

EEE3088F 2023 Initial Design Template

Q1 GitHub

https://github.com/BestNkhumeleni/EEE3088F_group22_2023

Q2 Power Subsystem Failure Management

- i. The circuit is designed in such a way that allows faulty components to be identified and isolated using Jumpers and Pin Headers.
- ii. Regarding the circuit traces, we Make sure that the circuit board has enough space between traces and have an appropriate trace width to accommodate the voltage and current levels of the circuit. In case of any damage to the circuit traces, jumper wires and pin headers can be used as a workaround
- iii. The design incorporates several identical components which means that substitutes can be easily found if needed.
- iv. The design of the circuit will make Troubleshooting easier by facilitating the access to each component individually, additionally jumper wires can also be used to bypass malfunctioning parts.

Q3 Sensing Subsystem Failure Management

- I. Use sensors with high tolerance/reliability ratings together with over voltage and overcurrent protection and make use of both digital and analog sensors to combat failures such as component destruction.
- II. Thick traces and increase the distance between traces to prevent them from shorting each other.
- III. Use commonly available components.
- IV. Implement and testing and validating process to catch and correct any issue before shipping, by running the circuit through various simulations to insure that it meets the required specifications.
- V. Sensors should be positioned away from heat sources on the PCB. Generally, they should not be close to the LCD and battery, and to minimize any self-heating of the sensors and they should be acquired at a maximum sample rate of 1sps (RH + Temp).
- VI. A multilayer ceramic bypass X7R capacitor of 0.1 μ F between the VDD and GND pins , to filter out interference from the supply voltage.

Q4 Microcontroller interfacing Failure Management

(i) component failure/destruction

We'll have extra micro controllers to attach the hat to in the case of microcontroller failure.

(ii) trace damage

If the microcontroller trace is broken or damaged, we can use one of our other micro-controllers.

(iii) component shortage

This is unlikely to happen as the micro-controllers are already in our possession, but if all ours break then we'll have a fourth spare that is not being used at that time to run the code into.

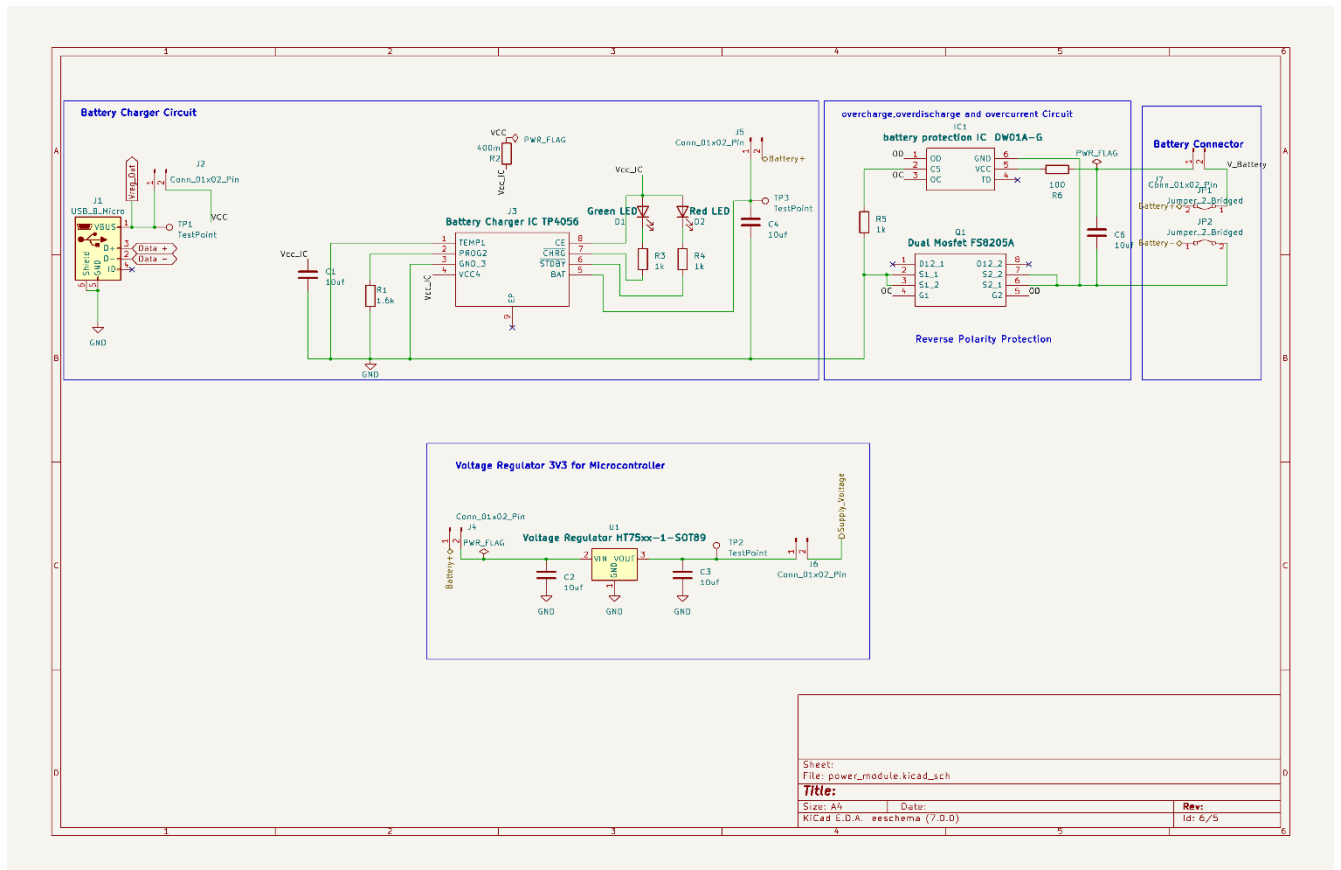
(iv) errors in your circuit design that are only detected post manufacture.

