

Mechanical standardization of semiconductor devices —

Part 1: Recommendations for the preparation of drawings of semiconductor devices

Committees responsible for this British Standard

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- EEA (the Association of Electronics, Telecommunications and Business Equipment Industries)
- Electronic Components Industry Federation
- GAMBICA (BEAMA Ltd.)
- Ministry of Defence
- National Supervising Inspectorate
- Society of British Aerospace Companies Ltd.

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Contents

	Page
Committees responsible	Inside front cover
Foreword	ii
Scope	1
Object	1
Section 1. General rules for all drawings	
1.1 Drawing layout	1
1.2 Dimensions and tolerances	1
1.3 Inter-conversion of inch and millimetre dimensions and rules for rounding off	2
Section 2. Additional rules for device and case outline drawings	
Section 3. Additional rules for base drawings	
3.1 General rules	4
3.2 Numbering of terminals	4
3.3 Methods for locating the datum line	5
Section 4. Additional rules for gauge drawings	
4.1 Gauging information	5
4.2 Reference letter symbols	5
Section 5. Rules for coding	
5.1 Device outlines	5
5.2 Bases	5
5.3 Case outlines	5
Appendix A Definitions	7
Appendix B Reference letter symbols	8
Appendix C Examples of semiconductor device drawings	10
Appendix D Conversion of toleranced dimensions from inches into millimetres and vice versa (extract of ISO Recommendation R 370)	14
Appendix	17
Appendix E Standardization philosophy	20
Appendix F Designation of metric screw threads (extract from Recommendation ISO/R 261)	24
Appendix G General philosophy of flat base devices	24
Appendix H Rules to specify the dimensions and the positions of the terminals on a base drawing	27
Figure 1	4
Figure 2	6
Figure 3	29
Figure 4	30
Figure 5	30
Figure 5a	31
Figure 6	31
Figure 7	32
Figure 7a	32
Table 1	8
Table 2	15
Table 3	16
Table 4 — Conversion from inches into millimetres	17
Table 5 — Conversion from millimetres into inches	19
Table 6 — Screw threads	24
Publication(s) referred to	Inside front cover

Foreword

This British Standard has been prepared under the direction of the Electronic Components Standards Policy Committee. It is technically equivalent to IEC 191-1:1966 “*Mechanical standardization of semiconductor devices — Part 1: Preparation of drawings of semiconductor devices*”, by the International Electrotechnical Commission (IEC) incorporating supplements A to C to IEC 191-1 (1966).

The differences between BS 3934-1 and IEC 191-1 are purely editorial in nature. For ease of reproduction, use has been made of the IEC text where appropriate; consequently some terminology and certain conventions are not identical with those used in British Standards.

This British Standard is Part of a series of standards corresponding to the Parts of the IEC publication on “Mechanical standardization of semiconductor devices”. The other Parts of BS 3934 are as follows.

- *Part 2: Schedule of international drawings giving dimensions;*
(Identical with IEC 191-2)
- *Part 3: Recommendations for the preparation of outline drawings of integrated circuits;*
(Technically equivalent to IEC 191-3)
- *Part 4: Recommendations for a coding system and classification into forms of package outlines for semiconductor devices;*
(Identical with IEC 191-4)
- *Part 5: Recommendations for tape automated bonding (TAB) of integrated circuits;*
(Identical with IEC 191-5)
- *Part 6: Specification for the preparation of outline drawings of surface mounted semiconductor device packages;*
(Identical with IEC 191-6)
- *Part 10: Schedule of UK national drawings giving dimensions.*

All purely national work in this area is issued in BS 3934-10.

BS 3934-1 to BS 3934-6 and BS 3934-10 supersede BS 3934:1965, which is withdrawn.

Cross-references

International Standard ^a	Corresponding British Standard
IEC 191-2:1966	BS 3934 <i>Mechanical standardization of semiconductor devices</i> Part 2:1992 <i>Schedule of international drawings giving dimensions</i> (Identical)
ISO/R 31-1:1978	BS 5775: <i>Specification for quantities, units and symbols</i> Part 1:1979 <i>Space and time</i> (Identical)
ISO/R 261:1962	BS 3643: <i>ISO metric screw threads</i> Part 1:1981 <i>Principles and basic data</i> (Technically equivalent)
ISO/R 263:1962	BS 1580 <i>Specification for Unified screw threads</i> Parts 1 & 2:1962 <i>Diameters ¼ in and larger</i> (Technically equivalent) Part 3:1965 <i>Diameters below ¼ in</i> (Technically equivalent)

^a Undated in the text.

