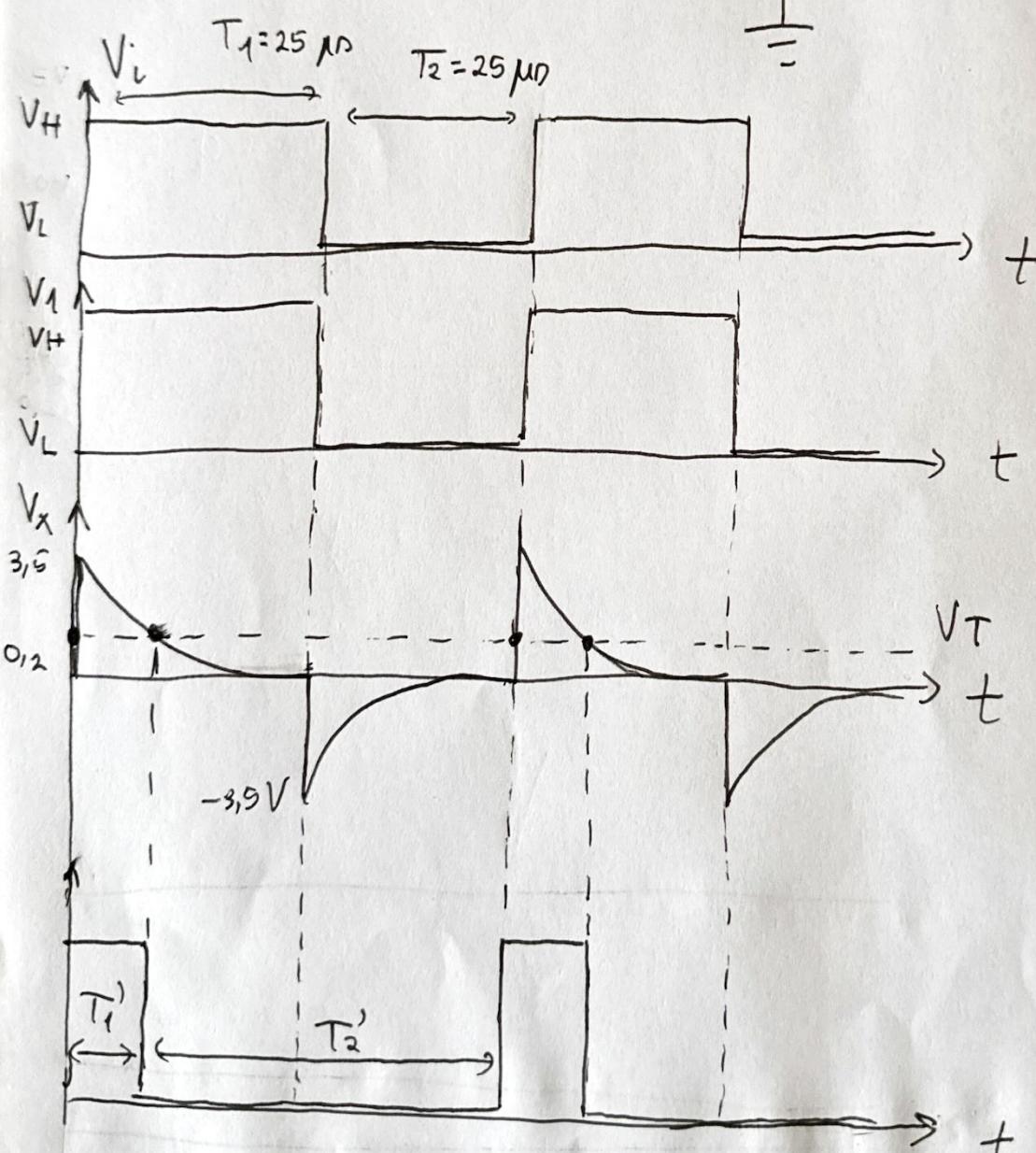
$$= 10 \mu\text{s} \ln \frac{0,2 - 3,5}{0,2 - 1,5} = 10 \mu\text{s} \ln \frac{3,3}{1,3} \approx 10 \mu\text{s}$$

