

Amulet Motion Controller

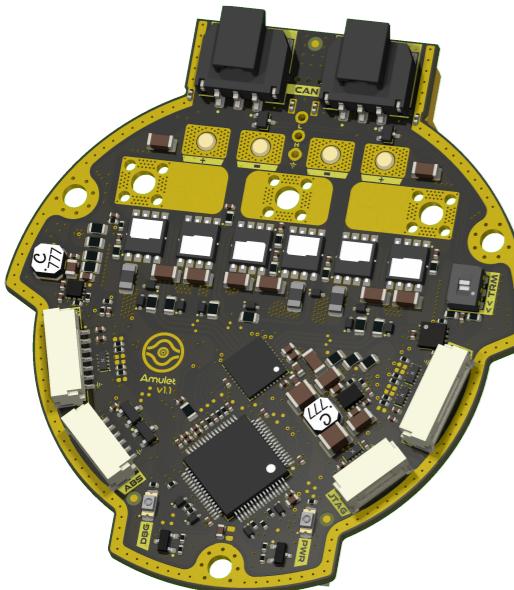
Variant: CHECKED

2024-12-16

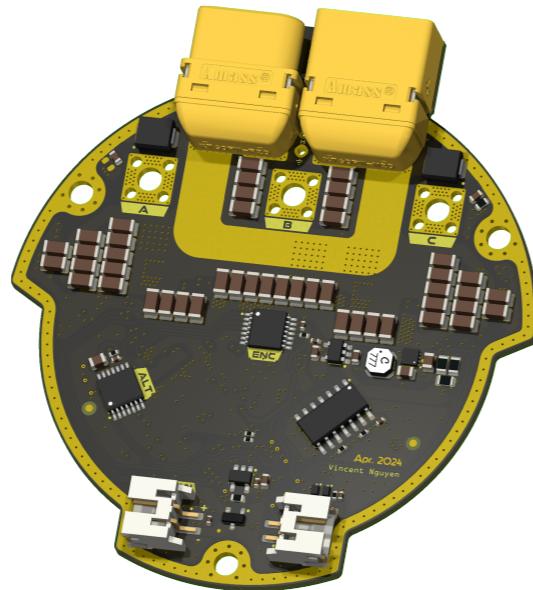
Rev 1.1.1+ (Unreleased)

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TOP VIEW



BOTTOM 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.

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.

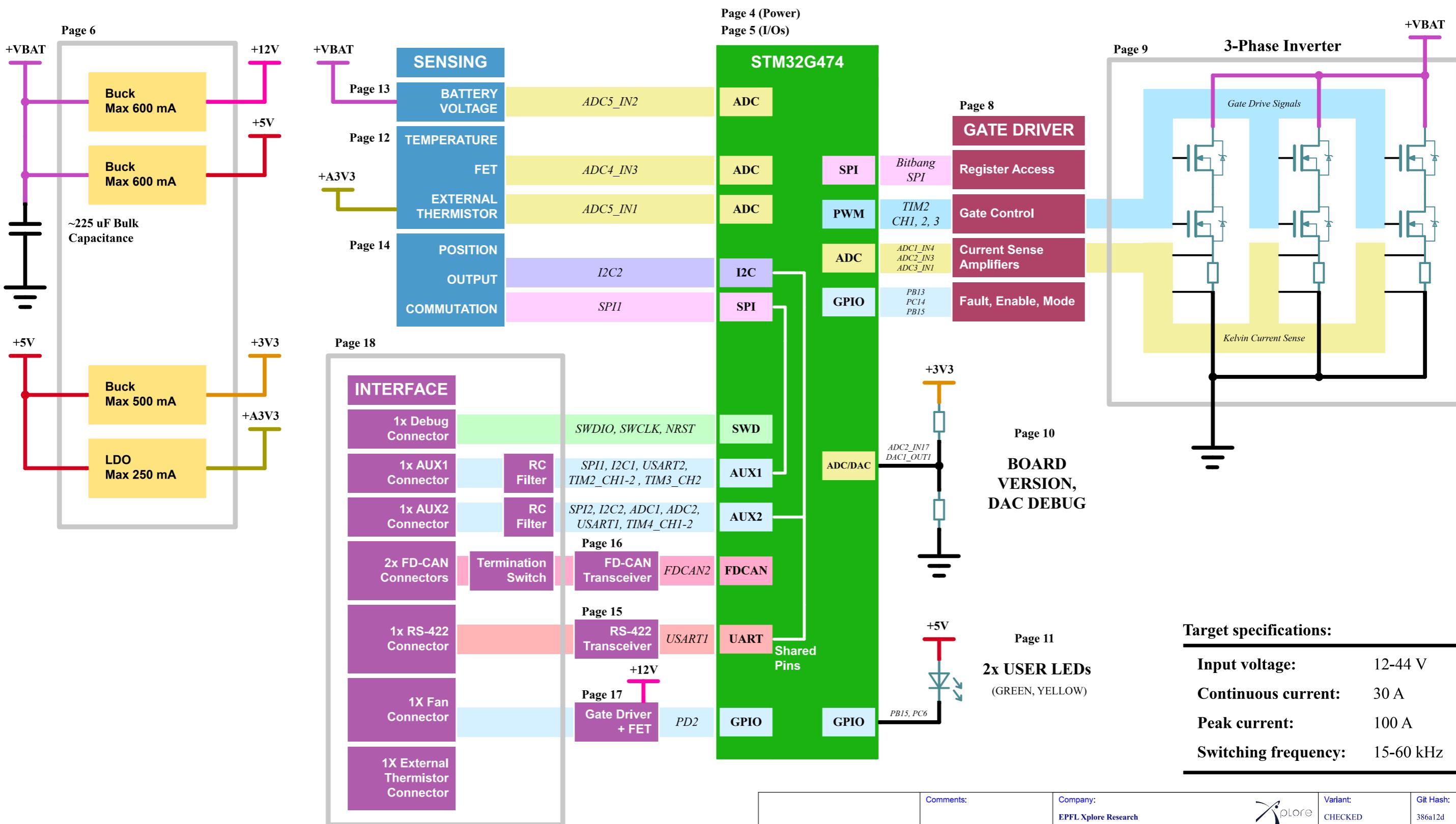
CHECKED - There shouldn't be any mistakes. Contact the engineer if you find any.

