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

**GB/T 42158-2023**

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**Micro-electromechanical systems technology (MEMS) -  
Description and measurement methods for micro trench and  
pyramidal needle structures**

微机电系统（MEMS）技术 微沟槽和棱锥式针结构的描述和测量方法

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### Foreword

This document is in accordance with the provisions of GB/T 1:1-2020 "Guidelines for Standardization Work Part 1: Structure and Drafting Rules for Standardization Documents" drafting: This document is equivalent to IEC 62047-26:2016 "Micro-electromechanical devices for semiconductor devices - Part 26: Description of micro-trench and needle structures Description and Measurement Methods": The following minimal editorial changes have been made to this document:

--- In order to further clarify the scope of application of the standard, the "needle structure" is changed to "pyramidal needle structure": In order to coordinate with the existing standards, the standard The quasi-name was changed to "Description and Measurement Methods of Micro-Groove and Pyramidal Needle Structures in Micro-Electro-Mechanical Systems (MEMS) Technology";

--- Corrected the error in the original text of IEC 62047-26:2016: In order to clearly show the cross-section of the sample, the "as in 4:2 in A:2:1:2 "As shown in Table 1" is changed to "as shown in Figure 1", and Table 1 of 4:2 does not give a cross-sectional view of the sample: Please note that some contents of this document may refer to patents: The issuing agency of this document assumes no responsibility for identifying patents: This document is proposed and managed by the National Micro-Electro-Mechanical Technology Standardization Technical Committee (SAC/TC336): This document was drafted by: Suzhou Institute of Quality and Standardization, China Machine Productivity Promotion Center Co., Ltd., Suzhou Lanxin Micro-Nano Technology Co., Ltd: Company, Southeast University, Suzhou Standardization Association, Meimoxinsheng (Hangzhou) Microelectronics Co., Ltd., Shenzhen Zhongtu Instrument Co., Ltd., Sichuan Fusheng Electric Co., Ltd., Shenzhen Meisi Advanced Electronics Co., Ltd., China National Accreditation Center for Conformity Assessment, Shenzhen Daoge Special Technology Co., Ltd: The main drafters of this document: Zhang Shuo, Gu Feng, Li Genzi, Shen Junjie, Yu Xiao, Zhou Zaifa, Wang Minrui, Jia Jianguo, Xu Baihong, Xu Keyu, Wang Zhiyuan, Liu Zhiguang:

microelectromechanical systems (MEMS) technology microgrooves and Description and Measurement of Pyramidal Needle Structure

## 1 Scope

GB/T 42158-2023 covers the description and measurement of micro trench and pyramidal needle structures in MEMS, adopting IEC 62047-26. These are the two shapes that anisotropic etching of silicon naturally produces, and they are the working parts of a great many devices: deep trenches isolate and store charge, pyramidal needles form microneedle arrays for transdermal delivery and the field emitter tips in vacuum microelectronics. Their geometry has to be stated unambiguously - sidewall angle, tip radius, aspect ratio - before it can be specified or measured. The standard sets the description of the microscale trench structure and of the pyramidal needle structure, each with its symbols, names and description rules, and the measurement methods, with informative annexes giving measurement examples and the dimensional measurement uncertainty. It took effect on 1 July 2023.

This document describes a microscale trench structure and a pyramidal needle structure and gives examples of measurements of the geometries of both structures: this document The depth of the middle groove structure is 1  $\mu\text{m}$ -100  $\mu\text{m}$ , the groove width and the groove interval width are both 5  $\mu\text{m}$ -150  $\mu\text{m}$ , and the aspect ratio is 0:0067-20: Pyramid needle structure has three or four faces, its height, lateral width and longitudinal width are 2  $\mu\text{m}$  or more, and the outer contour size can include Contained in a cube of side length 100  $\mu\text{m}$ : This document is applicable to the design of MEMS structures and the evaluation of the geometries after fabrication of MEMS structures:

## 2 Normative references

This document has no normative references:

## 3 Terms and Definitions

The following terms and definitions apply to this document: 3:

1 Trench structure trenchstructure Etching on the substrate forms one or more structures whose upper surface is rectangular and whose cross-section is consistent (identical) trapezoidal: 3:2 A pointed convex structure consisting of at least three faces on a planar base, the convex structure being on a vertical face of the planar base have a plane of symmetry: 3:3 trench array walandtrench A structure in which two or more trench structures are arranged in parallel at regular intervals: 3:4 corrugated structure scalop In the deep reactive ion etching (DRIE) process of silicon, polymer passivation protection and bottom selective etching in the trench are repeated multiple times: The irregular periodic undulating structure of the side wall formed by etching:

## 4 Description of Microscale Trench Structure

1 Overview This document presents a method for characterizing the cross-sectional geometry of microscale trench structures: Figure 1 shows the cross-sectional view required for characterization: trench junction The geometric shape of the cross-section of the structure is the cross-sectional shape at the straight line vertically intersecting the groove structure when viewed from the upper surface of the substrate, and the error is  $\pm 1^\circ$  or smaller: