

MPPT Solar Converter

SOLAR CAR 2021

REV 2

△ Rev 2 firmware changes:

- Boost enable signal must be applied on pin PB7 once booted up
- Voltage Output transfer function is: $V_{OUT} = V_{OUT_TELEM} * (1010000/10000)$
- String input current transfer function is: $I_{IN} = (I_{IN_TELEM}/20)/0.01$
- If overvoltage fault occurs, can be cleared manually with button or with toggling pin PB_6 (fault will re-latch if fault still present after clear signal removed)
- Discharging output capacitance to get unplugged board to storage state can be accomplished by turning on pin PB1 (takes tens of seconds).

Title **COVER**

Engineer: Shelby Riggleman

Revision: 1

Date: 4/20/2022 Time: 10:15:14 AM Sheet 1 of 10

File: cover.SchDoc

Badgerloop Electrical
133 Engineering Research Building
1500 Engineering Drive
Madison, Wi 53706



Connectors

A

A

B

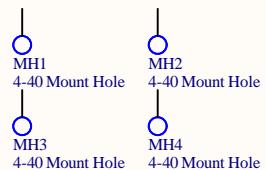
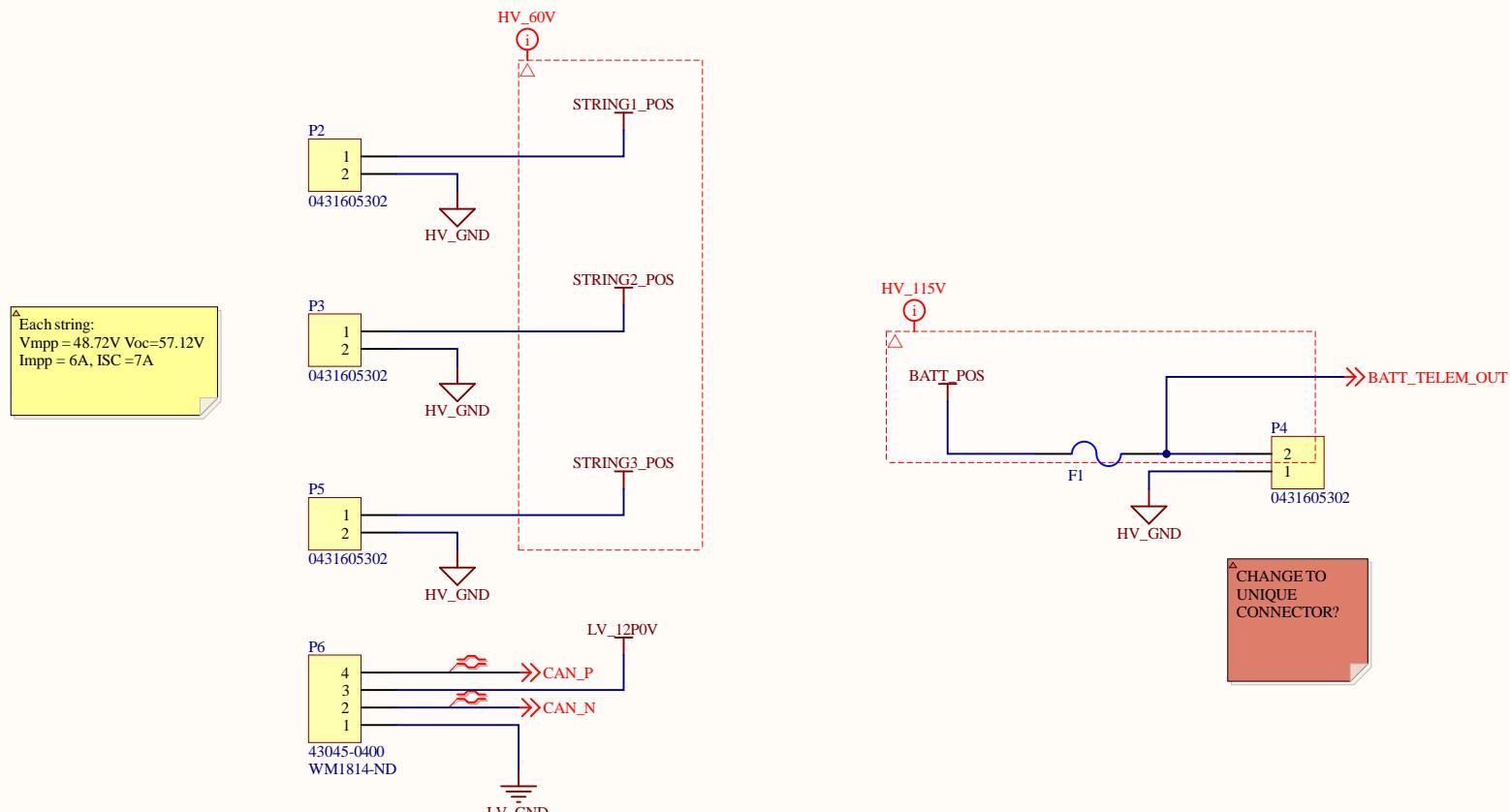
B