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

Date: 16-Dec-2024

	Comments:	Company:	Xplore	Variant:	Git Hash:		
		EPFL Xplore Research					
	Board Name:	Amulet Motion Controller			Project Name:		
		Chienpanzé					
	Sheet Title:	File Name:	Designer:	Date:	Revision:		
	Cover Page	amulet_controller.kicad_sch	Vincent Nguyen	2024-04-13	1.1.1+ (Unreleased)		
	Sheet Path:	/		Reviewer:	Size:		
	/				A3		
	Sheet:	1 of 21					

[2] Block Diagram

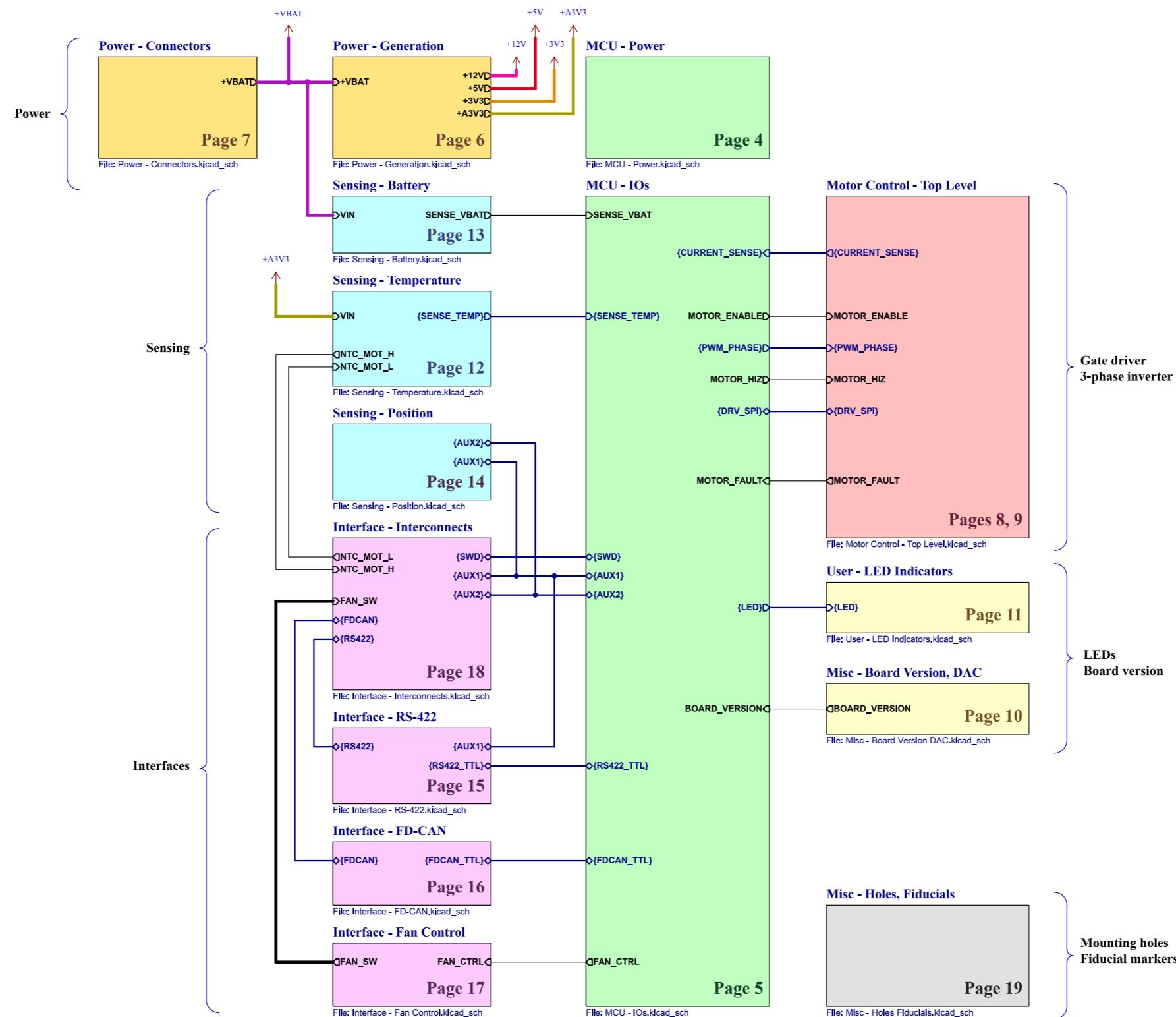


Target specifications:

Input voltage:	12-44 V
Continuous current:	30 A
Peak current:	100 A
Switching frequency:	15-60 kHz

Comments:	Company: EPFL Xplore Research	Variant: CHECKED	Git Hash: 386a12d
	Board Name: Amulet Motion Controller	Project Name: Chienpanzé	
Sheet Title: Block Diagram	File Name: Block Diagram.kicad_sch	Designer: Vincent Nguyen	Date: 2024-04-13
Sheet Path: /Block Diagram/	Reviewer:	Size: A3	Sheet: 2 of 21

