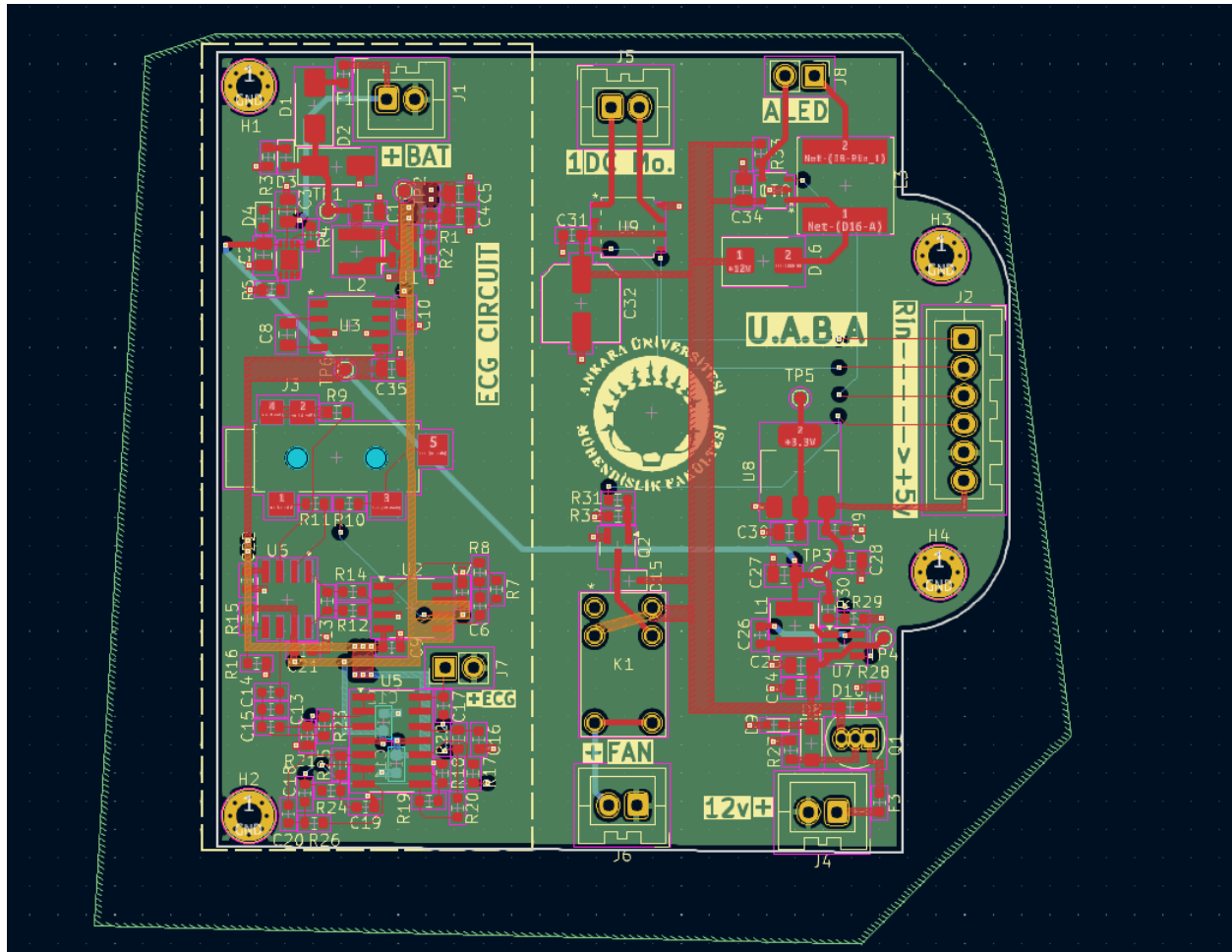


1- Soldered circuit



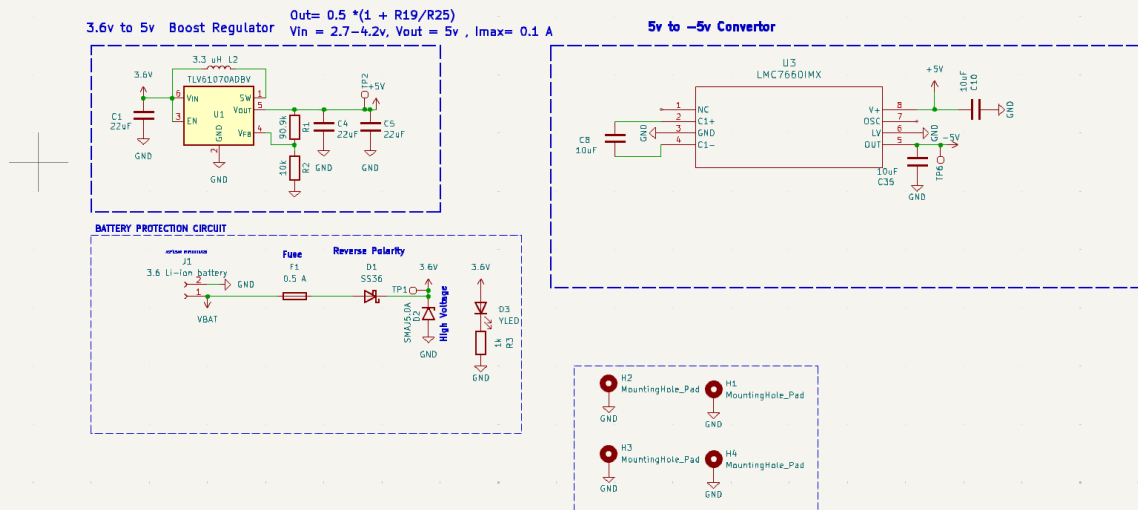
2- PCB design



3- Schematics

- a- Analog circuit's protection and regulators

a- Analog circuit's protection and regulators



The battery will provide 3.6v, at first there is high current protection (F1) , reverse polarity protection (D1) and high voltage protection (D2), then the 3.6v is boosted to 5v using boost regulator (TLV61070ADBv) and the output voltage is controlled using 2 resistors (R2, R1) by using the values in the formula in the picture, because of the low values of the ECG, -5v have to be provided to the negative voltage pin of the amplifiers, and it's supplied by another regulator (LMC7660IMX

