



Freescal Embedded Solutions Based on ARM Technology

Kinetis MCUs

i.MX applications processors

QorIQ communications processors

Vybrid controller solutions



Without intelligence, it doesn't matter how well connected you are.



Bringing intelligence to the Internet of Things

Cars communicating with highways to avoid accidents and traffic congestion. Home hubs talking to the smart grid to reduce energy consumption. Healthcare monitoring from across town. The billions of intelligent connections that make our world smarter, greener and safer. This is Freescale Connected Intelligence.

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Contents

ARM Solutions Portfolio	2	QorIQ Communications Processors	20
Kinetis MCUs	4	QorIQ LS1 family	21
Kinetis K series MCUs	5	Hybrid Controller Solutions	23
Kinetis L series MCUs	7	Hybrid VF3xx family	26
Kinetis E series MCUs	9	Hybrid VF5xx family	28
Kinetis M series MCUs	10	Hybrid VF6xx family	30
Kinetis W series MCUs	11	Design Resources	32
i.MX Applications Processors	12	Freescale enablement solutions	33
i.MX 6 series of applications processors	14	Partner enablement solutions	44
i.MX53 applications processors	16		
i.MX50 application processors	18		
i.MX28 applications processors	19		



Scalable. Innovative. Leading.

Your Number One Choice for ARM Solutions

Freescale is the leader in 32-bit embedded control, offering the market's broadest and best-enabled portfolio of solutions based on ARM® technology. Our end-to-end portfolio of high-performance, power-efficient MCUs and digital networking processors help realize the potential of the Internet of Things, reflecting our unique ability to deliver scalable, systems-focused processing and connectivity.

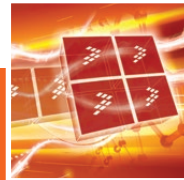
Our large ARM-powered portfolio includes scalable MCU and MPU families from small ultra-low-power Kinetis MCUs to i.MX and Vybrid multimedia processors with advanced performance and feature integration and QorIQ communications processors that deliver industry-leading power and performance. Each family has been designed to offer a broad range of performance, peripheral and packaging options, providing migration paths for end-product platform development. All families are supported

by industry-leading enablement (software and tool) bundles from Freescale and the extensive ARM ecosystem. Combined, our Kinetis, i.MX, QorIQ and Vybrid solutions offer the highest level of integration, the most comprehensive software and hardware enablement, and the broadest range of performance available within the ARM community. Whether you are a consumer, industrial, automotive or networking product designer, our ARM-based product families offer a solution that meets your requirements.



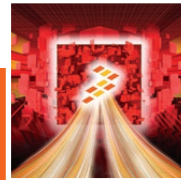
Kinetis MCUs

Hardware- and software-compatible ARM Cortex®-M0+ and ARM Cortex®-M4 MCU families with exceptional low-power performance, feature integration and Freescale enablement support



i.MX Applications Processors

Ultra-versatile solutions for multimedia and display applications with multicore scalability and market-leading power, performance and integration



QorIQ Communications Processors

Next-generation QorIQ processors are based on Layerscape architecture—the industry's first software-aware, core-agnostic architecture that delivers unprecedented efficiency and scale for the smarter, more capable networks of tomorrow—end to end

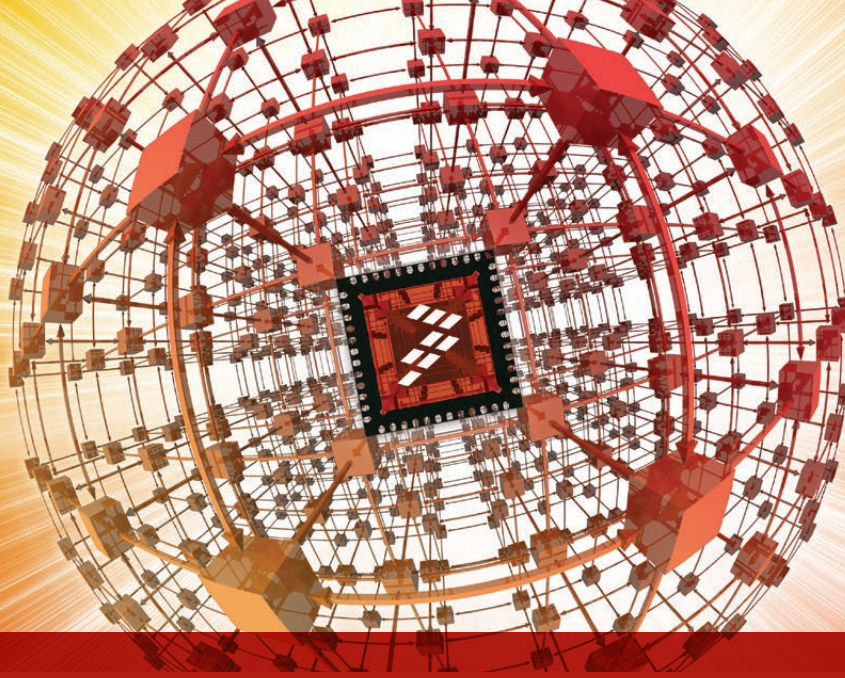


Vybrid Controller Solutions

Real-time, highly integrated solutions with dual-display capability to enable your system to control, interface, connect, secure and scale



Combined, our Kinetis, i.MX, QorIQ and Vybrid solutions offer the highest level of integration, the most comprehensive software and hardware enablement and the broadest range of performance available within the ARM community.



Kinetis MCUs

Scalable, ultra-low-power, mixed-signal MCUs

Our Kinetis portfolio of ARM® Cortex® MCUs consists of multiple hardware- and software-compatible ARM Cortex®-M0+ and Cortex®-M4 MCU families, including exceptional low-power performance, scalability and feature integration. All Kinetis MCUs are supported by a comprehensive Freescale and third-party hardware and software enablement system that reduces development costs and time to market.

Kinetis Series Overview

High Performance and Rich Integration

This extensive portfolio covers a broad range of applications. Seven MCU families within the Kinetis K series are based on the ARM Cortex-M4 processor and surrounded by a performance-oriented range of connectivity, mixed-signal, display and security options.

Kinetis
K
Series

Energy Efficiency

Ultra-low power is achieved by these ARM Cortex-M0+ MCUs in low pin-count packages.

Kinetis
L
Series

Kinetis
E
Series

High Voltage/Robust

With 2.7 V–5.5 V supply and a focus on exceptional EMC/ESD robustness, this series is well suited to a wide range of applications in electrically harsh environments and optimized for cost-sensitive applications with low pin-count options.

Kinetis
M
Series

Metrology/High Accuracy

The integration of highly accurate 24-bit sigma delta converters and low-noise amplifiers make the Kinetis M series particularly well suited for precision measurement in electricity meters, plus test and measurement.

Kinetis
W
Series

Wireless Communications

The Kinetis W series of MCUs is optimized for low-power wireless communication and integrates class-leading sub-1 GHz and 2.4 GHz RF transceivers, providing the right mix of performance, integration, connectivity and security.

Kinetis K Series MCUs Built on the ARM Cortex-M4 Core

High performance and rich integration

Kinetis K Series MCUs

The 32-bit Kinetis K series MCU family is based on the highest performance ARM® Cortex®-M-class core: the ARM Cortex®-M4. The K series includes 300 variants, spanning from 32 KB of flash up to 1 MB, along with a broad range of peripheral combinations for measurement and control, connectivity and security. Design teams looking for an MCU to provide the right ratio of price, performance and features are sure to find what they're looking for within this family.

Kinetis K Series: Less on the Outside

Freescale has developed the K series to be a highly integrated solution that enables developers to harness on-chip features in order to reduce the need for external components. For example, the analog integration in which 16-bit ADCs enable greater resolution minimizes the need for expensive external analog circuitry. In addition, there are integrated PGAs onboard. The analog comparators integrate built-in 6-bit DACs. The Kinetis K50 specifically has op-amps and tri-amps. The capacitive touch-sensing interface allows for direct connection with the external capacitive touchpads. A UART can support connections to a smart card or can support Manchester encoding. Additionally, there is a built-in regulator on the USB.

To learn more, visit freescale.com/Kinetis/Kseries.

Kinetis K Series: Industrial Applications

Memory	<ul style="list-style-type: none"> • Up to 1 MB of flash memory • Single cycle access to flash • Optional EEPROM • MPU and flash swap controller to enable robust firmware updates • CRC module • DRAM and NAND flash I/F
Power Efficiency	<ul style="list-style-type: none"> • M4 core with FPU, MAC and SIMD • 1.71–3.6 V voltage supply with full access to analog and memory across full range • Powerful DMA and X-bar switch enabling parallel processing • 200 μA/MHZ in run modes, fast wake-up times, 690 to 2μA in lower power Stop and 10 modes of operation to balance performance and power
Rich Mixed Signal	<ul style="list-style-type: none"> • Up to 4x configurable 16-bit ADCs supporting on-chip PGAs • High-speed analog comparator with integrated 6-bit DAC • 12-bit DAC • FlexTimers for ICAP, OCOMP and PWM
Connectivity	<ul style="list-style-type: none"> • 10/100 BaseT Ethernet MAC with stacks supporting IPv6 • USB 2.0 OTG module • Up to 2x FlexCAN, 2.0B compliant • Up to 6 UART, support available for smart card plus Manchester encoding • Up to 3 SPI with chip selects • I²S or serial audio I/F • I²C • SDIO I/F
Security	<ul style="list-style-type: none"> • Hardware encryption accelerator • Random number generator • Anti-tamper circuitry to monitor and help prevent application tampering and protect your IP
HMI	<ul style="list-style-type: none"> • Graphics controller supporting SVGA resolution • Parallel bus for camera I/F • Capacitive touch-sensing module

Kinetis K Series

Common Features	
System	
ARM Cortex-M4 Core + DSP	
Multiple Low-Power Operation Modes, Clock Gating, 1.71–3.6 V, 5 V Tolerant I/O [1]	
DMA, Memory Protection Unit [2], Crossbar Switch	
Operating Temp: -40 °C to +105 °C [3]	
Memory	
90 nm TFS Flash Memory (High Reliability, Fast Access)	
FlexMemory (EEPROM) [4]	
SRAM	
Internal Memory Security/Protection	
Analog Peripherals	
16-bit ADC	
Programmable Gain Amplifiers [1]	
12-bit DAC [5]	
High-Speed Comparators	
Low-Power Touch-Sensing Interface [7]	
Serial Interfaces	
UART, SPI, I ² C	
SAI (I ² S)	
Timers	
RTC	
Motor Control Timers	
Low-Power Timers	
Programmable Delay Block	
System Timers	
Other Peripherals	
CRC	
eSDHC [6]	
External Bus Interface [4]	

Optional Features													
CPU		Internal Memory		Communication			HMI	Security		Memory/Expansion		Analog	
K7x Family: Graphics LCD													
120 to 150 MHz	Floating-Point Unit	512 KB to 1 MB Flash	128 KB SRAM	USB OTG (FS and HS) [6]	CAN	Ethernet (IEEE® 1588)	Graphics LCD	Hardware Encryption	Tamper Detection	NAND Flash Controller	DRAM Controller	—	
K6x Family: Ethernet, Security													
100 to 150 MHz	Floating-Point Unit	256 KB to 1 MB Flash	64 KB to 128 KB SRAM	USB OTG (FS and HS)	CAN	Ethernet (IEEE 1588)	—	Hardware Encryption	Tamper Detection	NAND Flash Controller	DRAM Controller	—	
K5x Family: Analog Measurement Engine													
72 to 100 MHz	—	128 KB to 512 KB Flash	32 KB to 128 KB SRAM	USB OTG (FS)	—	Ethernet (IEEE 1588)	Segment LCD	Hardware Encryption	—	—	—	—	Measurement Engine
K4x Family: USB, Segment LCD													
72 to 100 MHz	—	64 KB to 512 KB Flash	16 KB to 128 KB SRAM	USB OTG (FS)	CAN	—	Segment LCD	—	—	—	—	—	—
K3x Family: Segment LCD													
72 to 100 MHz	—	64 KB to 512 KB Flash	16 KB to 128 KB SRAM	—	CAN	—	Segment LCD	—	—	—	—	—	—
K2x Family: USB													
50 to 120 MHz	Floating-Point Unit	32 KB to 1 MB Flash	8 KB to 128 KB SRAM	USB OTG (FS and HS)	CAN	—	—	Hardware Encryption	Tamper Detection	NAND Flash Controller	—	—	—
K1x Family: General Purpose													
50 to 120 MHz	Floating-Point Unit	32 KB to 1 MB Flash	8 KB to 128 KB SRAM	—	CAN	—	—	Hardware Encryption	Tamper Detection	NAND Flash Controller	—	—	—

[1] Feature not available on 50 MHz MCUs

[2] Feature not available on 50 MHz and 72 MHz MCUs

[3] Feature not available on K50 MCUs and CSP packages (K50 and CSP packages are -40 °C to +85 °C)

[4] Feature not available on all K10, K20, K30, K40, K50, K60 and K70 MCUs

[5] Feature not available on K10 and K20 50 MHz MCUs

[6] HS USB on 120/150 MHz MCUs only

[7] Feature not available on K11/12/21/22 MCUs

Freescale Development Tools for the Kinetis K Series

Development Tool Part Number	Kinetis Family Support	MSRP	Extended Hardware Support Options
FRDM-K20D50M	50 MHz MK10 and MK20	\$18	Tower System peripheral modules can be added for enhanced functionality, including 802.11.x, serial connectivity, analog, sensors, graphics LCD, audio, MFi interface (iPad®, iPhone®, iPod®), general I/O, 2.4 GHz and sub-1 GHz RF, motor control, memory, etc.
TWR-K20D50M	50 MHz MK10 and MK20	\$99	
TWR-K21D50M	50 MHz MK11, MK12, MK21 and MK22	\$99	
TWR-K20D72M	72 MHz MK10 and MK20	\$119	
TWR-K21F120M	120 MHz MK21 and MK22	\$99	
TWR-K40D100M	100 MHz MK30 and MK40	\$99	
TWR-K53N512	All MK50, MK51, MK52 & MK53 variants	\$109	
TWR-K60D100M	100 MHz MK10, MK20 and MK60	\$99	
TWR-K60F120M	120/150 MHz MK10, MK20 and MK60	\$99	
TWR-K70F120M	120/150 MHz MK61 and MK70	\$109	

Bundled kits with peripheral modules are available. For more information, visit freescale.com/Tower and freescale.com/Freedom.

Kinetis L Series MCUs Built on the ARM Cortex-M0+ Core

Energy efficiency

Kinetis L Series MCUs

Kinetis L series MCUs are the world's most energy efficient, bringing new design possibilities to entry-level applications that have previously been limited by 8-/16-bit MCU capabilities.

Kinetis L series MCUs combine the enhanced energy efficiency, performance and debug features of the new 32-bit ARM® Cortex®-M0+ core with the scalability, feature integration and enablement of the Kinetis MCU portfolio. Available with multiple flash memory options and a rich selection of analog, connectivity and HMI peripherals, Kinetis L series MCUs are also hardware and software compatible with Kinetis K series MCUs based on the ARM Cortex®-M4 core. Both are supported by an industry-leading Freescale enablement package that includes the CodeWarrior IDE with Processor Expert tool, Freescale Freedom development platform and MQX™ Lite RTOS, as well as the ARM third-party ecosystem.

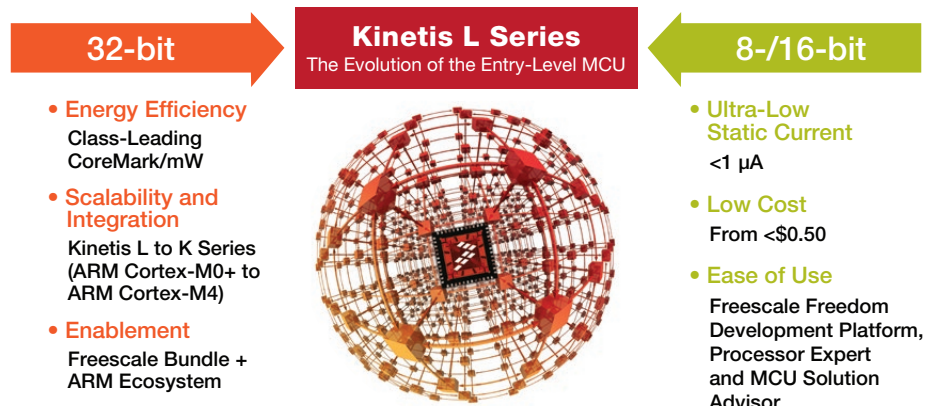
Energy Efficiency

Kinetis L series MCUs supplement the low-power ARM Cortex-M0+ core with the latest in low-power 90 nm process technology, platform design, operating modes and energy-saving peripherals. Combined, they increase the time spent in deep sleep modes, minimizing CPU activity and extending battery life.

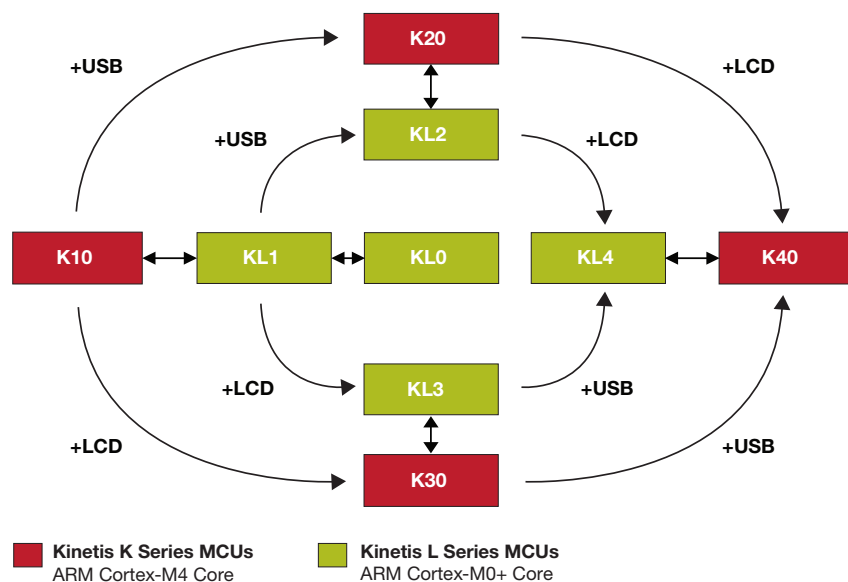
ARM Cortex-M0+ Core The World's Most Energy-Efficient Processor

- Kinetis L series MCUs based on the ARM Cortex-M0+ core deliver up to 2.42 CoreMark®/MHz*: 2x-40x more than 8- and 16-bit competitors and approximately 10 percent more than the ARM Cortex-M0
- Single-cycle access to I/O: Up to 50 percent faster than standard I/O for improved reaction time to external events

Evolution of the Entry-Level MCU



Kinetis L and K Series Compatibility



- Two-stage pipeline: Reduced cycles per instruction enables faster branch instruction and ISR entry
 - Excellent code density vs. 8-bit and 16-bit MCUs: Reduced flash size, system cost and power consumption
 - 56 instructions: Easy programming and efficient packaging of 8-/16-/32-bit data in memory. One hundred percent instruction set compatible with the ARM Cortex-M0 processor
 - Linear 4 GB address space: No complex paging, simpler software
 - Micro trace buffer: Lightweight trace solution for fast bug identification
- To learn more visit freescale.com/Kinetis/Lseries.
- *NOTE:** CoreMark: 1.0 : IAR Compiler 6.60, --endian=little --cpu=Cortex-M0+ -e --fpu=None -Ohs --use_c++_inline --no_size_constraints, Code in internal Flash - Data in internal RAM

Kinetis L Series

Common Features		Optional Features											
System		Family	Flash	SRAM	Pin Count	Key Features							
Memory						USB OTG	Seg LCD	DMA	LLWU	ADC	DAC	I ² S	TSI
ARM Cortex-M0+ Core, 48 MHz		KL46	128–256 KB	16–32 KB	64–121	✓	✓	✓	✓	16-bit	12-bit	✓	✓
Multiple Low-Power Modes and Peripherals, Low-Power Boot, Clock Gating		KL36	64–256 KB	8–32 KB	64–121		✓	✓	✓	16-bit	12-bit	✓	✓
1.71–3.6 V, –40° C to +105° C ^[1]		KL34	64 KB	8 KB	64–00		✓	✓	✓	12-bit			
Analog Peripherals		KL26	32–256 KB	4–32 KB	32–121	✓		✓	✓	16-bit	12-bit	✓	✓
90 nm TFS Flash, SRAM		KL25	32–128 KB	4–16 KB	32–80	✓		✓	✓	16-bit	12-bit		✓
Internal Memory Security/Protection		KL24	32–64 KB	4–8 KB	32–80	✓		✓	✓	12-bit			
Serial Interfaces		KL16	32–256 KB	4–32 KB	32–64			✓	✓	16-bit	12-bit	✓	✓
UART (including 1 LPUART)		KL15	32–128 KB	4–16 KB	32–80			✓	✓	16-bit	12-bit		✓
SPI, I ² C		KL14	32–64 KB	4–8 KB	32–80			✓	✓	12-bit			
Timers		KL05	8–32 KB	1–4 KB	24–48			✓	✓	12-bit	12-bit		✓
Real-Time Clock ^[2]		KL04	8–32 KB	1–4 KB	24–48			✓	✓	12-bit			
16-bit Low-Power TPMs (GP Timer/PWM)		KL02	8–32 KB	1–4 KB	16–32					12-bit			
Low-Power Timers													
32-bit Periodic Interrupt Timer													

[1] Feature not available on CSP packages
[2] For KL02, use software to support

Kinetis L Series: Energy Efficiency

Ultra-Efficient Processing	<ul style="list-style-type: none"> • ARM Cortex-M0+ processor • 90 nm low-power flash technology • Bit manipulation engine • Peripheral bridge crossbar and zero wait state flash memory controller
Ultra-Low-Power Modes	<ul style="list-style-type: none"> • 90 nm low-leakage flash technology • Multiple run, wait and stop modes, fast wake-up from deep sleep modes • Clock and power gating, low-power boot option • 2 μA typical sleep IDD power on reset (POR) active and 4.3 μS wake-up
Energy-Saving Peripherals	<ul style="list-style-type: none"> • Smart peripherals function in deep sleep modes and can make intelligent decisions and process data without waking up the core: ADMA, UART, timers, ADC, segment LCD and touch-sensing

Freescale Development Tools for the Kinetis L Series

Development Tool Part Number	Kinetis Family Support	MSRP	Extended Hardware Support Options
FRDM-KL02Z	48 MHz KL02Z	\$12.95	Arduino™ footprint-compatible with support for a rich set of third-party expansion boards (“shields”)
FRDM-KL05Z	48 MHz KL04Z/KL05Z	\$12.95	
FRDM-KL25Z	48 MHz KL14Z/KL15Z/KL24Z/KL25Z	\$12.95	
FRDM-KL26Z	48 MHz KL16Z/KL26Z	\$15	
FRDM-KL46Z	48 MHz KL16Z/KL26Z/KL34Z/KL36Z/KL46Z	\$15	
TWR-KL25Z48M	48 MHz KL14Z/KL15Z/KL24Z/KL25Z	\$99	Tower System peripheral modules can be added for enhanced functionality, including 802.11.x, serial connectivity, analog, sensors, graphics LCD, audio, Tower dock (iPad®, iPhone®, iPod®), general I/O, 2.4 GHz and sub-1 GHz RF, modules, motor control, memory modules, etc.
TWR-KL46Z48M	48 MHz KL16Z/KL26Z/KL34Z/KL36Z/KL46Z	\$149	

Bundled kits with peripheral modules are available. For more information, visit freescale.com/Tower and freescale.com/Freedom.

Kinetis E Series MCUs Built on the ARM Cortex-M0+ Core

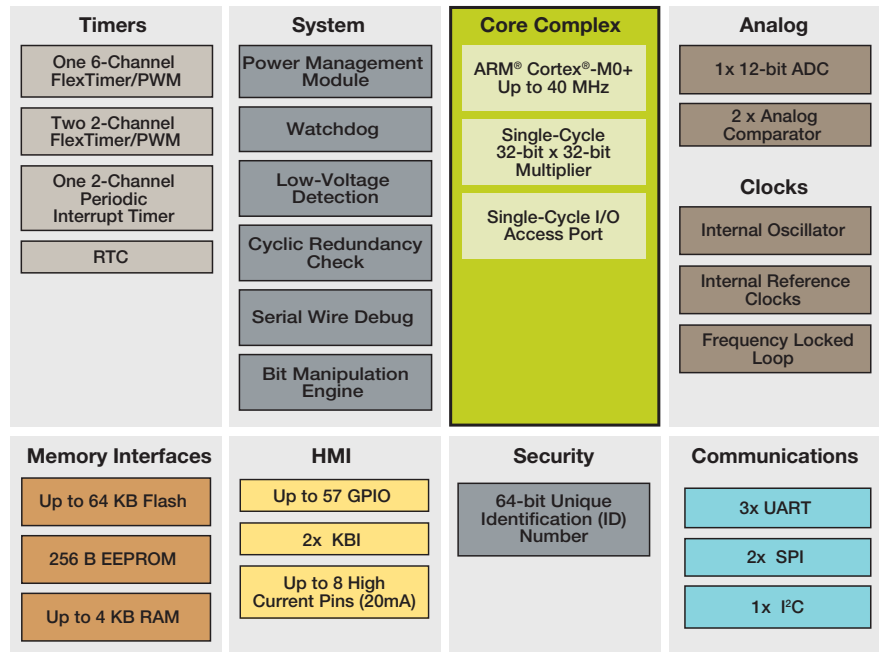
High voltage and robust

The Kinetis E series is the most scalable portfolio of ARM® Cortex®-M0+ MCUs in the industry. Designed to maintain high robustness for complex electrical noise environments and high-reliability applications, the Kinetis E series families offer a broad range of memory, peripheral and package options. They share common peripherals and pin counts, allowing developers to migrate easily within an MCU family or between MCU families to take advantage of more memory or feature integration. This scalability allows developers to standardize on the Kinetis E series for their end-product platforms, maximizing hardware and software reuse and reducing time to market.

Features

- 32-bit ARM Cortex-M0+ core
- Scalable memory footprints from 8 KB flash/1 KB SRAM to 128 KB flash/16 KB SRAM
- Precision mixed-signal capability with on-chip analog comparator and 12-bit ADC
- Powerful timers for a broad range of applications, including motor control
- Serial communication interfaces such as UART, SPI, I²C, etc.
- High security and safety with internal watchdog and programmable CRC module
- Single power supply (2.7–5.5 V) with full functional flash program/erase/read operations
- Ambient operation temperature range: –40 °C to +105 °C
- Robust 5 V MCU with 8-bit S08 compatibility

Kinetis KE02 Family Block Diagram



Freescale Development Tools for the Kinetis E Series

Development Tool Part Number	Kinetis Family Support	MSRP	Extended Hardware Support Options
FRDM-KE02Z	20 MHz KE02Z	\$12.95	Arduino™ footprint-compatible with support for a rich set of third-party expansion boards ("shields")
FRDM-KE02Z40M	40 MHz KE02Z	\$12.95	

For more information, visit freescale.com/Freedom.

