

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

**Normalisation mécanique des dispositifs à semi-conducteurs –
Partie 6: Règles générales pour la préparation des dessins d'encombrement des
boîtiers pour dispositifs à semi-conducteurs pour montage en surface**



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CONTENTS

FOREWORD.....	4
1 Scope.....	6
2 Normative references	6
3 Terms and definitions	6
4 Design rules	7
5 Dimensions to be specified	8
6 Notes	8
Annex A (informative) Illustration of the rules.....	12
Annex B (informative) Optional table format.....	36
Bibliography.....	38
Figure A.1 – Illustrations of terminal projection zone.....	13
Figure A.2 – Isometric view of an example of gauge	13
Figure A.3a – Top view	14
Figure A.3b – Side view	14
Figure A.3c – Lead section	14
Figure A.3d – Lead side view.....	14
Figure A.4 – Pattern of terminal position areas.....	14
Figure A.5a – Top view	17
Figure A.5b – Side view	17
Figure A.5c – Lead section	17
Figure A.5d – Lead side view.....	17
Figure A.6 – Pattern of terminal position areas	17
Figure A.7a – Top view	20
Figure A.7b – Side view	20
Figure A.7c – Lead section	20
Figure A.7d – Lead side view.....	20
Figure A.8 – Pattern of terminal position areas	20
Figure A.9a – Top view	23
Figure A.9b – Side view	23
Figure A.9c – Side view	23
Figure A.9d – Lead shape	23
Figure A.9e – Lead side view.....	23
Figure A.9f – Lead section	23
Figure A.10 – Pattern of terminal position areas	23
Figure A.11a – Top view	26
Figure A.11b – Side view	26
Figure A.11c – Side view	26
Figure A.11d – Lead section	27
Figure A.11e – Lead shape	27
Figure A.11f – Lead side view.....	27

Figure A.12 – Pattern of terminal position areas	27
Figure A.13a – Top View.....	30
Figure A.13b – Side View.....	30
Figure A.13c – Bottom view	30
Figure A.14 – Pattern of terminal position areas	30
Figure A.15a – Top view	33
Figure A.15b – Side view	33
Figure A.15c – Bottom view	33
Figure A.16 – Pattern of terminal position areas	33
Table 1 – Dimensions to be specified for Group 1	9
Table 2 – Dimensions to be specified for Group 2	10

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**MECHANICAL STANDARDIZATION
OF SEMICONDUCTOR DEVICES –**
**Part 6: General rules for the preparation of outline drawings
of surface mounted semiconductor device packages**

FOREWORD

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

This third edition of IEC 60191-6 cancels and replaces the second edition, published in 2004 and constitutes a technical revision. This edition includes the following significant changes with respect to the previous edition:

- a) scope is modified to cover all surface-mounted devices discrete semiconductors with lead count of greater or equal to 8;
- b) editorial modifications on several pages; and
- c) technical revision to ball grid array package (BGA) especially its geometrical drawing format. (two types of BGA would unify as one type as a result of revising drawing format.)

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

CDV	Report on voting
47D/736/CDV	47D/749/RVC

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 2.

A list of all parts of IEC 60191 series under the general title *Mechanical standardization of semiconductor devices* can be found on the IEC website.

The committee has decided that the contents of this amendment and the base publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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MECHANICAL STANDARDIZATION OF SEMICONDUCTOR DEVICES –

Part 6: General rules for the preparation of outline drawings of surface mounted semiconductor device packages

1 Scope

This part of IEC 60191 gives general rules for the preparation of outline drawings of surface-mounted semiconductor devices. It supplements IEC 60191-1 and IEC 60191-3. It covers all surface-mounted devices discrete semiconductors with lead count of greater or equal to 8, as well as integrated circuits classified as form E in Clause 3 of 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 60191-1:2007, *Mechanical standardization of semiconductor devices – Part 1: General rules for the preparation of outline drawings of discrete devices*

IEC 60191-4:2002, *Mechanical standardization of semiconductor devices – Part 4: Coding system and classification into forms of package outlines for semiconductor device packages*

ISO 1101:2004 *Geometrical Product Specifications (GPS) – Geometrical tolerancing – Tolerances of form, orientation, location and run-out*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 seating plane

plane which designates the plane of contact of the package, including any stand-off, with the surface on which it will be mounted

NOTE This plane is often used as the reference plane.

3.2 reference plane

plane parallel to the seating plane at a distance A_3 above seating plane (does not apply to leadless package)

NOTE 1 The distance A_3 is known as the reference plane distance. It determines the terminal projection zone (see Figure 1).

NOTE 2 This distance is a theoretical dimension which is not related to any feature of the package. Its value is chosen for each package so 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.

