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Providing Solutions Faster through Synergy

In recent years demand for higher mounting densities and improved reliability has been increasing. By utilizing the strengths of both partners to the merger, Renesas Technology is able to supply package solutions more rapidly than ever before.
**Package Mounting Height vs. Pin Count**

- **LQFP**
- **TQFP**
- **QFN**
- **BGA**
- **LGA**

Under development (including planning)

**Package Mounting Area vs. Pin Count**

- **LQFP**
- **TQFP**
- **QFN**
- **BGA**
- **LGA**

Under development (including planning)
New Technology
Three Dimensional Assembly Module 

MSM Multi Stratum Module

Thin Multi-Layer Packages for Mounting in Mobile Applications, and for Storage Cards

- Thin packages that can be mounted in mobile applications and memory cards
  0.3 mm per layer

- Wide variety of installed chips
  Flash, SRAM, DRAM, mobile RAM Controller, Logic, SoC

Multiple layers to suit the customers’ requirements

---

Line-up

Implementing system solutions tailored to customers’ requirements

---

Storage Card Applications

- Extremely Thin CSP
- Flash, SRAM, DRAM
- Mobile Applications
- CompactFlash® Card
- Memory Package

---

Mobile Applications

- Flash, SRAM, DRAM
- Mobile Applications
- CompactFlash® Card
- Memory Package
New Technology
Multi Stratum Module
MSM

Thin Multi-Layer Packages for Mounting in Mobile Applications, and for Storage Cards

- Thin packages that can be mounted in mobile applications and memory cards
  0.3 mm per layer
- Wide variety of installed chips
  Flash, SRAM, DRAM, mobile RAM Controller, Logic, SoC
- Multiple layers to suit the customers’ requirements

Line-up

- Implementing system solutions tailored to customers’ requirements

Basic Structure of MSM

Three Dimensional Assembly Module

- Interposer
- Resin
- KGP
- Known Good Package
- Ball
- LSI Chip

Single Layer

Multiple Layers

(8 Layers)

Same Chip
(1 Chip)

Extremely Thin CSP

Storage Card Applications

MSM-PKG
(2 to 4 Layers)

Memory Card

Cap

PCB

Mobile Applications

System in Package
SoC, Logic, Controller + Memory

Flash, SRAM, DRAM
mobile RAM

Memory Package

CompactFlash® is a trademark of SanDisk Corporation and is licensed royalty-free to the CFA which in turn will license it royalty-free to CFA members.
**MCP Line-up**

<table>
<thead>
<tr>
<th>Package height (mm)</th>
<th>Number of chips</th>
<th>2 chips</th>
<th>3 chips</th>
<th>4 chips</th>
<th>4 chips + spacer (same die)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.9</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>0.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**POP Mounting Examples**

- *Parallel Arrangement*
- *Crossing Arrangement*

**POP application Examples**

- Flexible arrangements possible using space below package.

**Line-up**

<table>
<thead>
<tr>
<th>PKG size (mm)</th>
<th>Pin pitch (mm)</th>
<th>Mounting Height (mm)</th>
<th>Pin count</th>
<th>&lt;5 Chips&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.5 X 7.5</td>
<td>0.75</td>
<td>1.2</td>
<td>48</td>
<td>67</td>
</tr>
<tr>
<td>8.5 X 10.8</td>
<td>0.80</td>
<td>1.4</td>
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<td>67</td>
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<tr>
<td>10 X 11</td>
<td>0.80</td>
<td>1.2</td>
<td>48</td>
<td>67</td>
</tr>
</tbody>
</table>

*Maximum number of chips (including spacer)*
**New Technology**

**MCP/POP**

**Multi Chip Package/Package on Package**

**Thin, Large-Capacity Packages for Mobile Applications**

- *Thin, large-capacity design accommodating up to 4 chips in a single package*
  - Mounting height of 0.7 mm with 3 chips and 1.0 mm with maximum 4 chips
  - Allows various combinations to suit customers’ requirements (Flash, SRAM, mobile RAM).

