BS EN 60191-6-22:2013

BSI Standards Publication

Mechanical standardization of semiconductor devices

Part 6-22: General rules for the preparation of outline drawings of surface mounted semiconductor device packages — Design guide for semiconductor packages Silicon Fine-pitch Ball Grid Array and Silicon Fine-pitch Land Grid Array (S-FBGA and S-FLGA)

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National foreword

This British Standard is the UK implementation of EN 60191-6-22:2013. It is identical to IEC 60191-6-22:2012.

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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Published by BSI Standards Limited 2013

ISBN 978 0 580 75720 4

ICS 31.080.01

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 April 2013.

Amendments issued since publication

Amd. No.	Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60191-6-22

March 2013

ICS 31.080.01

English version

Mechanical standardization of semiconductor devices - Part 6-22: General rules for the preparation of outline drawings of surface mounted semiconductor device packages - Design guide for semiconductor packages Silicon Fine-pitch Ball Grid Array and Silicon Fine-pitch Land Grid Array (S-FBGA and S-FLGA)

(IEC 60191-6-22:2012)

Normalisation mécanique des dispositifs à semiconducteurs -
Partie 6-22: Règles générales pour la préparation des dessins d'encombrement des dispositifs à semiconducteurs à montage en surface -
Guide de conception pour les boîtiers matriciels à billes et à pas fins en silicium et boîtiers matriciels à zone de contact plate et à pas fins en silicium
(S-FBGA et S-FLGA)
(CEI 60191-6-22:2012)

Mechanische Normung von Halbleiterbauelementen -
Teil 6-22: Allgemeine Regeln für die Erstellung von Gehäusezeichnungen von SMD-Halbleitergehäusen -
Konstruktionsleitfaden für Halbleitergehäuse Si-Feinraster-Ball-Grid-Array und Si-Feinraster-Land-Grid-Array
(S-FBGA und S-FLGA)
(IEC 60191-6-22:2012)

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Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Management Centre: Avenue Marnix 17, B - 1000 Brussels

Ref. No. EN 60191-6-22:2013 E

Foreword

The text of document 47D/812/CDV, future edition 1 of IEC 60191-6-22, prepared by SC 47D, "Semiconductor packaging", of IEC TC 47, "Semiconductor devices" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60191-6-22:2013.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2013-10-15
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2016-01-15

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Endorsement notice

The text of the International Standard IEC 60191-6-22:2012 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60191-6	NOTE	Harmonized as EN 60191-6.
IEC 60191-6-5	NOTE	Harmonized as EN 60191-6-5.
IEC 60191-6-12	NOTE	Harmonized as EN 60191-6-12.

CONTENTS

MECHANICAL STANDARDIZATION OF SEMICONDUCTOR DEVICES –

Part 6-22: General rules for the preparation of outline drawings of surface mounted semiconductor device packages – Design guide for semiconductor packages Silicon Fine-pitch Ball Grid Array and Silicon Fine-pitch Land Grid Array (S-FBGA and S-FLGA)

1 Scope

This part of IEC 60191 provides the outline drawings and dimensions common to silicon-based package structures and materials of ball grid array packages (BGA) and land grid array packages (LGA).

2 Normative references

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

Void

3 Terms and definitions

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

3.1
S-FBGA
FBGA composed of silicon die, dielectric layer(s) on the die, rerouting wires from the die pads to outer balls on the dielectric layer(s), and outer balls with heights more than 0,1 mm

3.2
S-FLGA
FLGA composed of silicon die, dielectric layer(s) on the die, rerouting wires from the die pads to outer lands on the dielectric layer(s), and outer lands with heights of 0,1 mm or less

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., whereas 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.

The letters I, O, Q, S, X and Z shall not be used for naming the terminal rows.

5 Code of package nominal dimensions

A code of package nominal dimensions is defined as the combination of package width *E* and length *D* which are shown in the second decimal place in millimeter.

6 Symbols and drawings

Symbols and drawings are shown in Figures 1, 2, 3 and 4.

