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STM32WB0 wireless MCU series

**Bluetooth® Low Energy 5.4 communications
in a compact, energy-efficient design**





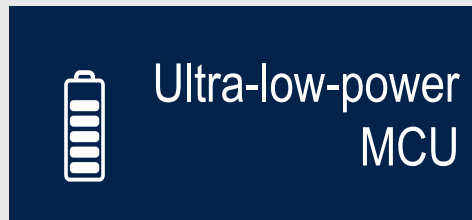
The STM32 portfolio

Five product categories



Wireless
MCU

Short- and long-range connectivity

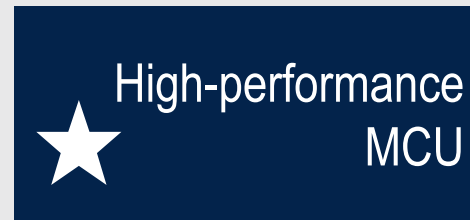


Ultra-low-power
MCU

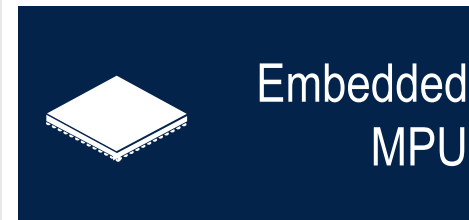
32-bit general-purpose microcontrollers: from 75 to 3,224 CoreMark score



Mainstream
MCU



High-performance
MCU



Embedded
MPU

32- and 64-bit microprocessors

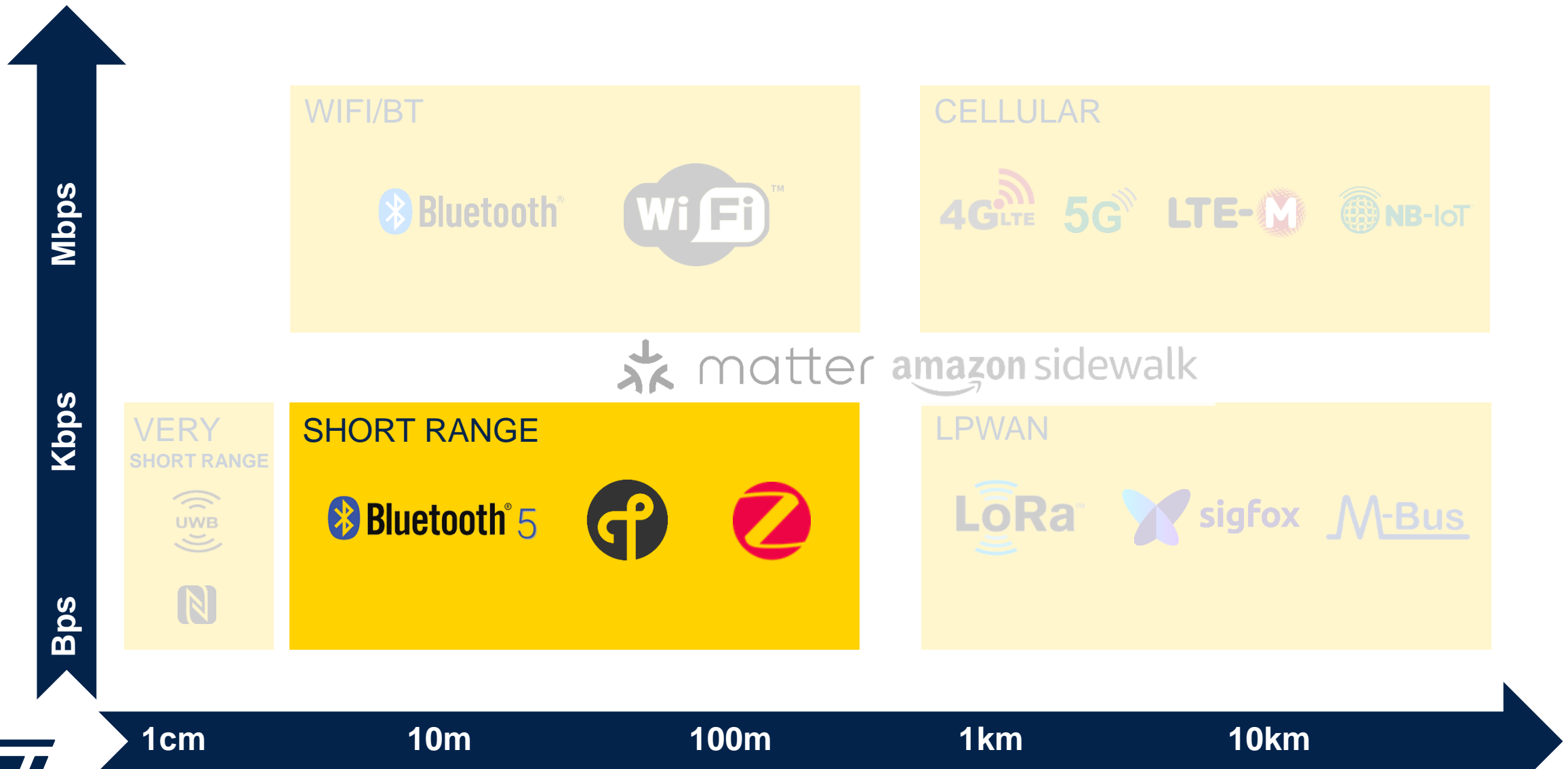


Enabling edge AI solutions

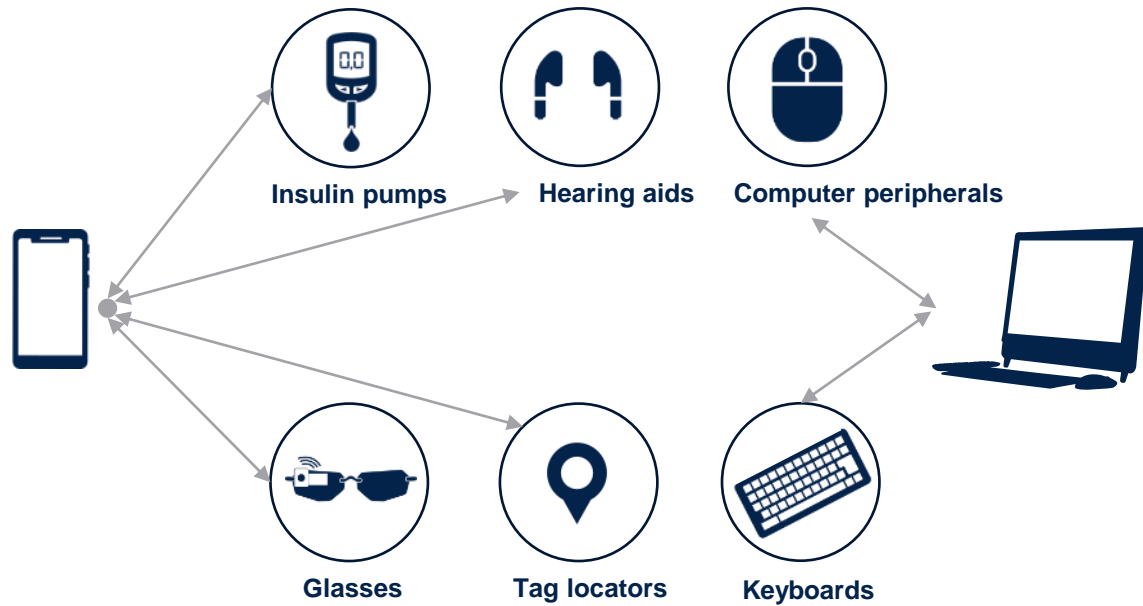


Scalable security

Communication technologies

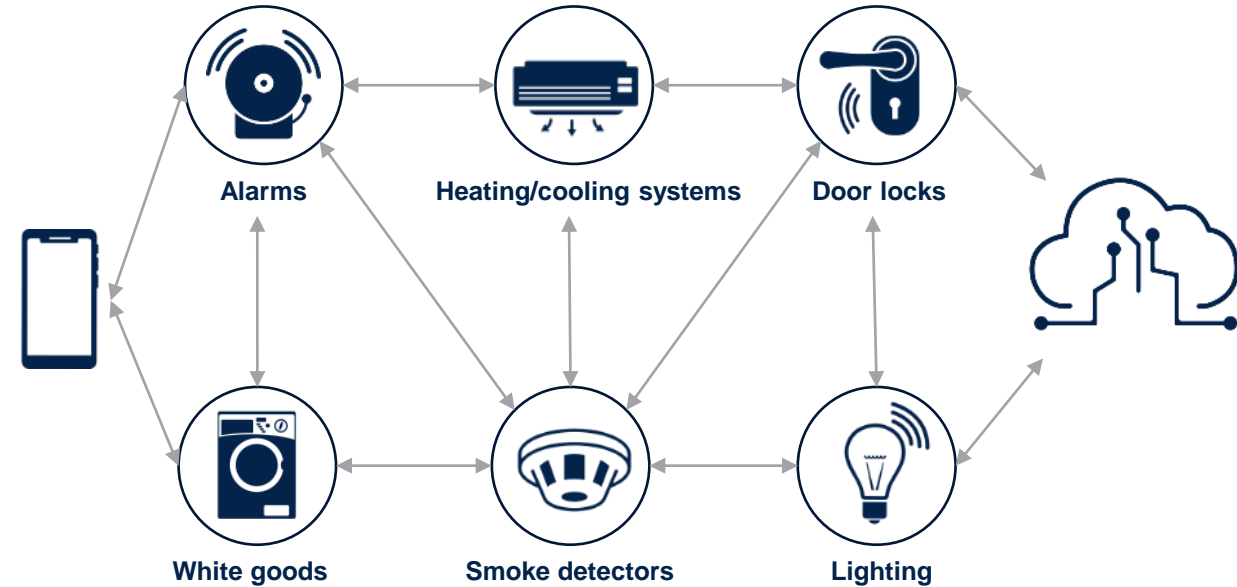


Bluetooth® technology is all around us



P2Point or P2Multi-Comm. devices

Connected to smartphones, laptops...
Mostly battery powered



Mesh communication devices

Home automation, Industry 4.0, power supplies for
consumer products and/or battery-powered devices





Bluetooth® Low Energy enables new applications





What the STM32WB0 series offers

Reliable wireless performance in a compact, energy-efficient design.