- *Large-capacity configuration allowing stacked accommodation of up to 8 chips*
  - Mounting height of 2.0 mm with maximum 8 chips and 1.4 mm with maximum 6 chips
  - Allows combinations of different chip types to suit customers’ requirements (Flash, SRAM, mobile RAM).

**MCP Line-up**

<table>
<thead>
<tr>
<th>Package height (mm)</th>
<th>Number of chips</th>
<th>2 chips</th>
<th>3 chips</th>
<th>4 chips</th>
<th>4 chips + spacer (same die)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.4</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>1.2</td>
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<tr>
<td>0.9</td>
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<tr>
<td>0.7</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**POP**

**Basic Structure of POP**

**Basic Structure of 4-Chip MCP**

**Basic S-CSP Structure with 4 Chips and 1 Spacer**

- **S-CSP**

**Stacked-Chip Scale Package**

**Thin Large-Capacity Packages for Mobile Applications**

- *Thin, large-capacity design accommodating up to 4 chips in a single package*
  - Mounting height of 1.2 mm with 3 chips and 1.4 mm with maximum 5 chips
  - Allows various combinations to suit customers’ requirements (Nor Flash, SRAM, mobile RAM, AND Flash, SDRAM).

**Line-up**

<table>
<thead>
<tr>
<th>PKG size (mm)</th>
<th>Pin pitch (mm)</th>
<th>Mounting Height (mm)</th>
<th>Pin Count</th>
<th>&lt;5 Chips&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.5 X 7.5</td>
<td>0.75</td>
<td>1.2</td>
<td>48</td>
<td>67</td>
</tr>
<tr>
<td>8.5 X 10.8</td>
<td>0.80</td>
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<td>88</td>
<td>144</td>
</tr>
<tr>
<td>10 X 11</td>
<td>0.80</td>
<td>1.2</td>
<td>72</td>
<td>88</td>
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</table>

**POP Mounting Examples**

- Parallel Arrangement
- Crossing Arrangement

**POP application Examples**

- Flexible arrangements possible using space below package.
Ultra-High-Pin-Count Packages Featuring High-Speed Operation and High Heat Radiation Capability

- Ultra-high-pin-count packages (500 to 2500 pins) supporting high-speed operation (GHz level)
- Use of flip-chip junctions and high-density build-up substrate
- Heat spreader structure for high heat radiation capability

**Line-up**

<table>
<thead>
<tr>
<th>Pin count</th>
<th>441</th>
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<th>576</th>
<th>784</th>
<th>961</th>
<th>1026</th>
<th>1268</th>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td></td>
</tr>
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<td>50 x 50</td>
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<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

**Applications**

- Small, high-density mounting
- High-reliability flex modules (stand-alone type WPP)
- High-speed transmission
- Lead-free

**Application Examples**

- **Automotive**: High-reliability applications
  - ECU modules (stand-alone type WPP)

- **Servers**: High transmissibility, high reliability
  - Ultra-high-speed cache memory (PKG type WPP)
  - Ultra-high-speed, ultra-high-pin-count SoCs (PKG type WPP)

**Wafer size**: ø200/ø300

**Rewiring rule**: 10 μm/13 μm minimum L/S

**Maximum thickness t**: 11 μm

**Bump Structure**

- **Bump pitch** (μm): 500, 250, 125, 100, 80, 50, 25, 10, 5
- **Basic Land size (μm)**: ≤70, 80, 90, 100, 110, 120, 130, 140, 150
- **Bump height (μm)**: ≤10, 25, 40, 60, 80, 100, 125, 150, 175, 200

**Individually Supported**

- Bump pitch
- Bump height
- L/S

**Flip-chip Ball Grid Array (FC-BGA)**
**New Technology**

**FC-BGA** Flip-chip Ball Grid Array

Ultra-High-Pin-Count Packages Featuring High-Speed Operation and High Heat Radiation Capability

