BS EN 60191-6-21:2010

BSI Standards Publication

Mechanical standardization of semiconductor devices

Part 6-21: General rules for the preparation of outline drawings of surface mounted semiconductor device packages — Measuring methods for package dimensions of small outline packages (SOP)

National foreword

This British Standard is the UK implementation of EN 60191-6-21:2010. It is identical to IEC 60191-6-21:2010.

The UK participation in its preparation was entrusted to Technical Committee EPL/47, Semiconductors.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Mechanical standardization of semiconductor devices - Part 6-21: General rules for the preparation of outline drawings of surface mounted semiconductor device packages - Measuring methods for package dimensions of small outline packages (SOP)

(IEC 60191-6-21:2010)

Normalisation mécanique des dispositifs à semiconducteurs -
Part 6-21: Règles générales pour la préparation des dessins d'encombrement des boîtiers pour dispositifs à semiconducteurs pour montage en surface -
Méthodes de mesure pour les dimensions des boîtiers de faible encombrement (SOP)
(CEI 60191-6-21:2010)

Mechanische Normung von Halbleiterbauelementen -
Teil 6-21: Allgemeine Regeln für die Erstellung von Gehäusezeichnungen von SMD-Halbleitergehäusen -
Messverfahren für Gehäusemaße von kleinen Gehäusen (SOP)
(IEC 60191-6-21:2010)

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Foreword

The text of document 47D/772/FDIS, future edition 1 of IEC 60191-6-21, prepared by SC 47D, Mechanical standardization for semiconductor devices, of IEC TC 47, Semiconductor devices, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60191-6-21 on 2010-10-01.

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– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2013-10-01

Annex ZA has been added by CENELEC.

Endorsement notice

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Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60191-4	-	Mechanical standardization of semiconductor devices - Part 4: Coding system and classification into forms of package outlines for semiconductor device packages	EN 60191-4	-
IEC 60191-6	-	Mechanical standardization of semiconductor devices - Part 6: General rules for the preparation of outline drawings of surface mounted semiconductor device packages	EN 60191-6	-

MECHANICAL STANDARDIZATION OF SEMICONDUCTOR DEVICES –

Part 6-21: General rules for the preparation of outline drawings of surface mounted semiconductor device packages – Measuring methods for package dimensions of small outline packages (SOP)

1 Scope

This part of IEC 60191 specifies methods to measure package dimensions of small outline packages (SOP), package outline form E in accordance to IEC 60191-4.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60191-4, *Mechanical standardization of semiconductor devices – Part 4: Coding system and classification into forms of package outlines for semiconductor device packages*

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

3 Terms and definitions

For the purposes of this document the terms and definitions given in IEC 60191-6 apply.

4 Measuring methods

4.1 Description of measuring method

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 the user.

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

c) The dimensions that cannot be measured unless the package is destroyed may be calculated from other dimensions or replaced by representative values. See 4.6.2.3.

4.2 Reference characters and drawing

Thin small outline package TSOP (1)

An outline drawing is given in Figure 1.

