

STM32 MCU & WIRELESS updates

STMicroelectronics and AVNET SILICA

Paolo Scannifio TME



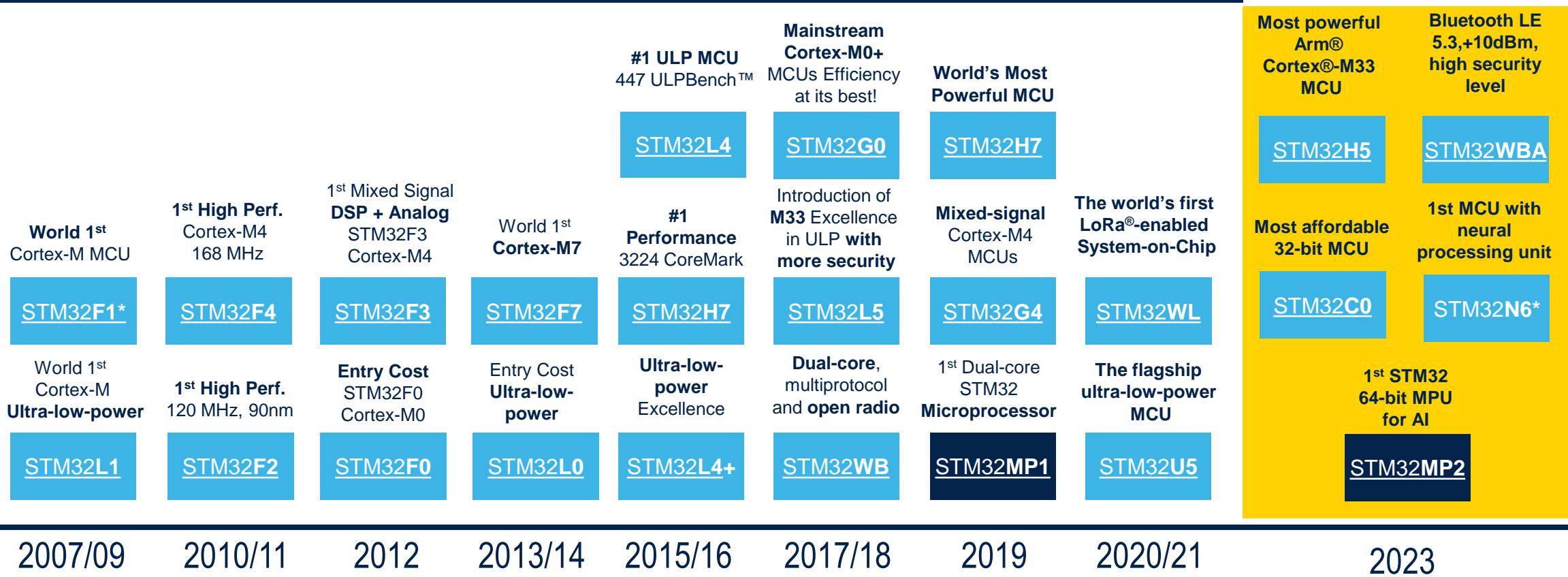
STM32 General introduction





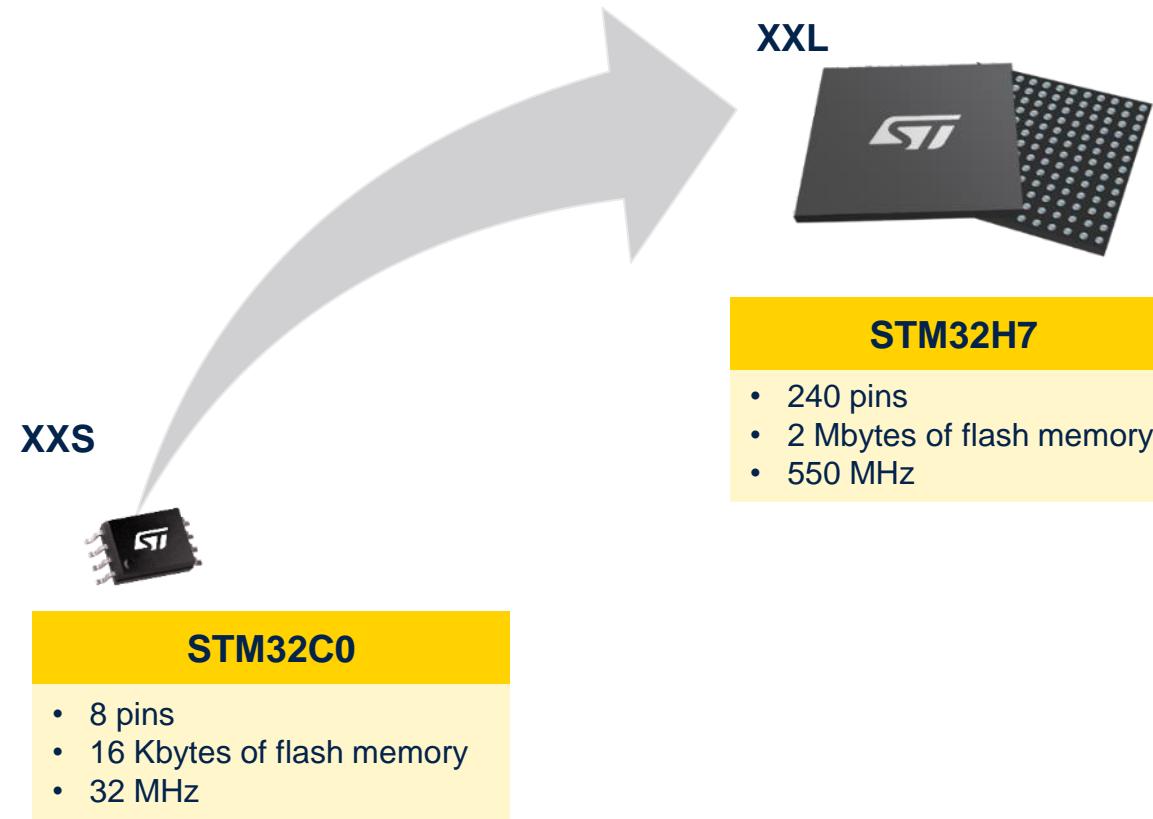
Continuous innovation since 2007

Leader in Arm® Cortex® 32-bit MCU & MPU

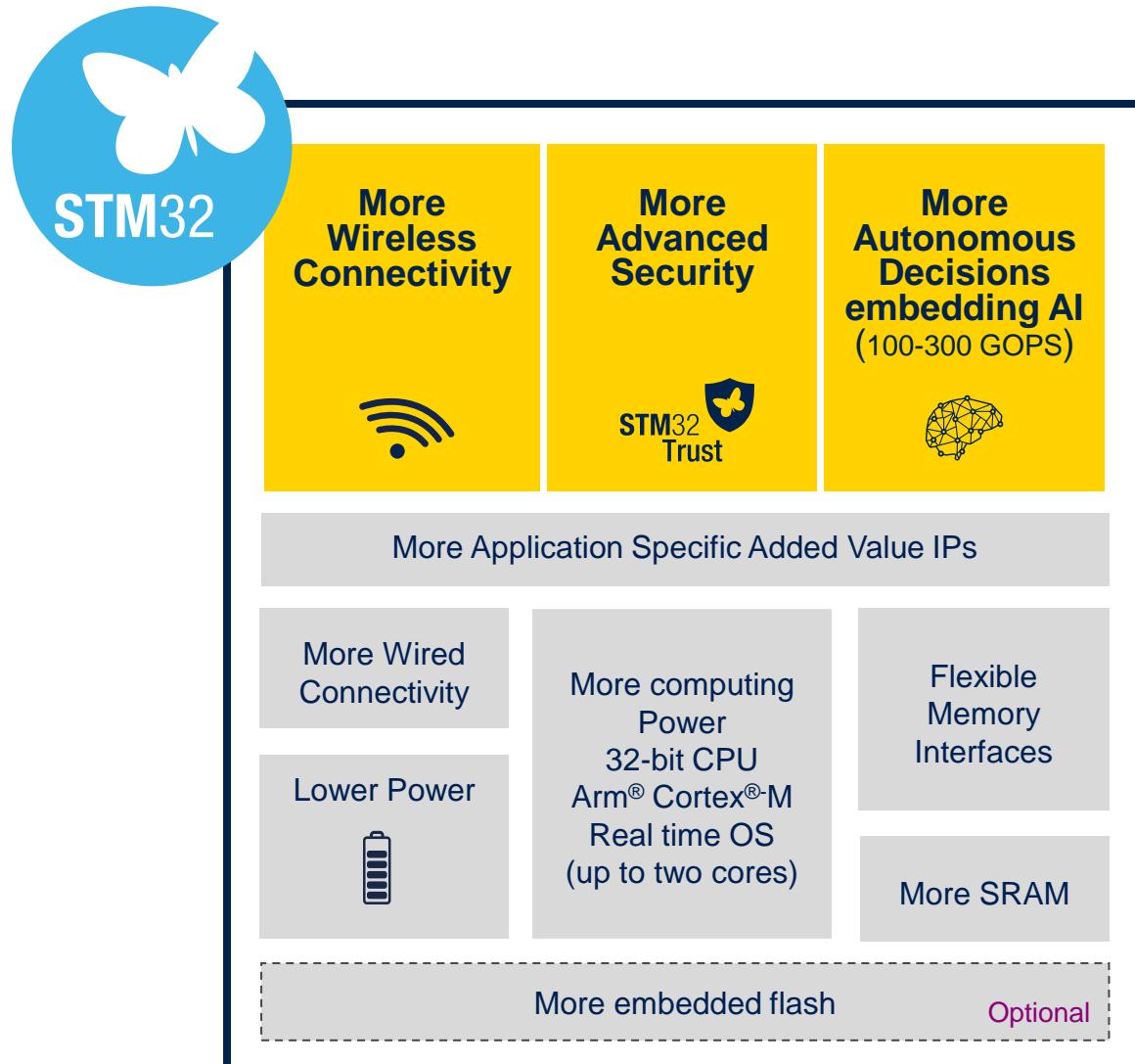
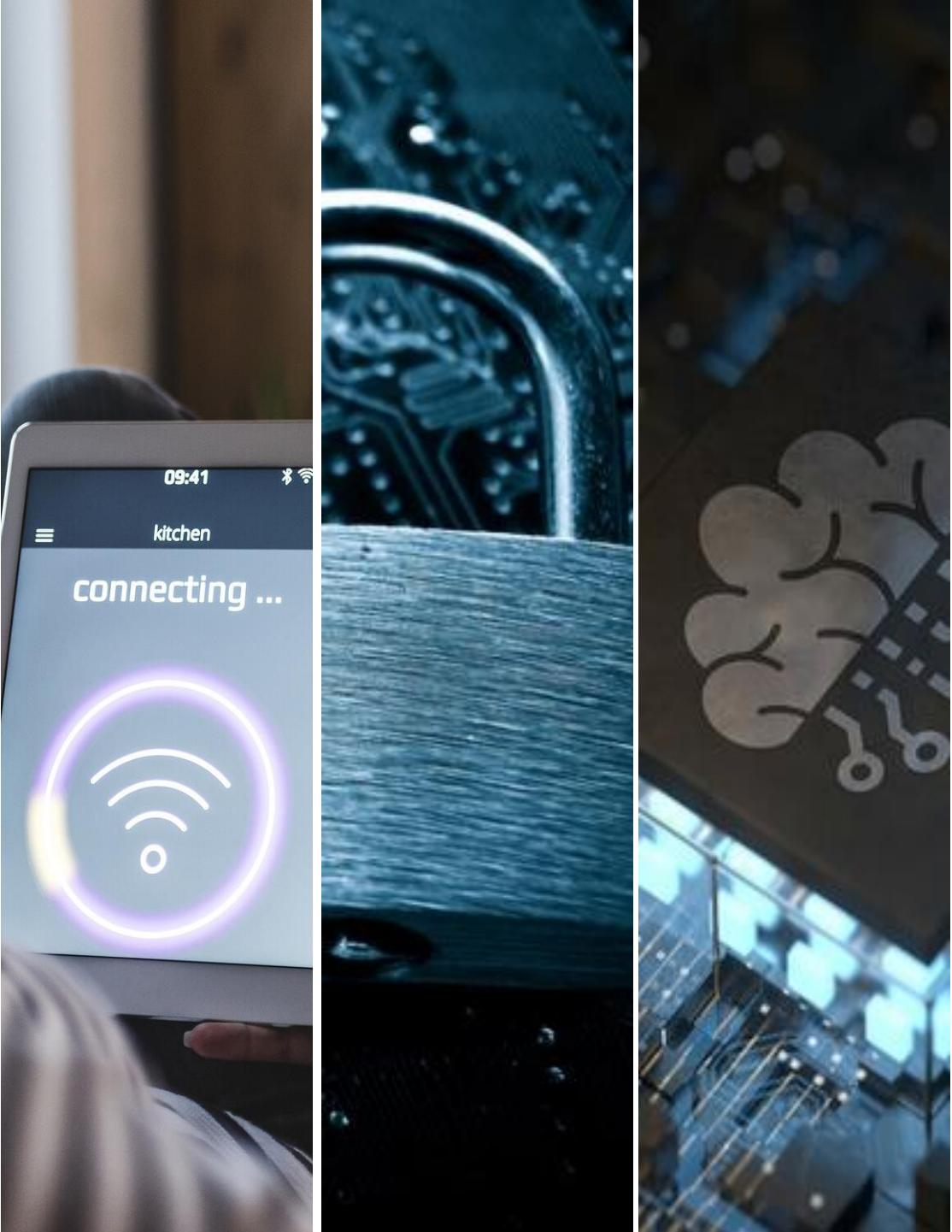