- Ultra-high-pin-count packages (500 to 2500 pins) supporting high-speed operation (GHz level)
- Use of flip-chip junctions and high-density build-up substrate
- Heat spreader structure for high heat radiation capability

**WPP** Wafer Process Package

Chip structure with redistributed interconnection and formed solder bumps for mounting at wafer level

- Small, high-density mounting
- High reliability
- High-speed transmission
- Lead-free

**Application Examples**

**Automotive:** High-reliability applications
- ECU modules (stand-alone type WPP)

**Servers:** High transmissibility, high reliability
- Ultra-high-speed cache memory (PKG type WPP)
- Ultra-high-speed, ultra-high-pin-count SoCs (PKG type WPP)

**Applications**

- Wafer size: ø200/ø300
- Rewiring rule: 10 µm/13 µm minimum L/S
- Maximum thickness t: 11 µm

**Bump Structure**

- Bump pitch (µm): 250, 250, ≤70, 80, 90, 100, 110, 120, 130, 140, 150
- Basic Land size (µm): 250, 150
- Bump height (µm): 300, 150
- Individual support: ≤250

**Table:**

<table>
<thead>
<tr>
<th>PKG size (mm)</th>
<th>Pin pitch (mm)</th>
<th>Pin count</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 X 25</td>
<td>1.00</td>
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</tr>
<tr>
<td>29 X 29</td>
<td>1.27</td>
<td></td>
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<tr>
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<td>1.27</td>
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</tr>
<tr>
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<td>1.00</td>
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<td>1.00</td>
<td></td>
</tr>
<tr>
<td>50 X 50</td>
<td>1.00</td>
<td></td>
</tr>
</tbody>
</table>

**Line-up**

- **784pin:** 37.5mm X 37.5mm
- **1848pin:** 45.0mm X 45.0mm
**Products**

**HQFP**
**Quad Flat Package with Heat sink**
Heat spreader type, high heat-radiation Packages for Automobile Applications

- Exposed heat spreader structure for low thermal resistance: 1.0˚C/W
- High-quality specifications for automobile and OA applications (JEDEC MSL-1)
- Suitable for high-temperature environments (Ambient environment: Tj = 150˚C Max., Ta = 125˚C Max.)
- Protruding corner header structure, protecting leads and simplifying visual inspection of mounting solder
- Industrial standard outline: ED-7311-15 (JEITA) MO-204 (JEDEC)

**Line-up**

<table>
<thead>
<tr>
<th>Package</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>HQFP1414-80</td>
<td><img src="image1" alt="Image" /></td>
</tr>
<tr>
<td>HQFP1414-100</td>
<td><img src="image2" alt="Image" /></td>
</tr>
<tr>
<td>HQFP1414-64</td>
<td><img src="image3" alt="Image" /></td>
</tr>
</tbody>
</table>

**Characteristics**

**Fig. Thermal resistance measured Results of HQFP (Type2) (Connected Heatspreader area to PWB)**

![Graph](image4)

- Connected soldering area: only 4 corner headers
- All exposed header area: S=Approx. 100%
- Boundary condition: Natural convection
- Mounted Renesas original PWB (FP=4, 100mm 100mm)

**Package Dimensions**

![Diagram](image5)

**Structure**

![Diagram](image6)
• Exposed heat spreader structure for low thermal resistance: $j_{c} = 1.0 \degree C/W$
• High-quality specifications for automobile and OA applications (JEDEC MSL-1)
• Suitable for high-temperature environments (Ambient environment: $T_J = 150^\circ C$ Max., $T_a = 125^\circ C$ Max.)
• Protruding corner header structure, protecting leads and simplifying visual inspection of mounting solder
• Industrial standard out line: ED-7311-15 (JEITA) MO-204 (JEDEC)

**Line-up**

<table>
<thead>
<tr>
<th>Products</th>
<th>Quad Flat Package with Heat sink</th>
</tr>
</thead>
<tbody>
<tr>
<td>HQFP</td>
<td>Heat spreader type, high heat-radiation Packages for Automobile Applications</td>
</tr>
</tbody>
</table>

