

A

A

B

B

C

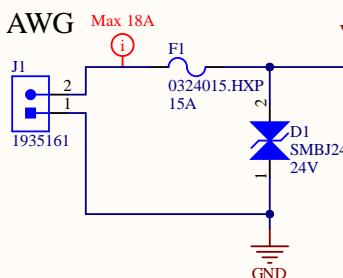
C

D

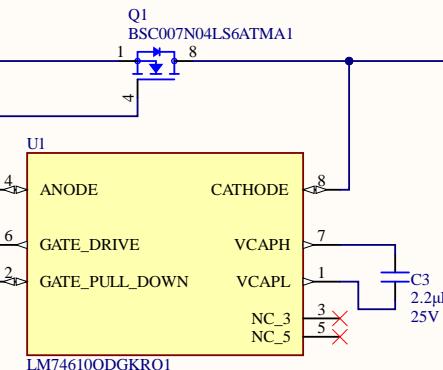
D

## Battery Input (6s1p)

12-26 AWG



## Ideal Diode Controller



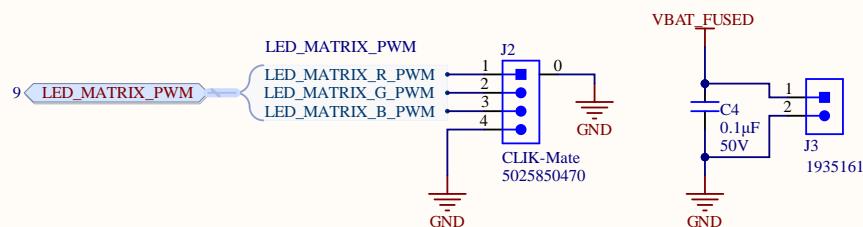
LED forward drop = 2.0V  
Max VBAT = 24V  
Min VBAT = 18V

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		Altium Limited L3, 12a Rodborough Rd Frenchs Forest NSW Australia 2086	UW ROBOTICS TEAM
Size: Letter	Drawn By: Cindy Li		
Date: 2020-11-07	Sheet 1 of 12		
File: C:\Users\lance\GitHub\MarsRover2020-PCB\Projects\Power Distribution Board\Rev2\SH1 - POWER.SchDoc			

