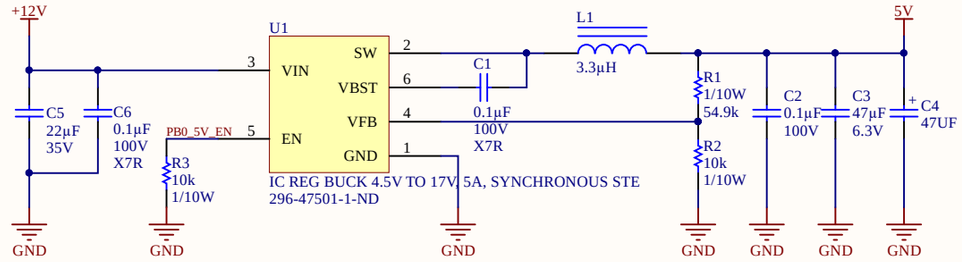
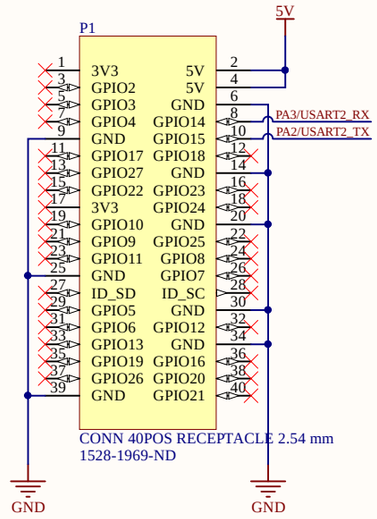
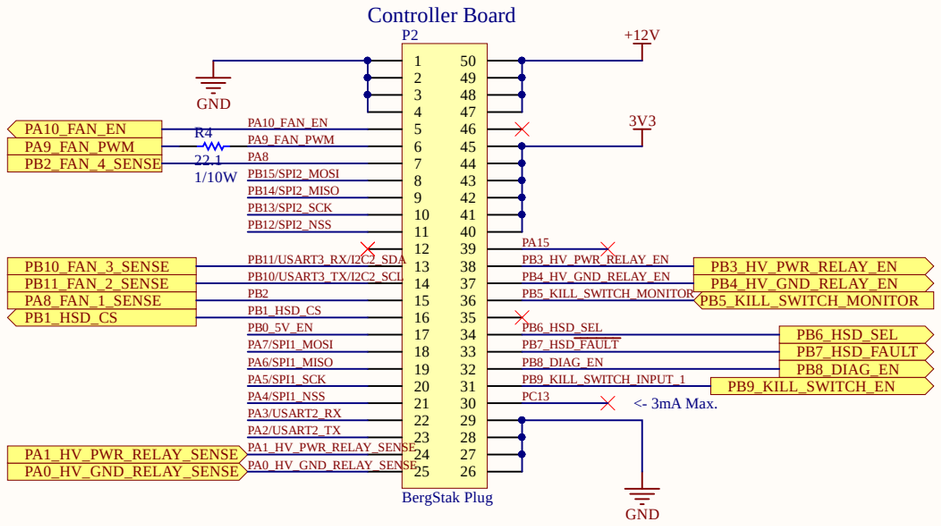
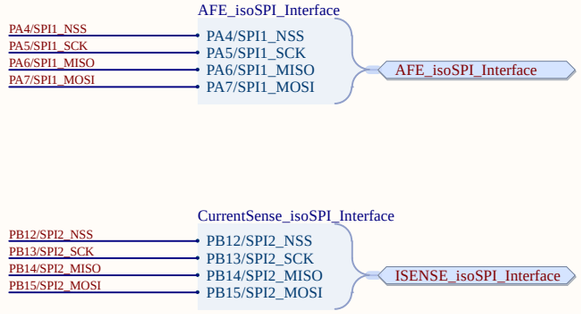








PROJECT	BMS_Carrier_Board.PrjPcb		
DOCUMENT	Controller Board Interface		
PART NUMBER	MS-ELE0003	VARIANT	BMS_Carrier_Board
DRAWN BY	Liam Hawkins	REVISION	1.0
LAST MODIFIED	2019-11-29	SHEET	1 OF 4

MIDNIGHT SUN

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

1	2	3	4	5	6

Table 4. SPI Modes

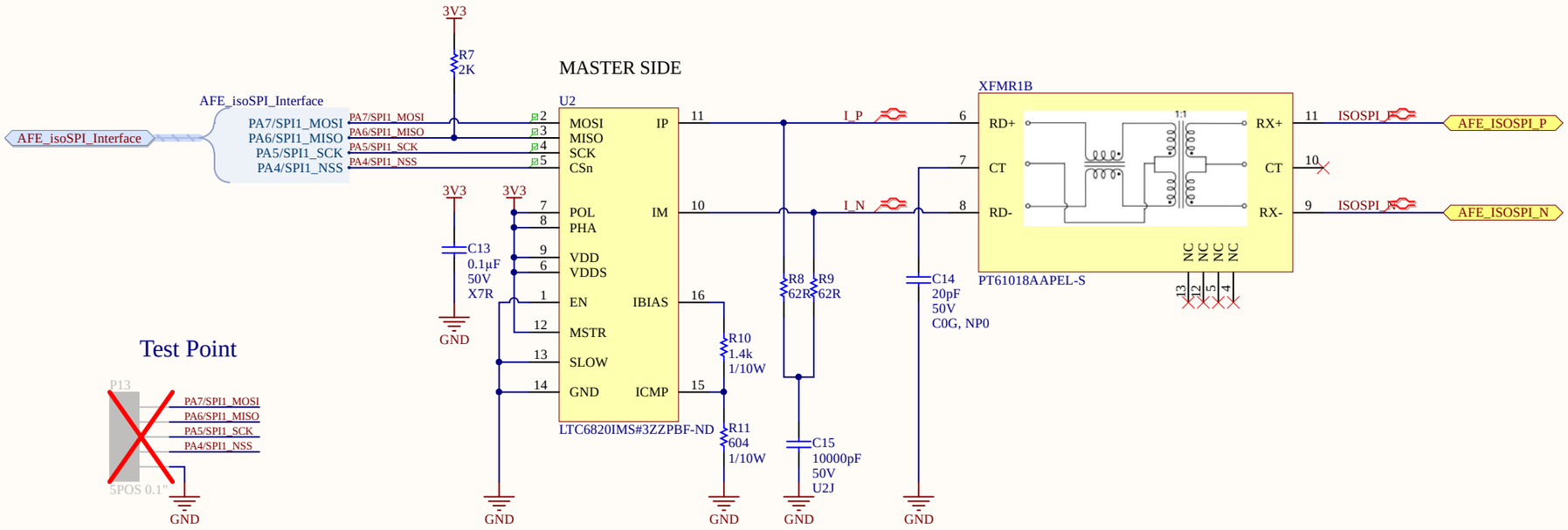
MODE	POL	PHA	DESCRIPTION
0	0	0	SCK Idles Low, Latches on Rising (1st) Edge
1	0	1	SCK Idles Low, Latches on Falling (2nd) Edge
2	1	0	SCK Idles High, Latches on Falling (1st) Edge
3	1	1	SCK Idles High, Latches on Rising (2nd) Edge

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



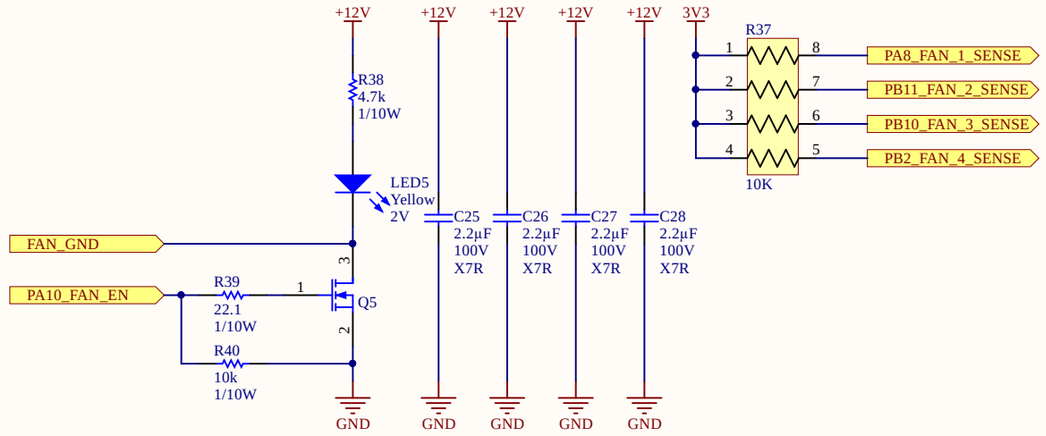
Test Point

PROJECT	BMS_Carrier_Board.PrjPcb
DOCUMENT	BMS Interface
PART NUMBER	MS-ELE0003
VARIANT	BMS_Carrier_Board
DRAWN BY	Liam Hawkins
REVISION	1.0
LAST MODIFIED	2019-11-29
SHEET	3 OF 4