Ideal for cost- and energy-sensitive wireless applications.

High wireless performance & longer battery life for IoT devices

- Best-in-class radio enabling robust and stable connectivity
- State-of-the-art radio efficiency
- Power control options



Cost effectiveness

- Optimal price point ensuring best value respect to feature availability
- High integration in tiny packages (integrated balun and HSE capacitors)
- Enables 2-layer PCBs for reduced BOM and simplified circuitry

An extensive wireless ecosystem for streamlined development

- STM32Cube framework supporting you every step of the way
- RF reference designs, IPD chip for easy impedance matching
- Bluetooth® Low Energy and Mesh stacks, software tools, and resources.



STM32 portfolio for 2.4 GHz connectivity

STM32WB series



MCUs

STM32WB55

STM32WB35

STM32WB15

STM32WB50

STM32WB30

STM32WB10

Modules

STM32WB5M

STM32WB1M

STM32WBA series



MCUs

STM32WBA54/55

STM32WBA52

BlueNRG series



System
on Chips

BlueNRG-1

BlueNRG-2/2N

Module

BlueNRG-M2SP/SA

STM32WB0 series



MCUs

BlueNRG-LPS >> STM32WB05xZ

BlueNRG-LP >> STM32WB06 / STM32WB07 STM32WB09

Network
coprocessor

STM32WB05xN

Typical applications and requirements

Performance



High processing
Enhanced security
High RF power output



Multiprotocol
Dual core
Rich feature set



Dual core
Simpler applications



Single core
Low-processing requirements



Space-constrained applications



Network processor
Bluetooth® Low Energy add-on



STM32WBA5x

UFQFPN32, UFQFPN48, Thin WLCSP41, UFBGA59, LGA module



STM32WB55/35

UFBGA129, WLCSP100, VQFN68, UQFN48, Module



STM32WB15

UQFN48, WLCSP49, Module



STM32WB0x

VQFPN32/48, WLCSP36/49



BlueNRG-1/2

QFN32, QFN48, WLCSP34, Module



STM32WB05xN

VQFPN32, WLCSP36

BlueNRG-2N

QFN32, WLCSP34

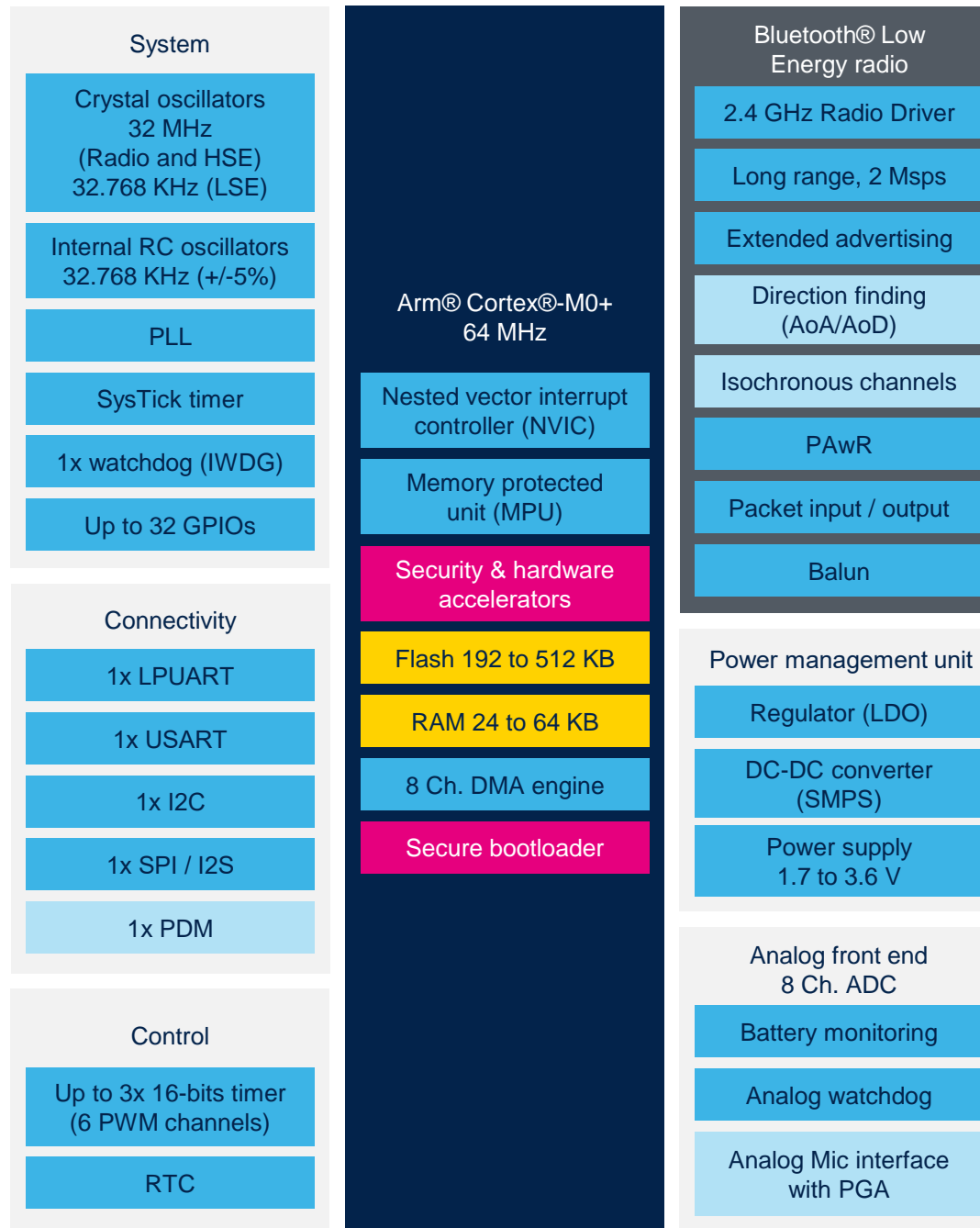
High-end applications

Low-end applications



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STM32WB0 block diagram



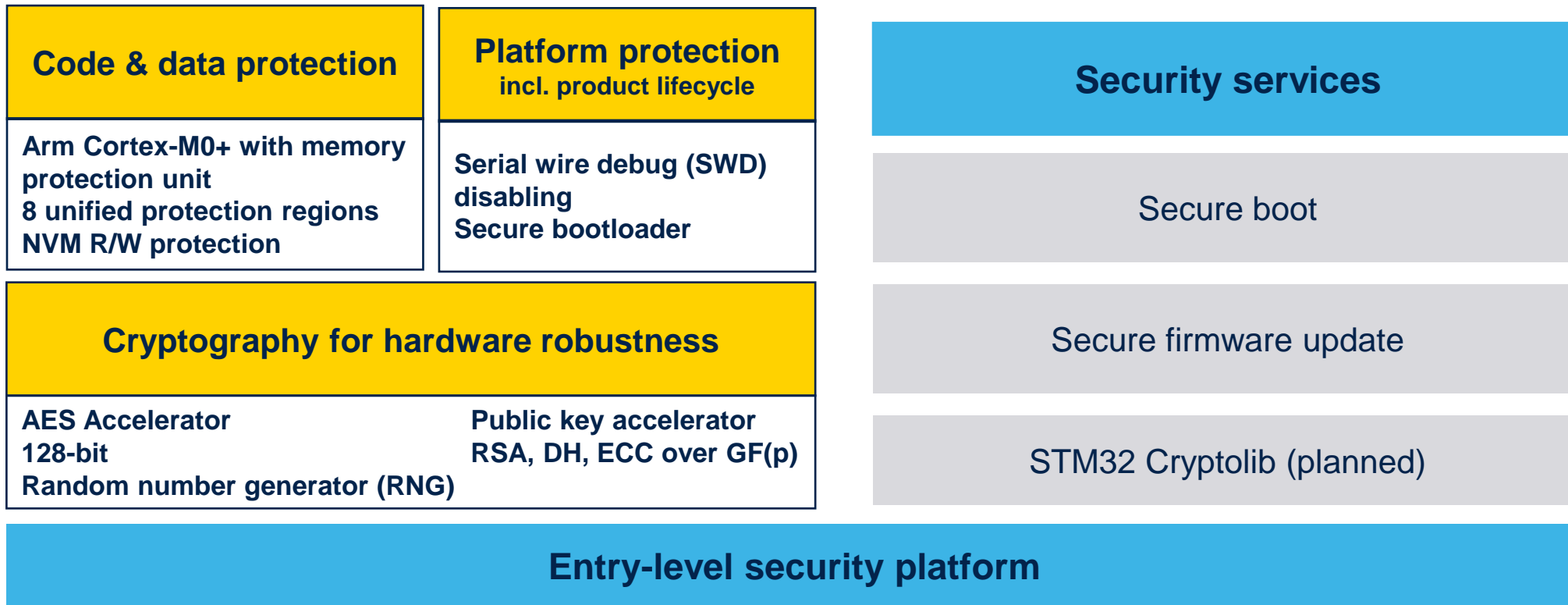
Reliable wireless performance

Security & hardware accelerators

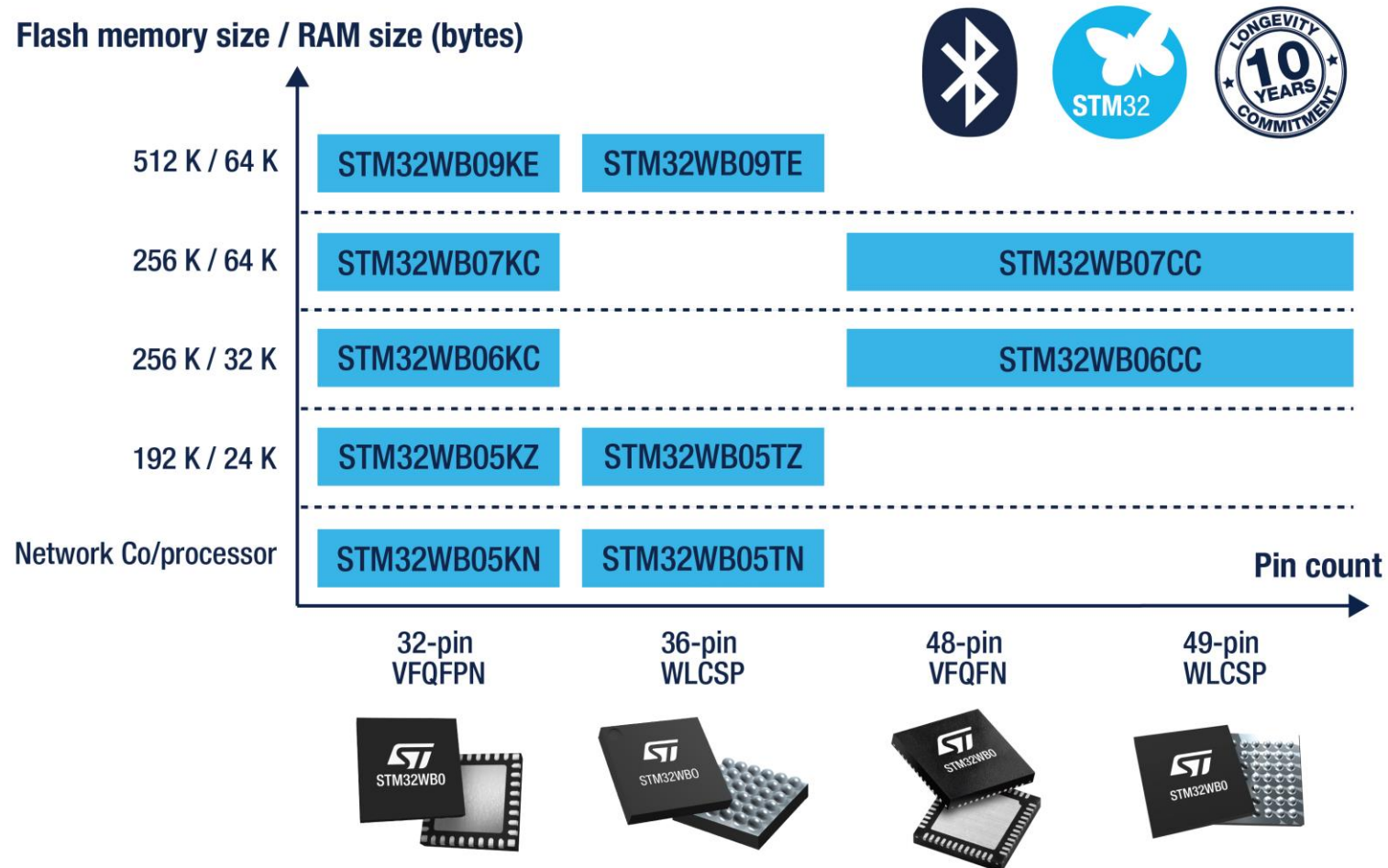
Flexible memory

Legend : Available on specific lines

The security essentials for enabling Bluetooth® Low Energy connectivity



STM32WB0 series portfolio





Useful features in the STM32WB0 series for your application segment



Tracking and monitoring

- -104 dBm Rx sensitivity (long range), +8 dBm Tx output power
- <0.8 uA sleep mode
- Cost effectiveness



Consumer

- ST sensors can be easily integrated with STM32WB0
- Rx: 3.6 mA and Tx: 4.9 mA (STM32WB09 peak consumption)
- Affordability



Industrial

- 10-year longevity commitment
- Bluetooth® Low Energy connectivity plug-in
- Bluetooth® Low Energy proprietary radio driver

Many application possibilities



FITNESS

- **8 dBm power output with 1 dBm stepping**
- Multipoint Bluetooth® Low Energy 5.4 connection
- **WLCSP36 2.83 x 2.99 mm, pitch 0.4 mm**
- Ultra low power consumption
- **Down to 19 nA in shutdown mode**
- Seamless integration with sensors
- Bluetooth® Low Energy advertisement extension & GATT caching



BEACONS / RETAIL

- **Advertisement extension capabilities**
- **Periodic advertisement sink transfer**
- Beacon profile available among a huge list set
- Embedded balun and capacitor less crystal to minimize BOM cost
- **Ultra low power consumption**
 - 3.6 mA Rx Current @ sensitivity Level
 - 4.9 mA Tx current @ 0dBm
 - 19 nA in shutdown mode
- Down to 1.7 operating voltage
- **2-Layer PCB design**



INDUSTRIAL

- **Long range capabilities, up to 1+ km**
- Up to 105°C extended temperature range
- 19 nA in shutdown mode
- 20 I/Os with wake-up capabilities
- **Rich set of peripherals**
- Security features
- 10-year commitment program
- **Supports CSA#2**



HEALTHCARE

- **8 dBm power output with 1dBm stepping**
- **Ultra low power consumption down to 750 nA in sleep mode**
- **2Mbps PHY at -94 dBm sensitivity**
- **Periodic advertisement Sink transfer**
- **GATT caching**
- **Internal DC-DC and balun integrated**
- **Rich set of peripherals**
- Security features
 - PKA, AES(256 bits), ECC(256 bits)
 - TRNG
 - 48-bit unique ID
 - Secure boot and firmware update



FINDERS / TRACKING

- Arm® Cortex® -M0+, 64 MHz, 512 KB flash, 64 KB SRAM
- AoA / AoD capabilities
- Dynamic power consumption: 14.5 uA/MHz
- Long Range capabilities, up to 1+ km
- Embedded balun and capacitor-less crystal to minimize BOM cost
- Ultra low power consumption
- WLCSP36 2.83 x 2.99 mm, pitch 0.4 mm



