Microcontrollers

Welcome to the Controller Continuum

Only from Freescale

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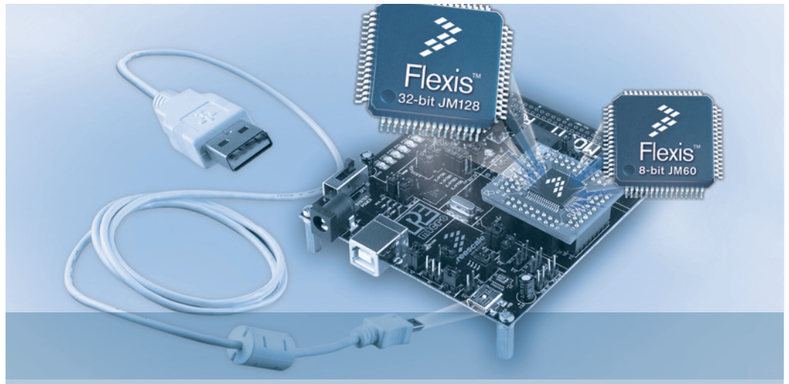

Welcome to the Controller Continuum

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It's time to break from tradition. In the past, bit boundaries have defined microcontroller (MCU) price and performance solutions for the consumer and industrial markets—8-bit for entry-level, easy-to-use applications and 32-bit for the high-end, performance-driven market. As 8-bit users reach their performance ceiling and need to move to a more powerful architecture, the increased complexities of 32-bit software, peripherals and development tools could significantly hinder new product development and time to market.

No more. Freescale is uniquely positioned to provide a path to performance from the low-end of 8-bit to highly integrated 32-bit MCUs. We created the Controller Continuum—a full spectrum of price and performance options and unprecedented compatibility between them.

What is the Controller Continuum?

Freescale's Controller Continuum is the industry's first and only roadmap for 8- and 32-bit compatible architectures. From the entry-level RS08 and S08 controllers to the full-featured ColdFire® devices, the Controller Continuum is a range of stepwise compatible MCUs sharing tools and peripherals to ease your design process and accelerate your time to market. Stepwise compatibility means that you can move from one device on the Continuum to the next compatible device on any point of the spectrum, from the low end to the high end. For example, you can move from an MC9S08JM60 (JM60) and migrate to an MCF51JM128 (JM128), and from there, migrate to the MCF5221x MCUs with minimal time and effort.

When optimizing for performance, price and functionality changes your requirements from 8- to 32-bit, or vice versa, it's as easy as swapping controllers on the same board and recompiling code. This connection point between 8- and 32-bit at the center of the Controller Continuum is our Flexis™ series of MCUs.

Flexis Series of Microcontrollers—JM family

Freescale's revolutionary 8-bit to 32-bit compatibility story comes to life with the Flexis series of MCUs. Freescale is adding to the series with the introduction of the Flexis JM family for USB applications.

The 8-bit JM60 and the 32-bit JM128, featuring USB, are the 8- to 32-bit connection point on the Controller Continuum where S08 and V1 ColdFire microcontroller duos share a common set of peripherals and development tools to deliver the ultimate in migration flexibility. You can quickly move from an 8-bit design to a 32-bit design in just a handful of clicks, perfect for developing a portfolio of products that span the performance spectrum. The next few pages will show you how the unique features of these devices can expand range of design possibilities.

The Freescale Advantage

Freescale is a world leader in embedded control. We pioneered MCU technology and have been a major technology innovator, developing the first flash memory-based MCUs. The Controller Continuum provides easy access to our market-leading products. We also make your development process quick and easy. With an entire ecosystem of tools, training and support including common development tools, reference designs, application notes and webcasts, Freescale gets you on the design fast track.

- **RS08 MCUs**—A reduced version of the S08 core, which is even more efficient and cost effective for applications such as simple electro-mechanical devices that are migrating to solid-state embedded control.
- **S08 MCUs**—An evolutionary step from our popular HC08 family of MCUs. With higher bus speeds and lower operating voltages than its predecessor, the S08 family is better suited for battery operated applications.
- **ColdFire embedded controllers**—Compatible, highly integrated and cost-effective 32-bit architectures (V1, V2, V3 and V4) that emphasize control, connectivity and security over a wide range of consumer and industrial applications.
- **Common tools**—With the CodeWarrior® Development Studio for Microcontrollers V6.1, we offer you a single tool suite for 8- and 32-bit microcontrollers. Learn more on page 8 about common software and hardware tools available to you.

