H8S and H8/300H

16-Bit Microcontrollers

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Inspire the Next

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Welcome

To Hitachi's 16-bit microcontroller families H8S and H8/300H.

Over the past decade Hitachi has enjoyed tremendous success in Europe's Microcontroller market place. All analysts show Hitachi's microcontrollers among the top players in Europe, in all categories (4, 8, 16 and 32-bit).

Hitachi owes this success to our commitment to Microcontrollers, to our outstanding technology (e.g. integrated Flash memory), to the excellent quality and to our belief that we must listen to our customer's requirements and then meet these.

As a result, Hitachi today offers a range of 16-bit Microcontrollers, which feature:-

Outstanding Memory Integration

e.g. H8/3052F with 512Kbyte Flash, H8S/2329F with 32K RAM

Leading Peripheral Integration

H8S/2633F

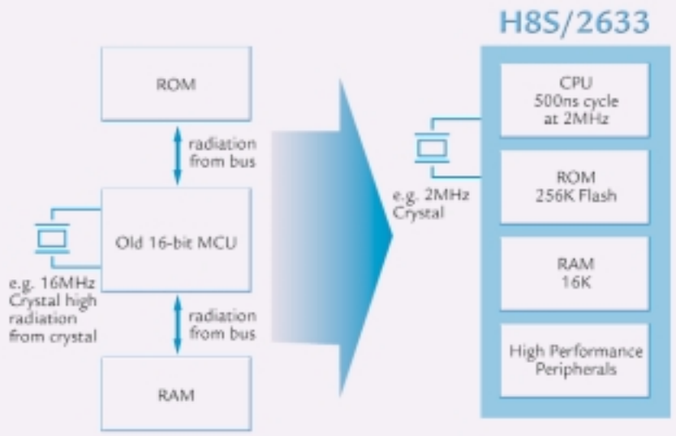
Highest Performance

H8S/2676F at 33MHz

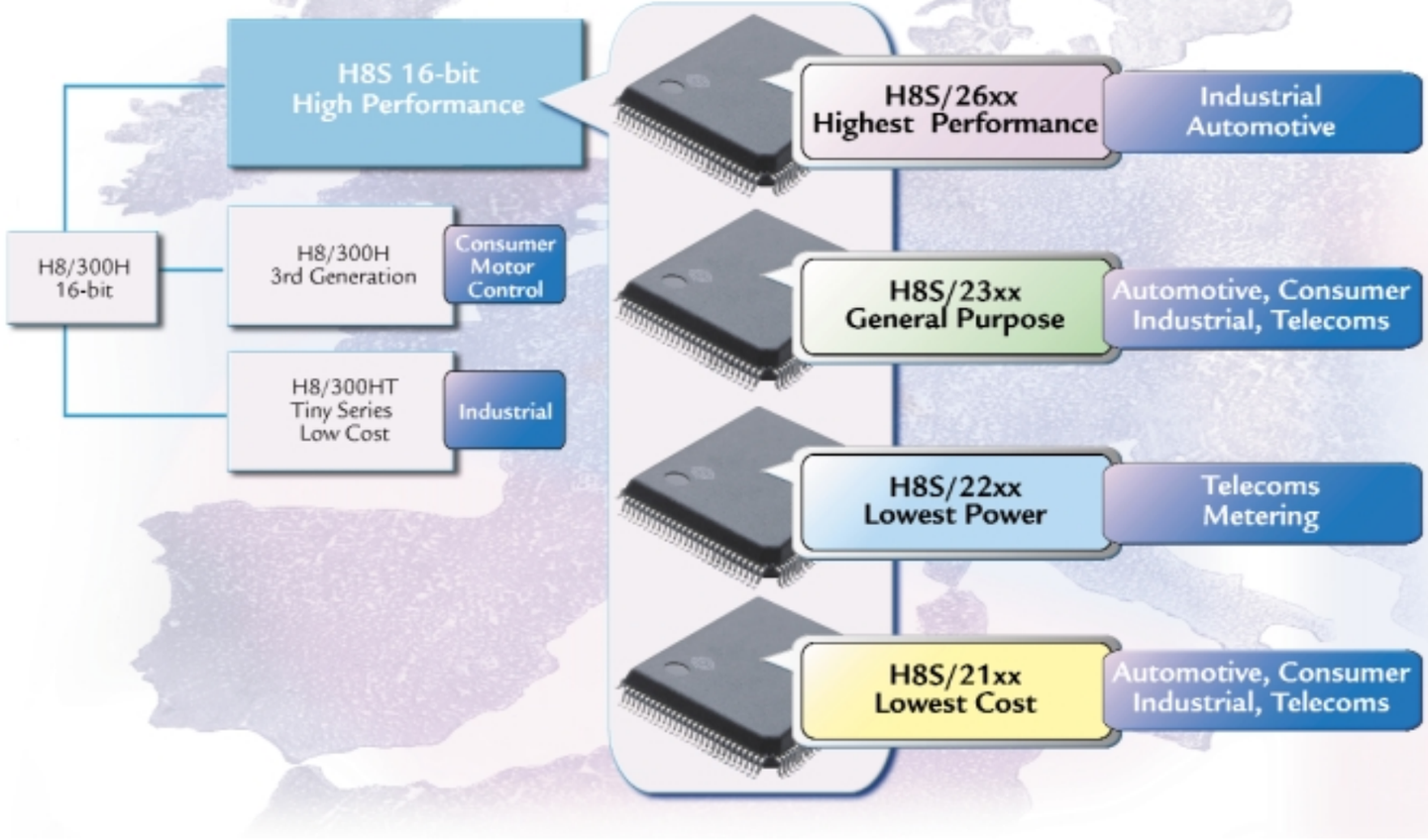
Lowest Power Consumption

H8S/2238F as low as 5mA at 3V/2MHz

Benefits



Using our 16-bit microcontrollers, our customers are able to tackle most of those design tasks, which developers face today. The high memory and peripheral integration allows to switch legacy multi-chip systems to single-chip, thus making systems smaller, light weight, lower power, more reliable and fast to build. Furthermore, where external busses can be removed, radiation can be greatly reduced.



Development Tools

The European electronics industry demands full service and support.

Hitachi responded by setting up a European engineering subsidiary 15 years ago: Hitachi Microsystems Europe (HMSE), based in Maidenhead, UK.

