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EIAJ EDR-7711

**Design guideline of open-top type socket
for Ball Grid Array(BGA)**

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Design guideline of open-top type socket for Ball Grid Array (BGA)

1. Scope of Application

This technical report defines the outline drawing and dimensions of the open-top type socket out of the test and burn-in sockets applied to the ball grid array package ("BGA" hereafter) provided in **EIAJ EDR-7315A** [Design guideline of Integrated Circuits for Ball Grid Array].

2. Definition of Technical Terms

The main terms used in this technical report shall conform to those defined in the **EIAJ ED-7300** [Recommended practice on standard for the preparation of outline drawings of semiconductor packages] and **EIAJ ED-7701** [Glossary of socket for BGA, LGA, FBGA and FLGA]. The new terms not included therein shall be defined in the text of this technical report.

3. Background

This technical report aims to standardize the outer dimensions of the sockets for BGA, where more attention is currently paid, to establish their compatibility as the need for the surface mount type rapidly increased due to enhanced functions and performance of electrical devices.

For defining each dimension, the object was to indicate the design standard value that is the concept of the design center as much as possible, aiming to enhance the function as a standardization index.

4. Socket Code

4.1 Construction of Socket Code

Socket Code is constructed as follows:

| Symbol of BGA Socket 4.2 (1) | Symbol of Socket type 4.2(2) | Symbol of Socket nominal dimension 4.2(3) | Number of terminal arrays 4.2(4) | Terminals pitch 4.2(5) |
|------------------------------------|------------------------------------|---|--|---------------------------|
| Example SBG | - TX | 3535A | - 2626 | - 127 |

4.2 Symbols

(1) Semiconductor sockets symbol

The symbol for BGA socket shall be expressed in 3 letters, "SBG". The first letter, S refers to socket and the rest to the package code. BGA shall be expressed as "BG".

(2) Socket type symbol

The symbol for socket type shall be expressed in T: open-top, C: clamshell, or X: option.

(3) Socket nominal dimension symbol

The symbol for socket nominal dimension shall be expressed in numbers. E x D (length x width of BGA package) is applied. The last alphabetical or numeric letter shall be expressed as A: uneven array specification or B: even array specification of each socket base.

(4) Number of terminal arrays

The symbol for number of terminal arrays shall be expressed in numbers, applying ME x MD of the number of applicable package terminal arrays.

(5) Terminals pitch

The symbol for terminal pitch of applicable package shall be expressed in numbers.

5. Terminal Number

The terminal number is provided as well as package. A is defined for the horizontal array nearest to the index corner when the socket body is mounted and the index is placed on the left-top side from an angle of the bottom side. As the array moves downward, the number changes in order. (B, C, AA, AB,) 1 is defined for the vertical array nearest to the index corner. As the array moves rightward, the number increases. (2, 3,) The terminal number is combined with these alphabets and numbers and expressed as A1 or B1. I, O, Q, S, X and Z are not used as horizontal arrays.

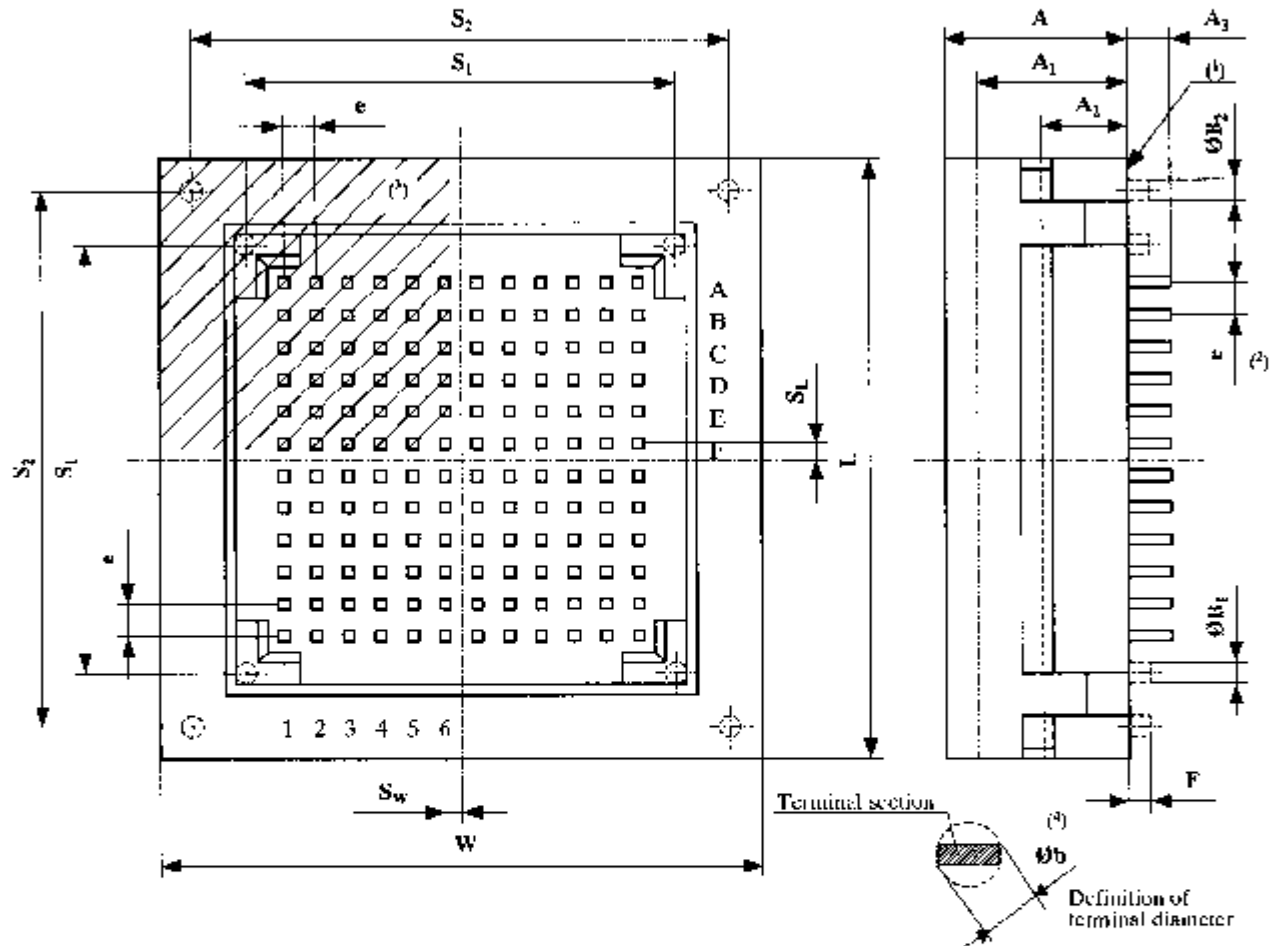
6. Nominal Dimensions

In this technical report, the dimension of package body (E x D) is the nominal dimension.

