

??? Controller

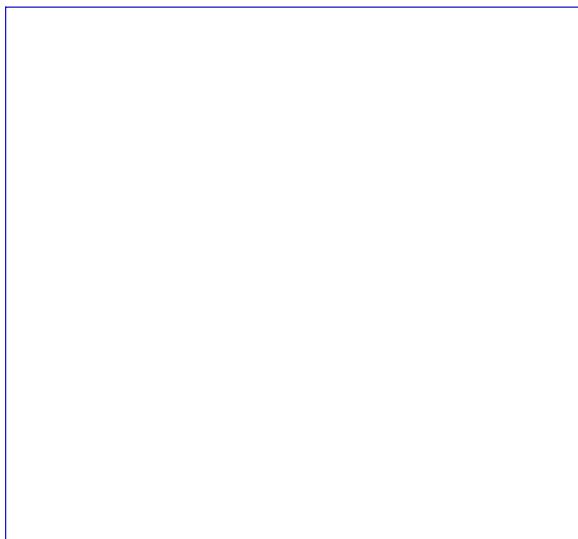
Variant: Preliminary

2023-12-09

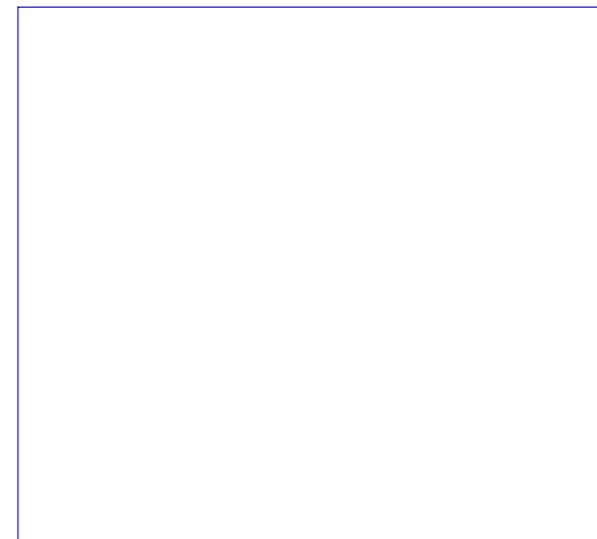
Rev 1.0

Page	Index	Page	Index	Page	Index	Page	Index
1	Cover page	11	User - LED Indicators	21	Revision History	31
2	Block diagram	12	Sensing - Temperature	22	32
3	Project architecture	13	Sensing - Battery	23	33
4	MCU - Power	14	Sensing - Position	24	34
5	MCU - I/O	15	Interface - RS-422	25	35
6	Power - Generation	16	Interface - FD-CAN	26	36
7	Power - Connectors	17	Interface - Fan Control	27	37
8	Motor Control - Top Level	18	Interface - Interconnects	28	38
9	Motor Control - Inverter	19	Mechanical - Holes	29	39
10	Misc - Board Version Divider	20	Power Sequencing	30	40

TOP VIEW



BOTTOM VIEW



NOTES

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 08-DEC-2023

DESIGN CONSIDERATIONS

DESIGN NOTE:
Example text for informational design notes.

DESIGN NOTE:
Example text for debug notes.

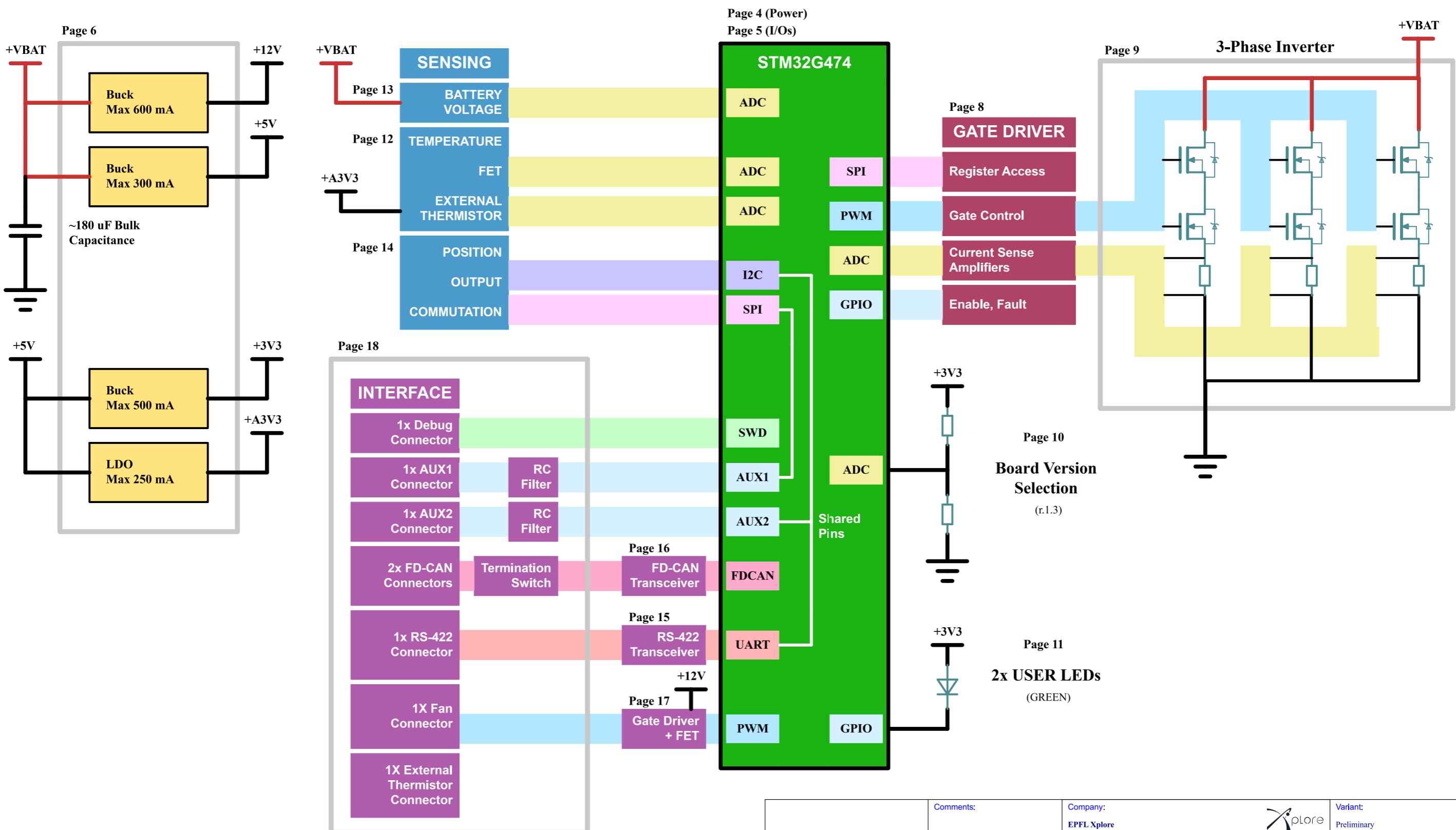
DESIGN NOTE:
Example text for cautionary design notes.

DESIGN NOTE:
Example text for critical design notes.

LAYOUT NOTE:
Example text for critical layout guidelines.

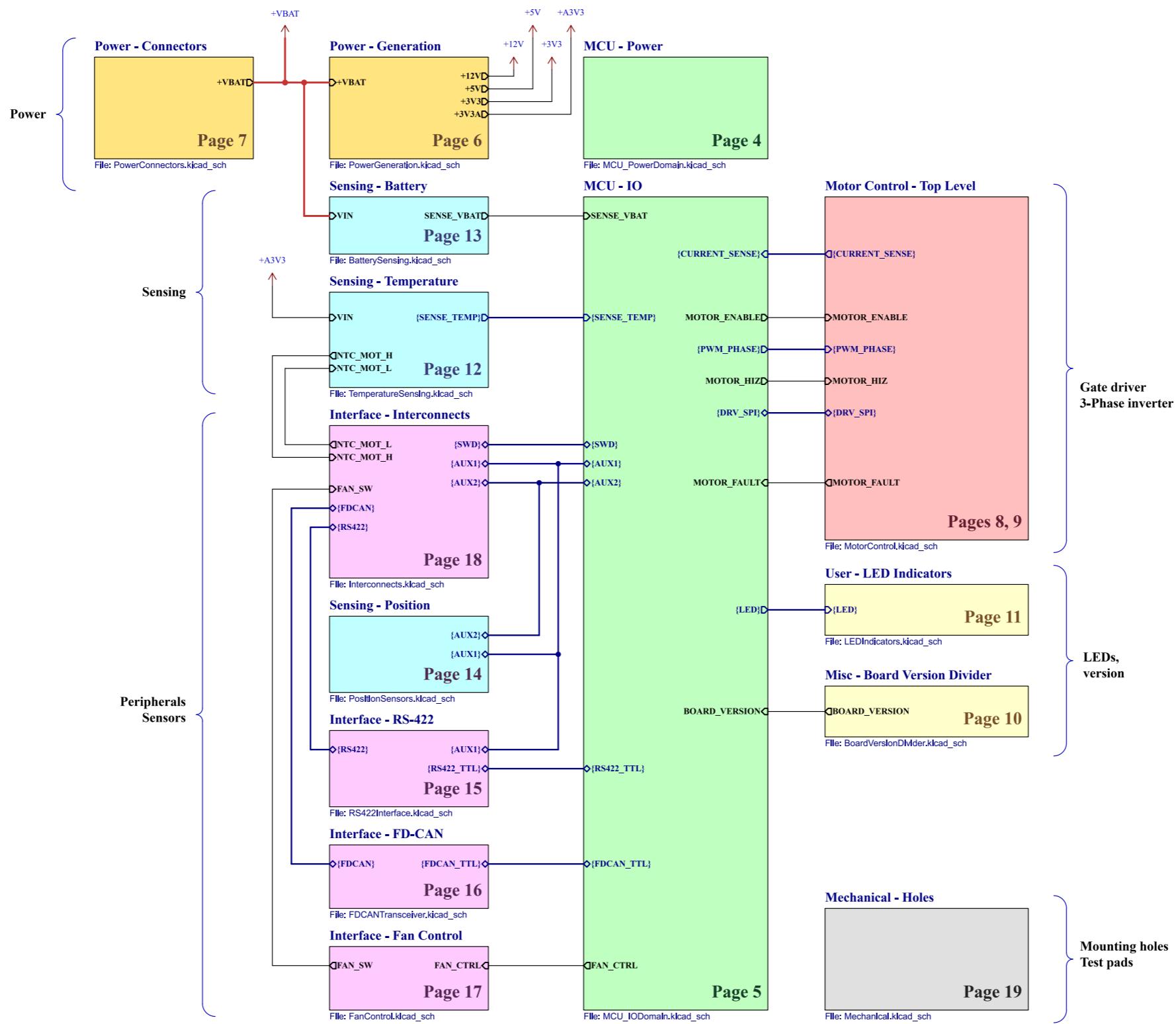
	Comments:	Company: EPFL Xplore	Variant: Preliminary
	Project Name: Chienpanzée	Board Name: ??? Controller	
Sheet Title: Cover Page	File Name: bldc_controller.kicad_sch	Designer: Vincent Nguyen	Date: 2023-10-12
Sheet Path: /		Reviewer:	Revision: 1.0

