SEMI E145-0414 (Reapproved 0519)
CLASSIFICATION FOR MEASUREMENT UNIT SYMBOLS IN XML

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1 Purpose

1.1 The inclusion of eXtensible markup language (XML) notation within current SEMI Standards reflects the industry's growing interest in XML technology. This Standard defines the measurement units' symbol representations in XML for the semiconductor industry based on units defined in SEMI E5, SEMI E6, and the International System of Units (SI). Its purpose is to provide a standardized set of symbols that represent common units for the semiconductor industry and to describe a method to add other symbols based on a standard approach using a common set of rules.

2 Scope

2.1 This Standard defines measurement unit symbols and describes a common method to add more symbols for those units not included in this Classification. It defines the unit object representation to be used in conjunction with other objects and provides its schema for representation in XML. A partial number of commonly used units and their symbols are also provided. This Classification includes the following:

- Unit Object Definition
- Unit Classification Table Definitions
- Definition of Standardized Symbols
- Rules for Adding Other Unit Symbols

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 This Classification defines specific symbols to be used for the representation of measurement units. This is not a complete set of unit symbol definitions, but a subset of them to be applied in the semiconductor industry in particular when referring to standardized measuring units.

4 Referenced Standards and Documents

4.1 *SEMI Standards and Safety Guidelines*

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

SEMI E6 — Guide for Equipment Semiconductor Installation Documentation

SEMI E30 — Specification for the Generic Model for Communications and Control of Manufacturing Equipment (GEM)

SEMI E121 — Guide for Style and Usage of XML for Semiconductor Manufacturing Applications

4.2 *ANSI Standards*[1]

ANSI/ASTM SI 10 — Standard for the Use of the International System of Units (SI)

ANSI/IEEE 260.1 — American National Standard Letter Symbols for Units of Measurement

[1] American National Standards Institute, 25 West 43rd Street, New York, NY 10036, USA; Telephone: +1.212.642.4900, Fax: +1.212.398.0023, http://www.ansi.org

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4.3 *NIST Documents*[2]

Guide for the Use of the International System of Units (SI); NIST Special Publication 811

The International System of Units (SI); NIST Special Publication 330

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

5 Terminology

5.1 *Abbreviations and Acronyms*

5.1.1 *CGPM* — General Conference on Weights and Measures

5.1.2 *CGS* — centimeter-gram-second system

5.1.3 *NIST* — National Institute of Standards and Technology

5.1.4 *SI* — International System of Units

5.1.5 *US* — United States

5.1.6 *XML* — eXtensible markup language

6 Units of Measurement

6.1 Certain data transactions require the specification of measurement units for parameters or data items exchanged between equipment and/or software applications. Units of measurement can also be defined to specify those parameters that characterize the semiconductor equipment capabilities. Sensor devices used internal to the equipment or around the factory require some kind of measurement units to be used in practice. Therefore, measurement units are used for specifications, characterization, process measurement; facilities requirements; common data exchange; ordering of parts; and in many other manufacturing stages. This Standard defines symbols and definitions of units that are commonly used in the semiconductor industry. It represents a partial list of units adopted by SEMI.

6.2 *Unit Object Definition* — The unit's object definition can be used in conjunction with other standards that require unit representation as a collection of attributes and values. Unit's most basic representation is shown in Figure 1. The attribute definitions are described below.

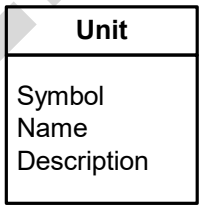

Figure 1
Unit Object Definition

6.2.1 *Symbol* — A unit symbol is a unique text string of unspecified length that represents the unit's measurement value and adds physical significance to the numeric value it represents. This unique identifier is in many cases all that is needed to describe a value and add some significance to it. The symbol is case sensitive.

6.2.2 *Name* — String containing the full name of the unit of measurement.

6.2.3 *Description* — Information that describes the unit of measurement. In some cases, description provides a definition of the unit given by an industry or standards development organization.

[2] National Institute of Standards and Technology, 100 Bureau Drive, Stop 3460, Gaithersburg, MD 20899-3460, USA; Telephone: +1.301.975.6478, http://www.nist.gov

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7 Basis of Classification

7.1 In general, units are grouped into some special category. These categories are chosen to describe the units' natural classification. In this Standard, the symbol that represents the measurement unit classifies the unit under one of three categories: Basic, Modified, and Combined.

7.2 *Unit Symbol Categories*

7.2.1 *Basic Unit* — Units that have a single symbol representation (e.g., coulomb [C], meter [m], newton [N], hertz [Hz]).

