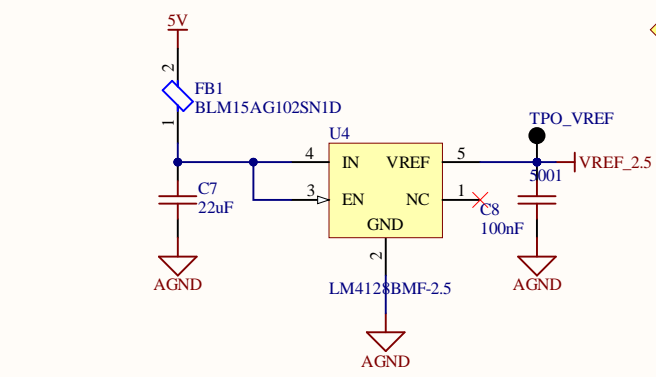
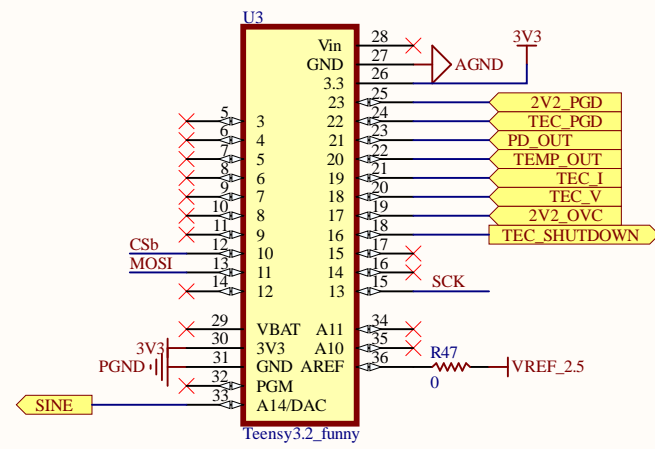
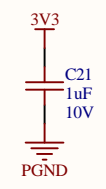


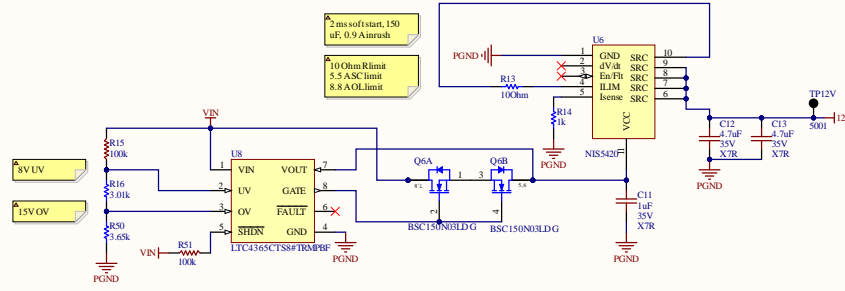
Desired functionality. Disabled unless interlock jumper is inserted. Conducting -> active



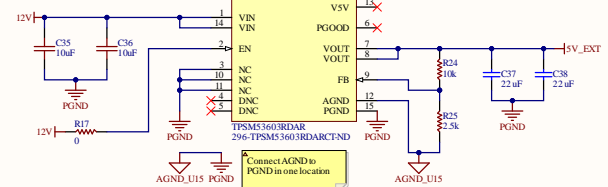
Global AGND is shared by anything using the 2.5 V reference. Teensy, DAC, TEC analog sensing, and photodiode.