C

C

D

D

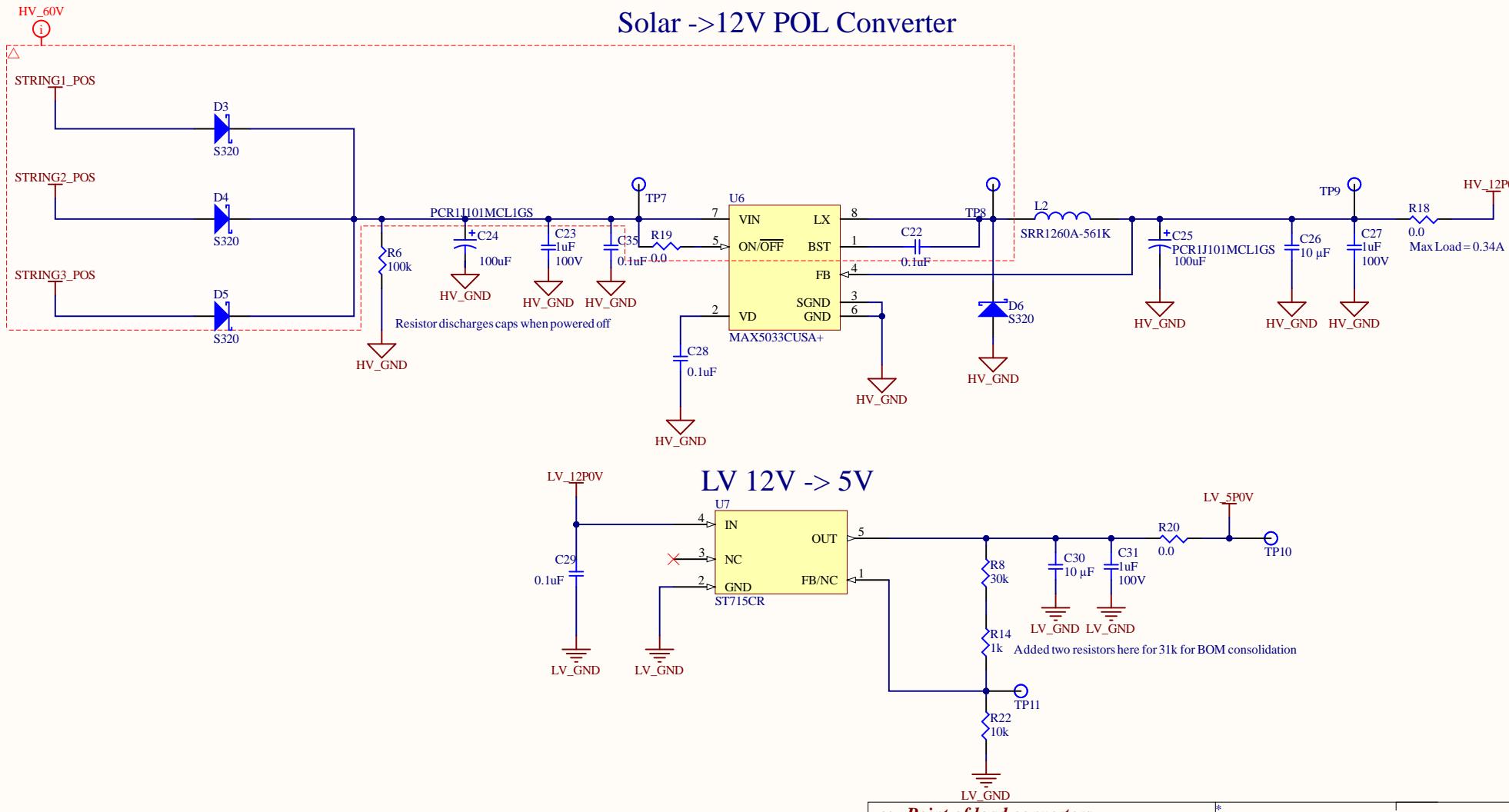


Title Connectors	
Engineer: Shelby Riggelman	Revision: 1
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File: Connectors.SchDoc	