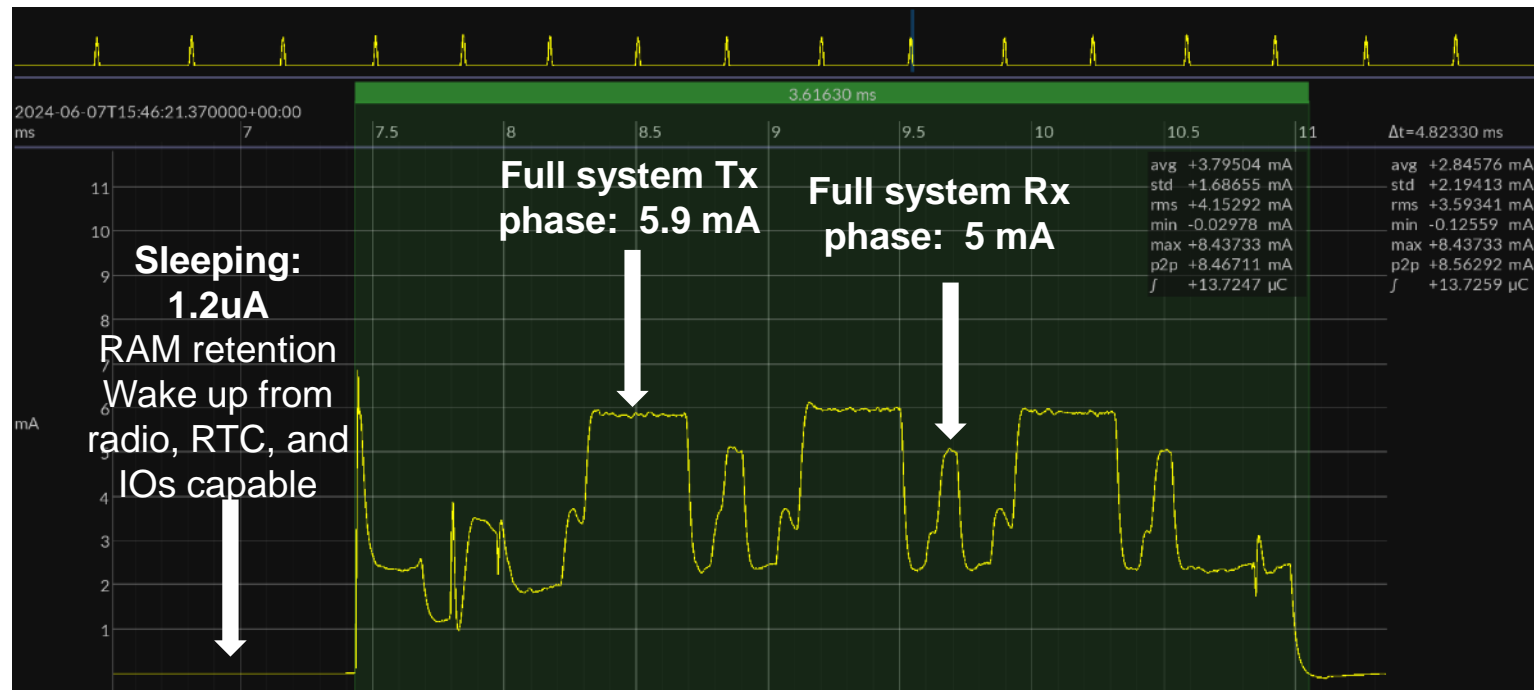
HOME AUTOMATION / LIGHTING

- **-104 dBm Rx sensitivity @ 125kbps**
- **8 dBm output power**
- Security features
 - PKA, AES(256 bits), ECC(256 bits)
 - TRNG
 - 48-bit unique ID
 - Secure boot and firmware update
- **No hard limit on the number of connections, depends on available RAM**
- Long Range up to 1+ km
- Seamless integration with our MEMS sensors
- **Bluetooth Mesh capable**



STM32WB0 offers best-in-class power consumption

STM32WB09 average power consumption during advertising



1.2 uA sleep current
Outstanding active Rx and Tx current



5.9 uA average power consumption (advertising 31 bytes, every 3 seconds, 3.3 V, +0 dBm)

Radio-only peak Tx: 4.9 mA

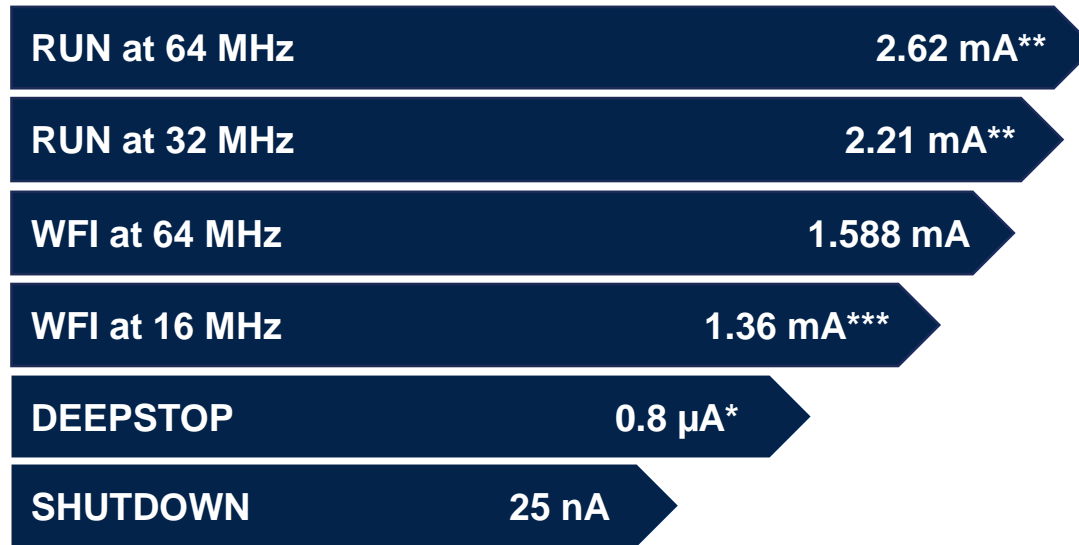
Radio-only peak Rx: 3.6 mA



STM32WB09 power consumption (SMPS mode)

Wake-up time

170 μ s



Typ @ SMPS ON 3.3 V @ 25 °C

*Wake-up GPIO, no timer, all RAM retained

**Dhrystone, clock source PLL64

***HSE direct, no PLL

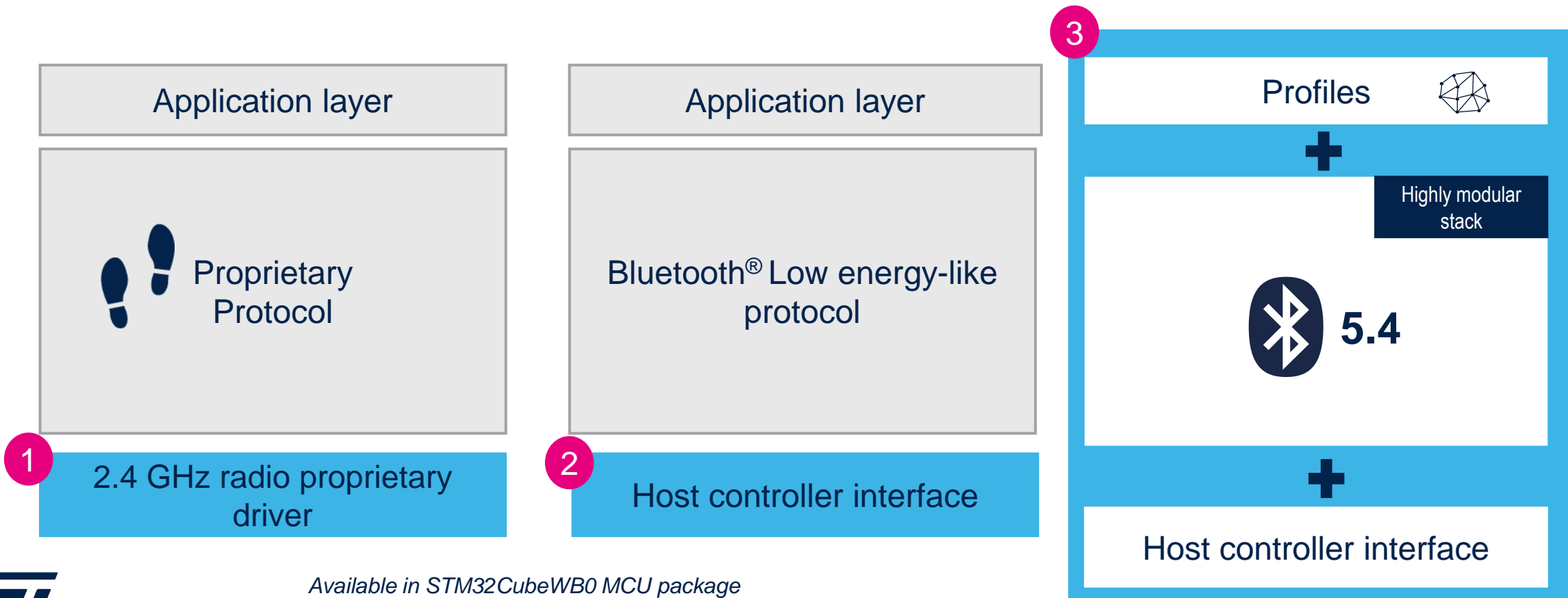
High efficiency

- 14.5 μ A/MHz from Arm Cortex®-M0+
- 4.9 mA radio peak Tx current
- 3.6 mA radio peak Rx current



Make it yours

Different levels of integration so you can customize your solution

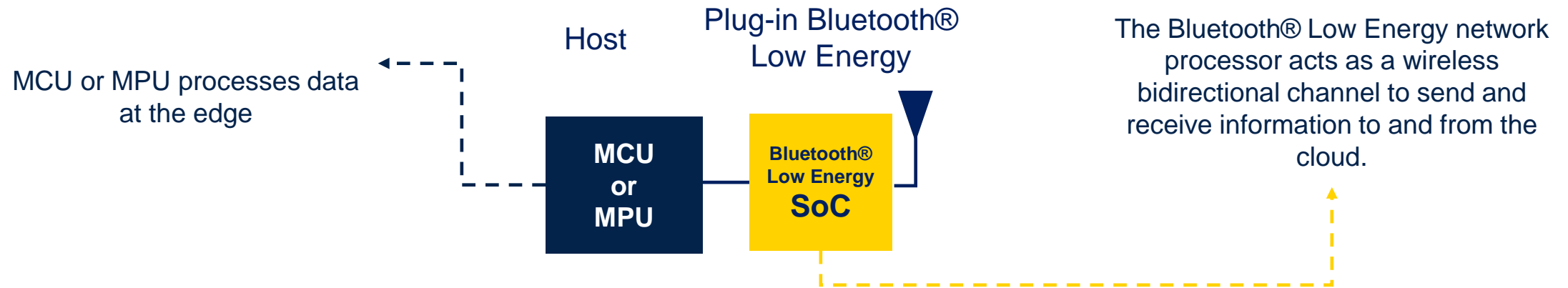


Available in STM32CubeWB0 MCU package

STM32WB05xN network coprocessors

Bluetooth® Low Energy and edge computing

Many IoT devices require edge computing, relying on real-time processing and analysis of data at the source to offload cloud infrastructures and enable ultralow latency.