Overview

The Kinetis KE02 sub-family is the entry-point into the Kinetis E series and is pin compatible across the E series and with the 8-bit S08P family. This sub-family includes a powerful array of analog, communication, timing and control peripherals with varying flash memory size and pin count and offers a series of highly robust, cost-effective and energy-

efficient MCUs that provide the appropriate entry-level solution. It is the next-generation MCU solution, offering enhanced ESD/EMC performance for cost-sensitive, high-reliability device applications used in high electrical noise environments.

To learn more, visit freescale.com/Kinetis/Eseries.

Kinetis M Series Built on the ARM Cortex-M0+ Core

Ultra-low-power, smart-metering MCUs with precision analog, security and HMI peripherals

Kinetis M series MCUs are based on the 32-bit ARM® Cortex®-M0+ core and provide a low-cost, highly integrated solution for one-, two- and three -phase electricity meters that require powerful 32-bit processing capability, precision analog, security and HMI functionality.

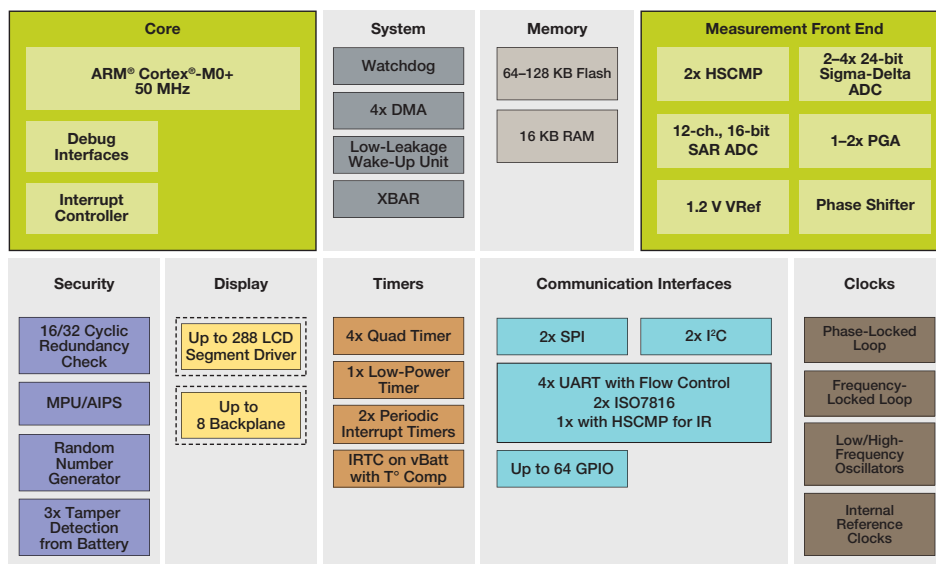
Each MCU includes a powerful analog front end that is configurable for different regions and enables power calculations with 0.1 percent accuracy. A high-accuracy real-time clock delivers less than 5 ppm drift overtemperature. Metrology firmware for calculating active, reactive and apparent power using a variety of algorithms is provided free of charge by Freescale. Precertified reference designs for Europe, China, India, the U.S. and Japan are available for customer evaluation. The Kinetis M series is supported by the Tower System hardware development platform.

Features

- High-performance ultra-low-power ARM Cortex-M0+ core
- 24-bit sigma-delta ADC and PGA achieving 94 dB SNR
- High-accuracy RTC with +5 PPM overtemperature
- Rich set of security: MPU, active tamper, RNG for Welmac-compliant meters
- Precertified metrology software

To learn more, visit freescale.com/Kinetis/Mseries.

Kinetis M Series Family



Optional

Kinetis M Series Selector Guide

Part Number	Purpose	Package	No.	LCD	Memory	
			SD		Flash	RAM
MKM14Z64CHH5	Single Phase	LGA 44	4	no	64 KB	16 KB
MKM14Z128CHH5	Two Phase	LGA 44	4	no	128 KB	16 KB
MKM33Z64CLH5	Single Phase	LQFP 64	3	8 x 17	64 KB	16 KB
MKM33Z128CLH5	Single Phase	LQFP 64	3	8 x 17	128 KB	16 KB
MKM33Z64CLL5	Single Phase	LQFP 100	3	8 x 38	64 KB	16 KB
MKM33Z128CLL5	Single Phase	LQFP 100	3	8 x 38	128 KB	16 KB
MKM34Z128CLL5	Two Phase	LQFP 100	4	8 x 38	128 KB	16 KB

Freescale Development Tools for the Kinetis M Series

Development Tool Part Number	Kinetis Family Support	MSRP	Extended Hardware Support Options
TWR-KM34Z50M	50 MHz KM13Z/KM14Z/ KM32Z/KM33Z/ KM34Z/KM38Z	TBD	Tower System peripheral modules can be added for enhanced functionality, including 802.11.x, serial connectivity, analog, sensors, graphics LCD, audio, Tower dock (iPad®, iPhone®, iPod®), general I/O, 2.4 GHz and sub-1 GHz RF, modules, motor control, memory modules, etc.

Bundled Tower System kits with peripheral boards are available. For more information, visit freescale.com/Tower.

Kinetis W Series MCUs Built on ARM Cortex Cores

Wireless communications

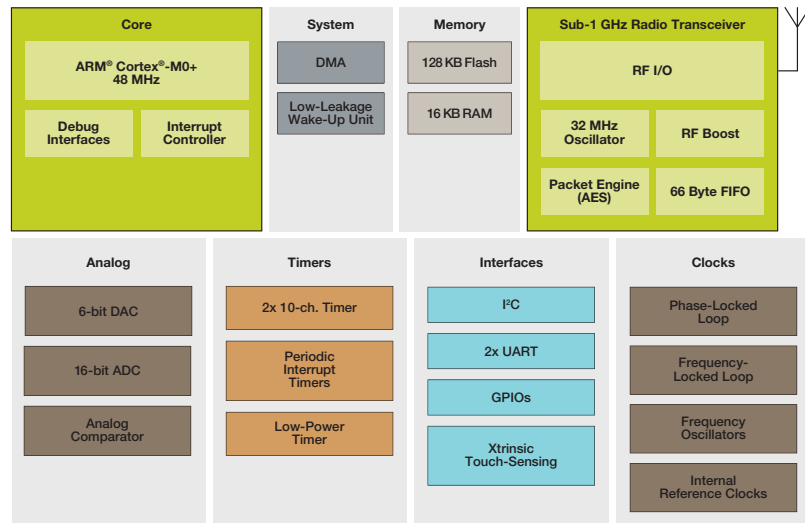
The Kinetis W series integrates class-leading sub-1 GHz and 2.4 GHz RF transceivers with ARM® Cortex® cores, providing robust feature sets for reliable, secure and low-power embedded wireless solutions. The Kinetis W series is optimized for wireless, providing the right mix of performance, integration, connectivity and security. The enablement packages include Freescale's Tower System development platforms, MQX™ RTOS support and CodeWarrior IDE, as well as support from IAR Systems and other partners. Whether you need sub-1 GHz or 2.4 GHz wireless, simple point-to-point or full mesh networking, the Kinetis W series has the solution to fit your needs.

The Kinetis KW0x Family of Sub-1 GHz MCUs

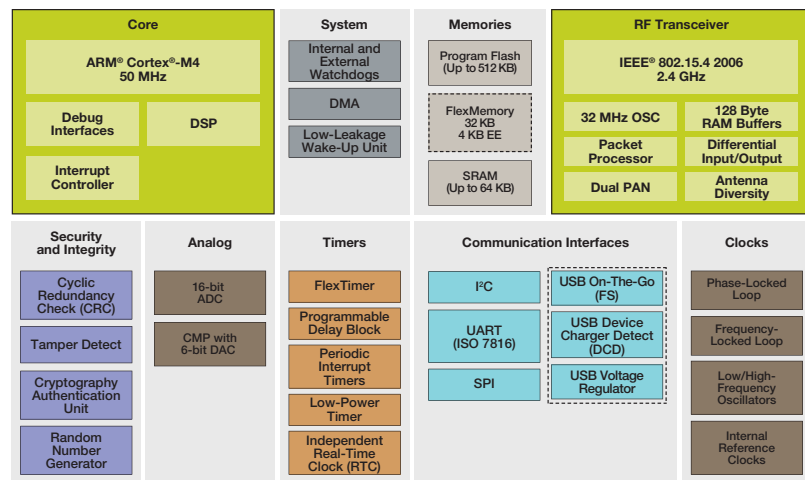
Overview

The Kinetis KW01 smart radio is an ARM Cortex®-M0+-based solution designed for wireless connectivity applications. The KW01 embeds a rich set of peripherals such as a high-performance bi-directional sub-1 GHz radio, capable of operating over a wide frequency range of 315, 433, 470, 868, 915, 928 and 960 MHz in the license-free industrial, scientific and medical (ISM) frequency bands. The KW01 smart radio supports OOK, FSK, GFSK and MSK signal modulation to transmit and receive information from 1.2 to 600 Kb/s for addressing the different types of communications required in the industrial market. An embedded front-end radio integrates high-performance, low-noise amplifiers and power amplifiers to reach a sensitivity of -120 dBm at 1.2 Kb/s and an output power adjustable from -18 to $+17$ dBm. The KW01 smart radio has 128 KB of on-chip, non-volatile flash memory and 16 KB of RAM for running various types of communication protocols, from proprietary protocols (simple media access controller (SMAC)) to globally standardized protocols (IEEE® 802.15.4). The Freescale platform approach includes hardware, software, tools and reference designs to help simplify development.

Kinetis KW0x Wireless Block Diagram



Kinetis KW2x Wireless Block Diagram



■ Freescale Technology □ Optional

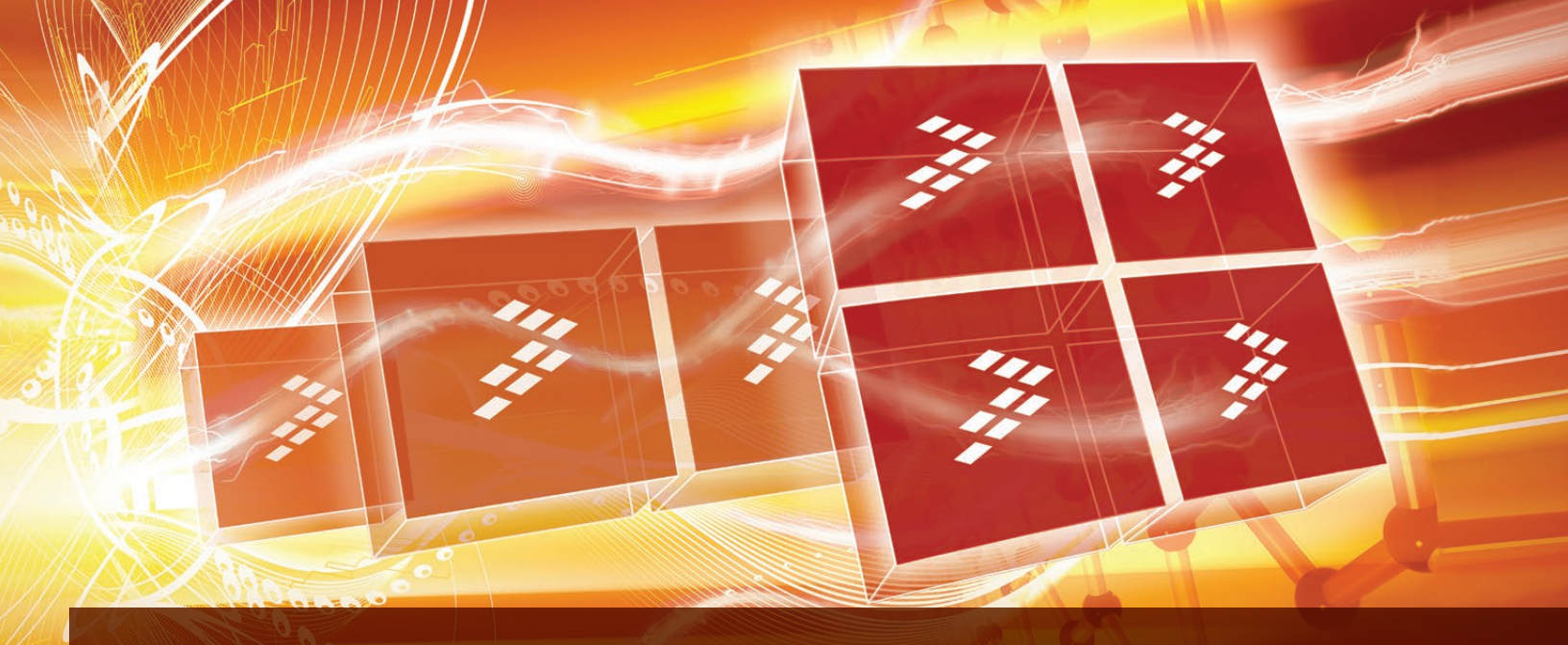
Kinetis KW2x Family of 2.4 GHz RF MCUs

Overview

The Kinetis KW2x integrates a class-leading 2.4 GHz RF transceiver, ARM Cortex-M4 core and a robust feature set for a reliable, secure and low-power IEEE 802.15.4 wireless solution. These wireless MCUs offer up to 512 KB of flash, 64 KB of RAM and up to 64 KB of FlexMemory. Dual PAN support allows the

system to simultaneously participate in two ZigBee® networks, eliminating the need for multiple radios. Software protocol stacks, tools, and IDE are compatible with Kinetis MCUs. ZigBee® protocol software is seamlessly integrated into Kinetis software development tools for rapid creation of embedded systems.

To learn more, visit freescale.com/Kinetis/Wseries.



i.MX Applications Processors

Scalable multicore platform with single-, dual- and quad-core families

The most versatile platform for multimedia and display applications, Freescale ARM®-based i.MX processors deliver an optimal balance of power, performance and integration to enable next-generation smart devices. i.MX solutions include processors based on ARM9™, ARM11™, ARM Cortex®-A8 and Cortex®-A9 core technologies and are powering applications across a rapidly growing number of consumer, automotive and industrial markets. Our solutions bring interactivity to a whole new world of products.

Multimedia Powerhouse

i.MX application processors have been implementing leading-edge multimedia capabilities for almost a decade by providing direct interfaces to high-end LCDs and cameras and integrating hardware acceleration for a number of advanced video codecs and graphics standards, enabling up to full HD 1080p video playback and an amazing user interface experience. Combine that with on-chip features such as the image processing unit (IPU), camera interfaces,

connectivity ports and performance-enhancing capabilities such as the ARM NEON™ SIMD accelerator and vector floating point coprocessors and i.MX applications processors become the ideal choice for customers seeking a balanced multimedia solution that offers best-in-class performance for power.

Advanced HMI

Display-centric devices across all market segments require an increasingly advanced and intuitive user interface in order to deliver the richest customer

experience. The i.MX applications processor portfolio enables this experience by integrating separate graphics accelerators to support both 2D and 3D graphics in hardware that can create and deliver stunning, realistic images to LCD panels ranging from QVGA up to WUXGA resolution with integrated touchscreen capabilities. By using on-chip acceleration, customers can easily add rich graphics, font rendering and enhanced web browsing with the provided device drivers and partner application software.

Energy Efficiency

i.MX applications processors deliver an optimal balance of performance and long battery life for rich multimedia experiences on the go. Plugged or unplugged, applications designed today must consider the total cost of using energy and the impact any excess power will have on the environment. A mix of integrated power management and companion PMIC solutions from Freescale ensure that the overall solution is optimized for energy efficiency and simplified implementation:

- Multiple independent power domains
- Dynamic voltage and frequency scaling
- Dynamic process and temperature compensation
- Proprietary power gating

i.MX Processor Markets



Smart Processing Solutions for the Connected World

The i.MX applications processor portfolio provides solutions across multiple market segments. With long product longevity and automotive qualification, i.MX processors are used for infotainment, gateways, connected radio and telematics systems.

The i.MX portfolio also has broad traction in the embedded market by enabling multimedia and connectivity everywhere. Example applications include medical systems for patient monitoring and diagnostics and imaging, smart energy solutions to support the global smart grid transition with smart thermostats, appliances and home energy management systems, industrial factory automation for HMI and industrial control, scanners/printers, building control, education devices and in-flight infotainment.

Connectivity and Communication

The i.MX portfolio features a number of options to support the continuously connected world. These include Ethernet with IEEE® 1588 hardware time stamping for real-time control, PCIe for connecting to external FPGAs or Wi-Fi®-based modules, SD/SDIO/MMC ports for external portable data storage and connectivity to wireless modules supporting protocols such as ZigBee®, Wi-Fi and Bluetooth®, USB modules with PHY for field upgradability, portable data storage and multiple serial ports to provide support for various network interfaces such as RS-232 and RS485. Additional connectivity features include I²S serial interfaces for connectivity to audio peripherals, dual CAN modules to enable industrial and automotive network bridging and interfaces for external mass storage, such as SATA.

Reliability, Safety and Security

The i.MX portfolio includes a variety of security features such as high-assurance boot, run-time integrity check, secure JTAG, secure storage, secure real-time clock and physical tamper detection. High-assurance boot with authenticity checking is used to ensure the correct software is on the correct device and is run every time the chip is reset. When it comes to security, a hardware encryption unit supports several encryption and hashing algorithms for program validation as well as authentication and securing data for transfer and storage. The tamper detection system has integrated sensors for voltage, frequency, temperature and external sensing for physical attack detection. For fail-safe applications, an independently clocked watchdog offers protection against code runaway.

Support for External Memory

i.MX application processors can interface to a variety of memories for program and data storage. Depending on the specific processor, external memory support for DRAMs includes 16-bit and/or 32-bit SDRAM, DDR1, DDR2, DDR3 and DDR3L, mDDR, LP-DDR2 and LV-DDR2 for flexibility in cost vs. performance and power.

For external flash support, i.MX processors can support a variety of NAND flash memories such as SLC, MLC or managed NANDs, as well as NOR memories. i.MX processors also provide error-correction functionality to improve the reliability of raw NAND. A parallel bus is supported for interfacing to external memory mapped peripherals such as FPGAs and ASICs.

Intelligent Integration

i.MX processors offer extensive peripheral integration, including display, cameras, connectivity, analog and security along with standard system features such as timers, pulse-width modulators, DMA and debug support. Through this intelligent integration of optimized peripherals, along with exceptional product scalability, i.MX processors reduce system-level discrete components, power consumption, board size, development effort and system cost.

i.MX 6 Series of Application Processors

Scalable multicore platform with single-, dual- and quad-core families

The i.MX 6 series unleashes a scalable multicore platform that includes single-, dual- and quad-core families based on the ARM® Cortex®-A9 architecture for next-generation consumer, industrial and automotive applications. By combining the power-efficient processing capabilities of the ARM Cortex-A9 architecture with bleeding-edge 3D and 2D graphics, as well as high-definition video, the i.MX 6 series provides a new level of multimedia performance to enable an unbounded next-generation user experience.

Complementing the industry-leading scalability of the i.MX 6 single-, dual- and quad-core offering is the PF series of power management ICs. Combined with the simplified power requirements of the i.MX 6 platforms, the PF series is capable of supplying all the voltage rails required by numerous applications, significantly reducing the bill of materials and simplifying the system design.

Target Applications

- Media tablets
- Education tablets
- E-Readers
- Automotive infotainment
- Aero infotainment
- HMI
- Portable healthcare
- IPTV
- IP phones
- Smart energy systems
- Intelligent industrial control systems
- Digital signage

The market for intelligent, multimedia-centric, touch-based devices is increasing exponentially. Tomorrow's battery-powered smart devices, auto infotainment and aero infotainment systems, medical systems, personal and enterprise-class intelligent control and data systems and new classes of devices never before seen need to

i.MX 6 Series at a Glance

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i.MX6SoloLite

- Single ARM Cortex-A9 up to 1 GHz
- 256 KB L2 cache, ARM NEON™, VFPv16 ARM TrustZone®
- 2D graphics
- 32-bit DDR3 and LPDDR2 at 400 MHz
- Integrated EPD controller



i.MX6Solo

- Single ARM Cortex-A9 up to 1.0 GHz
- 512 KB L2 cache, ARM NEON, VFPv16 ARM TrustZone
- 3D graphics with one shader
- 2D graphics
- 32-bit DDR3 and LPDDR2 at 400 MHz
- Integrated EPD controller
- HDMIV1.4 controller plus PHY
- LVDS controller plus PHY
- PCIe controller plus PHY
- MLB and FlexCAN controllers



i.MX6DualLite

- Dual ARM Cortex-A9 up to 1.0 GHz
- 512 KB L2 cache, ARM NEON, VFPv16 ARM TrustZone
- 3D graphics with one shader
- 2D graphics
- 64-bit DDR3 and 2-channel 32-bit LPDDR2 at 400 MHz
- Integrated EPD controller
- HDMIV1.4 controller plus PHY
- LVDS controller plus PHY
- PCIe controller plus PHY
- MLB and FlexCAN controllers



i.MX6Dual

- Dual ARM Cortex-A9 up to 1.2 GHz
- 1 MB L2 cache, ARM NEON, VFPv16 ARM TrustZone
- 3D graphics with four shaders
- Two 2D graphics engines
- 64-bit DDR3 and 2-channel 32-bit LPDDR2 at 533 MHz
- Integrated SATA-II
- HDMIV1.4 controller plus PHY
- LVDS controller plus PHY
- PCIe controller plus PHY
- MLB and FlexCAN controllers



i.MX6Quad

- Quad ARM Cortex-A9 up to 1.2 GHz
- 1 MB L2 cache, ARM NEON, VFPv16 ARM TrustZone
- 3D graphics with four shaders
- Two 2D graphics engines
- 64-bit DDR3 and 2-channel 32-bit LPDDR2 at 533 MHz
- Integrated SATA-II
- HDMIV1.4 controller plus PHY
- LVDS controller plus PHY
- PCIe controller plus PHY
- MLB and FlexCAN controllers



present data and user interface choices to the end user primarily through rich sound, video, voice, pictures and touch—rather than keyboards and mice. And the need for manufacturers to quickly provide multiple devices to fit specific market segments or niches and provide their customers with a broader range of choices is increasing just as quickly.

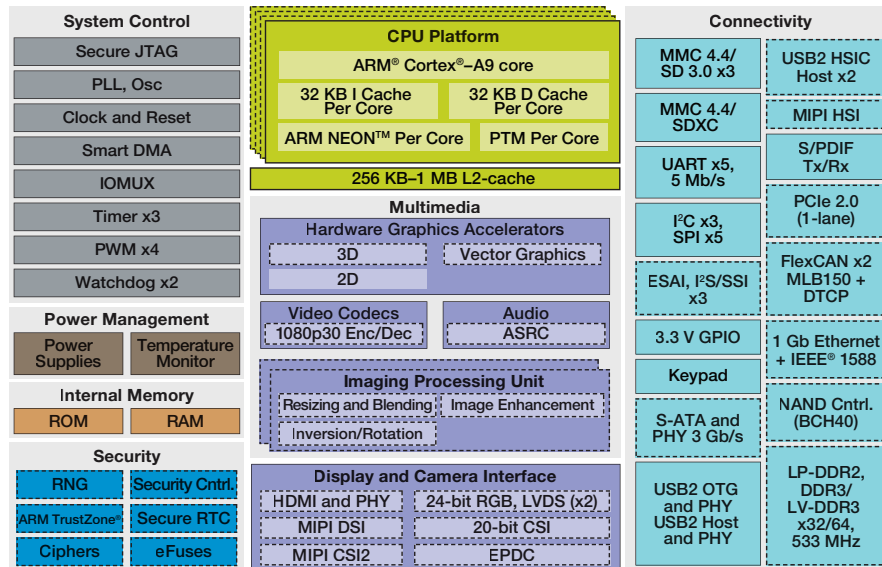
The i.MX 6 series was designed specifically to enable this new market by bringing together high-performance, scalable multimedia processing, a software-compatible family of five processors and pin-compatible processor solutions with integrated power management so that a manufacturer can deploy a full portfolio of products with a single hardware design.

Scalable Multicore Solutions

The i.MX 6 series reaches a new level of power versus performance by providing a scalable family of single-, dual- and quad-core processor families based on the ARM Cortex-A9 architecture. Single- and dual-core designs provide cost-effective performance scalability while the flagship i.MX 6Quad processor provides more performance at lower power for the most demanding applications with constrained power budgets. The pin*- and software-compatible i.MX 6 series allows designers to create a broad portfolio of products based on a common platform while providing compelling performance advantages for systems with constrained power budgets.

*i.MX 6SoloLite not pin compatible

i.MX 6 Series Applications Processors Block Diagram



Available on certain product families

Five Scalable Families

The i.MX 6Quad family encompasses a quad-core platform running up to 1.2 GHz with 1 MB of L2 cache and 64-bit DDR3 or 2-ch., 32-bit LPDDR2 support. Integrated FlexCAN, MLB busses, PCIe and SATA-2 provide broad connectivity options, while integration of LVDS, MIPI display port, MIPI camera port and HDMI v1.4 makes it an ideal platform for consumer, automotive and industrial multimedia applications.

The i.MX 6Dual family provides dual cores running up to 1.2 GHz with 1 MB of L2 cache, and 64-bit DDR3 or 2-ch., 32-bit LPDDR2 support. Leveraging the same integration of the i.MX 6Quad family, the i.MX 6Dual provides a scalable solution for consumer, automotive and industrial applications.

The i.MX 6DualLite family introduces dual cores running up to 1 GHz with 512 KB of L2 cache, and 64-bit DDR3 or 2-ch., 32-bit LPDDR2 support. With integrated FlexCAN and MLB busses, PCI Express®, LVDS, and support for MIPI cameras and displays, as well as HDMI v1.4, the device is a great fit for consumer, automotive and industrial multimedia-centric applications.

The i.MX 6Solo family provides a single core running up to 1 GHz with 512 KB of L2 cache and 32-bit DDR3/LPDDR2 support. Integrated

LVDS, MIPI display, MIPI camera port, HDMI v1.4, FlexCAN and MLB enables the i.MX 6Solo to be a flexible platform for consumer, automotive and industrial applications.

The i.MX 6SoloLite family introduces a single core running up to 1 GHz with 256 KB of L2 cache and 32-bit DDR3/LPDDR2 support. Targeted integration of an electronic paper display (EPD) controller makes it an ideal solution for next-generation e-readers and other emerging consumer and embedded devices using EPD technology.

Unbound User Experience

Next-generation graphics and high-definition video are central to the i.MX 6 series. The i.MX 6 series supports up to 1080p60 video playback, enabling exceptionally high-quality video with long battery life for devices playing high-definition content. The 3D graphics engine in the top-of-the-line i.MX 6Quad and i.MX 6Dual processors are capable of providing up to 200 Mt/s, which enables ultra-vivid, realistic graphics critical for gaming, applications that combine the power of the main cores with the until-now-untapped potential of the 3D engine to perform computational tasks. The combined multimedia processing power of the i.MX 6 series enables a new generation of smart devices, digital displays, industrial

instrumentation panels and auto and aero infotainment with compelling features such as augmented reality applications, content creation capabilities and multichannel HD video processing for a new level of user experience.

