

A

A

B

B

C

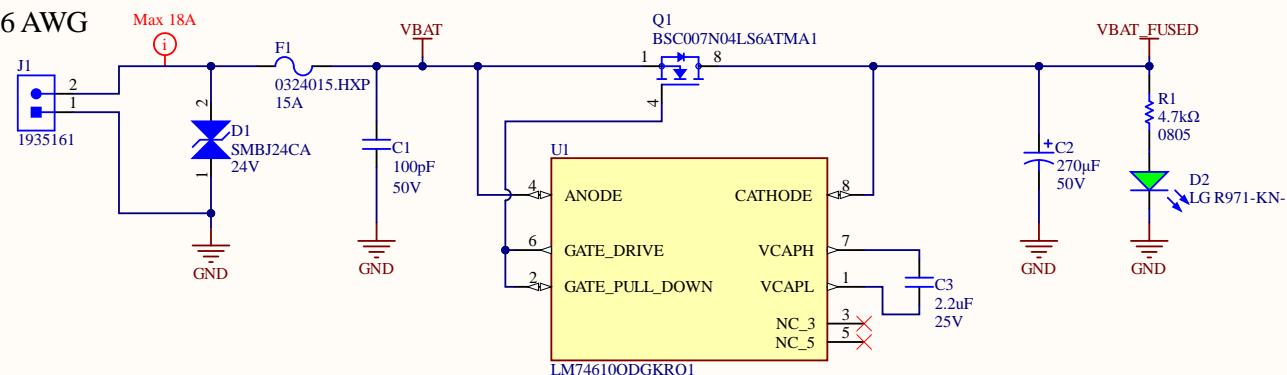
C

D

D

Battery Input (6s1p)

12-26 AWG



Ideal Diode Controller

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

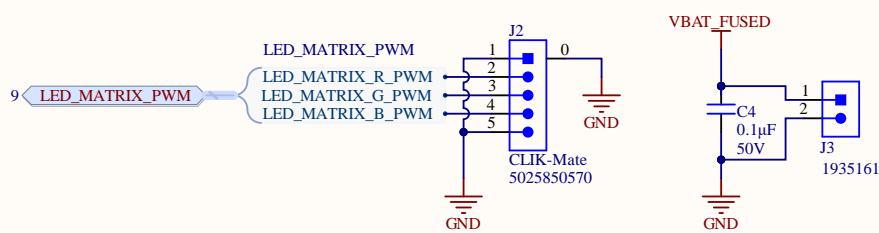
Max LED current = $(24-2)/4700 = 4.7\text{mA}$
Min LED current = $(18-2)/4700 = 3.4\text{mA}$

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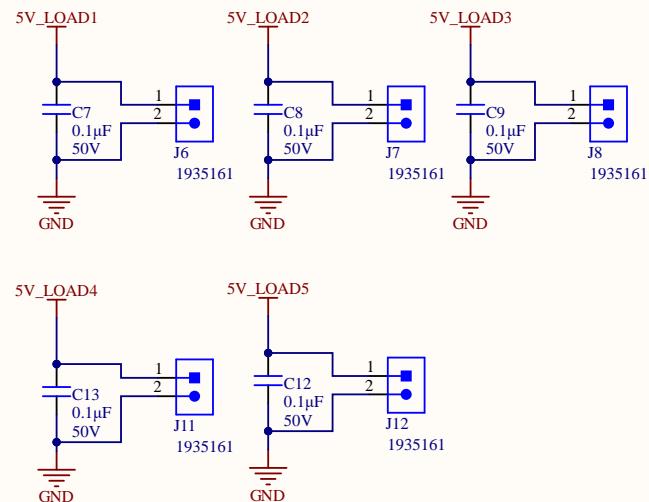
A

