IEC 63275-2

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Semiconductor devices – Reliability test method for silicon carbide discrete metal-oxide semiconductor field effect transistors – Part 2: Test method for bipolar degradation due to body diode operation

Dispositifs à semiconducteurs – Méthode d'essai de fiabilité pour les transistors à effet de champ métal-oxyde-semiconducteurs discrets en carbure de silicium – Partie 2: Méthode d'essai de la dégradation bipolaire due au fonctionnement de la diode intrinsèque

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IEC Secretariat
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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SEMICONDUCTOR DEVICES – RELIABILITY TEST METHOD FOR SILICON CARBIDE DISCRETE METAL-OXIDE SEMICONDUCTOR FIELD EFFECT TRANSISTORS –

Part 2: Test method for bipolar degradation due to body diode operation

FOREWORD

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Draft	Report on voting
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Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

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- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

Silicon carbide (SiC) is widely used as a semiconductor material for next-generation power semiconductor devices. SiC, as compared with silicon (Si), has superior physical properties such as a higher breakdown electric field, higher thermal conductivity, lower carrier generation rate, higher saturated electron drift velocity, and lower intrinsic carrier concentration. These attributes realize SiC-based power semiconductor devices with faster switching speeds, lower losses, higher blocking voltages, and higher temperature operation relative to standard Si based power semiconductor devices.

Possible reliability issues include on-state voltage drop change, on-state resistance increase and reverse drain voltage change of metal-oxide semiconductor field effect transistors due to a current flowing through the body diode. This occurs because the body diode current causes the formation of stacking faults that expand within the drift region of the MOSFET and impede current flow within the area that they occupy. This increases the on-state resistance and degrades the operation of the power electronics system. This effect will only occur if the active device volume contains basal plane dislocations (BPDs), and there is electron-hole pair (EHP) recombination such as occurs during forward biasing of the body diode of the SiC MOSFET. That means some of the devices may show parameter drift, others will not drift. Therefore, it is indispensable to establish an International Standard with regard to evaluation of on-state voltage drop change and on-state resistance change as reliability issues.

This document defines the evaluation method of on-state voltage drop change and on-state resistance change under body diode current stress on SiC metal-oxide semiconductor field effect transistors.