Power Input Protection

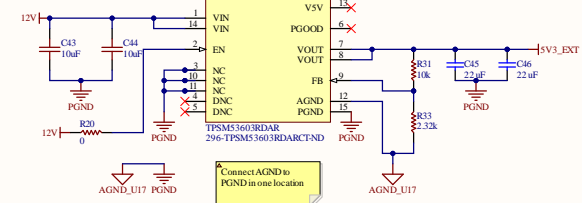


External 5V

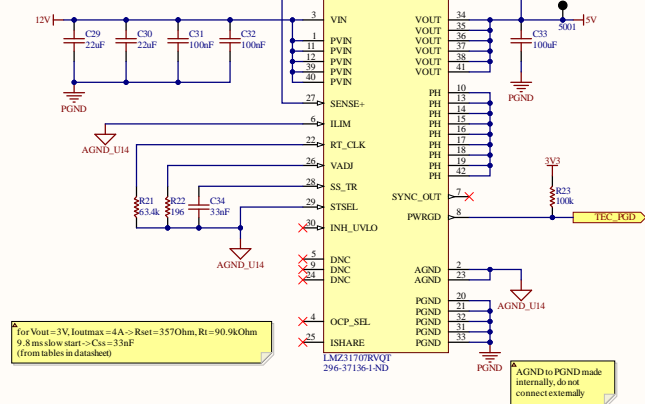


FB Voltage Divider: for R_FBT, 10kOhm is recommended
 $R_{FBT} = 10(V_{out} - 1)/I_{FBT}$
 $V_{out} = 5V \rightarrow 2.5k\Omega$
 $V_{out} = 5.3V \rightarrow 2.32k\Omega$
 $V_{out} = 3.3V \rightarrow 4.35k\Omega$

External 5V3



5V (TEC) Power

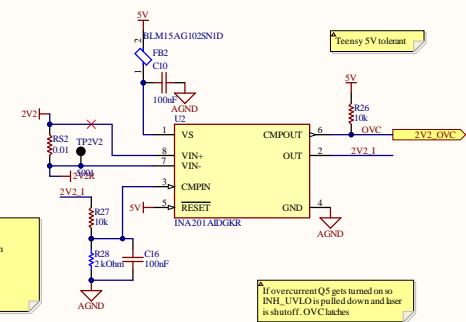


Laser > 15 W at 90% efficiency
 TEC > 20 W at 93% efficiency
 External connection 13 W at 90% efficiency
 Total power 53 W
 In current 5.5 A with 25% margin

For Vout = 3V, Ioutmax = 4A, Rset = 3570Ohm, Rt = 90.9kOhm
 9.8ms slow start -> Ciss = 33uF
 (from tables in datasheet)

AGND to PGND made internally, do not connect externally

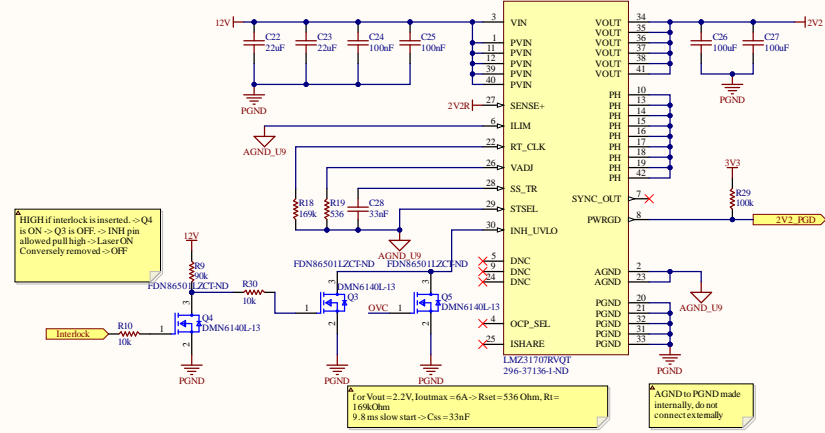
Laser Diode OVC



I_{max} = 7 A
 50 V/V gain
 R_{sense} = 0.01 Ohm
 V_{comp} = 0.9 V
 V_{max} = 3.5 V
 V_{th} = 0.6

If overcurrent Q5 gets turned on so INH_UVLO is pulled down and laser is shutdown. OVC latches

