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EIAJ EDR-7321

(旧ED-7409改正)

集積回路パッケージデザインガイド クワッドフラットI-リードパッケージ

Design guideline of integrated circuits for Quad Flat I-lead package (QFI)

1999年2月制定

作　成

半導体パッケージ標準化委員会

Technical Standerdization committee on Semiconductor Device Package

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Design guideline of integrated circuits for Quad Flat I-lead package (QFI)

1. SCOPE OF APPLICATION

This standard regulated outline drawings and dimensions of surface quad flat I-lead package (QFI), especially plastic packages, classified as form A under the **EIAJ ED-7300** (standard for preparing standard outline drawings (integrated circuits) of semiconductor devices).

2. TERMS

The definition of the terms used in this technical report complies with the **EIAJ ED-7300**. New terms will defined in the description of this technical report.

3. BACKGROUND

This technical report is intended to standardize the outer dimensions of QFIs and ensure compatibility between products. This standard shows the standard design values on the concept of the design centers as far as possible for standardization.

4. DEFINITION OF PACKAGE

A QFI is classified as Form A with I Terminal in the **EIAJ ED-7401A**, and defined a package with formed terminals which are led out of itself in four directions and are vertical toward the outside in junctions outside the package body for mounting on PCB surface.

5. NUMBER OF TERMINALS

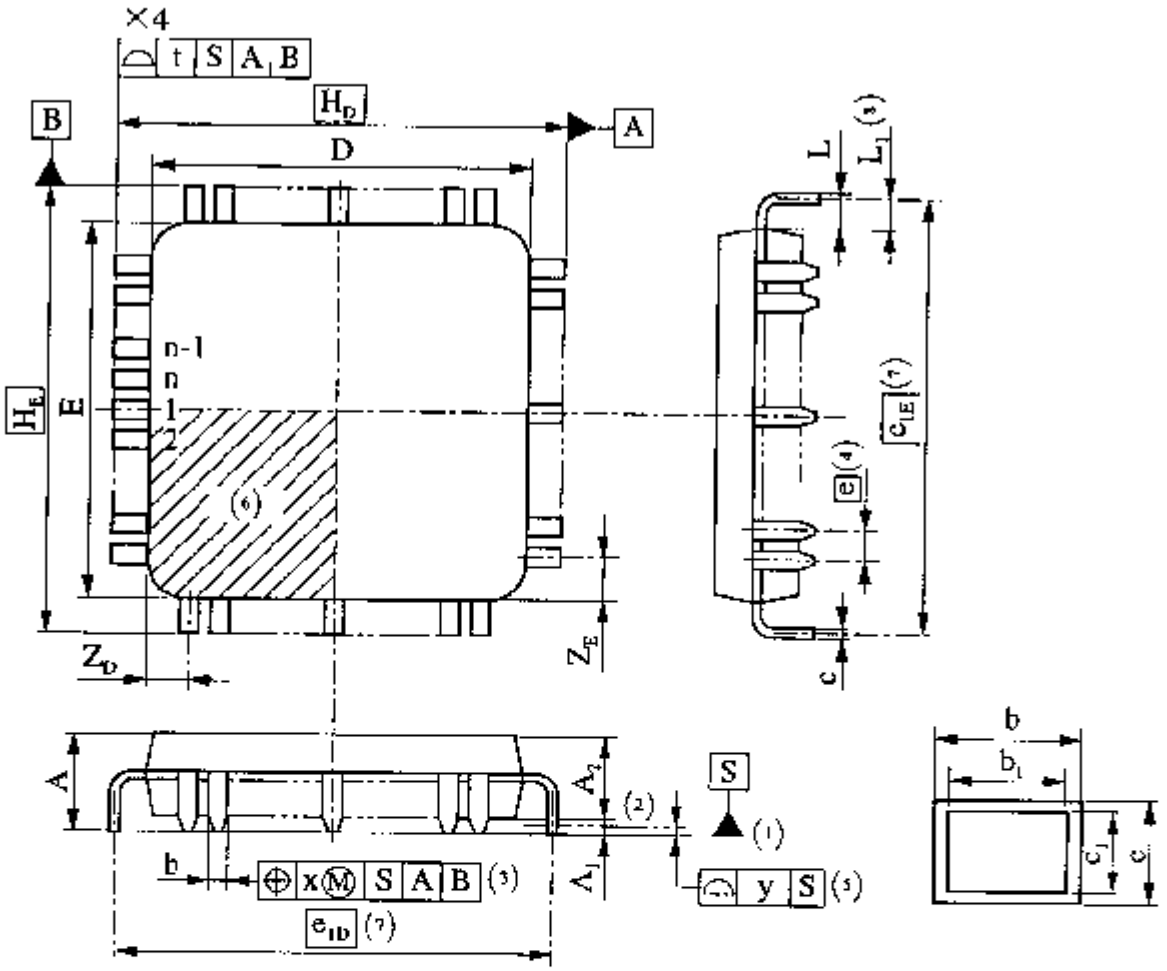
Numbering of Terminals complies with the **EIAJ ED-7300.**

