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8-bit Microcontrollers

# MC9S08QD4/2

**Target Applications**

- DC cooling fan applications
  - Computers
  - Low-power supplies
  - Battery chargers
- Digital capacitive discharge ignition (CDI) for motorcycles
- Industrial compressors
- Camera zoom control
- Walkie-talkies
- Vacuum cleaners
- Small and large appliances
  - Toasters
  - Low-end microwaves
- Industrial control
- Watchdog coprocessors
- Security systems
- Fan control
- AC voltage line monitors

**Overview**

The MC9S08QD4/2 provides design flexibility and integrated functionality for small appliances and DC fans. The QD includes up to 5.5V supply voltage, a 10-bit analog-to-digital converter (ADC) and two timers for improved motor control. The MC9S08QD extends the advantages of the low-end S08 core as a low pin count, small package 8-bit MCU. With pin and tool compatibility with MC9RS08KA and MC9S08QG8, the QD allows designers to move up and down the performance chain quickly and easily.

**Data Sheets**

MC9S08QD MC9S08QD Data Sheet

S08 CPU	
Up to 4K flash	4 KBI
256B RAM	4-ch., 10-bit ADC
ICS (0.2% resolution, 2% deviation)	1 x 1-ch., 16-bit timer
COP	1 x 2-ch., 16-bit timer
LVD	4 GPIO plus 1 in and 1 out

Features	Benefits
<b>8-bit HCS08 Central Processor Unit (CPU)</b>	
<ul style="list-style-type: none"> <li>• Up to 8 MHz S08 CPU for 125 ns minimum instruction time</li> <li>• HC08 instruction set with added background instruction</li> <li>• Support for up to 32 interrupt/reset sources</li> <li>• Supply voltage range of 2.7–5.5V</li> </ul>	<ul style="list-style-type: none"> <li>• Backward object-code compatibility with 68HC08 and 68HC05 allows existing code libraries to be used</li> <li>• Allows for efficient, compact module coding in assembly or C compiler</li> <li>• Allows for software flexibility and optimization for real-time applications</li> <li>• Greater scalability of power and performance through range of voltage for application needs</li> </ul>
<b>Integrated Third-Generation Flash Memory and RAM</b>	
<ul style="list-style-type: none"> <li>• Embedded flash that is in-application reprogrammable over the full operating voltage and temperature range with a single power supply</li> </ul>	<ul style="list-style-type: none"> <li>• Provides users a single solution for multiple platforms or a single platform that is field reprogrammable in virtually any environment</li> <li>• Allows for software flexibility and optimization for real-time applications</li> </ul>
<b>General Purpose Input/Output (GPIO) Lines</b>	
<ul style="list-style-type: none"> <li>• Outputs 10 mA each; 100 mA max for package</li> <li>• Four general-purpose input output (GPIO)</li> <li>• One input-only and one output-only line</li> <li>• Software selectable pull-ups on ports when used as input; internal pull-up on reset and interrupt request (IRQ) pin</li> <li>• Software selectable slew rate control and drive strength on ports when used as output</li> <li>• 4-pin keyboard interrupt module with software selectable polarity on edge or edge/level modes</li> <li>• 1-ch. timer/pulse-width modulator; each channel can be used for input capture, output compare, buffered edge-aligned PWM or buffered center-aligned PWM</li> <li>• Software-selectable pull-ups on ports when used as input; internal pull-up</li> <li>• Software-selectable slew rate control and drive strength on ports when used as output</li> <li>• Single-wire background debug interface</li> <li>• 8-pin plastic dual-inline package (PDIP) and 8-pin narrow body small outline integrated circuit (SOIC) packages</li> <li>• Internal pull-up on reset and IRQ pin</li> </ul>	<ul style="list-style-type: none"> <li>• High-current I/O allows direct drive of LED and other circuits to virtually eliminate external drivers and to help reduce system costs</li> <li>• Helps to reduce customer system cost by eliminating need for external resistors</li> <li>• Can configure ports for slower slew rate and weaker drive to minimize noise emissions from the MCU</li> <li>• Keyboard scan with programmable pull-ups/pull-downs virtually eliminates external glue logic when interfacing to simple keypads</li> <li>• Reduce customer system cost</li> </ul>

