EIAJ

Technical Report of Electronic Industries Association of Japan

E I A J EDR-7319

Design guideline of integrated circuits
For Quad Flat J-Lead Packages
(QFJ)

Established in December, 1998

Technical Report of Electronic Industries Association of Japan

Design guideline of integrated circuits
for Quad Flat J-Lead Packages
(QFJ)

1. SCOPE OF APPLICATION

This technical report covers the requirements for the outline drawings and dimensions of the Quad Flat J-Lead Packages (hereinafter referred to as QFJs),among the packages classified as form A in the EIAJ ED-7300 [Recommended practice on standard for the preparation of outline drawings of semiconductor packages].

Note   This technical report is revised edition of EIAJ ED-7407.

2. TERMS

The definition of the terms used in this technical report complies with the EIAJ ED-7300. The terms used in this standard and specified in the EIAJ ED-7300 comply with the definitions in this standard.

3. BACKGROUND

Cramming and speeding up of LSI chips are progressing all the way in correspondence to the Recent demands of compactness and high performance of electronic equipment. Moreover, there is an increasing demands for high-density construction of the mounting device as well as the package shape to be compact, thin, with multi-terminal. The popularity of the surface mounting device is increasing rapidly to cope with the said demands. This design guideline is intended to standardize the outline dimensions of QFJs and ensure compatibility between products. This standard shows the standard design values on the concept of the design center as far as possible for standardization. In addition, efforts to assure as much coherence as possible to the JEDEC standards.

4. DEFINITION OF QFJ PACKAGE

A QFJ is defined a package with formed terminals which are led out of itself in four directions and are bent in a J-shape toward the inner direction in junctions outside the package body for mounting on PCB surface.   QFJ have square solid and rectangular solid.

5. NUMBERING OF TERMINALS

Numbering of Terminals complies with the EIAJ ED-7300.

6. NOMINAL DIMENSIONS

In square solid, the dimensions of Package body(Package length :D or Package width :E)are applied to Nominal dimensions. In rectangular solid, the dimensions of Package body(Package length :D and Package width :E)are applied to Nominal dimensions.