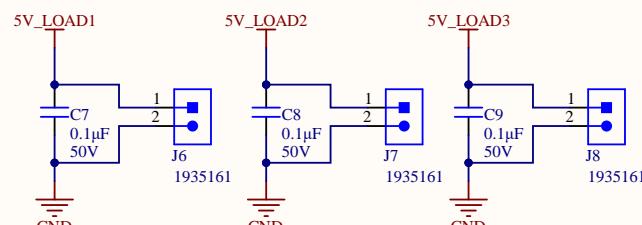
A

## LED Matrix

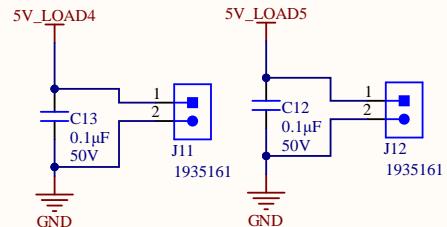


B

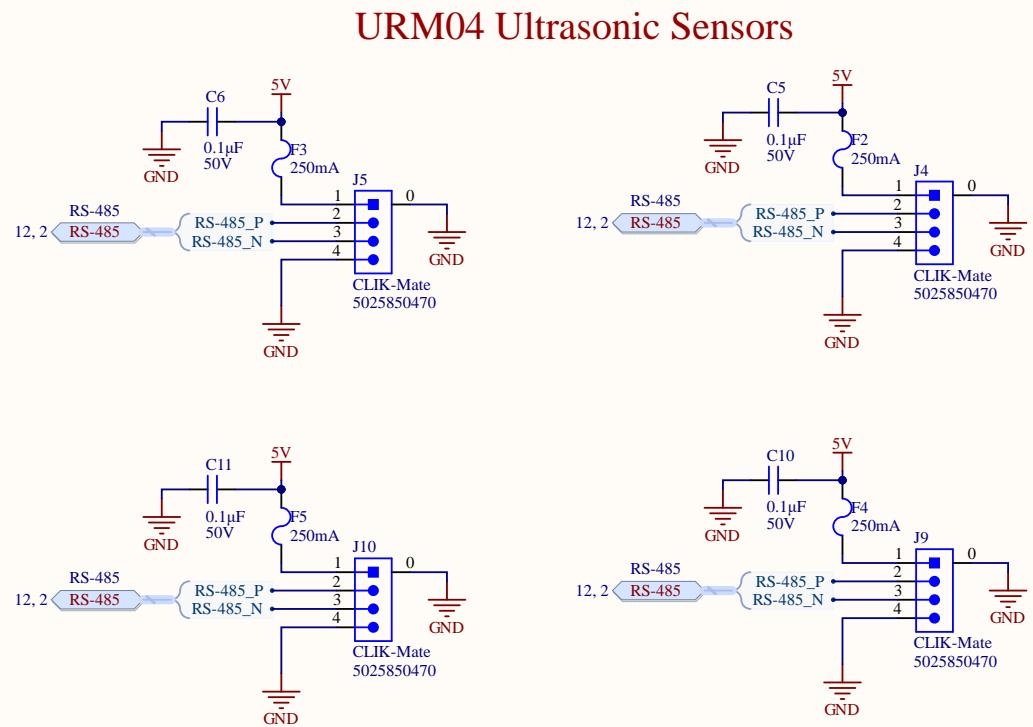
## 5V Output



C

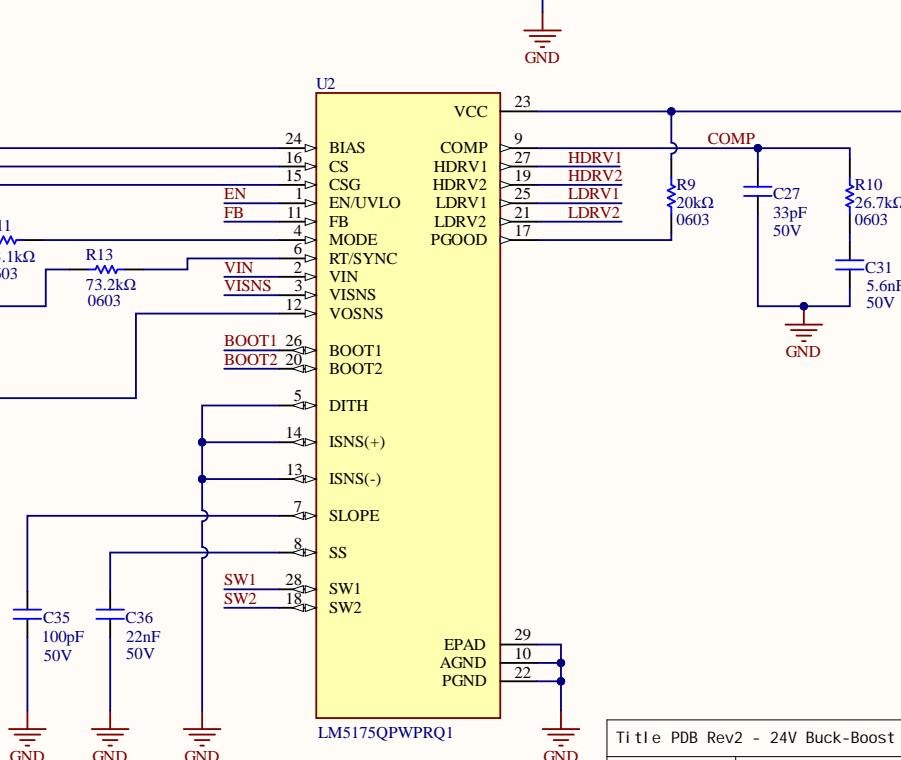
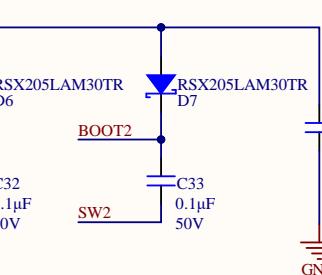
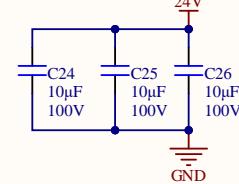
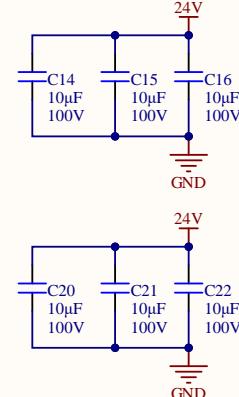
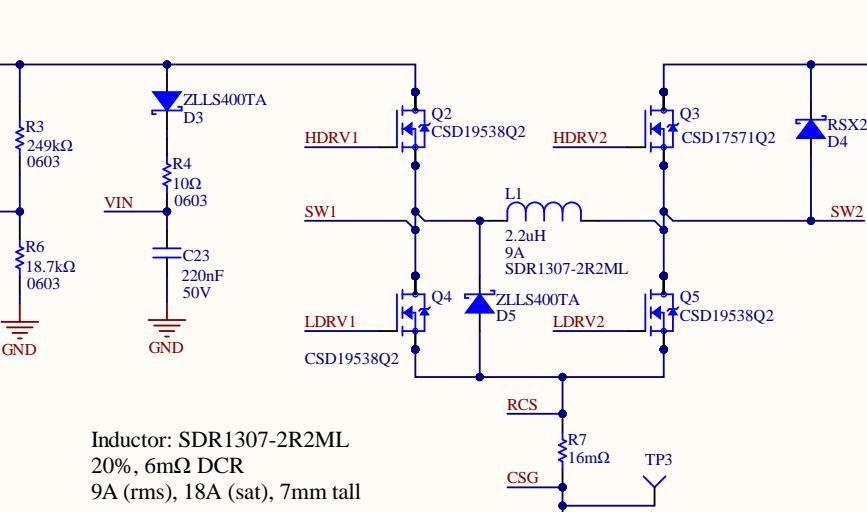
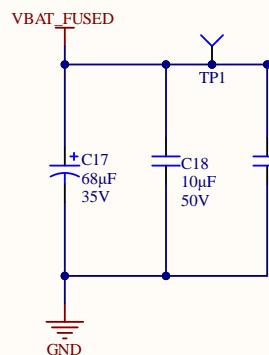


