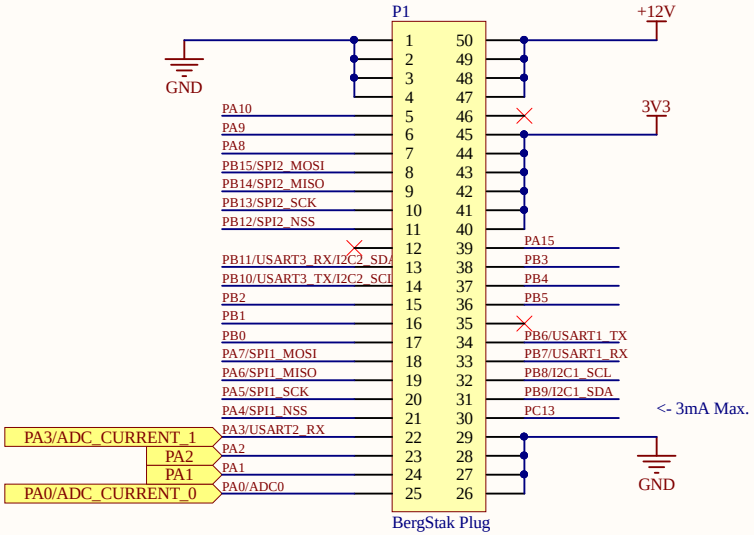
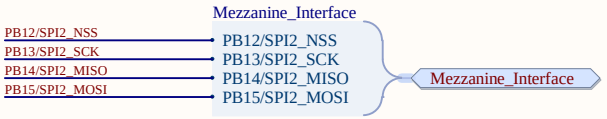
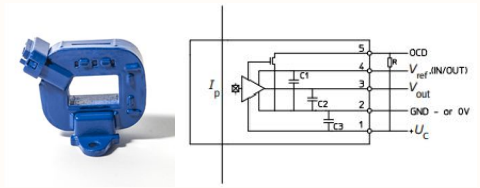




Project: ***BMS_Carrier_Board.PrjPcb***		MIDNIGHT SUN
Title: **Controller Board Interface**		
Project Lead: Kevin Chen, Taiping Li		University of Waterloo 200 University Ave W Waterloo, ON, Canada N2L 3E9
Size: Letter	Revision: 1.3	
Date: 7/18/2017	Sheet 1 of 4	Website: www.uwmidsun.com



Contact LEM for samples

HO 150-S Properties:
V_REF_ISENSE is a 2.5V internal reference
It can also be externally driven with btwn 0.5V and 2.65V (WE SHOULD PROBABLY DO THIS)

OCD (Overcurrent Detect) triggers at 2.93 * Nominal Primary Current I_PN

Project: ***BMS_Carrier_Board.PrjPcb***		MIDNIGHT SUN
Title: **Current Sense**		
Project Lead: Kevin Chen, Taiping Li		University of Waterloo 200 University Ave W Waterloo, ON, Canada N2L 3E9
Size: Letter	Revision: 1.3	
Date: 7/18/2017	Sheet 2 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