Laser Diode Power

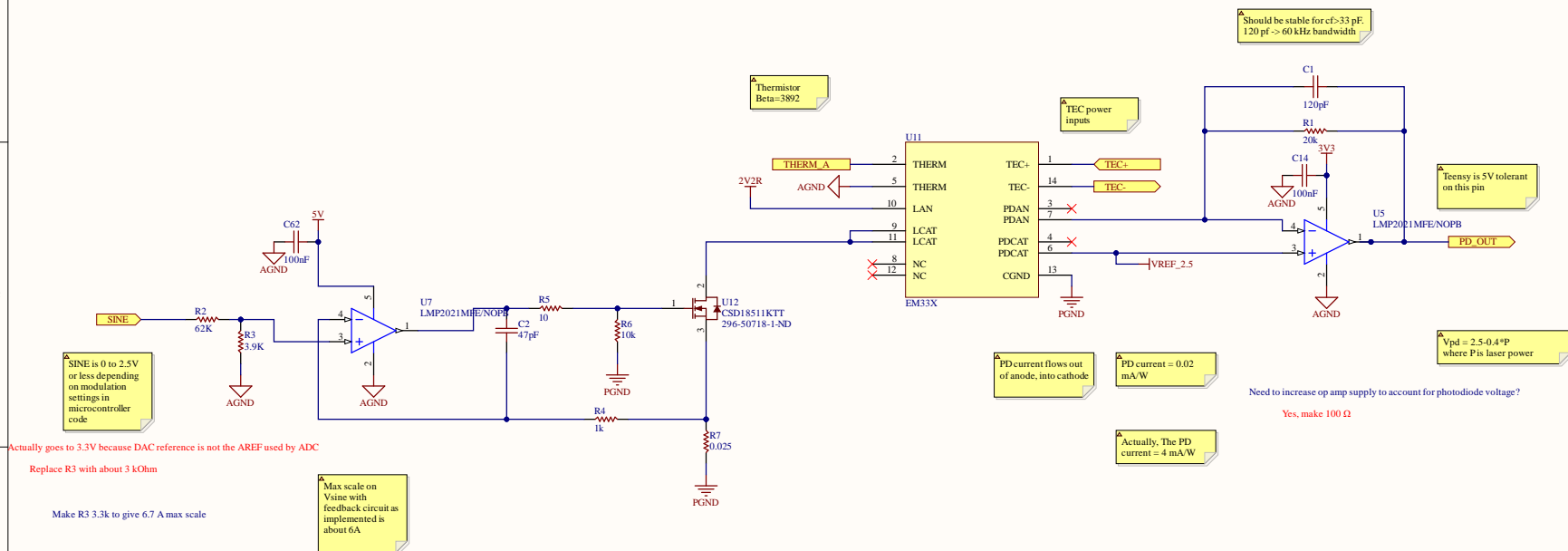


HIGH if interlock is inserted -> Q4 is ON -> Q3 is OFF -> INH pin allowed pull high -> Laser ON
 Conversely removed -> OFF