D

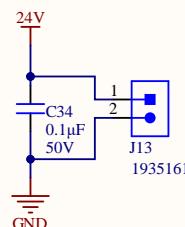


Input voltage range: 18-25.8V

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



## 24V Output



Title PDB Rev2 - 24V Buck-Boost Converter

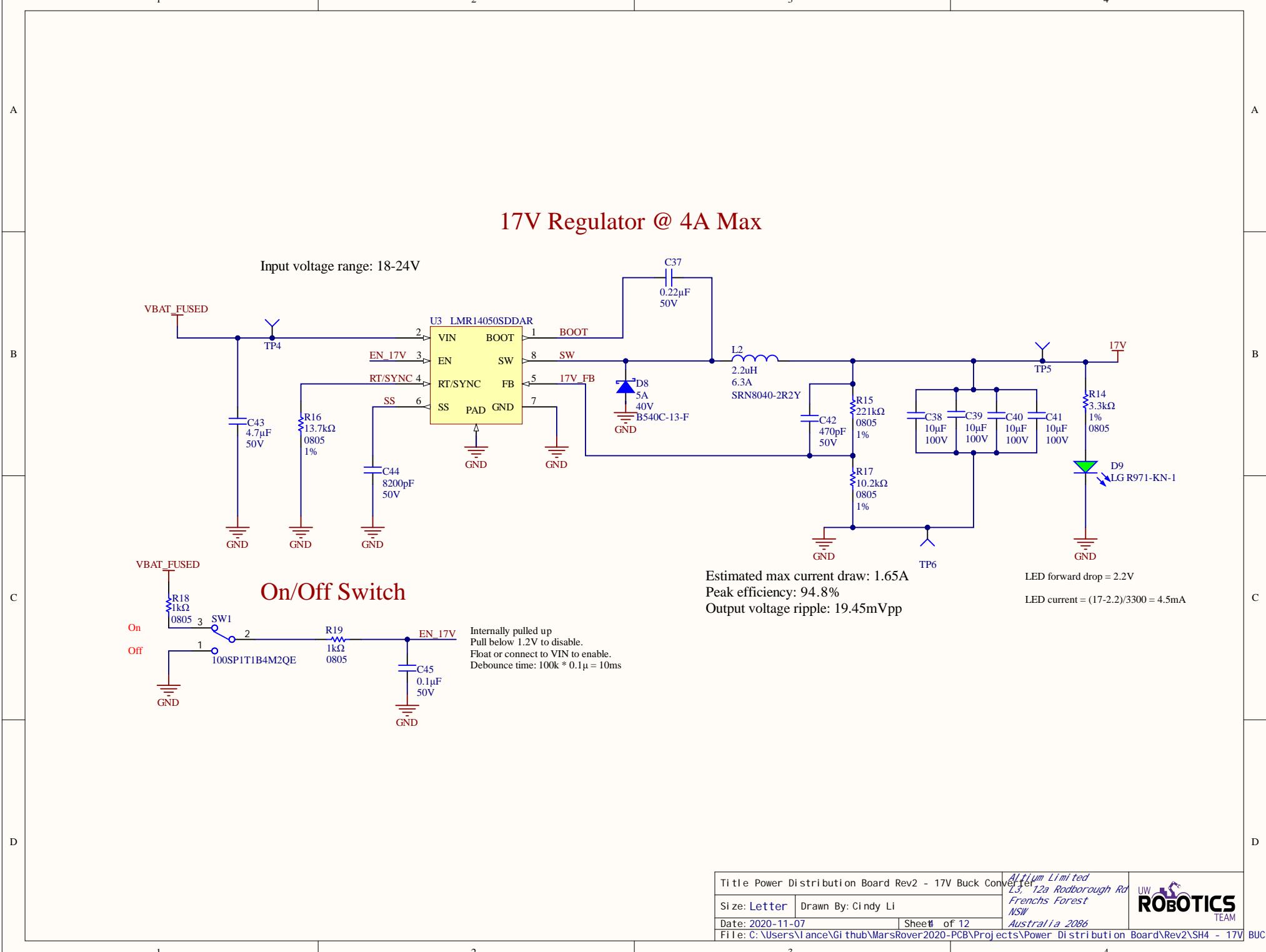
Size: Letter Drawn By: Cindy Li

