ARM® MICROCONTROLLER OVERVIEW

APF-DES-T2222

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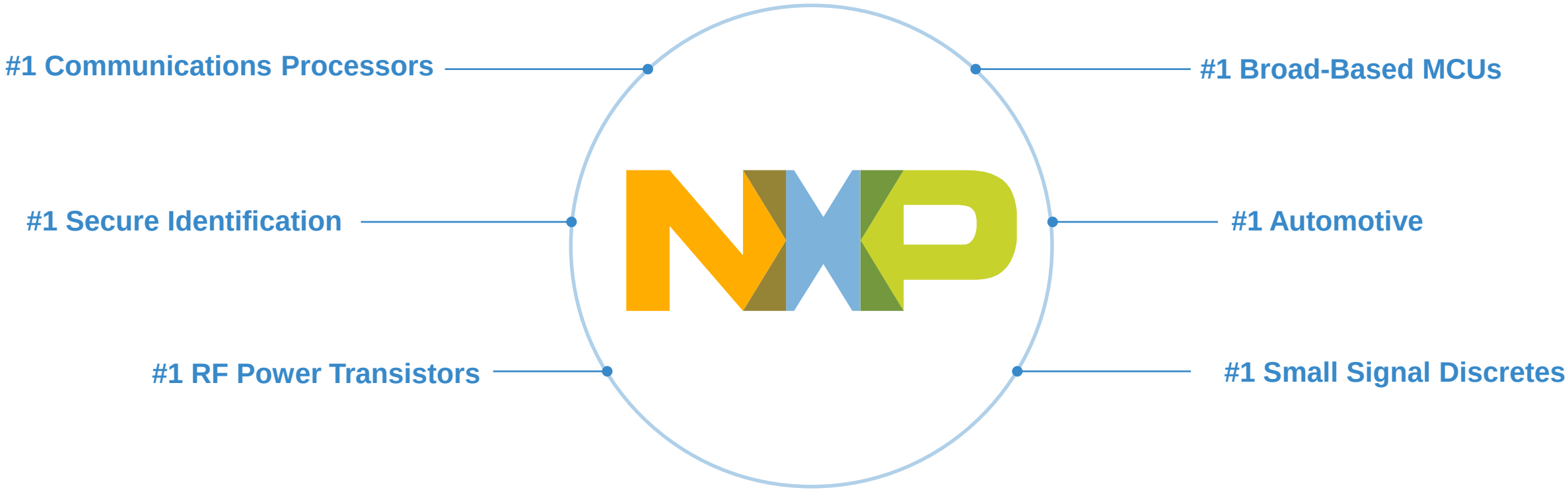
GC REGIONAL MARKETING MANAGER
NOVEMBER 16, 2016

SECURE CONNECTIONS FOR A SMARTER WORLD

A NEW POSITION OF STRENGTH



~45,000 Employees

11,000+ Engineers

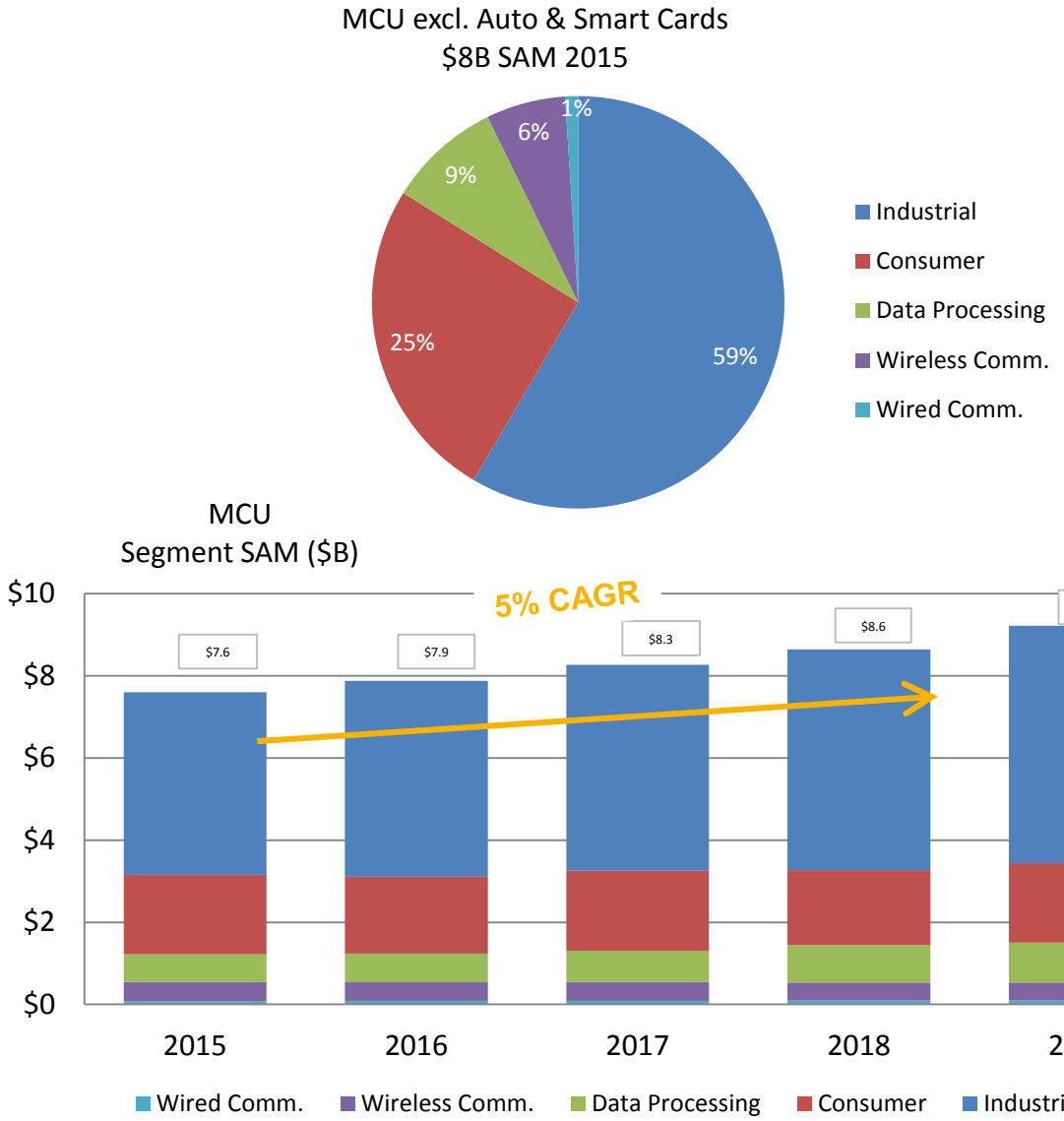
35+ Countries

9,000+ Patents

Integration of Powerhouse Portfolios

ARM Expertise	Broadest licensee of ARM cores in industry, with **1000+ products** developed to date based on ARM
Expansive Portfolio	Industry's most scalable portfolio Optimized performance and capabilities at each level
Development Tools	Incorporate ARM tools and extend Kinetis and LPC support to new ARM-based microcontrollers
Ecosystem Leadership	Support customer designs through industry leading partnerships and internal development, from boards to Operating Systems and middleware
Customer Centric	Continue best-in-class customer support model Deliver close to customer solutions

MCU Market Overview



Segment '15 SAM ($B)	Key Markets	'15 SAM ($B)	'15 – '19 CAGR
Industrial $4.9B	Automation	$1.9	7.1%
	Building & Home Control	$0.7	3.5%
	Power & Energy	$0.7	7.7%
	Healthcare	$0.7	7.8%
	Other	$0.9	
Consumer $2.1B	Appliance	$0.4	7.8%
	Wearables – Fitness & Wellness	$0.06	8.8%
	Other	$1.6	
Data Processing $0.6B	POS	$0.12	10.8%
	Other	$0.48	

Key Success Factors for MCU Market

Low Power · Scalable · Secure · Connectivity

Ease-of-use · Ecosystem · Customer-focus

Source: iSuppli 2Q '15

MICR BL

Why Customers Choose Us

- Extensive software and development environment
- Industry leading customer support, quality, and longevity
- Broad ecosystem of partners enabling system solutions
- Ease of use solutions tailored for mass market

Example Customers

BOSCH Invented for life, AVNET, arrow, Digi-Key, Electrolux, ABB, FLEXTRONICS, GREE, EMERSON Network Power, Haier, GARMIN, Continental, Honeywell, Insulet Corporation, Microsoft, MOUSER ELECTRONICS, SONOS, SONY, LAB126, Schneider Electric, SIEMENS, Whirlpool

Products

Kinetis and LPC 32-bit ARM® Microcontrollers	i.MX ARM® Applications Processors

Applications

Wearable / Healthcare
- Health / Fitness & Wireless Healthcare
- Diabetes & Cardiac Care
- Diagnostics & therapy

Smart Home
- Smart meters & grid
- Integrated wireless connectivity solutions
- Home energy control

Smart Accessories
- Game controllers and consoles
- Wearable computing
- eReaders, tablets, portable navigation

Vehicle Networking & Information
- Infotainment, software define radio
- Navigation systems, E-call

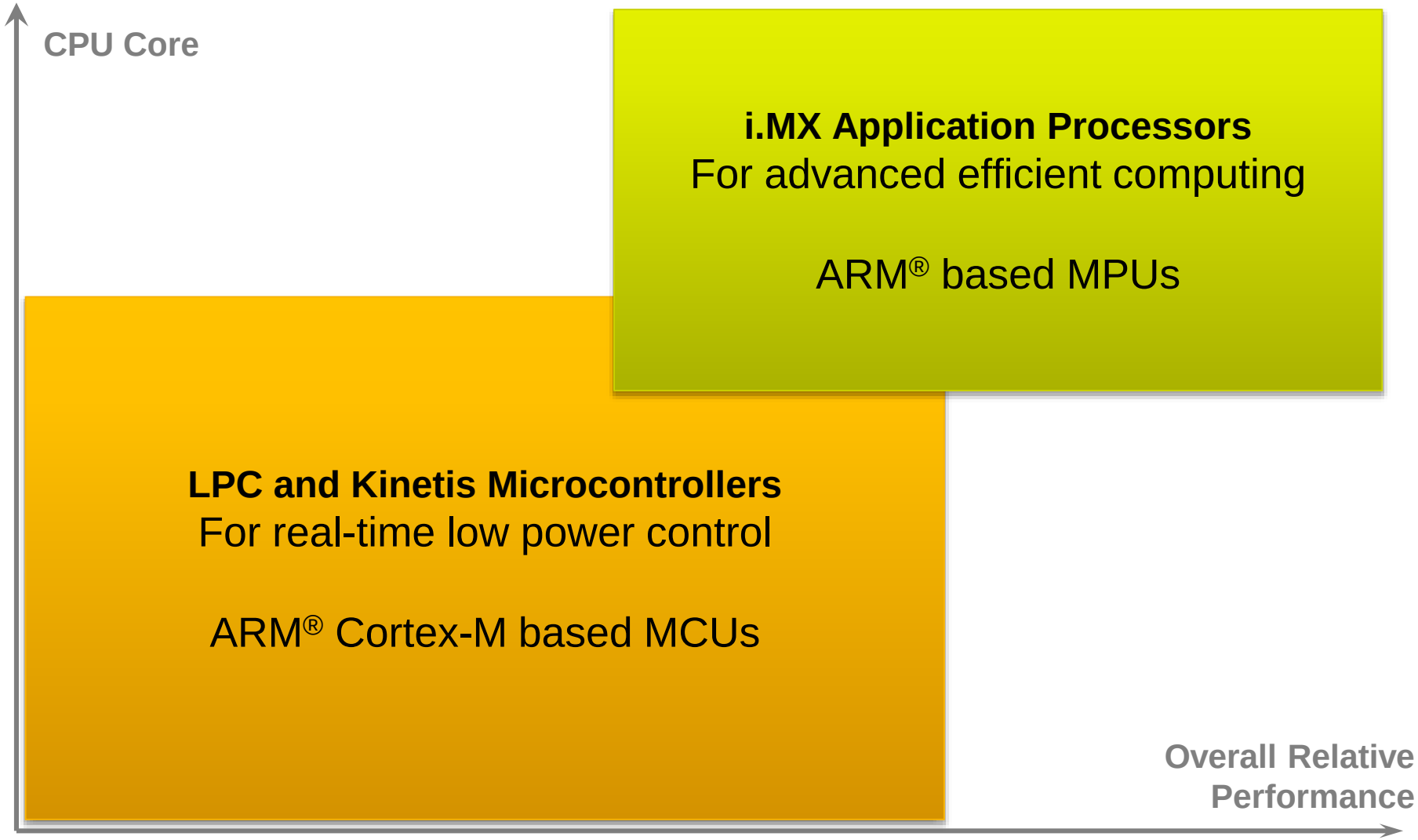
Home Appliances
- Energy efficient refrigerators, dishwashers
- Human-machine interface
- Connected appliances

Factory Automation & Drives
- Machine-to-machine
- Motor control
- Industrial networking

Strength in Product Longevity

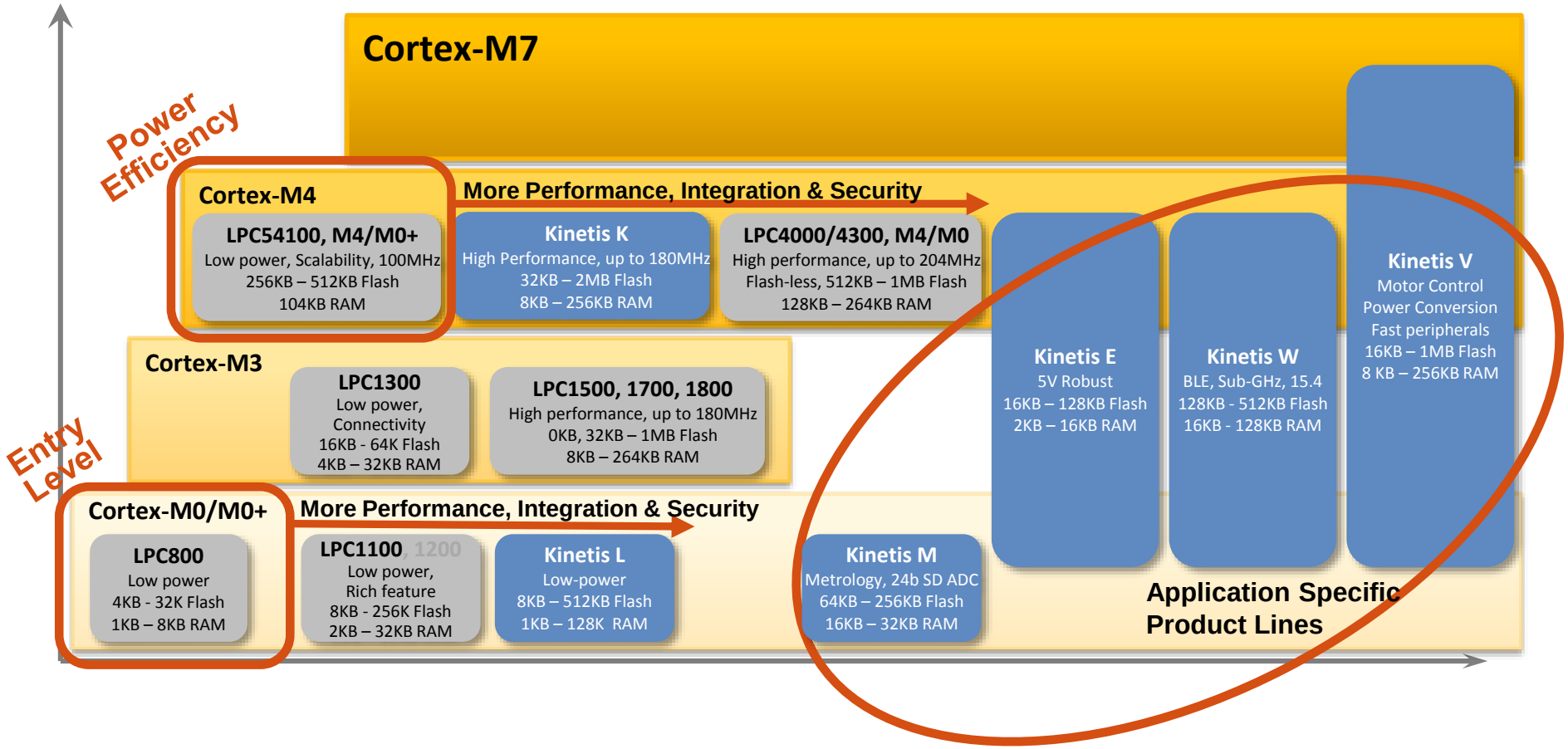
- NXP (both NXP LPC and former Freescale) have longstanding track records of **providing long-term production support** for our products
- NXP has a **formal product longevity program** for the market segments we serve
  - For the automotive and medical segments, NXP will make a broad range of solutions available for a minimum of **15 years**
  - For all other market segments in which NXP participates, NXP will make a broad range of solutions available for a minimum of **10 years**
  - **Life cycles** begin at the time of launch
  - Includes NXP's standard end-of-life notification policy
- For a complete list of participating products, visit, nxp.com/productlongevity