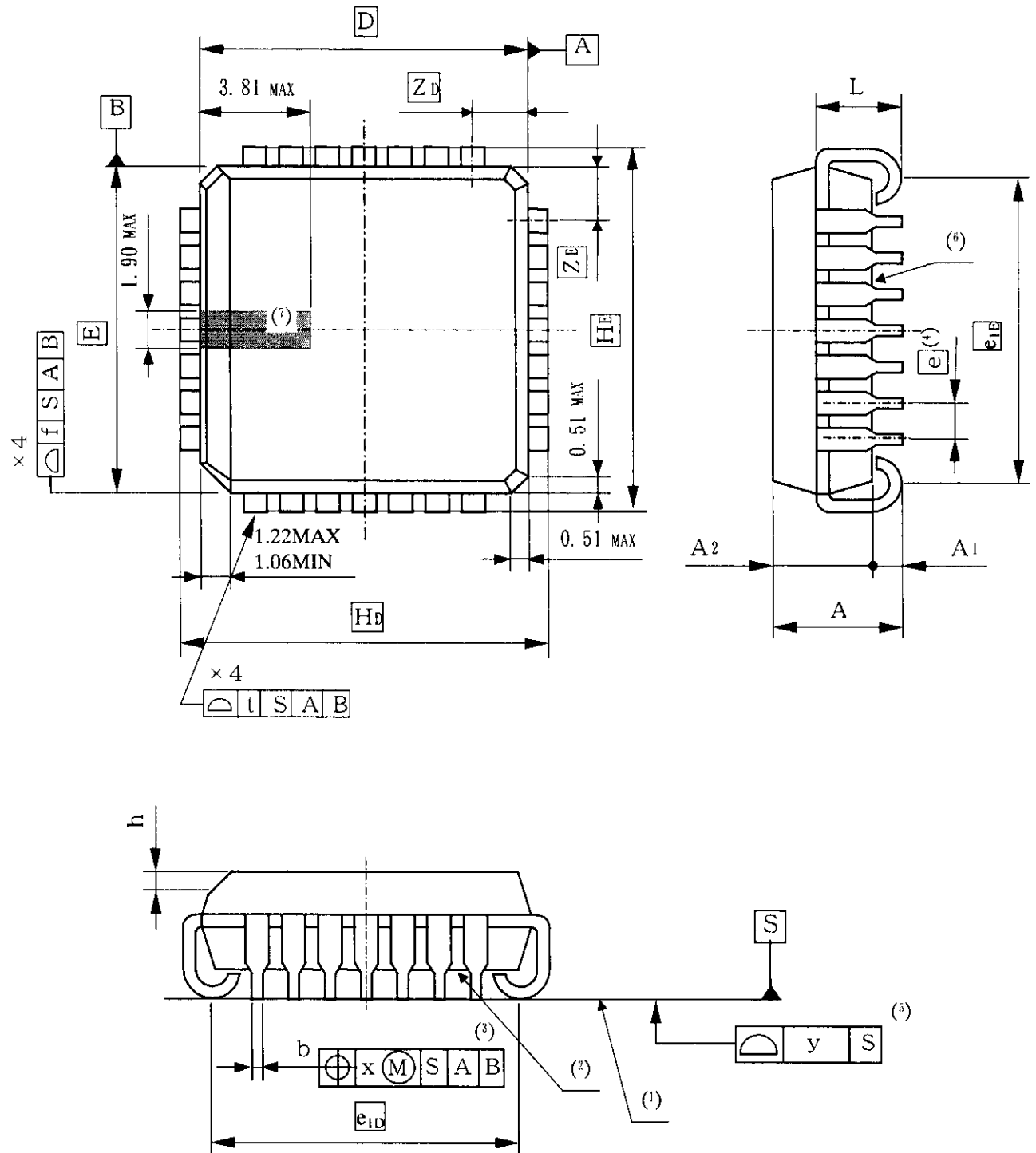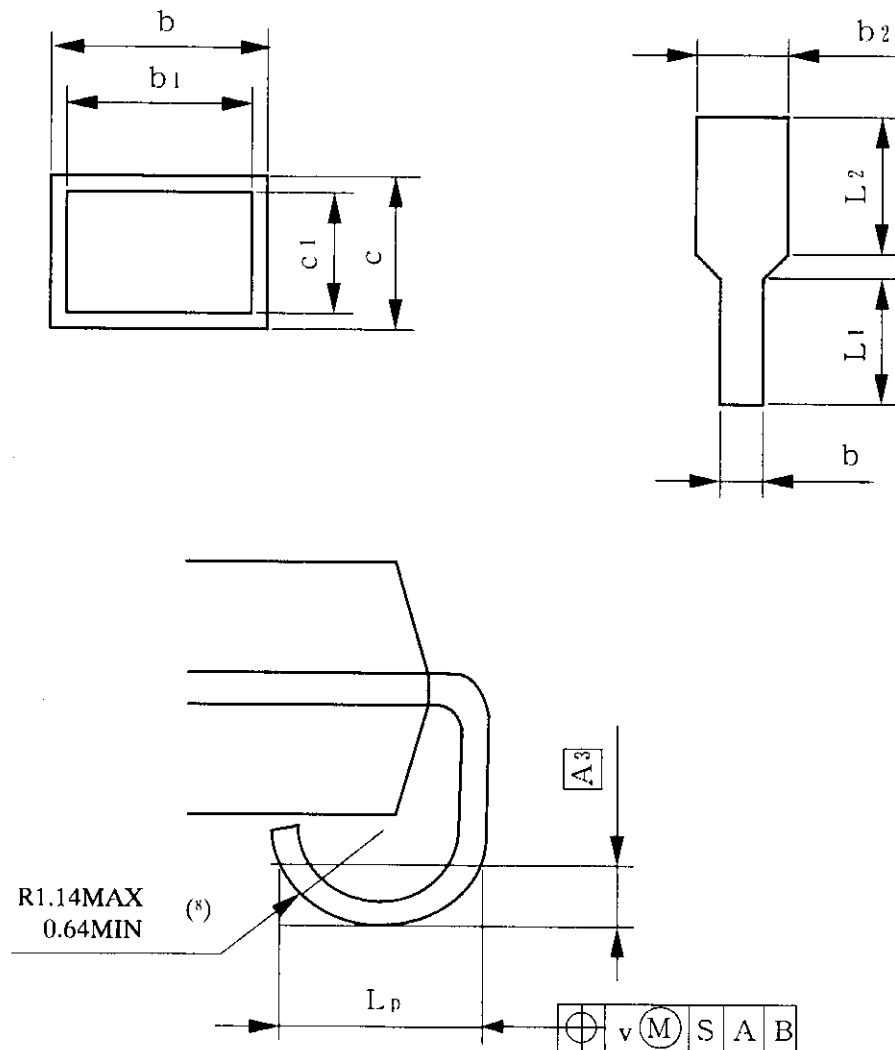## 7. REFERENCE CHARACTERS AND DRAWINGS

7.1 Outline Drawings

Figure 1

Figure 2

R1.14MAX
0.64MIN (8)

Note (1) The mounting surface, with which a package is in contact.

