

Classification of shapes of electronic components for placement on printed wiring boards

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- Electronic Components Industry Federation
- Electronic Engineering Association
- National Supervising Inspectorate
- Society of British Aerospace Companies Ltd.
- Surface Mount and Related Technologies
- Institution of Electronic and Radio Engineers
- Telecommunication Engineering and Manufacturing Association (TEMA)
- Ministry of Defence
- Department of Trade and Industry (Electronics Applications Division)
- British Telecommunications plc
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Foreword

This British Standard has been prepared under the direction of the Electronic Components Standards Committee. It gives a standardized approach to the description of component geometry.

The drawings given in this standard are compatible with those given in BS 3934 and the relevant detail specifications in the BS 9000, CECC and IECQ systems.

Since much of the work of laying-out electronic components on printed wiring boards is now performed by computer programs, the procedures in this standard have been designed to be compatible with input to and processing by computer systems. It is therefore intended that the classification described in this standard is used as the basis of a system for the description of electronic component geometry on a computer database, which has a direct interface to design programs. All the information is presented in a standard character set using the 7-bit codes described in BS 4730.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 85 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.

Section 1. General

1.1 Scope

This British Standard classifies the shapes of the most commonly used electronic components to assist in the design procedures involved in locating and connecting components on printed wiring boards. It gives details, through a set of reference drawings (in section 2), for defining shape and size of the component body, and the positions and sizes of its connecting leads.

NOTE This standard is not concerned with the electrical function of any of the connections.

1.2 Definitions

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

1.2.1

seating plane (reference plane)

the surface plane of the circuit on which the component is mounted

1.2.2

mounted height (seated height)

the furthest distance from the seating plane measured in a direction perpendicular to that plane of any point on the component body or of any rigid terminal

1.2.3

visual index

a reference feature, e.g. mark, chamfer, notch, tab etc. which identifies the position of terminal number 1 in a multi-lead component

1.2.4

mechanical index

a reference feature, e.g. tab, notch, flat, groove, etc. which provides orientation during automatic handling

1.2.5

origin of coordinates

for identification of terminal positions, the origin of coordinates is a point in the seating plane at the geometric centre either, where the leads are not disposed in a regular array, of the orthogonal projection of the outline of the main body of the component on to that plane or, where the leads are disposed in a regular circular or rectangular array, of the true centres of the leads at that plane

1.2.6

horizontal

refers to a direction parallel to the reference plane

1.2.7

vertical

refers to a direction at right angles to the reference plane

1.2.8

shape

the shape of a component is defined when all its external boundary surfaces have been defined

1.3 Related documents

This British Standard makes reference to the following publications:

BS 308, *Engineering drawing practice — Part 3: Geometrical tolerancing*.

BS 3934 (with Addenda), *Specification for dimensions of semiconductor devices and integrated electronic circuits*.

BS 4730, *Specification for UK 7-bit coded character set*.

BS 9000, *General requirements for a system for electronic components of assessed quality (together with detail specifications in the BS 9000 series)*.

IEC 191, *Mechanical standardization of semiconductor devices*.

CECC and IECQ systems

1.4 General principles

The information given for the shapes allows the following to be obtained:

- a) the maximum area occupied on the seating plane by the component as defined by its orthogonal projection from its mounted position;
- b) the maximum height of the component above the seating plane which may determine, or be determined by, the minimum spacing between adjacent circuits;
- c) the positions of leads which may or may not pass through the seating plane;
- d) the maximum cross section of the leads which determines the minimum diameter of the hole through which the leads should pass;
- e) the minimum lead length which is related to the thickness of the circuit substrate.

In most cases the shape of a component is specified as it is mounted. The main exception to this is where component leads need to be preformed before mounting, e.g. for components with axial leads. In such cases, the shape is specified before the forming operation.

1.5 Identification of drawings and dimensions

The complete code for the dimensions list for a component consists of three parts:

- a) a two-letter drawing code (for a list of codes, see the alphabetic index in section 2), followed by;
- b) a numeric code giving a salient property of the component, which may be either a major dimension or the number of leads, followed by:
- c) a hyphen and a serial number to distinguish components with the same drawing and numeric codes.

As a guide to the storage required in computer systems, the numeric codes under b) and c) are not expected to exceed three digits each. Under no circumstances will the complete code exceed eight characters.

Examples.

- a) 14-pin dual-in-line packages are coded DL 14-1, DL 14-2, etc.
- b) Tubular axial-lead components with body lengths between 8.50 mm and 9.49 mm are coded TA9-1 TA9-2, etc.

