

# MCF51QE128

## 32-bit Fact Sheet



### Target Applications

- HVAC building and control systems
- Health care monitoring and instrumentation
- Fire/security control and monitoring systems
- Factory and automation systems
- Measurement equipment
- Hand-held medical/industrial applications
- Low-power industrial applications

### Overview

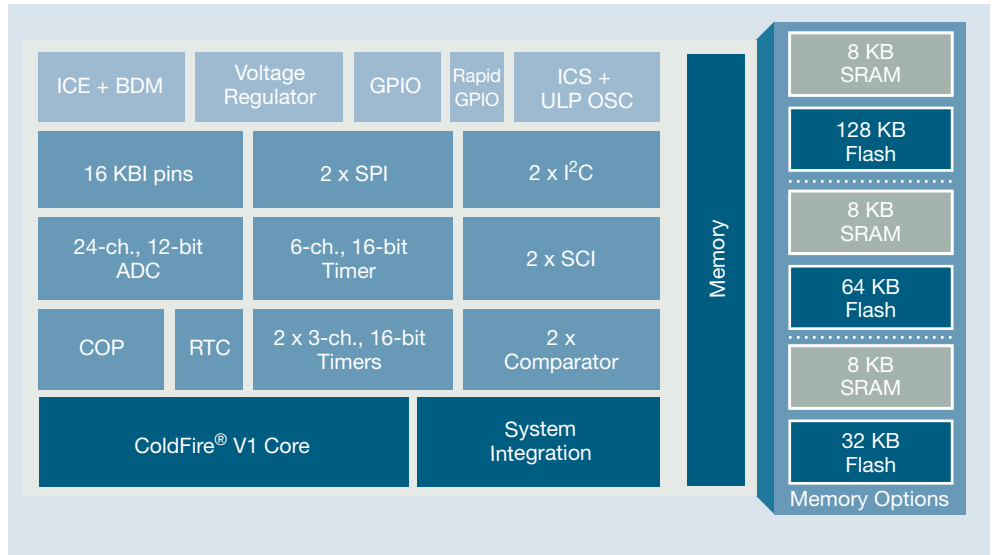
The Flexis™ series of controllers is the connection point on the Freescale Controller Continuum, where 8- and 32-bit compatibility becomes reality. The Flexis series includes complementary families of 8-bit S08 and 32-bit ColdFire® V1 microcontrollers that share a common set of peripherals and development 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 32-bit MCF51QE128 device extends the low end of the ColdFire embedded controller family with up to 128 KB flash memory and a 12-bit analog to digital converter (ADC) with up to 24 channels. The MCF51QE128 includes up to 3.6V supply voltage, a 50 MHz CPU core and three timers for improved motor control—for medical devices such as health care monitoring instrumentation and industrial equipment including networked smoke detectors and security cameras.

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

MCF51QE Block Diagram



### Features

#### 32-Bit ColdFire V1 Central Processing Unit (CPU)

- Up to 50 MHz ColdFire V1 core 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
- ColdFire Instruction Set Revision C (ISA\_C)
- Support for up to 256 interrupt/reset sources

### Benefits

- 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
- Provides additional instructions for easy handling of 8-bit and 16-bit data
- 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
- 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
- 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

- Allows continued application sampling in a reduced power state which extends the battery life
- 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

Features	Benefits
<b>Peripherals</b> <ul style="list-style-type: none"> <li>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</li> <li>Analog Digital Converter (ADC) up to 24-channel, 12-bit resolution; 2.5 <math>\mu</math>s conversion time; automatic compare function; 1.7 mV/<math>^{\circ}</math>C temperature sensor; internal bandgap reference channel; operation in stop3</li> <li>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</li> <li>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</li> <li>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</li> <li>Two I<sup>2</sup>Cs 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</li> </ul>	<ul style="list-style-type: none"> <li>Requires only single pin for input signal, freeing up additional pins for other use</li> <li>Allows other components in system to see result of comparator with minimal delay</li> <li>Can be used for single slope ADC and RC time constant measurements</li> <li>Having 24 channels allows up to 24 analog devices to be sampled at extremely high speeds. Provides functionality across operational voltage of the MCU</li> <li>Provides standard UART communications peripheral</li> <li>Allows full-duplex, asynchronous, NRZ serial communication between MCU and remote devices</li> <li>Edge interrupt can wake up MCU from low-power mode</li> <li>Having two SPI provides dedication to two separate devices. An example would be to have one SPI dedicated to a ZigBee<sup>®</sup>-ready transceiver, and the other for MCUs or peripherals</li> <li>Three TPMs allow for three different time bases, with a total of twelve timer channels</li> <li>Two I<sup>2</sup>C ports enable increased system memory by using an additional I<sup>2</sup>C EEPROM. This also creates an opportunity to add an additional I<sup>2</sup>C device</li> </ul>
<b>Input/Output</b> <ul style="list-style-type: none"> <li>16 bits of Rapid General Purpose Input/Output (RGPIO) connected to the CPU's high-speed local bus with set, clear and toggle functionality</li> <li>70 GPIO (General Purpose Input/Output), one input-only and one output-only pin</li> <li>16 Keyboard Interrupts (KBI) pins with selectable polarity</li> </ul>	<ul style="list-style-type: none"> <li>Results in large number of flexible I/O pins that allow developers to easily interface device into their own designs</li> <li>Can be used for reading input from a keypad or used as general pin interrupts</li> </ul>
<b>System Protection</b> <ul style="list-style-type: none"> <li>Watchdog computer operating properly (COP) reset with option to run from dedicated 1 kHz internal clock source or bus clock</li> <li>Low-voltage detection with reset or interrupt; selectable trip points</li> <li>Illegal op code detection with reset</li> <li>Flash block protection</li> </ul>	<ul style="list-style-type: none"> <li>Allows device to recognize runaway code (infinite loops) and resets processor to avoid lock-up states</li> <li>Alarms the developer of voltage drops outside of the typical operating range</li> <li>Allows the device to recognize erroneous code and resets the processor to avoid lock-up states</li> <li>Prevents unintentional programming of protected flash memory, which greatly reduces the chance of losing vital system code for vendor applications</li> </ul>
<b>Development Support</b> <ul style="list-style-type: none"> <li>Classic ColdFire Debug B+ functionality mapped into a single-pin BDM interface</li> <li>Real-time debug support</li> <li>Program trace support</li> </ul>	<ul style="list-style-type: none"> <li>Allows developers to use the same hardware cables between S08 and ColdFire V1 platforms</li> <li>Six hardware breakpoints which can be configured into a 1- or 2-level trigger with a programmable response (CPU halt or interrupt)</li> <li>Capture of processor status and debug data into on-chip trace buffer provides program trace capabilities and programmable start/stop recording conditions</li> </ul>

Package Options		
Part Number	Temp. Range	Package
MCF51QE128CLK	-40 $^{\circ}$ C to +85 $^{\circ}$ C	80 LQFP
MCF51QE128CLH	-40 $^{\circ}$ C to +85 $^{\circ}$ C	64 LQFP
MCF51QE64CLH	-40 $^{\circ}$ C to +85 $^{\circ}$ C	64 LQFP
MCF51QE32CLH	-40 $^{\circ}$ C to +85 $^{\circ}$ C	64 LQFP
MCF51QE32LH	0 $^{\circ}$ C to +70 $^{\circ}$ C	64 LQFP

### Cost-Effective Development Tools

#### DEMOQE128

\$99\*

Cost-effective demonstration kit, including the S08 and ColdFire<sup>®</sup> 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<sup>®</sup> 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-bit 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](http://www.freescale.com/flexis).