Standard of Electronic Industries Association of Japan

EIAJ ED-7300

Recommended practice on standard for the preparation of outline drawings of semiconductor packages

Established in August, 1997

Prepared by

Technical Standardization Committee on Semiconductor Device Package

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Examination Members

This Standard has been examined mainly by the Sub-committee on General Rule of Semiconductor Device Package of the Standardization Committee on Semiconductor Device Package. The following shows the examination members.

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<Sub-committee on General Rule of Semiconductor Device Package>

Chief	Fujitsu	Michio Sono
Sub-chief	Toshiba Corp.	Shuzo Akejima
Sub-chief	Sumitomo 3M	Hideo Odagiri
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	Fujitsu	Masanori Yoshimoto
	Matsushita Electronics	Sachio Yamaguchi
	Mitsubishi Electric	Toshiaki Shinohara
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11. Related or Reference Standards

(1) EIAJET-9001 "Rules for the drafting and presentation of EIAJ Standards"
(2) IEC Publication 191 "Mechanical standardization of semiconductor devices"
(3) ANSI Y14.5M-1982 "Dimensioning and Tolerancing"
(4) JIS Z 8310 " General Rules on Drafting"
(5) JIS B 0021 "Geometric Tolerance Indication Method"
(6) JIS B 0621 "Geometric Deviation Definition and Representation"
(7) JIS B 0023 "Tolerance Method Based on Maximum material principle"
(8) ISO Recommendation R370
(9) JEDEC JESD30-C

Based on these facts, the 10th Sub-committee on General Rules of Semiconductor Device Package performed final check in June, 1997. The standard was approved by the 7th Technical Standardization Committee on Semiconductor Device Package in 1997, then it was revised and issued.

10.3 Examined items

(1) Standards System

The last revision meeting examined re-structuring of the standards system corresponding to IEC191. EIAJ Standards corresponding to these standards had been available, but the Standards System was revised according to the operation Rule of the Technical Standardization Committee on Semiconductor Device Package issued in December 1995. What was standardized according to the Outline General Rule has been modified to be based on Technical Report System comprising Design Guide and Individual Standard.

At the same time, all codes and standards ranging from EIAJ ED-7401 to EIAJ ED-7401-4 have been revised as follows:

New EIAJ Standards		Corresponding IEC Standards
EIAJ ED-7300	Recommended practice on standard for the preparation of outline drawings of semiconductor packages	IEC191-1
EIAJ ED-7301	Manual for the standard of integrated circuit package	No standard
EIAJ ED-7302	Manual for the integrated circuits package design guideline	IEC191-3
EIAJ ED-7303	Name and code for integrated circuits package	IEC191-4
EIAJ ED-7304	Measuring method for package Dimensions of Ball Grid Array (BGA)	No standard
EIAJ ED-7304-1	Measuring method for package Dimensions of Small Outline Package (SOP)	No standard
EIAJ ED-7304-2	Measuring method for package Dimensions of Small Outline J-Lead Package (SOJ)	No standard
EIAJ ED-7304-3	Measuring method for package Dimensions of Quad Flat Package (QFP)	No standard
EIAJ ED-7305	Unit Design Guide for the Preparation of Package Outline Drawing of Integrated Circuits (Gullwing-Lead)	IEC191-6

10.4 Major Revisions

(a) "Outline General Rule"is changed to "Outline Standard".

10.5 Scope

This standard specifies the basic matters on preparation of the outline drawing general rules for semiconductor devices (integrated circuits) and on preparation of the outline drawing for discrete devices packages.

However, preparation of outline drawing general rules for discrete devices is not in progress. Although this revised standard is to be applied to both integrated circuits and discrete devices, not all of this standard is applied for present standardization on discrete devices. In contrast, all of the standard useful for discrete devices is not covered.

Therefore, unification as the original intent will be passed to future revisions or standardization in IEC.

10. Explanatory Notes

10.1 Purpose and Intent of Revision

The standard for preparation of outline drawings on integrated circuits has been EIAJ ED-7401 [Standard for Preparation of Outline Drawing for Semiconductor Devices (integrated circuits)], while the standard on discrete devices has been EIAJ ED-7501 [Standard for Preparation of Outline Drawing for Semiconductor Devices (discrete devices)]. Recently, the contents of the general rules on integrated circuits are being changed for further standardization and the pitches on packages are made finer, which cannot be covered by the traditional standard; EIAJ ED-7401.

In contrast, EIAJ ED-7501 that is the standard on discrete devices is based on IEC 191 and EIAJ ED-7401 on integrated circuits has been prepared on its extension. Therefore, it was expected to unify these standard in revision of this standard.

Two standard were integrated on account of, such background and was revised as EIAJ ED-7401A.

The revision in this time is making that standard proposal to international standard (IEC) is facilitated more, triggered by the fact that the Technical Standardization Committee on Semiconductor Device Package carried out a review of EIAJ standard system in December, 1995 a purpose.

This revised standard is positioned as one of six volumes that can be common matters in preparing standard. Its specific scope is the common rules on preparation of the outline drawings and items to be used in respective standard. (See the Explanatory Notes in EIAJ ED-7301.)

10.2 History of Revisions

Special Technical Committee on Semiconductor Device Package (former self of the Technical Standardization Committee on Semiconductor Device Package) planed preparation of the standard on the most basic common matters in preparing outline drawing general rules as a project in fiscal year 1991 for the purpose of proposing the EIAJ outline drawing general rules as an international standard. Practical operations were assigned to Working Group on General Rules for Semiconductor Device Package.

Since the managing company proposed the draft of contents on these common matters in January 31, 1992, the organization and the individual matters based on the tentative organization had been examined, and finally, the five-volume organization was employed. (For details, see the Explanatory Notes in EIAJ ED-7301.)

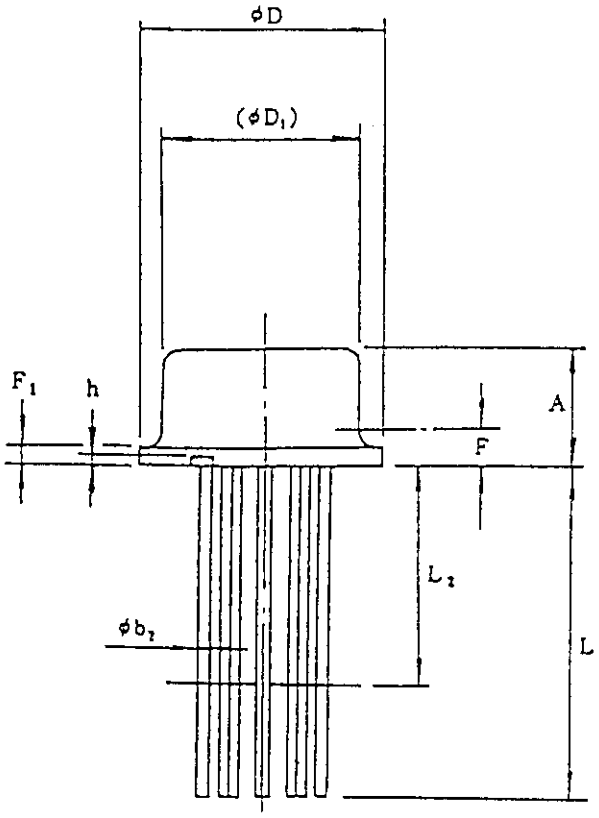
As the first volume of the five-volume organization, the scope covered by EIAJ ED-7401A was examined based on EIAJ ED-7401. Particularly, since it was required to unify EIAJ ED-7401A with discrete devices in terms of the scope covered by the standard, EIAJ ED-7501 was also used as a basis.

