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Study of Temperature Dependence of SiC JBS Diodes

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Abstract:

SiC (Silicon Carbide) is a wide band gap (~3.3 eV) material that has excellent material properties for application to high frequency, high power and high temperature devices. In addition, it is composed of a strong atom bonding between Si and C, it can be used for devices with improved thermal stability, and corrosion resistance. SiC has three times higher thermal conductivity than GaN, allowing to control heat more effectively.

Among power semiconductor diode structures devices, a 4H-SiC Junction barrier Schottky (JBS) diode has PN junction and Schottky junction through structural design. The main advantages of the JBS diode is the Schottky-like on-state and fast switching characteristics together with the off-state characteristics having a low leakage current similar to that of the PiN diode.

Comparing temperature dependence of Si SBD and PiN diode, their currents are increased, but SBD is higher than PiN diode. In this paper, we measured 4H-SiC SBD, PiN and JBS diode that were fabricated on the same wafer from room temperature to 473K. Subsequently compared with regards to their respective I-V characteristics. We use Parameters deduced from the observed I-V measurements, including threshold voltage, ideality factor and barrier height. we confirm that SBD is larger than PiN diode in current increase ratio on SiC and learn that SBD current increase ratio is higher because of carrier movement based on temperature.

Keywords

JBS diode, Temperature, Silicon Carbide

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