

Semiconductor devices - Mobile ion tests for metal-oxide semiconductor field effect transistors (MOSFETs)

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN 62417:2010 sisaldab Euroopa standardi EN 62417:2010 ingliskeelset teksti.

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**Semiconductor devices -
Mobile ion tests for metal-oxide semiconductor field effect transistors
(MOSFETs)
(IEC 62417:2010)**

Dispositifs à semiconducteurs -
Essais d'ions mobiles pour transistors
à semiconducteur à oxyde métallique
à effet de champ (MOSFET)
(CEI 62417:2010)

Halbleiterbauelemente -
Prüfverfahren auf mobile Ionen
für Feldeffekttransistoren mit Metall-Oxid-
Halbleiter (MOSFET)
(IEC 62417:2010)

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Management Centre: Avenue Marnix 17, B - 1000 Brussels

Foreword

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The following dates were fixed:

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|--|-------|------------|
| – latest date by which the EN has to be implemented at national level or publication of an identical national standard or by endorsement | (dop) | 2011-02-01 |
| – latest date by which the national standards conflicting with the EN have to be withdrawn | (dow) | 2013-05-01 |

Endorsement notice

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SEMICONDUCTOR DEVICES – MOBILE ION TESTS FOR METAL-OXIDE SEMICONDUCTOR FIELD EFFECT TRANSISTORS (MOSFETs)

1 Scope

This present standard provides a wafer level test procedure to determine the amount of positive mobile charge in oxide layers in metal-oxide semiconductor field effect transistors. . It is applicable to both active and parasitic field effect transistors. The mobile charge can cause degradation of microelectronic devices, e.g. by shifting the threshold voltage of MOSFETs or by inversion of the base in bipolar transistors.

2 Abbreviations and letter symbols

This standard uses the following abbreviations and letter symbols:

CV test	capacitance-voltage measurement
HFCV test	high frequency capacitance-voltage measurement
V_g	gate voltage
t_{ox}	oxide thickness
I_{ds}	drain-source current
V_{dd}	positive power supply voltage
$V_{dd,max}$	maximum supply voltage
V_t	transistor threshold voltage
$V_{t,initial}$	the absolute value of the threshold voltage before the test
V_{supply}	the absolute value of the supply voltage
ϵ_{ox}	dielectric constant of the oxide

3 General description

The stress applied is on test structures at an elevated temperature where mobile ions can overcome the energy barriers at the interfaces and the ion mobility in the oxide is sufficiently high. Two test methods are described in this document.

- Bias temperature stress (BTS)
- Voltage sweep (VS).

The bias temperature stress test is done on transistors. The threshold voltage is determined from an $I_{ds} - V_{gs}$ measurement at room temperature on fresh structures. The threshold voltage is defined as the gate voltage needed to force a fixed drain current through the transistor. Then, a positive gate stress is applied at a high temperature, to sweep the mobile ions towards the substrate. After the stress the test structure is cooled to room temperature with the bias still applied. A second $I_{ds} - V_{gs}$ curve is measured at room temperature. The sequence is completed with a negative gate stress at high temperature followed by an $I_{ds} - V_{gs}$ measurement at room temperature. Mobile charge causes a shift in the $I_{ds} - V_{gs}$ curve. The distance over which the curve is shifted is a measure of the amount of mobile charge in the insulator.