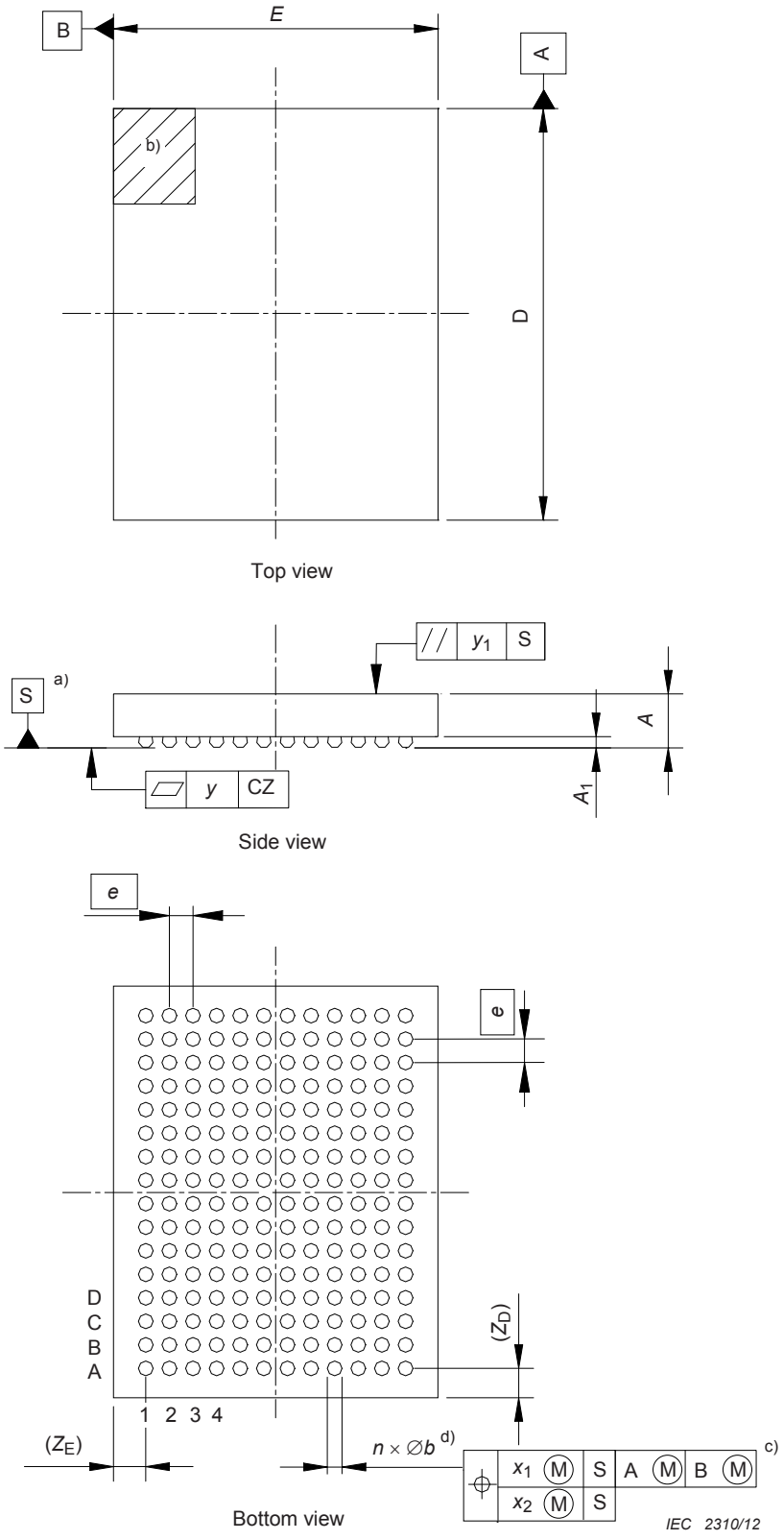

Figure 1 – S-FBGA outline

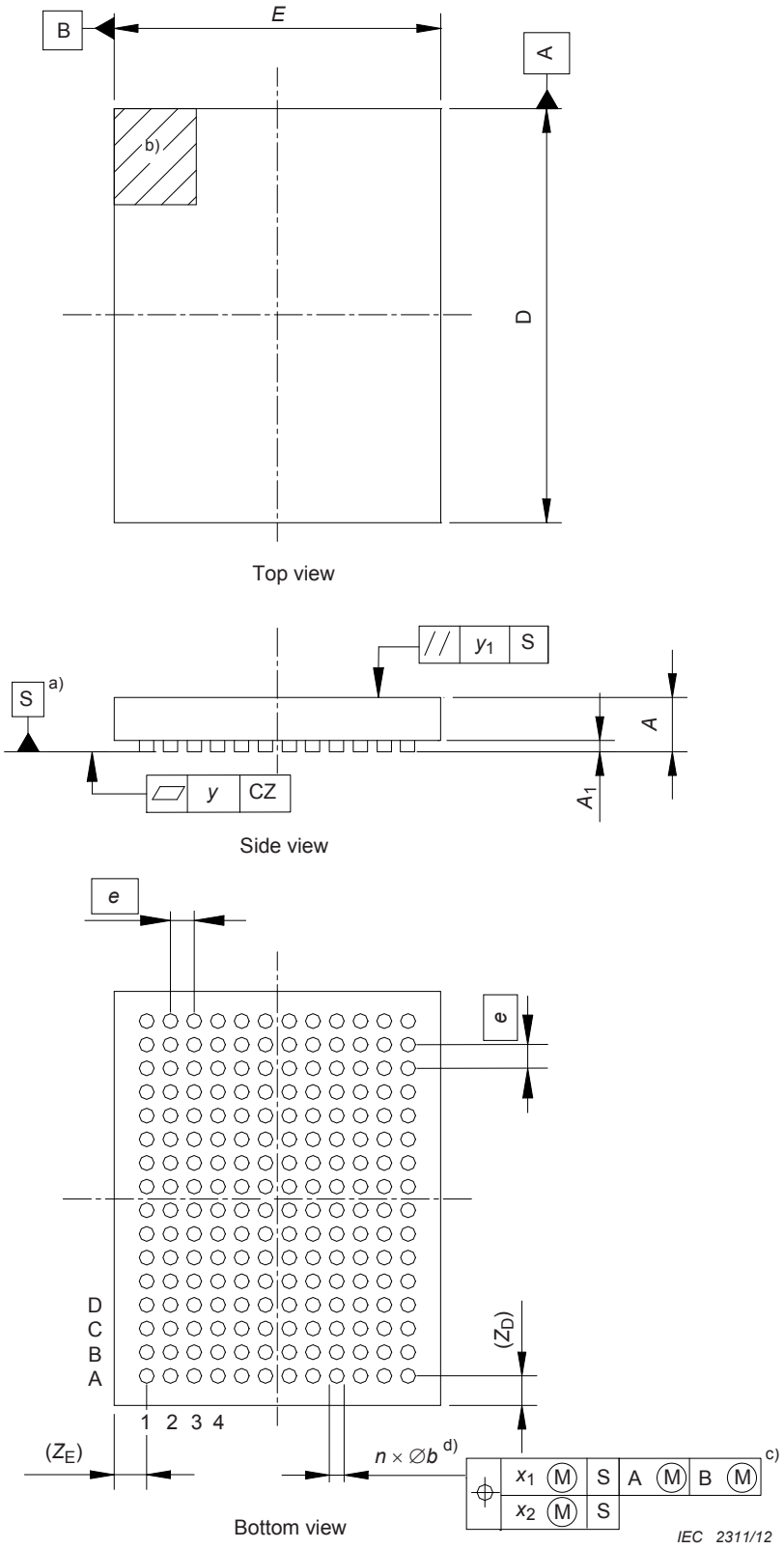

Figure 2 – S-FLGA outline

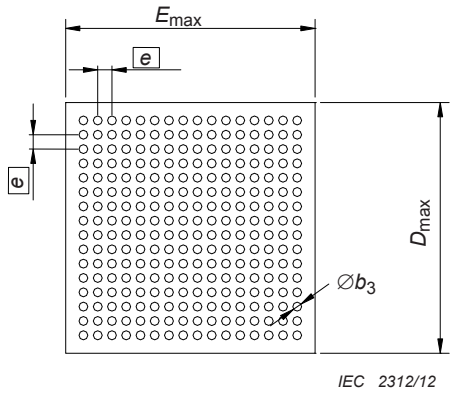

Figure 3 – Mechanical gauge drawing[e)]

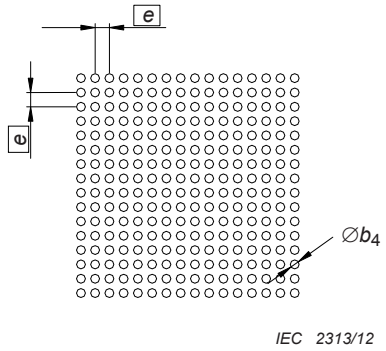

Figure 4 – Array of terminal-existence areas[f)]

Footnotes relating to Figures 1 to 4

a) Datum S is the seating plane on which a package stays.

b) The hatched zone is an index-marking area indicating A1 corner.

c) True positional tolerances of terminals, x_1 and x_2, are applied to all terminals.

d) The terminal diameter b is the maximum diameter of the ball as measured in a plane parallel to the seating plane.

e) An array of terminal-existence areas with regard to the datum S, A, and B is shown in the mechanical gauge drawing in Figure 3.

f) The array of terminal-existence areas with regard to the datum S is shown in Figure 4.

7 Dimensions

7.1 Group 1

Group 1 dimensions are shown in Table 1.

