

SEMI D26-1000

PROVISIONAL SPECIFICATION FOR LARGE AREA MASKS FOR FLAT PANEL DISPLAYS (NORTH AMERICA)

This specification was technically approved by the Global Flat Panel Display Committee and is the direct responsibility of the North American Flat Panel Display Committee. Current edition approved by the North American Regional Standards Committee on July 14, 2000. Initially available on SEMI OnLine August 2000; to be published October 2000.

1 Purpose

1.1 This specification establishes a set of standards to assist in specifying and ordering large area masks for the Flat Panel Display industry. A major objective is to improve the cycle time, order process efficiency and reduce the overall cost of manufacturing for both the mask maker and the customer.

1.2 This specification is intended for use in North America as an emerging market. However, the applicability of this specification is not restricted or limited to this region alone. This standard was developed to address a North American need for a common set of requirements for specifying, manufacturing, and ordering large area masks.

2 Scope

2.1 The following areas are covered by this document:

- 2.1.1 Registration and Accuracy
- 2.1.2 Critical Dimensions
- 2.1.3 Centrality
- 2.1.4 Pellicles
- 2.1.5 Edge Length and Thickness
- 2.1.6 Symbology
- 2.1.7 Data Formats
- 2.1.8 Auto Inspection Artifacts
- 2.1.9 Product Labeling

2.2 This specification is being issued so that the industry may evaluate the concept covered before its adoption as a full standard. It is expected that initial application will occur mostly in North America, however, nothing in this standard limits its use to this market region.

2.3 This standard does not purport to address safety issues, if any, associated with its use. It is the responsibility of the user of these standards to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

3 Limitations

3.1 The document does not seek to be comprehensive. Instead, the areas listed are meant to help move the current industry towards an agreed upon set of standards that are useful in reducing the overall cost of supplying masks for use by FPD manufacturers. The document only describes 1X full field masks up to 620 × 720 mm for all display types except for Plasma, TN and STN LCD technologies.

4 Referenced Standards

NOTE: As listed or revised, all documents cited shall be the latest publications of adopted standards.

4.1 SEMI Standards

SEMI D6 — Specification for Edge Length and Thickness for Flat Panel Display Mask Substrates

SEMI P1 — Specification for Hard Surface Photomask Substrates

SEMI P5 — Specification for Pellicles

SEMI P6 — Specification for Registration Marks for Photomasks

SEMI T8 — Specification for Marking of Glass Flat Panel Display Substrates with a Two-Dimensional Matrix Code Symbol

4.2 AIM International Technical Specifications¹

AIM International Symbology Specification – Data Matrix

5 Terminology

Each section of the document defines the terms used in that section, with the exception of:

5.1 *alignment bar, of a data matrix symbol* — A solid line of contiguous filled cells abutting a line of alternatively filled and empty cells (AIM International Symbology Specification Data Matrix)

¹ AIM International Inc., 11860 Sunrise Valley Drive, Suite 100, Reston, VA 20191, tel y703.391.7621, fax 703.391.7624

5.2 *border column* — The outermost column of a data matrix code symbol. This column is a portion of the finder pattern.

5.3 *border row* — The outermost row of a data matrix code symbol. This row is a portion of the finder pattern.

5.4 *cell, of a data matrix code symbol* — The area within which a dot may be placed to indicate a binary value.

6 Ordering Information

6.1 Purchase orders for substrates furnished to this specification shall include the following items:

Checklist:

6.2 Edge length

6.3 Long reference edge

6.4 Short reference edge

6.5 Orientation corner dimensions

6.6 Quality edge area exclusion

6.7 Thickness

6.8 Tolerance for all specified dimensions

6.9 Warp

6.10 Marking

6.10.1 Marking message characters

6.10.1.1 Quantity (46 to mm, where mm = 72)

6.10.1.2 Content of message characters related to Customer Specification Number, and message characters 47 and up, if present.

6.10.1.3 Location of mark, if different from Section 9.5.5

7 Requirements

7.1 *Materials Specification* — Substrate material shall be specified as high thermal expansion (HTE), medium thermal expansion (MTE), low thermal expansion (LTE), or ultra low thermal expansion (ULTE). Examples of HTE materials are soda lime glasses; examples of ULTE materials are synthetic quartz glasses. Substrate materials shall conform to thermal expansion and optical transmittance characteristics specified in SEMI P1. Selected physical properties of HTE, MTE, LTE, and ULTE materials are provided for information in SEMI P1.

