INTERNATIONAL STANDARD

IEC 60191-6-3

First edition
2000-09

Mechanical standardization of semiconductor devices –

Part 6-3: General rules for the preparation of outline drawings of surface mounted semiconductor device packages – Measuring methods for package dimensions of quad flat packs (QFP)

Normalisation mécanique des dispositifs à semiconducteurs –

Partie 6-3:
Règles générales pour la préparation des dessins d'encombrement des dispositifs à semiconducteurs à montage en surface – Méthodes de mesure pour les boîtiers plats quadrangulaires (QFP)

Reference number
IEC 60191-6-3:2000(E)

Numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series.

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MECHANICAL STANDARDIZATION OF SEMICONDUCTOR DEVICES –

Part 6-3: General rules for the preparation of outline drawings of surface mounted semiconductor device packages – Measuring methods for package dimensions of quad flat packs (QFP)

FOREWORD

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International Standard IEC 60191-6-3 has been prepared by subcommittee 47D: Mechanical standardization of semiconductor devices, of IEC technical committee 47: Semiconductor devices.

The text of this standard is based on the following documents:

FDIS	Report on voting
47D/370/FDIS	47D/388/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

The committee has decided that the contents of this publication will remain unchanged until 2003. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

MECHANICAL STANDARDIZATION OF SEMICONDUCTOR DEVICES –

Part 6-3: General rules for the preparation of outline drawings of surface mounted semiconductor device packages – Measuring methods for package dimensions of quad flat packs (QFP)

1 Scope

This part of IEC 60191 stipulates a method for quad flat packs (QFP) measuring dimensions which are classified into Form E.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60191. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of IEC 60191 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60191-6:1990, *Mechanical standardization of semiconductor devices – Part 6: General rules for the preparation of outline drawings of surface mounted semiconductor device packages*

3 Definitions

For the purpose of this part of IEC 60191, the definitions of IEC 60191-6 apply.

4 Measuring methods

4.1 The measuring methods described in this standard are for dimension values guaranteed to users on the basis of the following items.

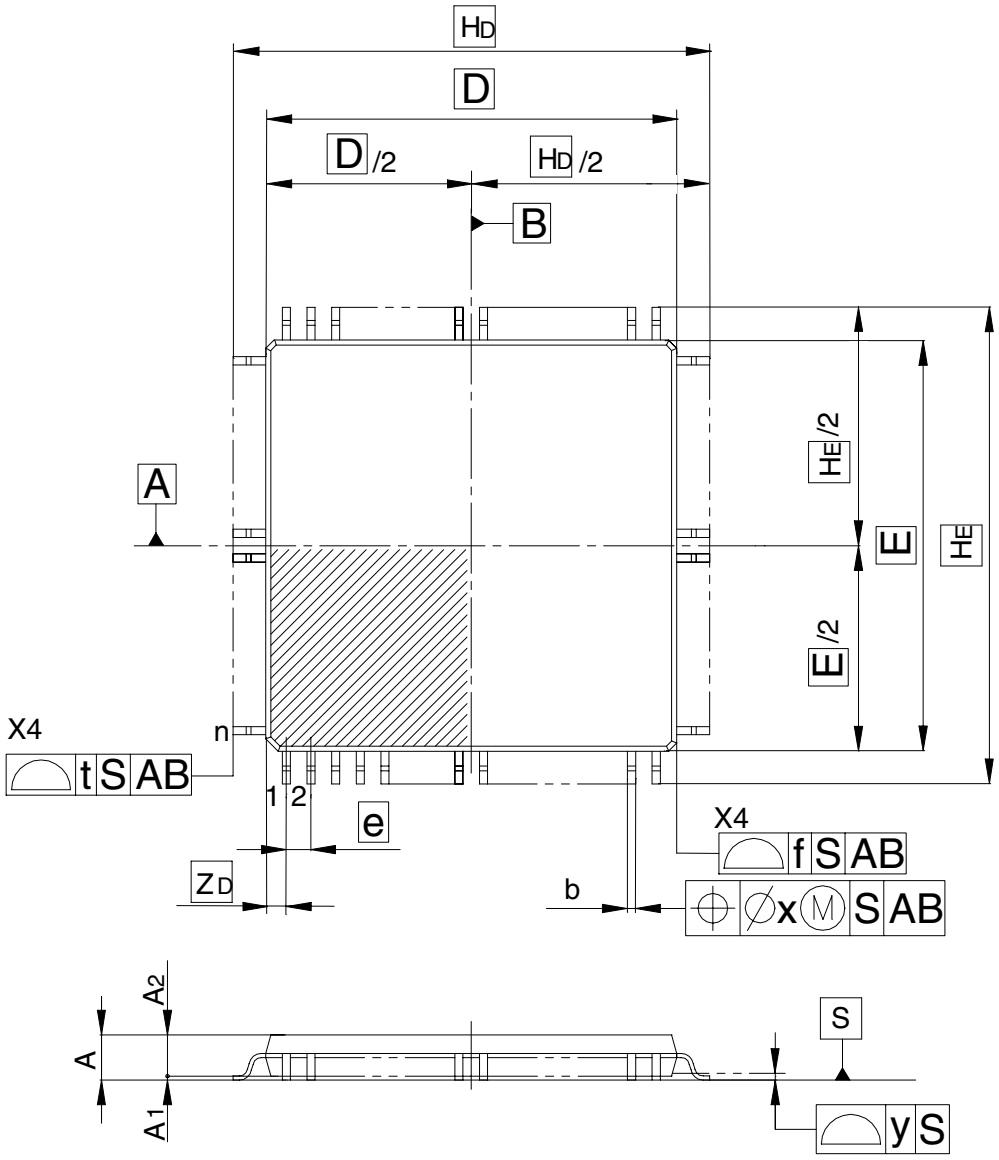
a) In general, measuring the dimensions shall be made with the semiconductor packages mounted on printed circuit-board as the guarantee is made to user.

