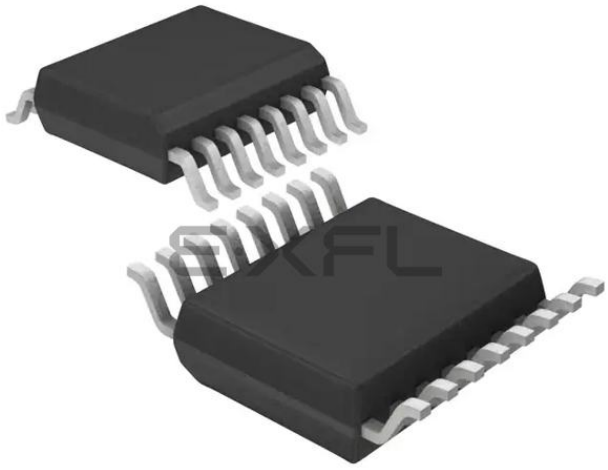


Welcome to E-XFL.COM

What is "Embedded - Microcontrollers"?

"Embedded - Microcontrollers" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable input/output peripherals. They are called "embedded" because they are embedded within electronic devices to control various functions, rather than serving as standalone computers. Microcontrollers are crucial in modern electronics, providing the intelligence and control needed for a wide range of applications.

Applications of "Embedded - Microcontrollers"

Details	
Product Status	Active
Core Processor	S08
Core Size	8-Bit
Speed	40MHz
Connectivity	I²C, LINbus, SCI, SPI
Peripherals	LVD, POR, PWM, WDT
Number of I/O	13
Program Memory Size	16KB (16K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	1K x 8
Voltage - Supply (Vcc/Vdd)	2.7V ~ 5.5V
Data Converters	A/D 8x10b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 125°C (TA)
Mounting Type	Surface Mount
Package / Case	16-TSSOP (0.173", 4.40mm Width)
Supplier Device Package	16-TSSOP
Purchase URL	https://www.e-xfl.com/product-detail/nxp-semiconductors/mc9s08sh16mtg

MC9S08SH32/16
Fact sheet

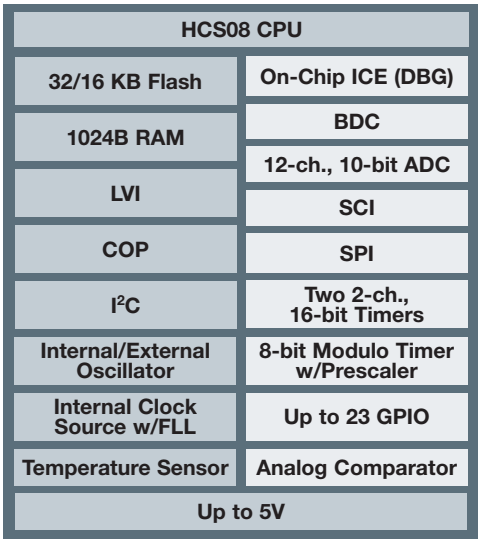
Target Applications

- Personal care/handheld devices (i.e. blenders, blowdryers)
- AC-powered consumer goods
- Power tools
- Fire alarms
- Wireless sensor applications including simple media access controller (SMAC)
- Watchdog coprocessors
- Small appliances
- Secure boot coprocessors
- Security systems

Overview

The MC9S08SH32/16 strengthens Freescale's entry-level 8-bit microcontroller portfolio by extending the advantages of the HCS08 core and peripherals to 5V. The highly integrated SH controllers are Freescale's low-pin-count S08s with 40 MHz ICS and includes an additional ganged output that can toggle multiple pins using one bit, allowing for higher current drive. The functionality is completed with strong analog capabilities, a complete set of serial modules, a temperature sensor and robust memory options ideal for general-purpose consumer and industrial applications in the 2.7V to 5.5V range.

