PACKAGE INFORMATION

1. PACKAGE CLASSIFICATIONS

This document is Chapter 1 of the package information document consisting of 8 chapters in total.

1. PACKAGE CLASSIFICATIONS

1.1   Packaging Trends

In recent years, marked advances have been made in the electronics field. One such advance has been the progression from vacuum tubes to transistors and finally, to ICs. ICs themselves have been more highly integrated into LSIs, VLSIs, and now, ULSIs.

With increased functions and pin counts, IC packages have had to change significantly in the last few years in order to keep-up with the advancement in semiconductor development.

Functions required for conventional IC packages are as follows:

1)   To protect IC chips from the external environment
2)   To facilitate the packaging and handling of IC chips
3)   To dissipate heat generated by IC chips
4)   To protect the electrical characteristics of the IC

Standard dual-in-line packages (DIP), which fulfill these basic requirements, have enjoyed wide usage in the electronics industry for a number of years.

With increasing integration and higher speed ICs, and with the miniaturization of electronic equipment, newer packages have been requested by the industry which incorporate the functions listed below:

1)   Multi-pin I/O
2)   Ultra-miniature packages
3)   Packages suited to high density ICs
4)   Improved heat resistance for use with reflow soldering techniques
5)   High throughput speed
6)   Improved heat dissipation
7)   Lower cost per pin

In response to these requests, OKI has developed a diversified family of packages to meet the myriad requirements of today's burgeoning electronics industry.

Smaller size

SURFACE MOUNTING TYPE

Higher Pin Count

DIP SOP SOJ SSOP TSOP

ZIP

QFJ

QFP

TQFP/LQFP

SKINNY DIP

TCP

SHRINK-DIP

PGA

BGA/LGA

CSP
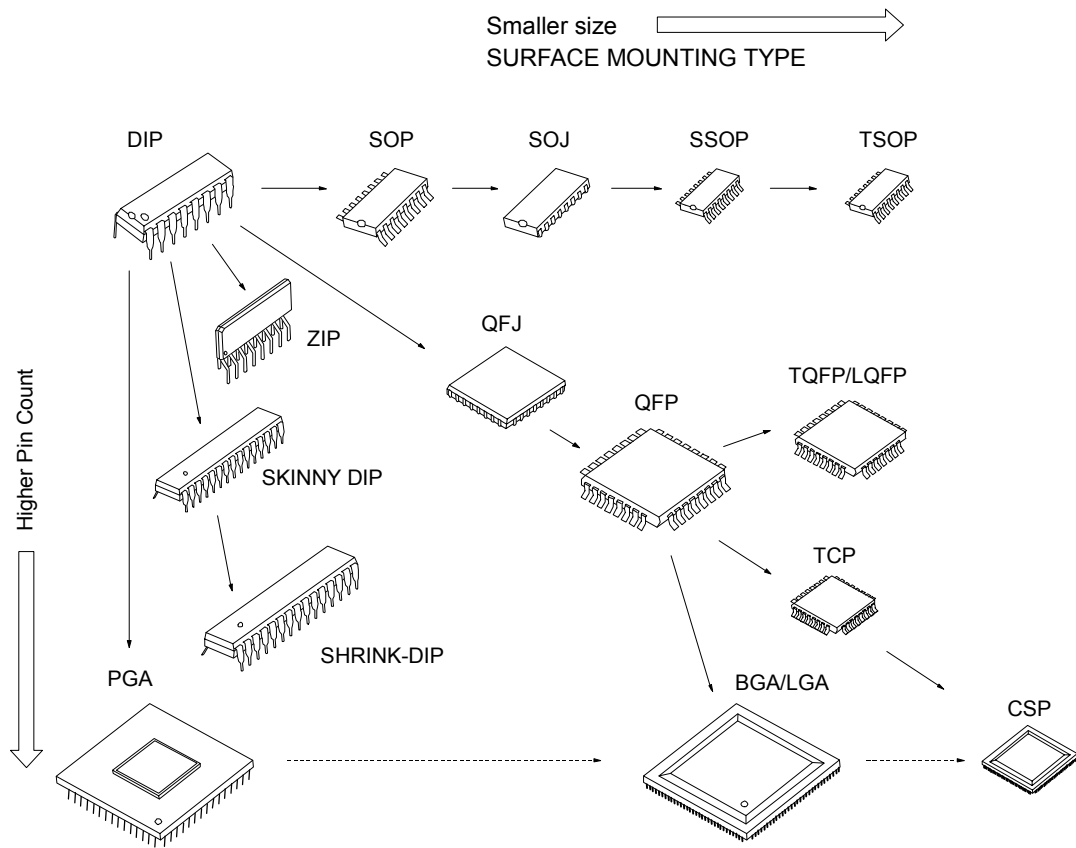
Figure 1.1.1   Packaging Trend
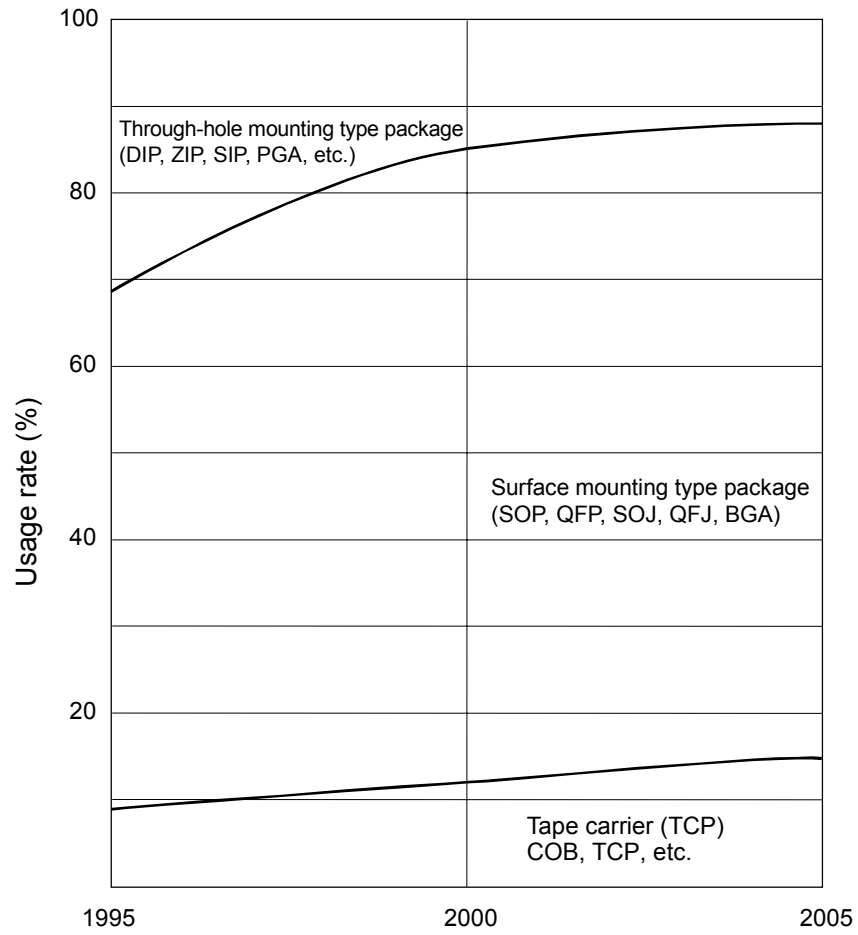
Figure 1.1.2   IC Package Demand Trend Forecast