From entry-level to high-performance applications



STM32 supports 3 key trends





STM32 portfolio



MPU



High-performance MCUs



Mainstream MCUs



Ultra-low-power MCUs



Wireless MCUs



STM32MP1
Up to 1 GHz Cortex-A7
209 MHz Cortex-M4

STM32MP2
Dual 1.5 GHz Cortex-A35
400 MHz Cortex-M33

STM32F7
1082 CoreMark
216 MHz Cortex-M7

STM32H7
Up to 3224 CoreMark
Up to 550 MHz Cortex -M7
240 MHz Cortex -M4

STM32N6
MCU with neural processing unit

STM32F2
Up to 398 CoreMark
120 MHz Cortex-M3

STM32F4
Up to 608 CoreMark
180 MHz Cortex-M4

STM32H5
Up to 1023 CoreMark
250 MHz Cortex-M33

STM32F3
245 CoreMark
72 MHz Cortex-M4

STM32G4
569 CoreMark
170 MHz Cortex-M4

Mixed-signal MCUs

STM32C0
114 CoreMark
48 MHz Cortex M0+

STM32F0
106 CoreMark
48 MHz Cortex-M0

STM32G0
142 CoreMark
64 MHz Cortex-M0+

STM32F1
177 CoreMark
72 MHz Cortex-M3

STM32L0
75 CoreMark
32 MHz Cortex-M0+

STM32L4
273 CoreMark
80 MHz Cortex-M4

STM32L4+
409 CoreMark
120 MHz Cortex-M4

STM32L5
443 CoreMark
110 MHz Cortex-M33

STM32U5
651 CoreMark
160 MHz Cortex-M33

BlueNRG-x
Cortex-M0+

STM32WB
216 CoreMark
64 MHz Cortex-M4
32 MHz Cortex-M0+

STM32WBA
407 CoreMark
100 MHz Cortex-M33

Spirit1
150-956MHz / 2(G)FSK,
GMSK

S2-LP (Spirit2)
413-1055MHz / 2/4(G)FSK,
OOK, ASK, 802.15.4g

STM32WL
162 CoreMark
48 MHz Cortex-M4
48 MHz Cortex-M0+

Latest product generation

New series introduced in 2023

Pre-announcement

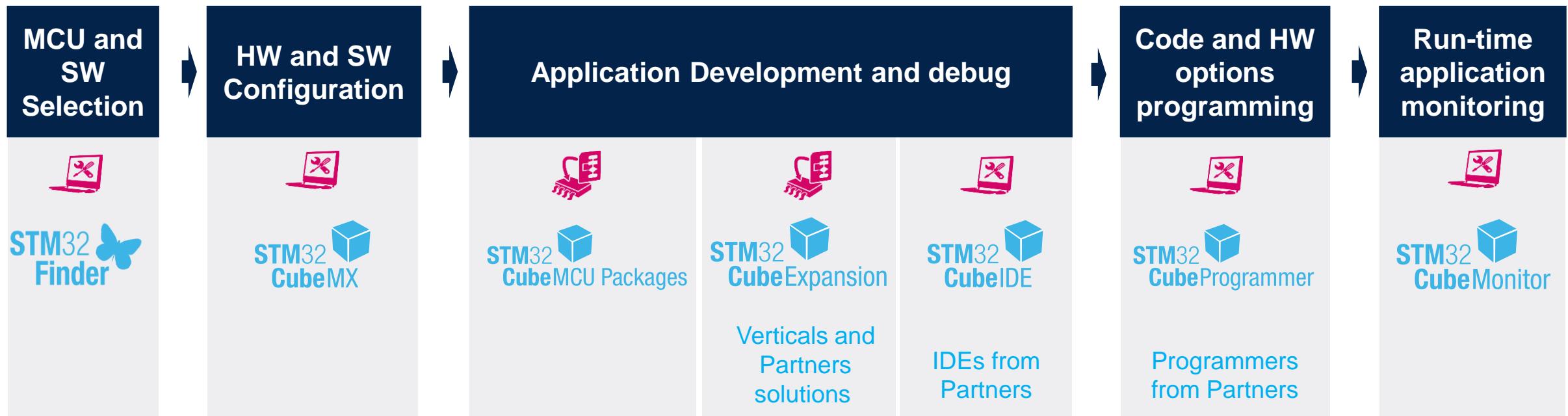
STM32 ecosystem



STM32Cube Framework

helping you releasing your creativity

Tools and software that support you during all your design steps



Consistency across the full STM32 portfolio

STM32 empowered by Cortex®-M33



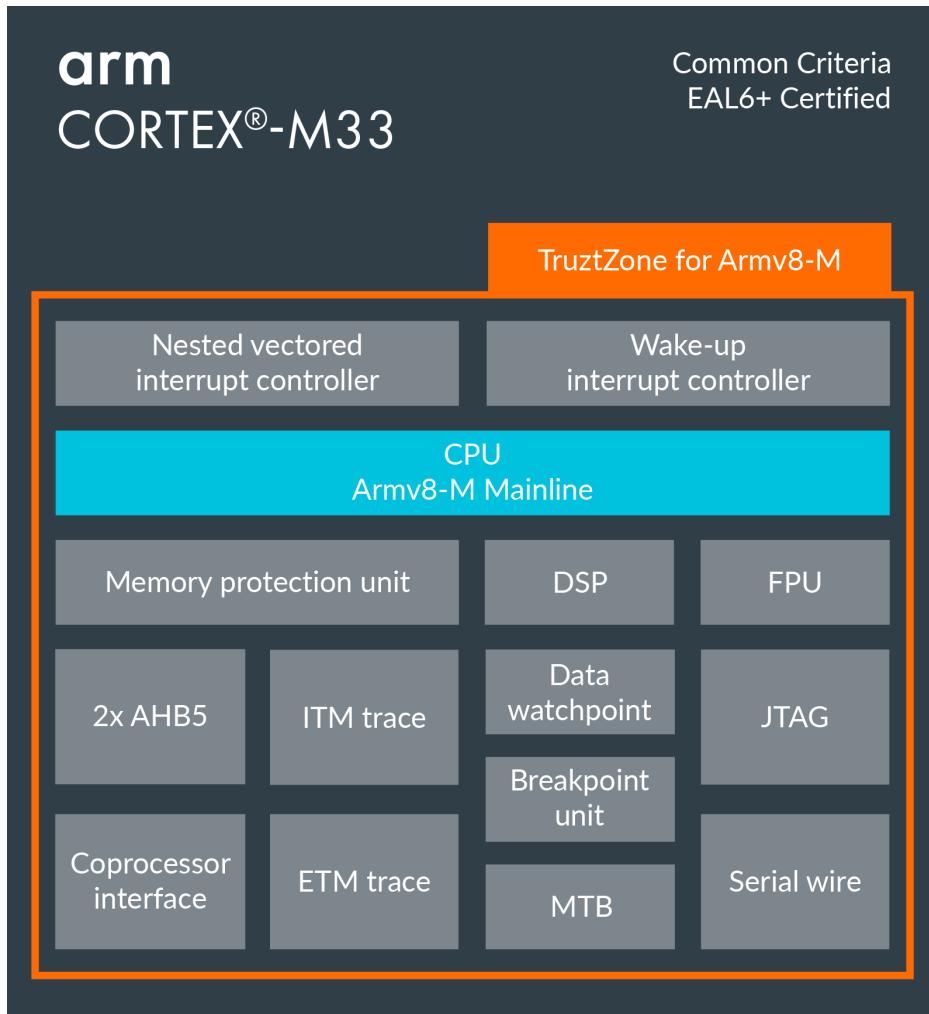
Cortex®-M compatibility

- Seamless architecture across all applications

Cortex-M0 & M0+	Cortex-M3	Cortex-M4	Cortex-M33	Cortex-M7
Ultra low power	First Cortex®-M CPU		High performance	



Cortex®-M33 in brief



Architecture	ARMv8-M with Mainline extension
Bus Interface	<u>2x AMBA5 AHB (Harvard bus architecture)</u>
ISA Support	<u>Thumb/Thumb-2</u>
Pipeline	Three-stage
SW Security	TZ, SAU up to 8 regions, Stack limit checking
DSP extension	DSP/SIMD: 16/32b MAC, 8/16b SIMD
FPU	SP, IEEE 754 complaint
Co-processor I/F	Up to 8 co-processor units
MPU	Up to 16 regions per security state
Interrupts	NMI + up to 480 interrupts, 8-256 priority levels
WIC	Wake-up Interrupt Controller
Sleep Modes	WFE, WFI, Sleep On Exit
Debug	JTAG & SWD up to 8 break- & 4 watch-points
Trace	ETM, MTB, DWT, ITM

STM32 based on Cortex®-M33



STM32L5

First STM32 based on Cortex®-M33 , 90nm

STM32U5

ULTRA LOW POWER
First STM32 based Arm® Cortex®-M33 40nm

STM32WBA5

2.4GHZ MULTIPROTTOCOL
First Wireless STM32 based Arm® Cortex®-M33 @
100Mhz

STM32H5

HIGH PERFORMANCE
First Arm® Cortex®-M33 on the mkt @ 250Mhz



STM32



Wireless MCU



Entry level MCU



MPU



Ultra Low Power MCU



High- Performance MCU



Analog rich MCU

STM32 ultra-low power MCUs

**90nm ULP
embedded Flash**

STM32L4 MCU

Cortex-M4 up to 120MHz
Up to 2MB Flash

STM32L5 MCU

Cortex-M33 up to 120MHz
512 KB Flash

STM32Ux MCU

Cortex-M0+
LCD segment
Up to 256KB Flash

Q1'24

**40nm ULP
embedded Flash**

STM32U5 MCU

Cortex-M33 up to 160MHz
Up to 4MB Flash

STM32U5 Enabling key new features



High energy efficiency

Innovative power management features
LPBAM*, DMA and IP autonomous in LP mode

High integration

Up to 4Mbytes internal flash memory
Up to 2.5Mbytes RAM
USB HS with integrated PHY

Higher security and safety

AES and PKA, side attack resistant
ECC on flash memory and SRAM

Graphics advanced capacity

First STM32 with advanced graphics accelerators
and NeoChrom GPU

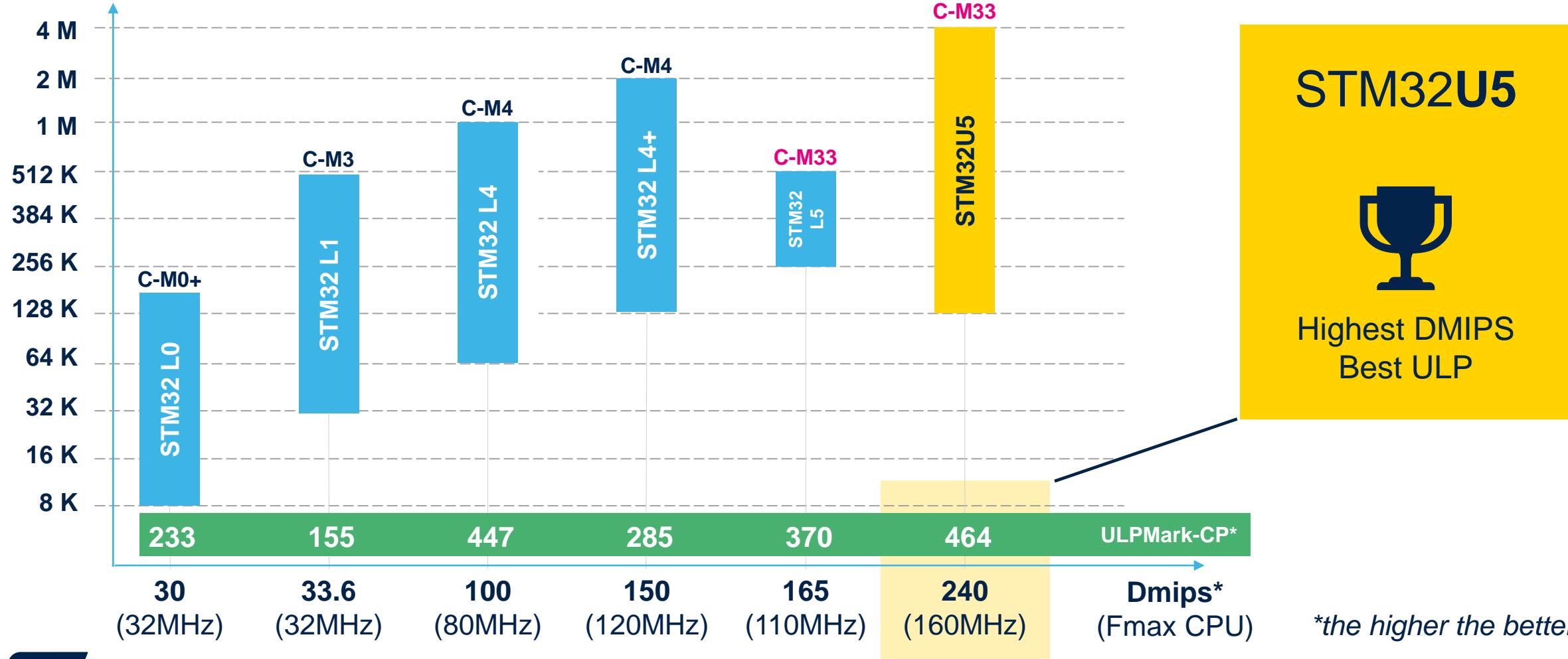
Improved data storage

100 Kcycles for 512Kbytes of Flash



STM32U5, the flagship of STM32 ULP series

Memory size (Bytes)



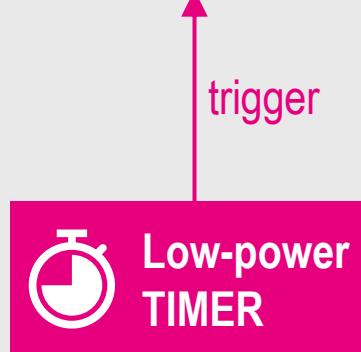
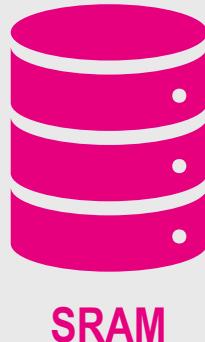


Cut MCU power consumption by 90%*

Low Power Background Autonomous Mode (LPBAM)

STM32U5

arm
Cortex-M33



wake-on-complete

- Peripherals:**
- I2C master or slave
 - SPI / UART reception or transmission
 - ADC / DAC
 - Voice Activity Detection
 - LPTIM
 - I/O