[3] Project Architecture



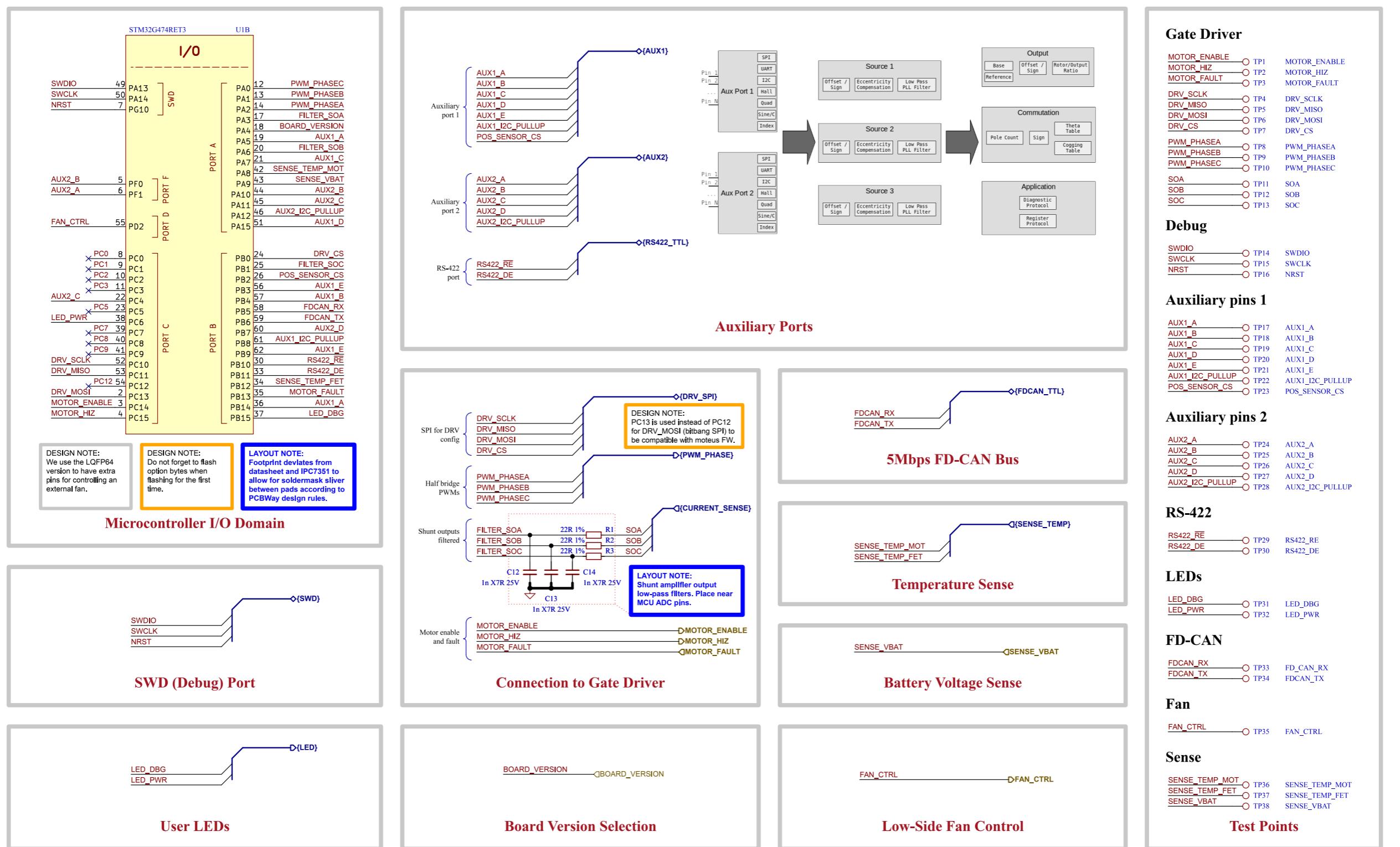
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	Sheet Title:	File Name:	Designer:	Date:
	Project Architecture	Project Architecture.kicad_sch	Vincent Nguyen	2023-12-22
	Sheet Path:	Reviewer:		Revision:
	/Project Architecture/			1.1.1+ (Unreleased)
	Size:	Sheet:		
	A3	3 of 21		