7. Reference Symbols and Schematics

7.1 Outline Drawings The outline drawings are shown in Figure 1.

Figure 1

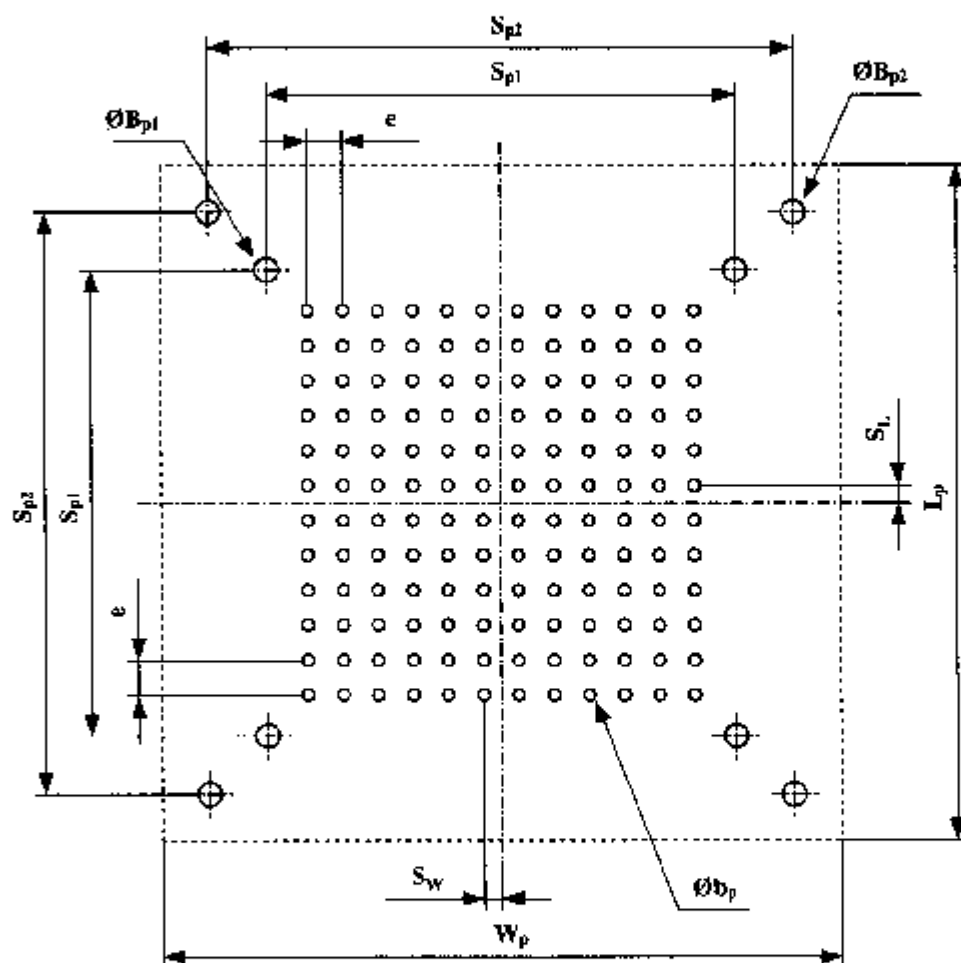


- Notes:**
- (1) Indicates mounting plane. Mounting plane is defined by the plane where the socket contacts its mounting surface.
 - (2) Stipulates true geometric position of the terminals.
 - (3) Indicates positional tolerance of the index mark. Index mark should be completely within the shaded area.
 - (4) Terminal diameter is defined as the maximum diameter of a circle circumscribed about a vertical projection of the terminal from the mounting plane.

7.2 Reference Symbols and Schematics of Recommended Socket Mounting Pattern on Printed Circuit Board

The drawing of the recommended socket mounting pattern on printed circuit board is shown in Figure 2 for reference in printed circuit board designing.

