

## Developing with ColdFire USB Solutions

To help developers with their ColdFire designs, Freescale offers Special Edition CodeWarrior Development Studio for Microcontrollers 6.x with Processor Expert rapid application development tool. Professional and Standard Editions of the CodeWarrior tools can also be purchased from Freescale.

Freescale also delivers a full range of tools that help enable Linux® OS solutions across a broad span of embedded applications. With fully maintained board support packages (BSPs), feature-rich, end-to-end development solutions for leading architectures, comprehensive services and flexible pricing, Freescale offers a comprehensive lineup of embedded Linux solutions with CodeWarrior Development Tools that help customers speed and simplify the creation of products based on the Linux OS.

## Sensors, Analog and Mixed Signal

Microcontrollers with integrated USB allow developers to design full systems, including sensor technology, power management and other analog and mixed signal devices, with greater communications flexibility. Freescale carries a full line of pressure, acceleration and capacitive touch sensors as well as power management ICs and other analog devices that combine critical functions into innovative USB-enabled solutions.

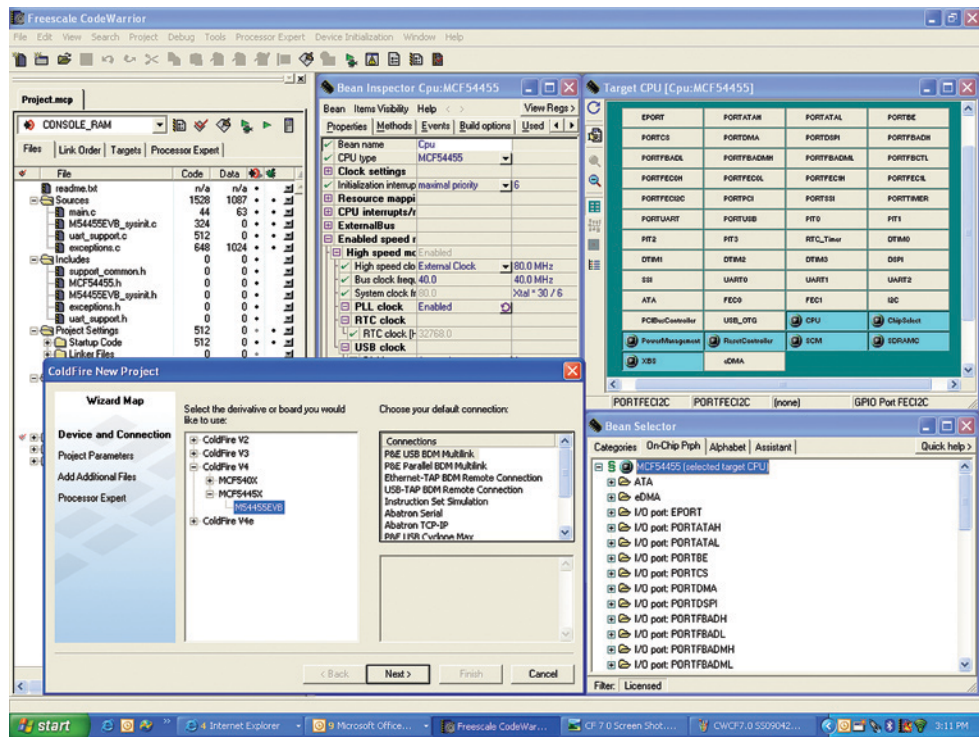
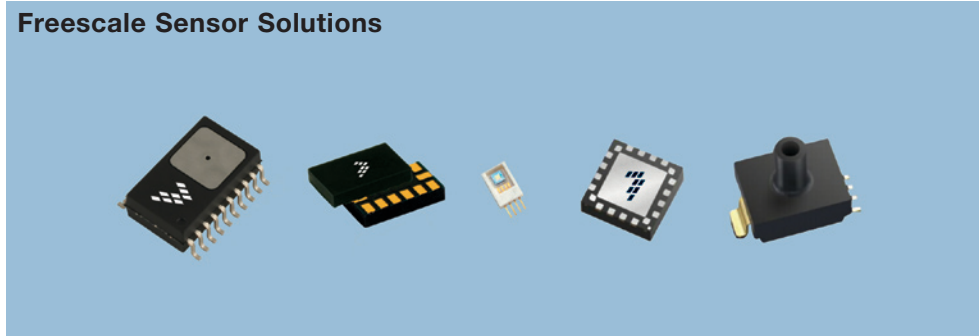
## Enabling Next-Generation Products Based on Flexis JM

