Microcontrollers
More Than You Expect
Solutions for consumer and industrial applications
# Table of Contents

Road Maps ................................................................. 3
Introduction ........................................................................ 4

## 8-bit Products
- MC9S08CG/QA Family .................................................. 6
- MC9RS08L Family New .................................................... 7
- MC9S08LG Family .......................................................... 8
- MC9S08LL Family ........................................................... 9
- MC9S08LH Family New ................................................... 10
- MC9S08GW New ............................................................ 11
- MC9S08D Family ............................................................ 12
- MC9S08PT/A/L Family ..................................................... 14

## Flexis 8- and 32-bit Products
- 8-bit MC9S08QB/E Family ............................................ 16
- 32-bit MCF51QE ColdFire Family ................................. 17
- 8-bit MC9S08JS/M Family .............................................. 18
- 32-bit MCF51JM ColdFire Family ................................. 19
- 8-bit MC9S08JE Family New .......................................... 20
- 32-bit MCF51JE Family New ........................................... 21
- 8-bit MC9S08MM Family New ........................................ 22
- 32-bit MCF51MM Family New ........................................ 23

## 32-bit ColdFire Products
- MCF51CN Family New .................................................. 24
- MCF51EM Family .......................................................... 25
- MCF5301x Family .......................................................... 26
- MCF5225x Family .......................................................... 27
- MCF51AG Family ........................................................... 28
- MCF5441x Family ........................................................... 29

## 32-bit ColdFire+ Products
- ColdFire+ MCF51Qx ..................................................... 30
- ColdFire+ MCF51Jx ..................................................... 32

## 32-bit Kinetics Products
- Kinetics K10 New ......................................................... 33
- Kinetics K20 New ......................................................... 34
- Kinetics K30 New ......................................................... 35
- Kinetics K40 New ......................................................... 36
- Kinetics K50 New ......................................................... 37
- Kinetics K60 New ......................................................... 38
- Kinetics K70 New ......................................................... 39

## 16-bit Products
- MC56F800x Family ..................................................... 40
- MC56F801x Family ..................................................... 41
- MC56F802x/3x Family .................................................. 42
- MC56F824x/5x New ..................................................... 43
- MC56F84xx Family ..................................................... 44

## 32-bit Power Architecture® Products
- Industrial PXN Family New ........................................... 45
- Industrial PXD Family New ........................................... 46
- Industrial PXR Family New ........................................... 47
- Industrial PXS Family New ........................................... 48

## Summary Information
- Freescale Ready Play Solutions ...................................... 49
- Summary of Hardware and Software Enablement Solutions 50
- Product Summaries ...................................................... 51
- 32-bit Third-Party Developer Resources .......................... 52

For a complete listing of available products with full orderable part numbers, visit freescale.com/MCU.
Introduction

Freescale is a leading supplier of embedded controllers with a strong legacy in both the industrial and consumer market. We have a broad portfolio of MCUs across our 8-, 16- and 32-bit platforms, featuring leading-edge low power, analog, control and communications IP. For more information on our portfolio, visit freescale.com/MCU. Freescale is committed to ensuring our products are available for our customers through the entire lifetime of their systems, to that extent, Freescale commits to a minimum product cycle of 10, and in some cases, 15 years for our MCUs targeting the industrial, automotive and medical markets. For more information on product longevity, visit freescale.com/productlongevity.

It's More Than Just Silicon
Freescale is dedicated to providing semiconductor solutions that build value into your products. When you purchase from us, you’re buying more than just an embedded processor. You’re getting access to a broad ecosystem of technical support services, development tools and training—all designed to make your job easier and your end products better.

Freescale 8-bit MCUs Simplify the Design Process
Freescale is focused on making it easier for companies to develop applications with 8-bit MCUs by providing a free software development suite. This enables companies to significantly reduce their development time and bill of materials. Our aim is to provide a fully bundled software and hardware platform that is ready to use out of the box, allowing designers to focus on developing application code.

Key Benefits of Our 8-bit Portfolio
- Broad, scalable portfolio ranging from small, cost-effective 1 KB MCUs to highly integrated 100-pin, 128 KB solutions
- Award-winning CodeWarrior software IDE to reduce the development cycle
- Flexible Tower hardware development platform for rapid evaluation and application development
- Hundreds of reference designs and example projects
- Direct support from freescale.com/support
- 10- or 15-year guaranteed lifetime

The 32-bit ColdFire Portfolio Advantage for Industrial and Consumer Markets
ColdFire architecture is unlike any other 32-bit architecture in the industry. With a wide portfolio of 32-bit solutions, an unparalleled range of performance and peripherals, and one of the lowest power 32-bit MCUs on the market, the ColdFire and ColdFire+ families offers incredible flexibility and choice. Enabled by a vast ecosystem of development tools and design resources, we help make 32-bit development possible.

The New 32-bit Kinetis Family of MCUs
32-bit Kinetis MCUs represent the most scalable portfolio of ARM® Cortex™-M4 MCUs in the industry. The portfolio consists of five MCU families with over 200 pin-, peripheral- and software-compatible devices with outstanding performance, memory and feature scalability. Enabled by innovative 90 nm thin-film storage (TFS) flash technology with unique FlexMemory (configurable embedded EEPROM), Kinetis MCUs feature the latest low-power innovations and high-performance, high-precision, mixed-signal capability. Kinetis MCUs are supported by a market-leading enablement bundle from Freescale and ARM third-party ecosystem partners.

The 16- and 32-bit DSC Family, Ideal for Advanced Digital Control and Power Conversion
Freescale is a pioneer in DSC solutions. Our 56800/56800E DSC architecture combines the computational power of a DSP with the control functionality of an MCU onto a single core. The 56800/56800E family combines the advantages of hybrid architecture with leading peripherals, advanced memory technology, software and development tools to give you the capability you need to develop winning solutions in complex digital control and measurement environments.
PX Series of Power Architecture® MCUs
The PX series of Power Architecture MCUs provides unmatched performance, comprehensive enablement and ruggedized safety features for the most complex industrial control applications, including motor drives, renewable energy, motion control, power generation, clinical medical, robotics applications and more. Options exist for both single- and multicore implementations with up to 600 DMIPS of performance. The family offers up to 4 MB of integrated flash memory. An embedded safety architecture helps meet challenging safety, reliability and environmental requirements. Runtime software, a development platform for rapid prototyping, and advanced debug and system modeling tools ensure easy development.

Software Enablement and Support
The increasing complexity of industrial applications and expanding functionality of semiconductors are driving embedded developers toward solutions that require the integration of proven hardware and software platforms. Freescale, along with a strong alliance network, offers comprehensive solutions that include development tools, debuggers, programmers and software.

Complimentary Software and Tools
- Freescale MQX™ RTOS, Ethernet, FileSystem, USB stacks and more
- Complimentary bare metal TCP/IP and USB stacks
- Freescale Linux® BSP
- CodeWarrior Development Studio
- Processor Expert software: A rapid application development tool in the CodeWarrior tool suite
- Digital signal processing library

Tower System
The Freescale Tower System is a modular development platform for 8-, 16- and 32-bit embedded processors that enables advanced development through rapid prototyping. Featuring multiple plug and play modules, the Tower System provides designers with building blocks for entry-level evaluation to advanced application development. For a complete list of development kits and modules offered as part of the Freescale Tower System, please visit freescale.com/Tower.

You Are Never Very Far from Freescale
We have hundreds of sales people and application engineers in the field and an extensive network of distributors around the world. Your Freescale representatives are trained to understand your needs and help you find the best solutions for your products.

Need direct support from a Freescale expert? We can help. Freescale provides guidance for your project. Our technical sales representatives and product specialists are available to respond to technical product questions and help you select and obtain the right devices, tools and software to build your next application. For more information, visit freescale.com/support.
Often it's not just the individual features, but the full feature set that matters. The MC9S08QG family enhances system functionality by integrating embedded modules that are frequently left off low-end MCUs.

These modules help to:
- Reduce system size
- Lessen the probability of board quality problems and conflicts
- Cut system cost
- Reduce design time

Key Features
- Powerful, advanced S08 core
- Multiple communications options: SCI, SPI and I²C, available on the S08G8 only
- High-resolution analog: 8-ch., 10-bit ADC and analog comparator
- “Extras” included: 2-ch., 16-bit timer, internal/external oscillator, LVI, COP and up to 13 GPIOs
- Multiple memory options: 8 KB or 2 KB flash memory and up to 512B RAM

Sample Application Notes
- AN2717/D: Transitioning from the HC08 Core to the MC9S08 Core
- AN3048: Analog-to-Digital Converter on an I²C Bus Using MC9S08QG8
- AN1818: Software SCI Routines with the 16-bit Timer Module

TWR-S08UNIV + TWR-S08DC-QG8
The Tower solution supports the RS08KA family and enables quick, simplified product evaluation and application development. It provides a cost-effective, extremely flexible development hardware platform, offering plug and play capabilities.

Features
- Tower System-compliant interface
- USB to BDM connection
- Two push button inputs
- A potentiometer
- USB powered
- TWR-PI interface for easy connection to sensor daughter cards

### MC9S08QG/QA Block Diagram

![MC9S08QG/QA Block Diagram](image)

### MC9S08QG/QA Family

So highly integrated, it’s redefining “entry level”

#### Device Flash RAM ADC Channels SCI ESCI SPI PC 16-bit Timer Channels Clock Type Package Applications/Additional Features

<table>
<thead>
<tr>
<th>Device</th>
<th>Flash</th>
<th>RAM</th>
<th>ADC Channels</th>
<th>SCI</th>
<th>ESCI</th>
<th>SPI</th>
<th>PC</th>
<th>16-bit Timer Channels</th>
<th>Clock Type</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC9S08QG4CFQ8</td>
<td>4 KB</td>
<td>256B</td>
<td>4-ch.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1-ch.</td>
<td>OSC</td>
<td>8 DFN</td>
<td>Fully integrated small packages</td>
</tr>
<tr>
<td>MC9S08QG4CDNE</td>
<td>4 KB</td>
<td>256B</td>
<td>4-ch.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1-ch.</td>
<td>OSC</td>
<td>8 SOIC</td>
<td>Fully integrated small packages</td>
</tr>
<tr>
<td>MC9S08QG4CPAE</td>
<td>4 KB</td>
<td>256B</td>
<td>4-ch.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1-ch.</td>
<td>OSC</td>
<td>8 PDIP</td>
<td>Fully integrated small packages</td>
</tr>
<tr>
<td>MC9S08QG4CDE</td>
<td>4 KB</td>
<td>512B</td>
<td>8-ch.</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>2-ch.</td>
<td>OSC</td>
<td>16 TSSOP</td>
</tr>
<tr>
<td>MC9S08QG4CFFE</td>
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<td>256B</td>
<td>8-ch.</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>2-ch.</td>
<td>OSC</td>
<td>16 QFN</td>
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<td>256B</td>
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<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>2-ch.</td>
<td>ICS</td>
<td>24 QFN</td>
</tr>
<tr>
<td>MC9S08QG3CFK8</td>
<td>8 KB</td>
<td>512B</td>
<td>8-ch.</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>2-ch.</td>
<td>ICS</td>
<td>24 QFN</td>
</tr>
<tr>
<td>MC9S08QG3CDE</td>
<td>8 KB</td>
<td>512B</td>
<td>8-ch.</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>2-ch.</td>
<td>OSC</td>
<td>16 TSSOP</td>
</tr>
<tr>
<td>MC9S08QG3CFE</td>
<td>8 KB</td>
<td>512B</td>
<td>8-ch.</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>2-ch.</td>
<td>OSC</td>
<td>16 QFN</td>
</tr>
<tr>
<td>MC9S08QG3CFBE</td>
<td>8 KB</td>
<td>512B</td>
<td>8-ch.</td>
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<td>1</td>
<td>-</td>
<td>1</td>
<td>2-ch.</td>
<td>OSC</td>
<td>16 PDIP</td>
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<td>OSC</td>
<td>8 SOIC</td>
<td>Fully integrated small packages</td>
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<td>MC9S08QG3CFQ8</td>
<td>8 KB</td>
<td>512B</td>
<td>4-ch.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1-ch.</td>
<td>OSC</td>
<td>8 DFN</td>
<td>Fully integrated small packages</td>
</tr>
<tr>
<td>MC9S08QG3CDNE</td>
<td>4 KB</td>
<td>256B</td>
<td>4-ch.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1-ch.</td>
<td>ICS</td>
<td>8 SOIC</td>
</tr>
<tr>
<td>MC9S08QG3CDE</td>
<td>4 KB</td>
<td>256B</td>
<td>4-ch.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1-ch.</td>
<td>ICS</td>
<td>8 PDIP</td>
</tr>
<tr>
<td>MC9S08QG3CFE</td>
<td>4 KB</td>
<td>256B</td>
<td>4-ch.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1-ch.</td>
<td>ICS</td>
<td>8 SOIC</td>
</tr>
<tr>
<td>MC9S08QG3CFBE</td>
<td>4 KB</td>
<td>256B</td>
<td>4-ch.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1-ch.</td>
<td>ICS</td>
<td>8 PDIP</td>
</tr>
<tr>
<td>MC9S08QG2CFQE</td>
<td>2 KB</td>
<td>160B</td>
<td>-</td>
<td>4-ch.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1-ch.</td>
<td>ICS</td>
</tr>
<tr>
<td>MC9S08QG2CDE</td>
<td>2 KB</td>
<td>160B</td>
<td>-</td>
<td>4-ch.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1-ch.</td>
<td>ICS</td>
</tr>
<tr>
<td>MC9S08QG2CFQE</td>
<td>2 KB</td>
<td>160B</td>
<td>-</td>
<td>4-ch.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1-ch.</td>
<td>ICS</td>
</tr>
</tbody>
</table>
Freescale introduces the first RS08 cost-effective MCUs with LCD drivers. The highly integrated MC9RS08LA8 and MC9RS08LE4 MCUs are intended for small appliances, medical equipment and other industrial and multi-market applications. The LA and LE families provide design flexibility with a large segment-based (8x mode) driver and the RS08LA8 derivative features an integrated charge pump to provide true system-on-a-chip functionality.

**Key Features**
- Small-footprint LCD solutions in 28-pin and 48-pin packages
- Flexible LCD solutions
  - x8 mode means customer can drive more segments with less pins
  - Flexible glass, drive 3V or 5V glass
  - Blink capability available even in stop mode
  - Charge pump, RS08LA8 only
- Cost-effective solutions based on ultra-low-end RS08 core
- Feature-rich analog and serial functionality

**Target Applications**
- Coffee machines
- Microwaves
- Portable ovens
- Frying machines
- Portable medical equipment
- Thermostat
- HVAC applications
- Security and access control
- Remote controls

**Development Tools**
- DEMO9RS08LA8
- DEMO9RS08LE4

The cost-effective demonstration kits contain everything a designer needs to develop and evaluate application code. The integrated USB multilink allows a designer to communicate with the board and target device with only a USB cable.

**Features**
- MC9RS08LA/E
- Integrated P&E USB-BDM
- On-board +5V regulator
- Power input selection jumpers
- Three push switches: User, reset and LED
- Buzzer
- Temperature sensor/themistor
- User option jumpers to disconnect peripherals
- MCU I/O connector
- 2.0 mm barrel connector
- BDM_PORT (not installed)
- USB connector
- DB9 connector

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**MC9RS08LA8 Block Diagram**

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**Device Flash RAM ADC Channels LCD RTI SCI SPI I2C 10-bit Timer Channels 8-bit MTIM Clock Type Package**

<table>
<thead>
<tr>
<th>Device</th>
<th>Flash</th>
<th>RAM</th>
<th>ADC Channels</th>
<th>LCD</th>
<th>RTI</th>
<th>SCI</th>
<th>SPI</th>
<th>I2C</th>
<th>10-bit Timer Channels</th>
<th>8-bit MTIM</th>
<th>Clock Type</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC9RS08LA8CGT 8 KB 256B 6-ch.</td>
<td>1</td>
<td>1</td>
<td></td>
<td>2-ch.</td>
<td>1</td>
<td>ICS</td>
<td>48 QFN</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MC9RS08LA8CLF 8 KB 256B 6-ch.</td>
<td>1</td>
<td>1</td>
<td></td>
<td>2-ch.</td>
<td>1</td>
<td>ICS</td>
<td>48 QFP</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>MC9RS08LE4CWL 4 KB 256B 8-ch.</td>
<td>1</td>
<td>1</td>
<td></td>
<td>2 x 2-ch.</td>
<td></td>
<td>ICS</td>
<td>28 SOIC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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The MC9S08LG family of 8-bit microcontrollers drives LCDs with up to 296 segments. This 5V LCD device offers improved performance and flexible pin functionality for a wide range of industrial and automotive applications, such as electric metering, home appliances, HVAC systems and entry-level instrument clusters.

Key Features/Benefits
- 2.7 to 5.5V operation available
- 16 KB and 32 KB flash, 4 KB RAM, 12-bit ADC
- Two hardware SCI, SPI, I²C
- Two independent 16-bit timers and one 8-bit timer
- Integrated LCD
  - Supporting both x8 and x4 mode up to 8 x 37 or 4 x 41 segments
  - Internal regulated charge pump for contrast control
- Dual bank flash for EEPROM emulation
- Internal clock source
- 40°C to 85°C for industrial and up to 105°C for automotive
- Up to 40 MHz HCS08 CPU core

Target Applications
- White goods
- Automotive instrument clusters
- Factory automation
- HVAC applications
- Security and access control
- Building control

Sample Application Notes
- AN3828: Stepper Motor Motion Control Driver for MC9S08LG32
- AN3823: LCD Driver for MC9S08LG32
- AN3802: Interfacing an LCD with the MC9S08LG32
- AN3821: How to Handle Dual Flash Architecture in MC9S08LG32
- AN3817: Interfacing Stepper Motor with MC9S08LG32

The DEMO9S08LG32 is a demonstration board for the MC9S08LG32 8-bit MCU. Application development is quick and easy with the integrated USB-BDM, sample software tools and examples. An optional BDM_PORT port is also provided to allow use of a BDM_PORT cable. One 80-pin connector provides access to all I/O signals on the target MCU.