Then, examination of EIAJ ED-7401A was proceeded along with examination of various revised points.

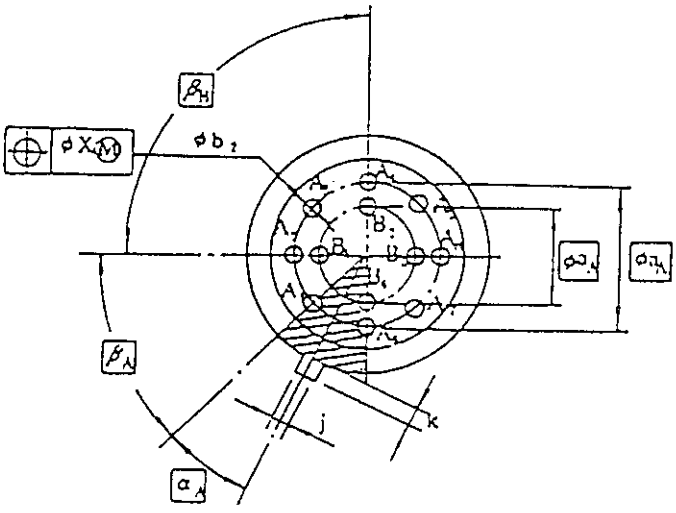
On the other hand, the basic concept on package standardization relating overall common matters and the way standardization should be including the way the general rules should be, SC code positioning, etc. were discussed.

During examination, it was determined that completion of the standard relating to common matters would be assigned to IEC when NWIP was proposed in IEC SC47D/WG2 in November, 1994. The standard was to be issued as revised EIAJ ED-7401 within fiscal year 1994.

The revision in this time has come to enforce and has come to combine to a change of a standard system, in conformity with the Technical Standardization Committee on Semiconductor Device Package operation prescription that was issued in December, 1995.

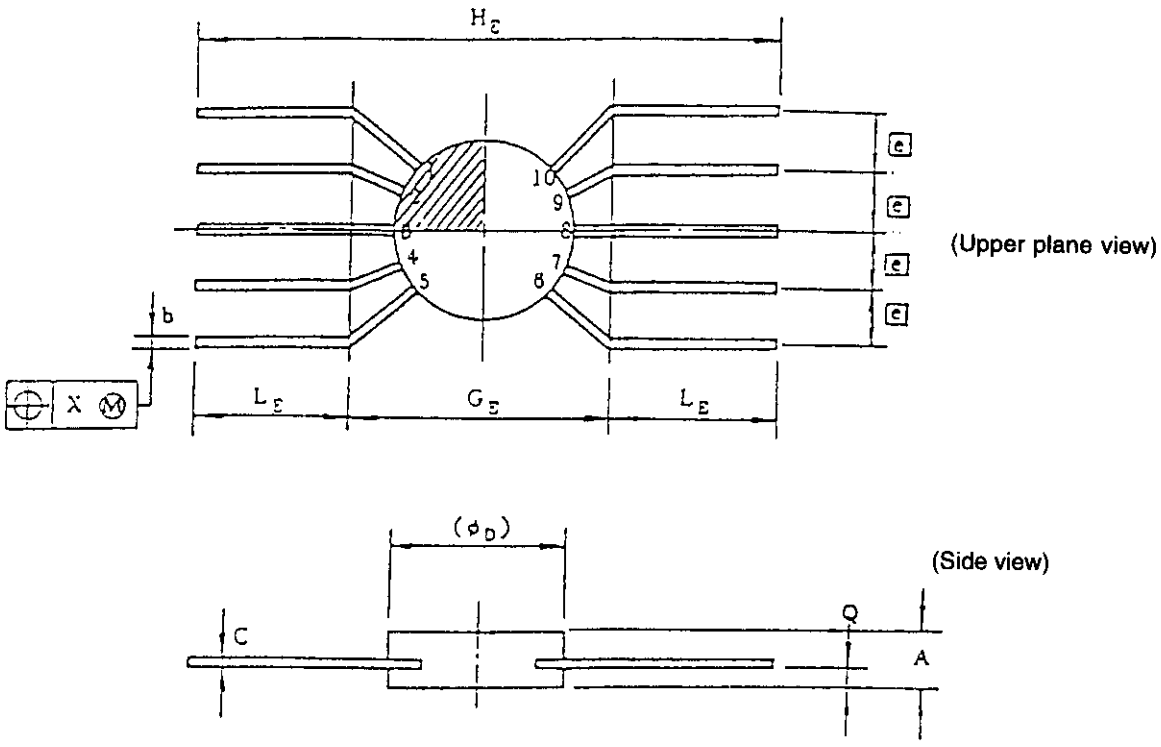


(Side view)