[2] Block Diagram



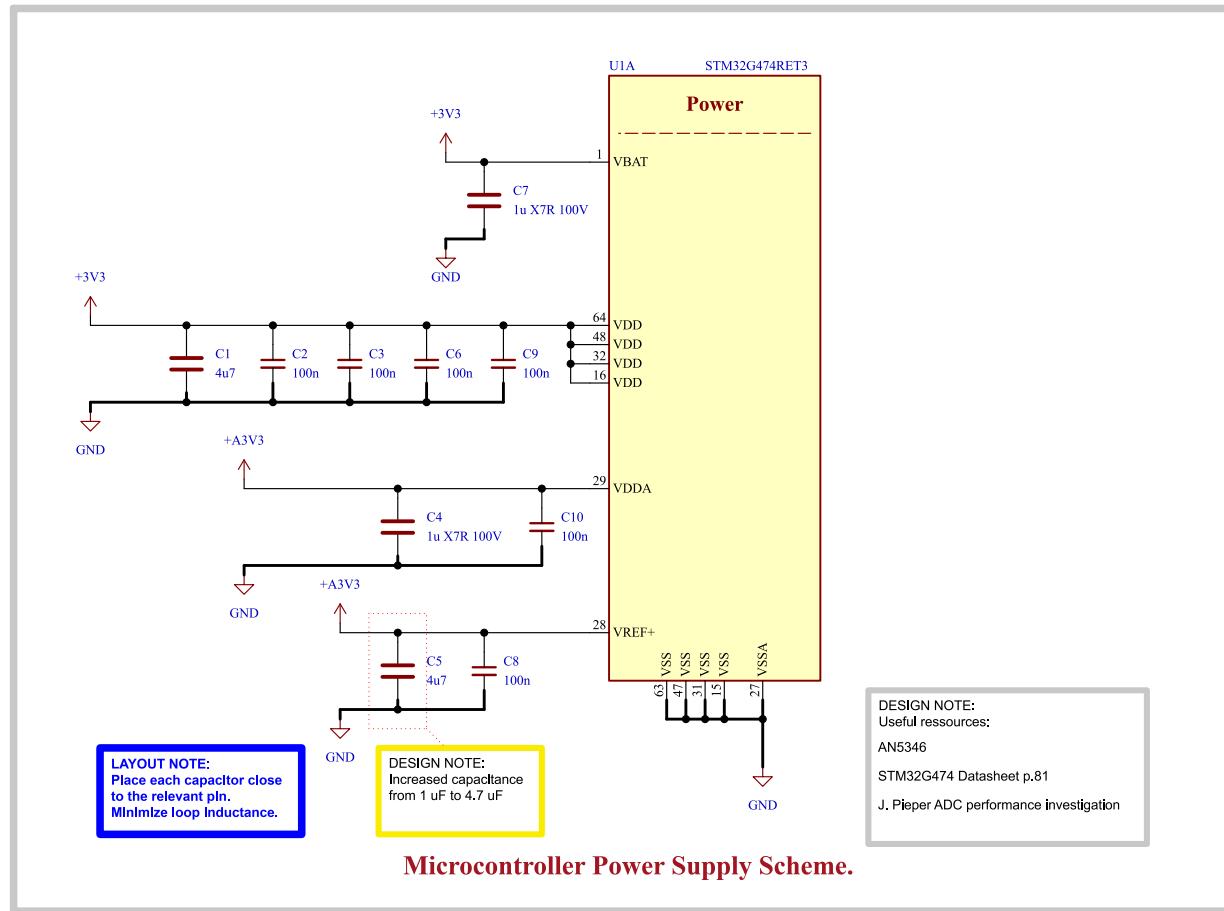
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		Project Name: Chienpanzée	
Sheet Title: Block Diagram	File Name: BlockDiagram.kicad_sch	Designer: Vincent Nguyen	Date: 2023-11-30
Sheet Path: /Block Diagram/	Reviewer:	Revision: 1.0	Size: A3
			Sheet: 2 of 21

[3] Project Architecture



	Comments:	Company:		
		EPFL Xplore		
	Project Name:	Chienpanzée		Board Name: ??? Controller
	Sheet Title:	File Name:	Designer:	Date: Revision:
	Project Architecture	ProjectArchitecture.kicad_sch	Vincent Nguyen	2023-11-25 1.0
	Sheet Path:	Reviewer:		Size: Sheet:
	/Project Architecture/			A3 3 of 21

[4] MCU - Power



A

A

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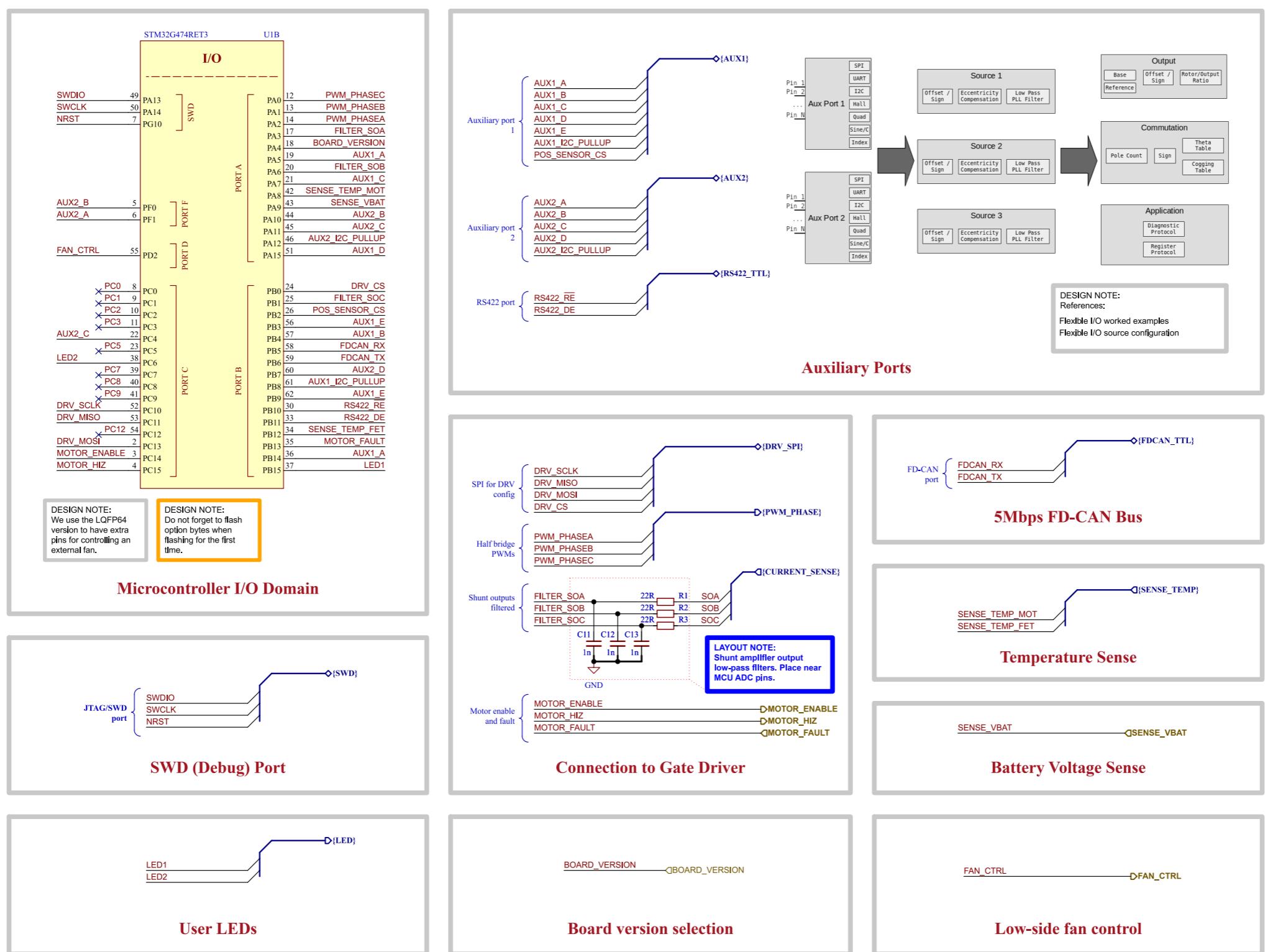
C