Features
- MC9S08LG32, 80 LQFP
- On-board 4 x 40 custom LCD glass
- Integrated P&E USB-BDM
- On-board +5V regulator
- 10 push switches: Eight user, one reset, one IRQ
- 12 LED indicators: Eight user, one VDD, one IRQ, one USB and one reset
- 5K ohm POT w/ LP filter for ADC input
- 80-pin MCU I/O pin header
- 2.0 mm barrel connector
- USB connector

MC9S08LG Family
Robust 5V LCD solution for industrial markets

MC9S08LG Block Diagram

<table>
<thead>
<tr>
<th>Device</th>
<th>Flash</th>
<th>RAM</th>
<th>ADC Channels</th>
<th>LCD</th>
<th>RTC</th>
<th>SCI</th>
<th>SPI</th>
<th>I²C</th>
<th>16-bit Timer Channels</th>
<th>8-bit MTIM</th>
<th>Clock Type</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC9S08LG32CLK</td>
<td>32 KB</td>
<td>2 KB</td>
<td>16-ch.</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2 x 6-ch.</td>
<td>Y</td>
<td>ICS</td>
<td>80 LQFP</td>
</tr>
<tr>
<td>MC9S08LG32CLH</td>
<td>32 KB</td>
<td>2 KB</td>
<td>12-ch.</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2 x 6-ch.</td>
<td>Y</td>
<td>ICS</td>
<td>64 LQFP</td>
</tr>
<tr>
<td>MC9S08LG32CLF</td>
<td>32 KB</td>
<td>2 KB</td>
<td>9-ch.</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2 x 6-ch.</td>
<td>Y</td>
<td>ICS</td>
<td>48 LQFP</td>
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<td>2</td>
<td>1</td>
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<td>2 x 6-ch.</td>
<td>Y</td>
<td>ICS</td>
<td>64 LQFP</td>
</tr>
<tr>
<td>MC9S08LG16CLF</td>
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<td>2 KB</td>
<td>9-ch.</td>
<td>1</td>
<td>1</td>
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<td>1</td>
<td>1</td>
<td>2 x 6-ch.</td>
<td>Y</td>
<td>ICS</td>
<td>48 LQFP</td>
</tr>
</tbody>
</table>
Freescale introduces the first S08 ultra-low-power MCU with LCD driver. The MC9S08LL16/8 helps you reach your target performance levels while minimizing power consumption in your design, demonstrating extreme energy efficiency for ultra-long operation in battery-powered applications.

**Key Features**
- Up to 40 MHz CPU (9S08LL64/36) 20 MHz bus speed
- Ultra-low-power MCU with six power saving modes, low-power oscillator and fast wake up from stop modes and industry-leading low power
- Flexible MCU solution
  - x8 mode means customer can drive more segments with less pins, up to 192 segments with 9S08LL16 and 288 segments with 9S08LL64
  - Flexible glass, drive 3V or 5V glass
  - Blink capability available even in stop mode
- Charge pump
- Time of day timer module for calendar/time recording/measurement with separate clock source

**Target Applications**
- Thermostats
- HVAC control
- Small and large appliances
- Remote control
- Industrial control terminals
- Portable medical equipment
- Building automation
- Security and access control

**Application Notes**
- AN3796: LCD Driver Specification
- AN3821: How to Handle Dual Flash Architecture in MC9S08LG32
- AN3822: Emulated EEPROM Implementation in Dual Flash Architecture and Demo Description on MC9S08LG32
- AN3990: Migrating from the MC9S08LL16 to MC9S08LL64 Microcontroller
- AN2764: Improving the Transient Immunity of Performance of Microcontroller-Based Applications
- AN2111: A Coding Standard for HCS08 Assembly Language

**MC9S08LL64 Block Diagram**

**Device Flash RAM ADC Channels LCD SCI SPI F/C 16-bit Timer Channels Clock Type Package**

<table>
<thead>
<tr>
<th>Device</th>
<th>Flash</th>
<th>RAM</th>
<th>ADC Channels</th>
<th>LCD</th>
<th>SCI</th>
<th>SPI</th>
<th>F/C</th>
<th>16-bit Timer Channels</th>
<th>Clock Type</th>
<th>Package</th>
</tr>
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<tr>
<td>MC9S08LL64CLK</td>
<td>64 KB</td>
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<td>10-ch.</td>
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<td>2</td>
<td>1</td>
<td>1</td>
<td>2 x 2-ch.</td>
<td>ICS</td>
<td>80 LQFP</td>
</tr>
<tr>
<td>MC9S08LL64CLH</td>
<td>64 KB</td>
<td>4 KB</td>
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<td>ICS</td>
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<td>1 x 2-ch.</td>
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<tr>
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<td>1</td>
<td>1 x 2-ch.</td>
<td>ICS</td>
<td>48 QFN</td>
</tr>
</tbody>
</table>

**DEMO9S08LL16**
The cost-effective DEMO9S08LL16 demonstration kit contains everything a designer needs to develop and evaluate application code. The integrated USB multilink allows a designer to communicate with the board and target device with only a USB cable.

**Features**
- MC9S08LL16, 64 LQFP
- Integrated P&E USB-BDM
- On-board +5V regulator
- Battery holder for li-ion battery
- Power input selection jumpers
- Five push switches: Four user and one reset
- 10 LED indicators: Eight user, one VDD and one USB
- 5K ohm POTS w/LP filter
- Light sensor w/LP filter and op amp
- User option jumpers to disconnect peripherals
- 40-pin MCU I/O connector
- 2.0 mm barrel connector
- BDM_PORT (not installed)
- USB connector
- DB9 connector

**TWR-S08LL64-KIT**
**TWR-S08LL64**

**Features**
- 5K one turn potentiometer—RS232 port
- MC9S08LL64 MCU
- 32,768 Hz Crystal
- Freescale 3-axis accelerometer
- ADC input to MCU buzzer light sensor with LP filter and opamp
- Mini-B USB connector
- One reset push button and four switches
- 2 x 28 segments LCD display

---

**MC9S08LL Family**

Ultra-low-power LCD solution driving more segments with fewer pins
**8-bit MC9S08LH**

Low-power segment LCD MCU with 16-bit ADC

Freescale expands the first S08 ultra-low-power MCU with LCD driver and increased ADC accuracy for medical and metering applications. The MC9S08LH family available with up to 64 KB flash helps you reach your target performance levels while minimizing power consumption in your design, demonstrating extreme energy efficiency for ultra-long operation in battery-powered applications. The S08LH also features a 16-bit ADC for accurate measurement.

**Key Features**
- 40 HMz 80 CPU
- Up to 64 KB flash memory, dual bank memory support
- Time of day for time stamping
- 288 segment LCD display with blink in stop mode capability
- Six flexible modes of operation to reduce overall power consumption
- 10-ch., 16-bit ADC
- 64-pin and 80-pin LQFP packages

**Application Note**
- AN3949: ADC16 Calibration Procedure and Programmable Delay Block Synchronization
- AN3796: LCD Driver Specification
- AN3821: How to Handle Dual Flash Architecture in MC9S08LG32
- AN3822: Emulated EEPROM Implementation in Dual Flash Architecture and Demo Description on MC9S08LG32
- AN3824: EEPROM Emulation Driver for MC9S08LG32 Application Notes
- AN3990: Migrating from the MC9S08LL16 to MC9S08LL64 Microcontroller
- DRM106: Thermostat Reference Design Using the MC9S08LL64
- AN2764: Improving the Transient Immunity Performance of Microcontroller-Based Applications
- AN2111: A Coding Standard for HCS08 Assembly Language

**TWR-S08LH64-KIT**

The cost-effective TWR-S08LH64-KIT development tool is part of the Tower System and features the MC9S08LH64 segment LCD controller with integrated 16-bit ADC. It provides everything needed to develop and evaluate application code. The integrated OSBDM allows communication with the board and target device with only a USB cable, while the board highlights the MCU’s low power features.

This module is designed to be combined and used with a variety of peripheral modules in the Tower System, and can also operate as a stand-alone debug tool that can be purchased separately from the complete kit, part number TWR-S08LH64.

**Features**
- 5K one-turn potentiometer
- RS232 port
- MC9S08LH64 MCU
- 32,768 Hz crystal
- Freescale 3-axis accelerometer ADC input to MCU
- Buzzer
- Light sensor with LP filter and opamp
- Mini-B USB connector
- One reset push button and four push switches
- 2 x 28 segments LCD display
  - 40-pin MCU I/O connector
  - 2 mm barrel connector
  - BDM_PORT (not installed)
  - USB connectors
  - DB9 connector

**Device Flash RAM ADC Channels Clock Type Package**

<table>
<thead>
<tr>
<th>Device</th>
<th>Flash</th>
<th>RAM</th>
<th>ADC Channels</th>
<th>LCD</th>
<th>SCI</th>
<th>SPI</th>
<th>I2C</th>
<th>16-bit Timer Channels</th>
<th>Clock Type</th>
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<tr>
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<td>1</td>
<td>1</td>
<td>2 x 2-ch.</td>
<td>ICS</td>
<td>80 LQFP</td>
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<tr>
<td>MC9S08LH64CLH</td>
<td>64 KB</td>
<td>2 KB</td>
<td>8-ch.</td>
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<td>1</td>
<td>1</td>
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<td>2 x 2-ch.</td>
<td>ICS</td>
<td>64 LQFP</td>
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<td>MC9S08LH36CLK</td>
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<td>8-ch.</td>
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<td>1</td>
<td>1</td>
<td>2 x 2-ch.</td>
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<td>80 LQFP</td>
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<tr>
<td>MC9S08LH36CLH</td>
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<td>2 KB</td>
<td>8-ch.</td>
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<td>1</td>
<td>1</td>
<td>2 x 2-ch.</td>
<td>ICS</td>
<td>64 LQFP</td>
</tr>
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</table>
8-bit MC9S08GW
8-bit MCU for flow metering

The MC9S08GW is a low-power 8-bit MCU family, based on the proven S08 core, and used in gas or water flow meters as well as single-phase electric meters. Two independent 16-bit SAR ADCs with a programmable delay block and a pulse counter with automatic sensor decoding for gas and water flow meters make this family ideal for electric metering applications. In addition, the flexible LCD controller enables it to be highly integrated. The MC9S08GW family comes with a full suite of hardware and software tools to make development quick and easy, including a cost-effective Tower module for getting started fast.

Key Features
- 40 MHz S08 CPU
- Up to 64 KB flash memory, dual bank memory support
- 288 segment LCD display with blink in stop mode capability
- Six flexible modes of operation to reduce overall power consumption
- 2 x 16-bit ADC with programmable delay block
- 64-pin and 80-pin LQFP packages
- Advanced IRTC for accurate calendaring with support for dedicated VBAT and anti-tamper capabilities

9S08GW 64/32 Block Diagram

Device Flash RAM ADC Channels AMCP LCD SCI SPI I²C Timers Clock Type Package

<table>
<thead>
<tr>
<th>Device</th>
<th>Flash</th>
<th>RAM</th>
<th>ADC Channels</th>
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<th>LCD</th>
<th>SCI</th>
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<th>I²C</th>
<th>Timers</th>
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<th>Package</th>
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<tr>
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<td>4 KB</td>
<td>7-ch, 6-bit</td>
<td>3</td>
<td>8 x 36</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>P Counter, PDB, RTC</td>
<td>ICS</td>
<td>80 LQFP</td>
</tr>
<tr>
<td>MC9S08GW64CLH</td>
<td>64 KB</td>
<td>4 KB</td>
<td>7-ch, 6-bit</td>
<td>3</td>
<td>8 x 36</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>TPM, 16-bit MTIM, 8-bit MTIM</td>
<td>ICS</td>
<td>64 LQFP</td>
</tr>
<tr>
<td>MC9S08GW32CLK</td>
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<td>7-ch, 6-bit</td>
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<td>3</td>
<td>1</td>
<td>TPM, 16-bit MTIM, 8-bit MTIM</td>
<td>ICS</td>
<td>80 LQFP</td>
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<tr>
<td>MC9S08GW32CLH</td>
<td>32 KB</td>
<td>2 KB</td>
<td>7-ch, 6-bit</td>
<td>3</td>
<td>8 x 36</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>TPM, 16-bit MTIM, 8-bit MTIM</td>
<td>ICS</td>
<td>64 LQFP</td>
</tr>
</tbody>
</table>

Sample Application Notes
- AN4257: IRTC Compensation and 1 Hz Clock Generation
- AN4262: Gas and Water Metering Application With MC9S08GW64
- AN4169: ADC Driver for MC9S08GW64
- AN4170: IRTC Driver for MC9S08GW64
- AN3949: ADC16 Calibration Procedure and Programmable Delay Block Synchronization
- AN4179: How to Interface and Drive a 3V or 5V LCD Glass with MC9S08GW64
- AN4168: ADC16 Calibration Procedure and Programmable Delay Block Synchronization For MC9S08GW64
- AN3827: Differences Between Controller Continuum ADC Modules
- AN1519: LCD Driver for the MC9S08LGW64
- AN1611: SCI Driver for the MC9S08GW64
- AN1518: FC Driver for the MC9S08GW64
- AN1600: MTIM Driver for the MC9S08GW64
- AN2111: A Coding Standard for HCS08 Assembly Language

Key Features
- 40 MHz S08 CPU
- Up to 64 KB flash memory, dual bank memory support
- 288 segment LCD display with blink in stop mode capability
- Six flexible modes of operation to reduce overall power consumption
- 2 x 16-bit ADC with programmable delay block
- 64-pin and 80-pin LQFP packages
- Advanced IRTC for accurate calendaring with support for dedicated VBAT and anti-tamper capabilities

Target Applications
- Low-end single-phase electricity meters
- Flow meters
- Measurement equipment
- Portable medical devices
- Building access control
- HVAC control systems
- Portable consumer devices

Sample Application Notes
- AN4257: IRTC Compensation and 1 Hz Clock Generation
- AN4262: Gas and Water Metering Application With MC9S08GW64
- AN4169: ADC Driver for MC9S08GW64
- AN4170: IRTC Driver for MC9S08GW64
- AN3949: ADC16 Calibration Procedure and Programmable Delay Block Synchronization
- AN4179: How to Interface and Drive a 3V or 5V LCD Glass with MC9S08GW64
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- AN3827: Differences Between Controller Continuum ADC Modules
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- AN2111: A Coding Standard for HCS08 Assembly Language

Device Flash RAM ADC Channels AMCP LCD SCI SPI I²C Timers Clock Type Package

<table>
<thead>
<tr>
<th>Device</th>
<th>Flash</th>
<th>RAM</th>
<th>ADC Channels</th>
<th>AMCP</th>
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<th>Timers</th>
<th>Clock Type</th>
<th>Package</th>
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<td>P Counter, PDB, RTC</td>
<td>ICS</td>
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<td>MC9S08GW64CLH</td>
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<td>4 KB</td>
<td>7-ch, 6-bit</td>
<td>3</td>
<td>8 x 36</td>
<td>4</td>
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<td>1</td>
<td>TPM, 16-bit MTIM, 8-bit MTIM</td>
<td>ICS</td>
<td>64 LQFP</td>
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<td>8 x 36</td>
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<td>8 x 36</td>
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<td>1</td>
<td>TPM, 16-bit MTIM, 8-bit MTIM</td>
<td>ICS</td>
<td>64 LQFP</td>
</tr>
</tbody>
</table>

TWR-S08GW64-KIT
The cost-effective TWR-S08GW64-KIT development tool is part of the Tower System and features the MC9S08GW64 segment LCD controller with integrated dual 16-bit ADC and P counter. It provides everything needed to develop and evaluate application code. The integrated OSU6WM allows communication with the board and target device with only a USB cable, while the board highlights the MCU’s low power features.

This module is designed to be combined and used with a variety of peripheral modules in the Tower System, and can also operate as a stand-alone debug tool that can be purchased separately from the complete kit, part number TWR-S08LH64.

Features
- 5K one-turn potentiometer
- RS232 port
- MC9S08GW64 MCU
- 32,768 Hz crystal
- Freescale 3-axis accelerometer
- ADC input to MCU
- Buzzer
- Light sensor with LP filter and op-amp
- Mini-B USB connector
- One reset push button and four push switches
- 2 x 28 segment LCD display
  - 40-pin MCU I/O connector
  - 2 mm barrel connector
- BDM_PORT (not installed)
- USB connectors
- DB9 connector
**MC9S08D Family**

The industry’s first 8-bit MCU family with embedded CAN, embedded EEPROM and on-chip emulation/debug for automotive and industrial markets

As power budgets tighten and the demand for more embedded content increases, the need for cost-effective, low-power and high-performance MCUs becomes essential. The S08 D family is the industry’s first family of 8-bit MCUs to offer embedded CAN, embedded EEPROM and on-chip emulation/debug. This highly integrated, next-generation family of MCUs is packed with features designed to provide increased performance as well as save power, development time, board space and cost.

There are three device sub-families within the S08 D-family: DZ, DV and DN MCUs. They provide developers freedom of choice to match their application and system requirements. The S08DZ is the high-end sub-family offering embedded CAN along with embedded EEPROM. S08DV is a lower cost option for those who need CAN but not embedded EEPROM. Finally, the S08DN removes the CAN module but still integrates embedded EEPROM for maximum design versatility in non-CAN-enabled applications.

**Key Features**

- On-chip components that help eliminate the need for external EEPROM, LVI circuit, voltage regulator, input/output (I/O) multiplexing, crystal, watchdog circuit, ADC and development tools
- On-chip emulation/debug that helps reduce development time since changes can be made on-board and in real time
- Increased RAM (up to 8 KB) that helps provide C/C++ developers the required memory to create code quickly
- Common tools among S08 D-families that help shorten development time
- 0.25µ technology that exhibits lower power consumption and increased CPU performance compared to its HC08 predecessor, allowing for more embedded content

**Target Applications**

- Industrial
  - Factory automation
  - Industrial machine control
  - Elevators
  - Escalators
  - Solar power systems
  - Measurement systems
  - Building automation
  - Cooling, heating
  - Security systems
  - Studio equipment
  - Deep freezers and refrigerators
- Automotive and more
  - Passenger vehicles
  - Body control
  - Motor control
  - Watchdog
  - Motorcycles
  - Passenger and cargo trains
  - Boats, ships and vessels as embedded network
  - Aircraft and aerospace electronics

**Sample Application Notes**

- AN3331: Migrating from the HC908AZ60A to MC9S08DZ60
- AN2717: M68HC08 to HCS08 Transition
- AN3499: Clock Options on the HC9S08 Family
- AN3305: On-Chip System Protection Basics for Automotive HCS08 Microcontrollers
- AN3387: HCS08 Automotive Low-Power Modes
- AN2111: A Coding Standard for HCS08 Assembly Language
- AN2497: HCS08 Background Debug Mode Versus HC08 Monitor Mode

**MC9S08DZ60 Block Diagram**

- 2 x SPI
- 2 x SCI
- 52 GPIO
- MCG
- 2 x ACMP
- WDT
- 2 x FC
- COP
- msCAN
- KBI
- RTC
- 8-ch., 16-bit Timer
- ICE + BDM
- 24-ch., 10-bit ADC
- Up to 128 KB Flash
- Up to 4 KB RAM
- 2 KB EEPROM
- S08 Core

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freescale.com/MCU
### DEMO9S08DZ60

**EVB9S08DZ128**

The DEMO9S08DZ60 is a demonstration board for the MC9S08DZ60 MCU. Application development is quick and easy with the integrated USB BDM, sample software tools and examples. An optional BDM_PORT is also provided to allow use of a BDM_PORT cable. Two, 40-pin connectors provide access to all I/O signals on the target MCU. The EVB9S08DZ128 should be used to evaluate the 9S08DZ/V/N128/96 parts only. Below are the features of the demo board. The EVB is more fully featured.