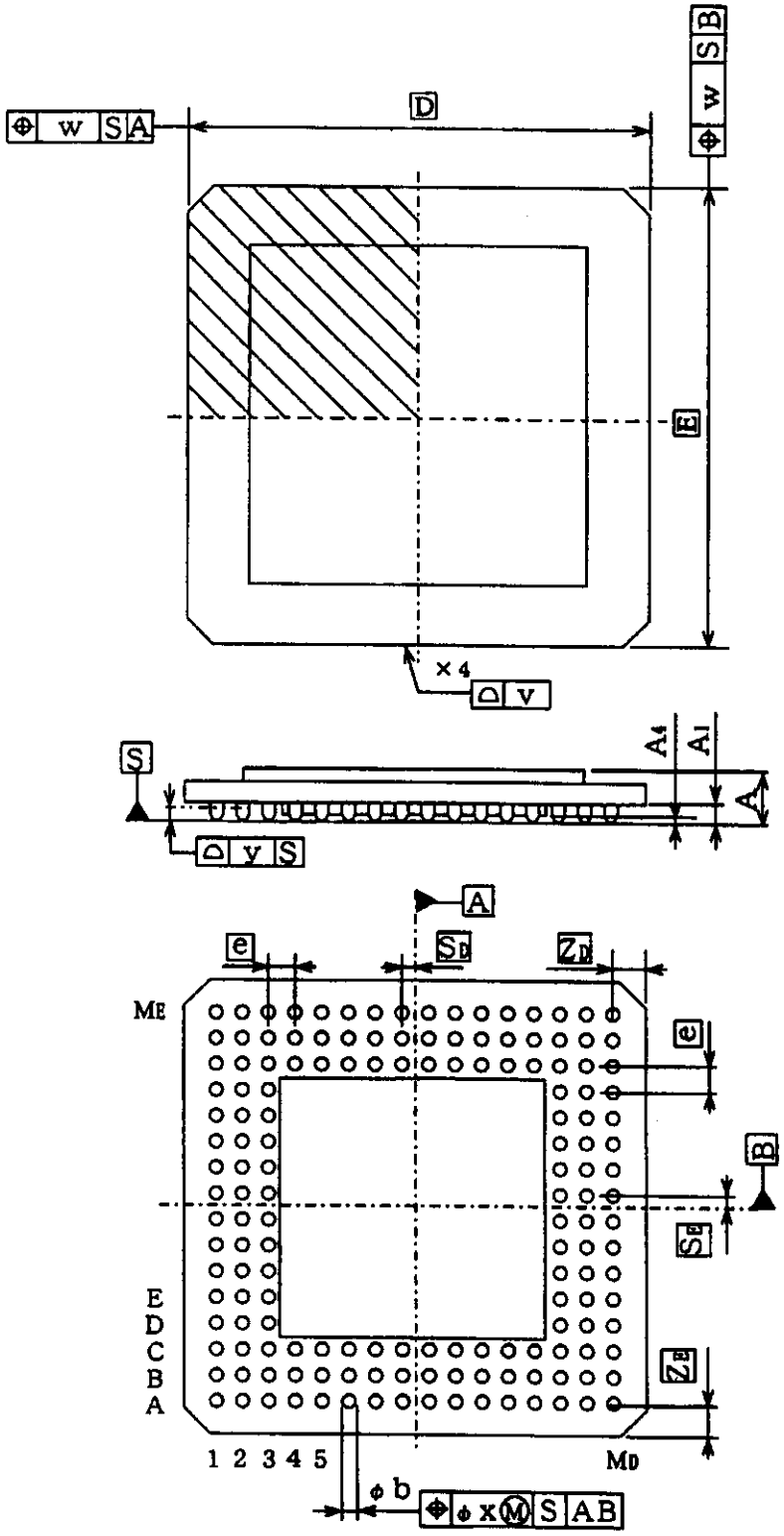


(Bottom view)

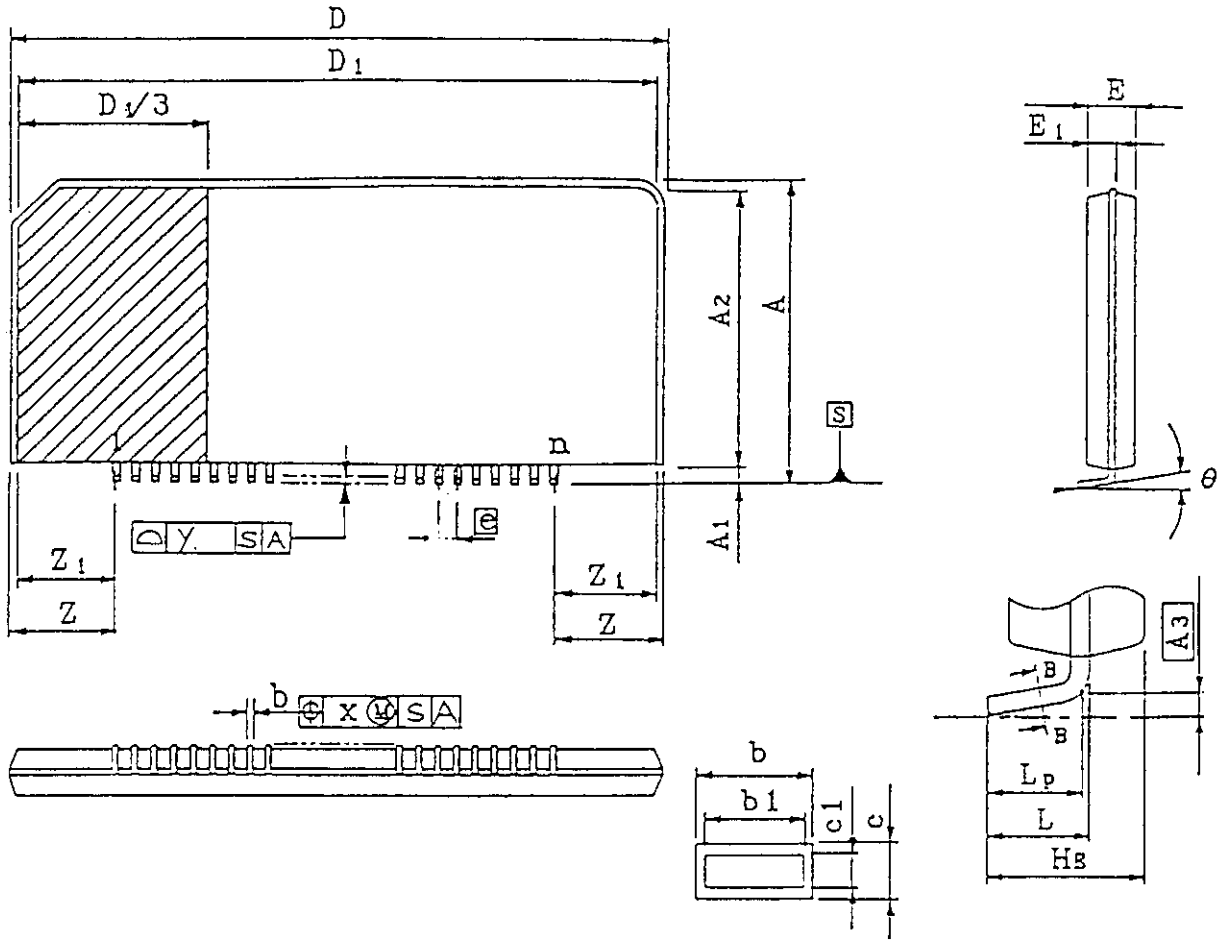
Attached Figure 6 Form F Example of outline drawing



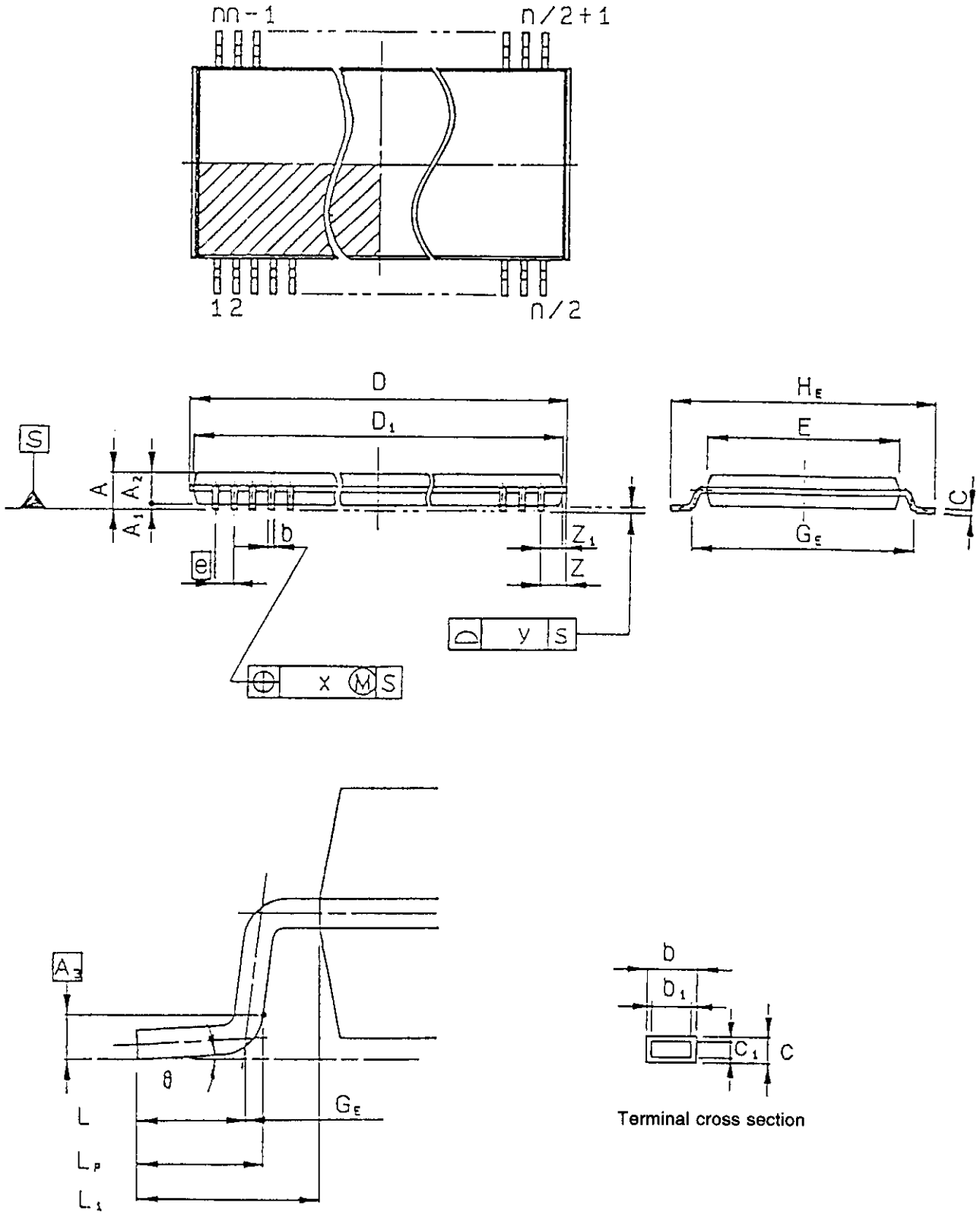
Attached Figure 5 Form E Example of outline drawing



