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CONTINUOUS SWITCHING OF ULTRA-HIGH VOLTAGE SILICON CARBIDE MOSFETS

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Silicon carbide power semiconductor devices are capable of increasing the power density of power electronics systems[1,2]. In recent years, devices rated to block voltages up to 20 kV have been demonstrated[3]. These research grade devices must be fully characterized to determine operating characteristics as well as failure mechanisms. The purpose of this paper is to demonstrate the continuous switching performance of ultra-high voltage MOSFETs rated for 15 kV / 10 A. A high voltage boost converter was developed to evaluate the continuous switching performance where the high-voltage MOSFET is utilized as the main switching element. During operation, the on-state voltage, gate leakage current, and dc characteristics are monitored to determine device degradation. Measured device degradation is presented as a comparison of initial and final dc characterization.

[1] J. A. Schrock, et al., "High-Mobility Stable 1200-V, 150-A 4H-SiC DMOSFET Long-Term Reliability Analysis Under High Current Density Transient Conditions," IEEE Trans. Power Electronics, vol. 30, no. 6, pp. 2891-2895, June 2015.
[2] L. Cheng, et al., "20 kV, 2 cm2, 4H-SiC gate turn-off thyristors for advanced pulsed power applications," 2013 Abstracts IEEE International Conference on Plasma Science (ICOPS), San Francisco, CA, 2013, pp. 1-1. doi: 10.1109/PLASMA.2013.6633193
[3] A. V. Bilbao, J. A. Schrock, W. B. Ray, M. D. Kelley and S. B. Bayne, "Analysis of advanced 20 KV/20 a silicon carbide power insulated gate bipolar transistor in resistive and inductive switching tests," 2015 IEEE Pulsed Power Conference (PPC), Austin, TX, 2015, pp. 1-3. doi: 10.1109/PPC.2015.7296953

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