1.2   Packaging Classification

[Classification by the mounting method]

1) Through-hole mount packages
    Through-hole packages have a structure in which the lead pins are inserted and soldered into holes (0.8 to 1.0 mm in diameter) drilled through the printed circuit (PC) board, and find wide applications in electronic equipment where board space is not at a premium or where costs are a constraint.
    DIPs, and PGAs are typical packages in this group. ZIPs, skinny DIPs, and shrink DIPs are high-pin-density IC packages which can be used in these applications.

2) Surface mount packages
    Surface mount packages have a flat structure in which the lead pins are soldered directly to the soldered pattern (called the mount pad) provided on the PC board, and are used in high-pin-density IC package situations because devices can be mounted on both sides of the PC board. QFPs and QFJs (PLCC) are typical packages in this group.

3) Custom packages
    Memory modules are packages which have several memory ICs mounted on a PC board, Tape carrier packages (TCP) using Tape Automated Bonding (TAB) techniques, Chip On Board (COB) packages, or IC card packages.   TCP and COB packages are custom designs conforming to the customer's specifications.

[Classification by package materials]

Packages are broadly classified into ceramic and plastic packages. Package materials can be selected according to their application or operating environment.

Ceramic packages are known for their high reliability, but plastic packages are becoming more popular due to their low cost (when compared to ceramic packages).   Reliability has improved considerably in the last few years making plastic a very attractive alternative to ceramic.

