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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 45716.1-2026

**Semiconductor devices - Bias-temperature instability test for
metal-oxide semiconductor field-effect transistors (MOSFETs) -
Part 1: Fast bias-temperature instability test for MOSFETs**

半导体器件 金属氧化物半导体场效应晶体管（MOSFETs）的偏置温度不稳定性
试验 第1部分：MOSFETs的快速偏置温度不稳定性试验

(English Translation)

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Table of Contents

Preface	
Introduction	
1 Scope	
2 Normative References	
3 Terms and Definitions	
4 Test equipment 3.	
4.1 Equipment	
4.2 Processing Requirements	
5 Test Samples	
5.1 Sample	
5.2 Antenna Protection Diode	
5.3 Sample Quantity	
6 Step	
6.1 General Explanation of Measurement Time	
6.2 Definition of Measurement Parameters	
6.3 Experiment	
6.4 Life Assessment	
Appendix A (Informative) BTI Recovery Effect	
Appendix B (Informative) Selection of Wide Gate Devices	
Reference	

Foreword

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part 1: Structure and Drafting Rules of Standardization Documents".

Drafting.

This document is Part 1 of GB/T 45716. GB/T 45716 has the following parts published.

---Bias temperature instability test for metal-oxide-semiconductor field-effect transistors (MOSFETs) (GB/T 45716-

2025);

---Bias Temperature Instability Testing of Metal-Oxide-Semiconductor Field-Effect

Transistors (MOSFETs) - Part 1.

This document is equivalent to IEC 62373-1:2020 "Semiconductor devices - Metal-oxide-semiconductor field-effect transistors (MOSFETs)" Bias Temperature Stability Testing Part 1: Rapid BTI Testing of MOSFETs.

The following minimal editorial changes have been made to this document.

---To align with existing standards, the standard name has been changed to "Bias Temperature of Metal-Oxide-Semiconductor Field-Effect Transistors (MOSFETs)".

Temperature Instability Testing Part 1: Rapid Bias Temperature Instability Testing of MOSFETs.

Please note that some content in this document may involve patents. The issuing organization of this document assumes no responsibility for identifying patents.

This document was proposed by the Ministry of Industry and Information Technology of the People's Republic of China.

This document is under the jurisdiction of the National Semiconductor Device Standardization Technical Committee (SAC/TC78).

Introduction

Semiconductor devices are general-purpose basic products in the electronics industry chain, and are the most basic units in electronic systems. GB/T 45716 is a standard for semiconductor devices.

Fundamental standards for testing conductor devices play a crucial role in evaluating the quality and reliability of semiconductor devices. It is proposed that two departments...

Composition.

---Bias temperature instability (BTI) test of metal-oxide-semiconductor field-effect transistors (MOSFETs). The purpose is to evaluate...

The BTI reliability of MOSFET devices is assessed, and the BTI lifetime of the devices is predicted.

---Bias Temperature Instability Testing of Metal-Oxide-Semiconductor Field-Effect Transistors (MOSFETs) - Part 1.

Rapid bias temperature instability (BTI) testing of MOSFETs. The aim is to more accurately represent the performance of MOSFETs using a rapid BTI testing method.

Characterize the BTI degradation of MOSFET devices, evaluate the BTI reliability of MOSFET devices, and predict the BTI of the devices.

life.

This document employs a rapid BTI (Brain-Induced Transistor) testing method to provide quantitative assessment criteria for the BTI effect in MOSFET transistors, contributing to the improvement of semiconductor...

The reliability of components plays a supporting role in ensuring the high reliability of the entire system.

BTI degradation is a critical cause of failure in semiconductor devices. GB/T 45716-2025 provides a test method for BTI failure.

With advancements in semiconductor technology, the recovery of BTI degradation is remarkable. The recovery of BTI degradation is significant after removing or reducing gate stress.

This happens within microseconds to milliseconds. Figure 1 shows the threshold values for MOSFET devices under BTI stress for 1000 s followed by stress removal.

Experimental data on voltage drift (ΔV_{th}). Figure 1 shows that BTI degradation recovers rapidly within seconds after stress removal at $t=1000s$, and within a few seconds...

It can recover to 40% within a minute. Therefore, it is necessary to adopt a rapid measurement method to avoid this effect, thereby accurately characterizing BTI.

Degradation amount.

Indexing symbol explanation.

ΔV_{th} --- the proportion of V_{th} degradation to the maximum degradation;

t --- the stress or recovery time, in seconds (s).

Figure 1. Recovery of threshold voltage drift (ΔV_{th}) over time after BTI stress removal.

The existing BTI test method described in GB/T 45716-2025 has the following disadvantages. it requires a fairly long set of measurements to obtain...

During the process of ΔV_{th} , once the stress is reduced, ΔV_{th} will immediately recover. The experimental procedure described in this document uses an alternative method to measure ΔV_{th} .

BTI degradation, this method minimizes partial recovery during the measurement process by using a very short measurement time.

Semiconductor devices Metal-oxide-semiconductor field-effect Bias temperature of transistors (MOSFETs) Instability Testing Part 1: MOSFETs Rapid bias temperature instability test

1 Scope

This document describes the rapid bias temperature instability used in silicon-based metal-oxide-semiconductor field-effect transistors (MOSFETs).

(BTI) test method.

This document also defines the terminology associated with standard BTI testing methods.

2 Normative references

This document has no normative references.

3 Terms and Definitions

The following terms and definitions apply to this document.

VDD

The appropriate operating voltage specified by the process.

Drain-source voltage V_{DS} the voltage between the drain and the source.

Gate-source voltage

V_{GS}

The voltage between the gate and the source.

Well-source voltage

V_{BS}

The voltage between the sink and the source.

Drain current

The current flowing through the drain when V_{BS} equals 0.