

Kinetis Microcontrollers EUF-IND-T0732

Ralf Lehmann

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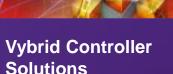
April 2013

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Comprehensive Portfolio Based on ARM **Technology**







Rich Apps in Real Time.



i.MX Application **Processors**

Your Interface to the World.



QorlQ Processors built on Layerscape Architecture

Accelerating the Network's IQ

Industry's most scalable ultra-low-power, mixedsignal MCU solutions based on the ARM® Cortex™-M4 and ARM® Cortex™-M0+ architectures.





Real-time, highly integrated solutions with best-in-class 2D graphics to enable your system to control, interface, connect, secure and scale.







Industry's most versatile solutions for multimedia and display applications, with multi-core scalability and market-leading power, performance & integration.



Industrial

Industry's first softwareaware, core-agnostic networking system architecture for the smarter, more capable networks of tomorrow – end to end.

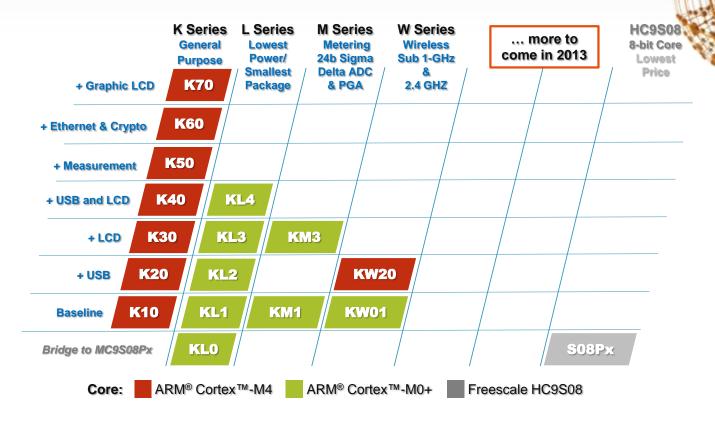


Freescale has the industry's broadest range of solutions built on ARM® technology for automotive, industrial, consumer and networking applications.

Find your ideal solution at the price, performance and power level you desire, and leverage the extensive software and tool bundles available to speed and ease your design process.

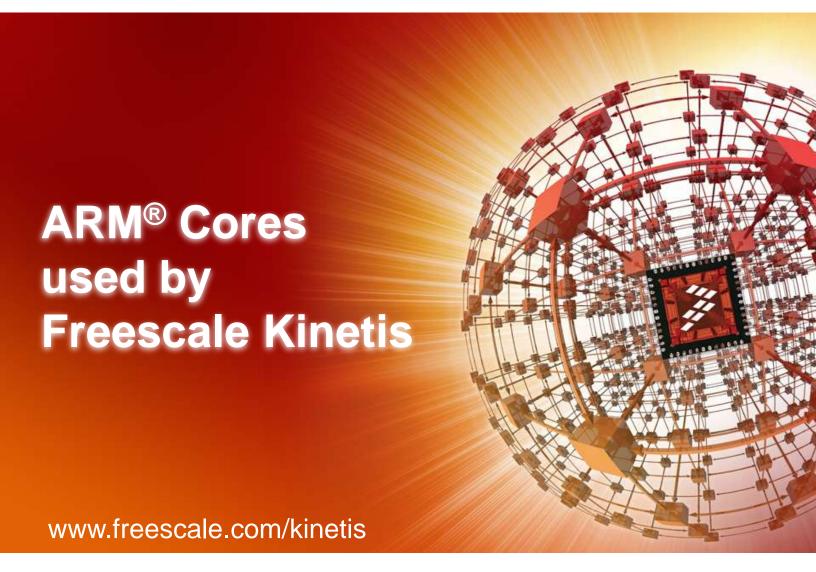


Kinetis MCU Families





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Kinetis Series powered by ARM[®] Cortex™

High performance data processing & I/O control. **Kinetis** architecture Support hardware divide, MAC, bit field processing, DSP. Cortex-M4 **ARMv7-M K Series** Floating point unit optional (Cortex-M4F). High performance data processing & I/O control. Support hardware divide, MAC (Multiply Accumulate), Cortex-M3 bit field processing. **Kinetis** General data processing, high performance I/O control, Cortex-M0+ mixed signal ASICs, replacement for 8/16-bit MCUs L Series architecture **ARMv6-M** General data processing, I/O control, mixed signal ASICs, Cortex-M0 replacement for 8-/16-bit MCUs For FPGA designs only. Cortex-M1 Optimized for FPGA and can work in most FPGA devices





Freescale, the Freescale loop, All/Nec, C-S, Code/TEST, Code/Matrics Code/Tec, Code/Te

Kinetis: Why ARM[®] Cortex[™]-M4?

Backwards compatible with ARM Cortex-M3

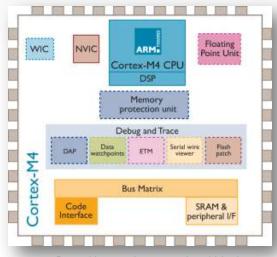
 Does everything the Cortex-M3 does and more but in less cycles (more energy efficient!)

New features

- Single cycle MAC (Up to 32 x 32 + 64 -> 64)
- DSP extensions, Single Precision Floating Point Unit

Freescale IP and Innovation

- Cache, Cross-Bar and DMA for increased throughput
- MPU for system resource protection
- Low-leakage Wake-up Unit for low power operation



Dotted boxes denote optional blocks

Architected for Digital Signal Processing

- Motor Control: advanced algorithms, faster control loops, more responsive to speed commands and changing loads, increased power efficiency
- Automation: high calculation and algorithm bandwidth at a low cost
- Power management: designed for low/battery powered systems (CLK @ 0.5x ARM Cortex M3)
- Audio and Video: 5x performance improvement over software, extended battery operation





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CM0+ Core & Platform Features



- ARM Cortex-M0+ Core
 - 100% compatible with Cortex M0
 - Efficient instruction set for low power and small code size
 - 0.95 DMIPS per MHz performance when executing from internal RAM (single cycle accesses)
 - Single cycle 32 bit x 32 bit multiply
 - NVIC with 4 priority levels and hardware preemption
 - I/O port for single cycle GPIO loads and stores
- Peripheral Bridge Crossbar (AXBS-Lite)
 - Support for concurrent accesses from DMA/CORE to memory and peripherals
- Bit Manipulation Engine (BME)
 - Decorated load and store capability for peripherals improving processing efficiency and small code size
- Flash Memory Controller (FMC)
 - 4-way, 4-set 32-bit Flash cache for improving flash access times
- Debug Facilities
 - Supports the standard ARM 2-pin serial wire debug (SWD) debug port only
 - Micro-Trace Buffer (MTB) for on-chip trace capabilities