Instrumentation Amplifier

Patient Protection

ECG INPUT

Right Leg Driver

TL084 Supply

0.05 Hz High Pass Filter

50 Hz Notch Filter

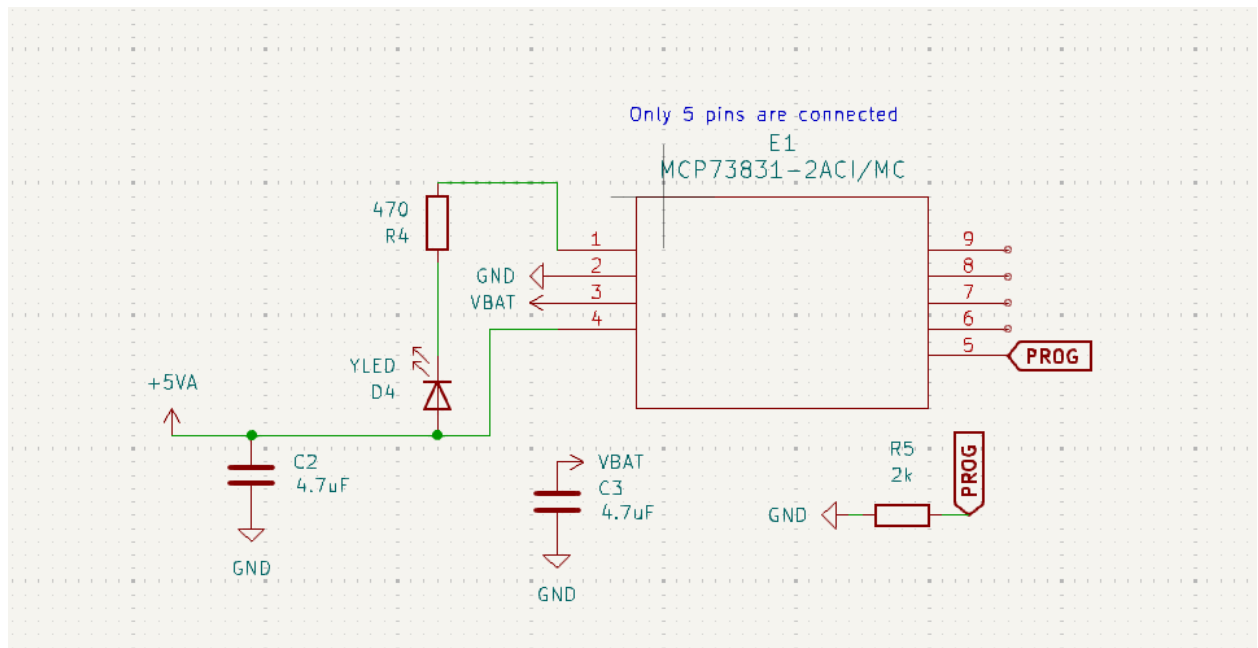
Main Amplifier

100 Hz Low Pass Filter

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 Title:
 Size: A4 Date:
 KiCad E.D.A. 8.0.5 Rev: 16/4/8

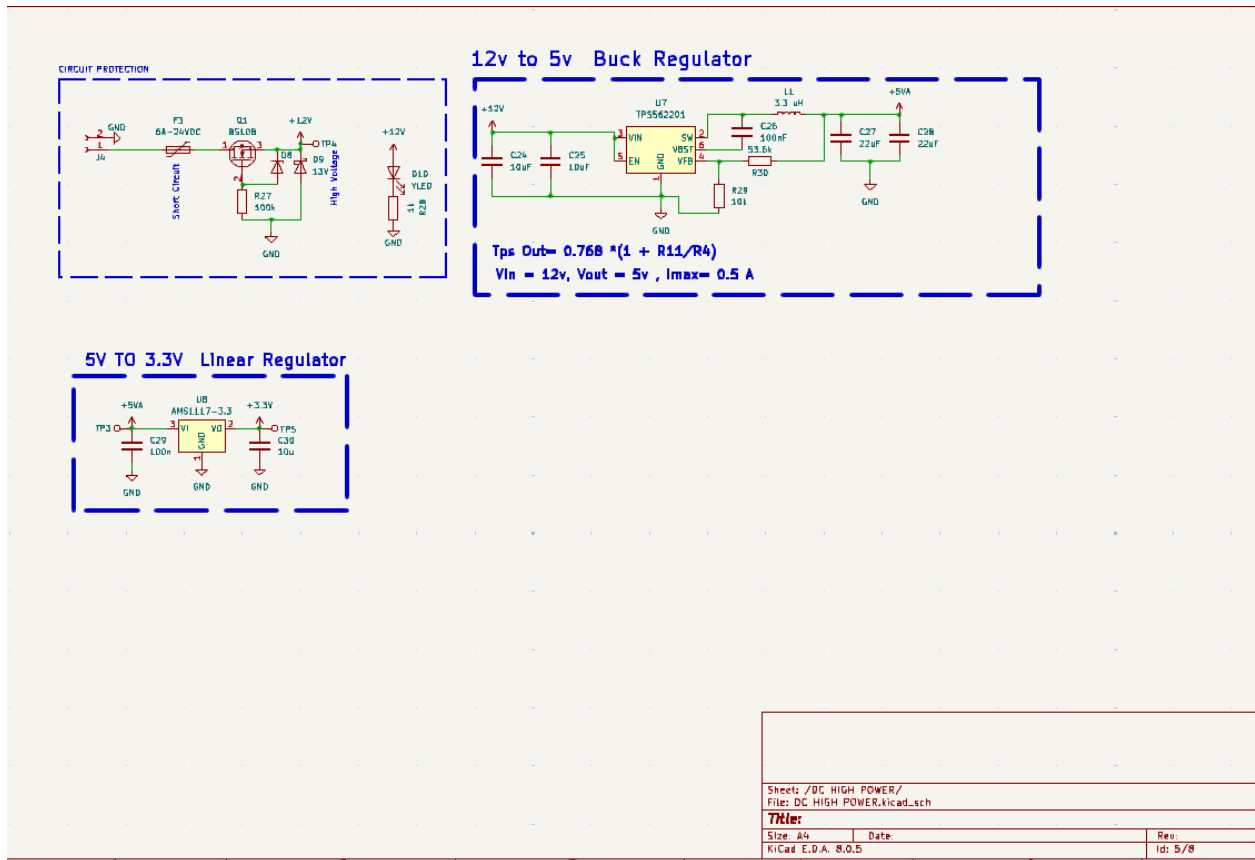
Before the amplifying patient protection (using high resistance resistors to minimize the current) and right leg driver (to eliminate the body's noise) are done. With a 10 gain the signal is amplified using the instrumentational amplifier (INA188ID), after that the signal is filtered by a 0.5Hz high pass filter and 50Hz notch filter, then the main amplifier amplifies the signal by a gain of 100, finally the signal is filtered using 100Hz low pass filter.

