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SPECIFICATION FOR
**DIMENSIONS OF
SEMICONDUCTOR DEVICES
AND INTEGRATED
ELECTRONIC CIRCUITS**

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The Institution desires to call attention to the fact that this British Standard does not purport to include all the necessary provisions of a contract.

In order to keep abreast of progress in the industries concerned, British Standards are subject to periodical review. Suggestions for improvements will be recorded and in due course brought to the notice of the committees charged with the revision of the standards to which they refer.

A complete list of British Standards, numbering over 9000, fully indexed and with a note of the contents of each, will be found in the BSI Catalogue. The BSI Catalogue may be consulted in many public libraries and similar institutions.

British Standards are revised, when necessary, by the issue either of amendment slips or of revised editions. It is important that users of British Standards should ascertain that they are in possession of the latest amendments or editions.

The following BSI references relate to the work on this standard:
Committee references TLE/12 and TLE/12/2.

Drafts for comment D 63/11631 and D 63/13937.

CO-OPERATING ORGANIZATIONS

The Telecommunication Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

British Broadcasting Corporation
*British Electrical and Allied Manufacturers' Association
*British Radio Equipment Manufacturers' Association
British Radio Valve Manufacturers' Association
British Railways Board
Cable and Wireless Ltd.
Crown Agents for Oversea Governments and Administrations
Electrical Contractors' Association, Incorporated
Electrical Research Association
*Electricity Council, the Generating Board and the Area Boards in England and Wales
*Electronic Engineering Association

*Electronic Valve and Semi-Conductor Manufacturers' Association
Institution of Electrical Engineers
*Institution of Electronic and Radio Engineers
*Ministry of Aviation
Ministry of Defence, Navy Department
Ministry of Labour (H.M. Factory Inspectorate)
*Post Office
*Radio and Electronic Component Manufacturers' Federation
Relay Services Association of Great Britain
*Science Research Council—
Radio Research Station
*Telecommunication Engineering and Manufacturing Association

The Government departments and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this standard:

National Physical Laboratory—
Ministry of Technology
Scientific Instrument Manufacturers Association

Society of British Aerospace Companies Limited
United Kingdom Atomic Energy Authority

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BRITISH STANDARD SPECIFICATION FOR DIMENSIONS OF SEMICONDUCTOR DEVICES AND INTEGRATED ELECTRONIC CIRCUITS

FOREWORD

This British Standard has been prepared under the authority of the Telecommunication Industry Standards Committee to meet the need for a record of the outlines, bases and gauges of semiconductor devices and integrated circuits in general use.

The drawings given are intended for use in conjunction with BS 9300, 'Semiconductor devices of assessed quality: Generic data and methods of test' and BS 9400, 'Integrated electronic circuits of assessed quality: Generic data and methods of test' and for describing devices in lists, catalogues, data sheets and technical correspondence.

International discussion under the aegis of the International Electrotechnical Commission (IEC) is continuously in progress on this subject and every effort has been made to conform with those international recommendations already published and to anticipate, so far as is possible, agreements which are likely to be reached in the international sphere in the near future. In order that amendments which will be issued from time to time may be readily incorporated into this standard it has been prepared in loose leaf form. It should be noted that the issue of amendments to holders of this standard is not automatic.

Guidance on the preparation of outline drawings and designation of package outline are given in IEC 191-1, 191-3 and 191-4. These standards should be used and referenced directly when appropriate.

SPECIFICATION

SCOPE

This British Standard records drawings of outlines, bases and gauges of various forms of semiconductor device and integrated circuit. Guidance on the interpretation and use of the drawings is also given.

USE AND INTERPRETATION OF DRAWINGS

General

The form of standardization represented by this standard is properly termed 'unification' and consists in combining the dimensions of a number of manufacturers' devices in a single drawing in such a way that the devices obtained are mechanically interchangeable.

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

If a manufacturer describes a device as conforming to a standard outline, the dimensions shown on the relevant data sheet will comply with the tolerances of the standard drawing. The equipment designer, when using the standard drawings, is strongly advised to use the tolerances shown in this standard if he wishes to take advantage of the availability of supplies from more than one manufacturer.

The dimensions on the standard drawing are such, however, that the tolerances shown are considered acceptable for the purposes of mechanical interchangeability in an equipment, or for adaptation to other accessories when incorporated in an equipment and for good engineering practice.

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

For devices used in high power equipment, where the packing density is not a vital consideration, the space required for the case of the device need not be defined as closely as the space required for the smaller transistors and diodes used in lower power apparatus.

Classification of drawings

The drawings in the standard are divided into three sections:

Section one: Device outlines referenced SO, followed by a hyphen and serial number, e.g. SO-1.

Section two: Device bases referenced SB, followed by a figure indicating the number of lead positions with a hyphen separating this figure from the serial number, e.g. SB0-1, SB3-1.

Section three: Device gauges referenced SG, followed by a hyphen and serial number, e.g. SG-1.

Information on the outlines and bases known to be associated is given in the index of cross references at the end of this standard.

In general, devices can be classified mechanically as follows:

(a) Wire-mounted double-ended devices:

All the information for mechanical interchangeability is given on a single drawing in section one, e.g. SO-6, SO-15.

(b) Wire-mounted single-ended devices:

The dimensions for cases or bodies are given in section one and those for the associated bases and terminal wires will be found in section two.

The case and base are defined separately because different bases may be associated with the same case or outline,

e.g. SO-12A, SO-44A, with SB2-3, SB2-4.

Some of the more commonly associated bases and outlines have now been prepared as composite drawings and a list of these is given in the index of cross references.

(c) Stud-mounted double-ended devices:

All the information for mechanical interchangeability is given on a single drawing in section one.

When metric threads are quoted the pitch is assumed to be coarse unless otherwise stated,

e.g. SO-10, SO-30A.

(d) Flat base mounted devices:

The outline drawing, given in section one, shows the details of the body and the terminations.

The base drawing (SB0 series in section two) combines the details of the clamping arrangements and the flat base zone of the device.

The case and base are defined separately because different bases may be associated with the same case or outline.

Each SB0 base drawing specifies a unique set of dimensions for the position of the fixing holes and the maximum size of the fixing screws and thus effectively constitutes a drilling jig for a heat sink.

The outline and associated base drawings together define the maximum space to be allowed for the whole of the mounted device,

e.g. SO-50A, SO-52B, with SB0-1, SB0-2.

Some flat base devices are shown complete on a single drawing in section one,

e.g. SO-38.

(e) Flat pack multi-lead devices:

All the information for mechanical interchangeability is given on a single drawing in section one,

e.g. SO-92.

(f) Unclassified:

Devices which do not fit into the above classification are treated individually; they generally appear in section one,

e.g. SO-26, SO-37.

Serial numbers and suffixes

The serial numbers of outlines or bases do not distinguish between the electrical functions of devices, i.e. diodes, transistors, etc.

Suffix letters A, B, etc., which sometimes follow a serial number are used to indicate variants which usually differ only in one feature. Examples of variants covered by suffix letters on outline drawings are:

- Can heights, e.g. SO-5A and SO-5B
- Inch and metric threads, e.g. SO-29A and SO-29B
- Stud length, e.g. SO-29A and SO-29C
- Hexagon size, e.g. SO-32A and SO-32C
- Presence of auxiliary leads, e.g. SO-52A and SO-52B
- Fixed lug and flying leads, e.g. SO-52B and SO-52C
(small diameter leads only)

Suffix letters on base drawings distinguish between long and short terminal versions, e.g. SB3-3A and SB3-3B.

Geometrical tolerancing

Some of the drawings in this standard have been prepared in accordance with the system of geometrical tolerancing described in Part 3 of BS 308 to which reference should be made for an explanation of the system.

Conversion of dimensions

Dimensions are converted in accordance with IEC Publication 191-1, Clause 1.3, except that in the case of conversion from millimetres to inches, no dimension will include more than three decimal places in the inch dimension. Where four decimal places of inches are obtained these will be rounded to the nearest three decimal places.

In those cases where a note on a drawing refers to 'reference dimensions' it is to be inferred that such dimensions are the prime units of measurement.

Cross reference index

A cross reference index is included at the end of this standard. It not only gives the association between outlines and bases but also refers to the symbolic names used in IEC Publication 191.

RULES FOR THE PREPARATION OF DRAWINGS

Definitions

For the purposes of this British Standard the following definitions apply:

Outline drawing. (Package outline drawing.) A drawing (of a device or package) which specifies the dimensional characteristics and other closely associated features which are required for mechanical interchangeability.

Mounted height. The mounted height is the distance from the seating plane to the top of the device or package or any rigid terminal present. For devices with axial flexible terminals it is defined as the distance above the seating plane within which the device can be mounted with its terminals bent at right angles.

Controlled cylindrical zone. This zone defines a portion of the body of a minimum length over which the diameter is controlled to closer tolerances than are allowed over the full length of the body. The zone may be used for mechanical mounting and for heat sink design on case rated devices.

Seating plane. The plane on which leaded packages and folded lead packages freely rest on their terminals, and on which leadless packages freely rest on their mounting base plane or terminals.

Reference plane. A plane parallel to the seating plane.

NOTE. The seating plane is often used as the reference plane.

Base plane. A plane drawn parallel to the seating plane through the lowest point of the device or package, excluding any stand-off.

Gauging plane. A plane perpendicular to the terminals, at which the position of the terminals is controlled.

NOTE. In some packages, two or more of the above mentioned planes may coincide.

Terminal position. One of a series of equally spaced locations on a circle or on a row which may or may not be occupied by a terminal.

Visual index. A reference feature (e.g. mark, chamfer, notch, tab, depression etc.) which identifies the first terminal position.

Index area. The area in which a portion or all of the visual index must lie.

Mechanical index. A feature (e.g. tab, notch, flat, groove etc.) which provides orientation during automatic handling.

Where possible, the mechanical index should coincide with the visual index.

Index centreline. A centre line through a visual index feature (e.g. tab) which is used to orientate the index with the first terminal position.

Grid reference corner. The first terminal position (viewed from the free end of the terminals) in an alpha-numeric grid system.

Terminal row. A series of equally spaced terminal positions which are located on a straight line.

Terminal circle. A series of equally spaced terminal positions which are located on a circle.

Letter symbols

The symbols given in the tables shall be used.

Numbering of terminals

In all instances, terminals are considered as being viewed from their free ends.

Single-ended devices with terminals in a linear array

(a) *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.

(b) *Asymmetrical linear array.* The terminals should be numbered progressively from the end having the most terminals.

Single-ended device with terminals in a circular array

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

(b) 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.

(c) 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.

Double-ended devices. Terminals on both end views should be numbered without duplication of numbers.

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 band, dot or other applied visual identification
- opposite to the end with the larger ferrule, flange, insert, etc.

Devices with terminals disposed in multiple circular arrays. The details given above for single-ended devices with terminals in a circular array apply as follows:

The terminals located on the pitch circle of largest diameter should be numbered A1, A2, A3 etc. and the terminals located on the other pitch circles of decreasing diameter should be numbered progressively B1, B2, B3 etc., C1, C2, C3 etc.

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.

Devices with terminals disposed in three or more rows. The terminal positions should be on an orthogonal network of equal pitch respectively in both directions.

Terminal positions shall be numbered whether or not a terminal is present.

With the device viewed from the free end of the terminals and from the index area in the lower left hand corner the first vertical row is numbered 1, the other vertical rows are numbered progressively from number 1.

The first horizontal row is lettered A, the other horizontal rows are lettered in alphabetical order from A (without using I and O).

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(Figure 1 shows an example of this designation system.)

When more than 24 rows are possible, the rows after row Z shall be given an alphabetical prefix, e.g. AA, AB, etc.

(Figure 2 shows an example of a device having two rows near to the edges of the long side of the package and with a pitch equal to ' e ' in one direction and ' $2e$ ' in the other and with a distance equal to ' $24e$ ' between the inner two rows.)

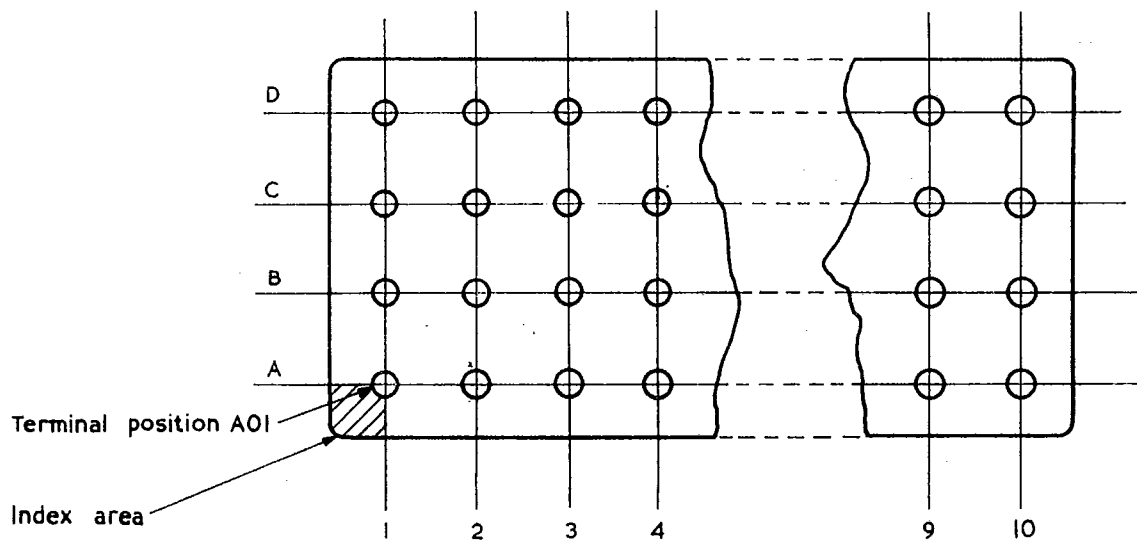


Figure 1

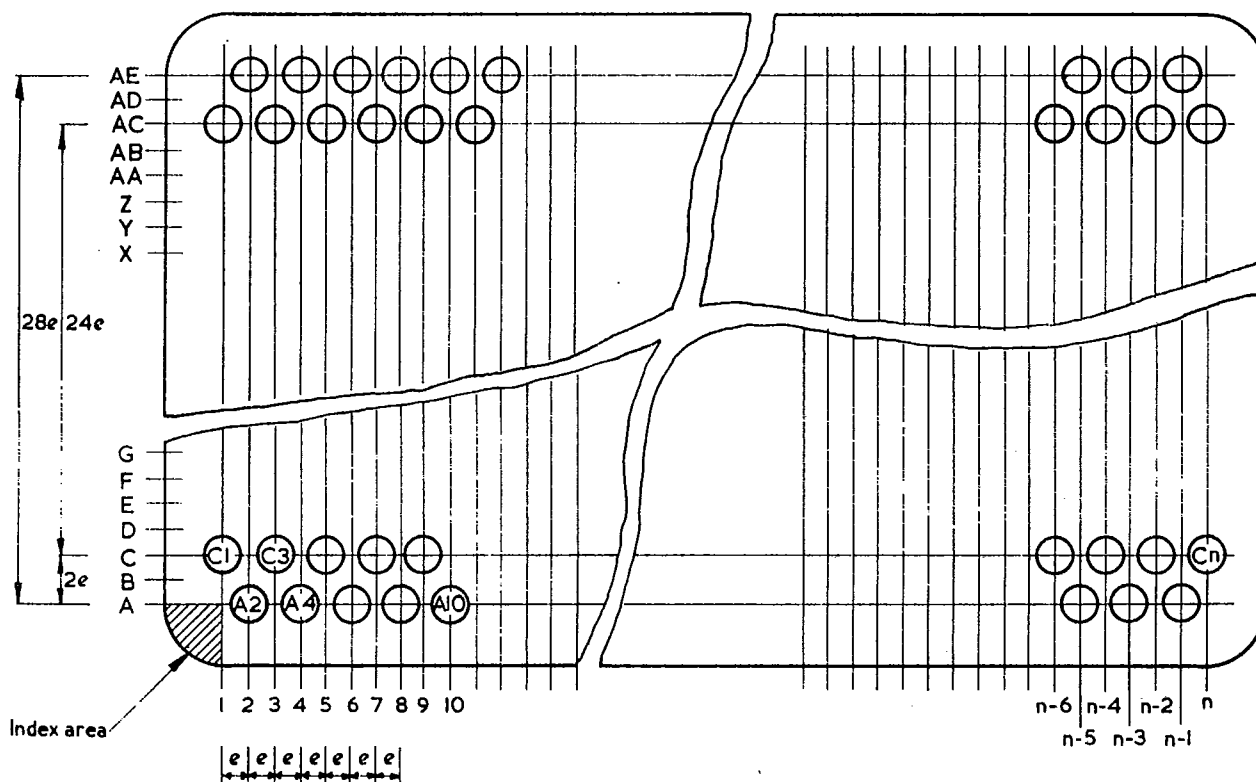


Figure 2

REFERENCE LETTER SYMBOLS
(for drawings of discrete semiconductor devices)

Where appropriate to the particular drawing being prepared, the dimensions listed in the following table should be given with the associated reference letter symbols.

