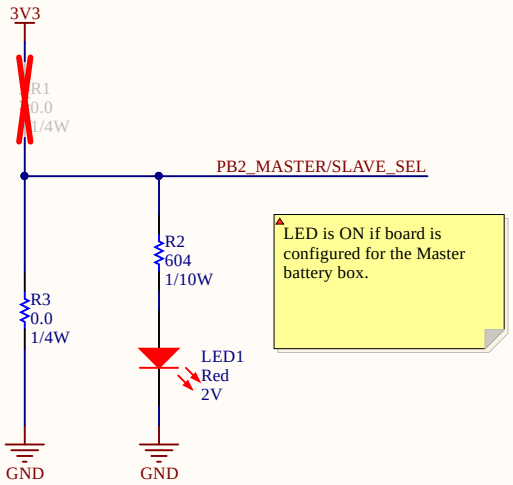
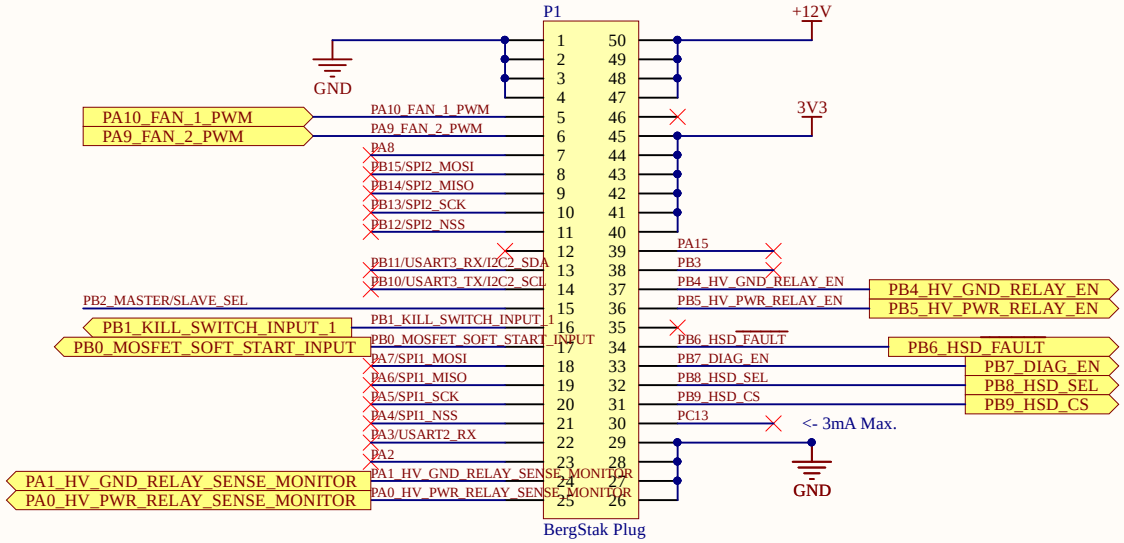
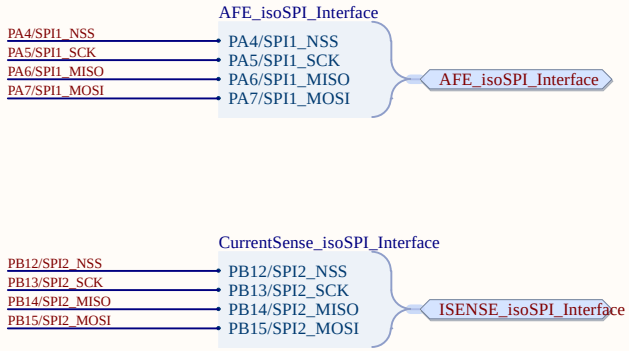


Controller Board





Project: ***BMS_Carrier_Board.PrjPcb***		MIDNIGHT SUN
Title: **Controller Board Interface**		
Project Lead: Aashmika Mali & Liam Hawkins		University of Waterloo 200 University Ave W Waterloo, ON, Canada N2L 3E9
Size: Letter	Revision: 4.0	
Date: 2019-04-06	Sheet 1 of 4	Website: www.uwmidsun.com

Table 4. SPI Modes

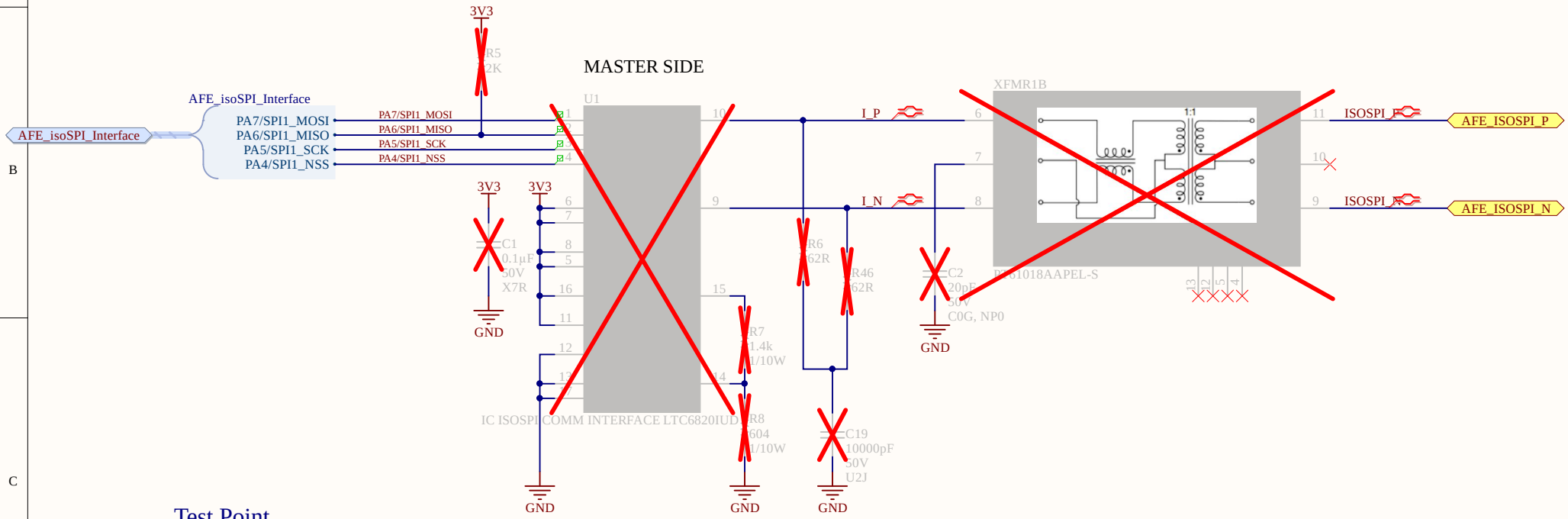
MODE	POL	PHA	DESCRIPTION
0	0	0	SCK Idles Low, Latches on Rising (1st) Edge
1	0	1	SCK Idles Low, Latches on Falling (2nd) Edge
2	1	0	SCK Idles High, Latches on Falling (1st) Edge
3	1	1	SCK Idles High, Latches on Rising (2nd) Edge

SCK idles high, latches on 2nd rising edge

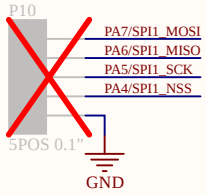
Pulse Drive Current I_IP = 20*I_BIAS = 20mA