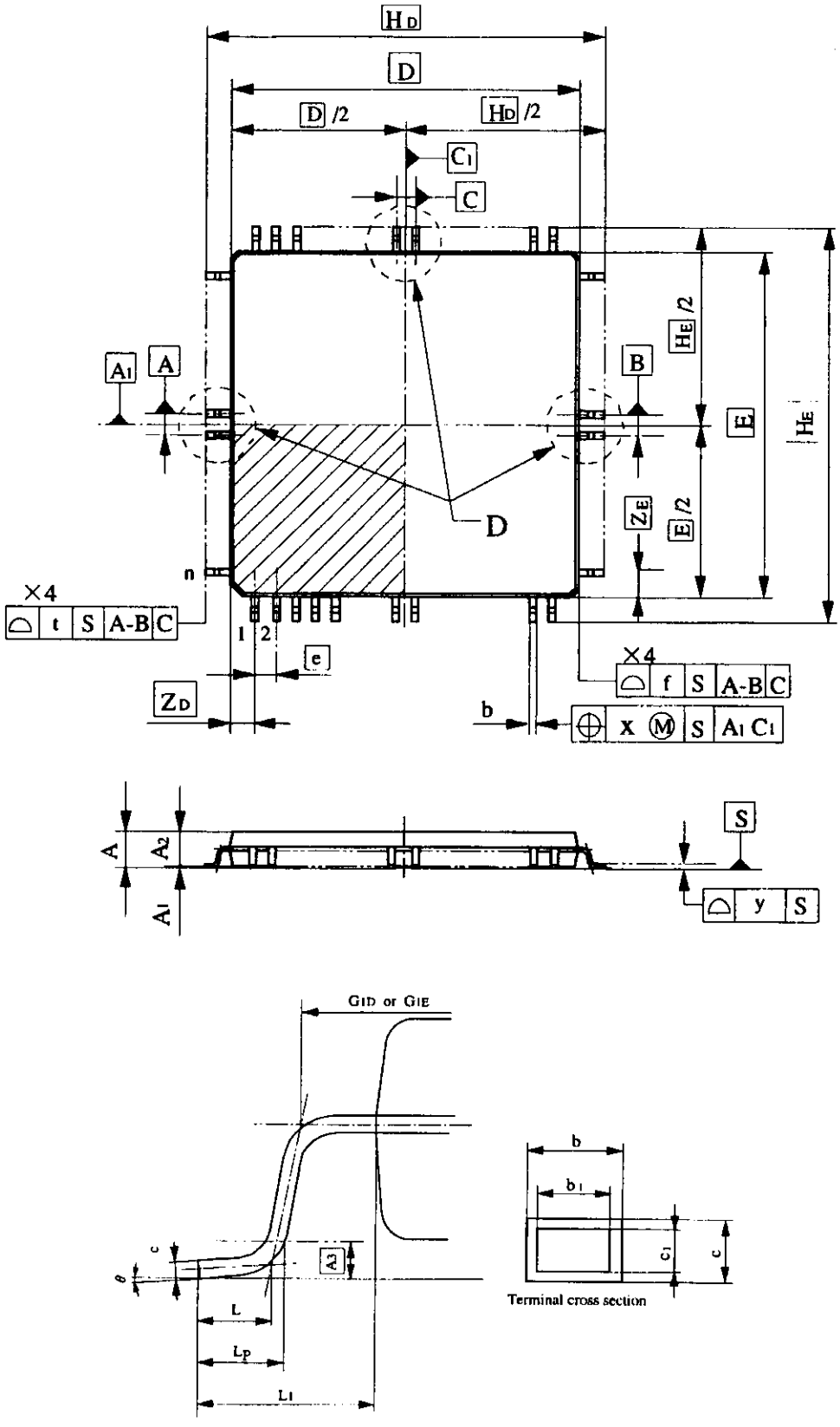
Attached Figure 4 Form D Example of outline drawing (BGA)



Attached Figure 3 Form C Example of outline drawing (SVP)



Attached Figure 2 Form B Example of outline drawing (SSOP)



Attached Figure 1 Form A Example of outline drawing (QFP)

Name of dimension	Reference symbol	Description
6. Dimensions associated with terminal positions		
Terminal pitch	e	An interval of centers of terminal arranged in line.
Terminal circle diameter	øa	A diameter of a circle having center positions of terminals arranged thereon in a package classified into Form F.
Terminal spacing, angular	β	An angle between terminal center positions laid out on the circumference on the package classified into Form F
Tolerance of terminal center position	x	For a through hole-mounted package, a positional tolerance of a center axis of an end of a terminal. For a surface-mounted package, it is the positional tolerance on a seating plane for the center axis of the end of the terminal.
Coplanarity	y	Terminal bottom planarity of surface mount package toward the seating plane.
7. Datum		
Primary datum plane	S	Shall be specified on a seating plane or base plane.
Secondary and tertiary datum planes	A, B	Shall be specified by a plane passing a center of a form of a package or a plane of a form.
8. Numerals		
Maximum number of terminal position	n	A total number of latent terminal positions according to a specified method of terminal positions. An actual number of existing terminals may be less than n.
Number of terminal matrix	M	Numbers of rows and columns of matrix-arranged terminals in a package classified into Form D.

Note: The dimension in parentheses in the name of dimension column space indicates the general dimension. Therefore, the applicable dimension name is specified in individual standard.