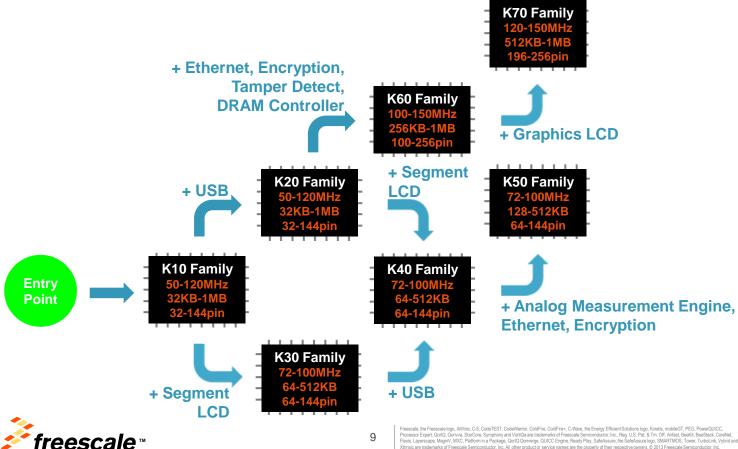
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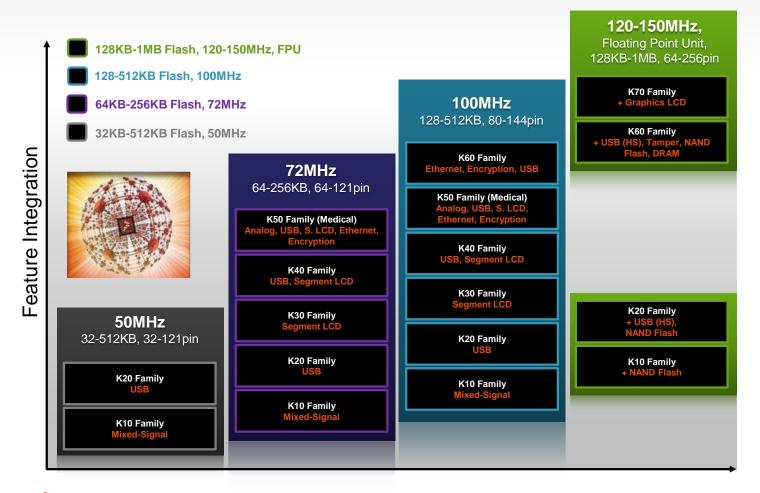
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K Series: MCU Family Compatibility

Hardware & software compatible MCU families with scalable performance, memory and feature integration



Kinetis K-Series: four Sub-Families available





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Why 32-bit, as 8-/16-bit can do the job already?



Feature rich

Easy-to-use

Connectivity

Extended battery life

Sleek design



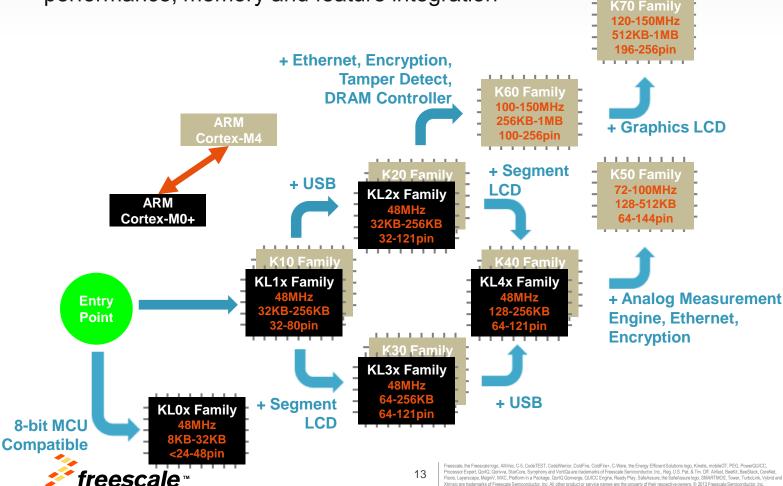
User expectations



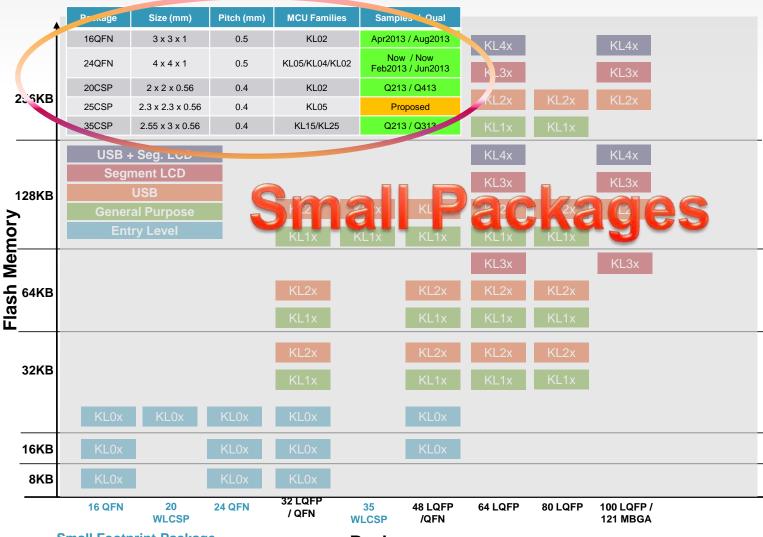
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Kinetis L/K Series: MCU Family Compatibility

Hardware & software compatible MCU families with scalable performance, memory and feature integration



Kinetis L Series: Memory & Package Scalability



Small Footprint Package

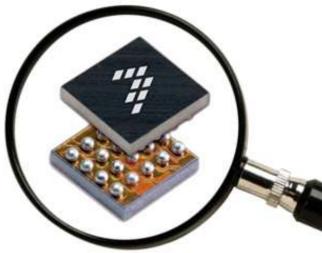
Package



The World's Smallest ARM® Powered MCU

Microscopic Package. Massive Potential.

- 1.9 mm x 2.0 mm x 0.56 mm
- Advanced wafer-level chip scale package for the ultimate in PCB area reduction
- 25% smaller with 60% more GPIO than the next competing solution
- 32-bit ARM® Cortex[™]-M0+ core with high density feature integration: 32 KB flash, precision analog, ultra low power and more
- Start developing today with the Kinetis L series FRDM-KL05Z Freescale Freedom development platform
- Mass Production planned for June 2013



For more information, visit freescale.com/Kinetis/KL02CSP



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Kinetis M - Highest precision and security

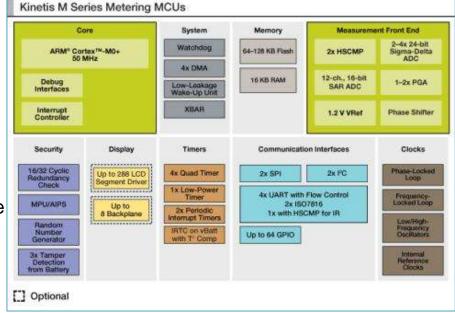
- Up to 48 MHz Cortex[™]-M0+ with Ultra-Low-Power
- Analog Front End
 - 24-bit sigma delta ADC with 94 dB SNR
 - Programmable gain amplifier with gains from 1 to 32 with low temperature drift
 - High precision internal voltage reference with low temperature drift

Security

- Tamper detection with time stamping
- Random number generator, memory protection unit