Reference letter symbol	Description of the dimension	Type of limits			Notes
		min.	—	max.	
<i>A</i>	Length from seating plane to top of case	min.	—	max.	
<i>a</i>	Pitch circle diameter of terminals	—	nom.*	—	
<i>B, b</i>	Diameter of a terminal, or of the larger terminal if the cross section is circular If the cross section is not circular, width or major axis of the cross section of a terminal	min.	—	max.	1, 2, 3
<i>B₁, b₁</i>	Other diameter of terminal as shown in figure 3	—	—	max.	
<i>B₂, b₂</i>	Other diameter of terminal as shown in figure 3	min.	—	max.	
<i>B₃, b₃</i>	Other diameter of terminal as shown in figure 3	—	—	max.	
<i>C, c</i>	Diameter of smaller terminal, if the cross section is circular If the cross section is not circular, thickness or minor axis of the cross section of a terminal	min.	—	max.	1, 2, 3, 4
<i>D</i>	Diameter or major axis of case	min.	—	max.	1
<i>D₁</i>	Smallest diameter of case	min.	—	max.	1
<i>D₂, D₃, etc.</i>	Other diameters of case	min.	—	max.	1
<i>d</i>	Distance from an axial reference line to a terminal centre	—	nom.*	—	
<i>E</i>	Minor axis of case	min.	—	max.	1
<i>E</i>	Or across flats dimension of a hexagon	min.	nom.	max.	1, 2
<i>e</i>	Distance between two terminal centres (distance between the centres of the nearest terminals when there are more than two terminals)	—	nom.*	—	
<i>e</i>	Or clearance between two terminals	min.	—	—	
<i>e₁, e₂, etc.</i>	Other distances between terminal centres	—	nom.*	—	
<i>e₁, e₂, etc.</i>	Or clearances between terminals	min.	—	—	
<i>F</i>	Thickness or length of flange zone of the case including any fillet if present	min.	—	max.	2
<i>G</i>	Overall length excluding terminals and slugs	min.	—	max.	1
<i>G₁</i>	Overall length excluding terminals but including slugs	—	—	max.	
<i>H</i>	Overall length including terminals	min.	—	—	
<i>h</i>	Height of a mechanical index	min.	—	max.	
<i>J</i>	Seated height or mounted height	—	—	max.	
<i>i</i>	Width or diameter of a mechanical index	min.	—	max.	
<i>K</i>	Length of top zone of the case	—	—	max.	
<i>k</i>	Length of a mechanical index	min.	—	max.	
<i>L, l</i>	Length of a terminal	min.	—	max.	2, 5, 6
<i>L₁, l₁</i>	Other length of terminal as shown in figure 3	—	—	max.	5
<i>L₂, l₂</i>	Other length of terminal as shown in figure 3	min.	—	—	5
<i>L₃, l₃</i>	Other length of terminal as shown in figure 3	min.	—	max.	2, 5
<i>M, m</i>	Diameter or width of a terminal, stud or slug	min.	—	max.	1
<i>N, n</i>	Overall length of a stud threaded entirely or partially or not at all	min.	—	max.	
<i>N₁, n₁</i>	Distance to end of full thread (unthreaded portion) of a stud	min.	—	max.	1
<i>O</i>	Distance between seating plane and centre of hole in the lug of a terminal	min.	—	max.	2
<i>P</i>	Length of controlled zone of the case	min.	—	—	
<i>p</i>	Diameter of a mounting hole	min.	—	max.	
<i>Q</i>	Other dimensions				
<i>q</i>	Distance between the centres of two mounting holes	min.	—	max.	
<i>R, r</i>	Curve radii	min.	—	max.	1, 2
<i>R₁, r₂</i>	Curve radii of the ends of the base seat	—	—	max.	
<i>S</i>	Distance from a reference line to the centre line of a terminal	min.	—	max.	1
<i>s</i>	Distance from the reference line through the centres of two terminals to the centre of the mounting hole which is the farthest from this reference line	—	nom.*	—	
<i>T, t</i>	Diameter of the hole (or smallest dimension of a non-circular hole) in a terminal lug or slug	min.	—	max.	2
<i>V, v</i>	Depth of a tapped hole	min.	—	max.	

* True geometrical position as defined in BS 308 : Part 3.

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REFERENCE LETTER SYMBOLS
(for drawings of discrete semiconductor devices) (*continued*)

Reference letter symbol	Description of the dimension	Type of limits			Notes
W, w	Diameter of the threaded portion of a stud with full thread form, or diameter of a tapped hole	Thread reference			7
$x-x$	Section reference, continuous				
$y-y$					
$x-y$	Section reference, not continuous				
Z, z	Other dimensions				
α	Small angle	—	nom.	—	
β, γ	Larger angles	—	nom.	—	
ϕ	Used in front of the reference letter on the drawing or in the table, indicates a diameter	—	—	—	

NOTE 1. Minimum dimension may be omitted where appropriate.

NOTE 2. Maximum dimension may be omitted where appropriate.

NOTE 3. To distinguish in the same drawing between major or minor axes of cross section of different terminals having different dimensions, the signs ' (prime), " (second), etc., may be used with reference letters *B*, *b* and *C*, *c*.NOTE 4. Reference letter symbols $C_1, c_1; C_2, c_2; C_3, c_3$ may also be used in the same manner as reference letter symbols *B* or *b*.

NOTE 5. Measured from the seating plane.

NOTE 6. For terminals of different overall lengths, the letter symbols $L_z, l_z, L_y, l_y, L_x, l_x, L_w, l_w$, etc., may be used.

NOTE 7. Metric and/or inch thread reference.

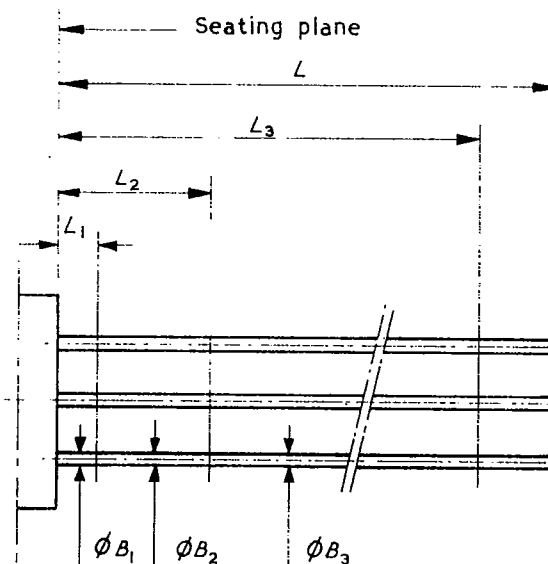
 ϕB_1 applies over the length L_1 ϕB_2 applies over the length $L_3 - L_1$ ϕB_3 applies over the length $L_3 - L_1$, or where appropriate $L - L_1$

Figure 3

REFERENCE LETTER SYMBOLS
(for drawings of integrated circuit outlines)

Where appropriate to the particular drawing being prepared, the dimensions listed in the following table should be given with the associated reference letter symbols.

NOTE. A cross (×) in the 'Form' columns means that the particular dimension may be specified on a drawing classified in this form. Figures in parentheses refer to notes following the table. Forms 1, 2, 3 and 4 are illustrated in the examples. Due to the many variants which can be expected, no values have been given for Form 5. The definitions of the terms used in the second column are given after the table.

Reference letter symbol	Dimension	Axial			Periph.	Limits		
		Form 1	Form 2	Form 3	Form 4	min.	nom.	max.
<i>A</i>	Seated height	×	×	×	×	—	—	max.
<i>A₁</i>	Stand-off height	×	×	×	×	min.	—	—
<i>A₂</i>	Package height	×	×	×	×	min.	—	max.
$\phi a, \phi a_A, \phi a_B$	Terminal circle diameter	—	—	×	—	—	nom.*	—
<i>B</i> (3)	Stand-off major dimension	×	×	×	×	min.	—	max.
<i>B₁</i> (3)	Stand-off minor dimension	×	×	×	×	min.	—	max.
ϕB (3)	Stand-off diameter	×	×	×	×	min.	—	max.
<i>b</i> (3)	Terminal width	×	×	—	×	min.	—	max.
<i>b₁, b₂, b₃</i> (3)	Other terminal width(s)	×	×	—	×	—	—	max.
$\phi b, \phi b_1, \phi b_3$ (3)	Terminal diameter(s)	×	×	×	×	—	—	max.
$\phi b_0, \phi b_2$ (3)	Terminal diameter(s)	×	×	×	×	min.	—	max.
<i>c</i> (3)	Terminal thickness	×	×	—	×	min.	—	max.
<i>D</i>	Package length	×	× (2)	—	× (2)	—	—	max.
<i>D₁, D₂</i>	Other package length(s)	×	×	—	×	min.	—	max.
ϕD	Package diameter	—	—	×	×	—	—	max.
$\phi D_1, \phi D_2$	Other package diameter(s)	—	—	×	×	min.	—	max.
<i>d, d₁, d₂, d_A, d_B</i>	Stand-off spacing, linear	×	×	×	×	(1)	—	max.
<i>E</i>	Package width	×	× (2)	—	× (2)	—	nom.*	—
<i>E₁, E₂</i>	Other package width(s)	×	×	—	×	min.	—	max.
<i>e, e₁, e₂, e_A, e_B</i>	Terminal spacing, linear	×	×	× (4)	×	(1)	—	max.
<i>F</i>	Flange zone height	×	—	×	—	min.	—	max.
<i>F₁</i>	Flange height	×	—	×	—	min.	—	max.
<i>G_D</i>	Package length zone	—	—	—	×	—	—	max.
<i>G_E</i>	Package width zone	—	—	—	×	—	—	max.
ϕG	Package diameter zone	—	—	—	×	—	—	max.
<i>H_D</i>	Overall length	—	—	—	×	min.	—	max.
<i>H_E</i>	Overall width	—	—	—	×	min.	—	max.
ϕH	Overall diameter	—	—	—	×	min.	—	max.
<i>h</i>	Index height or depth	×	×	×	×	min.	—	max.
<i>i</i>	Index width	×	×	×	×	(1)	—	max.
<i>k</i>	Index length	×	×	×	×	min.	—	max.
<i>L, L_n</i> (5)	Terminal length(s)	×	×	×	—	min.	—	max.
<i>L₁</i> (5)	Terminal length	×	×	×	—	—	—	max.
<i>L₂, L₃</i> (5)	Terminal length(s)	×	×	×	—	min.	—	max.
<i>L_D, L_L</i> (5)	Terminal length(s)	—	—	—	×	(1)	—	max.
<i>M_D</i>	Mounted length	—	×	—	—	min.	—	—
<i>M_E</i>	Mounted width	—	×	—	—	—	—	max.
<i>n</i>	Quantity of terminal positions	×	×	×	×	—	nom.	—
<i>n₁</i>	Allowable quantity of missing terminals	×	×	×	×	—	—	max.
ϕp	Package mounting hole diameter	×	×	×	×	min.	nom.	max.
<i>Q</i>	Terminal emergence height	—	×	—	×	(6)	—	max.
<i>Q₁</i>	Terminal emergence dimension	—	×	—	×	min.	—	max.
<i>Q₂, Q₃</i>	Other terminal emergence dimension	—	×	—	×	(1)	—	max.
<i>Z, Z₁, Z₂</i>	Package overhang(s)	×	×	—	×	min.	—	max.

* True geometrical position as defined in BS 308 : Part 3.

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REFERENCE LETTER SYMBOLS
(for drawings of integrated circuit outlines) (*continued*)

Reference letter symbol	Dimension	Axial			Periph.	Limits		
		Form 1	Form 2	Form 3		min.	nom.	max.
$\alpha, \alpha_A, \alpha_B$	Index datum angle(s)	—	—	×	—	—	nom.*	—
β, β_A, β_B	Terminal spacing, angular	—	—	×	×	—	nom.*	—
$\gamma, \gamma_1, \gamma_2$	Angular features associated with the base	—	—	×	—	min.	—	max.
θ	Terminal spread, angular	—	—	—	—	min.	—	max.
θ_1, θ_2	Angular features associated with the package	—	—	—	—	min. (1)	—	max. (2)

*True geometrical position as defined in BS 308: Part 3.

NOTE 1. Minimum dimension may be omitted where appropriate.

NOTE 2. Maximum dimension may be omitted where appropriate.

NOTE 3. To distinguish in the same drawing between major or minor dimensions or diameters of different stand-off, or between widths, thicknesses or diameters of different terminals, the signs (') prime, (") second, etc. may be used with reference letter symbols $B, B_1, \phi B, b, b_1, b_2, b_3, \phi b, \phi b_1, \phi b_2, \phi b_3$ and c .

NOTE 4. For rectilinear terminal positions only.

NOTE 5. For terminals of different lengths, the letter symbols L_z, L_y, L_x, L_w , etc. may be used.

NOTE 6. For holes with nominal diameters greater than 4 mm (0.157 in) the hole should preferably be dimensioned by reference to a bolt size; in addition, minimum and maximum dimensions of the hole diameter may be given if desired.

For holes with a nominal diameter equal to or less than 4 mm (0.157 in) minimum and maximum dimensions are required.

NOTE 7. Information on Z as regards $\frac{e}{2}$ (e.g. $Z \cdot \frac{e}{2}, \frac{e}{2} < Z < e$).

Dimensions and reference letter symbols

Seated height (A). Distance from the seating plane to the highest point of the package.

Stand-off height (A_1). Distance between the seating plane and the base plane.

Package height (A_2). Distance from the base plane to the highest point of the package.

Terminal circle diameter ($\phi a, \phi a_A, \phi a_B$, etc.). Diameter of the circle upon which the terminal positions are located. ϕa should be used for the largest pitch circle diameter when there is more than one pitch circle present.

Stand-off major dimension (B). Major dimension of the stand-off cross section.

Stand-off minor dimension (B_1). Minor dimension of the stand-off cross section.

Stand-off diameter (ϕB). Diameter of the stand-off cross section.

Terminal width (b). Major dimension of the cross section of a terminal.

Other terminal width(s) (b_1, b_2, b_3 , etc.).

Terminal diameter(s) ($\phi b, \phi b_0, \phi b_1, \phi b_2, \phi b_3$, etc.). Diameter of the circumscribed circle containing the terminal.

NOTE. ϕb_0 and ϕb_2 usually refer to diameters which are closely controlled over a specified terminal length (see figures 13 and 14).

Terminal thickness (c). Minor dimension of the cross section of a terminal.

Package length (D). Major dimension of the package, excluding terminals, measured in a plane parallel to the seating plane.

NOTE. If terminals are presented for mounting in two opposite directions only, they are deemed to extend in the width direction (E) (see figure 19a).

Other package length(s) (D_1, D_2 , etc.). Other package lengths, usually smaller than D .

Package diameter (ϕD). Major diameter of the package, excluding terminals, measured in a plane parallel to the seating plane.

Other package diameter(s) ($\phi D_1, \phi D_2$, etc.). Other package diameter(s), usually smaller than ϕD .

Stand-off spacing, linear (d, d_1, d_2, d_A, d_B , etc.). Linear spacing between true positions of stand-off centres.

Package width (E). Minor dimension of the package, excluding terminals, measured in a plane parallel to the seating plane.

Other package width(s) (E_1, E_2 , etc.). Other package width(s), usually smaller than E .

Terminal spacing, linear (e, e_1, e_2, e_A, e_B , etc.). Linear spacing between true positions of terminal centres.

Flange zone height (F). Overall dimension of the flange zone including any fillet, measured from the base plane.

Flange height (F_1). Flange dimension excluding any fillet.

Package length zone (G_D). Length of a zone which includes the package length, package irregularities and the uncontrolled part of any peripheral terminals which are presented for mounting in the length direction.

Package width zone (G_E). Length of a zone which includes the package width, package irregularities and the uncontrolled part of any peripheral terminals which are presented for mounting in the width direction.

Package diameter zone (ϕG). Diameter of a zone which includes the package diameter, package irregularities and the uncontrolled part of any peripheral terminals which are presented for mounting radially.

Overall length (H_D). Largest overall dimension, including package length, of peripheral terminals which are presented for mounting in the length direction.

Overall width (H_E). Largest overall dimension, including package width, of peripheral terminals which are presented for mounting in the width direction.

Overall diameter (ϕH). Largest overall diameter of peripheral terminals which are presented for mounting radially.

Index height or depth (h). Height or depth of index feature.

Index width (j). Width of index feature.

Index length (k). Length of index feature. On cylindrical packages, the index length (e.g. tab) is measured from the overall diameter ϕD of the device.

Terminal length(s) (L, L_0). Length(s) of terminal available for mounting, measured from the seating plane.

NOTE. L_0 usually refers to that part of the terminal over which the diameter (ϕb_0) is closely controlled (see figure 14).

Terminal length(s) (L_D, L_E). Controlled terminal zone(s) for mounting, measured from ends of peripheral terminals.

Terminal length(s) (L_1, L_2, L_3 , etc.). Terminal length(s) measured from the base plane.

NOTE. L_2-L_1 usually refers to that part of the terminal over which terminal diameter (ϕb_2) is closely controlled.

Mounted length (M_D). Overall length, measured in the D direction, including terminals when they are bent to be perpendicular to the seating plane.

Mounted width (M_E). Overall width, measured in the E direction, including terminals when they are bent to be perpendicular to the seating plane.

Quantity of terminal positions (n). Total quantity of potential terminal positions in accordance with the specified terminal position designation system. The actual quantity of terminals present may be less than (n).

Allowable quantity of missing terminals (n_1). Maximum quantity of terminal positions which can be unoccupied.

Package mounting hole diameter (ϕp). Diameter of the hole in the package for mounting.

Terminal emergence height (Q). Distance from the seating plane to the underside of the terminals where they emerge from the package.

Terminal emergence dimension (Q_1). Distance from the top surface of the package to the top surface of terminals where they emerge from the package.

Other terminal emergence dimensions (Q_2, Q_3 , etc.). Dimensions of other terminal features.

Package overhang(s) (Z, Z_1, Z_2 , etc.). Distance from the end terminal true position to the extremity of the package.

In the case where the terminals extend beyond the package, Z, Z_1 shall be specified as zero. Negative dimensions shall not be used.

The overhang at the opposite end of the package, if different from Z , shall be designated as Z_1 (see figure 4).

NOTE. It is recommended that the minimum and maximum values of $Z (Z_1)$ fulfil one of the following relations:

(a) $Z \leq \frac{e}{2}$, (b) $\frac{e}{2} < Z \leq e$, (c) $e < Z \leq \frac{3e}{2}$ etc.