Scalable ARM based Processors and Controllers



NXP's Breadth in Microcontrollers

Kinetis + LPC = Broad Portfolio of Microcontroller Families



LPC OVERVIEW

NXP LPC Microcontroller Portfolio At-a-Glance

From entry level

Easy to use
Exceptional power efficiency
Lowest pin count

LPC800 Series

Low power, basic control and connectivity

- 30 MHz Cortex-M0+ core
- Basic serial connectivity
- Basic analog
- Low-pincount packages including TSSOP and HVQFN and XSON
- Ideal for 8-/16-bit transition

LPC1100 Series

Power efficient, broad selection, industry-standard connectivity

- 50 MHz Cortex-M0+ & M0 cores
- Serial connectivity: USB with PHY, CAN with transceiver
- Best-in-class analog
- Broad package selection
- Migration path to LPC1300 Series

LPC1200 Series

Noise immunity for industrial applications

- 45 MHz Cortex-M0 core
- High-immunity rating (IEC61697-1)
- 8 kV ESD protection
- Basic analog
- Real-time clock
- Fm I^2C with 10x bus-drive capability

to high performance & integration

Power efficiency
Advanced connectivity
Flexible peripherals

LPC1300 Series

Performance and basic connectivity

- Up to 72 MHz Cortex-M3 core
- Serial connectivity : USB, CAN
- Pin-compatible upgrade for most LPC1100 Series devices

LPC1500 Series

High-precision motion control

- Up to 72 MHz Cortex-M3 core
- Optimized for sensored & sensorless brushless motor control; free FOC firmware
- Serial connectivity: USB, CAN
- Advanced analog subsystem and SCTimer/PWM

LPC1700 Series LPC4000 Series

High performance with DSP options, multi-connectivity, advanced peripherals

- Up to 120 MHz Cortex-M3 core
- Advanced connectivity: USB, CAN, Ethernet
- Graphic LCD controller
- Pin-compatible migration path to LPC4000 Series and ARM7 LPC2x00 Series
- Up to 120 MHz Cortex-M4/M4F cores with DSP
- Advanced conn.: USB, CAN, Ethernet
- Graphic LCD controller
- Analog comparators
- Drop-in perf. upgrade for LPC1700 and LPC2x00 series

LPC1800 Series LPC4300 Series

Best performance with DSP and dual-core options, multi-high-speed connectivity, advanced peripherals

- Industry's highest-performing Cortex-M3 core, up to 180 MHz
- Advanced conn.: dual Hi-Speed USB, dual CAN, 10/100 Ethernet
- Advanced, flexible timers for event-driven timing and PWM applications
- Drop-in compatible with LPC4300 Series
- Up to 204 MHz Cortex-M4F core with DSP capabilities and Cortex-M0 coprocessor(s)
- Partition tasks across cores to optimize performance
- Advanced conn.: dual Hi-Speed USB, dual CAN, 10/100 Ethernet, configurable high-speed serial I/O
- Best-in-class analog, up to 80 Msps, 12-bit ADC

and redefined power-efficiency

Flexible peripherals
Smart integration

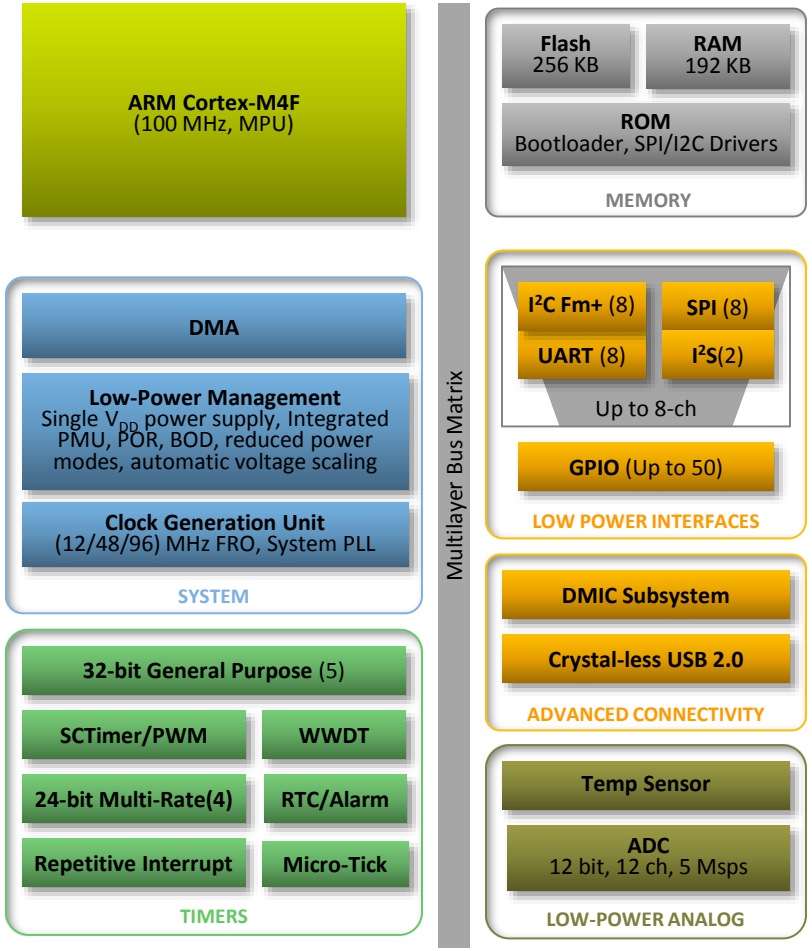
LPC54100 Series LPC54110 Series

Ultra-low-power for always-on sensor processing

- Up to 100 MHz single- & dual-core: Cortex-M4F & M0+ (opt.)
- Optimized for sensor listening, aggregation, fusion, and communication
- Ultra-low 'power down' mode, down to 3 µA for sensor listening
- Scalable power performance
- Up to 100 MHz single- & dual-core: Cortex-M4F & M0+ (opt.)
- Reduction in dynamic power
- Optimized for voice recognition and sound detection with integrated DMIC subsystem and HW VAD
- Scalable power performance

LPC54113: 100MHz Cortex-M4F with 256 KB Flash

Block Diagram and Key Features



CPU

- **100MHz Cortex-M4F**

Memory

- 256 KB Flash, **192 KB RAM**

Interfaces for connectivity & sensors

- Stereo DMIC subsystem
  - (PDM, decimator, HW VAD)
- **8 SPI, 8 I2C, 8 UART, 2 I²S channels.**
  Max 8 channels
- **Crystal-less FS USB**
- Power-efficient **5.0 Msps, 12-bit ADC**: full-spec performance (1.62 to 3.6V, -40 to 105 °C)

Clocks & timers

- **12/48/96 MHz FRO**, 100 kHz-1.5MHz WDOG OSC, 32 Xtal OSC, external clock input
- Basic & advanced timers including SCTimer/PWM
- Asynchronous peripheral bus

Packages

- LQFP64 (10 x 10 mm)
- WLCSP49 (3.45 x 3.45 mm)

Other

- Operating voltage: 1.62 to 3.6V
- Temperature range: -40 to 105 °C

Availability

LPC5411x Silicon
LPCXpresso 54114 (OM13089)
LPC54114 Audio & Voice Recognition Kit (OM13090)

Limited Early Access Samples **NOW**
Market Announcement **Embedded World**
Full Market Launch **May 30, 2016**
(WLCSP MP Jul-2016)

Target Applications

Consumer / Wearable / Personal Health Mgmt

- Wearables, fitness monitoring, home healthcare, and patient monitoring

Gaming / Entertainment

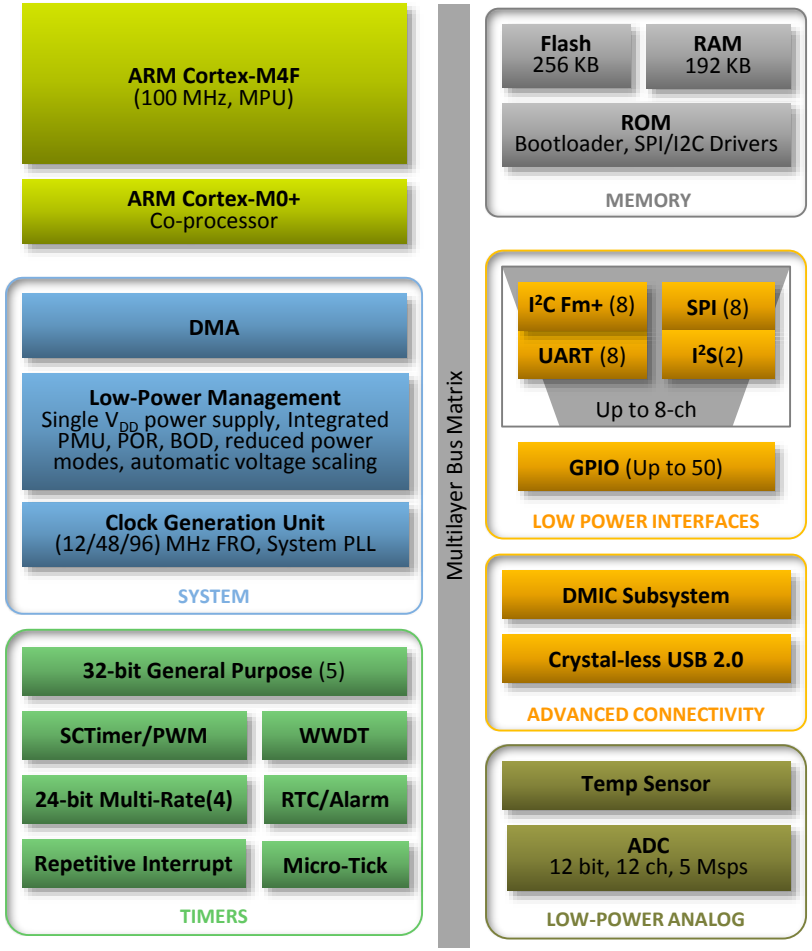
- Console / user motion control and orientation, voice and sound activation, general toys

Home / Building Automation & Control

- Access and lighting control, HVAC and smart thermostats, fire, safety and security
- UI with voice and sound activation

LPC54114: 100MHz Cortex-M4F/M0+ with 256 KB Flash

Block Diagram and Key Features



CPU

- **100MHz Cortex-M4F**
- **Cortex-M0+ Co-processor**

Memory

- 256 KB Flash, **192 KB RAM**

Interfaces for connectivity & sensors

- Stereo DMIC subsystem
  - (PDM, decimator, HW VAD)
- **8 SPI, 8 I2C, 8 UART, 2 I²S channels.**
  Max 8 channels
- **Crystal-less FS USB**
- Power-efficient **5.0 Msps, 12-bit ADC**: full-spec performance (1.62 to 3.6V, -40 to 105 °C)

Clocks & timers

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Packages

- LQFP64 (10 x 10 mm)
- WLCSP49 (3.45 x 3.45 mm)

Other

- Operating voltage: 1.62 to 3.6V
- Temperature range: -40 to 105 °C

Availability

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KINETIS OVERVIEW

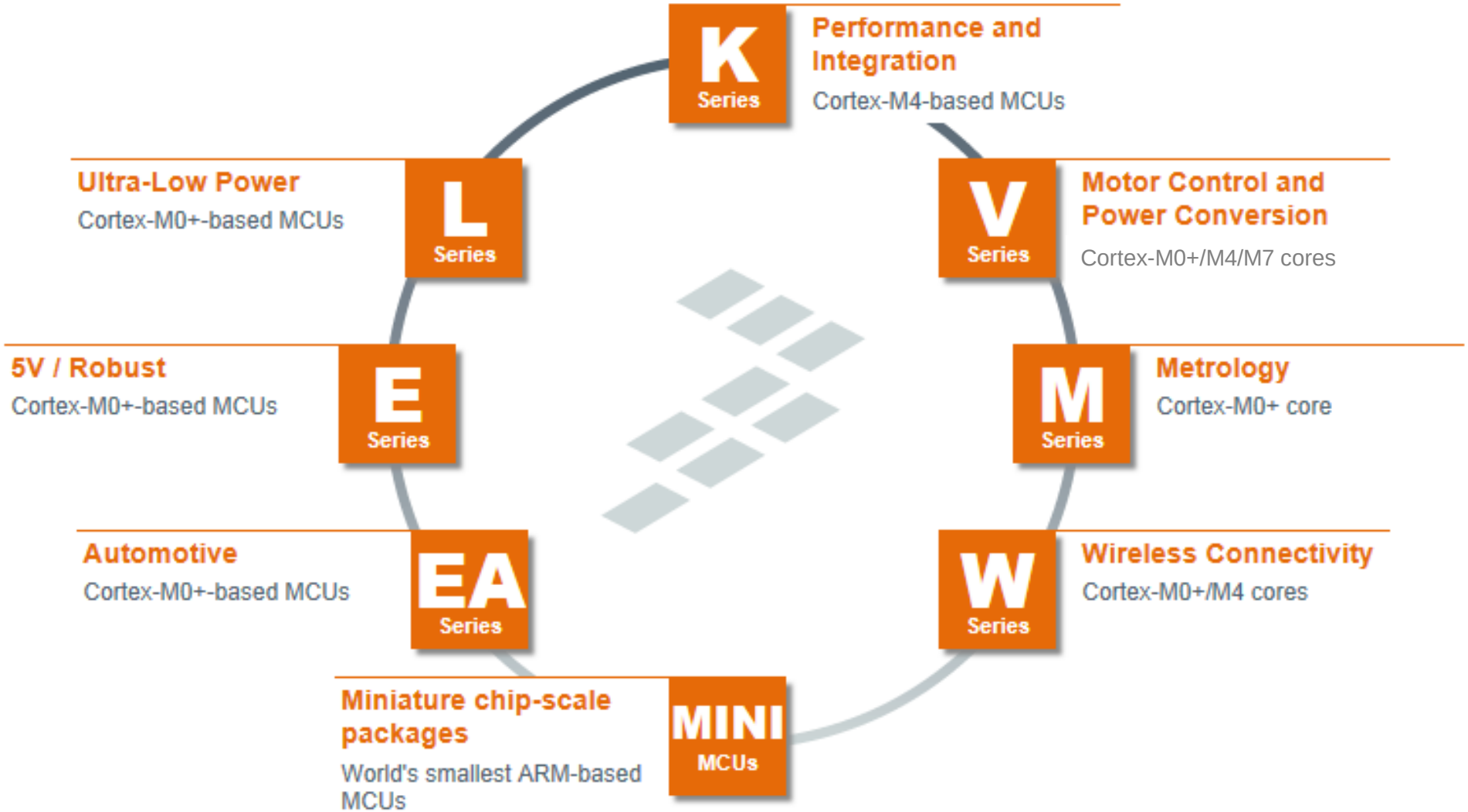
Kinetis Microcontrollers Platform

Security	Wireless Connectivity	Low Power	Ease of Use
			
Multiple Levels of Scalable Security Protecting communication, software and the physical system	**Integrated RF transceiver** BLE 4.2 802.15.4 / Thread / ZigBee	**Low Power Architecture for;** Efficient dynamic power, Ultra low static power with data retention	**Tools for power estimation, profiling** SDK and stacks for fast TTM

