32-bit SuperH™ SH-2 and SH-2A Controllers for Embedded Systems
Scalable 32-bit RISC controllers for feature-rich embedded applications

The popular Renesas SuperH™ SH-2 and SH-2A based 32-bit product line encompasses both microcontrollers (MCUs) and microprocessors (MPUs).

- MCUs include embedded flash and RAM for single-chip real-time embedded control systems
- MPUs include on-chip cache, RAM, connectivity and multimedia peripherals for digital audio and display control applications

Today’s SuperH MCU/MPU lineup builds on the SuperH core first introduced in 1993 and incorporates advanced design and process technology. It also enjoys a world-class development tool ecosystem.
Superscalar Core with 2 Instructions/clock & Independent Floating Point Unit

- Five stage, dual-issue pipeline
- Up to 2.4 DMIPS/MHz performance
- Multiple independent execution units
- Independent FPU pipeline
- Superscalar core and FPU are available in select MCUs and all MPUs

Industry’s Fastest On-chip Flash Memory

- SuperH MCUs include up to 100MHz single-cycle flash memory
- Allows higher performance at maximum frequency
- Eliminates the need to execute from RAM, thus freeing more RAM for data variables and lowering the device cost

Fast Interrupt Response with 16 Banks of Registers

- Only nine cycles from IRQ event to beginning of ISR code
- Hardware automatically saves the context in register banks FIFO
- Available in SH-2A based MCUs and MPUs

Extensive Built-in Peripheral Functions

- The high level of integration achieved by SuperH MCUs and MPUs reduces component counts, easing the packaging of compact embedded systems and reducing cost
SuperH devices include a wide range of features to enable a broad span of embedded systems. Here are four representative application examples.

**Factory Automation**

- Up to 480 DMIPS performance and 1MB flash enable advanced control algorithms & multiple connectivity interfaces
- Dual motor-control timers and special ADC module with multiple S/H units can drive any type of motor
- Second ADC module can interface with a variety of sensors
- Integrated Ethernet, CAN and USB
- BGO Data Flash allows CPU to continue to execute while Write operation is in progress

**Outdoor Heat Pump**

- Control two motors simultaneously
- Automatic dead-time insertion in PWM outputs
- Hardware-based automatic PWM shutdown upon fault input
- Dual ADC modules with multiple S/H units
- Programmable ADC trigger to enable one-shunt current detection method
- Multiple serial interfaces
Audio/Video Application

- Display Controller with Alpha blending and Chroma-keying
- 1MB of on-chip SRAM for Program Space and Frame Buffer
- Serial and Parallel Memory boot options
- BT.656 Video input

Medical Diagnostic System

- Achieve efficient motor control using SH7125 in small package and 65 DMIPS performance
- Perform both signal-processing and real-time control using SH7211 or SH7216
- Add connectivity and host interface using SH7286 or SH7216
- Implement advanced graphical interface using SH7264
Renesas Hardware and Software Tools

HEW – The Renesas Integrated Development Environment

The High-performance Embedded Workshop (HEW) is a state-of-the-art development and debugging environment with C/C++ compiler, debugger, editor, etc. It includes advanced features such as function browser, virtual desktop, and stack trace, to list just a few. A 256KB compiler evaluation version is available for free.

Renesas Emulators

Renesas offers a full range of emulation products, from the low-cost E10a on-chip debug emulator to our powerful E200F, a full in-circuit emulation system. The E10a emulator provides several hardware instruction and data breakpoints and a trace port. The E200F provides unlimited hardware breakpoints with real-time profiling capability.

www.america.renesas.com/tools

Motor Control Platform

The Renesas Motor Control Platform is a modular, versatile system that supports a wide range of motor types. The complete reference design is available on the Renesas web site.

- Up to 200VAC/20A
- Supports DCCT or 1-shunt current sensors
- Sensed and sensorless vector control algorithms

www.america.renesas.com/motorcontrol

Sample Codes, Libraries and Algorithms

Visit the Renesas web site for FREE sample code, along with motor control algorithms and libraries in source form for CAN, USB and Ethernet.

www.america.renesas.com/SWLibrary

Renesas Starter Kit (RSK)

A Renesas Starter Kit is a cost effective tool to get started with SuperH MCUs. It includes board, debugger, power supply and CD-ROM in one box.

SH/Tiny R0K571242S001BE
SH7285/86 R0K572867S000BE
SH7137 R0K571374S000BE
SH7670 R0K576705S000BE
SH7262 R0K572643S000BE
SH7216 R0K572167S000BE*

* Available in Q1, 2010

www.america.renesas.com/tools
Customers who choose SuperH MCUs and MPUs can obtain system development assistance not only from Renesas, but also from our technology partners – a large group of third-party experts around the globe. Many different operating systems, middleware packages and other products and services are available to simplify, speed-up, and reduce the engineering risk of new embedded system designs.

### Third-Party Support

System development products and services from a worldwide community of third-party experts

Customers who choose SuperH MCUs and MPUs can obtain system development assistance not only from Renesas, but also from our technology partners – a large group of third-party experts around the globe. Many different operating systems, middleware packages and other products and services are available to simplify, speed-up, and reduce the engineering risk of new embedded system designs.

