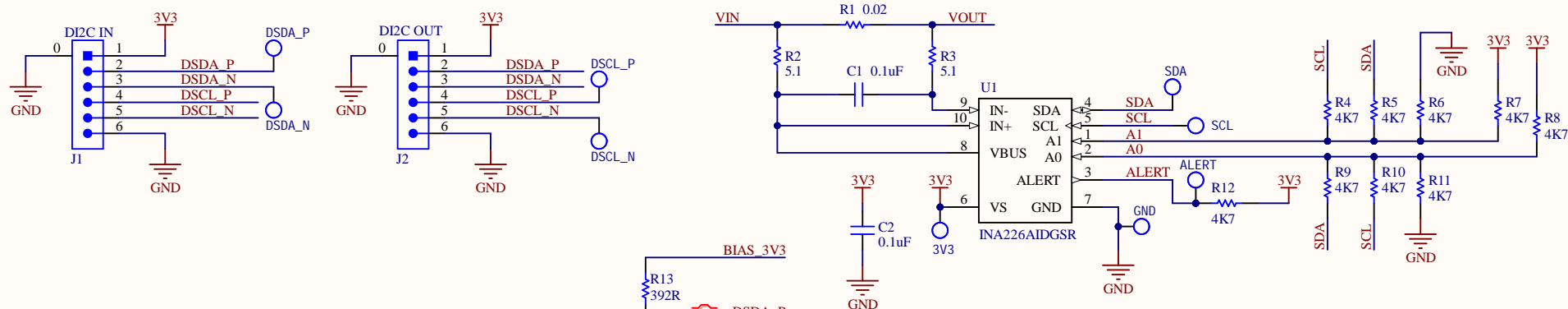


Turntable: I = 60.95 A, R = 0.75 mΩ, P = 2.786 W, Shunt V = 39.75 mV
 Bicep: I = 5.75 A, R = 15 mΩ, P = 0.496 W, Shunt V = 75 mV
 Elbow: I = 28.75 A, R = 3 mΩ, P = 2.48 W, Shunt V = 75 mV
 Wrist: I = 8.05 A, R = 10 mΩ, P = 0.648 W, Shunt V = 70 mV
 Claw: I = 6.325 A, R = 12 mΩ, P = 0.48 W, Shunt V = 66 mV
 Allen Key: I = 3.45 A, R = 22 mΩ, P = 0.262 W, Shunt V = 75.9 mV

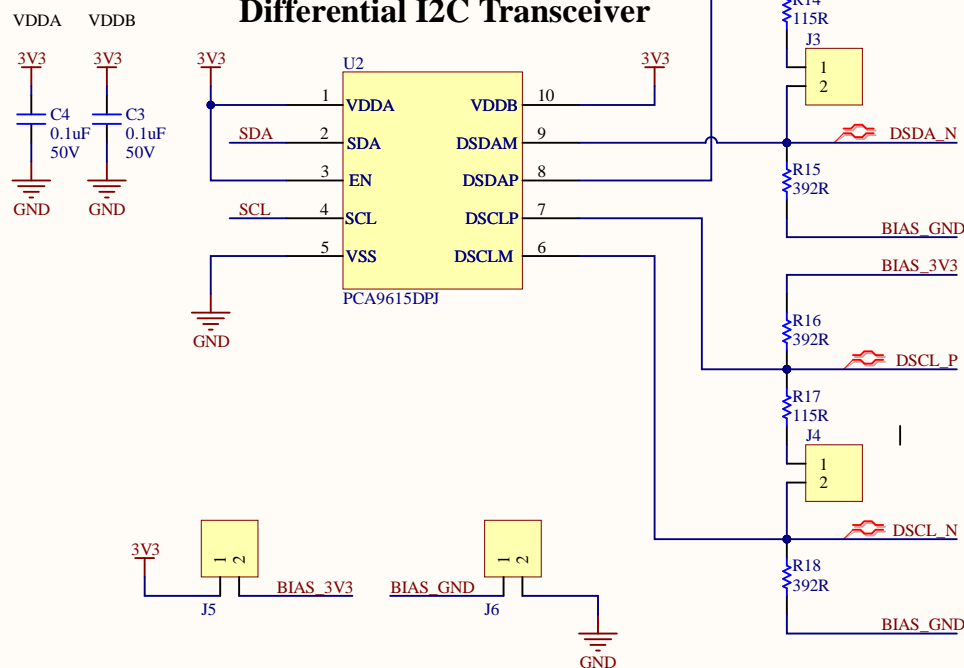
Mounting Holes

H1 H2
 H3 H4

I2C Address Resistors



Differential I2C Transceiver



Characteristic impedance of cable = $Z_0 = 100 \text{ Ohms}$
 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 = $Z_0 = 100 \text{ Ohms} = R_c = R_b$
 Bias resistors for FAILSAFE BIAS = $R_d = R_a$
 $V_{fsb} = V_{cc} (R_c / R_b) / (R_c / R_b + R_d + R_a)$
 Parallel terminating resistance = $100 / 100 = 50 \text{ Ohms}$, $V_{cc} = 3.3 \text{ V}$, $V_{fsb} = 0.2 \text{ V}$ (for FAILSAFE bias)
 Therefore, $R_a = R_d = (50 * 3.3 / 0.2 - 50) / 2 = 387.5 \text{ Ohms}$
 Recalculating total terminating resistance: $100 / ((387.5 * 2)) = 88.6 \text{ Ohms}$
 88.6 is more than 10% diff from Z_0 , therefore recalculate R_c using $Z_0 = R_c / (R_a + R_d) = 100$
 $R_c = Z_0 * (R_a + R_d) / (R_a + R_d - Z_0) = 114.8 \text{ Ohms}$
 Using 1% tolerance: $R_c = 115 \text{ Ohms}$ $R_a = R_d = 392 \text{ Ohms}$
 Check:
 $R_c / (R_a + R_d) = 100.3 = Z_0$
 $V_{fsb} = V_{cc} (R_c / R_b) / (R_c / R_b + R_d + R_a) = 3.3 (115 / 100) / ((115 / 100) + 2 * 392) = 0.21 \text{ V}$

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).

Title: Current Sensor Board

Size: Letter

Drawn By: Ayesha Ebrahim

Date: 6/3/2020

Sheet 1 of 1

File: C:\Users\Iance.bantoto\MarsRover2021-hardware\Projects\Current Sensor\Rev1\Current Sensor_SchDoc

UW Robotics
 200 University Avenue
 Waterloo
 Ontario
 Canada N2L 3G6

UW
ROBOTICS
 TEAM