

32-bit SuperH[™] SH-2 and SH-2A Controllers for Embedded Systems





SuperH SH-2 and SH-2A Controllers



Scalable 32-bit RISC controllers for feature-rich embedded applications

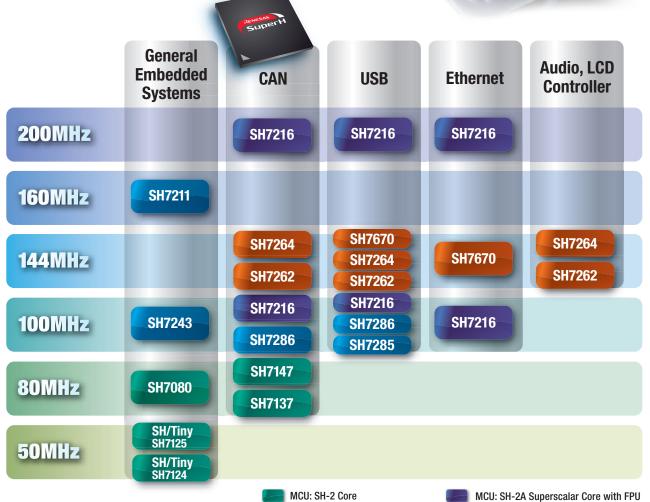
The popular Renesas SuperH[™] SH-2 and SH-2A based 32-bit product line encompasses both microcontrollers (MCUs) and microprocessors (MPUs).

- ► 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.

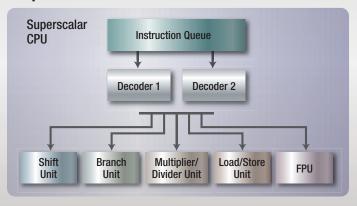


MPU: SH-2A Superscalar Core with FPU



MCU: SH-2A Superscalar Core

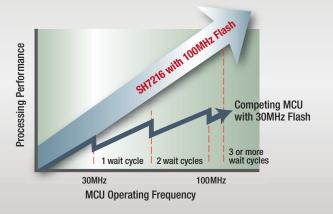
Superscalar Core with 2 Instructions/clock & Independent Floating Point Unit



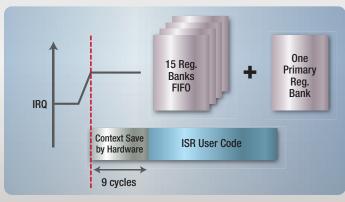
- ► Five stage, dual-issue pipeline
- ▶ Up to 2.4 DMIPS/MHz performance
- ▶ Multiple independent execution units
- ▶ Independent FPU pipeline
- ► Superscalar core and FPU are available in select MCUs and all MPUs

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



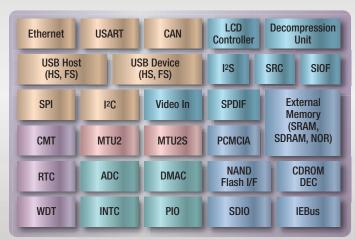
Fast Interrupt Response with 16 Banks of Registers