IC packages are classified as indicated below according to shape, material, and mounting methods.
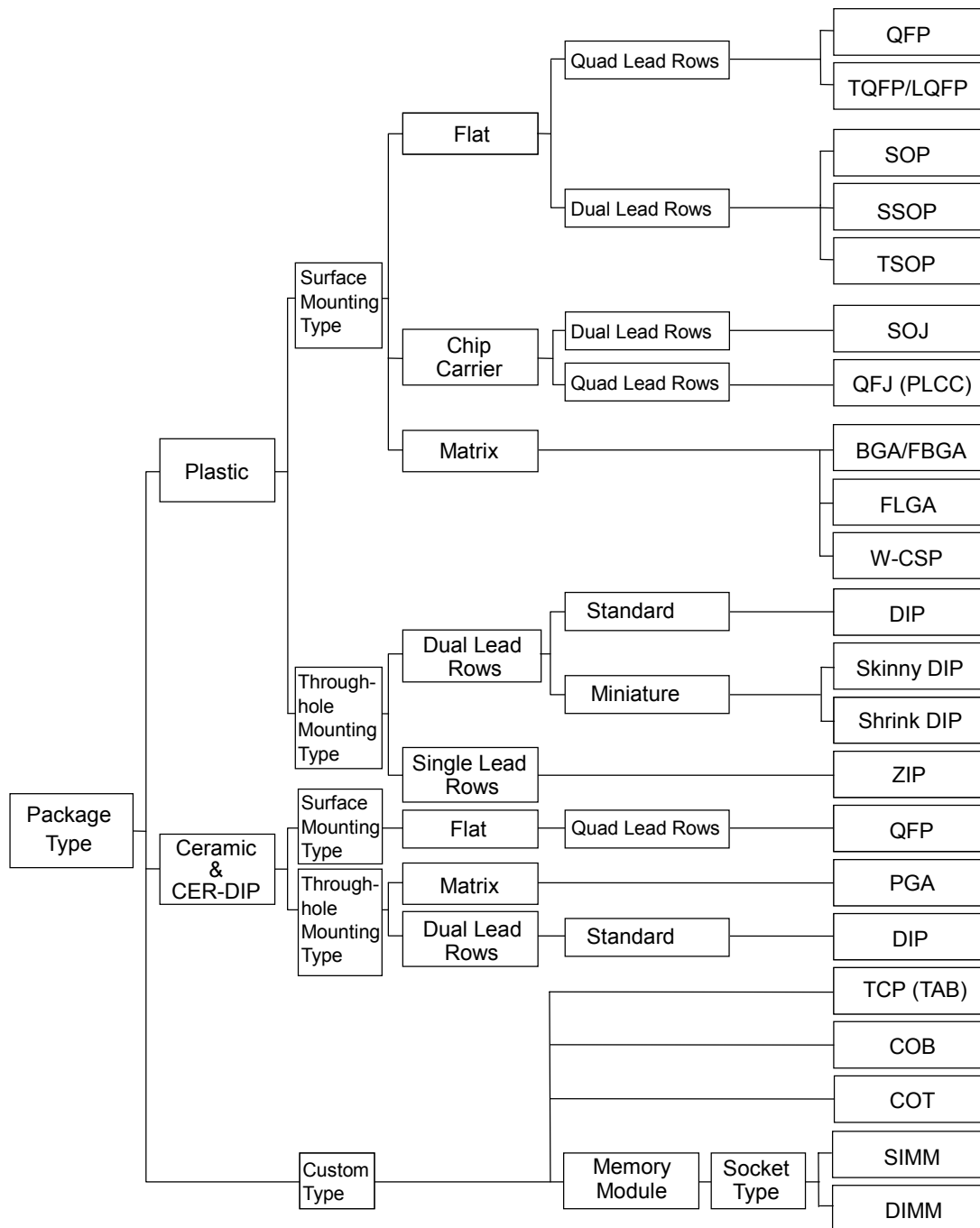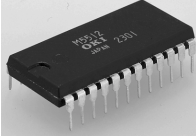
Package Type	Material	Mounting	Shape	Lead/Type	Sub-type	Package
Package Type	Plastic	Surface Mounting Type	Flat	Quad Lead Rows		QFP
						TQFP/LQFP
				Dual Lead Rows		SOP
						SSOP
						TSOP
			Chip Carrier	Dual Lead Rows		SOJ
				Quad Lead Rows		QFJ (PLCC)
			Matrix			BGA/FBGA
						FLGA
						W-CSP
		Through-hole Mounting Type	Dual Lead Rows	Standard		DIP
				Miniature		Skinny DIP
						Shrink DIP
			Single Lead Rows			ZIP
	Ceramic & CER-DIP	Surface Mounting Type	Flat	Quad Lead Rows		QFP
		Through-hole Mounting Type	Matrix			PGA
			Dual Lead Rows	Standard		DIP
	Custom Type					TCP (TAB)
						COB
						COT
			Memory Module	Socket Type		SIMM
						DIMM

