

SEMI P46-0706

SPECIFICATION FOR CRITICAL DIMENSION (CD) MEASUREMENT INFORMATION DATA ON PHOTOMASK BY XML

This standard was technically approved by the global Micropatterning Committee. This edition was approved for publication by the global Audits and Reviews Subcommittee on May 16, 2006. It was available at www.semi.org in June 2006 and on CD-ROM in July 2006.

1 Purpose

1.1 This specification of XML data structure defines the common input/output information used for the critical dimension (CD) measurement tools for photomask.

1.2 The equipment supplier using this standardized data structure can perform transmission and reception, without being dependent on specific software and specific hardware.

2 Scope

2.1 This standard can be applied to CD measurement on photomasks for semiconductor manufacturing.

2.2 This data structure defines data hierarchy, tag name, and contents for an XML file to be transmitted. A particular database or a particular programming language is not specified in this standard.

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 This standard does not specify particular schema.

3.2 This standard does not address namespace issue.

3.3 This standard is limited to the CD measurement on photomask.

4 Referenced Standards and Documents

4.1 SEMI Standards

4.1.1 SEMI P10 — Specification Of Data Structures For Photomask Orders

4.1.2 SEMI P41 — Specification For Mask Defect Data Handling With Xml, Between Defect Inspection Tools, Repair Tools, And Review Tools

4.2 World Wide Web Consortium Documents¹

4.2.1 Extensible Markup Language (XML) 1.0 (Second Edition) — W3C, 4 February 2004,
<http://www.w3.org/TR/2004/REC-xml-20040204/>

4.3 JEITA Documents²

4.3.1 Reticle Data Management Guideline Ver.2.0 (2004), http://jeita-smtc.elisasp.net/jp/doc_040510-jp.htm

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

5 Terminology

5.1 Abbreviations and Acronyms

5.1.1 CD — Critical Dimension

5.1.2 JDV — Job Deck Viewing

5.1.3 MCDMML — Mask Critical Dimension Measurement Markup Language

¹ World Wide Web Consortium (W3C), Website: www.w3c.org

² Japanese Electronic and Information Technology Industries Association, Tokyo Chamber of Commerce and Industry Bldg. 2-2, Marunouchi 3-chome, Chiyoda-ku, Tokyo 100-0005, Japan; Website: www.jeita.or.jp

5.2 Definitions

5.2.1 *job deck view* — viewing of chip layout on writing data.

5.2.2 *mask critical dimension markup language* — the name of the XML file defined in this standard.

6 Requirements

6.1 This standard defines the layered structure of an XML file, an element name, an attribute name and the contents described in them. Users of this standard have to define the style of the information described in an element and an attribute, and it must be published.

6.2 The information on CD measurement information is treated as one file. The MCDMML data item specifications defined in this standard are shown in Tables 2-5. The columns in these tables are described in the following sections. A layered structure is shown in Figures 2-5. Figure 1 is explanation of Figures 2-5.

6.2.1 *Item Name Column* — Name with which the data item is referenced.

6.2.2 *Element or Attribute Column* — Indicates whether the item is an element or an attribute.

6.2.3 *Data Type Column* — Type of data as defined in Table 1.