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Point of Load Converters

Solar ->12V POL Converter



Title **Point of load converters**

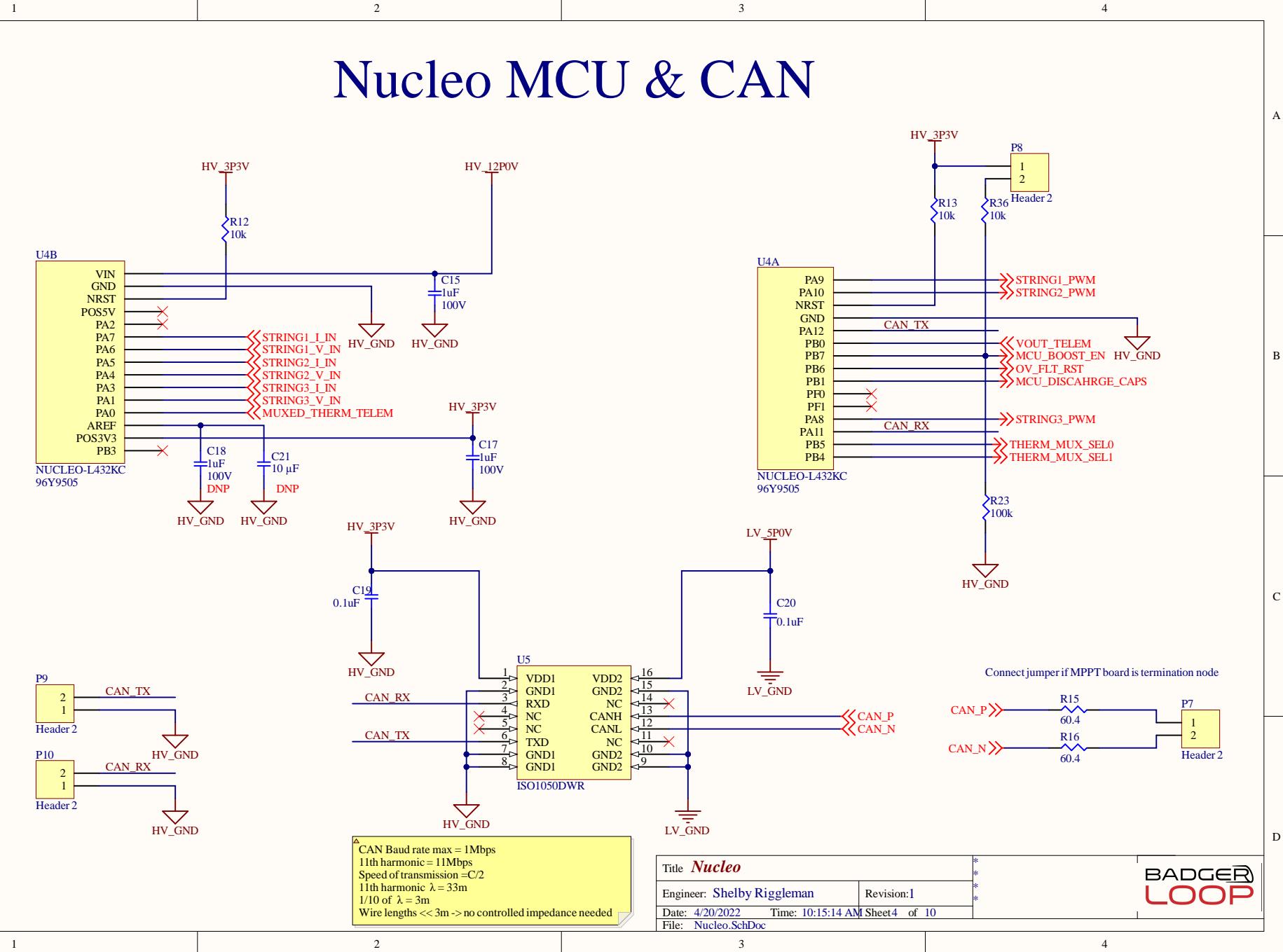
Engineer: Shelby Riggelman

Revision: 1

Date: 4/20/2022 Time: 10:15:14 AM Sheet 3 of 10