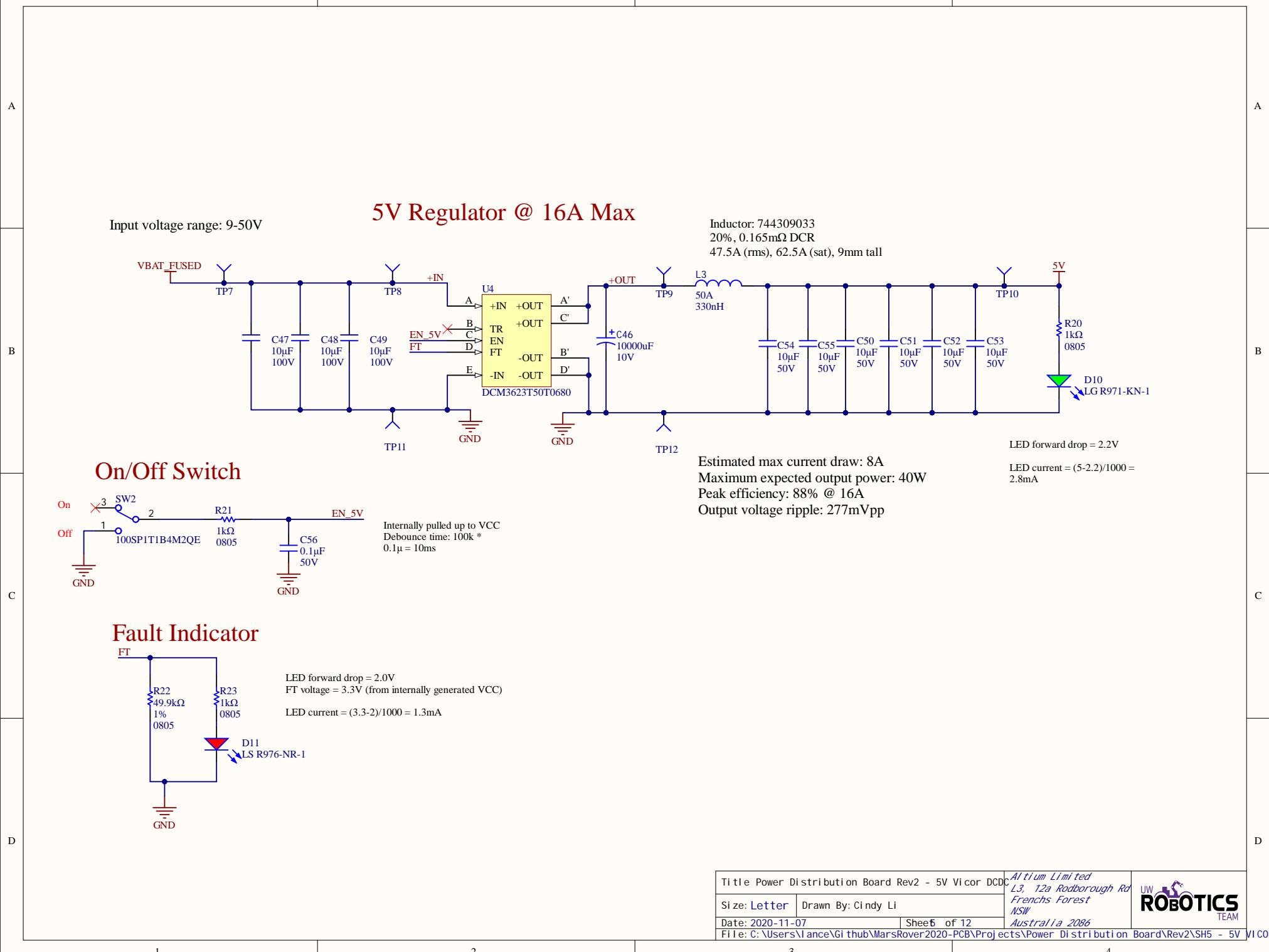
Date: 2020-11-07 Sheet 8 of 12

File: C:\Users\lance\GitHub\MarsRover2020-PCB\Projects\Power Distribution Board\Rev2\SH3 - 24V

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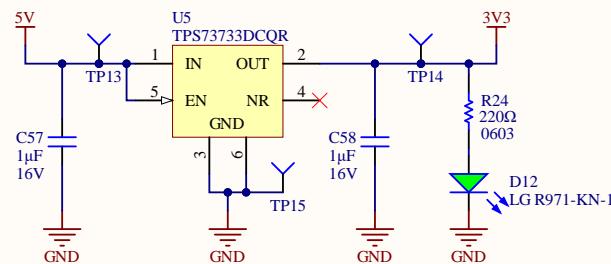
A

