

A

A

B

B

C

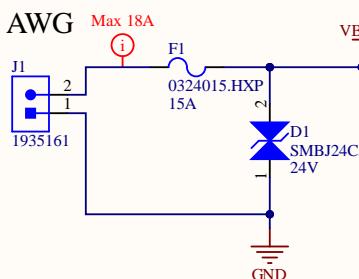
C

D

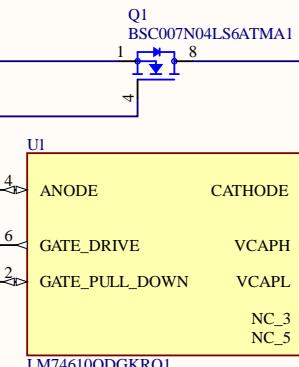
D

Battery Input (6s1p)

12-26 AWG



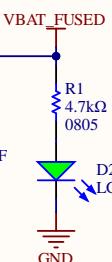
Ideal Diode Controller



LM74610QDGKRQ1

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

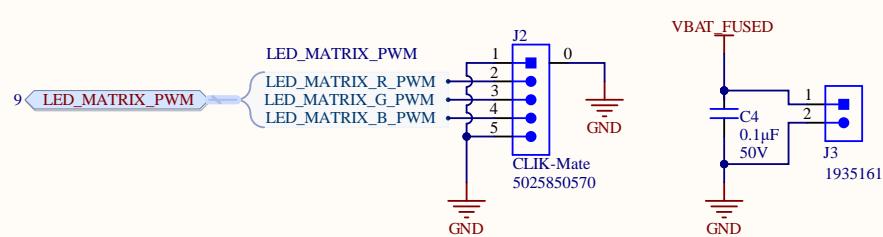
Max LED current = $(24-2)/4700 = 4.7\text{mA}$
Min LED current = $(18-2)/4700 = 3.4\text{mA}$



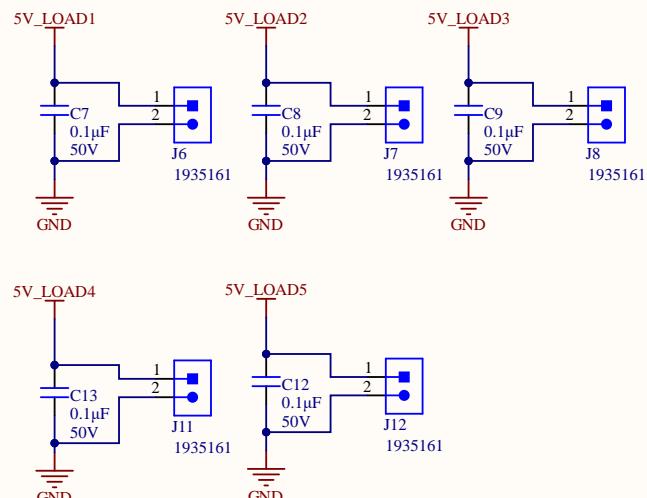
Title	Power Distribution Board Rev2 - Power	UW Robotics
Size:	Letter	200 University Avenue Waterloo Ontario Canada N2L 3G6
Date:	2020-11-11	Sheet 1 of 12
File:	C:\UWRT\MarsRover2021-hardware\Projects\Power	Distribution Board\Rev2\SH1 - POWER.SchDoc



