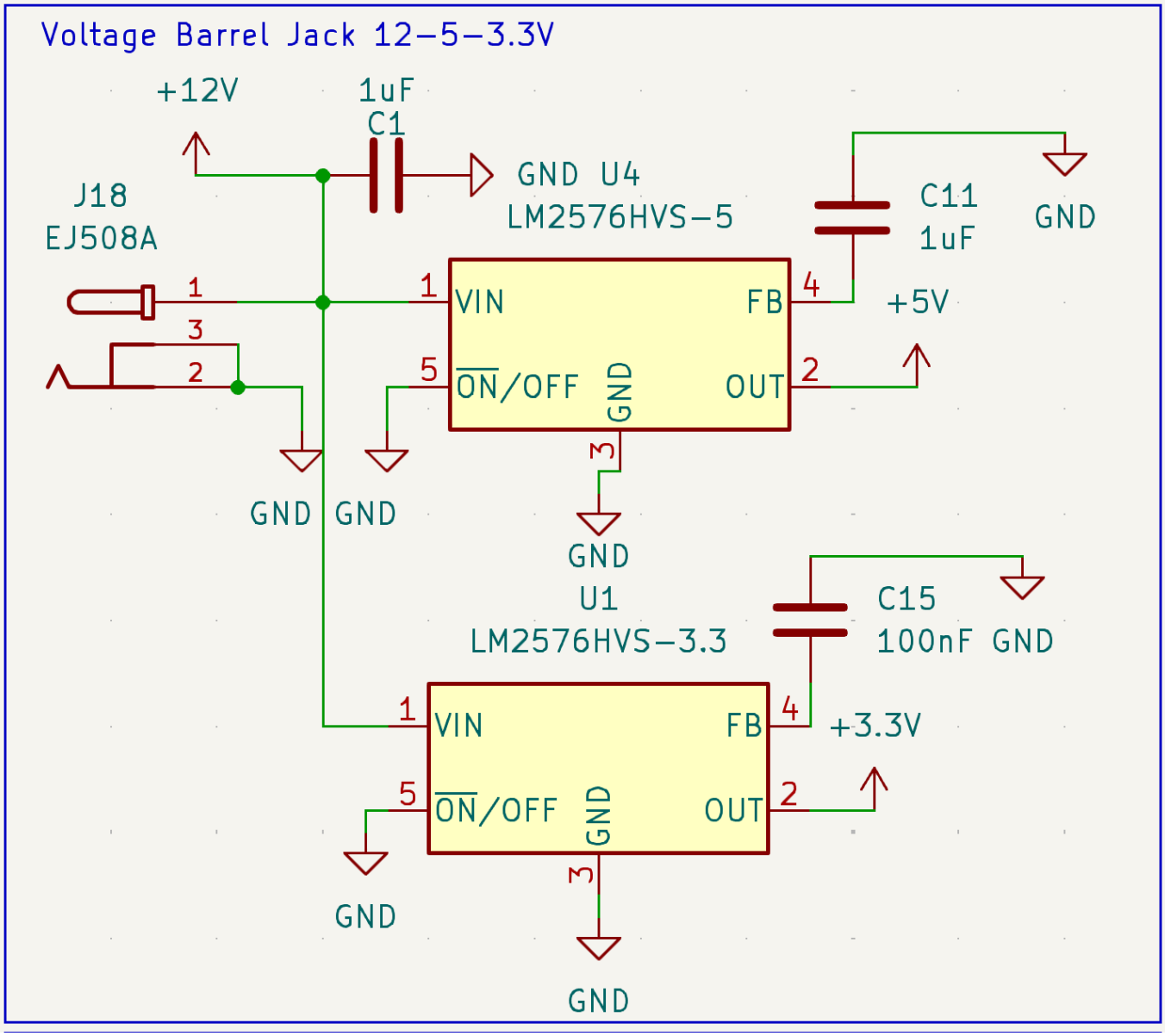
Introduction

The purpose of the chip is to enable an incubator to dispense ions over a cellular culture within the incubator. It consists of the following main parts:

- STM32F4 MCU
- 12V Barrel Jack, 12V-5V LDO, 12V-3.3V LDO
- CO2/Humidity/Temperature IC
- highdriver4 micropump driver and 4x mp6 micropumps
- Tag-Connect Debug port
- 4x Flow sensors
- Peltier Cooler
- CO2 Capsule

Voltage Barrel Jack



Electrical Specifications

- *EJ508A Barrel Jack*
  - Datasheet: https://www.memoryprotectiondevices.com/datasheets/EJ508A-datasheet.pdf
  - Maximum Voltage: 12V
  - Maximum Current: 5A
- *LM2576 LDO*
  - Datasheet: https://www.ti.com/lit/ds/symlink/lm2576.pdf
  - Maximum Supply Voltage: 60V
  - Maximum Current: Unknown
  - Output Voltage: 3.3V/5V
  - Output Current: 3A

