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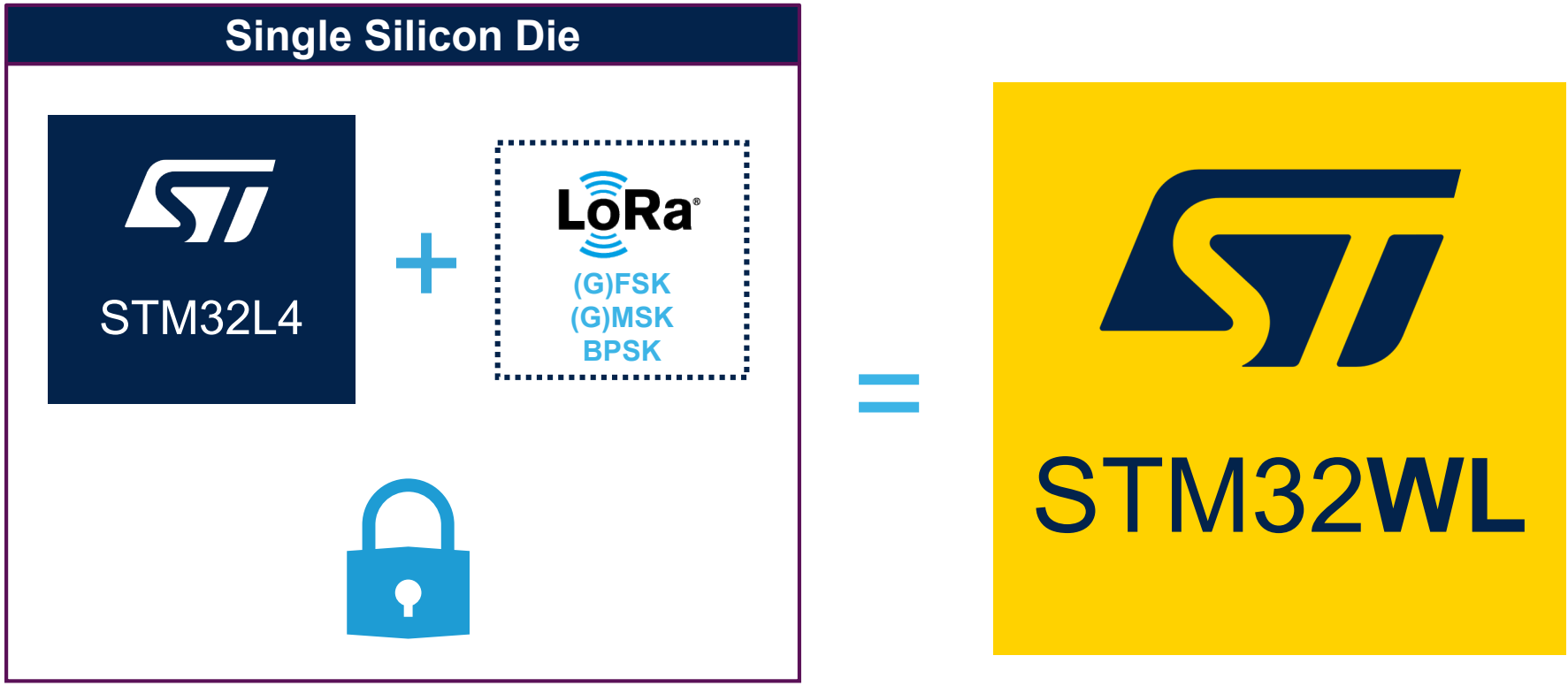
STM32WL series MCU
long-range wireless
system-on-chip

STM32

System-on-chip made for versatility

A Long-Range Wireless Microcontroller:
one die, many IoT possibilities

World First!



Make the choice of STM32WL series

The 7 key points that will make the difference

LoRa™
(G)FSK
(G)MSK
BPSK

Multi-modulation

Massive integration
Cost saving

Open platform

Ultra-low-power

STM32 Security

256KB
3.6 V
73-pin
1.8 V
48-pin
64KB Flash

A large offer is coming

LONGEVITY
10
YEARS
COMMITMENT

No matter what!

