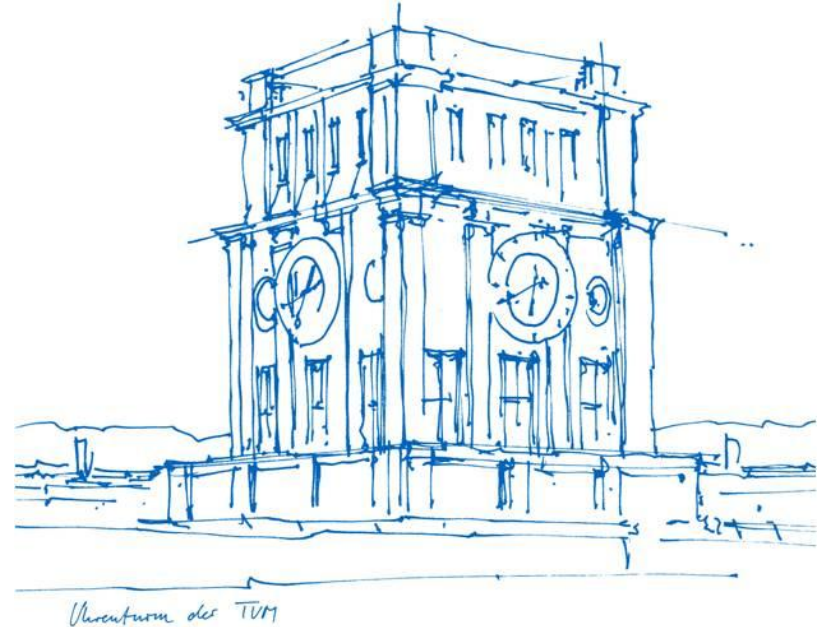


Interfacing a Two-Level Silicon Carbide Inverter to a Rapid Control Prototyping Platform

Seongmin Park

Supervisor: Eyke Aufderheide

Munich, 17th of July 2025



1. Recap

2. PCB Design

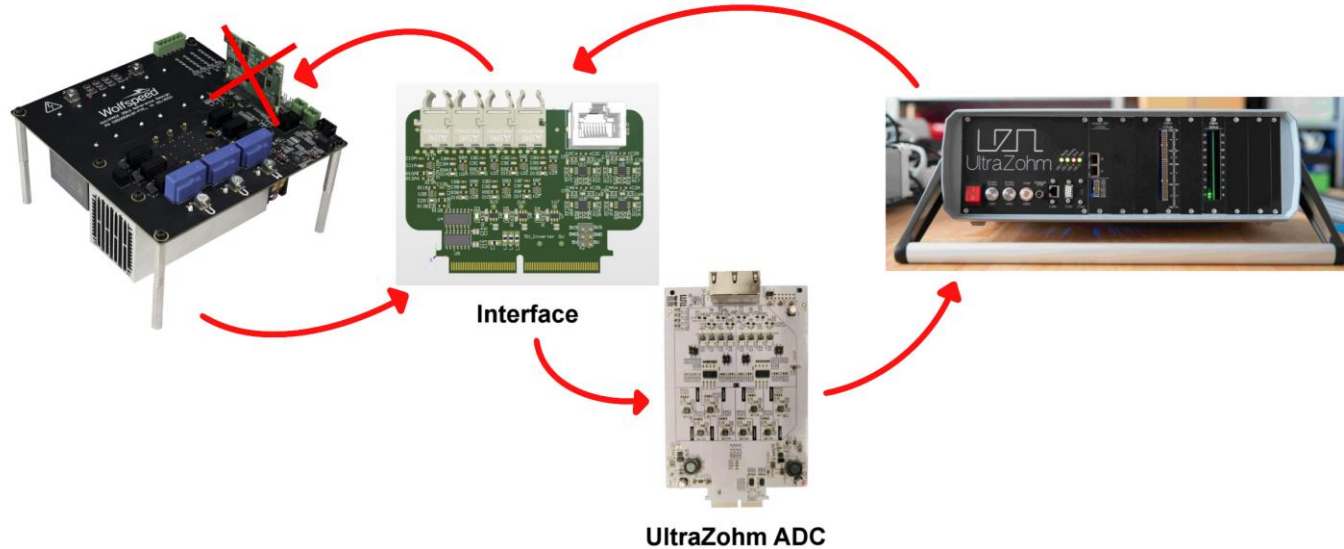
3. Testing

4. Conclusion

Recap

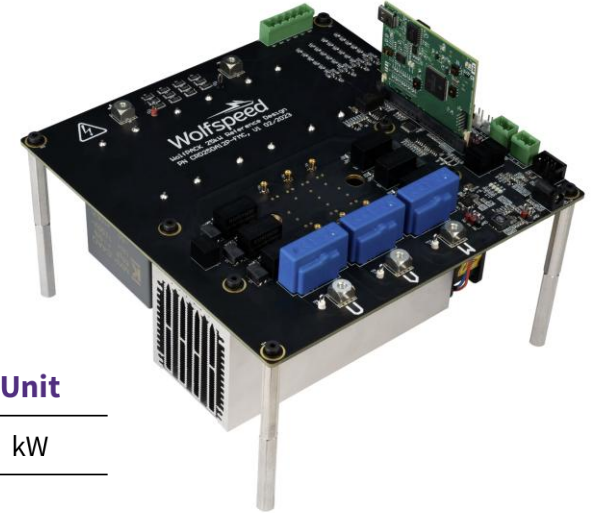
Goal

- PCB Interface connecting Wolfspeed Inverter to UltraZohm



Recap

Wolfspeed 25kW Three-Phase Inverter



Symbol	Parameter	Min.	Typ.	Max.	Unit
P_{OUT}	Output Power	—	—	25	kW
V_{DC}	DC Bus Voltage	—	800	1000	V
V_{AUX}	Low-Power Auxiliary Voltage	10.8	12	13.2	
I_{AUX}	Low-Power Auxiliary Current	—	—	5	A
I_{OUT}	Output Phase Current	—	—	30	A_{RMS}
f_s	Switching Frequency ¹	—	20	100	kHz
$R_{th,ja}$	Thermal Resistance, Junction-to-Ambient ¹		1.571		°C/W

Recap

Motivation Wolfspeed

- Trend towards complex control methods
- TI Controller Limitations

Motivation UltraZohm

- Off the shelf Inverter
- Multiple Power Levels
 - 20kW, 200kW, 300kW
- Outlook for 3-Level Inverter

