



# Kinetis MCU Portfolio Overview

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# Agenda

- Product Portfolio
  - General Purpose Kinetis K, L, E, W Series Portfolios
    - New Features
      - Crystal-less USB operation
      - Enhanced Security
      - FlexIO
      - Memory Expansion, on-the-fly decryption
  - Market Specific Kinetis V, M Series Portfolios
    - New Features
      - High Speed ADCs
- Software and Tools
- Connect with Kinetis MCU Experts

# Kinetis MCU Portfolio

*Aligned to the needs of a connected world*

## Low Power



Ultra efficient **dynamic power**

Ultra **low static power** consumption with full retention

**Low power peripherals**

Optimized Architecture  
Focused on Low Power

## Security



Providing Multiple Levels of **Scalable Security** options for **ultimate flexibility and protection**

Ensuring your **communication, software and physical system** is protected from threats.

## Connected



Integrated RF transceiver supporting

**BLE 4.2,**

**802.15.4**

**Thread**

**ZigBee**

## Easy to Use



Tools for Low Power Design, such as the power estimation, power profiler, and consumption calculator

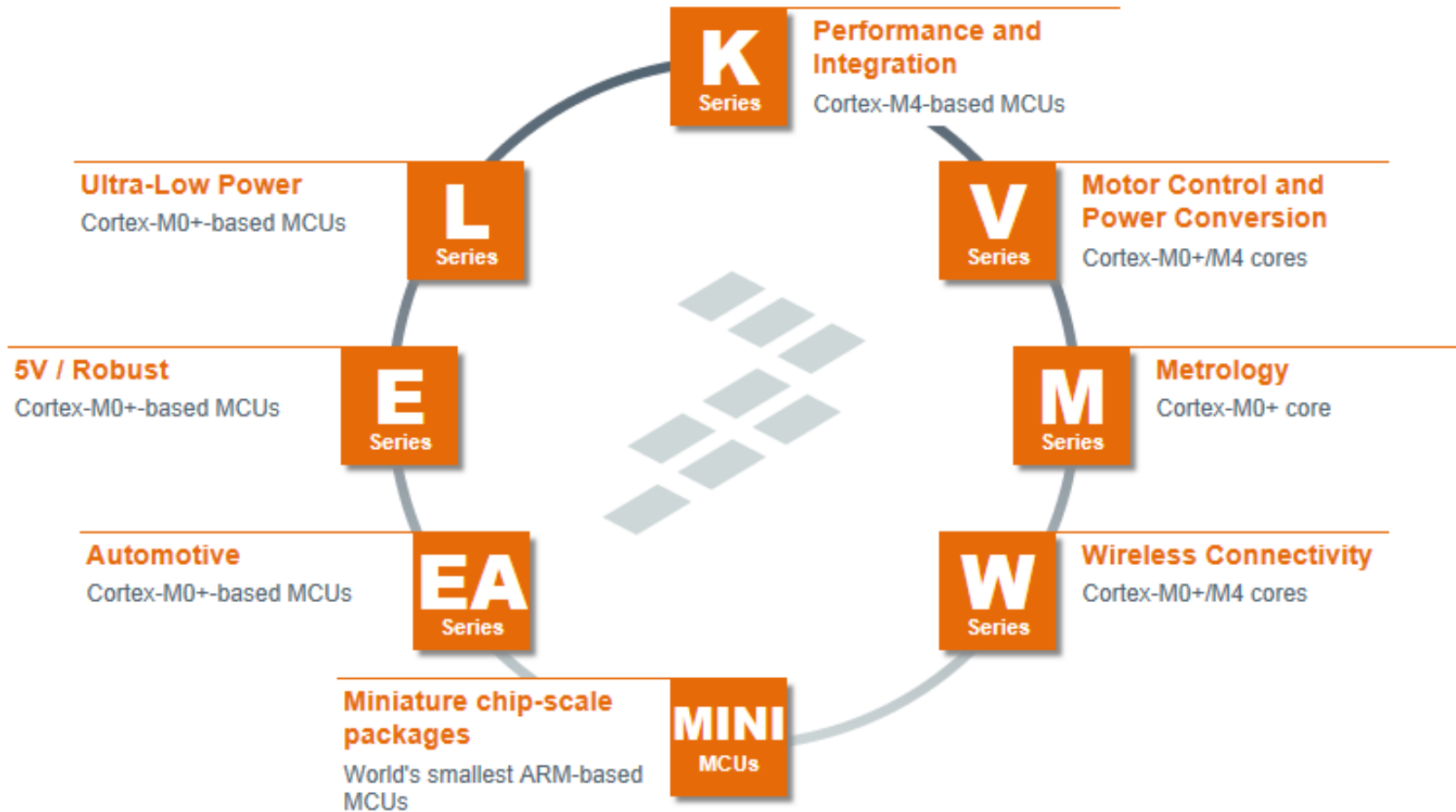
Complete software development kit and ROM based stacks for fast time to market and easy design

Leveraging **Low Power** Development, **Wireless Connectivity**, Decades of **Security Expertise**,  
With Focus on **Customer's Ease of Use** ... **the embedded IoT Leader**.

**Common Technology Platform for Maximum Re-use of Software and Hardware Development Efforts**

# Kinetis MCU Portfolio Today

## *Broad, Scalable ARM® Cortex®-M Portfolio*





# Freescale Product Longevity Program

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



# Kinetis K Series – Performance & Integration

## ARM® Cortex®-M4 Core

- Designed for scalability, performance efficiency, integration, connectivity, communications, HMI and security. Kinetis K offers industry-leading low-power and significant BOM savings through smart on-chip integration.



