



# H8S/2168 Series Microcontrollers

*High-speed, low-voltage 16-bit microcontrollers  
for IPMI applications*

## Overview

Renesas' H8S/2168 Series micro-controllers (MCUs) are high-speed (33MHz), low-voltage (3.3V), 16-bit devices for IPMI versions 1.5 and 2.0 remote management applications such as Baseband Management Controllers (BMCs), Satellite Management Controllers (SMCs), ATCA IPMI Controllers (IPMCs), and Peripheral Managers (PMs). Support for this device includes comprehensive software and hardware tools, debugging tools, and highly sophisticated IPMI firmware and software from third-party vendors.

## Features

### High Performance and Low Power

- Maximum clock speed: 33MHz
- Operating voltage: 3.0V to 3.6V
- Seven power-down modes

### Large On-chip Memory

- 256KB, 384KB or 512KB of flash with simplified on-chip programming capability through a serial port
- 40KB of SRAM

### 6 channels of Inter IC (I<sup>2</sup>C) bus I/F

- Each channel supports master and slave mode
- Each channel supports two slave addresses
- Supports bus speed up to 400kHz in master mode
- Start and stop conditions generated automatically in master mode
- Conforms to Philips I<sup>2</sup>C bus interface specification

### 3 channels of Low Pin Count (LPC) I/F

- Each channel supports I/O read/write mode
- Each channel has an independently programmable 16-bit address
- LPC channel 3 has separate 64-byte block transfer transmit and receive buffers
- LPC channel 3 supports Block Transfers (BT), KCS, and SMIC

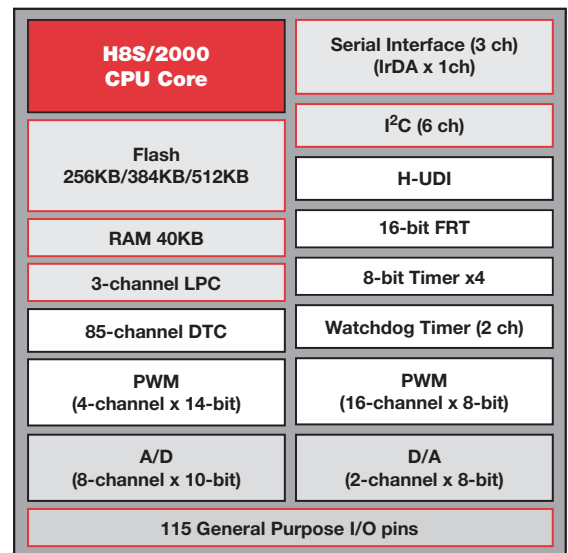
### 3 channels of serial communication I/F

- Choice of asynchronous or synchronous mode
- Full duplex communication capability
- Supports smart-card interface, ISO/IEC 7816-3
- Supports IrDA interface, standard version 1.0
- Cyclic Redundancy Check (CRC) operation circuitry for error detection in data blocks

### On-chip High-level User Debugging Interface (H-UDI)

- Enables easy real-time debugging using E10A emulator
- Supports boundary scan per IEEE Std. 1149.1 JTAG Interface

*H8S/2168, 2167, 2166 Block Diagram*



### 16/24-bit external bus interface

- 16-bit multiplexed bus for reduced pin count
- 24-bit non-multiplexed bus with programmable width for maximum pin flexibility
- Supports basic bus interface with 2-state or 3-state access and additional wait states when necessary
- Supports burst ROM interface
- Includes bus arbitration function

### Up to 85-channel Data Transfer Controller

- More flexibility and better functionality than DMA controller
- Supports single burst, chain, and repeat transfer modes
- Can be activated by interrupt or software control