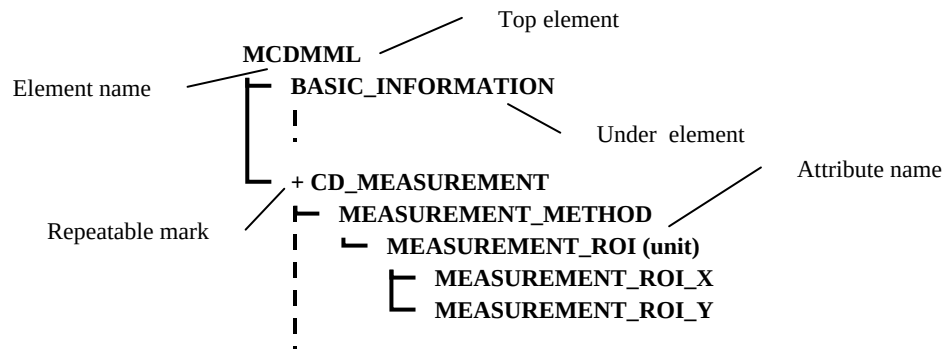


Figure 1
Explanation of Figures 2-5

Table 1 Data Types

Type	Description
String	A string of ASCII characters from 0–32767 characters in length.
Integer	A string of numeric characters (0...9) that represent an integer value.
Decimal	A string of real numbers that represent a decimal value.
Date Time	Date and time represents a specified time of a specified day. When use is made of the calendar date the representation is: YYYY-MM-DDThh:mm:ss +/- hh:mm where the capital letter T is used to separate the date and time components.

Table 2 Description of Basic Information Section

Item	Element or Attribute	Data type	Description
MCDMML	Element	-	Root element.
BASIC_INFORMATION	Element	-	Top element of Basic Information.
MASK_MAGNIFICATION	Element	-	Top element of mask magnification.
DATA_MAGNIFICATION	Element	Decimal	Data magnification.

<i>Item</i>	<i>Element or Attribute</i>	<i>Data type</i>	<i>Description</i>
MANUFACTURE_MAGNIFICATION	Element	Decimal	Reticle magnification.
MASK_NAME	Element	-	Top element of the mask name.
MASK_SERIES_NAME	Element	String	Series name of mask.
MASK_LAYER_NAME	Element	String	Layer name of mask.
MASK_LOT_NUMBER	Element	String	Manufacturing lot number.
DATE_INFORMATION	Element	-	Top element of date information.
INPUT_DATE	Element	-	Top element of input date information.
INPUT_DATE_DETAIL	Element	-	Top element of created date of the CD measurement recipe.
DATE	Element	DateTime	Date information.
OPERATOR	Element	String	Operator name who created basic information.
COMMENT	Element	String	Comment.
OUTPUT_DATE	Element	-	Top element of output date information.
OUTPUT_DATE_DETAIL	Element	-	Top element of created date of the CD measurement results.
START_DATE	Element	DateTime	Beginning date of CD measurement.
END_DATE	Element	DateTime	Ending date of CD measurement.
OPERATOR	Element	String	Operator name who measured critical dimension.
COMMENT	Element	String	Comment.
CD_CORRELATION	Element	-	Top element of correlation information.
CD_STD	Element	String	Reference standard name (refer to SEMI P10).
CD_CORRELATION_ID	Element	String	Identification number of correlation between vendor to customer (refer to SEMI P10).
CD_EQUIPMENT	Element	-	Top element of CD measurement tool information.
CD_EQUIP_REQD	Element	String	Acceptable measurement tool information (refer to SEMI P10).
EQUIP_SITE_REQD	Element	String	Identification of qualified manufacturing site (refer to SEMI P10).
EQUIP_SITE_USED	Element	String	Identification number of the measured tool.
MATERIAL	Element	-	Top element of the material.
SUBSTRATE	Element	Decimal	Top element of the substrate information.
BLANK_SIZE	Element	String	Blank size information (refer to SEMI P10).
MASK_ORIENTATION_INFORMATION	Element	-	Top element of the orientation information.
MASK_ORIENTATION_INFORMATION_JDV	Element	-	Top element of the orientation information on JDV.
MASK_ORIENTATION_JDV_MARK	Element	String	Information of orientation mark on JDV.
MASK_ORIENTATION_JDV	Element	String	Orientation information on JDV.
direction	Attribute	String	Direction information.
MASK_FLIP_JDV	Element	String	Flip information on JDV.
MASK_ORIENTATION_INFORMATION_MEASUREMENT	Element	-	Top element of the orientation on measurement.
MASK_ORIENTATION_MEASUREMENT_MARK	Element	String	Information of orientation mark on measurement.
MASK_ORIENTATION_MEASUREMENT	Element	String	Orientation information on measurement.