Transmitted Differential Signal Amplitude V_A = I_IP*120/2 = 1.2V

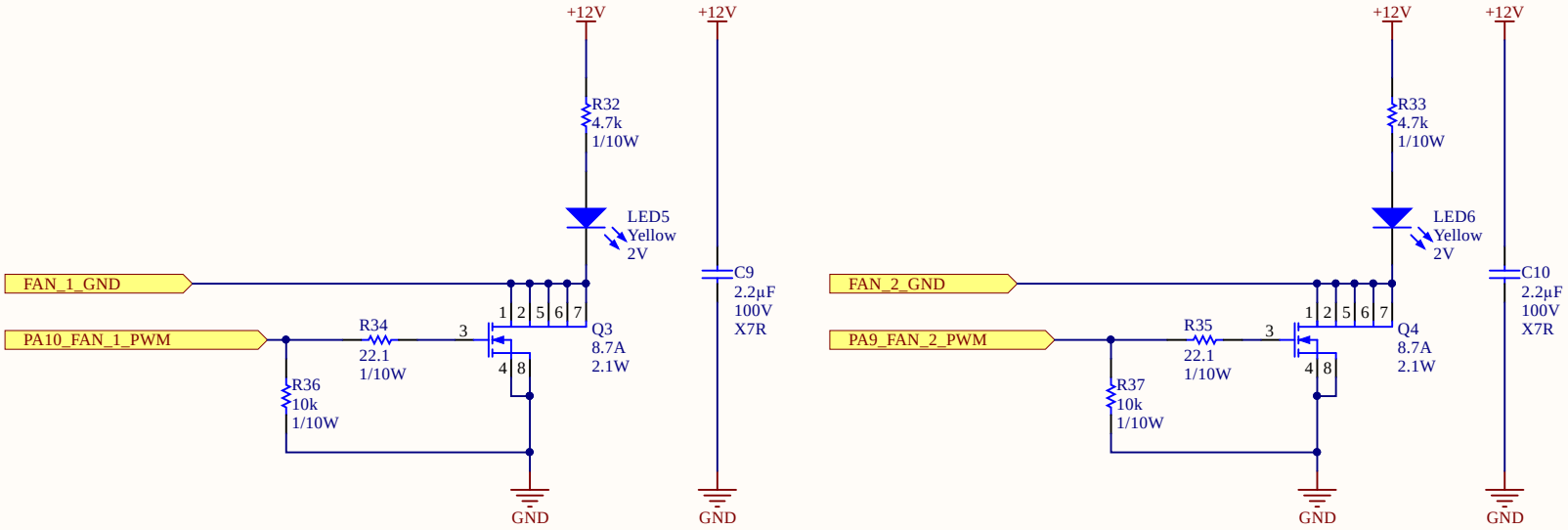
Bias Current I_BIAS can be adjusted from 0.1mA to 1mA
Currently set to 1mA



Test Point

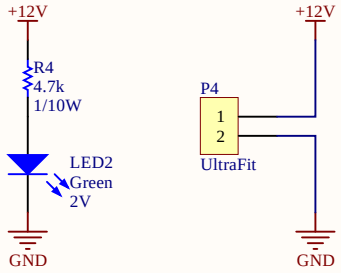


Project: ***BMS_Carrier_Board.PrjPcb***		MIDNIGHT SUN
Title: **BMS Interface**		
Project Lead: Aashmika Mali & Liam Hawkins		University of Waterloo 200 University Ave W Waterloo, ON, Canada N2L 3E9
Size: Letter	Revision: 4.0	
Date: 2019-04-06	Sheet 3 of 4	Website: www.uwmidsun.com

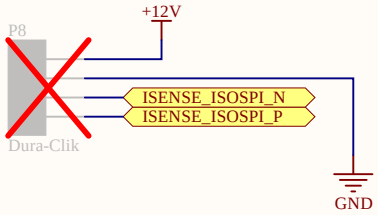


Project: ***BMS_Carrier_Board.PrjPcb***		MIDNIGHT SUN
Title: **BMS Fan and Relay Control**		
Project Lead: Aashmika Mali & Liam Hawkins		University of Waterloo 200 University Ave W Waterloo, ON, Canada N2L 3E9
Size: Letter	Revision: 4.0	
Date: 2019-04-06	Sheet 4 of 4	Website: www.uwmidsun.com

