EEE3088F Week 5

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Q1 Github [1]

https://github.com/murrayinglis/EEE3088-group-09

Branch: main

GERBER Files:

https://github.com/murrayinglis/EEE3088-group-09/tree/main/PCB/SCHEMATICS/GERBERS

Q2 Power Subsystem Failure Management [2]

(i)

A duplicate of the 3.3V regulator chip will be included on the board, with test points at the pins of this chip and near the other chip. So if the other 3.3V regulator chip fails, the traces can be scratched or the chip can be removed from the board. The test points can be shorted and the duplicate chip can be used instead.

(ii)

Use thick traces: We have used 0.5mm traces to account for temperature changes and spaced as far possible.

Test points at either side of a trace so that if it's damaged it can be shorted with a jumper.

(iii)

There are plenty of 3.3V regulator chips available on JLCPCB. One that is also a cheap, basic part and has a similar pinout to our regulator chip is the C14289. As of checking on 13/03/2023 it has 152575 in stock.

(iv)

Test points so components or certain modules in the circuit can be tested or shorted to remove them from the circuit. The test points are placed at the power input, ground and other inputs and outputs of the circuit in order. This is to account for the component not working or parts of the module circuitry not working.

Q3 Sensing Subsystem Failure Management [2]

(i)

For the light sensor chip, add a duplicate of the sensor chip with traces to the microcontroller. However, leave out power traces. If the original sensor fails, jumper cables can be used to power this sensor and the traces to the original sensor's power can be scratched out.

For the battery, the voltage divider resistances may be incorrect or the voltage divider isn't working as intended. If this occurs, an external resistor voltage divider network can be used and connected using jumper cables. Test points are included at the voltage divider to add this circuit.

Guard traces to prevent interference at the sensor output.

(ii)

Use thick traces to account for temperature changes and spaced as far possible.

Test points at either side of a trace so that if it's damaged it can be shorted with a jumper.

(iii)

There are plenty of light sensor chips available on JLCPCB. One that has a similar pinout to our light sensor chip is the BH1750FVI. As of checking on 13/03/2023 it has 1202 in stock.

(iv)

Test points so components or certain modules in the circuit can be tested or shorted to remove them from the circuit. The test points are placed at the power input, ground and other inputs and outputs of the circuit in order. This is to account for the component not working or parts of the module circuitry not working.

Q4 Microcontroller interfacing Failure Management [2]

(i)

A duplicate of the EEPROM will be included on the board, with test points at the pins of this chip and near the other chip. So if the other 3.3V regulator chip fails, the traces can be scratched or the chip can be removed from the board. The test points can be shorted and the duplicate chip can be used instead.

(ii)

Use thick traces to account for temperature changes and spaced as far possible.

Test points at either side of a trace so that if it's damaged it can be shorted with a jumper.

(iii)

We have found another EEPROM (C7562) with very similar specifications and the same pinout as the one we designed our circuit around (C6482). This backup component is a cheap, basic part and as of checking on 09/03/2023 it has 32937 in stock.

(iv)

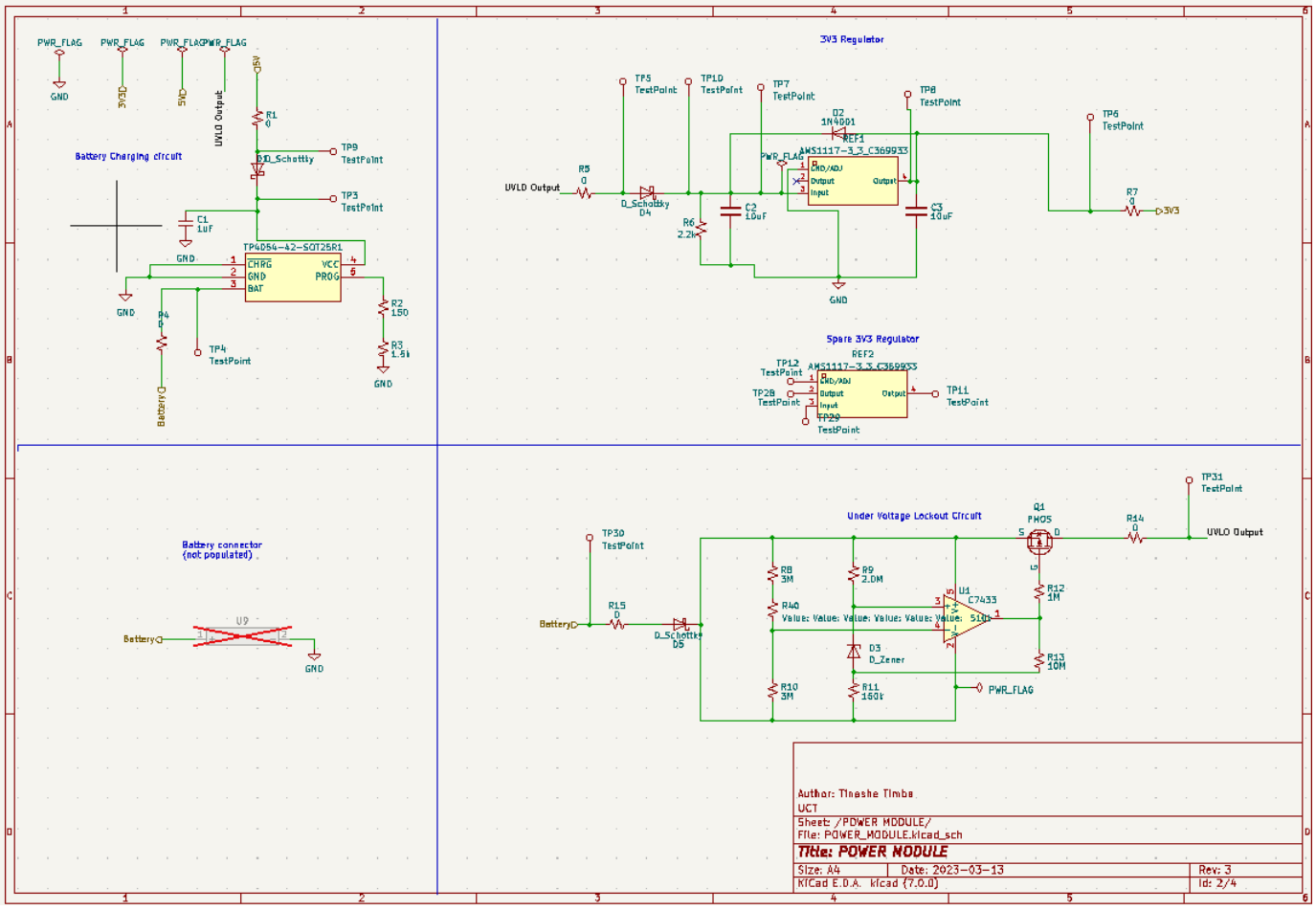
Test points so components or certain modules in the circuit can be tested or shorted to remove them from the circuit. The test points are placed at the power input, ground and other inputs and outputs of the circuit in order. This is to account for the component not working or parts of the module circuitry not working.