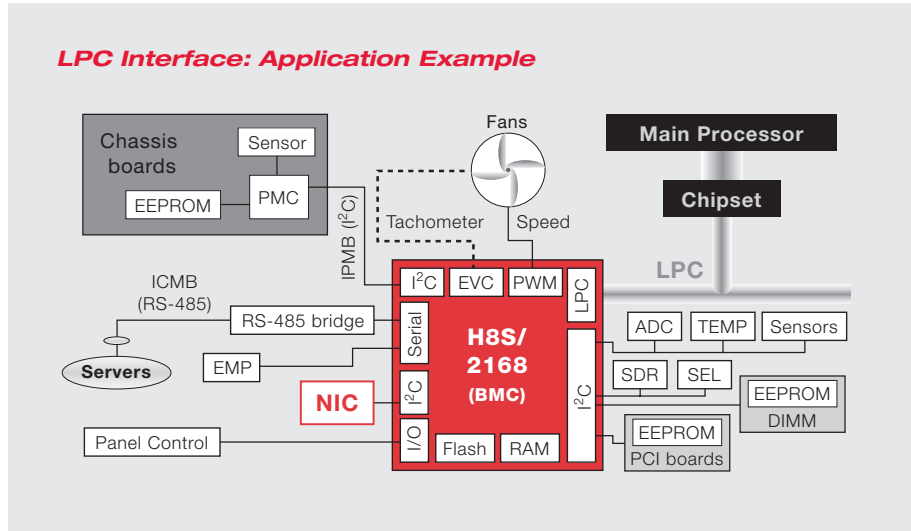
*(continued inside)*

# H8S/2168 Series Microcontrollers

## Features (continued)

### Rich-Featured Timers

- 2 channels of Watchdog timer
- 4-channel 14-bit PWM timer
  - Control frequency as low as 7Hz
- 16-bit Free Running Timer (FRT)
  - 2 channels of output compare
  - 4 channels of input capture
- 4 channels of 8-bit timer (TMR0, TMR1, TMR, TMRY)
  - 2 channels of output compare
  - Can also be used as 16-bit timer
- 8-bit PWM timer with 16 outputs
  - Duty cycle from 0 to 100% with 1/256 resolution
  - Direct or inverted PWM output



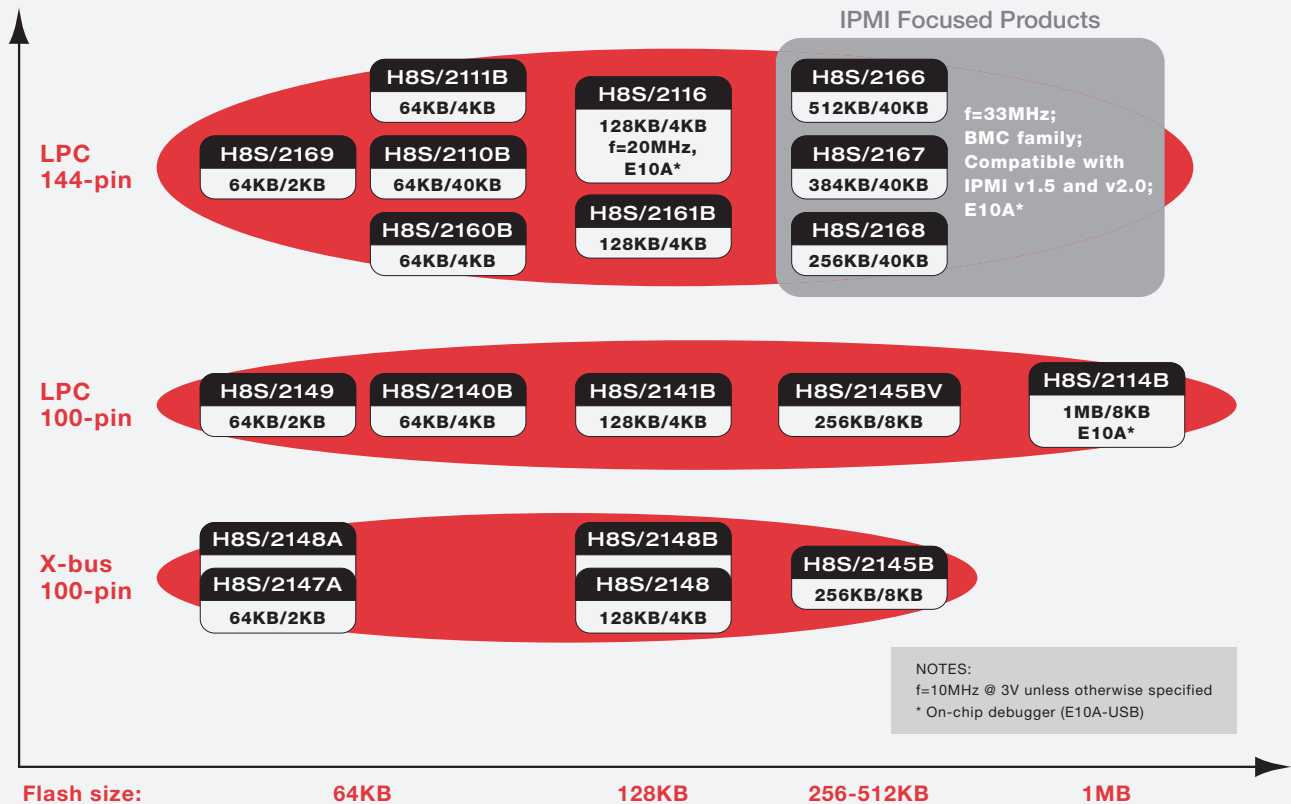
**8 channels of 10-bit successive-approximation A/D converter**

