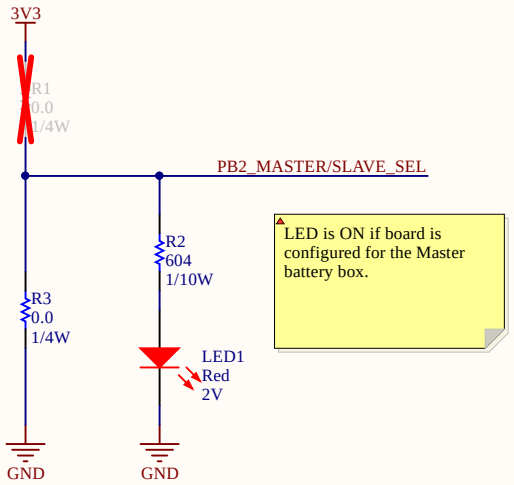
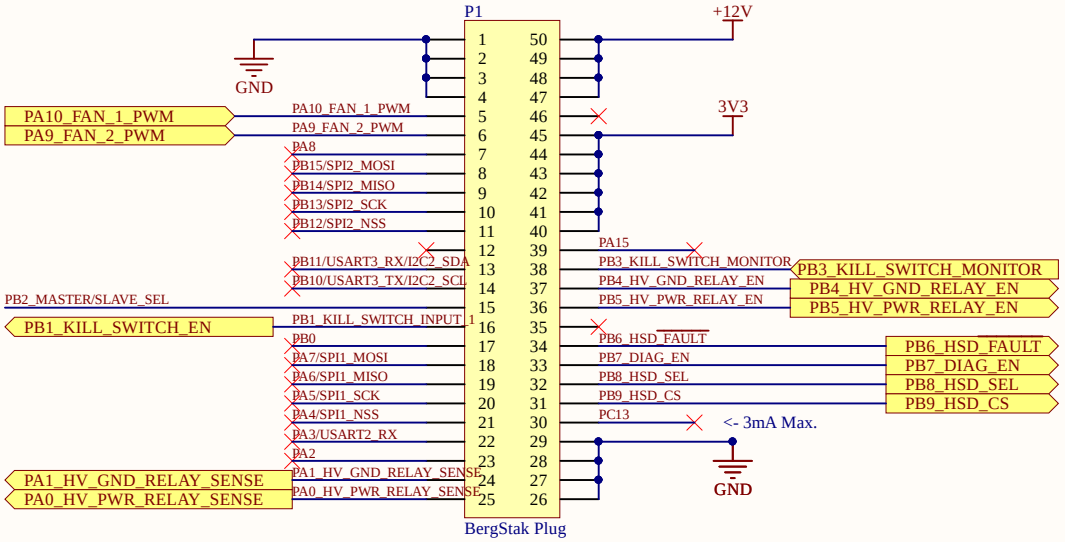
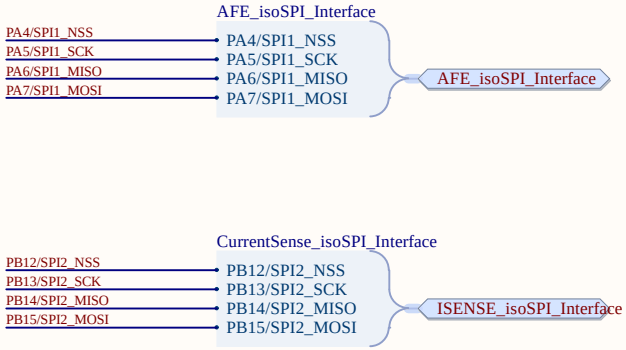


Controller Board





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: 5.0	
Date: 2019-06-12	Sheet 1 of 4	Website: www.uwmidsun.com

Table 4. SPI Modes

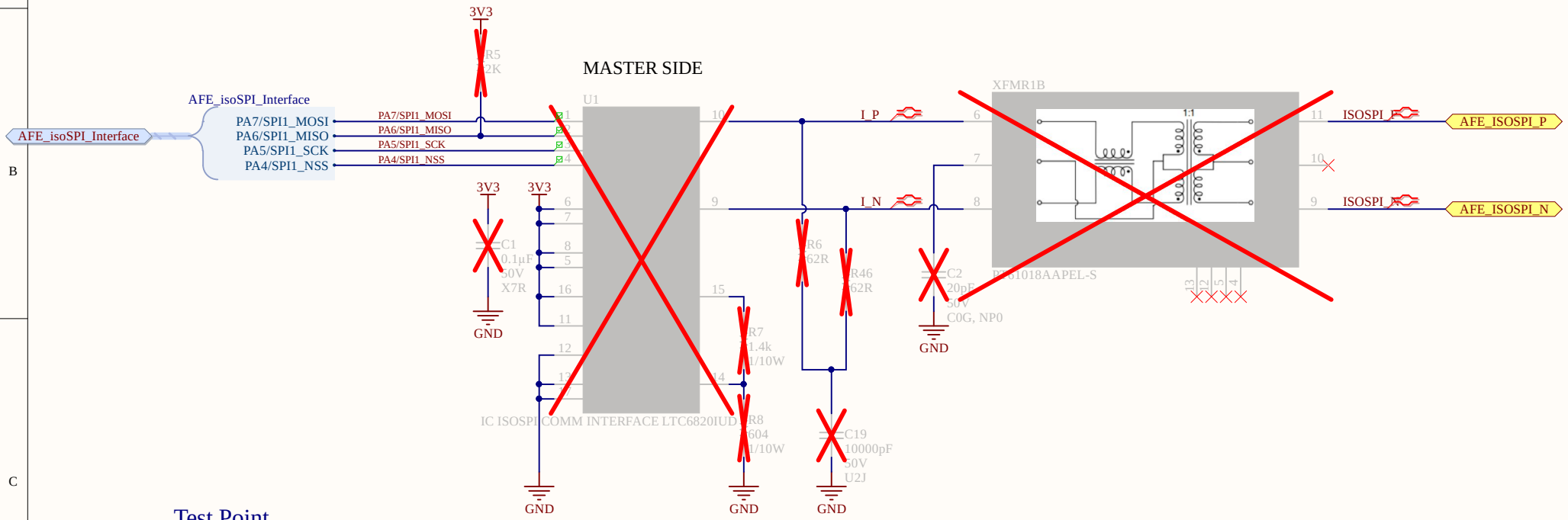
MODE	POL	PHA	DESCRIPTION
0	0	0	SCK Idles Low, Latches on Rising (1st) Edge
1	0	1	SCK Idles Low, Latches on Falling (2nd) Edge
2	1	0	SCK Idles High, Latches on Falling (1st) Edge
3	1	1	SCK Idles High, Latches on Rising (2nd) Edge

