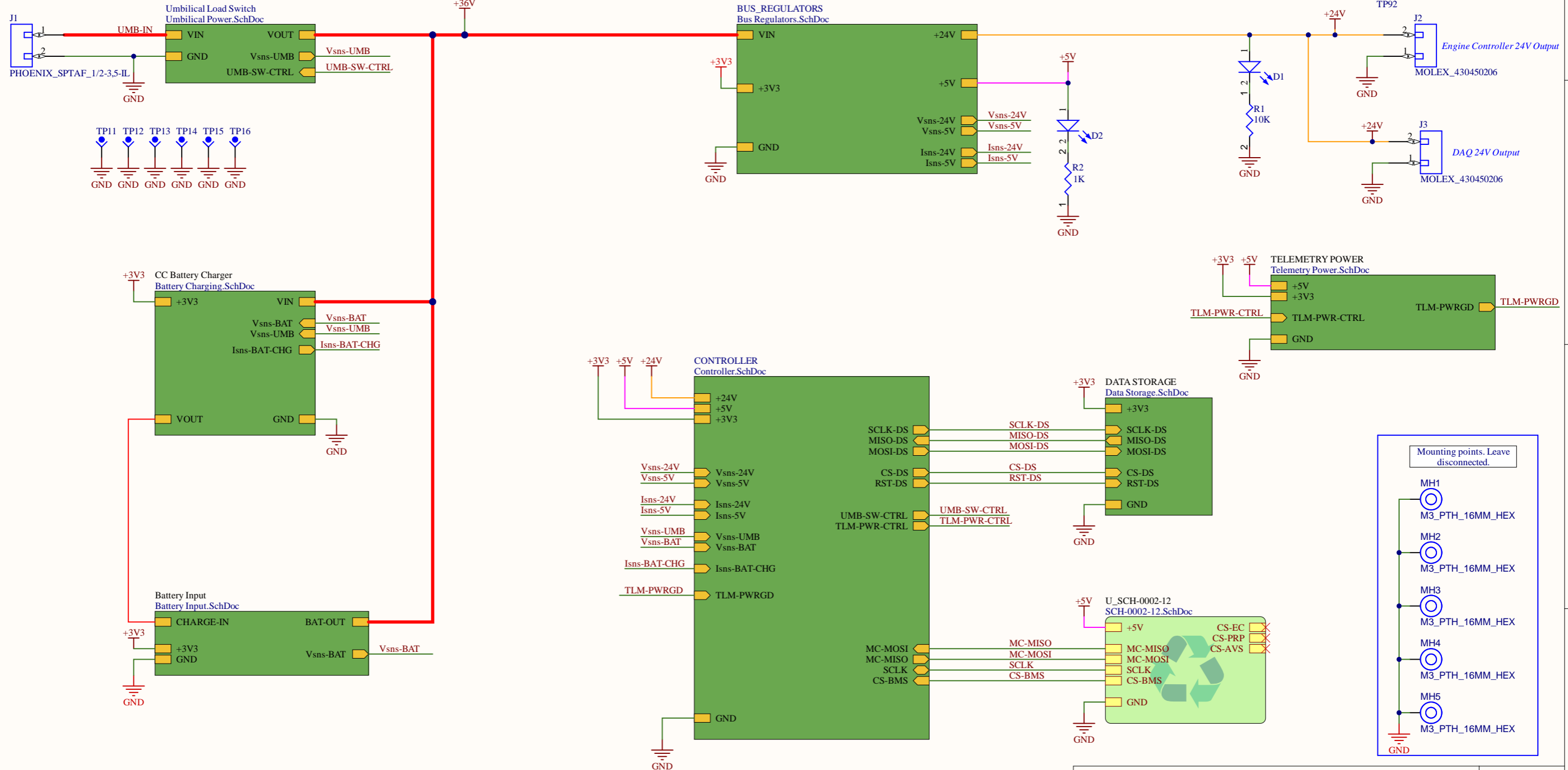


Simplified BMS Rev3.0

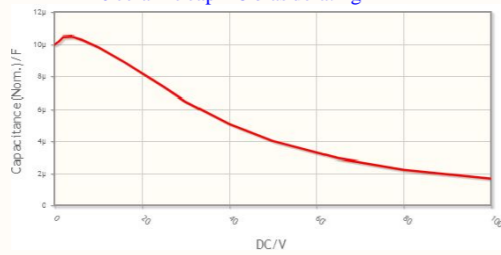
Subscale Power Distribution + "Battery Management" Board
 1x 24V/5A output bus
 1x 5V/2A output bus
 1x 3A 8S Li-ion battery charger
 100% quality guaranteed or your money back