**Power Efficiency**

**Up to 180MHz**



**Security**

**Up to 2MB flash, 256KB RAM**



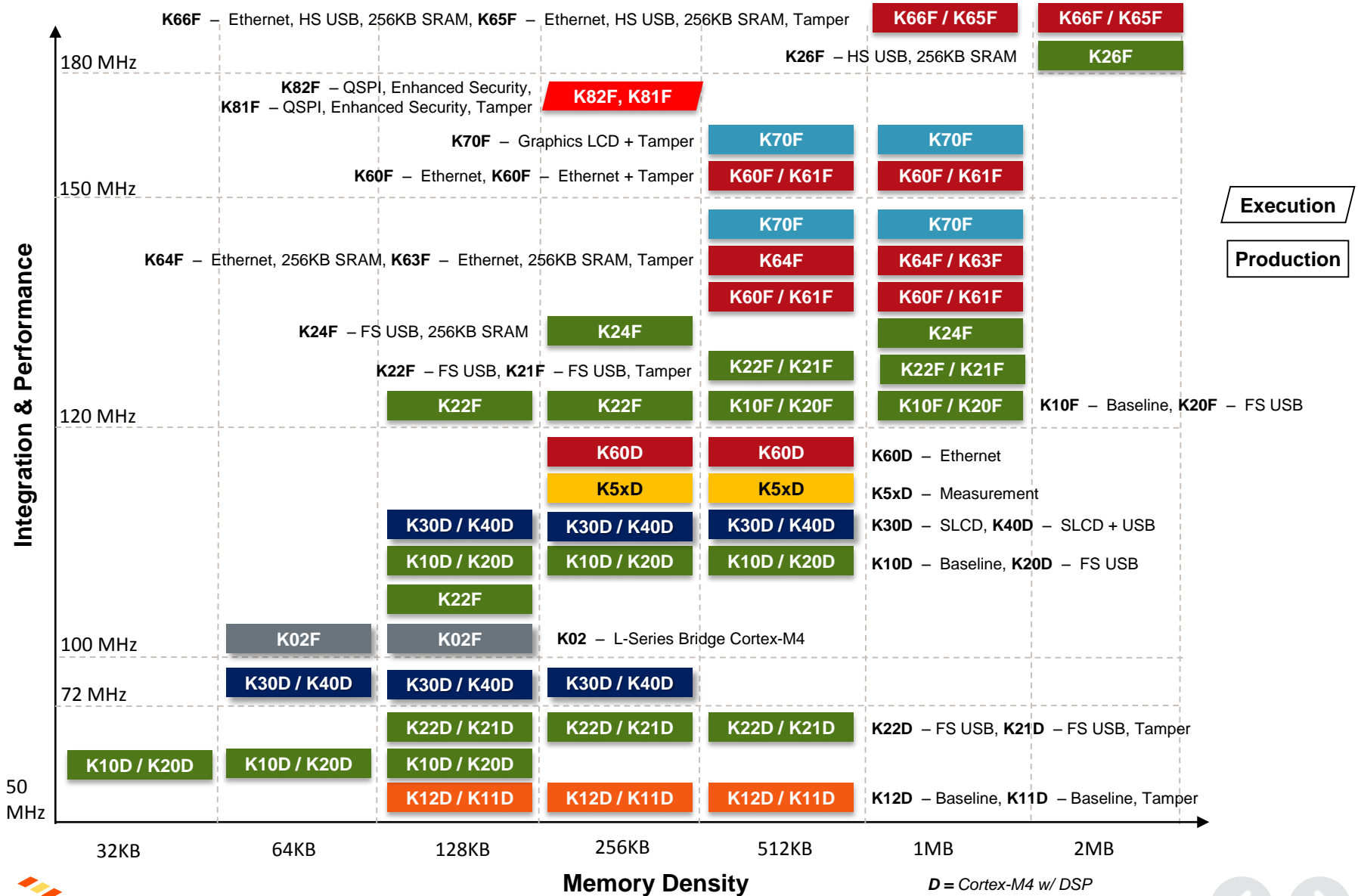
**Connectivity**

**Abundant memory expansion**

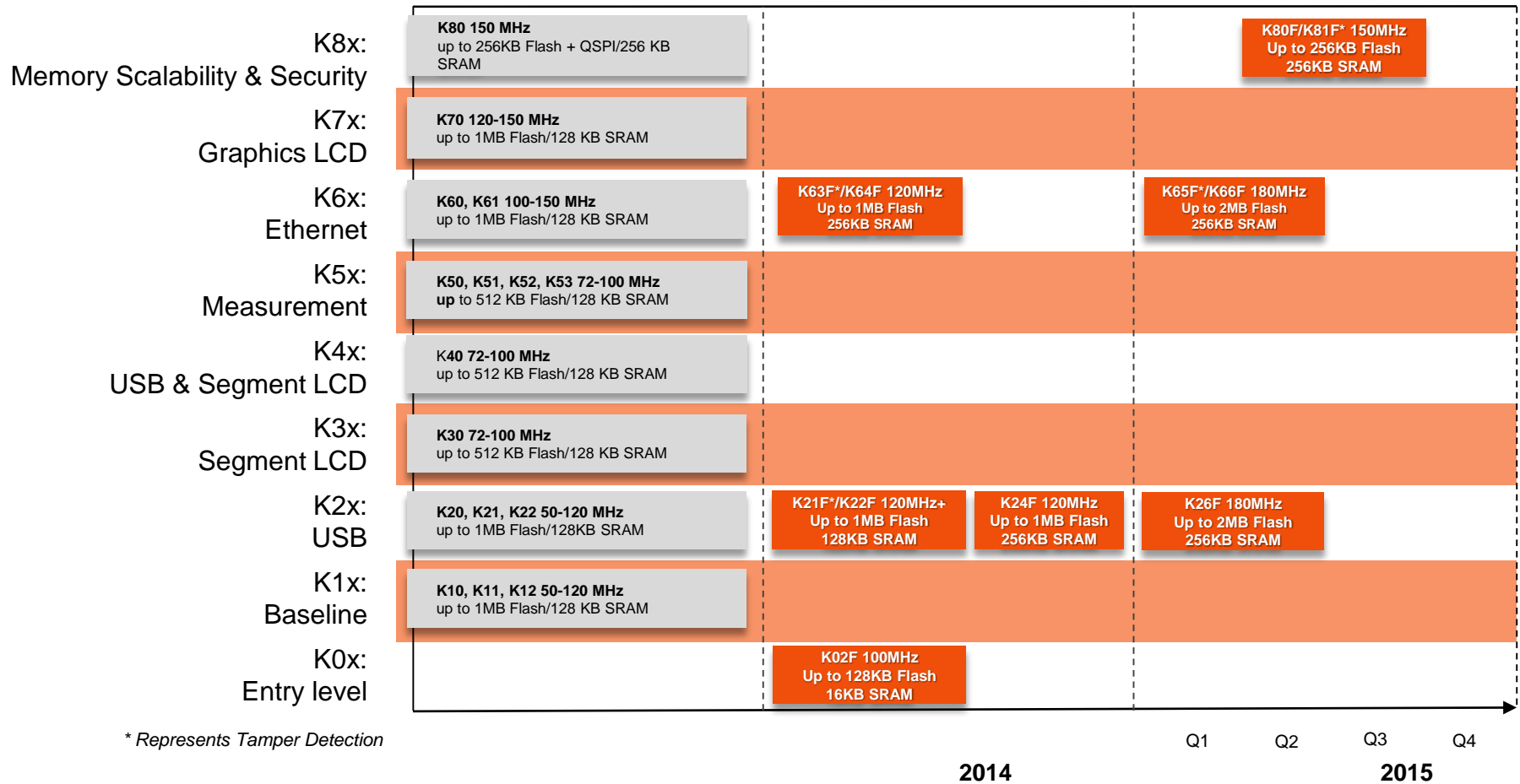


**Product and Software Scalability**

# Kinetis K Series Product Portfolio



# Kinetis K Series | Upcoming Products



# Kinetis K Power Efficiency

	Kinetis Power Modes	Recovery Time	K22F Typical Idd @ 3V and 25°C K02 128KB / K22 512KB
Leading Dynamic Power	RUN	-	170uA/MHz* / 188uA/MHz**
Innovative low power process technology (C90TFS)	VLPR	-	117uA/MHz*** / 157uA/MHz***
Low Power focused Platform Design	WAIT	-	3.5mA / 5.4mA @ 25MHz
Next Generation Cortex M4 core with FPU	VLPW	-	280uA / 450uA @ 4MHz
Asynchronous DMA Wake-up (ADMA)	STOP	5.7us	260uA / 280uA
Energy-saving peripherals are operational with ADMA feature that can wake-up DMA to perform transfer and return to current mode when complete	VLPS	5.7us	<b>2.8uA****</b> / 8.7uA
Low Leakage Wake-up Unit	LLS2	6.0us	- / <b>3.0uA****</b>
Enables complete shut-down of core logic, including AWIC, further reducing leakage currents in all low power modes	VLLS3	80us	1.3uA / 2.8uA
Supports 8 external input pins and up to 8 internal modules as wakeup sources; extends the low power wake-up capability of some internal peripherals to all power modes.	VLLS1	140us	630nA / 730nA
Wake-up inputs are activated in LLS or VLLS modes	VLLS0	140us	(70nA / 350nA) / (140nA / 430nA)

\* 72MHz core / 36MHz bus Compute operate, peripherals off, running from Flash

\*\* 80MHz core / 40MHz bus Compute operate, peripherals off, running from Flash

\*\*\* 4MHz core, bus clock.

\*\*\*\* Recommended low power operating mode



# Kinetis K26F, K66F & K65F MCUs

- Kinetis MCU portfolio expansion to reach higher memory densities and greater connectivity integration, while maintaining compatibility with earlier versions of Kinetis MCUs.



## More Memory and Performance

*2M Flash, 256KB RAM, 180MHz with 8KB of CPU cache.*



## Higher Integration

*Dual USB (Crystal-less) with HS embedded PHY, Ethernet, Dual CAN, SDHC and SDRAM controller*



## Complete Set of Security Features

*Cryptography Accelerator, True Random Number Generator, Active and passive Tamper pins to protect MCU from voltage, temperature and frequency threats*



## Power Efficiency

*Asynchronous DMA and other smart peripherals reduce power consumption*

Target  
Applications

Smart Wearables | IoT Data Concentrators | Medical Monitoring  
High-end Sales Kiosk | Building Control |  
Factory Automation | Industrial Drivers



# Crystal-less USB Device

- High Speed and Accurate 48MHz Internal Reference Clock
  - Typical +/- 0.5% output across full temp range (factory trimmed) by default
  - Clock recovery block within the USB to check the USB SOF (from USB Host) and adjust the 48MHz IRC with fine trim resolution 0.04% step on the fly... trimming within the 0.25% relative to the USB SOF (USB Host clock)
- Saving Cost (\$0.1x), Board Size (2x3mm<sup>2</sup>) and Power Consumption (100uA)

Symbol	Description	Min.	Typ.	Max.	Unit	Notes
V <sub>DD</sub>	Supply voltage	1.71	—	3.6	V	—
T	Temperature range	-40	—	125	°C	—
I <sub>DD</sub>	Supply current	—	400	500	µA	—
f <sub>IRC</sub>	Output frequency	—	48	—	MHz	—
f <sub>IRC_UT</sub>	Output frequency range (untrimmed)	—	±10	±25	%f <sub>IRC</sub>	—
f <sub>IRC_T</sub>	Output frequency range (trimmed)	—	±0.5	±1.0	%f <sub>IRC</sub>	—
Δf <sub>IRC_C</sub>	Coarse trim resolution	±0.5	±0.7	±1	%	—
Δf <sub>IRC_F</sub>	Fine trim resolution	±0.03	±0.04	±0.05	%	—
T <sub>j</sub>	Period jitter (RMS)	—	35	150	ps	—
T <sub>su</sub>	Startup time	—	2	3	µs	—

# Kinetis K80F, K81F MCUs

Cortex-M4 Class Microcontroller for IoT applications with extensive memory expansion, Enhanced Security and Flexible IO, to increase functionality and scalability.



## Optimized for Cost, Size and Power

*WLCSP with <5mm<sup>2</sup>x5mm<sup>2</sup> package size, lower flash density with high digital peripheral integration and low power capabilities*



## Memory Expansion

*Interfaces for SDRAM and external Serial NOR flash via **QuadSPI** with on-the-fly decryption to support unlimited scalability, increased cache (16KB), ROM for bootloaders*



## Enhanced Security Architecture

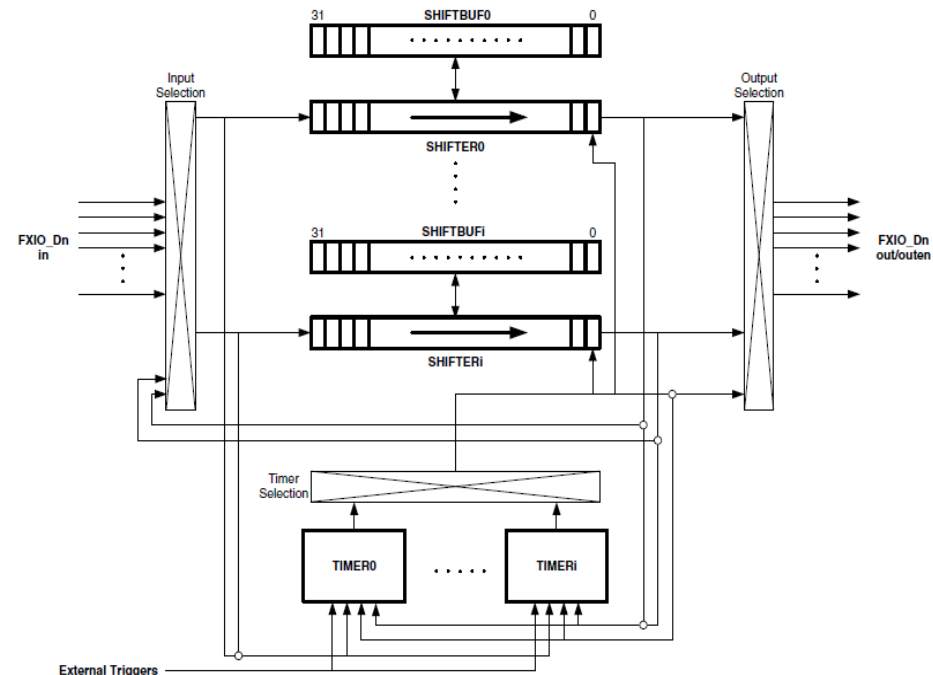
*New stand alone encryption acceleration, public key HW accelerator, True RNG, side band attack protection and firmware protection*

Target  
Applications

Point of Sale | Smart Wearables | IoT Edge Nodes & Gateways |  
Gaming Controllers | Smart Phone Accessories |  
Energy Monitoring Gateway | Process & Temperature Control |  
Home & Building Automation | Sensor Nodes

