

SEMI P1-83

SEMI SPECIFICATION FOR HARD SURFACE PHOTOMASK (PROPOSED)

General Requirements

1 Preface

This specification covers the general requirements of the glass substrate for hard surface photomasks.

2 Applicable Documents

2.1 ASTM Standards

ASTM E122 — Recommended Practice for Choice of Sample Size to Estimate Average Quality of a Lot or Process.
ASTM, 1916 Race Street, Philadelphia, PA 19103

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

ASTM F127 — Definitions of Terms Relating to Photomasking Technology for Microelectronics

MIL-STD-105D — Sampling Procedures and Tables for Inspection by Attributes

Federal Standard 209B — Clean Room and Work Station Requirements, Controlled Environment. Military Standards Commanding Officer, U.S. Naval Supply depot, Attn: Code DMD; 5801 Tabor Ave., Philadelphia 20, Pennsylvania

3 Definitions

See SEMI Definitions for Photomasking Technology and Tentative Revision to ASTM F127.

4 Ordering Information

4.1 Purchase orders for hard surface photomasking substrates furnished to this specification shall include the following:

Dimension	Paragraph 5
Material	Paragraph 6
Flatness Criteria	Paragraph 7
Visual Criteria	Paragraph 8
Lot Acceptance	Paragraph 9

5 Dimensions and Permissible Variations

The material shall conform to the dimensions and dimensional tolerances as specified in SEMI Standard P1.1.STD.1, Standard for Hard Surface Photomask Substrates.

6 Material Specifications

6.1 Thermal Characteristics 0–300°C

6.1.1 *HTE, high thermal expansion (e.g., white crown, soda lime)*. Coefficient of expansion between 80–100⁻⁷/°C.

6.1.2 *LTE, low thermal expansion (e.g., borosilicates)*. Coefficient of expansion from 30–50 × 10⁻¹/°C.

6.1.3 *ULTE, ultra low thermal expansion (e.g., fused silica)*. Coefficient of expansion less than 10 × 10⁻¹/°C.

6.2 Transmission Characteristics

6.2.1 HTE Photomask Substrates

	<i>Minimum % @</i>
<i>Wavelengths</i>	<i>1.5 mm Thickness*</i>
365 nanometers	80%
405 nanometers	85%
436 nanometers	90%

6.2.2 LTE Photomask Substrates

	<i>Minimum % @</i>
<i>Wavelengths</i>	<i>1.5 mm Thickness*</i>
365 nanometers	80%
405 nanometers	85%
436 nanometers	90%

*After correction for surface reflection

6.2.3 ULTE Photomask Substrates

	<i>Minimum % @</i>
<i>Wavelengths</i>	<i>1.5 mm Thickness*</i>
230 nanometers	To be agreed upon between supplier and user
254 nanometers	70%
365 nanometers	85%
405 nanometers	90%

*After correction for surface reflection

6.3 Physical Properties

Information on the following properties is provided for information only. (See Appendix 1)

6.3.1 Poissons Ratio

6.3.2 Density

6.3.3 Young Modulus

6.3.4 Modulus of Elasticity

6.3.5 Index of Refraction

6.3.6 Volume Resistivity

7 Flatness Area

7.1 Flatness Quality Area

7.1.1 *Circular Flatness Quality Area* (See SEMI Standard P1.1.STD.2 for Flatness of Hard Surface Photomask Substrates)

7.1.2 *Square Flatness Quality Area* (See SEMI Standard P1.1.STD.2 for Flatness of Hard Surface Photomask Substrates)

8 Visual Criteria

8.1 Visual Quality Area to be agreed upon between the supplier and user.

8.2 Defect Limits (See P1.1.STD.4)

Minimal Conditions or Dimensions — Minimal conditions or dimensions for defects are listed in P1.1.STD.4 and shall be used for determining substrate acceptability unless other minimal limiters are agreed upon by the interested parties. Terminology for P1.1.STD.4 the Book of SEMI Standards definitions and ASTM F127.

8.3 Glass Identification (See P1.1.STD.5)

9 Sampling

Unless otherwise specified, Recommended Practice ASTM E122 shall be used. When so specified, appropriate sample sizes shall be selected from each lot in accordance with MIL-STD-105D. Each quality characteristic shall be assigned an acceptable quality level (AQL) and lot total percent defective (LTPD) value in accordance with MIL-STD-105D definitions for critical, major and minor classifications may alternatively be assigned cumulative AQL and LTPD values. Inspection levels shall be agreed upon between the supplier and the user.

10 Test Methods

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

10.2 *Transmission* (to be agreed upon between the supplier and user)

10.3 *Flatness* (to be agreed upon between the supplier and user)

10.4 *Visual* (to be agreed upon between the supplier and user)

11 Handling

Substrates are to be handled on the edges only. Substrates are to be handled only with clean room approved gloves.

12 Certification

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.

13 Packing and Material

13.1 Substrates shall be packed in a class 100 environment as defined by Federal Standard 209B. 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 acceptable flatness side toward the front of the box. This orientation shall be indicated on each container. Packing shall comply with the applicable international, national, state, and local laws and regulations required for shipping.

13.2 Containers shall be labeled "Warning: Open and Handle Under Clean Room Conditions Only." Each shipment shall be identified by user purchase order number, drawing number (if applicable), quantity, vendor lot number and material identification.

SEMI STANDARD P1.1.STD.1 FOR HARD SURFACE PHOTOMASK SUBSTRATES

PLATE SIZE			Maximum Diagonal Difference	PLATE THICKNESS			
Dimension	Tolerance			Dimension	Tolerance		Units
	Min.	Max.			Min.	Max.	
2 ½ in. Square	62.74	63.50	1.14	1.52	1.40	1.65	mm
	2.470	2.500	.045	.060	.055	.065	in.
3 in. Square	75.44	76.20	1.14	1.52	1.40	1.65	mm
	2.970	3.000	.045	.060	.055	.065	in.
3 ½ in. Square	88.14	88.90	1.40	1.52	1.40	1.65	mm
	3.470	3.500	.055	.060	.055	.065	in.
4 in. Square	100.84	101.60	1.52	1.52	1.40	1.65	mm
	3.970	4.000	.060	.060	.055	.065	in.
				2.29	2.16	2.41	mm
				.090	.085	.095	in.
				6.35	6.22	6.48	mm
				.250	.245	.255	in.
5 in. Square	126.24	127.00	1.91	1.52	1.40	1.65	mm
	4.970	5.000	.075	.060	.055	.065	in.
				2.29	2.16	2.41	mm
				.090	.085	.095	in.
				6.35	6.22	6.48	mm
				.250	.245	.255	in.
6 in. Square	151.64	152.40	2.29	2.29	2.16	2.41	mm
	5.970	6.000	.090	.090	.085	.095	in.
				3.05	2.92	3.18	mm
				.120	.115	.125	in.
				6.35	6.22	6.48	mm
				.250	.245	.255	in.