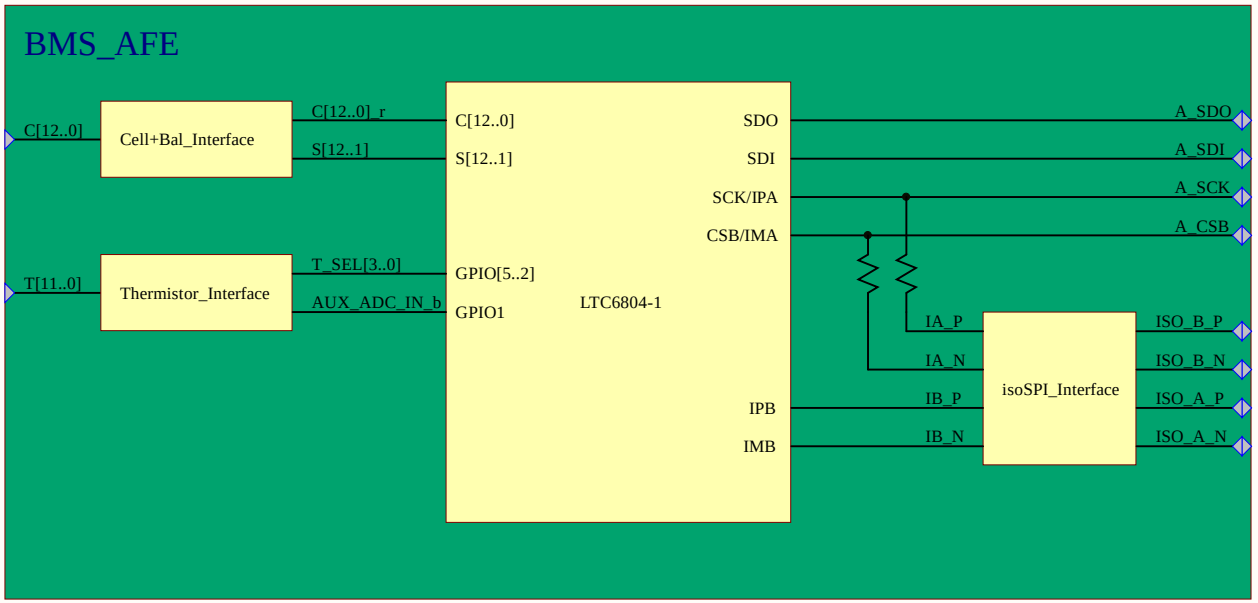
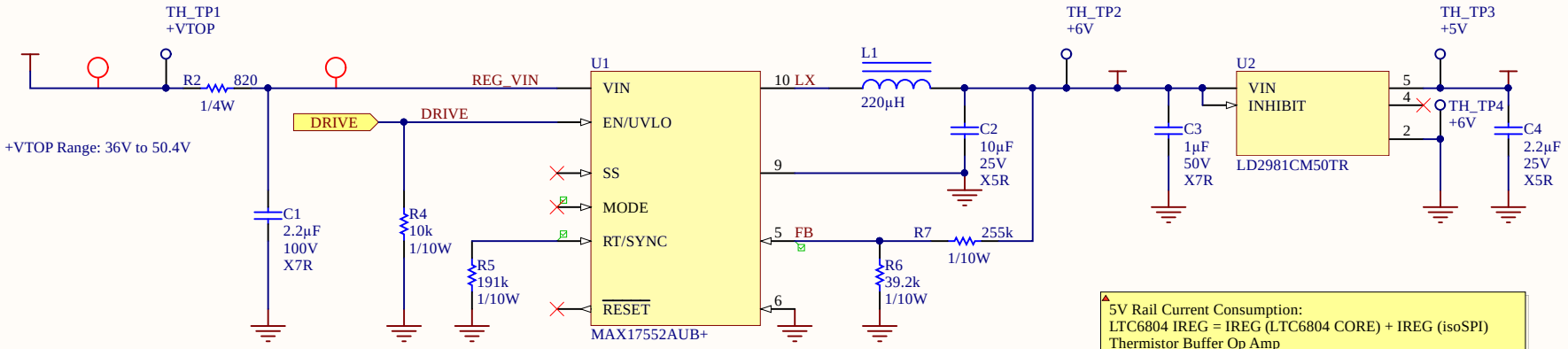
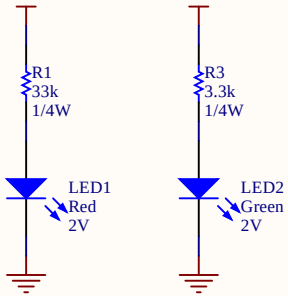
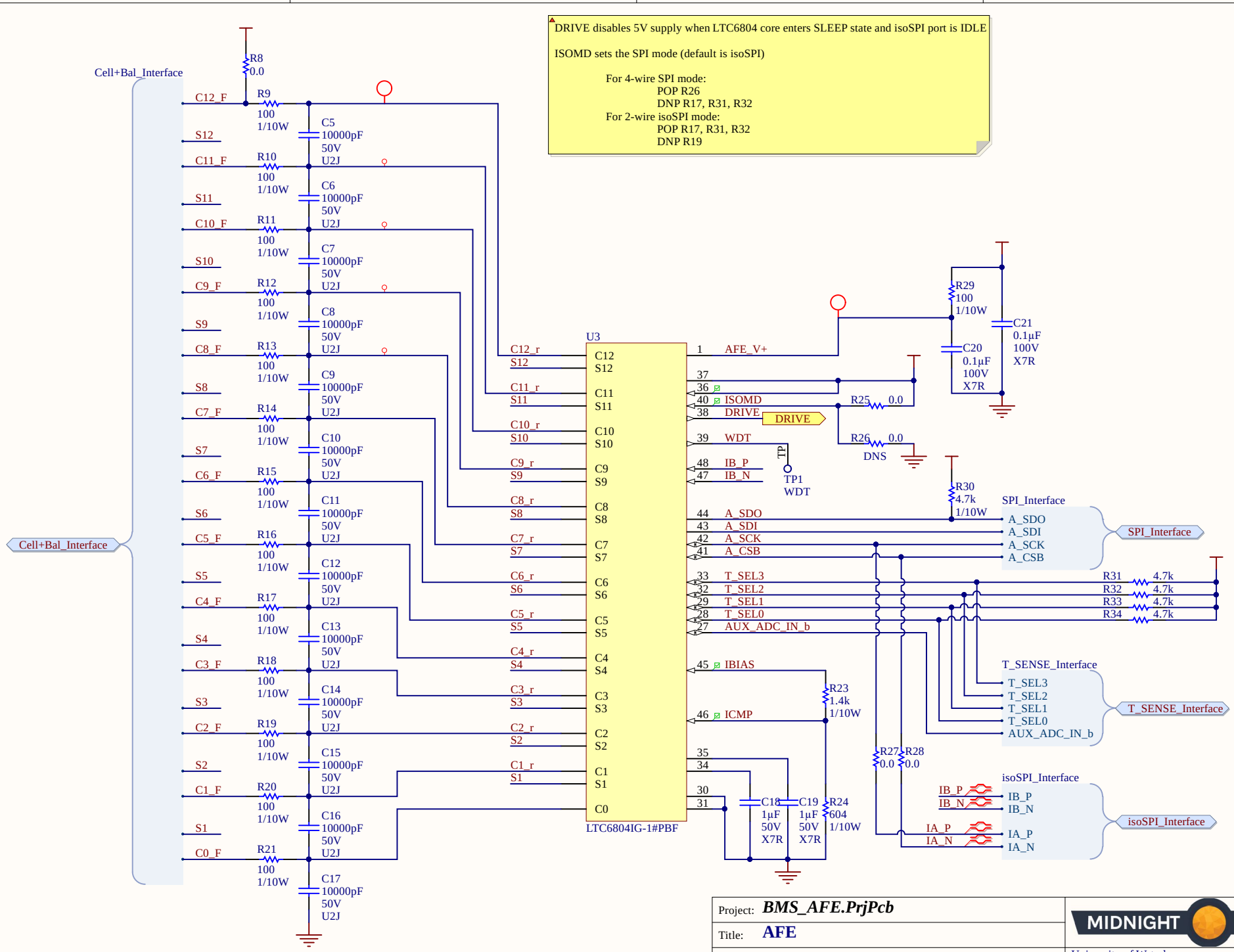


