

A Novel 4H-SiC Super Junction UMOSFET with Heterojunction Diode for Enhanced Reverse Recovery Characteristics and Low Switching Loss

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In this paper, a novel silicon carbide (SiC) super-junction *U*-shape metal-oxide semiconductor field-effect transistor (UMOSFET) with an integrated heterojunction diode (HJD) is proposed and investigated using numerical simulations. The integrated HJD substantially improves body diode characteristics and reduces switching losses without degrading the static characteristics of the device. In this structure, a p^+ shielding region between the *p*-poly region and *p*-pillar protects not only the bottom gate oxide but also the *p*-poly region from high electric fields. Compared with conventional SJ UMOSFETs, the proposed structure reduces the peak reverse recovery current (I_{RR}) by a factor of 2.58 and the reverse recovery charge (Q_{RR}) by a factor of 4.94. Moreover, the total switching energy loss is decreased by 50.2%.

Keywords: 4H-SiC, heterojunction, super-junction, body diode, reverse recovery, switching energy loss.

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