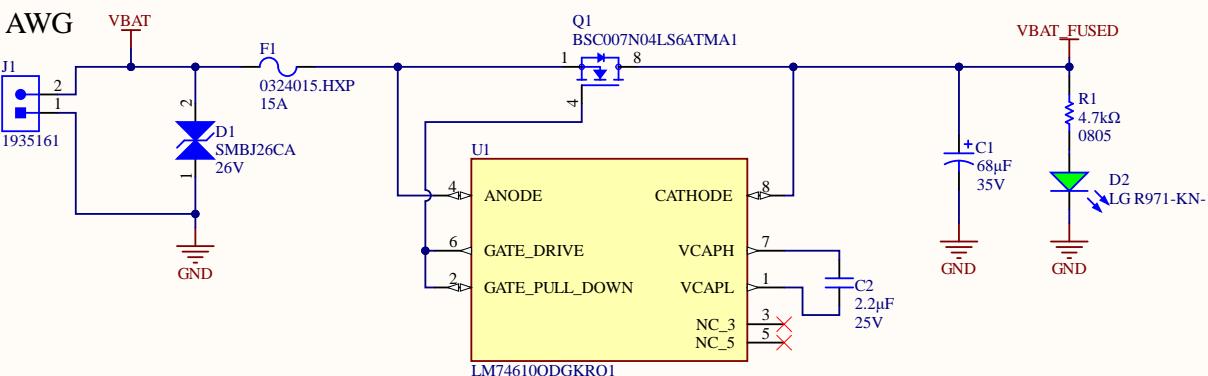


Battery Input (6s1p)

Input voltage range: 18-25.2V

12-26 AWG

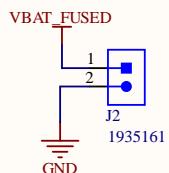


Ideal Diode Controller

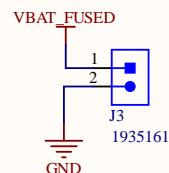
LED forward drop = 2.0V
Max VBAT = 24V
Min VBAT = 18V

Max LED current = $(24-2)/4700 = 4.7\text{mA}$
Min LED current = $(18-2)/4700 = 3.4\text{mA}$

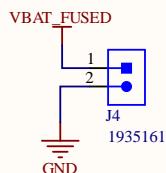
VBat (24V) Outputs



VBat (24V) power to LED Matrix board



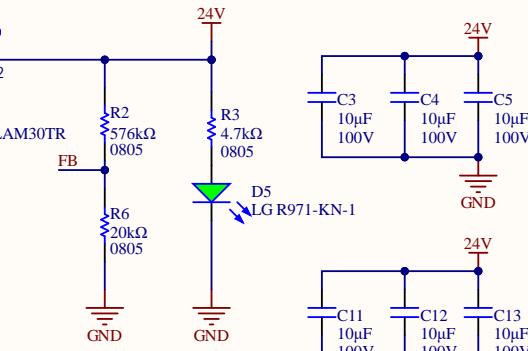
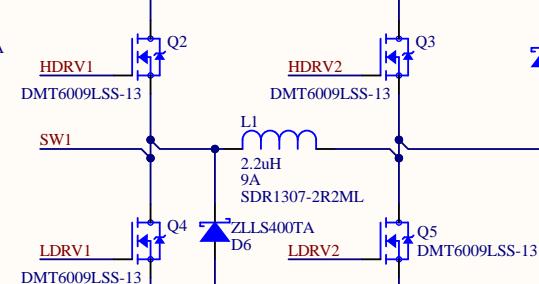
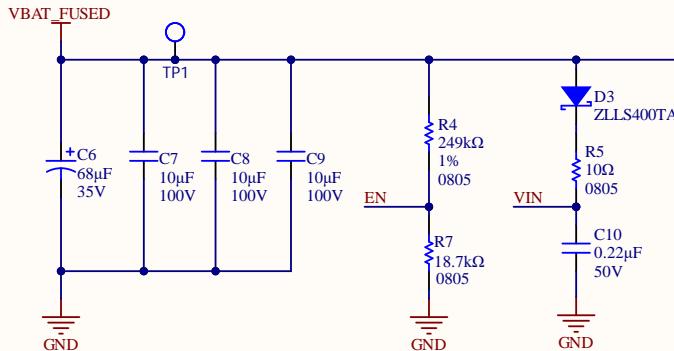
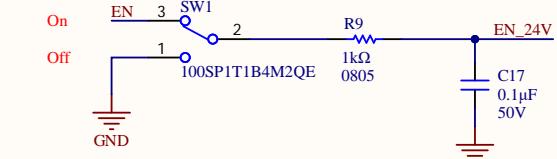
VBat (24V) power to Arm, Science, Gimbal, or Localization boards (to be decided in Rev3)



