

Amulet Motion Controller

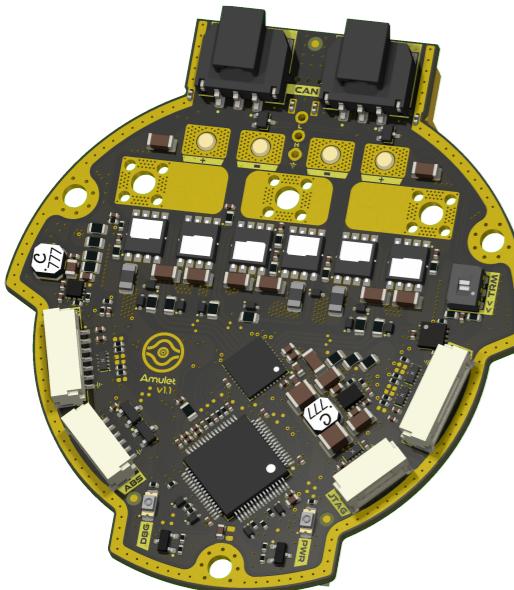
Variant: CHECKED

2024-11-26

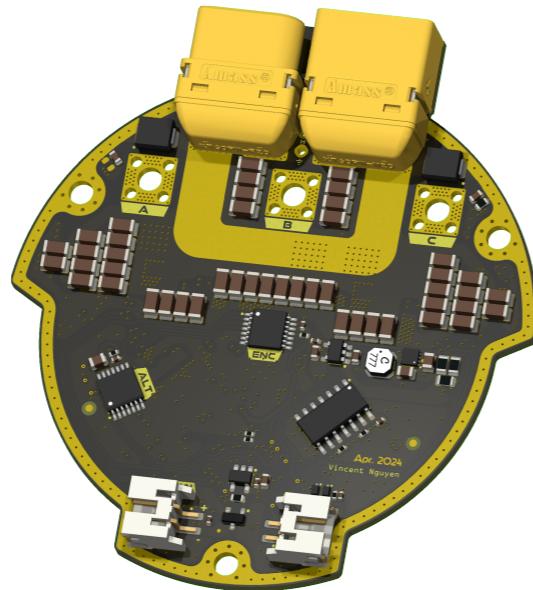
Rev 1.2.0

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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.

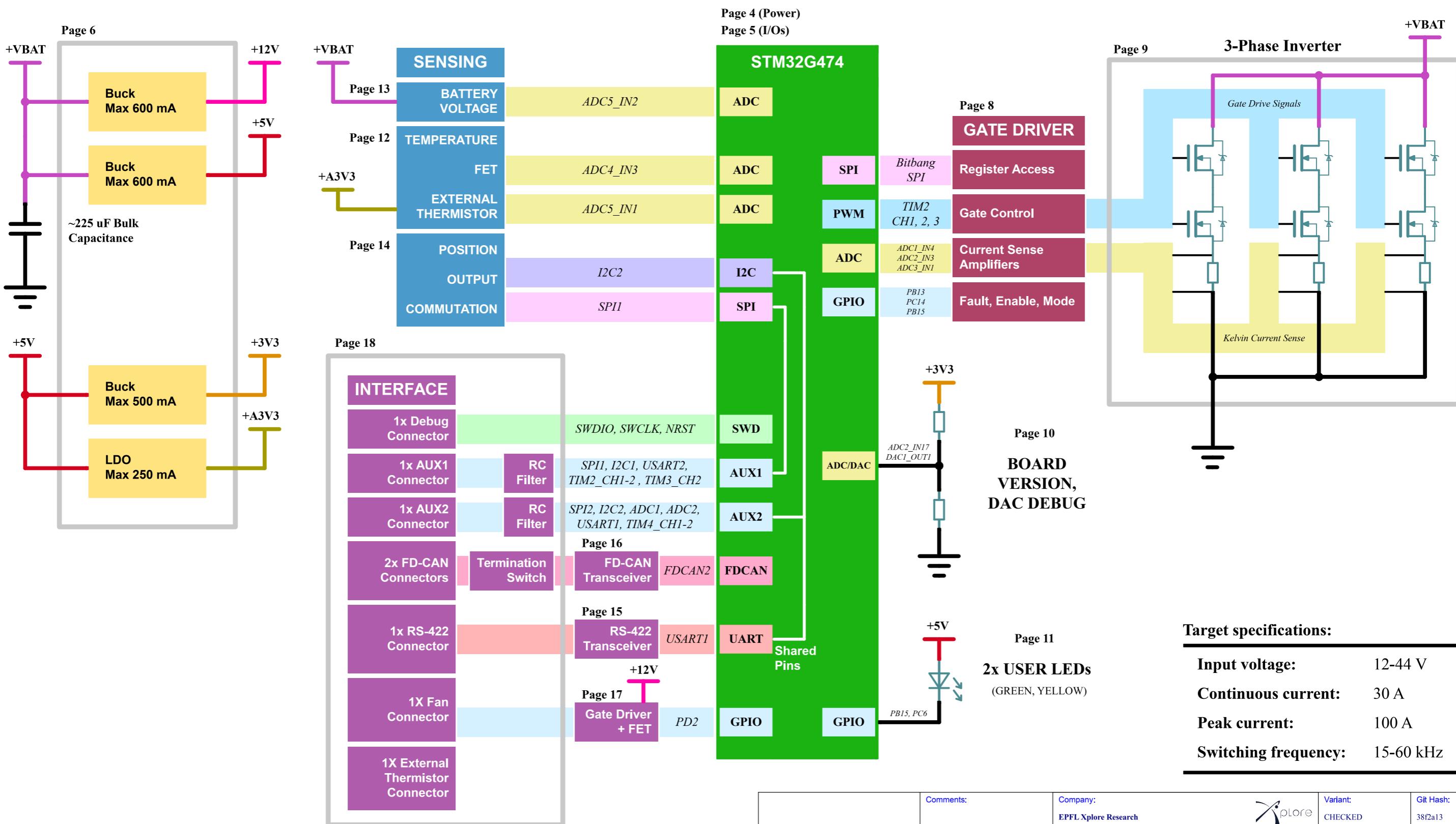
CHECKED - There shouldn't be any mistakes. Contact the engineer if you find any.