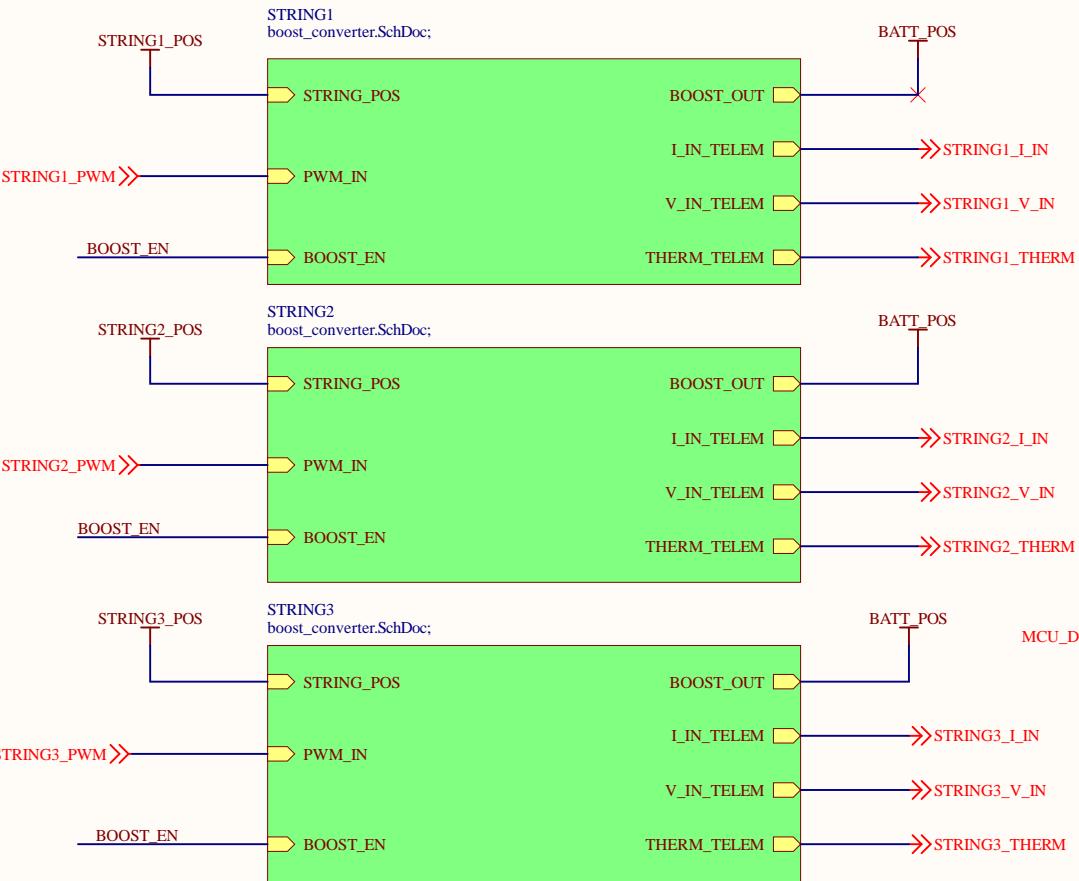
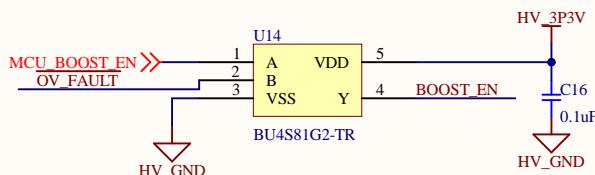
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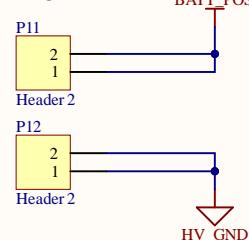


Solar Strings MPPTs

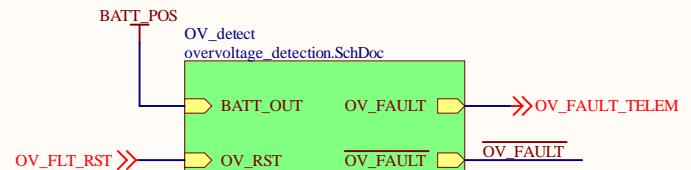
Boost Enable Signal (All)