- **MC9S08DZ**, 64 LQFP
- **4 MHz XTAL**
- **Integrated P&E USB BDM**
- **BNC connector**
- **Integrated R&E USB BDM**
- **BDM_PORT header for BDM cable support**
- **LIN PHY with two four-position Molex connectors**
- **HS-CAN PHY with three-position pin header connector**
- **LP filters on ADC inputs**
- **Two MCU_PORT socket headers for access to MCU I/O signals**
- **On-board +5V regulator**
- **Optional power from USB BDM or MCU_PORT connector**
- **Power input selection jumpers**
- **Power input from on-board regulator**
- **Power input from connector J1**
- **Optional power output through connector J1**
- **User components provided**
- **Three push switches: Two user, one reset**
- **One four-position DIP switch**
- **Seven LED indicators: Four user, VDD, USB power, USB power out**
- **Jumpers**
- **Connectors**

---

### Table: MC9S08DN/DS Family Continued

<table>
<thead>
<tr>
<th>Device</th>
<th>Flash</th>
<th>RAM</th>
<th>EEPROM</th>
<th>ADC 10-bit</th>
<th>CAN</th>
<th>SCI</th>
<th>SPI</th>
<th>IC</th>
<th>16-bit Timer Channels</th>
<th>Clock Type</th>
<th>Package</th>
<th>Applications/Additional Features</th>
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<td>-</td>
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<td>2</td>
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<td>1 x 6-ch., 1 x 2-ch.</td>
<td>MCG</td>
<td>64 LQFP</td>
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<tr>
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<td>48 LQFP</td>
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</tr>
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<td>1 x 6-ch., 1 x 2-ch.</td>
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<td>24-ch.</td>
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<td>2</td>
<td>1 x 6-ch., 1 x 2-ch.</td>
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<td>100 LQFP</td>
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<td>1</td>
<td>2</td>
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<td>1 x 6-ch., 1 x 2-ch.</td>
<td>MCG</td>
<td>48 LQFP</td>
<td></td>
</tr>
<tr>
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*All HC08 and S08 include COP, LVI, POR, KBI*
S08P Family
5V MCU family with excellent ESD/EFT for robust industrial environments

The scalable S08P family offers a wide range of feature and price options for product differentiation. Choose between the full-featured TSI enabled PT class, the equally full-featured PA class without TSI or the basic PL class for cost-sensitive applications.

Key Features
- Touch-sensing interface (PT class only)
- Scalable from .5 to 4 KB of RAM and 2 to 60 KB flash
- Up to 256B of EEPROM
- Up to 3x UART, 2x serial peripheral interface (SPI) and an inter-integrated circuit (I2C)
- Up to 16-channel, 12-bit analog to-digital converter (ADC) with four entry buffers

Target Applications
- Small appliances
- Power tools
- Home appliances
- Lighting
- Advanced lighting control
- HVAC building and control systems
- Electric metering
- Electric motor control
- Battery chargers and management
- High-end lighting control
- Circuit breakers
- Smart grid and smart metering

Application Notes
- AN4438: EMC Design Considerations for MC9S08PT60
- AN4347: Transitioning Applications from S08AC and S08FL Family to S08PT Family
- AN4431: TSI Module Application on the S08PT Family

S08PT/PA/PL Family Block Diagram

Core and System
- S08
  - 10 MHz
  - 20 MHz
- Background Debug Mode
- CRC
- Watchdog
- Unique ID
- POR
- LVD
- Watchdog

Clock Management
- Ext HS Osc
  - 4–20 MHz
- Int Osc
  - ~32 kHz
- FLL Clock Multiplier
- Ext LS Osc
  - 32 kHz
- PLL
- 2.7–5.5V Power Supply
- 4.5–5.5V Power Supply

Power Management
- Background Debug Mode
- Watchdog

Analog
- Up to 16-ch.
  - with 8 FIFO
- 8-bit ADC
- 12-bit ADC
- 1x Analog Comparator

Timers
- Up to 3x 16-bit Flex Timer
  - 6-ch. + 2-ch. + 2-ch.
- 1x 8-bit Modular Timer
- 1x 16-bit RTC

Communication
- Up to 3x UART
  - (LIN Capable)
- 1x SPI
- 1x 8-bit SPI
- 1x 16-bit SPI

I/O Ports
- Up to 57 GPIO
- 16 KBI
- IRQ
- 16 TSI
- Reset
- 8x 20 mA High Sink
- 2x True Open Drain

Features available on all classes
- Feature available only on PT class
- Feature available only on PT and PA classes
## S08P Part Numbers

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<th>Device</th>
<th>Flash</th>
<th>RAM</th>
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MC9S08QB/E Family

Outstanding low power consumption from industry’s first series of 8- and 32-bit pin, peripheral- and tool-compatible MCUs

Key Features

• High-performance 8-bit core
• 25 MHz bus frequency
• Memory
  - Up to 8 KB SRAM
  - Up to 128 KB flash
• 2 x SCI, 2 x PC, 2 x SPI
• 16-bit timers: 1 x 6-ch., 2 x 3-ch.
• 12-bit, 24-ch. ADC with two analog comparators
• Real-time counter
• 70 (mux-ed) GPIOs for 80-pin package
• Low-power features:
  - Internal clock source (ICS)
  - Wreg with fast start-up time and low regulation voltage
  - Ultra-low-power 32 kHz oscillator (standby current 1.5 uA)
  - Optimized clock tree and clock gating techniques
• Single wire background debug interface
• On-chip in-circuit emulator

Applications

• Health care monitoring and instrumentation
• HVAC and building control
• Gas, water and theater meters
• Measurement equipment
• Cell phone accessories
• Low-power wireless

Application Notes

• AN3465: Migrating within the Controller Continuum
• AN3460: Low-Power Design Enabled by MC9S08QE128 and MCF51QE128 Microcontrollers

DEMOQE128
(Supports 8- and 32-bit QE families)
TWR-S08UNIV + TWR-S08DC-QE64

DEMOQE128 Features

• MCU operates from internal clock source
• Footprint for external crystal components
• RS232 COM port
• Piezzo buzzer
• Potentiometer
• 3-axis accelerometer
• Five push buttons
• Eight LEDs
• USB MCU debug interface (MDI)
• BDM protocol
• Logic analyzer
• SCI traffic
• External BDM connector
• Prototyping areas
• Supports plug-in RF daughter cards for SMAC and 802.15.4

• AN3502: Differences Between the TI MSP430 and MC9S08QE128 and MCF51QE128 Flexis Microcontrollers
• AN3500: Blood Pressure Monitor Using Flexis QE128
• AN3499: Clock Options on the HC9S08 Family
• AN2497: HCS08 Background Debug Mode Versus HC08 Monitor Mode

Core

The Freescale Controller Continuum provides unique flexibility to transition from 8- to 32-bit. With pin, peripheral and tool compatibility, the QE128 devices simplify and speed the design process. Through an optimized architecture that provides lower operating voltage and current, the QE128 devices offer industry-leading ultra-low-power benefits to extend battery life. The MC9S08QB offers a lower cost alternative to the MC9S08QE in small flash sizes. The MC9S08QB/E selection criteria in end applications includes:

• Absolute minimum power consumption required
• Lower pin count or pin count options desired
• No application requirement for higher performance calculations or peripherals
• Greater cost sensitivity

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<th>Device</th>
<th>Flash</th>
<th>RAM</th>
<th>ADC Channels</th>
<th>ESCI</th>
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<td>8-ch., 1-channel</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1 x 1-ch.</td>
<td>CS</td>
<td>48 LQFP</td>
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<tr>
<td>MC9S08QE16HL</td>
<td>16 KB</td>
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<td>8-ch., 1-channel</td>
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<td>1</td>
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<td>1 x 1-ch.</td>
<td>CS</td>
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<tr>
<td>MC9S08QE8CL</td>
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<td>8-ch., 1-channel</td>
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<td>1 x 1-ch.</td>
<td>CS</td>
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<tr>
<td>MC9S08QE4CL</td>
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<td>256 B</td>
<td>8-ch., 1-channel</td>
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<td>1 x 1-ch.</td>
<td>CS</td>
<td>48 LQFP</td>
<td></td>
</tr>
</tbody>
</table>
The Freescale Controller Continuum provides unique flexibility to transition from 8-bit to 32-bit. With pin, peripheral and tool compatibility, the QE128 devices simplify and speed the design process. Through an optimized architecture that provides lower operating voltage and current, the QE128 devices offer industry-leading, ultra-low-power benefits to extend battery life.

Key Features
• New ColdFire V1 50 MHz core
  • Improved handling of byte and word operands
  • Standardized 8-bit bus to S08 peripherals
  • Same programming model as other ColdFire cores (V2–V4)
• Peripheral compatible with MC9S08QE family
• Pin compatible with MC9S08QE family
• Development tool compatible with MC9S08QE family
• New BDM interface compatible SS08 single-wire BDM
• Single CodeWarrior IDE

Applications
• HVAC building and control systems
• Health care monitoring and instrumentation
• Fire/security control and monitoring systems
• Factory and automation systems
• Measurement equipment
• Hand-held health care/industrial applications
• Low-power industrial applications

MCF51QE ColdFire Family
Making the design process quick, easy and limitless

DEMOQE128
(Supports 8- and 32-bit QE families)
DEMO51QE128
(Supports only ColdFire MCF51QE family)
Features
• MCU operates from internal clock source
• Footprint for external crystal components
• RS232 COM port
• Piezoe buzzer
• Potentiometer
• 3-axis accelerometer
• Five push buttons
• Eight LEDs
• USB MCU debug interface (MDI)
  • BDM protocol
  • Logic analyzer
  • SCI traffic
• External BDM connector
• Prototyping areas
• Supports plug-in RF daughter cards for SMAC and 802.15.4

MCF51QE Block Diagram

<table>
<thead>
<tr>
<th>Device</th>
<th>Flash</th>
<th>RAM</th>
<th>ADC Channels (12-bit)</th>
<th>ESCI</th>
<th>SPI</th>
<th>PC</th>
<th>16-bit Timer Channels</th>
<th>ACMP</th>
<th>Clock Type</th>
<th>RTC</th>
<th>Temp</th>
<th>Package</th>
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<tbody>
<tr>
<td>MCF51QE128CLH</td>
<td>128 KB</td>
<td>8 KB</td>
<td>24</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2 x 3-ch. + 1 x 6-ch.</td>
<td>2</td>
<td>ICS</td>
<td>Yes</td>
<td>-40 °C to +85 °C</td>
<td>64 LQFP</td>
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<td>128 KB</td>
<td>8 KB</td>
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<td>2 x 3-ch. + 1 x 6-ch.</td>
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<td>22</td>
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<td>2</td>
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<td>2 x 3-ch. + 1 x 6-ch.</td>
<td>2</td>
<td>ICS</td>
<td>Yes</td>
<td>-40 °C to +85 °C</td>
<td>64 LQFP</td>
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<tr>
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<td>8 KB</td>
<td>22</td>
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<td>2</td>
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<td>2 x 3-ch. + 1 x 6-ch.</td>
<td>2</td>
<td>ICS</td>
<td>Yes</td>
<td>-40 °C to +85 °C</td>
<td>64 LQFP</td>
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</table>
MC9S08JS/M Family

Industry-leading 8- and 32-bit compatible USB MCUs with complete hardware and software solutions

With 8- and 32-bit compatibility, as well as compatibility within our USB MCU portfolio, the JM family offers exceptional migration flexibility. The JM family offers a completely integrated USB solution with a complimentary USB stack to make development quick and easy while expanding our low-end USB portfolio. The MC9S08JS also features a pre-loaded USB bootloader.

Key Features
- Up to 4 KB SRAM, up to 60 KB flash
- Integrated USB 2.0 device
- 2 x SCI, FC, 2 x SPI
- 8-ch. KBI
- 16-bit timers: 1 x 2-ch., 1 x 6-ch.
- 12-bit, 12-ch. ADC
- Analog comparator
- External crystal support
- On-chip oscillator
- Multiple-purpose clock generation
- Phase-lock loop (PLL)
- External crystal support
- Complimentary USB software stack
- CodeWarrior for MCUs
- Processor Expert
- Complimentary USB stacks
- Packages: 64 LQFP, 64 QFP, 48 QFN, 44 LQFP

MC9S08JM Block Diagram

```
<table>
<thead>
<tr>
<th>Device</th>
<th>Flash</th>
<th>RAM</th>
<th>USB Bootloader</th>
<th>ADC Channels 12-bit</th>
<th>ADC Channels 10-bit</th>
<th>USB</th>
<th>SCI</th>
<th>SPI</th>
<th>PC</th>
<th>16-bit Timer Channels</th>
<th>Clock Type</th>
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<td>MC9S08JM00CHLH</td>
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<td>1</td>
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<td>MCG</td>
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</tbody>
</table>
```

DEMOJM

DEMOJM is a cost-effective kit enabling quick MCU evaluation. The kit includes a DEMOJM base board, a red MCF51.JM128 daughter card and a green MC9S08JM60 daughter card. The included kit can first be used to demonstrate the features of the MC9S08JM60 devices, starting with an on-chip USB device controller and transceiver. Then, move to MCF51.JM128 with an on-chip USB host and device dual-role controller. The USB features are supported in hardware through a dedicated USB mini-AB connector and in software through the included complimentary USB-LITE stack by CMX.

- MC9S08JM60 and MCF51.JM128 daughter cards
- Freescale MMA7260QT 3-axis accelerometer
- Virtual serial port
- USB device mode and host mode support with mini-AB USB connector
- CAN transceiver
- Eight user LEDs
- One Piezzo buzzer
- I²C pull-ups
- LTD with 10K ohm potentiometer
- Five push buttons
- CodeWarrior Special Edition
- Complimentary USB stack

Application Notes
- AN3564: In-Depth Understanding of the Freescale USB Stack for S08JM Devices
- AN3561: USB Bootloader for HCS08JM60
- AN3560: USB Device Development with JM60/16
- AN3565: USB and Using the CMX USB Stack with the JM Devices
MCF51JM ColdFire Family

Cost-effective Flexis 8- to 32-bit compatibility meets high performance and secure USB connectivity

The 32-bit MCF51JM128 device further extends the low end of the ColdFire embedded USB controller family with up to 128 KB of flash memory, a Full-Speed USB 2.0 controller with host, device and On-The-Go (OTG) support. An integrated CAN module which is ideal for linking industrial automation and control systems. The ColdFire JM family also features a hardware cryptographic acceleration unit (CAU), a random number generator accelerator (RNGA) and several system protection features such as low-voltage detect and a computer operating proper (COP) module.

Features
- CAN
- CAU
- 2 x SCI, PC, 2 x SPI
- 8-channel KBI
- 16-bit timers: 1 x 2-ch., 1 x 6-ch.
- 12-bit, 12-ch. ADC
- Analog comparator
- Up to 51 general-purpose I/O
- Multiple purpose clock generation
- PLL
- PLL
- On-chip oscillator
- External crystal support
- Integrated USB 2.0 Full-Speed host/device/OTG
- Complimentary USB software stack
- CodeWarrior for MCUs with Processor Expert

Applications
- HVAC building and 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

Application Notes
- AN3565: USB and Using the CMX USB Stack with the JM Devices
- AN3564: In-Depth Understanding of the Freescale USB Stack for S08JM Devices
- AN3560: The USB Device Development with S08JM (or In-Depth Understanding of the S08JM USB Module)
- AN3561: USB Bootloader for S08JM60
- AN3582: The USB Data Logger Based on S08JM60

MFC51JM128 Block Diagram

<table>
<thead>
<tr>
<th>Part Numbers</th>
<th>Flash</th>
<th>RAM</th>
<th>12-bit ADC</th>
<th>USB 2.0 Device (FS)</th>
<th>SCI</th>
<th>SPI</th>
<th>PC</th>
<th>CAN</th>
<th>Crypto</th>
<th>Timers</th>
<th>AMCP</th>
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<td>1 x 6-ch., 1 x 2-ch.</td>
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<tr>
<td>MCF51JM32EVLD</td>
<td>32 KB</td>
<td>16 KB</td>
<td>12</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1 x 6-ch., 1 x 2-ch.</td>
<td>1</td>
</tr>
<tr>
<td>MCF51JM32VQH</td>
<td>32 KB</td>
<td>16 KB</td>
<td>12</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1 x 6-ch., 1 x 2-ch.</td>
<td>1</td>
</tr>
<tr>
<td>MCF51JM32VLK</td>
<td>32 KB</td>
<td>16 KB</td>
<td>12</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1 x 6-ch., 1 x 2-ch.</td>
<td>1</td>
</tr>
<tr>
<td>MCF51JM32EVLD</td>
<td>32 KB</td>
<td>16 KB</td>
<td>12</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1 x 6-ch., 1 x 2-ch.</td>
<td>1</td>
</tr>
</tbody>
</table>

DEMOJM
DEMOJM is a cost-effective kit enabling quick MCU evaluation. The kit includes a DEMOJM base board, a red MCF51JM128 daughter card and a green MC9S08JM60 daughter card. The included kit can first be used to demonstrate the features of the MC9S08JM60 devices, starting with an on-chip USB device controller and transceiver. Then, move to MCF51JM128 with an on-chip USB host and device dual-role controller. The USB features are supported in hardware through a dedicated USB mini-AB connector and in software through the included complimentary USB-LITE stack by CMX.

- MC9S08JM60 and MCF51JM128 daughter cards
- Freescale MMA7260QT 3-axis accelerometer
- Virtual serial port
- USB device mode and host mode support with mini-AB USB connector
- CAN transceiver
- Eight user LEDs
- One Piezzo buzzer
- I²C pull-ups
- ADC with 10K ohm potentiometer
- Five push buttons
- CodeWarrior Special Edition
- Complimentary USB stack
8-bit MC9S08JE
Ultra-low-power USB MCU family

The MC9S08JE128/64 (JE128/64) provides ultra-low-power operation, USB connectivity and high measurement accuracy, all in a single 8-bit MCU, allowing designers to develop a more fully featured system at a lower cost. The JE128/64 integrates high-resolution ADC and DAC modules, a rich peripheral set including a USB 2.0 device controller and multiple serial interfaces.

The JE128/64 is part of the Freescale Flexis series, which includes both 8-bit S08 and 32-bit ColdFire V1 MCUs that have a common set of peripherals and development tools to deliver the ultimate in migration flexibility and ease of use. Freescale provides a comprehensive suite of development tools and software to help developers design quickly and easily.

