SECTION 1: PREPARATION AND SUBMISSION OF SOLID STATE PRODUCT OUTLINE DRAWINGS

Contents

Introduction

This clause is a guide to manufacturers of solid state products for the preparation and submission of outline drawings of solid state product packages (hereinafter referred to as outlines) for outline registration.

SECTION 1: PREPARATION AND SUBMISSION OF SOLID STATE PRODUCT OUTLINE DRAWINGS

1.1 Purpose of outlines

a) An outline should show all the dimensional and geometrical characteristics of a package needed to assure mechanical interchangeability with all other packages conforming to the same outline.

b) An outline should service a package user by specifying the general package configuration; the size, location and number designation of terminals; the space required by the packages; the size and location of surfaces for mounting heat sinks; body size for mechanical handling etc.

1.2 Terms and definitions

The following definitions will assist in the understanding and preparation of outline drawings:

240SP: A vertical DIMM socket with a module seating plane of 2.40 mm maximum above the motherboard (Formally known as LSP).

295SP: A vertical DIMM socket with a module seating plane of 2.95 mm maximum above the motherboard.

330SP: A vertical DIMM socket with a module seating plane of 3.30 mm maximum above the motherboard.

base plane: A plane parallel to the seating plane through the lowest point on the body of the package. It may coincide with the seating plane.

body: That part of the package or device exclusive of electrical terminals, studs, leads, etc.

component area: The zone(s) of a PCB (or substrate) within which components are permitted to be mounted.

NOTE The thickness of the populated PCB is allowed to exceed the specified thickness of the unpopulated PCB in these areas.

Component keep-out area: The zone(s) of a PCB (or substrate) within which no components are permitted to be mounted.

NOTE The thickness of the populated PCB is not allowed to exceed the specified thickness of the unpopulated PCB in these areas.

Component overhang area: The zone(s) of a PCB (or substrate) within which no components are permitted to be mounted but which underlie overhanging portions of components mounted within the component area.

NOTE The thickness of the populated PCB is allowed to exceed the specified thickness of the PCB in these areas.

gauge plane: A plane perpendicular to the terminal leads located at a defined distance from the seating plane. The location of the terminals is measured in the gauge plane.

1 Preparation and submission of solid state product outline drawings (cont'd)

1.2 Terms and definitions (cont'd)

index area: The area in which a portion or all of the visual or mechanical indexes must lie.

mechanical index: A mark, chamfer, notch, tab, flat, etc. that allows mechanical, optical, electrical or pneumatic sensing during mechanized handling. It may or may not identify the number one terminal position.

registered outline: A registered outline is one that has been (1) assigned a JEDEC outline designation, and (2) announced to the Industry through the JEDEC Type Registration System. The registered solid state product outlines are compiled in this publication.

seating plane: The reference plane that designates the interface between the package or its terminal and the surface on which it is mounted.

STD: Abbreviation for standard.

NOTE When referring to a socket, STD indicates the tall latch is used to engage the upper module latch notch.

terminal: That part of the package or device primarily used in making an electrical, mechanical, or thermal connection. Examples of terminals are flexible leads, rigid leads and studs.

visual index: A reference mark, chamfer, notch, tab, flat, etc., that identifies the number one terminal position.

VLP: Abbreviation for very low profile.

NOTE 1 When referring to a module, VLP indicates the module vertical dimension is 18.45 max for DDR2 and 18.90 max for DDR3.

NOTE 2 When referring to a socket, VLP indicates the short latch is used to engage the lower module latch notch.

1 Preparation and submission of solid state product outline drawings (cont'd)

1.3 Preparation of outlines

a) Views: The outline drawing shall include all views needed to clearly show the dimensional and geometrical features of the package. Enlarged detail views may be used.

b) Notes: Descriptive notes may be used at the bottom of or adjacent to the outlines with proper reference to the body of the drawing.

c) Dimensions: All dimensions on the outline should show the maximum and minimum limits to the required number of decimal places or be properly referenced such as to a thread standard.

ANSI Standard ANSI Y14.5 "Dimensioning and Tolerancing" (latest revision) will be used as the definitive reference on all outlines.

d) Indexes (Indices): The outline shall show the nature and location of the visual index used for terminal numbering, and if present the mechanical index used for package sensing or orientation.

e) Planes: Where applicable, the outline shall show the location of the base, gauge, and seating planes.

f) Terminals: Terminal designations shall be by number only. No reference to electrical connection such as emitter, base, etc., or internal connections shall be made.

g) Internal structure: No details of internal structure shall be shown except where such details may affect mechanical interchangeability such as in the case of photosensitive or light emitting devices.

h) Threads: Thread features shall be designated in the Unified System of Class 2A or 2B as applicable to plated finishes per ANSI B1.1-1960.

