

MC9S08AC16

Overview

Freescale Semiconductor's HCS08AC family of microcontrollers (MCUs) is part of the popular and rapidly growing HCS08 product family, featuring advanced on-chip development support, enhanced peripherals, increased memory options and improved system security.

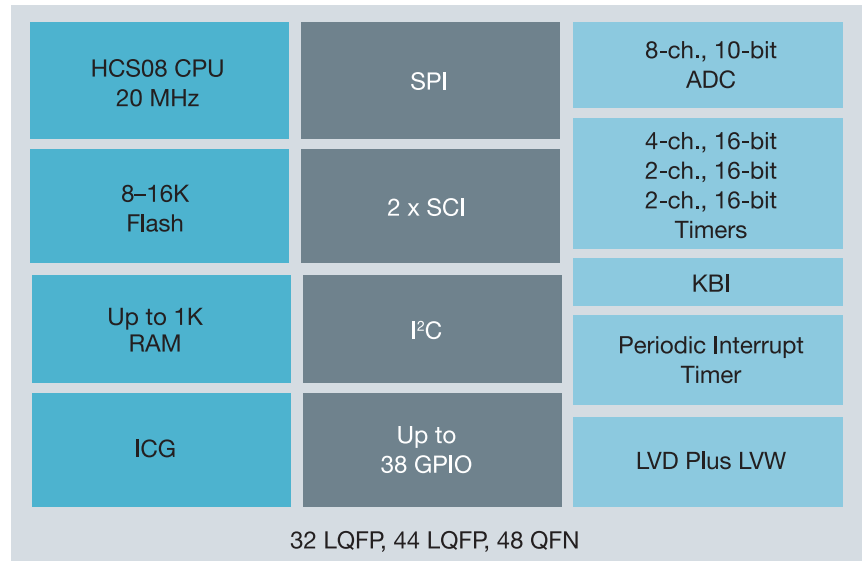
Using Freescale's industry-leading 0.25 μm flash, the MC9S08AC16 offers a migration path from Freescale's MC9S08AW products for applications that need enhanced peripherals, increased performance and improved system security. Other features include enhanced low-voltage warning, two serial communications interfaces (SCIs), a serial peripheral interface (SPI), an Inter-Integrated Circuit (I²C), a 10-bit analog-to-digital converter (ADC) and eight programmable 16-bit timer channels with center-aligned pulse-width modulation (PWM) capability.

This combination of performance and on-chip integration makes the MC9S08AC16 a perfect fit for many general embedded industrial control applications, specifically motor control applications.

Target Applications

- General Industrial Applications
 - Motor control
 - Building control
 - HVAC
- Appliance Applications
 - Dishwashers
 - Washing machines
 - Dryers
 - Refrigerators

AC16 Block Diagram



Features

8-bit HCS08 Central Processing Unit (CPU)

- High-performance 20 MHz CPU
 - 50 ns minimum instruction cycle time down to 2.7V at 20 MHz bus
- C-optimized architecture
- Multiply and divide instructions
- Optional reduced power modes
 - Support for up to 32 interrupt reset sources
- Auto wake-up with internal timer requires only 300 nA of additional current

Benefits

- Provides the performance needed in many high-performance 8-bit applications
- Produces extremely compact code with full 16-bit stack pointer and stack relative addressing
- Allows for greater software flexibility and optimizations in addition to saving power

Integrated Third-Generation Flash Memory

- In-application programming
- Self-timed fast programming
 - Program 8-bits in 20 us
 - Fast flash page erase, 20 ms
- 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
- Command program interface eliminates complex programming algorithms
- Flexibility—flash-based systems can be reprogrammed during the development cycle or late in the manufacturing cycle
- Flash is easily used for data EEPROM

Features

Internal Clock Generator

- Programmable frequency-locked loop (FLL) generates 8 MHz to 40 MHz
- Provides multiple options for clock source and in-application clock switching
 - 32 KHz to 16 MHz reference external crystal
 - External clock
- Trimmable with temperature and voltage compensation
- Post FLL divider gives one of eight bus rate dividers

10-bit ADC

- 8-channel ADC
- 2.5 us, 10-bit single conversion time

Timer with Ten Programmable Channels

- Two 2-channel 16-bit timer systems
- One 4-channel 16-bit timer systems
- Programmable for input, capture, output compare or buffered PWM
 - PWM can be edge or center aligned

Extensive Serial Communications

- Dual asynchronous SCIs
 - Flexible 13-bit module-based baud rate generators
 - Active edge on receive pin detection
 - Selectable receiver input polarity
 - LIN compatible
- Inter IC-bus (I²C)
 - Up to bus speed/20 Mbps throughput with minimal loading
 - Supports broadcasting mode and 10-bit addressing
- Synchronous SPI
 - Multi-master operation
 - 256 clock options