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Deep integration
Wide purposes

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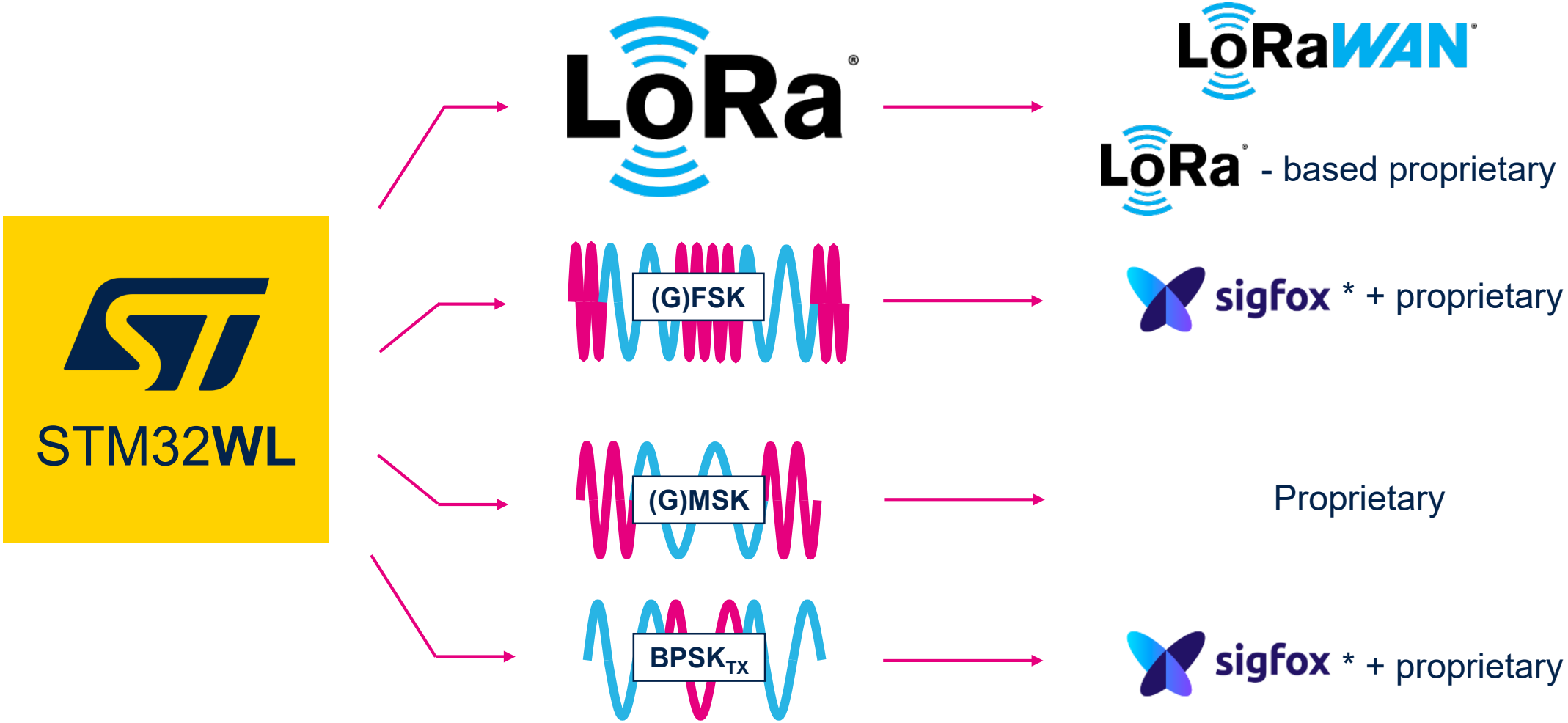
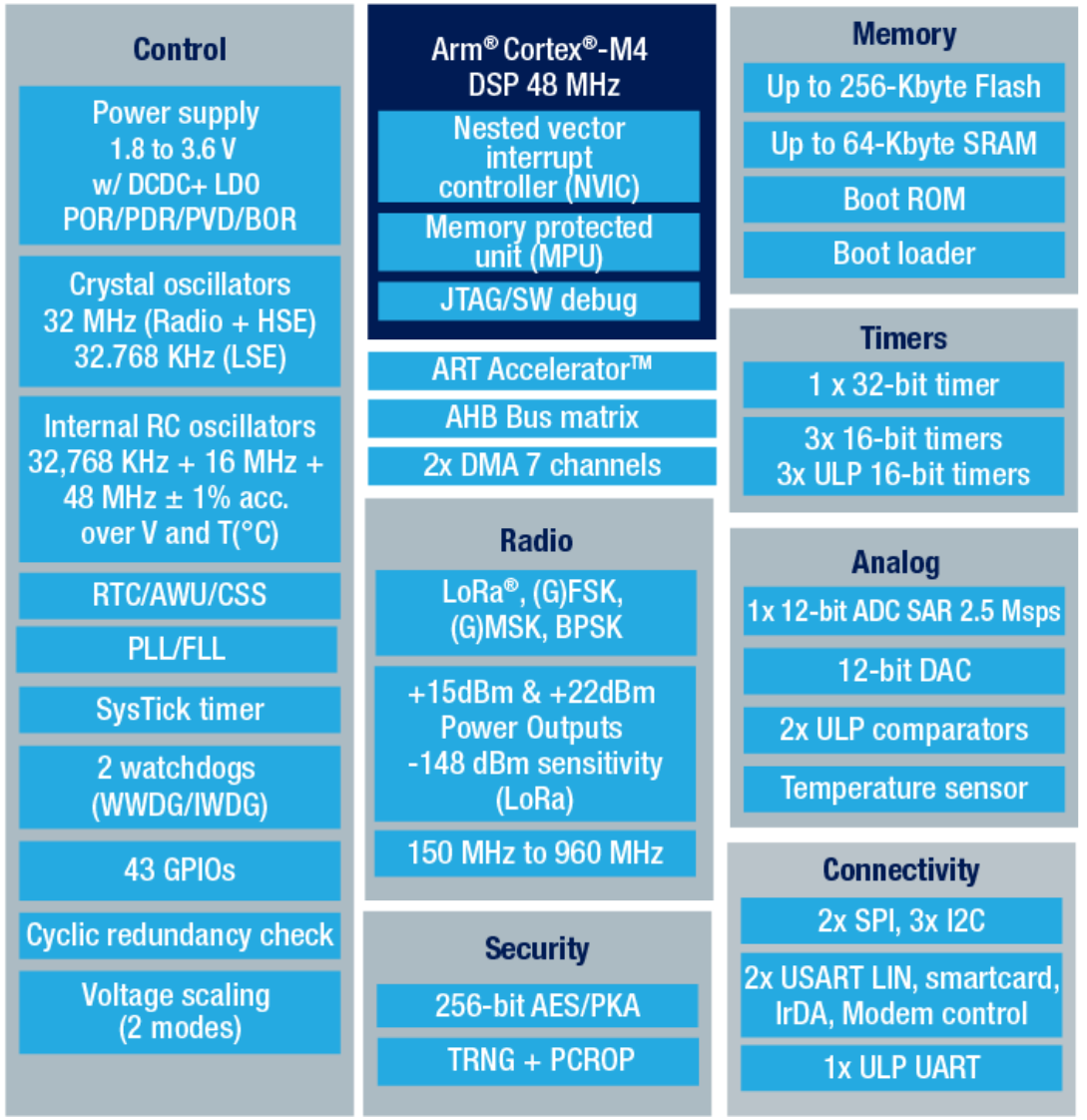
4 modulations - many protocols