Project: ***BMS_AFE.PrjPcb***		MIDNIGHT SUN
Title: **Block Diagram**		
Project Lead: Kevin Chen, Taiping Li		University of Waterloo 200 University Ave W Waterloo, ON, Canada N2L 3E9
Size: Letter	Revision: 3.1	
Date: 2018-10-19	Sheet 1 of 6	Website: www.uwmidsun.com

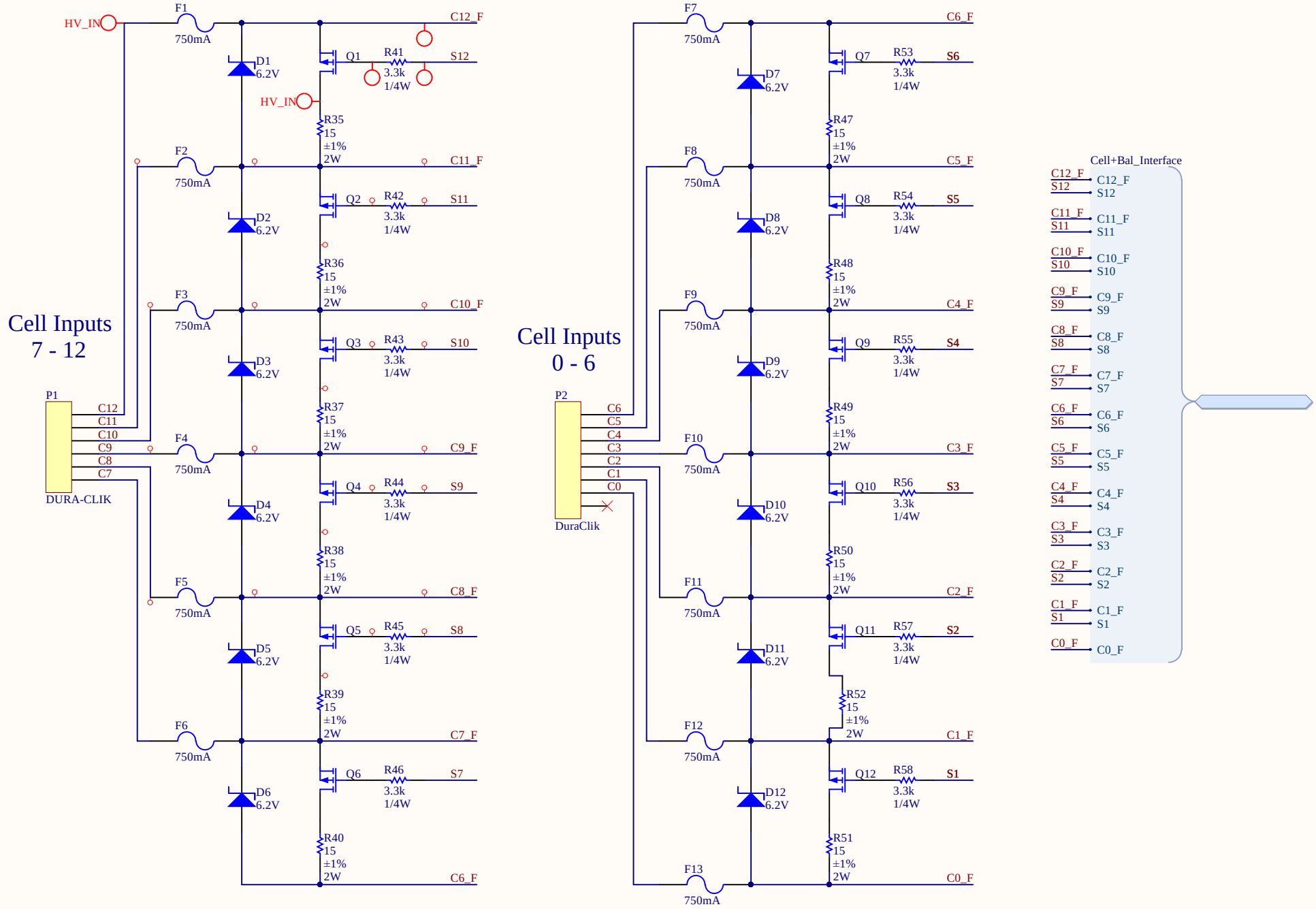




Project: ***BMS_AFE.PrjPcb***		MIDNIGHT SUN
Title: **Power Supplies**		
Project Lead: Kevin Chen, Taiping Li		University of Waterloo 200 University Ave W Waterloo, ON, Canada N2L 3E9
Size: Letter	Revision: 3.1	
Date: 2018-10-19	Sheet 2 of 6	Website: www.uwmidsun.com

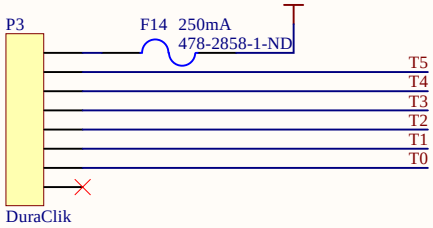


Project: ***BMS_AFE.PrjPcb***		MIDNIGHT SUN
Title: **AFE**		
Project Lead: Kevin Chen, Taiping Li		University of Waterloo 200 University Ave W Waterloo, ON, Canada N2L 3E9
Size: Letter	Revision: 3.1	
Date: 2018-10-19	Sheet 3 of 6	Website: www.uwmidsun.com