**2 channels of 8-bit D/A converter**

**115 general-purpose I/O ports**

- 24 ports can drive LEDs directly
- 8 pins with de-bounce capability

## Renesas Microcontrollers for PC Client and Server Applications



# High-speed, low-voltage 16-bit microcontrollers for IPMI applications

## Development Tools

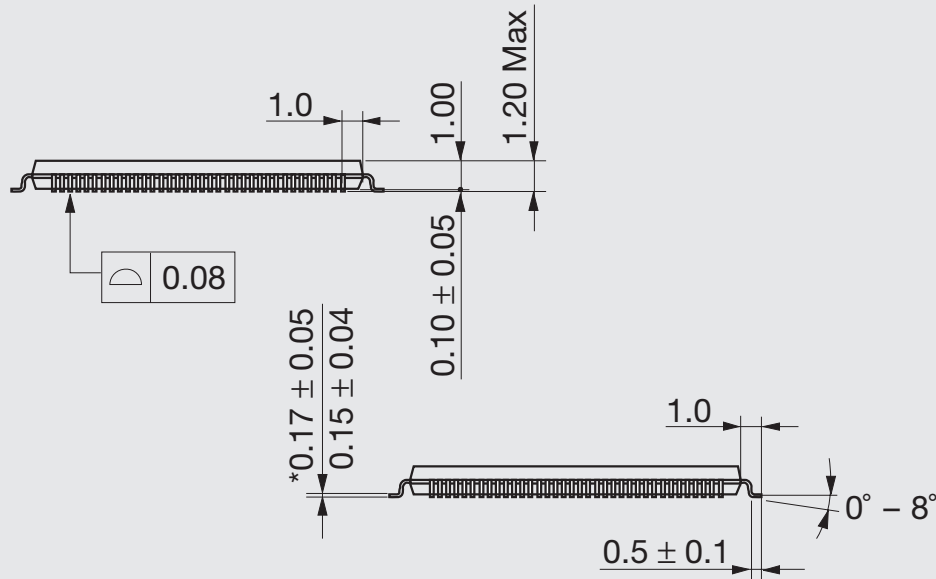
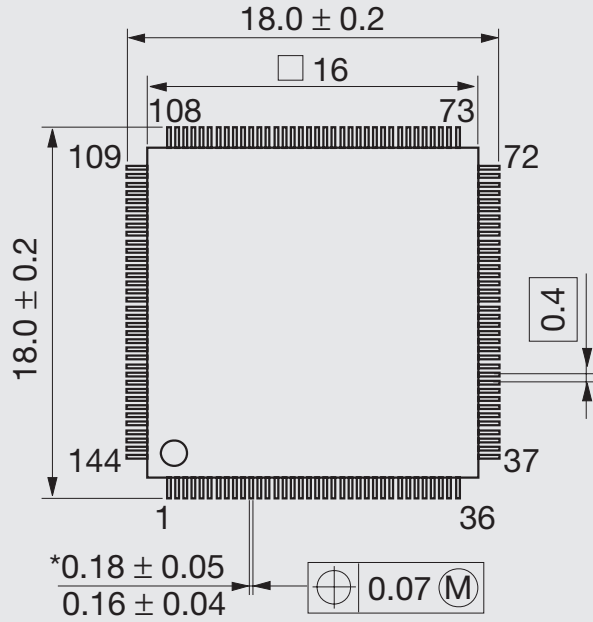
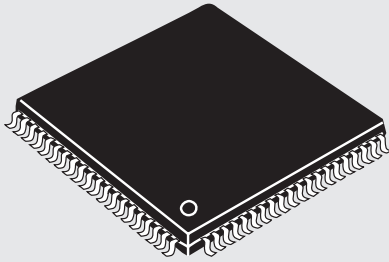
- **Evaluation Demo Board**— A low-cost Renesas evaluation/design tool consisting of an H8S/2166 development board and schematic.
- **E10A on-chip debugging emulator**—A low-cost Renesas debugging tool that uses an industry-standard JTAG interface to access debugging features built into the H8S/2168 MCU.
- **E6000 real-time in-circuit emulator**—Renesas' powerful zero-wait-state debugging tool that provides hardware and software breakpoints and a trace buffer.
- **HEW integrated development environment**—Renesas' graphical code development environment that includes project creation and management tools and a fully integrated C/C++ toolchain.
- **IPMI firmware and software**—Third-party solutions enable control of different peripherals for remote management applications such as BMC, SMC and PM. Versions 1.5 and 2.0 of this firmware and software are available from third-party vendors under a separate license.
- **HDI software**—High-level Debugging Interface software allows high-level debugging in C and comes integrated with the HEW.