Nominal Umbilical Input Voltage: 36V

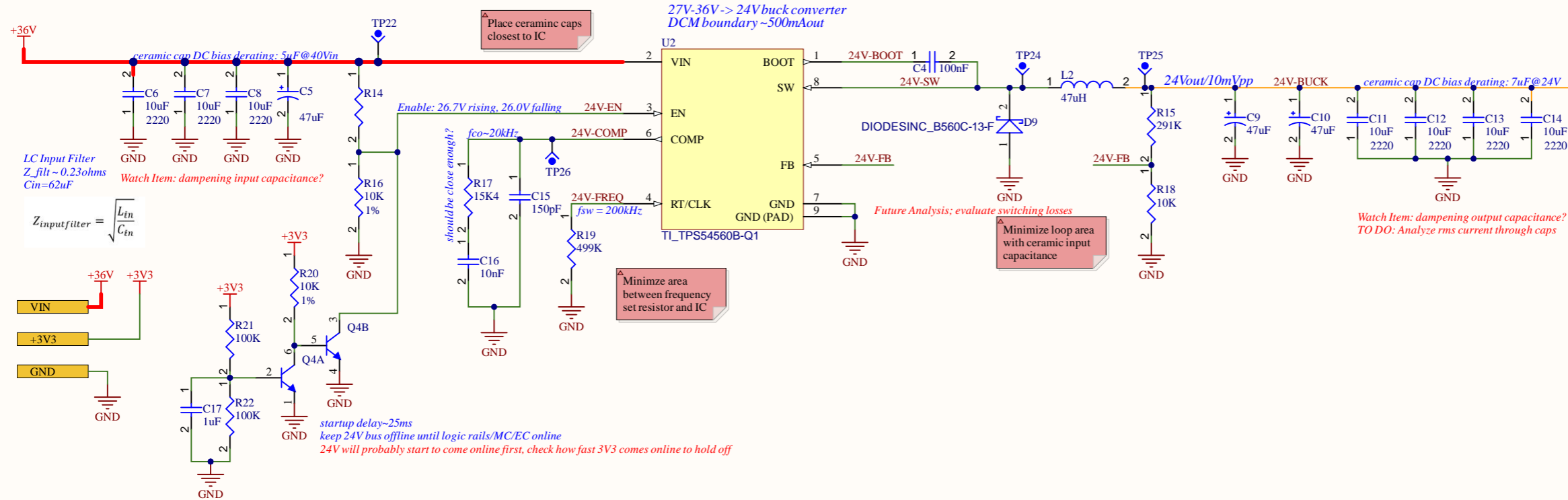


AVI Stack Power Bus Regulators

TDK 2220 ceramic cap DC bias derating

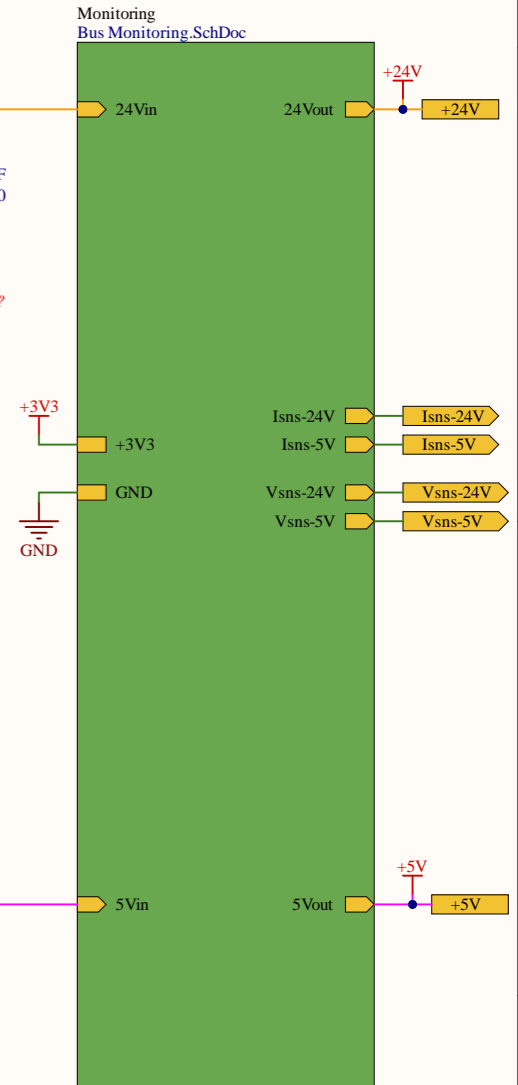


24V BUS

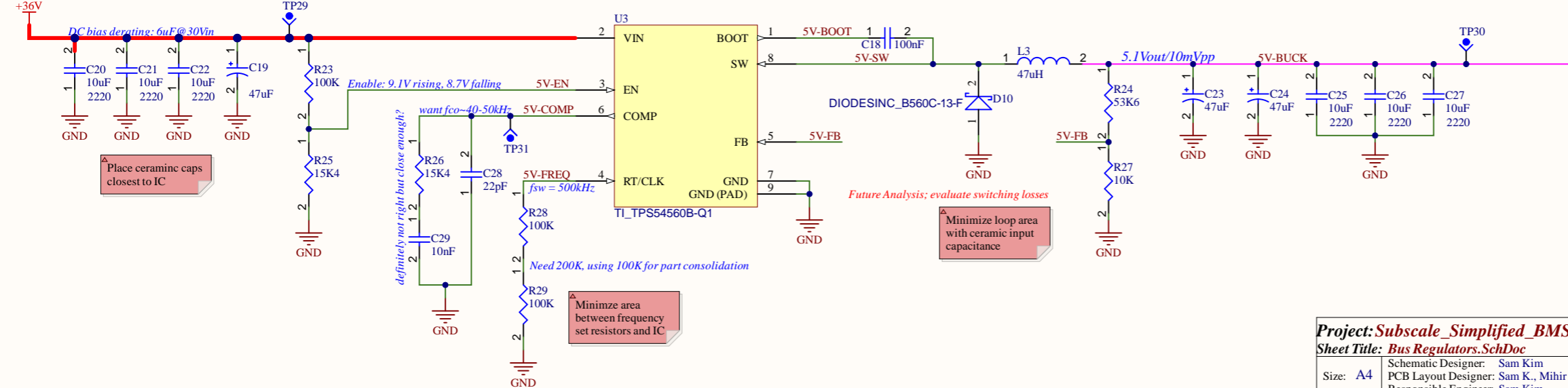


Bus Monitoring

Current/Voltage Measurements



5V BUS



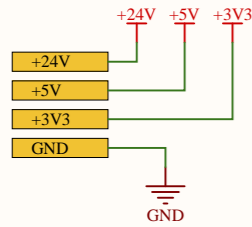
Project: Subscale_Simplified_BMS.PrjPcb			
Sheet Title: Bus Regulators.SchDoc			
Size: A4	Schematic Designer: Sam Kim	Yellow Jacket Space Program Georgia Tech Atlanta, GA	
Date: 12/11/2021	Revision: 3.0	Sheet: 2 of: 8	



