

A

A

B

B

C

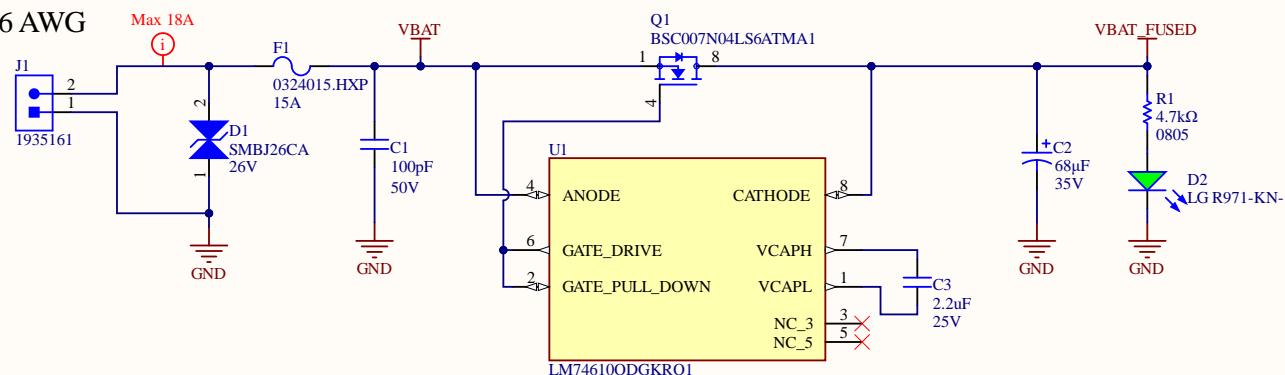
C

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 = $(18-2)/4700 = 3.4\text{mA}$

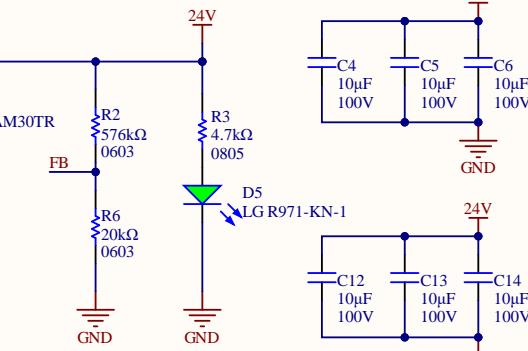
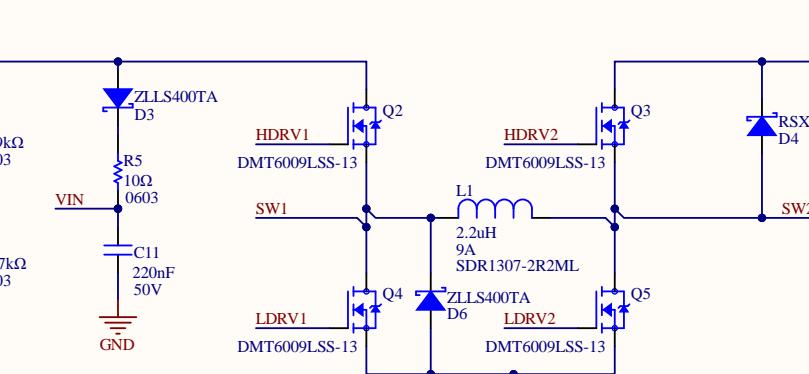
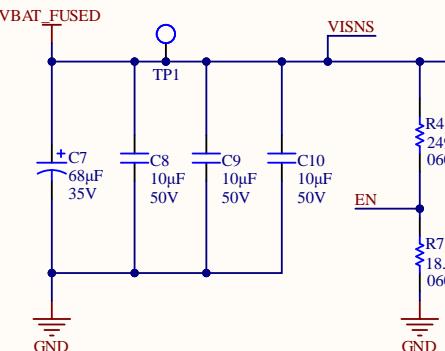
Title Power Distribution Board Rev2 - Power		UW Robotics 200 University Avenue Waterloo Ontario Canada N2L 3G6	UW ROBOTICS TEAM
Size: Letter	Drawn By: Cindy Li		
Date: 2020-11-14	Sheet 1 of 10		
File: C:\UWRT\MarsRover2021-hardware\Projects\Power Distribution Board\Rev2\SH1 - POWER.SchDoc			

