1. FUNCTIONAL REQUIREMENTS

The history of electronic components is one of miniaturization and of increasing component-mounting densities. Active devices have evolved from vacuum tube through transistors to integrated circuits that contain peripheral circuitry as well. IC integration has advanced from LSI to VLSI, and continuing improvements in semiconductor processing promise even greater advances in the future.

The packages that house these ICs have also changed to accommodate developments in chip and mounting technology. Mitsubishi Electric now offers a complete line of standard packages that fulfill the vast majority of commercial application requirements, and custom-made packages to meet specialized needs.

IC packages generally have to provide the following performance features:

— Easier packaging
— Sufficient mechanical protection to protect IC chip from the environment of actual use
— Heat generated in IC chip should be dissipated
— Package electrical characteristics should not affect device performance

In addition to such primary functions, recent evolution of the electronics industry has created important secondary requirements that include:

— More higher I/O pin counts
— Smaller and thinner package outlines
— A variety of packages for high density mounting
— Higher power dissipation and tighter dimensional tolerance for it
— Packages for automatic mounting
— Increased resistance to soldering temperatures
— Low internal stress and preventive measures to limit soft errors in sensitive devices
— Lower price.
2. IC PACKAGE CLASSIFICATION

The following pages classify Mitsubishi Packages by the sealing method and the mounting method. The conventions shown here are used throughout this DATA BOOK, so we suggest you take the time to review them.
PLASTIC PACKAGES

[Mounting Method] [No. of pinout side] [Type] [Outline]

Through-hole mount

Single side

SIP (Single Inline Package)

HSIP (SIP with Heatsink)

ZIP (Zig-zag Inline Package)

Dual sides

DIP (Dual Inline Package)

SDIP (Shrink Dual Inline Package)

Surface mount

Dual sides

SOP (Small Outline Package)

SSOP (Shrink Small Outline Package)

TSOP (Thin Small Outline Package)

SOJ (Small Outline J-leaded package)

Quadruple sides

QFP (Quad Flat Package)

LQFP (Low profile Quad Flat Package)

TQFP (Thin Quad Flat Package)

QFJ (Quad Flat J-leaded package)
IC PACKAGE CLASSIFICATION

BGA PACKAGE

<table>
<thead>
<tr>
<th>[Mounting Method]</th>
<th>No. of pinout side</th>
<th>[Type]</th>
<th>[Outline]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface mount</td>
<td>Bottom</td>
<td>BGA(Ball Grid Array)</td>
<td><img src="image" alt="BGA(Ball Grid Array)" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td>BGA(Cavity Down Type)</td>
<td><img src="image" alt="BGA(Cavity Down Type)" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td>FBGA(Fine pitch BGA)</td>
<td><img src="image" alt="FBGA(Fine pitch BGA)" /></td>
</tr>
<tr>
<td>TCP PACKAGE</td>
<td></td>
<td>M-CSP(Mold-Chip Scale Package)</td>
<td><img src="image" alt="M-CSP" /></td>
</tr>
</tbody>
</table>

| Surface mount     | Quadruple sides  | QTP (Quad Tape carrier Package) | ![QTP](image) |
METAL-SEALED PACKAGES

[Mounting Method] [No. of pinout sides] [Type] [Outline]

- Through-hole mount
  - Dual sides
    - DIP TYPE
  - Bottom
    - PGA (Pin Grid Array)
- Surface mount
  - Quadruple sides
    - QFP TYPE
      - QFN (Quad Flat Non-leaded package)
    - PIGGY BACK
- PIGGY BACK

MODULES

- Plug-in
3. PACKAGE STRUCTURE

The following diagrams show the structure of typical IC packages.