* Coming soon

STM32WL - a rich feature set

- Key features
- Arm® Cortex®-M4 DSP up to 48 MHz
- Up to 256 KB Flash and 64 KB SRAM
- Sub-GHz Radio – Multi-modulations
  - 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: 4.82 mA and TX: 15mA (at 10dBm) / 87mA (at 20dBm) [3.3V]
- Peripherals
    - 3xI²C, 2xUSART, 1xLP-UART, 2xSPI
- 7x timers + 2x ULP Comparators
- 1.8 to 3.6V voltage range (DC/DC, LDO)
- -40 to up to +105°C temperature range
  - 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



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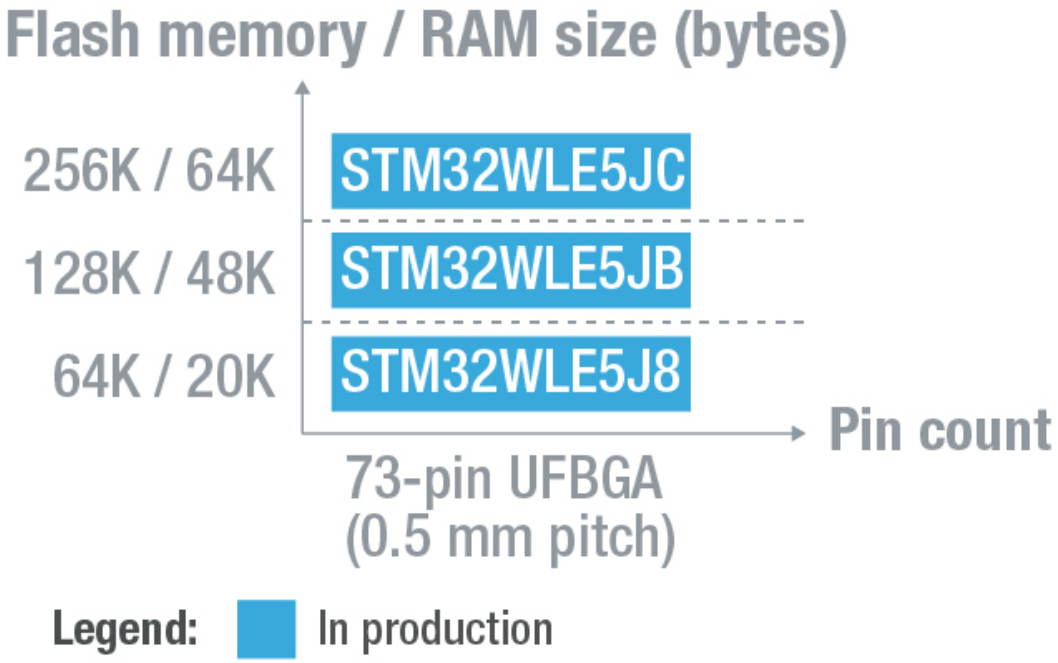
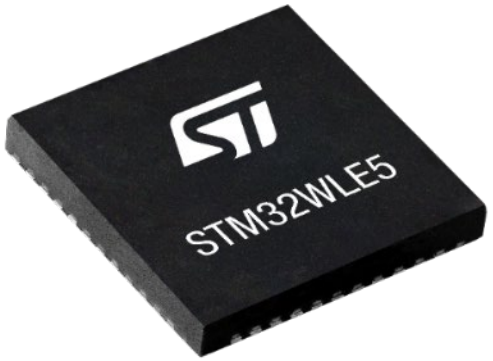
STM32WL Sub-GHz - portfolio





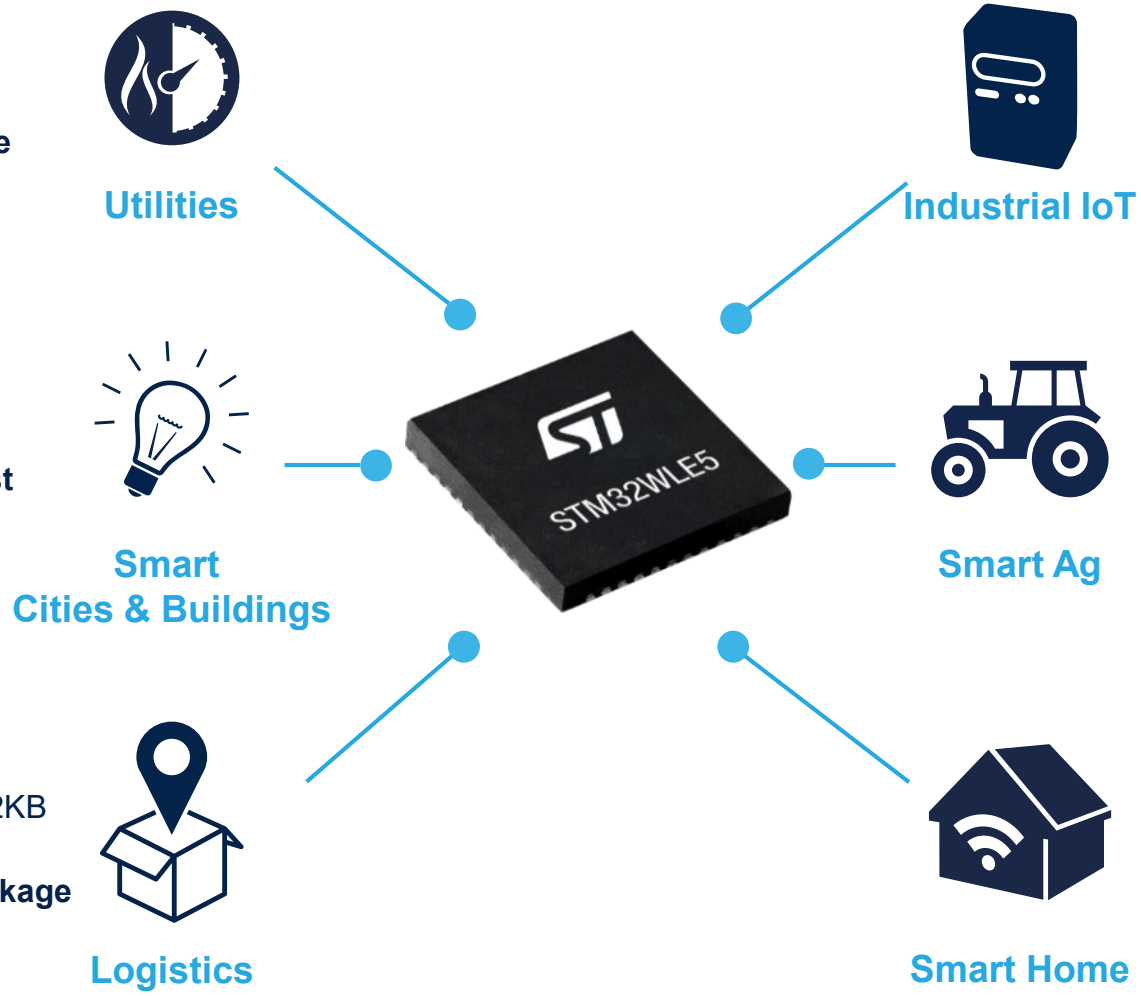
Up to 43 GPIOs for full flexibility
+
Tiny package footprint

