



MCX Microcontrollers

Cutting through complexity and scale

BL SCE
May 2025

The **complexity factors** at the edge



Then



Now

Increasing needs for designing today's edge devices

- **Higher processing** horsepower for simultaneous tasks
- **Lower power** with increased device active time – always on, always listening
- Everything **secure** and **connected**
- Disruptive trend in **edge AI**
- Product **quality**, **longevity** and supply **resiliency**
- Reduced total design **cost** and faster **time**-to-market

Cut through complexity and scale with MCX



MCX MCUs – Strong Legacy, Bold Future



Drive differentiation through innovation...

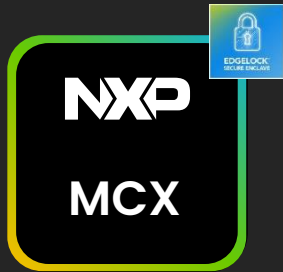
Cut through complexity with MCX's industry-leading technologies



Security requirements are evolving, stay in the game...

MCX is your simplest path towards security certifications

Hardware Foundation

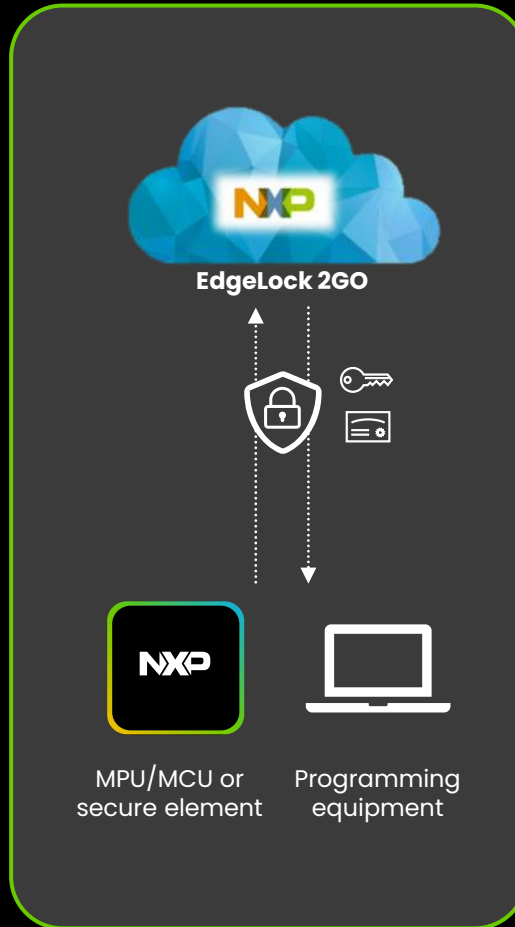


with integrated
EdgeLock® Secure Enclave

Go Beyond TrustZone®

- Higher degree of isolation
- Ease of use
- Runtime integrity protection

Technology Enablement



Use Cases

Device integrity upgrade

- Upgrade of legacy, non-secure equipment with authenticated boot, Post-Quantum secure

Easy Certification

- SESIP3
- PSA Level 3
- FIPS 140-3
- IEC 62443-4-2

Application Notes

Ease ISA/IEC 62443-4-2
compliance
with **MCX N**



AI/ML is moving from the Edge down to the Nodes...

MCX is the ultra low-power and compact platform for TinyML



eIQ® Neutron Neural Processing Unit

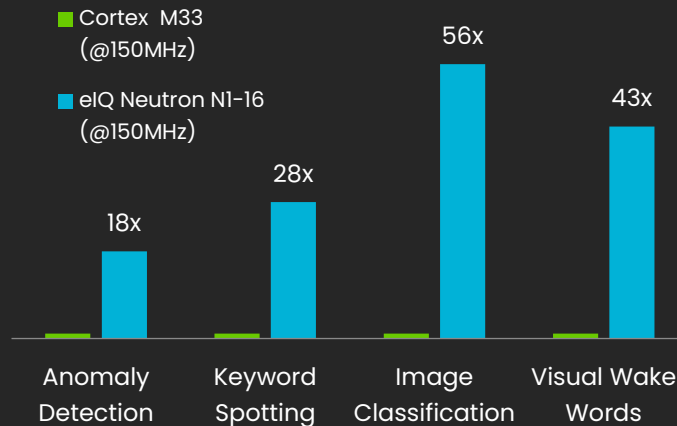
NXP-developed ML
accelerator

Designed to fit and
function in the
microcontroller world

Expands TinyML to
resource and power
constrained edge devices

Compared to using Arm Cortex-M33
core alone:

- 42x faster ML throughput
- 40x less energy
- 40% less ML model size



6x faster in object classification
than ARM Cortex-M7 at 1GHz!



NXP eIQ ML software toolkit



ML models for Industrial
& IoT applications

ML training, inference,
and optimization for
maximum performance

Example ML Use Cases



Command
recognition



Anomaly
detection



Cyber
security



Object
classification



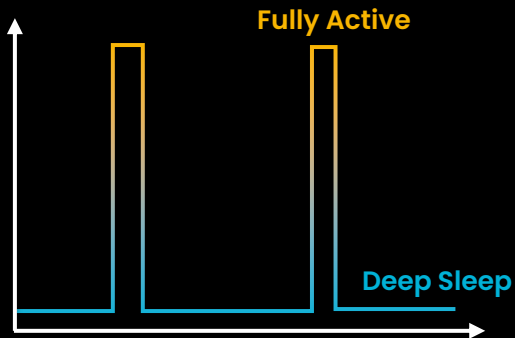
Presence
detection

The new low-power is your “on power”... MCX is your first choice for a micro that's always on, always sensing

