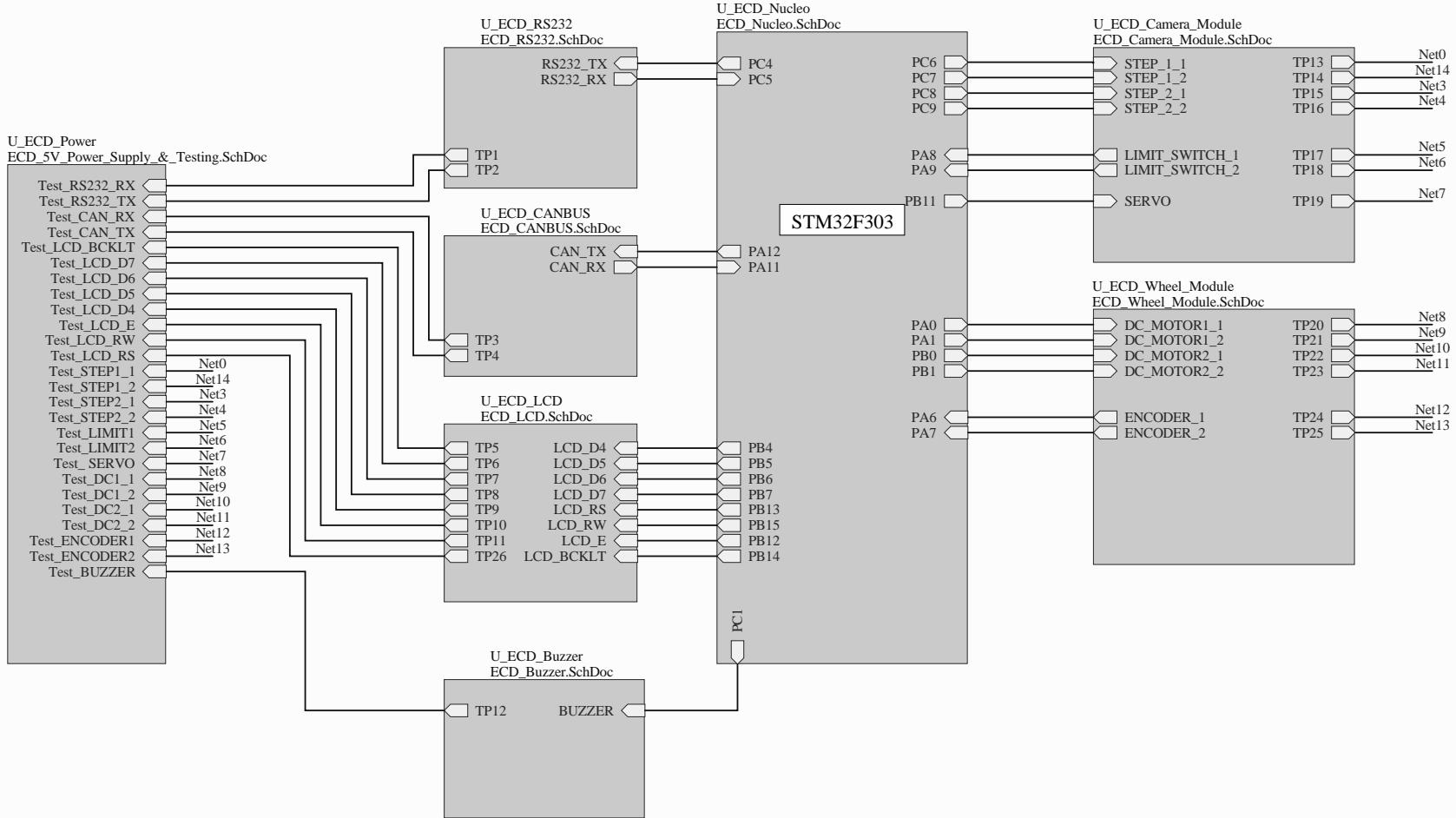


EMBEDDED CONTROLLER DESIGN



Title		
Size		Number
A4		1.0
Date: 3/7/2019		Sheet 1 of 10
File: C:\Users\...\ECD_TOP.SchDoc		Drawn By: Daniel E. Dreise

A

A

B

B

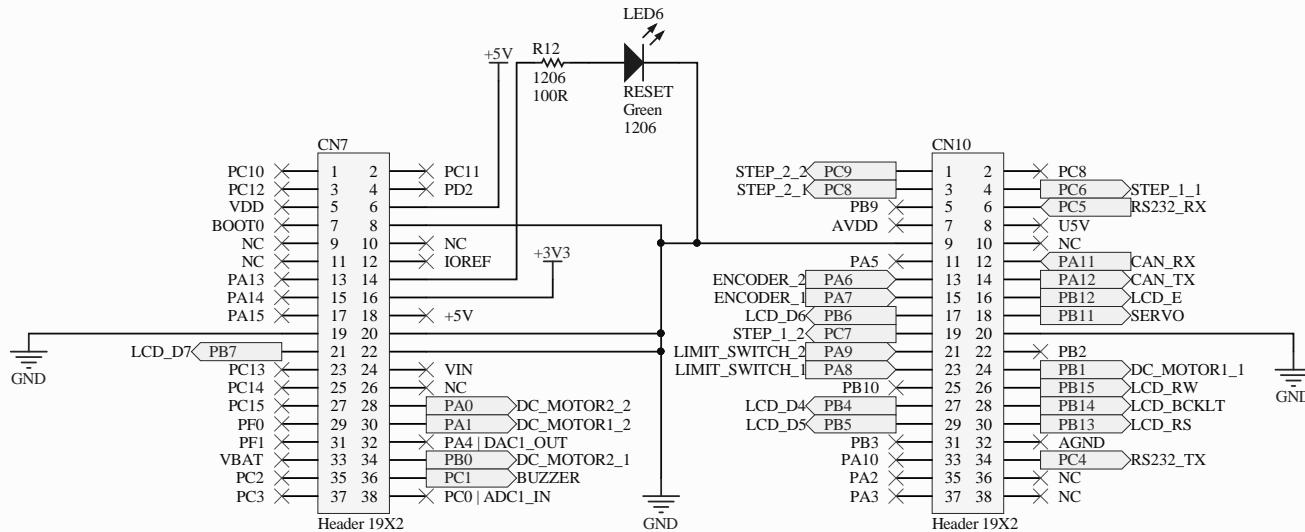
C

C

D

D

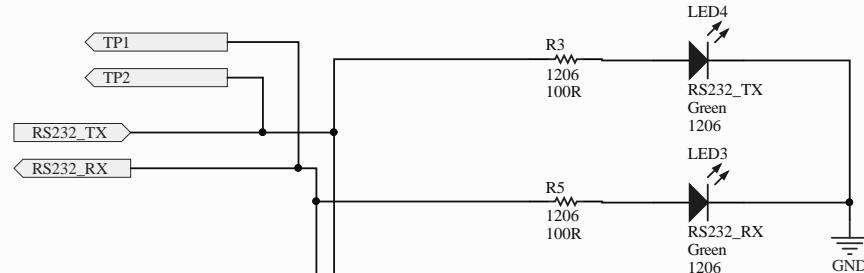
Headers to Connect to Nucleo



Title
Nucleo Board Header Pins

Size	Number	Revision
A4		1.0
Date:	3/7/2019	Sheet 2 of 10
File:	C:\Users\...\ECD_Nucleo.SchDoc	Drawn By: Daniel E. Dreise

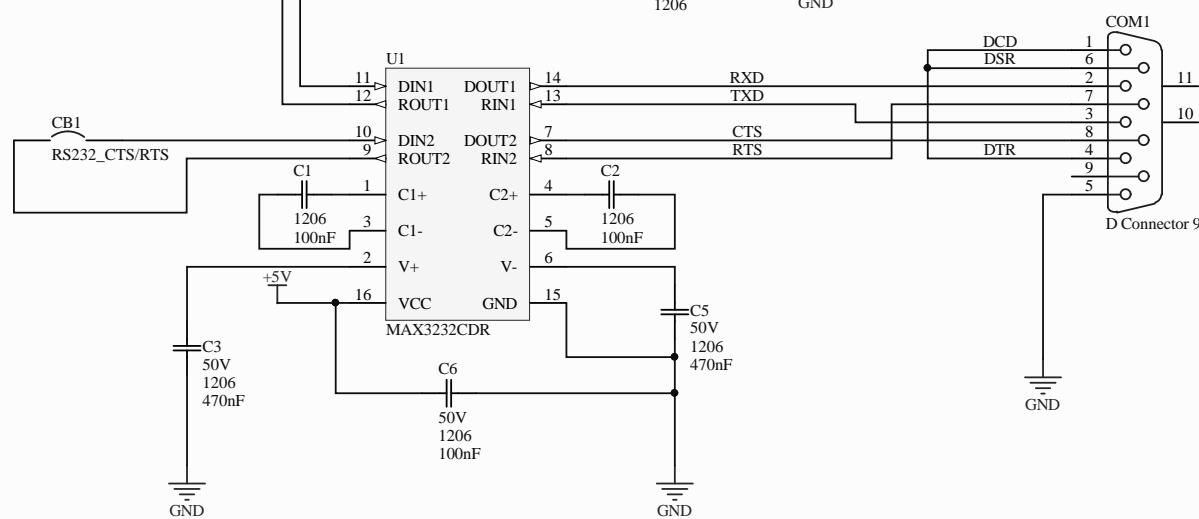
A



Pin Functions

DCD - Data Carrier Detect
 RXD - Receive Data
 TXD - Transmit Data
 DTR - Data Terminal Ready
 DSR - Data Set Ready
 RTS - Request to Send
 CTS - Clear to Send

B



C

Title		
RS3232 with DB9 Connector		
Size	Number	Revision
A4		1.0
Date:	3/7/2019	Sheet 3 of 10
File:	C:\Users\...\ECD_RS232.SchDoc	Drawn By: Daniel E. Dreise

1

2

3

4

A

A

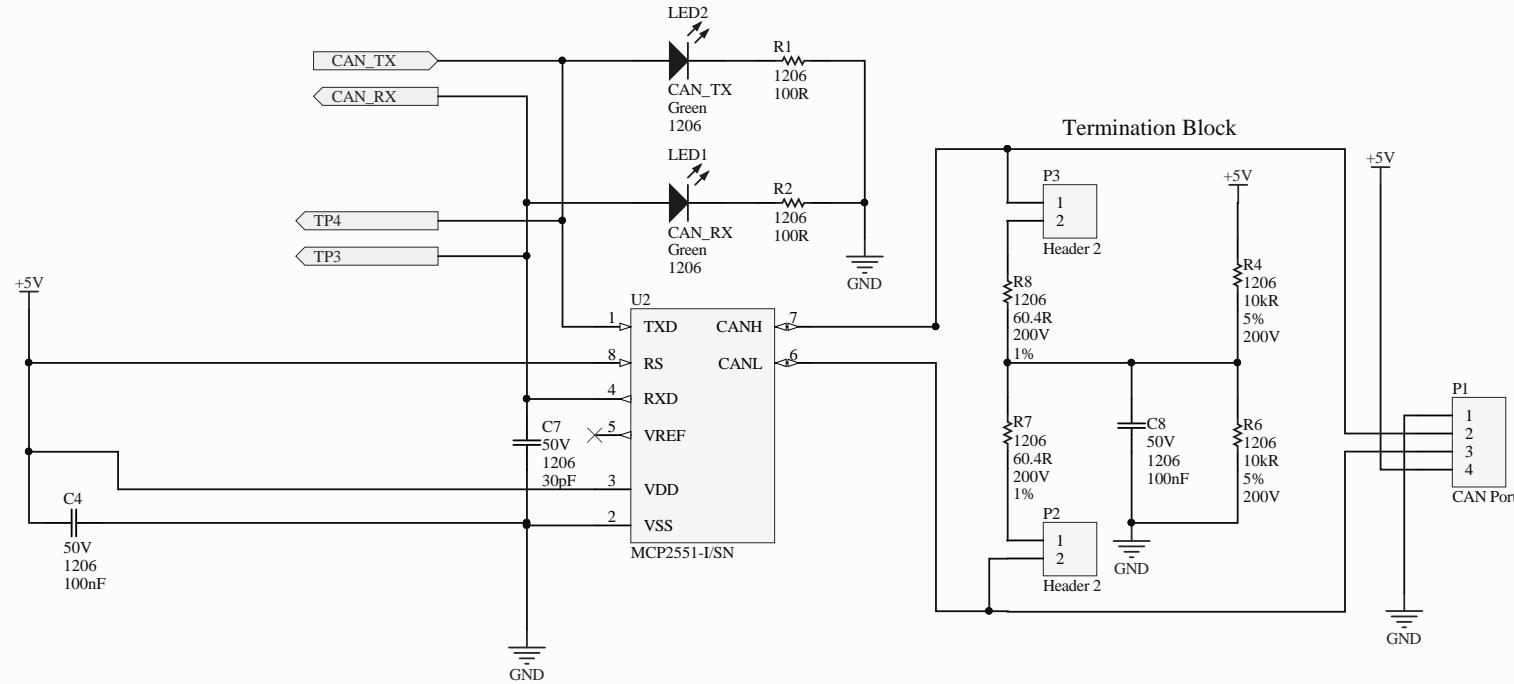
Rs controls if CAN Transceiver is in Standby or Normal mode. Put in Standby mode when not in use to save power.

Connect to Vcc for High Speed.

Connect to external resistor and then to ground for slope control.

Connect to ground for standby.

Result: Connecting to Vdd for High Speed transmission.



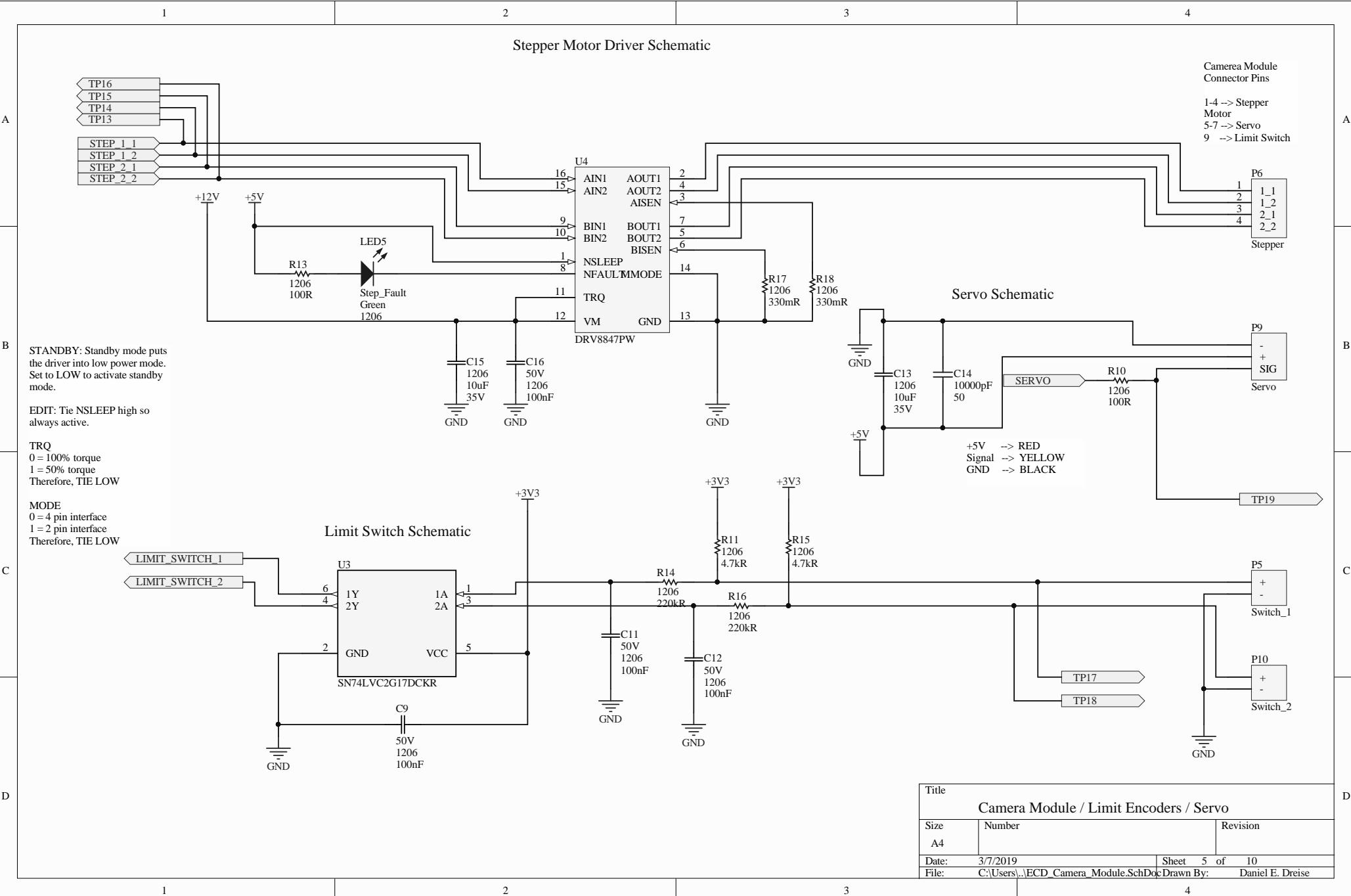
Title CAN BUS Transceiver with Slew and External Port Header		
Size A4	Number	Revision 1.0
Date: 3/7/2019	Sheet 4 of 10	
File: C:\Users\...\ECD_CANBUS.SchDoc	Drawn By: Daniel E. Dreise	