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

Kinetis MCU Portfolio

The right series for the application



Kinetis Microcontroller Portfolio

Performance & Integration

General Purpose
406 Products
23 Packages

- From 50 to 180 MHz
- 32kB to 2MB Flash
  8 to 256 kB SRAM
- Memory Expansion
- High Precision Analog
- Options with
  - Advanced Security & Protection
  - FS/HS+PHY USB
  - CAN, Ethernet
  - Segment/Graphics LCD
  - PGA/OpAmps
  - FlexIO

K Series

Wireless Connectivity

Application Specific
8 Products
4 Packages

- Sub-1GHz and 2.4GHz *(inc. BLE & 802.15.4, Zigbee, Thread)*
- 128 to 512kB Flash
  16 to 64 kB SRAM
- High Precision Analog
- Options with FS USB

W Series

Motor Control & Power Conversion

Application Specific
44 Products
5 Packages

- From 75 to 168 MHz
- 16 to 512kB Flash
  8 to 96 kB SRAM
- Fast, High Precision Analog, Timers/PWM
- Real-time computation and math acceleration
- Options with CAN

v Series

Ultra-Low Power

General Purpose
167 Products
19 Packages

- From 48 to 72 MHz
- 8kB to 256kB Flash
  1 to 96 kB SRAM
- Smart, Autonomous Peripherals/Timers
- High Precision Analog
- Options with
  - Advanced Security & Protection
  - Segment LCD
  - FlexIO

L Series

Metrology

Application Specific
16 Products
4 Packages

- From 50 to 75 MHz
- 64kB to 256kB Flash
  16 to 32 kB SRAM
- AFE w/ up to Quad 24b Sigma-Delta ADCs
- Options with
  - LCD

M Series

5V / Robust

Application Specific
42 Products
9 Packages

- From 20 to 48 MHz
- 8kB to 256kB Flash
  1 to 16 kB SRAM
- Enhanced ESD/EMC Performance
- High Current Output
- Options with
  - CAN

E Series

ARM Cortex-M4 Based MCUs

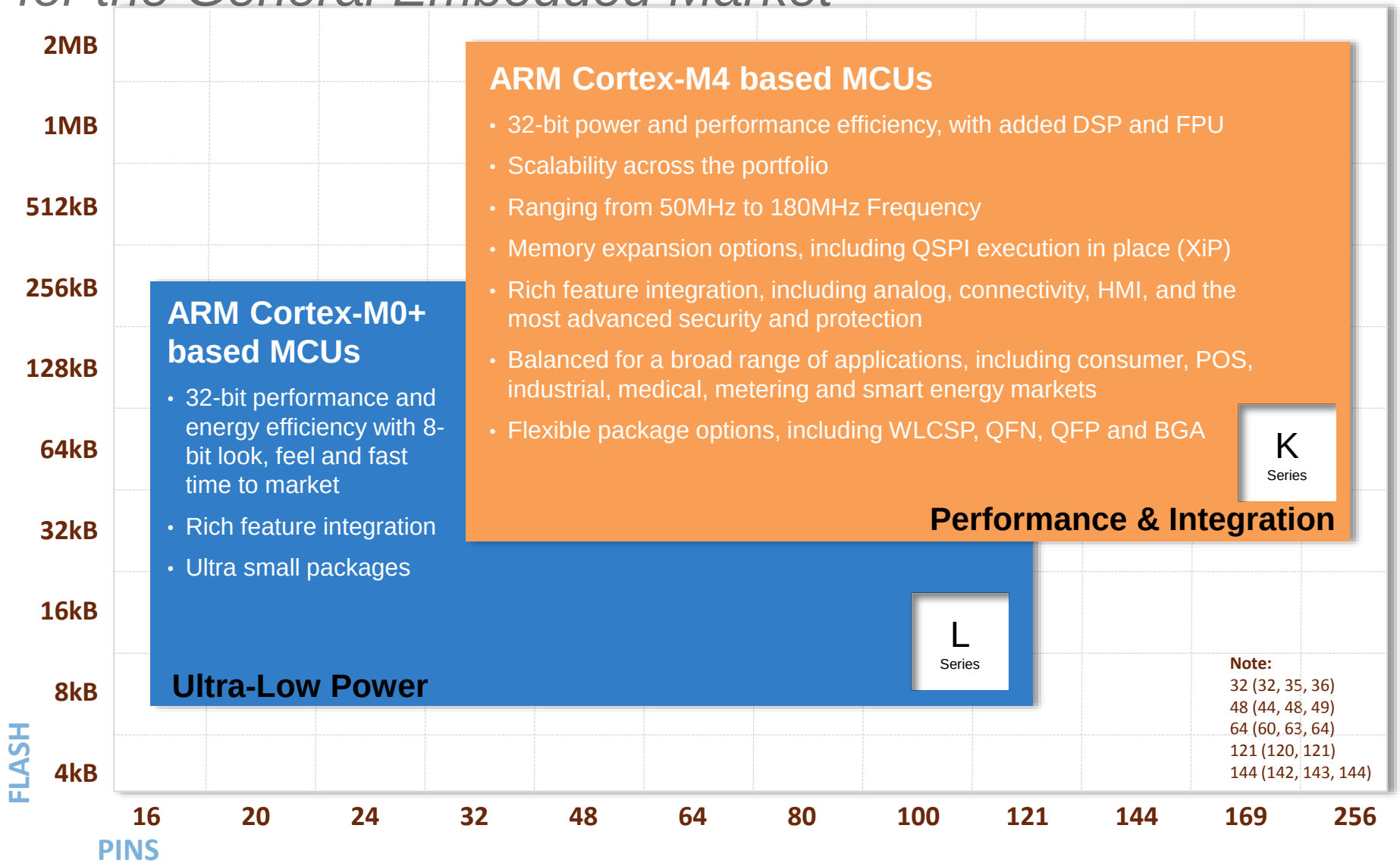
ARM Cortex-M7 Based MCUs

ARM Cortex-M0+ Based MCUs

Summary of Devices in Production Today

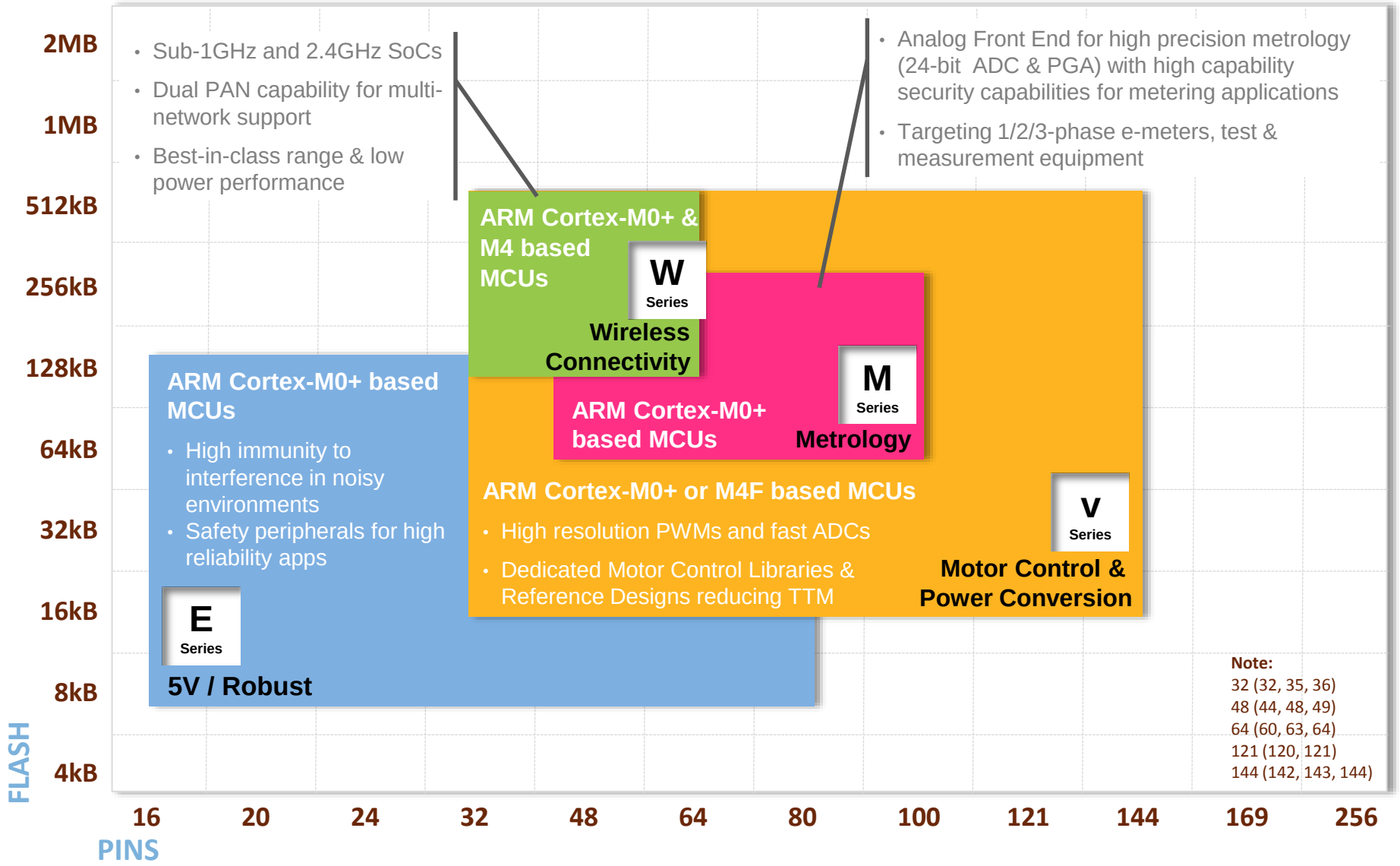
Kinetis General Purpose Portfolio Overview

Solutions for the General Embedded Market



Kinetis Application Specific Portfolio Overview

Targeted Solutions for Embedded Markets



From Kinetis to i.MX – Scalability in Action

POS & mPOS Architecture

Back-end system

Smartphone / tablet

Battery

PMU

Thermal Printer

RTC Real Time Clock

External Memory Nor, NAND, XIP Memory, DDRx etc.

wired Interfaces Serial USB Ethernet

wireless Interfaces Bluetooth WiFi

Main Controller Unit
Secure microcontroller
PCI compliant

Kinetis: **KL81, K81**, K21
iMX: **i.MX6UL**, i.MX7D, i.MX258

Sensors (for tamper resistance)

LEDs

Display (+ LCD Driver if not in the MCU

User Interface

EMVco Payment

Contact Reader **TDA80XX**

SAMs

Contactless Reader **CLRC663 PN5180**

Magstripe Card Reader

Legacy Payment

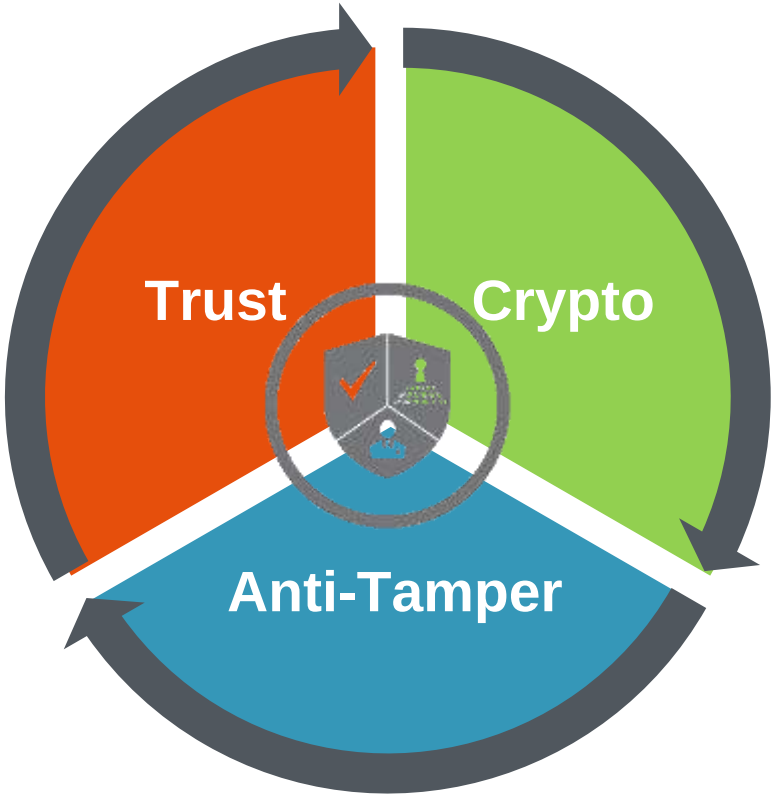
POS/mPOS

KINETIS SECURE

Kinetis Security Overview

Authorized Access

- Code I/P Protection
  - Internal Memory Protection
  - External Memory Protection
- Debug Port Protection
- Authentication
  - Software Updates
  - Device Verification
- Secure Boot



Data Protection

- Symmetric Encryption
  - DES/DES3, AES
- Asymmetric Encryption
  - RSA, ECC
- Hashing
  - CRC, MD5, SHA
- True Random Number Generation
- Security Protocols
  - SSL, HomeKit, Thread

Monitoring of physical and environmental attacks

- Tamper Detection
  - Physical
    - Enclosure Intrusion
    - Drilling and Probing
- Tamper Detection
  - Environmental
    - Voltage
    - Temperature
    - Frequency
- Secure Storage

Kinetis KL8x to K8x

World's most secure ARM® Cortex®-M based MCUs

Kinetis KL8x MCU
72MHz ARM Cortex-M0+

Advanced Security
Secure RAM & Boot,
Memory Protection Unit,
Low Power Trusted Crypto.
Engine (DES/3DES/AES/RSA),
Tamper Detection,
ISO7816-3 EMVSIM,
Random Number Generator

128/96KB Flash/SRAM,
USB, FlexIO, QuadSPI (XIP),
121 MBGA / 80 LQFP

+ Performance

+ Memory

+ Crypto throughput

+ Ext. memory expansion & protection

Kinetis K8x MCU
150MHz ARM Cortex-M4

Advanced Security
+
Crypto. Acceleration Unit,
On-the-Fly Decryption for
external memories

256/256/16KB
Flash/SRAM/Cache,
USB, FlexIO, QuadSPI (XIP),
SDRAM, SD/eMMC, FlexBus,
121 XFBGA / 100 LQFP

Hardware and software compatibility with PCI-certified enablement

Kinetis K8x/KL8x MCUs: Enablement

TWR-POS-K81 PIN Pad Reference Design

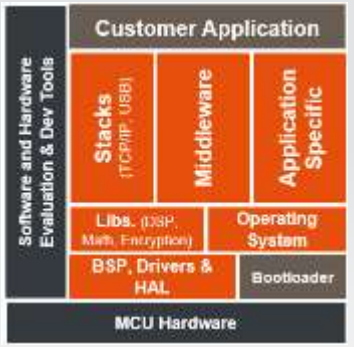
TWR-POS-K81

- POS PIN Pad Reference Design for customers seeking Payment Card Industry certifications
- Kinetis K81/KL81 MCU: tamper pins, chip security, EMVSIM, Kinetis SDK w/ Cryptographic Driver s/w
- Chip-and-PIN keypad based on Cirque® SecureSense™ technology (PCI PTS compliant without requiring physical protection for touch sensor)
- Available under NDA (incl. pre-PCI4.x certification reports. Full PCI 4.1 Certification expected Oct 2016)