b) In general, measurement may be made either by hand or automatically.

c) If a specified dimension is difficult to measure, the best alternative measuring method is defined as the formal measuring method.

d) The dimensions that cannot be measured unless the package is destroyed may be calculated from other dimensions or replaced by representative values.

4.2 Reference characters and drawing



IEC 1671/2000

Figure 1

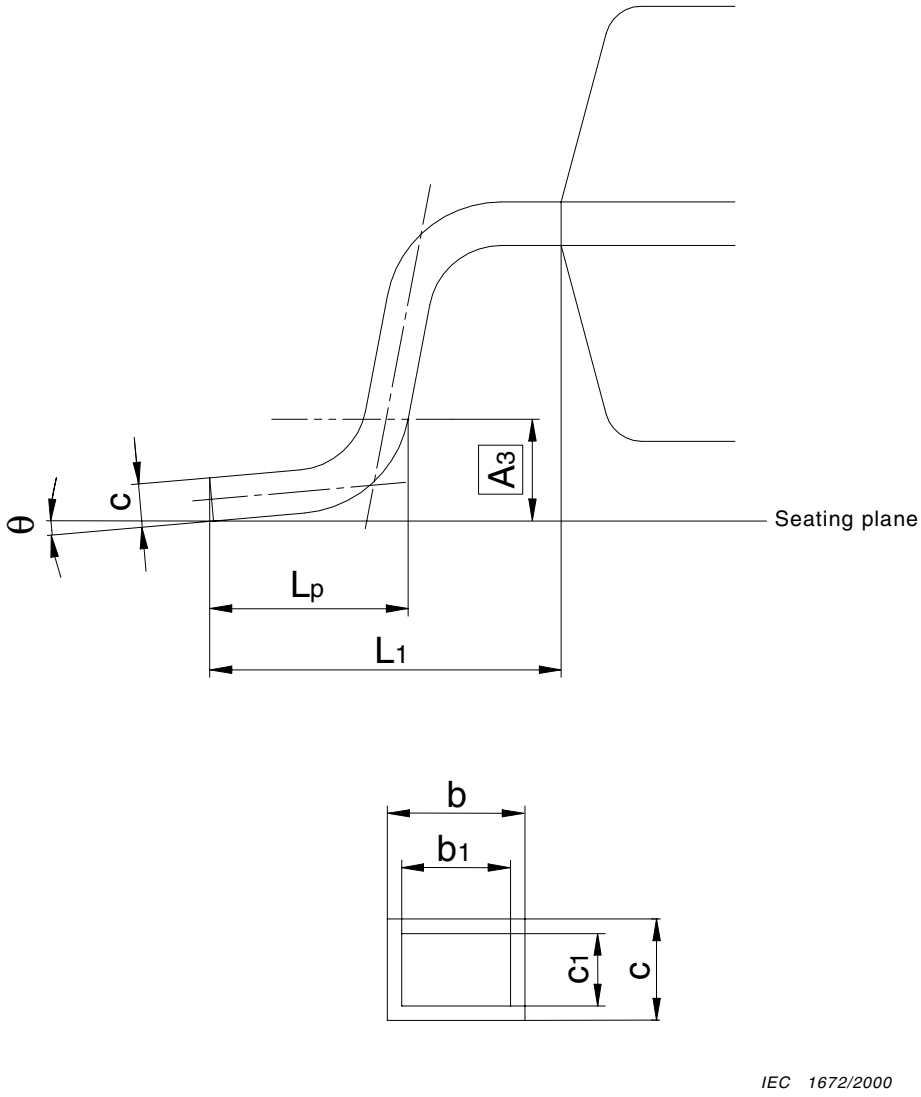


Figure 2

4.3 Datum

The datum shall be defined as follows.

