

SEMI E106-1104 (Withdrawn 0710)

OVERVIEW GUIDE TO SEMI STANDARDS FOR PHYSICAL INTERFACES AND CARRIERS FOR 300 mm WAFERS

This standard was technically approved by the global Physical Interfaces & Carriers Committee. This edition was approved for publication by the global Audits & Reviews Subcommittee on April 30, 2010. Initially available at www.semi.org in June 2010. Originally published October 2000; previously published November 2004. This document replaces SEMI PR6-0200 in its entirety

NOTICE: This document was balloted and approved for withdrawal in 2010.

1 Purpose

1.1 This document is intended to help users and suppliers of 300 mm carriers and production equipment to understand the complex interdependencies among the SEMI Standards for 300 mm physical interfaces and carriers and to determine which standards apply to which products. As shown in Figure 1, these standards are highly inter-related, have many complex dependencies, and inherit a numbering system (from legacy 200 mm standards) that is non-intuitive.

2 Scope

2.1 This document describes how the SEMI Standards for 300 mm physical interfaces and carriers work together. This document also clarifies the requirements (direct and indirect) on suppliers of each product, and suggests how users see these standards and options.

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.

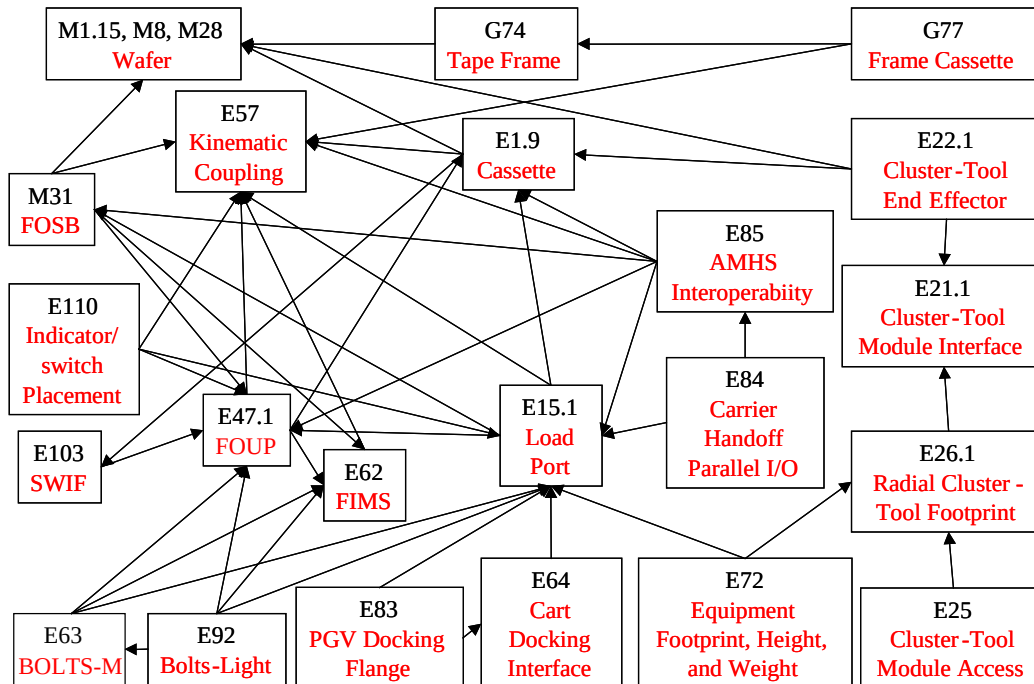


Figure 1
Complex Relationships and Dependencies Among 300 mm Standards

3 Limitations

3.1 *300 mm Only* — This document only covers SEMI Standards that are specific to 300 mm, even though other standards may apply to 300 mm equipment. For example, standards not described here include:

- metrics documents such as SEMI E10;
- minienvironment documents such as SEMI E45 and SEMI E46;
- facilities documents such as SEMI E70;
- reticle handling documents such as SEMI E100 which specifies a reticle SMIF pod for 6-inch or 230 mm reticles based on SEMI E19.4; or
- safety documents such as SEMI S2, SEMI S8, SEMI S11 and an upcoming Safety Guideline for Unmanned Transport Vehicle (UTV) Systems.

3.2 *Physical Interfaces and Carriers Only* — This document also does not cover standards that were generated by committees other than the SEMI Physical Interfaces and Carriers Committee, even though such standards may be specific to 300 mm. For example, standards not described here include:

- Information and Control documents such as SEMI E82; and
- Silicon documents such as SEMI M1.15, SEMI M8, and SEMI M28 (Developmental Wafers).

