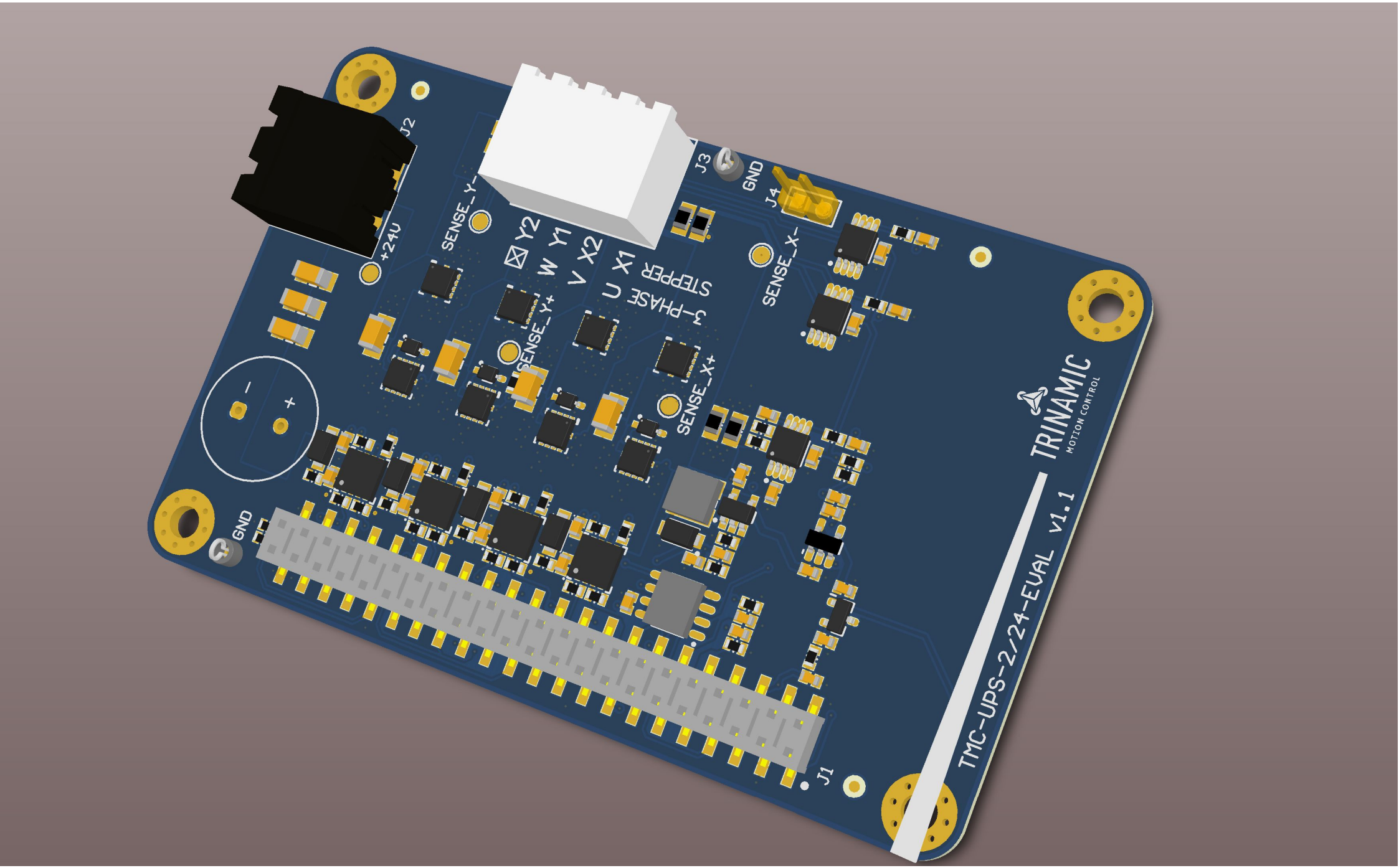
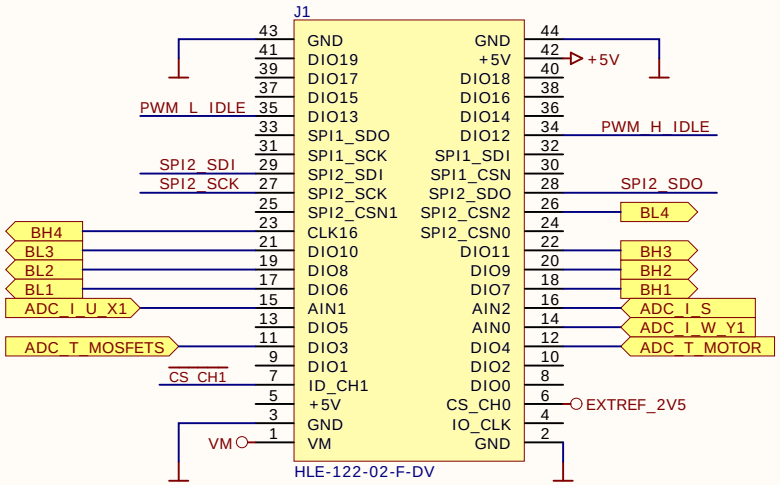
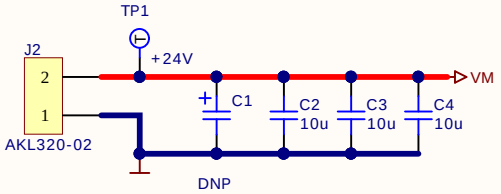

J2
+24V
SENSE_Y-
J3
GND
J4
SENSE_X-
Y2
W
Y1
V
X2
U
X1
STEPPER
3-PHASE
SENSE_Y+
SENSE_X+
GND
J1
TRINAMIC
MOTION CONTROL
TMC-UPS-2/24-EVAL v1.1

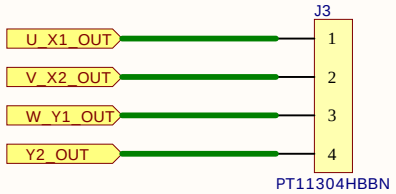
uC or Motor Controller Connector



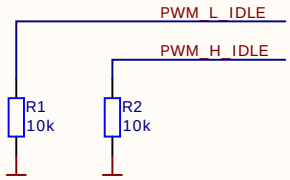
Power Connector



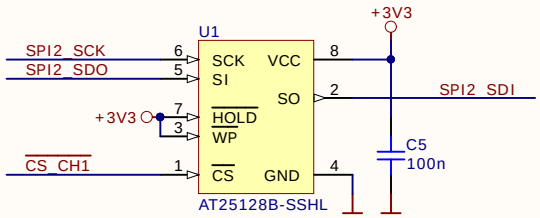
Motor Connector

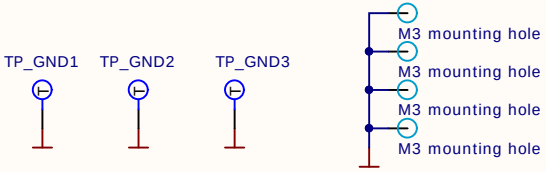


Bridge Idle State



Ident EEPROM





Title **UPS 2A/24V EVAL Main & I/O**		
Size: A4	Revision: V1.1	Initial
Date: 19.10.2017 Time: 10:23:36	Sheet 1 of 5	
File: UPS_2A_EVAL_V11_Main.SchDoc		

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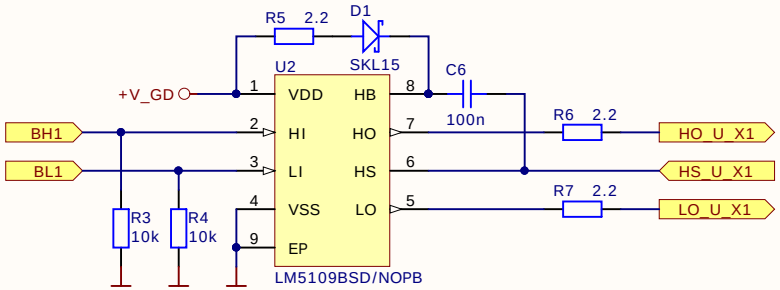
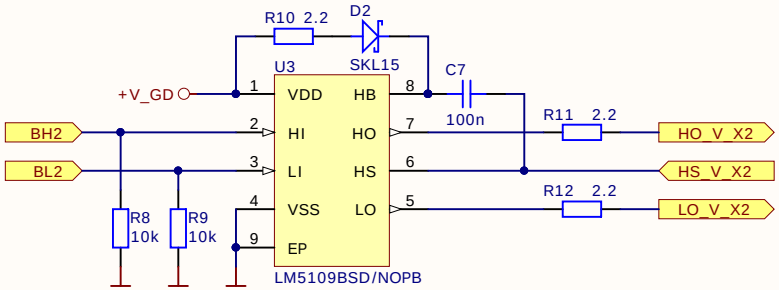
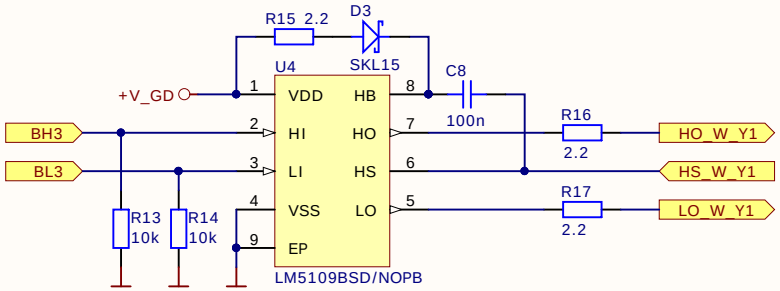
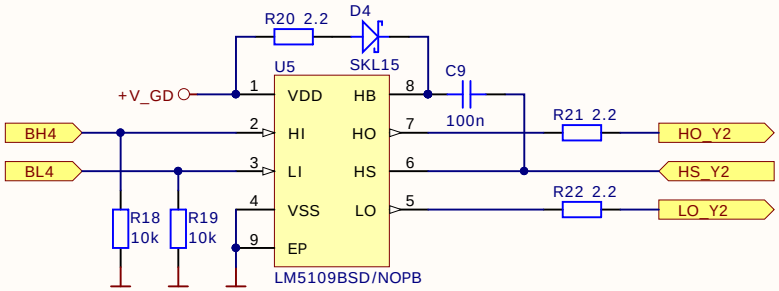
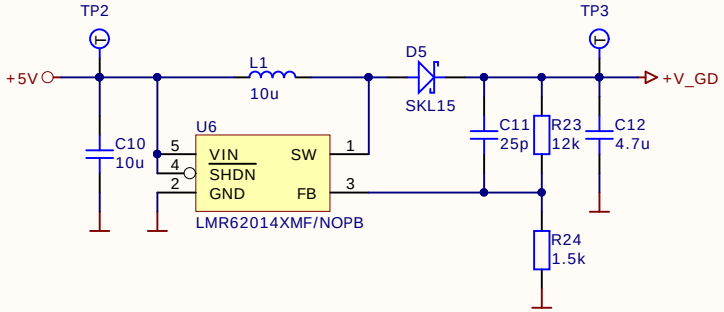
MOSFET Predrivers

