

# PRESS RELEASE

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## **Smaller, lighter, more efficient: Fraunhofer collaborated with Marelli in the development of a pure SiC inverter module for high-performance electric drives**

**One of the world's leading automotive suppliers, Marelli, has launched the first power module for electric and hybrid traction applications in motorsports. The new module was developed together with the Fraunhofer Institute for Reliability and Microintegration IZM. Based entirely on silicon carbide, the module enables higher conversion efficiencies and is smaller and lighter – a successful innovation for both motorsports and vehicles in general.**

Motorsports not only stands for high-speed, agile and lightweight vehicles, but also increasingly for alternative and environmentally friendly racing. Formula E is just as popular with fans as Formula 1. Motorsport technology pioneer Marelli is one of the world's leading automotive suppliers. Marelli is now also promoting electric drives and the use of silicon carbide technologies on the racetrack. The basis for this is the semiconductor material (SiC for short), meeting all the conditions of a fast but energy-efficient car thanks to higher efficiency and a more compact size. As Riccardo De Filippi, Senior Vice President and CEO of Marelli Motorsport, put it, "At Marelli Motorsport, our mission is to promote technological advances that can make the difference above all on the racetrack, while enabling next-generation technologies for the road vehicles of tomorrow."

Having worked on improving SiC technologies for many years, Fraunhofer IZM has now collaborated with Marelli to jointly develop a new module called EDI (Enhanced Direct-cooling Inverter).

Its distinctive feature is an innovative structural design without a base plate that drastically reduces the thermal resistance between the SiC components and the cooling fluid. The result is an extremely compact power stage that can exploit the efficiency advantage of silicon carbide, while allowing for more flexibility in packaging and cooling system design. Compared to a silicon-based design of the same rating, the new technology enables conversion efficiencies of up to 99.5%, reduces weight and size by 50% and boasts 50% higher heat dissipation into the cooling system.

Thanks to its excellent performance in hybrid and all-electric applications, silicon carbide has emerged as the technology of choice for high-voltage and high-temperature power electronics components such as inverters in the last few years. The use of SiC MOSFETs enables smaller, lighter and more efficient solutions –

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characteristics that are even more important when it comes to motorsports, where size, weight and efficiency are key design factors.

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Manufactured in the clean room of Marelli's Corbetta plant (Italy), the EDI power module has already been put through a series of reliability tests for motorsport usage profiles. Electrical and mechanical reliability tests yield very good results with respect to the robustness of the module's design. The new inverter module allows Marelli to supplement its range of electric drive products for both motorsports and road vehicle applications.



Development team in the Corbetta plant's clean room. © Marelli

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The Fraunhofer-Gesellschaft, headquartered in Germany, is the world's leading applied research organization. With its focus on developing key technologies that are vital for the future and enabling the commercial exploitation of this work by business and industry, Fraunhofer plays a central role in the innovation process. As a pioneer and catalyst for groundbreaking developments and scientific excellence, Fraunhofer helps shape society now and in the future. Founded in 1949, the Fraunhofer-Gesellschaft currently operates 75 institutes and research institutions throughout Germany. The majority of the organization's 29,000 employees are qualified scientists and engineers, who work with an annual research budget of 2.8 billion euros. Of this sum, 2.4 billion euros are generated through contract research.

Fraunhofer IZM: Invisible - but indispensable: nothing works without highly integrated microelectronics and microsystems technology. The basis for their integration into products is the availability of reliable and cost-effective packaging and interconnection technologies. Fraunhofer IZM, a world leader in the development and reliability assessment of electronic packaging technologies, provides its customers with customized system integration technologies at wafer, chip and board level. Research at Fraunhofer IZM also means making electronics more reliable and providing its customers with reliable information on the durability of the electronics.

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