Contribution ID: **698** Type: **Oral**

Investigation into the Reliability of Commercial 1.2-kV SiC MPS Diodes under Surge Current and Avalanche Events

Monday 24 June 2019 11:15 (15 minutes)

With the prospect of wide-bandgap (WBG) devices such as SiC (silicon carbide) taking the forefront to replace Si (silicon) in commercial applications, analysis must be done on surge current and avalanche energy reliability to verify the viability of replacing Si with SiC in terms of long-term reliability. Properties of SiC theoretically show superior thermal conductivity, and higher breakdown field, giving SiC devices the edge in power applications where temperature and voltage hold-off are vital. Power converters and inverters are often exposed to these events due to a load short circuit or transients before reaching steady-state. It is common for power semiconductor devices such as MOSFETs (metal-oxide-semiconductor field-effect transistors) or diodes to experience a short duration of overcurrent or overvoltage in these power switching applications. The surge current can potentially damage devices if not properly rated. Extended duration of overvoltage leads to avalanche breakdown, ending in catastrophic failure of the device. This paper investigates the surge current and avalanche breakdown capabilities of commercial SiC MPS diodes rated for 1.2 kV reverse voltage and 20 A continuous forward current. The diodes are rated for 164 A of non-repetitive surge current and 220 mJ of total avalanche energy. A testbed is designed and developed to test the reliability of commercial WBG diodes in surge and avalanche events. Each device is initially characterized, exposed to testing conditions, and then characterized again to monitor signs of degradation. Analysis of the data collected during and after testing was conducted to determine the reliability in commercial applications.

Keywords –SiC; WBG; wide-bandgap; MPS; merged pin; surge current; in-rush current; avalanche energy, pulsed power; reliability testing; power electronics

Authors: SALCEDO, Fernando; FORBES, Jonathan; Dr BAYNE, Stephen

Co-author: SINGH, Ranbir

Presenter: SALCEDO, Fernando

Session Classification: 10.1/10.2 Converters, Components,Magnetics, Swiches and Capacitors

Track Classification: 10.2 Components, magnetics, switches, capacitors