MIDNIGHT SUN

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

1	2	3	4	5	6

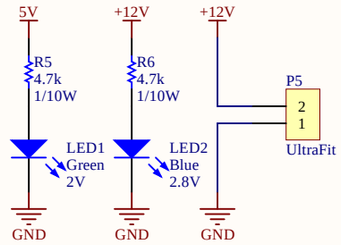


PROJECT	BMS_Carrier_Board.PrjPcb
DOCUMENT	BMS Fan and Relay Control
PART NUMBER	MS-ELE0003
VARIANT	BMS_Carrier_Board
DRAWN BY	Liam Hawkins
REVISION	1.0
LAST MODIFIED	2019-11-29
SHEET	4 OF 4

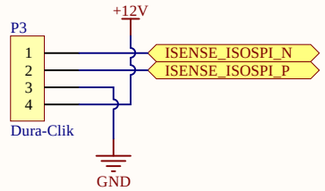
MIDNIGHT SUN

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

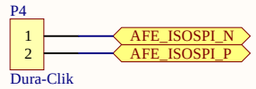
12V Power



BMS Current Sense

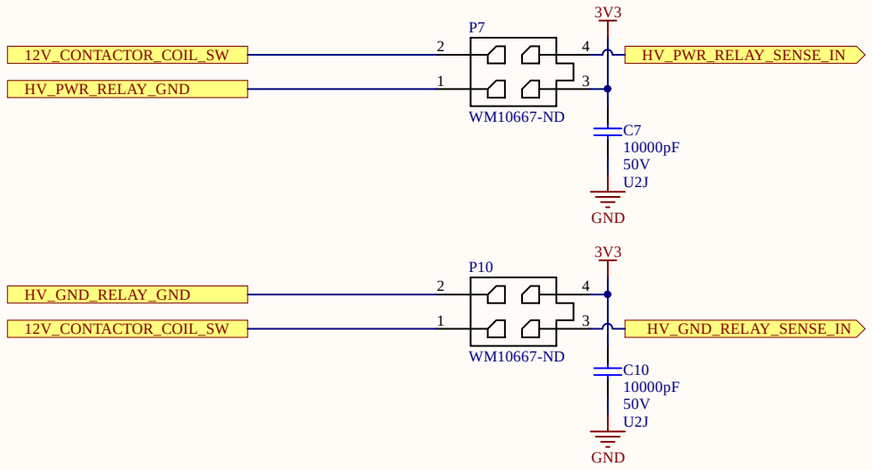


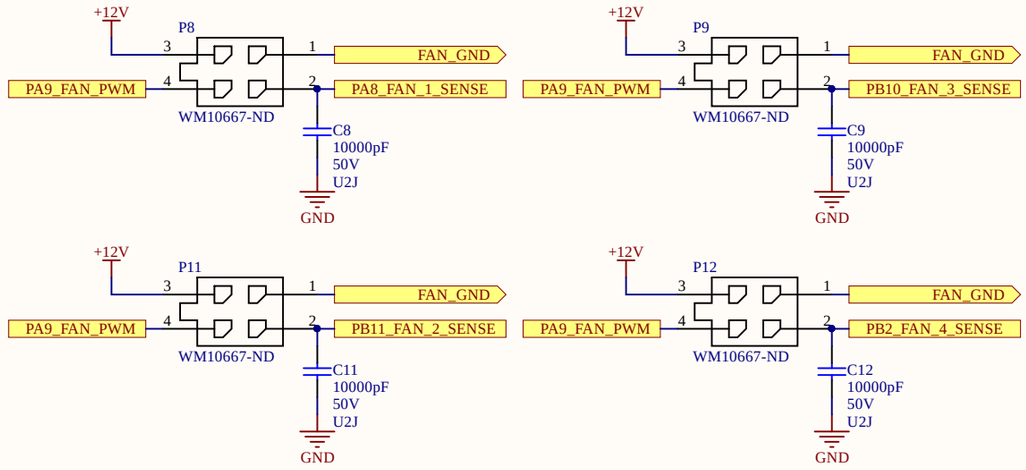
AFE isoSPI



Kill Switch

Relays & Fans



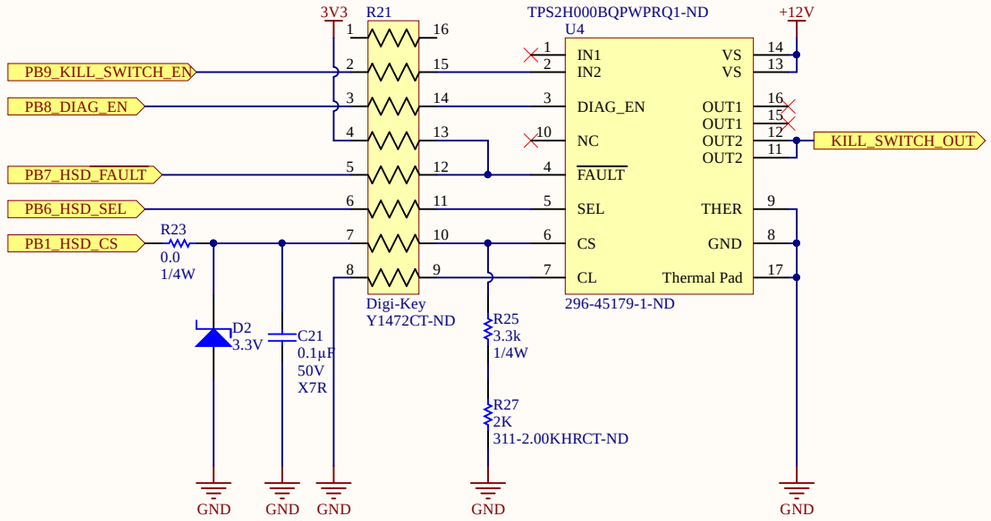


PROJECT	BMS_Carrier_Board.PrjPcb		
DOCUMENT	BMS Fan and Relay Control		
PART NUMBER	MS-ELE0003	VARIANT	BMS_Carrier_Board
DRAWN BY	Liam Hawkins	REVISION	1.0
LAST MODIFIED	2019-11-29	SHEET	4 OF 4

MIDNIGHT SUN

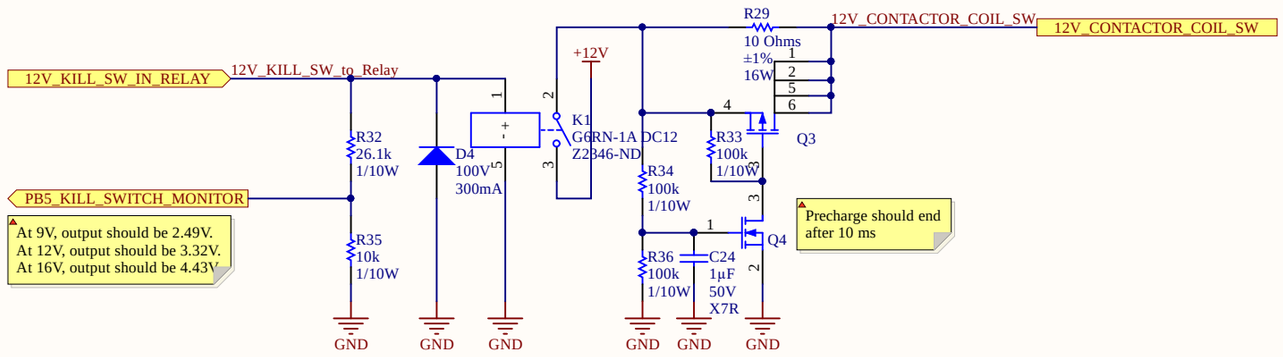
Engineering 5 - 1002
University of Waterloo
(519) 888-4567 x32978
hardware@uwmidsun.com