6. NOMINAL DIMENSIONS

The dimensions of center of outer-leads line (Symbol: $e_D \times e_E$) is applied to nominal dimensions.

7. REFERENCE CHARACTERS AND DRAWINGS

QFI Outline drawings



Notes:

(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 tolerances are applied to all terminals.

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

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

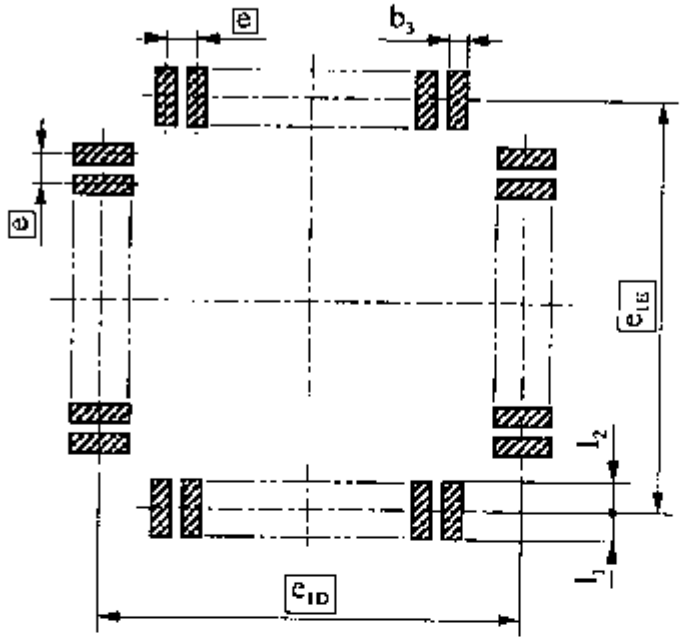
(6) Shows the allowable position of index mark, which must be included in the shaded area entirely.

(7) The dimensions of center of outer-leads line (Symbol: $e_{1D} \times e_{1E}$) is applied to nominal dimensions.

(8) This dimension is center of leads from package side

REMARKS. ALLOWABLE RANGE OF SOLDERING PART OF TERMINALS.

The range where the terminals to be sokdered can exist is shown in this figure as reference for the foot print design.



$L_{1max} = (t - c_{max}) / 2$

$L_{2max} = (t - c_{max}) / 2$

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

8. Overall Dimensions, Recommended value, Supplement

8.1 Group1

Table 1

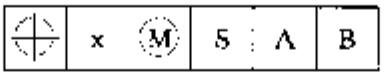
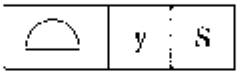
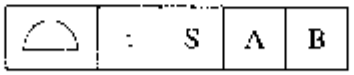
unit: mm