We will have a second code base in case our primary code base breaks or track different versions of our code using git hub and trace back when we run into code breaking issues.

We will also have extra microcontrollers in case our primary one breaks.

We can also reconfigure pins, if a pin breaks, we could set another pin to do its job instead.

Q5 Power subsystem schematic



Update: The two Mosfets for Reverse Polarity Protection and ULVO have been replaced by a Dual Mosfet IC which is connected to the battery protection IC (DW01) which protects the battery against Overcharging, Over discharging (UVLO).

The changes have been made to reduce the risk of failure of the Power Submodule.

Q6 Sensing subsystem schematic

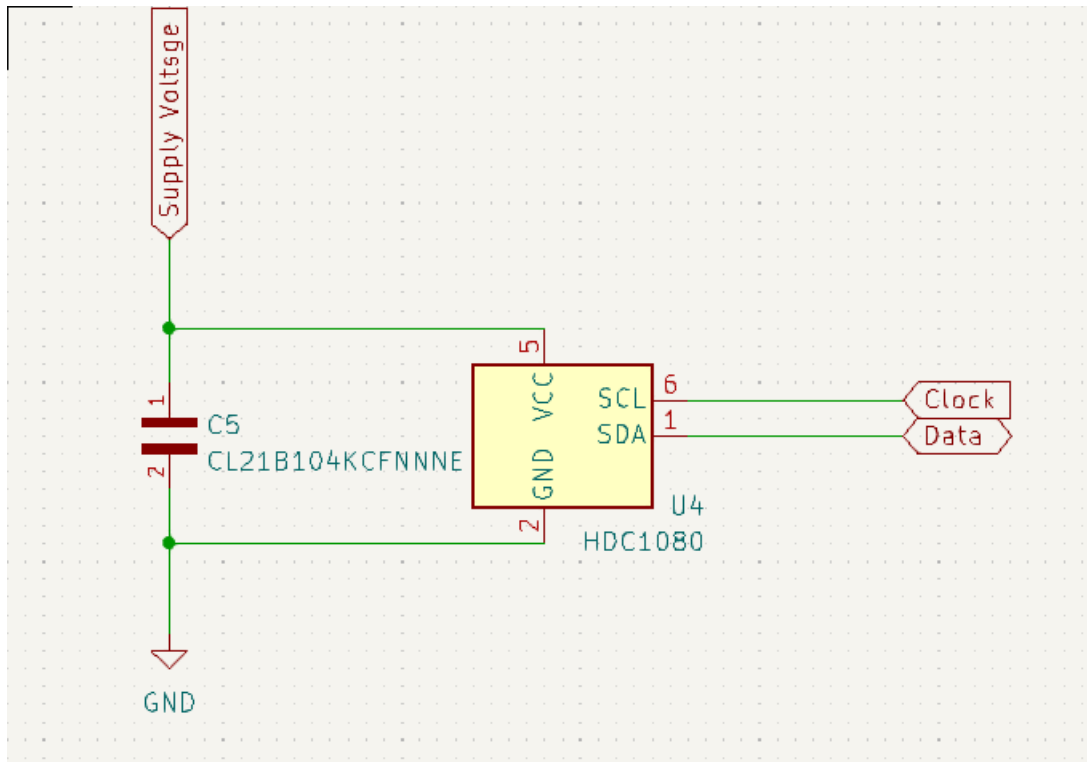


Figure 1: Digital Humidity and Temperature Sensor

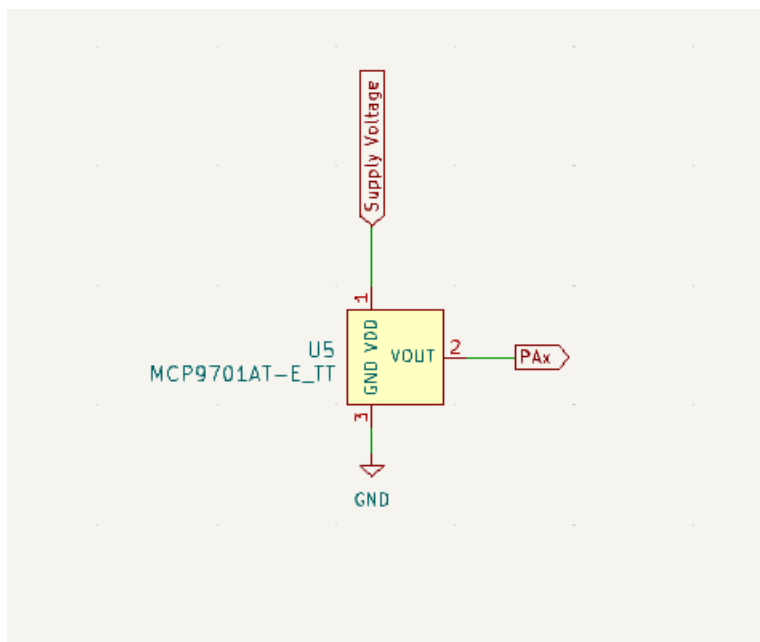
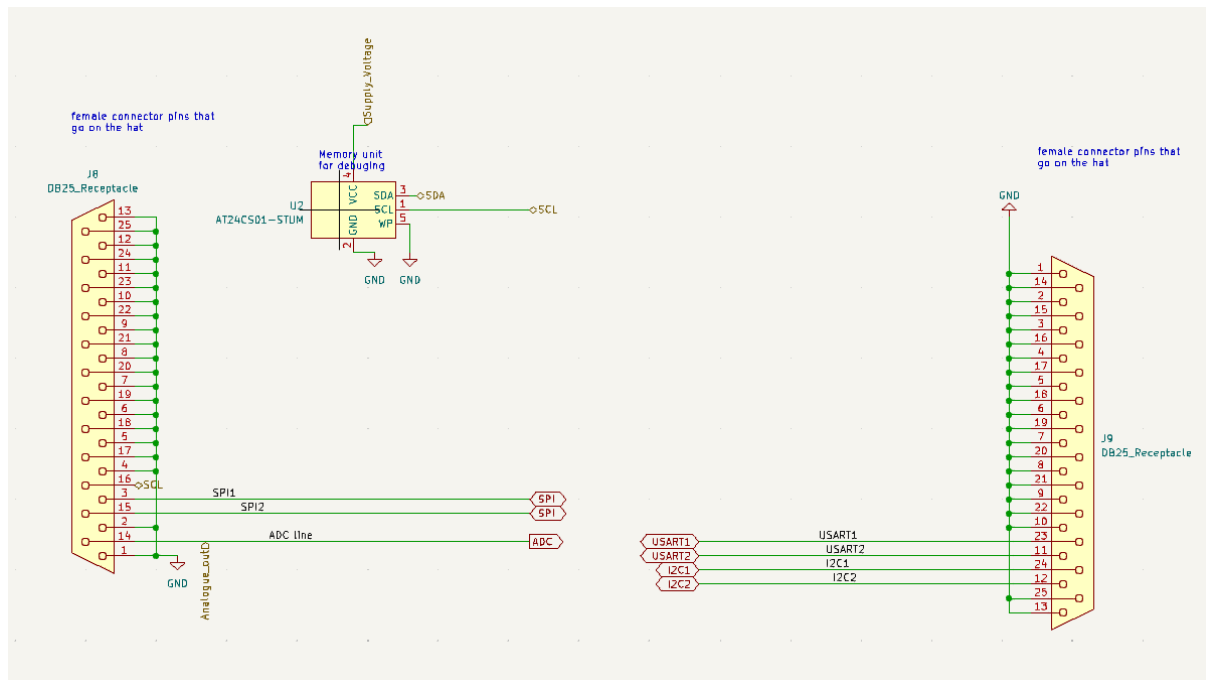


