

Amulet Motion Controller

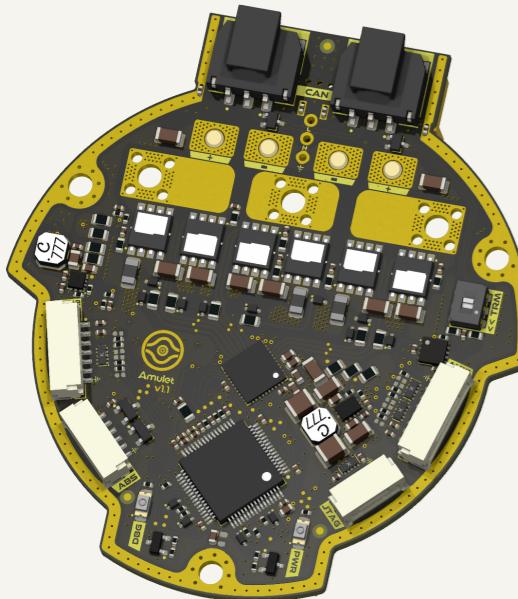
Variant: Released

2024-10-15

Rev 1.1

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TOP VIEW



DESIGN CONSIDERATIONS

DESIGN NOTE:
Example text for informational design notes.

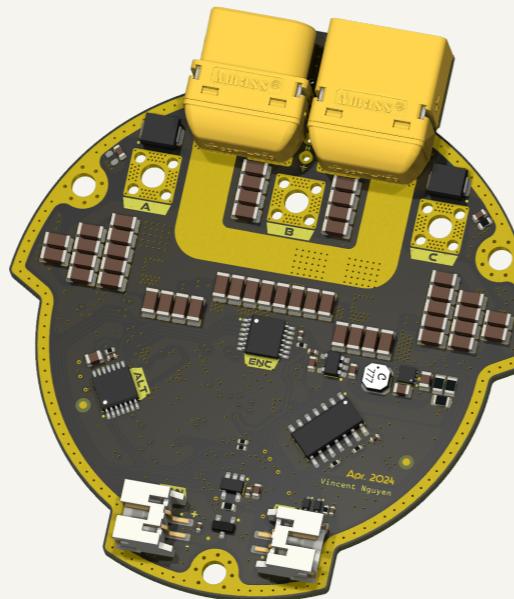
DESIGN NOTE:
Example text for debug notes.

DESIGN NOTE:
Example text for cautionary design notes.

DESIGN NOTE:
Example text for critical design notes.

LAYOUT NOTE:
Example text for critical layout guidelines.

BOTTOM VIEW



NOTES

Schematic based off Josh Pieper's moteus controllers.

Not fitted components are marked as

DRAFT - Very early stage of schematic, ignore details.

PRELIMINARY - Close to final schematic.

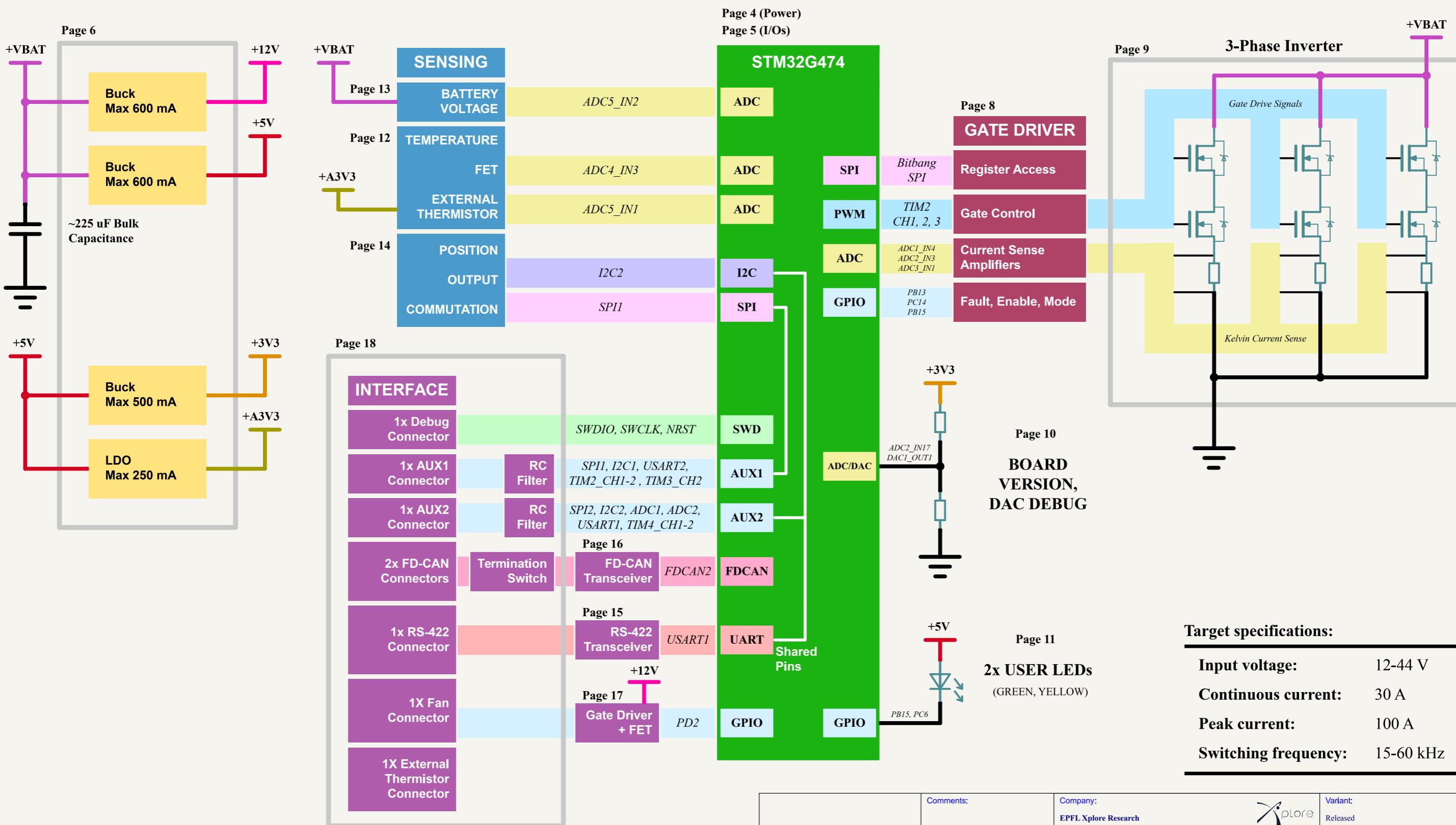
CHECKED - There shouldn't be any mistakes. Contact the engineer if you find any.

RELEASED - A board with this schematic has been sent to production.

Released 13-APR-2024

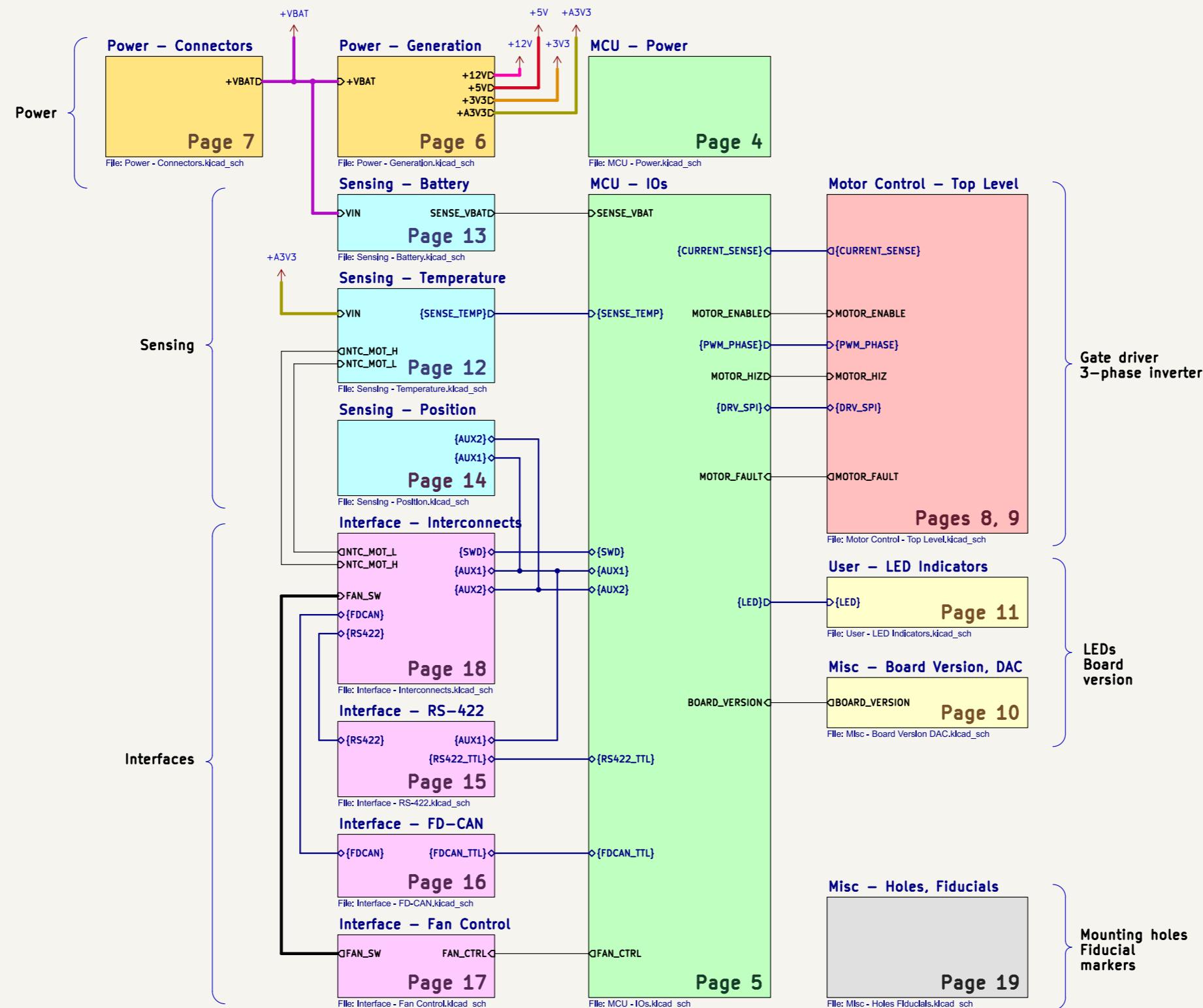
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| | Board Name: Amulet Motion Controller | Project Name: Chienpanzé | |
| | Sheet Title: Cover Page | File Name: amulet_controller.kicad_sch | Designer: Vincent Nguyen |
| | Sheet Path: / | Reviewer: | Date: 2024-04-13 Revision: 1.1 |
| | | Size: A3 | Sheet: 1 of 21 |