Name of dimension	Reference symbol	Description
3. Dimensions associated with terminals		
Reference height for terminal projection zone	A3	A height of a true geometrical position from a setting plane to specify a terminal projection zone.
Terminal length	L	Dimension of length of an inserted portion of a terminal from a seating plane for a through hole mounted package, dimension of length of a flat portion of a terminal, effective projection length of a flat portion of a terminal, for a surface-mounted package having the terminal forming the flat portion, and overall lengthwise length of a terminal for the other surface-mounted packages.
Length of terminal projection zone	Lp	An effective projection length effective for mounting terminals specified in a surface-mounting package having the terminals forming flat portions.
Terminal width	b	A dimension of maximum width of a terminal on a seating plane, including surface process of the terminal. Terminal diameter (øb) for the round pin shape.
Terminal thickness	c	A dimension of average thicknesswise dimension of a terminal on a setting plane, including surface process of the terminal.
Terminal angular	θ	A subtended angle of a terminal with a reference surface being a plane perpendicular to a seating plane in a through hole mounted package. It is an inclination angle of a terminal with a reference surface being a plane in parallel with a seating plane having a terminal flat portion made contact thereto, in a surface-mounted package.
4. Dimensions associated with stand or flange forms		
Flange/stand spacing linear	q	An interval of mounting centers of flanges or stands for use in mounting of a package on a board.
Standoff spacing(s), linear	d	Center-to-center dimension of shapes on the package providing standoffs
5. Dimensions associated with package index forms		
Index datum angle(s)	α	An angle of the index feature center position from the terminal reference line on the package classified into Form F

Attached Table 3 List of reference character and name specifications of typical dimensions

Name of dimension	Reference symbol	Description
1. Dimensions associated with package body		
Package length	D	A dimension of length of a package excluding terminals.
Package width	E	A dimension of width of a package excluding terminals.
Tolerance of package edge	f	It is the positional tolerance of package edge.
Package height	A2	A height from a base plane to a top of a package body.
2. Dimensions associated with both package body and terminals		
Overall length	HD	A maximum overall lengthwise dimension of length of a package including package length and terminals existing around it.
Overall width	HE	A maximum overall widthwise dimension of width of a package including package width and leads existing around it.
Tolerance of terminal tips	t	It is the positional tolerance of terminal tips.
(Facing terminal associated length)	GD	A lengthwise dimension specified at positions on facing terminals including package length. For a surface-mounted package having terminals forming plane portions, it shall be dimension between insides of the facing plane portions.
(Facing terminal associated width)	GE	A widthwise dimension specified at positions on facing terminals including package width. For a surface-mounted package having terminals forming plane portions, it shall be dimension between insides of the facing plane portions.
Package overhang(s)	Z	A distance from a true position of an outermost terminal to a most outside of an package body. For a terminal is shaped to project out of the package boxy, Z shall be specified 0, but not negative.
Seated height	A	A height from a seating plane to a top of a package body.
Standoff height	A1	A height from a seating plane to a top of a base plane.

Classification	Reference symbol	Name of dimension	Note
4. Dimentions associated with stand or flange forms	K, K1 ...		Dimensions of stand or flange associated length
	p, p1 ...		Dimensions of stand or flange associated width
	F, F1 ...		Dimensions of stand or flange associated height/thickness
	q	Stand center in-line interval	
	S, S1 ...		Dimensions of stand or flange center position associated
	øB, B, B1 ...		Dimensions of feature for stand-off associated width or diameter
	d	Stand-off center in-line interval	(Used for feature for stand-off)
5. Dimensions associated with package index forms	h, h1 ...		Dimensions of index feature associated height or depth
	k, k1 ...		Dimensions of index associated length
	j, j1 ...		Dimensions of index feature associated width/diameter
	α, β		Index feature associated angle
	[α], [αA], [αB] ...	Index reference position angle	
6. Dimensions associated with terminal mounting positions	[e]	Terminal pitch in-line interval	
	[e1], [e2] ...		Dimensions associated with terminal in-line interval
	[øa], [øaA], [øaB]	Terminal pitch circle diameter	
	[β], [βA], [βB]	Terminal reference position angle	
	x, v, w	Tolerance of terminal center position	x shall be used individually (geometrical tolerance value).
	y	Coplanarity	(Geometrical tolerance value)
7. Dimensions associated with datum	S	Primary datum plane	(Shall be used for seating plane or base plane.)
	A, B ...	Secondary datum plane	
8. Numerals	n	Number of terminal positions	
	M, MD, ME	Number of terminal arranged matrix	(A suffix character is applied when square grid is not used.)

Note: For dimensions that are assigned with the name of dimension (blank or enclosed by parentheses for the note column), Table 3 specifies the applications as major dimensions.

Attached Table 2 List of reference character and name specifications of dimensions

Classification	Reference symbol	Name of dimension	Note
1. Dimensions associated with package body	øD	Package diameter	
	D	Package length	
	D1, D2 ...		Dimension of package body associated length or diameter
	f	Tolerance of package edge	(Geometrical tolerance value)
	E	Package width	
	E1, E2 ...		Dimension of package body associated width
	A2	Package body height	
	A4, ...		Package body associated height
	R, R1 ...		Package body associated radius of curvature
2. Dimensions associated with both package body and leads	øH	Overall diameter	
	HD	Overall length	
	HE	Overall width	
	t	Positional tolerance of terminal tips	(Geometrical tolerance value)
	øG		Facing lead associated diameter
	GD		Dimensions of facing lead associated length
	GE		Dimensions of facing lead associated width
	Z, ZD, ZE	Package overhang	
	Z1, Z2 ...		Dimensions of facing lead associated width
	A	Seated height_	
	A1	Stand-off height	
	Q, Q1 ...		Dimensions of terminal projection position associated height (in reference to package body)
3. Dimensions associated with terminal	A3	Standard height of soldered points	
	L	Terminal length	
	L1, L2 ...		Dimensions of terminal associated length
	Lp	Length of soldered part	
	ø	Terminal diameter	
	b	Terminal width	
	b1, b2 ...		Dimensions of terminal associated width or diameter
	bp	Soldering width	
	c	Terminal thickness	
	c1, c2 ...		Dimensions of terminal associated thickness
	θ	Terminal angle	
	θ1, θ2 ...		Terminal associated angle

Attached Table 1 List of classified shapes of packages

EIAJ
JESD30-C

NO.	Terminal form	Form A	B	C	D	E	F	G	H
1	L-shaped terminal	QFP	SOP	SVP					
		FP	SO/FP						
2	J-shaped terminal	QFJ	SOJ						
		CC	SO						
3	I-shaped terminal	QFI	SOI						
				IP					
4	F-shaped terminal	QFF	SOF					QTP/DTP/ GQFP	
			FP/SO			DB			
5	Non-terminal	QFN	SON		LGA				
		CC							
6	T/H-terminal		DIP	SIP/ZIP					
			IP	IP					
7	Pin terminal				PGA				
			IP/FM		GA		DB/CY/LF		
8	Ball terminal				BGA				
					GA				

Note:

L-shaped terminal: Terminal with an L-shaped soldered part that is seen on QFP and SVP

J-shaped terminal: Terminal with a J-shaped soldered part that is seen on QFJ

I-shaped terminal: Terminal with an I-shaped soldered part that is seen on QFI

F-shaped terminal: Terminal not bent that is seen on SOF

Non-terminal: Shape having no protruding terminal that is seen on QFN and LGA

T/H (through-hole) terminal: Terminal having the T/H mounting soldered part that is seen on DIP

Pin terminal: Round pin terminal that is seen on PGA

Ball terminal: Ball- or bump-shaped terminal that is seen on BGA

9. Grouping dimensions

9.1 Scope

This subsection is used for the "list of dimensions of individual standard" in the standard.