Figure 1.2.1 Package Classification

1.3   Package Type and Characteristics

1)   Through-hole mounting type package

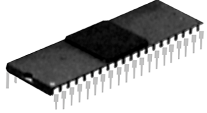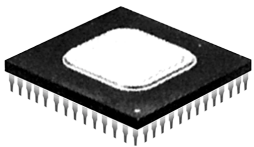| Type	Package Types			Package Symbol		Pin Count
				Old	New	
Through-hole Mounting Type	Plastic	DIP	Standard	RS	RA	8, 14, 16, 18, 20, 22, 24, 28, 32, 36, 40, 42, 48
			Skinny	RS	RC	20, 22
			Shrink	SS	RB	30, 42, 64
		ZIP		ZS	RD	20, 24, 28, 40

Package Name	Characteristics
Dual In-line Package	Standard DIP packages are most widely used. The lead pitch is 2.54 mm (100 mil), and the spacing between terminal rows is 300, 400, or 600 mil.
Skinny Dual In-line Package	Skinny DIP packages are standard DIPs with spacing between terminal rows of 7.62 mm (300 mil) and with 20 or more pins.
Shrink Dual In-line Package	Shrink DIP packages are standard DIPs with a lead pitch reduced to 1.778 mm (70 mil). They are smaller in external size than standard DIPs and suited to compact electronic equipment using high-pin-density IC packages.
Zigzag In-line Package	ZIP packages are featured by the leads which are drawn out from each package body into a single row to allow vertical mounting with a lead pitch of 1.27 mm (50 mil). The leads of each package are Zigzag folded, within the package surface thickness, into two rows. The Zigzag folding increases the lead pitch in each row to 2.54 mm (100 mil).

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1. PACKAGE CLASSIFICATIONS

Type	Package Types			Package Symbol		Pin Count
				Old	New	
Through-hole Mounting Type	Ceramic	Standard DIP		AS	AA	14, 16, 18, 20, 22, 24, 28, 40, 42, 48
		CER-DIP		AS	AB	8, 14, 16, 18, 22, 24, 28, 32, 40, 42
		PGA		AS	BA	73*2, 88, 133*2, 177*2, 209*2, 257*2*1, 301*2, 240, 365*2, 400

*1 Under development
*2 The PGA pin count includes a pin for preventing incorrect insertion.
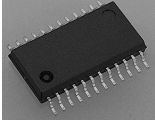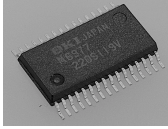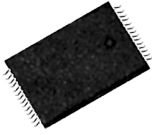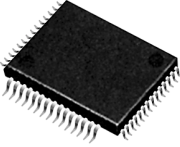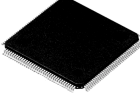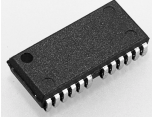
Package Name	Characteristics
Dual In-line Package	DIP packages are hermetic ceramic package. The lead pitch is 2.54 mm (100 mil) and the package body is made of ceramics. Metal or glass may be used as a sealing material.
Dual In-line Package (Glass Sealed)	Dual In-line packages are called "CER-DIP" package. The lead pitch is 2.54 mm (100 mil), and the package body is molded with powder ceramics. The sealing material is glass.
Pin Grid Array	PGA packages are featured by the leads which are drawn out vertically from each package body and arranged on the specified grid. The package body is made of ceramics, and the standard lead pitch is 2.54 mm (100 mil). PGA packages are suited to multipin packaging.

1. PACKAGE CLASSIFICATIONS

2)   Surface mounting type package

Type	Package Types			Package Symbol		Pin Count
				Old	New	
Surface Mounting Type	Plastic	SOP		MS	MA	8, 16
				GS	MA	24, 28, 32, 40, 44
		SSOP		MS	MB	20
				GS	MB	30, 32, 60, 64, 70
				GS-B	MB	60
		TSOP(1)		TS	TA	32, 40*[1]
		TSOP(2)				26/20, 26/24, 28/24, 28, 32, 44/40, 44, 48, 50/44, 50, 54, 66*[1], 70/64, 70, 86*[1]
		QFP		GS	GA	44, 56, 64, 80, 100, 128, 160, 208, 240, 272, 304
				GS-2	GA	44, 56
				GS-B	GA	64, 80, 100
		High Heat Dissipation QFP*[2]		GS-C	GA	208
		TQFP		TS	TB	44, 48, 64, 80, 100, 120
		LQFP		GS	TC	144, 176, 208
		SOJ		JS (SJ)	JA	26/20, 26/24, 28/24, 28, 32, 36, 40, 42, 50
		QFJ (PLCC)		JS	JB	18, 20, 22, 28, 32, 44, 68, 84
		BGA/FBGA		LS	LA	48, 84, 104, 144, 176, 224, 256, 352, 420, 560
		FLGA		—	LB	49, 56, 84
		Wafer Level CSP (W-CSP)		—	HA, HB	Custom design
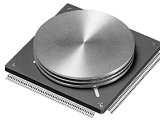
*[1] Under development
*[2] Built-in Heat Spreader