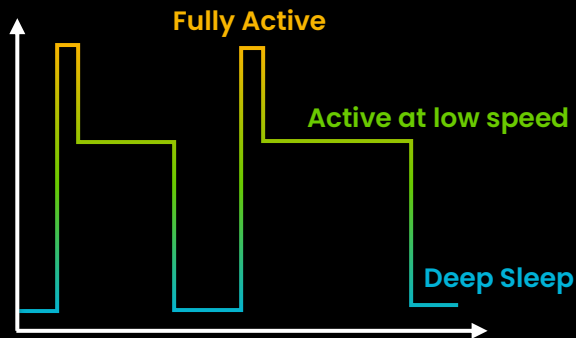
New requirements on today's edge devices:

- **Always sensing** – more active time for data acquisition
- **Distributed smart** – more tasks for edge processing

Then



Now



Energy curves for typical use cases

MCX



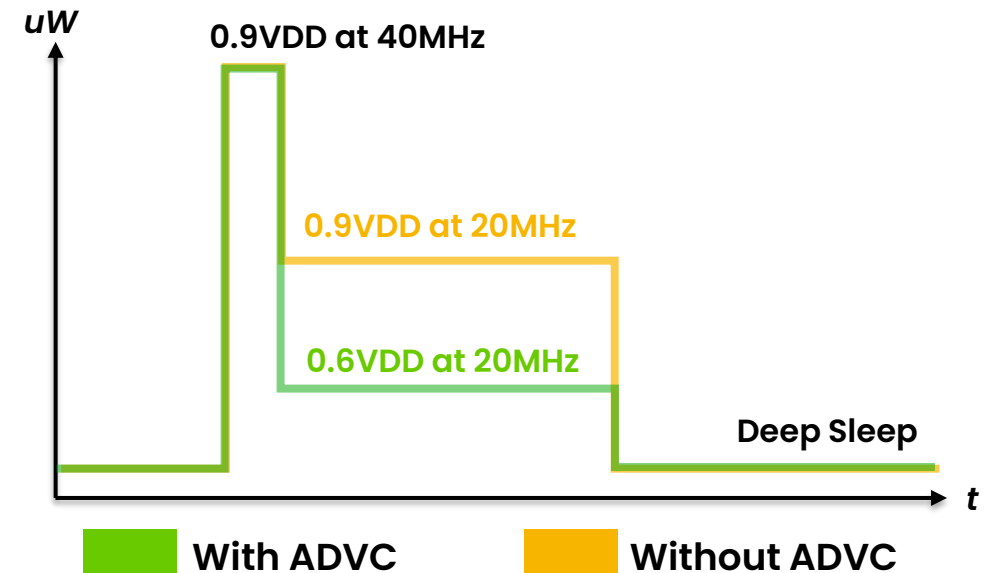
Adaptive Dynamic Voltage Control (ADVC)

NXP **patented technology** to control the VDD based on chip performance and environmental conditions

Down to **20+ $\mu\text{A}/\text{MHz}$** active power consumption

Near/sub-threshold – down to **0.6V** core voltage

Reduces power consumption to **45%** of typical core voltage at 0.9V



The world speaks analog...

MCX is the most integrated platform for mixed-signal processing



MCX A

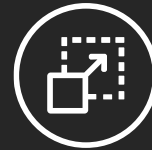
Where power efficiency meets cost



Power Efficient Cortex-M33
at 53uA/MHz



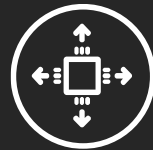
Low power at 0.4uA
with RAM retention



Scalable memory options
up to 1MB Flash, 128KB SRAM



Highly integrated **analog**
with 4Mps ADC and
Opamp as PGA



Rich interfaces for
CAN-FD, graphic LCD,
USB and I3C



Motor control subsystem
with quad. decoders and
flexible PWMs

Target Applications

Industrial Automation



Smart Home & Building



General Embedded



Moving to the new world standard...

MCX is your next stop from an 8-bit micro

It may be possible to continue designing around 8-bit technology...

But does it make sense – even economically – to stick to an increasingly limiting technology?

And why risk being left behind?

MCX C

It's easy for you to make the move to 32-bit



Simplicity with
Cortex-M0+ core



Sub-dollar 32-bit
MCU



Scalable path to
higher performance



At least **2x** more
CoreMarks®/mA



Single-cycle IO
access



50% smaller code
size

Wide Range of Applications



Built for reliability, certified for safety...
MCX empowers IEC 61508 compliant control at the core

MCX E

Reliable 5V safe-by-design MCUs

Robust

- Up to 5.5V supply
- Extended temperature mission profile
- Various LQFP package options

Reliable

- Large set of peripherals allows for high redundancy
- Up to 6x CAN FD and Ethernet with TSN

Safe

- Program flow monitor
- Full data integrity
- Clock, power and temperature monitoring

Secure

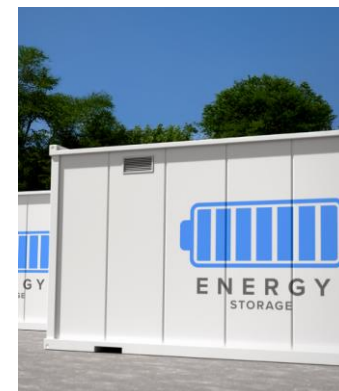
- EdgeLock® Security essential and advanced
- Security certification up to SESIP level 2

Reliability and safety in industrial and commercial applications



Functional Safety certification target

- IEC 61508 SIL 3 systematic capability



Everything connected, in every way...