Table 1 – Dimensions and tolerances in Group 1

Dimensions in millimeters

<table>
<tr><th>Term</th><th>Symbol</th><th>Specification</th><th>Recommended value</th><th>Notes</th></tr>
<tr><td>Code of package nominal dimensions</td><td>$E \times D$</td><td>Code of package nominal dimension is defined as the combination of package width E and length D, which are shown in the second decimal place in millimeter.</td><td>–</td><td>–</td></tr>
<tr><td>Package length</td><td>D</td><td>Package length is shown in the second decimal place in millimeter.
Package length D_{nom}
Minimum 0,50
Maximum 10,00
Tolerance v_D ± 0,05</td><td>–</td><td>v_D denotes tolerance.</td></tr>
<tr><td>Package width</td><td>E</td><td>Package width is shown in the second decimal place in millimeter.
Package width E_{nom}
Minimum 0,50
Maximum 10,00
Tolerance v_E ± 0,05</td><td>-M_D, M_E</td><td>v_E denotes tolerance.</td></tr>
<tr><td>Profile height</td><td>A</td><td>When $A \leq 0,65$, the tolerance of nominal height is ± 0,07.
When $0,80 \leq A \leq 1,0$, the tolerance of nominal height is ± 0,10.
A shall not exceed 1,0.</td><td>–</td><td>A includes package warpage and tilt allowances.</td></tr>
<tr><td>Stand-off height</td><td>A_1</td><td>**1)** For S-FBGA:
<table>
<tr><th>e</th><th>b_{nom}</th><th>min</th><th>nom</th><th>max</th></tr>
<tr><td>0,80</td><td>0,50</td><td>0,35</td><td>0,40</td><td>0,45</td></tr>
<tr><td>0,80</td><td>0,45</td><td>0,30</td><td>0,35</td><td>0,40</td></tr>
<tr><td>0,65</td><td>0,40</td><td>0,28</td><td>0,33</td><td>0,38</td></tr>
<tr><td>0,50</td><td>0,30</td><td>0,20</td><td>0,25</td><td>0,30</td></tr>
<tr><td>0,40</td><td>0,25</td><td>0,15</td><td>0,20</td><td>0,25</td></tr>
<tr><td>0,30</td><td>0,20</td><td>0,10</td><td>0,15</td><td>0,20</td></tr>
</table>
For low stand-off S-FBGA:
$A_1 \leq 0,20$
2) For S-FLGA:
$A_1 \leq 0,10$</td><td>–</td><td>–</td></tr>
</table>