Input voltage range: 18-25.8V

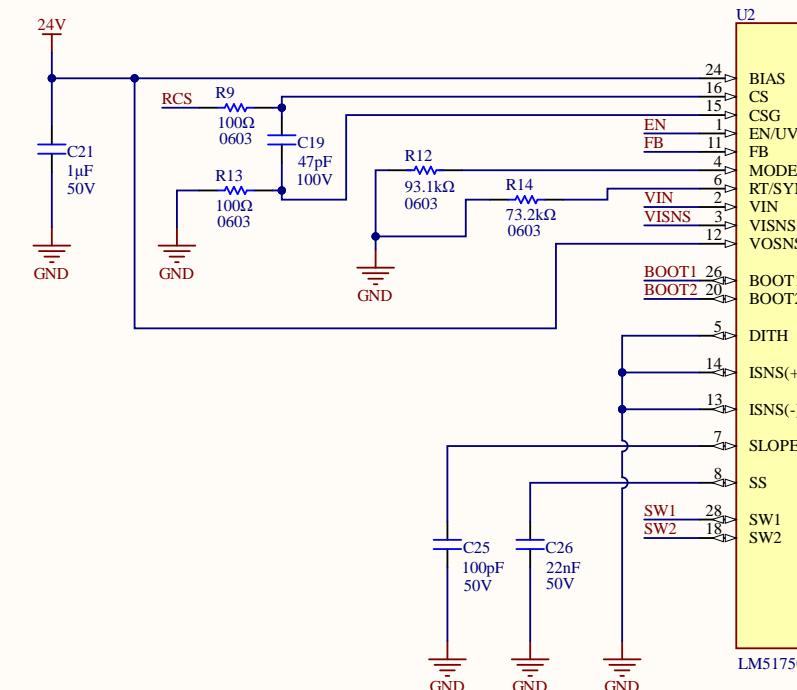
24V Buck-Boost Converter @ 3A Max

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

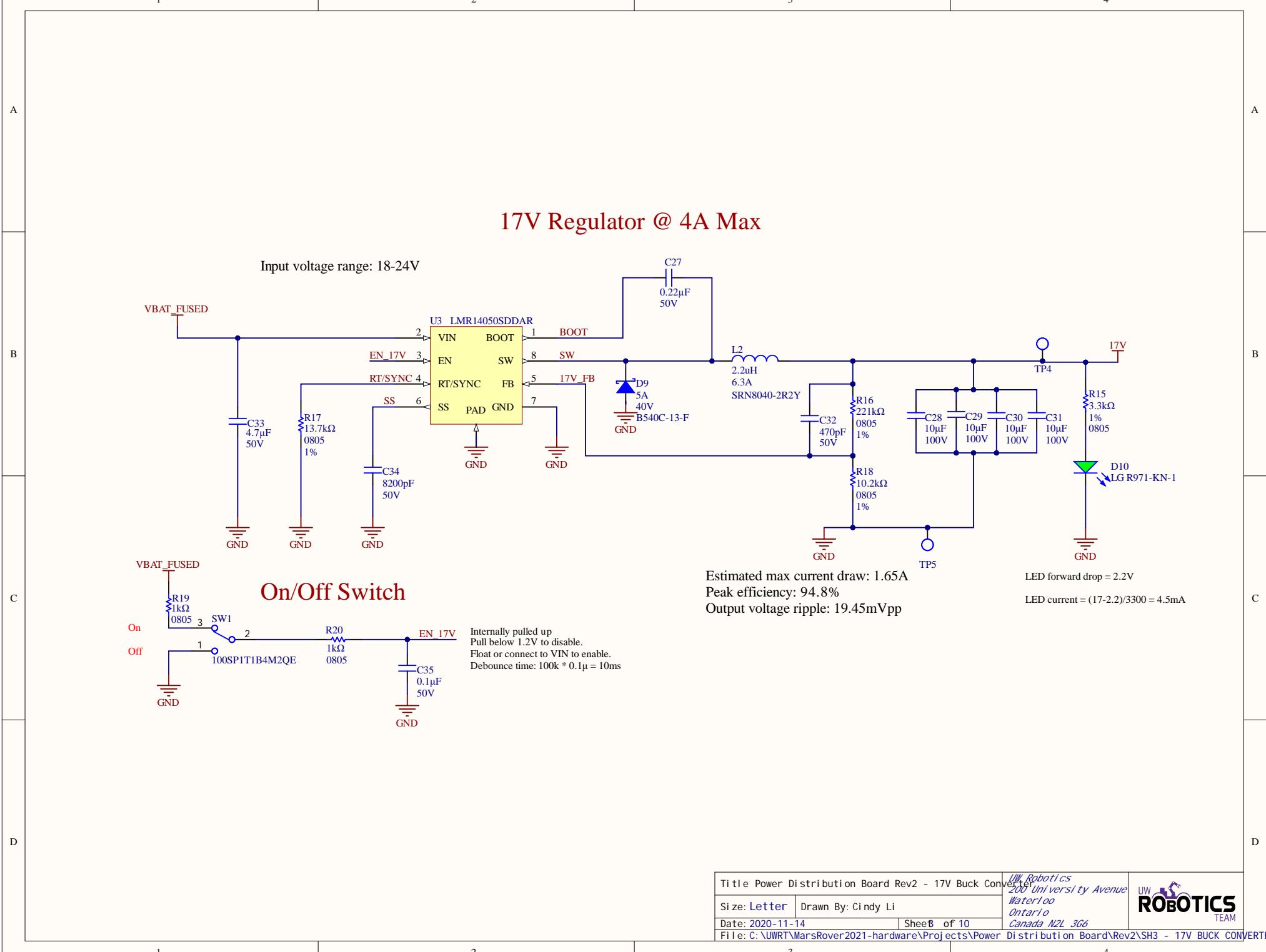
Size: Letter Drawn By: Cindy Li

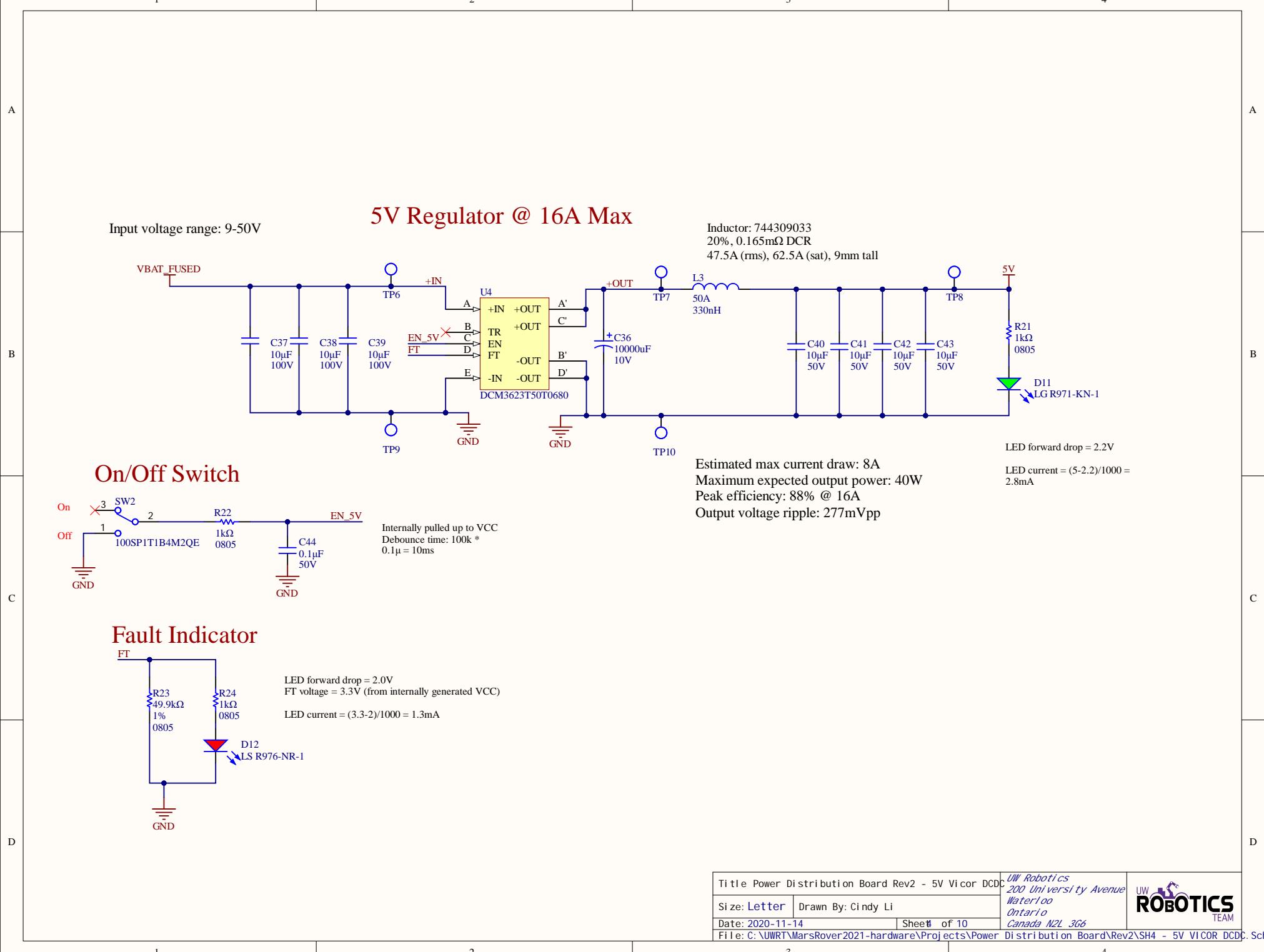