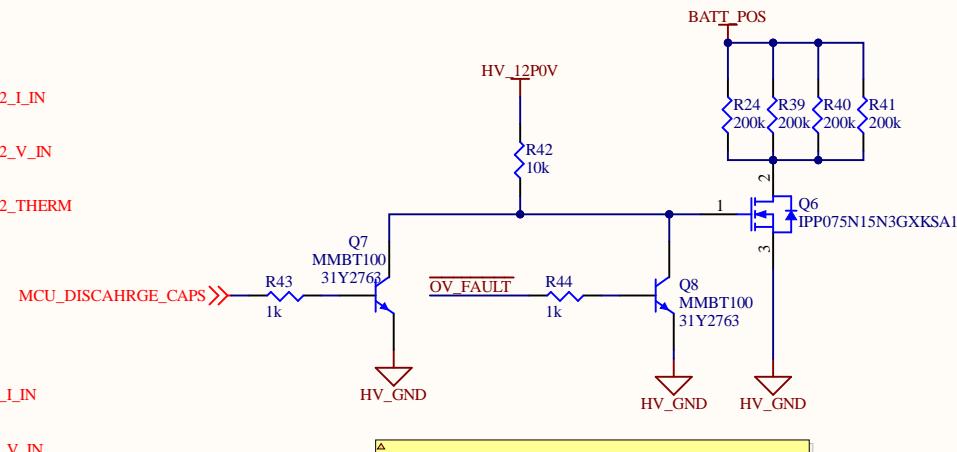
Debug Headers



Ovvoltage Detection



Ovvoltage Discharge



Title **Boost Strings**

Engineer: Shelby Riggeman

Revision: 1

Date: 4/20/2022 Time: 10:15:15 AM Sheet 5 of 10

File: solar_boost_strings.SchDoc

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Solar Boost Converter

1

2

3

4

A

B

C

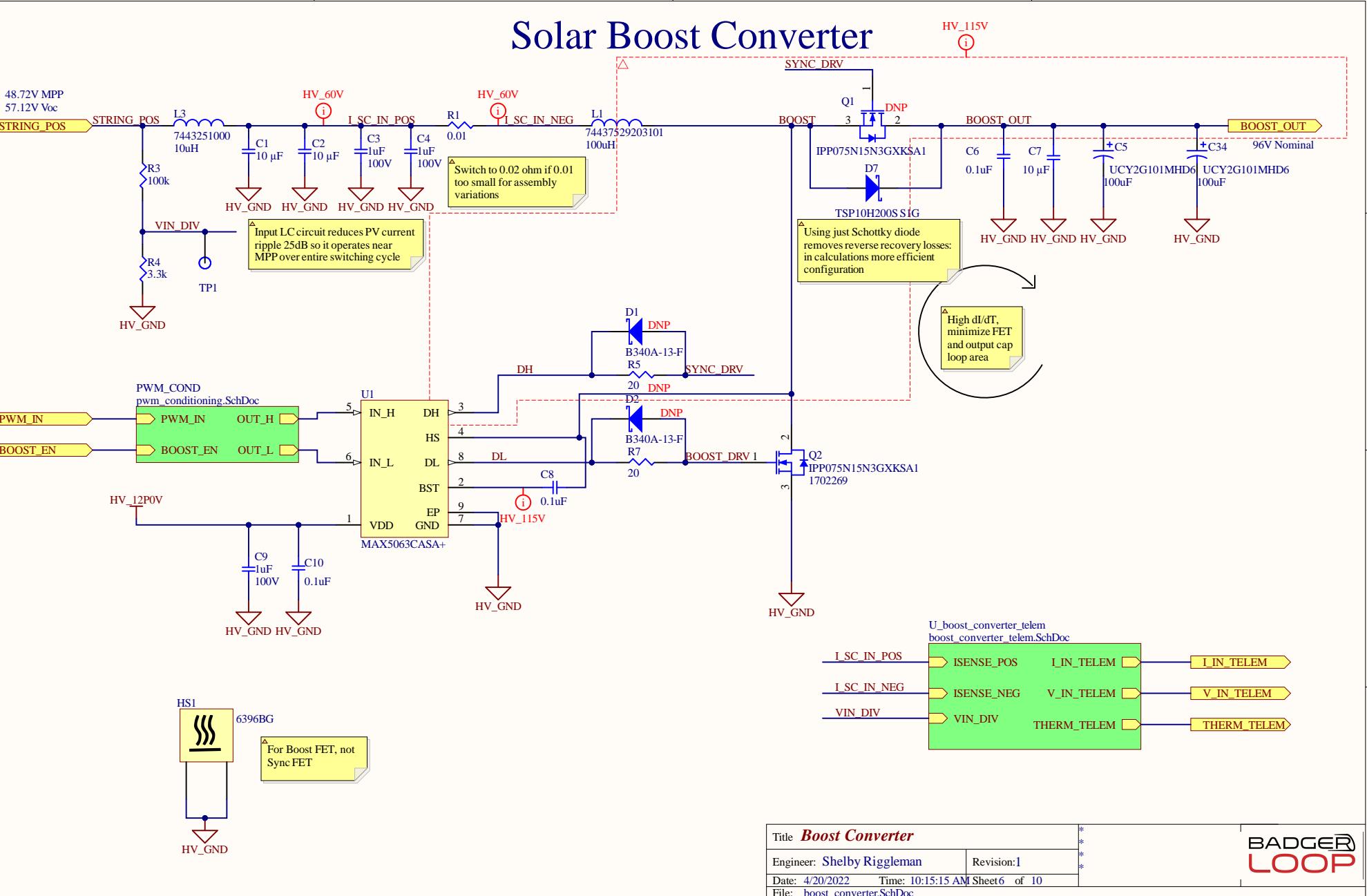
D

A

B

C

D



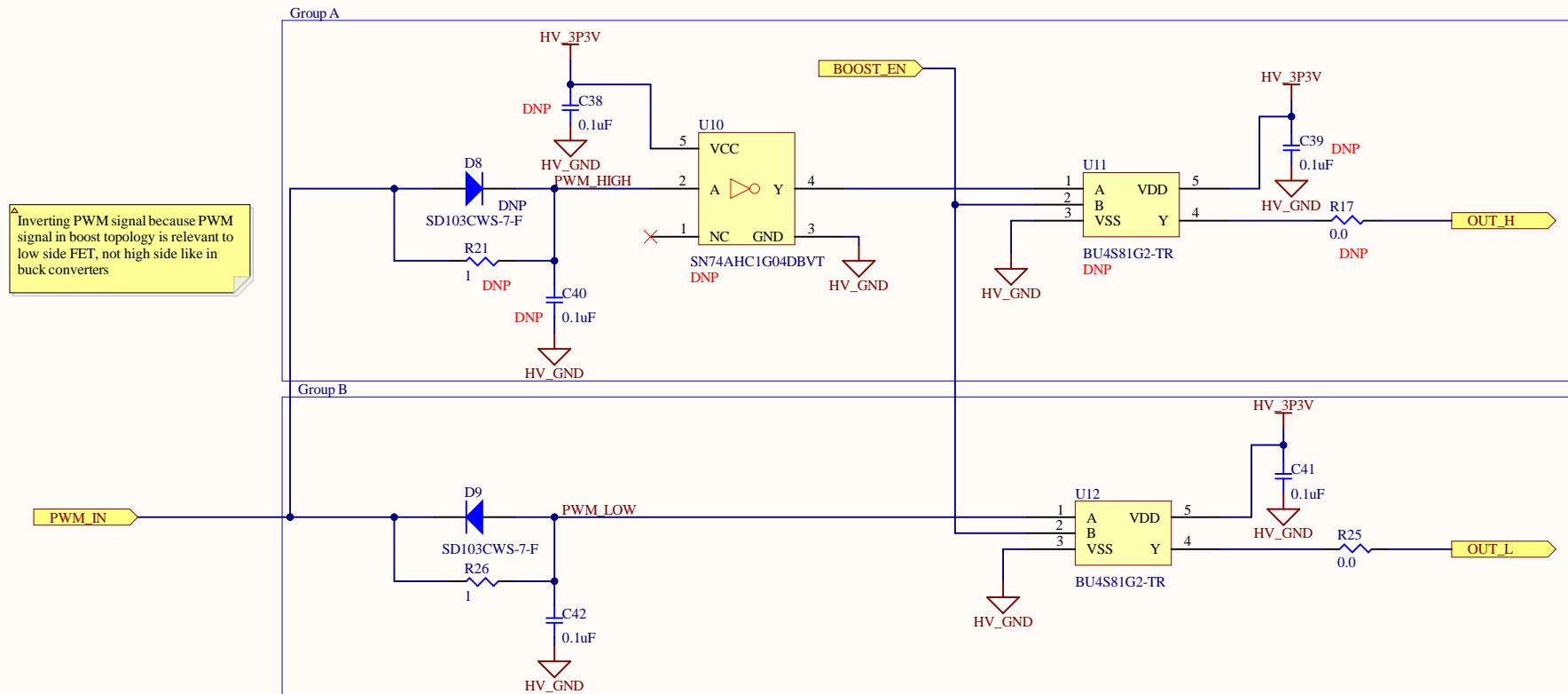
1

2

3

4

PWM Conditioning

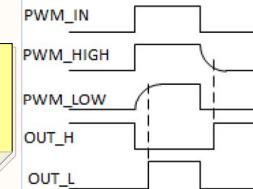


[△] Inverting PWM signal because PWM signal in boost topology is relevant to low side FET, not high side like in buck converters

Gate Driver	Sync. Config (2 FETS):	Async. Config (FET + Diode)
