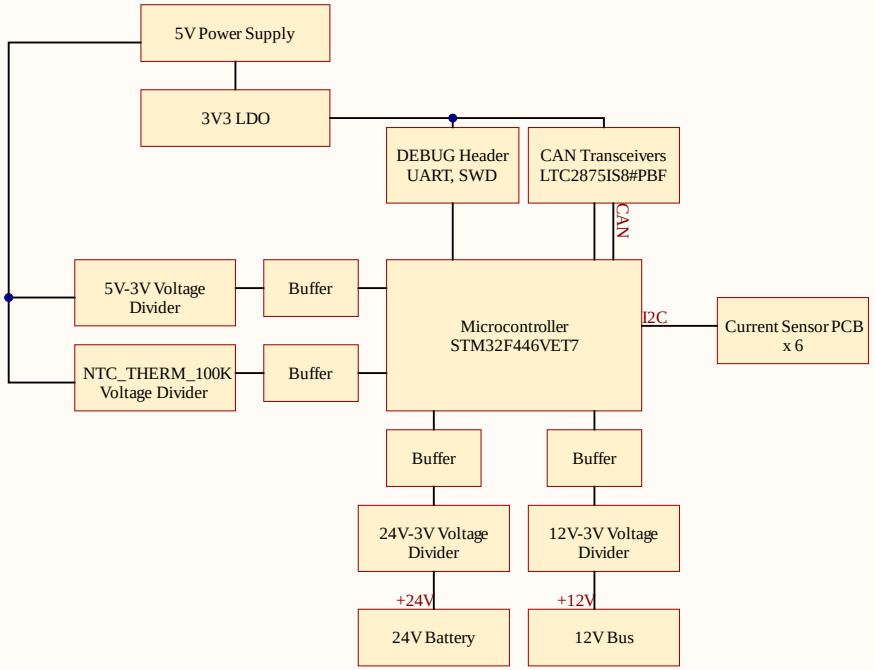
Safety Block Diagram



Title Safety - Block Diagram		UW Robotics 200 University Avenue Waterloo Ontario Canada N2L 3G6	UW ROBOTICS TEAM
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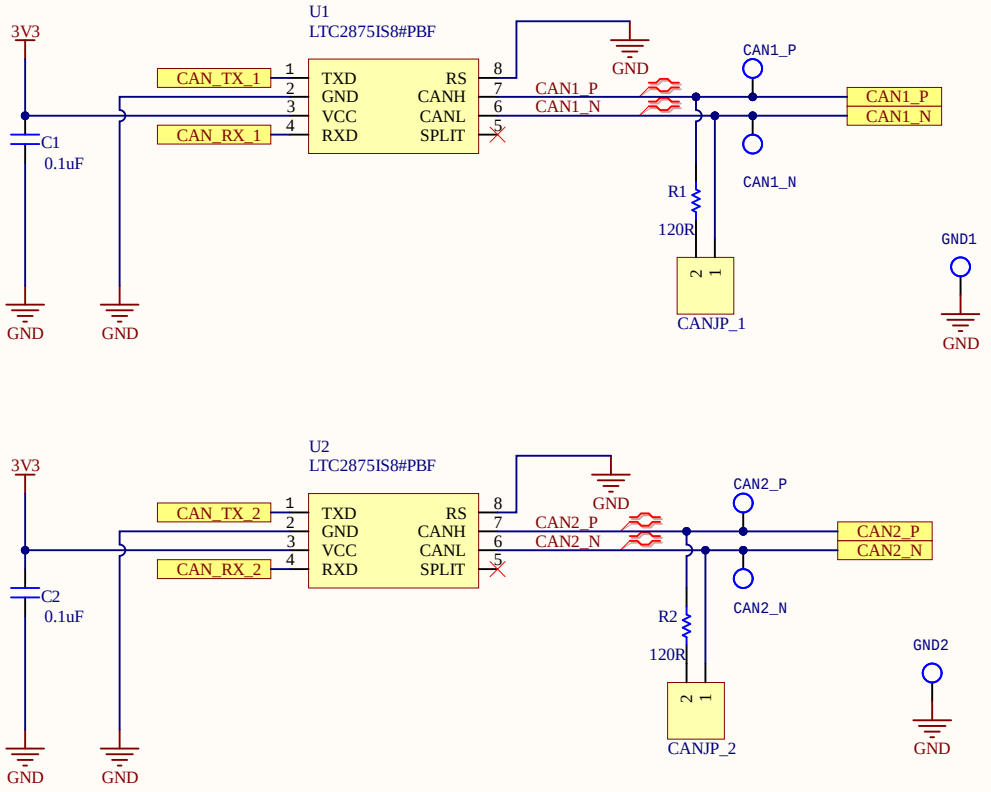
File: C:\Users\badpr\altium_porjects\MarsRover2020-PCB\Projects\Safety\Rev2\Block Diagram.SchDoc			