Tower & Freedom Modules

- TWR (full evaluation) or FRDM (entry-level) development modules
- KL8x MCU
  - **TWR-KL82Z72M**
  - **FRDM-KL82Z**
- K8x MCU:
  - **TWR-K80F150M**
  - **FRDM-K82F**
- 8MB SDRAM, 8MB Serial NOR Flash
- Multiple TWR and Arduino™ form-factor compatible peripheral modules
- Available (K8x/KL8x)

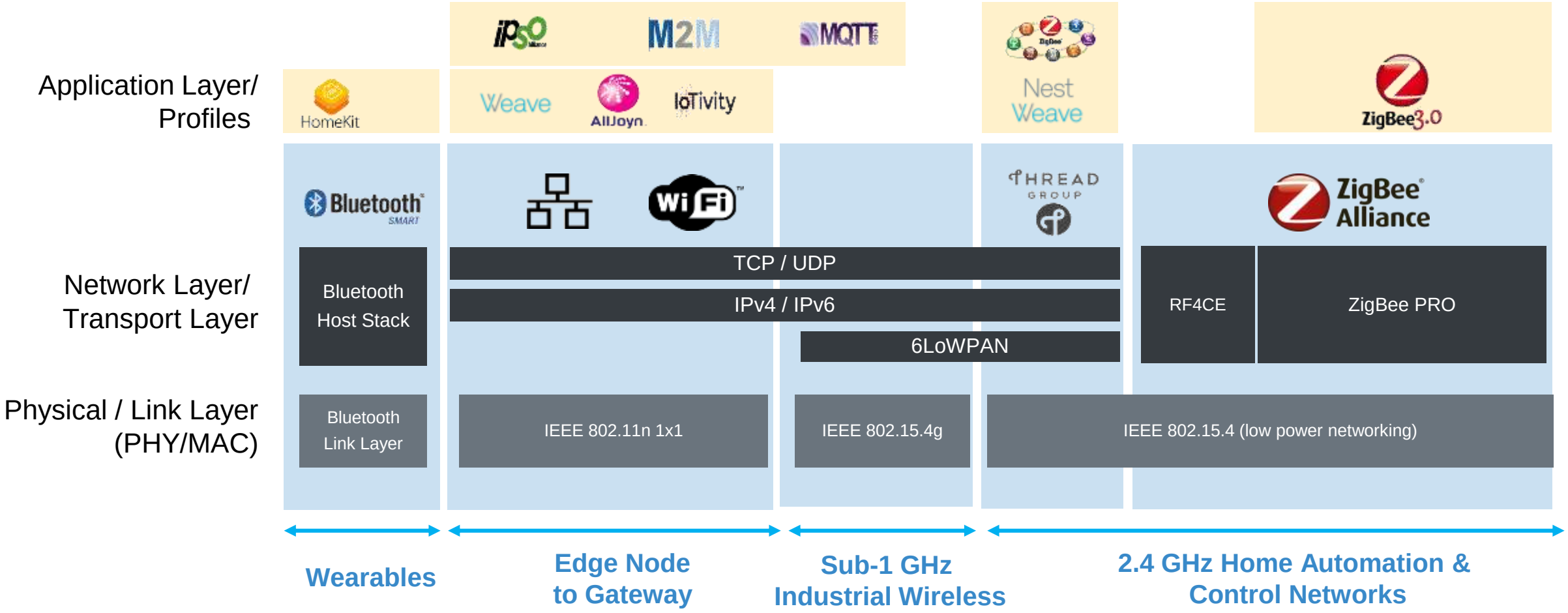
Security Software



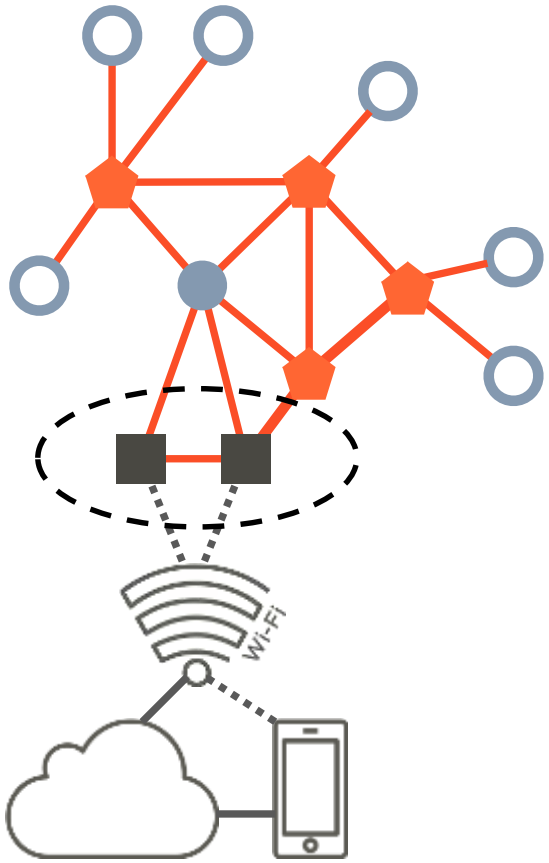
- Freescale Kinetis SDK software drivers for public key cryptography
- Support for multiple toolchains including GNU GCC, IAR, Keil, and Kinetis Design Studio

KINETIS CONNECT

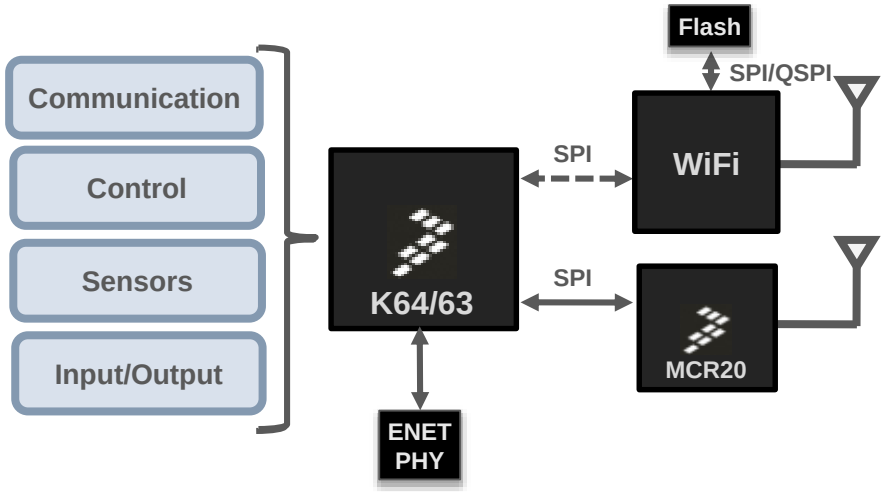
IoT Landscape



Thread Router (Ethernet/Wi-Fi)

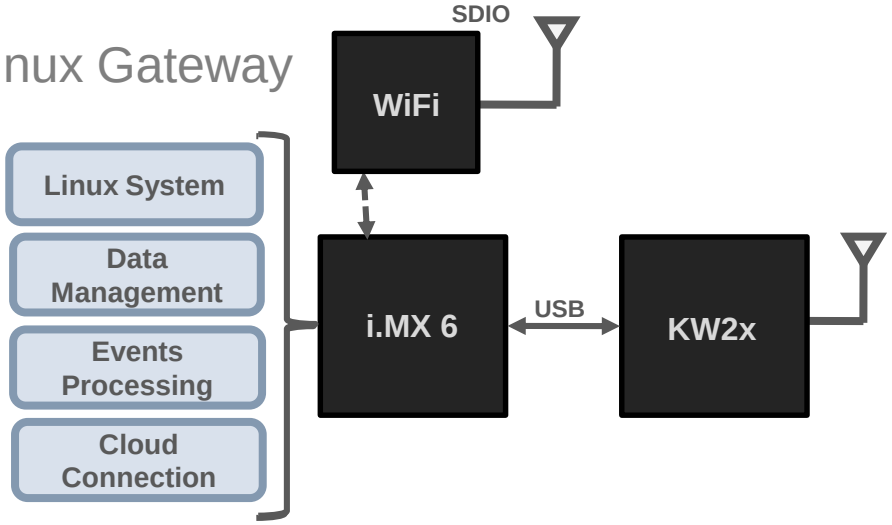


RTOS Boarder Router



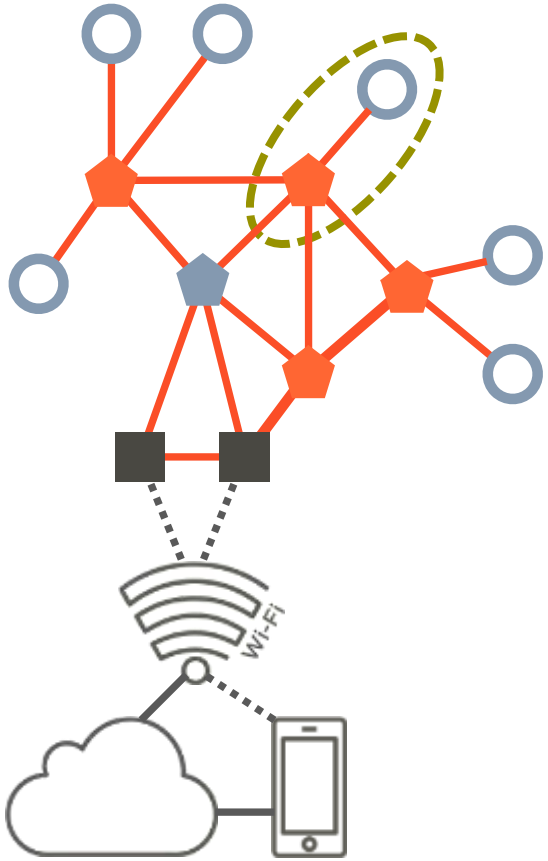
- Kinetis **K64** is standalone MCU with up to 1MB Flash, up to 256K RAM and embedded Ethernet
- Kinetis **K63** MCU adds tamper protection DryIce module
- **MCR20** is an 802.15.4 transceiver
- Thread, Wi-Fi and Ethernet share same IP stack

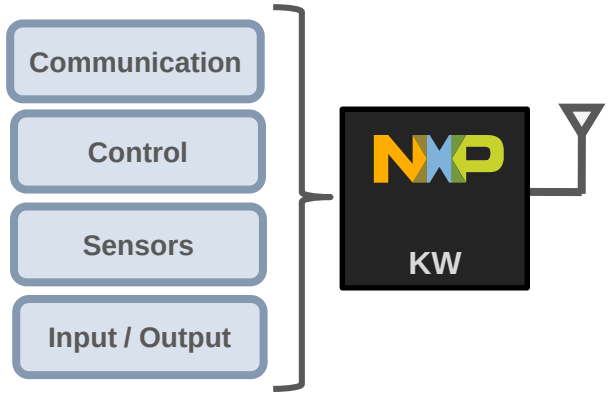
Linux Gateway



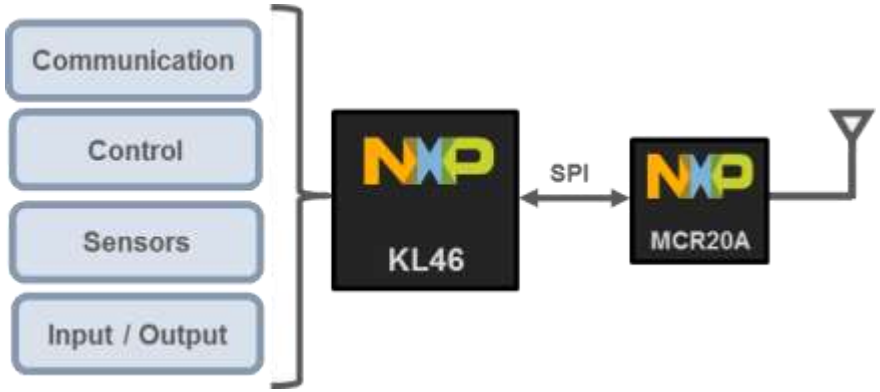
- **i.MX 6** Linux system handles Data Management and Analytics, Events Processing and Cloud Connection
- Kinetis **KW2x MCU** runs the Thread Border Router functionality

Thread Router and End Device





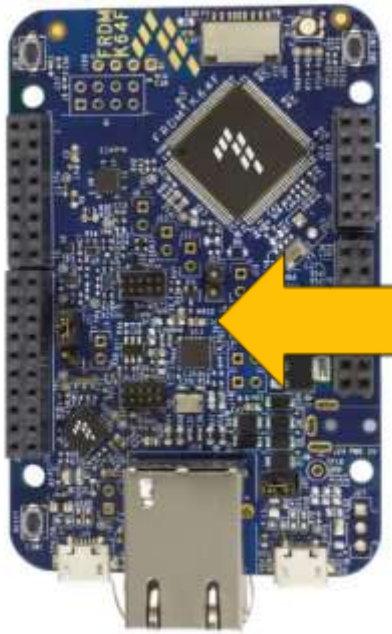
- **KW** devices with 512kB Flash and 64k RAM can run **Border Router or Router Eligible End Device** configurations with an Application
- **KW** devices with 32kB RAM can run Thread End Device configurations with an Application



- **Kinetis L** devices with 32kB RAM can run 802.15.4 MAC/PHY, Thread Network and Application as an **End Device**
- MCR20A is the 2.4GHz Transceiver

Target Development Systems: Gateways/Border Routers/End Nodes

K64F
RTOS Border Router



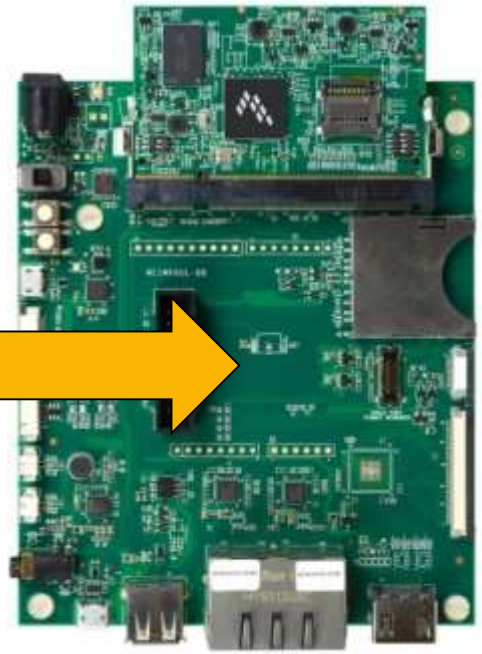
K64F Freedom Board

- 120 MHz Cortex-M4F
- Up to 1 MB Flash, UP to 258 KB RAM
- Integrated Ethernet
- Thread and ZigBee
- Launching Oct 6th

KW2x
FRDM-KW24D512

USB-KW24D512

i.MX6UL
Linux Gateway/Border Router



i.MX6Ul EVK

- 528MHz Cortex-A7 CPU
- 4 GB DDR3L DRAM memory
- 256 MB Quad SPI Flash
- Arduino/Freedom connector
- Launching Oct 6th

THREAD GROUP

The Thread Group was launched in July 2014

A nonprofit market education group offering product certification

Promoting Thread's use in connected products for the home

Thread will offer rigorous product certification to ensure security and interoperability

