

# SEMI T3-0697<sup>E</sup>

## SPECIFICATION FOR WAFER BOX LABELS

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This entire document was revised in 1996.

<sup>E</sup> 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 common format, content, size, and location for printed, machine-readable labels on wafer boxes to facilitate communication of data essential for advanced traceability and electronic data exchange systems. These labels differ from current commercial practice in that they provide less detailed information about parametric properties of the wafer.

1.2 This specification covers labels that contain two bar code symbols and their associated human-readable interpretation.

1.3 This specification also permits the optional inclusion of a two-dimensional matrix code symbol on the labels. This type of symbol can also be used for marking silicon wafers (SEMI T2), equipment and fixtures, and other items in the semiconductor manufacturing plant in addition to printed labels. This symbol can accommodate substantially more information than can the bar code symbols; it is included to provide for a smooth transition from existing traceability and labeling procedures to the comprehensive, unified system envisioned for the future in which common reading equipment can be used throughout the plant.

### 2 Scope

2.1 This specification covers labels for wafer boxes used for storage and transport of silicon wafers 100 mm in diameter and larger.

2.2 This specification provides for two similar labels in order that the contents of the wafer box can be identified when the wafer box is stored in either of two positions: with the side of the wafer box parallel with the front of the storage shelf or with the end of the wafer box parallel with the front of the storage shelf. Because wafer boxes are routinely stacked for storage, placement of box labels on the top or bottom of the box is not recommended.

2.3 This specification covers the content of the code fields on the label.

2.4 This specification defines a minimum size for the label consistent with sizes of wafer boxes investigated. If a larger flat area is available on the wafer boxes to be used, the size of either or both labels may be increased.

2.5 The size and location of the bar, matrix, and alpha-numeric code data fields on the label are defined for the minimum size label. If a label larger than the specified minimum size label is used, these data fields should be placed on the label with the same relative locations and dimensions, but additional information may be placed in the remainder of the label area (outside the specified data fields).

2.6 This specification includes descriptions of the characteristics of the code formats to be employed.

2.7 The labels covered by this specification are intended to be applied on the box itself, not on the box wrap portion of the wafer package, nor on the transport package (outer shipping carton) used for commercial transportation of wafer packages.

NOTE 1: Specifications for transaction labels, which are intended for use on the outer shipping carton, are given in ANSI/EIA 556-A.

2.8 Wafer box labels are intended to be applied in a cleanroom environment concurrent with the completion of production of the wafers. Although it is recognized that the materials of construction and the adhesives used to apply the label must be selected with this use in mind, their specification is beyond the scope of this document.

2.9 The dimensions in this specification are applicable to labels printed with printers which have nominal resolution of 203 dots per inch (dpi). Printers with higher resolution may be used, but many of the dimensions may differ from those in this specification and the code fields may not fit within the minimum size label. In such cases, it is necessary to ensure that the label is of a size that fits the box to be employed.

2.10 This specification is applicable to a variety of print configurations. Labels may be printed in either ladder or picket fence format, but the picket fence

format is preferred. Primary and secondary labels may be printed together or separately.

2.11 The format of the barcode is based on Code 39, as specified in AIM-USA Universal Symbol Specification Code 39.

2.12 The format of the 2D Data Matrix Code is specified in AIM-USA Universal Symbol 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 T1 — Specification for Back Surface Bar Code Marking of Silicon Wafers

SEMI T2 — Specification for Marking of Wafers with a Two-Dimensional Matrix Code Symbol

#### 3.2 Other Standards

AIM USS-39<sup>1</sup> — Universal Symbol Specification Code 39

AIM USS-DM — Universal Symbol Specification - Data Matrix

ANSI/ASC X3.182<sup>2</sup> — Bar Code Print Quality - Guideline

ANSI/FACT-1 — Data Application Identifier Standard

ANSI MH10.8.2 — Data Application Identifier Standard

CCITT X.25<sup>3</sup> — Interface between Data Terminal Equipment and Data Circuit-Termination Equipment for Terminals Operating in the Packet Mode and Connected to Public Data Networks by Dedicated Circuit

ANSI/EIA-556-A<sup>4</sup> — Outer Shipping Container Bar Code Label Standard

<sup>1</sup> AIM USA, 634 Alpha Drive, Pittsburgh, PA 15238, T 412.963.8588, F 412.963.8753

<sup>2</sup> American National Standards Institute, 11 W. 42nd St., New York, NY 10036, T 212.642.4900, F 212.398.0023

