

SEMI E158-1110

MECHANICAL SPECIFICATION FOR FAB WAFER CARRIER USED TO TRANSPORT AND STORE 450 mm WAFERS (450 FOUP) AND KINEMATIC COUPLING

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 August 27, 2010. Initially available at www.semi.org in October 2010. Originally published July 2010.

1 Purpose

1.1 The purpose of this document is to establish basic physical dimensions for the carriers intended to be used to transport and store 450 mm wafers, as specified by SEMI M74, within semiconductor device manufacturing facilities.

1.2 This document is intended to define the reference planes for the dimensions of the carriers and the load port features that will interact with the carriers.

1.3 This document is intended to define a set of requirements to ensure interoperability of load ports and carriers without limiting innovative solutions.

2 Scope

2.1 This document specifies the external features and dimensions of the 450 mm carrier.

2.2 This document specifies the interior exclusion volumes for supporting and restraining wafers in the 450 mm carrier.

2.3 This document specifies the critical dimensions and locations of the kinematic coupling pins that will support and position the 450 mm carriers.

2.4 This document defines three orthogonal reference planes as references for carrier dimensions.

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 The detailed methods and mechanisms inside a 450 FOUP door as to how a carrier door may be engaged to and disengaged from the carrier shell are not specified by this document.

4 Referenced Standards and Documents

4.1 SEMI Standards

SEMI E144 — Specification for RF Air Interface Between RFID Tags in Carriers and RFID Reader in Semiconductor Production and Material Handling Equipment

SEMI M74 — Specification for 450 mm Diameter Mechanical Handling Polished Wafers

NOTE 1: The SEMI global Physical Interfaces & Carriers Committee is developing a Mechanical Interface Specification for 450 mm Load Ports intended to be used in conjunction with this document.

4.2 ISO Standard¹

ISO 4287 — Geometrical Product Specifications (GPS) – Surface Texture: Profile Method – Terms, Definitions and Surface Texture Parameters

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

¹ International Organization for Standardization, ISO Central Secretariat, 1 rue de Varembe, Case postale 56, CH-1211 Geneva 20, Switzerland. Telephone: 41.22.749.01.11; Fax: 41.22.733.34.30; <http://www.iso.ch>

5 Terminology

5.1 Abbreviations and Acronyms

- 5.1.1 *BP* — bilateral plane
- 5.1.2 *CL* — center line
- 5.1.3 *EE* — end effector
- 5.1.4 *FOUP* — front-opening unified pod
- 5.1.5 *FP* — facial plane
- 5.1.6 *HP* — horizontal plane
- 5.1.7 *KC* — kinematic coupling
- 5.1.8 *KCP* — kinematic coupling pin
- 5.1.9 *OHT* — overhead hoist transport
- 5.1.10 *RFID* — radio frequency identification
- 5.1.11 *TIR* — total indicator runoff

5.2 Definitions

5.2.1 *450 FOUP* — used generally as a “term” only within this document to identify the front-opening carrier used in fabs for 450 mm wafers.

NOTE 2: Unless otherwise specified, the word ‘carrier’ used herein shall mean 450 FOUP.

5.2.2 *bilateral plane (BP)* — a vertical plane, defining $x=0$ of a system with three orthogonal planes (HP, BP, FP), coincident with the nominal location of the rear primary KC pin, and midway between the nominal locations of the front primary KC Pins.

5.2.3 *center line (CL)* — a horizontal line centered vertically on the carrier door used as the reference for z dimensions of door features.

5.2.4 *facial plane (FP)* — a vertical plane, defining $y=0$ of a system with three orthogonal planes (HP, BP, FP), $y_{33}=194 \pm 0$ mm in front of the nominal location of the rear primary KC pin.

5.2.5 *front (of carrier)* — the part of the carrier closest to the door.

5.2.6 *horizontal plane (HP)* — a horizontal plane, defining $z=0$ of a system with three orthogonal planes (HP, BP, FP), coincident with the nominal location of the uppermost points (tips) of the three kinematic coupling pins.

5.2.7 *nominal location* — the value a dimension would have if its tolerance were reduced to zero.

5.2.8 *nominal wafer seating plane* — a horizontal plane that bisects the wafer pickup volume. [SEMI E1.9]

5.2.9 *origin* — the intersection of the BP and FP.

5.2.10 *plane* — a theoretical surface which has infinite width and length, zero thickness and zero curvature.

5.2.11 *rear (of carrier)* — the part of the carrier farthest from its door.

5.2.12 *wafer deflection* — change in wafer shape (TIR) due to gravity while the wafer is resting on the carrier wafer supports with the carrier door open.

5.2.13 *wafer extraction volume* — the open space for extracting a wafer from the cassette.

5.2.14 *wafer mapping exclusion volume* — a space inside the carrier reserved for break-the-beam type wafer mapping.

5.2.15 *wafer pick-up volume* — the space that contains entire bottom of a wafer if the wafer has been pushed to the rear of the cassette.

5.2.16 *wafer seating plane* — the bottom surface of an ideally rigid flat disk that meets the diameter specification for 450 mm wafers, with negligible droop due to gravity, as it rests on the wafer supports.

5.2.17 *wafer set-down volume* — the open space for inserting and setting down a wafer in the cassette.

6 Reference Planes (HP, FP, BP) Specification

6.1 The HP, FP, and BP as described in the definition section are ideal planes, which are intended to be used to depict the position of certain features relatively to these planes. These planes are at position zero (x, y, z) with no tolerance associated, since these ideal planes do not represent a physical feature.

NOTE 3: The top surfaces of the kinematic coupling pins are not the surfaces on which the carrier rests. Appendix 1 shows how test fixtures can be made to rest on the KCPs to duplicate the position of a carrier.

6.2 FP and BP are defined as vertical planes and ideally are parallel to the gradient of the gravity field. All three planes are mutually perpendicular. Only positive numbers are used to define coordinates within this system of three planes. No negative numbers are used in order to be as close as possible to standard mechanical drawing practices. Necessary clarification on the position of a feature usually will be achieved via figures.

NOTE 4: For best understanding, the definitions of the reference planes should be read in the order HP, BP, FP.

6.3 *Reference Baselines* — One center line is defined:

- *CL* — Center line for the carrier door. It passes through the centers of the openings for the door pins. All the z -dimensions of door features are symmetric to the CL.