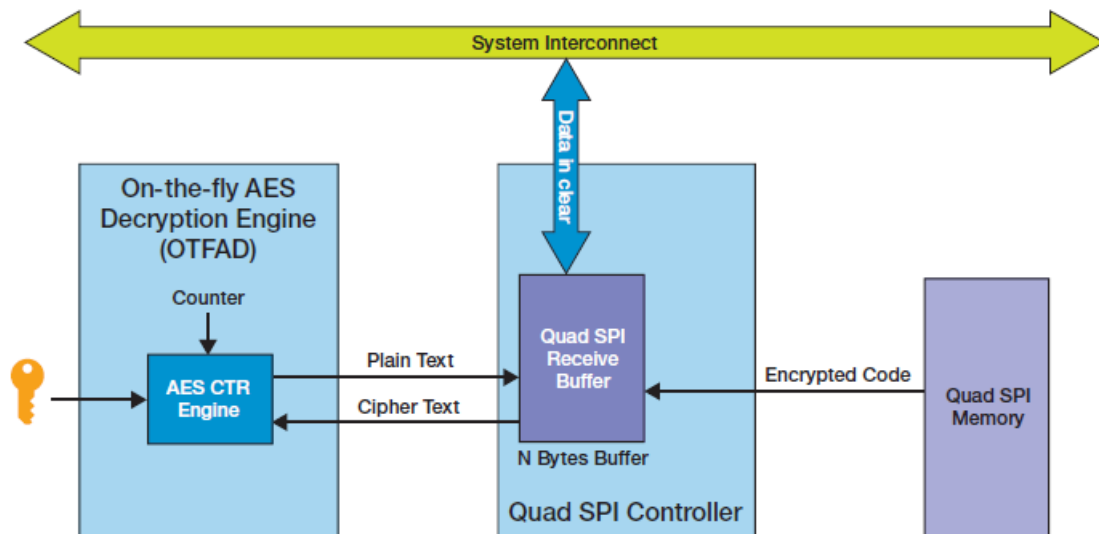
# FlexIO

- **A Highly configurable module that can emulate variety of serial communication protocols**
  - Array of 32-bit shift registers with transmit, receive and data match modes
  - Double buffered shifter operation for continuous data transfer
  - Shifter concatenation to support large transfer sizes
  - Automatic start/stop bit generation
  - Interrupt, DMA or polled transmit/receive operation
  - Programmable baud rates independent of bus clock frequency, with support for
  - Asynchronous operation during stop modes
  - Highly flexible 16-bit timers with support for a variety of internal or external trigger, reset, enable and disable conditions
- **Capable of supporting below protocols including, but not limited to**
  - UART, IIC, SPI, I2S, Camera Interface, PWM/Waveform generation
  - SDK supporting UART, IIC and SPI examples
  - Customized non-standard UART/IIC/SPI, etc.



# On-The-Fly AES Decryption Module (OTFAD)

- On-the-fly decryption module is combined with an external flash memory controller known as the QuadSPI to support interfacing to encrypted external serial NOR Flash memory.
- Combined access speed of QuadSPI, coupled with internal processor-local cache memories allow the application code to be executed directly from the external memory without the need to copy the code into another (faster) memory.
- The OTFAD engine implements a block cipher mode of operation, specifically supporting the counter mode (CTR) .
- OTFAD engine post decryption, transfers the data in clear back to QuadSPI Rx buffer that is then available for the system.
- Hardware support for 4 independent decryption segments, known as memory context
- Each context has a unique 128-bit key, 64-bit counter and 64-bit memory region descriptor



# Kinetis L Series – Low-Power, Easy to Use

## ARM Cortex-M0+

Ultra Low-Power, Ultra Small Scale, Super Easy to Use, Leading Scalability and Integration as an ideal solution for Internet of Things edge nodes

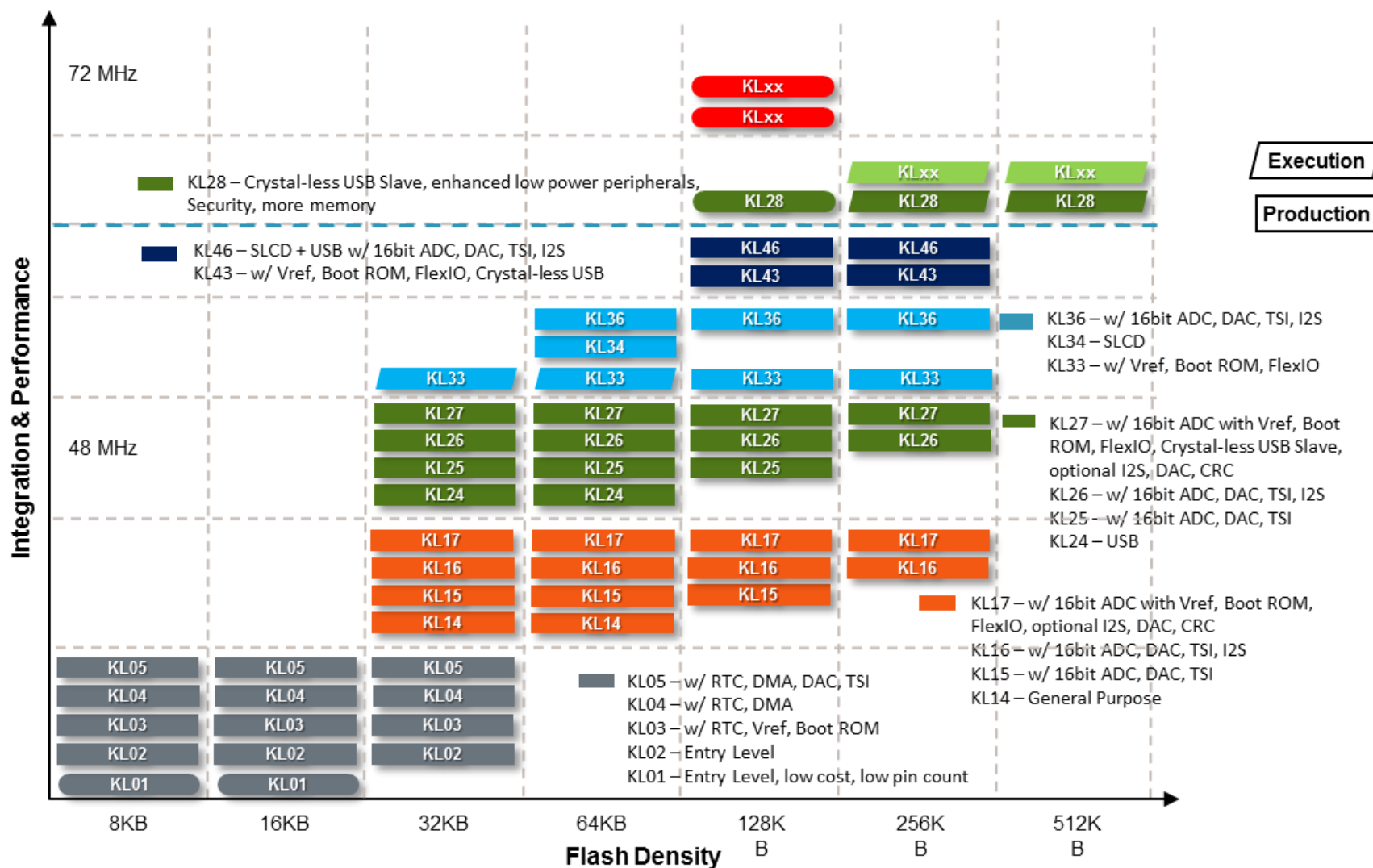
- ✓ **World's Most Energy Efficient ARM based Microcontroller**
- ✓ **World's Smallest ARM based Microcontroller**
- ✓ **Scalability and Integration with Super Ease of Use**

