E152 Standard Revision: EUV-pod Reticle Carrier

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EUV Reticle Handling TF Co-chairs/Key Contributors:

Long He (Intel), David Halbmaier (Entegris), John Lystad (Entegris), John Zimmerman (ASML), David Chen (SEMATECH), and Ota Kazuya (Nikon/SELETE), et al...

Outline

- **Background**
- **Key Revisions**
  1. **Add purge ports**
  2. *Add door sensor pad/ring*
  3. **Pod Info-pad configuration standardization**
  4. **RFID standardization**
  5. *Weight changes*
  6. *Editorial and technical corrections to E152*
- **Elimination of inner-pod types, how?**
- **Plans**

Background

- **EUV pod standard (SEMI E152) was published in July 2009.**
- **Changes have been raised since, both for improvements and new capabilities.**
- **Now, the EUV Reticle Handling TF is working on E152 revision.**

E152 Refresher

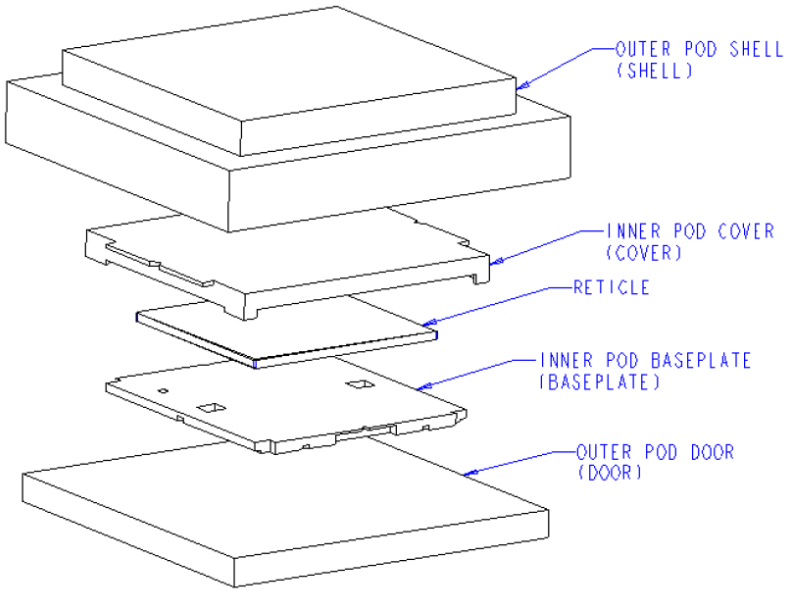


Figure 1
Exploded View of EUV Pod

SEMI E152-0709
MECHANICAL SPECIFICATION OF EUV POD FOR 150 mm EUVL RETICLES

This standard was technically approved by the global Physical Interfaces & Carriers Committee. This edition was approved for publication by the global Audits and Reviews Subcommittee on May 13, 2009. It was available at www.semi.org in June 2009 and on CD-ROM in July 2009.

1 Purpose

1.1 This standard specifies EUV Pod for the 150 mm Extreme Ultraviolet Lithography (EUVL) reticle, used to ship, transport and store a 6-inch reticle. The EUV Pod consists of an outer pod and a protective inner pod. The EUV Pod is to be used when a conventional reticle carrier does not meet the requirements of EUVL.

2 Scope

2.1 This standard is intended to set an appropriate level of specification that places minimal limits on innovation while ensuring modularity and their inter-changeability at all mechanical interfaces. Many requirements given in this specification are in the form of maximum or minimum dimensions with very few required surfaces. No material requirements or micro-contamination limits are given in this specification.

2.2 Because of high attenuation feature of EUV light, a conventional pellicle film cannot be placed in front of EUVL reticles. The inner pod is to protect reticles from particle contamination.

2.3 The EUV Pod has the following components and sub-components. The baseplate of inner pod has two possible configurations depending on the intended usage. They are designated Type A and Type B. Detail configuration requirements for each are shown in Table 2.