SCK idles high, latches on 2nd rising edge

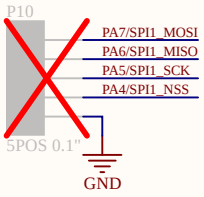
Pulse Drive Current I_IP = 20*I_BIAS = 20mA

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

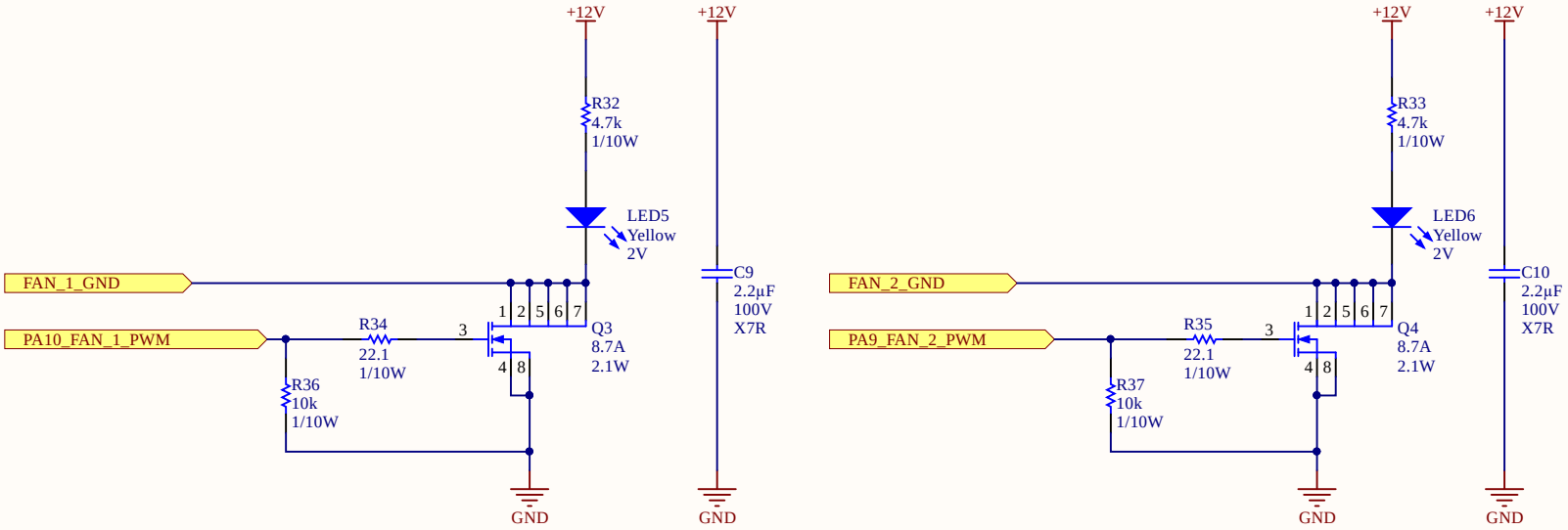
Bias Current I_BIAS can be adjusted from 0.1mA to 1mA
Currently set to 1mA



Test Point

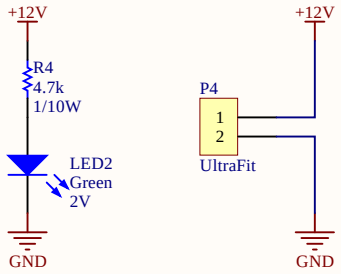


Project: ***BMS_Carrier_Board.PrjPcb***		MIDNIGHT SUN
Title: **BMS Interface**		
Project Lead: Aashmika Mali & Liam Hawkins		University of Waterloo 200 University Ave W Waterloo, ON, Canada N2L 3E9
Size: Letter	Revision: 5.0	
Date: 2019-06-12	Sheet 3 of 4	Website: www.uwmidsun.com

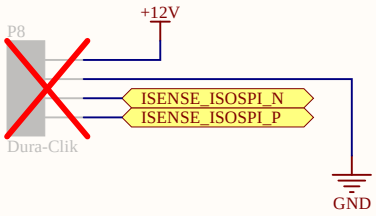


Project: ***BMS_Carrier_Board.PrjPcb***		MIDNIGHT SUN
Title: **BMS Fan and Relay Control**		
Project Lead: Aashmika Mali & Liam Hawkins		University of Waterloo 200 University Ave W Waterloo, ON, Canada N2L 3E9
Size: Letter	Revision: 5.0	
Date: 2019-06-12	Sheet 4 of 4	Website: www.uwmidsun.com