- PC peripherals
- Hospital beds
- Electric wheel chairs
- Lighting control systems
- Environmental and building automation
- Access control panels
- Laboratory equipment
- Stationary barcode scanners and barcode printers
- Patient monitoring systems
- Security systems
- Building and HVAC controls
- Industrial networking products

## ColdFire in Consumer and Industrial Applications

- Health care imaging
- Home health and patient monitoring
- Dialysis machines
- Cardiac rhythm management
- Hearing analysis equipment
- Powered beds
- Electric wheelchairs
- Smoke/heat detectors
- Fire alarm sounders and control panels
- CCTV cameras
- Intruder alarm motion detectors
- Access control
- Biometrics security systems
- Carbon dioxide detectors
- Remote monitoring/data collection
- I/O modules
- Industrial networking products
- Measurement equipment
- Cost-effective analog telephone adapters
- Cost-effective IP Phone
- Wi-Fi phone
- Card payment terminals
- Barcode scanners and printers
- Automatic teller machines
- Portable data collection terminals

## Freescale Sensor Solutions



## Simplified Connectivity

Freescale's Controller Continuum USB solutions

**Learn More:** For current information about Freescale products and documentation, please visit [www.freescale.com/usb](http://www.freescale.com/usb).



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Document Number: BRCTRLCTNUSBOSL  
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# USB Connectivity

Used in countless devices from PC peripherals and memory sticks to industrial equipment, universal serial bus (USB) connectivity has become a pervasive standard for serial communications. USB was born out of the need to provide a user-friendly connectivity solution that requires minimal or no user intervention for configuration and adds true plug-and-play capabilities for a wide range of devices simultaneously. USB is fast, bi-directional and cost-effective with a dynamically attachable serial interface that removes the port availability constraints for PCs and other devices. USB is becoming one of the most widely used and important connectivity standards in the consumer and industrial marketplace.

USB is a token-based (packet) standard with data transferred between the host and the device in a series of frames, transfers, transactions and packets within 1 Ms/1500 byte frames. It has been widely adopted across the globe for such applications as:

- PC peripherals and I/O modules
- Lighting control systems
- Test and measurement equipment
- Security and access panels
- Building and HVAC controls
- Patient monitoring systems
- Barcode scanners
- Point-of-sale printers

There are various versions of the USB specification that serve different application data rate and performance requirements.

- USB 2.0 Low-Speed: cost-effective 1.5 Mbps data rate at 10–100 Kbps performance for such applications as

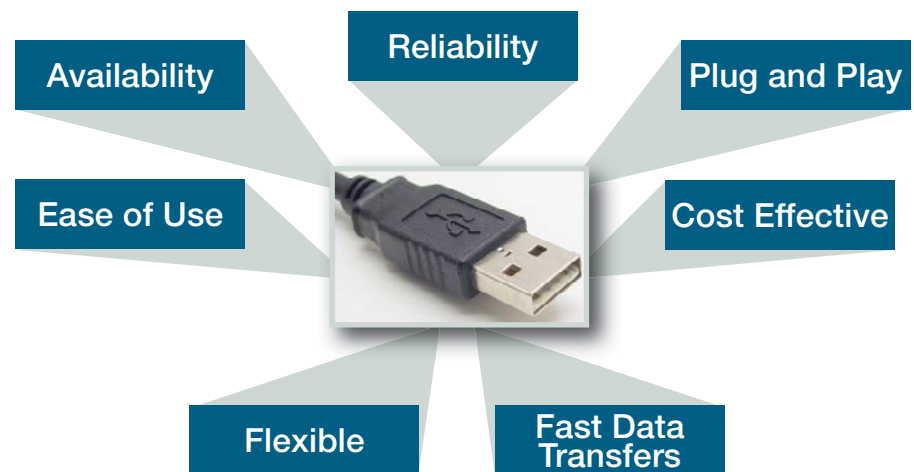


keyboards, computer mice and joysticks. Low-Speed USB has been phased out of most applications in favor of Full-Speed USB. Freescale primarily supports Full-Speed and Hi-Speed USB.