Date: 2020-11-14 Sheet of 10

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

UW Robotics
200 University Avenue
Waterloo
Ontario
Canada N2L 3G6

UW ROBOTICS
TEAM





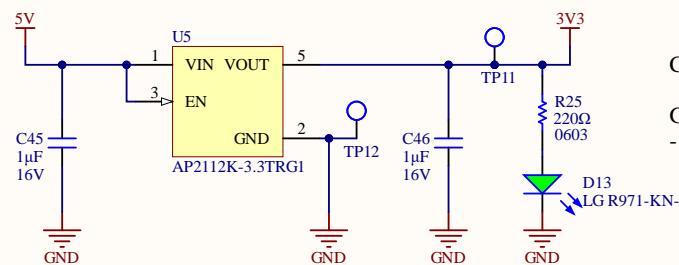
A

A

B

B

3.3V LDO @ 600mA Max



Current Calculations

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

C

C

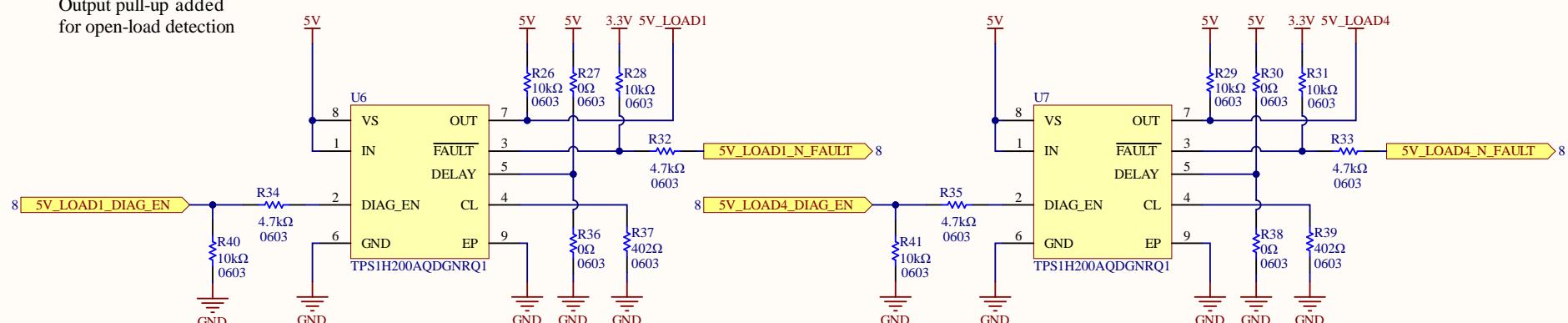
D

D

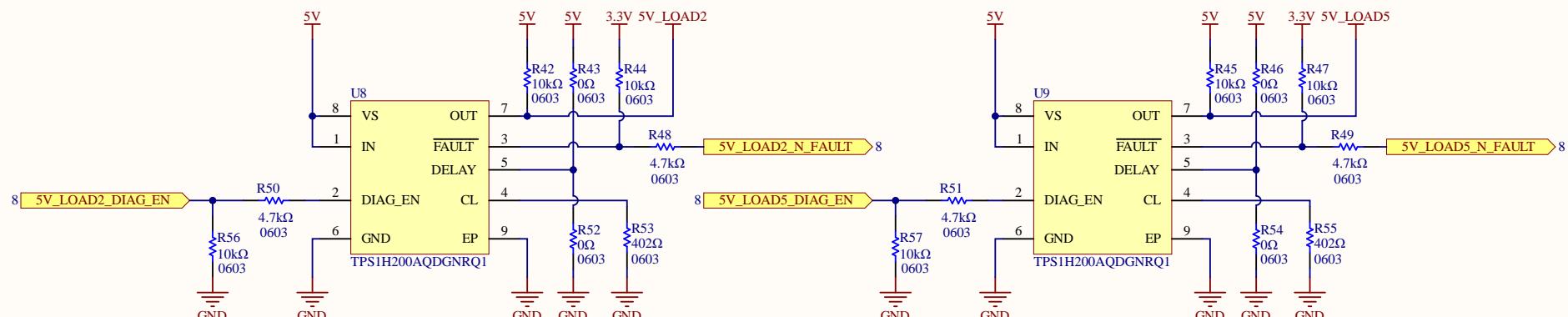
Title Power Distribution Board Rev2 - 3.3V Linear		UW Robotics
Size: Letter	Drawn By: Cindy Li	200 University Avenue Waterloo Ontario Canada N2L 3G6
