



8-bit Microcontrollers

MC9S08QA4/2

Target Applications

- Battery chargers
- Electronic power meters
- Handheld devices
- Home appliance
- Human input devices
- Industrial control
- Lighting control
- PC peripherals
- Remote control
- Secure boot co-processors
- Security and alarm systems
- Sensing systems
- SMAC as part of Zigbee configuration
- Small appliances
- Smart Battery
- Smoke and CO detection
- Toys
- Wireless communications
- Wireless sensor applications
- Watchdog co-processor

Overview

The MC9S08QA4 is a member of the low-cost, low-power, high-performance HCS08 Family of 8-bit microcontroller units (MCUs).

All MCUs in the family use the enhanced HCS08 core and are available with a variety of modules, memory sizes, memory types, and package types.

CWX-H08-SE Free**

CodeWarrior Special Edition for HC(S)08 MCUs; includes integrated development environment (IDE), linker, debugger, unlimited assembler, Processor Expert™ auto-code generator, full-chip simulation and 16 KB C compiler

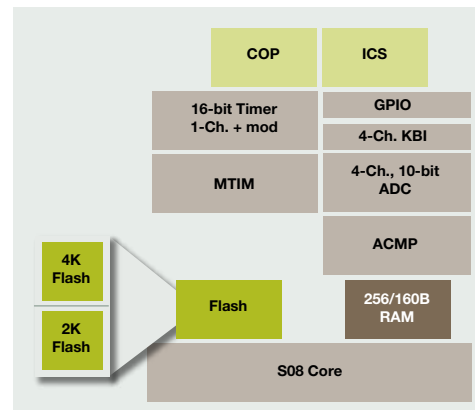
Cost-Effective Development Tools

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

DEMO9S08QA4E—\$50 MSRP

Cost-effective demonstration board with potentiometer, LEDs, serial port and built-in USB-BDM cable for debugging and programming

MC9S08QA4/2



Package Options

Part Number	Package	Temp. Range
MC9S08QA4CFCE	8-pin DFN	-40°C to 85°C
MC9S08QA4CPCE	8-pin PDIP	-40°C to 85°C
MC9S08QA4CSCE	8-pin SOIC	-40°C to 85°C
MC9S08QA2CFCE	8-pin DFN	-40°C to 85°C
MC9S08QA2CPCE	8-pin PDIP	-40°C to 85°C
MC9S08QA2CSCE	8-pin SOIC	-40°C to 85°C