**STRUCTURE OF METAL SEALED DIP**

- **CERAMIC BODY**
- **AI WIRE**
- **CHIP**
- **SEALING MATERIAL** (Au/Sn or Pb/Sn)
- **SEALING MATERIAL** (Au or Ni PLATING)
- **LEAD** (Pb/Sn or Au PLATING)
- **SOFT SOLDER** (Pb/Sn)

**STRUCTURE OF PLASTIC MOLDED DIP**

- **SOFT SOLDER** (Pb/Sn)
- **CHIP**
- **EPOXY RESIN**
- **SILVER SPOT PLATING**
- **LEAD** (Pb/Sn PLATING)
- **Au WIRE**

**STRUCTURE OF PLASTIC MOLDED SOP**

- **SOFT SOLDER OR ADHESIVE** (Pb/Sn)
- **CHIP**
- **EPOXY RESIN**
- **SILVER SPOT PLATING**
- **LEAD** (Pb/Sn PLATING)
- **Au WIRE**
STRUCTURE OF PLASTIC MOLDED QFP

- CHIP
- EPOXY RESIN
- Au WIRE
- SILVER SPOT PLATING
- SOFT SOLDER OR ADHESIVE (Pb/Sn)
- LEAD (Pb/Sn PLATING)

STRUCTURE OF PLASTIC MOLDED QFJ

- CHIP
- EPOXY RESIN
- Au WIRE
- SILVER SPOT PLATING
- SOFT SOLDER (Pb/Sn)
- LEAD (Pb/Sn PLATING)
STRUCTURE OF QTP

- CHIP
- EPOXY RESIN
- HEAT SPREADER
- LEAD (Pb/Sn PLATING)
- TAPE (Polyimide)
- TEST PAD

STRUCTURE OF HQFP

- EPOXY RESIN
- HEAT SPREADER
- Au WIRE
- CHIP
- SILVER SPOT PLATING
- SOFT SOLDER OR ADHESIVE (Pb/Sn)
- LEAD
STRUCTURE OF TSOP (LOC)

EPOXY RESIN

Au WIRE

INNER LEAD

SILVER SPOT PLATING

CHIP

OUTER LEAD
(Pb/Sn PLATING)

DIE PAD

CHIP

Au WIRE

INNER LEAD

DIE PAD

ADHESIVE
STRUCTURE OF BGA (M Flip–Chip BGA type)

Under Development

Epoxy resin

Solder Ball

LSI Chip

Inner Bump on Electrode Pad

Organic substrate

STRUCTURE OF FBGA

Epoxy resin

Au wire

Chip

Solder ball

Single layer substrate

Dielectric adhesive layer
STRUCTURE OF M-CSP (Mold Chip Scale Package)

- Solder Ball
- Epoxy resin
- LSI Chip
- Inner Bump on Electrode Pad
- Single layer substrate

STRUCTURE OF HSSOP

- Epoxy Resin
- Inner Lead
- Chip
- Au Wire
- Die Pad
- Outer Lead (Cu Alloy)
4. PACKAGE CODING CONVENTIONS

This data book is organized in accordance with our coding conventions of package type. This simple system is detailed below. Package codes provided in EIAJ are explained in Chapter 5.

Example

16 P 2 N - A

• Number of pins
  This is the standard number of pins that the package is designed to support. If devices have some pins removed or joined together, the actual number of pins will be smaller.

• Package Code
  C : Clear plastic molded
  D : Ceramic chip carrier
  F : Glass epoxy substrate type
  K : Glass-sealed ceramic package
  N : Glass-epoxy substrate (memory modules)
  P : Plastic molded
  S : Metal-sealed ceramic
  W: Tape carrier

• Primary Outline Code
  1 : DIP
  2 : SOP
  3 : TSOP
  4 : DIP
  5 : SIP, or ZIP
  6 : QFP
  7 : BGA
  8 : PGA
  9 : Special outline
  0 : QFN, QFJ, or SOJ
  F : TQFP
  H : CSP
  T : TSOP

• Secondary Outline Code (1)
  Special-purpose secondary codes describing package size, lead pitch and other information are included as needed.

• Secondary Outline Code (2)
  Special-purpose secondary codes describing lead shape such as lead bend are included as needed. Since no common rule for these secondary outline code (1),(2) exists, contact your sales representative for detail.