MAX5063A/MAX5063C	Populate all components	DNP Group A, or remove OUT_H resistor Short out PWM_LOW RC resistor
MIC4102	DNP Group B, or remove OUT_L resistor Short out PWM_HIGH RC resistor	DNP Group B, or remove OUT_L resistor Short out PWM_HIGH RC resistor
MIC4103	Populate all components	DNP Group A, or remove OUT_H resistor Short out PWM_LOW RC resistor

Default Configuration

[△] RC Circuits create delays between FET on times to prevent shoot through when converter is in synchronous configuration:



Title **PWM Conditioning**

Engineer: Shelby Riggelman

Revision: 1

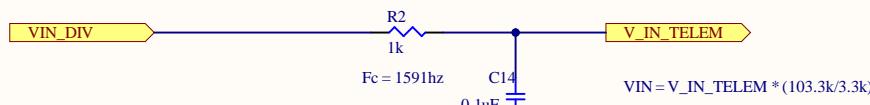
Date: 4/20/2022 Time: 10:15:15 AM Sheet 7 of 10

File: pwm_conditioning.SchDoc

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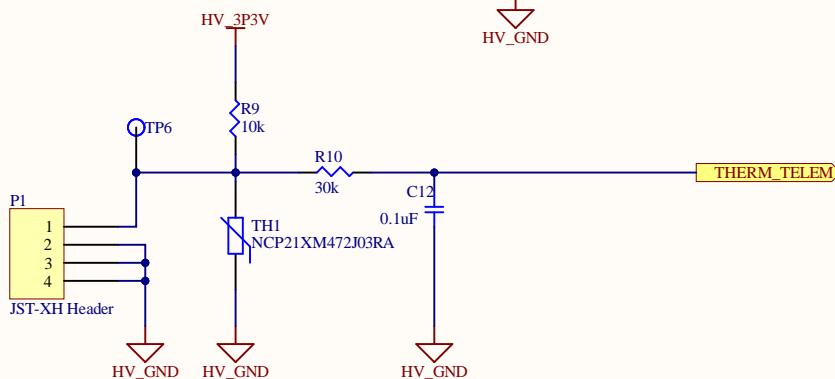
Solar Boost Converter Telemetry