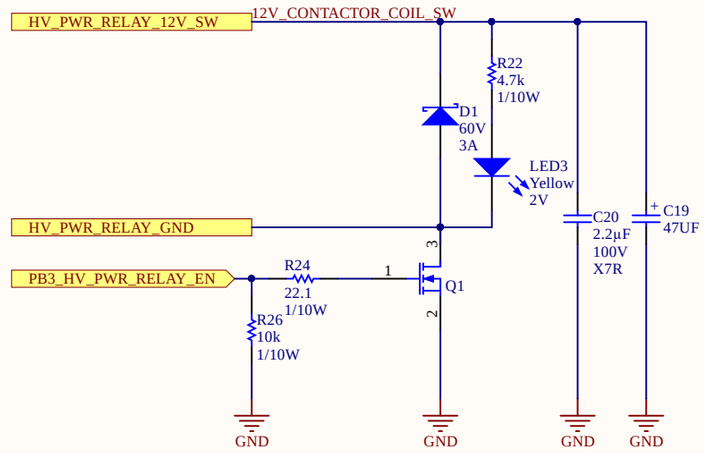
High Side Driver to Kill Switch

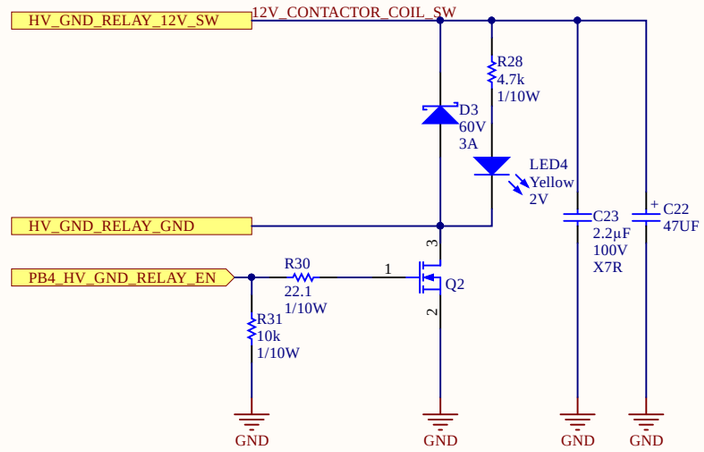


Kill Switch Relay

Should be high mainly (3.3 V input from MCU)



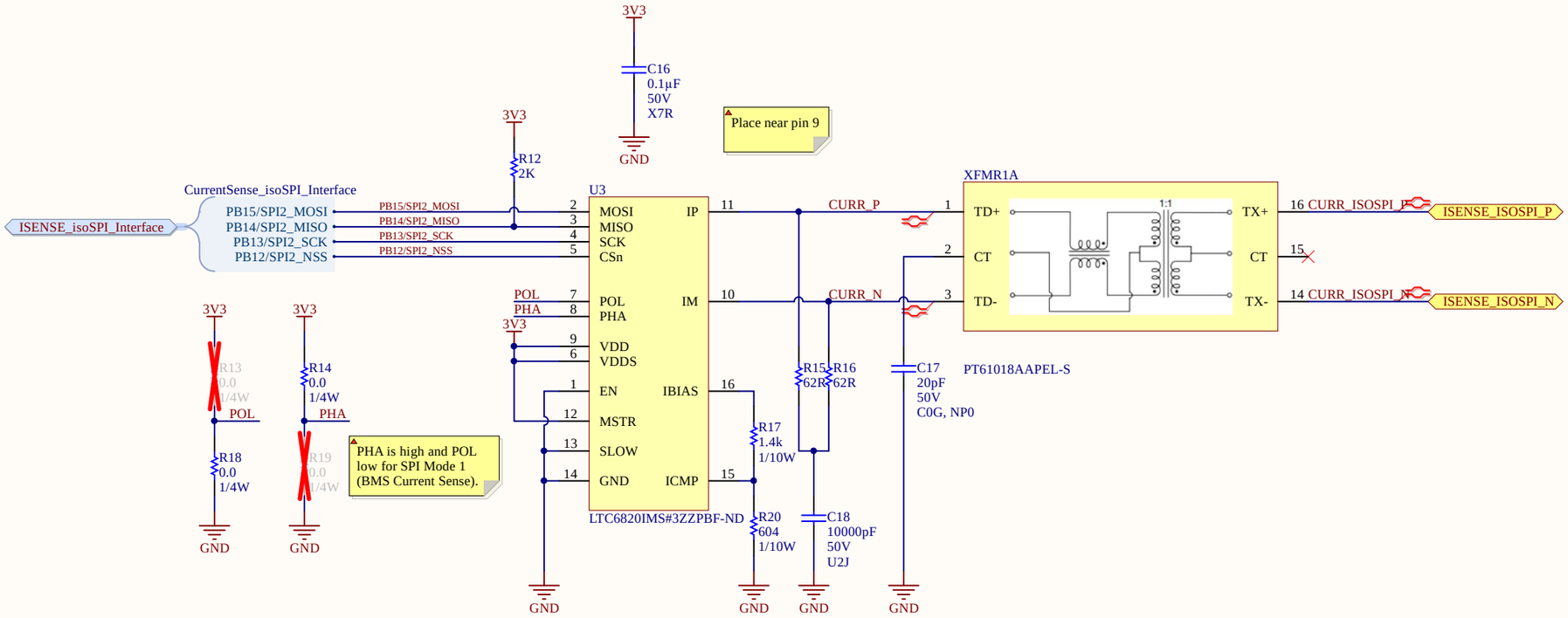




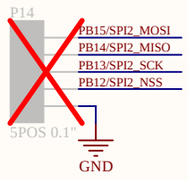
PROJECT	BMS_Carrier_Board.PrjPcb		
DOCUMENT	BMS Fan and Relay Control		
PART NUMBER	MS-ELE0003	VARIANT	BMS_Carrier_Board
DRAWN BY	Liam Hawkins	REVISION	1.0
LAST MODIFIED	2019-11-29	SHEET	4 OF 4

MIDNIGHT SUN

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



Test Point

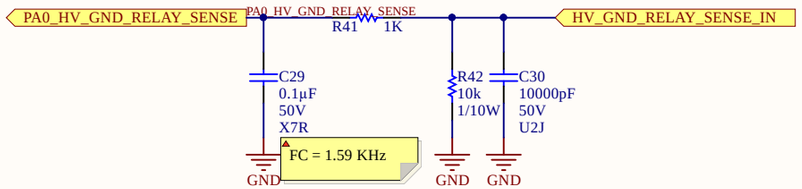


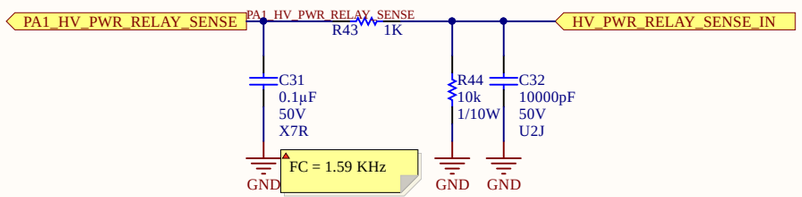
PROJECT	BMS_Carrier_Board.PrjPcb		
DOCUMENT	Current Sense isoSPI Interface		
PART NUMBER	MS-ELE0003	VARIANT	BMS_Carrier_Board
DRAWN BY	Liam Hawkins	REVISION	1.0
LAST MODIFIED	2019-11-29	SHEET * OF *	

