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

GB/T 47239.6-2026

**Semiconductor devices - Flexible and stretchable
semiconductor devices - Part 6: Test method for sheet
resistance of flexible conducting films**

(English Translation)

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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 6 of GB/T 47239 "Semiconductor Devices - Flexible and Stretchable Semiconductor Devices". GB/T 47239 has been issued.

The following parts were laid out.

- Part 1: Bending Test Methods for Conductive Thin Films on Flexible Substrates;
- Part 2: Evaluation methods for electron mobility, subthreshold swing, and threshold voltage of flexible devices;
- Part 3: Performance evaluation of thin-film transistors on flexible substrates in a raised state;
- Part 4: Fatigue evaluation of flexible conductive films on flexible semiconductor device substrates;
- Part 5: Test methods for thermal properties of flexible materials;
- Part 6: Thin-film resistance testing methods for flexible conductive films;

---Part 7: Test methods for barrier properties of flexible organic semiconductor packaging films;

---Part 8: Test methods for the ductility, flexibility and stability of flexible resistive memory;

---Part 9: Performance testing method for one-transistor-one-resistor (1T1R) memory cell.
Thin-film resistance testing method.

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

---The URLs for the ISO and IEC terminology databases have been removed from the terminology and definitions section;

---Change the sample length symbol in Figure 3 from "W" to "L", and change V43 in Figures 5 and C.3 to V34, and V14 to...

V41, change a_2 in formula (B.6) to a .

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

Flexible and stretchable semiconductor devices possess characteristics such as stretchability, bendability, deformability, light weight, and variable shape, and can be used in robotic skin, etc.

Applications include wearable devices, optoelectronic products, and energy storage products. This is driven by advancements in semiconductor device technology and the development of flexible, stretchable semiconductor devices.

The widespread application of semiconductors has placed higher demands on product quality and reliability. GB/T 47239 "Flexible and Stretchable Semiconductor Devices" the "Semiconductor Devices" standard is a fundamental standard for testing and experimenting with flexible and stretchable semiconductor devices, and is essential for evaluating the performance of these devices.

---Part 1: Bending Test Methods for Conductive Thin Films on Flexible Substrates. The purpose is to specify the bending test methods for conductive thin films on flexible semiconductor substrates.

Curved test method.

---Part 2: Evaluation Methods for Electron Mobility, Subthreshold Swing, and Threshold Voltage of Flexible Devices. The aim is to define the evaluation methods for flexible devices under bending conditions.

Evaluation methods for electrical parameters such as mobility, subthreshold swing, and threshold voltage of flexible thin-film transistor devices.

---Part 3: Performance Evaluation of Thin Film Transistors on Flexible Substrates in a Raised State. The aim is to define the performance of flexible substrates in a raised state.

Evaluation methods for thin-film transistor characteristics.

---Part 4: Fatigue Evaluation of Flexible Conductive Thin Films on Flexible Semiconductor Device Substrates. The aim is to specify the requirements for flexible semiconductor device substrates.

A fatigue evaluation method for flexible conductive films on a board.

---Part 5: Test methods for thermal properties of flexible materials. The purpose is to specify the test methods for the thermal properties of flexible materials.

---Part 6: Methods for testing the sheet resistance of flexible conductive films. The purpose is to specify the methods for testing the sheet resistance of flexible conductive films.

method.

---Part 7: Test Methods for Barrier Properties of Flexible Organic Semiconductor Packaging Films. The purpose is to specify the barrier properties of flexible organic semiconductor packaging films.

Test methods for membrane barrier properties.

---Part 8: Test methods for the ductility, flexibility, and stability of flexible resistive memory. The purpose is to specify the requirements for flexible resistive memory.

Terminology and definitions, as well as testing equipment and procedures for ductility, flexibility and stability.

---Part 9: Performance Test Methods for One-Transistor-One-Resistor (1T1R) Resistive Storage Cells. The purpose is to specify the performance test methods for one-transistor-one-resistor storage cells.

Terminology and definitions for resistive (1T1R) memory cells, as well as test apparatus and test stimuli for the performance parameters of resistive memory cells.

and testing process.

GB/T 47239 (all parts) corresponds to IEC 62951 (all parts), unifying the testing of flexible and stretchable semiconductor devices.

Flexible and stretchable semiconductor devices Part 6: Sheet Resistance of Flexible Conductive Thin Films Test methods

1 Scope

This document defines the terminology and definitions for the thin-film resistance testing of flexible conductive films under bending test conditions, and describes the test method.

The methods include the two-probe method, the four-probe method, and the Montgomery method. These methods can be used for in-situ and ex-situ measurements, as well as anisotropic thin-film resistivity measurements.

Measurement.

2 Normative references

The contents of the following documents, through normative references within the text, constitute essential provisions of this document. Dated citations are not included.

For references to documents, only the version corresponding to that date applies to this document; for undated references, the latest version (including all amendments) applies.

This document.

GB/T 2918-2018 Standard environment for conditioning and testing of plastic specimens (ISO 291:2008, IDT)

3 Terms and Definitions

The following terms and definitions apply to this document.

resistivity

The reciprocal of electrical conductivity.

[Source. GB/T 2900.60-2002, 121.12.04] 3.2 RS Resistivity divided by the thickness of the conductive film.

resistance

For a resistive two-terminal element or two-terminal circuit with terminals A and B, the quotient of the voltage u_{AB} between the terminals divided by the current i in the element or circuit is.

$R = u_{AB}/i$

In the formula. if the direction of current i is from A to B, then current i is preceded by a positive sign; otherwise, it is preceded by a negative sign.