- USB 2.0 Full-Speed: Higher performance with guaranteed latency and bandwidth. 12 Mbps data rate at 5–10 Mbps performance for such applications as printers, audio devices and floppy drives.
- USB 2.0 Hi-Speed: Vast bandwidth improvements with 480 Mbps data rate at 25–400 Mbps performance for such applications as video, storage and imaging.

By 2001, as the peripheral devices that could be interconnected and pass data to each

other proliferated, the USB On-the Go (OTG) specification was developed. Depending on the applications, a USB OTG device can dynamically decide whether it will be the host or the device. A designer can design a system where a user transfers information to a USB memory stick, in which case the system serves as the “host.” Then, using that same system, the designer may want to communicate to a larger host machine, in which case the system serves as the “device.” The OTG also greatly expands connectivity flexibility, allowing a user to transfer files between two hand-held devices or swap songs directly from one MP3 player to another.



# Freescale Offers the Whole USB Solution

Embedded connectivity is becoming increasingly important to design engineers and is a requirement for most next-generation consumer and industrial products. Designers need an affordable, flexible connectivity option, such as USB, to satisfy a wide range of applications. Choosing a microcontroller with an on-chip USB module is an ideal solution for adding connectivity to a system and saving cost, board size and parts count at the same time.

Freescale’s USB devices offer easy integration, reliability, software and hardware support enabling developers to streamline the design process and accelerate time to market.

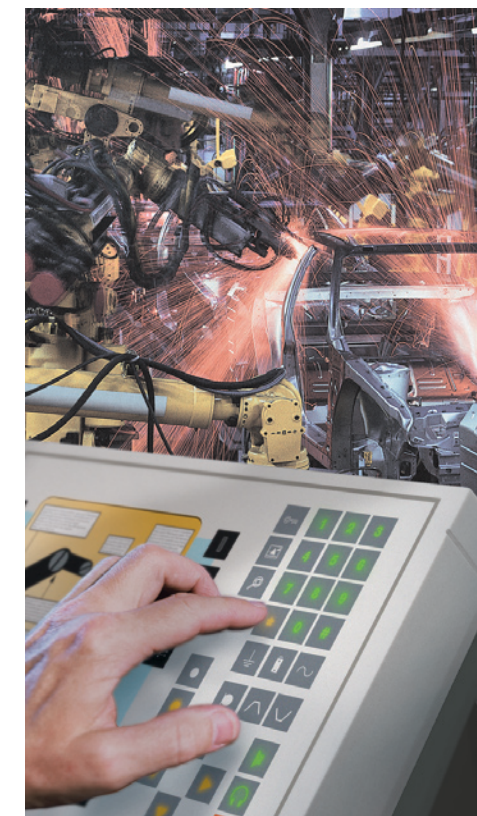
## Low- and Full-Speed USB Solutions

For lower power and smaller bandwidth requirements, Freescale offers a suite of low- and full-speed USB microcontrollers. Full-speed is easily backward compatible with low-speed devices.



## Hi-Speed USB Solutions

For applications that require higher performance and greater bandwidth, Freescale also offers a full product line of hi-speed USB microcontrollers. Hi-speed controllers are also backward compatible with full-speed USB.



## Complimentary USB Stack Software Freescale USB-LITE Stack by CMX

To complete the software solution, Freescale also offers complimentary USB software stacks, giving designers both the hardware and software they need to jump start their development. Freescale and CMX have collaborated to provide a complimentary USB stack for ColdFire® and S08 USB microcontrollers in the Controller Continuum. The stack for the 8-bit S08 USB controllers enables USB device modes while the stack for the 32-bit ColdFire USB controllers enables USB device and host modes. The stacks can be downloaded from [freescale.com/usb](http://freescale.com/usb).