Features

- Scalable single-, dual- and quad-core offerings based on ARM Cortex-A9 up to 1.2 GHz, with ARMv7™, ARM NEON™, VFPv3 and ARM TrustZone® support
- 32 KB instruction and data L1 caches and 256 KB to 1 MB of L2 cache
- Multi-stream-capable HD video engine delivering 1080p60 decode, 1080p30 encode and 3D video playback in HD in high-performance families
- Superior 3D graphics performance with up to quad shaders performing 200 MT/s
- Separate 2D and/or Vertex acceleration engines for an optimal user interface experience
- Stereoscopic image sensor support for 3D imaging
- Integrated market-specific I/Os, which may include HDMI v1.4 with integrated PHY, SD3.0, multiple USB 2.0 ports, Gigabit Ethernet, SATA-II with integrated PHY, PCI Express® with integrated PHY, MIPI CSI, MIPI DSI, MIPI HSI, MLB and FlexCAN for automotive applications
- Comprehensive security features
- Optional integration of an EPD display controller for e-reader and similar applications

Software and Tools

- i.MX 6 series Freescale supported
 - SABRE for automotive infotainment
 - SABRE platform for smart devices
 - SABRE board for smart devices
 - i.MX 6SoloLite EVK
 - Google Android™ OS
 - Linux® OS
- i.MX 6 series partner supported
 - Microsoft® Windows Embedded CE
 - Various RTOS, embedded boards, development tools, UI tools and software and middleware offerings (See Partner Enablement Solutions.)

i.MX53 Applications Processors

Take your multimedia experience to the max

The i.MX53 family of processors represents our advanced multimedia and power-efficient implementation of the ARM® Cortex®-A8 core with core processing speeds up to 1.2 GHz. It is optimized for both performance and power to meet the demands of high-end, advanced applications. Ideal for a broad range of applications in the consumer, automotive, medical and industrial markets, the i.MX53 includes an integrated display controller, full HD capability, enhanced graphics and connectivity features. The i.MX53 family also boasts a companion power management IC (PMIC)—MC34708—designed exclusively for i.MX processors.

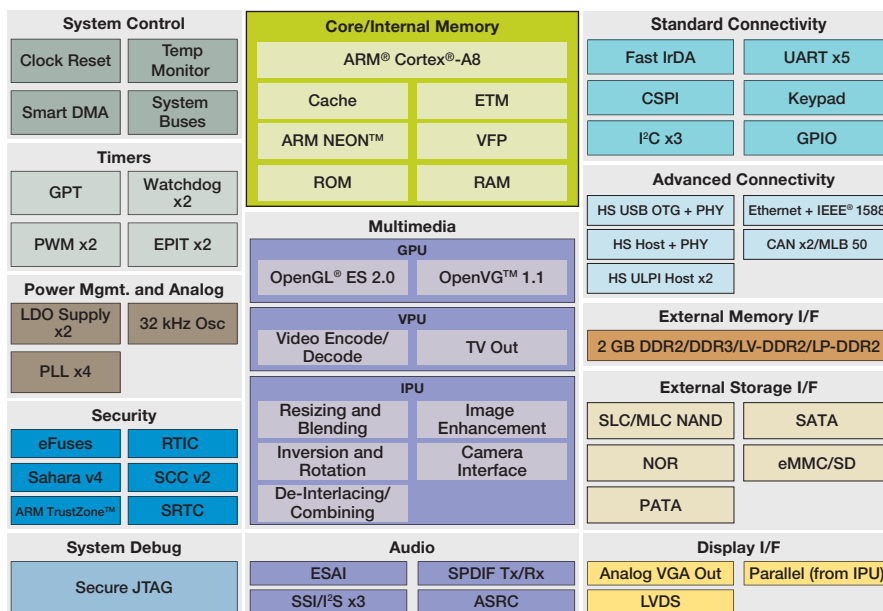
Target Applications

- Smart mobile devices
- Gaming devices
- Smart monitors
- Auto infotainment
- Digital signage
- Telehealth
- Video-enabled IP phones
- HMI for appliances, building control, factory/home automation, printers and security panels
- Patient monitors
- Point-of-sale terminals
- Surveillance cameras
- Security
- Barcode scanners

Consumer Applications

The i.MX535 supports 1080p multi-standard video playback with industry-leading low power consumption. With up to 1.2 GHz core speed, a faster graphics core enabling a more responsive user experience plus a higher level of system integration, i.MX535 applications processors balance the performance, power consumption, connectivity and multimedia capabilities necessary to drive the latest consumer products. These processors are ideal for products that require advanced user interfaces, sophisticated video processing,

i.MX53 Family Block Diagram



Note: Features vary depending on product selected.

multiple connectivity options and a high level of system integration. These features are the building blocks to power the next great applications at an approachable price target.

Automotive Applications

Our automotive i.MX53 processors provide the advanced performance required to drive the latest automotive systems. These processors are designed for applications that require advanced user interfaces, sophisticated video processing, 2D and 3D graphics, multiple connectivity options and a high level of system integration. Building on the success of the i.MX515 and i.MX535 in the consumer market, the automotive family of i.MX53 processors brings the consumer electronics user experience and device connectivity into the vehicles of the future.

Industrial Applications

The i.MX537, with core processing speeds up to 800 MHz, is optimized for both performance and power to meet the demands of high-end advanced industrial and medical applications. Integrated display controller, 1080p HD video decode and 720p video encode, enhanced graphics and connectivity features make the i.MX537 suitable for a wide range of applications such as human-machine interfaces (HMI) and patient monitors that require rich user interfaces with high-color displays and user interaction.

The i.MX537 provides key environmental differentiators for the industrial market. These include 3.3 V I/O support, a 0.8 mm pitch package to reduce PCB and manufacturing costs, extended temperature coverage for harsh environments, industrial qualification for extended reliability and a formal long product supply guarantee to support product life spans.

Software and Tools

- i.MX53 SABRE for tablets
- i.MX53 quick start boards

Development on the i.MX535 is made easy with a range of Freescale-provided board support packages (BSPs) optimized for multimedia performance and low-power operation. BSPs are available for the following operating systems:

- Android™
- Linux®
- Various RTOS, embedded boards, development tools, UI tools and software and middleware offerings (See Partner Enablement Solutions.)

Features

- CPU complex
- Up to 1.2 GHz ARM Cortex-A8
- 32 KB instruction and data caches
- Unified 256 KB L2 cache
- ARM NEON™ SIMD media accelerator
- Vector floating-point coprocessor
- Multimedia
 - Independent OpenGL® ES 2.0 and OpenVG™ 1.1 hardware accelerators
 - Multi-format 1080p HD video decoder and 720p HD video encoder hardware engine
 - 24-bit primary display support up to WSXGA resolution
 - 18-bit secondary display support
 - Analog 720p HD component TV output
 - High-quality hardware video de-interlacing
 - Image and video resize, inversion and rotation hardware
 - Alpha blending and color space conversion
 - Video/graphics combines four planes and hardware cursor
 - Display quality enhancement includes color correction, gamut mapping and gamma correction
- External memory interface
 - Up to 2 GB LP-DDR2, LV-DDR2, DDR2 and DDR3 SDRAM, 16-/32-bit
 - SLC/MLC NAND flash, 8-/16-bit

- Advanced power management
 - Multiple independent power domains
 - Dynamic voltage and frequency scaling
- Connectivity
 - High-Speed USB 2.0 OTG with PHY
 - High-Speed USB 2.0 host with PHY (3)
 - Two additional High-Speed USB 2.0 controllers
 - Integrated LVDS display interface
 - Wide array of serial interfaces, including SDIO, SPI, I²C and UART
 - I²S and S/PDIF audio interfaces
 - 10/100 Ethernet controller IEEE® 1588
 - PATA
 - SATA controller and PHY up to 1.5 Gb/s
 - CAN
- Security
 - Security controller, including secure RAM and security monitor
 - High-assurance boot, JTAG controller and real-time clock
 - Cipher and random number generator accelerators
 - Runtime integrity checker
 - Universal unique identification
 - Tamper resistant

General

- 19 x 19 mm, 0.8 mm pitch TEPBGA-2 package
- Industrial temperature grade offered

Benefits

- Ultra-fast processing and high-performance multimedia capabilities
- Complete hardware and software package provided to enable faster time to market and lower R&D investment
- Dedicated video and independent 2D/3D graphics hardware acceleration engines provides best-in-class performance for power
- Increased core speed for faster browsing
- Up to 2 GB external memory support prepares your end device for cloud computing applications and future OSs and browsers

- LP-DDR2, LV-DDR2, DDR2-800 and DDR3-800 SDRAM ready for greater design flexibility
- Optimized for low-power operation to give best performance for battery life
- Smartly integrated i.MX53 offers more on chip, including LVDS, USB PHYs, Ethernet and SATA, reducing the need for external components and passing on significant BOM savings

Multimedia Powerhouse

The multimedia performance of the i.MX53 processor is boosted by a multi-standard hardware video codec, autonomous image processing HD unit, ARM NEON™ SIMD, accelerometer, vector floating-point coprocessor and a programmable Smart DMA (SDMA) controller. Powerful 3D graphics acceleration is the key to mobile game designs.

i.MX53 processors provide an integrated 3D graphics processing unit with an incredible 33 Mt/s and effective 800 Mp/s (with overdraw). The 3D unit provides an exceptional user experience with hardware-accelerated Flash Player 10.x, gaming and advanced user interfaces. In addition, i.MX53 incorporates a 2D graphics processing unit to accelerate the windowing system and fonts.

Smart Speed Technology

Advanced power management features throughout the i.MX53 processor enable a rich suite of multimedia features and peripherals while maintaining minimum system power consumption in active and low-power modes.

i.MX50 Applications Processors

Streamlined performance

The i.MX50 family of applications processors delivers a low-power, streamlined solution for customers seeking ARM® Cortex®-A8 performance levels with flexible design features. The family features four derivatives, including the market-leading i.MX508 processor for e-readers, running at core speeds of 1 GHz and can be targeted towards a variety of consumer applications offering support for electronic paper display (EPD) in addition to LCD. The i.MX50 family also boasts a companion power management IC (PMIC) designed exclusively for i.MX processors.

Target Applications

- E-Readers
- Portable navigation devices
- Outdoor and digital signage
- Patient/client monitoring
- Home and office automation
- DECT phones

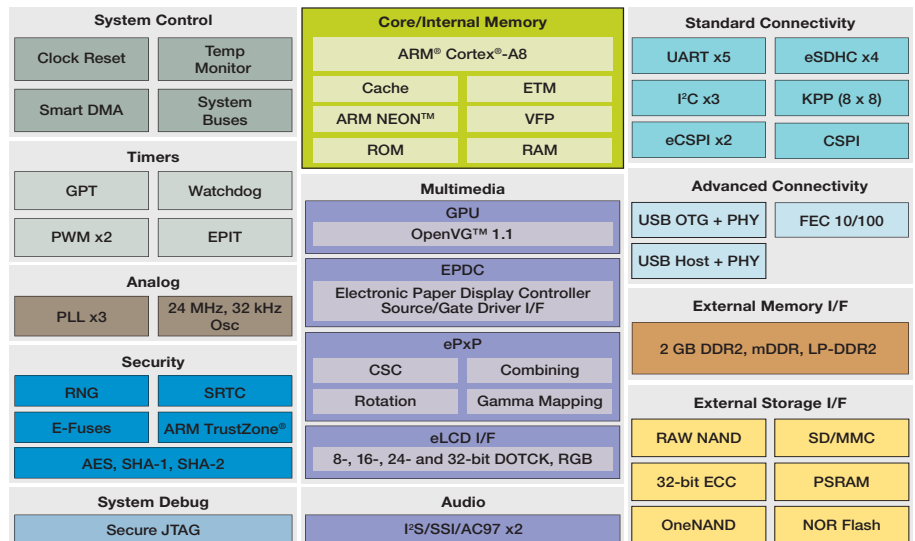
Electronic Paper Displays

The i.MX50 family consists of the first ARM-based device with an integrated EPD hardware interface. EPDs offer the following advantages:

- High resolution from any angle
- Sunlight readability
- Mimics the appearance of ink on paper
- Flexible
- Lightweight
- Durable
- Extremely low power
- Replaces paper in many applications

Part of the i.MX50 family, the i.MX508 is the first system-on-chip (SoC) solution designed specifically for e-readers that incorporates an ARM Cortex-A8 CPU and an integrated E Ink®-certified EPD controller to drive current and next-generation Pearl™ panels. The i.MX508 enables reduced system cost, longer battery life and higher performance for faster page flips and a better reading experience.

i.MX50 Family Block Diagram



Note: Features vary depending on product selected.

Features

- ARM Cortex-A8 800 MHz performance at 1 V with ARM NEON™ coprocessor
- Enhanced LCD controller interface supporting up to 1400 x 1050 resolution
- EPD controller for E Ink panels
- Enhanced pixel processing pipeline (ePxp) to handle post-display frame pre-processing
- OpenVG™ 2D graphics acceleration for enhanced user interfaces
- LP-DDR2 support for next-generation, low-power and high-speed memories, in addition to mDDR and DDR2
- Support for SD, SDIO and MMC-based media
- Static bus interface (WEIM) to support NOR and other memory-mapped devices
- Dual full duplex I²S interfaces for audio connectivity
- Three I²C interfaces and three SPI interfaces for peripheral control
- RAW NAND flash support with up to 32-bit ECC-level protection
- Dual USB controller and PHYs (OTG/host)
- 10/100 Ethernet
- Advanced security features such as high-assurance boot, DRM support and AES encryption/decryption

Software and Tools

- i.MX50 evaluation kit (EVK)
- SABRE platform for e-readers
- i.MX50 quick start board (partner supported)

Development on the i.MX50 is made easy with a range of Freescale-provided board support packages (BSPs) optimized for multimedia performance and low-power operation and multimedia software codecs.

- Android™
- Linux®
- Various RTOS, embedded boards, development tools, UI tools and software and middleware offerings (See Partner Enablement Solutions.)

Power Efficiency

The MC34708 PMIC is optimized for use with the i.MX50 and helps maximize power efficiency and battery life while supporting higher levels of integration to minimize board space and cost.

The i.MX50 family also includes power-saving modes and techniques, such as state retention power gating and dynamic voltage frequency scaling, and has five independent power domains for low-power modes.

i.MX28 Applications Processors

Intelligent integration, unmatched

The i.MX28 family of applications processors is part of our ARM9™ product portfolio.

The i.MX28 family integrates display, power management and connectivity features unmatched in ARM9-based devices, reducing system cost and complexity for cost-sensitive applications. With optimized performance and power consumption, the i.MX28 is an ideal fit for battery-operated or fanless equipment. Additionally, the LCD controller with touchscreen capability makes it possible to design creative and intuitive user interfaces. The i.MX28 family reaches new levels of integration in ARM9 devices and provides the enablement needed to help design differentiated industrial, automotive and consumer products in less time.

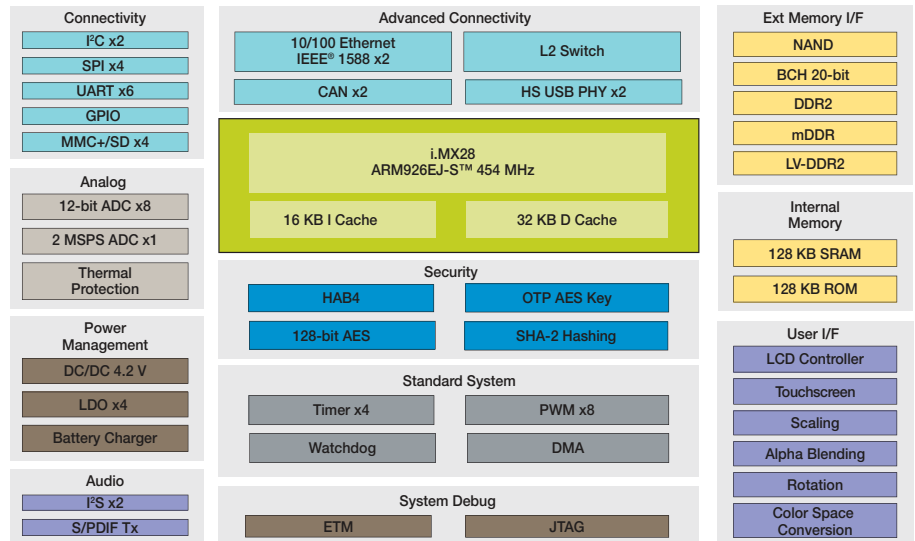
Target Applications

- Smart appliances
- Human-machine interface for appliances, building control, factory automation, printers and security panels
- Industrial control
- Media gateways/accessories
- Portable medical
- Smart energy gateways/meters
- Automotive audio systems
- Automotive connectivity modules

Industrial Needs

Like the rest of the i.MX portfolio, the i.MX28 family provides key environmental differentiators for the industrial market. These include 3.3 V I/O support, a 0.8 mm pitch package to reduce PCB and manufacturing costs, extended temperature coverage for harsh environments, industrial qualification for extended reliability, a formal long product supply guarantee to support product life spans and a strong ecosystem, including module manufacturers, software integrators and development tools.

i.MX28 Family Block Diagram



Features

- 454 MHz ARM926EJ-ST™-core with 16 KB/32 KB I and D cache
- PMU to power the device and drive external components supports li-ion batteries and direct connection to 5 V supplies
- Dual IEEE® 1588 10/100 Ethernet with RMIII support and L2 switch
- Dual CAN interfaces
- NAND support: SLC/MLC and eMMC 4.4 (managed NAND)
- Hardware BCH (up to 20-bit correction)
- 200 MHz 16-bit DDR2, LV-DDR2, mDDR external memory support
- Dual High-Speed USB with PHY
- Up to eight general-purpose 12-bit ADC channels and single 2 Ms/s ADC channel
- Temperature sensor for thermal protection
- Multiple connectivity ports (UARTs, SSP, SDIO, SPI, I²C and I²S)
- Product family supports various feature sets

Benefits

- Industrial-strength integration
- Reduces system cost and complexity and provides greater flexibility in system design
- Industry-leading power management eliminates external components
- High level of peripheral integration, including display, connectivity, real-time control, security and networking
- Industrial qualification and product longevity
- Supports the full life of the product in the field
- Optimized performance and power consumption
- Increased battery life for portable equipment
- Improved energy efficiency for wall-powered or fanless systems

Software and Tools

- Linux® and Windows® Embedded CE BSPs
- Multimedia codecs: Proven codecs enable faster time to market
- Various RTOS, embedded boards, development tools, UI tools and software and middleware offerings (See Partner Enablement Solutions.)



QorIQ Communications Processors

Industry's broadest portfolio, delivering unprecedented efficiency and scale for smarter, more capable networks

The Freescale QorIQ communications processor portfolio is unmatched in depth and breadth. With the addition of the next-generation QorIQ LS1 product family based on Layerscape architecture, comprising the QorIQ LS1020A, LS1021A and LS1022A devices integrating dual ARM® Cortex®-A7 cores, the portfolio extends performance to the smallest form factor, power-constrained networking applications. Optimized performance and power efficiency are key advantages of this new family, which includes compatible features such as virtualization and cache coherency that, together with pin compatibility, enables customers to simply and smoothly migrate applications between these next-generation QorIQ devices. Additionally, QorIQ LS1 processors built on Layerscape architecture deliver a unique combination of our unmatched networking expertise with ARM's extensive ecosystem.

Layerscape Architecture

Layerscape is the underlying network system architecture of the QorIQ LS series processors. The architecture enables next-generation networks with up to 100 Gb/s performance and enhanced packet-processing capabilities. Design effort is simplified with a standard, open programming model and a software-aware architecture framework that enables customers to fully exploit the underlying hardware for maximum optimization, with the capability to easily adapt to network changes for real-time "soft" control over the network. A uniform hardware and software model provides the compatibility and scalability required for customers designing end-to-end networking equipment from home- to carrier-class products. The unique, core-agnostic architecture incorporates the optimum core for the given application—ARM or Power Architecture® cores.

QorIQ LS1 Family

Highest level of integration under 3 W

The QorIQ LS1 family of processors is a member of the value-performance tier, delivering extensive integration and power efficiency for fanless, small form factor networked applications. Incorporating dual ARM® Cortex®-A7 cores running up to 1 GHz, the QorIQ LS1020A, LS1021A and LS1022A deliver pre-silicon CoreMark® performance of over 6,000, as well as virtualization support, advanced security features and the broadest array of high-speed interconnects and optimized peripheral features ever offered in a sub-3 W processor.

LS1021A Target Applications

- Enterprise AP routers for 802.11ac/n
- Multi-protocol IoT gateways
- Industrial and factory automation
- Mobile wireless routers
- Printing
- Building automation
- Smart energy

LS1020A and LS1022A Target Applications

- Enterprise AP routers for 802.11ac/n
- I/O line cards
- Controllers
- Security appliances
- IoT gateways
- Building automation
- Smart energy

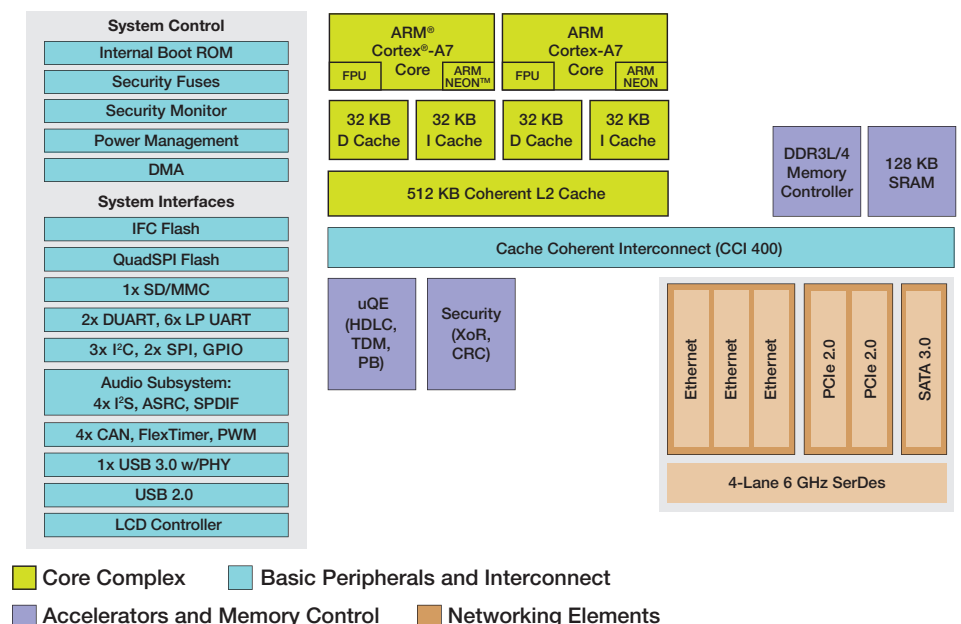
Core Complex

QorIQ LS1 processors integrate dual ARM Cortex-A7 cores running up to 1 GHz (600 MHz on the QorIQ LS1022A) with ECC-protected L1 and L2 caches, and share virtualization support and pin and software compatibility. Both ARM Cortex-A7 cores feature 32 KB of L1 instruction and data cache, share up to 512 KB of coherent L2 cache and feature the NEON SimD module and dual precision floating-point unit (FPU). The DDR memory controller supports 8-, 16- or 32-bit type 3L and 4 memory devices at up to 1600 MHz (QorIQ LS1022A limited to DDR3L at up to 1033 MHz).

QorIQ LS1 Family Features

Dual ARM Cortex-A7 cores with frequencies up to 1 GHz	Extreme power efficiency, delivering pre-silicon performance at over 6,000 CoreMarks®. Typical Total System Power of 3 W for improved performance without increased power utilization.
ECC-protected L1 and L2 cache memories	Only processor family in its class with ECC-protected caches and coherent 512 KB L2, adding performance and meeting networking requirements for high reliability
Support for virtualized Gb Ethernet	Enables partitioning of CPU resources on low-power parts for increased system productivity
Rich connectivity and peripheral features including PCI Express® Gen2, USB 3.0, SATA3, IFC, QuadSPI, CAN	High versatility that enables support for 802.11ac modules and high bandwidth connectivity for ASICs, 4G/LTE, SATA, low-cost NAND/NOR flash
LCD controller (DCU5)	Touchscreen support adds integrated HMI features for enhanced ease of use and BOM savings. Similar IP as Freescale Vybrid controller solutions and i.MX applications processors to allow for simple software migration.
QUICC Engine technology	Proven support for required industrial, building and factory protocols such as PROFIBUS, HDLC, TDM
DDR3L/4 memory	First in its class to offer support for DDR4 memory, ensuring continued performance efficiency

QorIQ LS1021A Processor Block Diagram



System Interfaces and Networking

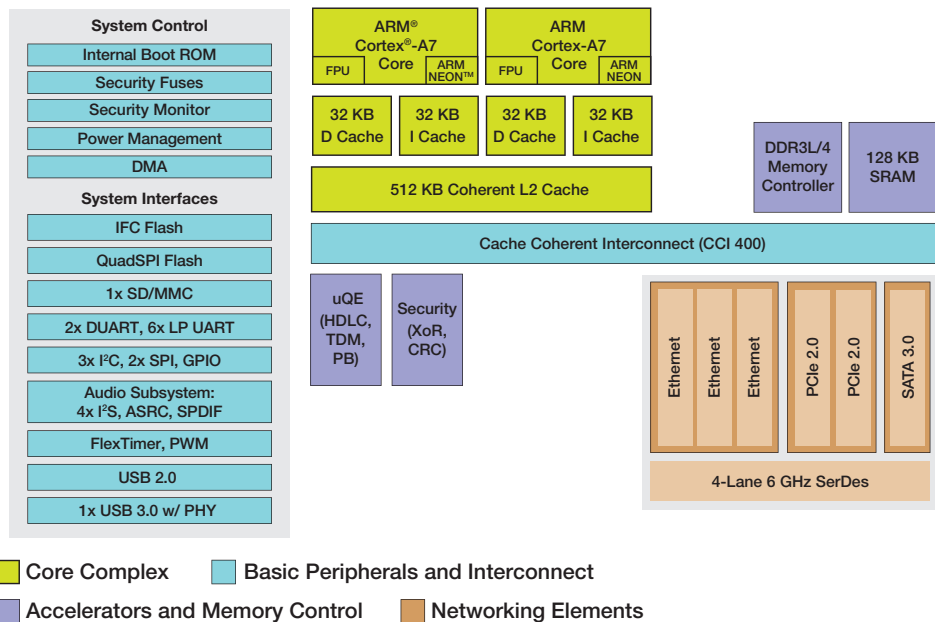
QorIQ LS1 processors feature a four-lane, 6 GHz multi-protocol SerDes that provides support for high-speed interfaces, including up to three Gigabit Ethernet ports with IEEE® 1588 support, dual DMA-controlled PCI Express® generation 2.0 ports and a single SATA 3.0 port. The QorIQ LS1 processors also feature dual USB controllers—one supporting SuperSpeed USB 3.0 with integrated PHY, the other supporting USB 2.0 functions. Additional interfaces include QuadSPI, IFC and support for SD/MMC. For network audio applications, the QorIQ LS1 processors include support for both ASRC and SPDIF. For industrial and power-constrained applications, the processors provide four CAN ports and up to 10 UARTS to support industrial protocols. In addition, Serial I/O includes three I²C and two SPI interfaces.