On-board Temp Sensing

Teensy 3.6 Microcontroller

Power bus telemetry sent to Master Computer as well as local data storage
All analog sensing occurring at max 200Hz

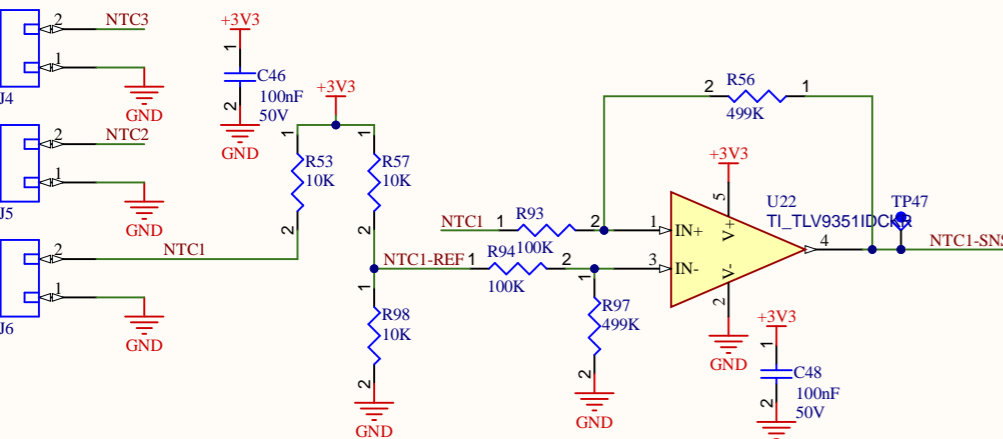


Series resistors on SPI drivers for impedance mismatches bc JLC doesn't frickin publish their default stackups

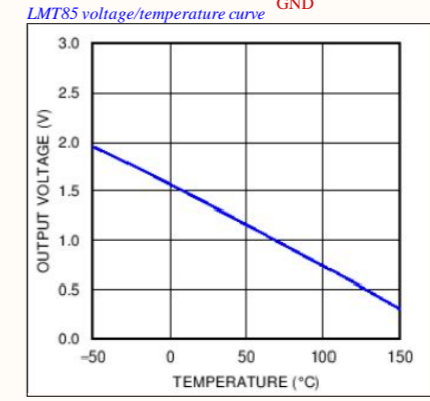
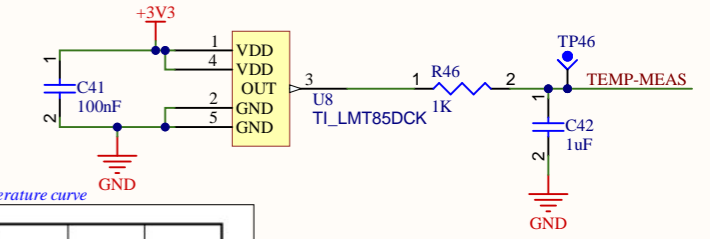
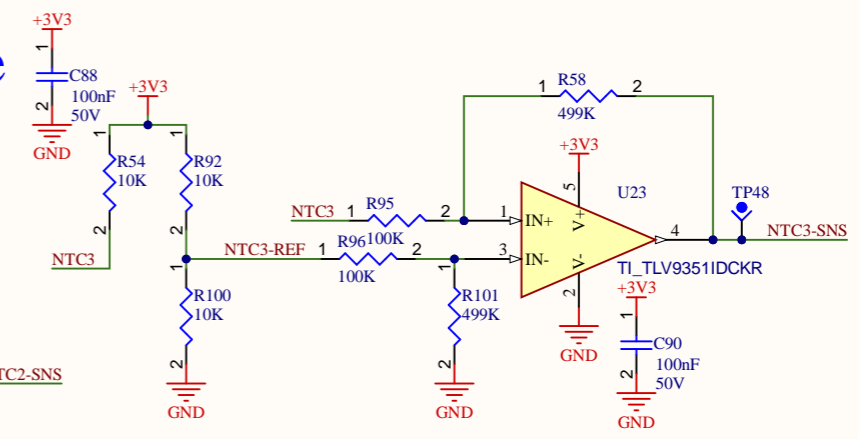
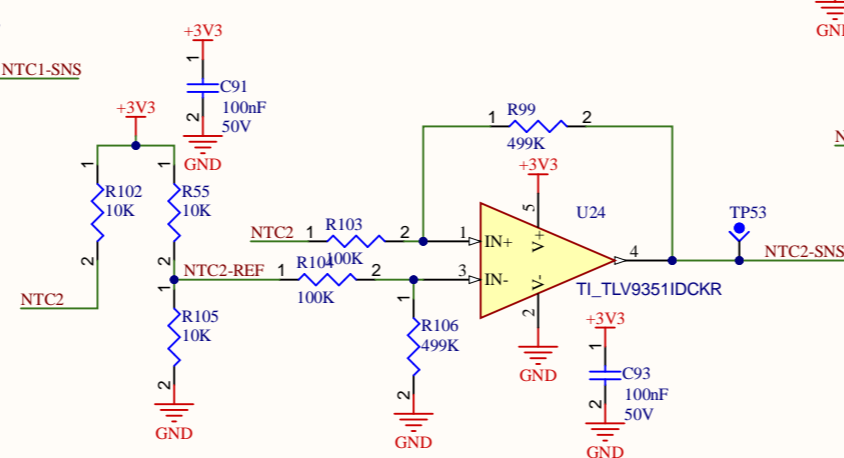
LAYOUT: Feel free to adjust pinout of Teensy except Master Computer SPI pins