1.6 Interpretation of reference drawings

All drawings are given in third angle projection. Plan views of components are given as viewed from above the component.

1.7 Identification of terminals

Where terminals are not in a regular array, all terminal positions are numbered on the drawing and the coordinates of the terminal position are suffixed by the corresponding number.

Where terminals are in a regular array, they are numbered sequentially in an anti-clockwise direction as viewed from above the component, i.e. as on the plan view given in the drawing. The position of terminal number one is the first position anti-clockwise from the index mark as viewed from above, and is indicated on the drawing. Each terminal is identified by the number of its positions. Terminals may not necessarily be present in all the numbered positions as provided for on the drawing, but those that are present will have the number of the position they occupy.

1.8 Sockets, heat sinks and stand-offs

Component drawings are all given on the assumption that components are mounted directly into the circuit. Where components are plugged into sockets, mounted on heat sinks or mounted on stand-offs such use will generally increase the total effective space occupied by the component, both the seated height and the area of the projection on the seating plane.

In the case of drawings of sockets intended for plug-in components, such as integrated circuits, the height shown is the additional seated height of the component resulting from the use of the socket.

1.9 Fixing holes and studs

Where components are attached to a circuit by studs or bolts through fixing holes, the positions and dimensions of these are shown on the drawings.

1.10 Adjustable components

Where components have a facility for mechanical adjustment, e.g. potentiometers, switches, the position of the adjuster or the space within which the adjusters lie is shown on the drawings.

1.11 Units of measurement

All linear dimensions are in millimetres and all angular dimensions are in degrees.

1.12 Tolerances

Generally, component body dimensions are maximum values taken from the original drawings. No minima are quoted and the values are thus not subject to any tolerance. Likewise, where minimum dimensions are quoted no maxima are given.

Where nominal dimensions are given for terminal, lead or mounting hole positions the actual position is within ± 0.2 mm of the nominal position in either coordinate direction.

Section 2. Reference drawings

2.1 Reference letter symbols

The table below lists the letter symbols used for the various dimensions on the drawings in this standard, together with their descriptions and whether they represent maximum, minimum or nominal values.

Also included are numeric codes which may be used in an information retrieval system to distinguish among cases where the same letter symbol is used for a different dimension. All such codes are integers except where they represent subscripted symbols: in such cases the subscript is given by the digit following a decimal point.

Reference letter symbol	Description on drawing	Numeric code	Full description	Limits
<i>A</i>	Seated height	51	The distance of the furthest part of the component above the reference plane measured in a direction perpendicular to that plane	max.
<i>a</i>	Index angle	31	The angle subtended by the arc joining the index mark and lead 1 at the centre of the circle on which leads are disposed in a regular array	nom.
<i>B</i>	Body diameter	33	Maximum overall diameter of a component with axial symmetry	max.
<i>B</i> ₁ , <i>B</i> ₂ , etc.		33.1, 33.2, etc.	Other diameters of a component with axial symmetry	max.
<i>b</i>	Angular lead pitch	32	The angle subtended by the arc joining adjacent leads at the centre of the circle on which the leads are disposed in a regular array	nom.
<i>C</i>	Termination circle	38	The diameter of the circle on which leads are disposed in a regular array	nom.
<i>C</i>	Termination circle	19	The diameter of the circle within which all terminations lie	max.
<i>c</i>	Termination angle	18	Angular limitation of the sector within which all terminations lie	max.
<i>D</i>	Diameter	3	Maximum overall diameter of a component with circular cross section, measured in a direction parallel to the reference plane	max.
<i>D</i>	Length	1	Maximum overall length or major axis of a component, measured in a direction parallel to the reference plane	max.
<i>D</i>	Body diameter	16	Maximum diameter of the body of a component	max.
<i>d</i>	Lead diameter	6	The maximum diameter of a lead or termination with circular cross section measured below the reference plane	max.
<i>d</i>	Lead diagonal	46	The maximum diagonal dimension of a lead or termination of rectangular cross section measured below the reference plane	max.
<i>d</i>	Termination diameter	22	The maximum diameter of a termination	max.
<i>E</i>	Width	2	Maximum overall width, thickness or minor axis of the component, measured in a direction parallel to the reference plane	max.
<i>F</i>	Flange thickness	43	Thickness of flange by which the component is mounted	max.
<i>G</i>	Length	47	Overall length of the component body, excluding leads	max.
<i>G</i>	Body length	23	The depth of the body of a component below the mounting plane	