Date: 2020-11-14	Sheet 6 of 10	
File: C:\UWRT\MarsRover2021-hardware\Projects\Power Distribution Board\Rev2\SH5 - 3.3V LINEAR REGULATOR.SchDoc		UW ROBOTICS TEAM

5V Loads Smart Switches

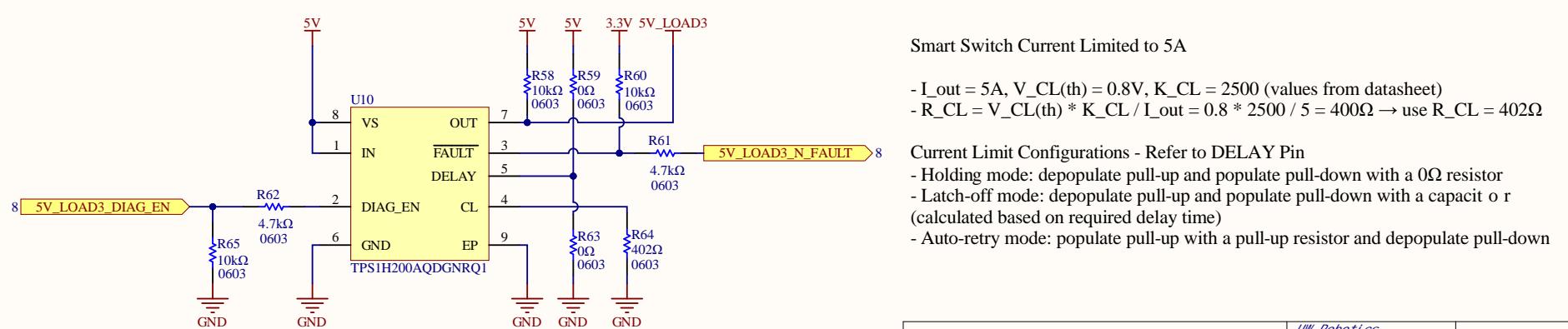
A
Output pull-up added for open-load detection