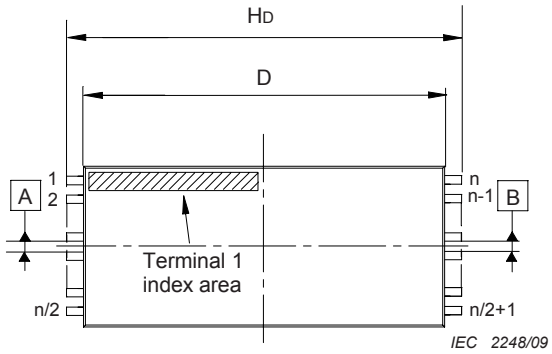

Figure 1a – Top view

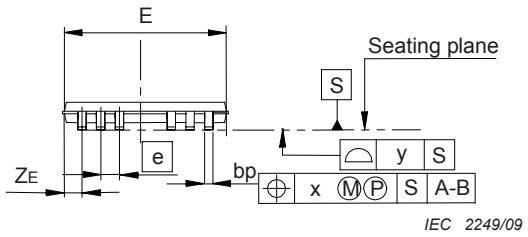

Figure 1b – Side view

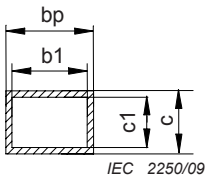

Figure 1c – Lead section

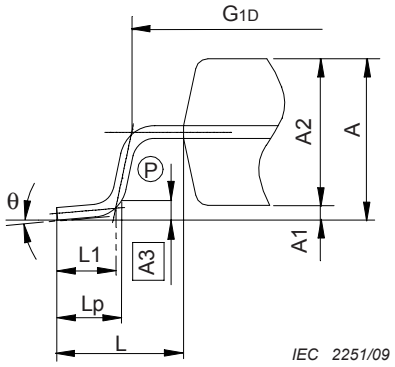

Figure 1d – Lead side view

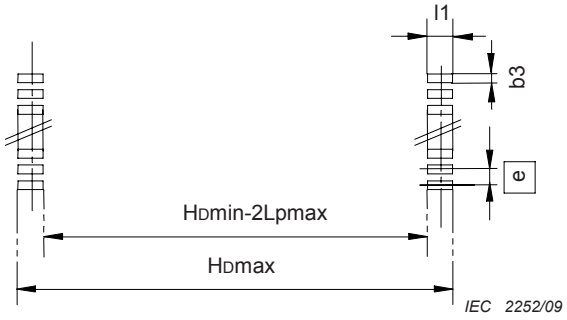

Figure 1e – Pattern of terminal position areas

Figure 1 – TSOP(1) outline drawings

Shrink small outline package SSOP, TSOP(2)

An outline drawing is given in Figure 2.

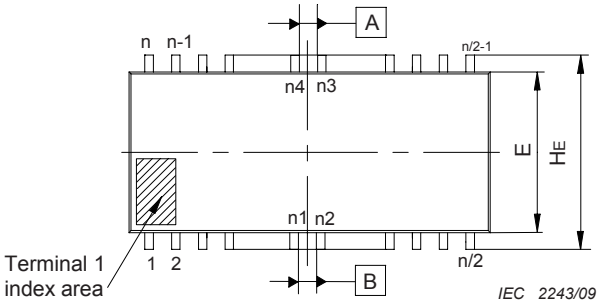

Figure 2a – Top view

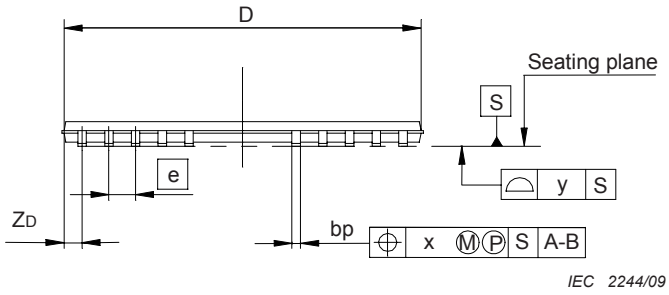

Figure 2b – Side view

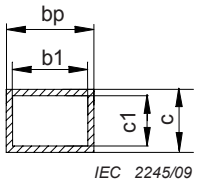

Figure 2c – Lead section

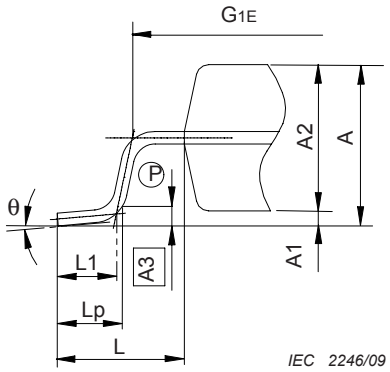

Figure 2d – Lead side view

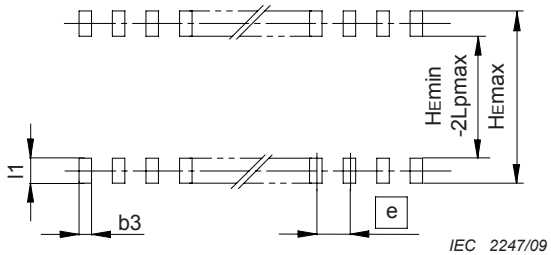

Figure 2e – Pattern of terminal position areas

Figure 2 – SSOP, TSOP(2) outline drawings

4.3 Mounting height A

4.3.1 Description

Let the height of a package from the seating plane to the top of the package be denoted as the mounting height. See Figure 3.

