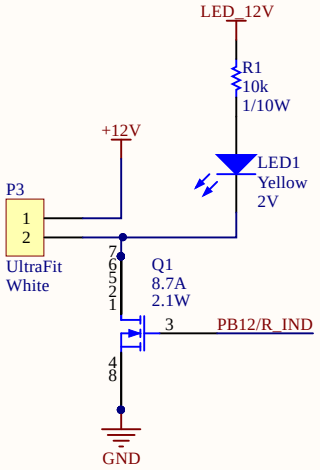
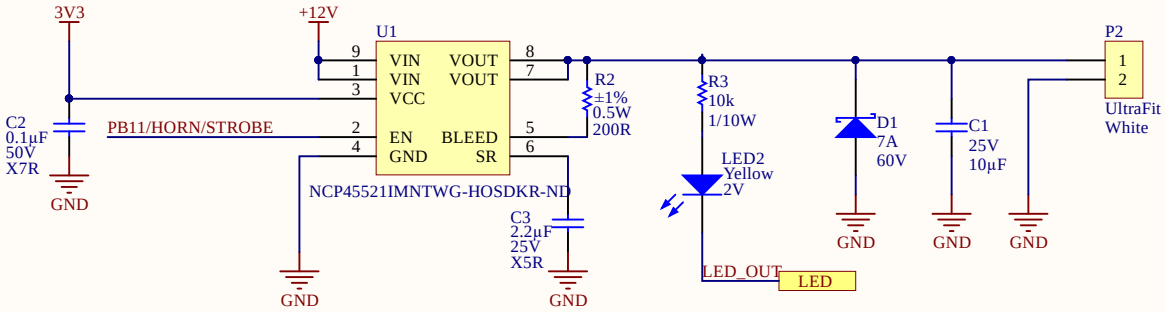
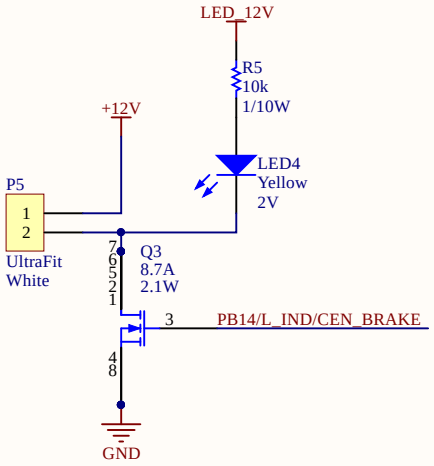
Side Right Indicator/NC

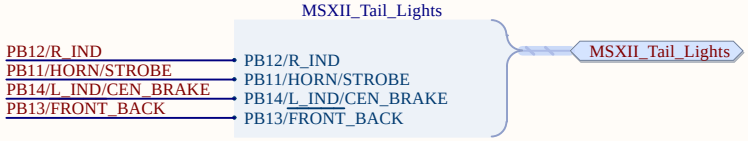


Horn/Strobe Light

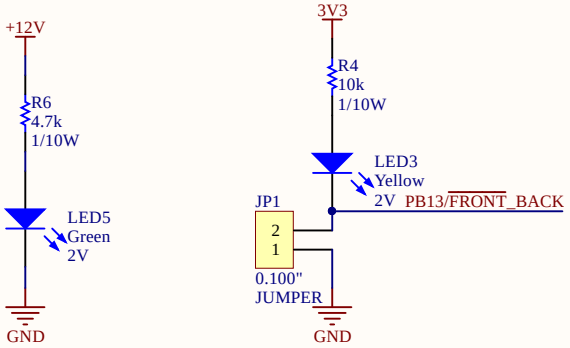


Side Left Indicator/Centre Brake Light

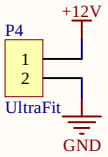




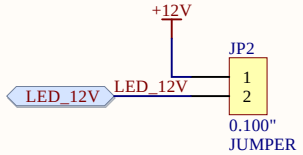
Distinguish Front vs Back



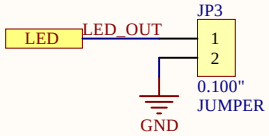
Power Supply



LED enable for mosfets



LED enable for HSD



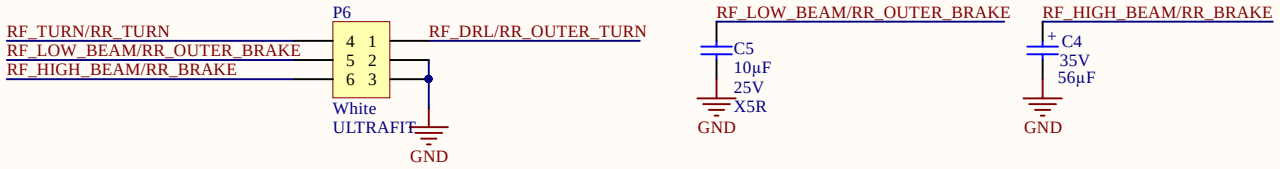
Note: LED ON when front and OFF when back