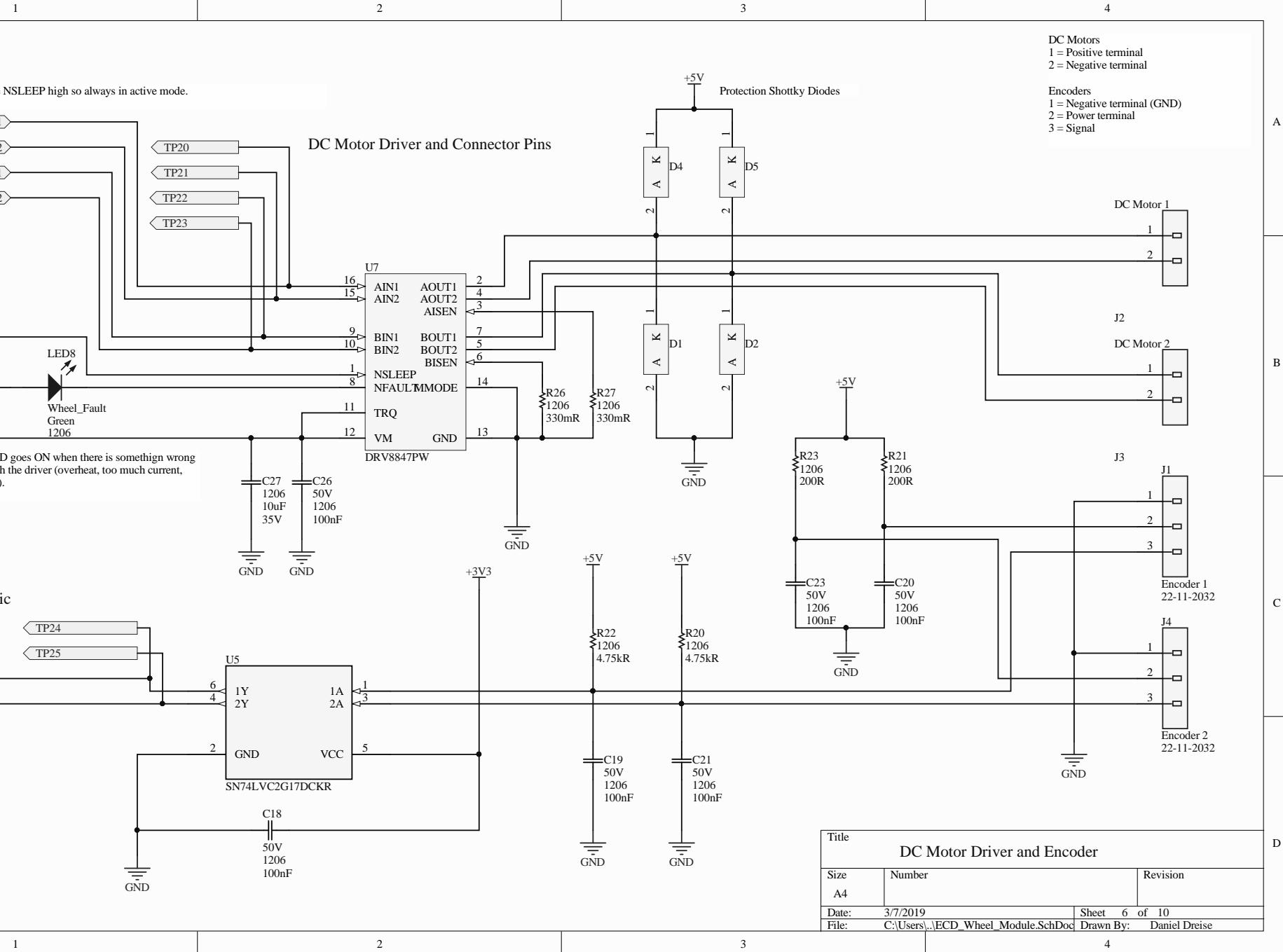
1

2

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4





A

A

B

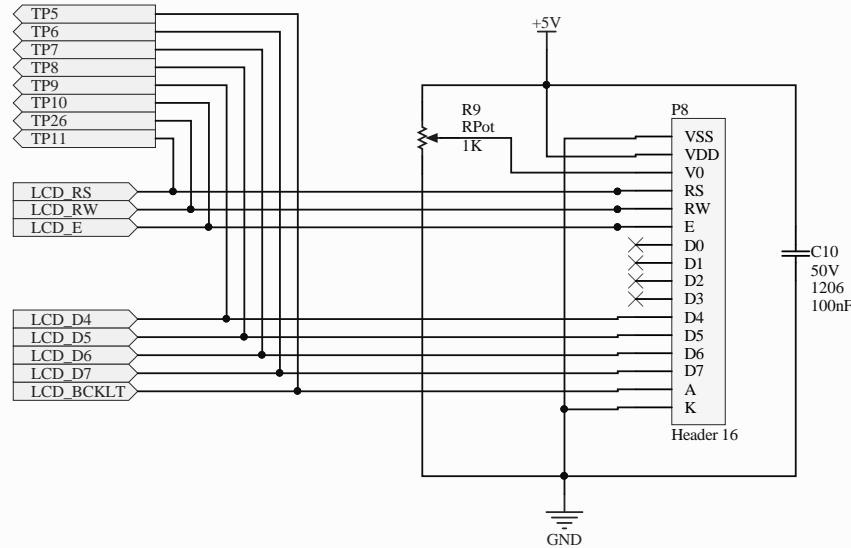
B

Pin Functions

RS - choose between DATA or INSTRUCTION
 RW - choose between READ or WRITE
 E - clock used for internal LCD driver

D.. - 4 bit data

BCKLT - backlight for LCD



C

C

D

D

Title
LCD Module Schematic and Connections

Size	Number	Revision
A4		

Date: 3/7/2019 Sheet 7 of 10
 File: C:\Users\...\ECD_LCD.SchDoc Drawn By: Daniel E. Dreise

1 2 3 4

A

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2

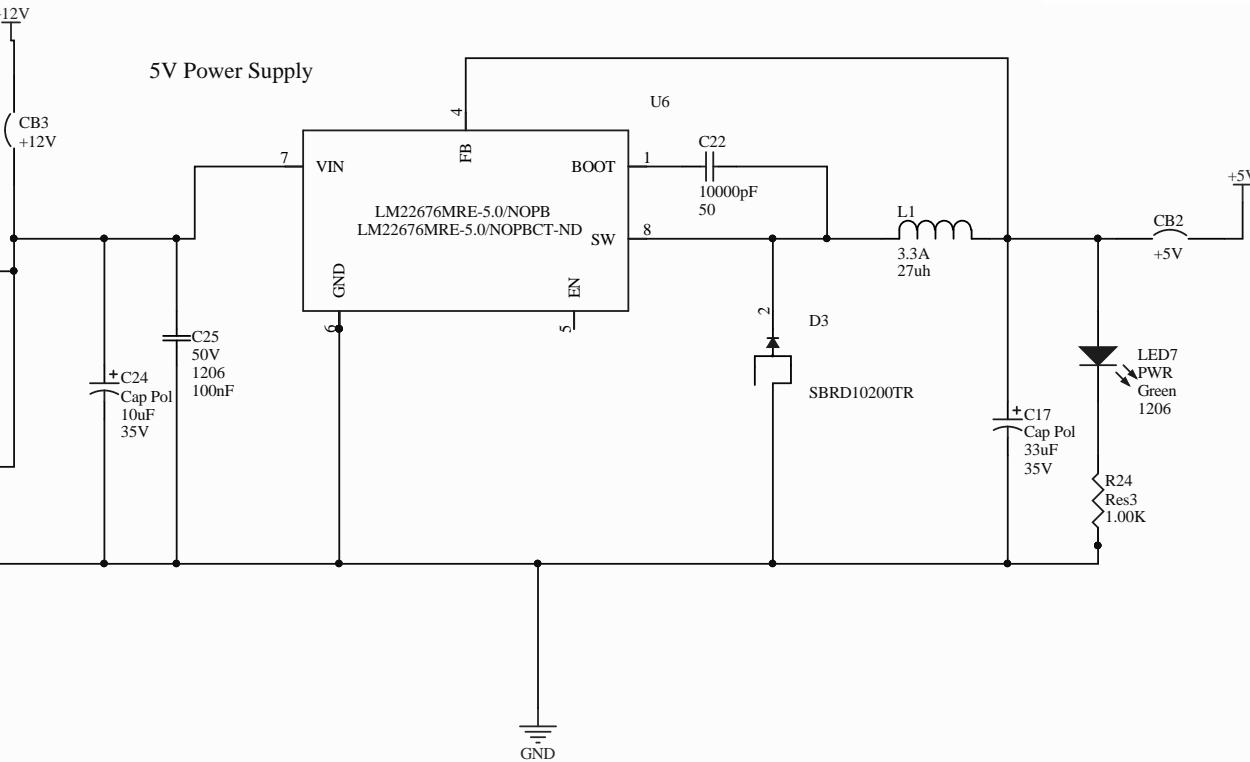
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4

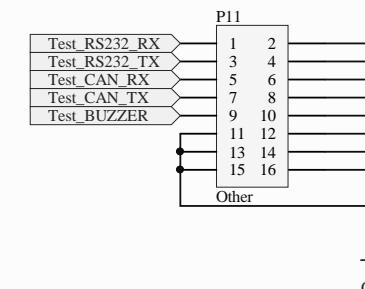
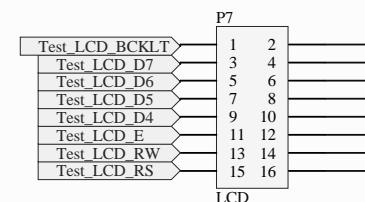
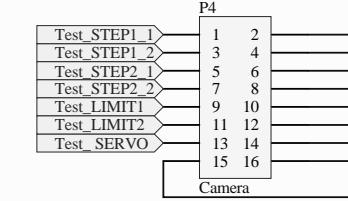
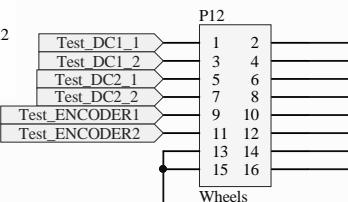
2

3

4



Testing points for various points throughout the design. Can use oscilloscope to interface using an 8x2 connector.



Title		
Power Supplies and Testing Pins		
Size	Number	Revision
A4		
Date:	3/7/2019	Sheet 8 of 10
File:	C:\Users\...\ECD_5V_Power_Supply & Testings.sldDoc	Daniel E. Dreise

A

A

B

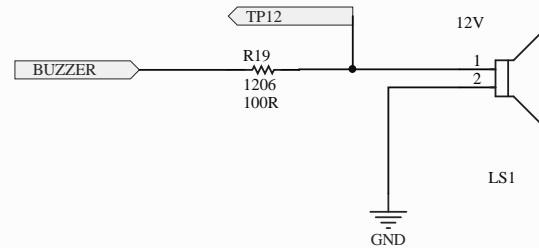
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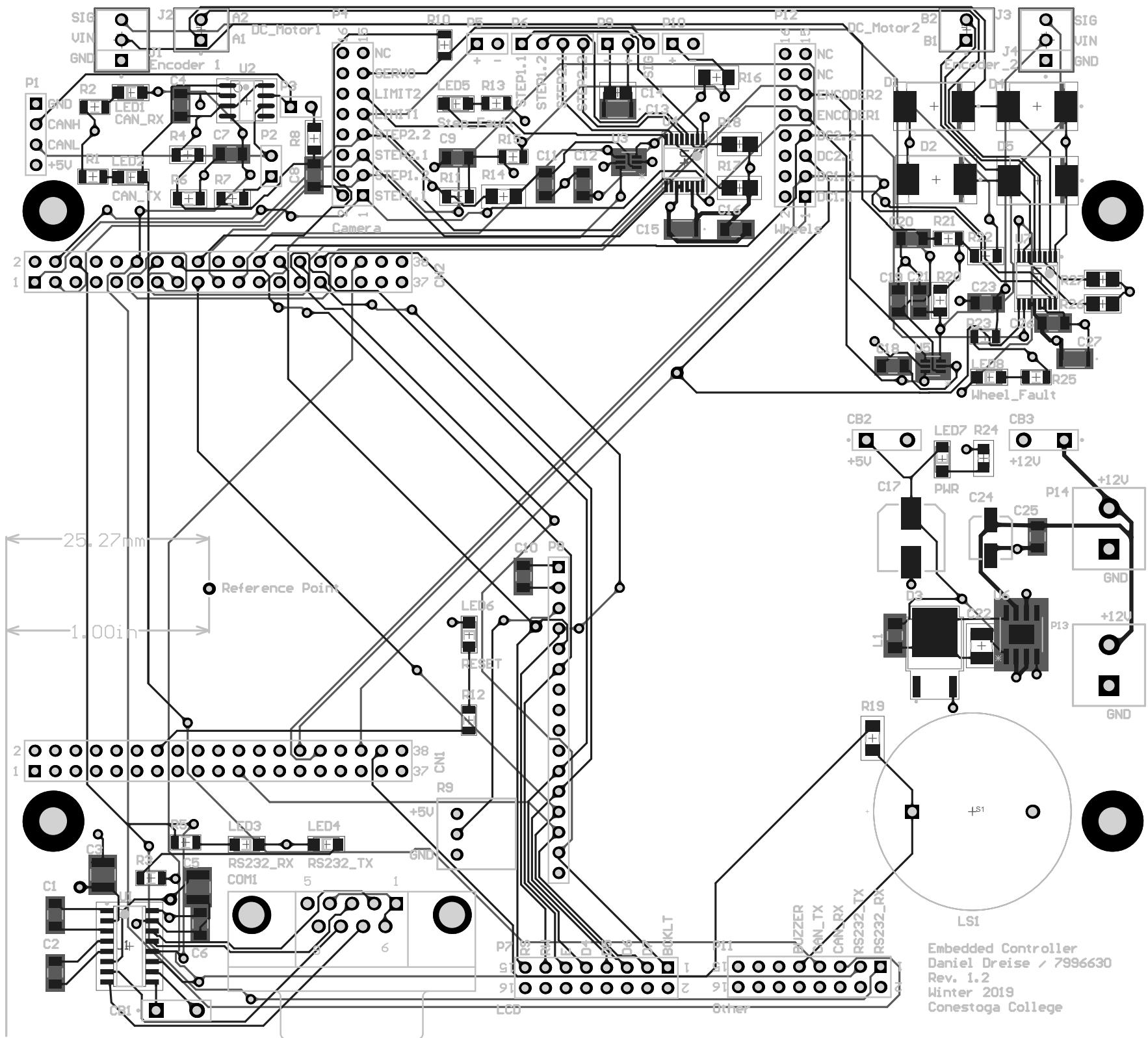
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D

D



Title		
Buzzer Speaker and Connections		Revision
Size	Number	
A4		
Date:	3/7/2019	Sheet 9 of 10
File:	C:\Users\...\ECD_Buzzer.SchDoc	Drawn By: Daniel E. Dreise



Embedded Controller
Daniel Dreise / 7996630
Rev. 1.2
Winter 2019
Conestoga College

