Introduction

Devices in the Hitachi SuperH MCM (multi-chip module) product family are based on popular SuperH RISC and RISC/DSP microprocessors. These standard system-on-substrate products combine 200-MHz SH-4, or 133-MHz SH3-DSP or 133-MHz SH-3 processors with 32 MB or 16 MB of synchronous DRAM (SDRAM). They solve a range of key design problems—and do so cost effectively—because they leverage Hitachi’s system design expertise, advanced packaging technologies, and high-quality/high-volume manufacturing and testing processes.

SuperH MCMs allow system manufacturers to simplify and improve the design of high-speed, high-performance embedded systems, while also reducing the product development cycle for a faster time to market. Applications include small digital cameras and other portable consumer products such as wireless devices, as well as factory automation systems and industrial and office equipment.

Features and Benefits

- High performance—Up to 200 MHz processor core speed and 100 MHz on-substrate bus speed, combined with tight coupling between the processor and memory, ensure the highest possible throughput.
- Small footprint—The 13x19-mm and 31x31-mm BGA packages use less space (up to 90% less board area than designs with MPU and SDRAM chips), decrease main printed-circuit board complexity and reduce pc-board cost (for example: 50% fewer layers are possible).
- Reduced bus capacitance and resistance—Low R and C help reduce power dissipation.
- Lower inductance—the low pin inductance of the MCM BGA packages, due to the short length of the solder balls, decreases voltage spikes.
- Reduced electromagnetic interference (EMI)—The MCM’s tightly coupled processor and memory generate less EMI than designs with separate processor and memory chips on a pc board.
- Low power—Power-efficient SuperH processors help extend battery life in portable applications.
- Standard parts—Off-the-shelf, fully proven and tested SuperH MCMs allow shorter system design/debug cycles without the development-time or NRE issues of SOC (system-on-chip) custom products.
- Process technology optimization—Unlike SOC solutions, MCMs assemble mixed geometry or technology devices on the same substrate, for performance and cost optimization.
- Single device implementation—By combining processors and memory, SuperH MCMs reduce system component counts for more reliable products.
- Upward code-compatible processors—The SH-3, SH3-DSP and SH-4 series processors in the SuperH MCMs ease the development of system upgrades and higher-performance designs.
- Ensured availability of small-capacity SDRAM—Hitachi will supply MCMs with small-capacity SDRAM well into the future, even if other suppliers stop making such SDRAMs, to avoid premature obsolescence of customers’ designs.
- Broad range of support tools—Extensive SuperH hardware and software support tools (low-cost evaluation and development kits, in-circuit emulators, high-performance C compilers, real-time operating systems, and more) facilitate rapid, efficient embedded system design.
The eight standard SuperH MCMs cover many key embedded system applications. Our basic recommendations are as follows:

- Devices in the HJ94 series are ideal for high-speed image processing systems. These are the highest-performance SuperH MCMs. They have a 200-MHz SH-4 (SH7750) RISC microprocessor connected to either a 32-MB or 16-MB SDRAM (four or two 64-Mbit chips) with a 100-MHz bus.

- Devices in the HJ93D series are great choices for multimedia devices with a built-in browser or network products such as routers that provide a built-in VoIP function. Such applications take advantage of the high-speed voice and image data compression/expansion processing capabilities of the 133-MHz SH7729 RISC/DSP processor, which has an SH3-DSP CPU core with a built-in DSP unit.

- Devices in the HJ93 series are well suited for portable information terminals such as handheld PCs. They incorporate a 133-MHz SH7709A RISC microprocessor (SH-3 CPU core) that delivers good performance with low power consumption.

Hitachi plans to expand the SuperH MCM product line with versions that offer increased functionality and value. We will work with customers to develop special MCMs that provide optimized functions and performance. Such customized MCMs will offer much shorter development times and much lower engineering costs than comparable SOC implementations.

Match MCM to Application

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Test Results of Radio-Frequency Current

MCM reduces radio-frequency current spread, thus reducing EMI problem on printed circuit board.

MCM (HJ940001BP) SH-4 (SH7750) + SDRAM 4pcs

Scan Area

MCM (HJ940001BP) SH-4 (SH7750) + SDRAM 4pcs

MCM Roadmap

<table>
<thead>
<tr>
<th>SuperH</th>
<th>Package (BGA)</th>
<th>Memory</th>
<th>Part Number</th>
<th>00/4Q</th>
<th>01/1Q</th>
<th>01/2Q</th>
<th>01/3Q</th>
<th>User's Manual</th>
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<td>▲</td>
<td>▲</td>
<td>Ver.0.7</td>
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<tr>
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<td>16MB</td>
<td>HJ945020BP</td>
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<td></td>
<td>27x27mm² 256pin</td>
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<td>HJ940001BP**</td>
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<td>SH3-DSP</td>
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* C-BGA = Ceramic BGA
** Not recommended for new designs
Performance and Power Consumption Comparison

Maximum frequency and power dissipations among MCM, system LSI and discrete part based PCB using HSPICE simulation

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<thead>
<tr>
<th>Condition</th>
<th>Maximum Frequency</th>
<th>Power Consumption</th>
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<tbody>
<tr>
<td>Process: 0.18 mm</td>
<td>4</td>
<td>0.3</td>
</tr>
<tr>
<td>Temperature: 27°C</td>
<td>3</td>
<td>0.5</td>
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<tr>
<td>Supply Voltage: Core 1.8V; I/O 3.3V</td>
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<tr>
<td>Discrete part based PCB: 120mm x 75mm</td>
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<tr>
<td>MCM size: 27mm x 27mm</td>
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<td></td>
</tr>
<tr>
<td>System LSI size: 8mm x 8mm</td>
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<td></td>
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Simulation Results

Ordering Information

<table>
<thead>
<tr>
<th>Processor</th>
<th>MPU Model</th>
<th>Memory (MB)</th>
<th>MCM Product Number</th>
<th>Package</th>
<th>No. of Solder Balls</th>
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<tbody>
<tr>
<td>SH-3</td>
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<td>HJ935050BP</td>
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<tr>
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<td>SH-3 DSP</td>
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<td>SH-3 DSP</td>
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<td>8 Exclusive SDRAM</td>
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<td>SH-4</td>
<td>SH7750</td>
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<td>HJ945020BP</td>
<td>31X31</td>
<td>353</td>
</tr>
</tbody>
</table>

Budgetary Pricing – Availability

Samples of the SuperH MCMs are available now. For pricing, please call your local Hitachi sales office.

Contacts

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