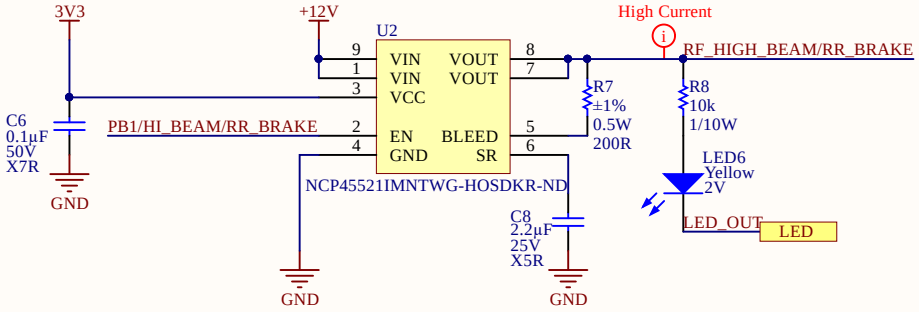
Project: ***Lights_Board.PrjPcb***		MIDNIGHT SUN
Title: **All Other Lights**		University of Waterloo 200 University Ave W Waterloo, ON, Canada N2L 3E9
Project Lead: Veronica Lee		
Size: Letter	Revision: 1.18	
Date: 2018-02-27	Sheet 1 of 3	Website: www.uwmidsun.com

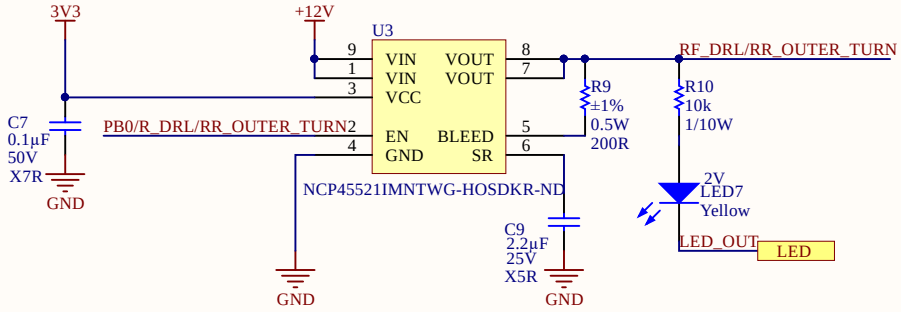
Right Headlight Assem/Rear Right Brake & Turn

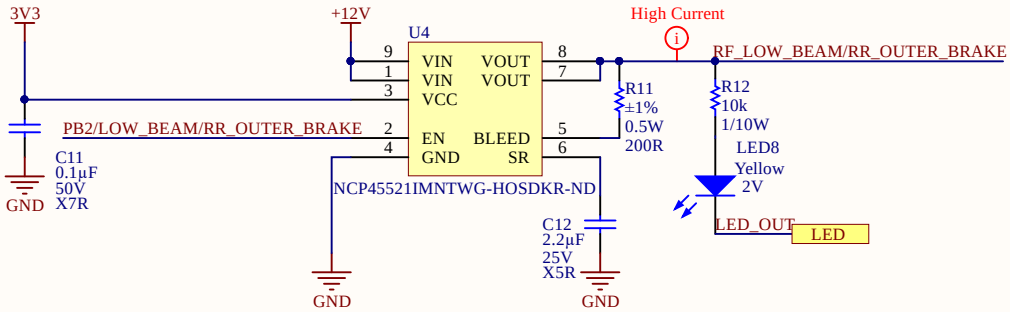
Do not populate capacitor on SR

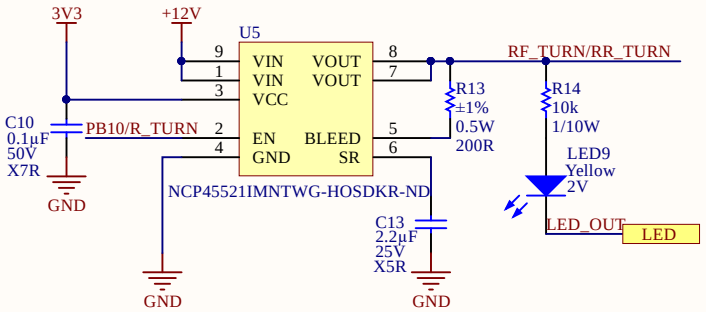
Note: High Beam will use Low Beam
Low Beam will use DRL
DRL will use parking light

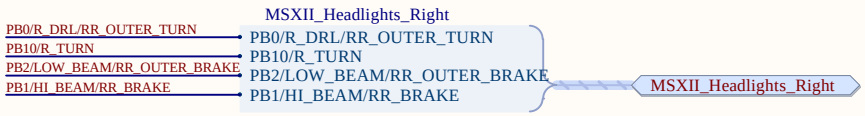










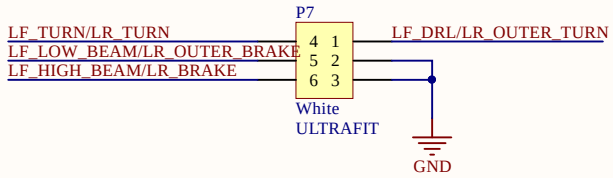


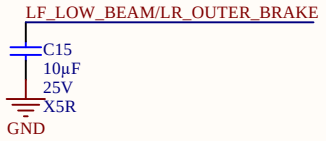
Project: *Lights_Board.PrjPcb*		MIDNIGHT SUN
Title: **Right Headlights**		University of Waterloo 200 University Ave W Waterloo, ON, Canada N2L 3E9
Project Lead: Veronica Lee		
Size: Letter	Revision: 1.18	
Date: 2018-02-27	Sheet 2 of 3	Website: www.uwmidsun.com