Package Name	Characteristics
Small Out-line L-Leaded Package	SOP packages are characterized by gull-wing type leads which are drawn out from each package body in two directions, and can be mounted flat. The standard lead pitch is 1.27 mm (50 mil).
Shrink Small Out-line L-Leaded Package	SOP packages with a lead pitch of less than 1.27 mm (50 mil) are called SSOP.
Thin Small Out-line L-Leaded Package	TSOP packages are ultra thin SOPs with a package L-Leaded mounting height of less than 1.27 mm, and are suited to ultra-thin electronic equipment such as smart cards.
Quad Flat L-Leaded Package	QFP packages are characterized by gull-wing type leads which are drawn out from each package body in four directions, and can be mounted flat. There are various QFPs available because the lead pitch is variable and the dimensions of the package body fixed.
Quad Flat L-Leaded Package with Heat Sink	QFP packages with a heat sink. (for high power device)
Quad Flat L-Leaded Package with Heat Spreader	QFP packages with built-in heat spreader. (for high power device)
Thin Quad Flat L-Leaded Package	Thin QFP packages have the package body heights (mold thickness) of 1.0 mm and of 1.27 mm.
Low Profile Quad Flat L-Leaded Package	LQFP packages have the package body height (mold thickness) of 1.4 mm.
Small Out-line J-Leaded Package	SOJ packages are characterized by J-shaped leads which are drawn out from each package body in two directions, and can be mounted flat. The standard lead pitch is 1.27 mm (50 mil).
Quad Flat J-Leaded Package	QFJ packages are characterized by J-shaped leads which are drawn out from each package body in four directions, and can be mounted flat. The standard lead pitch is 1.27 mm (50 mil).
Ball Grid Array/Fine Pitch BGA	BGA packages are surface mounting package with solder ball arrays on backside surface of printed circuit board (PCB).
Fine Pitch Land Grid Array	FLGA packages are surface mounting packages with solder land arrays on backside of printed circuit board (PCB).
Wafer Level Chip Size Package	A packaged wafer is cut and separated into individual chips.

Type			Package Types		Package Symbol		Pin Count
					Old	New	
Surface Mounting Type	Ceramic	HQFP			FS	FB	208, 256

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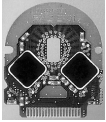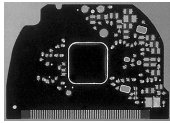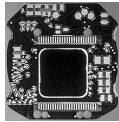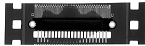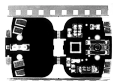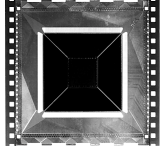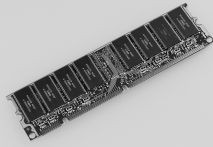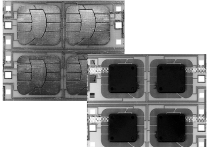
Package Name	Characteristics
Quad Flat Package	QFP packages are characterized by flat or gull wing leads which are drawn out from each package body in four directions, and can be mounted flat. These packages are fabricated in ceramics.

3) Special Packages

Type	Package Types		Package Symbol		Pin Count
			Old	New	
Special Packages	COB (Chip On Board)		KS	KA	Custom design
	TCP (Tape Carrier Package)		AV-Z	VA	Custom design
	Memory Module	Socket type	YS BS DS	YA YB YC YD YE	
	COT (Chip on Tape)		—	KC	IC card

Package Name	Characteristics
Chip On Board	COB packages are customer-specified packages with an IC chip mounted and sealed on each PC board.
Tape Carrier Package	TCP packages are constructed using Tape Automated Bonding (TAB) technique. TCP packages are suited to multi-pin, thin, compact, high density IC packages. Custom designs are available depending on the application.
Memory Module	Module packages are designed so that several surface mount IC packages are mounted on each PC board. These packages are high-density IC packages with sophisticated functions, and are mostly used for memories.
Chip On Tape	COT packages are customer-specified packages with an IC chip directly mounted and sealed on each tape substrate.

1.4　Package Lineup

OKI's package lineup is as follows.

