



STM32WL welcome

welcome session
revision 1.0



Hello, and welcome to the STM32WL training session

Training session organization



- Introduction
- System
- Memory
- Security & Safety
- Analog
- Communication & Peripherals
- Watchdogs & Timers
- Ecosystem
- Next steps



This session is organized to provide you with the most important information to ensure that you can develop your application as easily as possible. You will find a technical description of all the STM32WB modules including peripherals and development tools organized into specific sections: system, memory, security, analog, peripherals, watchdog and timers and ecosystem.

You can browse each section separately and learn about each module in the order of your choice and at your convenience.

This session also allows you to search directly for a keyword and you will have a direct access to the sections covering this information.

STM32WL series excellence in connectivity



Now, let's take a closer look at the STM32WL new series of wireless microcontrollers.

STM32w15x line - a rich feature set dual-core and enhanced security

Control	Arm® Cortex®-M4 DSP 48 MHz	Memory
Power supply 1.8 to 3.6V w/ DCDC+ LDO POR/PDR/PVD/BOR	Nested vector interrupt controller (NVIC)	Up to 256-Kbyte Flash Up to 64-Kbyte SRAM
Crystal oscillators 32 MHz (Radio + HSE) 32.768 kHz (LSE)	Memory protected unit (MPU)	CM4 or CM0 Boot Lock
Internal RC oscillators 32,768 kHz ± 16 MHz + 48 MHz ± 1% acc. over V and T(°C)	JTAG/SW debug	Boot loader
RTC/AWU/CSS	ART Accelerator™	Hide protect
PLL	AHB Bus matrix	
Systick timer	2x DMA 7 channels	Timers
2 watchdogs (WWDG/IWDG)	Radio	1 x 32-bit timer
43 GPIOs	LoRa®, (G)FSK, (G)MSK, BPSK	3x 16-bit timers 3x ULP 16-bit timers
Cyclic redundancy check	+15dBm & +22dBm Power Outputs -148 dBm sensitivity (LoRa)	Analog
Voltage scaling (2 modes)	150 MHz to 960 MHz	1x 12-bit ADC SAR 2.5 Mbps
		12-bit DAC
		2x ULP comparators
		Temperature sensor
Security	Arm® Cortex®-M0+ 48 MHz	Connectivity
AES 256-bit + TRNG + PCROP	Nested vector interrupt controller (NVIC)	2x SPI, 3x I2C
Tamper detection	Memory protected unit (MPU)	2x USART LIN, smartcard, IrDA, Modem control
Secure Areas	SW debug	1x ULP UART
Secure FW Install		
Debug control		
Boot Selection		
Secure Sub-GHz, MAC Layer, SFI		
Key Management Services		

Optional

KEY FEATURES

- Arm® Cortex®-M4 & DSP up to 48 MHz
- Optional Arm® Cortex®-M0+ up to 48 MHz
- Up to 256 KB Flash and 64 KB SRAM
- **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

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The STM32WL microcontroller is a new series of wireless MCUs with a built-in sub-GHz radio.

It is an evolution of the well-known and market-leading STM32L4 ultra-low-power series of MCUs extended with new peripherals to support the widest range of use cases and enriched with additional low-power functions to improve the overall power efficiency.

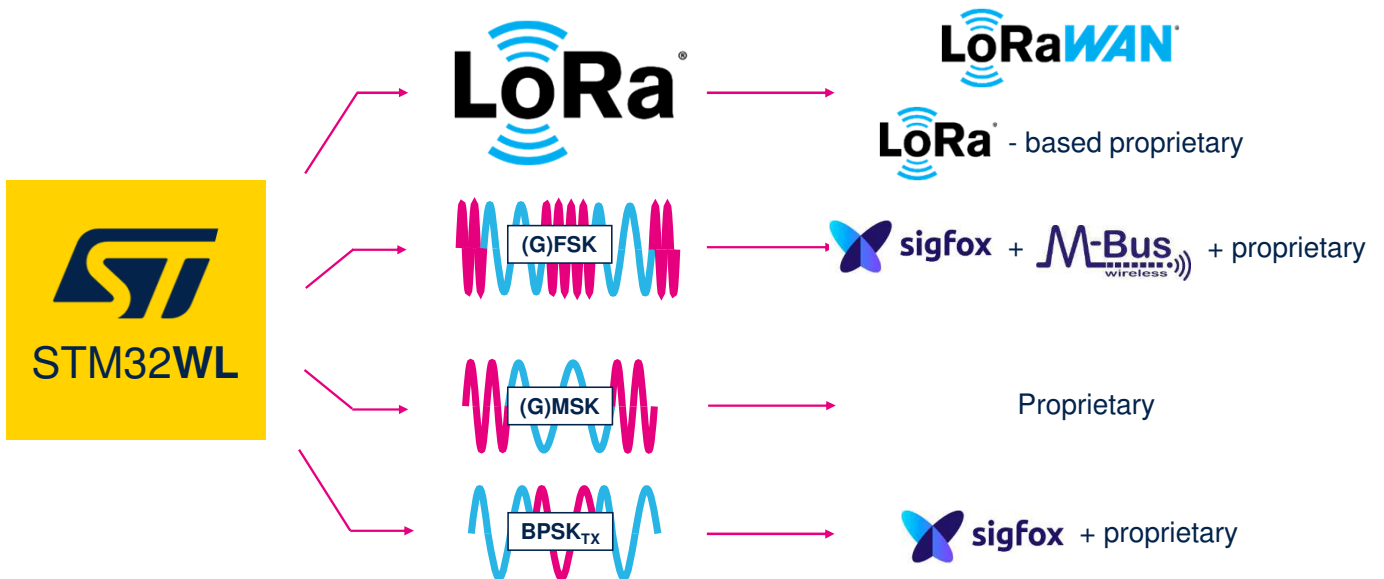
The STM32WL5 product line comes with a dual-core architecture made of a ARM Cortex-M4 core, a Cortex-M0+, and advanced security features.