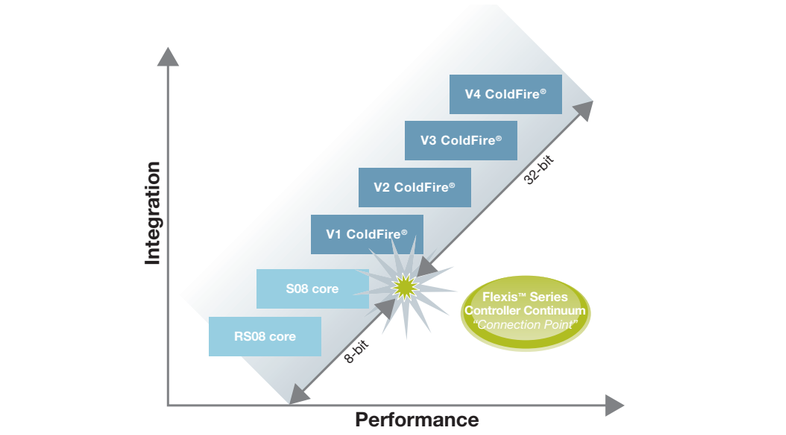
The Freescale **Controller Continuum**

The Freescale Controller Continuum provides stepwise compatibility up and down the performance spectrum. You can choose to enter the Controller Continuum at the entry-level RS08 family of MCUs, the more sophisticated S08 devices or the top-of-the-line ColdFire embedded controllers—each step has family members that share packaging, peripherals or pin-outs with the Controller Continuum. Add common software and hardware tools, and you have true stepwise compatibility—even across the 8- to 32-bit boundary.

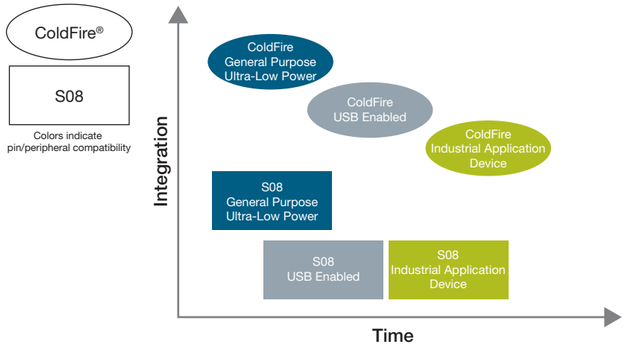
Freescale developed the Controller Continuum to help give you options for the best combination of performance, economy and functionality—and the flexibility to later upgrade your choice at negligible cost and with minimal effect on your time to market.

The Roadmap for Compatibility

The Freescale Controller Continuum



Flexis™ Series Roadmap

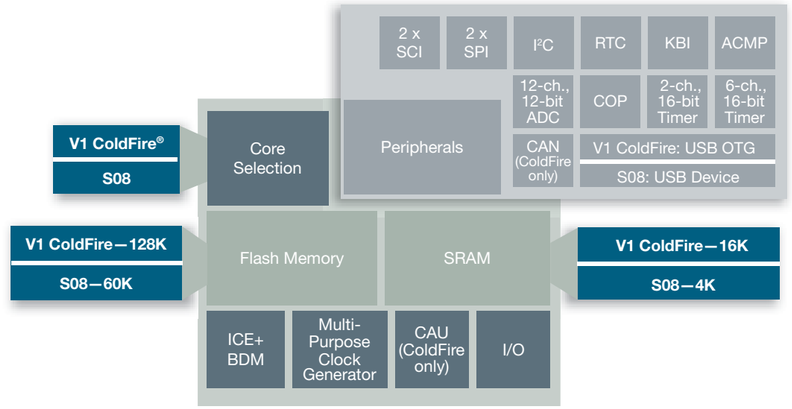


Roadmap designates planned devices.

The JM devices are the first USB-enabled members of the Flexis series of MCUs. We will continue to expand our portfolio of S08 and V1 ColdFire MCUs to include industrial application controllers and LCD controllers.

Introducing the **Flexis JM Family**

Freescale's JM60 and JM128 MCUs are the first USB-enbaled 8- and 32-bit devices in the Flexis series. This innovative duo breaks new ground in 8- to 32-bit compatibility. The JM60 (8-bit) and JM128 (32-bit ColdFire embedded controller) both feature basic building blocks for controller compatibility.



Complete USB Solution

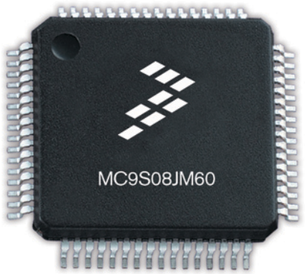
The JM family offers full hardware and software solutions to get you through the development process quickly and easily.