Features
- Up to 128 KB flash, 12 KB SRAM
- 12-bit SAR ADC with PDB
- Analog comparator
- VREF internal voltage reference
- Full-Speed USB 2.0 device supported with USB stack
- 2 x SPI, 2 x SCI and FC
- Seven flexible modes for low-power applications
- Low current consumption in stop modes
- Flexis series with compatible 32-bit MCU

Applications
- PC peripherals
- Data logger
- Portable medical devices
- USB bridge

Application Notes
- AN4115: IrDA Driver and SD Card File System on the MM/JE Flexis Families
- AN4116: Using the MM/JE Flexis Families for Infrared Communication
- AN3412: Dynamic LCD Driver Using GPIO Pins
- AN3949: ADC16 Calibration Procedure and Programmable Delay Block Synchronization
- AN3827: Differences Between Controller Continuum ADC Modules
- AN4223: Connecting Low-Cost External Electrodes to MED-EKG

Device Flash RAM ADC Channels AMCP USB OTG SCI SPI FC Timers Clock Type Package

<table>
<thead>
<tr>
<th>Device</th>
<th>Flash</th>
<th>RAM</th>
<th>ADC Channels</th>
<th>AMCP</th>
<th>USB OTG</th>
<th>SCI</th>
<th>SPI</th>
<th>FC</th>
<th>Timers</th>
<th>Clock Type</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC9S08JE128VLH</td>
<td>128 KB</td>
<td>12 KB</td>
<td>8-ch.</td>
<td>1</td>
<td>Y</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2 x 6-ch., 16-bit, T0D, PDB</td>
<td>MCG</td>
<td>64 LQFP</td>
</tr>
<tr>
<td>MC9S08JE128VLK</td>
<td>128 KB</td>
<td>12 KB</td>
<td>8-ch.</td>
<td>1</td>
<td>Y</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2 x 6-ch., 16-bit, T0D, PDB</td>
<td>MCG</td>
<td>80 LQFP</td>
</tr>
<tr>
<td>MC9S08JE128VMB</td>
<td>128 KB</td>
<td>12 KB</td>
<td>8-ch.</td>
<td>1</td>
<td>Y</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2 x 8-ch., 16-bit, T0D, PDB</td>
<td>MCG</td>
<td>81 MAPBGA</td>
</tr>
<tr>
<td>MC9S08JE64VLH</td>
<td>64 KB</td>
<td>12 KB</td>
<td>8-ch.</td>
<td>1</td>
<td>Y</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2 x 6-ch., 16-bit, T0D, PDB</td>
<td>MCG</td>
<td>64 LQFP</td>
</tr>
</tbody>
</table>
32-bit ColdFire MCF51JE
Ultra-low-power USB MCU family

The MCF51JE256/128 (JE256/128) provides ultra-low-power operation, USB connectivity and high measurement accuracy, all in a single 32-bit MCU, allowing designers to develop a more fully featured system at a lower cost. The JE256/128 integrates high-resolution ADC and DAC modules, rich peripheral set including a USB 2.0 host/device/OTG controller, multiple serial interfaces and an external bus interface.

The JE256/128 is part of the Freescale Flexis MCU series, which includes both 8-bit S08 and 32-bit ColdFire V1 MCUs with a common set of peripherals and development tools to deliver the ultimate in migration flexibility. The JE246/128 family is also easy to use. Freescale provides a comprehensive suite of development tools and software to help developers design quickly and easily.

Features
- ColdFire V1 core delivering a 50 MHz core speed and 25 MHz bus speed
- Up to 256 KB flash and 32 KB SRAM
- Low-power Stop 2 current: 500 nA (32 KB of active SRAM)
- 12-bit SAR ADC: High-resolution ADC
- PRACMP: Analog comparator with 5-bit DAC
- VREF: Internal voltage reference

Applications
- Blood glucose meter
- Portable ECG
- Heart rate monitor
- Blood pressure monitor
- Test and measurement equipment
- Fitness machines

Application Notes
- AN4115: IrDA Driver and SD Card File System on the MM/JE Flexis Families
- AN4116: Using the MM/JE Flexis Families for Infrared Communication
- AN3412: Dynamic LCD Driver Using GPIO Pins
- AN3949: ADC16 Calibration Procedure and Programmable Delay Block Synchronization
- AN3827: Differences Between Controller Continuum ADC Modules
- AN4223: Connecting Low-Cost External Electrodes to MED-EKG

Device Flash RAM ADC Channels AMCP USB OTG SCI SPI PC Timers Clock Type Package
MCF51JE256VML 256 KB 32 KB 8-ch. 1 Y 2 2 1 2 x 4-ch., 16-bit, TCD, PDB MCG 104 MAPBGA
MCF51JE256VLL 256 KB 32 KB 8-ch. 1 Y 2 2 1 2 x 4-ch., 16-bit, TCD, PDB MCG 100 LQFP
MCF51JE256VMB 256 KB 32 KB 8-ch. 1 Y 2 2 1 2 x 4-ch., 16-bit, TCD, PDB MCG 81 MAPBGA
MCF51JE256VLK 256 KB 32 KB 8-ch. 1 Y 2 2 1 2 x 4-ch., 16-bit, TCD, PDB MCG 80 LQFP
MCF51JE128VML 256 KB 32 KB 8-ch. 1 Y 2 2 1 2 x 4-ch., 16-bit, TCD, PDB MCG 104 MAPBGA
MCF51JE128VLL 256 KB 32 KB 8-ch. 1 Y 2 2 1 2 x 4-ch., 16-bit, TCD, PDB MCG 100 LQFP
MCF51JE128VMB 256 KB 32 KB 8-ch. 1 Y 2 2 1 2 x 4-ch., 16-bit, TCD, PDB MCG 81 MAPBGA
MCF51JE128VLK 256 KB 32 KB 8-ch. 1 Y 2 2 1 2 x 4-ch., 16-bit, TCD, PDB MCG 80 LQFP

TWR-MCF51JE256-KIT
The TWR-MCF51JE-KIT is a cost-effective development tool for the MCF51JE low-power USB MCU. This kit is part of the Freescale Tower System, a modular, reconfigurable development platform that allows designers to get to market faster with packaged evaluation boards, tools and runtime software.

The MCF51JE MCU module is designed to be a stand-alone debug tool and can also be purchased separately from the kit, part number TWR-MCF51JE.

Features
- Freescale Tower System compliant
- Integrated open-source BDM debugging tool
- Small form factor (59 mm x 90 mm)
- Supports external communications interfaces
- Includes power regulation circuitry with standardized bus
- Two 80-pin connectors on the outside to support debugging or expansion to LCD module
- RS232, RS485, CAN, USB
- Low power
8-bit MC9S08MM
Ultra-low-power MCU for portable medical applications

The MC9S08MM128/64/32 provides ultra-low-power operation, USB connectivity, graphic display support and unparalleled measurement accuracy, all in a single 8-bit MCU, allowing device designers to create more fully featured products at a lower cost.

The MC9S08MM128/64/32 is ideal for medical applications or any other application requiring a significant amount of precision analog such as instrumentation and industrial control. The MC9S08MM128/64/32 is part of the Flexis MCU series.

Features
- HCS08 core delivering a 48 MHz core speed and 24 MHz bus speed
- Up to 128 KB flash and 12 KB SRAM
- Low-power Stop 2 current: 450 nA (12 KB of active SRAM)
- 2 x general-purpose op-amps
- 2 x tri-amps
- 16-bit SAR ADC: High-resolution ADC
- PRACMP: Analog comparator

Applications
- Blood glucose meter
- Portable ECG
- Heart rate monitor
- Blood pressure monitor
- Test and measurement equipment
- Fitness machines

Application Notes
- AN4115: IrDA Driver and SD Card File System on the MM/JE Flexis Families
- AN4116: Using the MM/JE Flexis Families for Infrared Communication
- AN3412: Dynamic LCD Driver Using GPIO Pins
- AN3949: ADC16 Calibration Procedure and Programmable Delay Block Synchronization
- AN3827: Differences Between Controller Continuum ADC Modules
- AN4223: Connecting Low-Cost External Electrodes to MED-EKG

TWR-S08MM128-KIT
The TWR-S08MM128-KIT is a medical-oriented development tool for the 9S08MM128 MCU. This kit is part of the Freescale Tower System, a modular, reconfigurable development platform that allows designers to get to market faster with packaged evaluation boards, tools and runtime software.

The kit includes the MED-EKG which is an electrocardiograph sensor for medical applications development. The 9S08MM MCU module is designed to be a stand-alone debug tool and can also be purchased separately from the kit, part number TWR-S08MM128.

Features
- Freescale Tower System compliant
- Integrated open-source BDM debugging tool
- Small form factor (59 mm x 90 mm)
- Supports external communications interfaces
- Includes power regulation circuitry with standardized bus
- Two 80-pin connectors on the outside to support debugging or expansion to LCD module
- RS232, RS485, CAN, USB
- Open connector for MED-EKG development board
- Low power
- MED-EKG plug-in card

Device Flash RAM ADC Channels AMCP USB SCI SPI fC Clock Type
<table>
<thead>
<tr>
<th>Device</th>
<th>Flash</th>
<th>RAM</th>
<th>16-bit</th>
<th>12-bit</th>
<th>YM</th>
<th>Y</th>
<th>Y</th>
<th>2</th>
<th>2</th>
<th>1</th>
<th>2 x 4-ch.</th>
<th>16-bit</th>
<th>TDC</th>
<th>DOD</th>
<th>PDB</th>
<th>MCG</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC9S08MM128VLJ</td>
<td>128 KB</td>
<td>12 KB</td>
<td>Y</td>
<td>8-ch.</td>
<td>Y</td>
<td>Y</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2 x 4-ch., 16-bit, TDC, PDB</td>
<td>MCG</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MC9S08MM128VHL</td>
<td>128 KB</td>
<td>12 KB</td>
<td>Y</td>
<td>6-ch.</td>
<td>Y</td>
<td>Y</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>4-ch., 2-ch., 16-bit, TDC, PDB</td>
<td>MCG</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MC9S08MM128VMB</td>
<td>128 KB</td>
<td>12 KB</td>
<td>Y</td>
<td>8-ch.</td>
<td>Y</td>
<td>Y</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2 x 4-ch., 16-bit TDC, PDB</td>
<td>MCG</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>MC9S08MM64VHL</td>
<td>64 KB</td>
<td>12 KB</td>
<td>Y</td>
<td>6-ch.</td>
<td>Y</td>
<td>Y</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>4-ch., 2-ch., 16-bit TDC, PDB</td>
<td>MCG</td>
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</tr>
<tr>
<td>MC9S08MM32VHL</td>
<td>32 KB</td>
<td>4 KB</td>
<td>Y</td>
<td>6-ch.</td>
<td>Y</td>
<td>Y</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>4-ch., 2-ch., 16-bit TDC, PDB</td>
<td>MCG</td>
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<tr>
<td>MC9S08MM32AVL</td>
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<td>2 KB</td>
<td>Y</td>
<td>6-ch.</td>
<td>Y</td>
<td>N</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>4-ch., 2-ch., 16-bit TDC, PDB</td>
<td>MCG</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

The Freescale Technology

Optional
32-bit ColdFire MCF51MM
Ultra-low-power OTG enabled MCU for portable medical applications

The MCF51MM256/128 provides ultra-low-power operation, USB connectivity, graphic display support and unparalleled measurement accuracy, all in a single 32-bit MCU, allowing device designers to create more fully featured products at a lower cost.

The MCF51MM256/128 is ideal for medical applications or any other application requiring a significant amount of precision analog such as instrumentation and industrial control.

The MCF51MM256/128 is part of the Flexis MCU series.

Features
- ColdFire V1 core delivering a 50 MHz core speed and 25 MHz bus speed
- Up to 256 KB flash and 32 KB SRAM
- Low-power Stop 2 current: 500 nA (32K of active SRAM)
- 2 x op-amps
- 2 x tri-amps
- 16-bit SAR ADC: High-resolution ADC
- PRACMP: Analog comparator with 5-bit DAC
- VREF: Internal voltage reference
- USB: Device/host/OTG controller
- 2 x SPI, 2 x SCI and 1 x I2C
- Mini FlexBus (external bus interface)

Applications
- Blood glucose meter
- Portable ECG
- Heart rate monitor
- Blood pressure monitor
- Test and measurement equipment
- Fitness machines

Application Notes
- AN4115: IrDA Driver and SD Card File System on the MM/JE Flexis Families
- AN4116: Using the MM/JE Flexis Families for Infrared Communication
- AN3412: Dynamic LCD Driver Using GPIO Pins
- AN3949: ADC16 Calibration Procedure and Programmable Delay Block Synchronization
- AN3927: Differences Between Controller Continuum ADC Modules
- AN4223: Connecting Low-Cost External Electrodes to MED-EGK

TWR-MCF51MM-KIT
The TWR-MCF51MM-KIT is a medical-oriented development tool for the MCF51MM256 MCU. This kit is part of the Freescale Tower System, a modular, reconfigurable development platform that allows designers to get to market faster with packaged evaluation boards, tools and runtime software.

The kit includes the MED-EKG which is an electrocardiograph sensor for medical applications development. The MCF51MM MCU module is designed to be a stand-alone debug tool and can also be purchased separately from the kit, part number TWR-MCF51MM.

Features
- Freescale Tower System compliant
- Integrated open-source BDM debugging tool
- Small form factor
- Supports external communications interfaces
- Includes power regulation circuitry with standardized bus
- Two 80-pin connectors on the outside to support debugging or expansion to LCD module
- RS232, RS485, CAN, USB
- Open connector for MED-EKG development board
- Low power
MCF51CN Family
Small, sub-$3 Ethernet-enabled MCU

MCF51EM256 is Freescale’s new smart-meter-on-a-chip 32-bit ColdFire V1 core MCU with embedded LCD controller, 16-bit ADC and metrology-specific peripherals optimized for smart meter applications. MCF51EM256 comes with a full suite of hardware and software tools to make development quick and easy.

**Key Features**
- 32-bit ColdFire V1 CPU offering 47 MIPS at 50 MHz 3.3V single supply
- Up to 256 KB flash (dual bank)
- Up to 16 KB SRAM
- 1.8 to 3.6V operation
- Ultra-low-power operation
- 4 x 16 bit SAR ADC
- 288 segment LCD driver with integrated charge pump
- Up to 50 general-purpose input/outputs
- iRTC with dedicated 32 kHz Osc/ battery backup
- AMR SPI for simple connection to RF/PLM chipsets
- Freescale complimentary MQX RTOS available
- Background debug mode (BDM) for in-circuit debugging

**Applications**
- Industrial operator interfaces
- Consumer and industrial appliances
- Medical monitoring and instrumentation
- Point-of-sale and courier systems
- Security and building control systems single-phase e-meters
- PAN coordinator
- Serial-to-Ethernet bridge

**Application Notes**
- AN3942: Flash Programming Routines for the HCS08 and the ColdFire V1 Devices
- AN3906: Serial-to-Ethernet Bridge Using MCF51CN Family and FreeRTOS
- AN3930: Email Client Using MCF51CN Family and FreeRTOS
- AN3928: Web Server Using the MCF51CN Family and FreeRTOS
- AN3931: FTP Server Using MCF51CN Family and FreeRTOS

**Device Flash RAM Ethernet ADC Channels 16-bit Timers GPIO RTC Temp Package**

<table>
<thead>
<tr>
<th>Device</th>
<th>Flash</th>
<th>RAM</th>
<th>Ethernet</th>
<th>ADC Channels</th>
<th>MiniBus</th>
<th>SCI</th>
<th>SPI</th>
<th>I²C</th>
<th>GPIO</th>
<th>RTC</th>
<th>Temp</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCF51CN128CLK</td>
<td>128 KB</td>
<td>24 KB</td>
<td>Y</td>
<td>12-ch., 12-bit</td>
<td>yes</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2 x 3-ch.</td>
<td>70</td>
<td>Y</td>
<td>-40 °C to +85 °C</td>
</tr>
<tr>
<td>MCF51CN128CLH</td>
<td>128 KB</td>
<td>24 KB</td>
<td>Y</td>
<td>12-ch., No</td>
<td>No</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2 x 3-ch.</td>
<td>54</td>
<td>Y</td>
<td>-40 °C to +85 °C</td>
</tr>
<tr>
<td>MCF51CN128CTG</td>
<td>128 KB</td>
<td>24 KB</td>
<td>Y</td>
<td>12-ch., No</td>
<td>No</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2 x 3-ch.</td>
<td>38</td>
<td>Y</td>
<td>-40 °C to +85 °C</td>
</tr>
</tbody>
</table>
MCF51EM Family
Secure and robust MCU for e-metering/smart grid applications

MCF51EM256 is a smart-meter-on-a-chip 32-bit ColdFire V1 core MCU with embedded LCD controller, 16-bit ADC and metrology-specific peripherals optimized for smart meter application. MCF51EM256 comes with a full suite of hardware and software tools to make development quick and easy.

Features
- 32-bit ColdFire V1 CPU offering 47 MIPS at 50 MHz 3.3V single supply
- Up to 256 KB flash (dual bank)
- Up to 16 KB SRAM
- 1.8 to 3.6V operation
- Ultra-low-power operation
- 4 x 16 bit SAR ADC
- 288 segment LCD driver with integrated charge pump
- Up to 50 general-purpose input/outputs
- iRTC with dedicated 32 kHz osc/battery backup
- AMR SPI for simple connection to RF/PLM chipsets
- Freescale complimentary MQX RTOS available
- Background debug mode (BDM) for in-circuit debugging

Application Notes
- AN3796: LCD Driver Specification
- AN3827: Differences Between Controller Continuum ADC Modules
- AN3896: MCF51EM256 Performance Assessment with Algorithms Used in Metering Applications
- AN3949: Using the MCF51EM Family for Infrared Communication
- RDMCF51EM: MCF51EM Ply-Phase Metering Reference Design

MCF51EM Family
Secure and robust MCU for e-metering/smart grid applications

MCF51EM Block Diagram
The MCF5301x family of 32-bit MCUs combines low power, high integration and extensive connectivity with an audio subsystem, into a powerful platform for general industrial control applications, including digital voice functionality for intercom and public address systems. The audio system includes a speech codec, microphone, headset and loud speaker amplifiers, and an optional NRE-free VoIP-based digital voice solution designed specifically for industrial and consumer applications.

The MCF5301x family of 32-bit MCUs combines low power, high integration and extensive connectivity with an audio subsystem, into a powerful platform for general industrial control applications, including digital voice functionality for intercom and public address systems. The audio system includes a speech codec, microphone, headset and loud speaker amplifiers, and an optional NRE-free VoIP-based digital voice solution designed specifically for industrial and consumer applications.

