UNIVERSITATEA POLITEHNICA BUCURESTI

Proiect TIE 2025

„Diapazon electronic”

Facultatea de Electronica, Telecomunicatii si Tehnologia Informatiei

Departamentul de electronica tehnologica si tehnici de interconectare

Studenti

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Condrat Ioan-Andrei

Grupa 422A

Data predare
09.09.2025

Coordonator prof. dr. ing. Norocel Dragos Codreanu.

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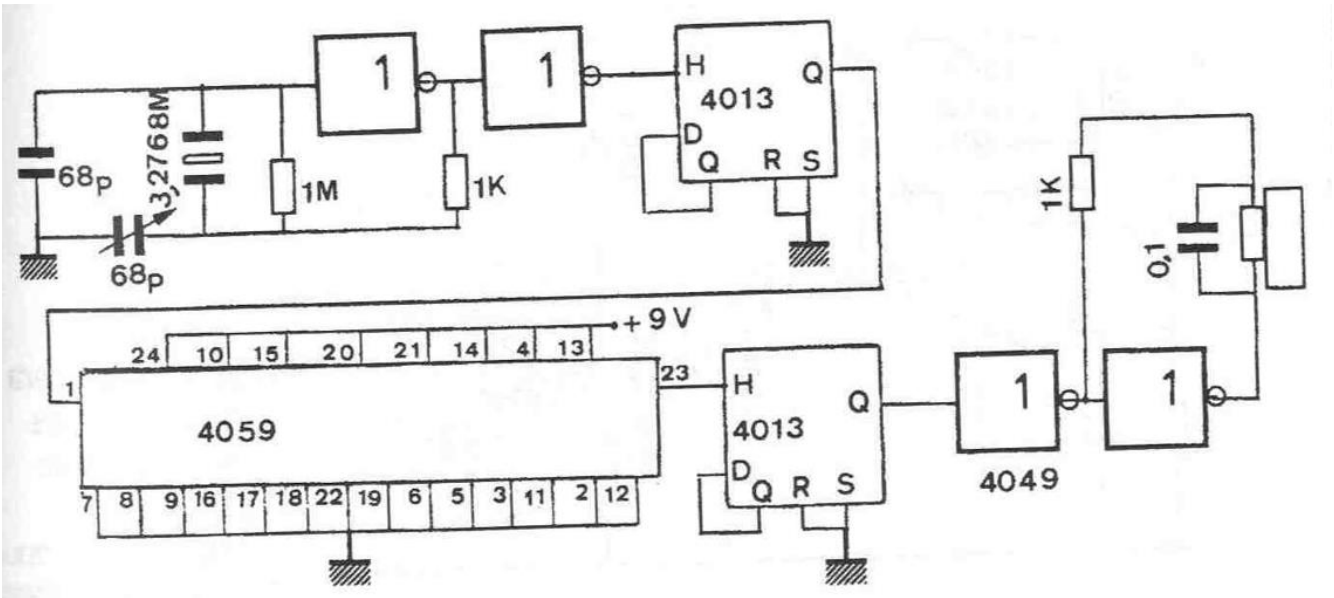
I. Date initiale de proiectare

In cadrul proiectului de fata se urmareste realizarea unui circuit imprimat (PCB) pentru un montaj de tip diapazon. Acest tip de circuit are rolul de generator de frecventa si poate fi utilizat ca etalon sau ca sursa stabila de semnal in diferite aplicatii.

Proiectul se bazeaza pe utilizarea a trei circuite integrate CMOS – CD4013, CD4049 si CD4059 – alaturi de rezistente, condensatoare si alte componente electronice auxiliare. Fiecare dintre aceste circuite are un rol bine stabilit: CD4013 functioneaza ca bistabil (flip-flop), CD4049 asigura functia de invertor si driver, iar CD4059 este folosit ca divizor de frecventa programabil.

Scopul principal este realizarea unei placi de circuit (in varianta finala – in cadrul unui modul electronic) , pornind de la schema electronica teoretica. Pentru atingerea acestui obiectiv, proiectul presupune: intelegerea principiului de functionare al circuitului diapazon si a rolului componentelor principale, proiectarea schemei electronice in Cadence OrCAD (17.2), realizarea layout-ului PCB (pcb de tip 2 layer – top si buttom) si adaptarea traseelor pentru o buna functionare, testarea si verificarea montajului final (optionala)

Lucrarea are rol educational si practic, deoarece permite aprofundarea notiunilor de electronica digitala si analogica, dar si familiarizarea cu etapele de proiectare a unui PCB. In plus, proiectul pune accent pe corelarea teoriei cu partea practica – de la alegerea componentelor si realizarea schemei, pana la implementarea fizica si verificarea rezultatului obtinut.



II. Functionarea schemei proiectate.

In schema electrica este prezentat circuitul unui diapazon electronic, utilizat pentru a produce un semnal audio ce urmeaza sa fie redat intr-un difuzor conectat extern la pinii de tip jumper a montajului (ce reprezinta iesirea circuitului).

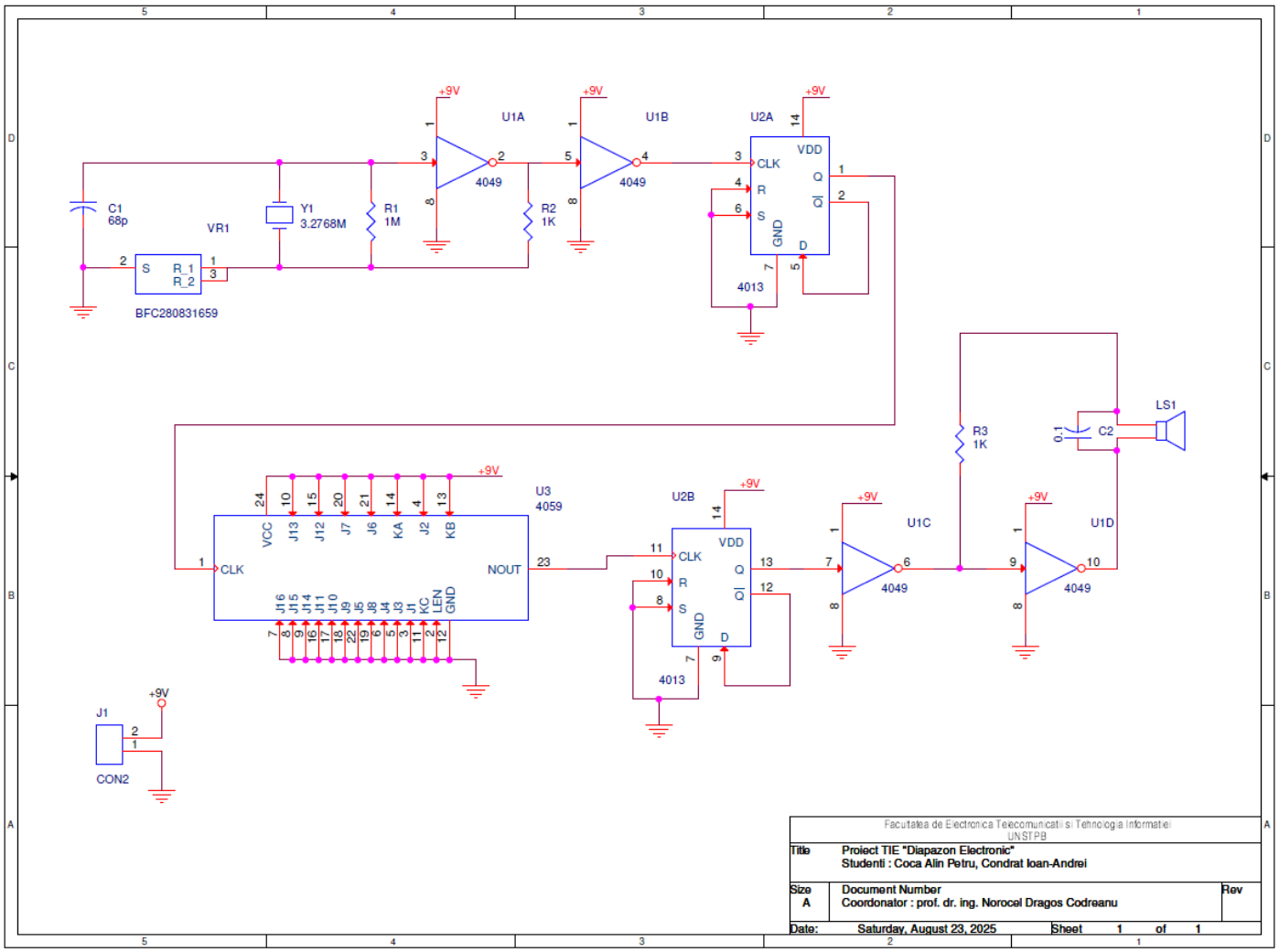
Schema se bazeaza pe un oscilator cu reactie care are in dotarea sa un cristal de quartz, fiind componenta principala in obtinerea unei tensiuni periodice, avand conectat la bornele sale o pereche de condensatoare de mica capacitate (68pF), unul de valoare fixa si unul de valoare ce poate fi reglata (condensator variabil).