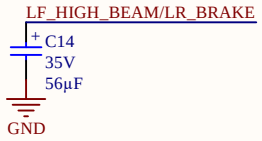
Left Headlight Assem/Rear left Brake & Turn

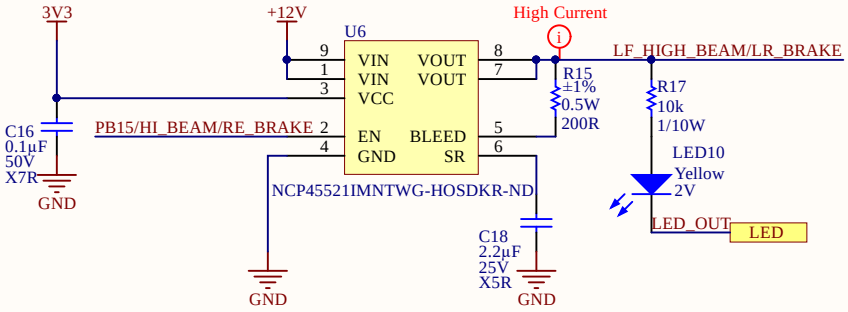
Do not populate capacitor on SR

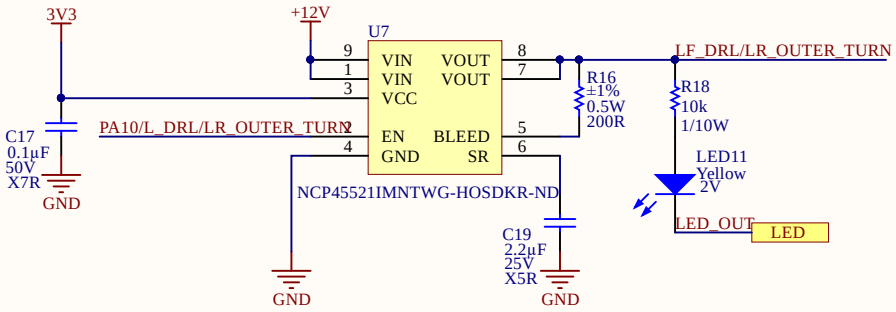
Note: High Beam will use Low Beam
Low Beam will use DRL
DRL will use parking light