B



C



D
Smart Switch Current Limited to 5A

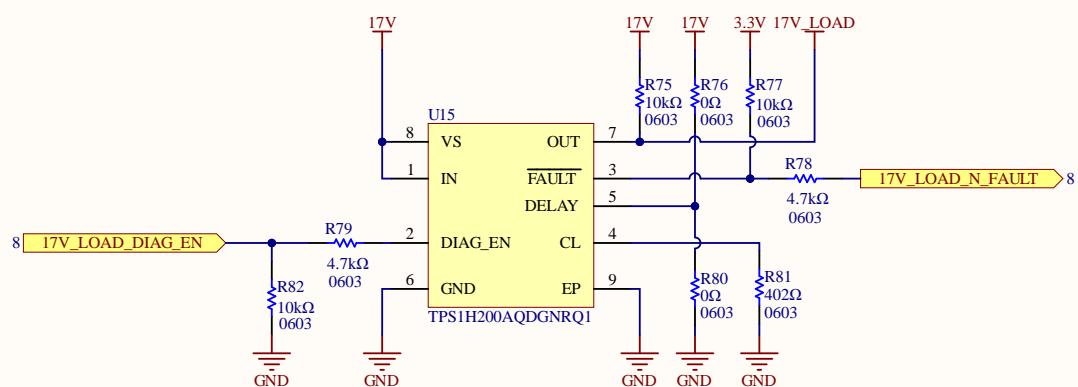
- $I_{out} = 5A$, $V_{CL(th)} = 0.8V$, $K_{CL} = 2500$ (values from datasheet)
- $R_{CL} = V_{CL(th)} * K_{CL} / I_{out} = 0.8 * 2500 / 5 = 400\Omega \rightarrow$ use $R_{CL} = 402\Omega$

E
Current Limit Configurations - Refer to DELAY Pin

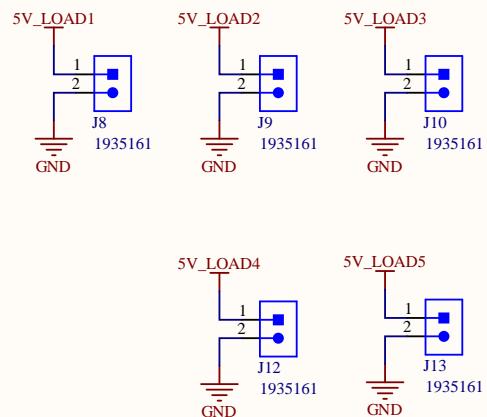
- Holding mode: depopulate pull-up and populate pull-down with a 0Ω resistor
- Latch-off mode: depopulate pull-up and populate pull-down with a capacitor or (calculated based on required delay time)
- Auto-retry mode: populate pull-up with a pull-up resistor and depopulate pull-down