Reference letter symbol	Description on drawing	Numeric code	Full description	Limits
<i>H</i>	Overall length	20	Overall length of the component, including terminations	max.
<i>K</i>	Clearance	21	Clearance between a termination and the mounting plane	min.
<i>L</i>	Lead length	5	Length of a termination or connecting lead	min.
<i>L</i>	Termination length	17	Length of a termination	min.
<i>L/1</i>	Termination length	17/1		
<i>L/2</i>	Termination length	17/2		
<i>M</i>	Stud diameter	34	Diameter of a threaded stud by which the component is to be attached to the circuit	max.
<i>N</i>	Stud length	35	Length of a fully or partially threaded stud by which the component is to be attached to the circuit	min.
<i>n</i>	Number of leads	58	Number of leads or terminations	
<i>P</i>	Dimension	40	Non-specific dimension	min.
		41		nom.
		42		max.
<i>p</i>	Hole diameter	30	Diameter or minor axis of mounting hole by which the component is to be attached to the circuit	min.
<i>Q</i>	Dimension	60	Non-specific dimension	min.
		61		nom.
		62		max.
<i>q</i>	Hole separation	29	Distance between the centres of two mounting holes, where the line joining them is parallel to a coordinate axis	nom.
<i>R</i>	Tag spacing	65	Tag spacing	max.
<i>s</i>	Hole position	59	The position of a mounting hole with reference to a nominated point or line	nom.
<i>t</i>	Lead thickness	37	Smaller dimension of a lead or termination with non-circular cross section	max.
<i>t</i>	Lead thickness	44	Smaller dimension of a lead or termination with non-circular cross section	max.
<i>t</i>	Tag thickness	39	Thickness of tag	nom.
<i>U</i>	Dimension	10	Non-specific dimension	max.
<i>w</i>	Lead width	36	Larger dimension of a lead or termination with non-circular cross section	max.
<i>w</i>	Lead width	45	Larger dimension of a lead or termination with non-circular cross section	min.
<i>X</i>	Adjuster offset	14	Distance between the centre of an adjuster and the y-axis, measured in a direction parallel to the reference plane	nom.
<i>X</i>	Lead separation	24	Distance between the centres of two leads where the line joining them is parallel to the x-axis	nom.
<i>X</i>	Lead offset	28	Distance between the origin and the line joining the centres of two leads parallel to the y-axis, measured parallel to the x-axis	nom.
<i>X</i>	Lead pitch	11	Distance between centres of adjacent leads where leads are disposed in a regular array along a line parallel to the x-axis	nom.

Reference letter symbol	Description on drawing	Numeric code	Full description	Limits
x	Lead position	54	x-coordinate of position of centre of lead with respect to the origin	nom.
$x_1, x_2, \text{etc.}$		54.1, 54.2, etc.	x-coordinates of leads with terminal numbers 1, 2, etc. respectively	nom.
Y	Adjuster offset	15	Distance between the centre of an adjuster and the x-axis, measured in a direction parallel to the reference plane	nom.
Y	Lead separation	27	Distance between the centres of two leads where the line joining them is parallel to the y-axis	nom.
Y	Lead offset	25	Distance between the origin and the line joining the centres of two leads parallel to the x-axis, measured parallel to the y-axis	nom.
Y	Lead pitch	12	Distance between centres of adjacent leads where leads are disposed in a regular array along a line parallel to the y-axis	nom.
y	Lead position	55	y-coordinate of position of centre of lead with respect to the origin	nom.
$y_1, y_2, \text{etc.}$		55.1, 55.2, etc.	y-coordinates of leads with terminal numbers 1, 2, etc. respectively	nom.