A related British Standard to ISO/R 370 is BS 2856 *“Precise conversion of inch and metric sizes on engineering drawings”*.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 32, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Scope

Part 1 of the complete Recommendation on Mechanical Standardization gives recommended practice for the preparation of drawings of semiconductor devices.

Part 2 of the complete Recommendation on Mechanical Standardization gives recommendations for the dimensions of semiconductor devices.

Object

The primary object of these drawings is to indicate the space which should be allowed for devices in an equipment together with other dimensional characteristics required to ensure mechanical interchangeability.

It must be understood that complete interchangeability involves other considerations such as the electrical and thermal characteristics of the semiconductor devices concerned.

The separate drawings in Part 2 are based on the individual national drawings presented to IEC and they represent a combination of the dimensions of similar semiconductor devices as made in the different countries.

The individual national drawings of a country represent the first combination of the dimensions of similar devices made by different manufacturers of that country.

The IEC drawings, therefore, represent the unification of the national standards which is the primary object of the International Electrotechnical Commission.

The international standardization represented by these drawings therefore encourages the manufacturers of devices to comply with the tolerances shown on the drawings in order to extend their range of customers internationally. It also gives equipment designers an assurance of mechanical interchangeability between the devices obtained from suppliers in different countries, provided they allow the space in their equipments that is indicated by the drawings and take note of the more precise information on bases, studs, etc.

NOTE Additional details on the standardization philosophy used in this Recommendation are given in Appendix E.

Section 1. General rules for all drawings

Definitions for certain terms used in this Recommendation are given in Appendix A.

1.1 Drawing layout

1.1.1 A drawing should show all dimensions required to ensure mechanical interchangeability.

1.1.2 The drawing using third angle projection, should include:

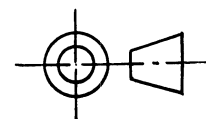
1.1.2.1 A suitable side-view.

1.1.2.2 Suitable end-views, where appropriate.

1.1.2.3 Such additional views and details as are required to show any special configuration or features.

1.1.3 The following information should be put in the cartouche, at the bottom of the page.

1.1.3.1 The projection method where there is more than one view, indicated as follows:



1.1.3.2 Date of publication of the drawing.

1.1.3.3 IEC code number.

1.1.3.4 Country of origin and code of that country indicated by sign Δ. Other interested countries and codes of those countries.

1.1.4 When a drawing is re-issued because of modifications, the changes made should be indicated by arrows in the margin. The date of publication of the revised issue and of the superseded issue should be stated.

1.1.5 While drawings need not to be drawn to scale, they should be roughly in proportion and, where necessary for clarity, enlarged detail drawing(s) should be used.

1.2 Dimensions and tolerances

1.2.1 Dimensions of bases, outlines, etc. quoted shall apply to the finished product. They should, therefore, not quote manufacturing tolerances, but give customers acceptance limits.

1.2.2 The following types of dimension may be used on the drawings as appropriate:

1.2.2.1 Tolerances dimensions

A tolerances dimension can be expressed:

- preferably by both minimum and maximum limits; or
- by a nominal value and maximum and minimum limits. Such a nominal value needs not necessarily be the average of two limits.

1.2.2.2 Untoleranced dimensions

1.2.2.2.1 Untoleranced limiting dimensions

i.e.: minimum only or maximum only.

1.2.2.2.2 Untoleranced nominal dimensions

These dimensions may be used:

- either for general information as an actual nominal figure;
- or to specify true geometrical position (by means of linear or angular dimensions). Such dimensions shall be indicated by an asterisk (*) after the numerical value, the asterisk in this sense meaning „true geometrical position”.

1.2.3 Single minimum, single maximum or single nominal (where not given for general information) dimensions should be stated in decimals to such a number of places as is considered adequate to express the degree of accuracy appropriate for that dimension; e.g. if measurement to the nearest 0.001 in is considered appropriate, the dimension should be expressed to the third decimal place (for example 0.500 in), but if the measurement to the nearest 0.01 in is sufficient, the dimension should be expressed to the second decimal place (for example 0.50 in) and so on. Similar consideration should be given to the number of decimal places necessary when an original dimension is expressed in millimetres.

1.2.4 Limiting values or nominal value and limits of a toleranced dimension should be stated with the same number of decimal places (e.g. 0.016 in min. – 0.017 in nom. – 0.019 in max.).