MCX is your wireless MCU leading **MATTER & Bluetooth Channel Sounding**

NXP's Leadership in  **matter** 

Innovation enabler and **trusted** partner, tested with ecosystem platform providers :



Radio Subsystem

Dedicated subsystem to ensure robust wireless operation

Upgradable to support future wireless standards, features and security vulnerabilities

Coexistence for Wi-Fi by design



MCX W

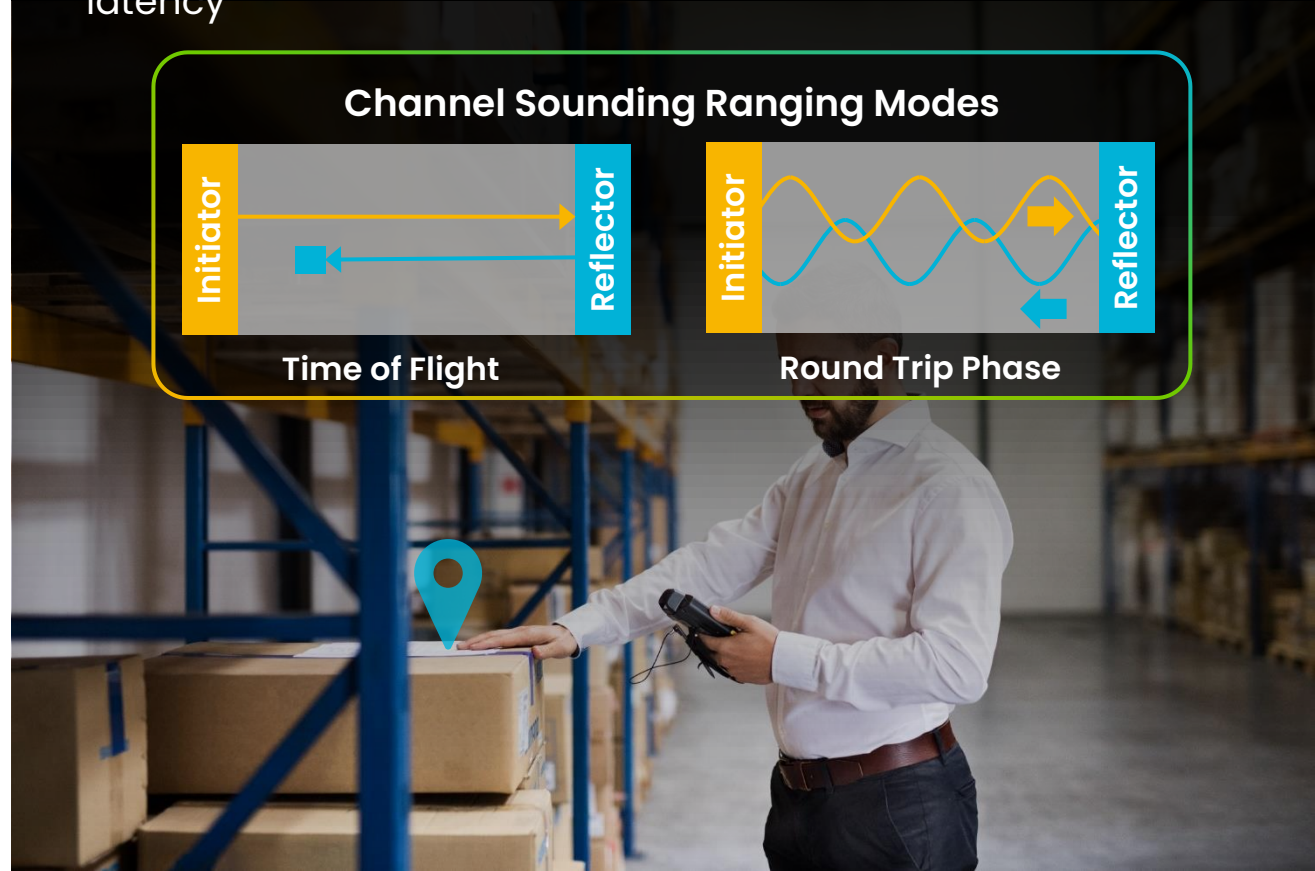
NXP's Leadership in Bluetooth Channel Sounding