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

Date: 26-Nov-2024

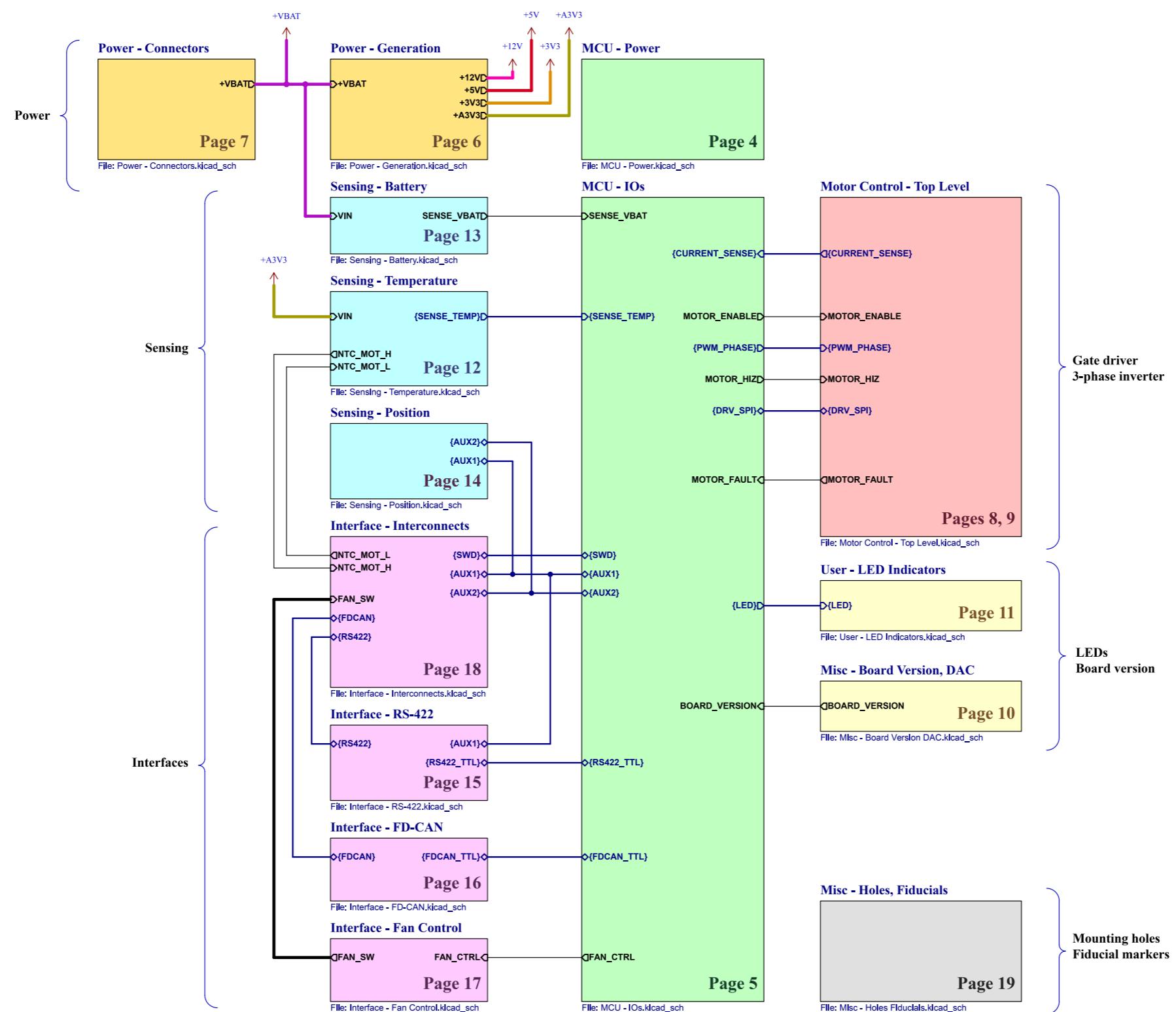
	Comments:	Company: EPFL Xplore Research	Variant: CHECKED	Git Hash: 38f2a13
	Board Name: Amulet Motion Controller	Project Name: Chienpanzé		
	Sheet Title: Cover Page	File Name: amulet_controller.kicad_sch	Designer: Vincent Nguyen	Date: 2024-04-13
	Sheet Path: /		Reviewer:	Revision: 1.2.0
			Size: A3	Sheet: 1 of 21

[2] Block Diagram



Comments:	Company: EPFL Xplore Research		Variant: CHECKED	Git Hash: 38f2a13
	Board Name: Amulet Motion Controller			
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



	Comments:	Company: EPFL Xplore Research	Variant: CHECKED	Git Hash: 38f2a13
	Board Name: Amulet Motion Controller	Project Name: Chienpanzé		
	Sheet Title: Project Architecture	File Name: Project Architecture.kicad_sch	Designer: Vincent Nguyen	Date: 2023-12-22
	Sheet Path: /Project Architecture/		Reviewer:	Revision: 1.2.0

