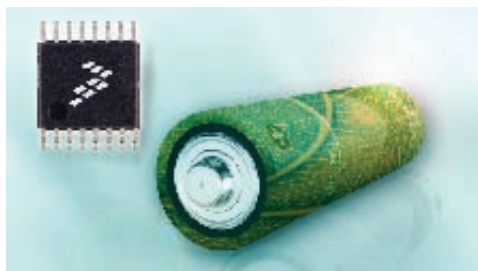


Ultra-Low-Power Microcontrollers

MC9S08QE8/4

Taking the lead in low power



Target Applications

- Low-power wireless applications
- Security systems
- Personal health care devices
- Cell phone accessories
- Commercial smoke detectors
- Security sensors
- Toys

Overview

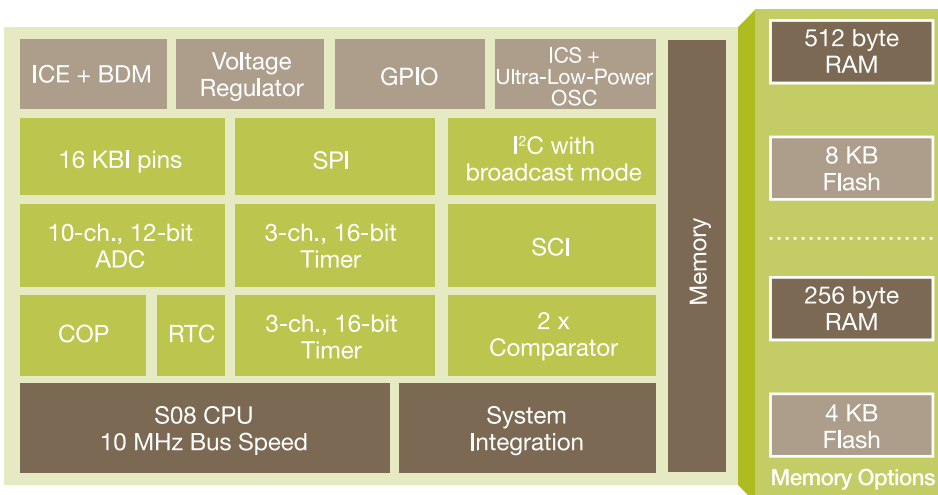
Achieving raw performance is no longer the number one issue—it's now “performance within an energy budget.” Freescale understands this challenge and offers a wide portfolio of S08 devices that help you reach target performance levels while minimizing low power in your design. The QE family demonstrates extreme energy efficiency for ultra-long operating life in battery-powered applications.

A member of the QE family, the QE8 32-pin-LQFP device is pin compatible with the QE128 S08 and ColdFire® V1 devices. The S08QE8 (QE8) microcontroller offers low-power features such as two ultra-low-power stop modes, new low-power run and wait modes, six μ s wake-up time, ultra-low-power external oscillator and clock gating registers to disable clocks to unused peripherals.

The QE8 offers up to 8 KB of flash memory and a 10-channel, 12-bit resolution analog-to-digital converter (ADC). The S08QE8 programs down to 1.8V, a 20 MHz CPU core, two timers, UART, SPI, I²C and two analog comparators—great for cost-effective portable health care applications.

To test your application with the QE8, take the Battery Calculator challenge, available at www.freescale.com/lowpower.

S08QE8/4 Block Diagram



Features

Power-Saving Features

- Two ultra-low-power (ULP) stop modes, one of which allows limited use of peripherals
- New low-power run and wait modes
- 6 μ s typical wake up time from stop mode
- Internal clock Source (ICS)—module containing a frequency locked-loop (FLL) controlled by internal or external reference
- Oscillator (OSC)—loop-control Pierce oscillator; crystal or ceramic resonator range of 31.25 kHz to 38.4 kHz or 1 MHz to 16 MHz
- Clock gating disables clocks to unused peripherals

Benefits

- Allows continued application sampling in a reduced power state which extends battery life
- Allows use of all chip peripherals in a low-power state
- Enables faster execution out of stop modes
- Provides choice of frequencies on-the-fly. Reducing frequency saves current.
- Includes ultra-low-power OSC for accurate timebase in low-power modes
- Provides flexibility to turn off individual modules
- Reduces power consumption

8-bit HCS08 Central Processing Unit (CPU)

- Up to 20 MHz HCS08 CPU from 1.8V to 3.6V and across temperature range of -40°C to +85°C
- HCS08 instruction set with added BGND instruction
- Offers high performance, even at low voltage levels for battery-operated applications
- Provides bus speed operation of 10 MHz from 1.8V to 3.6V
- Easy to learn and use architecture
- Backward object code compatibility with 68HC08 and 68HC05 for reuse of existing libraries can still be used
- Allows for efficient, compact module coding in assembly or C compiler
- BGND allows user to enter background debug mode that takes advantage of on-chip in-circuit emulator (ICE)

On-Chip Memory

- Up to 8 KB flash read/program/erase over full operating voltage and temperature
- Up to range of 1.8V to 3.6V random-access memory (RAM)
- Allows user to take full advantage of in-application, reprogrammability benefits in virtually any environment
- Security circuitry prevents unauthorized access to RAM and flash contents to reduce system power consumption