Material	Package Name	Lead Pitch (mm)	Nominal Size (mil)	8	14	16	18	20	22	24	28	30	32	36	40	42	48	64	73	88	133	177	209	240	257	301	365	400
Plastic	DIP	2.54	300mil	●	●	●	●																					
	DIP	2.54	300(WIDE)					●																				
	DIP	2.54	400mil						●																			
	DIP	2.54	600mil							●	●		●	●	●	●	●											
	Skinny DIP	2.54	300mil					●	●																			
	SDIP	1.778	400mil									●																
	SDIP	1.778	600mil													●												
	SDIP	1.778	750mil															●										
	ZIP	1.27	400mil					●		●	●																	
	ZIP	1.27	400(WIDE)					●																				
	ZIP	1.27	475mil												●													
Ceramic	DIP	2.54	300mil		●	●	●																					
	DIP	2.54	400mil						●																			
	DIP	2.54	600mil							●	●				●	●	●											
	CER-DIP	2.54	300mil	●	●	●	●																					
	CER-DIP	2.54	400mil							●	●				●	●												
	CER-DIP	2.54	600mil								●		●		●													
	WDIP	2.54	600mil								●				●													
	PGA	1.27	—																								●	●
	PGA	2.54	—																●	●	●	●	●	●	●	●		

Number of Pins

Table 1.4.1　Through-hole Mounting Type Package Lineup

Table 1.4.2 — Surface Mounting Type Package Lineup. Number of Pins.

Material	Package Name	Lead Pitch (mm)	Nominal Size (mil)	8	14	16	18	20	22	24	26/20	28/24	28	30	32	36	40	42	44/40	44	48	49/50	50/44	54	56	60	64	66	68	70/64	80	84/86	100	104	120	128	144/160	176	208/224	240/256	272/304	352/420	560
Plastic	SOP	1.27	—	●	●	●				●		●	●	●	●	●		●		●																							
	SSOP	1.0	—					●																																			
	SSOP	0.95	—					●																																			
	SSOP	0.8	—										●													●	●			●													
	SSOP	0.65	—									●								●						●			●	●												
	TSOP(1)	0.5	8 × 14 / 12 × 20									●		●			●	●		●			●			●		●	●	●												
	TSOP(2)	1.27	300mil								●	●			●																												
	TSOP(2)	1.27	400mil								●	●			●																												
	TSOP(2)	0.8	400mil															●	●		●	●	●																				
	TSOP(2)	0.8	550mil																		●																						
	TSOP(2)	0.65	400mil																	●								●															
	TSOP(2)	0.5	400mil															●									●		●	●													
	QFP	1.0	—																						●		●				●		●			●							
	QFP	0.8	—															●		●							●				●		●		●	●		●					
	QFP	0.65	—																										●				●		●	●	●	●	●	●	●	●	
	QFP	0.5	—																												●		●	●		●			●	●			
	LQFP	0.5	—																		●										●		●		●								
	TQFP	0.5	—																		●						●				●		●		●	●							
	TQFP	0.4	—																															●	●								
	SOJ	1.27	300mil								●	●				●	●						●																				
	SOJ	1.27	400mil									●			●														●		●												
	QFJ	1.27	—				●	●	●	●		●		●				●													●												
	QFJ	1.27	—											●																													
	BGA	1.0	—																			●									●	●	●	●		●	●		●		●	●	●
	FBGA	0.8	—																						●						●												
	FLGA	0.8	—																												●												
Ceramic	HQFP	0.65	—																																			●		●			
	HQFP	0.5	—																																						●		

Table 1.4.2   Surface Mounting Type Package Lineup

1.5 Package Symbols and Codes

This data book uses both old package codes and new package codes.
These package codes are not applicable to OKI's product names and their markings.
Note: This information is expressed as abbreviated codes.

1) Package code
   [New package code]

The package codes given on the outline view are those specified in ED-7303 (General Rules for Integrated Circuits Package Name and Code) established by Electronic Industries Association of Japan (EIAJ), as shown below.

$$\underset{(1)}{\square} - \underset{(2)}{\square\square\square} \; \underset{(3)}{\square\square\square} \; \underset{(4)}{\square\square\square\square\square} - \underset{(5)}{\square\square\square\square\square \times \square\square\square\square\square} - \underset{(6)}{\square\square\square\square} - \underset{(7)}{\square\square\square}$$

(1) : Package material :	See Table 1-5-1
(2) : Package structure characteristics:	See Table 1-5-2
(3) : Package name :	See Table 1-5-3
(4) : Number of package leads :	See Table 1-5-4
(5) : Reference package dimensions :	See Table 1-5-5
(6) : Lead pitches :	See Table 1-5-6
(7) : OKI's serial number:	See 2) Package Symbol

[Old package code]

The package codes given on the outline view are those specified in ED-7401-2 (General Rules for Integrated Circuits Package Name and Code) established by Electronic Industries Association of Japan (EIAJ), as shown below.