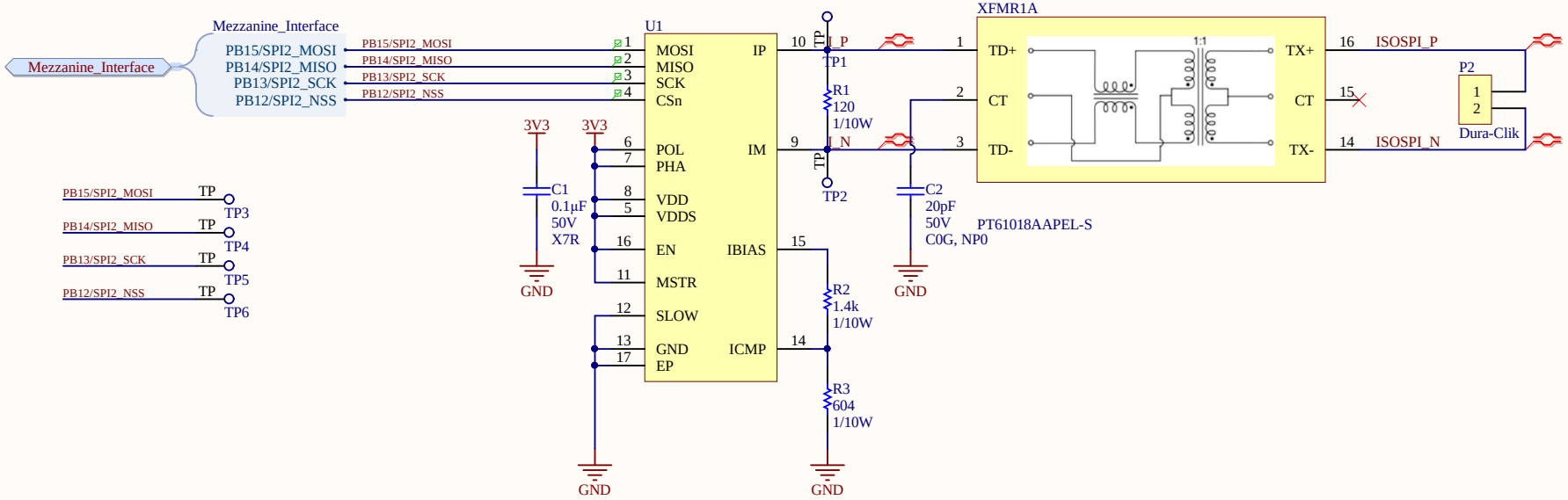
SCK idles high, latches on 2nd rising edge

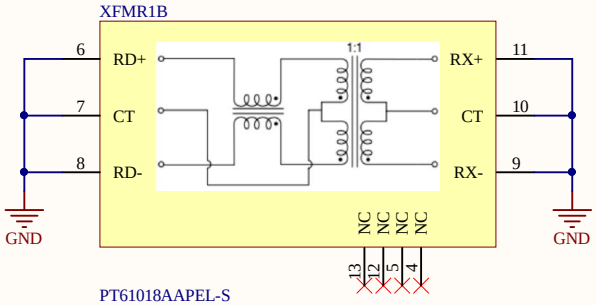
Pulse Drive Current I_IP = 20*I_BIAS = 20mA

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

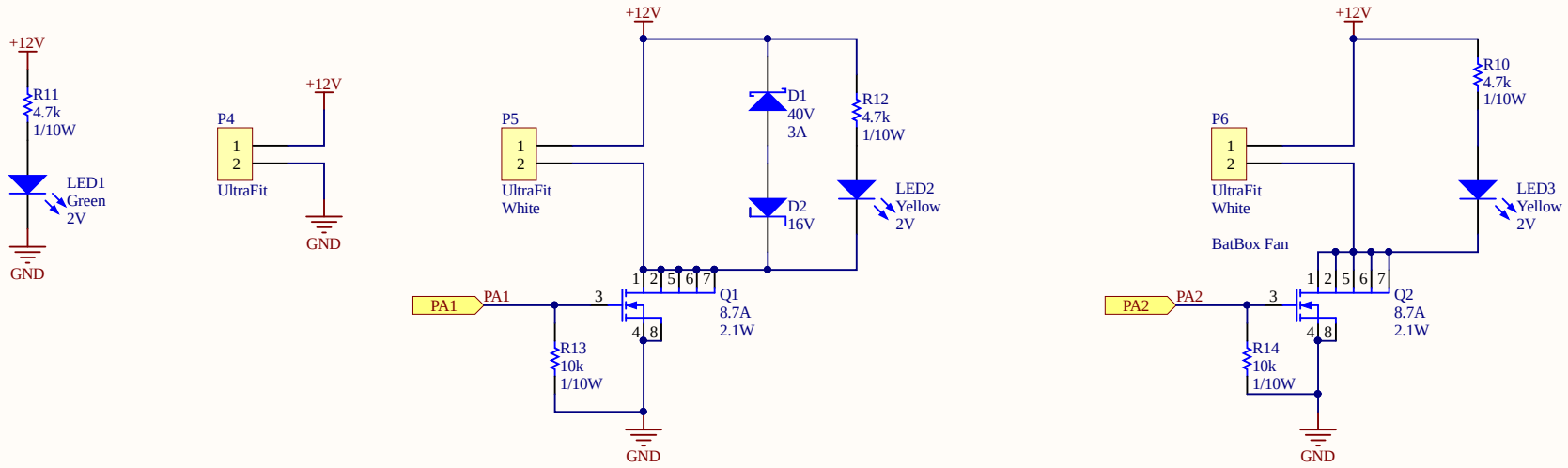
Bias Current I_BIAS can be adjusted from 0.1mA to 1mA
Currently set to 1mA

