

A

A

B

B

C

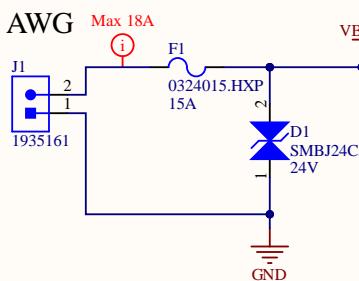
C

D

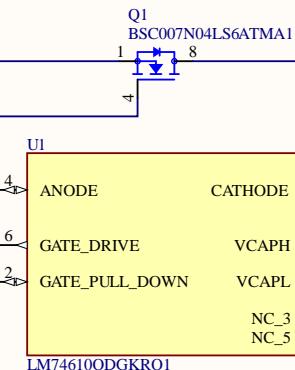
D

## Battery Input (6s1p)

12-26 AWG



## Ideal Diode Controller

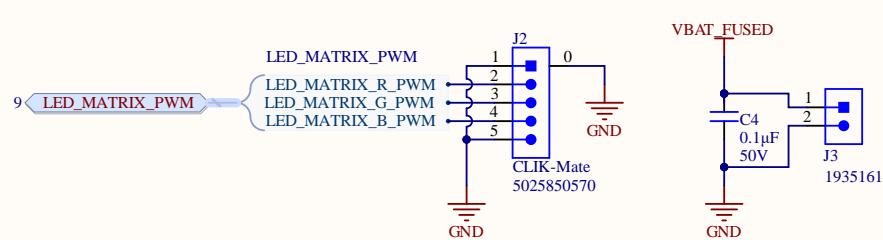


LED forward drop = 2.0V  
Max VBAT = 24V  
Min VBAT = 18V

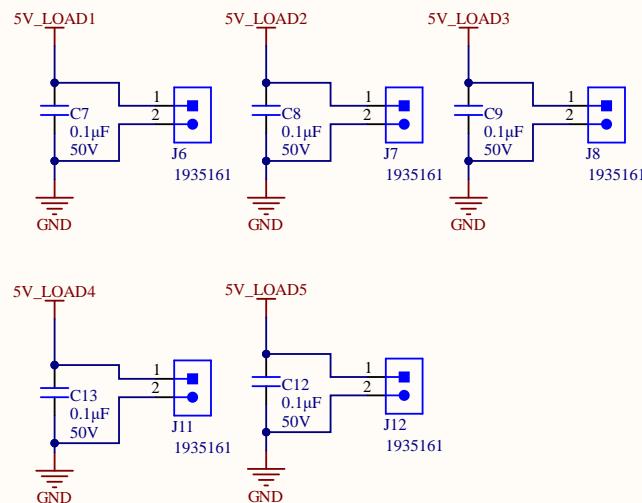
Max LED current =  $(24-2)/4700 = 4.7\text{mA}$   
Min LED current =  $(18-2)/4700 = 3.4\text{mA}$

Title	Power Distribution Board Rev2 - Power	UW Robotics
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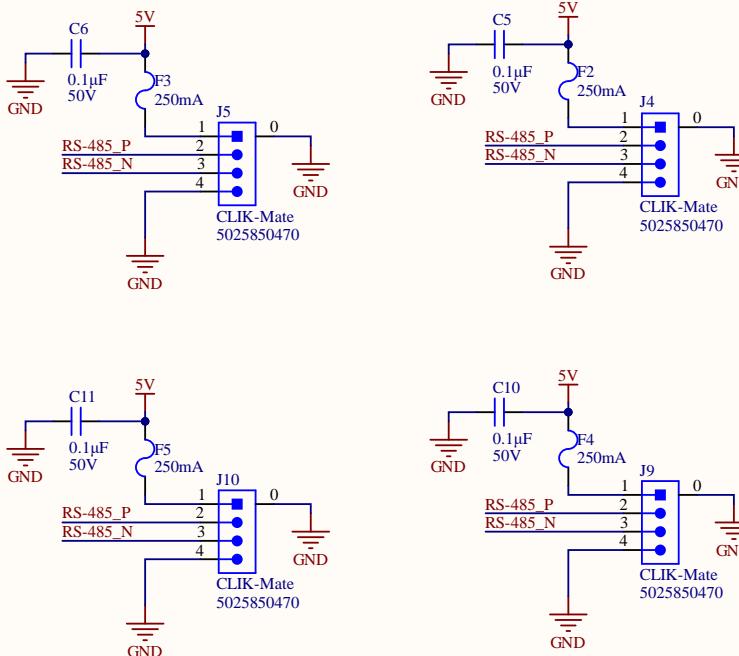
## LED Matrix