Bluetooth® Low Energy network processor

A reliable, flexible, and reusable plug-in solution.

- Host upscaling will **not affect the Bluetooth® Low Energy subsystem** and will **not require a new certification**
- Powerful computing and scalable resources
- Reusable Bluetooth® Low Energy component
- Highly flexible partitioning
- Independent Host/BLUETOOTH® LOW ENERGY subsystems
- Unconstrained design upgradability

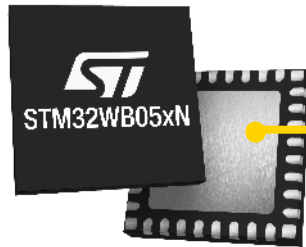


What the STM32WB05xN line offers

Most affordable STM32 device for adding wireless connectivity to existing applications.



From \$0.79
for 10k units



Bluetooth® Low Energy 5.4 certified network processor



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Plug-in solution: reduced software development effort and minimized lifecycle risks

- Precompiled binary libraries available from ST
 - Bluetooth® Low Energy essentials (2 Mbps data rate, Long range (Coded PHY), advertising extensions, AoA/AoD)
 - Bluetooth® Low Energy radio coprocessor (HCI interface)
- Simple host MCU/MPU serial driver
- Self-contained RF context, host MCU/MPU applications can be updated independently

Flexibility

- Hardware scalability and software design flexibility based on the Host capabilities

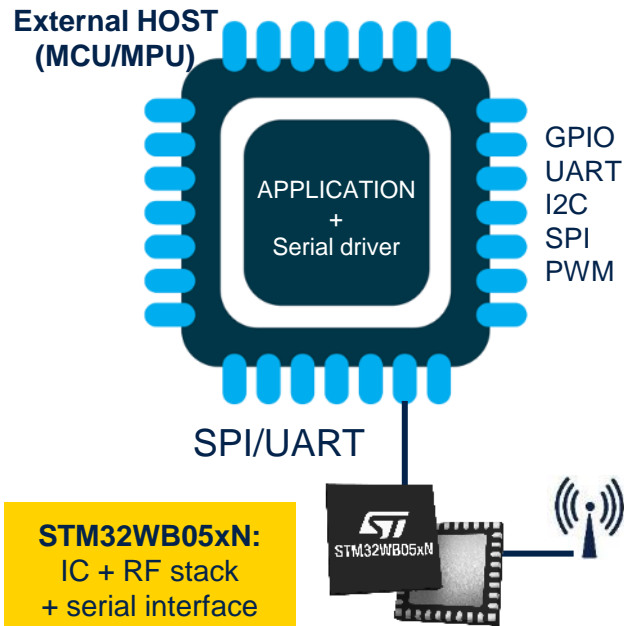
Ultra-low current consumption

- DEEPSTOP current consumption down to 800 nA
- Tx current consumption 4.3 mA (@ 0 dBm)
- Rx current consumption 3.4 mA (@ sensitivity level, 3.3 V)

Wireless applicative topologies

NETWORK COPROCESSOR

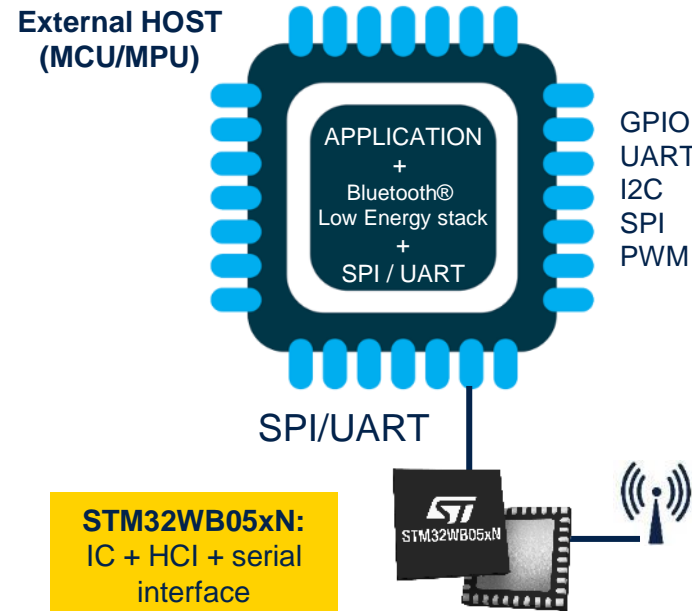
Radio link added through a simple and standard **serial interface**



Radio as a simple plug-in on a standard serial interface

RADIO COPROCESSOR

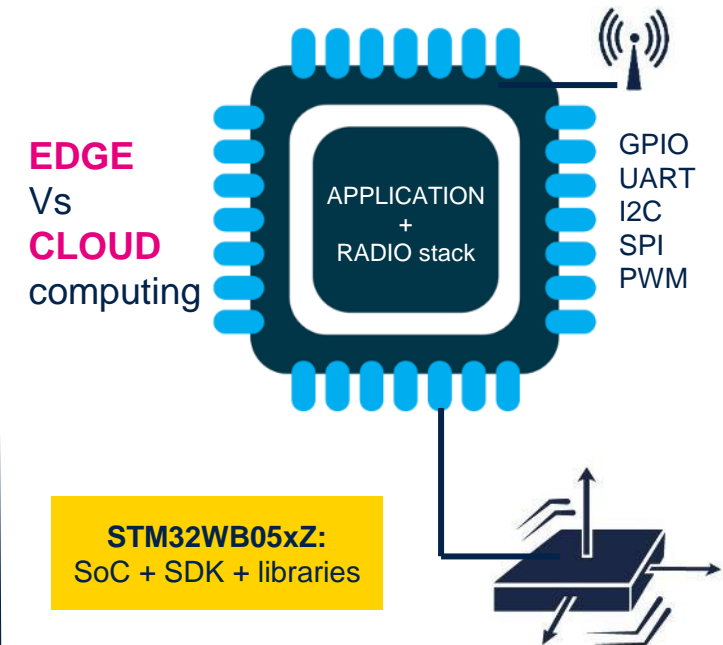
Application is running over a dedicated MCU along with the **Bluetooth® Low Energy Host stack**



