

1

2

3

4

A

A

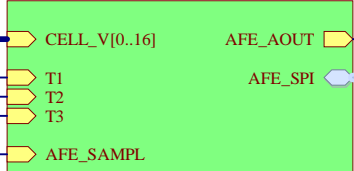
Battery Interface  
Battery\_Interface.SchDoc



Temperature Sense  
Temperature\_Sense.SchDoc



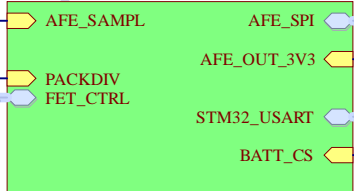
AFE  
MAX14921\_AFE.SchDoc



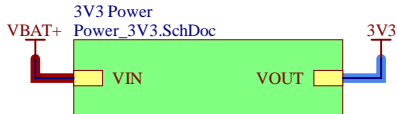
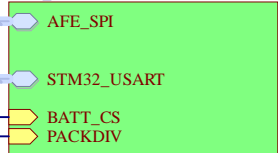
Analog Attenuator  
Analog\_Attenuator.SchDoc



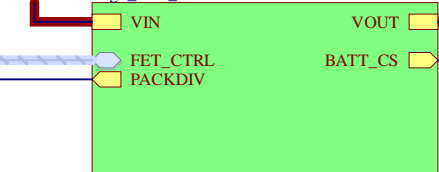
STM32 MCU  
STM32\_MCU.SchDoc



Pack Interface  
Pack\_Interface.SchDoc



High Side Switch  
High\_Side\_Switch.SchDoc



### Mounting Holes

- MH1
- MH2
- MH3
- MH4

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PROJECT LTO 16S BMS.PrjPcb, [No Variations]		
DOCUMENT Top.SchDoc		MODIFIED 2023-05-19
ENGINEER Farris Matar	REVIEWER *	SHEET 1 OF 11

1

2

3

4

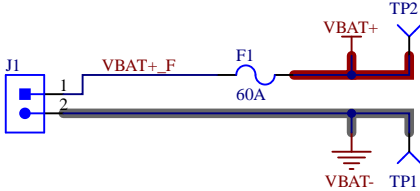
D

D

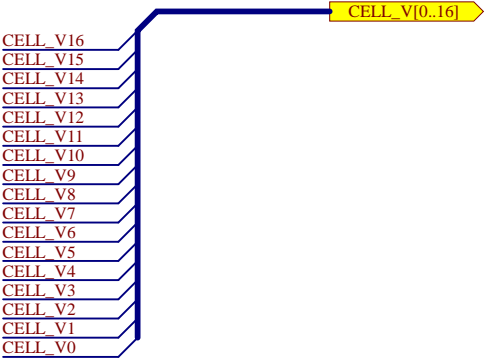
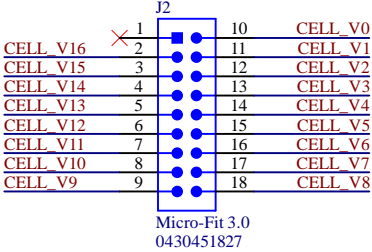
# BATTERY INTERFACE