Smart Home - What Thread run over it

Other IP-based Application Protocols

IPSO Alliance

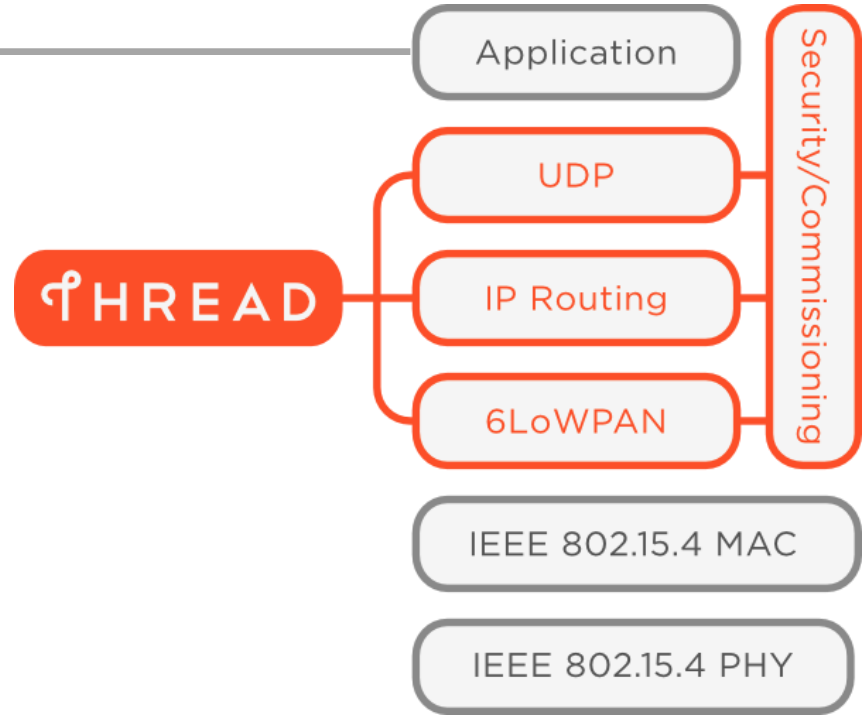
ZigBee Alliance

AllJoyn

IoTivity

Nest Weave

Example protocols



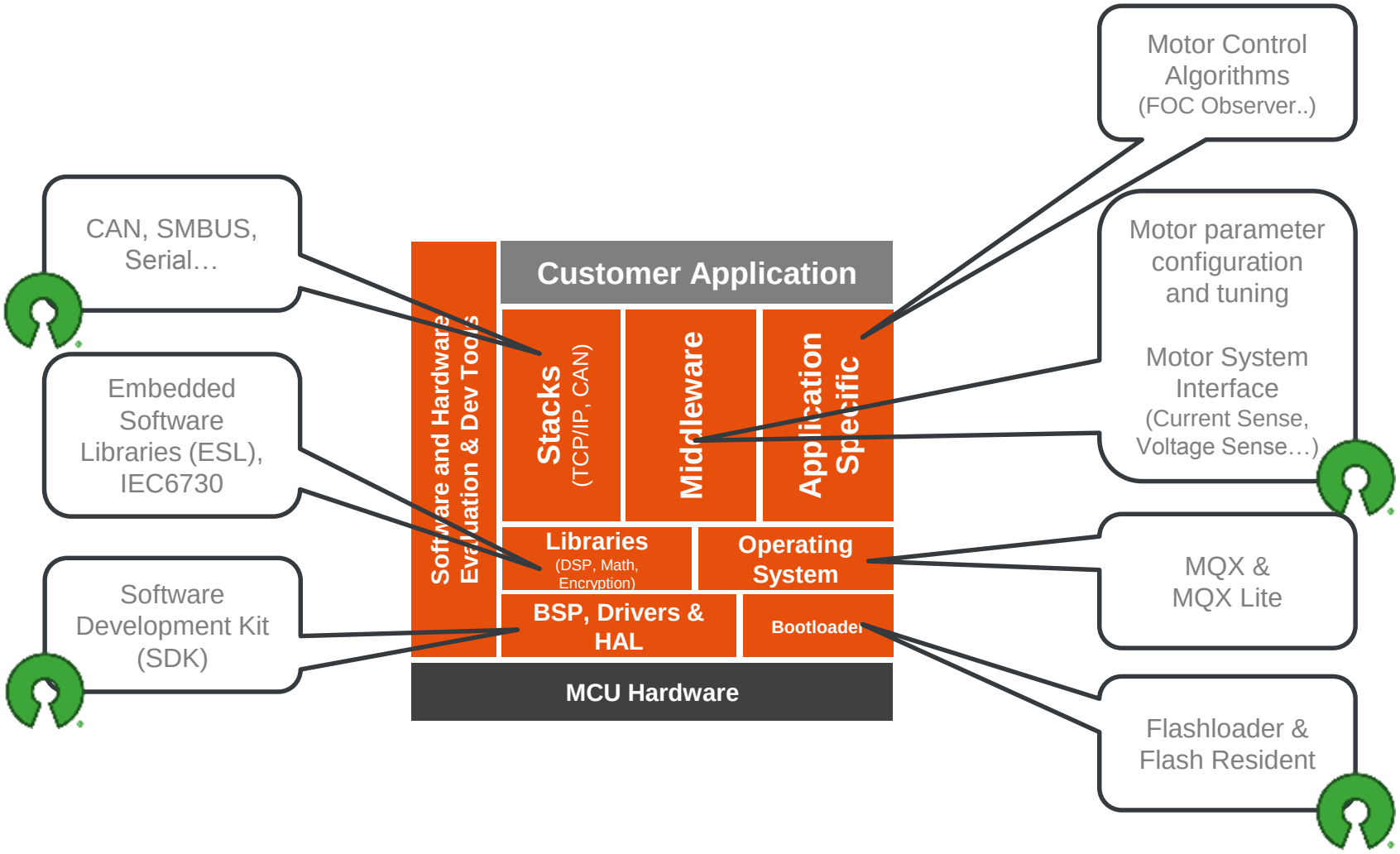
- Thread is a network and transport level stack
- Thread is “application-layer agnostic”
- Thread can support multiple application layers
  - ✓Any low bandwidth application layer that can run over IPv6

KINETIS CONTROL

Kinetis V series MCUs based on ARM Cortex Cores
For Motor Control & Digital Power Conversion

- Freescale's extensive motor and power control expertise and the latest ARM Cortex-M0+, M4 and M7 cores bring secure, connected, high efficiency motor control and power conversion to the mass market
- Efficient, next generation BLDC, PMSM and ACIM designs are enabled by optimized MCU performance and high speed/resolution analog and timing peripherals. High resolution eFlexPWMs support digital power conversion
- Performance and feature scalable MCU families from entry-level 75MHz MCUs, to advanced 220MHz MCUs, maximize hardware & software reuse and provide product flexibility
- Enablement including NXP Tower and Freedom development boards, Embedded Software Libraries and Kinetis Motor Suite reduce motor control learning curve and speed time to market

Kinetis V Series Motor Control Software System Solution



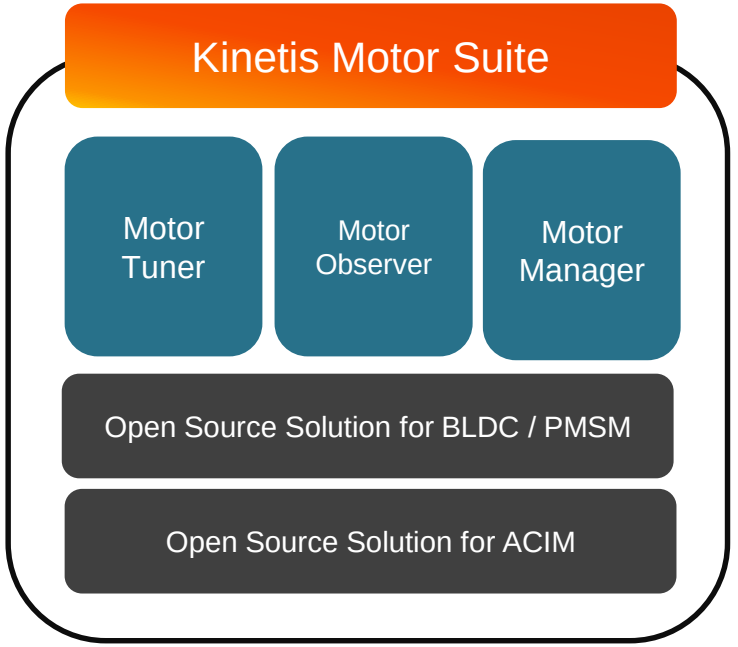
Kinetis Motor Suite – Bring Motor Control to the Masses

- **Motor Tuner:**
  - Wizard for initial motor configuration – gets your motor spinning in 5 steps

- **Motor Manager:**
  - Application development environment where customers access and update real-time system components during their application development.

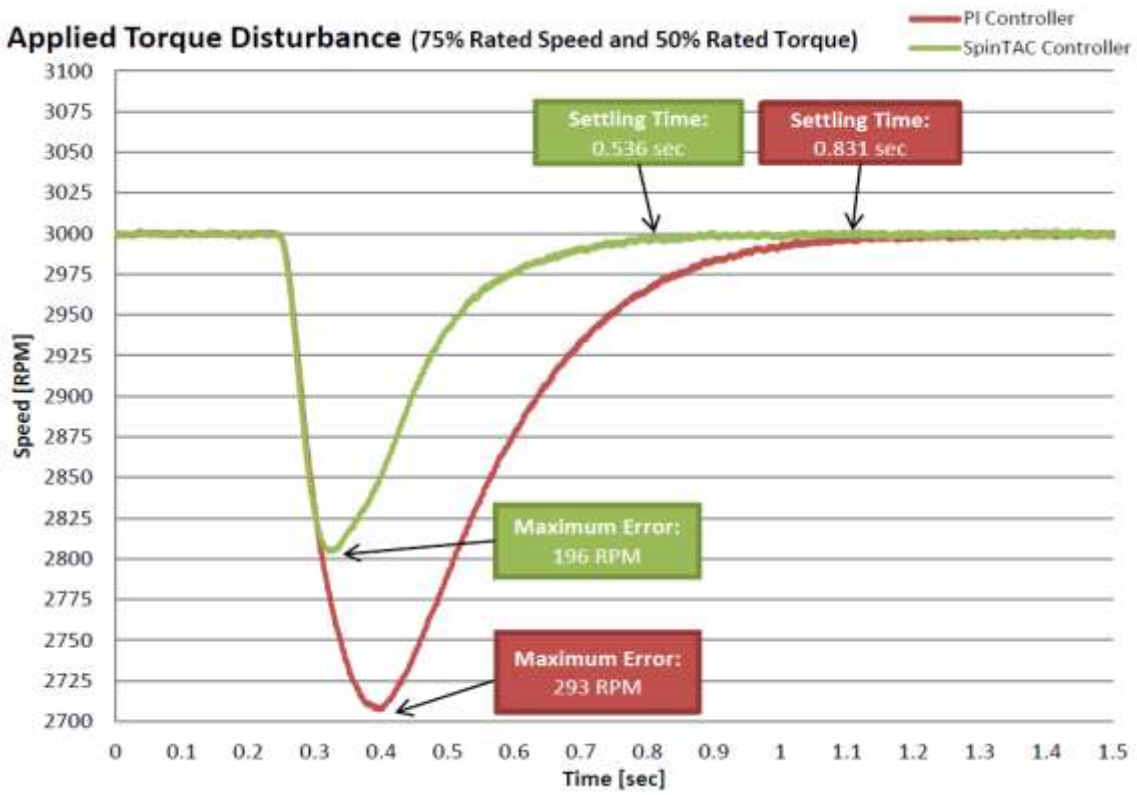
- **Motor Observer:**
  - Factory programmed flash with embedded motor control firmware for dynamic motor tuning and control.

- **Open Source Solution:**
  - The open source project with the motor control firmware configured via the GUI, and also accessible via an API.



KMS Tuner - motion control suite

Robust control - Simplified tuning - Integrated motion profile design



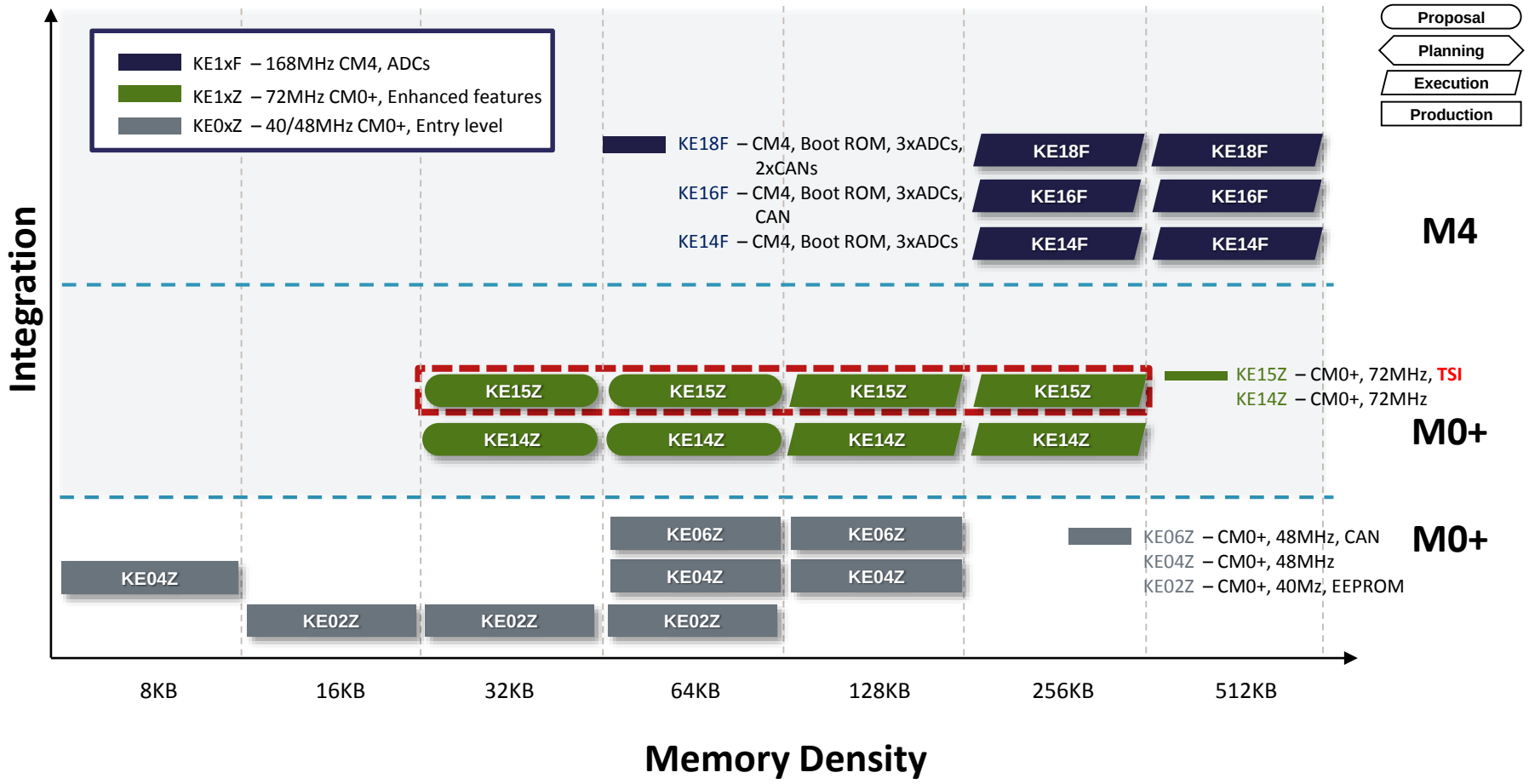
KMS motion controller rejects disturbances to maximize performance and machine life

- **Disturbance compensating controller**
  - Effective across full variable speed and load range
  - Based on a minimum information model
    - System Inertia -> Measurable
    - System Order -> Known
  - Any non-ideal behavior (i.e. load, wear, inertia change) is observed and compensated for by the controller
  - Single parameter to optimize response

