New STM32WB Series MCU
with built-in Bluetooth™ 5 and IEEE 802.15.4
Make the Choice of STM32WB Series

The 7 keys points to make the difference

- Open 2.4 GHz radio Multi-protocol
- Dual-core / Full control Ultra-low-power
- IoT Protection ready
- Massive integration Cost saving
- 1MB Flash
- 129-pin
- 3.6 V
- 48-pin
- 1.7 V
- 256KB Flash
- A large offer
- Advanced RF tool, Energy control with C code generation
- No matter what!
Multiprotocol and Open radio

**2.4 GHz Open**
- Proprietary protocol capable (BLE like or 802.15.4)
- Best-in-class RF with up to +6dBm output power and 102 dB link budget
- Energy sensitive application with only 4.5 mA in RX and 5.2 mA in TX (@ 0dBm)
- BOM cost reduction thanks to Integrated balun

**Bluetooth 5**
- Fully certified Bluetooth™ 5 radio
- 2x faster speed with 2Mbps capable mode
- Extend network coverage with BLE Mesh

**Last IEEE 802.15.4 standard ready**
- OpenThread certified, ZigBee 3.0*
- Static and Dynamic concurrent mode

* Coming soon
2.4 GHz Radio
+6 dBm output / -100 dBm sensitivity (802.15.4)
-96 dBm sensitivity (BLE 1 Mbps)

Profiles
Bluetooth 5
ZigBee* (Coming soon)
IEEE 802.15.4 MAC
6LoWPAN (RPL)
LLD 802.15.4
THREAD
Antenna
Simplicity of development

2 independent cores for real-time execution

**Mono-core**
- CPU -x
- Application Firmware
  + Peripherals
  + Radio stack

**STM32WB**
- Arm Cortex-M4
  - Application Firmware + Peripherals
- Arm Cortex-M0+
  - Radio Stack

**Drawbacks**
- Time sharing
- Longer processing time – Greedy current consumption
- Need companion MCU (increased cost)

**Benefits**
- SOC solution (1 single die)
- Full flexibility - Easy development – User experience
- Increase battery life
- All-in-1 solution - cost saving
- Speed up time to market
KEY FEATURES

- 2 independent cores for real time execution

- Ultra-low-power consumption
  - 50 µA/MHz Active mode (at 3.0V)
  - 2.1 µA Stop mode (Radio in standby + 256KB RAM)
  - < 50 nA Shutdown mode

- Peripherals
  - 2xI²C, 1xUSART, 1xLP-UART, 2xSPI, 1x USB 2.0 FS device supporting Battery Charging Detection, 1xSAI, Quad-SPI (XIP), 6x 16-bit timer (including LPWM and low-power one)

- 1.71 to 3.6V voltage range (DC/DC, LDO)

- -40 to +105°C temperature range
Benefit of Dual Cores processing

1. Independent Radio activity:
   - Uploading data to mesh network or smartphone
   - OTA of Radio protocol stack or application FW
   - Running on arm CM0+

2. Energy saving mode
   - RAM + RTC running @ 2.1µA
   - Fast wake up @ 5µs

3. Main application activity:
   - Computing data (sensor fusion …)
   - Flexible arm CM4 CPU speed up to 64 MHz
   - Batch Acquisition Mode (BAM) with CPU and Flash turned off

4. Dual CPU activity
   - 50µA/MHz only!
   - Both Radio and Application running independently

5. Super saving mode
   - Shutdown < 50 nA
   - Battery energy saving

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Competitor A

Competitor B
All in one MCU - Full flexibility control

- Robust RF link -100dBm sensitivity with IEEE 802.15.4 and +6 dBm output power
- Upgrade legacy 802.15.4 device to Bluetooth 5
- Update securely Radio and stack firmware with build-in RSS Bluetooth 5 and 802.15.4 protocols Mesh capable to extend network range

- Lighting
- Fleet maintenance
- Industrial devices
- Fitness/Healthcare
- Beaconing
- Home security and Audio

- Multipoint Bluetooth 5 connections
- Small form factor design with WLCSP100
- Battery life time care with < 50 nA Shutdown mode
- Dynamic Efficient 50 µA/MHz
- Extend memory storage with Quad-SPI
- Handle advanced algorithm with 1 Mbyte of Flash memory
- Cost optimized product with USB 2.0 crystal-less device

- -100 dBm sensitivity to increase area coverage
- Customer Key Storage (CKS) for trustable Application update
- Manage full duplex audio with embedded SAI
- USB FS 2.0 with Battery Charging Detection for remote device

- Retrofit legacy product to Bluetooth 5 and concurrency mode
- Remotely upgrade device with OTA capability
- Brand protection with Authenticated FW upgrade system

