

SEMI T16-0706

SPECIFICATION FOR USE OF DATA MATRIX SYMBOLOGY FOR AUTOMATED IDENTIFICATION OF EXTREME ULTRAVIOLET LITHOGRAPHY MASKS

This standard was technically approved by the global Traceability Committee. This edition was approved for publication by the global Audits and Reviews Subcommittee on May 16, 2006. It was available at www.semi.org in June 2006 and on CD-ROM in July 2006. Originally published November 2005.

1 Purpose

1.1 This specification provides a symbology for marking hard surface extreme ultraviolet (EUV) masks.

2 Scope

2.1 This specification defines the geometric and spatial relationships and content (including error checking and correcting code) of square two-dimensional, machine-readable, Data Matrix symbols for pattern-surface marking of resist-coated 6 inch EUV masks that comply with, or extrapolate from, the specifications of SEMI P37 and SEMI P38.

2.2 This specification addresses only the Data Matrix field characteristics and location. This Data Matrix field may contain the information previously contained in various bar code symbols on 6 inch optical reticles. The format of such information is not detailed in this specification.

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 Limitations

3.1 This specification does not cover any other code fields on the mask. These might be exposure tool-specific or user-specific or both. The location, symbology and content of these other fields, if they exist, are determined between the mask supplier and user.

NOTE 1: Data Matrix symbology is applicable to a broad range of semiconductor products including virgin wafers, processed and patterned FPD substrates, lead frames and reticles. The format and algorithms of this code are based on two-dimensional symbology specified in ISO/IEC 16022 — International Symbology Specification – Data Matrix.

3.2 Although this specification does not specify the marking techniques to be employed when complying with its requirements, it is assumed that the symbol will be obtained by e-beam exposure of individual dots in a resist coating. An experiment executed by International SEMATECH found such marks suitable.

4 Referenced Standards and Documents

4.1 SEMI Standards

SEMI P37 — Specification for Extreme Ultraviolet Lithography Mask Substrates

SEMI P38 — Specification for Absorbing Film Stacks and Multilayers on Extreme Ultraviolet Lithography Mask Blanks

4.2 ANSI Standard¹

ANSI MH10.8.2 — Data Application Identifier Standard

4.3 ISO/IEC Standard²

ISO/IEC 16022 — International Symbology Specification – Data Matrix

1 American National Standards Institute, New York Office: 11 West 42nd Street, New York, NY 10036, USA. Telephone: 212.642.4900; Fax: 212.398.0023 Website: www.ansi.org

2 International Organization for Standardization, ISO Central Secretariat, 1, rue de Varembe, Case postale 56, CH-1211 Genava 20, Switzerland. Telephone: 41.222.749.01.11; Fax: 41.22.733.34.30 Website: www.iso.ch

4.4 Uniform Code Council Standard³

Manufacturer Identification Codes

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

5 Terminology

5.1 Terms relating to the Data Matrix code symbol characteristics are defined in ISO/IEC 16022.

5.2 Definitions of terms relating to the marking area are as follows:

5.2.1 *mark area* — a rectangular area containing the mark field(s) and the surrounding quiet zone.

5.2.2 *mark field* — an area within which all mark dots occur.

5.2.3 *quiet zone* — an unpatterned, unmarked area that surrounds a mark field.

6 Ordering Information

6.1 Purchase orders for masks furnished to this specification shall specify the following optional items:

6.1.1 Number (15 to 91) of message characters.

6.1.2 Content of Message Characters 16 and up, if present.

7 Requirements

7.1 Data Matrix Code Symbol Dimensions

7.1.1 Each square matrix code symbol shall be composed of an array of 32 rows and 32 columns (see Table 1 and Figure 1) as defined in ISO/IEC 16022.

7.1.2 Cell spacing shall be 50 μm , center to center.

7.1.3 *Dot Shape and Size* — The nominal shape of the dot produced in the Data Matrix Code Symbol may be circular or square, at the option of the mask supplier. Its diameter or edge length shall be 50 $\pm$ 5 μm .

7.1.4 *Dot Misalignment* — The maximum allowable dot misalignment within a cell is 5 μm . This ensures that a minimum size dot covers a cell central area of radius $>25 \mu\text{m}$ as required by ISO/IEC 16022.

7.1.5 Border Rows and Columns (see Figure 1)

7.1.5.1 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.

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

7.1.5.3 For square Data Matrix code symbols, the reference point of the symbol is generally the physical centerpoint of the cell common to the primary border row and the primary border column. However, for the present application it is more convenient to reference the location of the Data Matrix code symbol to the bottom left corner of the cell containing the reference point, identified in the figures as the “reference corner.”

7.1.6 Quiet Zone

7.1.6.1 The quiet zone surrounding the Data Matrix code symbol shall be eight cells (400 μm) wide.

7.1.6.2 The area between the quiet zone and pellicle frame shall be filled with an unpatterned multilayer film stack.

7.2 Content of the Data Matrix Code Symbol

7.2.1 Each square Data Matrix code symbol shall contain between 15 and 91 message characters, together with error checking and correcting (ECC) 200 code characters, encoded in accordance with ISO/IEC 16022.

7.2.2 The message characters may include any of those designated as EDIFACT in Table 5 and Annexe J.3 of ISO/IEC 16022.

7.2.3 The first 15 message characters shall contain supplier-assigned 8-character mask identification code, followed by a 7-character supplier (manufacturer) identification code defined by UCC as a six-digit company identification, preceded by a zero (0).

7.2.4 The remaining message characters, if any, shall contain information as agreed between the supplier and user. This may require field identifiers and field concatenators (see ANSI MH10.8.2).

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