KINETIS
FOR
HOME APPLIANCE

Kinetis E Series Product Roadmap

2.7-5.5V MCUs with high reliability and robustness,
Based on ARM® Cortex-M® with best-in-class Enablement



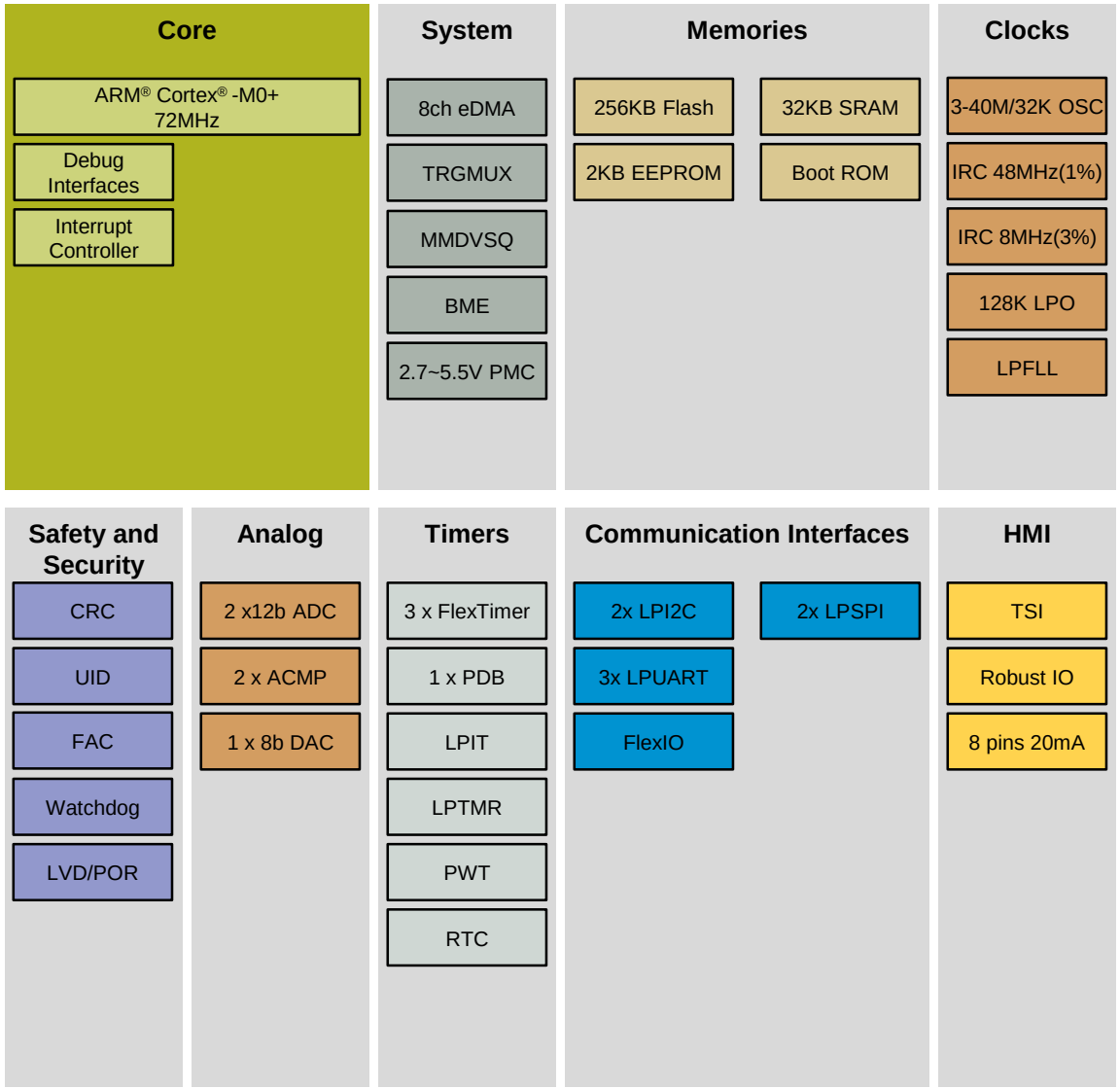
TSI Value Features

- ❑ Two operation modes
  Self-cap: up to 25 keys
  Mutual: up to 36 keys
- ❑ Advanced robust in EMC
  Pass IEC61000-4-6 standard test
- ❑ Advanced robust in waterproof
- ❑ High sensitivity and resolution
- ❑ No need for CPU interfere
- ❑ Ease of use
  NXP Touch Library support
  SDK touch APIs support
- ❑ No need for external components

KE15Z Master Block Diagram

Key Features:

- Core/System
  - ARM ® Cortex ® -M0+ up to 72MHz
  - 8ch eDMA
  - TRGMUX
  - MMDVSQ
- Memory
  - up to 256KB Flash
  - up to 32KB SRAM
  - up to 32KB FlexMemory / 2KB EEPROM
  - Boot ROM
- Communications
  - 3 x LPUART / 2 x LPSPI / 2 x LPI2C / FlexIO
- Analog
  - 2 x 12b ADC, 1MSPS
  - 2 x ACMP
  - 1 x 8b DAC
- Timers
  - 1 x 8ch FTM (PWM)
  - 2 x 4ch FTM (PWM/Quad Dec.)
  - 1 x PDB
  - 1 x 4ch LPIT / 1 x LPTMR / 1 x PWT
  - 1 x RTC
- Others
  - Up to 36 touch keys
  - Up to 89 GPIO with glitch filter
  - 2.7-5.5V, -40 to 105oC
- Packages: 100LQFP(0.5mm pitch)
  64LQFP(0.5mm pitch)
  Pin compatible within KE



KE15Z Availability

Sub-Family	Part Number	CM0+ (MHz)	Memory				Features											64LQFP	100LQFP
			Flash (KB)	SRAM (KB)	EEPROM (KB)	Boot ROM	DMA(ch)	BME	UART	SPI	I2C	TSI	FlexIO	ACMP	8b DAC	12b ADC	Total # of IOs		
KE15Z	MKE15Z128VLH7	72MHz	128	16	2	Y	8	1	3	2	2	1	1	2	1	2	58	√	
	MKE15Z128VLL7	72MHz	128	16	2	Y	8	1	3	2	2	1	1	2	1	2	89		√
	MKE15Z256VLH7	72MHz	256	32	2	Y	8	1	3	2	2	1	1	2	1	2	58	√	
	MKE15Z256VLL7	72MHz	256	32	2	Y	8	1	3	2	2	1	1	2	1	2	89		√

Boards Support

Freedom Platform

FRDM-KE15Z

- Ultra low -cost/power development platform
- Form factor compatible with Arduino platform
- Compatible with Freedom shield

Freedom Shield

FRDM-TOUCH

- This evaluation board, in a shield form factor, effectively turns a NXP Freedom development board platform into a complete motor control reference design

TSI Evaluation Board

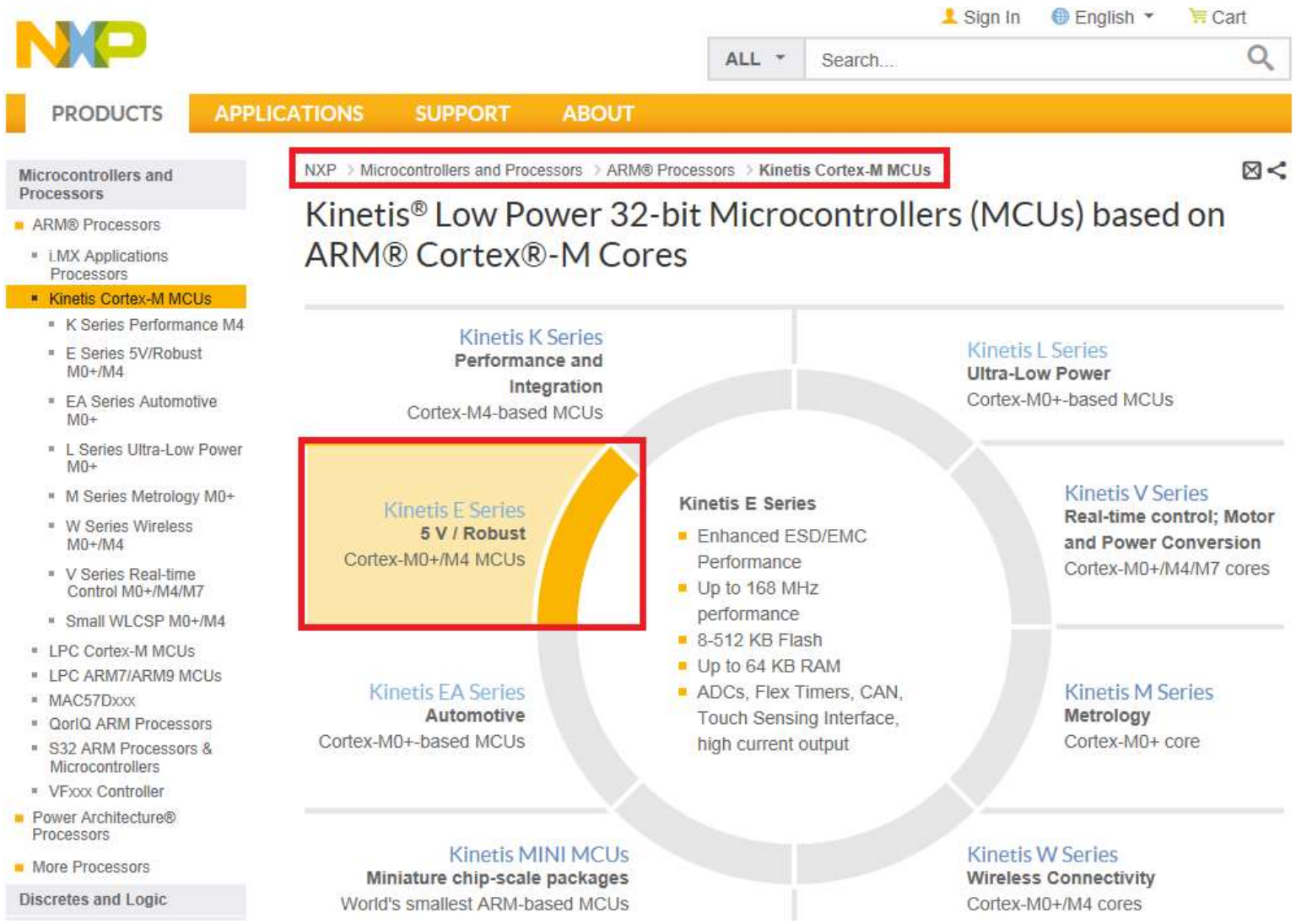
RD-KE15Z-TSI

- Evaluation board for new TSI hardware and software design

Touch Demo on FTF

https://community.nxp.com/docs/DOC-330392

More Supports on the Web



TSI Module Features and Application Benefits

Features

- Support both self capacitance mode and mutual capacitance mode
- Up to 25 touch sensing channels
- 16-bit sensing resolution and configurable sensitivity with sensitivity boost mode
- Advanced EMC performance, Support hardware noise filter and pass IEC61000-4-6 test
- Waterproof, pass salt water test

Application Benefits

- Easy for Touch tuning with the configurable sensitivity and high resolution
- Reliable touch production with advanced EMC performance

EASE OF USE

Kinetis Microcontroller Enablement – Ease of Use

Runtime Software

NXP Solutions:

Kinetis SDK/LPCOpen
- Drivers
- System Services
- FreeRTOS
- USB
- TCP/IP
- Filesystem

MQX PEG

Kinetis Bootloader

RTOS, Middleware Partners:

FreeRTOS, Micrium, ARM mbed, Green Hills Software, SEGGER, wolfSSL, expresslogic

Comprehensive frameworks and solutions for low-power, connected, and secure embedded systems

Software Development Tools

IDE / Toolchains:

Kinetis Design Studio, IAR Systems, SOMNIUM DRT, ARM KEIL Microcontroller Tools, LPCXPRESSO, atollic

Software Configuration:

Kinetis Expert
- Power Estimation
- BSP Tools
- Project Generator
- Power Analyzer

PEG, Processor Expert Software

Industry leading IDE support and intuitive software configuration tools to accelerate application development

Hardware Development Tools

Evaluation Kits:

Tower System

Freedom Development Platform

LPC Xpresso

Partner Solutions

SEGGER, P&E micro, 1 SYSTEM, LAUTERBACH DEVELOPMENT TOOLS

LPC-Link2

Low cost hardware platforms for evaluation and application development. Partner solutions for hardware debugging solutions

Application Specific

HomeKit

- HomeKit SDK
- Motor Control
- Wireless Charging
- Sensor Fusion
- MFi
- PEG GUI
- POS / EMV

Connectivity Solutions

Bluetooth SMART, 6LoWPAN, EtherNet, Wi Fi, THREAD GROUP, 802.15.4

Software frameworks and development tools for targeted applications and certified connectivity solutions

Support

Broad Market:
- OOB Walkthroughs
- NXP Community
- Embedded Blogs
- Kinetis Designs
- Kinetis Tutorials
- Application Notes
- Symbols & Footprints

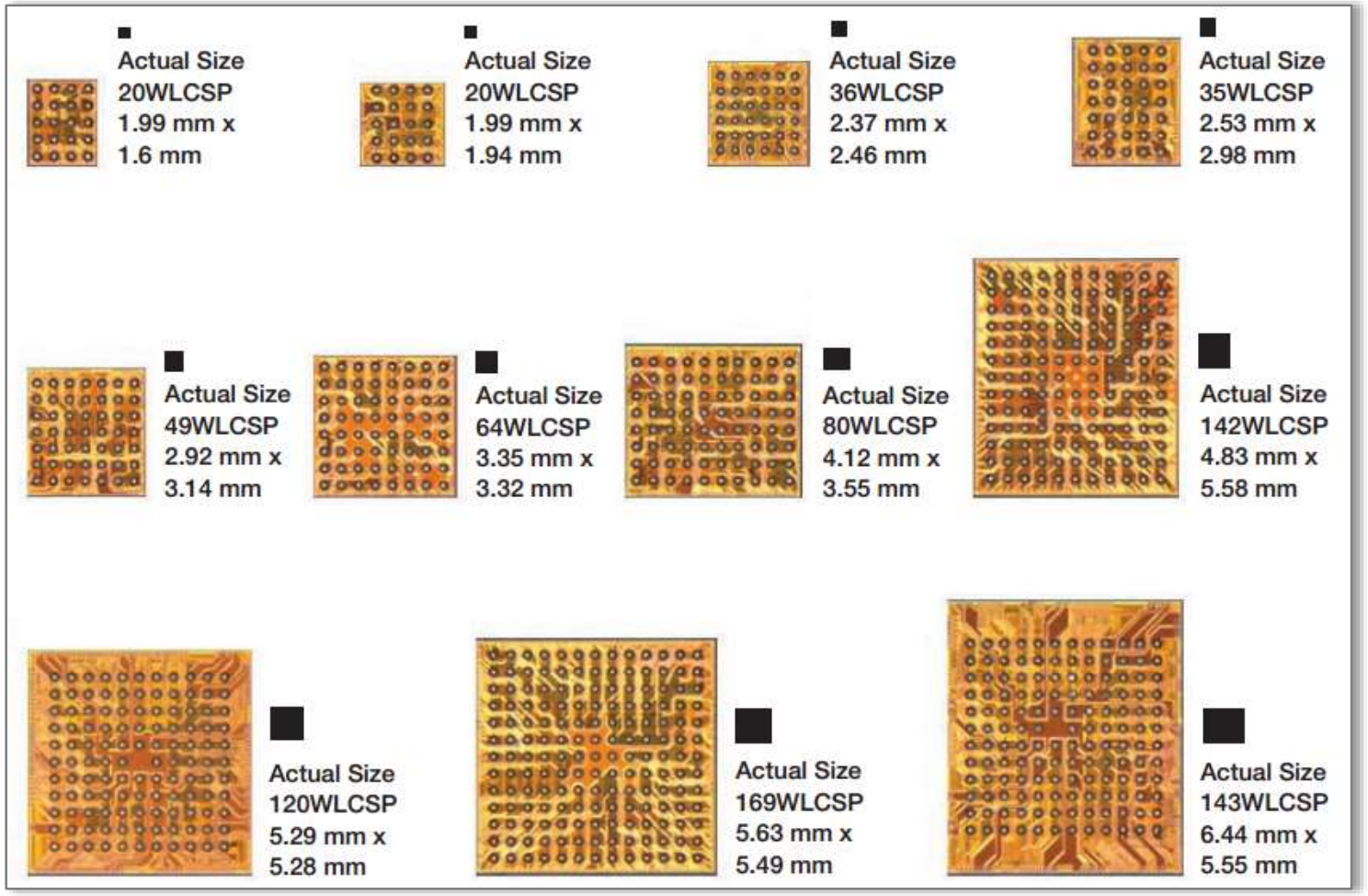
High Touch:
- Professional Support
- Professional Services

Get started quickly and get the support you need, when you need it

Kinetis Mini MCU Portfolio Overview

Wafer-Level Chip-Scale Packages

World's smallest & thinnest Cortex-M MCUs



Did You Know?