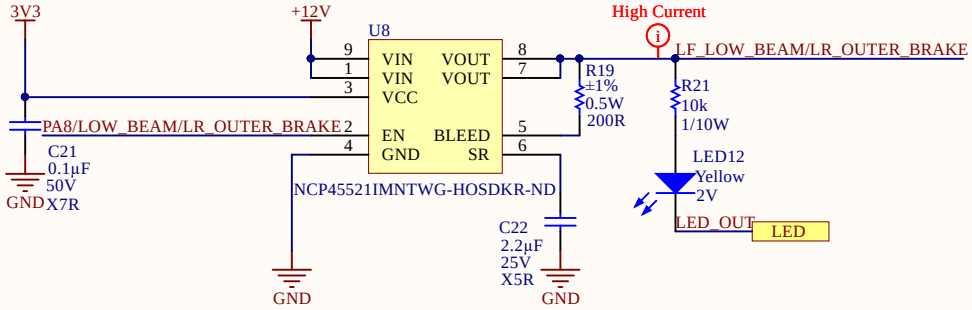


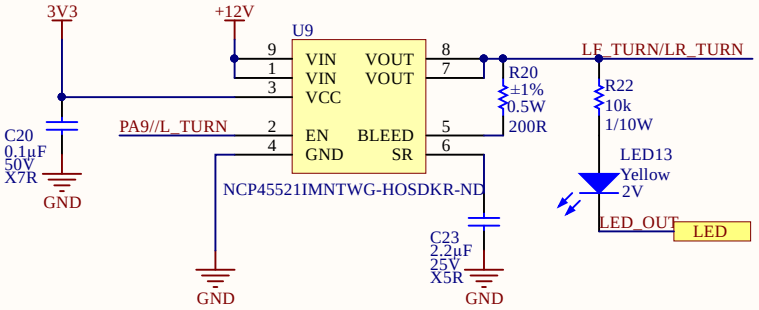


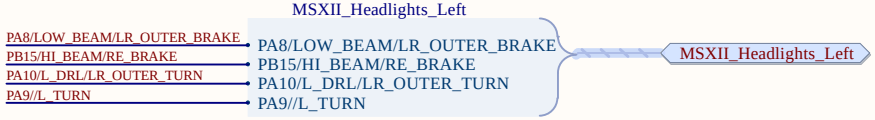




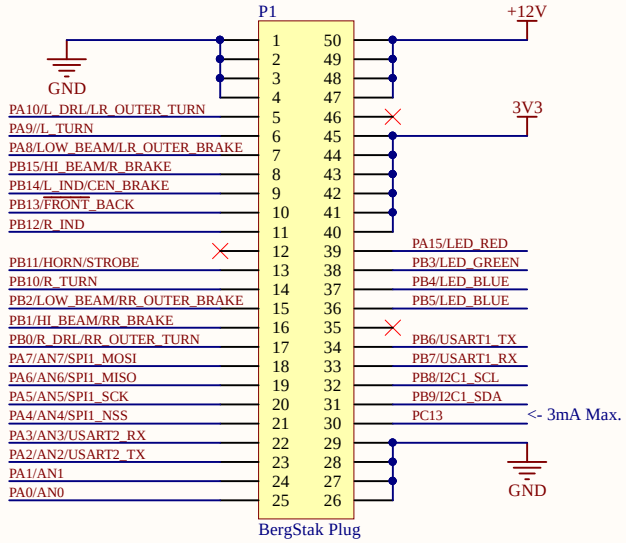


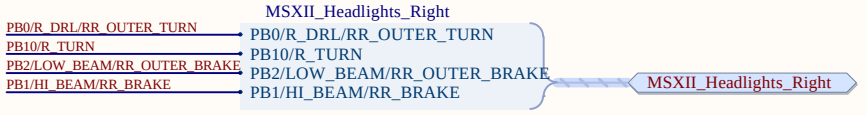


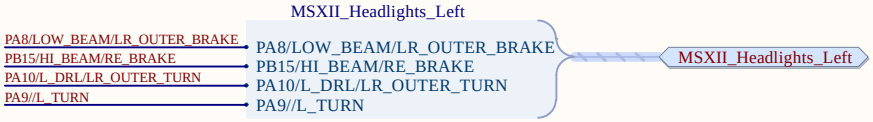




Project: *Lights_Board.PrjPcb*		MIDNIGHT SUN
Title: **Left Headlights**		University of Waterloo 200 University Ave W Waterloo, ON, Canada N2L 3E9
Project Lead: Veronica Lee		
Size: Letter	Revision: 1.18	
Date: 2018-02-27	Sheet 3 of 3	Website: www.uwmidsun.com





