

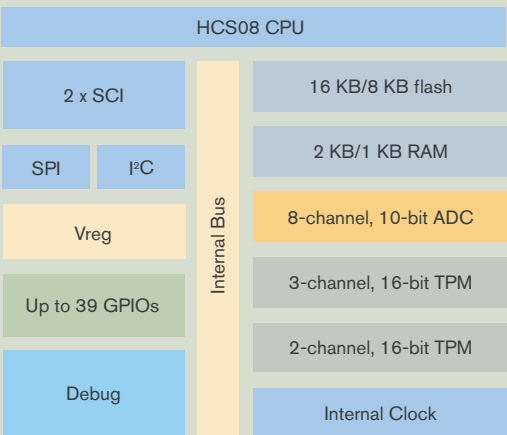
MC9S08GT16A/8A

Target Applications

- > ZigBee™ controller
- > Handheld instruments
- > Utility meters
- > Security systems
- > Portable consumer devices

Description

The MC9S08GT series of microcontrollers is part of the popular and rapidly growing HCS08 Family with advanced technology for long battery life, high performance and additional enhancements such as advanced on-chip development support. Using Freescale's 0.25µ flash, the GT16A/8A offers an upward migration path from Freescale's 68HC05 and 68HC08 architectures for applications that need lower power, more peripherals and higher performance. Other features include two serial communications interfaces (SCIs), a serial peripheral interface (SPI), an analog-to-digital converter (ADC) and two independent timer modules, offering a total of five programmable channels. A compact 32-pin package is also offered, providing scalability for smaller designs.



Features

8-bit HCS08 CPU Core

- > Low-power technology
 - Multiple power management modes including 20 nA powerdown
 - Optional auto wake-up from Stop 2 or Stop 3 modes with internal timer typically requires only 300 nA additional current
 - 1.8V operation
- > High performance when needed
 - 50 ns minimum instruction cycle time down to 2.1V at 20 MHz bus
 - 125 ns minimum instruction cycle time down to 1.8V at 8 MHz bus
- > C-optimized architecture with multiply and divide instructions

Benefits

- > Extends battery life with flexible power management
- > Designed to provide the higher performance required of many 8-bit applications while allowing low-power 1.8V operation
- > 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 of 20 ms (512B)
- > 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
- > Program flash down to 1.8V; read down to 1.8V
- > Ultrafast programming reduces system cost
- > 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

Internal Clock Generator

- > High gain oscillator option
- > 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 external crystal/resonator
 - Internal clock generator
 - External clock
- > Provides improved noise immunity in the oscillator circuit
- > Designed to reduce board space and system costs by eliminating external components
- > Allows fast startup from low power modes
- > 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

- > Eight-channel ADC
- > 14 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 down to 1.8V

Timer with Five Programmable Channels

- > 1 x 3 channel, 1 x 2 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

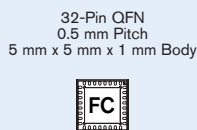
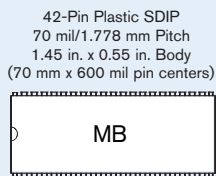
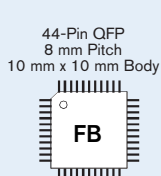
- > Dual asynchronous SCIs
 - Flexible 13-bit module-based baud rate generators
 - Double-buffered receive and transmit
- > Synchronous SPI up to 5 Mbps
- > Inter IC (I²C) bus
 - Multimaster operation
 - 256 clock options
- > Asynchronous communication between the MCU and a terminal, computer or a network 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

System Protection

- > Selectable low-voltage detect/reset at nominal 1.8V
- > Low-battery warning at nominal 2.4V or 2.1V
- > COP watchdog timer
- > Loss of clock detect (LOCD) (with option to disable for lower power consumption)
- > 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
- > Protects against external clock failure by switching to internal clock
- > Provided for extremely power sensitive applications

Up to 39 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



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

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Development Tools

- CWX-H08-SE** CodeWarrior™ Special Edition for HC(S)08/RS08 MCUs includes integrated development environment (IDE), linker, debugger, unlimited assembler, Processor Expert™ auto-code generator and full-chip simulation. 16 KB C Compiler included for HC(S)08 MCUs.
- M68DEMO908GB60E** Demonstration Board for MC9S08GB/GT Families: Battery-operated board with dual serial ports, switches, LEDs and small proto area
- M68EVB908GB60E** Evaluation Board for MC9S08GB/GT Families: Board includes LCD display, large breadboard area and universal power supply
- USBMULTILINKBDME** Universal in-circuit programmer/debugger for all HCS08/RS08 MCUs with on-chip BDM; USB host interface
- CYCLONEPROE** Universal stand-alone programmer with all the capabilities of the USBMULTILINKBDME plus the ability to function as a stand-alone programmer with push buttons and LEDs to control operation; supports HCS08s, HCS12s, RS08's and includes serial, Ethernet and USB interfaces

Package Options

Part Number	Package	Temp. Range
MC9S08GT16AMFDE	48 QFN	-40°C to +125°C
MC9S08GT16AMFBE	44 QFP	-40°C to +125°C
MC9S08GT16AMMBE	42 SDIP	-40°C to +125°C
MC9S08GT16AMFCE	32 QFN	-40°C to +125°C
MC9S08GT16ACFDE	48 QFN	-40°C to +85°C
MC9S08GT16ACFBE	44 QFP	-40°C to +85°C
MC9S08GT16ACMBE	42 SDIP	-40°C to +85°C
MC9S08GT16ACFCE	32 QFN	-40°C to +85°C
MC9S08GT8AMFDE	48 QFN	-40°C to +125°C
MC9S08GT8AMFBE	44 QFP	-40°C to +125°C
MC9S08GT8AMMBE	42 SDIP	-40°C to +125°C
MC9S08GT8AMFCE	32 QFN	-40°C to +125°C
MC9S08GT8ACFDE	48 QFN	-40°C to +85°C
MC9S08GT8ACFBE	44 QFP	-40°C to +85°C
MC9S08GT8ACMBE	42 SDIP	-40°C to +85°C
MC9S08GT8ACFCE	32 QFN	-40°C to +85°C

Package Options

MC9S08GT16A Data Sheet for GT16A/GT8A