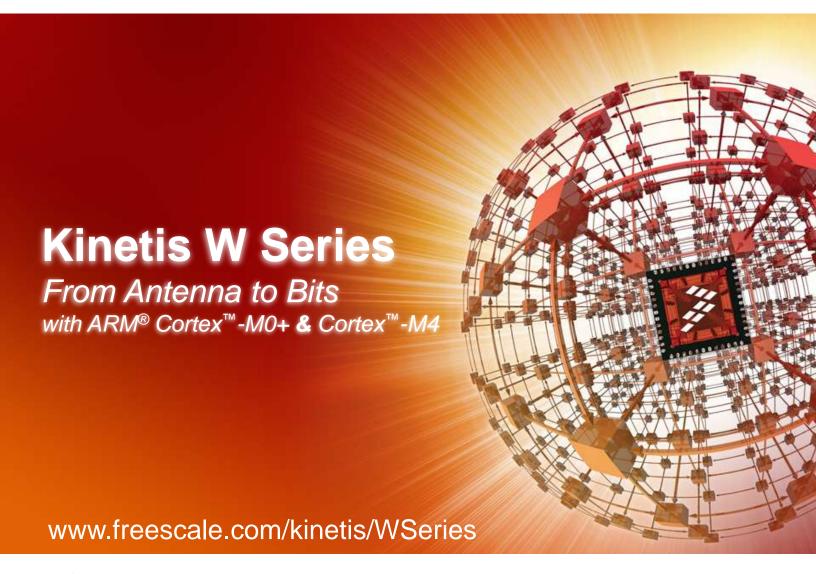
Interfaces

- LCD segment driver up to 288 (8x36) segments
- High accuracy RTC+5 ppm over temperature range
- 4x UART, 2x SPI, 2x IIC





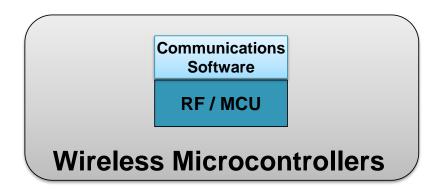
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Freescale Wireless Connectivity Strategy

To provide all wireless solutions (from antenna to bits) required for control and monitoring applications in consumer, residential, metering, medical and industrial applications.



- All ISM frequency bands: 315 MHz, 434 MHz, 868 MHz, 915 MHz, 2.4 GHz
- **Scalable wireless protocol**: From simple point-to-point lightweight protocol, up to full ZigBee-compliant applications.



Kinetis W − ARM® CortexTM-M & RF Transceiver

- KW01
 - Up to 48 MHz Cortex[™]-M0+ with Ultra-Low-Power
 - RF transceiver supports 290-340 MHz, 424-510 MHz, and 862-1020 MHz frequency bands
- KW20
 - Up to 50 MHz Cortex[™]-M4 with 16channel-DMA
 - Highly integrated 2.4 GHz RF transceiver
 - 802.15.4 Packet processor



















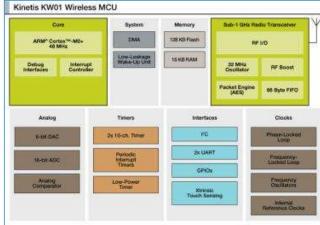


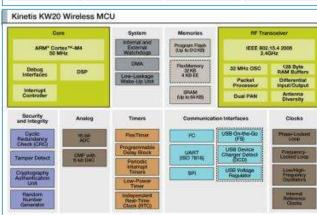




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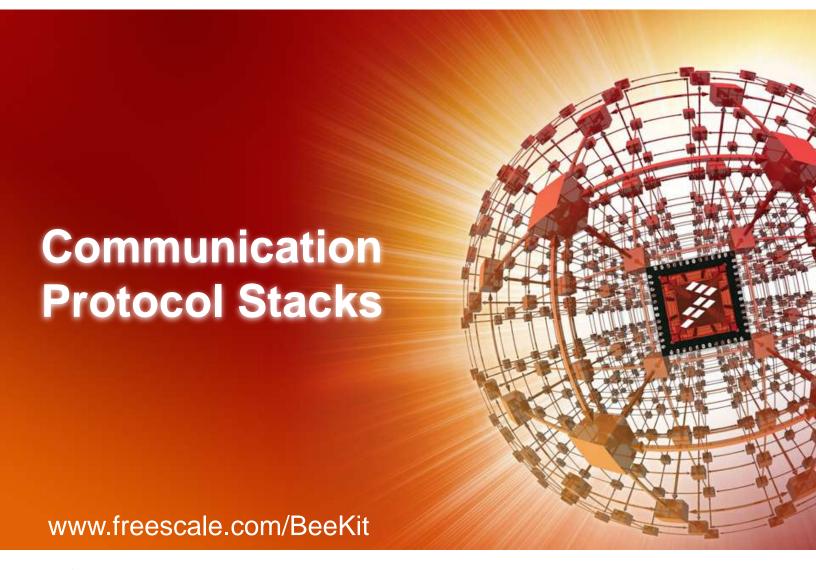
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2.4GHz Protocol Stack Comparison

Feature	SMAC	SynkroRF	ZigBee RF4CE	ZigBee 2007-PRO	ZigBee IP	
Typical Applications	Cable Replacement	Cable Replacement	RF Remote Control	Home Automation		
	Wireless Toys and Games	Wireless Control	Home Entertainment and Control	Smart Energy 1.x	Smart Energy 2.0	
			Home Automation	Building Automation Health Care		
Network Stack	No	Yes	Yes	Yes	Yes	
Network Profiles	No	No	Yes	Yes	Yes	
Memory Requirements	4-8K	32K	<40K	80-100K	256K min	
Network Topology	Point-to-Point	Co-existing Star	Co-existing Star	Tree	Tree	
	Star			Mesh	Mesh	
Typical # of Nodes	2-100	32 per Controlled Device	32 per Target Device	2-250 ZigBee 2-1000 ZigBee Pro	IP limit	
Typical IC Cost	\$1-2	\$2-3	\$2-3	\$3-4	\$4-5	
Typical Data Throughput	50-115K	70-100K	70-100K	30-70K	30-70K	



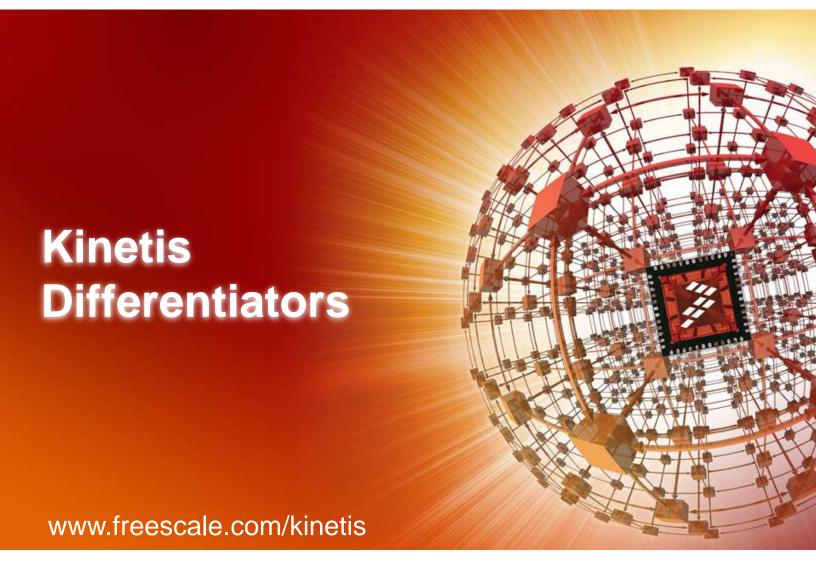
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Sub-GHz Protocol Stack Comparison

Feature	SMAC	802.15.4g	IPv6	Wireless M-Bus	
	Cable Replacement	Wireless Meter Reading	Internet of	Wireless Meter Reading (Europe)	
Typical Application	Medical	Building Control	Things M2M		
	iviedicai	Medical			
Standard	Proprietary	IEEE 802.15.4	6lowPAN	EN 13757-4:2005	
Network Stack	No	No	Yes	Yes	
Network Profiles	No	No	No	No	
Memory Requirements	4-8K	32K	128K	16-32K	
Network Topology	Point to Point	Peer-to-Peer		Point-to-Point	
	Ctor	Tree	IP	Star	
	Star	Mesh			
Typical # of Nodes	2-100	2-100	Not limited	2-100	
Data Rate	200 Kbps	50-200 Kbps	1-600Kbps	32-100 Kbps	
Protocol Stack Provider	Freescale	3 rd Party	3 rd Party	3 rd Party	



