Ultra-Low-Power Microcontrollers

MC9S08QB8/4: Simplicity with Substance

Taking the lead in low power

Target Applications

- Battery-powered applications
- Residential/commercial garage door openers
- Smoke detectors
- Remote window shutters
- Remote control applications
- Battery-operated toys and games

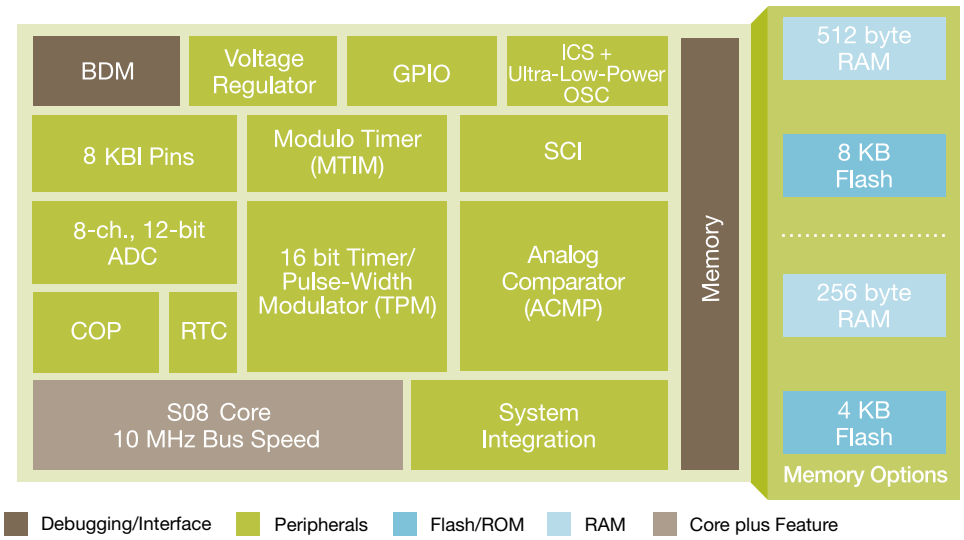
Overview

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 QB family demonstrates extreme energy efficiency for ultra-long operating life in battery-powered applications.

As a subset of QE family, the QB8 16-pin TSSOP and 28-pin SOIC are pin compatible with the QE8 device. The S08QB8 (QB8) microcontroller offers low-power features such as two ultra-low-power stop modes, new low-power run and wait modes, 6 µs wake-up time, ultra-low-power external oscillator and clock gating registers to disable clocks to unused peripherals.

The QB8 offers up to 8 KB of flash memory and an 8-channel, 12-bit resolution analog-to-digital converter (ADC). The S08QB8 can be powered down to 1.8V and still able to operate at maximum 20 MHz CPU speed. QB8 consists of a 8-bit modulo timer, a 16-bit timer/pulse width modulator, UART, real time counter, analog comparator, 8-channel keyboard interrupt module—perfect for cost-effective, battery sensitive, portable, low-power applications.

S08QB8/4 Block Diagram



Features	Benefits
Power-Saving Features	
• Two ultra-low-power stop modes, one of which allows limited use of peripherals	• Allows continued application sampling in a reduced power state which extends battery life
• New low-power run and wait modes	• Allows use of all chip peripherals in a low-power state
• 6 µs typical wake up time from stop mode	• Enables faster execution out of stop modes
• Internal clock Source (ICS)—module containing a frequency locked-loop (FLL) controlled by internal or external reference	• Provides choice of frequencies on the fly. Reducing frequency saves current.
• 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	• Includes ultra-low-power OSC for accurate timebase in low-power modes
• Clock gating disables clocks to unused peripherals	• 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	• 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
• HCS08 instruction set with added BGND instruction	• 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
On-Chip Memory	
• Up to 8 KB flash read/program/erase over full operating voltage and temperature	• Allows user to take full advantage of in-application, reprogrammability benefits in virtually any environment
• Up to 512 bytes of random access memory(RAM) with low ram retention voltage and security feature	• RAM can hold content with low voltage supply. This reduces over all power consumption. • Security circuitry prevents unauthorized access to RAM and flash content.

Features	Benefits
Peripherals	
• ADC—8-channel, 12-bit resolution for 28-pin and 24-pin packages, 10-bit resolution for 16-pin package; 2.5 µs conversion time for both 10-bit and 12-bit resolution; automatic compare function; internal temperature sensor; internal bandgap reference channel; operation in low-power stop mode	• Allows up to 8 external ADC channels to be sampled at extremely high speeds • Accuracy and full functionality guaranteed across 1.8V to 3.6V operating voltage of the MCU
• Timer/pulse-width modulator (TPM)—one channel with 16-bit counter, selectable input capture, output compare, or buffered edge- or center-aligned PWM • The TPM channel is located at PTA0 by default but it can also be selected by software to relocate at PTB5 port	• 16-bit base free running counter allow higher resolution for input capture results and longer TPM period comparing to the conventional 8-bit base counter • TPM channel reposition at different I/O port allows flexibility to apply TPM functions at different pin out as application desire
• 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	• 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
• Analog comparator (ACMP) with option to compare to an internal reference voltage. Output can be optionally routed to TPM as input capture trigger	• 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
• 8-bit module timer module with 8-bit prescaler (MTIM)	• A timer overflow interrupt can be enabled to generate periodic interrupts for time-based software loops
Input/Output	
• Up to 22 general purpose input/output (GPIO), one input-only and one output-only pin	• Results in large number of flexible I/O pins that allow developers to easily interface device into their own designs
• 8 keyboard interrupts (KBI) pins with selectable polarity	• Can be used for reading input from a keypad or used as general pin interrupts
System Protection	
• Watchdog computer operating properly (COP) reset with option to run from dedicated 1 kHz internal clock source or bus clock	• Allows device to recognize runaway code (infinite loops) and resets processor to avoid lock-up states
• Low-voltage detection with reset or interrupt; selectable trip points	• Alarms the developer of voltage drops outside of the typical operating range
• Illegal op code and illegal address detection with reset	• Allows the device to recognize erroneous code and resets the processor to avoid lock-up states
• Flash block protection	• Prevents unintentional programming of protected flash memory, which greatly reduces the chance of losing vital system code for vendor applications
Development Support	
• Breakpoint capability	• Allows single breakpoint setting during in-circuit debugging (plus three more breakpoints in on-chip debug module)

Package Options

Part Number	Temp. Range	Package
MC9S08QB8CWL	-40°C to +85°C	28-pin SOIC
MC9S08QB8CGK	-40°C to +85°C	24-pin QFN
MC9S08QB8CTG	-40°C to +85°C	16-pin TSSOP
MC9S08QB4CWL	-40°C to +85°C	28-pin SOIC
MC9S08QB4CGK	-40°C to +85°C	24-pin QFN
MC9S08QB4CTG	-40°C to +85°C	16-pin TSSOP

Cost-Effective Development Tools

DEMO9S08QB8

$69*

Cost-effective demonstration kit including QE family base board being reused by QB family and the QB8 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.

DC9S08QB8

$10*

Daughter card of QB8 to use on your DEMOQE base board.

CodeWarrior™ Development Studio for Microcontrollers 6.2

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 QB Family, please visit **www.freescale.com/lowpower.**

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