Flexis™ Microcontroller Series

MC9S08QE128
8-bit Fact Sheet

Energy Efficient Solutions
optimized for low power ™

S08QE128 Block Diagram

ICE + BDM	Voltage Regulator	GPIO	ICS + ULP OSC
16 KBI pins	2 x SPI	2 x I²C	
24-ch., 12-bit ADC	6-ch., 16-bit Timer	2 x SCI	
COP / RTC	2 x 3-ch., 16-bit Timers	2 x Comparator	
S08 CPU 25 MHz Bus Speed	System Integration		

Memory

Memory Options:
- 8 KB SRAM
- 128 KB Flash
- 4 KB SRAM
- 64 KB Flash

Target Applications
- Health care monitoring and instrumentation
- HVAC and building control
- Gas, water and heater meters
- Security cameras
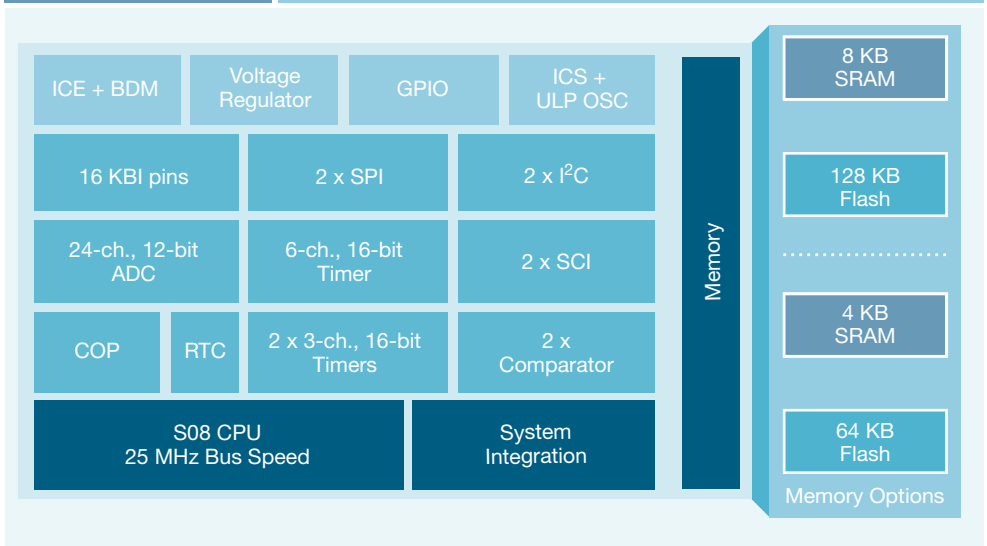- Digital cameras
- Measurement equipment

Overview

The Flexis™ series of controllers is the connection point on the Freescale Controller Continuum, where 8- and 32-bit compatibility becomes reality. The Flexis series includes complementary families of 8-bit S08 and 32-bit ColdFire® V1 microcontrollers that share a common set of peripherals and development tools to deliver the ultimate in migration flexibility. The QE family, comprised of a pin-compatible 8-bit and 32-bit device duo, is the first family in the Flexis series.

The S08QE128 device pushes the boundaries of 8-bit performance with up to 128 KB of flash memory and a 24-channel, 12-bit analog-to-digital converter (ADC). The S08QE128 includes up to 3.6V supply voltage, a 50 MHz CPU core and three timers for improved motor control—perfect for health care monitoring instrumentation and electronics such as digital and web cameras.

The 8-bit S08QE128 is pin-, peripheral- and tool-compatible with the 32-bit MCF51QE128 device, providing unprecedented design freedom across the performance spectrum.

Features	Benefits
8-bit HCS08 Central Processing Unit (CPU)	
• Up to 50.233 MHz HCS08 CPU from 2.1V to 3.6V, and 20 MHz CPU at 1.8V to 2.1V 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 25.117 MHz from 2.1V to 3.6V and 10 MHz from 1.8 to 2.1V
• 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 • BGND allows user to enter background debug mode that takes advantage of on-chip in-circuit emulator (ICE)
• Support for up to 32 interrupt/reset sources	• Allows for software flexibility and optimization for real-time applications
On-Chip Memory	
• Up to 128 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 8 KB random-access memory (RAM)	• Security circuitry prevents unauthorized access to RAM and flash contents to reduce system power consumption
Power-Saving Modes	
• Two ultra-low-power (ULP) stop modes, one of which allows limited use of peripherals • New ULP power wait mode • 6 µs typical wake up time from stop3 mode	• Allows continued application sampling in a reduced power state which extends battery life
• 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	• Eliminates use of an external clock source. This ultimately reduces system costs associated with development • Includes ultra-low-power OSC for accurate timebase in low-power modes

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Features	Benefits
Peripherals	
• 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	• 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
• Analog Digital Converter (ADC)—24-channel, 12-bit resolution; 2.5 µs conversion time; automatic compare function; 1.7 mV/°C temperature sensor; internal bandgap reference channel; operation in stop3	• Having 24 channels allows up to 24 analog devices to be sampled at extremely high speeds. Full functionality across operational voltage of the MCU
• 2x Serial Communications Interface (SCI)—Two modules 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
• 2x SCI (Serial Peripheral Interfaces)—Two modules with full-duplex or single-wire bidirectional; double-buffered transmit and receive; master or slave mode; MSB-first or LSB-first shifting	• Having two SPI provides dedication to two separate devices. An example would be to have one SPI dedicated to a ZigBee®-ready transceiver and the other for MCUs or peripherals
• Time pulse-width modulation (TPM)—one 6-channel (TMP3) and two 3-channel (TPM1 and TPM2); selectable input capture, output compare, or buffered edge- or center-aligned PWM on each channel	• Three TPMs allow for three different time bases, with a total of twelve timer channels
• Two 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	• Two I²C ports enable increased system memory by using an additional I²C EEPROM. This also creates an opportunity to add an additional I²C device
Input/Output	
• 70 GPIO (General Purpose Input/Output), 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
• 16 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 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	
• Single-wire background debug interface	• Allows developers to use the same hardware cables between S08 and ColdFire V1 platforms
• Breakpoint capability	• Allows single breakpoint setting during in-circuit debugging (plus three more breakpoints in on-chip debug module)
• 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	• Provides built-in full emulation without expense of traditional emulator

Package Options

Part Number	Temp. Range	Package
MC9S08QE128CLK	-40°C to +85°C	80 LQFP
MC9S08QE128CLH	-40°C to +85°C	64 LQFP
MC9S08QE128CFT	-40°C to +85°C	48 QFN
MC9S08QE128CQD	-40°C to +85°C	44 QFP
MC9S08QE128CLC	-40°C to +85°C	32 LQFP
MC9S08QE64CLH	-40°C to +85°C	64 LQFP

Cost-Effective Development Tools
DEMOQE128
$99*

Cost-effective demonstration kit, including the S08 and ColdFire® V1 daughter cards, as well as a serial port and built-in USB-BDM cable for debugging and programming.

EVBQE128
$325*

Full-featured evaluation system for the QE128 device family. This evaluation system enables full evaluation of both the MC9S08QE128 and MCF51QE128 devices.

CodeWarrior® Development Studio for Microcontrollers 6.0
Complimentary Special Edition**
CodeWarrior Development Studio for Microcontrollers is a single tool suite that supports software development for Freescale's 8- and 32-bit ColdFire V1 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/flexis.**

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