Figure 2



7.3 Overall Dimensions

Table 1

Unit: mm

| Name | Reference symbol | Stipulations | Recommended value | Supplement | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------------------------|------------------|--|------------------------|------------|---------|------|-----------------|-----------------|-----------------|---------|---------|------|---------|---------|---------|------|---------|---------|------|------|------|---------|------|------|------|---------|------|------|------|---------|------|------|------|---------|------|------|------|---|--|
| Nominal dimension | | (1) This value is based on the nominal dimensions of conformable BGA to the socket (2) Nominal dimensions of BGA are listed below. 15 x 15 21 x 21 27 x 27 35 x 35 40 x 40 45 x 45 50 x 50 | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Socket length | L | Socket length : L max <table><tr><th rowspan="2">Nominal Dimension (ND)</th><th colspan="3">L max</th></tr><tr><th>Group 1 (ND+32)</th><th>Group 2 (ND+24)</th><th>Group 3 (ND+16)</th></tr><tr><td>15 x 15</td><td>47.0</td><td>39.0</td><td>31.0</td></tr><tr><td>21 x 21</td><td>53.0</td><td>45.0</td><td>37.0</td></tr><tr><td>27 x 27</td><td>59.0</td><td>51.0</td><td>43.0</td></tr><tr><td>35 x 35</td><td>67.0</td><td>59.0</td><td>51.0</td></tr><tr><td>40 x 40</td><td>72.0</td><td>64.0</td><td>56.0</td></tr><tr><td>45 x 45</td><td>77.0</td><td>69.0</td><td>61.0</td></tr><tr><td>50 x 50</td><td>82.0</td><td>74.0</td><td>66.0</td></tr></table> | Nominal Dimension (ND) | L max | | | Group 1 (ND+32) | Group 2 (ND+24) | Group 3 (ND+16) | 15 x 15 | 47.0 | 39.0 | 31.0 | 21 x 21 | 53.0 | 45.0 | 37.0 | 27 x 27 | 59.0 | 51.0 | 43.0 | 35 x 35 | 67.0 | 59.0 | 51.0 | 40 x 40 | 72.0 | 64.0 | 56.0 | 45 x 45 | 77.0 | 69.0 | 61.0 | 50 x 50 | 82.0 | 74.0 | 66.0 | - | |
| Nominal Dimension (ND) | L max | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Group 1 (ND+32) | Group 2 (ND+24) | Group 3 (ND+16) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 x 15 | 47.0 | 39.0 | 31.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 21 x 21 | 53.0 | 45.0 | 37.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 27 x 27 | 59.0 | 51.0 | 43.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35 x 35 | 67.0 | 59.0 | 51.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 40 x 40 | 72.0 | 64.0 | 56.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 45 x 45 | 77.0 | 69.0 | 61.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50 x 50 | 82.0 | 74.0 | 66.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Socket width | W | Socket width : W max <table><tr><th rowspan="2">Nominal Dimension (ND)</th><th colspan="3">W max</th></tr><tr><th>Group 1 (ND+32)</th><th>Group 2 (ND+24)</th><th>Group 3 (ND+16)</th></tr><tr><td>15 x 15</td><td>47.0</td><td>39.0</td><td>31.0</td></tr><tr><td>21 x 21</td><td>53.0</td><td>45.0</td><td>37.0</td></tr><tr><td>27 x 27</td><td>59.0</td><td>51.0</td><td>43.0</td></tr><tr><td>35 x 35</td><td>67.0</td><td>59.0</td><td>51.0</td></tr><tr><td>40 x 40</td><td>72.0</td><td>64.0</td><td>56.0</td></tr><tr><td>45 x 45</td><td>77.0</td><td>69.0</td><td>61.0</td></tr><tr><td>50 x 50</td><td>82.0</td><td>74.0</td><td>66.0</td></tr></table> | Nominal Dimension (ND) | W max | | | Group 1 (ND+32) | Group 2 (ND+24) | Group 3 (ND+16) | 15 x 15 | 47.0 | 39.0 | 31.0 | 21 x 21 | 53.0 | 45.0 | 37.0 | 27 x 27 | 59.0 | 51.0 | 43.0 | 35 x 35 | 67.0 | 59.0 | 51.0 | 40 x 40 | 72.0 | 64.0 | 56.0 | 45 x 45 | 77.0 | 69.0 | 61.0 | 50 x 50 | 82.0 | 74.0 | 66.0 | - | |
| Nominal Dimension (ND) | W max | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Group 1 (ND+32) | Group 2 (ND+24) | Group 3 (ND+16) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 x 15 | 47.0 | 39.0 | 31.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 21 x 21 | 53.0 | 45.0 | 37.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 27 x 27 | 59.0 | 51.0 | 43.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35 x 35 | 67.0 | 59.0 | 51.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 40 x 40 | 72.0 | 64.0 | 56.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 45 x 45 | 77.0 | 69.0 | 61.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50 x 50 | 82.0 | 74.0 | 66.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Socket height | A | Socket height : A max <table><tr><th>Nominal Dimension</th><th>A max</th></tr><tr><td>15 x 15</td><td>22.0</td></tr><tr><td>21 x 21</td><td>22.0</td></tr><tr><td>27 x 27</td><td>22.0</td></tr><tr><td>35 x 35</td><td>22.0</td></tr><tr><td>40 x 40</td><td>25.0</td></tr><tr><td>45 x 45</td><td>25.0</td></tr><tr><td>50 x 50</td><td>25.0</td></tr></table> | Nominal Dimension | A max | 15 x 15 | 22.0 | 21 x 21 | 22.0 | 27 x 27 | 22.0 | 35 x 35 | 22.0 | 40 x 40 | 25.0 | 45 x 45 | 25.0 | 50 x 50 | 25.0 | - | | | | | | | | | | | | | | | | | | | | |
| Nominal Dimension | A max | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 x 15 | 22.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 21 x 21 | 22.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 27 x 27 | 22.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35 x 35 | 22.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 40 x 40 | 25.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 45 x 45 | 25.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50 x 50 | 25.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| End stroke height | A ₁ | A ₁ max = 16.0 | 14.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Seating plane height | A ₂ | A ₂ max = 14.0 | 10.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Table 1 (continued)

Unit: mm

| Name | Reference symbol | Stipulations | Recommended value | Supplement | | | | | | | | | | | | | | | | |
|---|------------------|---|-------------------|----------------|---------|------|---------|------|---------|------|---------|------|---------|------|---------|------|---------|------|---|--|
| Terminal distance | e | e = 1.50 e = 1.27 e = 1.0 | - | | | | | | | | | | | | | | | | | |
| Terminal length | A ₃ | A ₃ = 0.7 ~ 6.3 | - | | | | | | | | | | | | | | | | | |
| Terminal diameter | Ø b | Maximum distance of the terminal section <table><tr><td>e</td><td>Øb max</td></tr><tr><td>1.50</td><td>0.43</td></tr><tr><td>1.27</td><td>0.43</td></tr><tr><td>1.00</td><td>0.33</td></tr></table> | e | Øb max | 1.50 | 0.43 | 1.27 | 0.43 | 1.00 | 0.33 | - | | | | | | | | | |
| e | Øb max | | | | | | | | | | | | | | | | | | | |
| 1.50 | 0.43 | | | | | | | | | | | | | | | | | | | |
| 1.27 | 0.43 | | | | | | | | | | | | | | | | | | | |
| 1.00 | 0.33 | | | | | | | | | | | | | | | | | | | |
| Number of Alignment pin (inside) | n ₁ | n ₁ = 0 ~ 4 | - | | | | | | | | | | | | | | | | | |
| Number of Alignment pin (outside) | n ₂ | n ₂ = 0 ~ 4 | - | | | | | | | | | | | | | | | | | |
| Alignment pin length | F | F min = 1.0 | - | | | | | | | | | | | | | | | | | |
| Alignment pin distance (inside) | S ₁ | Nominal Dimension + 2.0 <table><tr><td>Nominal Dimension</td><td>S₁</td></tr><tr><td>15 x 15</td><td>17.0</td></tr><tr><td>21 x 21</td><td>23.0</td></tr><tr><td>27 x 27</td><td>29.0</td></tr><tr><td>35 x 35</td><td>37.0</td></tr><tr><td>40 x 40</td><td>42.0</td></tr><tr><td>45 x 45</td><td>47.0</td></tr><tr><td>50 x 50</td><td>52.0</td></tr></table> | Nominal Dimension | S ₁ | 15 x 15 | 17.0 | 21 x 21 | 23.0 | 27 x 27 | 29.0 | 35 x 35 | 37.0 | 40 x 40 | 42.0 | 45 x 45 | 47.0 | 50 x 50 | 52.0 | - | |
| Nominal Dimension | S ₁ | | | | | | | | | | | | | | | | | | | |
| 15 x 15 | 17.0 | | | | | | | | | | | | | | | | | | | |
| 21 x 21 | 23.0 | | | | | | | | | | | | | | | | | | | |
| 27 x 27 | 29.0 | | | | | | | | | | | | | | | | | | | |
| 35 x 35 | 37.0 | | | | | | | | | | | | | | | | | | | |
| 40 x 40 | 42.0 | | | | | | | | | | | | | | | | | | | |
| 45 x 45 | 47.0 | | | | | | | | | | | | | | | | | | | |
| 50 x 50 | 52.0 | | | | | | | | | | | | | | | | | | | |
| Alignment pin distance (outside) | S ₂ | Nominal Dimension + 8.0 <table><tr><td>Nominal Dimension</td><td>S₂</td></tr><tr><td>15 x 15</td><td>23.0</td></tr><tr><td>21 x 21</td><td>29.0</td></tr><tr><td>27 x 27</td><td>35.0</td></tr><tr><td>35 x 35</td><td>43.0</td></tr><tr><td>40 x 40</td><td>48.0</td></tr><tr><td>45 x 45</td><td>53.0</td></tr><tr><td>50 x 50</td><td>58.0</td></tr></table> | Nominal Dimension | S ₂ | 15 x 15 | 23.0 | 21 x 21 | 29.0 | 27 x 27 | 35.0 | 35 x 35 | 43.0 | 40 x 40 | 48.0 | 45 x 45 | 53.0 | 50 x 50 | 58.0 | - | |
| Nominal Dimension | S ₂ | | | | | | | | | | | | | | | | | | | |
| 15 x 15 | 23.0 | | | | | | | | | | | | | | | | | | | |
| 21 x 21 | 29.0 | | | | | | | | | | | | | | | | | | | |
| 27 x 27 | 35.0 | | | | | | | | | | | | | | | | | | | |
| 35 x 35 | 43.0 | | | | | | | | | | | | | | | | | | | |
| 40 x 40 | 48.0 | | | | | | | | | | | | | | | | | | | |
| 45 x 45 | 53.0 | | | | | | | | | | | | | | | | | | | |
| 50 x 50 | 58.0 | | | | | | | | | | | | | | | | | | | |
| Alignment pin diameter(inside) | ØB ₁ | ØB ₁ max = 1.5 | - | | | | | | | | | | | | | | | | | |
| Alignment pin diameter (outside) | ØB ₂ | ØB ₂ max = 2.0 | - | | | | | | | | | | | | | | | | | |
| Center terminal position in L-direction | S _L | When MI nom is an odd number, S _L = 0 When MI nom is an even number, S _L = e / 2 | - | | | | | | | | | | | | | | | | | |
| Center terminal position in W-direction | S _W | When Mw nom is an odd number, S _W = 0 When Mw nom is an even number, S _W = e / 2 | - | | | | | | | | | | | | | | | | | |