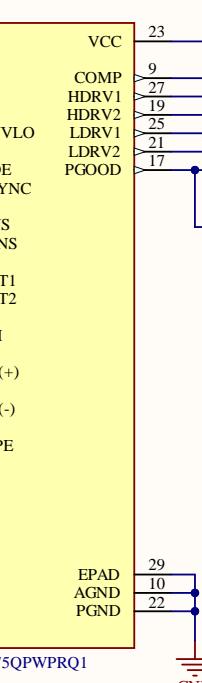
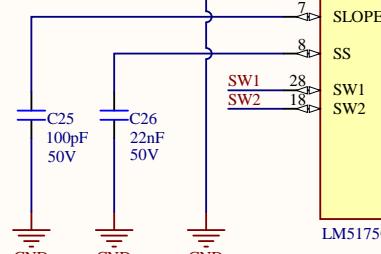
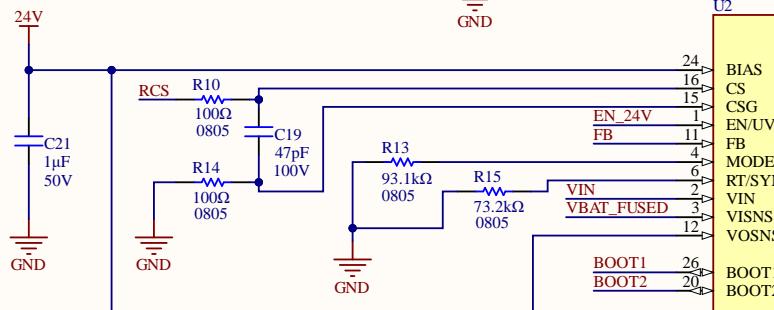
Input voltage range: 18-25.2V

24V Buck-Boost Converter @ 3A Max

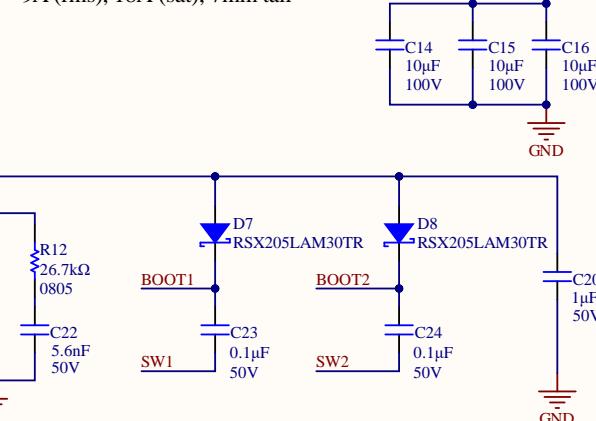
LED forward drop = 2.0V

LED current = $(24-2)/4700 = 4.7\text{mA}$ **On/Off Switch**

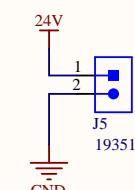
Pull below 0.4V to disable.
For $0.7\text{V} < \text{EN_24V} < 1.23\text{V}$, the controller operates in standby mode (VCC regulator enabled but PWM controller is not switching).
For $\text{EN_24V} > 1.23\text{V}$, the PWM function is enabled.
Debounce time: $100\text{k} * 0.1\mu\text{s} = 10\text{ms}$

