UNIVERSITATEA „POLITEHNICA” din BUCUREŞTI

Facultatea de Electronică, Telecomunicaţii şi Tehnologia Informaţiei

Proiect

Tehnologii de interconectare în electronică

Proiectarea unui modul electronic PCB a unui caleidoscop electronic

Coordonator: **Prof. Dr. Ing. Codreanu Norocel**

Neata Adrian Mihai 421D

Bucureşti 2021

Date inițiale de proiectare

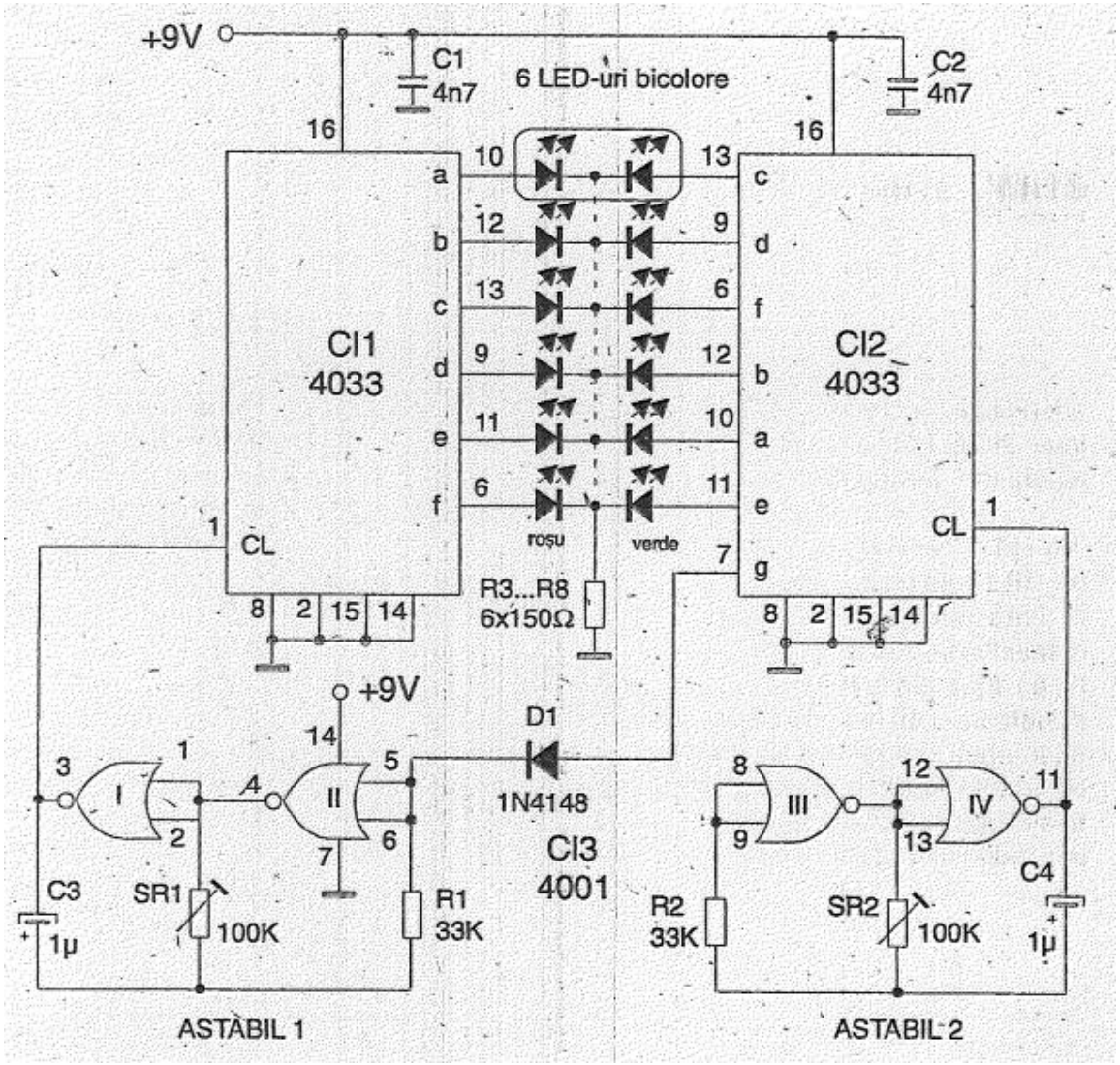
Scopul acestui proiect este de a realiza proiectarea unui caleidoscop electronic, cu ajutorul suitei de programe OrCAD Cadence. Acest montaj este efectuat din două CI de tip CMOS4033 și un CMOS 4001. Aceste CI comanda aprinderea a șapte segmente LED, ele fiind numărătoare-decodoare.

În design-ul PCB-ului vom folosi o placă de formă dreptunghiulară, cu dimensiunile de 65mm lungime și 55mm lățime. Traseele vor avea lățimi diferite, în funcție de utilizarea sa, astfel că traseele de semnal au 0.4mm, iar cele de alimentare vor avea 1mm. Spațierea dintre ele va fi de minim 0.4mm. Pentru găurile de prindere, vom alege un tip de gaură nemetalizată, de 3.2mm în diametru, pentru aceasta am ales tipul MȚG125, care are lungimea diametrului de 125mil (echivalentul a 3.2mm). Vom aplica aceste găuri în cele 4 colțuri ale plăcii, la distanță de 1.5M față de marginea acesteia (sau 150mil).

Pentru capsulele acestui proiect electronic, am folosit pentru fiecare componentă modelul preferat și optim în realizarea unei bune așezări pe proiect, în următoarea ordine:Rezistoare-RES400

- Capacitoare: CAPCK06
- Capacitoare polarizate:CAP196
- D1-DO35
- LED-uri -CAP196
- CON2-JUMPER2
- IC 4033: SOIC16
- IC 4001: SOIC16

Schema electrica (anexa1):



Specificaţii şi valori pentru proiect (anexa 2)

Echipa ("Team")	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.)
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

Conținut tehnic al proiectului

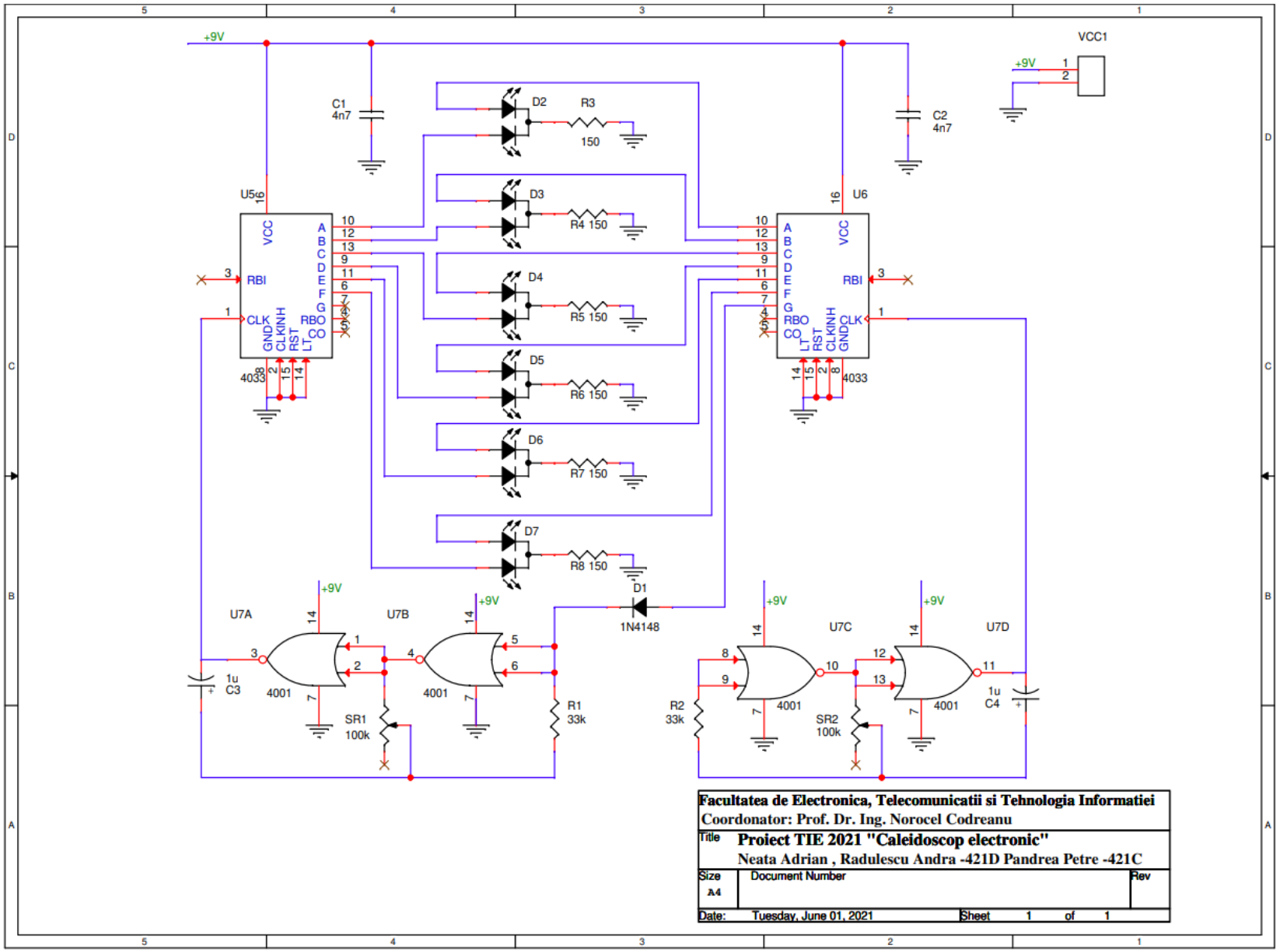
1.1 Descriere a funcționării schemei proiectate

În această aplicație se folosesc LED-uri în locul segmentelor de afișor, astfel că putem să le conectăm între ieșirile celor două CI4033. Ledurile sunt de două culori, roșu și verde, fiind conectate cele roșii la CI1, iar cele verzi la CI2. Pentru a crea culori aleatorii, cu ritm variabil, controlam tot acest ansamblu cu ajutorul unei intrări de tact. Reglarea vitezei în cele două numărătoare se face cu ajutorul celor două astabile, conectate cu porțile la CI4001. Potențiometrele au rolul de a regla frecvența celor două astabile la valori mai mici de 25Hz, pentru a asigura persistența retiniană.

Vom produce modificări periodice pentru a accentua fenomenul aleatoriu de aprindere a LED-urilor. Astfel, vom folosi o modalitate de a bloca astabilul 1 periodic. Ieșirea CI2, cu segmentul g, controlează astabilul prin dioda D1, și vom bloca astabilul de feicare dată când ieșirea va avea nivelul logic H.

LED-urile bicolore vor fi dispuse într-o formație de tip triunghi, culorile asemeni fiind pe aceeași parte. Pentru a finaliza acest proiect cu succes, se plasează trei oglinzi într-un tubm prevăzut cu un orificiu prin care putem privi rezultatul caleidoscopului.

