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EIAJ ED-7305

Unit Design Guide for the Preparation of Package Outline Drawing of Integrated Ciecuits (Gullwing - Lead)

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Unit Design Guide for the Preparation of Package Outline Drawing of Integrated Circuits (Gullwing - Lead)

1. SCOPE OF APPLICATION

This standard covers the requirements for the design rule of terminal shape, especially for the plastic packages with gullwing-leads (ex.QFP, SOP, SSOP, TSOP etc.), among the packages classified as form A and form B in the EIAJ ED-7300.

2. TERMS

The definition of the terms used in this standard complies with EIAJ ED-7300 and ED-7303 . The new terms that are not defined in EIAJ ED-7300 and ED-7303 are defined in this standard.

3. BACKGROUND

Recently , as electronic appliances become smaller and their functions are diversified, the demand for the surface mount package is rapidly increasing. Especially the line up of package with gullwing-leads (ex.QFP,SOP,SSOP,TSOP,etc.) become multiplied for their advantage of easy handling. This standard is intended to standardize the design of all types of gullwing-leads and to establish the common rule on terminal shapes irrespective of device and package types.

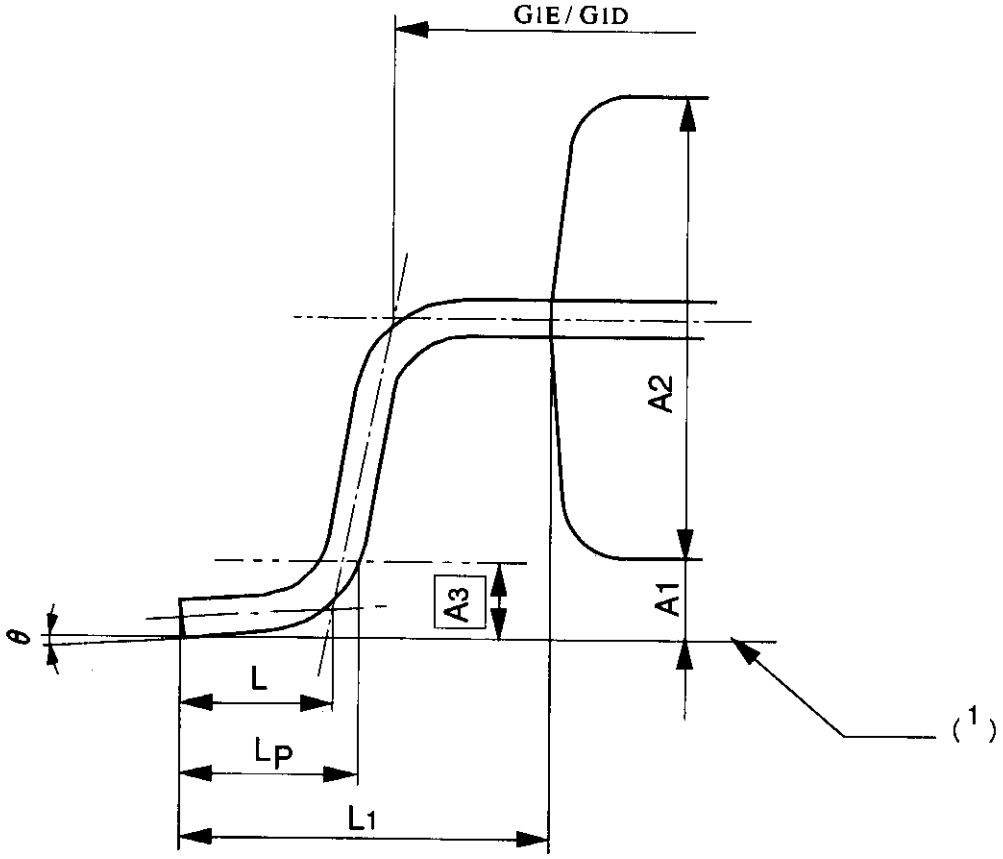
This standard is based on IEC191 series and one of EIAJ ED-7300 series,which consist of six standards. This standard covered the design rule of all types of gullwing-leads.