From 35uA/MHz

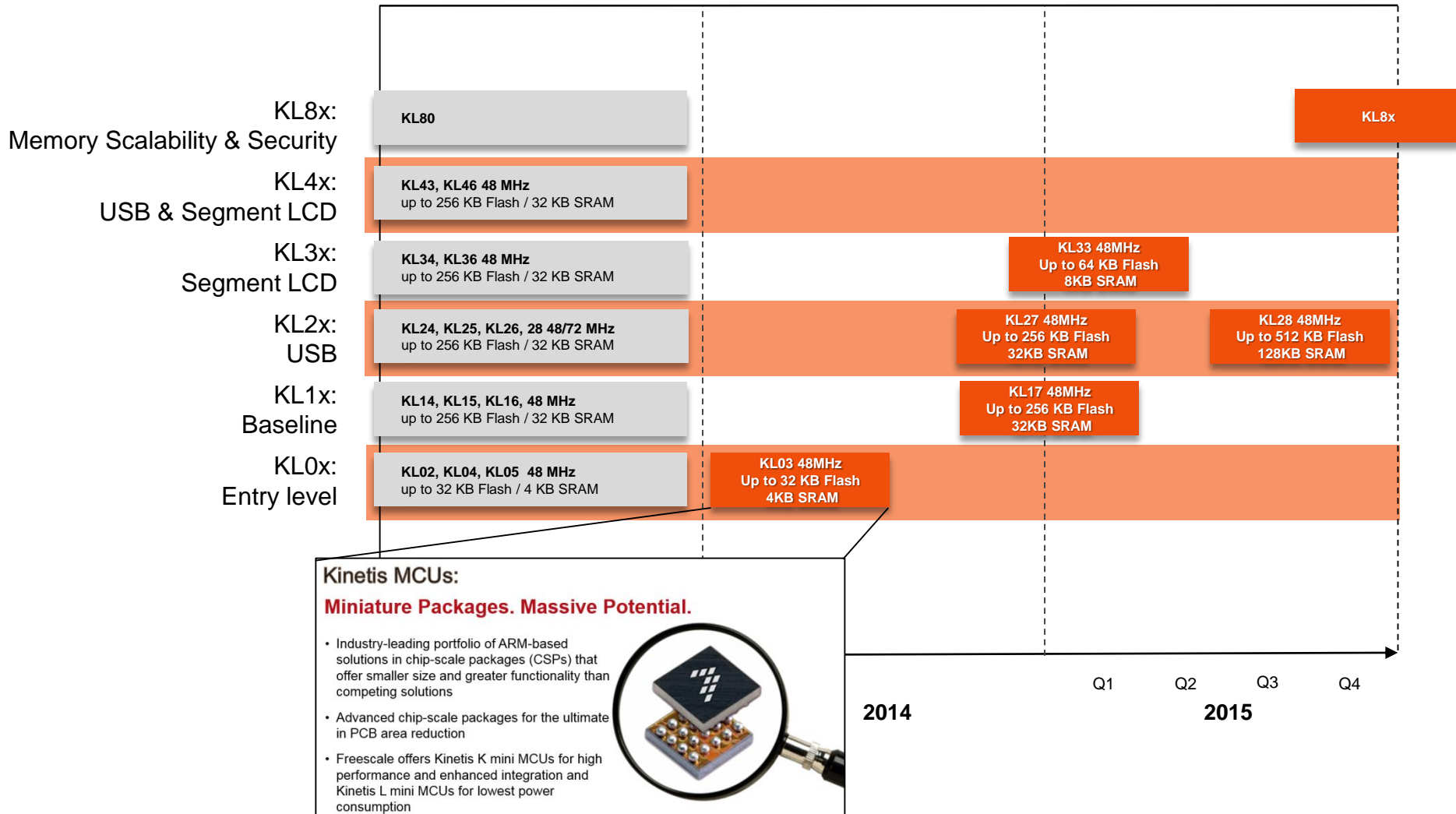
Up to 72MHz

Up to 512KB flash, 128KB RAM

# Kinetis L Series Product Portfolio



# Kinetis L Series | Upcoming Products



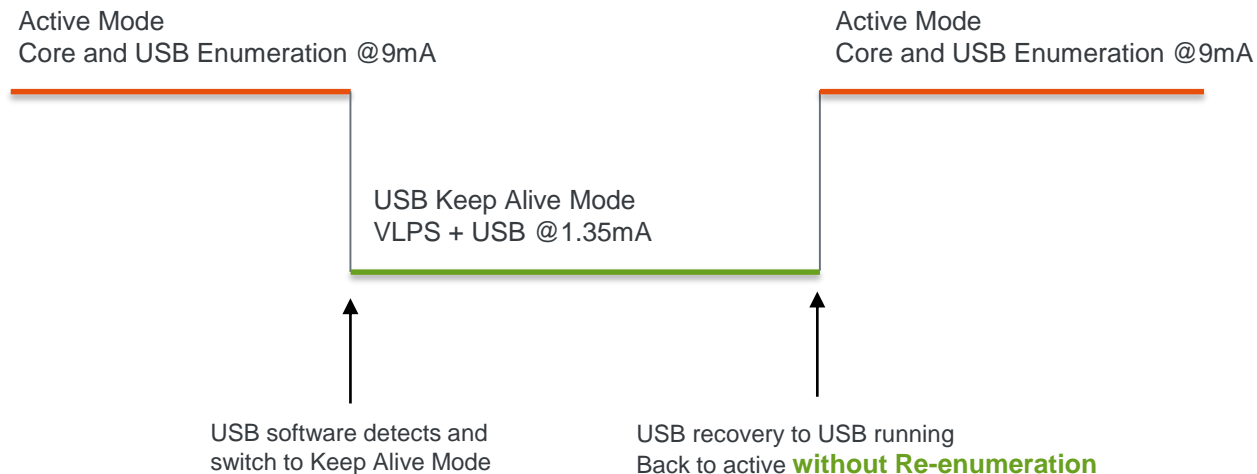
# Best Energy Efficiency – Dynamic and Static Power Consumption

Mode	CPU/BUS Frequency	Description	Peripheral Clocks	Typical IDD @3V, 25C	Recovery Time
RUN	48/24 MHz	Full speed RUN mode with specified CPU/BUS frequency, flash cache enabled, clocked by 48MHz IRC, with Compute mode and peripheral clocks on/off options	Enabled	5.62mA (117uA/MHz)	-
	48/24 MHz		Disabled	4.04mA (84uA/MHz)	-
	48/- MHz		Compute Mode*	3.39mA (70uA/MHz)	-
	24/24 MHz		Disabled	2.99mA	-
VLPR	4/1 MHz	Very Low Power RUN mode with specified CPU/BUS frequency, flash cache enabled, clocked by 8/2MHz IRC, with Compute mode and peripheral clocks on/off options	Enabled	329uA (82uA/MHz)	-
	4/1 MHz		Disabled	253uA (63uA/MHz)	-
	4/- MHz		Compute Mode	229uA (57uA/MHz)	-
	2/- MHz		Compute Mode	101uA (50uA/MHz)	-
WAIT	48/24 MHz	Full CPU/BUS frequency with CPU in SLEEP mode	Disabled	1.79mA	-
VLPW	4/1 MHz	Restricted CPU/BUS frequency with CPU in SLEEP mode	Disabled	218uA	-
STOP	OFF	MCU in static state with full retention, CPU clock is off, energy-saving peripherals functional with Asynchronous DMA, Asynchronous Wake-up Interrupt Controller detects wake-up source for CPU, LVD ON	OFF	160uA	7.5uS
VLPS	OFF	Same as STOP with LVD OFF, lowest mode with ADC and pin interrupt functional	OFF	2.09uA	7.5uS
LLS	OFF	MCU in low-leakage state with full retention, Low Leakage Wake-up Unit detects wake-up source, lowest mode with full RAM and I/O retention and fast wake-up, Asynchronous DMA in static state	OFF	1.58uA	7.5uS
VLLS3	OFF	Similar to LLS mode with wake-up following reset flow	OFF	1.35uA	93uS
VLLS1	OFF	Similar to VLLS3 mode with SRAM OFF, REGFILE retained for critical data	OFF	700nA	152uS
VLLS0	OFF	Similar to VLLS1, with REGFILE OFF, LPO OFF, optional POR ON/OFF, shelf mode	OFF	76/252nA	152uS

\*Compute Operation shuts off bus and system clock for lowest power core processing. Peripherals with an alternate asynchronous clock source can continue to operate.  
Test result from MKL27Z64VLH4 with code in flash and flash cache on

# USB Keep Alive with Ultra Low-Power

- 1.35mA power consumption in VLPS mode with USB bus remains active
- USB endpoints maintained in USB RAM
- Device wake up from stop mode by host sending in, out and setup token
- Saving significant power with USB connected to host in zero bandwidth (KL26 consumes 9mA in total in the same condition)
- Ideal for battery powered USB device applications



Note: need software modification on USB Host side to support this new feature

# Kinetis KL28 MCU

- Cortex-M0+ Class Microcontroller for IoT applications with large flash and RAM, advanced smart peripherals and hardware security features.



## **Large Memory Size**

Cortex-M0+ core architecture  
Up to 72MHz core frequency  
Up to 512KB flash memory and 128KB SRAM



## **Advanced Smart Low-Power Peripherals**

Low-Power IIC to work as master in low power mode  
Low-Power SPI to work as master in low power mode  
Crystal-less USB with keep alive in low power mode



## **Built in Hardware Security**

True Random Number Generator  
AES/DES/SHA/MD5  
Flash Access Control and Security

# Kinetis E Series

## ARM Cortex-M0+

Designed for applications which require high robustness to EMC/ESD, and/or full 5V IO capability.