9.2 Number of groups

Dimensions are classified into two groups: group 1 and group 2.

9.3 Definitions of the groups

(1) Group 1

Group 1 includes dimensions and numerals associated with mounting of packages and kinds of packages. The dimensions and numerals belonging to the group means values guaranteed to users and means that mechanical compatibility of mounting of packages can be recognized.

(2) Group 2

Group 2 includes dimensions that are not belonged to Group 1, but associated with fabrication of packages and dimensions of terminal position areas. The group is to achieve its own original purpose as the industrial standard. The group belongs to the dimensions and numerals of external shapes of packages useful for designing and manufacturing the packages by manufacturers and the dimensions of terminal position areas that can be referenced to in fabrications of mounting boards. Therefore, external dimensions of a package shall have nominal design values specified thereto.

8. Specifications of assigning reference symbols and names of dimensions

8.1 Specifications of assigning reference symbols and names for general dimensions

(1) Reference symbols: Reference symbols for general dimensions or numerals for use in external shapes are specified in Attached Table 2 according to subsection 8.2 for classification. Among them, typical dimensions and numerals are defined in Attached Table 3.

(2) Names: Names for general dimensions or numerals for use in external shapes are specified in Attached Table 2 according to the following classification. Among them, typical dimensions and numerals are defined in Attached Table 3. Dimensions of which names are not specified in Attached Table 2 are specified in the individual standard.

8.2 Classification

(1) Dimensions associated with package body: These are dimensions of a basic form of a package body. As examples, they are width, length, and height.

(2) Dimensions associated with both package body and terminals: These are dimensions including both a package body and terminals and such dimensions connecting the both as one end of a dimension index points the package body and the other is the terminals. As examples, they are total length and overhang.

(3) Dimensions associated with terminals: These are dimensions of individual terminal forms. As examples, they are terminal width and terminal angle.

(4) Dimensions associated with stand or flange forms.: These are dimensions of stands and flanges that are auxiliary forms attached to a package body.

(5) Dimensions associated with package index forms: These are dimensions associated with package index forms, such as chamfers and projections, of a package.

(6) Dimensions associated with terminal mounting positions: These are dimensions of mounting positions of terminals, basically represented by geometric tolerances. As examples, they are pitch of terminals in line.

(7) Datum and its associations: See subsection 4.5.3.

(8) Numerals: As examples, these are number of terminals and number of matrix of terminal arrangements.

8.3 Specifications of reference symbols and names for dimensions representing forms particular to packages.

(1) Reference symbols: Dimensions representing particular forms that are not classified in subsection 8.2 are to be specified in individual standard with use of upper and lower cases of alphabet that are not used in Attached Table 1.

(2) Names: Dimensions representing particular forms that are not classified in subsection 8.2 are to be specified in individual standard by proper names different from the ones used in Attached Table 1.

(5) Form E (cylinder): When the package body is viewed from the seating upper plane and the index is at the left or left bottom, the terminal at the left end of the lower horizontal row is 1. Successive numbering is applied counterclockwise.

(6) Form F (cylinder): When the terminals arranged on 2 or more circumferences with different radii.
Each circumferences should be indicated by means of the letters A, B, C, etc., and the positions on each circumference should be indicated by means of the numbers 1, 2, 3, etc.
The outermost group of terminals should be called A, and the other groups should be called B, C, etc., successively, toward the inner direction.
For each group of terminals, the first terminal after the reference line, in the clockwise direction, should be called terminal 1, and the other terminals should be called 2, 3, etc., successively in the clockwise direction.
Missing terminals, if any, should be handled as if they had been numbered.

(7) Form G (incomplete): Assuming the shape after mounting, apply the standard on form A to D.

Examples: Semi-product QTP, DTP, GQFP

(8) Form H (special): Apply numbering referred to form A to G.

(7) Form G (incomplete)
From G is a form that the package is not complete until postprocess is made to final external shape. The second classification shall be made by shape of the terminals.

Examples: Flat lead is QTP/DTP/GQFP.

(8) Form H (special)
Form H is a form that the package cannot be classified to any of Forms A to G.

7. Specifications of assigning terminal numbers

As a general rule for the numbering method, terminal numbers of a device are assigned as described below on the assumption that the package body is viewed from the seating upper plane and the index is placed at the left or left bottom.

(1) Form A (rectangular solid): When the package body is viewed from the seating upper plane and the index is at the left or left bottom, the terminal at the left end of the lower horizontal row is 1. Successive numbering is then applied counterclockwise.

Example: QFP, QFJ, QFI

However, for the I terminal and J terminal, when the package body is viewed from the seating upper plane and the index is at the left or left bottom, terminal at the center of the left vertical row (terminal just below the center line when the number of terminals is even) is numbered 1. Successive numbering is applied counterclockwise.

(2) Form B (rectangular solid): When the package body is viewed from the seating upper plane and the index is at the left or left bottom, the terminal at the left end of the lower horizontal row is 1. Successive numbering is applied counterclockwise.

Example: SOP, SOJ, DIP

(3) Form C (rectangular solid): When the package body is viewed from the seating upper plane and the index is at the left, the terminal at the left end. Then, numbering is applied from left to right. For ZIP etc. whose terminal lead out part is one row, terminals are treated as one row.

Example: SIP, ZIP, SVP

(4) Form D (rectangular solid): When the package body is viewed from the seating lower plane and the index is at the left or left bottom, the left vertical row nearest to the index is A.
Then, B, C, ..., AA, AB, ... are assigned from left to right. The lower horizontal row nearest to the index corner is 1. Then, 2, 3, ... are assigned from under to upper. Successive numbering is applied from bottom to top. Terminal numbers are represented such as A1 and AB2. Letters I, O, Q, S, X, and Z are not usable.

Examples: BGA, LGA.

6. Classification of shapes of semiconductor device packages

External shapes of semiconductor device packages are classified into the following eight forms. Each of the forms is defined by combination of a shape of the package body and portions having terminals protrude. The packages are further classified by combination of lead shapes.

It is assumed here that the packages are mounted in reference to a seating plane on board.

For reference, Table 1 shows the classification of integrated circuit packages based on JEDEC JESD30C.

(1) Form A (rectangular solid)

Form A is a form that the package body is shaped rectangular and has terminals protrude from four sides thereof in parallel with the seating plane. The second classification shall be made by shape of the terminals.

Examples:	L-shaped terminal is QFP, J-shaped terminal is QFJ, I-shaped terminal is QFI, Non-terminal is QFN, and Flat terminal is QFF.

(2) Form B (rectangular solid)

Form B is a form that the package body is shaped rectangular and has terminals protrude from two sides thereof in parallel with the setting plane. The second classification shall be made by shape of the terminals.

Examples:	L-shaped terminal is SOP, J-shaped terminal is SOJ, I-shaped terminal is SOI, Non-terminal is SON, T/H is DIP, and Flat is SOF.
NOTE:	A product of ceramic DIP with side braze shall be classified into Form B as a special case.