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Kinetis Key Differentiators

Technology

- Low Power 90nm process technology with ten (10) flexible power-modes and wake-up logic.
 Supply voltage from 1.71V to 3.6V.
- Performance Non-blocking bus-matrix-switch, K series with DSP extension in all sub-families,
 FLASH memory controller and MPU/DMA are only some features contributing, beside the ARM® CortexTM-M Core, for highest system performance in his class.
- Flex-Memory FLASH- and SRAM-memory combined with a state-machine for EEPROM Emulation enables up to 10M erase/write cycles with fast access times.
- Mixed-Signal 16-Bit ADCs, 12-bit DACs, High Speed comparators and additional "analog" peripherals
- Security Hardware-accelerated security algorithms and tamper detection for secure communication and safe operation.
- Touch-Sensing Hardware-supported capacitive touch-inputs with easy configuration through flexible touch-library.

Scalability

With over 300 derivates you will find the perfect fit for your application. Scalability is given between the series. Many common packages and functions make this an easy task.

Product Longevity

Freescale guaranties longevity of selected devices. 10 years for industrial devices and 15 years for medical and automotive devices.



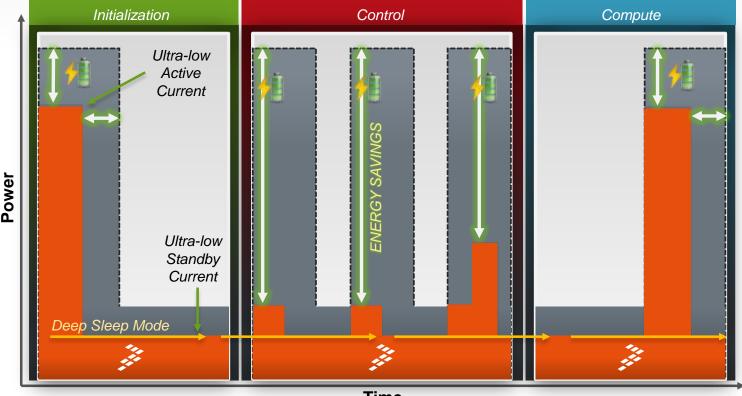
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Energy Efficiency: Energy = Power x Time

Very Low Active and Standby Power Consumption

Energy Saving Peripherals

Reduced Processing Time



Time

RUN @3V, 48 MHz	83 uA/MHz	VLLS0 Deep Sleep @3V	205 nA	CoreMark/MHz	1.77
VLPR @3V, 4 MHz	39 uA/MHz	LLS Deep Sleep @3V	1.7 uA	LLS Wake-up Time	4.3 us

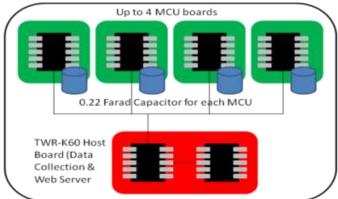


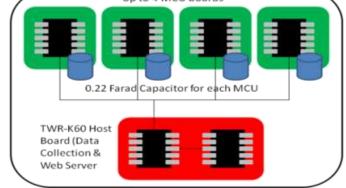
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Kinetis Energy Efficiency Demo

- Demonstrates energy efficiency of Kinetis devices
- Uses CoreMark benchmark
- · 4 sockets available for comparism
- Each socket with own .22F Cap
- Configurable compute/sleep ratio
- Webserver interface









What is FlexMemory?

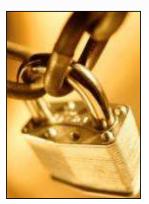
User Configurable As... Program or Data Flash EEPROM Flexibility No external EEPROMs Space for future expansion · Reduced system cost Main Program needs Memory No system resource impact Contiguous with main program · System performance maintained Flash · No complex coding schemes **Efficient** Configurable & high endurance · Read-while-write with the main • Up to 10 Million w/e cycles System SRAM program Flash High performance Use cases Fast write time = ~100 µSec · Program Flash: bootloader • Erase+write = 1.5 mSec code space Firmware Use cases Data Flash: large data tables Critical data retention (power loss) Frequently updated data **FlexMemory** Program/Data **EEPROM** Flash Or a combination of both



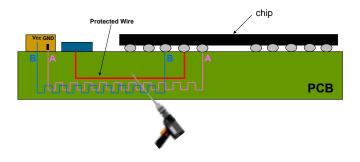
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Kinetis Security Summary

- The entire (current) Kinetis family includes enhanced Flash security, with user selectable:
 - Security bit, disables external and debug access
 - Backdoor access enable
 - Factory access enable
 - Block erase & re-program disable
 - Hardware protection against "Noise injection" attacks
 - Memory Protection Unit
 - 128-bit unique part identifier



- K21, K60 and K70 120/150 MHz parts in 256 MAPBGA packages, and K11/K21 50 MHz parts add:
 - Battery backed up Tamper detection, monitoring-
 - Supply voltage
 - Clock frequency
 - Temperature
 - External sensors
 - External physical tampering (e.g. drilling into PCB)
 - 256-bit secure user storage (key), erased on tamper
 - Secure real time clock





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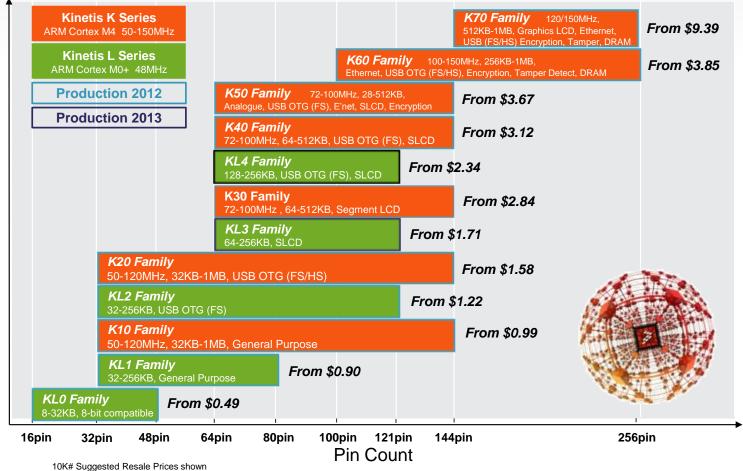




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Kinetis Portfolio Scalability

Production Qualified ARM Cortex-M0+ and Cortex-M4 MCUs



*freescale

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Kinetis K Series Package **Kinetis L Series Package**

Kinetis K/L Series: Packaging

Common Packages



32QFN 5 x 5 mm 0.5mm pitch (K10/20) (KL0/1/2)



48QFN 7 x 7 mm 0.5mm pitch (K10/20) (KL0/1*/2*)



48LQFP 7 x 7 mm 0.55mm pitch (K10/20) (KL0/1*/2*)



64LQFP 10 x 10 mm 0.5mm pitch (K10/20/30/40/50) (KL1/2/3/4)



80LQFP 12 x 12 mm 0.5mm pitch (KL1/2/3*/4*)



100LQFP 14 x 14 mm 0.5mm pitch (K10/20/30/40/50) (K10/20/30/40/50/60) (KL3/4)