Figure 2: Analog Temperature Sensor

Update: Changed the digital temperature sensor to a digital Humidity and temperature sensor.

Q7 Microcontroller interfacing Schematic



Q8 Planned ERCs

Reverse polarity testing

Voltage limiting

On/off scenarios

Overcurrent testing

Q9 Updated BOM

Updated bill of materials for the micro controller interfacing:

https://github.com/BestNkhumeleni/EEE3088F_group22_2023/blob/main/BOM/Intergration/Book1.xlsx

https://github.com/BestNkhumeleni/EEE3088F_group22_2023/tree/main/BOM/Intergration

Updated BOM for sensing:

https://github.com/BestNkhumeleni/EEE3088F_group22_2023/blob/main/BOM/Sensors/SensorBOM.xlsx

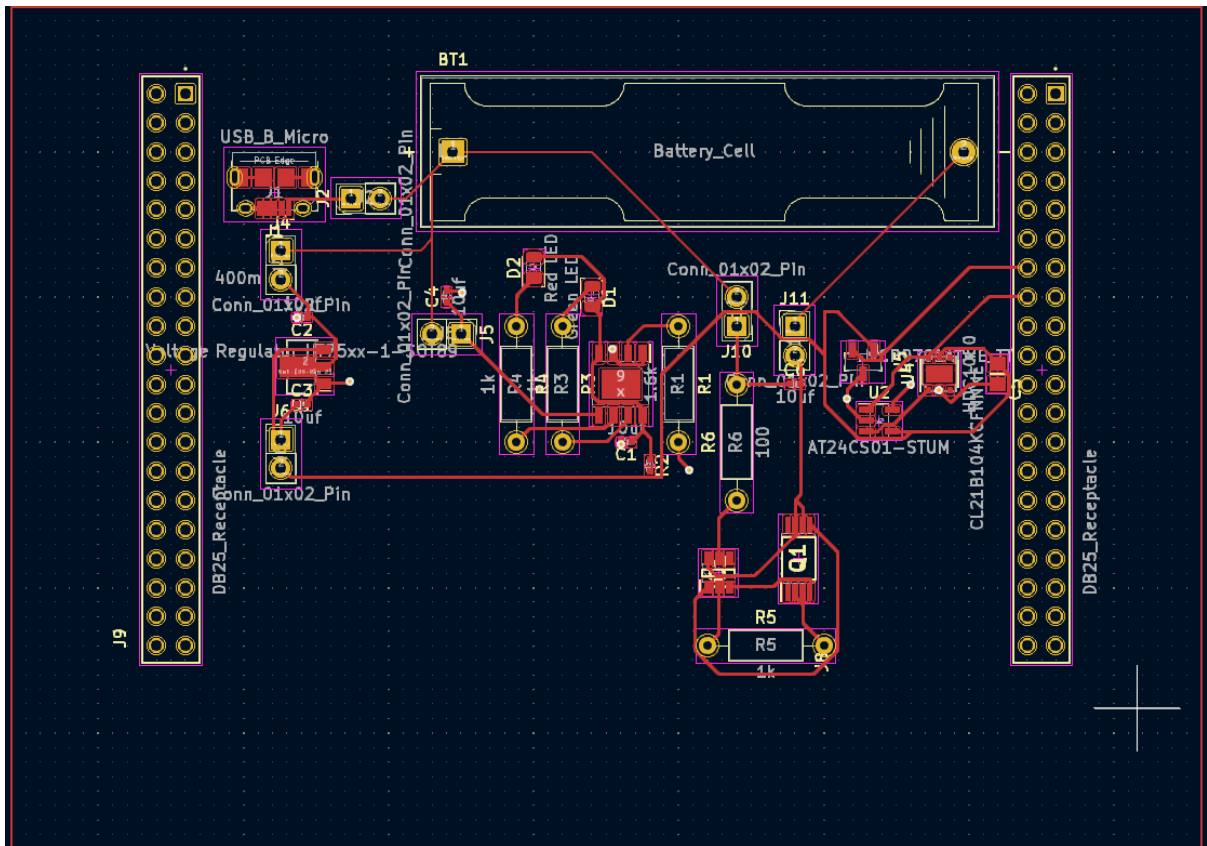
[Updated sensors BOM](#)

