EEE088F 2022
Initial Design
Group 7
JNSRYA006 TRFDEV001 CRGALE002

Q1 Github [1]

GitHub Repository Link here

Q2 Power Subsystem Failure Management [5]

Component failure/destruction, Trace Damage & Errors Post Manufacturing:

For component failure, trace damage & errors detected after manufacturing has been completed, the following points of the power circuit are able to be isolated, and excluded using jumpers which connect to the following pins on the STMDiscovery Board:

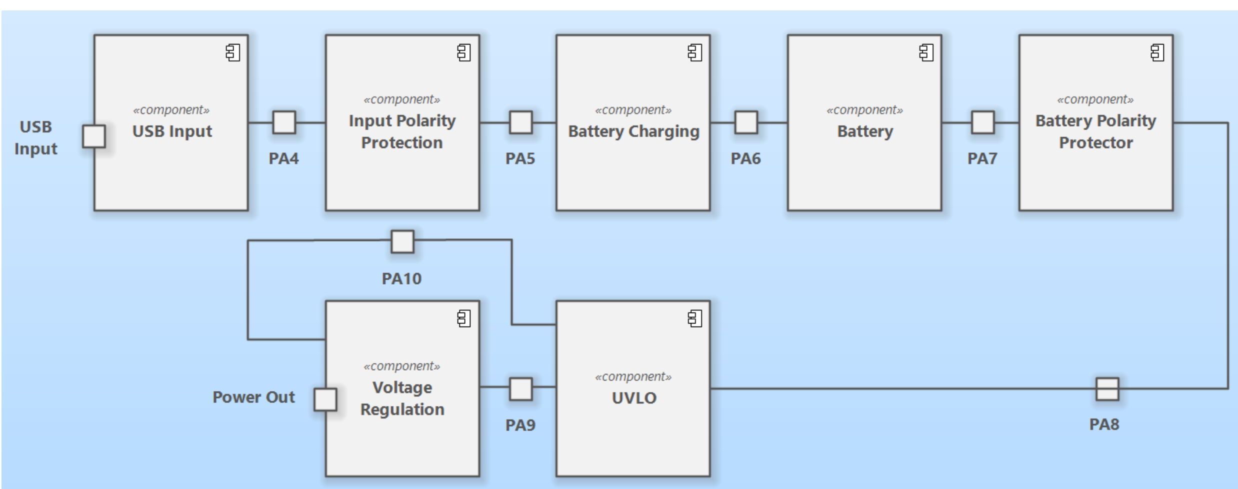


Figure 1: Diagram showing pin locations for jumpers in power module

Component Shortage:

Should there be a component shortage, alternatives for all components are available on JLCBPCB as basic parts and in similar price ranges except the AMS1117-3.3 (The voltage regulator), LM393DRG (Comparator in the UVLO), MICROXNJ (USB connector), 1N5819WS (Schottky Diode) & TP4056-42-ESOP8 (Battery Charger)

For these 5 ICs, the following alternatives are available:

Unavailable Component	Alternative Component	Alternative IC Part Number	Alternative IC Price	Price Increase per board
AMS1117-3.3	AMS1117-3.3V	C173386	$0.6858	$0.5003
LM393	LMS393DR	C67470	$0.7862	$0.6396
MICROXNJ	MICRO-01-G1P1-A1T2	C2682504	$0.6752	$0.6256
1N5819WS	1N5819W	C1884550	$0.6146	$0.6043
TP4056-42-ESOP8	TP4056X-42-ESOP8	C2763448	$0.8511	$0.5933

For all other components, such as resistors and capacitors, alternatives are available, as basic parts, for similar prices on JLCPCB.

Q3 Sensing Subsystem Failure Management [5]

In the event of a component shortage, three alternative temperature sensors with similar specifications and cheaper or equivalent unit price have been found: these have the reference codes: LM75BDP, GX18B20U, LM70CIMMX-3/NOPB.

