

A

A

B

B

C

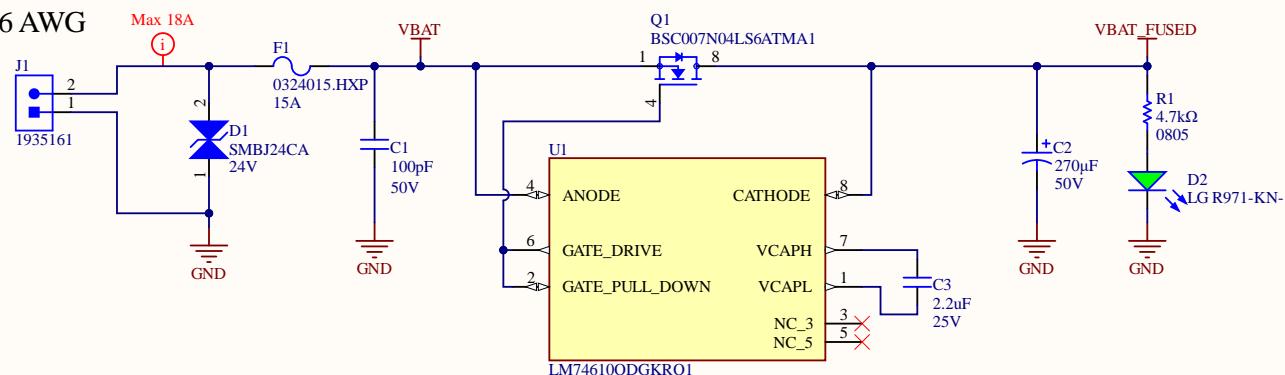
C

D

D

## Battery Input (6s1p)

12-26 AWG



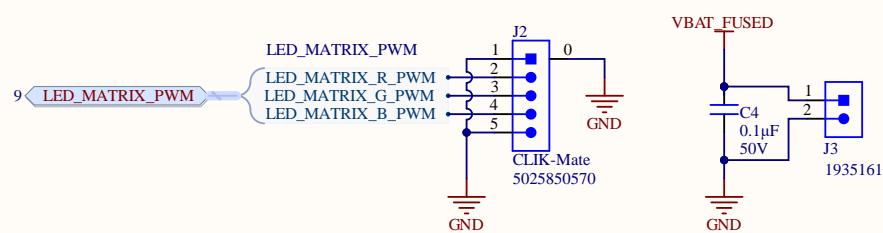
## Ideal Diode Controller

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

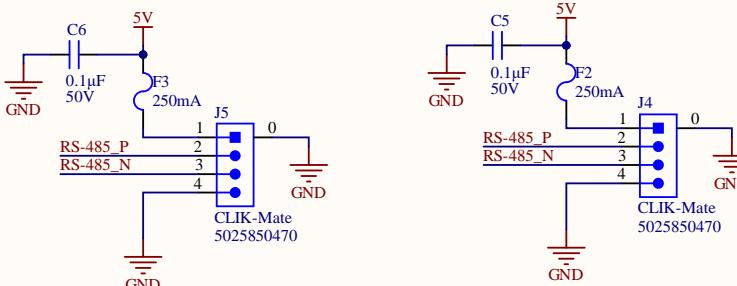
Max LED current =  $(24-2)/4700 = 4.7\text{mA}$   
Min LED current =  $(18-2)/4700 = 3.4\text{mA}$

Title Power Distribution Board Rev2 - Power		UW Robotics 200 University Avenue Waterloo Ontario Canada N2L 3G6	UW ROBOTICS TEAM
Size: Letter	Drawn By: Cindy Li		
Date: 2020-11-13	Sheet 1 of 11		
File: C:\UWRT\MarsRover2021-hardware\Projects\Power Distribution Board\Rev2\SH1 - POWER.SchDoc			