## 5V Output



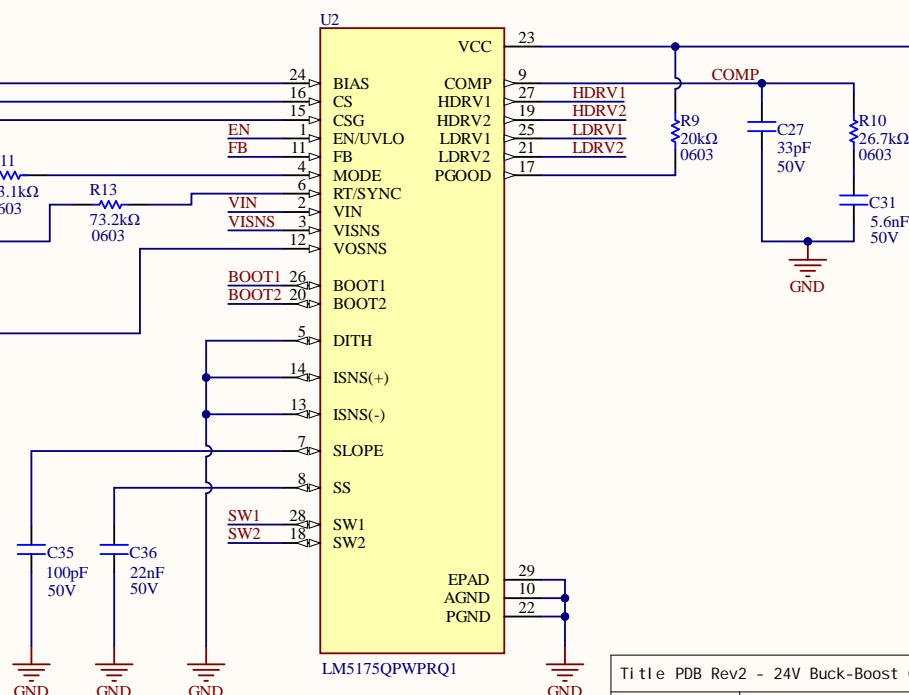
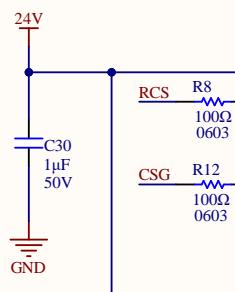
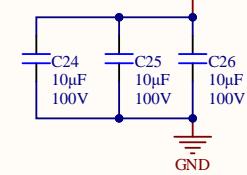
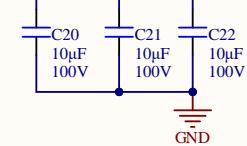
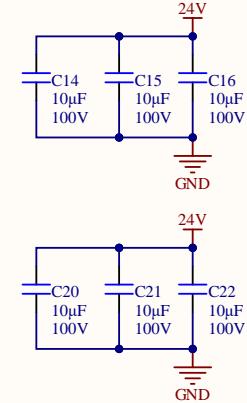
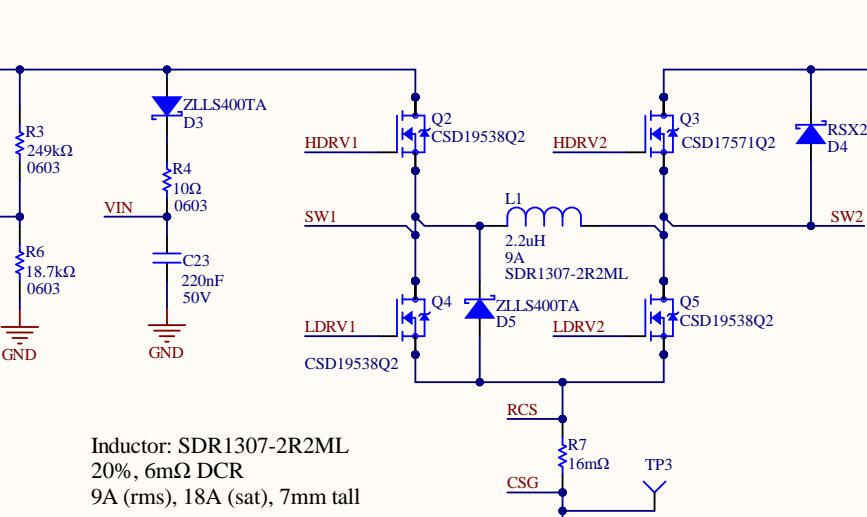
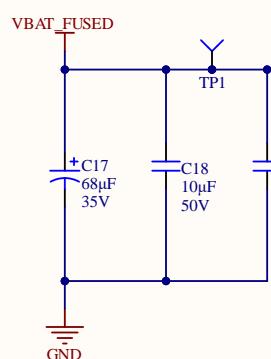
## URM04 Ultrasonic Sensors



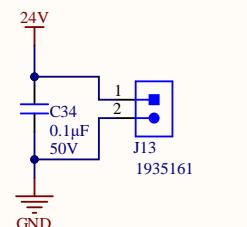
RS-485  
12, 2    RS-485    { RS-485\_P ← RS-485\_P  
                    RS-485\_N ← RS-485\_N }