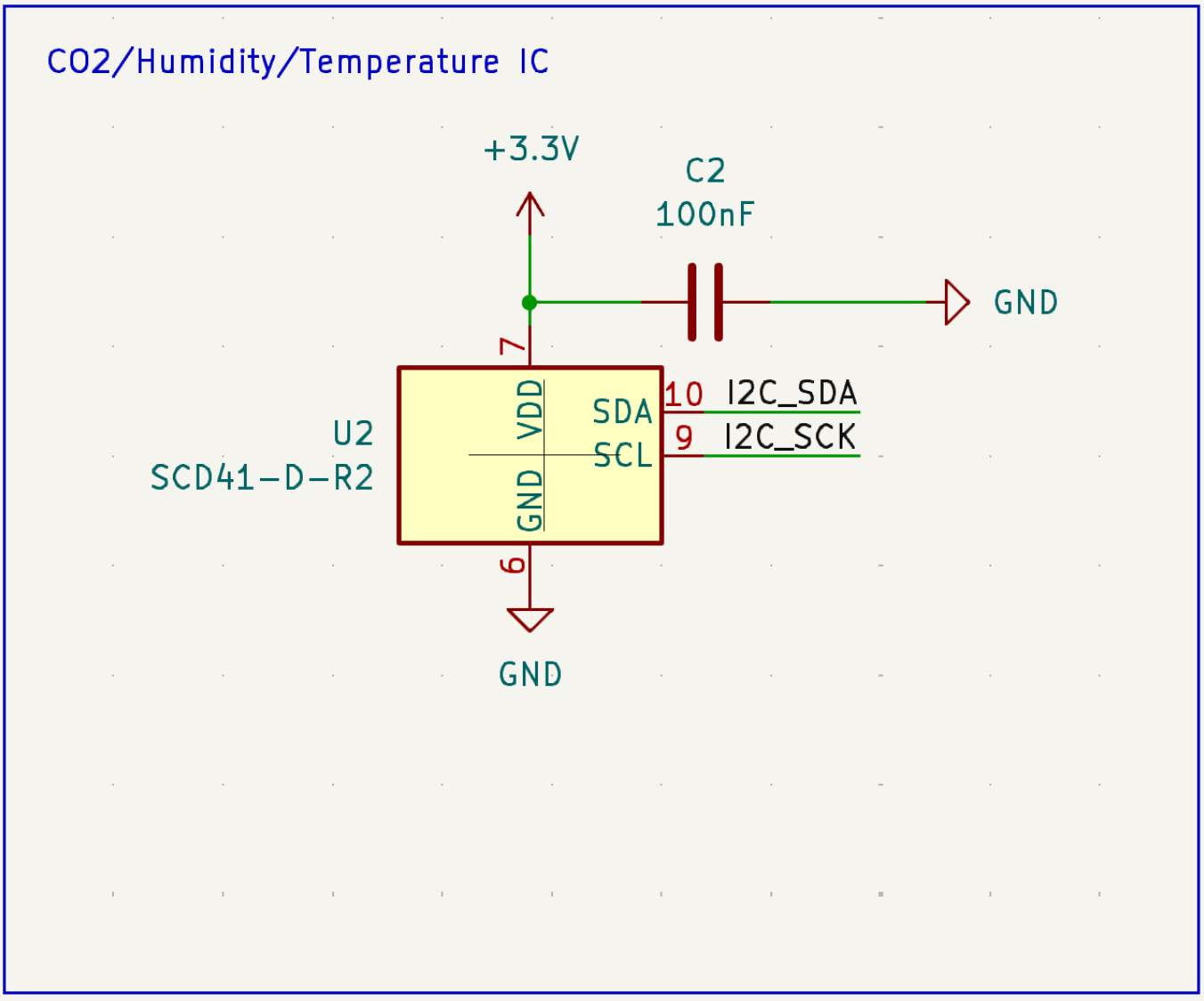
Function

The voltage barrel jack splits the incoming power into a 12V line, 5V line and 3.3V line. Two LDOs are connected in parallel. This will supply the entire board

Concerns

- The greatest current drawing component is the Peltier cooler which is connected to the 12V line and pulls 3.8A. Note that the 12V line is not limited to 3A so it should be able to supply it completely, however, there may not be enough current for the rest of the device or if it will distribute current correctly

Sensor IC



Electrical Specifications

- *SCD41*
  - Datasheet: https://sensirion.com/media/documents/48C4B7FB/64C134E7/Sensirion_SCD4x_Datasheet.pdf
  - Minimum Voltage: 2.4
  - Maximum Voltage: 5.5V
  - Peak Supply Current:
    - 175 typical mA to 205 max mA @ 3.3V
    - 115 typical mA to 137 max mA @ 5V