Example 1

30 P 4 B

• 30 pins
• Plastic-molded package
• DIP
• Secondary outline code indicating 70 mil (1.778 mm) lead pitch

Example 2

80 P 6 N - A

80 pins
Plastic-molded package
QFP
Secondary outline code (1) N added to discriminate from other 80-pin QFP
Secondary outline code (2) A indicating that the shape of bent leads is type A
# PLASTIC PACKAGE LINE-UP (3)

<table>
<thead>
<tr>
<th>PACKAGE</th>
<th>LEAD PITCH (mm)</th>
<th>WIDTH (mil)</th>
<th>PIN COUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>24 26 28 32 36 40 42 44 50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOJ Small Outline J-leaded Package</td>
<td>1.27</td>
<td>300</td>
<td>● ● ● ● ● ●</td>
</tr>
<tr>
<td></td>
<td>400</td>
<td>● ● ● ● ● ● ● ● ● ●</td>
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</tr>
<tr>
<td></td>
<td>0.8</td>
<td>400</td>
<td>● ● ● ● ● ● ● ● ● ●</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PACKAGE</th>
<th>LEAD PITCH (mm)</th>
<th>PIN COUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>QFP Quad Flat Package</td>
<td>1.0</td>
<td>●</td>
</tr>
<tr>
<td></td>
<td>0.8</td>
<td>● ● ● ● ● ●</td>
</tr>
<tr>
<td></td>
<td>0.65</td>
<td>● ● ● ● ● ● ● ● ● ●</td>
</tr>
<tr>
<td></td>
<td>0.5</td>
<td>● ● ● ● ● ● ● ● ● ● ● ●</td>
</tr>
<tr>
<td></td>
<td>0.4</td>
<td>● ● ● ● ● ● ● ● ● ● ● ● ● ●</td>
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<tr>
<td>HQFP Heat sink Quad Flat Package</td>
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<td>● ● ● ● ● ● ● ● ● ● ● ● ● ●</td>
</tr>
<tr>
<td></td>
<td>0.5</td>
<td>● ● ● ● ● ● ● ● ● ● ● ● ● ●</td>
</tr>
<tr>
<td></td>
<td>0.4</td>
<td>● ● ● ● ● ● ● ● ● ● ● ● ● ●</td>
</tr>
<tr>
<td>LQFP Low profile Quad Flat Package</td>
<td>0.8</td>
<td>● ● ● ● ● ● ● ● ● ● ● ● ● ●</td>
</tr>
<tr>
<td></td>
<td>0.65</td>
<td>● ● ● ● ● ● ● ● ● ● ● ● ● ●</td>
</tr>
<tr>
<td></td>
<td>0.5</td>
<td>● ● ● ● ● ● ● ● ● ● ● ● ● ●</td>
</tr>
<tr>
<td></td>
<td>0.4</td>
<td>● ● ● ● ● ● ● ● ● ● ● ● ● ●</td>
</tr>
<tr>
<td>TQFP Thin Quad Flat Package</td>
<td>0.65</td>
<td>● ● ● ● ● ● ● ● ● ● ● ● ● ●</td>
</tr>
<tr>
<td></td>
<td>0.5</td>
<td>● ● ● ● ● ● ● ● ● ● ● ● ● ●</td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
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</tr>
<tr>
<td>QFJ Quad Flat J-leaded Package</td>
<td>1.27</td>
<td>● ● ● ● ● ● ● ● ● ● ● ●</td>
</tr>
</tbody>
</table>

- ●: In production
- ○: Under development
- ◯: Under planning
### Plastic Package (Clear Resin Type) Line-Up

<table>
<thead>
<tr>
<th>PACKAGE</th>
<th>LEAD PITCH (mm)</th>
<th>PIN COUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>10 12 16 18 24</td>
</tr>
<tr>
<td>SOP Small Outline Package</td>
<td>1.27</td>
<td>●</td>
</tr>
<tr>
<td></td>
<td>0.8</td>
<td>● ● ● ● ●</td>
</tr>
<tr>
<td></td>
<td>0.65</td>
<td></td>
</tr>
</tbody>
</table>

### Glass Sealed Package Line-Up

<table>
<thead>
<tr>
<th>PACKAGE</th>
<th>LEAD PITCH (mm)</th>
<th>PIN COUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>CerQuad Ceramic Quad Flat Package</td>
<td>0.5</td>
<td>●</td>
</tr>
</tbody>
</table>