Complete Enablement, Rich Ecosystem

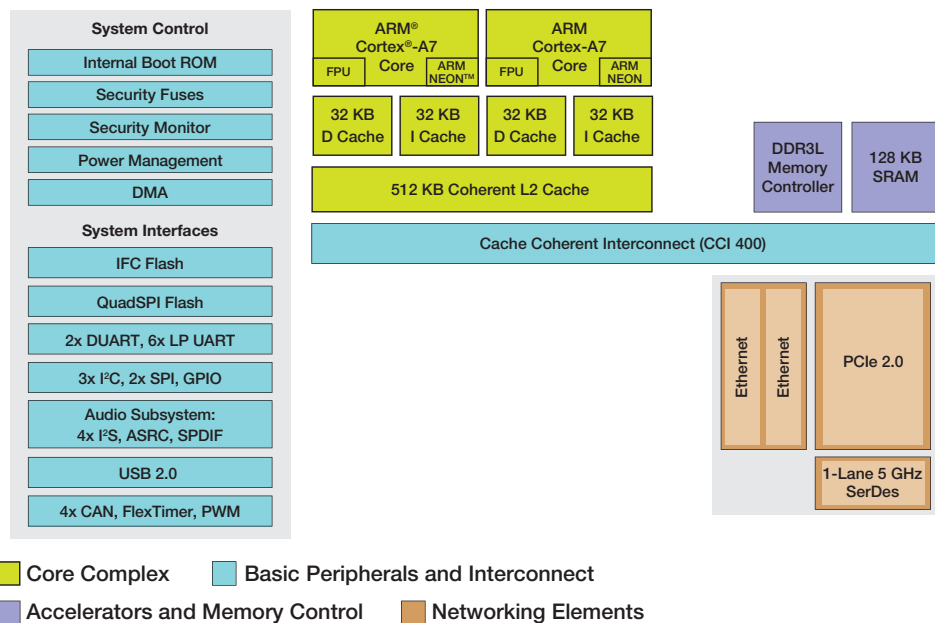
For customer evaluation, the QorIQ LS1 family will be supported by the modular Freescale Tower System, which will feature an integrated on-board probe for further cost savings, along with third-party platforms developed by Freescale's embedded board solution partners. Evaluation kits include a Linux® 3.12 BSP with optimized drivers to support peripherals and a six-month evaluation license for CodeWarrior development tools.

All QorIQ LS series devices are supported by our extensive third-party ecosystem, the largest and most established in the communications market. In conjunction with our expertise and worldwide support infrastructure, the ecosystem helps customers accelerate their migration from both competitive solutions and from legacy Freescale devices, preserve investment costs and reduce time to market.

QorIQ LS1020A Processor Block Diagram



QorIQ LS1022A Processor Block Diagram





Vybrid Controller Solutions

A multicore platform for industrial applications

The increasing complexity and demands of embedded systems creates greater need for sophisticated human-machine interfaces (HMI) and multiple connectivity options with safe, secure and predictable operation. To concurrently provide rich HMI and real-time control means bringing together two very different system paradigms. For example, HMI computation focuses on efficiently processing pixels and displaying them on a screen, while guaranteed determinism requires highly predictable response times for tasks.

A traditional systems-level solution for such divergent needs would combine different pieces of silicon, such as an applications MPU and a real-time MCU, on a board. It would also require developing software and a protocol to enable simultaneous communication between real-time control and rich HMI. Application developers face the tremendous challenge of seamlessly integrating these diverse technologies in a single system.

Our Vybrid portfolio brings to market a unique, low-power system solution that provides customers a way to combine rich applications requiring high-resolution graphical displays and connectivity with real-time determinism. The Vybrid portfolio enables customers to create systems that concurrently run a high-level operating system such as Linux® and a real-time operating system such as MQX™ on the same device. This, along with a communication API between the rich domain, the real-time domain and a tool chain that eases debug of such systems, dramatically shortens customer time to revenue. The families in the Vybrid portfolio span entry-level products for customers who want to upgrade from the Kinetis MCU to devices with large on-chip SRAM up to highly integrated, dual-core solutions intended to serve industrial markets.

Vybrid Controller Solutions Core Architecture

Vybrid devices have a dual-core architecture that combines the ARM® Cortex®-A5 application processor and the ARM Cortex®-M4 for real-time control. The Vybrid portfolio is designed to be a transitional product from Kinetis MCUs featuring the ARM Cortex-M4 core and the i.MX 6 series featuring the ARM Cortex®-A9 core, while also providing scalable devices that can address the needs of a market that demands critical safety and security, connectivity and rich HMI in the same piece of silicon. The Vybrid roadmap is built with this scalability and code compatibility in mind so that the performance of the device roadmap grows with the customer's needs long into the future.

One of the key benefits of the Vybrid portfolio that combines the ARM Cortex-A5 core with the ARM Cortex-M4 core is the partitioning of tasks based on their characteristics. For example, for tasks that need predictable interrupt management—a typical need for real-time applications—the Vybrid platform has the ARM Cortex-M4 core with a Nested Vector Interrupt Controller (NVIC). This allows graphical applications and connectivity stacks to be run on the ARM Cortex-A5 applications processor.

Software can be segmented so that tasks that need predictable latencies can be run on the ARM Cortex-M4 core and computer-intensive processes run on the ARM Cortex-A5 core.

ARM Cortex-A5 Core

The ARM Cortex-A5 processor is a high-performance, low-power core with an L1 and L2 cache subsystem that provides full virtual memory capabilities, a double-precision floating-point unit (FPU) and the ARM NEON™ media processing engine. It is intended as an upgrade for the ARM9™ and ARM11™ cores and is architecturally compatible with ARM Cortex-A9. The ARM Cortex-A5 also has ARM TrustZone® technology for creating secure applications.

Vybrid Family Details

Vybrid Families

	DDR	Camera Interface	Video ADC	USB Host w/PHY	USB OTG w/PHY	Segment LCD	TFT LCD	Ethernet Controller	L2 Switch	Security (HAB, Tamper, Det.)	External Bus
VF6xx Family [Heterogenous Dual Core] ARM Cortex-A5 up to 500 MHz ARM Cortex-M4 up to 167 MHz 364-pin MAPBGA	●	●	●	●	●	○	2	2	●	●	●
VF5xx Family ARM Cortex-A5 up to 500 MHz 364-pin MAPBGA	●	●	○	●	●	○	●	2	●	●	●
VF3xx Family ARM Cortex-A5 up to 266 MHz 176-pin LQFP	○	●	○	○	●	●	●	2	●	●	●

Common Platform, Analog and Digital		Tools
CRC and TZ Address Space Controllers	12-bit ADC	Packaged IDE
°C	12-bit DAC	
Programmable Delay Block	Secure JTAG	Packaged OS and Multicore Communication API
Flash Controller	Secure Fuses	
UARTs	Timers	Application Software Industrial Protocols Peripheral Drivers
Low-Voltage, Low-Power Multiple Operating Modes, Clock Gating (1.73–3.6 V)	Secure RAM	
	eSDHC	
	DMA	Third-Party Ecosystem Support
ESAI	SRAM	

ARM Cortex-M4 Core

The ARM Cortex-M4 core retains all the advantages of the ARM Cortex®-M3 core with an NVIC, which gives the deterministic interrupt handling capability demanded by real-time applications along with tightly coupled memory (TCM). Determinism is a factor of NVIC plus TCM. The ARM Cortex-M4 adds digital signal processing (DSP) capability

in the form of DSP and SIMD instruction extensions, a single-cycle MAC unit and single-precision FPU. In addition, Freescale has added a direct memory access (DMA) controller, crossbar switch and L1 on-chip cache memories, maximizing processor performance and bus bandwidth.

Tower Systems for Vybrid Controllers

Ordering Part Number	Description	MSRP (USD)
TWR-VF65GS10	<ul style="list-style-type: none"> TWR-VF65GS10 module, USB cable, quick start guide Complimentary one-year, nonrenewable license to ARM® Development Studio 5 (DS-5™) starter kit for Vybrid controller Tower System module (256 KB code size limitation) 	\$199
TWR-VF65GS10-KIT	<ul style="list-style-type: none"> TWR-VF65GS10 module, USB cable, quick start guide Complimentary one-year, nonrenewable license to ARM Development Studio 5 (DS-5) starter kit for Vybrid controller Tower System module (256 KB code size limitation) TWR-ELEV elevator modules TWR-SER serial module 	\$269
TWR-VF65GS10-PRO	<ul style="list-style-type: none"> TWR-VF65GS10 module, USB cable, quick start guide Complimentary one-year, nonrenewable license to ARM Development Studio 5 (DS-5) starter kit for Vybrid controller Tower System module (256 KB code size limitation) TWR-ELEV elevator modules TWR-SER2 enhanced serial module TWR-LCD-RGB graphical LCD module 	\$399
TWR-VF65GS10-DS5	<ul style="list-style-type: none"> Same as TWR-VF65GS10-PRO, except it includes one-year, renewable license for ARM Development Studio 5 (DS-5) Vybrid controllers edition (hardware platform independent, 1 MB code size limitation) 	\$1,500

Reliability, Safety and Security

Vybrid devices include a variety of data integrity and security hardware features for safeguarding memory, communication and system data. A cyclic redundancy check module is available for validating memory contents and communication data, while a memory protection unit provides data protection and increased software reliability. For fail-safe applications, an independently clocked watchdog offers protection against runaway code. When it comes to security, a hardware encryption unit supports several encryption and hashing algorithms for program validation as well as authentication and securing data for transfer and storage. The system security module includes a unique chip identifier, secure key storage and a hardware tamper detection system. The tamper detection system has integrated sensors for voltage, frequency, temperature and external sensing for physical attack detection.

Optimal System Performance

Vybrid devices are ideal for modern industrial applications that require higher integration of communication and connectivity interfaces, as well as HMI and UI acceleration.

Customers can easily take full advantage of all the integrated Vybrid features to create differentiated products by leveraging the provided reference board support packages (BSP) for high-level operating systems (such as Linux®) and real-time operating systems (such as MQX™) that include libraries and media frameworks tuned to the silicon architecture. The combination of high-efficiency silicon design, low-leakage process technology and software tuned for the silicon architecture results in low power consumption, eliminating the need for a fan or heat sink and helping to lower overall system BOM cost. As an example, because the platform architecture partitions tasks

between the applications processor and the deterministic MCU, the ARM Cortex-M4 core helps to improve efficiency in industrial motor control applications that can result in a reduced carbon footprint.

Get Started Today

The Freescale Tower System provides a modular and expandable development platform for evaluating and prototyping with Vybrid controller solutions. The TWR-VF65GS10 module is a development tool for the Vybrid family of controllers that operates as a standalone debug tool or as part of an assembled Tower System development platform. With full support from MQX Software Solutions, Timesys Linux BSP and the ARM DS-5 toolchain, your next application-rich design is at your fingertips. For more information, visit freescale.com/TWR-VF65GS10 and freescale.com/TWR-VF65GS10-DS5.

Vybrid VF3xx Family

Single-core solution with dual XiP quad SPI, dual Ethernet and L2 switch for appliances and energy control

The VF3xx family is the entry point into the Vybrid portfolio and features the ARM® Cortex®-A5 core. It provides an efficient solution for an applications processor with up to 1.5 MB of on-chip SRAM and a rich suite of communication, connectivity and human-machine interfaces (HMI).

Target Applications

- Industrial automation
 - Applications requiring simple 2D graphics (HMI)
- Industrial scanners and printers
- Large or high-quality small appliances
- Portable patient monitors
- Simple vending machines

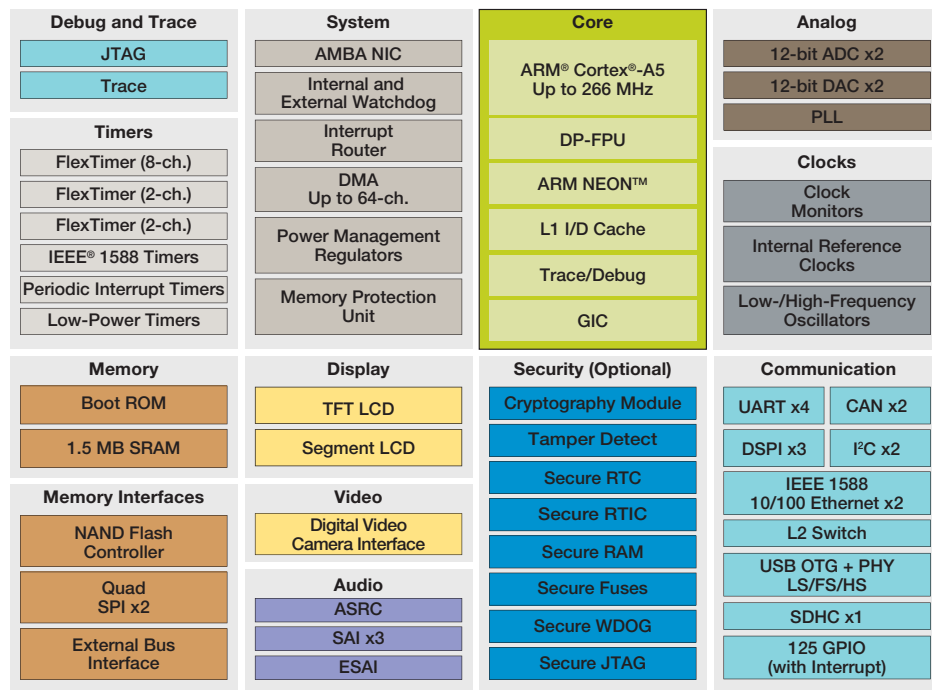
Mixed-Signal Capability

- Two 12-bit ADCs with configurable resolution. Single or differential output mode operation for improved noise rejection. 500 ns conversion time achievable with programmable delay block triggering.
- Two 12-bit DACs for analog waveform generation for audio applications or sensor manipulation

Memory

- Dual quad SPI supporting a double data rate interface, an enhanced read data buffering scheme, execute-in-place (XiP) and support for dual-die flashes
- Boot ROM with optional high-assurance boot for secure booting capability
- 1.5 MB on-chip SRAM with ECC support on 512 KB

Vybrid VF3xx Family Block Diagram



Performance

- ARM Cortex-A5 core running at 266 MHz, with double-precision floating-point, ARM NEON™ media processing engine for acceleration of media and signal processing, and ARM TrustZone® security extensions. 32 KB each of instruction and data L1 cache and 512 KB L2 cache for optimized bus bandwidth and on-chip SRAM execution performance.
- Up to 64-channel DMA for peripheral and memory servicing with reduced CPU loading and faster system throughput
- Crossbar switch enables concurrent multi-master bus accesses, increasing bus bandwidth

Timing and Control

- Three FlexTimers with a total of 12 channels. Hardware dead-time insertion and quadrature decoding for motor control
- Four-channel 32-bit periodic interrupt timer provides time base for RTOS task scheduler or trigger source for ADC conversion and programmable delay block

HMI

- TFT LCD display capable of WQVGA resolution
- 288 segment LCD controller

Multimedia

- Video interface unit with parallel camera support for 8- and 10-bit ITU656 video, up to 24-bit digital RGB
- Three synchronous audio interfaces implementing full-duplex serial interfaces with frame synchronization such as I²S, AC97 and CODEC/DSP interfaces
- Optional enhanced serial audio interface that provides a full-duplex serial port for communication with a variety of serial devices, including industry-standard codecs, SPDIF transceivers and other processors
- Asynchronous sample rate converter for rate conversion between 32, 44.1, 48 and 96 kHz

Connectivity and Communications

- USB 2.0 OTG controller with integrated high-speed PHY
- 10/100 Ethernet controllers with hardware time-stamping
- Layer 2 Ethernet switch
- Four UARTs with IrDA support, including two UART with ISO 7816 smart card support. Variety of data size, format and transmission/reception settings supported for multiple industrial communication protocols.
- Two CAN modules for industrial network bridging
- Three DSPI and two I²C interfaces

Reliability, Safety and Security

- TrustZone Address Space Controllers provide memory protection for all masters on the crossbar switch, increasing software reliability
- Cyclic redundancy check engine validates memory contents and communication data, increasing system reliability
- Independent-clocked COP guards against clock skew or code runaway for fail-safe applications such as the IEC 60730 safety standard for household appliances
- External watchdog monitor drives output pin to safe state external components if watchdog event occurs

Optional Secure Application Support

- Cryptography acceleration and assurance module
 - Supports acceleration and off-loading for selected crypto algorithms such as AES, DES, 3 DES and ArcFour Symmetric key block ciphers
- Random number generation
 - NIST compliant SP800-90
 - Combination of a true random number generator and a pseudo-random number generator

- Real-time integrity checker
 - Periodic check on system memory for unauthorized modifications
- Secure nonvolatile storage
 - Secure nonrollover real-time counter
 - Nonrollover monotonic counter
 - Zeroizable 256-bit secret key

External Peripheral Support

- Secure digital host controller supports SD, SDIO, MMC or CE-ATA cards for in-application software upgrades, media files or adding Wi-Fi® support
- NAND flash controller supports up to 32-bit ECC current and future NAND types. ECC management handled in hardware, minimizing software overhead.
- FlexBus external bus interface provides glueless interface options to memories and peripherals such as graphics displays. Supports up to four chip selects.

For more information, please visit freescale.com/VF3xx.

Hybrid VF5xx Family

Single-core solution with dual Ethernet and L2 switch for automation and control

The VF5xx family features the ARM® Cortex®-A5 core with speeds up to 500 MHz with 512 KB L2 cache, dual USB 2.0 OTG controllers with integrated PHY, dual 10/100 Ethernet controllers with L2 switch, up to 1.5 MB of on-chip SRAM and a rich suite of communication, connectivity and human-machine interfaces (HMI). The VF5xx family is pin and software compatible with the VF6xx family.

Target Applications

- Industrial automation
 - Applications requiring simple 2D graphics (HMI)
- Industrial scanners and printers
- Industrial vehicle control with HMI
- Large or high-quality small appliances
- Metering
 - Data concentrator
- Portable patient monitors
- Simple vending machines

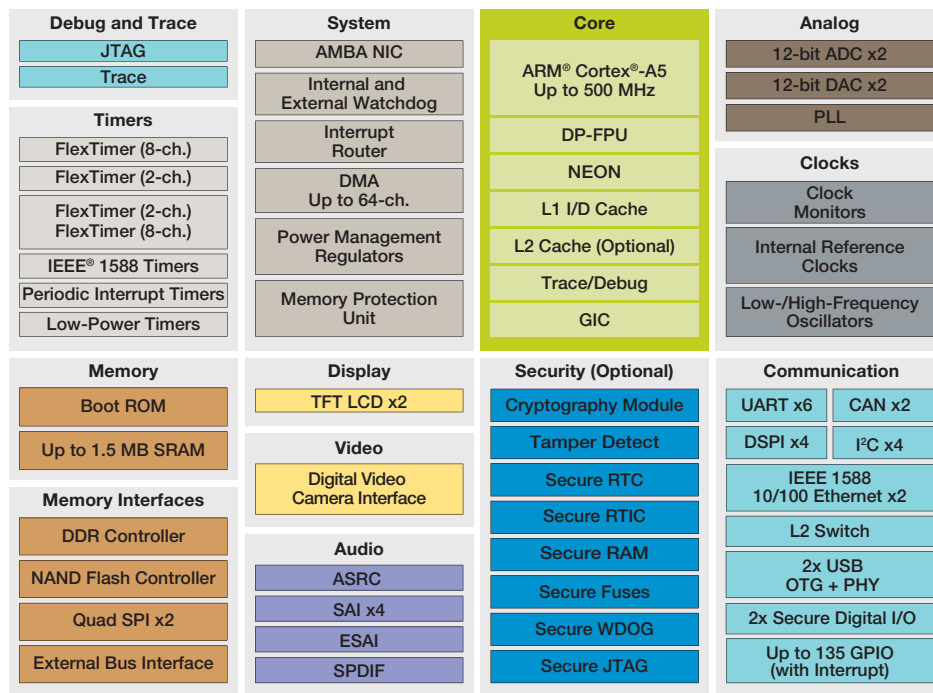
Mixed-Signal Capability

- Two 12-bit ADCs with configurable resolution. Single or differential output mode operation for improved noise rejection. 500 ns conversion time achievable with programmable delay block triggering.
- Two 12-bit DACs for analog waveform generation for audio applications or sensor manipulation

Memory

- Dual quad SPI supporting a double data rate interface, an enhanced read data buffering scheme, execute-in-place (XiP) and support for dual-die flashes
- Boot ROM with optional high-assurance boot for secure booting capability

Hybrid VF5xx Family Block Diagram



- Up to 1.5 MB on-chip SRAM with ECC support on 512 KB
- 16-bit DDR controller with PHY and ECC support capable of DDR3/LPDDR2 800 MHz data rate
- Up to 64-channel DMA for peripheral and memory servicing with reduced CPU loading and faster system throughput
- Crossbar switch enables concurrent multi-master bus accesses, increasing bus bandwidth

Performance

- ARM Cortex-A5 core with frequency up to 500 MHz, with double-precision floating-point, ARM NEON™ media processing engine for acceleration of media and signal processing, and ARM TrustZone® security extension. 32 KB each of instruction and data L1 cache and 512 KB L2 cache for optimized bus bandwidth and on-chip SRAM execution performance.

Timing and Control

- Four FlexTimers with a total of 20 channels. Hardware dead-time insertion and quadrature decoding for motor control.
- Four-channel 32-bit periodic interrupt timer provides time base for RTOS task scheduler or trigger source for ADC conversion and programmable delay block

HMI

- TFT LCD displays capable of XGA resolution

Multimedia

- Video interface unit with parallel camera support for 8- and 10-bit ITU656 video, up to 24-bit digital RGB
- Up to four synchronous audio interfaces implementing full-duplex serial interfaces with frame synchronization such as I²S, AC97 and CODEC/DSP
- Optional enhanced serial audio interface that provides a full-duplex serial port for serial communication with a variety of serial devices, including industry-standard codecs, SPDIF transceivers and other processors
- Sony Philips Digital Interface (S/PDIF) receives and transmits digital audio using the IEC 60958 standard consumer format
- Asynchronous sample rate converter for rate conversion between 32, 44.1, 48 and 96 kHz

Connectivity and Communications

- Dual USB 2.0 OTG controller with integrated PHY
- Dual 10/100 Ethernet controller with hardware time-stamping
- Layer 2 Ethernet switch

- Up to six UARTs with IrDA support, including two UARTs with ISO 7816 smart card support. Variety of data size, format and transmission/reception settings supported for multiple industrial communication protocols.
- Two CAN modules for industrial network bridging
- Four DSPI and four I²C interfaces

Reliability, Safety and Security

- TrustZone Address Space Controllers provide memory protection for all masters on the crossbar switch, increasing software reliability
- Cyclic redundancy check engine validates memory contents and communication data, increasing system reliability
- External watchdog monitor drives output pin to safe state external components if watchdog event occurs

Optional Secure Application Support

- Cryptography acceleration and assurance module
 - Supports acceleration and off-loading for selected crypto algorithms such as AES, DES and 3 DES and ArcFour Symmetric key block ciphers
- Random number generation
 - NIST compliant SP800-90
 - Combination of a true random number generator and a pseudo-random number generator

- Real-time integrity checker
 - Periodic check on system memory for unauthorized modifications
- Secure nonvolatile storage
 - Secure nonrollover real-time counter
 - Nonrollover monotonic counter
 - Zeroizable 256-bit secret key
- Tamper detection
 - Support for up to six external passive tamper detection pins or five active external tamper detection pin pairs

External Peripheral Support

- Secure digital host controller supports SD, SDIO, MMC or CE-ATA cards for in-application software upgrades, media files or adding Wi-Fi® support
- NAND flash controller supports up to 32-bit ECC current and future NAND types. ECC management handled in hardware, minimizing software overhead
- FlexBus external bus interface provides glueless interface options to memories and peripherals such as graphics displays. Supports up to four chip selects.

For more information, please visit freescale.com/VF5xx.

Vybrid VF6xx Family

Dual heterogeneous core solution with XGA display, dual USB, dual Ethernet and L2 switch for automation and HMI

The VF6xx is the heterogeneous dual-core family combining the ARM® Cortex®-A5 and Cortex®-M4 cores. It includes dual USB 2.0 OTG controllers with integrated PHY, dual 10/100 Ethernet controllers with L2 switch, up to 1.5 MB of on-chip SRAM and a rich suite of communication, connectivity and human-machine interfaces (HMI).

Target Applications

- Motor drives
- Industrial pumps and fans
- Power inverters
- Mobile patient care
 - Infusion pumps and respirators
- Energy grid protection
 - Circuit breakers, monitors and hubs
- Infrastructure control
 - Water treatment and gas pipelines
- Building control
 - Elevator and automated doors
- Kiosks with 2D displays
- Service robots

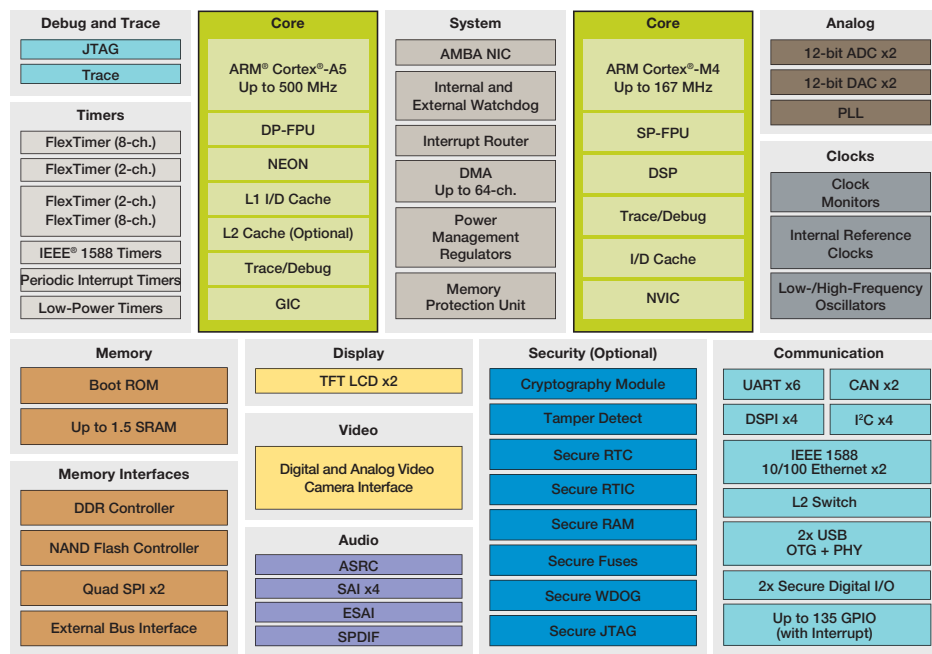
Mixed-Signal Capability

- Two 12-bit ADCs with configurable resolution. Single or differential output mode operation for improved noise rejection. 500 ns conversion time achievable with programmable delay block triggering.
- Two 12-bit DACs for analog waveform generation for audio applications or sensor manipulation

Memory

- Dual quad SPI supporting a double data rate interface, an enhanced read data buffering scheme, execute-in-place (XiP) and support for dual-die flashes

Hybrid VF6xx Family Block Diagram



- Boot ROM with optional high assurance boot for secure booting capability
- Up to 1.5 MB on-chip SRAM with ECC support on 512 KB
- 16-bit DDR controller with PHY and ECC support capable of DDR3/LPDDR2 800 MHz data rate
- ARM Cortex-A5 core with frequency up to 500 MHz, with 32 KB each instruction and data L1 cache and 512 KB L2 cache double-precision floating-point, ARM NEON™ media processing engine for acceleration of media and signal processing, and ARM TrustZone® security extension
- ARM Cortex-M4 core running up to 167 MHz, with 16 KB of instruction/data L1 cache plus 64 KB of tightly coupled memory, DSP support for single cycle 32-bit MAC, single instruction multiple data extensions and single-precision floating-point unit
- Up to 64-channel DMA for peripheral and memory servicing with reduced CPU loading and faster system throughput
- Crossbar switch enables concurrent multi-master bus accesses, increasing bus bandwidth

Performance

- ARM Cortex-A5 core with frequency up to 500 MHz, with 32 KB each instruction and data L1 cache and 512 KB L2 cache double-precision floating-point, ARM NEON™ media processing engine for acceleration of media and signal processing, and ARM TrustZone® security extension

Timing and Control

- Four FlexTimers with a total of 20 channels. Hardware dead-time insertion and quadrature decoding for motor control.