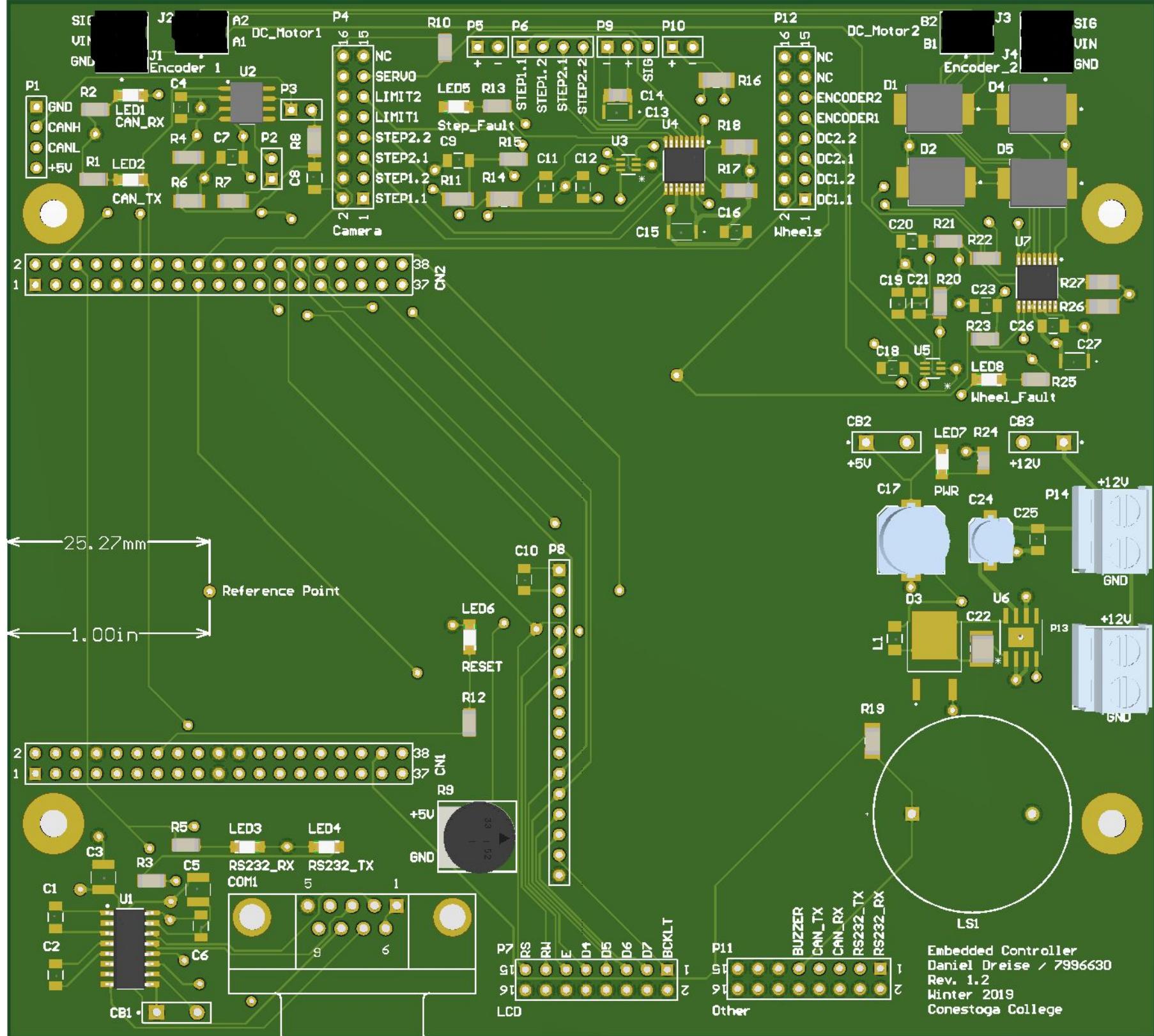
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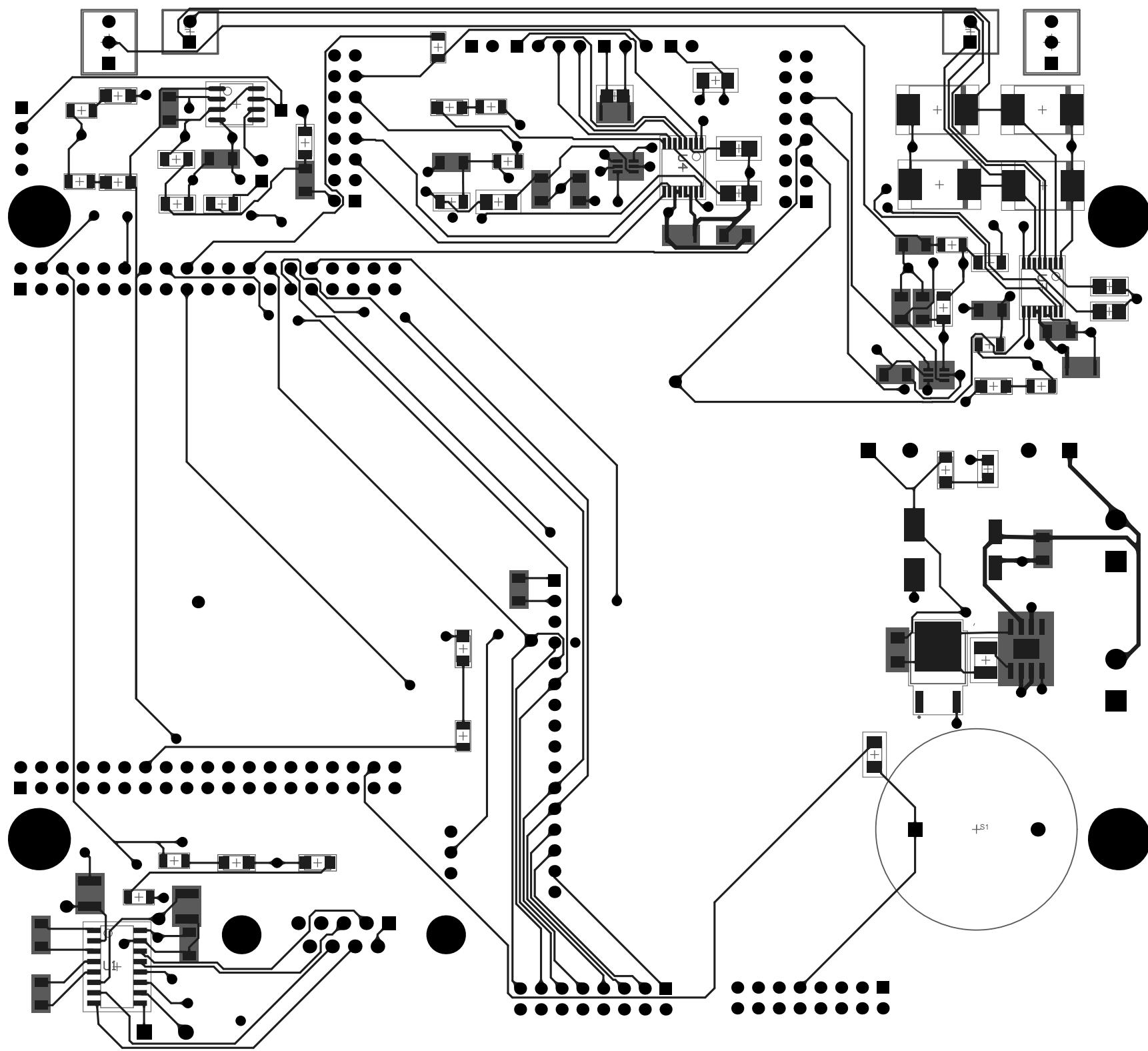
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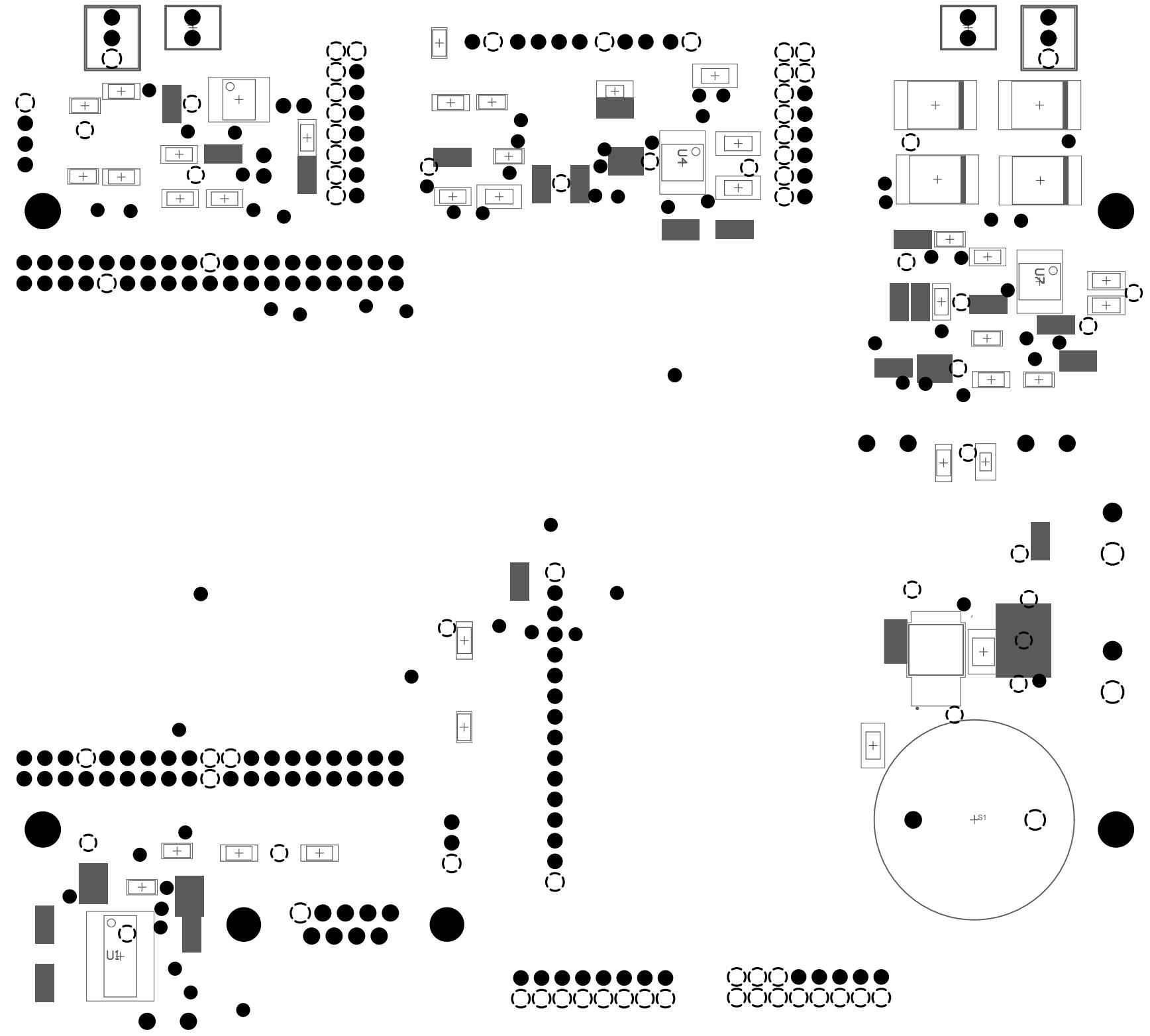
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Rule Violations 0

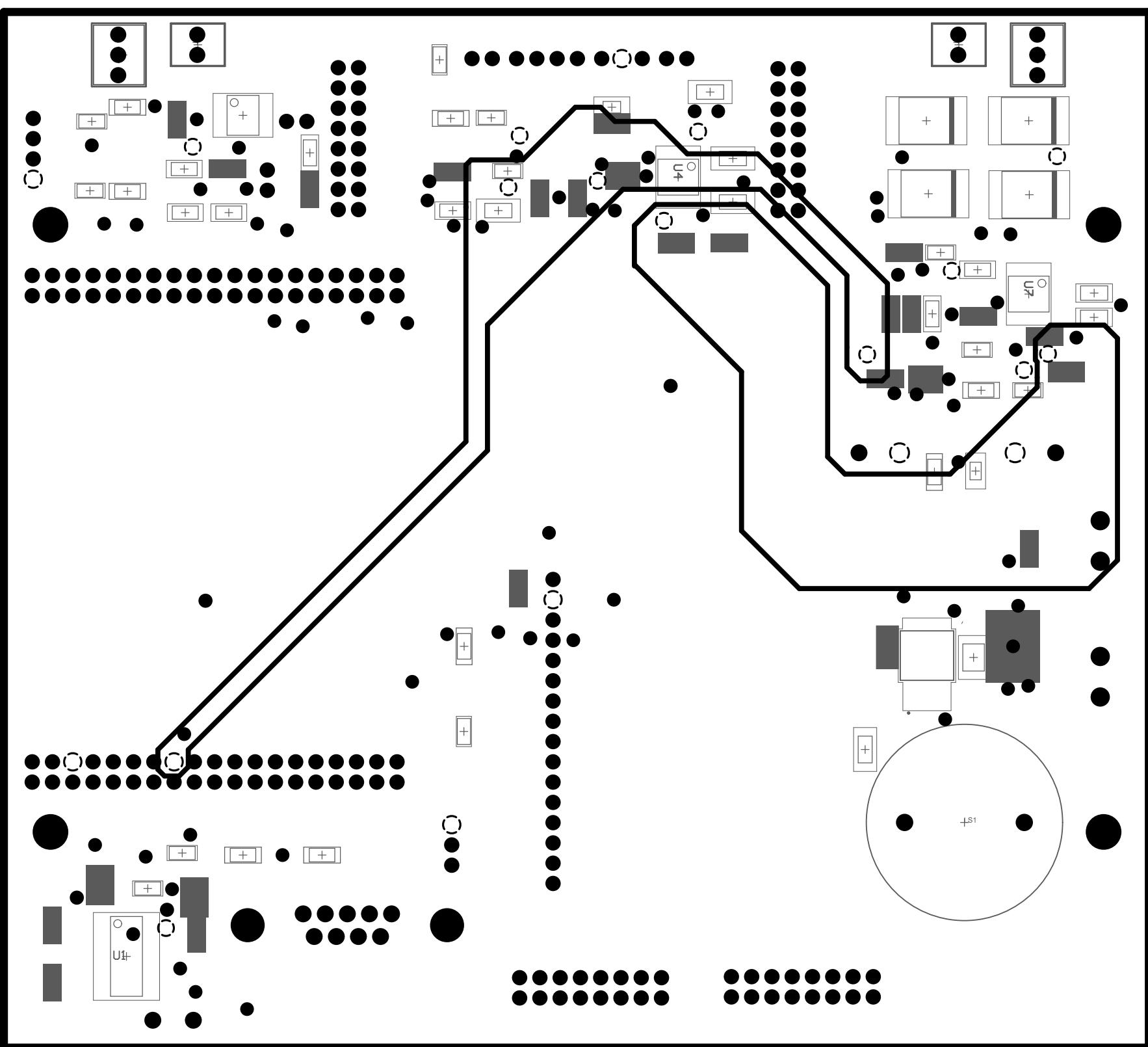
Warnings	
Total	0

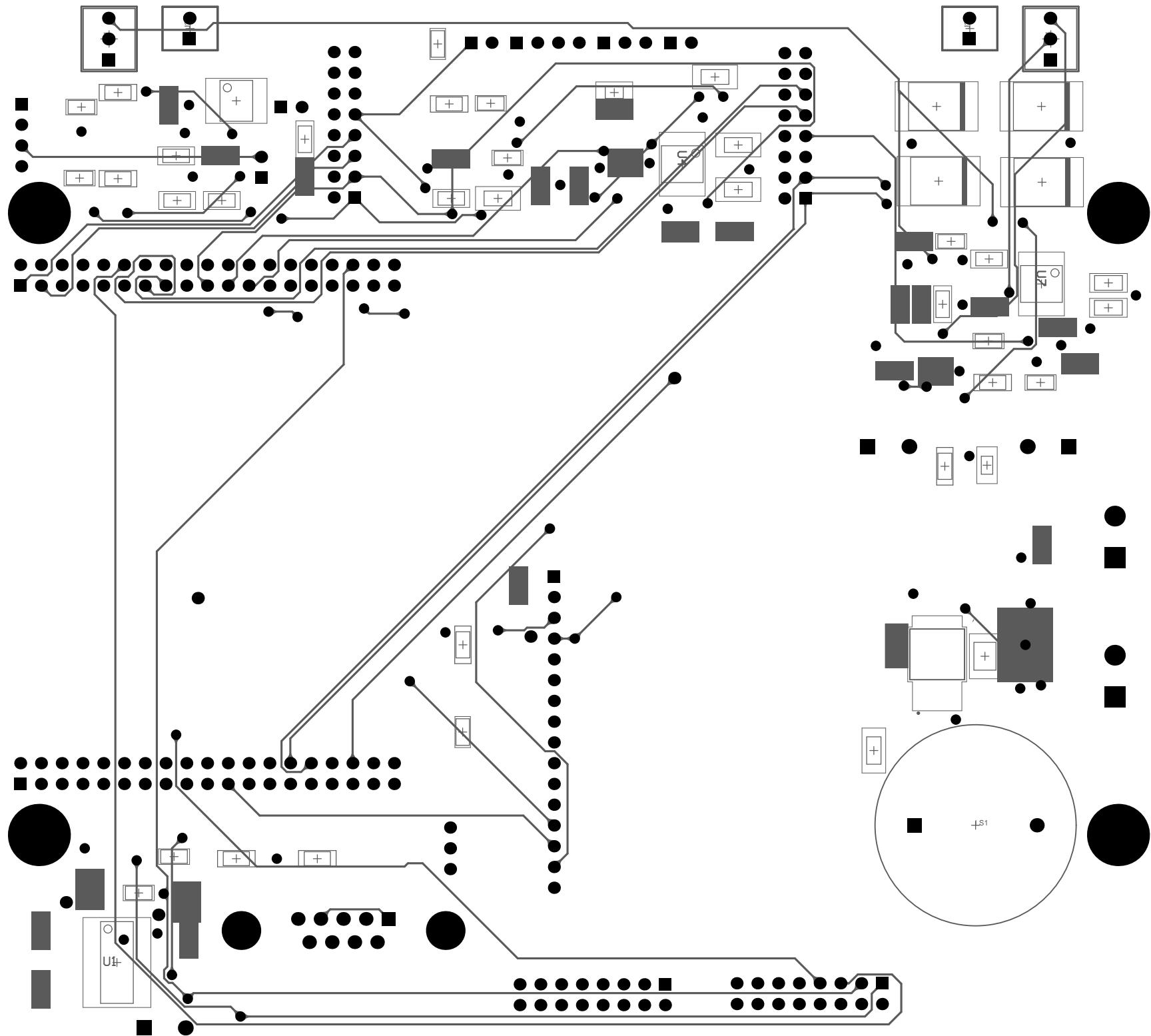
Rule Violations	
Clearance Constraint (Gap=7.874mil) (All), (All)	0
Short-Circuit Constraint (Allowed=No) (All), (All)	0
Un-Routed Net Constraint (All)	0
Modified Polygon (Allow modified: No), (Allow shelved: No)	0
Width Constraint (Min=10mil) (Max=27.559mil) (Preferred=10mil) (All)	0
Power Plane Connect Rule(Relief Connect)(Expansion=20mil) (Conductor Width=10mil) (Air Gap=10mil) (Entries=4)	0
Hole Size Constraint (Min=19.685mil) (Max=150mil) (All)	0
Hole To Hole Clearance (Gap=10mil) (All), (All)	0
Minimum Solder Mask Sliver (Gap=9mil) (All), (All)	0
Silk To Solder Mask (Clearance=5mil) (IsPad), (All)	0
Silk to Silk (Clearance=2mil) (All), (All)	0
Net Antennae (Tolerance=0mil) (All)	0
Height Constraint (Min=0mil) (Max=1000mil) (Preferred=500mil) (All)	0
Total	0

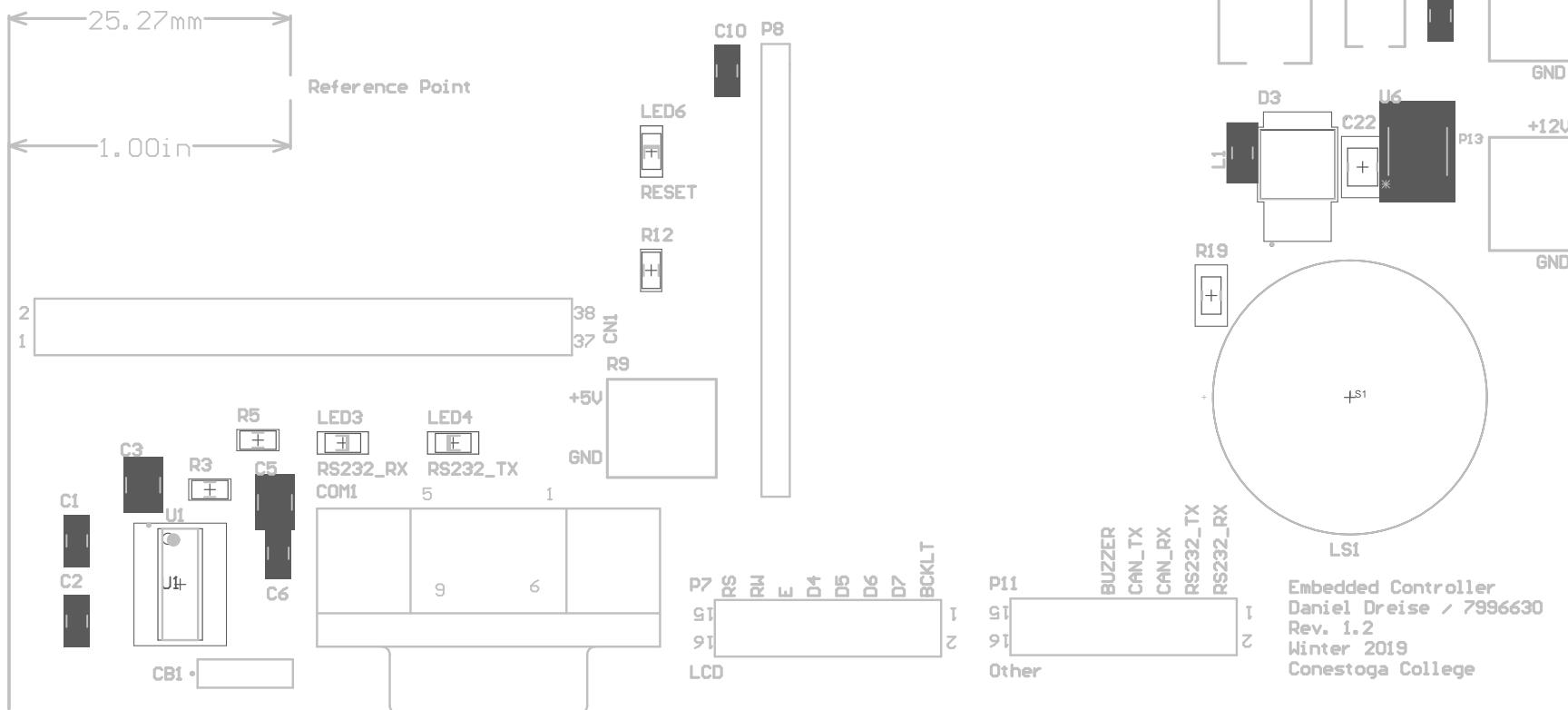
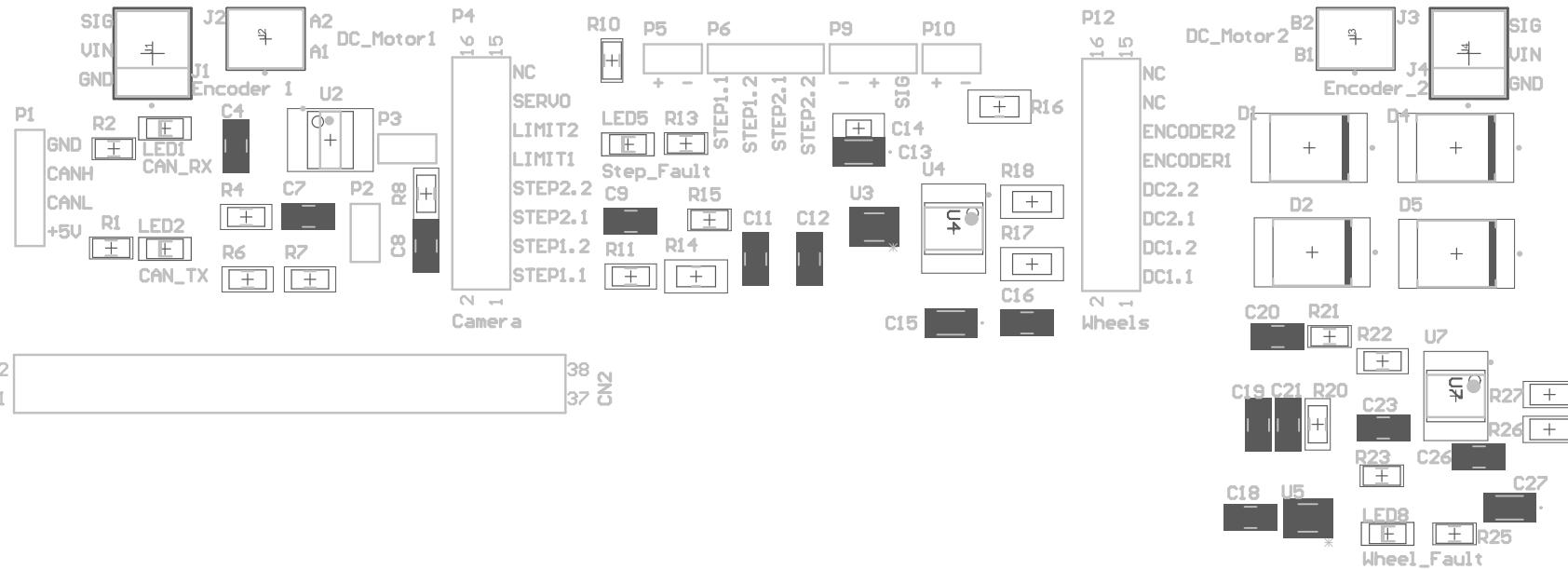