### The Renesas Ecosystem

A network of programs for your support

#### Alliance Partners

- The Alliance Partner Program allows you to connect instantly with hundreds of qualified design consulting and contracting professionals.

  www.America.Renesas.com/Alliance

#### Renesas Interactive

- Gain the technical knowledge you need. Research and learn at your own pace, where you want, when you want, for free.

  www.RenesasInteractive.com

#### My Renesas

- Customize your data retrieval needs on the Renesas web site. You’ll receive updates on the products that you’re interested in.

  www.America.Renesas.com/MyRenesas

#### Samples

- Get a first-hand look at our products. Let us know your needs, and we’ll get some samples out to you.

  www.America.Renesas.com/Samples
SH2 & SH-2A Family – Key Products

These devices are recommended for new system designs. Visit our web site for a complete listing.

<table>
<thead>
<tr>
<th>Series</th>
<th>Ordering Part Number</th>
<th>MHz</th>
<th>Cache</th>
<th>FPU</th>
<th>External Memory</th>
<th>Ethernet MAC</th>
<th>USB Host</th>
<th>USB Device</th>
<th>CAN</th>
<th>SPI</th>
<th>PC</th>
<th>Timers</th>
<th>ADC (Channels)</th>
<th>DAC</th>
<th>GPO</th>
<th>Additional Features</th>
<th>Temperature Range (ºC)</th>
<th>Package (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SH7216</td>
<td>RFSF2145ADF9W0</td>
<td>200</td>
<td>512</td>
<td>64</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>MTU2, MTU2S, CMT</td>
<td>Y</td>
<td>12-bit (0)</td>
<td>110</td>
<td>8 DMA Channels, OTC, 32K BGO Data Flash, HW PWM Shutdown, On-chip Debug &amp; Trace</td>
<td>-40 to +85</td>
<td>176QFP, 20x20x0.4</td>
<td></td>
</tr>
<tr>
<td>SH7217</td>
<td>RFSF2147ADF9W0</td>
<td>100</td>
<td>512</td>
<td>64</td>
<td>N</td>
<td>N</td>
<td>FS</td>
<td>Y</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>MTU2, MTU2S, CMT</td>
<td>Y</td>
<td>12-bit (0)</td>
<td>113</td>
<td>8 DMA Channels, OTC, HW PWM Shutdown, On-chip Debug &amp; Trace</td>
<td>-40 to +85</td>
<td>176QFP, 24x24x0.5</td>
</tr>
<tr>
<td>SH7218</td>
<td>RFSF2145GDF9W0</td>
<td>100</td>
<td>512</td>
<td>64</td>
<td>N</td>
<td>N</td>
<td>FS</td>
<td>Y</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>MTU2, MTU2S, CMT</td>
<td>Y</td>
<td>12-bit (0)</td>
<td>100</td>
<td>8 DMA Channels, OTC, HW PWM Shutdown, On-chip Debug &amp; Trace</td>
<td>-40 to +85</td>
<td>144QFP, 20x20x0.5</td>
</tr>
</tbody>
</table>

| SH7280 | RFSF2795D010F9W0 | 100 | 512 | 24 | - | - | - | - | - | - | - | - | - | - | - | - | - | 60 | 8 DMA Channels, OTC, HW PWM Shutdown, On-chip Debug & Trace | -40 to +85 | 140QFP, 20x20x0.5 |
| SH7281 | RFSF2795D100F9W0 | 100 | 512 | 24 | - | - | - | - | - | - | - | - | - | - | - | - | - | 60 | 8 DMA Channels, OTC, HW PWM Shutdown, On-chip Debug & Trace | -40 to +85 | 140QFP, 20x20x0.5 |
| SH7282 | RFSF2795D200F9W0 | 100 | 512 | 24 | - | - | - | - | - | - | - | - | - | - | - | - | - | 60 | 8 DMA Channels, OTC, HW PWM Shutdown, On-chip Debug & Trace | -40 to +85 | 140QFP, 20x20x0.5 |
| SH7283 | RFSF2795D300F9W0 | 100 | 512 | 24 | - | - | - | - | - | - | - | - | - | - | - | - | - | 60 | 8 DMA Channels, OTC, HW PWM Shutdown, On-chip Debug & Trace | -40 to +85 | 140QFP, 20x20x0.5 |

**Note:**
This table lists only select devices.
For the complete list, please contact Renesas Technology America, Inc.

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**Acronyms**
- CMT: Compare Match Timer
- RTC: Real Time Clock
- SRC: Sampling Rate Converter
- HF: Host Interface
- SD: SD Memory
- SPI: Serial Peripheral Interface
- USB: USB Interface
- INT: Interrupt Controller
- SIF: Serial I/O with FIFO
- MTU2: MultiFunction Timer Unit
- SPDIF: Sony/Philips Digital Interface
- MTU2: MultiFunction Timer Unit
- SPDiff: Sony/Philips Digital Interface

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