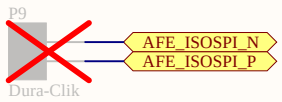
12V Power



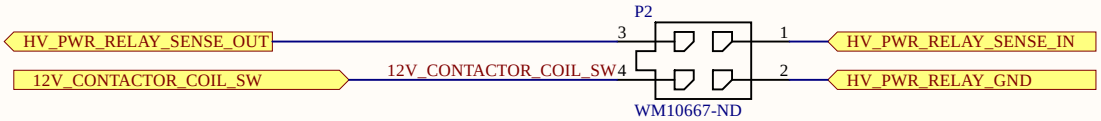
BMS Current Sense

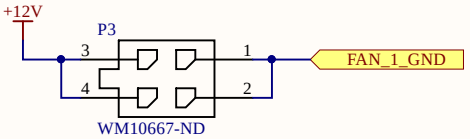


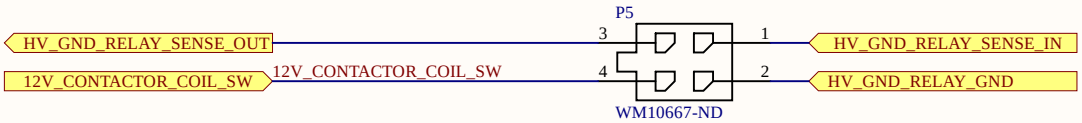
AFE isoSPI

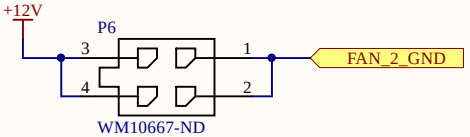


Fan & Relays



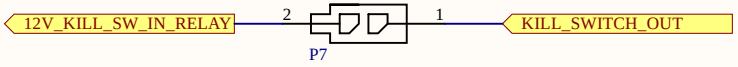






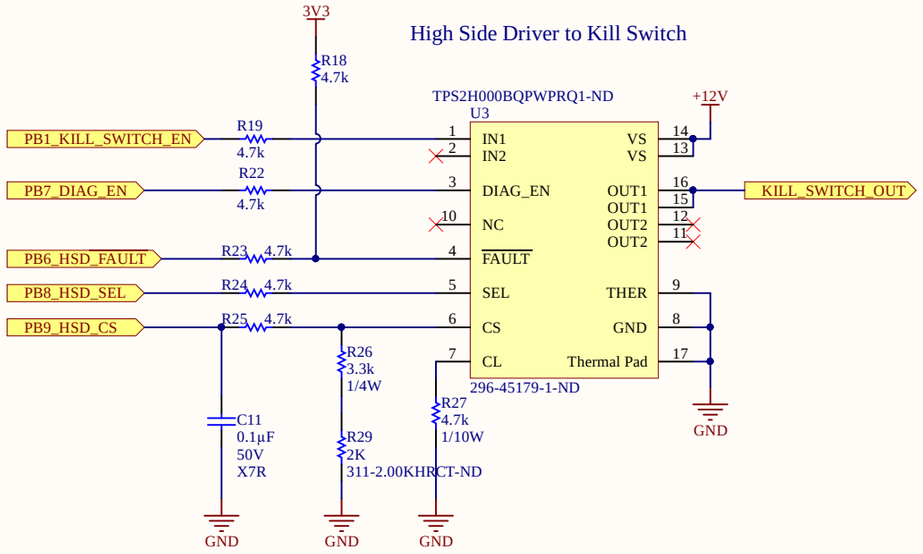
Kill Switch

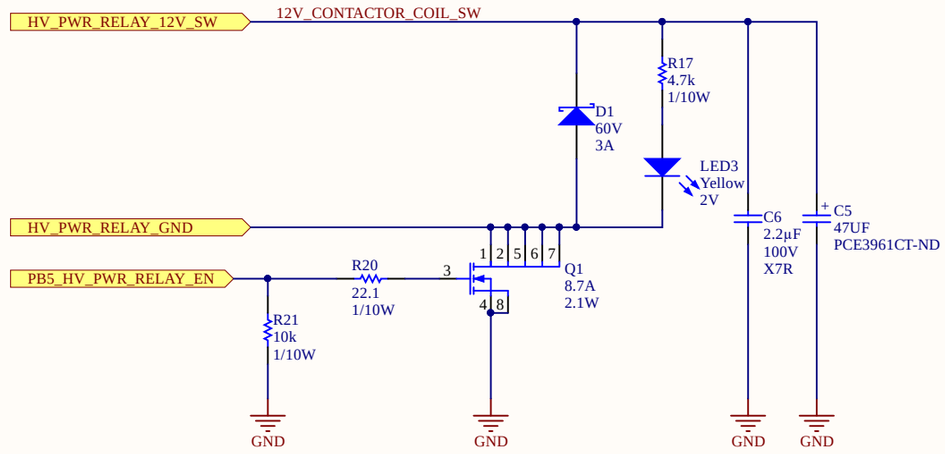
Manually short with a harness for slave



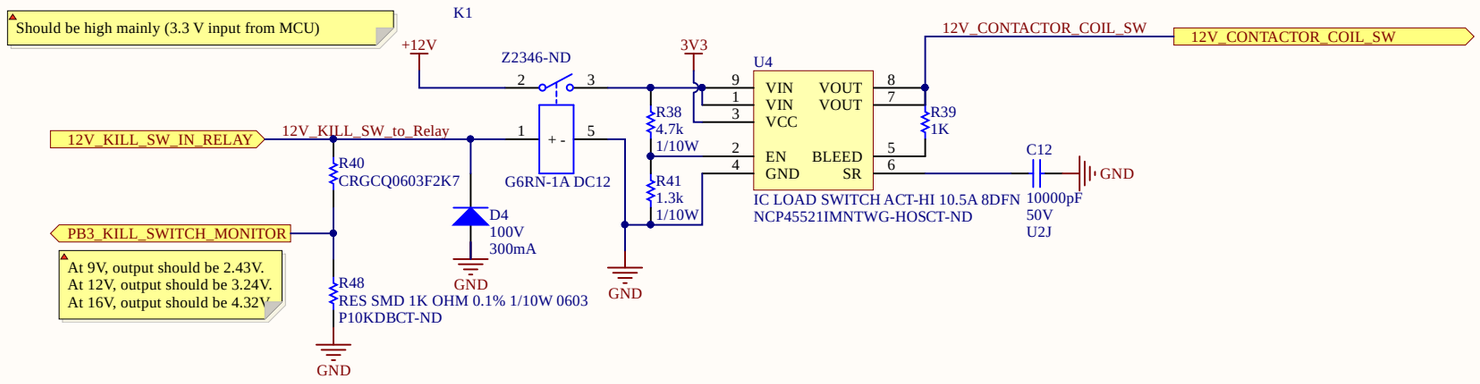
Project: ***BMS_Carrier_Board.PrjPcb***		MIDNIGHT SUN
Title: **BMS Fan and Relay Control**		
Project Lead: Aashmika Mali & Liam Hawkins		University of Waterloo 200 University Ave W Waterloo, ON, Canada N2L 3E9
Size: Letter	Revision: 5.0	
Date: 2019-06-12	Sheet 4 of 4	Website: www.uwmidsun.com