1.2 Schemă electrică tiparită în format A4



1.3 Raport de postprocesare “Design Rule Check”

Date and Time : 06/01/21 12:13:23

Checking Schematic: SCHEMATIC1

Checking Electrical Rules

Checking For Single Node Nets

Checking For Unconnected Bus Nets

Checking Physical Rules

Checking Pins and Pin Connections

Checking Schematic: SCHEMATIC1

INFO(ORCAP-2242): Checking Incorrect Pin Group Assignment

Report for Invalid References

Report for Duplicate References

Checking Entire Design: CALEIDOSCOP

Checking Power Pin Visibility

Checking Normal Convert View Sync

INFO(ORCAP-36105): Checking Missing Pin Numbers

Checking Device with Zero pins

INFO(ORCAP-36101): Checking Missing PCB Footprint Property

Checking Name Property for Hierarchical Instances

INFO(ORCAP-2211): Check High Speed Properties Syntax

INFO(ORCAP-2212): Check Power Ground Mismatch

Reporting Unused Refdes in multiple part packages

Part	Quantity	Reference

1.4 Raport de postprocesare “Cross Reference”

Proiect TIE 2021 "Caleidoscop electronic" Revised: Tuesday, June 01, 2021
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Facultatea de Electronica, Telecomunicatii si Tehnologia Informatiei

Design Name: C:\USERS\ADYCO\ONEDRIVE - UNIVERSITATEA POLITEHNICA BUCURESTI\POLI\ANUL 2 SEM 2\TEHNOLOGII DE INTERCONECTARE IN ELECTRONICA\PROIECT\CALEIDOSCOP.DSN

Cross Reference June 1,2021 12:15:23 Page1

Item	Part	Reference	SchematicName	Sheet	Library
1	1N4148	D1	SCHEMATIC1/PAGE1	1	C:\CADENCE\SPB_17.4\TOOLS\CAPTURE\LIBRARY\DISCRETE.OLB
2	1U	C3	SCHEMATIC1/PAGE1	1	C:\CADENCE\SPB_17.4\TOOLS\CAPTURE\LIBRARY\DISCRETE.OLB
3	1U	C4	SCHEMATIC1/PAGE1	1	C:\CADENCE\SPB_17.4\TOOLS\CAPTURE\LIBRARY\DISCRETE.OLB
4	4N7	C1	SCHEMATIC1/PAGE1	1	C:\CADENCE\SPB_17.4\TOOLS\CAPTURE\LIBRARY\DISCRETE.OLB
5	4N7	C2	SCHEMATIC1/PAGE1	1	C:\CADENCE\SPB_17.4\TOOLS\CAPTURE\LIBRARY\DISCRETE.OLB
6	33K	R1	SCHEMATIC1/PAGE1	1	C:\CADENCE\SPB_17.4\TOOLS\CAPTURE\LIBRARY\DISCRETE.OLB
7	33K	R2	SCHEMATIC1/PAGE1	1	C:\CADENCE\SPB_17.4\TOOLS\CAPTURE\LIBRARY\DISCRETE.OLB
8	100K	SR1	SCHEMATIC1/PAGE1	1	C:\USERS\ADYCO\ONEDRIVE - UNIVERSITATEA POLITEHNICA BUCURESTI\POLI\ANUL 2 SEM 2\TEHNOLOGII DE INTERCONECTARE IN ELECTRONICA\PROIECT\CALEIDOSCOP.DSN
9	100K	SR2	SCHEMATIC1/PAGE1	1	C:\USERS\ADYCO\ONEDRIVE - UNIVERSITATEA POLITEHNICA BUCURESTI\POLI\ANUL 2 SEM 2\TEHNOLOGII DE INTERCONECTARE IN ELECTRONICA\PROIECT\CALEIDOSCOP.DSN
10	150	R3	SCHEMATIC1/PAGE1	1	C:\CADENCE\SPB_17.4\TOOLS\CAPTURE\LIBRARY\DISCRETE.OLB
11	150	R4	SCHEMATIC1/PAGE1	1	C:\CADENCE\SPB_17.4\TOOLS\CAPTURE\LIBRARY\DISCRETE.OLB

12 150 R5 SCHEMATIC1/PAGE1 1 C:\CADENCE\SPB_17.4\TOOLS\CAPTURE\LIBRARY\DISCRETE.OLB
13 150 R6 SCHEMATIC1/PAGE1 1 C:\CADENCE\SPB_17.4\TOOLS\CAPTURE\LIBRARY\DISCRETE.OLB
14 150 R7 SCHEMATIC1/PAGE1 1 C:\CADENCE\SPB_17.4\TOOLS\CAPTURE\LIBRARY\DISCRETE.OLB
15 150 R8 SCHEMATIC1/PAGE1 1 C:\CADENCE\SPB_17.4\TOOLS\CAPTURE\LIBRARY\DISCRETE.OLB
16 4001 U7A SCHEMATIC1/PAGE1 1 C:\CADENCE\SPB_17.4\TOOLS\CAPTURE\LIBRARY\GATE.OLB
17 4001 U7B SCHEMATIC1/PAGE1 1 C:\CADENCE\SPB_17.4\TOOLS\CAPTURE\LIBRARY\GATE.OLB
18 4001 U7C SCHEMATIC1/PAGE1 1 C:\CADENCE\SPB_17.4\TOOLS\CAPTURE\LIBRARY\GATE.OLB
19 4001 U7D SCHEMATIC1/PAGE1 1 C:\CADENCE\SPB_17.4\TOOLS\CAPTURE\LIBRARY\GATE.OLB
20 4033 U5 SCHEMATIC1/PAGE1 1 C:\USERS\ADYCO\ONEDRIVE - UNIVERSITATEA POLITEHNICA BUCURESTI\POLI\ANUL 2 SEM 2\TEHNOLOGII DE INTERCONECTARE IN ELECTRONICA\PROIECT\CALEIDOSCOP.DSN
21 4033 U6 SCHEMATIC1/PAGE1 1 C:\USERS\ADYCO\ONEDRIVE - UNIVERSITATEA POLITEHNICA BUCURESTI\POLI\ANUL 2 SEM 2\TEHNOLOGII DE INTERCONECTARE IN ELECTRONICA\PROIECT\CALEIDOSCOP.DSN
22 CON2 VCC1 SCHEMATIC1/PAGE1 1 C:\CADENCE\SPB_17.4\TOOLS\CAPTURE\LIBRARY\CONNECTOR.OLB
23 LED BI-COLOUR D2 SCHEMATIC1/PAGE1 1 C:\USERS\ADYCO\ONEDRIVE - UNIVERSITATEA POLITEHNICA BUCURESTI\POLI\ANUL 2 SEM 2\TEHNOLOGII DE INTERCONECTARE IN ELECTRONICA\PROIECT\CALEIDOSCOP.DSN
24 LED BI-COLOUR D3 SCHEMATIC1/PAGE1 1 C:\USERS\ADYCO\ONEDRIVE - UNIVERSITATEA POLITEHNICA BUCURESTI\POLI\ANUL 2 SEM 2\TEHNOLOGII DE INTERCONECTARE IN ELECTRONICA\PROIECT\CALEIDOSCOP.DSN
25 LED BI-COLOUR D4 SCHEMATIC1/PAGE1 1 C:\USERS\ADYCO\ONEDRIVE - UNIVERSITATEA POLITEHNICA BUCURESTI\POLI\ANUL 2 SEM 2\TEHNOLOGII DE INTERCONECTARE IN ELECTRONICA\PROIECT\CALEIDOSCOP.DSN
26 LED BI-COLOUR D5 SCHEMATIC1/PAGE1 1 C:\USERS\ADYCO\ONEDRIVE - UNIVERSITATEA POLITEHNICA BUCURESTI\POLI\ANUL 2 SEM 2\TEHNOLOGII DE INTERCONECTARE IN ELECTRONICA\PROIECT\CALEIDOSCOP.DSN
27 LED BI-COLOUR D6 SCHEMATIC1/PAGE1 1 C:\USERS\ADYCO\ONEDRIVE - UNIVERSITATEA POLITEHNICA BUCURESTI\POLI\ANUL 2 SEM 2\TEHNOLOGII DE INTERCONECTARE IN ELECTRONICA\PROIECT\CALEIDOSCOP.DSN
28 LED BI-COLOUR D7 SCHEMATIC1/PAGE1 1 C:\USERS\ADYCO\ONEDRIVE - UNIVERSITATEA POLITEHNICA BUCURESTI\POLI\ANUL 2 SEM 2\TEHNOLOGII DE INTERCONECTARE IN ELECTRONICA\PROIECT\CALEIDOSCOP.DSN

1.5 Raport de postprocesare “Bill of materials”

Proiect TIE 2021 "Caleidoscop electronic" Revised: Tuesday, June 01, 2021

\ Revision:

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Bill Of Materials June 1,2021 12:17:09 Page1

Item	Quantity	Reference	Part
1	2	C1,C2	4n7
2	2	C3,C4	1u
3	1	D1	1N4148
4	6	D2,D3,D4,D5,D6,D7	LED BI-COLOUR

5	2	R1,R2	33k	
6	6	R3,R4,R5,R6,R7,R8		150
7	2	SR1,SR2	100k	
8	2	U5,U6	4033	
9	1	U7	4001	
10	1	VCC1	CON2	

Nr. Crt.	Cantitate	Referinta	Part	Descriere	Montare	Capsula	Producator	Distribuitor	Cod produs	Cantitate minima	Pret unitar (Lei)	Pret articol (Lei)
1	2	C1,C2	4n7	Ceramic Disc Capacitor, 4700 pF, 100 V, D Series, ± 10%, Y5P, 2.5 mm	THD	CAPCK06	VISHAY	Ro.farnell.com	D472K33Y5PH63L2R	1	0.67	0.67
2	2	C3,C4	1u	ElectrolyticCapacitor, 1 µF, 100 V, MCRH Series, ± 20%, Radial Leaded, 2000 hours @ 105°C3520 Series	THD	CAP196	MULTICOMP PRO	Ro.farnell.com	MCRH100V105M5X11	1	0,28	0.28
3	1	D1	1N4148	Small Signal Diode, Single, 100 V, 200 mA, 1 V, 4 ns, 4 A	THD	DO35	ON SEMICONDUCTOR	Ro.farnell.com	1N4148TA	5	0.73	3.65
4	6	D2->D7	LED BI-COLOUR	LED, Green, Red, Through Hole, T-1 3/4 (5mm), 60 °, Round, R 30mA, G 25mA	THD	JUMPER3	KINGBRIGHT	Ro.farnell.com	L-57EGW	5	2.25	11.25
5	2	R1,R2	33k	Through Hole Resistor, 33 kohm, MOR Series, 3 W, ± 5%, Axial Leaded, 350 V	THD	Res400	MULTICOMP PRO	Ro.farnell.com	MOR03SJ0333A19	1	0.78	0.78
6	6	R3->R8	150	SMD Chip Resistor, 150 ohm, ± 1%, 250 mW, 1206 [3216 Metric], Thick Film, General Purpose	SMD	Smr1206	MULTICOMP PRO	Ro.farnell.com	MCWR12X1500FTL	10	0.08	0.8
7	2	SR1,SR2	100k	Trimpot, Multi Turn, Cermet, Top Adjust, 100 kohm, Through Hole, 25 Turns	THD	Vres58	Bourns	Ro.farnell.com	3296W-1-104LF	1	10,45	10.45
8	2	U5,U6	4033	IC CD4033B CMOS Decade Counter/Divider with Ripple Blanking	SMD	SOIC16	Texas Instruments	www.digipart.com	CD4033B	1	4.79	4.79
9	1	U7	4001	Quad 2-Input NOR NAND Buffered B Series Gate	SMD	SOIC14	Texas Instruments	ro.farnell.com	CD4001UBM	1	2.64	2.64
10	1	Vcc1	CON2	Jumper pentru alimentare	THD	JUMPER2	Hirose	Ro.farnell.com	DF13-2P-1.25DSA	10	**1,01**	**10.1**

1.6 Raport de postprocesare “Wirelist”

Wire List

Proiect TIE 2021 "Caleidoscop electronic" Revised: Tuesday, June 01, 2021
\ Revision:
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<<< Component List >>>