(3) Form C (rectangular solid)

Form C is a form that the package body is shaped rectangular and mounted longitudinally and has terminal protrude from a single side thereof in line perpendicular to the seating plane. The second classification shall be made by shape of the terminals.

Examples:	T/H terminal is SIP/ZIP and L-shaped terminal is SVP.
NOTE:	A product of ceramic ZIP with side braze shall be classified into Form C as a special case.

(4) Form D (rectangular solid)

Form B is a form that the package body is shaped rectangular and has terminals protruded from a bottom thereof in a plural of lines or in matrix. The second classification shall be made by shape of the terminals.

Examples:	Pin terminal is PGA, Ball/bump terminal is BGA, and Non-terminal is LGA.

(5) Form E (cylindrical)

Form E is a form that the package body is shaped cylindrical and has terminal protrude from sides thereof. The second classification shall be made by shape of the terminals.

(6) Form F (cylindrical)

Form F is a form that the package body is shaped cylindrical and has terminals protrude from a bottom or top thereof. The second classification shall be made by shape of the terminals.

5. Definition of terms

Terms used in common for the standard are defined below, provided that terms specific to individual standard are clearly defined in the individual standard.

(1) Package outline: Package outline specifying necessary dimensions for mechanical interchangeability in mounting the device
(2) Seating plane: Plane contacting with the package body or its terminal in mounting the device
(3) Base plane: Plane passing through the lower-most plane of the package body that is in parallel with the seating plane
(4) Gauging plane: Plane that is perpendicular to the reference terminal in specifying the terminal positions
(5) Terminal: Package component that is arranged for electrical, mechanical, or thermal connection
(6) Package body: Package components excluding the terminals
(7) Visual index: This is provided as an index for specifying the device position, attitude, and orientation. It is a reference that allows visual identification of the first terminal (e.g. mark, chamfer, notch, tab, dent, etc.).
(8) Mechanical index: This is provided as an index for specifying the device position, attitude, and orientation. It allows mechanical, optical, electrical, or pneumatic identification (e.g. tab, notch, flat, groove, key, etc.).
(9) Index area: Area in which more than a half of indices exist
(10) Terminal row: Continuation of the positions of terminals laid out on a straight line with equivalent pitches
(11) Protrusion: Resin generated in molding a resin molded package. It is hardened between the lead frame and package body and remains on the package body.
(12) Gate bnrr: Resin not completely removed and remaining on the resin injection port of a resin molded package
(13) Terminal finish: Plating, etc. applied to the terminal by using a metal that is hard to be oxidized to maintain good contact with the seating plane in mounting the device
(14) Terminal position area: Area in which the terminal can exist considering the terminal position allowance in mounting the plane mounted package
(15) Foot print: Contact with terminals laid out on the seating plane in mounting the plane mounted package (i.e. pad group)
(16) Cavity: Parts (corresponding to the molded product) into which resin is injected on the upper and lower dies of the molding dies
(17) Nominal dimensions: Typical dimensions among outline dimensions that are important in the mounting design and optimal for representing the package size
(18) Standoff: Pitch between the seating plane and base plane
(19) Flange: Shape that is protruding for mounting on the board belonging to the package body or because of the package structure, mainly of the insertion mounted package
(20) Stand: Shape for mounting on the board belonging to the package body, mainly of the plane mounted package

(2) Allowable limit dimensions without tolerance (only maximum and minimum values)

Assuming that an original tolerance is a digit of one higher than a least significant digit of an indicated maximum and minimum values, an effective number of digits below decimal point after conversion shall be determined, converted, and rounded off with use of Method B. In conversion of inches to millimeters, Table 1 shall be used or in conversion of millimeters to inches, Table 2 shall be used.

Example 1: If a dimension is indicated in inches as "1.934 inch min," then the right conversion to millimeters is 1.934 × 25.4 = 49.1236 mm. As the original tolerance is assumed as 0.01 inch, or the digit of one higher than the last digit, it is found from Table 1 that the rounding digit is 0.01 mm. Hence, using Method B for rounding in the range of tolerance, the result is 49.13 mm min.

Example 2: If a dimension is indicated in millimeters as "49.9 mm max," then the right conversion to inches is 49.9/25.4 = 1.9645669 inch. As the original tolerance is assumed as 1 mm, or the digit of one higher than the last digit, it is found from Table 2 that the rounding digit is 0.001 mm. Hence, using Method B for rounding in the range of tolerance, the result is 1.964 inch max.

(3) Standard dimensions representing reference dimensions without tolerance

Assuming that an original tolerance is a digit of one higher than a least significant digit of an indicated number, an effective number of digits below decimal point after conversion shall be determined, converted, and rounded off with use of Method A. In conversion of inches to millimeters, Table 1 shall be used or in conversion of millimeters to inches, Table 2 shall be used.

Example 3: If a dimension is indicated in inches as "101 mm," then the right conversion to inches is 101/25.4 = 3.976378 inch. As the original tolerance is assumed as 10 mm, or the digit of one higher than the last digit, it is found from Table 2 that the rounding digit is 0.01 inch. Hence, using Method A for counting as one fractions more than 0.5 inclusive and cut away the rest, the result is 3.98 inch.

(4) Standard dimensions representing dimensions indicating geometrically true positions without tolerance

Assuming that an original tolerance is within a tolerance for a geometrical true position to be given, an effective number of digits below decimal point after conversion shall be determined, converted, and rounded off with use of Method A. In conversion of inches to millimeters, Table 1 shall be used or in conversion of millimeters to inches, Table 2 shall be used.

Example 4: If a right conversion of a reference point to a point to millimeters is 36.1442 mm and if the point has a position tolerance of 0.008 inch diameter given thereto, there is a tolerance region having the diameter of 0.008 inch. It is found from Table 1 that the rounding digit is 0.001 mm. Hence, using Method A for counting as one fractions more than 0.5 inclusive and cut away the rest, the result is 36.144 mm.

4.6 Conversion of inches and millimeters and rounding off values

Conversion of a dimension having tolerance in inches to that of millimeters and vice versa shall comply with ISO Recommendation R370. The following abstracted specifications therefore are based on that. If a contradiction is caused by use of the following specification, conversion of higher accuracy must be made.

[Abstract and summary of ISO R370]

(1) Conversion values: 1 inch = 25.4 mm or 1 mm = 1/25.4 inch

(2) Effective number of digits below decimal point
   (a) For conversion of inches to millimeters: Comply with Table 1.
   (b) For conversion of millimeters to inches: Comply with Table 2.

(3) Rounding off
   (a) Method A: By count as one fractions more than 0.5 inclusive and cut away the rest.
   (b) Method B: By rounding down a maximum value and rounding up a minimum value.

Table 1 Conversion to millimeters

Original tolerance		Effective number of digits below decimal point
Not less than	Less than	
in	in	mm
0.00001	0.0001	0.00001
0.0001	0.001	0.0001
0.001	0.01	0.001
0.01	0.1	0.01
0.1	1	0.1

Table 2 Conversion to inches

Original tolerance		Effective number of digits below decimal point
Not less than	Less than	
mm	mm	in
0.00003	0.005	0.000001
0.005	0.05	0.00001
0.05	0.5	0.0001
0.5	5	0.001
5	50	0.01

(1) Toleranced dimensions
   (a) Maximum and minimum values of toleranced dimensions
   Assuming that an original tolerance is one digit higher than a least significant digit of an indicated maximum and minimum values, an effective number of digits below decimal point after conversion shall be determined, converted, and rounded off with use of Method B. In conversion of inches to millimeters, Table 1 shall be used or in conversion of millimeters to inches, Table 2 shall be used.
   (b) Nominal values of toleranced dimensions
   With use of Method A, a dimension to be converted and rounded off shall be converted to the same number of digits below decimal point as the maximum and minimum values before rounding off.

example, the contour tolerance of plane shall be used to indicate uniformity of a lowest surface of a lead of a surface-installed package. It should be noticed that notation of single-side tolerance shall comply with ANSI Y 14.5M as it is not specified by JIS.