Best suited for many LPWAN market

- Worldwide compatibility **150 MHz to 960 MHz** Linear Range
- Multi-protocol capable
- ST Longevity commitment: **10 years life time**

- 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

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



- 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**

- 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

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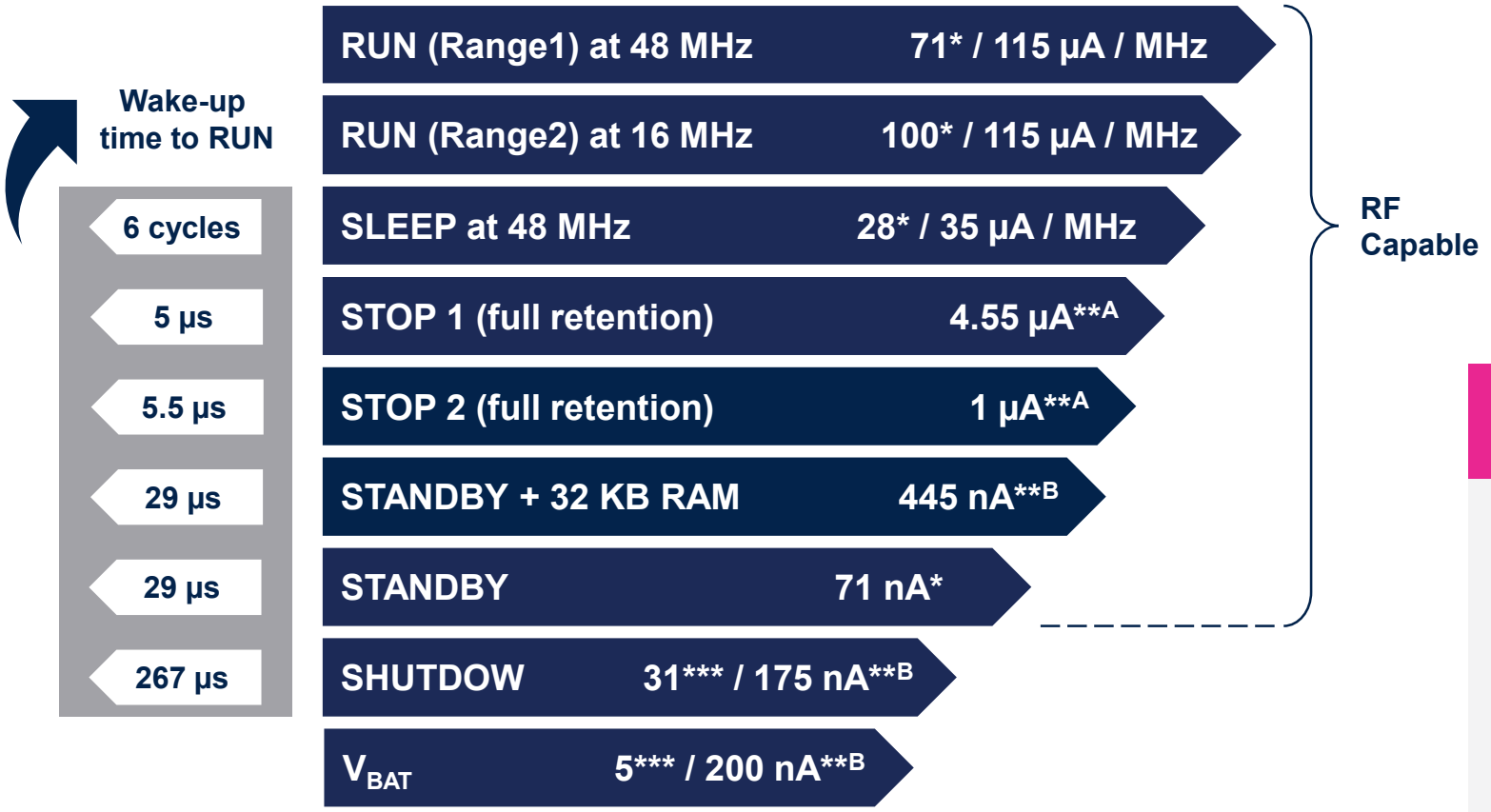
Flexible power scheme