(2) The base surface, which is in parallel with the mounting surface and links the lowest points, except the stand-off.

(3) The positional tolerance are applied to all terminals.

(4) Specifies the true geometric position of the terminal axis.

(5) Specifies the vertical shift of the flat part of each terminal form the mounting surface.

(6) The shape of the lower side of the package is arbitrary.

(7) Shows the allowable position of the index mark, which must be included in the shaded area entirely.

(8) Dimensions of terminal's R indicated by parenthesis is for reference.

REMARKS RANGE WHERE TERMINALS TO BE SOLDERED EXIST

The range where the terminals to be soldered can exist is shown in Figure 3 as reference for the foot print design.

Figure 3

$$l_{1\,max} = (L_{p\,max} + v) / 2$$

$$l_{2\,max} = (L_{p\,max} + v) / 2$$
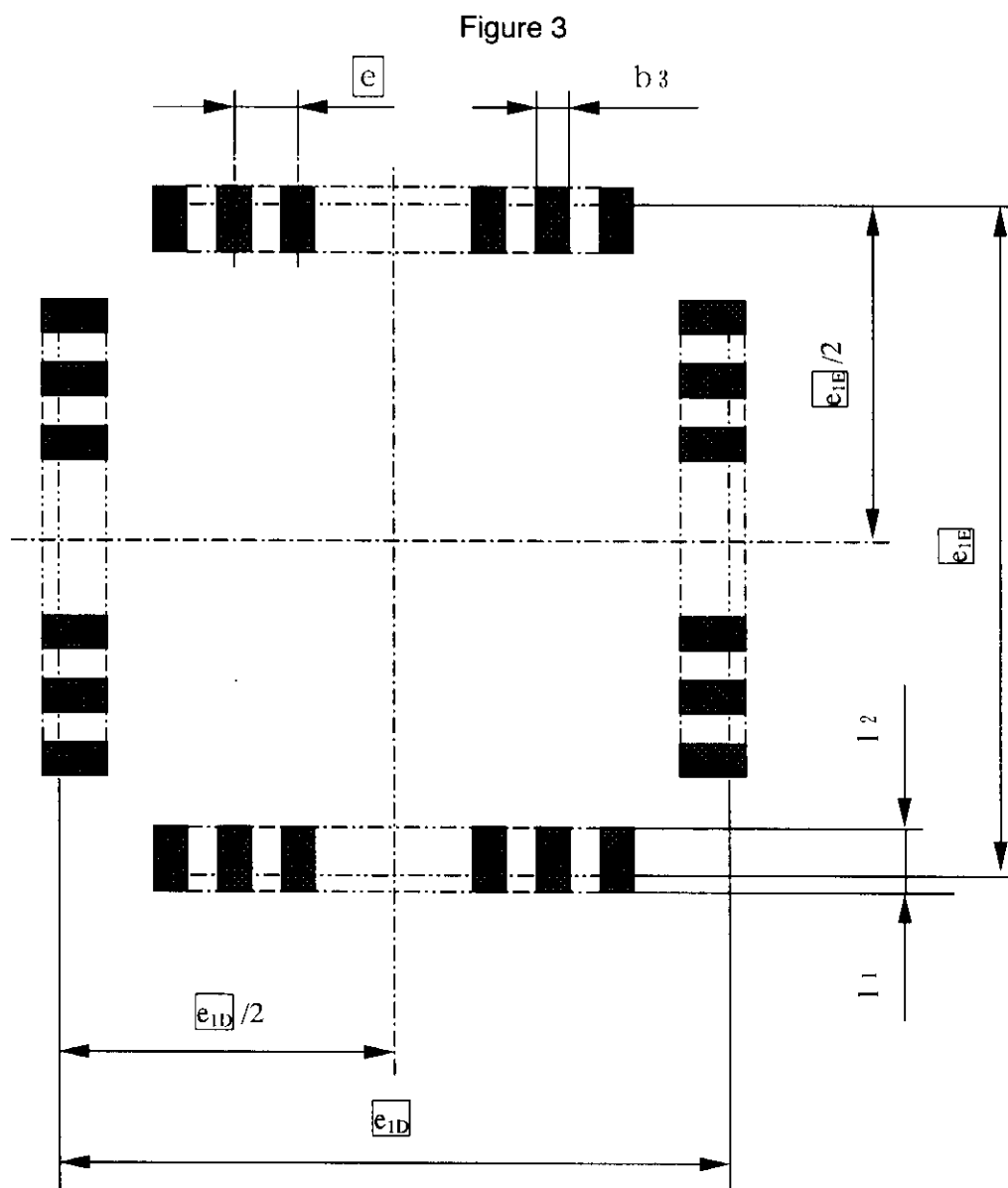
$$b_{3\,max} = b_{max} + x$$