As you will see in subsequent training modules, STM32WL series is also available through STM32WLE product line which is a single-core product based on ARM Cortex M4 only.

The advantage of such architecture is its full openness and multi-modulation capabilities, enabling users to flexibly

implement any compatible Sub-GHz protocol.

4 modulations - many protocols



Indeed, the four available modulations, namely: LoRa, GFSK, GMSK and BPSK, make STM32WL series suitable for LoRaWAN, Sigfox or W-MBUS implementations for instance.

As the system is fully open, such modulations can also be used for any custom implementation of proprietary protocols, or for many other standardized protocols.

Users will always be free to implement whatever protocol they need on STM32WL series!

Ideal for multiple applications in the LPWAN market

- Worldwide compatibility **150 to 960 MHz** Linear Range
- Multi-protocol capable
- ST Longevity commitment program: continuous supply for **10 years**



Utilities



Industrial IoT

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



Smart
Cities & Buildings



Smart Ag

- Up to **105 °C** MCU capable
- **Only 5 µs wakeup time** for best latencies
- Only 4.82 mA as LoRa RX consumption for battery optimization

- Link Budget > **160 dB** = Very long ranges
- Excellent battery lifetime: Only 15 mA for LoRa TX consumption @ 10 dBm
- **PCROP, ECC, TRNG, PKA**, for best design robustness

- **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**



Logistics



Smart Home

- Down to 71 µA/MHz in Run mode for efficient action
- < 1 µA Stop mode with full RAM for **battery life** optimization
- 12-bit ADC & DAC for mixed applicative use cases



Thanks to its rich set of features, the STM32WL can support a wide range of use cases from Utilities to Smart Homes, from Logistics to industrial monitoring, or any other IoT applications.

Make the choice of the STM32WL series

The 8 key points that make the difference

LoRa
(G)FSK
(G)MSK
BPSK

Multi-modulation



Massive integration
Cost saving



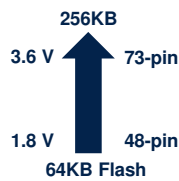
Open dual-core platform



Ultra-low-power



STM32 Security



A large offer



STM32
CubeMonitor

End-to-end ecosystem
(advanced RF testing tool,
C code generation tool...)



No matter what!



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This slide summarizes the 8 key points that make a difference for the selection of the STM32WL microcontroller in a new project.

With multi-modulation, total openness, advanced security features and a large ecosystem, STM32WL is the de-facto choice for long-range Sub-GHz IoT applications.

STM32WL is actually the first and sole LoRa-enabled System-on-Chip in the World! Which finally leads to massive cost savings for device-makers.



STM32 MCU wireless series

More than 60,000 customers

Over 6 billion STM32 shipped since 2007

★ High Perf MCUs

STM32F2
398 CoreMark
120 MHz

STM32F4
608 CoreMark
180 MHz

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

STM32F7
1082 CoreMark
216 MHz

>> Mainstream MCUs

STM32F0
106 CoreMark
48 MHz

STM32G0
142 CoreMark
64 MHz

STM32F1
177 CoreMark
72 MHz

STM32F3
245 CoreMark
72 MHz

STM32G4
550 CoreMark
170 MHz

🔋 Ultra-low Power MCUs

STM32L0
75 CoreMark
32 MHz

STM32L1
93 CoreMark
32 MHz

STM32L5
443 CoreMark
110 MHz

STM32L4
273 CoreMark
80 MHz

STM32L4+
409 CoreMark
120 MHz



📶 Wireless MCUs

STM32WL
161 CoreMark
48 MHz

STM32WB
216 CoreMark
64 MHz

Arm® Cortex® core

-M0

-M0+

-M3

-M33

-M4

-M7



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● Optimized for mixed-signal applications

● Dual-core architecture: Cortex-M4 and M0+

The STM32WL series benefits from ST's long experience in developing STM32 microcontrollers as well as a rich ecosystem based on its hardware and software tools already used throughout the STM32 MCU family.

Releasing your creativity



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Now let's get started with the training. Do not hesitate to follow the events and news about this product on our website at [www.st.com/stm32wl](#).
Enjoy!