Additionally three alternative light sensors with similar specs and cheaper or equivalent unit price have been researched and found. Their references are: BH1603FVC-TR,

BH1680FVC-TR, ALS-PDIC15-21C/L230/TR8

Testing and debugging will be crucial for the sensing unit since it is the source of all of the project's input data. For the sensing sub-unit each sensor's data line will have connect/disconnect points in the form of male pins on the board which can be connected/disconnected via a female jumper. In the event that there is component damage/failure and the sensors are giving incorrect readings this will allow us to isolate their data outputs from the rest of the PCB and identify the cause of the issue without the consideration of all the other components and their potential for loading/distorting the sensor's readings . Each sensor will also have a connect/disconnect point from the power source. The sensor will also be positioned such that their data line traces are as far from any high current traces as possible. This is to minimise any noise that may be produced by the electromagnetic fields around these traces.

The sensors will also be positioned with space around them on the PCB in case of errors only detected post manufacture. This will allow for an easier modification of the circuit around the sensor should it be necessary.

Additionally sensors with relatively large pins were chosen to facilitate the placement of probes directly on the part for troubleshooting. If the part gets damaged and needs replacing this will also make for an easier job when desoldering it and resoldering a replacement.

Q4 Microcontroller interfacing Failure Management [5]

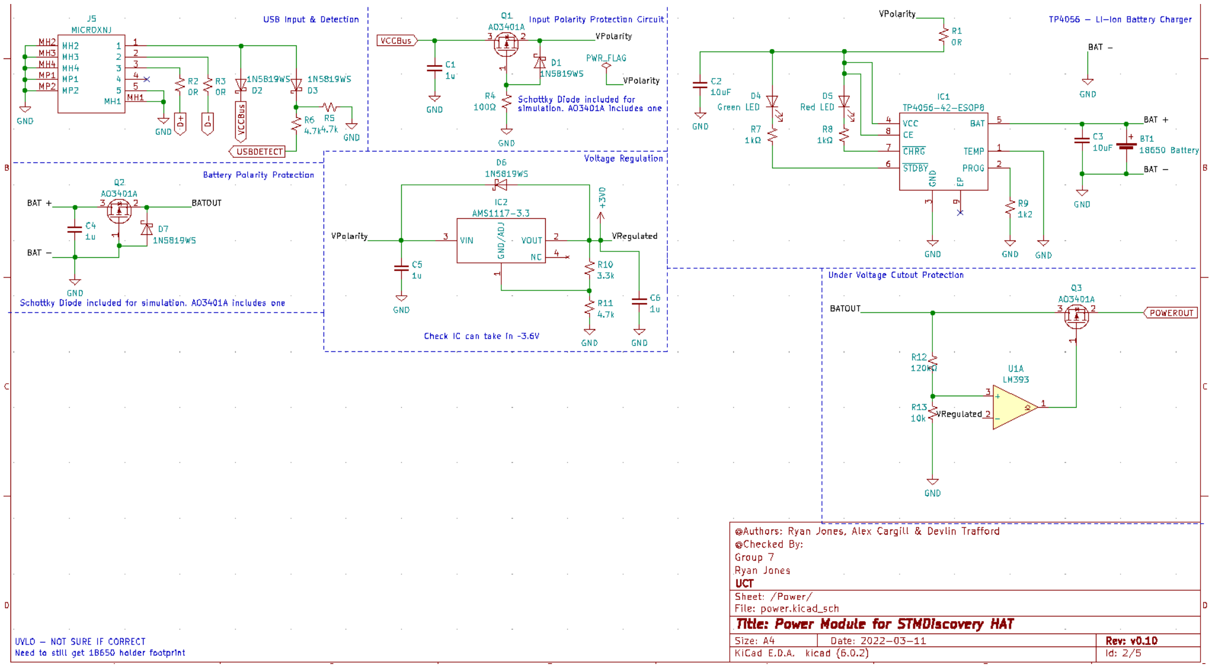
(i) I have chosen an EEPROM and USB To UART chip that are surface mounted devices with long leads and therefore will be unsolderable if a device fails. The same applies to resistors and capacitors in the circuit.

(ii) Double traces with jumpers will be added in order to allow for backup traces that can be used in the case of trace damage. Also I added Leds in order to test whether traces are damaged or not.

(iii) There is a large family of CH340 chips that can be used as USB to UART chips. The CH340G was chosen for its price and so there are a number of alternatives that are only slightly more expensive.