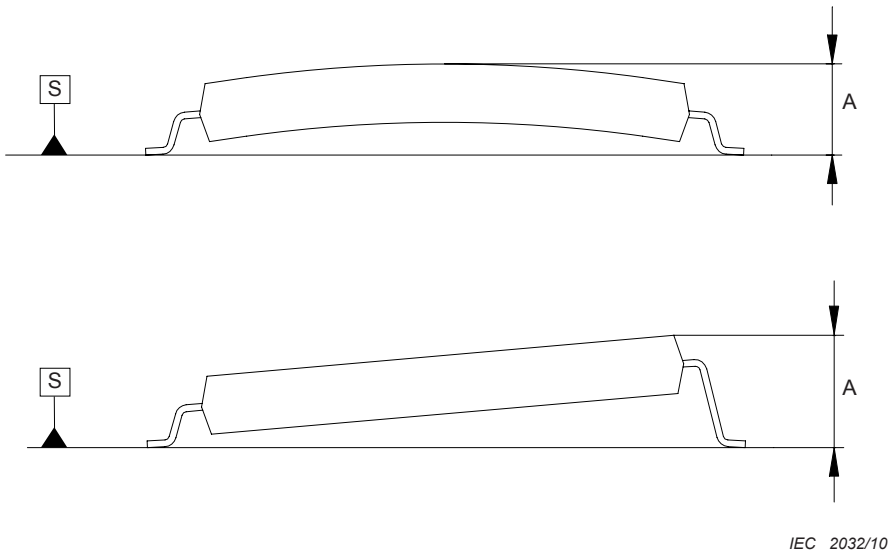

Figure 3 – Mounting height

4.3.2 Measuring method

The measuring method shall be as follows.

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

b) From the side or top, measure the distance to a highest point. Let the distance be denoted as the mounting height A.

4.4 Stand-off A1

4.4.1 Description

Let a distance from the seating plane to the lowest point of a package be denoted as the stand-off. See Figure 4.

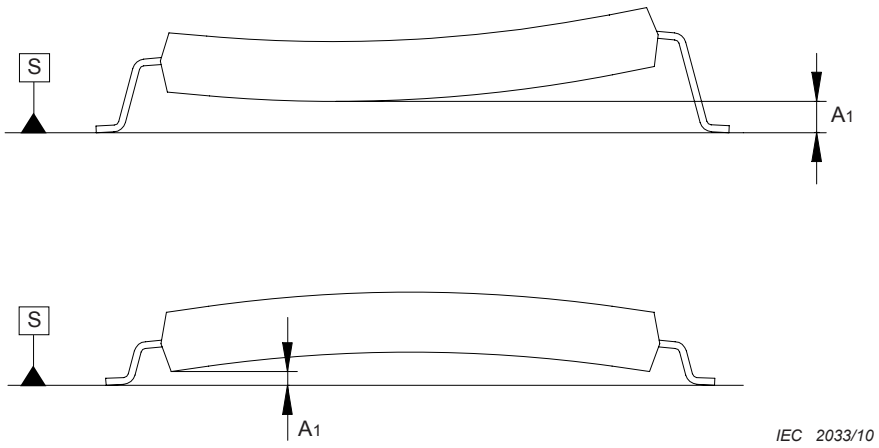

Figure 4 – Stand-off

4.4.2 Measuring method

The measuring method shall be as follows.

