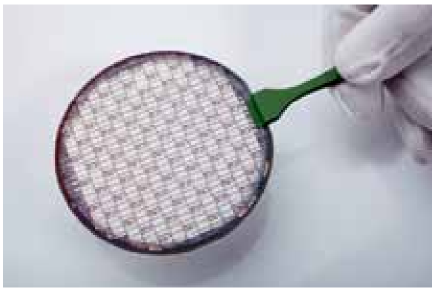
FBH's Portfolio

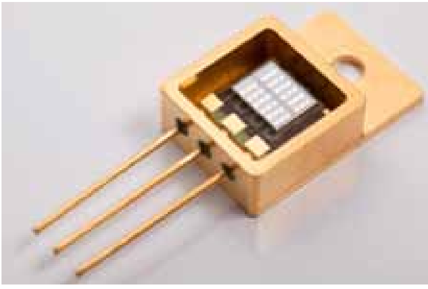
The FBH is an internationally recognized competence center for optoelectronic and electronic research based on III-V compound semiconductors. It operates industry-compatible and flexible clean room laboratories with vapor phase epitaxy units for the growth of GaAs- and GaN-based epitaxial structures and a III-V semiconductor process line for wafer diameters up to 4 inches. The work relies on comprehensive materials and process analysis equipment, a state-of-the-art device measurement environment, and excellent tools for simulation and CAD. In close cooperation with industry, its research results lead to cutting-edge products.



Processed GaN-on-SiC wafer containing power transistor chips

GaN Power Electronics at FBH

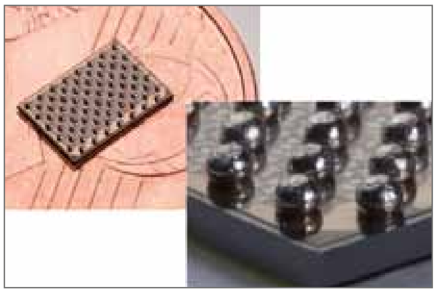
Gallium nitride (GaN) is characterized by its excellent dielectric breakdown strength. Thus, GaN-based High Electron Mobility Transistors (HEMTs) offer excellent power densities and combine high electron mobility with high saturation velocity. They are therefore well-suited for high frequencies, high voltages and very fast and low loss (efficient) switching applications.



Flip-chip mounted 50 A/ 250 V normally-off GaN power transistor

Innovative devices for power electronic applications aim at achieving fast and efficient high-voltage switching capabilities combined with normally-off behavior. Our developments towards GaN power HEMTs focus on increasing the breakdown voltage up to 1000 V. Further objectives are to develop and realize device concepts for low on-state resistances down to 10 m cm² as well as for normally-off devices. Accordingly, we optimize epitaxial designs and growth procedures as well as technological parameters and specific features such as field plates, passivation layers, and layout designs compatible to high-voltage applications.

By concentrating electrons in the transistor channel, high breakdown voltages are achieved. Thus, corresponding epitaxial layer designs are used providing a repelling electrostatic force to the electrons (back barrier designs). For normally-off GaN power transistors, we are focusing on p-GaN gate technology. This technology renders the intrinsic potential distribution close to the gate such that the devices can only be switched on at positive voltage. A threshold voltage of +1.5 V and a gate dynamic range of +5 V are characteristic values. Our high-current transistors up to 150 A rely on a two-dimensional scaling of the transistor width considering thermal issues and combining it with flip-chip mounting capability.



250 V / 75 A GaN power transistor optimized for flip-chip mounting GaN power transistor

The combination of these properties qualifies FBH transistors for power applications in automotive electronics, terrestrial and space-borne solar converter technology and others.

We are actively involved in various projects funded by industrial as well as public national and European sources.