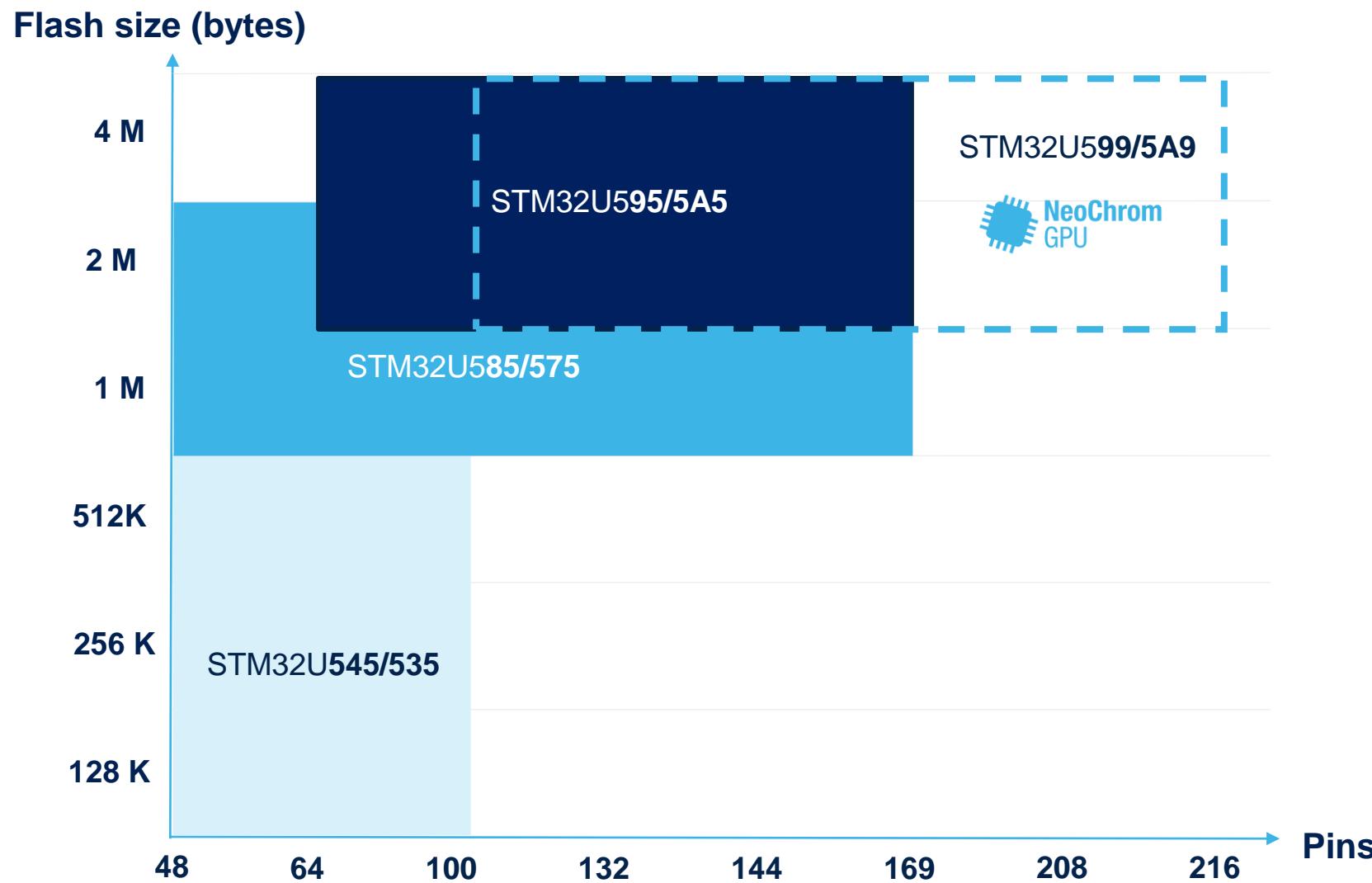
Enhanced security

Extensive functionality to protect your assets

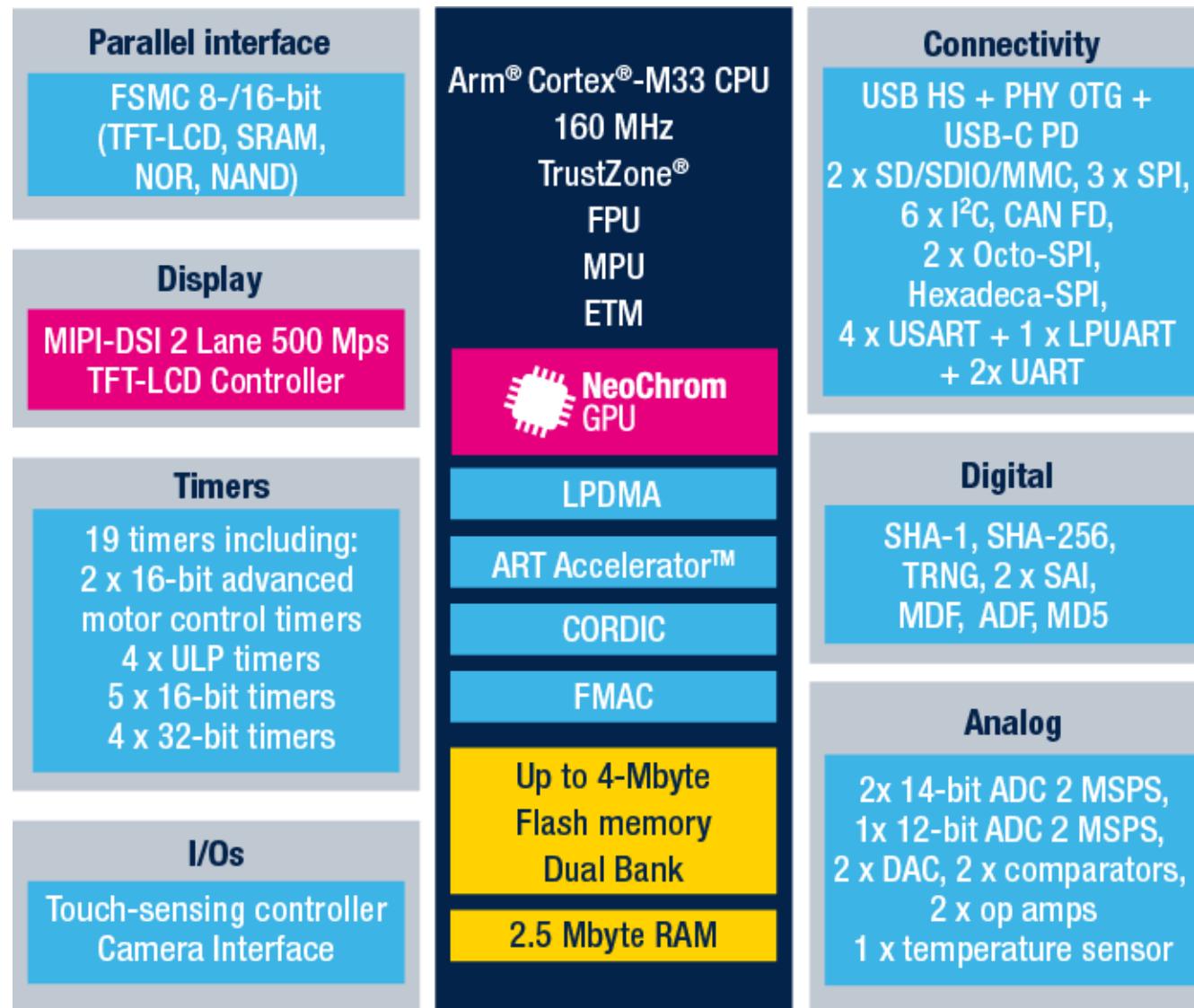
Isolation	Cryptography	Security assurance level	1 st STM32 MCU to reach Level 3
TrustZone® Secure Peripherals Secure DMA	Side channel AES, PKA Additional AES, PKA, SHA, TRNG CAVP certified CryptoLib	 	1 st STM32 MCU to reach Level 3
Lifecycle	Memory protections	Active tamper	Trust anchor
RDP: 4 protection level states Password based regression	OTP, HDP, WRP, RDP, MPU Ext. Flash encryption OTFDec Secure Debug	4x active pair of tamper pins. Volt. & Temp. monitoring (Vbat) Total tamper I/Os: 8	TF-M, Secure Boot, Secure Firmware Install Hardware Unique Keys



STM32U5 portfolio



STM32U5 offers high integration





STM32 development tools

Speed up evaluation, prototyping, and design with hardware tools



*\$348



*\$65



*\$89



*\$23



Evaluation boards

STM32U5 full feature evaluation
[STM32U575I-EV](#)

Discovery kit for IoT node

Direct connection to cloud services
[B-U585I-IOT02A](#)

Discovery kit for graphics

[STM32U5A9J-DK](#)

STM32 Nucleo

Affordable and quick prototyping
[NUCLEO-U575ZI-Q](#)
[NUCLEO-U5A5ZJ-Q](#)
[NUCLEO-U545RE-Q](#)

*Recommended Resale Price (RRP)



STM32



Wireless MCU



Entry level MCU



MPU



Ultra Low Power MCU



High- Performance MCU



Analog rich MCU

STM32 high Performance MCUs

**90nm embedded
Flash**

STM32F2 MCU

Cortex-M3 up to 120MHz
Up to 1MB Flash

STM32F4 MCU

Cortex-M4 up to 180MHz
Up to 2MB Flash

**40nm embedded
Flash**

STM32H5 MCU

Cortex-M33 at 250MHz
Up to 2MB Flash



STM32H5 MCU series



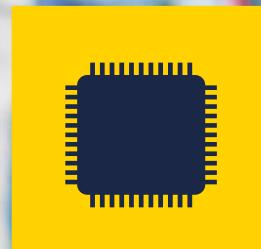
Most powerful Arm® Cortex®-M33 MCU

Industry-first 32-bit MCU with Arm® Cortex®-M33 core running as high as 250 MHz



Scalable security to address every need

From the most essential security building blocks to fully certified services maintained by ST



Optimized cost/performance trade-off

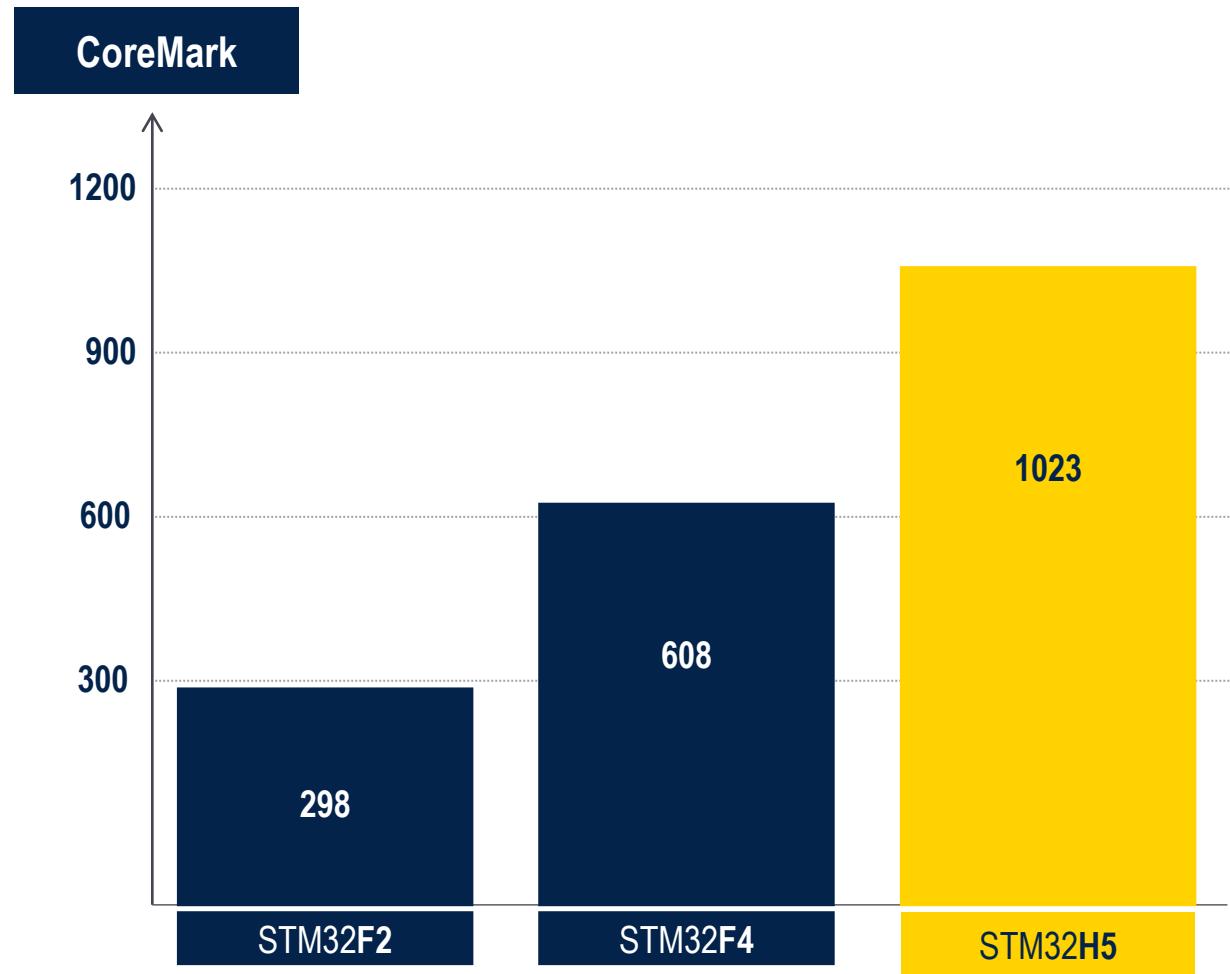
Based on ST's optimized 40 nm process technology
Large choice of memory, peripherals, and package options



Boosting application performance

STM32H5

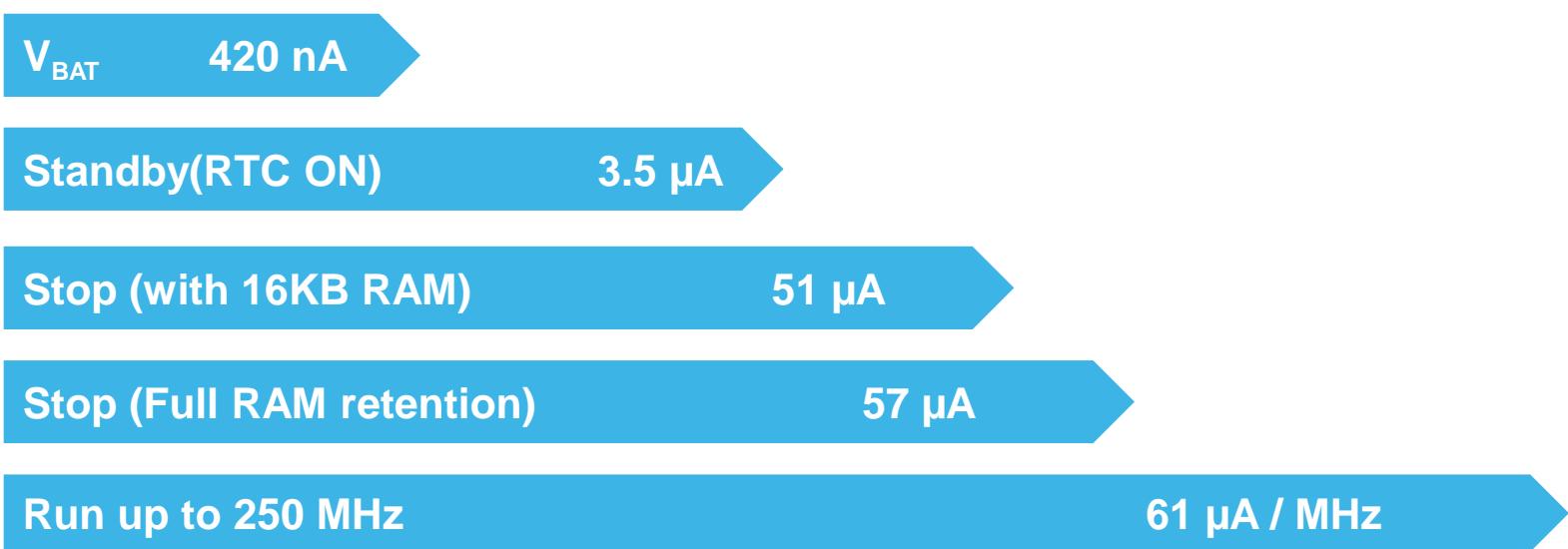
- Arm® Cortex®-M33 at **250 MHz**
375 DMIPS & 1023 CoreMark
- **Instruction and data cache** for internal and external memory (ART Accelerator™)
- Mathematics accelerators:
FMAC and **Cordic**





Flexible power modes

Efficient power consumption thanks to the switched mode power supply option (SMPS)



Typical: 25°C, V_{DD} = 3V, SMPS mode

Robust hardware features and turnkey SoC software implementations

Memory protections against illegal access control
OTP, HDP, WRP, MPU Ext. Flash Decryption OTFDec Secure Debug Active Tamper

Cryptography for hardware robustness
Side channel AES, PKA Additional AES, PKA, SHA, TRNG, OTFDec, HUK NIST - CAVP certified CryptoLib

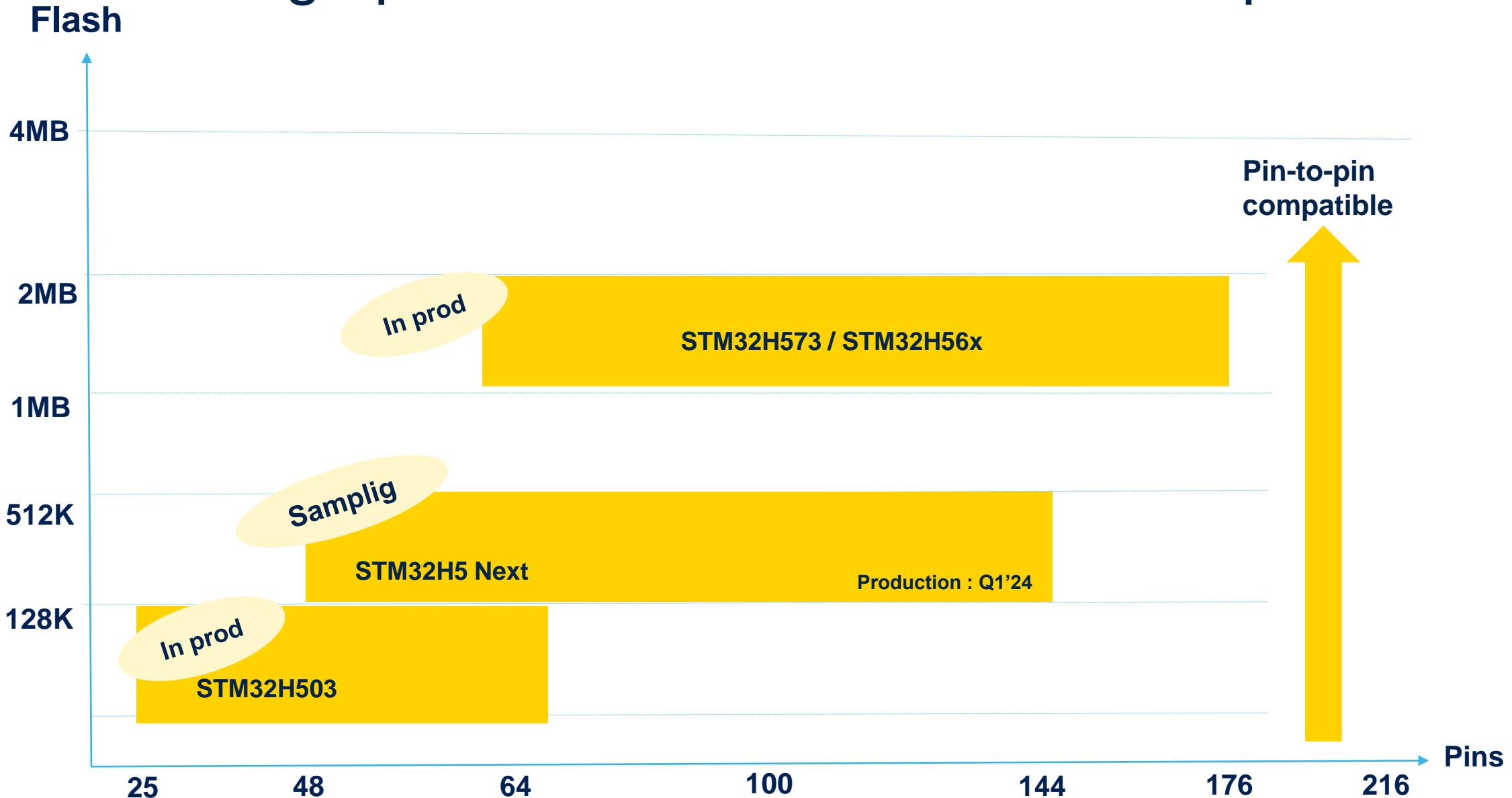
Platform authentication during product lifecycle
2 boot stages Protection level states Debug authentication
Code isolation for runtime protection