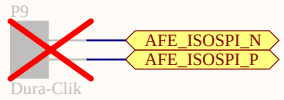
12V Power



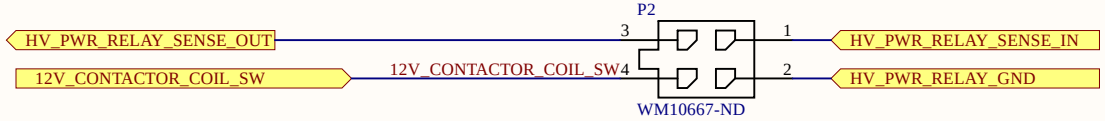
BMS Current Sense

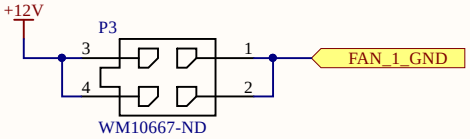


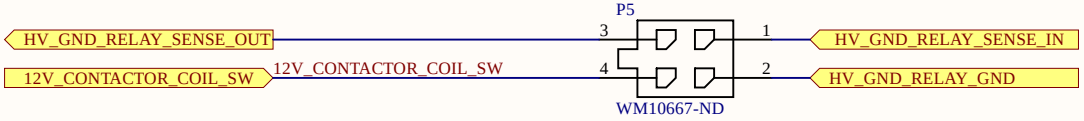
AFE isoSPI

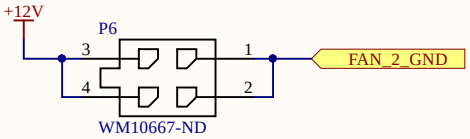


Fan & Relays

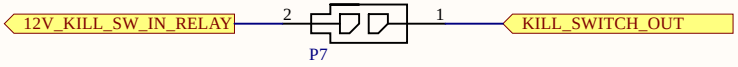








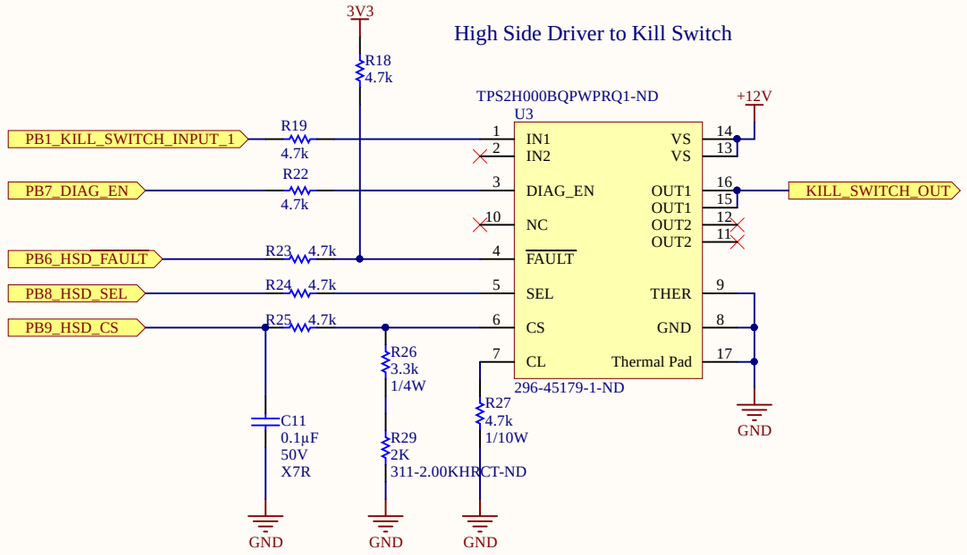
Kill Switch

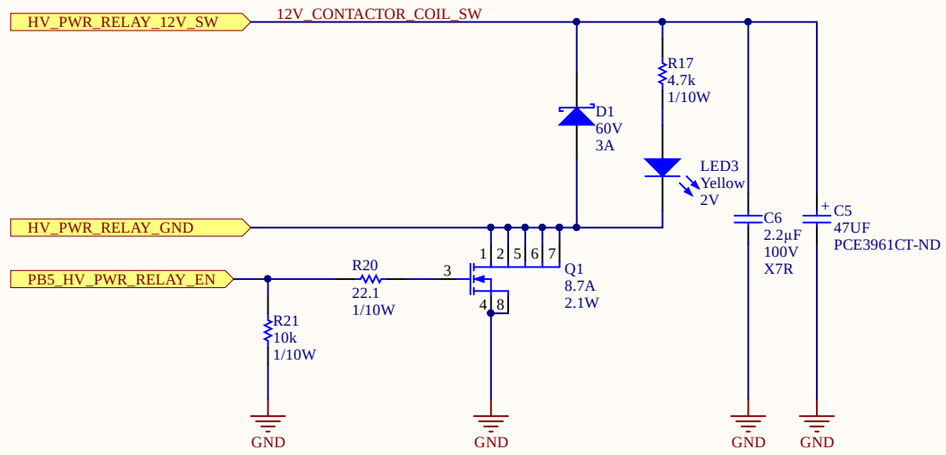


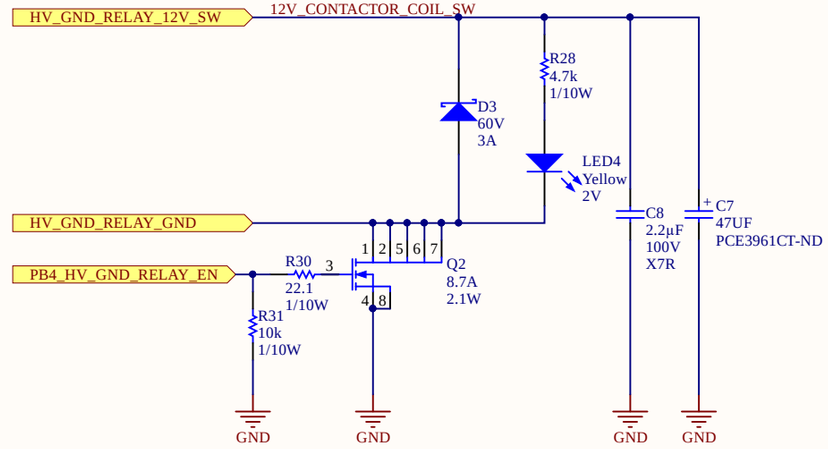
Manually short with a harness for slave

Project: ***BMS_Carrier_Board.PrjPcb***		MIDNIGHT SUN
Title: **BMS Fan and Relay Control**		
Project Lead: Aashmika Mali & Liam Hawkins		University of Waterloo 200 University Ave W Waterloo, ON, Canada N2L 3E9
Size: Letter	Revision: 4.0	
Date: 2019-04-06	Sheet 4 of 4	Website: www.uwmidsun.com

High Side Driver to Kill Switch



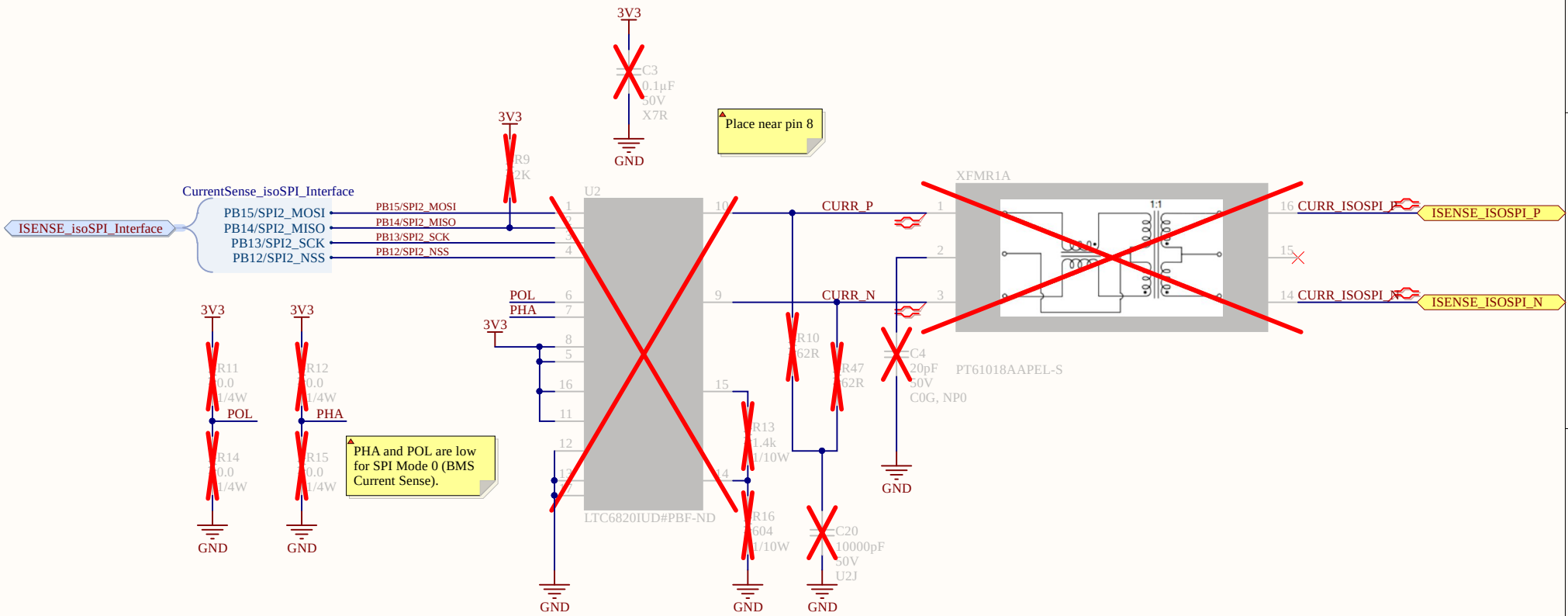




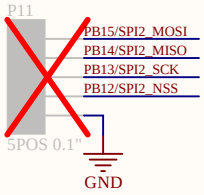
PROJECT	BMS_Carrier_Board.PrjPcb		
DOCUMENT	BMS Fan and Relay Control		
PART NUMBER	MS-ELE0003	VARIANT	BMS Carrier - Slave Battery Box
DRAWN BY	Aashmika Mali & Liam Hawkins	REVISION	4.0
LAST MODIFIED	2019-04-06	SHEET	4 OF 4

MIDNIGHT SUN

Engineering 5 - 1002
University of Waterloo
(519) 888-4567 x32978
hardware@uwmidsun.com