[2] Block Diagram



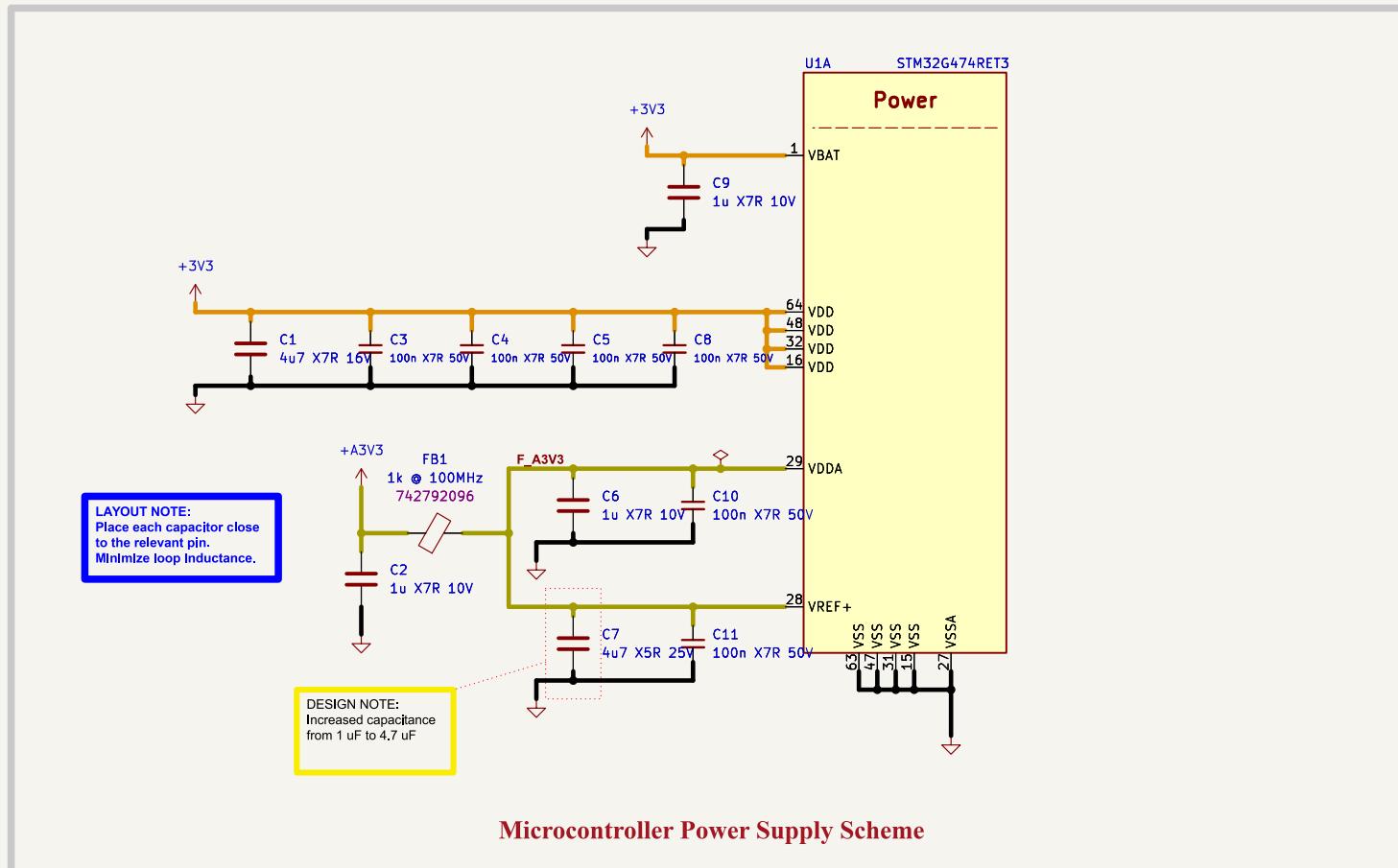
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| Sheet Title: Block Diagram | File Name: Block Diagram.kicad_sch | | Date: 2024-04-13 |
| Sheet Path: /Block Diagram/ | Designer: Vincent Nguyen | | Revision: 1.1 |
| Reviewer: | Size: A3 | | Sheet: 2 of 21 |

[3] Project Architecture



| | | | |
|--|--|--|---------------------------------|
| | Comments: | Company: EPFL Xplore Research | Variant: Released |
| | Board Name: Amulet Motion Controller | Project Name: Chienpanzé | |
| | Sheet Title: Project Architecture | File Name: Project Architecture.kicad_sch | Date: 2023-12-22 |
| | Sheet Path: /Project Architecture/ | Designer: Vincent Nguyen | Revision: 1.1 |
| | | Reviewer: | Size: A3 |
| | | | Sheet: 3 of 21 |

[4] MCU - Power



Comments:
AN5346
STM32G474 Datasheet p.81
J. Pieper ADC investigation

Company:
EPFL Xplore Research



Variant:
Released

Board Name:
Amulet Motion Controller

Project Name:
Chienpanzé

Sheet Title:
MCU - Power

File Name:
MCU - Power.kicad_sch

Designer:
Vincent Nguyen

Date: 2023-12-18
Revision: 1.1

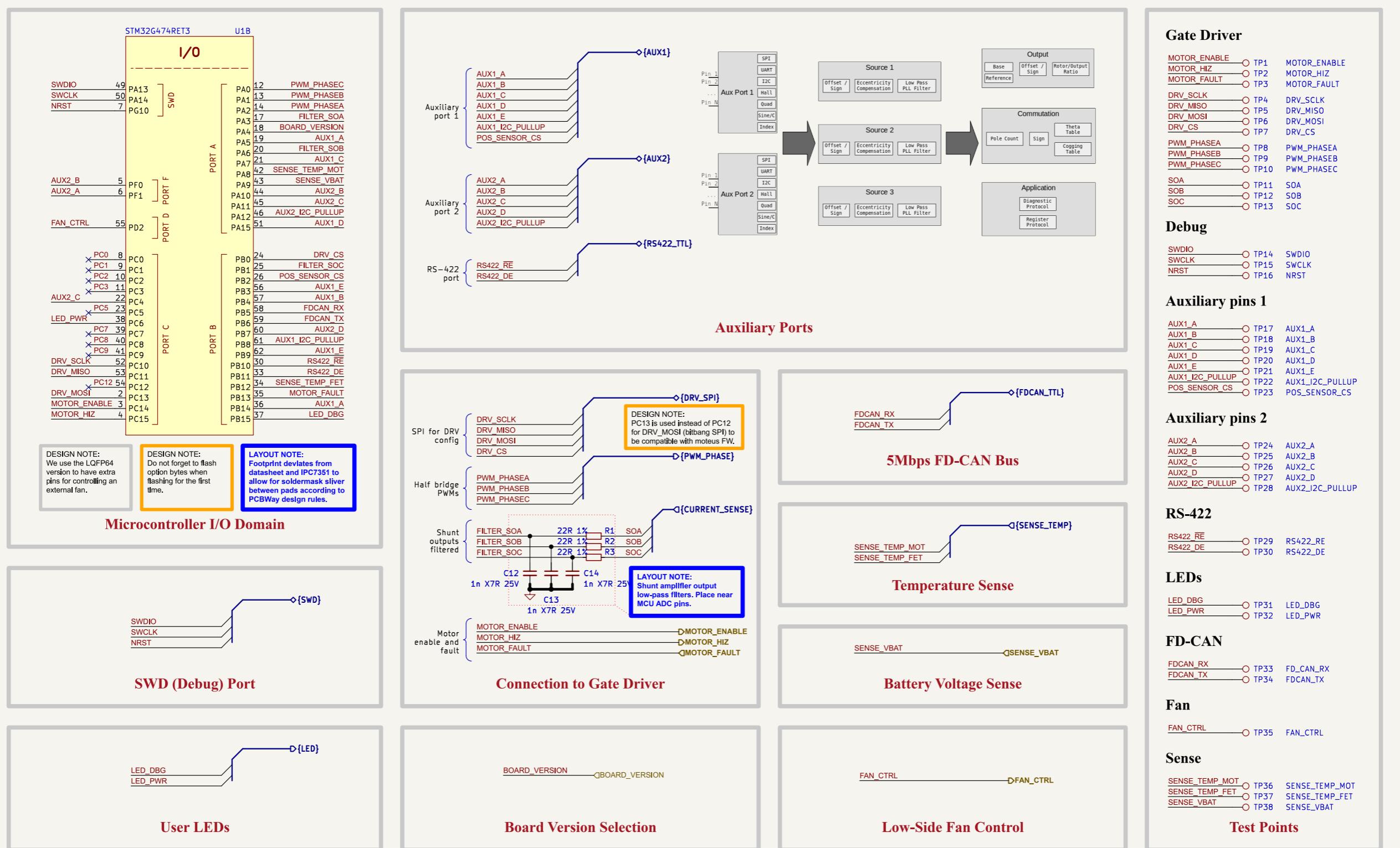
Sheet Path:
/Project Architecture/MCU - Power/