### **Robustness**

+/- 20KV PESD, +/- 4.4KV EFT



### **Fully compliant with 5V and 3V system**

2.7V to 5.5V power supply



### **Ease of migration from 8- and 16-bit MCUs**

Easy of use, 32b Cortex-M0+ Core, 8-bit peripherals

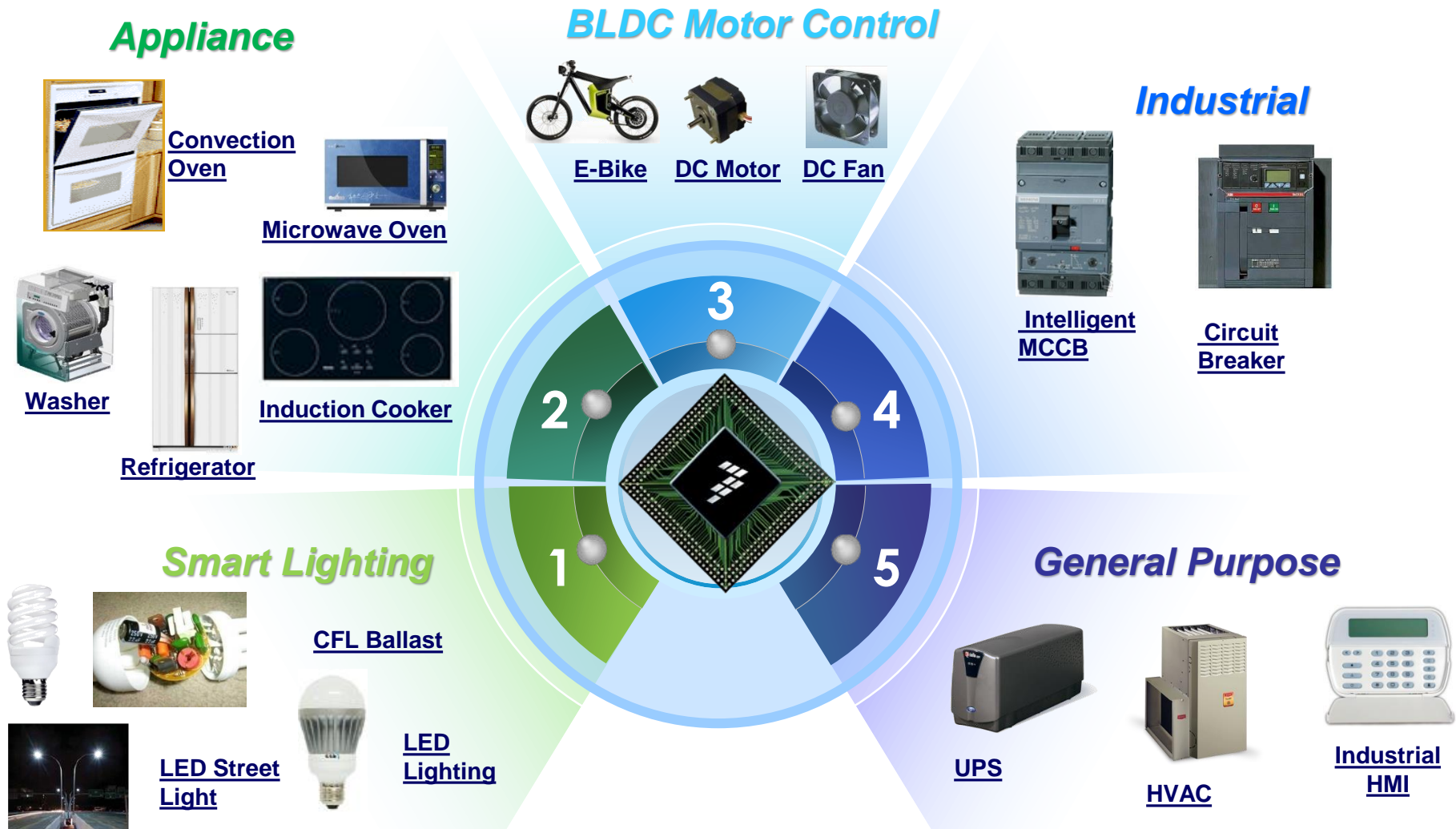
Up to 48MHz

8KB - 128KB Flash

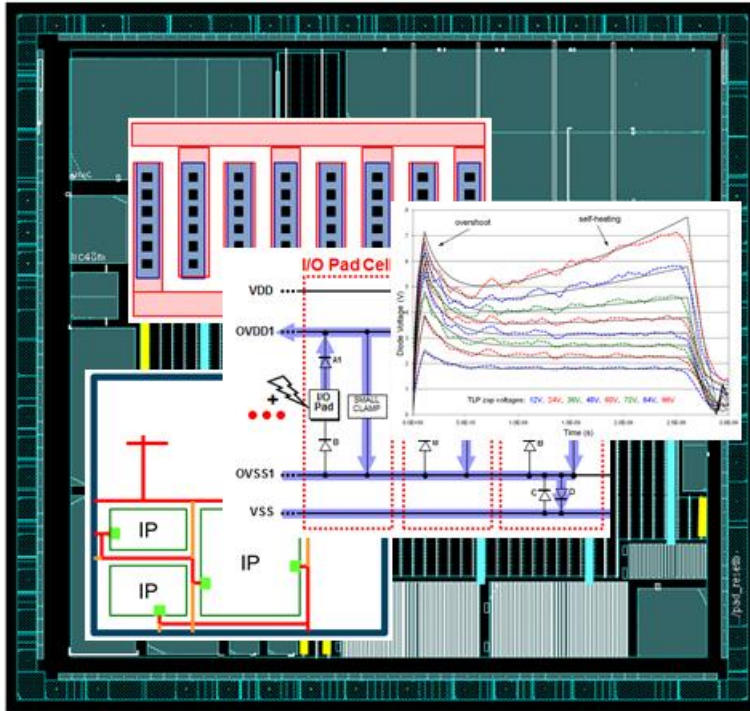
Up to 16KB RAM



# Kinetis E Series Target Market & Applications



# Chip Design for Robustness – I/O, SoC, Layout



## Special I/O Circuit

- Advanced TLP characterization tech
- Accurate simulation models
- Innovative ESD protection methodology

## Special SoC Design

- Considerate floor plan
- Optimized pad ring
- Averagely distributed ESD circuits

## Special Layout

- Optimized pad cell layout
- Enhanced soc guard ring
- Special vdd/vss routing

# Kinetis W Series

## Wireless Connectivity Microcontroller Solutions

ARM Cortex-M4 and ARM Cortex-M0+



### Integrated Radios

<1GHz and 2.4GHz RF



### Flexibility

Dual PAN

Thread, BLE, ZigBee



### Easy to Use

Complete h/w and s/w tool support

Up to 512KB flash, 64KB RAM

# Kinetis KW40Z Wireless MCU



- **Multi-Protocol Radio** – High performance radio supporting Bluetooth Low Energy v4.1 and IEEE 802.15.4 based standards including Thread and ZigBee
- **Ultra-Low Power** – Extremely low transmit, receive and standby currents that maximizes battery life including standard coin-cells
- **Software** – Fully compliant, certified Bluetooth Low Energy, 802.15.4 MAC, Thread and ZigBee protocol stacks
- **High-Precision Analog** – DC-DC Converter with Buck or Boost configuration, 16-bit Analog-to-Digital converter for highly accurate sensor measurements, 12-bit Digital-to-Analog and 6-bit Comparator

# Kinetis KW40Z MCU

## Core/Memory/System

- Cortex-M0+ running up to 48 MHz
- 160 KB Flash
- 20 KB SRAM
- Four independently programmable DMA controller channels

## Radio

- Support for BLE v4.1, 802.15.4-2011
- -92 dBm in BLE mode, -102 dBm in 802.15.4 mode
- -20 to +5 dBm programmable output power
- 6.2mA Rx & Tx (0dBm) current target (DC-DC enabled)
- <2uA low power current

## Communications/HMI/Timers

- 2xSPI, LP-UART, 2xI2C, CMT, GPIO with IRQ capability (KBI)
- Hardware Touch Sensing Inputs (TSI)
- 3xFlexTimer (TPM) with PWM & quadrature decode support
- Low Power (LPTMR), Programmable Interrupt (PIT) and RTC timers

## Analog

- 16-bit ADC with integrated temperature sensor and battery monitor
- 12-bit DAC and 6-bit High-speed Comparator

## Security

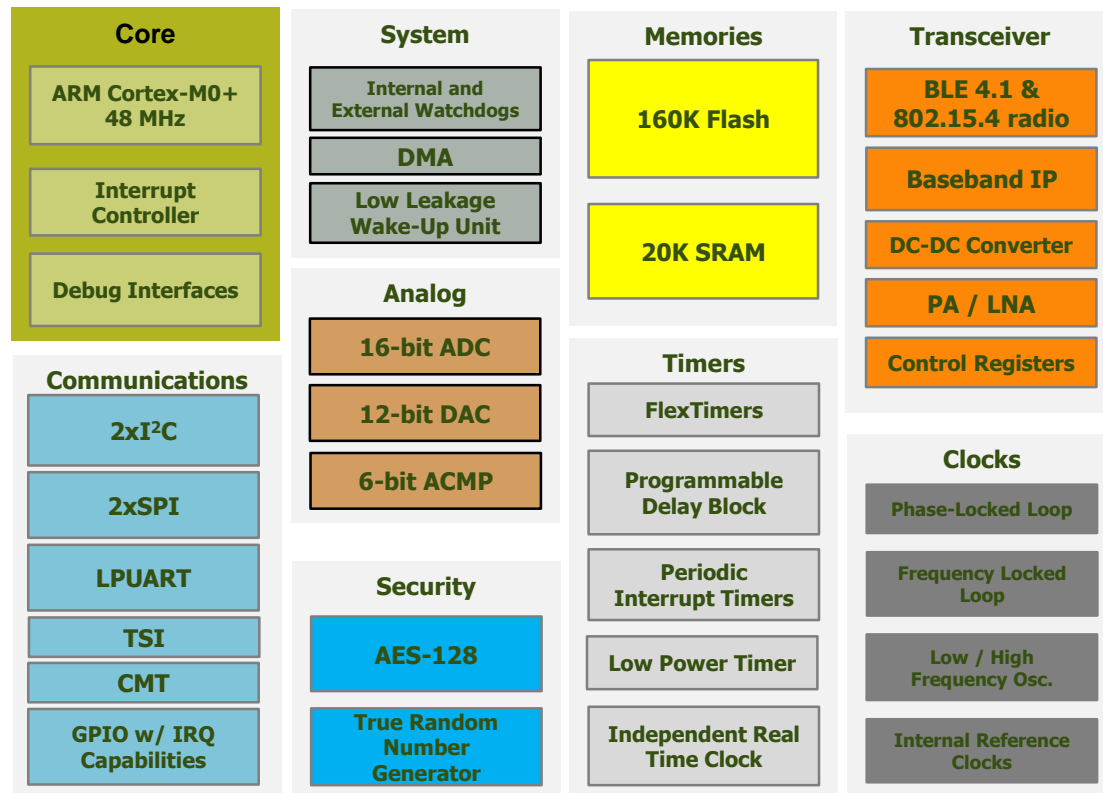
- AES Accelerator and True Random Number Generator

## Integrated DC/DC Converter

- Normal: 1.71V to 3.6V
- Buck : 2.1V to 4.2V for coin cell operation
- Boost : 0.9V to 1.795V for single alkaline battery operation

## Unique Identifiers

- 80-bit device ID programmed at factory
- 40-bit unique number can be used for Bluetooth Low Energy or IEEE 802.15.2 MAC Address



Device	Memory	Protocol	Package
MKW20Z160VHT4/R	160K Flash, 20K RAM	802.15.4	7x7 48-pin LGA
MKW30Z160VHM4/R	160K Flash, 20K RAM	BLE	5x5 32-pin LGA
MKW40Z160VHT4/R	160K Flash, 20K RAM	BLE & 802.15.4	7x7 48-pin LGA
Features	Description		
Software and Protocol Stacks	Bluetooth Low Energy Host Stack & Profiles Thread Stack (supports end node only) ZigBee 3.0 IEEE 802.15.4 MAC SMAC w/ Connectivity Test and Wireless UART KSDK, MQX/FreeRTOS		
Availability	Announcement – June 2015 @ FTF Launch – Q4'15		

# KW40Z Breakthrough Power Efficiency

	<i>Kinetis Power Modes</i>	<i>Recovery Time</i>	<i>KW40Z Typical Idd @ 3V and 25°C</i>
<b>Leading Dynamic Power</b>	<b>RUN</b>	-	3.8 mA*/ 6.1 mA***
Innovative low power process technology (C90TFS)	<b>VLPR</b>	-	161 uA**/ 732 uA***
Low Power focused Platform Design	<b>WAIT</b>	1.6us	2.7mA @ 48MHz
Next Generation Cortex M0+ core	<b>VLPW</b>	1.6us	140uA @ 4MHz
<b>Asynchronous DMA Wake-up (ADMA)</b>	<b>STOP</b>	4.5us	600uA
Energy-saving peripherals are operational with ADMA feature that can wake-up DMA to perform transfer and return to current mode when complete	<b>VLPS</b>	4.5us	4.6uA
<b>Low Leakage Wake-up Unit</b>	<b>LLS3</b>	<b>4.5us</b>	<b>1.7uA****</b>
Enables complete shut-down of core logic, including AWIC, further reducing leakage currents in all low power modes	<b>VLLS3</b>	47us	1.3uA
Supports 8 external input pins and up to 8 internal modules as wakeup sources; extends the low power wake-up capability of some internal peripherals to all power modes.	<b>VLLS1</b>	105us	700nA
Wake-up inputs are activated in LLS or VLLS modes	<b>VLLS0</b>	106us	140nA / 310nA

\*Compute Operation enabled: 3.8/mA @ 48MHz core / 24MHz bus)

\*\* Compute Operation enabled: 161uA @ 4MHz core / 800kHz bus)