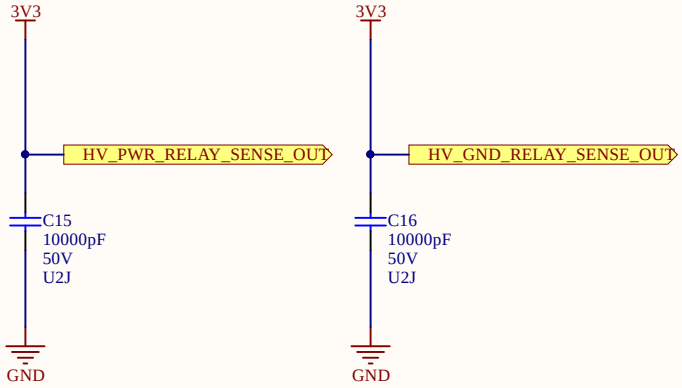


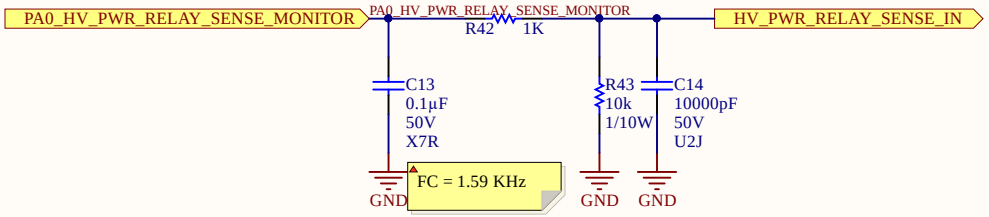
Test Point

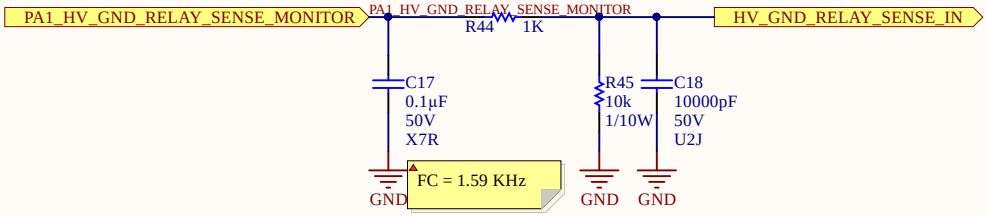


Project: ***BMS_Carrier_Board.PrjPcb***		MIDNIGHT SUN
Title: **Current Sense isoSPI Interface**		
Project Lead: Aashmika Mali & Liam Hawkins		University of Waterloo 200 University Ave W Waterloo, ON, Canada N2L 3E9
Size: Letter	Revision: 4.0	
Date: 2019-04-06	Sheet* of *	Website: www.uwmidsun.com