Input voltage range: 18-25.8V

## 24V Buck-Boost Converter @ 3A Max



## 24V Output



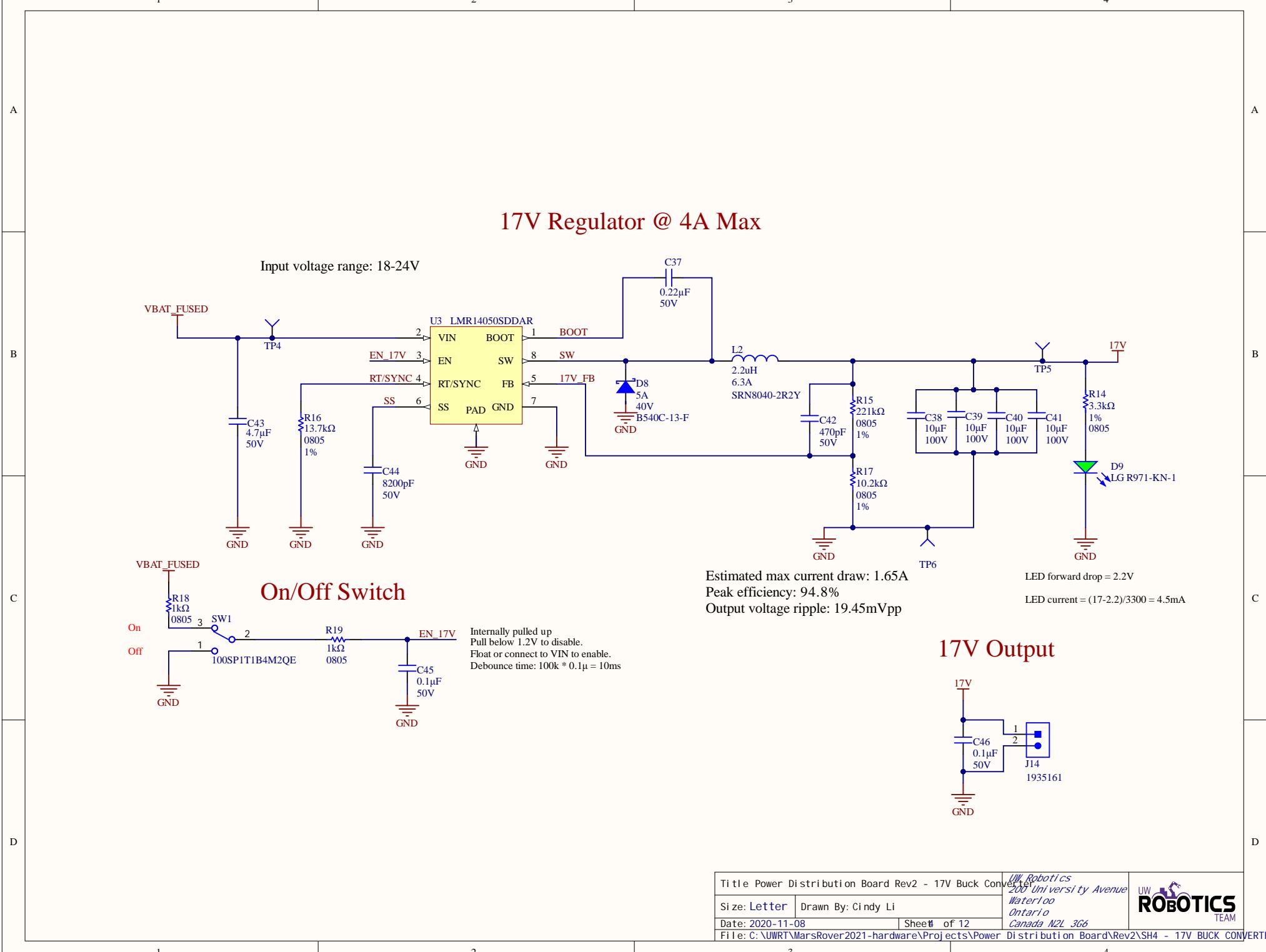
Title PDB Rev2 - 24V Buck-Boost Converter