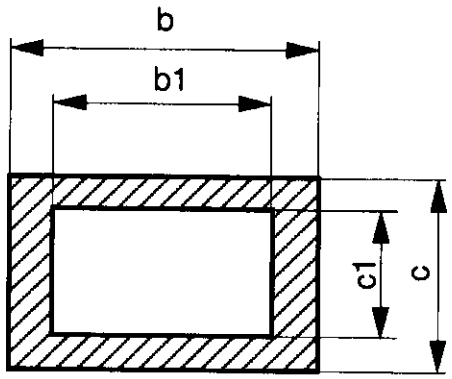
4. DEFINITION OF GULLWING-LEAD

It is defined that gullwing-lead is led out of itself and is flat toward the outside ofthe package body for being mounted on a PCB surface.

Ex. QFP , SOP , SSOP , TSOP

5. REFERENCE CHARACTERS AND DRAWINGS.





Terminal Section (2)

(1) The mounting surface , with which a package is in contact.
(2) The dimensions of the terminal section apply to the ranges of 0.1mm and 0.25mm from the end of a terminal

6. OUTLINE DIMENSION

The gullwing-lead design guides are shown in the tables below.

6.1 PACKAGE HEIGHT AND STAND-OFF HEIGHT

Table 1 shows the relationship between package height and stand-off height.

Table 1 (Unit : mm)

Package Height A2 nom	Stand-off Height A1nom	
1.0	0.1	
1.4	0.1	
2.7	Low Stand-off	0.1
	High Stand-off	0.4
3.4	Low Stand-off	0.1
	High Stand-off	0.4
3.8	Low Stand-off	0.1
	High Stand-off	0.4

Package height and stand-off height are defined in spite of terminal pitch.

6.2 TERMINAL THICKNESS AND WIDTH

Pb/Sn Solder Plating Table 2 (Unit : mm)

Terminal Pitch e	Terminal Width		Terminal Thickness	
	b1 nom	b nom	c1 nom	c nom
1.27	0.4	0.42	0.2 , 0.15 0.15 , 0.125 , 0.1	0.22 , 0.17 0.17 , 0.145 , 0.12
1.25	0.4	0.42	0.15 , 0.125 , 0.1	0.17 , 0.145 , 0.12
1.0	0.4	0.42	0.15 , 0.125 , 0.1	0.17 , 0.145 , 0.12
0.8	0.3	0.32	0.15 , 0.125 , 0.1	0.17 , 0.145 , 0.12
0.65	0.22	0.24	0.15 , 0.125 , 0.1	0.17 , 0.145 , 0.12
0.5	0.2	0.22	0.15 , 0.125 , 0.1	0.17 , 0.145 , 0.12
0.4	0.16	0.18	0.15 , 0.125 , 0.1	0.17 , 0.145 , 0.12
0.3	0.12	0.14	0.15 , 0.125 , 0.1	0.17 , 0.145 , 0.12

Palladium Plating Table 3 (Unit : mm)

Terminal Pitch e	Terminal Width		Terminal Thickness	
	b1 nom	b nom	c1 nom	c nom
1.27	0.4	0.4	0.2 , 0.15 0.15 , 0.125 , 0.1	0.2 , 0.15 0.15 , 0.125 , 0.1
1.25	0.4	0.4	0.15 , 0.125 , 0.1	0.15 , 0.125 , 0.1
1.0	0.4	0.4	0.15 , 0.125 , 0.1	0.15 , 0.125 , 0.1
0.8	0.3	0.3	0.15 , 0.125 , 0.1	0.15 , 0.125 , 0.1
0.65	0.22	0.22	0.15 , 0.125 , 0.1	0.15 , 0.125 , 0.1
0.5	0.2	0.2	0.15 , 0.125 , 0.1	0.15 , 0.125 , 0.1
0.4	0.16	0.16	0.15 , 0.125 , 0.1	0.15 , 0.125 , 0.1
0.3	0.12	0.12	0.15 , 0.125 , 0.1	0.15 , 0.125 , 0.1