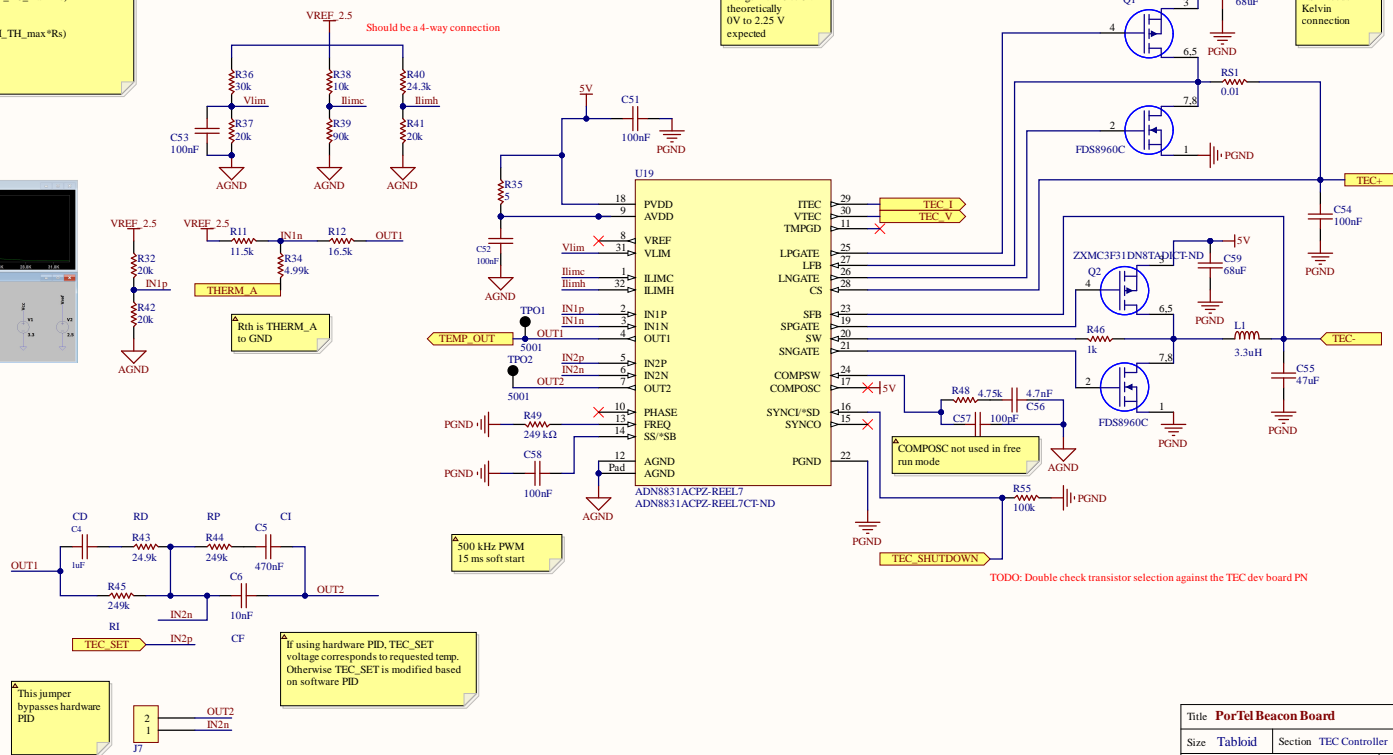
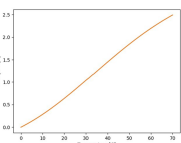
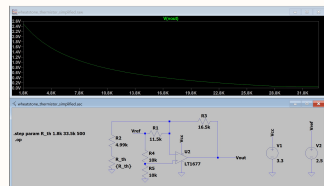
For Vout = 2.2V, Ioutmax = 6A -> Rset = 536 Ohm, Rt = 169kOhm
 9.8ms slow start -> Ciss = 33uF