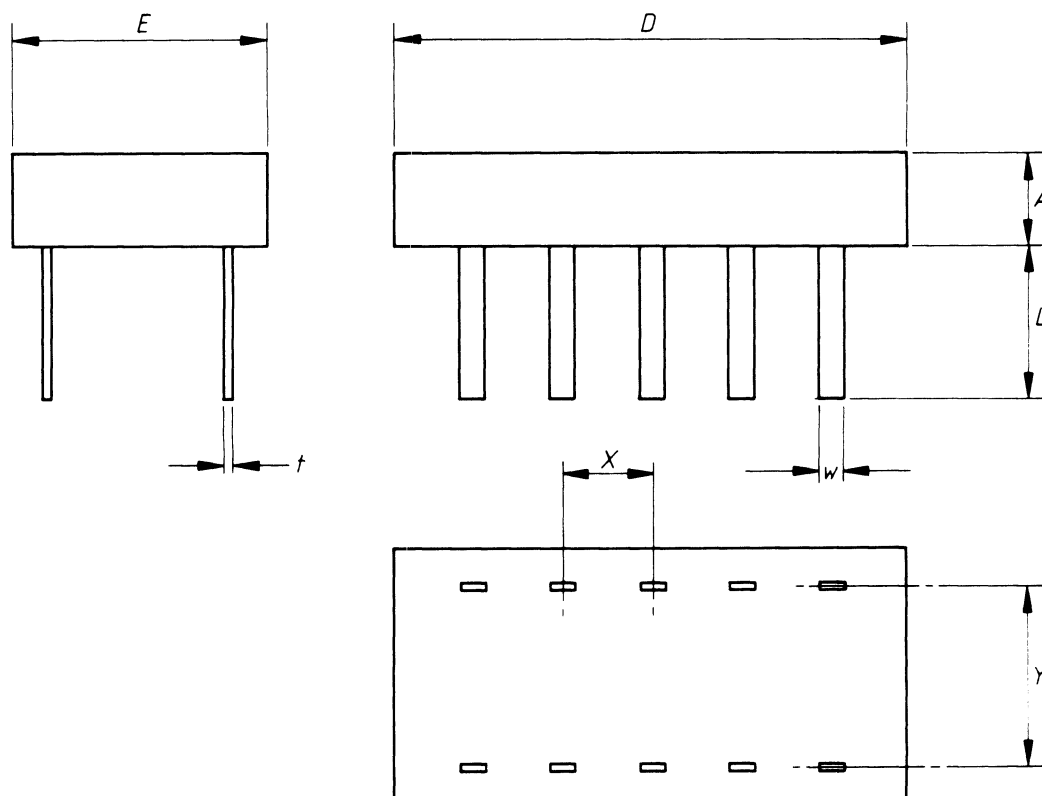
2.2 Drawing codes: alphabetic index

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DL Dual-in-line package, multi-lead	9
BR Bead package, two radial leads	11
CS Cylindrical package, single-ended, two leads	13
CT Cylindrical package, stud mounting	15
DA Disc package, two axial leads	17
DD Disc package, double tag	19
TA Tubular package, two axial leads	21
DP Disc package, PCB mounting	23
DR Disc package, two radial leads	25
DS Disc package, stud mounting	27
DT Disc package, potting tag	29
FP Flat pack, multi-lead	31
PA Potentiometer, panel mounting	33
PB Potentiometer, panel mounting	35
PC Potentiometer, panel mounting	37
PD Potentiometer, panel mounting	39
PE Potentiometer, panel mounting	41
PF Potentiometer, panel mounting	43
PP Rectangular package, three leads, horizontal adjuster	45
PQ Rectangular package, three leads, vertical adjuster	47
RA Rectangular package, two axial leads	49
RC Rectangular package, metallized ends	51
RR Rectangular package, two radial leads	53
RS Rectangular package, two strip leads	55
TR Tubular package, two radial leads	57
XA Oval package, two mounting holes, two leads	59
XB Stud-mounted package, one fixed tag	61
XC Cylindrical metal-can package, multi-lead	63
XD Top-hat package, axial leads	65
XE Stud-mounted package, two fixed tags	67
XF Stud-mounted package, one flexible lead with tag	69
XG Stud-mounted package, two flexible leads with tag	71
XH Stud-mounted package, one flexible lead	73
XK Flat package, three in-line leads	75
XL Near-cylindrical package, three leads on circle	77
XM Flat package, mounting hole, two/three leads	79
XN Flat package, three preformed leads	81
XP Moulded case, three mounting feet	83
XR Flat package with flange, mounting hole, two/three leads	85