HMSE provides our customers with locally designed and supported tools, ranging from low cost evaluation boards to fully featured real time emulators, plus all the software that goes with it.

H8S and H8/300H are part of Hitachi's H8 microcontroller family.

The H8 family comprises of a wide range of CISC microcontrollers from low-cost 8-bit to the most sophisticated, high-performance 16-bit. Yet all of these products are upwardly software compatible, for protection of our customer's software investment. This fact also allows our customers to quickly develop variants of a product, moving downwards to lower-cost-less-features or upwards to higher functionality.

H8S and H8/300H Selector Guide

	H8/3022	H8/3052	H8S/213x	H8S/214x	H8S/223x	H8S/231x,2x	H8S/234x,5x	H8S/2633	H8S/2676	H8S/261x	H8S/262x	H8S/2636
Flash	256k	512k	128k	128k	256k	256k	128k	256k	256k	128k	256k	128k
ROM option	Yes	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	-
RAM	8k	8k	4k	4k	16k	8k	4k,8k	16k	8k	4k	12k	4k
Vcc	3.3V	3.3V/5V	3.3V/5V	3.3V/5V	3.3V/5V	3.3V	3.3V/5V	3.3V/5V	3.3V	5V	3.3V/5V	5V
clock (MHz)	18	18	20	20	13	25	20	25	33	20	20	20
Timer	ITU	ITU	FRT+	FRT+	TPU+	TPU+	TPU+*	TPU+	TPU+	TPU	TPU	TPU
DMAC	-	Yes	-	-	-	Yes*	Yes*	Yes	Yes	-	-	
DTC	-	-	Yes*	Yes*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SCI	2	2	3	3	4	2-3	2-3	5	3	3	3	3
CAN	-	-	-	-	-	-	-	-	-	1	1	2
ADC	8ch 10bit	8ch 10bit	8ch 10bit	8ch 10bit	8ch 10bit	8ch 10bit	8ch 10bit	16ch 10bit	12ch 10bit	12ch 10bit	16ch 10bit	12ch 10bit
DAC	-	2ch 8bit	2ch 8bit	2ch 8bit	2ch 8bit	2ch 8bit	2ch 8bit	4ch 8bit	4ch 8bit	-	2ch 8bit*	2ch 8bit
Package	80-pin	100-pin	80-pin	100-pin	100-pin	100,120,128-pin	100,120,128-pin	120,128pin	144-pin	80-pin	100-pin	128-pin
Others	TPC	TPC	IIC*	IIC*	IIC* 32KHz	PPG*	PPG*	IIC, IrdA, PPG 32KHz	IrDA, PPG 103 I/O	MMT PPG	PPG 32KHz*	PPG 32KHz SM-PWM