Index datum angle ($\alpha, \alpha_A, \alpha_B$, etc.). Angular spacing between the index feature (datum) and the first terminal true position on a terminal circle.

α_A should be used for the angular spacing between the index feature and the first terminal located on the largest diameter circle.

Terminal spacing, angular (β, β_A, β_B , etc.). Angular spacing between true positions of terminal centres.

β_A refers to the largest diameter circle.

Angles, base ($\gamma, \gamma_1, \gamma_2$, etc.). Other angular features associated with the base.

Terminal spread, angular (θ). Angle between the terminal and a line perpendicular to seating plane.

Angles, package (θ_1, θ_2 , etc.). Other angular features associated with the package.

Additional dimensions and reference letters applicable to surface mounted services

Reference plane distance (A_3). Distance between the seating plane and a reference plane or projection plane, parallel to the seating plane.

NOTE. This distance is a theoretical dimension which is not related to any feature of the package. Its value is chosen for each package so that the length of terminal projection zone L_p is a good approximation of the terminal length used for mounting, e.g. the length of the part of the terminal that is soldered to the substrate.

Length of terminal projection zone (L_p). The distance measured parallel to the seating plane, between the tip of the terminal and the intersection of the inside face of the terminal with the reference plane, or, in the case of 'negative mounting angle' or 'J shape' terminals, the distance measured along the reference plane, between the two intersections of the reference plane with the terminals (see figure i).

Terminal installed distance (M_H). The distance between the outer edges of the tips of the terminals when they are compressed by the insertion tool jaws (see appendix A).

Width of terminal projection zone (b_p). The width of the part of the terminal situated in zone L_p .

NOTE. When the terminal width is uniform along the total length of the terminal, $b_p = b$.

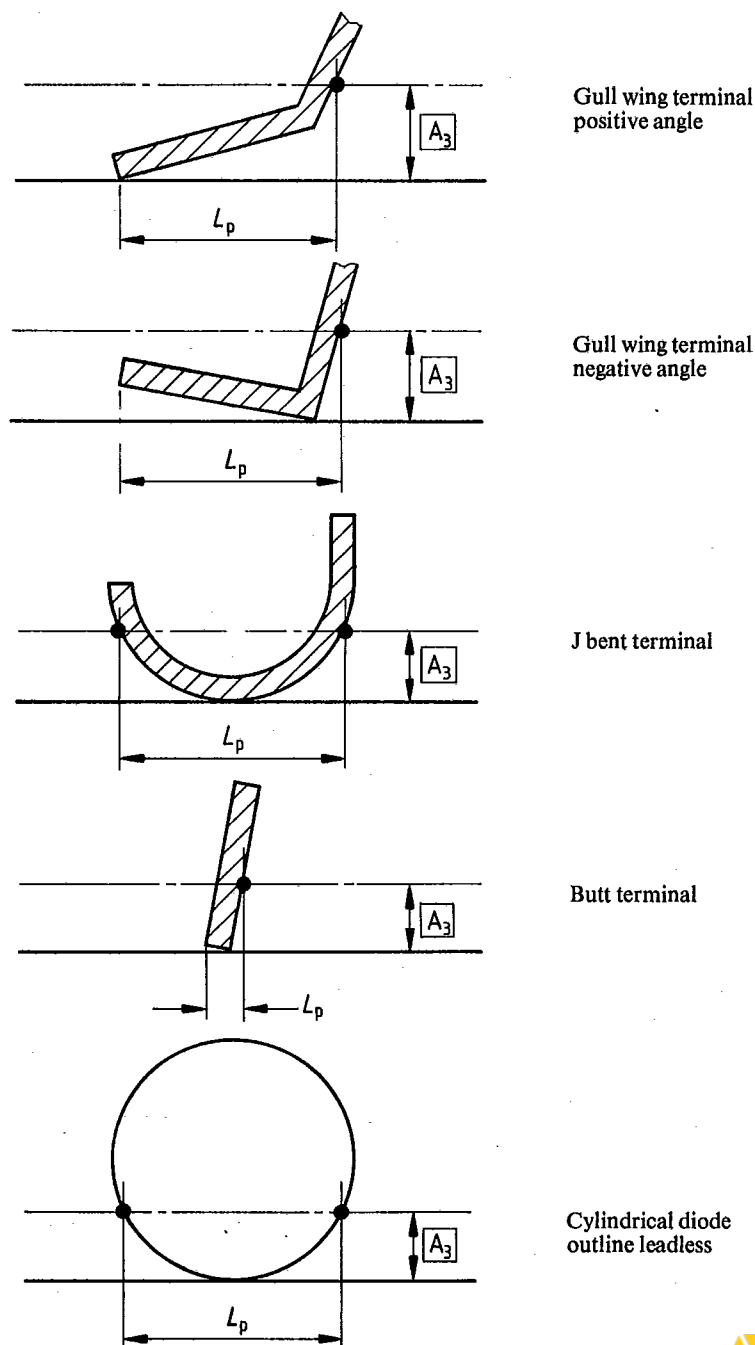


Figure i. Examples of dimension L_p

Surface of terminal projection zone (S_p). The projection on the seating plane of that outer part of the terminal intended for mounting.

NOTE. S_p is equal to the product of L_p and b_p .

Terminal land area (S_L). The maximum area on the seating plane within which the terminal projection zone is located.

NOTE. The terminal land area, S_L , is given by the equation

$$(L_{p, \max} + v) \times (b_{p, \max} + w)$$

where

v is the positional tolerance of $L_{p, \max}$

w is the positional tolerance of $b_{p, \max}$.

Pattern of terminal land areas (see figure ii). The group of all terminal land areas of a similar package in the seating plane.

For a leadless package it is the projection of its metallized pads or terminals on the seating plane.

The true position of the centre of each of the terminal land area is located on a grid with e/e_1 as modulus.

Gauge. A gauge as shown on figure iii may be used for inspection of dimensions.

When the device package is installed into the gauge, no part of the faces of the terminals should be in contact with the edges of the cavities of the gauge, i.e. the tips of the terminals of the package (or in cases of negative mounting angle or 'J' shape the lower incurved parts of the terminals) should stand freely on their mounting surfaces and neither the body of the package, nor other parts of the terminals, shall be in contact with the gauge.

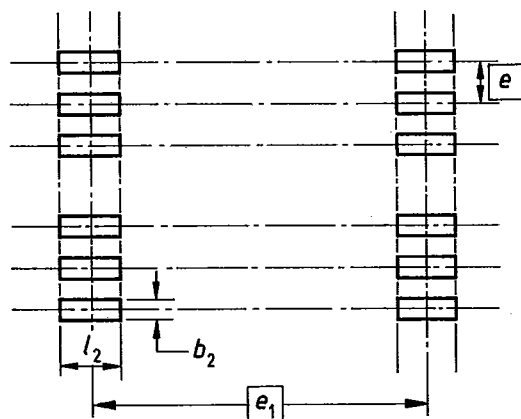


Figure ii. Pattern of terminal land areas

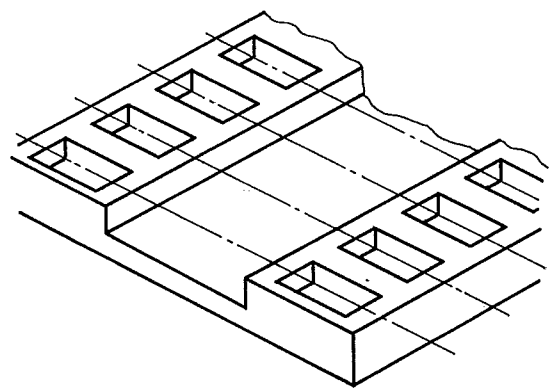


Figure iii. Isometric view of an example of gauge

Rules for the dimensioning of drawings of Form E, surface mounted, dual-in-line packages with bent leads

Dimensions

The dimensions to be given are shown in figure iv and in the following tables.

They are distributed in four groups according to their purposes.

NOTE. The same dimension may appear in more than one group, in which case the values of that dimension may differ in the various groups.

Recommended values for dimensions

The recommended values for each dimension are given in column 5 of the appropriate table.

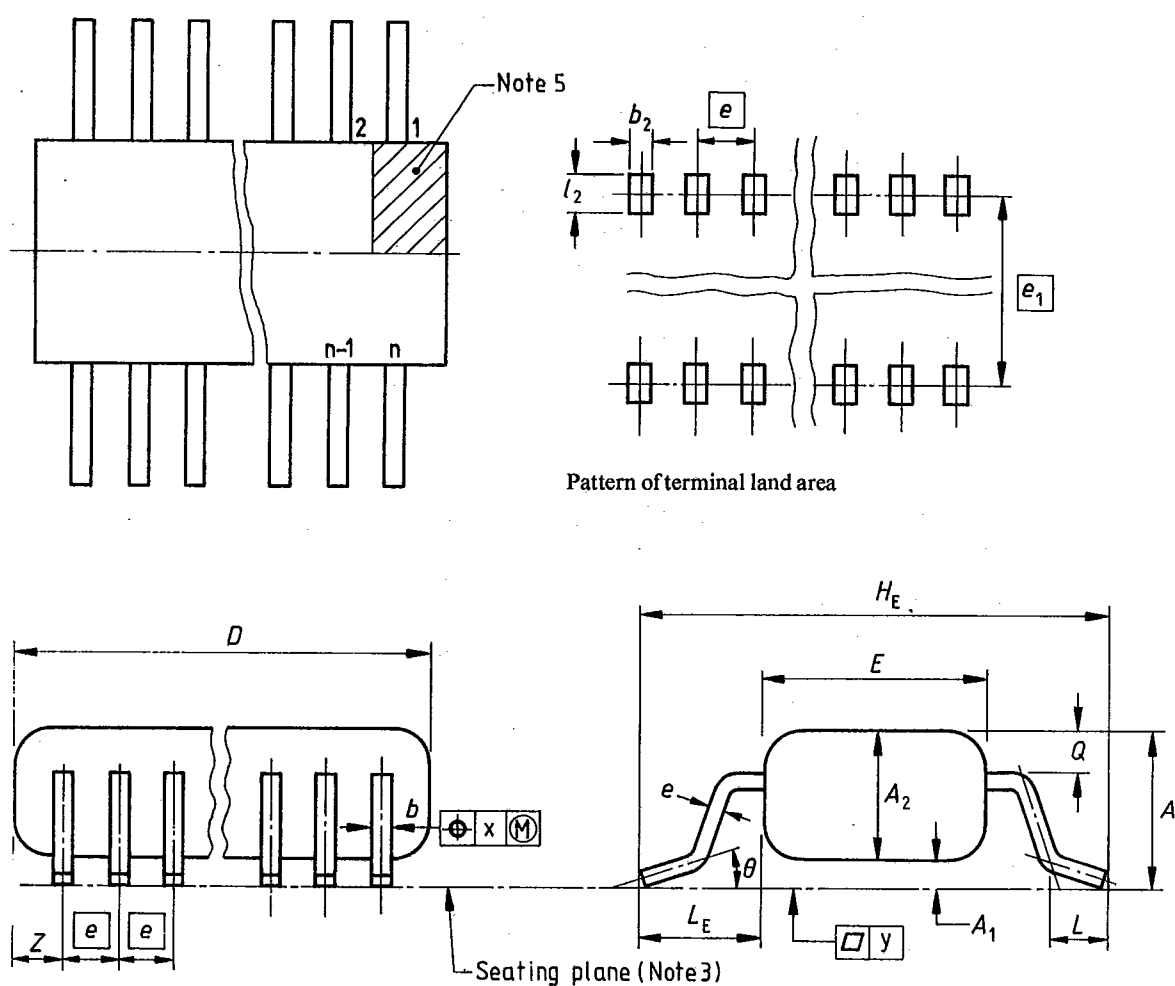


Figure iv. Drawings of form E, surface mounted, dual-in-line packages with bent leads

Group I. Dimensions appropriate to mounting and interchangeability

Ref.	Limits to be observed			Recommended values for the dimensions (mm)	Notes
	Min.	Nom.	Max.		
A	—	—	×	$A_{\max} = 0.508 \times m$ where $m = 3, 4, 5$ or 6	
A_1	×	—	×	$A_{1 \min} = 0.10$ $A_{1 \max} = 0.25$	
b	×	—	×	$b_{\min} = 0.25$ $b_{\max} = 0.51$	
e	—	× TP	—	$e_{\text{nom}} = 1.27$	
H_E	×	—	×	$H_{E \min} = 5.7 \quad 7.6 \quad 9.5 \quad 11.4$ and or or or $H_{E \max} = 7.0 \quad 8.9 \quad 10.8 \quad 12.7$	4
L_E	×	—	—	$L_{E \min} = 0.75$	
Z	—	—	×	$Z_{\max} = \text{either } e \text{ or } 0.5 \times e$	
θ	×	—	×	$\theta_{\min} = 2^\circ$ $\theta_{\max} = 10^\circ$	1
x	—	—	×	$x_{\max} = 0.13$	2
y	—	—	×	$y_{\max} = 0.10 \text{ or } 0.15$	3

Group II. Dimensions appropriate to mounting and gauging

Ref.	Limits to be observed			Recommended values for the dimensions (mm)	Notes
	Min.	Nom.	Max.		
e	—	× TP	—	$e_{\text{nom}} = 1.27$	
e_1	—	× TP	—	$e_{1 \text{ nom}} = 5.72, 7.62, 9.53 \text{ or } 11.43$	4
b_2	—	—	×	$b_{2 \max} = 0.76$	6
l_2	—	—	×	$l_{2 \max} = 1.27$	6

Group III. Dimensions appropriate to automated handling

Ref.	Limits to be observed			Recommended values for the dimensions (mm)	Notes
	Min.	Nom.	Max.		
A_2	×	—	×	$A_{2 \min} = 1.2 \quad 1.2 \quad 1.8 \quad 1.8$ and or or or $A_{2 \max} = 1.8 \quad 1.8 \quad 2.6 \quad 2.6$ and	
E	×	—	×	$E_{\min} = 3.8 \quad 5.0 \quad 6.3 \quad 8.2$ and or or or $E_{\max} = 4.7 \quad 6.2 \quad 8.1 \quad 10.0$	4
D	×	—	×	$D_{\min} = \left(\frac{n}{2} - 1 \right) e + b_{\max} + 0.1 + x$ $D_{\max} = \text{either } \frac{n}{2} e \text{ or } \left(\frac{n}{2} + 1 \right) e$	
Q	×	—	×	$Q_{\min} = 0.6$ $Q_{\max} = 2.0$	

Group IV. Dimensions for information only

Ref.	Limits to be observed			Recommended values for the dimensions (mm)	Notes
	Min.	Nom.	Max.		
<i>c</i>	×	—	×	$c_{\min} = 0.10$ $c_{\max} = 0.35$	

NOTE 1. A package may have terminals with either positive or negative angles (see figures v and vi). Both types of angles are not permitted on the same package. Positive angles are preferred.

NOTE 2. Positional tolerance.

NOTE 3. All terminal contact surfaces shall lie between the seating plane and a plane parallel to it y millimetres above it.

NOTE 4. The packages are classified into types based on the dimension e_1 . Dimensions H_E and E are directly related to e_1 .

NOTE 5. Zone of a visible index on the tip face.

NOTE 6. The terminal land areas given by $b_2 \times l_2$ include terminal position tolerances, but do not include tolerances stemming from printed board design and placement machine accuracies.

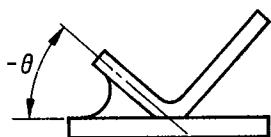


Figure v. Terminal with negative mounting angle

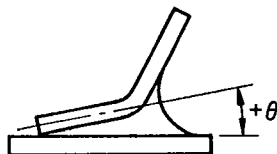


Figure vi. Terminal with positive mounting angle

RULES FOR DIMENSIONING INTEGRATED CIRCUIT PACKAGES OF FORM G**Dimensions**

The dimensions to be given are shown in figure vii and in the following tables. They are distributed in three groups according to their purposes.

NOTE. The same may appear in more than one group in which case the values of that dimension may differ in the various groups.

Recommended values for dimensions

The recommended values for each dimension are given in column 5 of the appropriate table.

