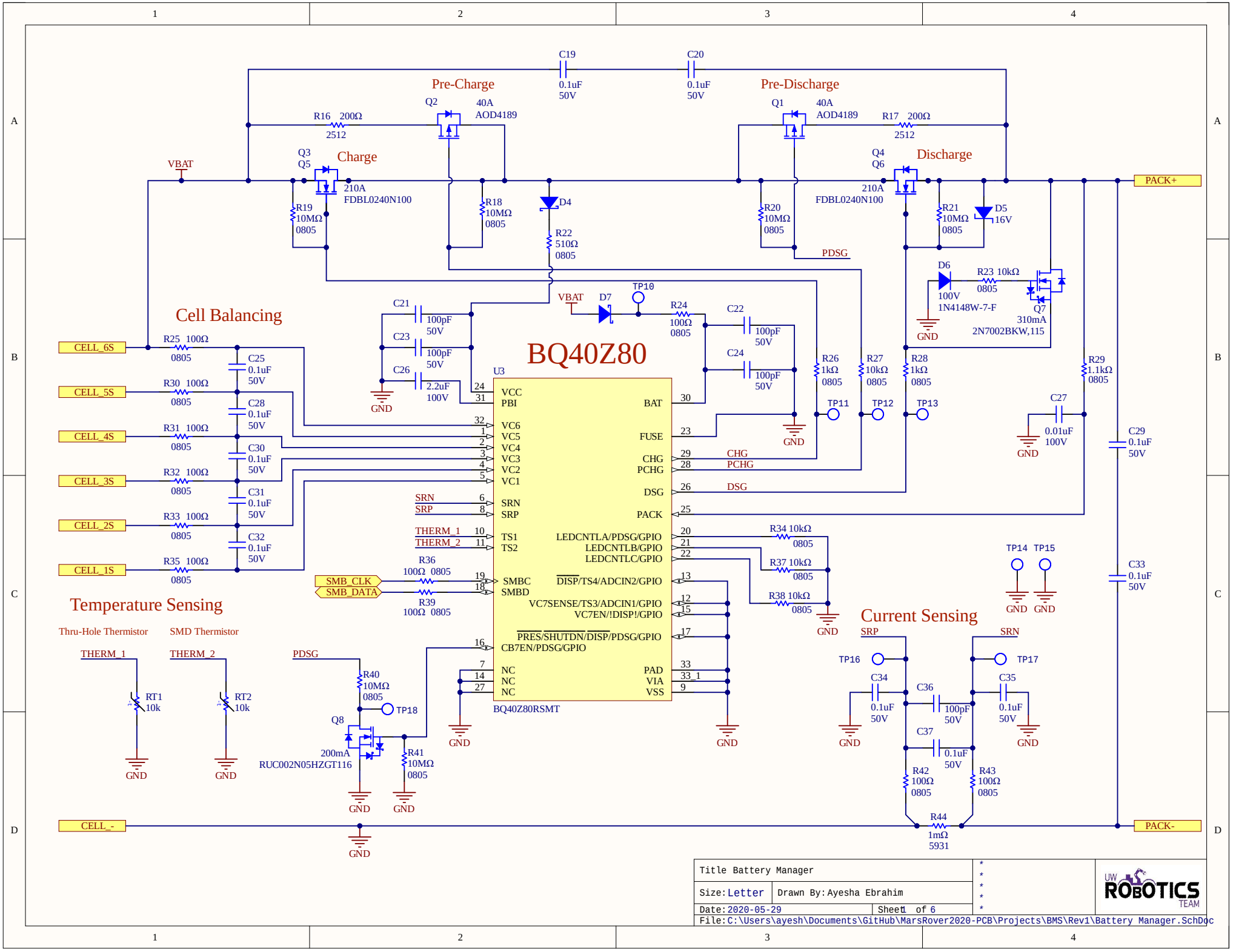
Pre-Charge
Pre-Discharge
Charge
Discharge
Cell Balancing
Temperature Sensing
Current Sensing
BQ40Z80
BQ40Z80RSMT
U3
VBAT
PACK+
PACK-
CELL_6S
CELL_5S
CELL_4S
CELL_3S
CELL_2S
CELL_1S
CELL_-
SMB_CLK
SMB_DATA
SRN
SRP
PDSG
CHG
PCHG
DSG
THERM_1
THERM_2
Thru-Hole Thermistor
SMD Thermistor
C19 0.1uF 50V
C20 0.1uF 50V
Q1 40A AOD4189
Q2 40A AOD4189
Q3 Q5 210A FDBL0240N100
Q4 Q6 210A FDBL0240N100
Q7 310mA 2N7002BKW,115
Q8 200mA RUC002N05HZGT116
D4
D5 16V
D6 100V 1N4148W-7-F
D7
R16 200Ω 2512
R17 200Ω 2512
R18 10MΩ 0805
R19 10MΩ 0805
R20 10MΩ 0805
R21 10MΩ 0805
R22 510Ω 0805
R23 10kΩ 0805
R24 100Ω 0805
R25 100Ω 0805
R26 1kΩ 0805
R27 10kΩ 0805
R28 1kΩ 0805
R29 1.1kΩ 0805
R30 100Ω 0805
R31 100Ω 0805
R32 100Ω 0805
R33 100Ω 0805
R34 10kΩ 0805
R35 100Ω 0805
R36 100Ω 0805
R37 10kΩ 0805
R38 10kΩ 0805
R39 100Ω 0805
R40 10MΩ 0805
R41 10MΩ 0805
R42 100Ω 0805
R43 100Ω 0805
R44 1mΩ 5931
C21 100pF 50V
C22 100pF 50V
C23 100pF 50V
C24 100pF 50V
C25 0.1uF 50V
C26 2.2uF 100V
C27 0.01uF 100V
C28 0.1uF 50V
C29 0.1uF 50V
C30 0.1uF 50V
C31 0.1uF 50V
C32 0.1uF 50V
C33 0.1uF 50V
C34 0.1uF 50V
C35 0.1uF 50V
C36 100pF 50V
C37 0.1uF 50V
RT1 10k
RT2 10k
TP10
TP11
TP12
TP13
TP14
TP15
TP16
TP17
TP18
GND
Title Battery Manager
Size: Letter
Drawn By: Ayesha Ebrahim
Date: 2020-05-29
Sheet 1 of 6
File: C:\Users\ayesh\Documents\GitHub\MarsRover2020-PCB\Projects\BMS\Rev1\Battery Manager.SchDoc
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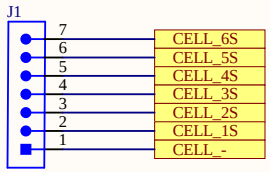
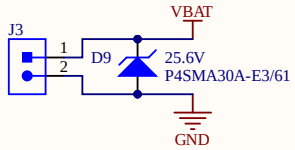
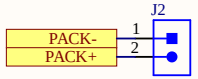
Battery Balancing