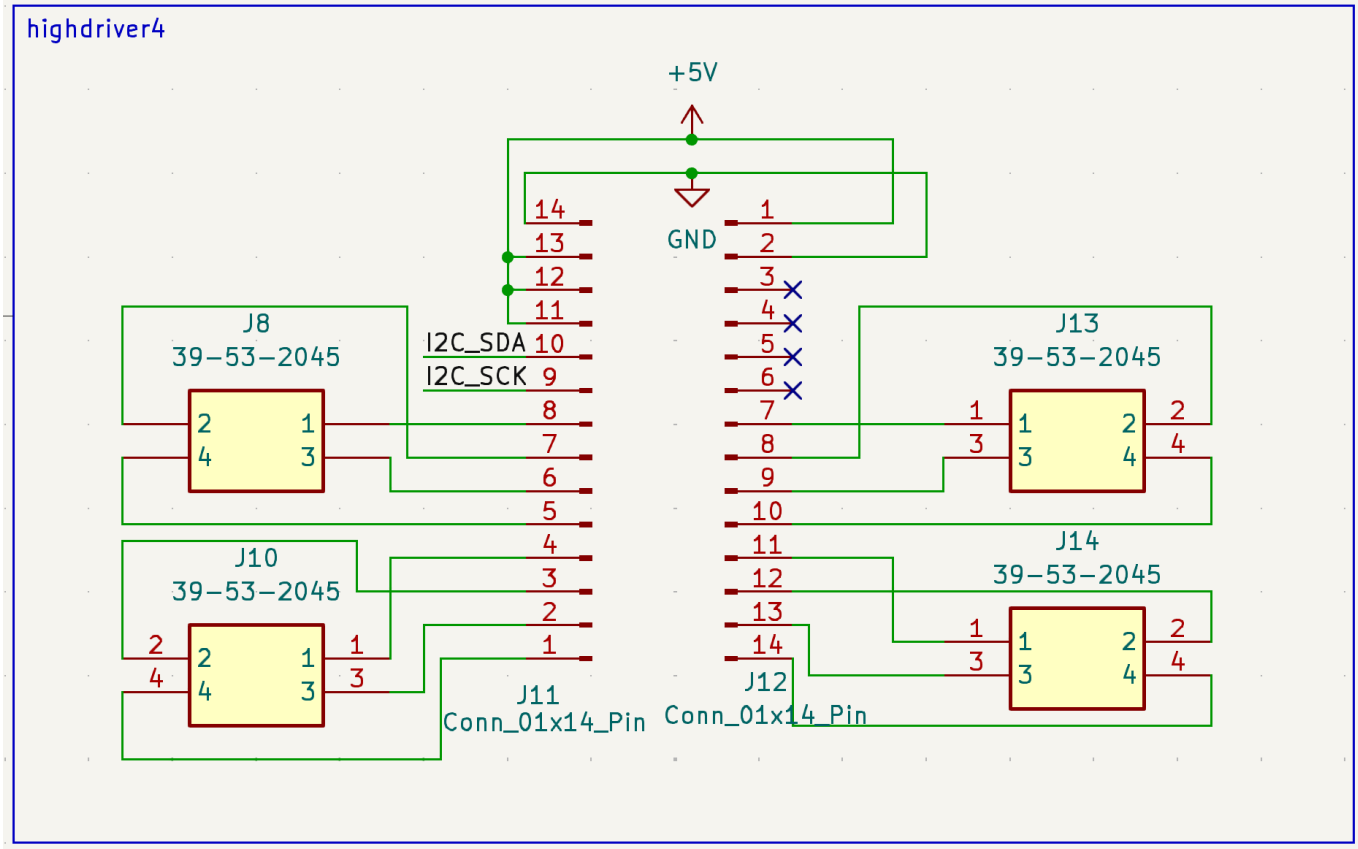
Function

The IC will do all the basic sensing of CO2/Humidity/Temperature and send it to the STM32

Concerns

- The footprint for the SCD41 looks similar to the SCD40 but it is supposed to be a connector with a detachable