CAN Transceivers



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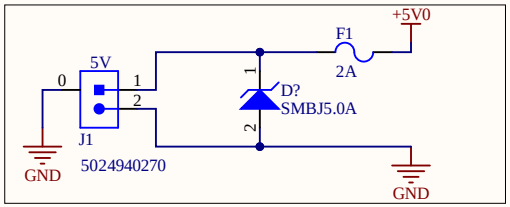
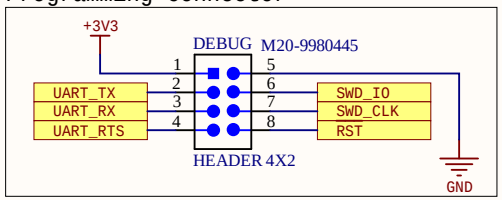
Connectors

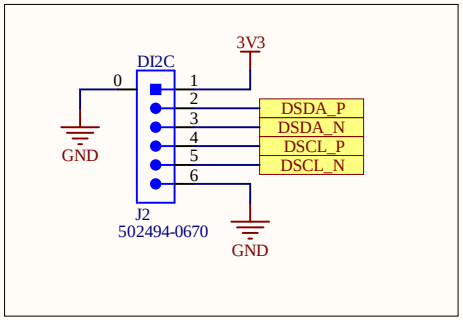
Power Connector



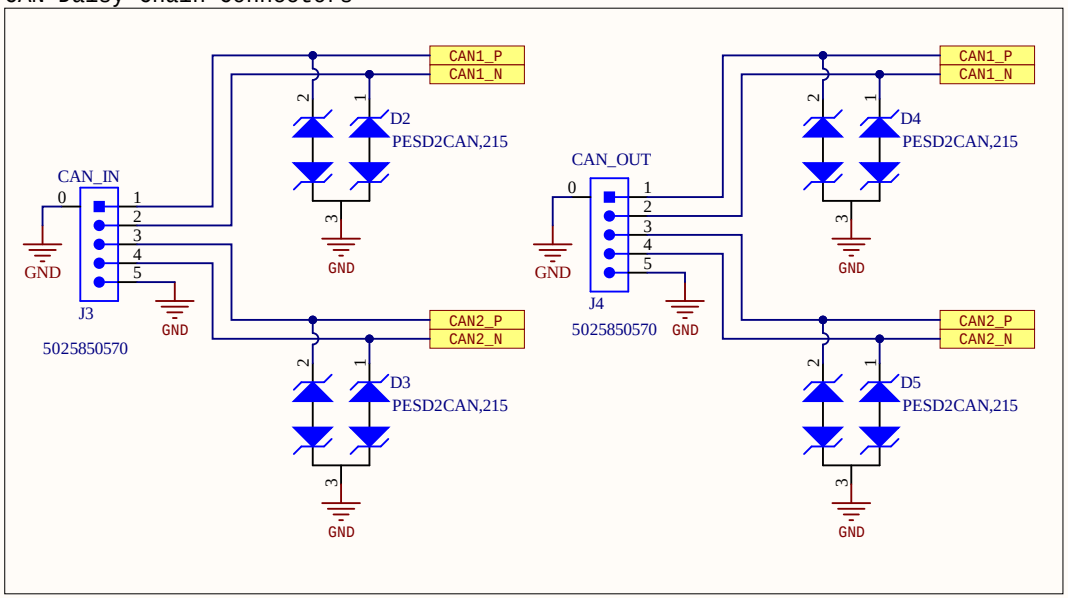
Programming Connector