- ► 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

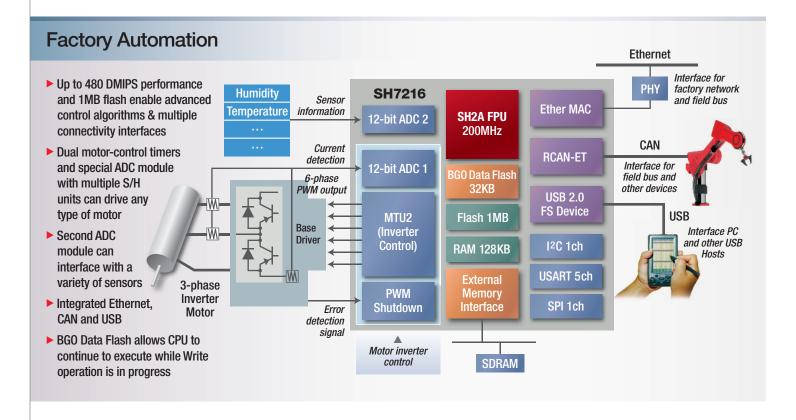


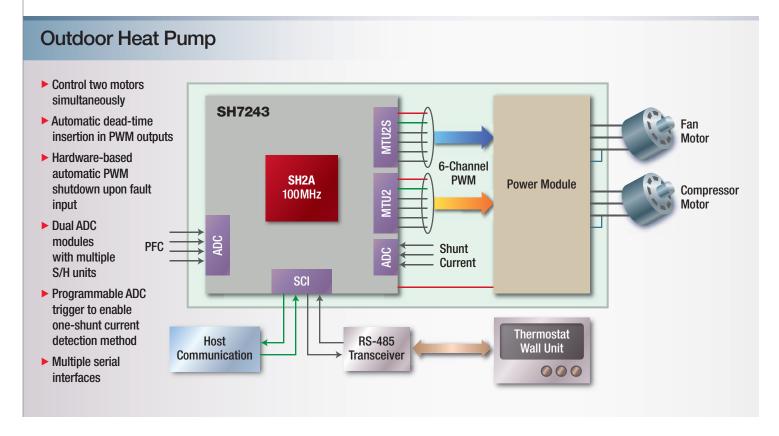
See back page for full peripheral names

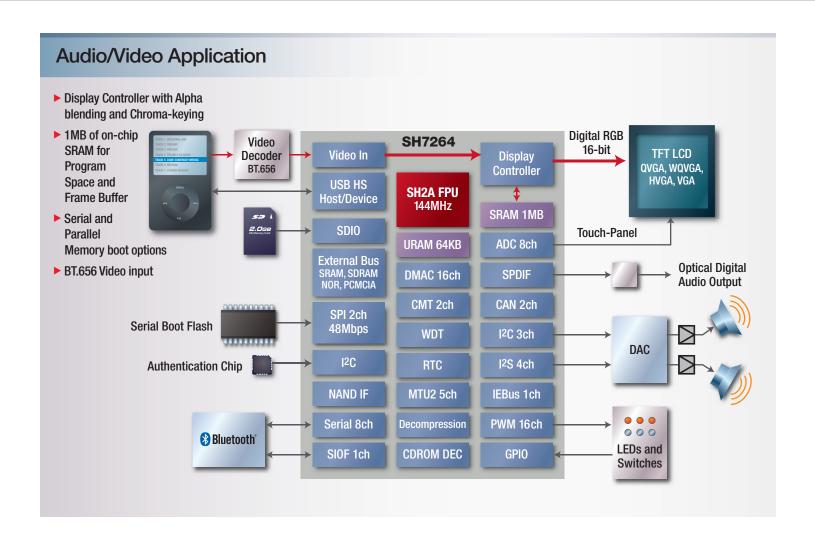
Illustrating the Design Potential and Versatility of SuperH MCUs and MPUs

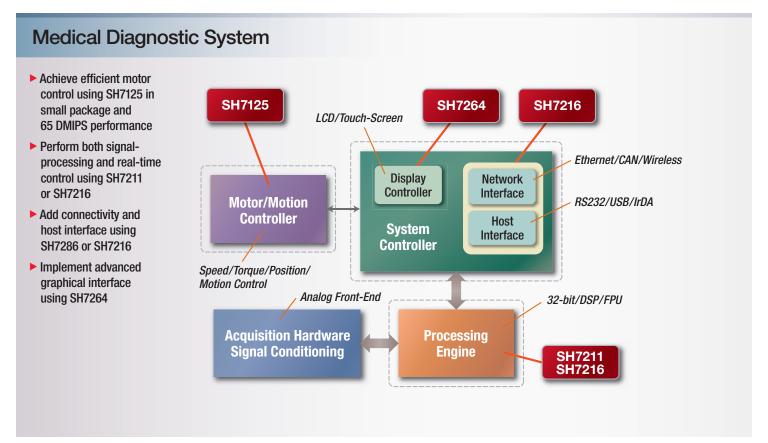


SuperH devices include a wide range of features to enable a broad span of embedded systems. Here are four representative application examples.





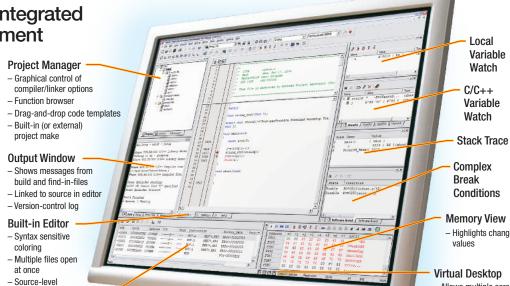




Renesas Hardware and Software Tools

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.



Conditions

- Highlights changed

- Allows multiple screen layouts to be recalled at the click of a button

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



System

debuaaina

Full Bus Trace

E10a On-Chip

Emulator

Motor Control Platform

available on the Renesas web site.

