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Design guideline of integrated circuits
for Plastic Dual Inline Package
(DIP)

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for Plastic Dual Inline Package
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1. SCOPE OF APPLICATION

This technical report regulates outline drawings and dimensions of Plastic Dual Inline Package (hereinafter referred to as DIP) whose terminal pitch is 2.54mm, and Plastic Shrink Dual Inline Package (SDIP) whose terminal pitch is 1.778mm, among the packages classified as from B in **EIAJ EDR-7300** (Recommended practice on General Rule for preparing standard outline drawings (integrated circuits) of semiconductor devices)

Note   This technical report is the revised edition of **EIAJ ED-7403-1**

2. TERMS

The definition of the terms used in this technical report complies with **EIAJ EDR-7300**.   New terms define in the description of this report.

3. BACKGROUND

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

4. DEFINITION OF DIP

DIP is classified as FORM B in the item 6 "Outline classification of the semiconductor package " of **EIAJ ED-7300**, and defined a package with formed terminals which are led out of the longer side of itself in two directions and which are perpendicular to the surface of a PCB.

5. DESIGNATION OF THE PIN NUMBER

Numbering of terminals complies with **EIAJ ED-7300**.

6. NOMINAL DIMENSIONS

The dimension of terminal in-line interval ($\boxed{e1}$) is applied to Nominal dimensions.

7. REFERENCE CHARACTERS AND DRAWINGS

7.1 Outline Drawings

Figure 1

Figure 2

Figure 3

Mounting
plane

Terminal Section[4]

