IEC 62373-1

Edition 1.0 2020-07

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Semiconductor devices – Bias-temperature stability test for metal-oxide, semiconductor, field-effect transistors (MOSFET) – Part 1: Fast BTI test for MOSFET

Dispositifs à semiconducteurs – Essai de stabilité de température en polarisation pour transistors à effet de champ metal-oxyde-semiconducteur (MOSFET) – Partie 1: Essai rapide de BTI pour les MOSFET

IEC 62373-1:2020-07(en-fr)

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Part 1: Fast BTI test for MOSFET

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

FDIS	Report on voting
47/2627/FDIS	47/2637/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62373 series, published under the general title *Semiconductor devices – Bias-temperature stability test for metal-oxide, semiconductor, field-effect transistors (MOSFET)*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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- withdrawn,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

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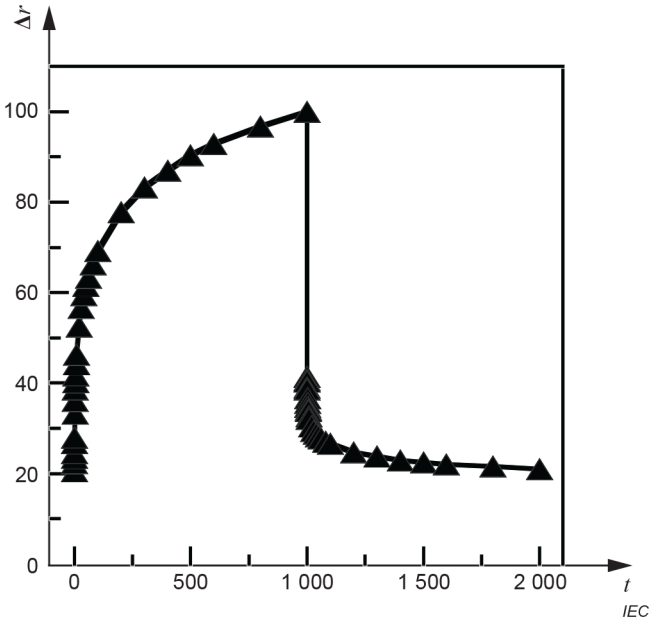
INTRODUCTION

BTI (bias temperature instability) degradation of semiconductor devices is a crucial failure. IEC 62373:2006 provides a method to test for this failure.

With advances in technology, the magnitude of recovery for BTI degradation has been remarkable. Recovery from BTI degradation occurs in microseconds to milliseconds after removing or reducing gate stress. Figure 1 below shows experiment data of V_{th} shift which is stressed in BTI condition for 1 000 s and not stressed after that [1][1]. It shows that the degradation is rapidly recovered, to about 40 % in a few seconds right after removing the stress at 1 000 s. Therefore, a fast measurement method is necessary to avoid this effect and to determine this degradation with exactitude.



Key

Δr ratio of V_{th} degradation amount to maximum degradation;

t stress or recovery time, expressed in seconds.

Figure 1 – Degradation (ΔV_{th}) recovering by BTI conditions removing with time

However, the existing test, described in IEC 62373, suffers from the disadvantage that the recovery process starts as soon as the stress is reduced while making the fairly lengthy set of measurements that establish the shift in threshold voltage. The procedure described in this standard uses an alternative method for measuring degradation that, by taking very little time, minimizes the partial recovery that occurs during the measurement.

[1] Numbers in square brackets refer to the Bibliography.

SEMICONDUCTOR DEVICES – BIAS-TEMPERATURE STABILITY TEST FOR METAL-OXIDE, SEMICONDUCTOR, FIELD-EFFECT TRANSISTORS (MOSFET) –

Part 1: Fast BTI test for MOSFET

1 Scope

This part of IEC 62373 provides the measurement procedure for a fast BTI (bias temperature instability) test of silicon based metal-oxide semiconductor field-effect transistors (MOSFETs).

This document also defines the terms pertaining to the conventional BTI test method.

2 Normative reference

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
nominal power supply voltage
V_{DD}
suitable value of the voltage used to designate the power supply of the technology

3.2
drain – source voltage
V_{DS}
voltage between the drain and the source

3.3
gate – source voltage
V_{GS}
voltage between the gate and the source

3.4
well – source voltage
V_{BS}
voltage between the well and the source

3.5
drain current
I_D
current monitored for drain terminal when V_{BS} is zero