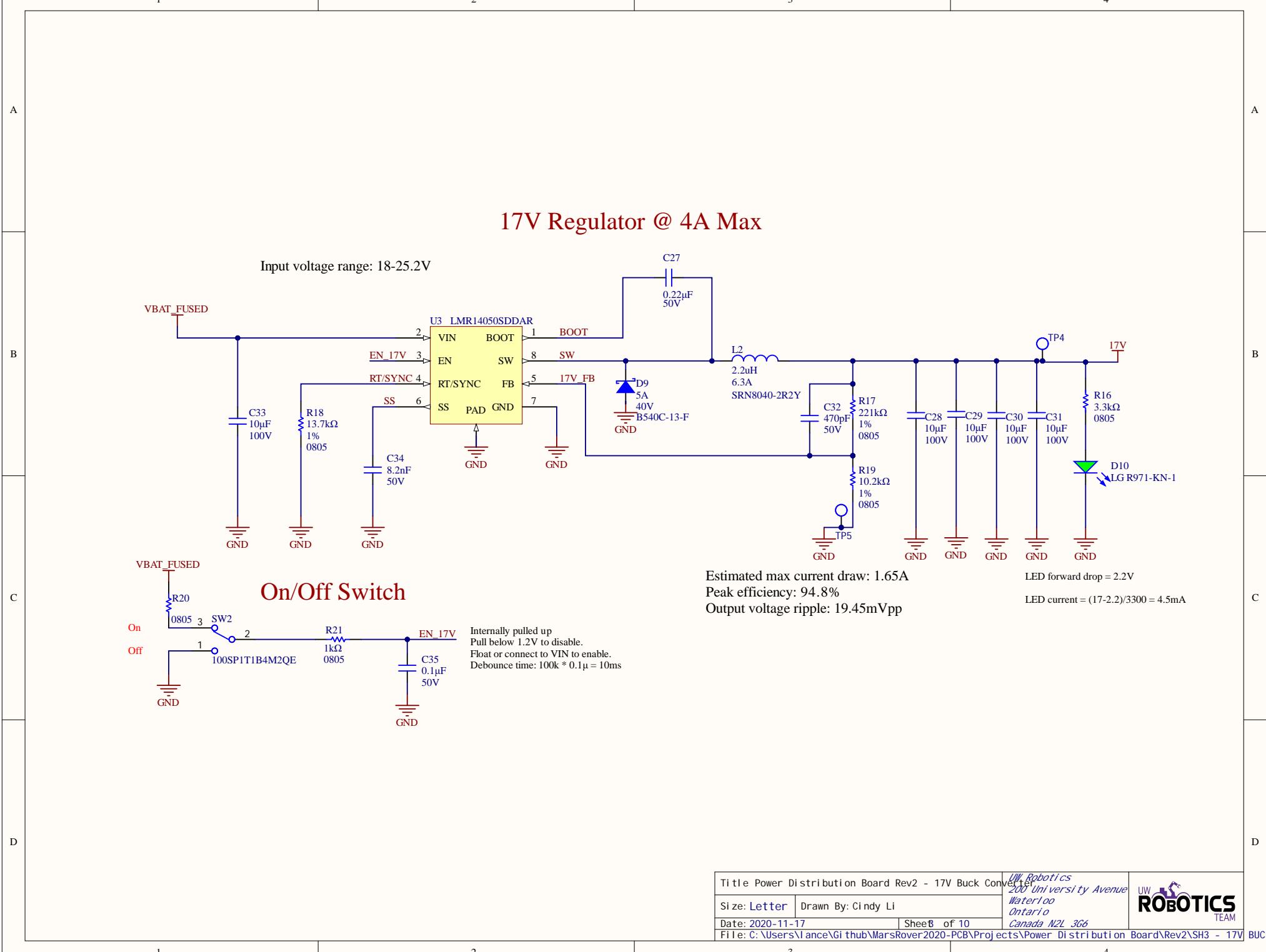


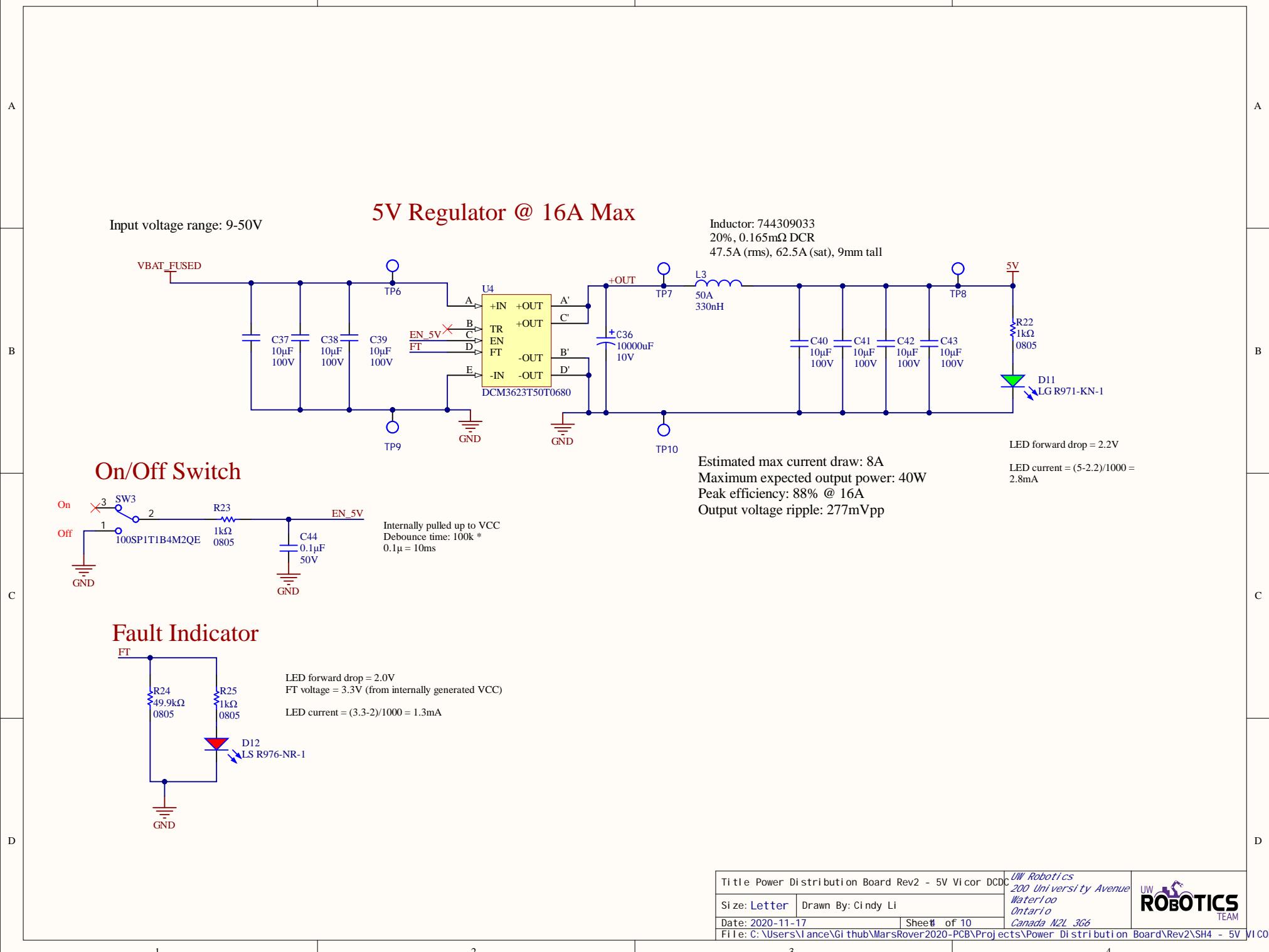
Inductor: SDR1307-2R2ML
20%, 6mΩ DCR
9A (rms), 18A (sat), 7mm tall

