SEMI G81-0703
SPECIFICATION FOR MAP DATA ITEMS

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1 Purpose

1.1 This Document describes the data items that relate to electronic substrate mapping.

2 Scope

2.1 This Document applies only to substrate map data items.

2.2 This Document does not address the transmission, file naming conventions, storage or archiving of substrate maps.

2.3 The specification of which data items are optional and which are required is not specified in this Document.

2.4 The size of each data item described in this Document is maximum size. The actual size may be further restricted by an application document.

2.5 The order of the data items is not restricted in this Document. The order of the data items may be restricted by an application document.

NOTICE: SEMI Standards and Safety Guidelines do not purport to address all safety issues associated with their use. It is the responsibility of the users of the Documents to establish appropriate safety and health practices, and determine the applicability of regulatory or other limitations prior to use.

3 Limitations

3.1 There are no known limitations within the defined scope.

4 Referenced Standards and Documents

4.1 *SEMI Standards and Safety Guidelines*

SEMI E5 — SEMI Equipment Communications Standard 2 Message Content (SECS-II)

SEMI T9 — Specification for Marking of Metal Lead-Frame Strips with a Two-Dimensional Data Matrix Code Symbol

4.2 *IEEE Standard*[1]

IEEE 754-1985 — IEEE Standard for Binary Floating–Point Arithmetic

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

5 Terminology

5.1 *Definitions*

5.1.1 *bottom side* — the bottom side of the substrate as defined in the corresponding Appendix (Appendix 1, 2, or 3).

5.1.2 *device* — the unit to which the device status code in the map is assigned including, but not limited to: die, multi-chip modules and packages.

5.1.3 *map* — a two-dimensional array of bin codes derived from electrical test data of a substrate including, but not limited to: wafer, tray, strip, or tape.

5.1.4 *substrate* — any carrier of a two-dimensional array of devices including, but not limited to: wafers, trays, strips, tape, panels, or boards.

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5.1.5 *top side* — the top side of the substrate as defined in the corresponding Appendix for that substrate (Appendix 1, 2, or 3).

6 Requirements

6.1 This Document does not define format of each data item specified in the following chapter. In order to implement this Specification, it requires standardized and/or specific format definition documents. Standardized format definition documents are those generic, application specific or equipment specific specification, supplied by SEMI. They may be format specification, static file specification or communication specification; for example, SEMI E5. Specific format definition documents may be defined by supplier and user.

6.2 Also this Document does not define communication protocol at all. If an implementation requires transfer data items defined in the following chapter, it is necessary to prepare a custom communication protocol document or to comply with the appropriate SEMI Communication Standards.

6.3 This Document places no special requirements on the transmission, file naming conventions, storage, or archiving of substrate maps.

7 Description

7.1 The substrate map data item specifications defined in this Document are shown in Table 2. The columns in this table are described in the following sections.

7.1.1 *Item Name Column* — The name by which the data item is referenced.

7.1.2 *Data Type Column* — The type of the data as defined in Table 1.

Table 1 Data Types and Sizes

Type	*Size*	*Definition*
String	0–32767	A string of ASCII characters from zero to 'Size' characters in length.
Integer	1,2,4	An integer value that may be represented by 'Size' bytes. For example, if Size = 2 then the value may be −32768 to 32767.
Float	4	IEEE single-precision 32-bit floating point type [IEEE 754-1985]

7.1.2.1 Generic data type definitions are used so that the data item definitions may be shared by several other standards, which may have their own distinct data type representations.

7.1.3 *Size Column* — The maximum number of characters that may be used to represent the data.

7.1.4 *Description Column* — Describes what the data item is and what value restrictions it has.

7.2 *Coordinate System Conventions*

7.2.1 Whenever reference is made to rows, columns, *X* or *Y* they are defined as follows.

7.2.2 The *X* axis is the horizontal axis from left to right when the substrate is rotated according to [Orientation] in Table 2. Columns increase along the *X* axis. Column zero is the column just before the left (or right, depending on OriginLocation) column containing measured devices.

7.2.3 The *Y* axis is the vertical axis from bottom to top when the substrate is rotated according to [Orientation] in Table 2. Rows increase along the *Y* axis. Row zero is the row just before the extreme top (or bottom depending on OriginLocation) row containing measured devices.

7.2.4 Columns increase along the *X*-axis. Rows increase along the *Y*-axis.

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Table 2 Substrate Map Data Items