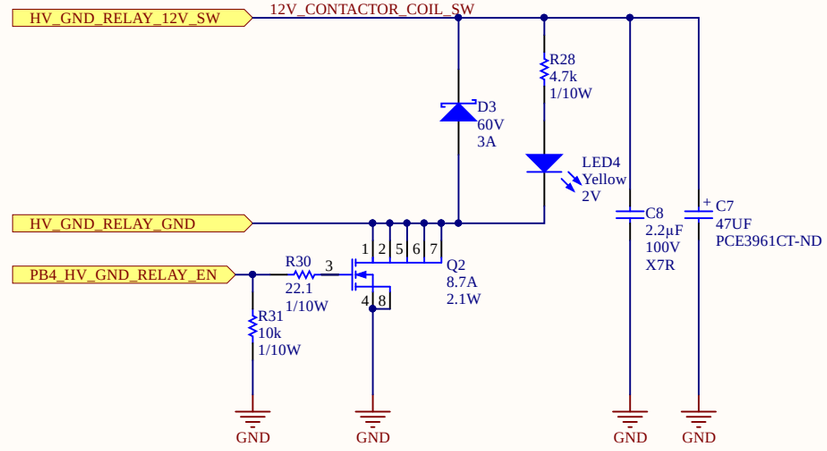
High Side Driver to Kill Switch





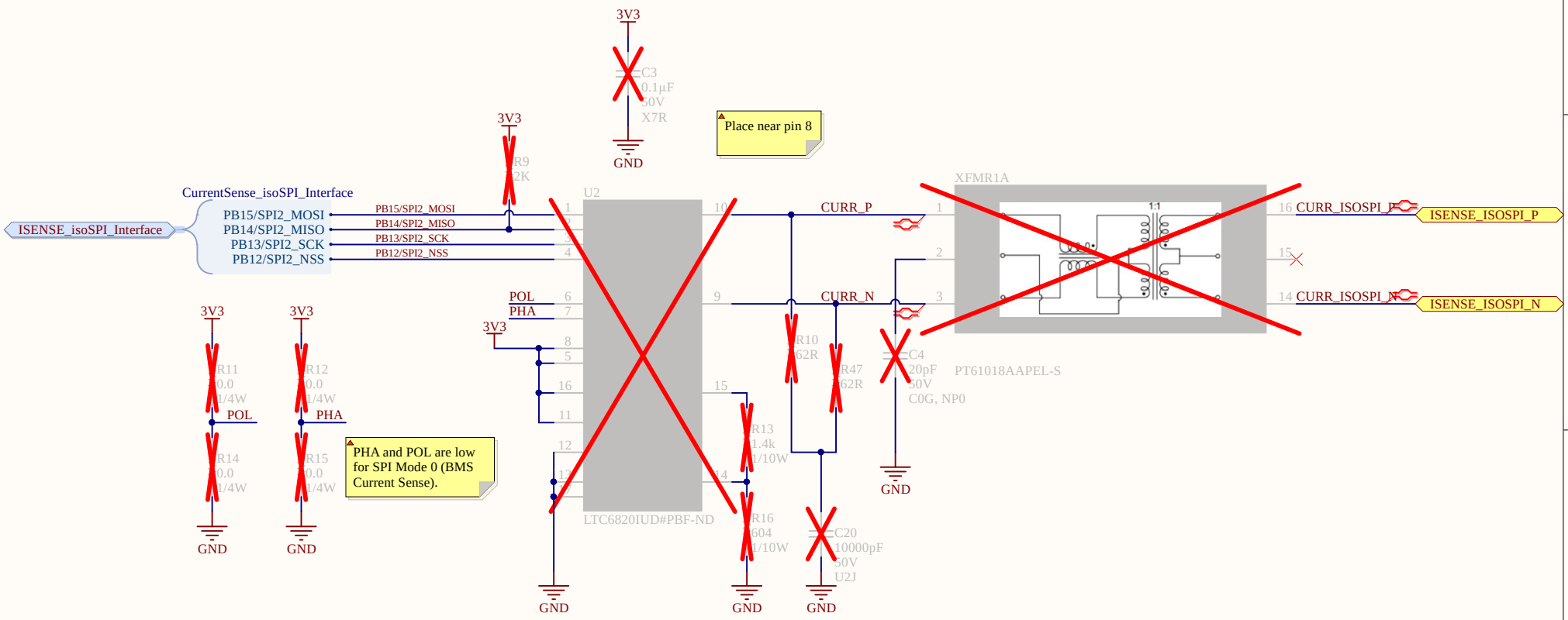
Kill Switch Relay



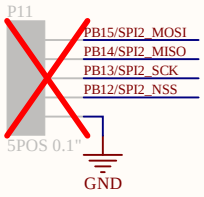


PROJECT	BMS_Carrier_Board.PrjPcb		
DOCUMENT	BMS Fan and Relay Control		
PART NUMBER	MS-ELE0003	VARIANT	BMS Carrier - Slave Battery Box
DRAWN BY	Aashmika Mali & Liam Hawkins	REVISION	5.0
LAST MODIFIED	2019-06-12	SHEET	4 OF 4