**24V Output**

24V power to ethernet switch







A

A

B

B

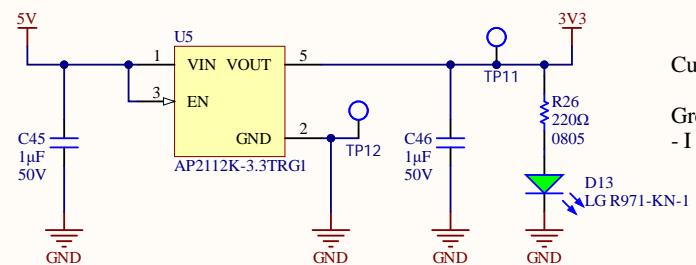
C

C

D

D

3.3V LDO @ 600mA Max



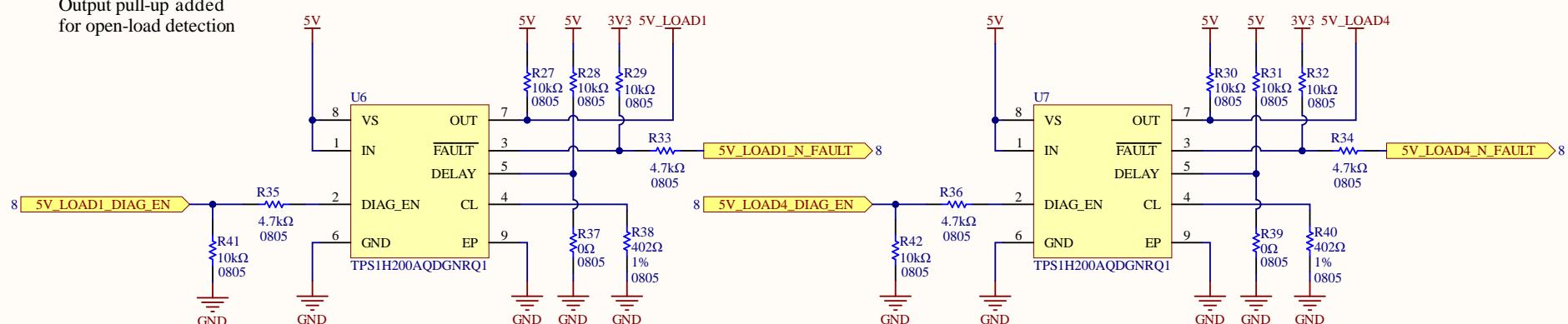
Current Calculations

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

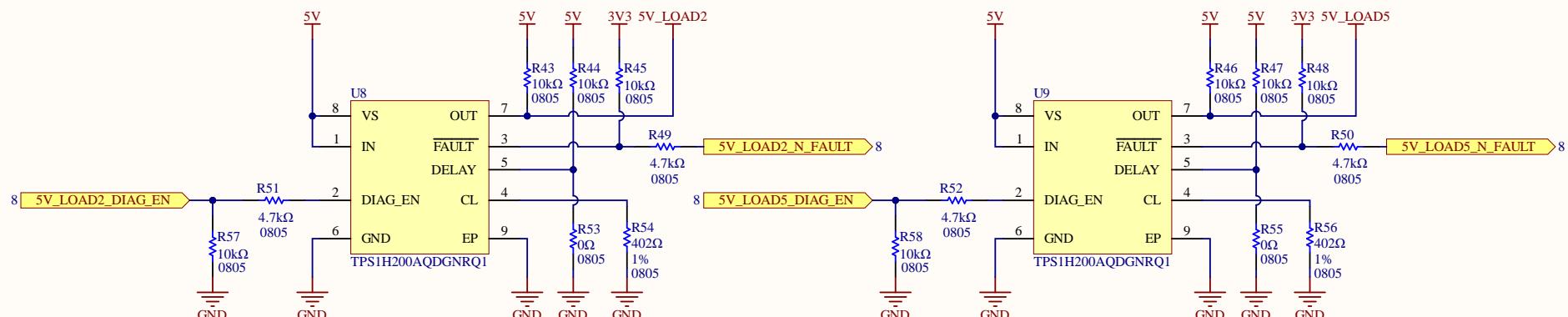
Title Power Distribution Board Rev2 - 3.3V Linear		<i>UW Robotics</i> 200 University Avenue Waterloo Ontario Canada N2L 3G6
Size: Letter	Drawn By: Cindy Li	
Date: 2020-11-17	Sheet 6 of 10	
File: C:\Users\lance\GitHub\MarsRover2020-PCB\Projects\Power Distribution Board\Rev2\SH5 - 3.3V LINEAR REGULATO		UW ROBOTICS TEAM

5V Loads Smart Switches

A
Output pull-up added for open-load detection



B



C

D

Smart Switch Current Limited to 5A

- $I_{out} = 5A$, $V_{CL(th)} = 0.8V$, $K_{CL} = 2500$ (values from datasheet)
- $R_{CL} = V_{CL(th)} * K_{CL} / I_{out} = 0.8 * 2500 / 5 = 400\Omega \rightarrow$ use $R_{CL} = 402\Omega$