1.4 Format of outline drawings

Published registered outlines should be used as a guide for outline preparation.

The outline drawing consist of two parts: (1) The drawing with dimensional symbols chosen from the appropriate Symbol Lists in this JEDEC Publication and applicable notes; and (2) a tabular listing relating the drawing symbols to the actual dimensional values.

The drawings and the tabular listing shall be 8 ½" X 11" black and white originals or black and white copies of suitable contract to assure readable reproduction. Both parts of the outline drawing may be on the same 8 ½" X 11" sheet if space permits.

No lettering shall be smaller than 1/8" in height and shall be read parallel to the 8 ½" side of the sheet.

The drawing should include at the bottom the date of submission, the name of the submitting company, and the name, address and telephone number of the person responsible for the drawing.

The JC-11 Committee on Mechanical Standardization will furnish guidance on the preparation of outline drawings. Requests for assistance may be directed to the JEDEC Mechanical Standardization Committee

1.5 Registration and standardization of product outlines

1.5.1 Registration

The registration process involves recognition by the JEDEC JC-11 Committee on Mechanical Standardization of an outline that is significantly different from previously registered outlines, the assignment of a JEDEC designation to that outline, and the release of the outline to industry. Registration of an outline by the JC-l 1 Committee is the first step toward standardization. Registration outlines reflect a product with anticipated usage in the electronics industry.

1.5.2 Standardization

The standardization process involves recognition by both the ETA's JEDEC JC-1 1 Committee on Mechanical Standardization and the JEDEC Council of a product with wide acceptance in the electronics industry, the assignment of a standards designation, and the release of the standard to the industry.

1.5.3 General Description of the JEDEC JC-11 Committee's Operating Procedure.

Please consult JEDEC Publication 21 and the JC-11 Operating Procedures for detailed requirements.

1.5.4 For Registration Outline

1) Request for outline registration made by subcommittee, task group or individual sponsor from a member company
2) Point Committee or Task Group review
3) Main Committee review and approval to ballot
4) Letter ballot, prepared by its sponsor and distributed for voting to the committee
5) Point Committee or Task Group review of letter ballot results, with reballoting if necessary
6) Main Committee review and publication approval
7) Preparation of final drawings by individual sponsor from a member company
8) Submittal to Editorial Committee for final review
9) Release of outline registration for publication by the JEDEC Office
10) During the third year of existence:
    - Reaffirmation of the registration outline
    - Elevation of the registration to a standard, or
    - Rescission of the registered outline

1.5 Registration and Standardization of Product Outlines (cont'd)

1.5.5 For Standard Outline

1) Request for outline Standardization made by subcommittee, task group or individual sponsor from a member company
2) Point Committee or Task Group review
3) Main Committee review and approval to ballot
4) Sponsor-prepared letter ballot distributed to committee members for formal voting
5) Point Committee or Task Group review of letter ballot results. Reballot if necessary
6) Main Committee review and approval for a JEDEC Council ballot
7) Sponsor-prepared JEDEC Council ballot distributed to Council members for formal voting
8) JEDEC Council review of ballot results
9) JEDEC Council approval for publication
10) Preparation of final drawings by individual sponsor from a member company
11) Submittal to JC-1 1 Editorial Committee for final review
12) Release of Standard Outline for publication by the JEDEC Office
13) During the third year of existence:
    - Reaffirmation of the standard outline, or
    - Rescission of the standard outline