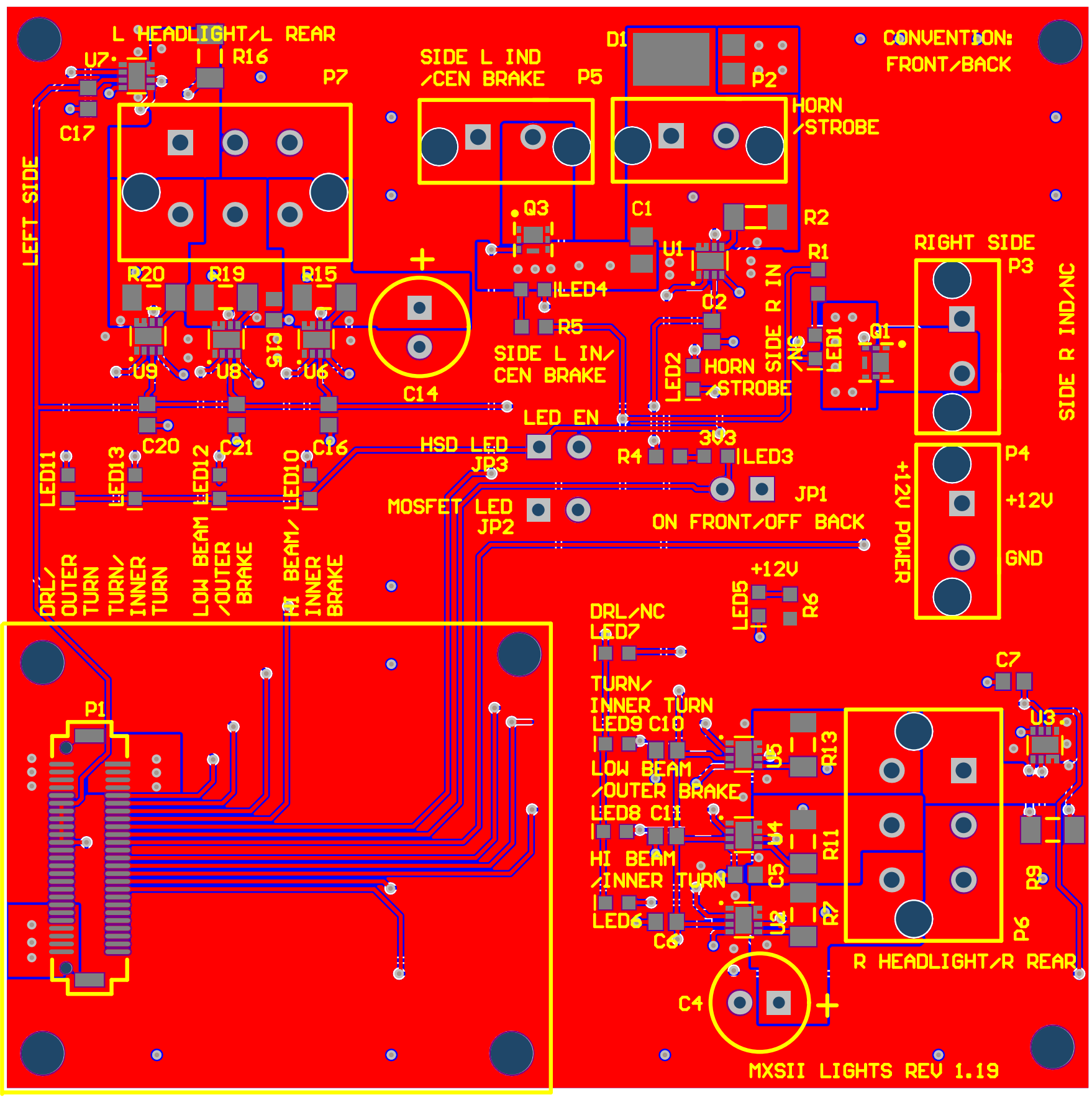


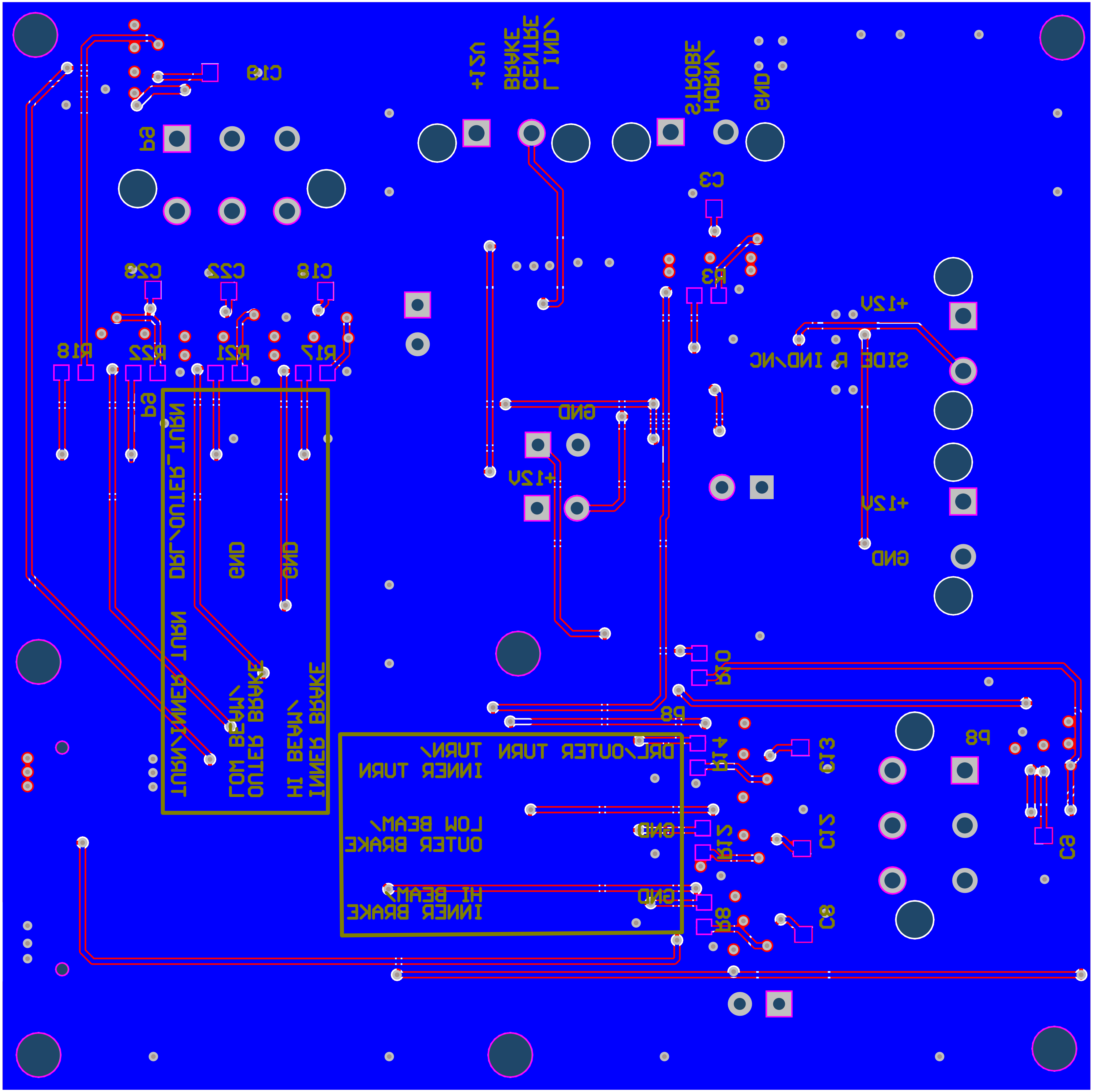
Project: ***Lights_Board.PrjPcb***		MIDNIGHT SUN
Title: *		
Project Lead: Veronica Lee		University of Waterloo 200 University Ave W Waterloo, ON, Canada N2L 3E9
Size: Letter	Revision: 1.18	
Date: 2018-02-27	Sheet* of *	Website: www.uwmidsun.com