[4] MCU - Power



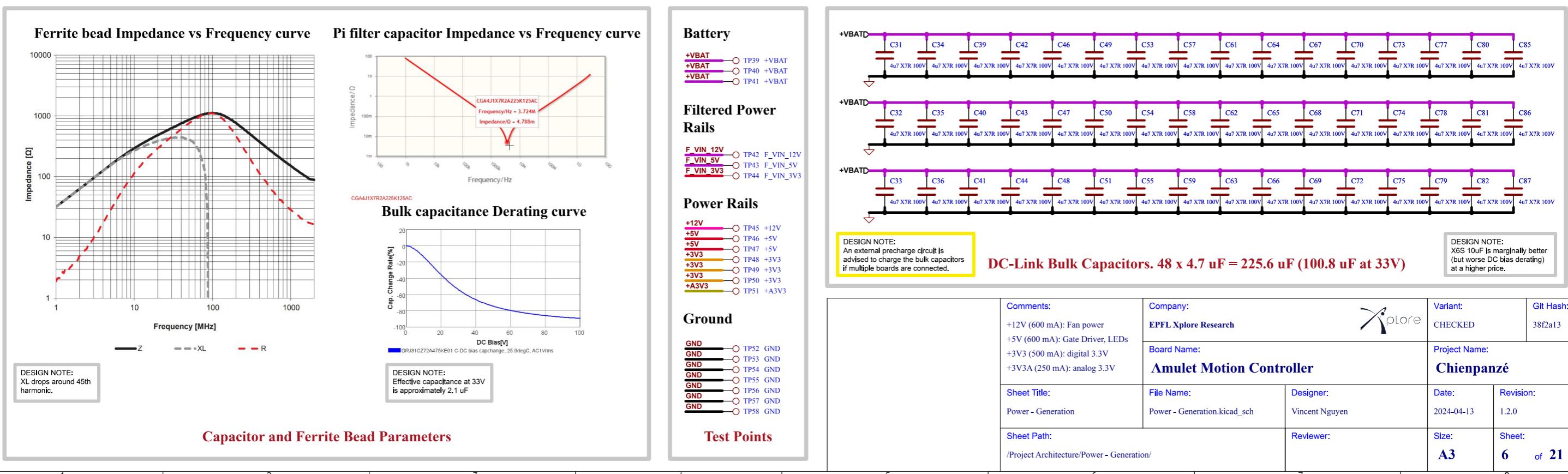
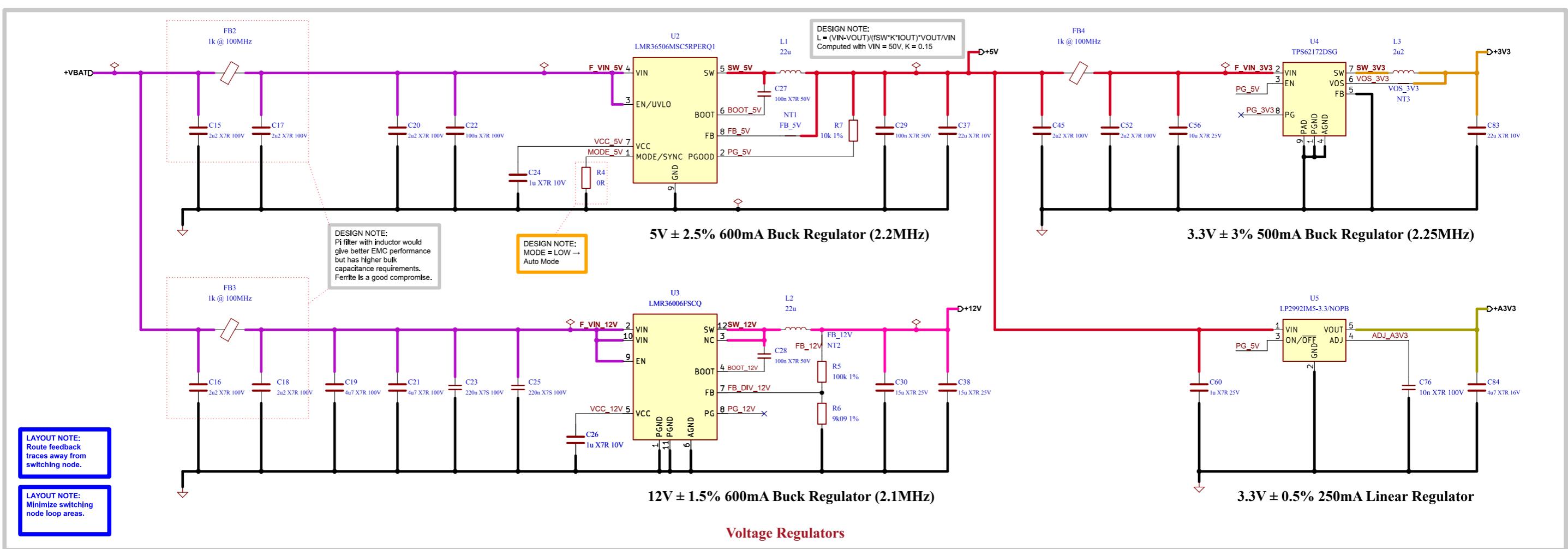
	Comments: AN5346 STM32G474 Datasheet p.81 J. Pieper ADC investigation	Company: EPFL Xplore Research	Variant: CHECKED	Git Hash: 38f2a13
	Board Name: Amulet Motion Controller			Project Name: Chienpanzé
	Sheet Title: MCU - Power	File Name: MCU - Power.kicad_sch	Designer: Vincent Nguyen	Date: 2023-12-18 Revision: 1.2.0
	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: 38f2a13
	Board Name: Amulet Motion Controller			
Sheet Title: MCU - I/Os		File Name: MCU - IOs.kicad_sch	Designer: Vincent Nguyen	Date: 2023-12-20
Sheet Path: /Project Architecture/MCU - IOs/		Reviewer:		Size: A3
Sheet: 5 of 21				