First wireless MCU to feature Bluetooth Channel Sounding

+/- 0.5 m accuracy utilizing Time of Flight and Round Trip Phase

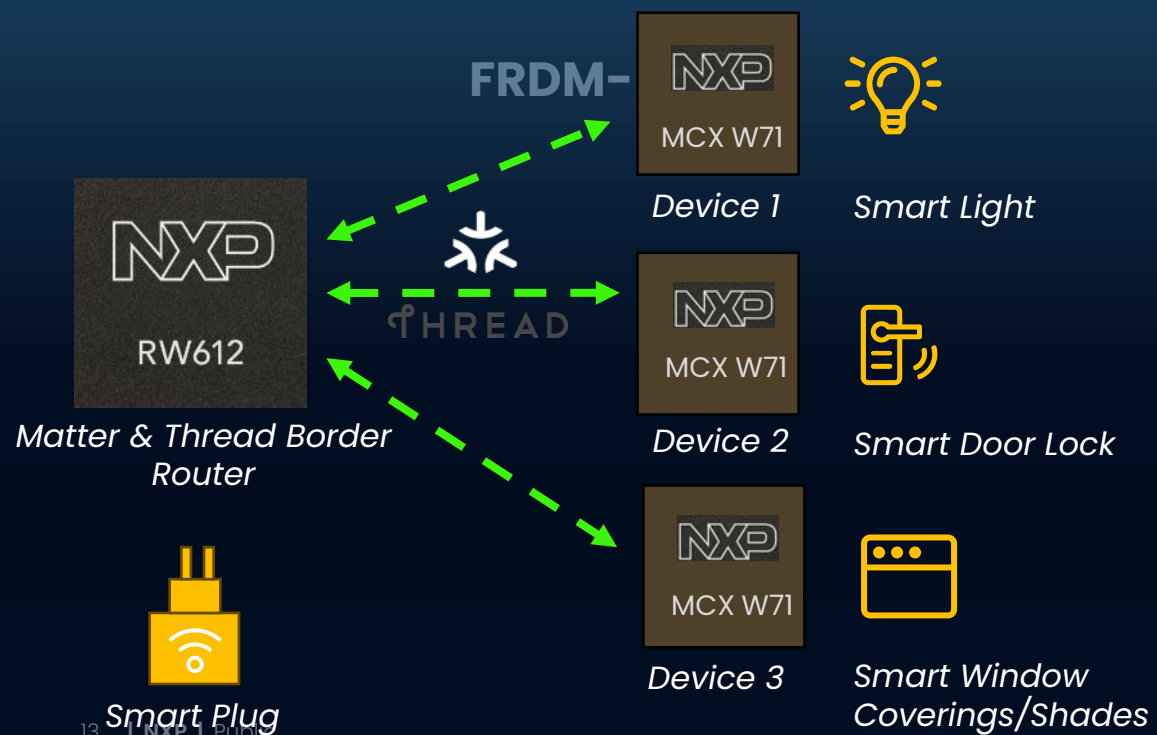
Integrated **Localization Compute Engine** (LCE) to reduce ranging latency

Channel Sounding Ranging Modes

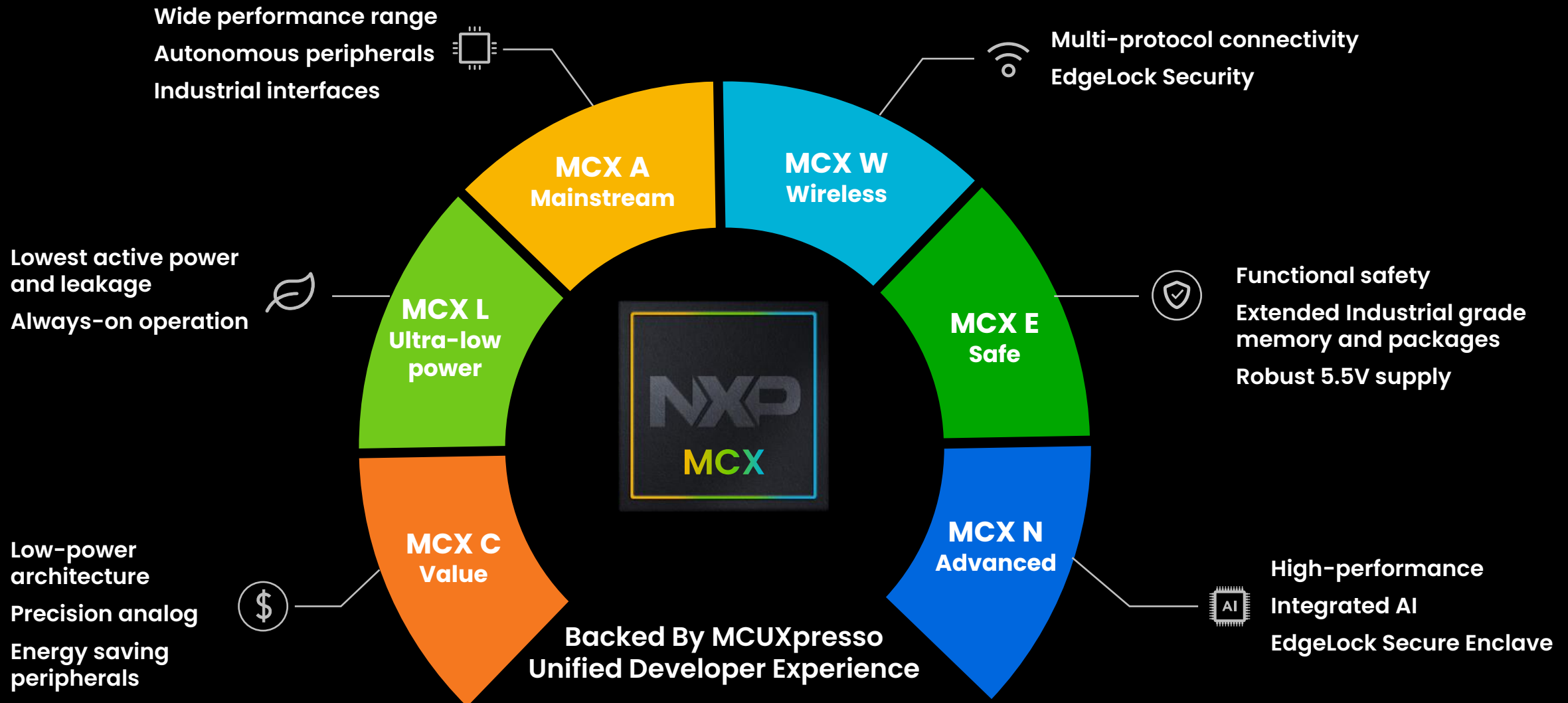


Create a Connected Ecosystem with RW612 and MCX W71


- ✓ Ease of Integration
- ✓ Excellent End User Experience
- ✓ Silicon Designed with Security