- **FDT software**—Renesas' Flash Development Toolkit, a workspace-based environment, simplifies programming the on-chip flash memory of the H8S/2168.
- **Many other support products**—A wide range of hardware and software development tools is offered by the large community of vendors that supports H8S MCUs.

<p><b>Third-Party IPMI Firmware</b></p> <p>The BMC provides an autonomous management subsystem with monitoring, event logging, and recovery control capabilities. The BMC can be interfaced with both in-system and out-of-system mechanisms, serving as a gateway for management applications to access platform hardware.</p>	<p><b>Features</b></p> <ul style="list-style-type: none"> <li>• Provides KCS and IPMB interfaces</li> <li>• Supports out-of-band over LAN</li> <li>• Manages sensor values based on preconfigured threshold limits</li> <li>• Monitors temperature and provides thermal management</li> <li>• Provides Platform Event Traps (PETs)</li> <li>• Provides capability to perform firmware updates</li> <li>• Provides a repository of logged system events</li> <li>• Provides a paging service for particular events</li> <li>• Provides the system interface for baseboard Watchdog timer</li> <li>• Controls chassis display devices such as LEDs and LCDs</li> <li>• Monitors/manages system power</li> <li>• Provides a Platform Event Filter</li> </ul>
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## Development Tool Features and Ordering Information

