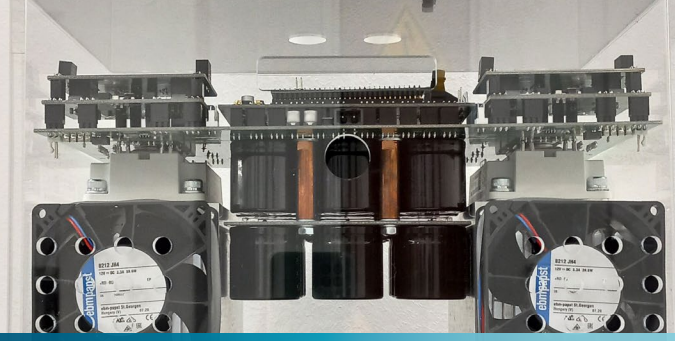
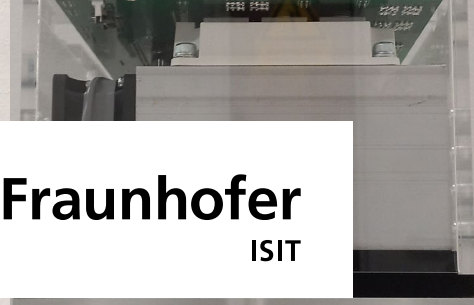
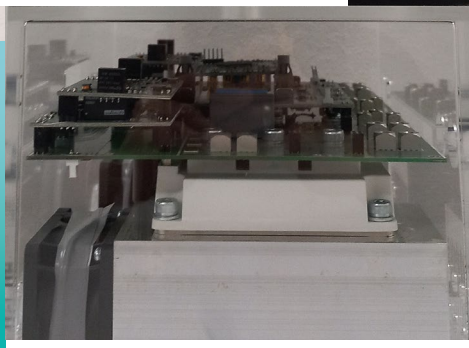




Fraunhofer ISIT

Modular Multilevel Converter for Hybrid Grids

Grid forming converter / Fault ride-through / Flexible power range



3 MMC cells stacked with acrylic cover

Highly efficient converters are widely used where energy transition translate into electrification of our society. Modular multilevel converter (MMC) depicting higher efficiency, improved power quality, inherent fault-tolerance, and enhanced density are replacing legacy 2-level inverters.

Fraunhofer ISIT is developing a wide range of expertise and facilities including a 10 kV – 500 kVA MMC with 5-10 full-bridge modules per arms, based on 1.7 kV IGBTs. Together with our customer in our medium-voltage laboratory equipped for test up to 10 kV – 1.6 kA, with state-of-the-art test equipment and auxiliary converters (e.g., 500 kVA 3Ph NPC) and battery emulation capability we are designing solutions including MV-power converters for grid forming and storage management systems.

Key attribute & requirements

Offshore Wind Farms

- High power transfer capability
- Low power losses for high distances
- Independent control of active and reactive power

Power Quality

- Fast dynamic for voltage regulation
- Lower harmonic distortion
- High efficiency for hot-standby solutions

Fast Charging stations

- High controllability
- High power density with less power processing stages
- Integration of energy storage units

Out Test facility

- Up to 1MW circulating power
- Power-Hardware-in-the-Loop- Simulation
- Up to 1600 A
- Battery emulation

Examples of projects realized with high efficient multilevel converter

Technical specifications	**Point to Point connection**	**MVDC Systems multiterminal DC**	**STATCOM**	**High Power – Adjustable** (Electric Motor Drive)
Voltage range DC	200 – 525 kV	160 – 200 kV	-	-
Voltage range AC	< 230 kV	< 110 kV	10 – 220 kV	< 10 kV
Power range	400 – 1000 MW	50 – 400 MW	± 300 MVAr	6 – 14 MVA
DC length	10 – 500 km	10 – 150 km	-	-
Number of cells per MMC arm	200 – 400	200 – 400	15 – 200	5 – 20
Expected lifetime	20 – 30 years	20 – 30 years	10 – 20 years	5 – 20 years

Benchmark for a 500 MW HVDC system

Cost positions	**2-Level-based VSC-HVDC**	**MMC-based VSC-HVDC**	**Comparison vs. standard**
Converter building footprint (Area)	38m x 35m (1 330m²)	70m x 45m (2 730m²)	+105%
Converter building volume	25 000m³	29 500m³	+18%
Converter building height	24m	15m	-38%
Overall HVDC site footprint (Area)	180m x 115m (20 700m²)	165m x 95m (15 675m²)	-24%
Efficiency	~ 98.3%	> 99%	-40% loss

Fraunhofer ISIT

Highly Efficient and Reliable Electronic Energy Systems

Applied research from device- to network-level power electronics made in Northern Germany

What we can do for you @Fraunhofer ISIT

Active reliability

- Sensor integration
- Lifetime analysis
- Reliability-driven control
- Multichip power modules

Hybrid grids

- Medium Voltage DC applications
- New components
- Grid forming converter

Battery integration

- Charging stations
- Grid support
- Bidirectional power transfer

Fraunhofer Institute for Silicon Technology ISIT

Fraunhoferstr. 1
25524 Itzehoe, Germany

ISIT@CAU
Kaiserstr. 4
24143 Kiel, Germany

Head of the Electronic Energy Systems
Prof. Dr.-Ing. Marco Liserre
marco.liserre@isit.fraunhofer.de
www.isit.fraunhofer.de/ees

Headquarter of the Fraunhofer ISIT