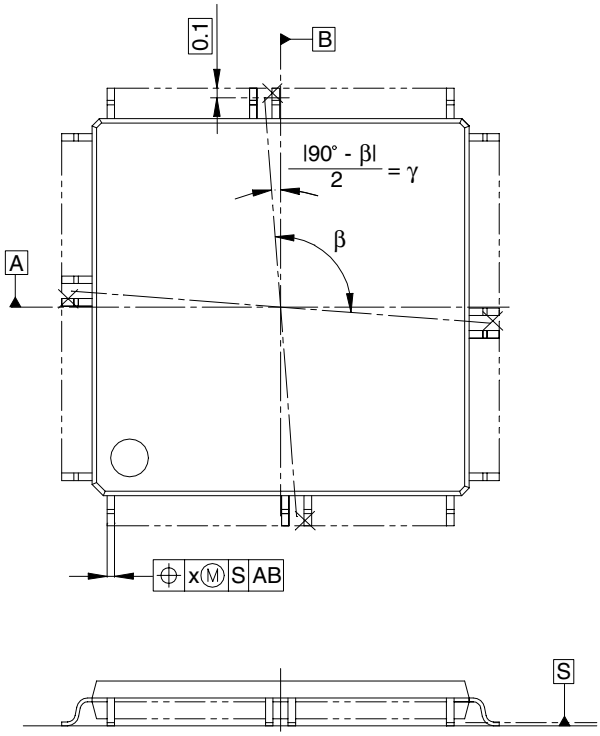


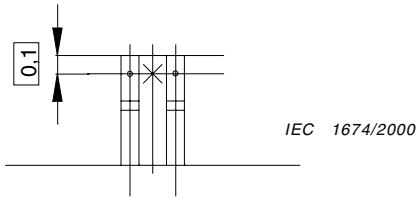
Figure 3

Centres of opposite sides of a package, which are defined below, shall be connected together. An angle β subtended by the two crossing lines shall be obtained.

A difference |90° - β| of the angle β from 90° shall be equally distributed to the sides to obtain rectangular axes. The rectangular axes are depicted as datum lines A and B of the package.

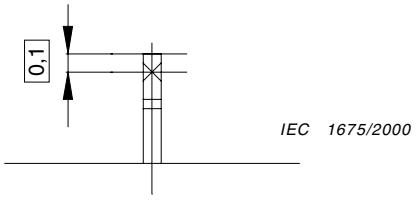
Description of the centres of sides

Even number of leads on a package side



A centre of facing sides of adjacent leads at a position 0,1 mm inside the top of the leads

Odd number of leads on a package side



The centre of leads at a position 0,1 mm inside the top of the leads

Figure 4

4.4 Overall width HE / overall length HD / Package width D / package length E

4.4.1 Description

a) As to the overall width and overall length, all lead tops should be located within the range t centring on the position which is at a theoretically correct distance of HE/2 or HD/2 from the datum A or B.

b) As to the package width and length, the package end-face should be located within the range f centring on the position which is at a theoretically correct distance of E/2 or D/2 from the datum A or B.