**Battery specs:**  
- 16s1p 20Ah LTO battery  
- 1.5V - 2.7V cell voltage range, 2.3V nominal

## Power Input

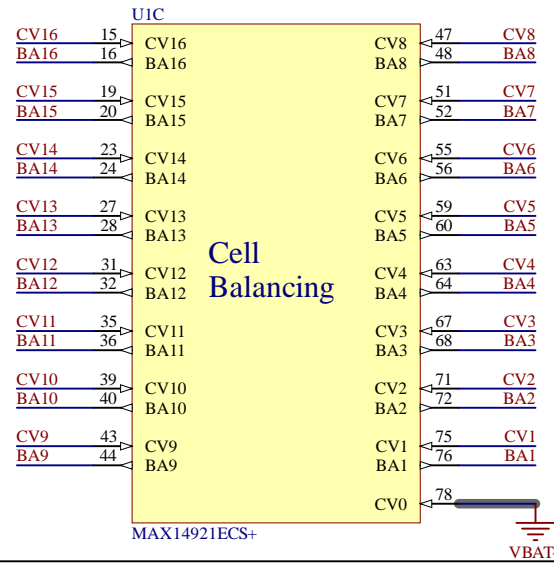
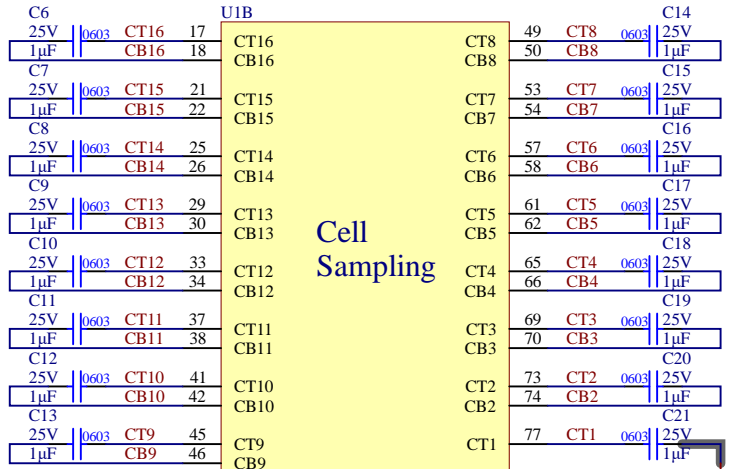
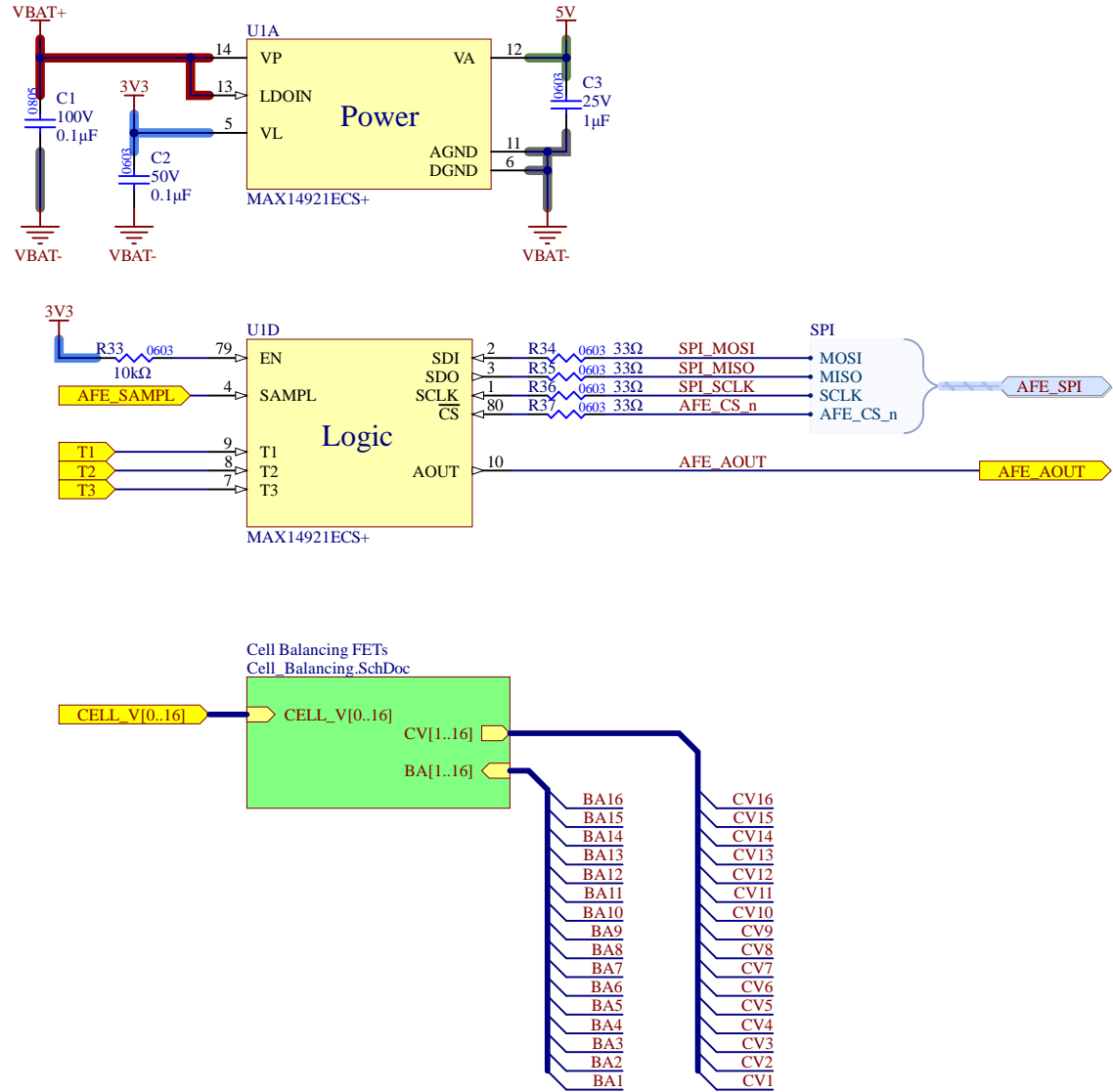


