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What is "<u>Embedded - Microcontrollers</u>"?

"<u>Embedded - Microcontrollers</u>" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable input/output peripherals. They are called "embedded" because they are embedded within electronic devices to control various functions, rather than serving as standalone computers. Microcontrollers are crucial in modern electronics, providing the intelligence and control needed for a wide range of applications.

Applications of "<u>Embedded - Microcontrollers</u>"

Details

|	
Product Status	Active
Core Processor	S08
Core Size	8-Bit
Speed	40MHz
Connectivity	I²C, SCI, SPI
Peripherals	LVD, POR, PWM, WDT
Number of I/O	54
Program Memory Size	32KB (32K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	2K x 8
Voltage - Supply (Vcc/Vdd)	2.7V ~ 5.5V
Data Converters	A/D 16x10b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 125°C (TA)
Mounting Type	Surface Mount
Package / Case	64-QFP
Supplier Device Package	64-QFP (14x14)
Purchase URL	https://www.e-xfl.com/product-detail/nxp-semiconductors/mc9s08aw32mfue

MC9S08AW60/32/16

freescale™
semiconductor

Target Applications
> Home appliances
> Industrial control
> Security systems
> Motor control
> Automotive body electronics

Overview
Freescale Semiconductor's HCS08AW family of microcontrollers (MCUs) is part of the popular and rapidly growing HCS08 Family with advanced technology for high performance and additional enhancements, such as advanced on-chip development support. Using Freescale's industry-leading 0.25 μs Flash, the MC9S08AW60/32/16 offers an upward migration path from Freescale's 68HC05 and 68HC08 architectures for applications that need enhanced peripherals and higher performance. Other features include enhanced low-voltage warning, two serial communications interfaces (SCIs), a serial peripheral interface (SPI), a 10-bit analog-to-digital converter (ADC), and eight programmable 16-bit timer channels with center-aligned pulse-width modulation (PWM) capability.
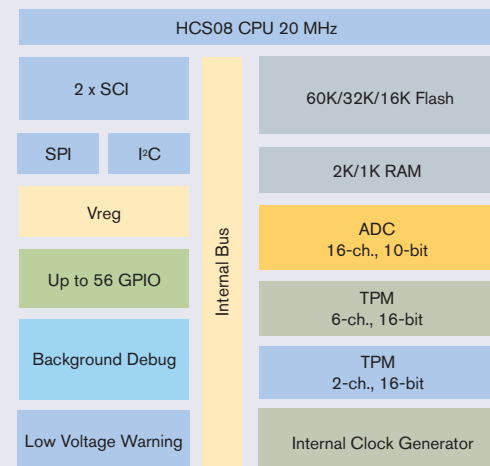
Features	Benefits
8-bit HCS08 CPU Core	

> High-performance CPU 20 MHz
  ▪ 50 ns minimum instruction cycle time down to 2.7V @ 20 MHz bus
  ▪ 125 ns minimum instruction cycle time
> C-optimized architecture with multiply and divide instructions
> Optional power modes
  ▪ Support for up to 32 interrupt/reset sources allows for greater software flexibility and optimization
  ▪ Optional auto wake-up from Stop 2 or Stop 3 modes with internal timer typically requires only 300 nA additional current
	> Designed to provide the higher performance required of many 8-bit applications
	> C-optimized architecture produces extremely compact code with full 16-bit stack pointer and stack-relative addressing
	> Multiply and divide instructions increase performance while reducing code size

On-Chip Debug Interface	
> Single-wire background debug mode > On-chip trace buffer with nine flexible trigger modes and multiple hardware breakpoints > Nonintrusive emulation	> Real-time emulation of MCU functions at full operating voltage and frequency range with no limitations, as compared to traditional emulators > On-chip trigger and buffer hardware replaces an emulator's expensive bus state analyzer > Nonintrusive debugging through a single, dedicated pin helps eliminate the need and cost of cumbersome emulator cables > View and change internal registers and memory while running application
Integrated Third-Generation Flash Memory	

> In-application reprogrammable
> Self-timed, fast programming
  ▪ Can program 8 bits in 20 μs
  ▪ Fast Flash page erase
    › 20 ms (512 bytes)
> 10K write/erase cycles minimum, 100K typical
> 15-year minimum data retention, 100 years typical
> Internal program/erase voltage generation
> Fine Flash granularity—512B Flash erase/1B Flash program
> Flexible block protection and enhanced security
> Single power supply program/erase
> Read/program/erase over full operation voltage and temperature
	> Ultra-fast programming reduces system cost (up to 100x faster than most embedded Flash)
	> Command programming interface virtually eliminates complex programming algorithms
	> Flexibility/maximum creativity—Flash-based systems can be reprogrammed many times during development cycle or late into the manufacturing cycle and can make in-application upgrades in the field
	> Flash easily used for data EEPROM

Block Diagram

HCS08 CPU 20 MHz		
2 x SCI		60K/32K/16K Flash
SPI / I²C	Internal Bus	2K/1K RAM
Vreg		ADC 16-ch., 10-bit
Up to 56 GPIO		TPM 6-ch., 16-bit
Background Debug		TPM 2-ch., 16-bit
Low Voltage Warning		Internal Clock Generator

![NXP logo]

Benefits

Internal Clock Generator

> Programmable frequency-locked loop (FLL) generates 8 MHz to 40 MHz (for bus rates up to 20 MHz)
> Post-FLL divider gives one of eight bus rate dividers
> Trimmable with temperature and voltage compensation (<2 percent drift)
> Provides multiple options for clock sources and in-application clock switching
  ▪ 32 KHz to 16 MHz reference external crystal/resonator
  ▪ Internal clock generator
  ▪ External clock