Se poate identifica grupul de componente cristal de quartz – condensatoare – rezistente si cele 2 circuite integrate (cu porti NOT) ca fiind un oscilator clasic cu inversoare si reactie rezistiva (cele 2 rezistente de valoare 1M si 1K) ce produce un semnal dreptunghiular care este repetat cu un factor de amplificare unitar cu ajutorul celui de al doilea circuit inversor (semnal ce este in faza cu cel prezent la bornele cristalului cu quartz).

Semnalul generat este injectat pe intrarea circuitului integrat 4013, care este un circuit basculant bistabil de tip D, configurat ca divizor de frecventa, utilizat pentru a creste perioada semnalului implicit, ce urmeaza a fi introdus in circuitul integrat 4059 (numarator sincron cresc/descresc. ce lucreaza ca divizor de frecventa programabil) care creste perioada semnalului cu o anumita valoarea, frecventa fiind redusa de N ori (N poate fi setat prin intermediul pinilor de intrare a circuitului integrat -> K1,K2,K3 si intrarile de tip J). In acest caz, dupa configuratia actuala si starea fiecarui pin, se constata ca N=1862, ceea ce arata ca frecventa semnalului de la iesire este scazuta de 1862 de ori fata de frecventa semnalului de la intrare si este introdus in circuitul cu bistabili de tip D.

Semnalul de la iesirea celui de al doilea bistabil este preluat si introdus in circuitele inversoare 4049 utilizate ca drivere / circuite de control pentru difuzor, alaturi de rezistenta de 1k, necesara atat limitarii curentului prin difuzor, cat si pentru filtrarea componentei de frecventa inalta de care se ocupa condensatorul de capacitate 0.1uF. (ce ofera si stabilitate si bass sporit in sunet.)

III. Schema electrica.



IV. DRC (Design Rules Check)

Date and Time : 08/27/25 11:51:03

Checking Schematic: SCHEMATIC1

Checking Electrical Rules

Checking For Single Node Nets

Checking For Unconnected Bus Nets

V. Rezultat Cross-Reference

Proiect TIE "Diapazon Electronic" Revised: Wednesday, August 27, 2025
Coordonator : prof. dr. ing. Norocel Dragos Codreanu Revision: Studenti : Coca Alin Petru, Condrat Ioan-Andrei

Design Name: C:\USERS\BY ASUS\DOCUMENTS\PROIECT_TIE_DIAPAZON\DIAPAZON880.DSN

Cross Reference August 27,2025 11:52:44 Page1

Item	Part	Reference	SchematicName	Sheet	Library
1	0.1	C2	SCHEMATIC1/DIAPAZON	1	C:\CADENCE\SPB_17.2\TOOLS\CAPTURE\LIBRARY\DISCRETE.OLB
2	1K	R2	SCHEMATIC1/DIAPAZON	1	C:\CADENCE\SPB_17.2\TOOLS\CAPTURE\LIBRARY\DISCRETE.OLB
3	1K	R3	SCHEMATIC1/DIAPAZON	1	C:\CADENCE\SPB_17.2\TOOLS\CAPTURE\LIBRARY\DISCRETE.OLB
4	1M	R1	SCHEMATIC1/DIAPAZON	1	C:\CADENCE\SPB_17.2\TOOLS\CAPTURE\LIBRARY\DISCRETE.OLB
5	3.2768M	Y1	SCHEMATIC1/DIAPAZON	1	C:\CADENCE\SPB_17.2\TOOLS\CAPTURE\LIBRARY\DISCRETE.OLB
6	68p	C1	SCHEMATIC1/DIAPAZON	1	C:\CADENCE\SPB_17.2\TOOLS\CAPTURE\LIBRARY\DISCRETE.OLB
7	4013	U2A	SCHEMATIC1/DIAPAZON	1	C:\USERS\BY ASUS\DOCUMENTS\PROIECT_TIE_DIAPAZON\DIAPAZON880.DSN
8	4013	U2B	SCHEMATIC1/DIAPAZON	1	C:\USERS\BY ASUS\DOCUMENTS\PROIECT_TIE_DIAPAZON\DIAPAZON880.DSN
9	4049	U1A	SCHEMATIC1/DIAPAZON	1	C:\USERS\BY ASUS\DOCUMENTS\PROIECT_TIE_DIAPAZON\DIAPAZON880.DSN
10	4049	U1B	SCHEMATIC1/DIAPAZON	1	C:\USERS\BY ASUS\DOCUMENTS\PROIECT_TIE_DIAPAZON\DIAPAZON880.DSN
11	4049	U1C	SCHEMATIC1/DIAPAZON	1	C:\USERS\BY ASUS\DOCUMENTS\PROIECT_TIE_DIAPAZON\DIAPAZON880.DSN
12	4049	U1D	SCHEMATIC1/DIAPAZON	1	C:\USERS\BY ASUS\DOCUMENTS\PROIECT_TIE_DIAPAZON\DIAPAZON880.DSN
13	4059	U3	SCHEMATIC1/DIAPAZON	1	C:\USERS\BY ASUS\DOCUMENTS\PROIECT_TIE_DIAPAZON\DIAPAZON880.DSN
14	BFC280831659	VR1	SCHEMATIC1/DIAPAZON	1	D:\CADENCE\SPB_17.2\TOOLS\CAPTURE\LIBRARY\PSPICE\BFC280831659.OLB
15	CON2	J1	SCHEMATIC1/DIAPAZON	1	D:\CADENCE\SPB_17.2\TOOLS\CAPTURE\LIBRARY\CONNECTOR.OLB
16	SPEAKER	LS1	SCHEMATIC1/DIAPAZON	1	C:\CADENCE\SPB_17.2\TOOLS\CAPTURE\LIBRARY\DISCRETE.OLB

VI. Bill of Materials (BOM)

Item	Cantitate	Componenta	Referinta	Producator	Distribuitor
1	1	condensator	C1	TDK	farnell
2	1	rezistor	R1	PANASONIC	farnell
3	1	rezistor	R2	VISHAY	farnell
4	1	rezistor	R3	VISHAY	farnell
5	1	quartz crystal	Y1	Wurth Elektronic	mouser
6	1	cap. variabil	C2	VISHAY	farnell
7	1	CD4049UB	U1	Texas Instruments	mouser
8	1	CD74HC4059	U3	Texas Instruments	mouser
9	1	CD4013B	U2,U4	Texas Instruments	mouser
10	1	condensator	C3	KYOCERA AVX	mouser
11	2	JUMPER	J1,J2	AMP - TE CONNECTIVITY	farnell

Componenta	Referinta	Producator	Distribuitor	Nr. part	Descriere	Package	Tehnologie	Cod prod.	Pret
condensator	C1	TDK	farnell	2435470	68 pF, 50 V, +/-5, NP0	0603	SMD	CGA3E2C0G1H680J080AA	0,35 RON
rezistor	R1	PANASONIC	farnell	4066416	1 kohm, ± 0.1%, 250 mW	1206	SMD	ERA8VEB1001V	2,76 RON
rezistor	R2	VISHAY	farnell	2352640	1 Mohm, ± 1%, 250 mW	1206	SMD	RCV12061M00FKEA	0,58 RON
rezistor	R3	VISHAY	farnell	3235217	1 kohm, ± 5%, 500 mW	1206	SMD	RCS12061K00JNEA	0,37 RON
quartz crystal	Y1	Wurth Elektronic	mouser	710-830028430	30ppm 13.4 x 4.9mm 3,2768MHz	HC49	SMD	830028430	2,21 RON
cap. variabil	C2	VISHAY	farnell	BFC280831659	5.5 pF to 65 pF, 150 VDC	BFC2 808	THT	BFC280831659	36,420 lei
CD4049UB	U1	Texas Instruments	mouser	595-CD4049UBDR	IC, 4000, 6 Input, 6 Output	SOIC16	SMD	CD4049UBDR	1,56 RON
CD74HC4059	U3	Texas Instruments	mouser	595-CD74HC4059M96	Counter ICs Prog Div by N	SOIC24	SMD	CD74HC4059M96	15,59 RON
CD4013B	U2,U4	Texas Instruments	mouser	595-CD4013BPWRE4	Flip-Flops Dual CMOS	SOIC14	SMD	CD4013BPWRE4	1,56 RON
condensator	C3	KYOCERA AVX	mouser	581-KAM21BR71H104JT	MLCC - 50V .1uF X7R 5%	0805	SMD	KAM21BR71H104JT	0,865 RON
JUMPER	J1,J2	AMP - TE CONNECTIVITY	farnell	826926-2	2.54 mm, 1 rows, 2 contacts	HEADER	THT	826926-2	1,32 lei (10buc.)