<table>
<tr><th>Name</th><th>Reference symbol</th><th>Standards</th><th>Recommended value</th><th>Remarks</th></tr>
<tr><td>Nominal dimension</td><td>$\boxed{e_{1D}}\times\boxed{e_{1E}}$</td><td>
·The dimensions of center of outer-leads line (Symbol: $\boxed{e_{1D}}\times\boxed{e_{1E}}$) is applied to nominal dimensions.
·Nominal dimension are defined below;
$\boxed{e_{1D}} = D+2\times L_1$
$\boxed{e_{1E}} = E+2\times L_1$
Nominal dimensions are listed below.
Square ($\boxed{e_{1D}}\times\boxed{e_{1E}}$)
<table>
<tr><th rowspan="2">Nominal dimension (mil) $\boxed{e_{1D}}\times\boxed{e_{1E}}$ \ Terminal Pitch</th><th colspan="3">Number of terminals</th></tr>
<tr><th>1.270 (50mil)</th><th>1.016 (40mil)</th><th>0.762 (30mil)</th></tr>
<tr><td>5.08×5.08 (200×200)</td><td>–</td><td>–</td><td>20</td></tr>
<tr><td>6.35×6.35 (250×250)</td><td>–</td><td>20</td><td>–</td></tr>
<tr><td>7.62×7.62 (300×30)</td><td>20</td><td>–</td><td>28</td></tr>
<tr><td>8.89×8.89 (350×350)</td><td>–</td><td>28</td><td>–</td></tr>
<tr><td>10.16×10.16 (400×400)</td><td>28</td><td>–</td><td>44</td></tr>
<tr><td>12.70×12.70 (500×500)</td><td>–</td><td>44</td><td>52</td></tr>
<tr><td>15.24×15.24 (600×600)</td><td>44</td><td>52</td><td>–</td></tr>
<tr><td>17.78×17.78 (700×700)</td><td>52</td><td>–</td><td>68</td></tr>
<tr><td>20.32×20.32 (800×800)</td><td>–</td><td>68</td><td>84</td></tr>
<tr><td>22.86×22.86 (900×900)</td><td>68</td><td>84</td><td>100</td></tr>
</table>
</td><td>$\boxed{e_{1D}} = \boxed{e_{1E}}$</td><td></td></tr>
<tr><td>Package Width</td><td>E</td><td rowspan="2">·Package width E,and Package legth D are defined below.
$E=\boxed{e}\times(\frac{n}{4}-1)+2\times Z_E$
$D=\boxed{e}\times(\frac{n}{4}-1)-2\times Z_D$
Dimension E,D are not regulation, but desired including dimension ZE max, Z_{Dmax} Stipulation.</td><td rowspan="2"></td><td rowspan="2">Dimension E, D does not include resin fines and gate remainders. Maximun and Minimum demension defined Package Standards.</td></tr>
<tr><td>Package length</td><td>D</td></tr>
<tr><td>Mounting height</td><td>A</td><td>Mounting height value is defined below:
$A_{max} = 3.05$</td><td></td><td></td></tr>
</table>

Table 1 (continued) unit: mm

<table>
<tr><th>Name</th><th>Reference symbol</th><th>Standards</th><th>Recommended value</th><th>Remarks</th></tr>
<tr><td>Stand-off height</td><td>A_1</td><td>Stand-off height value is defined below:
$A_{1min} = 0$
$A_{1max} = 0.75$</td><td></td><td>It use properly within use.</td></tr>
<tr><td>Package height</td><td>A_2</td><td>·Dimension E, D is not regulation,but desired including Recommended value dimension.</td><td>1.53～3.05</td><td>Maximun and Minimum demension defined Package Standards.</td></tr>
<tr><td>Termial pitch</td><td>e</td><td>e =1.270 (50mil)
e =1.016 (40mil)
e =0.762 (30mil)</td><td></td><td>·These values denote the true geometric position.</td></tr>
<tr><td rowspan="2">Terminal width</td><td>b</td><td>·Maximum and Minimum dimension are below table to all terminal pitch.
<table>
<tr><th>e</th><th>b_{1min}</th><th>b_{1max}</th></tr>
<tr><td>1.270 (50mil)</td><td>0.30</td><td>0.54</td></tr>
<tr><td>1.016 (40mil)</td><td>0.30</td><td>0.54</td></tr>
<tr><td>0.762 (30mil)</td><td>0.25</td><td>0.49</td></tr>
</table></td><td>
<table>
<tr><th>e</th><th>b_{1nom}</th></tr>
<tr><td>1.270 (50mil)</td><td>0.42</td></tr>
<tr><td>1.016 (40mil)</td><td>0.42</td></tr>
<tr><td>0.762 (30mil)</td><td>0.37</td></tr>
</table></td><td></td></tr>
<tr><td>b_1</td><td>·Maximum and Minimum dimension are below table to all terminal pitch.
<table>
<tr><th>e</th><th>b_{1min}</th><th>b_{1max}</th></tr>
<tr><td>1.270 (50mil)</td><td>0.30</td><td>0.50</td></tr>
<tr><td>1.016 (40mil)</td><td>0.30</td><td>0.50</td></tr>
<tr><td>0.762 (30mil)</td><td>0.25</td><td>0.45</td></tr>
</table></td><td>
<table>
<tr><th>e</th><th>b_{1nom}</th></tr>
<tr><td>1.270 (50mil)</td><td>0.37</td></tr>
<tr><td>1.016 (40mil)</td><td>0.37</td></tr>
<tr><td>0.762 (30mil)</td><td>0.32</td></tr>
</table></td><td></td></tr>
<tr><td rowspan="2">Terminal thickness</td><td>c</td><td>$c_{min} = 0.17$
$c_{max} = 0.32$</td><td>$c_{nom} = 0.27$</td><td rowspan="2"></td></tr>
<tr><td>c_1</td><td>$c_{1min} = 0.15$
$c_{1max} = 0.30$</td><td>$c_{1nom} = 0.25$</td></tr>
</table>