8. OUTER DIMENSION

Table 1 below shows the standard dimension. Combinations of the standard dimension shown below allow a number of package variation. If package are designed newly, their dimensions shall be selected in the Table of Standard Package Dimension List in the Appendix.

8.1 Group 1

Table 1   Unit : mm

Description	Symbol	Standards	Recommended Values	Remarks
Nominal dimensions	E = D E × D	Combination of package width E and package length D is regarded as Nominal dimensions. (1) Square solid series Type E = D 　I　8.89(350mil)　　II　11.43(450mil) 　III　16.51(650mil)　IV　19.05(750mil) 　V　24.13(950mil)　VI　29.21(1150mil) 　VII　34.29(1350mil)　VIII　41.91(1650mil) (2) Rectangular solid series Type E × D 　I　7.24×10.80(285×425mil) 　II　7.37×12.45(290×490mil) 　III　8.89×13.97(350×550mil) 　IV　11.43×13.97(450×550mil)	————	The nominal Dimension series Is equivalent to The body Dimension series.
Package width	E	The maximum and minimum values of E and D shall be specified as shown below. (1) Square solid series		The package dimensions do not include the resin burrs and gate remainders. The resin burrs and gate remainders should be max=0.25 at each side.
Package length	D	(2) Rectangular solid series		

Square solid series table (under Package width):

Nominal dimensions	E = D min	E = D max
8.89 (350mil)	8.89	9.04
11.43 (450mil)	11.43	11.58
16.51 (650mil)	16.51	16.66
19.05 (750mil)	19.05	19.20
24.13 (950mil)	24.13	24.33
29.21 (1150mil)	29.21	29.41
34.29 (1350mil)	34.29	34.49
41.91 (1650mil)	41.91	42.11

Rectangular solid series table (under Package length):

Nominal dimensions	E min	E max	D min	D max
7.24×10.80 (285×425mil)	7.17	7.31	10.72	10.87
7.37×12.45 (290×490mil)	7.29	7.44	12.37	12.52
8.89×13.97 (350×550mil)	8.82	8.96	13.90	14.04
11.43×13.97 (450×550mil)	11.36	11.50	13.90	14.04

Table 1 (Continued)

Unit : mm

Description	Symbol	Standards	Recommended Values	Remarks
Tolerance of package edge	f	(1) The tolerance of package edge shall be specified in the outline drawing ⌓ | f | S | A | B (2) The symbol f shall be replaced with any of the values shown below. | f | | 0.18 |	——	

Overall width — H_E

Standard values shall be specified as shown below.

(1) Square solid series

Nominal dimensions \ Reference symbol	$H_E = H_D$	
	min	max
8.89 (350mil)	9.78	10.03
11.43 (450mil)	12.32	12.57
16.51 (650mil)	17.40	17.65
19.05 (750mil)	19.94	20.19
24.13 (950mil)	25.02	25.27
29.21 (1150mil)	30.10	30.35
34.29 (1350mil)	35.18	35.43
41.91 (1650mil)	42.80	43.05

Overall length — H_D

(2) Rectangular solid series

Nominal dimensions \ Reference symbol	H_E		H_D	
	min	max	min	max
7.24 × 10.80 (285 × 425mil)	8.06	8.30	11.61	11.86
7.37 × 12.45 (290 × 490mil)	8.13	8.50	13.21	13.58
8.89 × 13.97 (350 × 550mil)	9.78	10.03	14.86	15.11
11.43 × 13.97 (450 × 550mil)	12.32	12.57	14.86	15.11

Table 1 (Continued)