$\phi\,0.8\pm0.05$
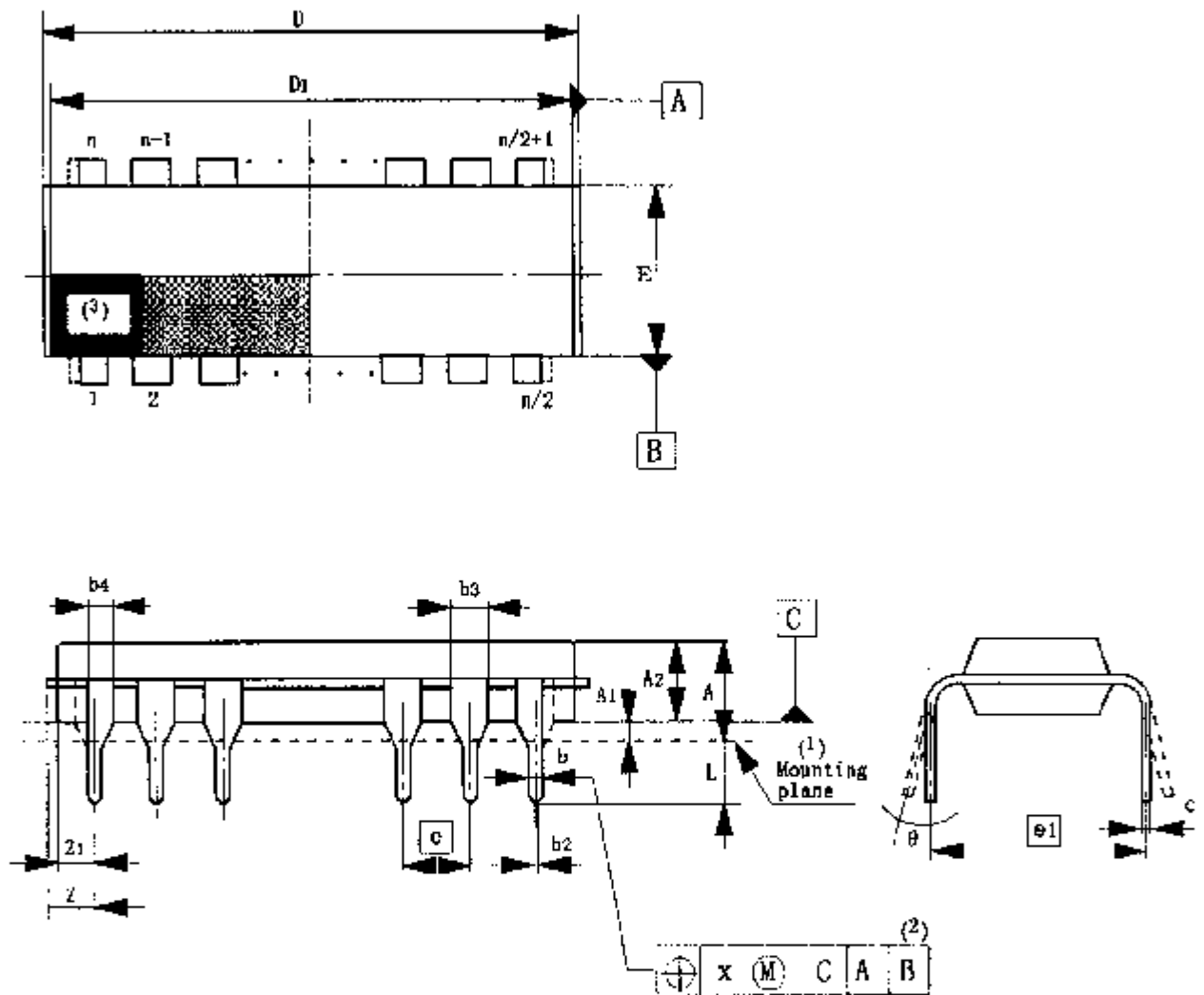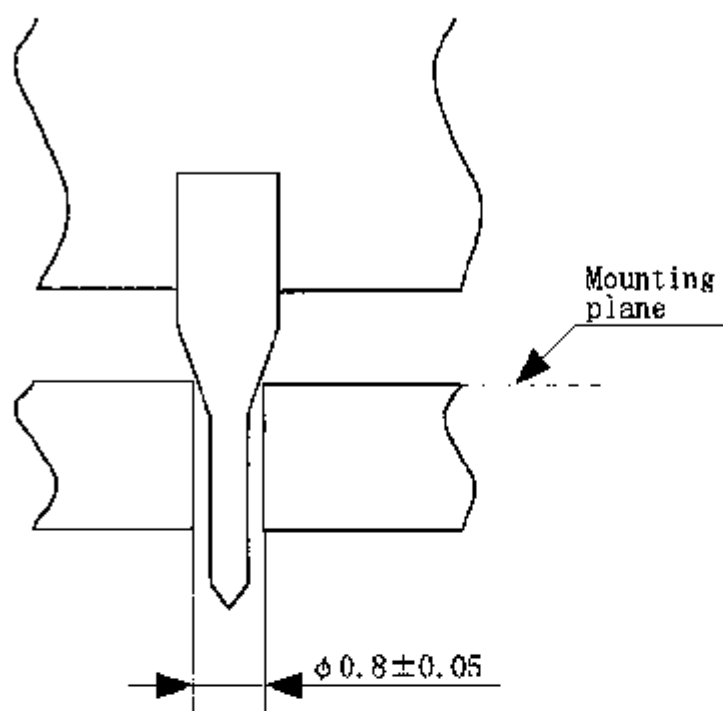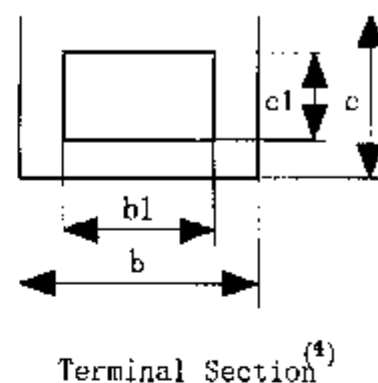
(1) The mounting plane is the dimension that determined when the pins are completely inserted in the holes that are sized $\phi\,0.8\pm0.05$mm and that have their centers located on the grid whose modules is $\boxed{e}$ / $\boxed{e1}$.
    (refer to **Figure 2**)

(2) The maximum material conditions (Refer to ISO/2692) apply to the positional tolerance of the terminals.

(3) The index mark indicates the pin No.1.
    By the way, 1/2 or more of the area of this index mark must be contained within the hatched zone.

(4) The dimensions of the terminal section apply to the ranges from 1.0mm to 1.5mm from the tip of terminals.

8.   OUTER DIMENSION

Table 1 below shows the standard dimension.   Combination of the standard dimension shown below allow a number of package variation.   If packages are design 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	Standard	Recommended Values	Remarks
Nominal Dimensions	$\boxed{e1}$	terminal in-line interval is applied to Nominal dimensions	———	

Nominal Dimensions	$\boxed{e1}$
300mil	7.62
400mil	10.16
500mil	12.70
600mil	15.24
750mil	19.05
900mil	22.86

Description	Symbol	Standard	Recommended Values	Remarks
Package width	E	$E_{min} = \boxed{e1} - 2.54$ $E_{max} = \boxed{e1} - 0.25$	$E_{nom} = \boxed{e1} - 1.27$	It is recommended that the upper and lower cavities be equal. If they are not deferent, the larger dimension shall be regarded as E.