<sup>3</sup> Contained in CCITT Blue Book Volume VIII.2, available from American National Standards Institute, 11 W. 42nd St., New York, NY 10036, T 212.642.4900, F 212.398.0023

<sup>4</sup> Electronic Industries Association, 2001 Pennsylvania Ave., Washington, DC 20006, T 202.457.4900, F 202.457.4985

EIA-625 (Proposed) — Engineering Standards Proposal - Product Package Bar Code Standard for Non-Retail Applications

EIA (Draft) — The Global Electronics Guidelines for Bar Code/2D Marking of Products and Packages in Conjunction with EDI

UCC/EAN-128<sup>5</sup> — Application Identifier Standard

### 4 Terminology

4.1 Definitions of terms relating to wafer boxes (see Figure 1) are as follows:

4.1.1 *bar end, of a wafer box base* — the end of the box base that is next to the first pocket of the cassette inside the base or the first pocket of the base itself.

4.1.2 *base, of a wafer box* — the open-top container into which wafers are placed, either in cassettes or into integrally molded pockets.

4.1.3 *box wrap* — the wrapping or bagging applied over the wafer box to comprise the product package.

NOTE 2: The box wrap is usually sealed under clean room conditions.

4.1.4 *cover, of a wafer shipping box* — the portion of the box which closes the top of the base.

4.1.5 *wafer box* — a sealable container consisting of a base and a cover, used for storing or transporting wafers. Compare with transport package in ANSI/EIA-556-A.

4.1.6 *wafer box label* — the label on the wafer box identifying the product and its manufacturer.

4.1.7 *wafer package* — the combination of a wafer box and box wrap.

4.1.8 *wall end, of a wafer shipping box* — the end of the shipping box that is opposite the bar end.

4.2 Terms relating to bar code characteristics are defined in SEMI T1. Definitions for additional terms relating to the product package, product package label, and bar code format and characteristics can be found in ANSI/EIA-556-A, Appendix A.

4.3 Terms relating to the data matrix code symbol characteristics are defined in SEMI T2 and AIM-USA USS-Data Matrix.

4.4 Definitions of terms relating to code content are as follows:

<sup>5</sup> Uniform Code Council, Inc., 8163 Old Yankee Road, Dayton, Ohio 45458, T 513.435.3870

4.4.1 *customer product ID* — a unique combination of alphanumeric characters assigned by a customer or purchaser to identify a product.

4.4.2 *data field* — a specific portion or area of a label designated to contain a human readable interpretation, a bar code symbol, or a two-dimensional matrix code symbol.

4.4.3 *data identifier* — a specified character or character string that defines the category or intended use of data that follows.

4.4.4 *encrypted data* — data entered by the vendor, usually to facilitate traceability, that may or may not be shared with the customer.

4.4.5 *human readable interpretation (hri)* — the interpretation of all or a portion of a bar or matrix code symbols presented in a type font which can be read by persons.

4.4.6 *message character* — a character that contains data, encoded into a bar or matrix code symbol.

NOTE 3: Data identifiers and concatenation characters are considered to be message characters, but start/stop characters are not.

4.4.7 *message length* — the number of message characters contained in a single encoded message.

4.4.8 *traceability number, of a wafer box label* — a string of message characters comprising a lot number, vendor code (including manufacturing location, if desired), and date of labeling together with the appropriate data identifier and concatenation characters.

## 5 Ordering Information

5.1 Purchase orders for the wafers furnished with wafer box labels in conformance with this specification shall include the following:

5.1.1 Statement that the wafer box label conforms to SEMI Specification T3.

5.1.2 Content of message characters for customer part number field.

5.1.3 Label format (see Figure 7)

5.1.3.1 *Type 1* — Company Field + Data Matrix Field

5.1.3.2 *Type 2* — Company Field + Bar Code Field with hri fields

5.1.3.3 *Type 3* — Company Field + Data Matrix Field + Bar Code Field with hri fields

5.1.3.4 *Type 4* — Company Field + Data Matrix Field1 + Bar Code Field with hri fields + Data Matrix Field2

5.1.3.5 *Type 5* — Company Field + Data Matrix Field1 + Data Matrix Field2

5.2 In addition, the following optional items may be specified:

5.2.1 Content of message characters, if desired, for one or more of the following: customer part number revision, customer specification number, customer drawing number, and customer drawing number revision.