$$\underset{(1)}{\square\square} \; \underset{(2)}{\square\square\square\square} \; \underset{(3)}{\square\square\square} - \underset{(4)}{\square} - \underset{(5)}{\square\square\square\square} - \underset{(6)}{\square\square\square\square} - \underset{(7)}{\square\square\square}$$

(1) : Package structure characteristics:	See Table 1-5-2
(2) : Package name :	See Table 1-5-3
(3) : Number of package leads :	See Table 1-5-4
(4) : Package material :	See Table 1-5-1
(5) : Reference package dimensions :	See Table 1-5-5
(6) : Lead pitches :	See Table 1-5-6
(7) : OKI's serial number:	See 2) Package Symbol

Examples:

1) P-HQFP208-40 × 40-0.65-K (HQFP208-P-4040-0.65-K)
   This indicates a plastic QFP type package with a heat sink, consisting of 208 leads with a package body size of 40 mm x 40 mm and a normal bending lead pitch of 0.65 mm.

2) P-DIP42-13.7 × 51.98-2.54 (DIP42-P-600-2.54)
   This indicates a plastic DIP type package consisting of 42 leads with package body width of 13.7 mm, package body length of 51.98 mm and a lead picth of 2.54 mm.

3)   P-SOJ26/20-7.62 × 17.15-1.27 (SOJ26/20-P-300-1.27)
     This indicatesa a plastic SOJ type package consisting of 20 leads (up to 26 leads) with package body width of 7.62 mm, package body length of 17.15 mm and a lead pitch of 1.27 mm.

4)   P-TFLGA48-0707-0.80
     This indicates a plastic LGA type package consisting of 48 leads with package body height of 1.2 mm or less, package body size of 7 mm x 7 mm and a lead pitch of 0.80 mm.

Table 1.5.1   Package Material

Code	Material	Applicable Package
C	Ceramic	Multi-layer ceramic package
G	Ceramic	Hermetic ceramic package sealed with glass
P	Plastic	Package molded with resin

Table 1.5.2   Package Structure Characteristics

Function	Code	Applicable Package
Additional structural function	H	Package with a heat sink
	W	Package with a translucent window
Package thickness	T	Package with a package body thickness of 1.0 mm
	L	Package with a package body thickness of 1.4 mm
Lead pitch & position	S	Standard package with a smaller lead pitch
	F	BGA and LGA packages with a pitch of 0.8 mm or less
		QFP package with a pitch of 0.5 mm or less
	I	Package with pins that are laid out interstitially

Table 1.5.3   Package Names

Code	Package Name
QFP	Quad Flat Package
QFJ	Quad Flat J-Leaded Package
DIP	Dual In-line Package
SOP	Small Out-line Package
SOJ	Small Out-line J-Leaded Package
ZIP	Zigzag In-line Package
PGA	Pin Grid Array
BGA	Ball Grid Array
LGA	Land Grid Array

Table 1.5.4   Number of Package Leads (Typical Example)

Code	Package Name
0008	8
0014	14
0064	64
0144	144
0256	256

Table 1.5.5   Reference Package Dimensions (Typical Example)

Package Name	Reference Dimensions	Code Example
QFP	Package body size (mm)	1010, 1420
QFJ	Package body size (square or rectangle)	S115, R400
ZIP	Maximum package mounting height	0325, 0400
DIP	Spacing between terminal rows	0300, 0400
PGA	Matrix size	S10U, R11D
	(cavity up or down)	
SOP	Inter-mount pad center distance	0225, 0300
TSOP(1)	Outermost size (mm)	1014, 0820
TSOP(2)	Package body width	0300, 0400
SOJ	Package body width	0300, 0400
SSOP	Package body width	0300, 0044
BGA	Package body/size (mm)	2727, 3535
LGA	Package body/size (mm)	0806

Note: English characters in the code examples are shown below.
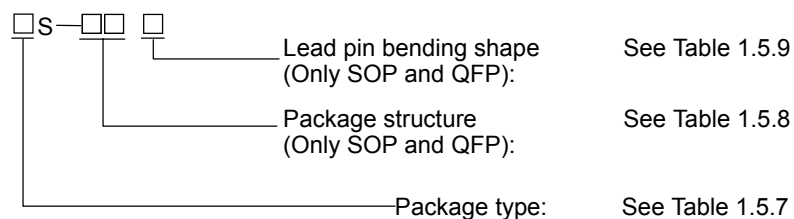
S   :   SQUARE

R   :   RECTANGLE

U   :   CAVITY UP

D   :   CAVITY DOWN

Table 1.5.6   Lead Pitches (Typical Example)