D

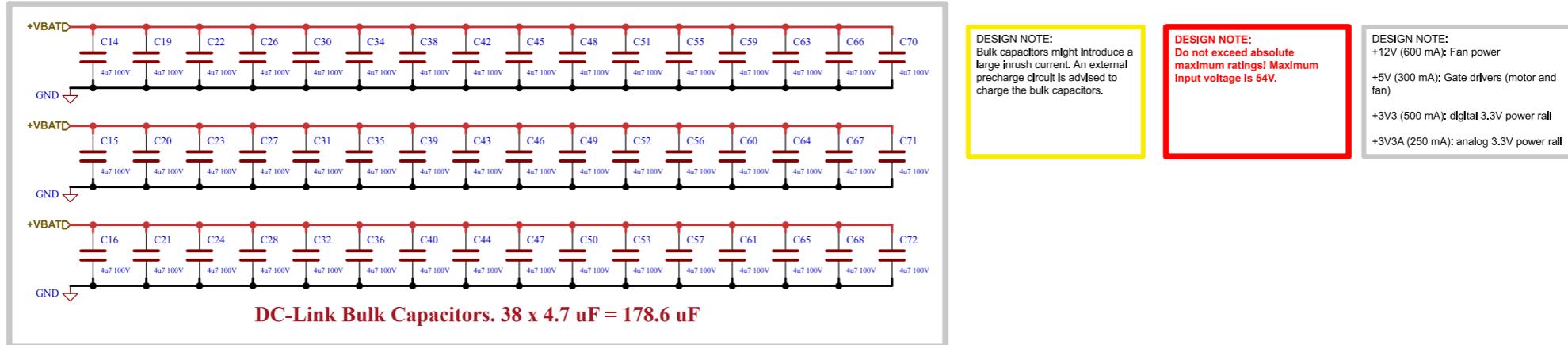
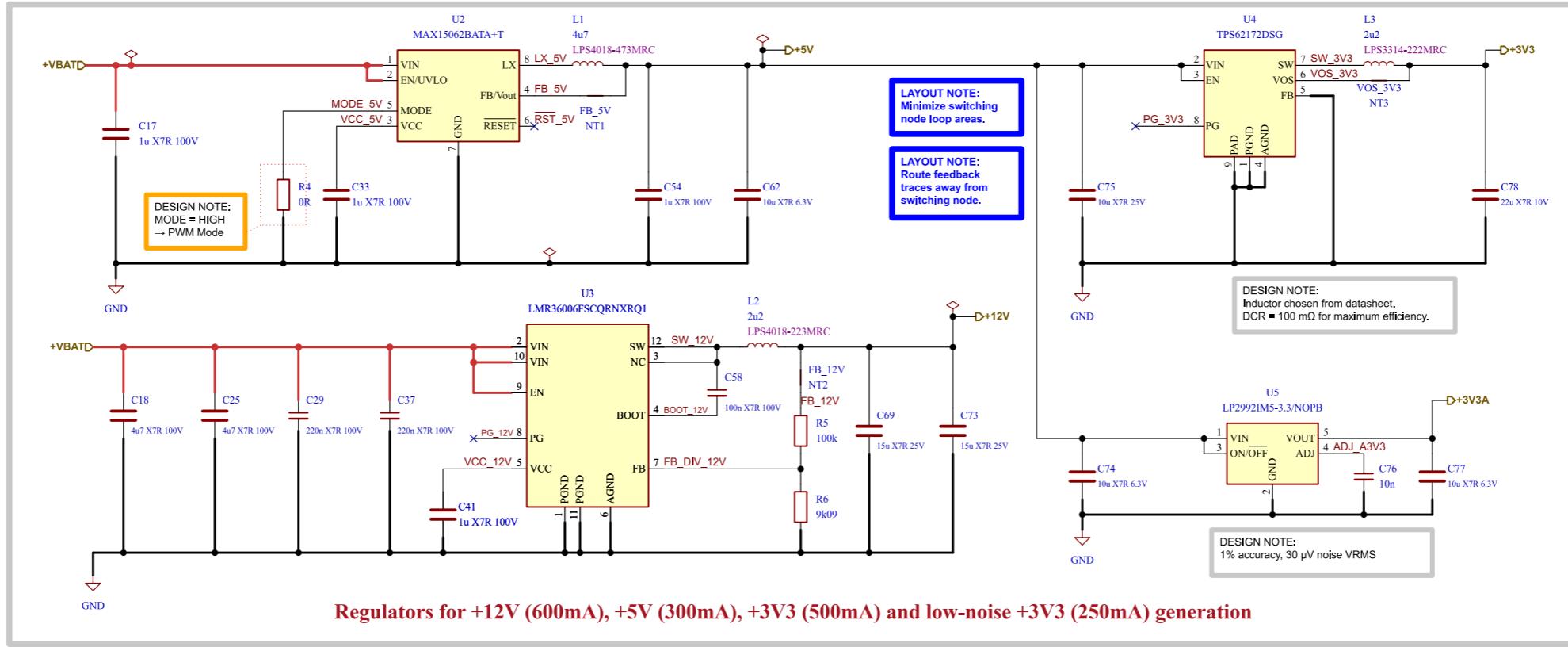
D

		Comments:	Company: EPFL Xplore	Variant: Preliminary
		Project Name: Chienpanzée	Board Name: ??? Controller	
		Sheet Title: MCU - Power	File Name: MCU_PowerDomain.kicad_sch	Designer: Vincent Nguyen
		Sheet Path: /Project Architecture/MCU - Power/	Reviewer:	Date: 2023-10-14 Revision: 1.0