64MAPBGA 5 x 5 mm 0.5mm pitch (K10/20) (KL1*/2*/3*/4*)



121MAPBGA 8 x 8 mm 0.65mm pitch (K10/20/30/40/50/60) (KL2/3/4)

Kinetis L Series Only



20WLCSP 2x2x0.56 mm 0.4mm pitch (KL0)



25WLCSP 2.3x2.3x0.56 mm 0.4mm pitch (KL0*)



35WLCSP 2.55x3x0.56 mm 0.4mm pitch (KL1*/2*)



16QFN 3x3x1 mm 0.5mm pitch (KL02)



24QFN 4 x4x1 mm 0.5mm pitch (KL0x)



32LQFP $7 \times 7 \text{ mm}$ 0.8mm pitch (KL0)



Kinetis K Series Only



90WLCSP 3.9x4.4x0.56 mm 0.4mm pitch (K10/20*)



110WLCSP 3.9x4.4x0.56 mm 0.4mm pitch (K10/20*)



120WLCSP 5.3x5.3x0.56 mm 0.4mm pitch (K10/20/60)



143WLCSP 6.5x5.6x0.56 mm 0.4mm pitch (K61)



144LQFP 20 x 20 mm 0.5mm pitch (K10/20/30/40/50/60)



144MAPBGA 13 x 13 mm 1.0mm pitch (K10/20/30/40/50/60)



256MAPBGA 17 x 17 mm 1.0mm pitch (K60/70)

*proposed

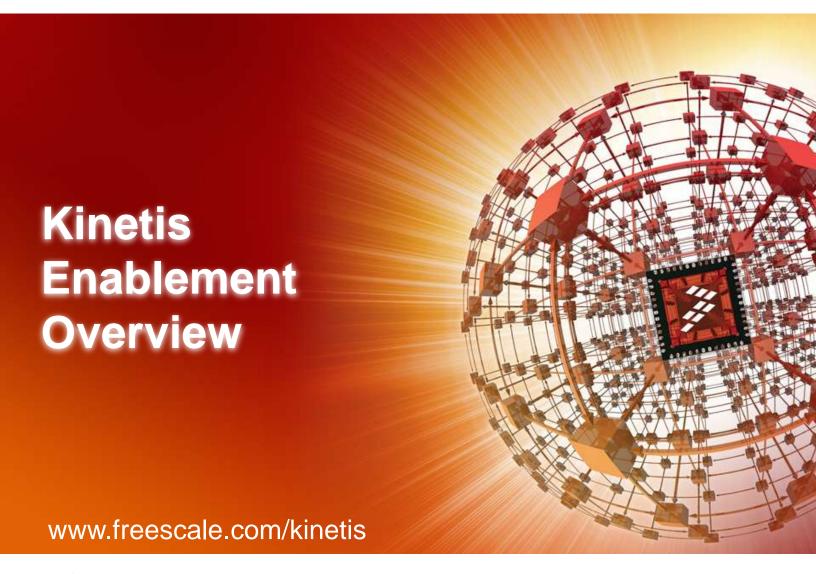
Freescale Product Longevity Program

- The embedded market needs long-term product support
- Freescale has a longstanding track record of providing long-term production support for our products
- Freescale is pleased to introduce a formal product longevity program for the market segments we serve
 - For the automotive and medical segments,
 Freescale will make a broad range of program devices available for a minimum of 15 years
 - For all other market segments in which Freescale participates, Freescale will make a broad range of devices available for a minimum of 10 years
 - Life cycles begin at the time of launch
- For terms and conditions and to see a list of participating Freescale products available under this program:

www.freescale.com/productlongevity

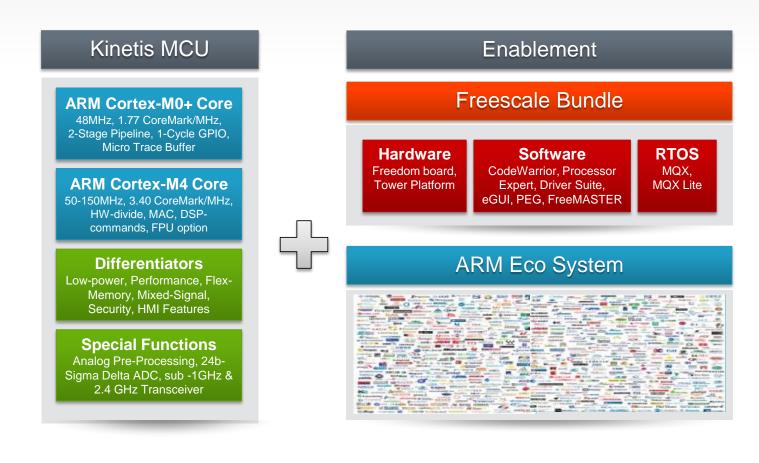


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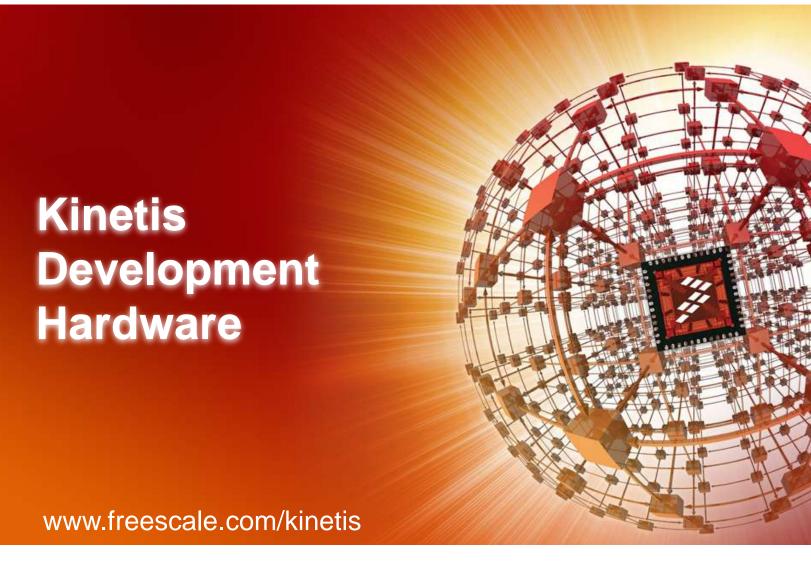
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Kinetis Enablement Overview





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Freedom Platform

- small, low-power, cost-effective evaluation and development system
- quick application prototyping and demonstration
- Low-cost (\$10–15 MSRP)
- Designed in an industry-standard compact form factor
- Easy access to the MCU I/O pins
- Integrated open-standard serial and debug interface (OpenSDA)
- Compatible with a rich-set of third-party expansion boards

FRDM-KL02Z* FRDM-KL26Z*

FRDM-KL05Z FRDM-KL46Z*

FRDM-KL25Z FRDM-K20D50M*





*coming soon

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Freescale Tower System

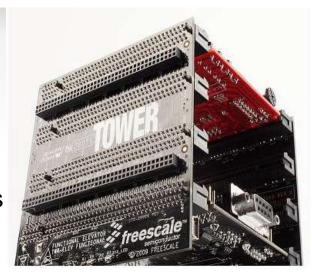
- Modular development platform
- Also for rapid prototyping
- Interchangeable and reusable modules
- Open source design files
- Easy to customize
- Reduced low level design effort
- Sold in kits or as individual modules

Processor modules with debug interface and stand-alone operation.