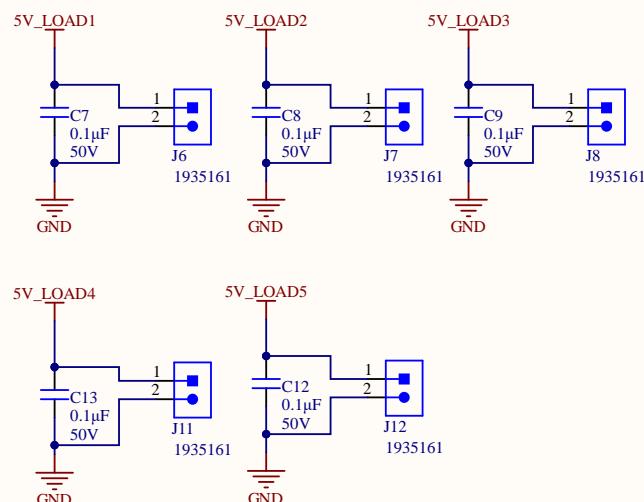
## LED Matrix



## URM04 Ultrasonic Sensors



## 5V Output



## Mounting Holes

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

RS-485 connection:

```

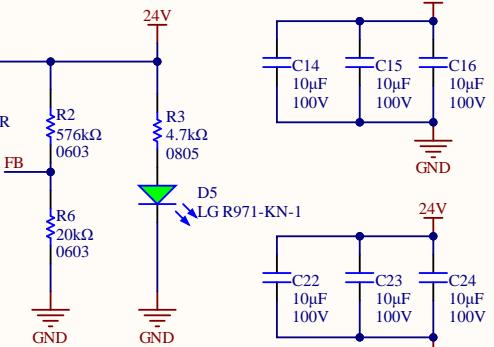
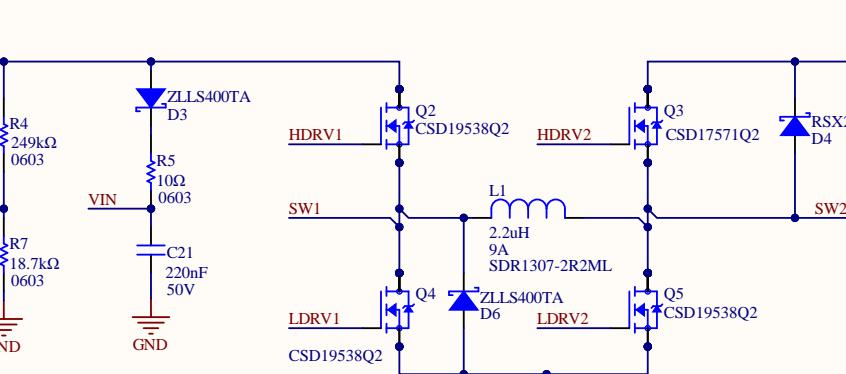
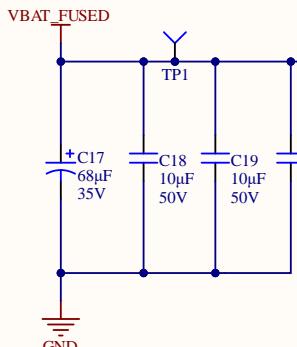
    11 RS-485 --- RS-485_P
                    RS-485_N
  
```

Input voltage range: 18-25.8V

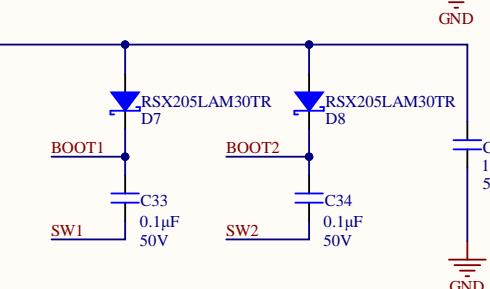
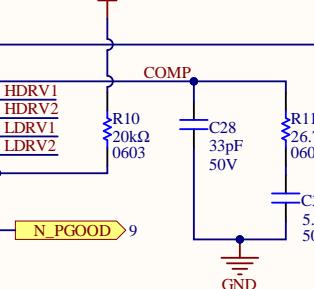
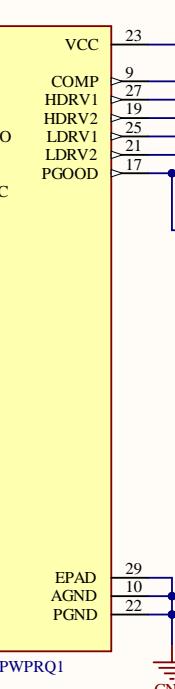
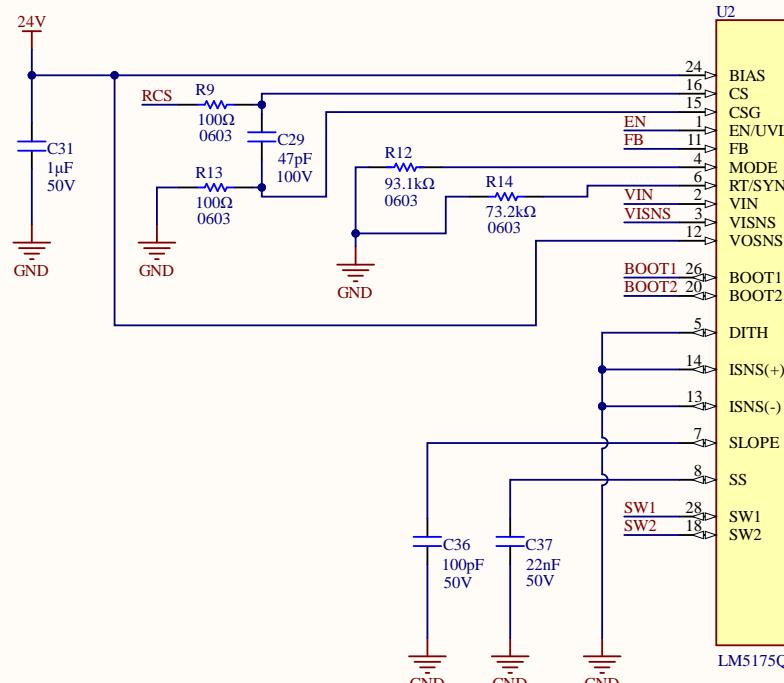
## 24V Buck-Boost Converter @ 3A Max