[4] MCU - Power



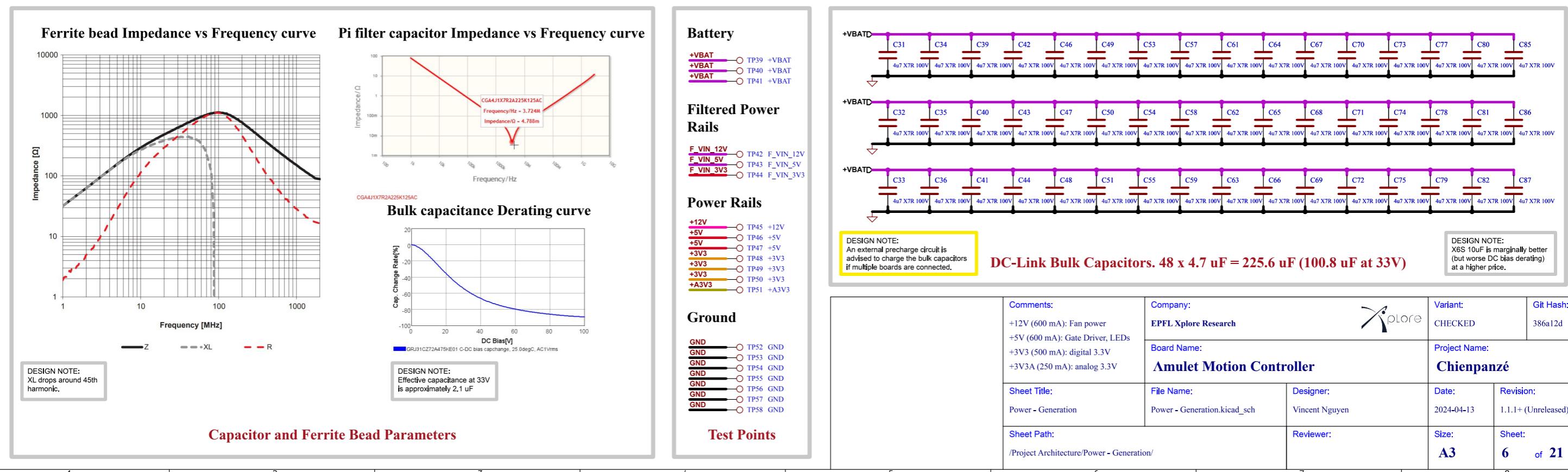
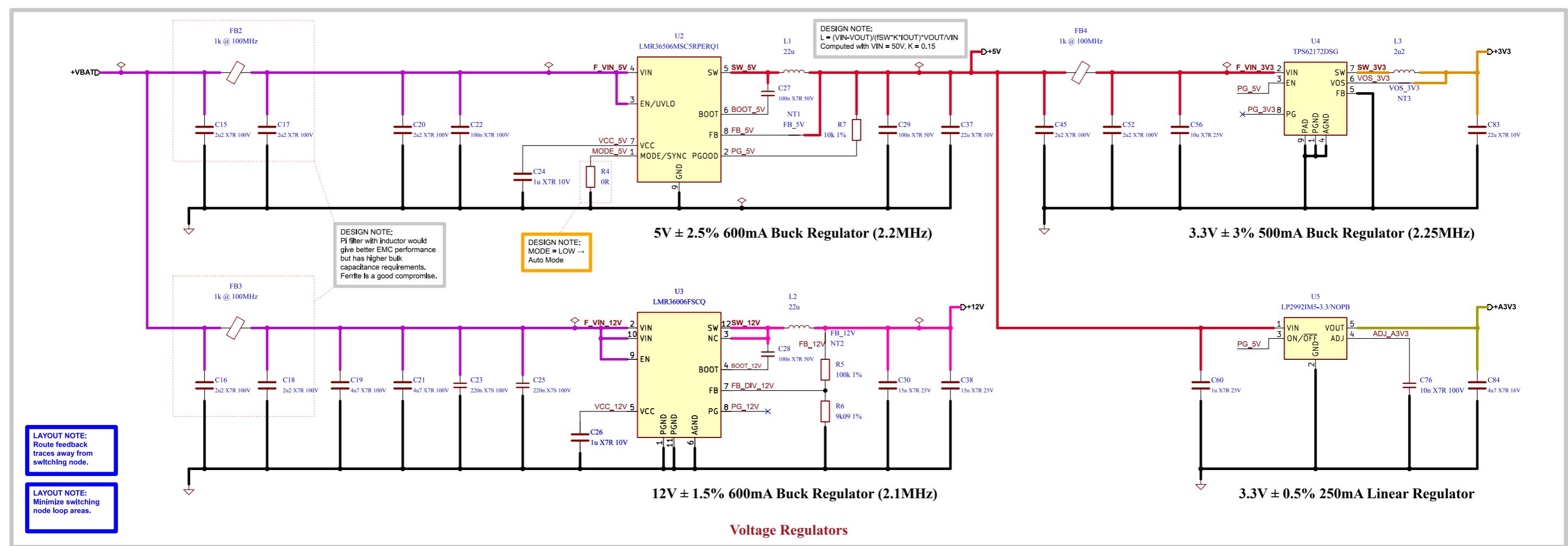
	Comments: AN5346 STM32G474 Datasheet p.81 J. Pieper ADC investigation	Company: EPFL Xplore Research 	Variant: CHECKED	Git Hash: 386a12d
	Board Name: Amulet Motion Controller			Project Name: Chienpanzé
	Sheet Title: MCU - Power	File Name: MCU - Power.kicad_sch	Designer: Vincent Nguyen	Date: 2023-12-18 Revision: 1.1.1+ (Unreleased)
	Sheet Path: /Project Architecture/MCU - Power/		Reviewer:	Size: A4 Sheet: 4 of 21

[5] MCU - I/Os



Comments: References: Flexible I/O worked examples Flexible I/O source configuration	Company: EPFL Xplore Research		Variant: CHECKED	Git Hash: 386a12d
	Board Name: Amulet Motion Controller	Project Name: Chienpanzé		
Sheet Title: MCU - I/Os	File Name: MCU - IOs.kicad_sch		Date: 2023-12-20	Revision: 1.1.1+ (Unreleased)
Sheet Path: /Project Architecture/MCU - IOs/	Reviewer:		Size: A3	Sheet: 5 of 21