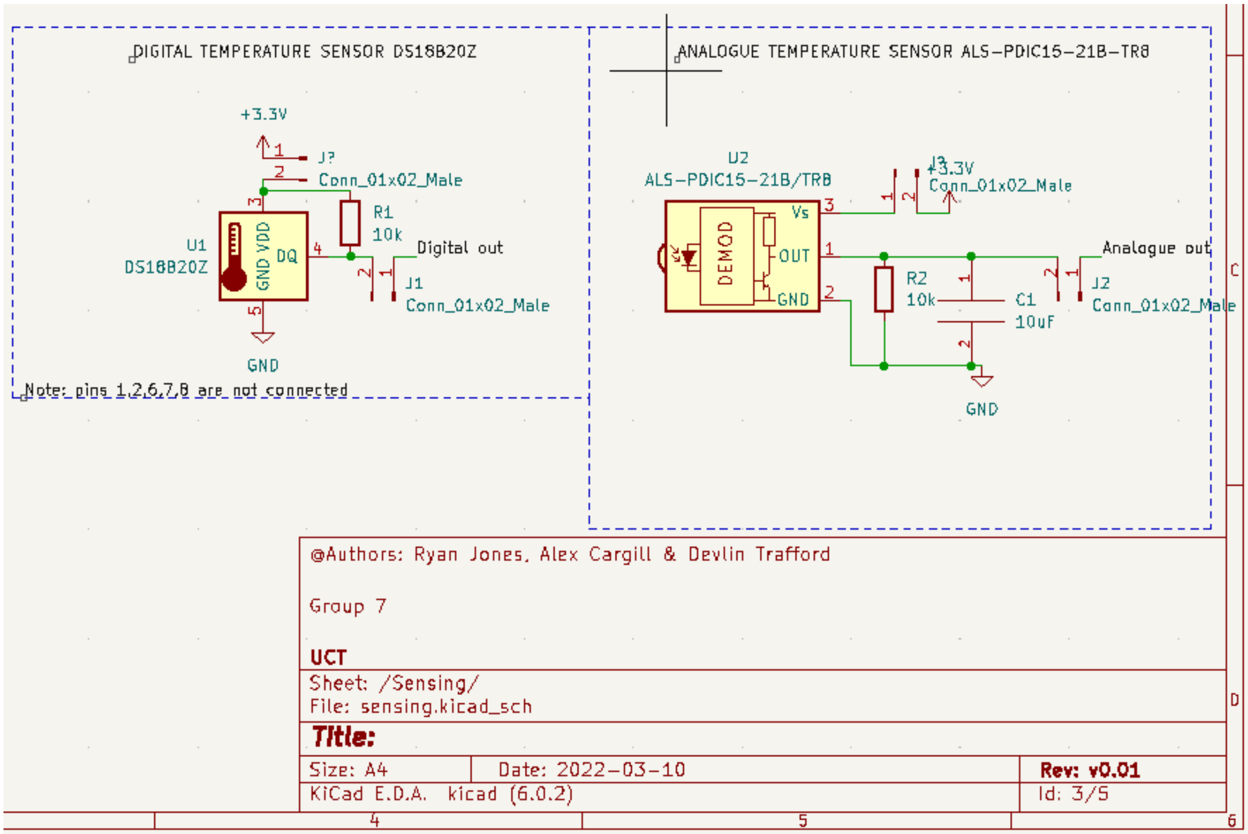
(iv) I have mentally prepared myself for the possibility. But apart from that I have inserted as many jumpers as our budget will allow in order to rewire connections. Furthermore, I will draw traces to unused pins in case they are needed once the board has been printed.