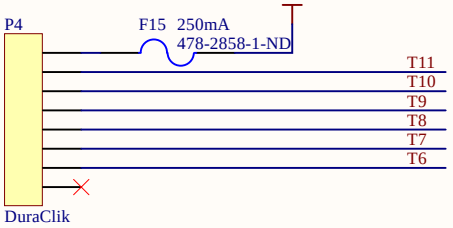


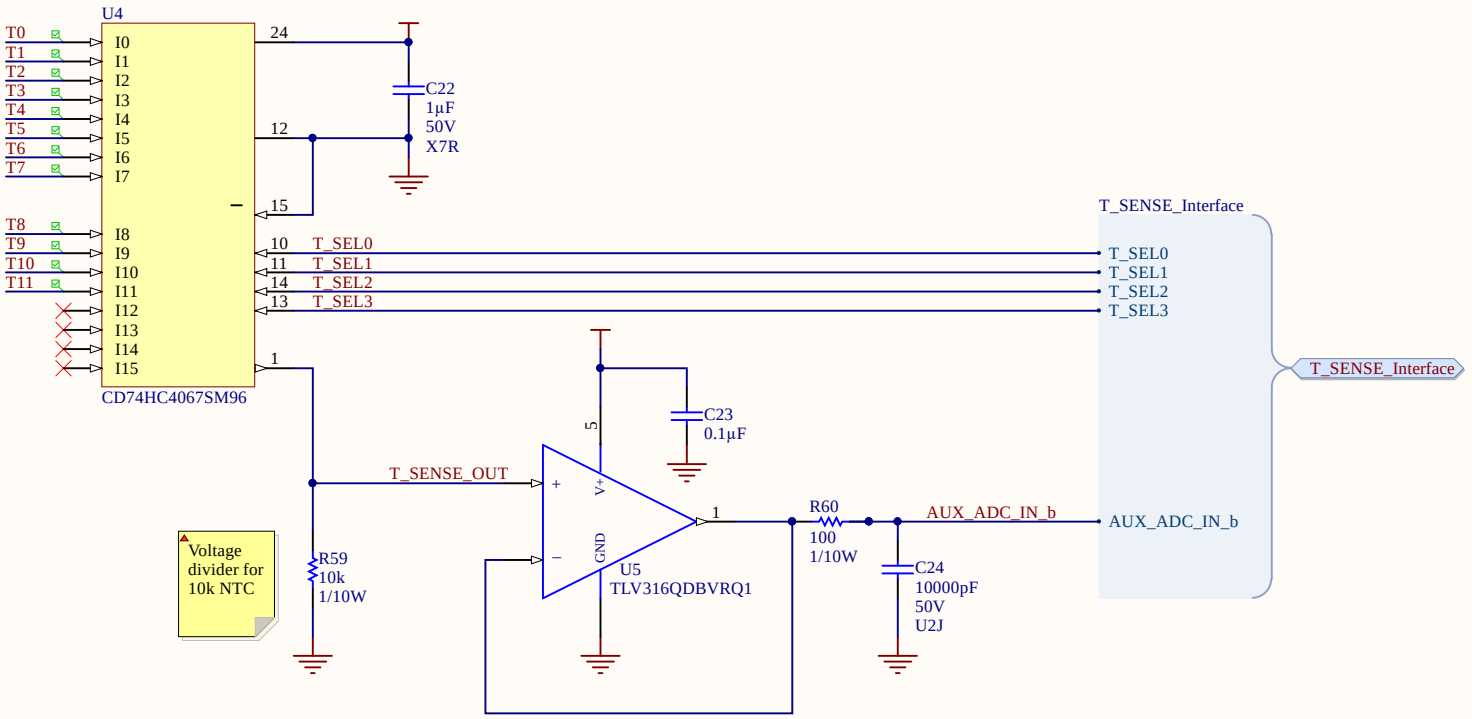
Project: ***BMS_AFE.PrjPcb***		MIDNIGHT SUN
Title: **Cell+Balancing Interface**		
Project Lead: Kevin Chen, Taiping Li		University of Waterloo 200 University Ave W Waterloo, ON, Canada N2L 3E9
Size: Letter	Revision: 3.1	
Date: 2018-10-19	Sheet 4 of 6	Website: www.uwmidsun.com