2.3 Drawings

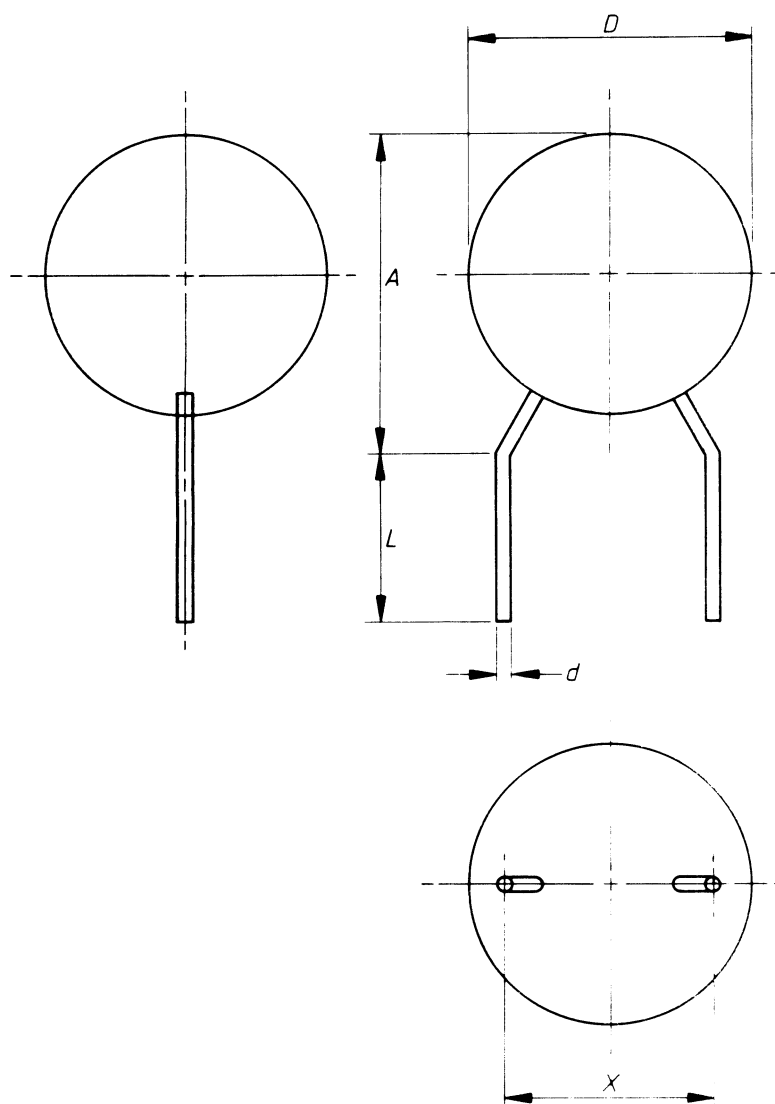
DL Dual-in-line package, multi-lead

Third angle projection



All dimensions are in millimetres.
All angles are in degrees.

Parameter	Symbol	Code	Limits
Number of leads	n	58	
Length	D	1	max.
Width	E	2	max.
Lead pitch	X	11	nom.
Lead pitch	Y	12	nom.
Seated height	A	51	max.
Lead length	L	5	min.
Lead width	w	36	max.
Lead thickness	t	37	max.
For full details, refer to the relevant detail specification.			

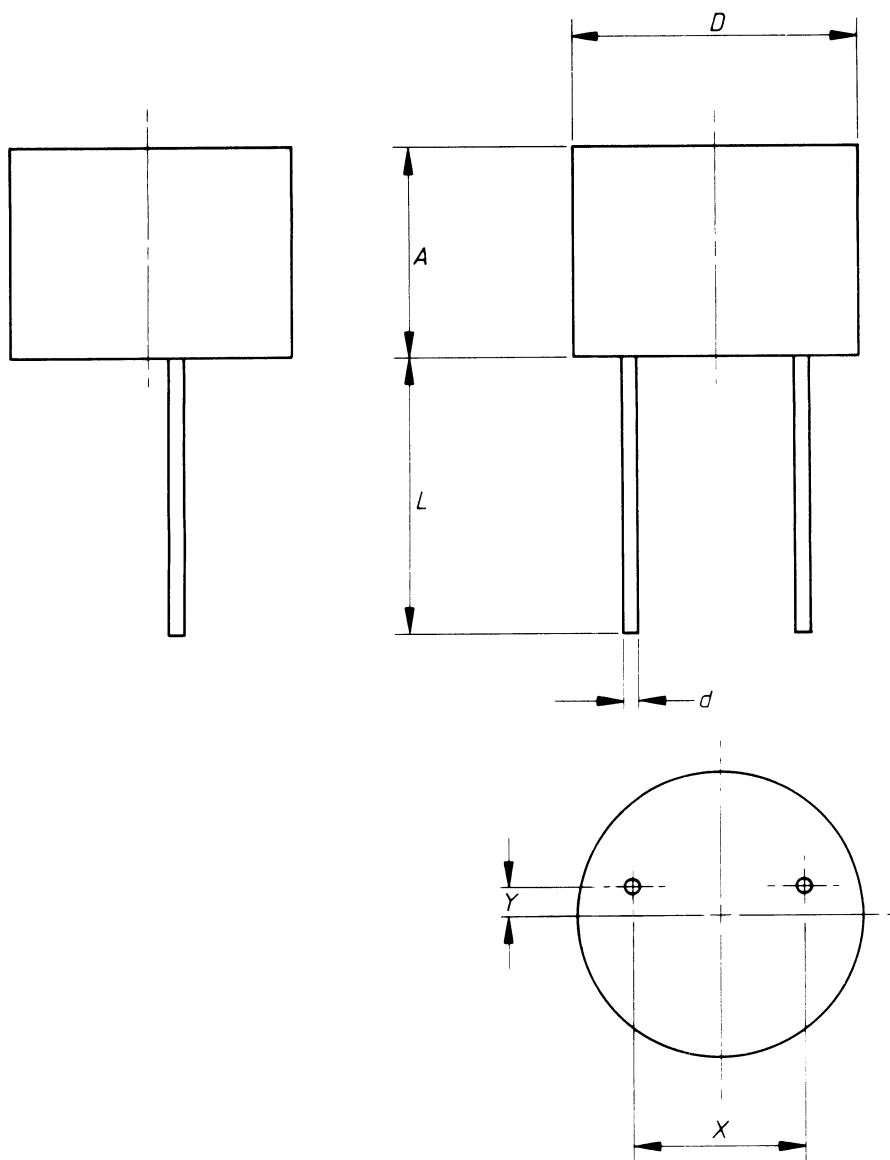
BR Bead package, two radial leads**Third angle projection**