## Cell Sensing Inputs



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PROJECT LTO 16S BMS.PrjPcb, [No Variations]		
DOCUMENT Battery_Interface.SchDoc		MODIFIED 2023-06-15
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# MAX19421 AFE



University of Waterloo 200 University Ave W Waterloo, Ontario, Canada N2L 3G1		REV 1.0
PROJECT LTO 16S BMS.PrjPcb, [No Variations]		
DOCUMENT MAX14921_AFE.SchDoc		MODIFIED 2023-06-15
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A

B

C

D

A

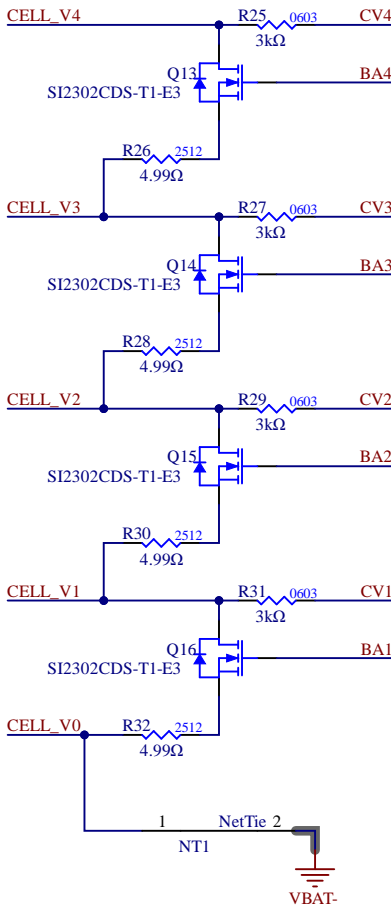
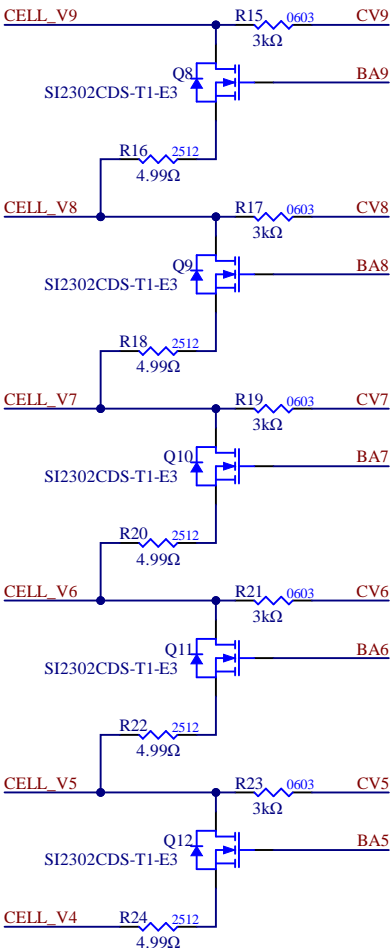
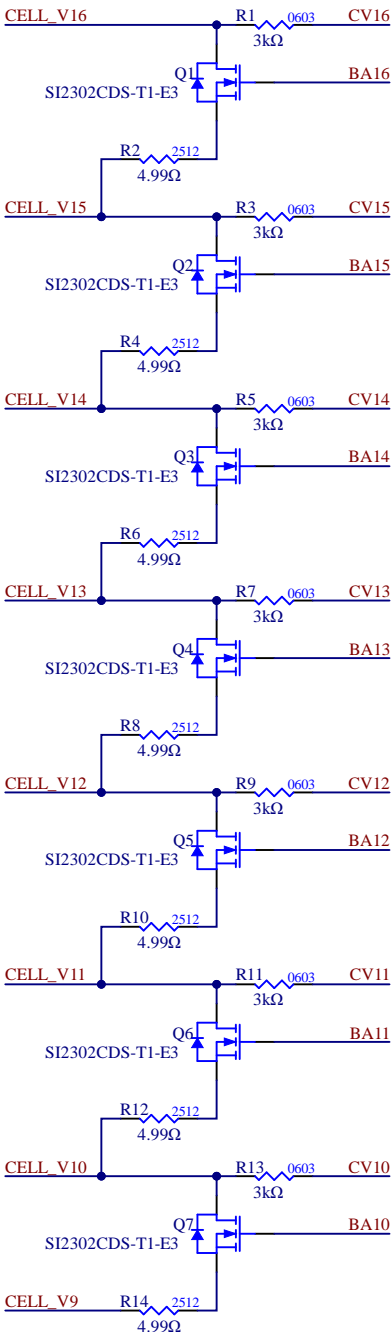
B

