



Designation: F 2074 – 00

Standard Guide for Measuring Diameter of Silicon and Other Semiconductor Wafers¹

This standard is issued under the fixed designation F 2074; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

INTRODUCTION

This guide is proposed to replace ASTM Test Method F 613-93, Standard Test Method for Measuring Diameter of Semiconductor Wafers. That test method is being withdrawn because the reported measurement precision achievable with that test method is not adequate for current wafer technology. This guide is intended to be used with measurement technology appropriate for the application, but it includes no recommendations as to such measurement technology.

1. Scope

1.1 This guide defines standardized positions for measuring diameter of circular wafers of silicon and other semiconducting materials that contain flats or notches on the periphery. It was developed for use with silicon wafers with standard diameter and flat positions as given in SEMI Specifications M1.

1.2 It may be applied to other semiconductor wafers if the flat locations are properly taken into account.

1.3 Wafers of any size can be measured provided that suitable test jigs and instruments are available.

1.4 Roundness of wafers cannot be determined from measurements made solely at the positions defined in this guide. No information is provided concerning the diameter of the wafer at points other than those measured.

2. Referenced Documents

2.1 SEMI Standards²

Specifications M1, for Polished Monocrystalline Silicon Wafers

Specification M20, for Establishing a Wafer Coordinate System

3. Terminology

3.1 Definitions:

3.1.1 *diameter*—of a semiconductor wafer, the linear dimension across the surface of a circular wafer that contains the wafer center and excludes flats or other peripheral fiducial geometries.

¹ This guide is under the jurisdiction of ASTM Committee F01 on Electronics and is the direct responsibility of Subcommittee F01.06 on Silicon Materials and Process Control.

Current edition approved Dec. 10, 2000. Published February 2001.

² Available from Semiconductor Equipment and Materials International, 3081 Zanker Rd., San Jose, CA 95134, www.semi.org.

3.1.2 *indent*—of a semiconductor wafer, an edge defect that extends from the front surface to the back surface.

4. Significance and Use

4.1 The diameter of semiconductor wafers is an important parameter in microelectronic fabrication. Wafer diameters must conform to the limits specified in SEMI M1; or other agreed upon limits, or product that is otherwise suitable may not fit correctly in process equipment.

4.2 Cam-follower edge rounding usually results in wafers that are circular. However, wafers ground with edge-follower edge rounding equipment may be elliptically shaped. Measurements made at the three positions specified in this guide do not provide complete information about the roundness of the wafer.

5. Interferences

5.1 If an indent or uneven edge occurs at the periphery of the wafer at the measurement position, the resulting diameter measurement will be in error.

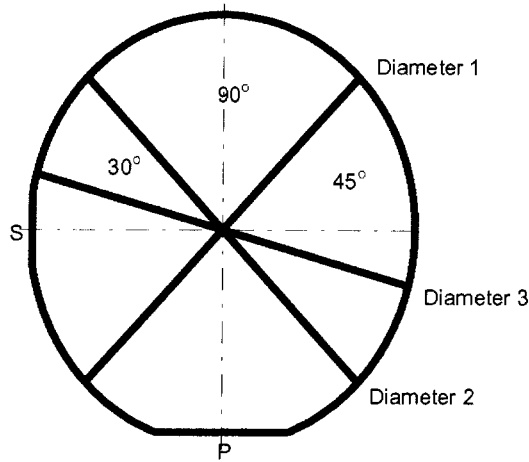
5.2 If the wafer is not circular, the measured diameter may differ from that found by other means.

