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# MC9S08JM16

## 8-bit USB microcontroller

### Target Applications

- PC peripherals
- Uninterrupted power supplies
- Touch panels
- Gamepads
- Label printers
- Remote controls
- I/O modules
- Industrial networking products
- Stationary barcode scanners
- Barcode scanners
- Utility meters
- Industrial printers
- Data loggers
- Automatic drug dispensers
- Motion controllers
- Laboratory equipment
- Lighting control systems
- Security control panels
- Cash register printers
- Measurement equipment

### Overview

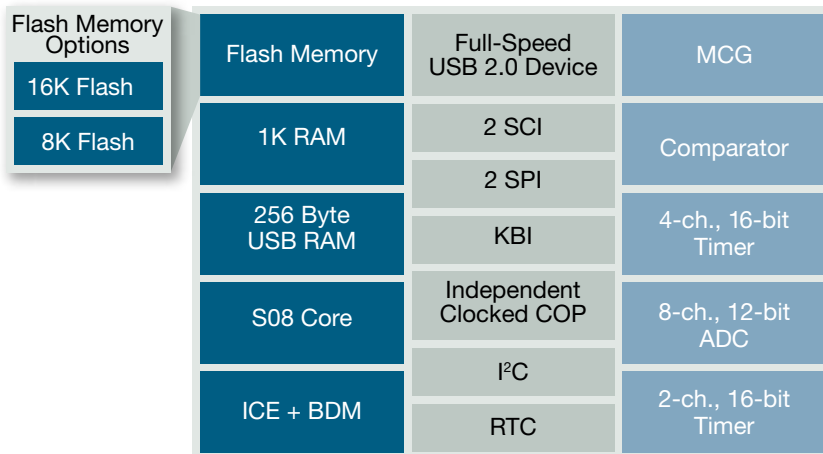
The 8-bit MC9S08JM16 device further extends Freescale's entry-level 8-bit embedded USB controller family with up to 16 KB of flash memory, a full-speed USB 2.0 device controller and an eight-channel, 12-bit analog-to-digital converter. The S08 JM family also has several system protection features, such as low voltage detection and a computer operating properly (COP) module.

The MC9S08JM16 device is well suited for a variety of industrial control and consumer applications. Such applications include PC peripherals, industrial printers and touch panels.

The MC9S08JM16 devices, like the other USB microcontrollers in the Controller Continuum, are supported by the Freescale USB-LITE Stack by CMX. This complimentary USB stack provides support for certain HID and CDC classes. Source code for the complimentary stack is available.

The MC9S08JM16 is software compatible with other devices in the Controller Continuum, providing a direct migration path to higher performing USB microcontrollers.

### MC9S08JM16 Block Diagram



Features	Benefits
<b>8-bit HCS08 Central Processing Unit (CPU)</b> <ul style="list-style-type: none"> <li>• Up to 24 MHz internal bus (48 MHz HCS08 core) frequency offering 2.7 to 5.5V across temperature range of -40°C to +85°C</li> <li>• Support for up to 32 peripheral interrupt/request resources</li> </ul>	<ul style="list-style-type: none"> <li>• Offers strong performance throughout the entire voltage range</li> <li>• Allows for exceptional software flexibility and optimization for real-time applications</li> </ul>
<b>On-Chip Memory</b> <ul style="list-style-type: none"> <li>• Up to 16K flash read/program/erase over full operating voltage and temperature</li> <li>• Up to 1K RAM</li> <li>• 256 Byte USB RAM</li> </ul>	<ul style="list-style-type: none"> <li>• Allows user to take full advantage of in-application, re-programmability benefits</li> <li>• Security circuitry to help prevent unauthorized access to RAM</li> <li>• Flash contents help to reduce system power consumption</li> <li>• Improve data transfer speed by providing data buffering</li> </ul>
<b>Power-Saving Modes</b> <ul style="list-style-type: none"> <li>• Wait plus two stop modes</li> <li>• Multi-purpose clock generator (MCG)</li> </ul>	<ul style="list-style-type: none"> <li>• Allows continuation of sampling application in a reduced power state which reduces system power consumption</li> <li>• Frequency-locked loop (FLL): Internal or external reference can be used to control the FLL</li> <li>• Phase-locked loop (PLL): Voltage controlled oscillator (VCO). Modulo VCO frequency divider. Lock detector with interrupt capability</li> <li>• Internal reference clock: Can be selected as the clock source for the MCU</li> <li>• External reference clock: Provides control for a separate crystal oscillator. Clock monitor with reset capability. Can be selected as the clock source for the MCU.</li> <li>• Reference divider provided</li> <li>• Clock source can be divided by 1, 2, 4 or 8</li> </ul>
<b>Peripherals</b> <ul style="list-style-type: none"> <li>• USB device module</li> </ul>	<ul style="list-style-type: none"> <li>• Full-speed USB 2.0 (12 Mbps) module with dedicated on-chip 3.3V regulator</li> <li>• Supports control, interrupt, isochronous and bulk transfers</li> </ul>