Highdriver4



Electrical Specifications

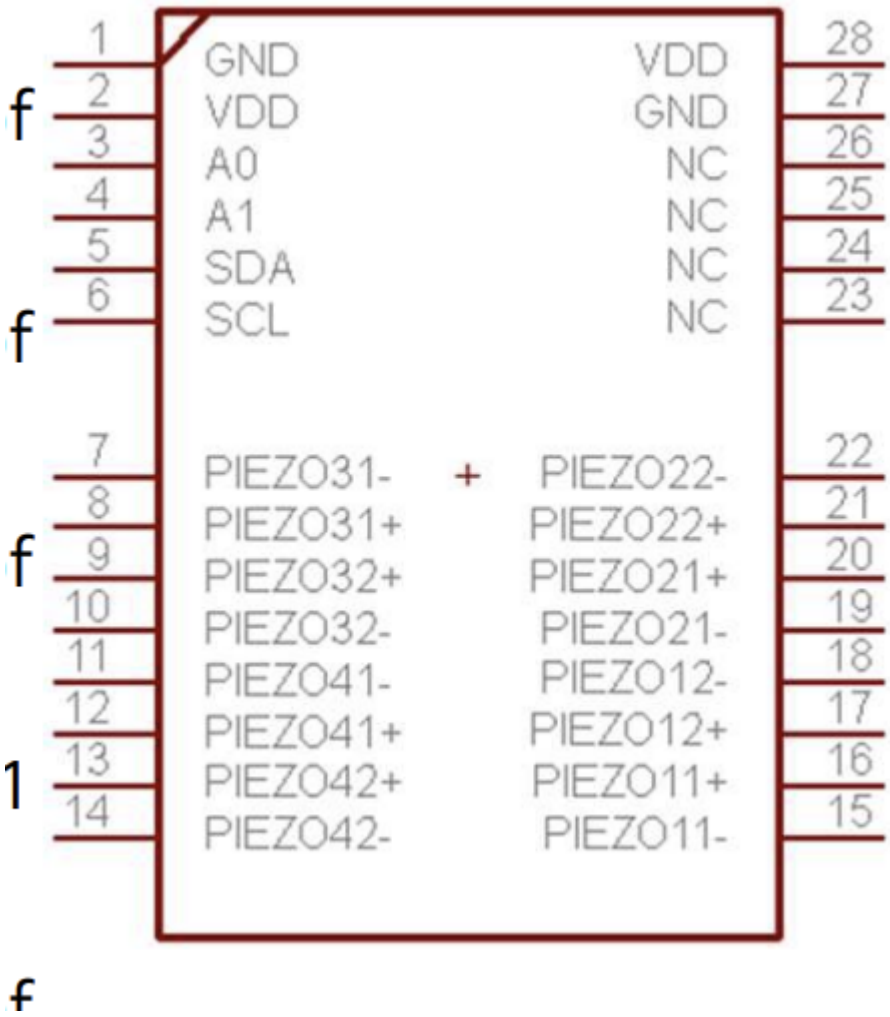
- *highdriver4*
  - Datasheet: https://www.repcomsrl.com/wp-content/uploads/2021/04/mp6_electronics_Datasheet.pdf
  - Minimum Voltage: 2.4
  - Maximum Voltage: 5.5V
  - Input supply current: 75mA
- *mp6 micropump*
  - Datasheet: https://mm.digikey.com/Volume0/opasdata/d220001/medias/docus/5561/mp6%20micropumps.pdf
  - Output voltage: 250 Vpp
- *Molex Connector*
  - Datasheet: https://www.molex.com/en-us/products/part-detail/39532045?display=pdf

Function

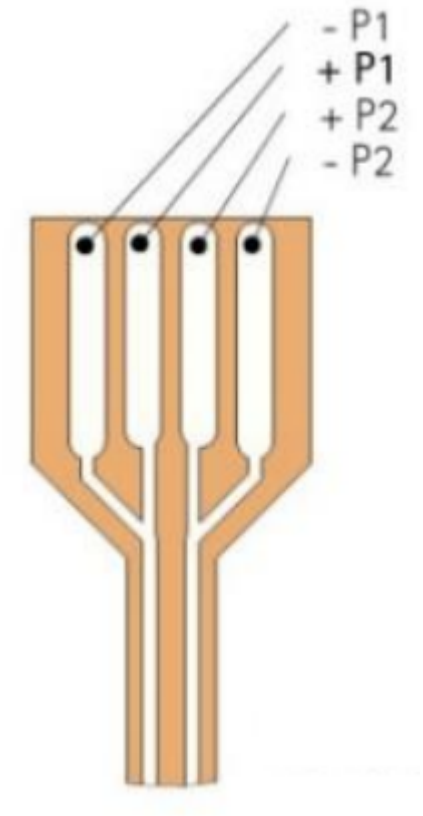
The highdriver4 will drive all 4 micropumps to dispense ions to the cells. The micropumps are connected via molex connectors

Concerns

- Will there be crosstalk between signals since high output voltage of mp6
- Want to double check that all pins are connected correctly
  highdriver4 pins