Componenta	Referinta	Producator	Distribuitor	Nr. part	Descriere	Package	Tehnologie	Cod prod.	Pret
condensator	C1	TDK	farnell	2435470	68 pF, 50 V, +/-5, NP0	0603	SMD	CGA3E2C0G1H680J080AA	0,35 RON
rezistor	R1	PANASONIC	farnell	4066416	1 kohm, ± 0.1%, 250 mW	1206	SMD	ERA8VEB1001V	2,76 RON
rezistor	R2	VISHAY	farnell	2352640	1 Mohm, ± 1%, 250 mW	1206	SMD	RCV12061M00FKEA	0,58 RON
rezistor	R3	VISHAY	farnell	3235217	1 kohm, ± 5%, 500 mW	1206	SMD	RCS12061K00JNEA	0,37 RON
quartz crystal	Y1	Wurth Elektronic	mouser	710-830028430	30ppm 13.4 x 4.9mm 3,2768MHz	HC49	SMD	830028430	2,21 RON
cap. variabil	C2	VISHAY	farnell	BFC280831659	5.5 pF to 65 pF, 150 VDC	BFC2 808	THT	BFC280831659	36,420 lei
CD4049UB	U1	Texas Instruments	mouser	595-CD4049UBDR	IC, 4000, 6 Input, 6 Output	SOIC16	SMD	CD4049UBDR	1,56 RON
CD74HC4059	U3	Texas Instruments	mouser	595-CD74HC4059M96	Counter ICs Prog Div by N	SOIC24	SMD	CD74HC4059M96	15,59 RON
CD4013B	U2,U4	Texas Instruments	mouser	595-CD4013BPWRE4	Flip-Flops Dual CMOS	SOIC14	SMD	CD4013BPWRE4	1,56 RON
condensator	C3	KYOCERA AVX	mouser	581-KAM21BR71H104JT	MLCC - 50V .1uF X7R 5%	0805	SMD	KAM21BR71H104JT	0,865 RON
JUMPER	J1,J2	AMP - TE CONNECTIVITY	farnell	826926-2	2.54 mm, 1 rows, 2 contacts	HEADER	THT	826926-2	1,32 lei (10buc.)

VII. Verificare Wirelist.

Wire List

Proiect TIE "Diapazon Electronic" Revised: Wednesday, August 27, 2025
Coordonator : prof. dr. ing. Norocel Dragos CoRevision: Studenti : Coca Alin Petru, Condrat Ioan-Andrei

<<< Component List >>>

68p	C1	smc0603
0.1	C2	smc0805
CON2	J1	jumper2
SPEAKER	LS1	jumper2
1M	R1	smc1206
1K	R2	smc1206
1K	R3	smc1206
4049	U1	CD4049
4013	U2	PTCD4013
4059	U3	CD74HC4059
BFC280831659	VR1	BFC280831659
3.2768M	Y1	P2QUARTZ

<<< Wire List >>>

NODE	REFERENCE	PIN #	PIN NAME	PIN TYPE	PART VALUE
[00001] +9V					
	U1	1	VCC	Power	4049
	U3	4	J2	Input	4059
	U3	21	J6	Input	4059
	U3	20	J7	Input	4059
	U3	15	J12	Input	4059
	U3	10	J13	Input	4059
	U3	14	KA	Input	4059
	U3	13	KB	Input	4059
	U3	24	VCC	Power	4059
	U2	14	VDD	Power	4013
	J1	2	2	Passive	CON2
[00002] GND					
	C1	2	2	Passive	68p
	U1	8	VSS	Power	4049
	U3	3	J1	Input	4059
	U3	5	J3	Input	4059
	U3	6	J4	Input	4059
	U3	22	J5	Input	4059

U3	19	J8	Input	4059
U3	18	J9	Input	4059
U3	17	J10	Input	4059
U3	16	J11	Input	4059
U3	9	J14	Input	4059
U3	8	J15	Input	4059
U3	7	J16	Input	4059
U3	2	LEN	Input	4059
U3	11	KC	Input	4059
U3	12	GND	Power	4059
VR1	2	S	Passive	BFC280831659
U2	6	S_A	Input	4013
U2	7	GND	Power	4013
U2	4	R_A	Input	4013
U2	8	S_B	Input	4013
U2	10	R_B	Input	4013
J1	1	1	Passive	CON2

[00003] N00452

Y1	2	2	Passive	3.2768M
C1	1	1	Passive	68p
R1	1	1	Passive	1M
U1	3	I_A	Input	4049

[00004] N00494

Y1	1	1	Passive	3.2768M
R1	2	2	Passive	1M
R2	2	2	Passive	1K
VR1	1	R_1	Passive	BFC280831659
VR1	3	R_2	Passive	BFC280831659