Updated BOM for power system:

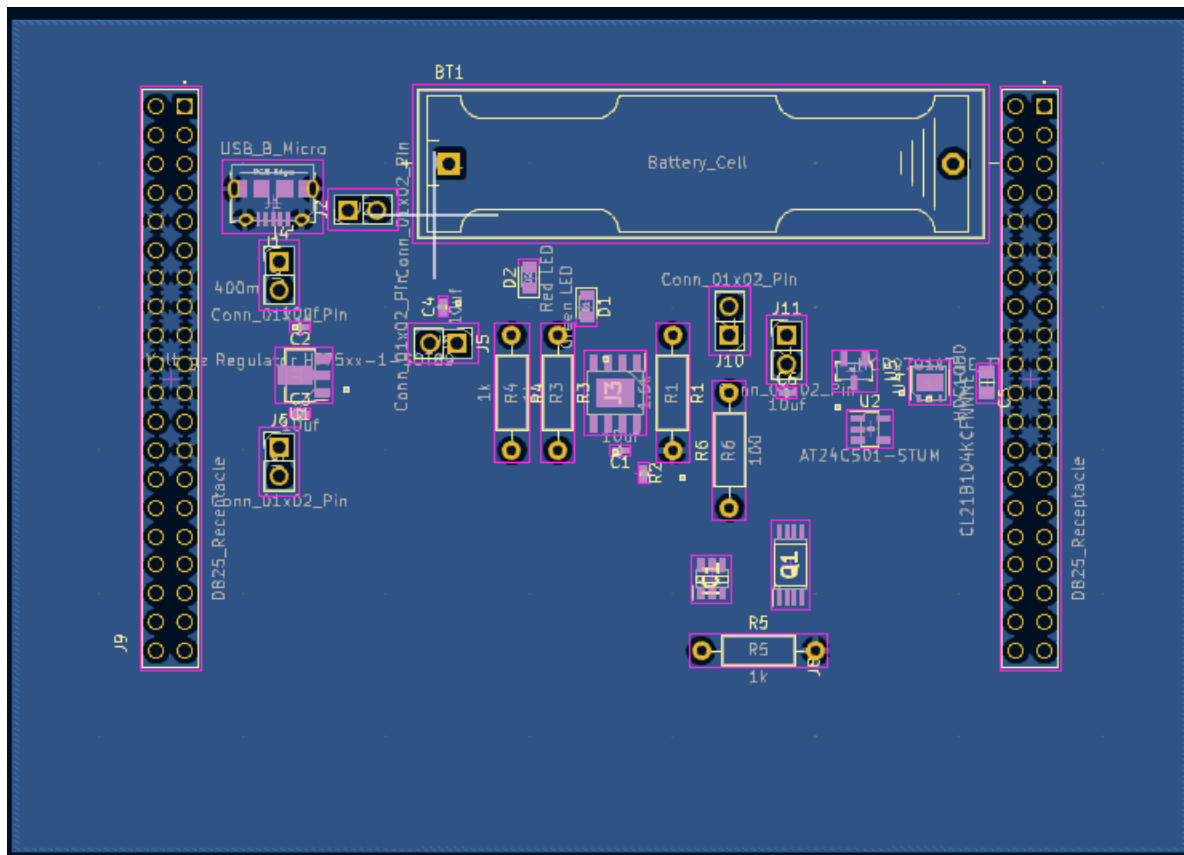
https://github.com/BestNkhumeleni/EEE3088F_group22_2023/blob/main/BOM/Power%20Module/EEE3088F_Power_Submodule_BOM.csv

