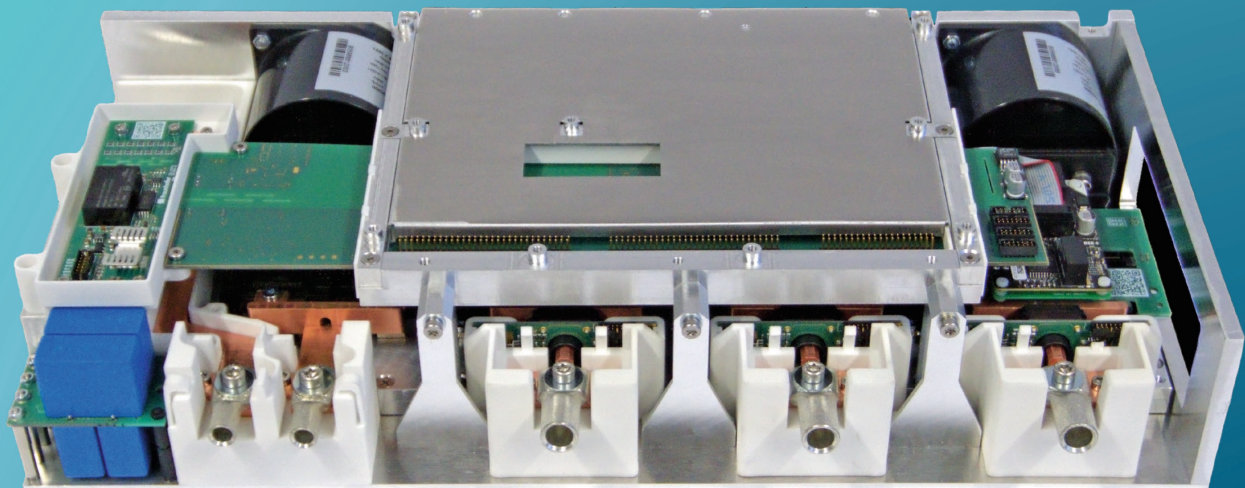
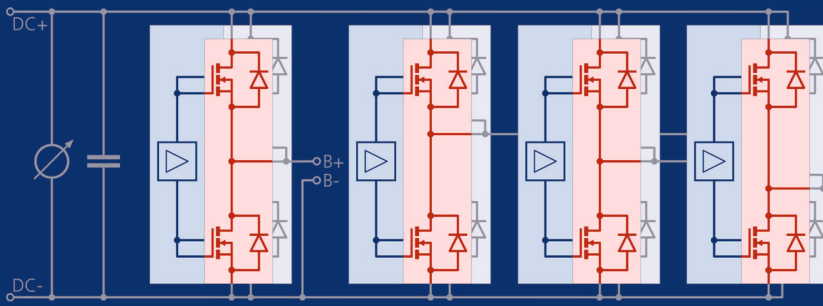


450 kW Railway Traction Inverter

with 50 % Weight and 30 % Loss Reduction





Symbolic schematic of the inverter topology



Inside view of the inverter

Motivation

- New railway drivetrains for higher efficiency and lower weight
- Reduction of drivetrain losses with novel SiC power semiconductors
- Increased motor speed for lower overall volume and weight
- Higher power density due to lower weight

Technical data

Topology	Full-SiC-B6 inverter with brake chopper
Input voltage range	690 – 950 V _{DC}
Maximum power	450 kW
Switching frequency	20 kHz
Phase current	450 A _{RMS}
Dimensions	520 x 250 x 116 mm ³ (L x W x H)
Volume	15.1 L
Weight	13.75 kg

Fraunhofer Institute for Integrated Systems and Device Technology IISB

Schottkystrasse 10
91058 Erlangen, Germany

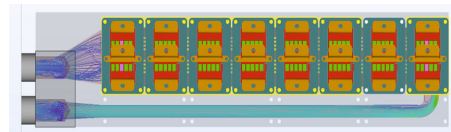
Contact

Simon Quergfelder
Medium Voltage Electronics
Tel.: +49 9131 761-653
simon.quergfelder@iisb.fraunhofer.de

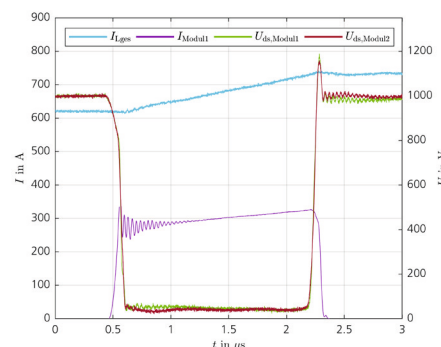
www.iisb.fraunhofer.de

Key advantages

- Weight reduction by 50 % compared to state of the art inverters
- Driving cycle loss reduction by 30 % compared to state of the art semiconductors
- Optimized heatsink design with FEM simulation:

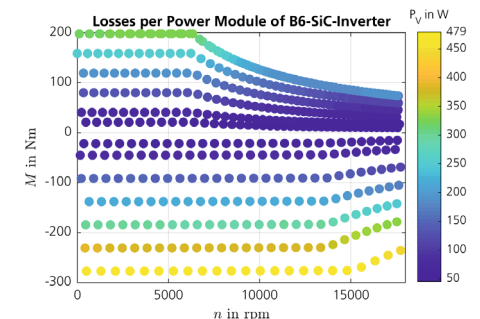


- Integrated voltage and current sensors
- 450 kW maximum output power for driving and braking
- 1200 V SiC MOSFET modules with high industrial market penetration and lower costs
- Parallel operation of standard 1200 V SiC modules for higher output power
- Automated control software and prototype evaluation with hardware in the loop setups
- Emergency breaking: Clean switching even at 1000 V_{DC} link voltage and 740 A current due to low inductance busbar design:



Our technical toolchain

- Modeling and simulation of the whole drivetrain
- Topology and technology studies including control and modulation



- Machine modeling & construction
- Thermal design based on FEM simulation
- Commissioning with model based control software development
- Automated prototype evaluation with hardware in the loop setups
- Commissioning with active and passive loads as well as motor test benches

Our knowledge for your benefit

- Broad experiences in power electronics development from PCB to full systems
- In-house hard- and software design as well as motor design
- 500 m² power electronic labs and test benches
- Battery and hydrogen test benches
- Close cooperation with FAU Erlangen-Nuremberg and LZE Bayern
- Megawatt motor test bench to be installed in 2023