[00005] N00555

R2	1	1	Passive	1K
U1	5	I_B	Input	4049
U1	2	O_A	Output	4049

[00006] N01503

U3	1	CLK	Input	4059
U2	1	Q_A	Output	4013

[00007] N02785

U1	6	O_C	Output	4049
U1	9	I_D	Input	4049
R3	2	2	Passive	1K

[00008] N02849

U1	10	O_D	Output	4049

LS1	2	2	Passive	SPEAKER
C2	1	1	Passive	0.1

[00009] N02853

R3	1	1	Passive	1K
LS1	1	1	Passive	SPEAKER
C2	2	2	Passive	0.1

[00010] N19077

U2	5	D_A	Input	4013
U2	2	Q_A	Output	4013

[00011] N19833

U1	7	I_C	Input	4049
U2	13	Q_B	Output	4013

[00012] N19841

U2	9	D_B	Input	4013
U2	12	Q_B	Output	4013

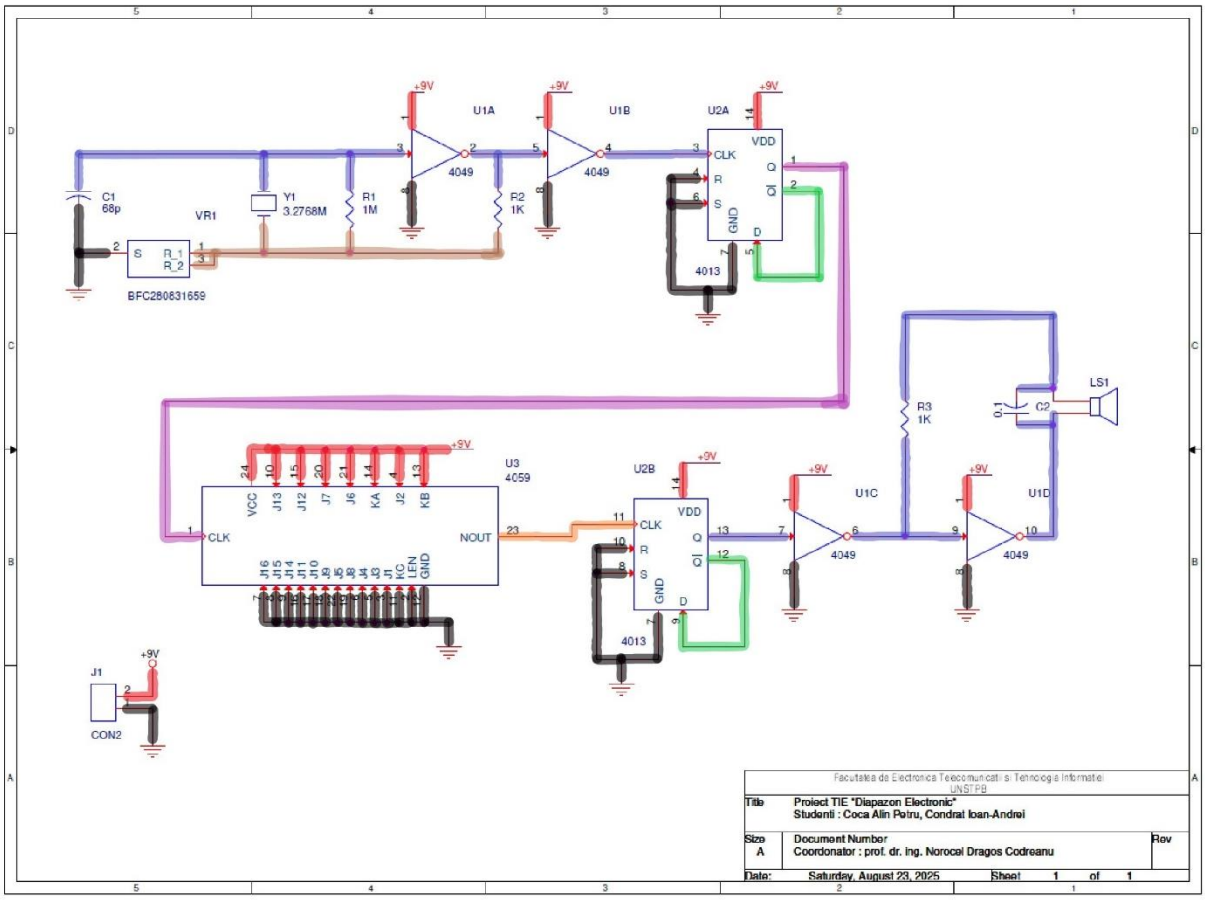
[00013] N19859

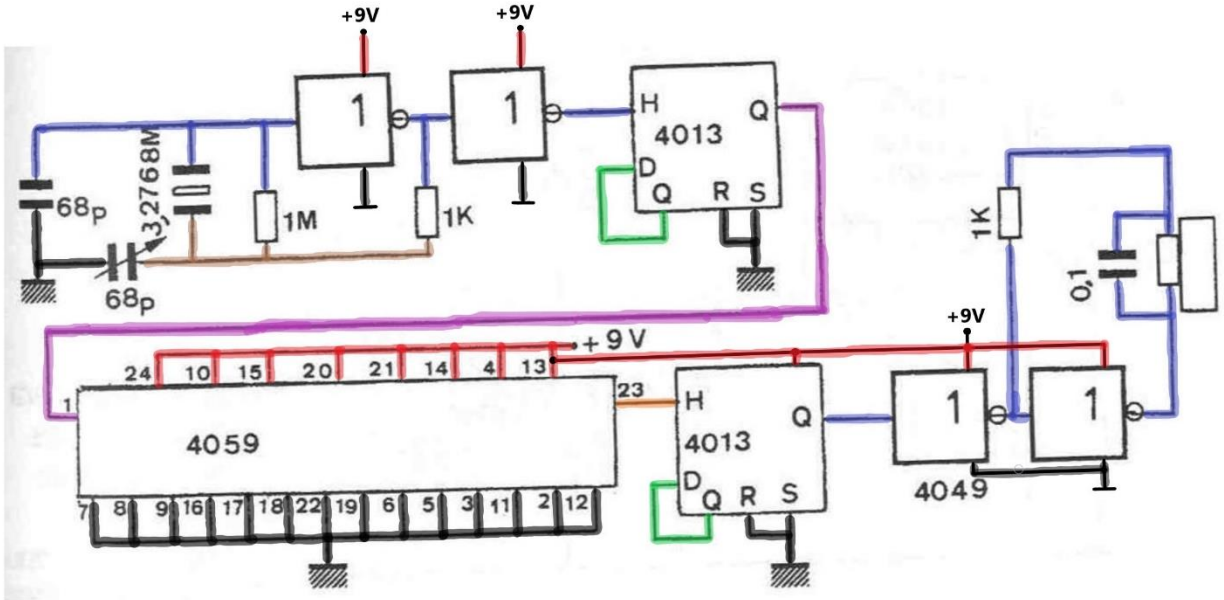
U3	23	NOUT	Output	4059
U2	11	CLK_B	Input	4013

[00014] N21382

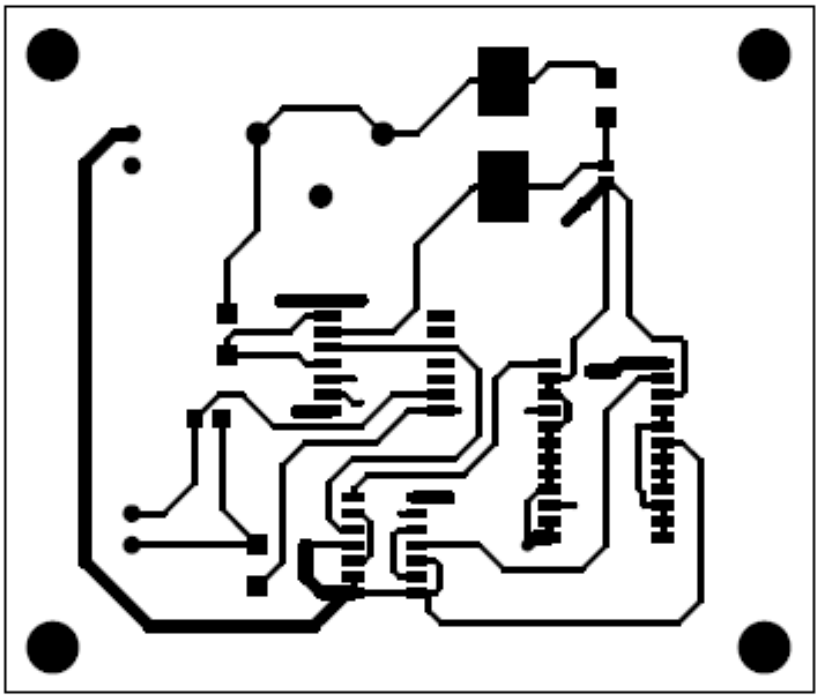
U1	4	O_B	Output	4049
U2	3	CLK_A	Input	4013

VIII. Verificarea net-urilor





IX. TOP Layer



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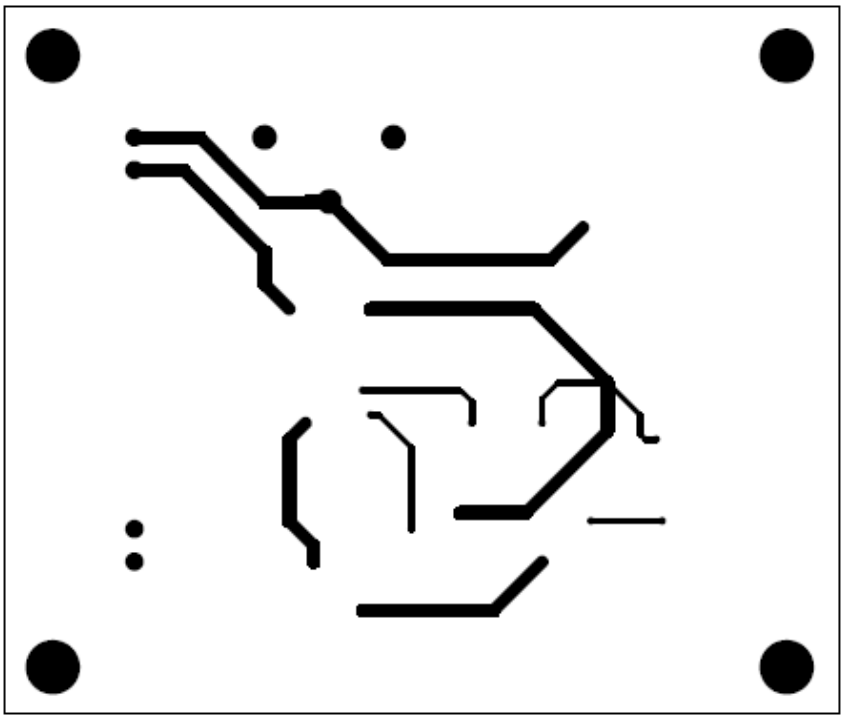
Date:	Wednesday, August 27, 2025	Sheet 1 of 1	

X. BOTTOM Layer



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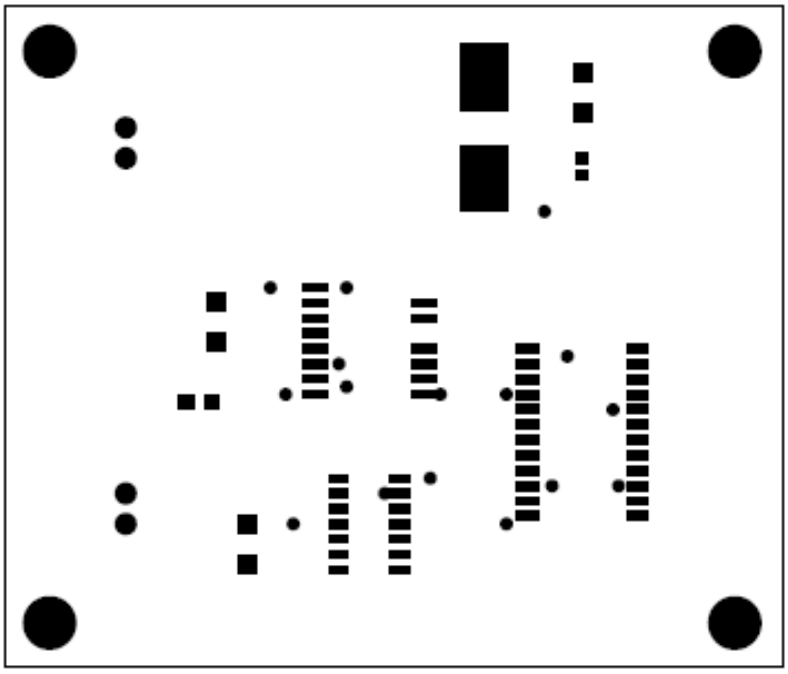
XI. Layer Soldermask TOP