1.5.6 Rescission of a Registration Outline

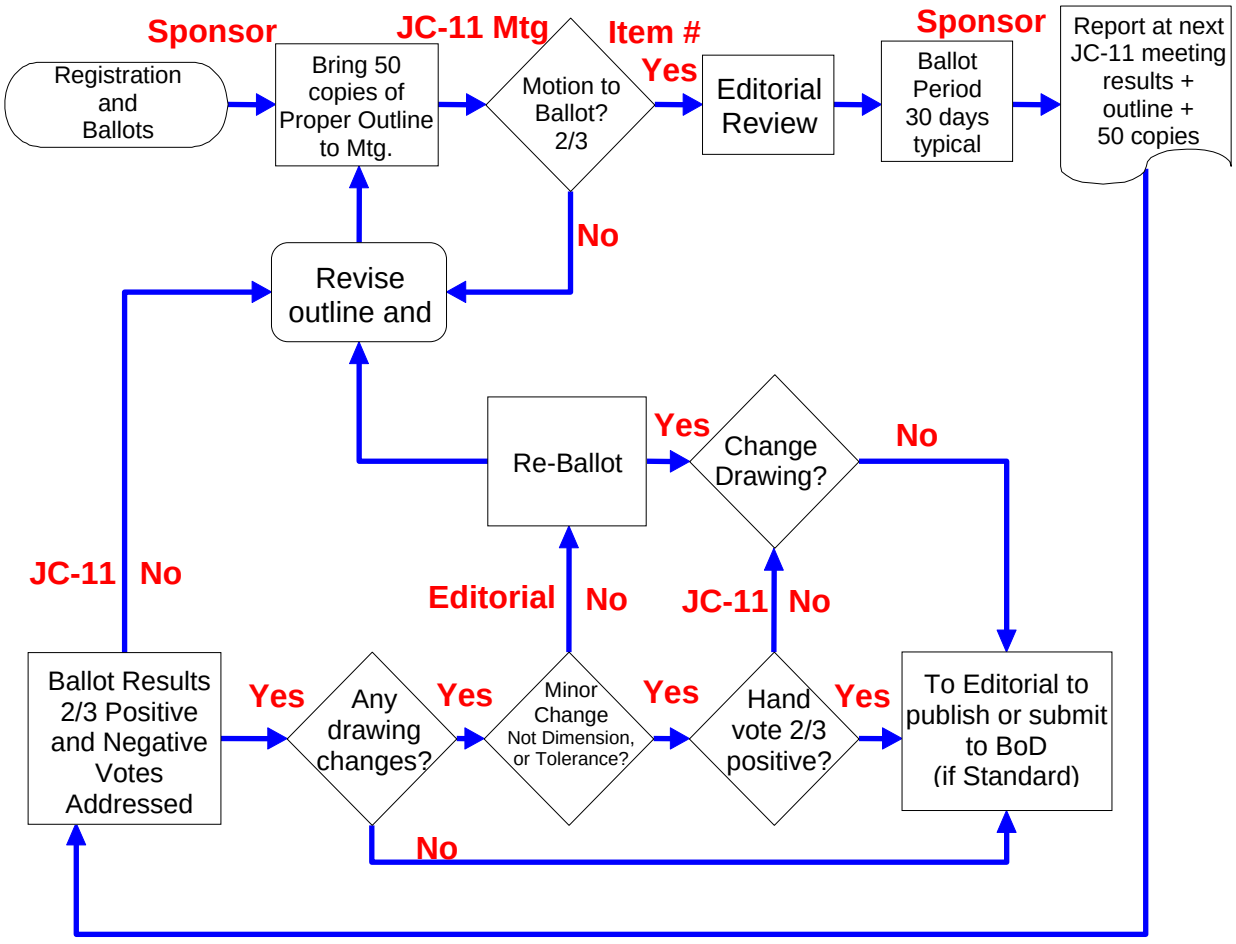
1) Proposal for rescission by subcommittee, task group or individual sponsor from a member company.
2) Total Committee review and approval to ballot.
3) Sponsor-prepared Letter ballot distributed to the committee for formal voting.
4) Subcommittee or Task Group review of ballot results.
5) Total Committee review and approval for Rescission.
6) If approved, issuance by the JEDEC Office of a notice that the outline has been rescinded.
7) Outline removed from JEP *95* by the JEDEC Office and retained in inactive files.

1.5 Registration and Standardization of Product Outlines (cont'd)

1.5.7 Rescission of a Standard Outline

1) Proposal for rescission by subcommittee, task group or individual sponsor from a member company.
2) Total Committee review and approval to ballot.
3) Sponsor-prepared letter ballot distributed to the committee for formal voting.
4) Subcommittee or Task Group review of ballot results.
5) Total Committee review and approval for submittal to Board of Directors.
6) Sponsor-prepared JEDEC Council ballot distributed to the Council members for formal voting.
7) JEDEC Board of Directors approval to rescind.
8) If approved, issuance by the JEDEC Office of a notice that the outline has been rescinded.
9) Outline removed from JEP95 by the JEDEC Office and retained in "inactive files".