C

D

CELL\_V[0..16]

CELL\_V16  
CELL\_V15  
CELL\_V14  
CELL\_V13  
CELL\_V12  
CELL\_V11  
CELL\_V10  
CELL\_V9  
CELL\_V8  
CELL\_V7  
CELL\_V6  
CELL\_V5  
CELL\_V4  
CELL\_V3  
CELL\_V2  
CELL\_V1  
CELL\_V0



CV16  
CV15  
CV14  
CV13  
CV12  
CV11  
CV10  
CV9  
CV8  
CV7  
CV6  
CV5  
CV4  
CV3  
CV2  
CV1

CV[1..16]

BA16  
BA15  
BA14  
BA13  
BA12  
BA11  
BA10  
BA9  
BA8  
BA7  
BA6  
BA5  
BA4  
BA3  
BA2  
BA1

BA[1..16]

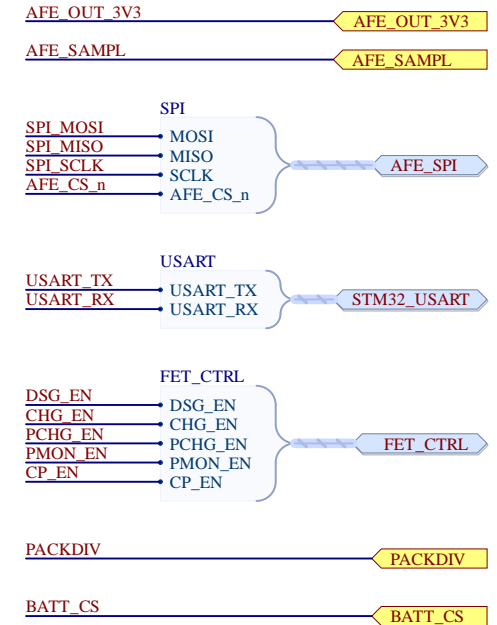
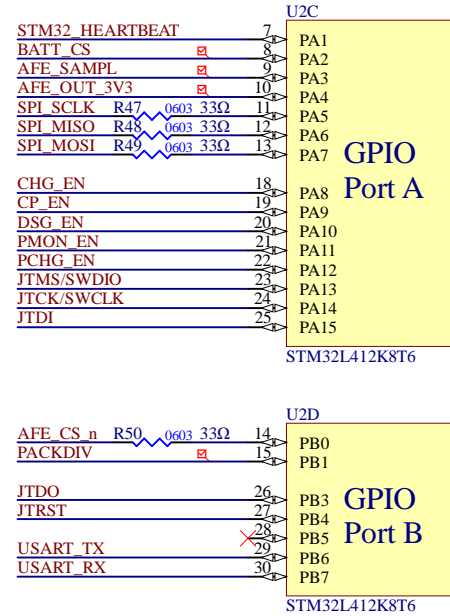
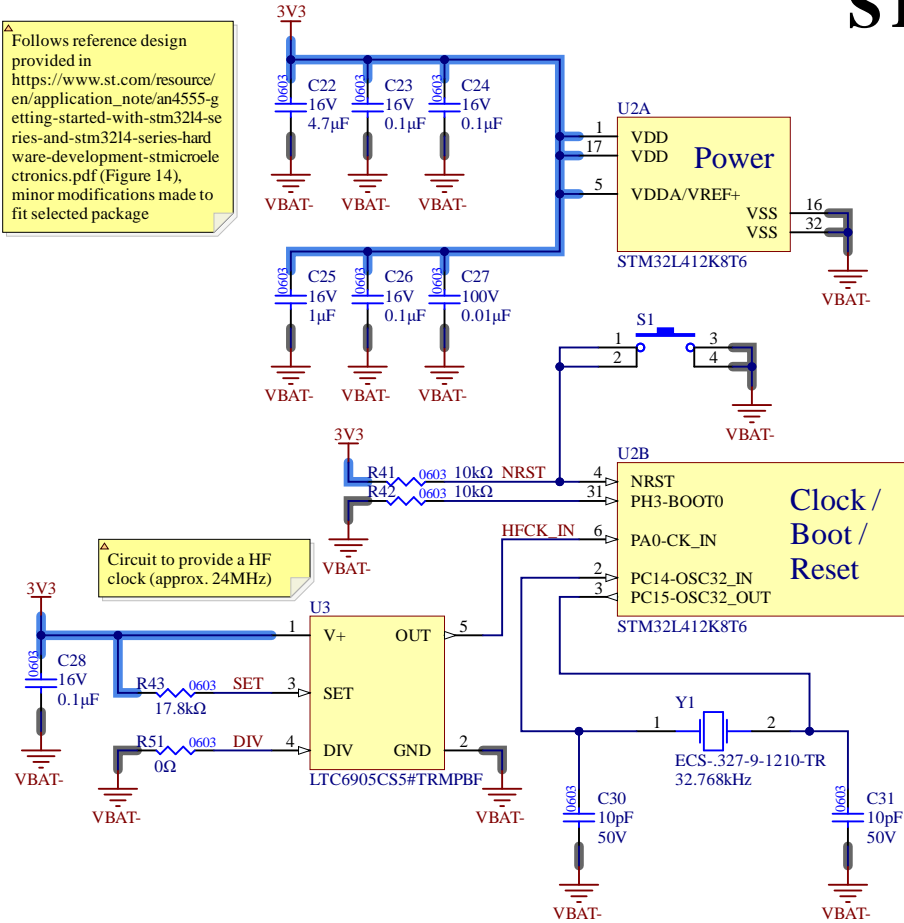
# CELL BALANCING

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PROJECT LTO 16S BMS.PrjPcb, [No Variations]		
DOCUMENT Cell_Balancing.SchDoc		MODIFIED 2023-06-15
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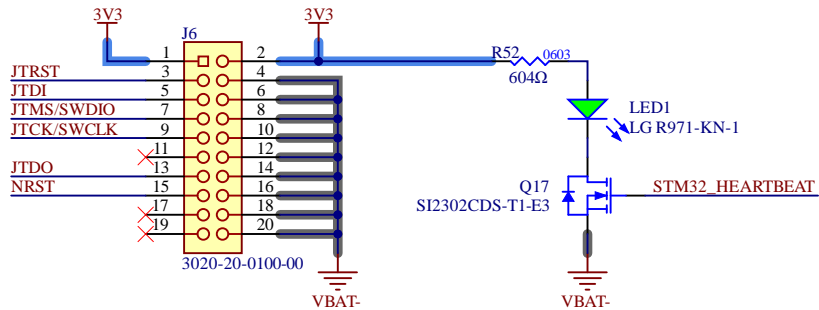
# STM32 MCU