Table 1 *(Continued)*

Dimensions in millimeters

<table>
<tr><th>Term</th><th>Symbol</th><th>Specification</th><th>Recommended value</th><th>Notes</th></tr>
<tr><td>Terminal pitch</td><td>e</td><td>e = 0,80
0,65
0,50
0,40
0,30
0,25</td><td>–</td><td>–</td></tr>
<tr><td>Terminal diameter</td><td>b</td><td>1) For S-FBGA:
<table>
<tr><th>e</th><th>min</th><th>nom</th><th>max</th></tr>
<tr><td>0,80</td><td>0,45</td><td>0,50</td><td>0,55</td></tr>
<tr><td>0,80</td><td>0,40</td><td>0,45</td><td>0,50</td></tr>
<tr><td>0,65</td><td>0,35</td><td>0,40</td><td>0,45</td></tr>
<tr><td>0,50</td><td>0,25</td><td>0,30</td><td>0,35</td></tr>
<tr><td>0,40</td><td>0,20</td><td>0,25</td><td>0,30</td></tr>
<tr><td>0,30</td><td>0,17</td><td>0,20</td><td>0,23</td></tr>
</table>
2) For S-FLGA:
<table>
<tr><th>e</th><th>min</th><th>nom</th><th>max</th></tr>
<tr><td>0,80</td><td>0,35</td><td>0,40</td><td>0,45</td></tr>
<tr><td>0,65</td><td>0,28</td><td>0,33</td><td>0,38</td></tr>
<tr><td>0,50</td><td>0,20</td><td>0,25</td><td>0,30</td></tr>
<tr><td>0,40</td><td>0,15</td><td>0,20</td><td>0,25</td></tr>
<tr><td>0,30</td><td>0,12</td><td>0,15</td><td>0,18</td></tr>
<tr><td>0,25</td><td>0,10</td><td>0,13</td><td>0,16</td></tr>
</table></td><td>
<table>
<tr><th>e</th><th>nom</th></tr>
<tr><td>0,80</td><td>0,50</td></tr>
<tr><td>0,65</td><td>0,40</td></tr>
<tr><td>0,50</td><td>0,30</td></tr>
<tr><td>0,40</td><td>0,25</td></tr>
<tr><td>0,30</td><td>0,20</td></tr>
</table>
–</td><td>–
–</td></tr>
<tr><td>Datum-based positional tolerance of terminals</td><td>x1</td><td>x1 = 0,08</td><td>–</td><td>–</td></tr>
<tr><td>Relative positional tolerance of terminals</td><td>x2</td><td>
<table>
<tr><th>e</th><th>x2</th></tr>
<tr><td>0,80</td><td>0,08</td></tr>
<tr><td>0,65</td><td>0,08</td></tr>
<tr><td>0,50</td><td>0,05</td></tr>
<tr><td>0,40</td><td>0,05</td></tr>
<tr><td>0,30</td><td>0,03</td></tr>
<tr><td>0,25</td><td>0,03</td></tr>
</table></td><td>–</td><td>–</td></tr>
</table>

Table 1 *(Continued)*

Dimensions in millimeters

Term	Symbol	Specification	Recommended value	Notes
Coplanarity	y	$\boxed{e}$ / y: 0,80 / 0,10; 0,65 / 0,08; 0,50 / 0,05; 0,40 / 0,05; 0,30 / 0,05; 0,25 / 0,05	–	–
Parallelism of the top surface	y_1	y_1 = 0,08	–	–
Number of terminals	n	n = $M_E \times M_D$; $(M_E - 1) \times M_D$; $M_E \times (M_D - 1)$; $(M_E - 1) \times (M_D - 1)$	–	Numbers of matrices in M_E and M_D are shown in Table 3.
Maximum matrix size in length	M_D			
Maximum matrix size in width	M_E	$M_E \leq (E - b_{max} - v_E - x_1 - x_2) / \boxed{e} + 1$ $M_D \leq (D - b_{max} - v_D - x_1 - x_2) / \boxed{e} + 1$		

7.2 Group 2

Group 2 dimensions are shown in Table 2.