c- Charger circuit



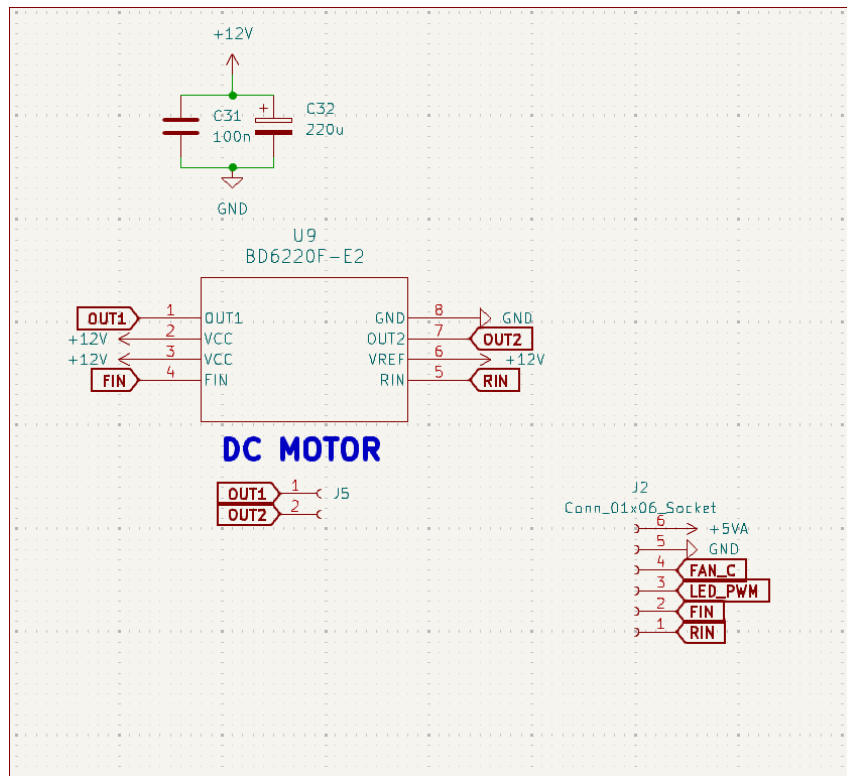
To charge the battery with a charge module (MCP73831-2ACI/MC) with a 0.5A charging current.

d- High voltage protection and regulation circuit



For the high voltage section same protection is done but due to the high current for reverse polarity protection transistor is done instead of Schottky diode. After that the 12v dc voltage is regulated to 5v using buck regulator (TPS562201), after that the 5v is regulated to 3.3v using linear regulator (AMS1117-3.3).