mp6 micropump



Serial Wire Debug Port

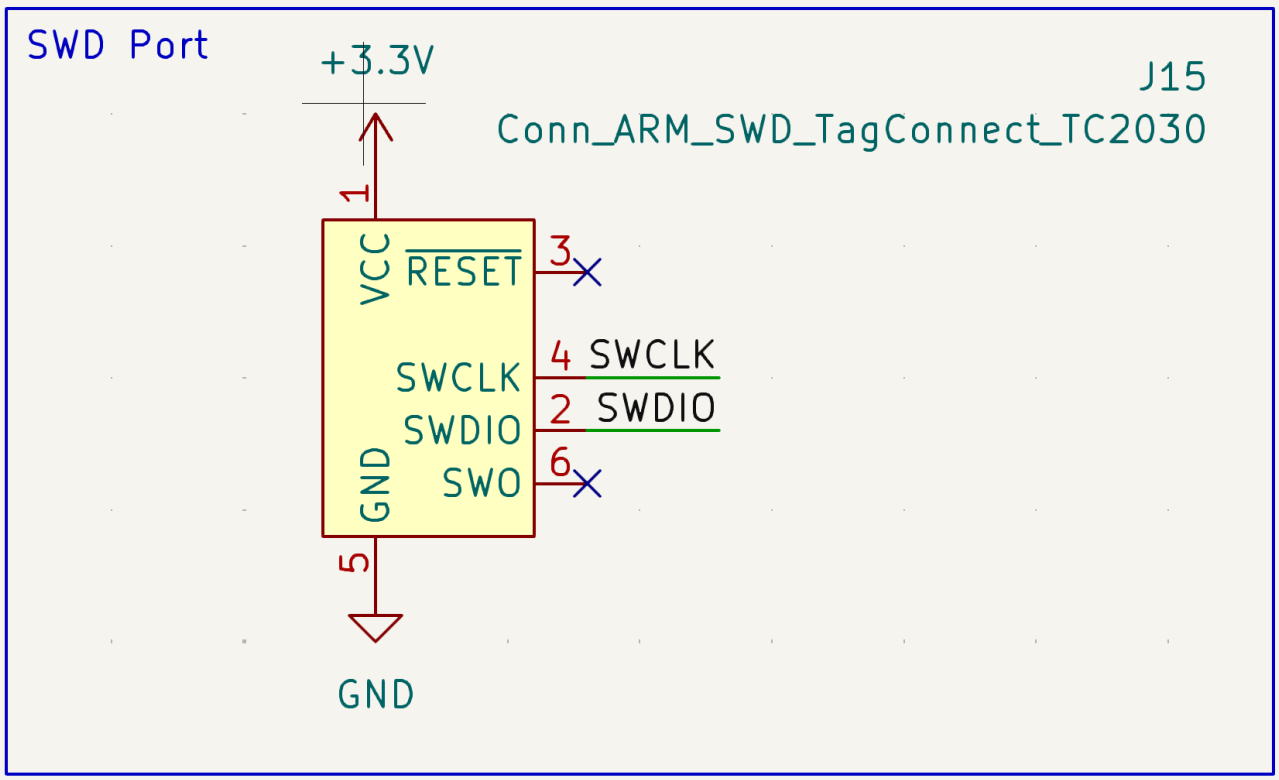
- *mp6 micropump*
  - Datasheet: https://mm.digikey.com/Volume0/opasdata/d220001/medias/docus/2084/TC2030-IDC_RevB.pdf

Function

The Tag-Connect will be used to debug the PCB

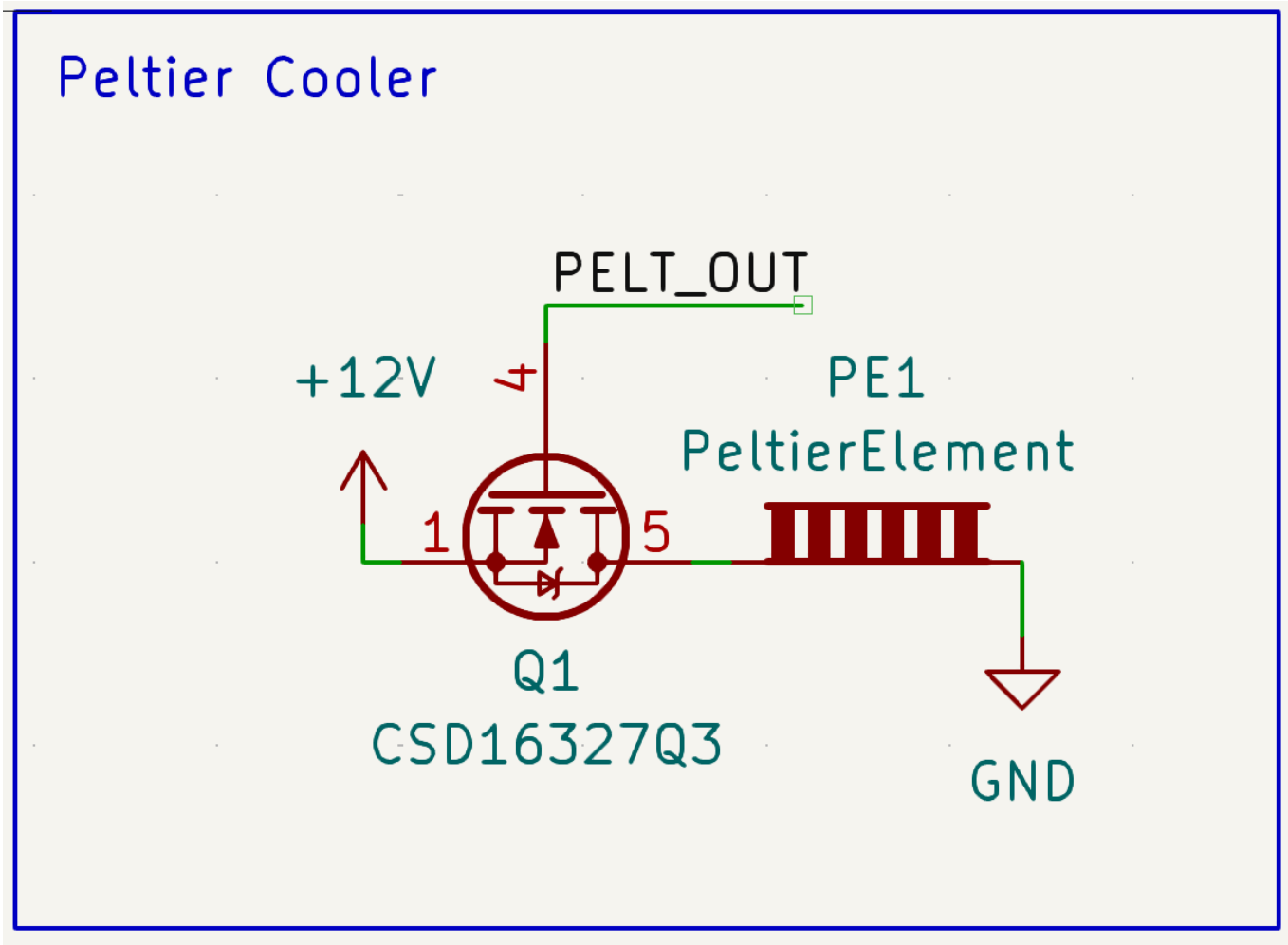
Concerns

- Want to ensure the mechanically – this will fit without any issus



- Design specifications are:
- Traces must be more than 0.2mm outside of the keep-out area
- Large components should not block the area
- Don't deposit solder paste on contact area
- Don't put vias between contact pads

Peltier Cooler



Electrical Specifications

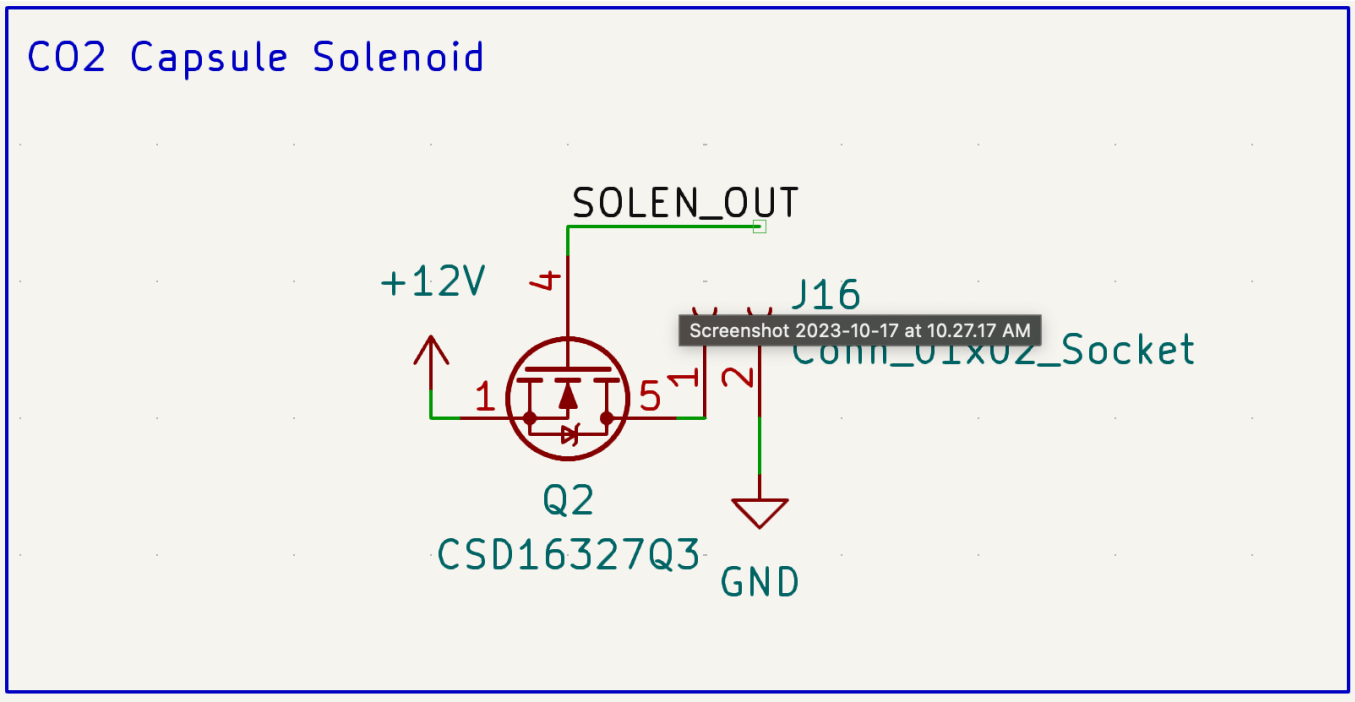
- *Peltier Cooler*
  - Datasheet: https://www.lairdthermal.com/datasheets/datasheet-PCX4-4-F1-1515-TA-RT-W6.pdf
  - Maximum Voltage: 5.7V
  - Maximum Current: 4.1A