4n7	C1	CAPCK06
4n7	C2	CAPCK06
1u	C3	CAP196
1u	C4	CAP196
1N4148	D1	DO35
LED BI-COLOUR	D2	jumper3
LED BI-COLOUR	D3	jumper3
LED BI-COLOUR	D4	jumper3
LED BI-COLOUR	D5	jumper3
LED BI-COLOUR	D6	jumper3
LED BI-COLOUR	D7	jumper3
33k	R1	res400
33k	R2	res400
150	R3	smr1206
150	R4	smr1206
150	R5	smr1206
150	R6	smr1206
150	R7	smr1206
150	R8	smr1206

100k	SR1	vres58
100k	SR2	vres58
4033	U5	SOIC16
4033	U6	SOIC16
4001	U7	soic14
CON2	VCC1	jumper2

<<< Wire List >>>

NODE	REFERENCE	PIN #	PIN NAME	PIN TYPE	PART VALUE
[00001] +9V					
	C1	1	1	Passive	4n7
	C2	1	1	Passive	4n7
	U5	16	VCC	Power	4033
	U6	16	VCC	Power	4033
	VCC1	1	1	Passive	CON2
	U7	14	VDD	Power	4001
[00002] GND					
	C1	2	2	Passive	4n7
	C2	2	2	Passive	4n7
	R3	1	1	Passive	150
	R4	2	2	Passive	150
	R5	2	2	Passive	150
	R6	2	2	Passive	150
	R7	2	2	Passive	150
	R8	2	2	Passive	150
	U5	2	CLKINH	Input	4033
	U5	15	RST	Input	4033
	U5	14	LT	Input	4033
	U5	8	GND	Power	4033

U6	2	CLKINH	Input	4033
U6	15	RST	Input	4033
U6	14	LT	Input	4033
U6	8	GND	Power	4033
VCC1	2	2	Passive	CON2
U7	7	GND	Power	4001

[00003] N04758

U7	1	I0_A	Input	4001
U7	2	I1_A	Input	4001
U7	4	O_B	Output	4001
SR1	1	A	Passive	100k

[00004] N05153

C3	1	1	Passive	1u
R1	2	2	Passive	33k
SR1	2	WIPER	Passive	100k

[00005] N07928

D1	2	A	Passive	1N4148
U6	7	G	Output	4033

[00006] N09153

C3	2	2	Passive	1u
U5	1	CLK	Input	4033
U7	3	O_A	Output	4001

[00007] N09380

C4	2	2	Passive	1u
U6	1	CLK	Input	4033
U7	11	O_D	Output	4001

[00008] N09448

R2	2	2	Passive	33k
C4	1	1	Passive	1u
SR2	2	WIPER	Passive	100k

[00009] N10890

U6	6	F	Output	4033
D7	2	ANODE1	Passive	LED BI-COLOUR

[00010] N10905

U6	13	C	Output	4033
D4	2	ANODE1	Passive	LED BI-COLOUR

[00011] N10928

U6	10	A	Output	4033
D2	2	ANODE1	Passive	LED BI-COLOUR

[00012] N10992

U6	12	B	Output	4033
D3	2	ANODE1	Passive	LED BI-COLOUR

[00013] N134251

R3	2	2	Passive	150
D2	3	CATHODE	Passive	LED BI-COLOUR

[00014] N137160

R4	1	1	Passive	150
D3	3	CATHODE	Passive	LED BI-COLOUR

[00015] N138190

R5	1	1	Passive	150
D4	3	CATHODE	Passive	LED BI-COLOUR

[00016] N139250

R6	1	1	Passive	150
D5	3	CATHODE	Passive	LED BI-COLOUR

[00017] N140280

R7	1	1	Passive	150
D6	3	CATHODE	Passive	LED BI-COLOUR

[00018] N141330

R8	1	1	Passive	150
D7	3	CATHODE	Passive	LED BI-COLOUR

[00019] N15766

U5	13	C	Output	4033
D4	1	ANODE	Passive	LED BI-COLOUR

[00020] N17402

U6	9	D	Output	4033
D5	2	ANODE1	Passive	LED BI-COLOUR

[00021] N17408

U6	11	E	Output	4033
D6	2	ANODE1	Passive	LED BI-COLOUR

[00022] N18189

D1	1	K	Passive	1N4148
R1	1	1	Passive	33k
U7	5	I0_B	Input	4001
U7	6	I1_B	Input	4001

[00023] N23206

R2	1	1	Passive	33k
U7	8	I0_C	Input	4001
U7	9	I1_C	Input	4001

[00024] N27043

U5	10	A	Output	4033
D2	1	ANODE	Passive	LED BI-COLOUR

[00025] N29756

U5	9	D	Output	4033
D5	1	ANODE	Passive	LED BI-COLOUR

[00026] N29910

U5	11	E	Output	4033
D6	1	ANODE	Passive	LED BI-COLOUR

[00027] N29955

U5	6	F	Output	4033
D7	1	ANODE	Passive	LED BI-COLOUR

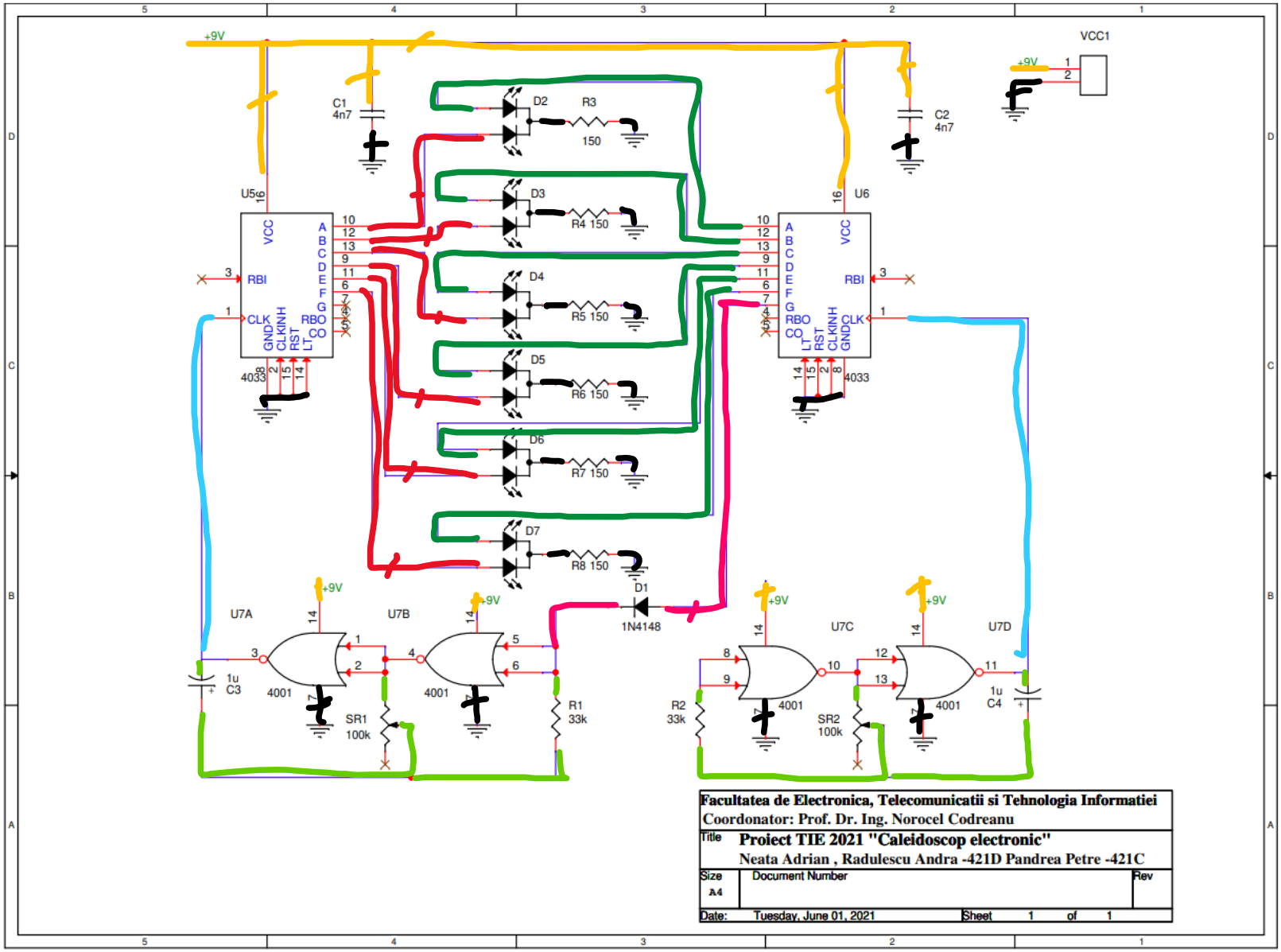
[00028] N31126

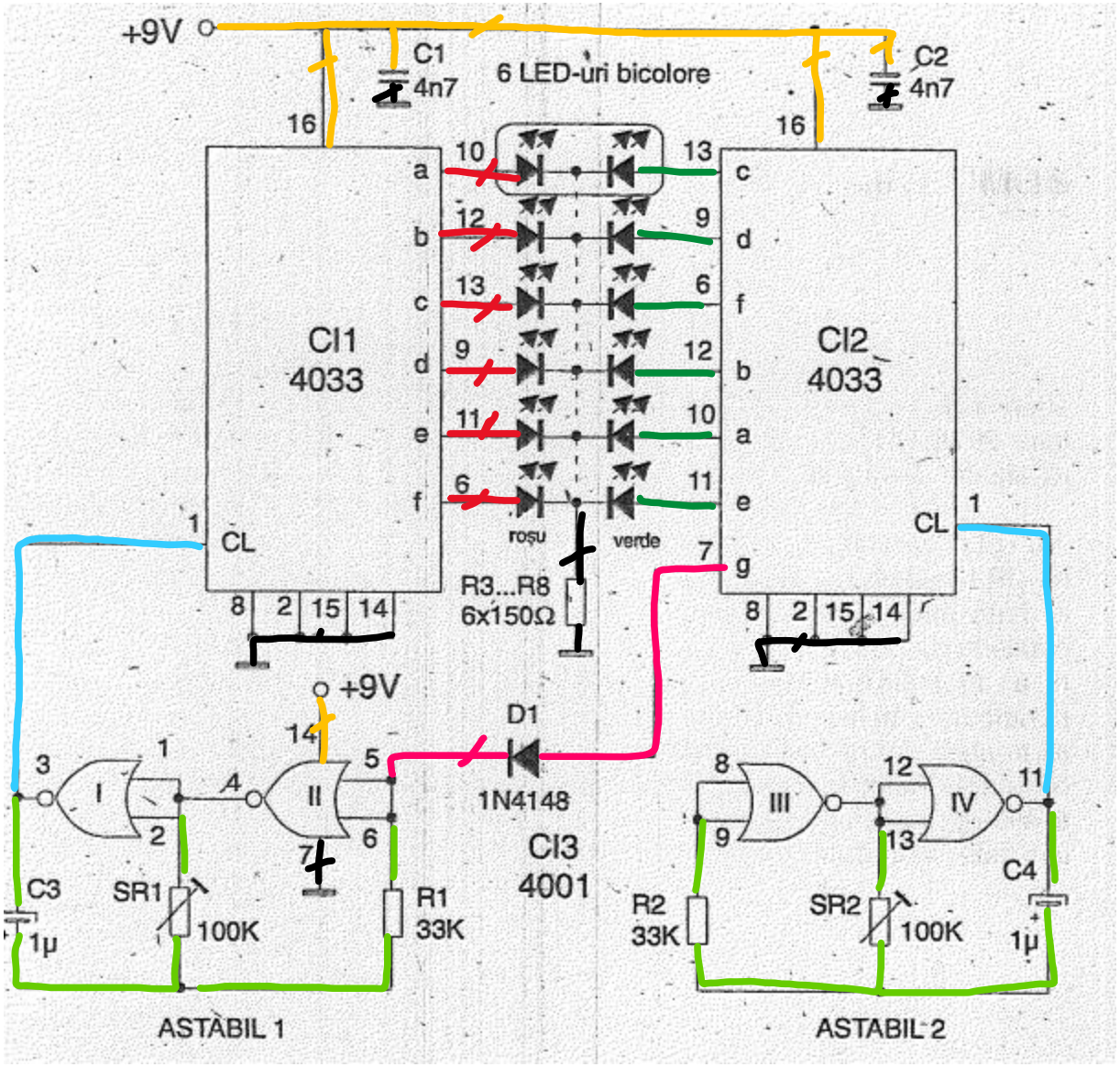
U5	12	B	Output	4033
D3	1	ANODE	Passive	LED BI-COLOUR