1.5.8 JEDEC JC-11 Registration and Standards Ballot Flowchart



1.6 Outline classification

Outlines are grouped according to the number of leads they have:

- Diode Outlines (DO) for two leads
- Transistor Outlines (TO) for three or four leads
- Microelectronic outlines (MO) for five or more leads

There are two other categories: UO for Uncased outlines and CO for Carrier outlines.

The designation system used for numbering outlines is as follows:

a) Sequential numbering

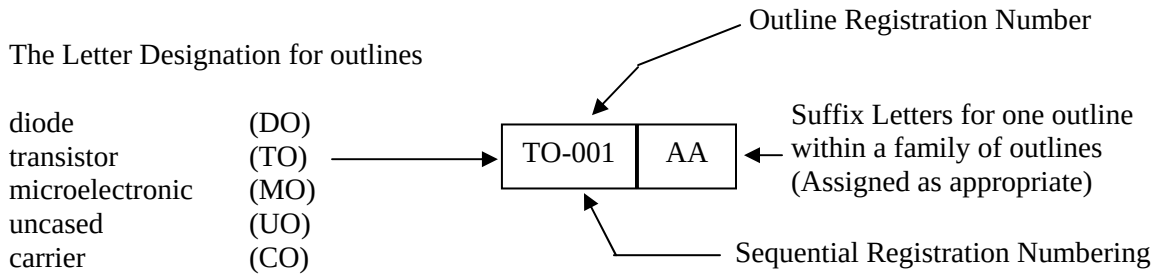
Outlines are designated with two letters (DO, TO, MO, UO, CO) followed by sequential numbers (e.g., DO-35, TO-220, MO-16).

b) Suffix lettering

Two letters follow the number to designate which member of the family of variation (e.g., DO-OO1AA, TO-226AB, MO-069AE). Often the only differentiation between variations is the lead count.

c) Acronyms

In 1990 JEDEC published an acronym system in JEDEC Standard 30. Outline drawings that were published after that time show the acronym in the title block, see example below.



1.7 Preferred numbers for dimensions

1.7.1 Introduction

The dimensions of a manufactured product are determined with a view to utility or appearance. In the latter case the designer has freedom in the choice of sizes. In those cases where size must be determined on the basis of utility alone, wide limits of variation are often permitted. In the absence of any guidance as to what values should be used, the sizes chosen by different designers will often show a widespread. As a result, the trend is away from such uniformity of sizes as would be advantageous as well as practicable. As the term indicates, the adoption of a series of Preferred Numbers to be used by all designers, in preference to other sizes, tends to unify sizes selected by different designers and in turn generates the uniformity and consequent interchangeability which is indispensable to successful standardization work.

The word “size” as used should, be interpreted very broadly. In many cases it will refer to a dimension of length, area; etc. it may also refer to a weight, a capacity to perform, a rating, etc.

1.7.2 Scope

Preferred numbers are series of numbers selected for use in standardization purposes in preference to any other numbers. Their use will lead to simplified practice and should, therefore, be employed whenever possible for standard sizes and ratings, or for a series thereof, in applications similar to the following:

- Important linear dimensions, such as diameters and lengths.
- Areas, volumes, weights and capacities.
- Characteristic ratios of figures for all kinds of units.

1.7.3 Applicable documents

ANSI Z17. 1-1958, *Preferred Numbers*.

ISO 3-1973 (E), *Preferred Numbers*, Series of Preferred Numbers

ISO 17-1973 (E), *Guide to the Use of Preferred Numbers and of Series of Preferred Numbers*.

ISO 497-1973 (3), *Guide to the Choice of Series of Preferred Numbers and or Series Containing More Rounded Values of Preferred Numbers*.

1.7.4 Advantages of preferred numbers

Advantages to be realized from the use of preferred numbers include, but are not necessarily limited to:

- A logical means of uninterrupted coverage of a complete range of requirements.
- The ability to insert intermediate values without disruption of the series.
- Maintenance of constant ratios in product and quotient calculations.
- Ease of conversion to other systems of measurement by virtue of constant conversion factors.
- The possible use of inexpensive available standard material, components, tools and gauges.
- Minimizing the quantity of sizes in a set and maintaining other parameters in the same ratio such as mass, density, strength, resistance, thermal properties, etc.

1.7 Preferred numbers for dimensions (cont'd)

1.7.5 Principles

Two basic methods are available to generate a set of sizes:

1.7.5.1 Arithmetic Progression

Adding a constant value to each size to determine the next larger size. This method is used when it is required to maintain equal spacing on a linear scale.