ITU: 5ch 16-bit timer with up to 10 IC/OC
FRT+: Free running timer (16-bit) plus 8-bit timers
TPU: 6ch 16-bit timer with up to 16 IC/OC
TPU+: 6ch 16-bit timer with up to 16 IC/OC plus 8bit timers
MMT: Motor management timer, special timer for AC drives
PPG/TPC: 16ch real time outputs
32KHz: 32KHz subclock
SW-PWM: Stepper motor PWM generation

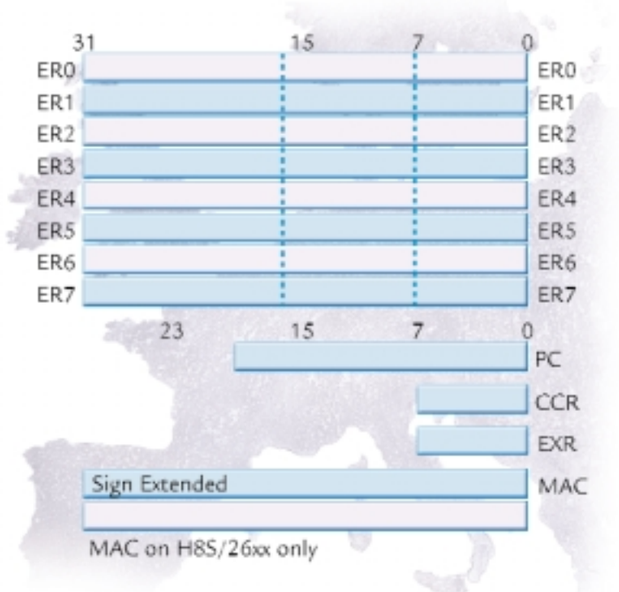
note *: depending on variant

CPU's

H8S and H8/300H share the same basic CPU architecture, a general purpose register architecture, which offers advantages for:

- **Programming in C**
- **Porting Code**
- **Code Density**
- **Speed**

The H8S/26xx variants also offer a Multiply-Accumlate hardware unit. Hence H8S offers industry leading 16bit-performance, e.g. 33 native MIPS peak performance on a 33MHz H8S/2676, which results in about 15 MIPS Dhrystone.



The H8/300H and H8S CPU core features 32-bit wide registers, which can also be used in 32-bit, 16-bit and 8-bit fractions. Beyond this, the instruction set provides many powerful bit-manipulation-instructions

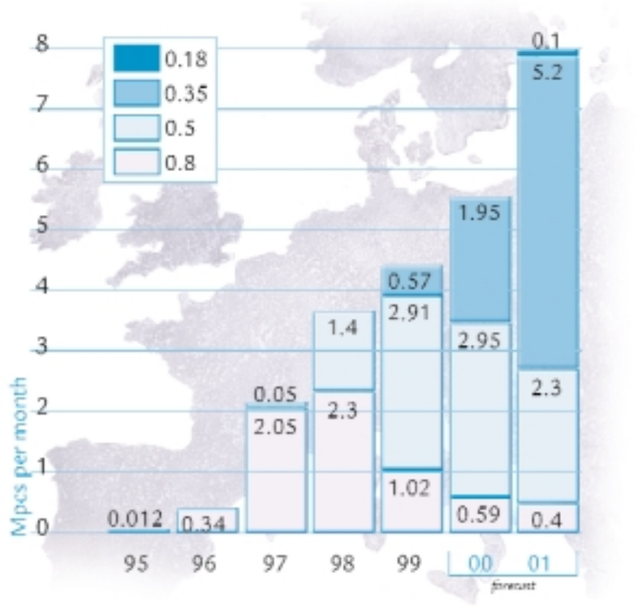
Memory

A traditional strengths of Hitachi is the integration of memory. H8S and H8/300H offer numerous memory options. For example, H8S/2329F offers an unheard off 384Kbyte of integrated Flash and 32K RAM!