MIDNIGHT SUN

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

Firmware Detection State of Contactor





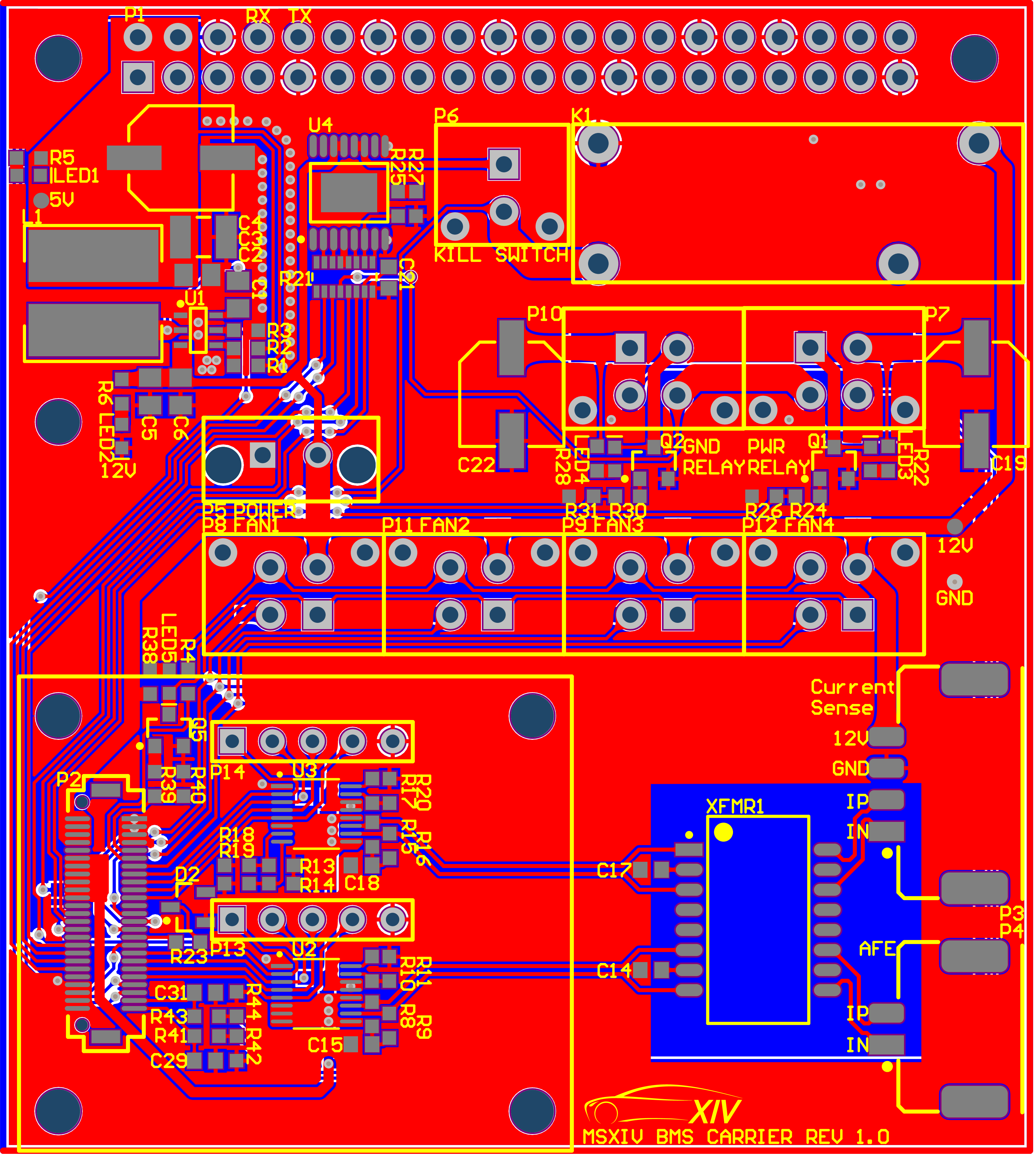
PROJECT	BMS_Carrier_Board.PrjPcb		
DOCUMENT	Firmware Detection State of Contactor		
PART NUMBER	MS-ELE0003	VARIANT	BMS_Carrier_Board
DRAWN BY	Liam Hawkins	REVISION	1.0
LAST MODIFIED	2019-11-29	SHEET * OF *	

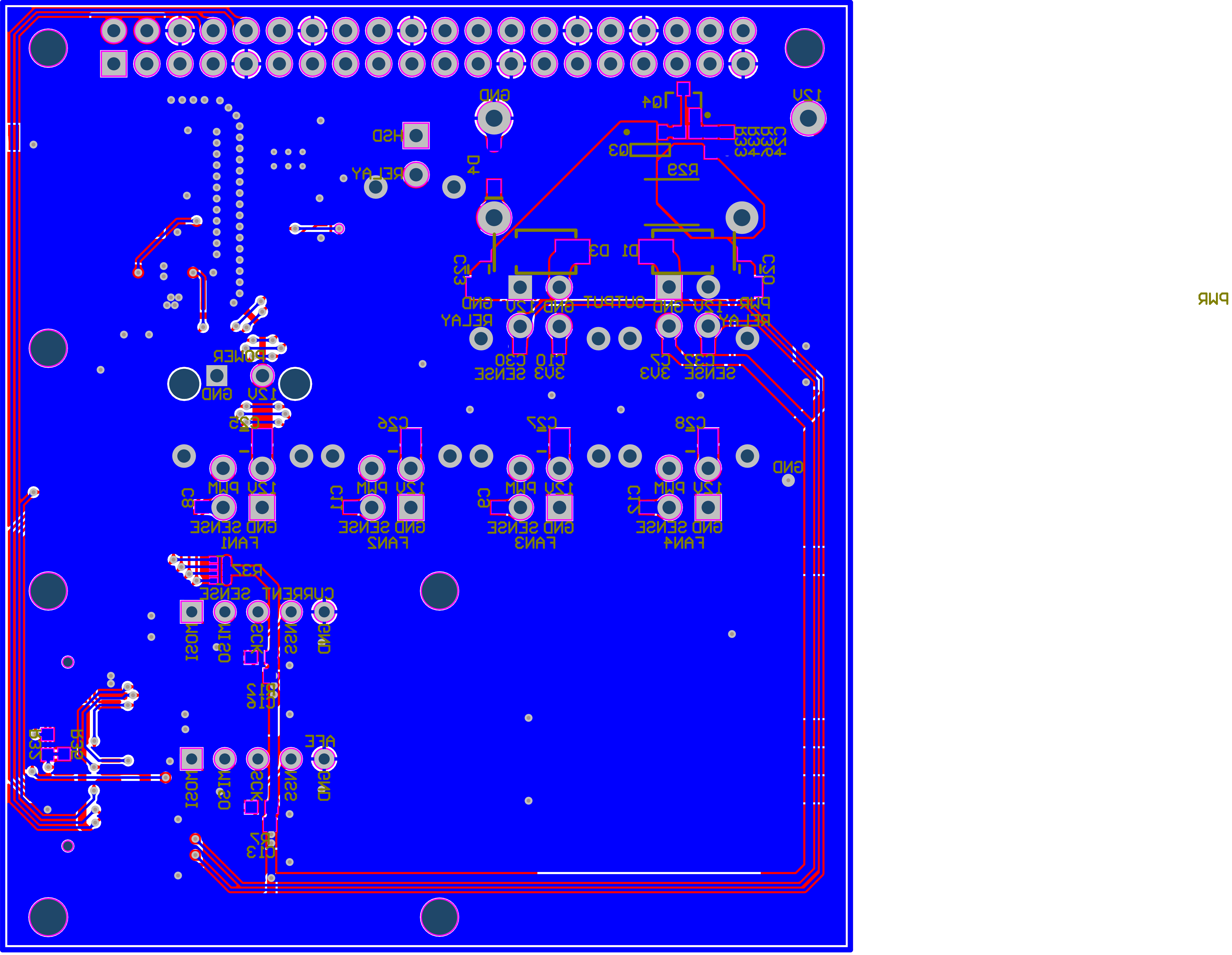
MIDNIGHT SUN
Engineering 5 - 1002
University of Waterloo
(519) 888-4567 x32978
hardware@uwmidsun.com

Bill of Materials

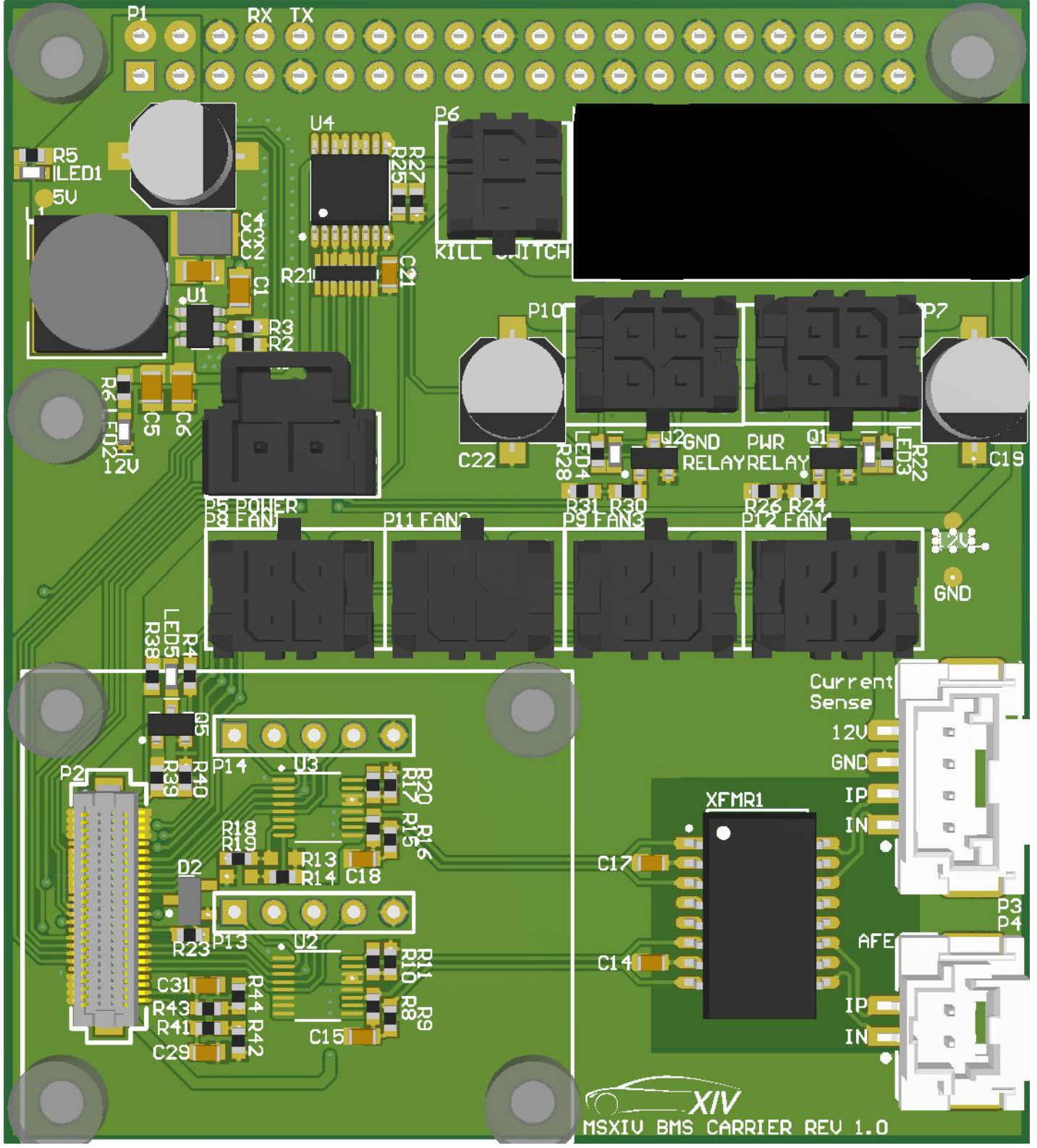
Project:	BMS_Carrier_Board.PrjPcb
Revision:	1.0
Project Lead:	Liam Hawkins
Generated On:	2019-11-29 10:34 AM
Production Quantity:	1
Currency	CAD
Total Parts Count:	107