MASTER SIDE

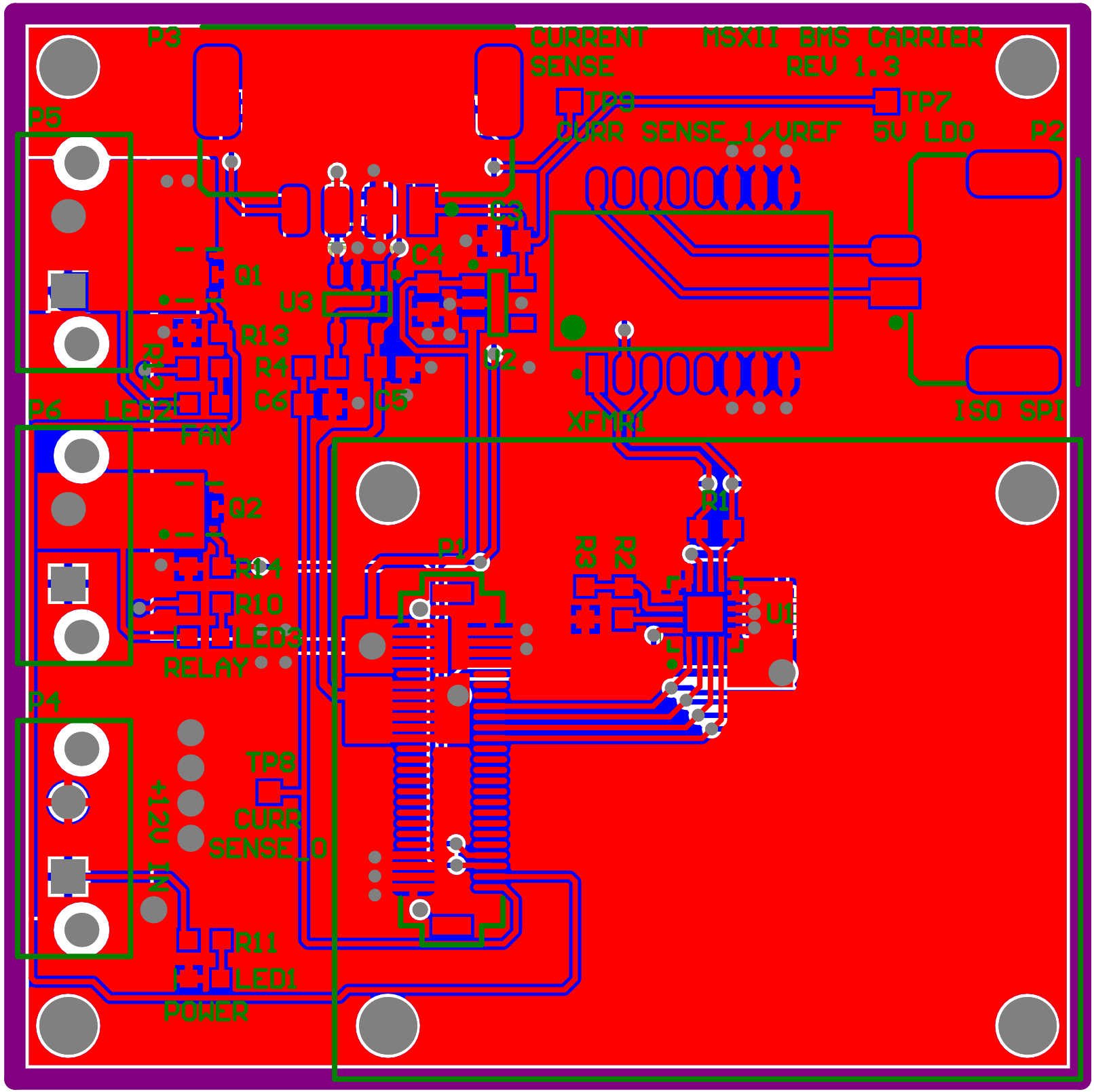




Project: ***BMS_Carrier_Board.PrjPcb***		MIDNIGHT SUN
Title: **BMS Interface**		
Project Lead: Kevin Chen		University of Waterloo 200 University Ave W Waterloo, ON, Canada N2L 3E9
Size: Letter	Revision: 1.3	
Date: 7/18/2017	Sheet 3 of 4	Website: www.uwmidsun.com