Hitachi has been shipping microcontrollers with integrated Flash memory for many years now, currently at a run rate of about 6Mpcs per month.

Announcing on-chip Flash memory microcontroller products is one thing, successful mass production at competitive cost level is another.

Consequently On-chip Flash memory is Hitachi's standard ROM technology (apart from mask ROM), Hitachi stopped developing new OTP products years ago.



Hitachi's impressive on-chip flash billings history proves just how well this technology is understood. In fact the accumulated volume has now exceeded 150Mpcs.

The peripherals on Hitachi's 16-bit microcontrollers are designed to boost system performance and functionality.

DMAC and DTC

In systems with a high performance CPU and up to 16Mbyte of memory, it is paramount that the CPU's performance is not wasted transfering data. Instead the CPU should be concentrating on calculations, it's very purpose. Most peripherals are designed with this in mind, but there are two peripherals which serve no other purpose then moving data, the Direct Memory Access Controller (DMAC) and the Data Transfer Controller (DTC). Most H8/300H or H8S derivatives have either one of these or both. The DMAC focuses on peak transfer performance, while the DTC is slower but more flexible. In fact the DTC is a unique module with features that allow to build entire autonomous subsystems in conjunction with other peripherals, which then can handle significant tasks with almost no CPU intervention.

Timers

Most H8/300H derivatives have the ITU timer unit, a 5 channel 16-bit timer with up to 10 input capture or output compare (IC/OC) and special AC motor control PWM modes, which make H8/300H a major success in Europe's motor drive market. Most H8S have the TPU timer unit with 6 channels of 16-bit timers and up to 16 IC/OC. Both, ITU and TPU, can be clocked straight from the system clock, also a feature rarely found on other microcontrollers.

Most variants also have one or two watchdog timers (WDT), which can also be used as interval timers. Those products with two WDT have a 32KHz subclock to drive the second WDT. This feature allows numerous additional low-power features and can also be used to implement real-time clocks.

Serial Ports

Hitachi's 16-bit products feature up to 5 serial ports (SCI), which amongst them support an incredible 6 modes: asynchronous (UART style), synchronous, multi-master mode, a subset of ISO7816-3 (smart card interface), IIC and IrdA (infrared). On variants with a DTC, all SCI can be served by the DTC, therefore dramatically reducing the CPU load to handle the data traffic from and to up to 5 SCI. In fact without DTC support this amount of traffic could potentially, depending on baud rates, fully load the CPU.

Realtime Outputs

Many derivatives feature a Timing Pattern Controller (TPC) or a Programmable Pulse Generator (PPG). These are up to 16 digital outputs which drive new data patterns onto the pins under timer control, hence without the jitter which would be caused by interrupt latency if the CPU was used. Also, obviously this mechanism of generating a stream of data patterns again reduces CPU load dramatically. These modules can be used, for example, to drive stepper motors or to replace a LCD timing controller.

Controller Area Network (CAN)

In the European automotive industry, a strategic target area for Hitachi, CAN has become mandatory. Hence Hitachi has developed a range of H8S products with an on-chip full CAN (2.0B) controller. There are general purpose derivatives, like H8S/2623F, which also aim on indutrial applications and ASSP for gateways (between low and high speed CAN) and dashboard (H8S/2636F and H8S/2646F).

Hitachi's CAN module has 15 programmable receive/transmit buffers and one receive-only buffer with local acceptance filtering (LAFM). It also has an internal priority sorting mechanism to avoid priority inversion.

Other Peripherals

Beyond all those peripherals mentioned, most products also have Analog-Digital-Converters (ADC), with 10bit resolution and usually with 8 channels, some products also have Digital-Analog-Converters (DAC) with 8bit resolution (usually 2 channel). Most products have bus state controller (BSC) for glueless connection of external memory or peripherals. All products have an interupt controller with at least 2 priority levels (most H8S have 8) and a number of external interrupt pins.

Last but not least, Hitachi's 16-bit microcontrollers offer variants with over 100 input/output port pins, with features like 10mA drive, programmable open drain and pull-up, schmitt trigger characteristics and interrupt capability (depending on device).