[6] Power - Generation

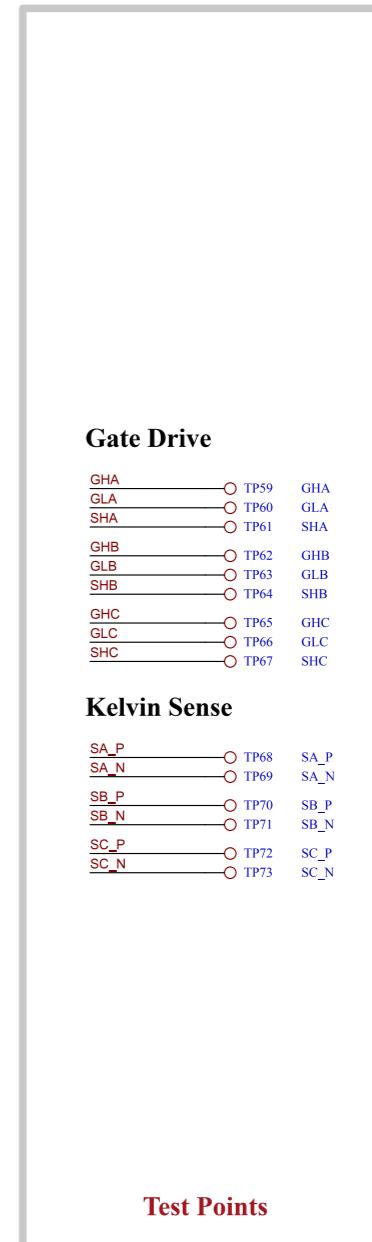
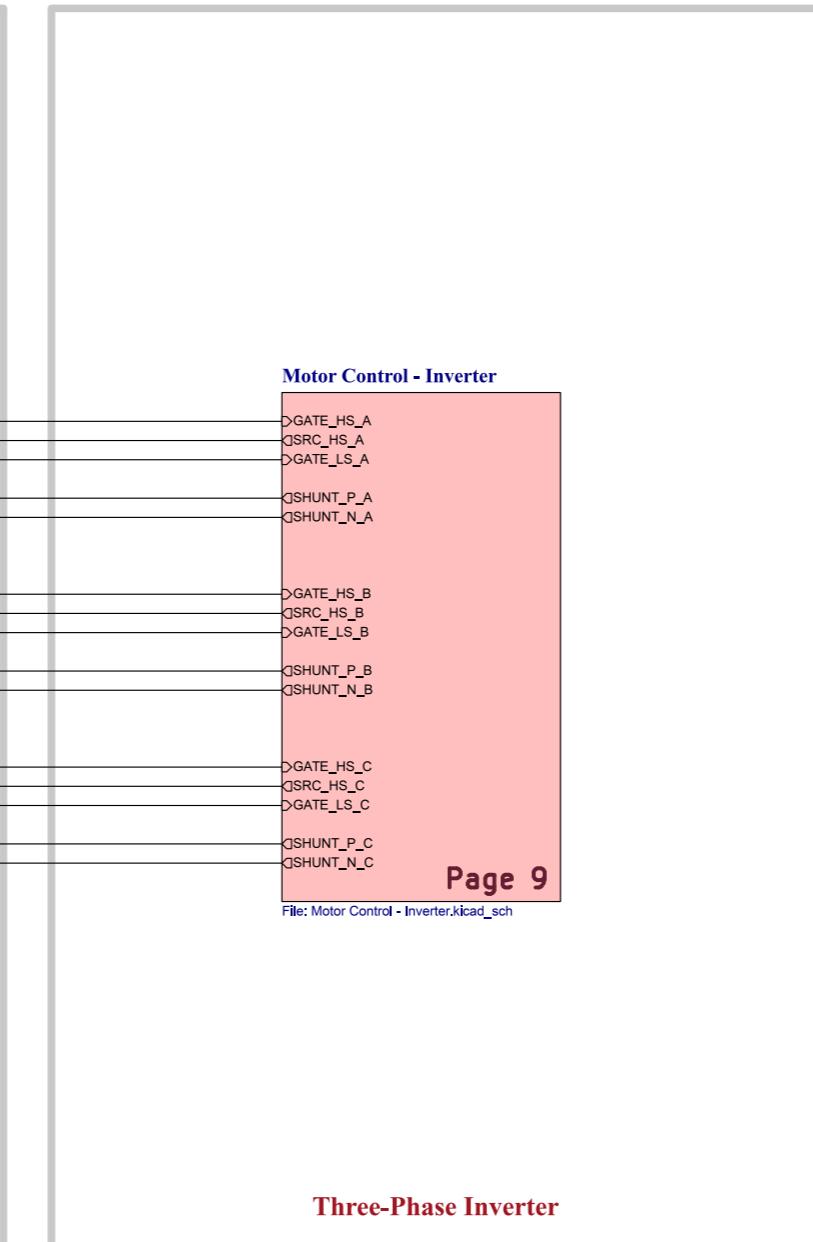
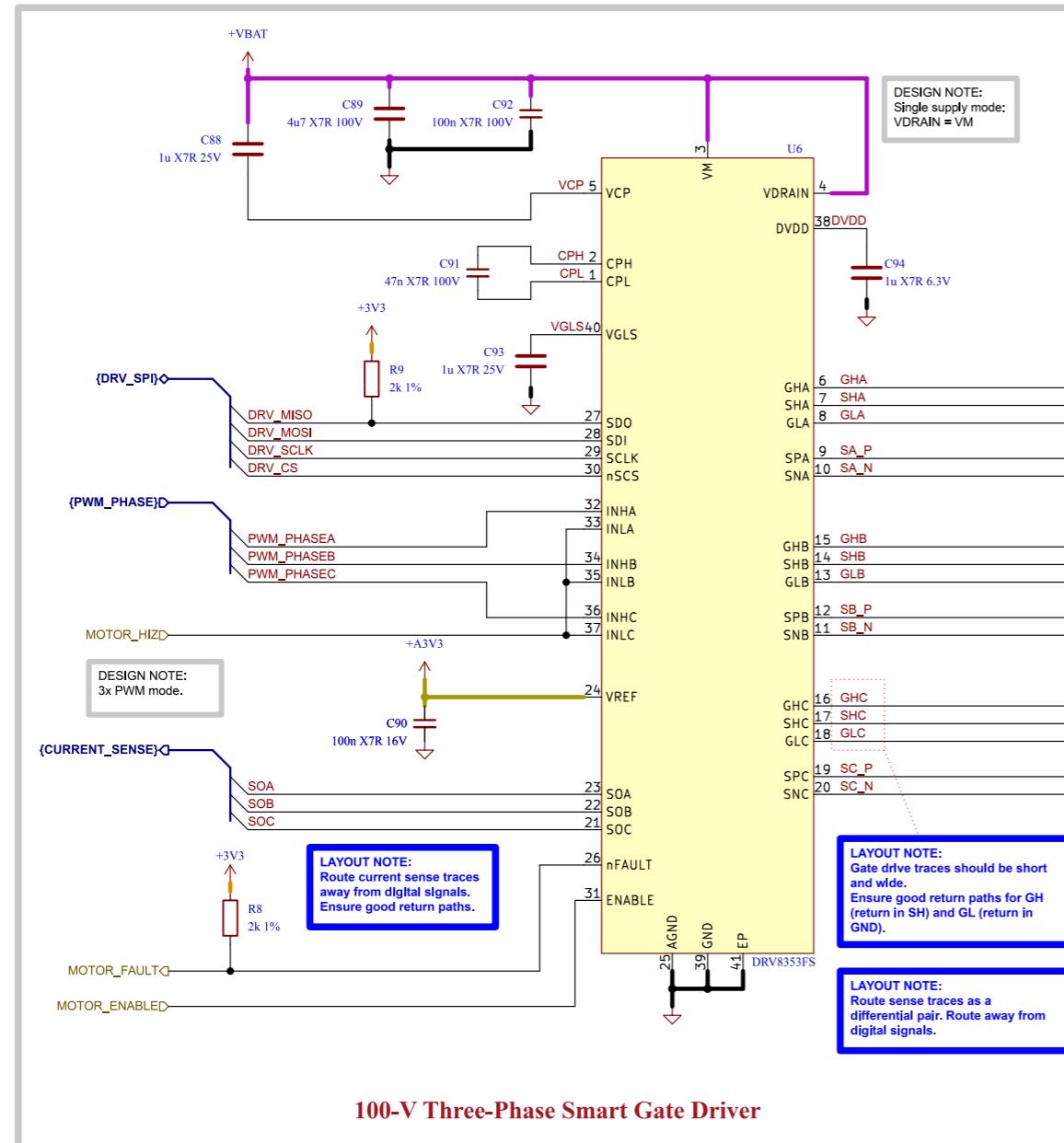


