

MDR Format Specification

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Association of Super-Advanced Electronics Technology (ASET)

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MDR format specifications

1 Purpose

Mask D2I/ASET are aiming towards importing a concept for mask data rank in order to describe the importance of the mask data, and the proposal of an effective manufacturing flow which thinks about the importance of mask pattern.

Mask data rank shows the priority definition of pattern importance which has converted design intents into numbers and can be utilized for mask manufacturing. Utilizing mask data rank, we can identify and sort out the importance of reticle patterns in mask writing and inspection. Optimizing the max beam size in mask writing and controlling defect sensing threshold in mask inspection by utilizing importance of patterns, TAT could be reduced. This document defines the mask data rank format specifications, namely “MDR”.

2 Scope

MDR specification applies to the input data format for mask inspection and writing tools.

NOTICE: This specification does not purport to address safety issues, if any, associated with its use. It is the responsibility of the users of this specification to establish appropriate safety and health practices and determine the applicability of regulatory or other limitations prior to use.

3 Limitations

This document will always be required to remain compliant with SEMI P39 OASIS, so that this document is always a formal subset of SEMI P39 OASIS.

4 Referenced Standards and Documents

4.1 SEMI Standards

SEMIP39__OASIS™ OPEN ARTWARK SYSTEM INTERCHANGE STANDARD

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

5 Terminology

5.1 Abbreviations and Acronyms

5.1.1 OASIS™__OPEN ARTWARK SYSTEM INTERCHANGE STANDARD

5.2 Symbol

5.2.1 A — acceptable record

The records are generated as needed in the input data for mask tools by the software. The mask tools perform processing according to the contents of the records.

5.2.2 I — ignore record

The records may be generated in the input data for mask tools by the software, but will be ignored by the mask tools. The mask tools do not respond to the records.

5.2.3 M — mandatory record

The records must be generated in the input data for EB mask tools by the software. If the records do not exist, the mask tools treat it as an error.

5.2.4 X — prohibited record

The records are prohibited to exist in the input data for mask tools. If the records exist, the mask tools treat it as an error.

6 Requirements

6.1 Background

Since it is impossible to feed the design data from semiconductor companies to mask shops in terms of information confidentiality, a practical measure needs to be sought for smooth conveyance of the design intent. Thus we have defined MDR (Mask Date Rank) format to describe mask data rank information.

The MDR format is the format for Feed-forward information flow called DAM shown in Figure 1, and it is based on the OASIS format. The priority is expressed as polygon records with data type values which identify the criticality of the areas. Since there is only polygon data in MDR, it has no sensitive information. Thus, design engineers can readily give the design intent information to mask manufacturing engineers by utilizing MDR.

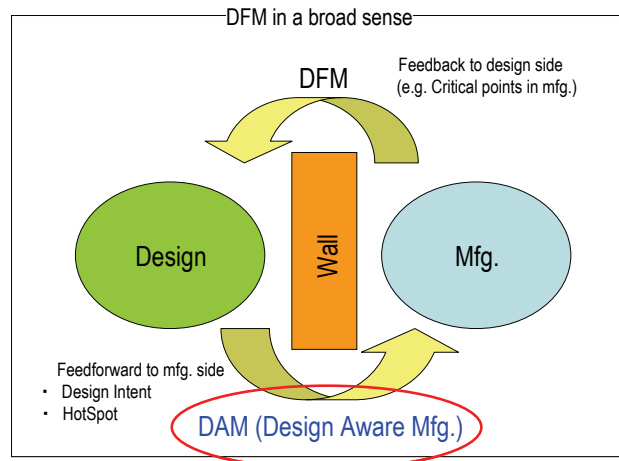


Figure 1. DAM

6.2 Concept of MDR

The MDR format is based on the OASIS format and the priority is expressed as polygon records with data type values which identify the criticality of the areas. The MDR polygons have three types: GLOBAL, LOCAL and LOCATION.

The GLOBAL polygons are used to specify the priority regions on a full mask level, such as main die or peripheral area. In order to express the priority regions based on individual mask patterns, the LOCAL polygons are used. LOCAL polygons are usually larger than the original mask patterns so that they enclose the mask patterns with some marginal distances. LOCATION polygons are generated where it is judged to be a hotspot or are used to specify the priority of space between patterns between polygons.