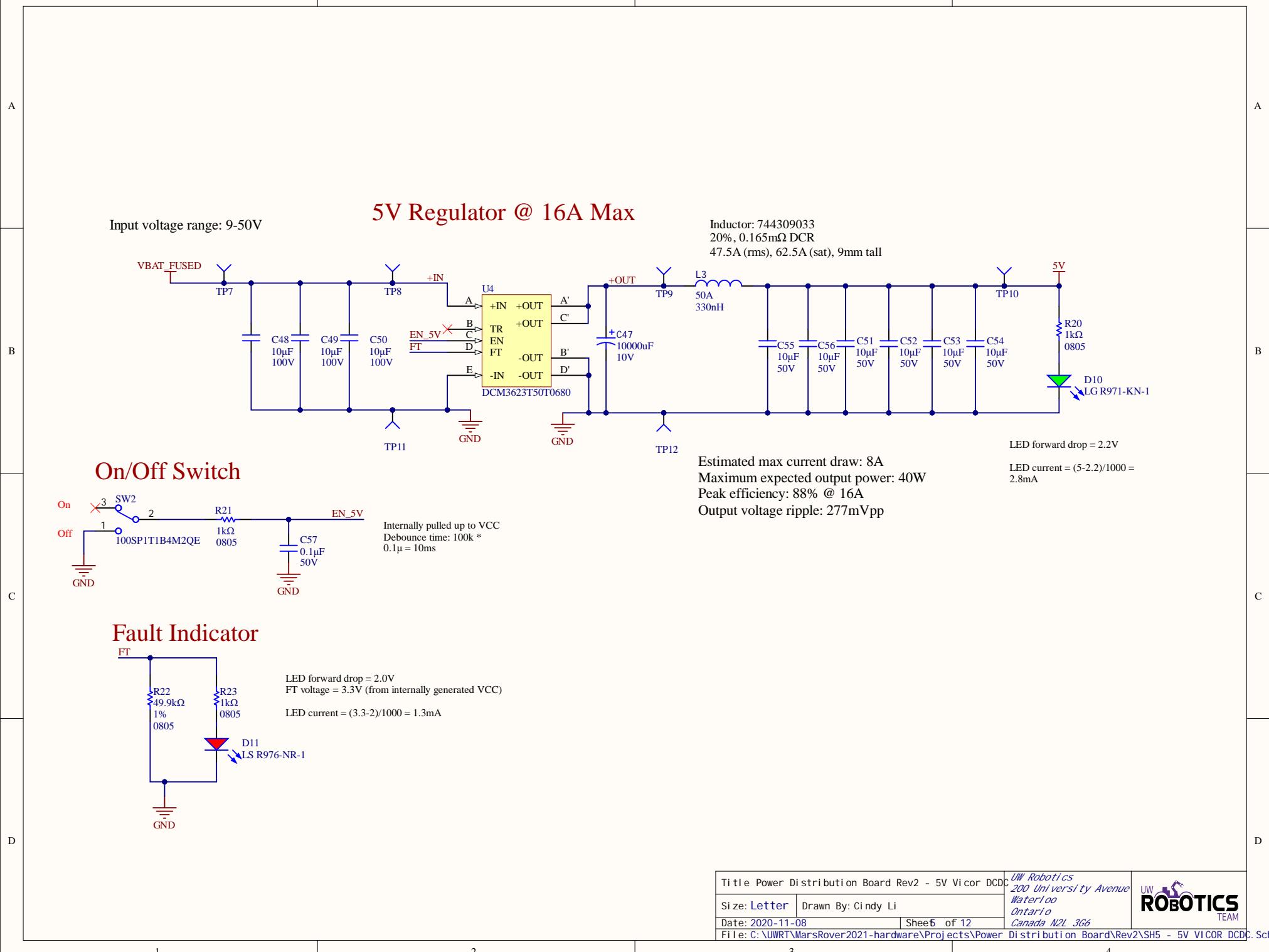
Size: Letter Drawn By: Cindy Li

Date: 2020-11-08 Sheet 8 of 12

File: C:\UWRT\火星探测器2021\硬件\项目\电源\分布板\Rev2\SH3 - 24V BUCK-BOOST CONVERTER.SchD

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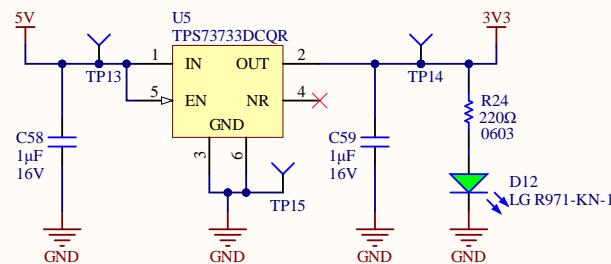
A