Unit : mm

Description	Symbol	Standards	Recommended Values	Remarks
Seated height	A	Standard values shall be specified as shown below. (1) Square solid series <table><tr><td colspan="2">Reference symbol</td><td colspan="2">A</td></tr><tr><td colspan="2">Nominal dimensions</td><td>min</td><td>max</td></tr><tr><td colspan="2">Less than 16.51(650mil)</td><td>4.20</td><td>4.57</td></tr><tr><td colspan="2">19.05(750mil) or more</td><td>4.20</td><td>5.08</td></tr></table> (2) Rectangular solid series $A\max = 3.55$ $A\min = 2.54$	(1) Square solid series <table><tr><td>Nominal dimensions</td><td>A_{nom}</td></tr><tr><td>Less than 16.51(650mil)</td><td>4.38</td></tr><tr><td>19.05(750mil) or more</td><td>4.64</td></tr></table> (2) Rectangular solid series $A_{nom} = 3.05$	
Stand-off height	A_1	Minimum values shall be specified as shown below. (1) Square solid series $A_1\min = 0.51$ (2) Rectangular solid series $A_1\min = 0.38$	$A_{1nom} = 0.90$	
Package body height	A_2	The package body height is as recommended value.	(1) Square solid series <table><tr><td>Nominal dimensions</td><td>A_{2nom}</td></tr><tr><td>Less than 16.51(650mil)</td><td>3.48</td></tr><tr><td>19.05(750mil) or more</td><td>3.74</td></tr></table> (2) Rectangular solid series $A_{2nom} = 2.15$	
Standard height of soldered points	$\boxed{A_3}$	$\boxed{A_3} = 0.50$	———	
Terminal width	b	The maximum and minimum values of the top of terminal width shall be specified as shown below. $b_{max} = 0.58$ $b_{min} = 0.33$	(1) Sn/Pb Solder plating $b_{nom} = 0.45$ (2) Pd plating $b_{nom} = 0.43$	(1) b_1 denotes the material width of a terminal. (2) b denotes the width of a plated terminal. (3) As Pd plating, it is very thin so terminal width is $b_{1nom} = b_{nom}$
	b_1	The maximum and minimum values of the terminal width b_1 shall be specified as shown below. $b_{1max} = 0.54$ $b_{1min} = 0.33$	$b_{1nom} = 0.43$	
	b_2	The maximum and minimum values of the terminal width b_2 shall be specified as shown below. $b_{2max} = 0.86$ $b_{2min} = 0.66$	$b_{2nom} = 0.71$	The tie bar cutting remainder is not included.

Table 1 (Continued)

Unit : mm
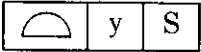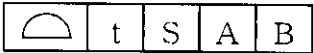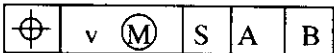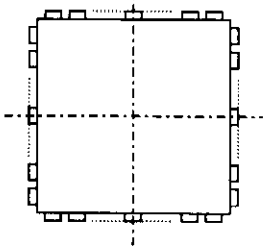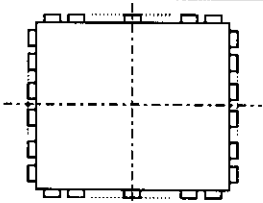
Description	Symbol	Standards	Recommended Values	Remarks
Terminal thickness	c	$c = 0.10 \sim 0.34$	Sn/Pb Solder plating $c_{nom} = 0.22$ Pd plating $c_{nom} = 0.20$	(1) c1 denotes the material thickness of a terminal. (2) c denotes the thickness of a plated terminal.
	c_1	$c_1 = 0.10 \sim 0.30$	$c_{1nom} = 0.20$	(3) As Pd plating, it is very thin so terminal thickness is $c_{1nom} = c_{nom}$
Terminal pitch in-line interval	$\boxed{c}$	$\boxed{e} = 1.27$	————	This value denotes the true geometric position.
Tolerance of terminl center position	x	(1) The tolerance of terminal center shall be specified in the outline drawing. $\boxed{\oplus} \; \boxed{x \; \circledM} \; \boxed{S} \; \boxed{A} \; \boxed{B}$ (2) The symbol x shall be replaced with any of the values shown below. $x = 0.18$	————	(1) The concept of the maximum mounting condition(MMC) shall be applied
Coplanarity	y	(1) The coplanarity shall be specified in the outline drawing. $\boxed{\triangle} \; \boxed{y} \; \boxed{S}$ (2) The symbol y shall be replaced with any of the values shown below. $y = 0.10$	————	
Positional tolerance of terminal tips	t	(1) The tolerance of the terminal tips shall be specified in the outline drawing. $\boxed{\triangle} \; \boxed{t} \; \boxed{S} \; \boxed{A} \; \boxed{B}$ (2) The symbol t shall be replaced with any of the values shown below. $t = 0.18$	————	
Tolerance of terminal row interval	v	(1) The tolerance of the terminal row interval shall be specified in the outline drawing. $\boxed{\oplus} \; \boxed{v \; \circledM} \; \boxed{S} \; \boxed{A} \; \boxed{B}$ (2) The symbol v shall be replaced with any of the values shown below. $v = 0.18$	————	