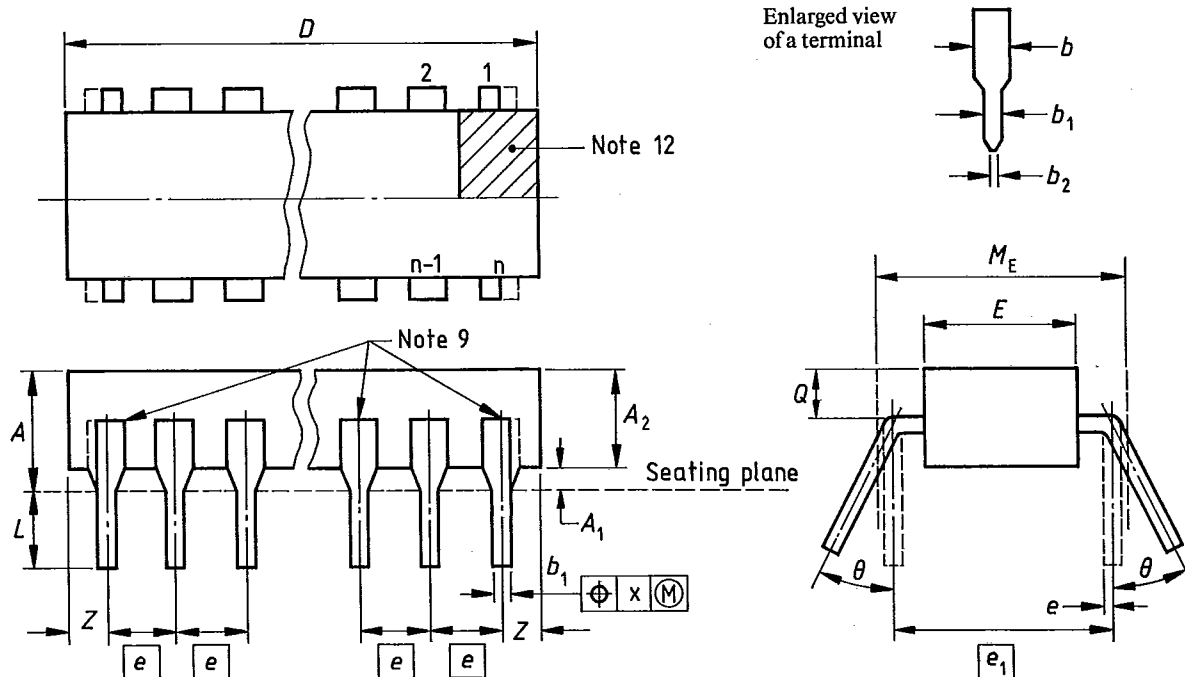


Figure vii. Drawings of Form G, integrated circuit packages intended for automated handling

Group I. Dimensions appropriate to mounting and interchangeability

Ref.	Limits to be observed			Recommended values for the dimensions (mm)	Notes
	Min.	Nom.	Max.		
A	—	—	×	$A_{\max}$ = either 5.1 or 5.84	1, 2
A_1	×	—	—	$A_{1 \min}$ = either 0.38 or 0.51	1, 2
b_1	×	—	×	$b_{1 \min}$ = 0.35 0.35 0.43 $b_{1 \max}$ = 0.51 0.59 0.64 or or	4, 5
c	×	—	×	$c_{\min}$ = 0.10 0.20 0.23 $c_{\max}$ = 0.16 0.36 0.51	5
e	—	× TP	—	e_{nom} = 2.54	4
e_1	—	× TP	—	$e_{1 \text{ nom}}$ = 7.62, 10.16, 12.70, 15.24, 17.78 or 22.86	4, 6
L	×	—	×	$L_{\min}$ = 2.54 2.9 3.2 4.5 3.5 or or or or	1, 7
M_E	—	—	×	$L_{\max}$ = 3.00 3.4 3.9 5.0 5.0 $M_{E \max}$ = 8.5, 11.1, 13.6, 16.1, 18.7 or 23.8	8
Z	—	—	×	$Z_{\max}$ = 0, $\frac{e}{2}$ or e	
θ	—	×	×	θ = either nom. 5° or max. 15°	8
n	—	—	—		9

Group II. Dimensions appropriate to mounting and gauging

Ref.	Limits to be observed			Recommended values for the dimensions (mm)	Notes
	Min.	Nom.	Max.		
M_H	×	—	×		
Q_1	×	—	×		

Group III. Dimensions appropriate to automated handling

Ref.	Limits to be observed			Recommended values for the dimensions (mm)	Notes
	Min.	Nom.	Max.		
A_2	x	—	x		11
b	x	—	x		
b_2	—	—	x		
D	x	—	x		
E	x	—	x		
Q	x	—	x		

NOTE 1. The position of the seating plane is determined when the device terminals are fully inserted into their respective holes. The diameter of the hole is given in the following table.

Ref.		Value (mm)		
b_1	min.	0.35	0.35	0.43
	max.	0.51	0.59	0.64
c_1	min.	0.10	0.20	0.23
	max.	0.16	0.36	0.51
hole diameter		0.60 ± 0.05	0.80 ± 0.05	1.00 ± 0.05

The centres of these holes are located on a grid with e/e_1 as modulus.

NOTE 2. Any combination of $A_{\max}$ and A_1 values is allowed.

NOTE 3. The terminal bending form and the terminal contour within M_E and above the seating plane are optional, but adequate clearance should be made to ensure that conductors on the mounting area can pass between the terminals.

NOTE 4. The maximum material condition (see BS 308 : Part 3) applies to the positional tolerance of the terminals.

NOTE 5. Only the three combinations of b_1 and c , as shown in the table, are permitted.

NOTE 6. Dimension e_1 is given for mounting purposes and corresponds to the zero value for angle θ .

NOTE 7. When pointed leads for automated insertion are specified only the following three ranges of values are permitted for dimension L .

- (a) 2.54 mm to 3.00 mm;
- (b) 2.9 mm to 3.4 mm;
- (c) 3.2 mm to 3.9 mm.

The range 2.9 mm to 3.4 mm is preferred.

NOTE 8. Overall distance between outer faces of terminals when they are fully inserted as specified in note 1. Dimension θ is valid only for certain modes of attachment of the terminals to the case body. The reference plane from which angle θ is measured, is the base plane. Values from 5° to 15° are preferred for angle θ ; however angles between 0° to 15° are allowed.

NOTE 9. 'n' refers to the total number of terminal positions.

NOTE 10. See appendix A.

NOTE 11. $b_{2\max} = \frac{1}{2} b_{1\max}$.

NOTE 12. Index area indicates terminal No. 1.

DRAWINGS OF INTEGRATED CIRCUIT OUTLINES

(Examples)

The following drawings illustrate the use of reference letter symbols, methods of terminal identification, index area marking and the use of geometrical tolerancing.

Examples of 'axial' and 'peripheral' layouts are given as follows:

Form 1 (axial)	Figures 4, 5, 6, 7, 8 and 9
Form 2 (axial)	Figures 10, 11 and 12
Form 3 (axial)	Figures 13, 14 and 15
Form 4 (peripheral)	Figures 16, 17, 18, 19a and 19b.

Form 5 (special), for which no examples are given, refers to combinations of axial and peripheral layouts or to layouts which for other reasons, e.g. leadless packages, do not fall within the axial or peripheral categories.

In the drawings, the dimensions shown within brackets may be omitted where appropriate. Where examples of geometrical tolerancing are shown, the letter 'x' in the tolerance frame would be replaced by the appropriate tolerance value. Index areas are indicated by hatching.

A schematic diagram of a vertical column. The column consists of a rectangular head and a cylindrical body. The head has a height labeled A . Below the head is a horizontal line labeled "Seating plane / Base plane". The cylindrical body has a diameter labeled Φb and a total height labeled L from the base plane to the top of the head. A dashed vertical line indicates the central axis of the column.

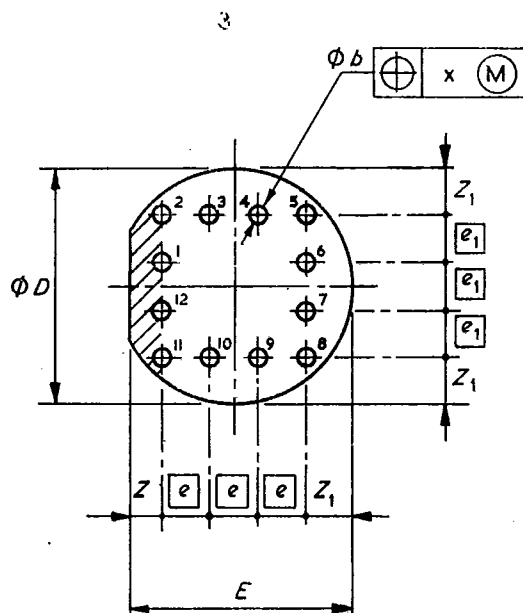
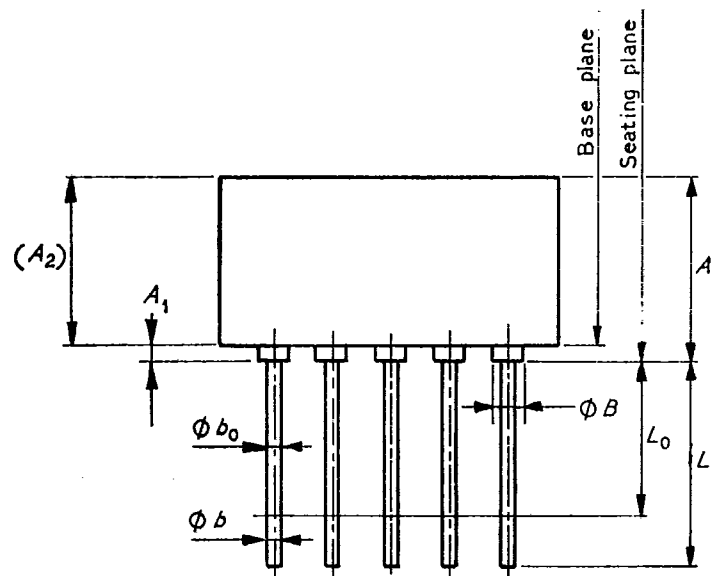


Figure 5

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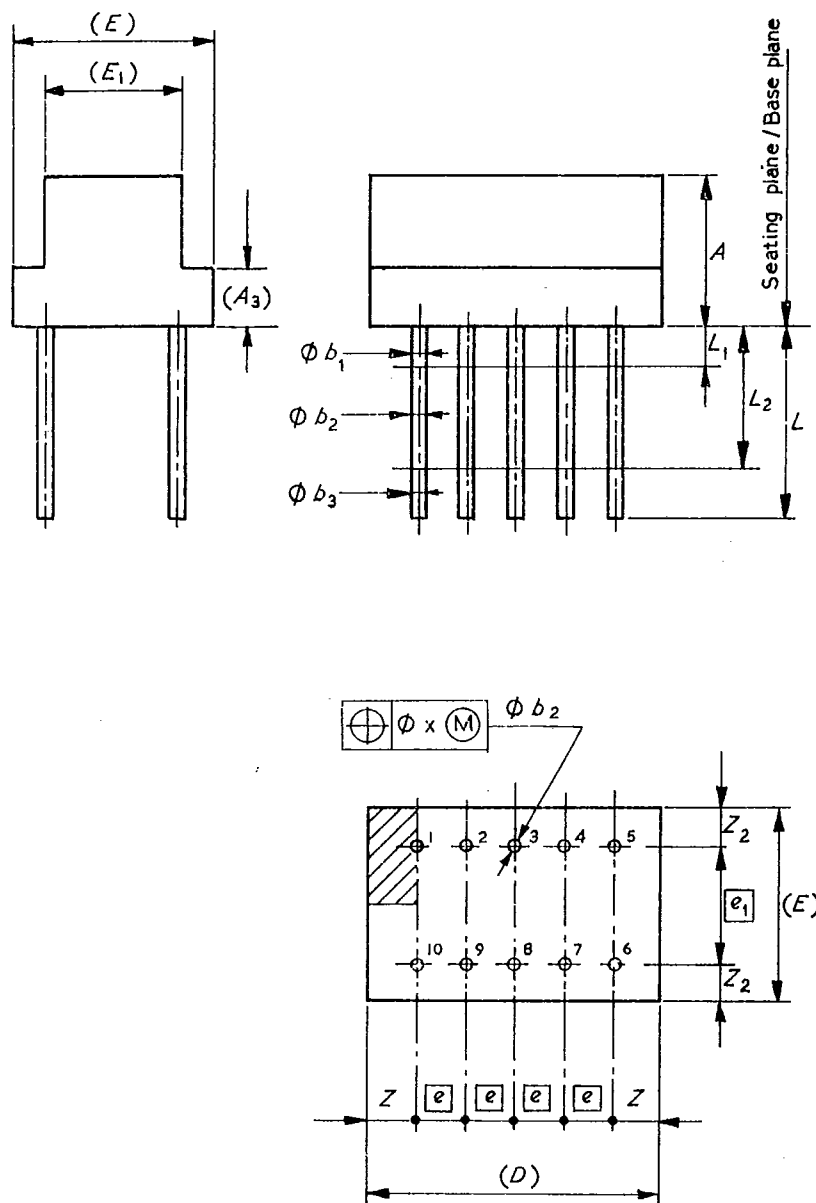
FORM 1
(continued)

Figure 6

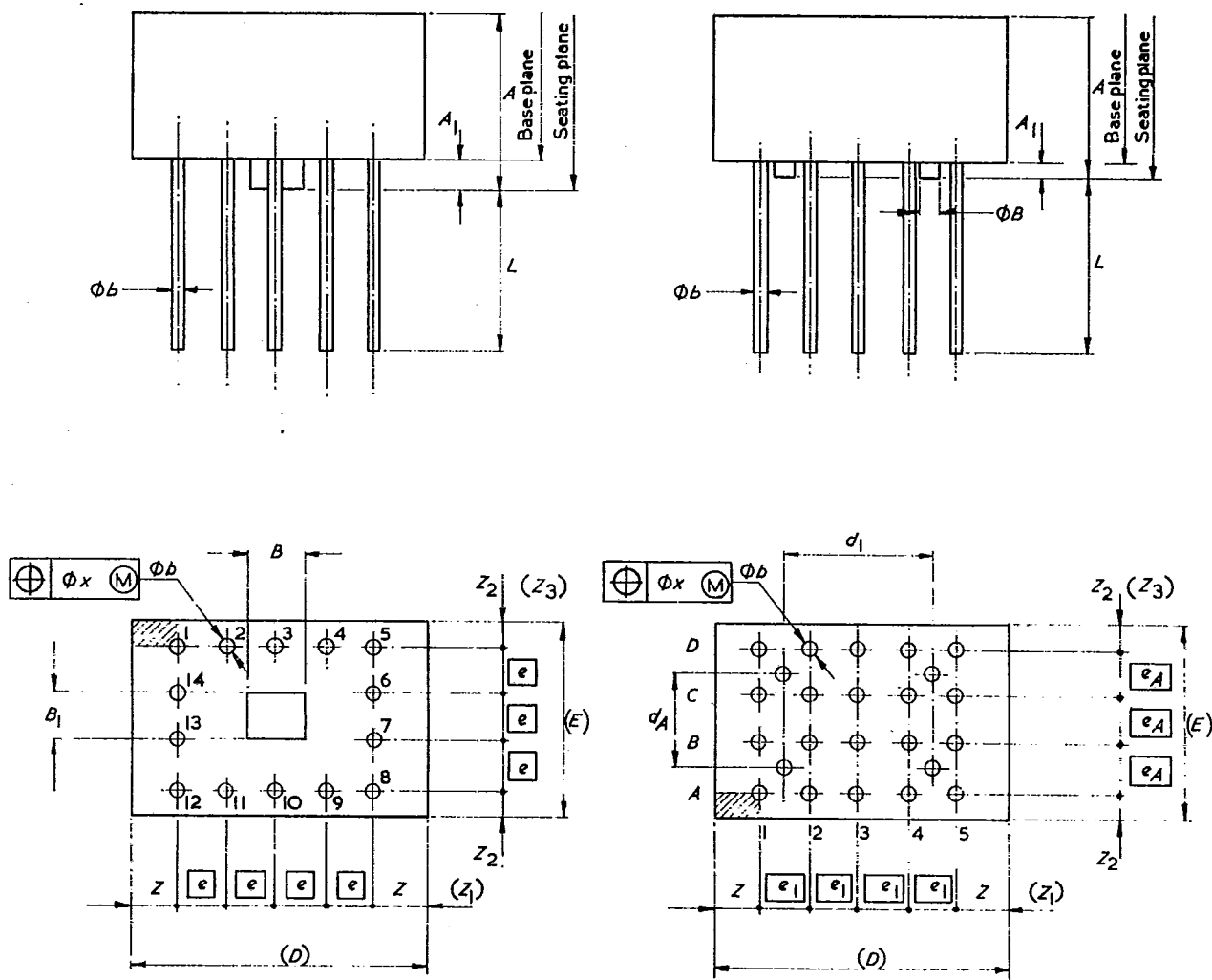
FORM 1
(continued)

Figure 7

Figure 8

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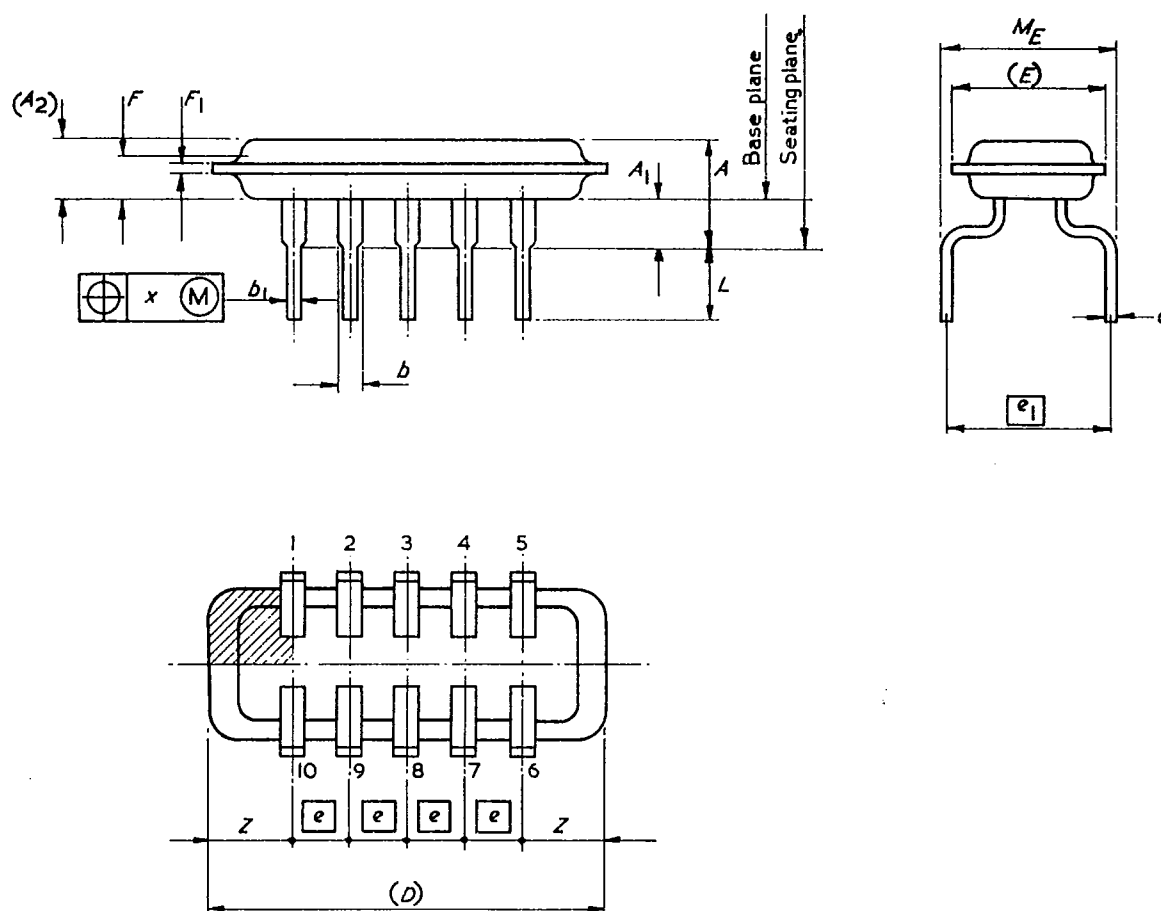
FORM 1
(continued)