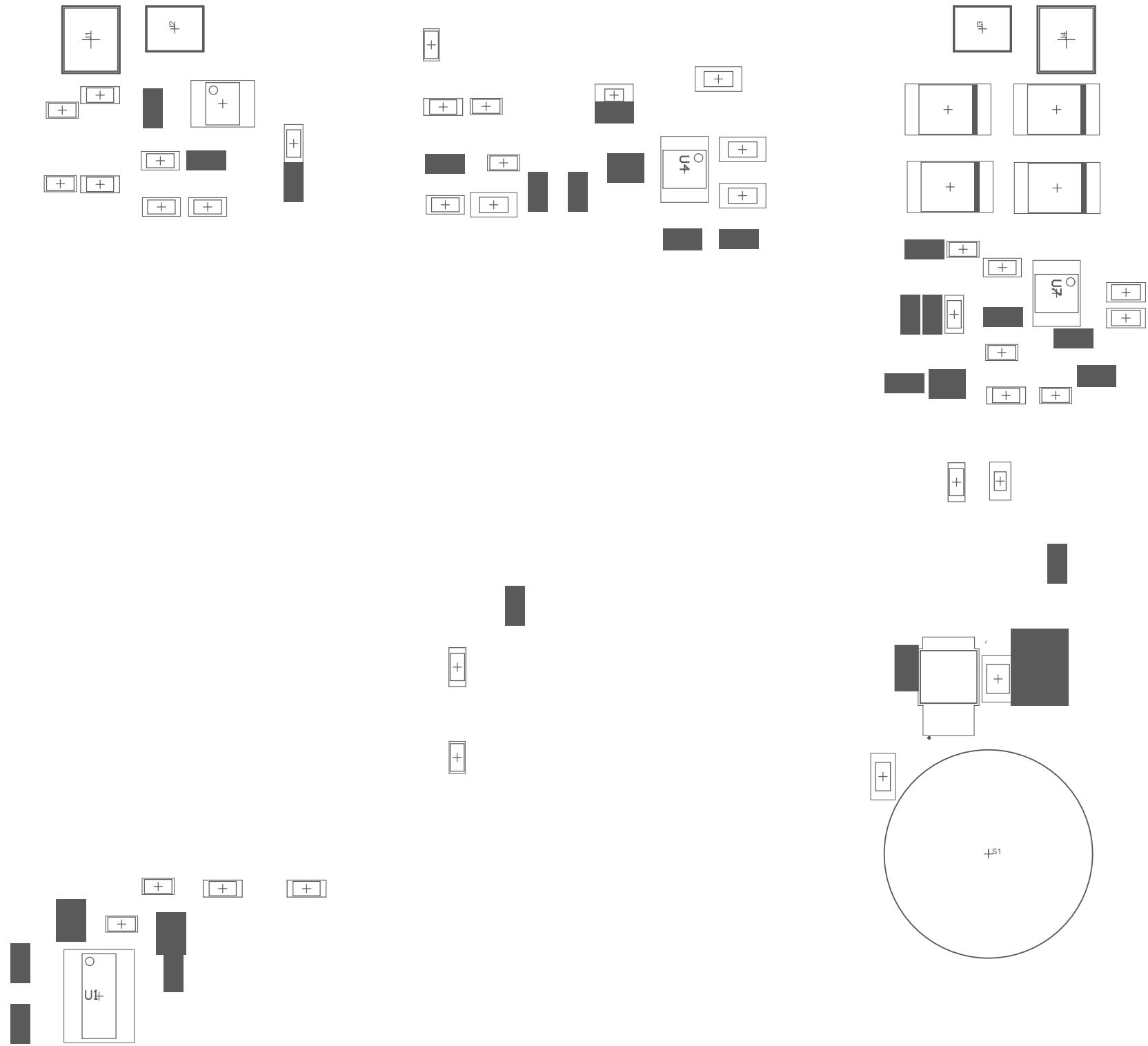


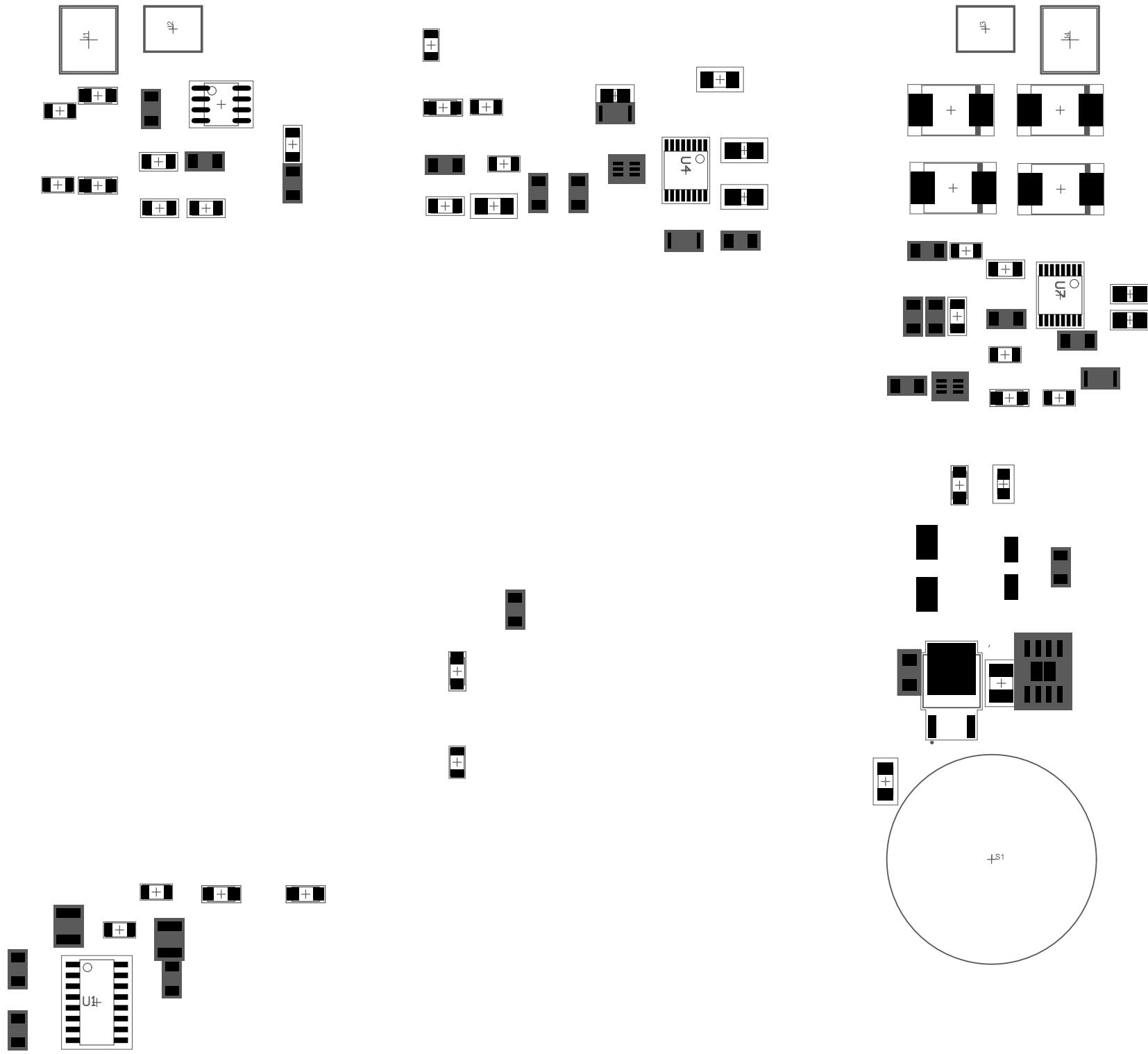


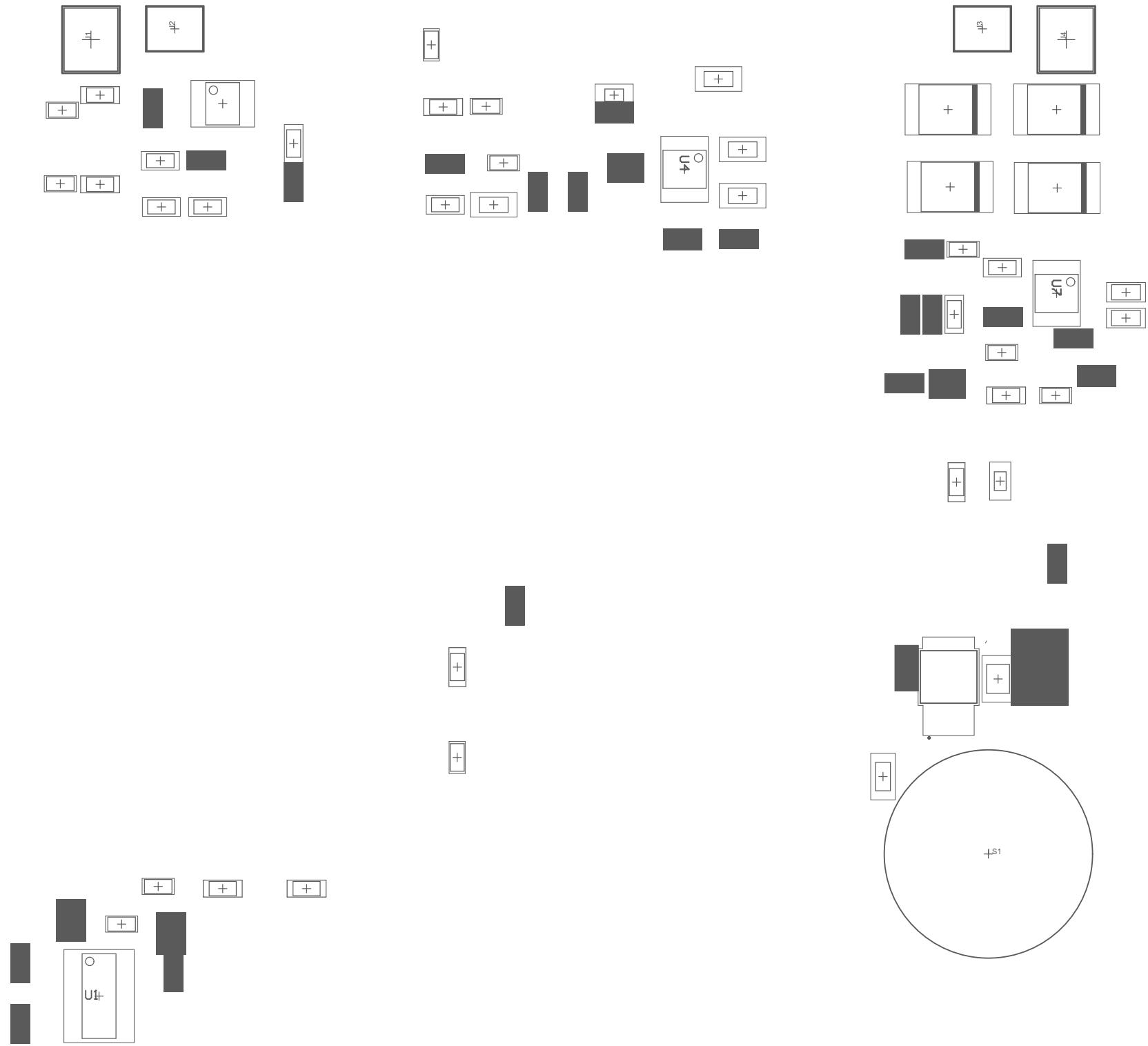


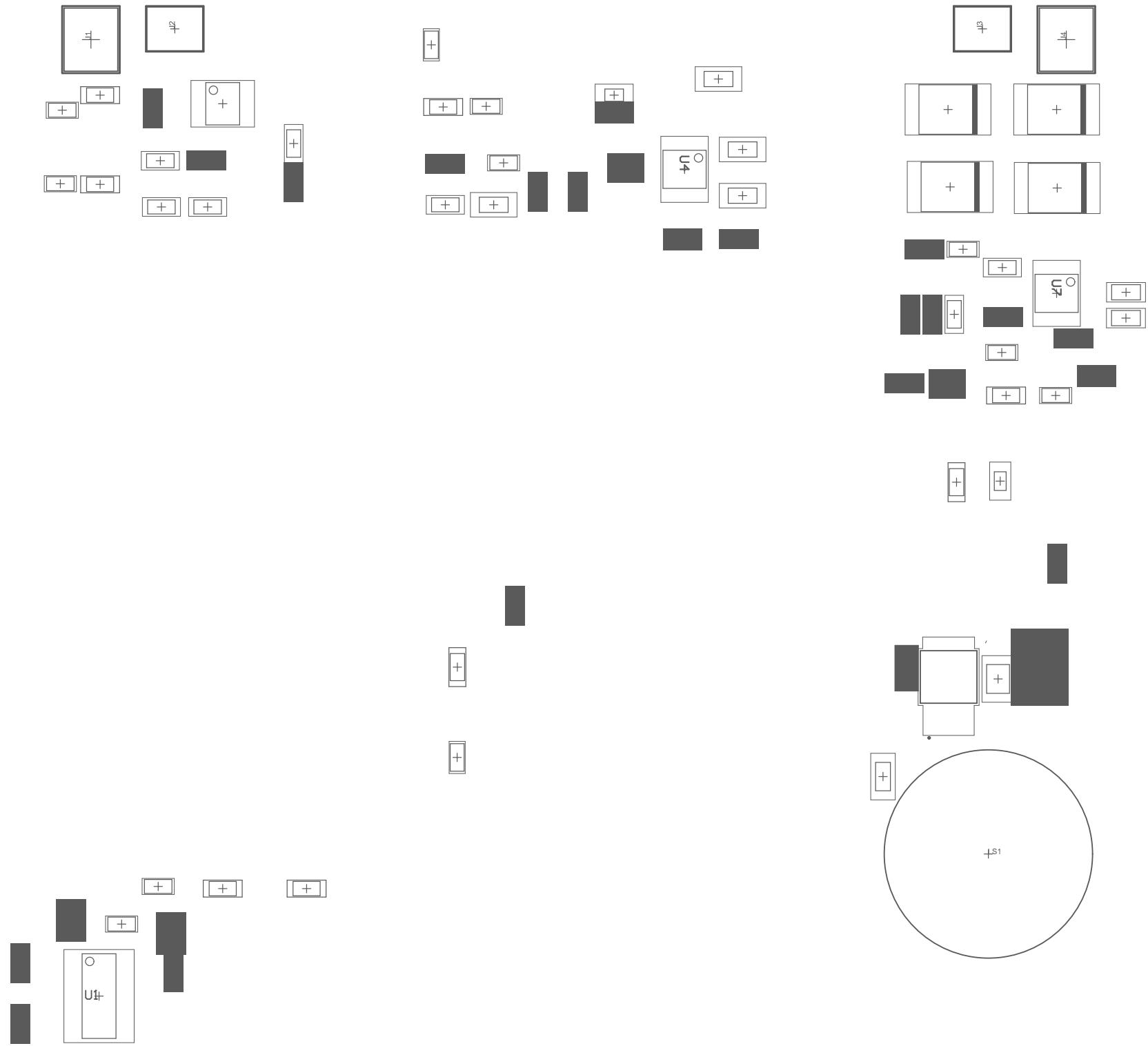


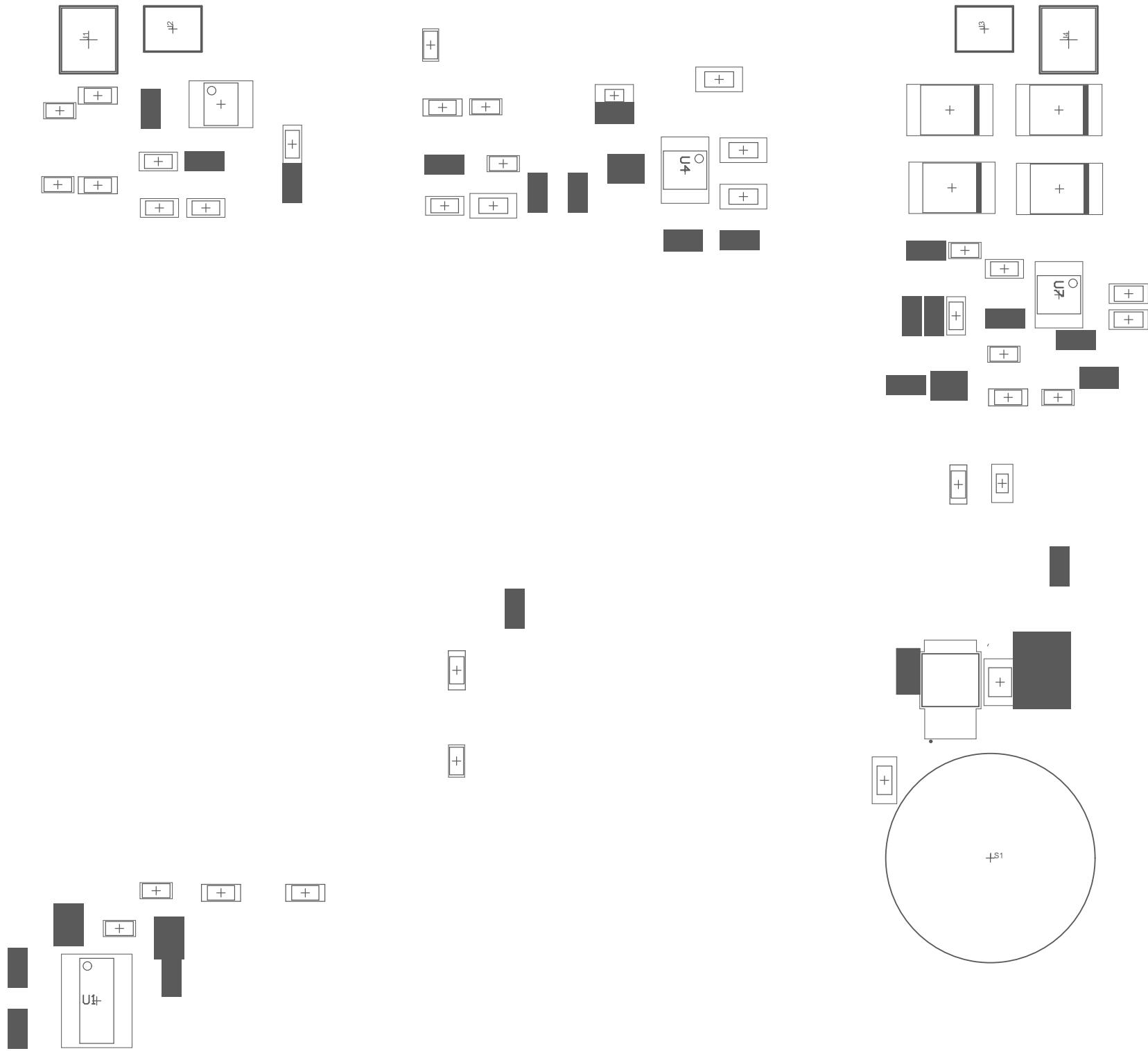
Embedded Controller
Daniel Dreise / 7996630
Rev. 1.2
Winter 2019
Conestoga College