Features	Benefits
8-bit HCS08 Central Processor Unit (CPU)	
<ul style="list-style-type: none"> Up to 20 MHz HCS08 CPU (10 MHz bus frequency) for 100 ns minimum instruction time HCS08 instruction set with added BGND instruction 	<ul style="list-style-type: none"> Offering high performance, even at low voltage levels for battery-operated applications Backward object-code compatibility with 68HC08 and 68HC05 so existing code libraries can still be used Allows for efficient, compact module coding in assembly or C compiler
<ul style="list-style-type: none"> Support for up to 32 interrupt/reset sources 	<ul style="list-style-type: none"> Allows for software flexibility and optimization for real-time applications
Integrated Third-Generation Flash Memory and RAM	
<ul style="list-style-type: none"> Embedded flash that is in-application reprogrammable over the full operating voltage and temperature range with a single power supply 	<ul style="list-style-type: none"> Provides users a single solution for multiple platforms or a single platform that is field reprogrammable in virtually any environment Does not require additional pin or power supply for flash programming, simplifying the interface for inline programming and allowing for more GPIO pins
<ul style="list-style-type: none"> Extremely fast, byte-writable programming; as fast as 20 us/byte 	<ul style="list-style-type: none"> Helps reduce production programming costs through ultra-fast programming, as well as lowering system power consumption due to shorter writes
<ul style="list-style-type: none"> Up to 100,000 write/erase cycles at typical voltage and temperature (10k minimum write/erase); 100 years typical data retention (15 years minimum) 	<ul style="list-style-type: none"> Allows electrically erasable programmable read-only memory (EEPROM) emulation, reducing system costs and board real estate
Flexible Clock Options	
<ul style="list-style-type: none"> Internal clock source (ICS) module containing a frequency-locked loop (FLL) controlled by internal or external reference 	<ul style="list-style-type: none"> Can eliminate the cost of all external clock components, reduce board space and increase system reliability
<ul style="list-style-type: none"> Precision trimming of internal reference allows typical 0.1 percent resolution and +0.5 percent to -1 percent deviation over operating temperature and voltage 	<ul style="list-style-type: none"> Provides one of the most accurate internal clock sources on the market for the money
<ul style="list-style-type: none"> Internal reference can be trimmed from 31.25 kHz to 39.065 kHz, allowing for 8 MHz to 10 MHz FLL output 	<ul style="list-style-type: none"> Can use trimming to adjust bus clocks for optimal serial communication baud rates and/or timer intervals
4 Bidirectional Input/Output (I/O) Lines; One Input Only and One Output Only Line	
<ul style="list-style-type: none"> Outputs 10 mA each; 60 mA max for package 	<ul style="list-style-type: none"> High-current I/O allows direct drive of LED and other circuits to virtually eliminate external drivers and reduce system costs
<ul style="list-style-type: none"> Software selectable pull-ups on ports when used as input; internal pull-up on reset and interrupt request (IRQ) pin 	<ul style="list-style-type: none"> Reduces customer system cost by eliminating need for external resistors
<ul style="list-style-type: none"> Software selectable slew rate control and drive strength on ports when used as output 	<ul style="list-style-type: none"> Can configure ports for slower slew rate and weaker drive to minimize noise emissions from the MCU
<ul style="list-style-type: none"> 4-pin keyboard interrupt module with software selectable polarity on edge or edge/level modes 	<ul style="list-style-type: none"> Keyboard scan with programmable pull-ups/pulldowns virtually eliminate external glue logic when interfacing to simple keypads
Integrated Analog Peripherals	
<ul style="list-style-type: none"> 4-ch., 10-bit analog-to-digital converter (ADC) 	<ul style="list-style-type: none"> Easy interface to analog inputs, such as sensors
Automatic compare function, software programmable for greater than/equal to or less than conditions	<ul style="list-style-type: none"> Used to set conversion complete and generate interrupt only when result matches condition
Asynchronous clock source	<ul style="list-style-type: none"> Can be used to run ADC when MCU clocks are off, such as in STOP3 low-power mode
Temperature sensor	<ul style="list-style-type: none"> Calculates temperature without any external components and saves an ADC input channel for other use
Internal bandgap reference channel	<ul style="list-style-type: none"> Constant voltage source for calibrating ADC results requires no external components
Hardware triggerable using the RTI counter	<ul style="list-style-type: none"> Takes periodic measurements without CPU involvement; can be used in STOP3 with compare function to take measurement and wake MCU from STOP3 only when compare level is reached
Low-power and high-speed options	<ul style="list-style-type: none"> Flexible configuration to meet high-performance and low power requirements
Analog comparator module (ACMP)	
Option to compare to internal reference	<ul style="list-style-type: none"> Requires only single pin for input signal
Option to route comparator output directly to pin	<ul style="list-style-type: none"> Allows other components in system to see results of comparator with minimal delay
Output can be optionally routed to TPM module as Input capture trigger	<ul style="list-style-type: none"> Can be used for single slope ADC and resistance/capacitance (RC) time constant measurements
Two Timer Modules	
<ul style="list-style-type: none"> Programmable 16-bit timer/PWM module (TPM) 	<ul style="list-style-type: none"> One of the most flexible timer modules for the money; each channel can be independently programmable for input capture, output compare, buffered edge-aligned pulse width modulation (PWM) or buffered center-aligned PWM
<ul style="list-style-type: none"> 8-bit modulo timer module (MTIM) with 8-bit prescaler 	<ul style="list-style-type: none"> Timer overflow interrupt can be enabled to generate periodic interrupts for time-based software loops
System Protection	
<ul style="list-style-type: none"> Watchdog computer operating properly (COP) reset with option to run from dedicated 1 kHz internal clock source or bus clock 	<ul style="list-style-type: none"> Resets device in instance of runaway or corrupted code, and independent clock source provides additional protection in case of loss of clock
<ul style="list-style-type: none"> Low-voltage detection with reset or interrupt 	<ul style="list-style-type: none"> Allows system to write/save important variables before voltage drops too low Can hold device in reset until reliable voltage levels are reapplied to the part
<ul style="list-style-type: none"> Illegal opcode detection with reset 	<ul style="list-style-type: none"> Resets device in instance of runaway or corrupted code
<ul style="list-style-type: none"> Flexible block protection 	<ul style="list-style-type: none"> Secures code sections so that it cannot be accidentally corrupted by runaway code Option to protect various block sizes Option to put bootloader code in protected space and clear flash for reprogramming
<ul style="list-style-type: none"> Security feature for flash and RAM 	<ul style="list-style-type: none"> Prevents unauthorized access to memory to protect a customer's valuable software IP
<ul style="list-style-type: none"> Always-on power-on reset (POR) circuitry 	<ul style="list-style-type: none"> Significantly reduces risk of code runaway due to brownout situations

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