Code	Lead Pitch
2.54	2.54 mm
1.78	1.778 mm
1.27	1.27 mm
1.00	1.00 mm
0.80	0.80 mm
0.65	0.65 mm
0.50	0.50 mm
0.40	0.40 mm
0.30	0.30 mm

2)   Package symbols

The package symbol indicates the package name and shape as shown below.
[Old package symbol]

□S—□□ □

Lead pin bending shape   See Table 1.5.9
(Only SOP and QFP):

Package structure   See Table 1.5.8
(Only SOP and QFP):

Package type: See Table 1.5.7

Table 1.5.7   Package Type

Package Symbol	Package Type	
R	Plastic standard DIP, plastic skinny DIP	
S	Plastic shrink DIP	
Z	Plastic ZIP	
A	Ceramic DIP, CER-DIP, ceramic PGA	
M	Plastic SOP with 20 or less pins	
G	Plastic SOP with more than 20 pins, plastic QFP	
J	Plastic SOJ, plastic QFJ (PLCC)	
F	Ceramic QFN	
B	SIMM/DIMM	Refer to "Memory Module Data Book" as to detail.
D	SIMM	
K	COB	
AV-Z	Tape carrier package (TAB)	
T	Plastic TSOP, plastic TQFP	
L	Plastic BGA	

Table 1.5.8   Package Structure

Package Symbol	Package Structure
—, D	Normal heat resistant package (with reflow soldering capability)
B, Z	New heat resistant package (with reflow soldering capability)
2	New heat resistant package (Thick type) (with reflow soldering capability)
C	Built-in thermal spreader

Table 1.5.9   Lead Pin Bending Shape

Package Symbol	Lead Structure	External View (Side)
K	Normal bending	
L	Reverse bending	

[New package symbol]

☐☐

Package type   See Table 1.5.10

Table 1.5.10   Package Type

Material	Package Type	New Symbol
Ceramic	Standard DIP	AA
	CER-DIP	AB
	PGA	BA
	HQFP	FB
Plastic	Standard DIP	RA
	Shrink DIP	RB
	Skinny DIP	RC
	ZIP	RD
	SOP*	MA
	SSOP*	MB
	TSOP (1)*	TA
	TSOP (2)*	TA
	QFP*	GA
	(High Heat Dissipation QFP)*	GA
	TQFP*	TB
	LQFP*	TC
	SOJ	JA
	QFJ (PLCC)	JB
	BGA/FBGA	LA
	FLGA	LB
	W-CSP	HA, HB
Custom type	COB	KA
	COT	KC
	TCP	VA
	SIMM (Gold Plating)	YA
	SIMM (Solder Plating)	YB
	DIMM (Gold Plating)	YC
	S/O SIMM (Gold Plating)	YD
	S/O DIMM (Gold Plating)	YE

       * Reverse bending   *Y

Note: An additional symbol may be inserted into the 2nd position of a package symbol for each device.

3) Product Naming

Oki has manufactured ICs for over 30 years.
Several kinds of package symbols have been used in OKI IC names with a top symbol such as MSM, MSL or MSC indicating a structure.
Because recently kinds of devices have increased and long package symbols are required due to multi-functions of devices, it becomes necessary to change the product naming method.
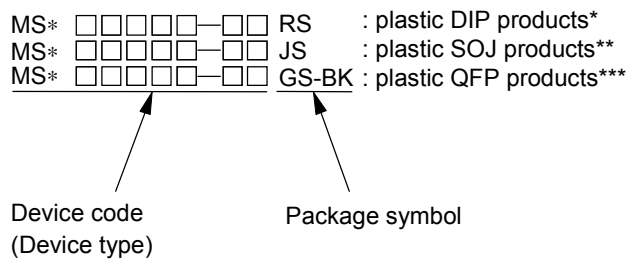The new product naming method is used for new products.
For upgraded gate arrays and mask ROM products with a new code, the new product naming method is used only for package symbols and option codes.
The old product naming method is used for the existing products.
For more details, please contact Oki's sales person.

[Old product naming]

MS∗ □□□□□—□□ RS   : plastic DIP products*
MS∗ □□□□□—□□ JS   : plastic SOJ products**
MS∗ □□□□□—□□ GS-BK : plastic QFP products***

Device code   Package symbol
(Device type)

*   This IC name format is also used for plastic skinny DIP products.
**   This IC name format is also used for plastic QFJ products.
***   This IC name format is also used for plastic SOP products.

[New product naming]

M∗ □□□□□□—□□ RA   : plastic DIP products
M∗ □□□□□□—□□ TB   : plastic TQFP products
M∗ □□□□□□—□□ JA   : plastic QFP products

Device code + Package symbol = Product name