AGND to PGND made internally, do not connect externally

GNDs are connected internal to the Tenney

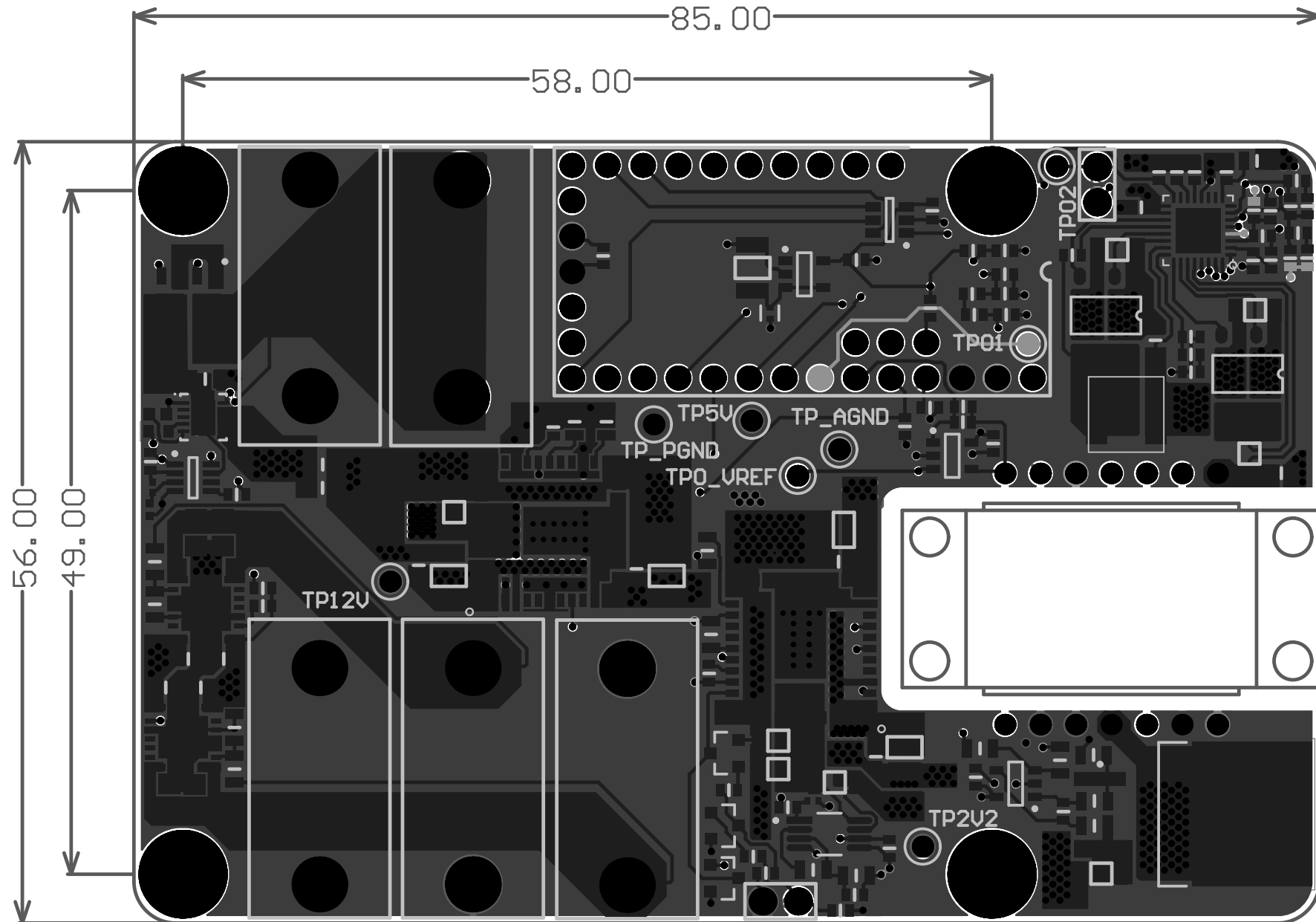


Parameters:
 $V_{ref} = 2.5 \text{ V}$, $I_{TC_max} = 4 \text{ A}$, $I_{TH_max} = 0.5 \text{ A}$,
 $R_{sense} = 0.01 \text{ ohms}$, $V_{T_max} = 5 \text{ V}$
 $V_{ILIMC} = (V_{ref}/2) + (25^\circ \text{I}_{TC_max} * R_s)$
 $\rightarrow V_{ILIMC} = 2.25 \text{ V}$
 $V_{ILIMH} = (V_{ref}/2) - (25^\circ \text{I}_{TH_max} * R_s)$
 $\rightarrow V_{ILIMH} = 1.125 \text{ V}$
 $V_{VLM} = V_{T_max}/5$
 $\rightarrow V_{VLM} = 1 \text{ V}$



Title PorTel Beacon Board			CLICK		 MIT AEROASTRO 33-207 / 77 Mass. Ave. Cambridge, MA 02139
Size Tabloid	Section TEC Controller		Revision 1.2		
Date 6/24/2022	Time 11:23:39 AM	Sheet 5 of 5	Drawn Nicholas Belston		
File C:\Users\nickb\Documents\GitHub\PorTel-Beacon\TECCController.SchDoc					

Increase via size? 10 mil?