Reviewer:

Size:
A4

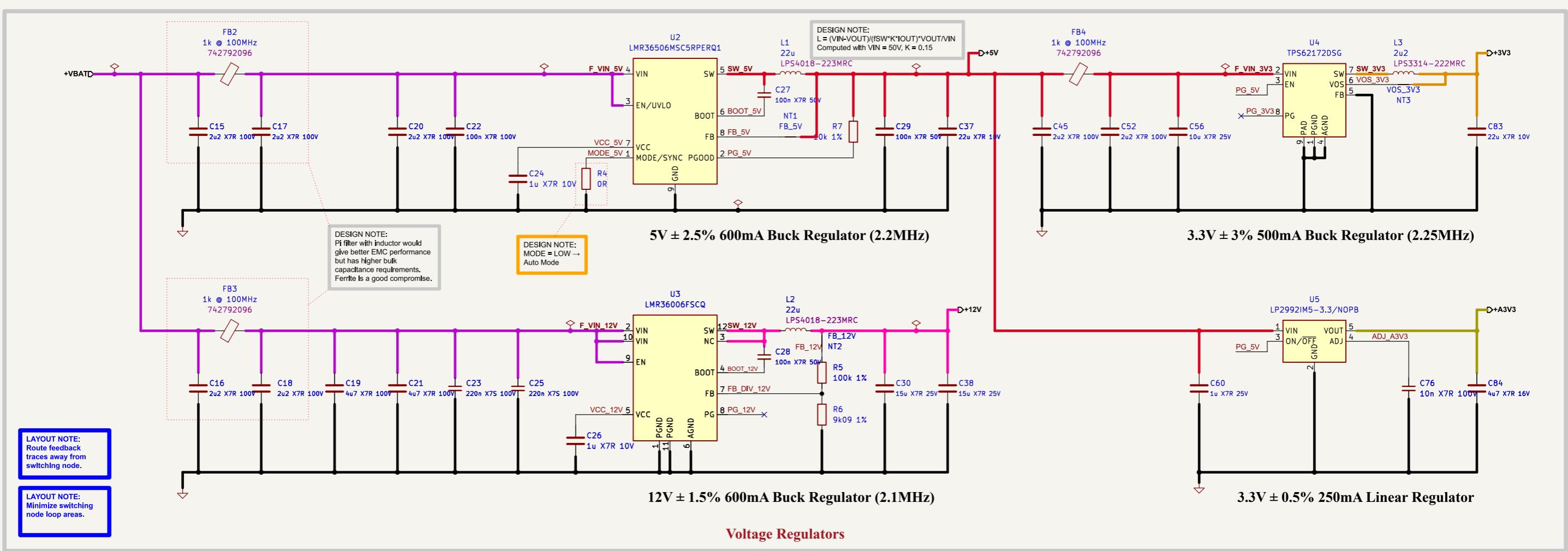
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4 of **21**

[5] MCU - I/Os

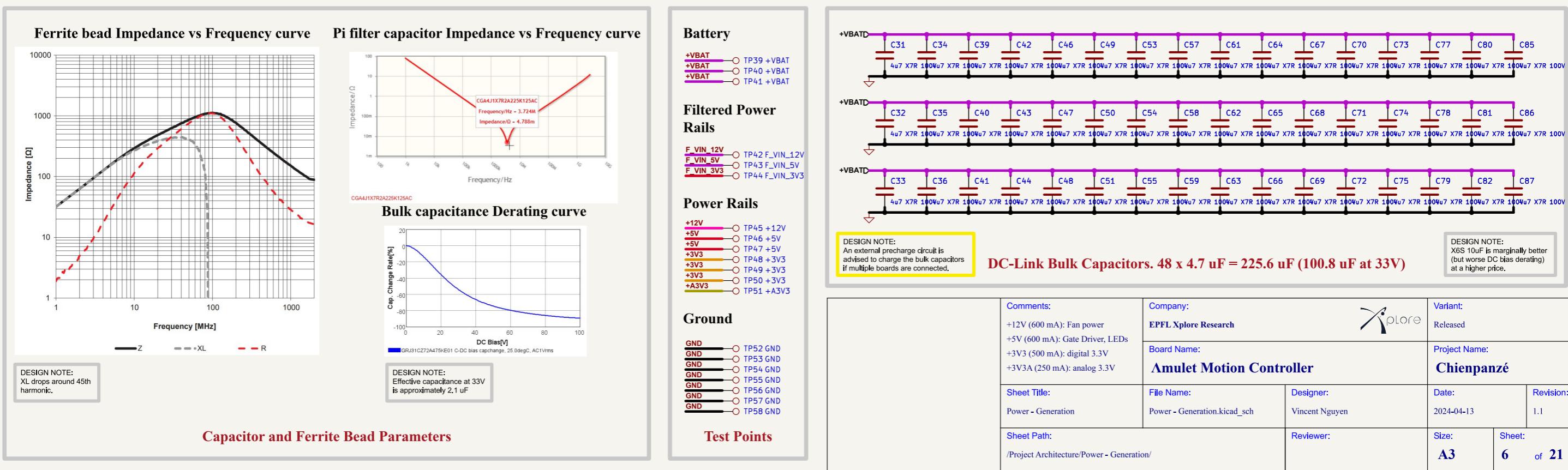


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|---|--|------------------------------------|---------------------------------|
| Comments: References: Flexible I/O worked examples Flexible I/O source configuration | Company: EPFL Xplore Research | | Variant: Released |
| | Board Name: Amulet Motion Controller | Project Name: Chienpanzé | |
| Sheet Title: MCU - I/Os | File Name: MCU - IOs.kicad_sch | Designer: Vincent Nguyen | Date: 2023-12-20 |
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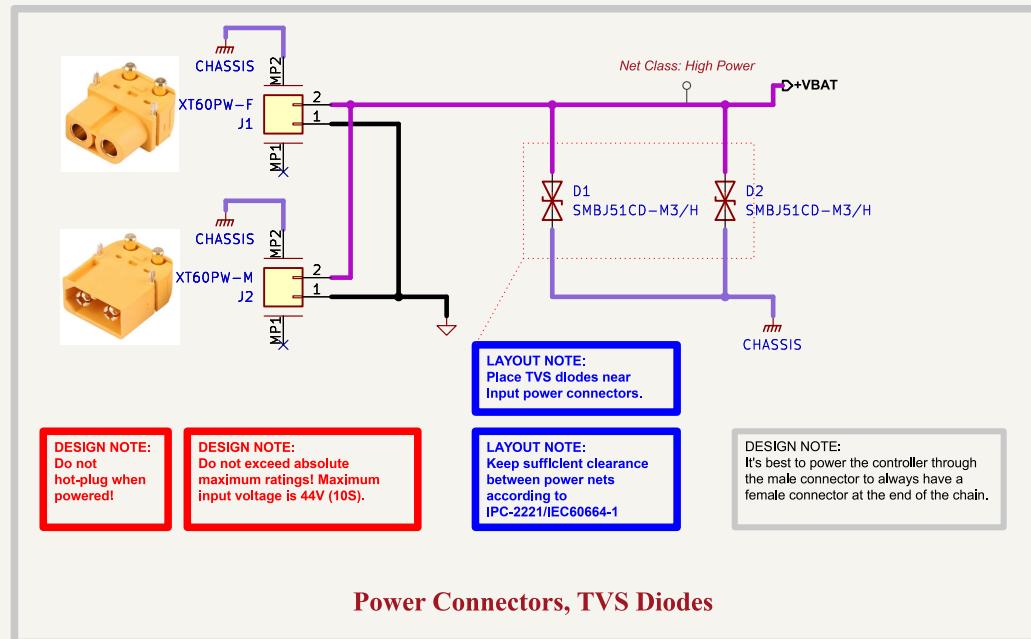
[6] Power - Generation