Table 1 (continued)

| Unit: mm | | | | |
|----------------------------|------------------|--|-------------------|------------|
| Name | Reference symbol | Stipulations | Recommended value | Supplement |
| Number of terminals | n | See Table 2 | - | |
| Matrix size in L-direction | M_L | | | |
| Matrix size in W-direction | M_W | | | |
| Package setting direction | | Direction of shifting for Package Insertion. This is to provide the direction of package shifting in order to ensure uniformity when fitting a package to a socket that has a larger terminal matrix than the package, when that package has an odd number of rows less than the socket. The direction of shifting shall be upper left. | - | |

Table 2

| Nominal Dimension | $e = 1.50$ | | | | $e = 1.27$ | | | | $e = 1.00$ | | | |
|-------------------|--------------------------|------------|------------------------------|-----------|--------------------------|------------|------------------------------|-----------|--------------------------|------------|------------------------------|-----------|
| | M_{Lmax} M_{Wmax} | n_{Tmax} | $M_{Lmax}-1$ $M_{Wmax}-1$ | n_{max} | M_{Lmax} M_{Wmax} | n_{Tmax} | $M_{Lmax}-1$ $M_{Wmax}-1$ | n_{max} | M_{Lmax} M_{Wmax} | n_{Tmax} | $M_{Lmax}-1$ $M_{Wmax}-1$ | n_{max} |
| 15 x 15 | 10 | 100 | 9 | 81 | 11 | 121 | 10 | 100 | 14 | 196 | 13 | 169 |
| 21 x 21 | 14 | 196 | 13 | 169 | 16 | 256 | 15 | 225 | 20 | 400 | 19 | 361 |
| 27 x 27 | 18 | 324 | 17 | 289 | 21 | 441 | 20 | 400 | 26 | 676 | 25 | 625 |
| 35 x 35 | 23 | 529 | 22 | 484 | 27 | 729 | 26 | 676 | 34 | 1156 | 33 | 1089 |
| 40 x 40 | 26 | 676 | 25 | 625 | 31 | 961 | 30 | 900 | 39 | 1521 | 38 | 1444 |
| 45 x 45 | 30 | 900 | 29 | 841 | 35 | 1225 | 34 | 1156 | 44 | 1936 | 43 | 1849 |
| 50 x 50 | 33 | 1089 | 32 | 1024 | 39 | 1521 | 38 | 1444 | 49 | 2401 | 48 | 2304 |

7.4 Recommended Dimensions of Socket Mounting Pattern on Printed Circuit Board

Table 3

| Unit: mm | | | | | | | |
|------------------------|------------------|------------------------------------|-------------------|------------|-----------|---------|---------|
| Name | Reference symbol | Stipulations | Recommended value | Supplement | | | |
| Socket mounting length | L_p | Socket mounting length : L_p max | - | | | | |
| | | $L_p = L + 1.0$ | | | | | |
| | | Nominal dimension | | | L_p max | | |
| | | | | | Group 1 | Group 2 | Group 3 |
| | | 15 x 15 | | | 48.0 | 40.0 | 32.0 |
| | | 21 x 21 | | | 54.0 | 46.0 | 38.0 |
| | | 27 x 27 | | | 60.0 | 52.0 | 44.0 |
| | | 35 x 35 | | | 68.0 | 60.0 | 52.0 |
| | | 40 x 40 | | | 73.0 | 65.0 | 57.0 |
| | | 45 x 45 | | | 78.0 | 70.0 | 62.0 |
| 50 x 50 | 83.0 | 75.0 | 67.0 | | | | |

Table 3 (continued)