- Four-channel 32-bit periodic interrupt timer provides time base for RTOS task scheduler or trigger source for ADC conversion and programmable delay block

HMI

- TFT LCD displays capable of up to XGA resolution

Multimedia

- Digital and analog video interface unit with parallel camera support for 8- and 10-bit ITU656 video, up to 24-bit digital RGB
- Up to four synchronous audio interfaces implementing full-duplex serial interfaces with frame synchronization such as I²S, AC97 and CODEC/DSP
- Optional enhanced serial audio interface that provides a full-duplex serial port for serial communication with a variety of serial devices, including industry-standard codecs, SPDIF transceivers and other processors
- Sony Philips Digital Interface receives and transmits digital audio using the IEC 60958 standard consumer format
- Asynchronous sample rate converter for rate conversion between 32, 44.1, 48 and 96 kHz

Connectivity and Communications

- Dual USB 2.0 OTG controller with integrated PHY
- Dual 10/100 Ethernet controller with hardware time-stamping
- Layer 2 Ethernet switch

- Up to six UARTs with IrDA support, including two UARTs with ISO 7816 smart card support. Variety of data size, format and transmission/reception settings supported for multiple industrial communication protocols.
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- Cyclic redundancy check engine validates memory contents and communication data, increasing system reliability
- Independent-clocked COP guards against clock skew or code runaway for fail-safe applications such as the IEC 60730 safety standard for household appliances
- External watchdog monitor drives output pin to safe state external components if watchdog event occurs

Optional Secure Application Support

- Cryptography acceleration and assurance module
 - Supports acceleration and off-loading for selected crypto algorithms such as AES, DES and 3 DES and ArcFour Symmetric key block ciphers
- Random number generation
 - NIST compliant SP800-90
 - Combination of a true random number generator and a pseudo-random number generator

- Real-time integrity checker
 - Periodic check on system memory for unauthorized modifications
- Secure nonvolatile storage
 - Secure nonrollover real-time counter
 - Nonrollover monotonic counter
 - Zeroizable 256-bit secret key
- Tamper detection
 - Support for up to six external passive tamper detection pins or five active external tamper detection pin pairs

External Peripheral Support

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For more information, please visit freescale.com/VF6xx.

Design Resources

Contents

Freescale Enablement Solutions

Freescale Tower System	33
Freescale Freedom development platform	35
Freescale MQX software solutions	36

Processor Expert software	39
PEG graphics software	40
Freescale i.MX development tools	42
i.MX applications processor software solutions	43

Partner Enablement Solutions

ARM	44
<i>Preferred Partner</i> Green Hills Software	46
<i>Preferred Partner</i> Mentor Graphics	47
<i>Preferred Partner</i> QNX Software Systems	48
<i>Preferred Partner</i> Wind River	49
Ac6	50
Adeneo Embedded	50
Advantech	50
Arcturus	51
Arium	51
Atollic	51
Bluetechnix	52
Boundary Devices	52
congatec AG	52
Cybercom	53
Digi International	53
Elektrobit	53
Embedded Access	54
Embest	54
Emcraft	54
Emtrion	55
FirstView	55
FreeRTOS	55
GainSpan	56

Garz & Fricke	56
HILFI GmbH	56
IAR Systems	57
iWave Systems	57
Ka-Ro	57
Kontron	58
Lauterbach	58
M2CoreTech	58
MicroSys	59
Motomic Software	59
NetModule	59
NovTech	60
P&E Microcomputer Systems	60
PHYTEC	60
Prevas Technologies	61
RealVNC	61
Rightware	61
SECO	62
Silex Technology	62
Sophia Systems	62
TechNexion	63
Timesys	63
TQ-Components	63
Embedded board solutions	64

Freescale Enablement Solutions

Software and development solutions

Freescale Tower System

The Freescale Tower System is a modular development platform for 8-, 16- and 32-bit MCUs and MPUs that enables advanced development through rapid prototyping. Featuring multiple development boards or modules, the Tower System provides designers with building blocks for entry-level to advanced development.

Modular and Expandable

- Controller modules provide easy-to-use, reconfigurable hardware
- Interchangeable peripheral modules (including communications, 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 allows quick development with proven designs
- Integrated debugging interface allows for easy programming and run control via standard USB cable

Cost Effective

- Interchangeable peripheral modules can be reused with all Tower System controller modules, eliminating the need to purchase redundant hardware for future designs
- Enabling technologies like LCD, Wi-Fi®, motor control, serial and memory interfacing are offered off-the-shelf at a low cost to provide a customized enablement solution

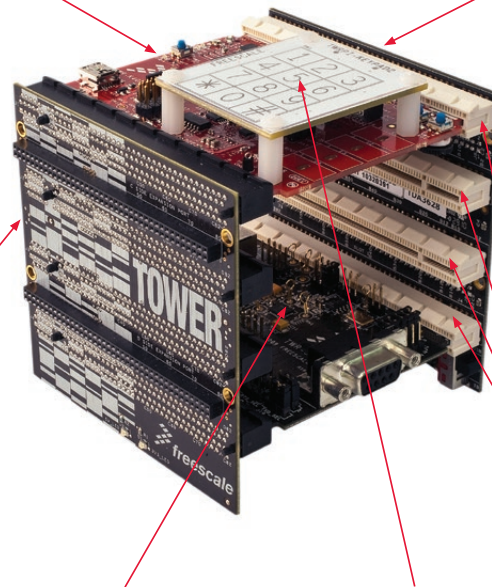
The Freescale Tower System

Controller/Processor Module (MCU/MPU)

- Tower MCU/MPU board
- Works stand-alone or in Tower System
- Features integrated debugging interface for easy programming and run control via standard USB cable

Secondary Elevator

- Additional and secondary serial and expansion bus signals
- Standardized signal assignments
- Mounting holes and expansion connectors for side-mounting peripheral



Peripheral Module

- Adds features and functionality to your designs
- Interchangeable with other peripheral modules and compatible with all controller/processor modules
- Examples include serial interface, memory, Wi-Fi®, graphical LCD, motor control, audio, Xtrinsic-sensing and high-precision analog modules

Tower Plug-In (TWRPI)

- Designed to attach to modules that have a TWRPI socket(s)
- Adds features and functionality
- Swappable with other TWRPIs
- Examples include accelerometers, key pads, touchpads, sliders and rotary touchpads

Primary Elevator

- Common serial and expansion bus signals
- Two 2 x 80 connectors on back side for easy signal access and side-mounting board (LCD module)
- Power regulation circuitry
- Standardized signal assignments
- Mounting holes

Size

- Fully assembled Tower System is approx. 3.5" H x 3.5" W x 3.5" D

Board Connectors

- Four card-edge connectors
- Uses PCI Express® connectors (x16, 90 mm/ 3.5" long, 164 pins)

Tower System Modules

Controller/Processor Modules (8-, 16-, 32-bit)		freescale.com/TowerController
Works standalone or as part of Tower System		Allows rapid prototyping
Features open source debugging interface		Provides easy programming and run control via standard USB cable
Peripheral Modules		freescale.com/TowerPeripheral
Can be reused with all Tower System controller modules		Eliminates the need to buy/develop redundant hardware
Interchangeable peripheral modules: Serial, memory, graphical LCD, prototyping, sensor		Enables advanced development and broad functionality
Tower Plug-Ins		freescale.com/TWRPI
Designed to attach to any Tower System module with a TWRPI socket(s)		Adds features and functionality with little investment
Swappable components		Allows for design flexibility
Elevator Modules		freescale.com/TowerELEV
Two 2 x 80 connectors		Provides easy signal access and side-mounting board (i.e., LCD module)
Power regulation circuitry		Provides power to all boards
Standardized signal assignments		Allows for customized peripheral module development
Four card-edge connectors available		Allows easy expansion using PCI Express® connectors (x16, 90 mm/3.5" long, 164 pins)

Take Your Design to the Next Level

For a complete list of development kits and modules offered as part of the Freescale Tower System, please visit freescale.com/Tower.

Partner Modules

Tap into a powerful ecosystem of Freescale technology alliances for building smarter, better connected solutions. Designed to help you shorten your design cycle and get your products to market faster, these technology alliances provide you with access to rich design tools, peripherals and world-class support and training. A number of partners have developed modules for the Tower System. Some examples include the i.MX515 ARM® Cortex™-A8 Tower computer module and StackableUSB™ I/O device carrier module from MicroSys, as well as the rapid prototyping system (RPS) AM1 and FM1 modules from iMn MicroControl.



Tower Geeks Online Community

TowerGeeks.org is an online design engineer community that allows members to interact, develop designs and share ideas. Offering a direct path to explore and interact with other engineers designing with the Tower System, **TowerGeeks.org** is a great way to discuss your projects, post videos of your progress, ask questions through the forum and upload software. With updates through Twitter and Facebook, it's easy to get involved.



Follow Tower Geeks on Twitter
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Visit Freescale on Facebook
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Freescale Freedom Development Platform

Overview

The Freescale Freedom development platform is a small, low-power, cost-effective evaluation and development system for quick application prototyping and demonstration of Kinetis MCU families.

Each platform offers an easy-to-use mass-storage device mode flash programmer, virtual serial port and classic programming and run-control capabilities.

It's easy to get started. Simply choose your preferred Freescale Freedom development hardware, select compatible software, connect with the community and go.

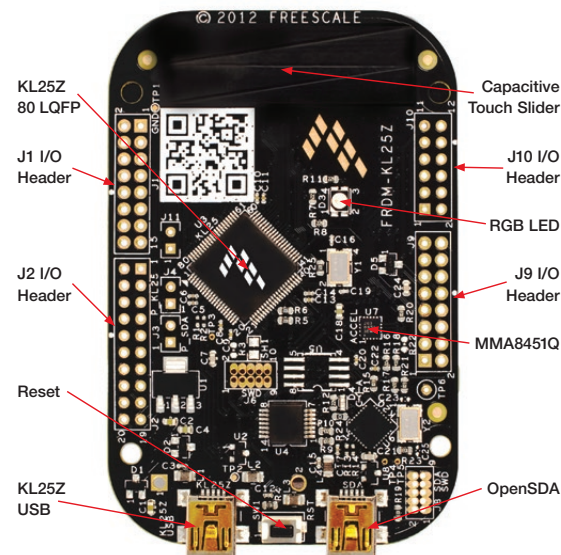
Features

- Cost-effective (starting at \$12.95)
- Small size (approximately 3.25" x 2"), fits within a mint tin
- Arduino™ footprint-compatible with support for a rich set of third-party expansion boards ("shields")
- Easy access to the MCU I/O pins
- Integrated open-standard serial and debug adapter (OpenSDA) with support for several industry-standard debug interfaces

Software Enablement and Support

- Rich ARM® ecosystem includes Keil, IAR, SEGGER, CodeWarrior, mbed and more
- Freescale MQX™ Lite RTOS: Very light MQX kernel for resource-limited MCUs that allows applications to run with less than 4 KB RAM
- Processor Expert software and embedded components
- FRDM-KL25Z is mbed-enabled through the built-in USB flash programming interface (OpenSDA). Simply plug it in, drop on an "mbed interface" program binary and it's up and running

Example Freescale Freedom Development Platform: FRDM-KL25Z



OpenSDA: Open-Standard Serial And Debug Adapter

The integrated debug circuit, OpenSDA, bridges serial and debug communications between a USB host and an embedded target processor. OpenSDA features a mass storage device bootloader that provides a quick and easy mechanism for loading different OpenSDA applications such as flash programmers, run-control debug interfaces, serial-to-USB converters and more, including:

- Freescale mass storage device flash programming interface eliminates tool installation for quick evaluation of demonstration applications
- P&E Multilink interface provides run-control debugging and compatibility with IDE tools
- SEGGER OpenSDA firmware makes OpenSDA compatible to J-Link Lite
- mbed interface application provides connection to mbed online tools and supports a virtual serial port, CMSIS-DAP, and a mass-storage programming interface
- CMSIS-DAP interface (standalone): New ARM standard for embedded debug interface

Get Started

Learn more at freescale.com/freedom.



Get your FRDM-KL25Z mbed-enabled from mbed.org.

Enable your OpenSDA as a Segger J-Link Lite at segger.com/opensda.html.

For a complete list of boards offered as part of the Freescale Freedom development platform, please visit freescale.com/Freedom.

Freescale MQX Software Solutions

The increasing complexity of industrial applications and expanding functionality of semiconductors are driving embedded developers toward solutions that combine proven hardware and software platforms. To help accelerate time to market and improve application development success, we offer the MQX™ real-time operating system (RTOS) with TCP/IP and USB software stacks and peripheral drivers to Kinetis ARM® MCU, Vybrid controller solutions, PX series Power Architecture® MCU and ColdFire MCU customers at no additional charge. MQX solutions also support several i.MX MPUs*. The combination of Freescale MQX software solutions with our silicon portfolio creates a comprehensive source for hardware, software, tools and services.

Learn more at freescale.com/MQX.

Reducing Cost, Accelerating Success

Providing complimentary Freescale MQX software solutions with our silicon products helps to alleviate much of the initial software investment hurdle faced by embedded developers. Comparable full-featured software offerings may cost developers as much as \$95,000 (USD) in licensing fees.

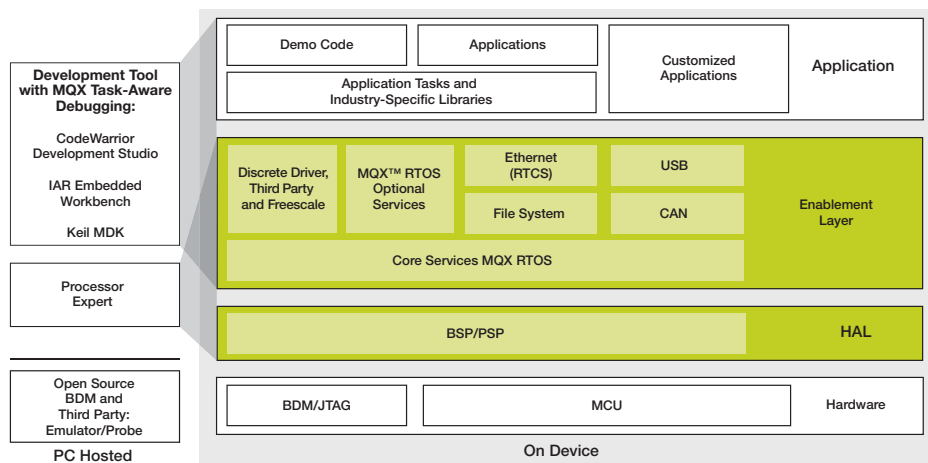
Freescale MQX is deployed as production-ready source code, including communications software stacks and peripheral drivers, at no additional cost. Freescale MQX is provided with a commercial-friendly software licensing model, enabling developers to keep their source modifications while being able to distribute the required binary code.

Full Featured, Proven and Scalable

The MQX RTOS has been the backbone of embedded products based on Freescale silicon for more than 15 years. MQX software deployment spans a broad range of market segments and leading manufacturers worldwide.

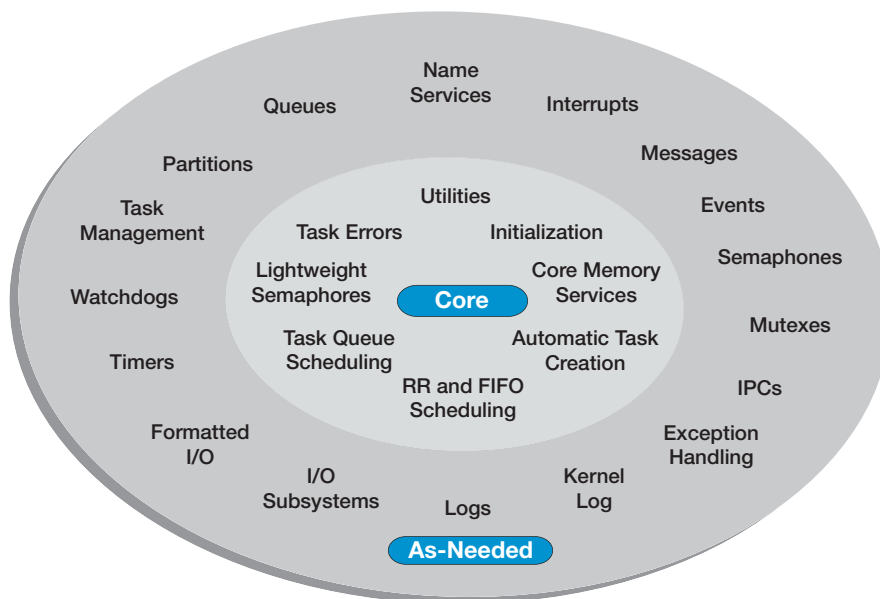
*via partner support.

Comprehensive Freescale Solution



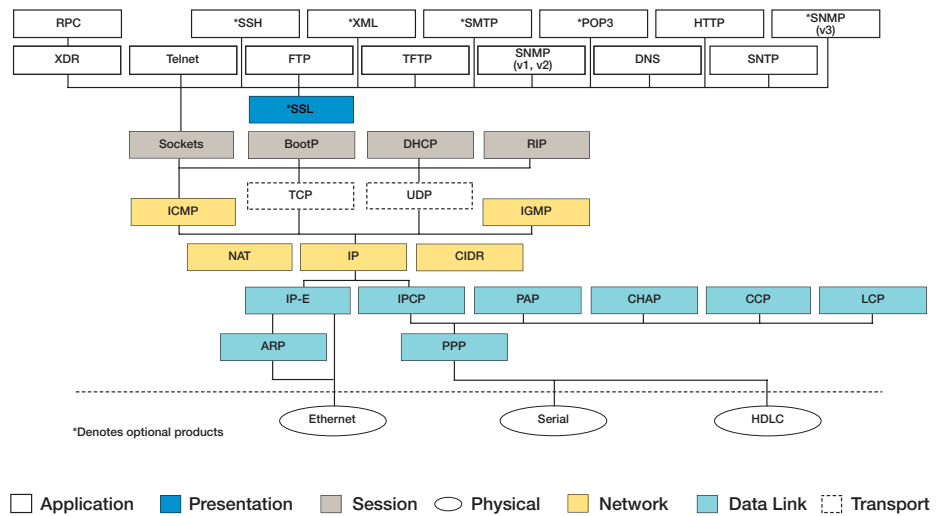
■ Freescale MQX Software Solutions

MQX RTOS: Customizable Component Set



The Freescale MQX RTOS offers powerful, preemptive real-time performance with optimized context switch and interrupt time to enable fast, highly predictable response times. Its small, configurable size conserves memory space for embedded applications and it can be configured to take as little as 6 KB of ROM, including kernel, interrupts, semaphores, queues and memory manager. The Freescale MQX RTOS offers a straightforward application programming interface with a modular, component-based architecture that makes it very scalable. Components are linked in only if needed, preventing unused functions from bloating the memory footprint. Plug-ins, such as security, industrial protocols and graphical interfaces from our strong network of partners, can also be added.

MQX Real-Time TCP/IP Communication Suite



Freescale MQX Add-on Software

<p>Real-time TCP/IP communication suite (RTCS) optional components Available from Embedded Access Inc.</p>	<ul style="list-style-type: none"> • Network management: Support for SNMP version 1 and 2 is built into RTCS. EAI offers MQX SNMPv3. • XML parsing and framing: The MQX XML component enables your device to accept data in XML, as well as send data packaged in XML • Email communication: The MQX SMTP module provides your device with outbound email communication and MQX POP3 provides the capability to accept incoming email communication
<p>NanoSSL™ and NanoSSH™ software by Mocana Available from freescale.com/nanossl, freescale.com/nanossh</p>	<ul style="list-style-type: none"> • NanoSSH: Provides privacy, authentication and ensures data integrity between a secure server and its clients • NanoSSL: Cryptographic protocols that provide security for communications over networks such as the Internet
<p>PEG+ graphics library Available from swellsoftware.com</p>	<ul style="list-style-type: none"> • Portable embedded GUI library designed to provide a professional-quality GUI for embedded systems applications • Small, fast and easily ported to virtually any hardware configuration capable of supporting graphical output
<p>SEGGER emWin graphics library/GUI Available from SEGGER Microcontroller</p>	<ul style="list-style-type: none"> • emWin is designed to provide an efficient, LCD controller-independent GUI for any application that operates with a graphical LCD
<p>Freescale eGUI: Graphical LCD driver Available from freescale.com/EGUI</p>	<ul style="list-style-type: none"> • The complimentary Freescale embedded graphical user interface (eGUI) allows single-chip MCU systems to implement a graphical user interface and drive the latest generation of color graphics LCD panels with integrated display RAM and simple serial peripheral interface (SPI) or parallel bus interface
<p>CANOpen master/slave for embedded devices Available from IXXAT</p>	<ul style="list-style-type: none"> • Unburdens the developer from dealing with CAN-specific details such as bit-timing and implementation-specific functions
<p>Industrial network and field bus protocols Available from IXXAT</p>	<ul style="list-style-type: none"> • Profinet RT for I/O device • EtherNet/IP for adapter and scanner • Ethernet powerlink for managing and controlled nodes • EtherCAT for slave nodes • SERCOS III for slave devices • Precision time protocol IEEE® 1588-2008 (v2)
<p>SFFS flash file system Available from Embedded Access, Inc.</p>	<ul style="list-style-type: none"> • SFFS is a safe flash file system that can support almost any NOR or NAND flash device • Provides wear leveling, bad block handling and ECC K30C algorithms to ensure you get optimal use out of a flash device
<p>Microbrowsers Available from Motomic Software</p>	<p>The uButterfly Browser runs on MQX and browses, parses and renders HTML/CSS content</p> <ul style="list-style-type: none"> • Browse HTML 4/CSS 2.1 web pages • Enable dynamic HTML, active graphics and media • An optional SDK allows browsing embedded/instanced within C, C++ or Qt apps (available as a separate product)
<p>OS Changer—Reuse application on MQX Available from MapuSoft Technologies</p>	<p>OS Changer is a C/C++ source-level virtualization technology that allows you to easily reuse your software developed for one OS on MQX while providing real-time performance. Available OS changer porting kits: VxWorks® Porting Kit, pSOS, Linux®/POSIX®, Windows®, Nucleus, micro-ITRON</p>
<p>Floodgate Packet Filter, an embedded firewall product Available from Icon Labs</p>	<p>Floodgate provides protection from Internet-based threats by controlling what packets are the embedded device processes. Encryption and authentication may protect your device from a hacker trying to access your device, but Floodgate can prevent the hacker from even attempting to connect.</p>

Freescale MQX Real-Time TCP/IP Communication Suite

The Freescale MQX real-time communication suite (RTCS) is a fast, efficient and low-footprint embedded Internet stack that supports a rich set of standard TCP/IP protocols. It comes complete with a number of application layer protocols such as Telnet, FTP, SNMP v1 and SNMP v2. A number of optional, pre-integrated protocols and products are also available from third parties. The scalability of the Freescale MQX RTCS allows developers to easily define the feature set needed to accommodate a variety of ROM and RAM memory budgets.

Certifiable to Medical and Aerospace Standards

Even for applications that do not require formal certification, the robustness of MQX provides a trusted platform that has been proven in thousands of time-critical, sophisticated applications. For designs that do have a formal certification process to follow, MQX is an excellent choice. Past licensees have certified MQX-based applications to medical specifications (CFR 820.30 Part 21, IEC 60601-1) and the aerospace requirements listed under DO-178b. Safety-critical applications based on MQX include eye surgery equipment, drug injection equipment, radiation dose monitoring equipment, aircraft braking systems and aircraft navigation equipment.

MQX RTOS Support

Freescale offers a range of MQX RTOS support options based on your design needs. Whether you are just getting started with MQX RTOS or are deep into your development project, it's easy to get the support you need, when you need it.

Learn more at freescale.com/MQX/support.