MC9S08SH32/16 Block Diagram



Features	Benefits
8-bit HCS08 Central Processor Unit (CPU)	
• Up to 40 MHz HCS08 CPU (20 MHz bus frequency) for 50 ns minimum instruction time	• Offering high performance up to 5V, ideal for industrial applications
• HC08 instruction set with added BGND instruction	• 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
• Support for up to 32 interrupt/reset sources	• Allows for software flexibility and optimization for real-time applications
Integrated Third-Generation Flash Memory and RAM	
• Embedded flash that is in-application reprogrammable over the full operating voltage and temperature range with a single power supply	• 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 in-line programming and allowing for more GPIO pins
• Extremely fast, byte-writable programming; as fast as 20 us/byte	• Helps reduce production programming costs through ultra-fast programming, as well as lowering system power consumption due to shorter writes
• Up to 100,000 write/erase cycles at typical voltage and temperature (10k minimum write/erase); 100 years typical data retention (15 years minimum)	• Allows electrically erasable programmable read-only memory (EEPROM) emulation, reducing system costs and board real estate
Flexible Clock Options	
• Internal clock source (ICS) module containing a frequency-locked loop (FLL) controlled by internal or external reference	• Can eliminate the cost of all external clock components, reduce board space and increase system reliability
• Precision trimming of internal reference allows typical 0.1 percent resolution and +0.5 percent to -1 percent deviation over operating temperature and voltage	• Provides one of the most accurate internal clock sources on the market for the money
• Internal reference can be trimmed from 31.25 kHz to 39.065 kHz, allowing for 16 MHz to 20 MHz FLL output	• Can use trimming to adjust bus clocks for optimal serial communication baud rates and/or timer intervals
• Low-power oscillator module (XOSC) with software selectable crystal or ceramic resonator range, 31.25 kHz to 38.4 kHz or 1 MHz to 16 MHz, and supports external clock source input up to 40 MHz	• 32 kHz oscillator provides low-power option for systems requiring time-keeping functionality (i.e., time and date) while in low-power modes
23 Bidirectional Input/Output (I/O) Lines; One Output-Only Line	
• Outputs 10 mA each; 60 mA max for package	• High-current I/O allows direct drive of LED and other circuits to virtually eliminate external drivers and reduce system costs
• Software selectable pull-ups on ports when used as input; internal pull-up on reset and interrupt request (IRQ) pin	• Reduces customer system cost by eliminating need for external resistors
• Software selectable slew rate control and drive strength on ports when used as output	• Can configure ports for slower slew rate and weaker drive to minimize noise emissions from the MCU
• 8-pin keyboard interrupt module with software selectable polarity on edge or edge/level modes	• Keyboard scan with programmable pull-ups/pull-downs virtually eliminate external glue logic when interfacing to simple keypads
Ganged Output Option for PTB (5:2) and PTC (3:0)	
• Allows single write to change state of multiple pins	
• Drives up to 80 mA without risk of runaway code shorting	
• Provides option to tie multiple pins from different ports to same control registers	
• Safely drives multiple outputs	
Multiple Serial Communication Options	
• Serial communications interface module with option for 13-bit break capabilities and double-buffered transmit and receive	• All serial peripherals available for use in parallel on 16-pin devices
• Serial peripheral interface module and I2C bus module	

freescale semiconductor

Features	Benefits
Integrated Analog Peripherals	
• 16-ch., 10-bit analog-to-digital converter (ADC)	• Easy interface to analog inputs, such as sensors
○ Automatic compare function, software programmable for greater than/equal to or less than conditions	• Used to set conversion complete and generate interrupt only when result matches condition
○ Asynchronous clock source	• Can be used to run ADC when MCU clocks are off, such as in STOP3 low-power mode
○ Temperature sensor	• Calculates temperature without any external components and saves an ADC input channel for other use
○ Internal bandgap reference channel	• Constant voltage source for calibrating ADC results requires no external components
○ Hardware triggerable using the RTI counter	• 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	• Flexible configuration to meet high-performance and low-power requirements
• Analog comparator module (ACMP)	
○ Option to compare to internal reference	• Requires only single pin for input signal
○ Option to route comparator output directly to pin	• 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	• Can be used for single slope ADC and resistance-capacitance (RC) time constant measurements
• Real-time-counter (RTC)	
○ 8-bit modulus counter with binary or decimal based prescaler	• Free-running, on-chip, low-power oscillator (1 kHz) for cyclic wake-up without external components, runs in all MCU mode
○ External clock source for prescise time base, time-of-day, calendar or task scheduling functions	
Three Timer Modules	
• Programmable 16-bit timer/PWM modules (TPM1 and TPM2)	• Each channel can be independently programmable for input capture, output compare, buffered edge-aligned pulse width modulation (PWM) or buffered center-aligned PWM
• 8-bit modulo timer module (MTIM) with 8-bit prescaler	• Timer overflow interrupt can be enabled to generate periodic interrupts for time-based software loops
System Protection	
• Watchdog computer operating properly (COP) reset with option to run from dedicated 1 kHz internal clock source or bus clock	• Resets device in instance of runaway or corrupted code, and independent clock source provides additional protection in case of loss of clock
• Low-voltage detection with reset or interrupt	• Allows system to write/save important variables before voltage drops to low • Can hold device in reset until reliable voltage levels are reapplied to the part
• Illegal opcode detection with reset	• Resets device in instance of runaway or corrupted code
• Flexible block protection	• 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
• Security feature for flash and RAM	• Prevents unauthorized access to memory to protect a customer's valuable software IP
• Always-on power-on reset (POR) circuitry	• Significantly reduces risk of code runaway due to brownout situations
Background Debugging System and On-Chip In-Circuit Emulation (ICE) with Real-Time Bus Capture	
• On-chip ICE	• Provides single-wire debugging and emulation interface; eliminates need for expensive emulation tools • Provides circuit emulation without the need for additional, expensive development hardware

Cost-Effective Development Tools

DEMO9S08SH32 **$69***

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

M68CYCLONEPRO **$499***

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

USBMULTILINKBDM **$99***

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

CWS-H08-STDED-CX **Free****

CodeWarrior® Special Edition for Microcontrollers; includes integrated development environment (IDE), 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
MC9S08SH32CTG	16-pin TSSOP	-40°C to +85°C
MC9S08SH32CTJ	20-pin TSSOP	-40°C to +85°C
MC9S08SH32CWL	28-pin SOIC	-40°C to +85°C
MC9S08SH32CTL	28-pin TSSOP	-40°C to +85°C
MC9S08SH16CTG	16-pin TSSOP	-40°C to +85°C
MC9S08SH16CTJ	20-pin TSSOP	-40°C to +85°C
MC9S08SH16CWL	28-pin SOIC	-40°C to +85°C
MC9S08SH16CTL	28-pin TSSOP	-40°C to +85°C

Learn More: For current information about Freescale products and documentation, please visit **www.freescale.com/entry8**.

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