400-V SiC MOSFETs Benefit AI Server Power Supplies

Infineon's CoolSiC MOSFET 400-V family is based on the second-generation (G2) CoolSiC technology introduced earlier this year. This MOSFET portfolio was specially developed for use in the ac-dc stage of artificial intelligence (AI) servers, complementing Infineon's recently announced power supply (PSU) roadmap. The devices are also well suited for solar and energy storage systems (ESSs), inverter motor control, industrial and auxiliary power supplies (SMPSs) as well as solid-state circuit breakers for residential buildings.

The family features ultra-low conduction and switching losses when compared to existing 650-V SiC and Si MOSFETs. Implemented in a multi-level PFC, the ac-dc stage of the AI server PSU can attain a power density of more than 100 W/in³ and is proven to reach 99.5% efficiency. This is an efficiency improvement of 0.3 percentage points over solutions using 650-V SiC MOSFETs, according to the vendor (see the figure).

The MOSFET portfolio comprises a total of 10 products: five $R_{DS(ON)}$ classes from 11 to 45 mΩ in Kelvin-source TOLL and D²PAK-7 packages with .XT package interconnect technology. The drain-source breakdown voltage of 400 V at T_{vj} = 25°C makes them suitable for use in two- and three-level converters and for synchronous rectification.

With the increasing power requirements of AI processors, server PSUs must deliver more and more power without exceeding the defined dimensions of the server racks. This is driven by a surge in energy demand of high-level GPUs, which could consume 2 kW and more per chip by the end of the decade. These needs, as well as the emergence of increasingly demanding applications and the associated specific customer requirements have prompted Infineon Technologies to extend the development of SiC MOSFETs at voltages below 650 V.

In addition, the system solution for AI server PSUs is completed by implementing CoolGaN transistors in the dc-dc stage. With this combination of high-performance MOSFETs and transistors, the power supply can deliver more than 8 kW with an increase in power density by a factor of more than three compared to current solutions, according to Infineon.

The components offer high robustness under harsh switching conditions and are 100% avalanche tested. The highly robust CoolSiC technology in combination with the .XT interconnect technology enables the devices to cope with power peaks and transients caused by sudden changes in the power requirements of the AI processor. Both the connection technology and a low and positive $R_{DS(ON)}$ temperature coefficient enable excellent performance under operating conditions with higher junction temperatures.

Engineering samples of the CoolSiC MOSFET 400-V portfolio are now available and will go into series production starting in October 2024. More information is available on the CoolSiC MOSFETs Generation 2 page.

For more about the G2 technology see the press release and for more on the company's PSU roadmap see the road map press release. Further information about Infineon's SiC, GaN and Si solutions for powering AI PSUs is available on the Powering AI PSU solutions page

Figure. Infineon has launched 400-V CoolSiC MOSFETs specially developed for use in powering AI servers. When these devices are applied in a multi-level PFC, the ac-dc stage of the AI server PSU can attain a power density of more than 100 W/in³ and reaches 99.5% efficiency.