<i>Item</i>	<i>Element or Attribute</i>	<i>Data type</i>	<i>Description</i>
direction	Attribute	String	Direction information.
MASK_FLIP_MEASUREMENT	Element	String	Flip information on measurement (refer to Figures 6 and 7).
COORDINATE_ORIGIN_INFORMATION	Element	-	Top element of the coordinate information.
JDV_COORDINATE_ORIGIN_INFORMATION	Element	-	Top element of the coordinate information on JDV.
JDV_COORDINATE_SYSTEM	Element	String	Coordinate system on JDV.
JDV_ORIGIN_NAME	Element	String	Origin name information on JDV.
JDV_ORIGIN_LOCATION	Element	-	Top element of the origin location on JDV.
unit	Attribute	String	Unit system.
JDV_ORIGIN_LOCATION_X	Element	Decimal	X origin location on JDV.
JDV_ORIGIN_LOCATION_Y	Element	Decimal	Y origin location on JDV.
TOOL_COORDINATE_ORIGIN_INFORMATION	Element	-	Top element of the origin location on measurement.
TOOL_COORDINATE_SYSTEM	Element	String	Coordinate system on measurement.
TOOL_ORIGIN_NAME	Element	String	Origin name information on measurement.
TOOL_ORIGIN_LOCATION	Element	-	Top element of the origin location on measurement.
unit	Attribute	String	Unit system.
TOOL_ORIGIN_LOCATION_X	Element	Decimal	X origin location on measurement.
TOOL_ORIGIN_LOCATION_Y	Element	Decimal	Y origin location on measurement.
TOOL_STAGE_INFORMATION	Element	-	Top element of the measurement tool stage information.
TOOL_STAGE_MAGNIFICATION	Element	-	Top element of the magnification information on measurement tool stage.
unit	Attribute	String	Unit system.
TOOL_STAGE_MAGNIFICATION_X	Element	Decimal	X magnification information of the measurement tool stage.
TOOL_STAGE_MAGNIFICATION_Y	Element	Decimal	Y magnification information of the measurement tool stage.
TOOL_STAGE_SKEW	Element	Decimal	Skew information of the measurement tool stage.
unit	Attribute	String	Unit system.

Table 3 Measurement Condition Section

<i>Item</i>	<i>Element or Attribute</i>	<i>Data type</i>	<i>Description</i>
MEASUREMENT_CONDITION	Element	-	Top element of the common information for CD measurement.
REFERENCE_POINT	Element	-	Top element of the reference point information between JDV and CD measurement tool (refer to Figure 8).
REFERENCE_LOCATION	Element	-	Top element of the reference point location information on the writing data.
unit	Attribute	String	Unit system.
REFERENCE_LOCATION_X	Element	Decimal	X location of the reference point on the writing data.

<i>Item</i>	<i>Element or Attribute</i>	<i>Data type</i>	<i>Description</i>
REFERENCE_LOCATION_Y	Element	Decimal	Y location of the reference point on the writing data.
MEASUREMENT_REFERENCE_LOCATION	Element	-	Top element of the reference point location information on the measurement tool.
unit	Attribute	String	Unit system.
MEASUREMENT_REFERENCE_LOCATION_X	Element	Decimal	X location of the reference point on the measurement tool.
MEASUREMENT_REFERENCE_LOCATION_Y	Element	Decimal	Y location of the reference point on the measurement tool.
MEASUREMENT_RECIPE	Element	-	Top element of the measurement recipe. The user is able to expand the original elements to the subordinate position of this element.
MEASUREMENT_RECIPE_NAME	Element	String	Measurement recipe name in measurement tool.