Function

This Peltier cooler will provide temperature control for the incubator/

Concerns

Solenoid



Electrical Specifications

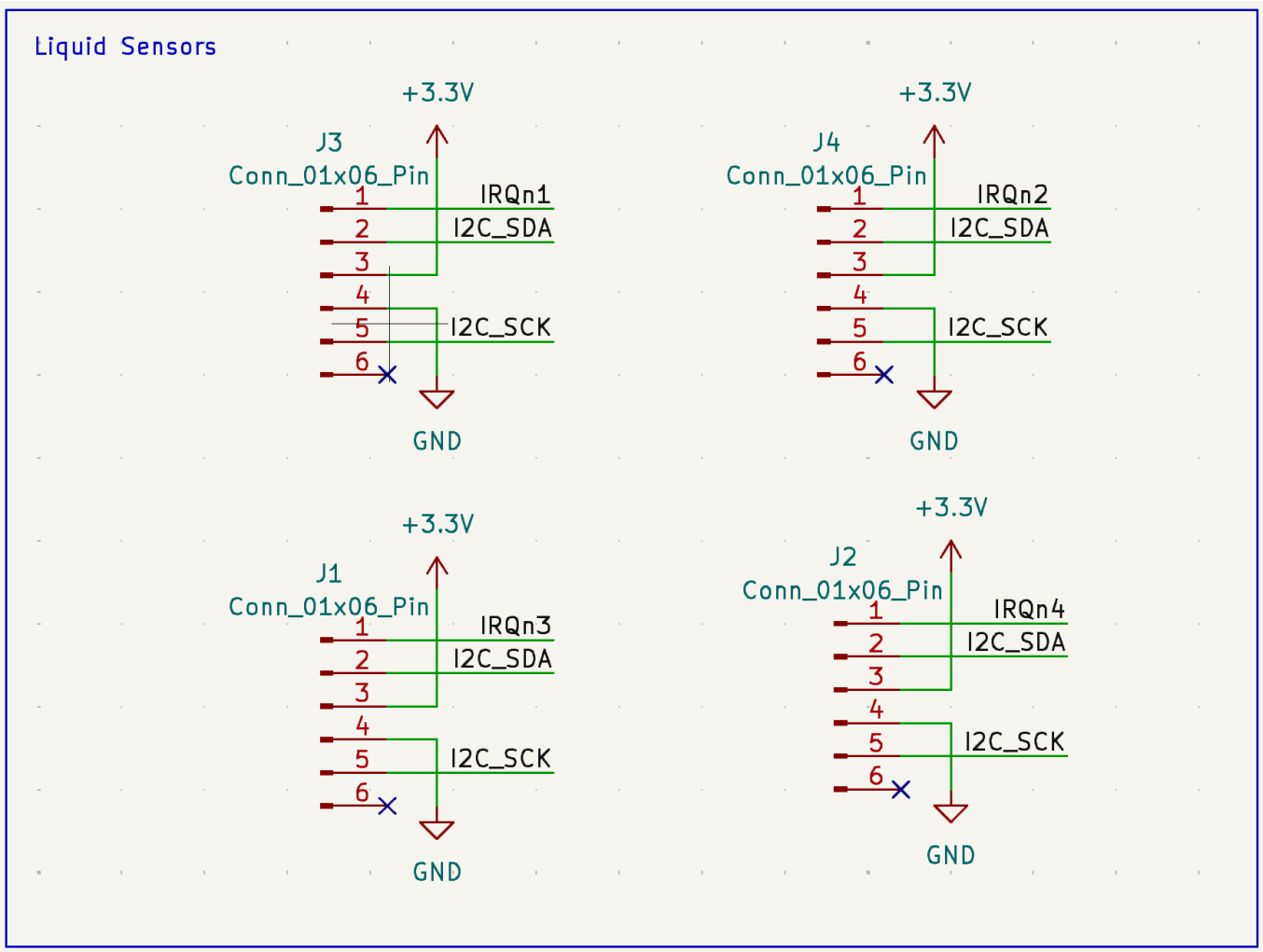
- *CO2 Solenoid*
  - Datasheet: https://mm.digikey.com/Volume0/opasdata/d220001/medias/docus/778/B12P-XXX-B-3.pdf
  - Voltage: 12V
  - Maximum Current: 400mA (Double check this)