Thermistor Inputs
0 - 5

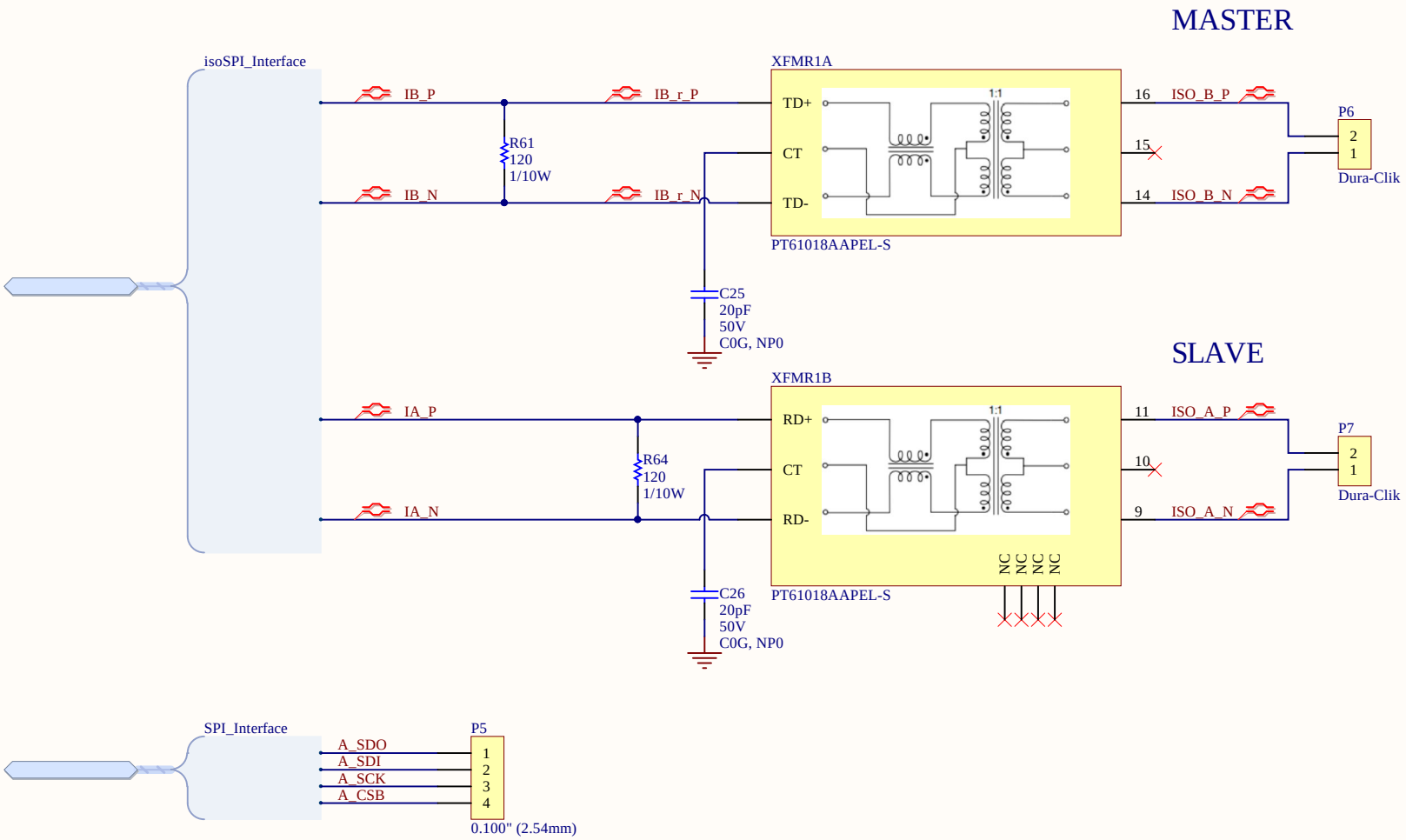


Thermistor Inputs
6 - 11





Project: ***BMS_AFE.PrjPcb***		MIDNIGHT SUN
Title: **Thermistor Interface**		
Project Lead: Kevin Chen, Taiping Li		University of Waterloo 200 University Ave W Waterloo, ON, Canada N2L 3E9
Size: Letter	Revision: 3.1	
Date: 2018-10-19	Sheet 5 of 6	Website: www.uwmidsun.com



Project: ***BMS_AFE.PrjPcb***		MIDNIGHT SUN
Title: **isoSPI Interface**		
Project Lead: Kevin Chen, Taiping Li		University of Waterloo 200 University Ave W Waterloo, ON, Canada N2L 3E9
Size: Letter	Revision: 3.1	
Date: 2018-10-19	Sheet 6 of 6	Website: www.uwmidsun.com

Bill of Materials

Project:	BMS_AFE.PrjPcb
Revision:	3.1
Project Lead:	Kevin Chen, Taiping Li
Generated On:	2018-10-19 10:45:20 PM
Production Quantity:	1
Currency	CAD
Total Parts Count:	146

