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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Mechanical standardization of semiconductor devices – Part 6-18: General rules for the preparation of outline drawings of surface mounted semiconductor device packages – Design guide for ball grid array (BGA)

Normalisation mécanique des dispositifs à semiconducteurs – Partie 6-18: Règles générales pour la préparation des dessins d'encombrement des dispositifs à semiconducteurs pour montage en surface – Guide de conception pour les boîtiers matriciels à billes (BGA)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

MECHANICAL STANDARDIZATION OF SEMICONDUCTOR DEVICES –

Part 6-18: General rules for the preparation of outline drawings of surface mounted semiconductor device packages – Design guide for ball grid array (BGA)

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International Standard IEC 60191-6-18 has been prepared by subcommittee 47D: Mechanical standardization for semiconductor devices, of IEC technical committee 47: Semiconductor devices.

This standard cancels and replaces IEC/PAS 60191-6-18 published in 2008. This first edition constitutes a technical revision.

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

FDIS	Report on voting
47D/753A/FDIS	47D/758/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.

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This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all the parts in the 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 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

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- withdrawn,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

The contents of the corrigendum of May 2010 have been included in this copy.

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MECHANICAL STANDARDIZATION OF SEMICONDUCTOR DEVICES –

Part 6-18: General rules for the preparation of outline drawings of surface mounted semiconductor device packages – Design guide for ball grid array (BGA)

1 Scope

This part of IEC 60191 provides standard outline drawings, dimensions, and recommended variations for all square ball grid array packages (BGA), whose terminal pitch is 1 mm or larger.

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 applies.

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 IEC 60191 (series) and the following apply.

3.1
ball grid array
BGA
package that has metal balls attached to one side of a substrate in a matrix of at least three rows and three columns; terminals may be missing from some row-column intersections

NOTE BGA stands for “Ball Grid Array” in compliance with the existing standards (See Bibliography).

3.2
plastic ball grid array
P-BGA
BGA with a rigid organic substrate

3.3
tape ball grid array
T-BGA
BGA with a polyimide tape substrate

3.4
ceramic ball grid array
C-BGA
BGA with a ceramic substrate

3.5
P-BGA (Flip chip interconnection)
BGA with an organic substrate and a die bonded to a substrate through metal bumps

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3.6
recommended BGA variation
BGA variation with the specific dimensions and ball counts as the first choice for production packages other than recommended BGA variations are the least choice for production to avoid endless proliferation of BGA outlines.

4 Terminal position numbering

When a package is viewed from the terminal side with the index corner in the bottom left corner position, terminal rows are lettered from bottom to top starting with A, then B, C,,,, AA, AB, etc., while terminal columns are numbered from left to right starting with 1. Terminal positions are designated by a row-column grid system and shown as alphanumeric identification, e.g., A1, B1, or AC34. The letters I, O, Q, S, X and Z are not used for naming the terminal rows.

5 Nominal package dimension

A nominal package dimension is defined as “the package width (E) × length (D)”, which is expressed in the tenths place in millimetre.