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

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

4.5 Body thickness A2

4.5.1 Description

The body thickness is defined as a distance between planes, parallel to the reference surface, tangent to the highest and lowest points of the body. See Figure 5.

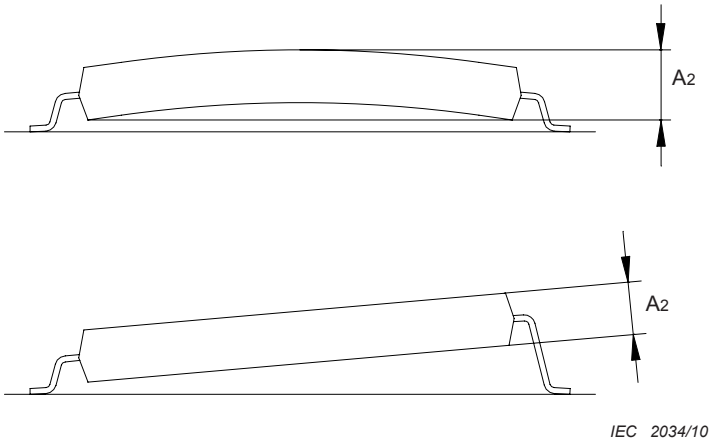

Figure 5 – Body thickness A2

4.5.2 Measuring method

The measuring method shall be as follows.

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 package.

4.6 Lead widths bp and b1, lead thickness c and c1

4.6.1 Description

The outmost width and outmost thickness in a range of 0,1 mm 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 are as shown on the right part of Figure 6.

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

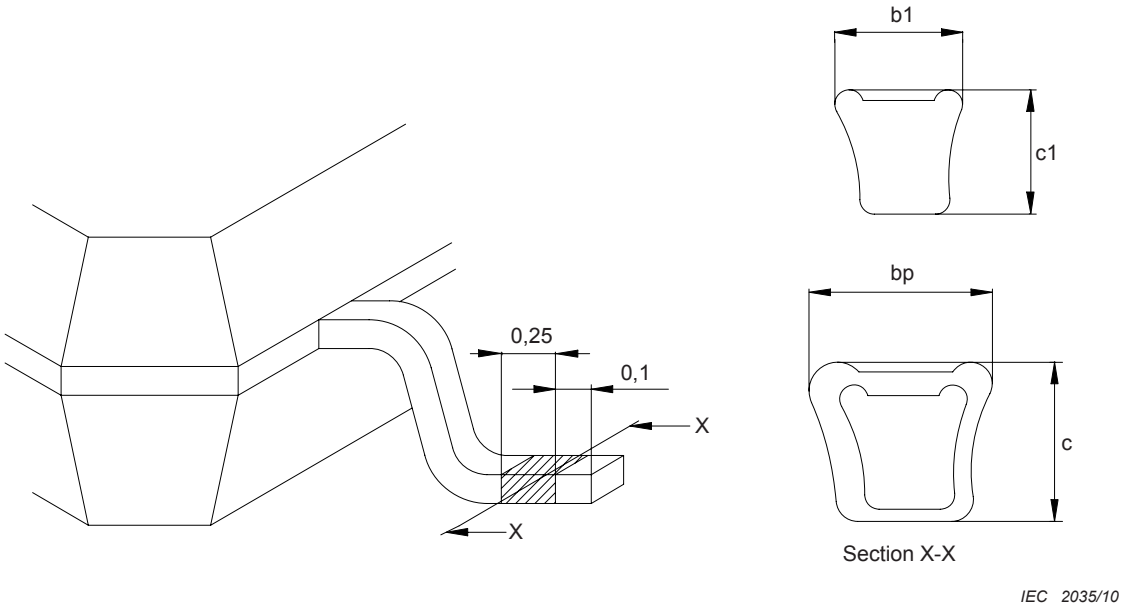

Figure 6 – Lead widths bp and b1, lead thickness c and c1

4.6.2 Measuring method

4.6.2.1 Lead widths bp and b1

a) Put the package on the surface plate.

b) Make the lead centre intersect perpendicularly to the measuring reference.

c) Measure the lead width from the upper surface, as shown in Figure 6.