LibRef	Designator	Manufacturer 1	Manufacturer Part Number 1	Supplier 1	Supplier Part Number 1	Supplier Unit Price 1	Supplier Order Qty 1	Supplier Subtotal 1
CAP CER 2.2UF 100V ±20% X7R 1206	C1	Murata Electronics North America	GRM31CR72A225MA73L	Digi-Key	490-12773-1-ND			
CAP CER 10uF 25V 20% X5R 0603	C2	Murata Electronics North America	GRM188R61E106MA73D	Digi-Key	490-7202-1-ND			
CAP CER 1UF 50V 10% X7R 0603	C3, C18, C19, C22	Taiyo Yuden	UMK107AB7105KA-T	Digi-Key	587-3247-1-ND			
CAP CER 2.2UF 25V 10% X5R 0603	C4	Murata Electronics North America	GRM188R61E225KA12D	Digi-Key	490-10731-1-ND			
CAP CER 10nF 50V 5% X7R 0603	C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, C24	KEMET	C0603C103J5JAC7867	Digi-Key	399-13384-1-ND			
CAP CER 0.1UF 100V 10% X7R 0805	C20, C21	Murata Electronics North America	GCM21BR72A104KA37L	Digi-Key	490-4789-1-ND			
CAP CER 0.1UF 50V 10% X7R 0603	C23	AVX Corporation	06035C104KAT2A	Digi-Key	478-5052-1-ND			
CAP CER 20PF 50V ±5% C0G/NP0 0603	C25, C26	Murata Electronics North America	GRM1885C1H200JA01D	Digi-Key	490-1410-1-ND			
DIODE ZENER 6.2V 5W DO214AA	D1, D2, D3, D4, D5, D6, D7, D8, D9, D10, D11, D12	Micro Commercial Co	SMBJ5341B-TP	Digi-Key	SMBJ5341B-TPMSCT-ND			
FUSE SMT 750MA	F1, F2, F3, F4, F5, F6, F7, F8, F9, F10, F11, F12, F13	Bel Fuse Inc.	C2Q 750	Digi-Key	507-1090-1-ND			
FUSE 250MA 32VDC 0603	F14, F15	Loading...	Loading...	Digi-Key	478-2858-1-ND			
IND 220uH 0.59A 20%	L1	Laird-Signal Integrity Products	TYS6045221M-10	Digi-Key	240-2742-1-ND			
LED RED CLEAR 2V 0603	LED1	Loading...	Loading...	Digi-Key	732-4978-1-ND			
LED GREEN CLEAR 2V 0603	LED2	Loading...	Loading...	Digi-Key	732-4980-1-ND			
CONN 6POS DURA-CLIK 0.079"	P1	Loading...	Loading...	Digi-Key	WM10866CT-ND			
CONN 8POS DURA-CLIK 0.079"	P2, P3, P4	Molex, LLC	5600200820	Digi-Key	WM10868CT-ND			
CONN 4POS HEADR MALE 0.1"	P5	Wurth Electronics Inc.	61300411121	Digi-Key	732-5317-ND			
CONN 2POS DURA-CLIK 0.079" VERT	P6, P7	Loading...	Loading...	Digi-Key	WM10862CT-ND			
MOSFET P-CH 16V 2.5A X2-DFN2015	Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q9, Q10, Q11, Q12	Diodes Incorporated	DMG3415UFY4Q-7	Digi-Key	DMG3415UFY4Q-7DICT-ND			
RES 33K OHM 1% 1/4W 0603	R1	Panasonic Electronic Components	ERJ-PA3F3302V	Digi-Key	P33KBYCT-ND			