Outline



1. Recap

2. PCB Design

3. Testing

4. Conclusion

PCB Design

Signal Overview



Digital Optical

**6x Gate Signals
Gate Driver Disable**



Overcurrent Detection



Temperature



Analog

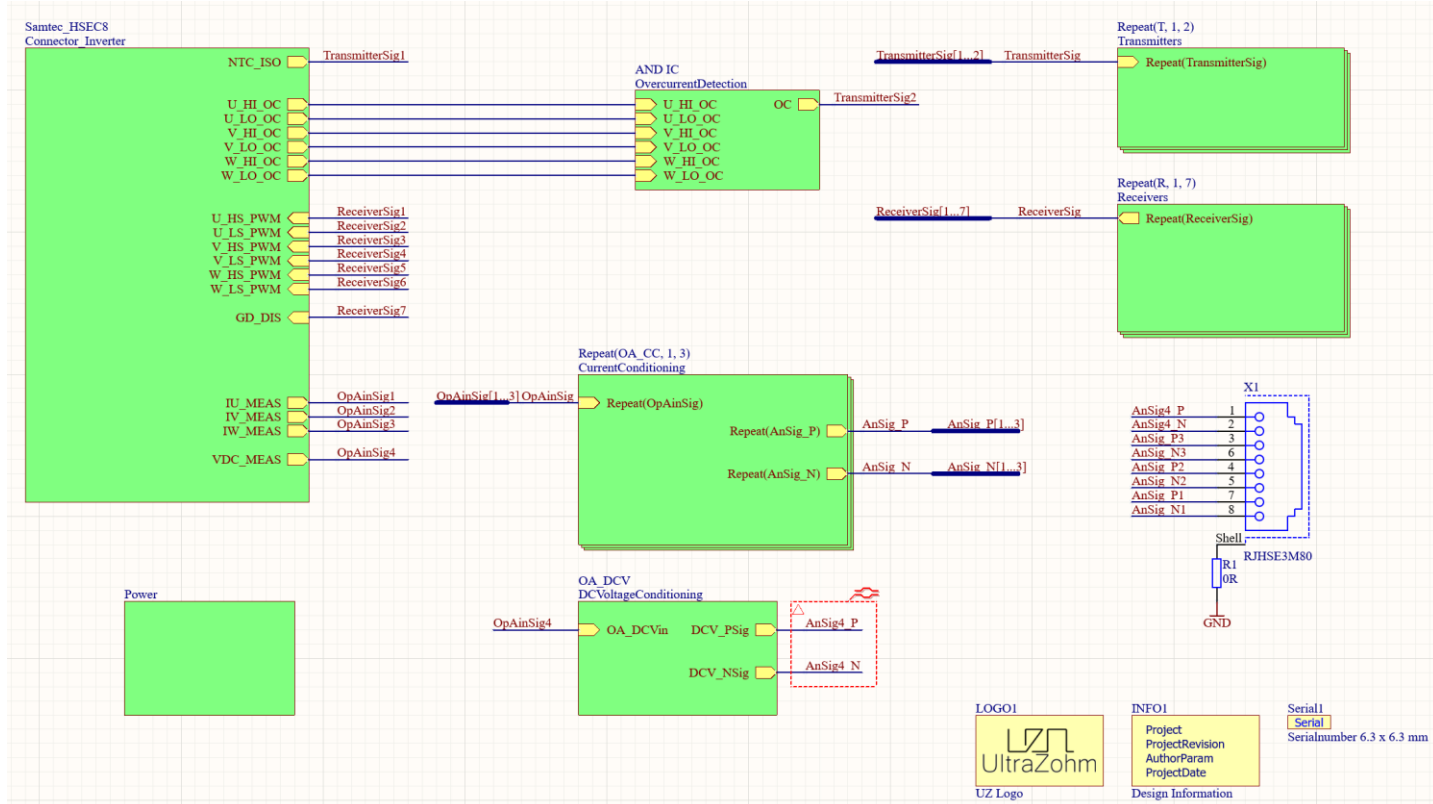


**3x Current Sensing
DC Voltage Sensing**