3.3**terminal position area**

maximum area on the seating plane within which the terminal projection zone is located, taking into account the maximum values of L_p and b_p

NOTE 1 The surface of the terminal position area is equal to $l_1 \times b_3$ with, generally

$$l_1 = L_p \text{ max.} + (\text{HDmax.} - \text{HDmin.})/2$$

$$= L_p \text{ max.} + (\text{HEmax.} - \text{HEmin.})/2$$

$$\text{and } b_3 = b_p \text{ max.} + x$$

NOTE 2 Checking can be carried out by means of an appropriate gauge (see Figure 2)

3.4**pattern of terminal position areas**

group of all terminal position areas of a leaded package or folded lead package in the seating plane

NOTE 1 For a leadless package, it is the projection of its metallized pads or terminals on the seating plane.

NOTE 2 The true positions of the centres of the terminal position areas are located on a grid with a modulus

$$\boxed{e} / \boxed{eD} \quad \text{or} \quad \boxed{e} / \boxed{eE}$$

NOTE 3 The pattern of terminal position areas does not include tolerances stemming from mounting substrates (printed board) design and placement machine accuracy.

3.5**coplanarity of terminals**

profile tolerance controlling the location of the crowns of the bottom terminals with respect to the seating plane

NOTE In all the other cases, the requirement for coplanarity of terminals is clarified by a note.

3.6**datum**

geometrical established planes for controlling the tolerance zone

NOTE Datum S should be established by seating plane.

4 Design rules

The outline drawing of a surface-mounted semiconductor device package shall comprise in the given sequence:

- the drawing (strictly speaking);
- the tables of dimensions;
- the notes to the tables and the drawings;
- the codification.

The drawing shall conform with the general rules for drawings laid down in IEC 60191-1, Clause 4 and Clause 5, as well as with the specific definitions of Clause 3 above.

The following, Clause 5 and Clause 6 give, respectively, the tables of dimensions to be specified and the notes to be called, where relevant. Supplementary dimensions and notes may be added when required.

The codification of package outlines shall be in accordance with IEC 60191-4.

5 Dimensions to be specified

Crosses in the Table 1 and Table 2 indicate where values have to be specified. In the auxiliary right-hand column, a code indicates for which outline families each dimension is generally relevant, as follows:

L: leaded packages	packages with gull-wing leads	for example; QFP, SOP, TSOP
F: folded lead packages	packages with J-bent leads	for example; QFJ, SOJ
P: leadless packages	packages with no leads	for example; QFN
B: ball grid array packages	packages with ball leads	for example; BGA

6 Notes

Notes referred to in the tables and in the drawings appear after Table 2; in the auxiliary right-hand column, a code indicates for which outline families each note is generally relevant (with the same code as in Clause 5 above).

For each particular outline package or package family, the applicable notes shall be numbered sequentially from 1 in the order they are in the tables and then on the drawing.

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Table 1 – Dimensions to be specified for Group 1

Group 1 includes dimensions and numerals associated with mounting of packages and kinds of packages. The dimensions and numerals belonging to the group mean values guaranteed to users and imply that mechanical compatibility of mounting of packages can be recognized.

Ref.	Min.	Nom.	Max.	Notes
n	-	x	-	2
nD	-	x	-	3
nE	-	x	-	3
A	-	-	x	
A1	x	-	x	
A2	-	x	-	
A3	-	x(*)	-	4
bp	x	-	x	4
∅bp	x	[x]	x	4
∅b	x	-	x	4
C	x	-	x	
D	x	x	x	4
E	x	x	x	4
e	-	x(*)	-	4
f	-	-	x	
Hd	x	x	x	4
HE	x	x	x	4
h	x	-	x	
k	x	-	x	
k1	x	-	x	
Lp	x	-	x	4
t	-	-	x	
v	-	-	x	
w	-	-	x	
x	-	-	x	
x1	-	-	x	
y	-	-	x	
y1	-	-	x	
θ	x	-	x	

Concerned family

LFPB
LFP
LFP
LFPB
LFB
LF
LF
LFP
B
B
LF
LFPB
LFPB
LFPB
LF
LF
F
P
P
LFP
LF
B
B
LFPB
B
LFPB
B
L

Table 2 – Dimensions to be specified for Group 2

Group 2 includes dimensions that do not belong to Group 1, but are associated with the fabrication of packages and dimensions of terminal position areas. The group is to achieve its own original purpose as an industry standard. The group belongs to the dimensions and numerals of external shapes of packages useful for design and manufacture and the dimensions of terminal position areas that can be referenced to in fabrications of mounting boards. Therefore, external dimensions of a package shall have nominal design values specified thereto.