LED Matrix



B

5V Output



D

Mounting Holes

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

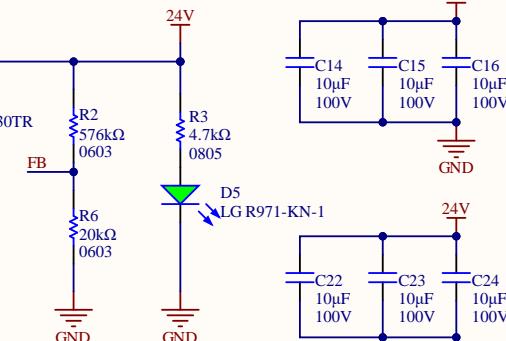
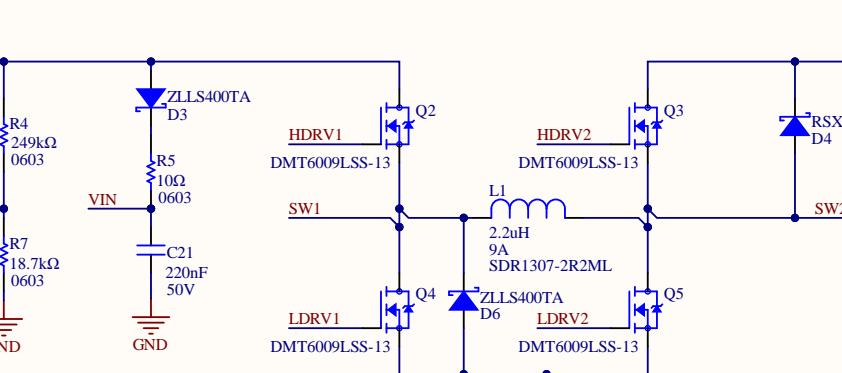
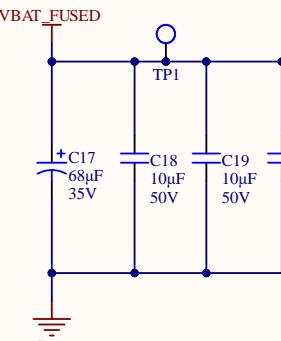
RS-485 → RS-485_P → RS-485_N → RS-485_N

Input voltage range: 18-25.8V

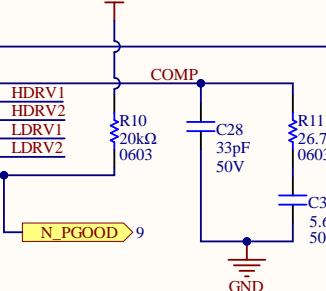
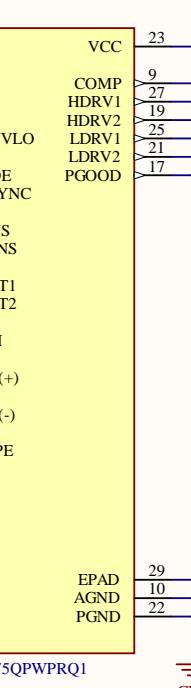
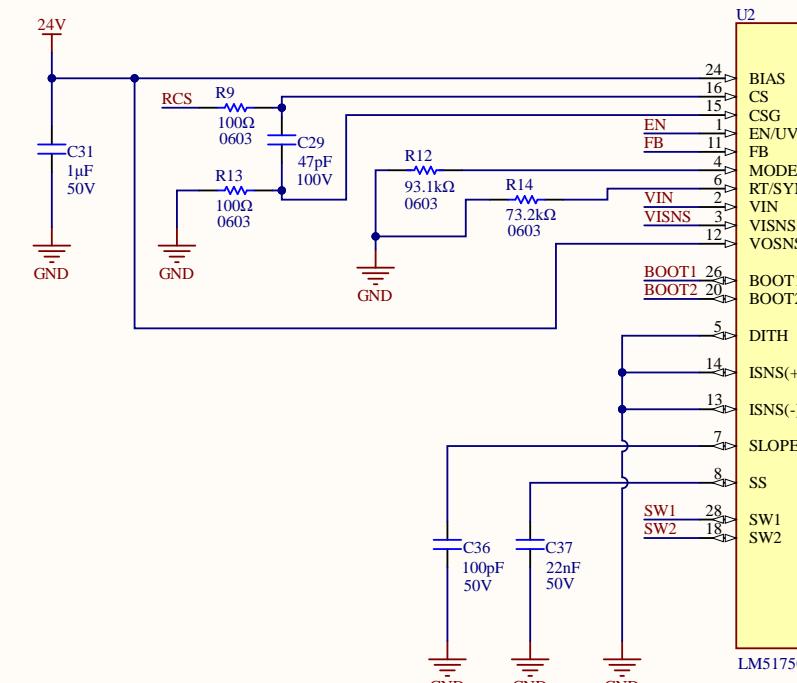
24V Buck-Boost Converter @ 3A Max