Table 1 (Continued)   Unit : mm

Description	Symbol	Standards		Recommended Values	Remarks
Length of soldered part	L_p	L_p max.=1.74 L_p min.=1.20		———	
Number of terminal positions	n	Maximum number of terminal shall be specified as shown below.		———	
		E x D	n		
		8.89×8.89(350×350mil)	20		
		11.43×11.43(450×450mil)	28		
		16.51×16.51(650×650mil)	44		
		19.05×19.05(750×750mil)	52		
		24.13×24.13(950×950mil)	68		
		29.21×29.21(1150×1150mil)	84		
		34.29×34.29(1350×1350mil)	100		
		41.91×41.91(1650×1650mil)	124		
		7.24×10.80(285×425mil)	18		
		7.37×12.45(290×490mil)	22		
		8.89×13.97(350×550mil)	28		
		11.43×13.97(450×550mil)	32		

Table 1 (Continued)   Unit : mm

Description	Symbol	Standards	Recommended Values	Remarks
Terminal layout		Terminal shall be arranged as shown below.		

E x D (mil)	Terminal layout
8.89×8.89(350×350mil) 11.43×11.43(450×450mil) 16.51×16.51(650×650mil) 19.05×19.05(750×750mil) 24.13×24.13(950×950mil) 29.21×29.21(1150×1150mil) 34.29×34.29(1350×1350mil) 41.91×41.91(1650×1650mil) 8.89×13.97(350×550mil) 11.43×13.97(450×550mil)	 The package center coincides with the terminal center.
7.24×10.80(285×425mil) 7.37×12.45(290×490mil)	 The terminal center is shifted by e/2 from the package center.

8.2 Group 2

Table 1 (Continued)　　　　　　　　　　　　　　　　　　Unit : mm

Description	Symbol	Standards	Recommended Values	Remarks
Terminal length	L	Standard values shall be specified as shown below. (1) Square solid series | Nominal dimensions \ Reference symbol	L min	L max
Less than 16.51 (650mil)	2.29	3.04
19.05 (750mil) or more	2.29	3.30 | (2) Rectangular solid series 　　$L\,max=2.41$ 　　$L\,min=1.53$		
	L_1	Inflectional point of terminal width (b, b_2) shall be specified as shown below. 　$L_1 min.=0.64$	——	
	L_2	Inflectional point of terminal width (b, b_2) shall be specified as shown below. 　$L_1 min.=0.64$	——	
Chamfer	h	The maximum and minimum values of the top of terminal width shall be specified as shown below. (1) Square solid series　　$h_{max}=1.42$ 　　　　　　　　　　　　　$h_{min}=1.07$ (2) Rectangular solid series　$h_{max}=0.74$ 　　　　　　　　　　　　　$h_{min}=0.58$	——	
Package overhang	Z_E	$Z_E=(\,E\,-(nE-1)\times e\,)/2$ nE: The number of terminals along a widthwise side of a package	——	(1) Resin burrs or gate remainders are not included.
	Z_D	$Z_D=(\,D\,-(nD-1)\times e\,)/2$ nD: The number of terminals along a lengthwise side of a package.	——	

Table 1 (Continued)   Unit : mm

Description	Symbol	Standards	Recommended Values	Remarks
Terminal row interval	e_{1E} e_{1D}	Standard values shall be specified as shown below. (1) Square solid series		

(1) Square solid series

	$e_{1E} = e_{1D}$	
	min	max
8.89 (350mil)	7.37	8.38
11.43 (450mil)	9.91	10.92
16.51 (650mil)	14.99	16.00
19.05 (750mil)	17.53	18.54
24.13 (950mil)	22.61	23.62
29.21 (1150mil)	27.69	28.70
34.29 (1350mil)	32.77	33.78
41.91 (1650mil)	40.39	41.40

(2) Rectangular solid series

	e_{1E}		e_{1D}	
	min	max	min	max
7.24 × 10.80 (285 × 425mil)	5.64	6.73	9.20	10.28
7.37 × 12.45 (290 × 490mil)	5.64	6.73	10.72	11.81
8.89 × 13.97 (350 × 550mil)	7.37	8.38	12.47	13.46
11.43 × 13.97 (450 × 550mil)	9.91	10.92	12.47	13.46

9. STANDARD PACKAGE LIST

To further clarify the combinations of part dimensions, the combinations of recommended package classifications shall be indicated as shown below as assistance in the design and development of new package in the future.