Figure 9

FORM 2

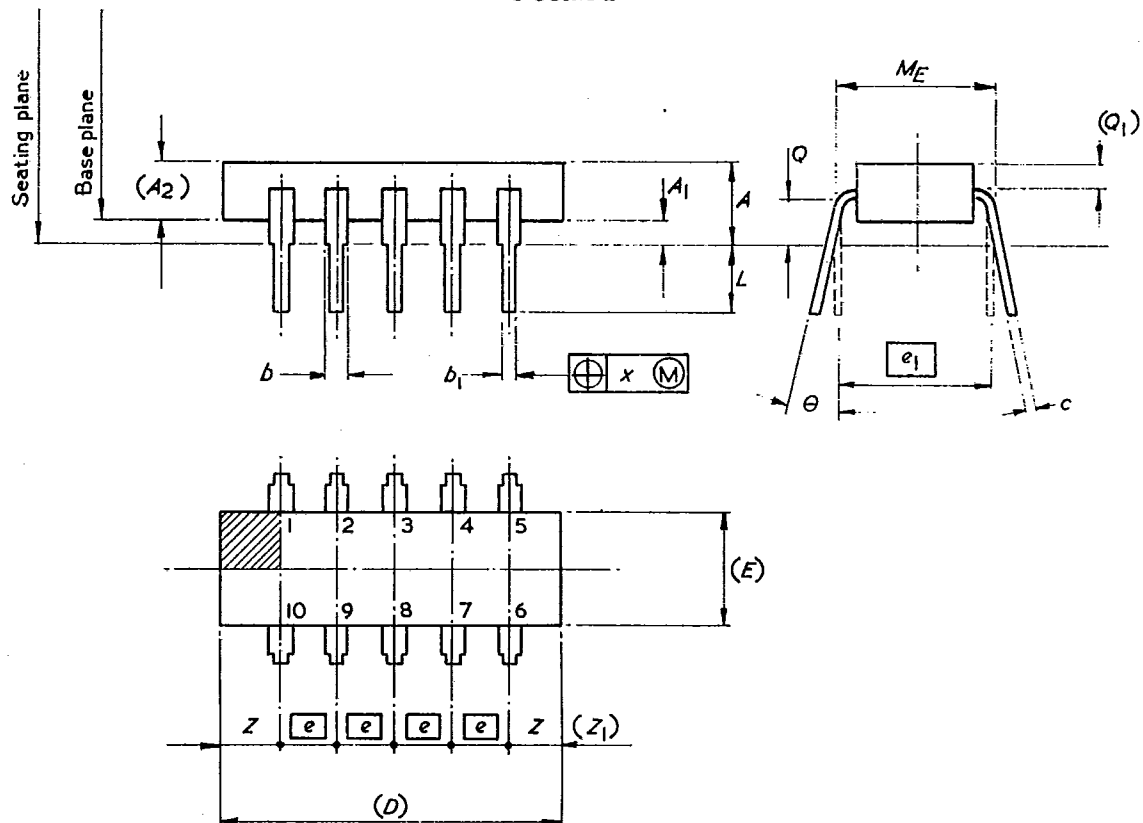


Figure 10

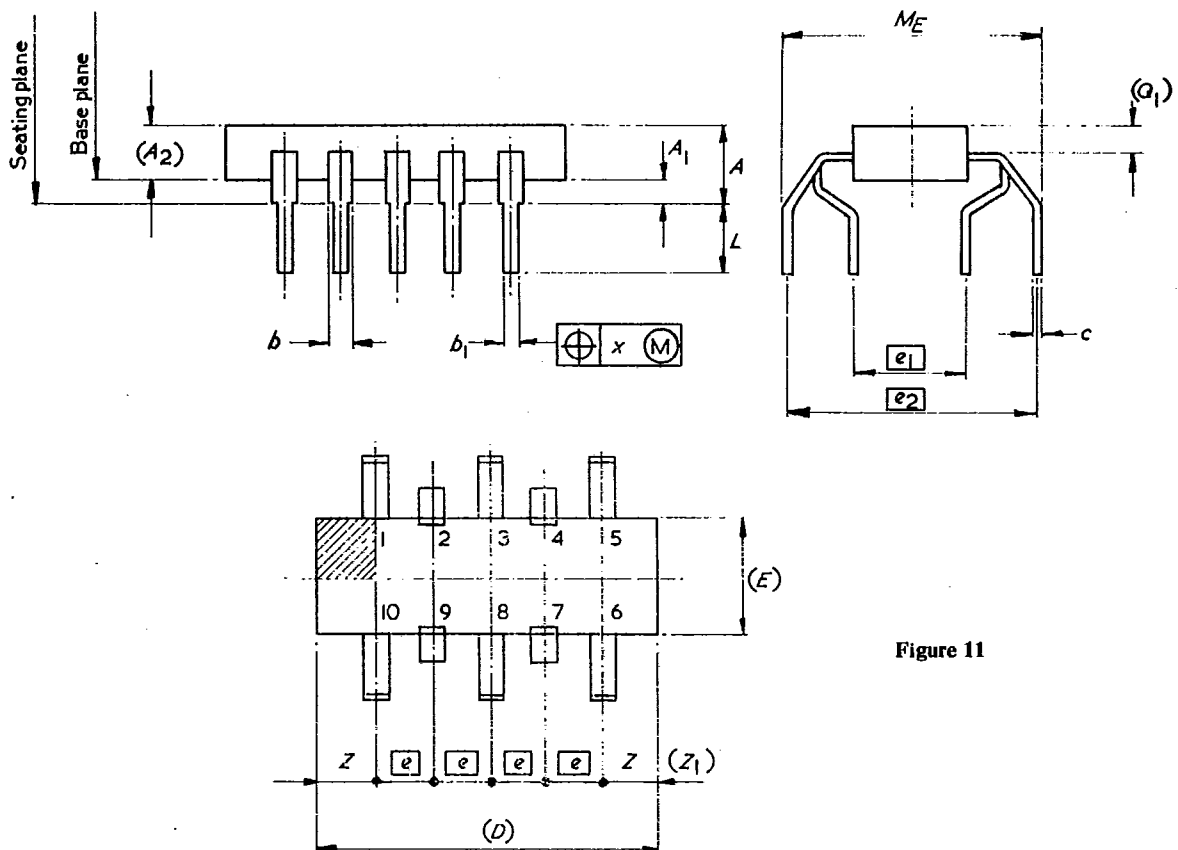


Figure 11

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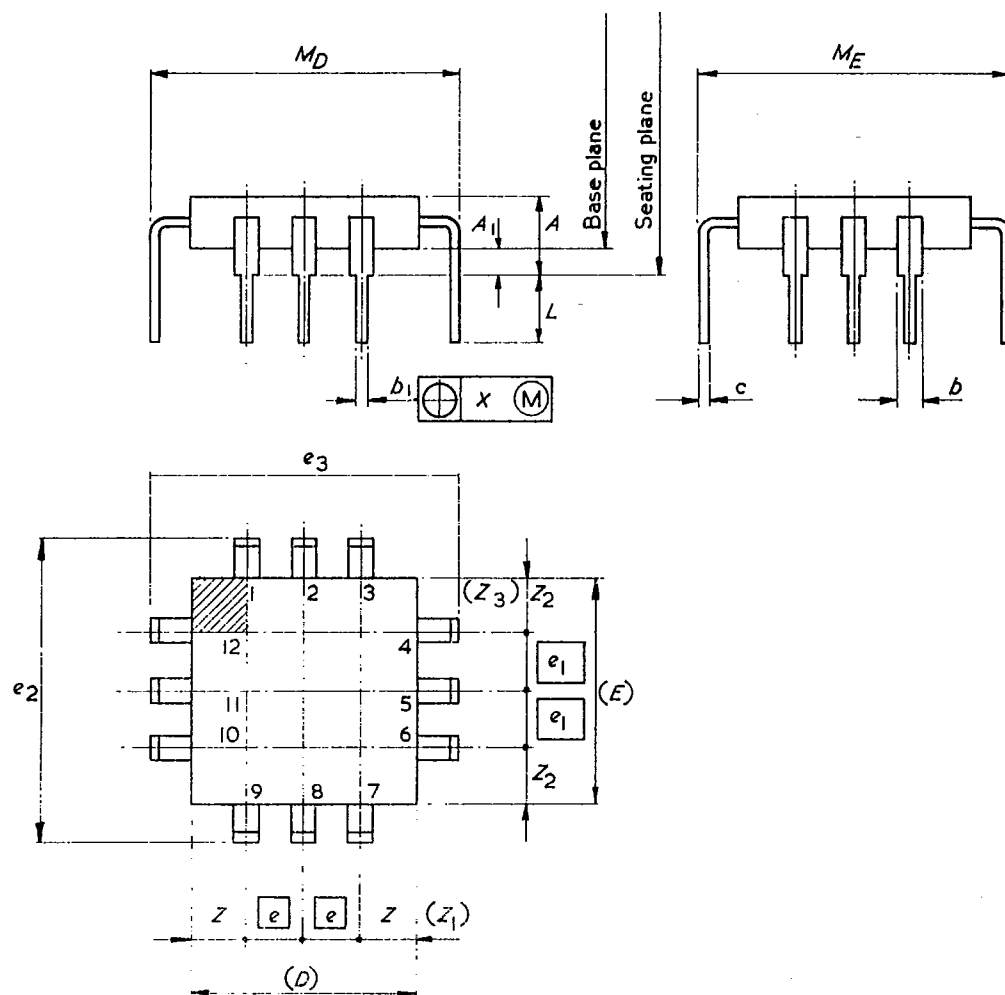
FORM 2
(continued)

Figure 12

FORM 3

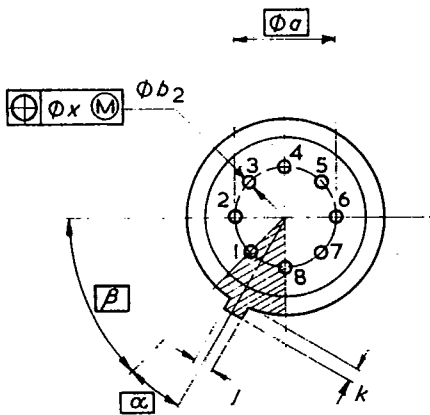
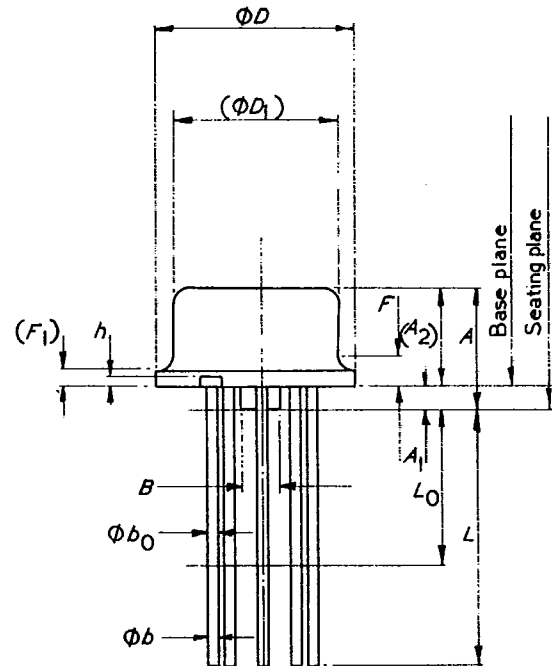
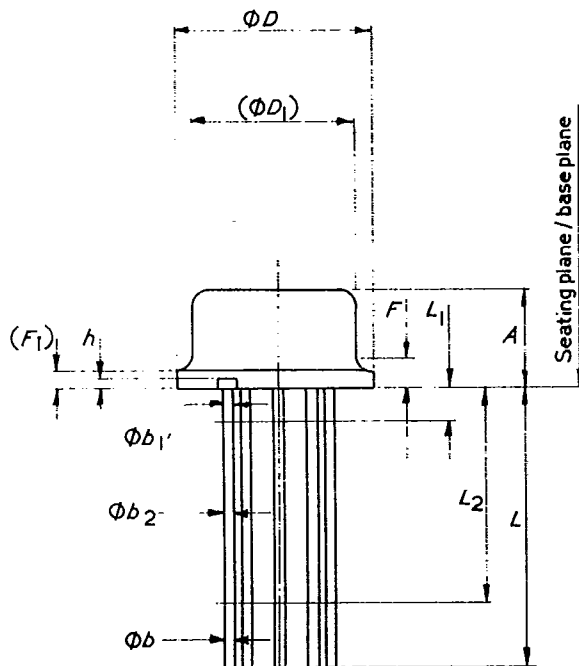


Figure 13

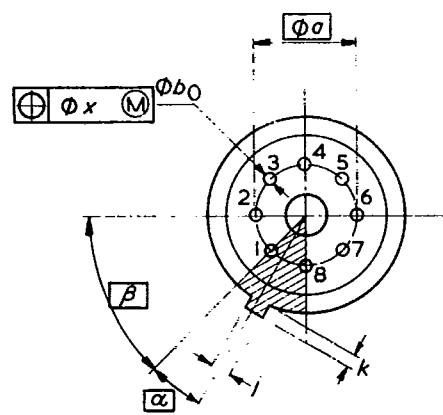


Figure 14

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FORM 3
(continued)