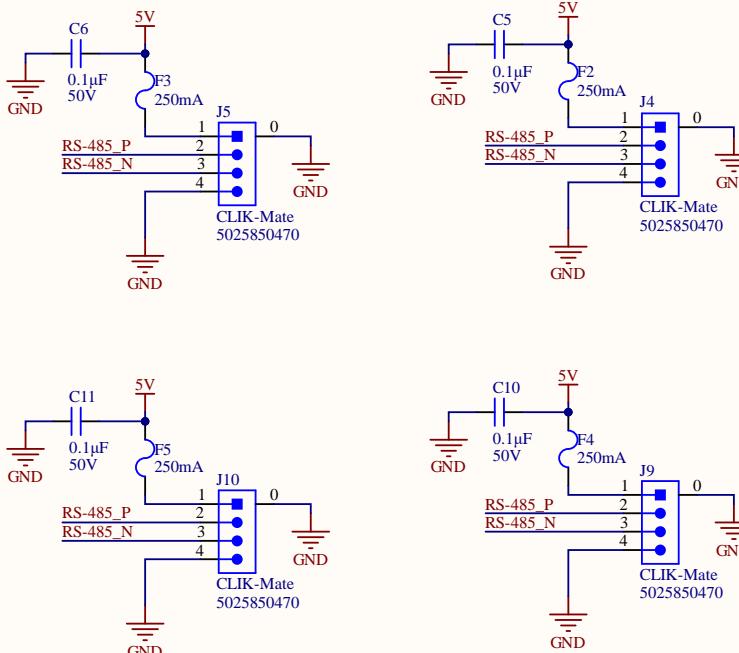
LED Matrix



5V Output



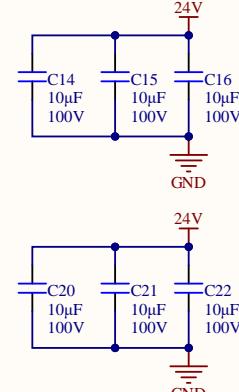
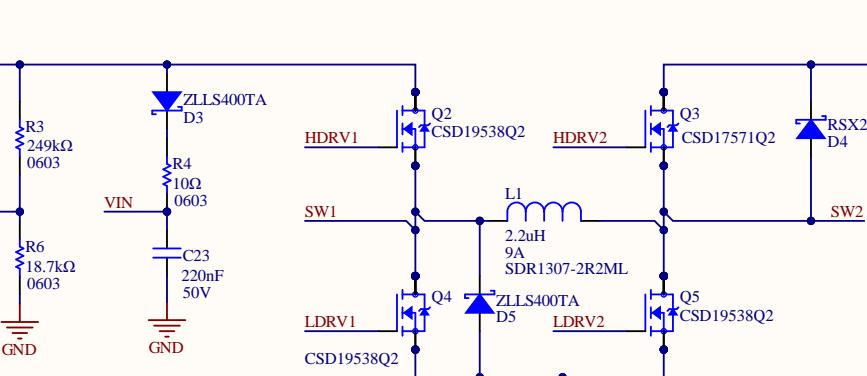
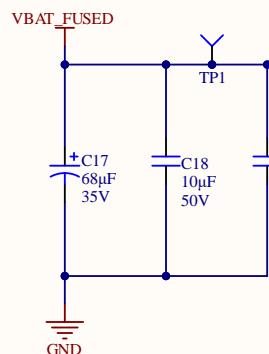
URM04 Ultrasonic Sensors



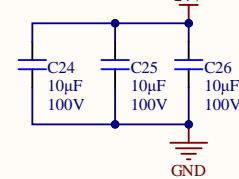
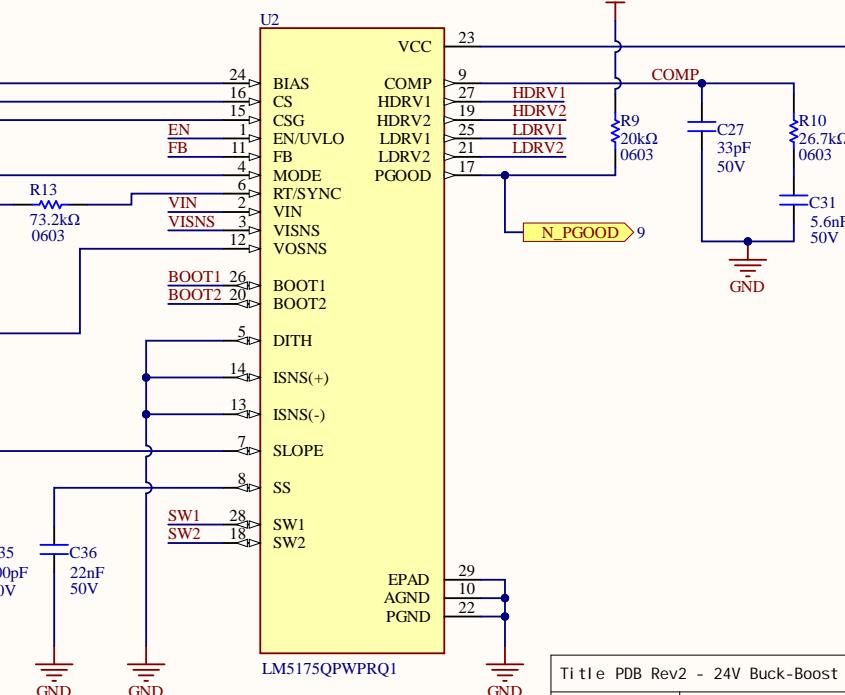
RS-485
12 RS-485 → RS-485_P
RS-485_N ← RS-485_N