Unit: mm

| Name | Reference symbol | Stipulations | Recommended value | Supplement | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|-----------------------|---|-------------------|-----------------------|---------|------|---------|---------|---------|---------|---------|------|---------|------|---------|------|---------|------|---------|------|------|------|---------|------|------|------|---------|------|------|------|---------|------|------|------|---------|------|------|------|---|--|
| Socket mounting width | W_p | Socket mounting width: W_p max $W_p = W + 1.0$ <table><tr><th>Nominal Dimension</th><th colspan="3">W_p max</th></tr><tr><th></th><th>Group 1</th><th>Group 2</th><th>Group 3</th></tr><tr><td>15 x 15</td><td>48.0</td><td>40.0</td><td>32.0</td></tr><tr><td>21 x 21</td><td>54.0</td><td>46.0</td><td>38.0</td></tr><tr><td>27 x 27</td><td>60.0</td><td>52.0</td><td>44.0</td></tr><tr><td>35 x 35</td><td>68.0</td><td>60.0</td><td>52.0</td></tr><tr><td>40 x 40</td><td>73.0</td><td>65.0</td><td>57.0</td></tr><tr><td>45 x 45</td><td>78.0</td><td>70.0</td><td>62.0</td></tr><tr><td>50 x 50</td><td>83.0</td><td>75.0</td><td>67.0</td></tr></table> | Nominal Dimension | W_p max | | | | Group 1 | Group 2 | Group 3 | 15 x 15 | 48.0 | 40.0 | 32.0 | 21 x 21 | 54.0 | 46.0 | 38.0 | 27 x 27 | 60.0 | 52.0 | 44.0 | 35 x 35 | 68.0 | 60.0 | 52.0 | 40 x 40 | 73.0 | 65.0 | 57.0 | 45 x 45 | 78.0 | 70.0 | 62.0 | 50 x 50 | 83.0 | 75.0 | 67.0 | - | |
| Nominal Dimension | W_p max | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Group 1 | Group 2 | Group 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 x 15 | 48.0 | 40.0 | 32.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 21 x 21 | 54.0 | 46.0 | 38.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 27 x 27 | 60.0 | 52.0 | 44.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35 x 35 | 68.0 | 60.0 | 52.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 40 x 40 | 73.0 | 65.0 | 57.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 45 x 45 | 78.0 | 70.0 | 62.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50 x 50 | 83.0 | 75.0 | 67.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Through hole diameter | $\varnothing b_p$ | Through hole diameter <table><tr><th>e</th><th>$\varnothing b_p$ min</th></tr><tr><td>1.50</td><td>0.45</td></tr><tr><td>1.27</td><td>0.45</td></tr><tr><td>1.00</td><td>0.35</td></tr></table> | e | $\varnothing b_p$ min | 1.50 | 0.45 | 1.27 | 0.45 | 1.00 | 0.35 | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| e | $\varnothing b_p$ min | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.50 | 0.45 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.27 | 0.45 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.00 | 0.35 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Distance between holes for alignment pin (inside) | S_{p1} | Nominal dimension +2.0 $S_{p1} = S_1$ <table><tr><th>Nominal dimension</th><th>S_{p1}</th></tr><tr><td>15 x 15</td><td>17.0</td></tr><tr><td>21 x 21</td><td>23.0</td></tr><tr><td>27 x 27</td><td>29.0</td></tr><tr><td>35 x 35</td><td>37.0</td></tr><tr><td>40 x 40</td><td>42.0</td></tr><tr><td>45 x 45</td><td>47.0</td></tr><tr><td>50 x 50</td><td>52.0</td></tr></table> | Nominal dimension | S_{p1} | 15 x 15 | 17.0 | 21 x 21 | 23.0 | 27 x 27 | 29.0 | 35 x 35 | 37.0 | 40 x 40 | 42.0 | 45 x 45 | 47.0 | 50 x 50 | 52.0 | - | | | | | | | | | | | | | | | | | | | | | |
| Nominal dimension | S_{p1} | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 x 15 | 17.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 21 x 21 | 23.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 27 x 27 | 29.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35 x 35 | 37.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 40 x 40 | 42.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 45 x 45 | 47.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50 x 50 | 52.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Distance between holes for alignment pin (outside) | S_{p2} | Nominal Dimension +8.0 $S_{p2} = S_2$ <table><tr><th>Nominal dimension</th><th>S_{p2}</th></tr><tr><td>15 x 15</td><td>23.0</td></tr><tr><td>21 x 21</td><td>29.0</td></tr><tr><td>27 x 27</td><td>35.0</td></tr><tr><td>35 x 35</td><td>43.0</td></tr><tr><td>40 x 40</td><td>48.0</td></tr><tr><td>45 x 45</td><td>53.0</td></tr><tr><td>50 x 50</td><td>58.0</td></tr></table> | Nominal dimension | S_{p2} | 15 x 15 | 23.0 | 21 x 21 | 29.0 | 27 x 27 | 35.0 | 35 x 35 | 43.0 | 40 x 40 | 48.0 | 45 x 45 | 53.0 | 50 x 50 | 58.0 | - | | | | | | | | | | | | | | | | | | | | | |
| Nominal dimension | S_{p2} | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 x 15 | 23.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 21 x 21 | 29.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 27 x 27 | 35.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35 x 35 | 43.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 40 x 40 | 48.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 45 x 45 | 53.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50 x 50 | 58.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hole diameter of alignment pin (inside) | $\varnothing B_{p1}$ | $\varnothing B_{p1} = \varnothing B_1 + 0.1$ $\varnothing B_{p1} \text{ min} = 1.6$ | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hole diameter of alignment pin (outside) | $\varnothing B_{p2}$ | $\varnothing B_{p2} = \varnothing B_2 + 0.1$ $\varnothing B_{p2} \text{ min} = 2.1$ | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

8. Individual Outline Drawing Standard Registration

To propose the registration of an individual standard for a new outline Form 5 of the Technical Standardization Committee on Semiconductor Device Package Administrative Procedure must be completed. The standardization procedure must then be followed. When concluded, (*) mark in the package dimension table shown below will be changed to dimensions or letters.

Table 4.

| Reference Number | | | |
|------------------|-----------------------------|---------|---------|
| Socket Code | ***_*_*_*****_****_*_*_*_** | | |
| Reference Symbol | Minimum | Nominal | Maximum |
| L | | | * |
| W | | | * |
| A | | * | * |
| A ₁ | | | * |
| A ₂ | | | * |
| c | | * | |
| A ₃ | | * | |
| Øb | | | * |
| n ₁ | * | | * |
| n ₂ | * | | * |
| F | * | | |
| S ₁ | | * | |
| S ₂ | | * | |
| ØB ₁ | | | * |
| ØB ₂ | | | * |
| S _L | | * | |
| S _W | | * | |
| n | | * | |
| M ₁ | | * | |
| M _W | | * | |

EXPLANATION

1. Purpose of Establishment

This design guideline was established for the purpose of the standardization of BGA socket design and its related parts design.

2. Process of Deliberation

Standardization of semiconductor package has been actively executed by JEDEC/JC-11 in U.S.A. and by EIAJ/Technical Standardization Committee on Semiconductor Device Package in Japan. On the other hand, Test and Burn-in Socket, which is indispensable for development of package, has been developed independently by each semiconductor maker and socket maker with their own specifications. In such situation, necessity of the standardization activity of the socket was raised to the Committee, and a survey was implemented and a meeting was held for discussion. Findings from the survey report showed 22 members out of 54 Technical Standardization Committee on Semiconductor Device Package members answered the questionnaire and 17 members out of 22 were positive for standardization. In the meeting held on June 26, 1997, the members agreed for standardization, then establishment of Semiconductor Socket Project Group was approved by Technical Standardization Committee on Semiconductor Device Package on the following day.