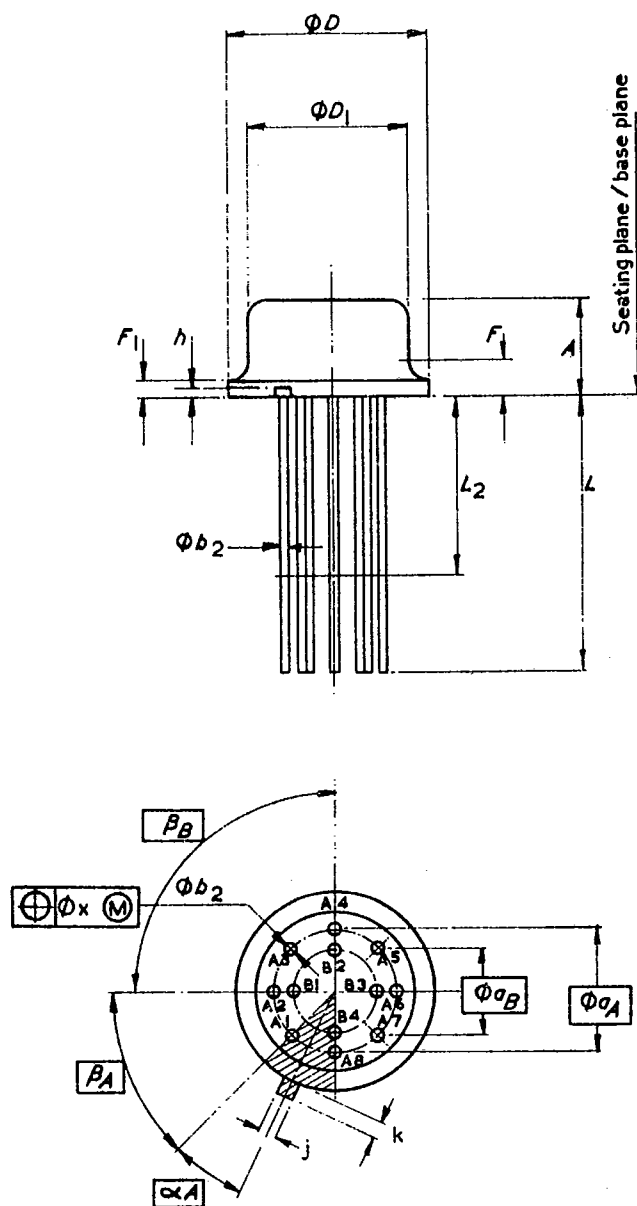


Figure 15

FORM 4

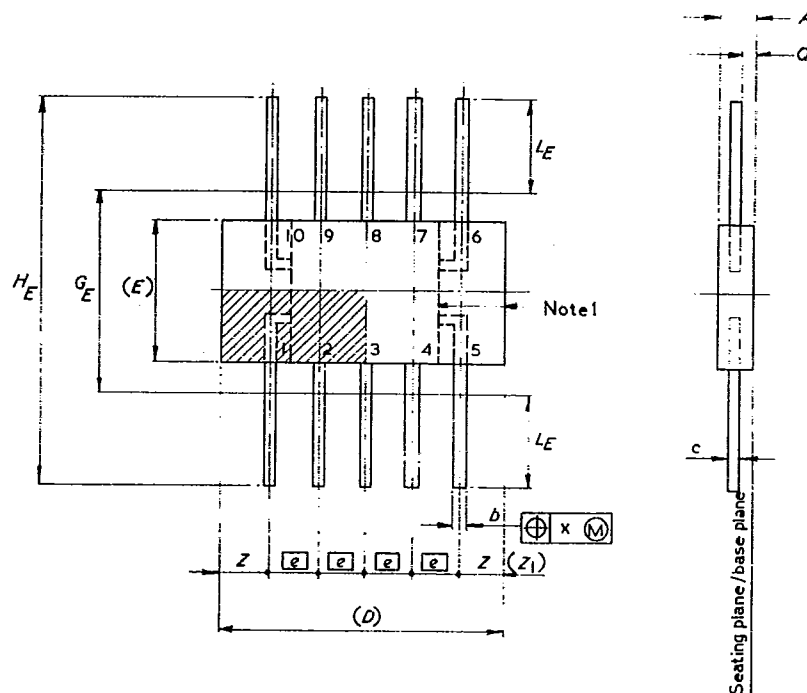


Figure 16

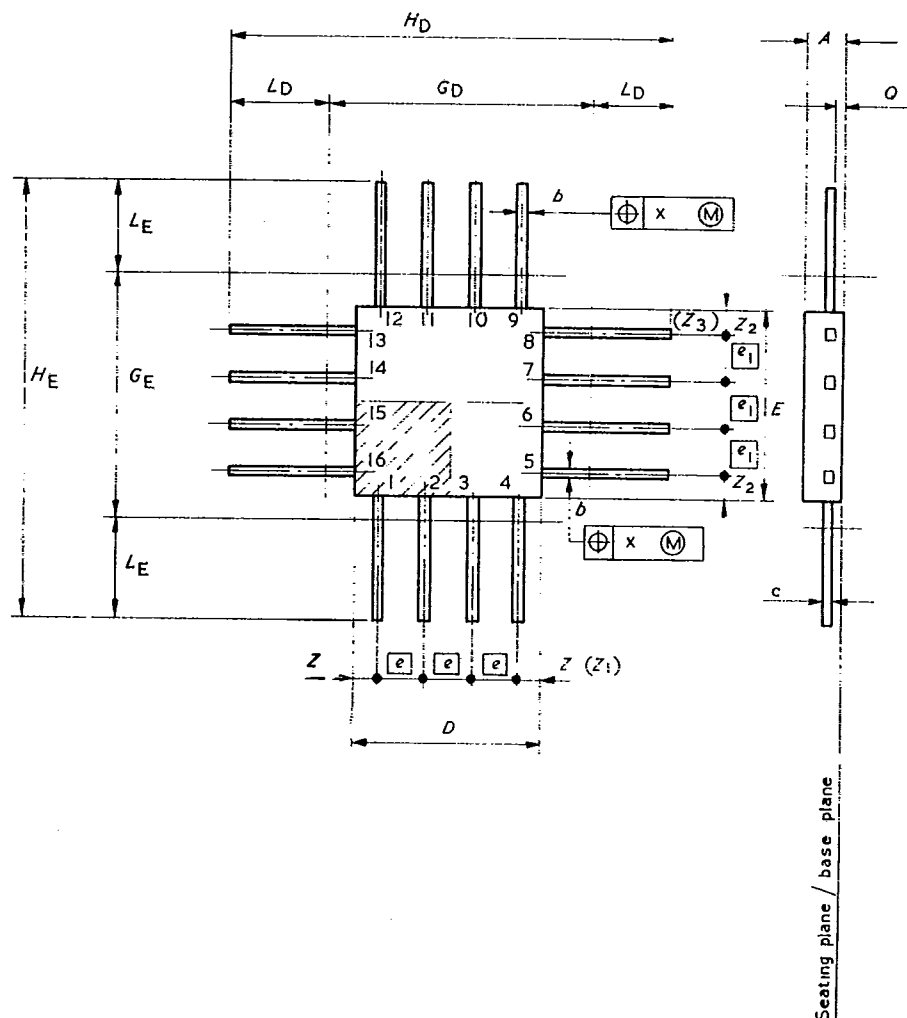


Figure 17

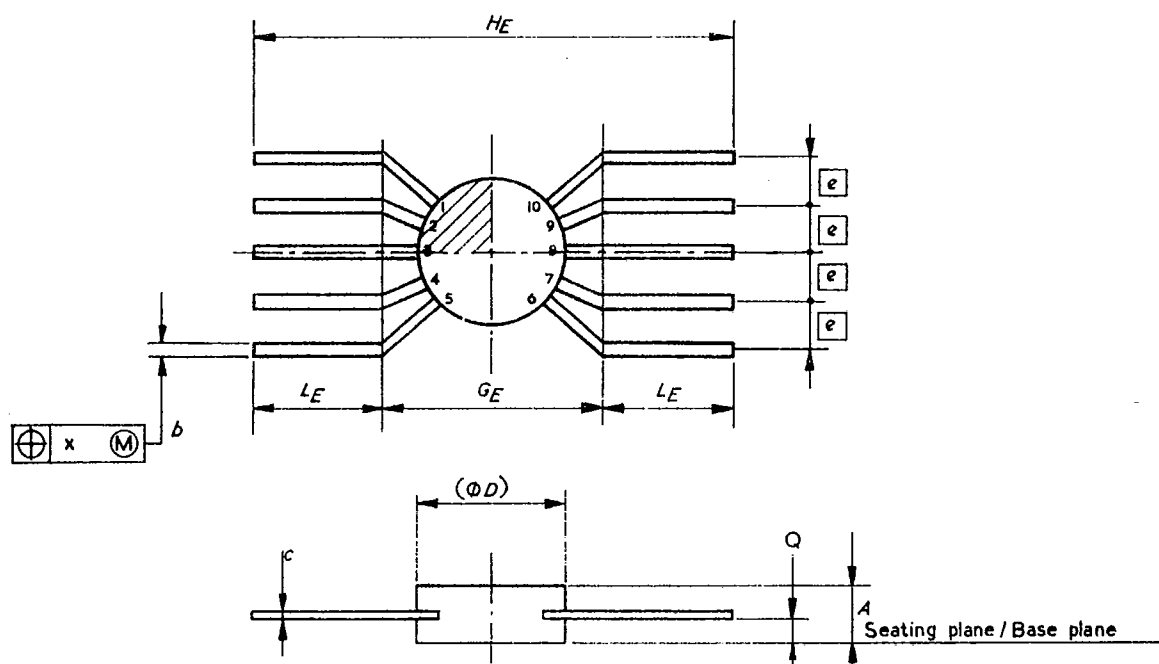
FORM 4
(continued)

Figure 18

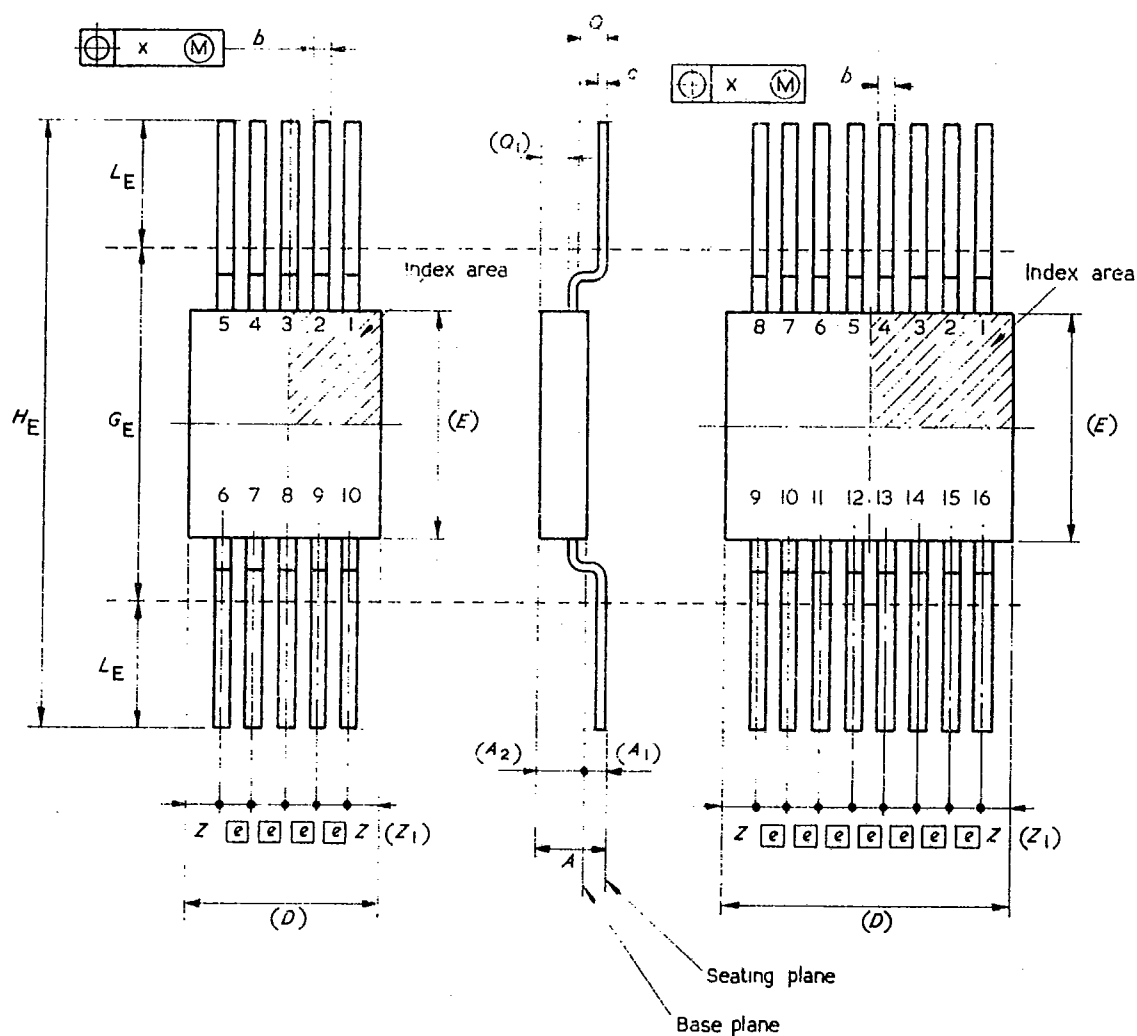


Figure 19a

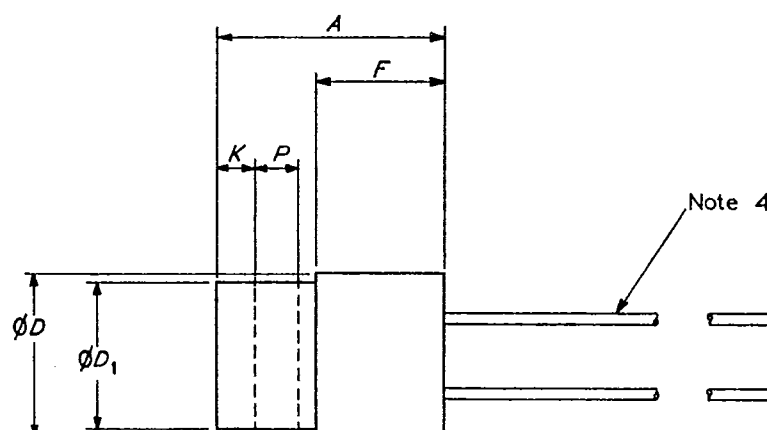
Figure 19b

SECTION ONE : OUTLINES

LIST OF DRAWINGS

SO-1	SO-53C	SO-132A to C
SO-2	SO-56	SO-133A and B
SO-3	SO-57	SO-134A and B
SO-5A	SO-58 and 59	SO-135A and B
SO-5B	SO-60, 62, 63, 64 and 66	SO-136
SO-6, 7 and 8	SO-73	SO-137
SO-10A and B	SO-78	SO-138
SO-12A	SO-84	SO-139/SO-140
SO-12B	SO-85	SO-141A to C
SO-12C	SO-86	SO-142A and B
SO-12D	SO-87A to H	SO-143
SO-13A and B	SO-88	SO-144A to D
SO-14A	SO-90/SO-91/SO-157	SO-145A to D
SO-14B	SO-92A to D	SO-145E
SO-15A to C	SO-93A to E	SO-147
SO-16	SO-94	SO-148
SO-17A	SO-95	SO-149
SO-17B	SO-96	SO-150
SO-21	SO-97	SO-153
SO-22	SO-98	SO-154
SO-23	SO-99	SO-155
SO-25	SO-100	SO-161/SO-162
SO-26	SO-101	SO-163
SO-28	SO-102	SO-164/SO-165
SO-29A and B	SO-103	SO-166
SO-29C	SO-104	SO-167
SO-30A	SO-105	SO-170 to SO-173
SO-30C	SO-107	SO-175
SO-31	SO-108A and B	SO-176
SO-32A	SO-109	SO-177
SO-32B	SO-110	SO-178
SO-32C	SO-111	SO-179
SO-35A	SO-112	SO-180
SO-36	SO-113	SO-181
SO-37	SO-114	SO-182
SO-38	SO-115	SO-186A to C
SO-40	SO-116	SO-187A to D
SO-42	SO-117A to C	SO-188A to F
SO-43A	SO-118A to C	SO-189A to C
SO-43B	SO-119A to F	SO-190
SO-44A	SO-120A and B	SO-191
SO-44B	SO-121	SO-192A to D
SO-45	SO-122	SO-193A to C
SO-46	SO-123	SO-194
SO-47	SO-124	SO-195A to Q
SO-48	SO-125	SO-196
SO-50A	SO-126	SO-197
SO-51A	SO-127A and B	SO-198
SO-52A	SO-128A and B	SO-199A to D
SO-52B	SO-129A and B	SO-200
SO-52C	SO-130A and B	SO-201A and B
SO-53A	SO-131	SO-202A and B
		SO-203A and B

SEMICONDUCTOR DEVICE OUTLINE SO-1



The inch dimensions are derived from the original millimetre dimensions

Ref.	Dimensions							Notes
	Millimetres			Degrees	Inches			
	Min.	Nom.	Max.	Nom.	Min.	Nom.	Max.	
<i>A</i>	6.6		8.25		0.260		0.324	
<i>φD</i>			6.5				0.255	1
<i>φD₁</i>	5.1		5.8		0.201		0.228	2
<i>F</i>			4.83				0.1901	1
<i>K</i>			1.5				0.059	3
<i>P</i>	2.0				0.079			2

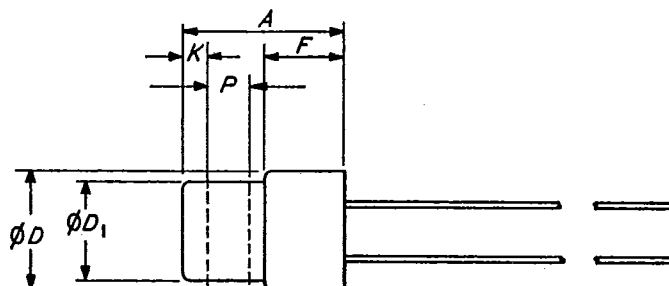
NOTE 1. Dimensions ϕD and F are included to permit the use of a flange (not necessarily at the base). Where no flange is present, dimensions ϕD and F may become ϕD_1 and zero and therefore no minimum dimensions are specified.

NOTE 2. Controlled cylindrical zone: the variation in diameter within this zone should not exceed 0.2 mm (0.0078 in).

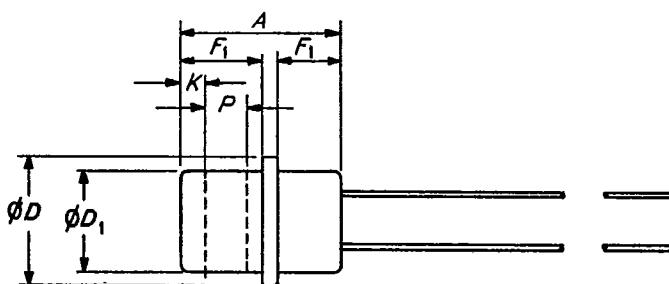
NOTE 3. Maximum diameter not greater than that of the controlled cylindrical zone.

NOTE 4. For details of the leads see the associated base drawing specified by the manufacturer.

For the bases at present known to be associated with this outline, see the index of cross references.

SUB-DIVISIONS OF
SEMICONDUCTOR DEVICE OUTLINE SO-1

SO-1/1



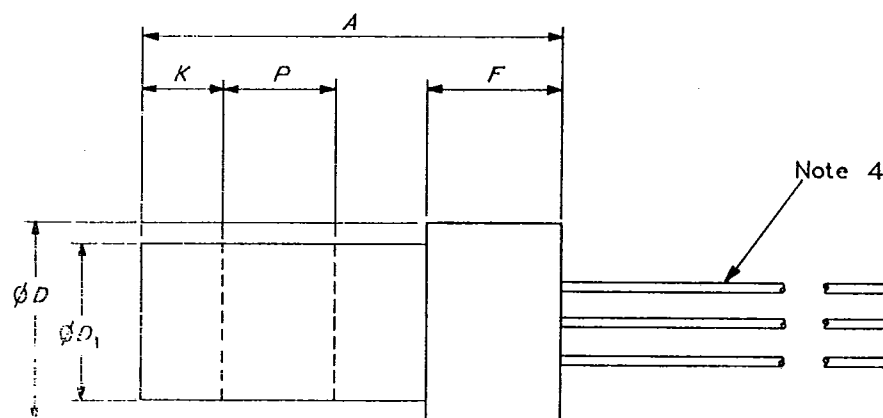
SO-1/2

The inch dimensions are derived from the original millimetre dimensions

Ref.	Dimensions							Notes
	Millimetres			Degrees	Inches			
	Min.	Nom.	Max.	Nom.	Min.	Nom.	Max.	
<i>A</i>	6.6		8.25		0.260		0.324	
<i>φD</i>	5.7		6.5		0.225		0.255	
<i>φD₁</i>	5.1		5.8		0.201		0.228	
<i>F</i>	0.5		4.0		0.020		0.157	
<i>F₁</i>	3.4				0.134			
<i>K</i>			1.5				0.059	
<i>P</i>	2.0				0.079			1

NOTE 1. Controlled cylindrical zone: the variation in diameter within this zone must not be greater than 0.2 mm (0.008 in).

