Leakage Current Mechanisms in Silicon Carbide MOSFETs - A Review

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Abstract

MOSFETs are integral components in modern electronics, renowned for their efficiency and performance. However, leakage currents, including drain-source (I_{DSS}) and gate-source (I_{GSS}) currents, pose significant challenges to device reliability and overall system efficiency, leading to issues such as increased power loss, thermal stress, and reduced lifespan of devices. This review delves into the mechanisms underlying leakage currents in SiC MOSFETs, a promising technology for high-power applications. The key factors contributing to leakage, such as gate oxide degradation, material properties, and device architecture, have been identified by examining the research conducted over the past few years. Understanding the leakage current mechanisms is crucial for developing effective mitigation strategies and optimizing SiC MOSFET performance. This review concludes by summarizing key findings and highlighting the importance of ongoing research. © The Korean Institute of Electrical and Electronic Material Engineers 2025.

Author keywords

Gate leakage; Junctions; Leakage currents; MOSFET; Silicon carbide (SiC); Tunneling

Indexed keywords

Engineering controlled terms

Efficiency; Leakage currents; Power MOSFET; Tunneling (excavation)

Engineering uncontrolled terms

'current; Gate-leakage; Integral components; Junction; Leakage current mechanisms; MOS-FET; MOSFETs; Silicon carbide; Silicon carbide MOSFETs; Tunneling

Engineering main heading

Silicon carbide

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