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Temperature Distribution and Switching Characteristics of 1700V 4H-SiC

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Abstract:

Silicon Carbide (SiC) is a Wide band gap semiconductor with band gap energy about 3 times that of silicon (Si). For the same breakdown voltage, SiC devices offer theoretical Specific on-resistance two orders of magnitude lower than that of silicon device and SiC has high critical field (2.2 X 10^6 V/cm) and mobility (9900 cm^2/Vs) and excellent thermal conductivity (4.9 W/Kcm). Using the SiC material properties, SiC based power devices are actively applied as an inverter for electric vehicles, aerospace and new renewable energy.[1]

And research is on going to reduce the on-resistance of the Planar MOSFETs from the high voltage operating condition. Therefore, as a way to reduce the on-resistance value, the Trench gate MOSFETs are a promising solution to reduce the on-resistance value by not having a region of the Junction Field Effect Transistor (JFET), reducing the size of cells, and increasing the Degree of Integration of the element. However, when a high voltage is applied, the field concentration phenomenon at the bottom oxide edge, which results in the breakdown of the gate oxides and consequently degrades the reliability of the devices.[2]

In this study, the electrical characteristics of the 1700V class planar DMOSFET and the Trench gate MOSFET were analyzed and the thermal analysis and switching characteristics were compared The research found that the Trench gate MOSFET has a lower resistance value in the MOSFET, which affects switching characteristics and as thermal analysis, confirmed that the consideration when we designing the MOSFETs

Reference

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Keywords

4H-SiC, Trench, MOSFET

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