String Input Voltage

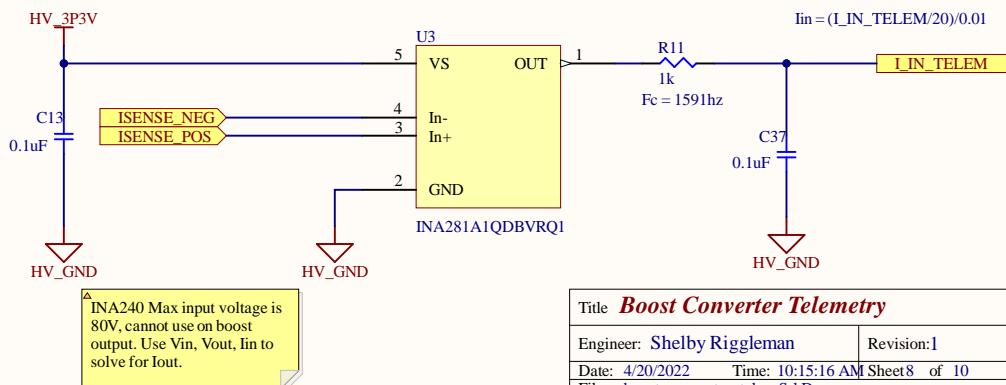


△ UPDATE COMPONENTS TO
CREATE CORNER
FREQUENCY HIGHER THAN
CONTROL LOOP UPDATE
RATE UPON TESTING

Thermistor Output



String Input Current



△ UPDATE COMPONENTS TO
CREATE CORNER
FREQUENCY HIGHER THAN
CONTROL LOOP UPDATE
RATE UPON TESTING

Title **Boost Converter Telemetry**

Engineer: Shelby Riggelman Revision: 1

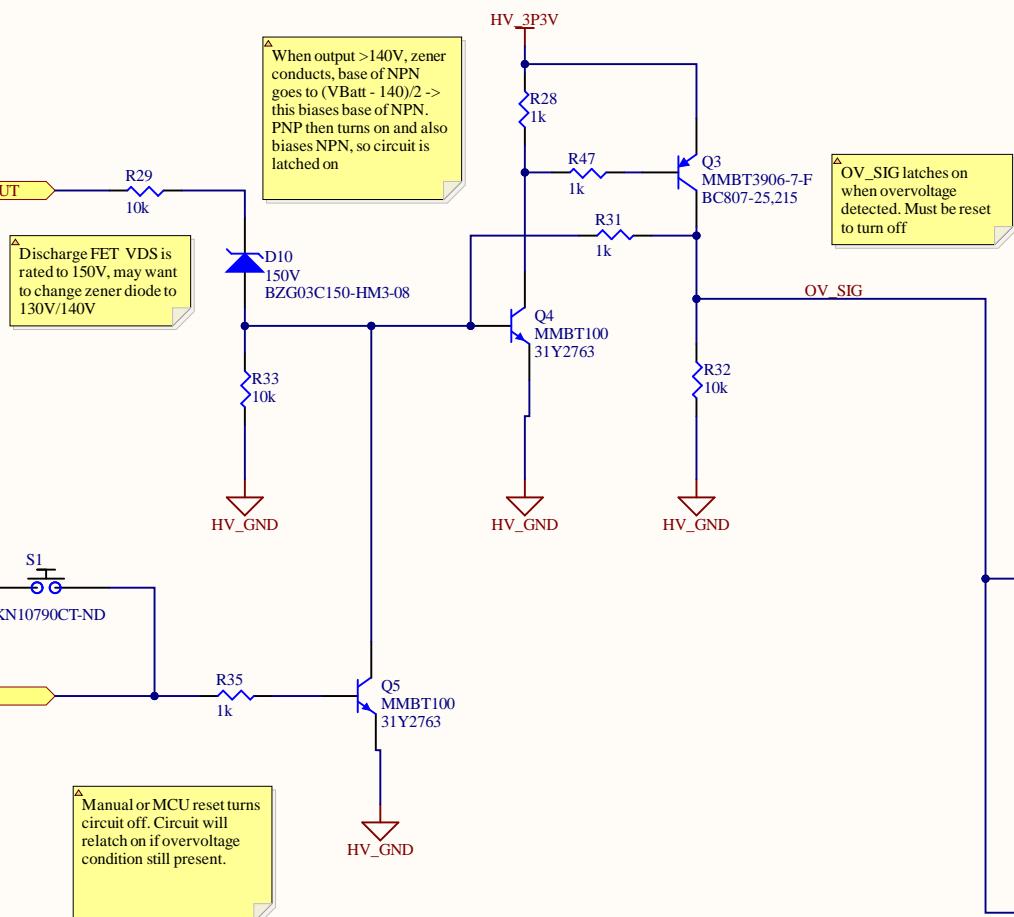
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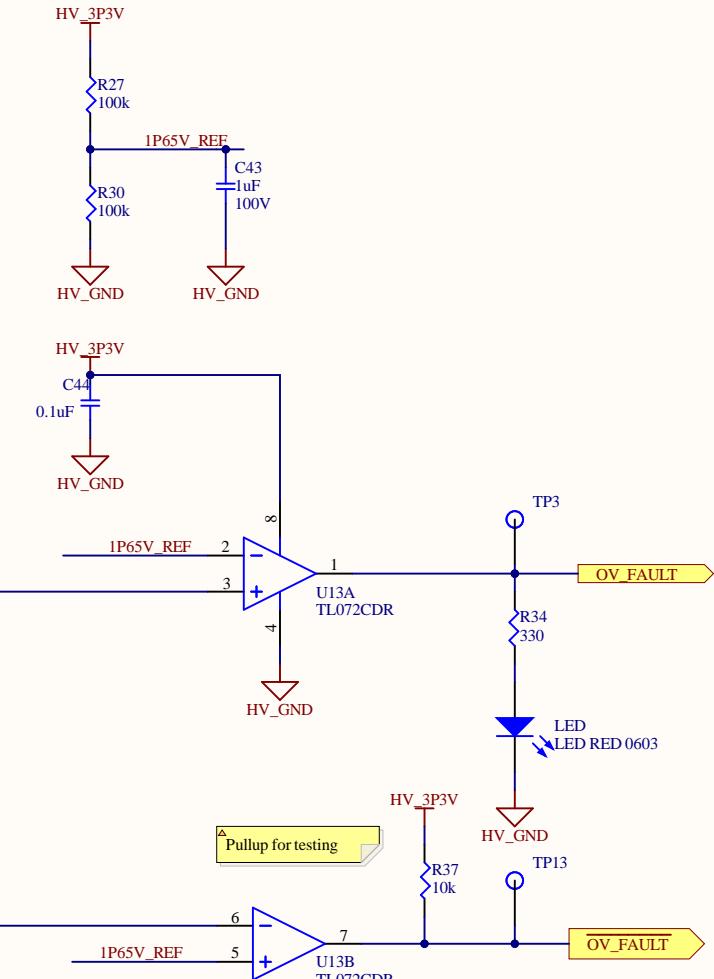
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Overvoltage Detection

