

SEMI MS3-0307

TERMINOLOGY FOR MEMS TECHNOLOGY

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NOTICE: This document replaces SEMI PR11-1105 in its entirety.

1 Purpose

1.1 Micro Electro-Mechanical Systems (MEMS) technology, while related in many ways to integrated circuit and device technology, has many differences as well. Terminology for MEMS, in particular, often differs significantly. To promote common understanding and clear communication among suppliers, customers, and others in the field, these terms should be defined.

1.2 This terminology document covers definitions of terms used in MEMS technology, especially in those areas of greatest interest to the SEMI community.

2 Scope

2.1 This terminology covers terms describing generic attributes of MEMS devices and of materials and processes used in their manufacture. These attributes include electrical, structural, chemical, dimensional and other characteristics and nomenclature.

2.2 This terminology is applicable for use in connection with research, development, process control, inspection, and procurement of MEMS materials and structures.

2.3 Almost all of the terms for which definitions are listed are nouns. Unless the part of speech is given for any particular term, it can be assumed that the term is a noun.

NOTICE: This standard does not purport to address safety issues, if any, associated with its use. It is the responsibility of the users of this standard to establish appropriate safety and health practices and determine the applicability of regulatory or other limitations prior to use.

3 Limitations

3.1 Terms defined adequately for MEMS usage in standard English-language dictionaries are not further defined here.

4 Referenced Standards and Documents

4.1 ASTM Standard¹

E 2444 — Terminology Relating to Measurements Taken on Thin, Reflecting Films. Referenced definitions reprinted, with permission, from the Annual Book of ASTM Standards.

NOTICE: Unless otherwise indicated, all documents cited shall be the latest published versions.

5 Abbreviations and Acronyms

5.1 *DRIE* — Deep Reactive Ion-Etch, a dry-etch process used to create high-aspect-ratio structures in silicon.

5.2 *HARM* — High Aspect Ratio Micromachining.

5.3 *LIGA* — Lithographie, Galvanoformung und Abformung, the German words for lithography, electroforming, and molding; a micromachining technology used in the production of high-aspect ratio, precision microstructures.

5.4 *MEMS* — Micro Electro-Mechanical System (see also MST).

5.5 *MOEMS* — Micro Electro-Optical Mechanical System (i.e., MEMS having optical functionality).

5.6 *MST* — Micro-System-Technology. MST is a more common term than MEMS in Europe and Japan.

5.7 *SMD* — Surface-Mount Device

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5.8 *SMT* — Surface-Mount Technology

5.9 *SOI* — Silicon On Isolator, or Silicon On Insulator; a silicon wafer in which the active silicon layer is separated by an isolating layer (silicon dioxide) from the silicon substrate.

6 Definitions

6.1 *actuator* — a device that performs mechanical work using electric energy, chemical energy, or other energy forms.

6.2 *anchor* — in a surface-micromachining process, that portion of a structure which is attached to the underlying layer (see Figure 1).

6.3 *anchor lip* — in a surface-micromachining process, the extension of a structure around the edges of the anchor (see Figure 1).

6.4 *anisotropic etching* — process exploiting the occurrence of differing etch rates in different crystallographic directions in a material.

6.5 *aspect ratio* — the ratio of the long dimension to one of the other dimension(s) (width or length) of a two- or three-dimensional structure.

6.6 *backside patterning* — generation of images on the backside of wafers using masks

6.7 *bimetallic actuator* — a device that creates motion by exploiting the (usually thermal) properties of structures having two metallic layers (bimetal).

6.8 *BioMEMS* — MEMS for biological, biomedical or certain analytical applications.

6.9 *bonding* — a process of joining irreversibly two substrates face-to-face.

6.10 *bonding aligner* — a tool that positions patterned substrates prior their being bonded.

6.11 *bonding, anodic* — a technique for bonding a glass substrate, which contains movable ions, to an electrically conducting substrate (e.g., silicon, metal).

6.12 *bonding, diffusion* — joining materials by heating them below their melting points while pressing them together to achieve solid state adherence by interdiffusion of their atoms.

6.13 *bonding, eutectic* — joining of mutually soluble (usually metallic) materials by an alloy of both having a melting point lower than that of either material.

6.14 *bonding, glass frit* — a process of adhering two or more wafers using a low melting point glass powder (frit) as an intermediate layer.

6.15 *bonding, low temperature* — wafer bonding process by surface activation, during which the temperature stays below 150°C.

6.16 *bonding, thermal compression* — a process using heat and pressure to cause plastic flow of materials for bonding.

6.17 *bonding, thermosonic* — a process using pressure, elevated temperature, and high frequency vibrational energy for wafer bonding (see *bonding, ultrasonic*).

6.18 *bonding, ultrasonic* — a process using pressure and high frequency vibrational energy for wafer bonding (see *bonding, thermosonic*).

6.19 *bonding, wafer* — a process that creates permanent face-to-face attachment between two substrates (see *wafer*).

6.20 *Bosch process* — a proprietary silicon micromachining technique using alternating DRIE and deposition to create deep structures with vertical walls, such as high aspect ratio holes or posts.

6.21 *breaking strength* — the stress acting in a solid material at the moment when it is broken by external force [ASTM E 2444].

6.22 *bulk micromachining* — a MEMS fabrication process by which substrate material is removed precisely at specified locations.

6.23 *chemical machining* — a process that forms structures of desired geometry, dimensions, and surface conditions by concentrating or limiting chemical dissolution in specific locations on a material.

6.24 *comb drive* — an electrostatically actuated MEMS device, incorporating interdigitated fingers, used in inertial sensors and RF resonators.

6.25 *cell handling* — manipulation or treatment of biological cells.