LibRef	Designator	Manufacturer 1	Manufacturer Part Number 1	Supplier 1	Supplier Part Number 1	Supplier Unit Price 1	Quantity	Supplier Subtotal 1
CAP CER 0.1UF 100V 10% X7R 0805	C1, C2, C6	Murata	GCM21BR72A104KA37L	Digi-Key	490-4789-1-ND	0.39848	3	$ 1.20
CAP CER 47UF 6.3V X7R 1210	C3	Murata	GCJ32ER70J476KE01L	Digi-Key	490-10559-1-ND	1.78	1	$ 1.78
CAP ALUM 47UF 20% 35V SMD	C4, C19, C22			Digi-Key	CE3961CT-ND, [NoParam]		3	
CAP CER 22UF 35V X5R 0805	C5	TDK	C2012X5R1V226M125AC	Digi-Key	445-14428-1-ND	1.51	1	$ 1.51
CAP CER 10nF 50V 5% X7R 0603	7, C8, C9, C10, C11, C12, C15, C18, C30, C3	KEMET	C0603C103J5JACTU	Digi-Key	399-13384-1-ND	0.29753	10	$ 2.98
CAP CER 0.1UF 50V 10% X7R 0603	C13, C16, C21, C29, C31	Kyocera AVX	06035C104KAT2A	Digi-Key	478-5052-1-ND	0.19924	5	$ 1.00
CAP CER 20PF 50V ±5% C0G/NP0 0603	C14, C17	Murata	GRM1885C1H200JA01D	Digi-Key	490-1410-1-ND	0.13283	2	$ 0.27
CAP CER 2.2UF 100V ±20% X7R 1206	C20, C23, C25, C26, C27, C28	Murata	GRM31CR72A225MA73L	Digi-Key	490-12773-1-ND		6	
CAP CER 1UF 50V 10% X7R 0603	C24	Taiyo Yuden	UMK107AB7105KA-T	Digi-Key	587-3247-1-ND	0.35863	1	$ 0.36
DIODE SCHOTTKY 60V 3A SMA	D1, D3	Diodes	B360A-13-F	Digi-Key	B360A-FDICT-ND	0.50474	2	$ 1.01
DIODE ZENER 3.3V 250mW	D2	Rohm	BZX84C3V3LFHT116	Digi-Key	ZX84C3V3LFHT116CT-N	0.17268	1	$ 0.17
DIODE GEN PURP 100V 300MA SOD123	D4	Diodes Zetex	1N4148WQ-7-F	Digi-Key	1N4148WQ-7-FDICT-ND	0.26565	1	$ 0.27
RELAY SPST 12V 8A OMRON	K1	Omron	G6RN-1ADC12	Digi-Key	Z2346-ND	5.41	1	$ 5.41
IND 3.3uH 5.2A 20MOHM SMD	L1	TDK	VLP8040T-3R3N	Digi-Key	445-6581-1-ND	0.79696	1	$ 0.80
LED GREEN CLEAR 2V 0603	LED1	Wurth Electronics	150060VS75000	Digi-Key	732-4980-1-ND	0.18596	1	$ 0.19
LED BLUE CLEAR 2.8V 0603	LED2	Vishay Lite-On	LTST-C193TBKT-5A	Digi-Key	160-1827-1-ND	0.59772	1	$ 0.60
LED YELLOW CLEAR 2.1V 0603	LED3, LED4, LED5	Wurth Electronics	150060YS75000	Digi-Key	732-4981-1-ND	0.18596	3	$ 0.56
CONN 40POS RECEPTACLE 2.54 mm	P1	Adafruit Industries	1992	Digi-Key	1528-1969-ND	3.92	1	$ 3.92
CONN 50POS Bergstak Plug 0.02"	P2	Amphenol FCI	10132797-055100LF	Digi-Key	609-5226-1-ND	1.91	1	$ 1.91
CONN 4POS DURA-CLIK 0.079"	P3	Molex	560020-0420	Digi-Key	WM10864CT-ND	2.2	1	$ 2.20
CONN 2POS DURA-CLIK 0.079" VERT	P4	Molex	5600200220	Digi-Key	WM10862CT-ND	1.04	1	$ 1.04
CONN 2POS ULTRA-FIT 0.138"	P5	Molex	1722861302	Digi-Key	WM11673-ND	1.94	1	$ 1.94
CONN 2POS MICRO-FIT 3mm	P6	Molex	43045-0227	Digi-Key	WM10657-ND	1.12	1	$ 1.12
CONN 4POS MICRO-FIT 3mm	P7, P8, P9, P10, P11, P12	Molex	0430450427	Digi-Key	WM10667-ND	1.78	6	$ 10.68
MOSFET N-CH 30V 6.2A 0.9W SOT-23	Q1, Q2, Q4, Q5	Diodes	DMN3023L-7	Digi-Key	DMN3023L-7DICT-ND	0.49146	4	$ 1.97
MOSFET P-CH 30V 4A 1.6W SOT-23-6	Q3	STMicroelectronics	STT4P3LLH6	Digi-Key	497-15521-1-ND	0.71727	1	$ 0.72
RES 54.9K OHM 1% 1/10W 0603	R1	Panasonic	ERJ-3EKF5492V	Digi-Key	P54.9KHCT-ND	0.13283	1	$ 0.13
RES 10K OHM 1% 1/10W 0603	R2, R3, R26, R31, R35, R40, R42, R44	Yageo Phycomp	RC0603FR-0710KL	Digi-Key	311-10.0KHRCT-ND	0.13283	8	$ 1.06
RES 22.1 OHM 1% 1/10W 0603	R4, R24, R30, R39	Yageo	RC0603FR-0722R1L	Digi-Key	311-22.1HRCT-ND	0.13283	4	$ 0.53
RES 4.7K OHM 1% 1/10W 0603	R5, R6, R22, R28, R38	Yageo Phycomp	RC0603FR-074K7L	Digi-Key	311-4.70KHRCT-ND	0.13283	5	$ 0.66
RES 2K OHM 1% 1/10W 0603	R7, R12, R27	Yageo	RC0603FR-072KL	Digi-Key	311-2.00KHRCT-ND	0.13283	3	$ 0.40
RES 62 OHM 0.1% 1/10W 0603	R8, R9, R15, R16	Panasonic	ERA3AEB620V	Digi-Key	P62DBCT-ND	0.46489	4	$ 1.86
RES 1.4k OHM 1% 1/10W 0603	R10, R17	Yageo	RC0603FR-071K4L	Digi-Key	311-1.40KHRCT-ND	0.13283	2	$ 0.27
RES 604 OHM 1% 1/10W 0603	R11, R20	Yageo	RC0603FR-07604RL	Digi-Key	311-604HRCT-ND	0.13283	2	$ 0.27
RES 0.0 OHM 1/4W 0603	R14, R18, R23	Vishay Dale	CRCW06030000Z0EAHP	Digi-Key	541-0.0SBCT-ND	0.22581	3	$ 0.68
RES ARRAY 4.7K OHM 8 RES 1506	R21	Panasonic	EXB-2HV472JV	Digi-Key	Y1472CT-ND	0.3852	1	$ 0.39
RES 3.3K OHM 1% 1/4W 0603	R25	Panasonic	ERJ-PA3F3301V	Digi-Key	P3.3KBYCT-ND	0.21252	1	$ 0.21
RES 10 OHM 1% 16W 2512	R29	Susumu	CPA2512Q10R0FS-T10	Digi-Key	CPA25Q10.0CT-ND	3.89	1	$ 3.89
RES 26.1K OHM 1% 1/10W 0603	R32	Yageo Phycomp	RC0603FR-0726K1L	Digi-Key	311-26.1KHRCT-ND	0.13283	1	$ 0.13
RES 100K OHM 5% 1/8W 0603	R33, R34, R36	Yageo	RC0603JR-07100KL	Digi-Key	311-100KGRCT-ND	0.13283	3	$ 0.40
RES ARRAY 10K OHM 1% 4 RES 0804	R37	Vishay Dale	CRA04S08310K0FTD	Digi-Key	CRA4S810.0KACT-ND	0.57116	1	$ 0.57
RES 1K OHM 5% 1/10W 0603	R41, R43	Yageo	RC0603JR-071KL	Digi-Key	311-1.0KGRCT-ND	0.13283	2	$ 0.27
REG BUCK 4.5V TO 17V, 5A, SYNCHRONOUS S	U1	Texas Instruments	TPS565201DDCT	Digi-Key	296-47501-1-ND	1.98	1	$ 1.98
ISOSPI COMM INTERFACE LTC6820IMS#3ZZP	U2, U3	Analog Devices / Linear	LTC6820IMS#3ZZPBF	Digi-Key	LTC6820IMS#3ZZPBF-ND	8.02	2	$ 16.05
IC HSD Dual-Channel 40V 1KOhm	U4	Texas Instruments	TPS2H000BQPWPRQ1	Digi-Key	PS2H000BQPWPRQ1-ND		1	
IC PULSE XFMR 1CT:1CT 350UH SMD	XFMR1	Bourns	PT61018AAPEL-S	Digi-Key	PT61018AAPEL-SCT-ND	5.09	1	$ 5.09
							Total:	$ 78.42


P1
RX
TX
P2
U4
R27
R25
P6
K1
R5
LED1
5V
L1
C4
C3
C2
C1
R21
U1
R3
R2
R1
R6
LED2
12V
C5
C6
KILL SWITCH
P10
P7
Q2
Q1
GND RELAY
PWR RELAY
LED3
R22
C19
C22
R28
LED4
R31
R30
R26
R24
P5 POWER
P8 FAN1
P11 FAN2
P9 FAN3
P12 FAN4
12V
GND
R38
LED5
R4
Q5
R39
R40
P14
U3
R20
R17
R16
R15
R18
R19
R13
R14
C18
D2
P13
U2
R23
R11
R10
R9
R8
C31
R43
R41
C29
R44
R42
C15
Current Sense
12V
GND
IP
IN
XFMR1
C17
C14
P3
P4
AFE
IP
IN
XIV
MSXIV BMS CARRIER REV 1.0



GND
12V
HSD
RELAY
D4
Q4
Q3
R29
R33
R34
R30
D3
D1
C33
C20
GND 12V GND OUTPUT GND 12V PWR
RELAY
RELAY
C30 C10
SENSE 3V3
C7 C32
3V3 SENSE
POWER
GND 12V
C25
C26
C27
C28
GND
PWM 12V
C8
GND SENSE
FAN1
C11
FAN2
C9
FAN3
C17
FAN4
R37
CURRENT SENSE
MOSI
MISO
SCK
SS
GND
R12
C16
AFE
R35
R33
R7
C13
PWR


P1
RX
TX
U4
P6
R5
LED1
5V
R25
R27
KILL SWITCH
C4
C3
C2
R21
C21
U1
C1
R3
R2
P10
P7
R6
LED2
12V
C5
C6
C22
LED4
R28
Q2
GND
RELAY
PWR
RELAY
Q1
LED3
R22
C19
P5 POWER
P8 FAN
P11 FAN2
R31
R30
P9 FAN3
R26
R24
P12 FAN4
12V
GND
R4
LED5
R38
Q5
P14
U3
R39
R40
P2
R17
R20
R15
R16
R18
R19
R13
R14
C18
D2
R23
P13
U2
R10
R11
R8
R9
C31
R43
R41
C29
R44
R42
C15
Current
Sense
12V
GND
IP
IN
XFMR1
C17
C14
P3
P4
AFE
IP
IN
XIV
MSXIV BMS CARRIER REV 1.0

Electrical Rules Check Report

Class	Document	Message
Warning	BMS Carrier - Connectors.SchDoc	Net PA8 has no driving source (Pin C12-1,Pin P2-7,Pin P12-2,Pin R37-5)
Warning	BMS Carrier - Connectors.SchDoc	Net PB2 has no driving source (Pin C8-1,Pin P2-15,Pin P8-2,Pin R37-8)
Warning	BMS Carrier - Connectors.SchDoc	Net PB10/USART3_TX/I2C2_SCL has no driving source (Pin C11-1,Pin P2-14,Pin P11-2,Pin R37-7)
Warning	BMS Carrier - Connectors.SchDoc	Net PB11/USART3_RX/I2C2_SDA has no driving source (Pin C9-1,Pin P2-13,Pin P9-2,Pin R37-6)
Warning	BMS Carrier - Connectors.SchDoc	PA8 contains Output Port and Unspecified Port objects (Port PB2_FAN_4_SENSE,Port PB2_FAN_4_SENSE,Port PB2_FAN_4_SENSE)
Warning	BMS Carrier - Connectors.SchDoc	PB2 contains Output Port and Unspecified Port objects (Port PA8_FAN_1_SENSE,Port PA8_FAN_1_SENSE,Port PA8_FAN_1_SENSE)
Warning	BMS Carrier - Connectors.SchDoc	PB10/USART3_TX/I2C2_SCL contains Output Port and Unspecified Port objects (Port PB11_FAN_2_SENSE,Port PB11_FAN_2_SENSE,Port PB11_FAN_2_SENSE)
Warning	BMS Carrier - Connectors.SchDoc	PB11/USART3_RX/I2C2_SDA contains Output Port and Unspecified Port objects (Port PB10_FAN_3_SENSE,Port PB10_FAN_3_SENSE,Port PB10_FAN_3_SENSE)

Design Rules Verification Report

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

Warnings 0
Rule Violations 157

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)	157
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	157