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

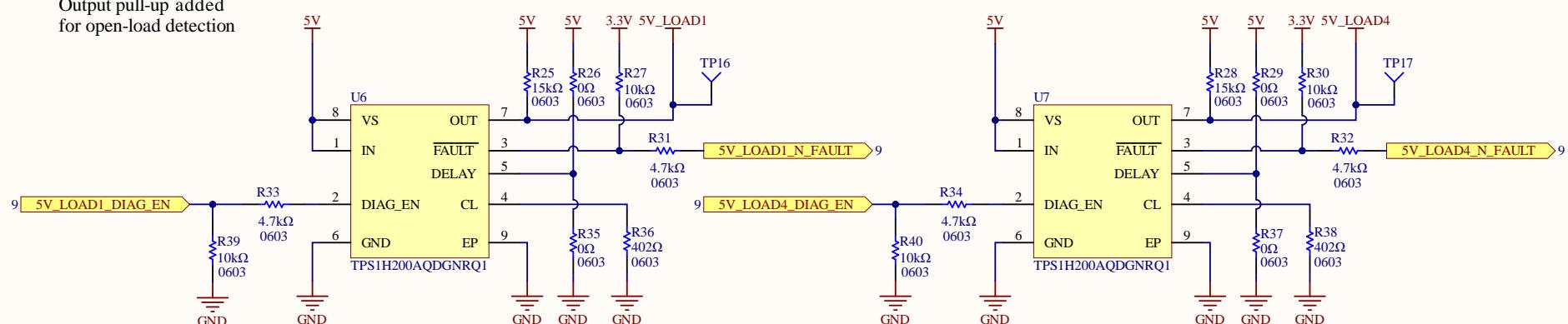
D

D

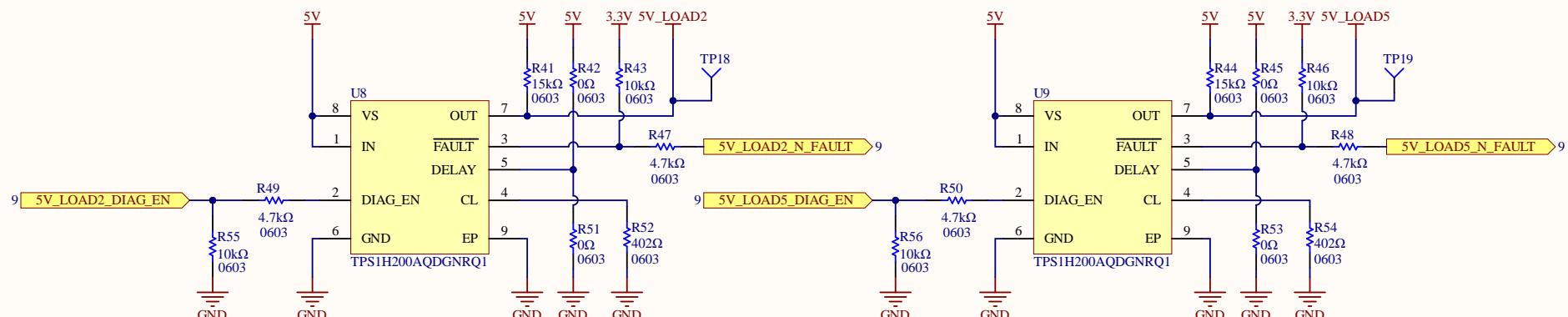
Title Power Distribution Board Rev2 - 3.3V Linear		Altium Limited 23/728 Rodborough Rd Frenchs Forest NSW Australia 2086
Size: Letter	Drawn By: Cindy Li	
Date: 2020-11-07	Sheet 6 of 12	
File: C:\Users\lance\GitHub\MarsRover2020-PCB\Projects\Power Distribution Board\Rev2\SH6 - 3.3V LINEAR REGULATOR		UW ROBOTICS TEAM

## 5V Loads Smart Switches

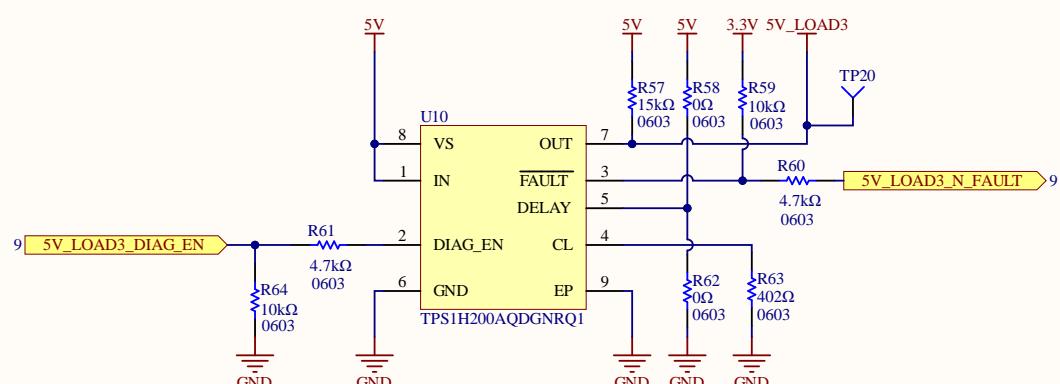
A  
Output pull-up added for open-load detection



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  $R_{CL} = 402\Omega$

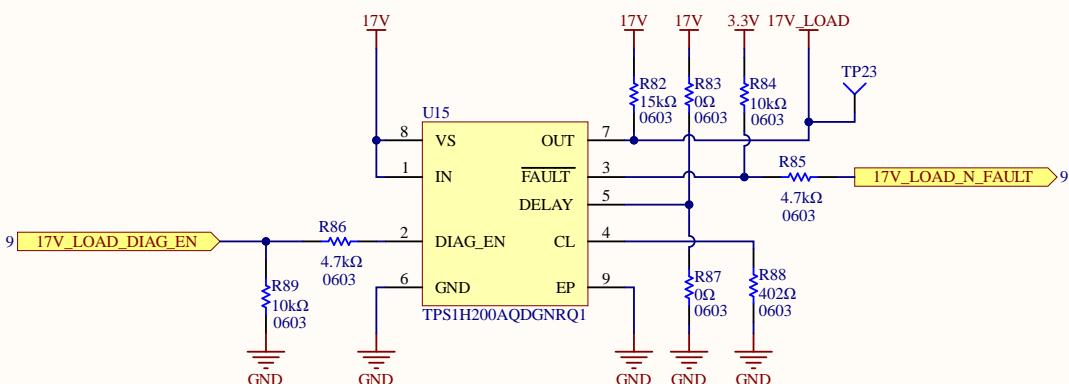
Current Limit Configurations - Refer to DELAY Pin