1.7.5.2 Geometric Progression

Multiplication of each size by a constant value to determine the next larger size.

The squares of the values in the geometric progression are also a geometric progression with numbers that fit a similar series-. The same hold true for cubing the values. In general, multiplication and division of numbers in the geometric progression yields numbers in similar series. Another property of the geometric progression is that a constant percentage is maintained between values. An example of geometric progression is the American Wire Gauge (AWG) system.

1.7.6 Preferred numbers

To facilitate the standardization of a series of sizes or ratings along logical and $ratio_1$ lines, preferred numbers have been selected to have definite relations to one another. The numbers in these series range from 10 to 100 and are as follows:

5-Series: This series gives 5 numbers approximately 60% apart. These are 10, 16, 25, 40 and 63.

10-Series: This series gives 10 numbers approximately 25% apart. These are 10, 12.5, 16, 20, 25, 31.5, 40, 50, 63 and 80.

20-Series: This series gives 20 numbers approximately 12% apart. These are 10, 11.2, 12.5,14, 16, 18, 20, 22.4, 25, 28, 31.5, 35.5, 40, 45, 50, 56, 63, 71, 80 and 90.

40-Series: This series gives 40 numbers approximately 6% apart. These are 10, 10.6, 11.2, 11.8, 12.5, 13.2, 14, 15, 16, 17, 18, 19, 20, 21.2, 22.4, 23.6, 25, 26.5, 28, 30, 31.5, 33.5, 35.5, 37.5, 40, 42.5, 45, 47.5, 50, 53, 56, 60, 63, 67, 71, 75, 80, 85, 90 and 95.

Preferred numbers above 100 are obtained by multiplying the given numbers by 10, 100, etc. Numbers below 10 are obtained by dividing by 10, 100, etc.

1.7 Preferred numbers for dimensions (cont'd)

1.7.7 Theoretical basis for the preferred numbers system

Each preferred numbers series closely approximates a geometrical series. The exact geometrical series starts with the number 10 and each succeeding number may be found by multiplying the number before it by:

$\sqrt[5]{10}$ or 1.5849 for the 5 series.

$\sqrt[10]{10}$ or 1.2589 for the 10 series.

$\sqrt[20]{10}$ or 1.1220 for the 20 series.

$\sqrt[40]{10}$ or 1.0593 for the 40 series.

1.7.8 Use of preferred numbers

The current trend is toward more usage of the Basic Series of Preferred Numbers since this represents the minimum number of sizes in a complete set; however, there will always be deviations as special requirements are met. In selecting commercial components, it is advisable to determine the current standards governing the manufacturing and stocking, and the extent to which manufacturers are supplying those standards. If a preferred series is contained in the sizing, preference should be given to selection from the lowest numbered preferred series that can satisfy requirements.

Utilization and application of preferred numbers is determined by the required design tolerances as follows:

Step 1
Select the allowable mean value for the size of a feature. This is the optimum design point and the allowable limits. Next, locate a preferred number fitting within the allowable limits, tempered by existing standards, availability and cost, giving preference to the lowest preferred number series.

Step 2
Determine the allowable limits in repeatability of the value selected in Step 1. This repeatability limit requirement must be imposed to maintain fit and interchangeability. Once these limits are determined, preferred numbers can be examined to see if they can be used for the component tolerance, commensurate with available standard tolerances and scale values of measurement instrumentation.

NOTE 1 If no preferred number meets the criteria above, a unique design is required.

NOTE 2 If this practice is followed, the designer can reduce the number of basic sizes and established tolerances.

1.7.9 ISO R series

ISO R1 and ISO R497 describe the series as the Basic Series of Preferred Numbers, with P5, R10, R20, and R40 describing the sets of 5, 10, 20 and 40 respectively.

1.7 Preferred numbers for dimensions (cont'd)

1.7.10 Basic series tables

Table 1 lists the full basic series preferred numbers. Columns 1-4 show the rounded values for the individual series. These are the values that should be selected for design work with preference given to the lowest R series. Column 5 assigns a serial number to each row of Figures for reference purposes in using the Table. Column 6 lists the mantissa for each logarithmic value in ascending increments equal to the 40th root of 10. (This is the logarithmic of 10 divided by 40.) Column 7 shows the antilog for each of the logarithmics in Column 6. These are the exact numerical values that are rounded off to produce the preferred numbers in Columns 1-4. When performing calculations with these series, the exact value (Column 7) should be used. Column 8 shows the percent error between the exact values and the rounded values.