All dimensions are in millimetres.
All angles are in degrees.

Parameter	Symbol	Code	Limits
Diameter	D	3	max.
Seated height	A	51	max.
Lead length	L	5	min.
Lead diameter	d	6	max.
Lead separation	X	24	nom.
For full details, refer to the relevant detail specification.			

CS Cylindrical package, single-ended, two leads

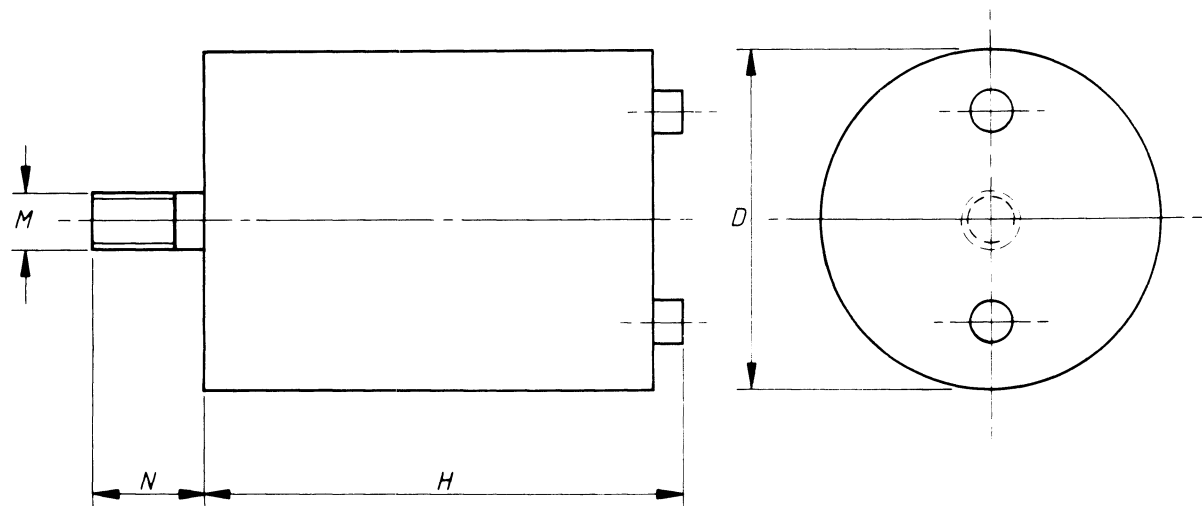
Third angle projection



All dimensions are in millimetres.
All angles are in degrees.