> Designed to reduce board space and system costs by eliminating external components
> Improved accuracy across temperature and voltage allows reliable serial communications with no external clock components
> Improved flexibility when making choices between cost, precision, current draw and performance
> Designed to eliminate noise due to external clock components

10-bit Analog-to-Digital Converter (ADC)

> 16-channel ADC
> 2.5 µs, 10-bit single conversion time

> Fast, easy conversion from analog inputs such as temperature, pressure and fluid levels, to digital values
> Robust specified operation
> Asynchronous clock source can be used to run ADC in stop mode

Timer with Eight Programmable Channels

> 2-channel and 6-channel, 16-bit timer systems
> Each channel programmable for:
  ▪ Input capture, output compare or buffered pulse-width modulator (PWM)
  ▪ PWM can be edge- or center-aligned
> 16-bit free-running or up/down (CPWM) count operation

> Flexible, programmable timer system
> Center-aligned PWMs are designed to allow noise minimization by distributing the edges of PWMs

Extensive Serial Communications

> Dual asynchronous SCIs
  ▪ Flexible 13-bit module-based baud rate generators
  ▪ Double-buffered receive and transmit
  ▪ LIN compatible
> Synchronous SPI
  ▪ Up to 5 Mbps
> Inter-IC (I²C) bus
  ▪ Multimaster operation
  ▪ 256 clock options

> Asynchronous communication between the MCU and a terminal, computer or a network of microcontrollers with accurate baud rate matching
> High-speed synchronous communication between multiple MCUs or between MCU and serial peripherals
> Designed to provide a simple, efficient method of data exchange between devices
> All serial peripherals are available for use in parallel on all devices

System Protection

> Selectable low-voltage detect/reset
> Enhanced low-voltage warning
> COP watchdog timer

> Designed to reduce system cost
> Designed to improve reliability by resetting the MCU in the event of code runaway or when voltage drops below trip point

Up to 56 Input/Output (I/O) Lines

> Programmable pull-ups
> High-current drivers
> Eight keyboard interrupts
> Controlled rise/fall times minimize noise

> Designed to reduce system cost
> Designed to allow direct drive of LED and other circuits to eliminate external drivers and reduce system costs

Cost-Effective Development Tools

For more information, please refer to the Freescale Development Tool Selector Guide (SG1011).

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DEMO9S08AW60E *$85**	MC9S08AW60 Demonstration Board: ZIF Socket, built-in USB-BDM, LEDs, serial port, switches, acceleration sensor and I/O header
USBMULTILINKBDM *$99**	Universal HCS08/HCS12 in-circuit emulator, debugger and Flash programmer; USB-PC interface
M68CYCLONEPRO *$499**	HC08/HCS08/HC12/HCS12 stand-alone Flash programmer or in-circuit emulator, debugger, Flash programmer; USB, serial or Ethernet interface options
CWX-H08-SE *Free***	CodeWarrior™ Special Edition for HC(S)08 MCUs; includes IDE, linker, debugger, unlimited assembler, Processor Expert™ auto-code generator, full-chip simulation and 16K C compiler

Package Options

| Part Number	Package	Temp. Range
MC9S08AW60CPUE	64 LQFP	-40°C to +85°C
MC9S08AW32CPUE	64 LQFP	-40°C to +85°C
MC9S08AW16CPUE	64 LQFP	-40°C to +85°C
MC9S08AW60CFUE	64 QFP	-40°C to +85°C
MC9S08AW32CFUE	64 QFP	-40°C to +85°C
MC9S08AW16CFUE	64 QFP	-40°C to +85°C
MC9S08AW60CFDE	48 QFN	-40°C to +85°C
MC9S08AW32CFDE	48 QFN	-40°C to +85°C
MC9S08AW16CFDE	48 QFN	-40°C to +85°C
MC9S08AW60CFGE	44 LQFP	-40°C to +85°C
MC9S08AW32CFGE	44 LQFP	-40°C to +85°C
MC9S08AW16CFGE	44 LQFP	-40°C to +85°C
MC9S08AW60MPUE	64 LQFP	-40°C to +125°C
MC9S08AW32MPUE	64 LQFP	-40°C to +125°C
MC9S08AW16MPUE	64 LQFP	-40°C to +125°C
MC9S08AW60MFUE	64 QFP	-40°C to +125°C
MC9S08AW32MFUE	64 QFP	-40°C to +125°C
MC9S08AW16MFUE	64 QFP	-40°C to +125°C
MC9S08AW60MFDE	48 QFN	-40°C to +125°C
MC9S08AW32MFDE	48 QFN	-40°C to +125°C
MC9S08AW16MFDE	48 QFN	-40°C to +125°C
MC9S08AW60MFGE	44 LQFP	-40°C to +125°C
MC9S08AW32MFGE	44 LQFP	-40°C to +125°C
MC9S08AW16MFGE	44 LQFP	-40°C to +125°C

64-Pin QFP 0.8 mm Pitch 14 mm x 14 mm Body — FU
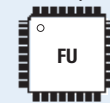
64-Pin LQFP 0.65 mm Pitch 10 mm x 10 mm Body — PU
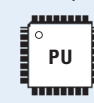
44-Pin LQFP 0.8 mm Pitch 10 mm x 10 mm Body — FG
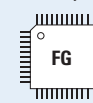
48-Pin QFN 0.5 mm Pitch 7 mm x 7 mm Body — FD

Learn More: For more information about Freescale's products, visit **www.freescale.com**.

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