[6] Power - Generation



[7] Power - Connectors



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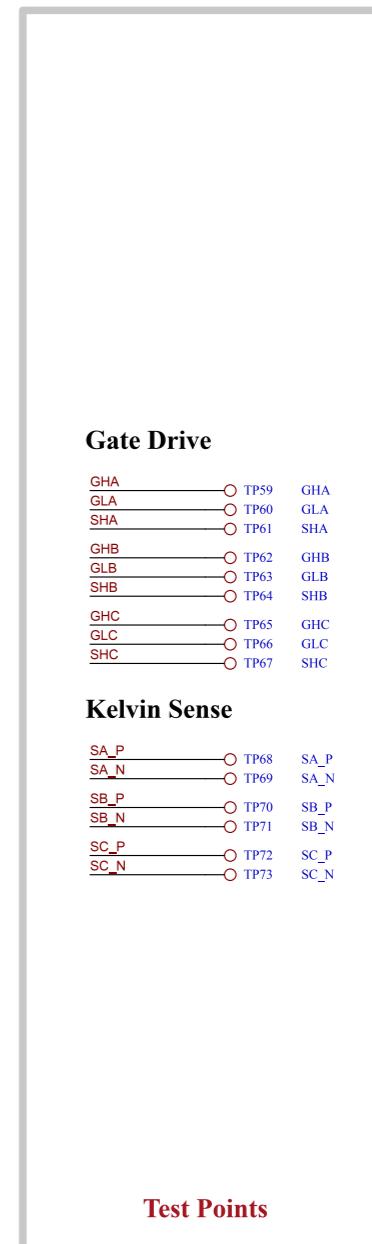
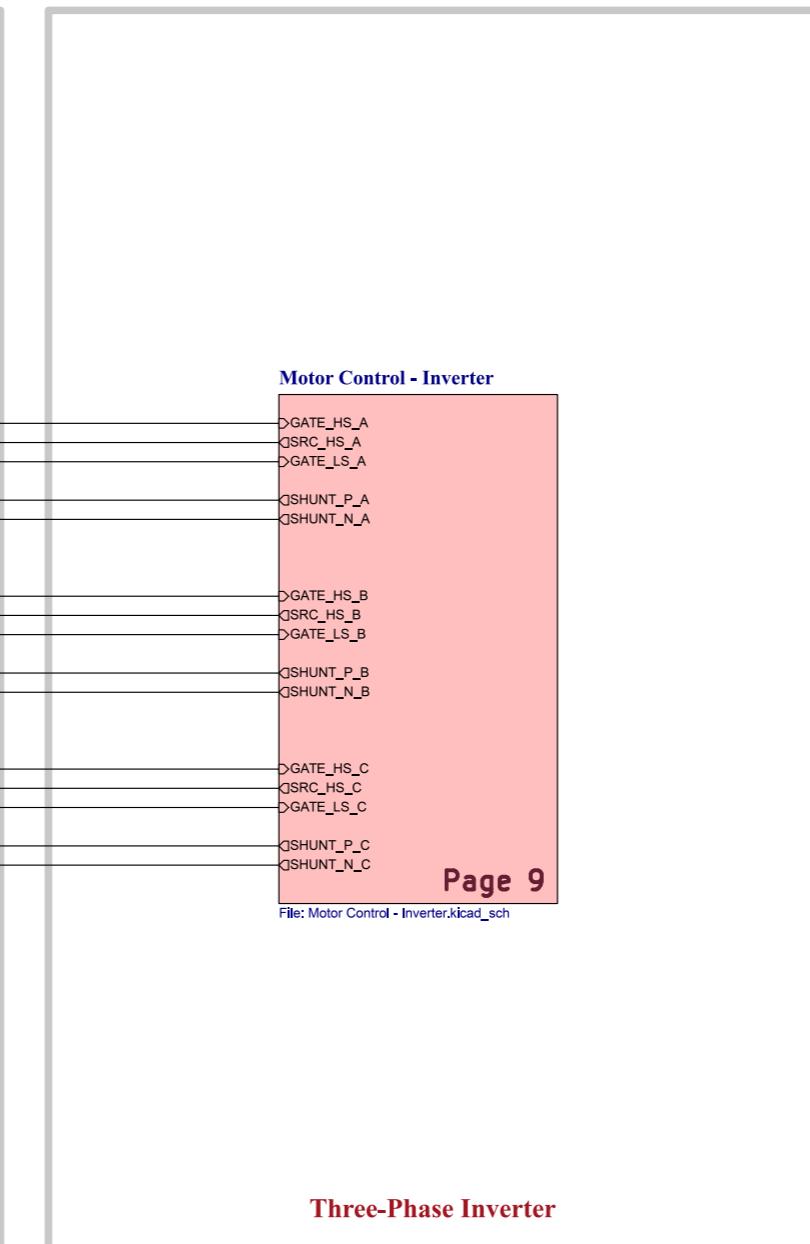
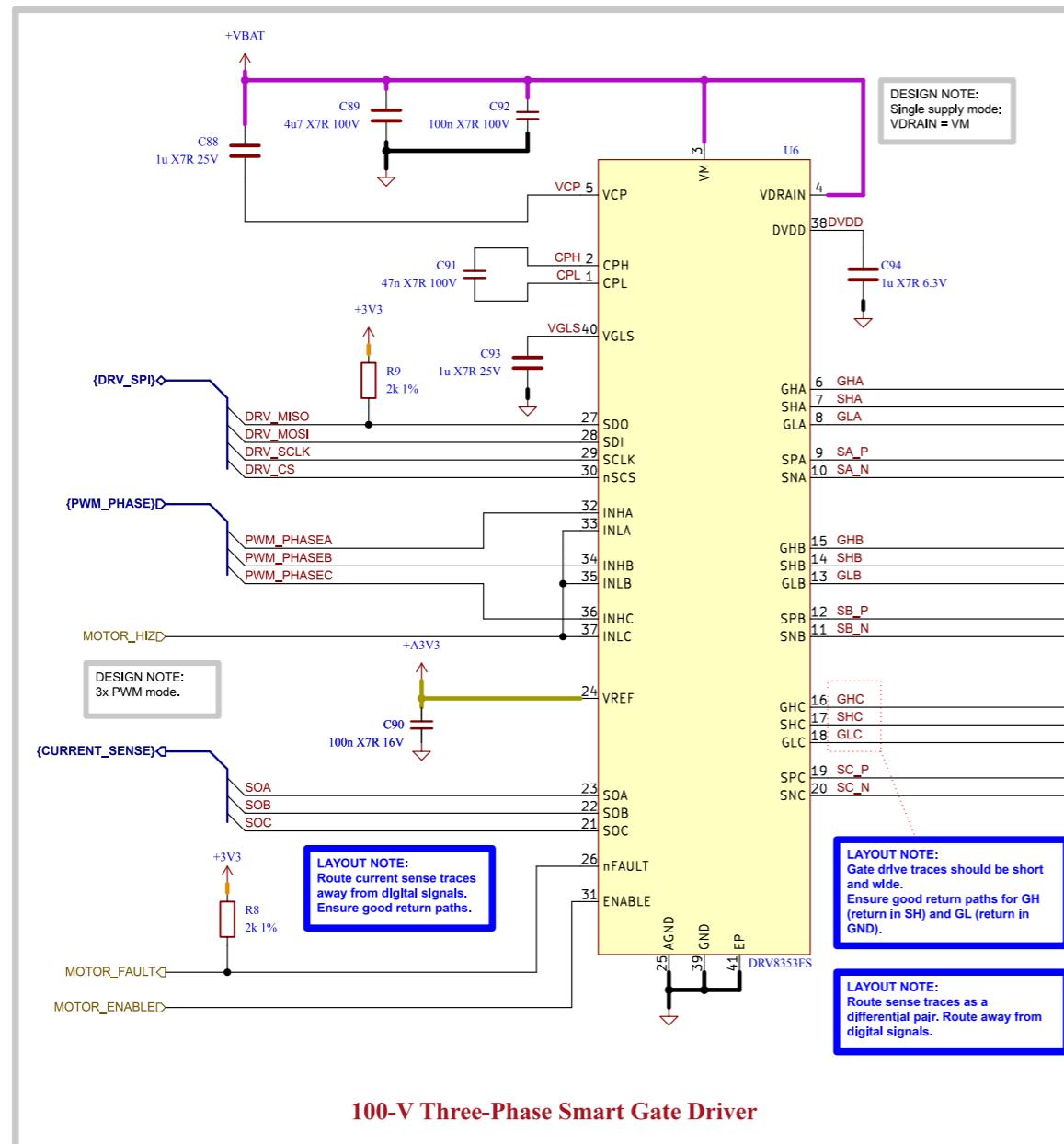
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[8] Motor Control - Top Level