[00029] N35604

U7	10	O_C	Output	4001
U7	12	I0_D	Input	4001
U7	13	I1_D	Input	4001
SR2	1	A	Passive	100k

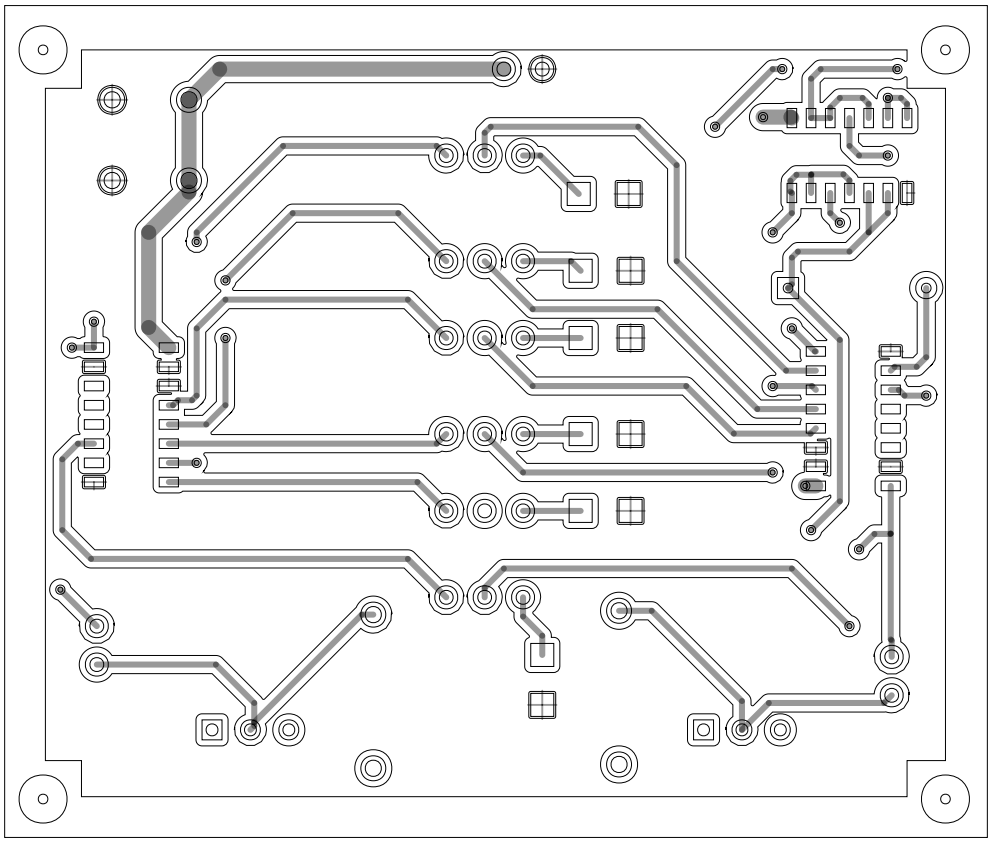
1.7 Prezentarea corelației dintre anexa 1 și proiectul CAD generat



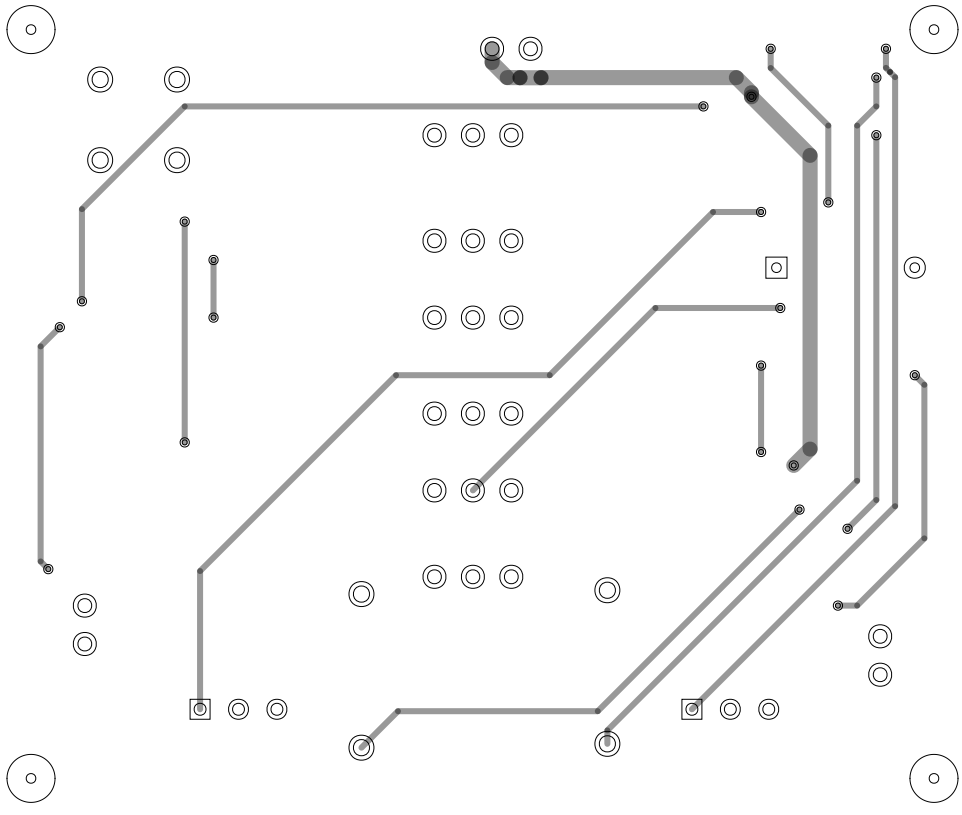

+9V
C1
4n7
6 LED-uri bicolore
C2
4n7
16
16
CI1
4033
CI2
4033
a
b
c
d
e
f
10
12
13
9
11
6
13
9
6
12
10
11
roșu
verde
1
CL
1
CL
7
g
8
2
15
14
8
2
15
14
R3...R8
6x150Ω
+9V
14
D1
1N4148
CI3
4001
I
II
III
IV
3
1
2
4
5
6
7
8
9
12
13
11
C3
1µ
SR1
100K
R1
33K
R2
33K
SR2
100K
C4
1µ
ASTABIL 1
ASTABIL 2

Avem prezentate în format pdf A4 cu scara 2:1 toate layerele importante ale PCB-ului, în această ordine:

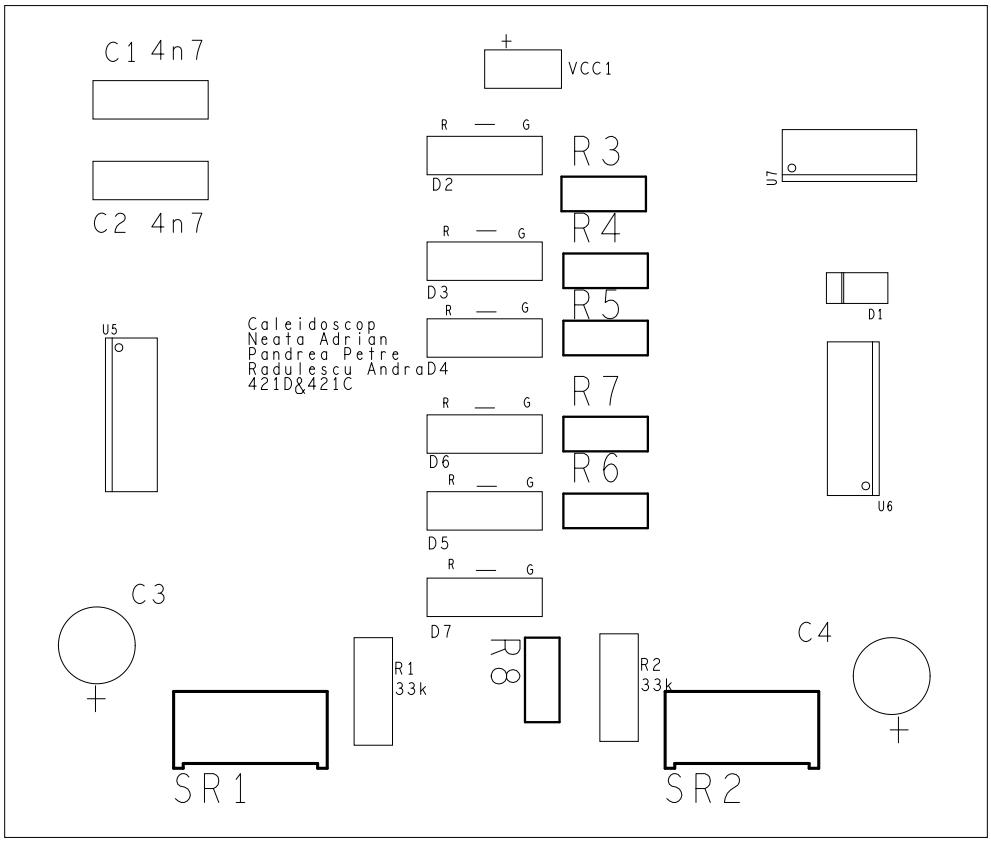
- TOP
- BOTTOM
- Silk-Screen-TOP
- Solder-Mask-TOP
- Solder-Mask-BOTTOM
- Assembly-drawing-TOP