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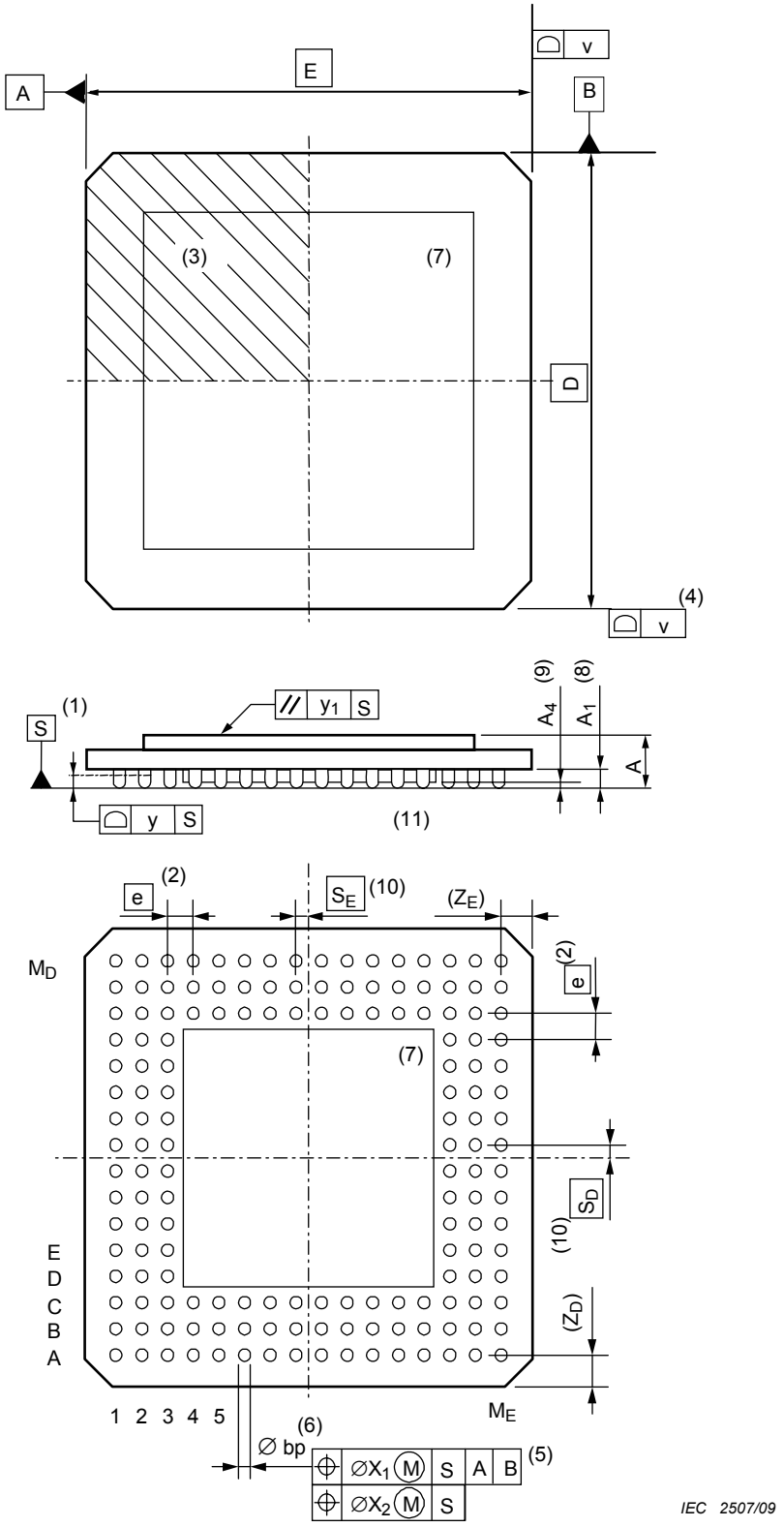
6 Symbols and drawings

BGA outline is shown in the Figure 1 and 2.



The symbols in this figure are explained in IEC 60191-6.