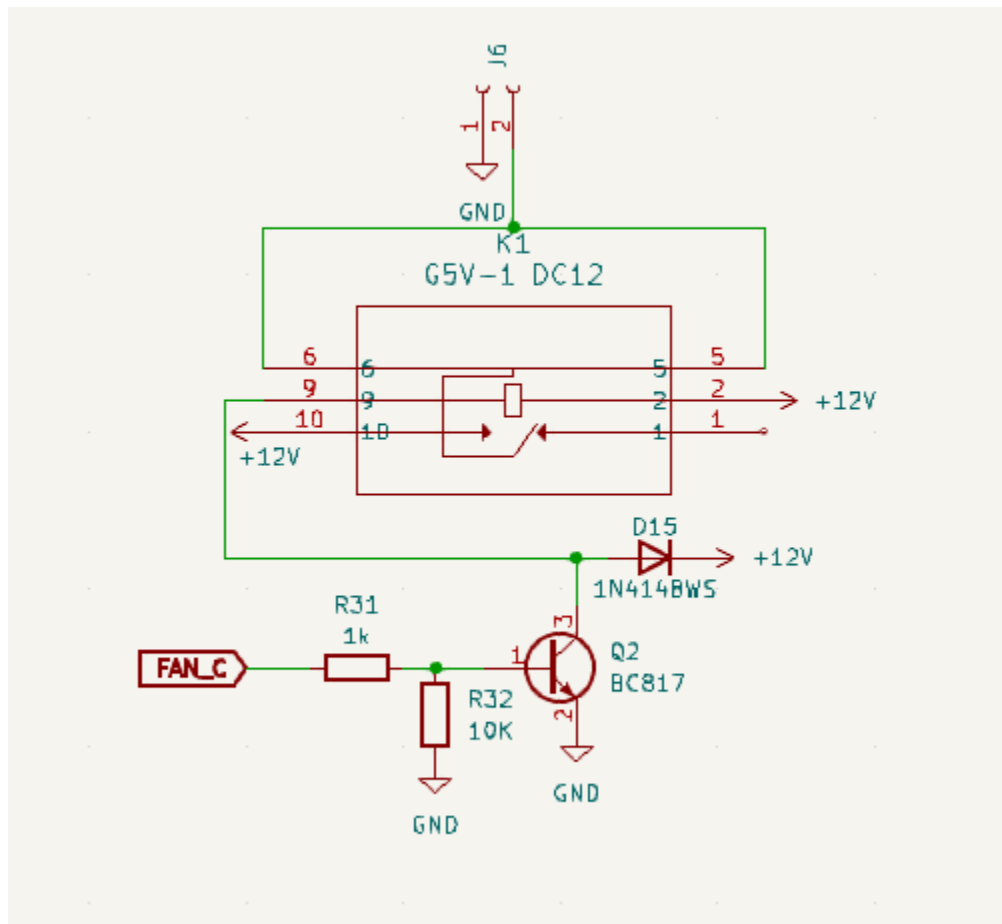
e- DC motor driver and control connector



In here there is a dc motor driver (BD6220F-E2) and 2 decoupling capacitors connected to it, its supplied with 12v for motor