6.3 TERMINAL SHAPE

Table 4 (Unit : mm)

Package Height A2 nom	Standard Height of Soldered Part A3	Length of Soldered Part Lp	Angle of Terminal Flat Portions θ	Terminal Length L1	Notes
1.0	0.25	0.45 ~ 0.75	0 ~ 8°	1.0	
1.4		0.45 ~ 0.75		1.0	
2.0		0.45 ~ 0.75		1.0	e ≦0.50
		0.73 ~ 1.03		1.6	e ≧ 0.65
2.7		0.45 ~ 0.75		1.0	e ≦0.50
		0.73 ~ 1.03		1.6	e ≧ 0.65
3.4		0.45 ~ 0.75		1.3	e ≦0.50
		0.73 ~ 1.03		1.6	e ≧ 0.65
3.8		0.45 ~ 0.75		1.3	e ≦0.50
		0.73 ~ 1.03		1.6	e ≧ 0.65

6.4 TOLERANCE OF TERMINAL CENTER POSITION AND COPLANARITY

Table 5 (Unit : mm)

Terminal Pitch e	Tolerance of Terminal Center Position x	Coplanarity y
1.27	0.25	0.10
1.25	0.25	
1.0	0.2	
0.8	0.16	
0.65	0.13	
0.5	0.08	0.08
0.4	0.07	
0.3	0.06	0.05

EXPLANATORY NOTES

1. OBJECT OF ESTABLISHMENT

The package with gullwing-leads have a wealth lineup (such as QFP,SOP,SSOP and TSOP), because they are easy to handle. However,the united rule has not been established and so the package have been developed and produced based on their own design rules. The lacks in unity among the design rules for the packages with gullwing-leads are shown in table 1 through table 8.

This standard is intended to standardize the design of all type of gullwing-leads and to establish the united rule irrespective package type.Additionally EIAJ will actively propose it to IEC191 seriese and make it a united design guide for all of the world.

2. CONVENTIONAL DESIGN RULE FOR GULLWING-LEAD PACKAGE

Conventional design rules for the packages with gullwing-leads are listed in table 1 through table 8.

(1)PACKAGE HEIGHT AND STAND-OFF HEIGHT

The relationship between the packageheight and stand-off height for each package type is shown in the table below.

QFP — Table 1 — (Unit : mm)

Package Height A2 nom	Stand-off Height A1nom		Terminal Pitch e
1.0	0.1		0.3 , 0.4 , 0.5 , 0.65 , 0.8
1.4	0.1		0.3 , 0.4 , 0.5 , 0.65 , 0.8
2.0	Low Stand-off	0.1	0.5 , 0.65 , 0.8 , 1.0
	High Stand-off	0.4	
2.7	Low Stand-off	0.1	0.4 , 0.5 , 0.65 , 0.8 , 1.0
	High Stand-off	0.4	
3.4	Low Stand-off	0.1	0.4 , 0.5 , 0.65 , 0.8
	High Stand-off	0.4	
3.8	Low Stand-off	0.1	0.4 , 0.5 , 0.65
	High Stand-off	0.4	

SSOP — Table 2 — (Unit : mm)

Package Height A2 nom	Stand-off Height A1nom	Terminal Pitch e
1.0 , 1.2 , 1.4 , 1.5 , 1.7 2.7	0.1	0.3 , 0.4 , 0.5 , 0.65 , 0.8 , 1.0

TSOP I

Table 3 (Unit : mm)

Package Height A2 nom	Stand-off Height A1nom	Terminal Pitch e
1.0	0.1	0.3 , 0.4 , 0.5 , 0.65

TSOP II

Table 4 (Unit : mm)

Package Height A2 nom	Stand-off Height A1nom	Terminal Pitch e
1.0	0.1	0.5 , 0.65 , 0.8 , 1.0 , 1.25 , 1.27

(2) TERMINAL THICKNESS AND WIDTH

Pb/Sn Solder Plating

Table 5 (Unit : mm)