System Protection

- Selectable low-voltage detect/reset
- Enhanced low-voltage warning
- COP watchdog timer
 - Option to run COP off independent clock source or bus

Input/Output

- Up to 38 GPIO pins
 - Programmable pull ups
 - High-current drivers
 - Eight keyboard interrupts
 - Controlled rise/fall times minimize noise
- Results in a large number of flexible I/O pins that allow vendors to easily interface the device into their own designs as every peripheral pin is GPIO capable
- Reduces system cost

On-Chip Debug Interface

- Single-wire background debug mode
- On-chip trace buffer with nine flexible trigger modes and multiple hardware breakpoints.
- Non-intrusive emulation
- Real-time emulation of MCU functions at full operating voltage and frequency range with no limitations
- On-chip trigger and buffer hardware replaces emulator's expensive bus state analyzer
- Non-intrusive debugging through a single dedicated pin helps eliminate the need of cost emulator cables
- View and change internal registers and memory while running an application

Benefits

- Designed to reduce board space and system cost by eliminating the need for external components
- Accuracy across temperature and voltage allows reliable serial communications without external clocks
- The lack of external components decreases noise
- Fast, easy conversion from analog inputs such as temperature, pressure and fluid levels, to digital values
- Robust specified operation

- Flexible, programmable timer system.
- Center aligned PWM's are designed to allow noise minimization by distributing the edges of the PWM.

- Asynchronous communication between the MCU and a terminal, computer or a network with accurate baud rate matching
- SCI interrupts and flags can be set when an active edge occurs on RxD pin
- SCI can correctly receive data whose polarity was inverted during transmission
- High-speed synchronous communication between multiple MCUs or between MCU and serial peripherals
- Provides a simple, efficient method of data exchange between devices
- Serial peripherals are available for use in parallel

- Provides additional system security
- The addition of a 1 kHz independent oscillator provides two additional timeout options

Product Selector Guide

Part Number	Temp. Range	Package
MC9S08AC16CFDE	-40°C to +85°C	48-pin QFN
MC9S08AC16MFDE	-40°C to +125°C	48-pin QFN
MC9S08AC16CFGE	-40°C to +85°C	44-pin LQFP
MC9S08AC16MFGE	-40°C to +125°C	44-pin LQFP
MC9S08AC16CFJE	-40°C to +85°C	32-pin LQFP
MC9S08AC16MFJE	-40°C to +125°C	32-pin LQFP
MC9S08AC8CFDE	-40°C to +85°C	48-pin QFN
MC9S08AC8MFDE	-40°C to +125°C	48-pin QFN
MC9S08AC8CFGE	-40°C to +85°C	44-pin LQFP
MC9S08AC8MFGE	-40°C to +125°C	44-pin LQFP
MC9S08AC8CFJE	-40°C to +85°C	32-pin LQFP
MC9S08AC8MFJE	-40°C to +125°C	32-pin LQFP

All parts are available in tape & reel packages. They are also available in extended temperature ranges. See datasheet for details.

Cost Effective Development Tools

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

DEMO9S08AC60

\$85*

Full-featured evaluation system for the AC16/8 device family. The DEMO9S08AC60 is powered by the MC9S08AC60 processor and features an ZIF Socket, a built-in USB BDM, LEDs, a serial port, an acceleration sensor and an I/O header. This kit comes complete with everything you need to get your board up and running quickly and easily.

USBMULTILINKBDM

\$99*

A universal in-circuit emulator and debugger, capable of flash programming that can also be used on HCS08 and HCS12 products. Comes standard with USB-PC interface.

M68CYCLONEPRO

\$499*

A stand-alone flash programmer that can also be used as an in-circuit emulator and debugger on HC08, HCS08, HC12 and HCS12 products. Comes standard with USB, serial and Ethernet interface options.

CodeWarrior® Development Studio for HC(S)08 Architectures, V6.1

Complimentary

CodeWarrior Development Studio for HC(S)08 architectures is a single tool suite that supports software development for Freescale's HC(S)08 family of 8-bit products. Support for all Freescale HC(S)08 devices coupled with the cross-platform capabilities of the award-winning CodeWarrior Integrated Development Environment (IDE) simplifies code migration and reuse for faster product development. CodeWarrior® Development Studio for HC(S)08 Architectures, version 6.1 is a complete integrated development environment for ColdFire® hardware bring-up through embedded applications.

*Prices indicated are MSRP

Learn More:

For current information about Freescale products and documentation, please visit www.freescale.com/8bit.