Flexis™ Microcontroller Series

MCF51QE128
32-bit Fact Sheet

Energy Efficient Solutions
optimized for low power™

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
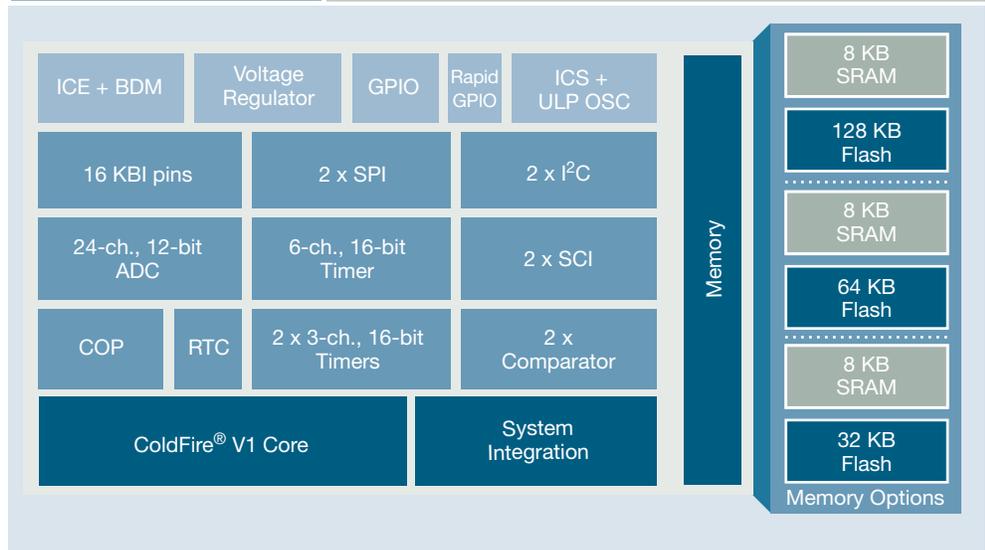
Overview

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—perfect 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

ICE + BDM	Voltage Regulator	GPIO	Rapid 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
ColdFire® V1 Core		System Integration		

Memory

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

Features	Benefits
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	• 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
• ColdFire Instruction Set Revision C (ISA_C)	• Provides additional instructions for easy handling of 8-bit and 16-bit data
• Support for up to 256 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	• Security circuitry prevents unauthorized access to RAM and flash contents to reduce system power consumption
• Up to 8 KB random-access memory (RAM)	
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 the battery life
• Internal clock Source (ICS) Module containing a frequency locked-loop (FLL) controlled by internal or external reference	• Eliminates use of an external clock source. This ultimately reduces system costs associated with development
• 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

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Features / Benefits

Peripherals

Features	Benefits
• 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 up 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) up to 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. Provides 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 I²Cs 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

Features	Benefits
• 16 bits of Rapid General Purpose Input/Output (RGPIO) connected to the CPU's high-speed local bus with set, clear and toggle functionality • 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

Features	Benefits
• 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

Features	Benefits
• Classic ColdFire Debug B+ functionality mapped into a single-pin BDM interface	• Allows developers to use the same hardware cables between S08 and ColdFire V1 platforms
• Real-time debug support	• Six hardware breakpoints which can be configured into a 1- or 2-level trigger with a programmable response (CPU halt or interrupt)
• Program trace support	• Capture of processor status and debug data into on-chip trace buffer provides program trace capabilities and programmable start/stop recording conditions

Package Options

Part Number	Temp. Range	Package
MCF51QE128CLK	-40°C to +85°C	80 LQFP
MCF51QE128CLH	-40°C to +85°C	64 LQFP
MCF51QE64CLH	-40°C to +85°C	64 LQFP
MCF51QE32CLH	-40°C to +85°C	64 LQFP
MCF51QE32LH	0°C to +70°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-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.**

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