Total cost : \$20.5285

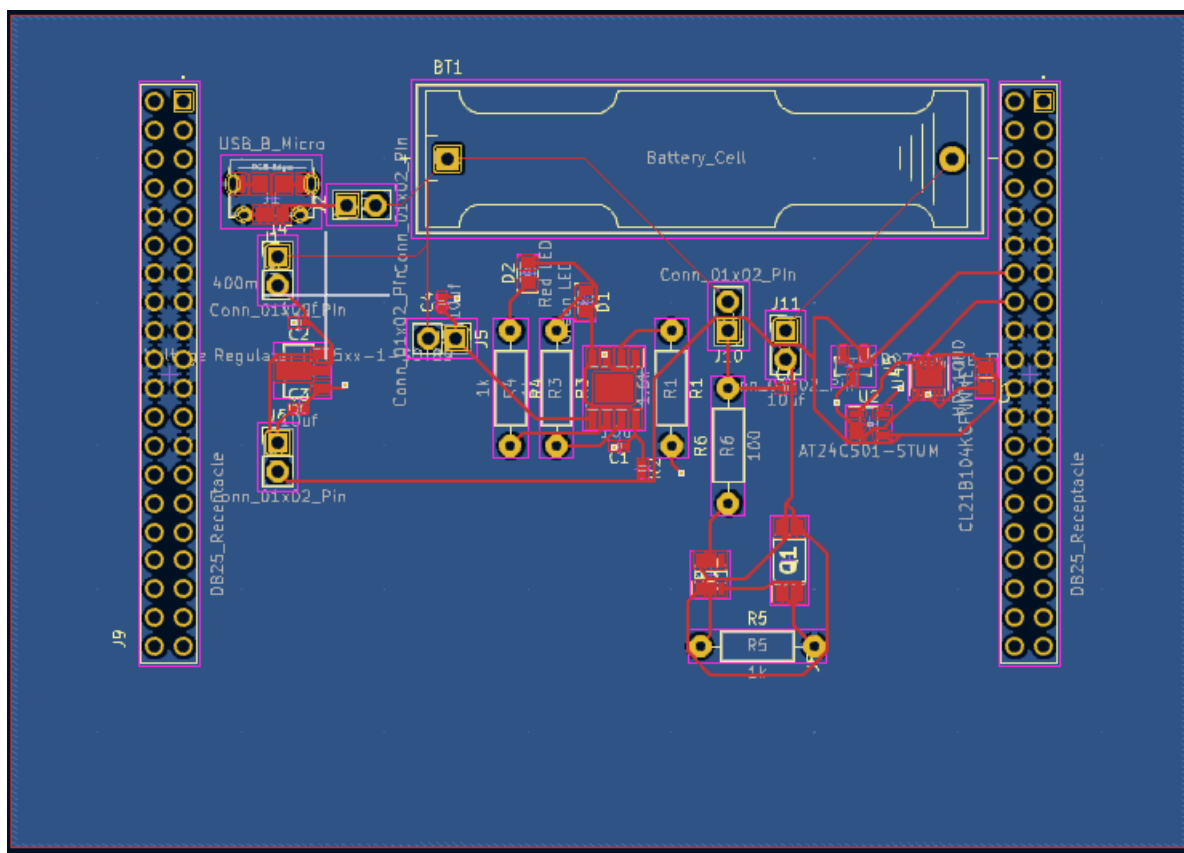
Q11 PCB [15]