Follows reference design provided in  
[https://www.st.com/resource/en/application\\_note/an4555-getting-started-with-stm32l4-series-and-stm32l4-series-hard-ware-development-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4555-getting-started-with-stm32l4-series-and-stm32l4-series-hard-ware-development-stmicroelectronics.pdf) (Figure 14),  
 minor modifications made to fit selected package

Header to choose between a debug heartbeat signal and the pushbutton startup signal



## Debug / Programming Connector



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PROJECT	LTO 16S BMS.PrjPcb, [No Variations]
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DOCUMENT  
STM32\_MCU.SchDoc

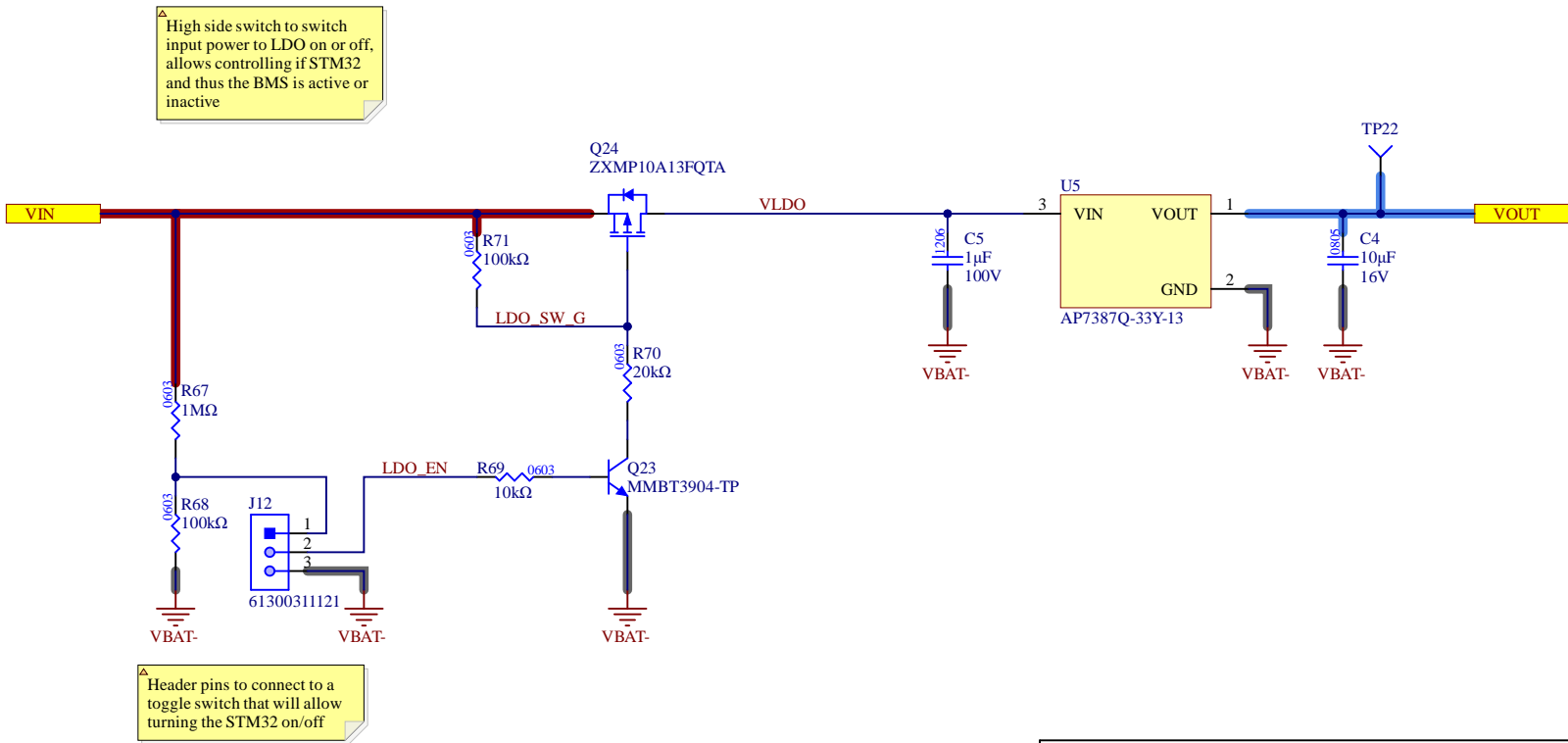
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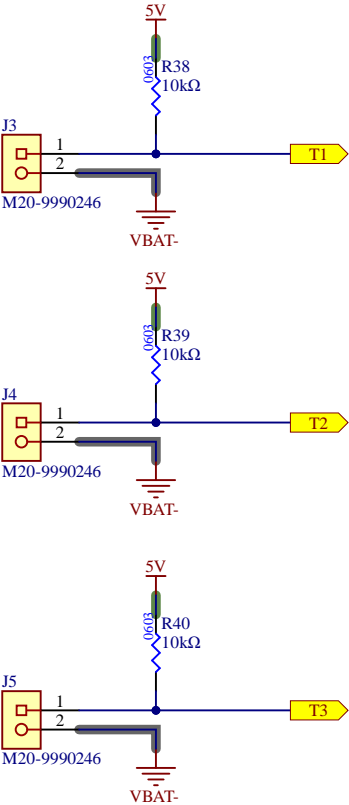
SHEET 5 OF 11