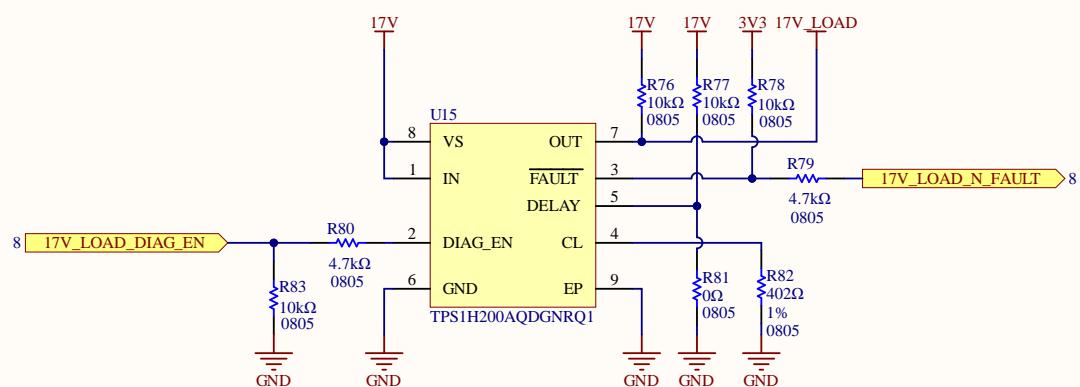
Current Limit Configurations - Refer to DELAY Pin

- Holding mode: depopulate pull-up and populate pull-down with a 0Ω resistor
- Latch-off mode: depopulate pull-up and populate pull-down with a capacitor or (calculated based on required delay time)
- Auto-retry mode: populate pull-up with a pull-up resistor and depopulate pull-down

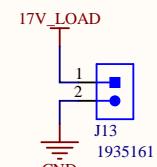
A

A

17V Load Smart Switch

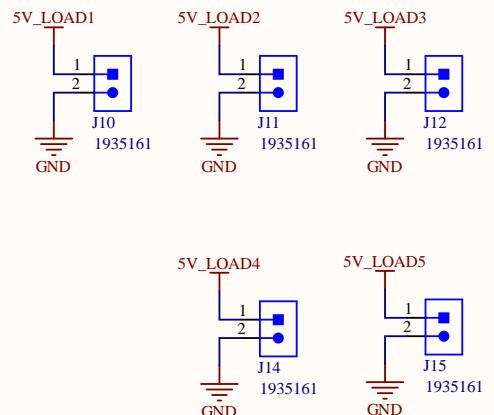


17V Output



17V power to Nvidia Jetson board

5V Outputs

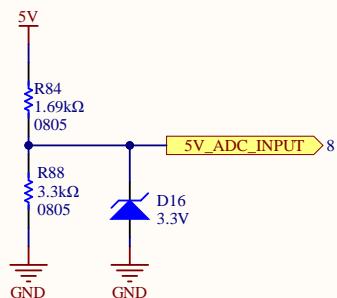


5V power to Arm, Science, Gimbal, and Localization boards (plus one spare)