**MCF5301x Family**
Rich connectivity MPU with complete VoIP solution

**Features**
- 32-bit ColdFire V3 CPU 240 MHz 47 MIPS
- 128 KB SRAM
- Audio codec
- NRE-free VoIP software with uCLinux RTOS
- 2 x Ethernet MAC
- USB host control and USB OTG with integrated PHY
- CAN controller
- Freescale complimentary MQX RTOS available

**Applications**
- Building automation
- Home automation
- Fire and alarm systems
- Access control
- Factory automation
- Medical monitoring equipment
- Point of sale systems
- Intercom and public address systems

**MCF5301x Block Diagram**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Core</th>
<th>Frequency</th>
<th>SRAM</th>
<th>DMA</th>
<th>Other</th>
<th>VoIP Codec /SSI</th>
<th>Crypto</th>
<th>Serial Comms</th>
<th>VoIP S/W</th>
<th>Temp</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCF53010CQT240</td>
<td>V3 with eMAC and H/W Div</td>
<td>240 MHz</td>
<td>128 KB</td>
<td>16-ch.</td>
<td>2 x Ethernet, USB OTG, USB Host, SDIO</td>
<td>Y</td>
<td>3 x UART, SPI, PC</td>
<td>-</td>
<td>-40 °C to +85 °C</td>
<td>208 LFQFP</td>
<td></td>
</tr>
<tr>
<td>MCF53011CQT240</td>
<td>V3 with eMAC and H/W Div</td>
<td>240 MHz</td>
<td>128 KB</td>
<td>16-ch.</td>
<td>2 x Ethernet, USB OTG, USB Host, SDIO</td>
<td>Y</td>
<td>3 x UART, SPI, PC</td>
<td>-</td>
<td>-40 °C to +85 °C</td>
<td>208 LFQFP</td>
<td></td>
</tr>
<tr>
<td>MCF53012CQT240</td>
<td>V3 with eMAC and H/W Div</td>
<td>240 MHz</td>
<td>128 KB</td>
<td>16-ch.</td>
<td>2 x Ethernet, USB OTG, USB Host, SDIO</td>
<td>Y</td>
<td>3 x UART, SPI, PC</td>
<td>Y</td>
<td>-40 °C to +85 °C</td>
<td>208 LFQFP</td>
<td></td>
</tr>
<tr>
<td>MCF53013CQT240</td>
<td>V3 with eMAC and H/W Div</td>
<td>240 MHz</td>
<td>128 KB</td>
<td>16-ch.</td>
<td>2 x Ethernet, USB OTG, USB Host, SDIO</td>
<td>Y</td>
<td>3 x UART, SPI, PC</td>
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<td>240 MHz</td>
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<td>256 MAPBGA</td>
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MCF5225x Family
One-stop connectivity MCU, including free RTOS

The MCF5225x family consists of highly integrated devices with on-chip USB, Ethernet, CAN and encryption functions, featuring the complete Freescale MQX RTOS software at no additional cost. This solution is ideal for factory automation, building control and medical applications.

Features
• 32-bit ColdFire architecture running up to 80 MHz core and bus speed, with excellent code density and interrupt handling for small real-time applications
• Rich range of connectivity peripherals
  • 10/100 Ethernet MAC
  • USB 2.0 OTG controller plus transceiver
  • CAN controller with optional hardware encryption accelerator
• Functional as single-chip solution with up to 512 KB flash or expanded mode with cost-effective external memory

Freescale MQX RTOS with full kernel, stacks and drivers
• Fully integrated software and hardware solution, including RTOS, compilers and debuggers to save on development time and resources
• Including bundled Freescale MQX free-of-charge RTOS featuring RTCs TCP/IP stack, USB stack and file system
• Bundled VoIP software available for industrial VoIP applications. NRE free, royalties required. Contact your Freescale representative for more information.

Applications
• Building and factory automation
• Small industrial Web servers
• Security access and control
• Network bridges
• Home automation Web servers
• Remote monitoring and control
• Medical networks

TWR-MCF5225x-KIT
Features
• Freescale Tower System compliant
• MCF5225X ColdFire V2 MCU
• Integrated OSBDM interface
• TWR-SER peripheral module features:
  • RS232 and RS485
  • Ethernet
  • CAN
  • USB supporting host, device and OTG modes

MCF5225x Block Diagram

<table>
<thead>
<tr>
<th>Device</th>
<th>Core</th>
<th>MHz</th>
<th>Flash</th>
<th>SRAM</th>
<th>MAC/ eMAC</th>
<th>RW Divide</th>
<th>DMA*</th>
<th>GPT*</th>
<th>Other</th>
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<td>-40 °C to +85 °C</td>
<td>144 MABGA</td>
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</table>
The MCF51AG family expands the 32-bit ColdFire MCU portfolio by offering products with DMA and iEvent modules to handle data transaction and interrupt management, thereby off-loading CPU overhead and increasing overall performance. The device targets intelligent smart appliance and industrial applications. The peripheral set is also well aligned to the needs of advanced three-phase motor control applications, where it can improve the overall energy efficiency of the application. Also included is functionality important for system safety and integrity, such as an advanced independently clocked COP, external watchdog monitor and a cyclic redundancy check (CRC) engine providing CLK failure protection and memory content validation for applications covered by regulations such as IEC60730.

**Applications**

- Room air conditioning
- White goods control panel
- Small appliances
- Three-phase BLDC motor control
- Heating and boiler control

**Application Notes**

- AN3628: Creating an External Bus Interface Using Rapid GPIO and Timers Application
- AN4213: Migration to TSS 2.0
- AN3464: Migrating Code Between ColdFire V1 and V2
- TNCNWMCUPORT: Porting Tip: Migrating from 8-bit S08 to 32-bit ColdFire V1 Using CodeWarrior for Microcontrollers V6.x
- AN3942: Flash Programming Routines for the HCS08 and the ColdFire (V1) Devices
- TN270: Converting Projects for ColdFire V1 to CodeWarrior Microcontrollers V6.3
- AN3465: Migrating Within the Controller Continuum

**TWR-MCF51AG-KIT**

The TWR-MCF51AG-KIT is part of the Freescale Tower System, a modular development platform that enables rapid prototyping and tool re-use through reconfigurable hardware. The kit contains the TWR-MCF51AG MCU module, along with elevator boards (TWR-ELEV), and prototyping board (TWR-PROTO). The TWR-MCF51AG MCU module is designed to be a stand-alone debug tool and can also be purchased separately from the kit, part number TWR-MCF51AG.

**Features**

- Freescale Tower System compliant
- Integrated open-source BDM debugging tool
- MPR121 touch sensor
- Capacitive touch pads
- 3-axis accelerometer
- Potentiometer
- Four LEDs
- Small form factor
- Mini-B USB connector
- Supports external communications interfaces
- Includes power regulation circuitry with standardized bus

---

**Device Flash RAM ADC Channels HSAMCP SCI SPI I2C 16-bit Timers Other Package**

<table>
<thead>
<tr>
<th>Device</th>
<th>Flash</th>
<th>RAM</th>
<th>ADC Channels</th>
<th>HSAMCP</th>
<th>SCI</th>
<th>SPI</th>
<th>I2C</th>
<th>16-bit Timers</th>
<th>Other</th>
<th>Package</th>
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<td>16 KB</td>
<td>12-ch.</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>2 x 6-ch., 16-bit FTM, 2-ch., 16-bit TPM, RTC, WDT</td>
<td>4-ch. DMA, Internal DAC (x2), iEvent, COP, CRC</td>
<td>48 LQFP</td>
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**Freescale Technology**
32-bit ColdFire MCF5441x

Integrated control and connectivity solution

The MCF5441x offers MCU peripherals with MPU performance, including integrated analog, an L2 switch and dual Ethernet. Add Linux and MQX RTOS, plus Eclipse-based CodeWarrior IDE and you've got a powerful development package for network-connected industrial applications.

**Features**
- Dual Ethernet with integrated L2 switch and high precision hardware time stamping (IEEE® 1588) with optional hardware encryption
- ColdFire V4M core with MPU, MAC and H/W Divide running up to 250 MHz
- Integrated motion control/timer with high-speed precision PWM and dual high-speed ADCs
- USB 2.0 OTG controller and optional USB 2.0 host controller
- Up to 10 UARTs possible, saving the expense of external UART expansion chips
- A range of interface for external memory including a DDR2 DRAM controller, SDIO, NAND flash interface, serial boot facility and system bus
- Low-power, real-time control industrial MPU addressing the rapid growth in industrial Ethernet
- Turn key support for embedded voice and VoIP applications

**Applications**
- Access panels
- Elevators
- Security
- HVAC
- Ethernet to serial bridges
- Networked control power grid controller
- Medical diagnostics, non-portable data analysis and processing
- Motor control
- VoIP phones

**Application Notes**
- AN3514: ColdFire Serial Boot Facility
- AN3520: Simplified EHCI Data Structures for High-End ColdFire Family USB Modules
- AN3522: DDR2 SDRAM on the ColdFire MCF5445x Microprocessor

**TWR-MCF5441x-KIT**

The TWR-MCF5441x-KIT module is part of the Freescale Tower System, a modular development platform that enables rapid prototyping and tool re-use through reconfigurable hardware.

The TWR-MCF5441x-KIT features the MCF54418 MPU, which offers MCU peripherals with MPU performance, including integrated analog, an L2 switch and dual Ethernet.

**Features**
- MCF54418 ColdFire V4 processor card
- Industrial Ethernet PHY configurable as:
  - 10/100 dual- or single-port RMII
  - 10/100 single-port MI
- Industrial high-speed, dual-role USB (host/device) over UPLI
- Dedicated host mode USB port
- Four concurrent RS232 serial transceivers, including one S08JS16 based serial-to-USB
- RS485 transceiver
- CAN transceiver
The ColdFire+ MCF51Qx portfolio is defined by four families that scale from 32 to 128 KB of flash with innovative FlexMemory, configurable embedded EEPROM. Featuring ultra-low-power capabilities and available in small 5 x 5 mm footprint packages, the MCF51QX family also offers a rich combination of analog peripherals, including high-accuracy 16-bit analog-digital-conversion (ADC), hardware encryption, an innovative touch-sensing interface and more. These key features make this a highly integrated, cost-effective 32-bit MCU solution for consumer and industrial applications. All four ColdFire+ MCF51Qx families are software and pin compatible with each other as well as the ColdFire+ MCF51Jx families to maximize code re-use and shorten development time and investment.

Applications
- Secure portable or battery-powered applications
- Wireless sensor nodes
- Security control pads
- Video game accessories
- eToll machines
- Digital audio bridges
- Medical devices
- Building control systems

Application Notes
- AN3949: ADC16 Calibration Procedure and Programmable Delay
- AN3827: Differences Between Controller Continuum ADC Modules
- AN3464: Migrating Code Between ColdFire V1 and V2
- AN3942: Flash Programming Routines for the HCS08 and the ColdFire (V1) Devices
- AN3465: Migrating within the Controller Continuum
- AN4223: Connecting Low-Cost External Electrodes to MED-EKG

Features
- Innovative FlexMemory, configurable EEPROM
- 10 flexible ultra-low-power modes
- 16-bit ADC and 12-bit DAC provide flexible and powerful mixed signal capability
- Crypto acceleration unit and random number generator for secure communication
- Integrated capacitive touch sensing and display support: Low-power touch-sensing interface (TSI)
- Small foot-print packages designed for space-constrained applications
- Ultra-low-power operation making it suitable for portable and battery-operated devices
## 32-bit ColdFire+ MCF51Qx

Continued

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<th>RAM</th>
<th>Flexmemory</th>
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The ColdFire+ MCF51Jx portfolio is defined by two families that scale from 32 to 128 KB of flash with innovative FlexMemory and configurable EEPROM. Featuring ultra-low-power capabilities and available in small 5 x 5 mm footprint packages, the MCF51Jx family also offers a rich combination of additive peripherals including USB On-the-Go (OTG), a serial audio interface, high-accuracy analog, hardware encryption, an integrated touch-sensing interface and more. These key features make these 32-bit MCUs a highly integrated, cost-effective solution for consumer and industrial applications.

The ColdFire+ MCF51Jx families are software and pin compatible with each other as well as the ColdFire+ MCF51Qx families to maximize code re-use and shorten development time and investment.

### Features
- Innovative FlexMemory, configurable EEPROM
- 10 flexible ultra-low-power modes
- Crypto acceleration unit and random number generator for secure communication
- Integrated capacitive touch sensing and display support: Low-power touch-sensing interface (TSI)
- Small footprint packages designed for space-constrained applications
- Integrated USB 2.0 Full-Speed device/host/OTG controller supports connection via USB and battery charging
- Serial audio interface provides direct interface to codecs and to Inter-IC sound (IFS) audio devices

### Applications
- Digital audio bridges
- Portable accessories
- Secure portable or battery-powered applications
- Wireless sensor nodes
- Security control pads
- Video game accessories
- Medical devices
- Building control systems
- Data loggers

### Application Notes
- AN3949: ADC16 Calibration Procedure and Programmable Delay
- AN3827: Differences Between Controller Continuum ADC Modules
- AN3464: Migrating Code Between ColdFire V1 and V2
- AN3942: Flash Programming Routines for the HCS08 and the ColdFire (V1) Devices

### TWR-MCF51JF-KIT
The TWR-MCF51JF module is part of the Freescale Tower System, a modular development platform that enables rapid prototyping and tool re-use through reconfigurable hardware. Take your design to the next level and begin constructing your Tower System today. The TWR-MCF51JF tower system can operate as a stand-alone debug tool and can be purchased separately as a kit, part number TWR-MCF51JF-KIT, including the TWR-MCF51JF module, TWR-PROTO and TWR-ELEV.

### Key Features
- MCF51JF128 device in a 64 LQFP package.
- On-board debugger (OSBDM)
- Full-Speed USB 2.0 dual-role interface
- Capacitive touch and push buttons
- Potentiometer
- Audio input/output
- Power plug-in sockets
- TWR-SER card for serial plug-in functionality
- Potentiometer, 4x LEDs, 2x push buttons, infrared port
- AN3465: Migrating Within the Controller Continuum
- AN3577: Creating a USB-to-Wireless Bridge with the MC1319x/20x and ColdFire Processors with USB OTG Module
- AN3927: Freescale USB Mass Storage Device Boot Loader
- AN3748: USB Boot Loader for MCF51JM128

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Freescale.com/MCU
32-bit Kinetics K10
General-purpose, low-power, mixed-signal MCU

The K10 MCU family is the entry point into the Kinetics portfolio. Devices start from 32 KB of flash in a small footprint 5 x 5 mm 32 QFN package extending up to 1 MB in a 144 MAPBGA package with a rich suite of analog, communication, timing and control peripherals. High memory density K10 family devices include a single precision floating point unit and NAND flash controller. Pin compatibility, flexible low-power capabilities and innovative FlexMemory help to solve many of the major pain points for system implementation.

Features
- Up to 150 MHz ARM Cortex-M4 core
- 32 KB flash: 1 MB program flash and 128 KB SRAM
- FlexMemory providing H/W EEPROM
- 32-pin QFN through to 256 MAPBGA
- 2 x CAN
- Up to 2 x 16-bit ADC with PGA, 12-bit DAC, analog comparators, voltage reference
- Motor control timers
- Low-power operation
- Serial communications

Applications
- Building access control
- HVAC
- Fire and security systems
- Remote sensor networks
- Metering and measurement
- Motor control

### TWR-K60N512-KIT

The TWR-K60N512-KIT is a development tool for the K60 and K10/20 families of Kinetics MCUs. This kit is part of the Freescale Tower System, a modular, reusable development platform that allows designers to get to market faster with packaged evaluation boards, tools and runtime software. The K60 MCU module can operate as a stand-alone debug tool and can be purchased separately from the kit, part number TWR-K60N512.

#### Key Features
- K60N512 capacitive touch pads
- Integrated, open-source JTAG
- SD card slot
- MMA7660 3-axis accelerometer
- Tower plug-in (TWRPI) socket for expansion (sensors, etc.)
- Touch TWRPI socket adds support for various capacitive touch boards
- TWR-SER board with USB, Ethernet, RS232/RS485, CAN, SPI, PC, Flexbus, etc.
- Potentiometer, four LEDs, two push buttons, infrared port

#### Application Notes
- KQRUG: Kinetics Peripheral Module Quick Reference
- ADC Calculator: Define Requirements of ADC and Calculate Conversion Times

---

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freescale.com/MCU
32-bit Kinetis K20
USB-enabled, low-power, mixed-signal MCU

The K20 MCU family is pin, peripheral and software compatible with the K10 MCU family and adds full and High-Speed USB 2.0 On-The-Go with device charge detect capability. Devices start from 32 KB of flash in 5 x 5 mm 32 QFN packages extending up to 1 MB in a 144 MAPBGA package with a rich suite of analog, communication, timing and control peripherals. High memory density K20 family devices include a single precision floating point unit and NAND flash controller.

Features
- Up to 150 MHz ARM Cortex-M4 core
- 32 KB flash; 1 MB program flash and 129 KB SRAM
- FlexMemory providing H/W EEPROM
- 32-pin QFN through to 256 MAPBGA
- USB 2.0-compliant OTG module with integrated PHY (option to support external ULPI PHY for High-Speed USB)
- Up to 2 x 16-bit ADC with PGA, 12-bit DAC, analog comparators, voltage reference
- Motor control timers
- Low-power operation
- Serial communications

Applications
- Building access control
- HVAC
- Fire and security systems
- Remote sensor networks
- Metering and measurement
- Motor control

TWR-K60N512-KIT
The TWR-K60N512-KIT is a development tool for the K60 and K10/20 families of Kinetis MCUs. This kit is part of the Freescale Tower System, a modular, reusable development platform that allows designers to get to market faster with packaged evaluation boards, tools and runtime software. The K60 MCU module can operate as a stand-alone debug tool and can be purchased separately from the kit, part number TWR-K60N512.

Key Features
- K60N512 capacitive touch pads
- Integrated, open-source JTAG
- SD card slot
- MMA7660 3-axis accelerometer
- Tower plug-in (TWRPI) socket for expansion (sensors, etc.)
- Touch TWRPI socket adds support for various capacitive touch boards
- TWR-SER board with USB, Ethernet, RS232/RS485, CAN, SPI, I2C, Flexbus, etc.
- Potentiometer, four LEDs, two push buttons, infrared port

Application Notes
- KQURG: Kinetis Peripheral Module Quick Reference
- ADC Calculator: Define Requirements of ADC and Calculate Conversion Times

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32-bit Kinetis K30
Low-power segment display-enabled MCU with rich mixed-signal capabilities

The K30 MCU family is pin, peripheral and software compatible with the K10 MCU family and adds a flexible low-power segment LCD controller with support for up to 320 segments. Devices start from 64 KB of flash in 64 QFN packages extending up to 512 KB in a 144 MAPBGA package with a rich suite of analog, communication, timing and control peripherals.

