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ColdFire® V4

MCF5445x Family
ColdFire® embedded controllers

Target Applications
- Network attached storage
- Point-of-sale terminals
- HVAC building and control systems
- Medical instrumentation and monitors
- Embedded VoIP
- Fire/security control and monitoring systems
- Factory and automation systems
- Test and measurement equipment

Overview

Freescale Semiconductor continues to expand the Controller Continuum by introducing an advanced high performance, highly integrated product family, the MCF5445x family. The ColdFire MCF5445x microprocessors are designed for power-conscious developers needing a high performance 32-bit microprocessor plus a rich set of on-chip connectivity peripherals including Ethernet, USB On-The-Go (OTG) and Peripheral Component Interconnect (PCI). These highly integrated microprocessors open the door to expanding application capabilities while driving down the total system cost and power requirements.

The MCF5445x products are based on the V4m ColdFire microarchitecture featuring an enhanced multiply-accumulate unit (eMAC), hardware divide and a memory management unit (MMU), allowing designers to run protected mode OS, such as Linux® OS as well as other third party RTOSs. In addition, the MCF5445x family features 32 Kbytes of internal SRAM and 16Kbytes of both I-Cache and D-Cache and a DDR2/DDR memory controller that allows the use of DDR1, DDR2 and Mobile DDR memory. The MCF5445x also contain four 32-bit timers with DMA request capability, a 16-channel DMA controller, an I²C module, 3 UARTs, a DMA SPI, a hardware encryption module, an SSI module, a serial boot facility and an ATAPI hard drive controller.

The combination of performance and on-chip integrations make the MCF5445x family an ideal solution for consumer applications such as network attached storage and Ethernet gateways. This product also fits well in embedded control applications such as industrial control, embedded VoIP, factory automation, point-of-sale, medical and testing equipment.

MCF5445x Family Block Diagram
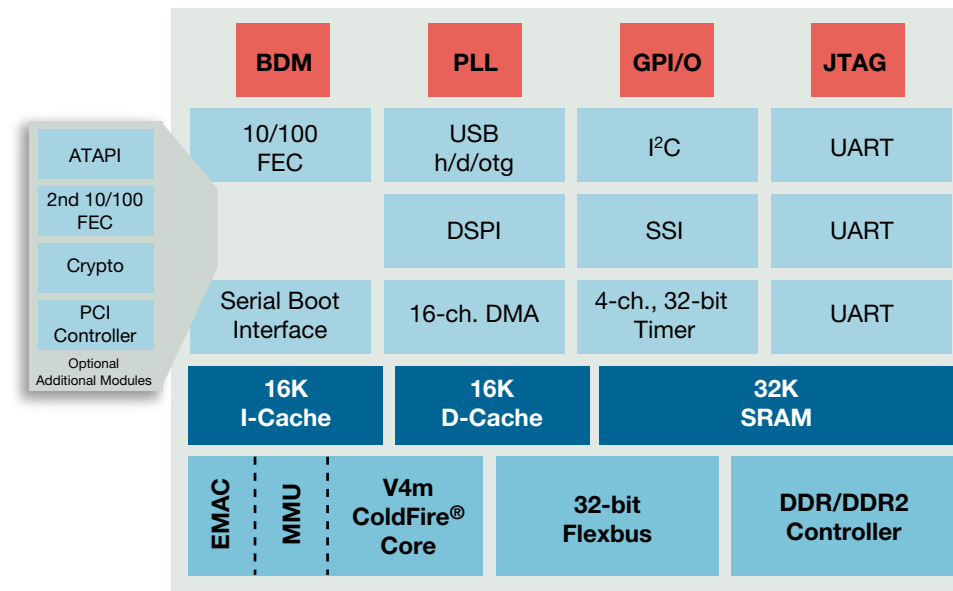
Package Options

Part Number	Temp. Range	Features	Package	Speeds*	10k Resale Pricing**
MCF54455	0° to 70°, -40° to +85°	USB 2.0 OTG with Transceiver, 2xFEC, PCI, DDR2, ATA, Crypto	360 PBGA	266 MHz, 200 MHz	$18.95
MCF54454	0° to 70°, -40° to +85°	USB 2.0 OTG with Transceiver, 2xFEC, PCI, DDR2, ATA	360 PBGA	266 MHz, 200 MHz	$16.95
MCF54453	0° to 70°, -40° to +85°	USB 2.0 OTG with Transceiver, 2xFEC, PCI, DDR2, Crypto	360 PBGA	266 MHz, 200 MHz	$15.95
MCF54452	0° to 70°, -40° to +85°	USB 2.0 OTG with Transceiver, 2xFEC, PCI, DDR2	360 PBGA	266 MHz, 200 MHz	$13.95
MCF54451	0° to 70°, -40° to +85°	USB 2.0 OTG with Transceiver, FEC, DDR2, Crypto	256 MAPBGA	240 MHz, 180 MHz	$11.95
MCF54450	0° to 70°, -40° to +85°	USB 2.0 OTG with Transceiver, FEC, DDR2	256 MAPBGA	240 MHz, 180 MHz	$9.95