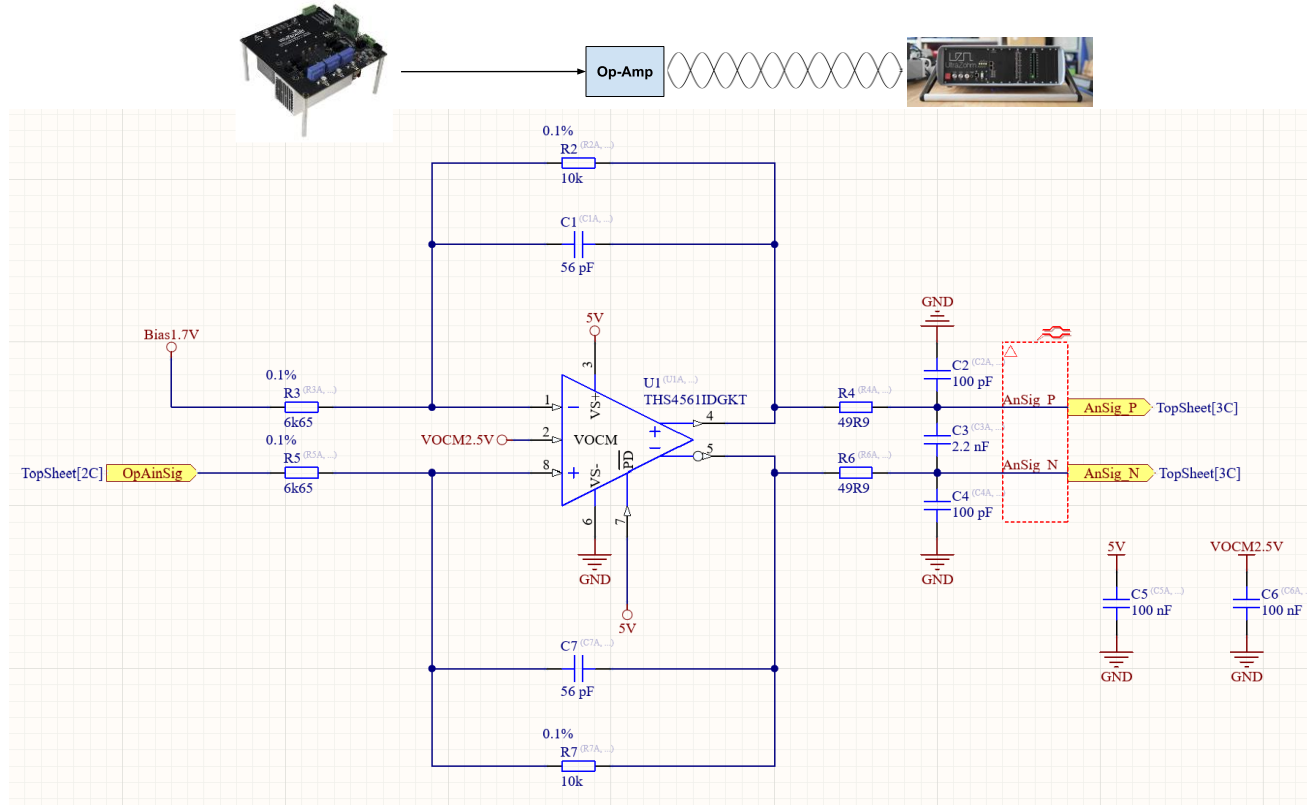
PCB Design

Altium – Schematic Design



PCB Design

Altium – Schematic Design



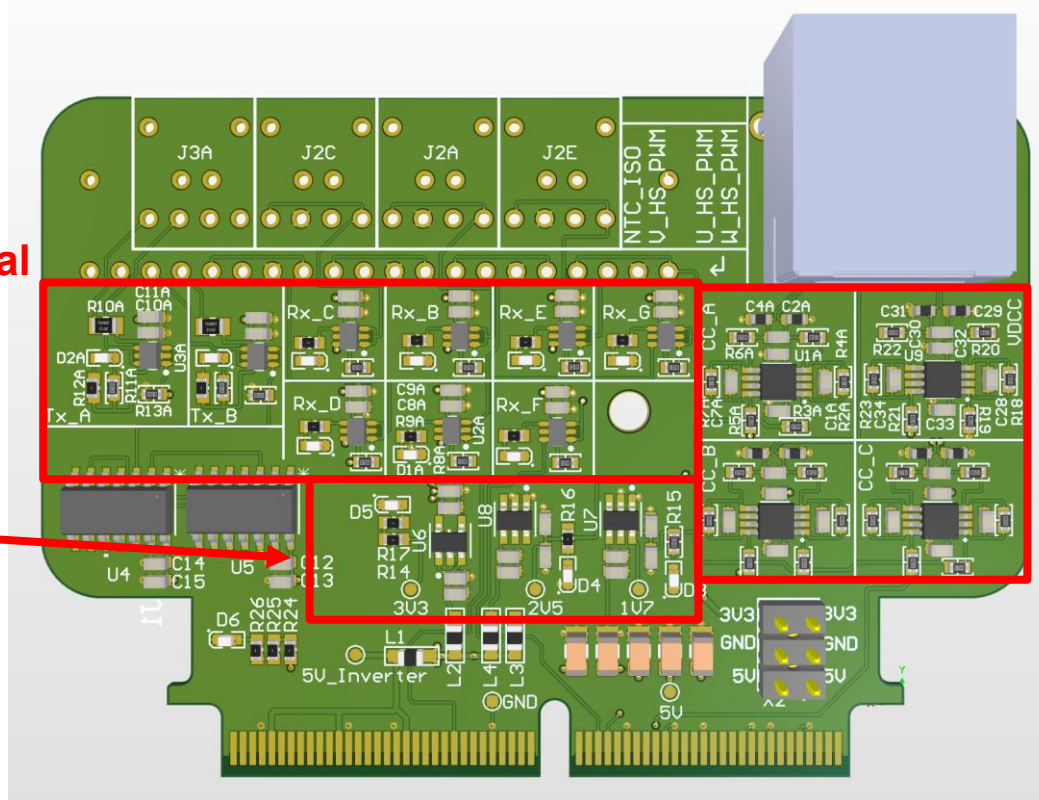
PCB Design

Component Layout

Digital Optical
Signals

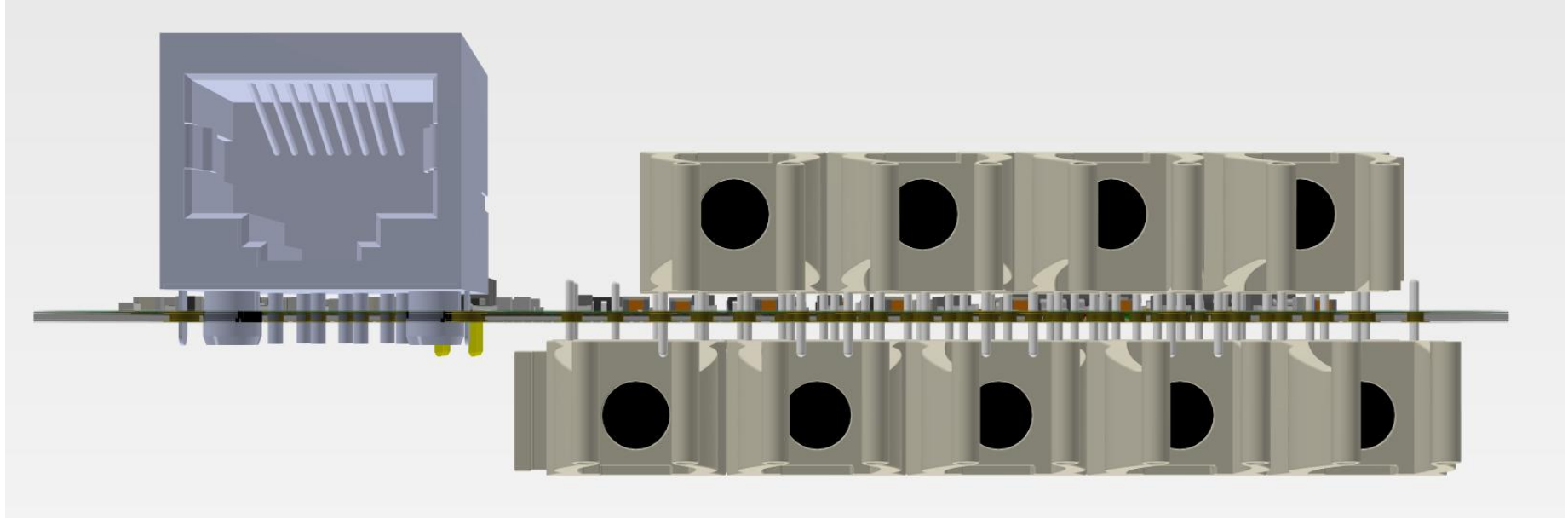
Power

Analog Signals



PCB Design

Altium – Component Layout