Evaluation Board	E10A	E6000	Ordering Information	
<ul style="list-style-type: none"> <li>• Allows interaction with major BMC functionality</li> <li>• JTAG based E10A support for easy debugging</li> <li>• 3-channels of buffered serial interface</li> <li>• Includes both linear &amp; PWM fan outputs with tachometer inputs</li> <li>• Capability to monitor and measure internal power supply voltages</li> <li>• Ample GP I/O pins brought out for user interfacing</li> <li>• Supports optional expansion memory</li> </ul>	<ul style="list-style-type: none"> <li>• JTAG interface</li> <li>• USB host interface</li> <li>• Uses 3-pin interface on H8S/2168, plus NMI and RESET</li> <li>• 256 PC breakpoints</li> <li>• Hardware breakpoint on Address and data</li> <li>• 4-level branch trace</li> <li>• Single-stepping at C and assembly level</li> <li>• Ability to program on-chip Flash</li> </ul>	<ul style="list-style-type: none"> <li>• Zero-wait-state and real-time emulation</li> <li>• 256 PC breakpoints</li> <li>• Up to 12 hardware breakpoints</li> <li>• 80-bit wide, 32k-cycle trace buffer</li> <li>• Four user logic probes</li> <li>• Multiple target clock selection</li> <li>• HDI debugging software included</li> <li>• Compatible with Windows 95/98/NT/2000/XP</li> </ul>	<p><b>Evaluation Board</b></p> <ul style="list-style-type: none"> <li>• <b>Device:</b> H8S/2168</li> <li>– <b>Part No:</b> 3DK2166</li> </ul> <p><b>HEW</b></p> <ul style="list-style-type: none"> <li>• <b>Part Numbers:</b></li> <li>RTA-HEWH8-1U</li> <li>RTA-HEWH8-1UL</li> <li>RTA-HEWH8-5U</li> <li>RTA-HEWH8-5UL</li> </ul> <p>• <b>H8 HEW CD comes with</b></p> <ul style="list-style-type: none"> <li>– High-performance Embedded Workshop (HEW)</li> <li>– H8 C/C++ and X-assembly tool chain</li> <li>– Cycle-accurate Simulator</li> <li>– High-level Debugging Interface (HDI)</li> <li>– User Manuals as Acrobat PDFs, Installer</li> </ul>	<p><b>E10A Emulator</b></p> <ul style="list-style-type: none"> <li>• <b>Device:</b> H8S/2168</li> <li>– <b>Part No:</b> HS0005KCU01H (USB)</li> </ul> <p><b>E6000 Emulator</b></p> <ul style="list-style-type: none"> <li>• <b>Device:</b> H8S/2168</li> <li>– <b>Part No:</b> HS2168EPI61H</li> </ul> <p>• <b>Interface Board Part No.</b></p> <ul style="list-style-type: none"> <li>USB Interface Card HS6000EIU02H</li> <li>LAN Interface Card HS6000ELN01H</li> <li>PCI Interface Card HS6000E1C02H</li> </ul> <p>• <b>User Interface Cable</b></p> <ul style="list-style-type: none"> <li>HS2168ECN61H (TQFP-144)</li> </ul>
<p><b>HDI</b></p> <ul style="list-style-type: none"> <li>• High-level debugging in C</li> <li>• C-level, mixed or assembly-level display option</li> <li>• Step over, step into, step out functions</li> <li>• Register display</li> <li>• C-level watch points</li> <li>• Memory window</li> </ul>	<p><b>HEW</b></p> <ul style="list-style-type: none"> <li>• Flexible code development environment</li> <li>• Project Wizard (HEW) for easy setup</li> <li>• Hierarchical project support</li> <li>• File dependency scanning—non-source files can be added</li> <li>• Renesas H8 C/C++ compiler toolchain</li> <li>• Fully featured integrated editor</li> <li>• Customizable build process and Integrated MAKE facility</li> </ul>	<p><b>FDT</b></p> <ul style="list-style-type: none"> <li>• Supports direct connection to customer's own target</li> <li>• Supports BOOT and USER modes</li> <li>• Serial communication interface</li> <li>• Advance messaging levels to aid hardware development</li> </ul> <p>Free download at: <a href="http://www.renesas.com">http://www.renesas.com</a></p>		

**H8S/2168 Package Outline**



For more information, visit our web site at [www.renesas.com](http://www.renesas.com)

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