4 Referenced Standards and Documents

4.1 SEMI Standards

SEMI E1.9 — Mechanical Specification for Cassettes Used to Transport and Store 300 mm Wafers

SEMI E10 — Specification for Definition and Measurement of Equipment Reliability, Availability, and Maintainability (RAM)

SEMI E15 — Specification for Tool Load Port

SEMI E15.1 — Specification for 300 mm Tool Load Port

SEMI E19 — Standard Mechanical Interface (SMIF)

SEMI E19.4 — 200 mm Standard Mechanical Interface (SMIF)

SEMI E21.1 — Cluster Tool Module Interface 300 mm: Mechanical Interface and Wafer Transport Standard

SEMI E22.1 — Cluster Tool Module Interface 300 mm: Transport Module End Effector Exclusion Volume Standard

SEMI E23 — Specification for Cassette Transfer Parallel I/O Interface

SEMI E25 — Cluster Tool Module Interface: Module Access Guideline

SEMI E26.1 — Radial Cluster Tool Footprint 300 mm Standard

SEMI E45 — Test Method for the Determination of Inorganic Contamination from Minienvironments Using Vapor Phase Decomposition-Total Reflection X-Ray Spectroscopy (VPD-TXRF), VPD-Atomic Absorption Spectroscopy (VPD-AAS), or VPD/Inductively Coupled Plasma-Mass Spectrometry (VPD/ICP-MS)

SEMI E46 — Test Method for the Determination of Organic Contamination from Minienvironments Using Ion Mobility Spectrometry (IMS)

SEMI E47.1 — Provisional Mechanical Specification for Boxes and Pods Used to Transport and Store 300 mm Wafers

SEMI E57 — Mechanical Specification for Kinematic Couplings Used to Align and Support 300 mm Wafer Carriers

SEMI E62 — Provisional Specification for 300 mm Front-Opening Interface Mechanical Standard (FIMS)

SEMI E63 — Mechanical Specification for 300 mm Box Opener/Loader to Tool Standard (BOLTS-M) Interface

SEMI E64 — Specification for 300 mm Cart to SEMI E15.1 Docking Interface Port

SEMI E70 — Guide for Tool Accommodation Process

SEMI E72 — Specification and Guide for 300 mm Equipment Footprint, Height, and Weight

SEMI E82 — Specification for Interbay/Intrabay AMHS SEM (IBSEM)

SEMI E83 — Specification for 300 mm PGV Mechanical Docking Flange

SEMI E84 — Specification for Enhanced Carrier Handoff Parallel I/O Interface

SEMI E85 — Specification for Physical AMHS Stocker to Interbay Transport System Interoperability

SEMI E92 — Specification for 300 mm Light Weight and Compact Box Opener/Loader to Tool-Interoperability Standard (BOLTS/Light)

SEMI E99 — The Carrier ID Reader/Writer Functional Standard: Specification of Concepts, Behavior, and Services

SEMI E99.1 — Specification for SECS-I and SECS-II Protocol for Carrier ID Reader/Writer Functional Standard

SEMI E100 — Specification for a Reticle SMIF Pod (RSP) Used to Transport and Store 6 Inch or 230 mm Reticles

SEMI E101 — Guide for EFEM Functional Structure Model

SEMI E103 — Provisional Mechanical Specification for a 300 mm Single-Wafer Box System that Emulates a FOUP

SEMI G74 — Specification for Tape Frame for 300 mm Wafers

SEMI G77 — Specification for Frame Cassette for 300 mm Wafers

SEMI M1.15 — Standard for 300 mm Polished Monocrystalline Silicon Wafers (Notched)

SEMI M8 — Specification for Polished Monocrystalline Silicon Test Wafers

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

SEMI M29 — Specification for 300 mm Shipping Box

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

SEMI S2 — Environmental, Health, and Safety Guideline for Semiconductor Manufacturing Equipment

SEMI S8 — Safety Guidelines for Ergonomics Engineering of Semiconductor Manufacturing Equipment

SEMI S11 — Environmental, Safety, and Health Guidelines for Semiconductor Manufacturing Equipment Minienvironments

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

5 Terminology

5.1 Abbreviations and Acronyms

- 5.1.1 AGV — automatic guided vehicle (as defined in SEMI E101).
- 5.1.2 PGV — person guided vehicle (cart) (as defined in SEMI E101).
- 5.1.3 RGV — rail guided vehicle (moving on the floor) (as defined in SEMI E101).