[5] MCU - I/O

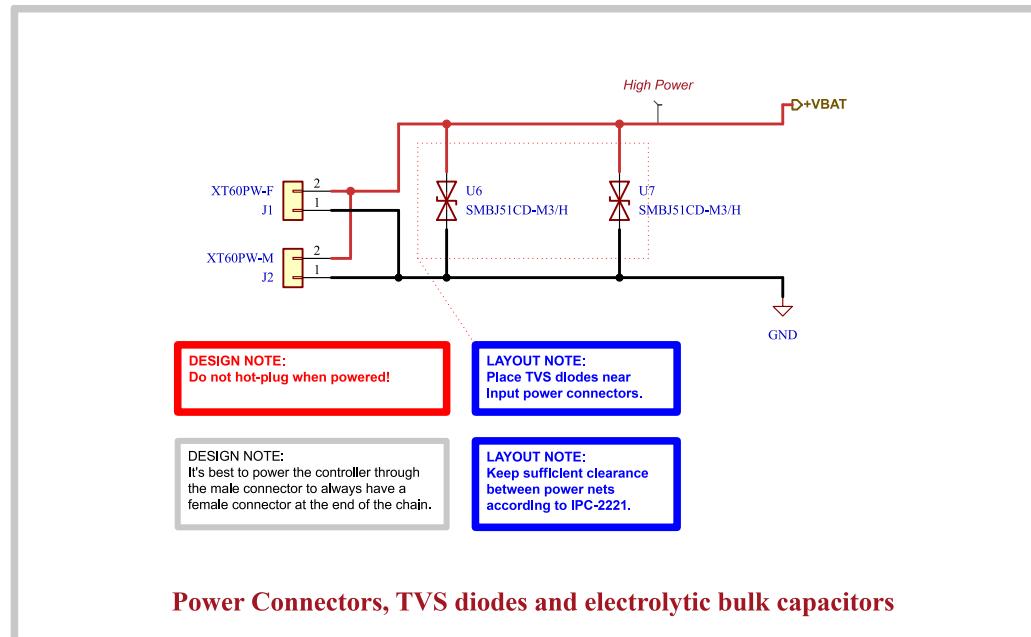


[6] Power - Generation



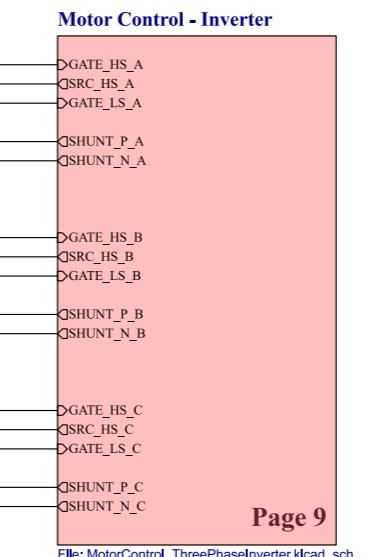
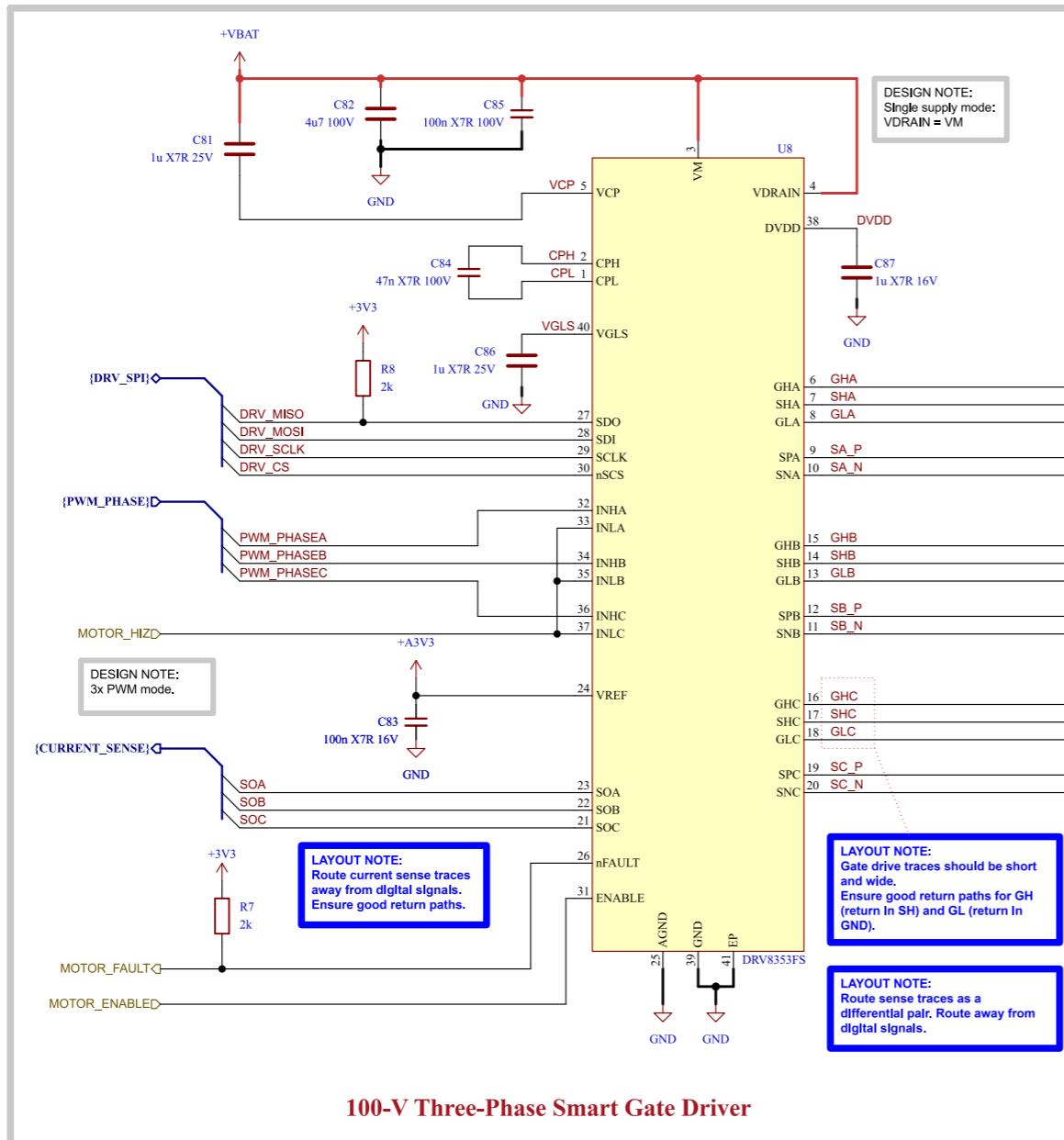
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		EPFL Xplore	Preliminary
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	Sheet Title:	File Name:	Date: 2023-10-21 Revision: 1.0
	Power - Generation	PowerGeneration.kicad_sch	Vincent Nguyen
	Sheet Path:	Reviewer:	Size: A3 Sheet: 6 of 21
	/Project Architecture/Power - Generation/		

[7] Power - Connectors



	Comments:	Company: EPFL Xplore	Variant: Preliminary
	Project Name: Chienpanzée		
	Sheet Title: Power - Connectors	File Name: PowerConnectors.kicad_sch	Designer: Vincent Nguyen
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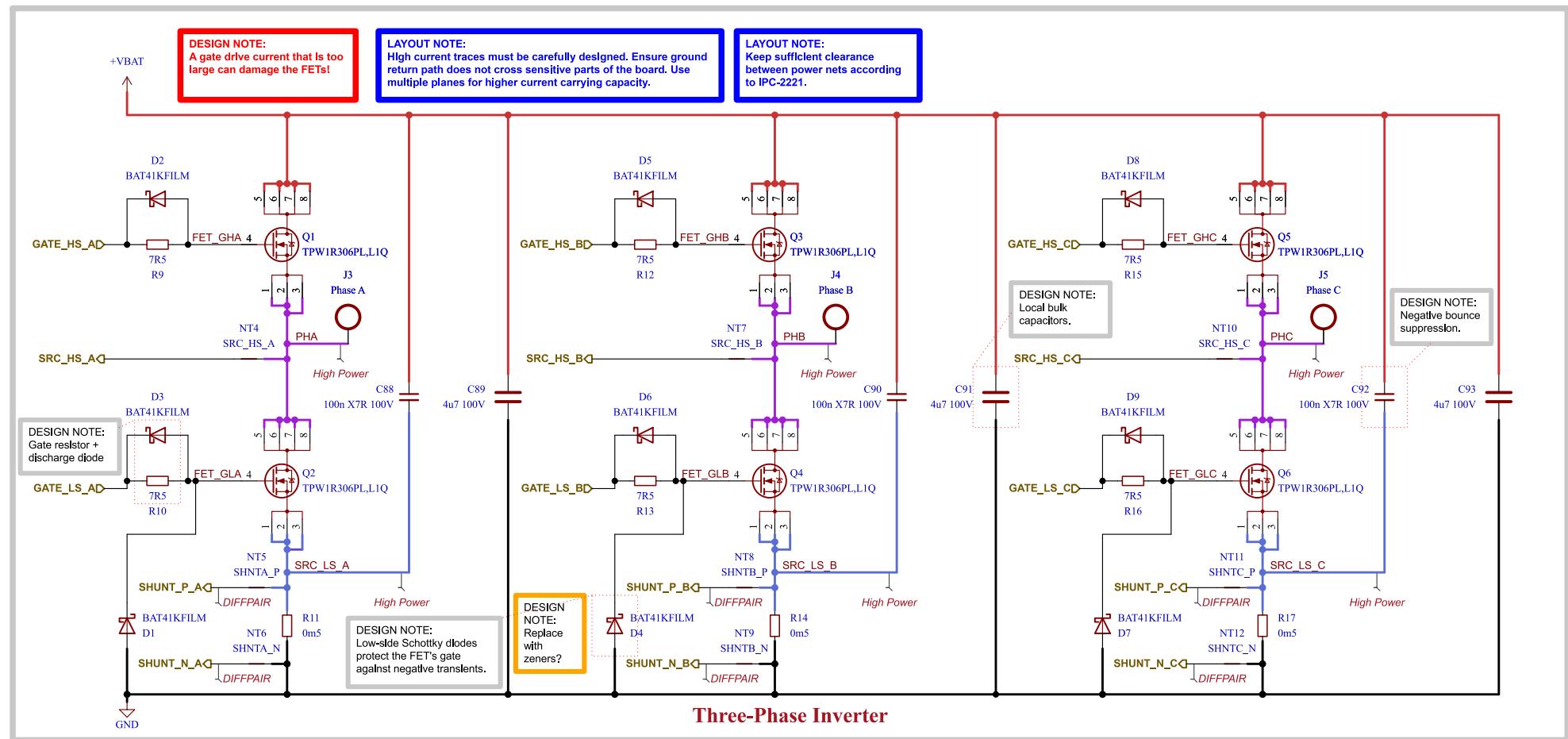
[8] Motor Control - Top Level



Page 9

	Comments:	Company:	Variant:	
		EPFL Xplore	Preliminary	
	Project Name:	Chienpanzée		Board Name: ??? Controller
	Sheet Title:	File Name:	Designer:	Date: Revision:
	Motor Control - Top Level	MotorControl.kicad_sch	Vincent Nguyen	2023-10-16 1.0
	Sheet Path:	Reviewer:		Size: Sheet:
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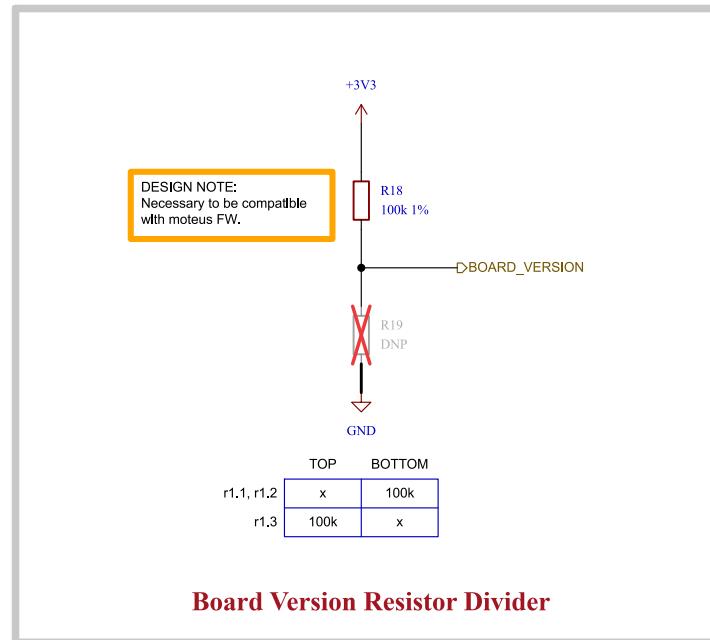
[9] Motor Control - Inverter