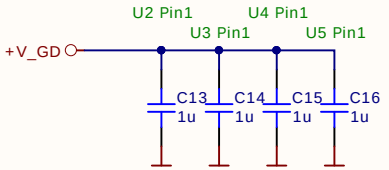












Title **UPS 2A/24V EVAL Predrivers**		
Size: A4	Revision: V1.1	Initial
Date: 19.10.2017 Time: 10:23:36		Sheet 2 of 6
File: UPS_2A_EVAL_V11_Predriver.SchDoc		

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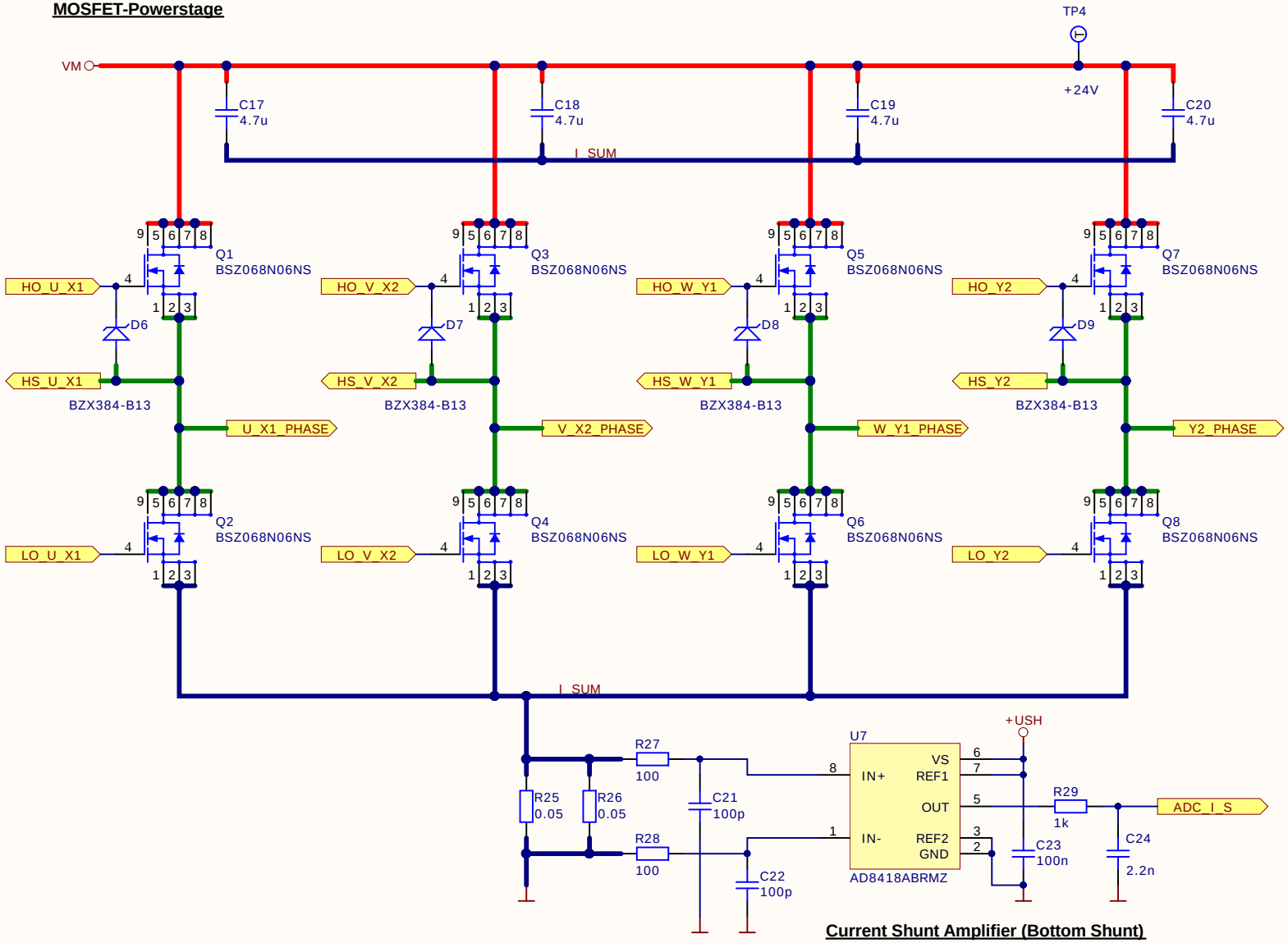
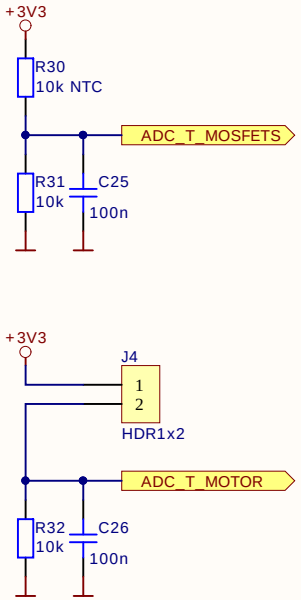
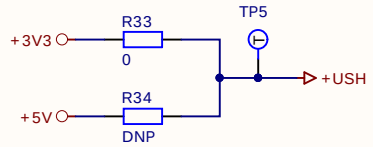
MOSFET-Powerstage



Temp sensing



Shunt Amplifier power select (default +3.3V)



Current Shunt Amplifier (Bottom Shunt)

Title: UPS 2A/24V EVAL MOSFETs		
Size: A4	Revision: V1.1	Initial
Date: 19.10.2017 Time: 10:23:36	Sheet 3 of 5	
File: UPS_2A_EVAL_V11_MOSFETs.SchDoc		

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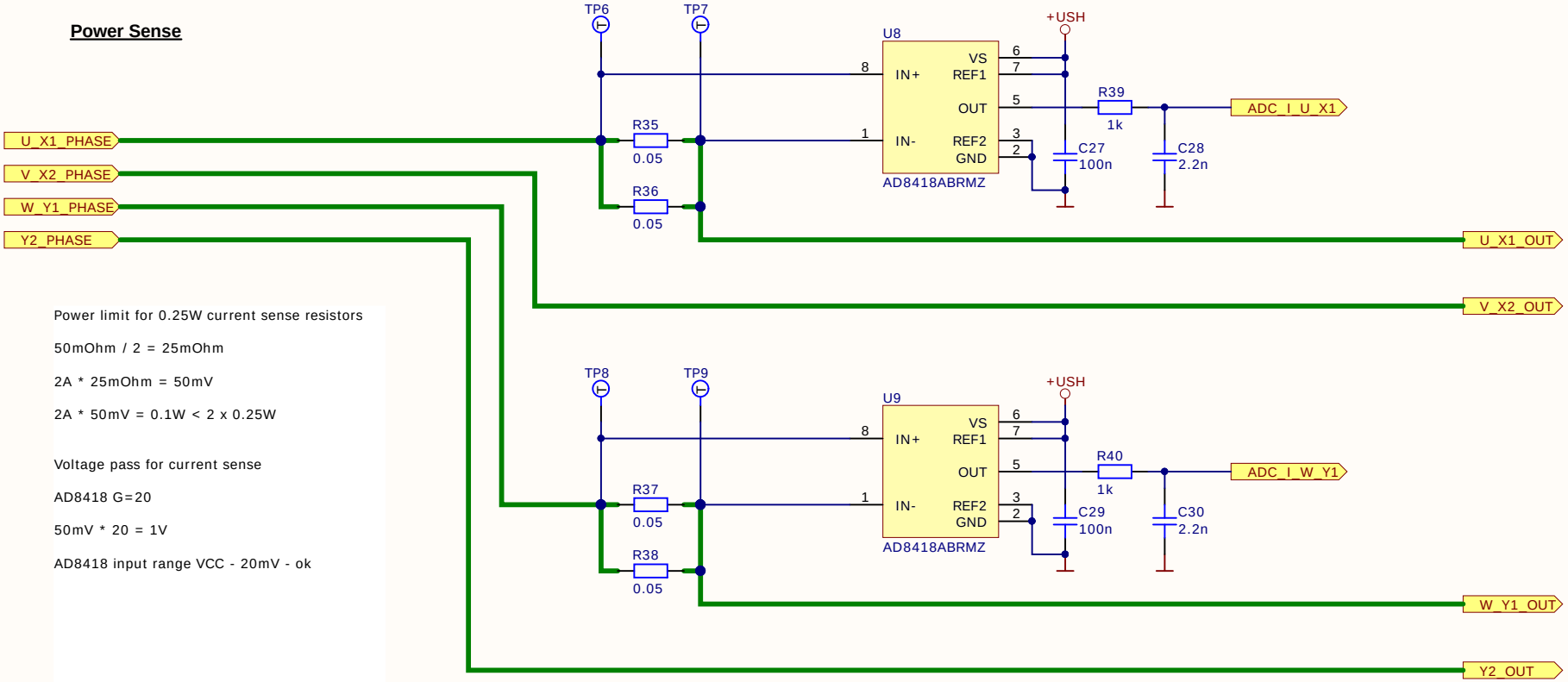
Power Sense