Terminal Pitch e	Terminal Width		Terminal Thickness		Package Type
	b1 nom	b nom	c1 nom	c nom	
1.27	0.4	0.42	0.2 , 0.15	0.22 , 0.17	SOP
			0.15 , 0.125 , 0.1	0.17 , 0.145 , 0.12	TSOP II
1.25	0.4	0.42	0.15 , 0.125 , 0.1	0.17 , 0.145 , 0.12	TSOP II
1.0	0.4	0.42	0.15 , 0.125 , 0.1	0.17 , 0.145 , 0.12	QFP/SSOP/TSOP II
0.8	0.35	0.37	0.15 , 0.125 , 0.1	0.17 , 0.145 , 0.12	QFP
	0.3	0.32	0.15 , 0.125 , 0.1	0.17 , 0.145 , 0.12	SSOP/TSOP II
0.65	0.3	0.32	0.15 , 0.125 , 0.1	0.17 , 0.145 , 0.12	QFP
	0.22	0.24	0.15 , 0.125 , 0.1	0.17 , 0.145 , 0.12	SSOP/TSOP I /TSOP II
0.5	0.2	0.22	0.15 , 0.125 , 0.1	0.17 , 0.145 , 0.12	QFP/SSOP/TSOP I /TSOP II
0.4	0.16	0.18	0.15 , 0.125 , 0.1	0.17 , 0.145 , 0.12	QFP/SSOP/TSOP I
0.3	0.12	0.14	0.15 , 0.125 , 0.1	0.17 , 0.145 , 0.12	QFP/SSOP/TSOP I

Palladium Plating

Table 6

(Unit : mm)

Terminal Pitch e	Terminal Width		Terminal Thickness		Package Type
	b1 nom	b nom	c1 nom	c nom	
1.27	0.4	0.4	0.2 , 0.15	0.2 , 0.15	SOP
			0.15 , 0.125 , 0.1	0.15 , 0.125 , 0.1	TSOP II
1.25	0.4	0.4	0.15 , 0.125 , 0.1	0.15 , 0.125 , 0.1	TSOP II
1.0	0.4	0.4	0.15 , 0.125 , 0.1	0.15 , 0.125 , 0.1	QFP/SSOP/TSOP II
0.8	0.35	0.35	0.15 , 0.125 , 0.1	0.15 , 0.125 , 0.1	QFP
	0.3	0.3	0.15 , 0.125 , 0.1	0.15 , 0.125 , 0.1	SSOP/TSOP II
0.65	0.3	0.3	0.15 , 0.125 , 0.1	0.15 , 0.125 , 0.1	QFP
	0.22	0.22	0.15 , 0.125 , 0.1	0.15 , 0.125 , 0.1	SSOP/TSOP I /TSOP II
0.5	0.2	0.2	0.15 , 0.125 , 0.1	0.15 , 0.125 , 0.1	QFP/SSOP/TSOP I /TSOP II
0.4	0.16	0.16	0.15 , 0.125 , 0.1	0.15 , 0.125 , 0.1	QFP/SSOP/TSOP I
0.3	0.12	0.12	0.15 , 0.125 , 0.1	0.15 , 0.125 , 0.1	QFP/SSOP/TSOP I

(3) LEAD SHAPE

Table 7 (Unit : mm)