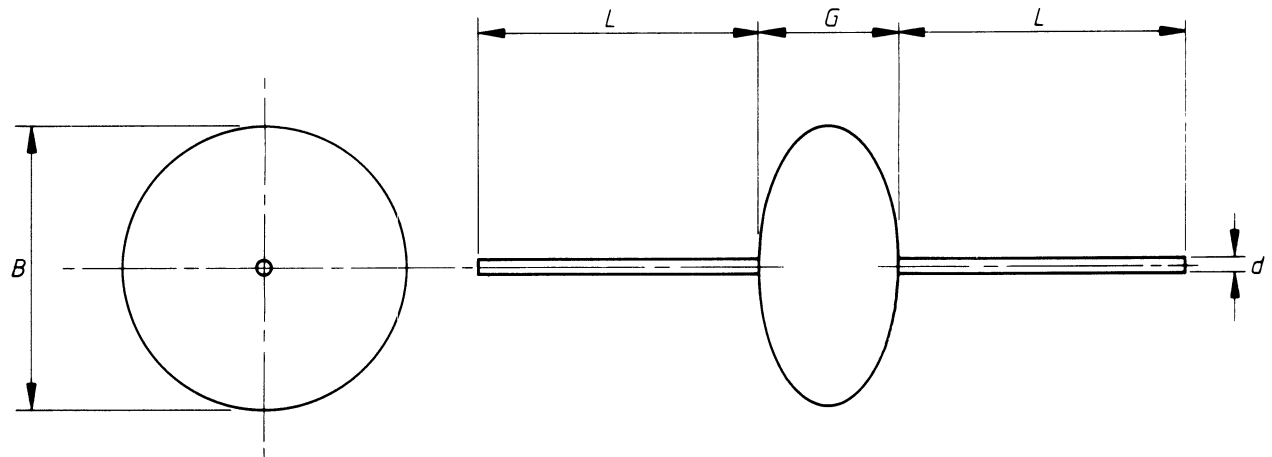
Parameter	Symbol	Code	Limits
Diameter	D	3	max.
Seated height	A	51	max.
Lead length	L	5	min.
Lead diameter	d	6	max.
Lead separation	X	24	nom.
Lead offset	Y	25	nom.
For full details; refer to the relevant detail specification.			

CT Cylindrical package, stud mounting
Third angle projection



All dimensions are in millimetres.
 All angles are in degrees.

Parameter	Symbol	Code	Limits
Diameter	<i>D</i>	3	max.
Overall length	<i>H</i>	20	max.
Stud diameter	<i>M</i>	34	max.
Stud length	<i>N</i>	35	min.
For full details, refer to the relevant detail specification.			

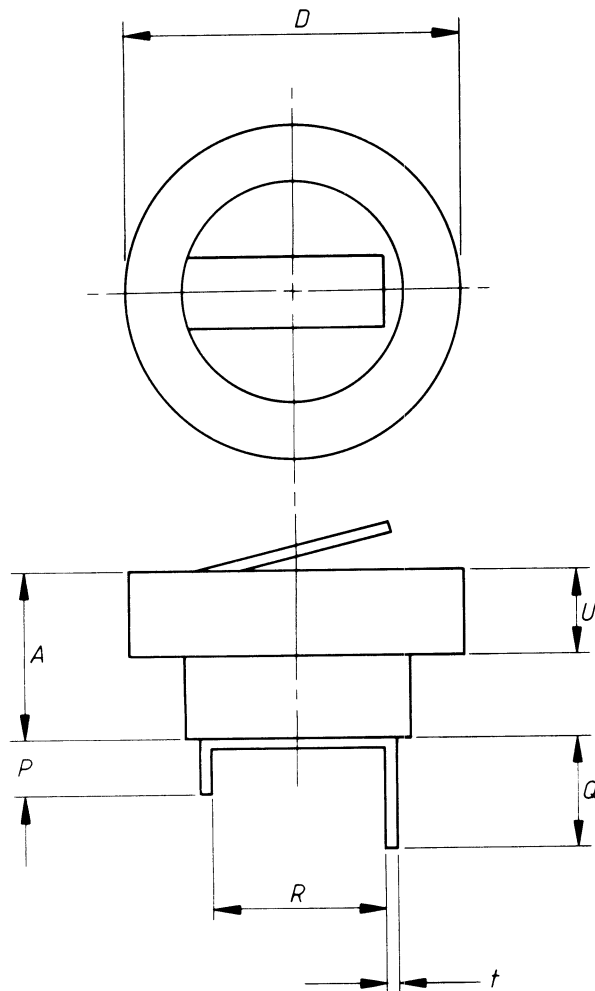
DA Disc package, two axial leads**Third angle projection**

All dimensions are in millimetres.

All angles are in degrees.

Parameter	Symbol	Code	Limits
Body diameter	B	33	max.
Length	G	47	max.
Lead length	L	5	min.
Lead diameter	d	6	max.
For full details, refer to the relevant detail specification.			