Cost effective







www.freescale.com/tower

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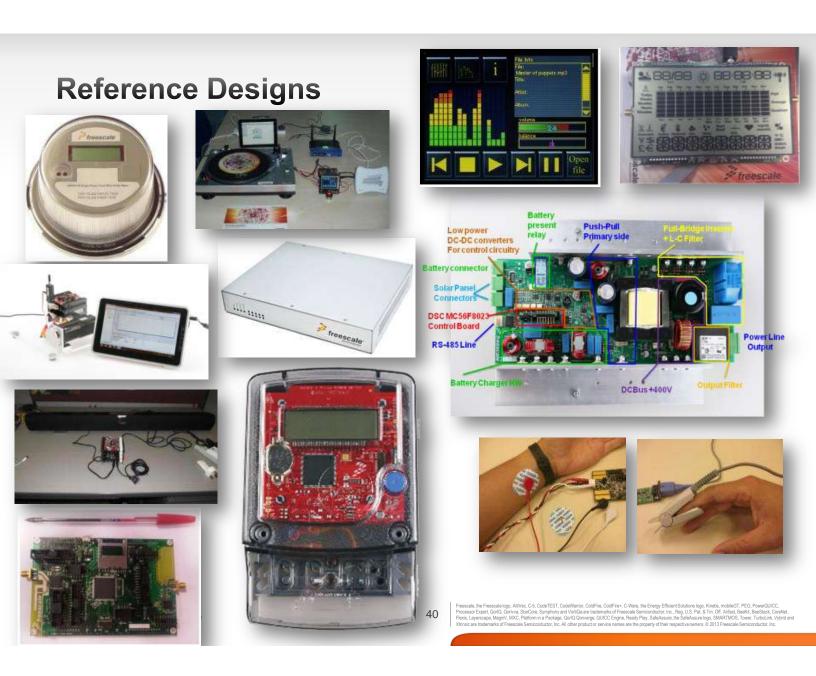
Device Specific Evaluation Boards

 Evaluation boards addressing special functions and capabilities of Kinetis devices.



*freescale

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Kinetis tools by our Channel Partners

Avnet WiGo

- Freedom Add-on board
- WiFi-Module & LiPo Battery
- Many sensors accessible through web-server



Future - Intersil

- Intersil highprecision analog & power devices
 - Pressure/Strain
 - Thermocouple
 - Power
- Freedom add-on board



Arrow Cloud Connect

- Free online tool chain
- Supports Freedom Platform
- Code library & knowledge base
- iDigi Internet of Things Interface





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The ARM® Eco System

Use the broad support for ARM® microcontroller by many companies.

· Re-use your existing debugger and programmer for Freescale Kinetis.







SYSTEM













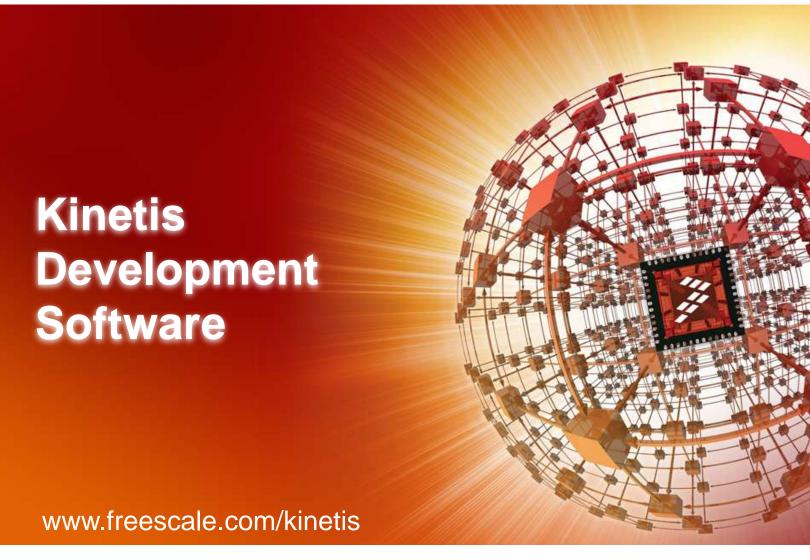














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Downloaded from Elcodis.com electronic components distributor

Overview CodeWarrior

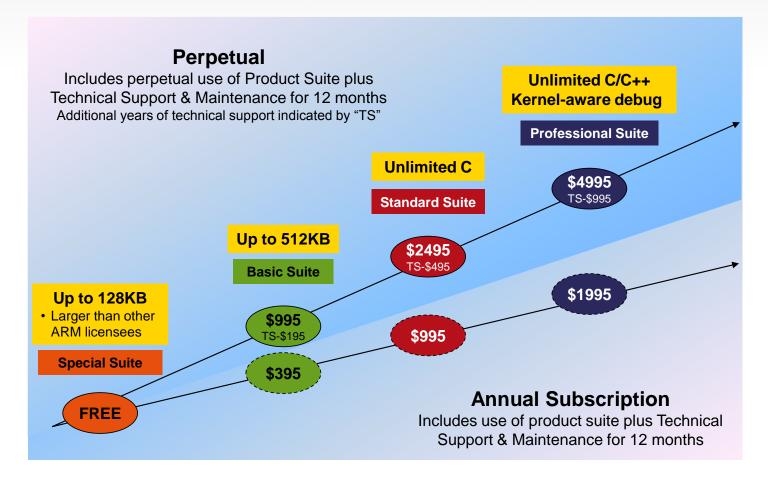
- · Freescale's design environment
- CW for Microcontrollers from 10.x on is Eclipse based
- Different versions available Basic, Standard, Professional
- Free "Special Suite" with 64k (CM0+) / 128k (CM4) code size limit
- Adds GCC 4.7.3 in CodeWarrior version 10.3 update 1.0.0





Freescale, the Freescale logs, ATMVC C-y. Code Stock, Code Stock,

CodeWarrior Pricing and Packaging Model





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Processor Expert Concept

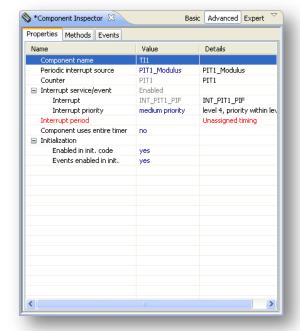
- Processor Expert
 - Provides features that fully support design time configuration
- Configuration of Whole Device
 - Configuration of selected CPU
 - Configuration of components selected by user needed in application
- Code Generator
 - Able to generate both:
 - Drivers code
 - Required configuration files
 - Settings are reflected in generated code
 - Changing settings requires re-generate the code
- Basic Element of the Processor Expert is Embedded Component
 - Components can be seen as objects that represents design time configuration and run time code (methods and events)



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Embedded Components

- Component
 - Building block of an application
 - Functionality separated into small objects
 - Components have interface (similar way classes have in object-oriented programming)
 - Properties
 - · Modify/Customize object behavior
 - Set during design-time
 - Methods
 - · Procedures that can be executed
 - Function calls
 - Events
 - · Indication of state changing
 - · Usually implementation of ISRs





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Processor Expert: On-line Training

CodeWarrior version

Microcontroller Driver Suite (Standalone / 3rd party version)



<u>Processor Expert:</u> <u>Introduction (CodeWarrior)</u>



Processor Expert:
Working with Components
(CodeWarrior)



Processor Expert:
The Code Model
(CodeWarrior)



Processor Expert:
Creating an MQX Lite
Project (CodeWarrior)



Processor Expert:
An MQX Lite Example
(CodeWarrior)



Processor Expert:
Exporting and Importing
Templates (CodeWarrior)



Processor Expert: Introduction (Driver Suite)



Processor Expert:
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Processor Expert: Creating an MQX Lite Project (Driver Suite)



Processor Expert:
An MQX Lite Example
(Driver Suite)



Processor Expert:
Exporting and Importing
Templates (Driver Suite)



Processor Expert: Integrating with IAR Embedded



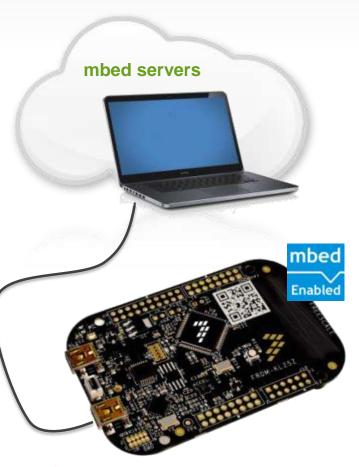
Processor Expert: Integrating with Keil Microvision



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mbed.org – What is it?