- The 32-bit JM128 microcontroller features USB OTG, providing flexible control and connectivity options enabling USB host, device or On-The-Go (OTG) functionality. The 8-bit JM60 microcontroller features a USB device, ideal for upgrading applications to a USB serial interface.
- Freescale offers a stand-alone, complimentary, easy-to-use USB stack that helps you get up and running in minutes. This stack is also available for all USB MCUs in the Controller Continuum.
- All JM devices feature an integrated transceiver that helps you save money, time and board space by eliminating components.
- A full support and training ecosystem of reference designs, application notes, software examples, on-line trainings and webcasts help you get started quickly.

Easy to Migrate

We've significantly reduced the learning curves normally associated with migrating between 8- and 32-bit technologies. With a new version of CodeWarrior and a wide selection of software and hardware development tools, you can get on the design fast track and simplify your development cycle. We also offer extensive training and documentation to make the process even easier. To learn more about the tools and training available to you, visit **www.freescale.com/flexis** or page 8 of this brochure.

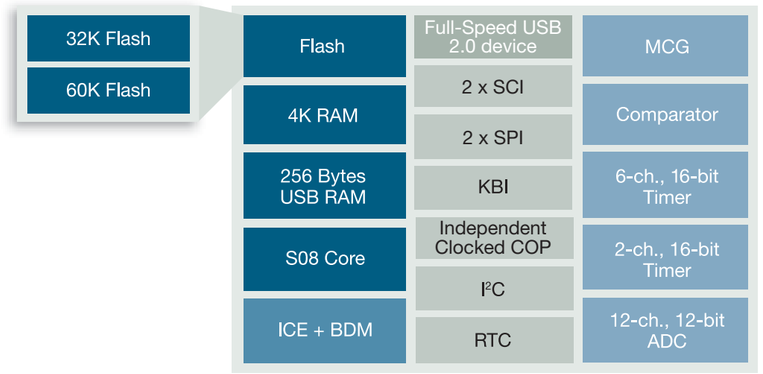
The Flexis 8-bit **JM60**



MC9S08JM60:

- 48 MHz HCS08 core
- 24 MHz bus frequency
- 2.7–5.5V operating range
- 64-pin LQFP, 64-pin QFP 48-pin QFN, 44-pin LQFP

MC9S08JM60 Block Diagram



Features Shared with the JM128 ColdFire Embedded Controller

- 12-channel, 12-bit analog-to-digital converter (ADC)
- Analog comparators
- 2 x SCI, 2 x SPI, I²C
- 16-bit timers: 1 x 2-ch., 1 x 6-ch.
- Real-time counter (RTC)
- Multi-purpose clock generation
- Pin compatibility in 64- and 44-pin LQFP packages
- Common development tools including CodeWarrior for Microcontrollers V6.1

Features Unique to the S08 JM MCUs

- Integrated Full-Speed USB 2.0 device
- Complimentary USB device stack from CMX
- Up to 60 KB flash memory
- Up to 4KB random access memory (RAM)
- 256 Bytes USB RAM
- Up to 51 general-purpose input/output ports (GPIO)
- Single-wire background debug interface
- -40C° to +85C° temperature range

Use Cases

You can use one or both JM MCUs in your designs, depending on your product requirements. Use the JM60 when:

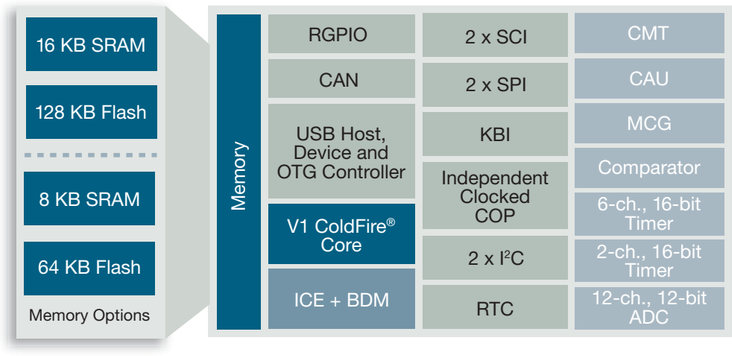
- Low-pin-count options are desired
- There are no requirements for higher performance calculations or peripherals
- Cost sensitivity is a primary issue

The Flexis 32-bit **JM128**

MCF51JM128:

- 50.33 MHz V1 ColdFire core
- 25.17 MHz bus frequency
- 2.7–5.5V operating range
- 80-pin LQFP, 64-pin LQFP, 64-pin QFP, 44-pin LQFP package options