Features	Benefits
<b>Peripherals (continued)</b>	
<ul style="list-style-type: none"> <li>Analog comparators (ACMP)—Analog comparator with option to compare to internal reference</li> </ul>	<ul style="list-style-type: none"> <li>Requires only single pin for input signal, freeing up other pin for other use</li> <li>Allows other system components to see comparator result with minimal delay</li> <li>Can be used for single slope ADC and RC time constant measurements</li> </ul>
<ul style="list-style-type: none"> <li>Analog-to-digital converter (ADC)—Eight-channel, 12-bit resolution</li> </ul>	<ul style="list-style-type: none"> <li>Output formatted in 12-, 10- or 8-bit right-justified format</li> <li>Single or continuous conversion</li> <li>Operation in low-power modes for lower noise operation</li> <li>Asynchronous clock source for lower noise operation</li> </ul>
<ul style="list-style-type: none"> <li>Two serial communications interface (SCI) modules offering asynchronous communications</li> </ul>	<ul style="list-style-type: none"> <li>Provides standard UART communications peripheral</li> <li>Allows full-duplex, asynchronous, NRZ serial communication between MCU and remote devices</li> </ul>
<ul style="list-style-type: none"> <li>I<sup>2</sup>C with up to 100 kbps with maximum bus loading; multi-master operation; programmable slave address; interrupt driven byte-by-byte data transfer; supports broadcast mode and 10-bit addressing</li> </ul>	<ul style="list-style-type: none"> <li>Ability to add an additional I<sup>2</sup>C device</li> </ul>
<ul style="list-style-type: none"> <li>SPI—Two serial peripheral interfaces with full-duplex or single-wire bidirectional; double-buffered transmit and receive; master or slave mode; MSB-first or LSB-first shifting</li> </ul>	<ul style="list-style-type: none"> <li>Having two SPI allows two separate dedicated devices, for example, one SPI dedicated to a ZigBee<sup>®</sup> transceiver, and the other to MCUs or peripherals</li> </ul>
<ul style="list-style-type: none"> <li>Timer pulse width modulation (TPM)—Up to six channels</li> </ul>	<ul style="list-style-type: none"> <li>Each channel may be input capture, output compare or edge-aligned PWM</li> <li>Input capture trigger on either rising or falling edge</li> <li>Selectable polarity on PWM outputs</li> <li>Timer clock source selectable as prescaled bus clock, fixed system clock or an external clock pin</li> </ul>
<b>Input/Output</b>	
<ul style="list-style-type: none"> <li>Up to seven Keyboard Interrupt (KBI) pins with selectable polarity</li> </ul>	<ul style="list-style-type: none"> <li>Each KBI pin is programmable as falling edge only, rising edge only, falling edge and low level, or rising edge and high level interrupt sensitivity</li> </ul>
<ul style="list-style-type: none"> <li>37 general purpose input/output (GPIO)s</li> </ul>	<ul style="list-style-type: none"> <li>Results in a large number of flexible I/O pins that allow vendors to easily interface the device into their own designs</li> </ul>
<b>System Protection</b>	
<ul style="list-style-type: none"> <li>Watchdog computer operating properly (COP) reset with option to run from dedicated 1 kHz internal clock source or bus clock</li> </ul>	<ul style="list-style-type: none"> <li>Allows the device to recognize run-away code (infinite loops) and resets the processor to help avoid lock-up states</li> </ul>
<ul style="list-style-type: none"> <li>Low-voltage detection with reset or interrupt; selectable trip points</li> </ul>	<ul style="list-style-type: none"> <li>Alerts the developer to voltage drops outside of the typical operating range</li> </ul>
<ul style="list-style-type: none"> <li>Illegal op code detection with reset</li> </ul>	<ul style="list-style-type: none"> <li>Allows the device to recognize erroneous code and resets the processor to help avoid lock-up states</li> </ul>
<ul style="list-style-type: none"> <li>Flash block protection</li> </ul>	<ul style="list-style-type: none"> <li>Prevents unauthorized access to flash RAM which greatly reduces the chance of losing vital system code for vendor applications</li> </ul>
<b>Hardware Development Support</b>	
<ul style="list-style-type: none"> <li>Single-wire background debug interface</li> </ul>	<ul style="list-style-type: none"> <li>This allows developers to use the same interface for multiple platforms</li> </ul>
<ul style="list-style-type: none"> <li>Breakpoint capability</li> </ul>	<ul style="list-style-type: none"> <li>Allows single breakpoint setting during in-circuit debugging (plus two more breakpoints in on-chip debug module)</li> </ul>
<ul style="list-style-type: none"> <li>On-chip in-circuit emulator (ICE) debug module (containing three comparators and nine trigger modes). Eight deep FIFO for storing change-of-flow addresses and event-only data, debug module supports both tag and force breakpoints.</li> </ul>	<ul style="list-style-type: none"> <li>Grants full access to built-in chip emulation without the added expense of traditional emulator hardware</li> </ul>