**Characteristics**

- **Fig. Thermal resistance measured Results of HQFP (Type2)**
  - Connected soldering area to PWB
  - Boundary condition: Natural convection
  - Mounted Renesas original PWB (FP=4, 100mm 100mm)

**Structure**

- **Package Dimensions**
  - Pin No.
    - 1, 2, 3 Source
    - 4 Gate, 3 Drain
  - Loss Free Package LFPAK
  - Low on-resistance Packages for Power MOSFET

- Wireless structure for low on-resistance
  - 2.1 mΩ typ.
- Exposed drain electrode structure for low thermal resistance: $j_{ch-c}: 3 \degree C/W$
- Low inductance: 1.1 nH
- Small package: Same board footprint as SOP8
- Industrial standard package: SC-100 (JEITA) MO-235 (JEDEC)
- Lead-free
### WPAK

**Very Very Thin Package**

Ultra thin type Packages for power MOSFET for Mobile Applications

- Thin type: Max. 0.8 mm mounting height
- Low thermal resistance (θch-c): 5°C/W
- Small package: Same board footprint as SOP8
- Flat lead structure (HSON equivalent)
- Lead-free

### LQFP

**Low Profile Quad Flat Package**

High reliability, Standard Lead type Packages with rich line-ups

- High pin-count, ideal for high-functionality, high-I/O-count LSIs
- Small size, allowing high-density mounting
- Thin QFP (LQFP) with package mounting height of 1.70 mm or less
- Small die pad structure, enabling highly heat-resistant mounting

### Package Dimensions

![Diagram of WPAK Package Dimensions](image1)

#### Basic Structure

- Thin type: Max. 0.8 mm mounting height
- Low thermal resistance (θch-c): 5°C/W
- Small package: Same board footprint as SOP8
- Flat lead structure (HSON equivalent)
- Lead-free

### Line-up

#### Package Size and Pin Options

<table>
<thead>
<tr>
<th>PKG size (mm)</th>
<th>Pin pitch (mm)</th>
<th>Pin count</th>
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</thead>
<tbody>
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<td>0.80</td>
<td>80</td>
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<tr>
<td></td>
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<td>64</td>
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<td></td>
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<td>56</td>
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<td>48</td>
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</tbody>
</table>

**Pennsylvania**
• Thin type: Max. 0.8 mm mounting height
• Low thermal resistance (θch-c): 5°C/W
• Small package: Same board footprint as SOP8
• Flat lead structure (HSON equivalent)
• Lead-free

**WPAK**

**Very Very Thin Package**

Ultra thin type Packages for power MOSFET for Mobile Applications

- Pin No.: 1, 2, 3 Source
  4 Gate, 5, 6, 7, 8 : Drain

**LQFP**

**Low Profile Quad Flat Package**

High reliability, Standard Lead type Packages with rich line-ups

- High pin-count, ideal for high-functionality, high-I/O-count LSIs
- Small size, allowing high-density mounting
- Thin QFP (LQFP) with package mounting height of 1.70 mm or less
- Small die pad structure, enabling highly heat-resistant mounting

**Package Dimensions**

**Line-up**

<table>
<thead>
<tr>
<th>PKG size (mm)</th>
<th>Pin pitch (mm)</th>
<th>Pin count</th>
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</table>
• Small size, ideal for reducing size and weight for mobile applications.
• Allows orientation toward thinner implementation
Max. 1.0 mm mounting height model are in mass production

• Surface placement of solder balls, allowing high-pin-count and small package size
• Thin package with mounting height of 1.4 mm or less
• Small size offering excellent electrical characteristics
• High quality and reliability

---

**QFN**
Quad Flat Non-lead Package
Small, thin Packages for Mobile Applications

**FBGA**
Fine-pitch Ball Grid Array
High reliability, Standard Array type Packages with rich line-ups

---

**Line-up**

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<th>Pin count</th>
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**Line-up**
Smaller Packages and Lower Impedance

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**QFN Quad Flat Non-lead Package**

- Small, thin Packages for Mobile Applications.
- Allows orientation toward thinner implementation.
- Max. 1.0 mm mounting height model are in mass production.