The required manufacturing accuracy can be specified by the INNERALLOWANCE or OUTERALLOWANCE property value. These allowance values are maximum allowable displacement of manufactured mask edges from their true locations. Utilizing INTENT property values, it is possible to describe any information by character.

6.3 Specification of MDR

- When MDR is the same area of mask data, applying any mask data is acceptable.
- There is no restriction in class.
- With reference to GLOBAL, LOCAL and LOCATION, figures are written to different layers.

- (d) Importance is defined by datatype. 0 is the most important, and priority decrease as the numbers rise.
- (e) Only the internal connotation of each figure is valid.
- (f) If there are multiple figures on the same layer, the number closes to 0 gets priority.
- (g) If there are multiple figures on a different layer, which layer gets priority is application-dependent.
- (h) The data that extends over more than one file is disabled.
- (i) The area designation figures POLYGON, RECT, TRAPEZOID and CTRAPEZOID can be used. PATH, CIRCLE and XGEOMETRY can not be used.

6.4 OASIS Format Specification

See SEMI P39 for OASIS Format Specification.

6.5 Additional Records in MDR

In MDR, following standard user properties are added to PROPERTY record. These properties contain file-level and polygon-level standard properties.

6.5.1 file-level standard properties

6.5.1.1 S_MDR_VERSION

This property declares the version of MDR specification. Its value consists of a single a-string record. With this specification, the value is "1". It is a mandatory record in MDR.

6.5.1.2 S_MDR_GLOBALPRIORITY_LAYER

This property shows a layer number for the GLOBAL. Its value consists of a single unsigned-integer record. The GLOBAL is shown in Figure 2. The priority of chip units is defined. Slanting lines are not allowed.

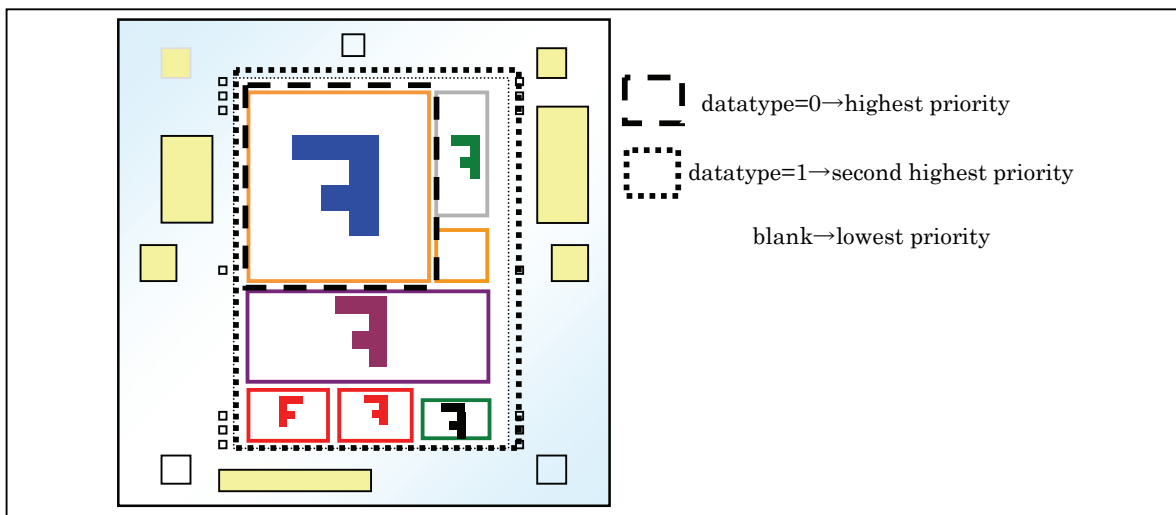


Figure 2. GLOBAL area

6.5.1.3 S_MDR_LOCALPRIORITY_LAYER

This property shows a layer number for LOCAL. Its value consists of a single unsigned-integer record. LOCAL is shown in Figure 3. The priority of pattern is defined. Slanting lines are allowed.