Line #	Name	Description	Designator	Quantity	Procurement Instructions	Special Note	Manufacturer 1	Manufacturer Part Number 1	Manufacturer Lifecycle 1	Supplier 1	Supplier Part Number 1	Supplier Unit Price 1	Supplier Subtotal 1
	SIL02	2.54mm Header 1x2	J6_17	2	Turnkey		TE Connectivity	5-146274-2	Volume Production	Mouser	571-5-146274-2	0.32	0.64
	5001	Test Point, Black, 1-Pin THD, RoHS, Bulk	TP2V2, TP5V, TP12V, TP_AGND, TP_PGND, TP01, TP02, TP0_VREF	8	Turnkey		KeyStone Electronics	5001	Volume Production	Future Electronics	A273627	0.158	1.26
	100pF	603 Capacitor	C57	1	Turnkey		Yxosira AVX	06033C101KA12A	Volume Production	Newark	92246330	0.019	0.019
	10nF	603 Capacitor	C6	1	Turnkey		Yxosira AVX	06035C103KA12A	Volume Production	Newark	264C5491	0.007	0.007
	ADN8831ACPZ-REEL7	A High Efficiency TEC Controller Solution	U19	1	Consignment	No Overage Available!	Analog Devices	ADN8831ACPZ-REEL7	Volume Production	Digi-Key	ADN8831ACPZ-REEL7CT-ND		
	BLM15AG102SN1D	FERRITE BEAD 1 KOHM 0402 11N	F81_F82	2	Turnkey		Murata	BLM15AG102SN1D	Volume Production	Digi-Key	490-1007-1-ND	0.1	0.2
	B5C150N03LD G	N-Channel OptiMOS 3 Power-Transistor, 30 V VDS, 20 A ID, -55 to 150 degC, PG-TDSON-8-4, Reel, Green	Q6	1	Turnkey		Infineon	B5C150N03LDG	Volume Production	Digi-Key	B5C150N03LDGATMA1CT-ND	1.2	1.2
	1uF	603 Capacitor	C21	1	Turnkey		KEMET	C0603C105K3PACTU	Volume Production	Newark	36X2618	0.036	0.036
	120pF	603 Capacitor	C1	1	Turnkey		KEMET	C0603C121J5GACTU	Volume Production	Newark	78H7742	0.002	0.002
	33nF	603 Capacitor	C28_C34	2	Turnkey		KEMET	C0603C333K3RACTU	Volume Production	Newark	07X0804	0.01	0.02
	47pF	603 Capacitor	C2	1	Turnkey		KEMET	C0603C470J3GACTU	Volume Production	Newark	72H8528	0.005	0.005
	4.7nF	603 Capacitor	C56	1	Turnkey		KEMET	C0603C472J5GACTU	Volume Production	Newark	264C7998	0.087	0.087
	470nF	603 Capacitor	C5	1	Turnkey		KEMET	C0603C474K4RACTU	Volume Production	Newark	12AC0600	0.129	0.129
	4.7uF	805 Capacitor	C12_C13	2	Turnkey		KEMET	C0805C475K3PACTU	Volume Production	Avnet	12N4441	0.198	0.396
	100uF	1206 Capacitor	C26_C27_C33	3	Turnkey		TDK	C3216XSR1A107M160AC	Volume Production	Newark	12T1945	0.648	1.94
	68uF	1206 Capacitor	C9_C59	2	Turnkey		TDK	C3216XSR1A68M160AC	Volume Production	Arrow Electronics	C3216XSR1A68M160AC	0.488	0.976
	100nF	603 Capacitor	C3_C8_C10_C14_C16_C24_C25_C31_C32_C51_C52_C53_C54_C58_C62	15	Turnkey		Yageo	CC0603KRX7R8BB104	Volume Production	Mouser	603-CC603KRX7R8BB104	0.026	0.39
	100k	603 Resistor	R15_R23_R29_R51_R55	5	Turnkey		TE Connectivity	CFP0603B100K1	Volume Production	Arrow Electronics	2PFD603B100K1	0.6196	3.1
	3.65k		R50	1	Turnkey		Vishay	CRCW04023K65FKEE	Volume Production	Digi-Key	541-3.65KLC1T-ND	0.1	0.1
	4.99k	603 Resistor	R34	1	Turnkey		Vishay	CRCW06034K99FKEA	Volume Production	RSComponent s	6790490	0.05038	2.52
	11.5k	603 Resistor	R11	1	Turnkey		Vishay	CRCW060311K5FKEA	Volume Production	Mouser	71-CRCW0603-11.5K-E3	0.1	0.1
	20k	603 Resistor	R1_R37	2	Turnkey		Vishay	CRCW060320K0FKEA	Volume Production				
	20k	603 Resistor	R32_R41_R42	3	Turnkey		Vishay	CRCW060320K0FKEA	Volume Production				
	50k	603 Resistor	R36	1	Turnkey		Vishay	CRCW060350K0FKEA	Volume Production	Newark	24W2881	0.005	0.005