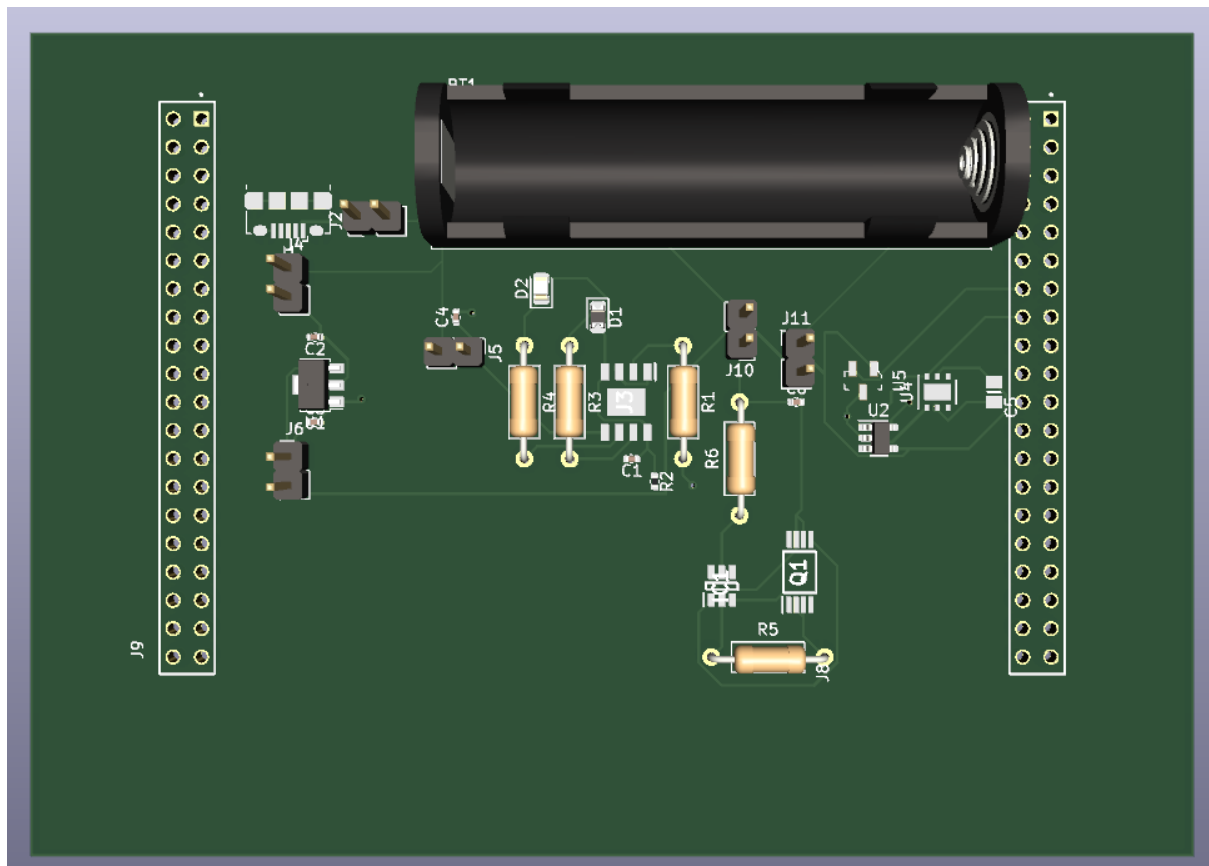
Top copper layer



bottom copper layer, also ground layer



overall



3D view

Gerber location:

https://github.com/BestNkhumeleni/EEE3088F_group22_2023/tree/main/Overall%20schematic/Gerber%20files