Firmware Detection State of Contactor





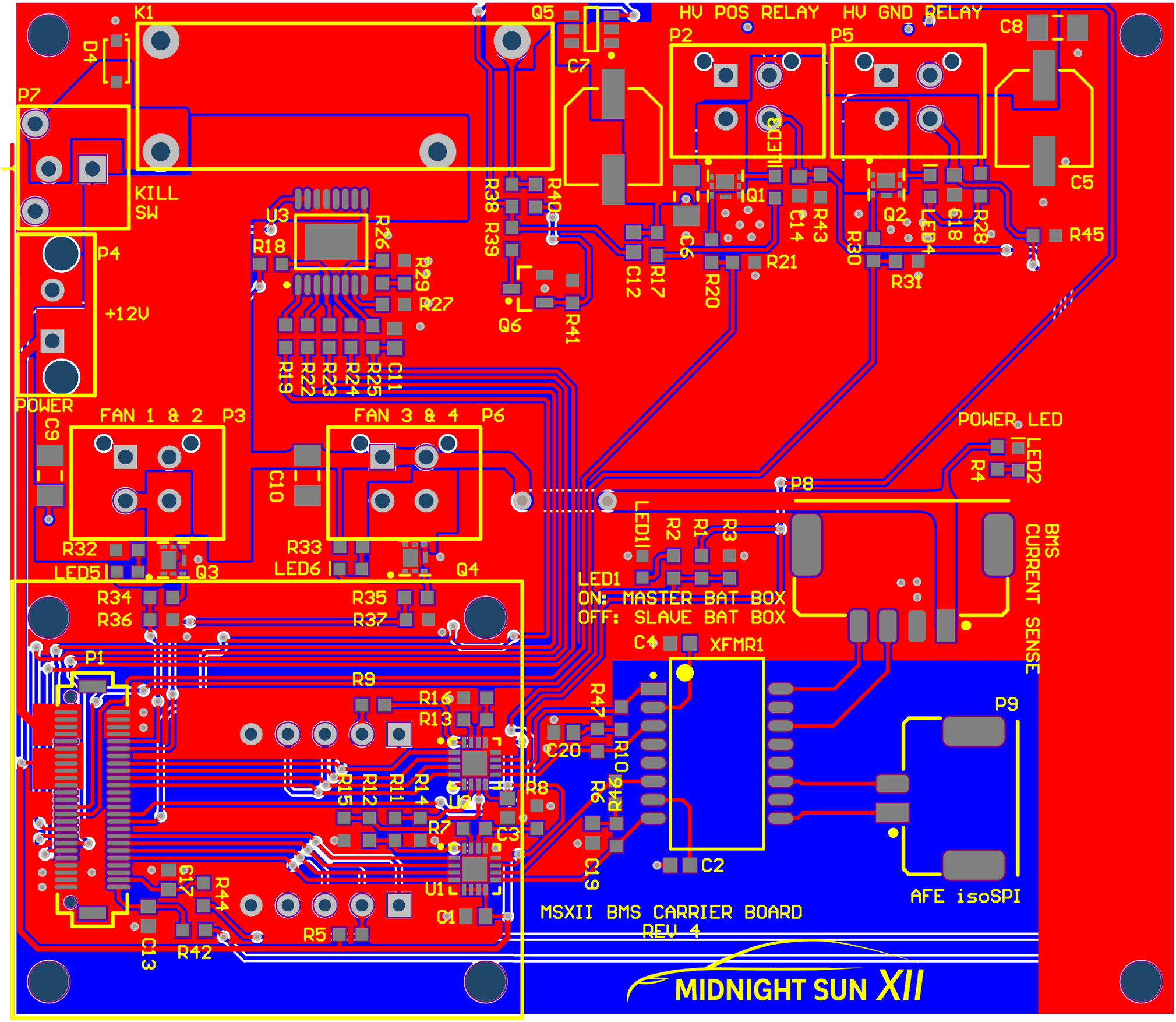


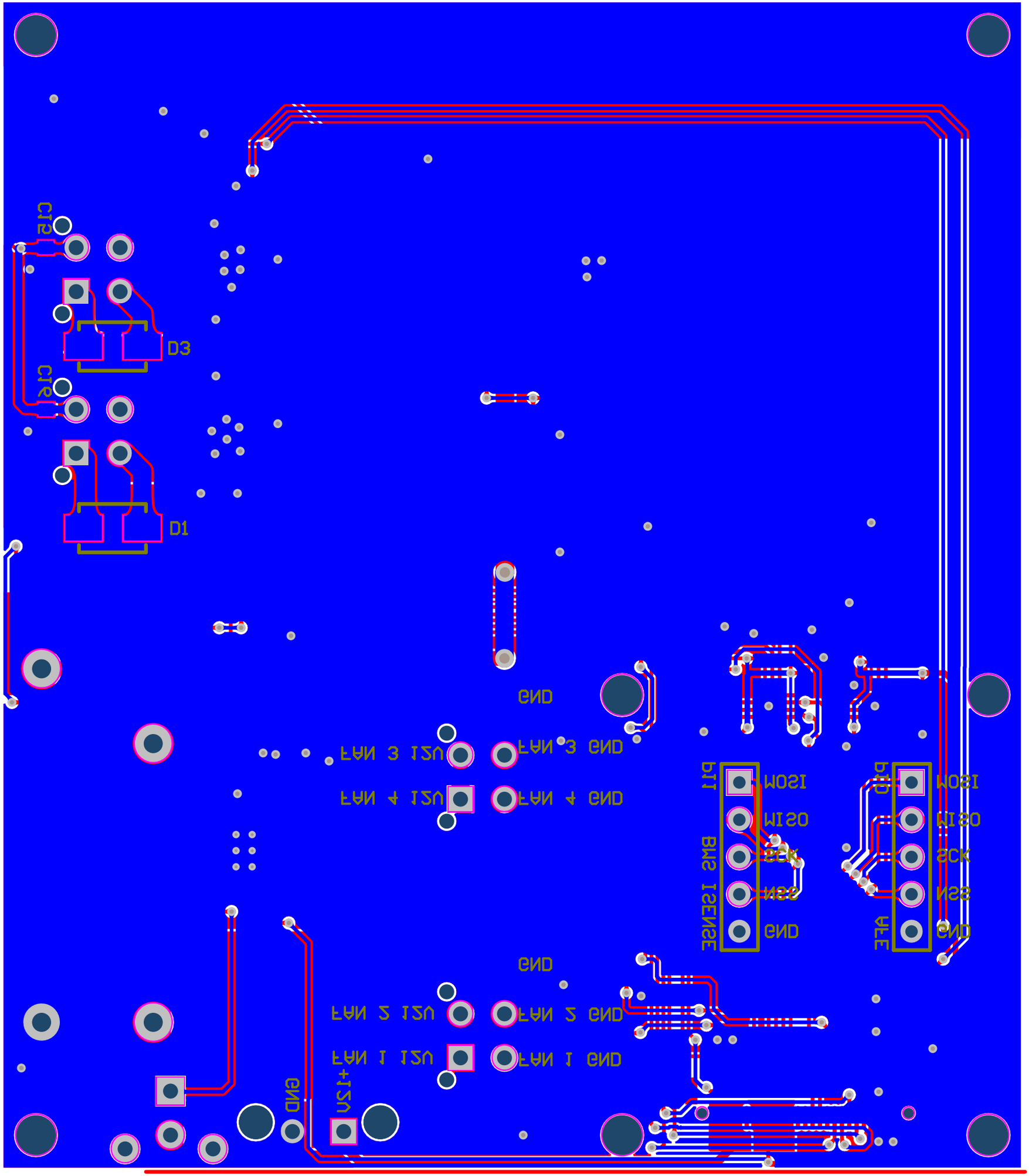
Project: ***BMS_Carrier_Board.PrjPcb***		MIDNIGHT SUN
Title: **Firmware Detection State of Contactor**		
Project Author: Aashmika Mali & Liam Hawkins		University of Waterloo 200 University Ave W Waterloo, ON, Canada N2L 3E9
Size: Letter	Revision: 4.0	
Date: 2019-04-06	Sheet* of *	Website:

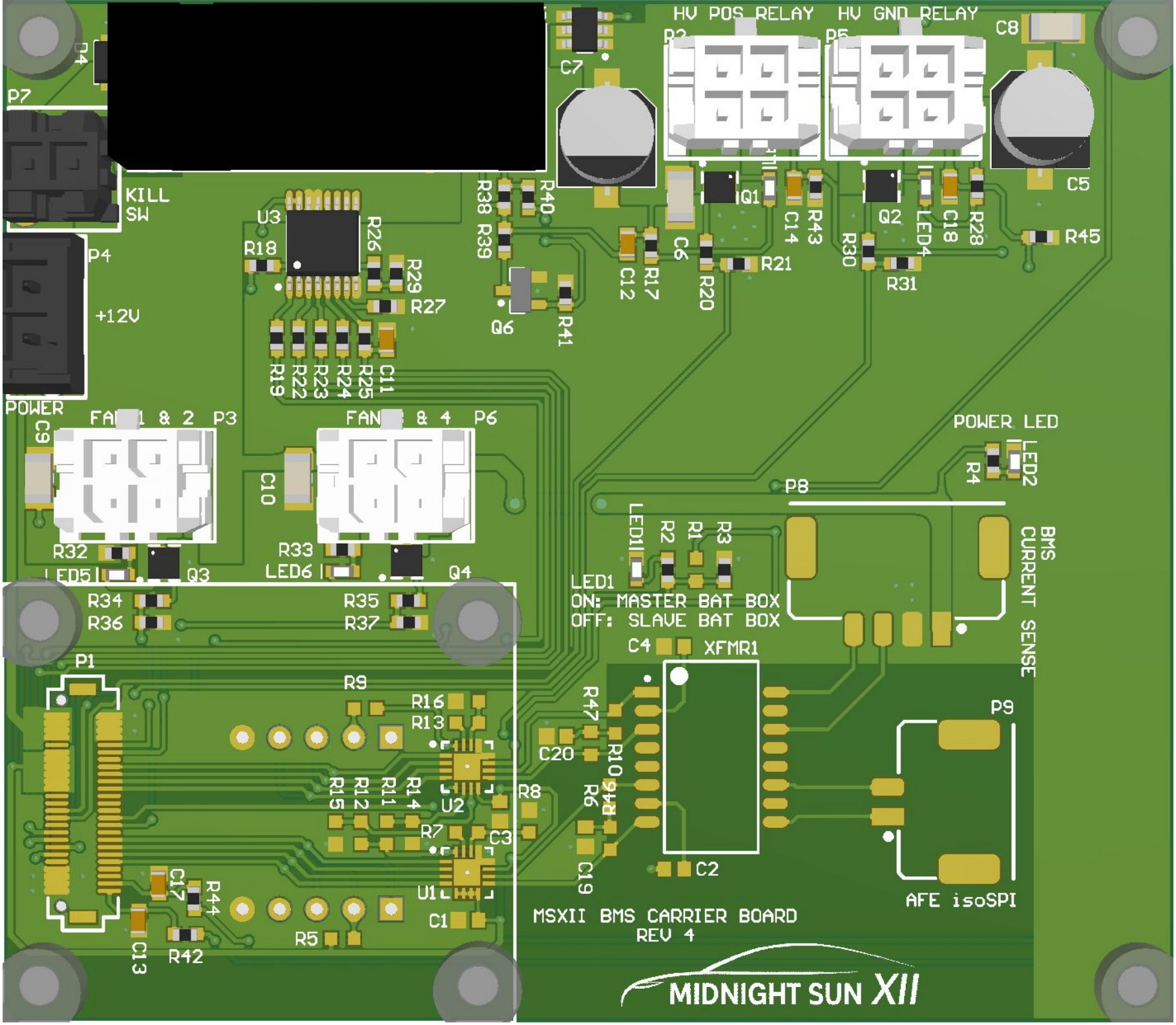
Bill of Materials

Project:	BMS_Carrier_Board.PrjPcb
Revision:	4.0
Project Lead:	Aashmika Mali & Liam Hawkins
Generated On:	2019-04-06 3:25:34 PM
Production Quantity:	1
Currency	CAD
Total Parts Count:	70

