



**THE DATASHEET OF
MC9S08SE4CWL**





8-bit microcontroller

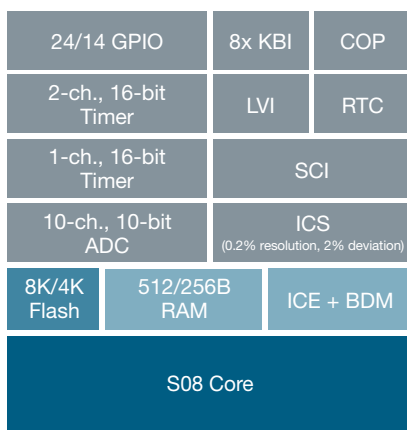
MC9S08SE8/4

Do more with less

Target Applications

- Personal care/handheld devices
- AC-powered consumer goods
- Power tools
- Security systems
- Lawnmowers
- Small appliances
- Treadmills
- Vacuum cleaners
- Industrial appliances/compressors
- DC computer cooling fans
- Power supplies
- AC voltage line monitors

MC9S08SE8/4 Block Diagram



Features	Benefits
8-bit HCS08 Central Processor Unit (CPU)	
<ul style="list-style-type: none"> • Up to 20 MHz HCS08 (10 MHz internal bus frequency) • HC08 instruction set with added BGND instruction 	<ul style="list-style-type: none"> • Offers high performance up to 5V, ideal for industrial applications • Enables backward object-code compatibility with 68HC08 and 68HC05 • Allows existing code libraries to be used • Allows for efficient, compact module coding in assembly or C complier
<ul style="list-style-type: none"> • Supports up to 32 interrupt/reset sources 	<ul style="list-style-type: none"> • Enables 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, thus simplifying the interface for in-line programming and allowing for more GPIO pins
<ul style="list-style-type: none"> • Extremely fast, byte-writable programming; as fast as 20 μs (burst mode) 	<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 with a frequency-locked loop (FLL) controlled by internal or external reference 	<ul style="list-style-type: none"> • Eliminates the cost of utilizing external clock components, reducing board space and increasing system reliability
<ul style="list-style-type: none"> • Precision trimming of internal reference allows typical 0.2 percent resolution and 2 percent deviation over operating temperature and voltage 	<ul style="list-style-type: none"> • Provides one of the most accurate and cost-effective internal clock sources in the market
<ul style="list-style-type: none"> • Internal reference can be trimmed from 31.25 kHz to 38.4 kHz, allowing for up to 10 MHz FLL output 	<ul style="list-style-type: none"> • Enables adjustment of bus clocks for optimal serial communication baud rates and/or timer intervals
<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 32 kHz oscillator provides low-power option for systems requiring time-keeping functionality (i.e. time and date) while in low-power modes
22 I/O Pins, One Input-Only Pin and One Output-Only Pin	
<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, virtually eliminating external drivers and reducing system costs
<ul style="list-style-type: none"> • Software-selectable pull-ups on ports when used as inputs; internal pull-up on reset and interrupt request (IRQ) pin 	<ul style="list-style-type: none"> • Reduces customer's system cost by eliminating the 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"> • Allows user to configure ports for slower slew rate and weaker drive to minimize noise emissions from the MCU
<ul style="list-style-type: none"> • 8-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/pull-downs virtually eliminates external glue logic when interfacing to simple keypads

Overview

The MC9S08SE8/4 strengthens Freescale's entry level 8-bit microcontroller portfolio by extending the advantages of the HCS08 core and peripherals to 5V. The highly integrated SE controllers give you the choice of cost-effective higher-pin-count devices, with 20 MHz CPU, for entry-level products. Functionality is enhanced with rich analog capabilities, a complete set of serial modules, a temperature sensor and robust memory options, which are ideal for general-purpose consumer and industrial applications in the 2.7V to 5.5V range.