Features	Benefits
<b>Integrated Analog Peripherals</b>	
<ul style="list-style-type: none"> <li>4-ch., 10-bit ADC with automatic compare function</li> <li>ADC channel connected to on-chip temperature sensor</li> <li>Automatic compare function, software programmable for greater-than, equal-to or less-than conditions</li> <li>Asynchronous clock source</li> <li>Temperature sensor</li> <li>Internal bandgap reference channel</li> <li>Hardware triggerable using the real-time interrupt counter</li> <li>Low-power and high-speed options</li> <li>Can be used for single slope APC and resistance-capacitance time</li> <li>Easy interface to analog inputs/sensors</li> <li>Used to set conversion complete and generate interrupt only when result matches condition</li> </ul>	<ul style="list-style-type: none"> <li>Can be used to run ADC when MCU clocks are off, such as in STOP3 low-power mode</li> <li>Calculates temperature without any external components and saves an ADC input channel for other use</li> <li>Constant voltage source for calibrating ADC results requires no external components</li> <li>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</li> <li>Flexible configuration to meet high performance and low power requirements</li> </ul>
<b>Flexible Clock Options</b>	
<ul style="list-style-type: none"> <li>Internal clock source module containing a frequency-locked loop controlled by internal reference</li> </ul>	<ul style="list-style-type: none"> <li>Can eliminate cost of external clock components, use little board space and help to increase system reliability</li> </ul>
<b>Two Timer Modules</b>	
<ul style="list-style-type: none"> <li>Programmable 16-bit timer/PWM (TPM) module</li> <li>2-ch. TPM; each channel can be used for input capture, output compare, buffered edge-aligned pulse width modulation (PWM) or buffered center-aligned PWM</li> <li>1 x 1-ch., 16-bit timer</li> <li>1 x 2-ch., 16-bit timer</li> </ul>	<ul style="list-style-type: none"> <li>One of the most cost-effective and flexible timer modules; each channel is independently programmable for input capture, output compare or buffered edge-aligned PWM or buffered center-aligned PWM</li> <li>Timer overflow interrupt can be enabled to generate periodic interrupts for time-based software loops</li> <li>Two separate time bases provide different interrupt options</li> </ul>
<b>System Protection</b>	
<ul style="list-style-type: none"> <li>Watchdog computer operating properly reset with option to run from dedicated 1 kHz internal clock source or bus clock</li> <li>Low-voltage detection with reset or interrupt</li> <li>Illegal opcode detection with reset</li> <li>Flexible flash block protection</li> <li>Security feature for flash and RAM</li> <li>Always-on power-on reset circuitry</li> </ul>	<ul style="list-style-type: none"> <li>Resets device in instance of runaway or corrupted code, and independent clock source provides additional protection in case of loss of clock</li> <li>Allows system to write/save important variables before voltage drops too low</li> <li>Can hold device in reset until reliable voltage levels are reapplied to the part</li> <li>Helps to secure code sections so that they cannot be accidentally corrupted by runaway code</li> <li>Option to protect various block sizes</li> <li>Option to put bootloader code in protected space and clear flash for reprogramming</li> <li>Helps prevent unauthorized access to memory to protect a customer's software</li> </ul>

## Cost-Effective Development Tools

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

**DEMO9S08QD4** **US\$59\***

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

**CYCLONEPROE** **US\$499\***

HC08/HCS08/HC12/HCS12 stand-alone flash programmer or in circuit emulator, debugger, flash programmer; USB, serial or Ethernet interface options

**USBMULTILINKBDM** **US\$99\***

Universal HC08 in-circuit debugger and flash programmer; USB-PC interface

**CWX-HXX-SE** **Complimentary\*\***

CodeWarrior® Special Edition for HC(S)08/RS08 MCUs includes integrated development environment, linker, debugger, unlimited assembler, Processor Expert™ auto-code generator, full-chip simulation and 16 KB C compiler

\*Prices indicated are MSRP

\*\*Subject to license agreement and registration

## Package Options

Part Number	Package	Temp. Range
MC9S08QD2CSC	8-pin SOIC	-40° C to +85° C
MC9S08QD2CPC	8-pin PDIP	-40° C to +85° C
MC9S08QD4CSC	8-pin SOIC	-40° C to +85° C
MC9S08QD4CPC	8-pin PDIP	-40° C to +85° C
MC9S08QD4VSC	8-pin SOIC	-40° C to +105° C
MC9S08QD4VPC	8-pin PDIP	-40° C to +105° C
MC9S08QD4MSC	8-pin SOIC	-40° C to +125° C
MC9S08QD4MPC	8-pin PDIP	-40° C to +125° C

## Learn More:

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