A

17V Load Smart Switch

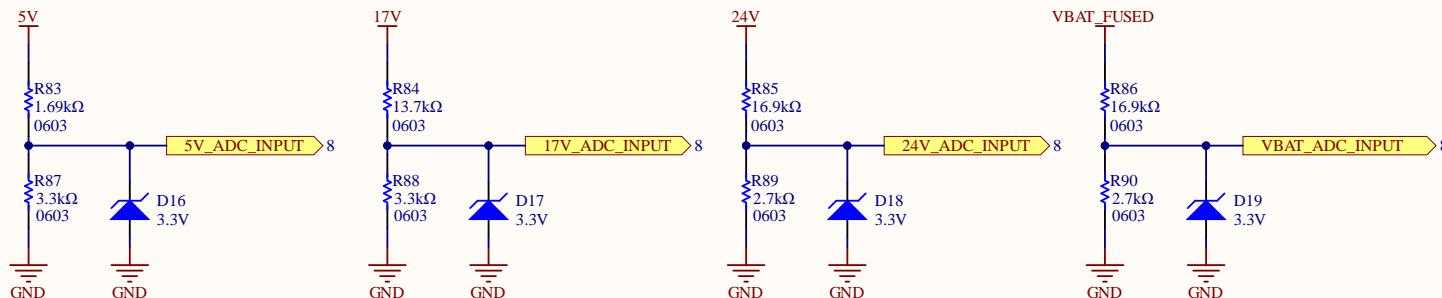


17V Output



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

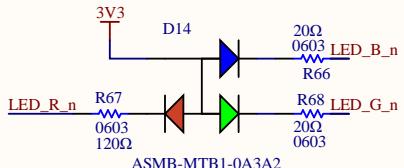
1

2

3

4

Status LED

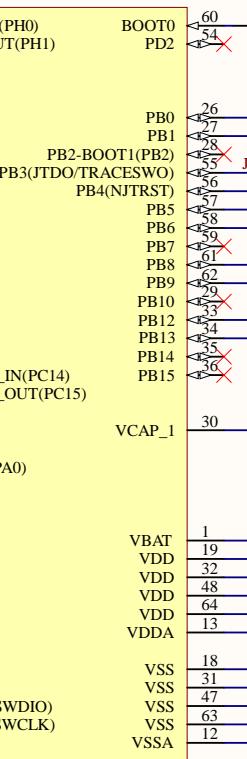
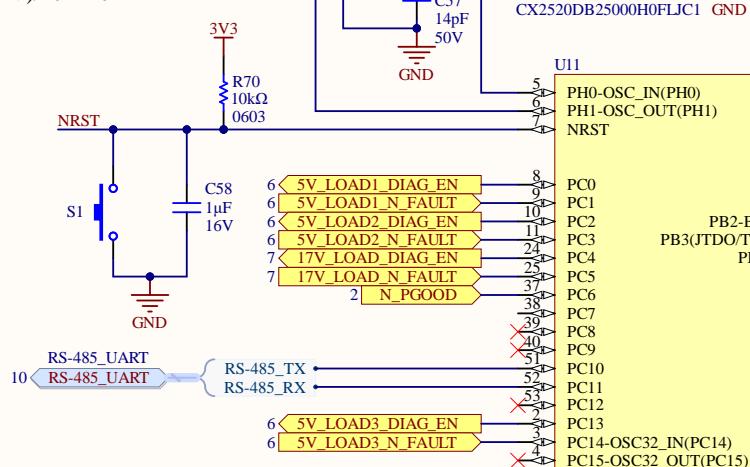


Current Calculations

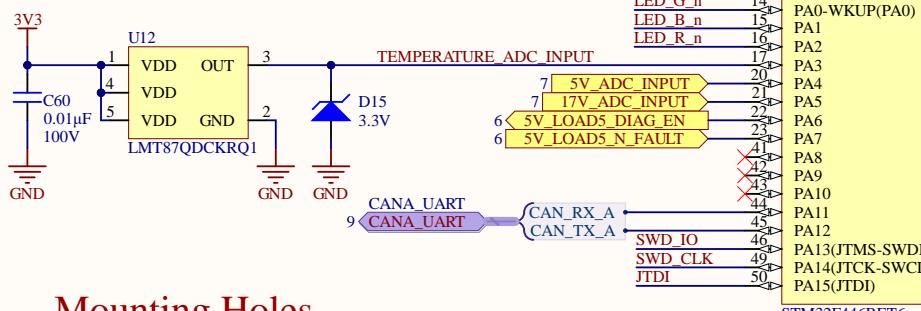
RGB LED voltage drops:

- 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



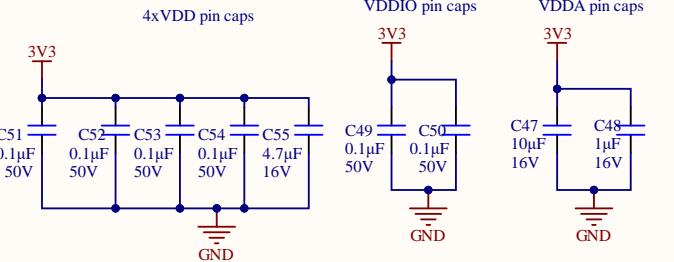
Temperature Sensor



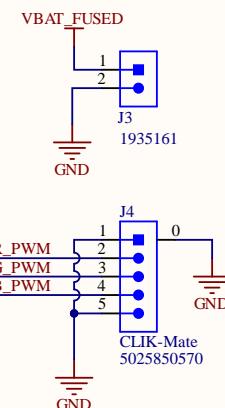
Mounting Holes

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

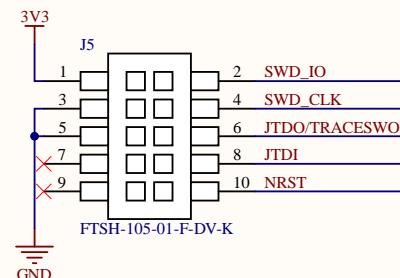
Decoupling Caps



LED Matrix



Debug/Programming



A

A

B

B

C

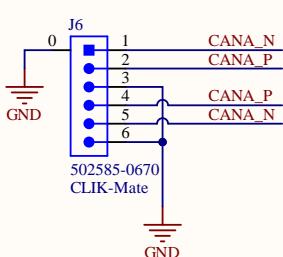
C

D

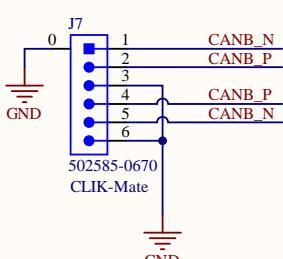
D

CAN Transceivers

CAN BUS A



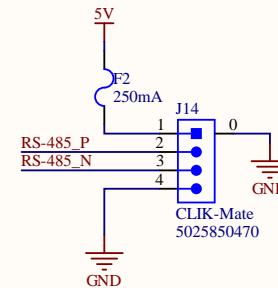
CAN BUS B



URM04 Ultrasonic Sensors

A

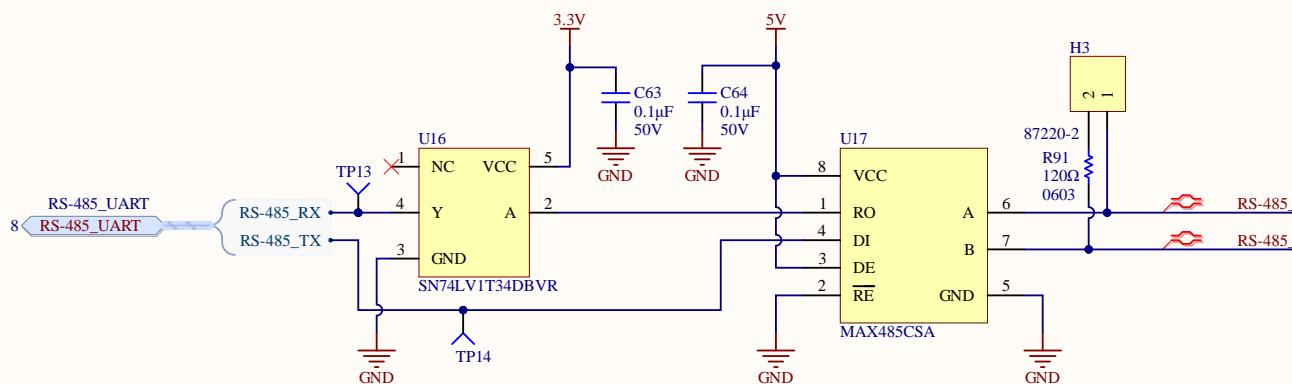
A



B

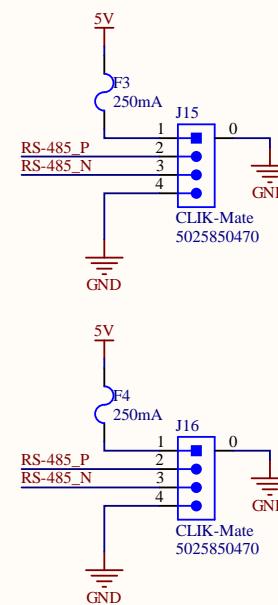
B

RS-485 Transceiver



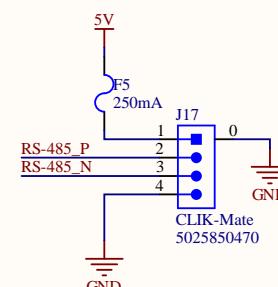
C

C



D

D



Title: Power Distribution Board Rev2 - RS-485	UW Robotics 200 University Avenue Waterloo Ontario Canada N2L 3G6	UW ROBOTICS TEAM
Size: Letter	Drawn By: Cindy Li	
Date: 2020-11-14	Sheet 10 of 10	
File: C:\UWRT\MarsRover2021-hardware\Projects\Power Distribution Board\Rev2\SH10 - RS-485.SchDoc		