Features and Benefits

Freescale MQX™ RTOS	
Small code density	<ul style="list-style-type: none"> Context switch and low-level interrupt routines hand-optimized in assembly Can be configured to a memory footprint of 12 KB ROM and 2.5 KB RAM on CFV2, including kernel, task applications, LW semaphore, interrupt stack, queues and memory manager
Component-based architecture	<ul style="list-style-type: none"> 25 components—eight core, 17 optional Components are linked in only if needed, preventing unused functions from bloating the memory footprint
Full and lite services	<ul style="list-style-type: none"> Further control of size, RAM/ROM utilization and performance options
Real-time, priority-based preemptive multithreading	<ul style="list-style-type: none"> Threads execute in order of priority Allows high-priority threads to meet their deadlines consistently, no matter how many other threads are competing for CPU time
Optimized for Freescale architecture	<ul style="list-style-type: none"> Optimized assembly code to accelerate key real-time portions of the RTOS such as context switching
Faster development time	<ul style="list-style-type: none"> Allows for faster development time by relieving engineers from creating an efficient scheduling system and interrupt handling Use of multiple communication protocols such as USB or TCP/IP
Code reuse	<ul style="list-style-type: none"> Provides a framework with a simple API to build and organize the features across our broad portfolio of embedded processors
Intuitive API	<ul style="list-style-type: none"> Writing code for MQX is straightforward with a complete API and available reference documentation
Fast boot sequence	<ul style="list-style-type: none"> Ensures the application is running fast after the hardware has been reset
Simple message passing between processors	<ul style="list-style-type: none"> Messages can be either from a system/private pool and sent with either an urgent status, or a user-defined priority, and can be broadcast or task specific For maximum flexibility, a receiving task can be operating on either the same CPU as the sending task or on a different CPU within the same system
Freescale MQX RTCS	
Designed for embedded applications	<ul style="list-style-type: none"> Specifically designed for adding TCP/IP connectivity to embedded systems Provides fully compliant feature set of networking stacks and configurable enough to fit into the small memory confines of an embedded devices Tightly integrated with Freescale MQX RTOS device drivers for Ethernet and other access layers Tested on Freescale embedded architectures
Small configurable memory footprint	<ul style="list-style-type: none"> Implemented as a C library Allows only the features and protocols used by the application to be included in the image Can be configured to take as little as 30 KB of ROM
RTCS protocol support	<ul style="list-style-type: none"> Provided with a large number of standard protocols One product allows real TCP/IP applications without the need to acquire other application-level protocols
Advanced networking protocols for RTCS	<ul style="list-style-type: none"> RTCS can be extended to support additional industry-standard protocols, including security, advanced routing/network access, embedded web server/email support and network management protocols
Very scalable	<ul style="list-style-type: none"> Customizable suite can meet a wide range of application RAM and ROM requirement by selectively choosing only the necessary protocols for your design
Full featured	<ul style="list-style-type: none"> Great flexibility in the way you provide connectivity to your device, ranging from simple application such as Ethernet-serial to complex gateway systems
Support for standard protocols and sockets	<ul style="list-style-type: none"> RTCS not only provides application layer protocols but is a complete OSI model solution that spans data link to application layer standard protocols
Freescale MQX File System	
Designed for embedded applications	<ul style="list-style-type: none"> Provides full MS-DOS compatible file system that is configurable to fit into small memory footprint Brings support for desktop PC features such as long file names, multiple disk volumes and directory handling to embedded systems
Portability and modularity	<ul style="list-style-type: none"> The MFS FAT file system provides a portable, compatible implementation of the MS-DOS file system and library of file system functions File system functions are separated from the device driver functions, allowing for increased modularity Supports different types of storage media Trivial file system is a simple read-only file system used to avoid the need of MFS in HTTP
Freescale MQX USB Host/Device Stack	
Designed for embedded applications	<ul style="list-style-type: none"> Specifically designed for adding USB functionality to embedded systems Provides fully compliant USB 1.1 and 2.0 feature set of stacks and drivers
Small configurable memory footprint	<ul style="list-style-type: none"> Designed to fit in a small <10 KB RAM with code size of <32 KB
Supports a variety of class functionality	<ul style="list-style-type: none"> Supports personal healthcare device class (PHDC), human-interface device (HID), mass storage device (MSD), communications device class (CDC), audio class, On-The-Go USB 2.0 standard supplement and PHDC USB.org standard classes

Processor Expert Software

Processor Expert is a rapid application design tool that combines easy-to-use component-based application creation with an expert knowledge system.

- CPU, on-chip peripherals, external peripherals and software functionality are encapsulated into embedded components.
- Each component's functionality can be tailored to fit application requirements by modifying the component's properties, methods and events.
- When the project is built, Processor Expert automatically generates highly optimized embedded C code.

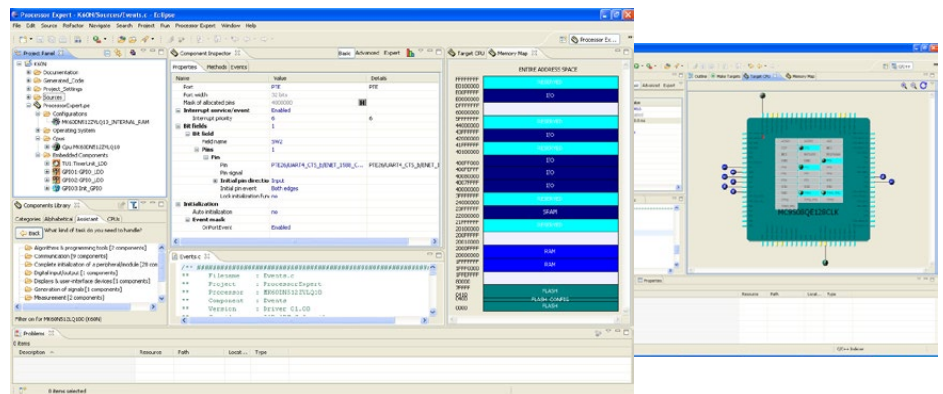
Processor Expert software is integrated in Eclipse and can be used both with Eclipse or with non-Eclipse users for all the supported platforms. It nicely integrates into the Eclipse or external IDEs and takes advantage of the Eclipse framework and ecosystem with version control, automatic documentation and advanced editing functionality.

The Processor Expert Knowledge Base incorporates all the information from the data sheets: It knows everything about pin muxing, clock and interrupt configuration, hardware and peripheral capabilities, and offers a convenient graphical user interface to configure it. Processor Expert checks the consistency of the MCU configuration settings and flags errors that otherwise are hard to find. Using Processor Expert helps get you started with a new design in minutes, and there is no need to read thousands of reference manual pages first.

Processor Expert includes the Component Development Environment (CDE). With this, you do not have to accept generic one-size-fits-all drivers. You can design custom peripheral drivers ideally suited to your needs, without having to know everything about the hardware. A wizard guides you through creating software components that you can use and distribute to bring software development and engineering to the next level.

Features	Benefits
Graphical User Interface	<ul style="list-style-type: none"> • Allows an application to be specified by the functionality needed • Eclipse framework with multiple detachable views, multimonitor support and highly configurable look and feel
Embedded Components	<ul style="list-style-type: none"> • Components and drivers for on-chip peripherals (BitIO, SCI, CAN, USB, Timers, LCD, etc.) • Bare metal (no RTOS) and RTOS aware, including MQX • Additional components can be created or downloaded and added to the system, e.g. FreeRTOS or off-chip devices (EEPROM, transceivers, LCD displays, etc.)
Automatic Code and Documentation Generator	<ul style="list-style-type: none"> • Creates tested, optimized C code tuned to application needs and the selected Freescale device • Automatically generates text and open source doxygen documentation for HTML or PDF formats • Static code generation so generated drivers can be used without the need for Processor Expert in projects
Built-In Knowledge Base	<ul style="list-style-type: none"> • No need to read the data sheet: Processor Expert knows the pins available, which pins can be used in which mode and what settings are possible • Generates tested and working code sequences for the most complicated peripheral usage: configuring the MCU clocks is just a matter of a few clicks • Direct access to low-level MCU registers and functionality using highly optimized PDD macros • Immediately flags resource conflicts and incorrect settings so errors are caught early in the design cycle
Component Development Environment	<ul style="list-style-type: none"> • Allows user-specific hardware-independent embedded components to be created • Graphical user interface with wizard to assist software driver code and component generation • Components and driver code sharable with other developers

Processor Expert Software: Microcontroller Driver Suite



PEG Graphics Software

Freescale provides graphical user interface (GUI) solutions for embedded devices. Freescale's PEG Pro, PEG+ and PEG Lite product offering includes a GUI library for embedded development that works tightly with real-time operating systems. The graphical development solution allows developers to layout user interface screens and controls using the PEG library and external resources to generate C++ code.

The PEG product family is designed to meet widely varying power, performance and memory requirements, helping to:

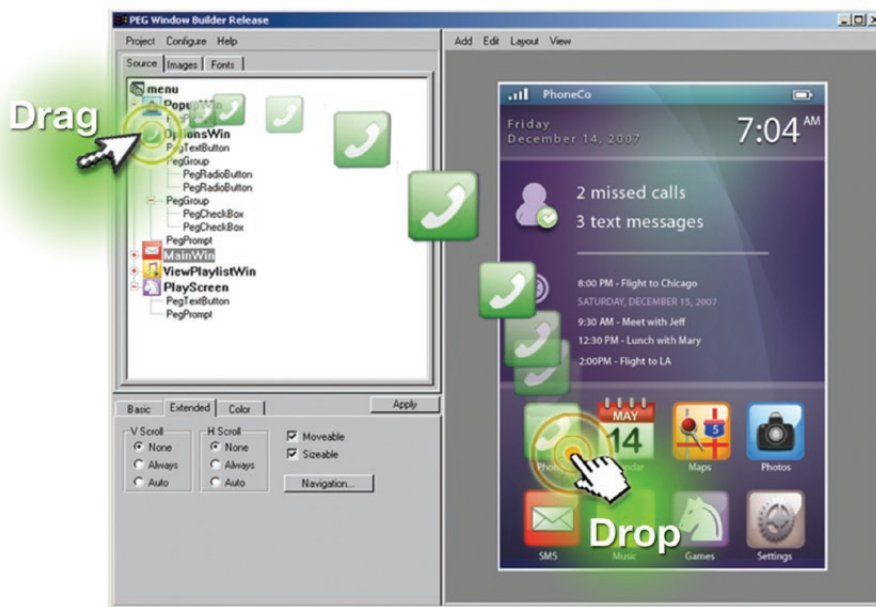
- Reduce product development risk
- Lower in-house development costs
- Accelerate time to market

PEG software accelerates GUI design for embedded devices by allowing developers to create prototypes on a Windows®- or Linux®-based PC by providing a complete visual layout and design tool to enable GUI design to take place in parallel to the embedded software/hardware development.

The PEG WindowBuilder automatically generates C++ source code that is ready to be compiled and linked into any application, further accelerating the deployment of the final product.

Freescale's PEG graphic solutions work hand in hand with real-time operating systems to incorporate LCD screens and display interfaces into future products. The GUI development tools address a variety of embedded systems, including consumer electronics, industrial, medical and communications markets.

PEG Graphics Software



Target Applications

Appliance	Consumer	General Purpose	Medical	Factory Automation
<ul style="list-style-type: none"> • Human-machine interface • Small home appliances • Large appliances 	<ul style="list-style-type: none"> • Digital TV and set-top box applications • Handheld GPS units • Printers • Smartphones • Digital cameras 	<ul style="list-style-type: none"> • Connected multimedia devices • Automotive infotainment • Home security systems • Test and measurement devices • POS kiosks 	<ul style="list-style-type: none"> • Blood glucose monitors • Electro-cardiogram • Ventilators • Patient monitors • Defibrillators 	<ul style="list-style-type: none"> • Industrial automation • Human-machine interface

Features

- Highly customizable, small footprint for cost-sensitive applications
- Multilingual support, including Unicode
- High color, including true anti-alias line and font drawing support and per-pixel alpha blending
- Designed for cross platform application development, highly portable across OS and CPUs
- Screen transition effects: slide-in, wipe, fade
- Touchscreen support
- Support for multiple graphics layers
- Runtime "theme" support
- Button, sliders, scrolling text, dials, progress bars, multiline text box and spreadsheet
- Integrated font creation and image conversion utilities

Benefits

- Reduce development time and costs
- Rapid user interface development
- Resolve product usability issues before committing to a physical design
- Standardize on graphics software solutions across products
- Differentiate your product with a sophisticated user experience
- Flexibility in selecting the processor/graphics controller

PEG Graphics Software

PEG Lite	PEG+	PEG Pro
<ul style="list-style-type: none"> Free source-code license on Freescale silicon Up to 16-bit color Very small footprint Basic widgets Dual-language capable 	<ul style="list-style-type: none"> Multiple window updates Alpha-blended images Runtime image decoders and language resources Custom widget integration Dynamic themes Multilanguage capable 	<ul style="list-style-type: none"> Screen transitions Blending of transparent images and windows True anti-aliasing Gradient manager Transparent text with drop shadow effects
One of the smallest footprints and most efficient code bases available		
Starting at 42 KB Typical 42–52 KB	Starting at 48 KB Typical 48–72 KB	Starting at 64 KB Typical 64–96 KB
Professional Services provides custom consulting and software development, including driver development UI development and graphic design.		

Licensing Option for PEG Software

(Discounted pricing shown below is for Freescale silicon only)

	Part Number	Limited Runtime License (<10 K)	Part Number	Unlimited Runtime Product License (>10 K)**
PEG Lite*	DL-PEGLT-CI-F	\$0	DL-PEGLT-PS-F	\$0
PEG+	DL-PEGPL-CI-F	\$7,000	DL-PEGPL-PS-F	\$21,000
PEG Pro	DL-PEGPR-CI-F	\$7,500	DL-PEGPR-PS-F	\$22,500
Additional Seat	PEG-WB-SEAT-F	\$1,500		
	Part Number	Developer Project License (DPL) Technical Support Renewal***	Part Number	Support and Maintenance Renewal for Unlimited Runtime Product License
PEG Lite	DLT-PEGLT-CI-F	\$1,000	DLT-PEGLT-PS-F	\$3,000
PEG+	DLT-PEGPL-CI-F	\$1,400	DLT-PEGPL-PS-F	\$4,200
PEG Pro	DLT-PEGPR-CI-F	\$1,500	DLT-PEGPR-PS-F	\$4,500

* PEG Lite is available as a free license for Freescale silicon (initial 12 months of support not included).

** Additional unlimited licensing options available to extend a license to a product family and to multiple MCUs.

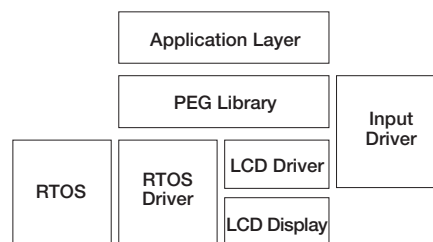
*** A PEG license includes 12 months of technical support and maintenance and three WindowBuilder developer seats.

PEG Window Builder for Rapid Development

WindowBuilder allows a designer to layout each of the screens for a project through a simple-to-use interface, providing a “what you see is what you get (WYSIWYG)” display.

- Full WYSIWYG development
 - Simulation environment for PEG+ and PEG Pro
 - Runs on PC/Linux®/X11 to allow proof of concept development
 - Enables parallel hardware/software development
 - Made available for free evaluation

PEG Software Architecture



Supported Ecosystem and Partners

RTOS

- Analog Devices VDK
- Mentor Graphics® Nucleus
- Phar Lap ETS
- CMX-RTX™
- eCosPro
- Freescale MQX™
- Enea OSE
- eSol PrKERNEL eT-KERNEL v4
- Express Logic ThreadX®
- Green Hills INTEGRITY and μ-velOSity™
- C EXECUTIVE®
- Kadak AMX™
- Keil RTX, ARTX
- LinuxWorks
- LynxOS®
- Micrium μC/OS-II
- Micro Digital SMX®
- Microsoft® WinCE, 2000, XP, Vista
- On Time
- Quadros RTXC
- Any uTRON compatible
- WindRiver® VxWorks®

Hardware

- Freescale ColdFire and Kinetis MCUs, i.MX processors and Power Architecture® cores
- Renesas H8,SH
- MIPS R3000, R4000
- All ARM® cores, including NXP and Samsung
- Intel®/Marvell StrongARM
- Altera® Nios® II
- Analog Devices Blackfin®
- Texas Instruments

Free Evaluation – freescale.com/peg

For other licensing options, please contact pegsales@freescale.com or 1-810-385-2893

Pricing subject to change. For current pricing contact a sales representative.

GUI Interface: Three Basic Drivers

- LCD driver
- RTOS driver
- Input drivers

PEG’s modular form enables a rapid development process

- The core library interfaces to different RTOSs, input devices and LCD controllers by replacing the underlining drivers

i.MX Development Tools

i.MX Community

Take your designs to the next level, reduce your design complexity and accelerate your time to market with i.MX development boards and solutions. Our i.MX development boards support a broad portfolio of products, include readily available design files and are supported by a rich ecosystem and community of developers at imxcommunity.org.

SABRE: Smart Application Blueprint for Rapid Engineering

Accelerate your time to market with the Smart Application Blueprint for Rapid Engineering (SABRE) series of market-focused development systems based on the i.MX family of multimedia applications processors. SABRE platforms deliver the advanced technology features required for your market's next-generation applications, including tablets, e-readers and automotive infotainment systems. From hardware accelerators and multimedia codecs to an expansive portfolio of software development tools including board support packages (BSPs), SABRE platforms come highly optimized with the best offerings from Freescale and our technology partners so you can maximize the performance and power savings features of the processor in your design.

SABRE Reference Designs

SABRE Board for Smart Devices

The SABRE board for smart devices introduces developers to quad-core processing and bleeding-edge multimedia and graphics applications on the i.MX 6Quad processor. Developers are able to work with the majority of the i.MX 6Quad processor's primary features while remaining schematically compatible with their i.MX 6Quad, i.MX 6Dual, i.MX 6DualLite and i.MX 6Solo designs. The SABRE board for smart devices includes complete hardware design files, BSP for Android™, Linux® and Windows® Embedded (via third party) and a bootable SD card containing an Android BSP image. More information is available at freescale.com/SABRESDB.

SABRE Board and Platform for Smart Devices Based on the i.MX 6 Series—Features

SABRE Board for Smart Devices

- i.MX 6Quad 1 GHz CPU
- Memory
 - 1 GB DDR3
 - 8 GB eMMC flash
- Display options
 - HDMI connector
 - 2x LVDS connectors
 - LCD expansion port connector (parallel, 24-bit)
- Audio features
 - Stereo audio codec
 - 2x 3.5 mm audio ports (stereo headphone and microphone)
- Connectivity and storage
 - 2x full-size SD/MMC card slots
 - mPCIe connector
 - SATA 22-pin connector
 - 10/100/1000 Ethernet connector
 - USB OTG connector
 - 1x micro USB connector
- Other
 - 20-pin JTAG connector
 - Sensors: accelerometer, compass
 - Expansion connector: MIPI CSI, I²C, SSI, SPI
 - Power management IC: Freescale PF Series 101

Red indicates change from column to the left

SABRE Platform for Smart Devices

- i.MX 6Quad 1 GHz or **i.MX 6DualLite 1 GHz CPU**
- Memory
 - 1 GB DDR3
 - 8 GB eMMC flash
 - **4 MB SPI Nor flash**
- Display options
 - HDMI connector
 - **10" WXGA LVDS panel with capacitive touch**
 - 1x LVDS connector
 - LCD expansion port connector (parallel, 24-bit)
 - **EPDC expansion port connector (i.MX 6DualLite)**
- Audio features
 - Stereo audio codec
 - 2x 3.5 mm audio ports (stereo headphone and microphone)
 - **2x board mounted digital microphones**
- Connectivity and storage
 - 2x full-size SD/MMC card slots
 - mPCIe connector
 - SATA 22-pin connector (i.MX 6Quad)
 - 10/100/1000 Ethernet connector
 - USB OTG connector
 - 1x micro USB connector
 - **GPS module with antenna**
- Other
 - 20-pin JTAG connector
 - **2x 5 MP cameras**
 - Sensors: accelerometer, compass, **ambient light sensor**
 - Expansion Connector: MIPI CSI, I²C, SSI, SPI
 - Power management IC: Freescale PF Series 101

SABRE Platform for Smart Devices

The SABRE platform for smart devices is based on the i.MX 6Quad and i.MX 6DualLite processor families and can be targeted toward any device requiring an intelligent display, connectivity, low power and amazing user experience. It provides a foundation for enabling new product designs in markets such as portable computing, education, industrial, digital displays, medical and home automation. The SABRE platform for smart devices includes complete hardware design files, BSP for Android and Linux, and a bootable SD card containing an Android BSP image. More information is available at freescale.com/SABRESDB.

i.MX Evaluation Kits (EVKs)

Our EVKs offer developers a cost-effective platform to develop, debug and demonstrate their next great product without compromising performance. EVKs support the features of the device in a small, single-board design with optional add-on modules to enable developers with a complete development platform for less than \$600. A range of peripheral and connectivity options makes the EVK suitable for developing a wide range of consumer, industrial and automotive applications.

i.MX28 evaluation kit:
freescale.com/iMX28evk

i.MX50 evaluation kit:
freescale.com/iMX50evk

i.MX53 quick start board:
freescale.com/imx53QSB

i.MX 6SoloLite evaluation kit:
freescale.com/6SLevk

i.MX Applications Processor Software Solutions

Our i.MX portfolio is provided with highly optimized BSPs, multimedia codecs and middleware to shorten product development and speed time to market all while maximizing the capabilities of the i.MX series feature sets.

Android™

Freescale supports the Android OS through BSPs for the i.MX range of application processors and featured tools such as the SABRE platform for smart devices, based on the i.MX 6Quad and i.MX 6DualLite processor families.

Using a layered approach with the right selection of components to interface into the Android stack results in a more complete and ready solution. Designers can directly develop applications on this integrated solution or easily modify their own drivers based on our reference code.

The i.MX family of applications processors running Android OS is an excellent platform for building a high-performance, low-power and cost-effective mobile device.

Features

- Integrated and tested Android framework with optimized codecs, graphics and a development and debug environment
- Common code base across i.MX SoCs to greatly reduce porting effort to next-generation i.MX processors
- Source code for selected drivers and middleware
- Source code for unit tests
- Toolchain included with the BSP
- Documentation (e.g., reference manual, user guide, release notes)



For more information, visit
freescale.com/iMXAndroid.

Linux®

Quickly get your Linux-based designs started with the i.MX family of processors by using our Linux development tools. Our goal is to provide you with a comprehensive Linux environment that is easy to develop your designs and reduce your time to market.

Linux board support packages (BSPs) are tested and certified ensuring a fully operational toolchain, kernel and board-specific modules that are ready to use together within a fixed configuration for i.MX hardware development tools. These BSPs provide the foundation you need to begin your project quickly.

Features

- Linux kernel and device drivers
- Applications/services
- Libraries
- GNU tools (e.g., compilers, linkers, etc.)
- Deployment mechanisms



For more information, visit
freescale.com/iMXLinux.

Microsoft®

Windows® Embedded Compact BSPs for i.MX applications processors are available through Freescale's wide ecosystem of partners and include offerings such as Windows Compact 7 and Windows Compact 2013.



For more information, visit
freescale.com/iMXWindowsEmbedded.

i.MX High-Performance Multimedia Codecs

These high-performance multimedia codecs enable a series of popular audio, video and image applications using i.MX applications processors. The multimedia codecs are provided as a standalone software package to support various use cases, such as audio playback, video record and image display, with codecs for H.264, H.263, MPEG-4, Windows Media Video (WMV), Windows Media Audio (WMA), Advanced Audio Encoding (AAC) and Enhanced aacPlus. Also available are imaging codecs such as JPEG, GIF, PNG and BMP. The multimedia codecs support the GStreamer multimedia framework running on the Linux operating system and OpenMAX™ framework for Android.

For more information, visit
freescale.com/iMXtools.

Partner Enablement Solutions

Design and support ecosystem for embedded solutions

ARM

Keil MCU Development Kit

The Keil MCU Development Kit (MDK-ARM) supports all ARM® Cortex®-M MCUs, including our Kinetis MCU family. It combines the µVision™ IDE/debugger with ARM Compiler toolchain to provide developers with an easy-to-use, feature-rich environment.

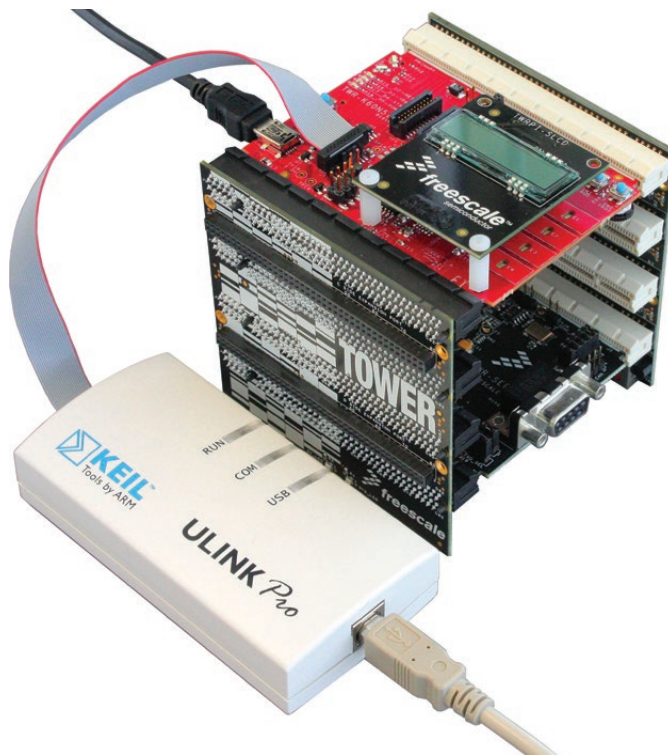
MDK provides many unique features designed to help you quickly develop your project.

- **Device database:** Automatically configures device and project parameters
- **Trace and analysis tools:** Optimizes and verifies the application by measuring performance and code coverage
- **Fully functional RTX real-time operating system:** Adds resource management to the application
- **Extensive middleware:** MDK-ARM Professional contains a rich set of middleware components, including a TCP/IP networking stack, USB host and device support and a flash file system. Kinetis K60 and K70 devices are fully supported.

MDK-ARM consists of the several powerful components for debugging and analysis:

- **ARM compilation tools:** Deliver optimized, high-performance code for all ARM-powered devices. Further code size savings can be gained by selecting the MicroLib library.
- **Debugger:** Can be configured as a simulator or target debugger and provides a single environment for application testing.
- **System viewer:** Provides an advanced method of viewing and modifying peripheral registers.
- **Analysis tools:** Work with the simulator or with target hardware via the ULINKpro™ streaming trace adapter.
- **Configurable logic analyzer:** Provides a graphical display of signals and variables. Users can display the specific instructions that caused variable changes.
- **Debugger:** Provides code coverage statistics to verify applications that require certification testing and validation.

Keil ULINKpro



- **Performance analyzer:** Displays the execution time recorded for functions, including the time spent in a function and the number of calls to it.
- **Execution profiler:** Records execution statistics for each CPU instruction, including the execution count and execution time for each instruction.

All ARM Cortex-M-based devices feature ARM CoreSight™ technology with advanced debug and trace capabilities. With a ULINK adapter it allows the user to control the CPU, single step one source or assembler line, set breakpoints while the processor is running, and read/write memory and peripheral registers on the fly. All ARM Cortex®-M3 and Cortex®-M4 devices provide data and event trace. MDK provides a number of ways to analyze this information while your system is running, including a trace window, debug viewer, exceptions window, event counters and a logic analyzer.

All Cortex-M devices with ETM provide instruction trace. The Keil ULINKpro is the only trace adapter that streams instruction trace directly to your PC. This enables debugging of historical sequences, execution profiling and code coverage analysis. The virtually unlimited stream of trace information enables MDK to provide complete code coverage of your program. Code coverage identifies every instruction that has been executed, ensuring thorough testing of your application. This is an essential requirement for complete software verification and certification.

For more information, visit keil.com/freescale.



ARM

Development Studio 5 (DS-5)

The ARM® Development Studio 5 (DS-5™) is a complete suite of software development tools for ARM processor-based cores, including Vybrid controller solutions and i.MX applications processor families. DS-5 accelerates software development by providing an easy-to-use, integrated toolchain.