LAYOUT: Place zener closest to teensy.

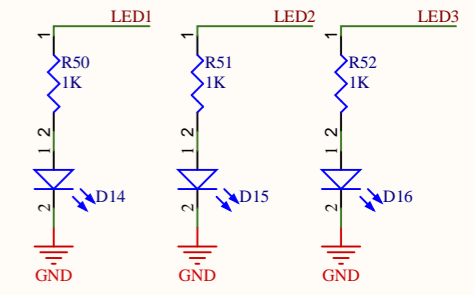
Expect NTC with R25 = 10k B25/50 3380



Battery Temperature Sense

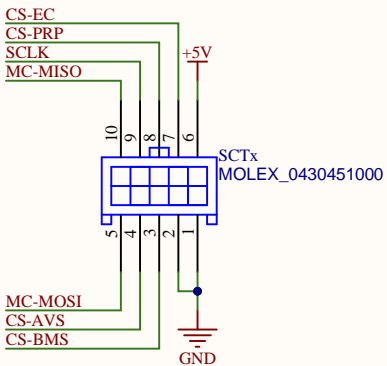
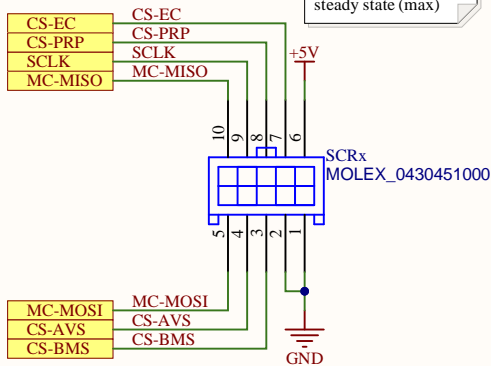
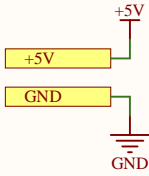



Status LEDs



Assembly Note: 26AWG wire

5V bus - expect 4A steady state (max)

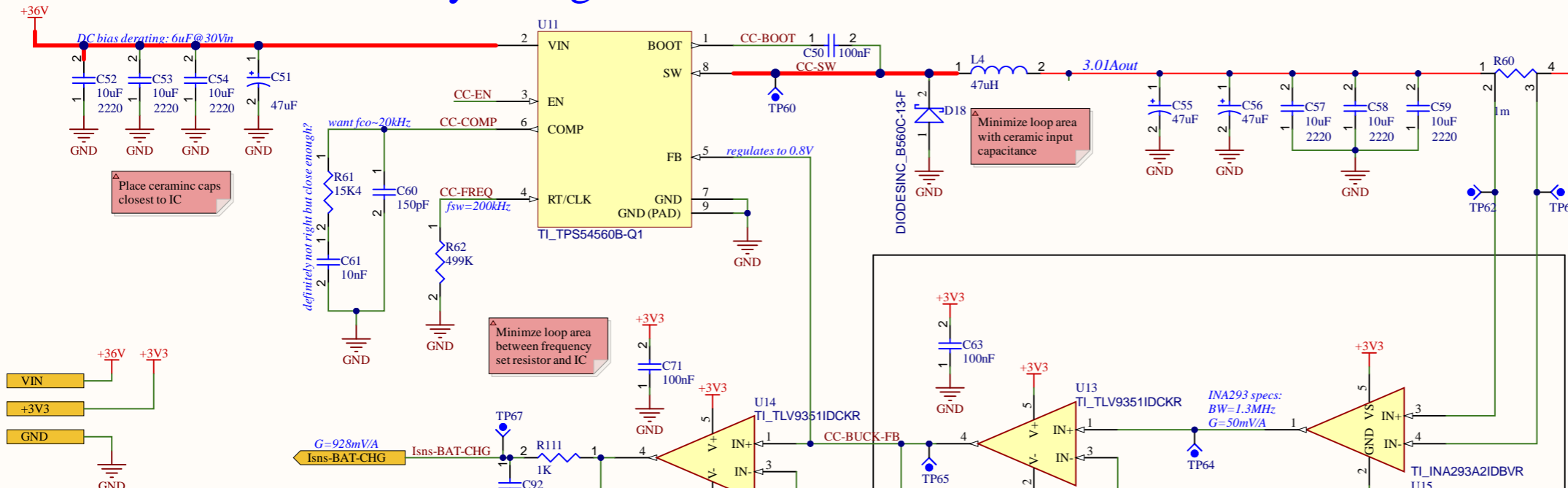


Project: Subscale Simplified BMS.PrjPcb		
Sheet Title: SCH-0002-12.SchDoc ERM8/ERF8 Stacking Connectors		
Size: A4	Schematic Designer: Sam Kim PCB Layout Designer: N/A Responsible Engineer: Rithvik Nagarajan	
Date: 12/11/2021	Revision: 2.0	Sheet: B of N/A