Flexible power scheme FlexPowerControl

Typ with LDO @ V_{DD} = 3 V @ 25 °C



* Typical values with SMPS, RF OFF
**A RTC clocked by LSI / **B RTC clocked by LSE
*** All OFF

Benchmark Scores

- High Efficiency
  - ➔ CoreMark score = 162[1]
- Ultra Low-Power Platform
  - ➔ ULPBbench score ≈ 204[1]

[1] Pending certification

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Flexible power scheme matching your application needs

LPWANs made easy through Ultra-Low-Power tradeoffs

Seamless toolbox
(I²C, SPI, USART, ADC/DAC, Timers, Comparators etc.)

Power mode	Arm® Cortex®-M4	Peripherals	RAM Retention	RF
Run	✓	✓	Yes	✓
Sleep	X	✓	Yes	✓
Stop 0	X	✓	Yes	✓
Stop 1	X	✓	Yes	✓
Stop 2	X	Subset	Yes	✓
Standby	X	X	Yes	✓
Shutdown	X	X	X	X

RF available
In all power modes

Back-up registers are **always** available

Efficient power management
STOP modes comparison

Flexible peripherals power mapping

		STOP0	STOP1	STOP2
Consumption (without Real Time Clock)		Typ, 25 °C, 3 V, LDO		
		400 µA	4.55 µA	1 µA
Wakeup time to 48 MHz	**Flash**	2.2 µs	5 µs	5.5 µs
	RAM	2.2 µs	5.1 µs	5.5 µs
Wakeup clock		≤ 48 MHz		
Regulator		Main or Low-Power regulator		Low-power regulator
Peripherals		All	All	CSS, RTC, 3 Tamper Pins, 1x LPUART, 1x I²C, VREFBUF, 2x COMP, 1x LPTIM, Dual-WDG, CRC, EXTI

No impact on wakeup time from embedded DCDC

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Ultra-low power & iot ready for worldwide applications

Best LoRa-enabled IP on the market

Transmission		
Parameter	Settings	Value
TX	+10 dBm 868/915 MHz	15 mA DCDC
TX	+20 dBm 868/915 MHz	87 mA DCDC

Worldwide Compatibility

Reception		
Parameter	Settings	Value
LoRa Sensitivity	BW_L = 10.4 kHz SF = 12	-148 dBm
2-FSK Sensitivity	BR_F = 0.6 kb/s FDA = 0.8 kHz BW_F = 4 kHz	-125 dBm
RX	FSK 4.8kb/s buck 100mA max	4.47 mA DCDC 8.18 mA LDO
RX	LoRa® 125 kHz	4.82 mA DCDC 8.9 mA LDO

