

## ColdFire® Embedded Controllers

# MCF5221x

## Fact Sheet

### Overview

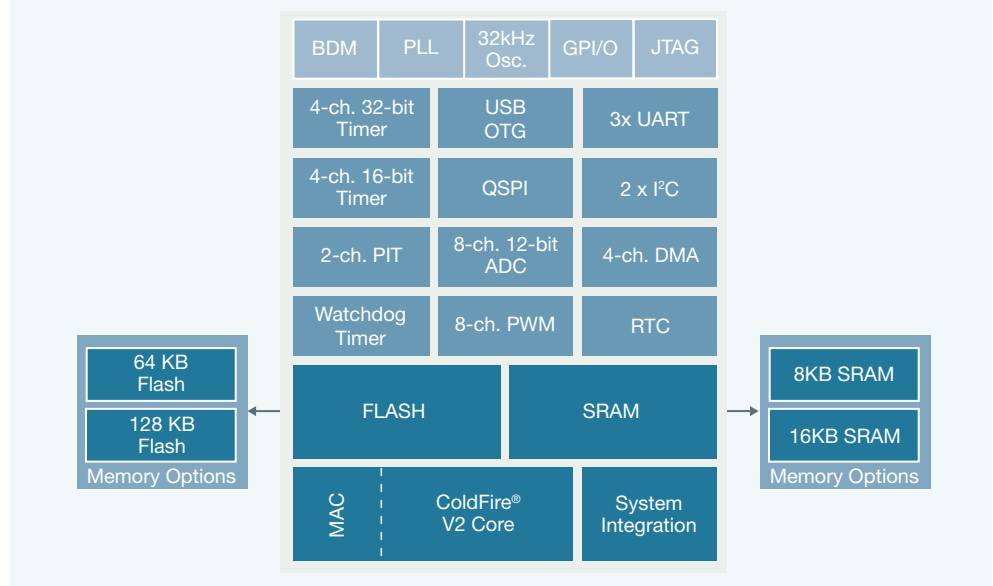
Freescale Semiconductor continues to expand the broad portfolio of ColdFire® embedded controllers with the low cost, low power MCF5221x product family. The MCF5221x represents a family of highly-integrated 32-bit microcontrollers based on the popular Version 2 ColdFire core with a multiply-accumulate unit (MAC) and divider providing 76 Dhrystone 2.1 MIPS at a frequency up to 80 MHz out of flash memory. An integrated USB On-The-Go (OTG) controller makes it ideal for applications requiring device or host connectivity functionality.

The MCF5221x gives product designers a cost-effective, full-featured solution that allows them to create next-generation systems quickly and efficiently. In addition to the USB-OTG, the MCF5221x features 16 Kbytes of internal static random access memory (SRAM) and up to 128 Kbytes of flash memory, 8-channel, 12-bit analog-to-digital converter (ADC), four 32-bit timers with DMA request capability and a 4-channel DMA controller.

The communications peripherals enable easy connection to other systems. Three universal asynchronous receiver/transmitters (UARTs) provide medium to long distance communication to other control systems or computers. Two inter-integrated circuit (I<sup>2</sup>C) modules and a queued serial peripheral interface (QSPI) allow in-system communication to connected peripherals.

The MCF5221x family is ideal for embedded control applications needing USB connectivity such as general industrial control, factory and home automation, electronic point-of-sale terminals, medical devices, electronic test equipment and consumer applications.

### MCF5221x Block Diagram



### Features

### Benefits

#### 32-Bit ColdFire V2 Central Processing Unit (CPU)

Up to 80-MHz/3.3V CPU

Offers high performance at low voltage levels for battery-operated 32-bit applications

Temperature range of -40°C to 85°C and 0°C to 70°C

Allows for application development in the industrial market or consumer market

Support for up to 127 interrupt sources with priority and level encoding

Allows for software flexibility and optimization for real-time applications

Multiply-Accumulate (MAC) unit with 32-bit accumulator to support 16x16 or 32x32 operations.

Provides hardware acceleration of multiply and divide instructions improving overall system performance

#### On-Chip Memory

Up to 128 Kbytes of interleaved flash memory supporting 2-1-1 accesses

Allows user to take full advantage of in-application, re-programmability benefits in virtually any environment

Up to 16-Kbyte dual-ported SRAM on CPU internal bus, supporting core and DMA access with standby power supply support

Allows write access from the DMA and CPU simultaneously, freeing the CPU resource quickly

#### Power Management

Reduced power wait mode

Allows for analog sampling in a reduced power state

Internal relaxation oscillator—internal clock source

Eliminates the use of an external clock source which ultimately reduces the system costs

Oscillator (OSC)—Loop-control Pierce oscillator; Fundamental mode Crystal or ceramic resonator

