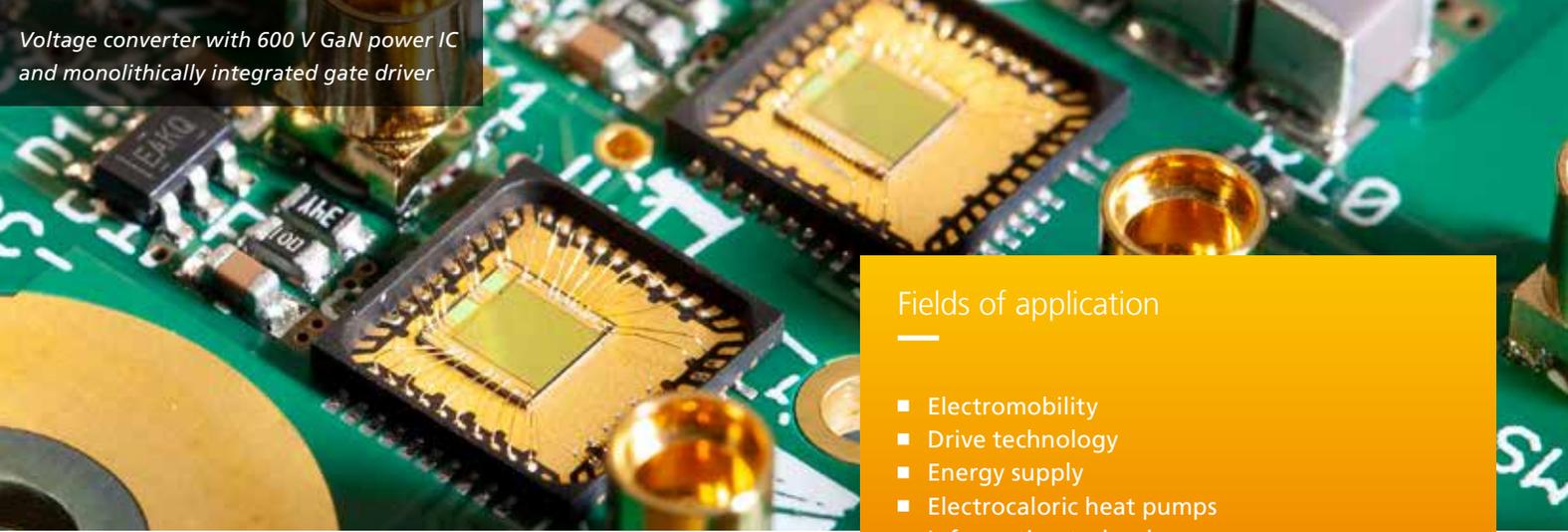


Voltage converter with 600 V GaN power IC and monolithically integrated gate driver



- Fields of application
- Electromobility
 - Drive technology
 - Energy supply
 - Electrocaloric heat pumps
 - Information technology

Energy efficiency in all areas

Fraunhofer IAF develops novel components, integrated circuits (ICs) and modules along the value chain based on the wide-bandgap compound semiconductor gallium nitride (GaN) for various applications in the field of efficient energy conversion.