Package Options		
Part Number	Temp. Range	Package
MC9S08JM16CGT	-40°C to +85°C	48-pin QFN
MC9S08JM16CLD	-40°C to +85°C	44-pin LQFP
MC9S08JM16CLC	-40°C to +85°C	32-pin LQFP
MC9S08JM8CGT	-40°C to +85°C	48-pin QFN
MC9S08JM8CLD	-40°C to +85°C	44-pin LQFP
MC9S08JM8CLC	-40°C to +85°C	32-pin LQFP

### Cost-Effective Development Tools

#### DEMO9S08JM16

\$79 USD\*

Cost-effective demonstration kit featuring the JM16 daughter card. Support for USB full speed device. Built-in USB-BDM circuitry is available for debugging and programming, serial communication, and simple logic analyzer.

#### DC9S08JM16

\$10 USD\*

The JM16 daughter card can also be ordered independently to use on the DEMOJM demonstration kit.

#### CodeWarrior<sup>®</sup> Development Studio for Microcontrollers 6.1

Complimentary\*\*

CodeWarrior Development Studio for Microcontrollers is an integrated tool suite that supports software development for Freescale's 8-bit or 32-bit microcontrollers. Designers can further accelerate application development with the help of the Processor Expert™ tool, which is an award-winning rapid application development tool in the CodeWarrior tool suite.

#### Freescale USB-LITE Stack by CMX

Complimentary\*\*

Freescale is providing a comprehensive USB software solution through a complimentary USB stack. Freescale USB-LITE Stack by CMX enables USB device modes of operation. The USB stack supports several HID and CDC to UART projects. The complimentary stack also interfaces with CodeWarrior Development Studio, providing a productive, comprehensive development environment for designing embedded applications.

\* Prices indicated are MSRP

\*\* Subject to license agreement

### Learn More:

For more information about the JM family, please visit [www.freescale.com/8bit](http://www.freescale.com/8bit).