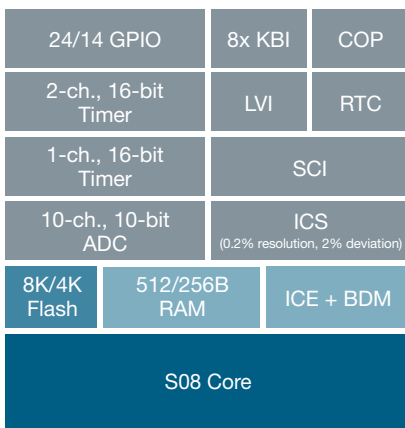8-bit microcontroller

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

24/14 GPIO	8x KBI	COP
2-ch., 16-bit Timer	LVI	RTC
1-ch., 16-bit Timer	SCI	
10-ch., 10-bit ADC	ICS (0.2% resolution, 2% deviation)	
8K/4K Flash	512/256B RAM	ICE + BDM
S08 Core		

Features	Benefits
8-bit HCS08 Central Processor Unit (CPU)	
• Up to 20 MHz HCS08 (10 MHz internal bus frequency)	• Offers high performance up to 5V, ideal for industrial applications
• HC08 instruction set with added BGND instruction	• 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
• Supports up to 32 interrupt/reset sources	• Enables 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, thus simplifying the interface for in-line programming and allowing for more GPIO pins
• Extremely fast, byte-writable programming; as fast as 20 µs (burst mode)	• 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 with a frequency-locked loop (FLL) controlled by internal or external reference	• Eliminates the cost of utilizing external clock components, reducing board space and increasing system reliability
• Precision trimming of internal reference allows typical 0.2 percent resolution and 2 percent deviation over operating temperature and voltage	• Provides one of the most accurate and cost-effective internal clock sources in the market
• Internal reference can be trimmed from 31.25 kHz to 38.4 kHz, allowing for up to 10 MHz FLL output	• Enables adjustment of 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	• 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	
• Outputs 10 mA each; 60 mA max for package	• High-current I/O allows direct drive of LED and other circuits, virtually eliminating external drivers and reducing system costs
• Software-selectable pull-ups on ports when used as inputs; internal pull-up on reset and interrupt request (IRQ) pin	• Reduces customer's system cost by eliminating the need for external resistors
• Software-selectable slew rate control and drive strength on ports when used as output	• Allows user to 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 eliminates external glue logic when interfacing to simple keypads

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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.

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

Features	Benefits
Ganged Output Option for PTB (5:2) and PTC (3:0)	
• Allows single write to change state of multiple pins • Provides option to tie multiple pins from different ports to same control registers	• Safely drives multiple outputs
Multiple Serial Communication Options	
• Serial communication 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
10-channel, 10-bit Analog-to-Digital Converter (ADC)	
• Automatic compare function, software programmable for greater than, equal to or less than conditions	• Easy interface to analog inputs, such as sensors • Used to set conversion complete and generate interrupt only when result matches condition
• Asynchronous clock source	• Can be used to run the 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
• Hardware triggerable using the RTC 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
Real-Time Counter (RTC)	
• 8-bit modulus counter with binary or decimal-based prescaler	• Serve as a cyclic wakeup from low-power modes without the need of external components
• Three software selectable clock sources: 1 kHz internal low-power oscillator, external clock and 32 kHz internal clock	• Provides precise time base for time-of-day, calendar or task scheduling functions
Three Timer Modules	
• Programmable 16-bit timer/PWM modules (TPM1 and TPM2)	• Each channel is independently programmable for input capture, output compare, buffered edge-aligned pulse width modulation (PWM) or buffered center-aligned PWM
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 • 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 too 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
• 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
Development Support	
• Background debugging system • On-chip in-circuit emulation (ICE) with real-time bus capture	• 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

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
MC9S08SE8MRL	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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