Table 1 (continued) unit: mm

Name	Reference symbol	Standards	Recommended value	Remarks
Tolerance of terminal center position	x	(1) Tolerance of terminal center position express in outline drawings.  (2) The symbol x shall be replaced with any of the values shown below. c: 1.270 (50mil) → x: 0.05 c: 1.016 (40mil) → x: 0.20 c: 0.762 (30mil) → x: 0.15		If applied MMC. ($x \leqq$ c/5)
Coplanarity	y	 ・The coplanarity shall be specified in the outline drwaing. ・The symbol y shall be replaced with any of the values shown below. y = 0.15		
Overall width	H_F	・Nominal dimensions is defined below: $H_F = E + 2 \times f$.		
Overall length	H_D	・Nominal dimensions is defined below: $H_D = D + 2 \times f$.		
Positional tolerance of terminal tips	t	・The tolerance of the terminal tips shall be indicated in the outline drawing.  ・The character t shall be replaced with any of values shown below. t = 0.35		

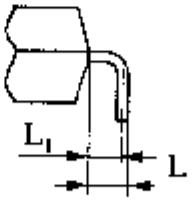
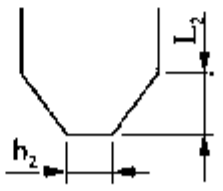
8.2 Group2

Table 1 (continued)

unit: mm

Name	Reference symbol	Standards	Recommended value	Remarks
Maximum number of terminal position	n	Standard number of terminal shall be specified as shown below.		

Nominal dimension (mil) $e_{1x} \times e_{1y}$ \ Terminal Pitch	Number of terminals 1.270 (50mil)	1.016 (40mil)	0.762 (30mil)
5.08×5.08 (200×200)		–	20
6.35×6.35 (250×250)		20	–
7.62×7.62 (300×300)	20	–	28
8.89×8.89 (350×350)	–	28	–
10.16×10.16 (400×400)	28	–	44
12.70×12.70 (500×500)	–	44	52
15.24×15.24 (600×600)	44	52	–
17.78×17.78 (700×700)	52	–	68
20.32×20.32 (800×800)	–	68	84
22.86×22.86 (900×900)	68	84	100

Terminal length	L L_1	・Terminal length defined as shown below (in outline drawing): $L_1 = 1.- \left(\frac{e}{2} \right)$ $L_{1min} = 0.5$ $L_{1max} = 1.2$ 	$L_{1min} = 0.75$	
Terminal Tip	b_2 L_2	・Terminal Tip defined as shown below. $L_{2min} = 0.25$ $b_{2min} = 0.20$ 		
Package over hang	Z_E Z_D	・Maximum values is defined below: Z_{Emax} , $Z_{Dmax} = 3 \times$ [e]	Z_{Emax} , Z_{Dmax} = [e] or $1.5 \times$ [e] or $2 \times$ [e]	Z_{Emax} , Z_{Dmax} is resin burrs or residual gates are not included.

9. 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 2**.