Q5 Power Subsystem Schematic [2]

The updated schematic for the power subsystem includes the battery holder (which will be “Do Not Populate” on the board). The battery holder is needed as a power source for the ERCs.

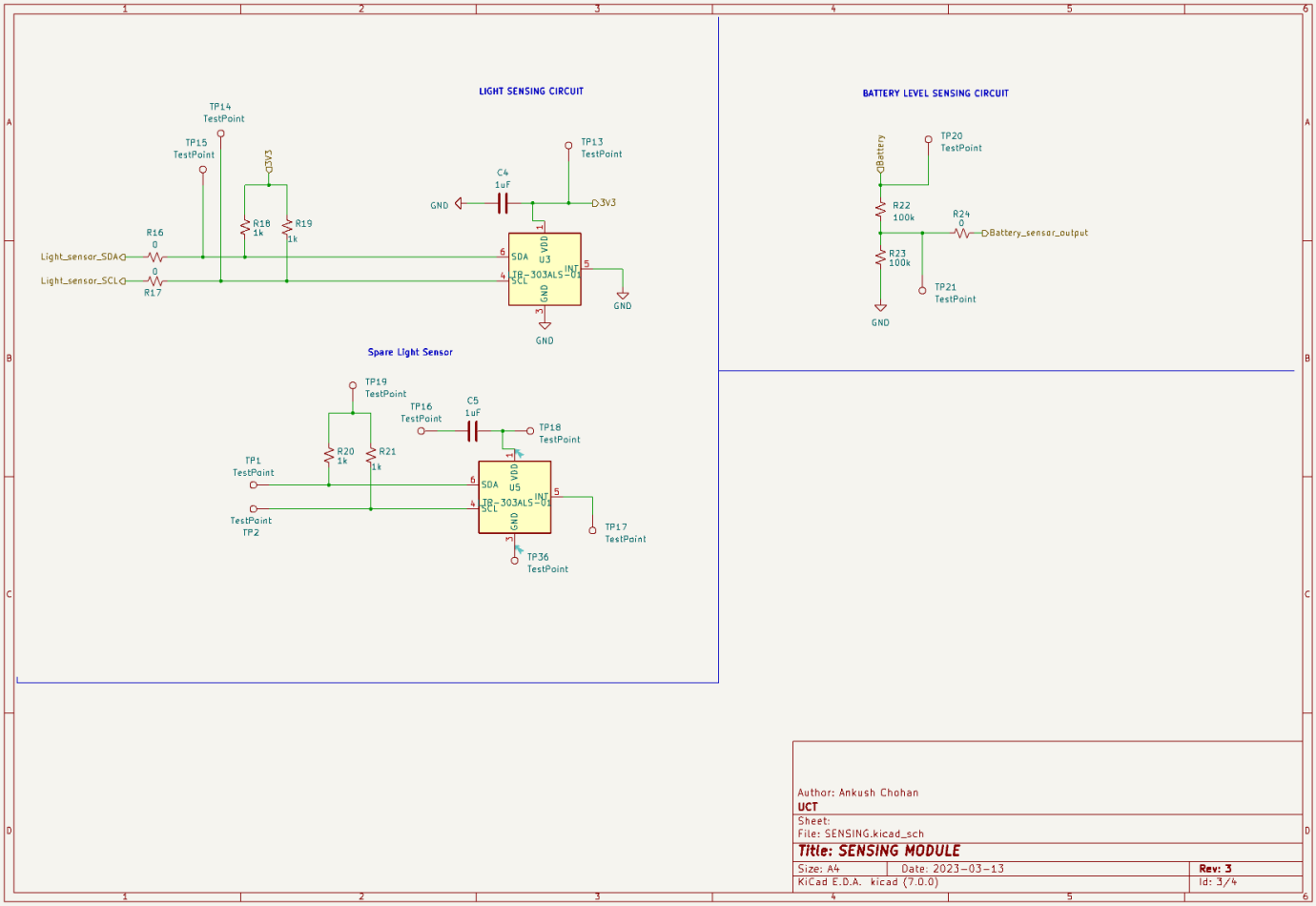
Power flags are also included for labelling GND and power sources for passing the ERCs.