Table 2 Standard Package List

Nominal dimensions E x D	Terminal number n	Seated height A		Stand-off height A_1
		min.	max.	min.
8.89×8.89(350×350 mil)	20	4.20	4.57	0.51
11.43×11.43(450×450 mil)	28	4.20	4.57	0.51
16.51×16.51(650×650 mil)	44	4.20	4.57	0.51
19.05×19.05(750×750 mil)	52	4.20	5.08	0.51
24.13×24.13(950×950 mil)	68	4.20	5.08	0.51
29.21×29.21(1150×1150 mil)	84	4.20	5.08	0.51
34.29×34.29(1350×1350 mil)	100	4.20	5.08	0.51
41.91×41.91(1650×1650 mil)	124	4.20	5.08	0.51
7.24×10.80(285×425 mil)	18	3.18	3.55	0.38
7.37×12.45(290×490 mil)	18	3.18	3.55	0.38
7.37×12.45 (290×490 mil)	22	3.18	3.55	0.38
8.89×13.97(350×550 mil)	28	3.18	3.55	0.38
11.43×13.97(450×550 mil)	32	3.18	3.55	0.38

10. STANDARD REGISTRATION

When you need to register a new outline specification on the standard, complete the appendix format 5 in Technical Standardization Committee on Semiconductor Device Package steering rule, in compliance with the Standardization Rule.

In order to make a package dimension table, which comes under Item 2, Appendix format 5, fill the dimensions marked with (✓) in the following table 3.

Table 3

Serial Number				
External Type	P-QFJ-○○○○ − ○○○○ × ○○○○ − ○. ○○			
Reference Symbol		min	nom	max
Group 1	E		✓	
	D		✓	
	f			✓
	HE		✓	
	HD		✓	
	A			✓
	A1	✓	✓	✓
	A2	✓	✓	✓
	A3		✓	
	b	✓		✓
	b1	✓	✓	✓
	b2	✓		✓
	c	✓		✓
	c1	✓		✓
	e		✓	
	x			✓
	y			✓
	t			✓
	v			✓
	Lp	✓		✓
	n		✓	
Group 2	L	✓		✓
	L1		✓	
	L2		✓	
	h			
	c1E		✓	
	c1D		✓	
	ZE		✓	
	ZD		✓	

11. RELATED STANDARDS

    (1) EIAJ ET-9001   "Rules for the drafting and presentation of EIAJ Standards"

    (2) EIAJ ED-7300   "Recommended practice on General Rules for the preparation of outline drawings of semiconductor packages"

    (3) EIAJ ED-7301   "Manual for the standard of integrated circuits package"

    (4) EIAJ ED-7302   "Manual for integrated circuits package design guideline"

    (5) EIAJ ED-7303   "Name and code for integrated circuits package"

EXPLANATION

1. OBJECTIVES OF THE TECHNICAL REPORT

The technical report has been prepared to show the industry standard and to offer a design guideline when developing the Quad Flat J-Lead Package(hereinafter referred as QFJs), automatic mounting equipment for it, and related parts(thereof).

2. HISTORY OF REVIEW

EIAJ ED-7407 "General Rules for the Preparation of Outline Drawings of Integrated Circuits, Quad Flat J-Lead Packages" has been issued prior to the technical report.

EIAJ ED-7407 was established and issued in Jun,1988 after the review made by the former "Technical Committee on Semiconductor Package Outlines"(currently "Special Technical Committee on Semiconductor Package").

To abolish EIAJ ED-7407 in 1998, this standard was reviewed by the Plastic Package Subcommittee under "Technical Standardization Committee on Semiconductor Device Package".

During the review, the technical report has been assured the coherence between EIAJ ED-7407 and JEDEC standard (MO-047, MS-016).

3. KEY POINTS FOR THE REIEW

(1) Datum marking

EIAJ ED-7406A "General Rules for the Preparation of Outline Drawings of Integrated Circuits Small Outline J-Lead Packages" was referred to upon determining the datum. This decision was made on the philosophy that it was appropriate to define and control the relative positions between the (respective) terminals that are aligned to be bonded on the mount pad of the substrate when mounting the package on it.