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

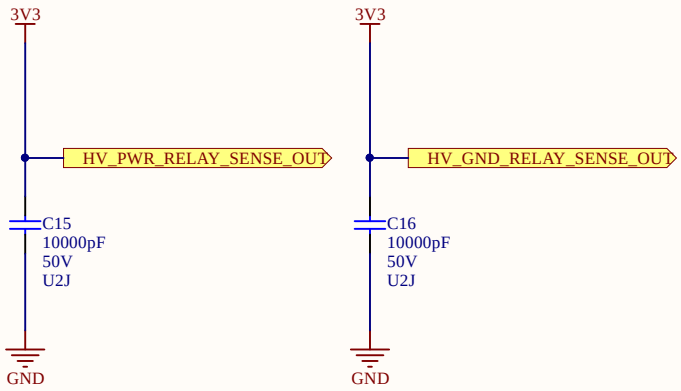


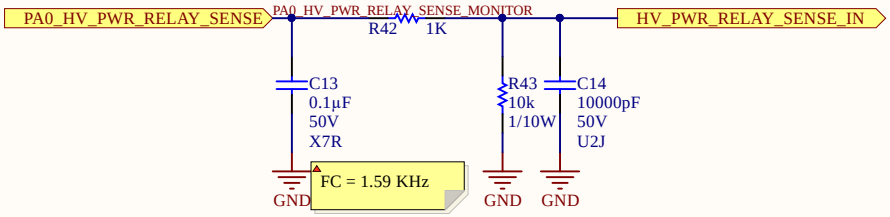
Test Point

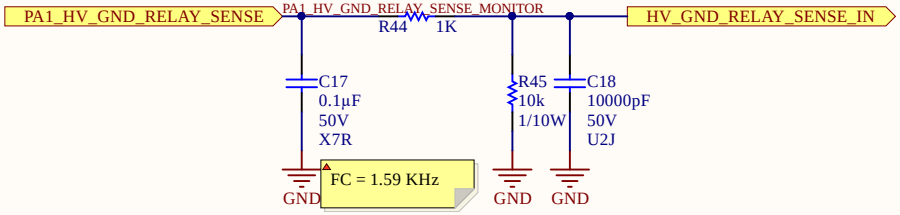


Project: ***BMS_Carrier_Board.PrjPcb***		MIDNIGHT SUN
Title: **Current Sense isoSPI Interface**		
Project Lead: Aashmika Mali & Liam Hawkins		University of Waterloo 200 University Ave W Waterloo, ON, Canada N2L 3E9
Size: Letter	Revision: 5.0	
Date: 2019-06-12	Sheet* of *	Website: www.uwmidsun.com