### USB Device Class Support:

- General HID
- Keyboard HID
- Mouse HID
- CDC devices

### USB Host Class Support:

- HID host
- Host mass storage



# Flexis™ JM Family of Cost-Effective USB Solutions

The ColdFire-based MCF51JM128 and the S08-based MC9S08JM60 belong to the Flexis JM family. The Flexis JM family devices expand the Freescale Controller Continuum by providing pin, peripheral and tool compatibility between 8- and 32-bit controllers with USB functionality. By using the JM family of devices, product designers can easily upgrade industrial or consumer applications with USB functionality to provide more control and communications options. The JM family offers full hardware and software solutions to get you through the development process quickly and easily.

## Flexis MCF51JM128

The 32-bit JM128 microcontroller integrates USB 2.0 Full-Speed OTG, providing flexible control and connectivity options (enabling USB host or USB device functionality). It also features:

- 50.33 MHz V1 ColdFire core
- 25.17 MHz bus frequency
- 2.7–5.5V operating range
- Up to 128 KB flash
- Up to 16 KB SRAM
- CAN module
- Cryptographic acceleration unit

## Flexis MC9S08JM60

The 8-bit JM60 microcontroller integrates a USB 2.0 Full-Speed device, providing flexible control and connectivity options. It also features:

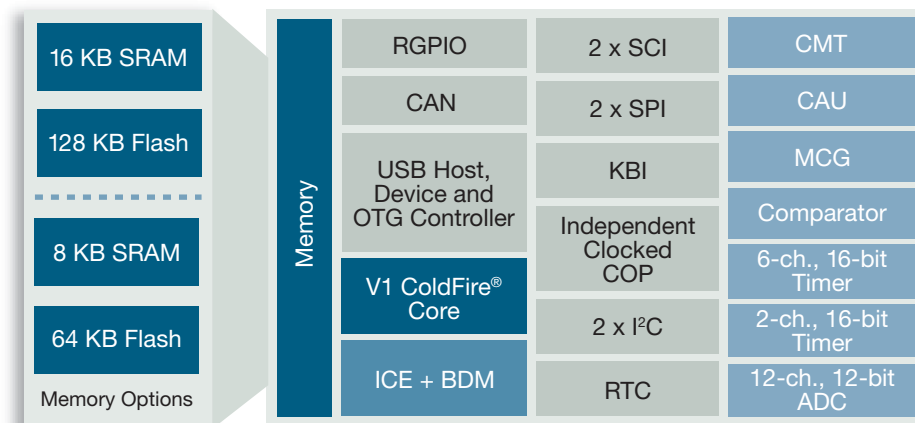
- 48 MHz S08 core
- 24 MHz bus frequency
- 2.7–5.5V operating range
- Up to 60 KB flash
- Up to 4 KB SRAM
- 256 Bytes USB RAM

In addition, all JM family devices offer stepwise peripheral and software compatibility to Freescale's higher performing USB microcontrollers, including the MCF5221x and MCF5222x ColdFire family products.