Voltage Regulators



[7] Power - Connectors



A

B

C

D

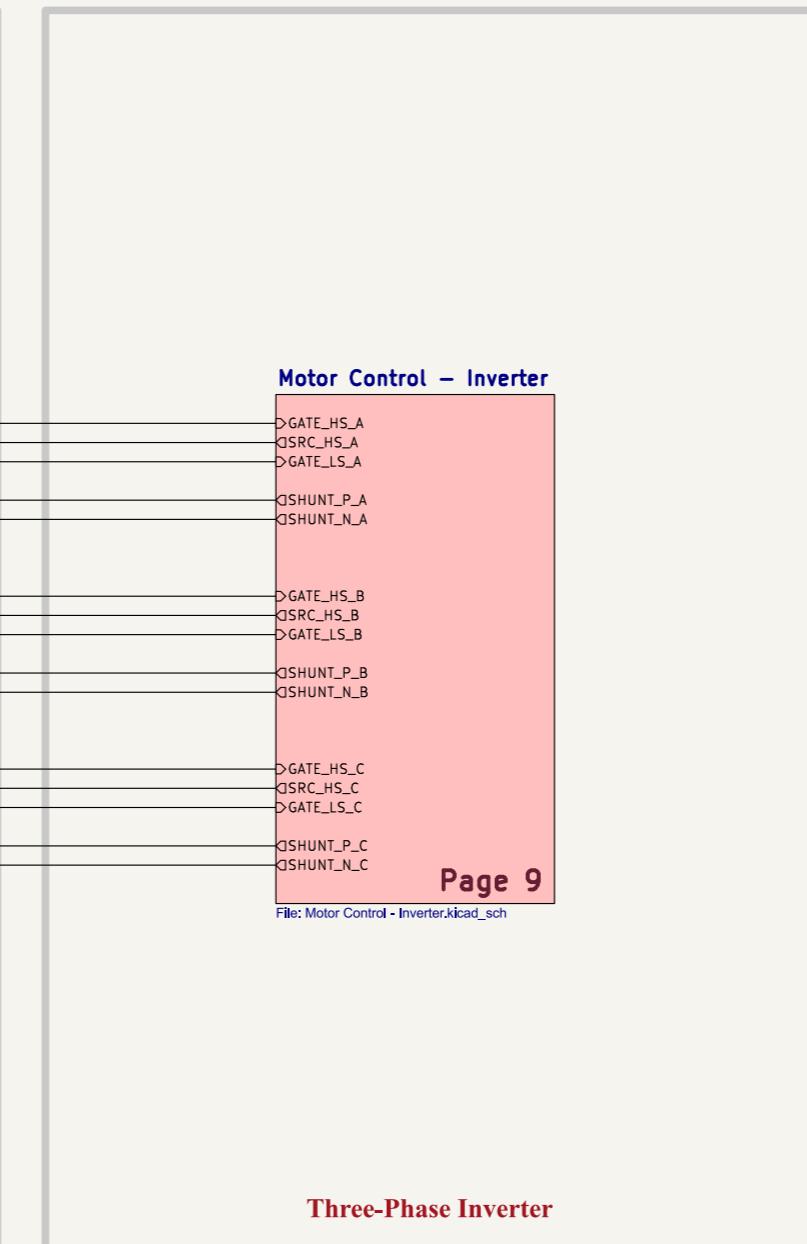
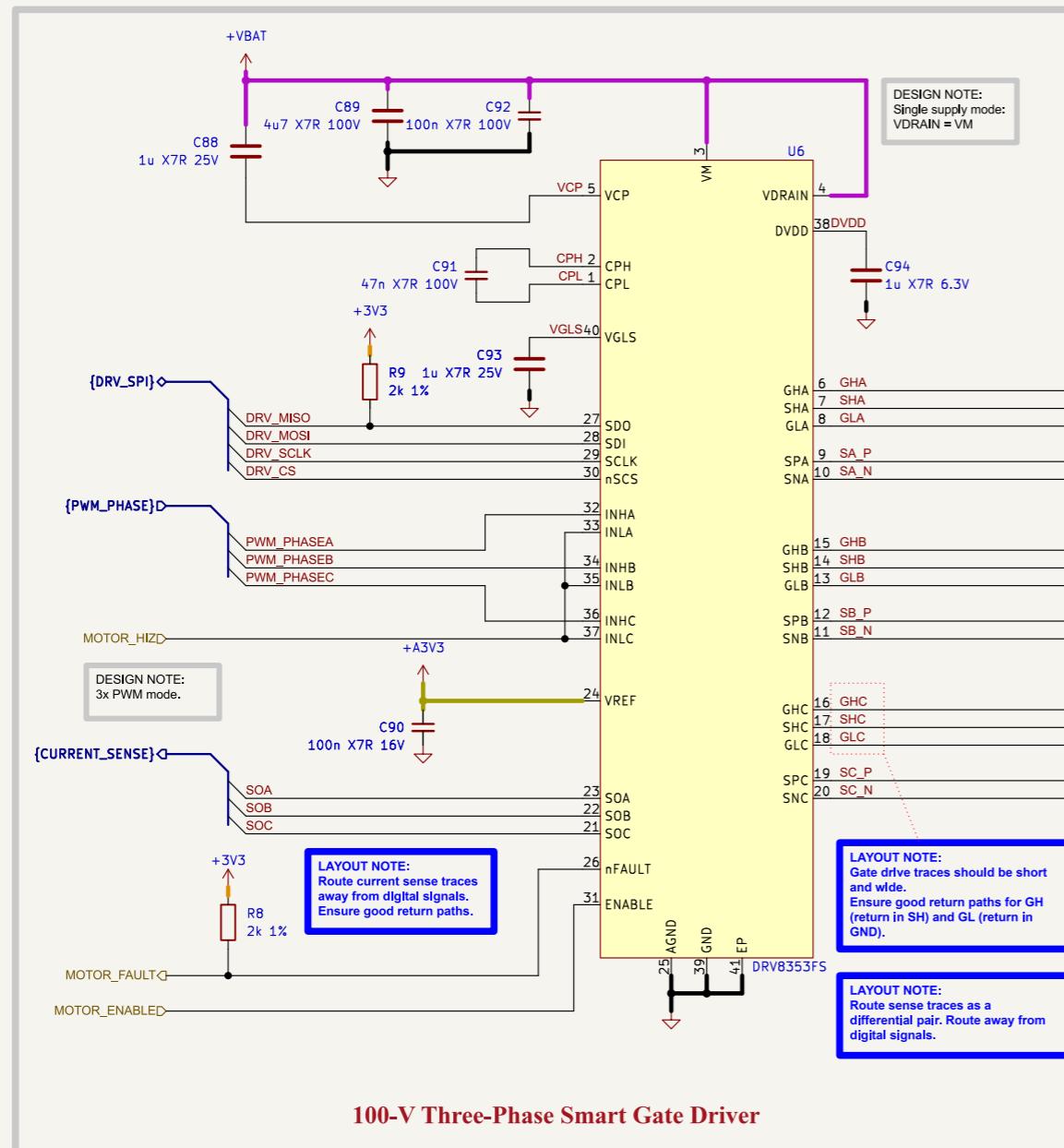
A