Features
- Up to 100 MHz ARM Cortex-M4 core
- 32 KB flash: 512 KB program flash and 128 KB SRAM
- FlexMemory providing H/W EEPROM
- 32-pin QFN through to 144-pin packages
- Low-power segment LCD, supporting up to 288 pins with segment fail detect option
- Up to 2 x 16-bit ADC with PGA, 12-bit DAC, analog comparators, voltage reference
- Motor control timers
- Low-power operation
- Serial communications

Applications
- Single- and three-phase e-meters
- Flow meters
- Test and measurement equipment
- Portable medical devices
- Building access control
- HVAC control systems
- Instrumentation
- Digital audio bridges and accessories

Application Notes
- KQURG: Kinetis Peripheral Module Quick Reference
- ADC Calculator: Define Requirements of ADC and Calculate Conversion Times

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</table>

Optional

The K30 MCU family is pin, peripheral and software compatible with the K10 MCU family and adds a flexible low-power segment LCD controller with support for up to 320 segments. Devices start from 64 KB of flash in 64 QFN packages extending up to 512 KB in a 144 MAPBGA package with a rich suite of analog, communication, timing and control peripherals.

Features
- Up to 100 MHz ARM Cortex-M4 core
- 32 KB flash: 512 KB program flash and 128 KB SRAM
- FlexMemory providing H/W EEPROM
- 32-pin QFN through to 144-pin packages
- Low-power segment LCD, supporting up to 288 pins with segment fail detect option
- Up to 2 x 16-bit ADC with PGA, 12-bit DAC, analog comparators, voltage reference
- Motor control timers
- Low-power operation
- Serial communications

Applications
- Single- and three-phase e-meters
- Flow meters
- Test and measurement equipment
- Portable medical devices
- Building access control
- HVAC control systems
- Instrumentation
- Digital audio bridges and accessories

Application Notes
- KQURG: Kinetis Peripheral Module Quick Reference
- ADC Calculator: Define Requirements of ADC and Calculate Conversion Times
32-bit Kinetis K40
Low-power segment display- and USB-enabled MCU with rich mixed-signal capabilities

Kinetic K40 Mid-Performance USB and Segment LCD MCUs

Applications
- GPS receivers
- Blood glucose meters
- Bike computers
- Currency counters
- Single and three-phase e-meters
- Test and measurement equipment
- Portable medical devices
- Building access control
- HVAC control systems
- Instrumentation
- Digital audio bridges and accessories

TWR-K40X256-KIT
The TWR-K40X256-KIT is a development tool for the K40 and K30 families of Kinetis MCUs. This kit is part of the Freescale Tower System, a modular, reusable development platform that allows designers to get to market faster with packaged evaluation boards, tools and runtime software. The K40 MCU module can operate as a stand-alone debug tool and can be purchased separately from the kit, part number TWR-K40X256.

Key Features
- K40X256 in 144 MAPBGA
- Capacitive touch pads
- Integrated, open-source JTAG
- SD card slot
- MMA7660 3-axis accelerometer
- Segment LCD 28 segments
- Tower plug-in (TWRPI) socket for expansion (sensors, etc.)
- Touch TWRPI socket adds support for various capacitive touch boards (keypads, rotary dials, sliders, etc.)
- Tower connectivity for access to USB, Ethernet, RS232/RS485, CAN, SPI, PC, Flexbus, etc.
- Potentiometer, four LEDs, two push buttons, infrared port

Application Notes
- KQURG: Kinetis Peripheral Module Quick Reference
- ADC Calculator; Define Requirements of ADC and Calculate Conversion Times

<table>
<thead>
<tr>
<th>Device</th>
<th>CPU (MHz)</th>
<th>Memory</th>
<th>Feature Options</th>
<th>Packages</th>
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<td>CAN</td>
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<td>Memory Protection Unit</td>
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</tr>
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</table>
### Kinetic K50 Mid-Performance Measurement MCUs

#### Core
- **ARM® Cortex™-M4** 72 MHz

#### Debug Interfaces
- **DSP**

#### Interrupt Controller

#### Analog
- 16-bit ADC
- PGA
- Analog Comparator
- 6-bit DAC
- OPAMP
- TRUMAP

#### Security and Integrity
- Cyclic Redundancy Check (CRC)

#### System
- Internal and External Watchdog
- DMA
- Low-Leakage Wakeup Unit

#### Memories
- Program Flash (128 to 256 KB)
- FlexMemory (32 KB) (2 KB EE)
- External Bus Interface (FlexBus)

#### Communication Interfaces
- PIC
- FS
- UART (ISO 7816)
- SPI
- USB On-the-Go (L/F/B)

#### Phase-Locked Loop
- Programmable Clock
- Low/High-Frequency Oscillators
- Internal Reference Clocks

#### Timers
- Flex Timer
- Carrier Modulator Transmitter
- Programmable Delay Block
- Periodic Interrupt Timers
- Power-Low Timer
- Independent Real-Time Clock (RTC)

#### LCD
- FlexMemory providing H/W EEPROM
- Small 64-pin QFN through to 144-pin packages
- Low-power segment LCD, supporting up to 288 pins with segment fall detection
- Low/Full-Speed USB 2.0 On-the-Go module
- Up to 2 x 16-bit ADC with PGA, 12-bit DAC, analog comparators, voltage reference, op-amp and tri-amp
- Optional Ethernet and H/W encryption
- Motor control timers

#### Applications
- Low-power portable medical devices
- Clinical and lab equipment
- Test/measurement equipment
- Instrumentation applications
- Monitor and telehealth applications

#### Application Notes
- **KQURG:** Kinetic Peripheral Module Quick Reference
- **ADC Calculator:** Define Requirements of ADC and Calculate Conversion Times

#### TWR-K53N512-KIT
- The TWR-K53N512-KIT is a development tool for the K53 family of Kinetics MCUs. This kit is part of the Freescale Tower System, a modular, reusable development platform that allows designers to get to market faster with packaged evaluation boards, tools and runtime software. The TWR-K53N512 MCU module can operate as a stand-alone debug tool and can be purchased separately from the kit. The module provides interface to the medical expansion connector and TWRPI-SLCD modules.

#### Key Features
- Features MKS5N12CMD100 MAPBGA 144-pin MCU
- Tower-compatible processor module
- S08JM60 based open-source JTAG (JTAG) circuit
- User-controlled status LEDs
- Capacitive touch pad sensors and mechanical push buttons
- Medical expansion connector (connect AFE plug-in such as TWR-MCF511MM)
- SD card slot
- Connect TWRPI-SLCD board (28 segment LCD) through TWRPI interface
- Compatible with TWR-SDERI (Ethernet, USB connectivity)
- MMA7660 accelerometer

### Optional

The K50 MCU family is pin-, peripheral- and software-compatible with other Kinetics MCUs and provides designers with an analog measurement engine consisting of integrated operational and transimpedance amplifiers and high-resolution ADC and DAC modules. The family also features IEEE 1588 Ethernet and hardware encryption, Full-Speed USB 2.0 On-The-Go with device charger detect capability and a flexible low-power segment LCD controller with support for up to 320 segments. Devices start from 128 KB of flash in 64 QFN packages extending up to 512 KB in a 144 MAPBGA package.

### Features
- Up to 100 MHz ARM Cortex-M4 core
- 128 KB flash: 512 KB program flash and up to 128 KB SRAM
- FlexMemory providing H/W EEPROM
- Small 64-pin QFN through to 144-pin packages
- Programmable Clock
- Low-Leakage Wakeup Unit
- Low/High-Frequency Oscillators
- Internal Reference Clocks

### Memory and Feature Options

<table>
<thead>
<tr>
<th>Device</th>
<th>CPU (MHz)</th>
<th>Memory</th>
<th>Feature Options</th>
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<td>512</td>
<td>128</td>
<td></td>
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</tbody>
</table>

- **Flash (KB):** 128/256/512/1024
- **FlexMemory (KB):** 32/64/128/256
- **SRAM (KB):** 128/256/512/640
- **Tri-Amp:** 128/256/512/1024
- **DAC:** 16-bit ADC
- **Ethernet:** Full-Speed USB 2.0 On-the-Go
- **Communications Interface:** FlexBus
- **ADC:** PDB, VREF
- **Other:** IEEE® 1588 Eth, CAU + RNG, PDB, VREF

#### More Than You Expect | 2012

freescale.com/MCU
32-bit Kinetis K60
Low-power MCU with integrated rich connectivity, HMI and mixed-signal IP

Table: Kinetis K60 Family Features

<table>
<thead>
<tr>
<th>Device</th>
<th>CPU (MHz)</th>
<th>Memory</th>
<th>Feature Options</th>
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<td>150</td>
<td>1024 KB</td>
<td>128 KB</td>
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</table>

Key Features:
- K60N512 in 144 MAPBGA, K60N512WMD100
- Capacitive touch pads
- Integrated, open-source JTAG
- SD card slot
- MMA7660 3-axis accelerometer
- Tower plug-in (TWRI) socket for expansion (sensors, etc.)
- Touch TWRI socket adds support for various capacitive touch boards (keypads, rotary dials, sliders, etc.)
- Tower connectivity for access to USB, Ethernet, RS232/RS485, CAN, SPI, PC, Flexbus, etc.
- Potentiometer, four LEDs, two push-buttons, infrared port

Applications:
- Building automation controllers
- Elevator control panels
- Instrumentation clusters
- Surveillance cameras

Application Notes:
- KQURG: Kinetis Peripheral Module Quick Reference
- ADC Calculator: Define Requirements of ADC and Calculate Conversion Times

Kinetis K60 Family

Core
- ARM Cortex-M4
- 128 KB flash: 1 MB program flash and 128 KB SRAM
- 80 pin QFN through to 256 MAPBGA
- USB 2.0-compliant OTG module with integrated PHY
- 128 KB flash: 1 MB program flash and 128 KB SRAM
- FlexMemory providing H/W EEPROM
- 80 pin QFN through to 256 MAPBGA
- USB 2.0-compliant OTG module with integrated PHY (option to support external ULPI PHY for High-Speed USB)

Features:
- Up to 150 MHz ARM Cortex-M4 core
- 128 KB flash: 1 MB program flash and 128 KB SRAM
- FlexMemory providing H/W EEPROM
- 80 pin QFN through to 256 MAPBGA
- USB 2.0-compliant OTG module with integrated PHY (option to support external ULPI PHY for High-Speed USB)
- Ethernet, Full- and High-Speed USB 2.0 On-The-Go with device charge detect capability, hardware encryption and tamper detection capabilities. Devices start from 256 KB of flash in 100 QFP packages extending up to 1 MB in a 256 MAPBGA package with a rich suite of analog, communication, timing and control peripherals. High memory density K60 family devices include an optional single precision floating point unit, NAND flash controller and DRAM controller.

Security and Integrity
- Secure boot
- Security key store

Analog
- 12-bit ADC
- 16-bit DAC
- 6-bit DAC
- Gain Amplifier

_timers
- Motor Control
- Real-Time Clock
- I2C

Security
- CAU+RNG,
- Tamper Detect,
- NAND Controller,
- IEEE 1588 ETH,
- USB OTG (FS),
- CAU+RNG

HMI
- GPIO
- LCD
- Touch-Sensing

Clocks
- PLL
- Low-Power
- External Clock
- Internal Clocks

Processors
- ARM Cortex-M4
- ARM Cortex-M4
- 128 KB flash: 1 MB program flash and 128 KB SRAM
- 80 pin QFN through to 256 MAPBGA
- USB 2.0-compliant OTG module with integrated PHY (option to support external ULPI PHY for High-Speed USB)
32-bit Kinetics K70
Rich connectivity and HMI-enabled MCU with anti-tamper capabilities

### Kinetics K70 Family

<table>
<thead>
<tr>
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<th>System</th>
<th>Memories</th>
<th>Clocks</th>
</tr>
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<tbody>
<tr>
<td>ARM Cortex M4</td>
<td>Standard Peripherals</td>
<td>Program Flash (512 KB)</td>
<td>Power Control</td>
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<tr>
<td>24-bit DAC</td>
<td>Memory Protection Unit (MPU)</td>
<td>Oscillator</td>
<td>External Clock Source (ECS)</td>
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<tr>
<td>12-bit ADC</td>
<td>Low-Power Timer</td>
<td>Internal Clock Source (ICS)</td>
<td>Cache</td>
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<tr>
<td>12-bit DAC</td>
<td>LCD Interface</td>
<td>SRAM Controller</td>
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<tr>
<td>SPI</td>
<td>NAND Flash Controller</td>
<td>I²C</td>
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<td>SPI Controller</td>
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<td>12-bit DAC</td>
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<td>Secure Digital Host Controller</td>
<td>Programmable Gain Amplifier</td>
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<tr>
<td>Secure Digital Card Interface</td>
<td>5V Tolerant I/O</td>
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<tr>
<td>Secure Digital Card Controller</td>
<td>Other</td>
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</tbody>
</table>

### Features
- Up to 1150 MHz ARM Cortex-M4 core
- 512 KB flash: 1 MB program flash and 128 KB SRAM
- FlexMemory providing H/W EEPROM
- 196 or 256 MAPBGA packages
- 24-bit SVGA graphics controller
- IEEE 1588 enabled Ethernet MAC
- USB 2.0-compliant OTG module with integrated PHY (option to support external ULP PHY for High-Speed USB)
- Optional H/W encryption accelerator
- Anti-tamper support
- Up to 4 x 16-bit ADC with PGA, 12-bit DAC, analog comparators, voltage reference

### Applications
- Building automation controllers
- Elevator control panels
- Instrumentation clusters
- Surveillance cameras

### Application Notes
- KQURG: Kinetics Peripheral Module Quick Reference
- ADC Calculator: Define Requirements of ADC and Calculate Conversion Times

### TWR-K70N1M0-KIT
The TWR-K70N1M0-KIT is a development tool for the K70 family of Kinetics MCUs. This kit is part of the Freescale Tower System, a modular, reusable development platform that allows designers to get to market faster with packaged evaluation boards, tools and runtime software. The K70 MCU module can operate as a stand-alone debug tool and can be purchased separately from the kit, part number TWR-K70N1M0.

#### Key Features
- K70N1M0 in 256 MAPBGA
- Capacitive touch pads
- Integrated, open-source JTAG
- SD card slot
- MMA7660 3-axis accelerometer
- Tower plug-in (TWRPI) socket for expansion (sensors, etc.)
- Touch TWRPI socket adds support for various capacitive touch boards (keypads, rotary dials, sliders, etc.)
- Tower connectivity for access to graphical display, USB, Ethernet, RS232/RS485, CAN, SPI, I²C, Flexbus, etc.
- Potentiometer, four LEDs, two push buttons, infrared port

### Device Specifications

<table>
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<th>Device</th>
<th>CPU (MHz)</th>
<th>Memory</th>
<th>Feature Options</th>
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<td>512</td>
<td>-</td>
</tr>
<tr>
<td>MK70N1M0Wy120</td>
<td>120</td>
<td>128</td>
<td>-</td>
</tr>
<tr>
<td>MK70N1M0Wy150</td>
<td>150</td>
<td>128</td>
<td>-</td>
</tr>
</tbody>
</table>

- Flash (KB): 512
- FlexMemory (KB): 128
- Cache (KB): 16
- Single Precision Floating Point: 
  - CAN
  - Memory Protection
  - Secure Digital Host Controller
  - NAND Flash Controller
  - 12-bit DAC
- Programmable Gain Amplifier
- 5V Tolerant I/O

### Other
- Graphic LCD, IEEE 1588 Eth, USB OTG (FS/HS), CAU-RNG, Tamper Detect, NAND Controller, 4 ADC Blocks, FPU, DRAM Controller

- MJ

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freescale.com/MCU
The devices in the MC56F8006 series are members of the Freescale family of DSCs. The entry-level MC56F8006/2 DSC provides the most cost-optimized solution for mathematically intensive, power-sensitive real-time control applications.

**Features**
- 56800E core running at 32 MHz
- Single-cycle 16 x 16-bit parallel multiplier-accumulator (MAC)
- Four 36-bit accumulators, including extension bits
- Two 2x–16x programmable gain amplifiers (GPAs)
- Three analog comparators
- Two 12-bit ADCs

**Applications**
- Power tools
- Arc fault detection
- Small and large appliances
- Servo drives
- HVAC
- Facotry automation
- Portable medical applications
- General motor control
- Security and access control

**Application Notes**
- AN3815: Implementing a Modular High Brightness RGB LED Network
- AN3843: Single-Phase Two-Channel Interleaved PFC Converter Using MC56F8006
- AN3814: Static Serial Bootloader for MC56F800x/801x/802x/803x

---

**56F8006 Block Diagram**

<table>
<thead>
<tr>
<th>Core</th>
<th>Memory Options</th>
<th>2 KB SRAM</th>
<th>16B Flash</th>
<th>2 KB SRAM</th>
<th>12B Flash</th>
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<tbody>
<tr>
<td>Three Analog Comparators</td>
<td>Power Supervisor</td>
<td>Two 16-bit Timers</td>
<td>COP</td>
<td>16-bit Periodic Interval Timer</td>
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</tr>
<tr>
<td>Two 2x–16x Wideband PGAs</td>
<td>Flash/RAM</td>
<td>High-Speed SCI</td>
<td>SPI</td>
<td>Programmable Delay Timer</td>
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<tr>
<td>Voltage Regulators</td>
<td>Interrupt Controller</td>
<td>I²C</td>
<td>Six-Output PWM</td>
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<tr>
<td>System Integration Module (SIM)</td>
<td>System Clock Control (PLL, SIM, Osc)</td>
<td>56800E Core/32 MIPS</td>
<td>JTAG/EOnCE</td>
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---

**Device MHz Flash (KB) RAM (KB) 16-bit Timer PWM AMCP 12-bit ADC SCI SPI I²C Clock RTC Other Package**

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<thead>
<tr>
<th>Device</th>
<th>MHz</th>
<th>Flash (KB)</th>
<th>RAM (KB)</th>
<th>16-bit Timer</th>
<th>PWM</th>
<th>AMCP</th>
<th>12-bit ADC</th>
<th>SCI</th>
<th>SPI</th>
<th>I²C</th>
<th>Clock</th>
<th>RTC</th>
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<th>Package</th>
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<tbody>
<tr>
<td>MC56F8006VLF</td>
<td>32 MHz</td>
<td>16 KB</td>
<td>2 KB</td>
<td>2 x 16-bit + PIT</td>
<td>6-ch.</td>
<td>2</td>
<td>2 x 12-ch.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>ICS</td>
<td>Y</td>
<td>PGA, PDB, ROSC, COP/WDT</td>
<td>48 LQFP</td>
</tr>
<tr>
<td>MC56F8006CLC</td>
<td>32 MHz</td>
<td>16 KB</td>
<td>2 KB</td>
<td>2 x 16-bit + PIT</td>
<td>6-ch.</td>
<td>2</td>
<td>2 x 9-ch.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>ICS</td>
<td>Y</td>
<td>PGA, PDB, ROSC, COP/WDT</td>
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<tr>
<td>MC56F8006VWL</td>
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<td>16 KB</td>
<td>2 KB</td>
<td>2 x 16-bit + PIT</td>
<td>6-ch.</td>
<td>2</td>
<td>2 x 8-ch.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>ICS</td>
<td>Y</td>
<td>PGA, PDB, ROSC, COP/WDT</td>
<td>28 SOIC</td>
</tr>
<tr>
<td>MC56F8002VWL</td>
<td>32 MHz</td>
<td>12 KB</td>
<td>2 KB</td>
<td>2 x 16-bit + PIT</td>
<td>6-ch.</td>
<td>2</td>
<td>2 x 8-ch.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>ICS</td>
<td>Y</td>
<td>PGA, PDB, ROSC, COP/WDT</td>
<td>28 SOIC</td>
</tr>
</tbody>
</table>
MC56F801x Family
32 MIPS DSP/MCU core + 96 MHz PWM/timers + fast 12-bit ADC = an unbeatable price/performance solution

