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SiC MOSFETs Increase Short-Circuit Robustness

NoMIS Power has extended the short circuit withstand time (SCWT) of its next-generation SiC MOSFETs to a minimum of 5 µs. According to the vendor, this surpasses the current industry standard of 2 to 3 µs and is achieved without compromising specific on-resistance.

Nomis comments that, historically, the lower short-circuit robustness of SiC MOSFETs compared to silicon-based IGBTs has posed a major challenge for their use in high-voltage and high-reliability environments. This advancement from NoMIS Power unlocks new opportunities for system designers seeking to maximize performance while maintaining fault tolerance.

By tuning the trade-off between Ron,sp and SCWT using NoMIS Power's proprietary SiC MOSFET fabrication design and process flow, the performance shown in Figs. 1 and 2 was achieved; and can be similarly managed depending on the specific application. Complete optimization of SiC MOSFETs with long SCWT using this approach will allow NoMIS Power to further extend the SCWT while maintaining negligible impact on Ron,sp.

"At NoMIS Power, we have focused extensively on device architecture engineering, leading to a significant advancement in SiC short-circuit withstand time," said Woongje Sung, CTO at NoMIS Power. "We believe this achievement provides valuable advantages to the power electronics community, helping engineers integrate SiC solutions with greater confidence in applications where robustness is critical."

NoMIS Power's long SCWT devices are well-screened for latent defects and offer easier gate driver desaturation (dSat) design for high di/dt and dv/dt, enabling faster switching frequencies of up to hundreds of kilohertz. According to the vendor, initial test results demonstrate a 2x to 4x increase in short-circuit withstand time compared to existing SiC devices, positioning NoMIS Power's technology as a frontrunner in the next generation of power semiconductors.

Additionally, when coupled with packaging innovations that impact junction-to-case thermal capacitance, alongside novel thermal management techniques with high heat transfer coefficients, the overall SCWT of the SiC MOSFET can be further improved.

The impact of this innovation extends across multiple industries, including renewable energy, electric transportation, and high-power industrial applications. A longer short-circuit withstand time ensures rugged and reliable performance in critical applications, reinforcing the robustness of SiC-based power systems.

For example, built-in redundancy of the SiC MOSFETs inside power converters, which impacts costs as well as power density, can be reduced. Furthermore, applications sensitive to electromagnetic inference, that cannot solely rely on digital control and sensing schemes to detect and act upon short-circuit events, will now be able to effectively utilize SiC MOSFETs with lower risk. As SiC adoption accelerates, NoMIS Power's breakthrough will play a pivotal role in enhancing the reliability and safety of SiC-based power converters and systems, says the vendor.

For more information, see the company's website.

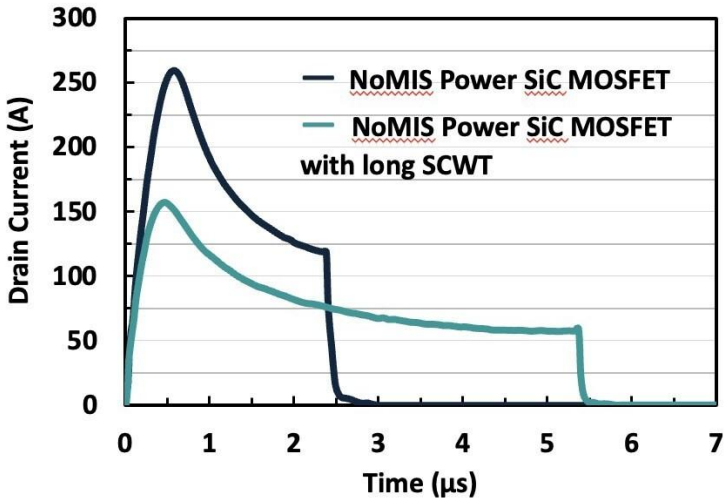

Fig. 1. Drain currents of the NoMIS Power SiC MOSFET and NoMIS Power SiC MOSFET with long SCWT under short-circuit conditions right before failure. Drain currents of the 1.2-kV, 80-mΩ SiC MOSFET (dark blue) and the long SCWT 1.2-kV, 80-mΩ SiC MOSFET (light blue) from NoMIS Power are compared. The measurement for short-circuit was conducted under the following conditions: Rg of 20 Ω, Vgs of 20 V, and a Vds of 800 V.

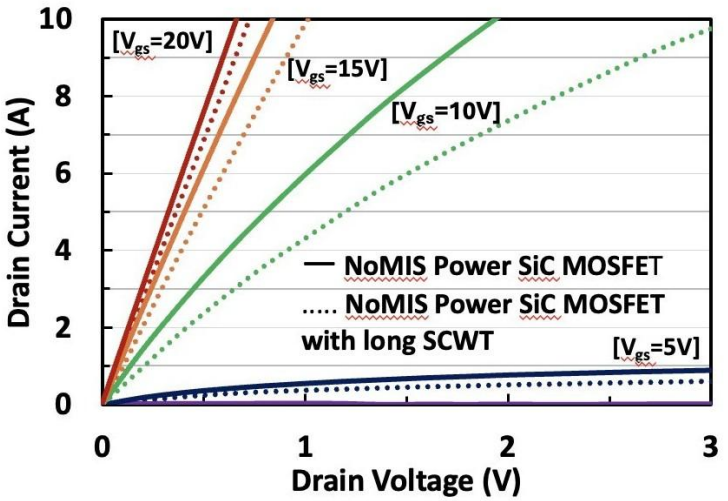

Fig. 2. Typical output characteristics of NoMIS Power's 1.2-kV, 80-mΩ SiC MOSFET and its 1.2-kV, 80-mΩ SiC MOSFET with long SCWT showing no significant negative impact on on-resistance.