

SEMI P33-0998 (Withdrawn 0706) PROVISIONAL SPECIFICATION FOR DEVELOPMENTAL 230 mm SQUARE HARD SURFACE PHOTOMASK SUBSTRATES

This standard was technically approved by the global Micropatterning Committee. This edition was approved for publication by the global Audits and Reviews Subcommittee on May 16, 2006. It was available at www.semi.org in June 2006. Originally published in 1998.

NOTICE: This Document was balloted and approved for withdrawal in 2006.

1 Purpose

1.1 To define the dimensional requirements for nominally square hard surface photomask substrates of 230 mm nominal edge length for research on, and development of, process and manufacturing equipment, pellicles, carriers, other accessory materials, and any related mask designs.

2 Scope

2.1 This specification covers information pertaining to glass substrates for 230 mm square hard surface photomasks. This information includes, but is not limited to, physical dimensions, testing criteria, and measurement criteria.

NOTICE: SEMI Standards and Safety Guidelines do not purport to address all safety issues associated with their use. It is the responsibility of the users of the Documents to establish appropriate safety and health practices, and determine the applicability of regulatory or other limitations prior to use.

3 Referenced Standards and Documents

3.1 ANSI/ASQ Standard¹

ANSI/ASQ Z1.4 — Sampling Procedures and Tables for Inspection by Attributes

3.2 ASTM Standard²

ASTM E228 — Test for Linear Thermal Expansion of Rigid Solids with a Vitreous Silical Dilatometer

3.3 Federal Standard³

FED-STD-209E — Clean Room and Work Station Requirements, Controlled Environments

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

4 Terminology

4.1 Definitions

4.1.1 *230 mm* — the nominal edge length for the reticle generation defined in this specification. Also referred to as “9 inch” size.

4.1.2 *critical side* — major side intended for patterning. The critical side has no chamfered corner(s) (see § 9.2), and has flatness equal to or better than the noncritical side (see § 8.1).

4.1.3 *noncritical side* — major side not intended for patterning. Any and all chamfered corners are on the noncritical side (see § 9.2, Figures 5 and 6).

NOTE 1: Selected terms relating to photomasking are given for information only in Appendix 2, Related Information.

¹ American National Standards Institute, 25 West 43rd Street, New York, NY 10036, USA; Telephone: 212.642.4900, Fax: 212.398.0023, <http://www.ansi.org>

² ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, USA; Telephone: 610.832.9585, Fax: 610.832.9555, <http://www.astm.org>

³ Federal Standard, available from <http://www.everyspec.com>

5 Ordering Information

5.1 Purchase orders for hard surface photomask substrates furnished to this specification shall include the following:

5.1.1 Nominal edge length, nominal thickness dimension, edge criteria, and parallelism of major sides (see § 6);

5.1.2 Material (see § 7);

5.1.3 Flatness quality area and flatness Total Indicated Reading (TIR; see § 8);

5.1.4 Visual quality area (see § 9); and

5.1.5 Lot acceptance criteria (see § 10).

6 Dimensions and Permissible Variations

6.1 The substrates shall conform to the dimensional tolerances appropriate to the nominal edge length and thickness as listed in Table 1. Dimensions are illustrated in Figure 1, and a fixture for measuring the squareness dimensions is shown in Figure 2.

6.2 Substrates shall have beveled edges. The edges shall conform to the dimensional tolerances appropriate to the nominal thickness listed in Table 2. Dimensions are illustrated in Figure 3.

6.3 The major sides of square substrates shall be parallel within 5.0 μm along both major axes. Measurements are taken within the quality flatness area, along both major axes. Calculation of parallelism is illustrated in Figure 7.

7 Material Specifications

7.1 Substrate materials shall be specified “ultra low thermal expansion” (ULTE). An example of ULTE material is fused silica (quartz).

7.2 Selected physical properties of ULTE materials are provided for information only in Appendix 1.

8 Flatness Specifications

8.1 Substrates shall be supplied with two major sides having flatness (TIR) of 1, 2, or 5 μm over a square quality flatness area as defined in Figure 4. Sides are not required to have equivalent flatness. (NOTE: 0.5 μm is not yet available but is widely expected in the near future. Flatness of 0.5 μm is very desirable for semiconductor production, and equipment suppliers may want to consider this in their designs.)

9 Visual Criteria

9.1 A visual quality area, which may or may not correspond with the flatness area, shall be agreed upon between the user and supplier.

9.2 Fused silica (ULTE) substrates shall be identified with one corner chamfer as shown in Figure 5. Dimensions of the chamfer shall be as specified in Figure 6. The corner chamfer is made only on the non-critical side of the substrate.

10 Sampling

10.1 Unless otherwise specified, appropriate sample sizes shall be selected from each lot in accordance with ANSI/ASQ Z1.4. Each quality characteristic shall be assigned an acceptable quality level (AQL) in accordance with ANSI/ASQ Z1.4 definitions for critical, major, and minor classifications. If desired, and so specified in the contract or order, each of these classifications may alternatively be assigned cumulative AQL values. Inspection levels shall be agreed upon between user and supplier.