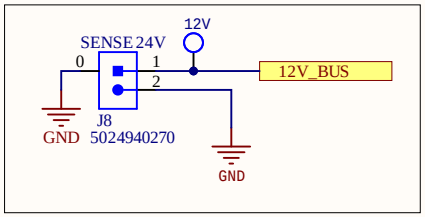
I2C Current Sensors



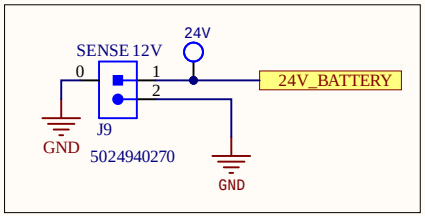
CAN Daisy Chain Connectors



Motor Voltage



Battery Voltage



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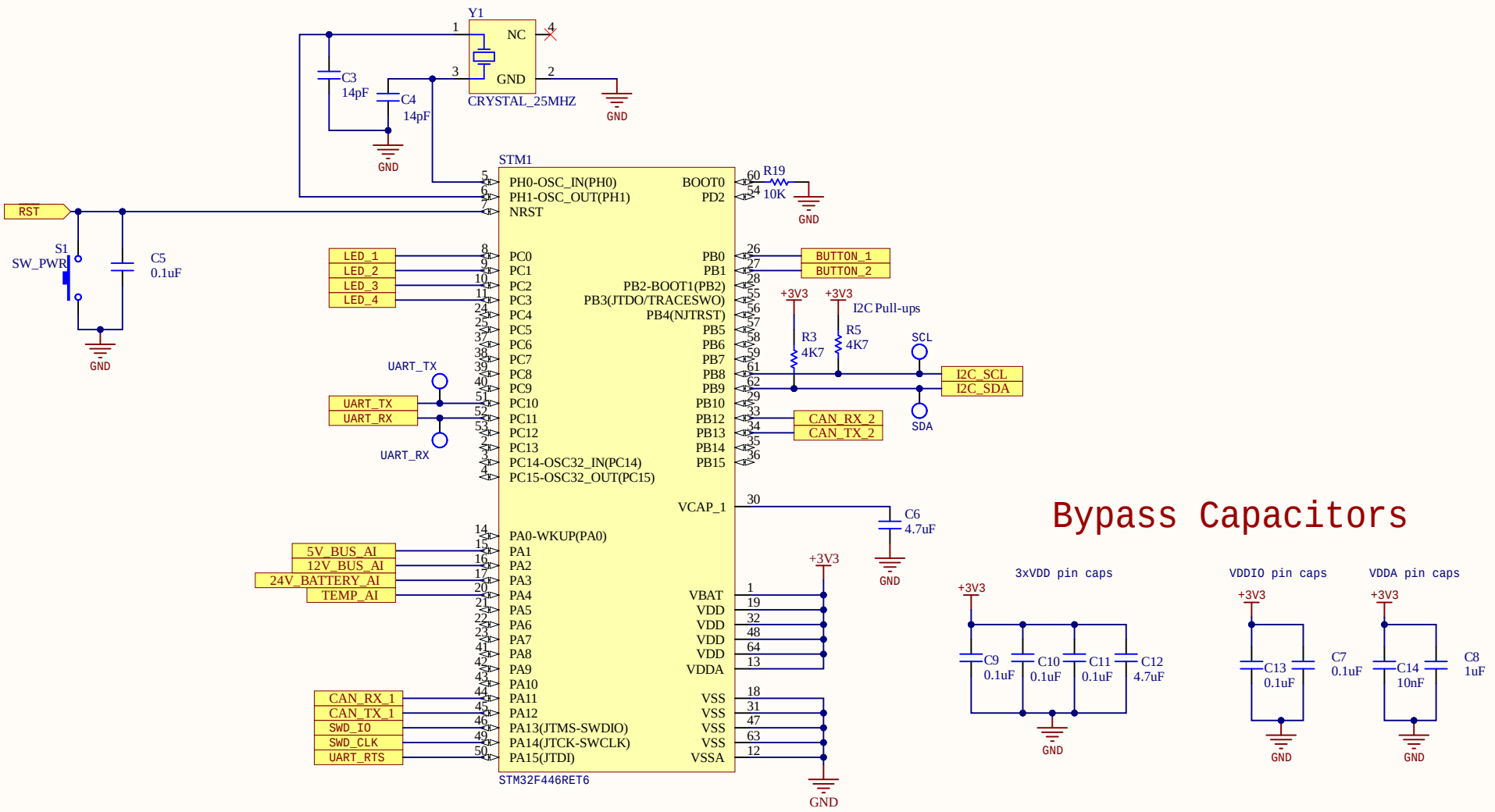
OffSheet

