



Standard Test Method for Thickness and Thickness Variation of Silicon Wafers¹

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1. Scope

1.1 This test method² covers measurement of the thickness of silicon wafers, polished or unpolished, and estimation of the variation in thickness across the wafer.

1.2 This test method is intended primarily for use with wafers that meet the dimension and tolerance requirements of SEMI Specifications M 1. However, it can be applied to circular silicon, wafers or substrates of any diameter and thickness that can be handled without breaking.

1.3 This test method is suitable for both contact and contactless gaging equipment. Precision statements have been established for each.

1.4 The values stated in inch-pound units are to be regarded as standard. The values in parentheses are for information only.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 SEMI Standard:

Specifications M 1, for Polished Monocrystalline Silicon Wafers³

2.2 Federal Standards:

Fed. Std. No. 209B Clean Room and Work Station Requirements, Controlled Environment⁴

Fed. Spec. GGG-G-15C Gage Blocks and Accessories (Inch and Metric), Nov. 6, 1970⁵

3. Terminology

3.1 Definitions:

3.1.1 *back surface*—of a semiconductor wafer, the exposed surface opposite to that upon which active semiconductor devices have been or will be fabricated.

3.1.2 *front surface*—of a semiconductor wafer, the exposed surface upon which active semiconductor devices have been or will be fabricated.

3.1.3 *thickness*—of a semiconductor wafer, the distance through the wafer between corresponding points on the front and back surfaces.

3.1.4 *total thickness variation, TTV*—of a semiconductor wafer, the difference between the maximum and minimum values of the thickness of the wafer.

4. Summary of Test Method

4.1 The thickness of the wafer is measured at its center and at four other sites whose positions are defined with respect to the primary flat or other index mark. Two of the sites fall along a diameter and two along a second diameter, perpendicular to the first.

4.2 The thickness measured at the center of the wafer is generally taken as the nominal thickness of the wafer.

4.3 The maximum difference between any two of the five thickness measurements is taken as the total thickness variation of the wafer.

5. Significance and Use

5.1 Wafer thickness and thickness variations must be controlled to suit the requirements of fixtures and equipment used in microelectronic processing. Estimates of these parameters, based on a representative sample from a given lot of wafers, will aid in determining whether or not wafers from that lot are acceptable for the intended processing steps.

5.2 Wafers that are too thin may break during normal processing operations. Wafers that are too thick may cause mechanical jamming. Wafers with thicknesses outside the desired tolerance may not have appropriate thermal mass or electrical resistance for certain processing steps.

5.3 Excessive thickness variations may cause problems with mechanical handling of the wafers during processing. In addition, such variations may cause deviations from surface flatness that adversely affect photolithographic processes. The effect of thickness variations on photolithographic processes

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² DIN 50441/1 is an equivalent method. It is the responsibility of DIN Committee NMP 221, with which Committee F-1 maintains close liaison. DIN 50441/1. Determination of the Geometric Dimensions of Semiconductor Slices; Measurement of Thickness, available from Beuth Verlag, GmbH, Burggrafenstrasse 4-10, D-1000 Berlin 30, Federal Republic of Germany.

³ Available from Semiconductor Equipment and Materials International, 805 East Middlefield Rd., Mountain View, CA 94043.

⁴ Available from GSA Business Service Centers in Boston, New York, Atlanta, Chicago, Kansas City, Mo., Fort Worth, Denver, San Francisco, Los Angeles, and Seattle.

⁵ Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.