Bill of Materials

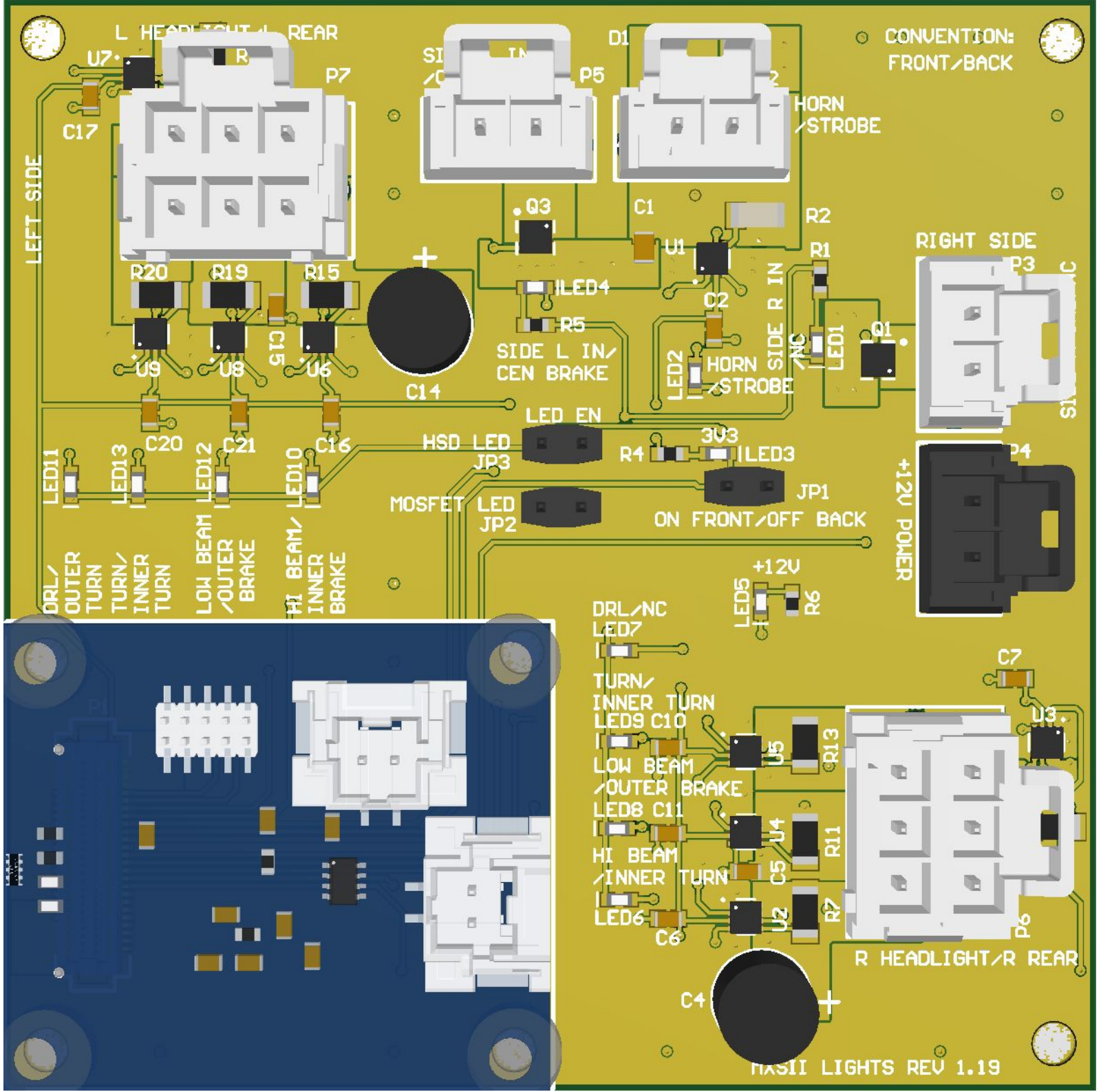
Project:	Lights_Board.PrjPcb
Revision:	1.18
Project Lead:	Veronica Lee
Generated On:	2018-02-27 10:56:28 PM
Production Quantity:	1
Currency	<none>
Total Parts Count:	71