Key Features and Benefits

- Support for all ARM processors
- Integration with the industry standard Eclipse IDE, which provides a large ecosystem of third-party plug-ins
- Powerful C/C++ compilation tools
- Debugger supports all phases of development from bootloader to Linux®/RTOS kernel and applications
- System-wide performance and power analysis for Linux and Android™
- Correlation of performance bottlenecks (e.g., cache misses, interrupts) and software execution
- Fast simulator for ARM software development on the host computer with typical speeds above 250 MHz
- Support and maintenance contract
- Flexible C/C++ editor and project manager

DSTREAM™

The ARM DSTREAM high-performance debug and trace unit enables software debug and optimization on any ARM processor-based hardware target. DSTREAM enables the connection of DS-5 debugger and third-party debuggers to ARM processor-based devices via JTAG or serial-wire debug. DSTREAM uses FPGA acceleration to deliver high download speeds and fast stepping through code on single- and multi-processor devices.

DS-5 Debugger and DSTREAM



Key Features

- Code download at speeds of up to 2500 Kb/s
- JTAG clocks of up to 60 MHz provide fast software upload over the existing debug port
- Large 4 GB trace buffer enables long-time trace on fast targets

Energy Analysis

The ARM Energy Probe is an easily deployable Streamline accessory that collects voltage, current and power from up to three probe points in the system to allow software developers to optimize system energy consumption.

Key Features

- **Simple setup:** No dependency on ICE or trace units means easy connection and cost-effectiveness to enable wide deployment.

- **Multiple channels:** Each of the three channels is independently configured to permit simultaneous measurement of peak and average current, voltage and/or power on key system components.
- **Energy information:** Just select any time slice on the Streamline Timeline view to accumulate power readings and estimate the energy consumed within that time window.
- **Smart data synchronization:** Streamline uses advanced DSP techniques to detect known power consumption patterns on the CPU to synchronize performance data and the probe readings, which are received via an independent USB connection to the host PC.



Green Hills Software

Runtime Software: Application Specific, Middleware and Operating Systems

INTEGRITY® Multivisor™ Secure Virtualization

INTEGRITY Multivisor technology is the industry's most secure, reliable and flexible embedded virtualization solution. Leveraging hardware virtualization features found on the ARM® architecture core, INTEGRITY Multivisor virtualization guarantees the safe and secure execution of open guest operating systems such as Linux®, Android™ and GENIVI® running alongside system-critical applications and services found in automotive, networking and industrial applications.

INTEGRITY® real-time operating system

The flagship of the Green Hills Software family of operating systems, the INTEGRITY RTOS provides an advanced partitioning architecture for embedded systems that requires guaranteed reliability, absolute security and optimum deterministic real-time response. On Freescale processors with an MMU, the INTEGRITY RTOS guarantees applications the necessary CPU and memory resources while fully protecting the operating system, device drivers and other applications from errant and malicious code. Unlike other memory-protected operating systems, the INTEGRITY RTOS never sacrifices real-time performance for security and protection.

INTEGRITY

μ-velOSity™ real-time microkernel

The royalty-free μ-velOSity microkernel is the smallest of the Green Hills Software RTOS family. Its frugal memory footprint of 2.6 KB and simple programming interface are perfect for lightweight applications running on Freescale MCUs without an MMU.



Software Development Tools

MULTI® IDE, TimeMachine™ and optimizing compilers

The MULTI IDE is a complete integrated development environment for embedded applications written in C/C++, and Embedded C++. It includes optimizing compilers, advanced multicore debugger, profiler, run-time memory checking, MISRA C quality checker, project builder, editor, instruction set simulator and more.

The TimeMachine debugging suite extends the MULTI environment by leveraging trace data from Freescale processors, enabling embedded software developers to execute their application in reverse and find and fix bugs faster.




Hardware Development Tools

Green Hills Processor Probes

The Green Hills Probe is an advanced multicore, multi-user hardware device that connects through the JTAG or BDM. It enables deep visibility into the processor during board bring-up and, when used with the MULTI debugger, brings ultra-fast program download and run-control for multicore application debugging.

Green Hills Software's SuperTrace™ Probe adds trace capability to the Green Hills Probe and can capture up to 8 GB of trace data on multicore ARM architecture cores. With its exceptionally large storage capability, the SuperTrace Probe can collect billions of trace frames, radically extending program visibility to help find more bugs faster and with more precision.

Software and Solutions Integrator (SSI)

Custom Engineering Services

Green Hills Software's Custom Engineering Services offer system architecture guidance and software development services, such as adding special features, customizing existing products and inventing new technologies.

Services include custom development for new architectures, DSP specialization, Frozen Branch, MULTI IDE customization, advanced debugging, third-party extension/porting, hardware solutions, customer services and instruction set simulators.

Supported ARM families

- i.MX, Kinetis and Vybrid product families
- ARM Cortex®-M4/M0, A5/M4, A8/A9, A15 processors

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



Mentor Graphics

Runtime Software: Application Specific, Middleware and Operating Systems

Mentor Embedded Nucleus® RTOS, Mentor Embedded Linux®, Android™

With the Nucleus RTOS, you can rely on an RTOS deployed on nearly three billion devices. In addition to a scalable kernel with a footprint as small as 2 KB, you can make use of a rich set of networking, connectivity, storage and security functionality while keeping power consumption under control with an integrated Nucleus power management framework.

Mentor Embedded Linux (MEL), based on the Yocto Project™, enables you to customize your product with a supported customized Linux solution. In addition to board support that enables you to deliver rich multimedia experiences, MEL is pre-enabled with out-of-the-box tracing and performance analysis, so you can more easily address the functional and performance needs of your embedded device.

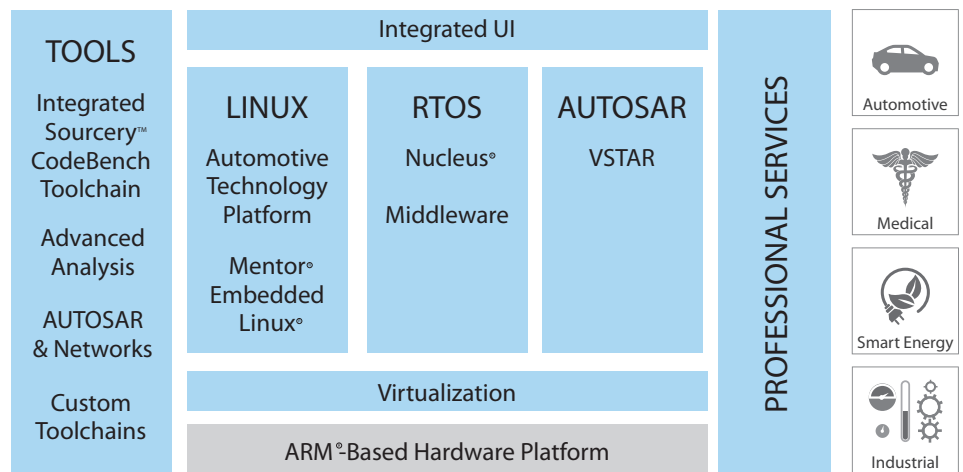
Mentor also provides both UI and customization solutions on Android-based devices to speed time to market.

Software Development Tools

Mentor Embedded Sourcery™ CodeBench

Sourcery CodeBench goes beyond a compiler to provide developers with an array of C/C++ development tools for ARM®-based devices. Developers gain far greater insight into bare metal, Nucleus or Linux®-based embedded systems through the powerful IDE, optimized GNU/GCC compiler, advanced hardware debugging and functional, timing and performance analysis features.

Accelerating ARM-Based Design



Linux is the registered trademark of Linus Torvalds in the U.S. and other countries.

Mentor Embedded AUTOSAR solutions

Mentor Graphics® offers several AUTOSAR tools specifically for developing vehicular embedded systems. Design, explore and compare AUTOSAR based electronic and SW architectures with the Volcano Vehicle Systems Architecture (VSA) system design tool. Use the Volcano Vehicle System Integrator (VSI) execution environment to get early validation of software functionality on virtual ECUs. Build your CAN, LIN and FlexRay networks with the Volcano VSA COM Designer and maintain timing requirements, variants, configurations and releases. The Volcano VSTAR AUTOSAR Basic Software (BSW) stack offers a fully AUTOSAR 4.0 compliant and scalable middleware for ECU design with optional support for LIN, CAN, and FlexRay stacks.

Software and Solutions Integrator (SSI)

Mentor Embedded Professional Services

Unleash the full power of your product designs with unmatched expertise from Mentor Embedded Professional Services. Mentor experts not only assist in developing and optimizing software for intelligent ARM-based devices, but they also bring a comprehensive approach to the requirements of product planning, development and deployment. Onsite consulting engagements help system developers set up and configure development environments to build Linux- and Android-based devices. Mentor's global team of service professionals are active and trusted participants within the open source community. They bring expertise in optimizing Linux, Android and open source software serving the automotive, medical, mobile handset, smart energy and industrial markets.

For more information on Mentor Graphics, please visit freescale.com/MentorGraphics.



QNX Software Systems

Runtime Software: Application Specific, Middleware and Operating Systems

QNX® OS

The QNX® OS is a full-featured and robust OS that scales to meet the requirements of real-time embedded systems. It offers true microkernel design, modular architecture and a clean strategy for migrating from single-core to multicore processing. This OS offering addresses automotive safety, medical devices and security.

QNX CAR Platform

The QNX CAR Platform for infotainment supports a rich choice of application environments and smartphone platforms, as well as a comprehensive set of pre-integrated components to build connected, media-rich infotainment systems.

QNX Accelerator Kit

The QNX Accelerator Kit offers freely available pre-integrated software for components such as wireless and touchscreen graphics that let developers move quickly through the prototyping phase.

QNX Acoustic Processing Suite

The QNX Acoustic Processing Suite is a modular library of field-proven algorithms that improves the clarity, quality and accuracy of voice communications for hands-free and speech recognition systems.

QNX Multimedia Suite

The QNX Multimedia Suite is a fully customizable, full-featured framework for quickly building high-value digital infotainment solutions.

Software Development Tools

QNX Momentics® Tool Suite

The QNX Momentics Tool Suite is a comprehensive, Eclipse-based integrated development environment with innovative profiling tools for maximum insight into system behavior. These unique tools give developers

QNX Powers What Matters



at-a-glance views of real-time interactions, memory profiles and more, enabling shorter debug times and faster time to market. Multicore-specific tools help developers migrate code cleanly from single-core to multicore systems and safely optimize performance.

QNX SDK for HTML5

The QNX SDK for HTML5 is an extension of the open source BlackBerry® WebWorks™ framework, specially optimized for automotive environments. It allows developers to write, test and package feature-rich automotive apps based on HTML5, CSS3, JavaScript® and other open standards. Just as important, it provides the missing glue between high-level apps and the car, through specialized APIs that provide access to automotive devices and hardware. These APIs include JavaScript classes that can access the underlying services offered by the QNX CAR application platform.

Software and Solutions Integrator (SSI)

QNX Professional Services

QNX Professional Services helps customers drive innovation while minimizing risk. This

dedicated group of engineers offers a unique mix of experience, skills and contacts, as well as clean IP to directly address key development challenges and ensure success. From concept through production to maintenance, QNX Professional Services complements and enhances your company's strengths to help you hit your production deadlines on time, on budget and on spec with a product that meets or exceeds your customer's expectations.

QNX Automotive Solutions

QNX Automotive Solutions provides quality engineering support to help tier one system integrators and OEMs eliminate program delays and meet or exceed project milestones and start of production (SOP) commitments. Based on extensive hands-on experience in automotive development, support, and integration in all areas of the QNX product portfolio, its team of senior engineers applies field-proven engineering and project-management practices to ensure successful results.

For more information about QNX, please visit freescale.com/QNX.



Wind River

Runtime Software: Application Specific, Middleware and Operating Systems

Wind River® VxWorks®, Wind River Linux®, Android™

Wind River is proud to support Freescale i.MX processors with VxWorks, the industry-leading real-time operating system with a demonstrated track record of success across millions of applications in the embedded systems market. Deployed in diverse verticals, from consumer devices to aerospace and defense, and from networking to medical, VxWorks maintains its leadership position by providing a mature and proven foundation for customer innovation.

Wind River also supports i.MX processors with a market-leading, commercial-grade embedded Linux platform and a suite of Android-based products for embedded applications.

Software Development Tools

Wind River Workbench, Diab Compiler, Simics

The pressures to develop more efficiently are real. You're building complex products with shrinking budgets and distributed teams, and your competition is moving at a dizzying pace. Wind River has thoughtfully designed a collection of technologies to help you power through critical activities in every phase of your development life cycle.

When your development environment is built in lockstep with your Wind River platform, you get the highest level of control to configure, analyze and debug your system. Extend Wind River Workbench with Wind River Workbench On-Chip Debugging for agent and agentless debugging, and pair it with Wind River Diab Compiler for highly optimized, standards-compliant object code. Take advantage of full

A Foundation for Your Innovation



system simulation with Wind River Simics to break all the rules of software development as you know them and ship faster than you ever thought possible.

Hardware Development Tools

Wind River Probe and ICE

Use Wind River JTAG debugging tools to take full control of your entire system: CPU, operating system kernel, device drivers and applications. Your system may boast one core or multiple cores; it may be running multiple operating systems across multiple CPUs or on devices distributed around the world and may even be set up as a virtualized system. Regardless of the complexity of your configuration, JTAG debugging tools from Wind River give you control of the entire system in one context, from one window.

Software and Solutions Integrator (SSI)

Wind River Professional Services

Wind River offers services designed to help customers attain a competitive advantage. We provide consultative thought leadership, deep technical capabilities, and innovative industry solutions to help you overcome your most strategic and pressing development challenges.

For over 30 years, Wind River Professional Services has been here to serve as your partner, working together with your teams so they can focus on your core competencies and deliver market-leading devices and systems. We help your teams bring safe, secure, reliable and compliant mission-critical systems to market, delivering services across the entire range of planning, development and management.

For more information about Wind River, please visit freescale.com/WindRiver.

WIND RIVER

Ac6

Ac6-training is a leading provider of training services on embedded systems, from the deepest hardware elements to the most advanced software components, including programming languages and their use for embedded systems. Freescale processors and MCUs are described with detailed hardware courses on CPU cores, peripherals and buses. Application-oriented courses with hands-on labs help you build industrial and embedded systems.

Ac6-training also covers low-end, bare-metal or RTOS-enabled MCU-based deeply embedded systems rather than high-end, Android™, Linux® or Windows®-based systems; in all cases Ac6 covers both system-level or application-level subjects.

Ac6 has also developed innovative programming tools for building, programming and managing Linux embedded systems—the Ac6 System Workbench for Linux—that are

provided free of charge to all Linux courses attendees.

For more information, please visit freescale.com/Ac6.



RUNTIME SOFTWARE: APPLICATION SPECIFIC, MIDDLEWARE AND OPERATING SYSTEMS | SSI SERVICES | TRAINING SERVICES

Adeneo Embedded

Adeneo Embedded provides solutions for Freescale i.MX and Vybrid technologies, such as reference board support packages for embedded Linux®, Android™, QNX® and Windows® Embedded Compact, as well as multimedia and graphical solutions based on Qt and Silverlight technologies. For over 10 years in partnership with Freescale, Adeneo Embedded has developed embedded operating system and software integration on high-end ARM®-embedded MPUs, including all i.MX MPUs up to the recently released i.MX 6 series, for which Adeneo Embedded is the editor of the Windows Embedded Compact 7 and Compact 2013 reference BSPs.

BSPs and drivers reference solutions

Together, Freescale's i.MX 6 advanced multicore architecture and Adeneo Embedded's state-of-the-art BSPs provide the most efficient and successful solution for the development of medical, industrial, automotive and consumer embedded devices.

Software and solutions integrator (SSI)

Services include in-depth technical training, dedicated support contracts and full development services from low-level BSP and drivers up to advanced graphical applications. These services are focused on helping OEMs develop successful and robust embedded devices for medical, industrial, automotive and consumer markets.

Training services

Training sessions have been adapted to Freescale's development platforms to cover specific integration of Embedded Linux, Android, QNX or Windows Embedded Compact on i.MX and Vybrid architectures. Training sessions range from one day to one week and are available as "public" multi-customer events, ideal for initial technology ramp-up and as "private" onsite sessions to cover customer specific requirements.

For more information, please visit freescale.com/Adeneo-Embedded.



INDEPENDENT DESIGN HOUSE (IDH) SERVICES | EMBEDDED BOARD SOLUTION

Advantech

Founded in 1983, Advantech delivers visionary and trustworthy network computing solutions that empower businesses. By embedding its innovative mission-critical hardware, leading telecom and networking equipment, manufacturers are able to power the world communications infrastructure. With an

extensive deployed base, Advantech Networks & Telecom Group designs both standard and custom products for ATCA, MicroTCA and OEM-ready network appliances. In partnership with major CPU, NPU and DSP manufacturers, the company partners locally with customers to evaluate project requirements, share

design knowledge and develop optimized solutions together—all backed up by its global deployment expertise.

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

ADVANTECH

Arcturus

IP voice communication, management, M2M middleware and system solutions

Arcturus Networks, Inc. is a leading provider of embedded solutions for communication and industrial applications. Recognized as a pioneer, Arcturus has contributed to the innovation of thousands of products and has helped to establish embedded Linux® as a de facto global standard. Since 2002, Arcturus

has focused on middleware solutions to enable device management, M2M, IP audio and IP voice communication, including audio intelligibility and psychoacoustics. Arcturus middleware, reference designs and modular hardware systems reduce time-to-market and overall project risk by combining proven solutions with direct support.

Arcturus has partnered with Freescale for over a decade, recently developing specialized reference designs with bundled middleware packages targeting building systems,

transportation and healthcare markets. Arcturus is a member of the ARM® Connected Community, offering support of a range of ARM cores from ARM® Cortex®-M4 MCUs to ARM Cortex®-A8 application processors, Linux, Android™, MQX™ RTOS and bare-metal systems.

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



Arium

Arium is a leading supplier of hardware-assisted debug tools, providing controllers with flexible debug connectivity for Freescale devices with ARM® cores. The LX-1000 Trace Port Analyzer and the LC-500S are the most popular configurations. The LX-1000 is modular and supports either parallel ETM trace or serial trace. The LC-500S offers reliable run control and intuitive stepping features and is designed for speed with fast file and image downloads and quick stepping through code. When coupled with SourcePoint™, Arium's flagship debugger, the software developer is provided maximum visibility into the complex

hardware-software and software-software interactions. Both controllers operate on Microsoft® Windows® and Linux® hosts, and they offer debug of UEFI and Linux kernel, device driver and application source code.

SourcePoint Software Debugger

With the daily tasks of the software developer in mind, SourcePoint is rich in the firmware development attributes necessary for SoC development and powerful enough for applications development. It includes address translation, dynamic page translation, multiple code formats and a self-diagnostic test suite.

It operates in multiprocessor and multicluster environments and runs on either Windows or Linux hosts. SourcePoint offers UEFI and Linux OS-aware features.

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



Atollic

Atollic® is committed to helping engineers create better embedded systems with C/C++ development and testing tools that provide unique features for improving software quality. Unlike traditional C/C++ development tools, the Atollic TrueSTUDIO® IDE guides users through the process of developing high-quality embedded software. Atollic TrueSTUDIO brings the best principles from the automotive and aerospace industries to all embedded developers.

Atollic TrueSTUDIO is a world-class compiler and debugger IDE with integrated features for source code reviews, MISRA C checking, code complexity analysis and team collaboration. The debugger includes a crash analyzer and

RTOS kernel awareness, as well as dual-core and multiprocessor support.

Atollic TrueVERIFIER® adds in-target software test automation with auto-generated and auto-executed unit tests, enabling better-tested products.

Atollic TrueANALYZER® adds system-level test quality measurement, performing in-target execution flow analysis (up to MC/DC coverage) and providing test and quality confidence.

Atollic's development services complement their development and testing tools: Atollic TrueSTUDIO, TrueVERIFIER and TrueANALYZER.

Focused on the Freescale Kinetis, Vybrid and i.MX processor families, development services deliver lower development costs, shorter time to market, lower risk of field upgrades and fewer field returns. Typical services include customized software platforms, application development, integration of middleware, wireless connectivity, software testing, code compliance, and metrics and source code review.

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



Bluetechnix

Optimized embedded systems and sensor solutions of highest quality—Experts in 3D time-of-flight sensor technology

In business since 2004, Bluetechnix is well known for being a manufacturer of high-quality embedded systems such as time-of-flight (ToF)-based depth sensors, 2D smart cameras and system on modules (SoM) for Blackfin® DSPs and i.MX applications processors using ARM® technology. More than 20 developers continuously expand the Bluetechnix broad

product and service portfolio. Their R&D department is tightly connected to the Vienna University of Technology (TU Vienna), UAS Technikum Wien and the Austrian Academy of Science to incorporate the latest technological advancements in their applications. Bluetechnix provides an ISO-accredited test center for electromagnetic compatibility (EMC) measurements at its development headquarters in Vienna, allowing them to provide product certification services in-house. State-of-the-art products, flexibility and personal support are the cornerstones of their long-term success.

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



Boundary Devices

Boundary Devices is a complete hardware and software solutions provider specializing in network-connected, fanless, low-power multimedia devices. With decades of experience designing ARM-based boards and numerous i.MX processor designs completed based on the i.MX51, i.MX53, and i.MX 6 processors, Boundary Devices is uniquely positioned to provide customers the perfect solution for i.MX processor-based designs. In the i.MX 6 family, Boundary Devices has released a wide variety of products, including the BD-SL-i.MX 6 series low-cost development platform, the Nitrogen6X single board computer, and the Nitrogen6X-SOM.

These products were designed to allow customers to get to market quickly and with a reasonable price. In situations where the standard product is not quite right, Boundary Devices can design custom hardware platforms with associated BSPs. The key to any embedded project is software support, and the i.MX 6 platform from Boundary Devices supports many different operating systems including QNX, Android 4.1 Jelly Bean, Windows Embedded Compact 7 and various flavors of Linux.

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



congatec AG

congatec AG, headquartered in Deggendorf, Germany, is a leading supplier of industrial computer modules using the standard form factors Qseven, COM Express®, XTX and ETX. congatec's products can be used in a variety of industries and applications, such as industrial automation, medical technology, automotive supplies, aerospace and transportation. Their core knowledge and technical know-how include unique extended BIOS features as well as comprehensive driver

and board support packages. Following the design-in phase, customers receive support via extensive product lifecycle management. The company's products are manufactured by specialist service providers in accordance with modern quality standards. congatec currently has 124 employees and entities in Taiwan, Japan, the U.S. and the Czech Republic.

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



Cybercom

Cybercom is Freescale's proven partner for Bluetooth® connectivity. For 15 years, Cybercom has been contributing in the evolution of Bluetooth technology, developing systems and products for automotive, medical, consumer and industrial applications. Together, Freescale and Cybercom are able to provide robust Bluetooth connectivity, meeting vehicle manufacturers' requirements on the latest Bluetooth features and device interoperability. Cybercom blueGO significantly reduces time to market and the need for device interoperability testing.

Cybercom blueGO is a professionally maintained Bluetooth software application

framework, offering tier-1 suppliers a robust, generic and portable multiprofile and multiconnection Bluetooth solution. The underlying stack, integrated in the solution delivered by Cybercom, is the market-leading Blue SDK Bluetooth stack from its partner iAnywhere.

Cybercom is a Nordic consulting company, designing and adding intelligence to products and devices, assuring efficient and manageable connectivity, providing a future connected world with meaningful solutions.

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



Digi International

Digi provides wireless solutions for vertical M2M applications, including purpose-built products for medical devices and energy applications. Its low-cost development kits make it easy to get to market quickly. Full support is provided for Android™, Linux® and Microsoft® Windows® Embedded Compact. The Device Cloud™ by Etherios, a Digi International company, provides remote monitoring and control from anywhere in the world, and the new Device Cloud Connector

provides built-in cloud connectivity for Freescale MPUs and MCUs. Products include Systems-on-Modules (SOMs) for Freescale i.MX28 and i.MX53 applications processors with integrated 802.11a/b/g/n wireless and Bluetooth® 4.0. With application and wireless design services, Digi and Etherios are true end-to-end wireless solutions experts.

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



Elektrobit

EB's automotive software business has established itself internationally as one of the most important suppliers of embedded software solutions for the automotive industry. In addition to the development of innovative products, EB also specializes in services and consulting supplying implementations of serial software solutions for a broad range of infotainment, navigation, HMI, driver assistance and AUTOSAR systems. Based on more than a decade of expertise in developing software for automotive ECUs, EB offers industry-leading basic software and

corresponding configuration and analyzing tools. As a full-service provider, EB's global and knowledgeable ECU service teams take over responsibility for specific parts or even for the whole project when introducing the latest technologies like Ethernet, multicore systems, or ISO 26262-compliant functional safety products and solutions. Thanks to the close partnership with Freescale, EB's ECU software runs smoothly on several Freescale MCUs.

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



Embedded Access

Embedded Access provides customized board support packages (BSPs), boot loader, legacy code integration, full application development, driver development and communication protocols. For a project quick start, a shell of your application can be created with all components customized to the project's specification ready for high-level application code. MQX™ software experts handling your platform specifics allow your team to focus on their expertise, reducing development time, total costs and project risks.

Embedded Access can provide a customized release of the MQX platform for just about any

Freescale 32-bit MCU or MPU, including the Freescale MQX RTOS, RTCS TCP/IP stack, MFS file system, USB host, USB device, web server and more. Add-on packages are available, including GUI development, flash file system, XML Parser & Framer, SNMPv3 and the LUA scripting language. The MQX platform provides efficient, real-time performance and unprecedented scalability, allowing customers to fit a customized, feature-rich solution into a memory constrained MCU.

Embedded Access provides training for MQX platform components: MQX RTOS, RTCS TCP/IP stack, MFS file system and USB

stacks. Training can be held at your facility to minimize costs and eliminate travel time for your team. Courses typically run between two and four days.

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



EMBEDDED BOARD SOLUTIONS | IDH SERVICES

Embest

Embest is a global provider of embedded hardware and software. Formed in 2000, it's now part of element14 and Premier Farnell, global electronic components distributors with more than 70 years in the business. Embest offers professional development tools, evaluation boards, single-board computers (SBC) and hardware and software development services and applications. It also is an authorized distributor of ARM®, Parasoft®, Hewlett Packard™ and Cadsoft™ in China. They

provide embedded development tools, single-board computers and core modules, as well as OEM/ODM services for embedded products. Its vision is to use its technology and services to help customers develop and produce embedded products faster, more efficiently and with a high level of quality. The company works closely with ARM and leading ARM-based MCU and MPU suppliers and is also an ARM-approved training center (ARM ATC). Customers are sure to receive high efficiency

tools, mature embedded solutions, design and production services and complete support from Embest.