11 Test Methods

11.1 *Thermal Expansion* — Determine in accordance with ASTM E228.

11.2 Flatness (to be agreed upon between user and supplier).

11.3 Visual (to be agreed upon between user and supplier).

11.4 Parallelism (to be agreed upon between user and supplier; non-contact methods are preferred).

12 Handling

12.1 Substrates are to be handled on the edges only. Substrates are to be handled with gloves approved for cleanroom use, when human handling is required.

13 Orientation

13.1 For ULTE substrates with a single corner chamfer (see § 9.2), it is recommended that all orientation be performed referencing the corner of the substrate diagonally opposite the chamfer. See Figure 8 for more information.

14 Certification

14.1 Upon request of the purchaser in the contract or order, a manufacturer's or supplier's certification that the material was manufactured and tested in accordance with this specification, together with a report of the test results, shall be furnished at the time of shipment.

15 Packing and Marking

15.1 Substrates shall be packed in a class 100 environment as defined by FED-STD-209E. Containers shall be designed to prevent glass-to-glass contact, and to protect the substrates from contamination in handling and transit. Substrates shall be shipped with the critical side toward the front or bottom of the shipping carrier, depending on carrier configuration. The substrate shipping position shall be indicated on each container. Packaging shall comply with the applicable internal, national, state, and local laws and regulations required for shipping.

15.2 Containers shall be labeled **“Warning: Open and Handle Under Cleanroom Conditions Only”** as well as identified by user purchase order number (if applicable), drawing number (if applicable), quantity, supplier lot number, and material identification.

Table 1 Specifications for Edge Length, Squareness, and Thickness for Square Substrates

<i>Nominal Edge Length</i>	<i>Edge Length Minimum</i>	<i>Edge Length Maximum</i>	<i>Squareness</i>	<i>Thickness Minimum</i>	<i>Thickness Maximum</i>	<i>Units</i>
230 mm	229.6	230.0	0.186/213	8.90	9.10	mm

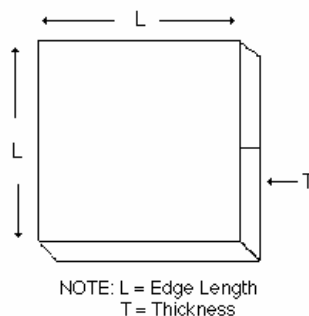


Figure 1
Square Hard Surface Photomask Substrate

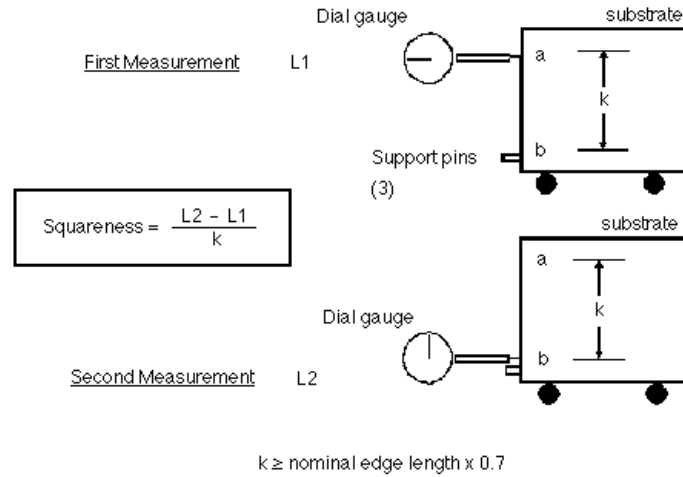


Figure 2
Measurement Fixture and Calculation to Determine Substrate Squareness

Table 2 Specifications for Beveled and Rounded Edge Dimensions

<i>T</i>	<i>A</i>	<i>A</i>	<i>B</i>	<i>B</i>	<i>C</i>	<i>C</i>	
<i>Nominal</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Units</i>
9.00	0.20	0.60	0.20	0.60	2.00	3.00	mm

#1 "D" is radius of curvature of concerns.

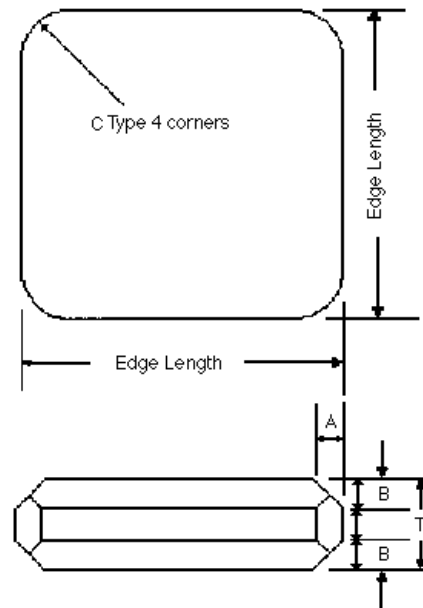


Figure 3
Beveled Edge Dimensions