life.augmented

STM32L5 MCU series excellence in ultra-low-power with more security

STM32

The STM32 portfolio

Five product categories

- **Wireless MCU** — Short- and long-range connectivity
- **Ultra-low-power MCU**
- **Mainstream MCU**
- **High-performance MCU**

32-bit general-purpose microcontrollers: from 75 to 3,224 CoreMark score

- **Embedded MPU** — 32- and 64-bit microprocessors





Enabling edge AI solutions

Scalable security

MPU portfolio

MCU portfolio

Main concerns for embedded design

	**Security**	Increase the robustness against attacks
	**Low power consumption**	Long lifetime, small battery size
	**Integration, performance, ecosystem**	Best fit versus the application requirements

First STM32 based on Arm® Cortex® -M33

STM32L5 is the answer

More security with TrustZone and ST security implementation

- HW to increase resistance to logical and board level attack

Lower Power consumption

- STM32 ultra-low-power technology

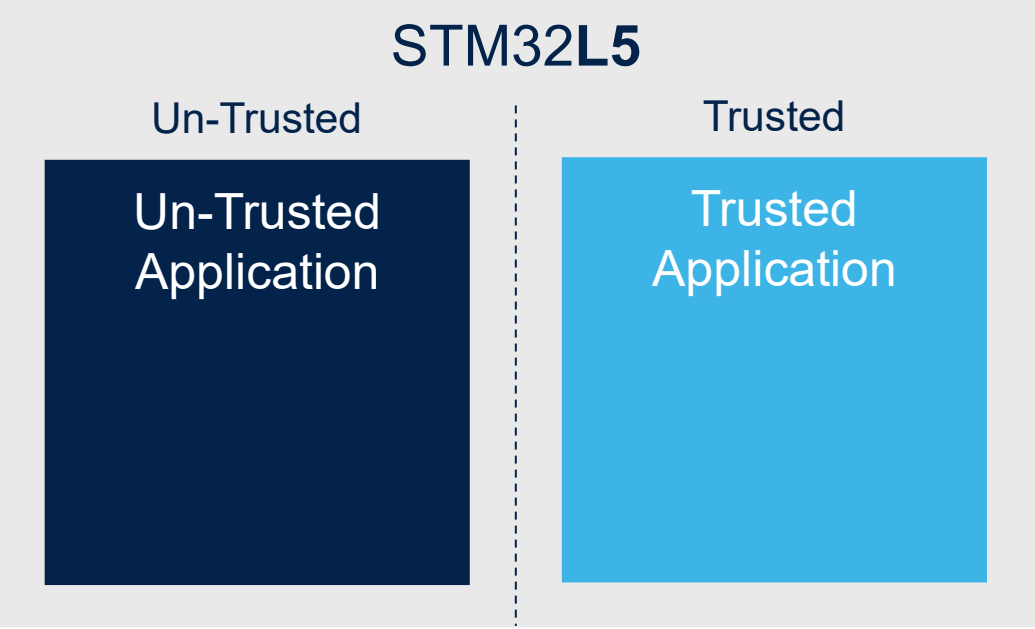
Integration, performance, ecosystem

- More performance, choice of packages and wide ecosystem

life.augmented

Security: TrustZone for isolation

ST implementation provides a high granularity of isolation

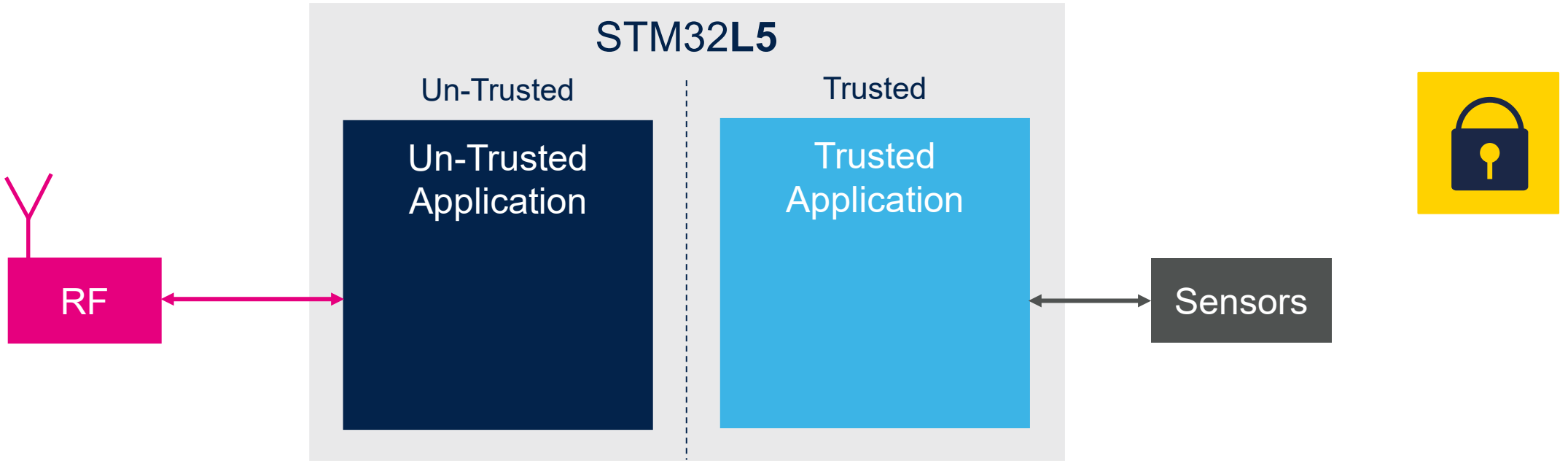


- **Each** GPIO or peripheral, DMA channel, clock configuration register, ART or small part of Flash memory or SRAM can be configured as **Trusted** or **un-Trusted**
- **Full isolation** of trusted and non-trusted worlds

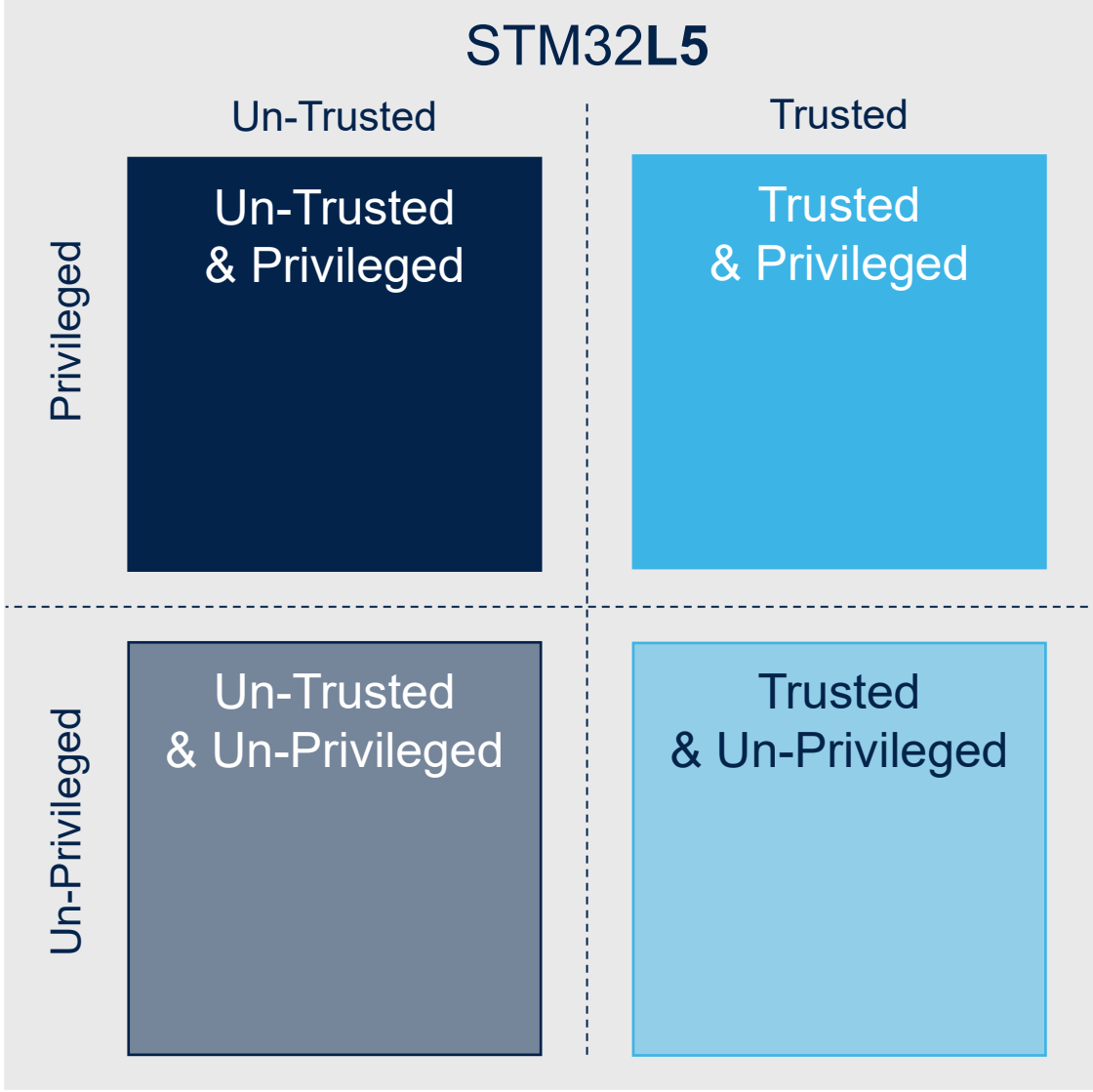
Security: TrustZone for isolation

TrustZone provides full isolation

Example of IoT application implementation

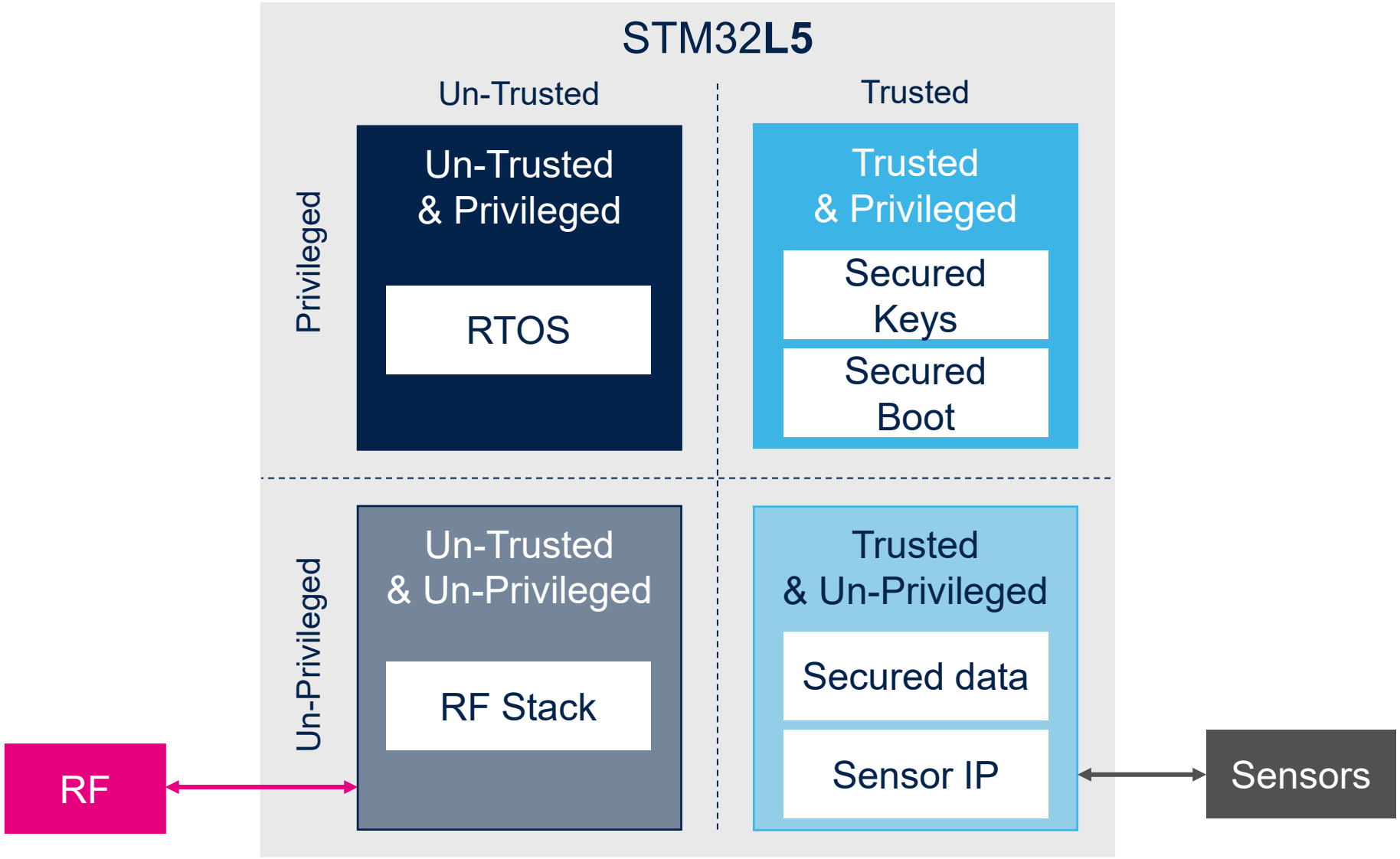


Security: TrustZone and privileged zones



- More partitioning
- Possibility to separate the trusted and un-trusted area with **privileged and un-privileged** zone
- Strong **granularity** to define each part of memory or each peripheral, DMA channel as privileged or un-privileged

TrustZone: example



A full set of security

Encryption
Decryption
Authentication

- AES-128/256 Encryption
- SHA-256 Authentication
- **Public Key Acceleration (PKA): for RSA, Diffie-Hellmann or ECC (Elliptic Curve Cryptography)**
- Certified Crypto library
- True Random Number Generator
- Unique ID
- OTP Zone

STM32**L5**

Memory & IP Protection

- **Active and static Anti-tamper detection**
- Memory Protection Unit (MPU)
- Secure Boot
- Read and Write Protection
- **HDP (Hide Protect)**
- **Unique Boot Entry**
- **OTFDEC (On-the-fly decryption) on Octo SPI to protect external memory**
- JTAG fuse
- **TrustZone**
- **SFI (Secure Firmware Installation)**

life.augmented

Extends battery lifetime

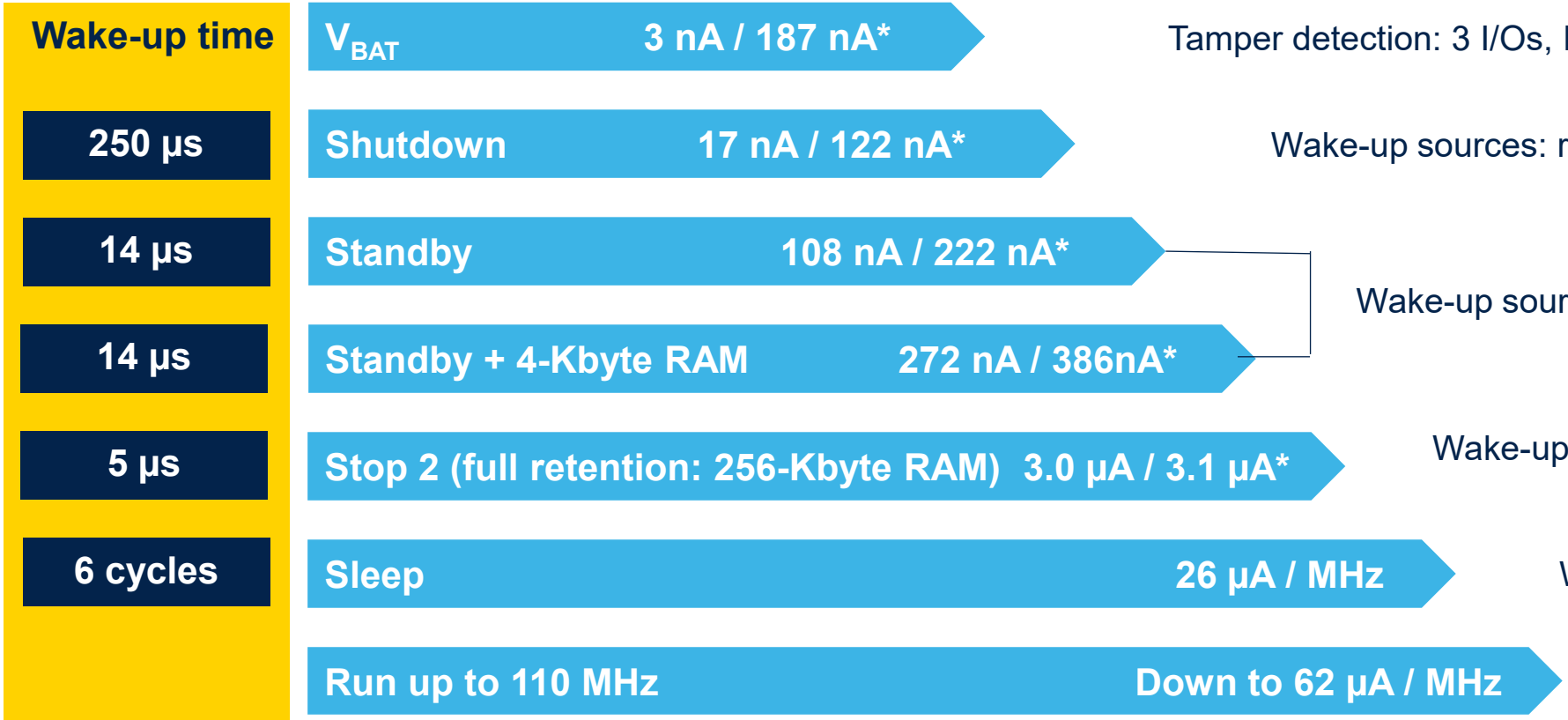
- STM32L5 reuses the STM32L4/L4+ technology achieving **best-in-class** power consumption
- STM32L5 integrates an optional **SMPS** (DC/DC buck voltage regulator) which can be enabled/disabled on the fly to avoid external noise for external RF or data acquisition.
- Proven by EEMBC test results:

ULPBENCH™ An EEMBC Benchmark	**370 ULPMark-CP™**
ULPBENCH™ An EEMBC Benchmark	**54 ULPMark-PP™**
COREMARK® An EEMBC Benchmark	**443**

life.augmented

Ultra-low-power modes

Best power consumption numbers with full flexibility

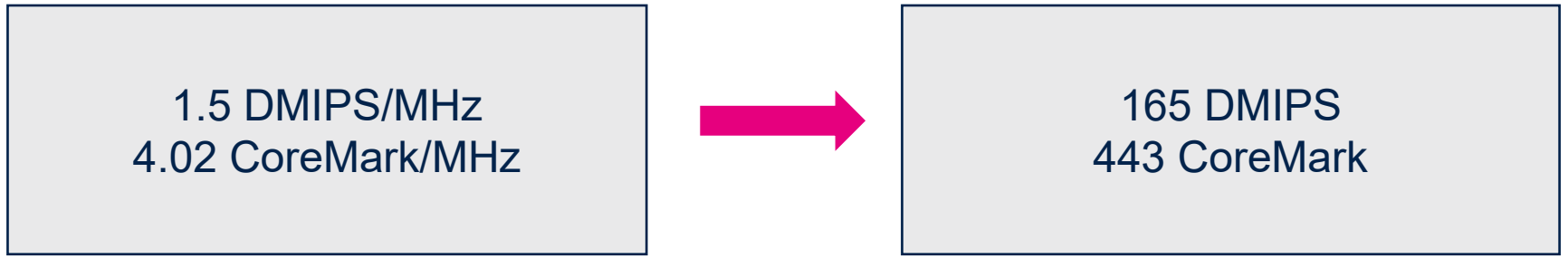


Note : * without RTC / with RTC

More performance

Better responsiveness of the application

- **New** Arm® Cortex®-M33 performance: **+20%** versus Cortex-M4



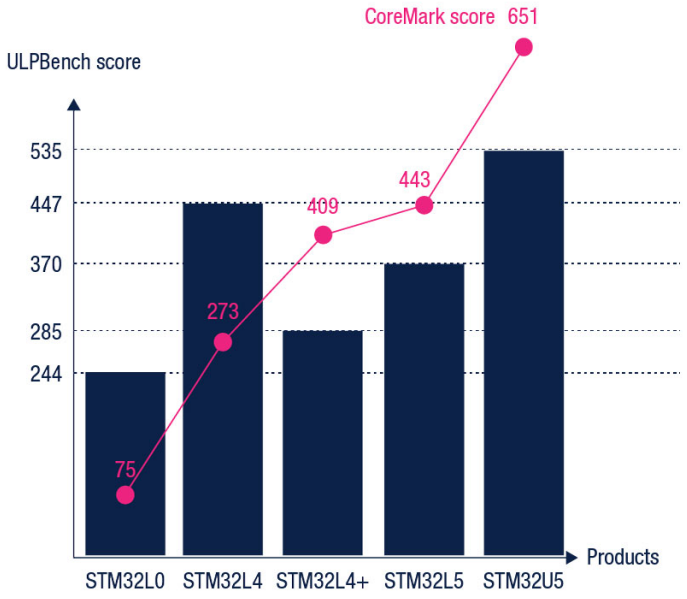
- **New** ST ART Accelerator™: working both on internal and **external** Flash
  - 8 Kbytes of instruction cache

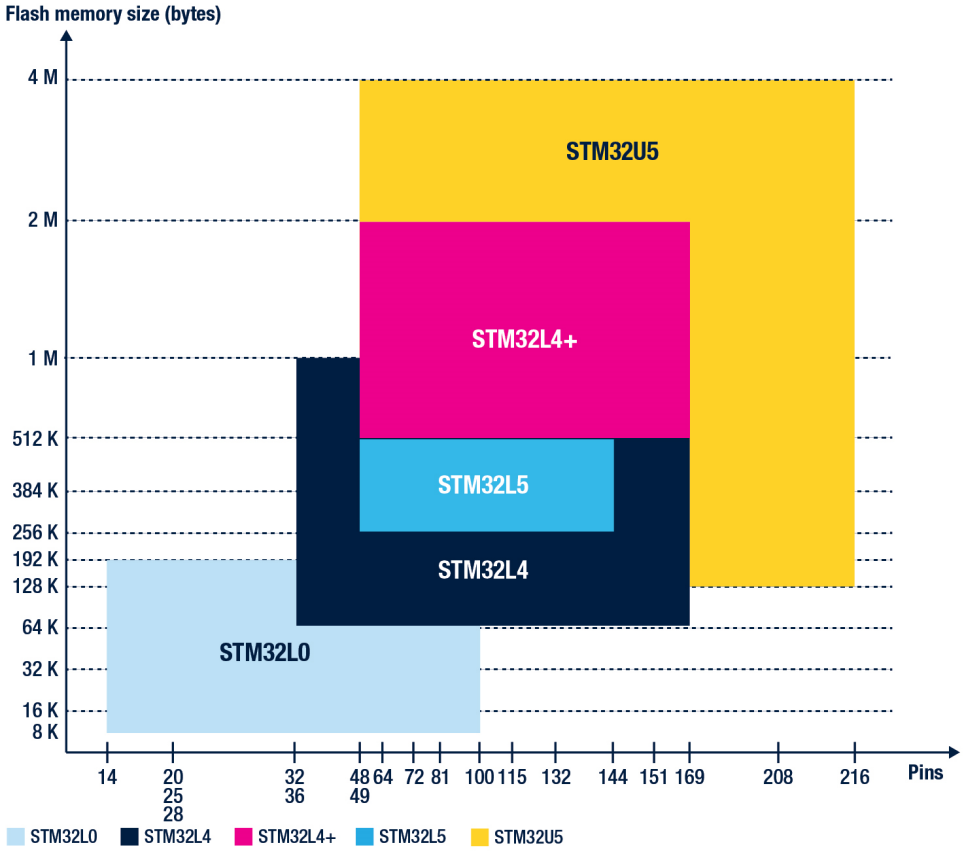
STM32L, a complete offer

STM32L5 completes the ultra-low-power family

STM32 Ultra-low power MCUs
32-bit Arm® Cortex®-M

STM32U5	• 32-bit Arm® Cortex®-M33 + FPU at 160 MHz • From 1 to 4 Mbytes of Flash memory • Lowest power mode + RAM + RTC: 0.35 µA
STM32L5	• 32-bit Arm® Cortex®-M33 + FPU at 110 MHz • From 256 to 512 Kbytes of Flash memory • Lowest power mode + RAM + RTC: 0.35 µA
STM32L4+	• 32-bit Arm® Cortex®-M4 + FPU at 120 MHz • From 512 Kbytes up to 2 Mbytes of Flash memory • Lowest power mode + RAM + RTC: 0.39 µA
STM32L4	• 32-bit Arm® Cortex®-M4 + FPU at 80 MHz • From 64 Kbytes to 1 Mbyte of Flash memory • Lowest power mode + RAM + RTC: 0.34 µA
STM32L0	• 32-bit Arm® Cortex®-M0+ at 32 MHz • From 8 to 192 Kbytes of Flash memory • Lowest power mode + RAM + RTC: 0.67 µA





life.augmented

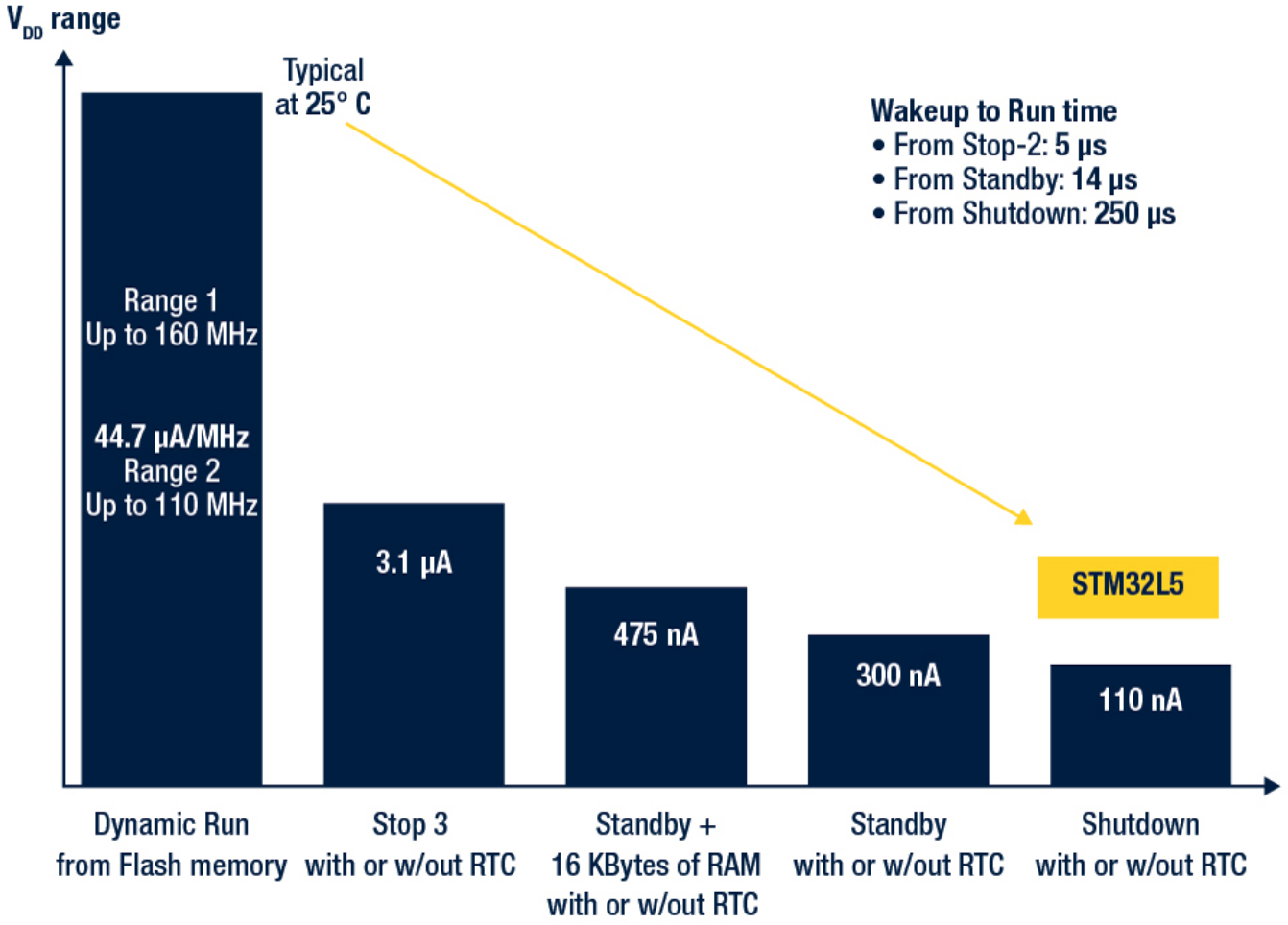
STM32L5 MCU series

- ART Accelerator™
- USART, SPI, I²C
- Octo-SPI
- 16- and 32-bit timers
- SAI + audio PLL
- SHA, TRNG
- 2x 12-bit DAC
- Temperature sensor
- Low voltage 1.71V to 3.6V
- V_{bat} mode
- Unique ID
- Capacitive Touch sensing

Product line	Flash (KB)	RAM (KB)	Memory I/F	2x Op-Amp	2x Comp	4ch / 2x Sigma Delta Interface	12-bit ADC 5 Msps 16-bit HW oversampling	USB 2.0 Device XTAL-less USB Type-C & Power Delivery	CAN-FD	AES, PKA, OTFDEC 128-/256-bit
STM32L552 USB Device & CAN-FD	512 to 256	256	SDIO FSMC Octo SPI	•	•	•	2	•	•	
STM32L562 USB Device & CAN-FD & AES	512 to 256	256	SDIO FSMC Octo SPI	•	•	•	2	•	•	•

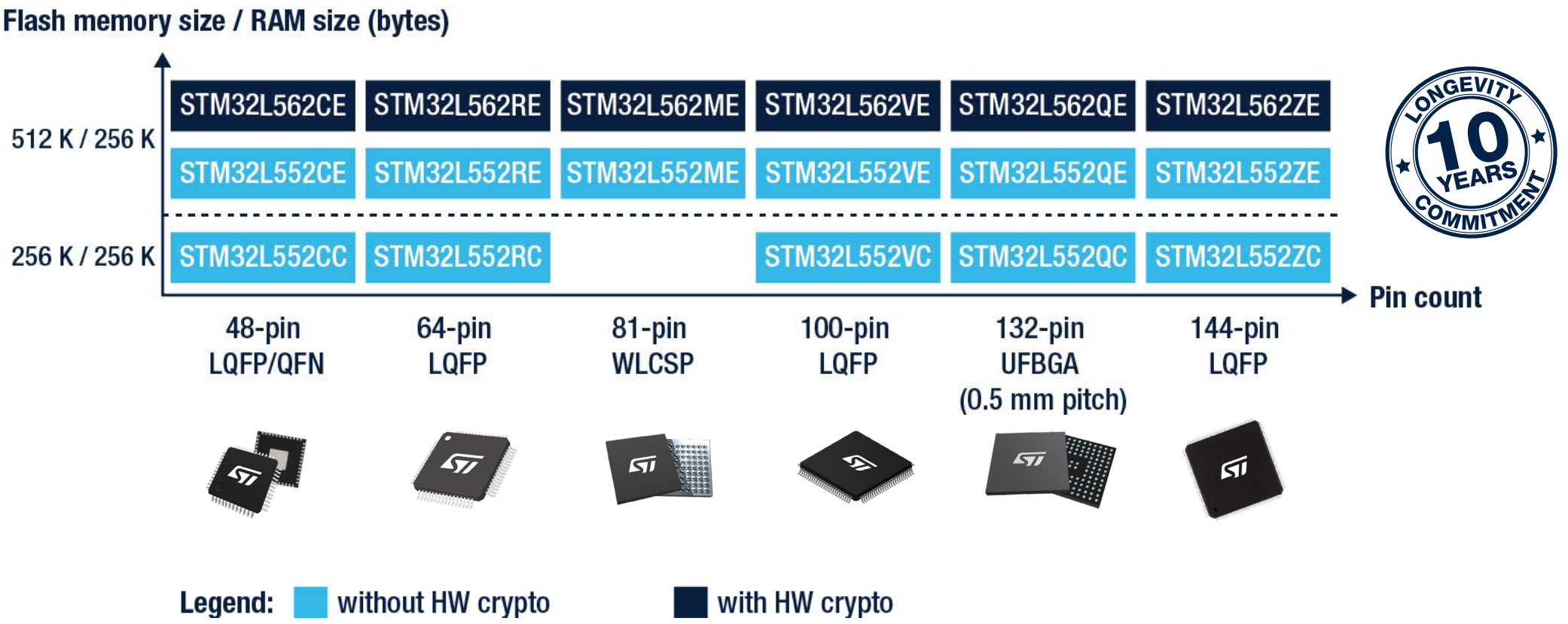
life.augmented

STM32L5 ULTRA-LOW-POWER



Large portfolio

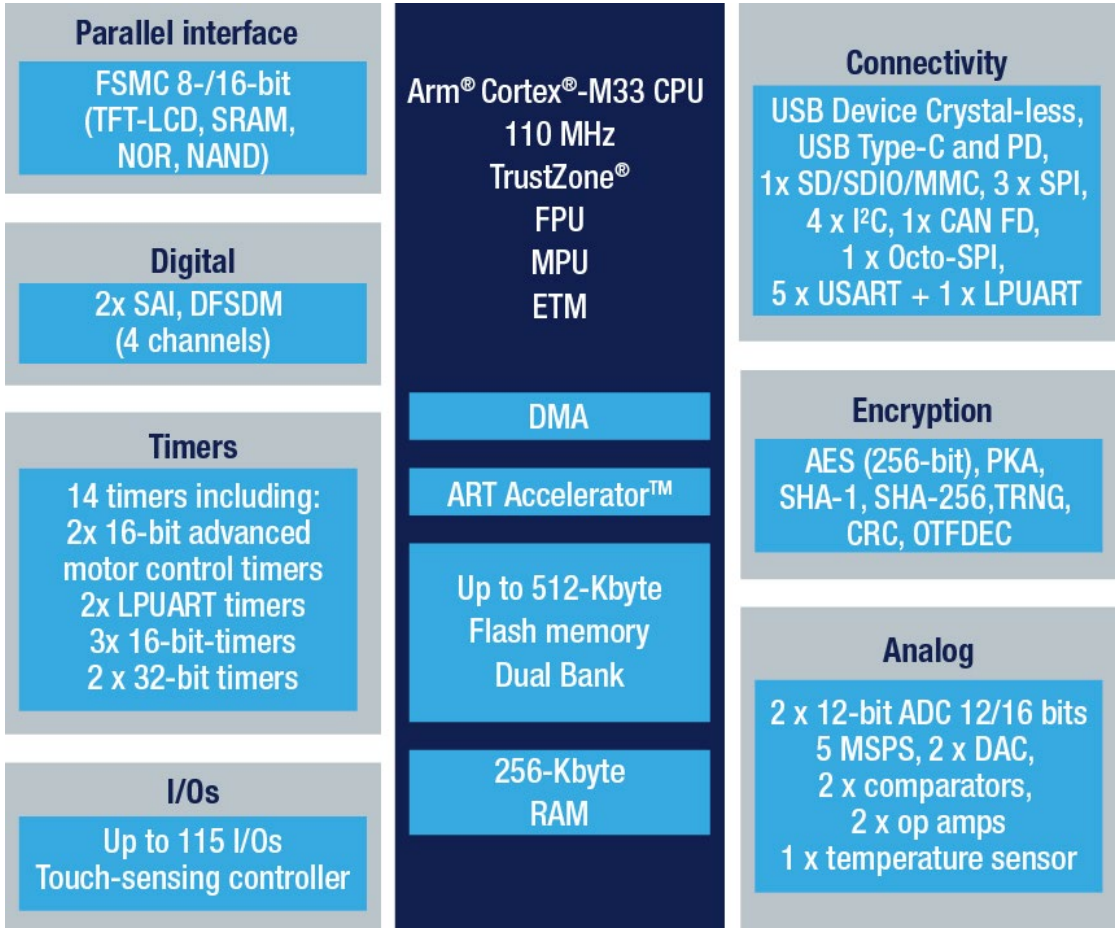
7 packages, several options



life.augmented

High integration and innovation

Large memory, USB Type-C™ w/ power delivery controller, CAN FD



STM32L ULP portfolio

STM32L5 completes the ultra-low-power subclass

Cost-smart ULP champion	ULP With performance	ULP with more performance	ULP with security	ULP & Security
STM32L0	**STM32L4**	**STM32L4+**	**STM32L5**	**STM32U5**
Cortex-M0+ at 32 MHz 1.65 to 3.6V 8-/16-bit applications Wide range of pin-counts	Cortex-M4 w/ FPU at 80 MHz 1.71 to 3.6V High-performance, advanced analog circuits	Cortex-M4 w/ FPU at 120 MHz 1.71 to 3.6V Wide choice of memory sizes	Cortex-M33 w/ FPU at 110 MHz 1.71 to 3.6V Wide choice of memory sizes	Cortex-M33 w/ FPU at 160 MHz 1.71 to 3.6V Wide choice of memory sizes
4 product lines, Cost-effective, Smaller packages, USB, LCD, Analog 8 to 192 Kbytes of Flash, Up to 20 Kbytes of SRAM	5 product lines, 5-MSPS ADC, PGA, Compar., DAC, Op Amp, USB OTG, LCD, AES 64 Kbytes to 1 Mbyte Up to 320 Kbytes of SRAM	4 product