LED forward drop = 2.0V

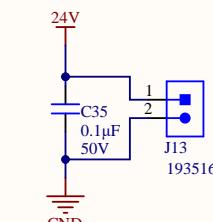
LED current = $(24-2)/4700 = 4.7mA$



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



24V Output



Title PDB Rev2 - 24V Buck-Boost Converter

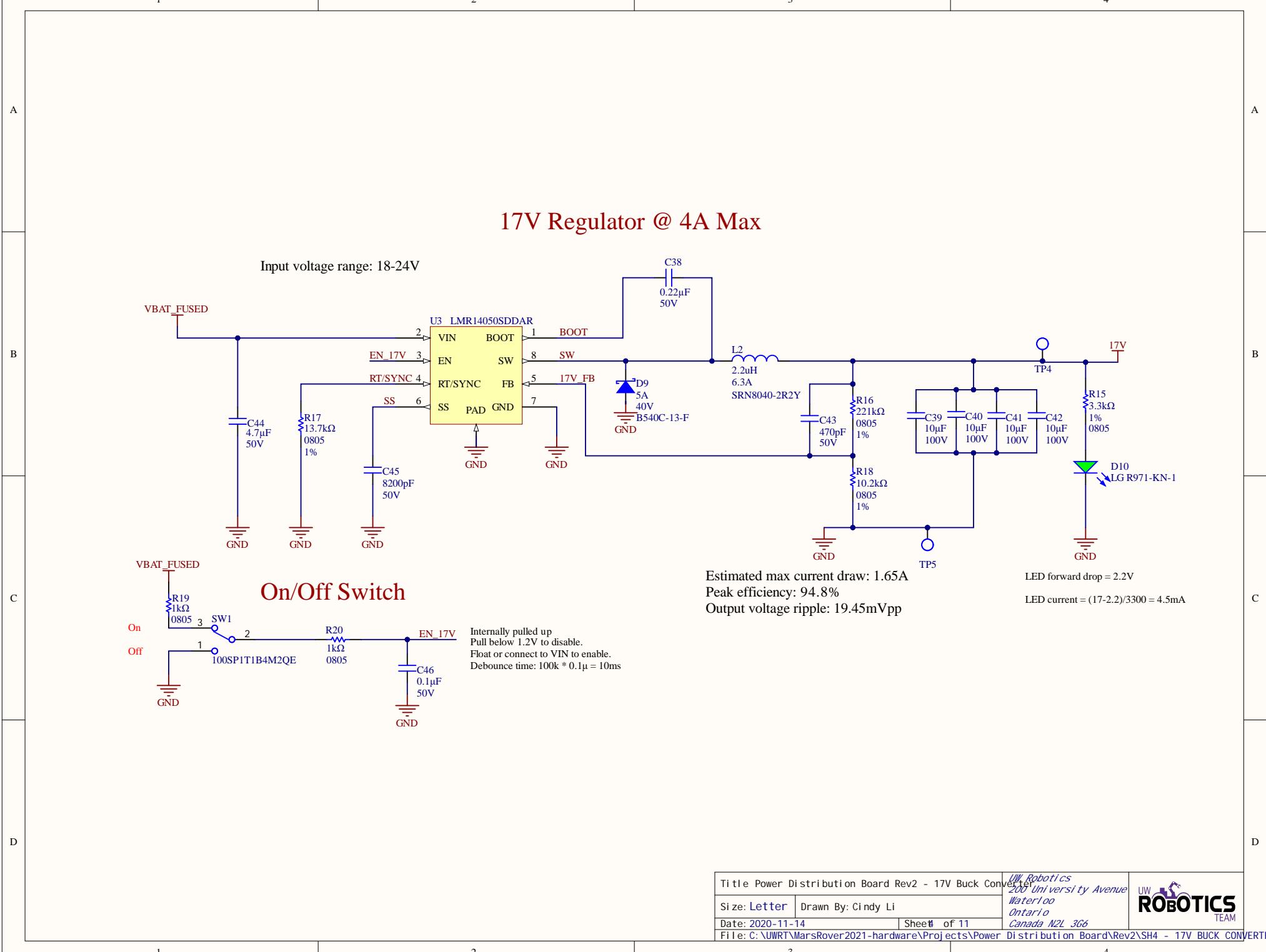
Size: Letter Drawn By: Cindy Li

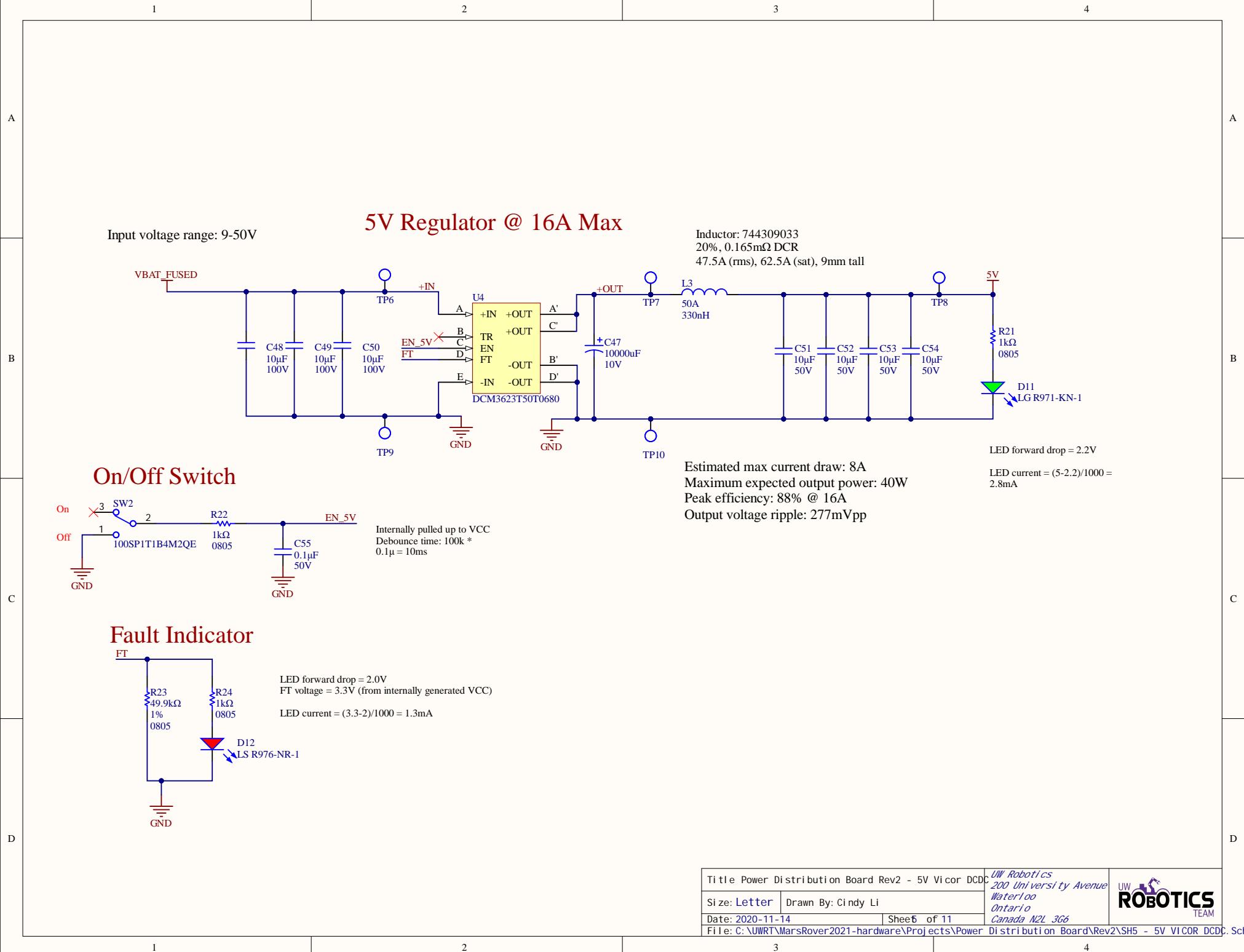