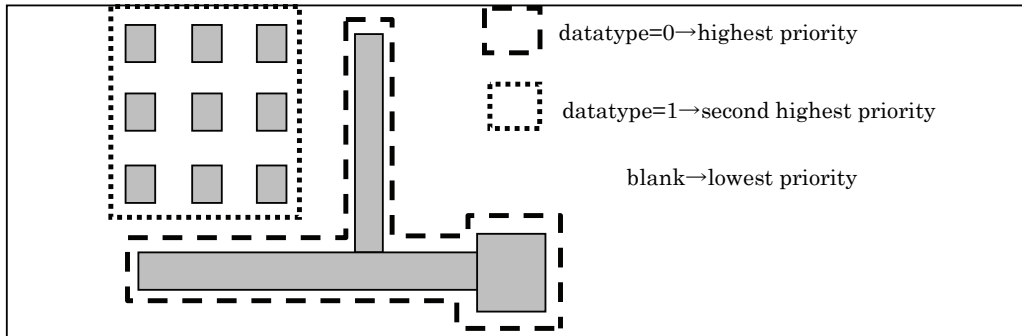


Figure 3. LOCAL area

6.5.1.4 S_MDR_LOCATION_LAYER

This property shows a layer number for LOCATION. Its value consists of a single unsigned-integer record. LOCATION is shown in Figure 4. The priority of space between patterns is defined.

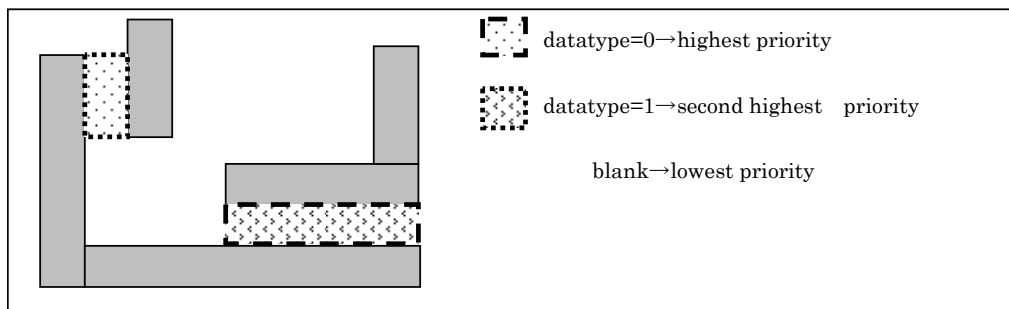


Figure 4. LOCATION area

6.5.2 polygon level standard property

6.5.2.1 S_MDR_INNERALLOWANCE

This property shows the margin of error between the layers on the inner side. Its value consists of a single signed-integer record. It is based on the database unit. INNERALLOWANCE is shown in Figure 5. This value is the maximum inner allowable displacement of manufactured mask edges from their true locations.

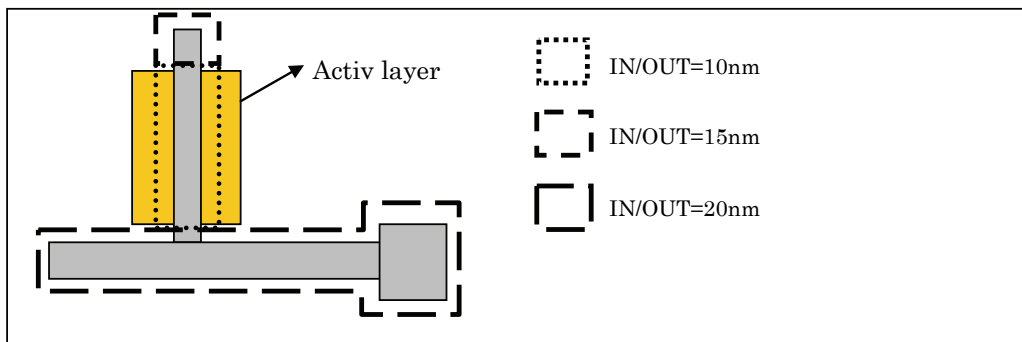


Figure 5. Inner/outer allowance

6.5.2.2 S_MDR_OUTERALLOWANCE

This property shows the margin of error between the layers on the outer side. Its value consists of a single signed-integer record. It is based on the database unit. OUTERALLOWANCE is shown in Figure 5. (refer back to Figure 5) This value is maximum outer allowable displacement of manufactured mask edges from their true locations.

6.5.2.3 S_MDR_INTENT

This property shows the information of design intent. Its value consists of the character record. It is recommended to use reference mode in PROPSTRING for compression. INTENT is shown in Figure 6. This value shows design intent information.