lines, 5-MSPS ADC, PGA, Compar., DAC, Op Amp, USB OTG, LCD, AES 1 to 2 Mbytes of Flash, Up to 640 Kbytes of SRAM	1 product line, 5-MSPS ADC, PGA, Compar., DAC, Op Amp, USB Type C, AES 256 to 512 Kbytes of Flash, Up to 256 Kbytes of SRAM	4 product lines, 5-MSPS ADC, PGA, Compar., DAC, Op Amp, USB Type C, AES 128 Kbytes to 4 Mbytes of Flash, Up to 2514 Kbytes of SRAM

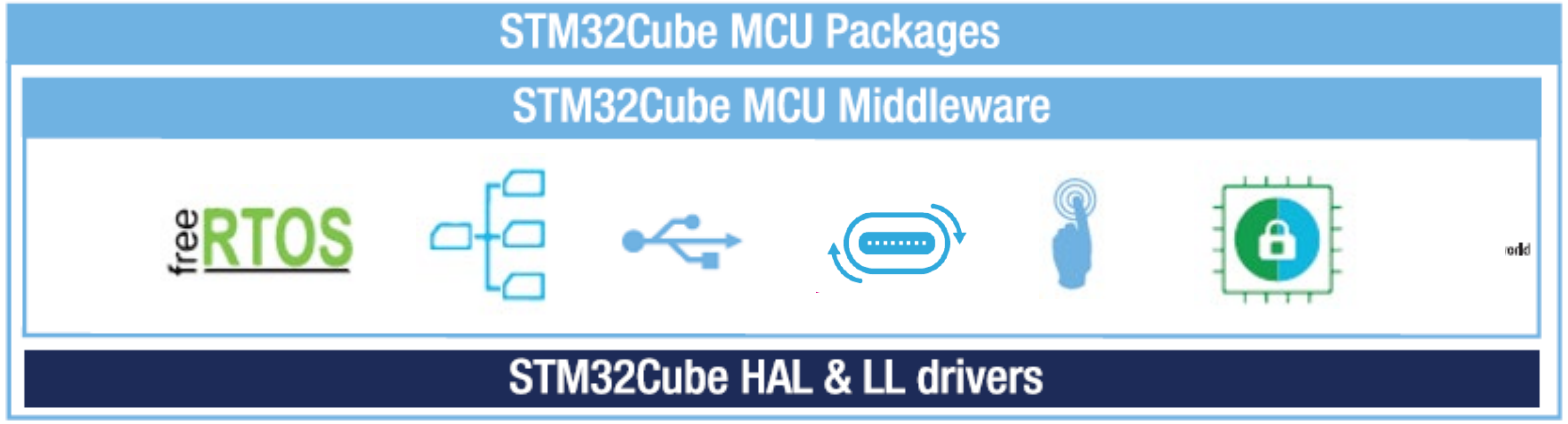
life.augmented

A complete ecosystem

life.augmented

STM32CubeL5
One-stop-shop software package

STM32 CubeMCU Packages



Peripheral drivers

HAL API

Hardware Abstraction Layer, highly portable and easy to use

LL APIs

Low-Layer APIs, light weight and highly optimized for runtime efficiency

STM32Cube Middleware

Generic Middleware

- **FreeRTOS**
- FatFS file system
- **mbedTLS** and **mbedCrypto**
- USB Device stacks

Dedicated Middleware

- **Secure Boot and Secure Firmware Update**
- **TF-M for trusted execution environment**
- **USB-PD device driver**
- STM32 Touch Sensing library

Project Examples

STM32CubeMX ready

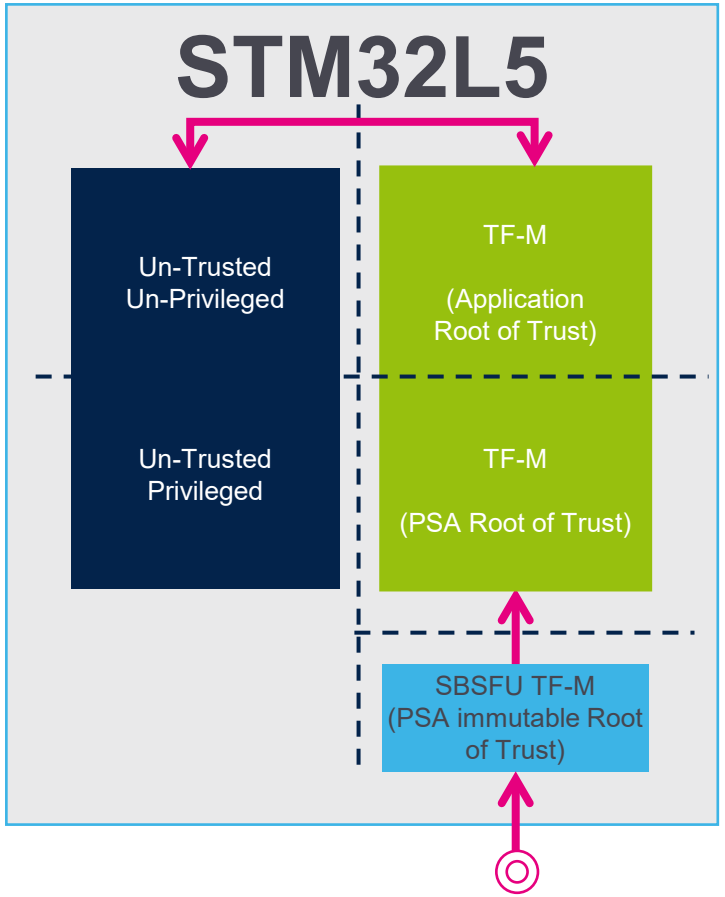
More than 300 project examples for KEIL, IAR and STM32CubeIDE toolchains, with a STM32CubeMX configuration file

www.st.com/stm32cubel5

life.augmented

SBSFU and TF-M in STM32CubeL5

Reference code framework for a trusted Execution Environment



TF-M Framework

- Isolation and Secure execution
- Secure services (crypto, initial attestation, secure storage)
- Easy addition of user secure services
- Leveraging STM32L5 security features