	249k	603 Resistor	R44_R45	2	Turnkey		Vishay	CRCW0603249KFEA	Volume Production	Newark	52K8326	0.1	0.2
	CSD18511KTT	40-V, N channel NexFET™ power MOSFET, single D2PAK, 2.6 mOhm	U12	1	Consignment		Texas Instruments	CSD18510KTT	Volume Production	Digi-Key	296-50718-1-ND		
	DAC121S101CIMK/NOPB	12-Bit Micro Power, RRO Digital-to-Analog Converter, 6-pin Tiny SOT23, Pb-Free	U1	1	Consignment		TI National Semiconductor	DAC121S101CIMK/NOPB	Volume Production	RSComponent s	A512111	3.1	15.5
	Tes9932_2ummy		U3	1	DNP		Spartan	DEV-13736					
	EM33X	5W Cooled 9XX Multimode Lasers in 14-Pin Package	U11	1	DNP		Gooch and Housego	EM33X	Manual Solution				
	3.9k	805 Resistor	R3	1	Turnkey		Panasonic	ERA6AE8392V	Volume Production	Newark	42AC0822	0.042	0.042
	1k		R14	1	Turnkey		Panasonic	ERA-3AE8102V	Volume Production	RSComponent s	0566800	0.43831	2.19
	1k	603 Resistor	R46	1	Turnkey		Panasonic	ERA-3AE8103V	Volume Production	RSComponent s	0566890	0.77922	3.9
	10k	603 Resistor	R10_R26_R30	3	Turnkey		Panasonic	ERA-3AE8103V	Volume Production	RSComponent s	0566890	0.77922	3.9
	10k	603 Resistor	R38	1	Turnkey		Panasonic	ERA-3AE8103V	Volume Production	RSComponent s	0566890	0.77922	3.9
	63.4k	805 Resistor	R21	1	Turnkey		Panasonic	ERA-6AE86342V		Arrow Electronics	ERA-6AE86342V	0.3454	0.3454
	16.5k	603 Resistor	R12	1	Turnkey		Panasonic	ERJ6KF1652V	Volume Production	Avnet	65T8349	0.009	0.009
	10k		R53_R56_R58	3	Turnkey		Panasonic	ERJ-2GE1103X	Volume Production	Newark	12AC0920	0.003	0.009
	2 KOhm		R28	1	Turnkey		Panasonic	ERJ-3EK22001V	Volume Production	Mouser	667-ERJ-3EK22001V	0.1	0.1
	24.3k	603 Resistor	R40	1	Turnkey		Panasonic	ERJ-3EK2432V	Volume Production	Allied Electronics	70265735	0.016	0.016
	24.9k	603 Resistor	R43	1	Turnkey		Panasonic	ERJ-3EK2492V	Volume Production	Allied Electronics	70265738	0.016	0.016
	149k	805 Resistor	R18	1	Turnkey		Panasonic	ERJ-6EF1493V	Volume Production	Newark	51W9910	0.003	0.003
	0.01	1206 Resistor	R51_R52	2	Turnkey		Panasonic	ERJ-8BF010V	Volume Production	Digi-Key	P010AUCT-ND		
	0.025	1206 Resistor	R7	1	Turnkey		Panasonic	ERJ-8CVF025V		Newark	52W0479	0.078	0.078
	DMN6140L-13	MOSFET N-CH 60V 1.6A SOT23	Q3_Q4_Q5	3	Consignment		ON Semiconductor / Fairchild	FDN86501LZ		Arrow Electronics	FDN86501LZ	1.72	5.16
	22uF	1210 Capacitor	C7_C22_C23_C29_C30	5	Turnkey		Murata	GRM32ER61E226KE15L	Not Recommended for New Design	Future Electronics	5237714	0.64	3.2
	1uF	805 Capacitor	C11	1	Turnkey		Murata	GRM216R61E105KA12D	Not Recommended for New Design	Future Electronics	7699986	0.325	0.325
	22 uF		C37_C38_C45_C46	4	Turnkey		Murata	GRM219R61A226MEA0D	Not Recommended for New Design	Arrow Electronics	GRM219R61A226MEA0D	0.4765	
	47uF	805 Capacitor	C55	1	Turnkey		Murata	GRT21BR60476ME13L	Volume Production	Digi-Key	490-12371-1-ND	0.49	0.49
	INA201AIDGKR	IC CURRENT MONITOR 3.5% BVSSOP	U2	1	Consignment		Texas Instruments	INA201AIDGKR	Volume Production				
	LM4128BMF-2.5	Precision Micropower Series Voltage Reference, 5-pin SOT-23	U4	1	Consignment		TI National Semiconductor	LM4128D01MF2.5/NOPB	Volume Production	Digi-Key	296-LM4128D01MF2.5/NOPB CT-ND	3.37	3.37
	LMP2021MFE/NOPB	Zero Drift, Low Noise, EMI Hardened Amplifier, 5-pin SOT-23, Pb-Free	U5_U7	2	Turnkey		TI National Semiconductor	LMP2021MFE/NOPB	Volume Production	Digi-Key	LMP2021MFE/NOPBCT-ND	3.71	7.42