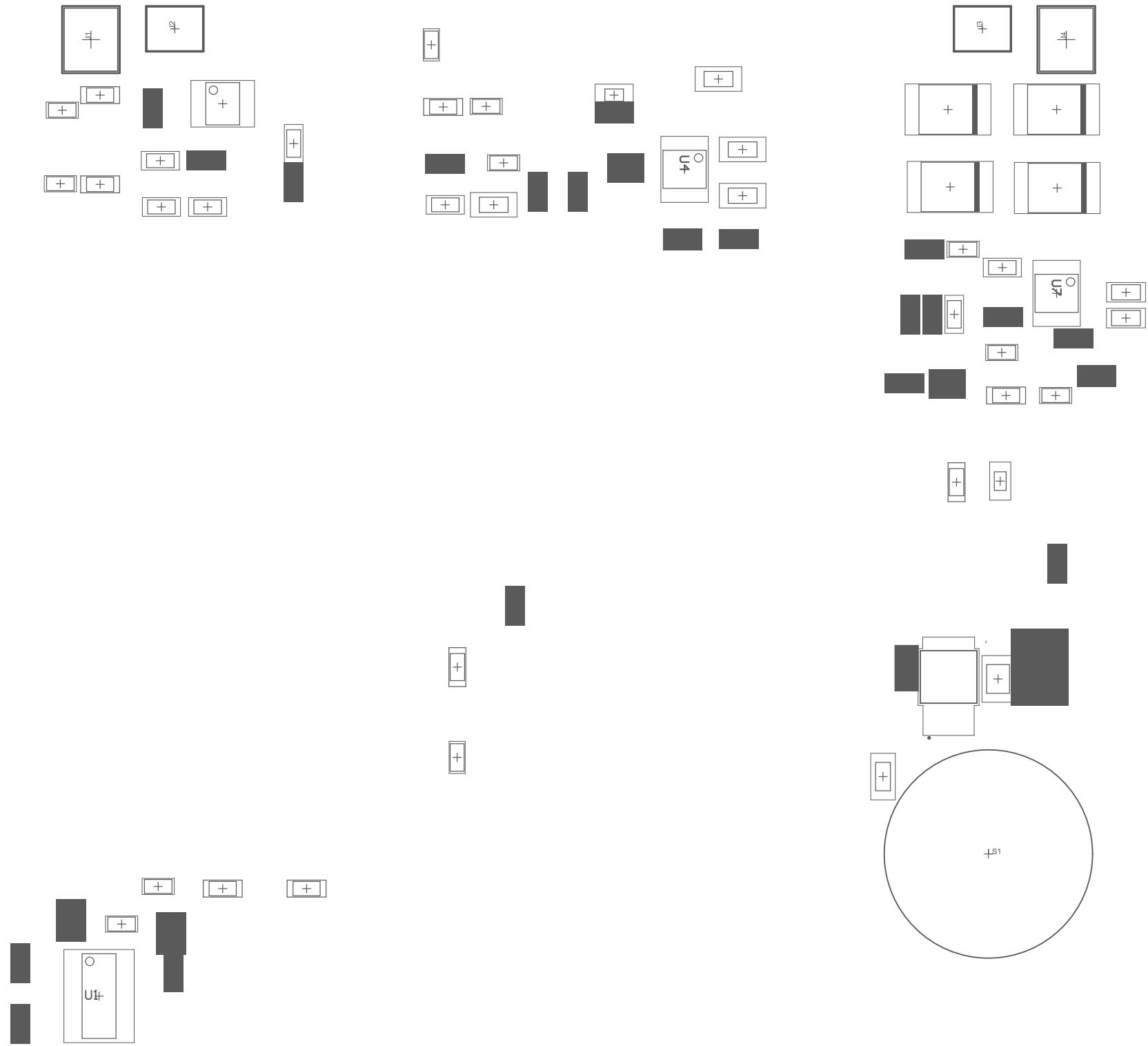


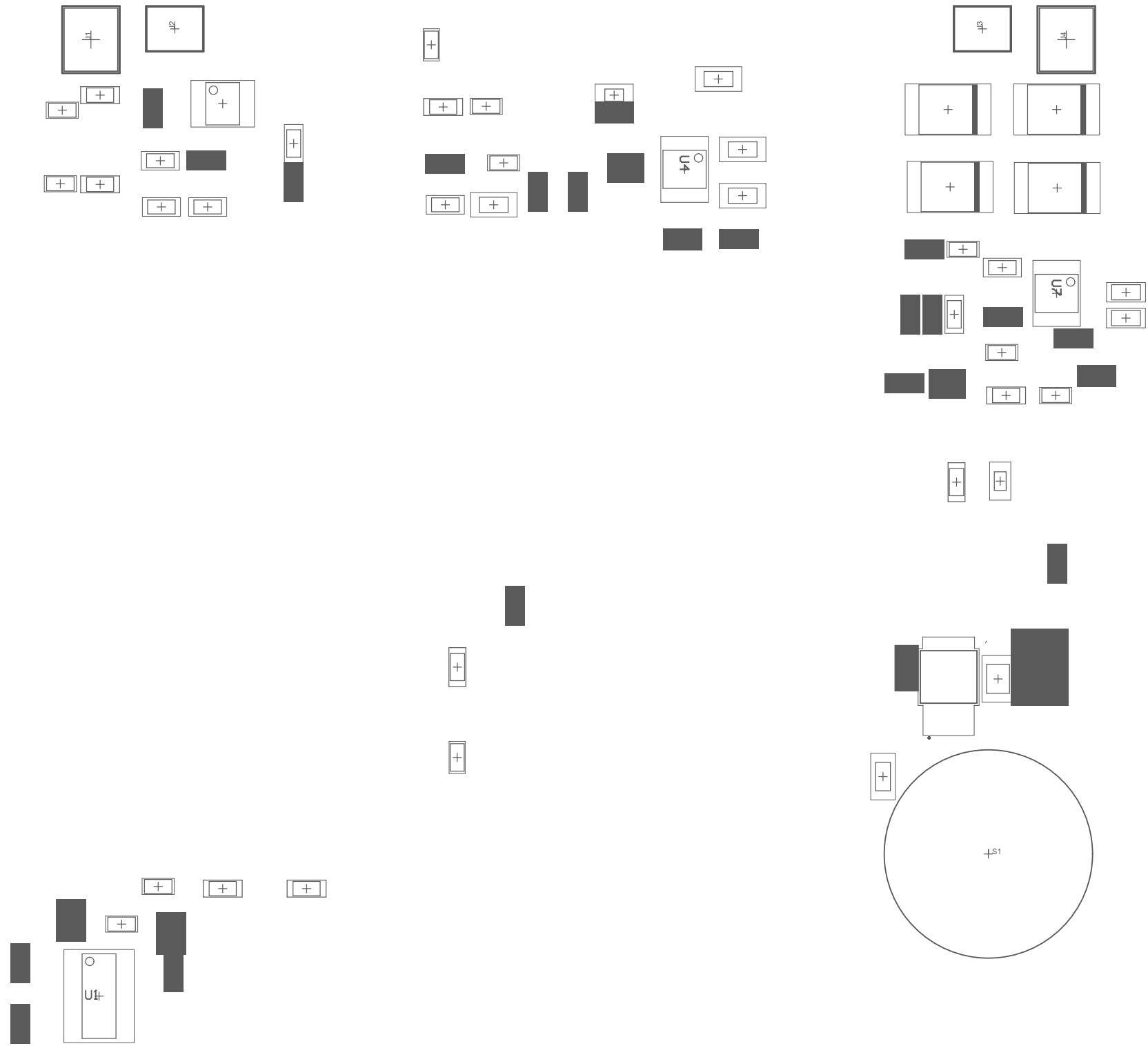


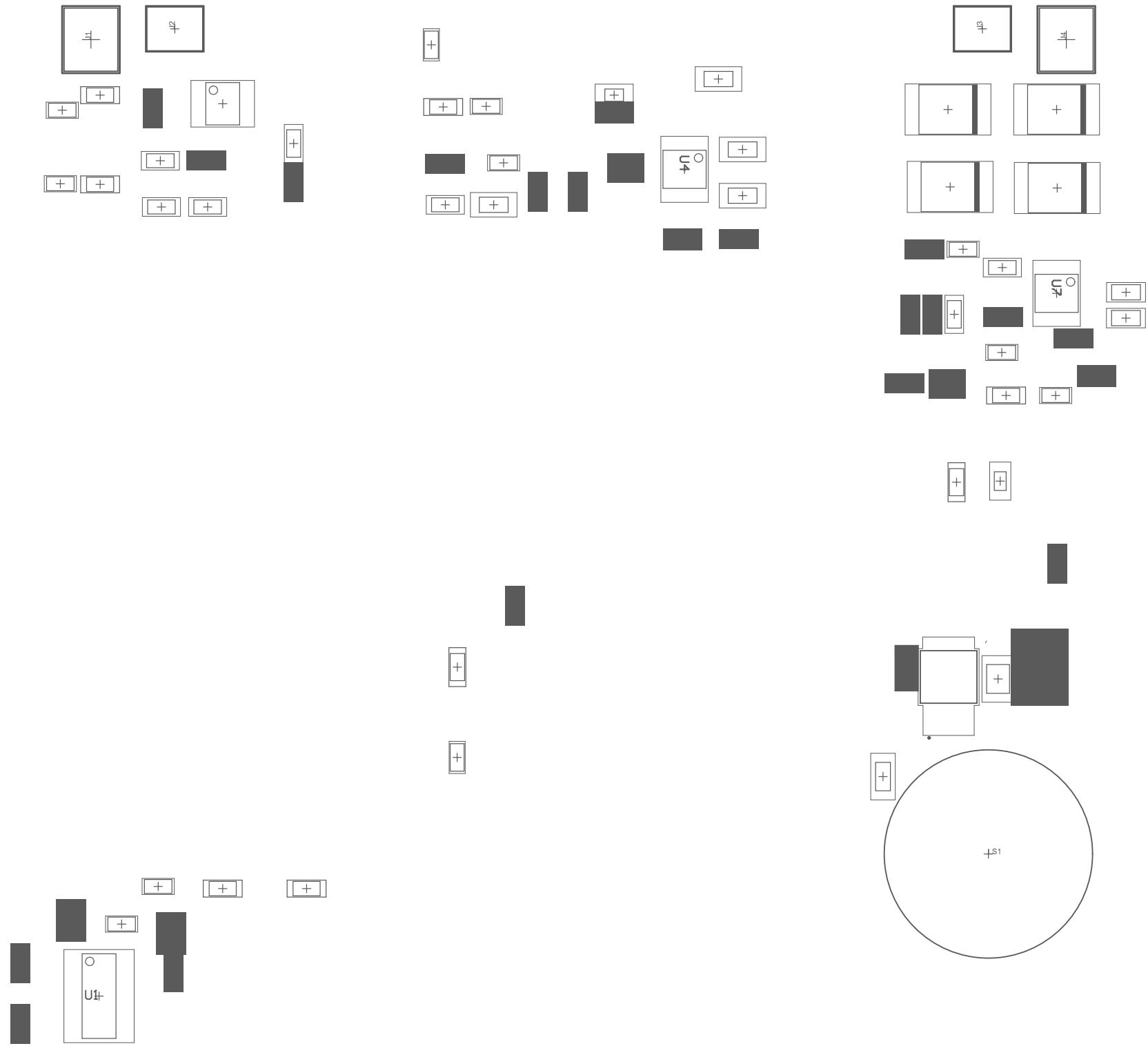


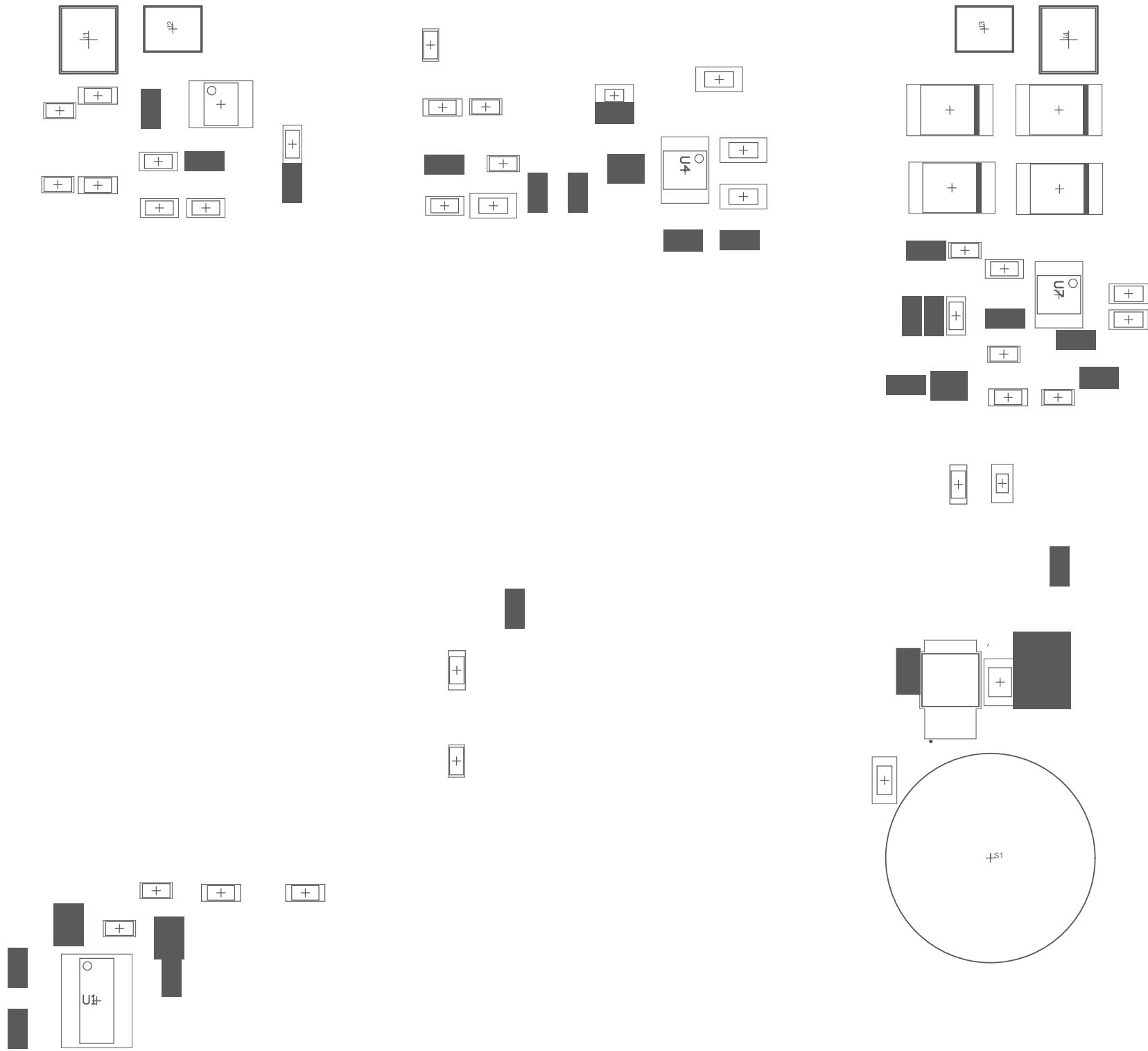


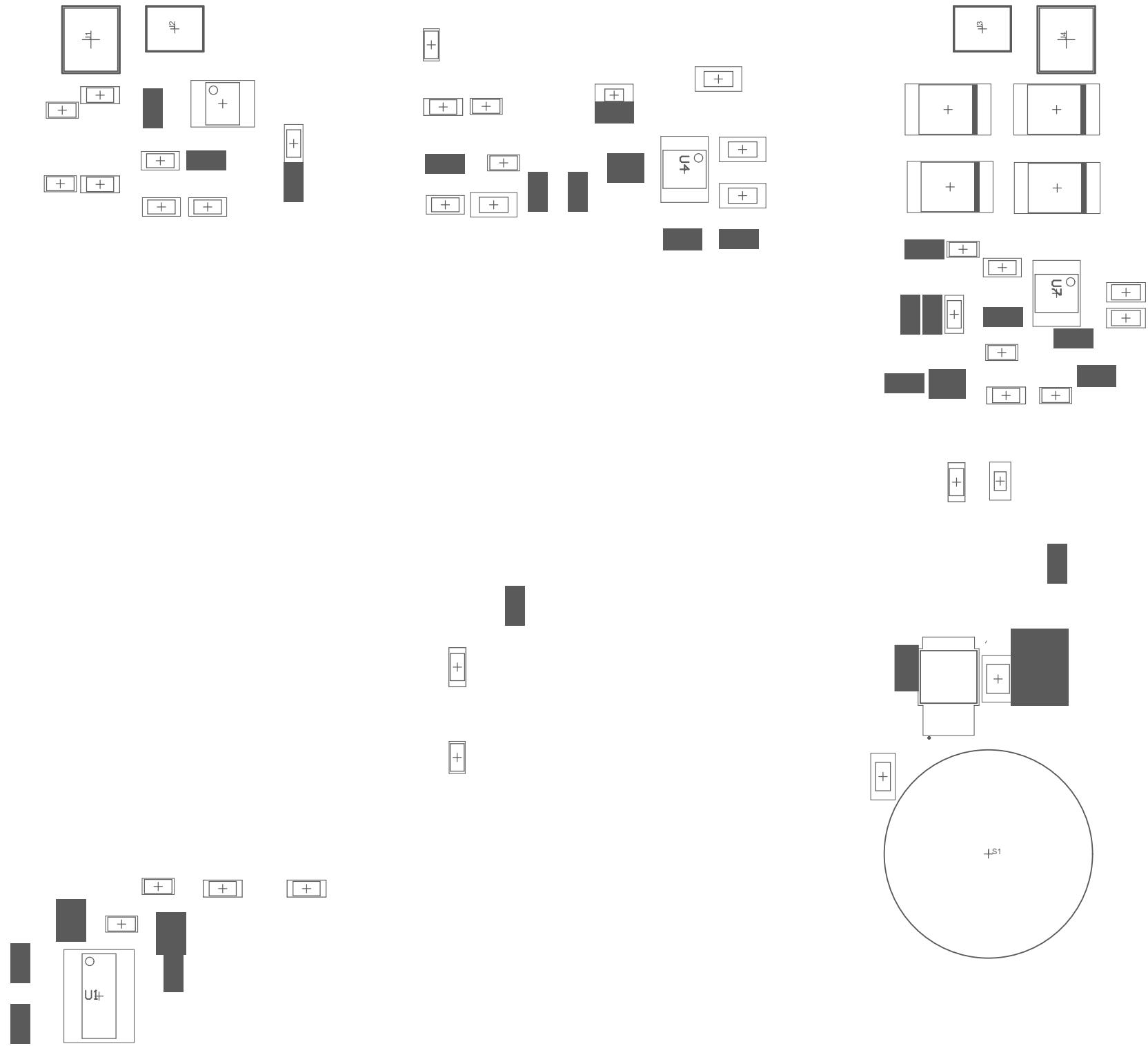


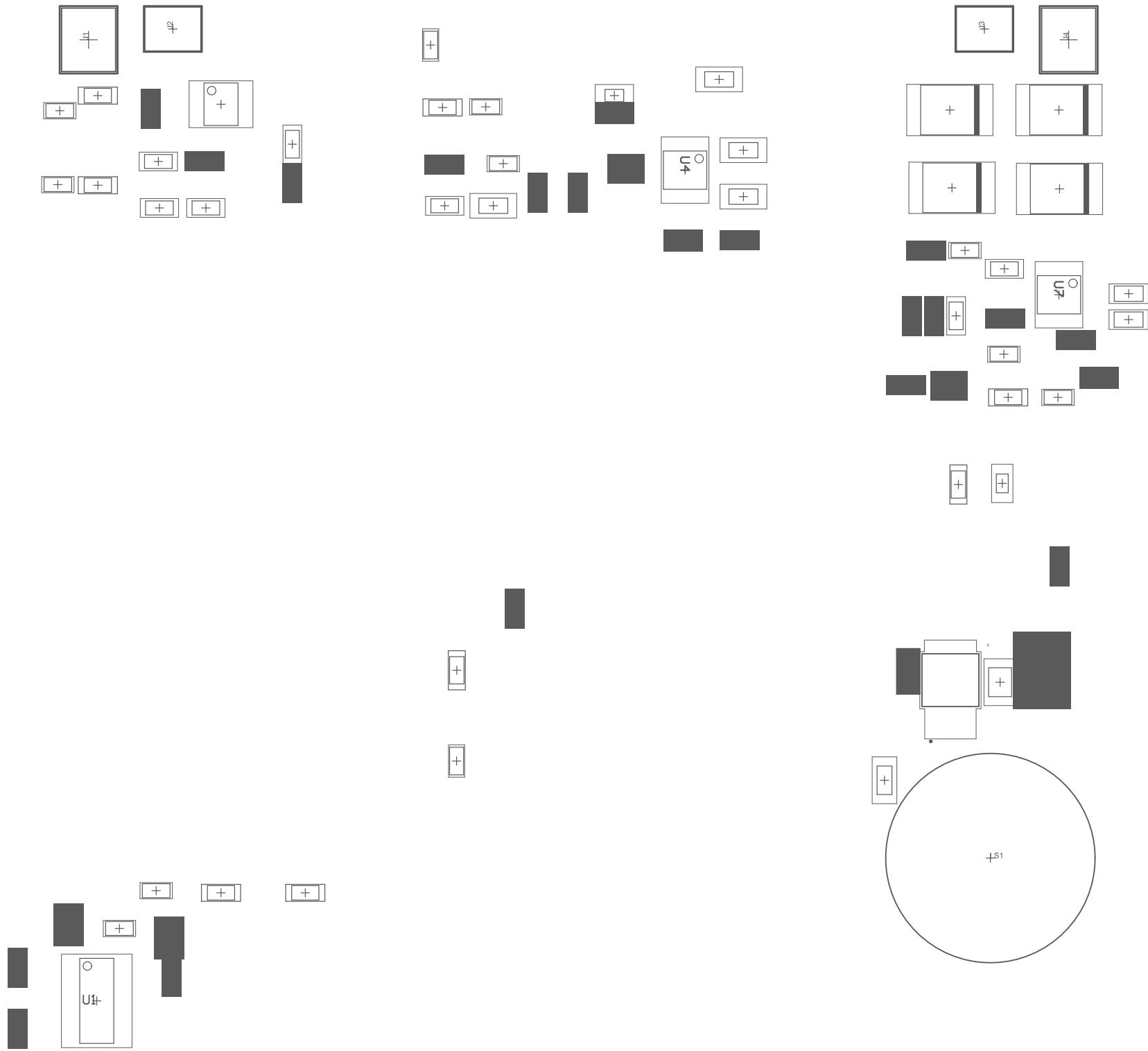


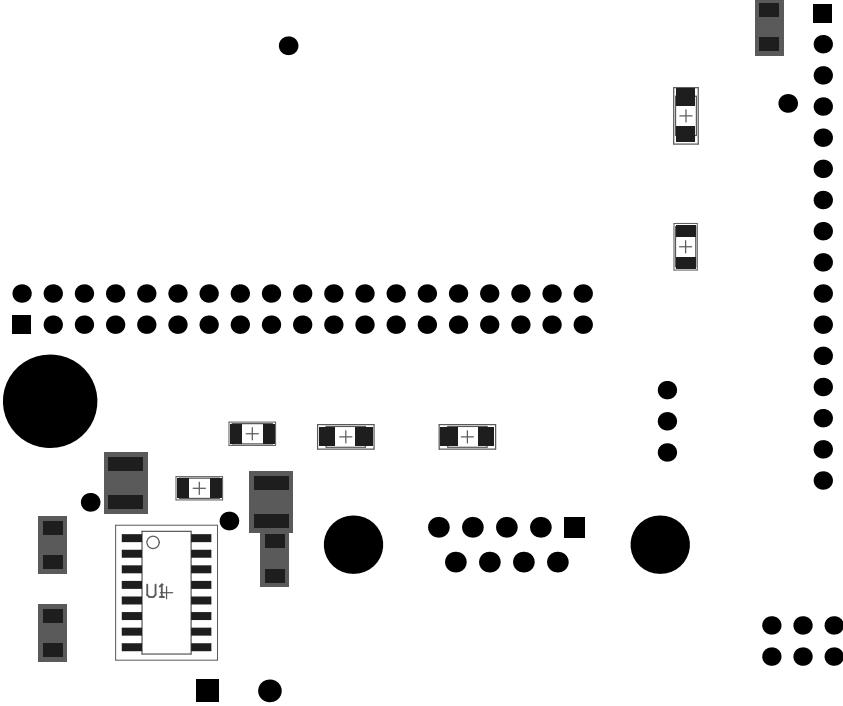
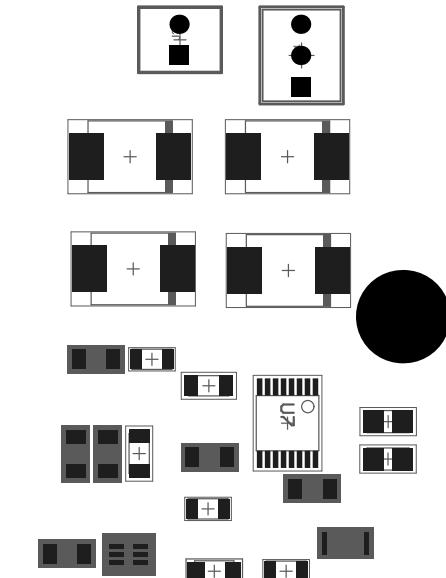
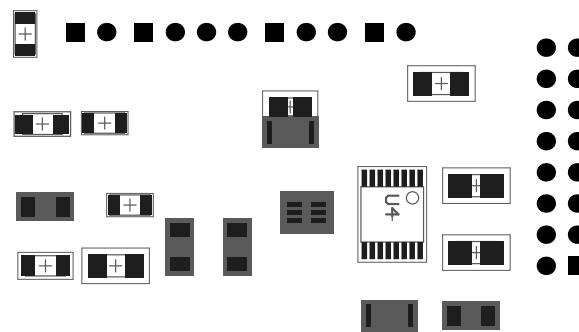