STM32F446RET6



Bypass Capacitors

Title MCU		UW Robotics 200 University Avenue Waterloo Ontario Canada N2L 3G6
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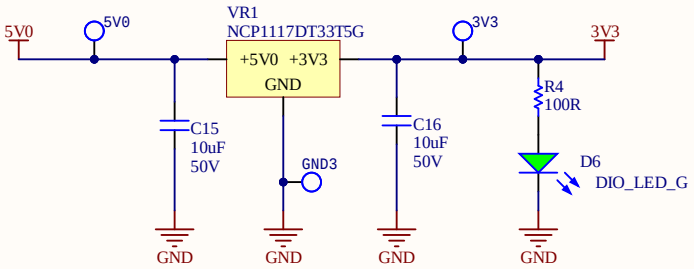
5V-3.3V LDO



Current Calculations

Green LED voltage drop: 2.2V
- I = (3.3-2.2V)/120 = 10.83mA

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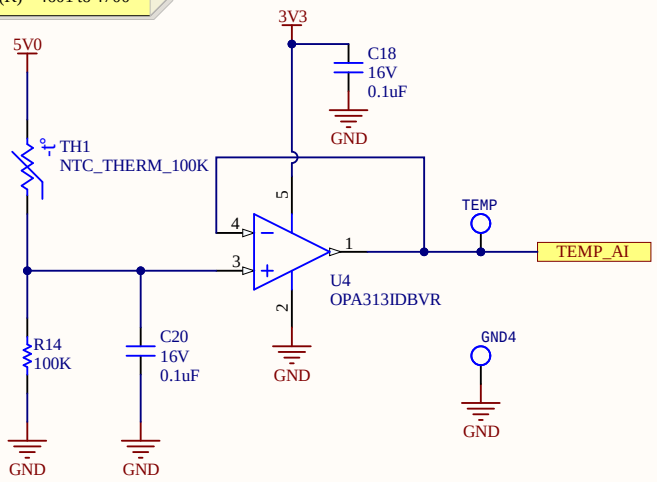
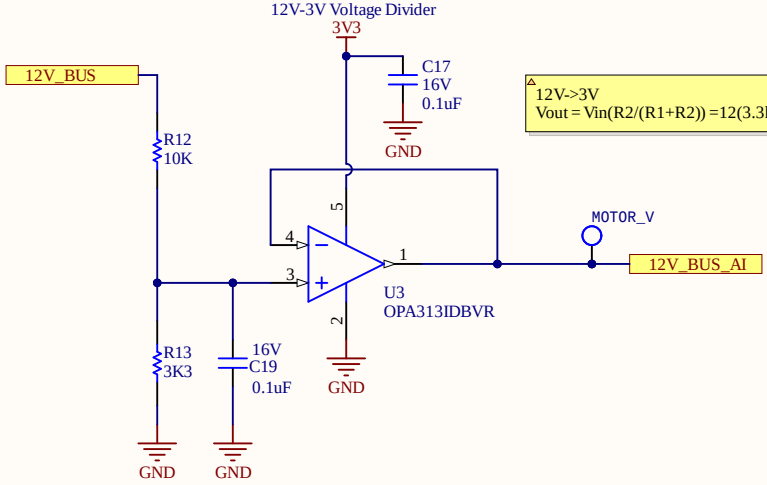
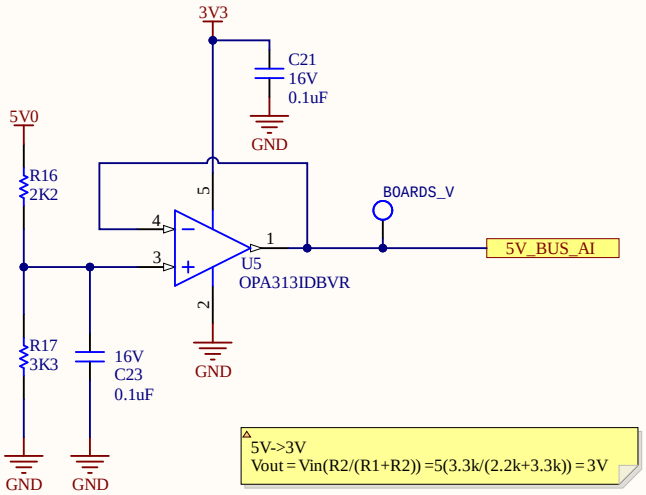
Thermistor Parameter:
Beta value (K) = 4601 to 4700