B

C

D

[8] Motor Control - Top Level

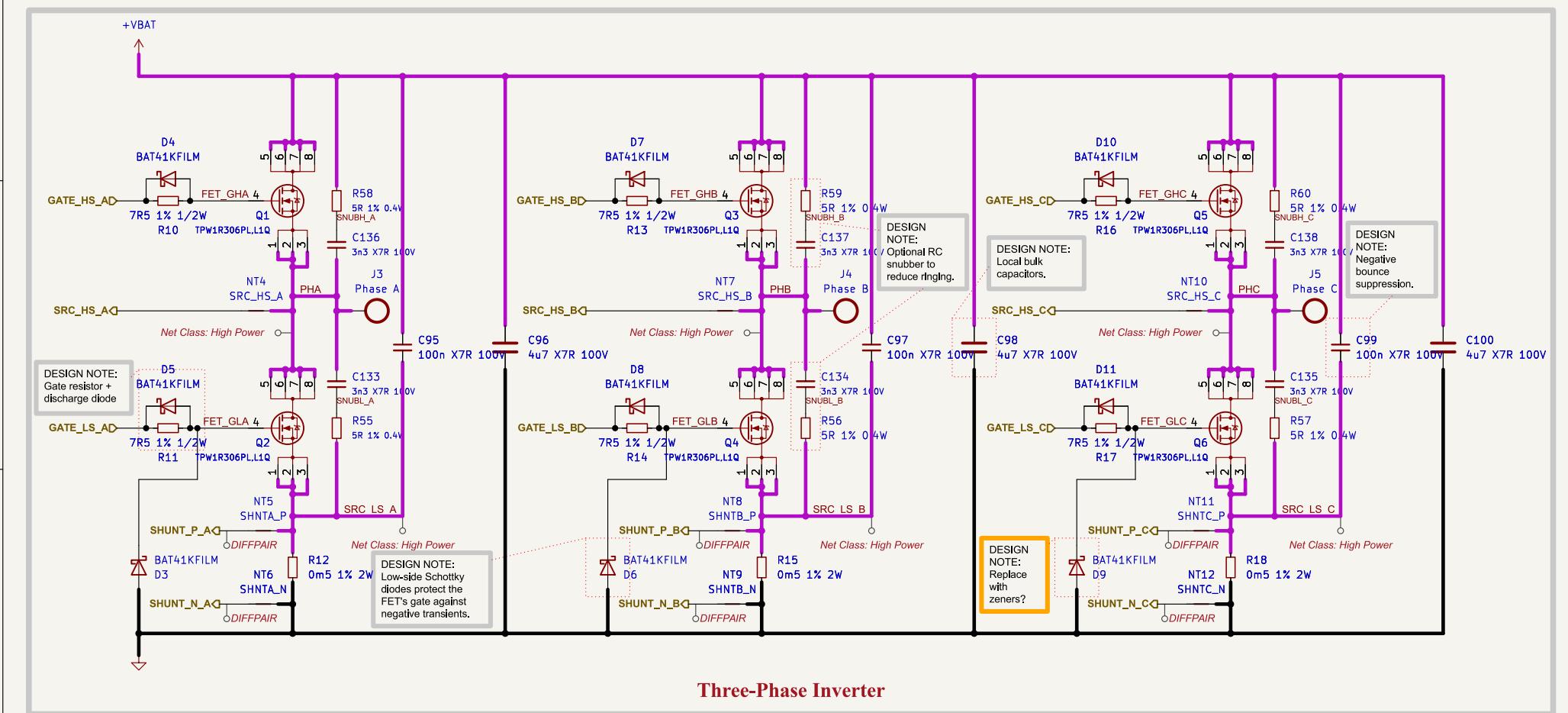


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Three-Phase Inverter

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| | Sheet Title: Motor Control - Top Level | File Name: Motor Control - Top Level.kicad_sch | Designer: Vincent Nguyen |
| | Sheet Path: /Project Architecture/Motor Control - Top Level/ | Reviewer: | Date: 2023-12-20 Revision: 1.1 |

[9] Motor Control - Inverter



LAYOUT NOTE:
High current traces must be
carefully designed. Ensure
ground return path does not
cross sensitive parts of the
board. Use multiple planes for
higher current carrying
capacity.

LAYOUT NOTE:
Keep sufficient clearance
between power nets according
to IPC-2221/IEC60664-1.

DESIGN NOTE:
A gate drive current that is too
large can damage the FETs!

Comments:
System Design Considerations for
High-Power Motor Driver Applications
Best Practices for Board Layout
of Motor Drivers
Proper RC Snubber Design
for Motor Drivers

Sheet Title:
Motor Control - Inverter
Sheet Path:
/Project Architecture/Motor Control - Top Level/Motor Control - Inverter/

Company:
EPFL Xplore Research

Board Name:
Amulet Motion Controller

File Name:
Motor Control - Inverter.kicad_sch

Designer:
Vincent Nguyen



Variant:
Released

Project Name:
Chienpanzé

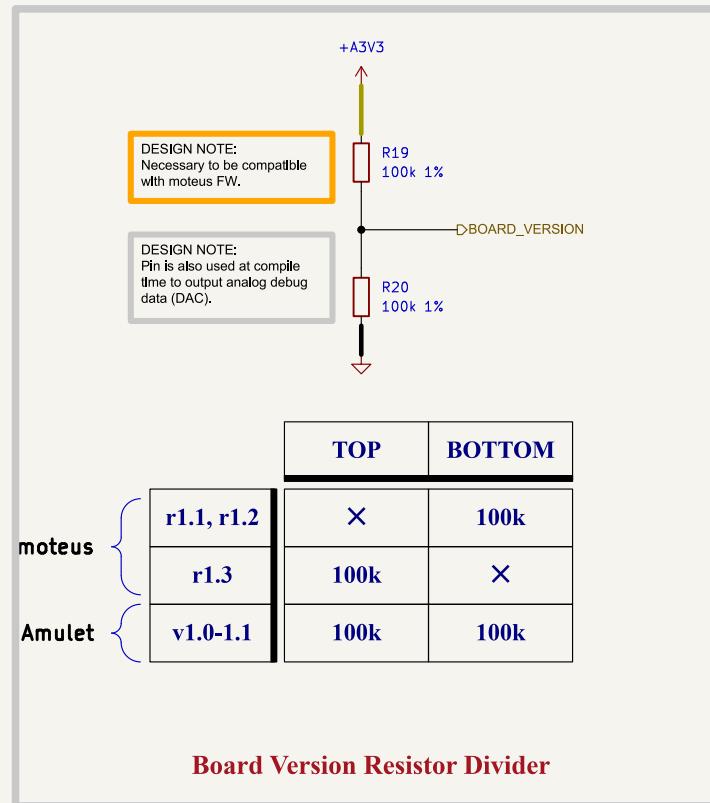
Date:
2024-01-25

Revision:
1.1

Size:
A4

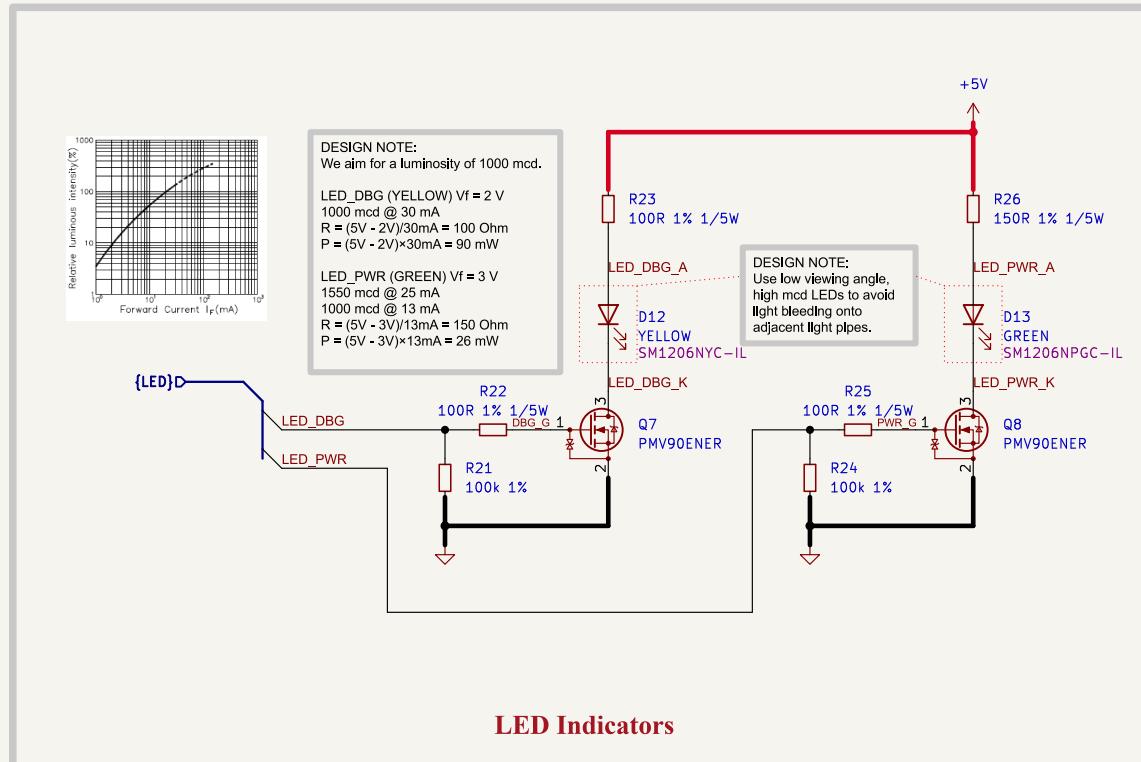
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[10] Misc - Board Version, DAC