	Comments:	Company:	Variant:
	EPFL Xplore Research		CHECKED
	Board Name:	Project Name:	
	Amulet Motion Controller	Chienpanzé	
	Sheet Title:	File Name:	Date:
	Motor Control - Top Level	Motor Control - Top Level.kicad_sch	2023-12-20
	Designer:	Reviewer:	Revision:
	Vincent Nguyen		1.1.1+ (Unreleased)
	Sheet Path:	Size:	Sheet:
	/Project Architecture/Motor Control - Top Level/	A3	8 of 21

[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:
CHECKED

Git Hash:
386a12d

Project Name:
Chienpanzé

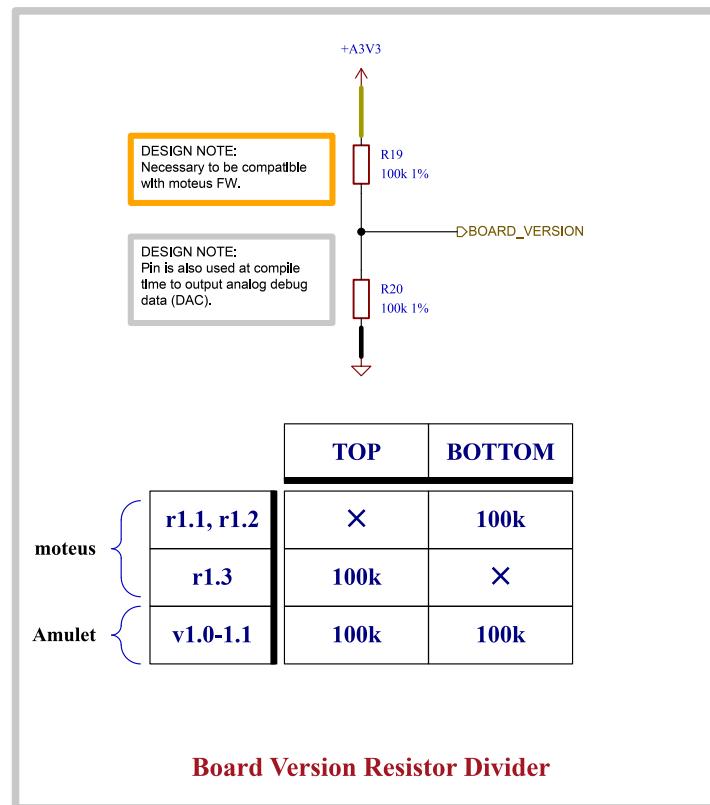
Date:
2024-01-25

Revision:
1.1.1+ (Unreleased)

Size:
A4

Sheet:
9 of 21

[10] Misc - Board Version, DAC



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D		Board Name: Amulet Motion Controller		
D	Sheet Title: Misc - Board Version, DAC	File Name: Misc - Board Version DAC.kicad_sch	Designer: Vincent Nguyen	Date: 2024-04-13
	Sheet Path: /Project Architecture/Misc - Board Version, DAC/		Reviewers:	Revision: 1.1.1+ (Unreleased)
1	2	3	4	5

[11] User - LED Indicators



	Comments:	Company: EPFL Xplore Research	Variant: CHECKED	Git Hash: 386a12d
	Board Name: Amulet Motion Controller	Project Name: Chienpanzé		
	Sheet Title: User - LED Indicators	File Name: User - LED Indicators.kicad_sch	Designer: Vincent Nguyen	Date: 2023-12-19 Revision: 1.1.1+ (Unreleased)
	Sheet Path: /Project Architecture/User - LED Indicators/		Reviewer:	Size: A4 Sheet: 11 of 21