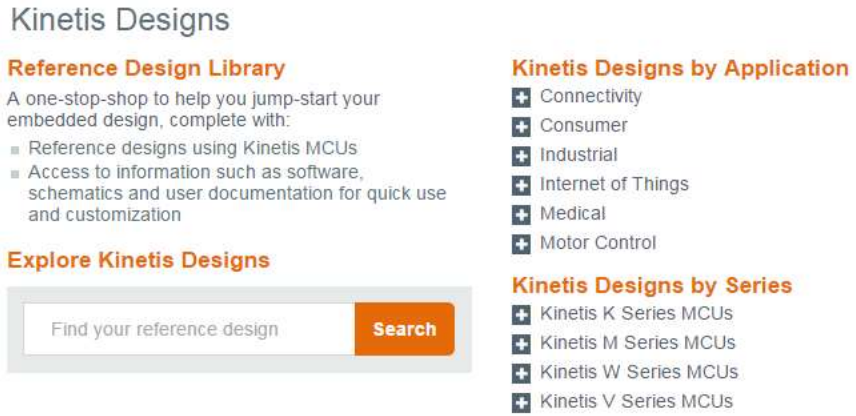
- At 0.34 mm height, the ultra-thin Kinetis K22 MCU is less than half the height of a credit card.
- 19,000 Kinetis mini MCUs fit on a piece of paper (U.S. letter size).
- 23,000 Kinetis mini MCUs fill a golf ball.
- 3.2 million Kinetis mini MCUs fill a soccer ball.

Kinetis Designs

Full Turn Key Reference Solutions, www.nxp.com/kinetisdesigns

Kinetis Design	Description
The BLE Heart Rate Monitor	The BLE Heart Rate Monitor demonstrates a wireless electrocardiogram (ECG) acquisition system. Powered by small Li-Ion coin-cell rechargeable battery, the low-power design features can provide the power of upto 40 hours of continuous use.
BLE Controlled Robot	The BLE controlled robot reference deign is developed using Freescale FRDM-KW40Z and Polulu Zumo Robot and can be controlled using a cellphone App.
Quadcopter Drone	The Quadcopter Drone combines four separate ESC boards into one controlled by with a single Freescale Kinetis KV4x or Kinetis KV5x MCU and it's capable of driving four BLDC motors.
3-Phase AC Induction motor Control	The 3-Phase AC Induction Motor Control Reference Design is based on Kinetis V Series MCUs and intended to provide the example for 3-phase sensorless AC induction motor control solutions. The Reference design utilizes closed-loop field oriented vector speed (FOC) control mechanism.
3-Phase PMSM Motor Control	The 3-Phase PMSM Motor Control Reference Design is based on Kinetis V Series MCUs and intended to provide the example for 3-phase sensorless PMSM motor control solutions. The Reference design utilizes closed-loop field oriented vector speed (FOC) control mechanism.
3-Phase Brushless DC Motor Control	The 3-Phase BLDC motor Control is based on Kinetis V Series MCUs and provides the example for 3-phase sensorless BLDC motor control solutions. The Reference Design utilizes six-step commutation process, including closed-loop speed control and dynamic motor current limitation.
Full-Bridge DC-DC Switch Mode Power Supply (SMPS)	The full-bridge DC-DC converter is a transformer-isolated buck converter and contains full-bridge inverter block, transformer, synchronous rectification block, and filter.
Class-D Audio Amplifier	The 1000 W class-D audio amplifier reference design is intended to provide an example for an audio amplifier along with a push-pull power converter and operates using the Kinetis KV1x Tower platform or K64 Freedom board
One Phase Power Meter	The single-phase meter reference design is used for measurement and registration of active and reactive energy in single-phase two-wire networks for direct connection and pre-certified according to European EN50470- 1, EN50470-3, class B and C, IEC 62053-21 and IEC 62052-11International Standards
Two Phase Power Meter	The two-phase power meter reference design is used for measurement and registration of active and reactive energy in single-phase three-wire networks for direct connection. It is pre-certified according to ANSI C12.20, class 0.2
Three Phase Power Meter	Three-phase meter reference design is used for measurement and registration of active and reactive energy in three-phase networks for direct connection and pre-certified with European EN50470- 1, EN50470-3, class B and C, IEC 62053-21 and IEC 62052-11 international standards

- Freely available with every Kinetis Design:
  - Printed Circuit Board Bill of Materials
  - Printed Circuit Board Design Files
  - Schematics
  - Lab & Test Software
  - Application Software



THE ONLY SUPPLIER TO PROVIDE COMPLETE SCALABLE SOLUTIONS

MCUs & CPUs

Suite of Sensors

Wi-Fi, BT, Thread, ZigBee Wireless Interconnects

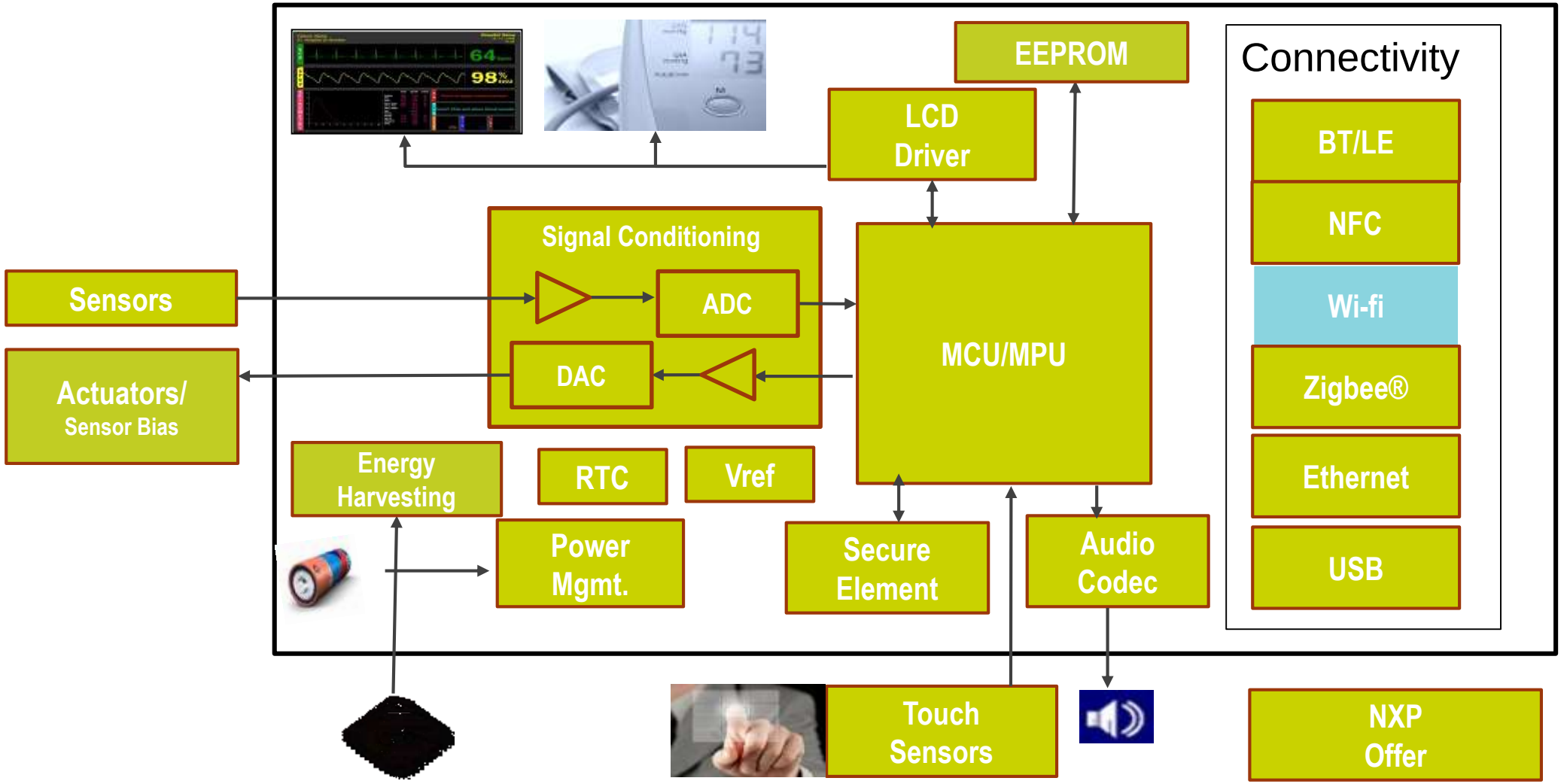
Power Management

Complete HW & SW Security Suite

IoT Module Packaging

Source: Tirias Research

Solutions for Smart Healthcare



Solutions for Smart Home

Pressure Sensor
Gyro
Accelerometer
Magnetometer
Sensor Data Analytics
Audio Codec
GPS
I²C(s)
I²S
UART
Bluetooth
BLE/Thread
Wi-Fi
SPI
UART
SDIO
Main Processor
(MCU/MPU)
Ext.
Bus
Timer
Display
Piezo Vibe
SPI
SPI
Timer
Co-Processor
MCU
UART
USB
USB
USB Mini-AB
I²C
I²C
Ext.
Bus
Ext.
Bus
Ext. SRAM
Ext. FLASH
NFC
Security
Power Management
(Batt. Charge)
Battery
I²C
Or
Analog
Sensor
Fusion
Sensor
algorithms

Solutions for Point of Sales (POS)

Back-end system

Smartphone / Tablet

Battery

Power Mgmt.

External Memory

QSPI

Main Controller Unit
Secure Microcontroller
PCI-compliant

Kinetis - K81
or i.MX 6UL

Contact Reader TDA8035

Contactless Reader PN5180

EMVco Payment

Sensors
(for tamper resistance)

POS/mPOS

Solutions for Wearables

Motion
- Pedometer/distance
- Gestures
- Sleep analysis
- Calorie counting
- User context
- Tap detection

Biometrics
- Heart rate/rhythm
- Respiratory rate
- Perspiration
- Body fat

Touch
- Cap touch

SpO2 | bioZ

SENSORS

Voice Triggering
- Voice commands
- Speech recognition

Context Awareness
- User context

Sound quality
- Enhanced sound
- Wind noise reduction
- Speaker as a microphone

Gestures
- Ultrasonic gestures

Display UI
- Graphics for LCD, eINK, etc..

DMIC | Smart Amp | Codec

USER INTERFACE

MPU | MCU | MCU + BT | Software

- **Sensor Processing**
  - Interface
  - Data aggregation
  - Fusion, algorithms
- **UI Processing**
  - LCD
  - Graphics
  - Touch, gestures
  - Sound quality
- **Wired & Wireless Connectivity Protocol Processing**
- **Application Processing**
  - Android / Linux
  - Notifications
  - Apps
- **Power Management**

PROCESSING & SOFTWARE

Payment
- Tap to pay

Non-Payment
- Access control
- Ticketing
- Secure card emulation
- FIDO dual factor auth

NFC | Secure Element

SECURITY & PAYMENT

Simplified Connectivity
- Smartphone
- Wearable
- IoT

Simplified Pairing
- Point-to-Pair
- Wireless pairing

BT Smart | ZigBee® | Magnetic Induction | NFC

WIRELESS CONNECTIVITY

Charging
- Wireless charging (A4WP & Qi)
- System charging
- Battery mgmt.

Wireless Power RX | Charger

POWER

NXP Products

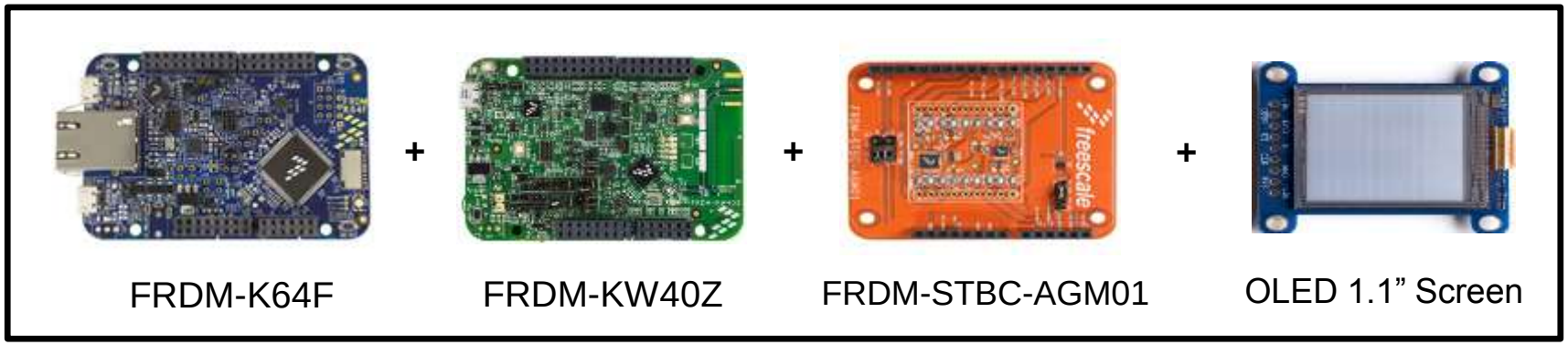
HexiWear | Value Preposition to Customers

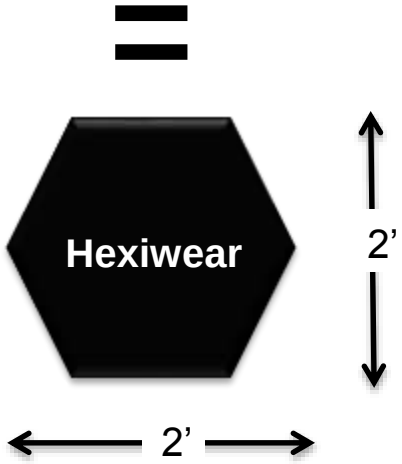
- **Faster Time to Market:** Versatile solution created to reduce development / design time for IoT applications.
- **Path to Manufacturing:** Designed to get customer faster to manufacturing. The BOM is readily available in the market and the design files/schematic is open source.
- **Optimized Hardware Design:** The hardware design is optimized and includes several best practices suggested for NXP engineers for low power applications.
- **Robust Software:** The software includes everything from the embedded drivers to the cloud connectivity, all open source , easy to use and optimized.
- **Community Supported:** Hexiwear is a true community based solution and enables customers to utilize from the rich pool of resources that will be created by community.