As the target of standardization, the project group selected socket for BGA package ("BGA" hereafter) and FBGA package ("FBGA" hereafter) which was most topical at that time during the first meeting of Semiconductor Socket Project Group held in July 24, and discussion on the standardization of socket outline dimensions required for printed circuit board design have been started. Some members requested to standardize the durability and function of the socket also but the request was postponed since the evaluation method was not unified and it may take longer time for the standardization. There are various type of sockets such as for burn-in, test and production use. This time, the test and burn-in socket was selected since the standardization of its outline dimension is expected to be most beneficial.

Approximately two and half year was spent until this report was issued as the design guideline because of the difficulty to unify sockets which the makers have completed its development. This Design Guideline is expected to be functional as a standard for development of new BGA sockets although range of dimension became extensive as the result to include sockets currently available as many as possible.

In regards to description on datum definition which is relating to dimension of distance between alignment pins, alignment pin holes, diameter of alignment pin, alignment pin holes and length and width of socket, it is decided to leave the issue to future examination because of difficulty to define exact dimensions at this stage where tolerant standard is applied.

3. Background of Respective Standard Defined

(1) Scope of application

As mentioned above, the most topical issue was the BGA test and burn-in socket at that time, the open top type; one of the BGA test and burn-in socket types, was selected as the first item to be standardized. Since BGA and FBGA has been independently standardized in the respective package design guideline, it was also decided to standardize the socket for BGA and FBGA separately in respective design guideline.

(2) Socket code

As a symbol to designate a socket code, not only the socket nominal dimension but also the number of applicable terminal matrix of BGA was applied. The reason is that the nominal dimension does not always include the length and width of the applicable BGA package. For details, refer to the appendix; "Example of application on BGA package and IC Socket".

(3) Nominal dimension

If the socket length and width are used as the nominal dimension, it is difficult to judge if a given package is able to be accommodated by the selected socket. Therefore, the nominal dimension of the applicable BGA is used for the nominal dimension of the socket.

In case that the nominal dimension of the socket and the BGA is different, the socket will be applicable with the BGA by inserting package positioning guide units in the socket providing the socket nominal dimension is larger than that of BGA.

For details, refer to the appendix; "Example of application on BGA package and IC Socket".

(4) Length and width of socket

Since the socket outline dimensions vary among socket makers due to the difference of its mechanism, they were categorized into three groups. Group 1 includes most of the socket dimensions currently available, group 2 includes the dimensions which may be achievable with the technologies currently available, and group 3 indicates the dimensions targeted for future development. Socket maker should design the socket based on the socket outline specified in either group in this guideline and notify the selected group name to their users.

The length and width were limited to define with its maximum dimension since those dimensions are required by semiconductor makers for their printed circuit board design.

(5) Socket height, seating plane height and end stroke height

These dimensions were defined based on the sockets currently available.

(6) Terminal length and diameter

Wide range terminal length was specified because the terminals should slightly extrude from the backside of the printed circuit board the thickness of which varies with the number of board layers in order to solder the terminals on printed circuit board securely. The terminal diameter was defined based on the dimensions of the socket currently available.

(7) Alignment pin

It was unable to standardize the alignment pin with the consideration to sockets currently available since the pin have been required for various kinds of purpose such as for alignment of the socket to the printed circuit board and for ease of terminal insertion to the printed circuit board. Therefore, the number of pins was specified with wide range of choice from 0 to 8, and only the minimum length was specified as an inevitable dimension. Position of the pin was determined assuming the internal pin is used to align the terminals to the printed circuit board and the external pin is used to align the socket housing to the printed circuit board. The pin diameter was defined based on the dimensions of the socket currently available. As an option, screw hole for mounting of the socket on printed circuit board may also be accepted instead of alignment pin.

(8) Number of terminals and matrix

The number of terminals and matrix of the socket were specified to accommodate all BGA packages for which the outline dimensions have been standardized. That is to say, the number of socket terminals and its matrix is specified in accordance with "Maximum Matrix" and "Maximum Matrix -1" specified in BGA package design guideline.

(9) Package setting direction

When an even/uneven socket terminal matrix is not consistent with that of BGA terminal matrix, for example, when number of the socket terminal row is 33 and that for the BGA is 32, the BGA have to be shifted to a side in the socket. This shifting direction is required to be unified in order to assure right connection between the socket and the BGA. For details, refer to the appendix; "Examples of application on BGA package and IC Socket".

(10) Socket mounting length and width

As a reference to design the printed circuit board, the dimension of geographic area need for socket mounting and operation was defined. "The socket outline dimension + 1.0mm" was specified as the mounting length and width. This value includes the socket outline dimensional tolerance, the alignment pin positional tolerance and the printed circuit board dimensional tolerance.

(11) Through hole diameter

Through hole diameter is key dimension to design the circuit pattern of printed circuit boards, then it was specified in accordance with the popular dimension currently applied.

(12) Alignment hole diameter

This diameter was specified for "alignment pin diameter +0.1mm", considering the tolerances of the socket and the printed circuited board.

4. Examples of Application on BGA package and IC Socket

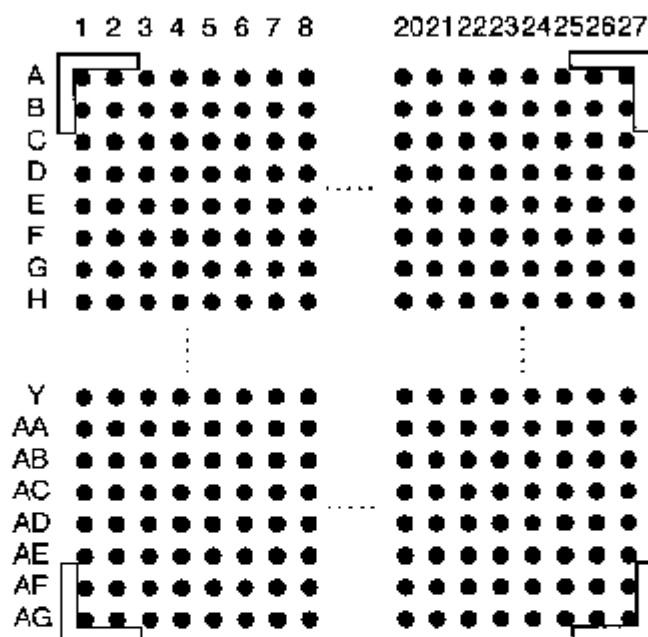
(1) IC Socket: Nominal dimensions 35x35,

Matrix size of L-direction ML=27, Matrix size of W-direction MW=27, Terminal pitch e=1.27