LibRef	Designator	Manufacturer 1	Manufacturer Part Number 1	Supplier 1	Supplier Part Number 1	Supplier Unit Price 1	Quantity	Supplier Subtotal 1
CAP ALUM 47UF 20% 35V SMD	C5, C7	Panasonic	EEE1VA470WP	Digi-Key	PCE3961CT-ND	0.55	2	$ 1.10
CAP CER 2.2UF 100V ±20% X7R 1206	C6, C8, C9, C10	Murata	GRM31CR72A225MA73L	Digi-Key	490-12773-1-ND		4	
CAP CER 0.1UF 50V 10% X7R 0603	C11, C13, C17	Kyocera AVX	06035C-104KAT2A	Digi-Key	478-5052-1-ND	0.21	3	$ 0.64
CAP CER 4.7UF 25V 10% X5R 0603	C12	Murata	GRM188R61E475KE11D	Digi-Key	490-7203-1-ND	0.5	1	$ 0.50
CAP CER 10nF 50V 5% X7R 0603	C14, C15, C16, C18	KEMET	C0603C103J5JACTU	Digi-Key	399-13384-1-ND	0.48	4	$ 1.93
DIODE SCHOTTKY 60V 3A SMA	D1, D3	Diodes	B360A-13-F	Digi-Key	B360A-FDICT-ND	0.55	2	$ 1.10
DIODE GEN PURP 100V 300MA SOD123	D4	Diodes Zetex	1N4148WQ-7-F	Digi-Key	1N4148WQ-7-FDICT-ND	0.29	1	$ 0.29
RELAY SPST 12V 8A OMRON	K1	Omron	G6RN-1ADC12	Digi-Key	Z2346-ND	5.45	1	$ 5.45
LED RED CLEAR 2V 0603	LED1	Wurth Electronics	150060RS75000	Digi-Key	732-4978-1-ND	0.19	1	$ 0.19
LED GREEN CLEAR 2V 0603	LED2	Wurth Electronics	150060VS75000	Digi-Key	732-4980-1-ND	0.19	1	$ 0.19
LED YELLOW CLEAR 2.1V 0603	LED3, LED4, LED5, LED6	Wurth Electronics	150060YS75000	Digi-Key	732-4981-1-ND	0.19	4	$ 0.75
CONN 50POS Bergstak Plug 0.02"	P1	Amphenol FCI	10132797-055100LF	Digi-Key	609-5226-1-ND	1.87	1	$ 1.87
CONN 4POS MICRO-FIT 3mm	P2, P3, P5, P6	Molex	0430450427	Digi-Key	WM10667-ND	1.79	4	$ 7.17
CONN 2POS ULTRA-FIT 0.138"	P4	Molex	1722861302	Digi-Key	WM11673-ND	1.95	1	$ 1.95
CONN 2POS MICRO-FIT 3mm	P7	Molex	0430450227	Digi-Key	WM10657-ND	1.12	1	$ 1.12
MOSFET N-CH 30V 8.7A 2.1W 6-PQFN (2x2)	Q1, Q2, Q3, Q4	International Rectifier	IRLHS6342TRPBF	Digi-Key	IRLHS6342TRPBFCT-ND	0.9	4	$ 3.59
MOSFET P-CH 30V 4A 1.6W SOT-23-6	Q5	STMicroelectronics	STT4P3LLH6	Digi-Key	497-15521-1-ND	0.87	1	$ 0.87
MOSFET N-CH 60V 310MA SOT23	Q6	Diodes	DMN65D8L-7	Digi-Key	DMN65D8L-7DICT-ND	0.25	1	$ 0.25
RES 604 OHM 1% 1/10W 0603	R2	Yageo	RC0603FR-07604RL	Digi-Key	311-604HRCT-ND	0.13	1	$ 0.13
RES 0.0 OHM 1/4W 0603	R3, R40	Vishay Dale	CRCW06030000Z0EAHP	Digi-Key	541-0.0SBCT-ND	0.23	2	$ 0.46
RES 4.7K OHM 1% 1/10W 0603	R4, R17, R18, R19, R22, R23, R24, R25, R27, R28, R32, R33	Yageo Phycomp	RC0603FR-074K7L	Digi-Key	311-4.70KHRCT-ND	0.03	12	$ 0.39
RES 22.1 OHM 1% 1/10W 0603	R20, R30, R34, R35	Yageo	RC0603FR-0722R1L	Digi-Key	311-22.1HRCT-ND	0.13	4	$ 0.54
RES 10K OHM 1% 1/10W 0603	R21, R31, R36, R37, R41, R43, R45	Yageo Phycomp	RC0603FR-0710KL	Digi-Key	311-10.0KHRCT-ND	0.13	7	$ 0.94
RES 3.3K OHM 1% 1/4W 0603	R26	Panasonic	ERJPA3F3301V	Digi-Key	P3.3KBYCT-ND	0.21	1	$ 0.21
RES 2K OHM 1% 1/10W 0603	R29	Yageo	RC0603FR-072KL	Digi-Key	311-2.00KHRCT-ND	0.13	1	$ 0.13
RES 330 OHM 1% 1/10W 0603	R38	TE Connectivity	CRGCQ0603F330R	Digi-Key	A129682TR-ND		1	
RES 1K OHM 5% 1/10W 0603	R39, R42, R44	Yageo	RC0603JR-071KL	Digi-Key	311-1.0KGRCT-ND	0.13	3	$ 0.40
IC HSD Dual-Channel 40V 1KOhm	U3	Texas Instruments	TPS2H000BQPWPRQ1	Digi-Key	TPS2H000BQPWPRQ1-ND		1	
							Total:	$ 32.16


K1
Q5
HV POS RELAY
HV GND RELAY
P2
P5
C8
D4
C7
P7
KILL
SW
LED3
C5
Q1
C14
R43
Q2
LED1
C18
R28
R45
U3
R18
R26
R38
R39
R40
C6
R30
R21
R31
P4
+12V
R29
R27
Q6
R41
C12
R17
R20
R19
R22
R23
R24
R25
C11
POWER
C9
FAN 1 & 2
P3
FAN 3 & 4
P6
POWER LED
LED2
R4
C10
P8
LED1
R2
R1
R3
BMS
CURRENT SENSE
R32
R33
LED5
Q3
LED6
Q4
R34
R36
R35
R37
LED1
ON: MASTER BAT BOX
OFF: SLAVE BAT BOX
C4
XFMR1
P1
R9
R16
R13
R47
P9
C20
R10
R46
R6
R8
R15
R12
R11
R14
U2
R7
C3
C17
R44
U1
C19
C2
C1
R5
C13
R42
AFE isoSPI
MSXII BMS CARRIER BOARD
REV 4
MIDNIGHT SUN XII


C12
D3
C14
D1
GND
FAN 3 ISN
FAN 3 GND
FAN 4 ISN
FAN 4 GND
GND
FAN 2 ISN
FAN 2 GND
FAN 1 ISN
FAN 1 GND
GND
+12V
MOSI
MISO
SCK
NSS
GND
SENSE1 SMB
MOSI
MISO
SCK
NSS
GND
SENSE


HV POS RELAY
HV GND RELAY
P7
KILL SW
P4
+12V
POWER
FAN 1 & 2 P3
FAN 3 & 4 P6
POWER LED
LED2
P8
BMS CURRENT SENSE
LED1
ON: MASTER BAT BOX
OFF: SLAVE BAT BOX
XFMR1
P9
AFE isoSPI
MSXII BMS CARRIER BOARD
REV 4
MIDNIGHT SUN XII