4.6.2.2 Lead thickness c and c1

a) Put the package on the surface plate.

b) Measure the lead thickness from the side **b1**, and **c1** may be measured before plating, as shown in Figure 6.

4.6.2.3 Remarks

Remarks are as follows.

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 8 points on the four corners of the package as representative values.

4.7 Soldered portion length Lp

4.7.1 Description

The distance in a mounting direction from a cross point (a) of a plane A3 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. See Figure 7.

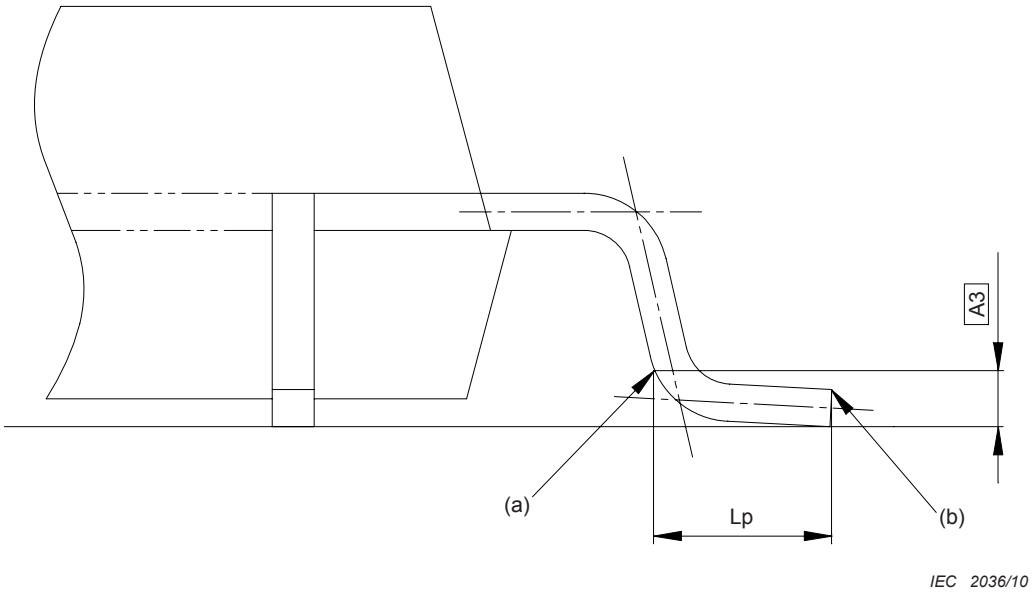

Figure 7 – Soldered portion length Lp

4.7.2 Measuring method

The measuring method shall be as follows.

a) Put the package on the surface plate.

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) as the soldered portion length.

4.7.3 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.

4.8 Positional tolerance of terminal tips

4.8.1 Description

Let **S**, **A**, and **B** denote datum as shown in the above figures. Obtain positions of tips of leads at the points of 0,1 mm inside from the tips. Obtain differences from the theoretical positions. Acceptable differences are defined as the tolerance at centre positions of terminal tips. See Figures 8, 9 and 10.

