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Guideline for evaluating bias temperature instability of silicon carbide metal-oxide-semiconductor devices for power electronic conversion

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CONTENTS

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The text of this International Standard is based on the following documents:

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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.

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– reconfirmed,
– withdrawn, or
– revised.

INTRODUCTION

The objective of this document is to provide useful definitions and procedures for characterizing the threshold voltage instability of SiC-based power electronic conversion semiconductor (PECS) devices having a gate dielectric region biased to turn devices on and off. This typically refers to MOS (Metal-Oxide-Semiconductor) devices such as field-effect transistors (MOSFETs, Metal-Oxide-Semiconductor Field Effect Transistors)) and insulated-gate bipolar transistors (IGBTs). For simplicity reasons, in the following paragraphs the terms MOSFET or MOS device are used only, while the content is valid for IGBT’s as well. Monitoring of threshold-voltage instability in MOS devices is commonly referred to by the term “bias-temperature instability” (BTI), while the applied stress to check for instability is usually referred to as “bias-temperature-stress” (BTS). The terms BTI, BTS, and threshold-voltage instability will be used throughout this document.

1 Scope

The scope of this document covers SiC-based PECS devices having a gate dielectric region biased to turn devices on and off. This typically refers to MOS devices such as MOSFETs and IGBTs. In this document, only NMOS (N-type MOS) devices are discussed as these are dominant for power device applications; however, the procedures apply to PMOS (P-type MOS) devices as well.

This document does not define device failure criteria, acceptable use conditions or acceptable lifetime targets. That is up to the device manufacturers and users. However, it provides stress procedures such that the threshold voltage stability over time as affected by gate bias and temperature can be demonstrated and evaluated.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60747-8:2010, *Semiconductor devices - Discrete devices - Part 8: Field-effect transistors*

IEC 63505, *Guidelines for measuring the threshold voltage (V_T) of SiC MOSFETs*

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