supply, and the motors will be connected to OUT1 and OUT2 pins.

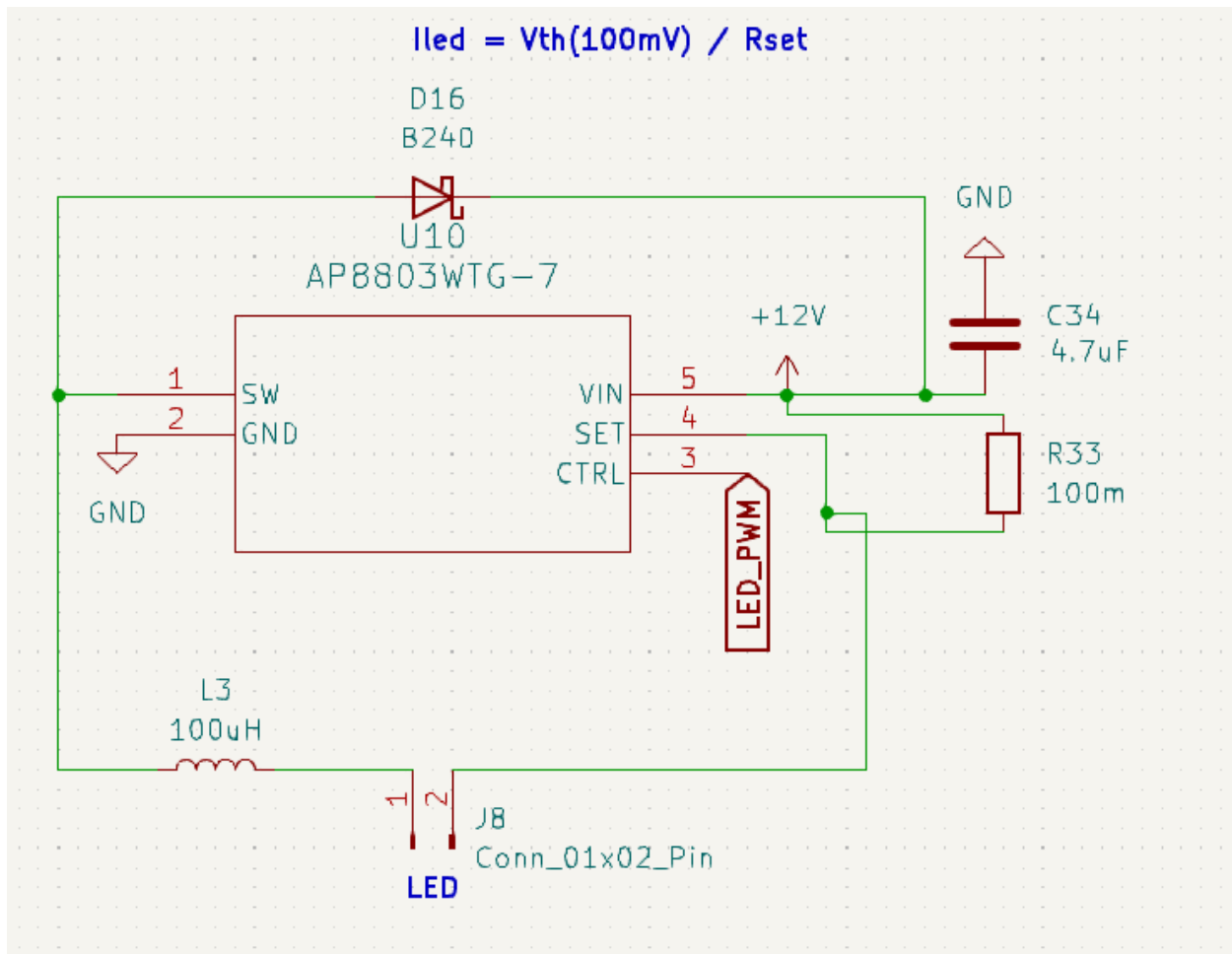
For the control connector there is 5v output to test the circuit and other pins for the other components control.