2.3.1 Key:

Required feature: ▪

Optional feature: ◊

Outer pod shell

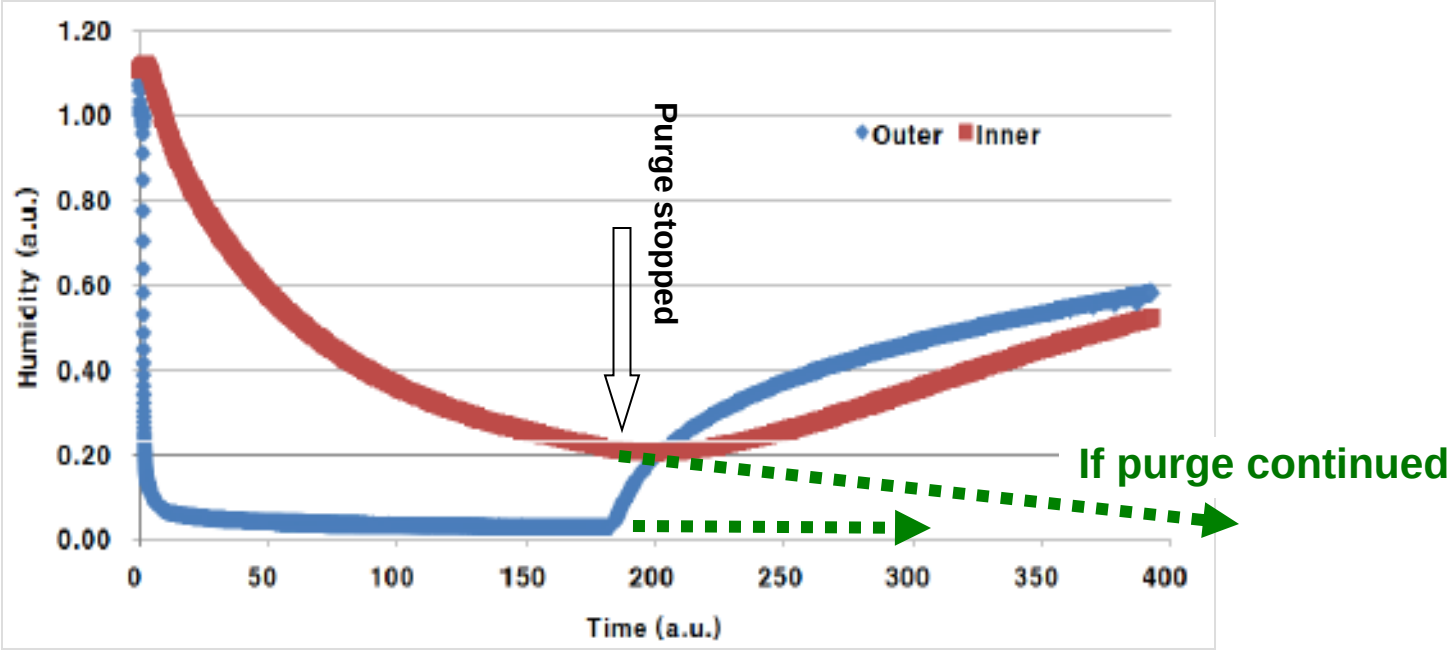
- ▪ One (1) EUV pod ID placement volume
- ◊ Top robotic handling flange
- ◊ Two (2) side robotic handling flanges

Outer pod door

- ▪ Four (4) door sensing pads
- ▪ Four (4) info pads

EUV-pod Purging Curves

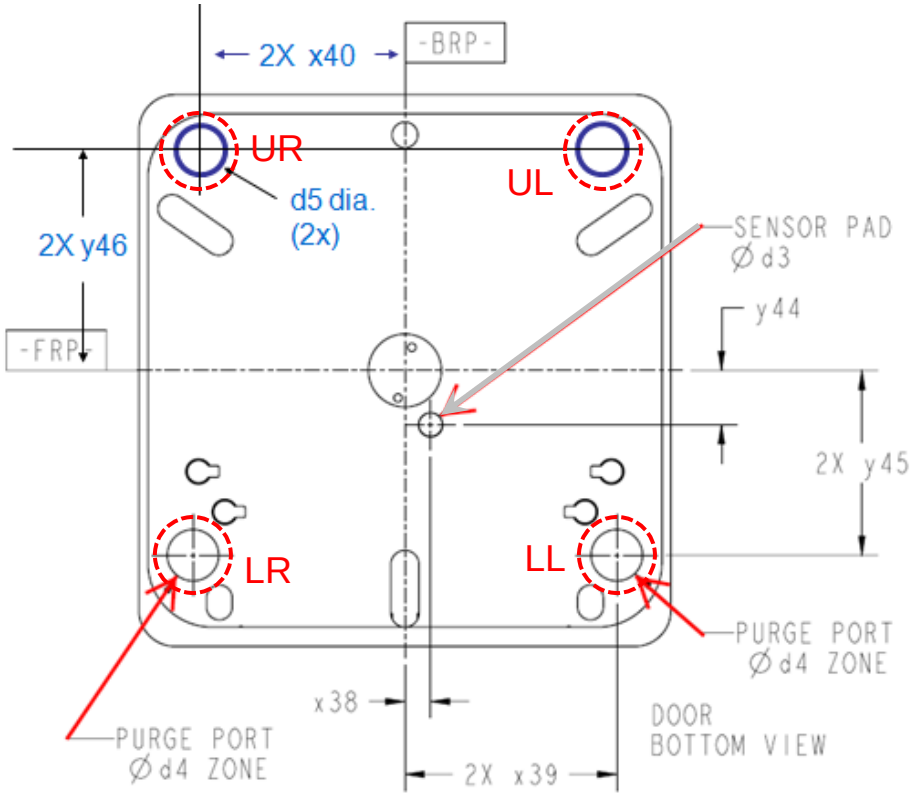
- **For haze prevention, good storage is essentially about how to best keep mask "dry."**
  - Other haze formation mechanisms exist, but maybe secondary.



