SEMI T3-1213 (Reapproved 0419)
SPECIFICATION FOR WAFER BOX LABELS

This Standard was technically approved by the Traceability Global Technical Committee. This edition was approved for publication by the global Audits and Reviews Subcommittee on December 17, 2018. Available at www.semiviews.org and www.semi.org in April 2019; originally published in 1995; previously published December 2013.

1 Purpose

1.1 This Specification provides 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 those used in common commercial practice in that they provide less detailed information about parametric properties of the wafer. Such information is now readily stored in advanced traceability systems.

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

1.3 This Specification also covers a two-dimensional Data Matrix code symbol that can accommodate substantially more information than can the bar code symbols. This symbol 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. If the Data Matrix symbol is used without the bar code symbols, provision is made for an associated human readable interpretation.

1.4 Labels provided in accordance with this Specification satisfy the special requirements of 300 mm Wafer Shipping Systems, detailed in SEMI M45, for both front opening shipping box (FOSB) labels and bag labels.

2 Scope

2.1 This Specification covers size, message content and symbology requirements of labels for wafer boxes used for storage and transport of silicon wafers 100 mm in diameter and larger.

2.2 For wafer boxes used with 100 to 200 mm diameter wafers, 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 For FOSBs used with 300 mm wafers, this Specification provides for two identical labels, one to be placed on the FOSB and the other to be placed on the outer bag. These requirements are consistent with the requirements of SEMI M45. SEMI M31 specifies FOSB dimensions.

2.4 The message content and locations of the symbols used on the labels covered by this Specification are designed to fit in a space consistent with size of the available flat area on wafer boxes investigated. If a larger flat area is available on the wafer boxes to be used, the label size may be increased and additional message content included.

2.5 This Specification includes descriptions of the characteristics of the code formats to be employed.

2.6 The labels covered by this Specification may be applied on the box itself, and on the box wrap portion of the wafer package, but not 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-B.

2.6.1 The format of the barcode is based on Code 39, as specified in ISO/IEC 16388.

2.6.2 The format of the Data Matrix Code is specified in ISO/IEC 16022.

SUPERSEDED

Documents Document Sharing Hub
Full document details: SEMI T3-1213-0419R

2.7 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.

2.8 The dimensions in this Specification are applicable to labels printed with printers that 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 or may not fit within the specified label size and format. In such cases, the user of this Specification must ensure that the label is of a size that fits the box to be employed.

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 — Specification for Polished Single Crystal Silicon Wafers

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

SEMI M13 — Specification for Alphanumeric Marking of Silicon Wafers

SEMI M31 — Specification for Mechanical Features of Front-Opening Shipping Box Used to Transport and Ship 300 mm Wafers

SEMI M45 —Specification for 300 mm Wafer Shipping System

SEMI T7 — Specification for Back-surface Marking of Double-side Polished Wafers with a Two-Dimensional Data Matrix Code Symbol

3.2 *ANSI Standards*[1]

ANSI/ASC X3.182 — Bar Code Print Quality Guidelines

ANSI MH10.8.2 — Data Identifier and Application Identifier Standard

3.3 *ISO/IEC Standards*[2]

ISO/IEC 15417 — Information Technology – Automatic Identification and Data Capture Techniques – Code 128 Symbology Specification

ISO/IEC 16022 — Information Technology – Automatic Identification and Data Capture Techniques – Data Matrix Symbology Specification

ISO/IEC 16388 — Information Technology – Automatic Identification and Data Capture Techniques – Code 39 Symbology Specification

3.4 *MHI Standards*[3]

CEA-556-C — Outer Shipping Container Bar Code Label Standard

CEA-706-A — Component Marking Standard

3.5 *Other Documents*

SEMI AUX001 — List of Wafer Supplier Identification Codes

[1] American National Standards Institute, 25 West 43rd Street, New York, NY 10036, USA; Telephone: +1.212.642.4900, Fax: +1.212.398.0023, http://www.ansi.org

[2] International Organization for Standardization, ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland; Telephone: +41.22.749.01.11, http://www.iso.org

[3] Material Handling Institute, 8720 Rad Oak Blvd., Suite 201, Charlotte, NC, 28217, USA; Telephone: +1.704.676.1190, Fax: +1.704.676.1199, http://www.mhi.org

SUPERSEDED

Documents
Document Sharing Hub

Full document details: SEMI T3-1213-0419R

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 CEA-556-C.

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 FOSBs are defined in SEMI M31.

4.3 Definitions for additional terms relating to the product package, product package label, and bar code format and characteristics can be found in CEA-556-C, Appendix A.

4.4 Terms relating to the data matrix code symbol characteristics are defined in ISO/IEC 16022.

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

4.5.1 *customer information field* — a 35-character field containing the customer product ID and, if desired, other customer assigned information.

4.5.2 *customer product ID* — a unique combination of alphanumeric characters assigned by a customer or purchaser to identify a product, sometimes called customer part number.

4.5.3 *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.

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

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

4.5.6 *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.

4.5.7 *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.

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

4.5.9 *traceability number, of a wafer box label* — a string of 35 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 T3.

SUPERSEDED

Documents Document Sharing Hub

Full document details: SEMI T3-1213-0419R

5.1.2 Content of message characters for customer information field.

5.1.3 Label type (see § 7.1) or, if additional space is available on the box, dimensions of labels and placement of fields thereon.