Function

This solenoid will add CO2 to the incubator

Concerns

Flow Sensors



Electrical Specifications

- *Liquid Sensors*
  - Datasheet: https://sensirion.com/media/documents/C4F8D965/65290BC3/LQ_DS_SLF3S-0600F_Datasheet.pdf
  - Voltage Range: 3.2-3.8V
  - Maximum Current: 4.5-6mA

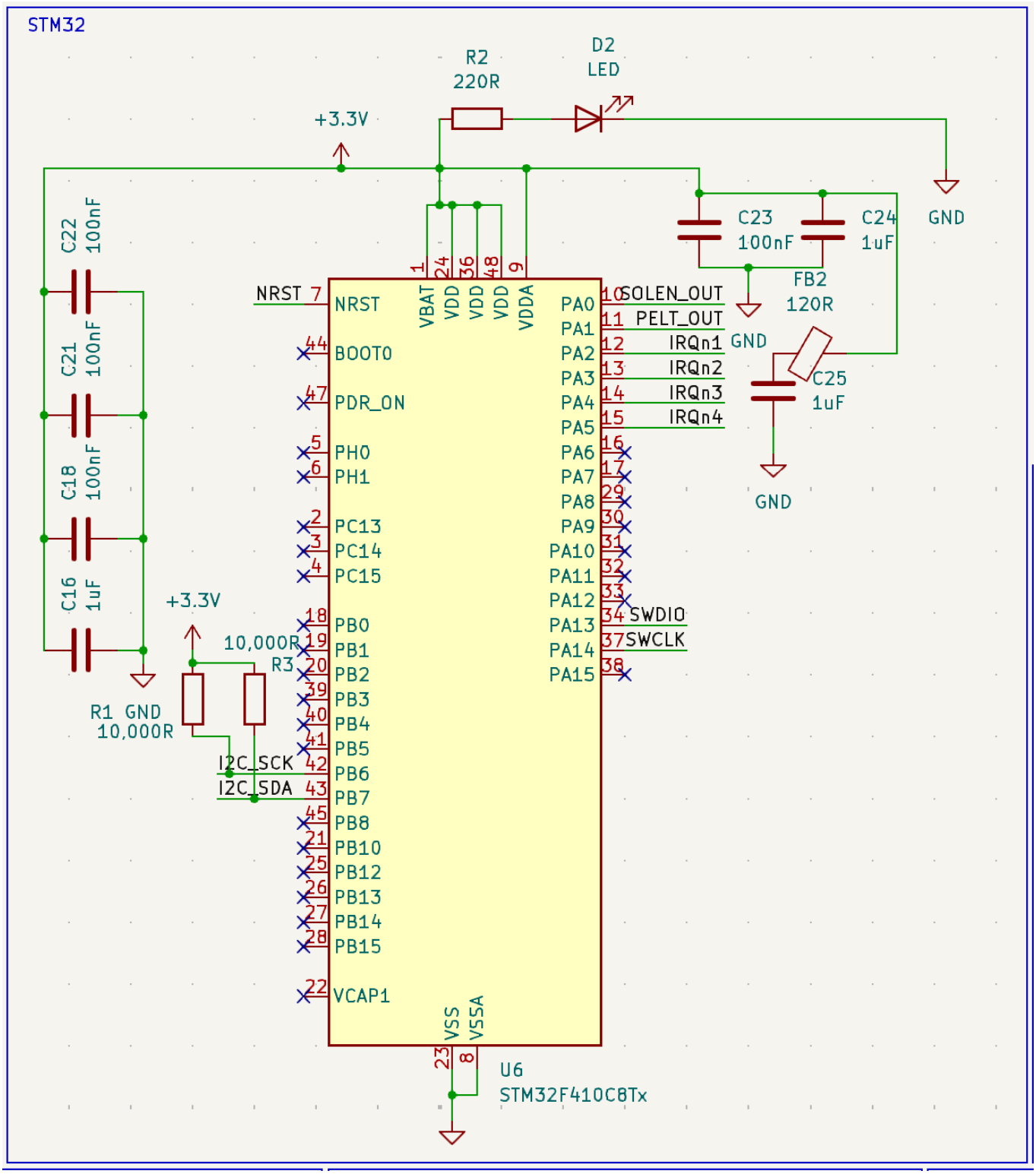
Function

These sensors will be used to measure the amount of liquid flowing in and out of the cell

Concerns

Ensure that the pins ordered

STM32F4



Electrical Specifications

- STM32
  - Datasheet: https://sensirion.com/media/documents/C4F8D965/65290BC3/LQ_DS_SLF3S-

0600F_Datasheet.pdf

- Voltage Range: 1.7V - 3.6 V
- Maximum Current: 4.5-6mA

Function

The MCU controls all the devices and also takes in sensor data

Concerns