A

B

B

## 5V to 3.3V LDO (Max 1A)



### Current Calculations

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

C

C

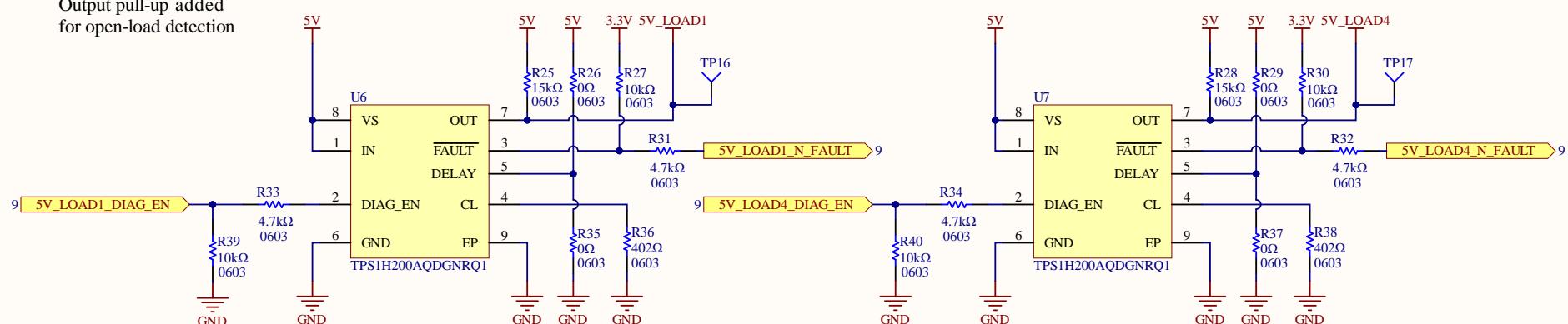
D

D

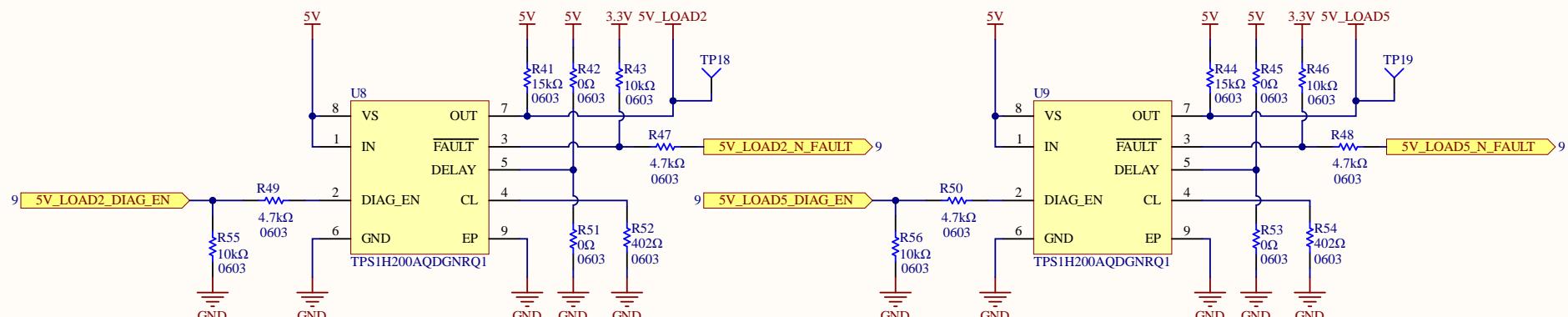
Title Power Distribution Board Rev2 - 3.3V Linear		<i>UW Robotics</i> 200 University Avenue Waterloo Ontario Canada N2L 3G6
Size: Letter	Drawn By: Cindy Li	
Date: 2020-11-08	Sheet 6 of 12	
File: C:\UWRT\MarsRover2021-hardware\Projects\Power Distribution Board\Rev2\SH6 - 3.3V LINEAR REGULATOR.SchDoc		<b>UW ROBOTICS TEAM</b>

## 5V Loads Smart Switches

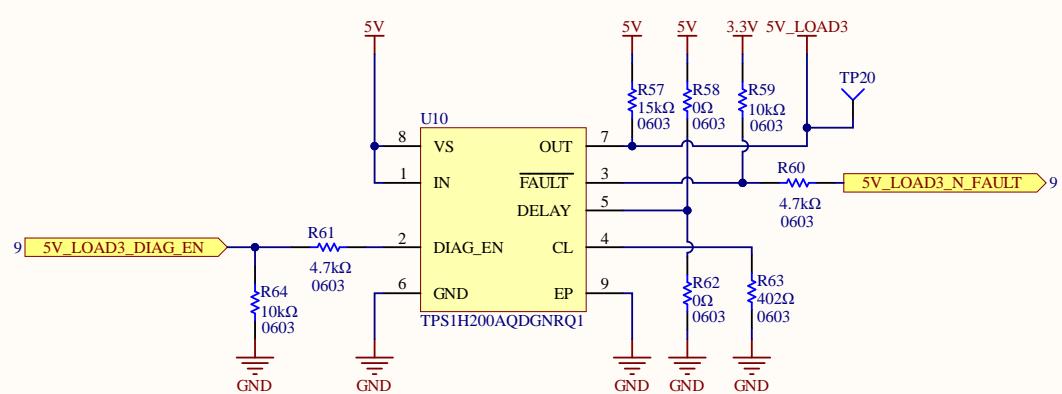
A  
Output pull-up added for open-load detection



