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GB/T 4937.44-2025

Semiconductor devices - Mechanical and climatic test methods - Part 44: Neutron beam irradiated single event effect (SEE) test method for semiconductor devices

半导体器件 机械和气候试验方法 第44部分：半导体器件的中子辐照单粒子效应（SEE）试验方法

(English Translation)

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Preview: page 1 of 5 shown, 10 in the full document. Complete English PDF, instant download:
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Table of Contents

Foreword
Introduction
1 Scope
2 Normative references
3 Terms and Definitions

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 44 of GB/T 4937, "Mechanical and Climatic Test Methods for Semiconductor Devices". GB/T 4937 has been published.

The following section.

---Part 1: General Provisions;

---Part 2: Low Pressure;

---Part 3: External Visual Inspection;

---Part 4: Highly Accelerated Steady-State Damp Heat Test (HAST);

---Part 8: Sealing;

---Part 10: Mechanical Impact Devices and Components;

---Part 11: Rapid Temperature Change in Two-Liquid Tank Method;

---Part 12: Sweep Frequency Vibration;

---Part 13: Salt Spray;

---Part 14: Lead Strength (Lead Wire Secureness);

---Part 15: Solder Heat Resistance of Through-Hole Mounting Devices;

---Part 16: Particle Collision Noise Detection (PIND);

---Part 17: Neutron Irradiation;

---Part 18: Ionizing Radiation (Total Dose);

Preview: page 2 of 5 shown, 10 in the full document. Complete English PDF, instant download:
https://chinastandards.org/standards/gb-t-4937-44-2025

---Part 19: Chip Shear Strength;

---Part 20: Combined Effects of Moisture and Soldering Heat on Molded Surface Mount Devices;

---Part 20-1.Handling, Packaging, Marking, and Shipping of Surface Mount Devices Sensitive to the Combined Effects of Moisture and Solder Heat;

---Part 21: Solderability;

---Part 22: Bond Strength;

---Part 23: High-Temperature Operating Life;

---Part 24: Accelerated Moisture Resistance Test with Unbiased Strong Accelerated Stress;

---Part 25: Temperature Cycling;

---Part 26: Electrostatic Discharge (ESD) Sensitivity Testing Human Model (HBM);

---Part 27: Electrostatic Discharge (ESD) Sensitivity Testing Machine Model (MM);

---Part 29: Latch Test;

---Part 30: Pretreatment of Unsealed Surface Mount Devices Prior to Reliability Testing;

---Part 31: Flammability of Molded Devices (Internal Causes);

---Part 32: Flammability of Molded Devices (Externally Caused);

---Part 33: Accelerated Moisture-Resistant, Non-Offset High-Pressure Cooking;

---Part 34: Power Cycling;

---Part 35: Acoustic Microscopy Inspection of Plastic-Encapsulated Electronic Components;

---Part 36: Steady-state acceleration;

---Part 37: Plate drop test method using accelerometers;

---Part 38: Soft Fault Testing Methods for Semiconductor Devices with Storage;

---Part 39: Measurement of moisture diffusivity and water solubility of organic materials for semiconductor devices;

---Part 40: Plate Drop Test Method Using Strain Gauges;

---Part 42: Temperature and Humidity Storage;

---Part 44: Test methods for single-event effects (SEE) by neutron irradiation on semiconductor devices.

This document is equivalent to IEC 60749-44:2016 "Mechanical and climatic testing methods for semiconductor devices - Part 44: Semiconductor devices" the experimental

Preview: page 3 of 5 shown, 10 in the full document. Complete English PDF, instant download:
https://chinastandards.org/standards/gb-t-4937-44-2025

method for single-event effect (SEE) neutron irradiation.

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

---The terms 3.21 MBU and 3.23 MCU have been deleted from Chapter 3, Terminology and Definitions, as they were duplicates of those in 3.3 and 3.4, respectively.

---Note 3 in section 3.5 has been deleted;

---Added notes to 4.2 and 6.3;

---Informative Appendix B includes additional information about the atmospheric neutron irradiation spectrometer at the my country Spallation Neutron Source;

---The references have been adjusted.

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 4937 "Semiconductor Devices" the "Mechanical and Climate Test Methods for Semiconductor Devices" is a fundamental and universal standard for testing semiconductor devices, used for evaluating and assessing semiconductors.

The device plays a crucial role in quality and reliability and is planned to consist of 44 parts.

---Part 1: General Principles. The purpose is to establish general guidelines for mechanical and climatic testing methods for semiconductor devices.

---Part 2: Low Pressure. The purpose is to test the ability of components and materials to avoid electrical breakdown failure.

---Part 3: External Visual Inspection. The purpose is to inspect whether the materials, design, structure, markings, and manufacturing processes of semiconductor devices meet the required standards.

Requirements for procurement documents.

---Part 4: Strong Accelerated Steady-State Damp Heat Test (HAST). The purpose is to specify the Strong Accelerated Steady-State Damp Heat Test (HAST) to detect...

Preview: page 4 of 5 shown, 10 in the full document. Complete English PDF, instant download:
https://chinastandards.org/standards/gb-t-4937-44-2025

To test the reliability of non-hermetically sealed semiconductor devices in humid environments.

---Part 5: Steady-State Temperature and Humidity Offset Lifetime Test. The purpose is to specify the steady-state temperature and humidity offset lifetime test to detect non-hermetic leaks.

Reliability of packaged semiconductor devices in humid environments.

---Part 6: High-Temperature Storage. The purpose is to investigate the effects of high-temperature storage on semiconductor devices without applying electrical stress.

---Part 7: Internal Moisture Measurement and Other Residual Gas Analysis. The purpose is to assess the quality of the packaging process and provide information on the gas content.

Information on the long-term chemical stability of the substance within the shell.

---Part 8: Sealing. The purpose is to detect the leakage rate of semiconductor devices.

---Part 9: Marking Durability. The purpose is to test the durability of markings on semiconductor devices.

---Part 10: Mechanical Shock Devices and Components. The purpose is to test semiconductor devices and printed circuit board assemblies against moderate stress.

The ability to adapt to shocks.

---Part 11: Rapid Temperature Change Two-Batter Method. The purpose is to define the rapid temperature change (two-batter method) for semiconductor devices.

The test procedures, failure criteria, and other related content.

---Part 12: Sweep Frequency Vibration. The purpose is to detect the effect of vibration on semiconductor devices within a specified frequency range.

---Part 13: Salt Spray. The purpose is to test the corrosion resistance of semiconductor devices.

---Part 14: Lead Strength (Lead Bonding). The purpose is to test the bonding strength of semiconductor device lead/package interfaces and leads.

Solid.

---Part 15: Solder Heat Resistance of Through-Hole Mounted Devices. The purpose is to test the solder heat resistance of through-hole mounted solid-state packaged semiconductor devices.

The ability to withstand the thermal stress generated by peak soldering or soldering leads with a soldering iron.

---Part 16: Particle Collision Noise Detection (PIND). The purpose is to specify a method for

Preview: page 5 of 5 shown, 10 in the full document. Complete English PDF, instant download:
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