\*\*\* Running Coremark algorithm, KEIL 4.54 optimized for speed

\*\*\*\* Recommended low power operating mode

# Market Specific Kinetis Series



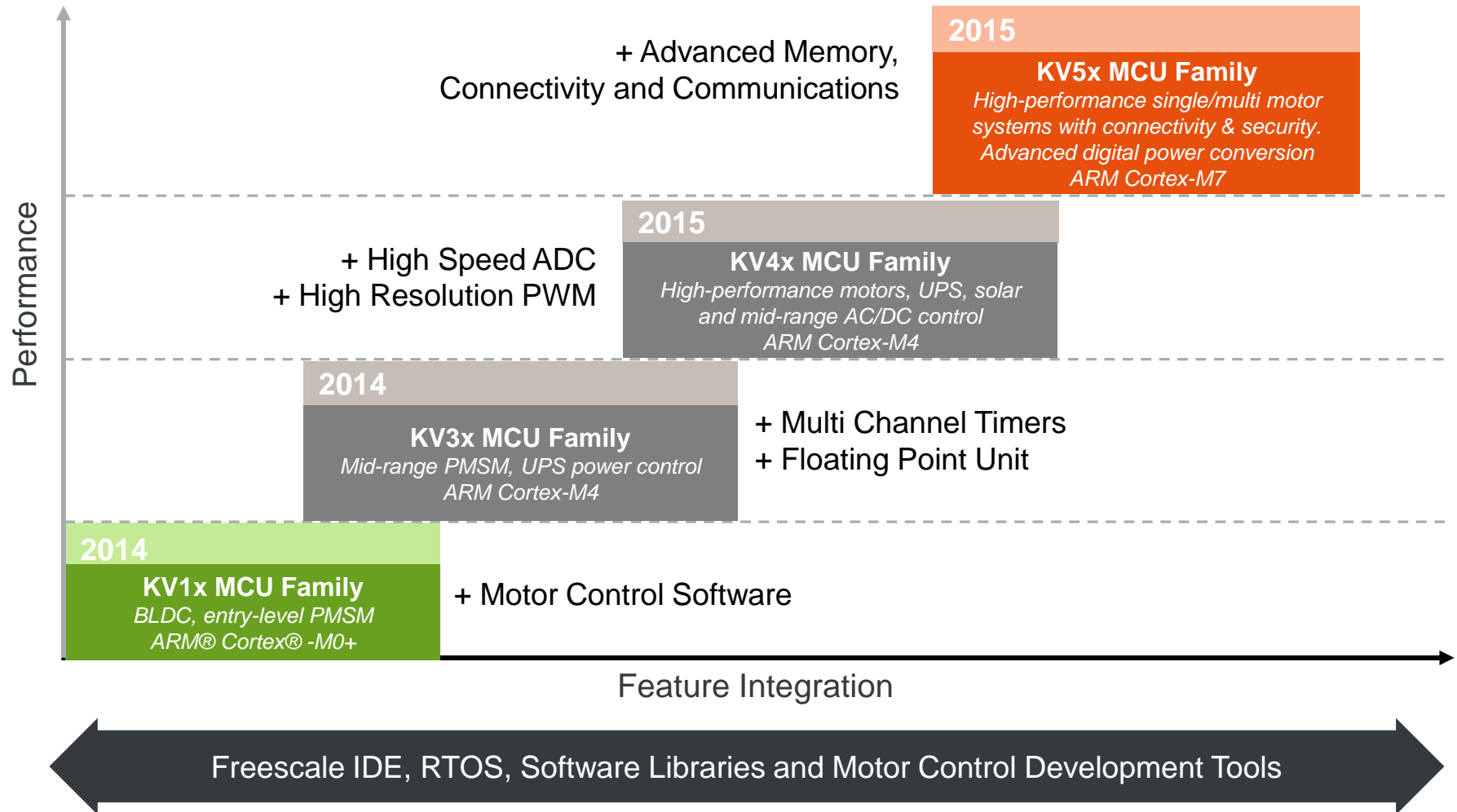
# Kinetis V Series

## Motor Control & Power Conversions

ARM Cortex-M7, ARM Cortex-M4 and ARM Cortex-M0+

- ✓ High Efficiency: Next generation BLDC, PMSM and ACIM and digital power conversion designs
- ✓ High Speed/Resolution Peripherals
- ✓ High-Performance: from entry-level 75MHz MCUs, to advanced 240MHz MCUs, maximize hardware & software reuse and end product flexibility
- ✓ Fully Enabled: Freescale Tower and Freedom development boards, Embedded Software Libraries and Kinetis Motor Suite reduce motor control learning curve and speed time to market

# New Levels of Performance, Reliability and Power Efficiency for Motor Control and Digital Power Conversion

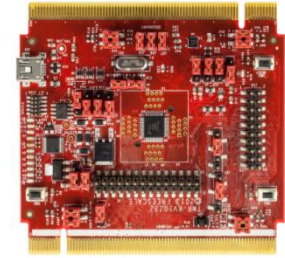


# Kinetis V Series: Enablement

## TWR-KV10Z32 Tower System MCU Module

**\$99SRP**

- MKV10Z32VLF7 MCU (75MHz, CM0+, 32KB, 48LQFP)
- See out-of-box video @ [www.freescale.com/TWR-KV10Z32](http://www.freescale.com/TWR-KV10Z32) running BLDC trapezoidal algorithm. IAR IDE & FreeMASTER tool



**TWR-KV10Z32**

## TWR-KV31F120M TWR System MCU Module

**\$99SRP**

- MKV31F512VLL12 (120MHz, CM4, 512KB, 100LQFP)
- See out-of-box demo @ [www.freescale.com/TWR-KV31F120M](http://www.freescale.com/TWR-KV31F120M) running PMSM FOC algorithm with FlexTimer. IAR IDE & FreeMASTER tool



**TWR-KV31F120M**

## TWR-KV46F150M Tower System MCU Module

**\$129SRP**

- MKV46F256VLL15 (150MHz, CM4, 256KB, 100LQFP)
- Out-of-box demo running PMSM FOC algorithm with eFlexPWM. IAR IDE & FreeMASTER tool. [www.freescale.com/TWR-KV46F150M](http://www.freescale.com/TWR-KV46F150M)



**TWR-KV46F150M**

## TWR-MC-LV3PH Tower System Motor Driver Module

**\$249SRP**

- 12-24/50 V, up to 8A, 3-phase MOSFET gate drivers with over/under current protection, BLDC motor



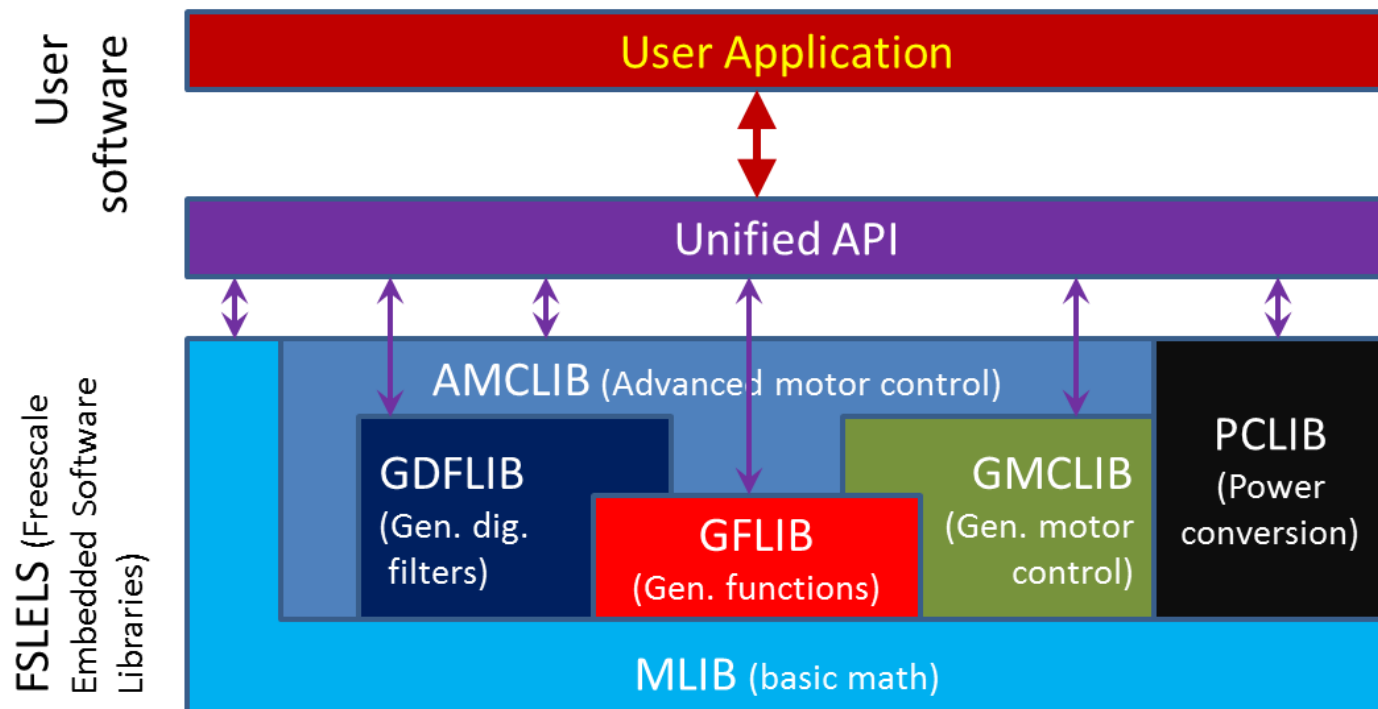
**TWR-MC-LV3PH**

Kinetis Design Studio IDE, Kinetis SDK + Processor Expert, MQX RTOS, FreeMASTER, Motor Control Tool Box, ARM ecosystem support



# Freescal Embedded Software Libraries

- Libraries of s/w algorithms for Math, Motor Control, Power Conversion, Filters and Advanced functions
- Supports Kinetis MCUs, DSCs and key compilers (CW, KDS, IAR, Keil)
- Algorithms tested extensively through MATLAB Simulink reference models
- **Free of charge** : Binary code released through Freescale website
- **Paid**: Source code, optimized code, advanced functions (including patented)



# Kinetis M Series

## ARM Cortex-M0+

- Enabling high accuracy, secure 1-, 2- & 3-phase electricity metering solutions through a rich analog front end, hardware tamper detection and multiple low-power features in a 32-bit ARM Cortex-M0+ MCU



### High Accuracy Analog Front End (AFE)

4x24-bit Sigma Delta ADCs for simultaneous voltage and current measurements



### Security & HMI

Active and passive tamper pins with auto time stamping to protect against external intrusion