DESIGN NOTE:
References:
 System Design Considerations for High-Power Motor Driver Applications
 Best Practices for Board Layout of Motor Drivers

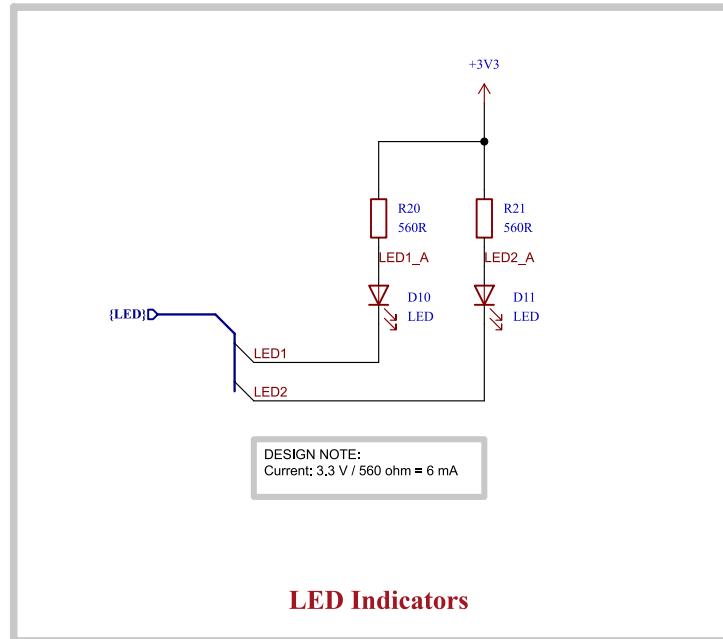
Comments:	Company: EPFL Xplore	Variant: Preliminary
Project Name: Chienpanzée	Board Name: ??? Controller	
Sheet Title: Motor Control - Inverter	File Name: MotorControl_ThreePhaseInverter.kicad_wl	Designer: Volcent Nguyen
Sheet Path: /Project Architecture/Motor Control - Top Level/Motor Control - Inverter/	Reviewer:	Date: 2023-10-18
	Size: A4	Sheet: 9 of 21

[10] Misc - Board Version Divider



	Comments:	Company: EPFL Xplore	 olore	Variant: Preliminary
		Project Name: Chienpanzée		Board Name: ??? Controller
Sheet Title: Sheet Path:	File Name: BoardVersionDivider.kicad_sch	Designer: Vincent Nguyen	Date: 2023-10-14	Revision: 1.0
		Reviewer:	Size: A4	Sheet: 10 of 21
1		3	4	5

[11] User - LED Indicators



	Comments:	Company: EPFL Xplore		Variant: Preliminary	
		Project Name: Chienpanzée		Board Name: ??? Controller	
	Sheet Title: User - LED Indicators	File Name: LEDIndicators.kicad_sch	Designer: Vincent Nguyen	Date: 2023-10-15	Revision: 1.0
	Sheet Path: /Project Architecture/User - LED Indicators/		Reviewer:	Size: A4	Sheet: 11 of 21

[12] Sensing - Temperature

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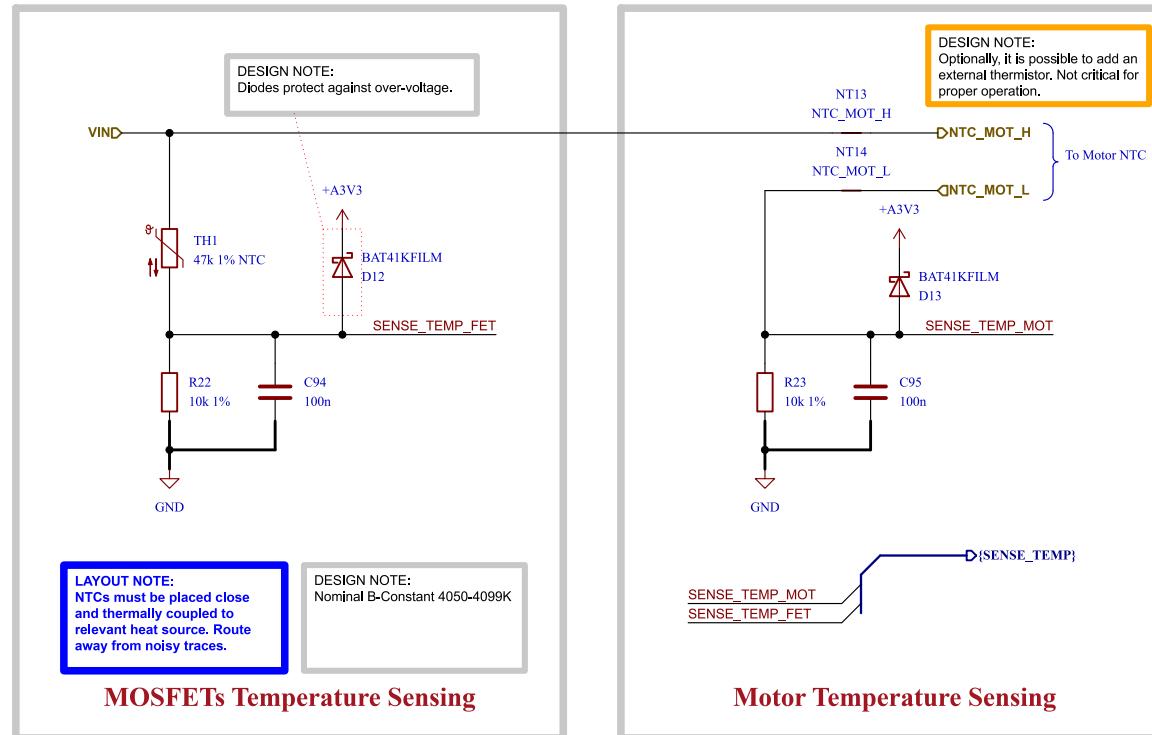
D

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	Project Name: Chienpanzée	Board Name: ??? Controller	
	Sheet Title: Sensing - Temperature	File Name: TemperatureSensing.kicad_sch	Designer: Vincent Nguyen
	Sheet Path: /Project Architecture/Sensing - Temperature/	Reviewer:	Date: 2023-10-14 Revision: 1.0



A4 **Sheet:**
12 **of** **21**

[13] Sensing - Battery

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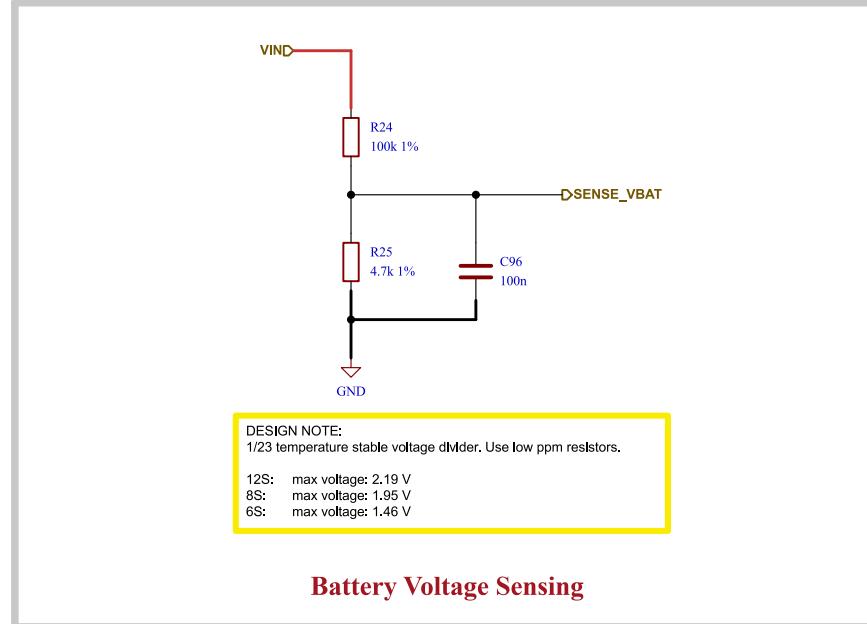
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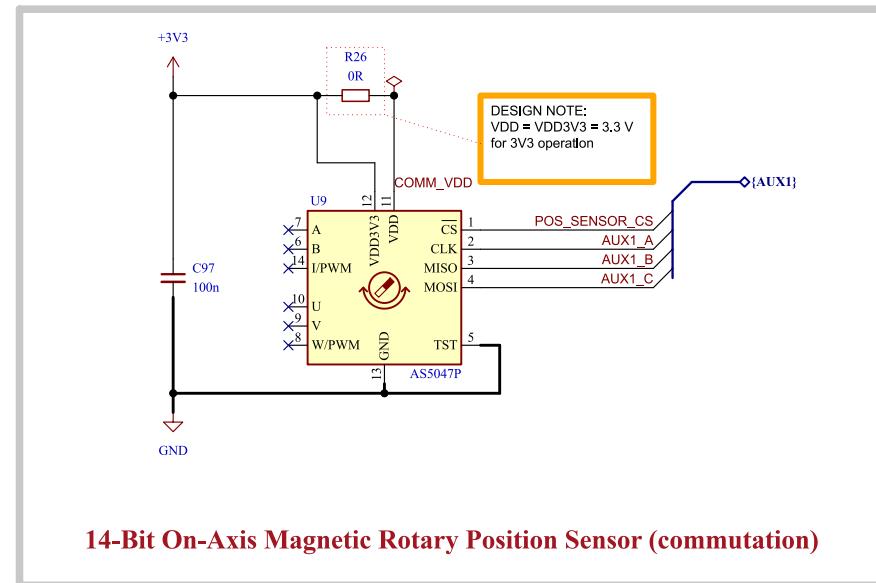
D