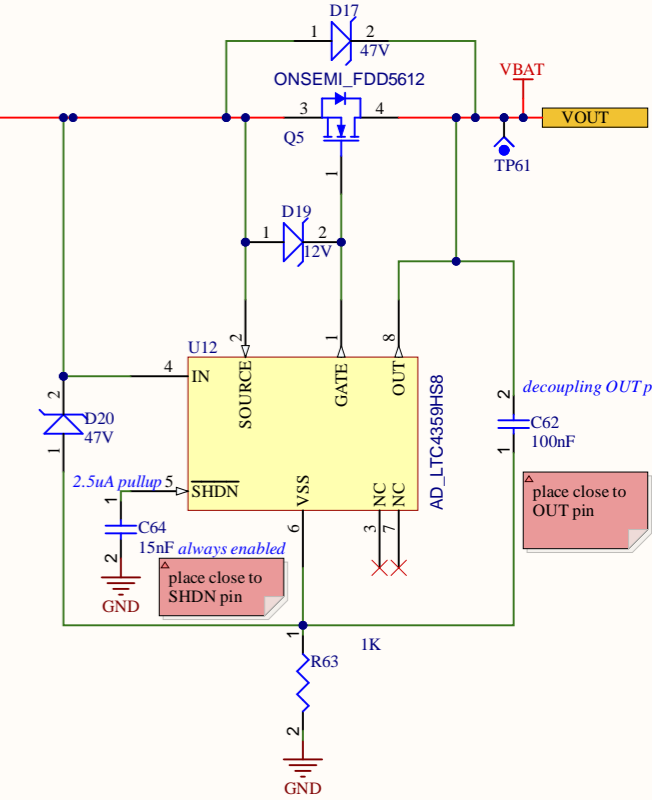
Yellow Jacket Space Program
 Georgia Tech
 Atlanta, GA

Constant Current Battery Charger

27V-36V -> 3A buck converter
DCM boundary ~100mAout

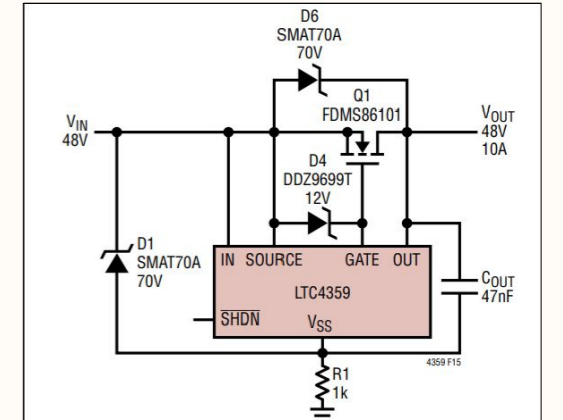
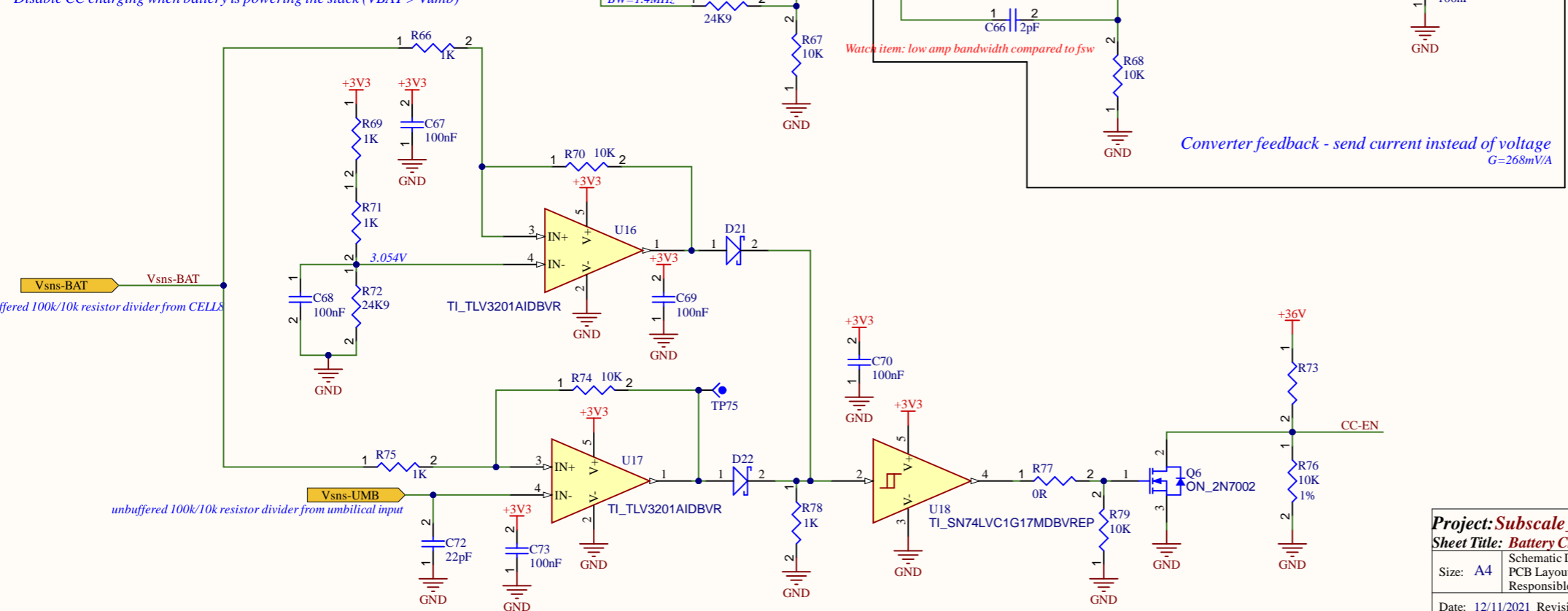