RES 820 OHM 5% 1/4W 0603	R2	Rohm Semiconductor	ESR03EZPJ821	Digi-Key	RHM820DCT-ND			
RES 3.3K OHM 1% 1/4W 0603	R3, R41, R42, R43, R44, R45, R46, R53, R54, R55, R56, R57, R58	Panasonic Electronic Components	ERJ-PA3F3301V	Digi-Key	P3.3KBYCT-ND			
RES 10K OHM 1% 1/10W 0603	R4, R59	Yageo	RC0603FR-0710KL	Digi-Key	311-10.0KHRCT-ND			
RES 191K OHM 1% 1/10W 0603	R5	Yageo	RC0603FR-07191KL	Digi-Key	311-191KHRCT-ND			
RES 39.2K OHM 1% 1/10W 0603	R6	Yageo	RC0603FR-0739K2L	Digi-Key	311-39.2KHRCT-ND			
RES 255K OHM 1% 1/10W 0603	R7	Yageo	RC0603FR-07255KL	Digi-Key	311-255KHRCT-ND			
RES 0.0 OHM 1/4W 0603	R8, R25, R27, R28	Vishay Dale	CRCW06030000Z0EAHP	Digi-Key	541-0.0SBCT-ND			
RES 100 OHM 1% 1/10W 0603	R9, R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R29, R60	Yageo	RC0603FR-07100RL	Digi-Key	311-100HRCT-ND			
RES 1.4k OHM 1% 1/10W 0603	R23	Yageo	RC0603FR-071K4L	Digi-Key	311-1.40KHRCT-ND			
RES 604 OHM 1% 1/10W 0603	R24	Yageo	RC0603FR-07604RL	Digi-Key	311-604HRCT-ND			
RES 4.7K OHM 1% 1/10W 0603	R30, R31, R32, R33, R34	Yageo	RC0603FR-074K7L	Digi-Key	311-4.70KHRCT-ND			
RES 15 OHM 1% 2W 2512	R35, R36, R37, R38, R39, R40, R47, R48, R49, R50, R51, R52	TE Connectivity Passive Product	352115RFT	Digi-Key	A115988CT-ND			
RES 120 OHM 1% 1/10W 0603	R61, R64	Yageo	RC0603FR-07120RL	Digi-Key	311-120HRCT-ND			
Thru Test Point	TH_TP1							
Thru Test Point	TH_TP2, TH_TP4							
Thru Test Point	TH_TP3							
Test Point	TP1							
IC REG BUCK ADJ 0.1A 10UMAX	U1	Maxim Integrated	MAX17552AUB+	Digi-Key	MAX17552AUB+-ND			
IC REG LDO 5V 0.1A SOT23-5	U2	STMicroelectronics	LD2981CM50TR	Digi-Key	497-7787-1-ND			
IC MONITOR BATT STACK 48SSOP	U3	Linear Technology	LTC6804IG-1#PBF	Digi-Key	LTC6804IG-1#PBF-ND			
IC MUX/DEMUX 1X16 24SSOP	U4	Texas Instruments	CD74HC4067SM96	Digi-Key	296-9226-1-ND			
IC OP AMP GEN PURPOSE RR 10MHZ SOT-23-5	U5	Texas Instruments	TLV316QDBVRQ1	Digi-Key	296-45323-1-ND			
IC PULSE XFMR 1CT:1CT 350UH SMD	XFMR1	Loading...	Loading...	Digi-Key	PT61018AAPEL-SCT-ND			
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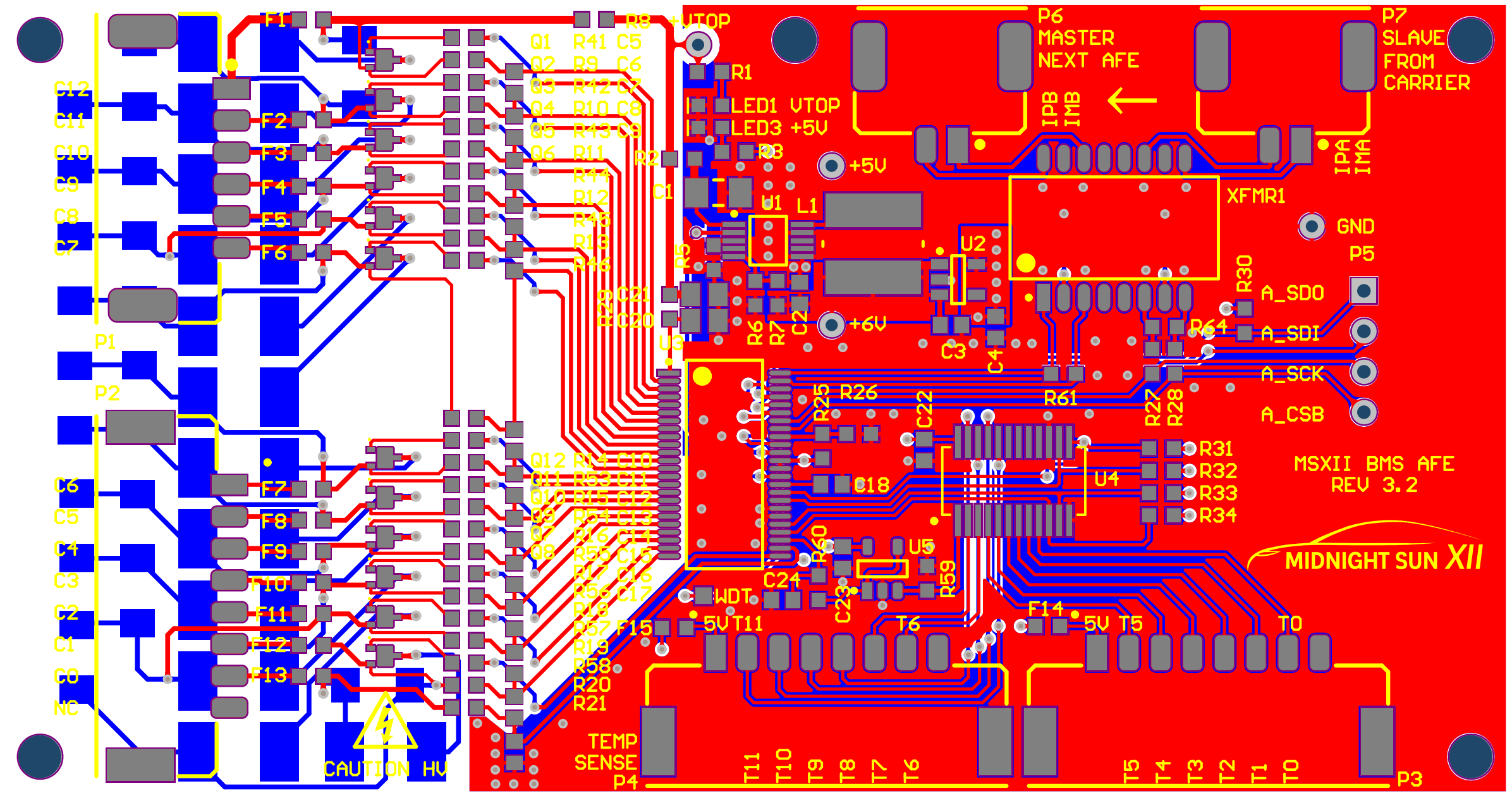
P6
MASTER
NEXT AFE
P7
SLAVE
FROM
CARRIER
+VTOP
LED1 VTOP
LED3 +5V
IPB
IMB
IPA
IMA
XFMR1
GND
P5
A_SDO
A_SDI
A_SCK
A_CSB
+5V
+6V
MSXII BMS AFE
REV 3.2
MIDNIGHT SUN XII
WDT
5V
TEMP
SENSE
P4
P3
P1
P2
CAUTION HV