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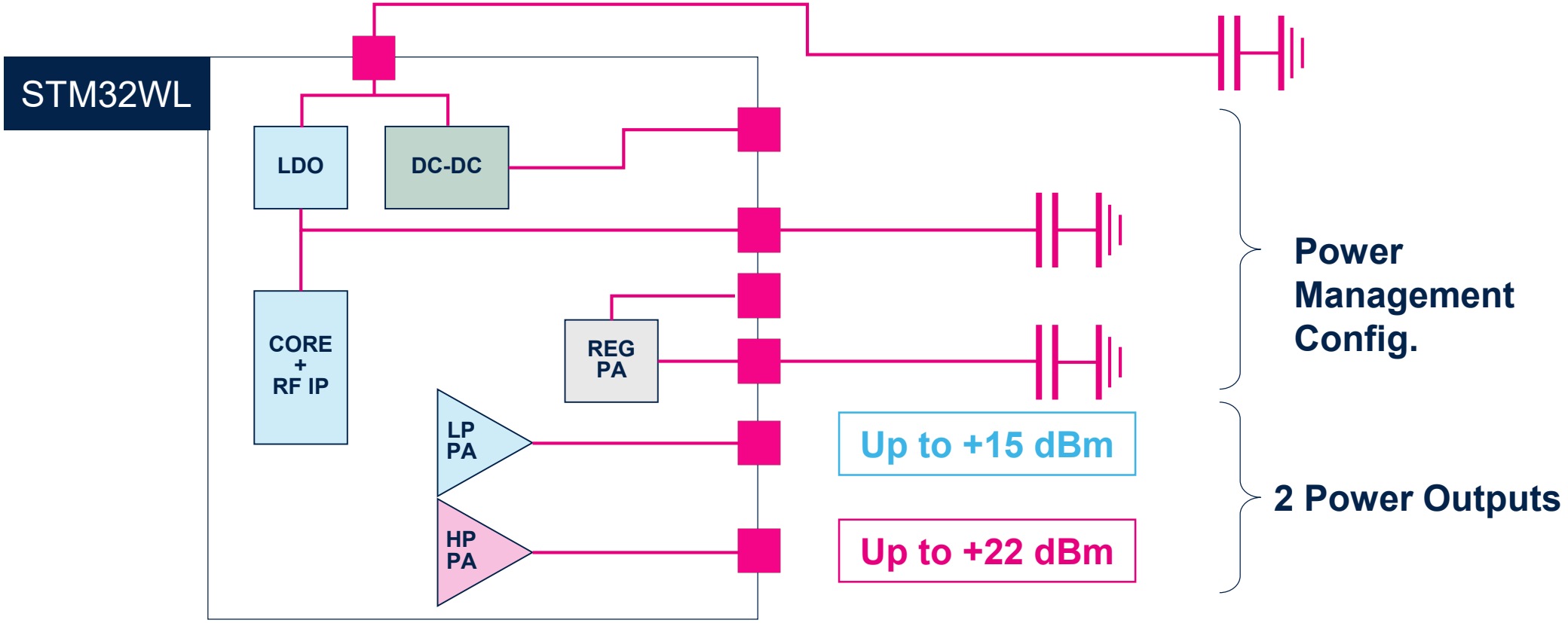
Flexible power implementation

Tailor STM32WL to your IoT needs



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Advanced features and ecosystem

STM32WL - safety and security

Secure you application with embedded safety & security

Safety

- Back-up clock circuitry
- Supply monitoring
- Dual watchdog
- Flash memory with ECC (address status register)
- SRAM Parity check
- Cyclic Redundancy Check
- Brown-out reset in all modes
- Clock Security System
- Backup byte registers

Device integrity

Data Integrity

STM32**WL**

Security

- Anti-Tamper detection
- Boot Lock
- Read & Write protection
- Memory Protection Unit (MPU)
- Software IP Protection
- True Random Number Generator
- Private Key Accelerator
- Unique IDs (64- and 96-bit)

Anti intrusion Traceability

Privileges Permission Management

Firmware IP Protection

Data encryption

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Chips & stacks delivery model