Specific integration of radio middleware/driver required

APPLICATION PROCESSOR

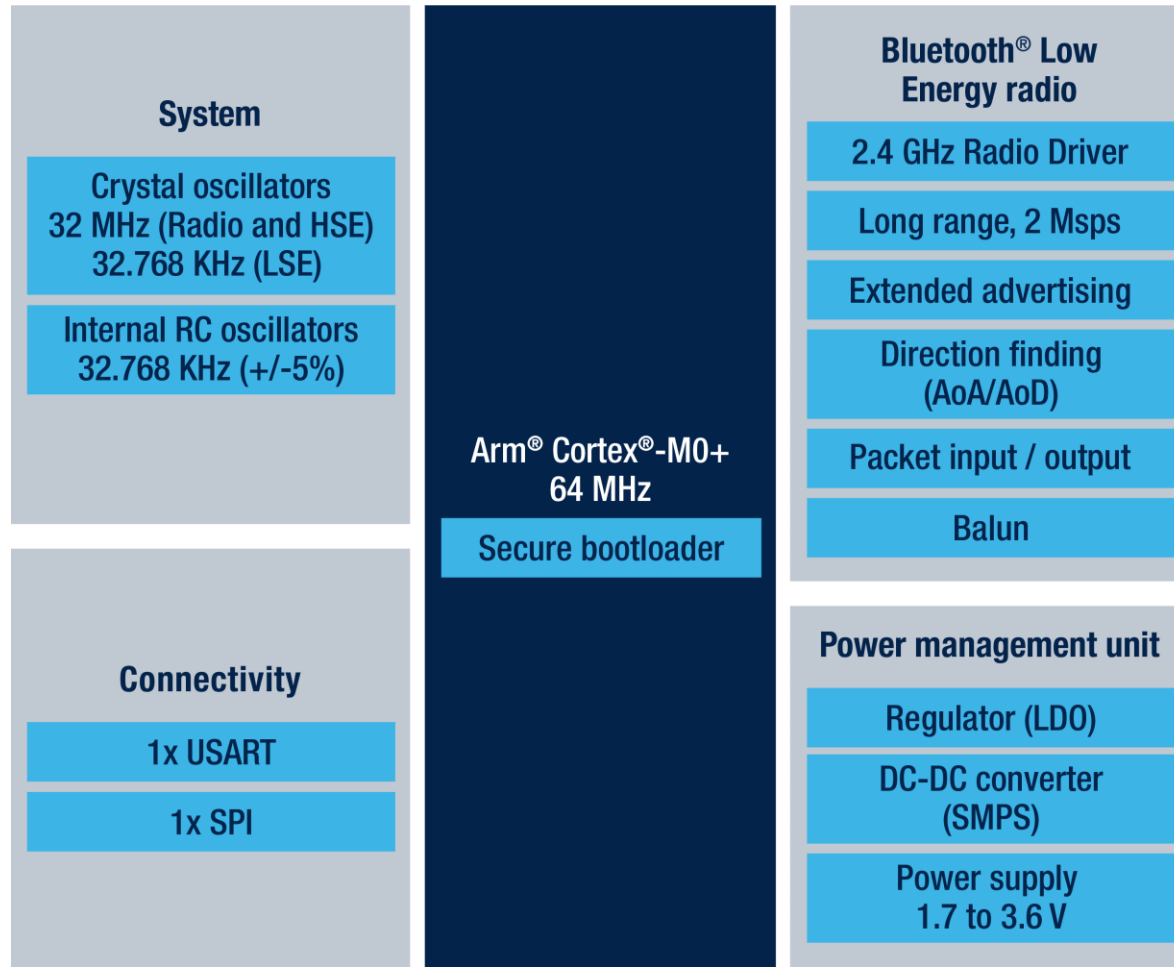
Data acquisition, processing, and radio connectivity in a single-chip



Full code ownership in all-in-one image (data, processing, radio)

STM32WB05xN

STM32WB05xN block diagram

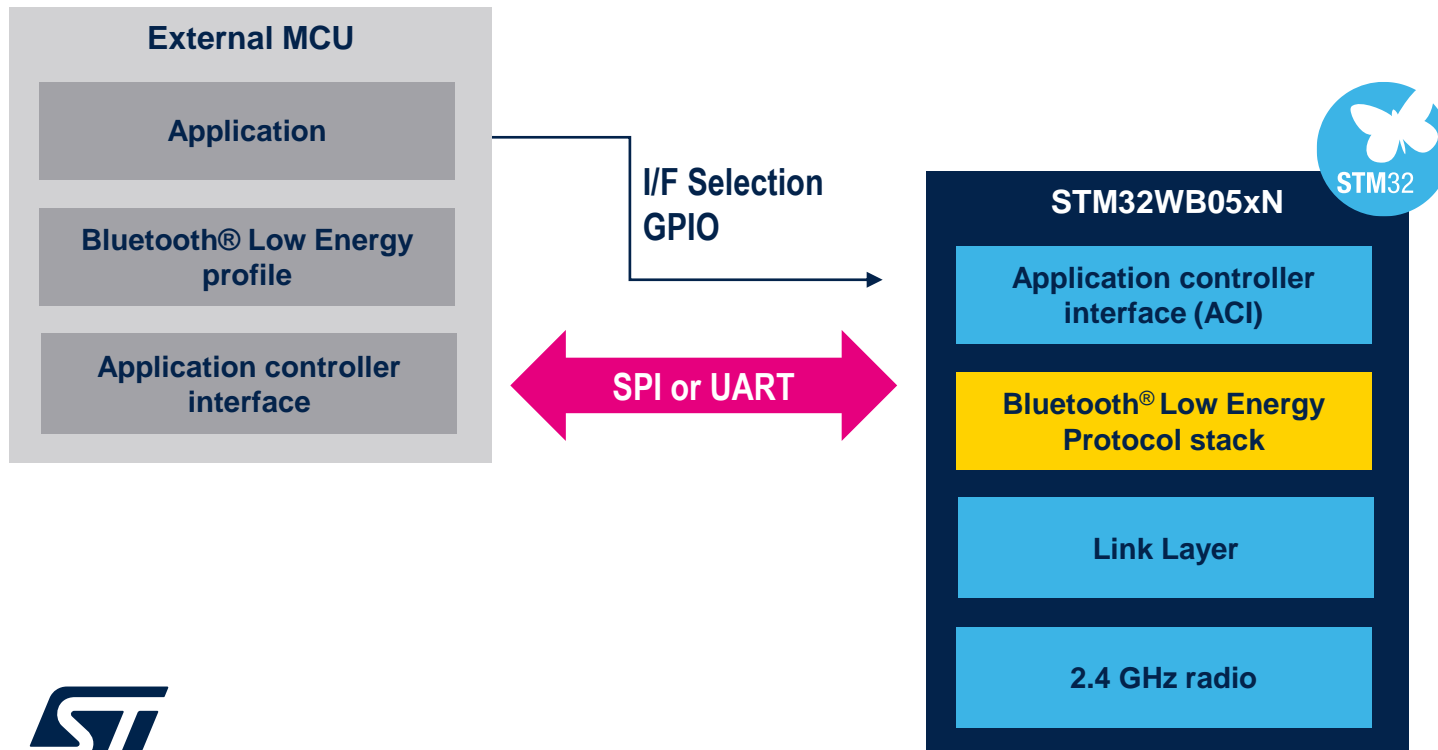


Offering a precompiled, certified, and upgradable Bluetooth® Low Energy stack

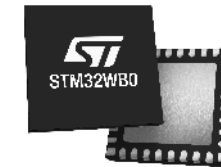
Easier integration of wireless connectivity into existing products

STM32WB05xN is suitable for applications where Bluetooth® Low Energy needs to be added to existing products

Simplified integration



Pin-out - top view



VFQFPN32

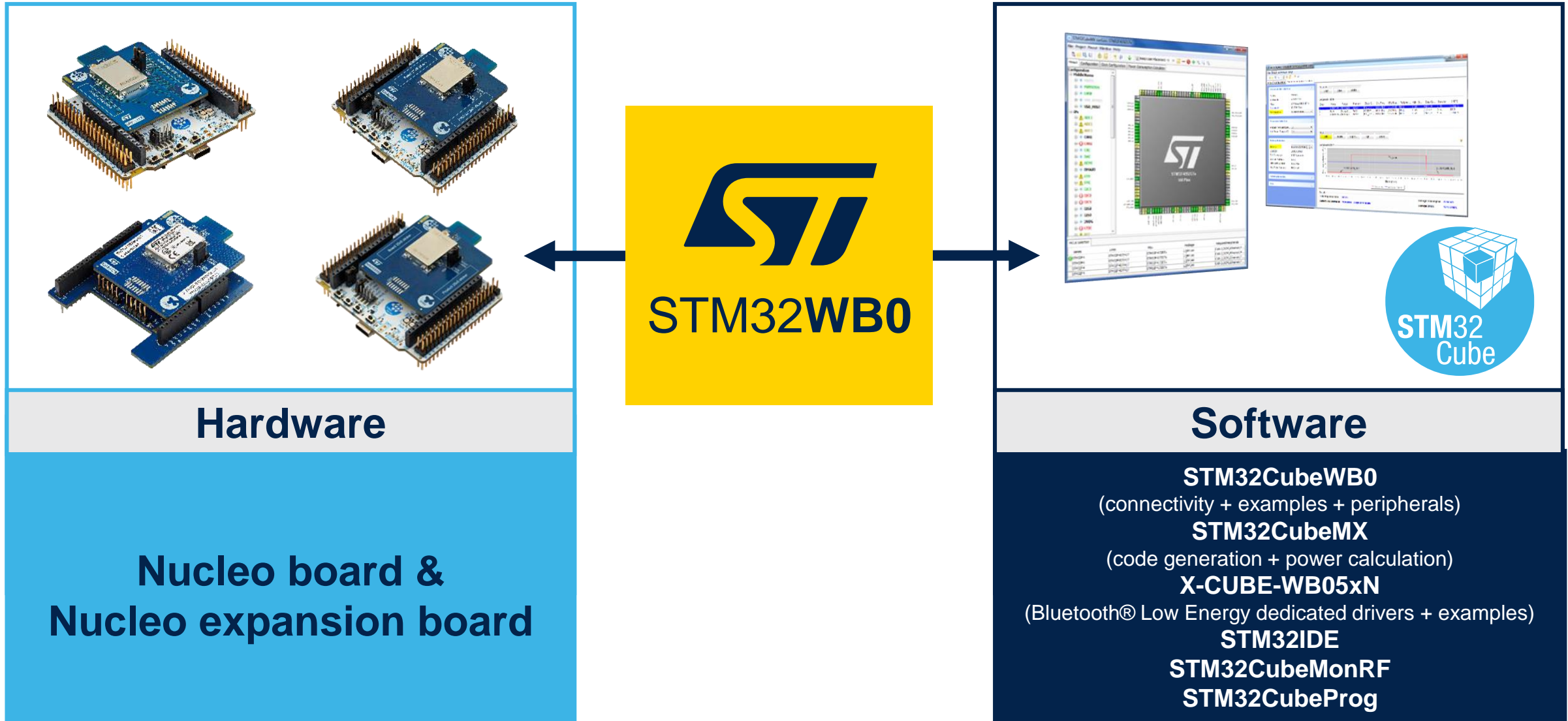


WLCSP36

Pin count (main ones)	Name	Description
5x	SPI	Communication interface + IRQ
2x	UART	Communication interface
1	Reset	Reset