B



C



D

### Smart Switch Current Limited to 5A

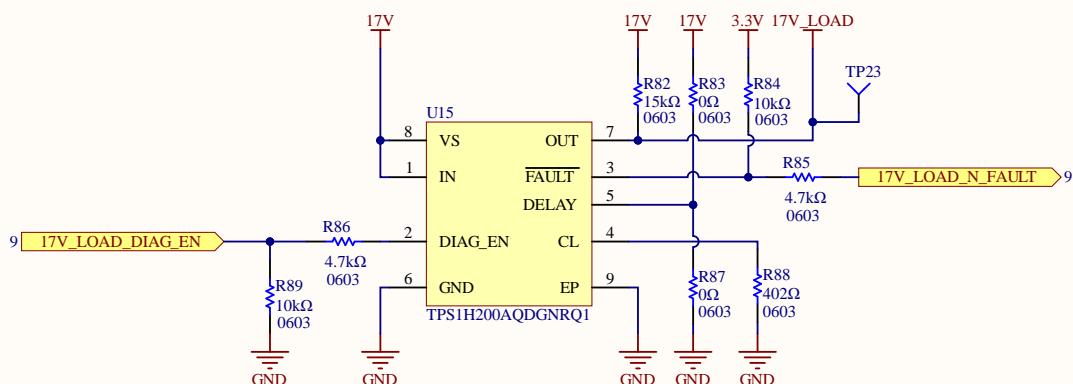
- $I_{out} = 5A$ ,  $V_{CL(th)} = 0.8V$ ,  $K_{CL} = 2500$  (values from datasheet)
- $R_{CL} = V_{CL(th)} * K_{CL} / I_{out} = 0.8 * 2500 / 5 = 400\Omega \rightarrow$  use  $R_{CL} = 402\Omega$

### Current Limit Configurations - Refer to DELAY Pin

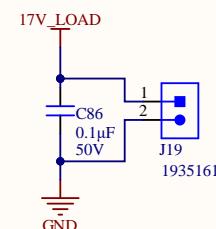
- Holding mode: depopulate pull-up and populate pull-down with a  $0\Omega$  resistor
- Latch-off mode: depopulate pull-up and populate pull-down with a capacitor or resistor (calculated based on required delay time)
- Auto-retry mode: populate pull-up with a pull-up resistor and depopulate pull-down

A

## 17V Load Smart Switch

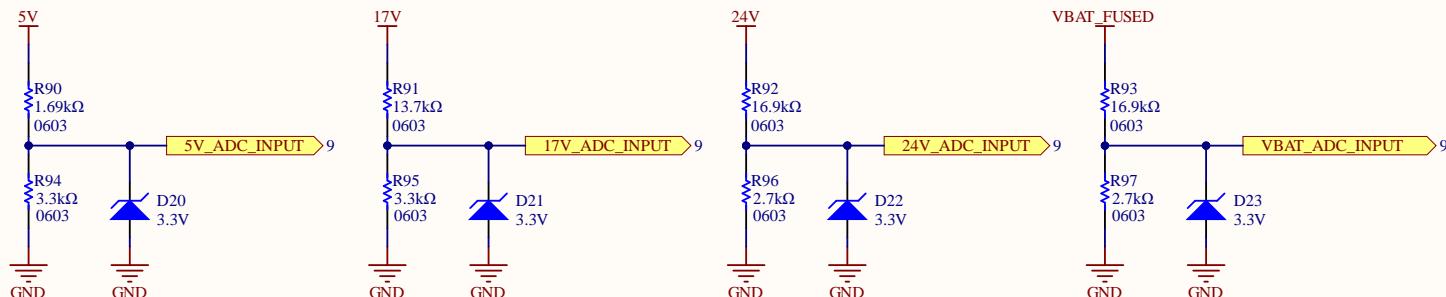


## 17V Output



B

## Power Rail Voltage Monitoring



Divides 5V to 3.3V

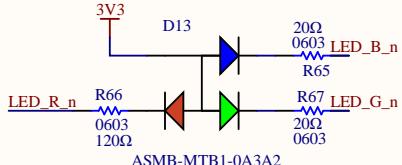
Divides 17V to 3.3V

Divides 24V to 3.3V

Divides 24V to 3.3V

D

## Status LED

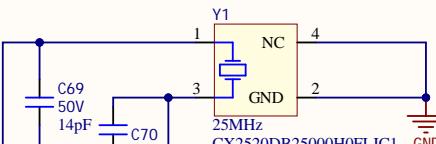


## Current Calculations

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

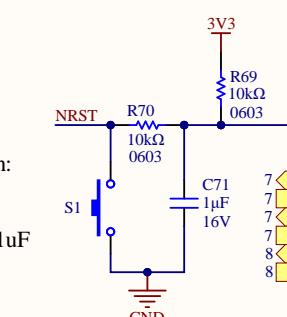
## STM32F446RET6



## Debounce Calculation:

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

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



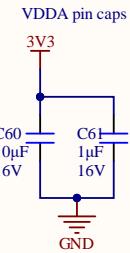
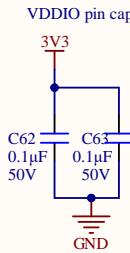
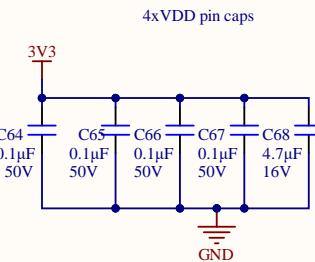
RS-485\_UART: 12 → RS-485\_UART → RS-485\_RX → RS-485\_TX → 10 → N\_USB\_RESET