Figure 1 – Cavity down type

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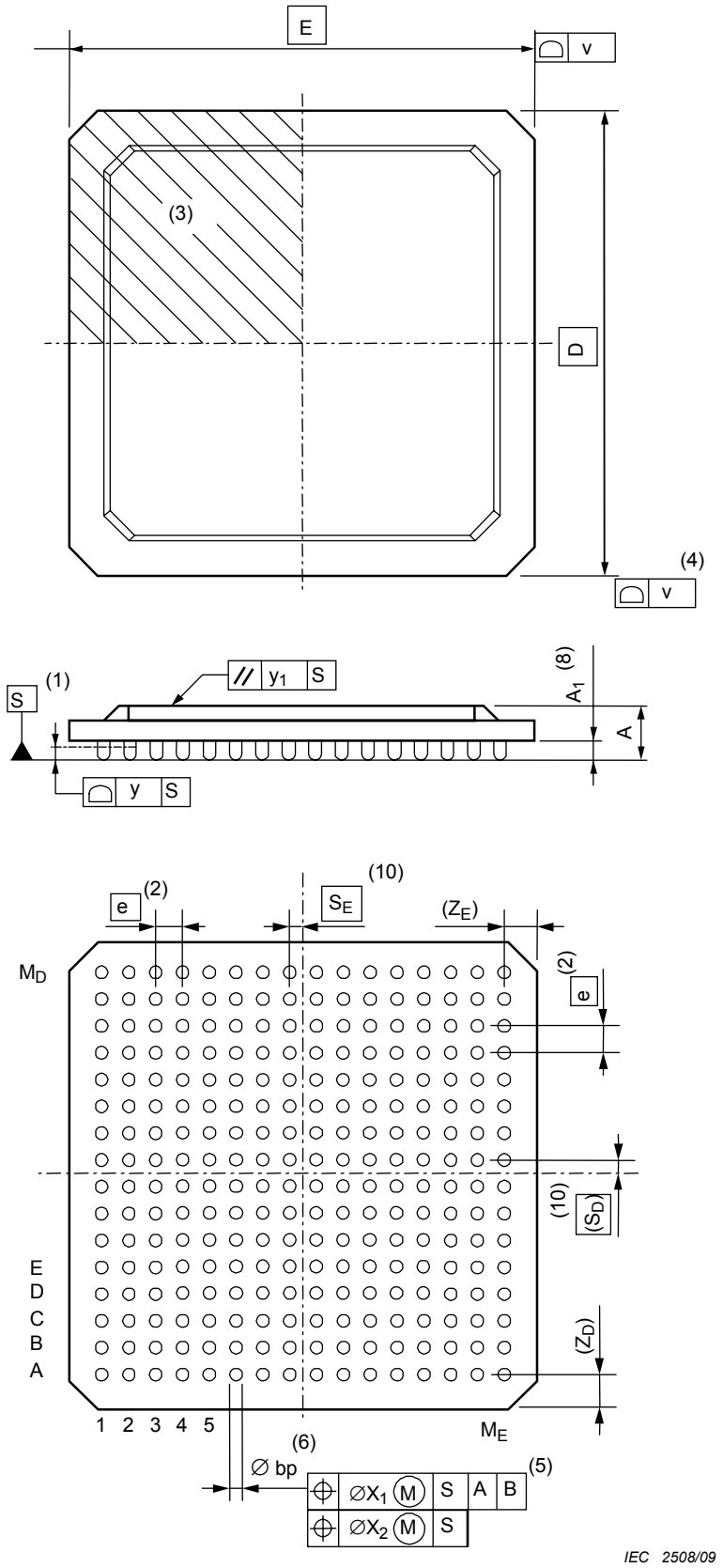

The symbols in this figure are explained in IEC 60191-6.

Figure 2 – Cavity up type

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Notes relating to Figure 1 and Figure 2:

(1) Datum S is defined as the seating plane on which a package free stands by contact of the balls.

(2) The distance between the centrelines of any two adjacent rows or columns of balls.

(3) The hatched zone indicates the index-marking area where whole index mark will be contained.

(4) The profile tolerance that controls of package size and orientation is applied to all four sides of the package outline.

(5) The tolerance of position that controls the relationship of the balls applies to all balls.

(6) The terminal diameter “bp” is the maximum diameter of individual balls as measured in the plane parallel to the seating plane.

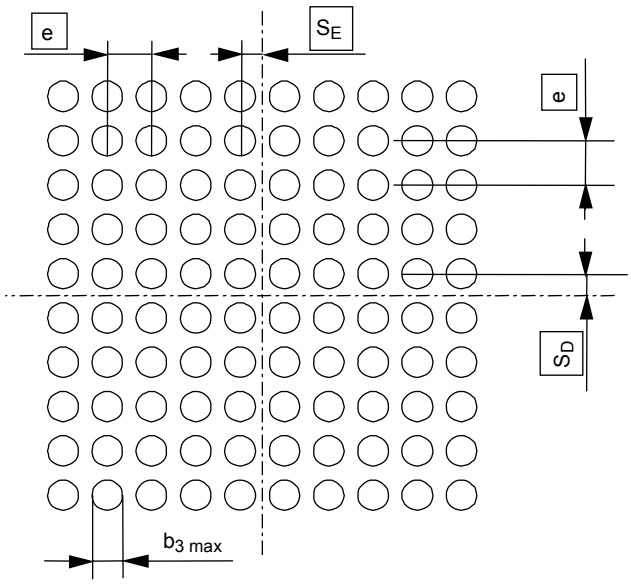
(7) It shows the lid made of mould compound, glob top resin, metal cap, ceramics, etc. It may be flat, convex, or concave shape.