Seongmin Park | 16.07.2025

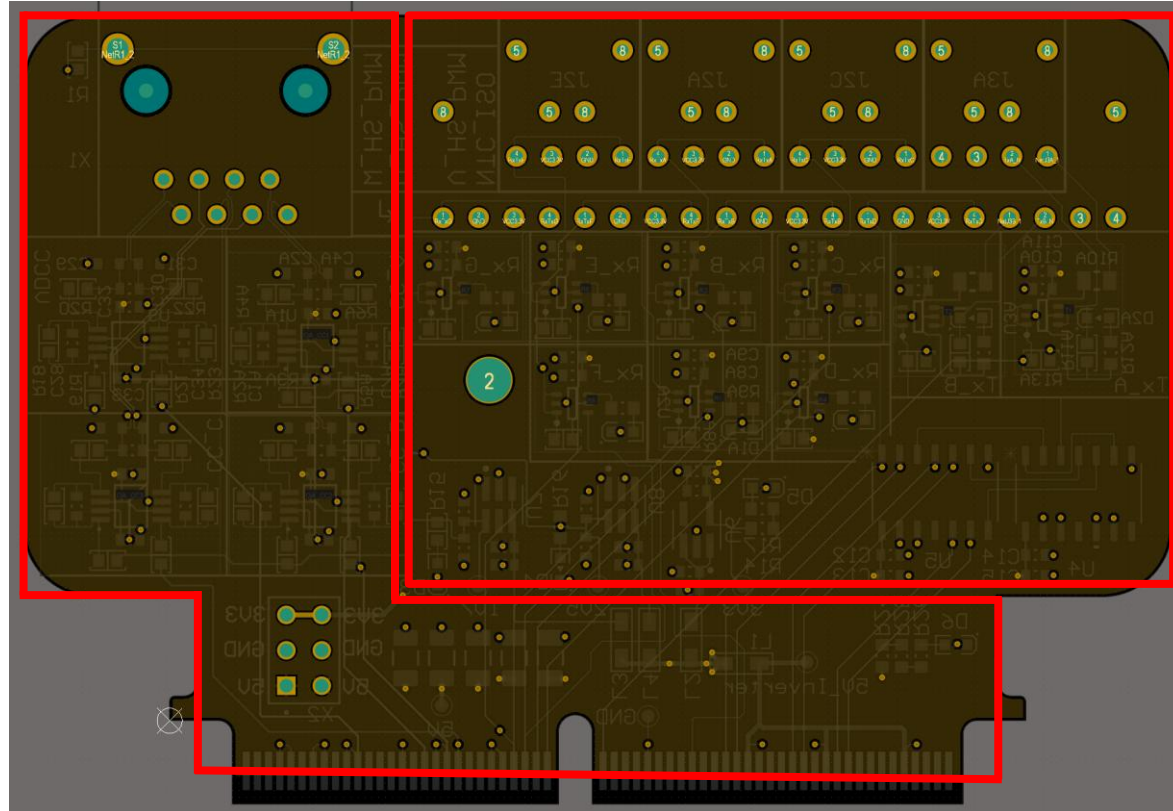


PCB Design

Polygon Layers

**5V Supply
Polygon**

**3.3V Supply
Polygon**



Outline



1. Recap

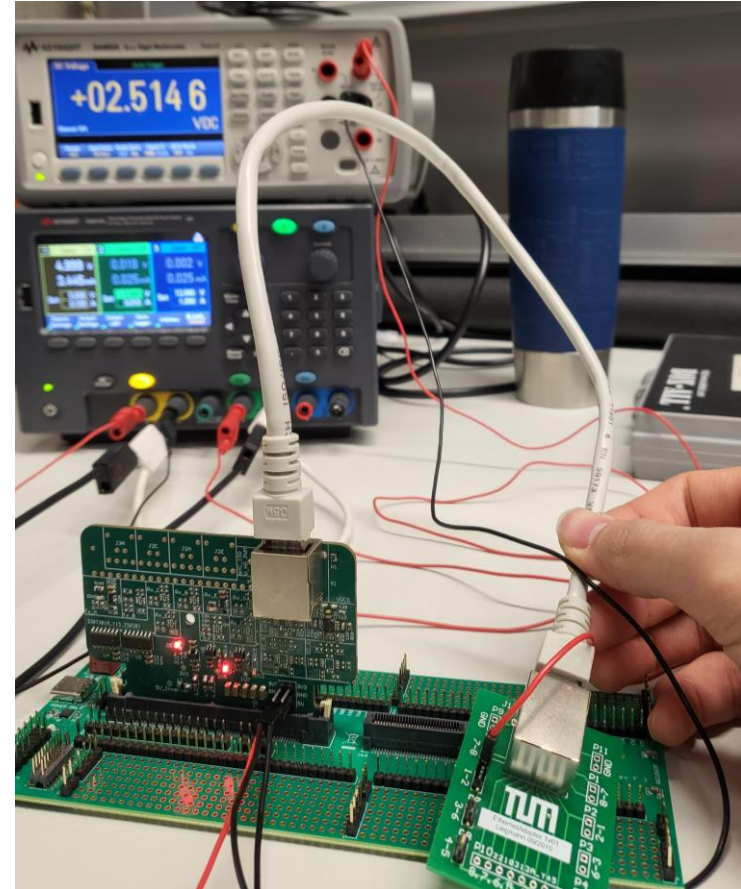
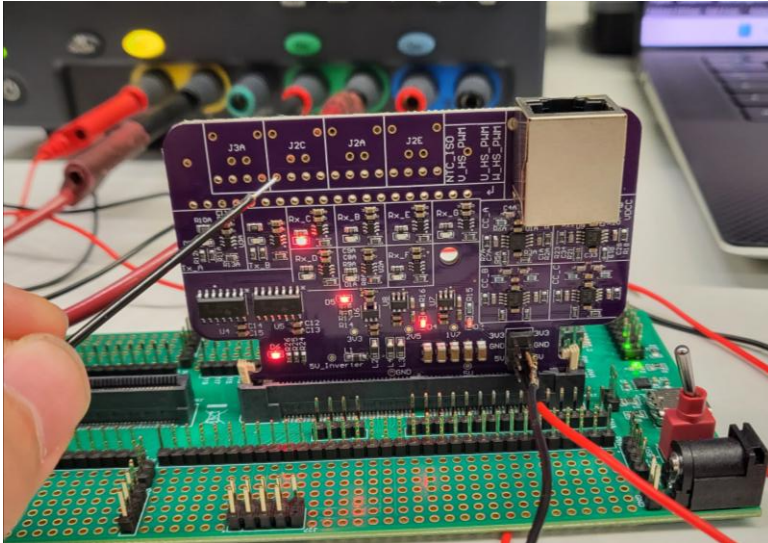
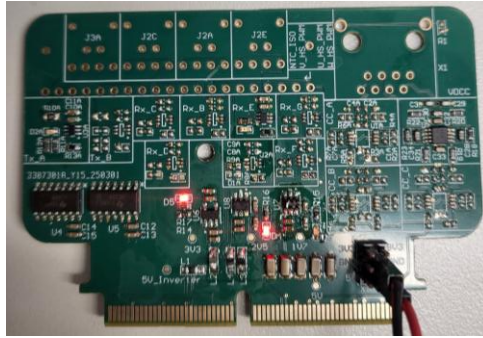
2. PCB Design