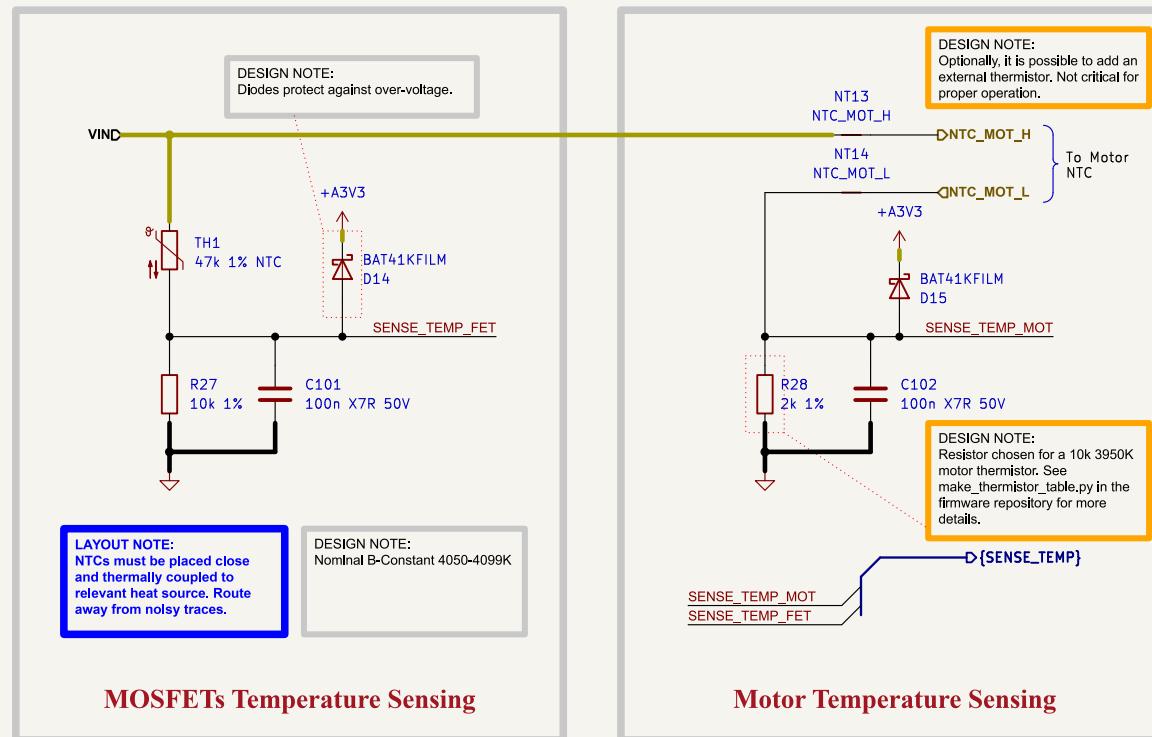
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| | Sheet Path: /Project Architecture/Misc - Board Version, DAC/ | Reviewer: | Date: 2024-04-13 Revision: 1.1 |
| | | | Size: A4 Sheet: 10 of 21 |

[11] User - LED Indicators



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|--|---|---|-----------------------------------|
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| | Board Name: Amulet Motion Controller | | |
| | Sheet Title: User - LED Indicators | File Name: User - LED Indicators.kicad_sch | Designer: Vincent Nguyen |
| | Sheet Path: /Project Architecture/User - LED Indicators/ | Reviewer: | Date: 2023-12-19 Revision: 1.1 |

[12] Sensing - Temperature



A

B

C

D

A

B

C

D

| | | | |
|--|---|---|-----------------------------------|
| | Comments: | Company: EPFL Xplore Research | Variant: Released |
| | Board Name: Amulet Motion Controller | | |
| | Sheet Title: Sensing - Temperature | File Name: Sensing - Temperature.kicad_sch | Designer: Vincent Nguyen |
| | Sheet Path: /Project Architecture/Sensing - Temperature/ | Reviewer: | Date: 2024-04-13 Revision: 1.1 |

[13] Sensing - Battery

A

A

B

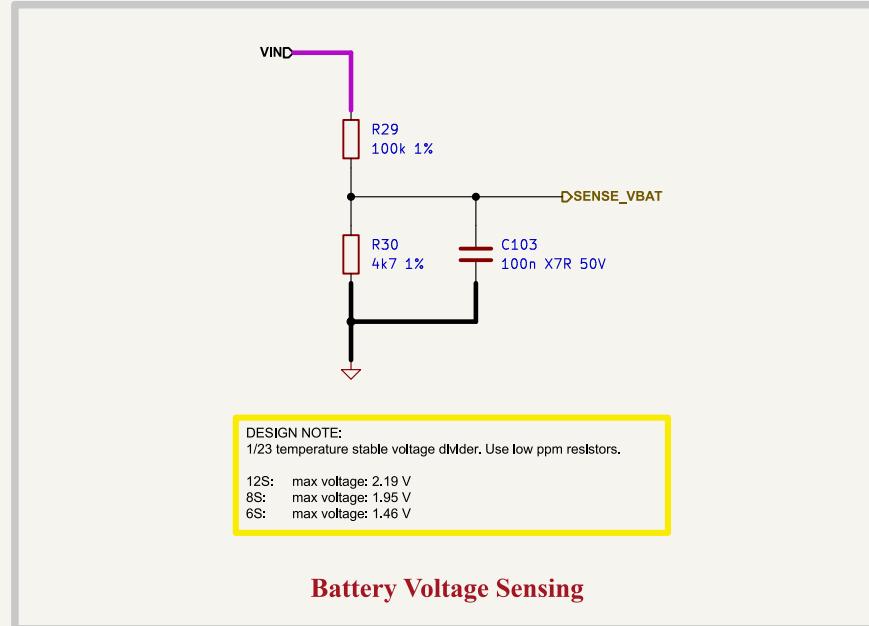
B

C

C

D

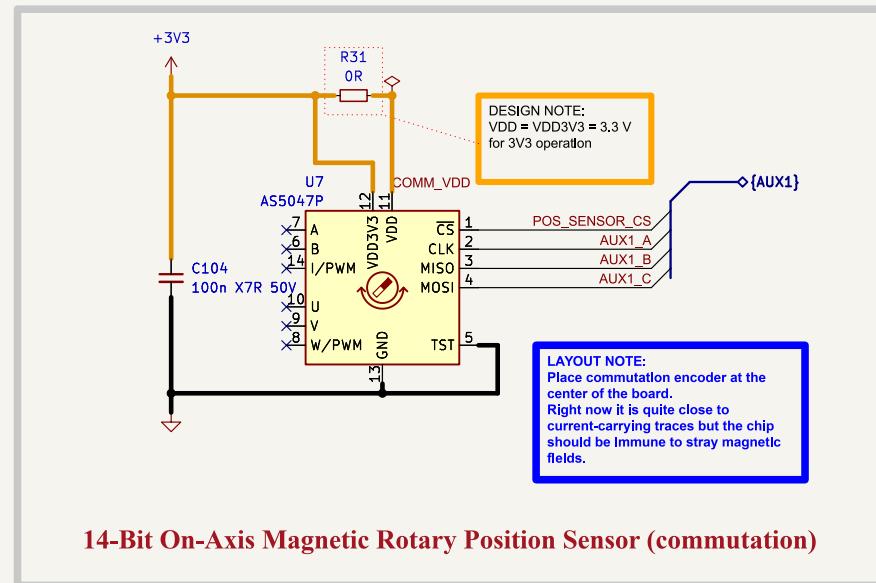
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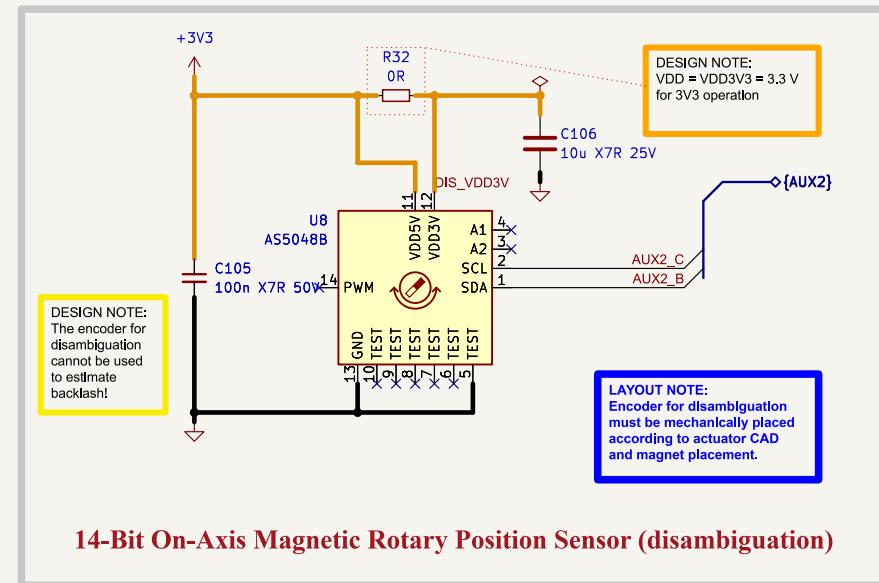
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| | Sheet Title: Sensing - Battery | File Name: Sensing - Battery.kicad_sch | Designer: Vincent Nguyen | Date: 2023-10-14 | Revision: 1.1 |
| | Sheet Path: /Project Architecture/Sensing - Battery/ | | Reviewer: | Size: A4 | Sheet: 13 of 21 |

[14] Sensing - Position

A



DESIGN NOTE:
AS5047P senses magnet mounted on planetary sun gear, for commutation.
AS5048B senses magnet mounted on shaft with same reduction factor as planetary gearbox for disambiguation.