### Metal Sealed Package Line-Up

<table>
<thead>
<tr>
<th>PACKAGE</th>
<th>PIN COUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30 42 52 64 72 80 100 124 128 135 145 149 160 177 179 209 281 287 361</td>
</tr>
<tr>
<td>DIP Dual Inline Package</td>
<td>● ● ● ●</td>
</tr>
<tr>
<td>PGA Pin Grid Array</td>
<td>● ● ● ● ● ● ● ● ● ● ● ●</td>
</tr>
<tr>
<td>QFP Quad Flat Package</td>
<td>● ●</td>
</tr>
<tr>
<td>QFN Non-leaded Package</td>
<td>● ● ● ● ●</td>
</tr>
<tr>
<td>PIGGY BACK DIP Type</td>
<td>● ●</td>
</tr>
<tr>
<td>QFP Type</td>
<td>●</td>
</tr>
<tr>
<td>QFN Type</td>
<td>● ●</td>
</tr>
</tbody>
</table>

* ●: In production  ○: Under development  ○: Under planning
# Mitsubishi Integrated Circuit Packages

## Package Line-Up

### Single Inline Lead Type

<table>
<thead>
<tr>
<th>PACKAGE</th>
<th>PIN COUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ball Grid Array</td>
<td>36 48 153 175 199 207 225 239 255 256 272 299 385 456 479 516 520</td>
</tr>
</tbody>
</table>

### Zig-zag Inline Lead Type

<table>
<thead>
<tr>
<th>PACKAGE</th>
<th>PIN COUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ball Grid Array</td>
<td>36 48 153 175 199 207 225 239 255 256 272 299 385 456 479 516 520</td>
</tr>
</tbody>
</table>

### Single Inline Leadless Type

<table>
<thead>
<tr>
<th>PACKAGE</th>
<th>PIN COUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ball Grid Array</td>
<td>36 48 153 175 199 207 225 239 255 256 272 299 385 456 479 516 520</td>
</tr>
</tbody>
</table>

### Ball Grid Array Package Line-Up

<table>
<thead>
<tr>
<th>PACKAGE</th>
<th>LEAD PITCH (mm)</th>
<th>PIN COUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ball Grid Array</td>
<td>1.5</td>
<td>●</td>
</tr>
<tr>
<td></td>
<td>1.27</td>
<td>●</td>
</tr>
<tr>
<td></td>
<td>1.0</td>
<td>●</td>
</tr>
<tr>
<td>Fine pitch Ball Grid Array</td>
<td>0.8</td>
<td>●</td>
</tr>
<tr>
<td>Mold-Chip Scale Package</td>
<td>0.75</td>
<td>●</td>
</tr>
<tr>
<td></td>
<td>0.65</td>
<td>●</td>
</tr>
</tbody>
</table>

### Tape Carrier Package Line-Up

<table>
<thead>
<tr>
<th>PACKAGE</th>
<th>LEAD PITCH (mm)</th>
<th>PIN COUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quad Tape carrier Package</td>
<td>0.25</td>
<td>●</td>
</tr>
</tbody>
</table>

### Module Package Line-Up

<table>
<thead>
<tr>
<th>PACKAGE</th>
<th>LEAD PITCH (mm)</th>
<th>PIN COUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Inline Lead Type</td>
<td>2.54</td>
<td>●</td>
</tr>
<tr>
<td>Zig-zag Inline Lead Type</td>
<td>1.27</td>
<td>●</td>
</tr>
<tr>
<td>Single Inline Leadless Type</td>
<td>2.54</td>
<td>●</td>
</tr>
<tr>
<td></td>
<td>1.27</td>
<td>●</td>
</tr>
</tbody>
</table>

### Status Indications

- ●: In production
- ○: Under development
- ◯: Under planning

---

**NOTE:**

- BGA: Ball Grid Array
- FBGA: Fine pitch Ball Grid Array
- M-CSP: Mold-Chip Scale Package
- M-CSP: Mold-Chip Scale Package
- QTP: Quad Tape carrier Package
- M-CSP: Mold-Chip Scale Package

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Mar. '98