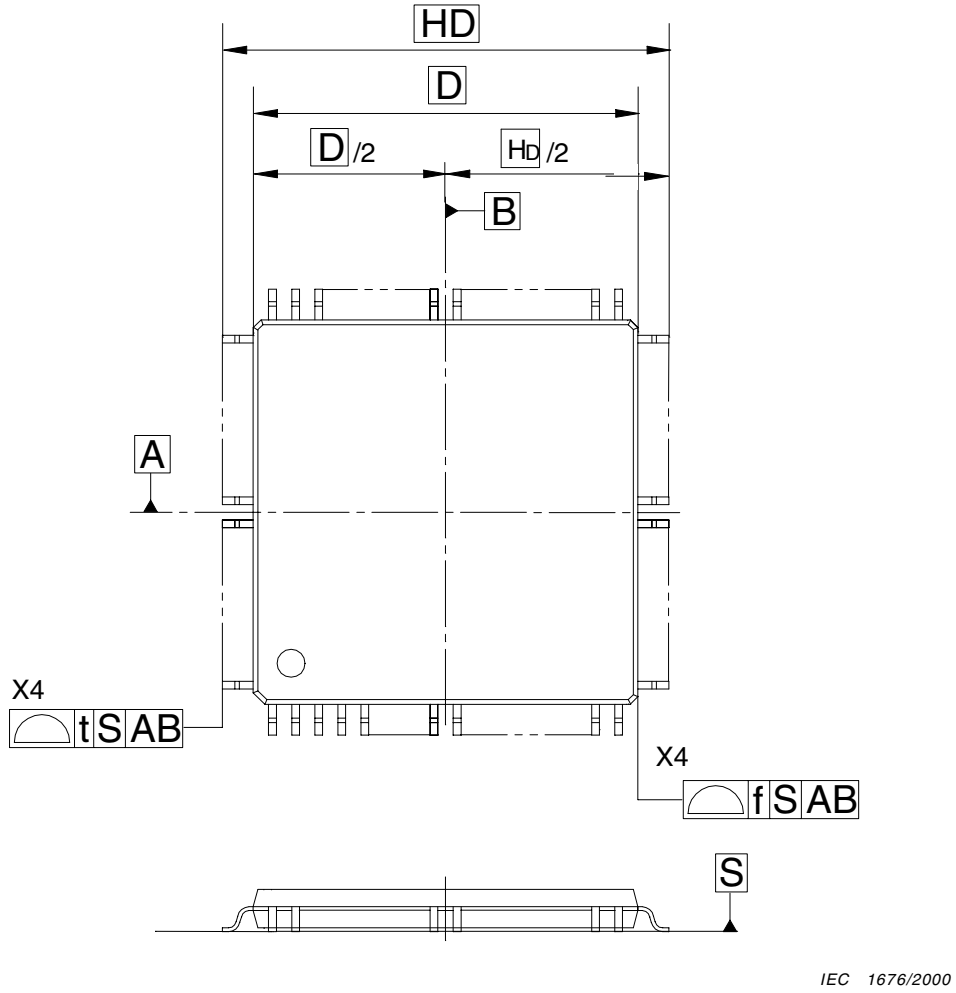


Figure 5

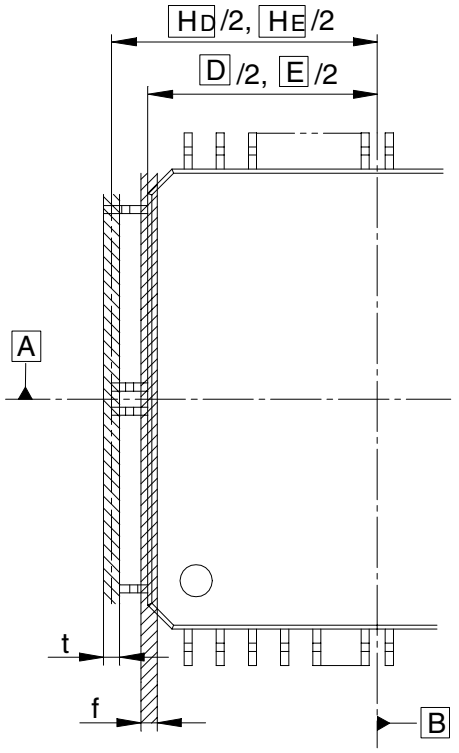


Figure 6

4.4.2 Measuring method

a) HE/HD

1) Put the package on the surface plate to establish the datum reference S.
2) Make the datum A and B coincide with the measuring reference.
3) Find the logically precise distances HD/2 and HE/2 from the datum A and B.

   Then check if the tip of every lead on each package side is within the tolerance t (range) specified as the centre.

b) E/D

1) Put the package on the surface plate to establish the datum reference S.
2) Make the datum A and B coincide with the measuring reference.
3) Find the theoretically precise distances D/2 and E/2 from the datum A and B.

   Then check if the package edge on each package side is within the tolerance f (range) specified as the centre.

4.5 Mounting height *A*

4.5.1 Description

Let the height of a package from the seating plane to the top of the package be denoted as the mounting height. The mounting height therefore includes inclination and warping of the package.

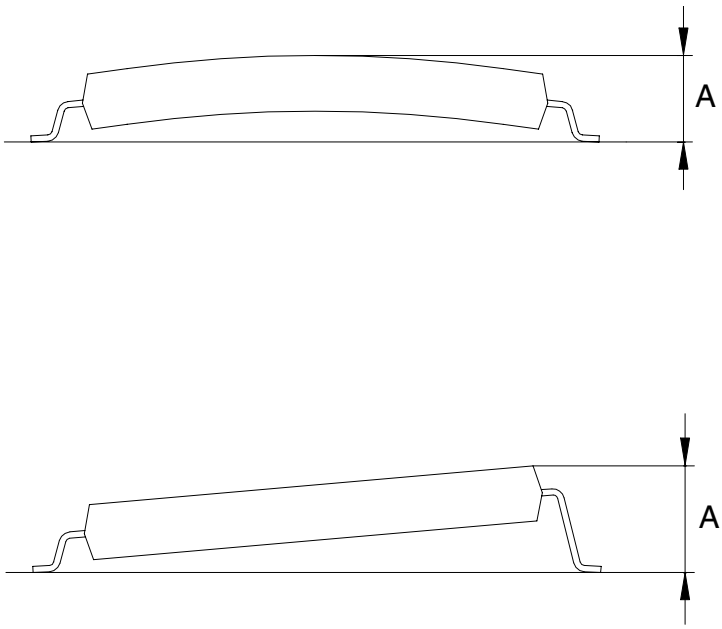


Figure 7

4.5.2 Measuring method

a) Put the package on the surface plate to establish the seating plane. From the side or the top, measure the distance to a highest point.

b) Let the distance be denoted as the mounting height.