Table 4 Mask Specification and Results Section

<i>Item</i>	<i>Element or Attribute</i>	<i>Data type</i>	<i>Description</i>
MASK_SPECIFICATION_AND_RESULTS	Element	-	Top element of specification and results on reticle.
CD_SET	Element	-	Top element of the measurement group for specification and results.
unit	Attribute	String	Unit system.
CD_GROUP_NAME	Element	String	Measurement group name (refer to SEMI P10).
NUMBER_OF_DECIMALS	Element	Integer	Number of decimals.
CD_SET_SPECIFICATION	Element	-	Top element of specifications on this measurement group.
CD_MEAN	Element	Decimal	Specification of mean.
CD_MIN	Element	Decimal	Specification of minimum.
CD_MAX	Element	Decimal	Specification of maximum.
CD_TOLERANCE	Element	Decimal	Specification of tolerance (refer to SEMI P10).
CD_RANGE	Element	Decimal	Specification of range (refer to SEMI P10).
CD_THREE_SIGMA	Element	Decimal	Specification of three sigma (refer to SEMI P10).
CD_DEVIATION_FROM_TARGET	Element	Decimal	Specification of CD deviation from target (refer to SEMI P10).
CD_DEVIATION_FROM_MEAN	Element	Decimal	Specification of CD deviation from mean (refer to SEMI P10).
CD_SET_RESULT	Element	-	Top element of results on this measurement group.
MEASURED_CD_MEAN	Element	Decimal	Measurement result of mean (refer to SEMI P10).
judgment	Attribute	String	Judgment information.
MEASURED_CD_MIN	Element	Decimal	Measurement result of minimum (refer to SEMI P10).
judgment	Attribute	String	Judgment information.
MEASURED_CD_MAX	Element	Decimal	Measurement result of maximum (refer to SEMI P10).

<i>Item</i>	<i>Element or Attribute</i>	<i>Data type</i>	<i>Description</i>
judgment	Attribute	String	Judgment information.
MEASURED_CD_TOLERANCE	Element	Decimal	Measurement result of tolerance (refer to SEMI P10).
judgment	Attribute	String	Judgment information.
MEASURED_CD_RANGE	Element	Decimal	Measurement result of range (refer to SEMI P10).
judgment	Attribute	String	Judgment information.
MEASURED_CD_THREE_SIGMA	Element	Decimal	Measurement result of three sigma (refer to SEMI P10).
judgment	Attribute	String	Judgment information.
MEASURED_CD_DEVIATION_FROM_TARGET	Element	Decimal	Measurement result of CD deviation from target (refer to SEMI P10).
judgment	Attribute	String	Judgment information.
MEASURED_CD_DEVIATION_FROM_MEAN	Element	Decimal	Measurement result of CD deviation from mean (refer to SEMI P10).
judgment	Attribute	String	Judgment information.
CD_XY_DEFINITION	Element	-	Top element of the specification and results for CD XY definition.
unit	Attribute	String	Unit system.
CD_XY_GROUP_NAME	Element	String	Measurement group name.
NUMBER_OF_DECIMALS	Element	Integer	Number of decimals.
CD_XY_DEFINITION_SPECIFICATION	Element	-	Top element of the specification for CD XY definition.
CD_XY_TOLERANCE	Element	Decimal	Specification of CD XY tolerance (refer to SEMI P10).
CD_XY_DEVIATION	Element	Decimal	Specification of CD XY deviation (refer to SEMI P10).
CD_XY_DEFINITION_RESULT	Element	-	Top element of CD XY definition results.
MEASURED_CD_XY_TOLERANCE	Element	Decimal	Measurement result of CD XY tolerance (refer to SEMI P10).
judgment	Attribute	String	Judgment information.
MEASURED_CD_XY_DEVIATION	Element	Decimal	Measurement result of CD XY deviation (refer to SEMI P10).
judgment	Attribute	String	Judgment information.
CD_CLEAR_DARK_DEFINITION	Element	-	Top element of the specification and results for CD CLEAR DARK definition.
unit	Attribute	String	Unit system.
CD_CLEAR_DARK_GROUP_NAME	Element	String	Measurement group name.
NUMBER_OF_DECIMALS	Element	Integer	Number of decimals.
CD_CLEAR_DARK_DEFINITION_SPECIFICATION	Element	-	Top element of the specification for CD CLEAR DARK definition.
CD_CLEAR_MEAN	Element	Decimal	Specification of mean.
CD_CLEAR_RANGE	Element	Decimal	Specification of range.
CD_DARK_MEAN	Element	Decimal	Specification of mean.
CD_DARK_RANGE	Element	Decimal	Specification of range.
CD_CLEAR_DARK_TOLERANCE	Element	Decimal	Specification of tolerance (refer to SEMI P10).