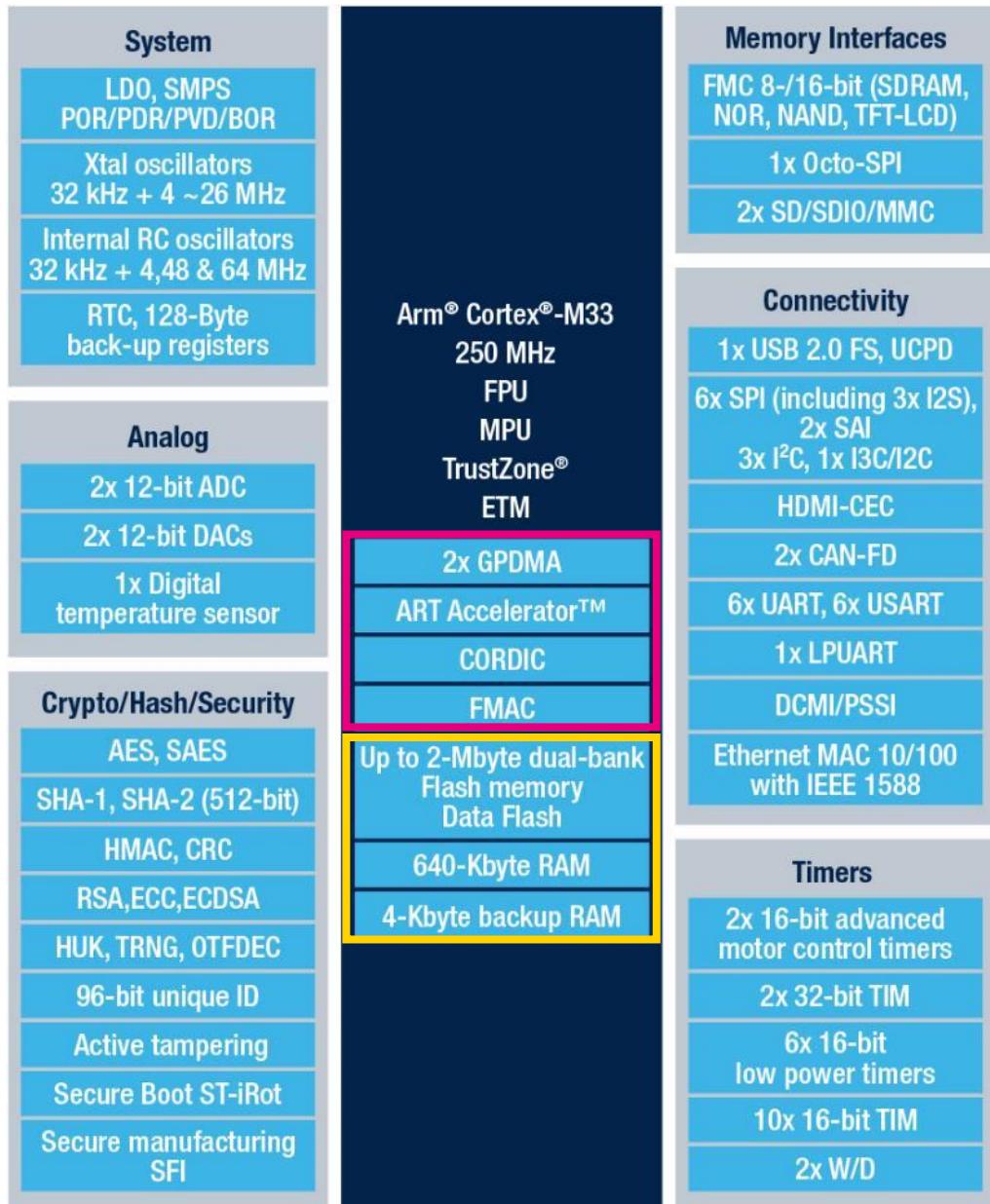
Turnkey SOC security services
STM32Trust TEE Secure Manager
Easy registration to clouds & servers
Multi-tenant IP protection
Pre-integrated 3 rd party PKI lifecycle
Immutable Root of Trust

State-of-the-art security assurance level



High performance H5 Baseline complete family





STM32H573 MCU block diagram

Numerous integrated peripherals



Advanced accelerators

Large embedded memory



Development tools for STM32H5 series

Jump-start your evaluation, prototyping, and design

* \$15

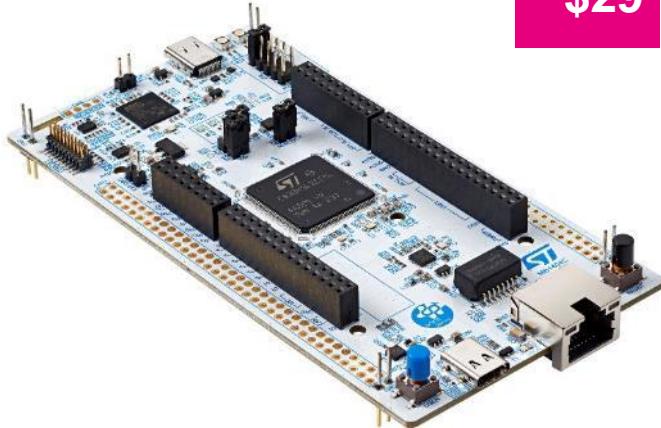


NUCLEO-H503RB

Affordable prototyping

USB, Arduino uno IF, 64-pin MCU

* \$29



NUCLEO-H563ZI

Affordable prototyping

USB, Ethernet, Arduino uno IF,
144-pin MCU

* \$99



Available in Q2'23

STM32H573I-DK

Multi-connectivity kit

USB, Ethernet, MicroSD, Display,
512-Mbit Octo-SPI flash, Audio,
Multi-extension IFs, 176-pin MCU

*Recommended Resale Price (RRP)



STM32



Wireless MCU



Entry level MCU



MPU



Ultra Low Power MCU

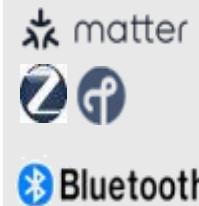


High- Performance MCU



Analog rich MCU

STM32 Wireless MCUs



STM32WB & BLUENRG MCUs

Dual Core & Cortex M0+

up to 64Mhz

Up to 1MB Flash

90nm ULP embedded Flash

STM32WBA MCUs

Cortex M33 - PSA Level 3, SESIP L3

up to 100Mhz

Up to 2MB Flash, 320KB RAM

40nm ULP embedded Flash

Q2'24

STM32WW4 Copro

Wifi 4 – SESIP L3



Spirit 1 & S2-LP STM32WL5



STM32WL3 MCU

Cortex M0+

Up to 256KB ULP embedded Flash

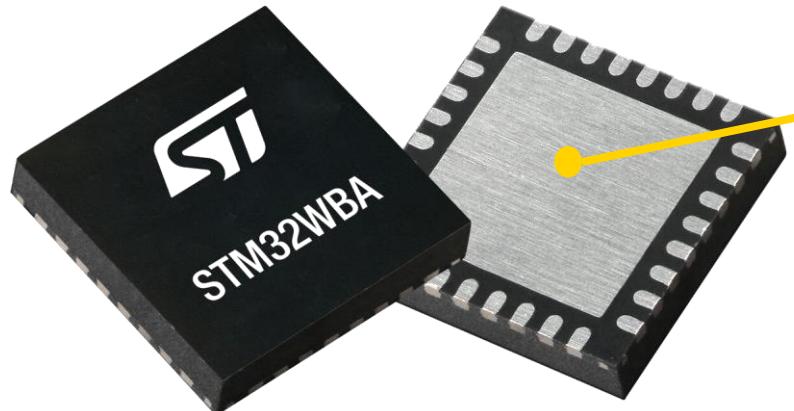
Q1'24



STM32WBA5x an ultralow power Bluetooth® Low Energy 5.4 platform



Bluetooth Low Energy 5.4



Built using 40nm process technology



Integrated 2.4GHz radio

Bluetooth® Low Energy 5.4 (long range, 2Msps, advertising extension)
+10 dBm output power

High performance

- Arm® Cortex®-M33 at 100MHz
- 407 CoreMark score
- 100 K cycles for 256 Kbytes of Flash

Enhanced security

- TrustZone® technology, target SESIP Level 3

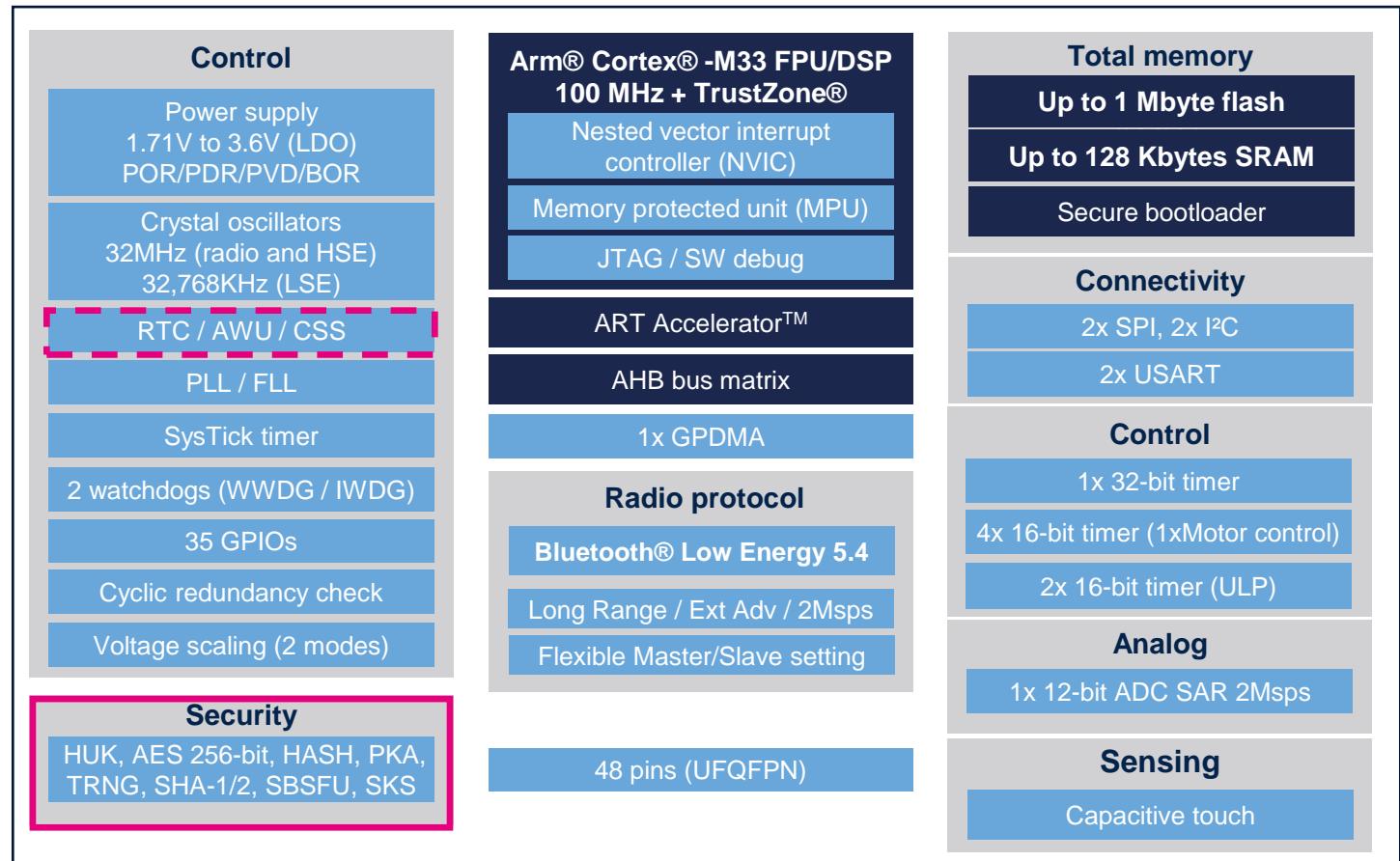
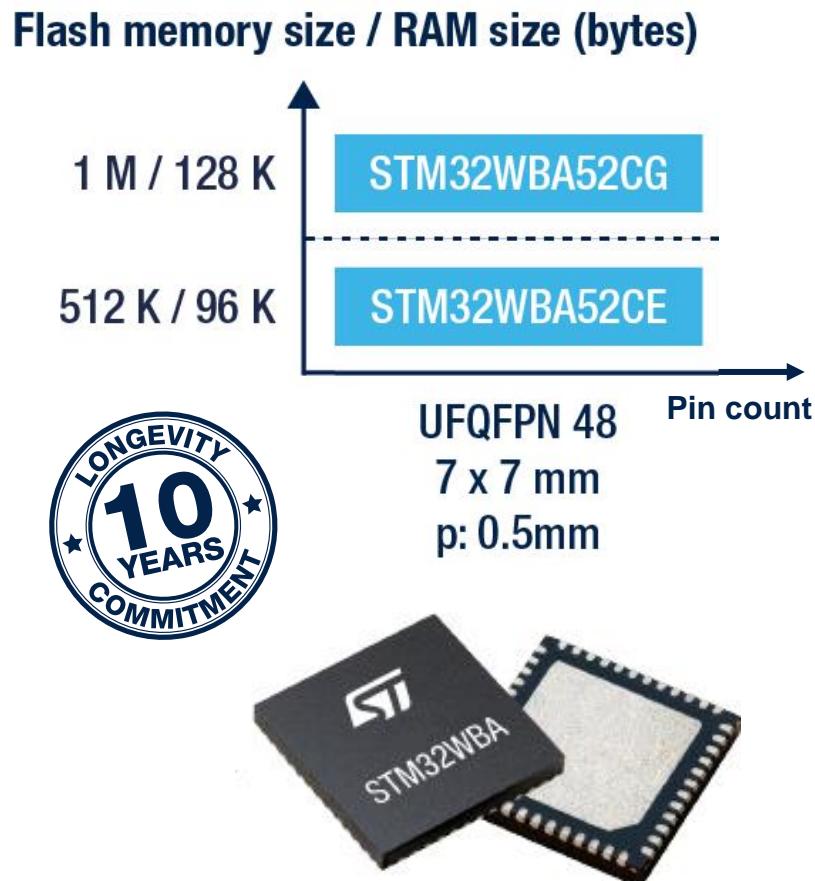
Leveraging STM32U5 ultra-low-power platform

- Low-power direct memory access (LP-DMA)
- Flexible power-saving states with fast wake-up times
- Same digital and analog peripherals



STM32WBA52x

Product ID card & block diagram



— Side attack resistant
- - - Active antitamper

STM32WBA5x a versatile product

Robust RF link **106dBm** with **Bluetooth® Low Energy**
• and •
• +10 dBm output power
• Update **securely** radio and stack firmware with SBSFU
• Bluetooth 5.4 multi-connections to extend network range

Down to **2.4µA mode with RTC** and 64KB of RAM
• Security: AES, PKA side attack resistant
• Security: RTC active tampers enabled
• Robustness: 100KB cycle flash memory cycle capable

Beacon profile available among a huge list
• Bluetooth® Low Energy, long-range capable
Embedded balun + matching to minimize design cost
Advertising extension for increased beacon lifetime
Up to +10 dBm output power to get best beacon range
2.4µA ULP-mode with full RAM for battery life optimization
Down to 1.71V power supply full feature capable