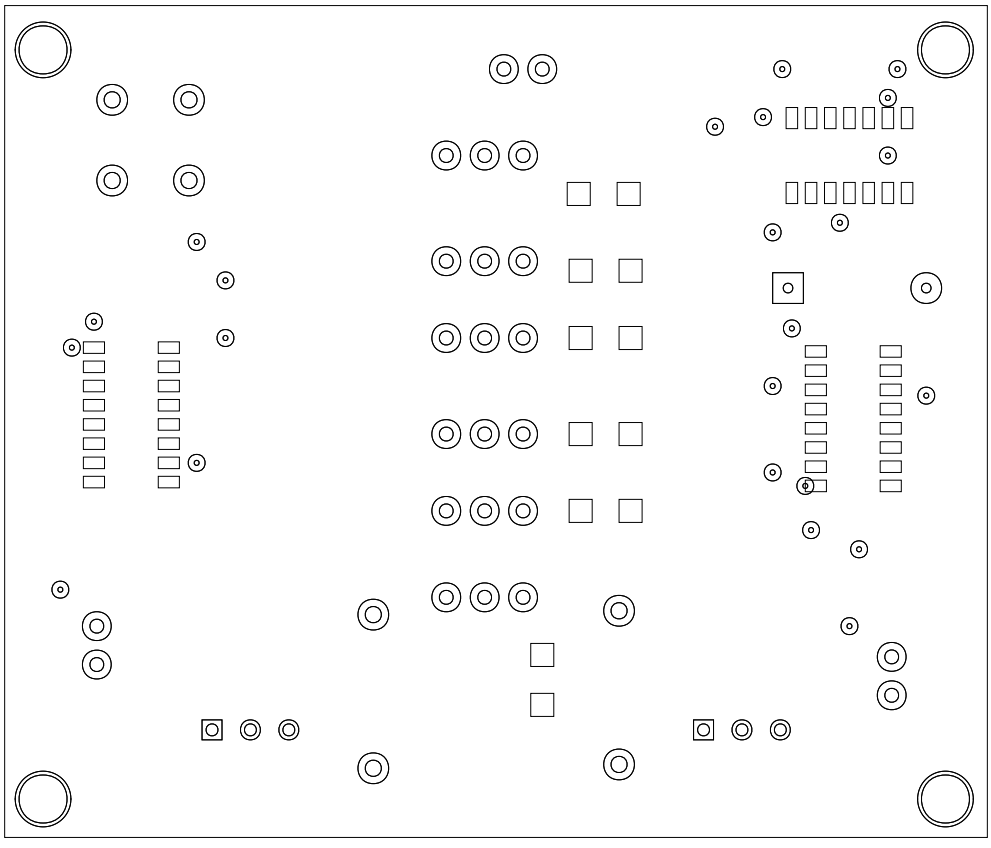


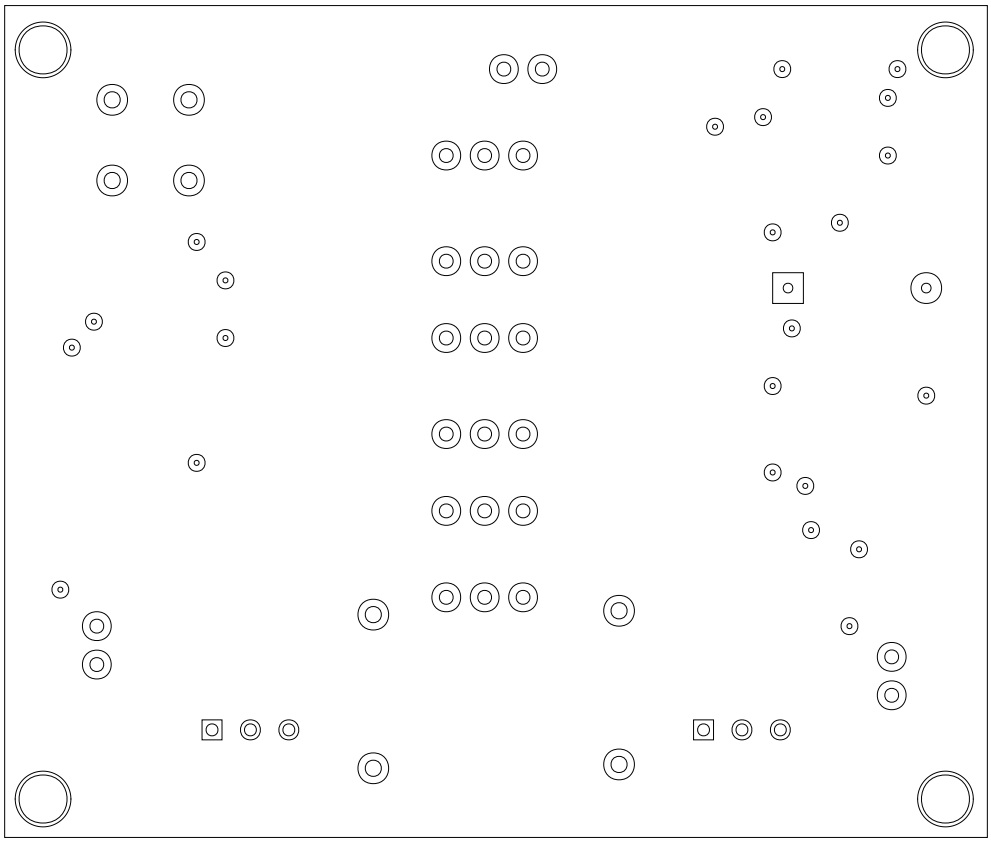
ART FILM - TOP_FIRE

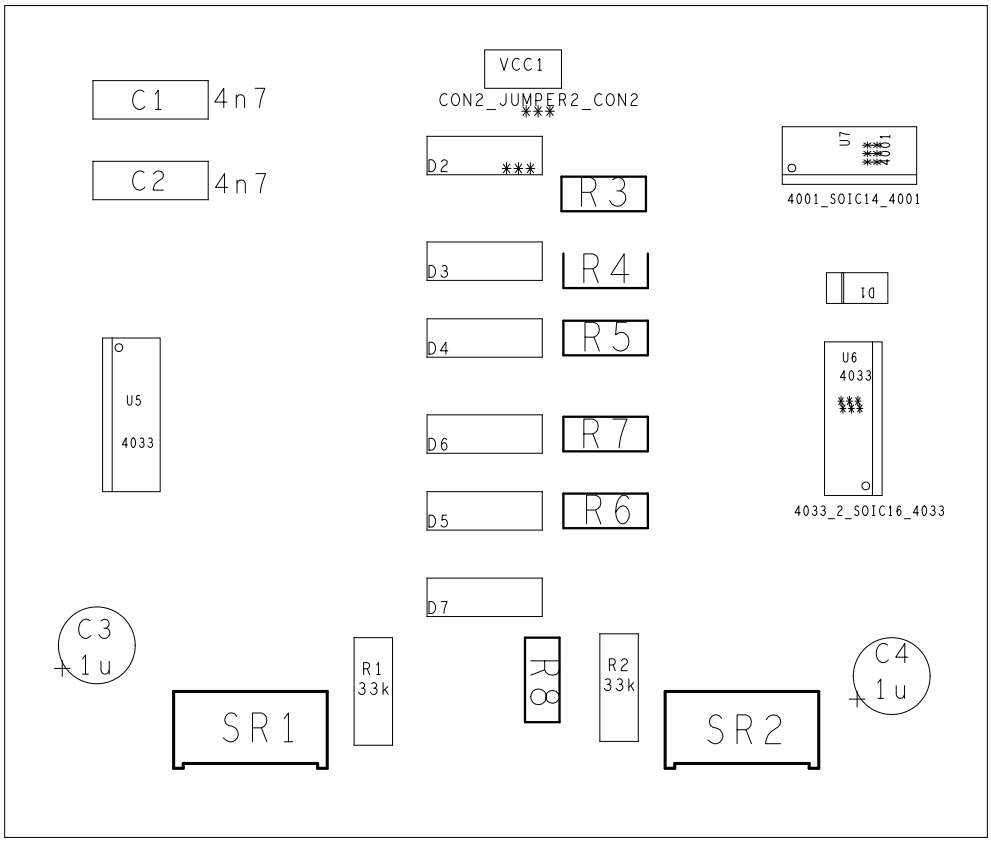


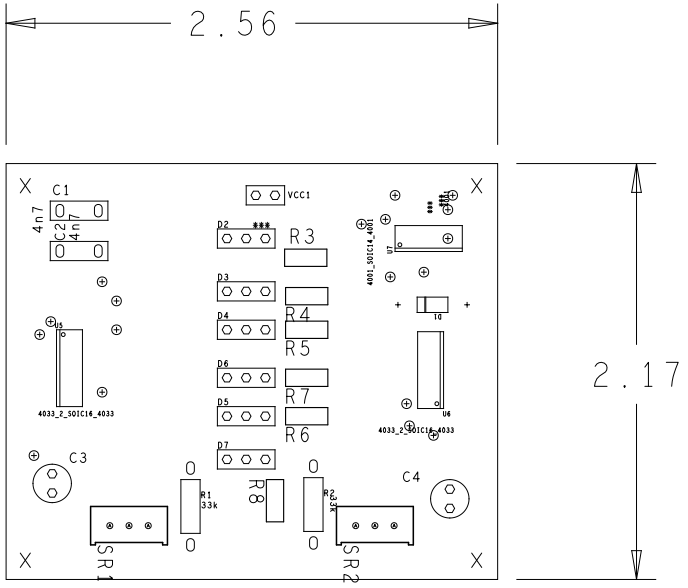
ART FILM - BOTTOM

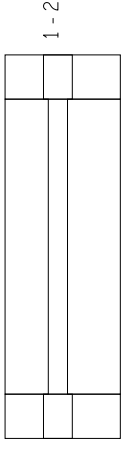

C1 4n7
C2 4n7
VCC1
R G
D2
D3
D4
D5
D6
D7
R3
R4
R5
R7
R6
R8
U5
U6
U7
D1
Caleidoscop
Neata Adrian
Pandrea Petre
Radulescu Andra
421D&421C
C3
C4
R1
33k
R2
33k
SR1
SR2






C1
4n7
C2
4n7
VCC1
CON2_JUMPER2_CON2
D2
R3
D3
R4
D4
R5
D6
R7
D5
R6
D7
U7
4001
4001_SOIC14_4001
D1
U6
4033
4033_2_SOIC16_4033
U5
4033
C3
1u
R1
33k
R8
R2
33k
C4
1u
SR1
SR2





