

Press Release

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Leveling up the electronics for e-mobility

European project develops next generation of on-board chargers

Electric cars should be better for the environment, powerful, but also affordable. However, the chargers built into them are hindering progress, as current models are reaching their limits in terms of efficiency, size, and reliability. The EU-funded HiPower 5.0 project aims to revolutionize this technology, with Fraunhofer IZM making an essential contribution.

Mobility is key if the European Union wants to reach its own climate goals: Traffic accounts for 28% of the climate emissions in the EU, with a full 80% due to road traffic. Electric vehicles could be a game changer.

The on-board chargers or OBCs built into electric vehicles convert the electricity from the grid into energy suitable for the batteries. As chargers become more powerful, their efficiency, heat management, and size become increasingly challenging. Conventional silicon-based technology leaves only little room for further optimization. Energy losses mean more heat, which in turn means more need for cooling. More cooling requires larger systems, meaning the most powerful OBCs are not suitable for all vehicle sizes.

Simpler systems with fewer components promise greater efficiency, lower costs, and wider market acceptance. This is why the HiPower 5.0 consortium has dedicated its work on the automotive use case, overseen by the Fraunhofer Institute for Reliability and Microintegration IZM, to producing a powerful 22 kW OBC with a total size of only four liters - far smaller than the current market average of twelve liters.

Novel semiconductor allows for a more compact design

The innovation revolves around novel gallium nitride (GaN) semiconductors provided by Infineon. These monolithically integrated, bidirectional GaN switches enable more efficient conversion in a smaller package since they are designed to control the flow of electricity in both directions. Thus, a single component does the work of what were originally two separate semiconductors, paving the way for new technological opportunities. Circuit designs now become possible that would have required costly compromises with more conventional components.

However, the material alone is not the only critical factor, but also the way in which all the components in the vehicle work together. This is where the many years of experience with packaging and system development at Fraunhofer IZM come into play: The components are

not optimized individually. Rather, design decisions are always governed by the system as a whole: Several electronic components are embedded directly into the circuit boards, which shortens critical paths, reduces potential losses, and saves precious space overall.

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A first working unit demonstrating the potential of the innovative technical approaches was a [compact and powerful 22kW on-board charger for electric cars](#). Fraunhofer IZM first exhibited the charger, which was still without bidirectional GaN components, at the 2024 PCIM Europe.

From semiconductor to finished vehicle: An unbroken European value chain

The goal of the HiPower 5.0 consortium is to harness the advantages of modern GaN and wide-bandgap semiconductors in market-ready products within a fully European value chain. In addition to the automotive sector, the consortium is also addressing applications in the marine shipping industry.

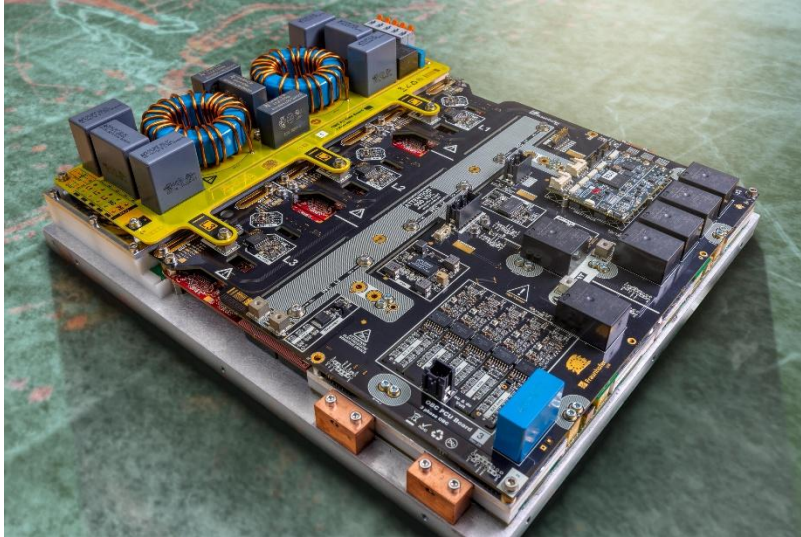
The HiPower 5.0 project brings together partners from ten European nations, including two OEMs, 21 tier-1 and tier-2 suppliers, six specialists for power electronics, ten universities, and seven research institutions. From August 2025 to June 2028, they are working on six use cases, supported by 33.7 million Euro in funding from the EU and its member states. The German Federal Ministry of Research, Technology, and Space is contributing 5.74 million Euro and the Free State of Saxony is contributing 0.12 million Euro.

More information on HiPower 5.0: <https://hipower50.eu/>

(Text: Steffen Schindler)

Project partners

AVL List GmbH, AVL-AST, Aalborg University, Ampere SAS, Austria Technologie & Systemtechnik AG, AVL Moravia S.R.O., AVL Software and Function GmbH, CEA Leti, DEIF A/S, DEIF Wind Power Technology Austria GmbH, DENPAFLUX, Elaphe Pogonske Tehnologije, Fraunhofer IZM, Ideas & Motion, Infineon Technologies AG, Infineon Technologies Austria AG, Interuniversitair Micro-Electronica Centrum, Lumency, Mahle Electric Drives Slovenija, Mahle International GmbH, Mahle New Mobility Solutions GmbH, Mercedes Benz AG, Nederlandse organisatie voor toegepast natuurwetenschappelijk onderzoek, Politecnico di Torino, Prodrive Technologies Innovation Services B.V., Reden B.V, RWTH Aachen – ISEA, SIEMENS AG, Silicon Austria Labs GmbH, Slovenska Technicka Univerzita v Bratislave, Soitec SA, Soitec LAB, TDK Electronics AG, Technische Universität Chemnitz, Technische Universität Dortmund, Technische Universiteit Eindhoven, University of Stuttgart, University of West Bohemia, VALEO EAUTOMOTIVE GERMANY GMBH, VALEO SYSTEMES DE CONTROLE MOTEUR SAS, VIRTUAL VEHICLE Research GmbH, Vitesco Technologies France, Vitesco Technologies Germany GmbH, Vrije Universiteit Brussel, ZA HELIOX BV



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Fraunhofer IZM demonstrated the viability of compact, on-board chargers in 2024. Bidirectional GaN semiconductors can now level up their efficiency, cost, and scale © Fraunhofer IZM/Volker Mai | Print quality images: www.izm.fraunhofer.de/pics

HiPower 5.0

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The **Fraunhofer-Gesellschaft**, headquartered in Germany, is one of the world's leading organizations for applied research. Founded in 1949, the Fraunhofer-Gesellschaft currently operates 75 institutes and research units throughout Germany. Its nearly 32,000 employees, predominantly scientists and engineers, work with an annual business volume of 3.6 billion euros; 3.1 billion euros of this stems from contract research.

The **Fraunhofer Institute for Reliability and Microintegration IZM** is one of the world's premier research institutions for electronics packaging. With its dedication to developing miniaturized, high-reliability electronics in cutting-edge lab facilities, the institute works to maintain the competitive edge of Germany and Europe.

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