Lighting



Fleet maintenance



Industrial devices



Beacons and sensors



Fitness/ healthcare



Home automation

- Retrofit legacy product to **Bluetooth® Low Energy 5.4**
- Remotely upgrade device with **OTA capability**
- **Brand protection** with authenticated FW upgrade system
- **IoT protection ready**

- Multipoint Bluetooth® Low Energy connections, up to 20 links
- Battery lifetime care with < 140 nA standby mode
- Dynamic efficient 45µA/MHz
- Battery care thanks top **GPDMA acquisition mode**
- Handle advanced algorithm with **1 Mbyte** of flash memory

- **10 years lifetime**
- High output power **+10dBm**
- **Capacitive Touch**
- **Fast wake-up**
- High MCU efficiency for advanced features **407 CoreMark**

Stronger security

Extensive functionality to protect your assets

Memory protections against illegal access control

OTP, HDP, WRP, MPU
Secure Debug
Active Tamper, 4 pairs & V/T

Platform protection during product lifecycle

RDP: 4 protection level states
Password based regression

Cryptography for hardware robustness

Side channel AES, PKA
Additional AES, SHA, TRNG,
HUK (Hardware Unique key)

Code isolation for runtime protection

4 isolation stages
Arm® TrustZone® technology

Security services

STM32Trust TEE TF-M

Secure boot & secure updates

Secure firmware install

NIST - CAVP certified CryptoLib



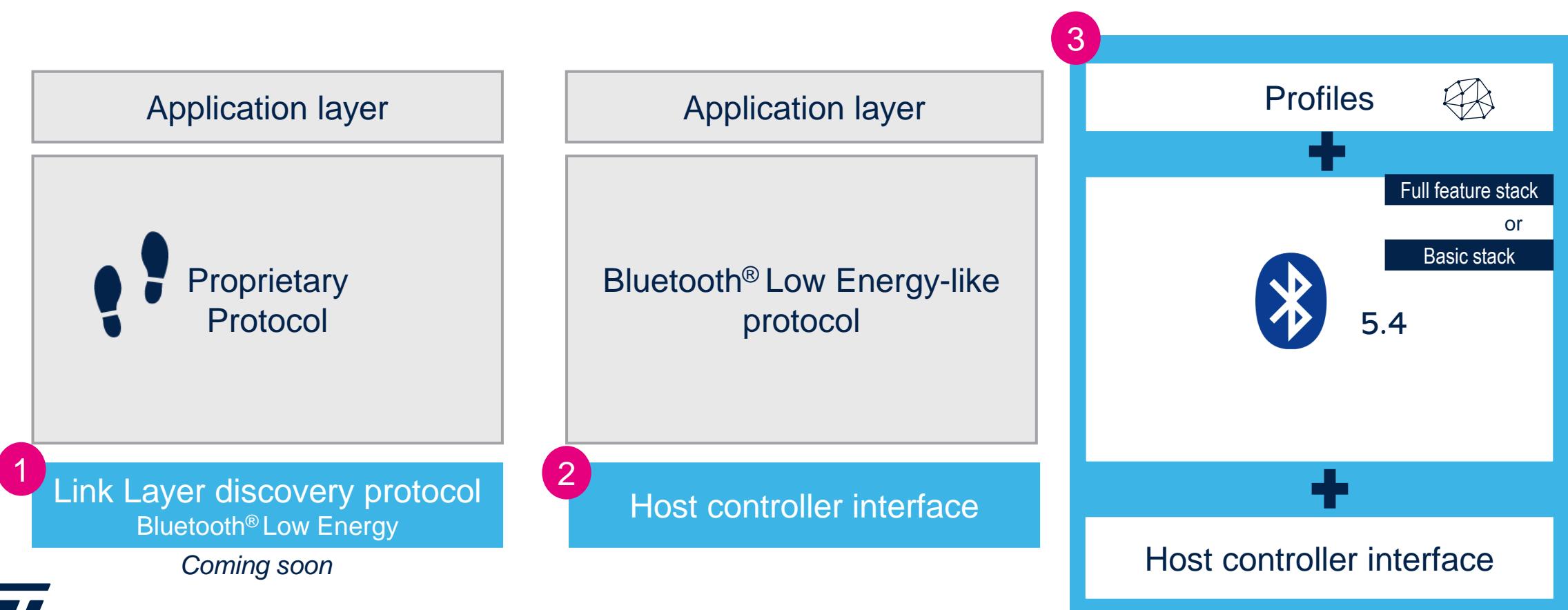
target certifications

State-of-the-art security assurance level

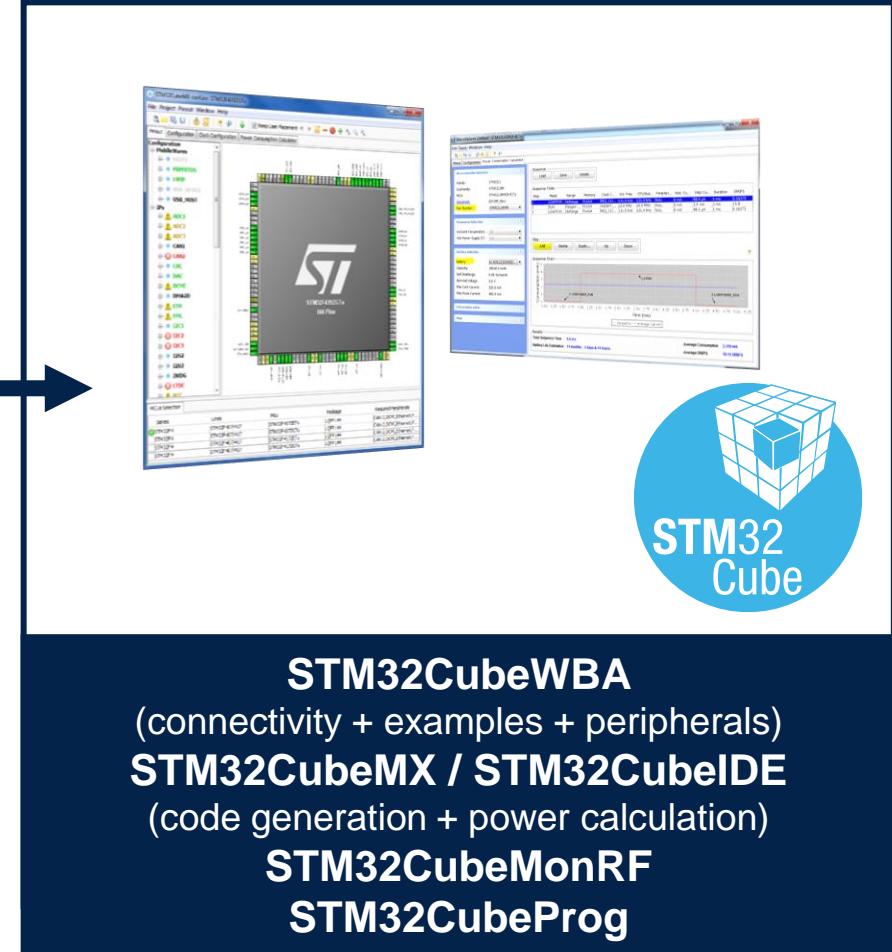
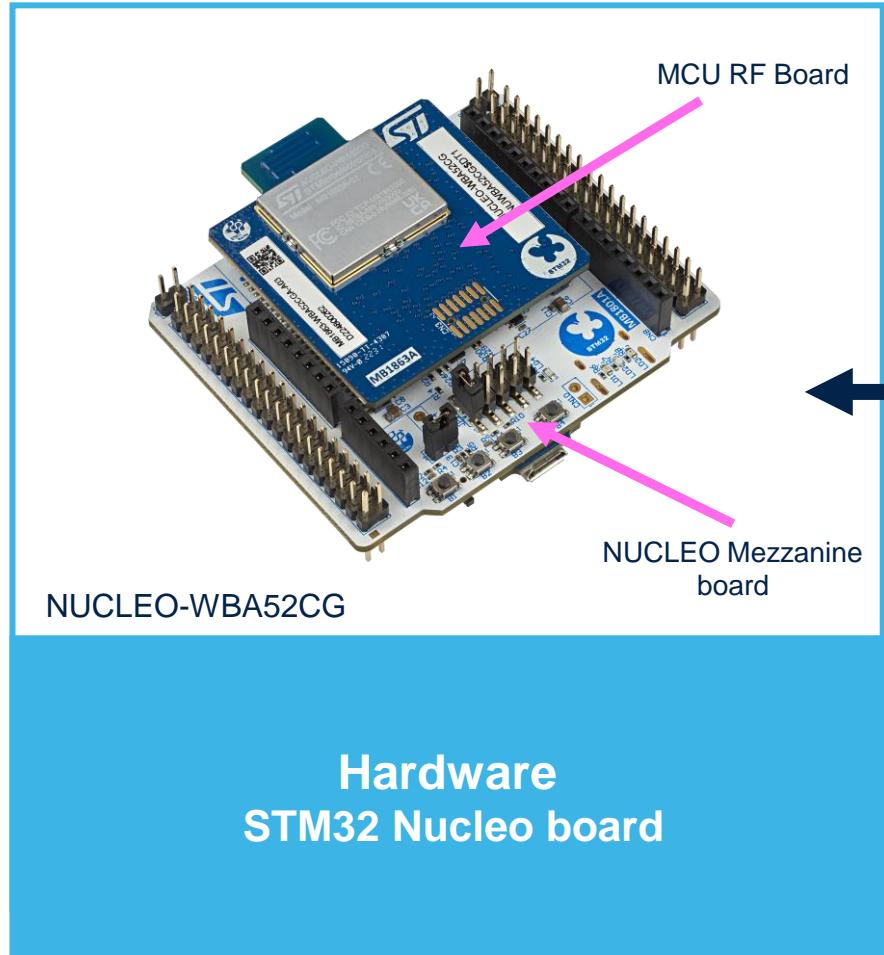


Make it yours

Different levels of integration so you can customize your solution



STM32WBA ecosystem simplifies the design journey



2.4Ghz portfolio





2.4GHz Bluetooth LE & Multiprotocol portfolio



matter

STM32WB

Dual core Arm® Cortex® M4 / M0+ & security

- Bluetooth® Low Energy 5.4 (2Mbps), Zigbee, Thread, Proprietary
- Multiprotocol, Matter

STM32WB55

STM32WB50

- Up to 1Mbytes flash
- Up to 256Kbytes RAM
- USB, LCD Driver, Quad-SPI

STM32WB35

STM32WB30

- 512KB flash
- 96kB RAM
- USB, LCD Driver, Quad-SPI

STM32WB15

STM32WB10

- 320 Kbytes flash
- 48Kbytes RAM
- excluding 802.15.4*

STM32WBA

Arm® Cortex® M33 w/ TrustZone® @100MHz

- Bluetooth® Low Energy 5.4 (long-range, 2Mbps, advertising extension), Zigbee, Thread, Proprietary
- Multiprotocol, Matter (gateway)

- Up to 1Mbytes flash
- Up to 128Kbytes RAM
- Up to +10dBm output power
- Enhanced security
- SMPS/ LDO

BlueNRG

Single core Arm® Cortex® M0 @32MHz or M0+ @64MHz

- Bluetooth® Low Energy

BlueNRG-1*

- 160Kbytes flash
- 24Kbytes RAM
- Bluetooth® Low Energy 5.2

BlueNRG-2*

- 256Kbytes flash
- 24Kbytes RAM
- Bluetooth® Low Energy 5.2

BlueNRG-LP

- 256Kbytes flash
- 64Kbytes RAM
- Bluetooth® Low Energy 5.3, (long-range, 2Mbps, adv. ext.)

BlueNRG-LPS

- 192Kbytes flash
- 24Kbytes RAM
- Bluetooth® Low Energy 5.3 (long-range, 2Mbps, adv. ext., AoA/AoD)

STM32WB09

- 512Kbytes flash
- 64Kbytes RAM
- Bluetooth® Low Energy 5.3 (long-range, 2Mbps, adv. ext., AoA/AoD, Isochronous Ch.)
- up to 8dBm output power



*: Arm® Cortex® M0

Module available

New Product in 2023

Product positioning

PERFORMANCE ↓

High processing
Enhanced security
High RF Power



Multi-protocol
Dual core
Reach feature set



Dual core
Simple application



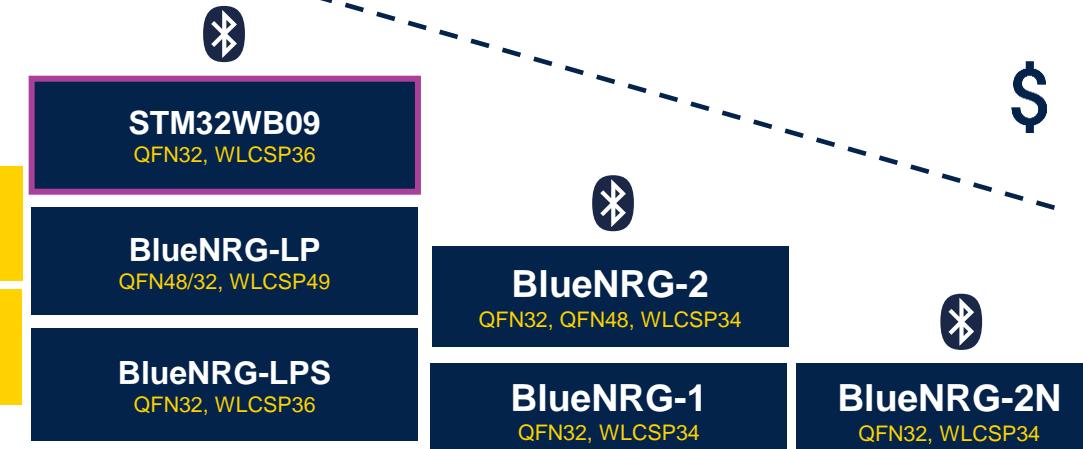
Single core



Tiny app



Network processor



High-end applications

Entry level applications

New Product in 2023

STM32WB09





What the STM32WB0 MCU series offers

Wireless performance
in a compact, energy-efficient design



5.3



High wireless performance

- System performance: Arm® Cortex® -M0+ core at 64 MHz
- Best-in-class radio enabling robust and stable connectivity

Certified for Bluetooth® Low Energy 5.3

- Upgradable, highly modular and robust Bluetooth® Low Energy stack, developed and maintained by ST

Longer battery life for IoT devices

- State-of-the-art radio efficiency (3.9 mA TX peak current / 3.2 mA RX peak current)
- Power control options, 15.5 μ A/MHz for the Cortex® -M0+ core

Lower costs

- Affordable price point
- High integration in tiny packages (balun, capacitor-less 32 MHz crystal) and enables 2-layer PCBs for reduced BOM and simplified circuitry

Streamlined development

- Extensive wireless design ecosystem with hardware (RF reference designs, IPD chip for easy impedance matching), Bluetooth® Low Energy and Mesh stacks, tools, and resources



STM32WB09 – key highlights

Bluetooth® Low Energy 5.3 certified

Radio performance

- RX Sensitivity level
 - -97 dBm at 1 Mbps
 - -104 dBm at 125 Kbps
- Up to +8 dBm output power level
- 3.9 mA TX peak current
- 3.2 mA RX peak current
- Fast data transfer: 2 Mbps data rate
- Distance Robustness: long-range 125 kbps or 500 kbps
- **Advertisement Extension:** 255 bytes advertising data, advertising data set and periodic advertising sync transfer
- **AoA/AoD direction finding**
- **Isochronous channels**

Reduced BOM cost

- Integrated balun
- Integrated capacitor-less 32 MHz crystal
- High accuracy low speed internal oscillator
- Enables 2-layer PCB designs