Tool for Rapid Prototyping with Microcontrollers

- Web-based Development:
 - Online IDE
 - Software Libraries
 - Robust Community
- OpenSDA on FRDM-KL25Z running mbed interface:
 - Serial Communications
 - Flash Programming
 - Run-control debug



www.mbed.org

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CooCox.org

- 4 steps to build an APP in CoIDE
 - Select device, Add & Configure code components, Build, Debug & Download



- according to the conventional using habits of embedded developers
- CoX library consists of 15 code components
 - GPIO, UART, SPI, I2C, Timer, PWM, RTC, WDT, ADC, ACMP...
- · At least 1 example for each on-chip peripheral
- Detailed help documentation in Doxygen format
- Free and timely technical support





www.CooCox.org

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CooCox

Efficient Software Tools

Open Source RTOS & Drivers

Downloaded from **Elcodis.com** electronic components distributor

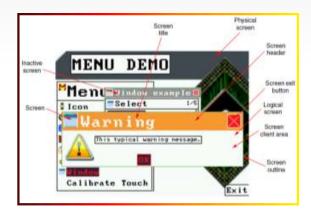
eGUI: Free Graphics LCD Driver

- Lightweight software component allowing graphics LCD panels to be driven from small microcontrollers
- Structure of driver brings complete software solution for applications needing a LCD screen
- Very light RAM and FLASH footprint
- The Freescale eGUI can be used stand alone or integrated into the MQX operating system.

Features

- Multiple platforms supported: S08, HCS12, ColdFire
- Extremely low flash and RAM footprint so that it can easily be used in a small MCU system.
- Smart support for screen oriented structure of user code.
- Supports LCD displays up to 1/4 VGA for MCU and larger for MPUs supported.
- Touch screen support.
- Tower LCD board supported.
- Easily ported to new display/controller combinations













The estates, that reference for the processor Expension of the processor Expension of Control Control

Portable Embedded GUI (PEG)



PEG Pro

Support for touchscreen displays, multi-layer alpha-blended graphics, high color depths and open GL support



- Screen transitions
- Multiple alpha-blended windows
- True anti-aliasing
- Gradient manager
- Open GL support
- Written in C++

Starting 225KB
Typical 225-250KB

PEG+

Most portable graphics software package for high-performance embedded displays



- Multiple window updates
- Alpha-blended images
- Run-time image decoders & language resources
- Custom widget integration
- Dynamic themes
- Written in C++

Starting at 128KB Typical 160-175KB

C/PEG

One of the smallest footprint solutions available for embedded GUIs



- Designed for:
 - Small LCDs (QVGA)
 - Low colour-depth
- Very small footprint
- Single window update
- Multi-language capable
- Written in ANSI C

Starting at 64KB Typical 90-110KB



www.frescale.com/PEG

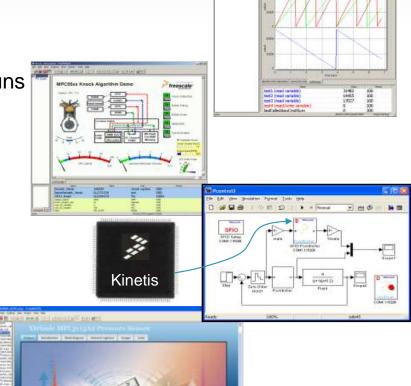
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FreeMASTER

- Real-time monitor and control of an app
 - Track your variables
 - Modify them while the system runs
- Data visualization
 - Design your own dashboard
- Data streaming e.g...
 - Send it to MATLAB® via FreeMASTER
- Demonstration platform
 - A product packaging tool

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Processor Expert Certific, Oprivive, StanCore, Symphony and Volcage to the base of the Section of the Section Section of the Section S

Embedded Software and Motor Control Libraries

- Wide group of algorithms
 - basic mathematics, logic, controllers, modulations, transformations up to advanced observers
- Tool for beginners as well as for professionals
 - motor control, power conversion, UPS etc.
- Libraries are optimized, tested and easy to use
- Implemented with C-callable function interface
- Implemented Algorithms
 - Sine, Cosine, Tangent, Arcus Sine, Arcus Cosine, Arcus Tangent, Arcus Tangent, Shifted Arcus Tangent, Square Root, Ramp, Limiter, Hysteresis, Signum, Look-up Table, PI Controller,
 - Clarke Transformation, Inverse Clarke Transformation, Park Transformation, Inverse Park Transformation, Space Vector Modulation, Vector Limiter, PMSM Decoupling, DC Bus Ripple Elimination
 - IIR filter, Moving avg. filter

Embedded Software and Motor Control Libraries



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Freescale's Made For iPod (MFi) Solutions

Freescale's MFi solutions are based on the TWR-DOCK peripheral module

- TWR-DOCK supports development and rapid prototyping of electronic accessories for iPod, iPhone and iPad devices
 - Available to MFi licensees on the MFi portal for \$139
 - Direct 30-pin dock connection
 - USB A receptacle for USB to 30-pin dock or Lightning™ cable connection
 - Analog audio and video signals with standard RCA and S-Video connectors
 - Digital audio streaming in both directions over USB
 - Control and communication with various devices
- Includes free interface software
- TWR-DOCK concentrates all MFi controlled items on one Tower module, without including any processors or other Freescale products
- TWR-DOCK may be used with a wide range of Tower System MCU/MPU, peripheral, sensor and communication
- Kinetis-based demos are available
- Vybrid support planned for early 2013
- A new TWR-DOCKx is in development for direct Lightning dock connection







The ARM® Eco System

Use the broad support for ARM® microcontroller by many companies.

 Re-use your existing IDE and Middleware for Freescale Kinetis.