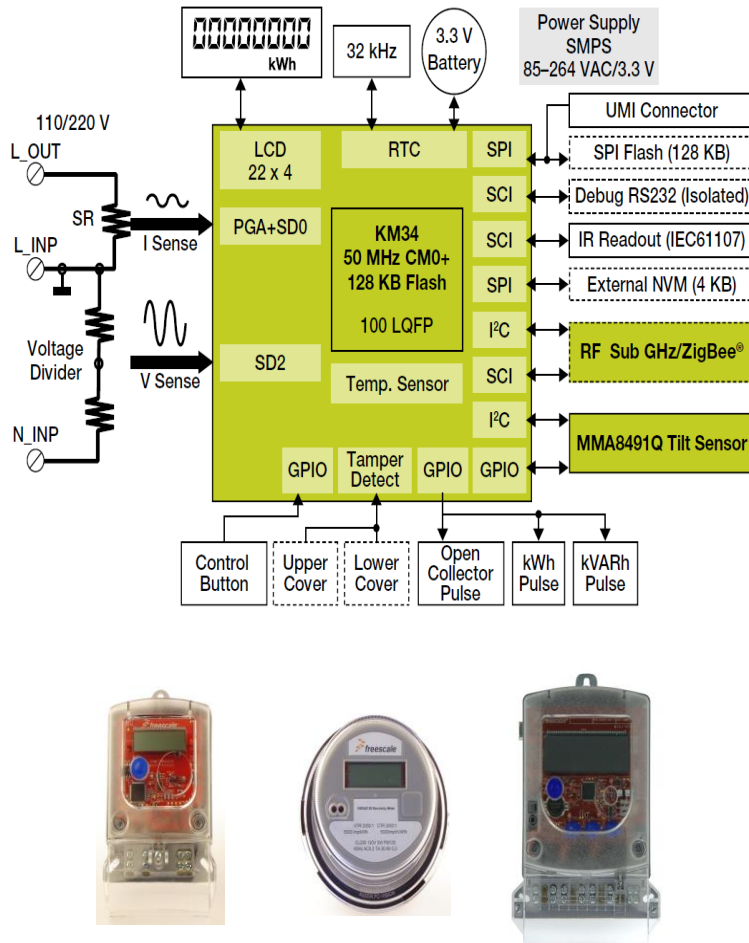


### Enablement

1,2, & 3-phase regionally specified electricity meter reference designs certified to international standards

# Electricity Meter Block Diagram

MEASURE → PROCESS → DISPLAY



## • Measure

- Electricity meters must measure phase voltages and phase currents consumed by connected load
- Measurement linearity of 0.1% over 2000:1 dynamic range.
- Shunt resistors, current transformers or Rogowski coils can be connected.

## • Process

- Accurate calculation of the active and reactive energies
- Time keeping with accuracy better than  $\pm 0.5s/day$  needed for billing purposes
- Tamper processing ensures security
- Load profiles and parameters storage

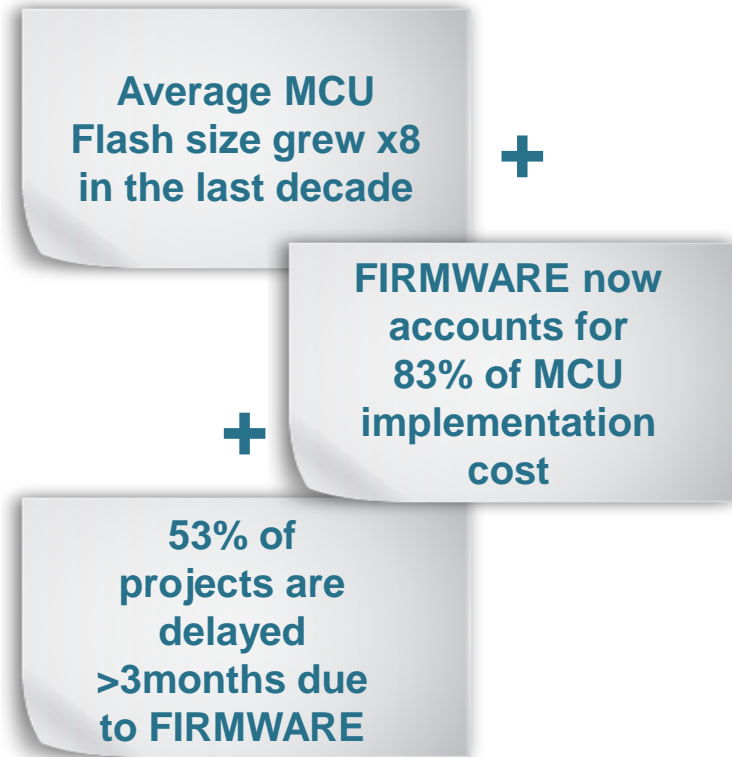
## • Display

- LCD display allows visual inspection
- HMI (control button) allows system configuration
- IR / RF communication allows download of data for utility companies and automatic meter reading

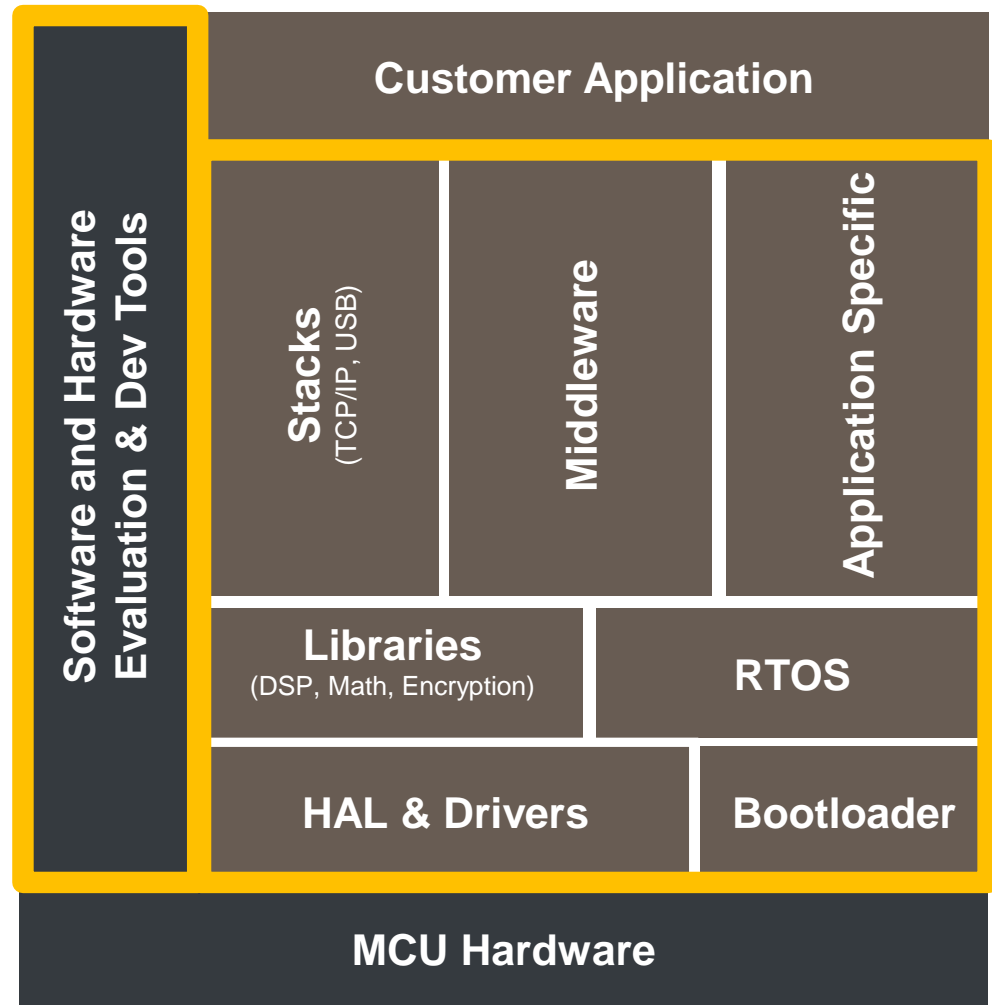
# Kinetis MCU Enablement



# Growing Importance of Enablement



Firmware is MCU developers **BIGGEST** pain point



# Freescalé's Microcontroller Enablement Bundle

## Solution Advisor Part Selector



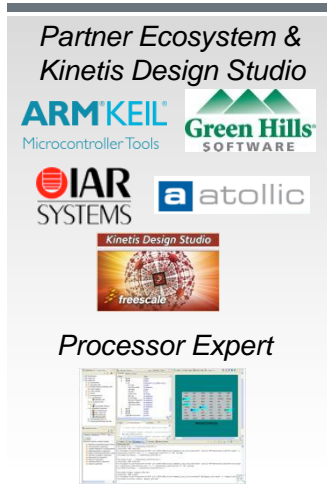
Find best-fit processors and tools with web-based interactive product selector

## Development Platforms



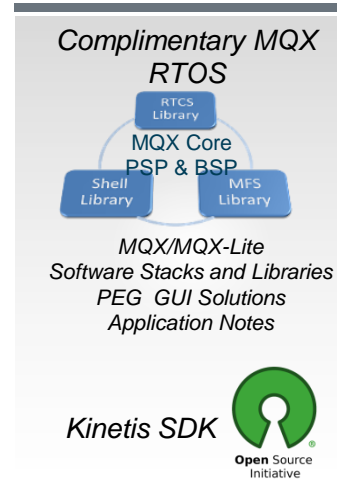
Low cost hardware platforms for prototyping application development

## Development Tools



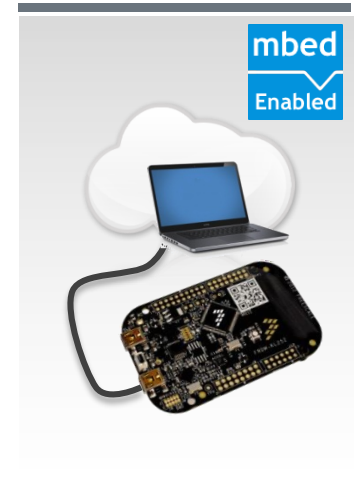
Visual and automated framework to accelerate development time, deliver software components

## Development Software



Comprehensive solution for embedded control and connectivity

## Online Enablement



Cloud enablement through freely available online design tools, communities, part selectors



# IDE Options for Kinetis MCUs ([www.freescale.com/kide](http://www.freescale.com/kide))

## Featured IDEs:

### Atollic TrueSTUDIO



- Professional Eclipse/GNU based IDE with a MISRA-C checker, code complexity analysis and source code review features.
- Advanced RTOS-aware debugger with ETM/ETB/SWV/ITM tracing, live variable watch view and fault analyzer. Dual-core and multi-processor debugging.
- Strong support for software engineering, workflow management, team collaboration and improved software quality.