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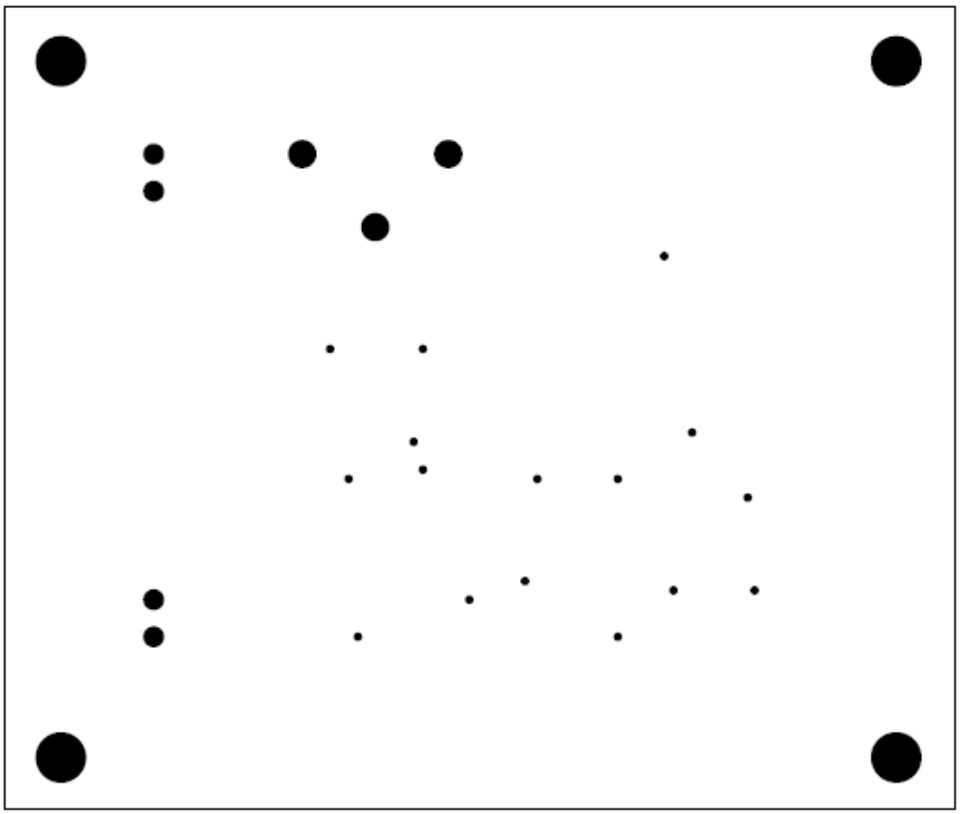
XII. Layer Soldermask BOTTOM



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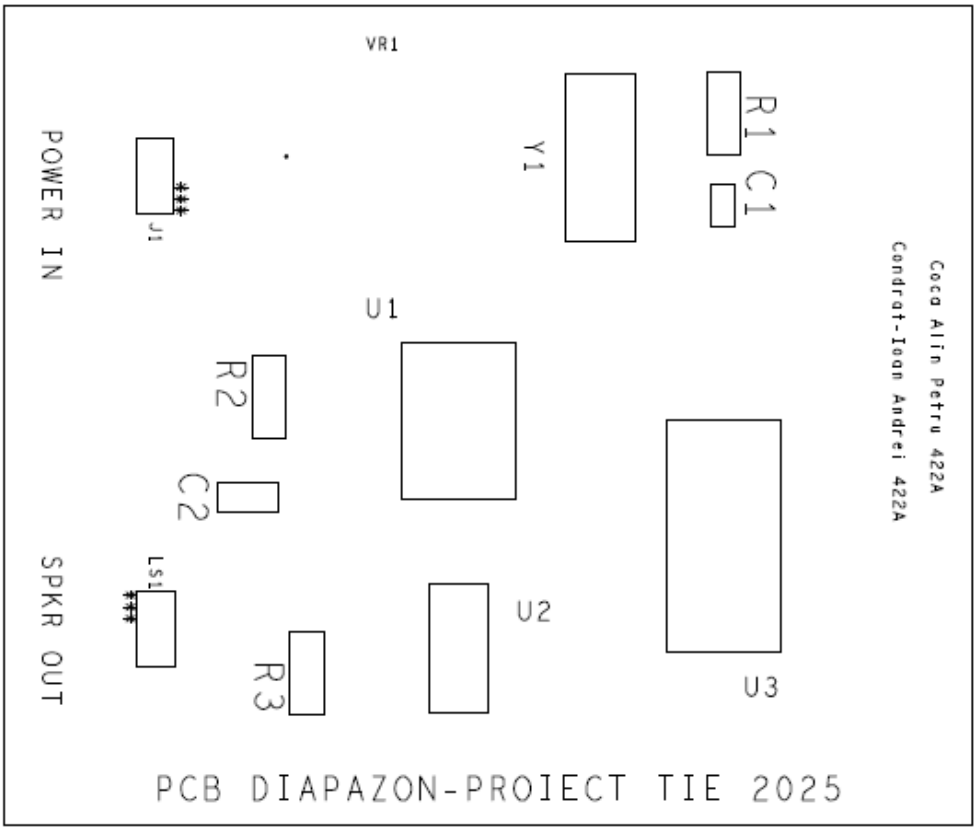
XIII. Silkscreen TOP layer



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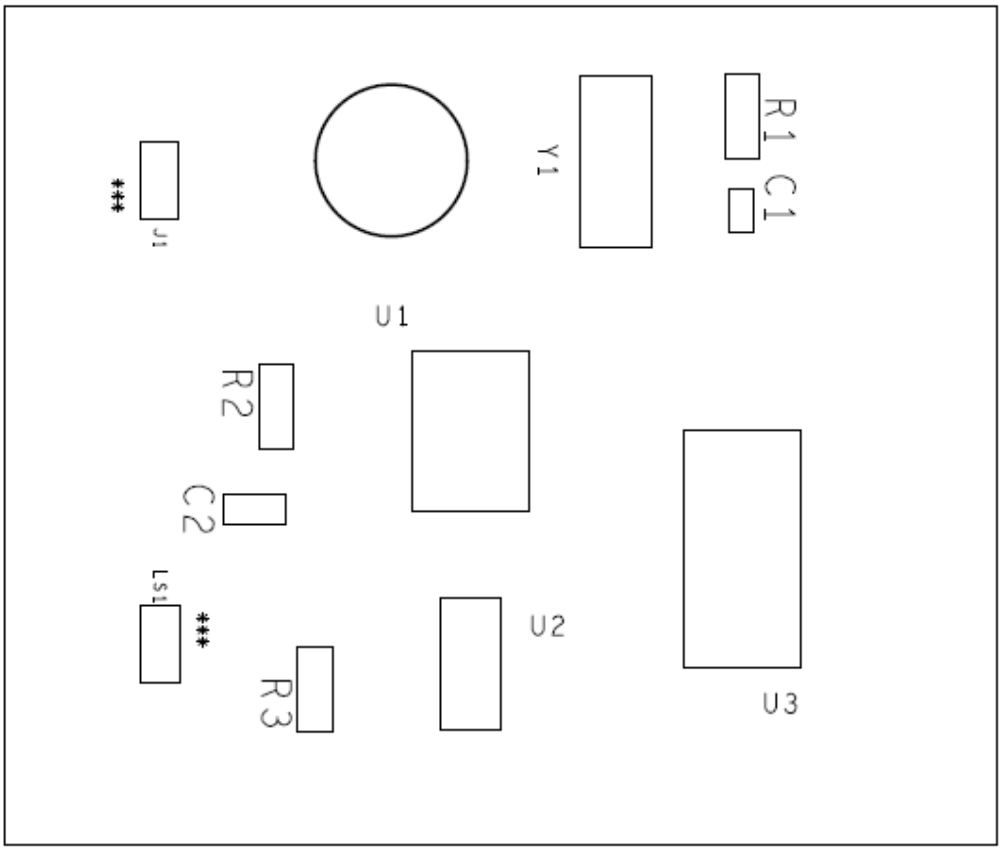
XIV. Assembly drawing TOP layer