- Up to 105°C radio capable
- Down to 600 nA mode with RTC and 32KB of RAM
- Only 5µs wakeup time over 16 wakeup lines
- PCROP, ECC, TRNG, PKA, for best design robustness
- Reduce BOM cost with built-in LCD booster

- Beacon profile available among a huge list
- Embedded balun to minimize design cost
- Only 5.2mA Radio TX current to extend beacon life time
- Up to +6 dBm output power to get best beacon range
- < 2.1 µA Stop mode with full RAM for battery life optimization
- Down to 1.71 full feature capable

- Up to 105°C radio capable
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IoT Protection Ready (1/4)

Radio stack and/or Application FW update

1. New FW package received
2. New FW detected
3. Update is launched
4. App Processor sends new FW package signature and encryption key for authentication
   - Authentication signature matches preprogrammed key
   - Case not, the process is aborted and device resets

---

Closed Sub-system
Radio + Key storage

Antenna

Network Processor Cortex-M0+
2.4 GHz radio
Modem (Bluetooth 5, 802.14.5)

Application Processor Cortex-M4
FPU + MPU
DSP instruction
64 MHz

AES 128-bit

Customer Key Storage

Empty Flash

FW Application V 1.0

FW Application V 2.0
IoT Protection Ready (2/4)

Radio stack and/or Application FW update

1. New FW package received
2. New FW detected
   Update is launched
3. App Processor send New FW package signature and encryption key for authentication
   Authentication signature matches preprogrammed key
   Case not, the process is aborted and device resets
4. New FW package is decrypted with proprietary Key. Device upload on going.
IoT Protection Ready (3/4)

Radio stack and/or Application FW update

- Application Processor
  - Cortex-M4
  - FPU + MPU
  - DSP instruction
  - 64 MHz

- Network Processor
  - Cortex-M0+
  - 32 MHz

- 2.4 GHz radio Modem (Bluetooth 5, 802.14.5)

- AES 128-bit

- Closed Sub-system
  - Radio + Key storage

STM32WB boots on and execute the new application

Protection ready!
## IoT Protection Ready (4/4)

STM32WB countermeasure against attacks

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<td>• 96-bit ID</td>
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## Silicon cost

- RF balun cost: Embedded
- External components: 7 (including crystal)
- 32 kHz Master clock output available
- Crystal for USB 2.0 FS operation: embedded
- LCD display booster: embedded (only single glass)
- Capacitive touch controller: embedded
- PCB cost: 2 layers PCB only

## Ecosystem cost

- Bluetooth 5 stack: Free of charge
- OpenThread stack: Free of charge
- ZigBee 3.0* stack (coming soon): Free of charge
- Generic 802.14.5 MAC: Free of charge
- Generic HCI drivers: Free of charge
- STM32CubeMX: Free of charge
- STM32CubeProgrammer: Free of charge
- STM32CubeMonitor-RF: Free of charge
- GCC-based IDEs: Free of charge
- Bluetooth 5 and 802.15.4 concurrency avoids to use a second radio MCU

* Coming soon

The more feature integration, the more the BOM drops down!
STM32WB - A large offer

Bluetooth 5, Thread, ZigBee 3.0 and proprietary protocol capable

Flash memory / RAM size (bytes)
1 M / 256 K
- STM32WB55CG
- STM32WB55RG
- STM32WB55VG

512 K / 256 K
- STM32WB55CE
- STM32WB55RE
- STM32WB55VE

256 K / 128 K
- STM32WB55CC
- STM32WB55RC
- STM32WB55VC

Legend:
- Light blue: In production
- Dark blue: Samples available

Pin count:
- 48-pin UQFN (0.5 mm pitch)
- 68-pin VQFN (0.4 mm pitch)
- 100-pin WLCSP (0.4 mm pitch)
- 129-pin UFBGA (0.5 mm pitch)

From 1.71 to 3.6V and from -40 to +105°C!
Prototyping made as easy as 1, 2, 3
STM32CubeWB – Embedded software

Allows developers to focus on their applicative differentiation only

- USB library: ST USB Device library
- File system: FatFS open source standard
- RTOS: FreeRTOS open source standard (CMSIS-RTOS v2 abstraction)
- ST Touch sensing library
- Bluetooth 5 and Thread stacks and services

- Abstraction of STM32
  - Through high level and portable APIs (HAL)
  - Through light and optimized APIs (LL)
- STM32 full peripheral coverage
- Production ready with CodeSonar™ and LDRA static code analysis
- Complete: hundreds of ready-to-use examples
- Permissive terms: Open-source BSD license
Software Development Tools

A complete flow, from configuration up to monitoring

STM32CubeMX
Configure & Generate Code

Partners IDEs
Compile and Debug

STM32CubeMonRF
Monitor

FREE IDE’s
IAR Systems
arm KEIL
arm MBED
ac6
TrueSTUDIO for STM32

STM32CubeMonitor-RF

STM32 WB

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