SBSFU TF-M

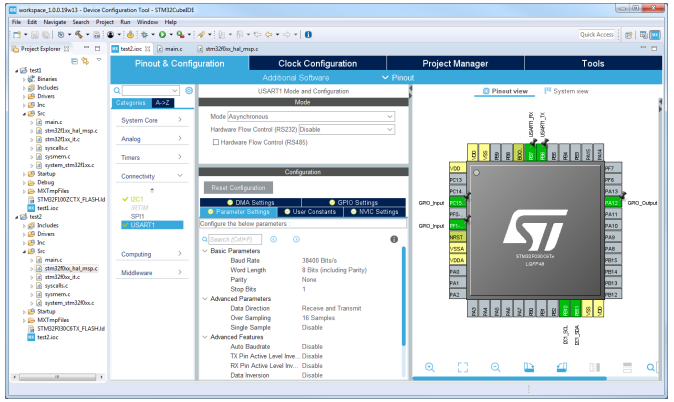
- Secure Boot
- Secure Firmware Update

life.augmented

STM32L5 is one of the first MCU PSA Level 2 certified

STM32CubeIDE

All-in-1 STM32 development tool



STM32 CubeIDE

Configure and generate code

STM32CubeMX integrated

STM32 CubeMX

Develop code, Compile and Link

TrustZone support

- TrueSTUDIO / SW4STM32 importer
- Advanced editor
- GNU C/C++ for Arm® toolchain

Program and Debug

TrustZone support

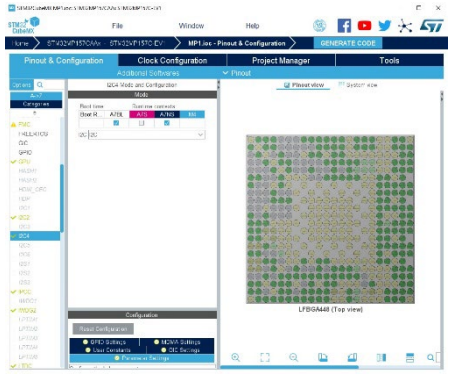
- GDB and OpenOCD debugger
- Support of ST-Link and J-Link debug probes

life.augmented

Partners IDEs development flow

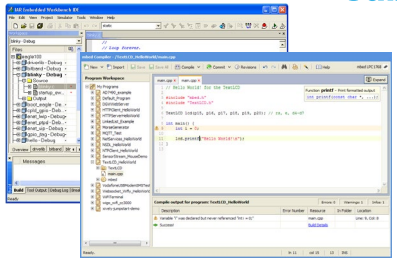
Arm® V8-M TrustZone architecture support

STM32 CubeMX

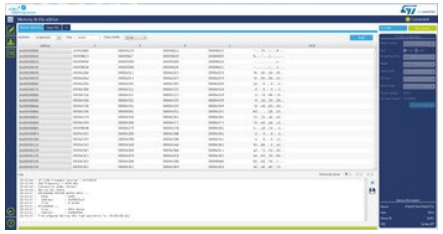


arm KEIL

STM32 CubeIDE



iar



STM32 CubeProgrammer

STM32CubeMX

STM32CubeMX enhanced for TrustZone

- Peripherals/middleware configuration
- Resources allocation to security domains

Optional step

IDEs
Compile and Debug

TrustZone Support

- Partners IDE
- STM32CubeIDE based on Eclipse
- TrustZone debugging

STM32 Programming Tool

STM32CubeProgrammer

- Device and memory configuration
- Program the application
- Secure Firmware Install

life.augmented

Configuration tool

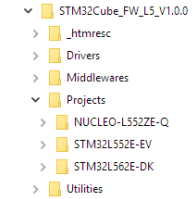
Power Consumption Calculator

MCU or board Selector

Code Generation

TrustZone support

Load an Example .ioc file



macOS®

Windows

Pinout Configuration

Middleware Parameters

FreeRTOS
FatFS
USB device

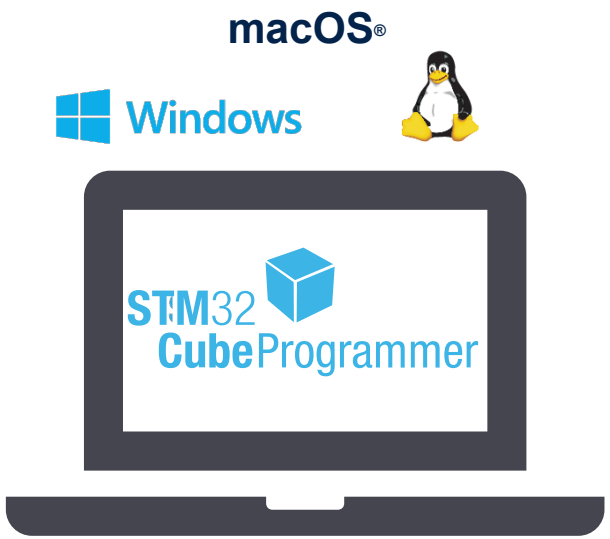
Clock Tree Initialization

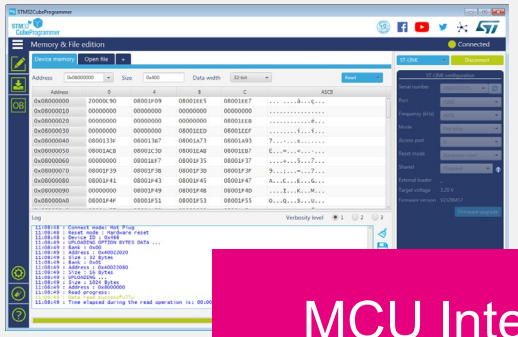
Peripherals Configuration

TrustZone configuration and GPIOs, memories, DMA, peripherals allocation to security domains

CAN I²C SPI UART

All-in-one programming software tool





MCU Internal Flash and external Flash services
MCU configuration (Option bytes)

Intuitive GUI
Command Line Interface for scripting
API DLL for Custom Integration

STLink (JTAG, SWD)
STM32 Bootloader Interface (USB, UART, SPI, I2C, CAN)
Secure Firmware install (SFI)