# 3.3V POWER



University of Waterloo 200 University Ave W Waterloo, Ontario, Canada N2L 3G1		REV 1.0
PROJECT LTO 16S BMS.PrjPcb, [No Variations]		
DOCUMENT Power_3V3.SchDoc		MODIFIED 2023-06-15
ENGINEER Farris Matar	REVIEWER *	SHEET 6 OF 11

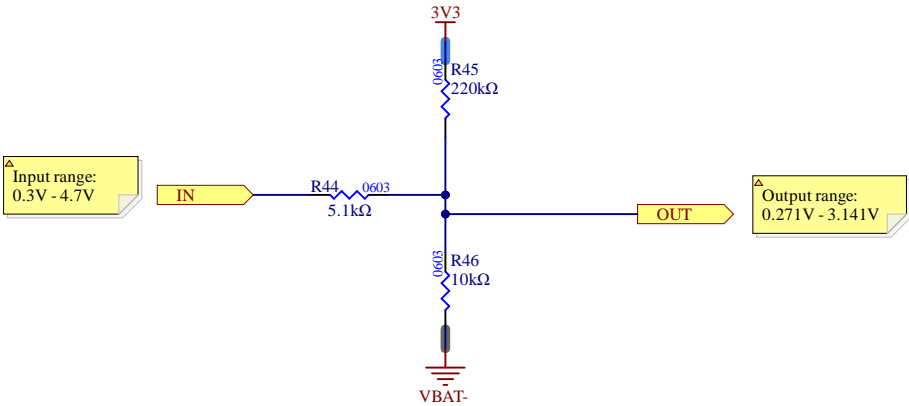
# TEMPERATURE SENSING



University of Waterloo 200 University Ave W Waterloo, Ontario, Canada N2L 3G1		REV 1.0
PROJECT LTO 16S BMS.PrjPcb, [No Variations]		
DOCUMENT Temperature_Sense.SchDoc		MODIFIED 2023-06-15
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# ANALOG ATTENUATOR

Δ Analog attenuator circuit, based on this TI post:  
[https://e2e.ti.com/blogs\\_/b/analogwire/posts/there-ways-to-scale-an-analog-input-signal](https://e2e.ti.com/blogs_/b/analogwire/posts/there-ways-to-scale-an-analog-input-signal)  
Falstad sim: <https://tinyurl.com/2k2x8zjf>