Input voltage range: 18-25.8V

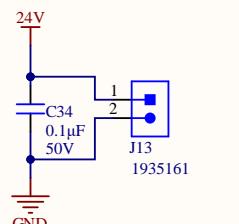
24V Buck-Boost Converter @ 3A Max



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



24V Output



Title PDB Rev2 - 24V Buck-Boost Converter

Size: Letter Drawn By: Cindy Li

Date: 2020-11-11 Sheet 8 of 12

File: C:\UWRT\MarsRover2021-hardware\Projects\Power

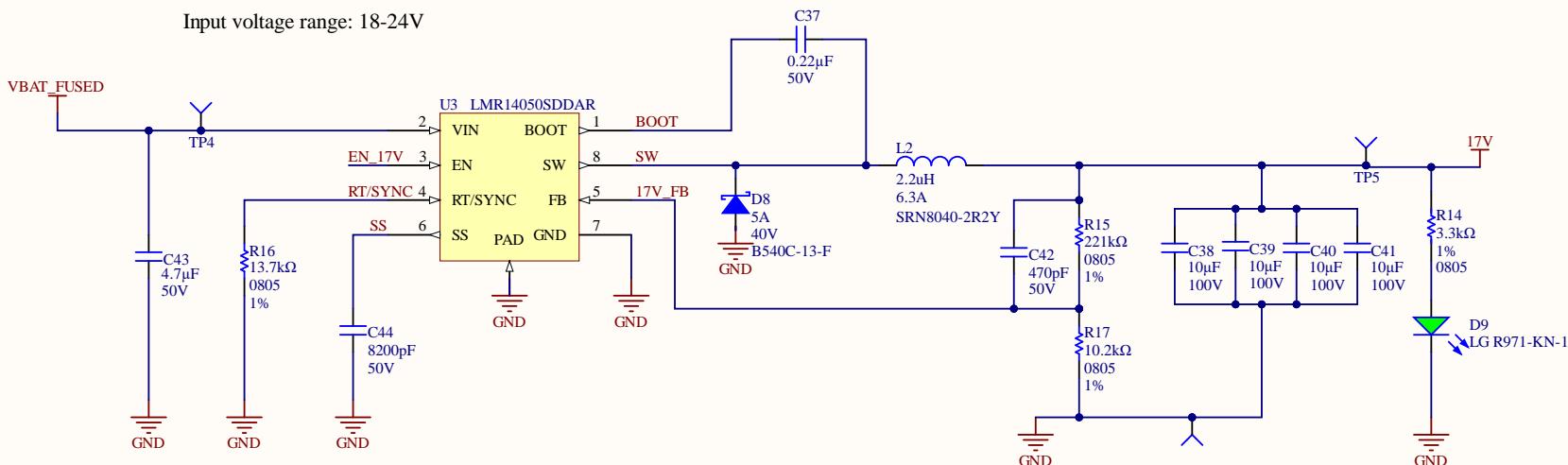
UW Robotics
200 University Avenue
Waterloo
Ontario
Canada N2L 3G6