* SURFACE
L1 TOP CONDUCTOR

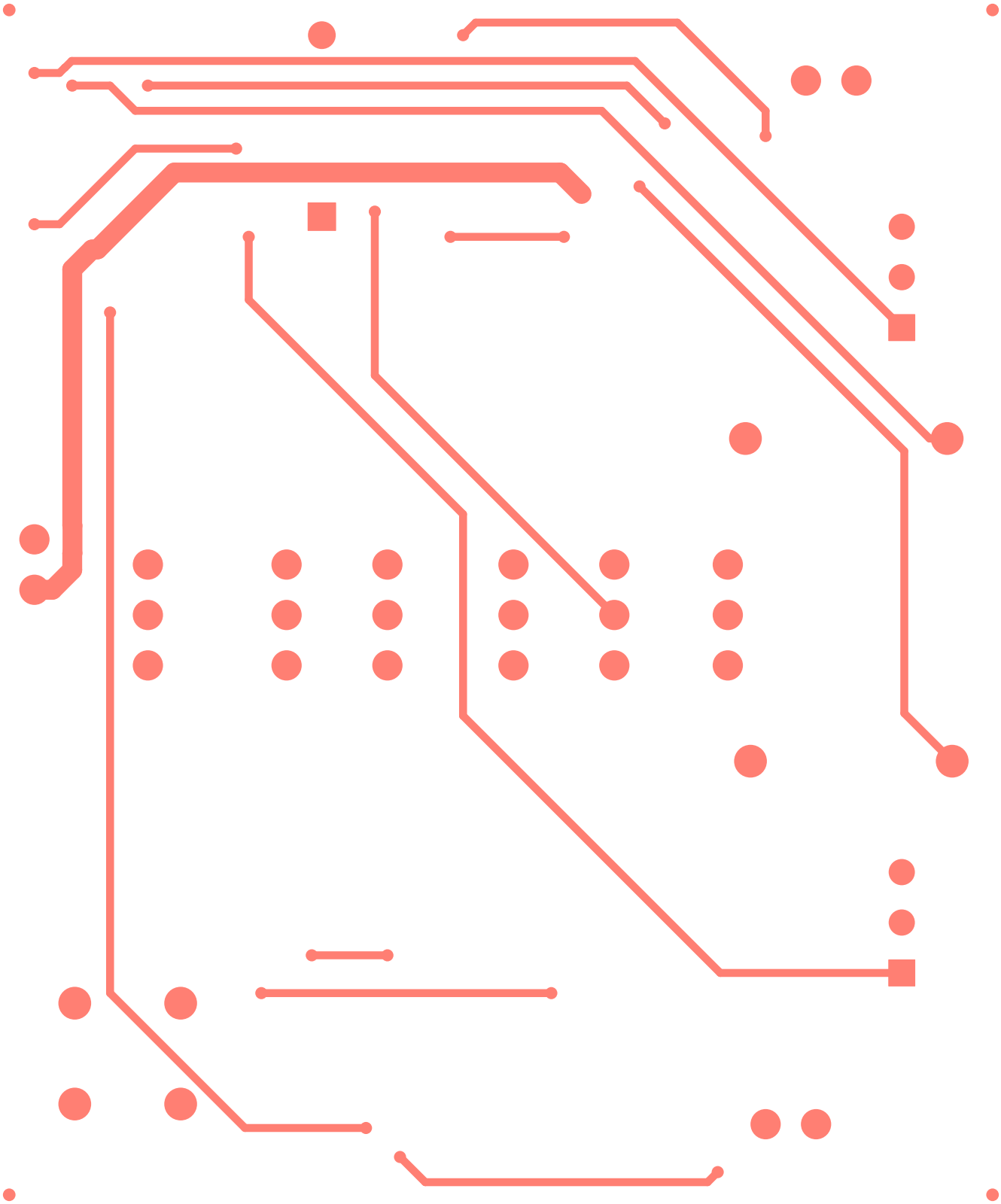
* DIELECTRIC

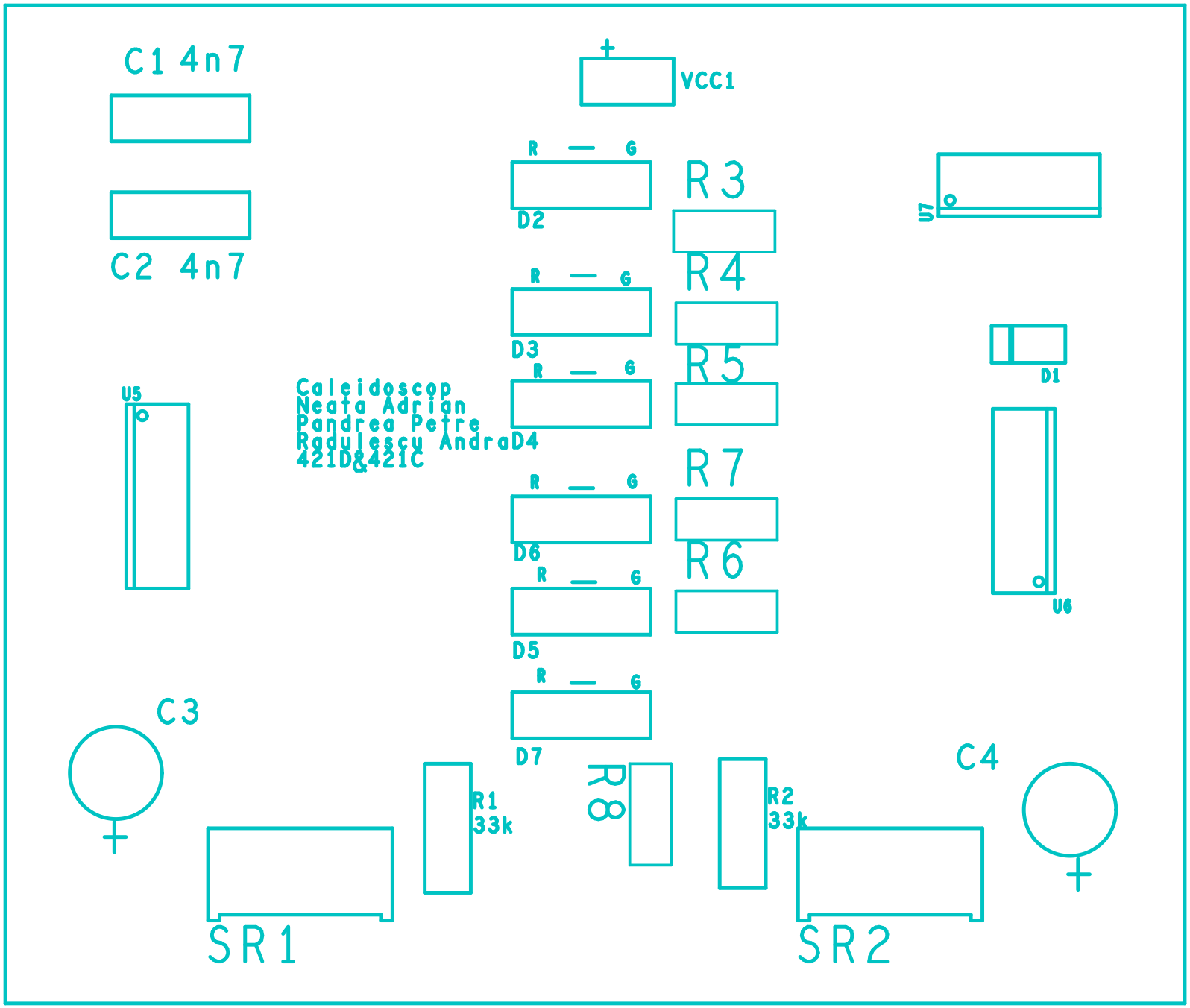
L2 BOTTOM CONDUCTOR

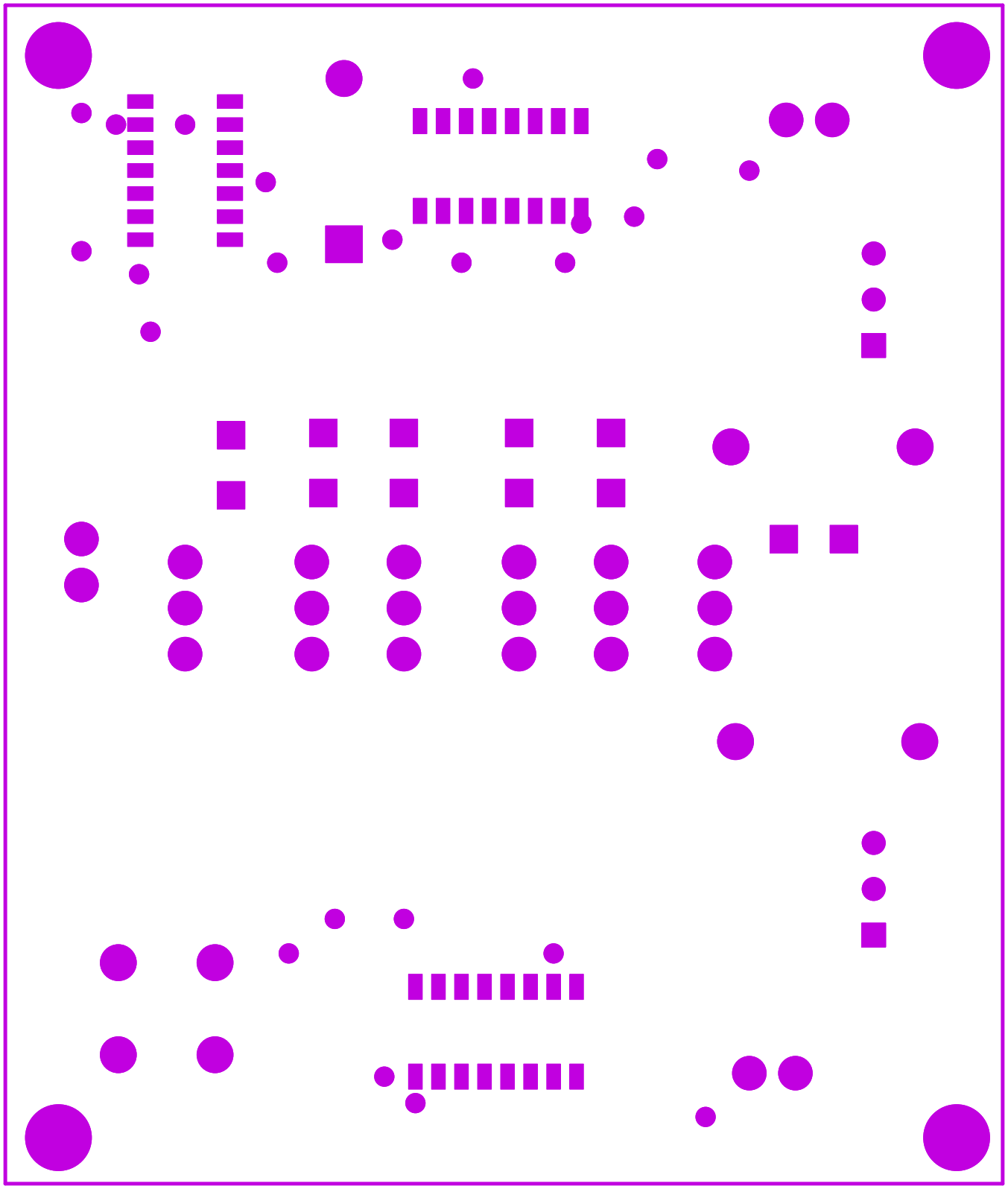
* SURFACE

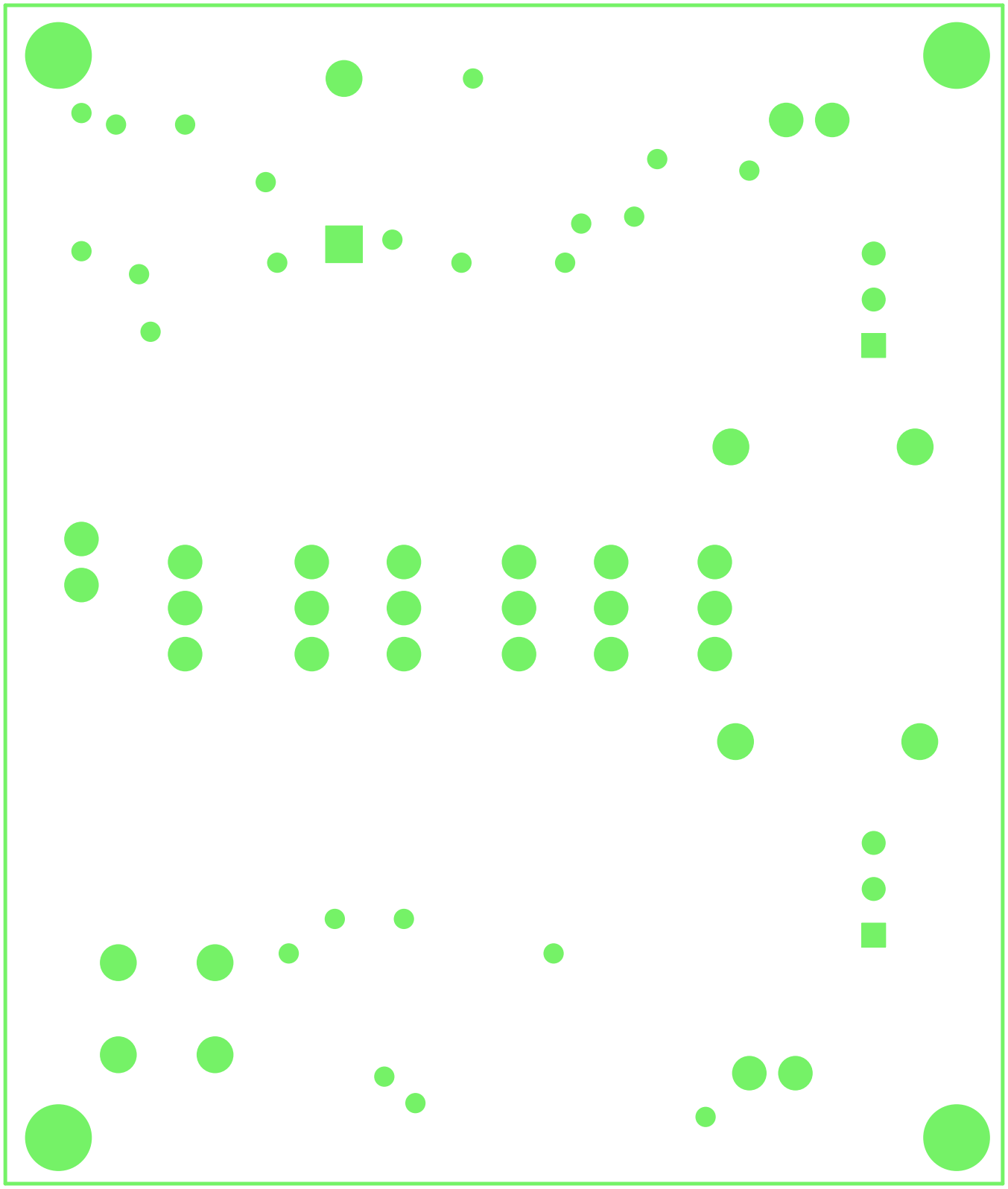
DESIGN CROSS SECTION CHART
TOTAL THICKNESS 10.4 MIL