4.6 Stand-off *A*1

4.6.1 Description

Let a distance from the seating plane to the lowest point of a package be **denoted as the stand-off**.

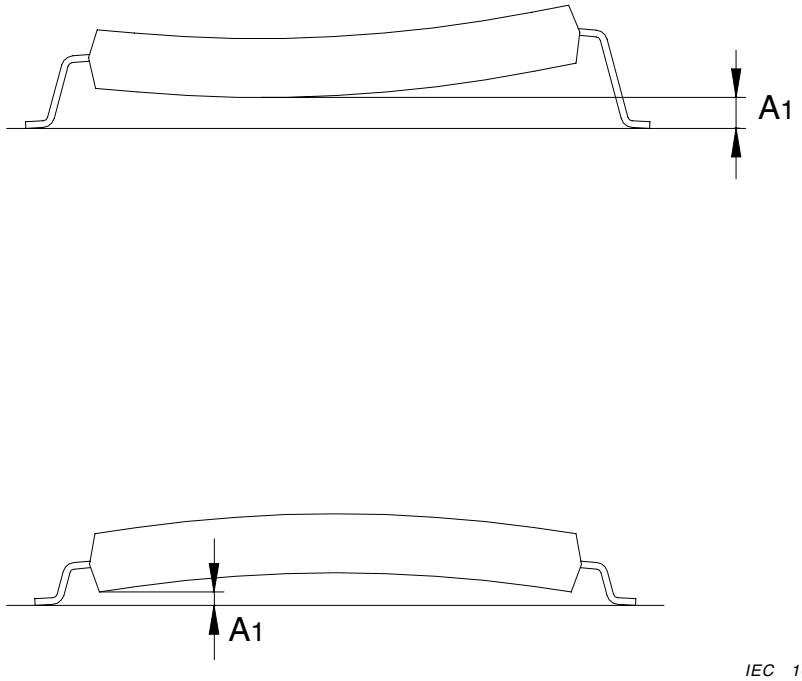


Figure 8

4.6.2 Measuring method

a) Put the package on the surface plate to establish the reference surface (seating plane).

b) Measure a distance from the reference surface to the lowest point of the package.

4.7 Body thickness *A*2

4.7.1 Description

The body thickness is defined as a distance between two parallel planes, tangent to the highest and lowest points of the body.

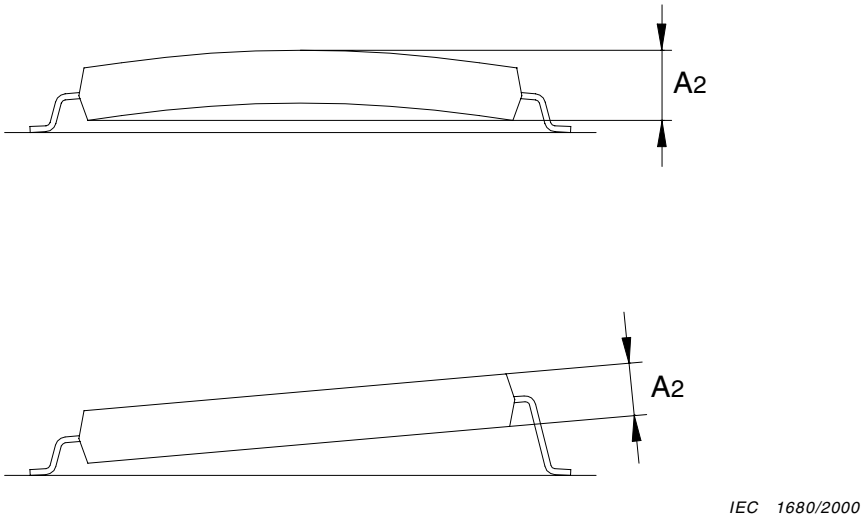


Figure 9

4.7.2 Measuring method

a) Put the package which is accurately dimensioned between surface plates which are larger than the package vertically in parallel. Never touch the leads.

b) Measure the total thickness including the surface plates with a micrometer and subtract the thickness of surface plates from the total thickness so as to obtain the thickness of the package.