Improves communications peripheral timing accuracy

Features Cont.	Benefits Cont.
<b>Peripherals</b>	
Universal Serial Bus On-The-Go (USB OTG) dual-mode host and device controller	Allows development of a fully compliant peripheral device that can also dynamically assume the role of a USB host
Battery backed Real Time Clock (RTC) with 32 KHz oscillator	Adds time of day and calendar functionality to system even while main power is removed from MCU.
Fast Analog to Digital Converter (ADC) 12-bit resolution; 1.125 $\mu$ s conversion time; automatic compare function and offset correction	Eight channels allows up to eight analog devices to be sampled at extremely high speeds with quick conversion times. Dual converters allow differential measuring and increase conversion speed
Serial communications interface (UART) 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 full duplex asynchronous/synchronous receiver and transmitter deriving an operating frequency from the internal bus clock or external clock using the timer pin
Serial peripheral interfaces (QSPI) with full-duplex or single-wire bidirectional; double-buffered transmit and receive; master or slave mode; MSB-first or LSB-first shifting	Allows full-duplex, asynchronous, NRZ serial communication between MCU and remote devices. Queued SPI provides messaging automation and buffering of messages
Two I <sup>2</sup> C modules with up to 400 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 I <sup>2</sup> C ports enable use of the external OTG interface, while having an additional expansion channel available that can be used by an LCD controller or IIC EEPROM, for example. This provides high bandwidth and ease of connectivity
Timer (TIM)—One 4-channel; Selectable input capture, output compare on each channel	Generates output waveforms and timer software delays. These functions allow simultaneous input waveform measurements and output waveform generation.
Pulse-Width Modulation (PWM)—8 channel module with PCM control	New PCM function eases external filter requirements
Two Programmable Interrupt Timer Modules (PIT)	Allows two programmable periodic interrupts to system. The second timer allows system application to have their own timer while scheduler or OS has its own
DMA controller with 4 fully programmable channels	Enables fast transfers of data with minimal processor interaction
<b>Input/Output</b>	
Up to 56 general purpose input/output (GPIO)s and one input-only and one output only pin	Results in a large number of flexible I/O pins that allow vendors to easily interface the device into their own designs
<b>System Protection</b>	
Secondary Watchdog Timer (SWT) Module	Allows the device to recognize run-away code and resets the processor to avoid lock-up states
Low-voltage detection with reset or interrupt	Alarms the system of voltage drops outside of the typical operating range
Flash block protection	Helps to prevent unauthorized access to flash RAM which greatly reduces the chance of losing vital system code
<b>Development Support</b>	
Real-time Trace Support	A fundamental debug function that defines the dynamic execution path
Background Debug Module (BDM)	Single wire interface for both programming and debugging that allows developers to use the same interface for multiple platforms
Breakpoint capability	Allows six breakpoints (4 PC, 1 address, and 1 data) that can be configured into one or two level trigger

## Target Applications

- HVAC building and control systems
- Medical instrumentation and monitors
- Fire/security control and monitoring systems
- Factory and automation systems
- Measurement equipment
- Hand-held medical/industrial applications
- Lighting control
- Industrial instrumentation
- Consumer electronics
- Low power industrial applications

## Cost Effective Development Tools

### M52211EVB

### US\$299 MSRP

Full-featured evaluation system for both the MCF5221x and the MCF521xx device families.

### CodeWarrior® Development Studio for Microcontrollers 6.4 Complimentary

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

### ColdFire USB Software Stack by CMX Complimentary

Freescale and CMX have collaborated to provide a complimentary USB stack for ColdFire Microcontrollers. This complimentary software package provides both USB host and USB device stacks for General HID, Joystick HID, Keyboard HID and Mouse HID.

## Package Options

Part Number	Temp. Range	Package
MCF52210CAE66	-40°C to 85°C	64 LQFP
MCF52210CEP66	-40°C to 85°C	64 QFN
MCF52210CVM66	-40°C to 85°C	81 MAPBGA
MCF52210CVM80	-40°C to 85°C	81 MAPBGA
MCF52211CAE66	-40°C to 85°C	64 LQFP
MCF52211CEP66	-40°C to 85°C	64 QFN
MCF52211CVM66	-40°C to 85°C	81 MAPBGA
MCF52211CVM80	-40°C to 85°C	81 MAPBGA
MCF52211CAF80	-40°C to 85°C	100 LQFP
MCF52212CAE50	-40°C to 85°C	64 LQFP
MCF52212AE50	0°C to 70°C	64 LQFP
MCF52213CAE50	-40°C to 85°C	64 LQFP
MCF52213AE50	0°C to 70°C	64 LQFP

## Learn More:

For more information about ColdFire family products, please visit [www.freescale.com/coldfire](http://www.freescale.com/coldfire).