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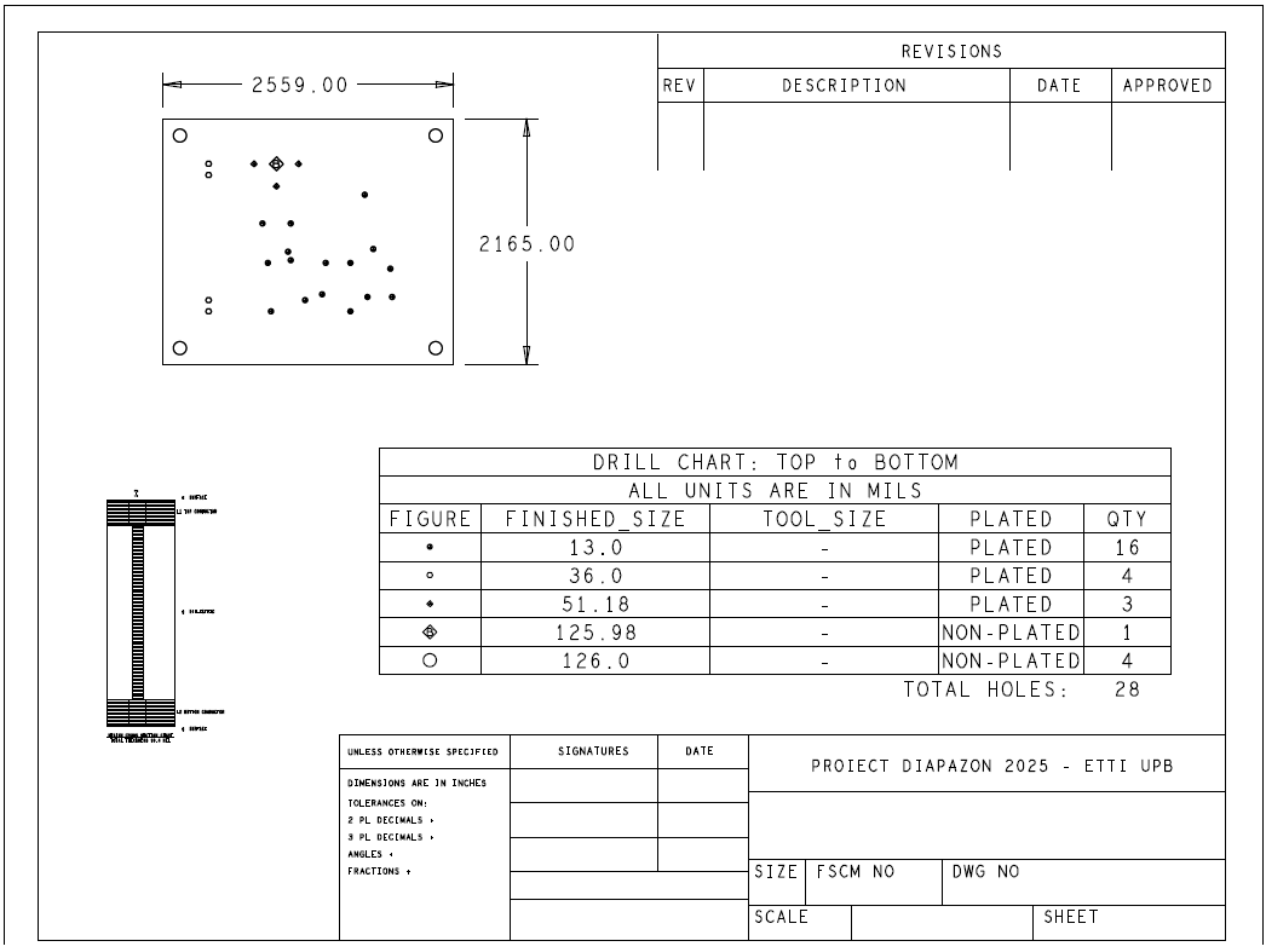
XV. Layer Fabrication



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Date:	Wednesday, August 27, 2025	Sheet 1 of 1

XVI. Concluzii

Realizarea acestui proiect a reprezentat o experienta completa de lucru cu unelte moderne de proiectare electronica, in special cu software-ul Cadence OrCAD 17.2, un program utilizat in industrie pentru desenarea schemelor si proiectarea placilor de circuit imprimat. Procesul de concepere a circuitului pentru un diapazon presupune atat trasarea conexiunilor dintre componente, cat si parcurgerea unor etape logice, fiecare cu importanta sa. Am inceput prin analiza si intelegerea circuitului de baza, alegerea componentelor potrivite si realizarea schemei electrice, iar ulterior am trecut la partea de proiectare a placii, unde a trebuit sa tinem cont de reguli de rutare si organizare.

Utilizarea programului OrCAD 17.2 a fost esentiala pentru o reprezentare clara si corecta a proiectului. Acesta ofera un mediu bine structurat pentru desenarea schemei electrice, verificarea erorilor, definirea footprint-urilor pentru componente si generarea layout-ului PCB-ului. Un aspect important a fost respectarea regulilor de design, cum ar fi distantele minime dintre trasee, grosimea traseelor in functie de curent, sau pozitionarea componentelor pentru a evita interferentele si pentru a obtine o placa usor de fabricat si asamblat.

Prin acest proiect am inteles mai bine ce presupune proiectarea unui PCB: nu este doar o chestiune de desen, ci un proces care implica gandire logica, atentie la detalii si planificare. Chiar si un circuit aparent simplu, cum este cel al diapazonului, scoate in evidenta importanta respectarii regulilor de design, a rutarii corecte si a verificarii conceptului inainte de realizarea efectiva a placii.

Beneficiile unui astfel de proiect sunt multiple: pe de o parte am dobandit cunostinte practice care se aplica si in proiecte mai complexe, pe de alta parte am inteles cat de utilizat este un software precum OrCAD 17.2, care face posibila trecerea de la idee la un produs concret. Am exersat si rabdarea, pentru ca fiecare detaliu conteaza, iar micile greseli in plasarea sau conectarea componentelor pot duce la probleme serioase in functionarea circuitului.

In final, pot spune ca proiectul cu diapazonul nu doar ca mi-a consolidat cunostintele despre electronica si proiectarea de PCB-uri, dar mi-a oferit si o imagine mai clara asupra procesului real din industrie. Experienta cu Cadence OrCAD 17.2 este una valoroasa, deoarece am fost familiarizati cu un standard folosit pe scara larga, si consideram ca exercitiul de fata este o baza solida pentru viitoare proiecte mai complexe.

XVII. Bibliografie

- https://www.youtube.com/@EMADesignAutomation
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- https://ro.farnell.com
- https://ro.mouser.com

XVIII. ANEXA 1

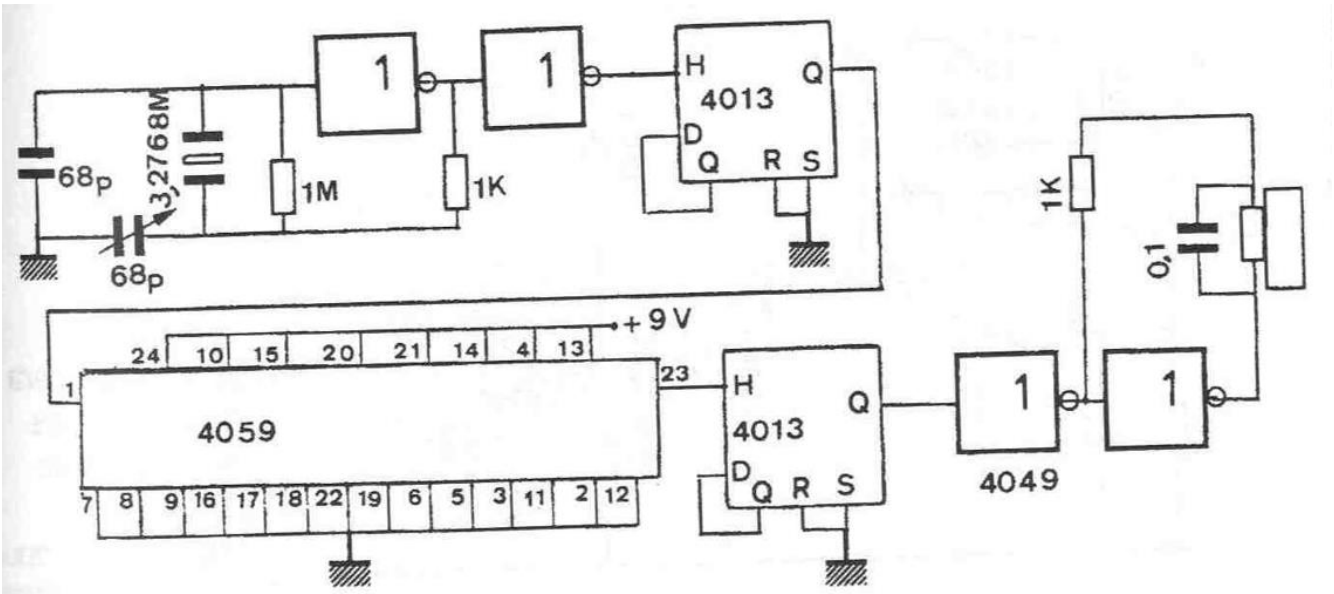
Schema prezentata descrie un diapazon electronic capabil sa genereze un semnal audio care este redat printr-un difuzor extern.