4.8 Lead widths b and b1, lead thickness c and c1

4.8.1 Description

The outmost width and outmost thickness in a range of 0,1 to 0,25 mm from the tip of the stable shape of the lead having little burrs and crushing shall be defined as the lead width and lead thickness. The lead width and lead thickness, as shown in the right-hand figure, include burrs, crushing, and sagging.

In this case, the outmost width and outmost thickness after surface plating shall be defined as b and c, and the outmost width and outmost thickness plating shall be defined as b1 and c1 respectively.

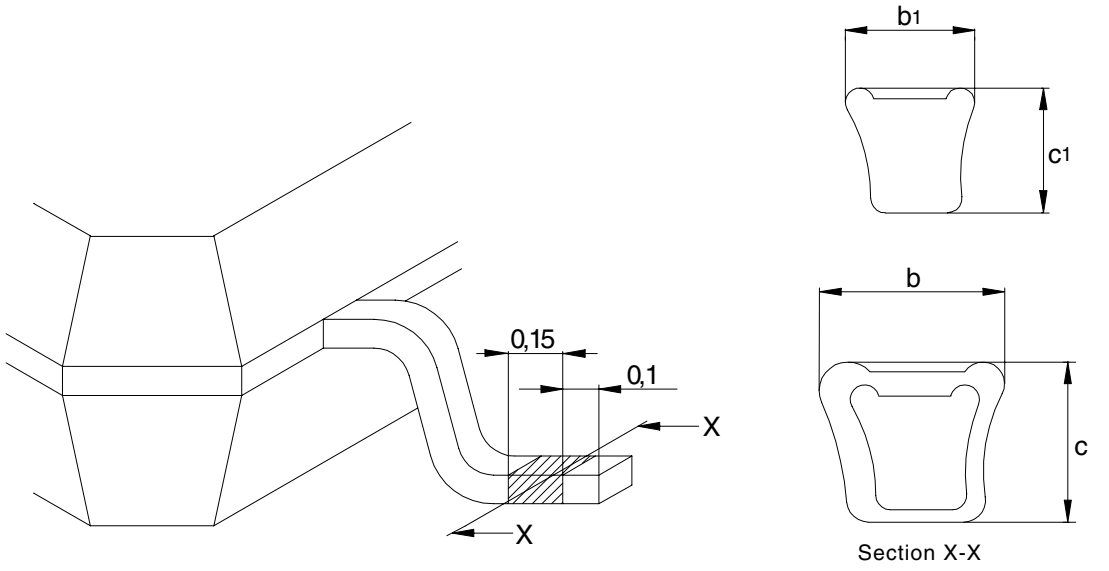


Figure 10

4.8.2 Measuring method

a) Lead widths b and b1
   1) Put the package on the surface plate.
   2) Make the lead centre intersect perpendicularly to the measuring reference.
   3) Measure the lead width (shown above) from the upper surface.

b) Lead thickness c and c1
   1) Put the package on the surface plate.
   2) Measure the lead thickness (shown above) from the side.

   b1 and c1 may be measured before plating.

4.8.3 Remarks

a) b1 and c1 may be measured before the lead is processed. If this occurs, after processing, measure b1 and c1 at the position within the above range.

b) The lead thickness may be measured at eight points on the four corners of the package as representative values.

4.9 Soldered portion length Lp

4.9.1 Description

The distance in a mounting direction from a cross-point (a) of a plane A_3 from, and in parallel with, the seating plane with an inside surface of a descending portion of the lead to a tip (b) of the lead.

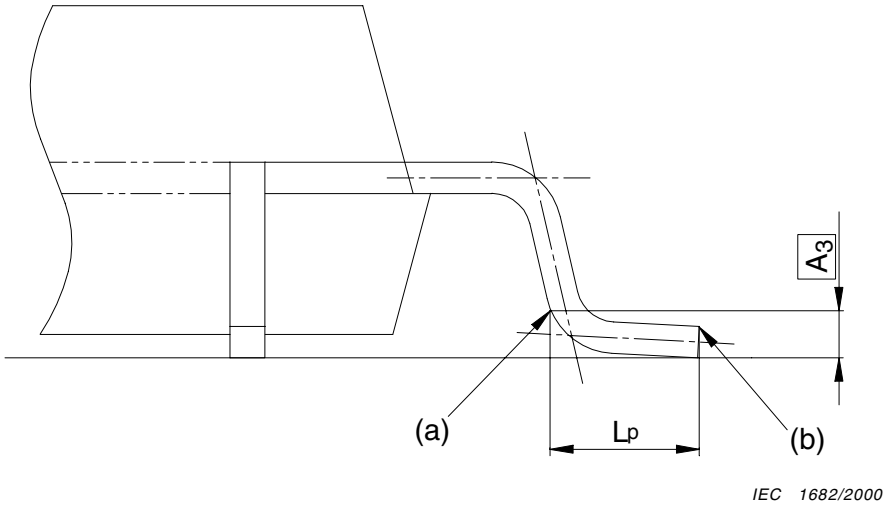


Figure 11

4.9.2 Measuring method

a) Put the package on the surface plate to establish the datum reference S (seating plane).

b) Make the datum parallel with the measuring reference.

c) Observe the lead toward the package side (in the seating plane direction).
Measure positions of points (a) and (b) in the seating plane direction.