Minimum Solder Mask Sliver (Gap=0.254mm) (All),(All)
Minimum Solder Mask Sliver Constraint: (0.172mm < 0.254mm) Between Pad C1-1(13.875mm,53.275mm) on Top Layer And Pad R3-1(13.6mm,51.9mm)
Minimum Solder Mask Sliver Constraint: (0.172mm < 0.254mm) Between Pad C1-1(13.875mm,53.275mm) on Top Layer And Pad R3-2(15.15mm,51.9mm)
Minimum Solder Mask Sliver Constraint: (0.072mm < 0.254mm) Between Pad C1-1(13.875mm,53.275mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad C11-1(25.676mm,33.916mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.222mm < 0.254mm) Between Pad C1-2(13.875mm,55.025mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.122mm < 0.254mm) Between Pad C12-1(48.401mm,33.9mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.222mm < 0.254mm) Between Pad C13-1(19.5mm,9.6mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.222mm < 0.254mm) Between Pad C13-2(18.15mm,9.6mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.027mm < 0.254mm) Between Pad C15-1(22.357mm,6.725mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.039mm < 0.254mm) Between Pad C15-1(22.357mm,6.725mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.077mm < 0.254mm) Between Pad C18-1(22.364mm,18.05mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.039mm < 0.254mm) Between Pad C18-1(22.364mm,18.05mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.147mm < 0.254mm) Between Pad C2-1(10.425mm,55.4mm) on Top Layer And Pad C3-1(10.225mm,57.8mm)
Minimum Solder Mask Sliver Constraint: (0.166mm < 0.254mm) Between Pad C21-1(23.405mm,55.899mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.166mm < 0.254mm) Between Pad C21-2(23.405mm,54.549mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.147mm < 0.254mm) Between Pad C2-2(12.175mm,55.4mm) on Top Layer And Pad C3-2(13.125mm,57.8mm)
Minimum Solder Mask Sliver Constraint: (0.158mm < 0.254mm) Between Pad C24-1(54.55mm,62.665mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.158mm < 0.254mm) Between Pad C24-2(54.55mm,61.315mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.097mm < 0.254mm) Between Pad C25-1(18.901mm,39mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.097mm < 0.254mm) Between Pad C25-2(16.151mm,39mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.097mm < 0.254mm) Between Pad C26-1(30.301mm,39mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.097mm < 0.254mm) Between Pad C26-2(27.551mm,39mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.097mm < 0.254mm) Between Pad C27-1(41.701mm,39mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.097mm < 0.254mm) Between Pad C27-2(38.951mm,39mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.097mm < 0.254mm) Between Pad C28-1(53.101mm,39mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.097mm < 0.254mm) Between Pad C28-2(50.351mm,39mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.227mm < 0.254mm) Between Pad C30-1(38.651mm,46.238mm) on Bottom Layer And Via
Minimum Solder Mask Sliver Constraint: (0.06mm < 0.254mm) Between Pad C8-1(14.263mm,33.933mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.122mm < 0.254mm) Between Pad C9-1(37.001mm,33.9mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.128mm < 0.254mm) Between Pad D2-2(11.825mm,16.35mm) on Top Layer And Via (13.01mm,16.9mm) from
Minimum Solder Mask Sliver Constraint: (0.127mm < 0.254mm) Between Pad D2-3(11.825mm,14.45mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.137mm < 0.254mm) Between Pad D4-1(36.678mm,61.69mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.125mm < 0.254mm) Between Pad K1-2(55.678mm,56.11mm) on Multi-Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.062mm < 0.254mm) Between Pad LED1-1(-0.136mm,61.71mm) on Top Layer And Pad R5-2(-0.15mm,62.8mm)
Minimum Solder Mask Sliver Constraint: (0.062mm < 0.254mm) Between Pad LED1-2(1.364mm,61.71mm) on Top Layer And Pad R5-1(1.4mm,62.8mm) on
Minimum Solder Mask Sliver Constraint: (0.095mm < 0.254mm) Between Pad LED3-1(53.9mm,43mm) on Top Layer And Pad R22-2(55.023mm,43mm) on
Minimum Solder Mask Sliver Constraint: (0.095mm < 0.254mm) Between Pad LED3-2(53.9mm,44.5mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.069mm < 0.254mm) Between Pad LED4-1(37.7mm,43mm) on Top Layer And Pad R28-2(36.603mm,43mm) on
Minimum Solder Mask Sliver Constraint: (0.069mm < 0.254mm) Between Pad LED4-2(37.7mm,44.5mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.183mm < 0.254mm) Between Pad LED5-1(9.51mm,30.416mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.162mm < 0.254mm) Between Pad LED5-1(9.51mm,30.416mm) on Top Layer And Pad R4-1(10.7mm,30.45mm)
Minimum Solder Mask Sliver Constraint: (0.183mm < 0.254mm) Between Pad LED5-2(9.51mm,28.916mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.162mm < 0.254mm) Between Pad LED5-2(9.51mm,28.916mm) on Top Layer And Pad R4-2(10.7mm,28.9mm)
Minimum Solder Mask Sliver Constraint: (0.105mm < 0.254mm) Between Pad P2-(4mm,22.05mm) on Multi-Layer And Pad P2-(5.5mm,22.8mm) on Top
Minimum Solder Mask Sliver Constraint: (0.105mm < 0.254mm) Between Pad P2-(4mm,7.95mm) on Multi-Layer And Pad P2-(5.5mm,7.2mm) on Top Layer
Minimum Solder Mask Sliver Constraint: (0.247mm < 0.254mm) Between Pad P2-4(7.3mm,19.5mm) on Top Layer And Via (7.3mm,20.4mm) from Top
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad Q1-1(50.7mm,42.5mm) on Top Layer And Pad R24-2(50.7mm,41.4mm) on
Minimum Solder Mask Sliver Constraint: (0.022mm < 0.254mm) Between Pad Q2-1(39.3mm,42.5mm) on Top Layer And Pad R30-2(39.3mm,41.4mm) on
Minimum Solder Mask Sliver Constraint: (0.198mm < 0.254mm) Between Pad Q3-1(47.7mm,62.665mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.198mm < 0.254mm) Between Pad Q3-2(48.65mm,62.665mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.182mm < 0.254mm) Between Pad Q3-3(49.6mm,62.665mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.198mm < 0.254mm) Between Pad Q3-4(49.6mm,59.935mm) on Bottom Layer And Pad

Minimum Solder Mask Sliver (Gap=0.254mm) (All),(All)
Minimum Solder Mask Sliver Constraint: (0.203mm < 0.254mm) Between Pad Q3-4(49.6mm,59.935mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.198mm < 0.254mm) Between Pad Q3-5(48.65mm,59.935mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.107mm < 0.254mm) Between Pad Q3-5(48.65mm,59.935mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.107mm < 0.254mm) Between Pad Q3-6(47.7mm,59.935mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.232mm < 0.254mm) Between Pad Q4-1(52.1mm,63.975mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.232mm < 0.254mm) Between Pad Q4-2(50.3mm,63.975mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.038mm < 0.254mm) Between Pad R10-1(22.357mm,12.275mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.141mm < 0.254mm) Between Pad R10-1(22.357mm,12.275mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.163mm < 0.254mm) Between Pad R10-1(22.357mm,12.275mm) on Top Layer And Via (23.448mm,12.275mm)
Minimum Solder Mask Sliver Constraint: (0.038mm < 0.254mm) Between Pad R10-2(22.357mm,10.725mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.132mm < 0.254mm) Between Pad R10-2(22.357mm,10.725mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.131mm < 0.254mm) Between Pad R10-2(22.357mm,10.725mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.131mm < 0.254mm) Between Pad R10-2(22.357mm,10.725mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.017mm < 0.254mm) Between Pad R1-1(15.15mm,49.675mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.017mm < 0.254mm) Between Pad R1-2(13.6mm,49.675mm) on Top Layer And Pad R2-1(13.6mm,50.745mm)
Minimum Solder Mask Sliver Constraint: (0.097mm < 0.254mm) Between Pad R13-1(17.38mm,18.05mm) on Top Layer And Pad R14-1(17.38mm,16.9mm)
Minimum Solder Mask Sliver Constraint: (0.097mm < 0.254mm) Between Pad R13-2(15.83mm,18.05mm) on Top Layer And Pad R14-2(15.83mm,16.9mm)
Minimum Solder Mask Sliver Constraint: (0.217mm < 0.254mm) Between Pad R13-2(15.83mm,18.05mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.238mm < 0.254mm) Between Pad R13-2(15.83mm,18.05mm) on Top Layer And Pad R19-1(14.56mm,16.9mm)
Minimum Solder Mask Sliver Constraint: (0.238mm < 0.254mm) Between Pad R14-2(15.83mm,16.9mm) on Top Layer And Pad R18-1(14.56mm,18.05mm)
Minimum Solder Mask Sliver Constraint: (0.217mm < 0.254mm) Between Pad R14-2(15.83mm,16.9mm) on Top Layer And Pad R19-1(14.56mm,16.9mm)
Minimum Solder Mask Sliver Constraint: (0.038mm < 0.254mm) Between Pad R15-1(22.364mm,20.78mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.15mm < 0.254mm) Between Pad R15-1(22.364mm,20.78mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.155mm < 0.254mm) Between Pad R15-1(22.364mm,20.78mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.203mm < 0.254mm) Between Pad R15-1(22.364mm,20.78mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.131mm < 0.254mm) Between Pad R15-1(22.364mm,20.78mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.131mm < 0.254mm) Between Pad R15-1(22.364mm,20.78mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.23mm < 0.254mm) Between Pad R15-1(22.364mm,20.78mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.038mm < 0.254mm) Between Pad R15-2(22.364mm,19.23mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.038mm < 0.254mm) Between Pad R15-2(22.364mm,19.23mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.131mm < 0.254mm) Between Pad R15-2(22.364mm,19.23mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.038mm < 0.254mm) Between Pad R17-1(22.364mm,23.533mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.131mm < 0.254mm) Between Pad R17-1(22.364mm,23.533mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.163mm < 0.254mm) Between Pad R17-1(22.364mm,23.533mm) on Top Layer And Via (23.456mm,23.533mm)
Minimum Solder Mask Sliver Constraint: (0.038mm < 0.254mm) Between Pad R17-2(22.364mm,21.983mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.131mm < 0.254mm) Between Pad R17-2(22.364mm,21.983mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.131mm < 0.254mm) Between Pad R17-2(22.364mm,21.983mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.134mm < 0.254mm) Between Pad R17-2(22.364mm,21.983mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.097mm < 0.254mm) Between Pad R18-1(14.56mm,18.05mm) on Top Layer And Pad R19-1(14.56mm,16.9mm)
Minimum Solder Mask Sliver Constraint: (0.097mm < 0.254mm) Between Pad R18-2(13.01mm,18.05mm) on Top Layer And Pad R19-2(13.01mm,16.9mm)
Minimum Solder Mask Sliver Constraint: (0.222mm < 0.254mm) Between Pad R18-2(13.01mm,18.05mm) on Top Layer And Via (13.01mm,16.9mm) from
Minimum Solder Mask Sliver Constraint: (0.222mm < 0.254mm) Between Pad R19-2(13.01mm,16.9mm) on Top Layer And Via (12.985mm,18.05mm) from
Minimum Solder Mask Sliver Constraint: (0.102mm < 0.254mm) Between Pad R2-1(13.6mm,50.745mm) on Top Layer And Pad R3-1(13.6mm,51.9mm) on
Minimum Solder Mask Sliver Constraint: (0.072mm < 0.254mm) Between Pad R2-1(13.6mm,50.745mm) on Top Layer And Pad U1-4(12.475mm,50.95mm)
Minimum Solder Mask Sliver Constraint: (0.227mm < 0.254mm) Between Pad R2-1(13.6mm,50.745mm) on Top Layer And Via (13.6mm,51.9mm) from Top
Minimum Solder Mask Sliver Constraint: (0.166mm < 0.254mm) Between Pad R21-10(21.875mm,56.2mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.166mm < 0.254mm) Between Pad R21-11(21.367mm,56.2mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.216mm < 0.254mm) Between Pad R21-11(21.367mm,56.2mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.166mm < 0.254mm) Between Pad R21-12(20.859mm,56.2mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.173mm < 0.254mm) Between Pad R21-12(20.859mm,56.2mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.187mm < 0.254mm) Between Pad R21-13(20.351mm,56.2mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.166mm < 0.254mm) Between Pad R21-13(20.351mm,56.2mm) on Top Layer And Pad