Ideal Diode to prevent backcharge of CC buck from battery



Battery Charge Enable

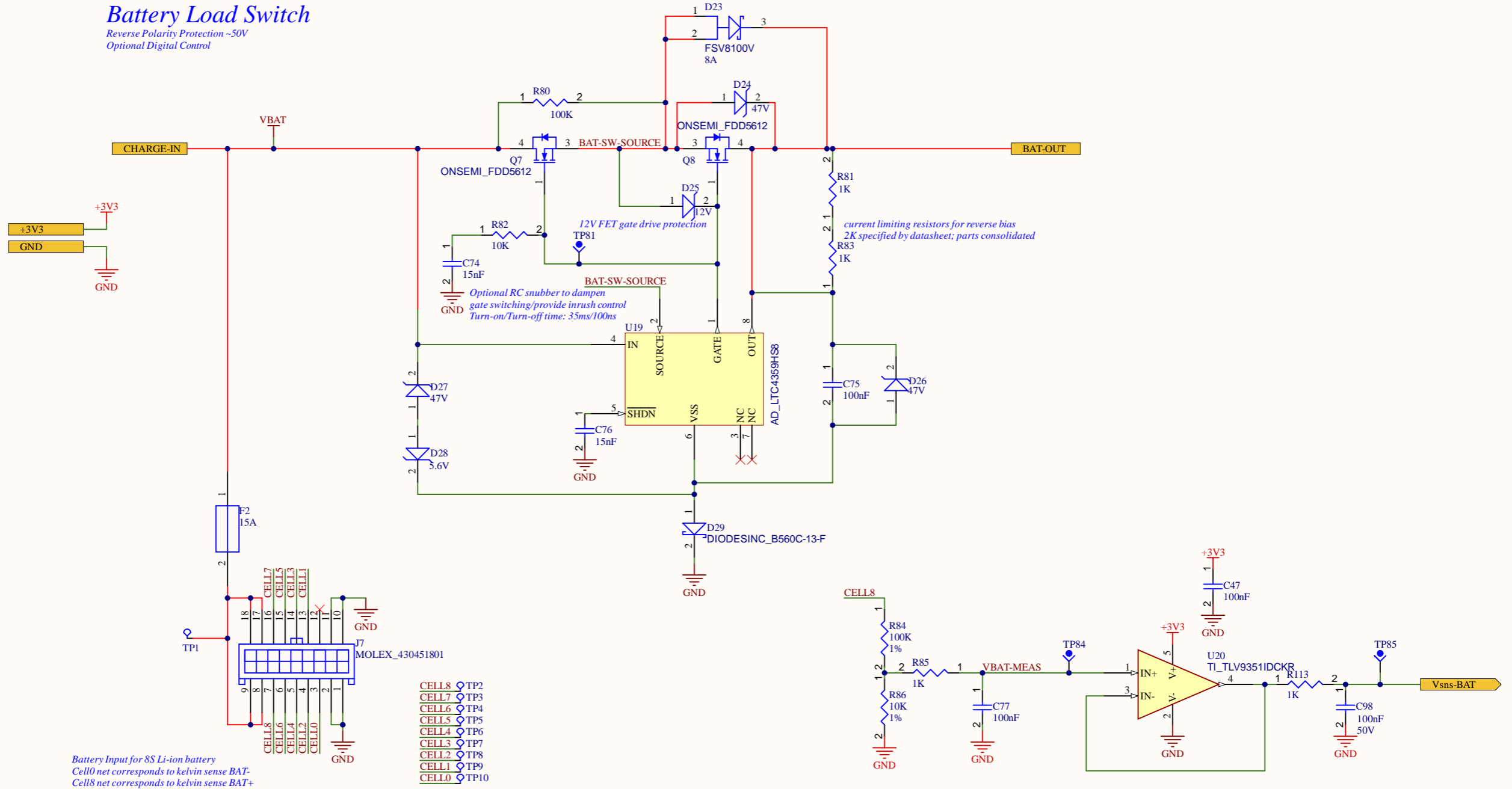
8S Li-ion CC ONLY battery charging
Disable CC charging when battery reaches full voltage (33.6V)
Disable CC charging when battery is powering the stack (VBAT > Vumb)