6. Measurement Positions

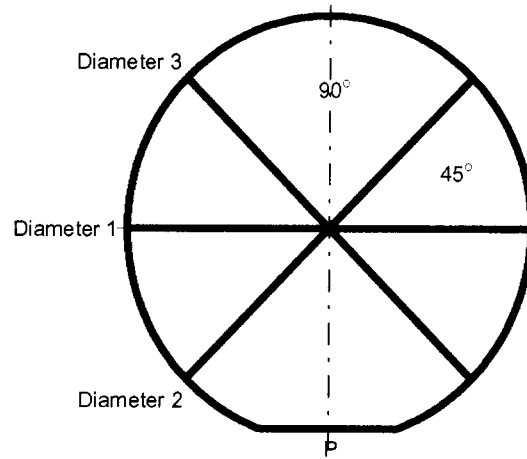
6.1 Measure the diameter at positions listed in Table 1. See Fig. 1. The angular positions in this table are given in degrees from the x-axis as defined in SEMI M20.

6.2 Calculate the diameter of the wafer as the average of the diameters measured at the three positions.

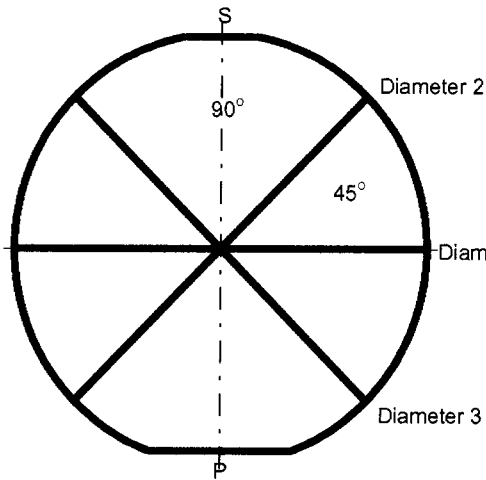
6.3 The relationships between wafer configurations and wafer conductivity types and orientations as defined in SEMI M1 are given in Table 2.



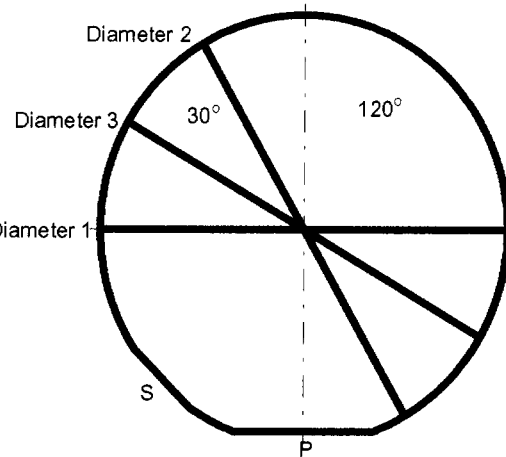
Configuration 1: flatted p [100] wafer with secondary flat



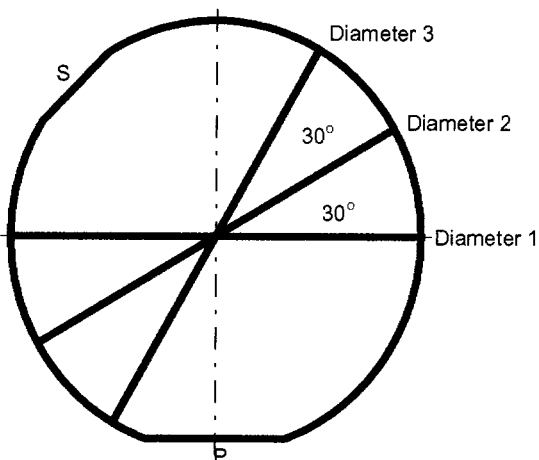
Configuration 2: any notched or flatted wafer without a secondary flat regardless of type or orientation (including flatted p [111] wafer)



Configuration 3: flatted n [100] wafer with secondary flat (diameter 125 mm and smaller)



Configuration 4: flatted n [111] wafer with secondary flat



Configuration 5: flatted n [100] wafer with secondary flat (diameter 150 mm only)

P = primary flat or notch location
S = secondary flat location

FIG. 1 Diameter Measurement Positions by Wafer Fiducial Category