(a) In case of BGA package: Length x width = 35x35,

Matrix size in D-direction MD=27, Matrix size in E-direction ME=27

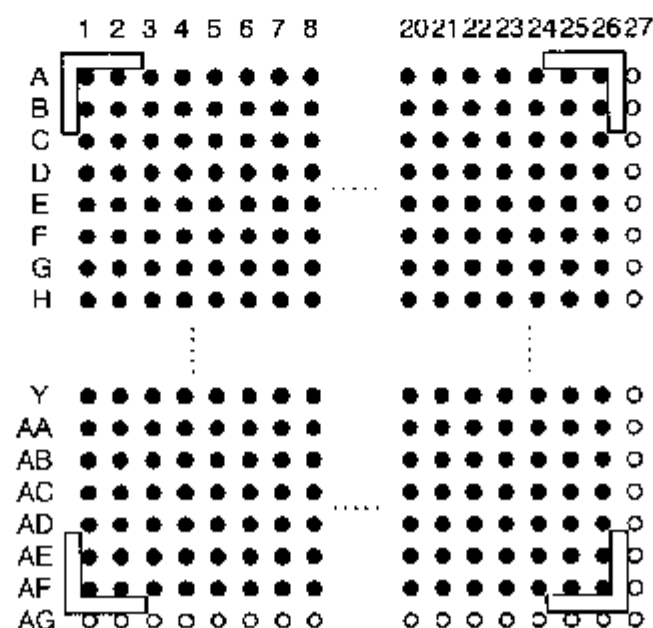
Socket code = **SBG-T-3535A-2727-127**



(b) In case of BGA package: Length x width = 35x35,

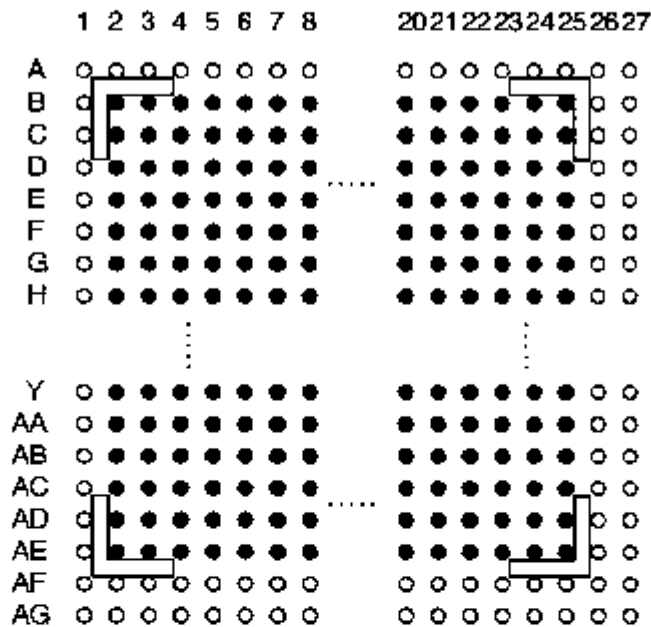
Matrix size in D-direction MD=26, Matrix size in E-direction ME=26

Socket code = **SBG-T-3535A-2626-127**

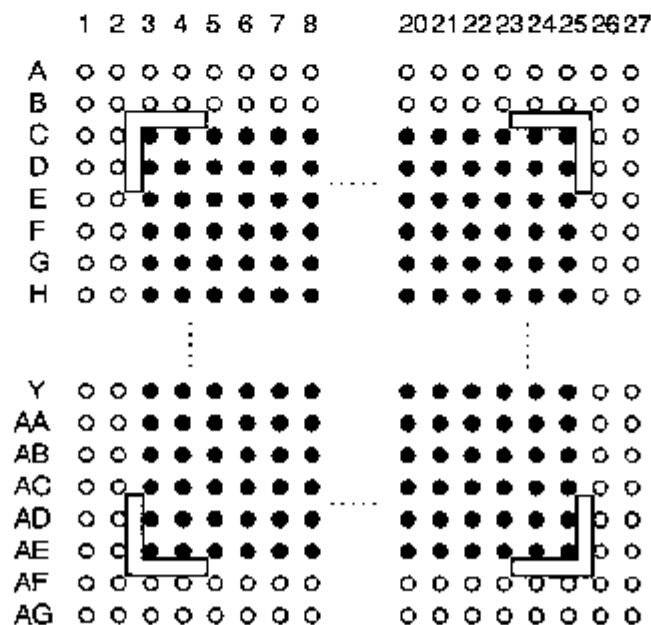


Above drawings are shown from the top side of the Socket (Package mounting surface), and black dots mean the contact area with BGA solder balls, and white dots mean the contact area without BGA solder balls.

- (c) In case of BGA package: Length x width = 31x31,
 Matrix size in D-direction MD=24, Matrix size in E-direction ME=24
 Socket code = **SBG-T-3535A-2424-127**



- (d) In case of BGA package: Length x width = 31x31,
 Matrix size in D-direction MD=23, Matrix size in E-direction ME=23
 Socket code = **SBG-T-3535A-2323-127**



Above drawings are shown from the top side of the Socket (Package mounting surface), and black dots mean the contact area with BGA solder balls, and white dots mean the contact area without BGA solder balls.

(2) IC Socket: Nominal dimensions 35x35,

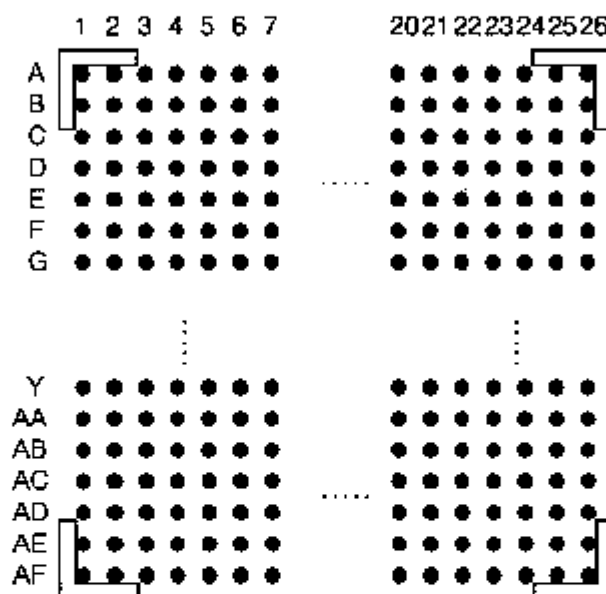
Matrix size of L-direction ML=26, Matrix size of W-direction MW=26, Terminal pitch=1.27