Advanced security set

- Flash read/write protection.
- Secure bootloader
- SWD access can be disabled

Power management

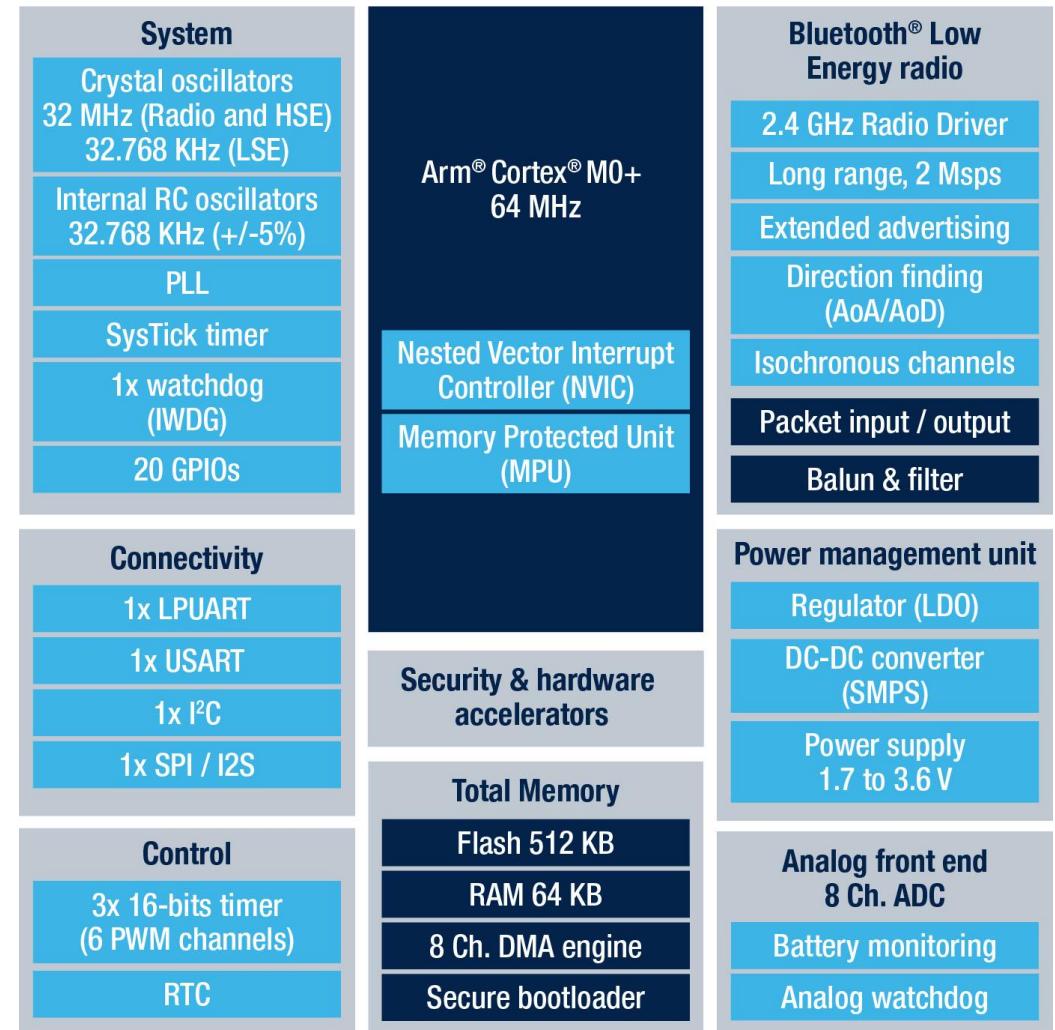
High efficiency embedded SMPS step-down converter with intelligent bypass mode

Operating temperature:

From -40 up to 85 °C / -40 up to 105 °C

Packages available:

QFN32 (20 GPIOs)
Available soon: WLCSP36* (20 GPIOs)





STM32WB0 MCU series portfolio



QFN32

STM32WB09KEV6

STM32WB09KEV7

WLCSP36*

STM32WB09TEF6

STM32WB09TEF7

*Preview – engineering samples available

Dual option available for temperature operating range (up to +85 °C and up to +105 °C)

MODULES



2.4GHz Module Offering

BlueNRG-M0L BlueNRG-M0A



Based on **BlueNRG-MS**

- BLE4.2 certification
- 64KB Flash / 12KB RAM
- DCDC
- +8dBm
- 2 layers PCB
- Size: 11.5 x 13.5mm
- CE, FCC, IC , TYPE, BQE, WPC

BlueNRG-M2SA BlueNRG-M2SP



Based on **BlueNRG-2**

- BLE5.2 certification
- 256KB Flash / 24KB RAM
- DCDC
- +8dBm
- Up to 14 GPIOs
- CE, FCC, IC , TYPE, BQE, WPC, SRRC, KCC

STM32WB5M



Based on **STM32WB55VGY**

- **World 1st STM32 2.4 GHz SIP**
- Dual-Core
- All-in-one BLE 5.4, Zigbee 3.0, OpenThread 1.3
- MATTER Ready
- 1MB Flash / 256KB SRAM
- 2 layers PCB, crystal included
- Size: 11x7.3mm
- FCC, CE, NCC, JRF, KC, SRRC, ISED, GOST

STM32WB1M



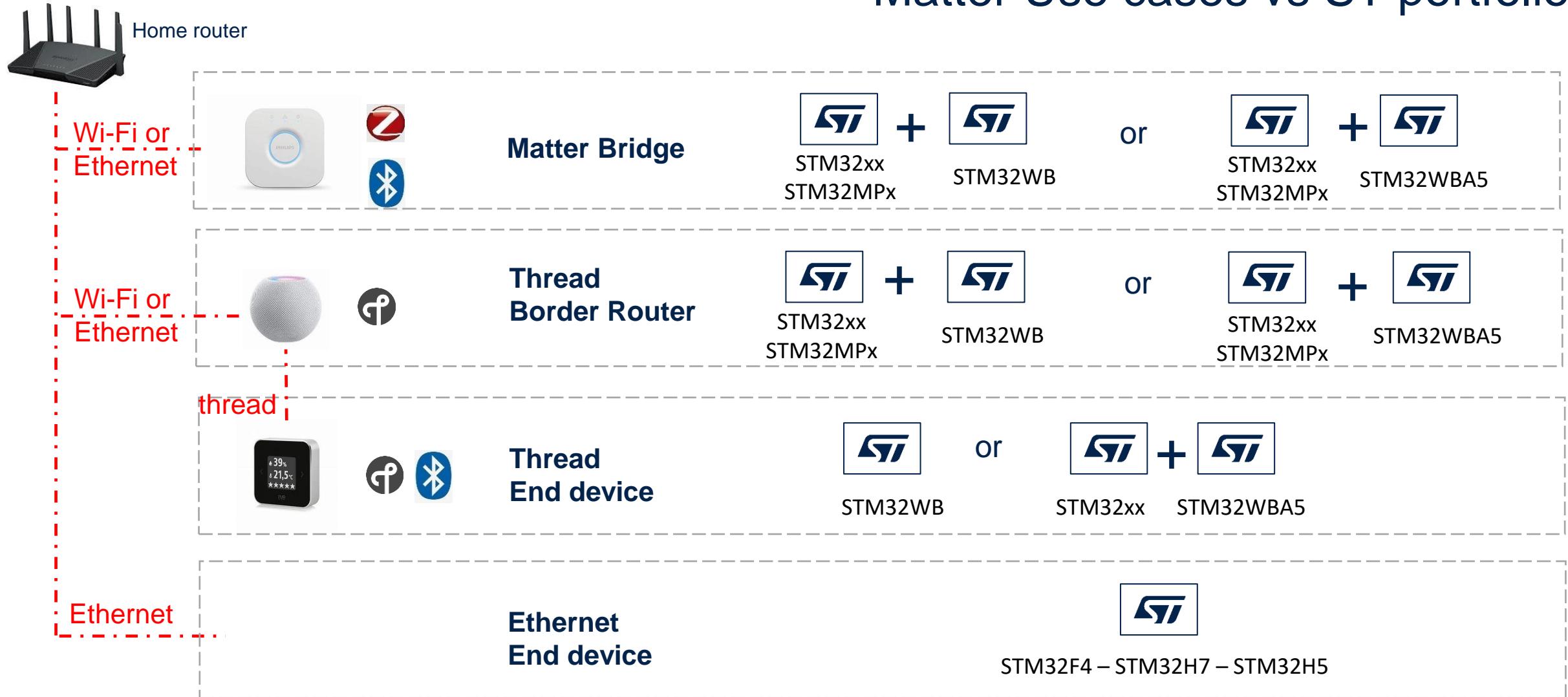
Based on **STM32WB15CCY**

- Tiny SIP form factor - Cost affordable
- Dual-Core
- BLE 5.4, Built-in FUS
- 320KB Flash, 48KB SRAM
- 2 layers PCB, crystal included
- Size: 10x6.5mm
- Possibility to connect to external antenna
- FCC, CE, NCC, JRF, KC, SRRC, ISED, GOST

MATTER in a NUTSHELL



Matter Use cases vs ST portfolio*



What is available today?

- Github Hotspot repository End Point
 - Based on Matter SDK 1.1, Lighting use case (On/Off) and Window Covering
- Github Hotspot repository Border Router
 - Based on MP1 and WB55
- Github Hotspot repository Matter to non Matter - Bridge
 - Based on H7 and WB55 (Zigbee coordinator)
- Github Connectivity Standard Alliance:
 - Lighting Application Thread End Device (WB55)

SUB-Ghz portfolio



The best Sub-GHz portfolio on the market

PERFORMANCE

STM32WL5x

Application processor
Dual core Cortex-M4 / M0+ @
48MHz

Build-in PA with 2x output power
Up to +15 dBm and up to +22 dBm
170 dB Link budget

Advanced Security, Rich Analog
Flash: up to 256KB / RAM: up to 64KB

Up to 72 GPIOs,
UFN48, BGA73

+ MODULE



STM32WLEx

Application processor
Cortex-M4 @ 48MHz

Build-in PA with 2x output power
Up to +15 dBm and up to +22 dBm
170 dB Link budget

Advanced Security, Rich Analog
Flash: up to 256KB / RAM: up to 64KB

Up to 72 GPIOs,
UFN48, BGA73



STM32WL3

Application processor
Cortex-M0+@ 64Mhz

Build-in PA with 2x output power
Up to +14 dBm and up to +20 dBm
152dB Link budget

LCD Driver
Low-Power analog sensing

FLASH up to 256KB /
RAM up to 32KB

Up to 32 GPIOs
QFN32/48

news

S2LP

Transceiver

Up to +16dBm output power
146 dB Link budget
QFN24

SPIRIT1

Transceiver

Up to +16dBm output power
136 dB Link budget
QFN20

STS1TX

Transmitter (TX only)
QFN20

ULTRA-LOW-POWER

LOW-POWER



STM32 Sub-Ghz Product Families

Sub-GHz SoC Dual Core

Sub-GHz SoC Single Core

Sub-GHz Transceiver

SUPPORTED
MODULATION

SUPPORTED
PROTOCOLS

1st Generation **SPIRIT1**

General Purpose Sub-GHz radio

2 (G)FSK
(G)MSK
-

OOK
ASK
-



STM32WL3x

2nd Generation **S2-LP**

Ultra Low Power Sub-GHz radio

2/4 (G)FSK
(G)MSK
BPSK (Sigfox)
OOK
ASK
-

+ DSSS and IQ I/F on WL3



STM32WL55

STM32WLE5

2 (G)FSK
(G)MSK
BPSK (Sigfox)
-

-
LoRa (WLx5 P/N)

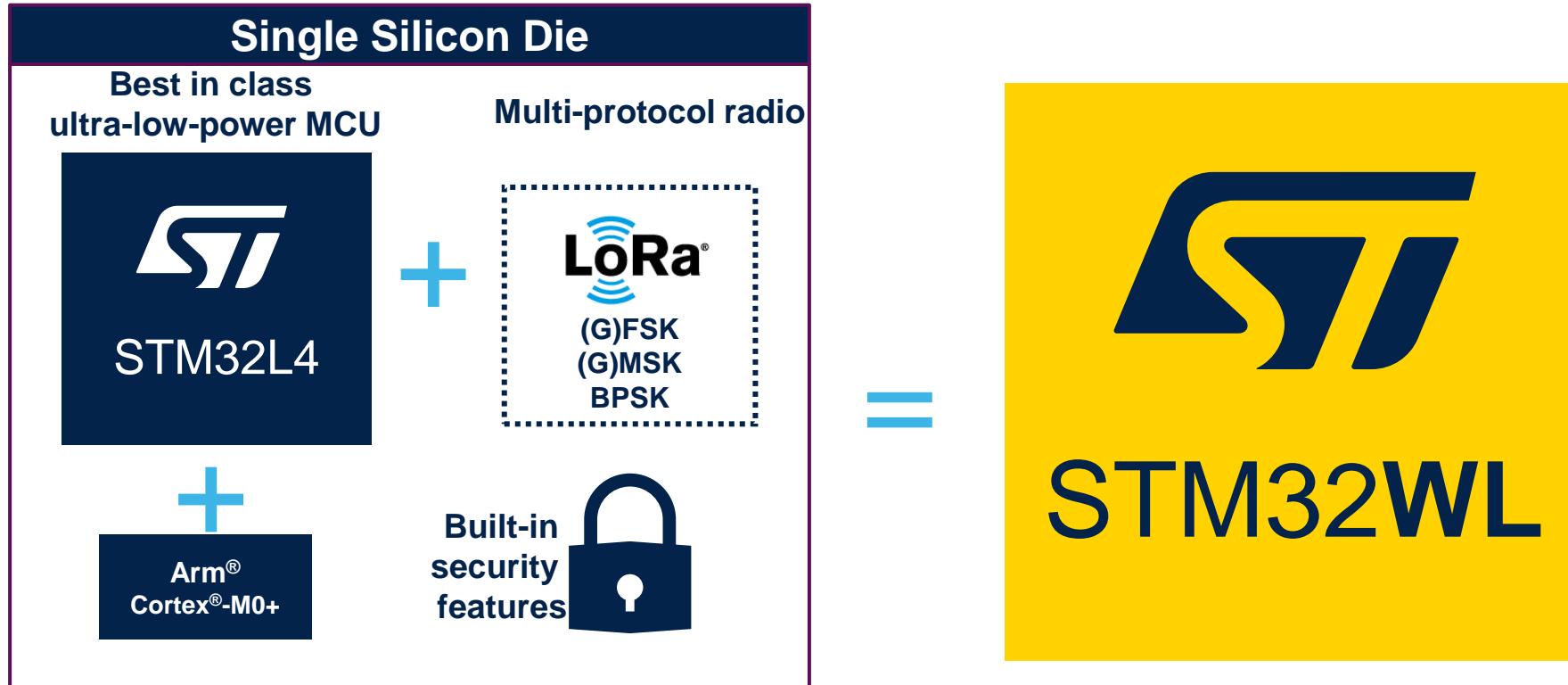


STM32WL5x / STM32WLE_x presentation



What is an STM32WL ?