3V3 → R71 → 0603 10K → BUTTON\_1 → LED\_G\_n, LED\_B\_n, LED\_R\_n

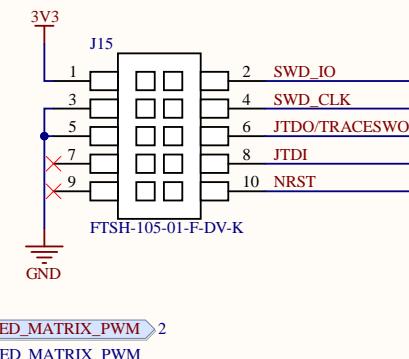
C73 → 1μF 16V → S2 → USB\_USART: 10 → CANA\_UART: 11 → CANA\_UART: 11 → CAN\_RX\_A, CAN\_TX\_A, SWD\_IO, SWD\_CLK, JTDO, JTDI

STM32F446RET6 pinout details:  
 PH0-OSC\_IN(PH0), PH1-OSC\_OUT(PH1), NRST  
 PC0, PC1, PC2, PC3, PC4, PC5, PC6, PC7, PC8, PC9, PC10, PC11, PC12, PC13, PC14, PC15  
 PB0, PB1, PB2-BOOT1(PB2), PB3(JTDO/TRACESWO), PB4(NJTRST), PB5, PB6, PB7, PB8, PB9, PB10, PB11, PB12, PB13, PB14, PB15  
 VCAP\_1, VBAT, VDD, VDDA, VSS, VSSA  
 MH1, MH2, MH3, MH4