**FBGA Fine-pitch Ball Grid Array**

- Surface placement of solder balls, allowing high pin-count and small package size.
- Thin package with mounting height of 1.4 mm or less.
- Small size offering excellent electrical characteristics.
- High quality and reliability.

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**Line-up**

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- **Lead**: Au Wire
- **Chip**: LSI
- **Resin**: Ball Die bond materials
- **Substrate**: Resin
Products

Overmold BGA, Pwr BGA
Overmold Ball Grid Array, Power Ball Grid Array

- High-Pin-Count Packages (250 to 1,500 Pins)
- Strengthened Power Supply and Ground to Support High-Speed Operation
- Internal Heat Spreader for Excellent Heat Dispersion (Power BGA)
- Higher Quality, Higher reliability

Overmold BGA

- Resin
- LSI Chip
- Au Wire
- Substrate
- Ball

Pwr BGA

- Cross-Sectional Structure

- Basic Structure

Area Array High-Pin-Count Packages

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LGA

Land Grid Array

- Smaller size achieved through surface pin land arrangement
- No balls, giving a thinner package
- High quality, high secondary mounting connection reliability

Cross-Sectional Structure

- Top View of Package
- Bottom View of Package

Line-up

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<td>0.65</td>
<td>145, 176</td>
</tr>
</tbody>
</table>
• High-Pin-Count Packages (250 to 1,500 Pins)
• Strengthened Power Supply and Ground to Support High-Speed Operation
• Internal Heat Spreader for Excellent Heat Dispersion (Power BGA)
• Higher Quality, Higher reliability

Overmold BGA

Area Array High-Pin-Count Packages

Overmold Ball Grid Array, Power Ball Grid Array

Smaller size achieved through surface pin land arrangement
• No balls, giving a thinner package
• High quality, high secondary mounting connection reliability

Pwr BGA

Basic Structure

Resin → LSI Chip → Au Wire → Ball → Substrate

Resin → LSI Chip → Au Wire → Heat spreader → Ball → Substrate

Line-up

PKG size (mm) | Pin pitch (mm) | Pin count (mm)
--- | --- | ---
17 X 17 | 1.0 | 256 268 272 277 316 324 329 345 385 398 433 454 468 580 753 769 953 1092 1144
19 X 19 | 1.0 | 377
21 X 21 | 1.27 | 0.65
23 X 23 | 1.27 | 0.5
27 X 27 | 1.27 | 0.65 0.5
31 X 31 | 1.27 | 0.65
35 X 35 | 1.27 | 0.5
37.5 X 37.5 | 1.27 | 0.5
40 X 40 | 1.0 | 0.5

Line-up

PKG size (mm) | Pin pitch (mm) | Pin count (mm)
--- | --- | ---
5 X 5 | 0.65 | 49 64 65 85 113 129 145 176
6 X 6 | 0.65 | 0.5
7 X 7 | 0.65 | 0.5
8 X 8 | 0.65 | 0.5
9 X 9 | 0.65 | 0.5

Cross-Sectional Structure

Resin → LSI Chip → Au Wire → Die bond materials → Land → Substrate

Top View of Package

Bottom View of Package
www.renesas.com increases the quality of your design and makes it faster.

Providing Solutions Faster through Synergy
In recent years demand for higher mounting densities and improved reliability has been increasing. By utilizing the strengths of both partners to the merger, Renesas Technology is able to supply package solutions more rapidly than ever before.

Various Search Engines
You can carry out various different searches - a model name search, function search, document search, or keyword search.

- Model name search: Lets you obtain product specifications based on a model name.
- Function/characteristics search: Carries out a search based on product function or specification values, and generates a product specification table.
- Document search: Lets you search on the basis of model name, document title, document number, etc.
- Keyword search: Searches all documentation at the Web Site.

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