LED forward drop = 2.0V

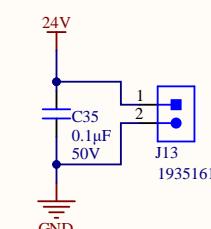
LED current =  $(24-2)/4700 = 4.7mA$



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



## 24V Output



Title PDB Rev2 - 24V Buck-Boost Converter

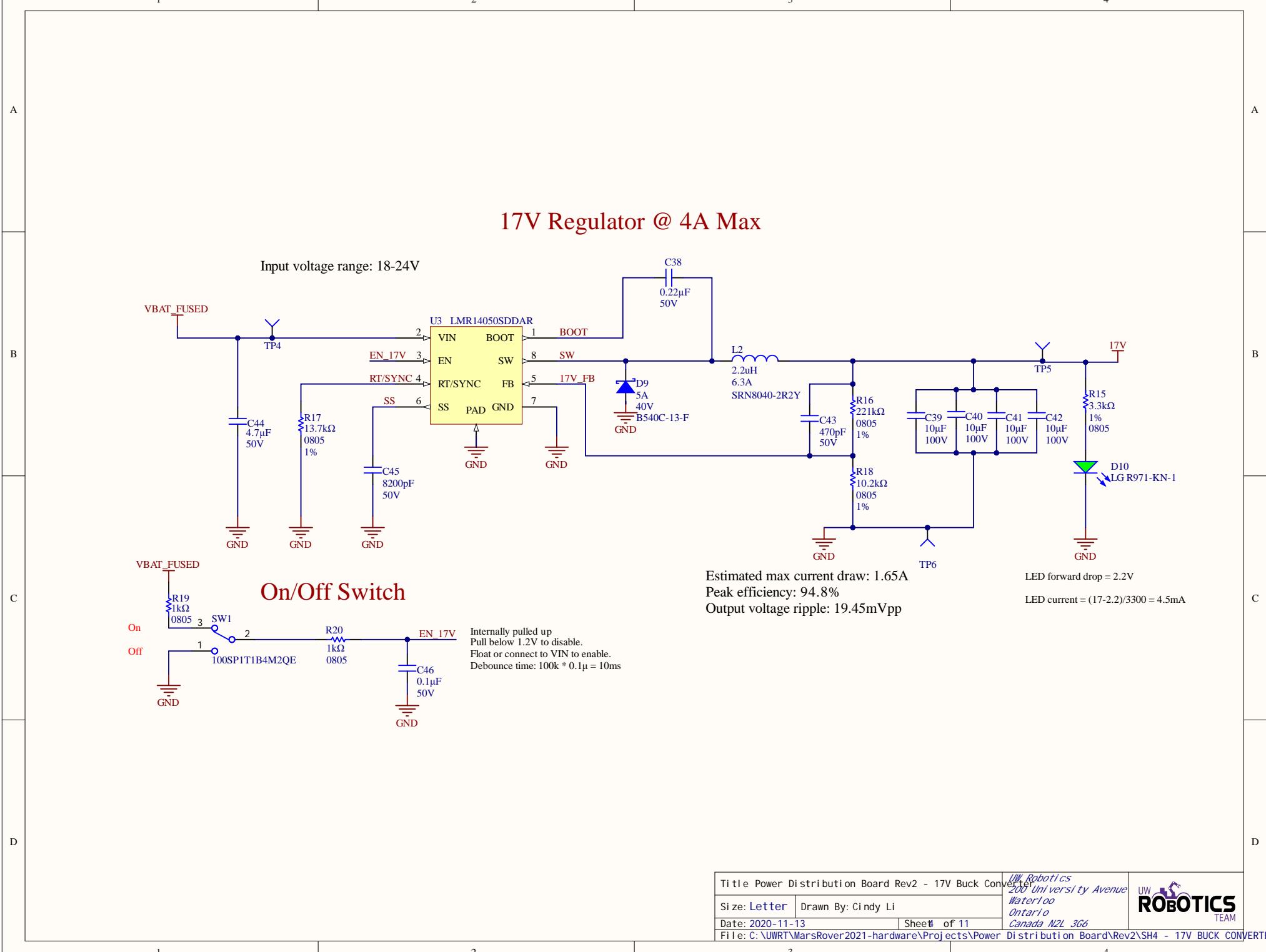
Size: Letter Drawn By: Cindy Li

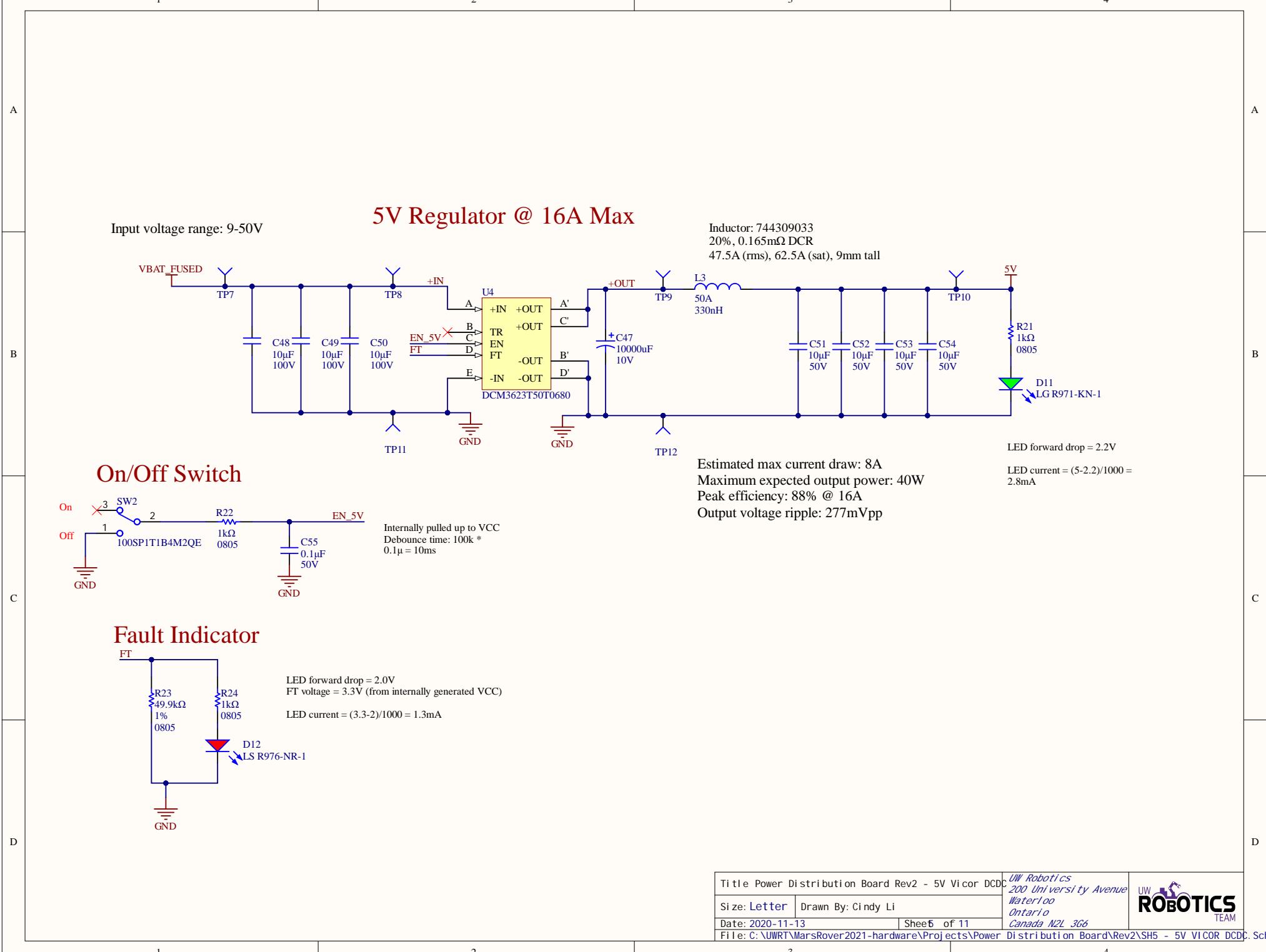
Date: 2020-11-13 Sheet 8 of 11