7.2 *Overlay* — Overlay refers to alignment of the printed pattern of one mask to another of the same set. Overlay error shall not exceed $\pm 6.0 \mu\text{m}$ for soda lime plates and $\pm 2.0 \mu\text{m}$ for quartz plates when plate

temperature is maintained within $\pm 1^\circ\text{C}$. Alignment or registration marks per SEMI P6 may be used to facilitate measurements.

7.3 *Positional Accuracy* — Relation between actual and desired locations of a printed feature on a glass substrate. This is a tolerance to be agreed upon by the end user and mask designer. The following guidelines should be used, with measurements being taken in a temperature and humidity controlled environment:

- $\pm 0.0157 \mu\text{m/mm}/^\circ\text{C}$ for soda lime masks
- $\pm 0.00394 \mu\text{m/mm}/^\circ\text{C}$ for quartz masks

Dimensioning from a central reference point shall be used.

7.4 *Critical Dimensions (CD)* — The gauging or measurement process is fundamental to manufacturing of masks. The purpose of this section is to define standard CD patterns to provide consistent evaluation and testing of micropatterning equipment, metrology instruments and processes used in large area mask photomask manufacturing.

7.4.1 Figures 1 and 2 are intended to illustrate the proper layout of each pattern cell and to define appropriate design elements used within each basic cell. The user will determine all appropriate dimensions for the feature as they apply to specific processing/equipment situations.

7.4.2 *L-bar cell (see Figure 1)* — The L-bar cell is designed to be a measurement site for isolated features as well as line and space groups in orthogonal axes. The basic cell consists of one or more groups of nested L-shaped lines at a specific pitch. The pitch is defined as twice the nominal feature width. The center L-bar of each group shall extend beyond the ends of the other L-bars by at least $10\mu\text{m}$. This implies that the number of bars is odd.

7.4.3 *Contact array cell (see Figure 2)* — The contact array cell is designed to provide resolution and proximity effect information over a wide range of contact sizes. The design elements will consist of a 5×5 contact array and an isolated contact. The 5×5 array will produce the maximal proximity for the center contact.

7.4.4 A label to indicate the nominal feature width must be placed near each basic cell. The labels must be of a clearly printable size. The details of the pattern cells, such as the orientation, magnitude, range of line widths and polarity of tone (clearfield vs. darkfield) shall be defined by the user.

7.4.4.1 The target CD should closely represent the size of the most critical feature in the end user's process, not necessarily the minimum feature. A reasonable tolerance is $\pm 10\%$ of the target CD.