[7] Power - Connectors



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	Board Name: Amulet Motion Controller			Project Name: Chienpanzé
	Sheet Title: Power - Connectors	File Name: Power - Connectors.kicad_sch	Designer: Vincent Nguyen	Date: 2023-12-31
	Sheet Path: /Project Architecture/Power - Connectors/		Reviewer:	Size: A4
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[8] Motor Control - Top Level



Page 9
File: Motor Control - Inverter.kicad_sch

Gate Drive

GHA	TP59	GHA
GLA	TP60	GLA
SHA	TP61	SHA
GHB	TP62	GHB
GLB	TP63	GLB
SHB	TP64	SHB
GHC	TP65	GHC
GLC	TP66	GLC
SHC	TP67	SHC

Kelvin Sense

SA_P	TP68	SA_P
SA_N	TP69	SA_N
SB_P	TP70	SB_P
SB_N	TP71	SB_N
SC_P	TP72	SC_P
SC_N	TP73	SC_N

Comments:	Company: EPFL Xplore Research		Variant: CHECKED	Git Hash: 38f2a13
	Board Name: Amulet Motion Controller		Project Name: Chienpanzé	
Sheet Title: Motor Control - Top Level	File Name: Motor Control - Top Level.kicad_sch	Designer: Vincent Nguyen	Date: 2023-12-20	Revision: 1.2.0
Sheet Path: /Project Architecture/Motor Control - Top Level/	Reviewer:	Size: A3	Sheet: 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:
38f2a13