STM32L5 hardware solutions

Speed-up evaluation prototyping and design

$275

Evaluation Boards

Full feature STM32L5 evaluation

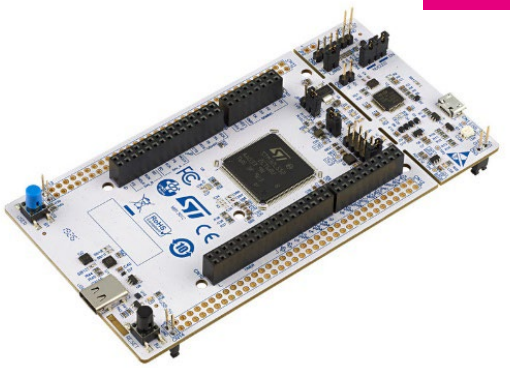
- STM32L552E-EV

$76

Discovery Kit

Flexible prototyping & demo

- STM32L562E-DK



$20

Nucleo Boards

Affordable and quick prototyping

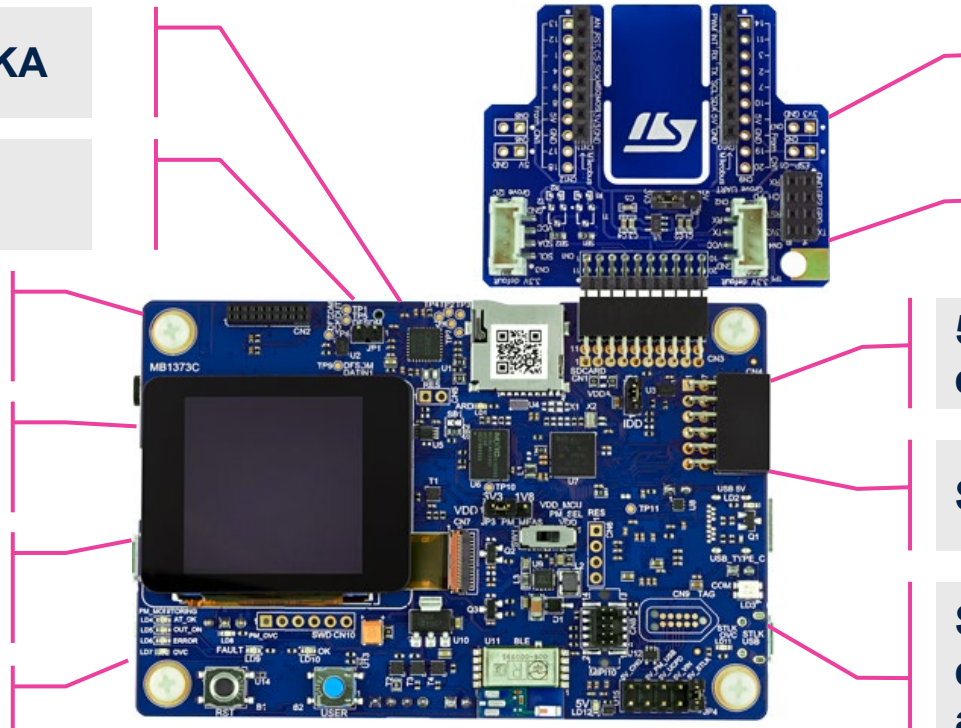
- NUCLEO-L552ZE-Q

life.augmented

Discovery kit

Prototype your wearable or sensor application with STM32L562E-DK

- STM32L562 MCU with AES and PKA
- 240 x 240 pixel-TFT color Display
- state-of-the-art Energy Meter
- 3D accelerometer and 3D gyroscope
- Bluetooth® V4.1 low energy module
- Audio Codec and Headphone amplifier



- Digital microphone
- USB Type-C™ Sink device FS
- 512Mbit Octal Flash memory extension
- ST-Link V3
- STMod+ connector with fan-out expansion board for Wi-Fi®, Grove and mikroBUS™ compatible connectors

STM32L562E-DK

Fan-out expansion board included

$76.22

life.augmented

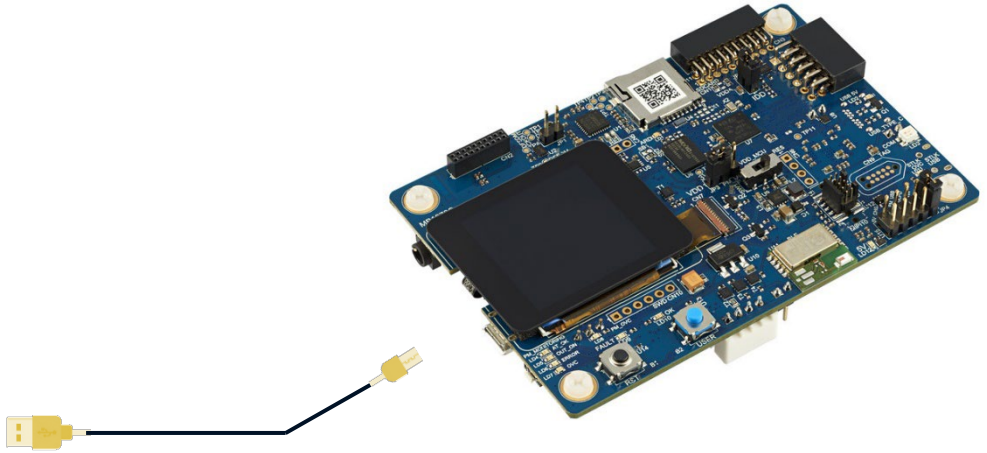
STM32CubeMonitor-power

State-of-the-art on-board power consumption measurement

STM32 CubeMonitor-Power

STM32L562E-DK

On-board Energy Meter
300 nA to 150 mA measurement range

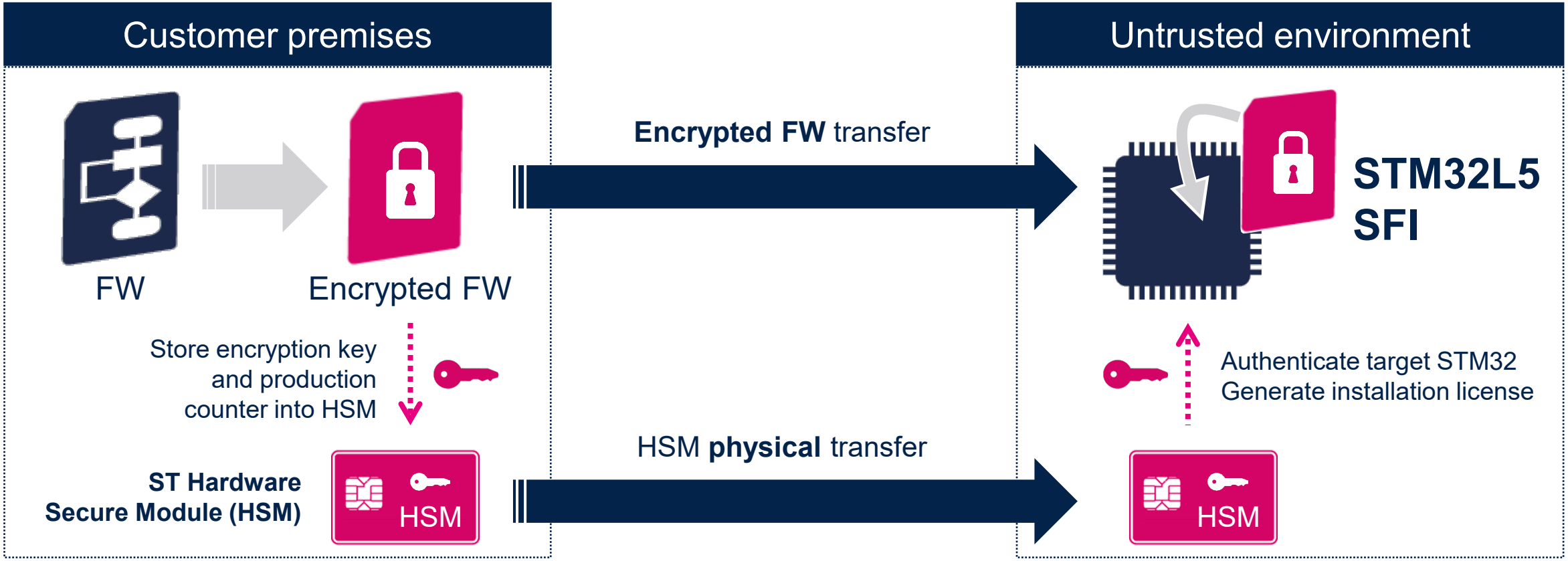


life.augmented

STM32 CubeProgrammer

Secure your production flow with Secure Firmware Install (SFI)

Protect your code and control the number of products manufactured



Number of products controlled

life.augmented

Conclusion

STM32L5 helps designers to answer IoT challenges

More security

Lower power consumption

Integration, performance, ecosystem

Releasing your creativity

- @STM32
- @ST_World
- community.st.com
- www.st.com/STM32l5
- STM32L5 Online Training
- wiki.st.com/stm32mcu
- github.com/stm32-hotspot
- STM32L5 blog articles

life.augmented

Our technology starts with You

Find out more at www.st.com/STM32L5

life.augmented