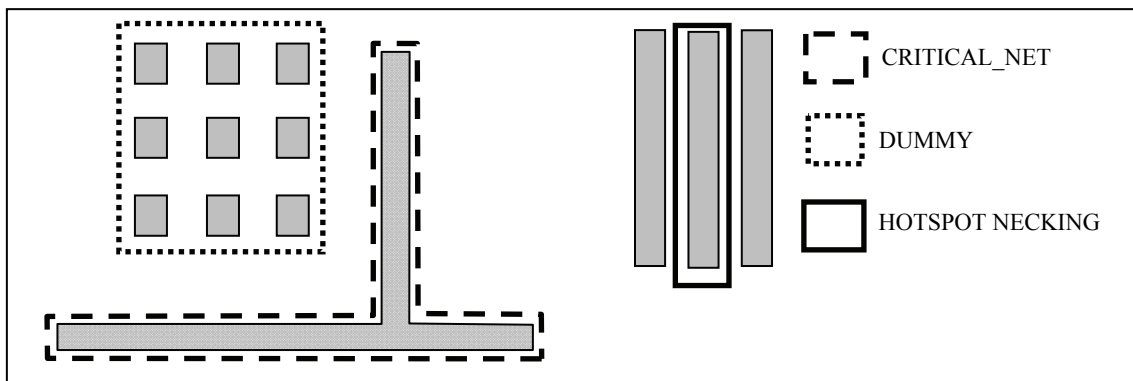


Figure 6. Intent information

6.6 Specification of the MDR Restrictions

6.6.1 Concept

MDR format is pursuant to SEMI P39.

6.6.2 Restrictions on OASIS Record

It is pursuant to SEMI P39.

6.6.3 Restrictions for property

The restrictions on file level standard property record of OASIS are shown in Table 1. And the restrictions on figure level standard property record of OASIS are shown in Table 2.

Table 1. Restriction for standard property (file level)

No	Property name		Restriction item	Content of restriction					Propriety
				Minimum	Maximum	Step	Unit	Comment	
1	S_MDR_VERSION	flags	MDR format version	-	-	-	-	Fixed to 1	M
2	S_MDR_GLOBALPRIORITY_LAYER	Layer-number	Layer number	0	$2^{64}-1$	1	-		A
3	S_MDR_LOCALPRIORITY_LAYER	Layer-number	Layer number	0	$2^{64}-1$	1	-		A
4	S_MDR_LOCATION_LAYER	Layer-number	Layer number	0	$2^{64}-1$	1	-		A

M: Mandatory, A: Acceptable, I: Ignore, X: Prohibited

Table 2. Restriction for standard property (figure level)

No	Property name		Restriction item	Content of restriction					Propriety
				Minimum	Maximum	Step	Unit	Comment	
1	S_MDR_INNERALLOWANCE	inner allowance	Inner allowance	1	$2^{64}-1$	1	Grid		A
2	S_MDR_OUTERALLOWANCE	outer allowance	Outer allowance	1	$2^{64}-1$	1	Grid		A
3	S_MDR_INTENT	string	Information for design intent	1	$2^{64}-1$			Recommend to refer PROPSTRING record	A

M: Mandatory, A: Acceptable, I: Ignore, X: Prohibited

6.6.4 Restrictions for hierarchy

Restriction for hierarchy is shown as Table 3.

Table 3. Restrictions for hierarchy of OASIS

No	Restriction item	Content of restriction	Record
1	Cell reference	Other MDF file cells are non-readable	PLACEMENT
2	Hierarchy num	No restrictions	PLACEMENT

6.6.5 Restrictions for cell name

There are no restrictions for cell name.

6.6.6 Restrictions for file name

There are no restrictions for file name.

6.6.7 Restrictions for figure

- The area designation figures POLYGON, RECT, TRAPEZOID and CTRAPEZOID can be used. PATH, CIRCLE, XGEOMETRY and XELEMENT can not be used.
- Only the internal connotation of each figure is valid.
- Importance is defined by datatype. 0 is the most important, and priority decrease as the numbers rise.
- If there are overlapping figures with different priority on the same layer, figures with higher importance get priority.
- If there are overlapping figures on a different layer, which layer gets priority is application-dependent.
- There are no restrictions for blank area.

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Produced by Mask Design, Drawing, and Inspection Technology Research Department,

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