Battery Input

Battery Load Switch

Reverse Polarity Protection ~50V
Optional Digital Control



Project: **Subscale_Simplified_BMS.PrjPcb**

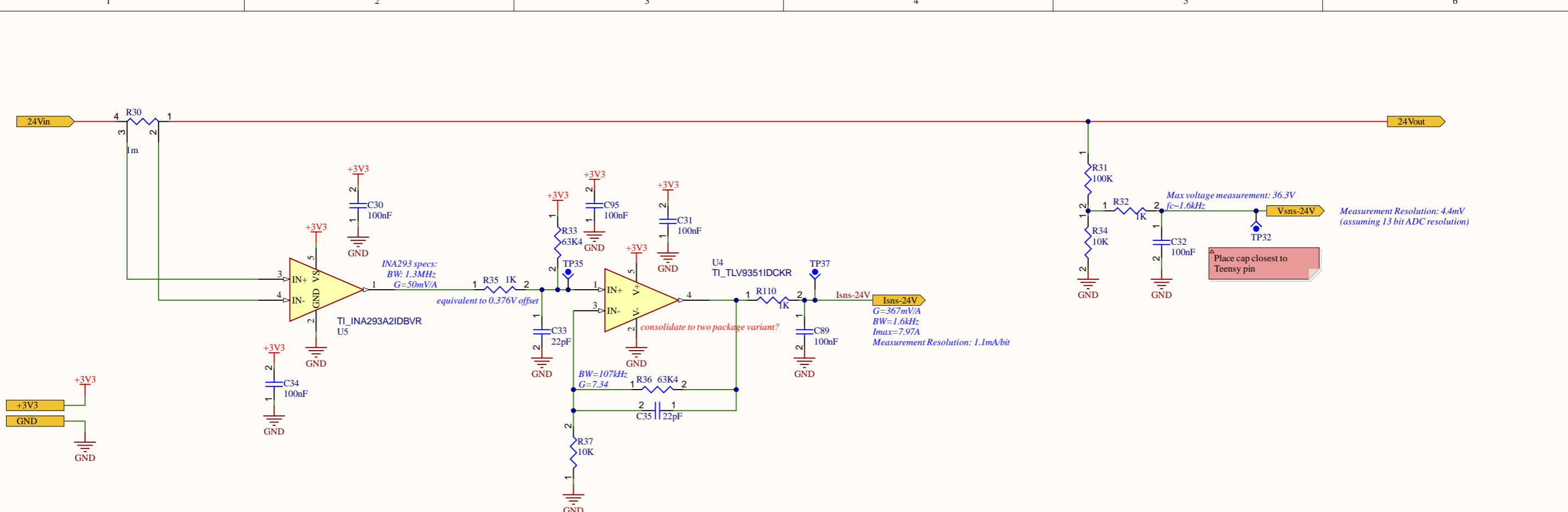
Sheet Title: **Battery Input.SchDoc**

Size: A4
 Schematic Designer: Sam Kim
 PCB Layout Designer: Sam K., Mihir K.
 Responsible Engineer: Sam Kim