Power limit for 0.25W current sense resistors

50mOhm / 2 = 25mOhm

2A * 25mOhm = 50mV

2A * 50mV = 0.1W < 2 x 0.25W

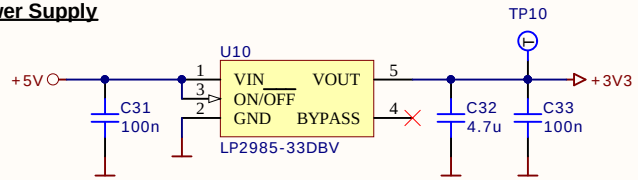
Voltage pass for current sense

AD8418 G=20

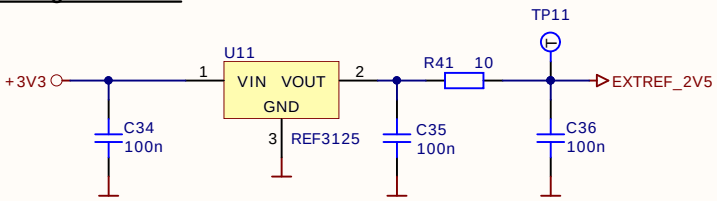
50mV * 20 = 1V

AD8418 input range VCC - 20mV - ok

3.3V Power Supply



Ext 2.5V Voltage Reference



Title **UPS 2A/24V EVAL Power Sense**		
Size: A4	Revision: V1.1	Initial
Date: 19.10.2017 Time: 10:23:36	Sheet 4 of 5	
File: UPS_2A_EVAL_V11_Power_Sense.SchDoc		

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UPS_2A_EVAL-V1.0 -> UPS_2A_EVAL-V1.1
1. Changed shunt resistors to 0.05 Ohm

UPS_2A_EVAL-V0.91 -> UPS_2A_EVAL-V1.0
1. Changed J2 to produced by Metz Connect AKL320-02
2. Added pull-down resistors to gate inputs on Predriver sheet, renumbered resistors
3. Changed C6-C9 voltage from 100V to 50V
4. Changed D1-D5 to SKL15, corrected polarity

UPS_2A_EVAL-V0.9 -> UPS_2A_EVAL-V0.91
1. Corrected log sheet
2. Moved input power capacitors to Main sheet
3. Renumbered C13 to C1 with DNP sign
4. Replaced C14 with three 10uF 35V capacitors
5. Renumbered all capacitors

UPS_10A_EVAL-V0.91 -> UPS_2A_EVAL-V0.9
1. Deleted SPI_ADC signal names from J1
2. Changed Q1-Q8 to BSZ068N06NS
3. Changed current sense resistors to 0.1 Ohm 0.25W
4. Changed aluminium elkos C13,C14 to 680uF 35V
5. Changed capacitors C15-C18 to 4.7uF 50V

UPS_10A_EVAL-V0.9(pre3) -> UPS_10A_EVAL-V0.91
1. Deleted unused on board SPI_ADC signals from J1
2. Changed Q1-Q8 to BSZ068N06NS
3. Changed current sense resistors to 0.1 Ohm 0.25W
4. Changed aluminium elkos C13,C14 to 680uF 35V
5. Changed capacitors C15-C18 to 4.7uF 50V

UPS_10A_EVAL-V0.9pre2 -> UPS_10A_EVAL-V0.9pre3
1. Renumbered TPs

UPS_10A_EVAL-V0.9pre1 -> UPS_10A_EVAL-V0.9pre2
1. Deleted unused MCLK signals from J1
2. Renumbered capacitors

UPS_10A_DEV-V0.9pre6 -> UPS_10A_EVAL-V0.9pre1
1. Deleted Delta-Sigma current measurement parts
2. Moved current measure amplifiers near to current sense resistors
3. Moved pover supplies to sheet 4
4. Deleted Phase_Current sheet (5)
4. Renumbered components on sheets 3 & 4

V0.9pre5 -> V0.9pre6
1. Added 100n capacitors to AD7403 output side power

V0.9pre5 -> V0.9pre6
1. Removed LC from power output
2. Removed voltage measurement from sheet 4
3. Added solder bridge resistors to select U10/U11/12 power source
4. Renumbered components

V0.9pre4 -> V0.9pre5

1. Renamed net between J1 pin 9 and U8 pin 7 to MCLK_W
2. Removed RC-s from power outputs
3. Removed jumpers from current shunt circuit

ToDo:

Drafted by: Peep Narusberg
Checked by: ---
Approved by: Stephan Kubisch

Title **UPS 2A/24V EVAL log and approval**		
Size: A4	Revision: V1.1	Initial
Date: 19.10.2017 Time: 10:23:36	Sheet 5 of 5	
File: UPS_2A_EVAL_V11_Log.SchDoc		