A Sub-1GHz wireless MCU supporting long range Wireless protocols



-  LoRaWAN™
-  sigfox
-  mioty
-  M-Bus wireless
-  ZETA
- Proprietary

STM32WL – All In One Sub-GHz SoC

- Worldwide compatibility
- 150 MHz to 960 MHz Linear Range
 - Multi-protocol capable
 - ST Longevity commitment:
10 years life time



Utilities

- Up to +22 dBm output power for wide coverage
- 148 dBm sensitivity with LoRa:
Robust RF Link
- Reduced BOM cost



Smart
Cities & Buildings



Logistics



Industrial IoT

- Unique-IDs for enhanced traceability
- Down to 390 nA mode with RTC and 32KB of RAM for extended Battery lifetime
- Small form factor with **UFBGA 5x5 package & module 10x10**



Smart Ag



Smart Home

- Up to 105 °C temperature rating
- Only 5 µs wakeup time
- Only 4.82 mA as LoRa RX consumption to extend battery life

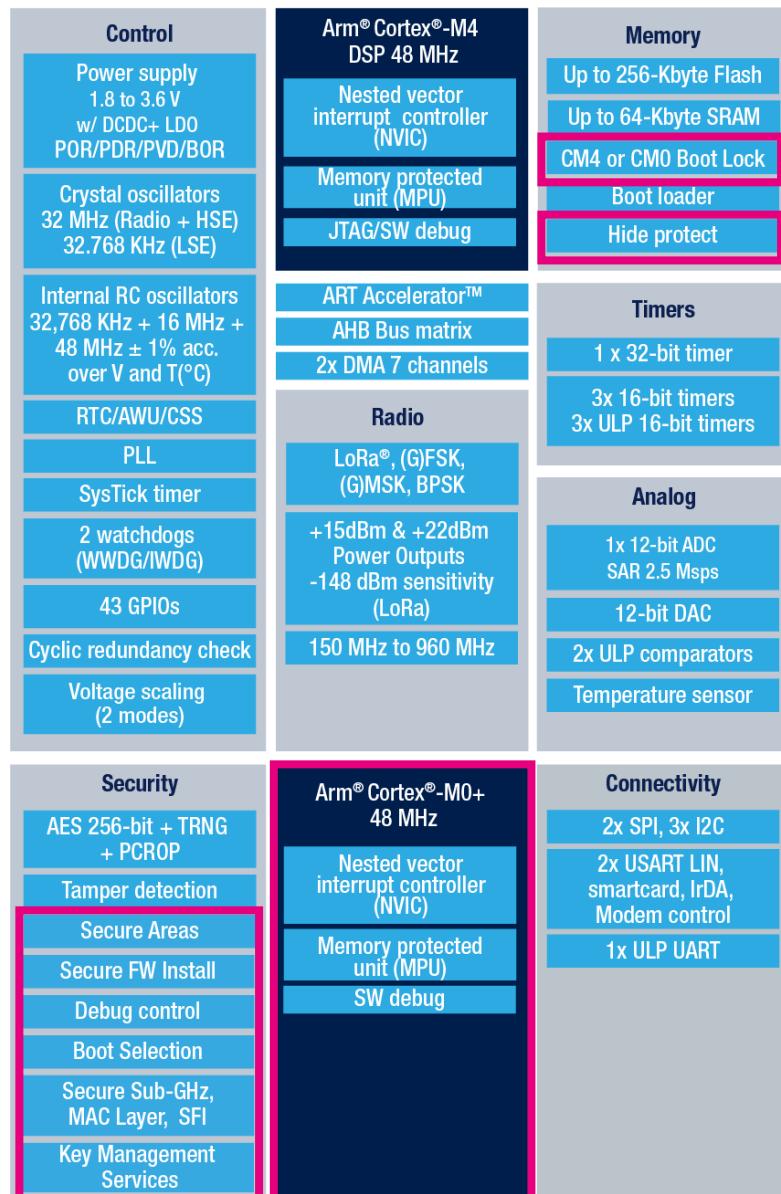


Comprehensive Ecosystem

- Extensive code examples in the **STM32CubeWL**
- LoRaWAN, SIGFOX, MBUS stacks available
- Fully supported STM32CubeMX (late 2020)

STM32WL5x Line - a rich feature set

Dual-core and enhanced security



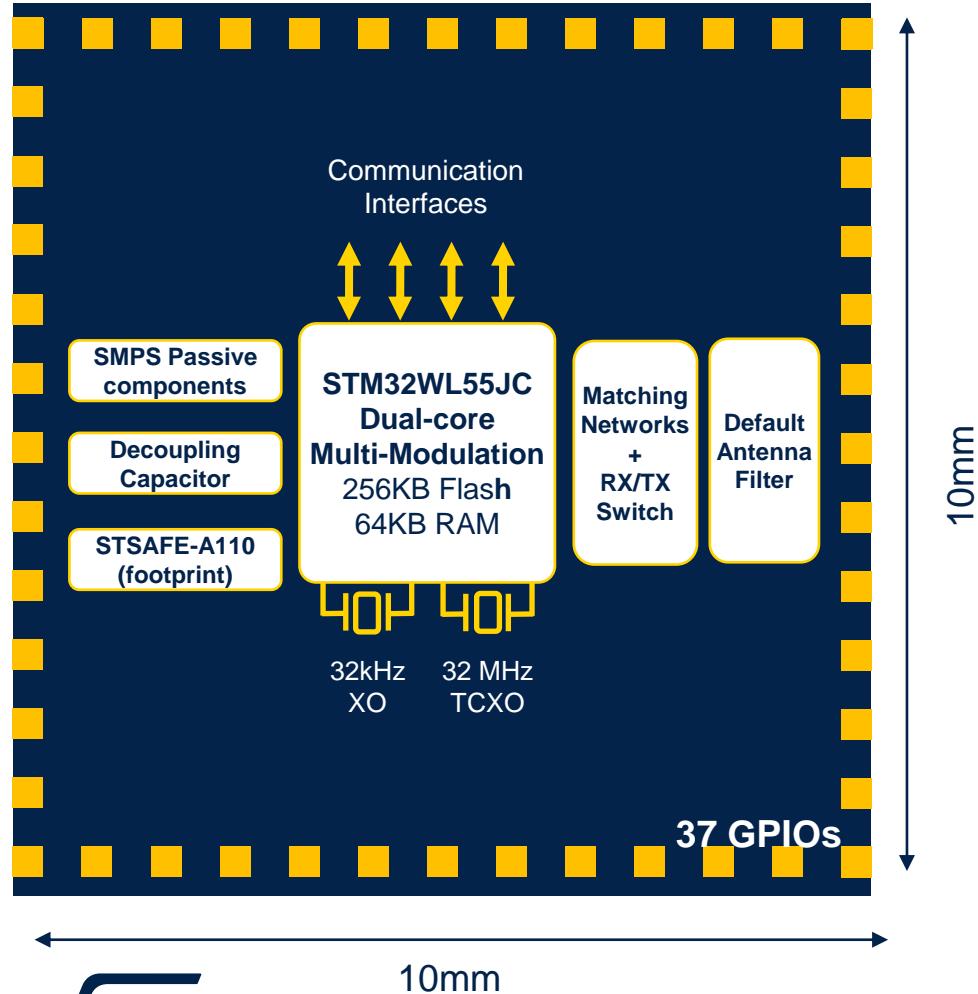
KEY FEATURES

- Arm® Cortex®-M4 & DSP up to 48 MHz
- Up to 256 KB Flash and 64 KB SRAM
- Arm® Cortex®-M0+ up to 48 MHz
- **Sub-GHz Radio**
 - Multi-modulation: LoRa, (G)FSK, (G)MSK, BPSK
 - 2 embedded power amplifiers:
 - 1 output up to +15 dBm
 - 1 output up to +22 dBm
 - LoRa RX sensitivity: -148 dBm (SF12, BW=10.4kHz)
 - RX: 4.82mA and TX: 15mA (at 10dBm) / 87mA (at 20dBm) [3.3V]
- **Ultra-Low Power consumption**
 - < 71µA/MHz Active mode (3V - RF OFF)
 - 1 µA Stop2 mode with RAM retention
 - 390 nA Standby mode with RTC
 - 31 nA Shutdown mode
- **Peripherals**
 - 3x I2C, 2x USART, 1x LP-UART, 2x SPI
 - 7x timers + 2x ULP Comparators
- **Advanced security features**
 - 1.8 to 3.6V voltage range (DC/DC, LDO)
 - -40 to up to +105°C temperature range



-> Packages: QFN48, BGA73
ST Confidential

STM32WL5M: Key takeaways



- **Open Module** (AT commands firmware available)
- **HF bands:** 864 to 928MHz
- **Selectable PA** : low power (up 15 dBm) / high power (up 22 dBm)
- **External Antenna**
- **Full BOM integrated:** Crystals, Decoupling, Matching, Filters
- **Allows 2 layers PCB**
- **Tiny form factor:** 10x10mm with 0.5mm pitch
- Operating range: -40°C to -85°C / 1.8V to 3.6V
- STSAFE internal footprint



STM32WLx ecosystem - More than just a stack!

Complete, CERTIFIED and Free of charge SubGHz ecosystem



NUCLEO

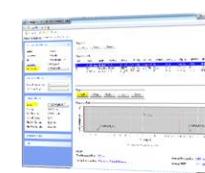


**Discovery
(Module)**

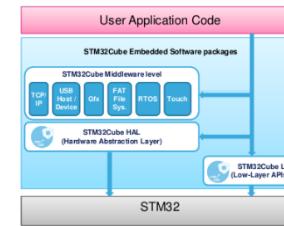
Available: Schematics, Gerbers and BOM



**STM32
CubeMX**



**STM32
CubeIDE**



**STM32
CubeWB**



**STM32
CubeMonitor-Power**



**STM32
CubeMonitor-RF**



Hardware tools

- NUCLEO-WL55JC
- DK32WL5M - Module
- Reference Design
- CERTIFICATION path support
(LoRaWAN, Sigfox)

Configure

- STM32CubeMX
- STM32CubeIDE

Develop & Program

- STM32CubeWL value proposition**
- LoRaWAN, Sigfox stack
- Concurrent mode LoRa/Sigfox
- Peripherals HAL + Examples
- Additional STM32 package**
- X-CUBE-SBSFU, X-CUBE-SAFEA1
- X-CUBE-SMCARD

Monitor & Finetune

- STM32CubeMonitor-Power
- STM32CubeMonitor

STM32WL3 presentation



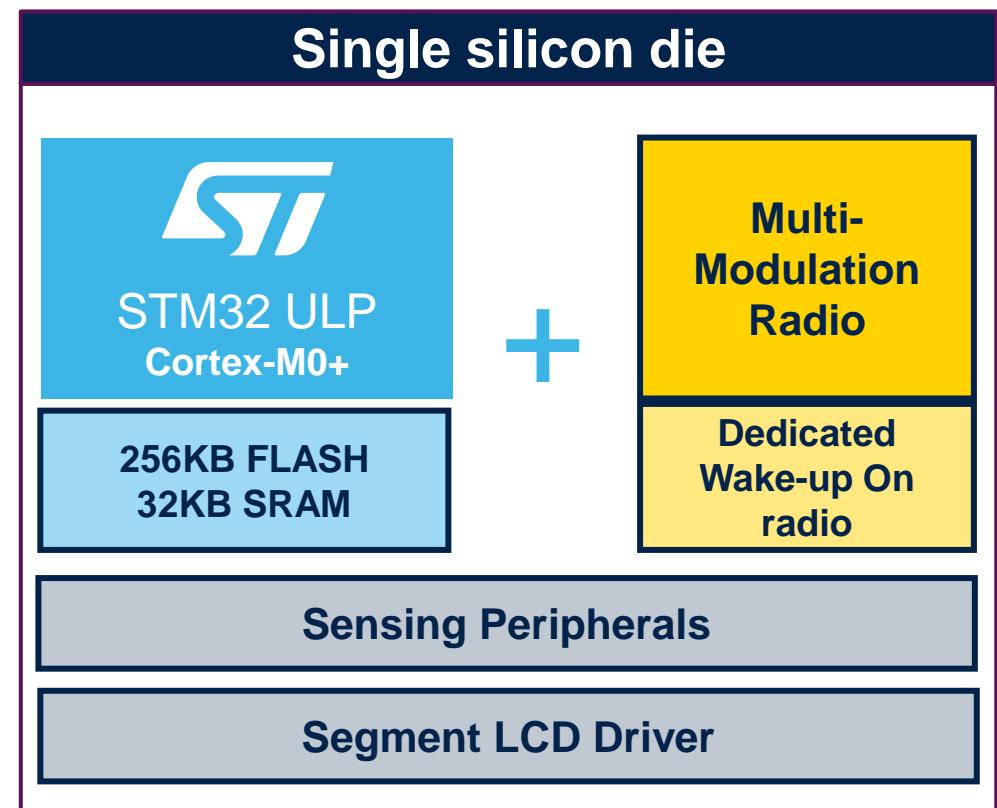


STM32WL3 New Sub-1GHz SoC

Unique wireless SoC combining multi-protocol Sub-GHz radio and application features