### Green Hills MULTI



- Complete & integrated software and hardware environment with advanced multicore debugger
- Industry first TimeMachine trace debugging & profiler
- EEMBC certified top performing C/C++ compilers

### Keil Microcontroller Development Kit



- Specifically designed for microcontroller applications, easy to learn and use, yet powerful enough for the most demanding embedded applications
- ARM C/C++ build toolchain and Execution Profiler and Performance Analyzer enable highly optimized programs
- Complete Code Coverage information about your program's execution

### IAR Embedded Workbench



- A powerful and reliable IDE designed for ease of use with outstanding compiler optimizations for size and speed
- The broadest Freescale ARM/Cortex MCU offering with dedicated versions available with functional safety certification
- Support for multi-core, low power debugging, trace, ...

## Complimentary Solutions:

### Kinetis Design Studio



- Complimentary basic capability integrated development environment (IDE) for Kinetis MCUs
- Eclipse and GCC-based IDE for C/C++ editing, compiling and debugging

### mbd Development Platforms



- The fastest way to get started with Kinetis MCUs
- Online project management and build tools – no installation required; option to export to traditional IDEs
- Includes comprehensive set of drivers, stacks and middleware with a large community of developers.

## Additional Ecosystem Partners:



Rowley Associates





# Kinetis Software Development Kit (SDK)



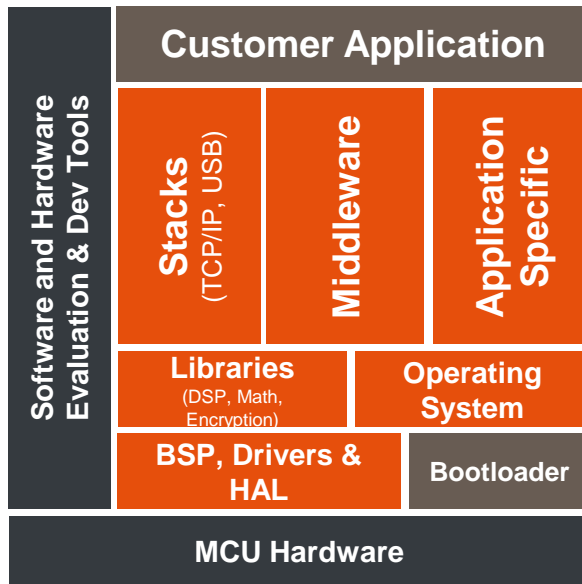
A complete software framework for developing applications across all Kinetis MCUs



HAL, peripheral drivers, libraries, middleware, utilities, and usage examples; delivered in C source

## Product Features

- Open source hardware abstraction layer (HAL) provides APIs for all Kinetis hardware resources
- BSD-licensed set of peripheral drivers with easy-to-use C-language APIs
- Comprehensive HAL and driver usage examples and sample applications for RTOS and bare-metal
- GUI configurable projects and peripheral drivers using Processor Expert
- CMSIS-CORE compatible startup plus CMSIS-DSP library and examples
- RTOS Abstraction Layer (OSA) with support for Freescale MQX, FreeRTOS, Micrium uC/OS, and bare-metal
- Integrates new Freescale unified USB stack, open source TCP/IP stack (lwIP), open source FAT file system, encryption math/DSP libraries, and more and
- Support for multiple toolchains including GNU GCC, IAR, Keil, and Kinetis Design Studio



Open Source Initiative





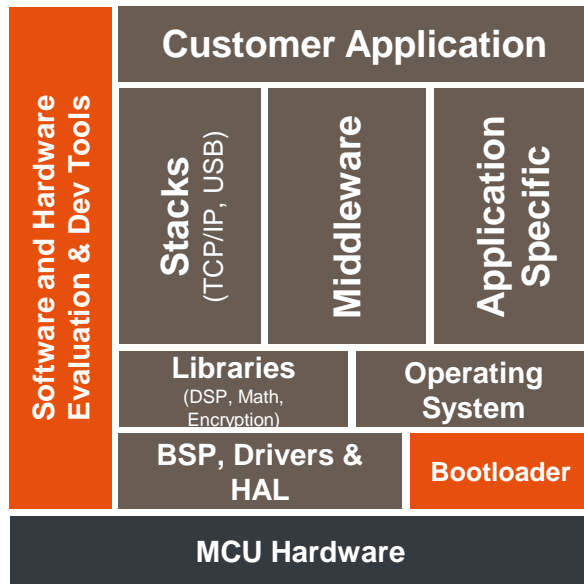
# Kinetis Bootloader



Flash programming over a serial connection: erase, program, verify



Flash, ROM or RAM based bootloader with open-source software and host-side programming utilities.



Open Source Initiative

## Product Features

- A common bootloader for Kinetis MCUs
- C/C++ Source code provided under a permissive BSD open source license
- Serial communications with a host via UART, SPI, I2C, and USB HID
  - Active peripheral detection
  - Common packet-based protocol for all peripherals
- Packet error detection and retransmission
- Configurable options for executing bootloader at startup or application runtime
- Command-line and GUI tools provided for Windows
- Designed to be flash, ROM or RAM resident
  - Failsafe boot mechanism on Kinetis devices with ROM
  - Pre-programmed into flash (on devices without a dedicated ROM) and executed from RAM for built-in factory programming
  - Fully customizable for use in customer applications providing reliable field updates



# Programming for Kinetis MCUs



- Service provided by Freescale that enables programming of customer's unique software during the production of the MCU
- Code submitted online via Freescale's MCU Programming Center ([Freescale.com/MCUprogramming](http://Freescale.com/MCUprogramming))
- Ships from Freescale directly to customer (if direct account) or distributor under special custom part number (part number begins with "SP")
- Available across the majority of Kinetis series
  - Kinetis K, L, M and V devices are program-capable
- Business terms
  - Programmed devices require 1 week additional lead time
  - >10% price adder with no NRE for first code submitted
  - Minimum order value may apply
  - Standard custom part number terms apply



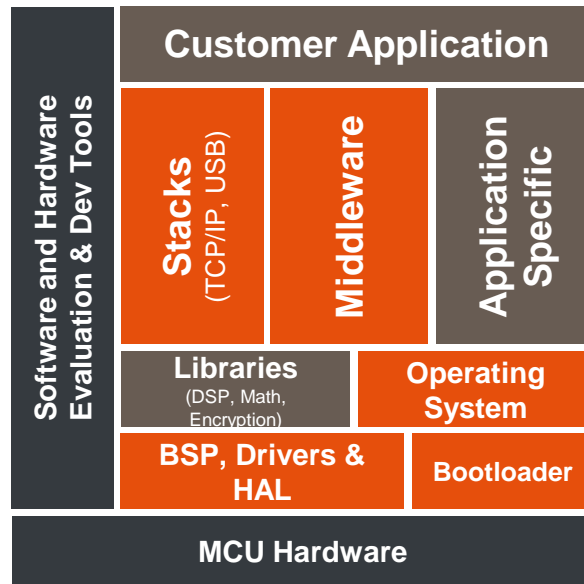
# Freescale MQX™ Software Solutions



Commercial-grade MCU software platform at no cost with optional support packages



Enabling the development of connected and intelligent applications of the future



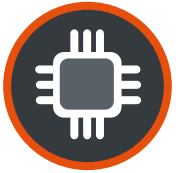
## Product Features

- MQX™ Real Time Operating System Kernel
  - Deterministic multi-tasking preemptive scheduler
  - Extensive inter-task synchronization, message passing, and much more
- MQX™ Real Time Communication Suite
  - Now with optional IPv6 add-on package*
  - Broad networking protocol support (TCP, UDP, ICMP, HTTP, DHCP, FTP, Telnet, ...)
  - Fully re-entrant, responsive, designed for embedded systems
- MQX™ File System
  - Embedded FAT file system compatible with FAT-12, FAT-16, or FAT-32 file systems
- Nand Flash File System (FFS)
- MQX™ USB Host/Device Stack
  - USB 1.0/2.0; low-/full-/high-speed
- Board Support Packages
  - Pre-configured MQX Kernel, stacks, and peripheral drivers for Freescale HW





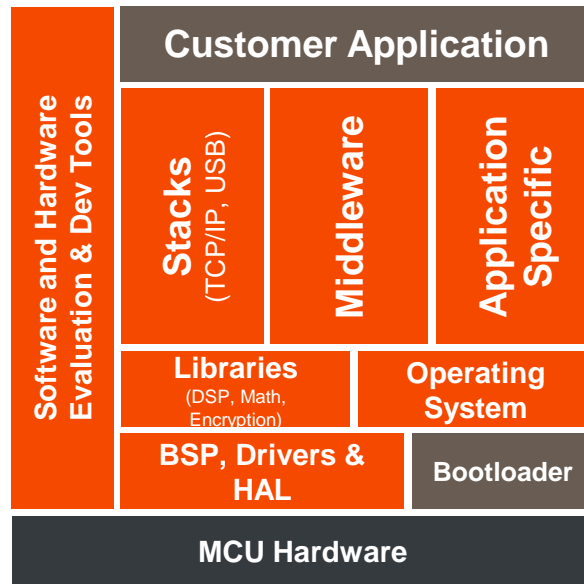
# Freescale Processor Expert Software



Create, configure, generate software and drivers for Freescale microcontrollers.



Master complex peripherals with a few mouse clicks, without the need to read thousands of data sheet pages.



## Product Features

- Standalone and integrated for
  - Eclipse based IDE's
  - Freescale CodeWarrior
  - IAR Embedded Workbench
  - Keil MDK
- Easy configuration of Kinetis SDK with Processor Expert Components
- Supports Kinetis, Vybrid, S08, S12, S12Z, ColdFire, DSC and Power Architecture with reusable software components
- Knowledge base of pins, registers, muxing, clocks and dependencies
- Initialization and driver code generation with design time consistency checking
- Bare Metal and RTOS drivers
- On-chip and Off-chip Device Drivers
- Middleware and Stacks: RTOS, TSS libraries and communication stacks
- Component Development Environment (CDE) to create and distribute own components





[www.Freescale.com](http://www.Freescale.com)