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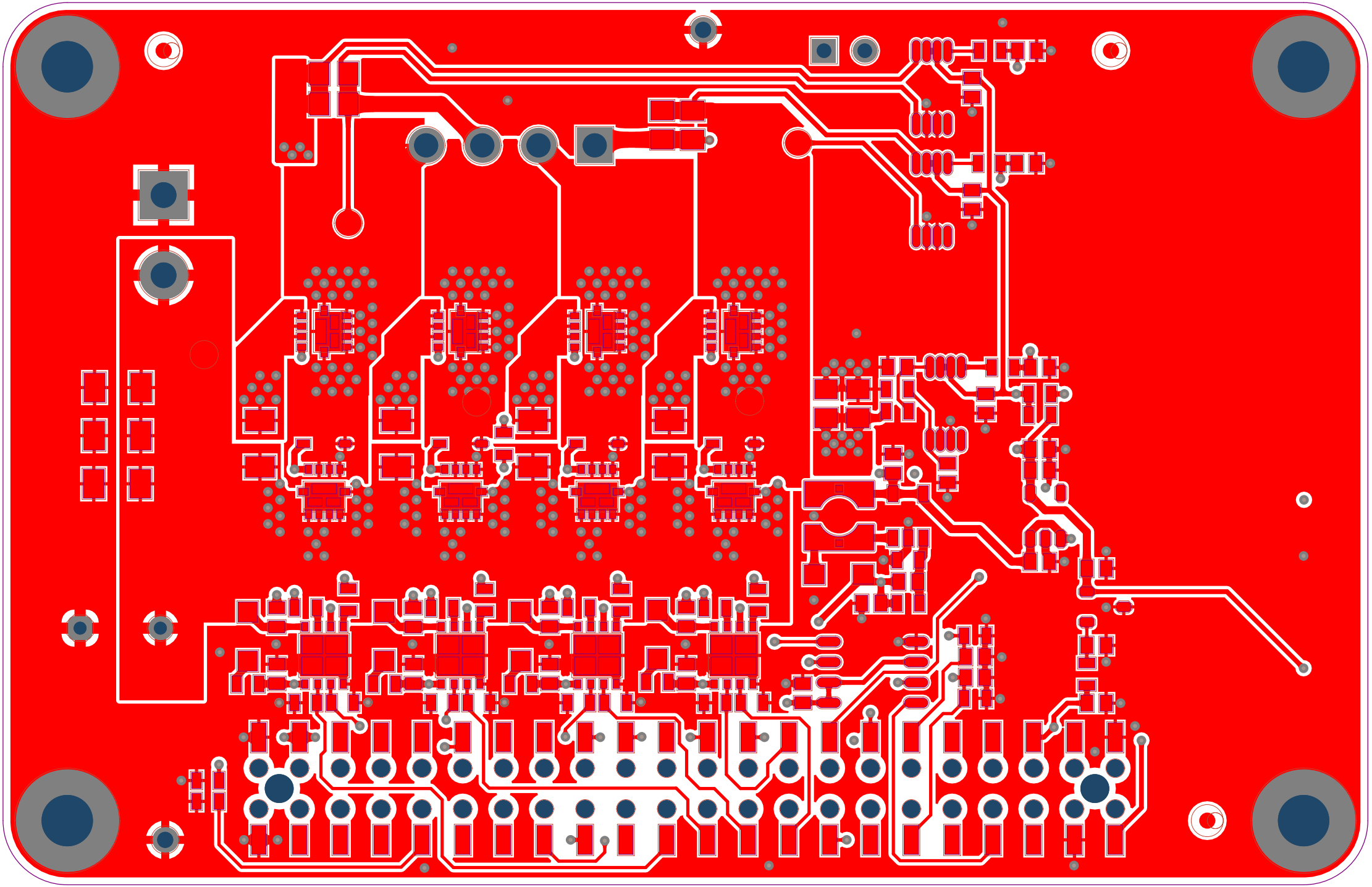
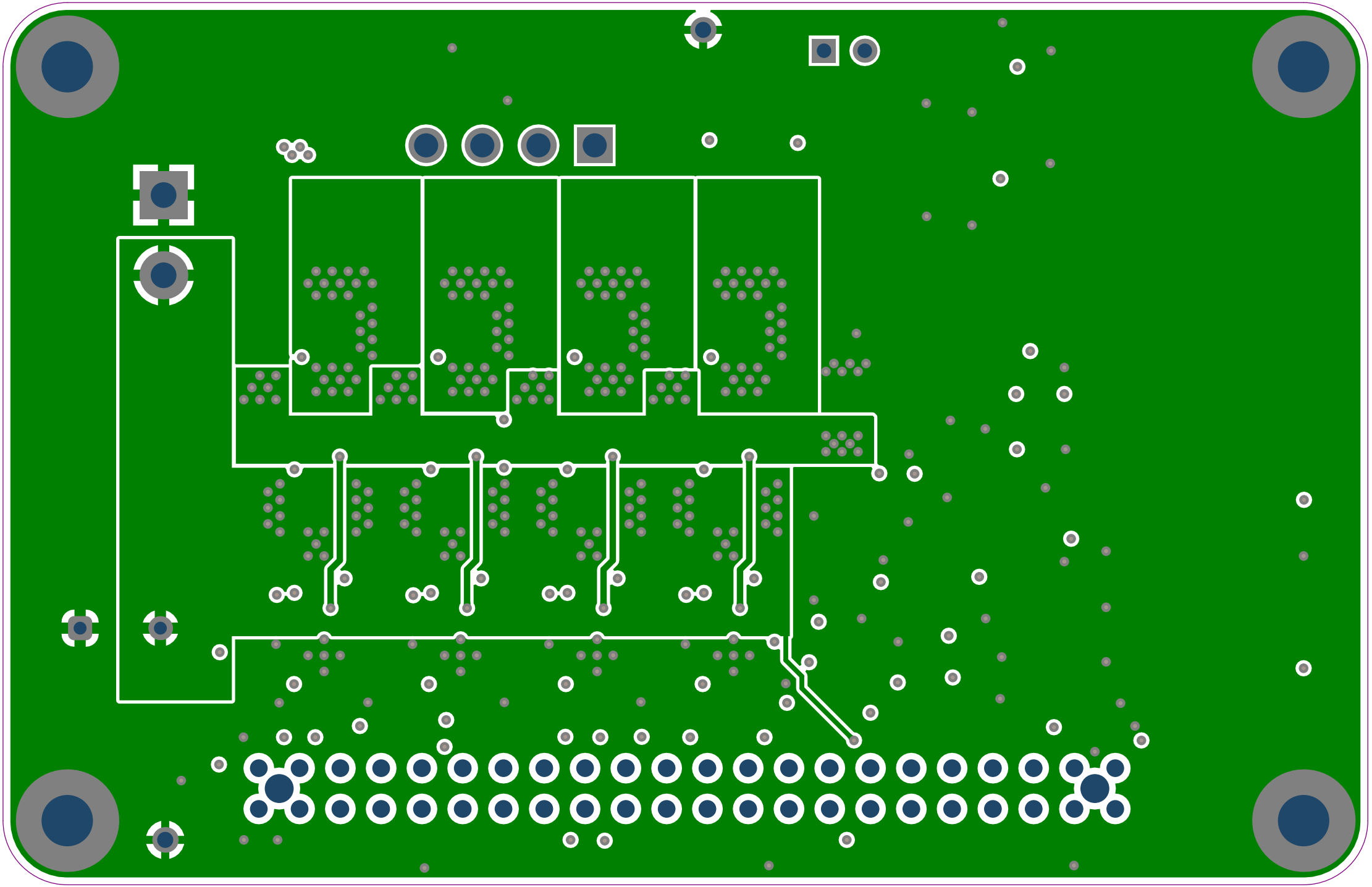
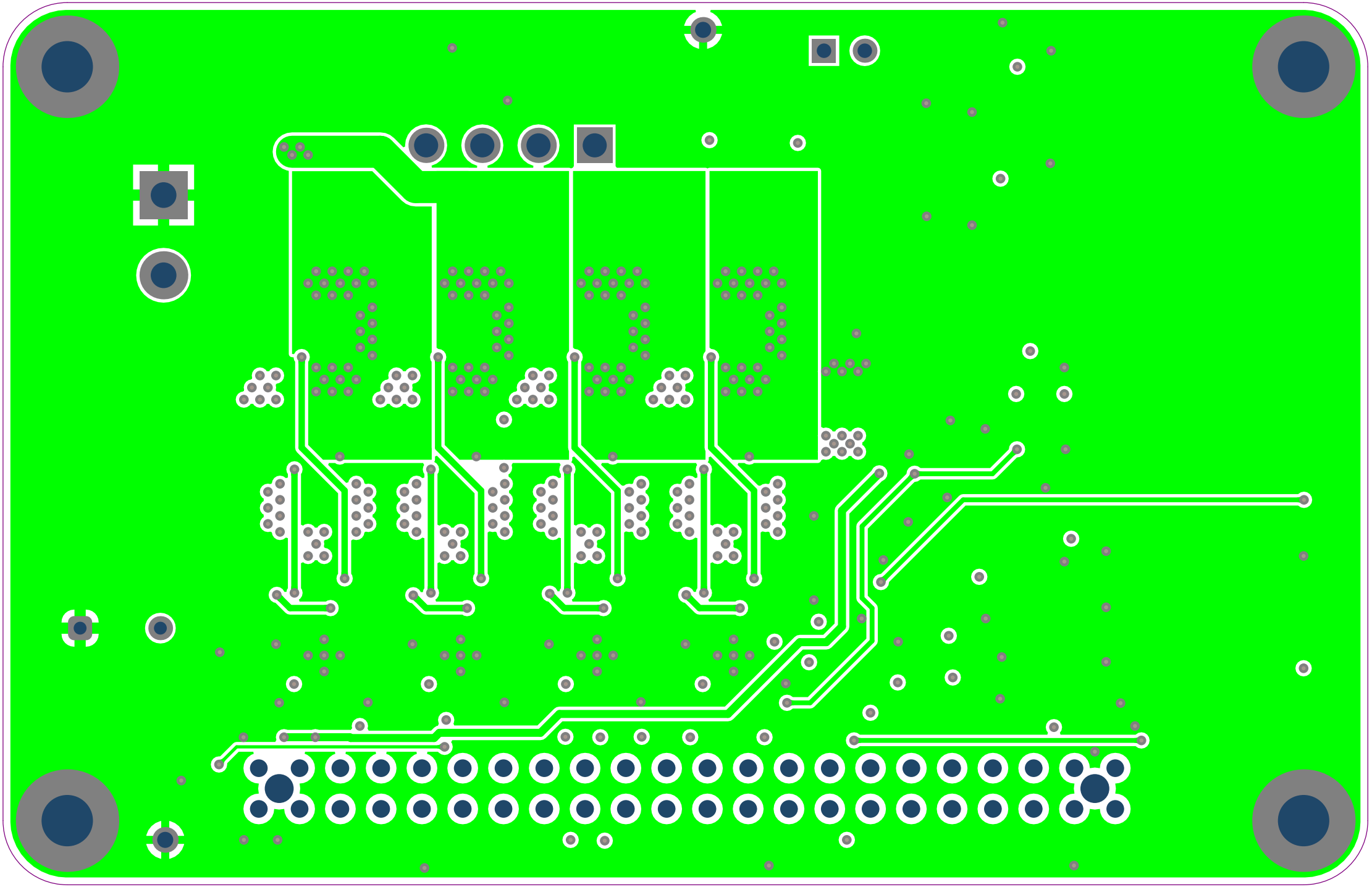
Designator	Quantity	Manufacturer	Part Number	Description	LibRef
C1	1	DNP	DNP	Polarized capacitor, pin 1 neg	50527
C2, C3, C4	3	Any	10u, 35V, X5R, 1206 (3216 metric) chip capacitor	Ceramic chip capacitor	20034
C5, C6, C7, C8, C9, C23, C25, C26, C27, C29, C31, C33, C34, C35, C36	15	Any	100n, 50V, X5R, 0603 (1608 metric) chip capacitor	Ceramic chip capacitor	20027
C10	1	Any	10u, 10V, X5R, 0603 (1608 metric) chip capacitor	Ceramic chip capacitor	20111
C11	1	Any	25p, 50V, C0G/NP0, 0603 (1608 metric) chip capacitor	Ceramic chip capacitor	20112
C12	1	Any	4.7u, 25V, X5R, 0603 (1608 metric) chip capacitor	Ceramic chip capacitor	20113
C13, C14, C15, C16	4	Any	1u, 25V, X5R, 0603 (1608 metric) chip capacitor	Ceramic chip capacitor	20077
C17, C18, C19, C20	4	Any	4.7u, 50V, X5R, 1206 (3216 metric) chip capacitor	Ceramic chip capacitor	20078
C21, C22	2	Any	100p, 100V, C0G/NP0, 0603 (1608 metric) chip capacitor	Ceramic chip capacitor	20083
C24, C28, C30	3	Any	2.2n, 50V, C0G/NP0, 0603 (1608 metric) chip capacitor	Ceramic chip capacitor	20056
C32	1	Any	4.7u, 10V, X5R, 0603 (1608 metric) chip capacitor	Ceramic chip capacitor	20084
D1, D2, D3, D4, D5	5	Diotec Semiconductor	SKL15	Schottky Diode, pin1 cathode	50567
D6, D7, D8, D9	4	Nexperia	BZX384-B13	Zener, pin1 cathode	50513
J1	1	Samtec	HLE-122-02-F-DV	Trinamic 44-pin connector	50289
J2	1	Metz Connect	AKL320-02	1X2 pin connector	50537
J3	1	Metz Connect	PT11304HBBN	1X4 pin connector	50511