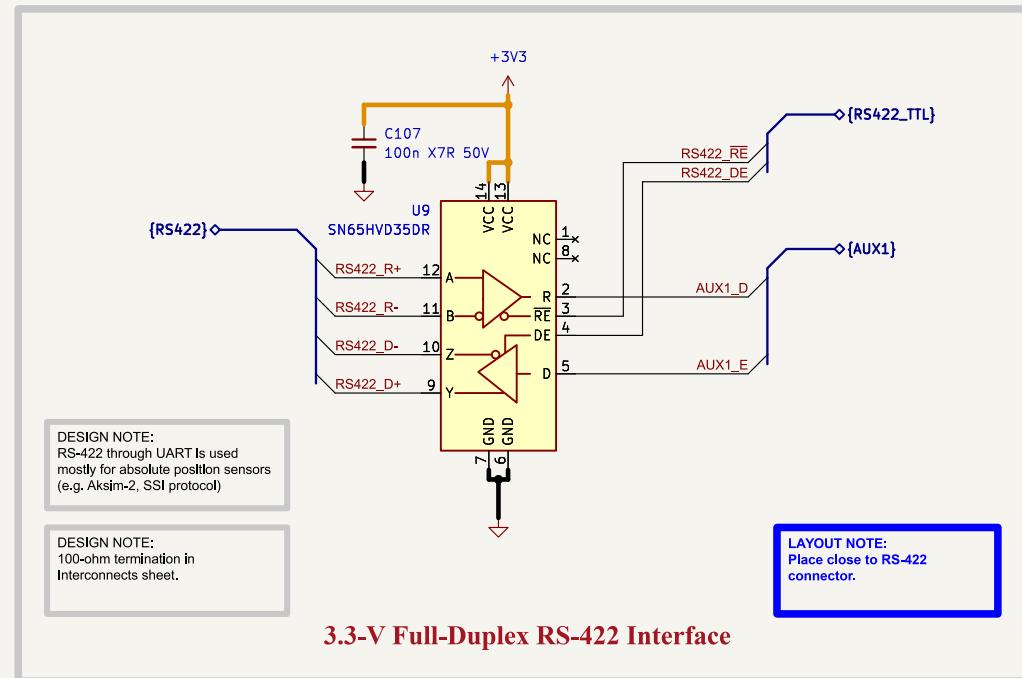


C

D

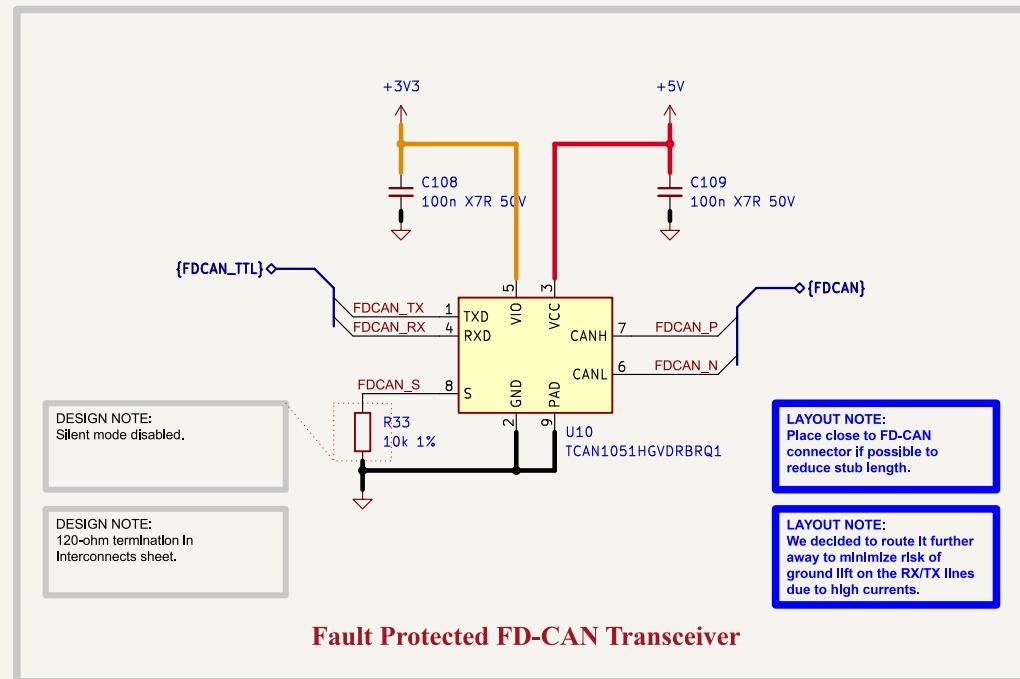
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[15] Interface - RS-422



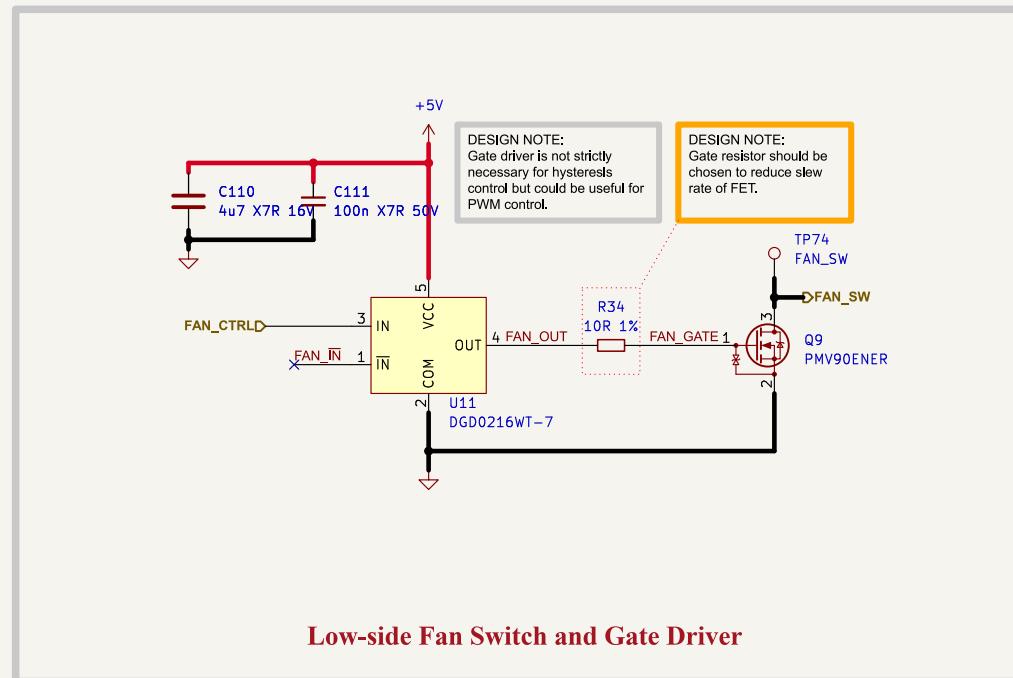
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| | Sheet Title: Interface - RS-422 | File Name: Interface - RS-422.kicad_sch | Designer: Vincent Nguyen Date: 2023-10-15 Revision: 1.1 |
| | Sheet Path: /Project Architecture/Interface - RS-422/ | Reviewer: | Size: A4 Sheet: 15 of 21 |

[16] Interface - FD-CAN



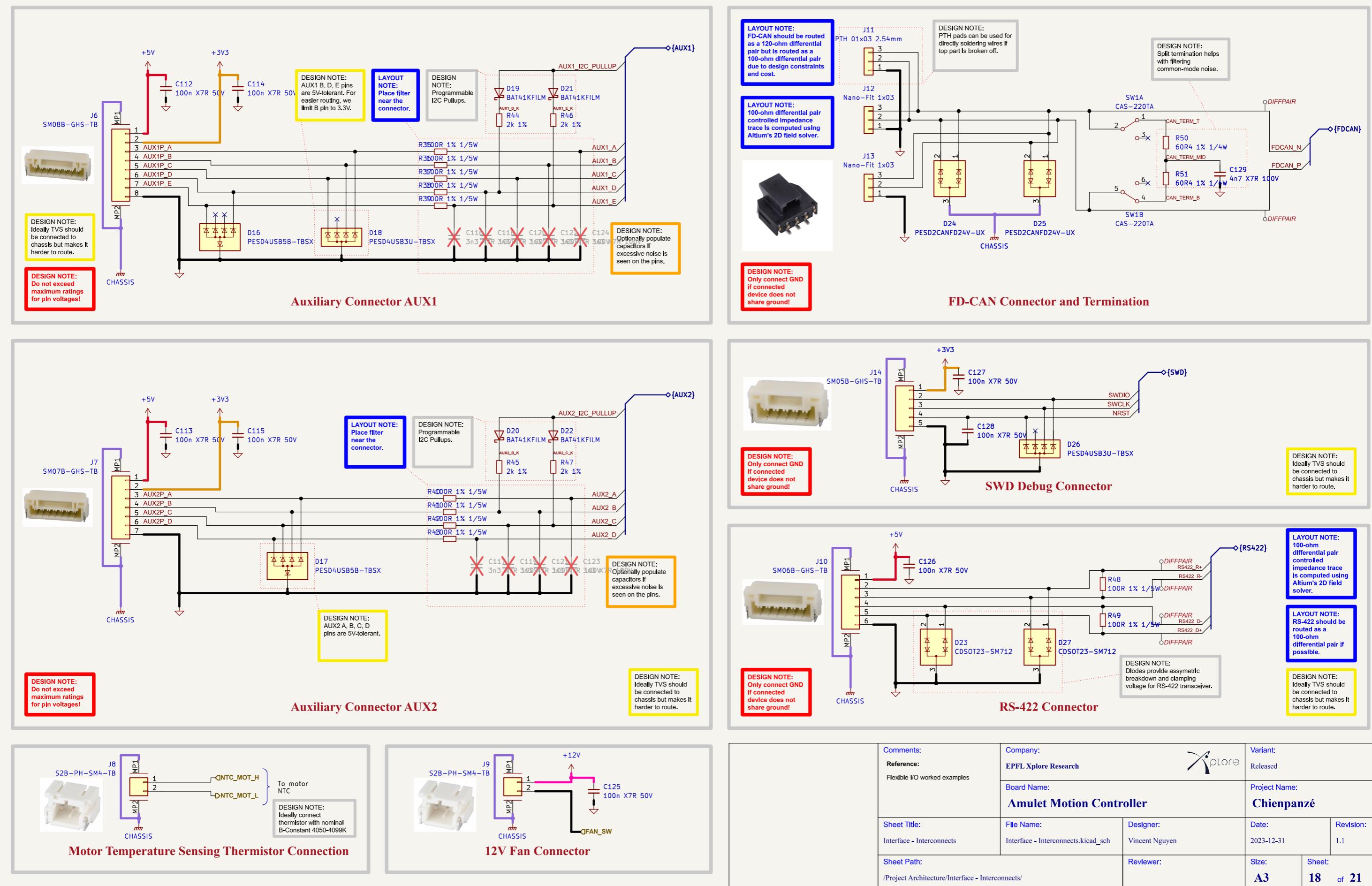
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| | | | 16 of 21 |