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TEAM

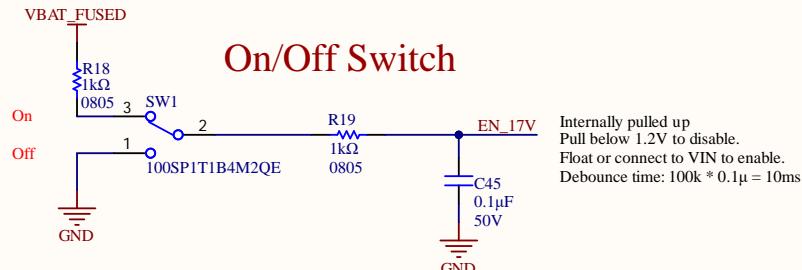
A

A

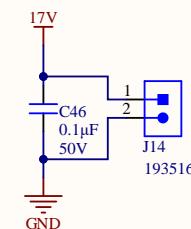
17V Regulator @ 4A Max



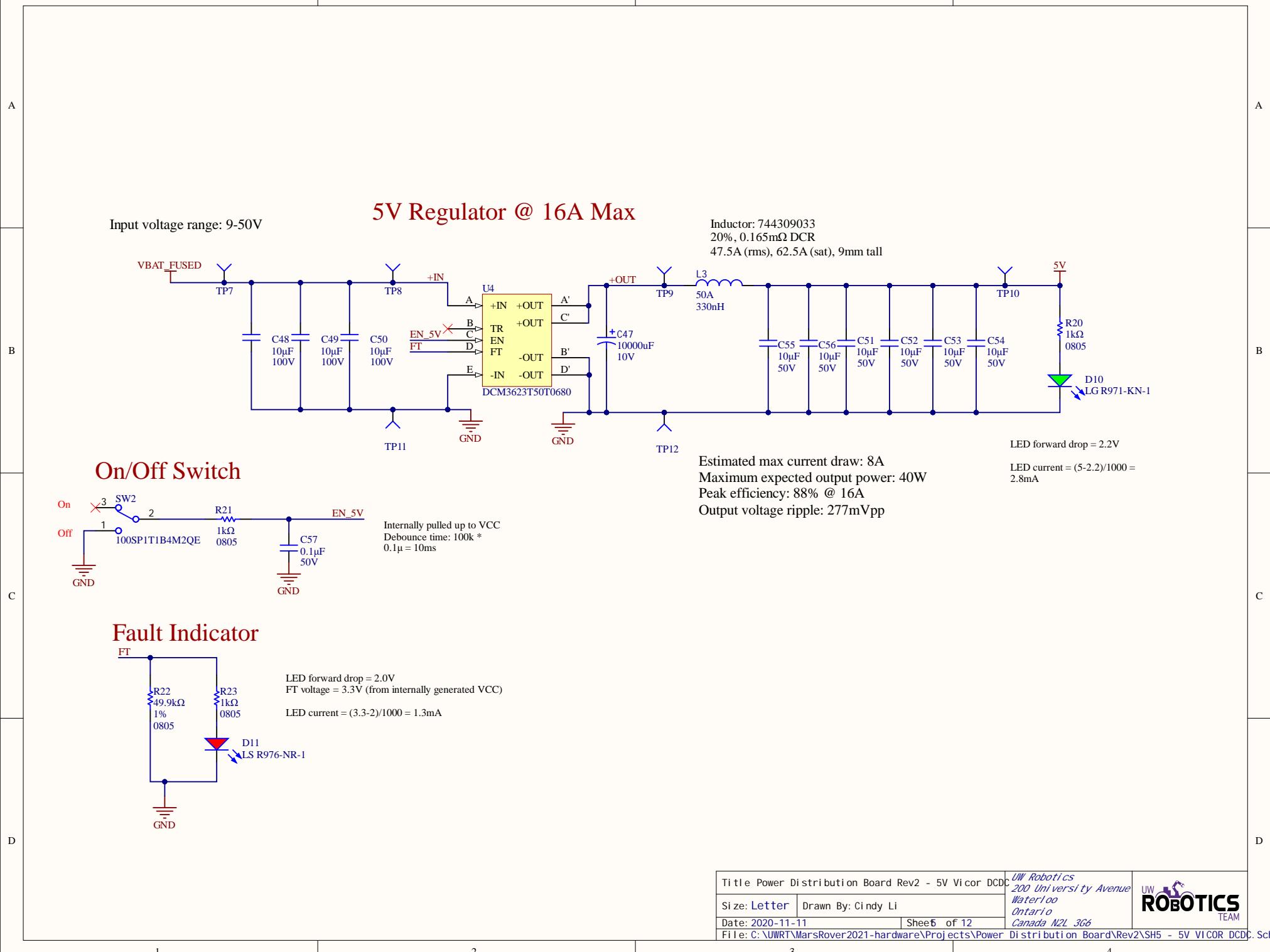
On/Off Switch



17V Output



Title Power Distribution Board Rev2 - 17V Buck Converter		UW Robotics 200 University Avenue Waterloo Ontario Canada N2L 3G6
Size: Letter	Drawn By: Cindy Li	
Date: 2020-11-11	Sheet 1 of 12	
File: C:\UWRT\MarsRover2021-hardware\Projects\Power Distribution Board\Rev2\SH4 - 17V BUCK CONVERTER.SchDoc		



A

A

B

B

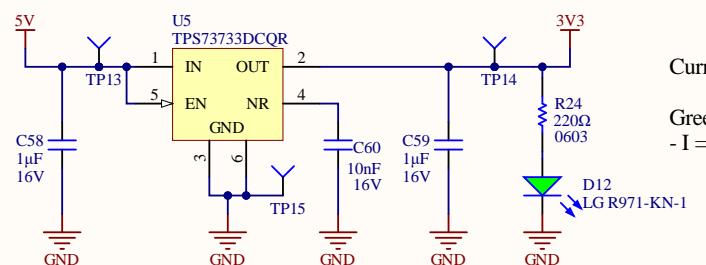
C

C

D

D

5V to 3.3V LDO (Max 1A)