(8) The primary stand-off height is defined by the height from the seating plane to the package substrate.

(9) The secondary stand-off height is defined by the height from the seating plane to the lid that is the lowest surface on the cavity-down configuration.

(10) S_D and S_E are the dimensions that define the positions of balls next to the datum A and B.

NOTE An array pattern of permissible terminal-existing zones including true position tolerance is shown in Figure 3.



$b_{3\ max} = bp_{max} + x$

IEC 2509/09

The symbols in this figure are explained in IEC 60191-6.

Figure 3 – Pattern of terminal position areas

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7 Dimensions

Table 1 – Group 1: Dimensions appropriate to mounting and interchangeability

Unit: mm

Term	Symbol	Specification	Recommended value
Nominal package dimension	E × D	(1) A nominal package dimension is defined as "the package width (E) × length (D)", which is expressed in the tenths place in millimetre. (2) Variations on nominal package dimensions are: 7,0×7,0 25,0×25,0 8,0×8,0 27,0×27,0 9,0×9,0 29,0×29,0 10,0×10,0 31,0×31,0 11,0×11,0 33,0×33,0 12,0×12,0 35,0×35,0 13,0×13,0 37,5×37,5 14,0×14,0 40,0×40,0 15,0×15,0 42,5×42,5 16,0×16,0 45,0×45,0 17,0×17,0 47,5×47,5 18,0×18,0 50,0×50,0 19,0×19,0 52,5×52,5 20,0×20,0 55,0×55,0 21,0×21,0 57,5×57,5 23,0×23,0 60,0×60,0	Refer to Table 4 through 9
Package length	D	(1) Package length D 7,0 25,0 8,0 27,0 9,0 29,0 10,0 31,0 11,0 33,0 12,0 35,0 13,0 37,5 14,0 40,0 15,0 42,5 16,0 45,0 17,0 47,5 18,0 50,0 19,0 52,5 20,0 55,0 21,0 57,5 23,0 60,0	Refer to Table 4 through 9

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Table 1 *(continued)*

Unit:mm

Term	Symbol	Specification	Recommended value
Package width	E	(1) Package width E 7,0 25,0 8,0 27,0 9,0 29,0 10,0 31,0 11,0 33,0 12,0 35,0 13,0 37,5 14,0 40,0 15,0 42,5 16,0 45,0 17,0 47,5 18,0 50,0 19,0 52,5 20,0 55,0 21,0 57,5 23,0 60,0	Refer to Table 4 through 9
Profile tolerance of package body	v	v = 0,20 Profile tolerance includes body-edge burr	-
Profile height	A	A_{max} 1,20 1,70 6,00 ”A” includes heat slug thickness, package warpage and tilt errors. “A” does not include the height of external heat sink or chip capacitors	-
Primary stand-off height	A_1	e / $A_{1\ min}$ / $A_{1\ nom}$ / $A_{1\ max}$ 1,27 / 0,5 / 0,6 / 0,7 1,00 / 0,4 / 0,5 / 0,6	-

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Table 1 *(continued)*

Unit mm

Term	Symbol	Specification	Recommended value
Secondary stand-off height	A_4	$A_{4\ min}$ = 0,25	–
Terminal grid pitch	e	1,27 1,00	–
Terminal diameter	bp	e / bp_{min} / bp_{nom} / bp_{max} 1,27 / 0,60 / 0,75 / 0,90 1,00 / 0,50 / 0,60 / 0,70	–
Positional tolerance with respect to the body datum	x_1	e / x_1 1,27 / 0,30 1,00 / 0,25	–
Terminal-to-terminal positional tolerance	x_2	e / x_2 1,27 / 0,15 1,00 / 0,10	
Coplanarity	y	e / y 1,27 / 0,20 1,00 / 0,20	–
Parallelism tolerance of the top surface	y_1	y_1 = 0,35	–
Center terminal(s) position in length	S_D	When M_D is an odd number, S_D = 0. When M_D is an even number, S_D = e /2.	–
Center terminal(s) position in width	S_E	When M_E is an odd number, S_E = 0. When M_E is even number, S_E = e /2.	–

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