Date: 2020-11-14 Sheet 8 of 11

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A

A

B

B

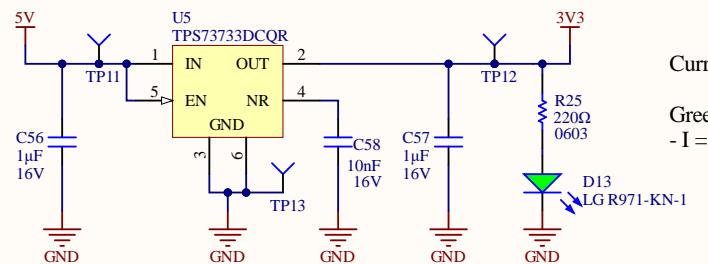
C

C

D

D

5V to 3.3V LDO @ 1A Max



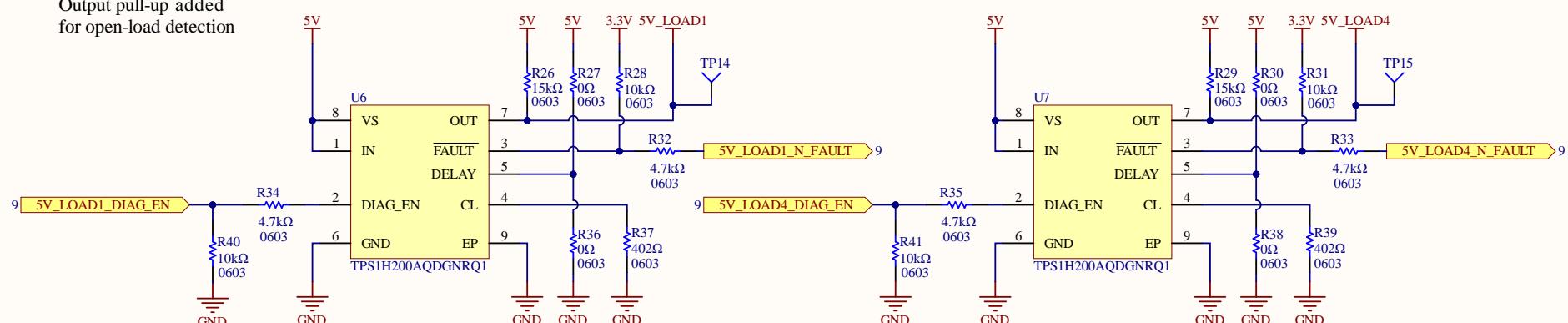
Current Calculations

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

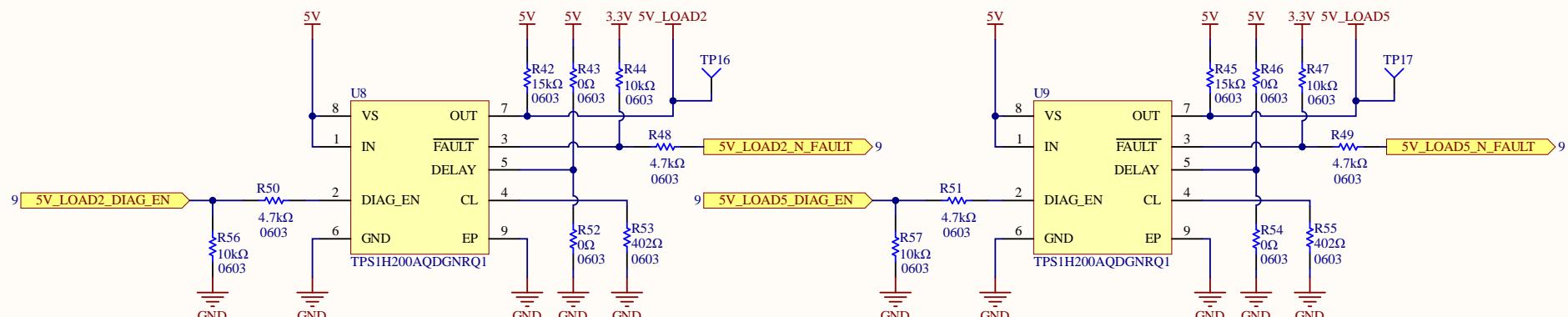
Title Power Distribution Board Rev2 - 3.3V Linear		<i>UW Robotics</i> 200 University Avenue Waterloo Ontario Canada N2L 3G6
Size: Letter	Drawn By: Cindy Li	
Date: 2020-11-14	Sheet 6 of 11	
File: C:\UWRT\MarsRover2021-hardware\Projects\Power Distribution Board\Rev2\SH6 - 3.3V LINEAR REGULATOR.SchDoc		UW ROBOTICS TEAM

