



32-bit Microcontrollers

## MCF51EM

Smart metering made easy with V1 ColdFire® MCU

### Target Applications

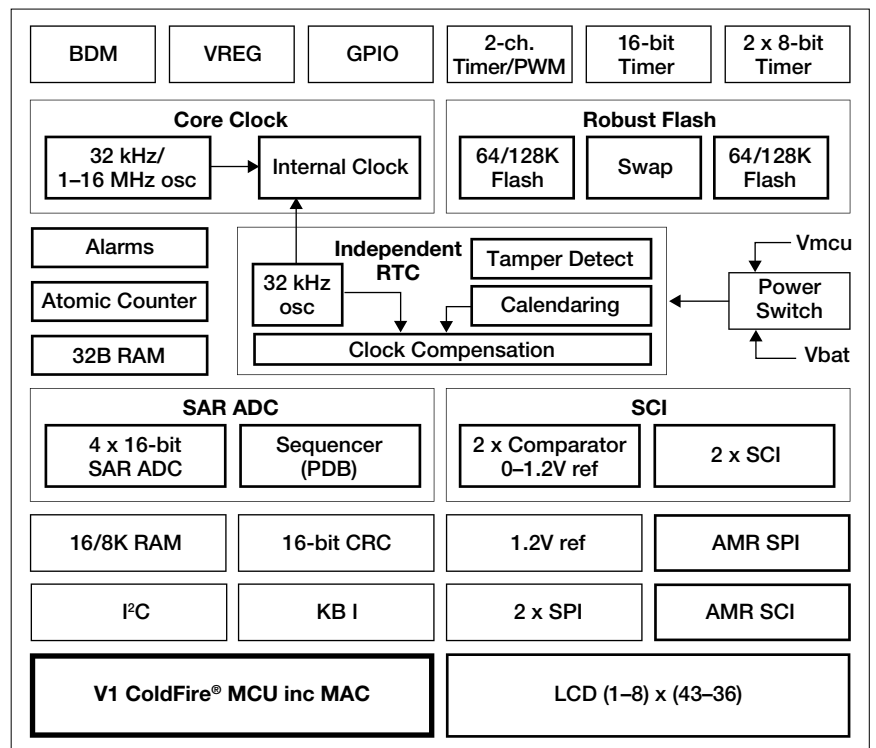
- Smart metering
- Sensor collection
- Phase measurement units
- Industrial energy measurement
- 1- and 3- phase electricity meters

### Overview

MCF51EM 32-bit MCU is a highly-integrated single-chip device with high-performance peripherals.

Unique features of the MCF51EM family include 4 x 16-bit SAR ADC with PDB for precision sequencing of four simultaneous conversions and four conversions with small delay required for CT compensation, up to 288 segment LCD driver and two blocks of 128 KB flash (256 KB total), independent RTC with tamper detection providing more than 15 years from CR2032 coin cell and more than 30 years when powered by MCU, 32-bit MAC and AMR SPI for 5V AMR interface. These features are ideal for smart metering applications.

MCF51EM Block Diagram



An optimized metering solution with MCF51EM MCU provides a turnkey reference design and development tools to shorten and simplify the smart metering design process.

## Development Tools

### DEMOEM (\$99)

Cost-effective demo based on MCF51EM256 with integrated BDM LCD glass, SPI external memory and MC9S08QE8 to emulate 3-phase signals.

### CodeWarrior™ Development Studio for Microcontrollers 6.2 Special Edition (Complimentary)

CodeWarrior Development Studio for Microcontrollers is a single tool suite that supports software development for Freescale's 8-bit and 32-bit 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.

### Product Selector Guide

Part Number	Temp Ranges	Package
MCF51EM256CLK	-40°C to +85°C	80LQFP
MCF51EM256CLL	-40°C to +85°C	100LQFP
MCF51EM128CLK	-40°C to +85°C	80LQFP
MCF51EM128CLL	-40°C to +85°C	100LQFP

Features	Benefits
<b>CPU and System Configuration</b>	
32-bit V1 ColdFire CPU offering 47MIPS at 50 MHz 3.3V single supply	Offers high performance through the entire voltage range
<b>On-Chip Memory</b>	
Up to 256 KB flash (dual bank)	Allows user to take full advantage of in-application, re-programmability benefits, robust update can keep system running while updating software
Up to 16 KB SRAM	Offers a security circuitry to help prevent unauthorized access to RAM
<b>Power Management</b>	
Low-power operation mode	Rapid response to interrupts from the low-power sleep mode
<b>Peripherals</b>	
4 x 16 bit SAR ADC	SoC integrated solution for energy metering
288 segment LCD driver	Flexible segment configuration
Up to 50 general purpose input/output (GPIO)	Results in a large number of flexible I/O pins
iRTC	Tamper detection
AMR SPI	Interface for automatic meter reading
<b>Development Support</b>	
Background debug mode for in-circuit debugging	Real-time trace and debug support

### MQX Software for ColdFire Microcontrollers

Freescale provides MQX embedded software optimized for ColdFire architecture. MQX offers a full-featured kernel RTOS with small configurable memory footprint and optimized real-time performance. MQX is complimentary for the MCF51EM family, and is available with full source code. MQX will shorten your development cycle while allowing you to focus on application development by incorporating a rich set of demos, including:

- **Single-Phase Electricity Metering**  
Accurate electrical parameters measuring by using the combined ADC, PDB and voltage reference module while utilizing the MQX critical mode interrupt handling method for timing critical situations.

- **Robust Flash Update**  
Allowing user to re-program the unit while the metering application is running.
- **Robust RTC**  
Including calendar, temper detection with timestamp and cause and standby RAM.

MQX products are tightly integrated with CodeWarrior Development Studio and IAR tools\* to allow developers to quickly create their own MQX-based applications.

\* Coming Soon

**Learn more:** For more information, visit [freescale.com/coldfire](http://freescale.com/coldfire), [freescale.com/metering](http://freescale.com/metering) and [freescale.com/mqx](http://freescale.com/mqx).