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

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A

A

B

B

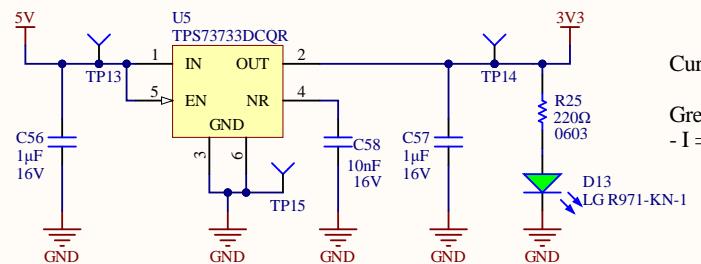
C

C

D

D

## 5V to 3.3V LDO @ 1A Max



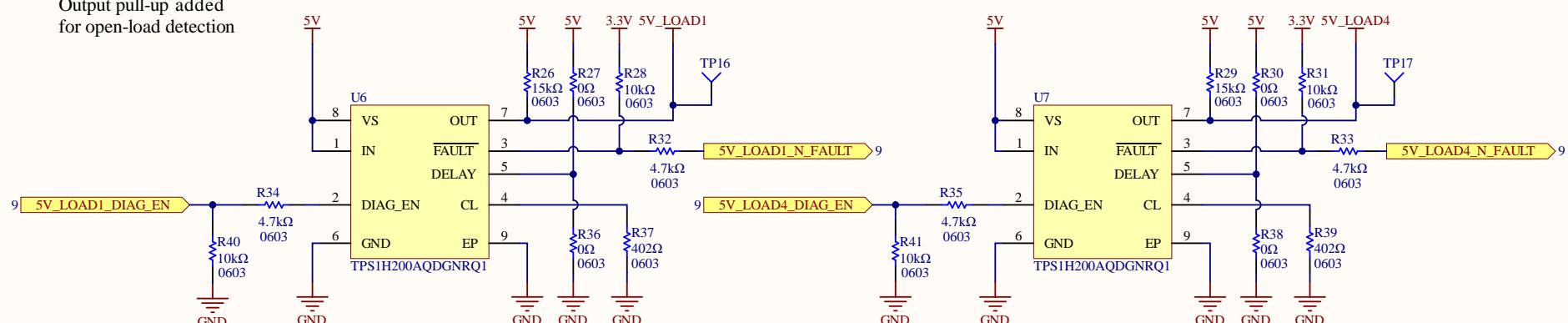
### Current Calculations

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

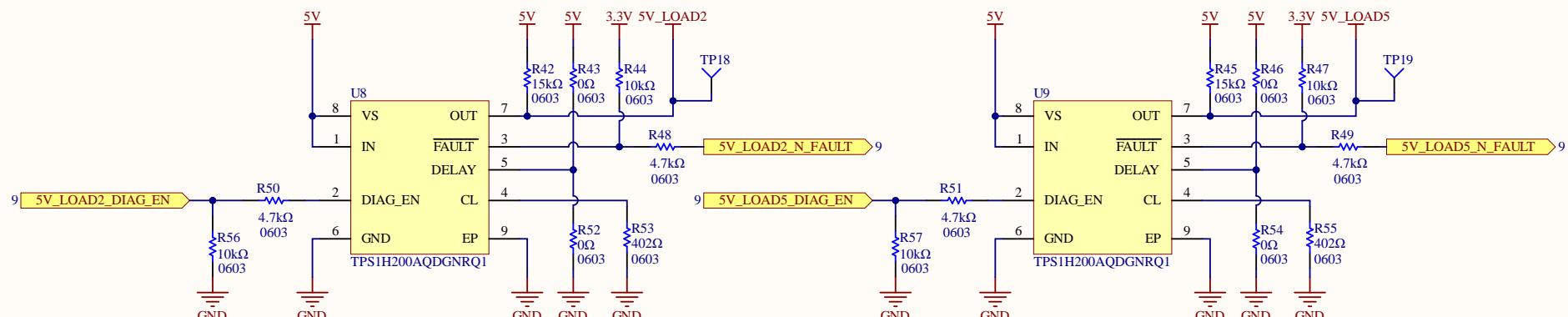