Q5 Power Subsystem Schematic [10]

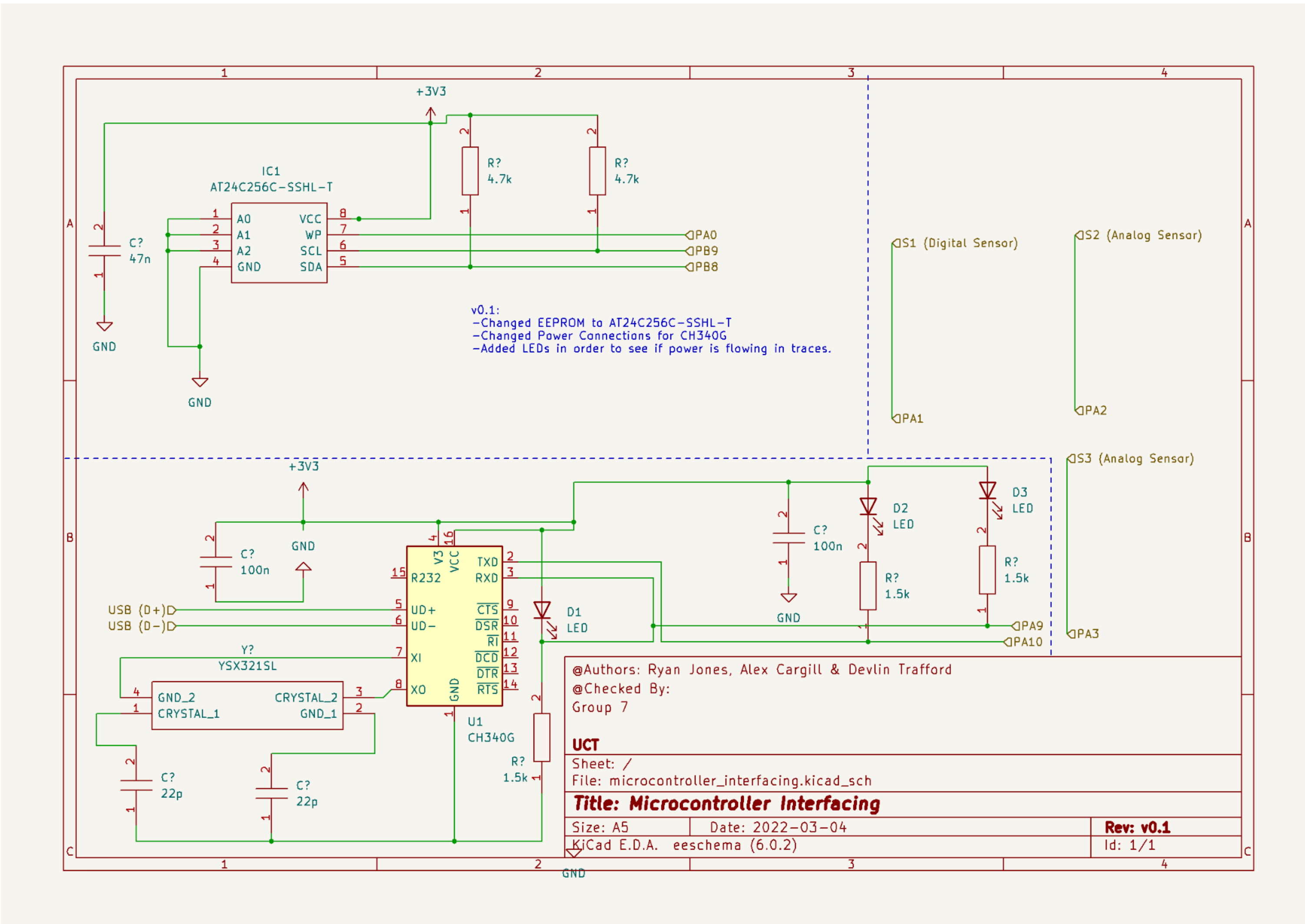


[Click here for better quality image]()

Q6 Sensing Subsystem Schematics [10]



Q7 Microcontroller interfacing Schematic [10]



Q8 Planned ERCs [5]

ERCs are designed to check if a circuit is electrically correct and connected correctly. This consists of the following checks if:

- All schematic connections are valid,
- There are any inputs or outputs that conflict,
- Any ports or pins are open and unconnected,
- And if any ports or pins overlap

KiCad gives a ERC.txt file after running an ERC, which is available on GitHub here.

The errors in the report are related to issues with hierarchical labels not being linked. This needs to be fixed, but does not impact the schematics of the submodule.

The same for the warnings in the report. These are related to labeling, that will be correct when a NetList is generated.

Q9 Updated BOM [4]

Update BOM available on GitHub here