D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
R32
R33
R34
R35
R36
R37
R38
R39
R40
R41
R42
R43
R44
R45
R46
R47
R48
R49
R50
R51
R52
R53
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C24
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10
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8
7
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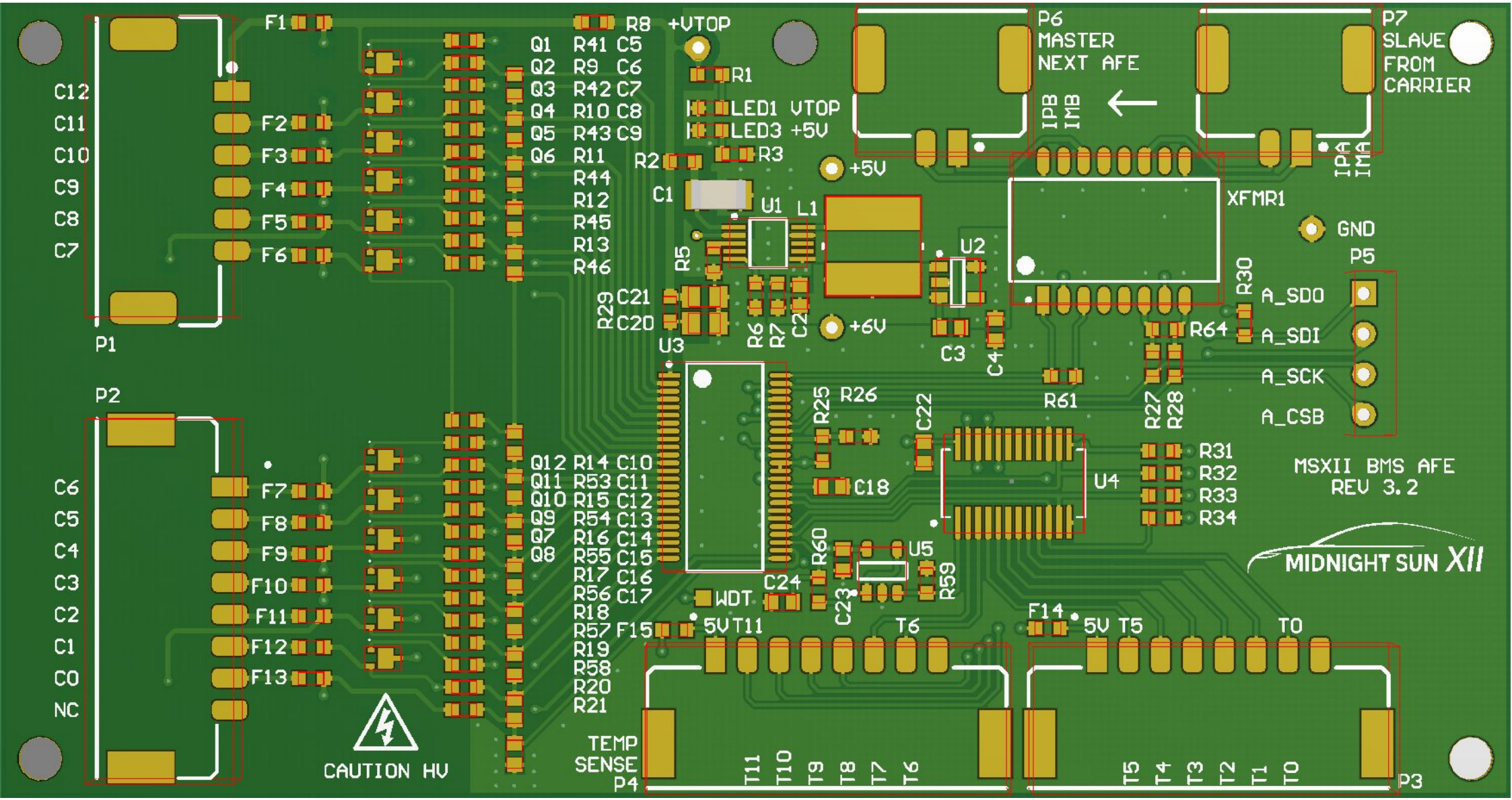
P6
MASTER
NEXT AFE
P7
SLAVE
FROM
CARRIER
IPB
IMB
IPA
IMA
XFMR1
GND
P5
A_SDO
A_SDI
A_SCK
A_CSB
MSXII BMS AFE
REV 3.2
MIDNIGHT SUN XII
+VTOP
LED1 VTOP
LED3 +5V
+5V
+6V
WDT
5V
TEMP
SENSE
CAUTION HV
P1
P2
P3
P4
U1
U2
U3
U4
U5
L1
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
F13
F14
F15
C12
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C10
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C2
C1
C0
NC
T11
T10
T9
T8
T7
T6
T5
T4
T3
T2
T1
T0

