

SEMI T2-0298 (Withdrawn 1110) SPECIFICATION FOR MARKING OF WAFERS WITH A TWO- DIMENSIONAL MATRIX CODE SYMBOL

This standard was technically approved by the global Traceability Committee. This edition was approved for publication by the global Audits & Reviews Subcommittee on August 27, 2010. Initially available at www.semi.org in October 2010. Originally published in 1993; previously published November 2004.

NOTICE: This document was balloted and approved for withdrawal in 2010.

1 Purpose

1.1 This specification is intended to provide a marking symbology that can be used to mark silicon wafers with minimum intrusion into the fixed quality area of the wafer.

2 Scope

2.1 This specification defines the geometric and spatial relationships and content (including the error checking and correcting code) of a two-dimensional (2-D), machine-readable, binary matrix code symbol for front surface marking of wafers of silicon which comply with SEMI M1, SEMI M2, or SEMI M11, and other materials with diameters of 125–200 mm. This specification allows for consistency of all wafer marking performed by wafer manufacturers. It may be used in conjunction with, or as an alternative to, the alphanumeric marking codes specified in SEMI M12 and SEMI M13 or a front surface bar code like that specified in SEMI T1.

2.2 Although this specification does not specify the marking techniques that may be employed when complying with its requirements, it is assumed that the symbol will be obtained by laser scribing individual dots.

2.3 The 2-D matrix code is applicable to a broad range of wafer products, including epitaxial wafers, SOI wafers, and unpatterned or patterned polished wafers. The format and algorithms of this code are based on the Data Matrix two-dimensional symbology specified in AIM International Symbology Specification — Data Matrix.

NOTICE: This standard does not purport to address safety issues, if any, associated with its use. It is the responsibility of the users of this standard 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 SEMI Standards

SEMI M1 — Specifications for Polished Single Crystal Silicon Wafers

SEMI M2 — Specification for Silicon Epitaxial Wafers for Discrete Device Applications

SEMI M11 — Specifications for Silicon Epitaxial Wafers for Integrated Circuit (IC) Applications

SEMI M12 — Specification for Serial Alphanumeric Marking of the Front Surface of Wafers

SEMI M13 — Specification for Alphanumeric Marking of Silicon Wafers

SEMI T1 — Specification for Back Surface Bar Code Marking of Silicon Wafers

3.2 AIM International Technical Specification¹

AIM International Symbology Specification — Data Matrix

3.3 ANSI Standard²

ANSI X3.4 — American Standard Code for Information Interchange (ASCII)

1 AIM International Inc., 125 Warrendale-Bayne Road, Warrendale, PA 15086, USA. Telephone: 724.934.4470; Fax: 724.934.4495; <http://www.aimglobal.org/>

2 American National Standards Institute, Headquarters: 1819 L Street, NW, Washington, DC 20036, USA. Telephone: 202.293.8020; Fax: 202.293.9287. New York Office: 11 West 42nd Street, New York, NY 10036, USA. Telephone: 212.642.4900; Fax: 212.398.0023; <http://www.ansi.org>

NOTE 1: This standard is equivalent to ISO 646, Information Processing – ISO 7-bit Coded Character Set for Information Processing.

3.4 Other Documents

SEMI AUX001 — List of Vendor Identification Codes

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

4 Terminology

4.1 Definitions

4.1.1 *binary values* — a dot in the wafer surface indicates the binary value 1. The absence of a dot, or a smooth surface surrounding a cell center point, indicates the binary value 0.

4.1.2 *border column* — the outermost column of a data matrix code symbol.

4.1.3 *border row* — the outermost row of a data matrix code symbol.

4.1.4 *cell center point, of an array* — the point at which the centerline of a row intersects the centerline of a column.

4.1.5 *cell spacing, of an array* — the (equal) vertical or horizontal distance between the cell center points of contiguous cells.

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

4.1.7 *center line, of a row or column* — the line positioned parallel to, and spaced equally between, the boundary lines of the row or column.

4.1.8 *central area, of a cell* — the area enclosed by a circle centered at the cell center point; used by code readers to sense the binary value of the cell.

4.1.9 *data matrix code symbol* — a two-dimensional array of square cells arranged in contiguous rows and columns.

4.1.10 *dot* — a localized region with a reflectance which differs from that of the surrounding surface.

NOTE 2: To assure reading efficiency, a minimum contrast of 30% is required between the reflectance value of a dot and the surrounding wafer surface. Various densitometers can provide such measurements nondestructively.

4.1.11 *dot misalignment, within a cell* — the distance between the physical center point of a dot and the cell center point.

4.1.12 *reference point, of a data matrix code symbol* — the physical center point of a corner cell common to a border row and border column, used to identify the physical location of the symbol on the object being marked with the symbol.

NOTE 3: The reference point is at a fixed location on the object. Different cells may be chosen as the reference point, depending on the desired orientation of the symbol on the object and the size variability of the symbol. The particular cell to be used as the reference point must be specified for each application.

5 Ordering Information

5.1 Purchase orders for wafers furnished to this specification shall include the following items:

5.1.1 Message Characters

5.1.1.1 Quantity (10 to *nn*, where *nn* is 11–31 and depends on the character set to be encoded [see Table 1]).

5.1.1.2 Content of Message Characters 11 and up, if present.

5.1.2 Cell Spacing (125 or 150 μm).

6 Requirements

6.1 Shape and Size of the Matrix Code Symbol

6.1.1 Each square matrix code symbol shall be composed of an equal even number (from 16–20) of rows and columns of equally spaced square cells. Cell spacing shall be either 125 or 150 μm (see Table 2, and Figures 1 and 2).

6.1.2 *Dot Size* — The nominal shape of the dot produced in the matrix may be circular or square. Its diameter or edge length (after polishing) shall be $100 \pm 10 \mu\text{m}$.

6.2 Border Rows and Columns (see Figure 3)

6.2.1 One border row and one border column shall contain a dot in each cell. These are identified as the primary border row and the primary border column. These are used by the code reader to determine the reference point and orientation of the matrix.

6.2.2 The opposing (secondary) border row and column shall contain dots in alternating cells.

6.2.3 The reference point of the symbol shall be the physical centerpoint of the cell common to the primary border row and the secondary border column.

6.2.4 The maximum dot misalignment within a cell is 20 μm . This ensures that a minimum size dot covers a cell central area of radius 25 μm (see Figure 4).

Table 1 Matrix Code Symbol Dimensions

<i>Square Arrays for Use on 125 to 200 mm Wafers</i>	$C_1, R_1 (\mu\text{m})^{\#1}$			$C_2, R_2 (\mu\text{m})^{\#1}$		
# of cells in row or column	16	18	20	16	18	20
125 μm spacing	1875	2125	2375	2000	2250	2500
150 μm	2250	2550	2850	2400	2700	3000

#1 See Figure 1 for pictorial representation of Dimensions C_1 , C_2 , R_1 , and R_2 .

Table 2 Message Character Count in Square Arrays for Use on 125 to 200 mm Wafers

<i># of Cells in a Row or Column</i>		16	18	20
Maximum # of Message Characters	8-bit	10	16	20
	Mostly uppercase	16	25	31