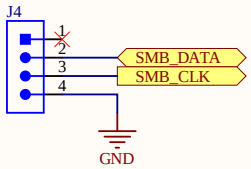
Battery In



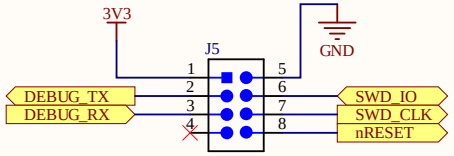
Pack Out



EV2400

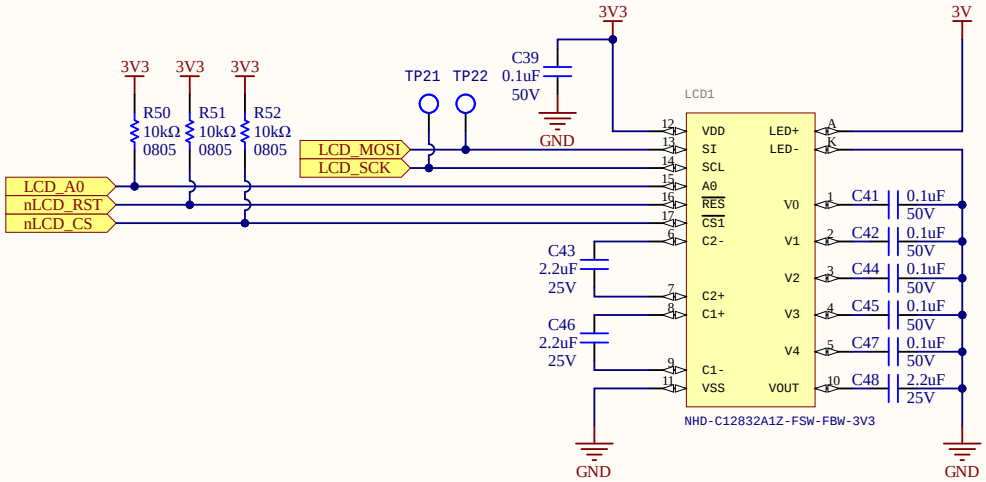


Debug/Programing



Title Connectors		UW Robotics 200 University Avenue Waterloo Ontario Canada N2L 3G6
Size: Letter	Drawn By: Ayesha Ebrahim	
Date: 2020-05-29	Sheet 2 of 6	
File: C:\Users\ayesh\Documents\GitHub\MarsRover2020-PCB\Projects\BMS\Rev1\Connectors.SchDoc		

