Press Release

Gallium Nitride Transistors Make High-Frequency Power Electronics More Efficient and Compact

Applications Seen in Aeronautics and Communications Electronics

Highly modern power transistors based on gallium nitride (GaN) enable power electronic switches to operate at much higher switching frequencies compared to those based on silicon (Si). An increased power density per volume and per weight, reduced costs, less material use and, in the case of a mobile system, increased system efficiency are among the advantages. Solutions and concepts for high-frequency power electronics of the future shall be developed in the collaborative project "GaN-resonant – Efficient, highly compact high frequency power electronics with GaN transistors", which is sponsored by the German Federal Ministry for Education and Research (BMBF). "GaN-resonant" was launched on July 1, 2013 and will be funded with around 1.2 million euro over the next three years by the German Federal Ministry for Education and Research (BMBF) in the context of its funding announcement "Leistungselektronik zur Energieeffizienzsteigerung (Power Electronics for Increasing Energy Efficiency)".

The Fraunhofer Institute for Solar Energy Systems ISE, the SUMIDA Components & Modules GmbH and the Liebherr Elektronik GmbH are all involved in the collaborative project "GaN-resonant". The project goal is to develop a resonant DC/DC converter with GaN transistors, which is to operate with switching frequencies well above 1 MHz and a nominal power of 3 kW. The simultaneous occurrence of extremely high switching frequencies and high transmitted power requires the use of special, innovative inductive components. The development of such devices makes up a significant part

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of the collaborative project. Due to high power losses, the solutions available today limit the technically practical switching frequency. Thus, the existing solutions are not suitable for future applications, which demand both a substantially higher power density and a higher efficiency at the same time. This accomplishment can only be realized by innovations in the area of inductive components (core materials and geometries, winding structures and cooling concepts).

In the area of control, synchronous to the applied switching frequency, new problems arising due to the higher frequencies will be addressed in the collaborative project. Such issues include, for example, broadband data acquisition and signal processing. In order to exploit the advantages of a high switching frequency, the computing power used to control the DC/DC converter must be increased by a similar amount as the switching frequency or parts of the control must be carried out with analog devices.

The field of aeronautical electronics is one possible application area for the resonant voltage converter under development. In this field, compactness and low weight are of utmost importance. The amount of harmful emissions, which are of particular concern especially at high elevations, can be reduced by decreasing the system's weight. With its higher power density, the electronics are also well-suited for other mobile applications. Low space requirements, low cooling demand and low weight are decisive criteria for the mobility sector. Another use is found in the power supply for server farms or communication electronics in general. Today the worldwide energy consumption for the communication infrastructure has reached immense proportions. In addition to saving material with this technology, the power loss can also be reduced. This leads not only to increased efficiency but also to lower cooling demands.

The cooperative partners Fraunhofer ISE, SUMIDA Components & Modules GmbH and Liebherr-Elektronik Gmbh make up a highly qualified consortium. With their various

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expertise in the fields of power electronics, inductive devices and aeronautical electronics, they complement each other ideally.

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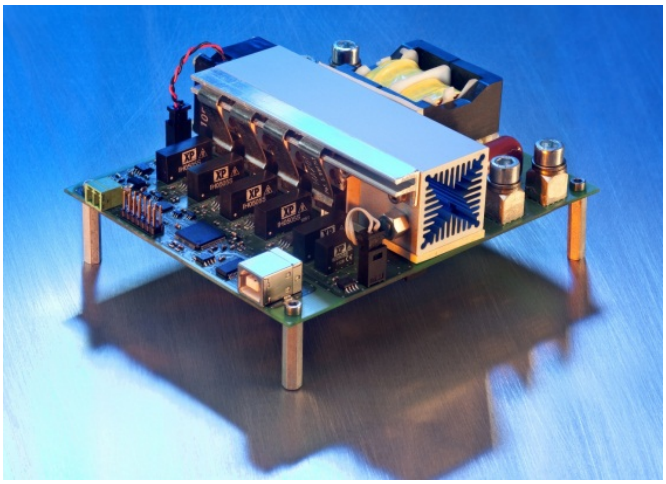

A laboratory prototype of a DC/DC converter with gallium nitride (GaN) power electronics, developed within the context of an internal Fraunhofer ISE study.
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