Project Name:
Chienpanzé

Date:
2024-01-25

Revision:
1.2.0

Size:
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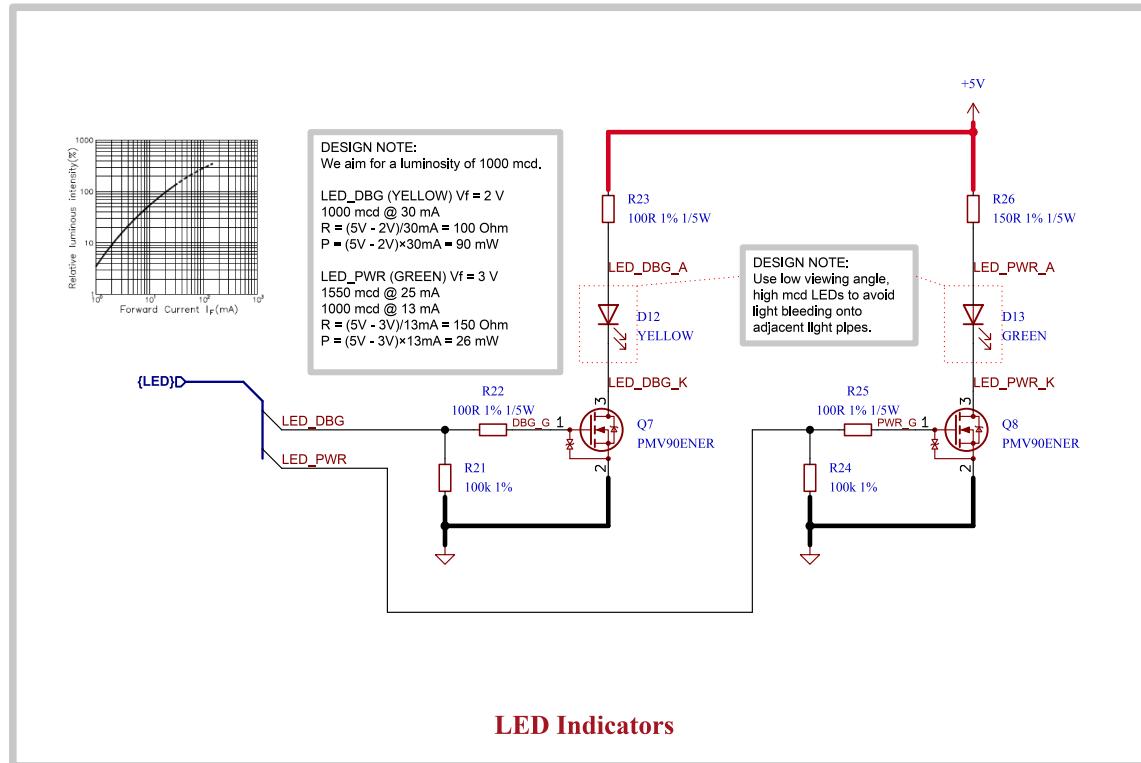
Sheet:
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[10] Misc - Board Version, DAC



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	Board Name: Amulet Motion Controller	Project Name: Chienpanzé		
	Sheet Title: Misc - Board Version, DAC	File Name: Misc - Board Version DAC.kicad_sch	Designer: Vincent Nguyen	Date: 2024-04-13 Revision: 1.2.0
	Sheet Path: /Project Architecture/Misc - Board Version, DAC/		Reviewer:	Size: A4 Sheet: 10 of 21

[11] User - LED Indicators



A

B

C

D

A

B

C

D

	Comments:	Company: EPFL Xplore Research	Variant: CHECKED	Git Hash: 38f2a13
	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
	Sheet Path: /Project Architecture/User - LED Indicators/		Reviewer:	Size: A4
			Sheet: 11 of 21	

[12] Sensing - Temperature

A

B

C

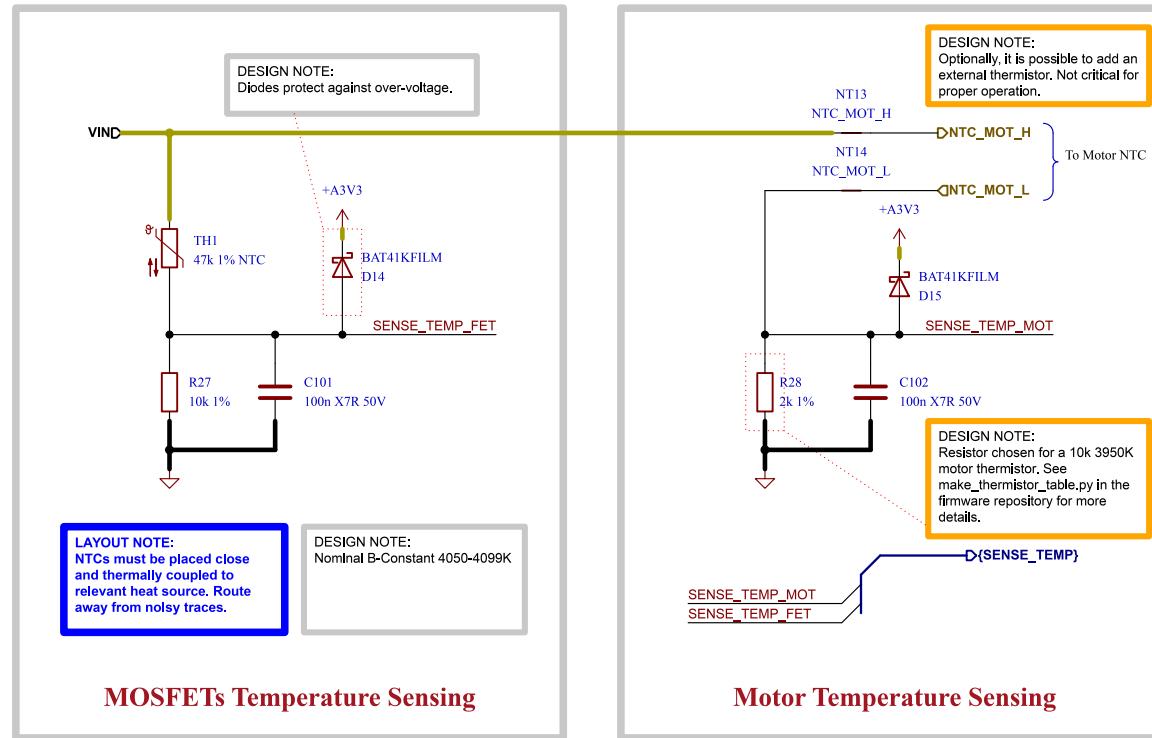
D

A

B

C

D



	Comments:	Company: EPFL Xplore Research	Variant: CHECKED	Git Hash: 38f2a13
	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: 1.2.0
	Sheet Path: /Project Architecture/Sensing - Temperature/		Reviewer:	Size: A4 Sheet: 12 of 21