J4	1	Any	1x2 2.54mm pin header	1X2 pin connector	50023
L1	1	Wuerth	744031100	Molded inductor	60031
Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8	8	Infineon	BSZ068N06NS	N-ch Enh-MOSFET; 5,6,7,8D 4G 1,2.3S	50524
R1, R2, R3, R4, R8, R9, R13, R14, R18, R19, R31, R32	12	Any	10k, 1%, 100mW, 0603 (1608 metric) chip resistor	Chip Resistor	10028
R5, R6, R7, R10, R11, R12, R15, R16, R17, R20, R21, R22	12	Any	2.2, 1%, 100mW, 0603 (1608 metric) chip resistor	Chip Resistor	10041
R23	1	Any	12k, 1%, 100mW, 0603 (1608 metric) chip resistor	Chip Resistor	10078
R24	1	Any	1.5k, 1%, 100mW, 0603 (1608 metric) chip resistor	Chip Resistor	10152
R25, R26, R35, R36, R37, R38	6	Any	0.05, 1%, 250mW, 0805 (2012 metric) chip resistor	Chip Resistor	10172
R27, R28	2	Any	100, 1%, 100mW, 0603 (1608 metric) chip resistor	Chip Resistor	10016
R29, R39, R40	3	Any	1k, 1%, 100mW, 0603 (1608 metric) chip resistor	Chip Resistor	10049
R30	1	Epcos	B57330V2103J260	Chip Resistor	40000
R33	1	Any	0, -, -, 0603 (1608 metric) chip resistor	Chip Resistor	10054
R34	1	DNP	DNP	Chip Resistor	40007
R41	1	Any	10, 1%, 100mW, 0603 (1608 metric) chip resistor	Chip Resistor	10002
U1	1	Atmel	AT25128B-SSHL	SPI Serial Flash Memory	50499
U2, U3, U4, U5	4	Texas Instruments	LM5109BSD/NOPB	High Voltage 1A Peak Half Bridge Gate Driver	50490
U6	1	Texas Instruments	LMR62014XMF/NOPB	LMR62014 SIMPLE SWITCHER® 20Vout, 1.4A Step-Up Voltage Regulator in SOT-23	50495
U7, U8, U9	3	Analog Devices	AD8418ABRMZ	Bidirectional, Zero Drift, Current Sense Amplifier	50496
U10	1	Texas Instruments	LP2985-33DBV	150-mA Low-noise LDO	50426
U11	1	Texas Instruments	REF3125	Series voltage reference	50316

