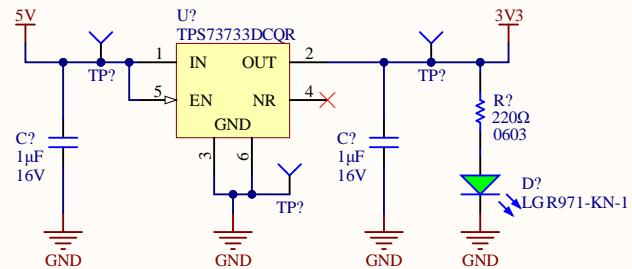


Mounting Holes

H1 H2

H3 H4

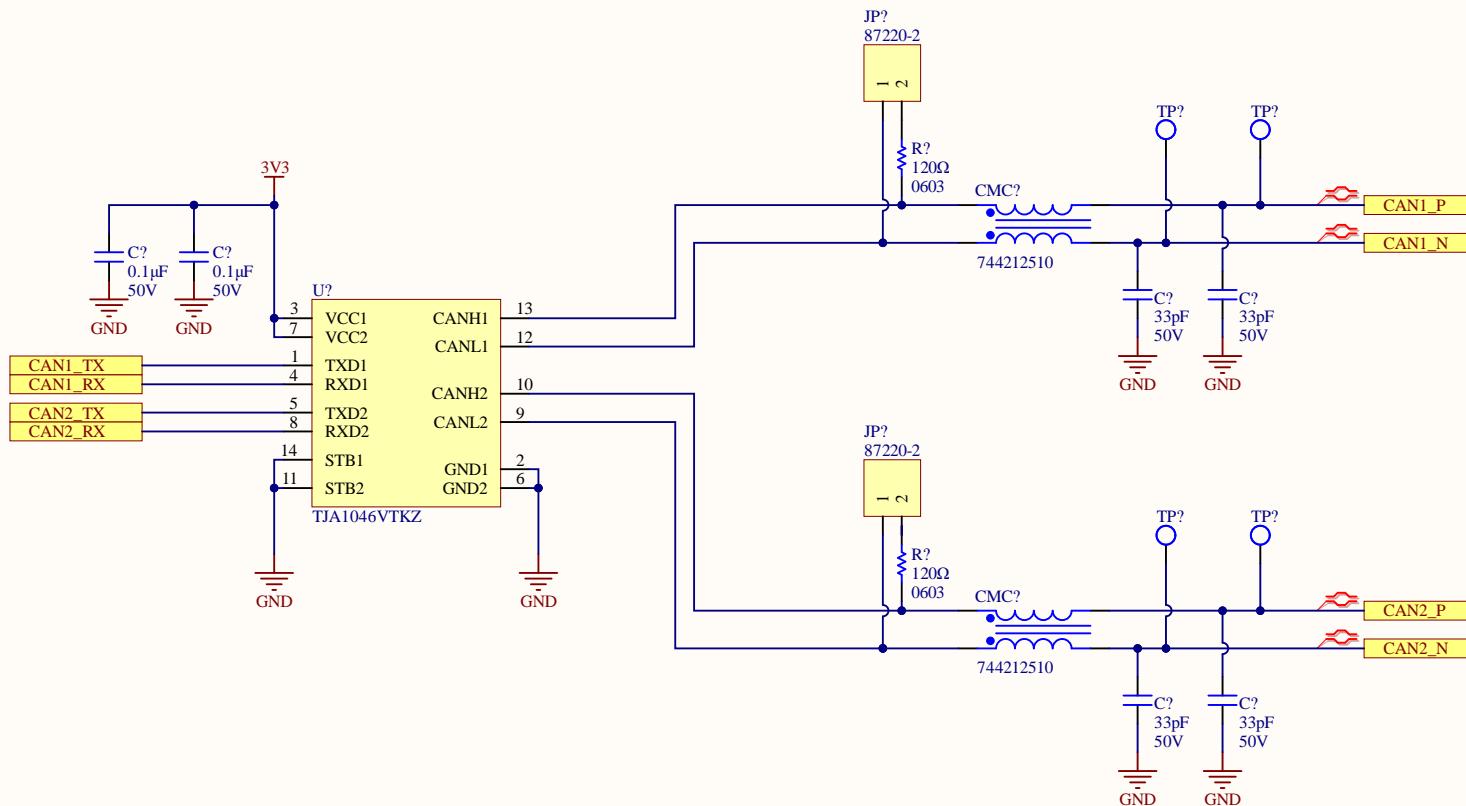
5V to 3.3V LDO (Max 1A)



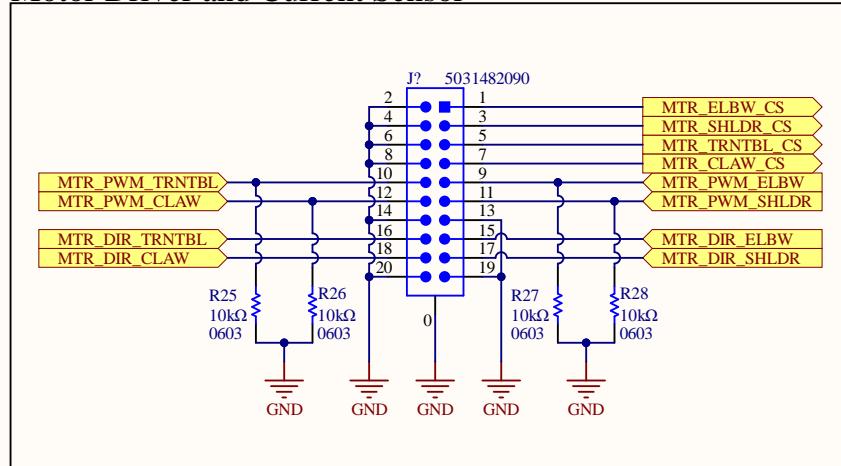
Current Calculations

Green LED voltage drop: 2.2V
 $- I = (3.3 - 2.2V) / 220 = 5mA$

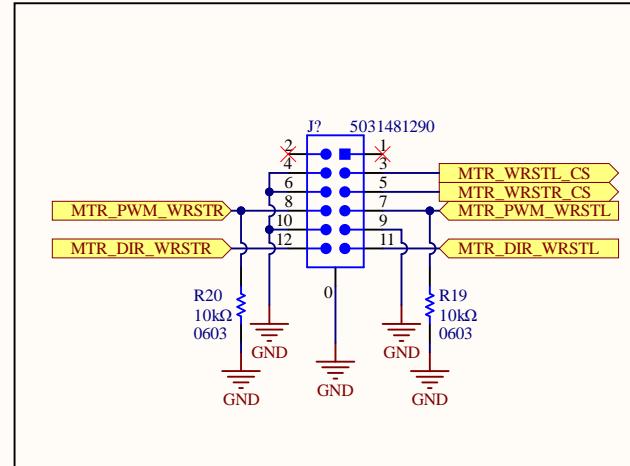