4.9.3 Remarks

As this measuring method can be done from the side, the values of the leads observable from the side are allowed as representative values.

4.10 Positional tolerance of terminal tips

4.10.1 Description

a) Obtain positions of tips of leads at points of 0,1 mm inside the tips.
b) Obtain differences from the theoretical positions.
c) The differences are defined as the positional tolerance of terminal tips.
d) The positional tolerance depends on the terminal width.
e) The positional tolerance value = (b max. – b nom. + x) /2

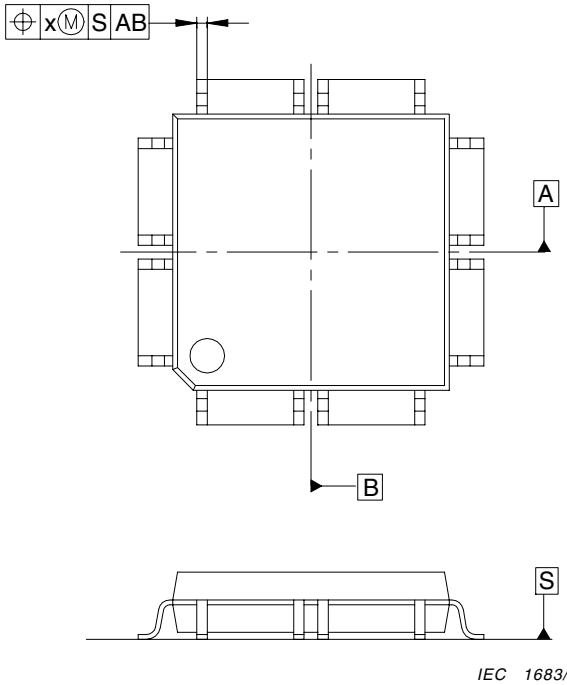


Figure 12

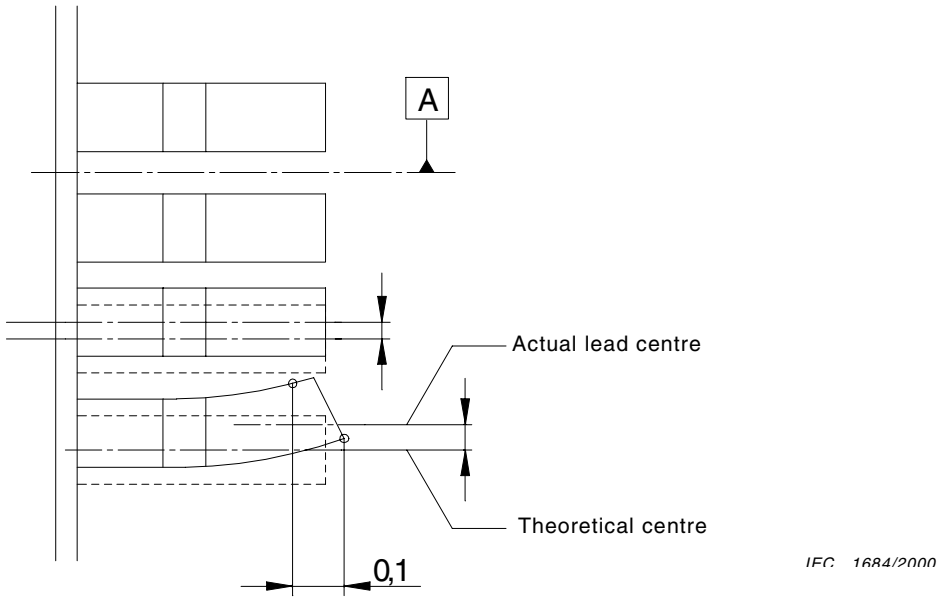


Figure 13

4.10.2 Measuring method

a) Put the package on the seating plane (surface plate or virtual plane).

b) Make the datum parallel with the measuring reference.

c) Obtain positions of ends of leads at points of 0,1 mm inside the tips.

d) Obtain differences from the theoretical centres of the leads.

e) Check the differences within positional tolerance.

NOTE Positional tolerance depends on the terminal width.