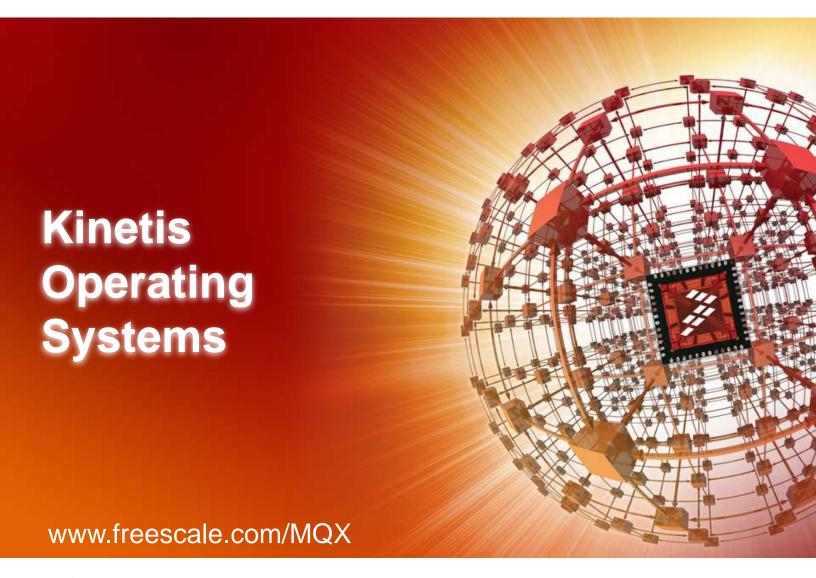










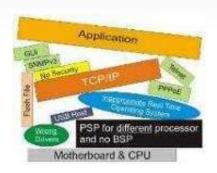




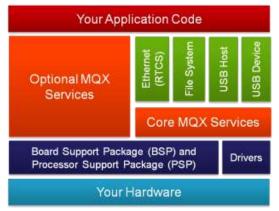
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Why MQX[™]?

- MQX is a run-time library of functions that programs use to become real-time multi-tasking applications.
- The main features are its scalable size, component-oriented architecture, and ease of use.
- MQX supports multi-processor applications and can be used with flexible embedded I/O products for networking, data communications, and file management



Past Customer Problem



MQX, the Solution



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MQX Lite RTOS - Overview

- Very light MQX kernel for resource-limited MCUs
 - Targeted at the Kinetis L family initially
 - Packaged as a Processor Expert component
- I/O capability provided by Processor Expert
 - USB via FSL bare-metal stack, also a Processor Expert component
 - No POSIX-like drivers or file access
- Programming model allows upward code migration
 - A true subset of the full MQX RTOS
 - Code built with MQX Lite will move to full MQX RTOS easily
 - Same task templates, same API some very minor differences
- Available as a component within the following Freescale s/ware offerings:
 - Processor Expert software, MCU driver suite Supports IAR, Keil, and GCC compilers / build chains
 - CodeWarrior Development Studio V10.3



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MQX Lite RTOS - Benefits

✓ Easy to configure

 Packaged as a Processor Expert component; with configurable options: set name of task function, priority, stack size (all the same parameters as an MQX task)

✓ Easy to add existing application

Just drop in the MQX Lite RTOS component, and get started in minutes

✓ Very light-weight

 Minimal app (Hello task, idle task, interrupt stack) – less than 4 KB RAM; optimized for resource-limited MCUs like Kinetis L Series family

✓ I/O capability provided by Processor Expert software

√ Take advantage of the broad spectrum of MCU logical device drivers; with access to libraries/stacks like USB Processor Expert component

✓ Real-time, priority-based pre-emptive task switching

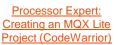
√ Threads execute in order of priority, allowing high-priority threads to meet their deadlines consistently, no matter how many other threads are competing for CPU time

Programming model allows upward code migration

✓ MQX Lite RTOS is a true subset of the full MQX RTOS: code built
with MQX Lite RTOS will easily move to the full MQX RTOS

MQX Lite with CodeWarrior Processor Expert







Processor Expert:
An MQX Lite Example
(CodeWarrior)

MQX Lite with Microcontroller Driver Suite Processor Expert



Processor Expert:
Creating an MQX Lite
Project (Driver Suite)



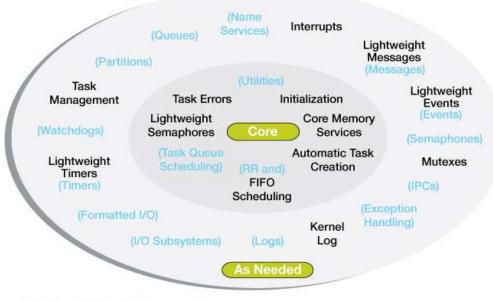
Processor Expert:
An MQX Lite Example
(Driver Suite)



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MQX vs. MQX Lite

Attribute	MQX RTOS	MQX Lite RTOS
Delivery Mechanism	Traditional installer with full source for Kernel, services and BSPs	Processor Expert (PEx) Kernel and services component, configurable software generated by PEx
I/O Drivers	MQX POSIX compatible drivers with option for using PEx drivers	PEx drivers only
Configurability	User selects needed services from full or lightweight versions	Reduced services available; lightweight options only



MQX Lite RTOS (MQX RTOS)



Freescale, the Freescale loop, All/Nec, C-S, Code/TEST, Code/Matrics Code/Tec, Code/Te

The ARM® Eco System

Use the broad support for ARM® microcontroller by many companies.

 Re-use your existing RTOS know how for Freescale Kinetis.









ecos





















MCU Solution Advisor web application

www.freescale.com/SolutionAdvisor

The Solution Advisor helps you quickly identify bestfit processor solutions from the following portfolios:

- 8-bit MCU (microcontroller)
- Kinetis K Series MCU
- Kinetis L Series MCU
- PX Series MCU
- Freescale DSC (digital signal controller)

Interactive MCU selector guide based on:

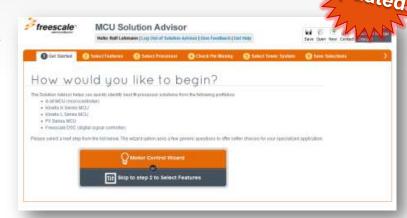
- operating characteristics
- packaging options
- memory and FlexMemory requirements
- a library of configurable hardware modules

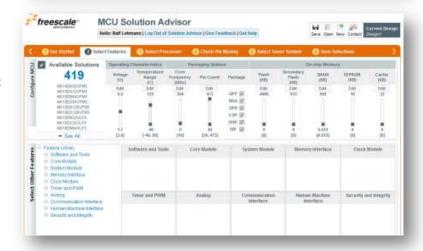
Dynamic, sortable, downloadable solution matrix

Pin Muxing verification and suggested placement (Full functionality will be restored soon)

Session and Contact Management Save, restore, invite, and share

Generates session summary reports







Frascale, the Frascale logs, AllVec, C.S. CodsTEST, CodelMartinc, ColdFire, Culffere, C.Wifer, the Energy Efficient Solutions logs, Kinelia, mobileQT, PEG, PowerQUICC, Processor Expert, Qorld, Qorivor, StarCore, Symphory and Vorifue are trudemarks of Fraescale Semiconductor, Inc., Reg. U. S. Pati. A. Tim. Off, Auftrast, Bekld, Rebestlox, CoreNet, Plans, Layerscape, Magnify, IMCC, Pations in a Package, Carlot Quoverge, QUICC Engine, Ready Play, Safekseure, the Safek-lessure logs, SIMPATMOS, Tower, TurboLink, Vybrid and

KINETIS SERIES

DESIGN POTENTIAL. REALIZED



Ultra-Scalable

Market's most scalable portfolio of low-power ARM Cortex-M0+ and ARM Cortex-M4 MCUs with over 300 hardware and software compatible devices

Mixed Signal

Exceptional integration with fast 16-bit ADCs, DACs, PGAs and more. Powerful, cost-effective signal conversion, conditioning and control

Energy Efficiency

The world's most energyefficient and scalable MCU Series with power optimized peripherals and flexible power modes

Comprehensive Enablement

Freescale MQX RTOS, Tower System and Eclipse-based CodeWarrior IDE, as well as Kinetis support from most ARM ecosystem providers





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