Electrical Rules Check Report

Class	Document	Message
Warning	BMS Carrier - Firmware Contactor Control.SchDoc	Global Power-Object 3V3 at 2600mil,5100milhas been reduced to local level by presence of port at 2800mil,4500mil
Warning	Controller_Board_Interface.SchDoc	Net 3V3 has no driving source (Pin C1-1,Pin C3-1,Pin C15-1,Pin C16-1,Pin P1-40,Pin P1-41,Pin P1-42,Pin P1-43,Pin P1-44,Pin P1-45,Pin P2-3,Pin P5-3,Pin R1-1,Pin R5-1,Pin R9-1,Pin R11-1,Pin R12-1,Pin R18-2,Pin U1-5,Pin U1-6,Pin U1-7,Pin U1-8,Pin U1-11,Pin U1-16,Pin U2-5,Pin U2-8,Pin U2-11,Pin U2-16)
Error	BMS Carrier - Connectors.SchDoc	Net 12V_CONTACTOR_COIL_SW contains multiple Input Ports (Port 12V_CONTACTOR_COIL_SW,Port 12V_CONTACTOR_COIL_SW)
Error	BMS Carrier - Battery Relay Controls.SchDoc	Net 12V_CONTACTOR_COIL_SW contains multiple Input Ports (Port 12V_CONTACTOR_COIL_SW,Port 12V_CONTACTOR_COIL_SW,Port HV_GND_RELAY_12V_SW,Port HV_PWR_RELAY_12V_SW)
Error	BMS Carrier - Battery Relay Controls.SchDoc	Net 12V_CONTACTOR_COIL_SW contains multiple Input Ports (Port HV_GND_RELAY_12V_SW,Port HV_PWR_RELAY_12V_SW)
Error	BMS Carrier - Battery Relay Controls.SchDoc	Net NetD1_1 contains multiple Input Ports (Port HV_PWR_RELAY_GND,Port HV_PWR_RELAY_GND)
Error	BMS Carrier - Battery Relay Controls.SchDoc	Net NetD3_1 contains multiple Input Ports (Port HV_GND_RELAY_GND,Port HV_GND_RELAY_GND)
Error	BMS Carrier - Fan Controls.SchDoc	Net NetLED5_2 contains multiple Input Ports (Port FAN_1_GND,Port FAN_1_GND)
Error	BMS Carrier - Fan Controls.SchDoc	Net NetLED6_2 contains multiple Input Ports (Port FAN_2_GND,Port FAN_2_GND)
Error	BMS Carrier - Fan Controls.SchDoc	Net PA9_FAN_2_PWM contains multiple Input Ports (Port PA9_FAN_2_PWM,Port PA9_FAN_2_PWM)
Error	BMS Carrier - Fan Controls.SchDoc	Net PA10_FAN_1_PWM contains multiple Input Ports (Port PA10_FAN_1_PWM,Port PA10_FAN_1_PWM)
Warning	Controller_Board_Interface.SchDoc	Net PB0_MOSFET_SOFT_START_INPUT has no driving source (Pin P1-17)
Error	BMS Carrier - AFE Interface.SchDoc	Net PB0_MOSFET_SOFT_START_INPUT has only one pin (Pin P1-17)
Warning	BMS Carrier - Battery Relay Controls.SchDoc	Unconnected line (4850mil,2100mil) To (4950mil,2100mil)

Design Rules Verification Report

Filename : C:\Users\Aashmika Mali\Documents\First Year\Midnight Sun\hardware\MSXII_BM

Warnings 0
Rule Violations 99

Warnings	
Total	0

Rule Violations	
Clearance Constraint (Gap=0.152mm) (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=0.203mm) (Max=2.54mm) (Preferred=0.203mm) (All)	0
Power Plane Connect Rule(Direct Connect)(Expansion=0.508mm) (Conductor Width=0.254mm) (Air Gap=0.254mm)	0
Hole Size Constraint (Min=0.025mm) (Max=5.08mm) (All)	0
Hole To Hole Clearance (Gap=0.254mm) (All),(All)	0
Minimum Solder Mask Sliver (Gap=0.254mm) (All),(All)	99
Silk To Solder Mask (Clearance=0.254mm) (Disabled)(IsPad),(All)	0
Silk to Silk (Clearance=0.254mm) (Disabled)(All),(All)	0
Net Antennae (Tolerance=0mm) (All)	0
Height Constraint (Min=0mm) (Max=25.4mm) (Prefered=12.7mm) (All)	0
Total	99

Minimum Solder Mask Sliver (Gap=0.254mm) (All),(All)
Minimum Solder Mask Sliver Constraint: (0.244mm < 0.254mm) Between Pad C13-1(9.324mm,7.675mm) on Top Layer And Pad C17-1(10.7mm,8.825mm)
Minimum Solder Mask Sliver Constraint: (0.105mm < 0.254mm) Between Pad P1-(4mm,22.05mm) on Multi-Layer And Pad P1-(5.5mm,22.8mm) on Top Layer
Minimum Solder Mask Sliver Constraint: (0.105mm < 0.254mm) Between Pad P1-(4mm,7.95mm) on Multi-Layer And Pad P1-(5.5mm,7.2mm) on Top Layer
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q1-1(48.025mm,57.8mm) on Top Layer And Pad Q1-2(48.025mm,57.15mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q1-2(48.025mm,57.15mm) on Top Layer And Pad Q1-3(48.025mm,56.5mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q1-3(48.025mm,56.5mm) on Top Layer And Pad Q1-7(48.95mm,57.445mm)
Minimum Solder Mask Sliver Constraint: (0.202mm < 0.254mm) Between Pad Q1-3(48.025mm,56.5mm) on Top Layer And Pad Q1-8(48.95mm,56.641mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q1-4(49.875mm,56.5mm) on Top Layer And Pad Q1-5(49.875mm,57.15mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q1-4(49.875mm,56.5mm) on Top Layer And Pad Q1-7(48.95mm,57.445mm)
Minimum Solder Mask Sliver Constraint: (0.202mm < 0.254mm) Between Pad Q1-4(49.875mm,56.5mm) on Top Layer And Pad Q1-8(48.95mm,56.641mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q1-5(49.875mm,57.15mm) on Top Layer And Pad Q1-6(49.875mm,57.8mm)
Minimum Solder Mask Sliver Constraint: (0.187mm < 0.254mm) Between Pad Q1-7(48.95mm,57.445mm) on Top Layer And Pad Q1-8(48.95mm,56.641mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q2-1(59.075mm,57.884mm) on Top Layer And Pac
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q2-2(59.075mm,57.234mm) on Top Layer And Pac
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q2-3(59.075mm,56.584mm) on Top Layer And Pad Q2-7(60mm,57.534mm)
Minimum Solder Mask Sliver Constraint: (0.202mm < 0.254mm) Between Pad Q2-3(59.075mm,56.584mm) on Top Layer And Pad Q2-8(60mm,56.494mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q2-4(60.925mm,56.584mm) on Top Layer And Pac
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q2-4(60.925mm,56.584mm) on Top Layer And Pad Q2-7(60mm,57.534mm)
Minimum Solder Mask Sliver Constraint: (0.202mm < 0.254mm) Between Pad Q2-4(60.925mm,56.584mm) on Top Layer And Pad Q2-8(60mm,56.494mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q2-5(60.925mm,57.234mm) on Top Layer And Pac
Minimum Solder Mask Sliver Constraint: (0.187mm < 0.254mm) Between Pad Q2-7(60mm,57.534mm) on Top Layer And Pad Q2-8(60mm,56.494mm) or
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q3-1(10.4mm,30.525mm) on Top Layer And Pad Q3-2(11.05mm,30.525mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q3-2(11.05mm,30.525mm) on Top Layer And Pad Q3-3(11.7mm,30.525mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q3-3(11.7mm,30.525mm) on Top Layer And Pad Q3-7(10.75mm,31.445mm)
Minimum Solder Mask Sliver Constraint: (0.202mm < 0.254mm) Between Pad Q3-3(11.7mm,30.525mm) on Top Layer And Pad Q3-8(11.79mm,31.445mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q3-4(11.7mm,32.375mm) on Top Layer And Pad Q3-5(11.05mm,32.375mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q3-4(11.7mm,32.375mm) on Top Layer And Pad Q3-7(10.75mm,31.445mm)
Minimum Solder Mask Sliver Constraint: (0.202mm < 0.254mm) Between Pad Q3-4(11.7mm,32.375mm) on Top Layer And Pad Q3-8(11.79mm,31.445mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q3-5(11.05mm,32.375mm) on Top Layer And Pad Q3-6(10.48mm,32.375mm)
Minimum Solder Mask Sliver Constraint: (0.187mm < 0.254mm) Between Pad Q3-7(10.75mm,31.45mm) on Top Layer And Pad Q3-8(11.79mm,31.445mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q4-1(26.975mm,30.695mm) on Top Layer And Pac
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q4-2(27.625mm,30.695mm) on Top Layer And Pac
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q4-3(28.275mm,30.695mm) on Top Layer And Pac
Minimum Solder Mask Sliver Constraint: (0.202mm < 0.254mm) Between Pad Q4-3(28.275mm,30.695mm) on Top Layer And Pac
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q4-4(28.275mm,32.545mm) on Top Layer And Pac
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q4-4(28.275mm,32.545mm) on Top Layer And Pac
Minimum Solder Mask Sliver Constraint: (0.202mm < 0.254mm) Between Pad Q4-4(28.275mm,32.545mm) on Top Layer And Pac
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q4-5(27.625mm,32.545mm) on Top Layer And Pac
Minimum Solder Mask Sliver Constraint: (0.187mm < 0.254mm) Between Pad Q4-7(27.325mm,31.62mm) on Top Layer And Pac
Minimum Solder Mask Sliver Constraint: (0.198mm < 0.254mm) Between Pad Q5-1(41.115mm,66.966mm) on Top Layer And Pac
Minimum Solder Mask Sliver Constraint: (0.198mm < 0.254mm) Between Pad Q5-2(41.115mm,67.916mm) on Top Layer And Pac
Minimum Solder Mask Sliver Constraint: (0.198mm < 0.254mm) Between Pad Q5-4(38.385mm,68.866mm) on Top Layer And Pac
Minimum Solder Mask Sliver Constraint: (0.198mm < 0.254mm) Between Pad Q5-5(38.385mm,67.916mm) on Top Layer And Pac
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U1-1(30.325mm,11mm) on Top Layer And Pad U1-17(31.75mm,10.25mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad U1-1(30.325mm,11mm) on Top Layer And Pad U1-2(30.325mm,10.5mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad U1-10(33.175mm,10mm) on Top Layer And Pad U1-11(33.175mm,10.5mm)
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U1-10(33.175mm,10mm) on Top Layer And Pad U1-17(31.75mm,10.25mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad U1-10(33.175mm,10mm) on Top Layer And Pad U1-9(33.175mm,9.5mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad U1-11(33.175mm,10.5mm) on Top Layer And Pad U1-12(33.175mm,11mm)
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U1-11(33.175mm,10.5mm) on Top Layer And Pac
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U1-12(33.175mm,11mm) on Top Layer And Pad U1-17(31.75mm,10.25mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad U1-13(32.5mm,11.675mm) on Top Layer And Pad U1-14(32mm,11.675mm)