Humidity measurements from EUV pod during initial purge and after gas shutoff (Samsung, 2010 EUV Symposium)

Purging Port Standardization

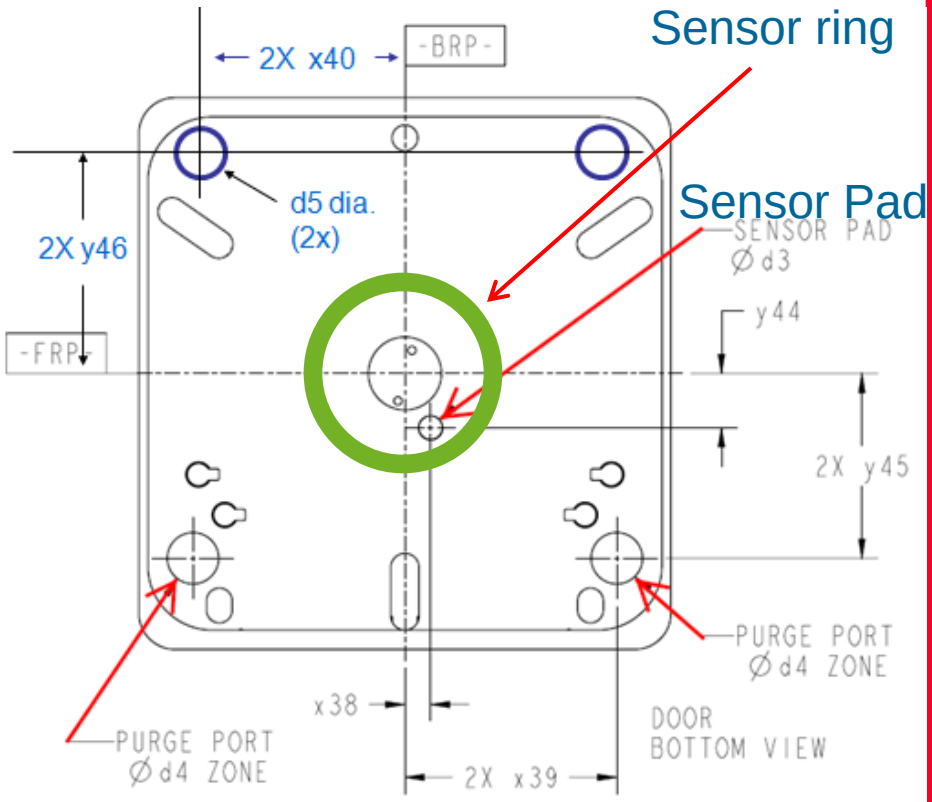
- **The need: Reticle purge capability**
- **Proposals:**
  - **Specify two (2) active purge ports at LR and LL corners.**
  - Reserve two (2) exclusion areas at UR and UL for two additional purging ports. The two exclusion areas are reserved for possible future needs. And E152 does not specify actual purging ports built to those areas.



Schematics of outer pod door bottom view

Outer-Pod Door Sensor for Automation

- **The need: Loadport automation**
- **Proposal:**
  - Two proposals are on the table. One is a small, raised sensor pad and the other is a big, raised ring.
  - But, SEMI (optical) Reticle Handling TF (owner of E100/RSP200 standard) recently proposes to add sensor pad/ring to E100. So the two TFs will need to work together on this one.