- Holding mode: depopulate pull-up and populate pull-down with a  $0\Omega$  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

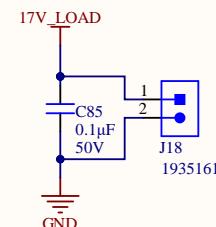
Title: Power Distribution Board Rev2 - Load Monitor	Altium Limited 13, 12a Rodborough Rd Frenchs Forest NSW Australia 2086
Size: Letter	Drawn By: Cindy Li
Date: 2020-11-07	Sheet of 12
File: C:\Users\lance\GitHub\MarsRover2020-PCB\Projects\Power Distribution Board\Rev2\SH7 - LOAD MONITORING 1.Sch	

A

## 17V Load Smart Switch

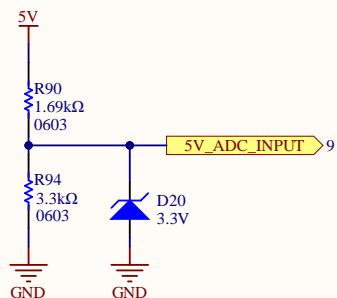


## 17V Output

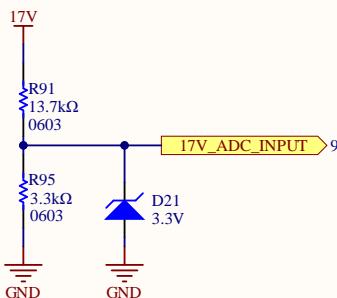


B

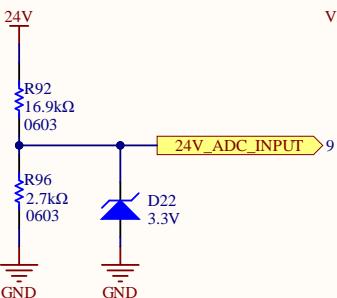
## Power Rail Voltage Monitoring



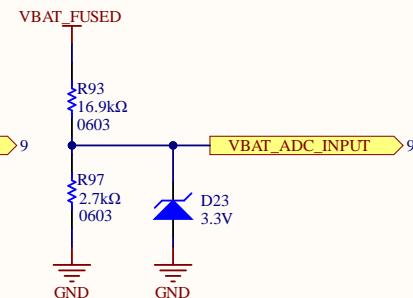
Divides 5V to 3.3V



Divides 17V to 3.3V



Divides 24V to 3.3V



Divides 24V to 3.3V

D

Title: Power Distribution Board Rev2 - Load Monitor	Altium Limited 10-12a Rodborough Rd Frenchs Forest NSW Australia 2086
Size: Letter	Drawn By: Cindy Li
Date: 2020-11-07	Sheet 8 of 12
File: C:\Users\lance\GitHub\MarsRover2020-PCB\Projects\Power Distribution Board\Rev2\SH8 - LOAD MONITORING. SchDoc	UW ROBOTICS TEAM

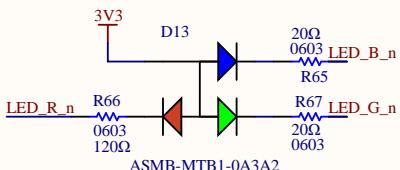
1

2

3

4

## Status LED

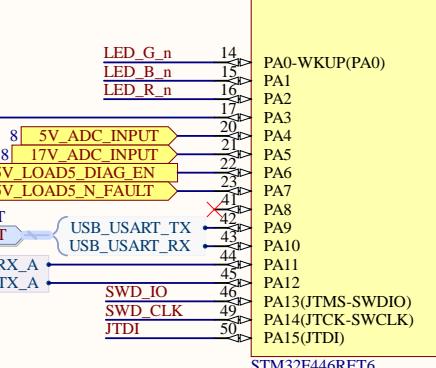
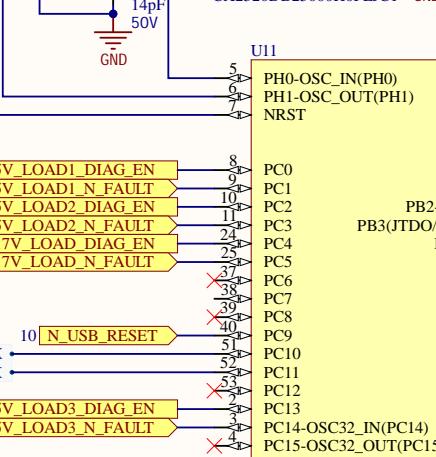
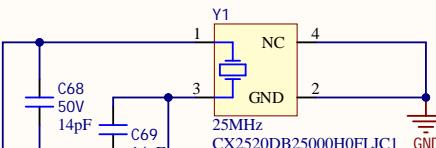