CAN Transceivers



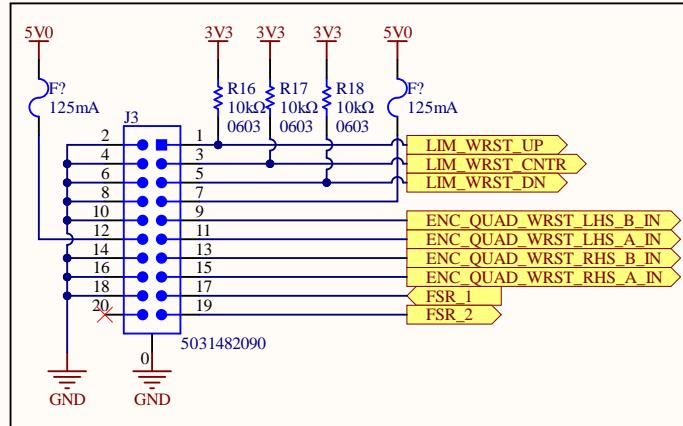
Motor Driver and Current Sensor



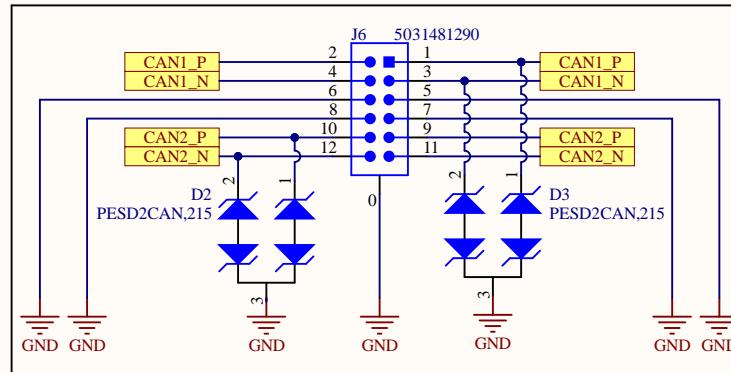
Wrist Motor Driver and Current Sensor