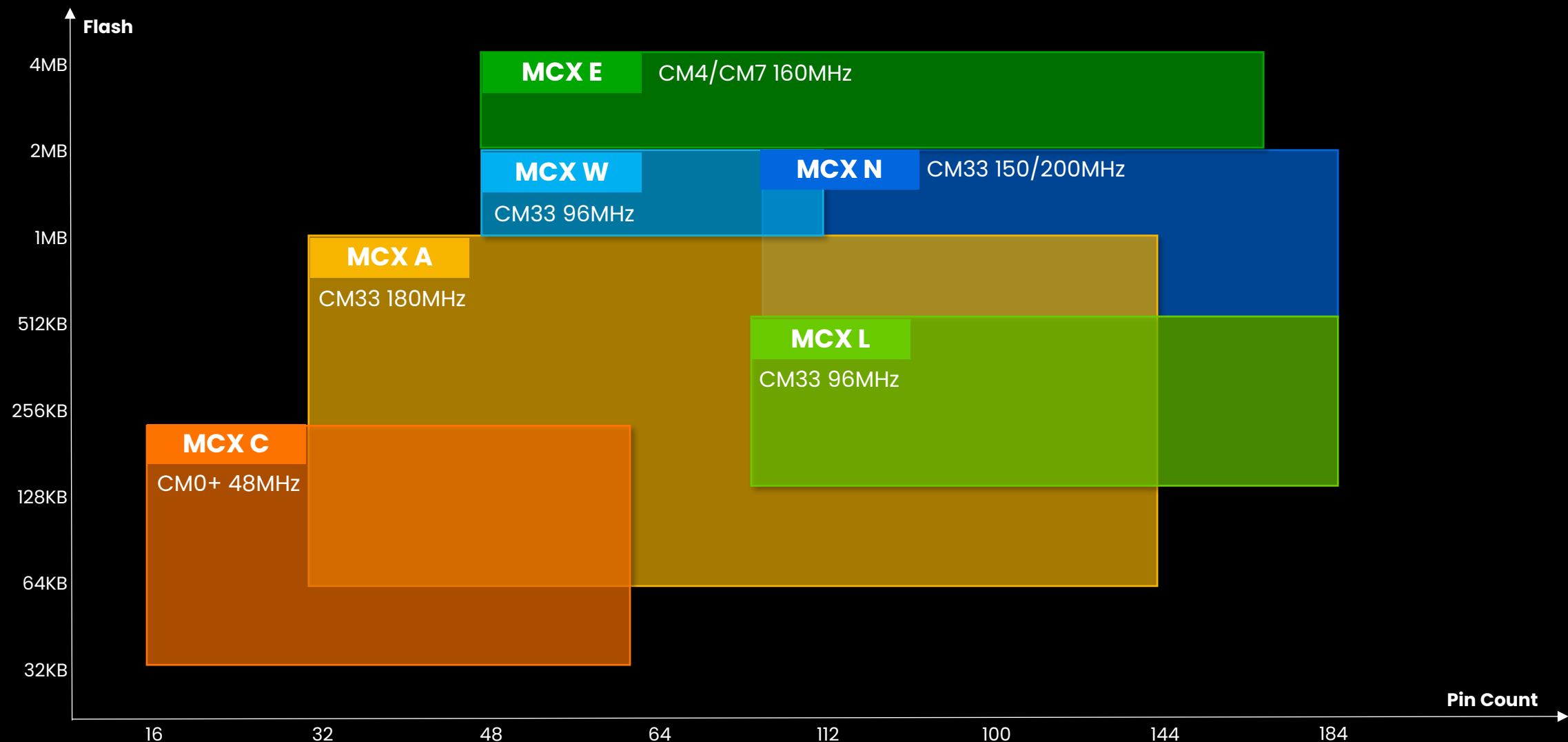
MCX MCUs – one portfolio, addressing numerous application needs



MCX MCUs – one portfolio, addressing numerous application needs

	Series Overview	Series Highlights
MCX A Power efficient & scalable	Cortex-M33 at up to 180MHz Up to 2MB Flash, 512KB SRAM, 169 pins	<ul style="list-style-type: none"> • Rich analog peripherals & motor control PWMs • I3C in a compact MCU footprint • Scalable memory and package options
MCX N High Performance & Integration	Cortex-M33 at 150/200MHz Up to 2MB Flash, 512KB SRAM, 184 pins	<ul style="list-style-type: none"> • AI/ML, camera, display and audio processing • SESIP3 / PSA L3 / FIPS 140-3 certification w/ Edgelock Secure Enclave • Power Line Communication Accelerator
MCX C Entry-level 32-bit	Cortex-M0+ at 48MHz Up to 256KB Flash, 32KB SRAM, 64 pins	<ul style="list-style-type: none"> • 2x more CoreMark/mA than 8/16-bit MCUs • Compact MCU with 16-bit high-precision ADC • Low-cost MCU with USB and segment LCD options
MCX L Always-on low power	Cortex-M33 at up to 96MHz Up to 512KB Flash, 128KB SRAM, 184 pins	<ul style="list-style-type: none"> • Down to 20+uA/MHz active power • Low-power ADC running at 5uA • Optimized for always-on, always-sensing applications
MCX E 5V & Industrial Functional Safety	Cortex-M4F / M7 at up to 160MHz Up to 4MB Flash, 128KB SRAM, 172 pins	<ul style="list-style-type: none"> • 5.5V supply with extended temperature range up to 135C • Up IEC61508 SIL3 industrial Functional Safety and SESIP level 2 security • Up to 6x CAN-FD and Ethernet with TSN
MCX W BLE & MATTER	Cortex-M33 at 96MHz Up to 2MB Flash, 256KB SRAM	<ul style="list-style-type: none"> • Software configurable and upgradable Radio Subsystem • Near-zero power consumption in shelf state • First MCU with Bluetooth channel sounding