5.2.2 If a two-dimensional matrix code symbol is included on the label:

5.2.3 Inclusion or exclusion of wafer identification information.

5.2.4 User-specified data, if required, and requirement, if any, for sharing of code for encrypted data.

5.2.5 Label locations on the wafer box, if different from the recommended locations.

5.2.6 Label size, if a label larger than the minimum size specified in this specification is required.

## 6 Content and Characteristics of Data Fields

### 6.1 Bar Code Symbols

6.1.1 The label shall contain two data fields for bar code symbols, when such symbols are specified. Each bar code symbol shall contain a maximum of 35 message characters in addition to the start/stop characters.

6.1.2 A non-printed message header is normally encoded when encoding multiple, concatenated data fields. However, this header is not encoded in the bar code fields to conserve space. The absence of this message header requires appropriate software in bar code reading systems, to separate the data fields.

6.1.3 The upper bar code data field shall contain a bar code symbol with the customer part number which consists of  $n$  characters, where  $n$  can be any whole number up to 34, preceded by a "P," the data identifier for this item as specified in ANSI/FACT-1. The message length in this symbol is thus  $n + 1$  characters.

6.1.3.1 Optionally, if less than 35 characters are used by the customer product ID, the upper bar code field may also contain one or more of the additional data fields listed below, up to the limit of 35 characters total. Each optional data field shall be preceded by the concatenator symbol "+" and the data identifier(s) below, in accordance with ANSI MH 10.8.2.

6.1.3.2 Field Identifier for *customer part number revision*: 2P

6.1.3.3 Field Identifier for *customer specification number*: 20P

6.1.3.4 Field Identifier for *customer specification revision*: 21P

6.1.3.5 Field Identifier for *customer drawing number*: 12P

6.1.3.6 Field Identifier for *customer drawing revision*: 22P

6.1.4 The lower bar code data field (see Table 2) shall contain a single bar code symbol with up to 35 message characters divided into four subfields, each separated from the adjacent field by the concatenation symbol "+." The first subfield contains the traceability number (lot number of  $k$  characters, where  $k$  can be any number

up to 16), preceded by the data identifier "1T." The second subfield contains the 2-character SEMI vendor identification code, preceded by the data identifier "1V." The third subfield contains the labeling date (YYMMDD), preceded by the data identifier "D." The fourth subfield contains the quantity, preceded by the data identifier "Q." The message characters in this symbol are distributed as shown in Table 2 and Figure 2. The quantity indicated on the label shall be the number of wafers in the wafer box to which the label is affixed; the unit of measure is understood as each (EA).

**Table 1 Content of Bar Code Symbol in Upper Bar Code Data Field**

| Character Location       | Symbol Content                         | Notes                |
|--------------------------|----------------------------------------|----------------------|
| First 1                  | Data Identifier                        | "P"                  |
| Next $n$ ( $n \leq 34$ ) | Customer Part Number                   | (Customer-specified) |
| Optional Fields          |                                        |                      |
| Number of characters     | Symbol Content                         | Notes                |
| 3                        | Concatenator + Data Identifier         | " +2P"               |
| message-dependent        | Customer Part Number Revision          | (Customer-specified) |
| 4                        | Concatenator + Data Identifier         | " +20P"              |
| message-dependent        | Customer Specification Number          | (Customer-specified) |
| 4                        | Concatenator + Data Identifier         | " +21P"              |
| message-dependent        | Customer Specification Number Revision | (Customer-specified) |
| 4                        | Concatenator + Data Identifier         | " +12P"              |
| message-dependent        | Customer Drawing Number                | (Customer-specified) |
| 4                        | Concatenator + Data Identifier         | " +22P"              |
| message-dependent        | Customer Drawing Revision              | (Customer-specified) |

**Table 2 Content of Bar Code Symbol in Lower Bar Code Data Field**

| Character Location       | Symbol Content                           | Notes               |
|--------------------------|------------------------------------------|---------------------|
| First 2                  | Data Identifier                          | "1T"                |
| Next $k$ ( $k \leq 16$ ) | Traceability Number: Lot Number          | (Supplier assigned) |
| Next 3                   | Concatenation Symbol and Data Identifier | " +1V"              |
| Next 2                   | Vendor Identification Code               | (SEMI) (see Note 1) |
| Next 2                   | Concatenation Symbol and Data Identifier | " +D"               |
| Next 6                   | Labeling Date                            | (YYMMDD)            |
| Next 2                   | Concatenation Symbol and Data            | " +Q"               |
| Next 2                   | Quantity (unit, EA, implied)             | (numeric)           |

NOTE 1: The SEMI vendor identification code may contain information on manufacturing location. SEMI AUX1 contains multiple codes indicating manufacturing location for some, but not all, wafer vendors. If desired, vendors whose codes do not now include manufacturing location identification can request additional codes for each location from SEMI, following the procedure in SEMI AUX1.