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 10uF 25V 10% X5R 0805	C1	Murata	GRM21BR61E106KA73L	Digi-Key	490-5523-1-ND	0.22	1	$ 0.22
CAP CER 0.1UF 50V 10% X7R 0603	C2, C6, C7, C10, C11, C16, C17, C20, C21	Kyocera AVX	06035C-104KAT2A	Digi-Key	478-5052-1-ND	0.1	9	$ 0.90
CAP ALUM 56UF 20% 35V RADIAL	C4, C14	Panasonic ECG	EEU-FC1V560H	Digi-Key	P19684CT-ND	0.37	2	$ 0.74
CAP CER 10uF 25V 20% X5R 0603	C5, C15	Murata	GRM188R61E106MA73D	Digi-Key	490-7202-1-ND	0.41	2	$ 0.82
DIODE SCHOTTKY 60V 7A POWERDI5	D1			Digi-Key				
CONN 2POS JUMPER 0.1"	JP1, JP2, JP3	Omron	XG8T-0231	Digi-Key	XG8T-0231-ND	0.19	3	$ 0.57
LED YELLOW CLEAR 2.1V 0603	LED1, LED2, LED3, LED4, LED6, LED7, LED8, LED9, LED10, LED11, LED12, LED13	Wurth Electronics	150060YS75000	Digi-Key	732-4981-1-ND	0.14	12	$ 1.68
LED GREEN CLEAR 2V 0603	LED5	Wurth Electronics	150060VS75000	Digi-Key	732-4980-1-ND	0.14	1	$ 0.14
CONN 50POS Bergstak Plug 0.02"	P1	Amphenol FCI	10132797-055100LF	Digi-Key	609-5226-1-ND	1.4	1	$ 1.40
CONN 2POS ULTRA-FIT NATURAL COLOR 0.138"	P2, P3, P5	Molex	1722872102	Digi-Key	WM11722-ND	0.82	3	$ 2.46
CONN 2POS ULTRA-FIT 0.138"	P4	Molex	1722861302	Digi-Key	WM11673-ND	1.38	1	$ 1.38
CONN 6POS ULTRA-FIT NATURAL COLOR 0.138"	P6, P7	Molex	1722992106	Digi-Key	WM11799-ND	1.27	2	$ 2.54
MOSFET N-CH 30V 8.7A 2.1W 6-PQFN (2x2)	Q1, Q3	Infineon	IRLHS6342TRPBF	Digi-Key	IRLHS6342TRPBFCT-ND	0.65	2	$ 1.30
RES 10K OHM 1% 1/10W 0603	R1, R3, R4, R5, R8, R10, R12, R14, R17, R18, R21, R22	Yageo	RC0603FR-0710KL	Digi-Key	311-10.0KHRCT-ND	0.02	12	$ 0.18
RES 200 OHM 5% 1/2W 0805	R2			Digi-Key				
RES 4.7K OHM 1% 1/10W 0603	R6	Yageo	RC0603FR-074K7L	Digi-Key	311-4.70KHRCT-ND	0.1	1	$ 0.10
RES SMD 200 OHM 1% 1/2W 0805	R7, R9, R11, R13, R15, R16, R19, R20			Digi-Key				
IC LOAD SWITCH ACT-HI 10.5A 8DFN	U1, U2, U3, U4, U5, U6, U7, U8, U9	ON Semiconductor	NCP45521IMNTWG-H	Digi-Key	NCP45521IMNTWG-HOSDKR-ND	1.08	9	$ 9.72
							Total:	$ 24.15


L HEADLIGHT/L REAR
U7
R16
P7
SIDE L IND
/CEN BRAKE
P5
D1
P2
CONVENTION:
FRONT/BACK
HORN
/STROBE
C17
LEFT SIDE
Q3
C1
R2
U1
R1
RIGHT SIDE
P3
R20
R19
R15
LED4
C2
SIDE R IN
R5
SIDE L IN/
CEN BRAKE
LED2
HORN
/STROBE
LED1
Q1
SIDE R IND/NC
U9
U8
U6
C14
LED EN
C20
C21
C16
HSD LED
JP3
3V3
R4
LED3
P4
+12V
LED11
LED13
LED12
LED10
MOSFET LED
JP2
JP1
ON FRONT/OFF BACK
REMOTE +12V POWER
GND
DRL/
OUTER
TURN
TURN/
INNER
TURN
LOW BEAM
/OUTER
BRAKE
HI BEAM/
INNER
BRAKE
+12V
LED5
R6
DRL/NC
LED7
C7
P1
TURN/
INNER TURN
LED9 C10
U5
R13
U3
LOW BEAM
/OUTER BRAKE
LED8 C11
U4
R11
HI BEAM
/INNER TURN
C5
R7
R9
LED6
U2
C6
P6
R HEADLIGHT/R REAR
C4
MXSII LIGHTS REV 1.19



C19
P9
+12V
BRAKE
CENTRE
L IND/
STROBE
HORN/
GND
C3
R3
C28
C22
C18
R18
R22
R21
R17
+12V
SIDE R IND/NC
GND
+12V
+12V
GND
DRL/OUTER TURN
GND
GND
TURN/INNER TURN
LOW BEAM/
OUTER BRAKE
HI BEAM/
INNER BRAKE
R10
P8
P8
DRL/OUTER TURN TURN/
INNER TURN
R14
C13
LOW BEAM/
OUTER BRAKE
GND
R12
C12
C9
HI BEAM/
INNER BRAKE
GND
R8
C8