MCF51JM128 Block Diagram



Features Shared with the JM60 HCS08 Embedded Controller

- 12-channel, 12-bit analog-to-digital converter (ADC)
- Analog comparators
- 2 x SCI, 2 x SPI, I²C
- 16-bit timers: 1 x 2-ch., 1 x 6-ch.
- Real-time counter (RTC)
- Multi-purpose clock generation
- Pin compatibility in 64- and 44-pin LQFP packages
- Common development tools including CodeWarrior for Microcontrollers V6.1

Features Unique to the V1 ColdFire JM MCUs

- Integrated Full-Speed USB 2.0 host/device/OTG
- Complimentary USB host/device/OTG stack from CMX
- An integrated CAN module
- Up to 128 KB flash memory
- Up to 16 KB random access memory (RAM)
- Up to 66 general-purpose input/output ports (GPIO)
- 16-bits of rapid general purpose input/output (RGPIO)
- Background debug module
- -40C° to +105C° temperature range
- Integrated Cryptographic Acceleration Unit (CAU)

Use Cases

You can use one or both JM MCUs in your designs, depending on your product requirements. Use the JM128 when:

- There is an immediate or near-term requirement for USB host/device/OTG
- When CAN function is needed
- You are interested in generating a cost-effective and low-overhead link to future 32-bit designs
- The application requires a path to higher flash densities (>128 KB)

Common Applications

The products in the Controller Continuum provide the unique flexibility to greatly simplify your new product development, whether you're upgrading to a higher performing S08 solution or transitioning to the 32-bit performance of the ColdFire family of embedded controllers. The Controller Continuum gives you the ability to quickly exploit business opportunities and speed your time to market in an almost unlimited variety of consumer and industrial applications, including:

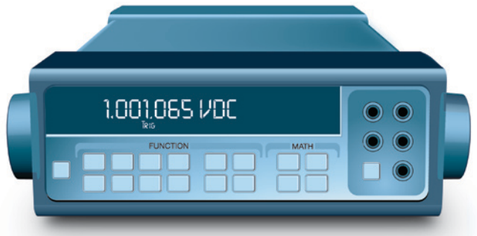
- HVAC building and control systems
- Lighting control systems
- Test and measurement equipment
- Environmental and building automation
- Security and access control panels
- Stationary barcode scanners and barcode printers
- PC peripherals and I/O modules
- Patient monitoring systems
- Laboratory equipment
- Industrial networking products
- Hospital beds and electric wheel chairs

Discover the **Range of Possibilities**

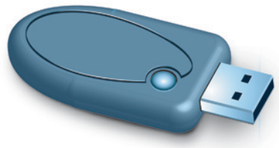
Freescale's Controller Continuum with the JM MCUs gives you unprecedented opportunities to expand into new markets without heavily investing in new product development resources. If you enter a market with a low-end product, you can scale the same application, using the tools you already have, to reach new markets with high performance requirements.

8- and 32-bit Applications

Datalogger



Multimeter



USB Token

Card Reader

The Full Breadth of the **Controller Continuum**

In addition to the Flexis series of controllers, the Controller Continuum in its entirety is a range of stepwise-compatible 8- and 32-bit devices that share a common set of tools. Read below to learn about the product families of the Freescale Controller Continuum.

RS08 Core Products

A reduced version of the S08 CPU, the RS08 core has been crafted to be more efficient and cost-effective for small memory size microcontrollers. Popular RS08 MCU products include:

- **MC9RS08 KA family**—the lowest entry point into the Controller Continuum, ideal for emerging applications such as simple electro-mechanical devices that are migrating to fully solid-state electronic operation or portable devices that have evolved into smaller or even disposable versions.

S08 Core Products

Optimized for extreme operating economy with a number of low-power options, the S08 core features:

- On-chip in-circuit emulation (ICE), which permits real-time emulation of MCU functions at full operating voltage and frequency range without the limitations of traditional emulators
- Integrated third-generation flash memory and RAM
- Multiple serial communications options
- Highly capable and high-performance analog functionality, including 10-bit ADC

Popular S08 MCU products include:

- **MC9S08QE family**—the industry's most power-efficient 8-bit offerings, with stop current of less than 300 nA and run current as low as 7 uA. Ideal for battery powered and handheld applications.
- **MC9S08QA family**—cost-effective, general-purpose 8-bit microcontroller with advanced capabilities to improve the performance of battery-powered applications.

ColdFire Embedded Controllers

Targeted at network-connected control applications in the commercial and industrial markets, various ColdFire family members support Ethernet, USB, Peripheral Component Interconnect (PCI), Controller Area Network (CAN) and Secured Internet Protocol (IPsec).