(b) Positional tolerance (position deviation)
This shall be used to indicate a magnitude of deviation (uniformity) from a point, linear feature, or plane feature from a theoretically right position defined in association with a datum or other form. As an example, the tolerance of position shall be used to indicate allowable values of a center line or center plane of a lead of a package from a theoretically right position.

(3) If another geometric tolerance is used as needed, refer to JIS B 0021 and B 0621.

(4) Notation of geometric tolerance

(a) If a geometric tolerance is indicated for a single feature, a tolerance indication block (rectangular block) having a tolerance symbol and tolerance value entered therein shall be connected with the feature by an index on the drawing. For an example, a tolerance of flatness to that.

(b) If a geometric tolerance is indicated for an associated form, datum shall be associated with a tolerance indication block on the drawing. For an example, positional tolerance corresponds to that.

4.4 Maximum material principle and minimum material principle

(1) In using the geometric tolerance, if a co-relationship between a dimension tolerance and geometric tolerance is given on the basis of a maximum material condition and minimum material condition, the maximum material principle and minimum material principle shall be used.

(2) The minimum material principle shall comply with ANSI Y 14.5M as only the maximum material principle is specified by JIS B 0023.

4.5 Datum

(1) If allowable limits of geometrical deviation of a feature are indicated in geometrical tolerance, the package must have a datum specified therein.

(2) The datum used shall be of a three-plane datum system as specified below.

(a) A primary datum plane (x-y plane) shall be specified by a base plane or seating plane of the package.

(b) A secondary and tertiary datum planes (y-z and x-z planes) shall be specified by a plane passing a center of a feature having the package (for example, a center of terminal width and a center of body width) or by a plane of a feature.

(c) A special package may have a datum specified in a method optimum to the feature, unless a single datum is used to specify.

(3) The datum shall be indicated in combination of a triangular symbol (right isosceles triangle) and character symbol. The character symbol shall be upper case of alphabet, being assigned A, B, C, and so on in order of high priority, provided that if a base plane or seating plane is specified as datum, it shall be assigned a character symbol 'S'.

4.2 Dimensions and tolerances

(1) The dimensions and tolerances entered on any of drawings shall be applied to final products. Therefore, they shall not indicate manufacturing tolerances, but limits acceptable on market.

(2) Drawings may have the following dimensions as needed.

(a) Dimensions with tolerances

The dimensions with tolerances are classified into two groups.

(a-1) Dimensions having both maximum and minimum values to indicate allowable limits.

(a-2) Nominal values and maximum and minimum values, in which the nominal values may not always be center values between the maximum and minimum values.

(b) Dimensions without tolerance

(b-1) Allowable limit dimensions without tolerance
Minimum or maximum value only.

(b-2) Nominal dimensions without tolerance
For use in the following two dimensions.

- Reference dimensions as standard values for manufacturing packages.
- Dimensions indicating true geometric positions within square blocks.

(3) Number of digits below decimal point for maximum, minimum, and nominal values, excluding reference values, must be the one to correspond to indicate accuracy.
As an example, a dimension to be measured at accuracy of 0.01 mm shall be indicated with two digits below the decimal point (for example, 0.50 mm). If a dimension to be measured enough at accuracy of 0.1 mm shall be indicated with one digit below the decimal point (for example, 0.5 mm).

(4) For a dimension with tolerance, its limit values or the nominal value and limit values must be indicated with the same number of digits below decimal point.
As an example, a minimum value is 1.35 mm, nominal value is 1.50 mm, and maximum value is 1.80 mm.

(5) In general, dimensions shall be all indicated with character symbols and must not be directly shown on drawings. They shall be entered in a "stipulation" or "recommended values" columns of a list of external dimensions and must correspond to reference character symbols on the drawings, unless they are dimensions of specific shapes and dimensions inherent to the package.

(6) Diameters must have a symbol 'ø' entered right before the reference character on the drawing. If a shape is not always circle, the symbol must not be used.

(7) If a plurality of angles are clearly equal, they may not be indicated other than a single position on the drawing.

4.3 Geometric tolerance

(1) If a dimension tolerance is specified as allowable values of geometrical deviation of a feature, a geometric tolerance shall be used.

(2) For the geometric tolerances on the drawings for the packages, the following kinds of ones shall be used.

(a) Profile of a surface (feature deviation)

This shall be used to indicate a magnitude of deviation (uniformity) of a virtual contour plane form, including plane, formed of a contour plane form, including plane, from a geometrically right contour plane or plane. As an

Standard of Electronic Industries Association of Japan

Recommended practice on standard for the preparation of outline drawings of semiconductor packages

1. SCOPE

This standard stipulates basic items needed to create Outline Drawings of integrated circuits and discrete semiconductor devices (hereinafter referred to as the Standard).

Note: Corresponding international standard: IEC Pub. 191 [Mechanical standardization of semiconductor devices]

2. History

General rules for integrated circuits have been prepared based on EIAJ ED-7401, while those for discrete devices have been prepared based on EIAJ ED-7501. However, along with the increasing density in integrated circuits and diversification of packages in recent years, it is clarified that recent general rules use the notation that is not covered by the traditional standards.

In reviewing EIAJ ED-7401 based on IEC 191, EIAJ ED-7401A re-organizes, revises, and adds the details. Also, EIAJ ED-7501 is revised by integrating basic matters with EIAJ ED-7401 for the purpose of making it as the standard in preparing generals rules on both integrated circuits and discrete devices.

This standard is the one that was revised that Technical Standardization Committee on Semiconductor Device Package respects international standard (IEC) in December, 1995 and follow the aforementioned flow, triggered by the fact that a standard system of EIAJ is restructured to a purpose.

Also, this standard is prescribing a common rule in the top that prepares outline drawings and also items that are used to each standard and be being positioned as one of 6 standard regarding preparation of semiconductor packages outline drawings standard that are composed of EIAJ ED-7305 from EIAJ ED-7300.

3. General requirements

Recommended practice on Standard for the preparation of outline drawings of semiconductor packages consist of:

(1) Drawings requirements
(2) Definition of terms
(3) Classification of forms of semiconductor device packages
(4) Specifications of assigning terminal numbers
(5) Specifications of assigning reference characters and names of dimensions
(6) Grouping dimensions

4. Drawings requirements

4.1 Drawings

(1) The drawings all must indicate the dimensions to make mechanical compatibility clear.
(2) In general, drawing shall comply with JIS Z 8310, provided that if the minimum material principle in geometric tolerance, it shall comply with ANSI Y 14.5M.
(3) Drawing shall make use of orthographic third-angle projections, including
    (a) Front view
    (b) Plan view or side view or both
    (c) Other third-angle projections, sectional view, or detailed view as needed
(4) Any of drawings may have columns of note provided as needed.