The schematic symbol for the 3V3 regulator was changed to match the footprint.



Q6 Sensing Subsystem Schematic [2]

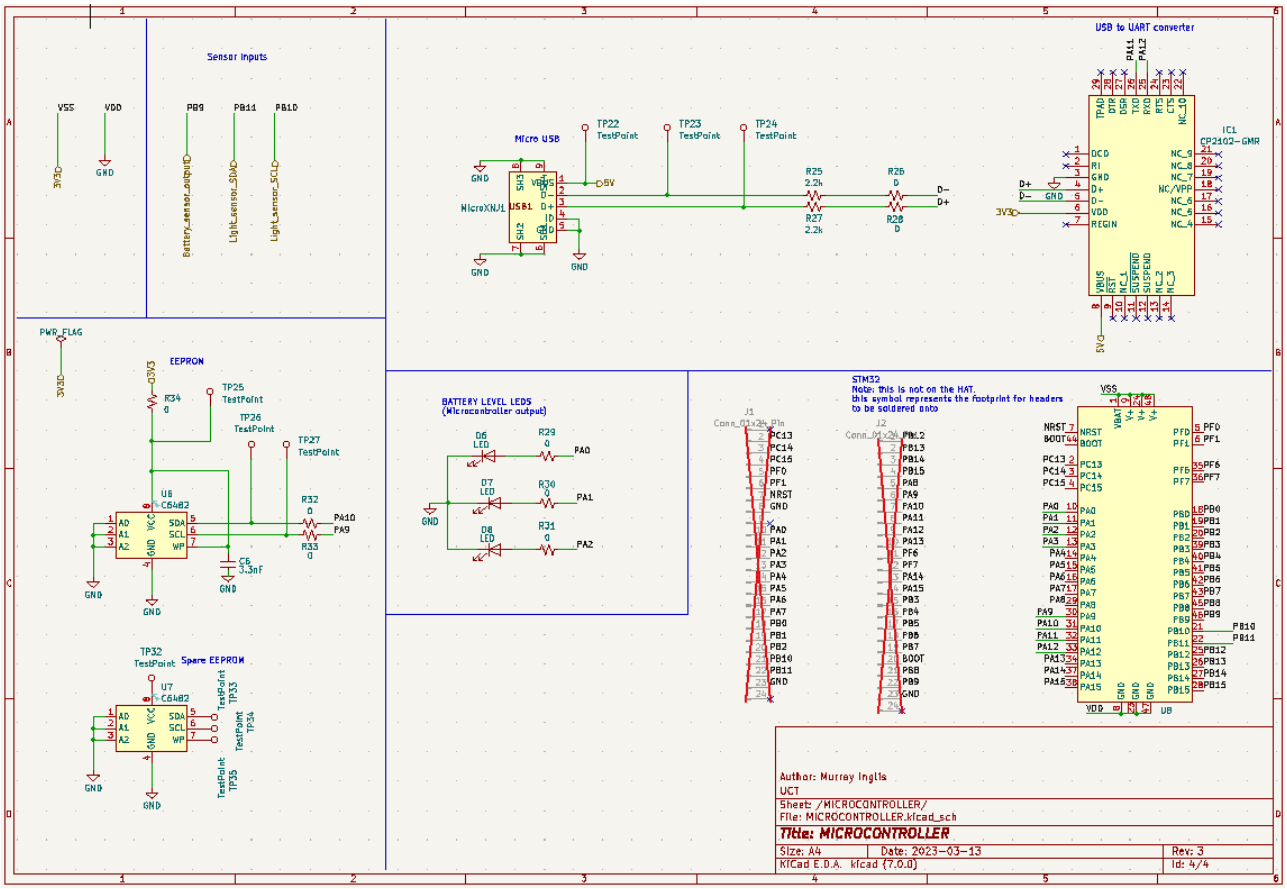
No changes made.