Table 2 – Dimensions and tolerances of Group 2

Dimensions in millimeters

Term	Symbol	Specification	Recommended value	Notes
Overhang dimension in length	Z_D	$Z_D = [D_{nom} - (M_D - 1) \times \boxed{e}] / 2$	–	Reference value
Overhang dimension in width	Z_E	$Z_E = [E_{nom} - (M_E - 1) \times \boxed{e}] / 2$	–	Reference value
Datum-defined terminal-existence area	b_3	$b_3 = b_{max} + x_1$	–	–
Relative terminal-existence area	b_4	$b_4 = b_{max} + x_2$	–	–

8 Combination list of D, E, M_D, and M_E

Combination lists of D, E, M_D, and M_E are shown in the following Tables 3, 4, 5, 6, 7 and 8.

Table 3 – e = 0,80 mm pitch S-FBGA and S-FLGA

BGA b_{max} = 0,55			BGA b_{max} = 0,50			LGA b_{max} = 0,45		
D or E mm	M_D or M_E	$M_D - 1$ or $M_E - 1$	D or E mm	M_D or M_E	$M_D - 1$ or $M_E - 1$	D or E mm	M_D or M_E	$M_D - 1$ or $M_E - 1$
1,56 – 2,35	2	–	1,51 – 2,30	2	–	1,46 – 2,25	2	–
2,36 – 3,15	3	2	2,31 – 3,10	3	2	2,26 – 3,05	3	2
3,16 – 3,95	4	3	3,11 – 3,90	4	3	3,06 – 3,85	4	3
3,96 – 4,75	5	4	3,91 – 4,70	5	4	3,86 – 4,65	5	4
4,76 – 5,55	6	5	4,71 – 5,50	6	5	4,66 – 5,45	6	5
5,56 – 6,35	7	6	5,51 – 6,30	7	6	5,46 – 6,25	7	6
6,36 – 7,15	8	7	6,31 – 7,10	8	7	6,26 – 7,05	8	7
7,16 – 7,95	9	8	7,11 – 7,90	9	8	7,06 – 7,85	9	8
7,96 – 8,75	10	9	7,91 – 8,70	10	9	7,86 – 8,65	10	9
8,76 – 9,55	11	10	8,71 – 9,50	11	10	8,66 – 9,45	11	10
9,56 – 10,35	12	11	9,51 – 10,30	12	11	9,46 – 10,25	12	11

Table 4 – e = 0,65 mm pitch S-FBGA and S-FLGA

BGA b_{max} = 0,45			LGA b_{max} = 0,38		
D or E mm	M_D or M_E	$M_D - 1$ or $M_E - 1$	D or E mm	M_D or M_E	$M_D - 1$ or $M_E - 1$
1,31 – 1,95	2	–	1,24 – 1,88	2	–
1,96 – 2,60	3	2	1,89 – 2,53	3	2
2,61 – 3,25	4	3	2,54 – 3,18	4	3
3,26 – 3,90	5	4	3,19 – 3,83	5	4
3,91 – 4,55	6	5	3,84 – 4,48	6	5
4,56 – 5,20	7	6	4,49 – 5,13	7	6
5,21 – 5,85	8	7	5,14 – 5,78	8	7
5,86 – 6,50	9	8	5,79 – 6,43	9	8
6,51 – 7,15	10	9	6,44 – 7,08	10	9
7,16 – 7,80	11	10	7,09 – 7,73	11	10
7,81 – 8,45	12	11	7,74 – 8,38	12	11
8,46 – 9,10	13	12	8,39 – 9,03	13	12
9,11 – 9,75	14	13	9,04 – 9,68	14	13
9,76 – 10,40	15	14	9,69 – 10,33	15	14