f- Fan control circuit



A relay is used with a transistor to control the fan, and a diode to block the current that is stored in the coil in the relay, and its controlled using the FAN_C pin in the control connector.

g- Led driver circuit



A led driver to control (AP8803WTG-7) the LED driver is supplied with 12v and the current is set using the R33 value so the LED current in this circuit is 1A.

4- BOM list

null	References	Value	Footprint	Quantity	LINK
1	C6, C7, C9, C11, C12, C17, C18, C20, C21, C22, C26, C29, C31	100nF	C_0603_1608Metric	13	https://ozdisan.com/Product/Detail/476015/C0603KRX7R9BB104
2	C8, C10, C24, C25, C30, C35	10uF	C_0805_2012Metric	6	https://ozdisan.com/p/57?ids=9695;452010,9697;356027&groupids=9695,9697&propids=452010,356027&SearchText=10uf&sayfaAdedi=20
3	C1, C4, C5, C27, C28	22uF	C_0805_2012Metric	5	https://ozdisan.com/pasif-komponentler/kapasitorler/smt-smd-ve-mlcc-kapasitorler/CL21A226MPCLRNC/522719
4	C2, C3, C34	4.7uF	C_0805_2012Metric	3	https://ozdisan.com/pasif-komponentler/kapasitorler/smt-smd-ve-mlcc-kapasitorler/CL21A226MPCLRNC/522719
5	C13, C14	10u	C_0603_1608Metric	2	https://ozdisan.com/pasif-komponentler/kapasitorler/smt-smd-ve-mlcc-kapasitorler/GRT188C81C106ME13D/732963
6	C15	470nF	C_0603_1608Metric	1	https://ozdisan.com/pasif-komponentler/kapasitorler/smt-smd-ve-mlcc-kapasitorler/CL10B474KA8NNNC/355575
7	C16	33n	C_0603_1608Metric	1	https://ozdisan.com/pasif-komponentler/kapasitorler/smt-smd-ve-mlcc-kapasitorler/CL10B333KB8NNNC/26341
8	C19	220nF	C_0603_1608Metric	1	CL10B224KO8NNNC
9	C32	220u	C_Elec_6.3x7.7	1	CD010M221E7DPKKKV00A ,
10	R2, R8, R18, R29, R32	10K	R_0603_1608Metric	5	CRT03F7E1002
11	R3, R16, R28, R31	1k	R_0603_1608Metric	4	CRT03J7E1001
12	R9, R10, R11	220k	R_0603_1608Metric	3	RC0603JR-07220KL
13	R7, R19	1M	R_0603_1608Metric	2	RC0603JR-071ML
14	R12, R14	22.6k	R_0603_1608Metric	2	0603SAF2262T5E
15	R15, R27	100k	R_0603_1608Metric	2	RC0603JR-07100KL
16	R24, R25	30.9k	R_0603_1608Metric	2	0603SAF3092T5E
17	R1	90.9k	R_0603_1608Metric	1	RC0603FR-0790K9L
18	R4	470	R_0603_1608Metric	1	RC0603JR-07470RL
19	R5	2k	R_0603_1608Metric	1	0603SAJ0202T5E
20	R13	6.98k	R_0603_1608Metric	1	0603SAF6981T5E
21	R17	20k	R_0603_1608Metric	1	0603SAJ0203T5E
22	R20	14.3k	R_0603_1608Metric	1	0603SAF1432T5E
23	R21	6.8M	R_0603_1608Metric	1	0603SAF6804T5E
24	R22	48.1k	R_0603_1608Metric	1	CRT03F7E4702 47k
25	R23	113k	R_0603_1608Metric	1	0603SAF1133T5E
26	R26	16.9k	R_0603_1608Metric	1	0603WGF1692T5E
27	R30	53.6k	R_0603_1608Metric	1	0603SAF5362T5E
28	R33	100m	R_0603_1608Metric	1	0603SAF100LT5E
29	L1	3.3 uH	L_Wurth_WE-LQSH-4020	1	FPI0302-3R3M
30	L2	3.3 uH	L_Abracon_ASPI-4030S	1	XFL4020-332MEC
31	L3	100uH	L_Changjiang_FNR8040S	1	SRN8040-101M
32	D3, D4, D10	YLED	LED_0603_1608Metric	3	27-21/GHC-YR2T1/3C
33	D1	SS36	D_SMA	1	SS36-DO214AB-HT
34	D2	SMAJ5.0A	D_SMA	1	SMAJ5.0A-E3/61T
35	D8	10V	Nexperia_CFP3_SOD-123W	1	MMSZ10V-HT