Nominal Dimensions	E_{min}	E_{max}	Nominal Dimensions	E_{nom}
300mil	5.08	7.37	300mil	6.35
400mil	7.62	9.90	400mil	8.91
500mil	10.16	12.44	500mil	11.43
600mil	12.70	14.98	600mil	13.97
750mil	16.51	18.79	750mil	17.78
900mil	20.32	22.60	900mil	21.59

Table 1 (Continued)

Unit mm

Description	Symbol	Standard	Recommended Values	Remarks
Package length	D	$D_{max} = \boxed{e} \times (n/2-1) + 2Z_{max}$	$D_{nom} = \boxed{e} \times (n/2-1) + 2Z_{nom}$	It is recommended that the upper and lower cavities be equal. If they are not deferent, the larger dimension shall be regarded as D.

$\boxed{e} = 2.54$

n	D_{max}
6	10.16
8	12.70
10	15.24
14	20.32
16	22.86
18	25.40
20	27.94
22	30.48
24	33.02
28	38.20
30	40.64
32	43.18
36	48.26
40	53.34
42	55.88
48	63.50
52	68.58
54	71.12
56	73.66
64	83.82

$\boxed{e} = 2.54$

n	D_{nom} $Z_{nom} = 0.99$	D_{nom} $Z_{nom} = 2.26$
6	7.06	9.60
8	9.60	12.14
10	12.14	14.68
14	17.22	19.76
16	19.76	22.30
18	22.30	24.84
20	24.84	27.38
22	27.38	29.92
24	29.92	32.46
28	35.00	37.54
30	37.54	40.08
32	40.08	42.62
36	45.16	47.70
40	50.24	52.78
42	52.78	55.32
48	60.40	62.67
52	65.48	68.02
54	68.02	70.56
56	70.56	73.10
64	80.72	83.26

$\boxed{e} = 1.778$

n	D_{max}
6	8.89
8	10.69
10	12.45
14	16.01
16	17.78
18	19.56
20	21.34
22	23.12
24	26.67
28	28.45
30	30.23
32	33.78
36	37.34
40	39.12
42	40.89
48	46.23
52	49.78
64	60.45

$\boxed{e} = 1.778$

n	D_{nom} $Z_{nom} = 0.99$	D_{nom} $Z_{nom} = 2.26$
6	6.30	8.08
8	8.08	9.86
10	9.86	11.64
14	13.42	15.19
16	15.19	16.97
18	16.97	18.75
20	18.75	20.53
22	20.53	22.31
24	22.31	24.08
28	25.86	27.64
30	27.64	29.42
32	29.42	31.20
36	32.97	34.75
40	36.53	38.31
42	38.31	40.09
48	43.64	45.42
52	47.20	48.98
64	57.83	59.64

| D_1 | $D_{max} = \boxed{e} \times (n/2-1) - 2Z_{max}$ | | |

Table 1 (Continued)

Unit mm

Description	Symbol	Standard	Recommended Values		Remarks
Seated height	A	$A_{max} = 5.72$	Nominal Dimensions	A_{nom}	A include the warp of a package
			less than 400mil	4.19	
			500mil and more	4.70	
Stand-off height	A_1	$A_{1 min} = 0.51$	$A_{1 nom} = 0.64$		
Package height	A_2	$A_{2 max} = 4.57$	Nominal Dimensions	A_{2nom}	A_2 include the warp of a package
			less than 400mil	3.56	
			500mil and more	4.06	

Table 1 (Continued)

Unit mm

Description	Symbol	Standard	Recommended Values	Remarks
Terminal width	b	b_{min}: 0.40 b_{max}: 0.61	(1) Solder plating $b_{nom}=0.52$ (2) Pd plating $b_{nom}=0.5$	(1) Values b apply to solder plated terminal. The standard thickness of the solder layer shall be 0.010+0.010-0.005 (2) As Pd plating, it is very thin, so terminal width is $b_1=b$
	b_1	b_{1min}: 0.40 b_{1max}: 0.61	$b_{1nom}=0.5$	b_1 donates the material width of a terminal.
Terminal end width	b_2	b_{2min}: 0 b_{2max}: 0.45	$b_{2nom}=0.25$	
Terminal shoulder width	b_3	$e=2.54$ b_{3min}: 0.85 b_{3max}: 2.00 $e=1.778$ b_{3max}: 0.85 b_{3max}: 1.42	e: 2.54 b_{3nom}: 1.27 e: 1.778 b_{3nom}: 1.00	
	b_4	$e=2.54$ b_{4min}: 0.85 b_{4max}: 2.00 $e=1.778$ b_{4min}: 0.85 b_{4max}: 1.42	$b_{4nom}=1.00$	

Table 1 (Continued)