Q7 Microcontroller interfacing Schematic [2]

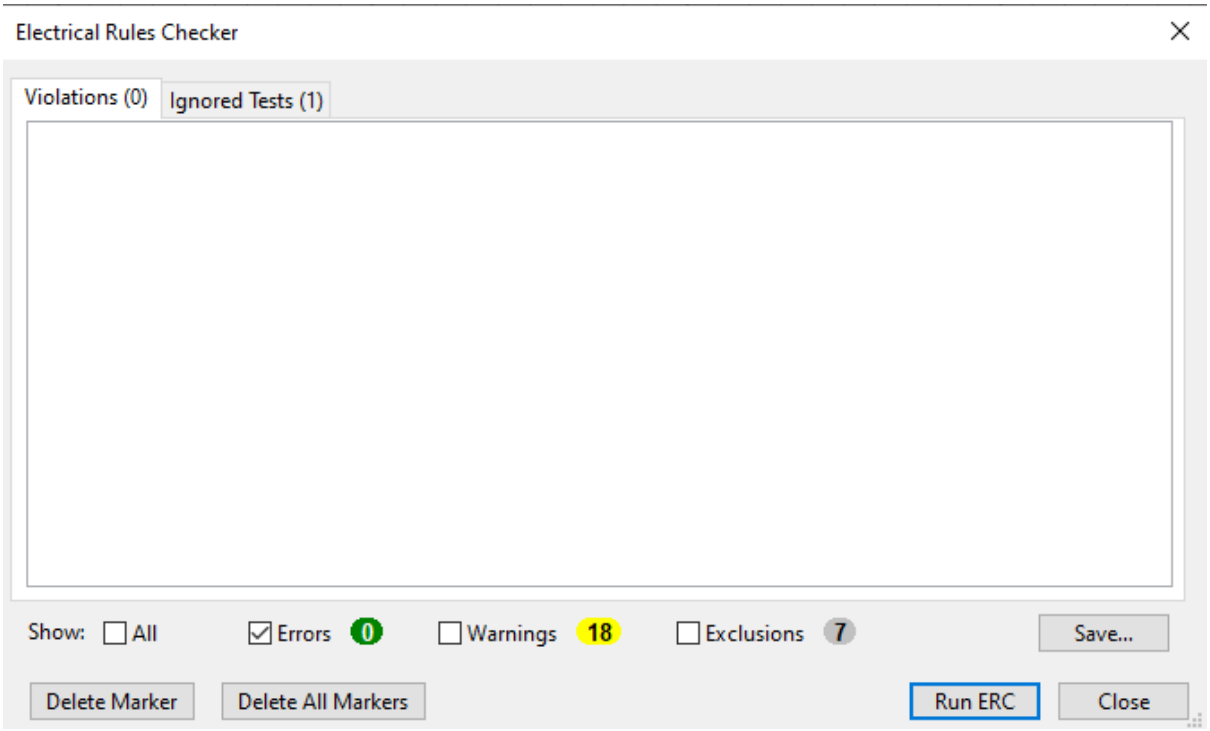
Added the symbol for the microcontroller and headers. These are both “Do Not Populate”. The symbol is only there so that the footprint is printed onto the PCB.

The 1x24 connectors were added to allow jumper cables to easily be connected to the STM. The connectors themselves are “Do not populate” as we will solder them on ourselves once the board is made.



Q8 Updated ERCs [2]