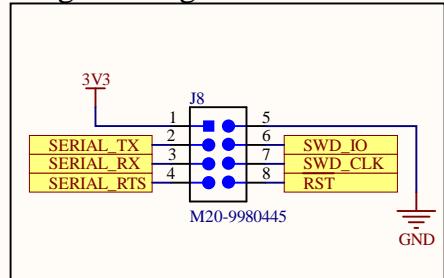
FSR and Wrist



CAN Connections



Programming Connector

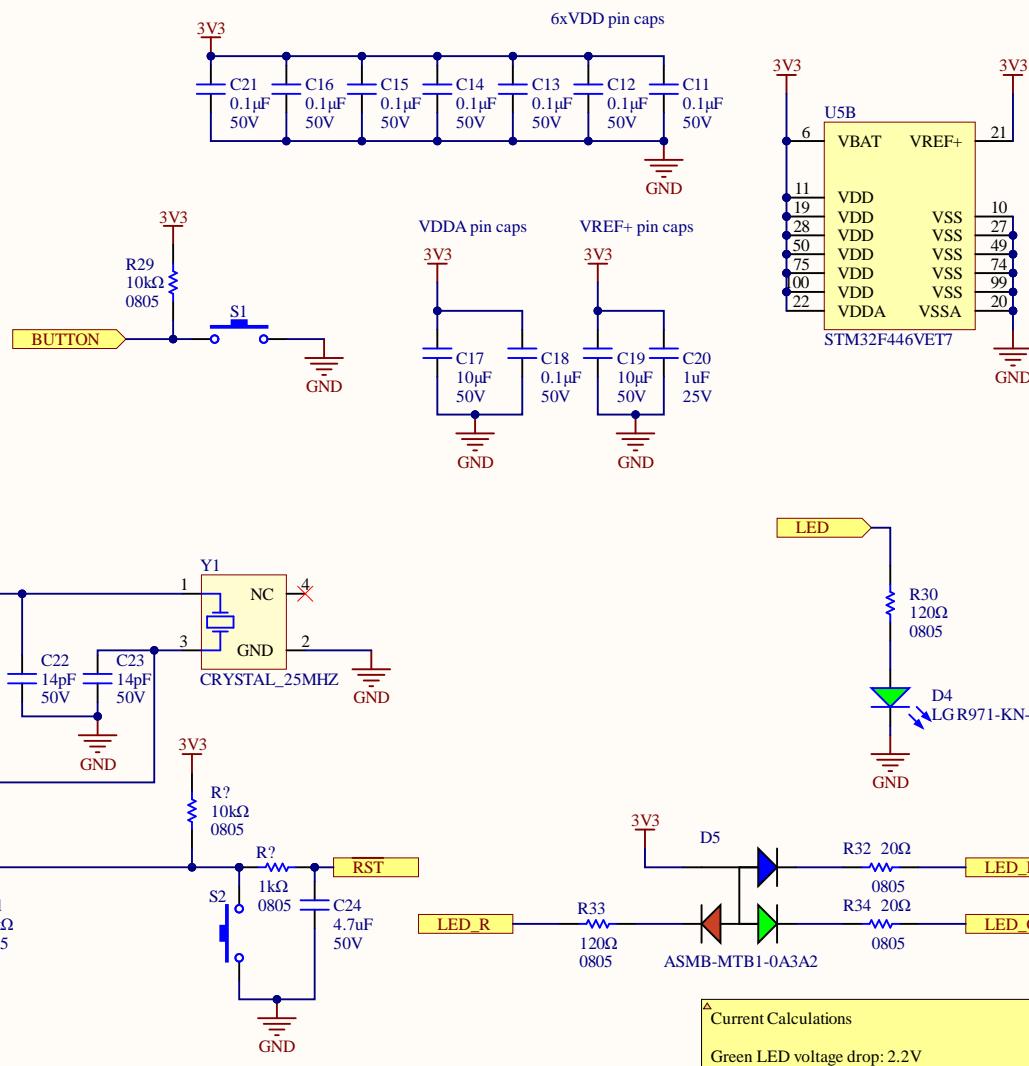
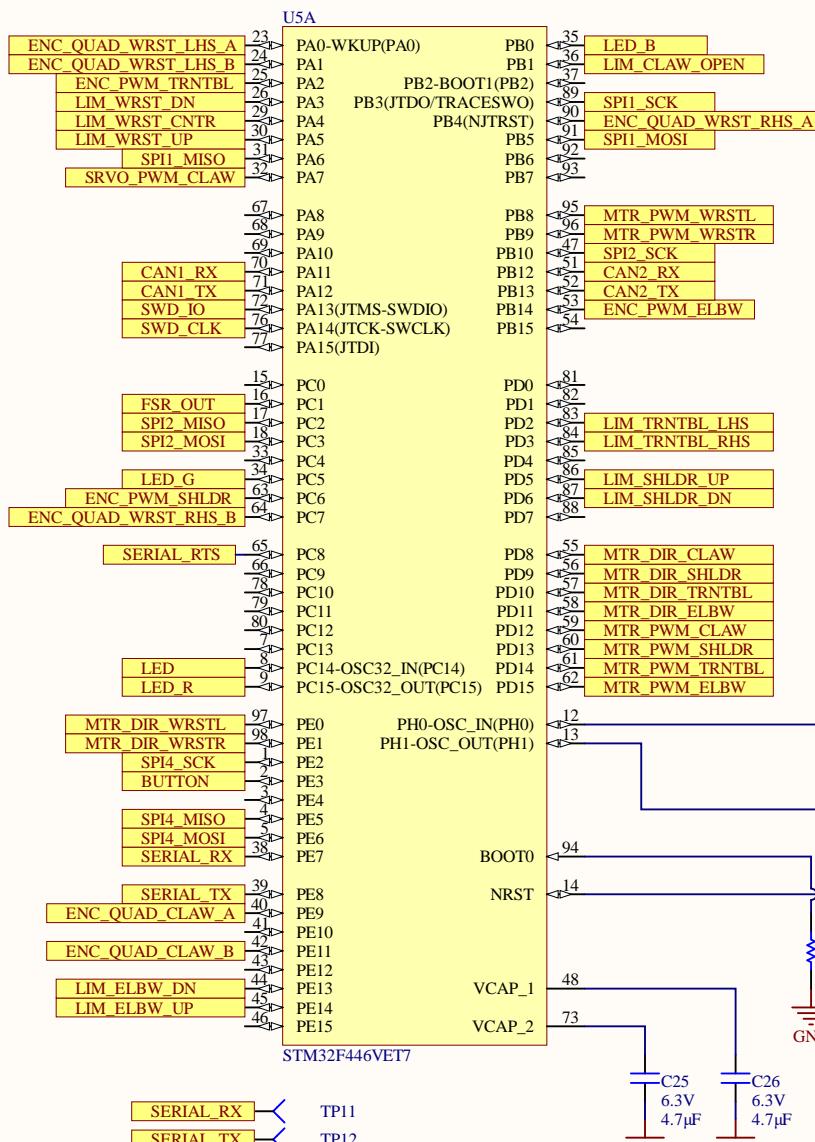