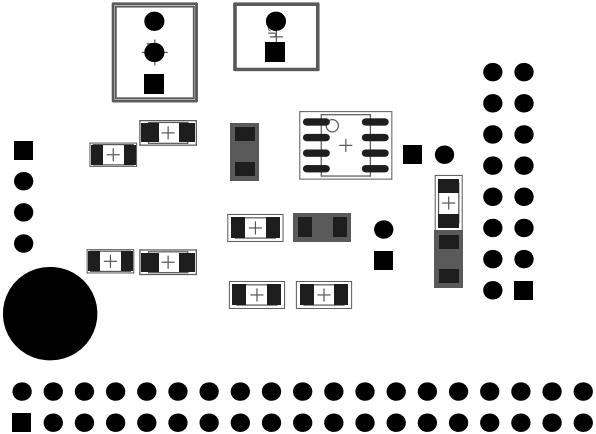




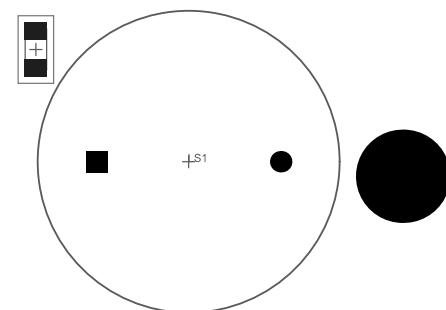
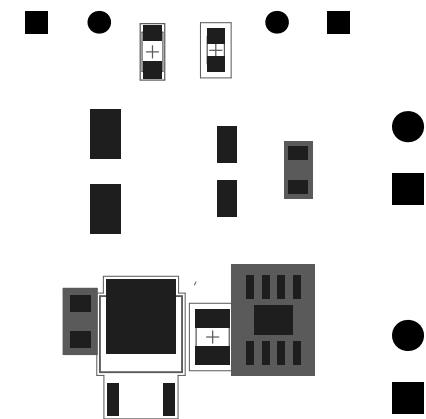


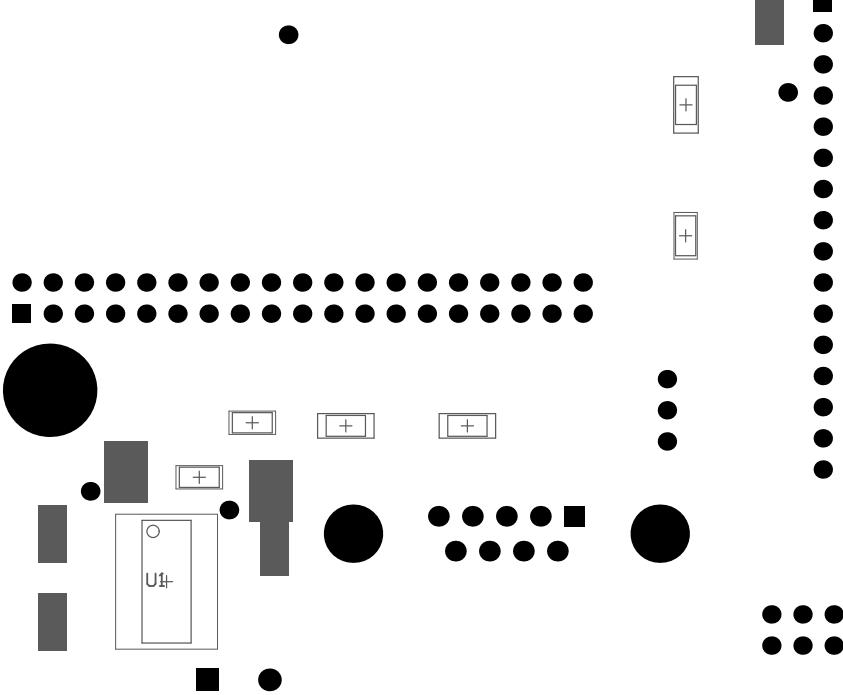
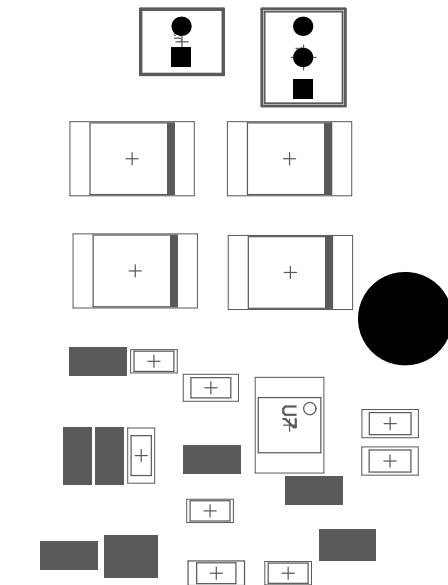
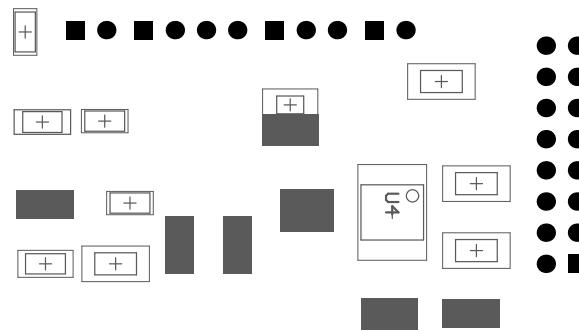
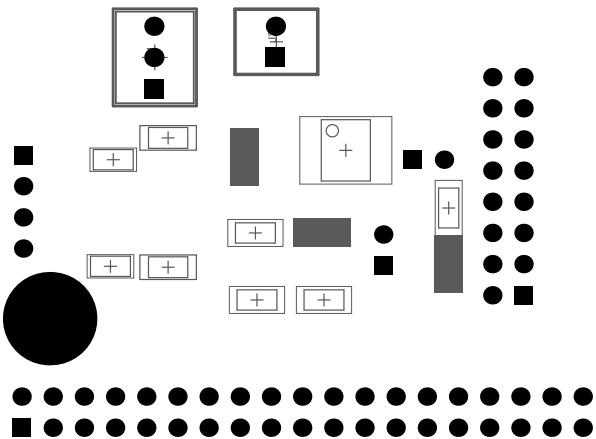




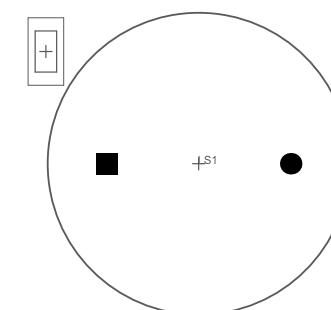
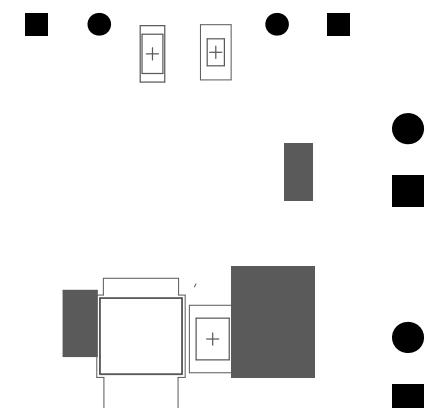