MCX Portfolio Positioning



MCX MCUs – one portfolio, addressing numerous application needs



Feature Highlights

	Low power	Accelerator	Security & Safety	Connectivity	Mixed-signal	Interface
MCX N High Performance & Integration	50uA/MHz active 3uA w/ RTC and full RAM retention	elQ Neutron NPU DSP Accel. Power Line Comms	Edglock Secure Enclave TrustZone	10/100 Ethernet HS & FS USB CAN-FD I3C	16-bit differential ADC Op Amps Motor control PWMs	Parallel LCD Parallel camera Cap. touch DMIC, I2S
MCX A Power efficient & scalable	53uA/MHz active 0.4uA with partial RAM retention	Math Accel.	TRNG, AES, SHA2 Life-cycle Management	FS USB CAN-FD I3C	16-bit high-speed ADC Op Amps Motor control PWMs	Parallel LCD
MCX C Entry-level 32-bit	0.18uA at Very Low-leakage STOP mode			FS USB	16-bit ADC	Segment LCD
MCX L Always-on low power	24uA/MHz active 1.5uA w/ RTC and full RAM retention		TRNG, AES, SHA2 Life-cycle Management		Low-power ADC in AON domain	Segment LCD Keypad
MCX E 5V & Industrial Functional Safety			Edglock Secure Enclave Industrial Functional Safety SIL2 capable	~6x CAN-FD 10/100 Ethernet w/ TSN	Motor control PWMs	
MCX W BLE & 15.4 Wireless	<55uA/MHz active		Edglock Secure Enclave TrustZone	15.4 & BLE CAN-FD I3C	16-bit ADC	Parallel LCD

MCX MCUs – one portfolio, addressing numerous application needs



Example Use Cases

	Sensing	HMI	Motor Control	Metering	Secure Access	Edge AI	Voice & Vision
MCX N High Performance & Integration	Sensor w/ HMI & data processing	Rich graphic LCD Cap. touch slider	Motor control w/ HMI & Ethernet	E-meter w/ PLC	Secure access w/ HMI	Image, audio & time-series ML	Microphone Audio DSP Parallel CSI
MCX A Power efficient & Scalable	Compact analog/digital sensor	Basic graphic LCD	Single/dual BLDC motor control			Time-series ML	
MCX C Entry-level 32-bit	Low-cost compact sensor	Segment LCD Low-end graphic LCD	Brushed DC motor control				
MCX L Always-on low power	Always-on low-power sensor	Segment LCD		Low-power meters			
MCX E 5V & Industrial Functional Safety	5V sensor interface		Motor control w/ Functional Safety		Factory secure access w/ Functional Safety	Time-series ML	
MCX W BLE & 15.4 Wireless	Sensor w/ wireless	Basic graphic LCD	Motor control + wireless	Meters with wireless	Secure access w/ wireless	Time-series ML	

Beyond the silicon...

Design with NXP as your trusted partner



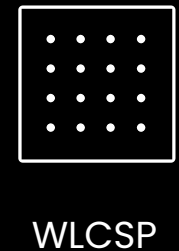
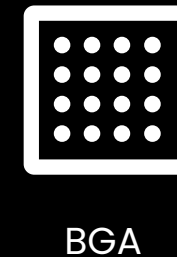
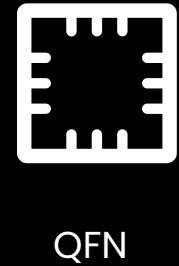
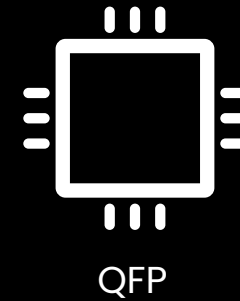
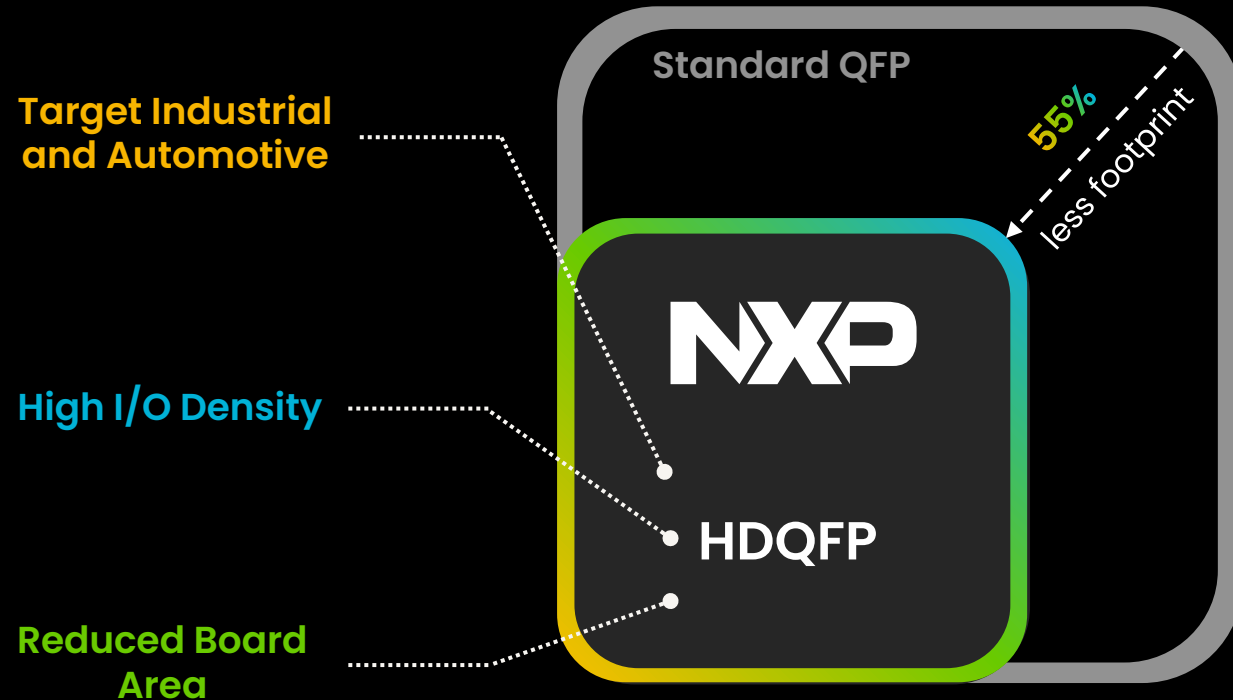
Scale your design with NXP's innovative package options