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PROJECT LTO 16S BMS.PrjPcb, [No Variations]		
DOCUMENT Analog_Attenuator.SchDoc		MODIFIED 2023-06-15
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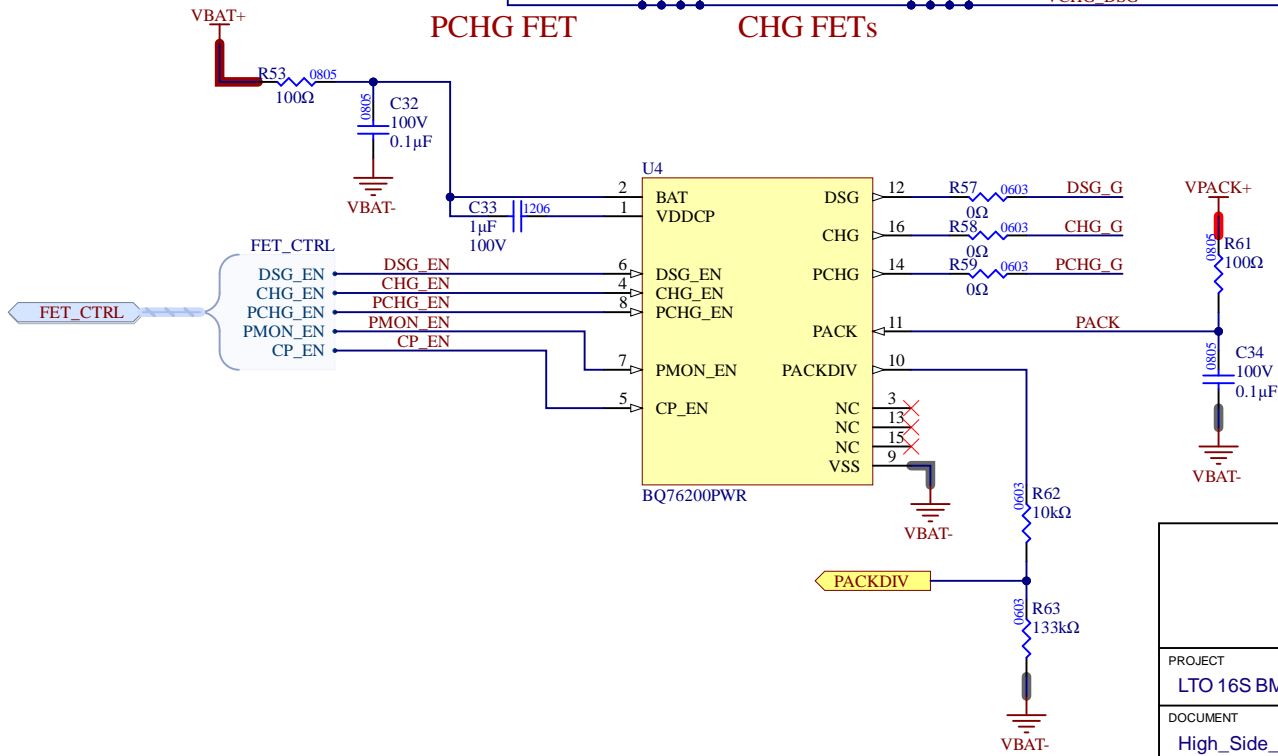


# HIGH SIDE POWER SWITCH

Parallel FETs configured based on TI app note: <https://www.ti.com/lit/an/slva729a/slva729a.pdf?ts=1684104737246>

Heatsinks available for FETs in case they get too hot

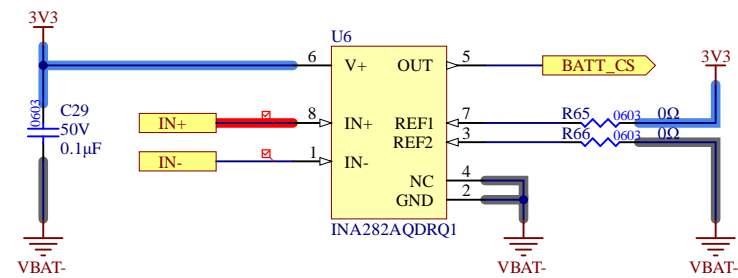
Max current: 25A  
Rsense power dissipation: 0.625W @ 25A



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PROJECT LTO 16S BMS.PrjPcb, [No Variations]		
DOCUMENT High_Side_Switch.SchDoc		MODIFIED 2023-06-15
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## CURRENT SENSE AMP

▲ Amplifier gain: 50V/V  
 Output at 0A: 1.65V  
 Output at 25A (CHG): 2.9V  
 Output at 25A (DSG): 0.4V



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N2L 3G1

REV  
1.0

PROJECT	LTO 16S BMS.PrjPcb, [No Variations]
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DOCUMENT  
Current\_Sense\_Amp.SchDoc

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