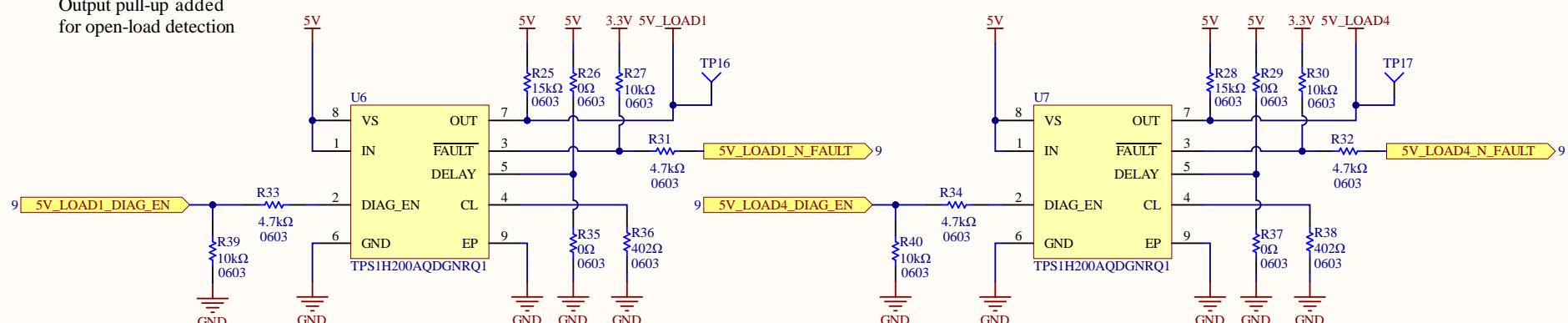
Current Calculations

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

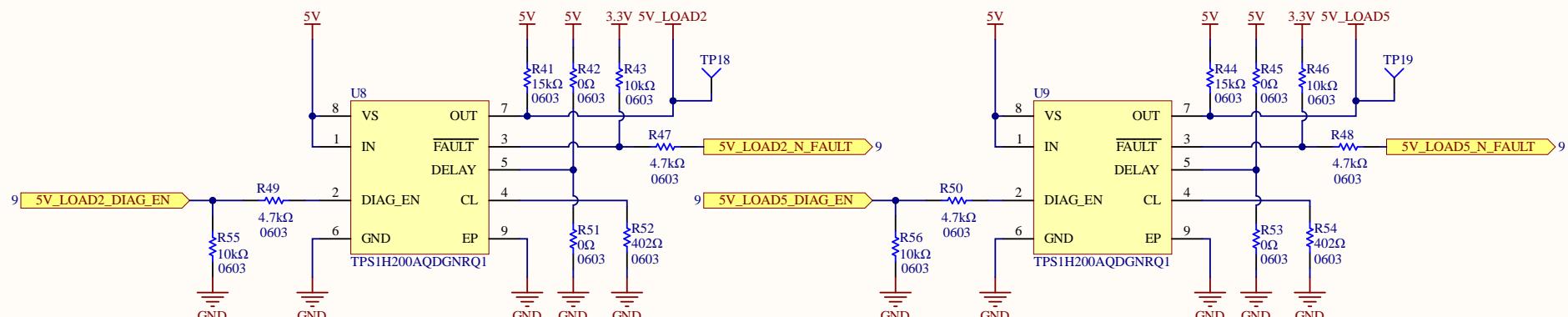
Title Power Distribution Board Rev2 - 3.3V Linear		<i>UW Robotics</i> 200 University Avenue Waterloo Ontario Canada N2L 3G6
Size: Letter	Drawn By: Cindy Li	
Date: 2020-11-11	Sheet 6 of 12	
File: C:\UWRT\MarsRover2021-hardware\Projects\Power Distribution Board\Rev2\SH6 - 3.3V LINEAR REGULATOR.SchDoc		UW ROBOTICS TEAM

5V Loads Smart Switches

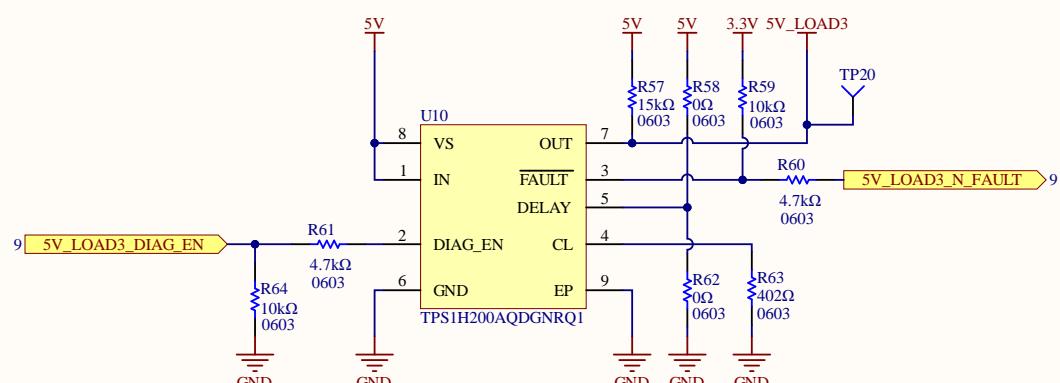
A
Output pull-up added for open-load detection