5V Loads Smart Switches

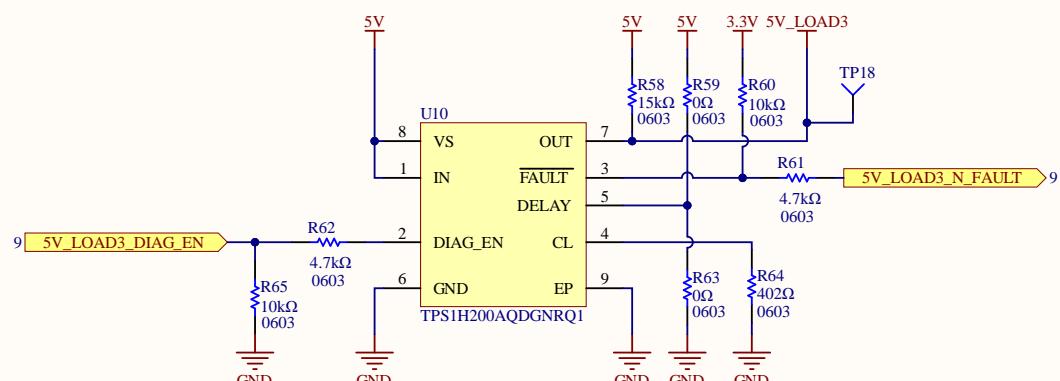
A
Output pull-up added
for open-load detection



B



C



Smart Switch Current Limited to 5A

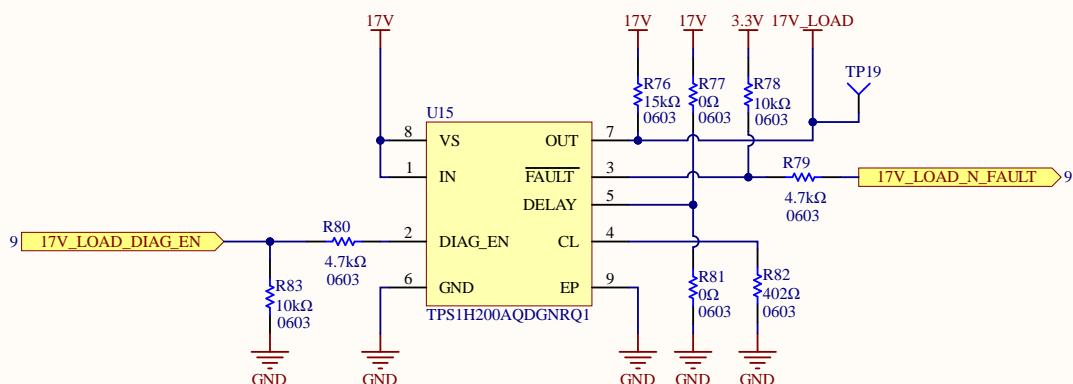
- $I_{out} = 5A$, $V_{CL(th)} = 0.8V$, $K_{CL} = 2500$ (values from datasheet)
- $R_{CL} = V_{CL(th)} * K_{CL} / I_{out} = 0.8 * 2500 / 5 = 400\Omega \rightarrow$ use $R_{CL} = 402\Omega$

Current Limit Configurations - Refer to DELAY Pin

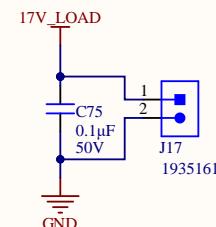
- Holding mode: depopulate pull-up and populate pull-down with a 0Ω resistor
- Latch-off mode: depopulate pull-up and populate pull-down with a capacitor or resistor (calculated based on required delay time)
- Auto-retry mode: populate pull-up with a pull-up resistor and depopulate pull-down