[12] Sensing - Temperature

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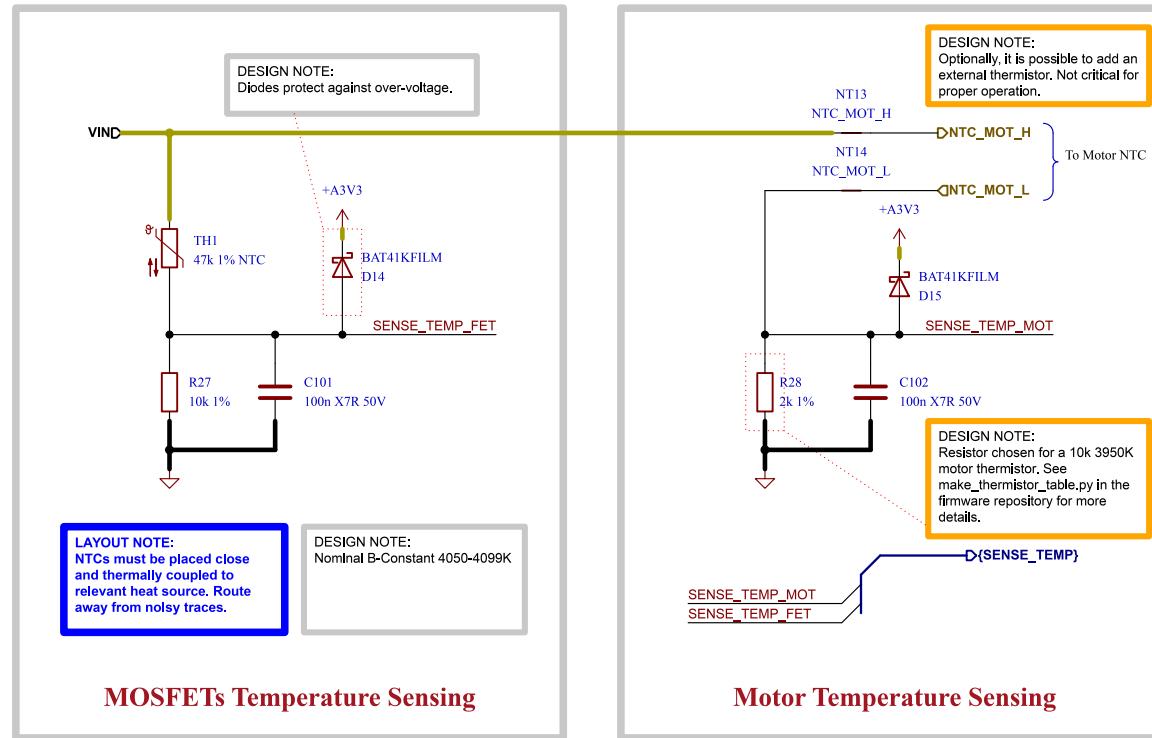
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	Comments:	Company: EPFL Xplore Research	Variant: CHECKED	Git Hash: 386a12d
	Board Name: Amulet Motion Controller	Project Name: Chienpanzé		
	Sheet Title: Sensing - Temperature	File Name: Sensing - Temperature.kicad_sch	Designer: Vincent Nguyen	Date: 2024-04-13
	Revision: 1.1.1+ (Unreleased)		Reviewer:	Size: A4
	Sheet Path: /Project Architecture/Sensing - Temperature/		Sheet: 12 of 21	

[13] Sensing - Battery

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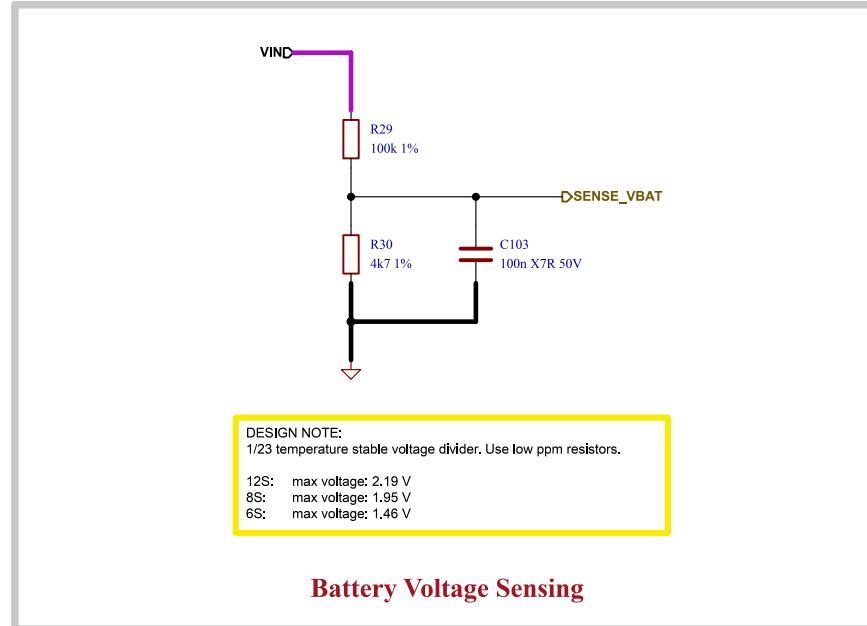
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	Comments:	Company: EPFL Xplore Research	Variant: CHECKED	Git Hash: 386a12d
	Board Name: Amulet Motion Controller			Project Name: Chienpanzé
	Sheet Title: Sensing - Battery	File Name: Sensing - Battery.kicad_sch	Designer: Vincent Nguyen	Date: 2023-10-14
	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.



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	Comments:	Company: EPFL Xplore Research	Variant: CHECKED	Git Hash: 386a12d
	Board Name: Amulet Motion Controller			Project Name: Chienpanzé
	Sheet Title: Sensing - Position	File Name: Sensing - Position.kicad_sch	Designer: Vincent Nguyen	Date: 2023-10-14
	Revision: 1.1.1+ (Unreleased)		Reviewer:	Size: A4
	Sheet Path: /Project Architecture/Sensing - Position/		Sheet: 14 of 21	

[15] Interface - RS-422



	Comments:	Company: EPFL Xplore Research 	Variant: CHECKED	Git Hash: 386a12d
	Board Name: Amulette Motion Controller			Project Name: Chienpanzé
	Sheet Title: Interface - RS-422	File Name: Interface - RS-422.kicad_sch	Designer: Vincent Nguyen	Date: 2023-10-15 Revision: 1.1.1+ (Unreleased)
	Sheet Path: /Project Architecture/Interface - RS-422/		Reviewer:	Size: A4 Sheet: 15 of 21