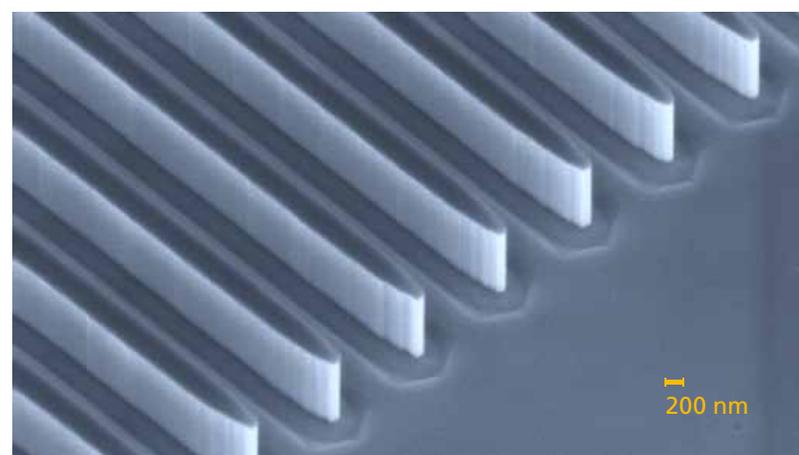
More GaN for less CO₂

Energy-efficient power semiconductors such as GaN help to reduce the CO₂ footprint in everyday life. For example, they enable fast-charging electric vehicles, highly efficient drive technology for industrial applications or environmentally friendly electrocaloric heat pumps.

Fraunhofer IAF is internationally leading in the research and development of novel GaN-based devices for various applications. In the development of innovative GaN devices, the institute focuses on energy efficiency, monolithic integration and electric strengths of up to 1200 V.

Monolithic integration minimizes space requirements

Researchers at Fraunhofer IAF are specialized in the monolithic integration of GaN-based high-electron-mobility transistors (HEMTs), optimized gate drivers, current and temperature sensors as well as single-chip power ICs with fully integrated half-bridge and control. The institute is also working on the monolithic integration of vertical HEMTs with lateral components. The aim of all activities is to achieve maximum performance with minimum losses on the smallest possible chip area.



Vertical and lateral 1200 V devices

Innovations in electronics require power devices that are suitable for higher voltages. A current example is the increase in battery voltage from 400 V to 800 V in electric cars, for which devices with an operating voltage of up to 1200 V are required. Fraunhofer IAF has responded to this demand with the development of lateral 1200 V GaN HEMTs and supported partners in the successful implementation of research results in commercial devices. The development of vertical GaN components is being further pursued at Fraunhofer IAF to achieve even better performance and cost advantages thanks to smaller chip areas.

Capabilities at a glance

- GaN epitaxy with MOCVD up to 8" wafers and processing of up to 4" wafers:
 - AlGa_N/Ga_N-on-Si (N-OFF, N-ON)
 - AlScN/Ga_N-on-Si
 - Ga_N-on-CMOS-heterointegration: micro-transfer printing, Wafer-to-Wafer, Si-substrate removal
 - Ga_N-on-Si, Ga_N-on-SiC, Ga_N-on-QST®, Ga_N-on-Sapphire, Ga_N-on-Diamond, Ga_N-on-GaN
- Components and ICs:
 - HEMT, CAVET, JFET, FinFET, MOSFET, diodes etc.
 - Monolithic half-bridges
 - Current sensors and temperature sensors
 - Protection circuits
 - Control logic
- Voltage classes: 48 V, 650 V, 1200 V
- Lateral and vertical monolithic integration

GaN-on-Sapphire-FinFET (fin field-effect transistor)

Why Fraunhofer IAF?

Fraunhofer IAF collaborates with national and international partners from science, research and industry to develop customized GaN power devices, monolithic integrated circuits, modules and subsystems for applications such as electromobility, electrocaloric heat pumps or information technology. The institute covers the entire value chain from circuit design and epitaxy, process technology, modelling, characterization, packaging technology to the construction and initial operation of demonstrators.

Based on the expertise of its researchers, its large network, and its unique research infrastructure with a 1000 m² clean room, Fraunhofer IAF plays a leading role worldwide in the field of application-oriented research on GaN power semiconductors. The institute uses its unique research infrastructure to continuously improve all steps of the GaN device value chain and to provide partners with the best possible support in product development.

What we offer:

- Epitaxy of III-V compound semiconductors according to customer specifications
- Process development and processing of wafers to transistors and integrated circuits
- Simulation-based design and realization of semiconductor devices and integrated circuits
- Power measurements, characterization of circuits, material analysis
- Application-specific development of devices, modules and demonstrators

We will be happy to present our research activities and services in the field of GaN power electronics to you in person.

Contact



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Efficient energy conversion with
GaN power circuits

GaN power electronics

