

SEMI T7-0415

SPECIFICATION FOR BACK SURFACE MARKING OF DOUBLE-SIDE POLISHED WAFERS WITH A TWO-DIMENSIONAL MATRIX CODE SYMBOL

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1 Purpose

1.1 This Specification is intended to provide a marking symbology that can be used to mark silicon wafers with minimal 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 double-side polished silicon wafers with diameters of 300 mm and 450 mm that comply with SEMI M1 and wafers of other materials with diameters of 300 mm and larger.

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 is 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 ISO/IEC 16022.

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 SEMI Standards and Safety Guidelines

SEMI M1 — Specifications for Polished Single Crystal Silicon Wafers

SEMI M12 — Specification for Serial Alphanumeric Marking of Silicon Wafers

3.2 ISO/IEC Standard¹

ISO/IEC 16022 — International Symbology Specification – Data Matrix

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

4 Terminology

4.1 Definitions

4.1.1 *alignment bar, of a data matrix code symbol* — a solid line of contiguous filled cells abutting a line of alternately filled and empty cells. [ISO/IEC 16022]

4.1.2 *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.

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

¹ International Organization for Standardization, ISO Central Secretariat, 1, ch. de la Voie-Creuse, CP 56, CH-1211 Geneva 20, Switzerland; Telephone: 41.22.749.01.11, Fax: 41.22.733.34.30, <http://www.iso.org>

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

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

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

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

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

4.1.9 *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.

4.1.10 *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. [ISO/IEC 16022]

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

NOTE 1: 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.

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

4.1.13 *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. [ISO/IEC 16022]

4.1.14 *quiet zone* — a region outside the finder pattern that contains no discontinuities in surface characteristics.

4.1.15 *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 2: 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 (see Figures 1 and 2)

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 ISO/IEC 16022.

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 $100\text{ }\mu\text{m} + 10\text{ }\mu\text{m} - 20\text{ }\mu\text{m}$.

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 The quiet zone shall constitute a region at least the size of a cell immediately outside the border rows and columns.

5.1.3.4 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.