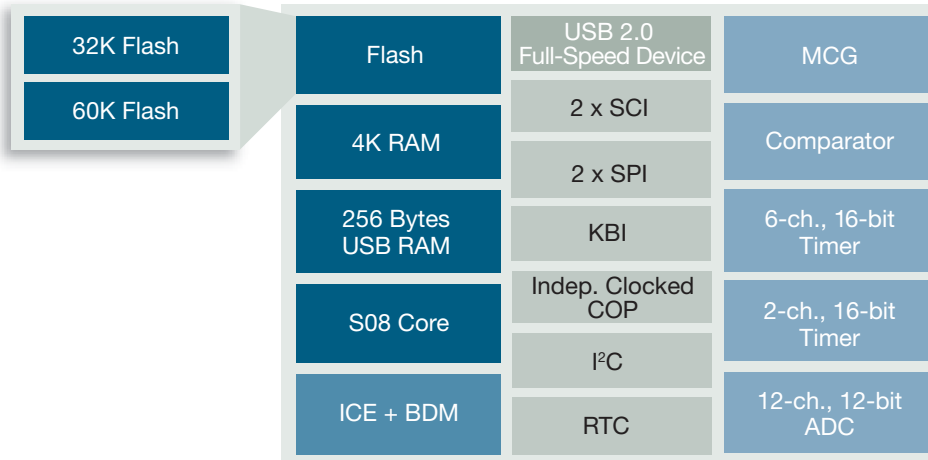
JM family	Part number	Temp range	Key features	Speed	Package
JM128	MCF51JM128	-40°C to + 105°C	Support USB 2.0 Full-Speed, Host/Device/OTG, 128K Flash, 16K RAM	50.33 MHz	80-pin LQFP*, 80-pin LQFP, 64-pin QFP, 64-pin LQFP, 44-pin LQFP
JM64	MCF51JM64	-40°C to + 105°C	Support USB 2.0 Full-Speed, Host/Device/OTG, 64K Flash, 8K RAM	50.33 MHz	80-pin LQFP*, 80-pin LQFP, 64-pin QFP, 64-pin LQFP, 44-pin LQFP
JM60	MC9S08JM60	-40°C to + 85°C	Support USB 2.0 Full-Speed, Device, 60K Flash, 4K RAM	48 MHz	64QFP, 64LQFP, 48QFN, 44LQFP
JM32	MC9S08JM32	-40°C to + 85°C	Support USB 2.0 Full-Speed, Device, 32K Flash, 4K RAM	48 MHz	64QFP, 64LQFP, 48QFN, 44LQFP

\* The device integrates CAU

### MCF51JM128 Block Diagram



### MC9S08JM60 Block Diagram



# Developing with JM Family Products

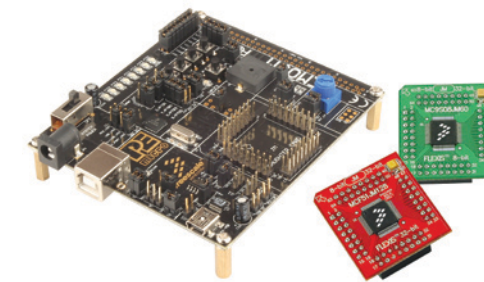
Developing new designs using JM family products has been greatly simplified through Freescale's full support ecosystem that includes software development tools, demo boards and evaluation kits, application notes and reference designs, software examples and online training webcasts.

## CodeWarrior® Development Studio

CodeWarrior Development Studio for Microcontrollers 6.x with Processor Expert™ rapid application development tool is a single tool suite that supports software development for 8-bit S08 and 32-bit V1 ColdFire controllers. The complimentary\* Special Edition, with compiler support for 32 KB for S08 devices and 64 KB for 32-bit devices, can be downloaded from [freescale.com/codewarrior](http://freescale.com/codewarrior). Professional Edition and Standard Edition can also be purchased from [freescale.com](http://freescale.com).

CodeWarrior Development Studio for Microcontrollers 6.x also features:

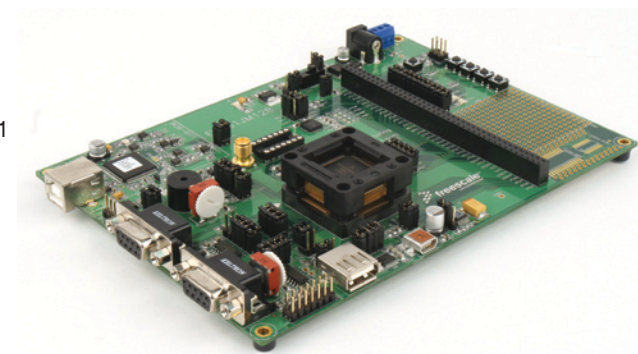
- Graphical source level debugger
- Flash programming support
- Full-chip simulation for S08, RS08 and V1 ColdFire microcontrollers
- Over 150 assembly and C example projects to use as templates for your next project
- Animated tutorials



## Cost-Effective Demo Boards

DEMOJM cost-effective demo board for 8-bit JM60 and 32-bit JM128:

- Base board with two 64 LQFP daughter cards supporting JM60 and JM128 controllers
- DVD with code examples, stacks, CodeWarrior 6.x for microcontrollers, documentation and training
- Power supply and USB P&E BDM



## Full evaluation system

EVB51JM128 evaluation kit for JM128 controller features:

- MCF51JM128 controller in 80-pin LQFP
- DVD with code examples, stacks, CodeWarrior 6.x for microcontrollers, documentation and training
- Power supply and USB BDM

## Application Notes

- AN3560: USB device development with S08JM
- AN3561: USB bootloader for S08JM60
- AN3564: In-depth understanding of the Freescale USB stack for S08JM devices
- AN3565: USB and using the CMX USB stack with the JM devices
- AN3582: The USB data logger based on S08JM60

Find your PDF copy to download by typing the "AN" number on the [freescale.com](http://freescale.com) search engine.

\* Subject to license agreement and registration

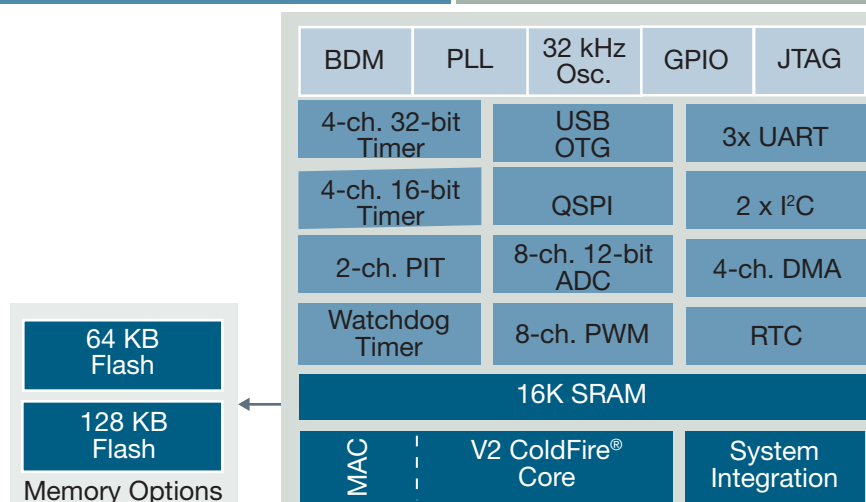
# The Latest Integrated ColdFire® USB Solutions

Freescale offers ColdFire solutions for full-speed and hi-speed USB device, host and OTG applications. The breadth of the ColdFire USB portfolio, offering a wide variety of performance, memory and on-chip peripheral needs, allows engineers to optimize their designs to match their price and performance requirements.

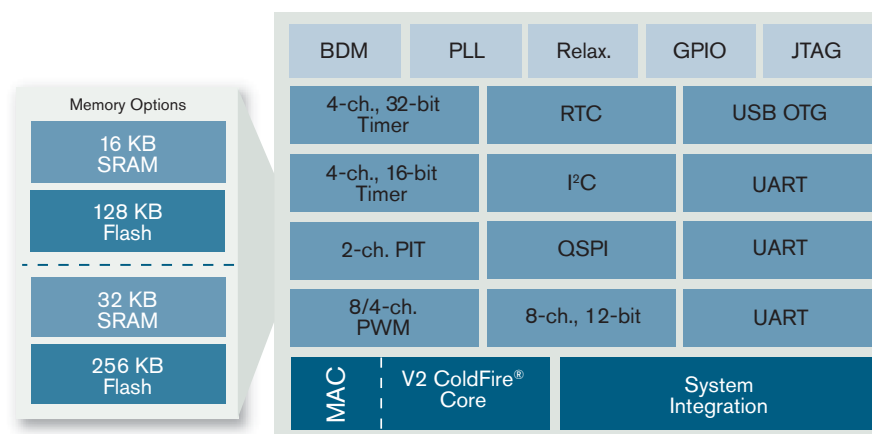
MCF5221x and MCF5222x family offers up to 80 MHz of performance with full-speed USB OTG and an integrated USB transceiver for entry-level 32-bit USB applications. The family features optimized peripherals that enable low-power consumption without compromising performance. The MCF5221x family is the highest value 32-bit full-speed USB OTG + PHY microcontroller in the industry.