Unit mm

Description	Symbol	Standard		Recommended Values	Remarks
Terminal thickness	c	c_{min}	c_{max}	(1) Solder plating	(1) b_1 donates the material width of a terminal.
		0.40	0.61	$c_{nom} = 0.27$	
				(2) Pd palting	(2) Values c apply to solder plated terminal. The standard thickness of the solder layer shall be 0.010+0.010-0.005
				$c_{nom} = 0.25$	
	c_1	c_{1min}	c_{1max}	$c_{1min} = 0.25$	
		0.40	0.61		(3) As Pd plating, it is very thin, so terminal width is $c_1 = c$
Terminal angle	θ	θ_{min}	θ_{max}	$\theta = 5° \sim 10°$	
		0°	15°		
Terminal pitch	$\boxed{e}$	$\boxed{e} = 2.54$ or 1.778			(1) The values denotes the geometrical position (2) The package whose terminal pitch is 1.778 mm shall be specified Shrink Dual Inline Package (SDIP).
Terminal in-line interval	$\boxed{e1}$	$\boxed{e1} = 2.54 \times m,$ m=3, 4, 5, 6, 7.5 or 9		m=3, 4, 5, 6, 7.5	
		m	$\boxed{e1}$		
		3	7.62		
		4	10.16		
		5	12.70		
		6	15.24		
		7.5	19.05		
		9	22.86		

Table 1 (Continued)

Unit mm

Description	Symbol	Standard	Recommended Values	Remarks
Positional tolerance of terminal tips	x	$x = 0.25$	———	
Number of terminals	n	Number of terminals must be selected from the following values : 6,8,10,14,16,18,20,22,24,28,30,32,36,40,42,48,52,54,56,64 Number of terminals for each terminal in-line interval is referred to Table 2 (Standard Package List)	———	

2. GROUP 2

Table 1 (Continued)

Unit mm

Description	Symbol	Standard	Recommended Values	Remarks
Package overhang	Z	$Z_{max} = \boxed{e}$	$\boxed{e} = 2.54$ $Z_{nom} = 0.99$ or 2.26 $\boxed{e} = 1.778$ $Z_{nom} = 1.37$ or 2.26	Z includes resin burrs or residual gates.
	Z_1	$Z_{1\,max} = \boxed{e} - 0.20$	$\boxed{e} = 2.54$ $Z_{nom} = 0.89$ or 2.16 $\boxed{e} = 1.778$ $Z_{nom} = 1.27$ or 2.16	Z_1 does not includes resin burrs or residual gates.
Terminal length	L	$\begin{array}{cc} L_{min} & L_{max} \\ 2.54 & 3.90 \end{array}$	$L_{nom} = 3.30$	

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 packages in the future.

Table 2

Nominal Dimensions	Number of terminals n	
	e =2.54	e =1.778
300mil	6,8,10,14,16,18,20,22,24,28, 32	20,22,24
400mil	14,18,20,22,24,28,32	28,30,36
500mil		36
600mil	14,24,28,30,32,36,40,42,48, 54,56	40,42,48,52
750mil	48	64
900mil	64	

10. STANDARD REGISTRATION

When you need to register a new outline specification on the standard, complete the appendix format 5 in The 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 ($\checkmark$)in the following **Table 3**.

Table 3

Serial Number				
External Type		P-DIP○○ − ○○○○ × ○○○○ − ○.○○ (P-DIP○○ − ○○○○ − ○.○○)		
Reference Symbol		min	nom	max
Group 1	e_1		$\checkmark$	
	E	$\checkmark$		$\checkmark$
	D			$\checkmark$
	D_1			$\checkmark$
	A			$\checkmark$
	A_1	$\checkmark$		
	A_2			$\checkmark$
	b	$\checkmark$		$\checkmark$
	b_1	$\checkmark$		$\checkmark$
	b_2	$\checkmark$		$\checkmark$
	b_3	$\checkmark$		$\checkmark$
	b_4	$\checkmark$		$\checkmark$
	c	$\checkmark$		$\checkmark$
	c_1	$\checkmark$		$\checkmark$
	θ	$\checkmark$		$\checkmark$
	e		$\checkmark$	
	X			$\checkmark$
	N		$\checkmark$	
Group 2	Z			$\checkmark$
	Z_1			$\checkmark$
	L	$\checkmark$		$\checkmark$

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 guide "

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

EXPLANATORY NOTES

1. OBJECTIVES OF THE TECHNICAL REPORT

This technical report has been prepared to show the industry standard and to offer design guidelines when developing the Plastic Dual Inline Package (hereinafter referred as DIP), and related parts.