Hexiwear | Based on Kinetis NXP Technology

Description of the Program

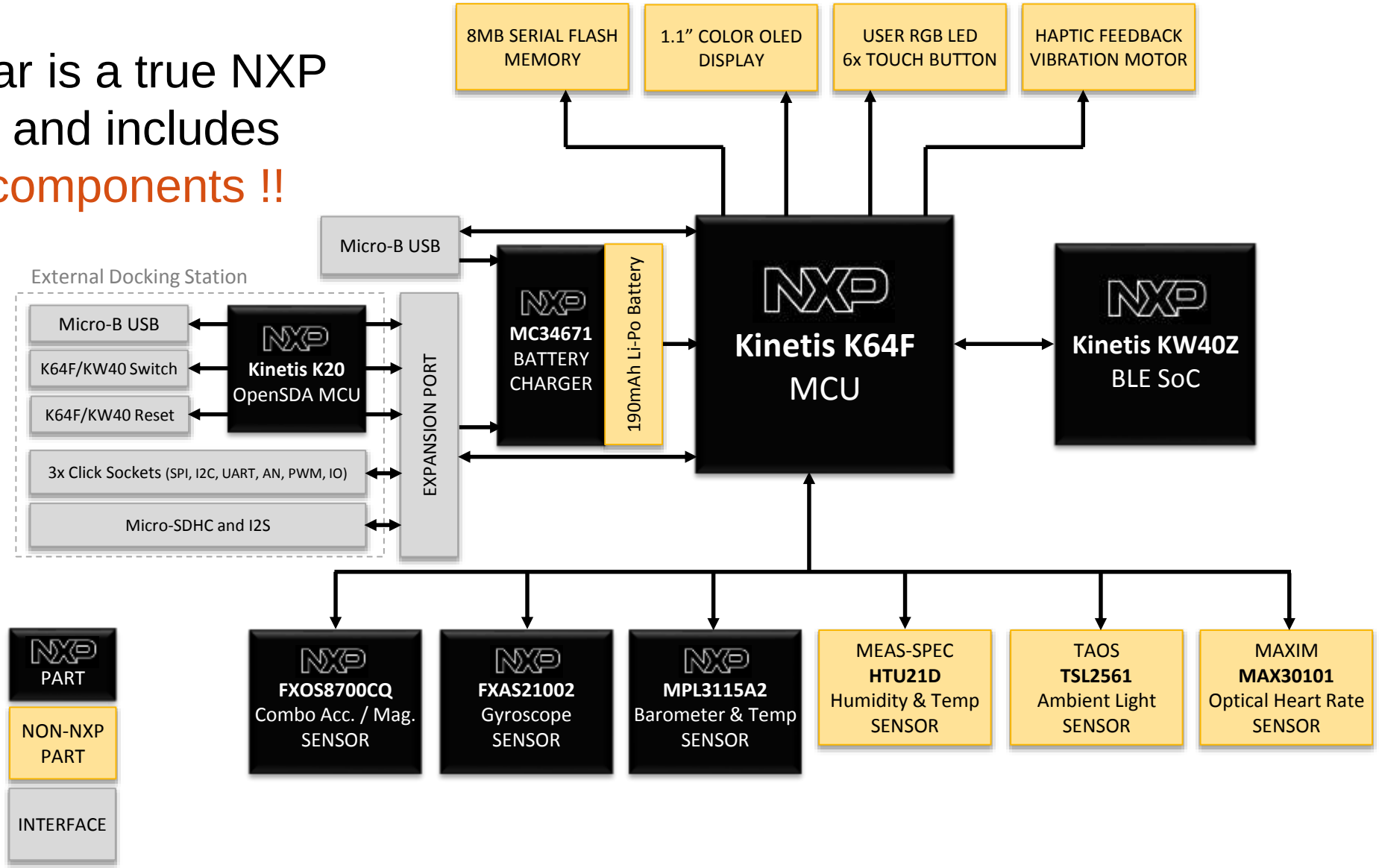
- **Small form factor**, low cost ($49 resale), modular hardware development platform, based on Kinetis MCU, with Wireless Connectivity and Sensor fusion. Comes supported with a development software package and user application demos.





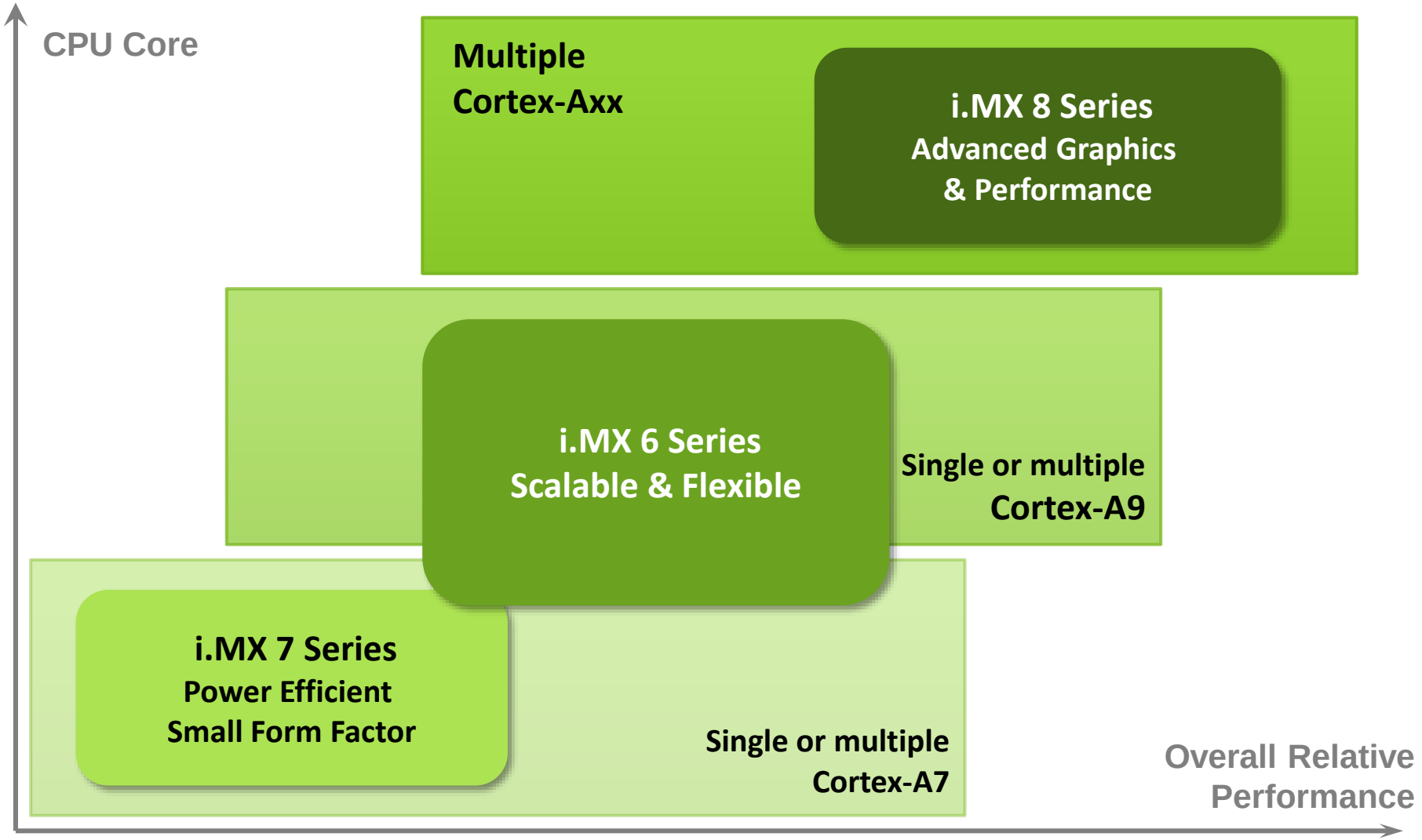
HexiWear | Block Diagram

- Hexiwear is a true NXP solution and includes 7 NXP components !!



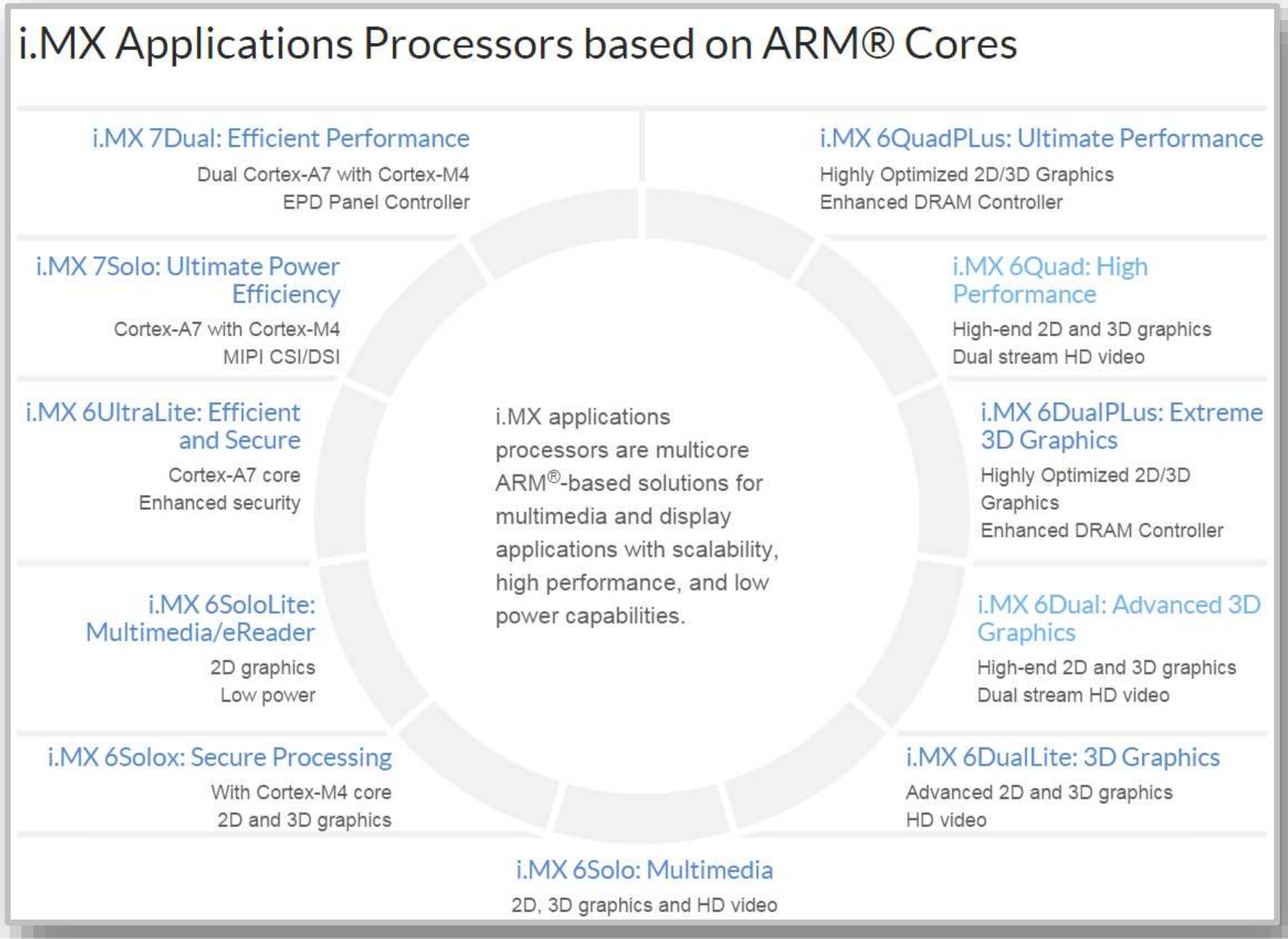
NEW FOR i.MX

i.MX Application Processors

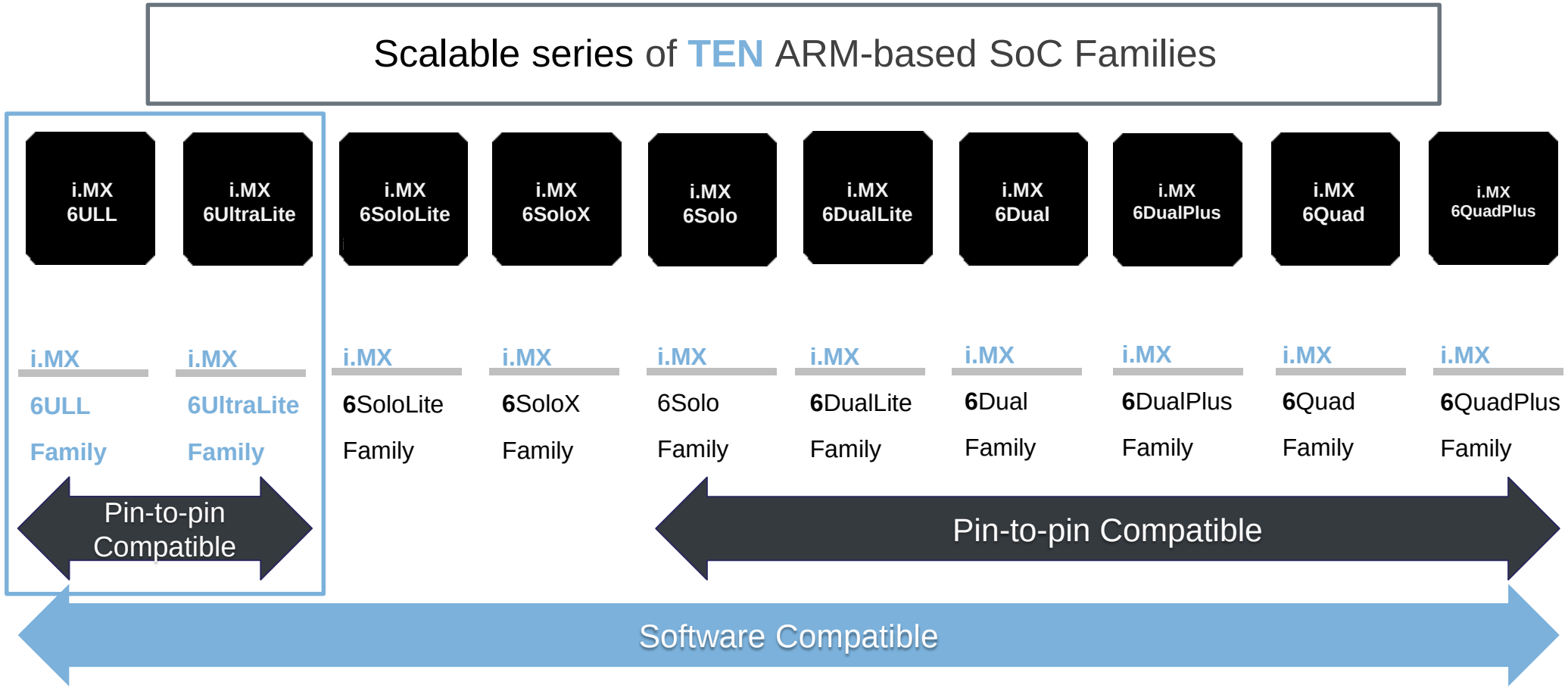


Partial devices contain an additional Cortex-M4 core

Overall Positioning



i.MX 6 Series: Supreme Scalability and Flexibility
Leverage One Design into Diverse Product Portfolio



6ULL FULL MARKET LAUNCH 21 NOV 2016

Expanded series for performance, power efficiency and lower BOM

Target Applications

- Human-machine interface (HMI)
- IoT gateways
- Home energy management systems
- Smart energy concentrators
- Intelligent industrial control systems
- Portable medical
- Streaming audio
- Printers and 2D scanners
- Smart appliances
- Low-end e-Readers





SECURE CONNECTIONS
FOR A SMARTER WORLD