

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

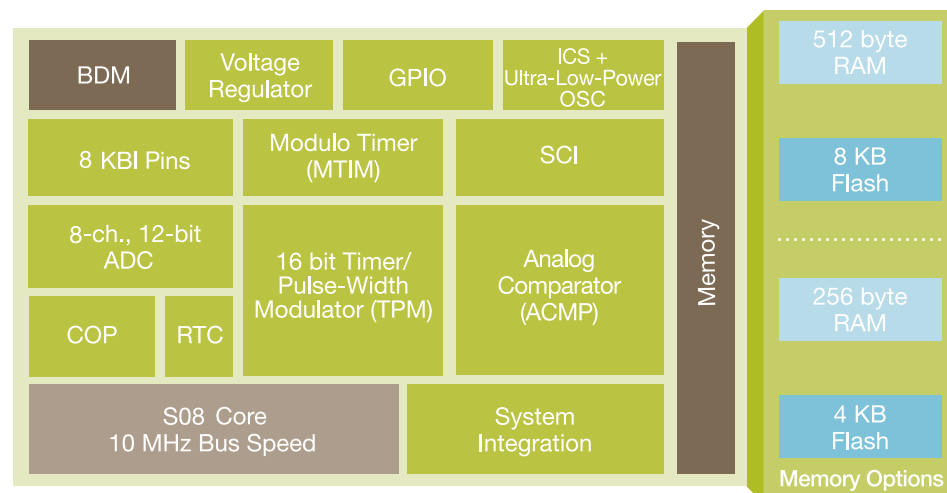
Overview

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 μ s 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



■ Debugging/Interface ■ Peripherals ■ Flash/ROM ■ RAM ■ Core plus Feature

Features

Benefits

Power-Saving Features

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| <ul style="list-style-type: none"> • Two ultra-low-power stop modes, one of which allows limited use of peripherals • New low-power run and wait modes • 6 μs typical wake up time from stop mode | <ul style="list-style-type: none"> • 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 |
| <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • Provides choice of frequencies on the fly. Reducing frequency saves current. • Includes ultra-low-power OSC for accurate timebase in low-power modes |
| <ul style="list-style-type: none"> • Clock gating disables clocks to unused peripherals | <ul style="list-style-type: none"> • Provides flexibility to turn off individual modules • Reduces power consumption |

8-bit HCS08 Central Processing Unit (CPU)

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| <ul style="list-style-type: none"> • Up to 20 MHz HCS08 CPU from 1.8V to 3.6V and across temperature range of -40°C to +85°C | <ul style="list-style-type: none"> • 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 |
| <ul style="list-style-type: none"> • HCS08 instruction set with added BGND instruction | <ul style="list-style-type: none"> • 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

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|--|---|
| <ul style="list-style-type: none"> • Up to 8 KB flash read/program/erase over full operating voltage and temperature | <ul style="list-style-type: none"> • Allows user to take full advantage of in-application, reprogrammability benefits in virtually any environment |
| <ul style="list-style-type: none"> • Up to 512 bytes of random access memory(RAM) with low ram retention voltage and security feature | <ul style="list-style-type: none"> • 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	Package Options		
Peripherals			Part Number	Temp. Range	Package
<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> 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 			
<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> 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 				
<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"> Analog comparator (ACMP) with option to compare to an internal reference voltage. Output can be optionally routed to TPM 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"> 8-bit module timer module with 8-bit prescaler (MTIM) 	<ul style="list-style-type: none"> A timer overflow interrupt can be enabled to generate periodic interrupts for time-based software loops 				
Input/Output			Cost-Effective Development Tools		
<ul style="list-style-type: none"> Up to 22 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 		DEMO9S08QB8		
<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 		\$69*		
System Protection			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.		
<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 		DC9S08QB8		
<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 		\$10*		
<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 		Daughter card of QB8 to use on your DEMOQE base board.		
<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 		CodeWarrior™ Development Studio for Microcontrollers 6.2		
Development Support			Complimentary** Special Edition		
<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) 		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.