



STM32WL – series presentation

series presentation
Revision 1.0



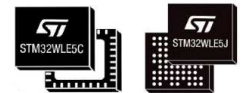
Hello, and welcome to this introduction to the STM32WL Series training session. It describes the feature sets of the various lines available in the STM32WL microcontroller series.

STM32wlex line - a rich feature set

Control	Arm® Cortex®-M4 DSP 48 MHz	Memory
Power supply 1.8 to 3.6 V w/ DDCG+ 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)	Boot Lock Boot loader
Internal RC oscillators 32,768 KHz + 16 MHz + 48 MHz ± 1% acc. over V and T(°C)	JTAG/SW debug	
RTC/AWU/CSS	ART Accelerator™	Timers
PLL	AHB Bus matrix	1 x 32-bit timer
SysTick timer	2x DMA 7 channels	3x 16-bit timers 3x ULP 16-bit timers
2 watchdogs (WWDG/IWDG)	Radio	Analog
43 GPIOs	LoRa®, (G)FSK, (G)MSK, BPSK	1x 12-bit ADC SAR 2.5 Msps
Cyclic redundancy check	+15dBm & +22dBm Power Outputs -148 dBm sensitivity (LoRa)	12-bit DAC
Voltage scaling (2 modes)	150 MHz to 960 MHz	2x ULP comparators Temperature sensor
Security		Connectivity
AES 256-bit + TRNG + PCROP		2x SPI, 3x I2C
Tamper detection		2x USART LIN, smartcard, IrDA, Modem control
		1x ULP UART

KEY FEATURES

- Arm® Cortex®-M4 & DSP 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
- 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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Let's now review some specific features of the STM32WL series.

First of all, the embedded sub-GHz radio benefits from a linear frequency range: from 150MHz up to 960MHz, to cover any local regulation in the world.

There is also multi-modulation compatibility through LoRa, GFSK, GMSK and BPSK. The STM32WL platform being fully open, this means customers can decide to implement any protocol in it, such as LoRaWAN or Sigfox for instance, but also any other custom, proprietary or standardized Sub-GHz protocol.

Two programmable power outputs are available: 15dBm and 22dBm, with 32 steps for each. The 15dBm output is the more optimized one in terms of power-consumption. Both an embedded LDO and an embedded SMPS are available inside the chip as well, so that customers can

adapt the power efficiency of the device according to their applicative needs.

Now in terms of architecture, we already saw on previous slides that the STM32WL series is available through 2 product lines. One is based on a single-core Cortex-M4-based architecture, whereas the other one is a dual-core architecture based on ARM Cortex M4 and M0+.

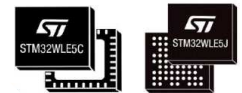
STM32wl5x line - a rich feature set dual-core and enhanced security

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



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



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Specific STM32WL features 1/2

- Autonomous Sub-GHz radio with linear frequency range: [150-960] MHz
- Multi-modulation radio: LoRa, (G)FSK, (G)MSK, BPSK
- 2 fully programmable power outputs: Up to 15dBm, Up to 22dBm
- Integrated SMPS to supply Core and Radio LDO's.
- Dual-core system
 - Cortex M4
 - Secured Cortex M0+
- Single-bank shared Flash

- Fully programmable memory and peripheral security
- HSE fixed frequency at 32 MHz