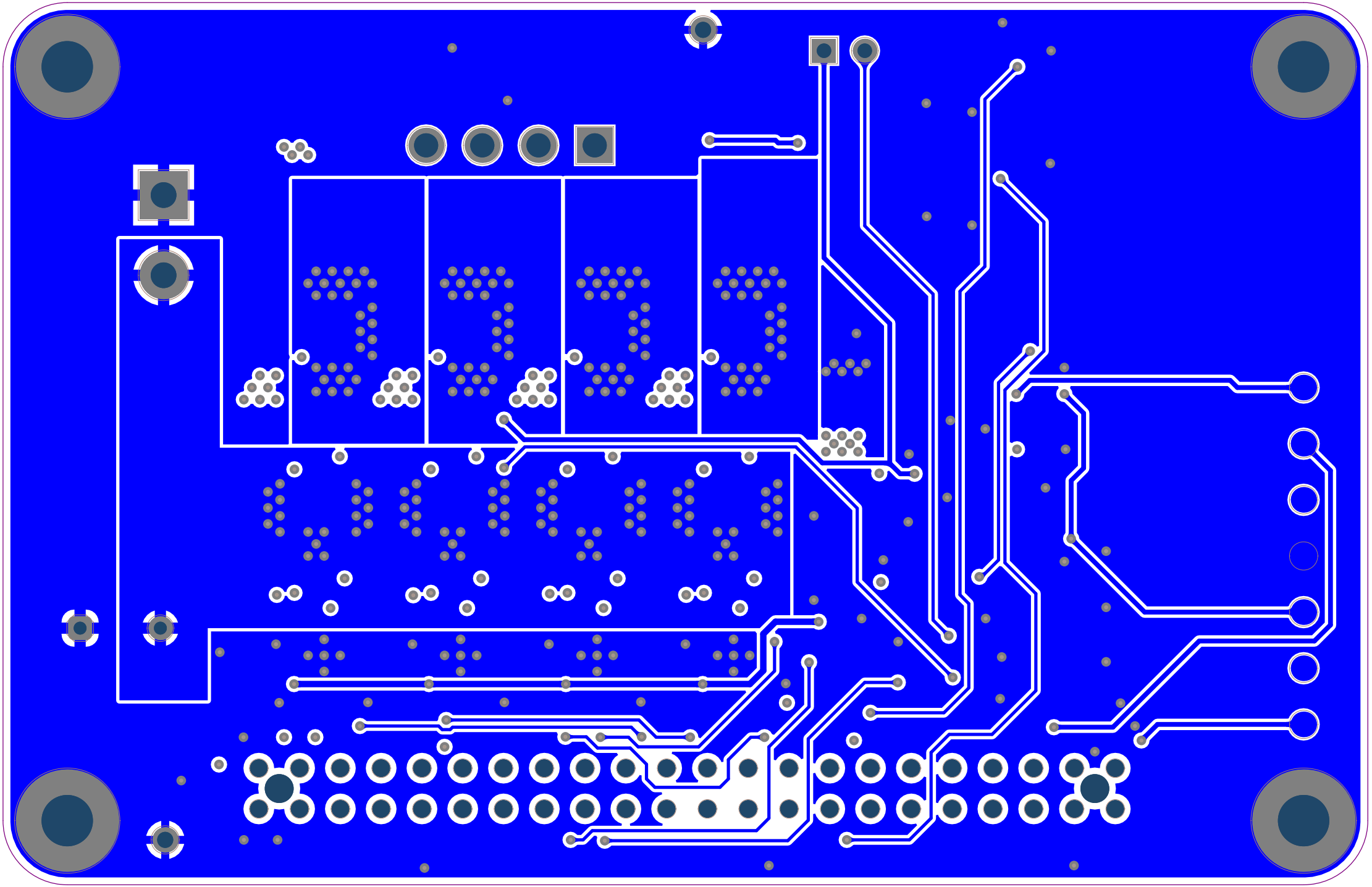
Board Stack Report

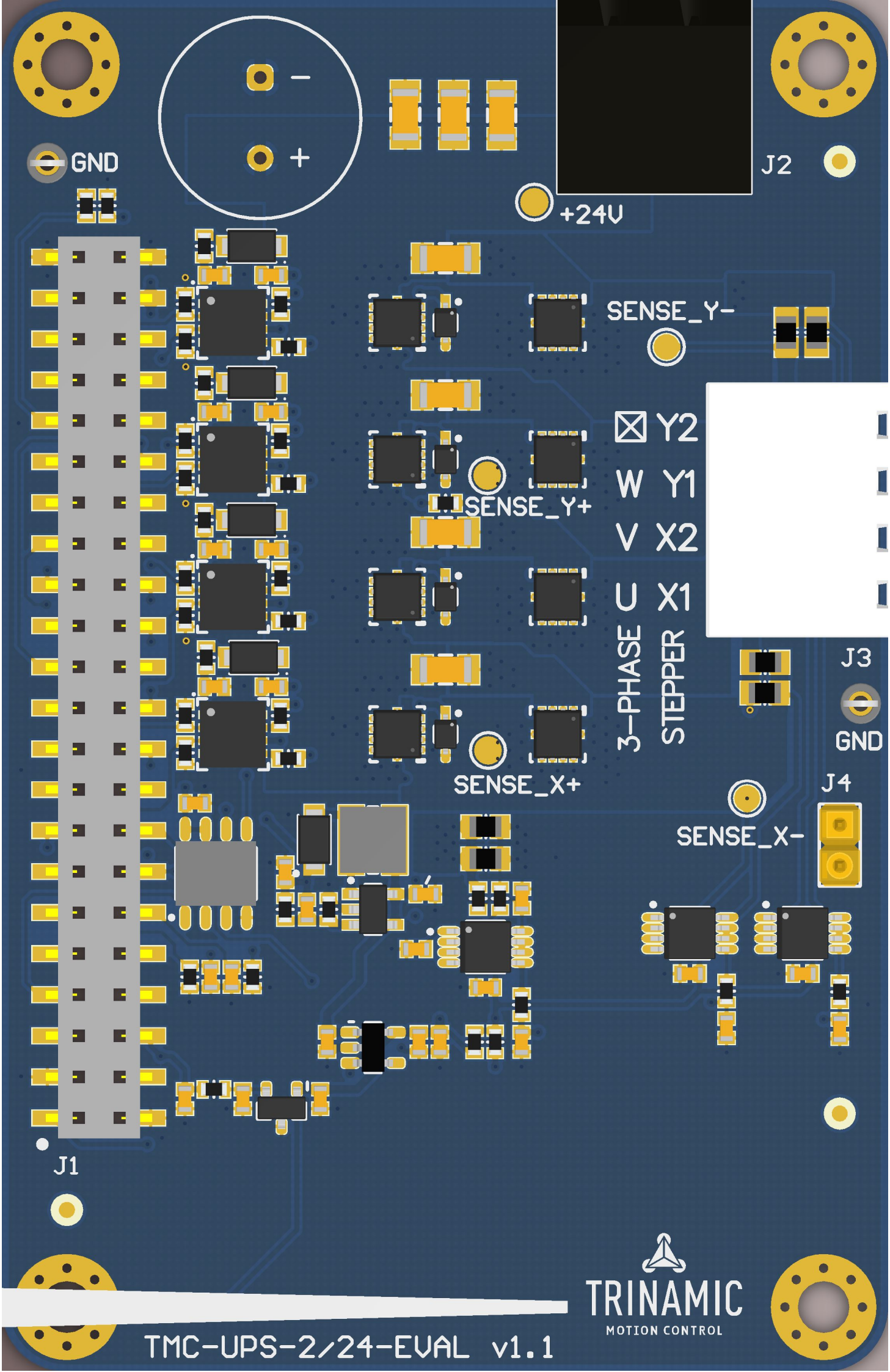
Stack Up		Layer Stack			
Layer	Board Layer Stack	Name	Material	Thickness	Constant
1		Top Paste			
2		Top Overlay			
3		Top Soldermask	Solder Resist	0.010mm	3.5
4		Top Layer	Copper	0.035mm	
5		Prepreg 7628-45		0.360mm	4.6
6		Mid1	Copper	0.036mm	
7		High Tg 1,08mm 35??m/35??m	FR-4	0.710mm	4.6
8		Mid2	Copper	0.036mm	
9		Prepreg 7628-45		0.360mm	4.6
10		Bottom Layer	Copper	0.035mm	
11		Bottom Soldermask	Solder Resist	0.010mm	3.5
12		Bottom Overlay			
13		Bottom Paste			
	Height : 1.592mm				










GND
J2
+24V
SENSE_Y-
Y2
W Y1
V X2
U X1
3-PHASE STEPPER
SENSE_Y+
J3
GND
SENSE_X+
J4
SENSE_X-
J1
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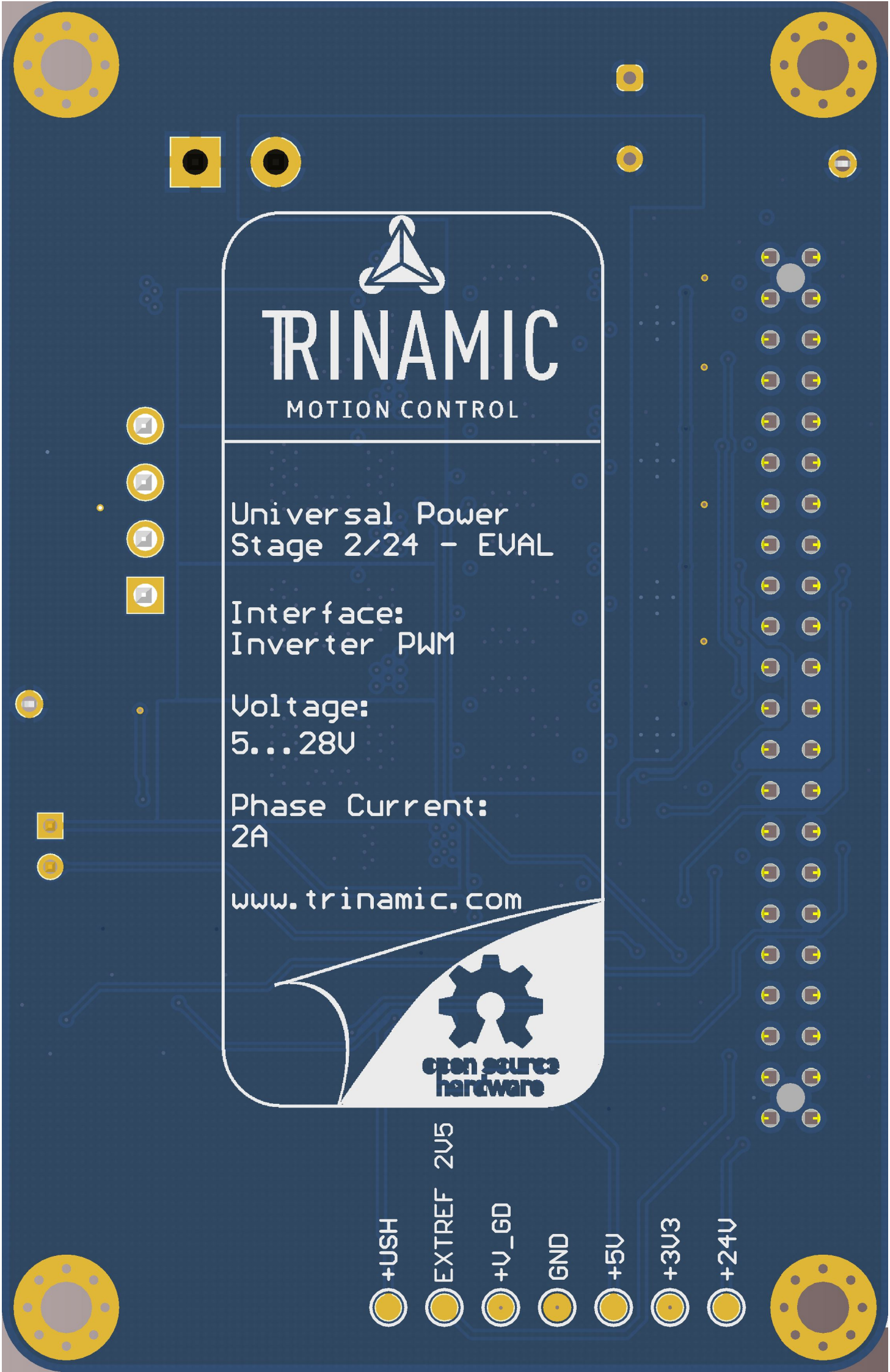
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MOTION CONTROL
Universal Power
Stage 2/24 - EVAL
Interface:
Inverter PWM
Voltage:
5...28V
Phase Current:
2A
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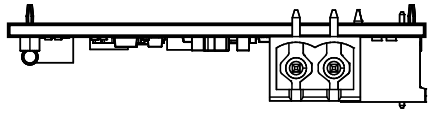
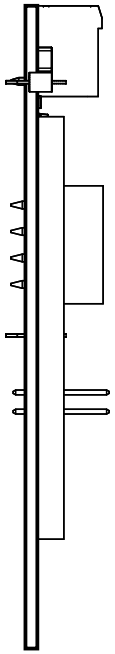
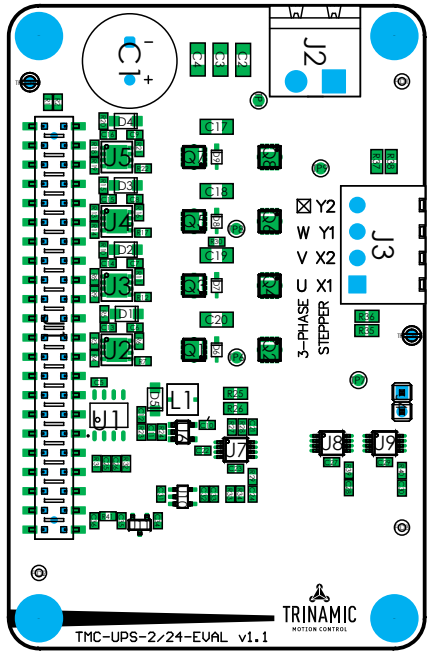
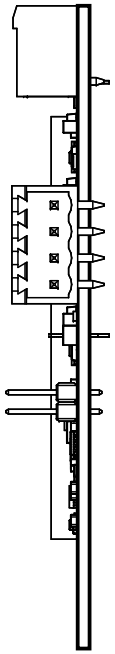
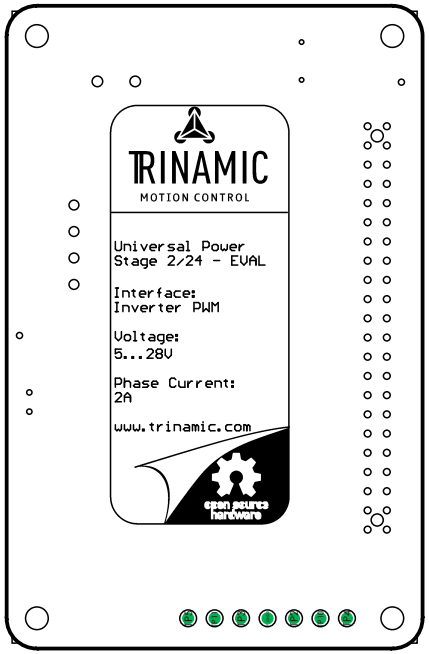
open source
hardware
+USH
EXTREF 2V5
+V_GD
GND
+5V
+3V3
+24V