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



EMBEDDED BOARD SOLUTIONS | HARDWARE DEVELOPMENT TOOLS | IDH SERVICES | RUNTIME SOFTWARE: APPLICATION SPECIFIC, MIDDLEWARE AND OPERATING SYSTEMS

Emcraft

Emcraft Systems provides system on modules (SoMs) for the Freescale Kinetis K70/K61 and Vybrid VF6/VF5 devices. The SoMs are specifically designed to make it easy, quick and cost-effective for embedded system designers to start using the Freescale devices in their applications. Emcraft Systems' starter kits provide a low-cost hardware platform, enabling development of embedded applications using the Kinetis K70/K61 and Vybrid VF6 devices. The starter kits are based on SoMs, include a breadboard area and come with the schematics of the baseboard. This allows for quick custom development and

easy transition from prototyping to building an end product. The kits can be used either standalone or in the Freescale Tower System.

Emcraft Systems offers hardware design, embedded software development and turn-key contract manufacturing services for customers that use Emcraft SoMs.

Pre-negotiated prices and close relationships with our contract manufacturing partners allow Emcraft to quote custom baseboard turn-key projects. Thus, customers can leverage volume purchasing power to save money and time.

Emcraft Systems provides embedded Linux® BSPs and cross-development environments for the Kinetis K61/K70 and Vybrid processor families. The cross-development environments for both Kinetis and Vybrid include the GCC cross-compiler and GDB debugger, as well as a number of preconfigured, ready-to-build and run sample projects to serve as helpful starting points for application development.

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



Emtrion

When it comes to high-quality and reliable high-end embedded systems design with a long-term useful life, Emtrion is the partner of choice. Emtrion produces hardware and software that helps drive smart companies forward. Its engineers, with more than 10 years of experience, provide customers with new and inventive embedded solutions again and again.

In keeping with its philosophy, Emtrion fosters partner networks that help it remain one step ahead in innovation. Its team is highly motivated and specializes in partnering

closely with clients to complete projects. Headquartered in Karlsruhe, Germany, Emtrion supplies companies around the world, the majority of which operate in the fields of automation engineering, medical engineering, measurement and control, as well as railway engineering.

Emtrion offers the following services: project management/coaching, technical seminars and workshops.

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



FirstView

FirstView Consultants is an Austin, Texas-headquartered company with rapid prototyping, system architecture and software solutions expertise in the automotive, medical and industrial markets. They custom tailor solutions, such as filling in gaps all the way to developing complete designs from idea to working solution.

They can scope and lead turn-key production or augment a team for targeted modules. Their capabilities within embedded systems run the

entire spectrum, from high-level planning and system architecture to specific hardware and software duties. Their dedicated multimedia team can improve system performance by analyzing and optimizing the graphics, video, camera and image processing, and their software team can create custom BSPs or fill in the gap by providing the expertise to create specific drivers.

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



FreeRTOS

FreeRTOS is a market leading RTOS from Real Time Engineers Ltd. that supports more than 30 architectures and receives more than 100,000 downloads a year. It is professionally developed, strictly quality controlled, robust, supported and free to embed in products without any requirement to expose proprietary source code. FreeRTOS has become the de facto standard RTOS for MCUs by removing common objections to using free software, and in so doing, providing a truly compelling free software model.

You can take a product to market using FreeRTOS without even talking to them, let alone paying any fees, and thousands of companies do just that. If, at any time, you would like to receive additional backup, written guarantees or indemnification, then there is a simple low cost commercial upgrade path. Your peace of mind comes with the knowledge that you can opt to take the commercial route at any time you choose.

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



GainSpan

GainSpan, a spinoff of Intel® Corporation, is an innovator and leader in enabling the Internet of Things through its wireless connectivity solutions. With a broad portfolio of ultra-low-power Wi-Fi® chips, modules and software, GainSpan allows customers to quickly and easily add connectivity to products targeting the connected home, smart energy, healthcare and audio and video applications, as well as industrial and commercial control/monitoring applications.

GainSpan's new ultra-low-power 802.11b/g/n GS2000 is a highly integrated, multimode, System-on-Chip (SoC) containing two ARM® Cortex®-M3 processors. The solution is highly flexible. The IPv4/IPv6 networking stack and services usually run on the GS2000 when paired with smaller MCUs such as the Kinetis L family; however, the stack and services can run on MCUs/MPUs such as the i.MX family.

Together, GainSpan and Freescale are accelerating development and adoption of a whole new class of battery- and line-powered connected devices.

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



IDH SERVICES | EMBEDDED BOARD SOLUTIONS

Garz & Fricke

Garz & Fricke GmbH has been developing and producing intelligent embedded systems since 1992. Made in Germany, its products stand for quality and progressive technology.

With 86 engineers, computing specialists and technicians in hardware and software, Garz & Fricke GmbH is the perfect OEM supplier for industrial controllers, metering and labs electronics, intelligent displays for automotive and naval designs, as well as vending machine technology.

Their product portfolio contains application-ready products such as intelligent touch panel computers, human-machine interface and/or control applications. Garz & Fricke provide full service from product set-up to mass production, including prototyping, hardware and software development. Their own THT and SMT production lines enable them to tune all related processes to each other.

Garz & Fricke GmbH focuses on a compact and complete touch panel series for integration into professional devices or standalone panels for the visualization and communication in industrial and home networks.

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



TRAINING SERVICES

HILF!GmbH

Consulting, training, system design and software development

As one of the leading training providers, HILF!GmbH offers more than 70 different, high-level topic centered training classes. As a global player, these courses are offered as onsite training as well. To date, HILF!GmbH has successfully trained more than 25,000 customers.

With a strong background working with Motorola, having started as an Authorized Motorola Training Partner in 1998, they provide comprehensive services for the complete Freescale portfolio. These services include consulting and training, as well as system design and software development, successfully performed in more than over 120 projects for large customers in the automotive industry, industrial automation, avionics and telecommunication.

Their portfolio includes the i.MX5x family of processors, i.MX 6 series processors and Kinetis MCUs based on the ARM® Cortex® architecture, the MPC5700 family, the P3041 QorIQ processor and eTPU programming.

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



IAR Systems

IAR Systems® provides a range of in-circuit debugging probes with support for ARM® and ARM Cortex® cores. The probes are targeted for simplified, seamless and more flexible development workflows, and are all completely integrated with IAR Embedded Workbench®.

I-jet™ is a high-performance debugging probe that enables power debugging by measuring target power consumption with a high degree of accuracy. IAR Systems' innovative power debugging technology is a methodology that provides developers with information about how the software implementation of an embedded system affects the system's power consumption and allows optimizations for lower power consumption. This technology can be extended with I-scope™, which adds in-circuit current and voltage measurement capabilities to I-jet.

The real-time, in-circuit debugging probe JTAGjet™-Trace offers advanced trace functionality, such as full instruction trace and function profiling, for ARM and ARM Cortex-based applications.

IAR Systems also supports Kinetis and Vybrid Tower kits, as well as the Freedom development platform.

IAR Systems is the world's leading supplier of embedded development tools. The C/C++ compiler and debugger tool suite IAR Embedded Workbench offers a complete set of development tools for embedded applications. It integrates the highly optimizing IAR C/C++ compiler, assembler, linker, librarian, text editor, project manager and C-SPY debugger in a user-friendly IDE. Industry-leading code generation technology generates efficient code for size and speed.

IAR Embedded Workbench is available for nearly the entire line-up of Freescale MCUs, including Kinetis ARM® Cortex®-M4 and ARM Cortex®-M0+ families, Vybrid controller solutions, i.MX families and the S08, HCS12 and ColdFire families. It is integrated with Freescale MQX Software Solutions and Freescale Processor Expert. Regardless of which Freescale device is chosen, customers will experience the same intuitive user interface coupled with target-specific support for each device.

IAR Systems also offers state machine tools and provides professional worldwide technical support.

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



SSI SERVICES | EMBEDDED BOARD SOLUTIONS

iWave Systems

iWave Systems is a design house specializing in the area of embedded hardware and software engineering services. iWave Systems is headquartered in Bangalore, India, which is considered to be one of the hottest technology centers in the world. iWave offers complete integrated solutions for product development and systems engineering.

Managed by technology professionals, iWave Systems is a registered private limited

company with more than two decades of experience. iWave Systems has extensive experience in industrial, automotive and medical domains.

iWave's products/services range from integrated real-time solutions and turnkey development, embedded software (e.g., RTOS, protocols, firmware, middleware/application, BSP, device driver development and porting services), board level hardware and FPGA

design and development services, ASIC modeling, simulation and verification to DSP (audio and video codec).

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



EMBEDDED BOARD SOLUTIONS

Ka-Ro

Ka-Ro's family concept of Computer-on-Modules is unique. Ka-Ro is a full-service provider with its own reference kits, production-ready modules, Windows CE and Linux® BSPs. Ka-Ro's comprehensive range of services covers customer- and application-specific development and component sourcing, and extends to individual or series manufacturing for the industrial investment

product markets. In the worldwide electronics market, Ka-Ro's Computer-on-Modules stand out with their unique characteristics, thanks to their superlatively small formats and low-power consumption. Its in-house, high-end production capabilities mean that Ka-Ro can offer aggressive, customer-oriented pricing.

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



Kontron

Kontron is a global leader in embedded computing technology. With more than 40% of its employees in research and development, Kontron creates many of the standards that drive the world's embedded computing platforms. Kontron's product longevity, local engineering and support, and value-added services help create sustainable and viable embedded solutions for OEMs and system integrators. Kontron works closely with its customers on their embedded application-ready platforms and custom solutions, enabling them to focus on their core competencies. The result is an accelerated time to market,

reduced total cost of ownership and an improved overall application with leading-edge, highly reliable embedded technology. Through an extensive portfolio, based on internationally accepted industry standards for hardware, software and connectivity, Kontron solutions range from COTS standard-based products, fully-integrated application-ready systems and platforms, as well as extended software service.

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



HARDWARE DEVELOPMENT TOOLS | SOFTWARE DEVELOPMENT TOOLS

Lauterbach

Debugger, real-time trace, logic analyzer

Lauterbach provides TRACE32®, an integrated debug environment for embedded designs. With its modular concept, the environment supports all ARM®-based chip architectures and can be easily migrated to other processors by simply replacing the debug cable. Data—captured and traced from the core and from external signals on the PCB—provide this information, which support and accelerate the software development of embedded applications in many aspects. The major task of a debugger is root cause detection of a bug, but it also provides Lauterbach

TRACE32 with runtime measurements, code coverage tests and energy profiling dedicated functions to optimize embedded systems' safety, performance and power efficiency. The PowerView is the GUI to the developer, which analyzes and presents the traced data in alphanumeric or graphical form, even correlating it with the high-level language (HLL) source code. Lauterbach's TRACE32 tools are appreciated tools and used worldwide in the process of development, validation and certification of embedded software.

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



IDH SERVICES

M2CoreTech

M2CoreTech provides the total solutions required for various multimedia terminals such as hardware design, board-supported packages and software applications (e.g., codec and protocol).

The company's main business areas are AVN (for automatic), digital information display (DID), mobile TV, PND/portable multimedia player (PMP), smart terminal (for supporting

the various functionality) and home network markets. Customers can enjoy the following benefits:

1. Easier development of their target product
2. Obtaining the best optimized performance
3. Speeding up entry into target markets

For more information, please visit freescale.com/M2CoreTech.



MicroSys

MicroSys designs and develops embedded system solutions for VMEbus, CompactPCI and other common bus infrastructures. Since 1975, customized solutions offering longevity are trademarks of their business as well. Successfully deployed products span from systems-on-modules up to fully integrated systems.

In 2000, the miriac CPU module family expanded its product portfolio. The flexible and modular Module-Carrier-Konzept can be used for both evaluation purposes of processor technology and serial production. The miriac

modules utilize 32-bit processors, such as Freescale's i.MX applications processors and other common embedded CPUs. With their low power consumption and the compact dimensions of a credit card form factor, the miriac modules can fit into any application in automotive, industrial automation, medical, railway, avionic, transportation, construction or defense. Operating systems such as VxWorks®, Microware OS-9, QNX®, Linux®, WinCE or Micrium microC/OS are supported.

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

RUNTIME SOFTWARE: APPLICATION SPECIFIC, MIDDLEWARE AND OPERATING SYSTEMS |
DEVELOPMENT TOOL PROVIDERS: SOFTWARE DEVELOPMENT TOOLS

Motomic Software

Turn products into touchpoints

Motomic helps manufacturers leverage the Internet of Things to understand how their customers use their products. Once clients understand product use, Motomic helps them turn those products into touchpoints that engage customers.

Products are rapidly becoming connected. With that connectedness comes the ability to understand and interact with the customer base. Motomic opens products to analytics and extends customer experience design to browsing, touchscreens and media on products, creating entirely new touchpoints

with completely new rich customer experiences, even on tiny MCU-class processors.

End users are delighted by context-sensitive experiences that instruct, entertain and transact. By fostering such opportunities, companies can create new revenue opportunities, lower support costs and build much tighter customer relationships and loyalty.

Founded in 2009 and privately-held, Motomic is located in the Silicon Valley/San Francisco area.

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

IDH SERVICES | EMBEDDED BOARD SOLUTIONS

NetModule

NetModule provides hardware and software engineering services and embedded systems for ARM®-based CPUs (e.g., Kinetis MCUs/i.MX applications processors). NetModule supports MQX™, WindRiver® VxWorks®, Windows® Embedded Compact and Embedded Linux®. Apart from engineering services, NetModule offers off-the-shelf

products, including the i.MX processor-based SBCs with the related evaluation boards and SW drivers for IEC 62439 (PRP/HSR) for different platforms.

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

NovTech

NovTech was founded in 1998 to provide rapid system solutions to OEMs. Since then, NovTech has designed and provided more than 65 turn-key designs ranging from 8-bit MCUs, 32-bit MPU embedded systems and analog to ASIC development systems and FPGA-based designs. NovTech is experienced in high-speed, real-time, hardware, firmware and software design as well as PCB layout, prototyping and troubleshooting. NovTech specializes in rapid prototyping and can

deliver systems, from concept to production-grade prototypes, in as little as two-and-a-half weeks. Technology specializations: embedded computing (32-bit CPUs), microcontrollers, system-on-chip (SoC), PC peripherals, ISA, PCI, PC-Card, USB, IEEE® 1394, communications, high-speed real-time control, imaging and encryption.

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



SOFTWARE DEVELOPMENT TOOLS | HARDWARE DEVELOPMENT TOOLS

P&E Microcomputer Systems

P&E Microcomputer Systems is an industry trendsetter in software and hardware development tools for Freescale microcontrollers. For Freescale Kinetis devices, P&E offers a variety of affordable, professional software. PROG for ARM® Cortex® devices is in-circuit flash programming software that programs the target device in interactive or command-line modes via a P&E hardware interface.

P&E also partners with Freescale to provide drivers, applications and firmware updates for Freescale's OpenSDA debug/programming interface that helps users affordably evaluate Kinetis devices.

P&E's hardware tools are ideal for both product development and small- or large-

scale production programming. The Multilink Universal and high-speed Multilink Universal FX are all-in-one development interfaces that support many Freescale MCUs, including Kinetis. The Tracelink is a high-speed interface that, when used with Freescale CodeWarrior, can capture up to 128 MB of external trace on Kinetis and ColdFire devices. P&E's Cyclone MAX is a versatile, rugged production programmer that handles small or large production runs with ease. Control of one or more Cyclones can be completely automated, or they can be operated manually in standalone mode with no PC required. The Cyclone MAX supports several Freescale architectures, including Kinetis.

P&E hardware is supported by recent versions of CodeWarrior (10.x), current P&E software applications and toolchains from many Freescale partners, including IAR Systems, Keil, Cosmic Software, Atollic® and Green Hills Software.

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



SSI SERVICES | IDH SERVICES | EMBEDDED BOARD SOLUTIONS

PHYTEC

PHYTEC specializes in microprocessor-based solutions for mobile and embedded systems. For more than 25 years, it has delivered SoM subassemblies, rapid development kits, hardware and software design services, end-to-end life cycle management and systems integration expertise that have enabled development of thousands of innovative embedded products.

Its strategic alliance with Freescale enables PHYTEC to provide first-to-market SoM solutions supporting Vybrid controller solutions, i.MX 6 series processors and

other processors that serve as CPU cores for embedded product development. End customers across a wide spectrum of industries, including automation and control, energy, medical and transportation, have made use of its complete portfolio of off-the-shelf building blocks and services to shorten time to market, reduce development costs and avoid substantial design risks.

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



Prevas Technologies

Prevas provides customer near development, utilizing highly specialized Centers of Excellence to solve complex niche tasks including complex carrier platforms, specialized development within EMC, audio, life science, industrial control, M2M connected devices, embedded OS or test systems. A fully supported hosted project management environment, including revision control, issue/requirement tracking and reporting is included with all projects—keeping the customer in control at all times.

Embedded Linux®, Android™ and Windows® Embedded

Prevas is an independent Embedded Linux BSP supplier for Industrial Embedded Linux and customizes and maintains professional BSPs for all types of ARM® solutions. For longevity, BSP maintenance for +10 years is a natural part of our Linux platform lifecycle.

Prevas also supplies customized Android BSPs for industrial use, including every step from BSP to application development.

Prevas' expertise in Windows Embedded ranges from boot loaders, BSPs and drivers to OS configuration, application development and testing. Prevas' experts within Windows

Embedded are certified by Microsoft® with access to authorized instructors.

Electronic Subsystem IP (ESIP)

Prevas' ESIP concept is a systematic breakdown of the carrier technologies into subsystems, which can be integrated into custom designs, supporting core technologies.

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



RealVNC

RealVNC has developed its VNC® remote access technology to create VNC Automotive, a solution that can automatically detect, access and control virtually any mobile device or desktop computer from a vehicle head unit or infotainment system either via MirrorLink™, iPod Out or VNC Automotive using USB, Wi-Fi® and Bluetooth®.

VNC Automotive is available as an OEM package for developers to integrate VNC technology within their own products.

The VNC Automotive SDK has been ported to all Freescale automotive chipsets and MirrorLink Certified on Freescale i.MX51 on Linux®, Windows CE, QNX® and Android™.

The SDK also supports other automotive operating systems and all leading mobile devices, including Windows® Mobile, Symbian, Blackberry®, iPhone® and Android.

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



Rightware

Automotive and mobile UI creation software

Rightware is a leading provider of high-performance, cross-platform UI technology for automotive, mobile and other embedded industries. Its Kanzi® UI solution is a complete package consisting of both PC-based, real-time UI creation software as well as a powerful 3D engine that enables immediate deployment of advanced UI on any devices that support OpenGL® ES.

Kanzi UI technology has been successfully adopted by premium car manufacturers such as Audi AG and tier-1 suppliers such as Visteon. Its proven capability will continue to be validated in other markets, such as smartphones, tablets, smart TV and other embedded devices.

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



SECO

SECO is a European designer and manufacturer of highly integrated systems and computer boards for embedded applications. Spanning its 30-plus years of experience, SECO has a proven ability to adapt its know-how to new, challenging customer needs and to provide its partners with cutting-edge solutions.

SECO's attention is focused on developing innovative products with high performance, low power consumption and heat dissipation, low

cost, increased functionality offering and a shorter time to market.

Thanks to innovative solutions, great research and design activities and to partnerships with major scientific universities and world-leading companies, SECO went international, becoming a global market leader that provides solutions to modern challenges.

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



COMPANION SILICON AND MODULES | RUNTIME SOFTWARE: APPLICATION SPECIFIC, MIDDLEWARE AND OPERATING SYSTEMS

Silex Technology

Silex Technology offers single- and dual-band wireless solutions, including SDIO Modules and SDIO Systems-in-Packages (SiPs), all based on the proven Qualcomm® Atheros AR6003 chip technology.

Superior Technology

The Silex SX-SDCAN, a low-power SDIO form factor wireless radio module, was specifically designed for the Freescale i.MX 6 series.

Built on the field-proven Qualcomm Atheros AR6003 802.11a/b/g/n radio, the SX-SDCAN is the only Freescale-recommended wireless connectivity solution for the i.MX 6 series.

Integrated Radio Software Support

Design engineers can easily implement Silex Wi-Fi® solutions with the Freescale i.MX 6 processor evaluation platforms, which include the Wi-Fi driver and security supplicant software. No engineering development is required to get started with your wireless evaluation.

Faster Time to Market

Silex Wi-Fi solutions are designed and validated to meet IEEE® standards and have been modular certified to save regulatory costs. Silex can help customers streamline development processes and beat competitors to market.

The software is available for the following RTOS: Linux®, Android™, Green Hills Software INTEGRITY®, Mentor® Graphics Nucleus®, QNX® Neutrino®, and Windows® Embedded Compact 7.

Silex Technology also provides engineering services to modify their software for customer-specific requirements. Whether it is porting to your target hardware platform or adding a custom feature, let them know your requirement and they will do their best to solve your problem.

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



EMBEDDED BOARD SOLUTIONS

Sohwa & Sophia Technologies

Sohwa & Sophia Technologies provides powerful and reliable real-time microprocessor emulation systems, reference platforms and other debug tools, enabling thousands of hardware and software engineers to complete their development projects on time and within budget. Sohwa & Sophia Technologies works

closely with semiconductor companies and other technology leaders to ensure its development and debugging solutions will overcome the most challenging embedded designs.

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



TechNexion

As a leading embedded solution provider, TechNexion designs and manufactures cutting-edge computing systems. Backed by experienced engineers and product specialists, its expertise is focused on creating and testing embedded systems that can be applied to networking security, factory automation, medical care equipment, media streaming applications and other industrial fields. TechNexion manufactures board level, system level and fully integrated industrial computer

products for OEMs and end users who seek to automate their applications quickly and cost-effectively. They have a simple goal: to be your industrial computer solution supplier. TechNexion is dedicated to providing you with a single source for your industrial PC needs—from its chassis for harsh industrial environments to its systems integration service, engineering support, customizing of industrial PCs and customer service. TechNexion attributes its success to its business ethics,

strategy, planning and implementation, which are considered the most important piece of TechNexion's unprecedented growth.

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



SOFTWARE DEVELOPMENT TOOLS | RUNTIME SOFTWARE: APPLICATION SPECIFIC, MIDDLEWARE AND OPERATING SYSTEMS | SSI SERVICES

Timesys

Timesys is an embedded Linux® solution pioneer committed to providing easy-to-use embedded Linux offerings with world-class support, professional services and training to embedded developers using Linux as their go-to-market platform.

LinuxLink is a complete and flexible suite of tools for embedded Linux platform and application development teams. Available for the popular ARM®-based Freescale i.MX applications processors and Vybrid controller solutions, LinuxLink combines an innovative build system, software repository, comprehensive suite of development tools for building feature-rich applications and debugging, and expert support to enable developers to deliver high-quality, differentiated embedded Linux products in a cost-effective and timely manner.

Embedded Linux and Android™ Professional Services

Timesys has an international customer base and proven record of successful Professional Services projects and deployments in markets, including industrial control/process automation, medical, automotive, telecommunications, networking, consumer electronics and military/aerospace. In addition, Timesys has extensive experience with Linux kernel and subsystem development, device driver development, board bring up, industrial buses and system optimization, including fast boot and power management.

Embedded Linux Software and Solutions Integrator Services

Timesys SSI Services offer product evaluation, design and integration and include OS integration (RTOS + Linux), HMI design, development and optimization, third-party and open-source software integration (e.g., Qt, GStreamer, Java™, OpenGL®, proprietary, etc.), camera integration and Android design and development.

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



TQ-Components

The TQ-Group is leading in 16-, 32- and 64-bit embedded systems. The TQ-Group has a wealth of experience in design and production of leading MCU/MPU systems specializing in industrial applications. TQ's product offerings supporting Freescale's ARM®-based architectures are all supported with embedded modules, starter kits and complete systems

like industrial terminals. This wide offering helps customers develop a variety of system solutions and provides an excellent core for applications in entertainment, human-machine interfaces and industrial control.

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



Embedded Board Solutions (EBS)

OEMs are faced with the increasing challenge of bringing innovative products to market quicker while balancing more complex solution requirements and limited resources. Additionally, technical device needs for many markets are continually being redefined with trends like embedding human-machine interfaces (HMI), machine-to-machine (M2M) technology and enabling portability and communication, forcing OEMs to step back and decide between “make vs. buy.”

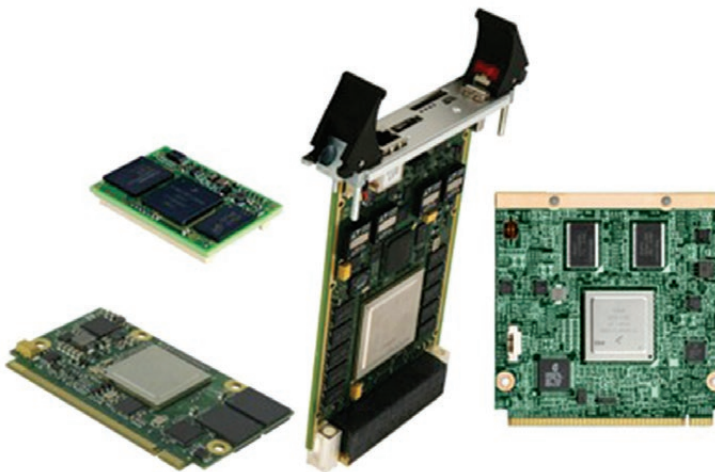
Through a strong ecosystem of EBS-proven partners, Freescale offers a full range of embedded board solutions with a spectrum of form factors, processors, features and software enablement tools. These ready-for-production solutions help ease the make vs. buy decision, allowing OEMs to focus on full system integration and software.

EBS: Your Ready-for-Production Solution

Freescale's EBS partners offer a range of boards with different form factors, such as Qseven, Arduino™, COM Express®, SMARC, VPX and EBX. These boards—many of which feature Freescale's Kinetis MCUs, i.MX applications processors, QorIQ communications processors and Vybrid controller solutions—help OEMs kick-start their designs, helping them speed time to market by addressing resource constraints, hardware complexity and new market challenges.

Our EBS partners' solutions support Freescale's product longevity standards of 10 years, 15 years and beyond. They also offer qualified consumer, industrial, medical, aerospace and defense solutions supported by development tools, technical expertise and flexible manufacturing.

Offering Standard to Custom Form Factors



Embedded Board Solutions Enablement

Freescale has long-standing relationships within the embedded board industry. We serve the same markets, including industrial, aerospace and defense, medical and consumer. However, our support for these markets is not in silicon alone. A close working relationship with OS and tool vendors is essential to ensure our customers have access to complete solutions that enable them to achieve their time-to-market goals. Our system integrators provide Linux®, WinCE®, Android™ OS- and QNX®-matching multimarket requirements.

As a company, Freescale continues to demonstrate its commitment to the embedded market through programs such as the EBS co-selling program, focused on innovating solutions to continue to ease challenges facing OEMs.

More Information

The Freescale Connect Program highlights our ecosystem partners, including Proven Embedded Board Partners that provide a complete spectrum of solutions and supporting software.

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



For more information about Freescale ARM products and documentation, please visit freescale.com/Kinetis, freescale.com/iMX, freescale.com/QorIQ, freescale.com/Vybrid and freescale.com/ARM

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