Package Height A2 nom	Standard Height of Soldered Points A3	Length of Standard Part Lp	Angle of Terminal Flat Portion θ	Terminal Pitch e	Width Betwee First Bent Part of Terminal G1E / G1D	Length of Flat Part of Terminal L	Terminal Length L1	Package Type
1.0	0.25	0.45 ~ 0.75	0 ~ 8°	0.3 , 0.4 0.5 , 0.65 0.8 , 1.0	Enom + 0.8 Dnom + 0.8	0.5	1.0	TQFP
					Enom + 0.8	0.5	1.0	SSOP
		0.45 ~ 0.75	0 ~ 8°	0.3 , 0.4 0.5 , 0.65	Enom + 0.4	0.5	0.8	TSOP I
		0.45 ~ 0.75	0 ~ 8°	0.5,0.65,0.8 1.0,1.27	Dnom + 0.4	0.5	0.8	TSOP II ソフトメトリック
				0.5,0.65,0.8 1.0,1.25	Dnom + 0.8	0.5	1.0	TSOP II ハード メトリック
1.2	0.25	0.45 ~ 0.75	0 ~ 8°	0.3 , 0.4 0.5 , 0.65 0.8 , 1.0	Enom + 0.8	0.5	1.0	SSOP
1.4	0.25	0.45 ~ 0.75	0 ~ 8°	0.3 , 0.4 0.5 , 0.65 0.8 , 1.0	Enom + 0.8 Dnom + 0.8	0.5	1.0	LQFP
					Enom + 0.8	0.5	1.0	SSOP
1.5	0.25	0.45 ~ 0.75	0 ~ 8°	0.3 , 0.4 0.5 , 0.65 0.8 , 1.0	Enom + 0.8	0.5	1.0	SSOP
1.7	0.25	0.45 ~ 0.75	0 ~ 8°	0.3 , 0.4 0.5 , 0.65 0.8 , 1.0	Enom + 0.8	0.5	1.0	SSOP
2.0	0.25	0.45 ~ 0.75	0 ~ 8°	0.3 , 0.4 0.5	Enom + 0.8 Dnom + 0.8	0.5	1.0	QFP
		0.73 ~ 1.03	0 ~ 8°	0.65 , 0.8 1.0	Enom + 1.4 Dnom + 1.4	0.8	1.6	QFP
2.7	0.25	0.45 ~ 0.75	0 ~ 8°	0.3 , 0.4 0.5	Enom + 0.8 Dnom + 0.8	0.5	1.0	QFP
		0.73 ~ 1.03	0 ~ 8°	0.65 , 0.8 1.0	Enom + 1.4 Dnom + 1.4	0.8	1.6	QFP
					Enom + 1.4	0.8	1.6	SSOP
3.4	0.25	0.45 ~ 0.75	0 ~ 8°	0.3 , 0.4 0.5	Enom + 1.4 Dnom + 1.4	0.5	1.3	QFP
		0.73 ~ 1.03	0 ~ 8°	0.65 , 0.8 1.0	Enom + 1.4 Dnom + 1.4	0.8	1.6	QFP
3.8	0.25	0.45 ~ 0.75	0 ~ 8°	0.3 , 0.4 0.5	Enom + 1.4 Dnom + 1.4	0.5	1.3	QFP
		0.73 ~ 1.03	0 ~ 8°	0.65 , 0.8 1.0	Enom + 1.4 Dnom + 1.4	0.8	1.6	QFP

(4) TOLERANCE OF TERMINAL CENTER POSITION AND COPLANARITY

Table 8 (Unit : mm)

Terminal Pitch e	Tolerance of Terminal Center Position x	Coplanarity y	Package Type
1.27	0.25	0.10	TSOP II
	0.12	0.10	SOP
1.25	0.25	0.10	TSOP II
1.0	0.20	0.10	QFP / TSOP II / SSOP
0.8	0.20	0.10	QFP
	0.16	0.10	TSOP II / SSOP
0.65	0.13	0.10	QFP / TSOP I , II /SSOP
0.5	0.08	0.08	QFP / SSOP
	0.10	0.08	TSOP II (Hard Metric)
	0.10	0.10	TSOP I , II (Soft Metric)
0.4	0.07	0.08	QFP / TSOP I / SSOP
0.3	0.06	0.05	QFP / TSOP I / SSOP

3. MEMBERS OF DISCUSSION

This design guide has been discussed at the Subcommittee on General Rules of Semiconductor Device Package Technical Standardization Committee on Semiconductor Device Package. The members are as shown below

<Technical Standardization Committee on Semiconductor Device Package>

Chairman : Toshiaki Shinohara MITSUBISHI Electric Corp.

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<Unit Design Guide for Gullwing-Lead Project>

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