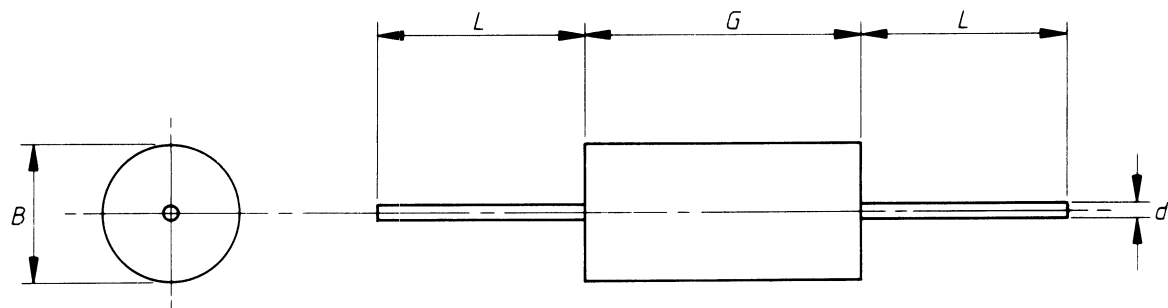
DD Disc package, double tag
Third angle projection



All dimensions are in millimetres.

All angles are in degrees.

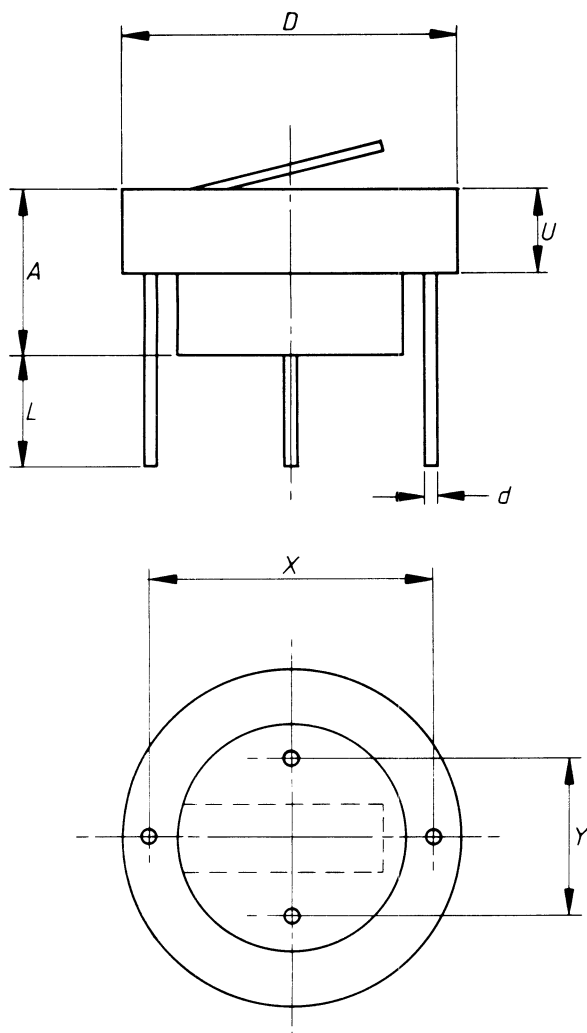
Parameter	Symbol	Code	Limits
Diameter	<i>D</i>	3	max.
Seated height	<i>A</i>	51	max.
Dimension	<i>U</i>	10	max.
Dimension	<i>P</i>	42	max.
Dimension	<i>Q</i>	62	max.
Dimension	<i>R</i>	65	max. (Tag spacing)
Tag thickness	<i>t</i>	39	nom.
For full details, refer to the relevant detail specification.			

TA Tubular package, two axial leads**Third angle projection**

All dimensions are in millimetres.

All angles are in degrees.

Parameter	Symbol	Code	Limits
Length	G	47	max.
Body diameter	B	33	max.
Lead length	L	5	min.
Lead diameter	d	6	max.
For full details, refer to the relevant detail specification.			

DP Disc package, PCB mounting**Third angle projection**

All dimensions are in millimetres.

All angles are in degrees.

Parameter	Symbol	Code	Limits
Diameter	D	3	max.
Seated height	A	51	max.
Dimension	U	10	max.
Lead length	L	5	min.
Lead diameter	d	6	max.
Lead pitch	X	11	nom.
Lead pitch	Y	12	nom.
For full details, refer to the relevant detail specification.			