3. Testing

4. Conclusion

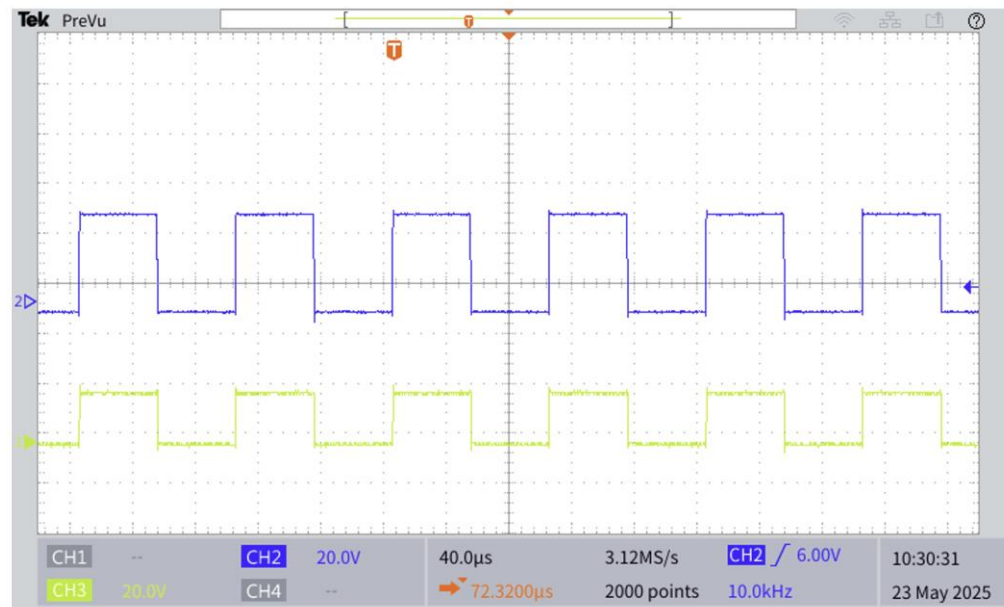
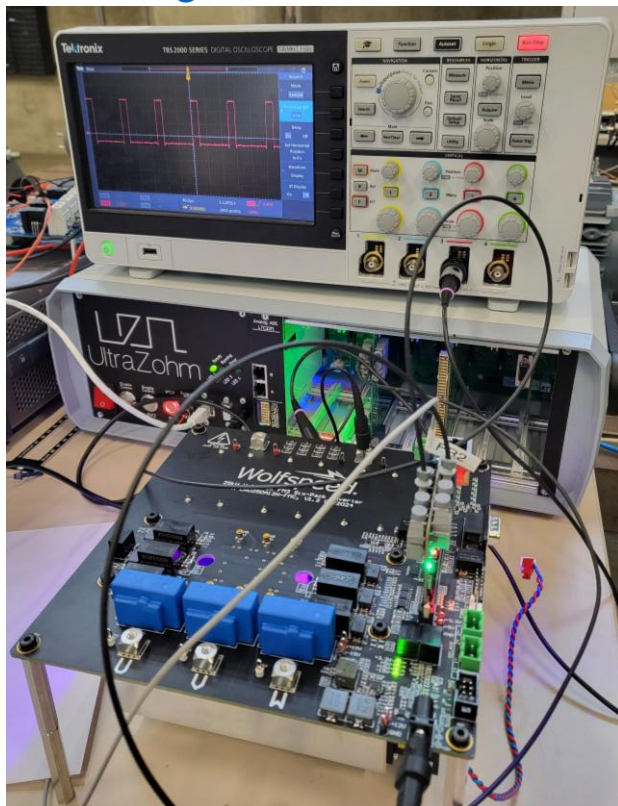
Testing

Board Bring Up



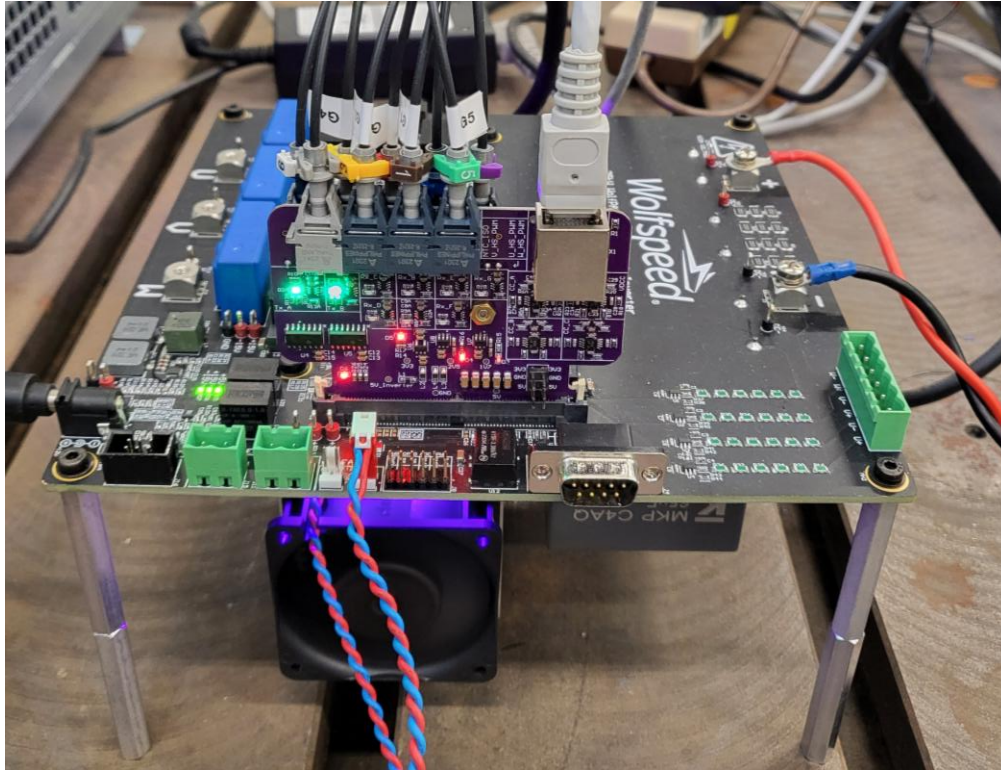
Testing

Digital Gate Signals



Testing

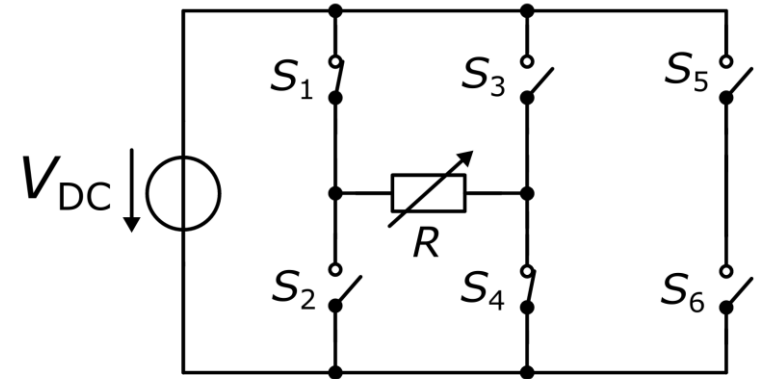
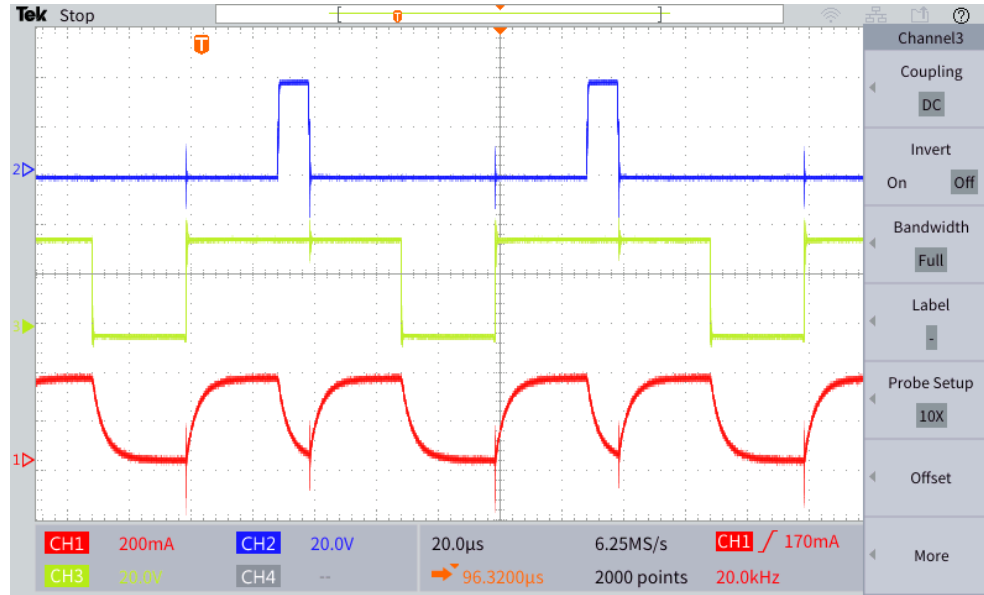
DC-Link & DC Voltage Sensing - Analog Sensing Signals