Minimum Solder Mask Sliver (Gap=0.254mm) (All),(All)
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U1-13(32.5mm,11.675mm) on Top Layer And Pac
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad U1-14(32mm,11.675mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U1-14(32mm,11.675mm) on Top Layer And Pad U1-15(31.5mm,11.675mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad U1-15(31.5mm,11.675mm) on Top Layer And Pad U1-16(31mm,11.675mm)
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U1-15(31.5mm,11.675mm) on Top Layer And Pac
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U1-16(31mm,11.675mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U1-17(31.75mm,10.25mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U1-17(31.75mm,10.25mm) on Top Layer And Pad U1-2(30.325mm,10.5mm)
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U1-17(31.75mm,10.25mm) on Top Layer And Pad U1-3(30.325mm,10mm)
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U1-17(31.75mm,10.25mm) on Top Layer And Pad U1-4(30.325mm,9.5mm)
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U1-17(31.75mm,10.25mm) on Top Layer And Pad U1-5(31mm,8.825mm)
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U1-17(31.75mm,10.25mm) on Top Layer And Pad U1-6(31.5mm,8.825mm)
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U1-17(31.75mm,10.25mm) on Top Layer And Pad U1-7(32mm,8.825mm)
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U1-17(31.75mm,10.25mm) on Top Layer And Pad U1-8(32.5mm,8.825mm)
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U1-17(31.75mm,10.25mm) on Top Layer And Pad U1-9(33.175mm,9.5mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad U1-2(30.325mm,10.5mm) on Top Layer And Pad U1-3(30.325mm,10mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad U1-3(30.325mm,10mm) on Top Layer And Pad U1-4(30.325mm,9.5mm) or
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad U1-5(31mm,8.825mm) on Top Layer And Pad U1-6(31.5mm,8.825mm) or
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad U1-6(31.5mm,8.825mm) on Top Layer And Pad U1-7(32mm,8.825mm) or
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad U1-7(32mm,8.825mm) on Top Layer And Pad U1-8(32.5mm,8.825mm) or
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U2-1(30.325mm,18.25mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad U2-1(30.325mm,18.25mm) on Top Layer And Pad U2-17(31.75mm,17.5mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad U2-10(33.175mm,17.25mm) on Top Layer And Pac
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U2-10(33.175mm,17.25mm) on Top Layer And Pac
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad U2-10(33.175mm,17.25mm) on Top Layer And Pac
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad U2-11(33.175mm,17.75mm) on Top Layer And Pac
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U2-11(33.175mm,17.75mm) on Top Layer And Pac
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U2-12(33.175mm,18.25mm) on Top Layer And Pac
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad U2-13(32.5mm,18.925mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U2-13(32.5mm,18.925mm) on Top Layer And Pad U2-14(32mm,18.925mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad U2-14(32mm,18.925mm) on Top Layer And Pad U2-17(31.75mm,17.5mm)
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U2-14(32mm,18.925mm) on Top Layer And Pad U2-15(31.5mm,18.925mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad U2-15(31.5mm,18.925mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U2-15(31.5mm,18.925mm) on Top Layer And Pad U2-16(31mm,18.925mm)
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U2-16(31mm,18.925mm) on Top Layer And Pad U2-17(31.75mm,17.5mm)
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U2-17(31.75mm,17.5mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U2-17(31.75mm,17.5mm) on Top Layer And Pad U2-2(30.325mm,17.75mm)
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U2-17(31.75mm,17.5mm) on Top Layer And Pad U2-3(30.325mm,17.25mm)
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U2-17(31.75mm,17.5mm) on Top Layer And Pad U2-4(30.325mm,16.75mm)
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U2-17(31.75mm,17.5mm) on Top Layer And Pad U2-5(31mm,16.075mm)
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U2-17(31.75mm,17.5mm) on Top Layer And Pad U2-6(31.5mm,16.075mm)
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U2-17(31.75mm,17.5mm) on Top Layer And Pad U2-7(32mm,16.075mm)
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U2-17(31.75mm,17.5mm) on Top Layer And Pad U2-8(32.5mm,16.075mm)
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U2-17(31.75mm,17.5mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad U2-2(30.325mm,17.75mm) on Top Layer And Pad U2-9(33.175mm,16.75mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad U2-3(30.325mm,17.25mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad U2-5(31mm,16.075mm) on Top Layer And Pad U2-6(31.5mm,16.075mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad U2-6(31.5mm,16.075mm) on Top Layer And Pad U2-7(32mm,16.075mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad U2-7(32mm,16.075mm) on Top Layer And Pad U2-8(32.5mm,16.075mm)