Item Name	*Data Type*	*Size*	*Description*
FormatRevision	String	256	Specifies the exact name and revision of the format used to represent substrate map data. This field can be used by a parser to automatically determine the format of the remaining substrate map data.
ProductId	String	256	Product identifier
LotId	String	32	Production lot identifier for this data.
Orientation	Integer	2	The orientation of the substrate in relation to the map data. This variable will increase in the right (clockwise) direction from 0°. This item may be used to specify that the map data be rotated. Since the map data is rectangular, only the values 0, 90, 180, and 270 are allowed in that case.
WaferSize	Integer	2	Diameter of Wafer in millimeters.
DeviceSizeX	Float	4	Device size on *X* axis in microns
DeviceSizeY	Float	4	Device size on *Y* axis in microns
StepSizeX	Float	4	The distance in microns from a reference point on one device to the same reference point on the adjacent device in the *X* direction. StepSizeX – DeviceSizeX is equal to the 'street' width between device in the *X* direction.
StepSizeY	Float	4	The distance in microns from a reference point on one device to the same reference point on the adjacent device in the *Y* direction. StepSizeY – DeviceSizeY is equal to the 'street' width between device in the *Y* direction.
FrameId	String	32	A character code that may be printed or encoded on the substrate, which uniquely identifies the substrate, and can be used to correlate the map with physical substrate.
Rows	Integer	2	The number of rows of (measured) device matrix on substrate, that is the number of devices on the *Y*-axis of the map data. It is required if the type of the map data is simple array structure.
Columns	Integer	2	The number of columns of (measured) device matrix on substrate, that is the number of devices on the *X*-axis of the map data. It is required if the type of the map data is simple array structure.
MapType	String	16	Possible variations of data structure, one of which is to be chosen for passing map data. This Document allows formats of the three types shown below. [MapType] = 'Row': Row/Column Format Expression using the coordinate showing the head of a row as well as the number of devices in the row and the bin data of the relevant row. Each bin data is attached in succession to each row. Example: X, Y, N, BIN, BIN, BIN, ..., BIN (N: Number of devices) [MapType] = 'Array': Array Format All of a substrate's bin data is expressed in a one-dimensional array form. Left to right and top down substrate map data will be set in a one-dimensional array. Example: BIN, BIN, BIN, ... [MapType] = 'Device': Coordinate Format Expressed by XY coordinates of each device on a substrate as well as bin data. Even when using this format, to prevent omission of data, it is best to set bin data for all devices tested in front end processing. Example: X, Y, BIN, ..., X, Y, BIN The MAP coordinates set here are values for the state with the substrate orientation flat rotated to the angle given by [Orientation]. Appendix 1 contains diagrams that illustrate each [MapType]. NOTE: MAP coordinates can also be negative values.
HeadingDeviceX	Integer	2	*X* coordinate of the heading device of a row in the map data. This item is used when [MapType] = 'Row'.

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Item Name	*Data Type*	*Size*	*Description*
HeadingDeviceY	Integer	2	*Y* coordinate of the heading device of a row in the map data. This item is used when [MapType] = 'Row'.
DeviceRow	Integer	2	Number of the devices on a row in the map data. This item is used when [MapType] = 'Row'.
DeviceX	Integer	2	*X* coordinate of the device in the map data. This item is used when [MapType] = 'Device'.
DeviceY	Integer	2	*Y* coordinate of the device in the map data. This item is used when [MapType] = 'Device'.
BinType	String	16	The format in which the bin code for each device will be represented in the [Map]. The choices are as follows: [BinType] = 'Ascii': Single ASCII character (1 byte per device) [BinType] = 'Decimal': 3 digit integer from 000 to 255 (1 byte per device) [BinType] = 'HexaDecimal': 2 digit Hexadecimal value from 00 to FF (1 byte per device) [BinType] = 'Integer2': 4 digit Hexadecimal value from 0000 to FFFF (2 bytes per device) Note 1: For readability when [BinType] = 'Decimal' there must be spaces added between each device and each row of devices should be on a new line. Note 2: When [BinType] = 'Ascii' or 'Hexadecimal' or 'Integer2' there must not be spaces between each device and for readability, each row should be on a new line.
ReferenceDeviceX	Integer	2	*X* coordinate of the reference device to align device matrix on physical substrate with the map data.
ReferenceDeviceY	Integer	2	*Y* coordinate of the reference device to align device matrix on physical substrate with the map data.
RefDevicePosX	Float	4	Offset in µm of the center of a reference device in the *X*-direction from the center of substrate.
RefDevicePosY	Float	4	Offset in µm of the center of a reference device in the *Y*-direction from the center of substrate.
MapName	String	32	A name that describes the purpose of the bin codes in the map. Possible examples include: 'CellStatus', 'DefectCode', 'MarkGrade', 'PackageGrade', 'SortGrade'.
MapVersion	String	32	The version is used to distinguish between multiple versions of maps for the same substrate with the same MapName.
BinCode	Integer	1	A bin category from 0 to 255, other that the value assigned to [NullBin], that may be assigned to a device. It should be represented according to [BinType]. Note: BinCode and NullBin may take on values from 0 to 255 is represented as Ascii, Decimal, Hexadecimal, or Binary, according to BinType. See definition of BinType for more information.
BinCount	Integer	4	The number of devices on the substrate with the specified [BinCode].
BinQuality	String	16	Describes the quality of the specified [BinCode]. The following values are reserved for the data item: 'Pass' – Indicates a quality that has commercial value 'Fail' – Indicates a quality that does not have commercial value Other values defined by an application.
BinDescription	String	256	A description of the specified [BinCode] (e.g., '100 MHz').
NullBin	Integer	1	Code to indicate no device or not measured device in [Data]. It should be represented according to [BinType].
SupplierName	String	256	Name of the supplier of the substrate.

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