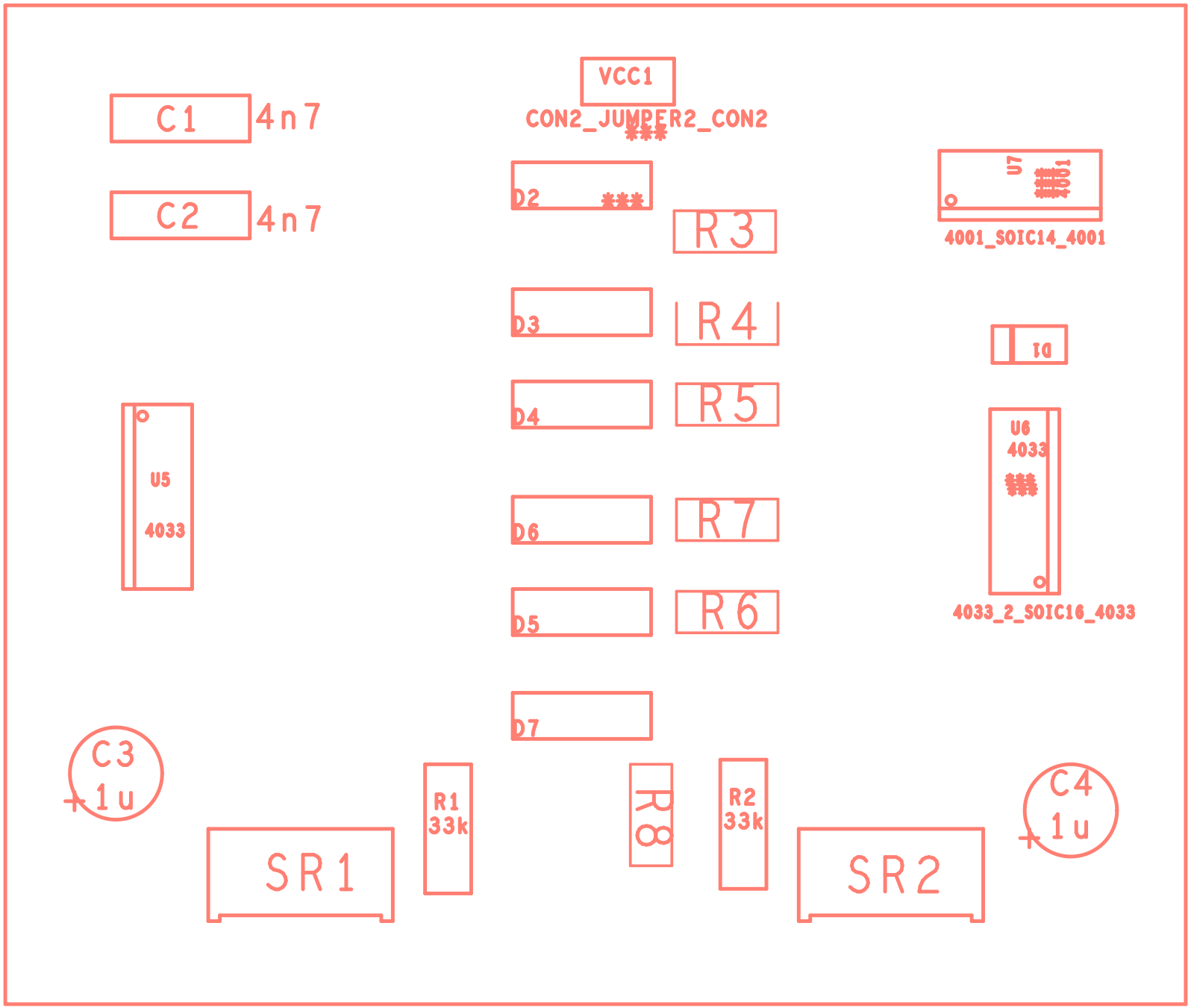
DRILL CHART: TOP to BOTTOM			
ALL UNITS ARE IN MILS			
FIGURE	FINISHED_SIZE	PLATED	QTY
⊕	13.0	PLATED	23
+	25.0	PLATED	2
⊛	31.0	PLATED	6
○	36.0	PLATED	24
O	42.0	PLATED	8
X	125.0	NON-PLATED	4




C1 4n7
C2 4n7
VCC1
R
G
D2
R3
U7
D3
R4
D1
U5
Caleidoscop
Neata Adrian
Pandrea Petre
Radulescu Andra
421D&421C
D4
R5
D6
R7
R6
D5
D7
C3
R1
33k
R8
R2
33k
C4
SR1
SR2
U6






C1
4n7
C2
4n7
VCC1
CON2_JUMPER2_CON2
D2
R3
D3
R4
D4
R5
D6
R7
D5
R6
D7
U7
4001
4001_SOIC14_4001
D1
U5
4033
U6
4033
4033_2_SOIC16_4033
C3
1u
R1
33k
R8
R2
33k
C4
1u
SR1
SR2

Concluzii

Proiectul de fata ne-a permis libertatea de a lucra in ritmul propriu si cu ideile adunate din partea echipei, astfel ca simpla colaborare pentru efectuarea unui caleidoscop electronic ne-a oferit o experienta deosebita in design-ul asistat de calculator. Programele utilizate ne-au permis simularea schemelor electrice, astfel ca am putut suplimenta cunostintele pentru acest vast domeniu de lucru. Cu ajutorul acestora, am evitat situatiile defavorabile, in care am fi fost obligati sa avem costuri inutile, timp irosit si, per total, neproductivitate.

Initierea de care am avut parte din pricina acestui proiect ne va ajuta in viitor la realizarea unor proiecte mult mai laborioase si complexe, fiind la nivel avansat fata de tema actuala, insa cu uneltele potrivite, inventiile si ideile pot deveni mai facil un proiect realizabil.

Astfel, caleidoscopul construit astazi genereaza bucurie in randul celor mici, dar si in randul celor mai mari, prin multitudinea de figuri colorate divers.

Bibliografie/Webografie

- https://www.cetti.ro/v2/
- https://ro.farnell.com/

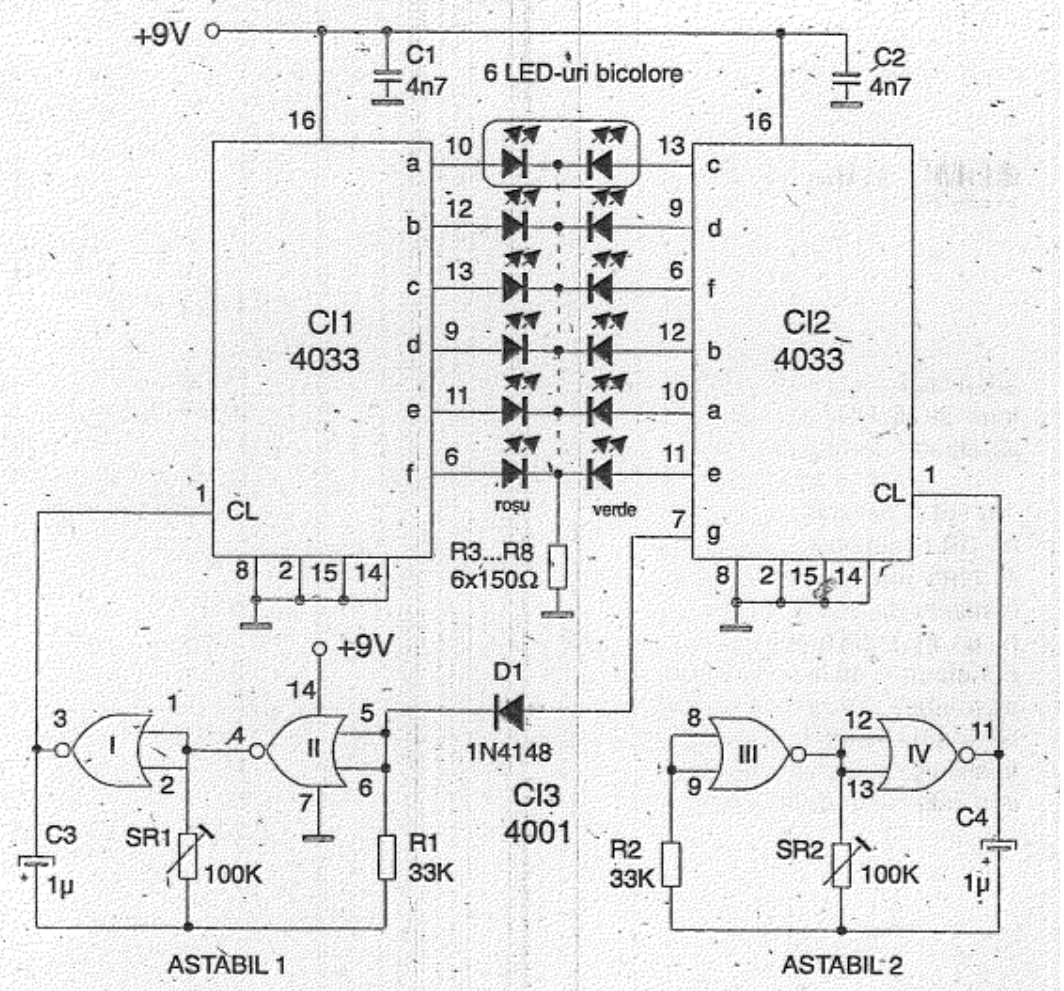
Anexa 1

186
4033

CALEIDOSCOP ELECTRONIC

Privind schema din **figura 186,** vom observa că montajul propus constă din două CI de tip CMOS 4033 și un CI de tip CMOS 4001. Primele două, adică CI1 și CI2, sunt numărătoare-decodoare, folosite în configurații identice. În mod curent, aceste CI comandă aprinderea celor șapte segmente ale unui afișor, notate de la *a* la *g*.