L HEADLIGHT/L REAR
P7
U7
C17
LEFT SIDE
P5
D1
HORN
/STROBE
CONVENTION:
FRONT/BACK
Q3
C1
R2
U1
R1
RIGHT SIDE
P3
R20
R19
R15
ILED4
C2
R5
SIDE L IN/
CEN BRAKE
SIDE R IN
/NC
LED1
Q1
U9
U8
C15
U6
C14
LED2
HORN
/STROBE
LED EN
HSD LED
JP3
3V3
R4
LED3
P4
+12V POWER
C20
C21
C16
LED11
LED13
LED12
LED10
MOSFET LED
JP2
JP1
ON FRONT/OFF BACK
DRL/
OUTER
TURN
TURN/
INNER
TURN
LOW BEAM
/OUTER
BRAKE
HI BEAM/
INNER
BRAKE
+12V
LED5
R6
DRL/NC
LED7
C7
U3
TURN/
INNER TURN
LED9 C10
U5
R13
LOW BEAM
/OUTER BRAKE
LED8 C11
U4
R11
HI BEAM
/INNER TURN
C5
LED6
C6
U2
R7
P6
R HEADLIGHT/R REAR
C4
MXSII LIGHTS REV 1.19

Electrical Rules Check Report

Class	Document	Message
Error	Controller_Board_Interface.SchDoc	Net PA0/AN0 has only one pin (Pin P1-25)
Error	Controller_Board_Interface.SchDoc	Net PA1/AN1 has only one pin (Pin P1-24)
Error	Controller_Board_Interface.SchDoc	Net PA2/AN2/USART2_TX has only one pin (Pin P1-23)
Error	Controller_Board_Interface.SchDoc	Net PA3/AN3/USART2_RX has only one pin (Pin P1-22)
Error	Controller_Board_Interface.SchDoc	Net PA4/AN4/SPI1_NSS has only one pin (Pin P1-21)
Error	Controller_Board_Interface.SchDoc	Net PA5/AN5/SPI1_SCK has only one pin (Pin P1-20)
Error	Controller_Board_Interface.SchDoc	Net PA6/AN6/SPI1_MISO has only one pin (Pin P1-19)
Error	Controller_Board_Interface.SchDoc	Net PA7/AN7/SPI1_MOSI has only one pin (Pin P1-18)
Error	Controller_Board_Interface.SchDoc	Net PA15/LED_RED has only one pin (Pin P1-39)
Error	Controller_Board_Interface.SchDoc	Net PB3/LED_GREEN has only one pin (Pin P1-38)
Error	Controller_Board_Interface.SchDoc	Net PB4/LED_BLUE has only one pin (Pin P1-37)
Error	Controller_Board_Interface.SchDoc	Net PB5/LED_BLUE has only one pin (Pin P1-36)
Error	Controller_Board_Interface.SchDoc	Net PB6/USART1_TX has only one pin (Pin P1-34)
Error	Controller_Board_Interface.SchDoc	Net PB7/USART1_RX has only one pin (Pin P1-33)
Error	Controller_Board_Interface.SchDoc	Net PB8/I2C1_SCL has only one pin (Pin P1-32)
Error	Controller_Board_Interface.SchDoc	Net PB9/I2C1_SDA has only one pin (Pin P1-31)
Error	Controller_Board_Interface.SchDoc	Net PB15/HI_BEAM/R_BRAKE has only one pin (Pin P1-8)
Error	Controller_Board_Interface.SchDoc	Net PB15/HI_BEAM/RE_BRAKE has only one pin (Pin U6-2)
Error	Controller_Board_Interface.SchDoc	Net PC13 has only one pin (Pin P1-30)

Design Rules Verification Report

Filename : C:\Users\Taiping\Documents\MidnightSun\hardware\MSXII_Lights\MSXII_Lights.Pc

Warnings 0
Rule Violations 4

Warnings	
Total	0

Rule Violations	
Un-Routed Net Constraint ((All))	0
Modified Polygon (Allow modified: No), (Allow shelved: No)	0
Power Plane Connect Rule(Direct Connect)(Expansion=0.508mm) (Conductor Width=0.254mm) (Air Gap=0.254mm)	0
Power Plane Connect Rule(Direct Connect)(Expansion=0.508mm) (Conductor Width=0.254mm) (Air Gap=0.254mm)	0
Power Plane Connect Rule(Direct Connect)(Expansion=0.508mm) (Conductor Width=0.254mm) (Air Gap=0.254mm)	0
Power Plane Connect Rule(Direct Connect)(Expansion=0.508mm) (Conductor Width=0.254mm) (Air Gap=0.254mm)	0
Power Plane Connect Rule(Direct Connect)(Expansion=0.508mm) (Conductor Width=0.254mm) (Air Gap=0.254mm)	0
Board Clearance Constraint (Gap=0mm) (All)	4
Total	4

Board Clearance Constraint (Gap=0mm) (All)
Board Outline Clearance(Outline Edge): (Collision < 0.406mm) Between Board Edge And Track (0.102mm,0.001mm)(0.102mm,30.001mm) on Top Overlay
Board Outline Clearance(Outline Edge): (Collision < 0.406mm) Between Board Edge And Track (0.202mm,0.101mm)(35.202mm,0.101mm) on Top Overlay
Board Outline Clearance(Outline Edge): (0.075mm < 0.406mm) Between Board Edge And Track (0.202mm,30.101mm)(35.202mm,30.101mm) on Top
Board Outline Clearance(Outline Edge): (Collision < 0.406mm) Between Board Edge And Track (35.202mm,0.101mm)(35.202mm,30.101mm) on Top