[16] Interface - FD-CAN



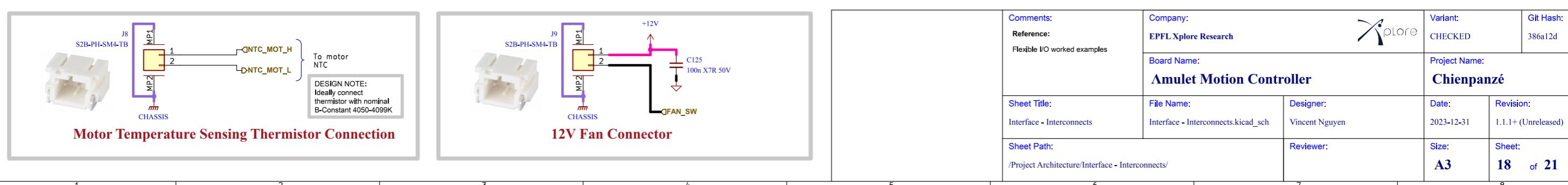
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	Board Name: Amulet Motion Controller			Project Name: Chienpanzé
	Sheet Title: Interface - FD-CAN	File Name: Interface - FD-CAN.kicad_sch	Designer: Vincent Nguyen	Date: 2023-10-15 Revision: 1.1.1+ (Unreleased)
	Sheet Path: /Project Architecture/Interface - FD-CAN/	Reviewer:	Size: A4	Sheet: 16 of 21

[17] Interface - Fan Control



	Comments:	Company: EPFL Xplore Research	Variant: CHECKED	Git Hash: 386a12d
	Board Name: Amulet Motion Controller			Project Name: Chienpanzé
	Sheet Title: Interface - Fan Control	File Name: Interface - Fan Control.kicad_sch	Designer: Vincent Nguyen	Date: 2023-11-19 Revision: 1.1.1+ (Unreleased)
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[18] Interface - Interconnects



[19] Misc - Holes, Fiducials

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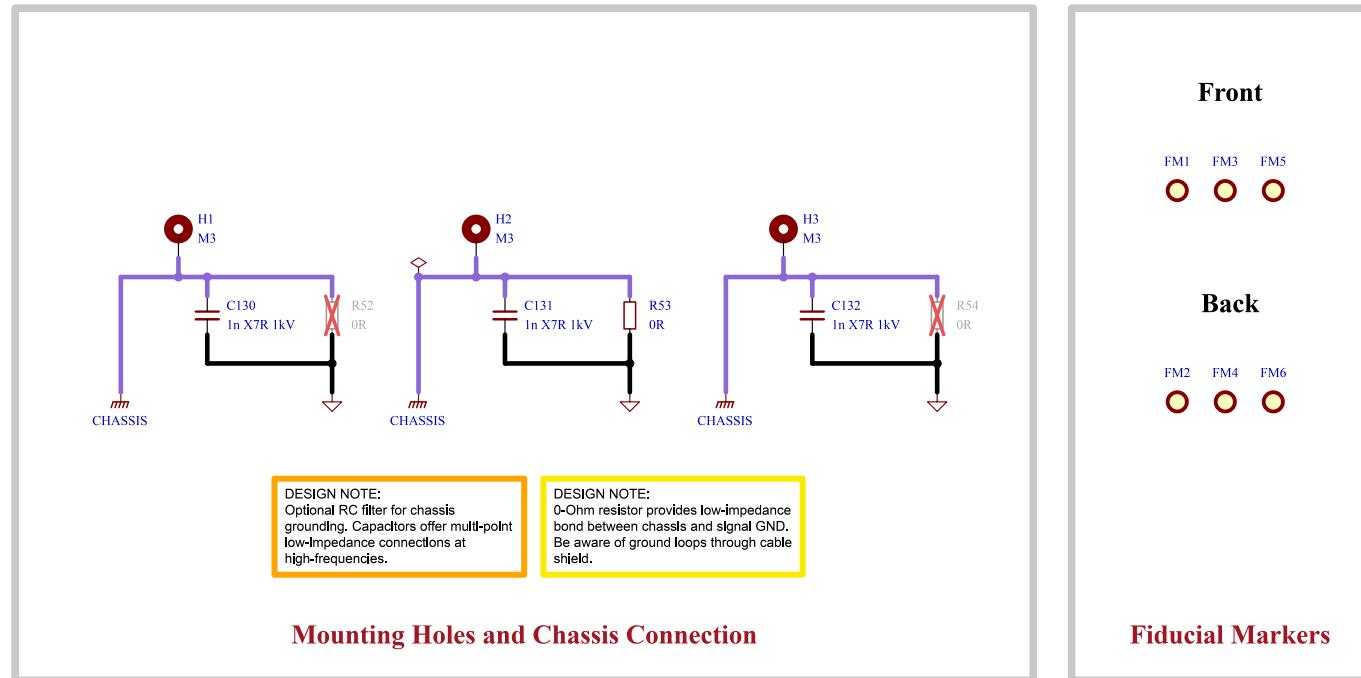
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	Comments:	Company: EPFL Xplore Research	Variant: CHECKED	Git Hash: 386a12d
	Board Name: Amulet Motion Controller	Project Name: Chienpanzé		
	Sheet Title: Misc - Holes, Fiducials	File Name: Misc - Holes Fiducials.kicad_sch	Designer: Vincent Nguyen	Date: 2023-10-22 Revision: 1.1.1+ (Unreleased)
	Sheet Path: /Project Architecture/Misc - Holes, Fiducials/		Reviewer:	Size: A4 Sheet: 19 of 21

[20] Power - Sequencing

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	Comments:	Company: EPFL Xplore Research	Variant: CHECKED	Git Hash: 386a12d
		Board Name: Amulet Motion Controller	Project Name: Chienpanzé	
	Sheet Title: Power - Sequencing	File Name: Power - Sequencing.kicad_sch	Designer: Vincent Nguyen	Date: 2024-03-12
	Sheet Path: /Power - Sequencing/		Reviewer:	Size: A4
				Sheet: 20 of 21

[21] Revision History

	Comments:	Company: EPFL Xplore Research	 xplore	Variant: CHECKED	Git Hash: 386a12d
		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: 1.1.1+ (Unreleased)
Sheet Path: /Revision History/		Reviewer:	Size:	Sheet:	21 of 21