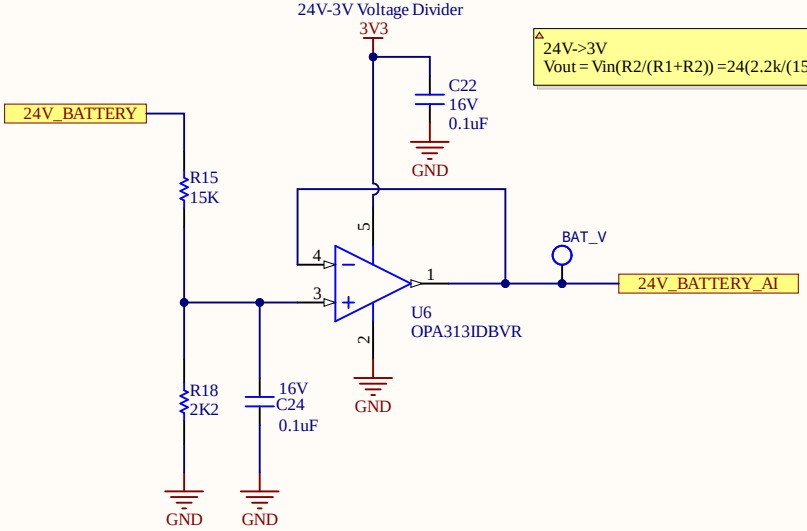
12V-3V Voltage Divider



5V-3V Voltage Divider



24V-3V Voltage Divider



Rev 2 TODO:
Consider putting two resistors in series for 24-3 voltage divider to reduce BOM line items