SEMICONDUCTOR DEVICE OUTLINE SO-2



The millimetre dimensions are derived from the original inch dimensions

Ref.	Dimensions							Notes
	Millimetres			Degrees	Inches			
	Min.	Nom.	Max.	Nom.	Min.	Nom.	Max.	
<i>A</i>	8.2		15.7		0.320		0.620	
<i>φD</i>			7.62				0.300	1
<i>φD₁</i>	4.58		6.09		0.180		0.240	2
<i>F</i>			4.82				0.190	1
<i>K</i>			3.04				0.120	3
<i>P</i>	3.99				0.157			2

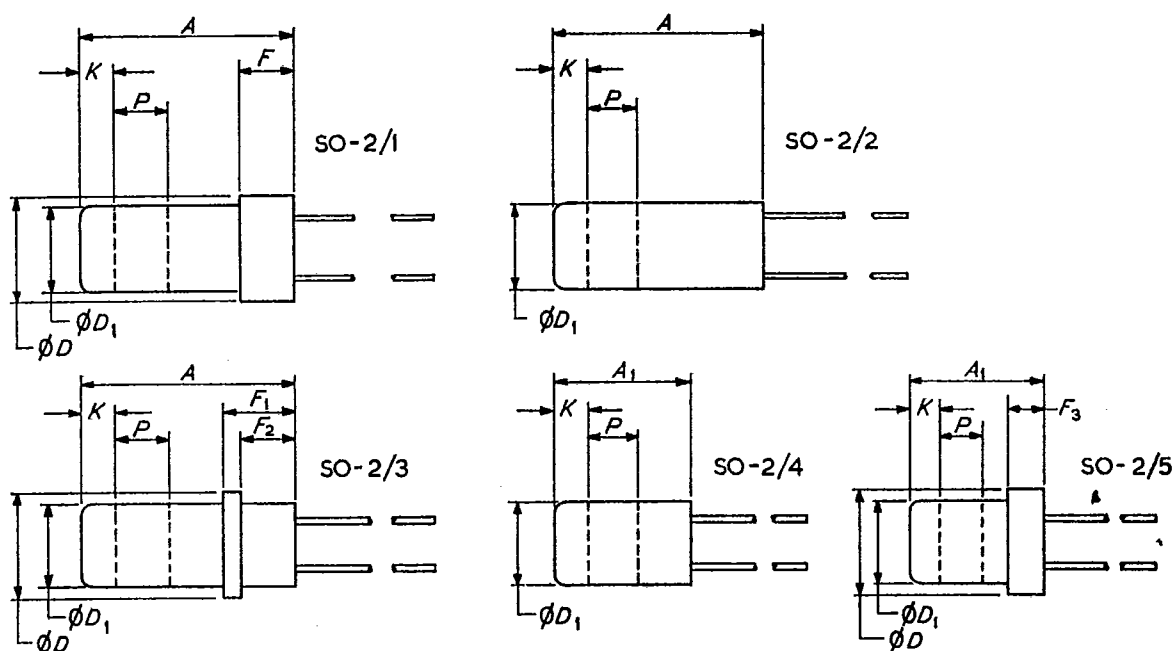
NOTE 1. Dimensions ϕD and F are included to permit the use of a flange (not necessarily at the base). Where no flange is present dimensions ϕD and F may become ϕD_1 and zero and therefore no minimum dimensions are specified.

NOTE 2. Controlled cylindrical zone: the variation in diameter within this zone shall not exceed (0.203 mm) 0.008 in.

NOTE 3. Maximum diameter not greater than that of the controlled cylindrical zone.

NOTE 4. For details of the leads see associated base drawing specified by the manufacturer

For the bases at present known to be associated with this outline, see the index of cross references.

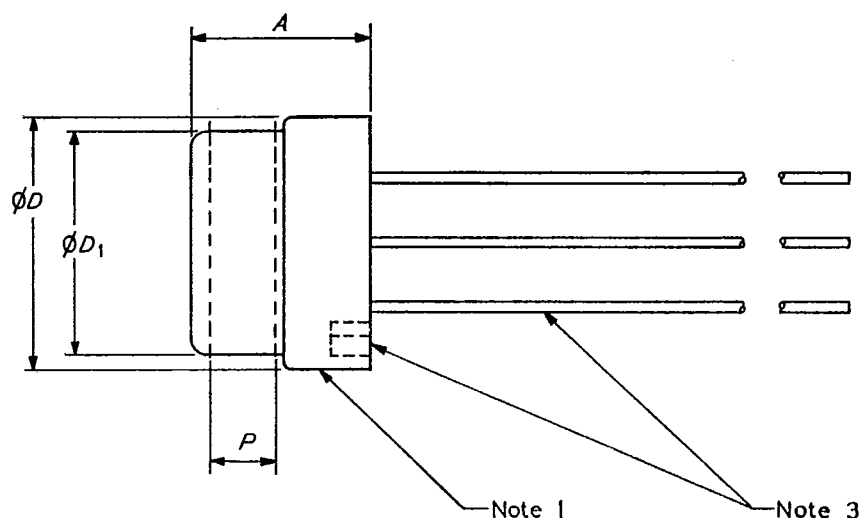
SUB-DIVISIONS OF
SEMICONDUCTOR DEVICE OUTLINE SO-2

The millimetre dimensions are derived from the original inch dimensions

Ref.	Dimensions							Notes
	Millimetres			Degrees	Inches			
	Min.	Nom.	Max.	Nom.	Min.	Nom.	Max.	
<i>A</i>	12.7		15.7		0.500		0.620	
<i>A</i> ₁	8.13		9.52		0.320		0.375	
<i>φD</i>	6.35		7.62		0.250		0.300	
<i>φD</i> ₁	4.58		6.09		0.180		0.240	
<i>F</i>	1.3		3.8		0.050		0.150	
<i>F</i> ₁			4.82				0.190	
<i>F</i> ₂	4.20				0.165			
<i>F</i> ₃	0.18		2.54		0.007		0.100	
<i>K</i>			3.04				0.120	
<i>P</i>	3.99				0.157			1

NOTE 1. Controlled cylindrical zone: the variation in diameter within this zone shall not be greater than (0.203 mm) 0.008 in.

SEMICONDUCTOR DEVICE OUTLINE SO-3



The millimetre dimensions are derived from the original inch dimensions

Ref.	Dimensions							Notes
	Millimetres			Degrees	Inches			
	Min.	Nom.	Max.	Nom.	Min.	Nom.	Max.	
<i>A</i>	5.85		6.60		0.230		0.260	
<i>ϕD</i>	8.64		9.39		0.340		0.370	1
<i>ϕD₁</i>	7.75		8.50		0.305		0.335	2
<i>P</i>	2.54				0.100			2

NOTE 1. Details of the outline in this zone are optional.

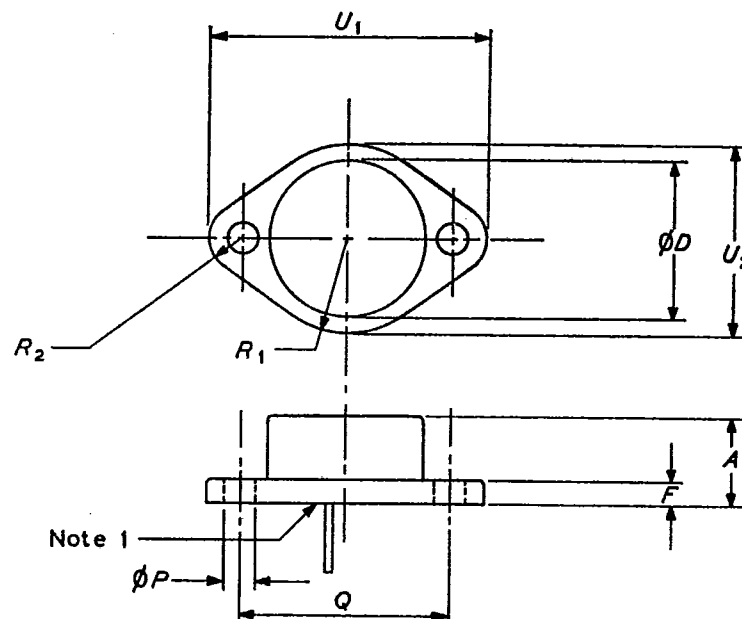
NOTE 2. Controlled cylindrical zone: the variation in diameter in this zone of length *P* shall not exceed (0.25 mm) 0.010 in.

NOTE 3. For details of the leads and index tab where present, see associated base drawing specified by the manufacturer.

NOTE 4. A similar outline which has tighter tolerances, especially in the flange zone, is the SO-44A.

For the bases at present known to be associated with this outline, see the index of cross references.

SEMICONDUCTOR DEVICE OUTLINE SO-5A



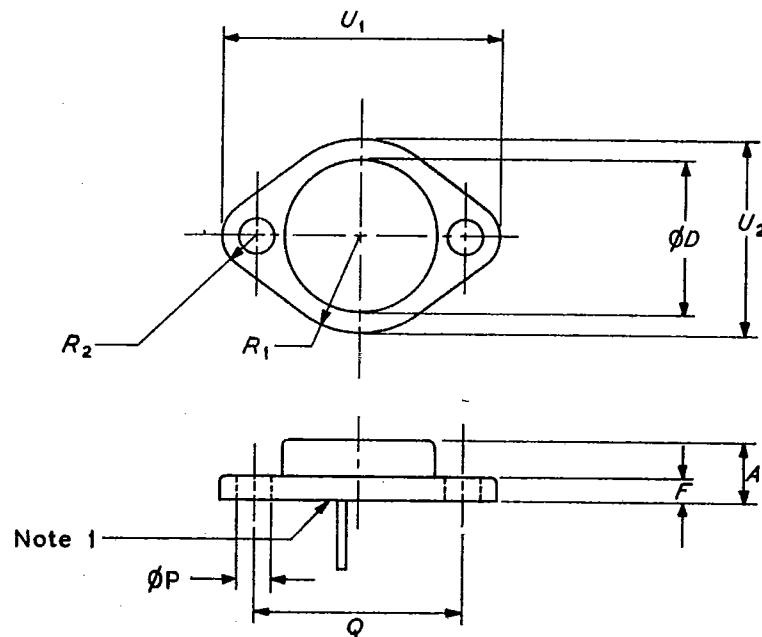
The millimetre dimensions are derived from the original inch dimensions

Ref.	Dimensions							Notes
	Millimetres			Degrees	Inches			
	Min.	Nom.	Max.	Nom.	Min.	Nom.	Max.	
<i>A</i>			12.06				0.475	
ϕD			22.86				0.900	
<i>F</i>	0.6		3.8		0.020		0.150	
ϕP	3.887		4.089		0.153		0.161	1
<i>Q</i>	30.03		30.27		1.182		1.192	1
Rad <i>R</i> ₁			13.58				0.535	
Rad <i>R</i> ₂			4.82				0.190	
<i>U</i> ₁			40.13				1.580	
<i>U</i> ₂			27.17				1.070	

NOTE 1. For further details, see the associated base drawing specified by the manufacturer.

For the bases at present known to be associated with this outline, see the index of cross references.

SEMICONDUCTOR DEVICE OUTLINE SO-5B



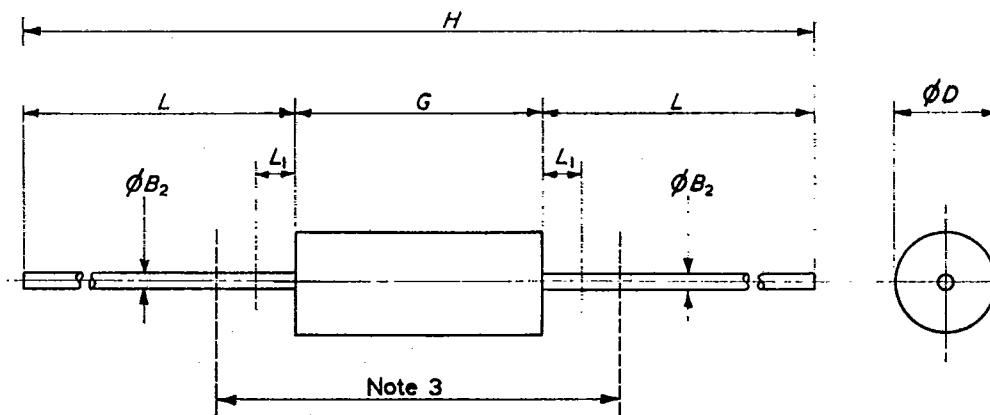
The millimetre dimensions are derived from the original inch dimensions

Ref.				Dimensions				Notes
		Millimetres		Degrees		Inches		
	Min.	Nom.	Max.	Nom.	Min.	Nom.	Max.	
<i>A</i>			8.63				0.340	
<i>φD</i>			22.86				0.900	
<i>F</i>	0.6		3.8		0.020		0.150	
<i>φP</i>	3.887		4.089		0.153		0.161	1
<i>Q</i>	30.03		30.27		1.182		1.192	1
Rad <i>R</i> ₁			13.58				0.535	
Rad <i>R</i> ₂			4.82				0.190	
<i>U</i> ₁			40.13				1.580	
<i>U</i> ₂			27.17				1.070	

NOTE 1. For further details see the associated base drawing specified by the manufacturer.

For the bases at present known to be associated with this outline, see the index of cross references.

OUTLINE DRAWINGS

SO-6
SO-7
SO-8

Dimensions (see Note 1)

Ref.	Millimetres			Inches			Notes
	Min.	Nom.	Max.	Min.	Nom.	Max.	
ϕB_2	0.458		0.558	0.018		0.022	2
G			7.62			0.300	
L	26			1.0			
L ₁			2.5			0.10	2
H	56.7*			2.23*			
SO-6							
ϕD			2.71			0.107	
SO-7							
ϕD			3.17			0.125	
SO-8							
ϕD			3.81			0.150	

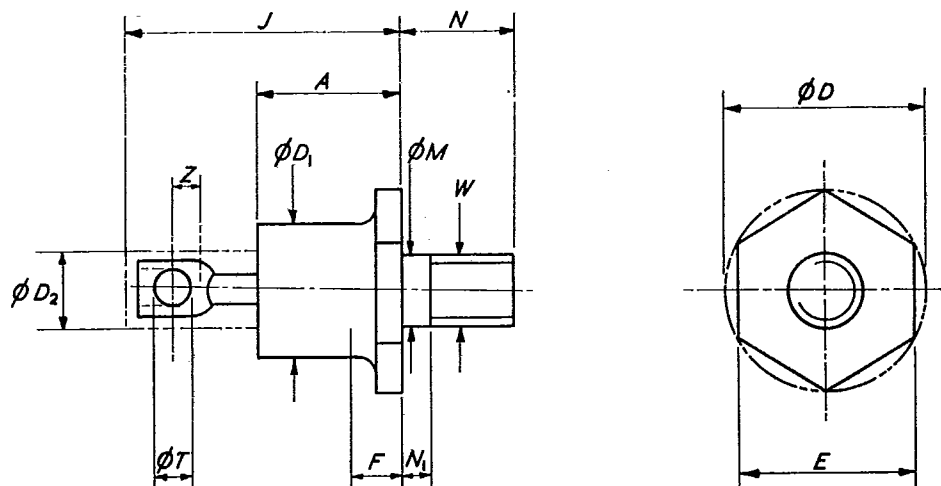
NOTE 1. The inch dimensions are the reference dimensions; the millimetre dimensions are given only for information.

NOTE 2. The terminal diameter is not controlled over length L_1 .

NOTE 3. The minimum axial length within which the device may be placed with the terminals bent at right angles is (16.0 mm) 0.63 in.

* These dimensions are additional to those in IEC drawing A1A/A1B/A1C.

OUTLINE DRAWINGS

SO-10A
SO-10B

Dimensions (see Note 1)

Ref.	Millimetres			Inches			Notes
	Min.	Nom.	Max.	Min.	Nom.	Max.	
<i>A</i>			10.28			0.405	
<i>φD</i>			12.82			0.505	
<i>φD₁</i>			10.76			0.424	
<i>φD₂</i>			6.35			0.250	2
<i>F</i>	2.0		4.4	0.075		0.175	
<i>J</i>			20.32			0.800	
<i>φM</i>							3
<i>N</i>	10.72		11.50	0.422		0.453	
<i>N₁</i>			2.03			0.080	4
<i>φT</i>	1.53			0.060			
<i>Z</i>	1.53*			0.060*			5
SO-10A							
<i>E</i>				0.424	7/16	0.437	
<i>W</i>					10-32 UNF 2 A		6
SO-10B							
<i>E</i>		11.0					
<i>W</i>		ISO ref. No. M5					6

NOTE 1. The inch dimensions are the reference dimensions; the millimetre dimensions are given only for information.

NOTE 2. The angular orientation of the terminal and its precise contour within the dotted lines are optional.

NOTE 3. The diameter M refers to zone N_1 . The maximum value should not exceed the outside diameter of the thread.

NOTE 4. Dimension to the end of the full thread.