Popular ColdFire devices include:

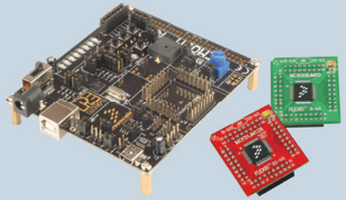
- **MCF5221x family**—V2 ColdFire core-based device featuring an integrated USB OTG and a wide variety of serial interface offerings, which makes the MCUs ideal for adding USB functionality to industrial applications quickly and easily.
- **MCF5223x family**—V2 ColdFire core-based device that features a 10/100 Fast Ethernet Controller (FEC), an Ethernet physical layer (EPHY) and flash memory in a single-chip solution. In addition, it includes CAN 2.0 and a cryptographic acceleration unit (CAU) for enhanced security.
- **MCF532x family**—V3 ColdFire core-based device that features USB host and On-The-Go peripherals plus an integrated super video graphic array (SVGA) LCD controller for applications with a graphical user interface (GUI).
- **MCF5445x**—V4 ColdFire core-based device families that feature a high level of integration, a broad range of communication peripherals and a memory management unit (MMU) that enables process isolation for a high level of reliability.

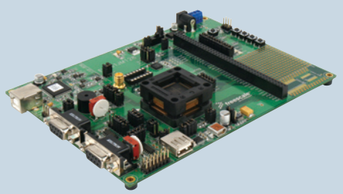
Get Started—
Get on the Fast Track

Easy, fast, accessible—that's what our tools and support environment is all about. Starting with your ideas, we help you speed your development process with easy-to-use tools that help you design with the Controller Continuum portfolio of devices. We also have self-support resources that give you:

- Access to a huge knowledge base of information
- Online training options
- Freescale-supported discussion forums

Our sophisticated search engine with a newly integrated parametric attribute tool extends your search across entire product families, which provides you with product comparison details so you can make well-informed feature trade-off decisions. Search, compare, explore or talk to us online or by phone—Freescale is there for you at every point of the design process.





Development Tools

CodeWarrior Development Studio for Microcontrollers V6.1

Freescale's CodeWarrior Development Studio for Microcontrollers V6.1 is a single, integrated tool suite designed to get you on the design fast track with RS08, HC(S)08 and V1 ColdFire members of the Freescale Controller Continuum. Whether your design is an 8-bit, entry-level application (e.g. smoke detector) or a 32-bit, high-end application (e.g. fire alarm control panel), CodeWarrior Development Studio for Microcontrollers provides optimized tools to take full advantage of the Freescale microcontroller you selected for your design.

Re-Target Your Application in Four Mouse Clicks

The award-winning CodeWarrior tool suite goes well beyond basic code generation and debugging—if market requirements change mid-project, the MCU Change Wizard allows you to re-target the project to a new microcontroller in as few as four mouse clicks. You simply select a new microcontroller (from the same or a different architecture: RS08, HC08, HCS08 or V1 ColdFire), select the default connection and the CodeWarrior tool suite automatically reconfigures your project for the new microcontroller with the correct build tools (compiler, assembler, linker), and the appropriate support files (header files, libraries and linker files). For projects switching between 8-bit and 32-bit Flexis™ series microcontrollers, this is the extent of the porting effort.

Porting Assistance at Your Fingertips

To move other 8-bit applications to V1 ColdFire, a porting guide is provided which details the differences between the architectures and the impact these differences have on software design. The V1 ColdFire compiler also flags code that needs to be manually inspected and ported (assembly code, interrupt service routines).

Easy Migration with Processor Expert™

If you use Processor Expert—a rapid application design tool integrated into the CodeWarrior tool suite—migrating between Freescale microcontrollers is a breeze. Just define the functionality you need for your application and Processor Expert generates tested, optimized C-code tuned for your application and the selected microcontroller. When you change the microcontroller with the MCU Change Wizard, Processor Expert maps the software and peripheral components that describe your application's functionality to the resources available on the new microcontroller. All you have to do is resolve any resource issues flagged by Processor Expert and you're finished.

DEMOJM: Flexis JM Family Cost-Effective Demo Board for the JM60 and JM128 MCUs

- Features base board with two 64-pin LQFP daughter cards supporting both JM60 and JM128. Kit includes DVD with code examples, stacks, CodeWarrior V6.1 for MCUs, documentation and training

EVB51JM128: Flexis JM Full Evaluation System for the JM128 MCUs

- Features the MCF51JM128 80-pin LQFP devices
- Kit includes DVD with code examples, stacks, CodeWarrior V6.1 for MCUs, documentation and training