$$T_3 = 50 \mu\text{s} - T_2 = 40 \mu\text{s}$$



RC trace now

$$G = 4,7 \mu S$$

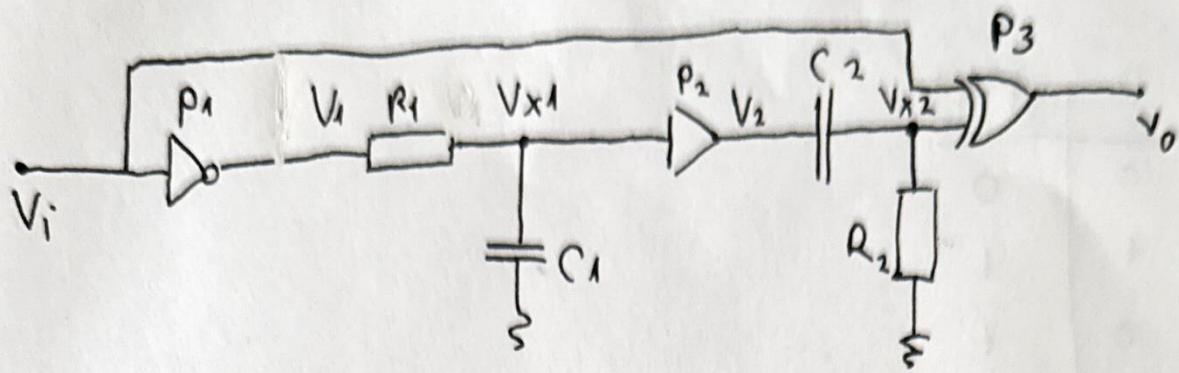


$$t = RC \ln \frac{V_f - V_i}{V_f - V_T}$$

$$T_1' = 4,7 \Omega n \frac{0,2 - 3,5}{0,2 - 1,5} = 4,7 \ln \frac{3,3}{1,3} =$$

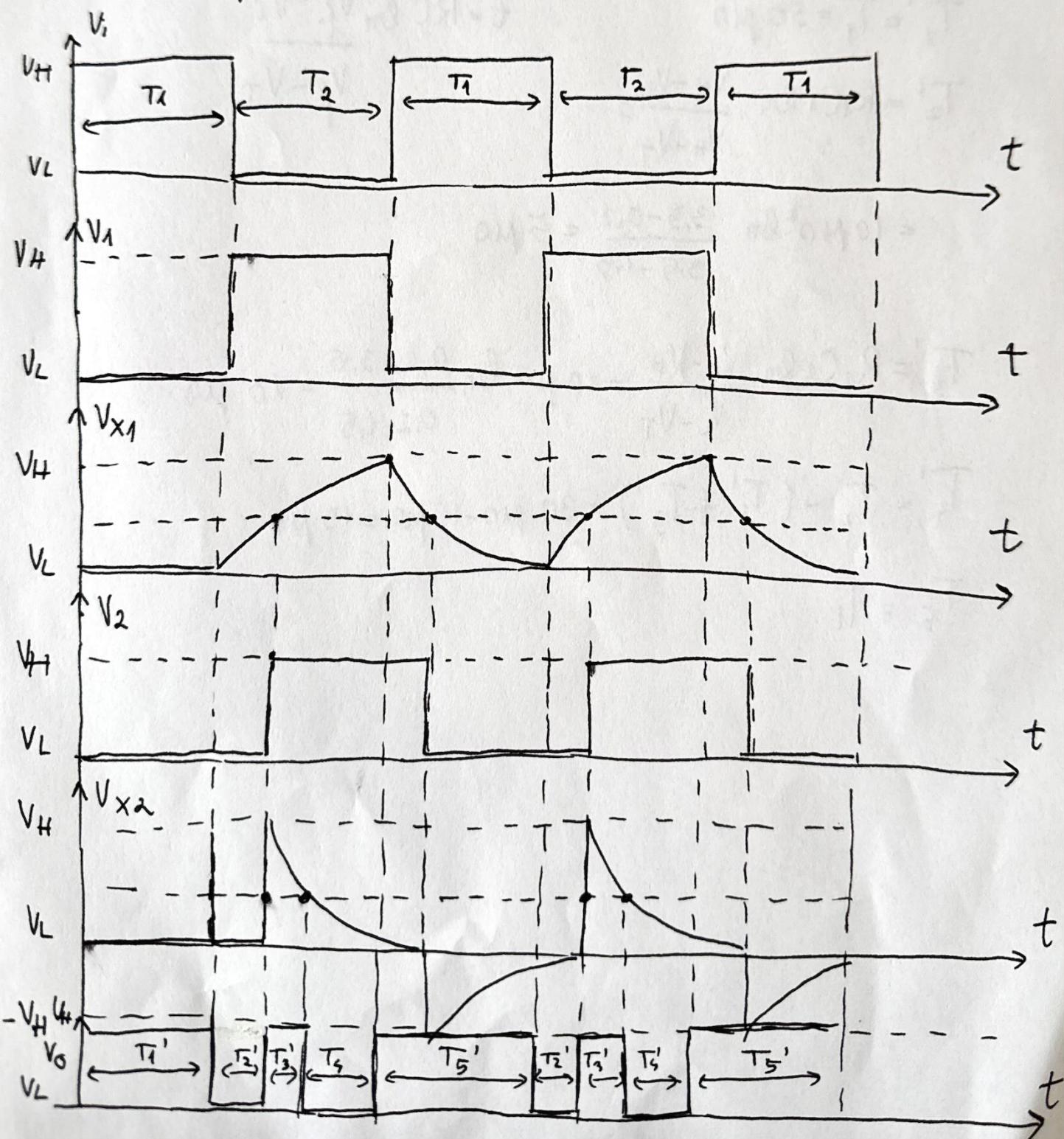
$$= 4,7 \mu s$$

$$T_2' = T_1 + T_2 - T_1' = 25 + 25 - 4,7 \approx 45,3 \mu\Omega$$



$$R_1 = 1 \text{ k}\Omega, C_1 = 10 \text{ mF}, C_2 = 20 \text{ mF}, R_2 = 0,5 \text{ k}\Omega$$

$$T_1 = T_2 = 30 \mu\text{s} \quad V_H = 3,5 \text{ V}, V_L = 0,2 \text{ V}, V_T = 1,5 \text{ V}$$



A	B	A^1B
0	0	0
0	1	1
1	0	1
1	1	0

$$T_1' = T_1 = 30 \mu\text{N}$$

$$T_2' = R_1 C_1 \ln \frac{V_H - V_L}{V_H - V_T} =$$

$$= 10 \mu\text{N} \cdot \ln \frac{3,5 - 0,2}{3,5 - 1,5} = 5 \mu\text{N}$$

$$T_3' = R_2 C_2 \ln \frac{V_L - V_H}{V_L - V_T} = 10 \mu\text{N} \ln \frac{0,2 - 3,5}{0,2 - 1,5} = 10 \mu\text{N}$$

$$T_4' = T_2' - (T_2' + T_3') = 30 \mu\text{N} - 15 \mu\text{N} = 15 \mu\text{N}$$

$$T_5' = T_1$$

$$t = RC \ln \frac{V_f - V_i}{V_f - V_T}$$