Key Features
• 56800E core: 32 MIPS @ 32 MHz
• Single-cycle 16 x 16-bit parallel multiplier-accumulator (MAC)
• Memory: Up to 16 KB of program flash, up to 2 KB of unified data/program RAM
• Up to 6-ch. high-speed pulse-width modulator (PWM) that can be clocked at up to 96 MHz
• Four 16-bit timers that can be clocked at up to 96 MHz
• Up to 2 x 4-ch. 12-bit high-performance analog-to-digital converters (ADC)
• Serial communication interface (SCI) with LIN slave functionality
• Serial peripheral interface (SPI)
• Computer operating properly (COP)
• I²C communication module

Applications
• Dimming lamp ballasts
• Switched-mode power supply
• Soft-switching PFC
• DC-DC power supplies
• Industrial motor control
• Appliance motor control
• Smart sensors
• Instrumentation

Application Notes
• AN1916-3: Phase BLDC Motor Control with Hall Sensors Using 56800/E Digital Signal Controllers
• AN3102: Unique Features of the 56F801x Family of Devices
• AN3103-56F8000: Clock Generation Guidelines to Ensure Correct Functionality
• AN3118: Production Flash Programming for the 56F8000 Family

56F8014 Block Diagram

Device   MIPS/MHz | Program/Data Flash (KB) | Program/Data RAM (KB) | Timer (16-Bit) | PWM (6-ch.) | Operating Voltage | PWM Fault Inputs | ADC (12-Bit) | SCI | SPI | I²C | Temp | Package
-------------------------------|------------------------|------------------------|----------------|-------------|-------------------|-----------------|-------------|-----|-----|-----|-------|----------
MC56F8011VFAE 32        | 12                     | 2                      | 4              | 1 x 6       | 3–3.6V            | 4               | 1           | 1   | 1   |     | –40 °C to +105 °C | 32 LQFP
MC56F8013VFAE 32        | 16                     | 4                      | 4              | 1 x 6       | 3–3.6V            | 4               | 1           | 1   | 1   |     | –40 °C to +105 °C | 32 LQFP
MC56F8013MFAE 32        | 16                     | 4                      | 4              | 1 x 6       | 3–3.6V            | 4               | 1           | 1   | 1   |     | –40 °C to +105 °C | 32 LQFP
MC56F8014VFAE 32        | 16                     | 4                      | 4              | 1 x 5       | 3–3.6V            | 3               | 1           | 1   | 1   |     | –40 °C to +105 °C | 32 LQFP
MC56F802x/3x Family
32 MIPS with extensive analog features for reduced system cost

The MC56F802x/3x family combines the processing power of a DSP with the functionality and ease of use of an MCU on a single chip. With a flexible set of peripherals, package and memory options from 16 to 64 KB flash memory, CAN and high-resolution PWM/timers running at up to 96 MHz, the 56F8000 series provides a cost-effective high-performance solution.

This family exceeds the requirements for Class B components for IEC60730 safety standards on automatic controls for household use, making it ideal for the appliance market.

Features
- 56800E core @ 32 MIPS/32 MHz
- 32 to 64 KB program/data flash
- 4 to 8 KB program/data RAM
- Tunable internal relaxation oscillator
- Eight 16-bit timers that can run at 96 MHz
- 6-ch. high-speed pulse width modulator (PWM) module with four programmable fault inputs, that can be clocked at 96 MHz
- Two 12-bit ADCs for six to eight inputs with internal or external Vref
- Up to two 12-bit digital to analog converters
- Two analog comparators
- Synchronization between PWM and ADC
- Optional MSCAN

Applications
- Advanced appliances requiring motor control
- Power monitoring
- Multiple stepper control
- High-speed, dual-loop BLDC control (compressors)
- Remote and hand-held sensing
- Instrumentation
- Switching power supply

Application Notes
- AN3118: Production Flash Programming for the 56F8000 Family
- AN1965: Design of Indirect Power Using the 56F800/E
- AN1975: Multiple Target Features Using Processor Expert and CodeWarrior
- AN1983: HCS12/16 to 56800/E Software Porting Considerations

MC56F802x Block Diagram

### Device Specifications

<table>
<thead>
<tr>
<th>Device</th>
<th>MIPS/ MHz</th>
<th>Program/Data Flash (KB)</th>
<th>Program/Data RAM (KB)</th>
<th>Timer (16-bit)</th>
<th>PWM (6-ch.)</th>
<th>Operating Voltage</th>
<th>PWM Fault Inputs</th>
<th>ADC (12-bit)</th>
<th>DAC (12-bit)</th>
<th>QSCI</th>
<th>QSPI</th>
<th>PC</th>
<th>CAN</th>
<th>Comparators</th>
<th>Temp.</th>
<th>Package</th>
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<tbody>
<tr>
<td>MC56F8023VLC</td>
<td>32</td>
<td>32</td>
<td>4</td>
<td>4</td>
<td>1 x 6</td>
<td>3-3.6V</td>
<td>4</td>
<td>2 x 3-ch.</td>
<td>2 (Internal)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>–40 °C to +105 °C</td>
<td>32 LQFP</td>
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<tr>
<td>MC56F8025VLD</td>
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<td>32</td>
<td>4</td>
<td>4</td>
<td>1 x 6</td>
<td>3-3.6V</td>
<td>4</td>
<td>2 x 4-ch.</td>
<td>2 (Internal)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
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<td>MC56F8036VLF</td>
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<td>8</td>
<td>4</td>
<td>1 x 6</td>
<td>3-3.6V</td>
<td>4</td>
<td>2 x 5-ch.</td>
<td>2 (Internal)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>–40 °C to +105 °C</td>
<td>48 LQFP</td>
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<tr>
<td>MC56F8037VLH</td>
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<td>8</td>
<td>8</td>
<td>1 x 6</td>
<td>3-3.6V</td>
<td>4</td>
<td>2 x 8-ch.</td>
<td>2 (External)</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>–40 °C to +105 °C</td>
<td>64 LQFP</td>
</tr>
</tbody>
</table>

MC56F8037EVM
The MC56F8037EVM evaluation module allows easier and faster development for 56F802x and 56F803x DSCs. The module includes an MC56F8037 DSC, RS-232 interface, user LEDs, user push button switches and a daughter card connector.

Features
- 56F8037 DSC
- JTAG port interface for external debug connection
- Built-in circuitry for RS-232 communication to host processor
- User LEDs
- User push button switches
- Daughter card connectors enabling connection to additional features such as the motor control daughter card (APMOTOR56F8000E)
The MC56F825x/MC56F824x is part of the 56800E core-based family of DSCs. It combines, on a single chip, DSP processing power and MCU functionality with a flexible set of peripherals including an eFlexPWM module with NanoEdge placement as well as two ultra-fast ADCs for a cost-effective solution. Because of its low cost, configuration flexibility and compact program code, it is a perfect fit for power conversion and motor control applications, making it well-suited for many other consumer and industrial applications.

**Features**
- 60 MHz operation frequency
- On-chip memory
- eFlexPWM with up to nine channels, including six channels with high-resolution NanoEdge placement
- Two 8-channel, 12-bit analog-to-digital converters (ADC) with dynamic x2 and x4 programmable amplifier
- Three analog comparators with integrated 5-bit DAC references
- Cyclic redundancy check (CRC) generator
- Multiple communication interfaces such as QSPI, QSCI with LIN functionality, SMBus-compatible I²C and MSCAN 2.0 A/B module
- Two 16-bit quad timers (2 x 4 16-bit timers)
- On-chip relaxation oscillator: 8 MHz (400 kHz at standby mode)
- Inter-module crossbar connection

**Applications**
- Solar inverters
- Advance power supplies
- High-end motor control
- Wireless charging devices

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**TWR-56F8257**
MC56F8257 Tower MCU module (TWR-56F8257) is a cost-effective evaluation, demonstration and development board. The TWR-56F8257 can operate stand-alone or as the main control board in a Tower System with peripheral modules. It can also be used as the main control board with an APMOTOR56F8000E motor control board.

**Features**
- Tower-compatible MCU module
- MC56F8257 DSC in an 64 LQFP package
- Nine LEDs controlled by the MC56F8257 DSC
- Motor control board connector for the APMOTOR56F8000E motor control board
- Four thermistors for single-ended or differential analog inputs to the MC56F8257 DSC
- CAN transceiver, header and termination
- JTAG header for the MC56F8257 DSC with header to disconnect from OSBDM
- MC9S08JM60 MCU with a 4 MHz crystal
- USB to SCI bridge
- Bootloader enabled header

---

**MC56F82xx Block Diagram**

**Application Notes**
- AN3103: 56F8000 Clock Generation Guidelines to Insure Correct Functionality
- AN1916: Three-Phase BLDC Motor Control with Hall Sensors Using 56800/E Digital Signal Controllers
- AN3118: Production Flash Programming for the 56F8000 Family
- AN4275: Serial Bootloader for 56F82xx
- AN1965: AN1965 Design of Indirect Power factor Correction Using the 56F800/E
- AN1975: Multiple Target Features Using Processor Expert and CodeWarrior

---

**Device MHz Flash (KB) RAM (KB) Timers High-Resolution PWM AMCP 12-bit ADC SCI SPI fC Clock Other Package**

<table>
<thead>
<tr>
<th>Device</th>
<th>MHz</th>
<th>Flash (KB)</th>
<th>RAM (KB)</th>
<th>Timers</th>
<th>High-Resolution PWM</th>
<th>AMCP</th>
<th>12-bit ADC</th>
<th>SCI</th>
<th>SPI</th>
<th>fC</th>
<th>Clock</th>
<th>Other</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC56F8245VLF</td>
<td>60</td>
<td>48 KB</td>
<td>6 KB</td>
<td>PDB, 8-ch., x 16-bit TPM, WDT, COP</td>
<td>6-ch.</td>
<td>3</td>
<td>2 x 4-ch.</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>12-bit DAC, PLL, Relax OSC</td>
<td>44 LQFP</td>
<td>48 LQFP</td>
</tr>
<tr>
<td>MC56F8246VLF</td>
<td>60</td>
<td>48 KB</td>
<td>6 KB</td>
<td>PDB, 8-ch., x 16-bit TPM, WDT, COP</td>
<td>6-ch.</td>
<td>3</td>
<td>2 x 5-ch.</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>Crystal Osc, Voltage Reg, 2 x PGA</td>
<td>44 LQFP</td>
<td>48 LQFP</td>
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<tr>
<td>MC56F8255VLD</td>
<td>60</td>
<td>64 KB</td>
<td>8 KB</td>
<td>PDB, 8-ch., x 16-bit TPM, WDT, COP</td>
<td>6-ch.</td>
<td>3</td>
<td>2 x 4-ch.</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>12-bit DAC, PLL, Relax OSC</td>
<td>44 LQFP</td>
<td>48 LQFP</td>
</tr>
<tr>
<td>MC56F8256LF</td>
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<td>64 KB</td>
<td>8 KB</td>
<td>PDB, 8-ch., x 16-bit TPM, WDT, COP</td>
<td>6-ch.</td>
<td>3</td>
<td>2 x 5-ch.</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>Crystal Osc, Voltage Reg, 2 x PGA</td>
<td>44 LQFP</td>
<td>48 LQFP</td>
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<tr>
<td>MC56F8257VLH</td>
<td>60</td>
<td>64 KB</td>
<td>8 KB</td>
<td>PDB, 8-ch., x 16-bit TPM, WDT, COP</td>
<td>6-ch.</td>
<td>3</td>
<td>2 x 6-ch.</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>Crystal Osc, PLL, Relax OSC</td>
<td>44 LQFP</td>
<td>48 LQFP</td>
</tr>
</tbody>
</table>

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freescale.com/MCU
32-bit 56F84xx
High-performance DSC for simplified design of advanced digital control systems

The MC56F84xx is based on our newly designed 32-bit DSP core. It is the market’s fastest DSP MCU, offering exceptional precision, sensing and control for the most efficient digital power conversion and advanced motor control applications. The MC56F84xx includes advanced high-speed and high-accuracy peripherals such as high-resolution pulse width modulation (PWM) with 312 pico-second resolution and dual, high-speed 12-bit analog-to-digital converters (ADCs) with built-in PGA sampling up to 3.3 mega samples per second (Msps) and one high precision 16-bit ADC. Faster application-specific control loops are driven via a high-speed 32-bit DSP core with single-cycle math computations, fractional arithmetic support and parallel moves.

Features
- 100 MHz/100 MIPS 32-bit DSP core
- 64 KB to 256 KB flash memory flexibility and DMA controller
- Single-cycle math computations, fractional arithmetic support and parallel moves
- Up to 24 PWM channels with input capture
- High-resolution PWMs with 312 pico-second resolution
- Two 12-bit high-speed ADCs with 3.3 Msps resolution
- 16-bit ADC with 1 Mpsp resolution

The MC56F84xx Tower MCU module is a low-cost evaluation, demonstration and development board. The TWR-56F84xx can operate stand-alone or as the main control board in a Tower system with peripheral modules.

Applications
- Off-grid solar power inverters
- Commercial solar power inverters
- Residential solar power inverters
- Fire and security systems
- Switched mode power supplies
- Wireless charging
- Smart sensors
- Arc fault detectors
- Circuit breakers
- Power quality monitors
- Brushed/brushless DC motors
- Permanent magnet synchronous motors
- Single and three-phase AC induction motors

The MC56F84xx Tower MCU module is a low-cost evaluation, demonstration and development board. The TWR-56F84xx can operate stand-alone or as the main control board in a Tower system with peripheral modules.

Features
- MC56F84xx
- Nine controlled LEDs
- Four thermistors for single-ended or differential analog input to the DSC
- CAN transceiver, header and termination
- JTAG header
- MC9S08JM60 MCU with a 4 MHz crystal provide
- USB-to-SCI bridge
- Bootloader enable header

More Than You Expect | 2012
freescale.com/MCU
32-bit PXN

Dual-core solution for industrial communication

The 32-bit dual-core PXN20 Power Architecture MCU supports a variety of communication protocols, allowing you to design a cost-effective, reliable industrial gateway with cutting-edge performance. A large amount of on-chip flash, on-chip SRAM with error correction code capability, 36-channel ADC, dual cores and a host of serial I/Os make the PXN20 a compelling solution for your next design cycle.

Features
- e200z6 and e200z0 dual processors running up to 116 MHz
- 2 MB on-chip flash
- Up to 592 KB on-chip SRAM
- 32-channel DMA
- EEPROM emulated in program flash (16 KB sectors)
- Up to 12x UART, 3x SPI, 6x CAN and 4x I2C
- ADC: 36-channel, 10-bit
- Fast Ethernet controller support
- Debug support JTAG interface, Nexus 3
- Timed I/Os: eMISOS 24-channel, 16-bit
- Internal timers: 8-ch., 32-bit programmable interrupt timers
- Temperature range of –40 °C to +105 °C
- Package options 208 MAPBGA
- Low-power modes

Applications
- Industrial network concentrators
- Factory automation
- Process controls
- Serial-to-Ethernet bridge
- Fire and security systems
- Switched mode power supplies
- Wireless charging
- Smart sensors
- Arc fault detectors
- Circuit breakers
- Power quality monitors
- Brushed/brushless DC motors
- Permanent magnet synchronous motors
- Single- and three-phase AC induction motors

### PXN20 Block Diagram

![PXN20 Block Diagram](image)

### TWR-PXN20

The Tower kit supporting the PXN families provides a Tower-compliant platform for cost-effective vehicle applications and can be used with the Tower platform for advanced application validation work. The Tower kit comes with complete documentation, including a certification pack for engineers looking to develop functionally safe systems.

#### Features
- PXN20 in a 256 MAPBGA package
- FlexCAN header
- Potentiometer interfaced to ADC
- RS232/RS485 interface
- GPIO buttons and LEDs
- TWRPI header
- MMA845x accelerometer
- Nexus interface, mini-JTAG and OSJTAG interfaces for debug and evaluation
- Expansion connectors to additional Tower peripheral cards
- Support for expanded TWR-Serial peripheral board for Ethernet and serial connectivity

### Part Number Core Speed Flash SRAM Timers ADC Ethernet SCI DSPI FlexCAN PC Other Temp. Package

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Core</th>
<th>Speed</th>
<th>Flash</th>
<th>SRAM</th>
<th>Timers</th>
<th>ADC</th>
<th>Ethernet</th>
<th>SCI</th>
<th>DSPI</th>
<th>FlexCAN</th>
<th>PC</th>
<th>Other</th>
<th>Temp.</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPXN2020VMG116</td>
<td>Dual Core, e200z6 and e200z0</td>
<td>116 MHz</td>
<td>2 MB</td>
<td>59.2KB</td>
<td>32-ch., 12-bit ADC</td>
<td>Yes</td>
<td>6</td>
<td>4</td>
<td>6</td>
<td>4</td>
<td></td>
<td>WDT, Sys Timer, 32-ch., eDMA, Ext. Bus I/F, Cross Trigger Unit, PIP, Semaphore Module</td>
<td>-40 °C to +105 °C</td>
<td>208MABBGA</td>
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<tr>
<td>MPXN2120VMG116</td>
<td>Dual Core, e200z6 and e200z0</td>
<td>116 MHz</td>
<td>2 MB</td>
<td>128 KB</td>
<td>32-ch., 12-bit ADC</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>208MABBGA</td>
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</table>
The PXD10 family of 32-bit Power Architecture MCUs provides a cost-effective, single-chip display solution for the industrial market. An integrated TFT display controller capable of driving WVGA resolution, parallel data interface (PDI) for digital video input, a TFT display controller capable of driving WVGA resolution, parallel data interface (PDI) for digital video input, a 40 x 4 LCD segment display driver, and six stepper motor drivers are features of the PXD10 family.