Firmware Detection State of Contactor





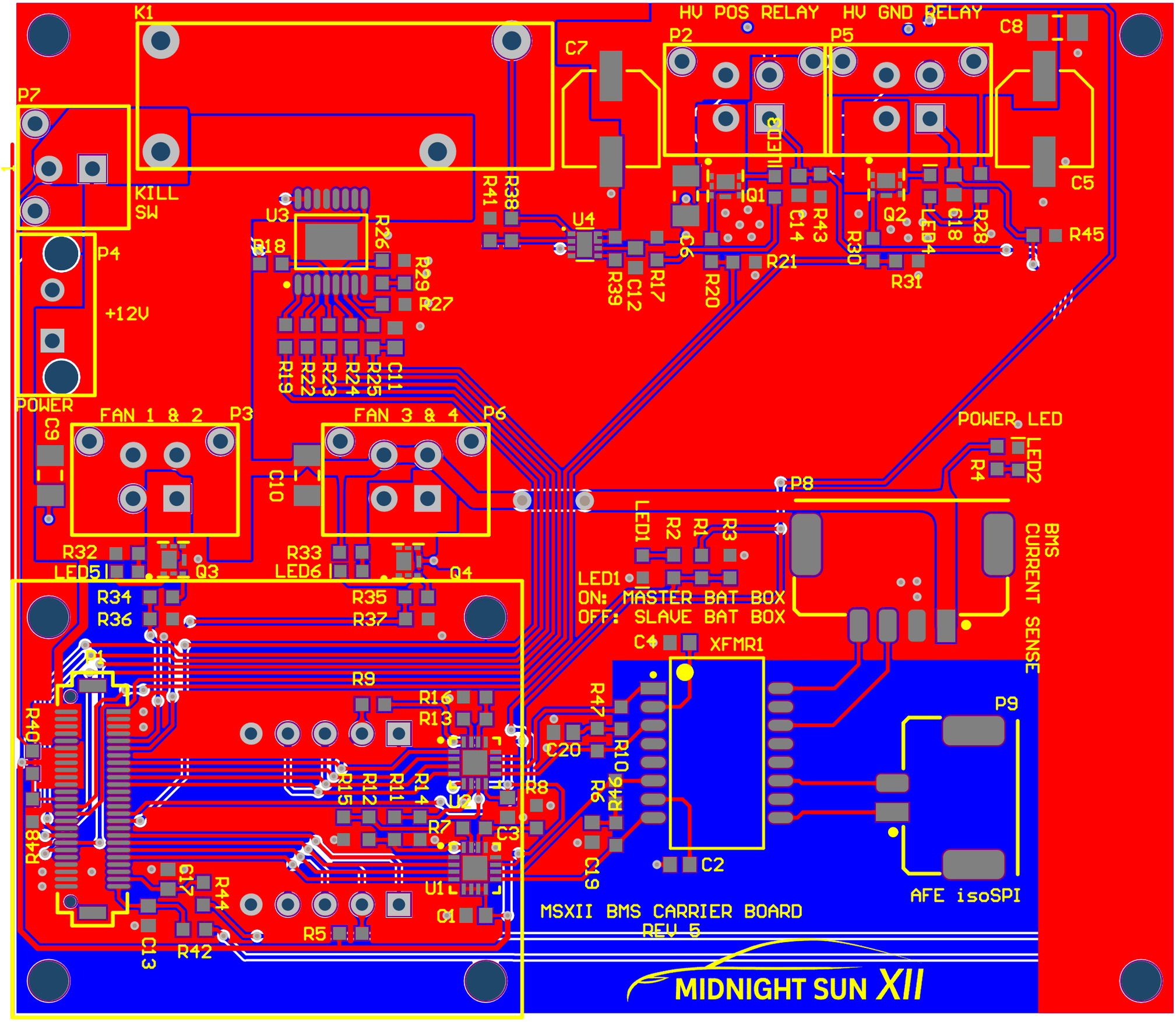


Project: ***BMS_Carrier_Board.PrjPcb***		MIDNIGHT SUN
Title: **Firmware Detection State of Contactor**		
Project Author: Aashmika Mali & Liam Hawkins		University of Waterloo 200 University Ave W Waterloo, ON, Canada N2L 3E9
Size: Letter	Revision: 5.0	
Date: 2019-06-12	Sheet* of *	Website:

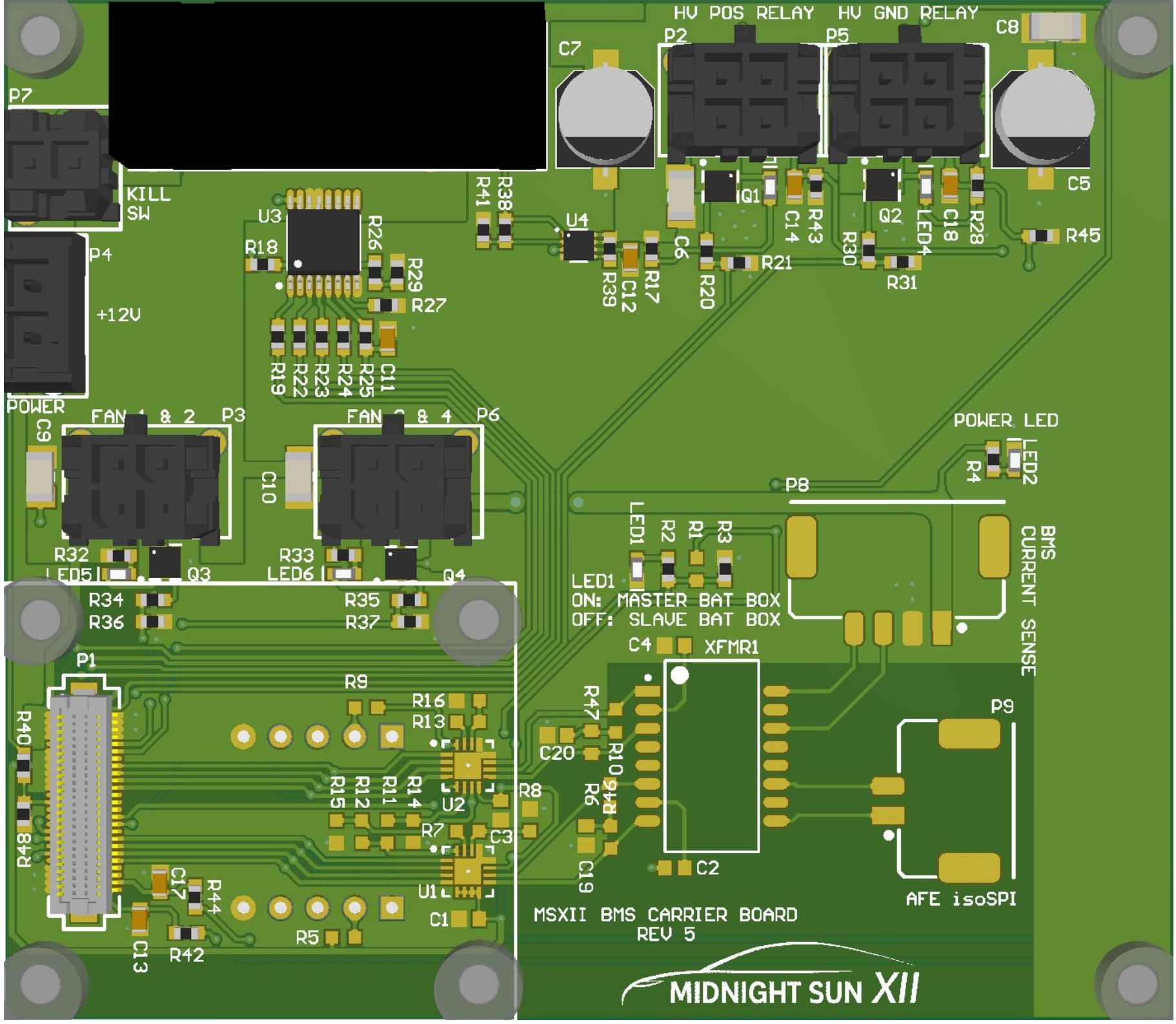
Bill of Materials

Project:	BMS_Carrier_Board.PrjPcb
Revision:	5.0
Project Lead:	Aashmika Mali & Liam Hawkins
Generated On:	2019-06-12 11:38 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	0.54606	2	$ 1.09
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	0.2131	3	$ 0.64
CAP CER 10nF 50V 5% X7R 0603	C12, C14, C15, C16, C18	KEMET	C0603C103J5JACTU	Digi-Key	399-13384-1-ND	0.47947	5	$ 2.40
DIODE SCHOTTKY 60V 3A SMA	D1, D3	Diodes	B360A-13-F	Digi-Key	B360A-FDICT-ND	0.5061	2	$ 1.01
DIODE GEN PURP 100V 300MA SOD123	D4	Diodes Zetex	1N4148WQ-7-F	Digi-Key	1N4148WQ-7-FDICT-ND	0.26637	1	$ 0.27
RELAY SPST 12V 8A OMRON	K1	Omron	G6RN-1ADC12	Digi-Key	Z2346-ND	5.42	1	$ 5.42
LED RED CLEAR 2V 0603	LED1	Wurth Electronics	150060RS75000	Digi-Key	732-4978-1-ND	0.18646	1	$ 0.19
LED GREEN CLEAR 2V 0603	LED2	Wurth Electronics	150060VS75000	Digi-Key	732-4980-1-ND	0.18646	1	$ 0.19
LED YELLOW CLEAR 2.1V 0603	LED3, LED4, LED5, LED6	Wurth Electronics	150060YS75000	Digi-Key	732-4981-1-ND	0.18646	4	$ 0.75
CONN 50POS Bergstak Plug 0.02"	P1	Amphenol FCI	10132797-055100LF	Digi-Key	609-5226-1-ND	1.86	1	$ 1.86
CONN 4POS MICRO-FIT 3mm	P2, P3, P5, P6	Molex	43045-0427	Digi-Key	WM10667-ND	1.78	4	$ 7.14
CONN 2POS ULTRA-FIT 0.138"	P4	Molex	1722861302	Digi-Key	WM11673-ND	1.94	1	$ 1.94
CONN 2POS MICRO-FIT 3mm	P7	Molex	43045-0227	Digi-Key	WM10657-ND	1.12	1	$ 1.12
MOSFET N-CH 30V 8.7A 2.1W 6-PQFN (2x2)	Q1, Q2, Q3, Q4	Infineon	IRLHS6342TRPBF	Digi-Key	IRLHS6342TRPBFCT-ND	0.89234	4	$ 3.57
RES 604 OHM 1% 1/10W 0603	R2	Yageo	RC0603FR-07604RL	Digi-Key	311-604HRCT-ND	0.13319	1	$ 0.13
RES 0.0 OHM 1/4W 0603	R3	Vishay Dale	CRCW06030000Z0EAHP	Digi-Key	541-0.0SBCT-ND	0.22641	1	$ 0.23
RES 4.7K OHM 1% 1/10W 0603	18, R19, R22, R23, R24, R25, R27, R28, R32	Yageo Phycomp	RC0603FR-074K7L	Digi-Key	311-4.70KHRCT-ND	0.03196	13	$ 0.42
RES 22.1 OHM 1% 1/10W 0603	R20, R30, R34, R35	Yageo	RC0603FR-0722R1L	Digi-Key	311-22.1HRCT-ND	0.13319	4	$ 0.53
RES 10K OHM 1% 1/10W 0603	R21, R31, R36, R37, R43, R45	Yageo Phycomp	RC0603FR-0710KL	Digi-Key	311-10.0KHRCT-ND	0.13319	6	$ 0.80
RES 3.3K OHM 1% 1/4W 0603	R26	Panasonic	ERJPA3F3301V	Digi-Key	P3.3KBYCT-ND	0.2131	1	$ 0.21
RES 2K OHM 1% 1/10W 0603	R29	Yageo	RC0603FR-072KL	Digi-Key	311-2.00KHRCT-ND	0.13319	1	$ 0.13
RES 1K OHM 5% 1/10W 0603	R39, R42, R44	Yageo	RC0603JR-071KL	Digi-Key	311-1.0KGRCT-ND	0.13319	3	$ 0.40
RES 2.7K OHM 1% 1/10W 0603	R40	TE Connectivity	CRGCQ0603F2K7	Digi-Key	A129693CT-ND	0.13319	1	$ 0.13
RES 1.3K OHM 1% 1/10W 0603	R41	Yageo	RC0603FR-071K3L	Digi-Key	311-1.30KHRCT-ND	0.13319	1	$ 0.13
RES SMD 1K OHM 0.1% 1/10W 0603	R48	Panasonic	ERA3AEB103V	Digi-Key	P10KDBCT-ND	0.46615	1	$ 0.47
IC HSD Dual-Channel 40V 1KOhm	U3	Texas Instruments	TPS2H000BQPWPRQ1	Digi-Key	PS2H000BQPWPRQ1-ND		1	
IC LOAD SWITCH ACT-HI 10.5A 8DFN	U4	ON Semiconductor	NCP45521IMNTWG-H	Digi-Key	P45521IMNTWG-HOSCT	1.16	1	$ 1.16
							Total:	$ 32.32


K1
HV POS RELAY
HV GND RELAY
P2
P5
C8
C7
P7
KILL
SW
C5
U3
U4
Q1
Q2
R41
R38
R26
R18
R29
R27
C6
C14
R43
R30
C18
R28
R45
R21
R31
C12
R39
R17
R20
P4
+12V
POWER
R19
R22
R23
R24
R25
C11
FAN 1 & 2
P3
FAN 3 & 4
P6
C9
C10
POWER LED
LED2
R4
P8
LED1
R2
R1
R3
BMS
CURRENT SENSE
R32
LED5
Q3
R33
LED6
Q4
R34
R36
R35
R37
LED1
ON: MASTER BAT BOX
OFF: SLAVE BAT BOX
C4
XFMR1
R9
R16
R13
R47
P9
R40
C20
R10
94R
R6
R8
R15
R12
R11
R14
U2
R7
C3
R48
C19
C2
C17
R44
U1
C1
AFE isoSPI
R5
R42
C13
MSXII BMS CARRIER BOARD
REV 5
MIDNIGHT SUN XII