MCF5445x family is a high-performance USB embedded microprocessor that offers 410 Dhrystone 2.1 MIPS at 266 MHz with a memory management unit (MMU) and enhanced multiply-accumulate (EMAC) unit. It features full-speed USB OTG with full-speed/hi-speed transceiver, plus two 10/100 Ethernet MACs and hardware accelerated encryption.

**MCF5221x Family Block Diagram**

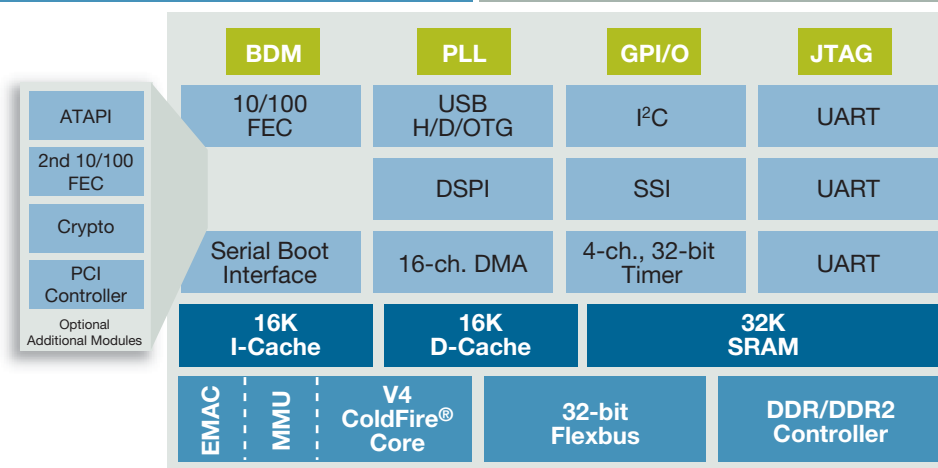


**MCF5222x Family Block Diagram**

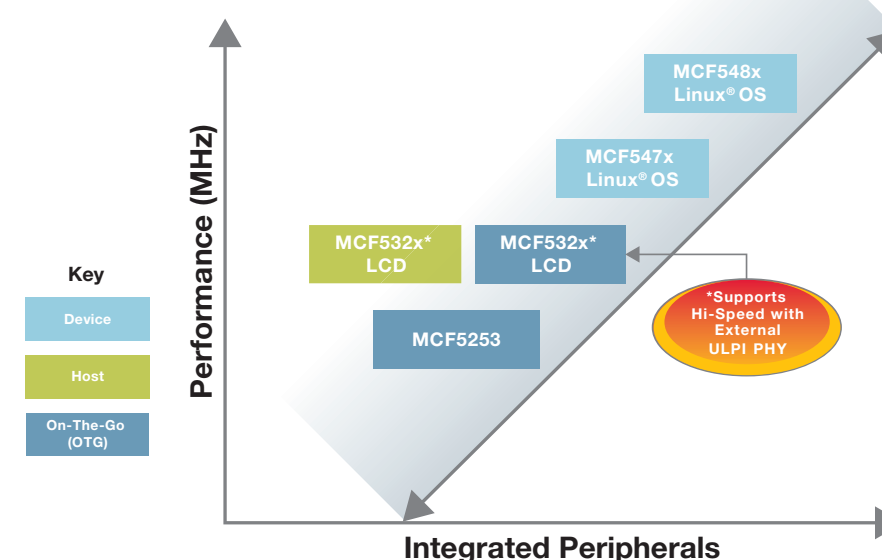


■ Freescale technology

**MCF5445x Family Block Diagram**



## Hi-Speed USB Solutions



Freescale also offers ColdFire embedded controllers with USB OTG and an integrated LCD controller to fill the growing demand for human interface on machine and industrial control applications while maintaining a rich level of connectivity and security integration.

## Low- and Full-Speed USB Solutions