Introducing the HDQFP

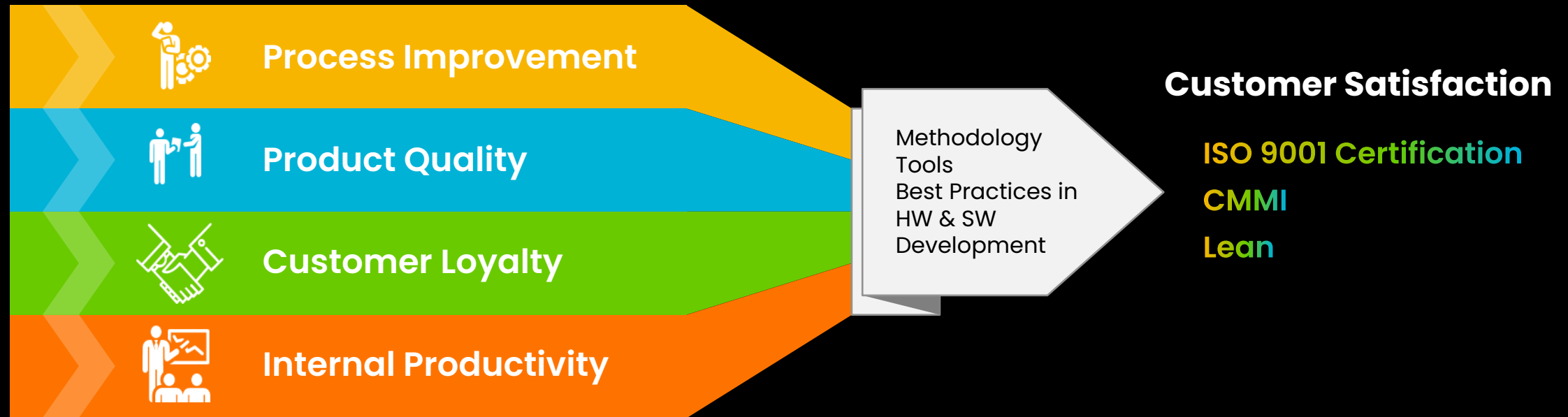
Our innovative IC packaging, helping simplify packaging portfolios by offering greater I/O density versus regular QFP.



Various **scalable** package options with pin-to-pin **compatibility** in select MCX families.



Commitment to Total Quality & Manufacturing Expertise



- Maintain **excellent delivery performance** to our distributors around the world
- Maintain **competitive lead times** on our broad mix of products
- Guarantee **longevity for 15 years** ... but always far exceeding this longevity

NXP **BCaM** (Business Creation and Management) is the heart of GSD Software Methodology

NXP **Corporate Quality** and **HW/SW methodology** teams drive Best Practices throughout the company with this common BCaM

NXP's Expertise for Use-case-driven Qualification Specifications

Qualification Level	Characteristics	
Commercial or Consumer Highest MHz**	5-year life*, 50% on Typically: 0°C to +85°C Tj	22K hours
Industrial Longest operating life**	10-year life*, 100% always on Typically: -40°C to +105°C Tj All MCX: -40°C to +125°C Tj Select MCX: -40°C to +135°C Tj	88K hours
Automotive Widest temperature range**	15-year life*, 10% on Typically: -40°C to +125°C Tj	13K hours

*Product Lifetime Usage application notes should be used to estimate expected power-on hours (PoH) for each use case scenario, e.g. AN12983

**These descriptions represent the typical result for each qualification

From prototype to production made easy...

MCUXpresso Developer Experience

Development Tools

Power of Choice

- **Multiple IDEs** for C/C++:
 - MCUXpresso for VS Code
 - MCUXpresso IDE
 - IAR Embedded Workbench
 - Keil MDK
- Debug probe options from NXP and partners
- Tools for simple device configuration and migration to custom hardware
- **FreeMASTER** data visualization & real-time debugging/control

Runtime Software

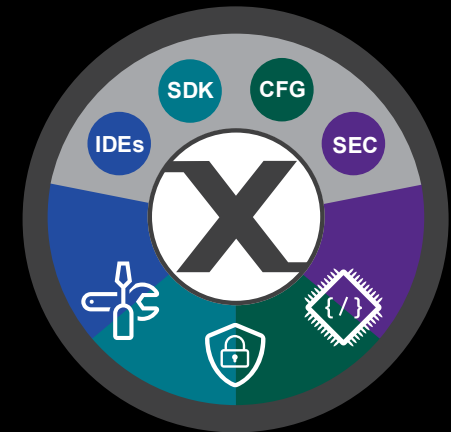
Simplify & Accelerate

- **MCUXpresso SDK** – download driver support directly from an IDE, SDK Builder or GitHub
- **Open-CMSIS-Packs** for access to MCUXpresso SDK using an open standard delivery mechanism
- **Zephyr** platform support and FreeRTOS examples
- Wide range of application software available from our **Application Code Hub**