Table 2, Metric Linear Sizes in Common Usage (in mm), illustrates an example for a modified R series that includes the arithmetic increments of .1, .5, 1 and 2. This series is contained in a number of current metric standards.

1.7 Preferred numbers for dimensions (cont'd)

1.7.10 Basic series tables (cont'd)

Table 1 — Basic series of preferred numbers

Basic series				Theoretical values			
R5	**R10**	**R20**	**R40**	**Serial number**	**Mantissa of logarithms**	**Calculated values**	**% difference of basic series & calculated values**
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1.00	1.00	1.00	1.00	0	000	1.0000	0
		1.12	1.06	1	025	1.0593	+0.07
			1.12	2	050	1.1220	-0.18
	1.25	1.25	1.18	3	075	1.1885	-0.71
			1.25	4	100	1.2589	-0.71
			1.32	5	125	1.3335	-1.01
1.60	1.60	1.40	1.40	6	150	1.4125	-0.88
			1.50	7	175	1.4962	+0.25
		1.60	1.60	8	200	1.5849	+0.95
		1.80	1.70	9	225	1.6788	+1.26
			1.80	10	250	1.7783	+1.22
			1.90	11	275	1.8836	÷0.87
	2.00	2.00	2.00	12	300	1.9953	+0.24
		2.24	2.12	13	325	2.1135	+0.31
			2.24	14	350	2.2387	+0.06
2.50	2.50	2.50	2.36	15	375	2.3714	-0.48
			2.50	16	400	2.5119	-0.47
			2.65	17	425	2.6607	-0.40
	3.15	2.80	2.80	18	450	2.8184	-0.65
			3.00	19	475	2.9854	+0.49
		3.15	3.15	20	500	3.1623	-0.39
		3.55	3.35	21	525	3.3497	+0.01
			3.55	22	550	3.5481	+0.05
			3.75	23	575	3.7584	-0.22
4.00	4.00	4.00	4.00	24	600	3.9811	+0.47
		4.50	4.25	25	625	4.2170	+0.78
			4.50	26	650	4.4668	÷0.74
	5.00	5.00	4.75	27	675	4.7315	+0.39
			5.00	28	700	5.0119	-0.24
			5.30	29	725	5.3088	-0.17
6.30	6.30	5.60	5.60	30	750	5.6234	-0.42
			6.00	31	775	5.9566	+0.73
		6.30	6.30	32	800	6.3096	-0.15
			6.70	33	825	6.6834	+0.25
		7.10	7.10	34	850	7.0795	+0.29
			7.50	35	875	7.4989	+0.01
	8.00	8.00	8.00	36	900	7.9433	+0.71
			8.50	37	925	8.4140	+1.02
		9.00	9.00	38	950	8.9125	+0.98
10.00	10.00	10.00	9.50	39	975	9.4406	+0.63
			10.00	40	000	10.0000	0

1.7 Preferred numbers for dimensions (cont'd)

1.7.10 Basic series tables (cont'd)

Table 2 — Metric linear sizes in common usage (in mm)

Choice		
First	**Second**	**Third**
1	1.1	1.3
1.2	1.4	1.5
1.6	1.8	1.7
		1.9
2	2.2	2.1
2.5		2.4
		2.6
3		3.2
	3.5	3.8
4		4.2
	4.5	4.8
5		5.2
	5.5	5.8
6		6.2
	6.5	6.8
	7	7.5
8		8.5
	9	9.5
10		

1.8 List of useful publications

Geo-Metrics III, *Dimensioning and Tolerancing*, Lowell W. Foster

ANSI Y14.5M-94, *Dimensioning and Tolerancing for Engineering Drawings*

JEP69B, *Preferred Lead Configurations for Field-Effect Transistors.*

JESD30, *Descriptive Designation System for Semiconductor Device Packages*.

EIA-415B, *General Standard for Sockets for Use With Dual and Single In Line Electronic Packages and Other Components*.

EIA-486A, *Lead Taping of Components in the Radical Configuration for Automatic Insertion*.

EIA-481A, *Taping of Surface Mount Components for Automatic Placement*.

EIA-488, *Sockets Individual Lead Types (For Electrical and Electronic Components).*

EIA-506, *Dimensional and Functional Characteristics Defining Sockets for Leadless Type A Chip Carriers*.

EIA-540, *Various Socket Standards for Different Types of Packages: PLCC. PGA. OFP. etc.*