Applications
- Building control display units
- Factory display units
- Ruggedized displays
- Industrial instrumentation

Application Notes
- AN4437: Solar Panel 3-Phase Inverter Controlled by the PXS20
- AN4389: PXS30 Self Test Control Unit
- Industrial instrumentation
- Ruggedized displays
- Up to 1 MB on-chip flash with flash controller
- Separate 4x 16 KB flash block for EEPROM emulation
- Up to 48 KB on-chip SRAM with ECC
- Up to 160 KB on-chip graphics SRAM (no ECC)
- e200 32-bit Book E compliant CPU core complex built on Power Architecture technology
- Variable length encoding (VLE) instruction set enables significant code size reduction over conventional Book E compliant code
- Sound generation and playback using PWM channels and eDMA

Features
- TFT display controller capable of driving WVGA resolution
- Parallel data interface (PDI) for digital video input
- 40 x 4 LCD segment display driver
- Six stepper motor drivers

Part Number
- MPXID1005VLQ64
e200z0 64 MHz 512 KB 48 KB 384 - - - -
- MPXID1010VLQ64
e200z0 64 MHz 1 MB 48 KB 160 WVGA Yes - 160 KB
- MPXID1010VLU64
e200z0 64 MHz 1 MB 48 KB 160 WVGA Yes - 160 KB
- MPXID2020VL125
e200z4 125 MHz 2 MB 64 KB - XGA Yes Yes 1 MB
- MPXID2020VL125
e200z4 125 MHz 2 MB 64 KB - XGA Yes Yes 1 MB
- MPXID2020VU125
e200z4 125 MHz 2 MB 64 KB - XGA Yes Yes 1 MB

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<tr>
<th>Part Number</th>
<th>Core</th>
<th>Speed</th>
<th>Flash</th>
<th>SRAM</th>
<th>Segment</th>
<th>Display</th>
<th>Video</th>
<th>H/W</th>
<th>Graphics</th>
<th>RAM</th>
<th>ADC</th>
<th>Stepper</th>
<th>DDR</th>
<th>Other</th>
<th>Temp.</th>
<th>Package</th>
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<tbody>
<tr>
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<td>e200z0</td>
<td>64 MHz</td>
<td>512 KB</td>
<td>48 KB</td>
<td>384</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>16-bit</td>
<td>6</td>
<td>-</td>
<td>Up to 4 UART, 4x I2C, 3x SPI, 3 x FlexCAN, Optional EBI, Sound Generator, RTC, 2x 16-ch., 32-bit Timers, Quad SPI Flash Interface, 16-ch. eDMA, WDT</td>
<td>-40 °C to +105 °C</td>
<td>144 LQFP</td>
<td></td>
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<tr>
<td>MPXID1010VLQ64</td>
<td>e200z0</td>
<td>64 MHz</td>
<td>1 MB</td>
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<td>MPXID2020VL125</td>
<td>e200z4</td>
<td>125 MHz</td>
<td>2 MB</td>
<td>64 KB</td>
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<td>XGA</td>
<td>Yes</td>
<td>Yes</td>
<td>1 MB</td>
<td>6</td>
<td>Yes (optional)</td>
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<td>64 KB</td>
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<td></td>
<td>416 PBGA</td>
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</table>
32-bit PXR
High-performance MCU for real-time applications

The PXR40 32-bit Power Architecture MCU family with integrated analog and processing power, offers industrial users a reliable, robust controller to meet a variety of timing critical application needs, such as motion/motor control, without sacrificing performance during complex operations.

The PXR40 Power Architecture MCU provides strong computing power with its 264 MHz clock speed and on-chip digital signal processing. Coupled with 4 MB of on-chip flash, quad ADCs, 64-channel dual timing unit and 256 KB RAM (for data storage), the designer has significant on-chip features to reduce external components.

The combination of exceptional performance, advanced signal processing capabilities and ultra-large flash memory array offered in the PXR40 Power Architecture MCU helps address the growing computational and timing demands within industrial markets.

Features
- e200z7 CPU at 264 MHz with integrated DSP capability provides the necessary computational performance for timing dependent applications
- SIMD module for DSP and floating point operations
- Variable length encoding (VLE)
- 4 MB flash memory with ECC
- 256 KB SRAM with ECC
- 64-channel dual programmable timing controller
- 64-channel 12-bit quad analog-to-digital converter (ADC)
- Robust communication capabilities: 4x CAN, 3x UART, 4x SPI ports

Applications
- Precision factory control
- Industrial automation
- Industrial transportation
- Motor control/drives
- Medical
- Timing applications

Application Notes
- AN4437: Solar Panel 3-Phase Inverter Controlled by the PX520
- AN4389: PXS30 Self Test Control Unit (STCU) Reset Configuration Data in Shadow Flash AN4431: TSI Module Application on the S08PT Family

TWR-PXR40
The Tower Kit supporting the PXR40 family provides a tower complaint platform for cost-effective vehicle applications and may be used with the Tower platform for advanced application validation work. The Tower kit comes with complete documentation, including a certification pack for engineers looking to develop functionally safe systems.

Features
- PXR40 in 416 MAPBGA package
- FlexCAN header
- Potentiometer interfaced to ADC
- RS485 interface
- CAN header
- eTPU headers
- GPIO buttons and LEDs
- TWRPI header
- MMA7445L accelerometer
- Nexus interface, mini-JTAG and OSJTAG interfaces for debug and evaluation
- Expansion connectors to additional Tower peripheral cards

PXR40 Block Diagram

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Core</th>
<th>Speed</th>
<th>Flash</th>
<th>SRAM</th>
<th>Timers</th>
<th>ADC</th>
<th>eTPU</th>
<th>SCI</th>
<th>DSPI</th>
<th>FlexCAN</th>
<th>Ext. Bus</th>
<th>Other</th>
<th>Temp.</th>
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<td>MPXR4030VVU264</td>
<td>e200z7</td>
<td>264 MHz</td>
<td>3 MB</td>
<td>192 KB</td>
<td>32-ch. + 32-bit Timer</td>
<td>4 x 16-ch., 12-bit ADC</td>
<td>2 x eTPU</td>
<td>3</td>
<td>2</td>
<td>Y</td>
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<td>416 PBGA</td>
<td>144 LQFP</td>
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<td>e200z7</td>
<td>264 MHz</td>
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<td>144 LQFP</td>
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</table>
32-bit PXS
Dual-core, single-chip MCU for functional safety applications

The PXS devices are 32-bit Power Architecture embedded MCUs designed for safety critical applications. All devices in this family are built around a dual core safety architecture and offer more processing power and larger memory sizes to handle a variety of industrial designs. The dual-core can be operated in lockstep mode (redundant processing and calculations) or decoupled parallel mode (independent core operations). The PXS MCUs are SafeAssure solutions.

Features
• High-performance 180 MHz e200z7d dual cores
• Up to 2 MB flash memory with ECC
• Up to 512 KB on-chip RAM with ECC
• Sphere of replication for key components (such as core, eDMA, XBAR)
• Redundancy checking units
• SoR connected to a Fault collection and control unit
• 3x PWM units with 4x 16-bit channels per module
• Communications interfaces
• 4x UART, 3x SPI, 4x CAN, 3xFlexCAN
• Ethernet
• Up to 4 12-bit analog-to-digital converters (ADCs)
• Safety Certification Pack available to support design efforts

Applications
• Boiler heating control
• Programmable logic control
• Input-output control
• Off-grid solar power inverters
• Commercial solar power inverters
• Residential solar power inverters
• Unmanned vehicles (ground, air, water)
• Motion control
• Process control
• Robot manipulation
• Robotics
• Medical/health care
• Anesthesia unit monitors
• Ventilators and respirators
• Motor control
• Stepper motor

Application Notes
• AN4437: Solar Panel 3-Phase Inverter Controlled by the PXS20
• AN4389: PXS30 Self Test Control Unit (STCU) Reset Configuration Data in Shadow Flash

TWR-PXS
The Tower kit supporting the PXS30 and PXS20 families provides a Tower-compliant platform for cost-effective vehicle applications and may be used with the Tower platform for advanced application validation work. The Tower kit comes with complete documentation, including a certification pack for engineers looking to develop functionally safe systems.

Features
• MPXS20 or MPXS30 in 473 MAPBGA
• FlexCAN header
• ADC header
• DDR2 memory
• GPIO buttons and LEDs
• RS485 connector
• MMA845x accelerometer
• Nexus interface, JTAG and OSJTAG interfaces for debug and evaluation
• Safety certification pack
• Expansion connectors to additional Tower peripheral cards

PXS30 Block Diagram

More Than You Expect | 2012

freescale.com/MCU
Freescale Ready Play Solutions
Seamlessly integrate functionality into embedded systems

Freescale Ready Play solutions integrate certified functionality into different applications, allowing customers to add features while reducing development cost, simplifying design cycles and enabling scalability in applications and systems.

- Reduce time to market
- Reduce development costs
- Simplify system design
- Reduce support costs
- Feature compatible with existing devices

Freescale is developing a complete range of Ready Play solutions, the first of which is a USB-to-Serial bridge (USB2SER) solution.

USB2SER
USB2SER is a simple, cost-effective solution to enable USB for an embedded system with a UART port, reducing external components count. It supports USB 2.0 Full-Speed and TTL RS232 or RS485 UART with options for hardware flow control, software flow control (Xon-Xoff), even or odd parity and stop bits configuration.

Features
- Single-chip USB to UART data transfer (RS232 or RS485)
- Certified Full-Speed USB 2.0 support
- UART with programmable custom baud rates from 300 bps to 115200 bps and hardware flow control (RTS/CTS) or software Xon/Xoff flow control
- Configurable USB VID, PID and device description strings in internal flash
- Compact 5 x 5 mm Pb-free RoHS-compliant 24 QFN package

Applications
- USB port to legacy applications
- Additional USB ports to application processors with limited bandwidth or USB ports
- Add USB to systems that require lengthy certifications (i.e. medical, military, aerospace)
- PC-peripheral bridges
- USB-to-Serial bridge

Ordering Information

<table>
<thead>
<tr>
<th>Item</th>
<th>Pricing (MSRP)</th>
</tr>
</thead>
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<tr>
<td>Device</td>
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<td>USB2SERA10CFK</td>
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<td>Development Tools</td>
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<td>EVUSB2SER</td>
<td>$19.99</td>
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<td>Tools and Software</td>
<td></td>
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<tr>
<td>USB2SER Software and Drivers and Setup GUI</td>
<td>Free</td>
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</tbody>
</table>
Summary of Hardware and Software Enablement Solutions
Everything you need. Just add your imagination.

Reference Designs
Freescale provides a range of vertical market and horizontal technology-focused turn key reference designs providing complete hardware and software enabling designs to reduce their time to market by reusing what Freescale has developed. Our reference designs span a number of areas, including:
- Metering
- Medical
- Power conversion and motor control
- Lighting
- Appliances

Tower System: Modular and Expandable
- Controller modules provide easy-to-use, reconfigurable hardware
- Interchangeable peripheral modules—serial, memory and graphical LCD—make customization easy
- Open-source hardware and standardized specifications promote the development of additional modules for added functionality and customization

Speeds Development Time
- Open source hardware and software allow quick development with proven designs

Low Cost
- Peripheral modules can be re-used with all Tower System controller modules, eliminating the need to purchase redundant hardware for future designs
- Enabling technologies like LCD, serial and memory interfacing are offered off-the-shelf at a low cost to provide a customized enablement solution

New CodeWarrior Development Studio
CodeWarrior is a complete integrated development environment that supports all key Freescale MCUs and MPUs across our 8-, 16- and 32-bit product range of Kinetis, ColdFire and Power Architecture-based families. The award-winning CodeWarrior IDE goes well beyond basic code generation and debugging by providing built-in features and utilities, so you can deliver better quality products to market faster.

More than 100 example projects are available to assist in your design efforts. By using the New Project Wizard, you can create a working project in as few as seven mouse clicks. And when market requirements change mid-project, the MCU Change Wizard allows you to re-target the project to a new MCU in as few as four mouse clicks, allowing you to choose the MCU and the default connection. The IDE automatically reconfigures your project with the correct build tools (compiler, assembler, linker) and the appropriate support files (header, libraries, linker).

Processor Expert is a rapid application design tool integrated into CodeWarrior tool suites that can be utilized with our Freescale MCU platforms to help halve your development cycle. It combines easy-to-use component-based application creation with an expert knowledge system.

Features
- A GUI that allows an application to be specified by the functionality needed
- Applications are created with embedded components that encapsulate initialization code and basic elements of embedded systems
- A code generator creates tested, optimized C code tuned to your application needs
- A built-in knowledge base immediately flags resource conflicts and incorrect settings
- A Component Wizard tool allows users to create their own hardware-independent embedded components

Freescale MQX RTOS
To help accelerate time to market and improve application development success, Freescale offers the Freescale MQX real-time operating system (RTOS) with TCP/IP and USB software stacks to particular ColdFire families at no additional charge. Freescale plans to expand the availability of this complimentary enablement software to include many embedded processors in its broad portfolio.

Full Featured and Powerful
The combination of Freescale MQX software solutions and silicon portfolio creates a comprehensive source for hardware, software, tools and services needs, providing a streamlined and powerful platform.

Universal Multilink (U-MULTILINK)*
A cost-effective development tool for (R)S08, S12(X), ColdFire, Kinetis and PX products that provides real-time, in-circuit flash programming, emulation and debugging through the BDM interface.

Proven and Valuable
MQX RTOS is a market-proven software, made available on Freescale processors for over 15 years and has been certified for use in military, avionics and medical applications.

Simple and Scalable
Freescale MQX software solutions offer a straightforward API with a modular architecture, making it simple to fine tune custom applications and scalable to fit most requirements.

For more information, please visit freescale.com/MQX.

Touch-Sensing Software (TSS)
Touch sensing helps increase product lifetimes by eliminating the mechanical wear and tear associated with push buttons and switches. The Xtronic TSS 2.5 now enables touch sensing in any ColdFire+ and Kinetis MCU in addition to all of our 8-bit S08 or 32-bit ColdFire V1 MCUs, giving designers the flexibility to select from more than 850 Freescale MCUs to add cost-effective touch-sensing functionality to their human-machine interface (HMI) designs.

The latest TSS library, TSS2.5 supports the touch-sensing input (TSI) module in the ColdFire+ and Kinetis MCU families for highly accurate and robust hardware-assisted touch-sensing, providing designers low-power modes (as low as 1uA) with wake-up through touch via the TSI pins. The TSI module has extremely high sensitivity with a very low capacitance measurement resolution.
# Development Tool Summary

## 8-bit Development Tool Summary

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## 32-bit Development Tool Summary

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## DSC Dev Tool Summary

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## Kinetics Dev Tool Summary

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</table>
# 32-bit Third-Party Developer Resources

Everything you need. Just add your imagination.

## Development Tools for ColdFire Families

### Evaluation Boards and Development Kits

<table>
<thead>
<tr>
<th>Company</th>
<th>Website</th>
</tr>
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<tbody>
<tr>
<td>Freescale Semiconductor</td>
<td>freescale.com</td>
</tr>
<tr>
<td>Axiom</td>
<td>axman.com</td>
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<tr>
<td>FSI Systems</td>
<td>fsisys.com</td>
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<td>Logic Product Development</td>
<td>logicpd.com</td>
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<td>NetBurner</td>
<td>netburner.com</td>
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<td>Intec Automation</td>
<td>steroidmicros.com</td>
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### Real-Time Operating Systems (RTOSs)

<table>
<thead>
<tr>
<th>Company</th>
<th>Website</th>
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<tbody>
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<td>Accelerated Technology/Mentor Graphics</td>
<td>acceleratedtechnology.com</td>
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<tr>
<td>eCosCentric</td>
<td>ecoscentric.com</td>
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<tr>
<td>CMX Systems</td>
<td>cmx.com</td>
</tr>
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<td>ExpressLogic</td>
<td>rtos.com</td>
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<tr>
<td>Freescale MQX</td>
<td>freescale.com/MQX</td>
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<td>Green Hills Software, Inc.</td>
<td>ghs.com</td>
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<td>InterNiche Technologies</td>
<td>iniche.com</td>
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<td>Keil</td>
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<td>Linux</td>
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<td>MicroDigital</td>
<td>smx-rtos.com</td>
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<td>MQX Embedded</td>
<td>mqxembedded.com</td>
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<td>NetBurner</td>
<td>netburner.com</td>
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<td>Quadros Systems, Inc.</td>
<td>quadros.com</td>
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<tr>
<td>µClinux</td>
<td>uclinux.org</td>
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</table>

### Compilers, Simulators, Debuggers

<table>
<thead>
<tr>
<th>Company</th>
<th>Website</th>
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<td>Accelerated Technology/Mentor Graphics</td>
<td>acceleratedtechnology.com</td>
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<td>Freescale CodeWarrior Tools</td>
<td>freescale.com/CodeWarrior</td>
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<td>Green Hills Software, Inc.</td>
<td>ghs.com</td>
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<td>iar.com</td>
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<tr>
<td>Keil</td>
<td>keil.com</td>
</tr>
<tr>
<td>P&amp;E Microcomputer Systems</td>
<td>pemicro.com</td>
</tr>
<tr>
<td>NetBurner</td>
<td>netburner.com</td>
</tr>
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</table>

### Stacks, Drivers, Translators

<table>
<thead>
<tr>
<th>Company</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accelerated Technology/Mentor Graphics</td>
<td>acceleratedtechnology.com</td>
</tr>
<tr>
<td>CMX Systems</td>
<td>cmx.com</td>
</tr>
<tr>
<td>ExpressLogic</td>
<td>rtos.com</td>
</tr>
<tr>
<td>Freescale</td>
<td>freescale.com</td>
</tr>
<tr>
<td>Green Hills Software, Inc.</td>
<td>ghs.com</td>
</tr>
<tr>
<td>InterNiche Technologies</td>
<td>iniche.com</td>
</tr>
<tr>
<td>Ixat</td>
<td>ixat.com</td>
</tr>
<tr>
<td>Keil</td>
<td>keil.com</td>
</tr>
<tr>
<td>Micro APL</td>
<td>microapl.com</td>
</tr>
<tr>
<td>Mocana Corporation</td>
<td>mocana.com</td>
</tr>
<tr>
<td>MQX Embedded</td>
<td>mqxembedded.com</td>
</tr>
<tr>
<td>NetBurner</td>
<td>netburner.com</td>
</tr>
<tr>
<td>Quadros Systems, Inc.</td>
<td>quadros.com</td>
</tr>
<tr>
<td>Treck Inc.</td>
<td>treck.com</td>
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</table>

### Specialized Tools

<table>
<thead>
<tr>
<th>Company</th>
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<tbody>
<tr>
<td>ASHWARE Inc. (eTPU)</td>
<td>ashware.com</td>
</tr>
<tr>
<td>Byte Craft Limited (eTPU)</td>
<td>bytecraft.com</td>
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<tr>
<td>Freescale (eTPU)</td>
<td>freescale.com</td>
</tr>
<tr>
<td>Nano-X (LCD)</td>
<td>microwindows.org</td>
</tr>
<tr>
<td>Freescale (Swell) PEG Software (LCD)</td>
<td>swellsoftware.com</td>
</tr>
<tr>
<td>Segger (LCD)</td>
<td>segger.com</td>
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