Title Power Distribution Board Rev2 - 3.3V Linear		UW Robotics 200 University Avenue Waterloo Ontario Canada N2L 3G6	UW ROBOTICS TEAM
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Date: 2020-11-13	Sheet 6 of 11		
File: C:\UWRT\MarsRover2021-hardware\Projects\Power Distribution Board\Rev2\SH6 - 3.3V LINEAR REGULATOR.SchDoc			

## 5V Loads Smart Switches

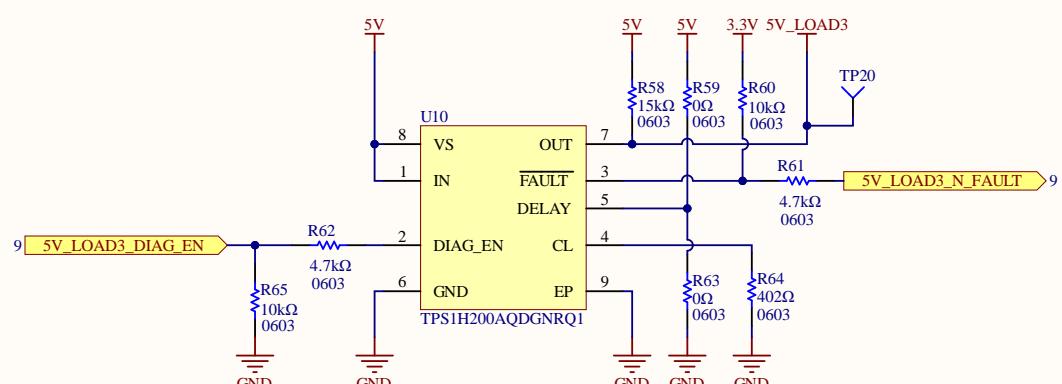
A  
Output pull-up added for open-load detection