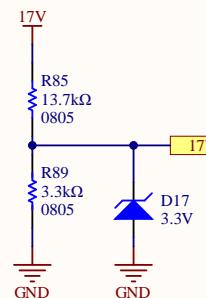
B

B

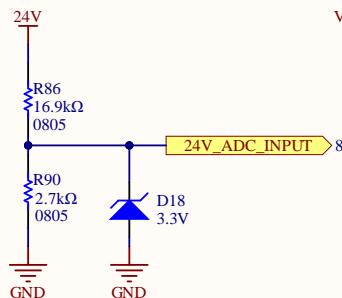
Power Rail Voltage Monitoring



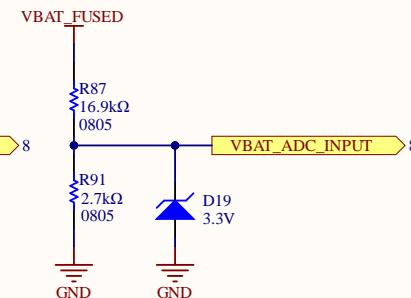
Divides 5V to 3.3V



Divides 17V to 3.3V



Divides 24V to 3.3V



Divides 24V to 3.3V

D

D

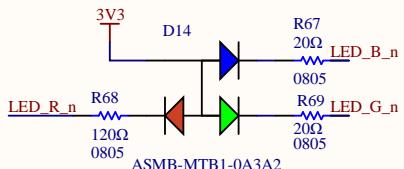
1

2

3

4

Status LED

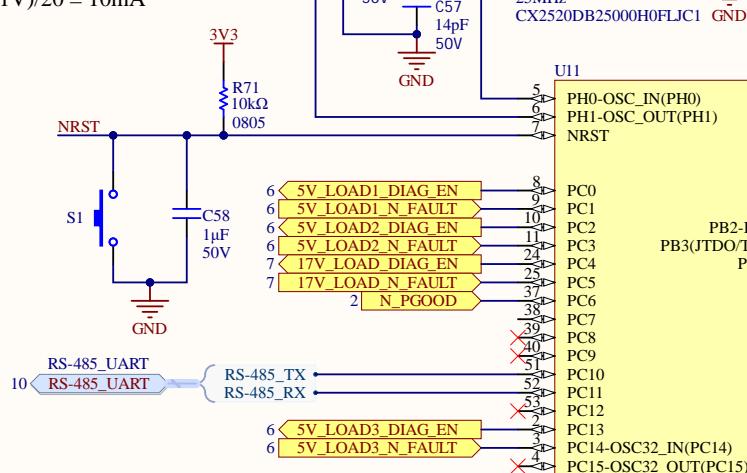


Current Calculations

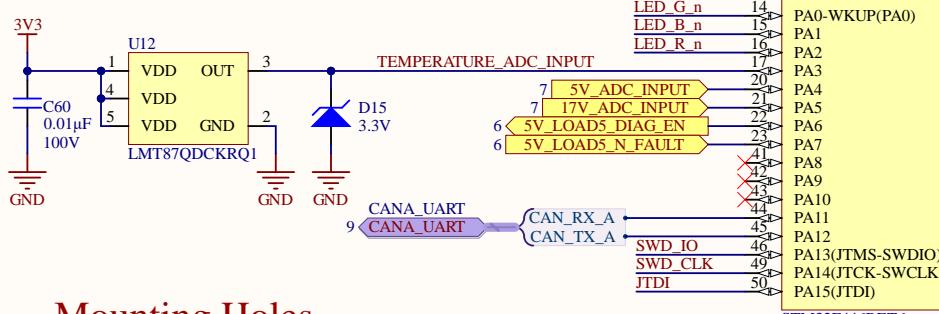
RGB LED voltage drops:

- Red: 2.1V: $I = (3.3 - 2.1V)/120 = 10mA$
- Blue: 3.1V: $I = (3.3 - 3.1V)/20 = 10mA$
- Green: 3.1V: $I = (3.3 - 3.1V)/20 = 10mA$