Table 5 – e = 0,50 mm pitch S-FBGA and S-FLGA

BGA b_{max} = 0,35			LGA b_{max} = 0,30		
D or E mm	M_D or M_E	M_{D-1} or M_{E-1}	D or E mm	M_D or M_E	M_{D-1} or M_{E-1}
1,03 – 1,52	2	–	0,98 – 1,47	2	–
1,53 – 2,02	3	2	1,48 – 1,97	3	2
2,03 – 2,52	4	3	1,98 – 2,47	4	3
2,53 – 3,02	5	4	2,48 – 2,97	5	4
3,03 – 3,52	6	5	2,98 – 3,47	6	5
3,53 – 4,02	7	6	3,48 – 3,97	7	6
4,03 – 4,52	8	7	3,98 – 4,47	8	7
4,53 – 5,02	9	8	4,48 – 4,97	9	8
5,03 – 5,52	10	9	4,98 – 5,47	10	9
5,53 – 6,02	11	10	5,48 – 5,97	11	10
6,03 – 6,52	12	11	5,98 – 6,47	12	11
6,53 – 7,02	13	12	6,48 – 6,97	13	12
7,03 – 7,52	14	13	6,98 – 7,47	14	13
7,53 – 8,02	15	14	7,48 – 7,97	15	14
8,03 – 8,52	16	15	7,98 – 8,47	16	15
8,53 – 9,02	17	16	8,48 – 8,97	17	16
9,03 – 9,52	18	17	8,98 – 9,47	18	17
9,53 – 10,02	19	18	9,48 – 9,97	19	18
			9,98 – 10,47	20	19

Table 6 – e = 0,40 mm pitch S-FBGA and S-FLGA

BGA b_{max} = 0,30			LGA b_{max} = 0,25		
D or E mm	M_D or M_E	M_{D-1} or M_{E-1}	D or E mm	M_D or M_E	M_{D-1} or M_{E-1}
0,88 – 1,27	2	–	0,83 – 1,22	2	–
1,28 – 1,67	3	2	1,23 – 1,62	3	2
1,68 – 2,07	4	3	1,63 – 2,02	4	3
2,08 – 2,47	5	4	2,03 – 2,42	5	4
2,48 – 2,87	6	5	2,43 – 2,82	6	5
2,88 – 3,27	7	6	2,83 – 3,22	7	6
3,28 – 3,67	8	7	3,23 – 3,62	8	7
3,68 – 4,07	9	8	3,63 – 4,02	9	8
4,08 – 4,47	10	9	4,03 – 4,42	10	9
4,48 – 4,87	11	10	4,43 – 4,82	11	10
4,88 – 5,27	12	11	4,83 – 5,22	12	11
5,28 – 5,67	13	12	5,23 – 5,62	13	12
5,68 – 6,07	14	13	5,63 – 6,02	14	13
6,08 – 6,47	15	14	6,03 – 6,42	15	14
6,48 – 6,87	16	15	6,43 – 6,82	16	15
6,88 – 7,27	17	16	6,83 – 7,22	17	16
7,28 – 7,67	18	17	7,23 – 7,62	18	17
7,68 – 8,07	19	18	7,63 – 8,02	19	18
8,08 – 8,47	20	19	8,03 – 8,42	20	19
8,48 – 8,87	21	20	8,43 – 8,82	21	20
8,88 – 9,27	22	21	8,83 – 9,22	22	21
9,28 – 9,67	23	22	9,23 – 9,62	23	22
9,68 – 10,07	24	23	9,63 – 10,02	24	23