Acronyms Explained
 FSR: Force Sensitive Resistor
 CLAW: Claw
 WRST: Wrist
 SHLDR: Shoulder
 ELBW: Elbow
 TRNTBL: Turntable
 DIR: Direction for motors
 CS: Analog current sensor signal

Bypass Capacitors

STM32F446VET7

Configure one more SPI bus and CS pins



Title: Arm - Microcontroller		UW Robotics 200 University Avenue Waterloo Ontario Canada N2L 3G6	
Size: Letter		Drawn By: Kyle Hong, Lance Bantoto	
Date: 11/5/2020		Sheet 4 of 9	
File: C:\Users\kyleh\Desktop\Works\UWRT\MarsRover2021-hardware\Projects\Arm\Rev2\SH6 - MICROCONTROLLER.			

Force Sensitive Resistor

[△]Sensor:
Manufacturer: Interlink Electronics
Manufacturer Part Number: 30-81794
Supplier: Digi-Key
Supplier Part Number: 1027-1001-ND
<https://cdn.sparkfun.com/assets/8/a/1/2/0/2010-10-26-DataSheet-FSR402-Layout2.pdf>
Resistance at 20N = 800 ohms
Resistance at 100N = 250 ohms

[△]Differential amplifier gain:
 $A_v = 825k/165k = 5$

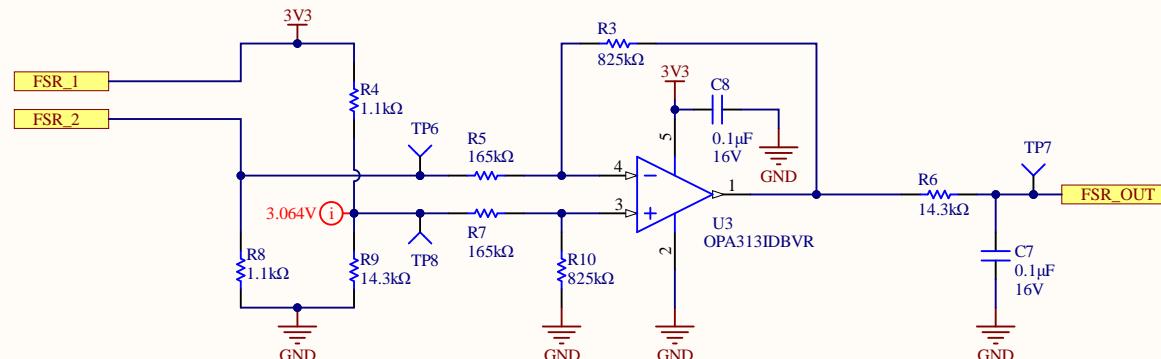
Wheatstone bridge voltage output values:
At 20N, $V_{out} = 3.2V$
At 100N, $V_{out} = 0.5V$

Low pass filter cutoff frequency:
 $f_c = 1/(2\pi \cdot 14.3k \cdot 0.1\mu F) = 111.30 \text{ Hz}$

Links to differential amplifier calculations and documentation
<https://docs.google.com/spreadsheets/d/1JzRwpCH-aMdlyAMp5zl6xFD8GIuJzvmOR8Y5Kzd1RN0/edit#gid=0>