Hardware Platforms

Rapid Prototyping

- **FRDM Boards** – compact, low-cost and scalable platform that utilizes expansion boards to develop for any application



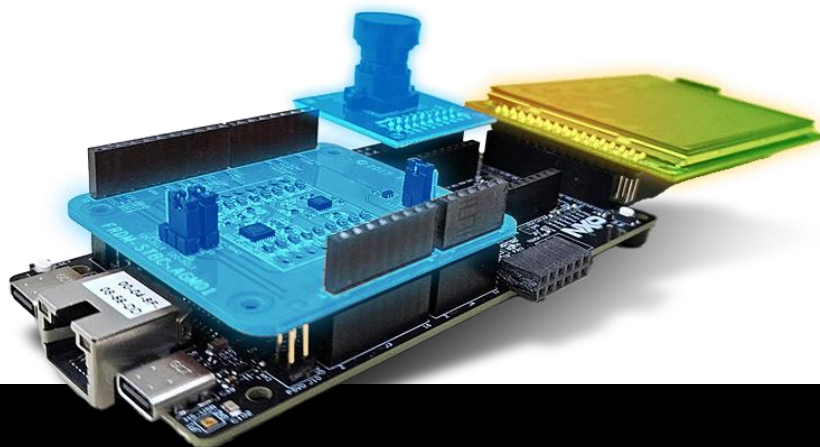
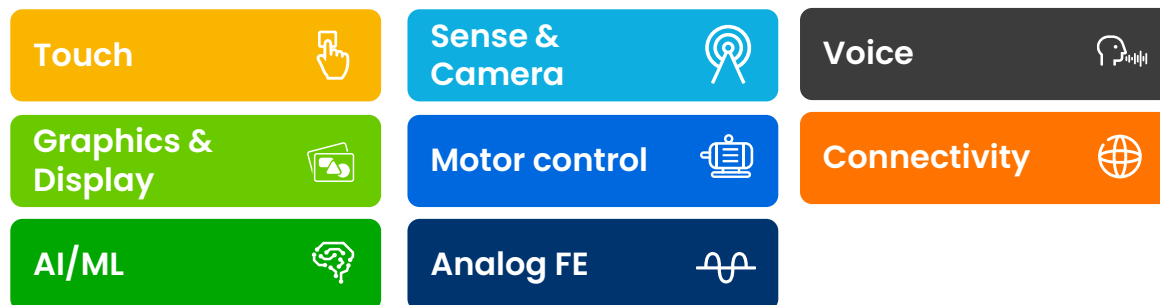
MCUXpresso Developer Experience

MCUs FRDM Boards

Scalable platform

Low cost, compact and scalable development boards for rapid prototyping.

They offer industry-standard headers for easy access to I/O's and additional tools to fast go to market.



Software Drivers

MCUXpresso SDK. Download direct from an IDE, use Github or customize for your needs

Open-CMSIS-Packs. Easily find and use middleware from NXP and Partners within any IDE



Expansion Boards

Expansion board hub to easy to find compatible boards and get benefit of software and drivers to expand board capabilities.



Software Examples

Application Code Hub with interactive dashboards and intuitive filtering to find application examples and expansion board software

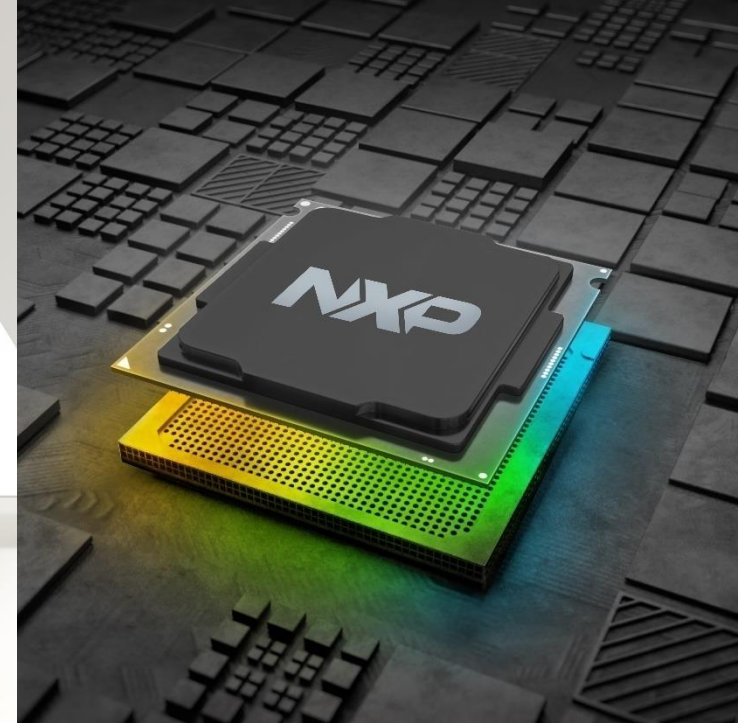


Cut through complexity and scale with
MCX

Strong Legacy, Bold Future –



Together, we make the **future**
bright.



-  One MCX portfolio
-  Numerous enabled technologies
-  Goes beyond the silicon