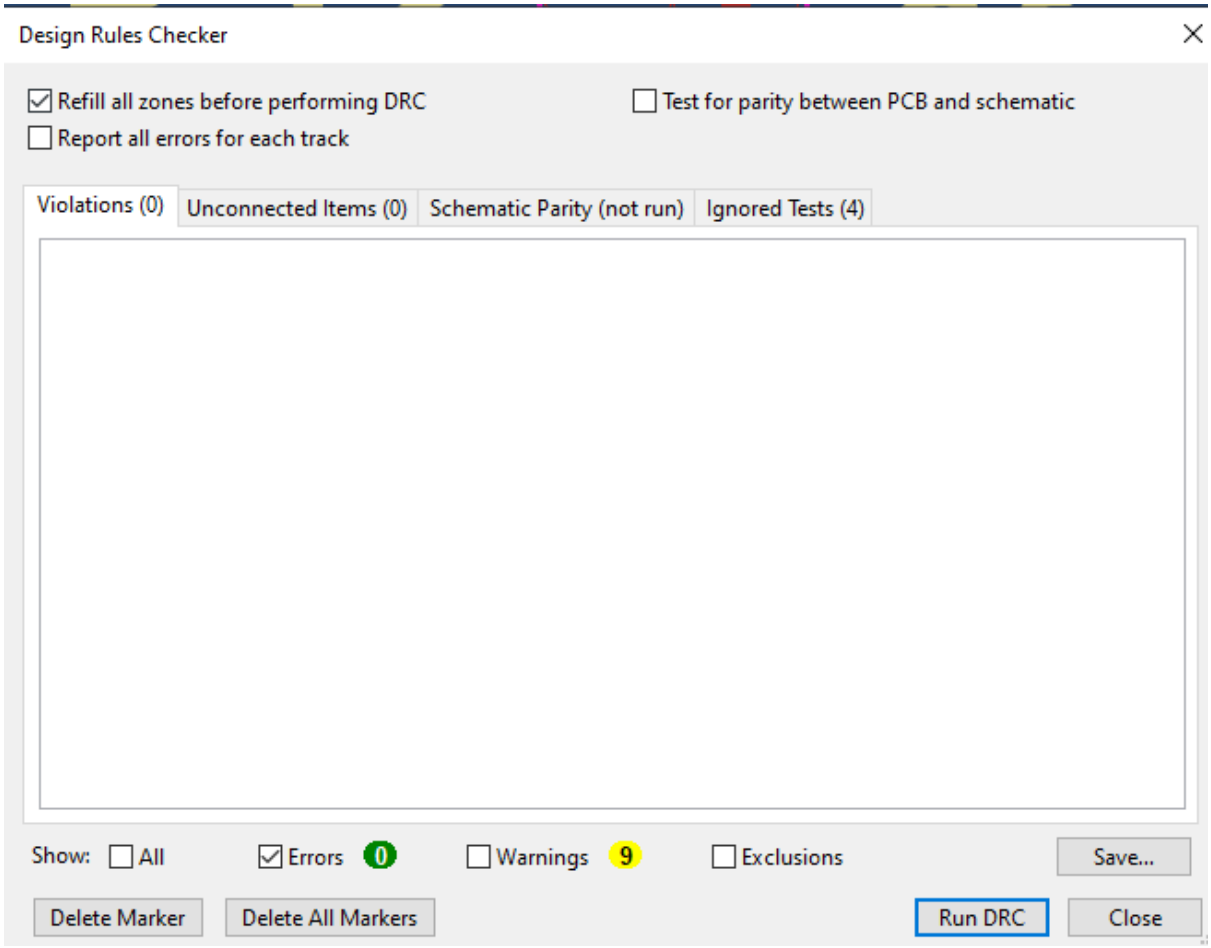
- Short circuit detection
- Open circuit detection
- Unconnected pin detection
- Clearance checks
- Net list comparison



Note: the exclusions were for the spare components that we included that are only connected to test points.

Q9 DRCs [2]

- Clearance checks
- Minimum track width checks
- Silkscreen checks
- Hole size checks
- Mask-to-pad clearance checks
- Solder mask expansion checks



Q10 Updated BOM [5]

https://github.com/murrayinglis/EEE3088-group-09/blob/main/PCB/SCHEMATICS/BOM.xlsx

Reference	Value	Extended	LCSC	Unit price	Qty	Total
C1, C4, C5	1uF		C28323	0,0058	3	0,0174
C2, C3	10uF		C19702	0,0066	2	0,0132
C6	3.3nF		C1613	0,0058	1	0,0058
D1, D4, D5	D_Schottky		C191023	0,0167	3	0,0501
D2	1N4001		C64898	0,0071	1	0,0071
D3	D_Zener		C8056	0,0111	1	0,0111
D6-D8	LED		C2286	0,0054	3	0,0162
IC1	CP2102-GMR		C6568	2,3774	1	2,3774
MicroXNJ1		YES	C404969	0,0333	1	0,0333
Q1	PMOS	YES	C2959854	0,0851	1	0,0851
R1, R4, R5, R7, R14-R17, R24, R26, R28-R34	0		C17168	0,0005	17	0,0085
R2	150		C22808	0,001	1	0,001
R3	1.5k		C25867	0,0005	1	0,0005
R6, R25, R27	2.2k		C17520	0,0017	3	0,0051
R8, R10	3M		C23156	0,0013	2	0,0026
R9	2.0M		C22976	0,0016	1	0,0016
R11	150k		C22807	0,001	1	0,001
R12	1M		C17927	0,0031	1	0,0031
R13	10M		C26108	0,0024	1	0,0024
R18-R21	1k		C11702	0,0005	4	0,002
R22, R23	100k		C17900	0,003	2	0,006
R40	510k		C11616	0,0005	1	0,0005
REF1, REF2	AMS1117-3_3_C369933	YES	C369933	0,0646	2	0,1292
TP4054-42-SOT25R1			C32574	0,1433	1	0,1433
U1	C7433		C7433	0,2804	1	0,2804
U3, U5	LTR-303ALS-01	YES	C364577	0,3887	2	0,7774
U6, U7	EPROM	YES	C6482	0,4906	2	0,9812
TOTAL						**4,9625**