B



C



### Smart Switch Current Limited to 5A

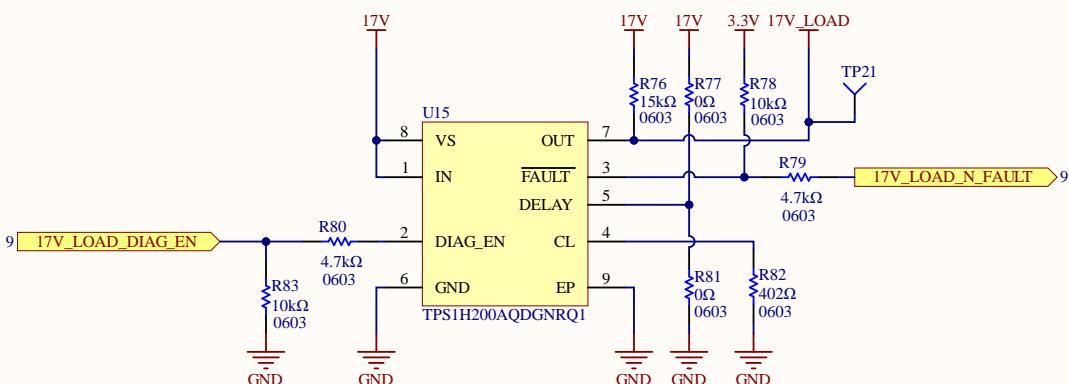
- $I_{out} = 5A$ ,  $V_{CL(th)} = 0.8V$ ,  $K_{CL} = 2500$  (values from datasheet)
- $R_{CL} = V_{CL(th)} * K_{CL} / I_{out} = 0.8 * 2500 / 5 = 400\Omega \rightarrow$  use  $R_{CL} = 402\Omega$

### Current Limit Configurations - Refer to DELAY Pin

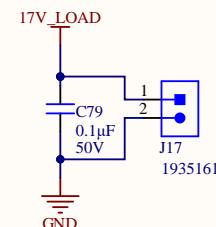
- Holding mode: depopulate pull-up and populate pull-down with a  $0\Omega$  resistor
- Latch-off mode: depopulate pull-up and populate pull-down with a capacitor or (calculated based on required delay time)
- Auto-retry mode: populate pull-up with a pull-up resistor and depopulate pull-down