În aplicația de față, în locul segmentelor dintr-un afișor, se folosesc LED-uri. Deoarece dispunem de două CI 4033, între ieșirile lor se conectează de fapt, LED-uri bicolore; secțiunile de culoare roșie sunt conectate la ieșirile CI1, iar cele verzi, la ieșirile CI2. Trebuie observat însă, că cele două secțiuni ale unui LED nu sunt conectate la ieșirile corespunzătoare aceluiași segment. Pentru a genera culori aleatorii, cu un ritm variabil și cu câteva pauze într-un ciclu, pe lângă modul special de conectare a LED-urilor bicolore la cele două CI 4033, acestea din urmă sunt controlate separat pe intrările de tact. Pentru a asigura viteze de avans diferite celor două numărătoare, se construiesc două astabile separate, cu porțile din CI3. Prin intermediul semireglabilelor SR1 și SR2, frecvența celor două astabile se reglează de către utilizator la valori mai mici de 25 Hz, corelate cu persistența retiniană.



Anexa 2

Specificaţii şi valori pentru proiect (anexa 2)

Echipa ("Team")	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.)
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

Anexa 3

TEXAS INSTRUMENTS

Data sheet acquired from Harris Semiconductor
SCHS016C – Revised September 2003

CD4001UB Types

CMOS Quad 2-Input NOR Gate

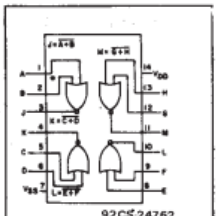
High-Voltage Types (20-Volt Rating)

■ CD4001UB quad 2-input NOR gate provides the system designer with direct implementation of the NOR function and supplements the existing family of CMOS gates.

The CD4001UB types are supplied in 14-lead hermetic dual-in-line ceramic packages (F3A suffix), 14-lead dual-in-line plastic packages (E suffix), 14-lead small-outline packages (M, MT, M96, and NSR suffixes), and 14-lead thin shrink small-outline packages (PW and PWR suffixes).

Features:

- Propagation delay time = 30 ns (typ.) at C_L = 50 pF, V_{DD} = 10 V
- Standardized symmetrical output characteristics
- 100% tested for maximum quiescent current at 20 V
- Meets all requirements of JEDEC Tentative **Standard No. 13B, "Standard Specifications** for Description of 'B' Series CMOS Devices"
- 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



92CS-24762

CD4001UB
FUNCTIONAL DIAGRAM

STATIC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	CONDITIONS			LIMITS AT INDICATED TEMPERATURES (°C)							UNITS
								+25			
	V_O (V)	V_{IN} (V)	V_{DD} (V)	−55	−40	+85	+125	Min.	Typ.	Max.	
Quiescent Device Current, I_{DD} Max.	–	0,5	5	0.25	0.25	7.5	7.5	–	0.01	0.25	μA
	–	0,10	10	0.5	0.5	15	15	–	0.01	0.5	
	–	0,15	15	1	1	30	30	–	0.01	1	
	–	0,20	20	5	5	150	150	–	0.02	5	
Output Low (Sink) Current I_{OL} Min.	0.4	0,5	5	0.64	0.61	0.42	0.36	0.51	1	–	mA
	0.5	0,10	10	1.6	1.5	1.1	0.9	1.3	2.6	–	
	1.5	0,15	15	4.2	4	2.8	2.4	3.4	6.8	–	
Output High (Source) Current, I_{OH} Min.	4.6	0,5	5	−0.64	−0.61	−0.42	−0.36	−0.51	−1	–	
	2.5	0,5	5	−2	−1.8	−1.3	−1.15	−1.6	−3.2	–	
	9.5	0,10	10	−1.6	−1.5	−1.1	−0.9	−1.3	−2.6	–	
	13.5	0,15	15	−4.2	−4	−2.8	−2.4	−3.4	−6.8	–	
Output Voltage: Low-Level, V_{OL} Max.	–	0,5	5	0.05				–	0	0.05	V
	–	0,10	10	0.05				–	0	0.05	
	–	0,15	15	0.05				–	0	0.05	
Output Voltage: High-Level, V_{OH} Min.	–	0,5	5	4.95				4.95	5	–	
	–	0,10	10	9.95				9.95	10	–	
	–	0,15	15	14.95				14.95	15	–	
Input Low Voltage, V_{IL} Max.	0.5, 4.5	–	5	1				–	–	1	V
	1, 9	–	10	2				–	–	2	
	1.5,13.5	–	15	2.5				–	–	2.5	
Input High Voltage, V_{IH} Min.	0.5	–	5	4				4	–	–	
	1	–	10	8				8	–	–	
	1.5	–	15	12.5				12.5	–	–	
Input Current I_{IN} Max.	–	0,18	18	±0.1	±0.1	±1	±1	–	$±10^{-5}$	±0.1	μA

Anexa 4

TEXAS INSTRUMENTS

Data sheet acquired from Harris Semiconductor
SCHS031B – Revised July 2003

CD4026B, CD4033B Types

CMOS
Decade Counters/Dividers

High-Voltage Types (20-Volt Rating)
With Decoded 7-Segment Display Outputs and:
Display Enable – CD4026B
Ripple Blanking – CD4033B

■ CD4026B and CD4033B each consist of a 5-stage Johnson decade counter and an output decoder which converts the Johnson code to a 7-segment decoded output for driving one stage in a numerical display.

These devices are particularly advantageous in display applications where low power dissipation and/or low package count are important.

Inputs common to both types are CLOCK, RESET, & CLOCK INHIBIT; common outputs are CARRY OUT and the seven decoded outputs (a, b, c, d, e, f, g). Additional inputs and outputs for the CD4026B include DISPLAY ENABLE input and DISPLAY ENABLE and UNGATED "C" SEGMENT" outputs. Signals peculiar to the CD4033B are RIPPLE-BLANKING INPUT AND LAMP TEST INPUT and a RIPPLE-BLANKING OUTPUT.

A high RESET signal clears the decade counter to its zero count. The counter is advanced one count at the positive clock signal transition if the CLOCK INHIBIT signal is low. Counter advancement via the clock line is inhibited when the CLOCK INHIBIT signal is high. The CLOCK INHIBIT signal can be used as a negative-edge clock if the clock line is held high. Antilock gating is provided on the JOHNSON counter, thus assuring proper counting sequence. The CARRY-OUT (C_{out}) signal completes one cycle every ten CLOCK INPUT cycles and is used to clock the succeeding decade directly in a multi-decade counting chain.

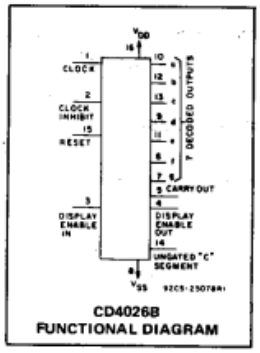
The seven decoded outputs (a, b, c, d, e, f, g) illuminate the proper segments in a seven segment display device used for representing the decimal numbers 0 to 9. The 7-segment outputs go high on selection in the CD4033B; in the CD4026B these outputs go high only when the DISPLAY ENABLE IN is high.

Features:

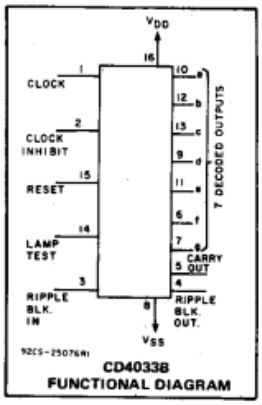
- Counter and 7-segment decoding in one package
- Easily interfaced with 7-segment display types
- Fully static counter operation: DC to 6 MHz (typ.) at V_{DD}=10 V
- Ideal for low-power displays
- Display enable output (CD4026B)
- "Ripple blanking" and lamp test (CD4033B)
- 100% tested for quiescent current at 20 V
- Standardized, symmetrical output characteristics
- 5-V, 10-V, and 15-V parametric ratings
- Schmitt-triggered clock inputs
- Meets all requirements of JEDEC Tentative Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices"

Applications

- Decade counting 7-segment decimal display
- Frequency division 7-segment decimal displays
- Clocks, watches, timers (e.g. ÷60, ÷ 60, ÷ 12 counter/display)
- Counter/display driver for meter applications



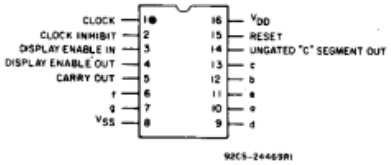
CD4026B
FUNCTIONAL DIAGRAM



CD4033B
FUNCTIONAL DIAGRAM

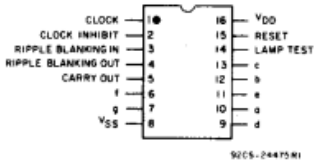
TERMINAL DIAGRAMS

Top View



CD4026B

Top View



CD4033B

MAXIMUM RATINGS, *Absolute-Maximum Values:*

DC SUPPLY-VOLTAGE RANGE, (V_{DD})
(Voltages referenced to V_{SS} Terminal) ..... -0.5V to +20V
INPUT VOLTAGE RANGE, ALL INPUTS ..... -0.5V to V_{DD} +0.5V
DC INPUT CURRENT, ANY ONE INPUT ..... ±10mA
POWER DISSIPATION PER PACKAGE (P_D):
For T_A = -55°C to +100°C 500mW
For T_A = +100°C to +125°C ..... Derate Linearity at 12mW/°C to 200mW
DEVICE DISSIPATION PER OUTPUT TRANSISTOR
FOR T_A = FULL PACKAGE-TEMPERATURE RANGE (All Package Types) 100mW
OPERATING-TEMPERATURE RANGE (T_A) ..... -55°C to +125°C
STORAGE TEMPERATURE RANGE (T_{stg}) ..... -65°C to +150°C
LEAD TEMPERATURE (DURING SOLDERING):
At distance 1/16 ± 1/32 inch (1.59 ± 0.79mm) from case for 10s max ..... +265°C

Anexa 5

Nr. Crt.	Cantitate	Referinta	Part	Link
1	2	C1,C2	4n7	https://ro.farnell.com/vishay/d472k33y5ph63l2r/cap-4700pf-100v-10-y5p/dp/1827841?ost=d472k33y+5ph63l2r&autoc=d472k33y5ph63l2r&pm=true
2	2	C3,C4	1u	https://ro.farnell.com/multicomp/mcrh100v105m5x11/cap-1-f-100v-20/dp/1902942?ost=mcrh100+v105m5x1+1&cfm=true&pm=true
3	1	D1	1N4148	https://ro.farnell.com/on-semiconductor/1n4148ta/diode-ultrafast-300ma-100v-do/dp/2322485?st=1n4148ta
4	6	D2->D7	LED BI-COLOUR	https://ro.farnell.com/kingbright/l-57egw/led-5mm-red-grn-14mcd-30mcd/dp/1142560?ost=l-57egw
5	2	R1,R2	33k	https://ro.farnell.com/multicomp/mor03sj0333a19/res-33k-5-3w-axial-metal-oxide/dp/1357922?ost=mor03sj0+333a19&autoc=mor03sj0333a19&pm=true
6	6	R3->R8	150	https://ro.farnell.com/multicomp/mcwr12x1500ftl/res-150r-1-0-25w-thick-film/dp/2447466?st=mcwr12x%201500ftl
7	2	SR1,SR2	100k	https://ro.farnell.com/bourns/3296w-1-104lf/trimmer-25-turn-100k/dp/9353194?ost=3296w-1-+104lf
8	2	U5,U6	4033	https://www.rocelec.com/part/TISCD4033BPW
9	1	U7	4001	https://ro.farnell.com/texas-instruments/cd4001ubm/logic-quad-2-in-nor-gate-14soic/dp/3006420?ost=cd4001ub+m&autoc=cd4001ubm&pm=true
10	1	Vcc1	CON2	https://ro.farnell.com/hirose-hrs/df13-2p-1-25dsa/connector-header-2pos-1row-1-25mm/dp/2427585?ost=DF13-2P-1.25DSA&exaMfpn=true&searchref=searchlookahead&scope=partnumberlookahead