1.2.5 The use of fractional inch dimensions is permitted to describe nominal hexagon sizes.

1.2.6 Numerical dimensions should not be shown directly on the figure(s). They should be shown in tabular form under the figure(s) and correspond to the reference letter symbols on the figure(s).

The letter symbols on the figure(s) should be upright. Upper case letters should be used for device outline and case outline dimensions and lower case letters for base dimensions.

If confusion should arise, upper case letters should preferably be used throughout.

1.2.7 In the case of a diameter, the symbol „Ø” should appear in front of the reference letter concerned both on the figure(s) and in the table.

In cases where the cross-section is uncontrolled (not necessarily round), the „Ø” symbol should not be used.

1.2.8 The table will give dimensions in both millimetres and inches. The basic dimensions and system (millimetres or inches) will be those of the drawing of the country of origin and this will be indicated immediately above the table.

The millimetre dimension should always appear on the left-hand side of the table.

1.2.9 The dimensions and limits which should normally be given and their corresponding reference letter symbols are contained in Table 1 of Appendix B. Some examples of drawings prepared in accordance with these rules are given in Appendix C.

Where a particular reference letter must be used for more than one dimension on the same drawing, use should be made of a suffix to identify the dimensions.

Appendix B cannot be expected to include all dimensions likely to be necessary for mechanical standardization, more particularly in the future. A distinction has been made between primary and secondary reference letter symbols, primary reference letter symbols being those which are used most frequently, secondary reference letter symbols being those which are used less frequently and which can, if necessary, be associated with dimensions other than those given in the table.

1.2.10 Where it is self-evident that several angles are equal, it is not necessary to show more than one angle on the figure(s).

1.2.11 Notes will be numbered and placed under the table of dimensions which will have a „notes” column on the right-hand side. The note reference will be placed opposite the dimension to which the note refers in the table or, when this dimension does not appear in the table, on the figure(s). The numerical sequence of the notes should follow the alphabetical sequence of the dimensional reference letters to which the notes refer. Notes referring to the figure(s) should follow notes referring to dimensions given in the table.

1.3 Inter-conversion of inch and millimetre dimensions and rules for rounding off

Conversion of toleranced dimensions from inches into millimetres or vice-versa should be made according to ISO Recommendation R 370 (see Appendix D).

Tables I and II of this ISO Recommendation R 370 may be extended as necessary.

WARNING. — When converting inch dimensions to millimetre dimensions and vice-versa, attention is drawn to the fact that the first columns of Tables I and II are headed “equal to at least”.

The following rules should be applied when using Appendix D.

1.3.1 Toleranced dimensions

1.3.1.1 *Maximum and minimum values of toleranced dimensions*

Convert and round off, using Method B.

1.3.1.2 *Nominal value of toleranced dimensions*

Convert and round off to the same number of decimal places as used in the maximum and minimum values of the same dimension, using Method A.

1.3.2 Untoleranced dimensions (maximum only or minimum only)

Convert and round off, using Method B, by assuming as the original tolerance the unity of the last but one expressed order.

If the application of this rule results in incompatibility, then greater precision should be used.

Example 1:

A dimension is expressed in inches as follows: 1.934 in min.

The exact conversion to millimetres gives: 49.1236 mm.

Assume the original tolerance to be 0.01 in (i.e. the unity of the last but one expressed order), then Table I indicates a rounding off to 0.01 mm.

By applying Method B (i.e. rounding off within the tolerance), one obtains 49.13 mm min.

Example 2:

A dimension is expressed in millimetres as follows: 49.9 mm max.

An accurate conversion to inches gives: 1.964 566 9 in.

Assume the original tolerance to be 1 mm (i.e. the unity of the last but one expressed order), then Table II indicates a rounding off to 0.001 in.

By applying Method B (i.e. rounding off within tolerance), one obtains 1.964 in max.

1.3.3 Untoleranced nominal dimensions given for general information

Convert and round off, using Method A, by assuming as the original tolerance the unity of the last but one expressed order.

Example:

A dimension is expressed in millimetres as follows: 101 mm.

An accurate conversion to inches gives: 3.976 378 in.

Assume the original tolerance to be 10 mm (i.e. the unity of the last but one expressed order), then Table II indicates a rounding off to 0.01 in.

By applying Method A, one obtains 3.98 in.

1.3.4 Untoleranced nominal dimensions given to specify true geometrical positions

Convert and round off, using Method A, by assuming as the original tolerance the diameter of the tolerance zone around the true geometrical position to be given.

Example:

The exact conversion to millimetres of the distance from some reference to a certain point gives 36.144 2 mm and there is a positional tolerance zone of 0.008 in diameter around it.