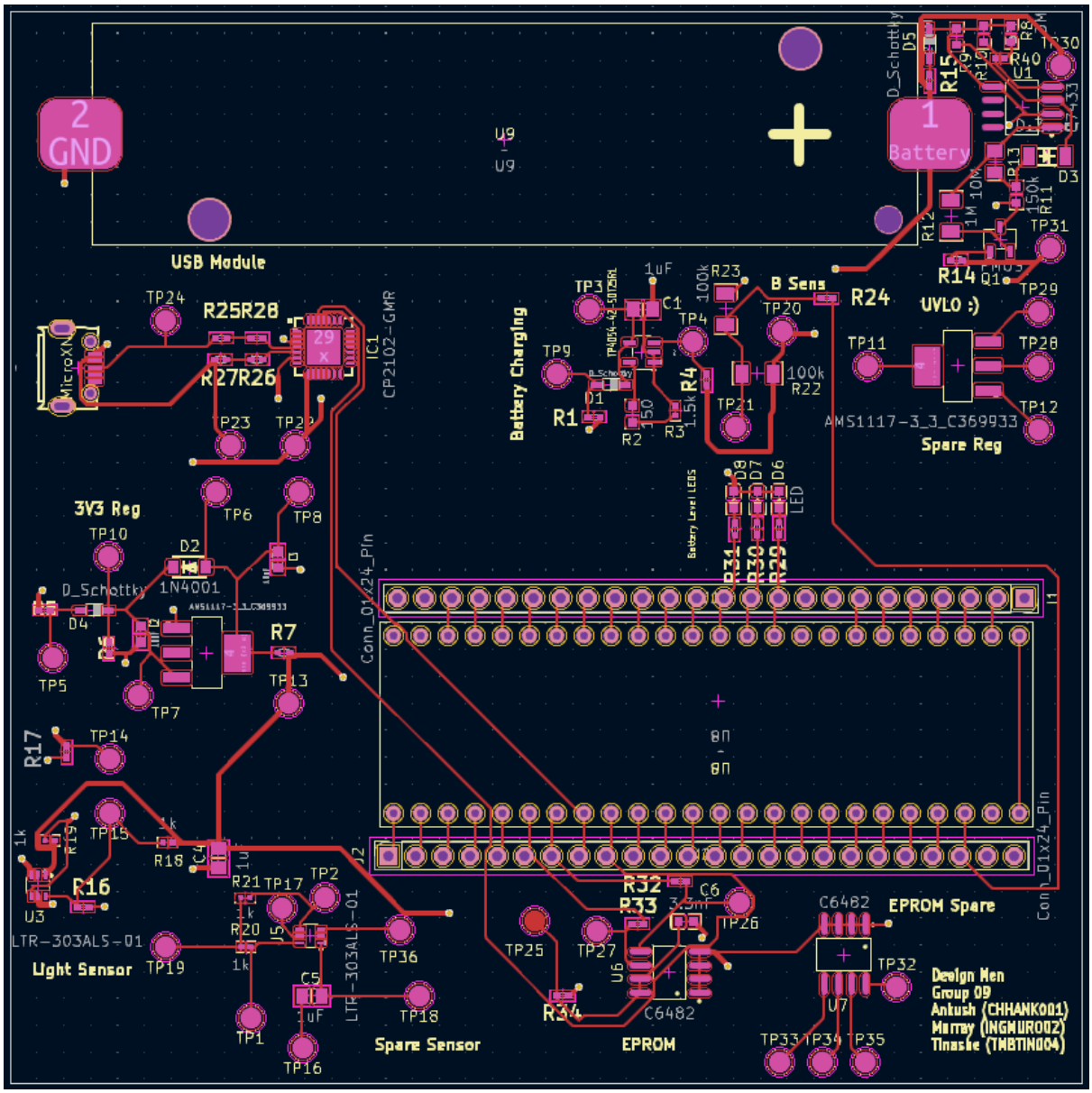
Including the cost for 5 boards and for the 5 extended parts:

Total budget:

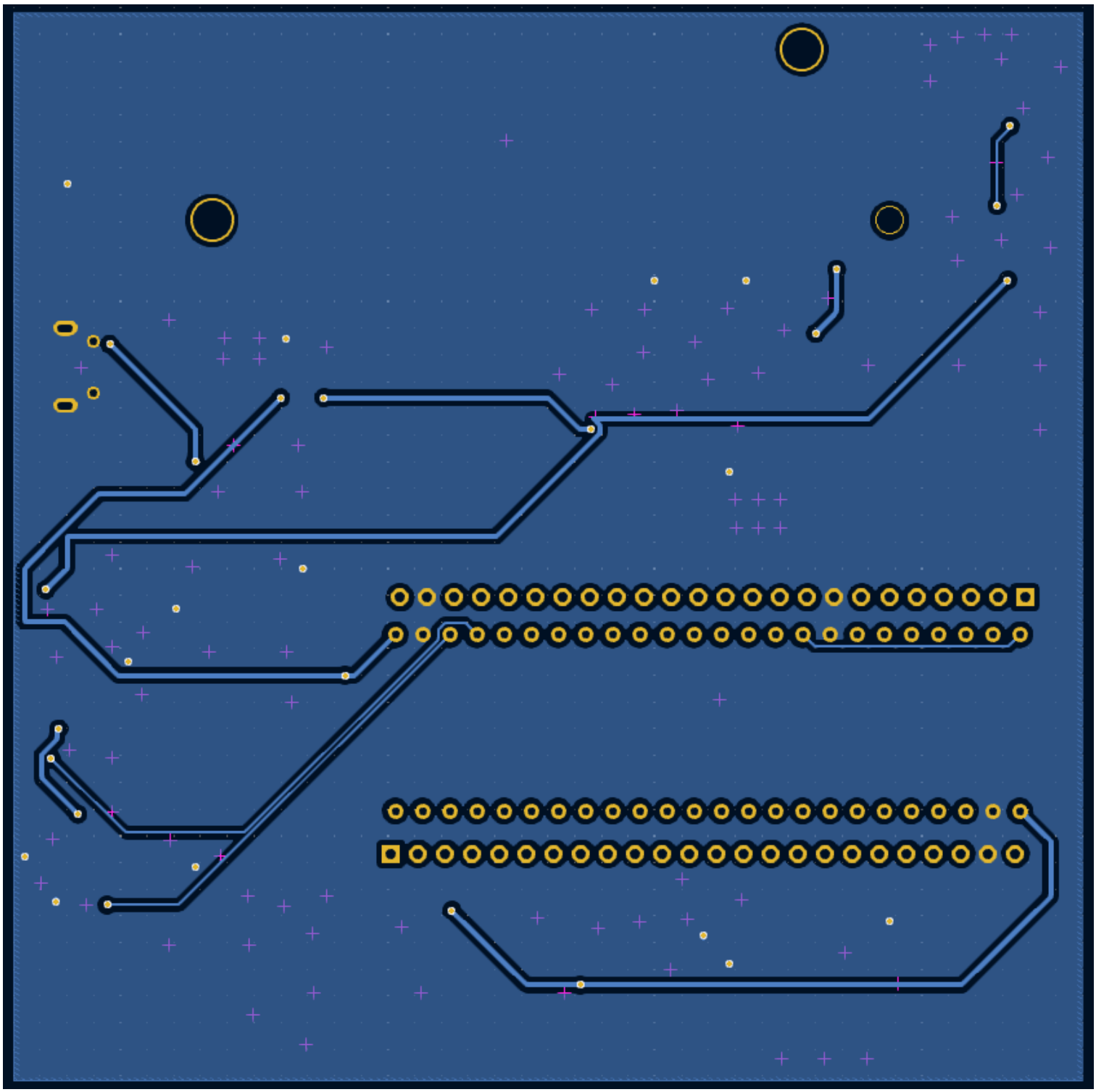
4.9625*5 + 3*5 = $39.8125

Q11 PCB [15]