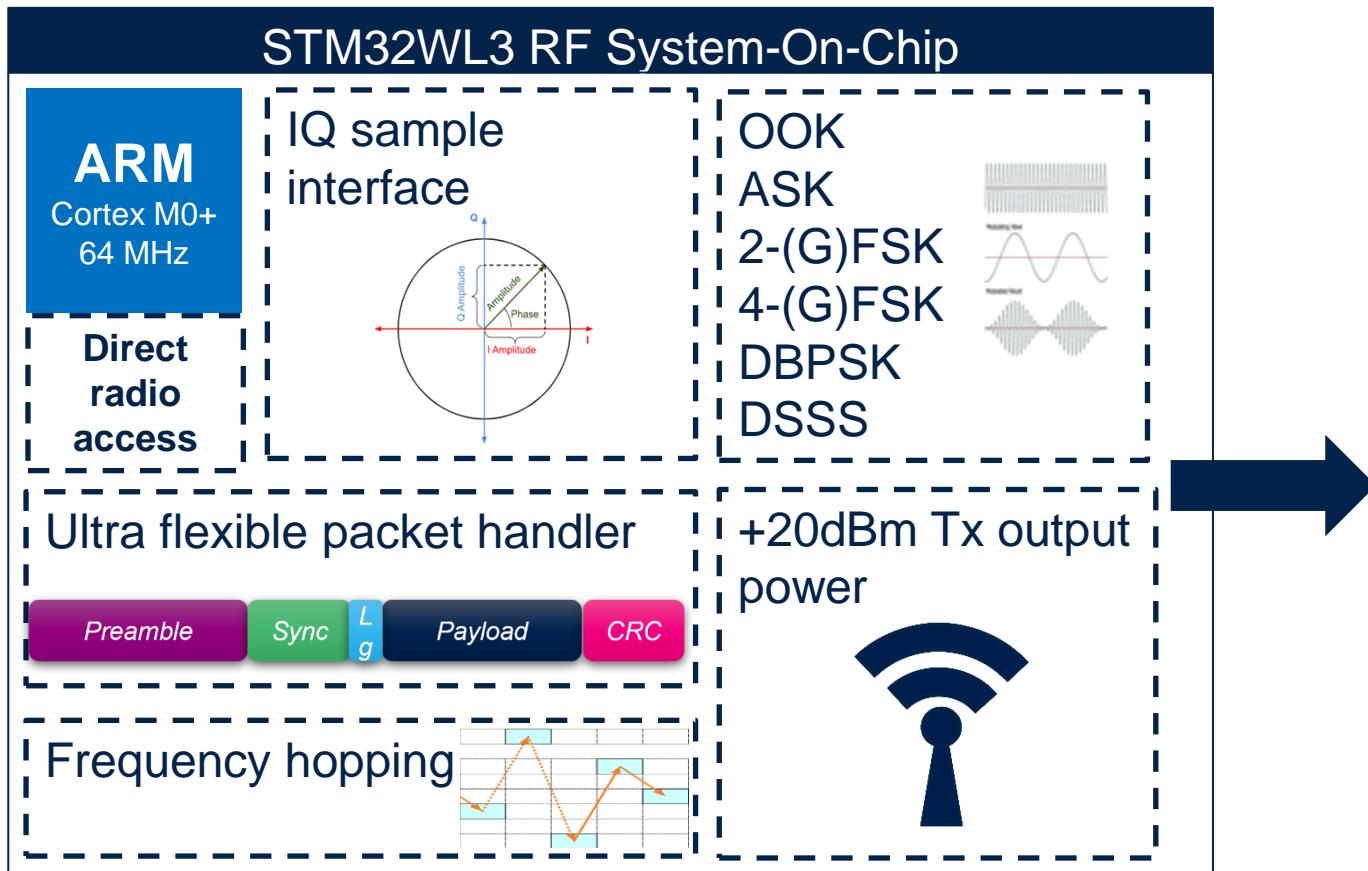


PACKAGE
QFN48 6x6mm
QFN32 5x5mm



STM32WL3 key features

Wide Sub-1 Ghz protocols support



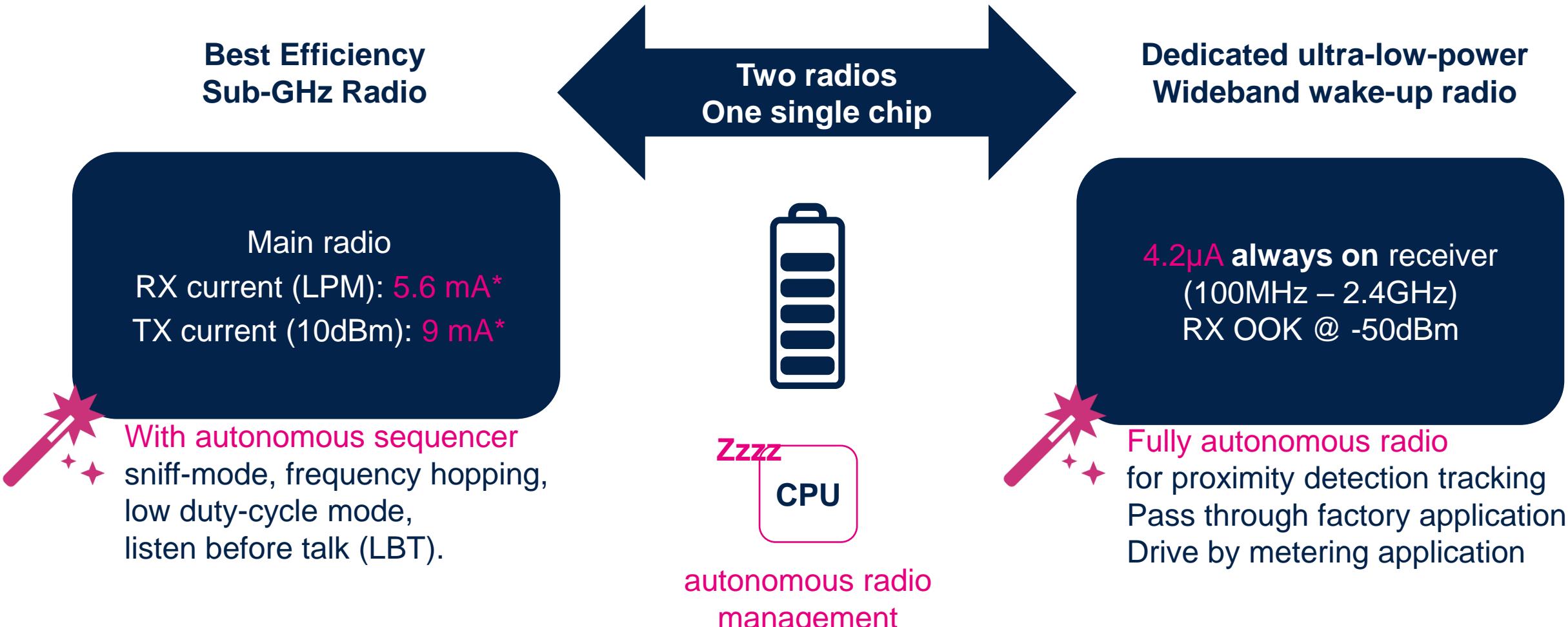
802.15.4g



Proprietary protocols :

- Alarms
- Smart Home
- Building automation
- Industrial monitoring

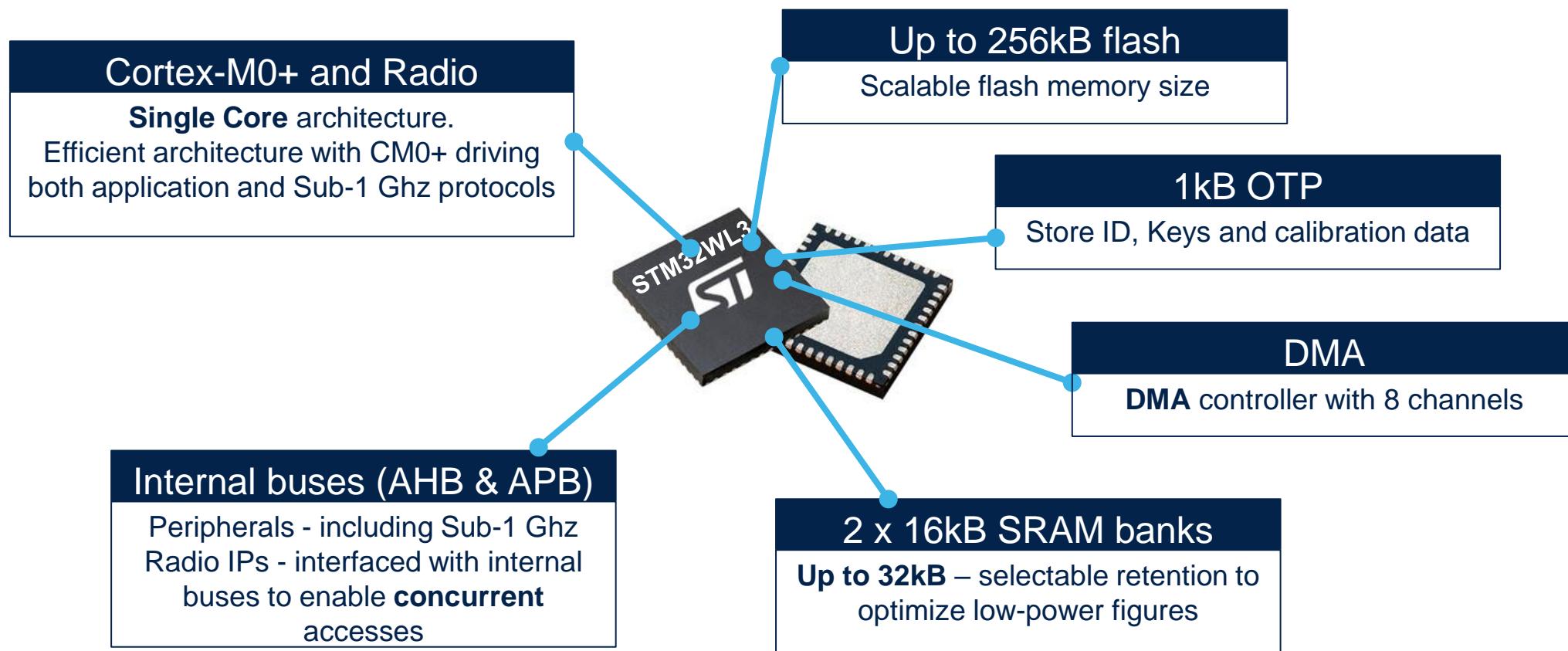
Extended battery life: Ultra low power Radio



* Including SoC core consumption (in WiFi mode)

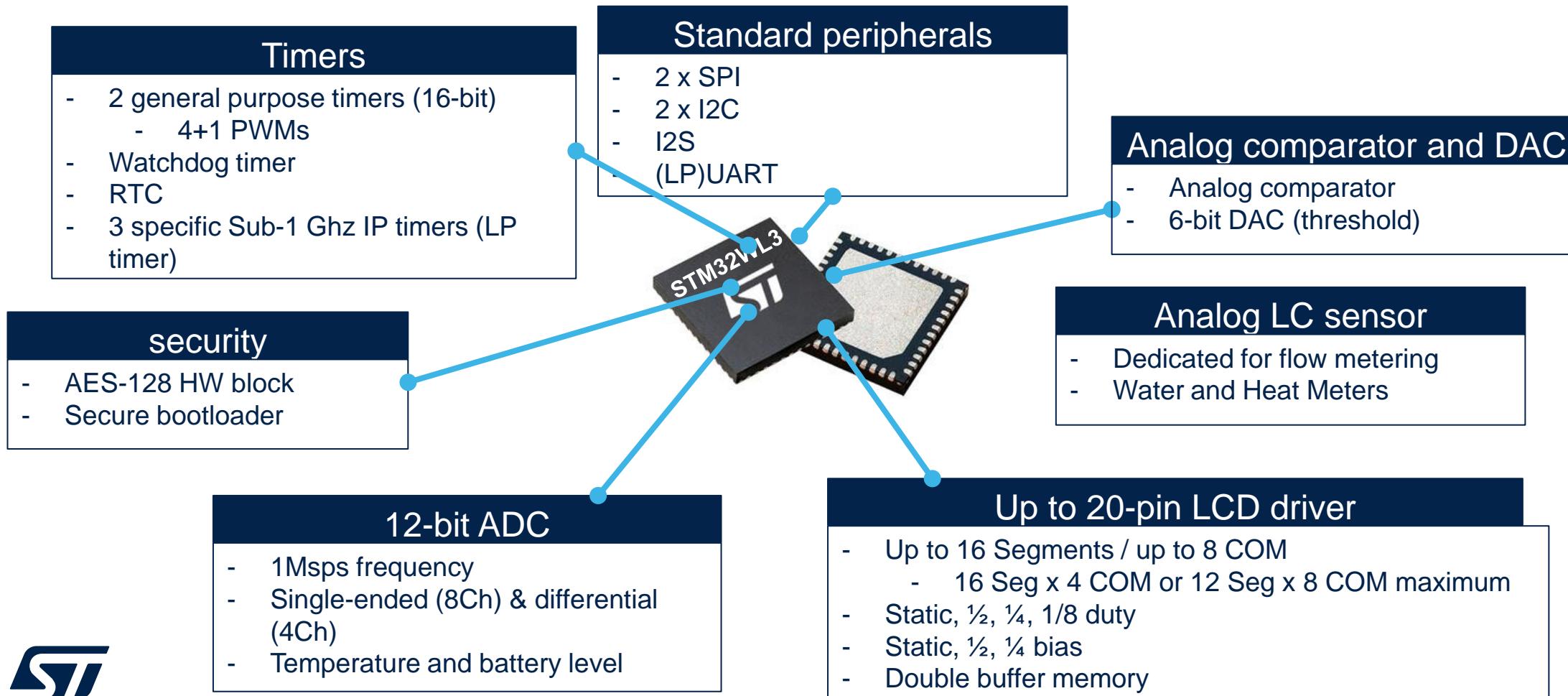
STM32WL3 key features

Reliable and efficient system architecture



STM32WL3 key features

STM32WL3 Peripheral and timers





Single Cortex-M0+ Core

Ultra flexible and low-power radio

- ✓ 7mA Tx @ +10dBm / 4mA Rx
- ✓ +20dBm max output power
- ✓ Proximity detection radio (4µA)

Memory

- ✓ Up to 256kB flash + 1kB OTP
- ✓ 16/32kB RAM

peripherals

- ✓ SPIs, I2Cs, I2S, USART, LPUART
- ✓ 20-pin LCD driver
- ✓ LC-sensor IP, Analog comparator



Control

Power supply from 1.7 to 3.6v with DCDC

Crystal oscillators
48MHz (Radio + HSE)
32.768 kHz (LSE)
Internal 32kHz RCO

Crystal oscillators
48MHz (Radio + HSE)
32.768 kHz (LSE)
Internal 32kHz RCO

Internal buses

AHB Bus Matrix
Direct radio register access

DMA 8 channels

Timers

2 16-bit GP timers + 16-bit prescalers, SysTick, RTC, PWMs

Watchdog

STM32WL3x resources

Arm® Cortex®-M0+

Up to 64MHz

Nested vector interrupt controller (NVIC)

Memory protection unit (MPU)

SWD interface

Low-power Radio

7mA @ +10dBm Tx
4mA Rx

2-(G)FSK, (G)MSK, 4-(G)MSK, OOK, ASK, DSSS, DBPSK

Up to +20dBm Tx power
-111dBm Rx sensitivity @ 38.4kbps

413-479MHz, 826-958MHz
169MHz*

16-bit IQ access

2nd Radio for proximity detection

Memory

64/128/256kB flash

16/32kB RAM

1kB OTP

ROM secure bootloader

Peripherals

2 x SPI, 2 x I2C, I2S, USART, LPUART

20-pin LCD driver

Up to 32 GPIOs

Analog

12-bit ADC SAR 1Msps

Analog comparator + DAC

3 LC-sensor channels

Temperature sensor

Free of Charge

Your wireless journey and how We can help

Support you to make the right choice

Make sure your choice was the right one

ST Product selection

- Training
- Benchmark
- Datasheet review

ST Product evaluation

- Eval kit bring-up
- Performance review

SW and HW Development

- Schematic review
- Layout review
- Software porting
- 1st PCB bring-up
- 1st RF test report
- Debugging

Testing and certification

- Regional RF test report
- Protocol RF tests
- Corner case debugging
- Certification process guidance

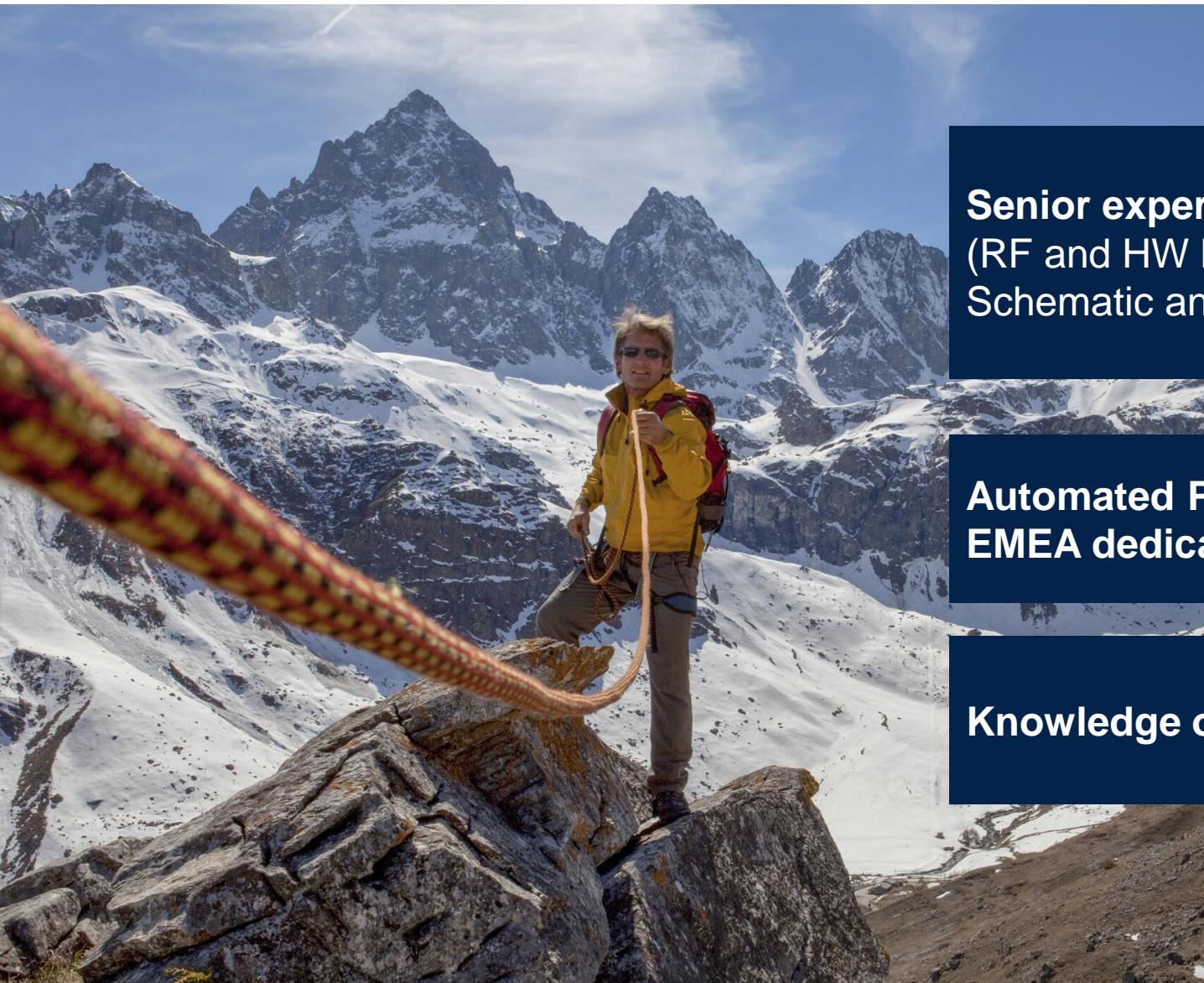
Industrialization

- RF Production tooling
- Ramp-up support

Don't wait too long to ask for any support.
The sooner the better!!

Please contact: ST MCU Marketing or FAE to get in touch with our RF lab services

What you can expect from our wireless support team



Senior expertise in wireless communication
(RF and HW bring-up services, SW and HW debugging,
Schematic and layout review)

Automated Pre-certification capabilities
EMEA dedicated application labs

Knowledge on your application

... in a fast and agile way



Let's HANDS ON now !

Manuel Marcias FAE