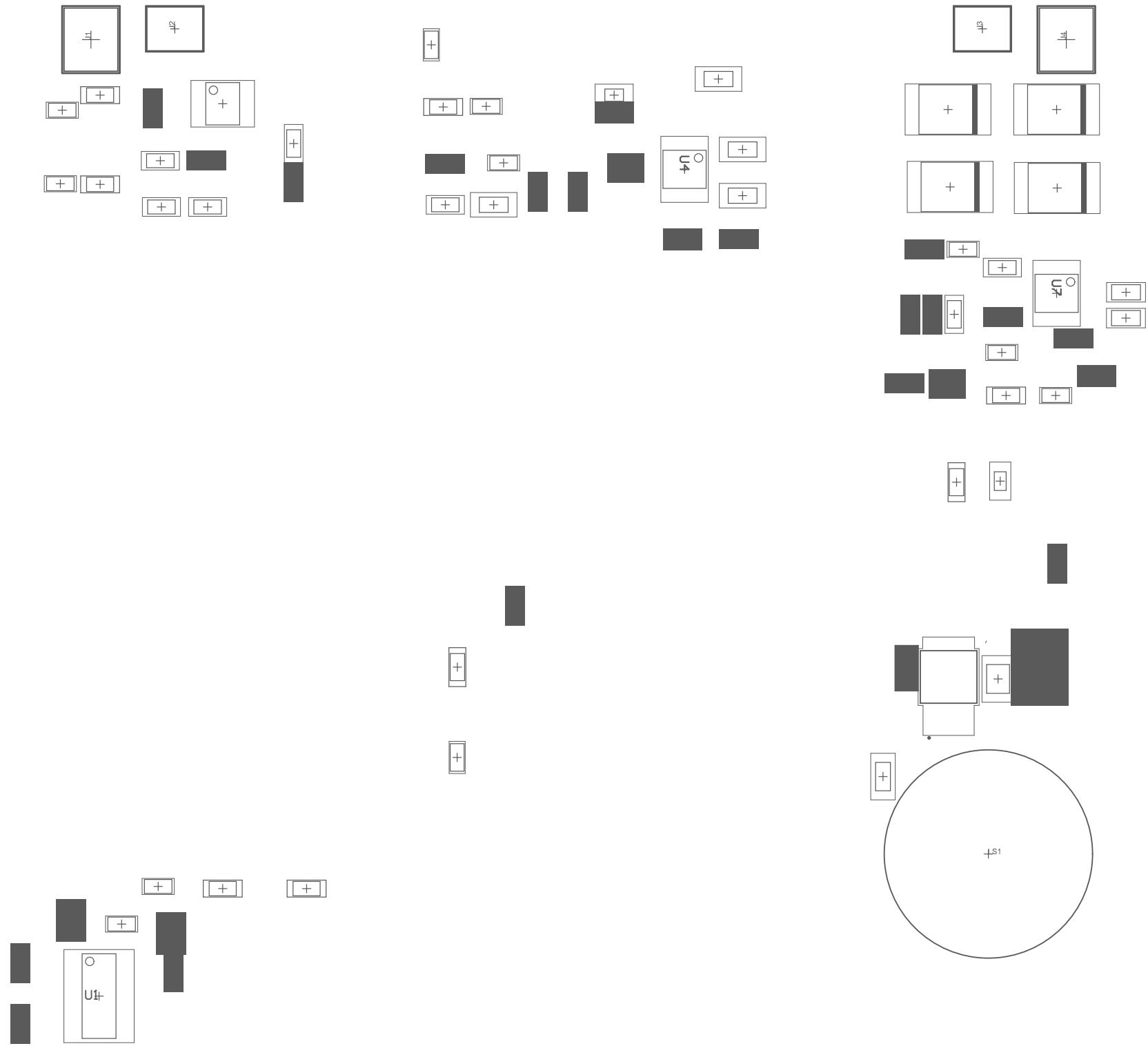
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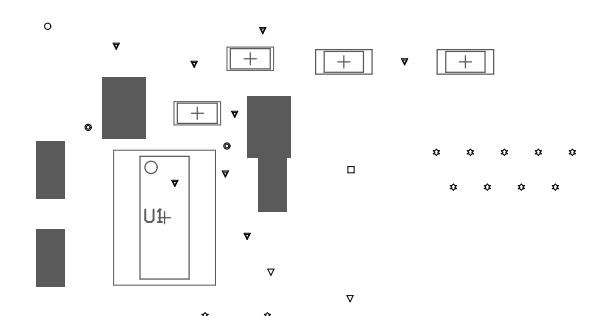
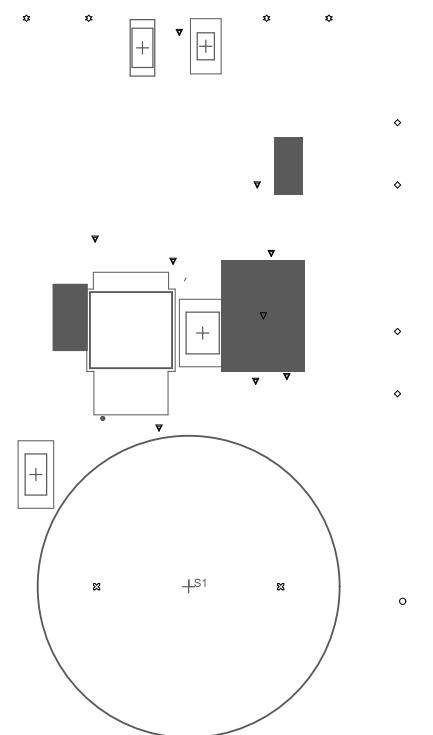
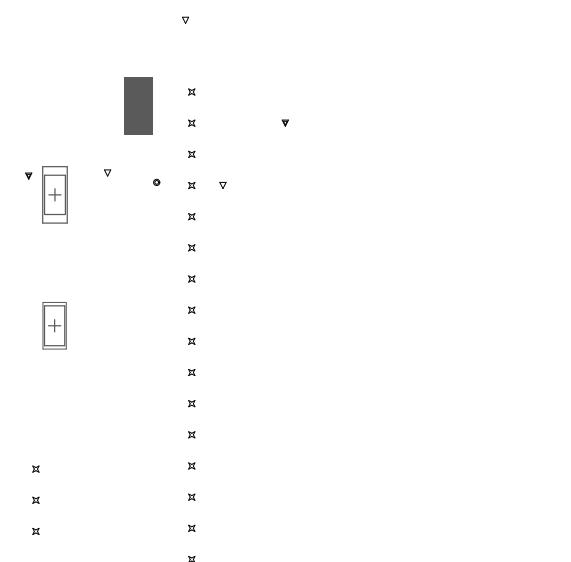
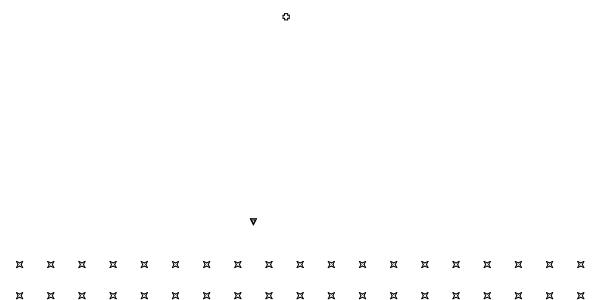
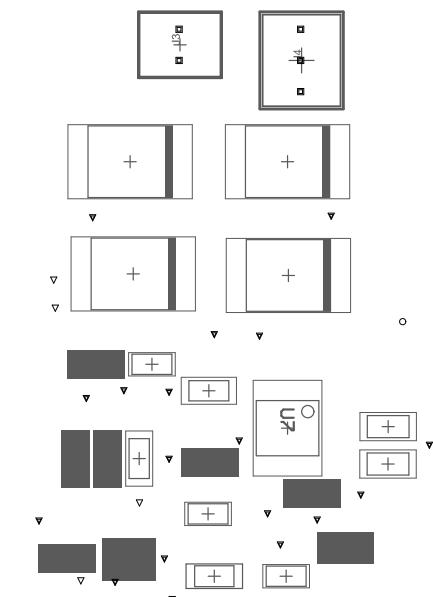
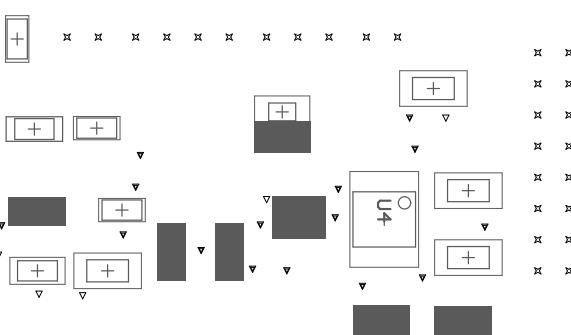
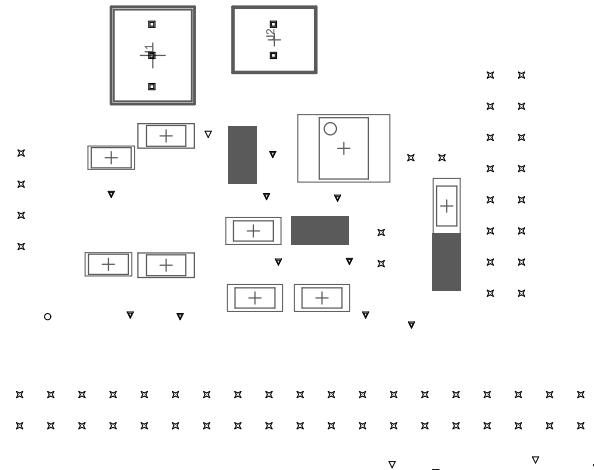




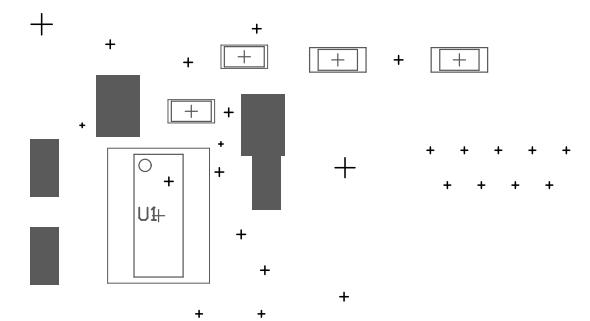
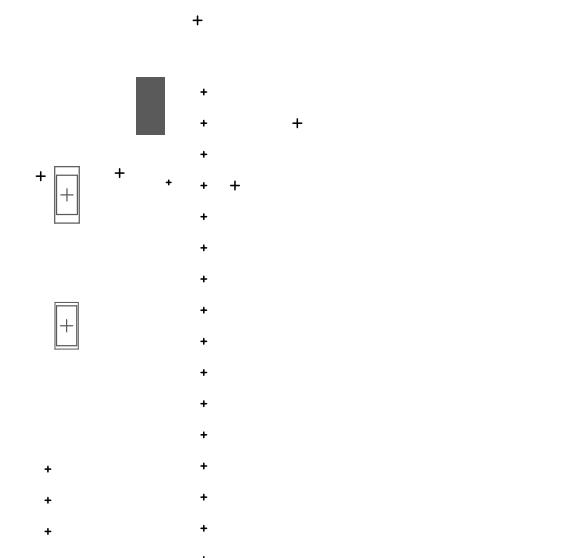
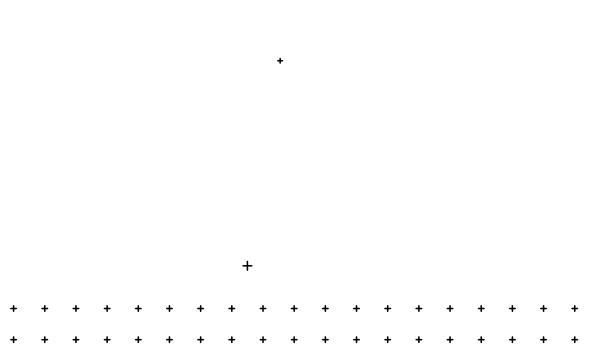
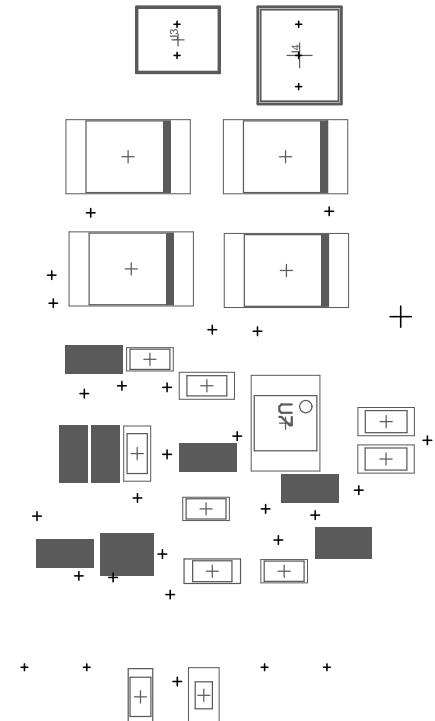
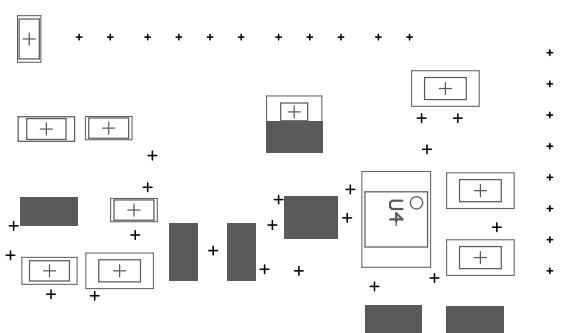
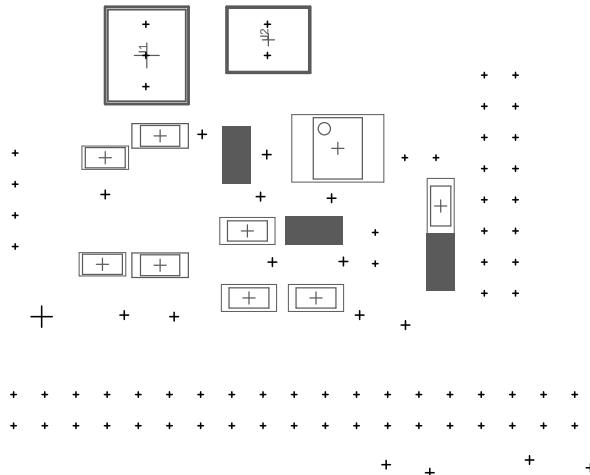
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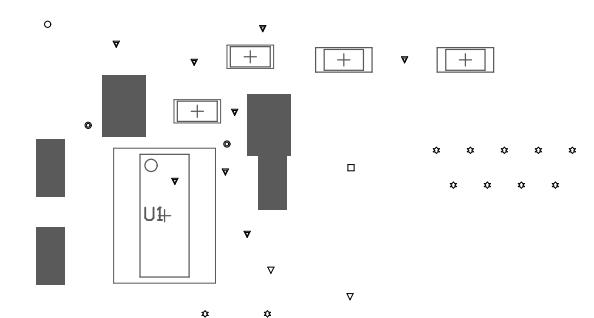
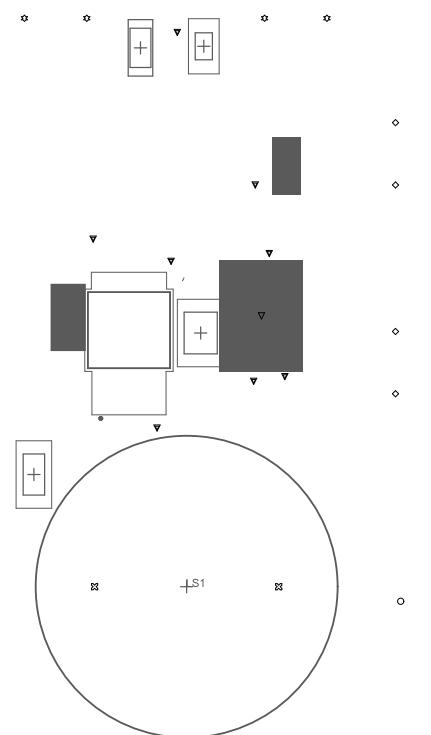
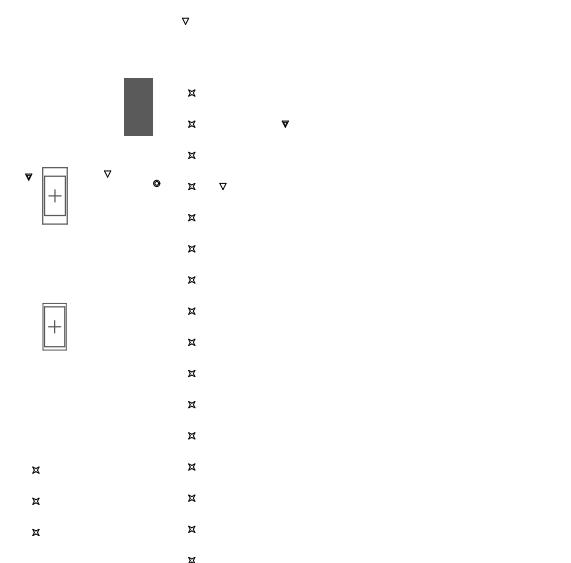
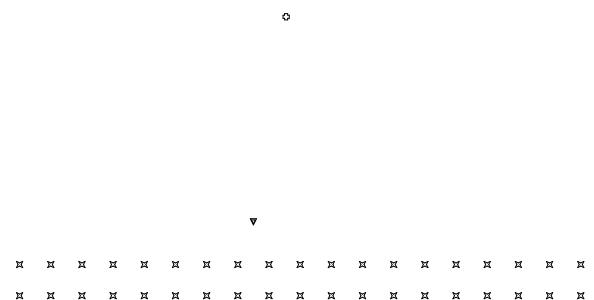
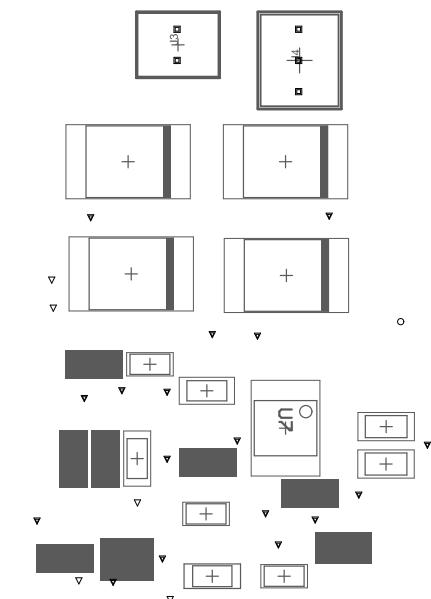
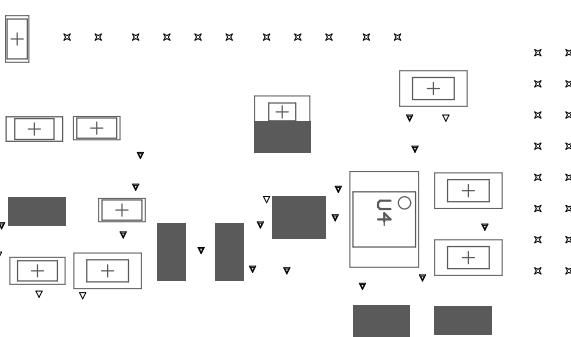
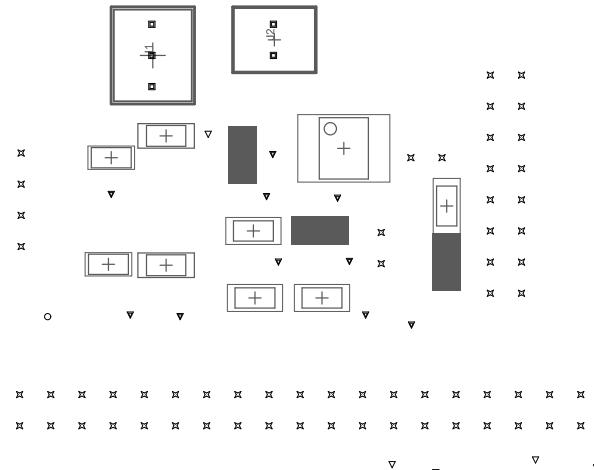