Table 2

Serial Number				
External type		P−QFI−○○○○−○○○○×○○○○ ○. ○○		
Reference Symbol		min	nom	max
Group 1	e_{1E}		✓	
	e_{1D}		✓	
	E	✓	✓	✓
	D	✓	✓	✓
	H_E		✓	
	H_D		✓	
	A	✓		✓
	A_1	✓		✓
	A_2	✓	✓	✓
	b	✓	✓	✓
	b_1	✓	✓	✓
	c	✓		✓
	c_1	✓		✓
	e		✓	
	x			✓
	y			✓
	t			✓
	n		✓	
Group 2	L		✓	
	L_1		✓	
	L_2		✓	
	b_2		✓	
	Z_E			✓
	Z_D			✓

Design guideline of integrated circuits for Quad Flat I-Lead Package(QFI) Comments

1. Object

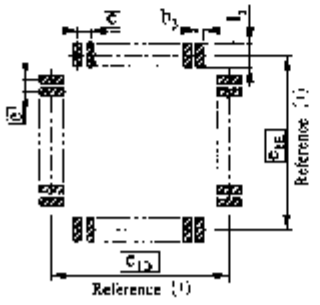
This technical report is established to provide the industrial standards for Quad Flat I-Lead Package (hereinafter called QFI), to provide the design guidelines in producing the QFI and developing the automatic mounting machines and related parts.

2. History of Discussion

This technical report succeeded **EIAJ ED-7409** [General Rules for the Preparation of Outline Drawings of Integrated Circuits Quad Flat I-Leaded Packages]. QFI is a square package with leads extending form each side of the body. The leads are formed in a I-shaped configuration (or butt lead) for surface mounting. The preparation of outline drawings of QFI was assigned in the work schedule of the 1987 term, and the relevant deliberations were started on the meeting of the Technical Committee on Semiconductor Package Outlines [the former committee of Technical Standardization Committee on Semiconductor Device Package] held May 1987. In its early stage, the discussions were focussed on adopting either the inch (mil) system or the millimeter (mm) system as the centerline-to-centerline spacing of the leads. Finally, it was decided to adopt the inch system from the standpoint of compatibility with PLCC, which is the conventional package. And three types of package, 50 mil, 40 mil and 30 mil were adopted as standard QFI. However, all dimensions were unified to the millimeter unit, with the mil unit as a reference unit. For the present, the maximum number of pins of QFI was limited to 100 and the variety of packages was limited to 10 types, because the committee took the limits of practical use into consideration when deciding the variation.
The deliberations for package name were started by adopting the name "MSP". But latter on, it was decided, in response to suggestion asking for the use of clear-cut name taking into consideration the lead configuration, to adopt the unified nomenclature "QFI" including the meaning of the I-shaped configuration. The final deliberation was concluded in June 1988.
EIAJ ED-7409 was abolished after the lapse of ten years in 1998. This technical report succeeding **ED-7409** was being deliberated as the design guideline by Plastic Subcommittee, which is one of subcommittees of Technical Standardization Committee on Semiconductor Device Package.

3. Reference drawing for QFI mounting pad (Unit mm)

Mounting pad layout of **EIAJ ED-7409** was changed to allowable range of soldering part of terminals. Mounting pad layout was moved to the comment section as a reference drawing.



e	b_{3nom}	l_{3nom}
1.270 (50mil)	0.65	1.5
1.016 (40mil)		
0.762 (30mil)	0.46	2.0

Note

(1) Indicate the spacing between the true geometrical center positions of the pad rows.
(2) Add other fine pitch packages according to the mounting technology.

10. COMMITEE MEMBERS

The Plastic Package Subcommittee of the Technical Standardization Committee on Semiconductor Device Packages has mainly deliberated this technical report. The subcommittee members are shown below.

<Technical Standardization Committee on Semiconductor Device Package>

Chairman	Shozo Minamide	SHARP CORPORATION

<Plastic Package Subcommittee>

Chief	Kaoru Sonobe	NEC CORPORATION
Vice-Chief	Takashi Okada	TOSHIBA CORPORATION
Vice-Chief	Takahiro Imura	TEXAS INSTRUMENTS JAPAN LTD.
Members	Hideo Shimada	ENPLAS CORPORATION
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