STM32WB0 development ecosystem

STM32WB0 ecosystem simplifies your design journey



STM32WB0 development boards

NUCLEO-WB07CC



- VFQFPN48 package
6 x 6 mm 0.4 mm pitch
- 32 GPIOs
- Arduino and Morpho connectors
- RF certified for protocols & regulations

NUCLEO-WB09KE



- VFQFPN32 package
5 x 5 mm 0.5 mm pitch
- 20 GPIOs
- Arduino and Morpho connectors
- RF certified for protocols & regulations

NUCLEO-WB05KZ



- VFQFPN32 package
5 x 5 mm 0.5 mm pitch
- 20 GPIOs
- Arduino and Morpho connectors
- RF certified for protocols & regulations

STM32WB05xN Nucleo expansion board

Discover many use cases powered by STM32WB05xN



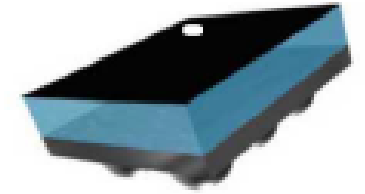
Nucleo Expansion daughter board

- STM32WB05KN, IPD (MLPF-NRG-01D3)
- 32MHz oscillator
- Arduino® UNO R3 connector

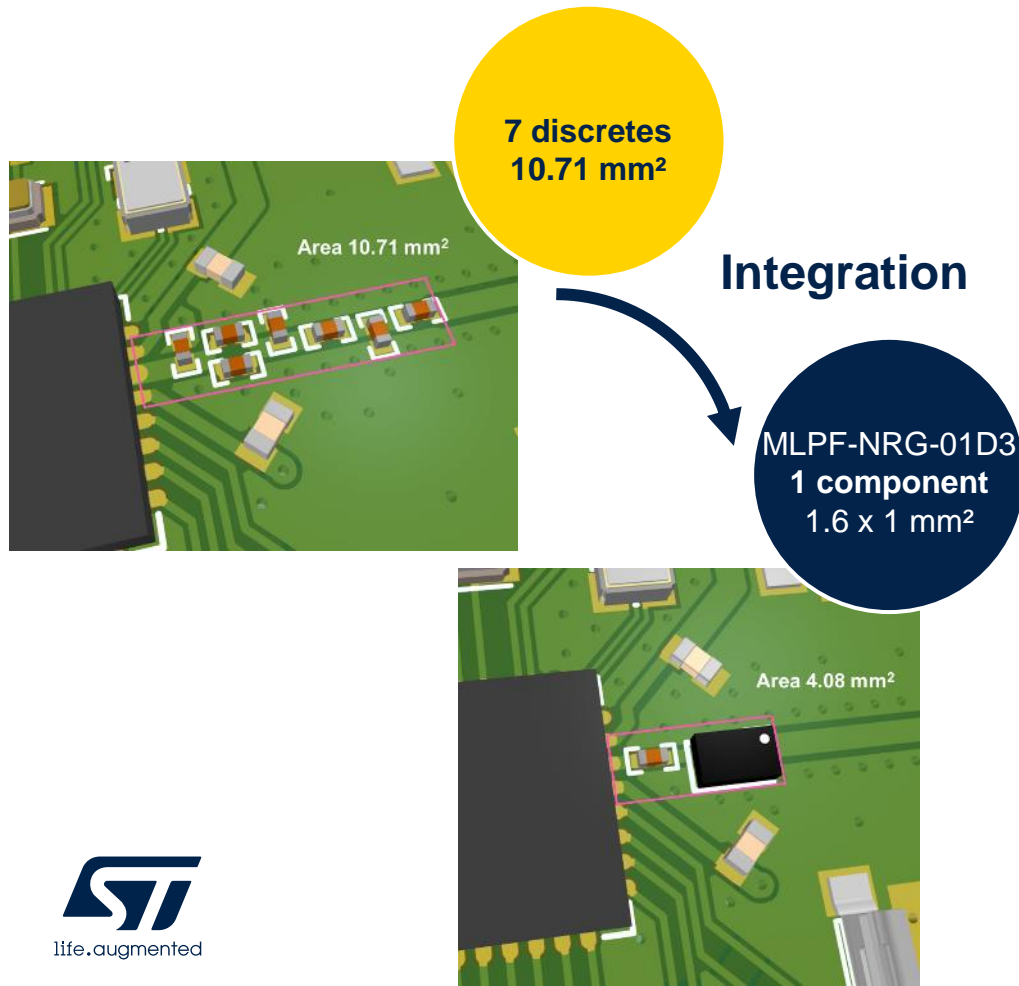
X-NUCLEO-WB05KN1

RF integrated passive devices (IPD) companion chip

Designed for the STM32WB0 MCUs,
the IPD replaces the components between the MCU and the antenna



Chip scale package on glass 6 bumps



Simpler integration

- Impedance matching, harmonics filtering and antenna protection
- Designed to simplify the RF path between all STM32WB0 devices and antenna

Efficiency

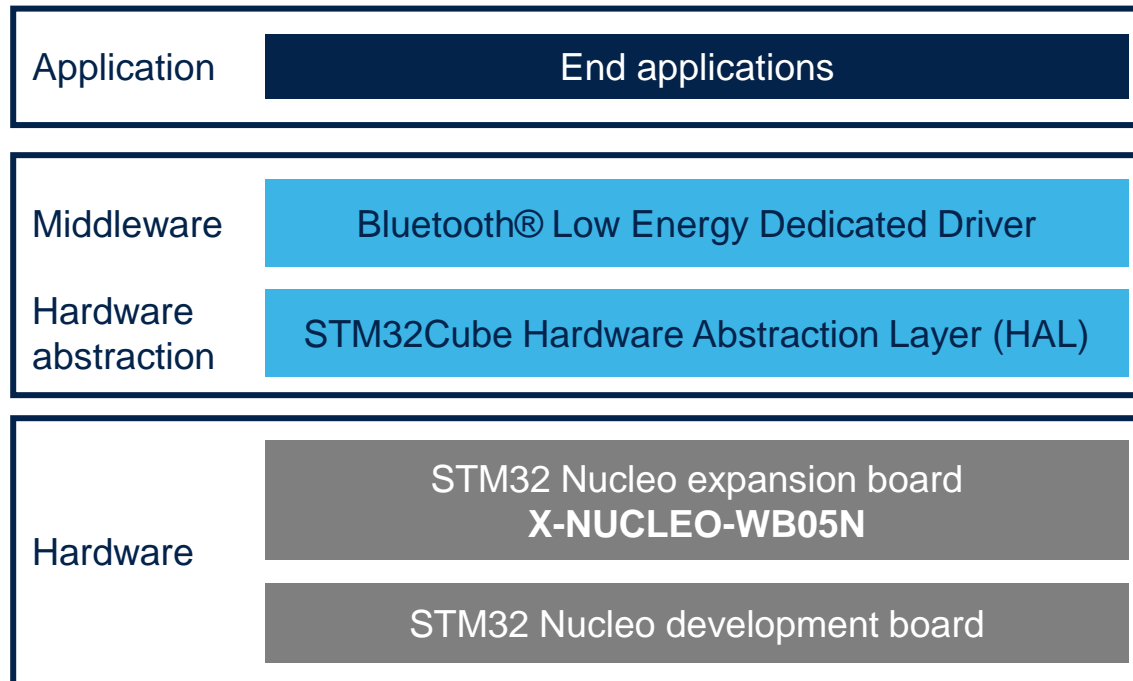
- Optimizes wireless performance

Cost effective

- BOM reduction
- Reliability improvement

X-CUBE-WB05N

STM32Cube expansion package: drivers for the STM32WB05xN

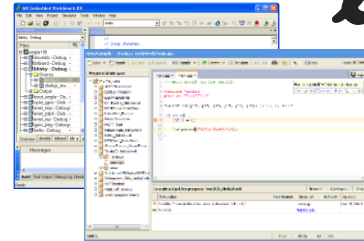
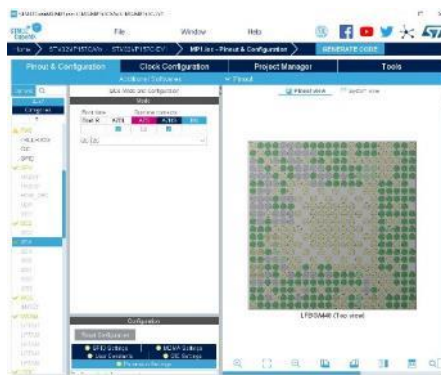


- Complete middleware to build Bluetooth® Low Energy applications using STM32WB05xN.
- Easy portability across different MCU families, thanks to STM32Cube technology.
- Numerous examples to get started with Bluetooth® Low Energy applications.
- Expansion package compatible with STM32CubeMX starting from version 1.1. Can be downloaded and installed directly from the tool.
- Free of charge, user-friendly license terms.