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 $R_{CL} = 402\Omega$

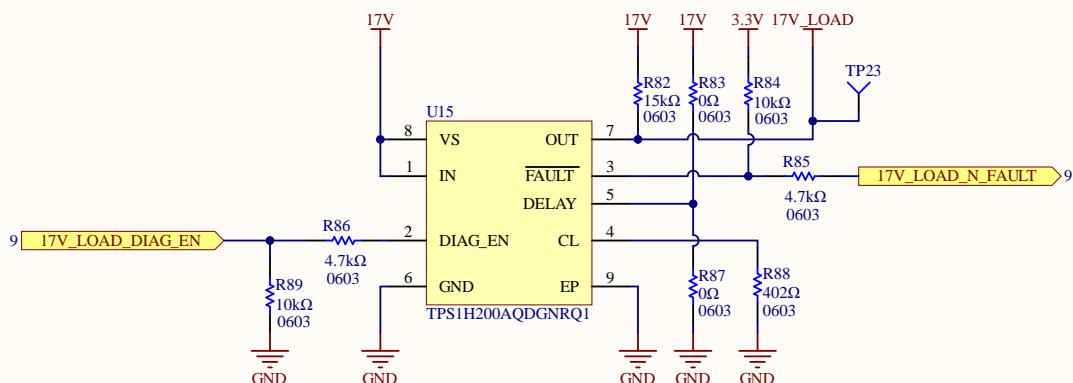
Current Limit Configurations - Refer to DELAY Pin

- 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

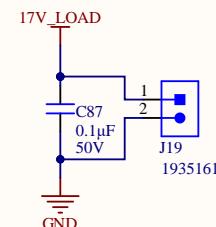
17V Load Smart Switch



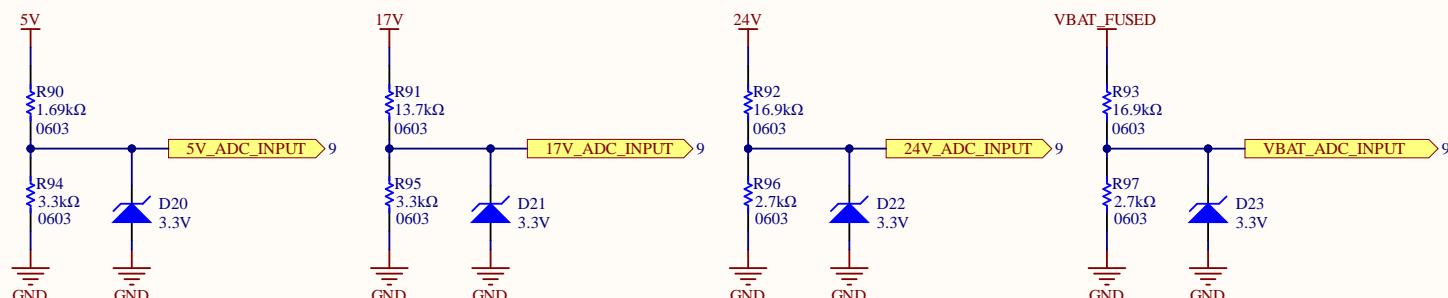
B

B

17V Output



Power Rail Voltage Monitoring



D

D

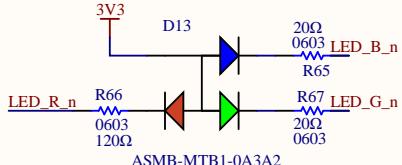
Divides 5V to 3.3V

Divides 17V to 3.3V

Divides 24V to 3.3V

Divides 24V to 3.3V

Status LED

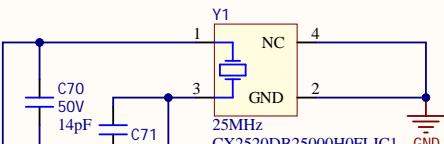


Current Calculations

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: $I = (3.3 - 3.1V)/20 = 10mA$

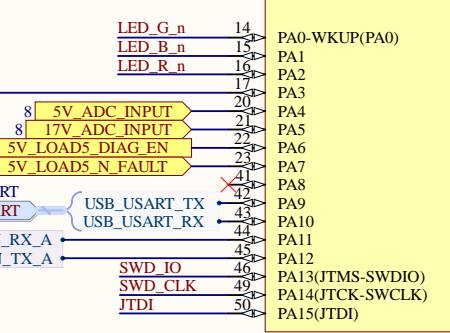
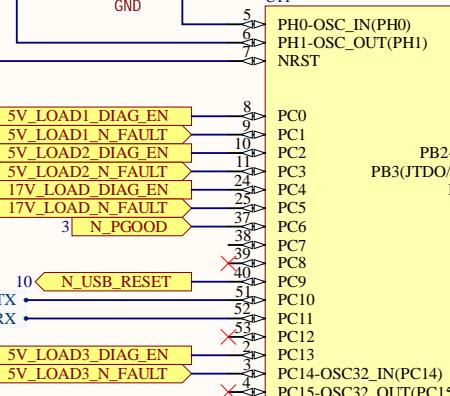
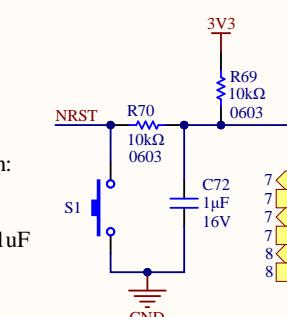
STM32F446RET6



Debounce Calculation:

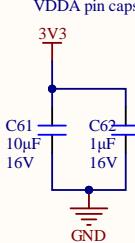
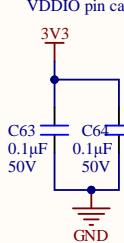
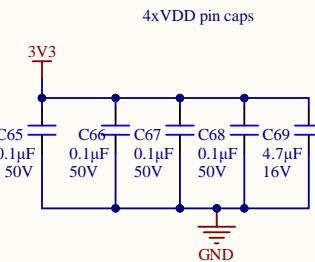
$$T = RC \rightarrow C = T/R$$

$$C = 10ms / 10k\Omega = 1\mu F$$

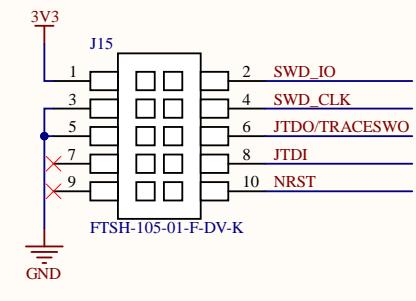


STM32F446RET6

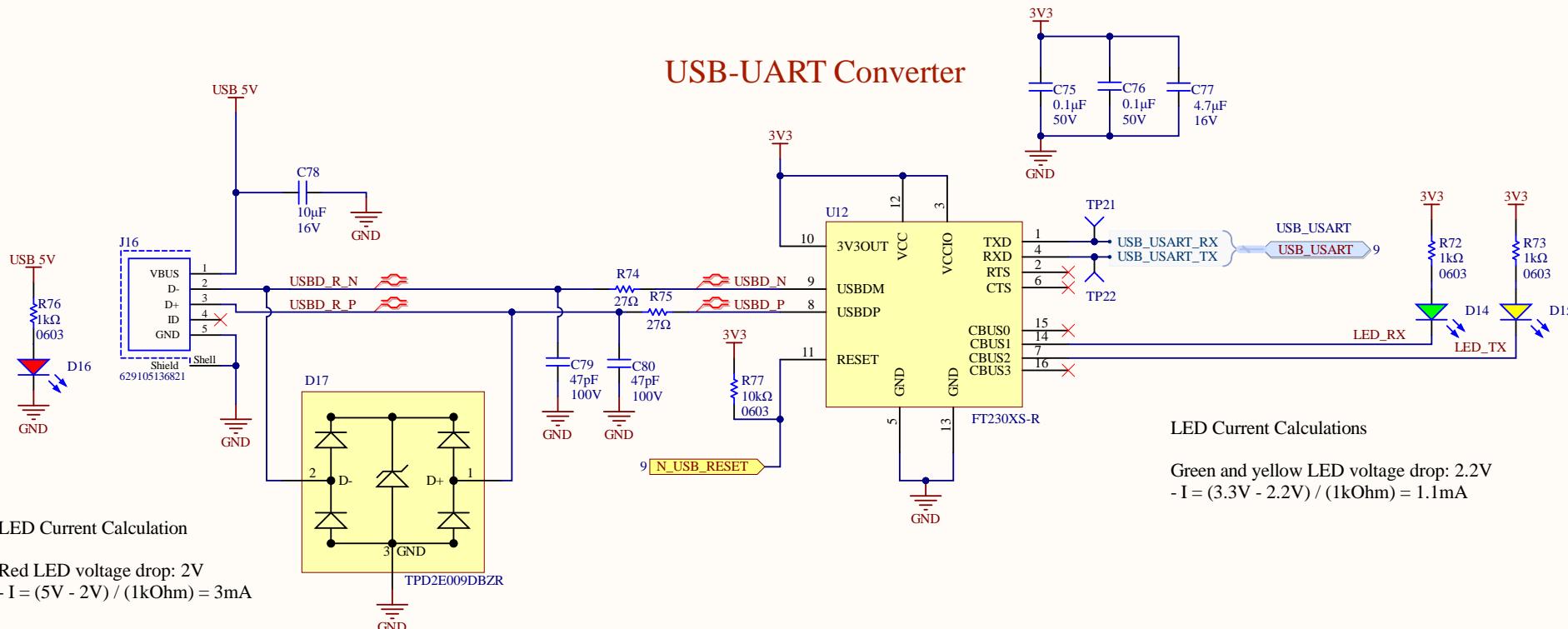
Decoupling Caps



Debug/Programming



USB-UART Converter

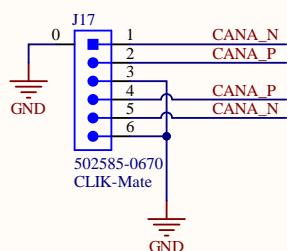


Title Power Distribution Board Rev2 - USB		UW Robotics
Size: Letter	Drawn By: Cindy Li	200 University Avenue Waterloo Ontario Canada N2L 3G6