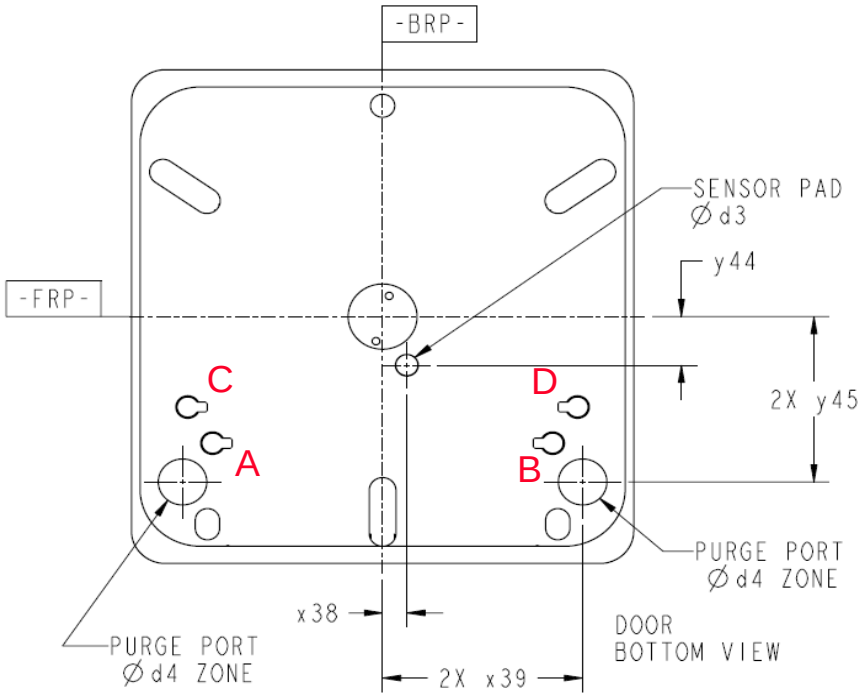
Schematics of outer pod door bottom view

Proposed Dimensions for Purge Areas and Sensor Pad

Symbol Used	*Value Specified (mm)*	*Measured From - to*
x38	12.7 +/- 0.5	BRP to center of sensor pad
x39	104.7 +/- 0.5	BRP to center of purge areas
x40	104.7 +/- 0.5	BRP to center of reserved areas
y44	27.0 +/- 0.5	FRP to center of sensor pad
y45	91.5 +/- 0.5	FRP to center of purge areas
y4	100.3 +/- 0.5	FRP to center of reserved areas
d3	10.0 minimum	Diameter of sensor pad
d4	25.0 maximum	Diameter of purge areas
d5	25.0 maximum	Diameter of reserved areas
z21	1.5 +/- 0.5	Distance from HRP to sensor pad

Info Pad Standardization

- **Need: Streamline pod management to prevent tool failures.**
- **It must be compliant with current E100/RSP200 standard.**



Four Possible Configurations Proposed for EUV Pods

Proposal:

- Standardize four (4) available configurations for EUV carriers: ***EUV–1,2,3,4.***
- Leave configuration assignments to end-users?
  - For example: end users may specify how carriers should be configured when delivered, through p-spec.
- Need to associate info pad configuration with RFID?

Configuration	*A*	*B*	*C*	*D*	
230 mm Reticle	x	x	o	●	E100
6 inch reticle	x	x	●	●	E100
EUV – 1	●	●	o	o	E152
EUV – 2	o	o	o	o	E152
EUV – 3	●	o	o	o	E152
EUV – 4	o	●	o	o	E152
Undefined	●	●	●	o	
Undefined	o	o	●	o	
Undefined	●	o	●	o	
Undefined	o	●	●	o	