A

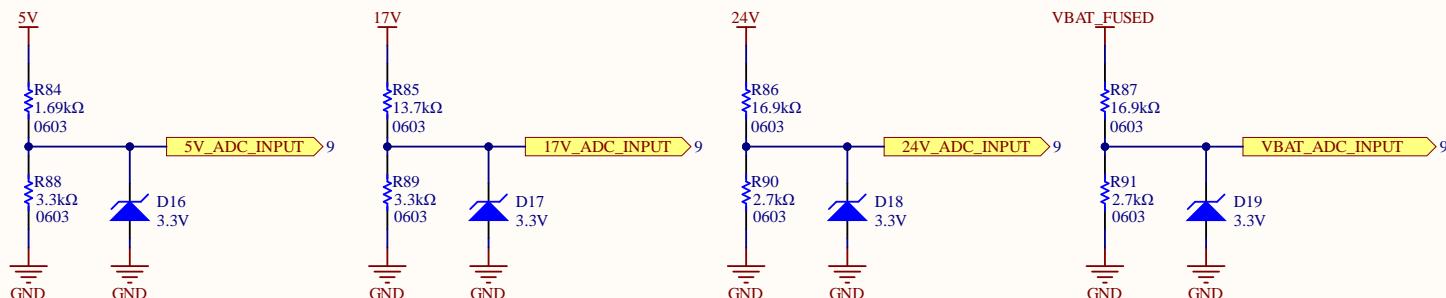
17V Load Smart Switch



17V Output



Power Rail Voltage Monitoring



Divides 5V to 3.3V

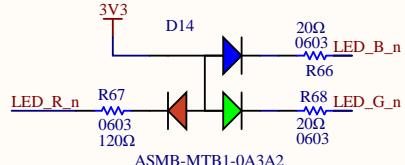
Divides 17V to 3.3V

Divides 24V to 3.3V

Divides 24V to 3.3V

D

Status LED

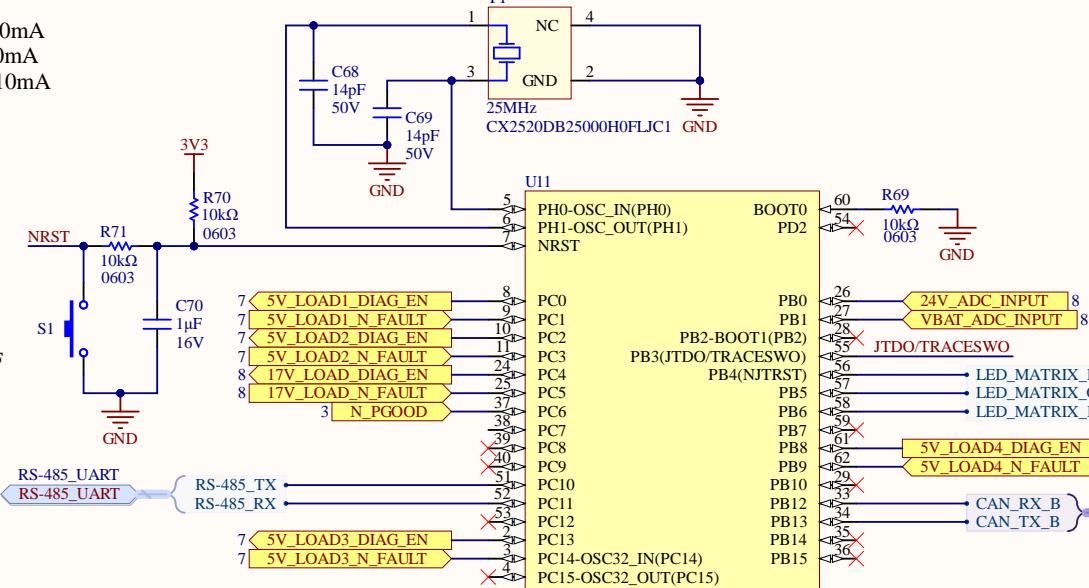


Current Calculations

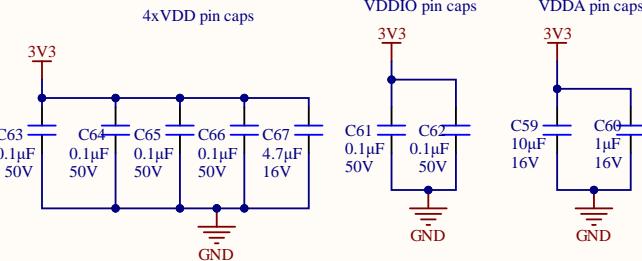
RGB LED voltage drops:

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

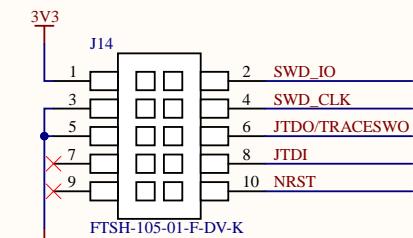
STM32F446RET6



Decoupling Caps



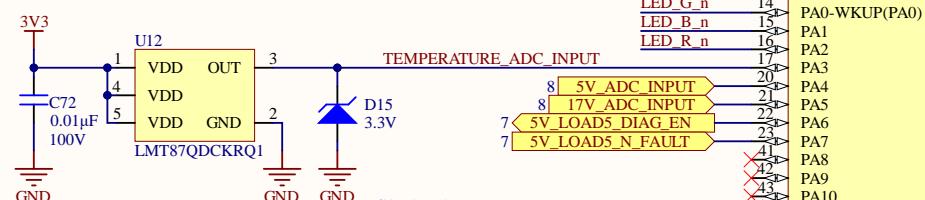
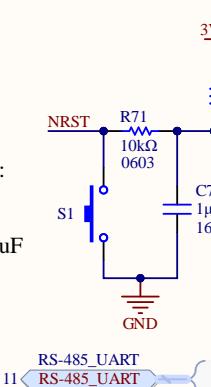
Debug/Programming



Debounce Calculation:

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

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



STM32F446RET6

Title: Power Distribution Board Rev2 - MCU

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A

A

B

B

C

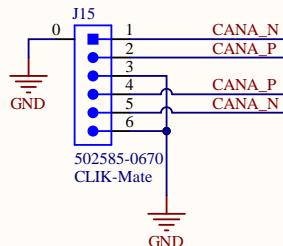
C

D

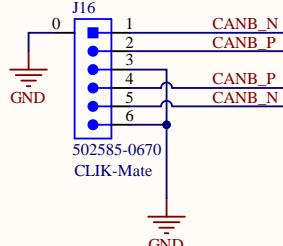
D

CAN Transceivers

CAN BUS A



CAN BUS B



A

A

B

B

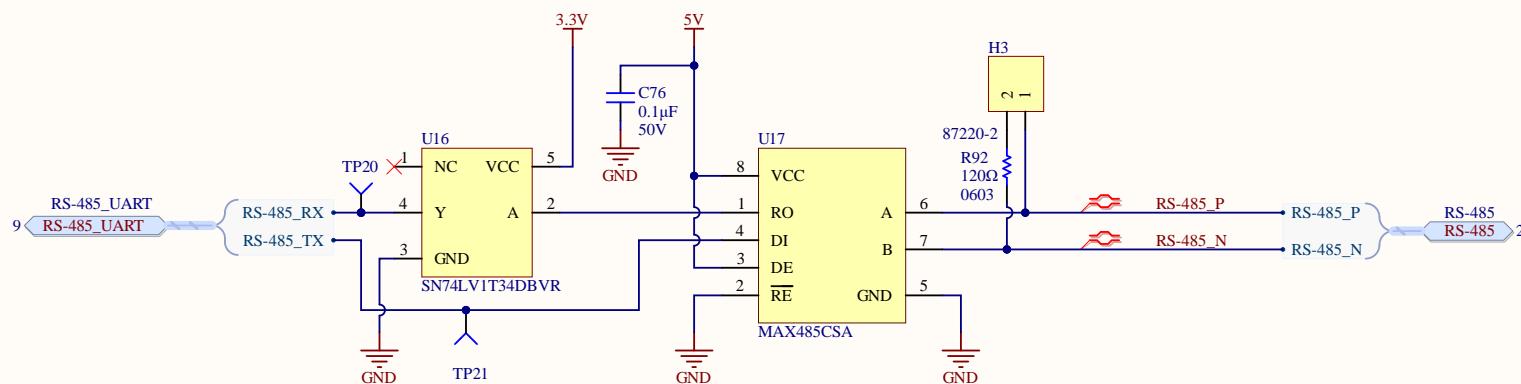
C

C

D

D

RS-485 Transceiver



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