Table 7 – e = 0,30 mm pitch S-FBGA and S-FLGA

BGA b_{max} = 0,23			LGA b_{max} = 0,18		
D or E mm	M_D or M_E	M_{D-1} or M_{E-1}	D or E mm	M_D or M_E	M_{D-1} or M_{E-1}
0,69 – 0,98	2	–	0,64 – 0,93	2	–
0,99 – 1,28	3	2	0,94 – 1,23	3	2
1,29 – 1,58	4	3	1,24 – 1,53	4	3
1,59 – 1,88	5	4	1,54 – 1,83	5	4
1,89 – 2,18	6	5	1,84 – 2,13	6	5
2,19 – 2,48	7	6	2,14 – 2,43	7	6
2,49 – 2,78	8	7	2,44 – 2,73	8	7
2,79 – 3,08	9	8	2,74 – 3,03	9	8
3,09 – 3,38	10	9	3,04 – 3,33	10	9
3,39 – 3,68	11	10	3,34 – 3,63	11	10
3,69 – 3,98	12	11	3,64 – 3,93	12	11
3,99 – 4,28	13	12	3,94 – 4,23	13	12
4,29 – 4,58	14	13	4,24 – 4,53	14	13
4,59 – 4,88	15	14	4,54 – 4,83	15	14
4,89 – 5,18	16	15	4,84 – 5,13	16	15
5,19 – 5,48	17	16	5,14 – 5,43	17	16
5,49 – 5,78	18	17	5,44 – 5,73	18	17
5,79 – 6,08	19	18	5,74 – 6,03	19	18
6,09 – 6,38	20	19	6,04 – 6,33	20	19
6,39 – 6,68	21	20	6,34 – 6,63	21	20
6,69 – 6,98	22	21	6,64 – 6,93	22	21
6,99 – 7,28	23	22	6,94 – 7,23	23	22
7,29 – 7,58	24	23	7,24 – 7,53	24	23
7,59 – 7,88	25	24	7,54 – 7,83	25	24
7,89 – 8,18	26	25	7,84 – 8,13	26	25
8,19 – 8,48	27	26	8,14 – 8,43	27	26
8,49 – 8,78	28	27	8,44 – 8,73	28	27
8,79 – 9,08	29	28	8,74 – 9,03	29	28
9,09 – 9,38	30	29	9,04 – 9,33	30	29
9,39 – 9,68	31	30	9,34 – 9,63	31	30
9,69 – 9,98	32	31	9,64 – 9,93	32	31
9,99 – 10,28	33	32	9,94 – 10,23	33	32

Table 8 – e = 0,25 mm pitch S-FLGA

D **or** ***E*** mm	M_D **or** M_E	M_{D_1} **or** M_{E_1}	***D*** **or** ***E*** mm	M_D **or** M_E	M_{D_1} **or** M_{E_1}
0,57 – 0,81	2	–	5,32 – 5,56	21	20
0,82 – 1,06	3	2	5,57 – 5,81	22	21
1,07 – 1,31	4	3	5,82 – 6,06	23	22
1,32 – 1,56	5	4	6,07 – 6,31	24	23
1,57 – 1,81	6	5	6,32 – 6,56	25	24
1,82 – 2,06	7	6	6,57 – 6,81	26	25
2,07 – 2,31	8	7	6,82 – 7,06	27	26
2,32 – 2,56	9	8	7,07 – 7,31	28	27
2,57 – 2,81	10	9	7,32 – 7,56	29	28
2,82 – 3,06	11	10	7,57 – 7,81	30	29
3,07 – 3,31	12	11	7,82 – 8,06	31	30
3,32 – 3,56	13	12	8,07 – 8,31	32	31
3,57 – 3,81	14	13	8,32 – 8,56	33	32
3,82 – 4,06	15	14	8,57 – 8,81	34	33
4,07 – 4,31	16	15	8,82 – 9,06	35	34
4,32 – 4,56	17	16	9,07 – 9,31	36	35
4,57 – 4,81	18	17	9,32 – 9,56	37	36
4,82 – 5,06	19	18	9,57 – 9,81	38	37
5,07 – 5,31	20	19	9,82 – 10,06	39	38

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