STM32F446RET6



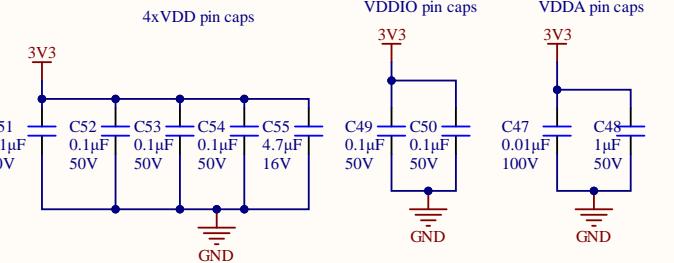
Temperature Sensor



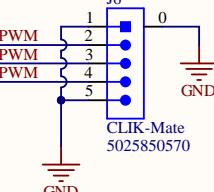
Mounting Holes

MH1	MH2
MOUNTING_HOLE_5/32	MOUNTING_HOLE_5/32
MH3	MH4
MOUNTING_HOLE_5/32	MOUNTING_HOLE_5/32

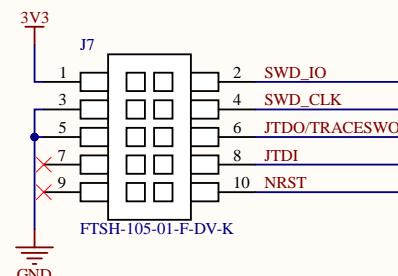
Decoupling Caps



LED Matrix



Debug/Programming



A

A

B

B

C

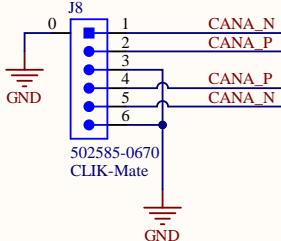
C

D

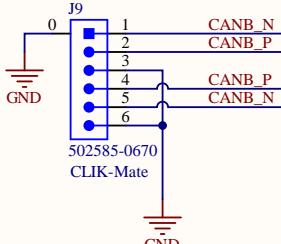
D

CAN Transceivers

CAN BUS A



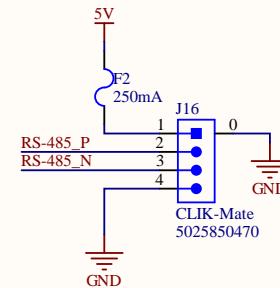
CAN BUS B



URM04 Ultrasonic Sensors

A

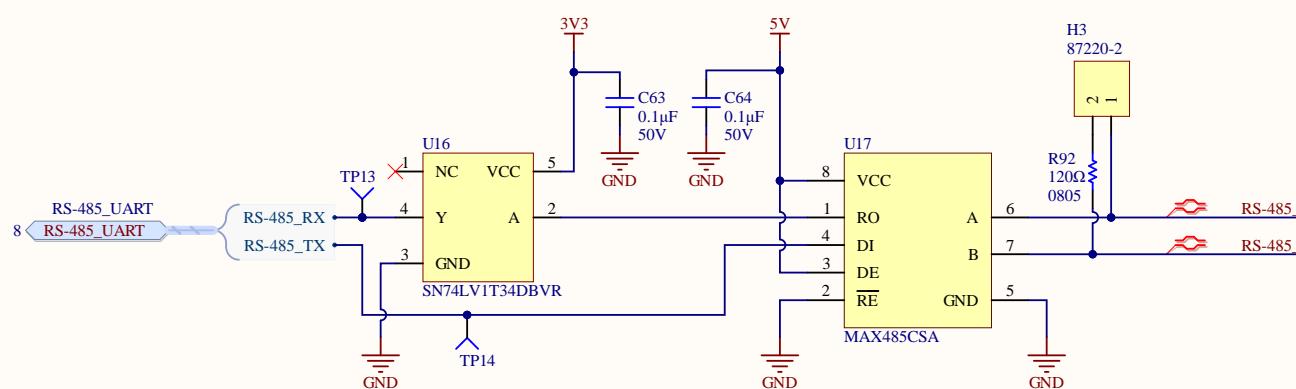
A



B

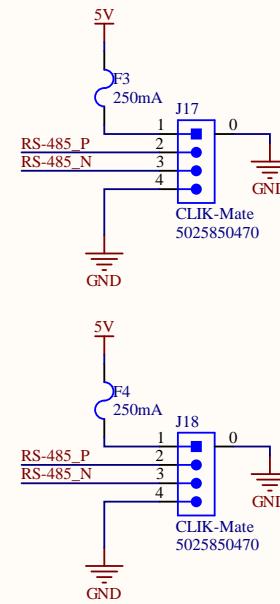
B

RS-485 Transceiver



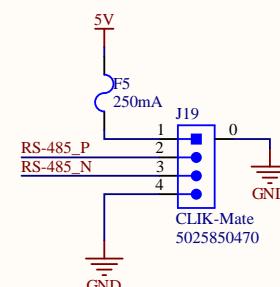
C

C



D

D



Title: Power Distribution Board Rev2 - RS-485	UW Robotics 200 University Avenue Waterloo Ontario Canada N2L 3G6	UW ROBOTICS TEAM
Size: Letter	Drawn By: Cindy Li	
Date: 2020-11-17	Sheet 10 of 10	
File: C:\Users\lance\GitHub\MarsRover2020-PCB\Projects\Power Distribution Board\Rev2\SH10 - RS-485.schDoc		