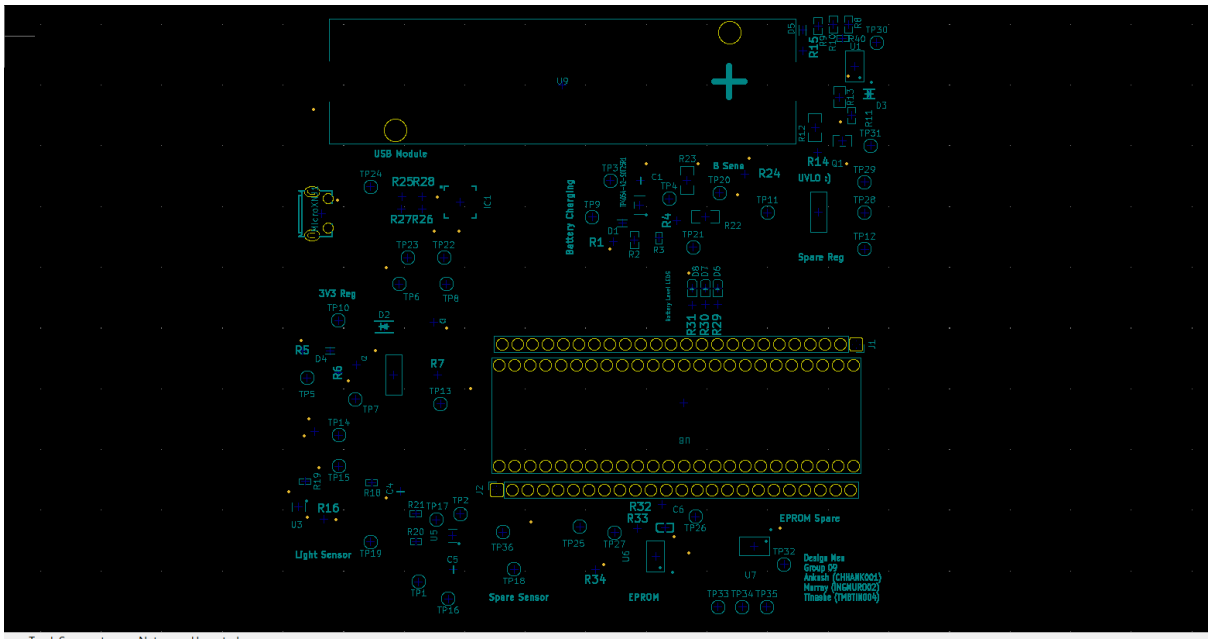
Front layout and routing



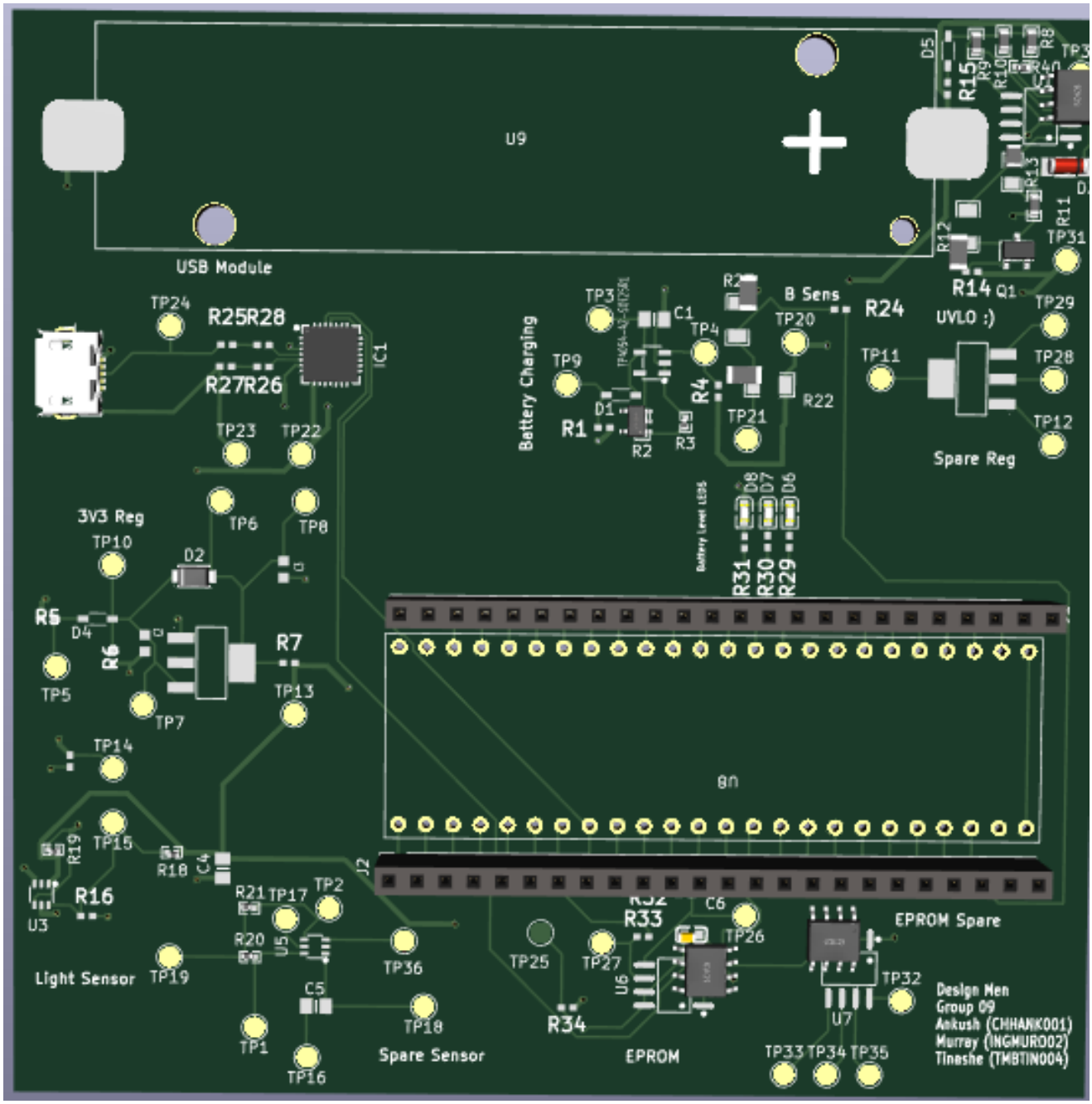
Back copper routing



SilkScreen


USB Module
Battery Charging
B Sens
UVLO :)
Spare Reg
3V3 Reg
Light Sensor
Spare Sensor
EPROM
EPROM Spare
Design Nos
Group 09
Ankush (CHHANK001)
Harrey (HSAHUR002)
Tinashe (TMBTIN004)

3D image


U9
USB Module
TP24
R25R28
R27R26
IC1
TP23
TP22
3V3 Reg
TP10
D2
TP6
TP8
R5
D4
R6
TP5
TP7
R7
TP13
TP14
TP15
R19
R18
C4
R16
U3
R21
TP17
TP2
R20
U5
Light Sensor
TP19
TP36
C5
TP1
TP16
TP18
Spare Sensor
TP25
TP27
R33
C6
TP26
R34
U6
EPROM
EPROM Spare
TP32
U7
TP33
TP34
TP35
Design Men
Group 09
Ankush (CHHANK001)
Murray (INGMUR002)
Tinashe (TMBTIN004)
Battery Charging
TP3
C1
TP4
TP9
D1
R1
R2
R3
R4
TP21
R22
B Sens
R24
TP20
UVLO :)
Q1
R14
TP11
TP29
TP28
TP12
Spare Reg
D8
D7
D6
R31
R30
R29
J2
8n
D5
R15
R9
R10
R8
R13
R11
R12
TP31