4.11 Coplanarity *y*

4.11.1 Description

The vertical distance from the seating plane to the lowest point of each lead shall be referred to as the coplanarity of the lowest surface of lead. The distance up to the lowest point of the lead farthest from the virtual plane shall be defined as y. The seating plane is simulated by a virtual plane.

Description of a virtual plane

Of the geometrical planes that pass the lowest points of three given leads, the plane on which the lowest points of all the other leads exist on the package body side shall be referred to as a virtual plane. In this case, however, the centre of the package gravity must exist inside the triangle formed with the three points or on one side of the triangle.

If there are plural combinations that satisfy the above conditions, a combination shall be adopted so that a larger y value may be obtained.

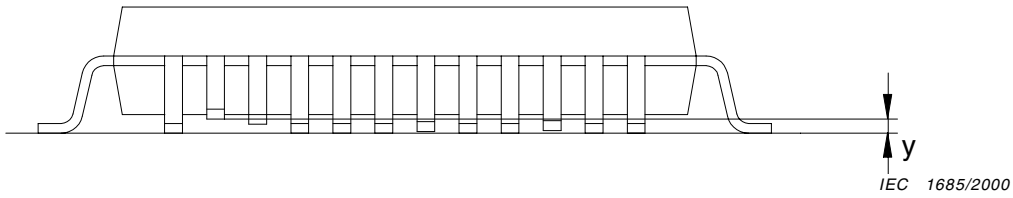


Figure 14

4.11.2 Measuring method

a) Calculate the virtual plate.

b) Observe the lowest surfaces of all the leads in front toward the sides and measure the distance of the lowest surfaces from the seating plane in a vertical direction.

c) The maximum value of the distances shall be defined as the coplanarity y of the lowest lead surfaces.

4.12 Angle θ of flat portion of lead

4.12.1 Description

An angle of flat portion of a lead of gull-wing type to the seating plane (virtual plane is defined as the angle θ of the flat portion of the lead).

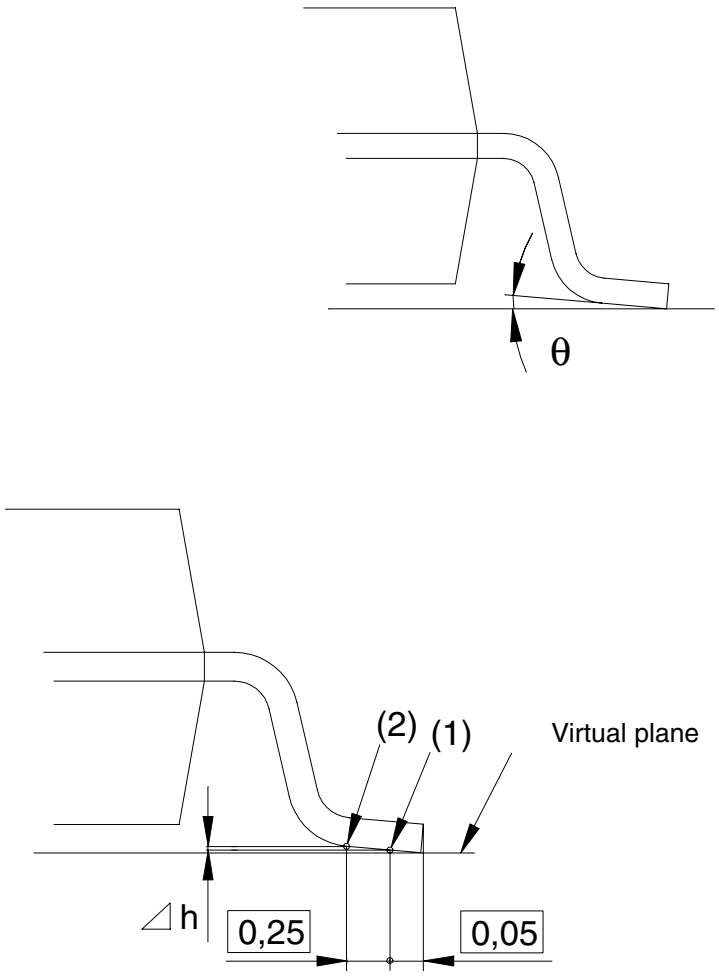


Figure 15

IEC 1686/2000

4.12.2 Measuring method

a) Put the package on the surface plate to establish the reference surface (seating plane).

b) Measure the height at the lowest point (1) of 0.05 mm inside the tip of the lead.

c) Measure the height at point (2) of 0,25 mm inside from the lowest point (1). Measure the difference Δ h.

d) Substitute the value for the following equation. Let the obtained value be denoted as the angle θ of the flat portion of lead.

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ISBN 2-8318-5422-9

ICS 31.080.01

Typeset and printed by the IEC Central Office
GENEVA, SWITZERLAND