(2) Definitions of dimension

Package width and package length, overall width, overall length were revised to the true geometric position. Positional tolerance of terminal tips and package edge, seated height, package over hang, standard height of soldered points, length of soldered part were added. Terminal width and thickness were revised to the dimension included plating width and thickness.

(3) Range where terminals to be soldered exit

Terms was revised from "Mount pad dimensions"

(4) Standard Package List

Standard Package List was added. Standard packages are registered in JEDEC standard (MO-047, MS-016).The list was defined maximum and minimum values of mounting height and minimum value of standoff height instead of package height and nominal value of standoff height.

(5) Standard Registration

Standard Registration format was added. EIAJ EDR-7311 "Design guideline of integrated circuits for Quad Flat Package" was referred to upon determining the registering dimensions.

4. BACKGROUND FOR THE RESPECTIVE DIMENSIONAL RULES

(1) Tolerance of package edge

The tolerance of 0.18mm was specified in order to assure the coherence with the JEDEC standard MS-016.

(2) Seated height recommended values

These dimensions were specified average of maximum and minimum values of seated height standard.

(3) Stand-off height recommended values

The A_{1nom} of 0.90mm was specified in order to assure the coherence with the EIAJ ED-7406A.

(4) Package height

These dimensions were specified only recommended values. These were calculated by recommended values of seated height and stand-off height.

(5) Standard height of soldered points

The A_3 of 0.50mm was specified in order to assure the coherence with the EIAJ ED-7406A.

(6) Terminal width

The b1 values were specified to be equal to the b values of EIAJ ED-7407. The b values were added plated thickness to b1 values. The b_2 values were specified to be added plated thickness to b_1 values of EIAJ ED-7407.

(7) Terminal thickness

The c_1 values were specified to be equal to the c values of EIAJ ED-7407. The c values were added plated thickness to c_1 values.

(8) Positional tolerance of terminal tips

The tolerance of 0.18mm was specified in order to assure the coherence with the JEDEC standard MS-016.

(9) Tolerance of terminal row interval

The tolerance of 0.18mm was specified in order to assure the coherence with tolerance of terminal center position.

(10) Length of soldered part

The length of maximum 1.74 and minimum 1.20 were specified in order to assure the coherence with the EIAJ ED-7406A.

(11) Number of terminal positions

EIAJ ED-7407 specified the number of terminal existing on a package side, which was standardized by number of terminal positions in order to comply with EIAJ ED-7300.

(12) Terminal layout

Terminal layout was added, for the number of terminal existing on a package side was deleted from this standard.

5. MEMBERS OF DISCUSSION

This technical report has been discussed by the Plastic Package Subcommittee of Technical Standardization Committee on Semiconductor Device Package . The members are as shown below.

\<Technical Standardization Committee on Semiconductor Device Packages\>

Chairman	Shouzou Minamide	SHARP CORPORATION

\<Plastic Package Subcommittee\>

Chairman	Kaoru Sonobe	NEC CORPORATION
Co-chairman	Takashi Okada	TOSHIBA CORPORATION
Co-chairman	Takahiro Imura	TEXAS INSTRUMENTS JAPAN LTD.
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	Hideya Haruguchi	SHARP CORPORATION
	Hidehito Odagiri	SUMITOMO 3M,LTD.
	Akitoshi Hara	SEIKO EPSON CO.
	Toshihiko Nojiri	SONY CORPORATION
	Toshihiro Murayama	SONY CORPORATION
	Kenji Kanesaka	NIPPON STEEL SEMICONDUCTOR CORPORATION
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	Hiroaki Hirano	SUMSUNG JAPAN CO.,LTD.
	Kenichi Kurihara	NEC CORPORATION
	Nobuo Sato	MOTOROLA JAPAN LTD.
	Nobuya Kanemitsu	HITACHI LTD.
	Masanori Yoshimoto	FUJITSU LIMITED
	Osamu Hirohashi	FUJI ELECTRIC CO.,LTD.
	Shigeki Sakaguchi	MATSUSHITA ELECTRONICS CORPORATION
	Kou Shimomura	MITSUBISHI ELECTRONIC CORPORATION
	Nanahiro Hayakawa	YAMAICHI ELECTRONICS CO.,LTD.
	Hitoshi Matsunaga	UNITECHNO INC.
	Kazumi Morimoto	ROHM CO.,LTD.