A

## 17V Load Smart Switch

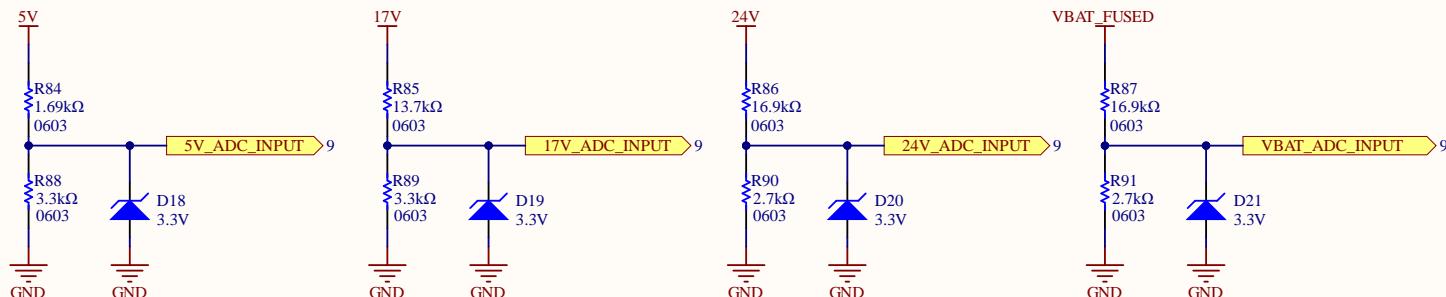


## 17V Output



B

## Power Rail Voltage Monitoring



Divides 5V to 3.3V

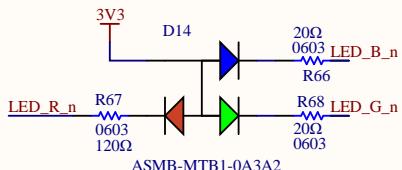
Divides 17V to 3.3V

Divides 24V to 3.3V

Divides 24V to 3.3V

D

## Status LED

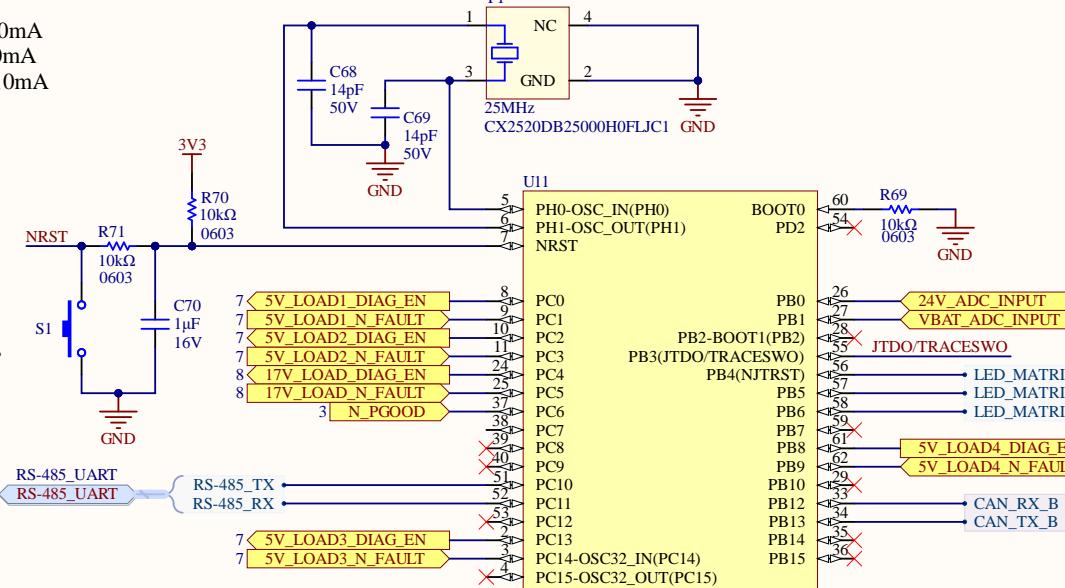


## Current Calculations

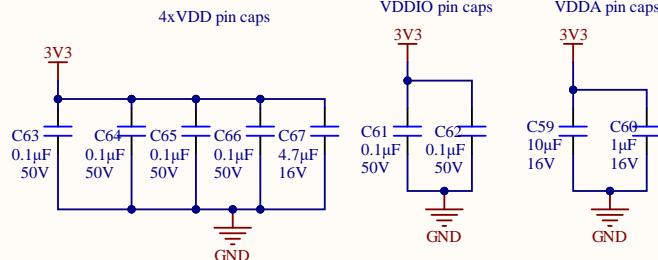
### RGB LED voltage drops:

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

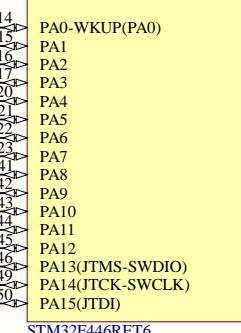
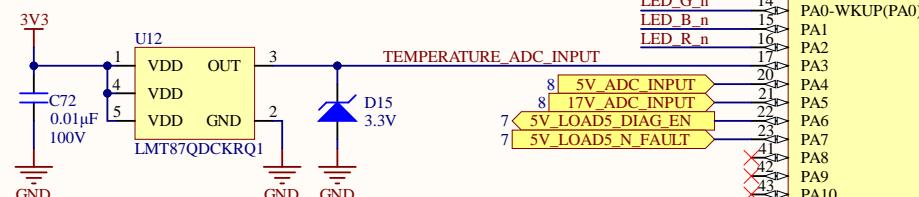
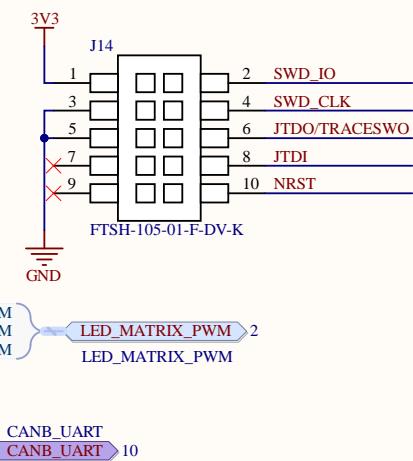
## STM32F446RET6