Features	Benefits
Peripherals	
<ul style="list-style-type: none"> Analog-to-digital converter (ADC)—10-channel, 12-bit resolution; 2.5 μs conversion time; automatic compare function; internal temperature sensor; internal bandgap reference channel; operation in stop mode 	<ul style="list-style-type: none"> Having 10 channels allows up to 10 analog devices to be sampled at extremely high speeds Accuracy and full functionality guaranteed across 1.8V to 3.6V operating voltage of the MCU
<ul style="list-style-type: none"> Timer—two 3-channel (TPM1 and TPM2); selectable input capture, output compare, or buffered edge- or center-aligned PWM on each channel 	<ul style="list-style-type: none"> Two TPMs allow for two different time bases, with a total of twelve timer channels
<ul style="list-style-type: none"> Serial Communications Interface (SCI)—module offering asynchronous communications, 13-bit break option, flexible baud rate generator, double buffered transmit and receive and optional H/W parity checking and generation 	<ul style="list-style-type: none"> Provides standard UART communications peripheral Allows full-duplex, asynchronous, NRZ serial communication between MCU and remote devices Edge interrupt can wake up MCU from low-power mode
<ul style="list-style-type: none"> Two analog comparators with option to compare to an internal reference—output can be optionally routed to timer/pulse width modulator (PWM) as input capture trigger 	<ul style="list-style-type: none"> Requires only single pin for input signal, freeing additional pins for other use Allows other components in system to see result of comparator with minimal delay Can be used for single slope ADC and RC time constant measurements
<ul style="list-style-type: none"> Serial Peripheral Interface (SPI)—one module with full-duplex or single-wire bidirectional; double-buffered transmit and receive; master or slave mode; MSB-first or LSB-first shifting 	<ul style="list-style-type: none"> Allows high speed (up to 5 Mbps) communications to other MCUs or peripherals such as MC1319x RF transceivers
<ul style="list-style-type: none"> I²C 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 	<ul style="list-style-type: none"> I²C port enables increased system memory by using an additional I²C EEPROM. This also creates an opportunity to add an additional I²C device.
Input/Output	
<ul style="list-style-type: none"> 27 General Purpose Input/Output (GPIO), one input-only and one output-only pin 	<ul style="list-style-type: none"> Results in large number of flexible I/O pins that allow developers to easily interface device into their own designs
<ul style="list-style-type: none"> 8 Keyboard Interrupts (KBI) pins with selectable polarity 	<ul style="list-style-type: none"> Can be used for reading input from a keypad or used as general pin interrupts
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 	<ul style="list-style-type: none"> Allows device to recognize runaway code (infinite loops) and resets processor to avoid lock-up states
<ul style="list-style-type: none"> Low-voltage detection with reset or interrupt; selectable trip points 	<ul style="list-style-type: none"> Alarms the developer of voltage drops outside of the typical operating range
<ul style="list-style-type: none"> Illegal op code and illegal address detection with reset 	<ul style="list-style-type: none"> Allows the device to recognize erroneous code and resets the processor to avoid lock-up states
<ul style="list-style-type: none"> Flash block protection 	<ul style="list-style-type: none"> Prevents unintentional programming of protected flash memory, which greatly reduces the chance of losing vital system code for vendor applications
Development Support	
<ul style="list-style-type: none"> Single-wire background debug interface 	<ul style="list-style-type: none"> Allows developers to use the same hardware cables between S08 and V1 ColdFire® platforms
<ul style="list-style-type: none"> Breakpoint capability 	<ul style="list-style-type: none"> Allows single breakpoint setting during in-circuit debugging (plus three more breakpoints in on-chip debug module)
<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> Provides built-in full emulation without expense of traditional emulator

Package Options		
Part Number	Temp. Range	Package
MC9S08QE4CPG	-40°C to +85°C	16-pin PDIP
MC9S08QE4CTG	-40°C to +85°C	16-pin TSSOP
MC9S08QE4CWJ	-40°C to +85°C	20-pin SOIC
MC9S08QE4CWL	-40°C to +85°C	28-pin SOIC
MC9S08QE4CLC	-40°C to +85°C	32-pin LQFP
MC9S08QE8CPG	-40°C to +85°C	16-pin PDIP
MC9S08QE8CTG	-40°C to +85°C	16-pin TSSOP
MC9S08QE8CWJ	-40°C to +85°C	20-pin SOIC
MC9S08QE8CWL	-40°C to +85°C	28-pin SOIC
MC9S08QE8CLC	-40°C to +85°C	32-pin LQFP

Cost-Effective Development Tools

DEMO9S08QE8

\$69*

Cost-effective demonstration kit including the QE8 daughter card, as well as serial port and built-in USB-BDM cable for debugging and programming. This tool includes a lab that demonstrates the ultra-low-power benefits.

DC9S08QE8

\$10*

Daughter card of QE8 to use on your DEMOQE128 demonstration kit.

CodeWarrior® Development Studio for Microcontrollers 6.1

Complimentary** Special Edition

CodeWarrior Development Studio for Microcontrollers is a single tool suite that supports software development for Freescale's 8- and 32-bit V1 ColdFire microcontrollers. Designers can further accelerate application development with the help of Processor Expert™, an award-winning rapid application development tool integrated into the CodeWarrior tool suite.

* Prices indicated are MSRP

** Subject to license agreement

Learn More:

For more information about the Flexis QE family, please visit www.freescale.com/lowpower.