7.2.2 *Modified Unit* — Units that belong to the Basic Unit category, but include prefixes and powers to further extend the unit symbol (e.g., millimeter [mm], kilometer [km], megavolt [MV]).

7.2.3 *Combined Unit* — Those units that are derived from the combination of Basic and/or Modified units (e.g., newton per meter [N/m], pascal second [Pa·s]).

7.3 *Conventions Used* — Special symbols are used by this Classification Document to be more compatible with XML parsers and programming techniques. The following changes to standard SI measurement symbols have been made.

7.3.1 A symbol's exponent is represented by the symbol followed by the power exponent (e.g., m^2 becomes m2).

7.3.2 The center dot used to connect combined units is replaced by a period (e.g., P·s becomes P.s).

7.3.3 The slash (/) is used before symbols in the denominator of a combined unit symbol (e.g., m/s^2 becomes m/s2). Only one slash (/) symbol is allowed to separate numerator and denominator unit symbols. Any unit symbol or combined symbols after the slash (/) represent units in the denominator (e.g., in kg/m.s the meter and second are both considered to be in the denominator).

7.3.4 Certain symbols are modified and replaced. (e.g., ° becomes deg, Ω becomes ohm, Å becomes Ang).

8 Measurement Unit Symbol Tables

8.1 The units defined in this Standard are classified into Basic, Combined and Modified Units. Each table includes the headings listed below.

Conventional Symbol	*XML Symbol*	*Name*	*Description*

Figure 2
Table Headings

8.1.1 *Conventional Symbol* — The symbol that is recognized by SI and approved by the Conference Generale des Poids et Mesures (CGMP).

8.1.2 *XML Symbol* — The XML symbol defined in this Standard. Its representation is explicit and is considered unique within the context of the specific measurement unit. The symbol can appear explicitly in the defined tables, or it can be an implicit combination of symbols combined with a prefix factor. For example, the symbol 'cm' indicates that it is the 'm' symbol combined with the 'c' prefix.

8.1.3 *Name* — The formal name of the measurement unit. This is an uncontrolled string. In general, there is little use that an application can make of the unit name and it is included for user readability. This value is optional. When included, it represents a universally recognized identifier of the unit. The naming convention used in this Document follows the IEEE/ASTM SI 10 recommendation where units are treated as common nouns in English. Thus, the first letter of a unit is not capitalized except at the beginning of a sentence or in capitalized material such as a title.

8.1.4 *Description* — A formal definition of the measurement unit that complements the unit's symbol and name. This is an uncontrolled string. In general, there is little use that an application can make of the unit description and it is used for documentation purpose. This value is optional. This attribute provides additional descriptive information to define the unit.

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9 Classification

9.1 *Basic Units* — All those units of measurement that can be converted to another unit classification and have a universally unique accepted symbol (e.g., A for ampere).

Table 1 Basic Units

Conventional Symbol	*XML Symbol*	*Name*	*Description*
(null string)	(null string)	non-dimensional quantity	Quantities not associated with a unit of measurement
A	A	ampere	Electric current
Å	Ang	angstrom	Equivalent to 0.1 nm (nanometer)
atm	atm	atmosphere	Pressure
B	B	bel	Logarithmic sound intensity
b	b	bar	Pressure
Bd	Bd	baud	Data rate
Bq	Bq	becquerel	Activity, usually meaning radioactivity
bit	bit	bit	A binary digit, having either the value 0 or 1
Btu	Btu	British Thermal Unit	The quantity of heat required to raise the temperature of one pound of water one degree Fahrenheit at or near 39.2°F.
byte	byte	byte	Unit of storage for computer memory
C	C	coulomb	Electric charge, quantity of electricity
cal	cal	calorie	Heat energy
cd	cd	candela	Luminous intensity
Ci	Ci	curie	A unit of activity of radioactivity
d	d	day	Time
ºC	degC	degree Celsius	Celsius temperature
cfh	cfh	cubic feet per hour	Flow
cfm	cfm	cubic feet per minute	Flow
cfs	cfs	cubic feet per second	Flow
cmh	cmh	cubic meter per hour	Liquid flow
ºF	degF	degree Fahrenheit	Fahrenheit temperature
°	deg	degree	Plane angle
die	Die	die	Individual integrated circuit
eV	eV	electronvolt	Energy
F	F	farad	Capacitance
ft	ft	foot	Length
Gal	Gal	gal	Acceleration
gal	gal	gallon (US)	Volume
gpm	gpm	gallons per minute	Liquid flow
gps	gps	gallons per second	Liquid flow
G	G	gauss	Magnetic density
g	g	gram	Mass
gf	gf	gram force	Weight of a gram mass
Gy	Gy	gray	Radiation dose
H	H	henry	Inductance
Hz	Hz	hertz	Frequency

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