LCD



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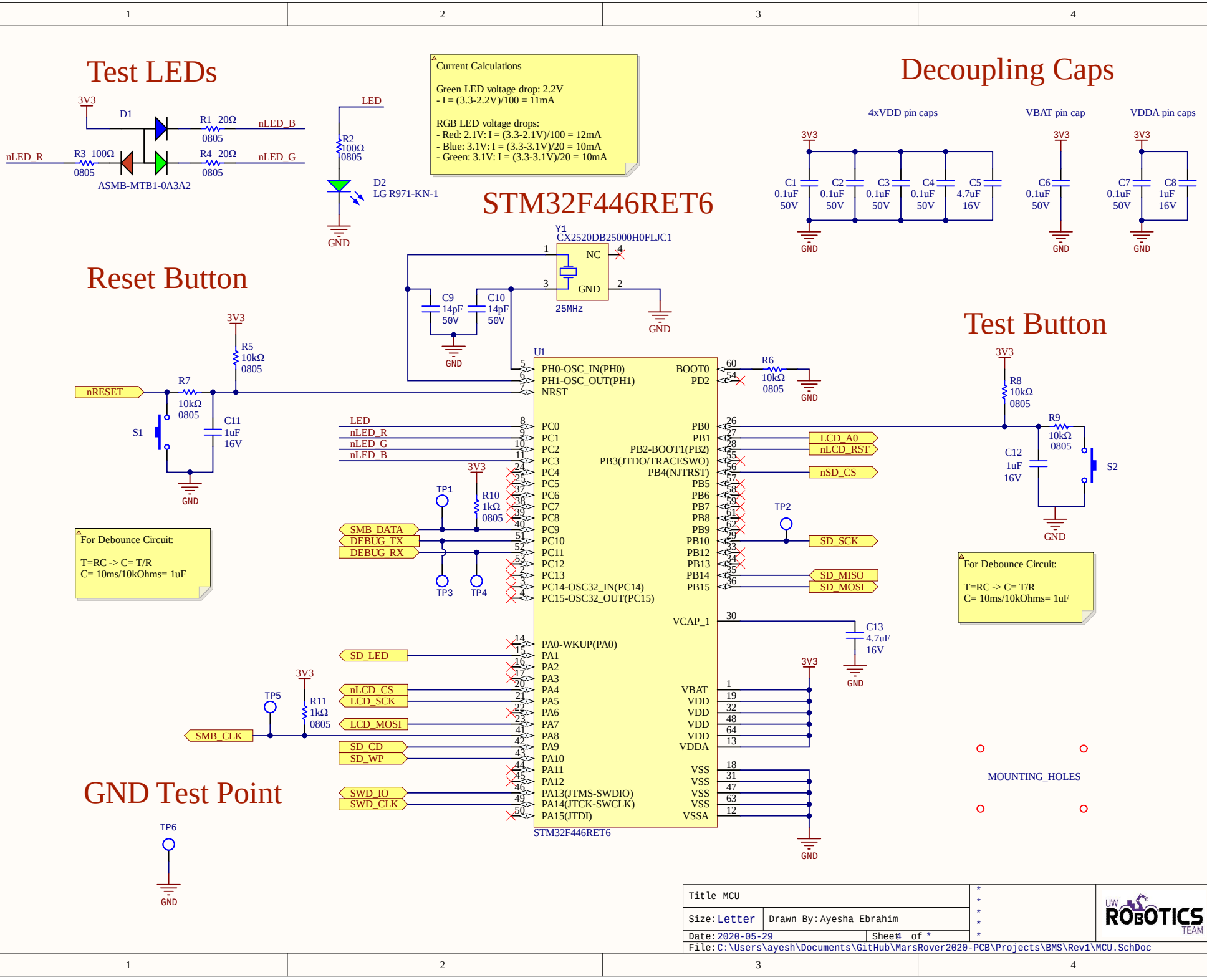
Size: Letter	Drawn By: Ayesha Ebrahim		
Date: 2020-05-29	Sheet 8 of *		
File: C:\Users\ayesh\Documents\GitHub\MarsRover2020-PCB\Projects\BMS\Rev1\LCD.SchDoc			