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	Sheet Path: /Project Architecture/Sensing - Battery/	Reviewer:	Date: 2023-10-14 Revision: 1.0

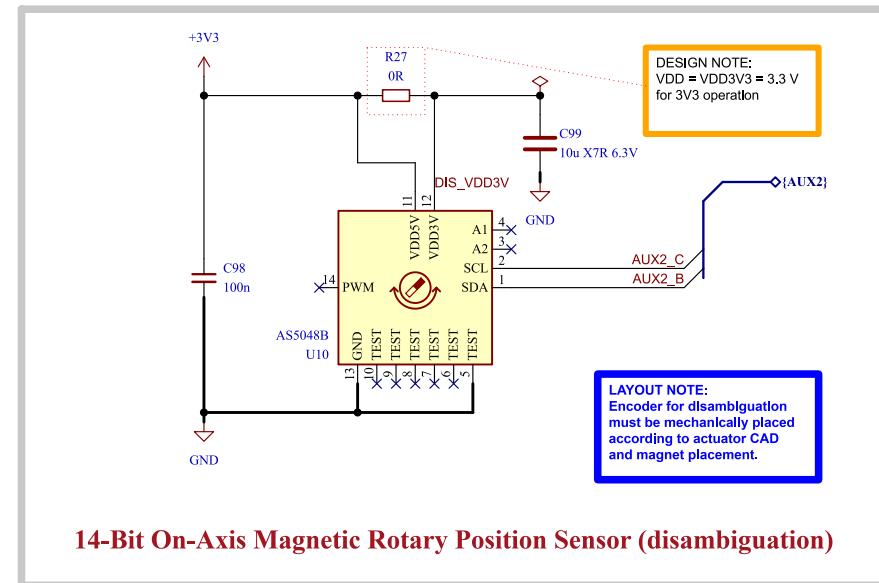
[14] Sensing - Position

A



14-Bit On-Axis Magnetic Rotary Position Sensor (commutation)

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.

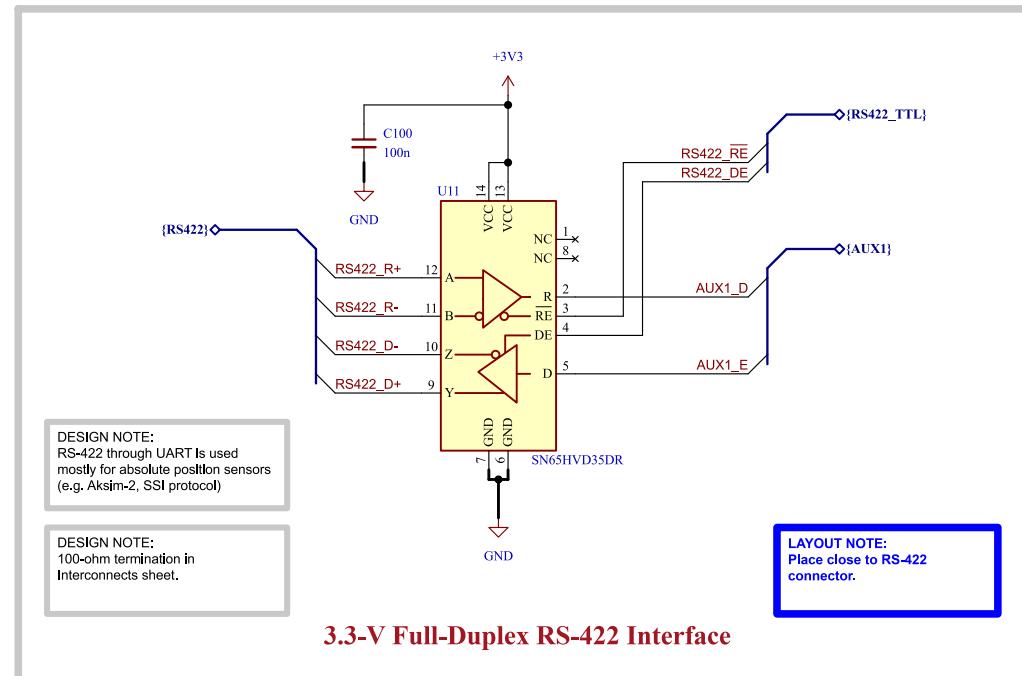


14-Bit On-Axis Magnetic Rotary Position Sensor (disambiguation)

DESIGN NOTE:
The encoder for disambiguation cannot be used to estimate backlash!

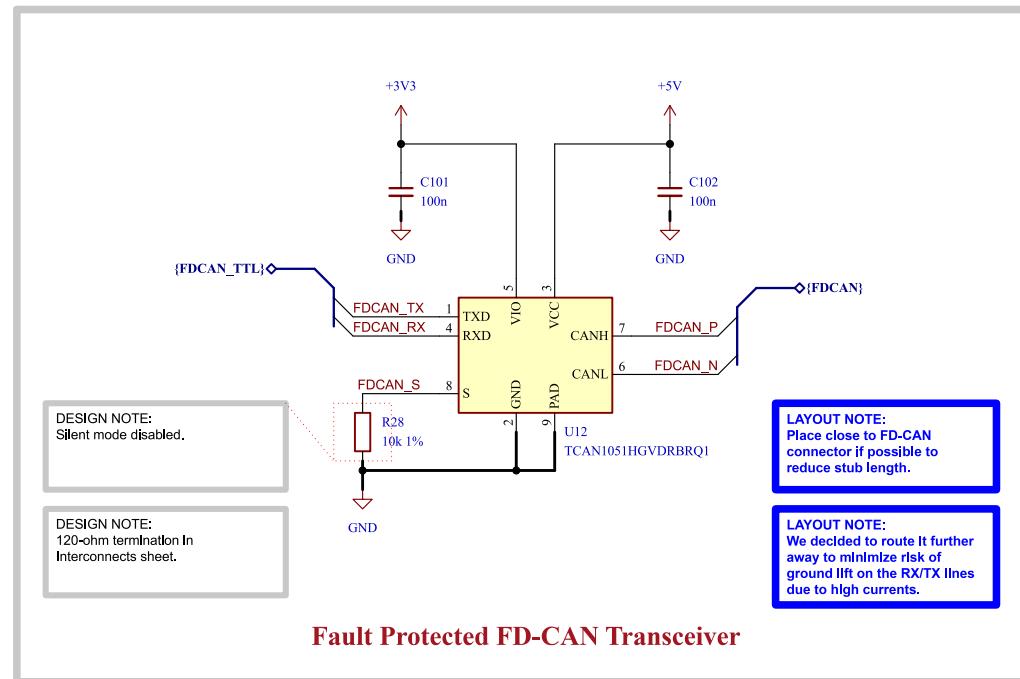
Comments:	Company: EPFL Xplore	Variant: Preliminary	
Project Name: Chienpanzée	Board Name: ??? Controller		
Sheet Title: Sensing - Position	File Name: PositionSensors.kicad_sch	Designer: Vincent Nguyen	Date: 2023-10-14
Sheet Path: /Project Architecture/Sensing - Position/	Reviewer:	Size: A4	Revision: 1.0

[15] Interface - RS-422



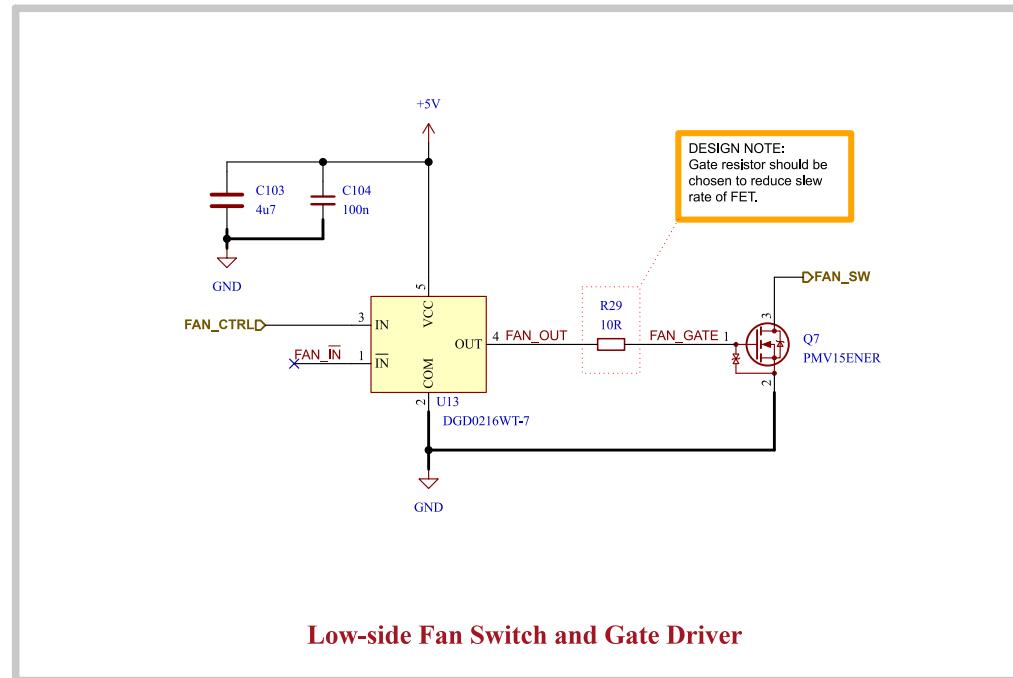
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	Project Name: Chienpanzée	Board Name: ??? Controller	
	Sheet Title: Interface - RS-422	File Name: RS422Interface.kicad_sch	Designer: Vincent Nguyen
	Sheet Path: /Project Architecture/Interface - RS-422/	Reviewer:	Date: 2023-10-15 Revision: 1.0