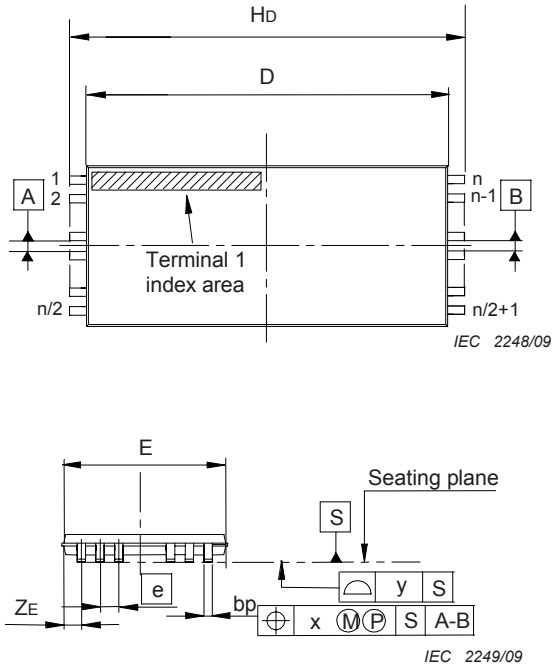

Figure 8 – TSOP(1) lead positional tolerance

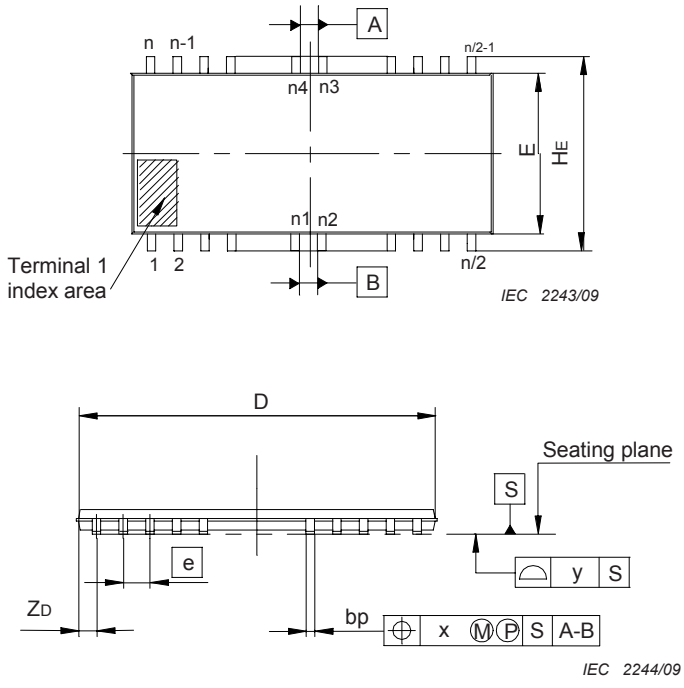

Figure 9 – SSOP and TSOP(2) lead positional tolerance

4.8.2 Measuring method

The measuring method shall be as follows.

a) Put the package on the surface plate.

b) Make the datum parallel with the measuring reference.

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

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

e) Check the differences within the tolerance of lead centre position.

f) The tolerance depends on the terminal width which is given as $\Delta x < (b_{max} - b + x) / 2$

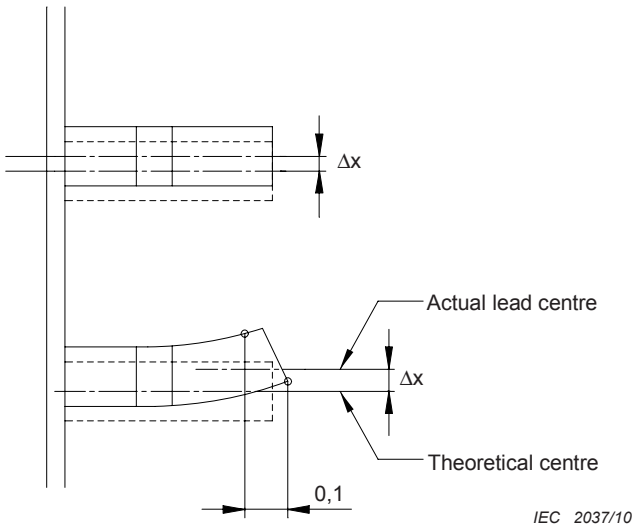

Figure 10 – Positional tolerance of terminals

4.9 Coplanarity y of lowest surfaces of leads

4.9.1 Description

The vertical distance from the seating plane to the lowest point of each lead shall be referred to as coplanarity of the lowest surfaces of the leads. The distance up to the lowest point of the lead furthest from the seating plane shall be defined as *y*. See Figure 11.