[13] Sensing - Battery

A

B

C

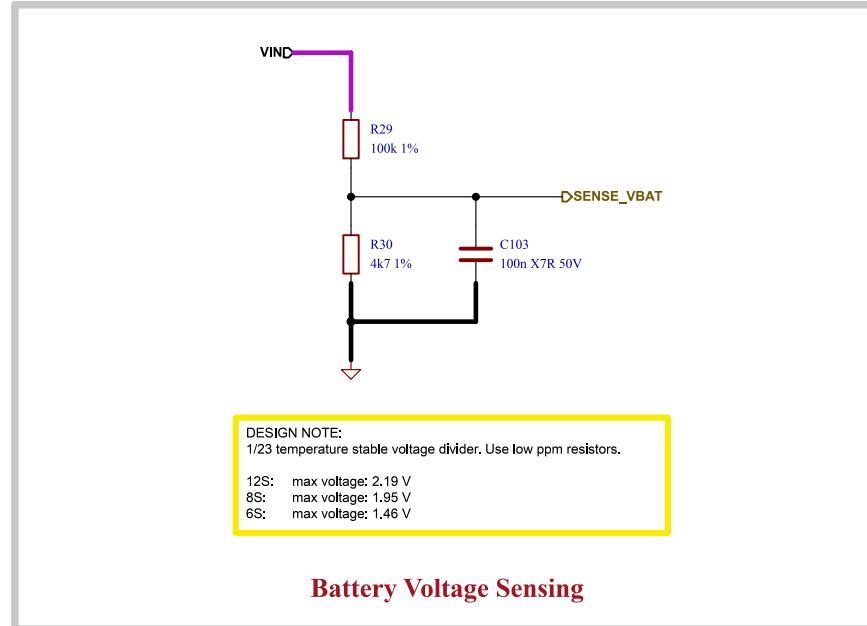
D

A

B

C

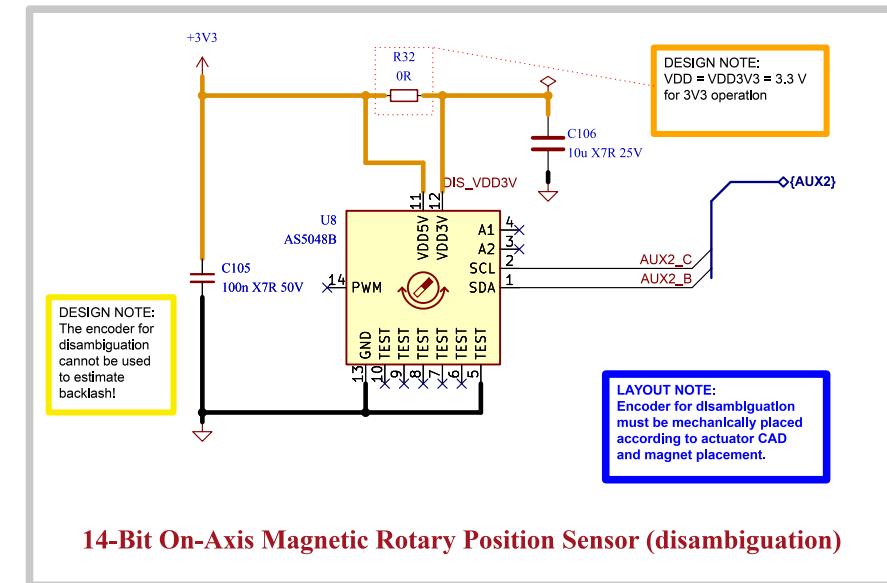
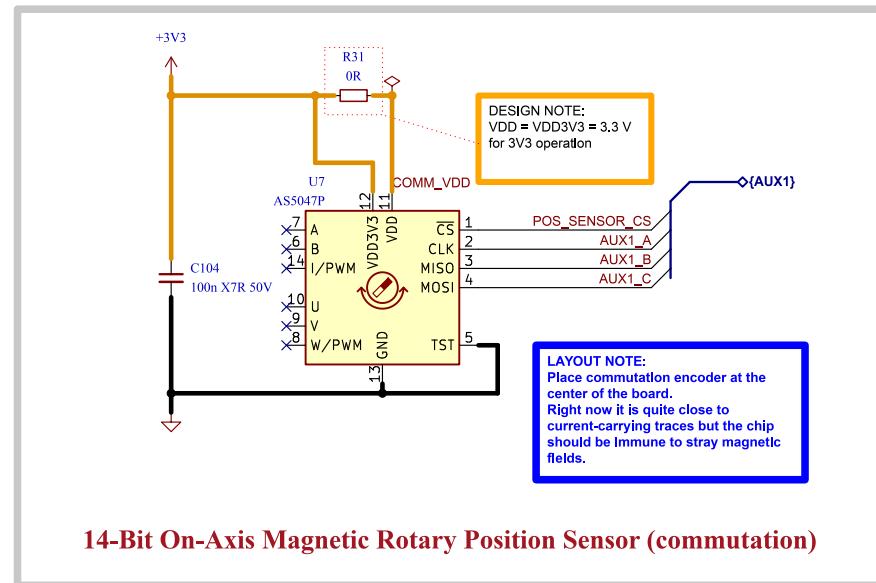
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	Board Name: Amulet Motion Controller			Project Name: Chienpanzé
	Sheet Title: Sensing - Battery	File Name: Sensing - Battery.kicad_sch	Designer: Vincent Nguyen	Date: 2023-10-14
	Sheet Path: /Project Architecture/Sensing - Battery/		Reviewer:	Size: 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.