36	D9	13V	D_SOD-523	1	BZT52B13T-HT
37	D15	1N4148WS	D_SOD-323	1	1N4148WS_R1_00001
38	D16	B240	D_SMB	1	SS26-E3/52T
39	U1	TLV61070ADB	SOT-23-6	1	
40	U2	OP07	SO-8_3.9x4.9mm_P1.27mm	1	OP07CDR
41	U3	LMC7660IMX	M08A_TEX	1	LMC7660IMX
42	U5	TL084	SOIC-14_3.9x8.7mm_P1.27mm	1	TL084CDT
43	U6	INA188ID	INA188ID	1	INA188IDR
44	U7	TPS562201	SOT-23-6		TPS562201DDCR
45	U8	AMS1117-3.3	SOT-223-3_TabPin2	1	AMS1117-3.3
46	U9	BD6220F-E2	SOP8_ROM-L	1	BD6220F-E2
47	U10	AP8803WTG-7	TSOT25-WT_DIO-L	1	AP8803WTG-7
48	F1	0.5 A	Fuse_0603_1608Metric	1	SF-0603SP050-2
49	F3	6A-24VDC	Fuse_0603_1608Metric	1	3412.0119.22
50	TP1, TP2, TP3, TP4, TP5, TP6	TestPoint	TestPoint_Pad_D1.0mm	6	
51	E1	MCP73831-2ACI/MC	DFN8_2x3MC_MCH-L	1	MCP73831-2ACI/MC
52	K1	G5V-1 DC12	G5V_1	1	G5V-1-DC12
53	Q1	BS108	TO-92 Inline	1	ZVP3304A
54	Q2	BC817	SOT-23	1	BC817-40-TP
55	J4, J5, J6	Conn_01x02_Socket	JST_XA_B02B-XASK-1_1x02_P2.50mm_Vertical	3	L-KLS1-2.50-02-H
56	J7, J8	Conn_01x02_Pin	PinHeader_1x02_P2.54mm_Vertical	2	L-KLS1-207-1-02-S
57	J1	3.6 Li-ion battery	JST_XA_B02B-XASK-1_1x02_P2.50mm_Vertical	1	L-KLS1-2.50-02-H
58	J2	Conn_01x06_Socket	JST_XA_B06B-XASK-1_1x06_P2.50mm_Vertical	1	L-KLS1-2.50-06-S
59	J3	35RASMT4BHNTRX	35RASMT4BHNTRX	1	L-KLS1-TPJ3.5-002C