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
  - 256KB Flash

- **Advanced RF tool, Energy control**
  - with C code generation

- **A large offer**

- **No matter what!**
Multiprotocol and Open radio

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

**2.4 GHz Open**
- Last IEEE 802.15.4 standard ready
- OpenThread certified, ZigBee 3.0*
- Static and Dynamic concurrent mode
- 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 4.5mA in RX and 5.2mA in TX (@ 0dBm)
- BOM cost reduction thanks to Integrated balun

* Coming soon
Make It Yours

Profiles
- Bluetooth 5
- ZigBee

Profiles
- ZCL
- 6LoWPAN (RPL)
- Thread

IEEE 802.15.4 MAC
LLD 802.15.4

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

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°C to +105°C temperature range

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Security
PCROP, PKA, TRNG
AES 256-bit, CKS

Arm® Cortex®-M4 MPU +
FPU + DSP Inst. @ 64 MHz

ART Accelerator™
Up to 1MB Flash
Up to 256KB SRAM

LCD 8x40

ADC 12-bit
2x Comp
Temp sensor
Cap. Touch

USB 2.0 FS
Crystal-less
SPI, I²C
LP-UART
SAI, Quad-SPI

Cortex-M0+ Core
@ 32 MHz
2.4 GHz Radio
BLE 5
802.15.4
Concurrent mode
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
All in one MCU - Full flexibility control

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

- Multipoint Bluetooth 5™ connections
- Small form factor design with CSP100 pins
- 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
- 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
Radio stack and/or Application FW update

1. New FW package received
2. New FW detected
   Update is launched
IoT Protection Ready (2/5)

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

Closed Sub-system
Radio + Key storage
IoT Protection Ready (3/5)

Radio stack and/or Application FW update

1. New FW package received
2. New FW detected
3. Update is launched
4. 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
5. New FW package is decrypted with proprietary Key. Device upload on going.
IoT Protection Ready (4/5)

Radio stack and/or Application FW update

STM32WB boots on and execute the new application

Closed Sub-system
Radio + Key storage

Radio stack
Empty Flash
FW Application V 2.0

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

Protection ready!
# STM32WB Countermeasure Against Attacks

## Non Invasive Attacks

- Environment modification
  - Temperature
  - Voltage
  - Clock ...
- Fault injection (glitches....)
- Exploit debug features
- Side channel, power Analysis, ...

## Software Attacks

- Low Authentication / Encryption
- Extract keys
- Exploitation of applicative test features
- Malware / Virus
- Replay, privilege escalation

## STM32WB Countermeasures

- Temperature sensor
- Power supply integrity monitor
- Clock security system
- Tamper pads
- Memory ECC, Parity check
- RTC alarm, registers, SRAM mass erase
- JTAG Read out protection
- BOOT from Flash only
- Customer Key Storage (CKS)
- RNG, Crypto accelerator, CRC
- Write memory protection
- Read Out memory protection
- Memory Protection Unit (MPU)
- Root Secure Service (RSS)
- Secure Firmware Update (SFU)
- Proprietary Code Read-Out Protection (PCROP)
- 96-bit ID
Massive cost saving

The more feature integration, the more the BOM drops down!

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
- STM32CubeMonitorRF: Free of charge
- STM32CubeProgrammer: Free of charge
- IDE (IAR™ EWARM; GCC-based IDEs): Free of charge
- Bluetooth™ 5 and 802.15.4 concurrency avoids to use a second radio MCU
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:
- In production
- 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°C to +105°C!
Prototyping made as easy as 1,2,3

Hardware Evaluation Pack

STM32CubeMX
- Code generation
- Power calculation

STM32CubeMonRF
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

More to come after mass market launch

Windows
macOS®
Find easily the MCU that suits YOU

Tablets/Phones/Computers ST MCU Finder

• Browse STM32 & STM8 families wide portfolio and select the product that best fit their needs

• Access to technical information

• Also works offline!

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14 MCU product series / More than 60 MCU product lines

High-performance

Mainstream

Ultra-low-power

Wireless

Cortex-M0
Cortex-M0+
Cortex-M3
Cortex-M4
Cortex-M33
Cortex-M7

Legend: Cortex-M0+ Radio Co-processor

More than
40,000 customers
Releasing Your Creativity

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