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

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

5.2.1.1 Inclusion or exclusion of wafer identification information.

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

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

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 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, the customer information field (see Table 1 and Figure 2), shall contain the customer product ID preceded by a 'P,' the data identifier for this item as specified in ANSI MH10.8.2.

6.1.3.1 Optionally, if the customer product ID occupies less than 34 characters, the customer identification field may also contain one or more of the subfields listed below, up to the limit of 35 characters total. Each optional subfield 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 and Figure 2) shall contain the 35-message character traceability number. This field is divided into four subfields, each separated from the adjacent field by the concatenation symbol '+.' The first subfield contains the lot number of 16 characters, 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 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). The message characters in this symbol are distributed as shown in Table 2.

Table 1 Content of Bar Code Symbol in Upper Bar Code Data Field (Customer Information Field)

Number of Characters	*Symbol Content*	*Notes*
Required Subfield		
First 1	Data Identifier	'P'
message-dependent	Customer Product ID (e.g., part number)	(Customer-specified)
Optional Subfields		
3	Concatenator + Data Identifier	'+2P'
message-dependent	Customer Part Number Revision	(Customer-specified)
4	Concatenator + Data Identifier	'+20P'

SUPERSEDED
Documents
Document Sharing Hub
Full document details: SEMI T3-1213-0419R

Number of Characters	*Symbol Content*	*Notes*
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)

#1 The total number of characters in the field shall not exceed 35; any character location not filled with data shall contain a dash.

Table 2 Content of Bar Code Symbol in Lower Bar Code Data Field (Traceability Number)

Character Location	*Symbol Content (All Required Fields)*	*Notes*
1–2	Data Identifier	'1T'
3–18	Lot Number	(Supplier assigned)
19–21	Concatenation Symbol and Data Identifier	'+1V'
22–23	Vendor Identification Code	(SEMI) (See #1)
24–25	Concatenation Symbol and Data Identifier	'+D'
26–31	Labeling Date	(YYMMDD) (See Related Information 1)
32–33	Concatenation Symbol and Data	'+Q'
34–35	Quantity (unit, EA, implied)	(numeric)

#1 The SEMI vendor identification code may contain information on manufacturing location. SEMI AUX001 contains multiple codes indicating manufacturing location for some, but not all, wafer suppliers. If desired, suppliers whose codes do not now include manufacturing location identification can request additional codes for each location from SEMI, following the procedure in SEMI AUX001.

6.1.5 All bar code symbols shall use the Code 39 bar code as specified in ISO/IEC 16388, unless an optional bar code is selected (see ¶ 6.1.9). 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. In the absence of a character at any assigned location, a dash (-) shall be used.

6.1.7 *Print Quality* — The Code 39 print quality shall be B/03/630 or better in accordance with ANSI/ASC 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 Symbology* — Code 128 may be used in lieu of Code 39. Users must verify that this code fits 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.).

6.2.3 There shall be a clear space of 0.5 mm (0.02 in.) above and below each human-readable symbol.

SUPERSEDED

Documents Document Sharing Hub
Full document details: SEMI T3-1213-0419R

6.3 *Data Matrix Code Symbol*

6.3.1 The label may contain up to two identical square two-dimensional matrix code symbols each with up to 682 message characters when six-bit characters are encoded using the EDIFACT encodation scheme described in Annex J3 of ISO/IEC 16022 (see also Table 11 in ISO/IEC 16022).

6.3.2 The first six characters shall contain the message header, in accordance with CEA 706; this header identifies a message that contains data identifiers that are in accordance with ANSI MH10.8.2. The header content is not printed.

6.3.3 The next 71 characters in the 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. In the absence of a character at any assigned location, a dash (-) shall be used. This information shall also be included if the bar codes are not printed.

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	0.125 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.
H	bar height (See #1)	9.0 mm	0.35 in.
L'	bar code symbol length (excl. quiet zones)	60.06 mm	2.365 in.
-	bar code density (excl. quiet zones)	0.583 cpmm	14.80 cpi
Q	width of quiet zone (See #1)	6.35 mm	0.25 in.
L	total length of bar code symbol	72.76 mm	2.865 in.

#1 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.

6.3.4 For boxes to be used for wafers between 100 and 200 mm in diameter, the content of the remainder of the data matrix code symbol is optional, as agreed between the customer and supplier. However, it is recommended that the remaining message characters in the Data Matrix code symbol include the following 500-character wafer identification information. For labels to be used on 300 mm FOSBs, the wafer identification information is required, in accordance with SEMI M45.

6.3.4.1 These next 500 characters identify the slot number and individual wafer identification of each wafer in the box, with a string of 25 twenty-character fields. Each of these fields contains:

1. The concatenation character ('+') and Data Identifier for the slot ID ('31T') and a two-digit number of the slot, and
2. the concatenation character ('+') and Data Identifier for the ID of the wafer in that slot ('32T') and the ten-character wafer ID including the two-character vendor identification code. The wafer ID number is comprised of

   i) the first ten characters of the marking codes specified in SEMI M12, SEMI M13, or

   ii) all ten characters of the marking code specified in SEMI T7.

6.3.4.2 The cassette/box slot sequence assumes slot 01 at the bar end and slot 25 at the other end of the box. Data matrix code symbols on labels on boxes or cassettes with less than 25 slots shall have one field for each slot.

SUPERSEDED

Documents
Document Sharing Hub
Full document details: SEMI T3-1213-0419R