	LMZ31707RVOT	Non-Isolated DC/DC Converters 7A Power Module w/ 2.95V-17V Input	U9_U14	2	Consignment	No Overage Available!	Texas Instruments	LMZ31707RVOT	Volume Production	Digi-Key	296-37136-1-ND		
	LTC4365TS87TRMPBF	UV, OV and Reverse Supply Protection Controller, 2.5 to 34 V Vin, 8-pin SOT23 (TS8-8), 0 to 70 degC, Pb-Free, Mini Tape and Reel	U8	1	Turnkey		Analog Devices / Linear Technology	LTC4365CTS87TRMPBF	Volume Production				
	NISS420		U6	1	Consignment		ON Semiconductor	NISS420MT6TXG	Volume Production	Arrow Electronics	NISS420MT6TXG	1.03	1.03
	3.01k		R16	1	Turnkey		Yageo	RC0402FR-073K01L	Volume Production	Newark	82AH7923	0.038	0.038
	3.3k		R52_R54_R57	3	Turnkey		Yageo	RC0402FR-073K3L	Volume Production	Mouser	603-RC0402FR-073K3L	0.012	0.12
	100ohm	Chip Resistor, 10 Ohm, +/- 1%, 0.1 W, -55 to 155 degC, 0603 (1608 Metric), RoHS, Tape and Reel	R13	1	Turnkey		Yageo	RC0603FR-0710RL	Volume Production	Newark	48Y4536	0.005	0.005
	90k	603 Resistor	R8_R9_R39	3	Turnkey		Yageo	RC0603FR-07390KL	Volume Production	Farnell	9238794	0.02671	0.22671
	0	603 Resistor	R47	1	Turnkey		Yageo	RC0603JR-070RL	Volume Production	Digi-Key	311-0.0GRCT-ND	0.1	0.1
	0	603 Resistor	R17_R20	2	Turnkey		Yageo	RC0603JR-070RP	Volume Production	Arrow Electronics	RC0603JR-070RP	0.0761	0.1522
	10k	805 Resistor	R6_R24_R27_R31	4	Turnkey		Yageo	RC0805FR-0710KL	Volume Production	Farnell	9237755	0.02771	0.27709
	53k	805 Resistor	R19	1	Turnkey		Yageo	RC0805FR-07536RL	Volume Production	Mouser	603-RC0805FR-07536RL	0.1	0.1
	1k	805 Resistor	R4	1	Turnkey		Suzumu	RG0212P-102-B-T5	Volume Production	Future Electronics	2000243	0.235	0.235
	5	805 Resistor	R35	1	Turnkey		Cyntec	RLT1220F-5R00-FNH		Digi-Key	2037-RLT1220F-5R00-FNHCT-ND	0.53	0.53
	10	805 Resistor	R5	1	Turnkey		Stackpole Electronics	RNCF0805AKT10R0	Volume Production	Arrow Electronics	RNCF0805AKT10R0	0.9219	0.9219
	19k	805 Resistor	R22	1	Turnkey		TE Connectivity	RP73PF2A19ABTDF	Volume Production				
	62k	805 Resistor	R2	1	Turnkey		Suzumu	RR1220P-623-D	Volume Production	Mouser	754-RR1220P-6230	0.15	0.15
	2.32k	805 Resistor	R23	1	Turnkey		Suzumu	RR1220P-2321-D-M	Volume Production	Mouser	754-RR1220P-2321D-M	0.15	0.15
	4.75k	603 Resistor	R48	1	Turnkey		Yageo	RT0603BRD074K75L	Volume Production	Newark	82AH8933	0.263	0.263
	3.3uH	Bourns SRP0520 3.3uH 4.8A Inductor	L1	1	Turnkey		Bourns	SRP0520-3R3K	Volume Production	Arrow Electronics	SRP0520-3R3K	0.4865	0.4865
	249 kΩ	603 Resistor	R49	1	Turnkey		Vishay Dale	TNPW0603249KBEEA		Newark	05R2341	0.089	0.089
	TPSM53603RDAR	36-V, 3-A step-down power module in small 5.5 x 5 x 4-mm Enhanced HotRod™ QFN with simple footprint	U15_U17	2	Consignment	No Overage Available!	Texas Instruments	TPSM53603RDAR	Volume Production	Digi-Key	296-TPSM53603RDARCT-ND		
	1uF	603 Capacitor	C4	1	Turnkey		Taiyo Yuden	UMK107B105KA-T	Volume Production	Newark	06X2717	0.043	0.043
	2.5k	805 Resistor	R25	1	Turnkey		VPG Foil Resistors	Y1629X50000T9R	Volume Production	Digi-Key	Y1629-2.50KACT-ND	8.53	8.53
	10uF	603 Capacitor	C35_C36_C43_C44	4	Turnkey		Murata	Z8B18AR61E106ME01L	Volume Production	Newark	03AC4785	0.129	0.516
	FDS8960C	MOSFET pair	Q1_Q2	2	Consignment		Diodes	ZXMC3F13DN81A		Mouser	632-ZXMC3F13DN81A	0.78	1.56