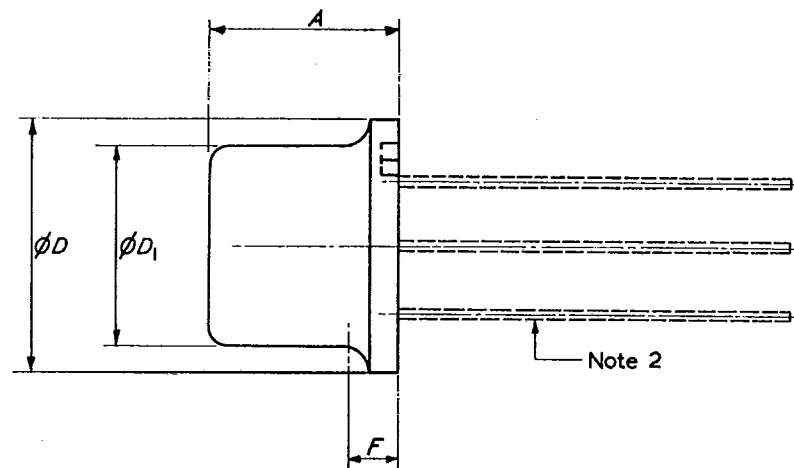
NOTE 5. Minimum flat.

NOTE 6. A clearance hole of (5.21 mm) 0.205 in minimum diameter ensures interchangeability between SO-10A and SO-10B.

* These dimensions are additional to those in IEC drawing A3U/A3M.

OUTLINE DRAWING

SO-12A



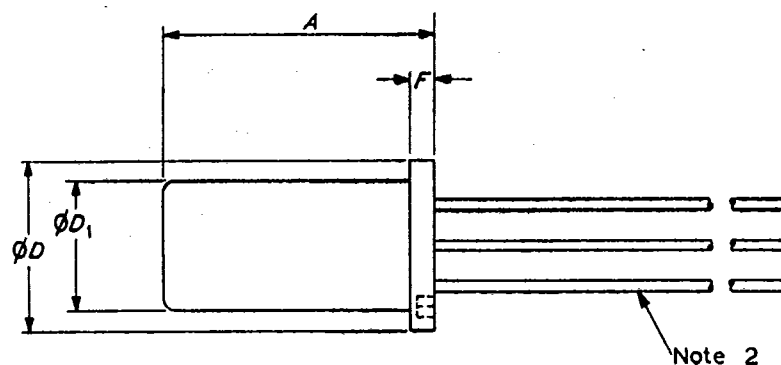
Dimensions (see Note 1)							
Ref.	Millimetres			Inches			Notes
	Min.	Nom.	Max.	Min.	Nom.	Max.	
<i>A</i>	4.32		5.33	0.170		0.210	
<i>ϕD</i>	5.31		5.84	0.209		0.230	
<i>ϕD</i> ₁	4.53		4.95	0.178		0.195	
<i>F</i>			1.01			0.040	

NOTE 1. The inch dimensions are the reference dimensions; the millimetre dimensions are given only for information.

NOTE 2. For details of the terminals see the associated base drawing specified by the manufacturer.

For the bases at present known to be associated with this outline, see the index of cross references.
Dimensions are identical to those in IEC drawing C7.

SEMICONDUCTOR DEVICE OUTLINE SO-12B



The millimetre dimensions are derived from the original inch dimensions

Ref.	Dimensions							Notes
	Millimetres			Degrees	Inches			
	Min.	Nom.	Max.	Nom.	Min.	Nom.	Max.	
<i>A</i>	7.3		10.2		0.285		0.405	
<i>φD</i>	5.31		6.09		0.209		0.240	
<i>φD₁</i>	4.53		4.95		0.178		0.195	
<i>F</i>	0.06		1.01		0.002		0.040	1

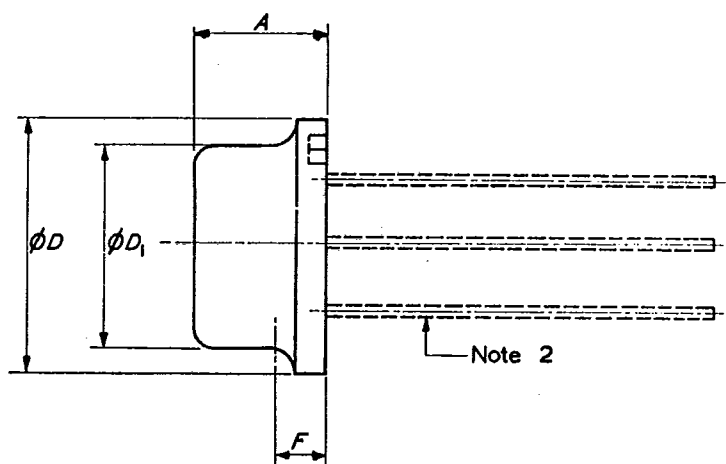
NOTE 1. This dimension includes any fillet present between the body and the flange.

NOTE 2. For details of the leads, see the associated base drawing specified by the manufacturer.

For the bases at present known to be associated with this outline, see the index of cross references.

OUTLINE DRAWING

SO-12C



Dimensions (see Note 1)

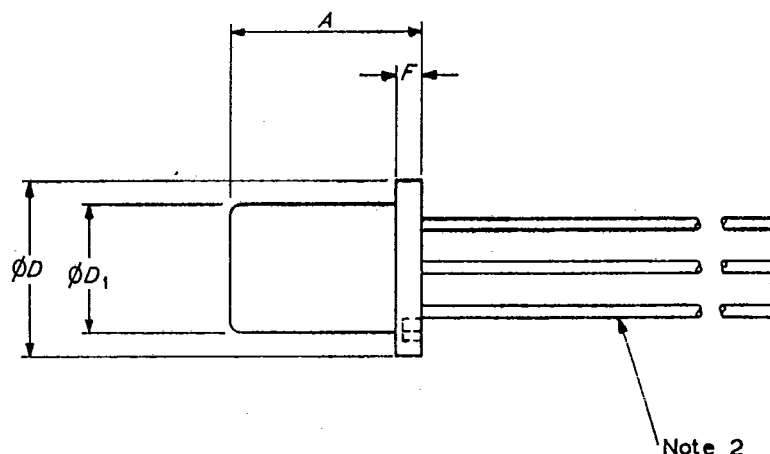
Ref.	Millimetres			Inches			Notes
	Min.	Nom.	Max.	Min.	Nom.	Max.	
<i>A</i>	1.53		2.15	0.060		0.085	
ϕD	5.31		5.84	0.209		0.230	
ϕD_1	4.53		4.95	0.178		0.195	
<i>F</i>			1.01			0.040	

NOTE 1. The inch dimensions are the reference dimensions; the millimetre dimensions are given only for information.

NOTE 2. For details of the terminals, see the associated base drawing specified by the manufacturer.

For the bases at present known to be associated with this outline, see the index of cross references.
Dimensions are identical to those in IEC drawing C10.

SEMICONDUCTOR DEVICE OUTLINE SO-12D



The millimetre dimensions are derived from the original inch dimensions

Ref.	Dimensions							Notes
	Millimetres			Degrees	Inches			
	Min.	Nom.	Max.	Nom.	Min.	Nom.	Max.	
<i>A</i>	5.34		7.23		0.210		0.285	
<i>φD</i>	5.31		6.09		0.209		0.240	
<i>φD₁</i>	4.53		4.95		0.178		0.195	
<i>F</i>	0.06		1.01		0.002		0.040	1

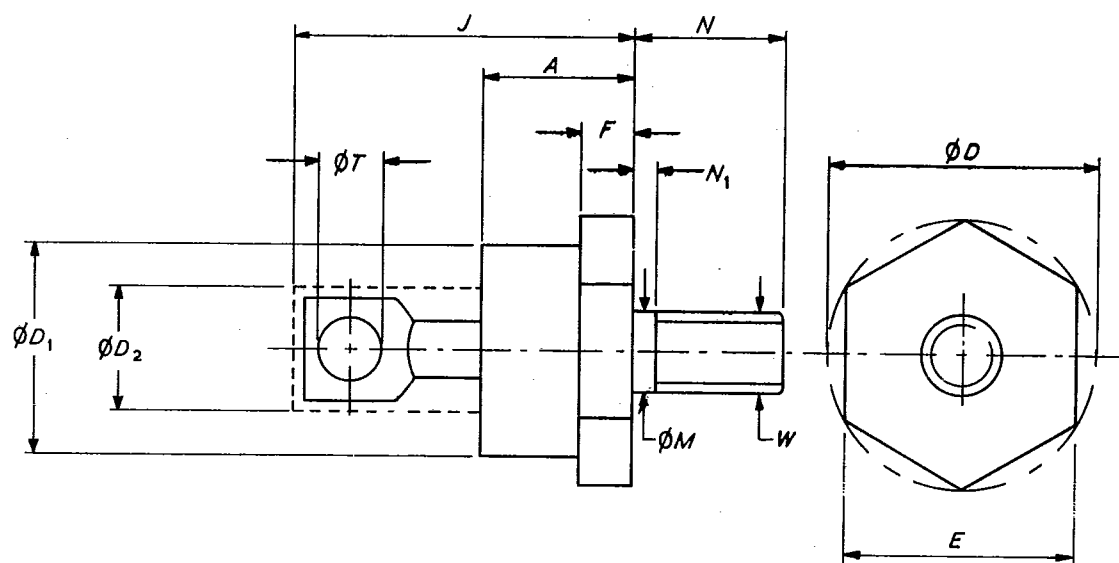
NOTE 1. This dimension includes any fillet present between the body and the flange.

NOTE 2. For details of the leads, see the associated base drawing specified by the manufacturer.

For the bases at present known to be associated with this outline, see the index of cross references.

OUTLINE DRAWING

SO-13A AND B



Dimensions (see Note 1)

Ref.	Millimetres			Inches			Notes
	Min.	Nom.	Max.	Min.	Nom.	Max.	
A			12.70			0.500	
øD			20.16			0.794	
øD ₁			16.94			0.667	
øD ₂			9.52			0.375	
F	2.93		5.08	0.115		0.200	2
J			25.40			1.000	
øM							3
N	10.72		12.70	0.422		0.500	
N ₁			2.26			0.089	3
øT	3.56		4.44	0.140		0.175	
SO-13A							
E				0.667	11/16	0.687	
W					1/4 28 UNF 2A		4
SO-13B							
E							5
W		ISO ref. No: M6					4

NOTE 1. The millimetre dimensions are the prime dimensions; the inch dimensions are given only for information.

NOTE 2. The angular orientation of the terminal and its precise contour within the dotted lines are optional.

NOTE 3. The diameter N refers to zone N_1 . The maximum value should not exceed the outside diameter of the thread.

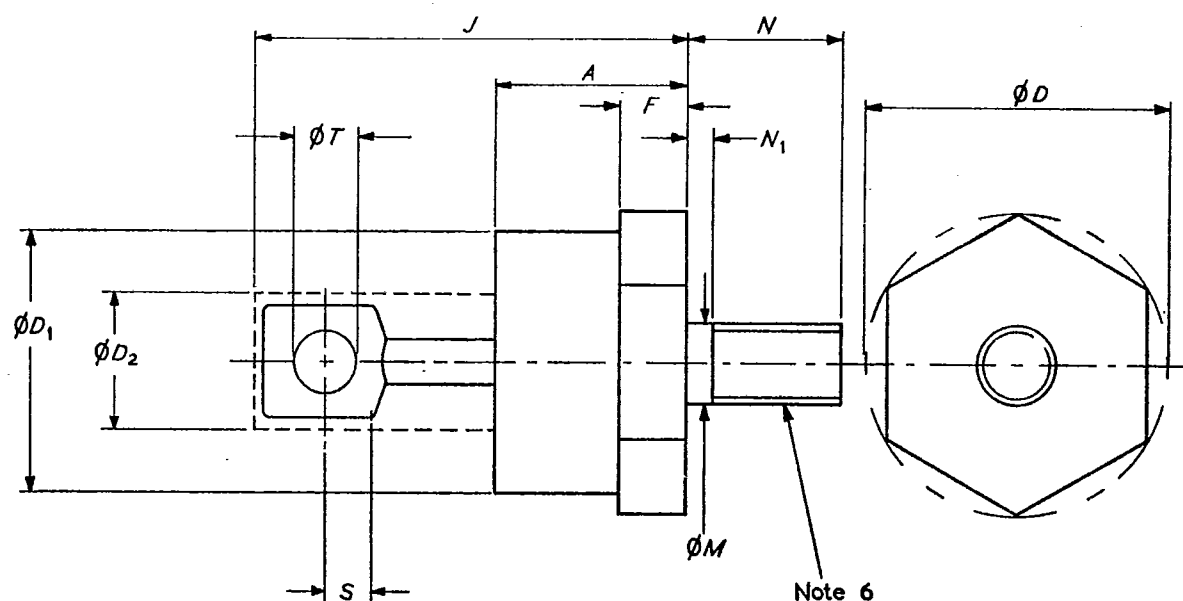
NOTE 4. A clearance hole of 0.276 in (7.01 mm) minimum diameter ensures interchangeability between type 1 and type 2 devices.

NOTE 5. Dimension E nominal of type 2 is: 16.00 mm or 17.0 mm.

For the future, preference should be given to 17.0 mm.

The figures and dimensions are identical with those in IEC drawing A4U and A4M.

SEMICONDUCTOR DEVICE OUTLINE SO-14A



The millimetre dimensions are derived from the original inch dimensions

Ref.	Dimensions							Notes
	Millimetres			Degrees	Inches			
	Min.	Nom.	Max.	Nom.	Min.	Nom.	Max.	
<i>A</i>			13.97				0.550	
<i>φD</i>			20.16				0.794	
<i>φD₁</i>			16.94				0.667	
<i>φD₂</i>			9.52				0.375	1
<i>F</i>	2.93		5.08		0.115		0.200	2
<i>J</i>			31.75				1.250	
<i>φM</i>	4.91		6.35		0.193		0.250	3
<i>N</i>	10.72		12.70		0.422		0.500	
<i>N₁</i>			2.26				0.089	4
<i>S</i>	3.05				0.120			5
<i>φT</i>	3.56		4.44		0.140		0.175	

NOTE 1. This zone includes a lug of undefined contour and orientation.

NOTE 2. This zone includes an $\frac{11}{16}$ in hexagon: (17.47 mm) 0.688 in max., (16.95 mm) 0.667 in min. across flats.

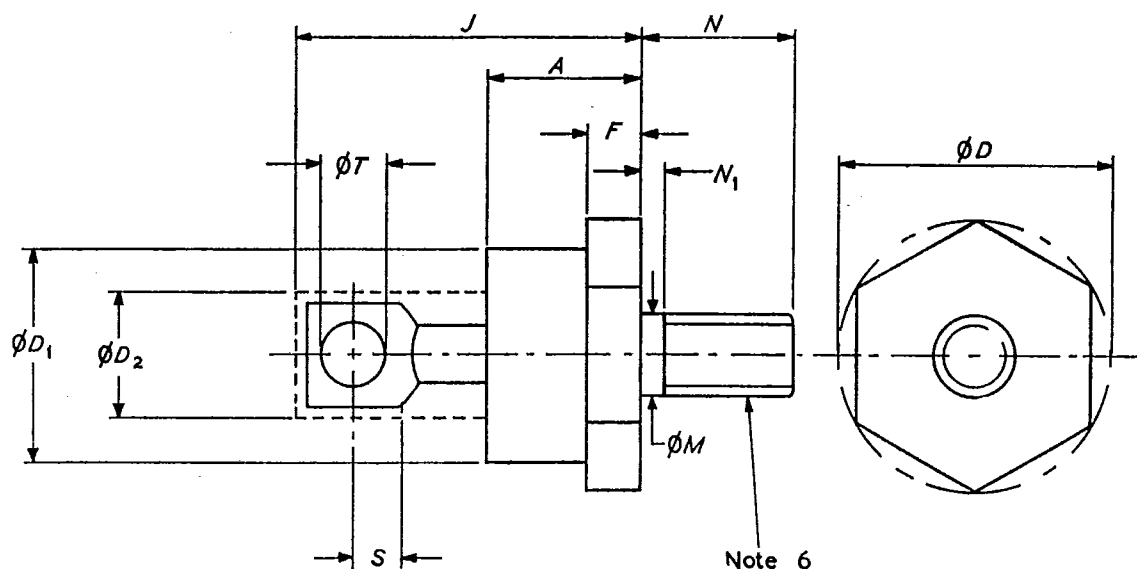
NOTE 3. ϕM refers to length N_1 .

NOTE 4. Dimension to end of full thread.

NOTE 5. Minimum flat.

NOTE 6. Thread $\frac{1}{4}$ -28UNF-2A.

SEMICONDUCTOR DEVICE OUTLINE SO-14B



The millimetre dimensions are derived from the original inch dimensions

Ref.	Dimensions							Notes
	Millimetres			Degrees	Inches			
	Min.	Nom.	Max.	Nom.	Min.	Nom.	Max.	
<i>A</i>			13.97				0.550	
<i>ϕD</i>			21.99				0.866	
<i>ϕD₁</i>			18.84				0.742	
<i>ϕD₂</i>			9.52				0.375	1
<i>F</i>	2.93		5.08		0.115		0.200	2
<i>J</i>			31.75				1.250	
<i>ϕM</i>	4.91		6.35		0.193		0.250	3
<i>N</i>	10.72		12.70		0.422		0.500	
<i>N₁</i>			2.26				0.089	4
<i>S</i>	3.05				0.120			5
<i>ϕT</i>	3.56		4.44		0.140		0.175	

NOTE 1. This zone includes a lug of undefined contour and orientation.

NOTE 2. This zone includes a $\frac{3}{4}$ in hexagon: (19.05 mm) 0.750 in max., (18.85 mm) 0.742 in min. across flats.NOTE 3. ϕM refers to length N_1 .

NOTE 4. Dimension to end of full thread.

NOTE 5. Minimum flat.

NOTE 6. Thread $\frac{1}{4}$ -28UNF-2A.