- DC Link Connected
- Measurement of Voltage Sensing Signals
- Testing Gate Driver Disable Signal

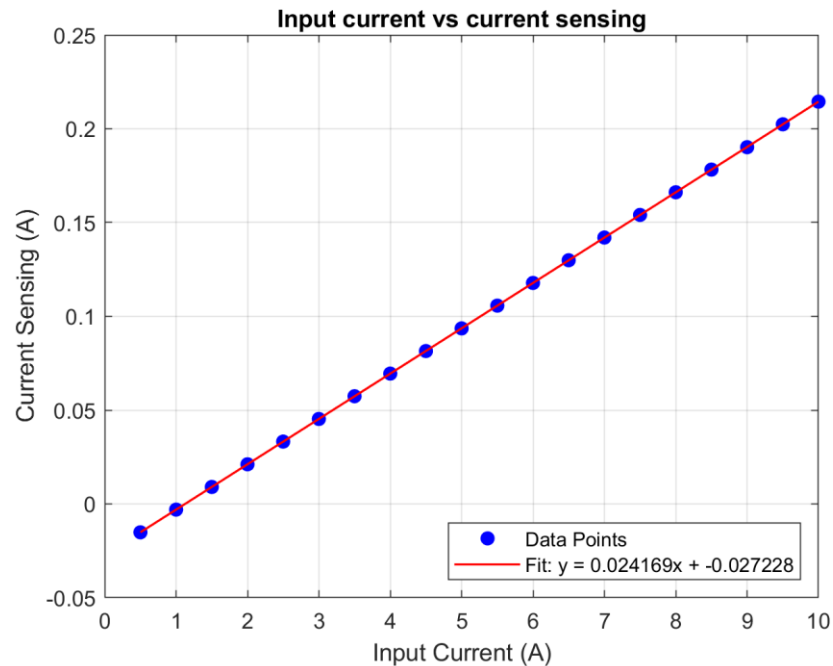
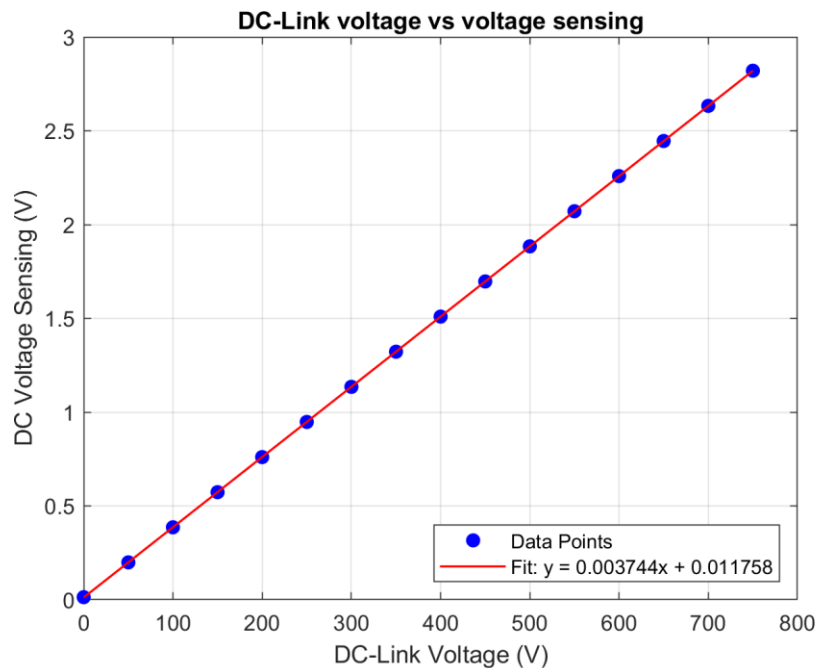
Testing