Features	Benefits
Ganged Output Option for PTB (5:2) and PTC (3:0)	
<ul style="list-style-type: none"> Allows single write to change state of multiple pins Provides option to tie multiple pins from different ports to same control registers 	<ul style="list-style-type: none"> Safely drives multiple outputs
Multiple Serial Communication Options	
<ul style="list-style-type: none"> Serial communication interface module with option for 13-bit break capabilities and double-buffered transmit and receive 	<ul style="list-style-type: none"> All serial peripherals available for use in parallel on 16-pin devices
10-channel, 10-bit Analog-to-Digital Converter (ADC)	
<ul style="list-style-type: none"> Automatic compare function, software programmable for greater than, equal to or less than conditions Asynchronous clock source Temperature sensor Hardware triggerable using the RTC counter 	<ul style="list-style-type: none"> Easy interface to analog inputs, such as sensors Used to set conversion complete and generate interrupt only when result matches condition Can be used to run the ADC when MCU clocks are off, such as in STOP3 low-power mode Calculates temperature without any external components and saves an ADC input channel for other use 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
<ul style="list-style-type: none"> Low-power and high-speed options 	<ul style="list-style-type: none"> Flexible configuration to meet high-performance and low-power requirements
Real-Time Counter (RTC)	
<ul style="list-style-type: none"> 8-bit modulus counter with binary or decimal-based prescaler Three software selectable clock sources: 1 kHz internal low-power oscillator, external clock and 32 kHz internal clock 	<ul style="list-style-type: none"> Serve as a cyclic wakeup from low-power modes without the need of external components Provides precise time base for time-of-day, calendar or task scheduling functions
Three Timer Modules	
<ul style="list-style-type: none"> Programmable 16-bit timer/PWM modules (TPM1 and TPM2) 	<ul style="list-style-type: none"> Each channel is independently programmable for input capture, output compare, buffered edge-aligned pulse width modulation (PWM) or buffered center-aligned PWM
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 Low-voltage detection with reset or interrupt Illegal opcode detection with reset Security feature for flash and RAM Always-on power-on reset (POR) circuitry 	<ul style="list-style-type: none"> Resets device in instance of runaway or corrupted code Independent clock source provides additional protection in case of loss of clock 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 Resets device in instance of runaway or corrupted code Prevents unauthorized access to memory to protect a customer's valuable software IP Significantly reduces risk of code runaway due to brownout situations
Development Support	
<ul style="list-style-type: none"> Background debugging system On-chip in-circuit emulation (ICE) with real-time bus capture 	<ul style="list-style-type: none"> Provides single-wire debugging and emulation interface; eliminates the need for expensive emulation tools Provides circuit emulation without the need for additional, expensive development hardware

Cost-Effective Development Tools

Part Number	Description
DEMO9S08SE8 \$75*	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 HCS08 in-circuit debugger and flash programmer; USB PC interface
CWX-HXX-SE Free**	CodeWarrior™ Special Edition for Microcontrollers; includes integrated development environment (IDE), linker, debugger, unlimited assembler, Processor Expert™ auto-code generator, full-chip simulation and 32 KB C compiler limitation

*Prices indicated are MSRP.

**Subject to license agreement and registration

Package Options

Part Number	Package	Temp. Range
MC9S08SE8CWL	SOIC28	-40°C to +85°C
MC9S08SE4CWL	SOIC28	-40°C to +85°C
MC9S08SE8VWL	SOIC28	-40°C to +105°C
MC9S08SE4VWL	SOIC28	-40°C to +105°C
MC9S08SE8MWL	SOIC28	-40°C to +125°C
MC9S08SE4MWL	SOIC28	-40°C to +125°C
MC9S08SE8CTG	TSSOP16	-40°C to +85°C
MC9S08SE4CTG	TSSOP16	-40°C to +85°C
MC9S08SE8VTG	TSSOP16	-40°C to +105°C

Package Options



Part Number	Package	Temp. Range
MC9S08SE4VTG	TSSOP16	-40°C to +105°C
MC9S08SE8MTG	TSSOP16	-40°C to +125°C
MC9S08SE4MTG	TSSOP16	-40°C to +125°C
MC9S08SE8CRL	PDIP28	-40°C to +85°C
MC9S08SE4CRL	PDIP28	-40°C to +85°C
MC9S08SE8VRL	PDIP28	-40°C to +105°C
MC9S08SE4VRL	PDIP28	-40°C to +105°C
MC9S08SE8MRL	PDIP28	-40°C to +125°C
MC9S08SE4MRL	PDIP28	-40°C to +125°C

Learn More:

For current information about Freescale products and documentation, please visit www.freescale.com/8bit.

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-  Cost Control Management
-  Shortage Management
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-  Excess Inventory Management