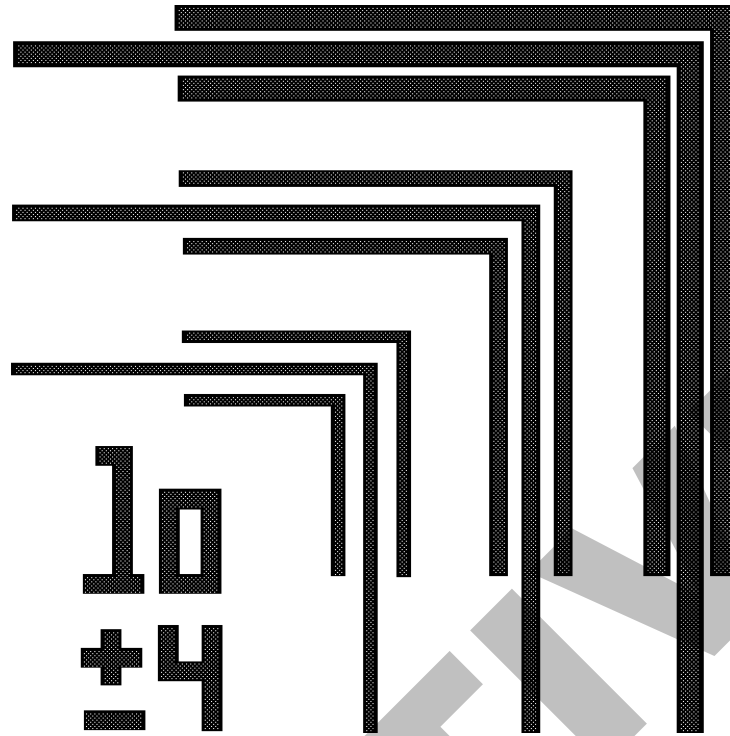


Figure 1
L-Bar Cell

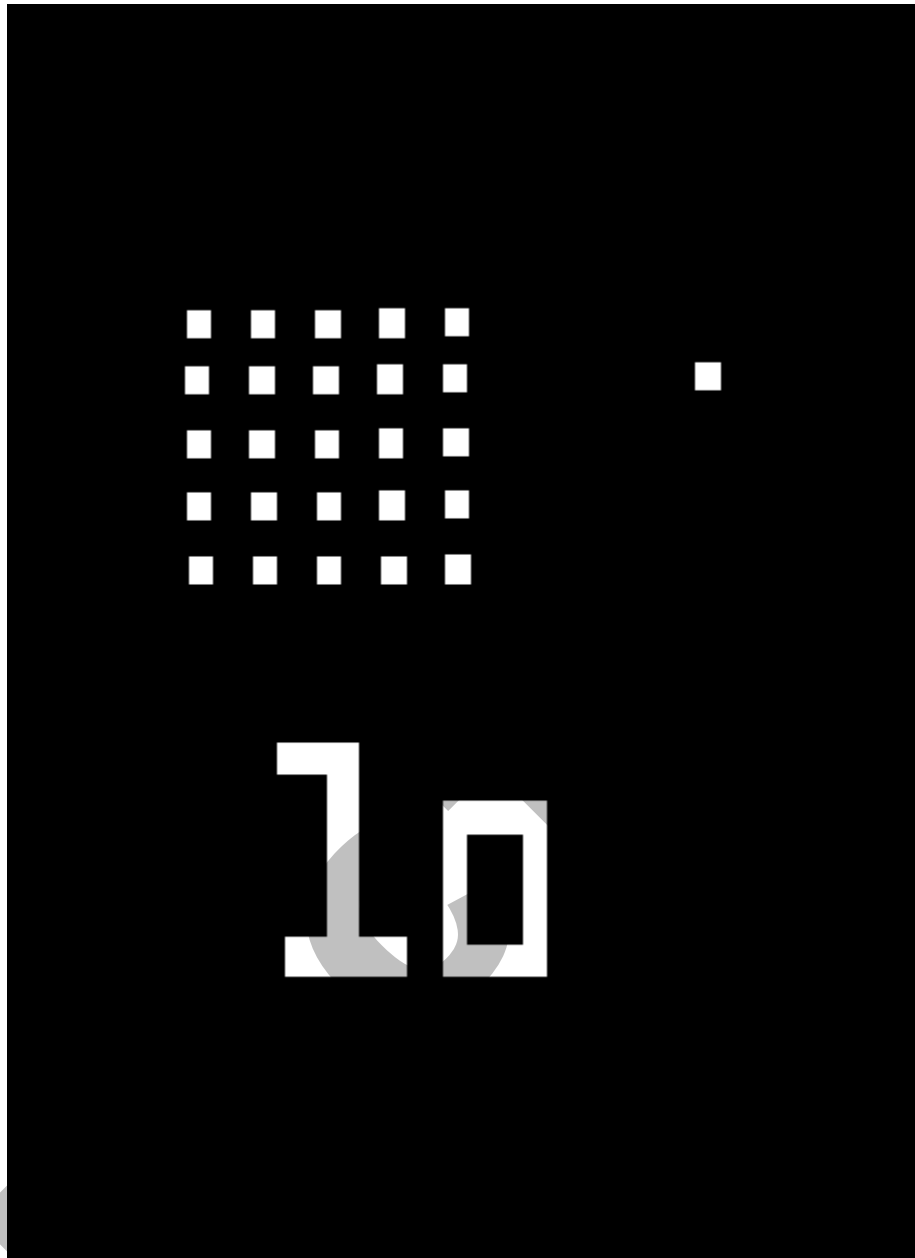


Figure 2
Contact Array Cell