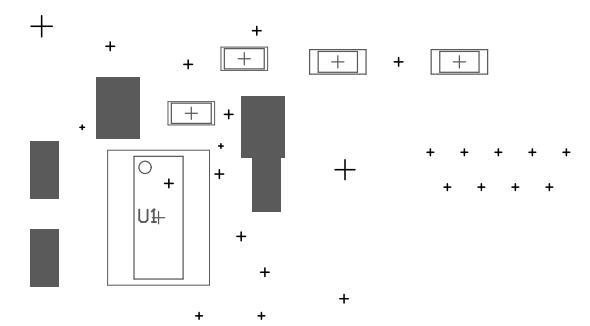
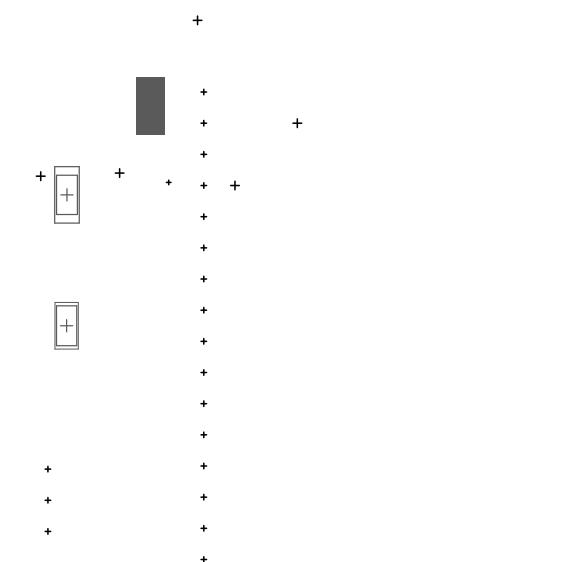
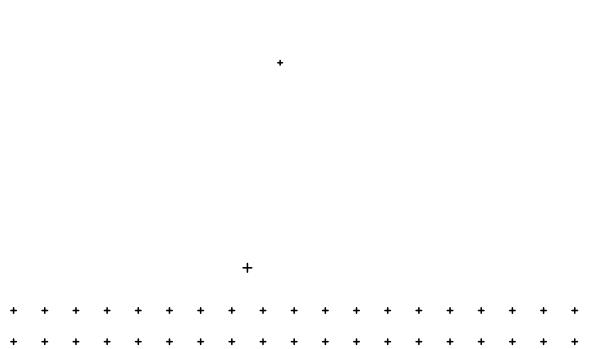
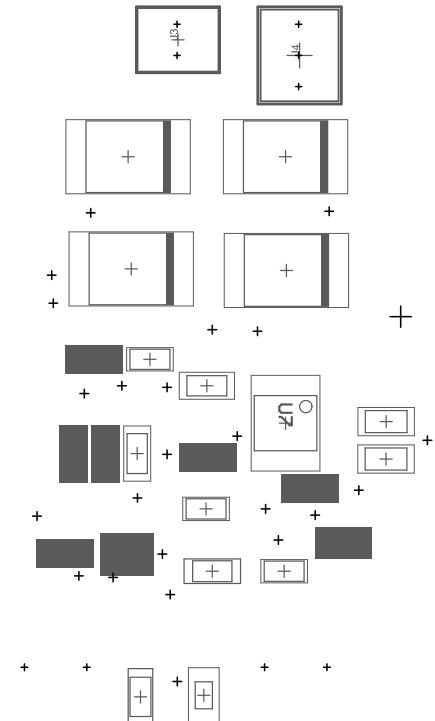
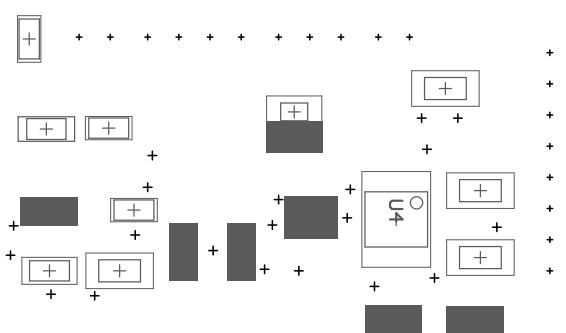
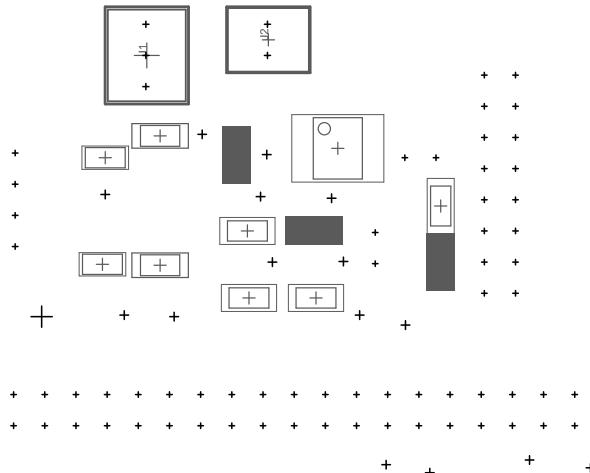
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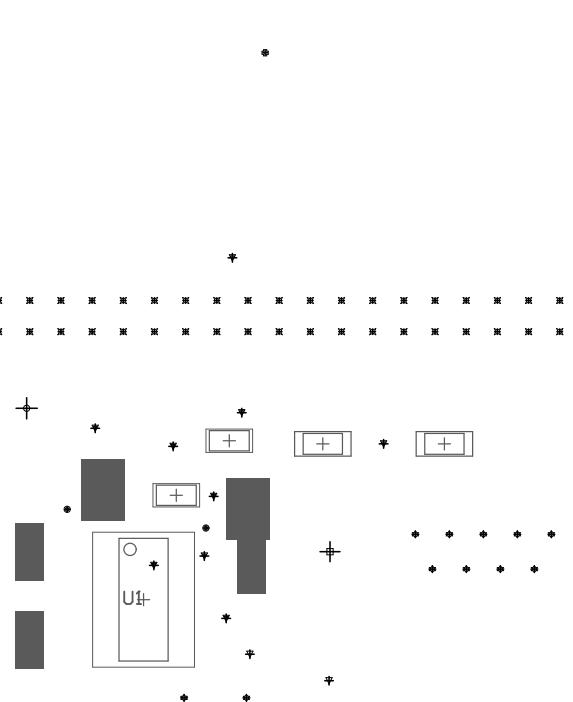
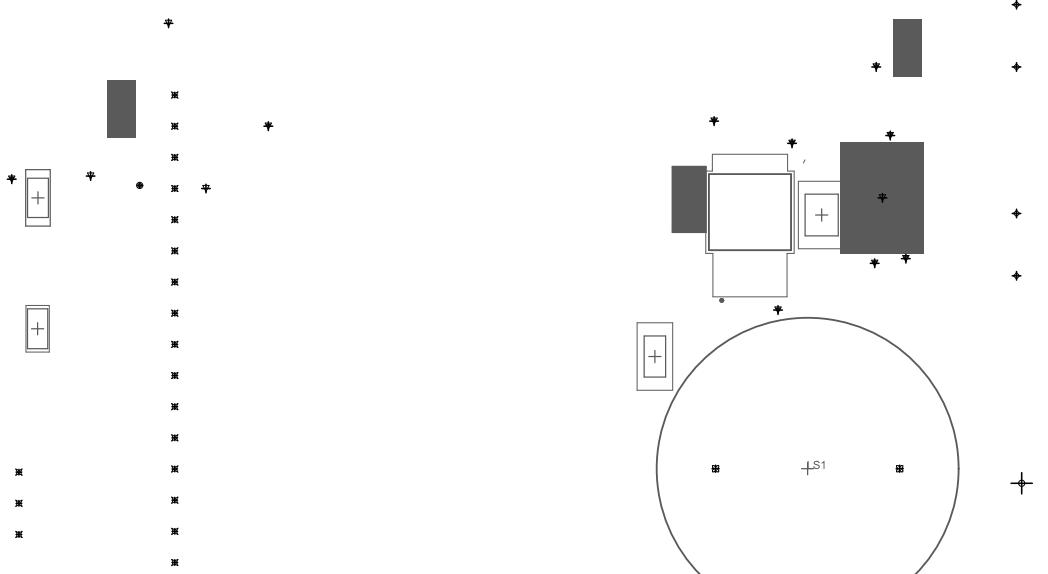
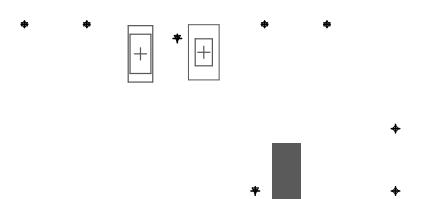
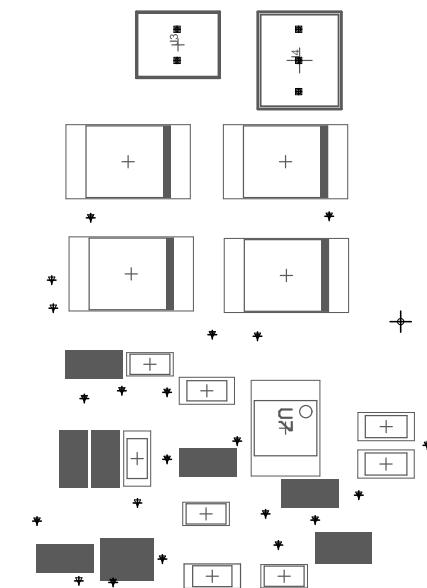
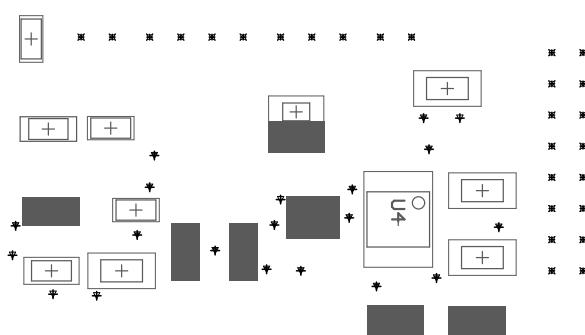
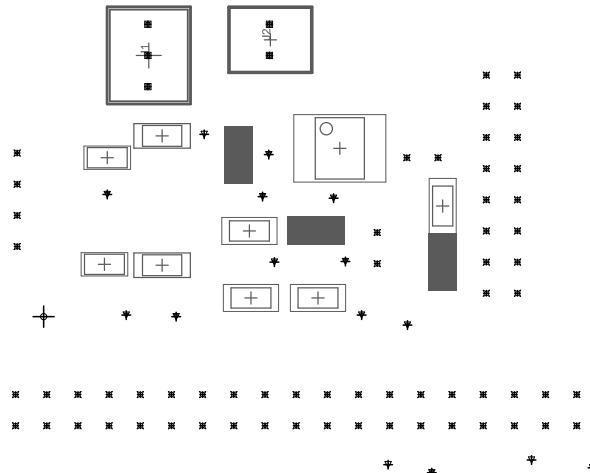
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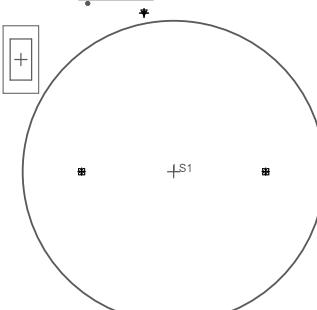
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Board Stack Report

Stack Up		Layer Stack			
Layer	Board Layer Stack	Name	Material	Thickness	Constant
1		Top Paste			
2		Top Overlay			
3		Top Solder	SM-001	1.00mil	4
4		Top Layer	Copper	1.38mil	
5		Dielectric 1	Core-022	7.00mil	4.3
6		Int1 (GND)	Copper	1.38mil	
7		Dielectric 3	Core-022	7.00mil	4.3
8		Int2 (PWR)	Copper	1.38mil	
9		Dielectric 5	Core-022	7.00mil	4.3
10		Bottom Layer	Copper	1.38mil	
11		Bottom Solder	SM-001	1.00mil	4
12		Bottom Overlay			
13		Bottom Paste			
		Height : 28.51mil			

Line #	Name	Description	Designator	Quantity	Manufacturer 1	Manufacturer Part Number 1	Manufacturer Lifecycle 1	Supplier 1	Supplier Part Number 1	Supplier Unit Price 1	Supplier Subtotal 1	
CC1206KRX7R9BB104	CAP CER 0.1UF 50V	C1, C2, C4, C6, C8, C9, C10,		17	Yageo	CC1206KRX7R9BB104	Volume Production	Digi-Key	311-1179-1-ND	0.163	2.77	
CC1206KKX7R9BB474	CAP CER 0.47UF 50V	C3, C5		2	Yageo	CC1206KKX7R9BB474	Volume Production	Digi-Key	311-1436-6-ND	0.35	0.7	
C1206C300J5GACTU	CAP CER 30PF 50V	C7		1	KEMET	C1206C300J5GACTU	Volume Production	Mouser	80-C1206C300J5G	0.45	0.45	
Part Number: C3216XSR1V106K160A4	CAP CER 10UF 35V	C13, C15, C27		3	TDK	CGASL3XSR1V106M160AB	Volume Production	Digi-Key	445-12866-6-ND	0.9	2.7	
Cap	CAP CER 1000pF	C14		1	Murata	GRM216R71H03MA01D	Volume Production	Digi-Key	490-11562-1-ND	0.1	0.1	
Cap Pol	CAP 85C 33uF ±20%	C17		1	Nichicon	UWX1V330MCL1GB	Volume Production	Digi-Key	493-2119-6-ND	0.37	0.37	
Cap	CAP CER 10000pF	C22		1	Kyocera AVX	12105A103AT2A	Volume Production	Digi-Key	478-1601-6-ND	1.18	1.18	
Cap Pol	CAP 85C 10uF ±20%	C24		1	Nichicon	UWX1V100MCL1GB	Volume Production	Digi-Key	493-2117-1-ND	0.36	0.36	
RS232_CTS/RTS	Circuit Breaker	CB1		1	n/a	n/a	Manual Solution	n/a	n/a	0.00744	0.00744	
+5V	Circuit Breaker	CB2		1	n/a	n/a	Manual Solution	n/a	n/a	0.00744	0.00744	
+12V	Circuit Breaker	CB3		1	n/a	n/a	Manual Solution	n/a	n/a	0.00744	0.00744	
Header_19X2	Header, 19-Pin, Du	CN1, CN2		2	Sullins	PPPC192LFBN-RC	Volume Production	Digi-Key	S7122-ND	2.26	4.52	
D Connector 9	Receptacle Assem	COM1		1	Assmann	A-DF09A/KG-T25	Unknown	Digi-Key	AE10921-ND	0.77	0.77	
MBRS340T3G	Schottky Power Rd	D1, D2, D4, D5		4	ON Semiconductor	MBRS340T-3G	Volume Production	Digi-Key	MBRS340T3GOSDKR-ND	0.5	2	
SBRD10200TR	SBRD10200 Series	D3		1	SMC	SBRD10200TR	Unknown	Digi-Key	1655-1939-1-ND	0.59	0.59	
Encoder 1	CONN 3 Positions	J1		1	Molex	22-11-2032	Volume Production	Digi-Key	WM2701-ND	0.56	0.56	
DC Motor 1		J2		1	Molex		22112022	Volume Production	Digi-Key	WM2700-ND	0.4	0.4
DC Motor 2		J3		1	Molex		22112022	Volume Production	Digi-Key	WM2700-ND	0.4	0.4
Encoder 2	CONN 3 Positions	J4		1	Molex		22-11-2032	Volume Production	Digi-Key	WM2701-ND	0.56	0.56
SDR1307-270ML	INDUCTOR 27UH	L1		1	Bourns	SDR1307-270ML	Volume Production	Digi-Key	SDR1307-270MLCT-ND	1.05	1.05	
150120GS75000	SMD mono-color	LED1, LED2, LED3, LED4, LE		8	Wurth Electronics	150120GS75000	Volume Production	Digi-Key	732-4990-6-ND	0.2	1.6	
PKB24SPCH3601-B0	Piezo buzzer for pl	L51		1	n/a	n/a	Manual Solution	n/a	n/a	0.00744	0.00744	
CAN Port	Header, 4-Pin	P1		1	Wurth Electronics		61300411121	Volume Production	Digi-Key	732-5317-ND	0.18	0.18
Header_2	Header, 2-Pin	P2, P3		2	Wurth Electronics		61300211121	Volume Production	Digi-Key	732-5315-ND	0.13	0.26
Camera	Header, 8-Pin, Du	P4		1	Amphenol FCI	68602-116HLF	Volume Production	Digi-Key	609-3364-ND	0.79	0.79	
Switch_1	Header, 2-Pin	P5		1	Wurth Electronics		61300211121	Volume Production	Digi-Key	732-5315-ND	0.13	0.13
Stepper	Header, 4-Pin	P6		1	Wurth Electronics		61300411121	Volume Production	Digi-Key	732-5317-ND	0.18	0.18
LCD	Header, 8-Pin, Du	P7		1	Amphenol FCI	68602-116HLF	Volume Production	Digi-Key	609-3364-ND	0.79	0.79	
Header_16	Header, 16-Pin	P8		1	Sullins	PPPC161LFBN-RC	Volume Production	Digi-Key	S7049-ND	1.02	1.02	
Servo	Header, 3-Pin	P9		1	Wurth Electronics		61300311121	Volume Production	Digi-Key	732-5316-ND	0.13	0.13
Switch_2	Header, 2-Pin	P10		1	Wurth Electronics		61300211121	Volume Production	Digi-Key	732-5315-ND	0.13	0.13
Other	Header, 8-Pin, Du	P11		1	Amphenol FCI	68602-116HLF	Volume Production	Digi-Key	609-3364-ND	0.79	0.79	
Wheels	Header, 8-Pin, Du	P12		1	Amphenol FCI	68602-116HLF	Volume Production	Digi-Key	609-3364-ND	0.79	0.79	
Terminal_2	Terminal, 2-Pin	P13, P14		2	TE Connectivity	282841-2	Volume Production	Digi-Key	A98342-ND	1.05	2.1	
ERJ-8GEYJ101V		R1, R2, R3, R5, R10, R12, R2		8	Panasonic	ERJ-8GEYJ101V	Volume Production	Digi-Key	P100EET-ND	0.074	0.74	
ERJ-8GEYJ103V		R4, R6		2	Panasonic	ERJ8GEYJ103V	Volume Production	Digi-Key	P10KEKDR-ND	0.1	0.2	
ERJ-8ENF60R4V		R7, R8		2	Panasonic	ERJ-8ENF60R4V	Volume Production	Mouser	667-ERJ-8ENF60R4V	0.1	0.2	
RPot	POT 10K OHM TH	R9		1	Bourns	3352T-1-103LF	Volume Production	Digi-Key	3352T-103LF-ND	1.85	1.85	
ERJ-8GEYJ472V		R11, R15		2	Panasonic	ERJ8GEYJ472V	Volume Production	Arrow	ERJ-8GEYJ472V	0.095	0.19	
ERA8AEB224V		R14, R16		2	Panasonic	ERA8AEB224V	Volume Production	Digi-Key	P220KBCC7-ND	0.66	1.32	
RL1632R-R330-F		R17, R18, R26, R27		4	Susumu	RL1632R-R330-F	Volume Production	Newark	28K1713	0.1	0.4	
TNPW1206100RBEAA		R19		1	Vishay Dale	TNPW1206100RBEAA	Volume Production	Arrow	TNPW1206100RBEAA	0.5145	0.5145	
ERJ-8ENF4751V		R20, R22		2	Panasonic	ERJ-8ENF4751V	Volume Production	Arrow	ERJ-8ENF4751V	0.095	0.19	
ERJ-8ENF2000V		R21, R23		2	Panasonic	ERJ-8ENF2000V	Volume Production	Allied Electronics	70265330	0.027	0.054	
Res3	RES SMD 1.00K OH	R24		1	Vishay	CRCW08051K00FKEAC	Unknown	Digi-Key	541-3977-6-ND	0.1	0.1	
MAX3232CDR	3-V to 5.5-V Multi	U1		1	Texas Instruments	MAX3232CDR	Volume Production	Digi-Key	296-13094-1-ND	1.89	1.89	
MCP2551-I/SN	High-Speed CAN T	U2		1	Microchip	MCP2551-I/SN	Volume Production	Digi-Key	MCP2551-I/SN-ND	1.05	1.05	
SN74LVC2G17DCKR	No Description Av	U3, U5		2	Texas Instruments	SN74LVC2G17DCKR	Volume Production	Digi-Key	296-13013-6-ND	0.55	1.1	
DRV8833PW	2 A Low Voltage D	U4, U7		2	Texas Instruments	DRV8847PWR	Manual Solution	Texas instruments	DRV8847PWR	1.41	2.81	
LM22676MRE-5.0/NOPB	LM22676MRE-5.0	U6		1	Texas Instruments	LM22676MRE-5.0/NOPB	Volume Production	Digi-Key	LM22676MRE-5.0/NOPBCT-ND	4.97	4.97	