x: Undefined
o: info pad (hole) open
●: info pad (hole) blocked

RFID Transponder Placement

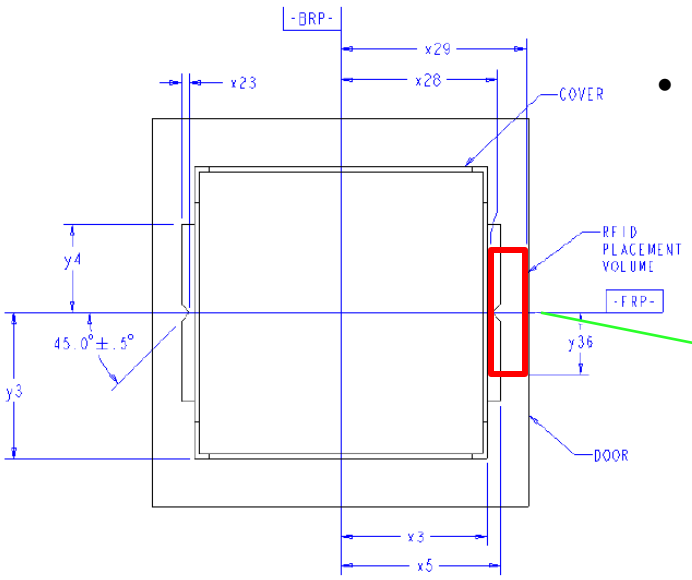


Figure 4

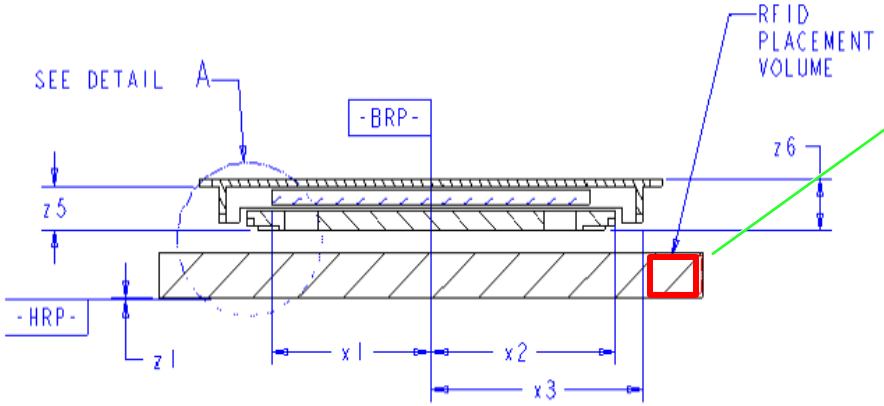


Figure 6
Inner Pod – Internal Front View

- The TI transponder is NOT standardized by E152. No need, either?
- **The physical location of the transponder is correct in the picture**. (caution with the drawings!)

RF transponder (*RI-TRP-DR2B*) placed in door, on its right side when looking up.

RFID Page Assignments

- **Proposal:**
  - The first 9 and last 4 pages for end-users
  - The remaining middle 4 pages for 4 pod ID's
- **Page 9-12 ID tracking optional?**
- **What about the data format?**

Page									Locked*	Page Assignment
0									*N*	*User defined*
1									*N*	*"*
2									*N*	*"*
3									*N*	*"*
4									*N*	*"*
5									*N*	*"*
6									*N*	*"*
7									*N*	*"*
8									*N*	*"*
9									***N***	***Door ID***
10									***N***	***Shell ID***
11									***N***	***Baseplate ID***
12									***N***	***Cover ID***
13									*N*	*User defined*
14									*N*	*"*
15									*N*	*"*
16									*N*	*"*

* Once a page is lock, it can not be unlocked without replacing the transponder. By default, pages will NOT be locked when delivered. However, end users may choose to lock, when permanent write is preferred.

More about RFID

Discussions:

- Is it value added to track pod down to components? Or, is it acceptable to allow component swaps?
- How to hold pod sets together when cleaned? Need to?
- About data format, standardize it or leave to end-users and tool/pod suppliers?
- Do we need to include RF transponder model in E152?

- Is it enough value added to move RFID to inner pod? If so, are we willing for needed infrastructure changes?
  - Current RF transponder is not suitable for this app.

Pod Weight Increase

- **Needs: Allow improvements while maintaining structural integrities**
  - The proposed changes amount to a 17% increase in total maximum weight.
  - Final weight specification will still be compliant with SEMI ergonomic standards.

Symbol	***Value***		
	Current	***Proposed***	***% change***
M1 (Base Plate Mass)	200 g Minimum 625 g Maximum	200 g Minimum 675 g Maximum	No change 8%
M2 (Inner Pod Mass)	400 g Minimum 1,100 g Maximum	400 g Minimum 1,200 g Maximum	No change 9%
M3 (Outer Pod Mass)	1,000 g Minimum 2,000 g Maximum	1,000 g Minimum 2,500 g Maximum	No change 25%

Inner Pod Base Coupling KC Pin Correction

Dimension corrections:

Z15 = **13.25** ± 0.25
D2 = 6.35 ± **0.07**

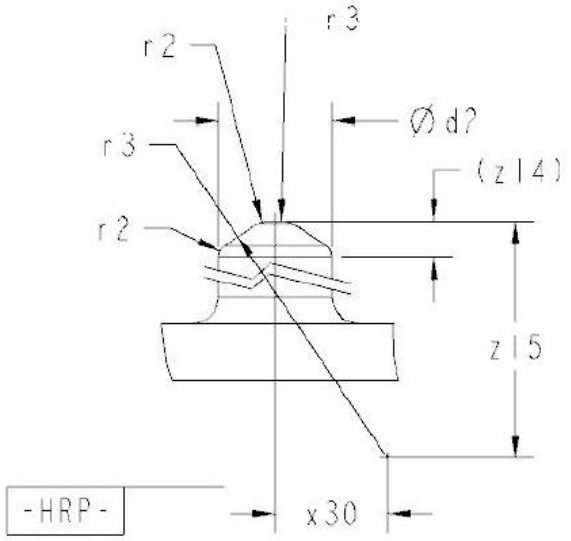


Figure 9
Kinematic Coupling Pin Geometry, Baseplate Interface

Part of E152 Table 1

z15	9	7.52	±0.25	Top of KC pin	Origin of KC pin radius
z17	7	See Table 2	See Table 2	Bottom of inner pod baseplate	Bottom of cover
z18	3	3.50	±0.25	Reticle front side	Bottom of reticle front edge grip exclusion volume option
z19	7	75.00	Maximum	Horizontal reference plane	Top of outer pod shell
z20	5	4.99	±0.15	Depth of baseplate handling holes	
d1	5	8.00	±0.10	Baseplate registration holes	
d2	9	6.35	±0.10	KC pin diameter	

For Type-B, x4 Does Not Apply (Background)

Feature above this line not allowed for Type B

For Type-B where y38 is set to "0." So x4 will not apply!