Minimum Solder Mask Sliver (Gap=0.254mm) (All),(All)
Minimum Solder Mask Sliver Constraint: (0.244mm < 0.254mm) Between Pad R21-14(19.843mm,56.2mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.166mm < 0.254mm) Between Pad R21-14(19.843mm,56.2mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.166mm < 0.254mm) Between Pad R21-15(19.335mm,56.2mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.166mm < 0.254mm) Between Pad R21-16(18.827mm,56.2mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.194mm < 0.254mm) Between Pad R21-16(18.827mm,56.2mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.216mm < 0.254mm) Between Pad R21-9(22.383mm,56.2mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.166mm < 0.254mm) Between Pad R21-9(22.383mm,56.2mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.102mm < 0.254mm) Between Pad R2-2(15.15mm,50.745mm) on Top Layer And Pad R3-2(15.15mm,51.9mm)
Minimum Solder Mask Sliver Constraint: (0.227mm < 0.254mm) Between Pad R2-2(15.15mm,50.745mm) on Top Layer And Via (15.15mm,51.9mm) from
Minimum Solder Mask Sliver Constraint: (0.147mm < 0.254mm) Between Pad R24-1(49.15mm,41.4mm) on Top Layer And Pad R26-1(47.95mm,41.4mm)
Minimum Solder Mask Sliver Constraint: (0.082mm < 0.254mm) Between Pad R25-1(24.004mm,59.125mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.235mm < 0.254mm) Between Pad R25-1(24.004mm,59.125mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.207mm < 0.254mm) Between Pad R25-1(24.004mm,59.125mm) on Top Layer And Via (25.14mm,59.125mm)
Minimum Solder Mask Sliver Constraint: (0.082mm < 0.254mm) Between Pad R25-2(24.004mm,60.675mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.163mm < 0.254mm) Between Pad R3-1(13.6mm,51.9mm) on Top Layer And Pad U1-4(12.475mm,50.95mm) on
Minimum Solder Mask Sliver Constraint: (0.072mm < 0.254mm) Between Pad R3-1(13.6mm,51.9mm) on Top Layer And Pad U1-5(12.475mm,51.9mm) on
Minimum Solder Mask Sliver Constraint: (0.163mm < 0.254mm) Between Pad R3-1(13.6mm,51.9mm) on Top Layer And Pad U1-6(12.475mm,52.85mm) on
Minimum Solder Mask Sliver Constraint: (0.202mm < 0.254mm) Between Pad R32-1(2.445mm,16.5mm) on Bottom Layer And Pad R35-2(3.7mm,16.55mm)
Minimum Solder Mask Sliver Constraint: (0.202mm < 0.254mm) Between Pad R32-2(2.445mm,14.95mm) on Bottom Layer And Pad R35-1(3.7mm,15mm)
Minimum Solder Mask Sliver Constraint: (0.147mm < 0.254mm) Between Pad R33-1(50.9mm,62.665mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.147mm < 0.254mm) Between Pad R33-2(50.9mm,61.115mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.136mm < 0.254mm) Between Pad R34-1(52.1mm,61.115mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.136mm < 0.254mm) Between Pad R34-2(52.1mm,62.665mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad R37-1(16.175mm,29.889mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad R37-2(16.175mm,29.339mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad R37-3(16.175mm,28.839mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad R37-5(15.175mm,28.289mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad R37-6(15.175mm,28.839mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad R37-7(15.175mm,29.339mm) on Bottom Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.206mm < 0.254mm) Between Pad R41-1(11.1mm,7.241mm) on Top Layer And Pad R43-1(11.1mm,8.5mm) on
Minimum Solder Mask Sliver Constraint: (0.072mm < 0.254mm) Between Pad R41-2(12.65mm,7.241mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.206mm < 0.254mm) Between Pad R41-2(12.65mm,7.241mm) on Top Layer And Pad R43-2(12.65mm,8.5mm)
Minimum Solder Mask Sliver Constraint: (0.218mm < 0.254mm) Between Pad R41-2(12.65mm,7.241mm) on Top Layer And Pad R44-1(13.775mm,8.5mm)
Minimum Solder Mask Sliver Constraint: (0.197mm < 0.254mm) Between Pad R41-2(12.65mm,7.241mm) on Top Layer And Via (13.775mm,7.266mm) from
Minimum Solder Mask Sliver Constraint: (0.218mm < 0.254mm) Between Pad R42-1(13.775mm,7.241mm) on Top Layer And Pad R43-2(12.65mm,8.5mm)
Minimum Solder Mask Sliver Constraint: (0.206mm < 0.254mm) Between Pad R42-1(13.775mm,7.241mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.072mm < 0.254mm) Between Pad R43-2(12.65mm,8.5mm) on Top Layer And Pad R44-1(13.775mm,8.5mm) on
Minimum Solder Mask Sliver Constraint: (0.197mm < 0.254mm) Between Pad R43-2(12.65mm,8.5mm) on Top Layer And Via (13.775mm,8.5mm) from Top
Minimum Solder Mask Sliver Constraint: (0.162mm < 0.254mm) Between Pad R5-1(1.4mm,62.8mm) on Top Layer And Via (1.364mm,61.71mm) from Top
Minimum Solder Mask Sliver Constraint: (0.038mm < 0.254mm) Between Pad R8-1(22.357mm,9.405mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.203mm < 0.254mm) Between Pad R8-1(22.357mm,9.405mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.131mm < 0.254mm) Between Pad R8-1(22.357mm,9.405mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.131mm < 0.254mm) Between Pad R8-1(22.357mm,9.405mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.23mm < 0.254mm) Between Pad R8-1(22.357mm,9.405mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.038mm < 0.254mm) Between Pad R8-2(22.357mm,7.855mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.038mm < 0.254mm) Between Pad R8-2(22.357mm,7.855mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.131mm < 0.254mm) Between Pad R8-2(22.357mm,7.855mm) on Top Layer And Pad
Minimum Solder Mask Sliver Constraint: (0.197mm < 0.254mm) Between Pad U1-5(12.475mm,51.9mm) on Top Layer And Via (13.6mm,51.9mm) from Top
Minimum Solder Mask Sliver Constraint: (0.204mm < 0.254mm) Between Pad U2-12(21.007mm,9.675mm) on Top Layer And Via (21mm,10.4mm) from Top
Minimum Solder Mask Sliver Constraint: (0.229mm < 0.254mm) Between Pad U3-12(21.014mm,21.05mm) on Top Layer And Via (21mm,21.8mm) from Top
Minimum Solder Mask Sliver Constraint: (0.23mm < 0.254mm) Between Pad U3-15(21.014mm,22.551mm) on Top Layer And Via (21mm,21.8mm) from Top
Minimum Solder Mask Sliver Constraint: (0.128mm < 0.254mm) Between Pad U4-10(22.525mm,63.55mm) on Top Layer And Via (23.381mm,63.55mm)

Minimum Solder Mask Sliver (Gap=0.254mm) (All),(All)
Minimum Solder Mask Sliver Constraint: (0.047mm < 0.254mm) Between Pad U4-7(22.525mm,57.65mm) on Top Layer And Via (23.3mm,57.6mm) from