Ref.	Min.	Nom.	Max.	Notes
b1	-	x	-	
b2	x	-	x	
b3	-	-	[x]	4
c1	-	x	-	
eD	-	x	-	4
eE	-	x	-	4
L	-	x	-	
L1	-	x	-	
L2	-	x	-	
l1	-	x	[x]	4
Sd	-	x	-	
SE	-	x	-	
Zd	-	x	-	
ZE	-	x	-	
G1D	-	x	-	
G1E	-	x	-	
h	-	x	-	

Concerned family

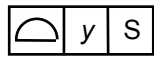
LF
F
LFPB
LF
FP
FP
LF
F
F
LFP
B
B
LFPB
LFPB
L
L
F

Explanation of the symbols and notes to the tables

Explanation of the symbols

(*) means true geometrical position

[] values given within square brackets are calculated values



means in this drawing that the distance from the seating plane to the nearest point of each terminal should not exceed y mm



projected tolerance zone (see ISO 1101, Clause 13)

NOTES

- 1 All dimensions are in millimetres.
- 2 n refers to the total number of terminal positions.
- 3 nD refers to the number of terminal positions on one side of the package in the direction of dimension D .

 nE refers to the number of terminal positions on one side of the package in the direction of dimension E .
- 4 Check of the dimensions and positions of package terminal is validly performed when it is ensured that these terminal fit with the pattern of terminal position areas. This can be carried out by means of an appropriate gauge.

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Annex A (informative)

Illustration of the rules

The above rules are illustrated by examples of application to several package families.

A.1 Structures of the examples

- Gull-wing lead package with two parallel rows of terminals (see Clause A.2);
- gull-wing lead package with two parallel rows of terminals (TSOP Type 2)(see Clause A.3);
- gull-wing lead package with one row of terminals on each of four sides (see Clause A.4);
- J-bend lead package with two parallel rows of terminals (see Clause A.5);
- J-bend lead package with one row of terminals on each of four sides (see Clause A.6);
- leadless package (see Clause A.7);
- ball grid array package (see Clause A.8).

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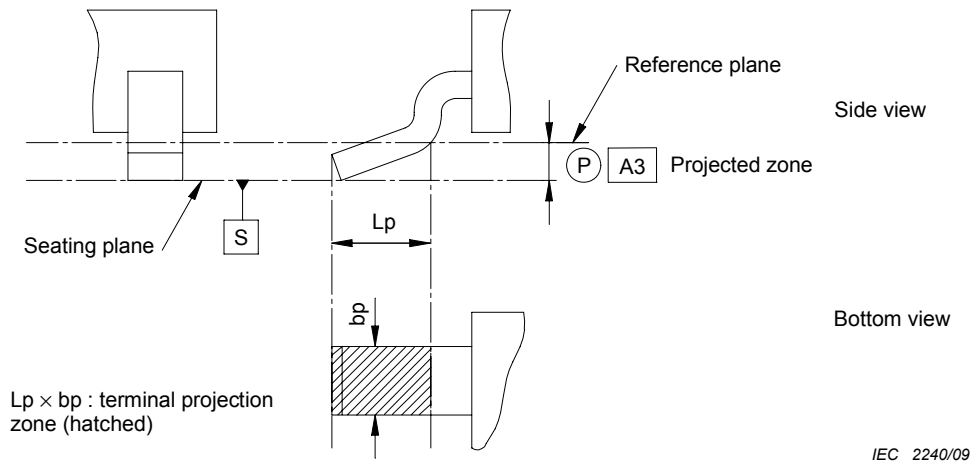


Figure A.1a

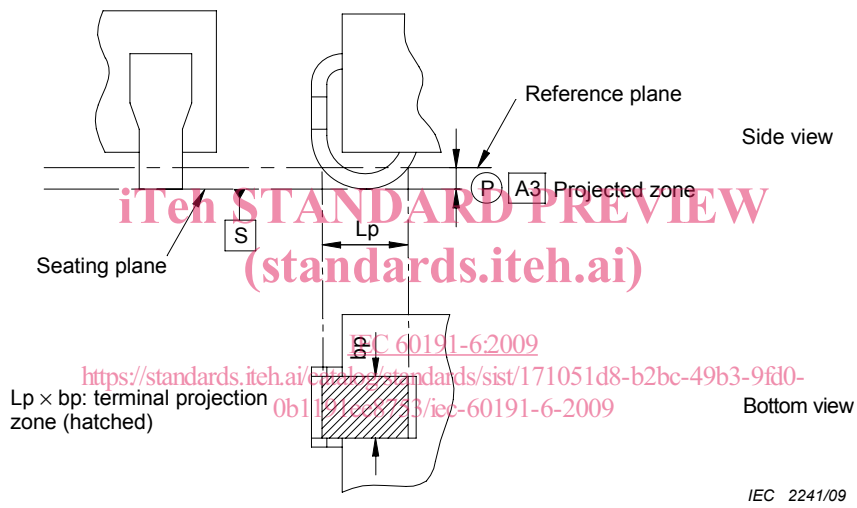
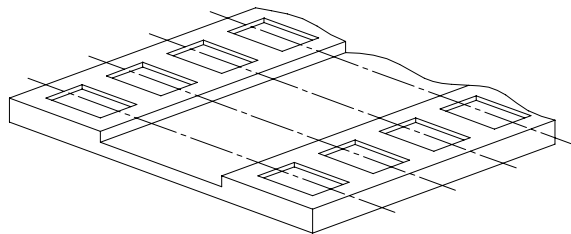


Figure A.1b

Figure A.1 – Illustrations of terminal projection zone



IEC 2242/09

Figure A.2 – Isometric view of an example of gauge