2. HISTORY OF REVIEW

Deliberations on **IC-74-3**-1983, the predecessor of these general rules, were started on the occasion of the First 1982 Meeting of the Technical Committee on Semiconductor Package Outlines (April 1982) and were finished on the occasion of the Second 1983 Meeting of the Technical Committee on Semiconductor Package Outlines (May 1983), and the general rules were issued in June 1983. Later on, since plastic DIP with package width surpassing the dimensional values stipulated in **IC-74-3** appeared on the market, deliberations aimed at revising **IC-74-3** were started on the occasion of the First 1987 Meeting of the Technical Committee on Semiconductor Package Outlines (April 1987). A fact-finding survey on real state of affairs of the existing plastic DIP was carried out in the first place, the deliberations on the matter were finished on the occasion of the 1st 1988 Meeting of the Technical Committee on Semiconductor Package Outline (April 1988), and then it was decided to establish and to issue these general rules.

EIAJ ED-7403-1 would be abolished by the lapse of ten years in 1999. Therefore, it was reviewed by Plastic Package Subcommittee under "Technical Standardization Committee on Semiconductor Device Package" and was issued as design guideline.

3. KEY POINTS FOR REVIEW

(1) Datum marking

The datum and geometrical tolerance were adopted from this technical report.

(2) Definitions of dimension

The recommended values in this technical were adopted the values on **EIAJ ED-7403-1** as far as possible. And a format was changed in according to **EIAJ ED-7302** "Manual for the standard of integrated circuits package".

The dimension of terminal in-line interval ($e1$) was applied to Nominal dimensions. And terminal width before treatment (b1) and terminal thickness before treatment (c1) was newly shown and Pd plating is added. Solder dipping was deleted because of less possibility of adoption.

(3) Standard package list

Standard package list was added in according to **EIAJ ED-7302**. The packages which were produced in 1999 were registered as standard packages.

(4) Standard registration

Standard registration list was added in according to **EIAJ ED-7302**.

4. Background for the respective dimensional rules

(1) Package length

The maximum value of the package length is an important dimensional item for the sake of determining the mounting density of the integrated circuit. The value of the maximum package length (D) must comprise mold protrusion, stumps of support cut off notches, gate remainders and the like because otherwise it has no meaning for the user. On the other hand, since the package length is the dimension the maker uses as a guideline for the sake of design it becomes difficult to stipulate the standard value for the sake of design when mold protrusion and the like are taken into account. Such being the case, it was decided to stipulate the package length D1 as a value not comprising mold protrusion and the like.

(2) Terminal width

b in **EIAJ ED-7403** meant terminal width after treatment, so it was replaced to b_i in this technical report. Terminal width before treatment was defined as b. Because terminal width before treatment (b_1) was added, b_1, b_2 in **EIAJ ED-7403** replace b_2, b_3 respectively. Pd plating was added to the exterior plating. Because of less possibility of adoption, solder dipping was deleted.

(3) Terminal thickness

c in the **EIAJ ED-7403** meant terminal thickness after treatment, so it replaced c_i in this technical report. Terminal thickness before treatment was defined as c. Pd plating was added to the exterior treatment. Solder dipping was deleted because of less possibility of adoption.

(4) Package over hang

The values of Z and Z_1 are stipulated by linking them with the above package length. Moreover, 2 distinct values are stipulated for Z_{nom} in the view of the following reasons.

In DIP with 100mil terminal pitch it is desirable to have overhang values under $\boxed{e}/2$ from the standpoint of high-density mounting. the value $Z_{nom} = 0.991mm$ (39mil) is determined by subtracting the margin of safety 0.279 (11mil) from $\boxed{e}/2$. It was decided to adopt the value $Z_{nom} = 2.262mm$ (89mil) as well, determined by subtracting the margin of safety 0.279mm (11mil) from $\boxed{e}$, because many packages with maximum overhang value surpassing $\boxed{e}/2$ were already being sold on the market when these general rules were being formulated.

The same consideration are applicable also to DIP with 1.778mm terminal pitch. The value $Z_{nom} = 1.3572mm$ (54mil), obtained by subtracting the margin of safety 0.406mm (16mil) from $\boxed{e}$, is adopted concurrently with the value $Z_{nom} = 2.261mm$ (89mil), obtained by subtracting the margin of safety 0.406mm (16mil) from $1.5\boxed{e}$.

(5) Number of terminals

Numbers of 54, 56 were added to the number of terminals which was determined by package length in **EIAJ ED-7403**.

5. COMMITTEE MEMBERS

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

<Technical Standardization Committee on Semiconductor Device Packages>

Chairman	Shozo Minamide	SHARP CORP.

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