[16] Interface - FD-CAN



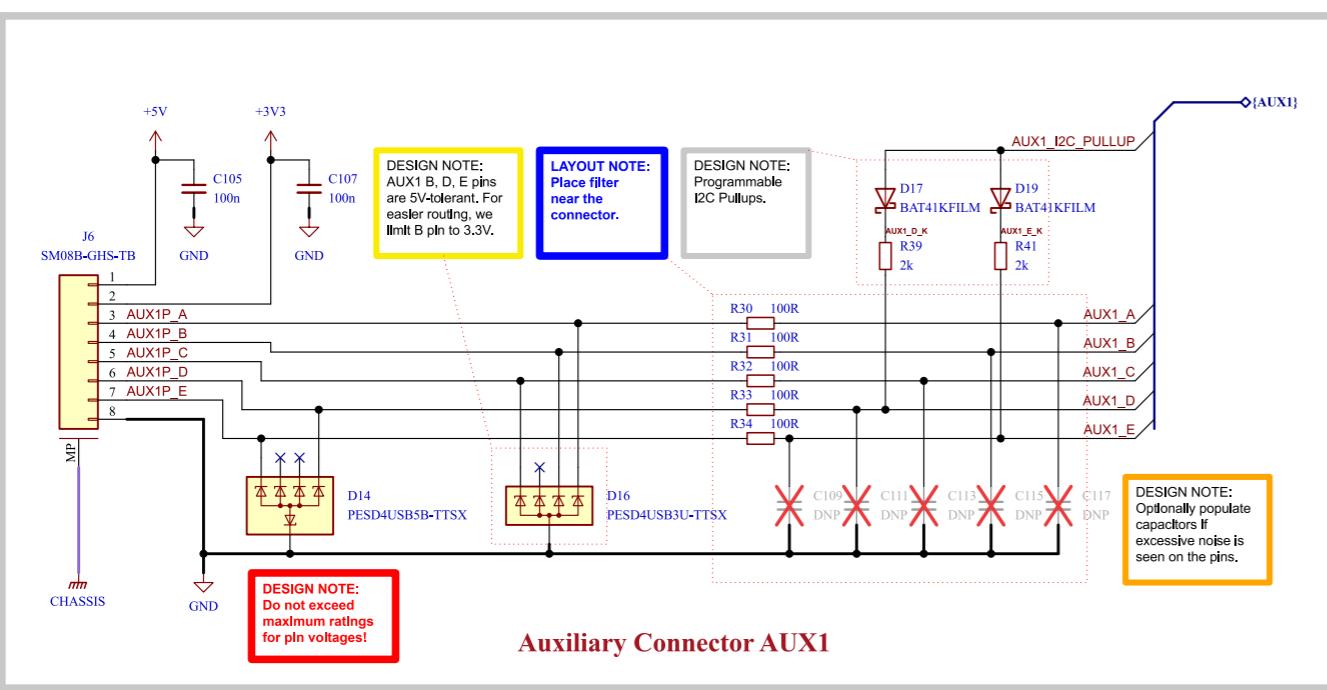
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	Project Name: Chienpanzée	Board Name: ??? Controller	
	Sheet Title: Interface - FD-CAN	File Name: FDCANTransceiver.kicad_sch	Designer: Vincent Nguyen
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[17] Interface - Fan Control

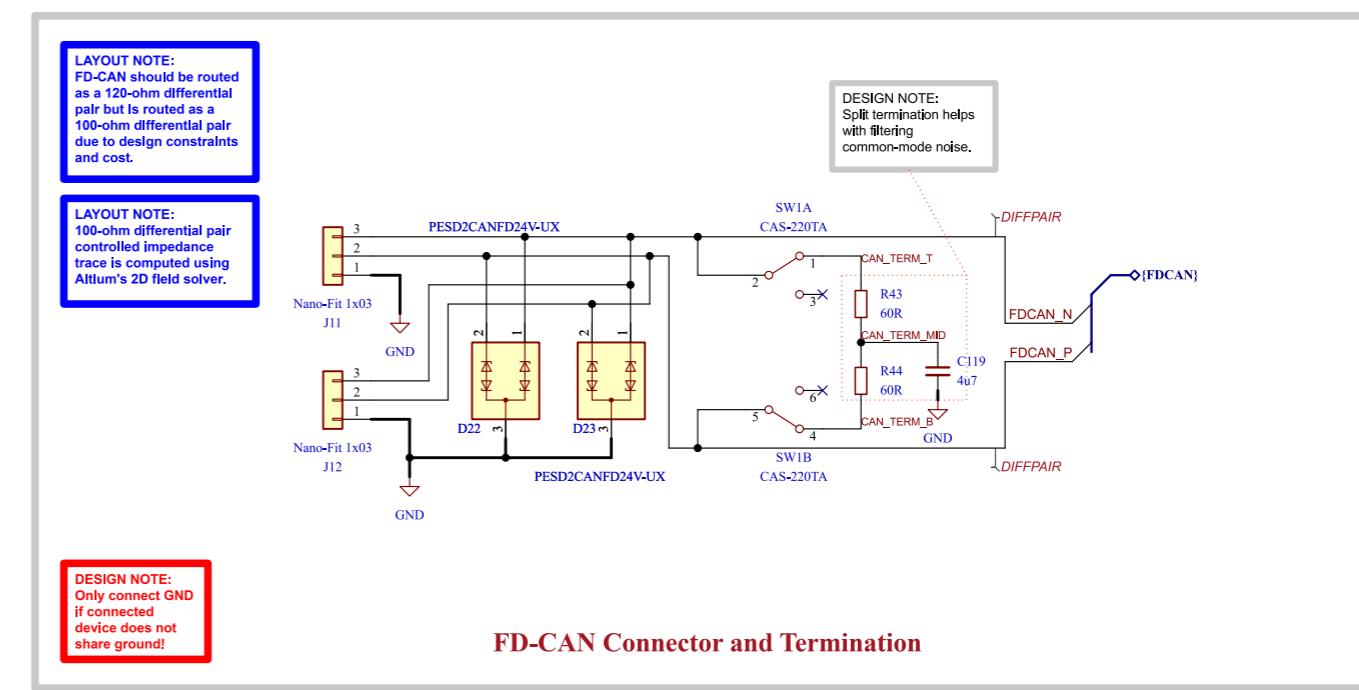


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	Project Name: Chienpanzée	Board Name: ??? Controller	
	Sheet Title: Interface - Fan Control	File Name: FanControl.kicad_sch	Designer: Vincent Nguyen
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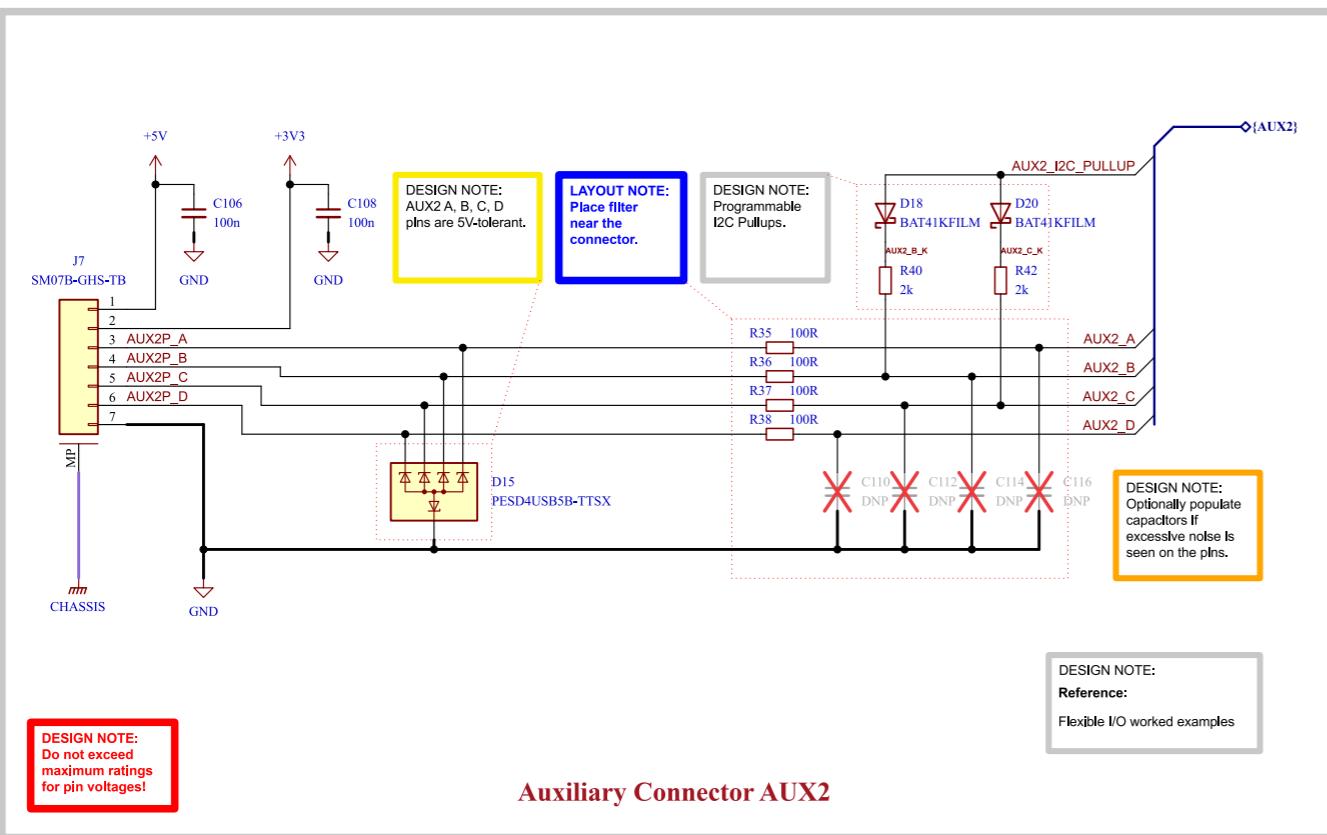
[18] Interface - Interconnects