Feature below this line not allowed for Type B

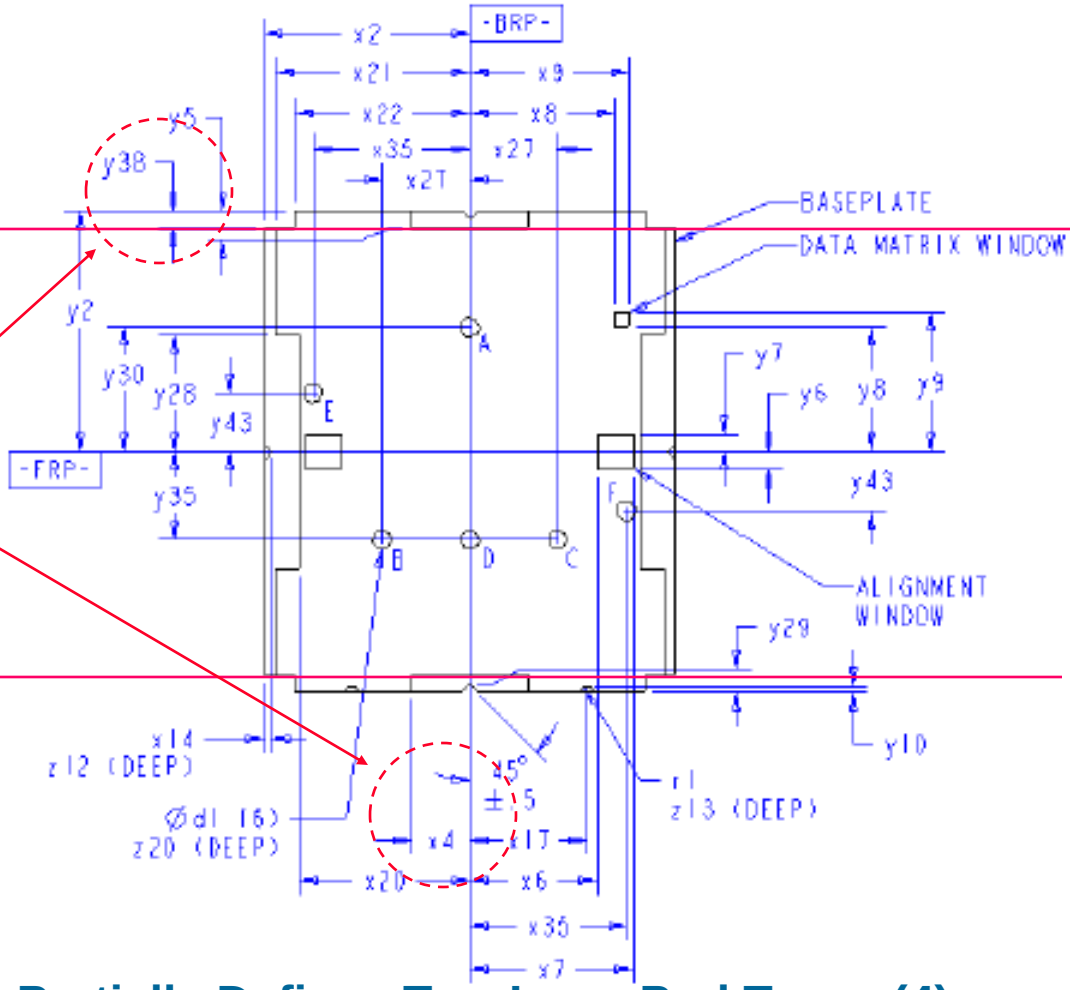
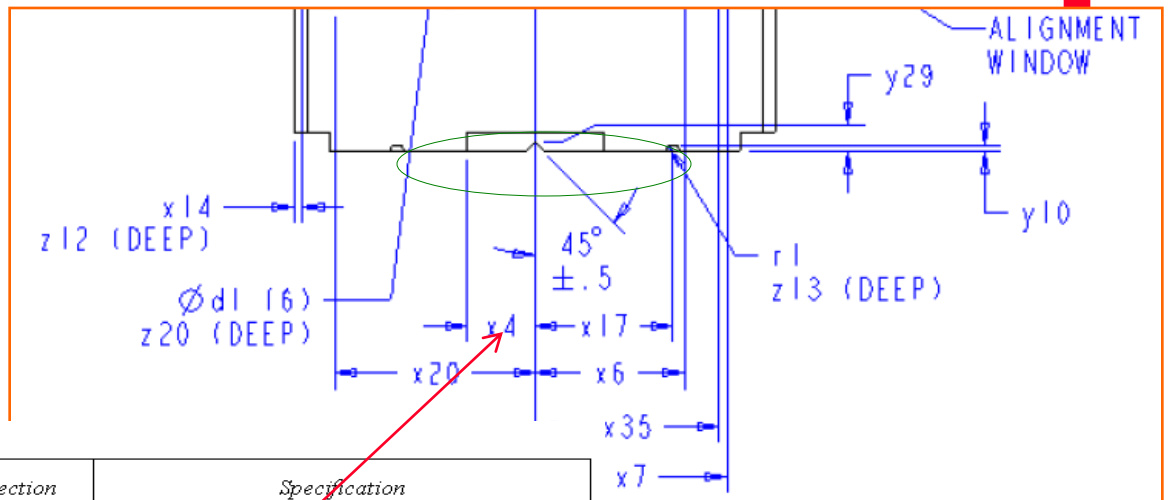