Project: ***BMS_Carrier_Board.PrjPcb***		MIDNIGHT SUN
Title: **BMS Fan and Relay Control**		
Project Lead: Kevin Chen, Taiping Li		University of Waterloo 200 University Ave W Waterloo, ON, Canada N2L 3E9
Size: Letter	Revision: 1.3	
Date: 7/18/2017	Sheet 4 of 4	Website: www.uwmidsun.com


P3
CURRENT SENSE
MSXII BMS CARRIER
REV 1.3
TP9
CURR SENSE_1/VREF
TP7
5V LDO
P2
P5
C3
C4
Q1
U3
R13
R4
C6
C5
Q2
P6
LED2
FAN
XFMR1
ISO SPI
R1
P1
R3
R2
U1
Q2
R14
R10
LED3
RELAY
P4
TP8
+12V
CURR SENSE_0
IN
R11
LED1
POWER

Bill of Materials

Bill of Materials For Project [BMS_Carrier_Board.PrjPcb] (No PCB Document Selected)

Source Data From: BMS_Carrier_Board.PrjPcb
Project: BMS_Carrier_Board.PrjPcb
Variant: None

Creation Date: 7/18/2017 9:54:09 PM
Print Date: 18-Jul-17 9:54:13 PM

Production Quantity: 1
Currency <none>

Footprint	Comment	LibRef	Designator	Description	Quantity	#Column Nam	#Column Name Error:Su	#Column Name Error:S	#Column Name Error:S	#Column Name Error:S	#Column Name Error:M	#Column Name Error:Manufacturer Part Num
CAP, 0603	CAP CER 0.1UF 50V 10% X7R 0603	CAP CER 0.1UF 50V 10% X7R 0603	C1, C5, C7	0.10µF ±10% 50V Ceramic Capacitor X7R 0603 (1608 Metric)	3							
CAP, 0603	CAP CER 20PF 50V ±5% C0G/NP0 0603	CAP CER 20PF 50V ±5% C0G/NP0 0603	C2	20pF ±5% 50V Ceramic Capacitor C0G, NP0 0603 (1608 Metric)	1							
CAP, 0603	CAP CER 2.2UF 25V 10% X5R 0603	CAP CER 2.2UF 25V 10% X5R 0603	C3	2.2µF ±10% 25V Ceramic Capacitor X5R 0603 (1608 Metric)	1							
CAP, 0603	CAP CER 1UF 50V 10% X7R 0603	CAP CER 1UF 50V 10% X7R 0603	C4	1µF ±10% 50V Ceramic Capacitor X7R 0603 (1608 Metric)	1							
CAP, 0603	CAP CER 10nF 50V 5% X7R 0603	CAP CER 10nF 50V 5% X7R 0603	C6, C8	10000pF ±5% 50V Ceramic Capacitor U2J 0603 (1608 Metric)	2							
DO-214AA Diode	DIODE SCHOTTKY 40V 3A DO-214AA (SMB)	DIODE SCHOTTKY 40V 3A DO-214AA (SMB)	D1	Diode Schottky 40V 3A Surface Mount DO-214AA (SMB)	1							
DO-214AA Diode	DIODE ZENER 16V 5W DO-214AA (SMB)	DIODE ZENER 16V 5W DO-214AA (SMB)	D2	Zener Diode 16V 5W ±5% Surface Mount DO-214AA (SMB)	1							
LED_0603	LED GREEN CLEAR 2V 0603	LED GREEN CLEAR 2V 0603	LED1	Green 572nm LED Indication - Discrete 2V 0603 (1608 Metric)	1							
LED_0603	LED YELLOW CLEAR 2.1V 0603	LED YELLOW CLEAR 2.1V 0603	LED2, LED3	Yellow 590nm LED Indication - Discrete 2V 0603 (1608 Metric)	2							
CONN, Bergstak 50 Pos Plug	CONN 50POS Bergstak Plug 0.02"	CONN 50POS Bergstak Plug 0.02"	P1	50 Position Connector Plug, Outer Shroud Contacts Surface Mount Gold	1							