Title Sense		UW Robotics 200 University Avenue Waterloo Ontario Canada N2L 3G6
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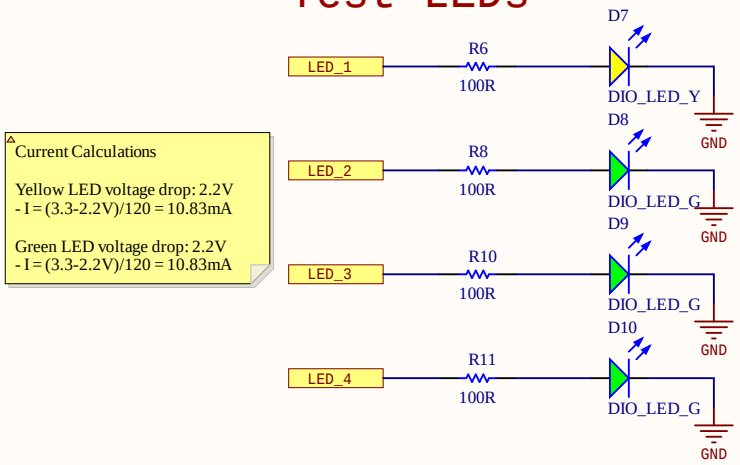
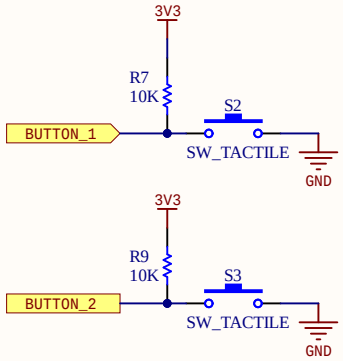
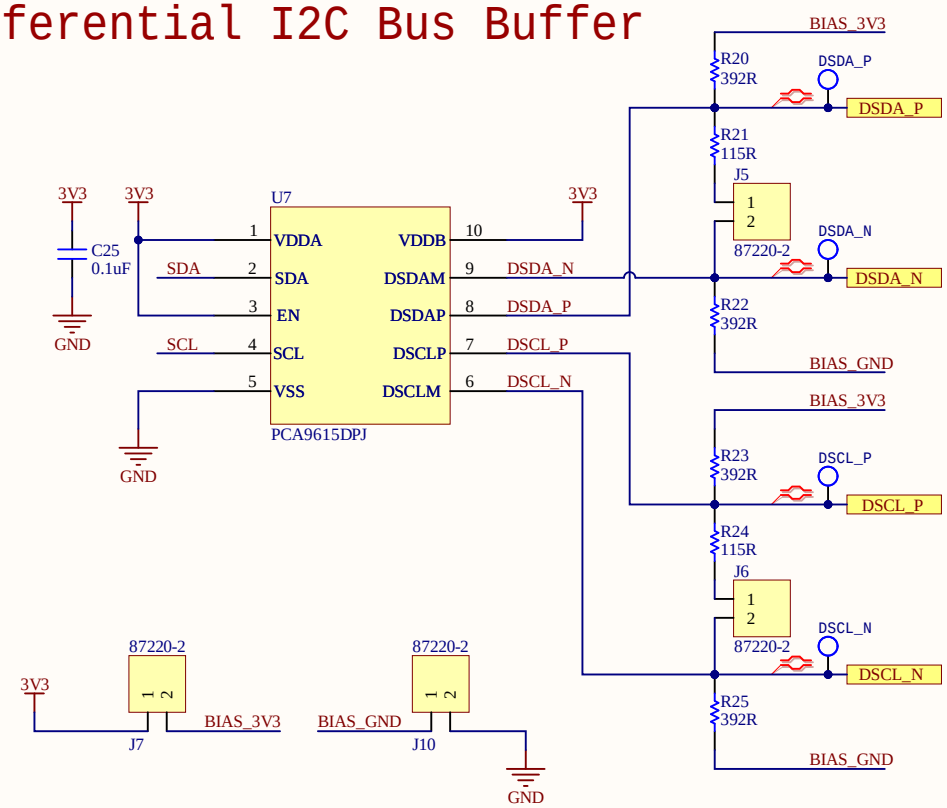
Test LEDs



Test Buttons



Differential I2C Bus Buffer



Characteristic impedance of cable= Zo = 100 Ohms
Cable: https://www.digikey.ca/product-detail/en/general-cable-carol-brand/C0601A-41-10/C0601AG-50-ND/7313814
Calculations & Theory: http://www.ti.com/lit/an/snla031/snla031.pdf pg3
Terminating resistance = Zo =100Ohm = Rc = Rb
Bias resistors for FAILSAFE BIAS = Rd = Ra
Vfsb = Vcc(Rc//Rb / (Rc//Rb + Rd + Ra))
Parallel terminating resistance = 100//100 = 50Ohms, Vcc = 3.3V, Vfsb= 0.2V (for FAILSAFE bias)
Therefore, Ra = Rd = (50*3.3/0.2 - 50)/2 = 387.5 Ohms
Recalculating total terminating resistance: 100// (387.5*2) = 88.6 Ohms
88.6 is more than 10% diff from Zo, therefore recalculate Rc using Zo = Rc//(Ra+Rd)=100
Rc = Zo*(Ra+Rd)/(Ra+Rd-Zo)= 114.8Ohms
Using 1% tolerance: Rc = 115 Ohms Ra=Rd=392Ohms
Check:
Rc//(Ra+Rd)=100.3=Zo
Fsb = Vcc(Rc//Rb / (Rc//Rb + Rd + Ra))= 3.3(115//100 / (115//100 + 2*392)) = 0.21V

Termination resistor(s) should only be used on Safety board and last current sensor in the chain of current sensors (ie the first and last node).

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Board Stack Report