Figure 5
Baseplate – Bottom View

In E152 Figure 5, y38 Partially Defines Two Inner Pod Types (4)

For Type-B, Change x4 to “Prohibited” (5)

- **Need: To correct typo in existing E152**
- When y38 =0, x4 = 0 or “prohibited.”



re 5
Bottom View

Table 2 Type A/B Inner Pod Baseplate Specification

Feature	*Symbol Used*	*Figure*	*Section*	*Specification*	
				Type A	*Type B*
Reticle Location Tolerance	x1	6	5.5	±0.55 mm	±0.25 mm
Reticle Location Tolerance	y1	7	5.5	±0.55 mm	±0.25 mm
Front Edge Grip Exclusion Volumes		3	5.2	Required	Not Required
Baseplate Windows		5, 8	5.9	Required	Not Required
Baseplate Corner Notch	x22	5, 8	5.8	72.00 ± 0.20 mm	Prohibited
Baseplate Corner Notch	y38	5		3.00 ± 0.25 mm	Prohibited
Secondary Baseplate Exclusion Volume	y5	5	5.7.1	3.00 ± 0.25 mm	Prohibited
Secondary Baseplate Exclusion Volume	z3	7	5.7.1	6.00 ± 0.25 mm	Prohibited
Baseplate Notch	y29	5	5.7.1	3.00 ± 0.25 mm	Prohibited
Cover Edge Limit (above base plate, along x22)	z17	7		5.00 mm, Minimum	Prohibited
Baseplate Exclusion Volume	y28	5, 8	5.7.1	50.00 ± 0.25 mm	40.00 ± 0.25 mm
Baseplate Exclusion Volume	x4	5	5.7.1	25.00 ± 0.25 mm	20.00 ± 0.25 mm
Baseplate Registration Hole Assignments		5, 8	5.14	A, B, C, D, E, F	A, B, C

E152 Specifies Two Inner-pod Types: A and B

Inner pod types called for in two area: (1) two inner pod types and (2) un-specified optical properties of baseplate windows for Type A.

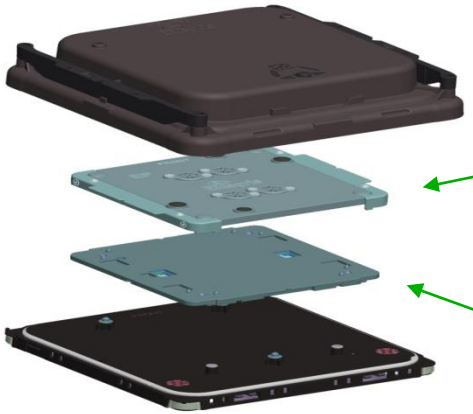
Examples:

Table 2 Type A/B Inner Pod Baseplate Specification

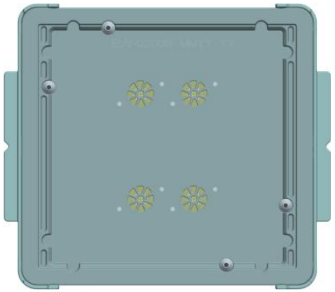
Feature	*Symbol Used*	*Figure*	*Section*	*Specification*	
				Type A	*Type B*
Reticle Location Tolerance	x1	6	5.5	±0.55 mm	±0.25 mm
Reticle Location Tolerance	y1	7	5.5	±0.55 mm	±0.25 mm
Front Edge Grip Exclusion Volumes		3	5.2	Required	Not Required
Baseplate Windows		5,8	5.9	Required	Not Required
Baseplate Corner Notch	x22	5,8	5.8	72.00 ± 0.20 mm	Prohibited
Baseplate Corner Notch	y38	5		3.00 ± 0.25 mm	Prohibited
Secondary Baseplate Exclusion Volume	y5	5	5.7.1	3.00 ± 0.25 mm	Prohibited
Secondary Baseplate Exclusion Volume	z3	7	5.7.1	6.00 ± 0.25 mm	Prohibited
Baseplate Notch	y29	5	5.7.1	3.00 ± 0.25 mm	Prohibited
Cover Edge Limit (above base plate, along x22)	z17	7		5.00 mm, Minimum	Prohibited
Baseplate Exclusion Volume	y28	5,8	5.7.1	50.00 ± 0.25 mm	40.00 ± 0.25 mm
Baseplate Exclusion Volume	x4	5	5.7.1	25.00 ± 0.25 mm	20.00 ± 0.25 mm
Baseplate Registration Hole Assignments		5,8	5.14	A, B, C, D, E, F	A, B, C

5.9 *Baseplate Features for Reticle Alignment and Data Matrix* — The baseplate must allow for optical alignment and identification of the SEMI T16 data matrix symbol on the quality surface of the reticle (see Table 2 for application). Alignment window locations are defined by x6, x7, y6 and y7 in Figure 5 and Table 1. The data matrix symbol window is defined by x8, x9, y8, y9 in Figure 5 and Table 1. This standard does not cover optical specifications for windows which can vary if different wavelengths were used for alignment and data matrix reading in different exposure tools.

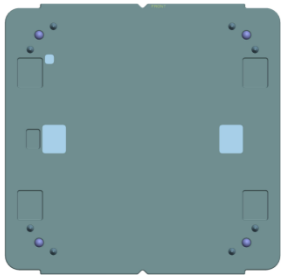
SEMI-E152 Two Inner-pod Types

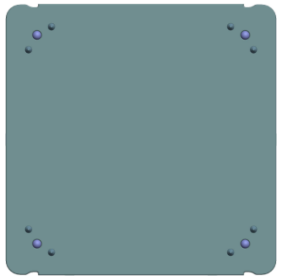


EUV-pod: a single type outer pod; two types of inner pod, major differences are on the baseplate



Inner pod cover





Inner pod baseplate

Inner pod Type-A for scanners

Type-B for uses other than by scanners

- **E152 specifies 1 outer pod, 2 inner pod types (A and B).**
- **Type-A is allowed to have multiple sub-types.**
- **Additional sensing features built to Type-A for positive identification by scanners**

  (Type-A: optical windows, more access to mask, relaxed spec, etc...)
- **All tools other than scanners required to be *"type-blind,"* i.e., only use identical interfaces available to all.**

Pod Type / Use for	Type B	Type A		
		Suppl-1	Suppl-2	Suppl-3
Suppl-1 Scanner	×	✓	×	?
Suppl-2 Scanner	×	×	✓	?
Suppl-3 Scanner	×	?	?	✓
Non-Scanners	✓	✓	✓	✓

A likely inner pod dedication scheme: green indicating compatible, red incompatible, gray unknown

Eliminate The Needs for Two Inner-pod Types, If and How?

- **Background:** Two inner-pod types have been specified primarily for performance concerns that Type A as specified may not meet particle-free requirements. Secondary is cost for non-scanner uses.
- **Current status:** Type-A has not been demonstrated particle-free, especially for shipping.
- **Blank shop:** If blank shops needed to implement EUV-pod, would Type-A make sense for blank shop applications?
- **Strategy discussion:**
  - What's the negative impact to keep both inner-pod type options open?
  - How to address potential blank shop need, where pod will never make to wafer fabs?.
  - How confident you are for Type-A to be particle-free as E152 currently specified and why?
  - What's the best approach to eliminate the needs for two inner-pod types?

(Ota-san will show his recent data in conference)

How to Eliminate The Needs for Multiple Sub-types of Type-A Inner-pods?

- **Problem:** E152 left window/optical property of Type-A inner pods unspecified. And scanner suppliers have already developed reticle alignment technology at different wavelengths.
- **How to eliminate the need for Type-A inner pod sub-types?**
  - Is it technically possible to share identical glass for all the wavelengths?
  - If so, how to specify the glass?

Next Step Plans

- **Submit SNARF for NA PIC approval to include agreed upon changes in current revision**
- **TF teleconference in every other week**

  (Only request for teleconf participations is >70% attendance.)
- **Face-face TF meeting at SEMICON West with focus on automation issues in July, 2011.**
- **Yellow ballot submission by August 29, 2011 (Standard Cycle 6)**