Connected as a Full Bridge – Analog Sensing Signals



Testing

Calibration

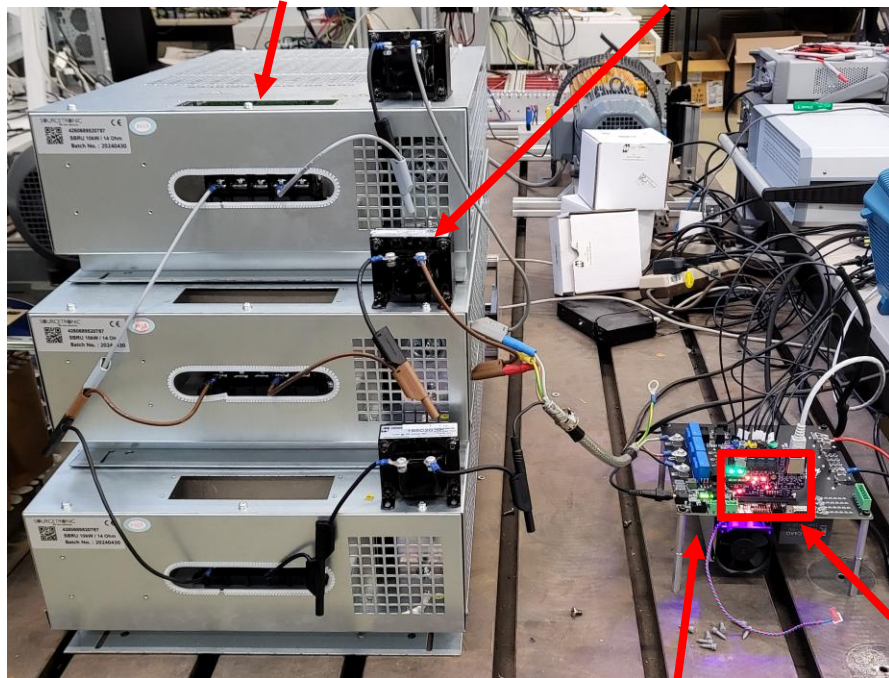


Testing

3-Phase

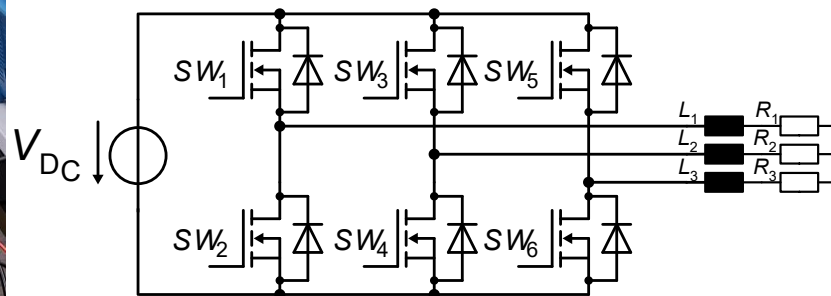
Break Resistor

Inductor



140hm Resistors, 1mH Inductors

Wolfspeed
Inverter



Interface
Board

Testing

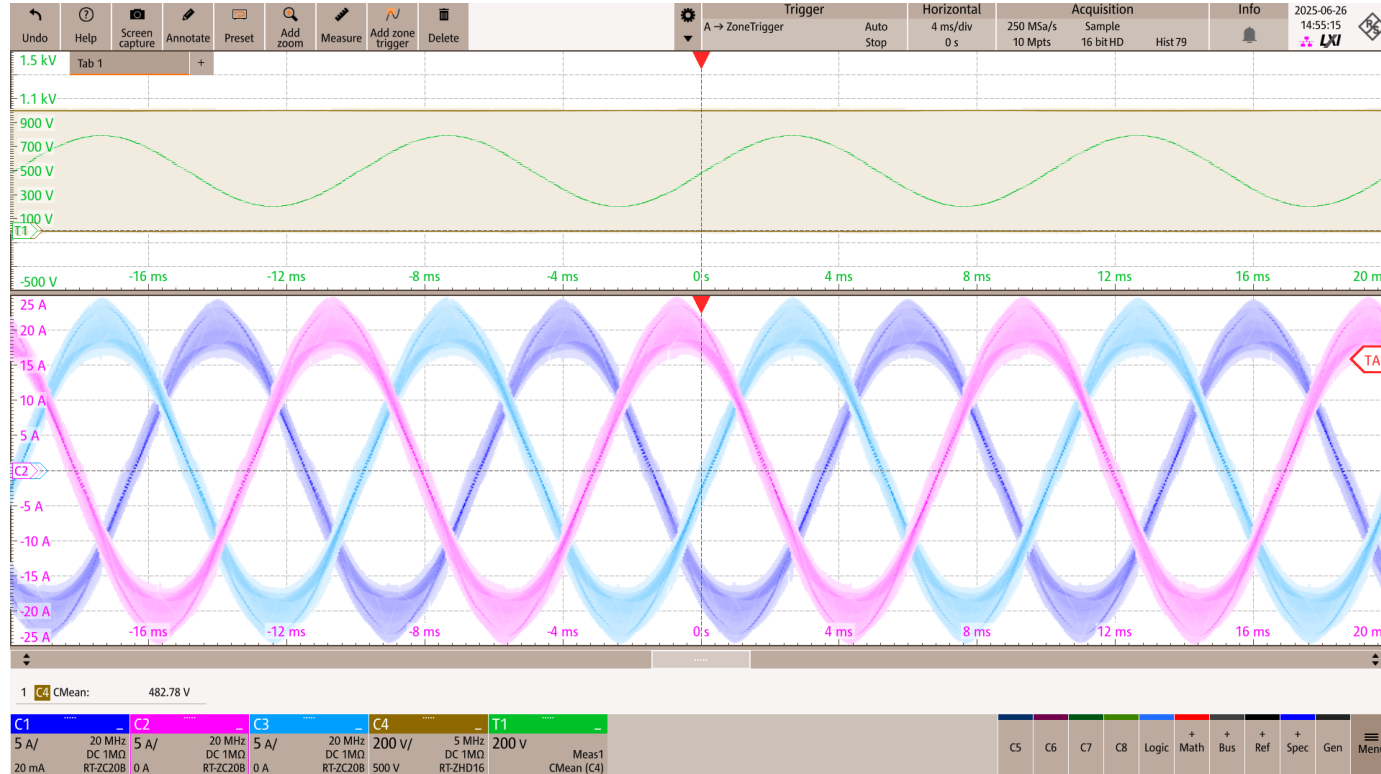
3-Phase Output Current



25kHz switching frequency
200V DC-Link
50Hz
8A Peak
0.45 Modulation Index

Testing

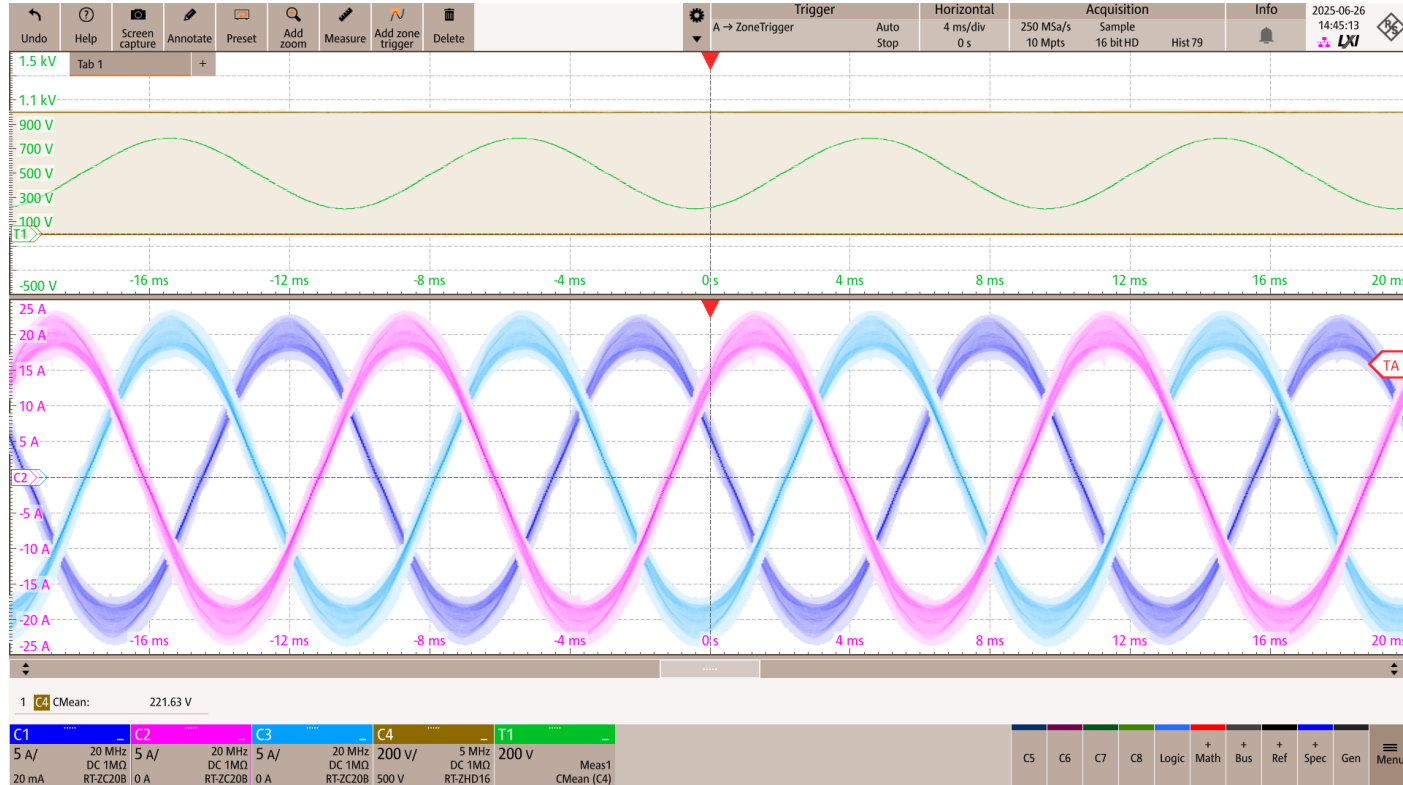
3-Phase Output Current