[△]Gain = 5

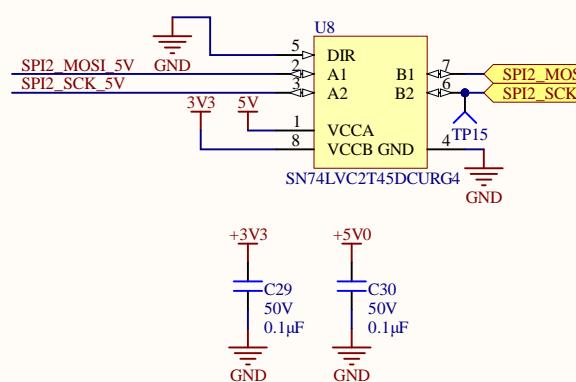
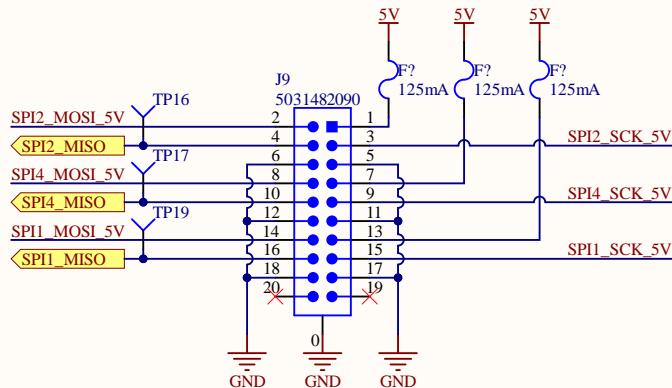
Wheatstone Bridge



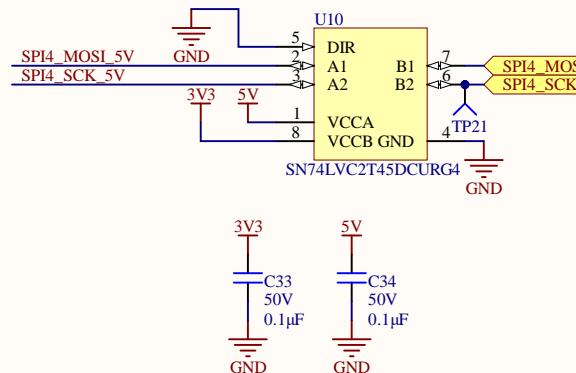
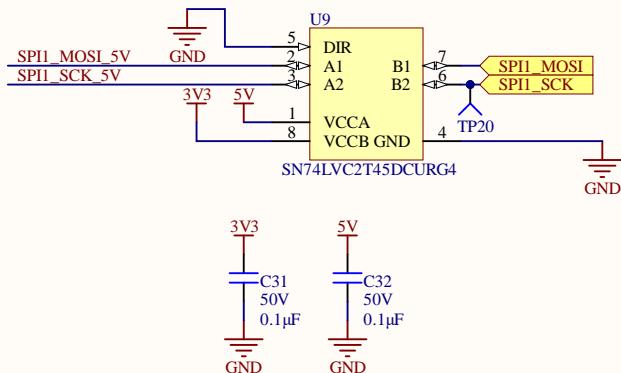
Differential Amplifier

Title: Arm - Claw Sensor		UW Robotics 200 University Avenue Waterloo Ontario Canada N2L 3G6
Size: Letter		Drawn By: Ayesha Ebrahim
Date: 11/5/2020		Sheet 7 of 9
File: C:\Users\kyli eh\Desktop\Works\UWRT\MarsRover2021-hardware\Projects\Arm\Rev2\SH8 - FORCE SENSITIVE F		TEAM