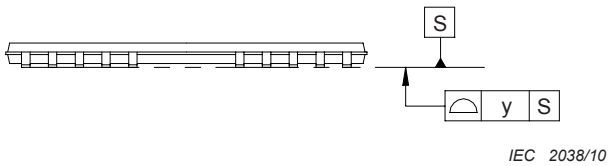

Figure 11 – Coplanarity

4.9.2 Measuring method

The measuring method shall be as follows.

a) Put the package on the surface plate.

b) Observe the lowest surfaces of all the leads from the front side of the leads to measure the vertical distances from the surface plate to the lowest surfaces.

c) The maximum value of the distances shall be defined as the coplanarity *y*.

d) Coplanarity may change because of the seesaw phenomenon. In the case of the seesaw, the larger *y* data shall be adopted. To avoid the seesaw's case, the virtual plane method can be the measuring method.

4.9.3 Additional measuring method (virtual plane method)

4.9.3.1 Description of virtual plane

Of the geometrical planes that pass the lowest points of the given 3 leads, the plane on which the lowest points of all the leads exist on the package body side shall be referred to as the virtual plane. In this case, however, the center of the package gravity must exist inside of the triangle formed with the 3 points or on one side of the triangle.

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

4.9.3.2 Measuring method with virtual plane

a) Obtain virtual plane.

b) Measure the vertical distances from the virtual plane to the lowest surfaces of the terminal tips.

c) The maximum value of the distances shall be defined as the coplanarity *y*.

4.10 Angle θ of flat portion of lead

4.10.1 Description

The angle of the flat portion of the lead of gull wing type to the seating plane is defined as the angle θ of the flat portion of the lead. See Figures 12 and 13.

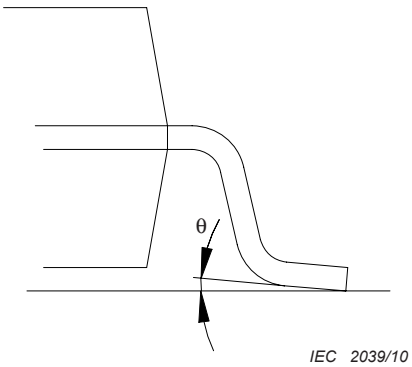

Figure 12 – Angle θ of flat portion of lead

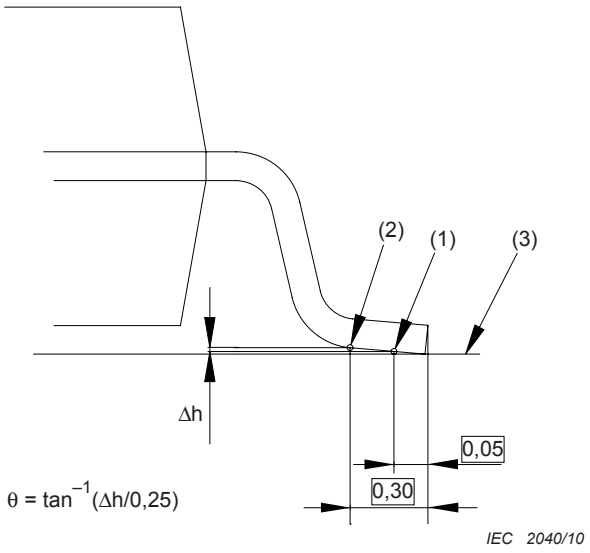

Figure 13 – θ measuring points

4.10.2 Measuring method

The measuring method shall be as follows.

a) Put the package on the surface plate. In Figure13, virtual plane is described as (3).

b) Make the datum parallel with the measuring reference.

c) Measure the height at the lowest point (1) of 0,05 mm inside from the tip of the lead.

d) Measure the height at the lowest point (2) of 0,30 mm inside from the tip of the lead. Calculate the difference Δh.

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

$$\theta = \tan^{-1}(\Delta h / 0{,}25)$$

4.10.3 Additional measuring method (virtual plane method)

Execute the above measuring method on the virtual plane instead of the surface plane.

4.10.4 Remarks

This measuring method can be done only from the side. Therefore, the values of the leads observable from the side are allowed as representative values.

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