## Current Calculations

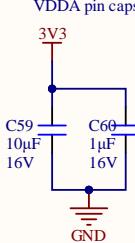
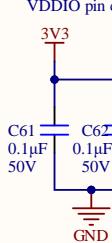
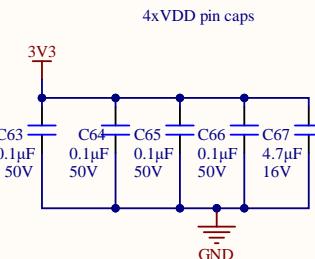
### RGB LED voltage drops:

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

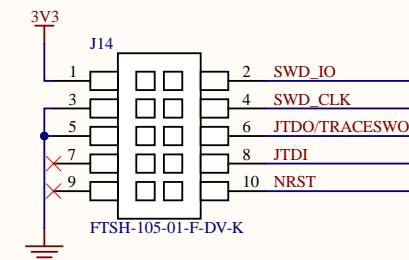
## STM32F446RET6



## Decoupling Caps



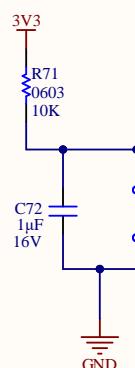
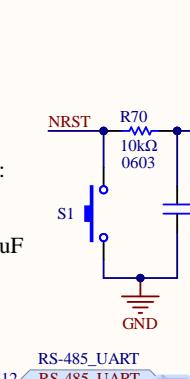
## Debug/Programming



## Debounce Calculation:

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

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



Title Power Distribution Board Rev2 - MCU

Size: Letter Drawn By: Cindy Li

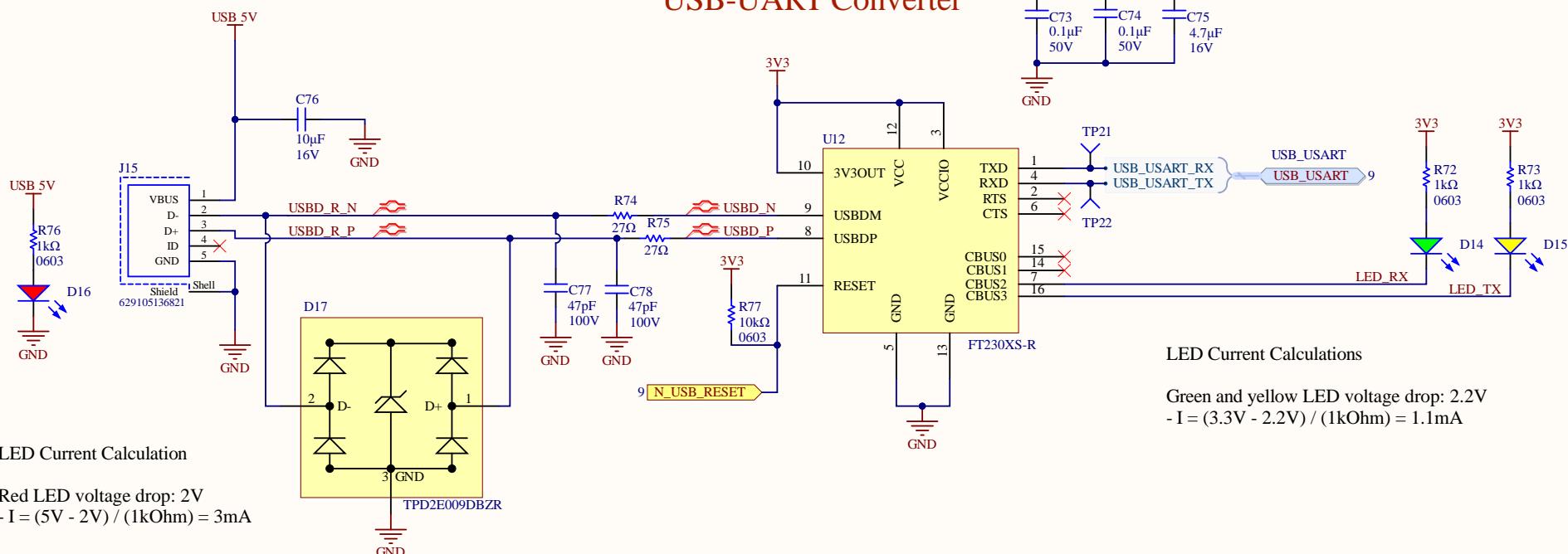
Date: 2020-11-07 Sheet 9 of 12

File: C:\Users\lance\GitHub\MarsRover2020-PCB\Projects\Power Distribution Board\Rev2\SH9 - MI