Electrical Rules Check Report

Class	Document	Message
Warning	AFE.SchDoc	Nets Wire IB_N has multiple names (Net Label IB_N,Net Label IB_N,Net Label IB_N,Net Label IB_r_N)
Warning	isoSPI_Interface.SchDoc	Nets Wire IB_N has multiple names (Net Label IB_N,Net Label IB_r_N)
Warning	AFE.SchDoc	Nets Wire IB_P has multiple names (Net Label IB_P,Net Label IB_P,Net Label IB_P,Net Label IB_r_P)
Warning	isoSPI_Interface.SchDoc	Nets Wire IB_P has multiple names (Net Label IB_P,Net Label IB_r_P)

Design Rules Verification Report

Filename : C:\Users\Taiping\Documents\MidnightSun\hardware\MSXII_BMS_AFE\AFE.PcbDoc

Warnings 0
Rule Violations 1

Warnings	
Total	0

Rule Violations	
Clearance Constraint (Gap=0.6mm) (InNetClass('HV_IN')),(InNet('GND'))	0
Clearance Constraint (Gap=0.152mm) (All),(All)	0
Clearance Constraint (Gap=0.6mm) (InNetClass('HV_IN')),(InNet('+5V'))	0
Clearance Constraint (Gap=0.6mm) (InNetClass('HV_IN')),(InNet('+6V'))	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=0.152mm) (Max=2.54mm) (Preferred=0.305mm) (All)	0
Power Plane Connect Rule(Relief Connect)(Expansion=0.508mm) (Conductor Width=0.254mm) (Air Gap=0.152mm)	0
Hole Size Constraint (Min=0.025mm) (Max=100mm) (All)	0
Hole To Hole Clearance (Gap=0.254mm) (All),(All)	0
Net Antennae (Tolerance=0mm) (All)	0
Board Clearance Constraint (Gap=0mm) (All)	1
Height Constraint (Min=0mm) (Max=25.4mm) (Prefered=12.7mm) (All)	0
Total	1

Board Clearance Constraint (Gap=0mm) (All)
Board Outline Clearance(Outline Edge): (0.15mm < 0.295mm) Between Text "D2" (9.4mm,48.9mm) on Bottom Overlay And Board Edge