As there is a positional tolerance with a diameter of 0.008 in, Table I indicates a rounding off to 0.001 mm.

By applying Method A, one obtains 36.144 mm.

Section 2. Additional rules for device and case outline drawings

2.1 The device outline drawings which appear in Chapter 1 of Part 2 should include all dimensional characteristics required for interchangeability in accordance with general rules.

2.2 The case outline drawings which appear in Chapter 3 of Part 2 should include all dimensional characteristics required for interchangeability in accordance with general rules, omitting the terminal dimensioning which will be given on the associated base drawings appearing in Chapter 2 of Part 2.

On the case outline drawings, the terminals should be shown only by dotted lines.

2.3 Where the requirements for mechanical interchangeability will permit, the minimum and maximum dimensions should be chosen so that the creation of unnecessary drawings of variants is avoided.

Section 3. Additional rules for base drawings

3.1 General rules

3.1.1 The base drawings which appear in Chapter II of Part 2 should include the dimensional characteristics required for interchangeability of the base and in certain instances for compatibility between the base and a socket.

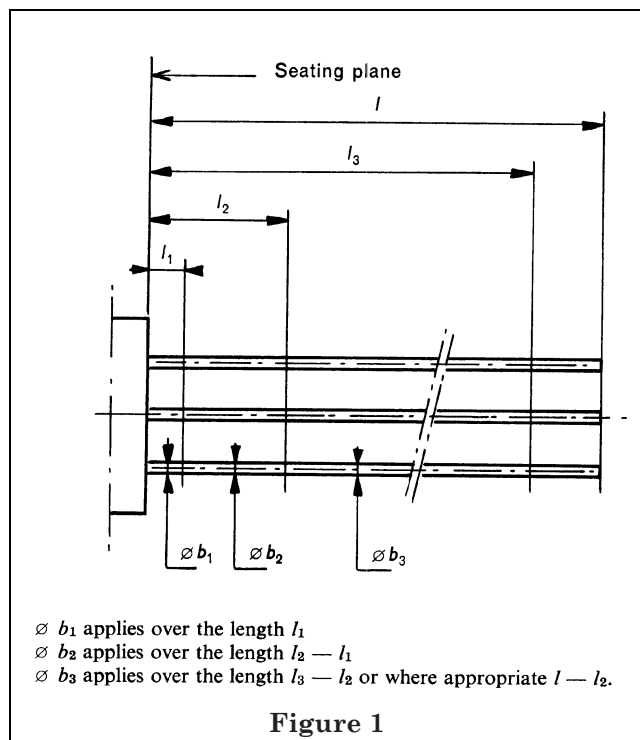
3.1.2 The terminals should be numbered in accordance with Clause 3.2.

3.1.3 The following system should be used to locate the terminals on the bases:

The true geometrical position of the terminals (or of the holes in gauges) is defined by angular spacing on a pitch circle (polar co-ordinates) or by rectangular co-ordinates in relation to certain fixed references. Such dimensions are not toleranced.

The positional tolerance is indicated by stating that the cross-section of each terminal at its point of origin or at a specified distance from the seating plane lies in a circle (of stated diameter) centred at the true geometrical point defining the terminal axis.

3.1.4 The following system should be used either in total or in part to indicate the dimensions of the terminals.



3.2 Numbering of terminals

Where possible, device terminals should be identified by numbers according to the system outlined in Sub-clauses 3.2.1 to 3.2.5. In all instances terminals are considered as being viewed from their free ends.

3.2.1 Single-ended devices with terminals in a linear array

3.2.1.1 Symmetrical linear array

The terminal nearest the reference mark should be numbered as No. 1, the other terminals should be numbered progressively from terminal No. 1.

3.2.1.2 Asymmetrical linear array

The terminals should be numbered progressively from the end having the most terminals.

3.2.2 Single-ended devices with terminals in a circular array

— The terminal, the centre of which is past the datum line, should be numbered as No. 1, the other terminals should be numbered progressively and in a clockwise sequence from No. 1.

— Where a terminal is situated in the centre of the base, this should be known as the centre terminal and shall not be given a number.

— Where omission of one terminal in an otherwise equally spaced array identifies the datum line, the position of the omitted terminal should not be numbered; but, in a fixed modular circular array, any location of omitted terminal which does not define a datum line should be numbered.

3.2.3 Double-ended devices

Terminals on both end views should be numbered without duplication of numbers.