Test LEDs
3V3
D1
R1 20Ω
0805
nLED_B
nLED_R
R3 100Ω
0805
R4 20Ω
0805
nLED_G
ASMB-MTB1-0A3A2
LED
R2
100Ω
0805
D2
LG R971-KN-1
GND
Current Calculations
Green LED voltage drop: 2.2V
- I = (3.3-2.2V)/100 = 11mA
RGB LED voltage drops:
- Red: 2.1V: I = (3.3-2.1V)/100 = 12mA
- Blue: 3.1V: I = (3.3-3.1V)/20 = 10mA
- Green: 3.1V: I = (3.3-3.1V)/20 = 10mA
Decoupling Caps
4xVDD pin caps
VBAT pin cap
VDDA pin caps
C1 0.1uF 50V
C2 0.1uF 50V
C3 0.1uF 50V
C4 0.1uF 50V
C5 4.7uF 16V
C6 0.1uF 50V
C7 0.1uF 50V
C8 1uF 16V
STM32F446RET6
Y1
CX2520DB25000H0FLJC1
NC
GND
25MHz
C9 14pF 50V
C10 14pF 50V
Reset Button
R5 10kΩ 0805
R7 10kΩ 0805
nRESET
S1
C11 1uF 16V
For Debounce Circuit:
T=RC -> C= T/R
C= 10ms/10kOhms= 1uF
U1
PH0-OSC_IN(PH0)
PH1-OSC_OUT(PH1)
NRST
BOOT0
PD2
R6 10kΩ 0805
PC0
PC1
PC2
PC3
PC4
PC5
PC6
PC7
PC8
PC9
PC10
PC11
PC12
PC13
PC14-OSC32_IN(PC14)
PC15-OSC32_OUT(PC15)
PB0
PB1
PB2-BOOT1(PB2)
PB3(JTDO/TRACESWO)
PB4(NJTRST)
PB5
PB6
PB7
PB8
PB9
PB10
PB12
PB13
PB14
PB15
LED
nLED_R
nLED_G
nLED_B
SMB_DATA
DEBUG_TX
DEBUG_RX
TP1
TP2
TP3
TP4
R10 1kΩ 0805
LCD_A0
nLCD_RST
nSD_CS
SD_SCK
SD_MISO
SD_MOSI
Test Button
R8 10kΩ 0805
R9 10kΩ 0805
C12 1uF 16V
S2
For Debounce Circuit:
T=RC -> C= T/R
C= 10ms/10kOhms= 1uF
VCAP_1
C13 4.7uF 16V
PA0-WKUP(PA0)
PA1
PA2
PA3
PA4
PA5
PA6
PA7
PA8
PA9
PA10
PA11
PA12
PA13(JTMS-SWDIO)
PA14(JTCK-SWCLK)
PA15(JTDI)
SD_LED
nLCD_CS
LCD_SCK
LCD_MOSI
SD_CD
SD_WP
SWD_IO
SWD_CLK
SMB_CLK
TP5
R11 1kΩ 0805
VBAT
VDD
VDDA
VSS
VSSA
STM32F446RET6
GND Test Point
TP6
MOUNTING_HOLES
Title MCU
Size: Letter
Drawn By: Ayesha Ebrahim
Date: 2020-05-29
Sheet * of *
File: C:\Users\ayesh\Documents\GitHub\MarsRover2020-PCB\Projects\BMS\Rev1\MCU.SchDoc
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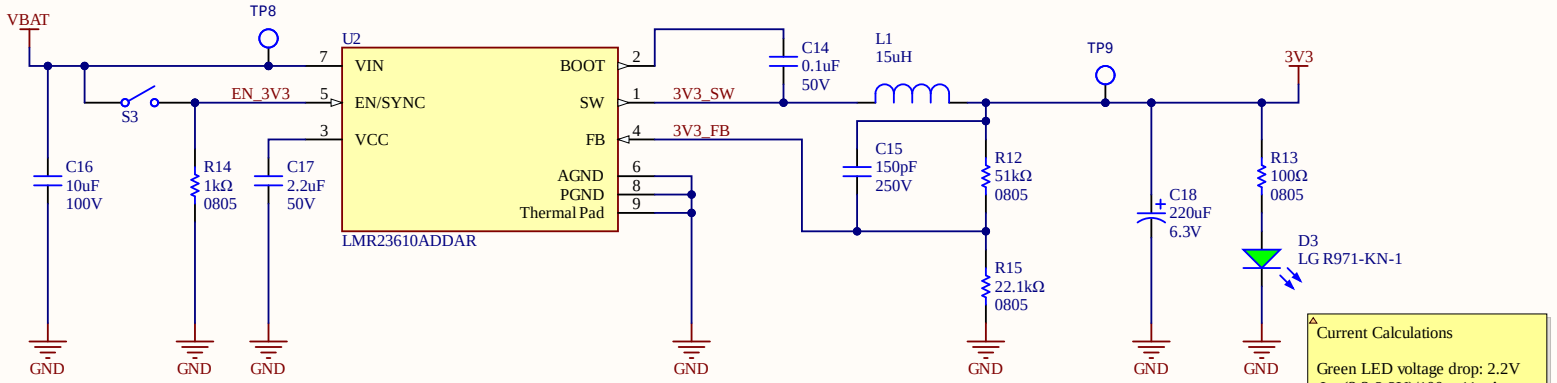
Battery Voltage to 3V3 Buck @ 1A Max