Circuitul are la baza un oscilator cu cristal de cuart, stabilizat prin doua condensatoare (unul fix si unul reglabil). Acesta produce un semnal dreptunghiular de frecventa ridicata.

Semnalul este procesat in etape:

- CD4013, un bistabil de tip D, functioneaza ca divizor de frecventa.
- CD4059, un numarator programabil, care are reduce frecventa de n ori (n poate fi configurat la o valoare dorita).
- Inversoarele 4049 sunt folosite ca drivere pentru difuzor, alaturi de o rezistenta de 1kΩ si un condensator de 0,1µF. Acestea limiteaza curentul, filtreaza armonicile inalte si ofera stabilitate, ceea ce duce la un sunet clar, cu zgomot de nivel scazut.

Pe scurt, montajul transforma semnalul stabil al cristalului intr-un ton audio constant, usor de reprodus in difuzor.



Specificaţii şi valori pentru proiect (anexa 2)

Echipa	2.3 [mm]	2.4 [mm]	2.5 [mm]	3.1, 3.2: forma şi dimensiunile plăcii [mm] & info cu privire la găurile de prindere (g.p.)
1	0,2	1,2	0,40	Dreptunghi, 70x50, cu 3 g.p. în 3 colţuri, plasate la 2 M distanţă de colţuri*
2	0,3	1,1	0,35	Dreptunghi, 70x55, cu 4 g.p. în cele 4 colţuri, plasate la 1,5 M distanţă de colţuri*
3	0,4	1,0	0,25	Dreptunghi, 70x60, cu 2 g.p. în 2 colţuri pe diagonală, plasate la 1,5 M distanţă de colţuri*
4	0,5	0,9	0,40	Pătrat, 65x65, cu 4 g.p. în cele 4 colţuri, plasate la 2 M distanţă de colţuri*
5	0,2	1,2	0,35	Pătrat, 50x50, cu 2 g.p. în 2 colţuri pe diagonală, plasate la 2 M distanţă de colţuri*
6	0,3	1,1	0,25	Pătrat, 60x60, cu 3 g.p. în 3 colţuri, plasate la 1,5 M distanţă de colţuri*
7	0,4	1,0	0,40	Dreptunghi, 65x55, cu 4 g.p. în cele 4 colţuri, plasate la 1,5 M distanţă de colţuri*
8	0,5	0,9	0,35	Dreptunghi, 75x45, cu 3 g.p. în 3 colţuri, plasate la 2 M distanţă de colţuri*
9	0,2	1,2	0,25	Dreptunghi, 70x55, cu 2 g.p. în 2 colţuri pe diagonală, plasate la 2 M distanţă de colţuri*
10	0,3	1,1	0,40	Pătrat, 70x70, cu 3 g.p. în 3 colţuri, plasate la 2 M distanţă de colţuri*
11	0,4	1,0	0,35	Pătrat, 55x55, cu 4 g.p. în cele 4 colţuri, plasate la 1,5 M distanţă de colţuri*
12	0,5	0,9	0,25	Pătrat, 65x65, cu 2 g.p. în 2 colţuri pe diagonală, plasate la 1,5 M distanţă de colţuri*
13	0,2	1,1	0,40	Dreptunghi, 75x45, cu 2 g.p. în 2 colţuri pe diagonală, plasate la 2 M distanţă de colţuri*
14	0,25	1,2	0,35	Dreptunghi, 75x60, cu 4 g.p. în colţuri, plasate la 2 M distanţă de colţuri*
15	0,35	1,0	0,3	Pătrat, 75X75, cu 3 g.p. în 3 colţuri, plasate la 1,5 M distanţă de colţuri*

* **OBS**: Distanţa faţă de colţ (de fapt, orice distanţă în electronică) se calculează pe principiul "centru la centru"; deci, în acest caz, "colţ la centrul găurii de prindere".

CD4049UB and CD4050B CMOS Hex Inverting Buffer and Converter

1 Features

- CD4049UB Inverting
- CD4050B Noninverting
- High Sink Current for Driving 2 TTL Loads
- High-to-Low Level Logic Conversion
- 100% Tested for Quiescent Current at 20 V
- Maximum Input Current of 1 µA at 18 V Over Full Package Temperature Range; 100 nA at 18 V and 25°C
- 5-V, 10-V, and 15-V Parametric Ratings

2 Applications

- CMOS to DTL or TTL Hex Converters
- CMOS Current *Sink* or *Source* Drivers
- CMOS High-to-Low Logic Level Converters

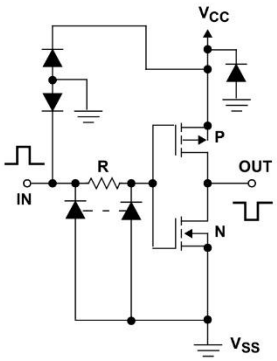
3 Description

The CD4049UB and CD4050B devices are inverting and noninverting hex buffers, and feature logic-level conversion using only one supply voltage (V_{CC}). The input-signal high level (V_{IH}) can exceed the V_{CC} supply voltage when these devices are used for logic-level conversions. These devices are intended for use as CMOS to DTL or TTL converters and can drive directly two DTL or TTL loads. (V_{CC} = 5 V, $V_{OL} \leq 0.4$ V, and $I_{OL} \geq 3.3$ mA.)

Device Information

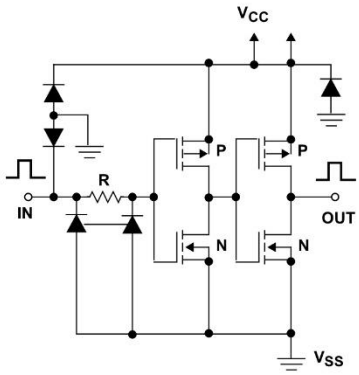
PART NUMBER(1)	PACKAGE	BODY SIZE (NOM)
CD4049UBE, CD4050BE	PDIP (16)	6.35 mm × 19.30 mm
CD4049UBD, CD4050BD	SOIC (16)	9.90 mm × 3.91 mm
CD4049UBDW, CD4050BDW	SOIC (16)	10.30 mm × 7.50 mm
CD4049UBNS, CD4050BNS	SO (16)	10.30 mm × 5.30 mm
CD4049UBPW, CD4050BPW	TSSOP (16)	5.00 mm × 4.40 mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.



1 of 6 Identical Units

Schematic Diagram of CD4049UB



1 of 6 Identical Units

Schematic Diagram of CD4050B

XXI. ANEXA 4

CD4013B CMOS Dual D-Type Flip-Flop

1 Features

- Asynchronous Set-Reset Capability
- Static Flip-Flop Operation
- Medium-Speed Operation: 16 MHz (Typical) Clock Toggle Rate at 10-V Supply
- Standardized Symmetrical Output Characteristics
- Maximum Input Current Of 1-µA at 18 V Over Full Package Temperature Range:
  - 100 nA at 18 V and 25°C
- Noise Margin (Over Full Package Temperature Range):
  - 1 V at V_{DD} = 5 V
  - 2 V at V_{DD} = 10 V
  - 2.5 V at V_{DD} = 15 V

2 Applications

- Power Delivery
- Grid Infrastructure
- Medical, Healthcare, and Fitness
- Body Electronics and Lighting
- Building Automation
- Telecom Infrastructure
- Test and Measurement

3 Description

The CD4013B device consists of two identical, independent data-type flip-flops. Each flip-flop has independent data, set, reset, and clock inputs and Q and $\overline{Q}$ outputs. These devices can be used for shift register applications, and, by connecting $\overline{Q}$ output to the data input, for counter and toggle applications. The logic level present at the D input is transferred to the Q output during the positive-going transition of the clock pulse. Setting or resetting is independent of the clock and is accomplished by a high level on the set or reset line, respectively.