	Comments:	Company: EPFL Xplore Research	Variant: CHECKED	Git Hash: 38f2a13
	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
	Sheet Path: /Project Architecture/Sensing - Position/		Reviewer:	Size: A4
				Sheet: 14 of 21

[15] Interface - RS-422



	Comments:	Company: EPFL Xplore Research	Variant: CHECKED	Git Hash: 38f2a13
	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
	Sheet Path: /Project Architecture/Interface - RS-422/		Reviewer:	Size: A4
				Sheet: 15 of 21

[16] Interface - FD-CAN



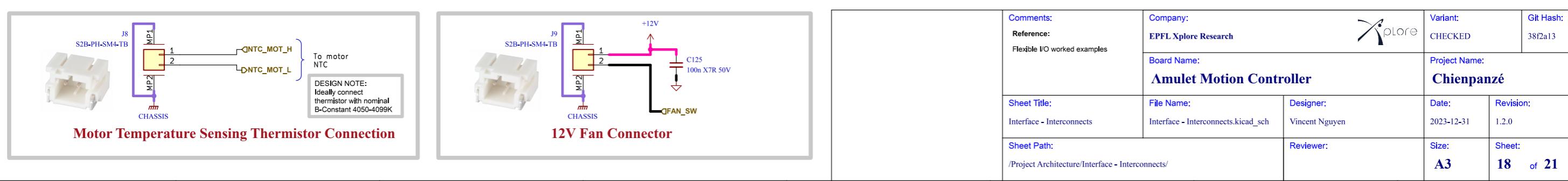
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	Board Name: Amulet Motion Controller			Project Name: Chienpanzé
	Sheet Title: Interface - FD-CAN	File Name: Interface - FD-CAN.kicad_sch	Designer: Vincent Nguyen	Date: 2023-10-15
	Sheet Path: /Project Architecture/Interface - FD-CAN/		Reviewer:	Size: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

[17] Interface - Fan Control



	Comments:	Company: EPFL Xplore Research	Variant: CHECKED	Git Hash: 38f2a13
	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
	Sheet Path: /Project Architecture/Interface - Fan Control/		Reviewer:	Size: A4
			Sheet: 17 of 21	

[18] Interface - Interconnects



Variant:
CHECKED

Git Hash:
38f2a13

Project Name:
Chienpanzé

Date:
2023-12-31

Revision:
1.2.0

Size:
A3

Sheet:
18 of **21**

[19] Misc - Holes, Fiducials

A

B

C

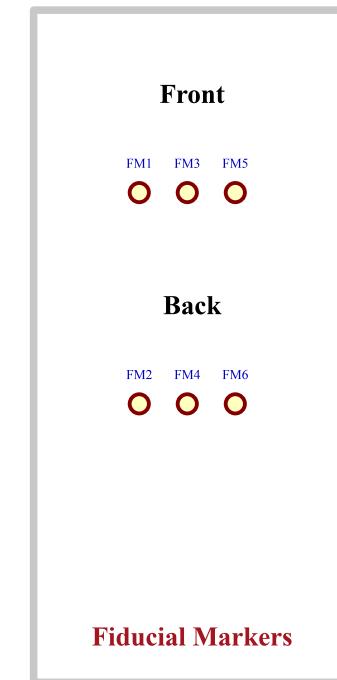
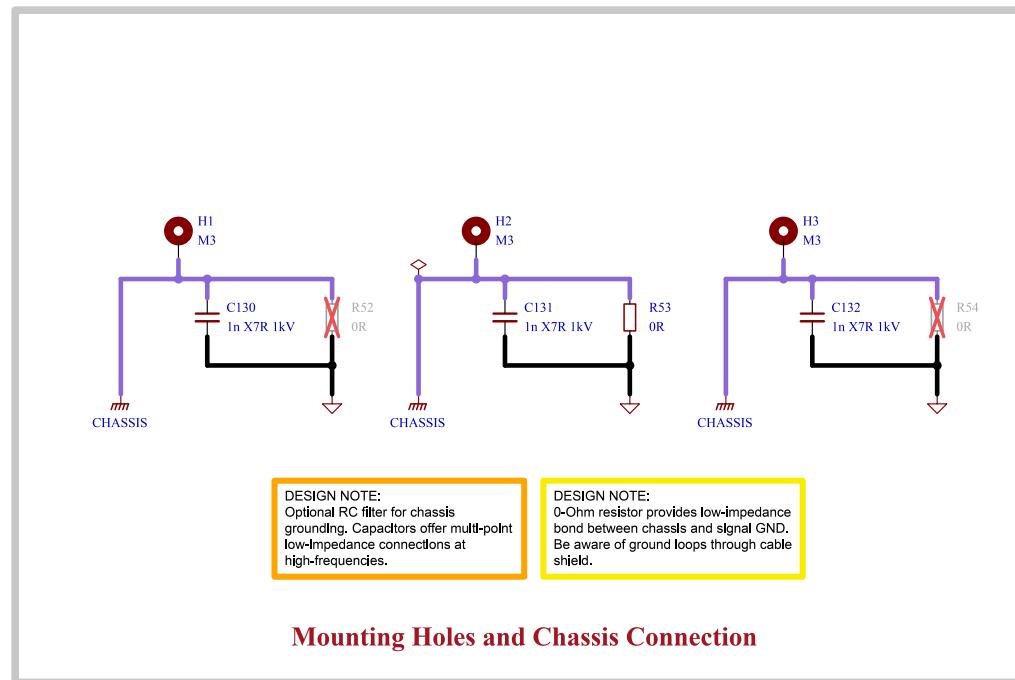
D

A

B

C

D



		Comments:	Company: EPFL Xplore Research	Variant: CHECKED	Git Hash: 38f2a13
		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: 1.2.0		Reviewer:	Size: A4
		Sheet Path: /Project Architecture/Misc - Holes, Fiducials/			Sheet: 19 of 21

[20] Power - Sequencing

A



B

C

D

	Comments:	Company: EPFL Xplore Research	Variant: CHECKED	Git Hash: 38f2a13
		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 Revision: 1.2.0
	Sheet Path: /Power - Sequencing/		Reviewer:	Size: A4 Sheet: 20 of 21

[21] Revision History

	Comments:	Company: EPFL Xplore Research	 xplore	Variant: CHECKED	Git Hash: 38f2a13
		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: 1.2.0
	Sheet Path: /Revision History/		Reviewer:	Size: A4	Sheet: 21 of 21