3.2.4 Devices with terminals disposed on a square or rectangular periphery

Visual identification of the top of the device should be provided. The means of identification of terminal position number one should also be provided. These identifications may be combined.

The terminal positions should be numbered progressively in an anti-clockwise direction around the periphery of the device as viewed from the top. The number one terminal position shall be the first position anti-clockwise from the means of identification.

Each terminal shall be identified by the number of its position. Terminals may not necessarily be present in all the numbered positions but those present shall have the number of the position.

3.2.5 Other devices

For devices having terminals, mounting studs, holes, in more than one plane, the following rules should apply. The numbering should start at the end:

- opposite to the end containing a threaded stud or hole;
- opposite to the end with the smallest number of terminals;
- opposite to the end identified by a hand, dot or other applied visual identification;
- opposite to the end with the larger ferrule, flange, insert, etc.

3.3 Methods for locating the datum line

These methods are listed below in order of preference. When more than one of these methods is possible for a given device, the method appearing earliest in the list should be used. When none of the following methods is possible, the method best suited to the device should be used.

The datum line is:

3.3.1 The radial line through the centre of the mechanical or visual index.

3.3.2 The radial line midway between the two terminals which obviously comprise a gap in an otherwise equally spaced circular terminal array.

3.3.3 The radial line 180° from the locating radius of the most isolated terminal.

3.3.4 The radial line 180° from the mid-point of, in order of preference:

- the two most widely spaced terminals;
- the two most closely spaced terminals.

3.3.5 The radial line through the centre of the index terminal. In order of preference, the index terminal is defined as that having:

- the smallest cross-sectional area at the point of emergence from the case;
- the greatest axial length, when one terminal is noticeably longer than the others;
- the smallest axial length, when one terminal is noticeably shorter than the others.

3.3.6 Particular case of lozenge — shaped bases

Given two orthogonal axes, X'X and Y'Y, the device is oriented so that:

- a) the greatest diagonal of the base coincides with the Y'Y axis, whereas the smallest diagonal coincides with the X'X axis;

- b) the greatest number of terminals is in the upper half (Figure 2 A, Figure 2 B, Figure 2 C) or in the right-hand half (Figure 2 D).

The numeration is clockwise, starting from the quadrant in the upper left-hand side.

If the terminals are disposed in a cross on the axis (Figure 2 E), it is necessary to mark on the body with a visual index the terminal which shall be considered as the first in the clockwise numeration.

Section 4. Additional rules for gauge drawings

The gauge drawings of semiconductor devices appear in Chapter 4 of Part 2.

4.1 Gauging information

Under consideration.

4.2 Reference letter symbols

Where possible, the same reference letters symbols should be used as on the associated case outline or base drawing.

Section 5. Rules for coding

The following coding system should be used to identify the device outlines, bases and case outlines covered by the drawings contained in this Recommendation.

5.1 Device outlines

Code: letter "A" followed by a serial number.

5.2 Bases

Code: letter "B" followed by a serial number.

5.3 Case outlines

Code: letter "C" followed by a serial number.

5.4 Where type variants having inch or metric threads are shown, these should be distinguished by adding U (for inch) and M (for metric) as suffixes to the serial number.

5.5 Where other type variants are shown as types A, B, C, etc., these should be distinguished by adding the appropriate suffix (A, B, C, etc.) to the serial number.

Examples:

A13, A27M, B5A, C16, A15UB.

5.6 For provisional drawings a letter P must be added at the beginning of the code. When such a provisional drawing reaches a publication stage, it should be given a final serial number in accordance with the recording rules.

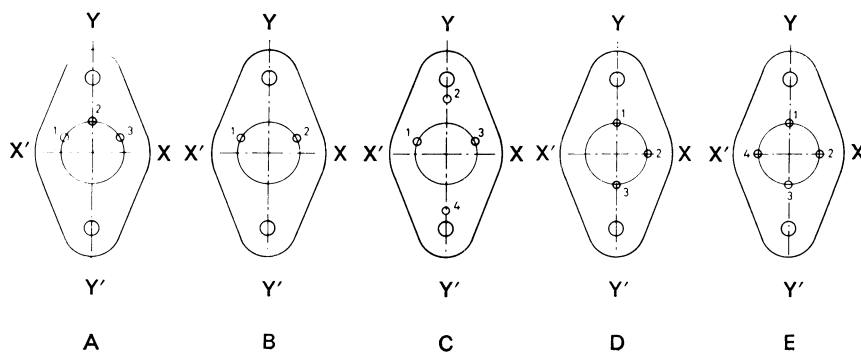


Figure 2