5.2 Definitions

- 5.2.1 *bilateral datum plane* — a vertical plane that bisects the wafers and that is perpendicular to both the horizontal and facial datum planes (as defined in SEMI E57).
- 5.2.2 *BOLTS plane* — a plane parallel to the facial datum plane near the front of the tool where the box opener/loader is attached (as defined in SEMI E63).
- 5.2.3 *box* — a protective portable container for a cassette and/or substrate(s).

5.2.4 *box opener/loader* or *BOLTS unit* — the equipment component that opens wafer carriers (if needed) and presents the carriers to the equipment's wafer handler for unloading and loading wafers (as defined in SEMI E63).

5.2.5 *carrier handler* — receives and passes the carriers from and/or to the external system (such as the factory material handling system). A carrier handler of the internal buffer type has the functions of handling and storing the carriers. A carrier handler for FOUPs has the opener(s) for opening and closing FOUPs.

5.2.6 *cart* — a floor-based carrier transfer vehicle (as defined in SEMI E101).

5.2.7 *cassette* — an open structure that holds one or more substrates.

5.2.8 *docking* — the act of locating a floor-based carrier transport vehicle for carrier transfer to/from equipment (as defined in SEMI E101).

5.2.9 *equipment front end module (EFEM)* — consists of the carrier handler that receives carriers from the factory material handling system on one or more load ports (as specified in SEMI E15.1), opens the carriers (if needed), and may include a substrate handler for unloading and loading wafers from the carrier to the process part of the equipment (as defined in SEMI E101).

5.2.10 *facial datum plane* — a vertical plane that bisects the wafers and that is parallel to the front side of the carrier (where wafers are removed or inserted). On tool load ports, it is also parallel to the load face plane specified in SEMI E15 on the side of the tool where the carrier is loaded and unloaded (as defined in SEMI E57).

5.2.11 *fixed buffer* — EFEM configuration with carrier places only on load port units arranged in a load port group (as defined in SEMI E101).

5.2.12 *front-opening unified pod (FOUP)* — a box (that complies with SEMI E47.1) with a non-removable cassette (so that its interior complies with SEMI E1.9) and with a front-opening interface (that mates with a FIMS port that complies with SEMI E62) (as defined in SEMI E47.1).

5.2.13 *horizontal datum plane* — a horizontal plane from which projects the kinematic-coupling pins on which the carrier sits. On tool load ports, it is at the load height specified in SEMI E15 and might not be physically realized as a surface (as defined in SEMI E57).

5.2.14 *internal buffer* — EFEM configuration with carrier places different from load port units (as defined in SEMI E101).

5.2.15 *minienvironment* — a localized environment created by an enclosure to isolate the product from contamination and people.

5.2.16 *OHT* — overhead transport system with hoist for lifting carriers between load port level and transport level (as defined in SEMI E101).

5.2.17 *pod* — a box having a Standard Mechanical Interface (SMIF) per SEMI E19.

5.2.18 *substrate handler* — transfers substrates between carriers and the process part of the equipment (as defined in SEMI E101).

5.2.19 *wafer carrier* — any cassette, box, pod, or boat that contains wafers (as defined in SEMI E15).

6 Description of the Standards

6.1 *Overview* — Figure 2 shows roughly what most of the SEMI Standards for 300 mm physical interfaces and carriers specify. However, this picture is greatly over-simplified. For example, a front-opening shipping box (FOSB) compliant with SEMI M31 (with its thicker door) generally cannot be opened by equipment load ports that are compliant with SEMI E63. Also, a wire link to an OHT for the carrier handoff parallel I/O can also be located at the top of the equipment. Furthermore, the atmospheric wafer handler for emptying the carrier will generally be different from the wafer handler used in the vacuum environment of the central handler module of a cluster tool.

6.2 *Kinematic Coupling* — The foundational document of the SEMI Standards for 300 mm physical interfaces and carriers is SEMI E57 which specifies the mechanical couplings used to ergonomically align and precisely support 300 mm wafer carriers. The kinematic coupling consists of three pins that mate with grooves on the bottom of the wafer carrier (which are not specified) for physical alignment and support. Most of the dimensions in the SEMI Standards for 300 mm physical interfaces and carriers are determined with respect to the three orthogonal datum