Broadcom Encoders



Change level shifters and remove MOSI

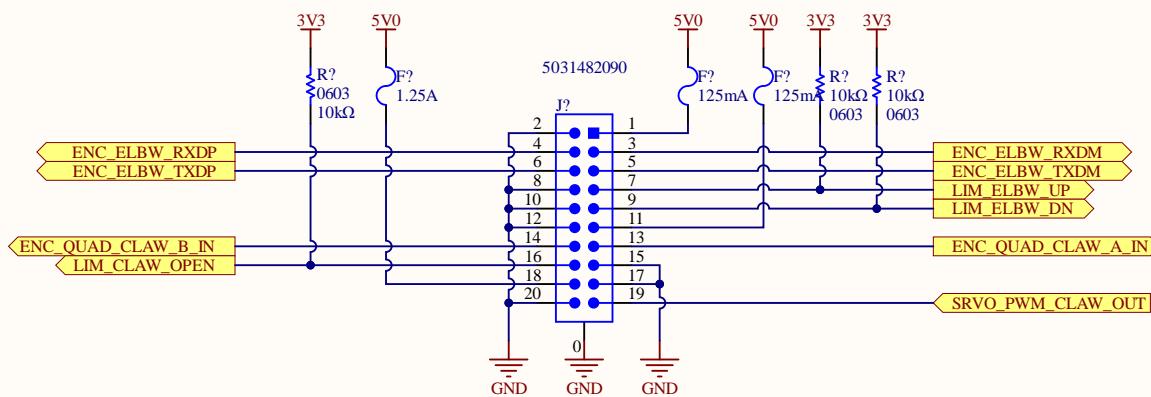


Encoder manufacturer: Broadcom
Encoder part number: AEAT-6012-A06

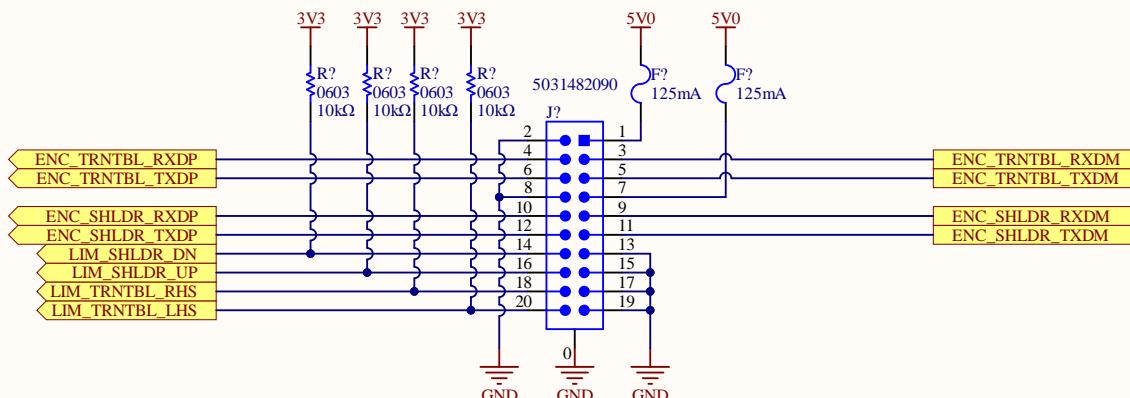
Did not level shift MISO signals since the STM32 SPI peripheral is 5V tolerant

Title: Arm - SPI Encoders	UW Robotics 200 University Avenue Waterloo Ontario Canada N2L 3G6
Size: Letter	Drawn By: N. Chapman, K. Hong
Date: 11/5/2020	Sheet 9 of 9
File: C:\Users\kyleh\Desktop\Works\UWRT\MarsRover2021-hardware\Projects\Arm\Rev2\SH4 - SPI ENCODERS.sch	UW ROBOTICS TEAM

Elbow and Claw



Shoulder and Turntable



Acronyms Explained

FSR: Force Sensitive Resistor
CLAW: Claw
WRST: Wrist
SHLDR: Shoulder
ELBW: Elbow
TRNTBL: Turntable
DIR: Direction for motors
CS: Analog current sensor signal

Title *	
Size: Letter	Drawn By: *
Date: 11/5/2020	Sheet* of *
File: C:\Users\kyleh\Desktop\Works\UWRT\MarsRover2021-hardware\Projects\Arm\Rev2\SH3 - CONNECTORS_2.Sch	