## Decoupling Caps



## Debug/Programming



Title Power Distribution Board Rev2 - MCU

Size: Letter Drawn By: Cindy Li

Date: 2020-11-13 Sheet 9 of 11

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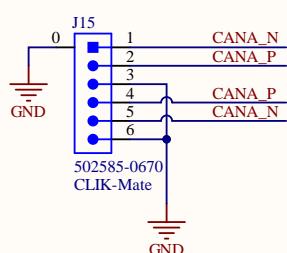
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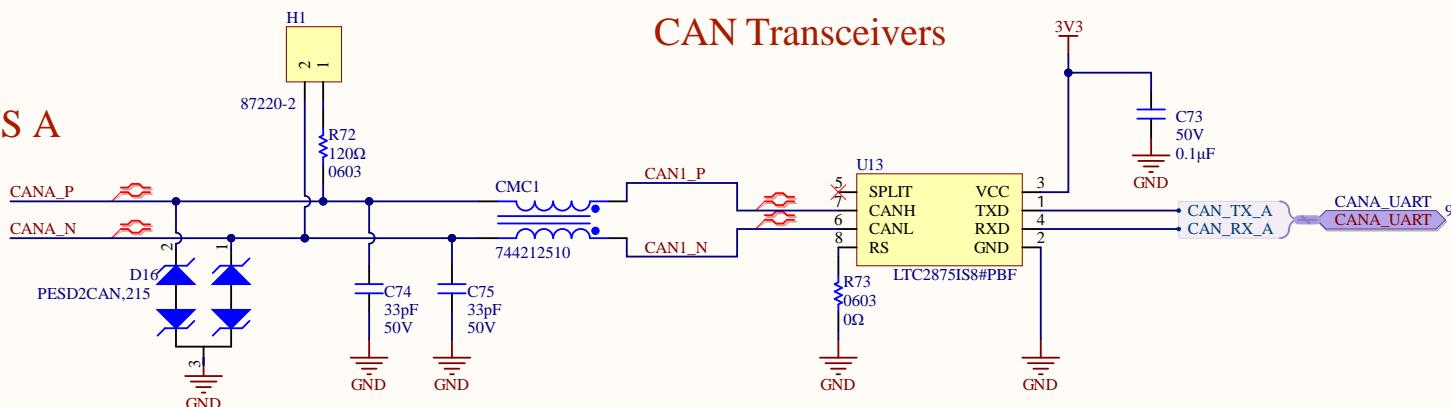
A

A

CAN BUS A



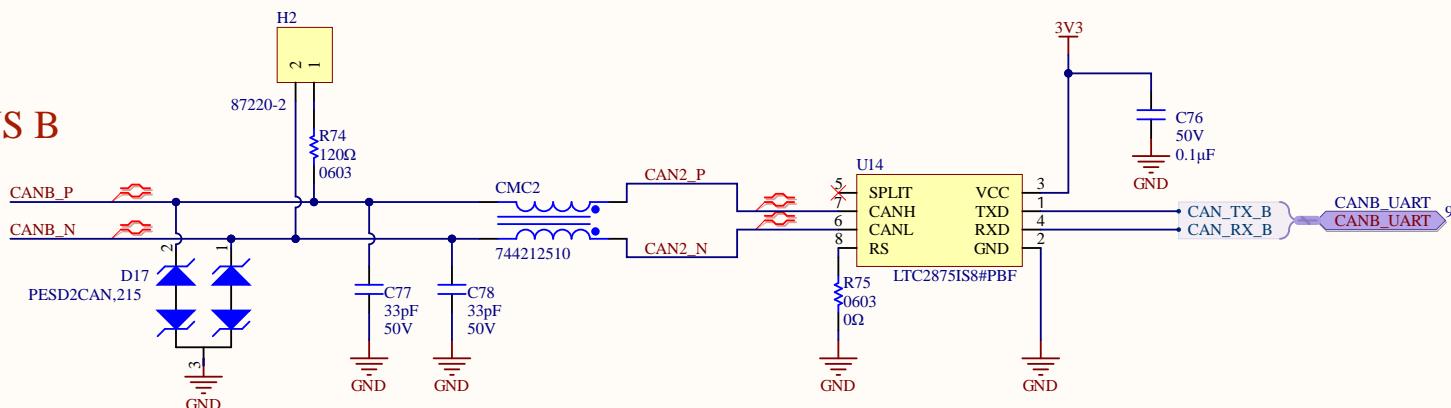
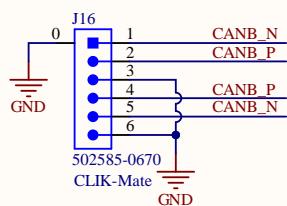
## CAN Transceivers



B

1

CAN BUS B



1

1

D

1

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Size:	Letter	Drawn By: Cindy Li		
Date:	2020-11-13	Sheet 0 of 11		
File:	C:\UWRT\MarsRover2021-hardware\Projects\Power		Distribution Board\Rev2\SH10 - CAN.SchDoc	

A

A

B

B

C

C

D

D

## RS-485 Transceiver

