

Your Guide to SEMI Specifications for Si Wafers

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A. Introduction

The full set of SEMI Specifications for Si Substrates and related SEMI Specification documents are extensive. In this brief article we outline the general contents of the SEMI Specifications for Si substrates referred to as SEMI M1-0302 & SEMI M1.1-M1.15. Please refer to the link at the VSI web site (Technology Library) for SEMI M1-0302, M1.1-M1.15 in order to fully review in detail the actual specifications. The file is a PDF file containing text, figures, diagrams, and tables.

The specifications cover the requirements for monocrystalline high purity silicon wafers used in the microelectronics and semiconductor industry. Terms, definitions, and all the specifications for wafer characteristics are included. These specifications are for single side polished wafers. US customary units are used to define 2" and 3" product, whereas SI (system international) units are designated for wafer diameters greater than 80mm. The PDF file contains the up-to-date SEMI specifications (as of June 2002) that have been technically approved by the Global Wafer Committee and are the responsibility of the North American Silicon Wafer Committee.

B. Your Guide to SEMI M1-0302

The entire PDF file for SEMI-0302 is approximately 50 pages long. Pages 1-27 of this document contain text, tables, figures, and diagrams related to all the essential specifications for Si wafers as outlined by SEMI. The table below is a quick reference for locating the necessary information.

General Topic	General Details	Page Numbers
Terms and Definitions	Many of the general and technical terms used when describing Si Wafers or Si Wafer Technology are defined.	See pgs 1-10
Test Methods	Test Methods used for measuring Si wafer characteristics are defined. These include measurement of thickness, orientation, dimension, etc.	See pgs 11-13
Defect Definitions	The defect definitions relevant to SEMI Specifications and Si wafers in general are defined and described. These include definitions for scratches, particulates, cracks, haze, etc.	See pgs 13-15
Crystallographic Orientation	The general definitions and descriptions for orientation are given.	See page 16

Edge Contours and Rounding	Diagrams and definitions for edge rounding are given.	See page 17
Flats and Notches	Diagrams and text are given to describe the locations and characteristics of wafer Flats and Notches.	See pgs 18,19
Surface Metal Contamination	Specifications and guidelines for surface metal contamination are given.	See pgs 26,27

C. Your Guide to SEMI M1-0302 attachments M1.1 – M1.15

Approximately the last 25 pages of the document are individual Tables outlining the full set of SEMI Specifications for each specific wafer type (i.e. 2”, 3”, 100mm, etc.). These tables very thoroughly, concisely, and accurately identify and define the SEMI Specifications for the wafer. Each wafer type includes about 2 pages of specification details. The following classifications are included and delineated.

- *Standard for 2 inch Polished Monocrystalline Silicon Wafers, (SEMI M1.1-89, Re-approved 0299)*
- *Standard for 3 inch Polished Monocrystalline Silicon Wafers, (SEMI M1.2-89, Re-approved 0299)*
- *Standard for 100mm Polished Monocrystalline Silicon Wafers (525 um thickness), (SEMI M1.5-89, Re-approved 0699)*
- *Standard for 100mm Polished Monocrystalline Silicon Wafers (625 um thickness), (SEMI M1.6-89, Re-approved 0699)*
- *Standard for 125mm Polished Monocrystalline Silicon Wafers, (SEMI M1.7-89, Re-approved 0699)*
- *Standard for 150mm Polished Monocrystalline Silicon Wafers, (SEMI M1.8-89, Re-approved 0699)*
- *Standard for 200mm Polished Monocrystalline Silicon Wafers, (Notched), (SEMI M1.9-89, Re-approved 0699)*
- *Standard for 200mm Polished Monocrystalline Silicon Wafers, (Fatted), (SEMI M1.9-89, Re-approved 0699)*
- *Standard for 100mm Polished Monocrystalline Silicon Wafers Without Secondary Flat (525 um thickness), (SEMI M1.11-90, Re-approved 0299)*
- *Standard for 125mm Polished Monocrystalline Silicon Wafers Without Secondary Flat, (SEMI M1.12-90, Re-approved 0299)*
- *Standard for 150mm Polished Monocrystalline Silicon Wafers Without Secondary Flat (625 um thickness), (SEMI M1.13-0699)*
- *Guidelines for 350mm and 400mm Polished Monocrystalline Silicon Wafers, (SEMI M1.14-96)*
- *Standard for 300mm Polished Monocrystalline Silicon Wafers, (Notched), (SEMI M1.15-0302)*

These documents for each wafer classification are included in the PDF file and should be referred to in order to learn the full set of SEMI Specifications for each wafer type. Below is a quick reference table regarding diameter, thickness, primary flat length, secondary flat length, and flat or notch location for 2” through 125mm diameter wafers.

Spec.	2"	3"	100mm	125mm
Diameter	2.000+/-0.015" 50.8+/-0.38mm	3.000+/-0.025" 76.2+/-0.63mm	100+/-0.5mm	125+/-0.5mm
Thickness	0.011+/-0.001" 279+/-25um	0.015+/-0.001" 381+/-25um	525+/-20 um or 625+/-20um	625+/-20um
Primary Flat Length	0.625+/-0.065" 15.88+/-1.65mm	0.875+/-0.125" 22.22+/-3.17mm	32.5+/-2.5mm	42.5+/-2.5
Secondary Flat Length	0.315+/-0.065" 8+/-1.65mm	0.44+/-0.06" 11.18+/-1.52mm	18.0+/-2.0mm	27.5+/-2.5
Primary Flat Location	{110}+/-1 deg.	{110}+/-1 deg.	{110}+/-1 deg.	{110}+/-1 deg.

Below is a quick reference table regarding diameter, thickness, primary flat length, secondary flat length, and flat or notch location for 150mm through 300mm diameter wafers.

Spec.	150mm	200mm	300mm
Diameter	150+/-0.2mm	200+/-0.2mm	300+/-0.2mm
Thickness	675+/-20um or 625+/-15um	725+/-20um	775+/-20um
Primary Flat Length	57.5+/-2.5mm	Notch	Notch
Secondary Flat Length	37.5+/-2.5mm		
Primary Flat Location	{110}+/-1 deg.	{110}+/-1 deg.	{110}+/-1 deg.

D. Summary

The Si wafer industry has extremely well defined SEMI specifications, and a general outline as to how to properly locate these specifications is given here. Specifications for thin wafers, Double Side Polished wafers, strange diameter wafers, 1" wafers, and other custom and semi-custom wafers are not strictly related to the SEMI M1-0302 protocols.

E. References

1. SEMI M1-0302, PDF file downloaded from SEMI site, June 2002