A



B



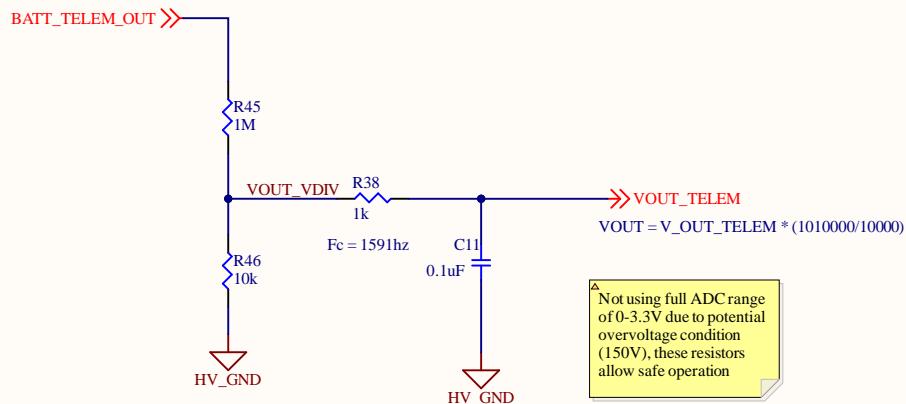
C

Title <i>Over-Voltage Detection</i>	
Engineer: Shelby Riggelman	Revision: 1
Date: 4/20/2022	Time: 10:15:16 AM Sheet 9 of 10
File: overvoltage_detection.SchDoc	

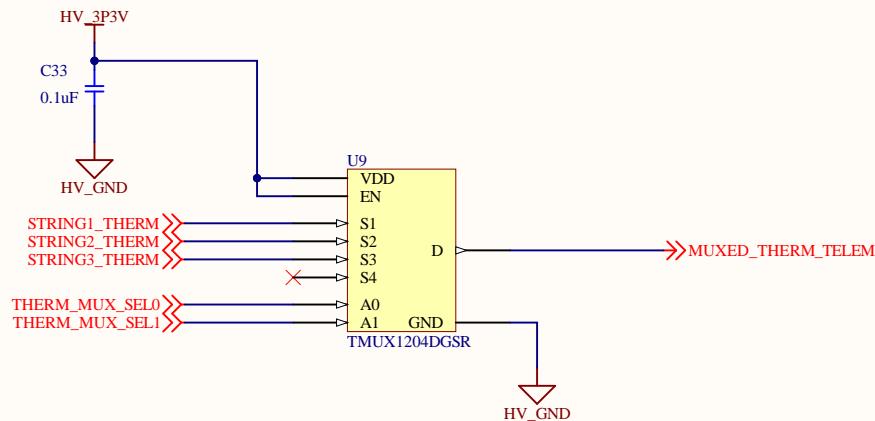
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Global Telemetry

Output (Battery) Voltage



String Thermistor Telem (Muxed)



Title Global Telemetry	
Engineer: Shelby Riggelman	Revision: 1
Date: 4/20/2022	Time: 10:15:16 AM Sheet 10 of 10
File: global_telem.SchDoc	

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