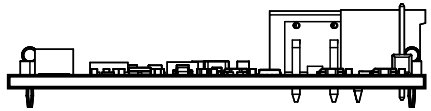












Title	Assembly Drawing		
Size A4	Revision V1.1	Project	UPS 2A/24V EVAL
Date	19.10.2017 10:23		Sheet 1 of 2
File	UPS_2A_EVAL_V11-A.PCBDwf		

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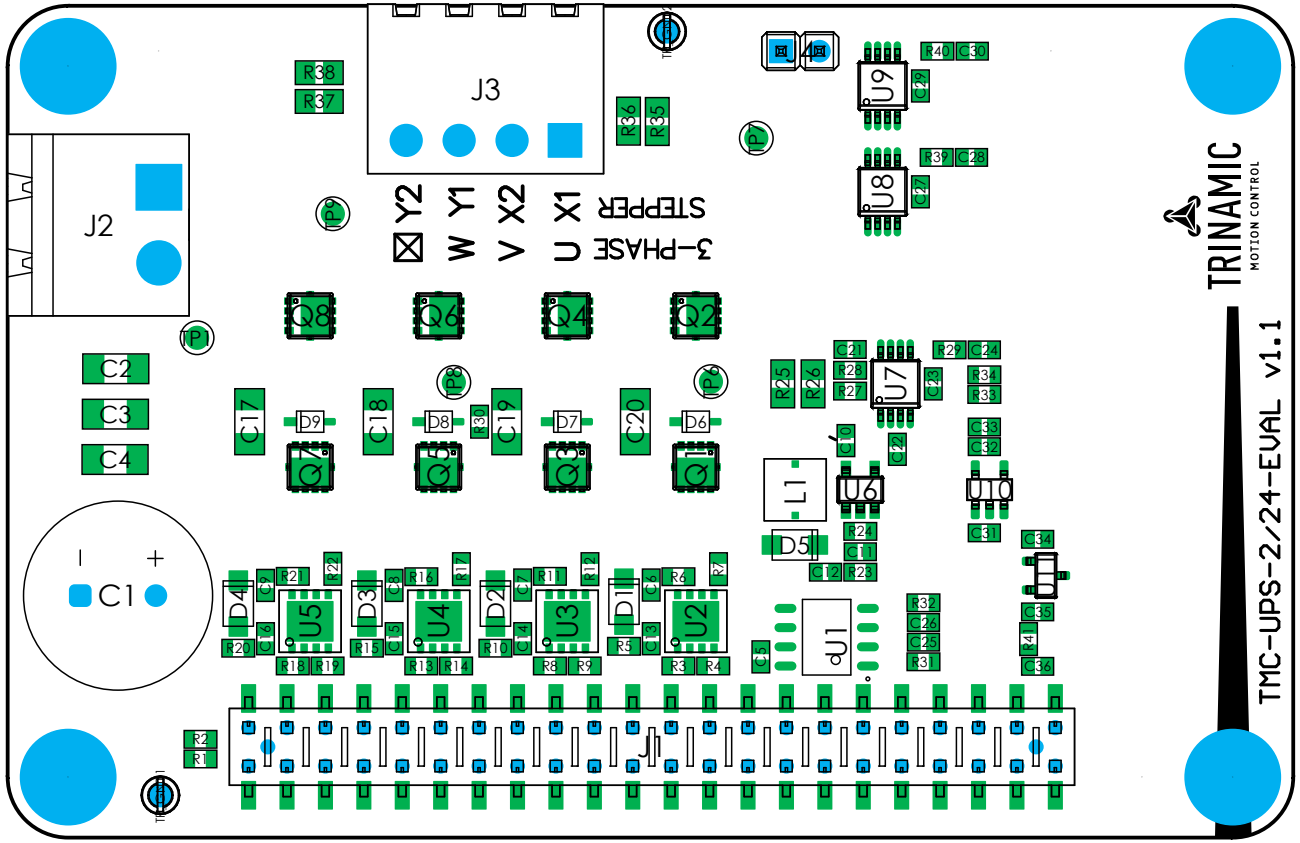
tmc_info@trinamic.com

Top Side View (2:1)



Title	Assembly Drawing		
Size A4	Revision V1.1	Project UPS 2A/24V EVAL	
Date 19.10.2017 10:23		Sheet 2 of 2	
File UPS_2A_EVAL_V11-A.PCBDwf			

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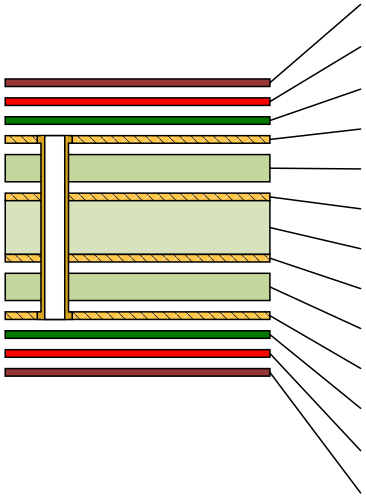
Layer Stack Legend



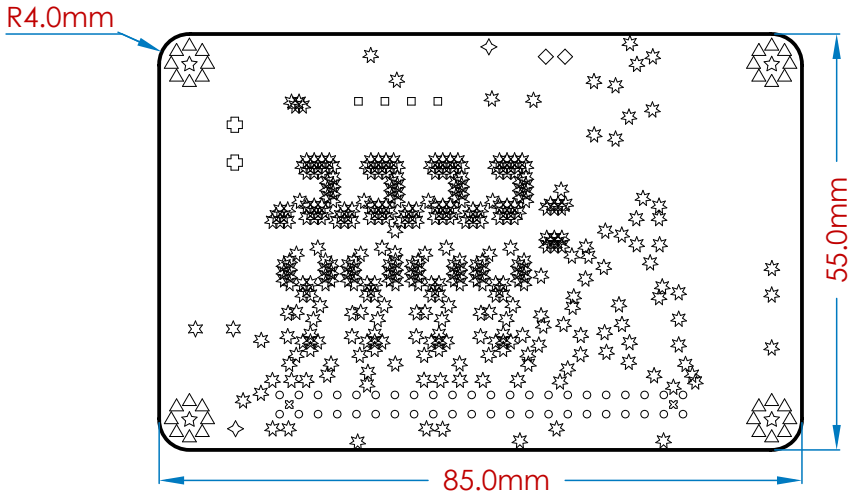
Material	Layer	Thickness	Gerber
	Top Paste		GTP
	Top Overlay		GTO
Surface Material	Top Soldermask	0.010mm	GTS
Copper	Top Layer	0.035mm	GTL
Prepreg		*0.360mm*	
Copper	Mid1	0.036mm	G1
Core		*0.710mm*	
Copper	Mid2	0.036mm	G2
Prepreg		*0.360mm*	
Copper	Bottom Layer	0.035mm	GBL
Surface Material	Bottom Soldermask	0.010mm	GBS
	Bottom Overlay		GBO
	Bottom Paste		GBP

Total thickness: 1.592mm

Notes:

1. Use current revision of all standards.
2. Board is to be manufactured in accordance to IPC-6012 Class 2.
3. Laminate (core) and prepreg to be in accordance with IPC-4101/126
4. Board finish shall be ENIG
5. Soldermask colour shall be WHITE
6. Silkscreen colour shall be BLACK
7. All hole dimensions apply after plating
8. All copper dimensions apply after plating

Drill Drawing View (Scale 1:1)



Drill Table

Symbol	Count	Hole Size	Plated	Via / Pad	Hole Tolerance
✡	379	0.25	Plated	Via	None
△	32	0.60	Plated	Via	None
✡	2	0.80	Plated	Pad	None
◇	2	0.90	Plated	Pad	None
✧	2	1.00	Plated	Pad	None
○	44	1.10	Non-Plated	Pad	None
□	4	1.50	Plated	Pad	None
⌖	2	1.60	Plated	Pad	None
⊠	2	1.80	Non-Plated	Pad	None
☆	4	3.20	Plated	Pad	None
	473 Total				

Title	Fabrication Drawing		
Size A4	Revision V1.1	Project UPS 2A/24V EVAL	
Date	19.10.2017 10:24	Sheet 1 of 4	
File	UPS_2A_EVAL_V11-F.PCBDwf		

