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Analysis of a New 15-kV SiC n-GTO under Pulsed Power Applications

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SiC (silicon carbide) GTOs (gate turn-off) are a substantiated choice for increased power density and thermal dissipating capabilities in pulsed power and power electronics applications due to their wide-bandgap characteristics. For the transition of Si (silicon) power devices to SiC, it is imperative to evaluate the long-term reliability of newly-developed SiC devices. The testbed consists of a PFN (pulse forming network) that subjects the device under test, a 1.0 cm^2 15 kV SiC n type (n-doped epi layer) GTO, up to a current level up to 800 A with a pulse width of 100 us. An IR (inferred radiation) camera integrated to the PFN monitored the thermal characteristics of the DUT during testing. The electrical characteristics of the device, such as forward I-V curve, breakdown voltage, forward and reverse gate conduction, and forward and reverse conduction, were taken between testing. A SEM (scanning electron microscope) was used to find physical evidence of degradation on the device. the DUT was subjected to 35,000 very high-current density pulses, at which point it exhibited a decrease in blocking capability. This paper will include analysis of the pulsed safe operating area and mode of failure outside of that operating area.

Keywords –SiC; GTO; wide-bandgap; PFN; pulsed power; reliability testing; power electronics

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