Yellow Jacket Space Program
 Georgia Tech
 Atlanta, GA

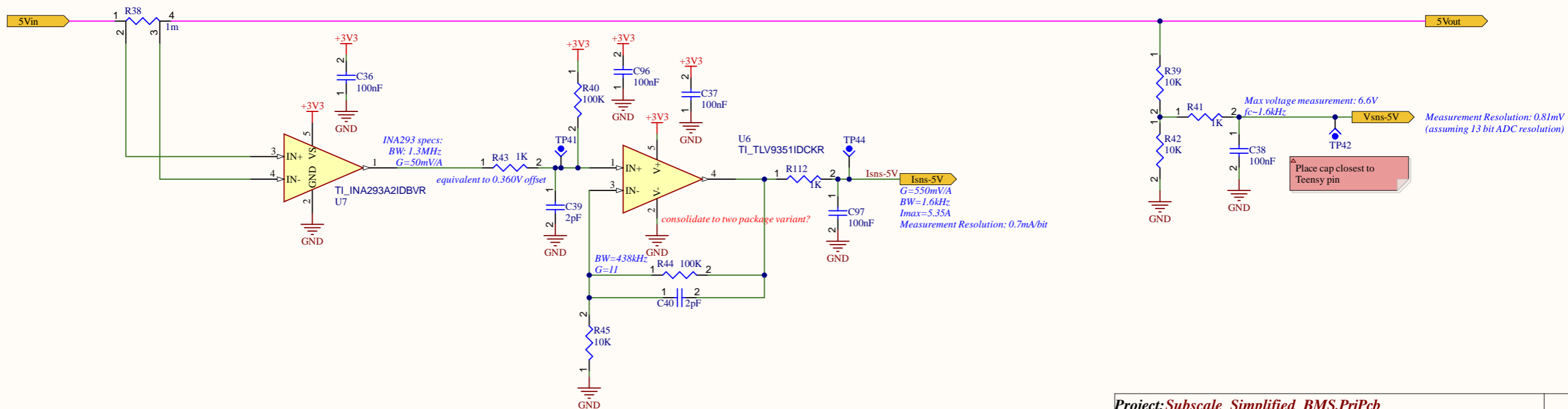


Date: 12/11/2021 Revision: 3.0 Sheet: * of: *



Current Measurements

Voltage Measurements



Project: *Subscale_Simplified_BMS.PrjPcb*

Sheet Title: *Bus Monitoring.SchDoc*

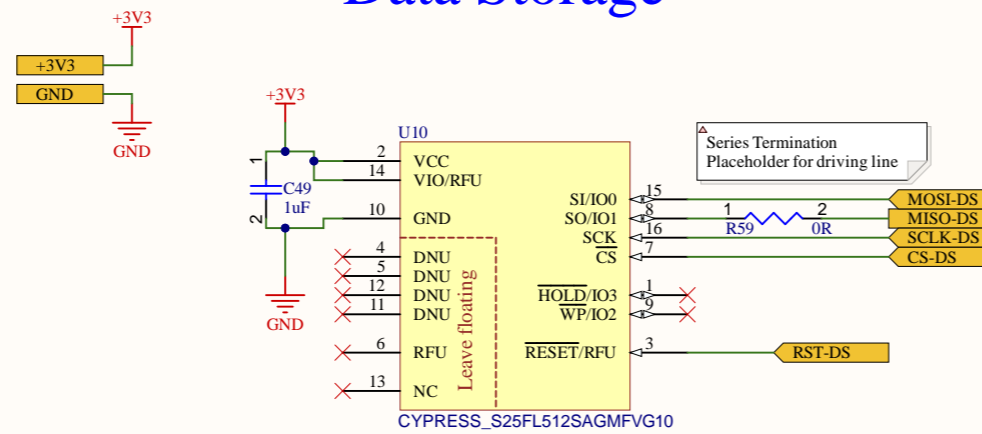
Size: A4
 Schematic Designer: Sam Kim
 PCB Layout Designer: Sam K., Mihir K.
 Responsible Engineer: Sam Kim

Yellow Jacket Space Program
 Georgia Tech
 Atlanta, GA



Date: 12/11/2021 Revision: 3.0 Sheet: * of: *

Data Storage



Project: **Subscale_Simplified_BMS.PrjPcb**

Sheet Title: **Data Storage.SchDoc**

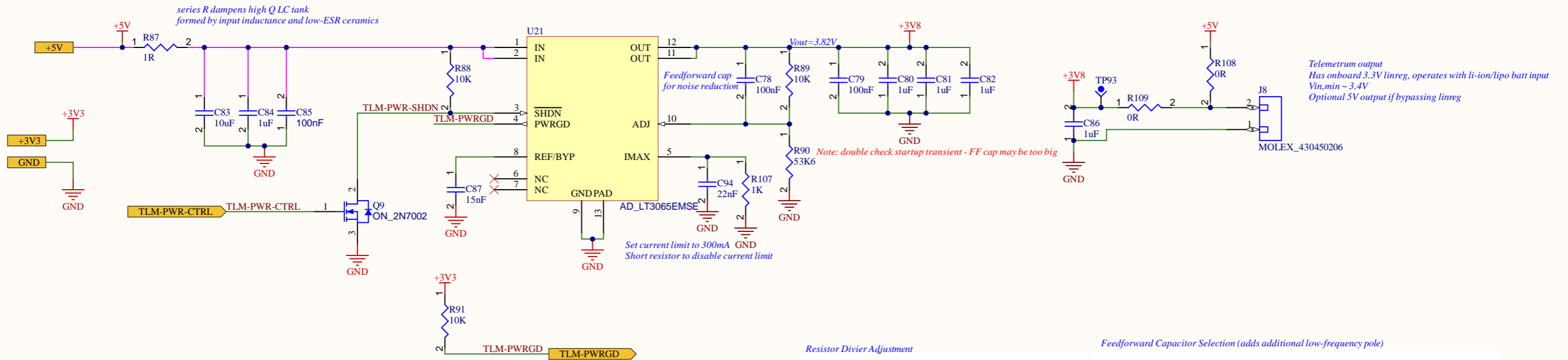
Size: **A4**
Schematic Designer: **Sam Kim**
PCB Layout Designer: **Sam K., Mihir K.**
Responsible Engineer: **Sam Kim**

Yellow Jacket Space Program
Georgia Tech
Atlanta, GA

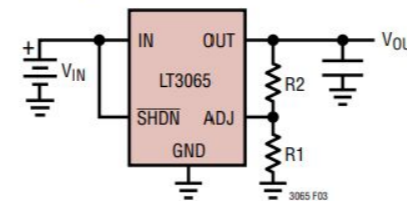


Date: **12/11/2021** Revision: **3.0** Sheet: ***** of: *****

Telemetry Power



Resistor Divider Adjustment



$$V_{OUT} = 0.6V \left(1 + \frac{R2}{R1}\right) - (I_{ADJ} \cdot R2)$$

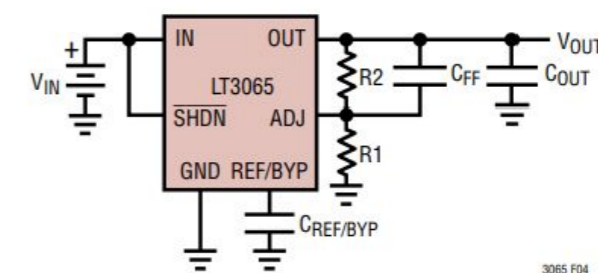
$$V_{ADJ} = 0.6V$$

$$I_{ADJ} = 16nA \text{ AT } 25^{\circ}C$$

OUTPUT RANGE = 0.6V TO 40V

Figure 3. Adjustable Operation

Feedforward Capacitor Selection (adds additional low-frequency pole)



$$C_{FF} \geq \frac{10nF}{10\mu A} \cdot (I_{FB_DIVIDER})$$

$$I_{FB_DIVIDER} = \frac{V_{OUT}}{R1 + R2}$$

Project: **Subscale_Simplified_BMS.PrjPcb**

Sheet Title: **Telemetry Power.SchDoc**

Size: A4
Schematic Designer: Sam Kim
PCB Layout Designer: Sam K., Mihir K.
Responsible Engineer: Sam Kim

Yellow Jacket Space Program
Georgia Tech
Atlanta, GA



Date: 12/11/2021 Revision: 3.0 Sheet: * of: *