Software tools for STM32WB0

Complete support of STM32WB0 & Arm® Cortex®-M0+ architecture



STM32CubeMX

Graphical tool
for easy configuration

- Configure and generate code
- Peripherals and middleware configuration

IDEs Compile and debug

Simple,
powerful solutions

- Partners IDE (Arm® Keil®) **FREE**
- IDE based on Eclipse **FREE**
- RTOS aware debug

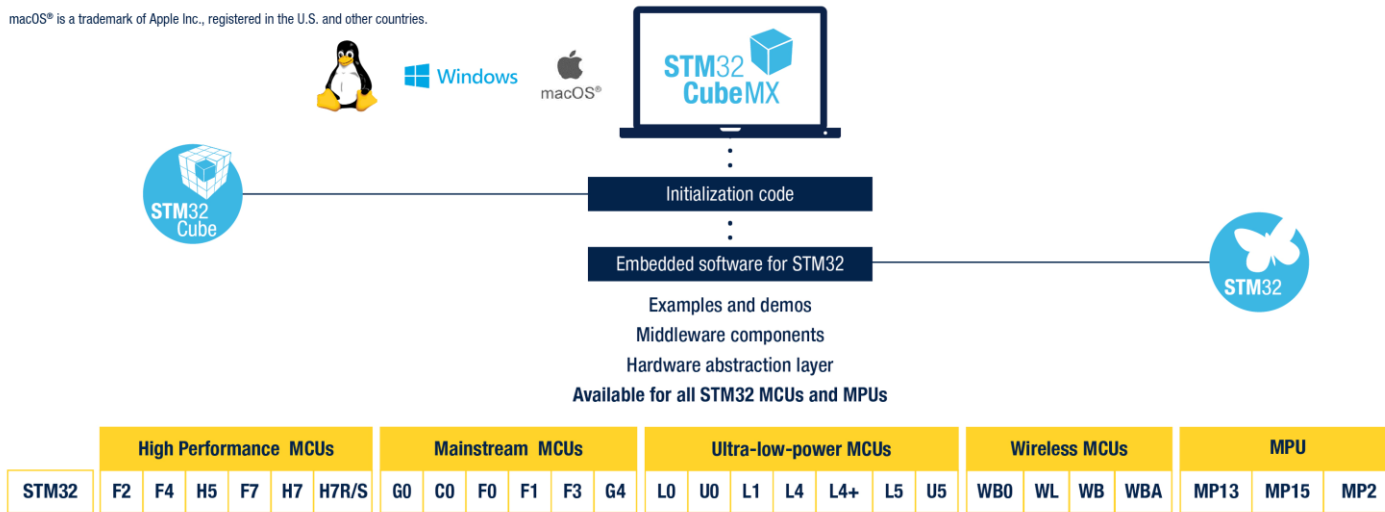
STM32 programming & monitoring tools

STM32CubeProg
STM32CubeMonitor

- Device and memory configuration
- Program the application
- Monitor variables at runtime

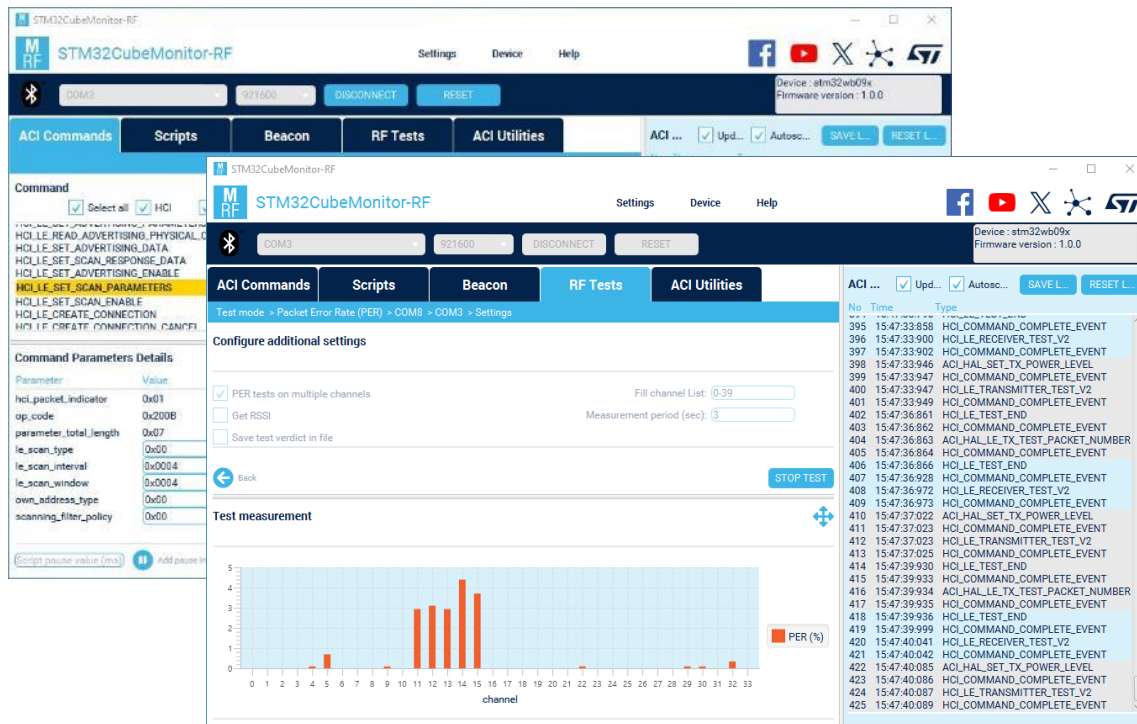
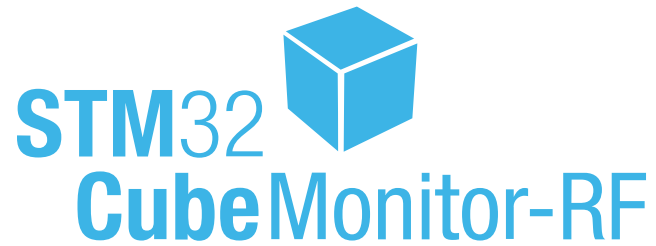
Extensive radio stack support

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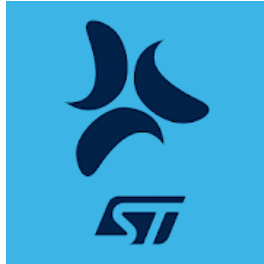
- Enabling the STM32_WPAN
- Integration of RTOS and radio use cases
- Configuration GUI for Bluetooth® Low Energy
- Examples generated with STM32CubeMX
- Bluetooth® Low Energy standardized and custom profiles

Evaluate radio performance and more



- Performance monitoring
- Radio testing
- Advanced scripting capabilities
- Data logging and report generation

ST Bluetooth® Low Energy smartphone apps



ST BLE Sensor



ST BLE StarNet

ST BLE Sensor – Used with our OOB demo

Read the data exported by a Bluetooth® Low Energy device using the BlueST protocol.

ST BLE StarNet (Star topology)

View the data exported by a Bluetooth® Low Energy gateway connected to a network of devices.

ST BLE Toolbox

Discover peripherals, services, and characteristics, and perform R&W. Users can collect cloud-based analytics on the Azure App Center, bond devices, test throughput, log messages.

New



ST BLE Toolbox

STM32WB0 ecosystem takeaways



- Dedicated Nucleo board and expansion board for prototyping
- Full support & integration of Bluetooth® Low Energy 5.4 stack
- Advanced RF stack integration with STM32CubeMX
- Advanced QoL features for STM32CubeMonRF
- Mobile applications to address applicative use cases
- Resources on GitHub, including STM32 hotspot

STM32WB0 takeaways



Wireless	Bluetooth® Low Energy 5.4 +8 dBm output power
Performance	Arm® Cortex®-M0+ at 64 MHz Higher flexibility for entry-level applications
Power efficiency	Extended battery lifetime Autonomous low-power mode
Cost-efficiency	Best value for cost-sensitive applications
Integration	Up to 512/64 Kbytes Flash/RAM memory Reduced BOM
Free ecosystem	Faster time to market Enhanced project design journey

Releasing your creativity



[@STM32](#)



[@ST_World](#)



[community.st.com](#)



[www.st.com/STM32WB0](#)



[wiki.st.com/stm32mcu](#)



[github.com/stm32-hotspot](#)



[STM32 MCU Developer Zone](#)

Our technology starts with You



Find out more at www.st.com/STM32WB0

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