Designed for 15V-25.2V input

Route for 0.5A in

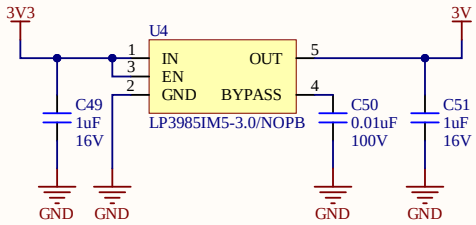
Inductor: SRN6045-150M
15uH, 20%, 95.8mOhm DCR (max)
1.9A (rms), 2.3A (sat), 4.5mm tall

Route for 1A out



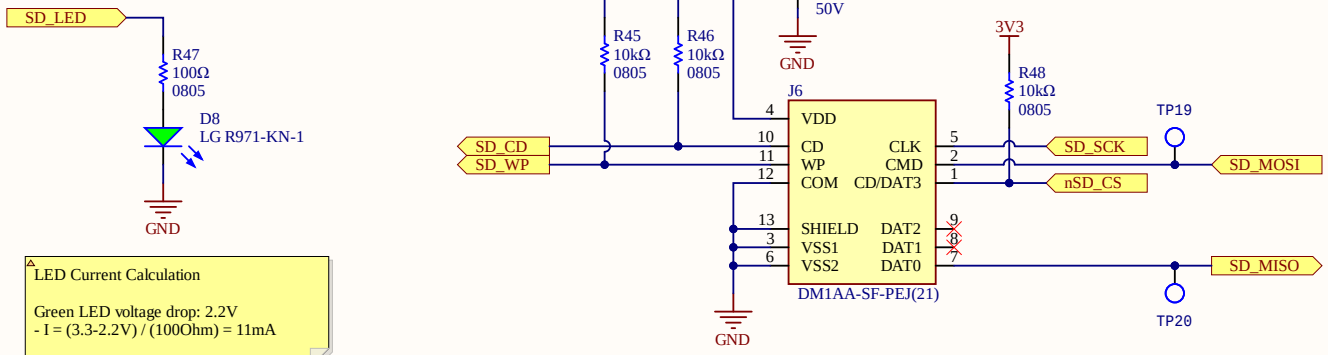
Max expected power on output = 1.65W
Max current = 0.5A
Expected Efficiency at 1A > 87.7%

3V3 to 3V LDO @ 150mA Max



Title Power			
Size: Letter	Drawn By: Ayesha Ebrahim		
Date: 2020-05-29	Sheet 5 of 6		
File: C:\Users\ayesh\Documents\GitHub\MarsRover2020-PCB\Projects\BMS\Rev1\Power.SchDoc			

SD Card Connector



Title SD Card			
Size: Letter	Drawn By: Ayesha Ebrahim		
Date: 2020-05-29	Sheet 6 of 6		
File: C:\Users\ayesh\Documents\GitHub\MarsRover2020-PCB\Projects\BMS\Rev1\SD Card.SchDoc			