SEMI T7-0997[E]
SPECIFICATION FOR BACK SURFACE MARKING OF DOUBLE-SIDE POLISHED WAFERS WITH A TWO-DIMENSIONAL MATRIX CODE SYMBOL

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[E] This document was modified in April 1999 to reflect the creation of SEMI AUX1 as the source for vendor identification codes. Changes were made to numerous sections. This document was also modified in April 2000 to clarify patent issues. Changes were made to the notice at the end of this document.

1 Purpose

1.1 This specification is intended to provide a marking symbology that can be used to mark silicon wafers with no 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 rectangular two-dimensional (2-D), machine-readable, binary data matrix code symbol for back surface marking of notched, double-side polished wafers of silicon which comply with SEMI M28, and other materials with diameters of 300 mm and larger. It may be used in conjunction with the alphanumeric marking codes specified in SEMI M12 and SEMI M13 or the bar code 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 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 two-dimensional symbology specified in AIM International Symbology Specification-Data Matrix.

3 Referenced Documents

3.1 *SEMI Standards*

SEMI AUX1 — List of Vendor Identification Codes

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

SEMI M13 — Specification for Alphanumeric Marking of Silicon Wafers

SEMI M28 — Specification for Developmental 300 mm Diameter Polished Single Crystal Silicon Wafers

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

3.2 *AIM International Technical Specification*[1]

AIM International Symbology Specification — Data Matrix

3.3 *ANSI Standards* [2]

ANSI MH10.8.2 — Data Application Identifier Standard

ANSI X3.4-1986 — American Standard Code for Information Interchange (ASCII)

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

4 Terminology

4.1 *alignment bar, of a data matrix code symbol* — a solid line of contiguous filled cells abutting a line of alternately filled and empty cells [AIM - Data Matrix].

4.2 *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.

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

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

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

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[2] *American National Standards Institute, 11 West 42nd Street, New York, NY 10036, tel.: 212-642-4900, fax: 212-398-0023.*

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

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

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

4.9 *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.

4.10 *data matrix code symbol* — a two-dimensional array of square cells arranged in contiguous rows and columns. In certain ECC200 symbols, data regions are separated by alignment patterns. The data region is surrounded by a finder pattern [AIM - Data Matrix].

4.11 *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.

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

4.13 *finder pattern, of a data matrix code symbol* — a perimeter to the data region. Two adjacent sides contain dots in every cell; these are used primarily to define physical size, orientation and symbol distortion. The two opposite sides are made up of cells containing dots in alternate cells [AIM Data Matrix].

4.14 *reference point, of a data matrix code symbol* — the physical center point of a corner cell common to the primary border row and the solid line of the alignment bar, 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 Requirements

5.1 *Shape and Size of the Data Matrix Code Symbol*

5.1.1 *Data Matrix Code Symbol Dimensions*

5.1.1.1 Each rectangular matrix code symbol shall be composed of an array of 8 rows and 32 columns with an alignment bar as defined in AIM ISS Data Matrix.

5.1.1.2 Cell spacing shall be 125 µm, center to center.

5.1.2 *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 µm ± 10 µm.

5.1.3 *Border Rows and Columns*

5.1.3.1 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 orientation of the matrix.

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

5.1.3.3 For these rectangular matrix code symbols, the reference point of the symbol shall be the physical centerpoint of the cell common to the primary border row and the center alignment bar.

5.1.4 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.

5.2 *Content of the Data Matrix Code Symbol*

5.2.1 Each rectangular matrix code symbol shall contain 10 message characters, together with the error checking and correcting (ECC200) code characters, encoded in accordance with AIM ISS-Data Matrix.

5.2.2 The message characters may include any of those designated as "mostly upper case" in AIM ISS-Data Matrix, in Table 5 and Annex J. The ten message characters shall contain two elements:

a. a vendor-assigned 8-character wafer identification code, followed by

b. a 2-character vendor identification code (see SEMI AUX1).

5.3 *Location of the Data Matrix Code Symbol*

5.3.1 With the wafer positioned back surface up and with the primary fiducial toward the operator, the origin of the data matrix code symbol shall be located as specified below.

5.3.1.1 The 8 row x 32 column rectangular 2-D matrix code symbol shall be placed entirely outside a fixed quality area (FQA) with a nominal edge exclusion of 3 mm. The reference point shall be located 148.95 ± 0.15 mm from the center of the wafer, along a radius 5.0 ± 0.1° counterclockwise from the axis of the notch fiducial bisector.

5.3.2 The primary row of the matrix code symbol shall be placed toward the periphery of the wafer.

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