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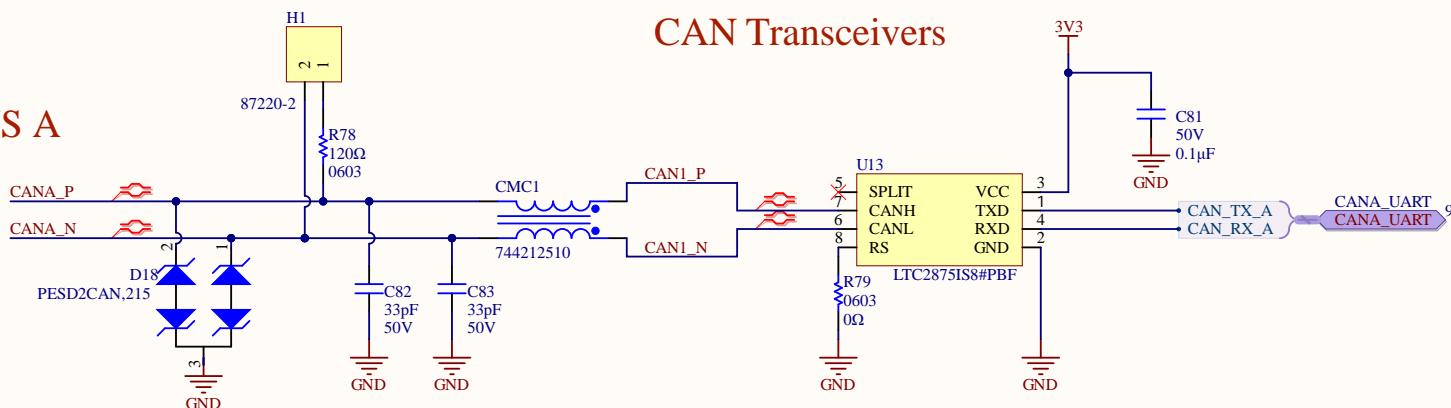
A

A

CAN BUS A



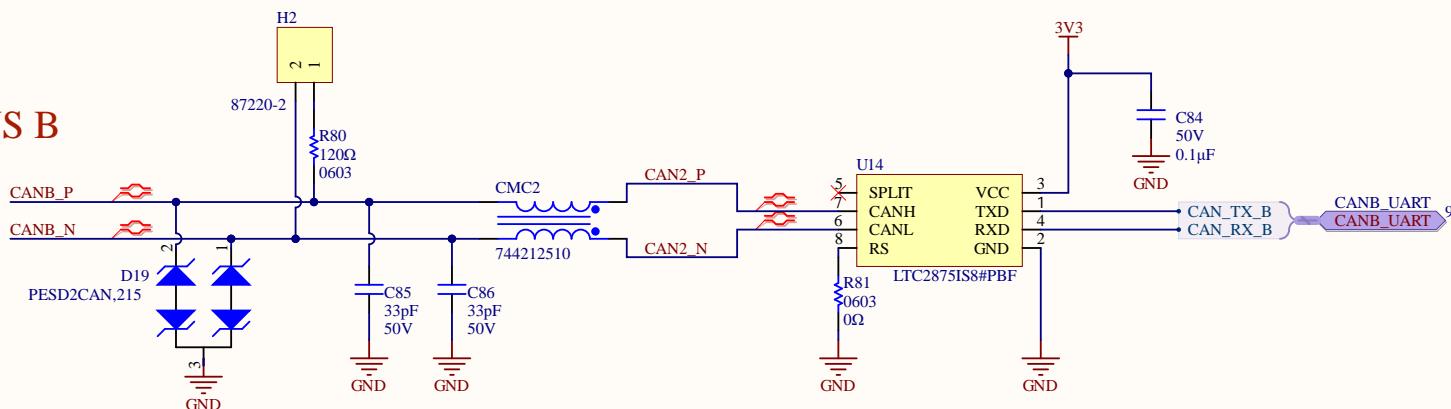
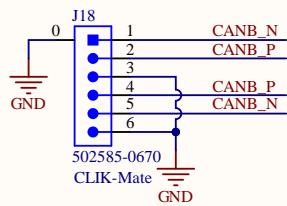
CAN Transceivers



B

1

CAN BUS B



1

1

D

1

Title Power Distribution Board Rev2 - CAN		<i>UW Robotics 200 University Avenue Waterloo Ontario Canada N2L 3G6</i>
Size: Letter	Drawn By: Cindy Li	
Date: 2020-11-11	Sheet 1 of 12	 UW ROBOTICS TEAM
File: C:\UWRT\MarsRover2021-hardware\Projects\Power		Distribution Board\Rev2\SH11 - CAN.SchDoc

A

A

B

B

C

C

D

D

RS-485 Transceiver