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

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



Renesas Starter Kit (RSK)

000

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	R0K576700S000BE
SH7262	R0K572643S000BE
SH7216	R0K572167S000BE*

^{*} Available in Q1, 2010

www.america.renesas.com/tools

Sample Codes, Libraries and Algorithms



www.america.renesas.com/SWLibrary

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.



www.micrium.com **RTOS** and Tools

-µC/OS-II™











FREE **GNU Tools**

www.kpitgnutools.com

IDE, Compiler and Debugger

- ► SH Toolchain for Windows & Linux
- HEW integration for Windows
- ► Eclipse IDE for Clipse Windows & Linux



www.cmx.com

RTOS and Middleware

- ► CMX-RTX
- CMX-MicroNet and CMX-TCP/IP
- CMX-USB
- CMX-FFS



www.segger.com

RTOS and Middleware

- ► emb0S
- emb0S/IP
- emUSB
- ▶ emFile
- emWin



www.swellsoftware.com

PEG™ Family of Embedded GUI Software

PEG Pro™

C/PEG+™



www.iar.com

IDE, Compiler and Debuggers

- ► IAR Embedded Workbench
- ▶ Hardware **Debug Probe**



www.rtos.com

RTOS and Middleware







ThreadX RTOS — OS-aware debugging in HEW

The Renesas Ecosystem

A network of programs for your support www.Renesas.com/Ecosystem

PARTNER

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

RenesasRulz

A forum and gathering place



for technical information and those who use Renesas MCUs and MPUs.

www.RenesasRulz.com

Renesas University

For educators and students. Teach with professional grade tools.

www.RenesasUniversity.com

Learn MCUs with a modern architecture.

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.