[17] Interface - Fan Control

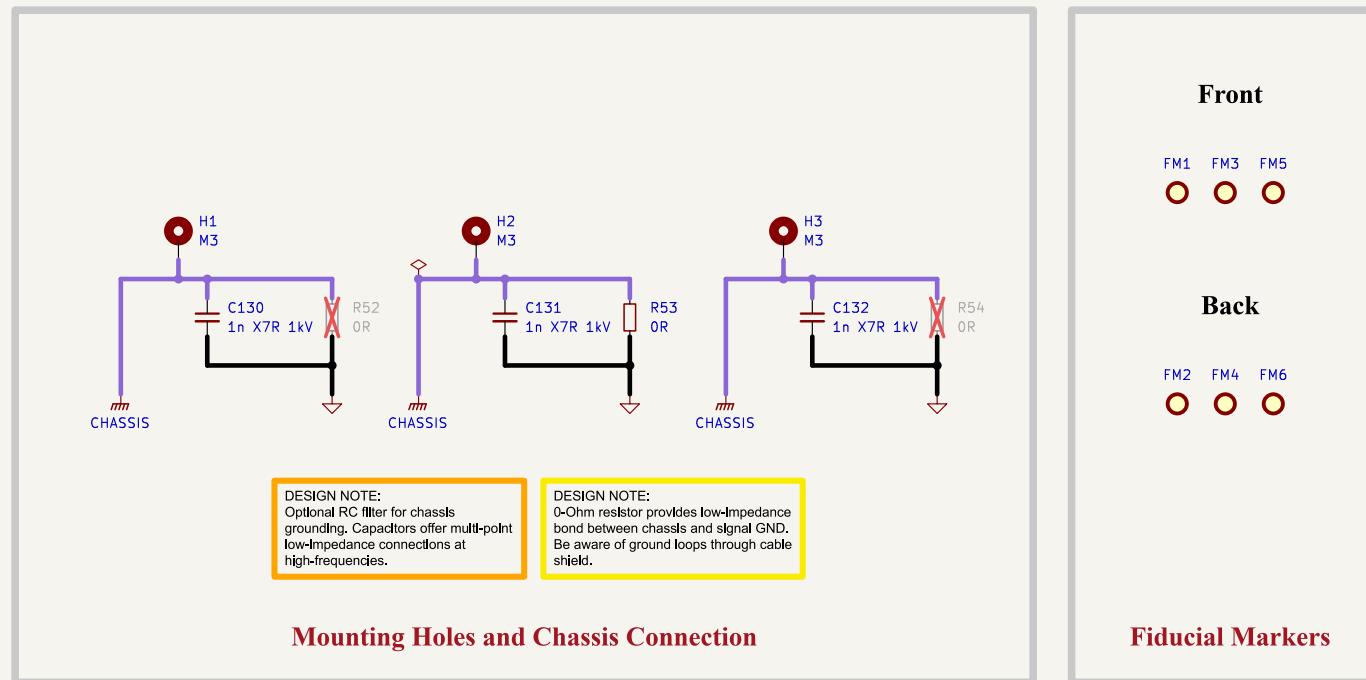


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| | Board Name: Amulet Motion Controller | | |
| | Sheet Title: Interface - Fan Control | File Name: Interface - Fan Control.kicad_sch | Designer: Vincent Nguyen |
| | Sheet Path: /Project Architecture/Interface - Fan Control/ | Reviewer: | Date: 2023-11-19 |
| | | Size: A4 | Sheet: 17 of 21 |

[18] Interface - Interconnects



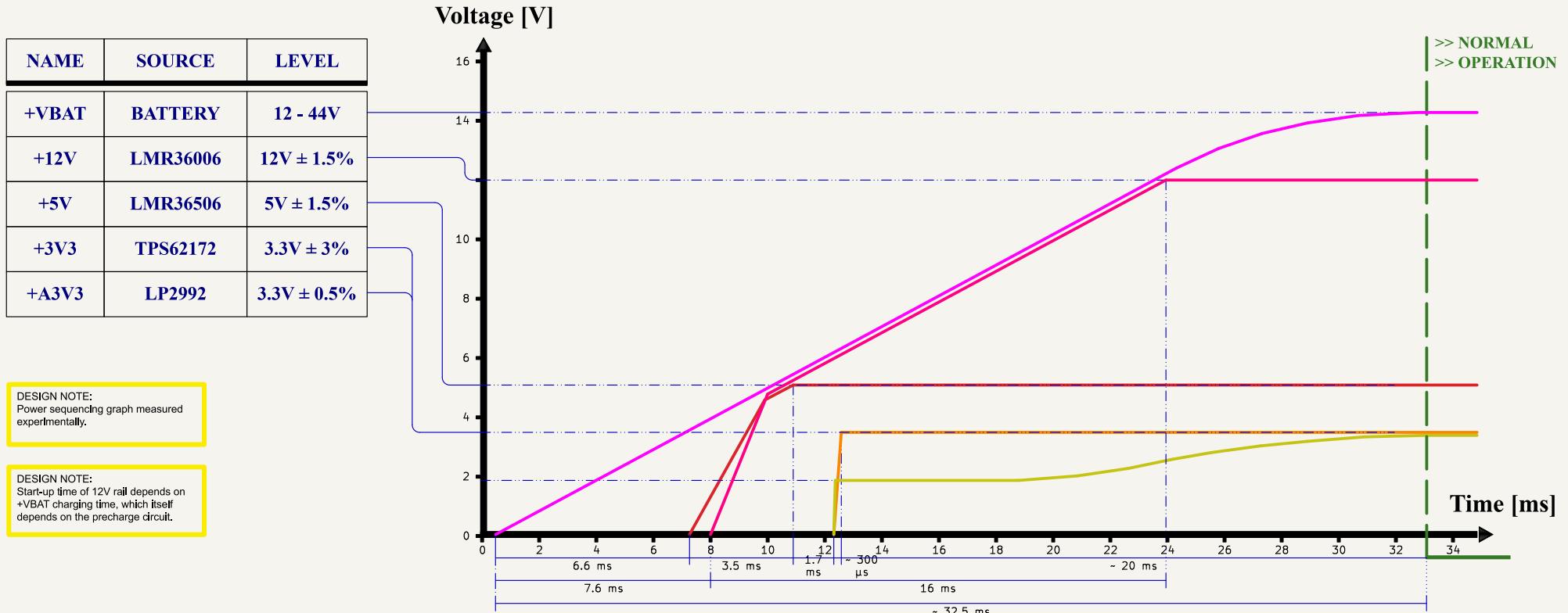
[19] Misc - Holes, Fiducials



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| | | | | Released | |
| | | Board Name: Amulet Motion Controller | | Project Name: Chienpanzé | |
| D | | Sheet Title: Misc - Holes, Fiducials | File Name: Misc - Holes Fiducials.kicad_sch | Designer: Vincent Nguyen | Date: 2023-10-22 Revision: 1.1 |
| | | Sheet Path: /Project Architecture/Misc - Holes, Fiducials/ | | Reviewer: | Size: A4 Sheet: 19 of 21 |

[20] Power - Sequencing

A



B

C

D

| | | | |
|--|-------------------------------------|--|---|
| | Comments: | Company: EPFL Xplore Research | Variant: Released |
| | | Board Name: Amulet Motion Controller | |
| | Sheet Title: Power - Sequencing | File Name: Power - Sequencing.kicad_sch | Designer: Vincent Nguyen |
| | Sheet Path: /Power - Sequencing/ | Reviewer: | Date: 2024-03-12 Revision: 1.1 |
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[21] Revision History

| | | | | |
|--|---|--|--|-------------------------------------|
| | Comments: | Company: EPFL Xplore Research |  Variant: Released | |
| | | Board Name: Amulet Motion Controller | Project Name: Chienpanzé | |
| | Sheet Title: Revision History | File Name: Revision History.kicad_sch | Designer: Vincent Nguyen | Date: 2024-01-03 Revision: 1.1 |
| | Sheet Path: /Revision History/ | Reviewer: | Size: A4 | Sheet: 21 of 21 |