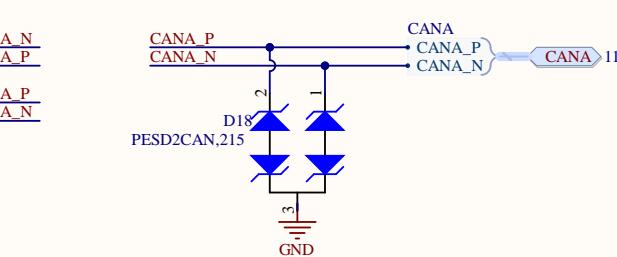
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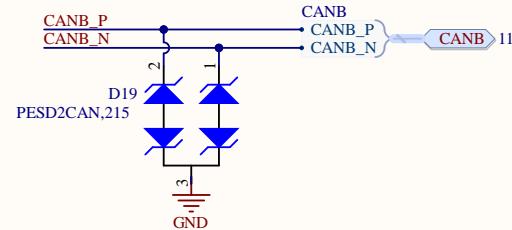
## USB-UART Converter



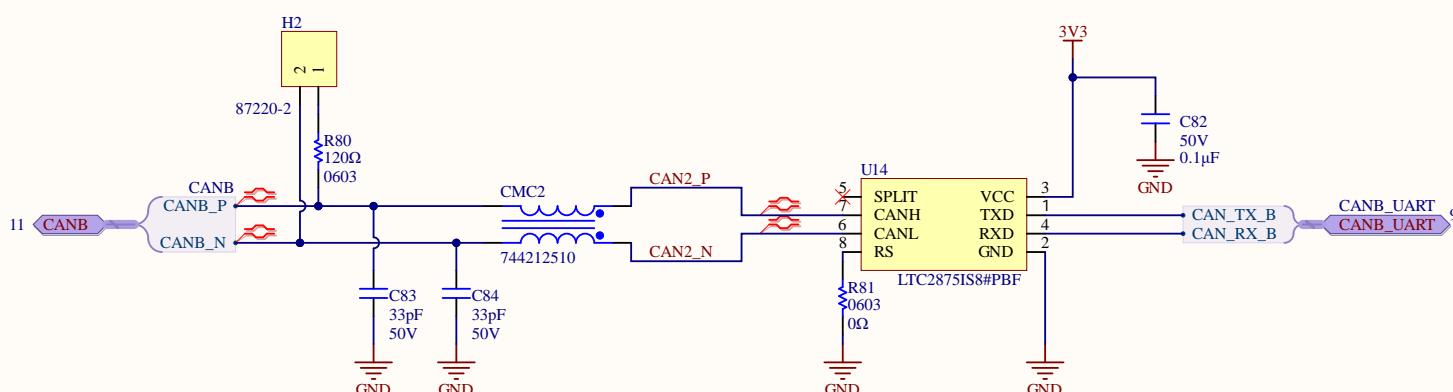
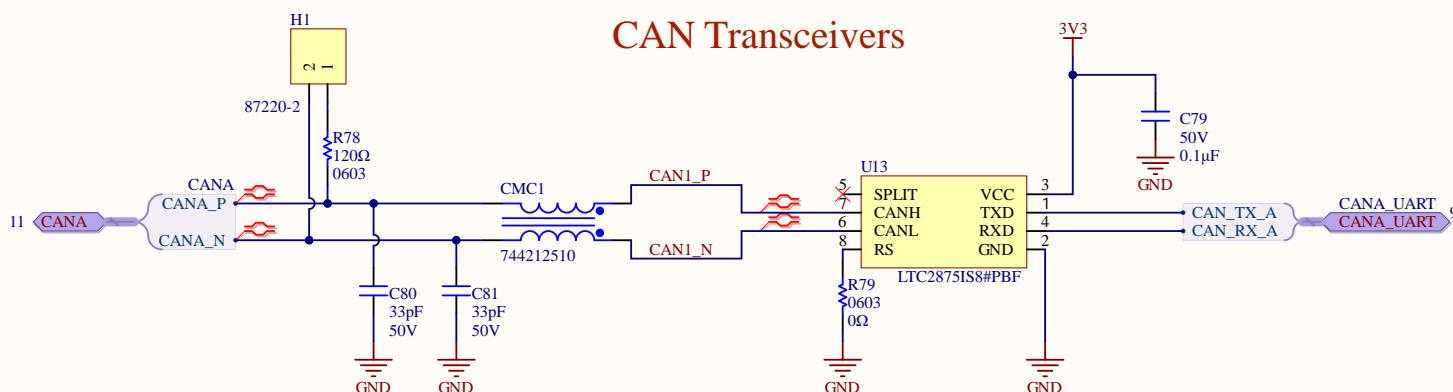
## CAN BUS A



## CAN BUS B



## CAN Transceivers



Title: Power Distribution Board Rev2 - CAN Transceiver	Altium Limited 13, 12a Rodborough Rd Frenchs Forest NSW Australia 2086
Size: Letter	Drawn By: Cindy Li
Date: 2020-11-07	Sheet 1 of 12
File: C:\Users\lance\GitHub\MarsRover2020-PCB\Projects\Power Distribution Board\Rev2\SH11 - CAN.SchDoc	UW ROBOTICS TEAM

## RS-485 Transceiver

Voltage divider on RS-485\_RX line divides 5V to 3.3V  
MAX485 logic high input voltage is 2V