SH7216 R5F72145ADFA#V0 200 512 64 1024 128 128 100	-	3.3	N	SRAM, SDRAM, NOR	Υ									ADC (Channels)	DAC	GPIO	Features	Temperature Range (°C)	Package (mm)
R5F72147ADFA#V0 1024 128	-	3.3		SDRAM,	Υ														
R5F72147GDFA#V0 100 1024 128 R5F72165ADFA#V0 200 512 64 R5F72167ADFA#V0 1004 128 R5F72167GDFA#V0 100 512 64 R5F72167GDFA#V0 512 64 R5F72865D100FA#U0 512 24	-	3.3		SDRAM,	•		FS	; Y	5				Y	12-bit (8)	-	110	8 DMA Channels, DTC, 32KB BGO Data Flash, HW PWM Shutdown, On-chip Debug & Trace	-40 to +85	176QFP, 20x20x0.4
R5F72147GDFA#V0 1024 128 R5F72165ADFA#V0 200 512 64 R5F72167ADFA#V0 1004 128 R5F72165GDFA#V0 100 512 64 R5F72167GDFA#V0 100 512 24 SH7280 R5F72865D100FA#U0 512 24	-	3.3	Υ	SDRAM,															
R5F72167ADFA#V0 200 1024 128 R5F72165GDFA#V0 100 1024 128 R5F72167GDFA#V0 100 512 24		5.0	Υ			N				1	1	MTU2, MTU2S, CMT							
R5F72167ADFA#V0 1024 128 R5F72165GDFA#V0 100 512 64 R5F72167GDFA#V0 100 512 24 SH7280 R5F72865D100FA#U0 512 24			Υ		Υ					ı.									
R5F72167GDFA#V0 100 1024 128 SH7280 R5F72865D100FA#U0 512 24																			
R5F72167GDFA#V0 1024 128 SH7280 R5F72865D100FA#U0 512 24	_																		
0200																			
R5F72866D100FA#U0 768 32			N	NOR		N		Y N	5			MTU2, MTU2S, CMT	Υ	12-bit		113	8 DMA Channels, DTC, HW PWM Shutdown, On-chip Debug & Trace	-40 to +85	1700ED
					N					1	1				2				176QFP, 24x24x0.5
R5F72867D100FA#U0 100 1024 32		3.3					FS												
R5F72855D100FP#U0 512 24															-				144QFP,
R5F72856D100FP#U0 768 32														(8)					20x20x0.5
SH7243 R5F72433D100FP#U0 100 128 8	_	3.3	N	SRAM, SDRAM,	N	N	N	N	5	_	_	MTU2, MTU2S,	Υ	12-bit	_	71	DMA Channels, DTC, HW PWM Shutdown,	-40 to +85	100QFP,
R5F72434D100FP#U0 256 12				NOR								CMT		(8)			On-chip Debug & Trace		14x14x0.5
SH7211 DF72115D160FPV 160 512 32	-	1.5, 3.3	N	SRAM, SDRAM, NOR	N	N	N	N	4	-	1	MTU2, MTU2S, CMT	Υ	12-bit (8)	-	75	8 DMA Channels, HW PWM Shutdown, On-chip Debug & Trace	-40 to +85	144QFP, 20x20x0.5
SH7137 DF71374AD80FPV		3.3	N		N	N	N	Υ	3	1	1	MTU2, MTU2S, CMT		12-bit		73	8 DMA Channels, DTC, HW PWM Shutdown, On-chip Debug -40 to +85	100QFP,	
DF71374AN80FPV 80 256 16	_			SRAM,									Υ	(16)	- -	73		-20 to +85	14x14x0.5
DF71364AD80FPV 250 10	-	3.3		NOR									'	12-bit		56		-40 to +85	80QFP,
DF71364AN80FPV														(12)		30		-20 to +85	14x14x0.65
SH7147 DF71474AK64FPV 256 12			N		N	N		1				MTU2, CM		12-bit (16)			DTC, HW PWM Shutdown, On-chip Debug & Trace		
DF71424AK64FPV								2	3		-					73		-40 to +125	
DF71475AK64FPV 64 384	-	3.3		SRAM, NOR			N	1		1			Υ		-				100QFP, 14x14x0.5
DF71426AK64FPV 512								2											
DF71476AK64FPV								1											
SH7080 DF70834AD80BGV 256 16			N	SRAM, SDRAM, NOR	N	N			4	1	1	MTU2, MTU2S, CMT		10-bit (10)		73	4 DMA Channels DTC	DMA Channels, DTC,	112QFP, 10x10x0.8
DF70845AD80FPV 80 512 32	_	3.3					N	N					Υ		-	84	HW PWM Shutdown, On-chip Debug &Trace	-40 to +85	112QFP, 20x20x0.65
DF70865AD80FPV 512 32																134			176QFP, 24x24x0.5
SH/Tiny DF71240AD50FPV 16 4			N	_	N	N	N	N		_	_	MTU2,	Y	10-bit		31 31 31 31	On-chip Debug	-40 to +85	48QFP, 10x10x0.6
DF71240AD50NPV																		-40 to +85	52QFN, 7x7x0.4
DF71242N50FPV															-			-20 to +85	48QFP, 10x10x0.65
DF71242D50FPV 50 64	_	4.5-5.5							3									-40 to +85	48QFP, 10x10x0.65
DF71252N50FPV 8		7.0-0.0	14	_	.,	14	.4	14	J			CMT		(8)		45	ուլ ույլի ըշրոն	-20 to +85	64QFP, 10x10x0.5
DF71243N50FPV																31		-20 to +85	48QFP, 10x10x0.65
DF71243D50FPV 128																31		-40 to +85	48QFP, 10x10x0.65
DF71253D50FPV																45		-40 to +85	64QFP, 10x10x0.5
SH7262 R5S72620P144FP#UZ 108	8KB		Y	SRAM, SDRAM, NAND, NOR		HS		N									LCD Controller, Video In, Decompression Unit, SSI,		176QFP,
R5S72621P144FP#UZ 144 –	Inst 8KB	1.2,			N		HS	2	8	2	3	MTU2, CMT,	Υ	10-bit	_	89	CDROM DEC, SRC, IEBus,	-40 to +85	
R5S72624P144FP#UZ 740		8KB 3.3 Data			N		по	N	8	2	3	RTC	ī	(4)		09	SDIO, SPDIF, 16 DMA Channels, JTAG Boundary Scan, On-chip Debug	24x24x0.5	
R5S72625P144FP#UZ	Data							2											
SH7264 R5S72640P144FP#UZ 108	8KB		Υ	SRAM, SDRAM, NAND, NOR	N	HS	HS	N				MTU2, CMT, RTC	Y	10-bit (4)			LCD Controller, Video In, Decompression Unit, SSI,		
DECTORALDIAAED#II7	Inst							2	8	2	3					89	CDROM DEC, SRC, IEBus,	-40 to ±85	208QFP,
R5S72644P144FP#UZ 144 - 740	8KB							N	0	_	3				-	69	SDIO, SPDIF, 16 DMA Channels, JTAG Boundary	28x28x0.5	
R5S72645P144FP#UZ	Data							2									Scan, On-chip Debug		
SH7670 R5S76700B200BG 200	8KB			CDAM													STIF, I2S, HIF, 8 DMA Channels, JTAG Boundary	-20 to +70	
R5S76700D133BG 133 – 32	Inst	1.2,	Υ	SRAM, SDRAM,	Υ	HS	HS	N	3	_	1	CMT	Υ	_		86	Scan, On-chip Debug	-40 to +85	256BGA,
R5S76710B200BG 200	8KB	3.3		NOR, PCMCIA	T	пъ	110	14	J		'	GIVII	'			00	STIF, I2S, HIF, SDIO, 8 DMA Channels, JTAG Boundary	-20 to +70 17x17x0.8	17x17x0.8
R5S76710D133BG 133	Data			. 0.710111													Scan, On-chip Debug	-40 to +85	

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

CMT: Compare Match Timer RTC: Real Time Clock SRC: Sampling Rate Converter
HIF: Host Interface SDIO: SD Memory IO SSI: Serial Sound Interface
INTC: Interrupt Controller SIOF: Serial I/O with FIFO STIF: Serial Stream Interface
MTU2: Multifunction Timer Unit SPDIF: Sony/Phillips Digital Interface

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