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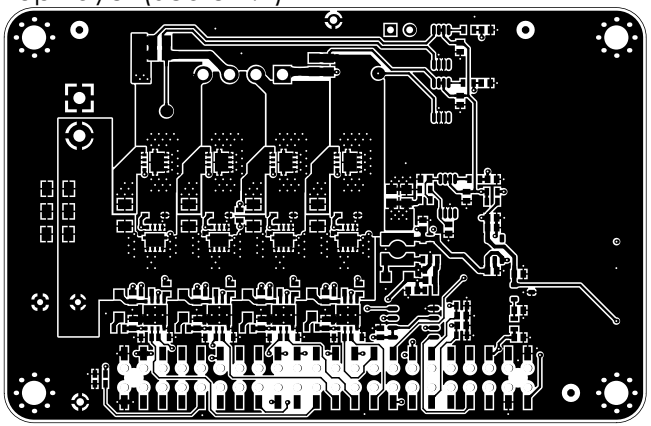
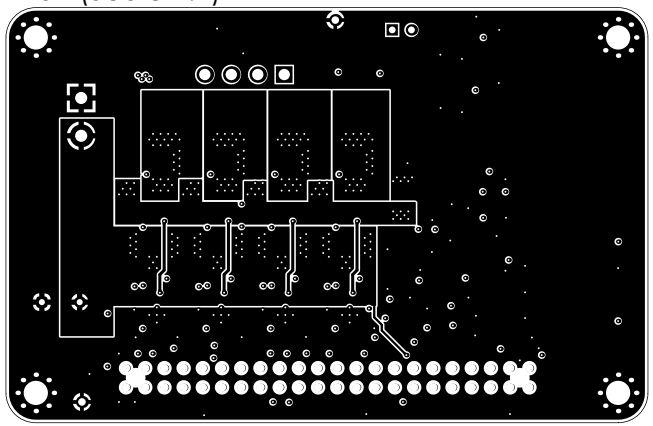
Germany
tmc_info@trinamic.com

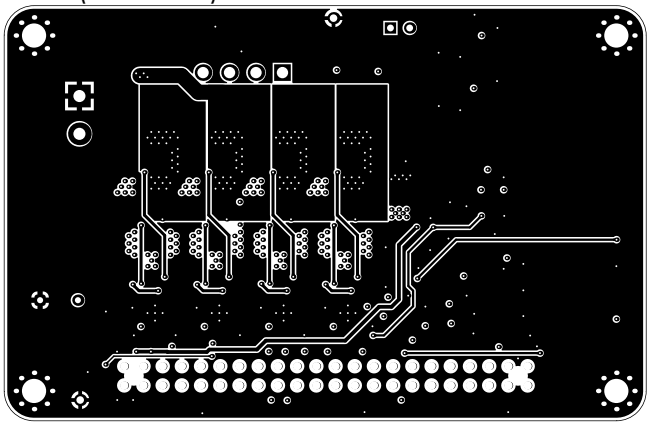
Top Layer (Scale 1:1)



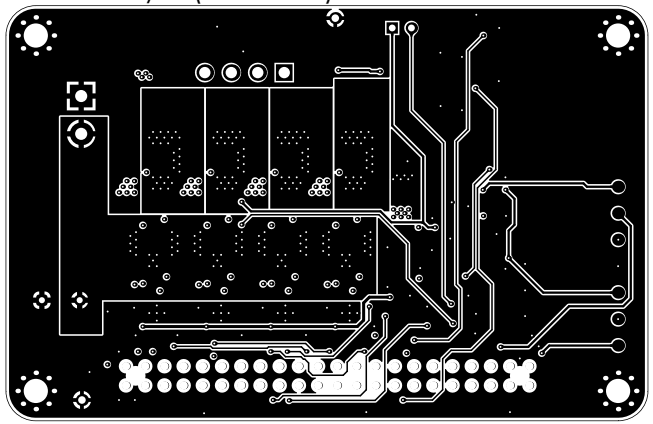
Mid1 (Scale 1:1)



Mid2 (Scale 1:1)



Bottom Layer (Scale 1:1)



Title	Fabrication Drawing		
Size A4	Revision V1.1	Project UPS 2A/24V EVAL	
Date 19.10.2017 10:24			Sheet 2 of 4
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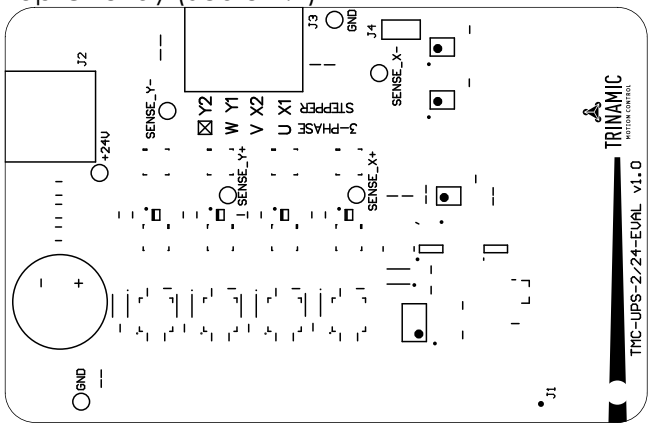
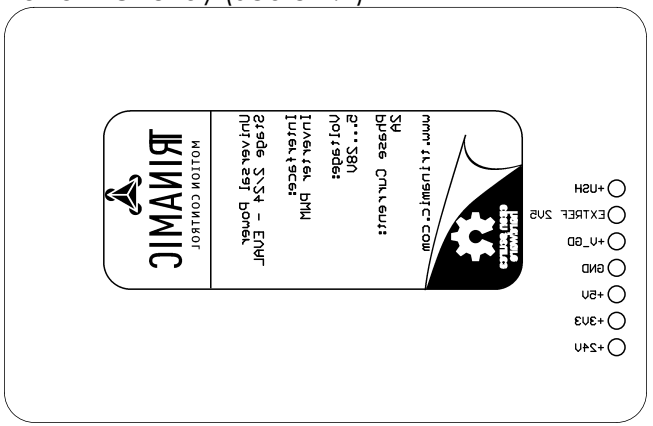
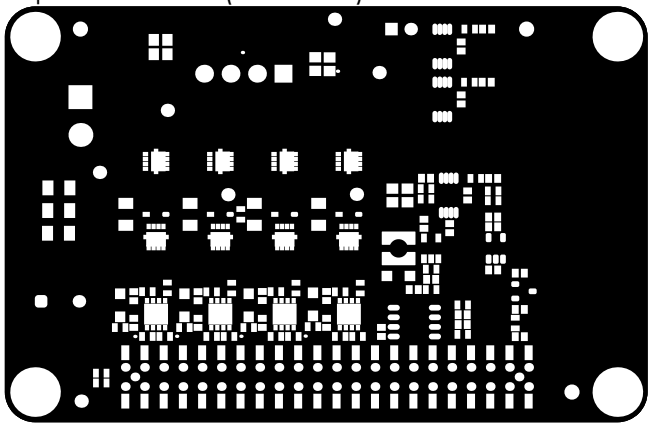
Top Overlay (Scale 1:1)



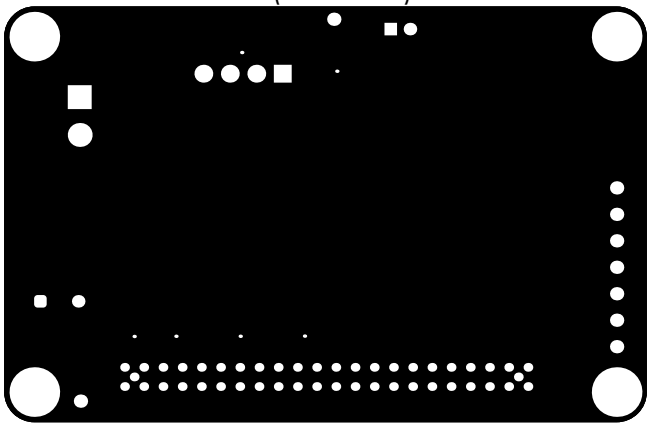
Bottom Overlay (Scale 1:1)



Top Soldermask (Scale 1:1)



Bottom Soldermask (Scale 1:1)



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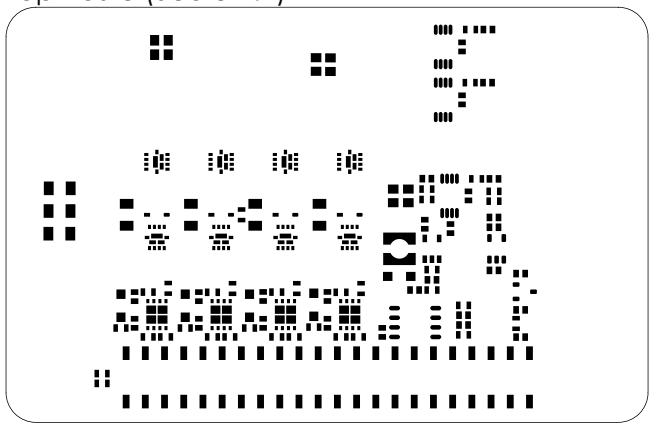
Top Paste (Scale 1:1)



Bottom Paste (Scale 1:1)

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