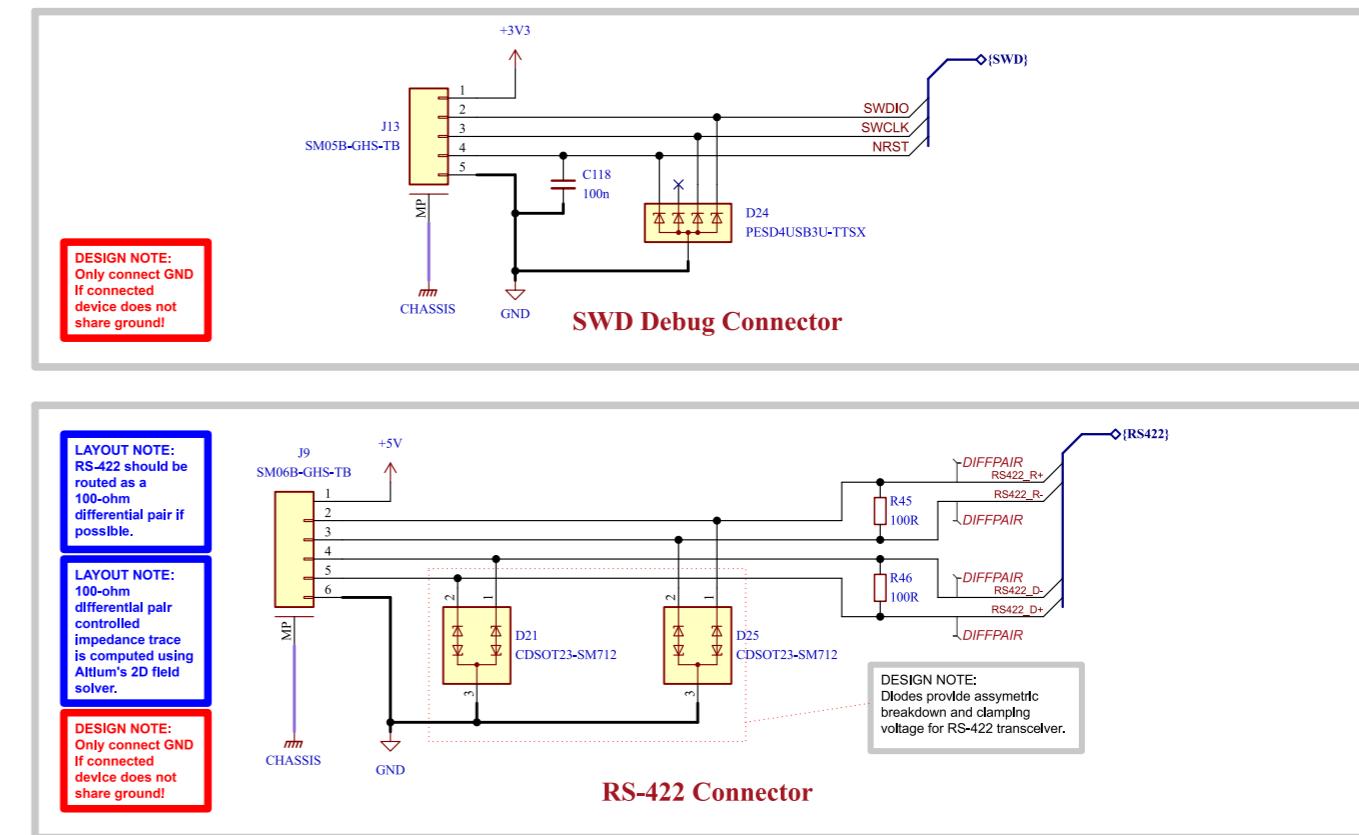
Auxiliary Connector AUX1



FD-CAN Connector and Termination



Auxiliary Connector AUX2

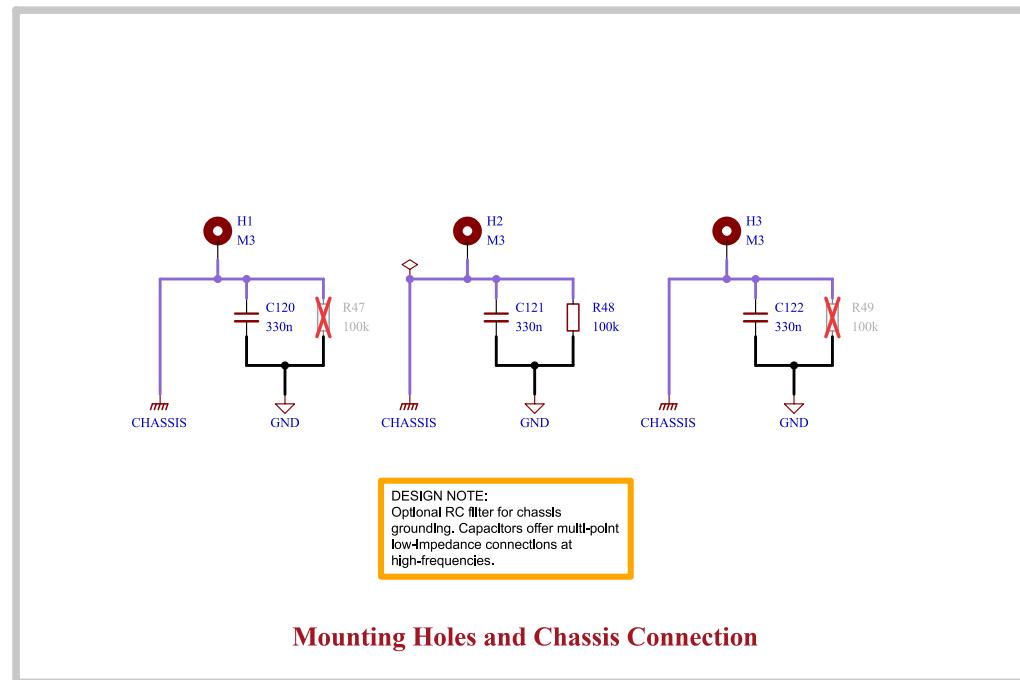


SWD Debug Connector

12V Fan Connector

Comments:	Company:	Variant:
	EPFL Xplore	Xplore Preliminary
Project Name:	Chienpanzée	Board Name:
Sheet Title:	File Name:	Date: Revision:
Interface - Interconnects	Interconnects.kicad_sch	Vincent Nguyen 2023-10-14 1.0
Sheet Path:	Reviewer:	Size: Sheet:
/Project Architecture/Interface - Interconnects/		A3 18 of 21

[19] Mechanical - Holes



	Comments:	Company: EPFL Xplore	Variant: Preliminary
	Project Name: Chienpanzée		Board Name: ??? Controller
	Sheet Title: Mechanical - Holes	File Name: Mechanical.kicad_sch	Designer: Vincent Nguyen
	Sheet Path: /Project Architecture/Mechanical - Holes	Reviewer:	Date: 2023-10-22 Revision: 1.0

[20] Power Sequencing

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D

	Comments:	Company: EPFL Xplore	Variant: Preliminary
	Project Name: Chienpanzée		
	Sheet Title: Power Sequencing	File Name: PowerSequencing.kicad_sch	Designer: Vincent Nguyen
	Sheet Path: /Power Sequencing/	Reviewer:	Date: 1.0
		Size: A4	Sheet: 20 of 21

[21] Revision History

A Rev 1.0

- Changed CPH-CPL capacitor to 47nF (gate driver)
- Changed FD-CAN transceiver IC
- Added TVS protection and termination switch to FD-CAN
- Added low-side switched 12V 600mA source for external fan
- Added LDO for analog supply
- Changed input power TVS diode to bidirectional and added one diode per connector
- Moved SOx low-pass filter to MCU section.
Should be placed near MCU to avoid noise coupling into ADC lines.
- Added second onboard I2C magnetic encoder for disambiguation.
- Switched PWM_PHASEA with PWM_PHASEC on STM32G474 pinout for easier routing.
- Changed RS422 pinout on connector
- Added ESD protection to all interfaces
- Added overvoltage protection on thermistor ADC inputs

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	Comments:	Company: EPFL Xplore 	Variant: Preliminary
	Project Name: Chienpanzée		
	Sheet Title: Revision History	File Name: RevisionHistory.kicad_sch	Designer: Vincent Nguyen Date: 2023-10-15 Revision: 1.0
	Sheet Path: /Revision History/	Reviewer:	Size: A4 Sheet: 21 of 21