* Indicated speeds are targets for the devices
** Suggested Resale Pricing

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Features / Benefits

Features	Benefits
32-Bit ColdFire V4 Central Processing Unit (CPU)	
• 410 MIPS at 266-MHz • 3.3V I/O, 1.5V core	○ Delivers high performance and functionality for improved system performance
• Memory Management Unit (MMU)	○ Allows for use of a protected memory OS
• Cryptography Acceleration Unit (CAU)	○ Helps to protect sensitive data using DES and AES block cipher engines and MD5, SHA-1 and HMAC hash accelerators
• Enhanced Multiply-Accumulate (eMAC) unit with four 48-bit accumulators to support 16x16 or 32x32 operations	○ Provides hardware acceleration of multiply instructions improving overall system performance ○ Allows for use in typical DSP type applications
On-Chip Memory	
• Independent 16Kbyte data and instruction caches	○ Increases system performance
• 32-Kbyte dual-ported SRAM on CPU internal bus, supporting core and DMA access with standby power supply support	○ Security circuitry to prevent unauthorized access to RAM contents and increase system performance for critical code, fast stack operations and Ethernet buffers
Power Management	
• Peripheral power management register	○ Allows the enable/disable of the clocks to most peripherals, lowering power consumption
• Processor sleep and whole chip stop modes	○ Minimizes power consumption for use in "green" products
Peripherals	
• DDR1/DDR2/Mobile DDR SDRAM Controller	○ Popular, economical and fast memory access which allows for a scalable solution to meet power and performance needs
• ATA Controller	○ Enables control of an external hard disk
• Peripheral Component Interconnect (PCI) Bus	○ Enables fast integration of any PCI-based peripheral (ex. Firewire, Bluetooth, WiFi, Graphics and DAQ systems, etc.)
• Universal Serial Bus (USB) 2.0 On-The-Go (OTG) Controller with full-speed transceiver	○ Configurable as Full-Speed device, host or OTG ○ High-Speed capable with off-chip ULPI PHY
• Two Fast Ethernet Media Access Controllers (FEC MAC)	○ Enables remote access, remote management, redundant networking or gateway functions
• 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
• Synchronous Serial Interface (SSI)	○ Audio CODEC interface using I²S mode within SSI module
• DMA Serial Peripheral Interfaces (DSPI) with full-duplex, three-wire synchronous transfer with up to 16 pre-programmed transfers • Master or slave configurable	○ Allows full-duplex, asynchronous, NRZ serial communication between MPU and remote devices ○ DMA SPI provides messaging automation and the scheduling of messages ○ Also used for Serial Boot to SPI-based flash devices
• I²Cs Module; Up to 400 kbps with maximum bus loading; Multi-master operation; Programmable slave address	○ I2C ports enable external interfaces to an LCD display, EEPROM, A/D controller, etc. I2C provides high bandwidth and ease of connectivity
• Real Time Clock (RTC) with separate power pins	○ Adds time of day and calendar functionality to system even while main power is removed from MPU
• DMA Timers	○ Four 32-bit timers used independently or for generating DMA transactions
• DMA Controller with 16 fully programmable channels.	○ Enables fast transfers of data with minimal processor interaction
• Programmable Interrupt Timer Modules (PIT)	○ Allows four programmable periodic interrupts to system, enabling system applications to have their own timer while scheduler or OS has its own
Input/Output	
• Up to 132 GPIO pins	○ Results in a large number of flexible I/O pins that allow vendors to easily interface the device into their own designs as every peripheral pin is GPIO capable
Development Support	
• Real-time Trace Support	○ A fundamental debug functionality that defines the dynamic instruction execution path
• Background Debug Interface (BDM)	○ This allows the 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 1 or 2 level trigger

Cost-Effective Development Tools
M54455EVB—*Suggested retail price - $850 (USD)*

Full-featured evaluation system for the MCF5445x device family. The M54455EVB is powered by the MCF54455VM266 processor and features an ATA interface, USB Host, USB Device, dual-10/100 Ethernet, four PCI slots, DDR2 SDRAM, and much more. This evaluation system comes packaged in a low-profile ATX case with all the necessary components to get up and running quickly and easily.

Linux BSP—Complimentary
Linux Board Support Packages (BSPs) for Freescale silicon are tested, certified and frozen, ensuring a fully operational tool chain, kernel and board specific modules that are ready to use together within a fixed configuration for specific hardware reference platforms. These BSPs provide the foundation you need to begin your project quickly.

CodeWarrior® Development Studio for ColdFire Architectures, v7.0—Complimentary
CodeWarrior Development Studio for ColdFire architectures is a single tool suite that supports software development for Freescale's ColdFire Family of 32-bit products. Support for all Freescale ColdFire devices coupled with the cross-platform capabilities of the award winning CodeWarrior Integrated Development Environment (IDE) simplifies code migration and re-use for faster product development. CodeWarrior Development Studio for ColdFire Architectures, version 7 is a comprehensive integrated development environment for ColdFire hardware bring-up through embedded applications.

3rd Party Tools—Trial Version Included
The ColdFire embedded controller family is supported by world-class development tool suites offered through leading third-party tools developers. Selected third parties tools have provided trial editions for initial evaluation.

Learn More: For more information about ColdFire family products, please visit **www.freescale.com/coldfire**.

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