Open chips, takeaway stacks

STM32WL

Arm Cortex-M4

Application Firmware
+
Peripherals
+
Radio stack

- **Open Platform**
- **Open stack**

LoRaWAN®

Certified LoRaWAN stack

Please contact your nearest ST Sales Office for more information

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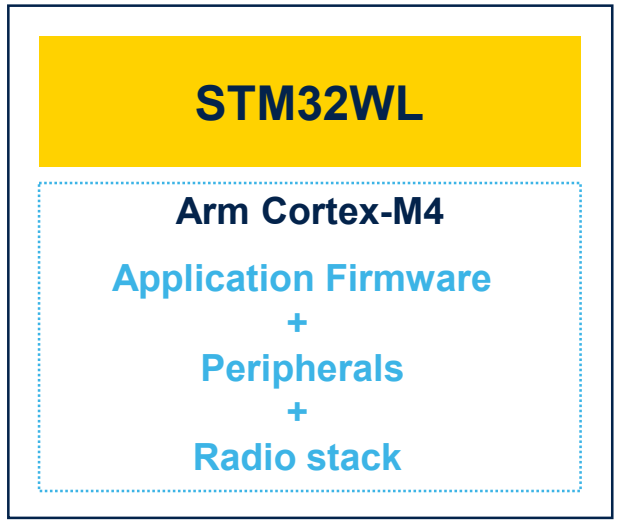
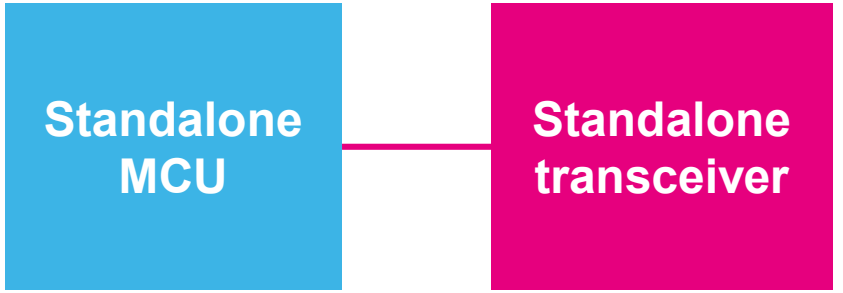
A higher level of integration

MCU + Radio 2-in-1 solution



VS



- SoC solution **(1 single die)**
- **All-in-1** solution - cost saving
- Simplified development helps speeding up time to market

- **2 standalone chips, or dice (SiP)**
- Bigger final PCB (increased cost)
- Wired communication more exposed

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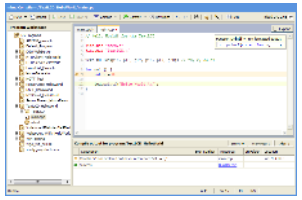
STM32WL – introductory ecosystem

Fully integrated into the rich and market-proven STM32 ecosystem

STM32 CubeProgrammer

STM32 CubeMX



arm KEIL

IAR SYSTEMS

LoRaWAN

sigfox

STM32 Nucleo-64	Dev tools	Stacks
Flexible prototyping	STM32CubeMX for pinout and clock configuration STM32CubeProg Partners IDE	LoRaWAN Sigfox[1]

[1] Coming soon

Please contact your nearest ST Sales Office for more information

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Save on your application cost

Integrated functionalities helps you drop the BOM down

Optimization of the silicon cost

- Deep integration factor
- Less external components
- Single 32 MHz crystal for CPU & embedded radio
- 32 kHz master clock output available

Optimization of the ecosystem cost

- LoRaWAN stack: free of charge
- STM32CubeMX: free of charge
- STM32CubeProg: free of charge
- System-on-chip avoids to use a second radio

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STM32 rolling longevity commitment

Longevity commitment is renewed every year

Starting in 2020

- **STM32F1** (launched in **2007**) — **22 years** of commitment
- **STM32L1** (launched in **2009**) — **20 years** of commitment
- **STM32F2** (launched in **2010**) — **19 years** of commitment
- **…**
- **STM32WB** (launched in **2018**) — **11 years** of commitment
- **STM32G0** (launched in **2018**) — **11 years** of commitment
- **STM32G4** (launched in **2019**) — **10 years** of commitment
- **STM32WL** (launched in **2020)** — **10 years** of commitment

STM32 MCU “Wireless” series

High Perf MCUs			STM32**F2** 398 CoreMark 120 MHz		STM32**F4** 608 CoreMark 180 MHz	**STM32H7** 3224 CoreMark 240 MHz Cortex -M4 480 MHz Cortex -M7	STM32**F7** 1082 CoreMark 216 MHz
Mainstream MCUs	STM32**F0** 106 CoreMark 48 MHz	STM32**G0** 142 CoreMark 64 MHz	STM32**F1** 177 CoreMark 72 MHz		STM32**F3** 245 CoreMark 72 MHz	STM32**G4** 550 CoreMark 170 MHz	
Ultra-low Power MCUs		STM32**L0** 75 CoreMark 32 MHz	STM32**L1** 93 CoreMark 32 MHz	STM32**L5** 424 CoreMark 110 MHz	STM32**L4** 273 CoreMark 80 MHz	STM32**L4+** 409 CoreMark 120 MHz	
Wireless MCUs				NEW STM32**WL** **161 CoreMark** **48 MHz**		STM32**WB** 216 CoreMark 64 MHz	
Arm® Cortex® core	-M0	-M0+	-M3	-M33	-M4		-M7

LONGEVITY 10 YEARS COMMITMENT

● Optimized for mixed-signal applications

● Cortex-M0+ Radio co-processor

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Thank you

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