A

Netzer Encoders

B

Add transceivers and level shifters and pull-ups

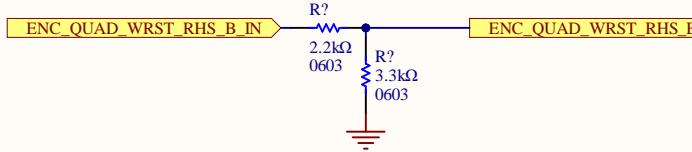
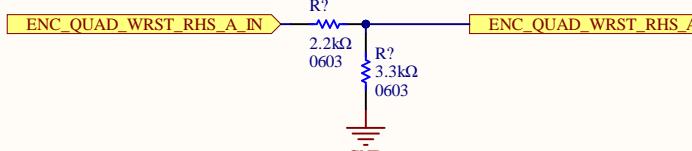
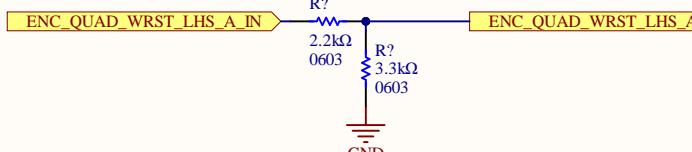
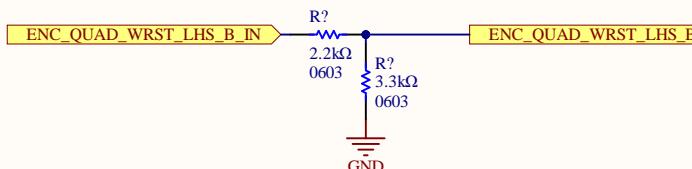
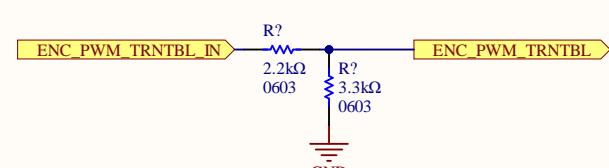
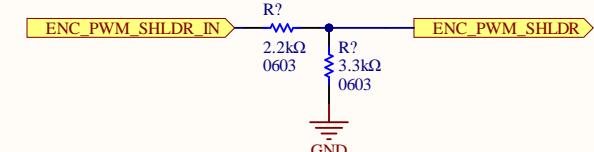
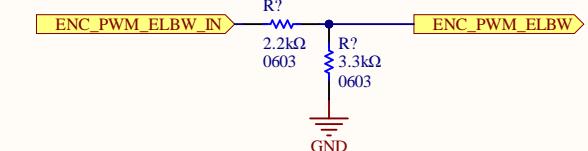
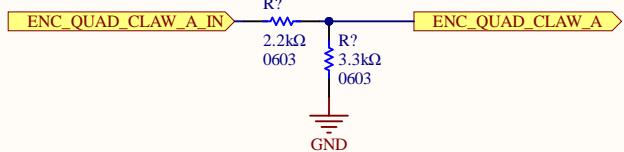
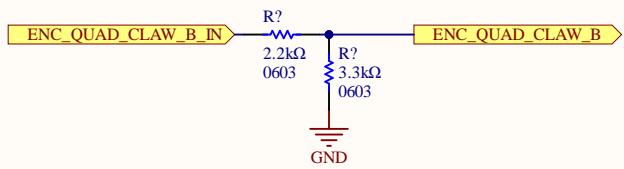
C

D

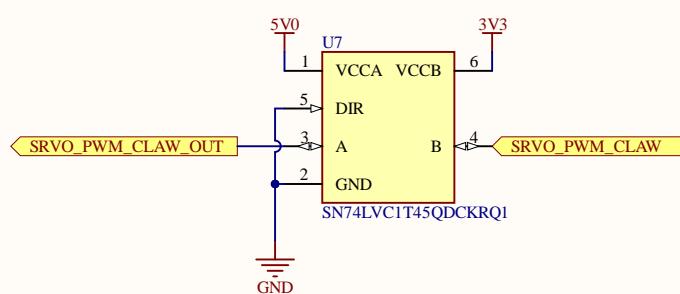
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Date: <input type="text" value="11/5/2020"/>	Sheet* of *
File: <input type="text" value="C:\Users\kyleh\Desktop\Works\UWRT\MarsRover2021-hardware\Projects\Arm\Rev2\SH5 - NETZER ENCODERS.dwg"/>	



5V-3V Voltage Dividers



Level Shifter



Title *		*
Size: Letter	Drawn By: Kyle Hong, Lance Bantoto	*
Date: 11/5/2020	Sheet* of *	*
File: C:\Users\kyleh\Desktop\Works\UWRT\MarsRover2021-hardware\Projects\Arm\Rev2\SH9 - SIGNAL CONDITIONING		