CONN, 2POS Dura-Click Vertical	Dura-Clik	CONN 2POS DURA-CLIK 0.079" VERT	P2	2 Positions Header, Shrouded Connector 0.079" (2.00mm) Surface Mount, Vertical Tin	1							
CONN, 4POS DURA-CLIK VERT	Dura-Clik	CONN 4POS DURA-CLIK 0.079"	P3	4 Positions Header Connector 0.079" (2.00mm) Surface Mount Tin	1							
CONN, 2POS ULTRA-FIT	CONN 2POS ULTRA-FIT 0.138"	CONN 2POS ULTRA-FIT 0.138"	P4	2 Positions Header, Shrouded Connector 0.138" (3.50mm) Through Hole Gold	1							
CONN, 2POS ULTRA-FIT - NATURAL COLOR	CONN 2POS ULTRA-FIT NATURAL COLOR 0.138"	CONN 2POS ULTRA-FIT NATURAL COLOR 0.138"	P5, P6	2 Positions Header, Shrouded Connector 0.138" (3.50mm) Through Hole	2							
MOSFET N-CH 30V 12A 2mmx2mm PQFN	MOSFET N-CH 30V 8.7A 2.1W 6-PQFN (2x2)	MOSFET N-CH 30V 8.7A 2.1W 6-PQFN (2x2)	Q1, Q2		2							
RES, 0603	RES 120 OHM 1% 1/10W 0603	RES 120 OHM 1% 1/10W 0603	R1	RES SMD 120 OHM 1% 1/10W 0603	1							
RES, 0603	RES 1.4k OHM 1% 1/10W 0603	RES 1.4k OHM 1% 1/10W 0603	R2	RES SMD 1.4K OHM 1% 1/10W 0603	1							
RES, 0603	RES 604 OHM 1% 1/10W 0603	RES 604 OHM 1% 1/10W 0603	R3	RES SMD 604 OHM 1% 1/10W 0603	1							
RES, 0603	RES 0.0 OHM 1/4W 0603	RES 0.0 OHM 1/4W 0603	R4, R7	RES SMD 0.0 OHM JUMPER 1/4W 0603	2							
RES, 0603	RES 4.7K OHM 1% 1/10W 0603	RES 4.7K OHM 1% 1/10W 0603	R5, R8, R10, R11, R12	4.7k Ohm ±1% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Moisture Resistant Thick Film	5							
RES, 0603	RES 6.8k OHM 1% 1/10W 0603	RES 6.8k OHM 1% 1/10W 0603	R6, R9	RES SMD 6.8K OHM 1% 1/10W 0603	2							
RES, 0603	RES 10K OHM 1% 1/10W 0603	RES 10K OHM 1% 1/10W 0603	R13, R14	RES SMD 10K OHM 1% 1/10W 0603	2							
Test Point	Test Point	Test Point	TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9		9							
IC COMM INTERFACE ISOSPI 16-QFN	IC ISOSPI COMM INTERFACE LTC6820IUD	IC ISOSPI COMM INTERFACE LTC6820IUD	U1	IC COMM INTERFACE ISOSPI 16-QFN	1							
SOT95P280X145-5N	IC REG LDO 5V 0.1A SOT23-5	IC REG LDO 5V 0.1A SOT23-5	U2	Linear Voltage Regulator IC Positive Fixed Output 5V 100mA SOT-23-5	1							
IC OP AMP GP RR 10MHZ SOT-23-5	IC OP AMP GEN PURPOSE RR 10MHZ SOT-23-5	IC OP AMP GEN PURPOSE RR 10MHZ SOT-23-5	U3, U4	General Purpose Amplifier 1 Circuit Rail-to-Rail SOT-23-5	2							
IC, PULSE XFMR 1CT:1CT 350UH SMD	IC PULSE XFMR 1CT:1CT 350UH SMD	IC PULSE XFMR 1CT:1CT 350UH SMD	XFMR1	PULSE XFMR 1CT:1CT 350UH SMD	1							
					49					$ -		

Approved **Notes**