25kHz switching frequency
999V / 9.61A DC-link input

Testing

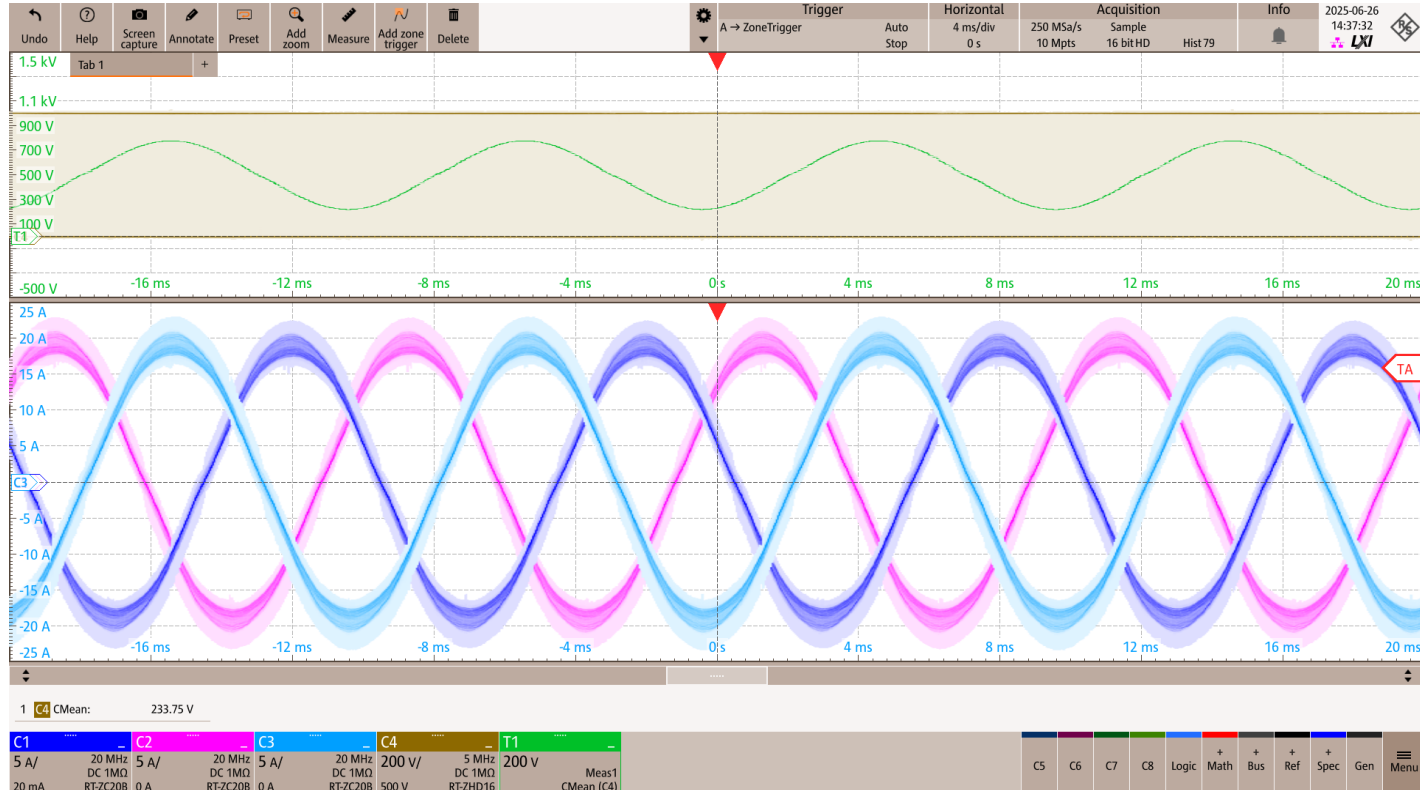
3-Phase Output Current



50kHz switching frequency
999V / 9.12A DC-link input

Testing

3-Phase Output Current



100kHz switching frequency
999V / 8.33A DC-link input

Outline



1. Recap

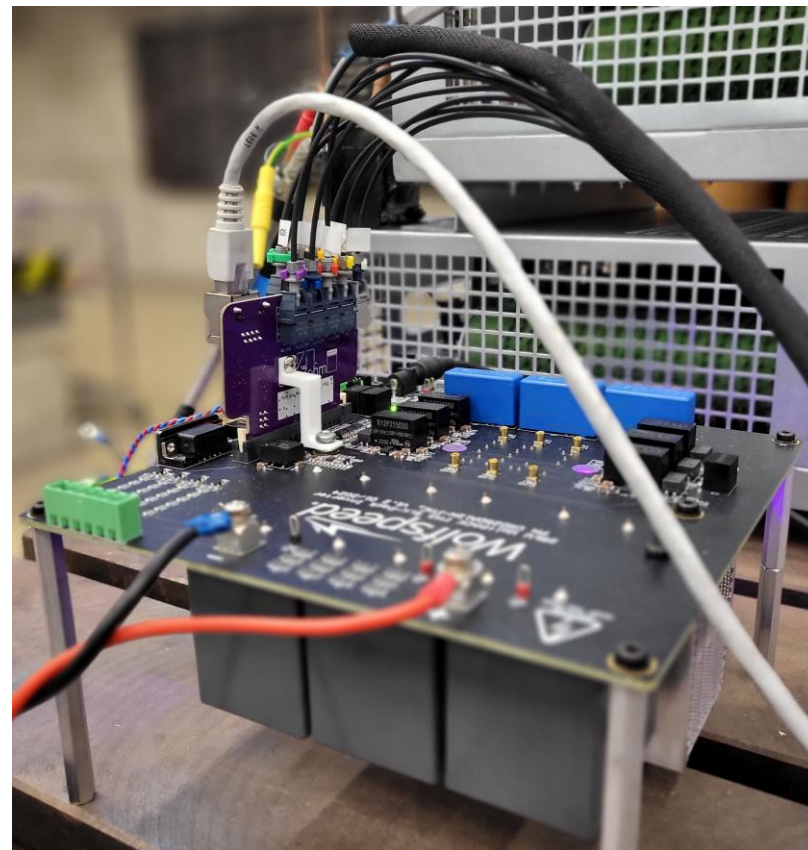
2. PCB Design

3. Testing

4. Conclusion

Conclusion

- Board Works! 🥳🥳🥳



Thank you!

Seongmin Park

Supervisor: Eyke Aufderheide

Munich, 16th of July 2025