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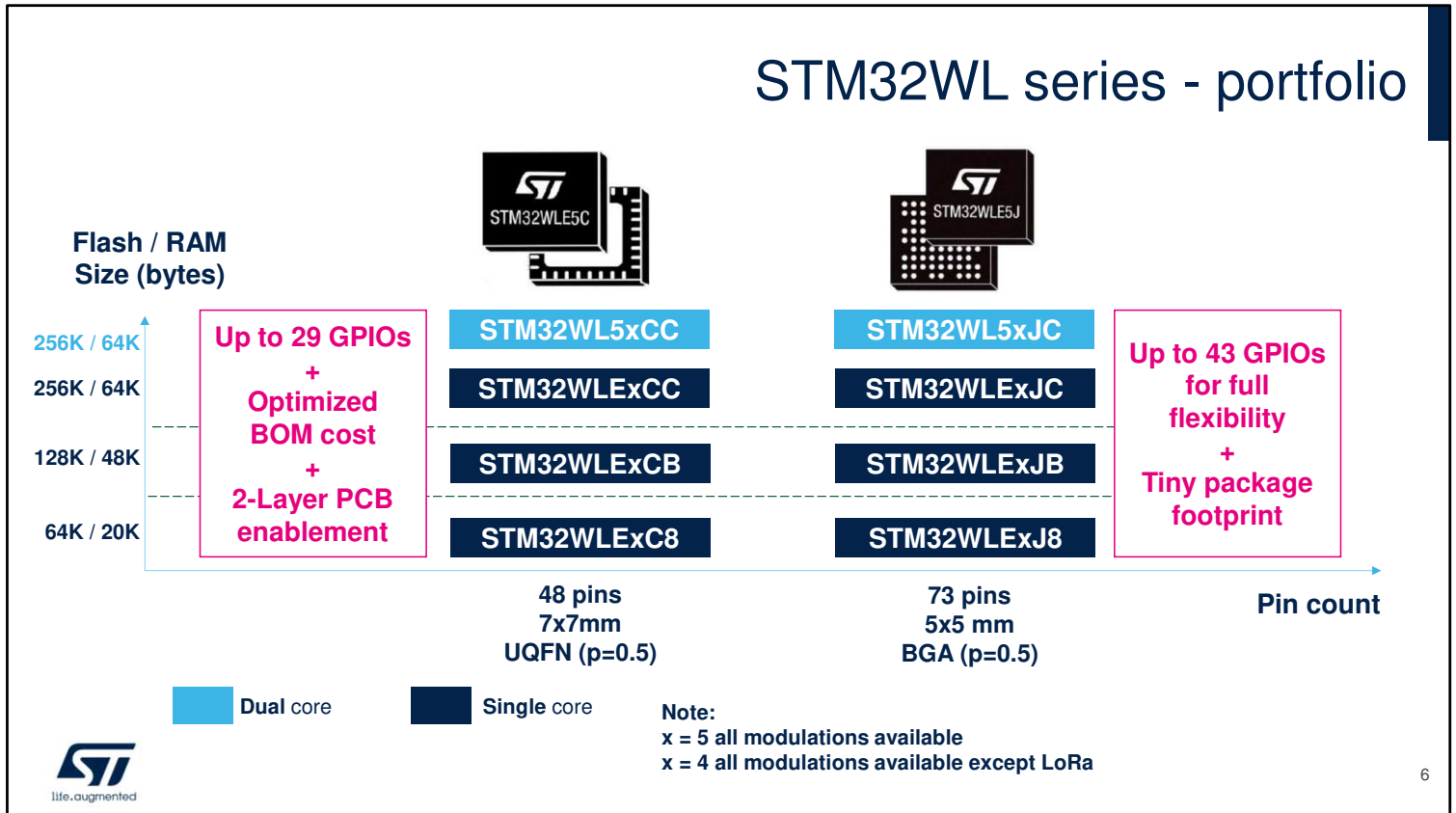
Specific STM32WL features 2/2

- SRAM split in 2 parts
 - SRAM2 backup RAM
 - SRAM1 non-backup RAM
- Security features:
 - Hardware encryption AES 256-bit
 - True random number generator (RNG)
 - Sector protection against read/write operations (PCROP, RDP, WRP)
 - 64-bit and 96-bit Unique IDs
 - Hardware public key accelerator (PKA)
 - Key management services
 - Secure sub-GHz MAC layer
 - Secure Firmware Install and Update SFI / SFU



Both product lines benefit from Safety and Security features. Only the dual-core version of STM32WL series enables advanced security features such as: Key Management Services, a securable Sub-GHz MAC layer or Secure Firmware install and update capabilities for example.

STM32WL series - portfolio



The STM32WL series can be encapsulated in a wide range of packages and part-numbers.

Please note that each package is available with a dual-core or single-core part-number.

Also, users can decide to purchase part-numbers including all the modulations, or all the modulations except LoRa.