6.1.5 All bar code symbols shall use the Code 39 bar code as specified in AIM USS-39, unless an optional bar code is selected (see Section 7.5). Code 39 is a variable length, discrete, self-checking, bi-directional bar code. Each character is composed of nine elements: Five bars and four spaces. Three of the nine elements are wide and six elements are narrow.

6.1.6 *Character Set* — The Code 39 character set consists of 43 characters: 0-9, A-Z, +, -, ., \$, /, %, and space. In addition, an asterisk (\*) is used only for both the start and stop characters; it cannot be used as a message character. No other characters shall be encoded in the bar code symbols of labels covered by this specification.

6.1.7 *Print Quality* — The Code 39 print quality shall be B/03/630 or better in accordance with ANSI X3.182. To assure reading efficiency, the minimum reflectance of the quiet zones shall be 60%, the minimum reflectance of spaces shall be 51%, and the maximum reflectance of bars shall be 10%.

6.1.8 *Symbol Dimensions* — Bar code symbol dimensions shall be as listed in Table 3.

6.1.9 *Other Bar Code Symbolology* — Code EAN 128 or Code 128 may be used in lieu of Code 39. Users must verify the codes will fit within the available label space.

## 6.2 Human-Readable Interpretation Symbols

6.2.1 Each bar code symbol data field on the label shall have an associated human-readable data field either immediately above or immediately below it. The symbol in each of the human-readable data fields shall contain all the message characters contained in the

associated bar code data field. Start and stop characters shall not be included, but the data field identifiers and concatenation symbols shall be included.

6.2.2 The nominal height of the human-readable characters shall be 2.0 mm (0.08 in.). This is dimension E in Figure 6.

6.2.3 There shall be a clear space of 0.5 mm (0.02 in.) above and below each human-readable symbol. This is dimension D in Figure 6.

## 6.3 Data Matrix Code Symbol

6.3.1 The label may contain one or two identical, square two-dimensional matrix code symbols each with up to 366 message characters when 8-bit ASCII characters are encoded, and substantially more when simpler character sets are encoded (see AIM-USS-Data Matrix Table 5, Table 11, and Annex K).

6.3.2 The first 6 characters shall contain the message header, in accordance with EIA *Global Electronics Guidelines*; this header identifies a message that contains data identifiers that are in accordance with ANSI HH10.8.2 *Data Identifier Standard*. The header content is not printed.

6.3.3 The next  $7+n+k+20$  characters in this matrix code symbol shall contain the information included in the two bar code symbols on the label, together with additional concatenation symbols, as summarized in Table 4. This information shall also be included if the bar codes are not printed.

NOTE 4:  $n$  is the number of characters in the customer part number (see Section 6.1.3), and  $k$  is the number of characters in the lot number (see Section 6.1.4).

**Table 3 Nominal Dimensions of Bar Code 39 Symbols**

| Symbol | Dimension                                  | Metric (SI) Value | U.S. Customary Value |
|--------|--------------------------------------------|-------------------|----------------------|
| -      | number of message characters               | 35                | 35                   |
| X      | width of narrow bar                        | 0.1251 mm         | 0.00493 in.          |
| N      | ratio of wide to narrow bar width          | 2.0               | 2.0                  |
| I      | nominal intercharacter gap                 | 0.1251 mm         | 0.00493 in.          |
| t      | printing tolerance [ $\pm 4/27(N^2/3)X$ ]  | 0.0247 mm         | 0.00097 in.          |
| H      | bar height <sup>A</sup>                    | 9.0 mm            | 0.035 in.            |
| L'     | bar code symbol length (excl. quiet zones) | 58.59 mm          | 2.307 in.            |
| -      | bar code density (excl. quiet zones)       | 0.69 cpmm         | 17.78 cpi            |
| Q      | width of quiet zone <sup>A</sup>           | 6.0 mm            | 0.25 in.             |
| L      | total length of bar code symbol            | 72.76 mm          | 2.865 in.            |

<sup>A</sup> The metric (SI) and U.S. Customary values of this dimension are not exact equivalents; the dimension has been rounded to obtain rational values in both systems.