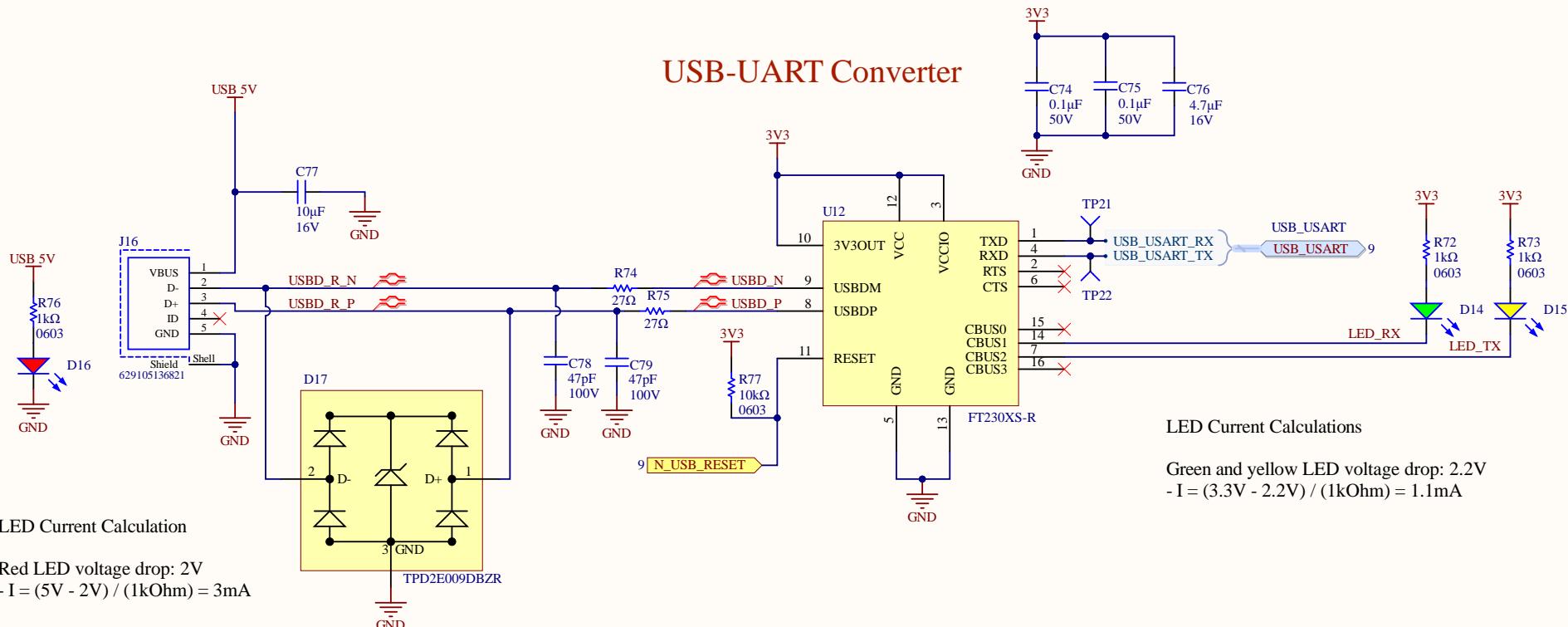
## Decoupling Caps



## Debug/Programming

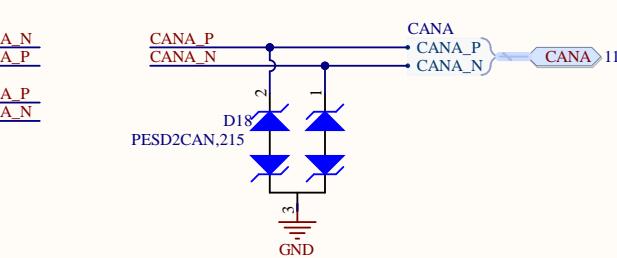


## USB-UART Converter

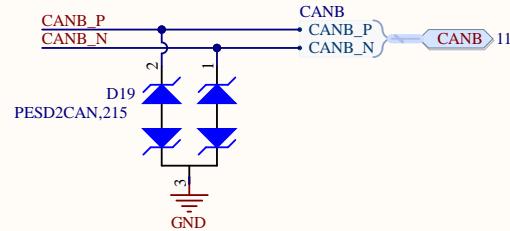


Title Power Distribution Board Rev2 - USB		UW Robotics
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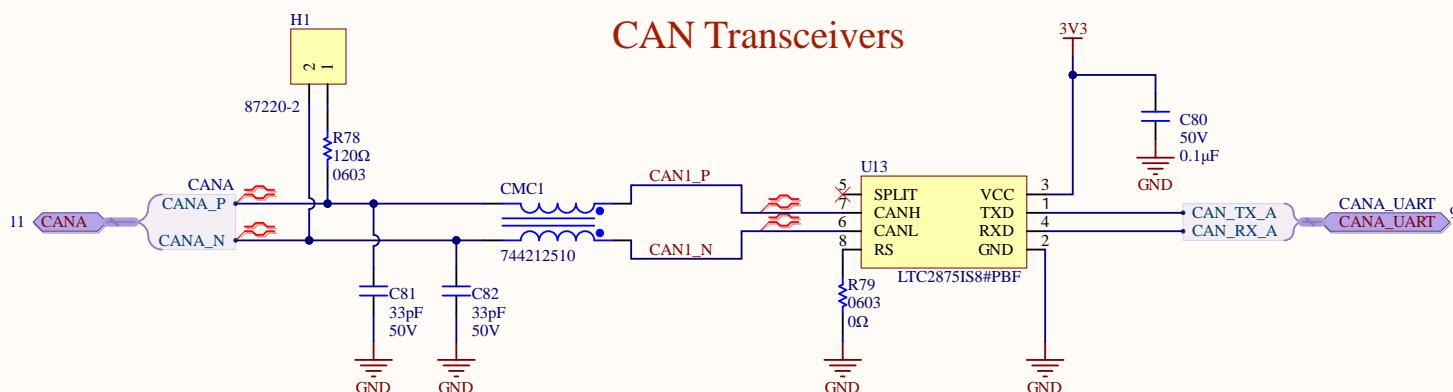
## CAN BUS A



## CAN BUS B



## CAN Transceivers



A

A

B

B

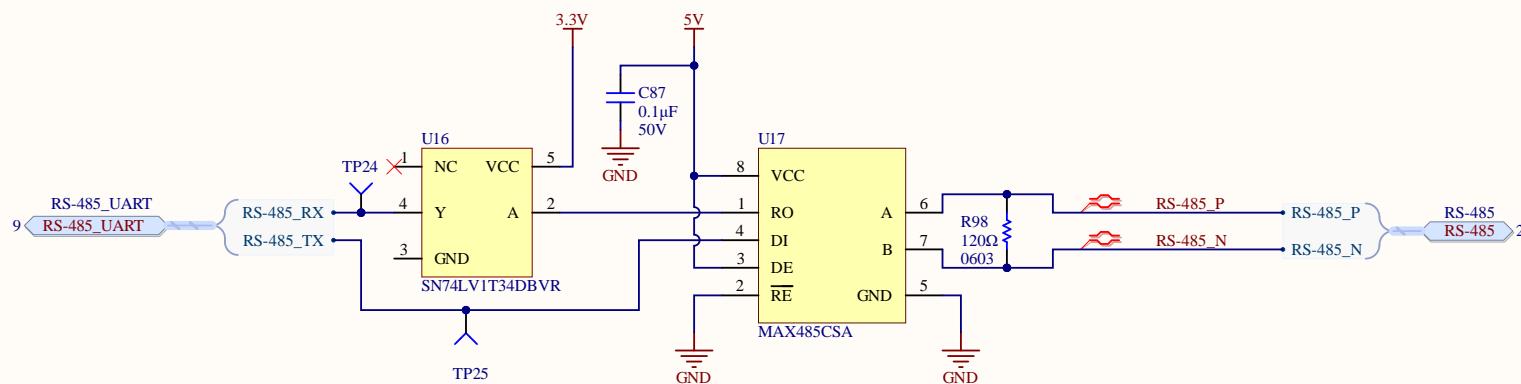
C

C

D

D

## RS-485 Transceiver



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