(a) In case of BGA package: Length x width = 35x35,

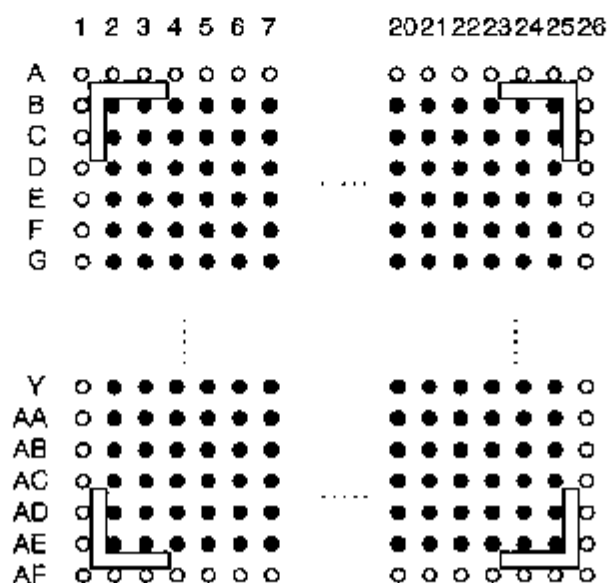
Matrix size in D-direction MD=27, Matrix size in E-direction ME=27

Socket code = **Impossible****(b) In case of BGA package: Length x width = 35x35,**

Matrix size in D-direction MD=26, Matrix size in E-direction ME=26

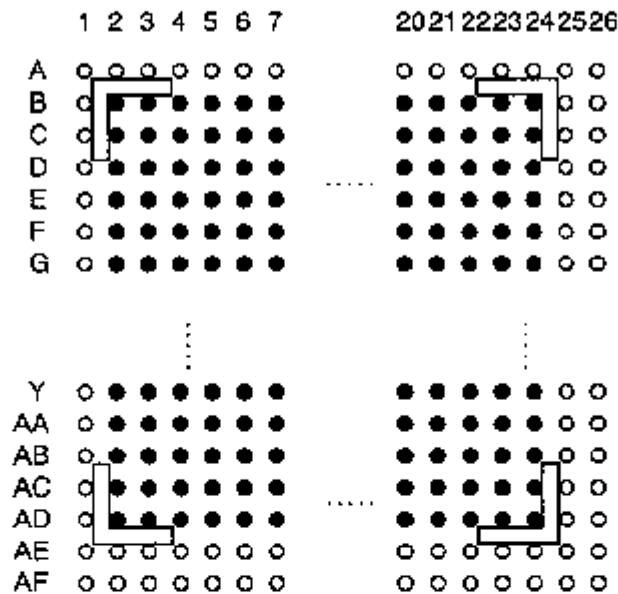
Socket code = **SBG-T-3535B-2626-127****(c) In case of BGA package: Length x width = 31x31,**

Matrix size in D-direction MD=24, Matrix size in E-direction ME=24

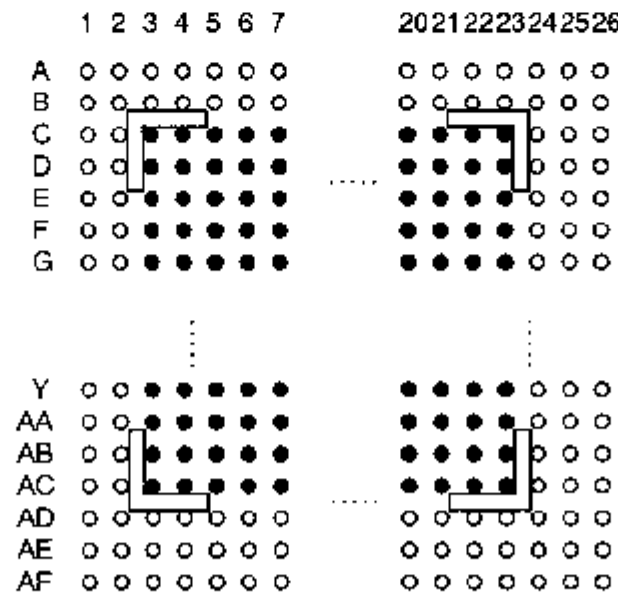
Socket code = **SBG-T-3535B-2424-127**

Above drawings are shown from the top side of the Socket (Package mounting surface), and black dots mean the contact area with BGA solder balls, and white dots mean the contact area without BGA solder balls.

- (d) In case of BGA package: Length x width = 31x31,
 Matrix size in D-direction MD=23, Matrix size in E-direction ME=23
 Socket code = **SBG-T-3535B-2323-127**



- (e) In case of BGA package: Length x width = 27x27,
 Matrix size in D-direction MD=21, Matrix size in E-direction ME=21
 Socket code = **SBG-T-3535B-2121-127**



Above drawings are shown from the top side of the Socket (Package mounting surface), and black dots mean the contact area with BGA solder balls, and white dots mean the contact area without BGA solder balls.

5. Members of the Committee

This design guideline was deliberated by Semiconductor Socket Project Group of Technical Standardization Committee on Semiconductor Device Package.

The members are as shown below.

<Technical Standardization Committee on Semiconductor Device Package>

| | | |
|-----------|------------------|-------------------|
| Chairman: | Shouzou Minamide | Sharp Corporation |
|-----------|------------------|-------------------|

<Semiconductor Socket Project Group>

| | | |
|------------|-------------------|------------------------------------|
| Leader: | Kazuhiro Tashiro | Fujitsu Ltd. |
| Co Leader: | Shunji Abe | Yamaichi Electronics Co.,Ltd. |
| Member: | Shuji Inoue | Intel Corporation |
| | Kazumasa Sato | Wells-CTI K.K. |
| | Tsutomu Kashiwagi | Enplas Corporation |
| | Hiroaki Hirao | Samsung Japan Corporation |
| | Tohru Hayashi | SANYO Electric Co.,Ltd. |
| | Syouzou Yokoyama | Shinon Electric Industry Co.,Ltd |
| | Takayuki Nagumo | Sumitomo 3M Limited |
| | Kazuo Yazawa | Seiko Epson Corp. |
| | Hisataka Izawa | Sony Corporation |
| | Akito Yoshida | Toshiba Corporation |
| | Tsunco Kobayashi | IBM Japan,Ltd. |
| | Masao Tohyama | Texas Instruments Japan Ltd. |
| | Hiroyuki Hosogi | Texas Instruments Japan Ltd. |
| | Kozaburo Suzuki | NEC Corporation |
| | Akira Kaneshige | Molex Japan Co.,Ltd. |
| | Usuke Enomoto | Hitachi,Ltd. |
| | Shigeru Kuriyama | Matsushita Electronics Corporation |
| | Hidekazu Iwasaki | Mitsubishi Electric Corporation |
| | Shinichi Nakamura | Unitechno Inc. |
| | Osamu Miyata | Rohm Co.,Ltd. |