J4
GND
+12V
FAN 1 12V
FAN 2 12V
FAN 3 12V
FAN 4 12V
FAN 1 GND
FAN 2 GND
FAN 4 GND
FAN 3 GND
GND
GND
GND
P11
BMS ISENSE
GND
MCS
SCK
MISO
MOSI
P10
AFE
GND
MCS
SCK
MISO
MOSI
D1
D3
C16
C15


HV POS RELAY
HV GND RELAY
P2
P5
C7
C8
C5
P7
KILL SW
P4
+12V
POWER
U3
U4
R18
R26
R29
R27
R19
R22
R23
R24
R25
C11
R41
R38
C6
Q1
C14
R43
Q2
LED4
C18
R28
R45
R30
R31
R21
R39
C12
R17
R20
FAN 1 & 2
P3
FAN 3 & 4
P6
C9
C10
R32
LED5
Q3
R33
LED6
Q4
R34
R36
R35
R37
POWER LED
LED2
R4
P8
LED1
R2
R1
R3
LED1
ON: MASTER BAT BOX
OFF: SLAVE BAT BOX
BMS CURRENT SENSE
C4
XFMR1
P1
R9
R16
R13
R40
R48
R15
R12
R11
R14
U2
R7
C3
U1
C1
R5
C17
R44
C13
R42
C20
R47
R10
R46
R6
R8
C19
C2
P9
AFE isoSPI
MSXII BMS CARRIER BOARD
REV 5
MIDNIGHT SUN XII

Electrical Rules Check Report

Class	Document	Message
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,Pin U4-3)
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	BMS Carrier - AFE Interface.SchDoc	Nets Wire PA0_HV_PWR_RELAY_SENSE has multiple names (Net Label PA0_HV_PWR_RELAY_SENSE,Net Label PA0_HV_PWR_RELAY_SENSE_MONITOR)
Warning	BMS Carrier - AFE Interface.SchDoc	Nets Wire PA1_HV_GND_RELAY_SENSE has multiple names (Net Label PA1_HV_GND_RELAY_SENSE,Net Label PA1_HV_GND_RELAY_SENSE_MONITOR)

Design Rules Verification Report

Filename : C:\Users\Liam\Documents\UWaterloo\Midnight Sun\Hardware Repository\hardw

Warnings 0
Rule Violations 102

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)	102
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	102

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: (0.027mm < 0.254mm) Between Pad D1-2(45.975mm,63.32mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.027mm < 0.254mm) Between Pad D3-2(57.11mm,63.32mm) on Bottom Layer And Pad P5-0(57mm,65.7mm) on
Minimum Solder Mask Sliver Constraint: (0.226mm < 0.254mm) Between Pad LED5-1(8.649mm,30.645mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.226mm < 0.254mm) Between Pad LED5-2(7.149mm,30.645mm) on Top Layer And Pad
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
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: (0.022mm < 0.254mm) Between Pad P2-0(54.975mm,65.7mm) on Multi-Layer And Pad P5-0(57mm,65.7mm) on
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,57.45mm)
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,56.41mm)
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,57.45mm)
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,56.41mm)
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,57.45mm) on Top Layer And Pad Q1-8(48.95mm,56.41mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q2-1(59.075mm,57.884mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q2-2(59.075mm,57.234mm) on Top Layer And Pad
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 Pad
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 Pad
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) on
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,31.45mm)
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,31.45mm)
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,31.45mm)
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,31.45mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q3-5(11.05mm,32.375mm) on Top Layer And Pad Q3-6(10.4mm,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,31.45mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q4-1(26.528mm,30.402mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q4-2(27.178mm,30.402mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q4-3(27.828mm,30.402mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.202mm < 0.254mm) Between Pad Q4-3(27.828mm,30.402mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q4-4(27.828mm,32.252mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q4-4(27.828mm,32.252mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.202mm < 0.254mm) Between Pad Q4-4(27.828mm,32.252mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad Q4-5(27.178mm,32.252mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.187mm < 0.254mm) Between Pad Q4-7(26.878mm,31.327mm) on Top Layer And Pad
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) on
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) on
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 Pad
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 (Gap=0.254mm) (All),(All)
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 Constraint: (0.022mm < 0.254mm) Between Pad U1-13(32.5mm,11.675mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.047mm < 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: (0.022mm < 0.254mm) Between Pad U1-14(32mm,11.675mm) on Top Layer And Pad U1-17(31.75mm,10.25mm)
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 Pad
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U1-16(31mm,11.675mm) on Top Layer And Pad U1-17(31.75mm,10.25mm)
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) on
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) on
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) on
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) on
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) on
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) on
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) on
Minimum Solder Mask Sliver Constraint: (0.022mm < 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 U2-1(30.325mm,18.25mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad U2-10(33.175mm,17.25mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U2-10(33.175mm,17.25mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad U2-10(33.175mm,17.25mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad U2-11(33.175mm,17.75mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U2-11(33.175mm,17.75mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U2-12(33.175mm,18.25mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.047mm < 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: (0.022mm < 0.254mm) Between Pad U2-13(32.5mm,18.925mm) on Top Layer And Pad U2-17(31.75mm,17.5mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 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: (0.022mm < 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: (0.047mm < 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 U2-15(31.5mm,18.925mm) on Top Layer And Pad U2-17(31.75mm,17.5mm)
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad U2-16(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 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) on
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) on
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 U2-9(33.175mm,16.75mm)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad U2-2(30.325mm,17.75mm) on Top Layer And Pad
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) on
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) on
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) on
Minimum Solder Mask Sliver Constraint: (0.098mm < 0.254mm) Between Pad U4-6(40.2mm,52.85mm) on Top Layer And Pad U4-8(40.05mm,53.6mm) on
Minimum Solder Mask Sliver Constraint: (0.048mm < 0.254mm) Between Pad U4-8(40.05mm,53.6mm) on Top Layer And Pad U4-9(39.3mm,53.1mm) on