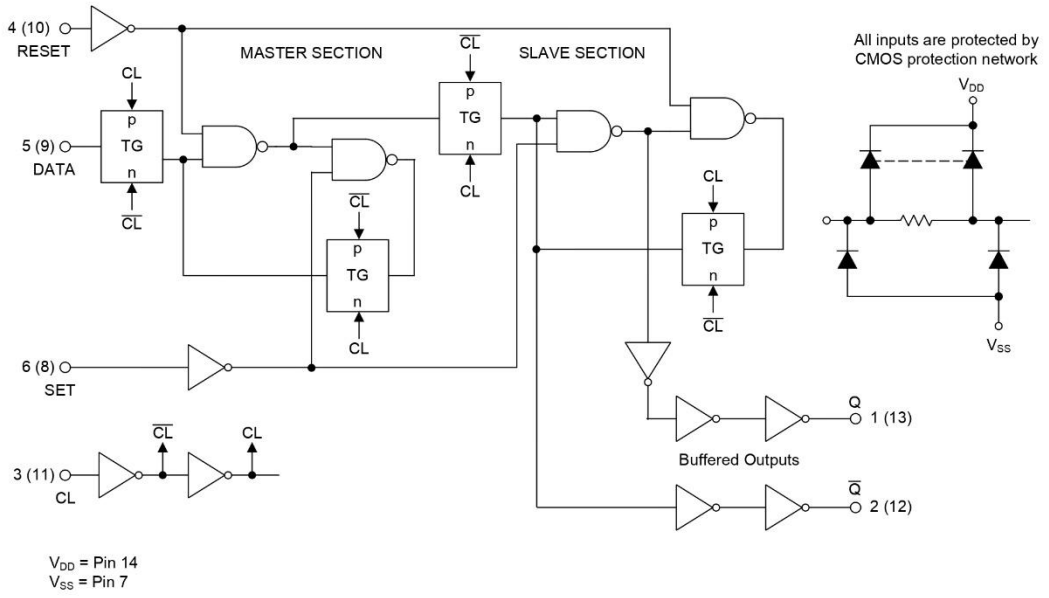
The CD4013B types are supplied in 14-pin dual-in-line plastic packages (E suffix), 14-pin small-outline packages (M, MT, M96, and NSR suffixes), and 14-pin thin shrink small-outline packages (PW and PWR suffixes).

Device Information(1)

PART NUMBER	PACKAGE	BODY SIZE (NOM)
CD4013BE	PDIP (14)	19.30 mm x 6.35 mm
CD4013BF	CDIP (14)	19.50 mm x 6.92 mm
CD4013BM	SOIC (14)	8.65 mm x 3.90 mm
CD4013BNS	SO (14)	10.20 mm x 5.30 mm
CD4013BPW	TSSOP (14)	5.00 mm x 4.40 mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.

Logic Diagram



TEXAS INSTRUMENTS

Data sheet acquired from Harris Semiconductor
SCHS206B

February 1998 - Revised May 2003

CD54HC4059, CD74HC4059

High-Speed CMOS Logic
CMOS Programmable Divide-by-N Counter

Features

- **Synchronous Programmable ÷N Counter N = 3 to 9999 or 15999**
- **Presettable Down-Counter**
- **Fully Static Operation**
- **Mode-Select Control of Initial Decade Counting Function (÷10, 8, 5, 4, 2)**
- **Master Preset Initialization**
- **Latchable ÷N Output**
- **Fanout (Over Temperature Range)**
  - **Standard Outputs . . . . . 10 LSTTL Loads**
  - **Bus Driver Outputs . . . . . 15 LSTTL Loads**
- **Wide Operating Temperature Range . . . -55°C to 125°C**
- **Balanced Propagation Delay and Transition Times**
- **Significant Power Reduction Compared to LSTTL Logic ICs**
- **HC Types**
  - **2V to 6V Operation**
  - **High Noise Immunity: N_{IL} = 30%, N_{IH} = 30% of V_{CC} at V_{CC} = 5V**

Applications

- **Communications Digital Frequency Synthesizers; VHF, UHF, FM, AM, etc.**
- **Fixed or Programmable Frequency Division**
- **"Time Out" Timer for Consumer-Application Industrial Controls**

Ordering Information

PART NUMBER	TEMP. RANGE (°C)	PACKAGE
CD54HC4059F3A	-55 to 125	24 Ld CERDIP
CD74HC4059E	-55 to 125	24 Ld PDIP
CD74HC4059M96	-55 to 125	24 Ld SOIC

NOTE: When ordering, use the entire part number. The suffix 96 denotes tape and reel.

Description

The 'HC4059 are high-speed silicon-gate devices that are pin-compatible with the CD4059A devices of the CD4000B series. These devices are divide-by-N down-counters that can be programmed to divide an input frequency by any number "N" from 3 to 15,999. The output signal is a pulse one clock cycle wide occurring at a rate equal to the input frequency divide by N. The down-counter is preset by means of 16 jam inputs.

The three Mode-Select Inputs K_a, K_b and K_c determine the modulus ("divide-by" number) of the first and last counting sections in accordance with the truth table. Every time the first (fastest) counting section goes through one cycle, it reduces by 1 the number that has been preset (jammed) into the three decades of the intermediate counting section an the last counting section, which consists of flip-flops that are not needed for opening the first counting section. For example, in the ÷2 mode, only one flip-flop is needed in the first counting section. Therefore the last counting section has three flip-flops that can be preset to a maximum count of seven with a place value of thousands. If ÷10 is desired for the first section, K_a is set "high", K_b "high" and K_c "low". Jam inputs J1, J2, J3, and J4 are used to preset the first counting section and there is no last counting section. The intermediate counting section consists of three cascaded BCD decade (÷10) counters presettable by means of Jam Inputs J5 through J16.

The Mode-Select Inputs permit frequency-synthesizer channel separations of 10, 12.5, 20, 25 or 50 parts. These inputs set the maximum value of N at 9999 (when the first counting section divides by 5 or 10) or 15,999 (when the first counting section divides by 8, 4, or 2).

The three decades of the intermediate counter can be preset to a binary 15 instead of a binary 9, while their place values are still 1, 10, and 100, multiplied by the number of the ÷N mode. For example, in the ÷8 mode, the number from which counting down begins can be preset to:

3rd Decade	1500
2nd Decade	150
1st Decade	15
Last Counting Section	1000

The total of these numbers (2665) times 8 equals 12,320. The first counting section can be preset to 7. Therefore, 21,327 is the maximum possible count in the ÷8 mode.

The highest count of the various modes is shown in the Extended Counter Range column. Control inputs K_b and K_c can be used to initiate and lock the counter in the "master preset" state. In this condition the flip-flops in the counter are preset in accordance with the jam inputs and the counter remains in that state as long as K_b and K_c both remain low. The counter begins to count down from the preset state when a counting mode other than the master preset mode is selected.

CAUTION: These devices are sensitive to electrostatic discharge. Users should follow proper IC Handling Procedures.

XXIII. ANEXA 6.

Nr. part	Link
1	https://ro.farnell.com/tdk/cga3e2c0g1h680j080aa/cap-68pf-50v-5-c0g-np0-0603/dp/2435470
2	https://ro.farnell.com/panasonic/era8veb1001v/res-1k-0-1-0-25w-thin-film-1206/dp/4066416
3	https://ro.farnell.com/vishay/rcv12061m00fkea/res-1m-1-0-25w-1206-thick-film/dp/2352640
4	https://ro.farnell.com/vishay/rcs12061k00jnea/resistor-rcs1206-200-1k0-et1-e3/dp/3235217
5	https://ro.mouser.com/ProductDetail/Wurth-Elektronik/830028430?qs=2WXlatMagcFMloNq%252Bnw2pw%3D%3D
6	https://ro.farnell.com/vishay/bfc280831659/cap-trimmer-5-5-65pf-150v/dp/4143685
7	https://ro.mouser.com/ProductDetail/Texas-Instruments/CD4049UBDR?qs=NLW4NjXEBS6oRdVn8RcZOQ%3D%3D
8	https://ro.mouser.com/ProductDetail/Texas-Instruments/CD74HC4059M96?qs=L4Mc90zKIpjWx4GKMuOBuQ%3D%3D
9	https://ro.mouser.com/ProductDetail/Texas-Instruments/CD4013BPWRE4?qs=vmM6vcLFxxHgaTltX2DeAQ%3D%3D
10	https://ro.mouser.com/ProductDetail/KYOCERA-AVX/KAM21BR71H104JT?qs=Jm2GQyTW%2Fbic6Zk4McEt6w%3D%3D
11	https://ro.farnell.com/amp-te-connectivity/826926-2/header-straight-2way/dp/1248140

** Acest tabel contine link-urile fiecarei componente din cadrul fisierului BOM, fiecare link cu id-ul sau (nr. part) corespunde unei componente.

Cost total componente: **63,585 lei** (RON)