STM32L4+ MCU series

Excellence in **ultra-low-power** with **more performance**

TIN Boon-Fai – MCU Marketing (ASEAN & India)

boon-fai.tin@st.com

STM32 L4+

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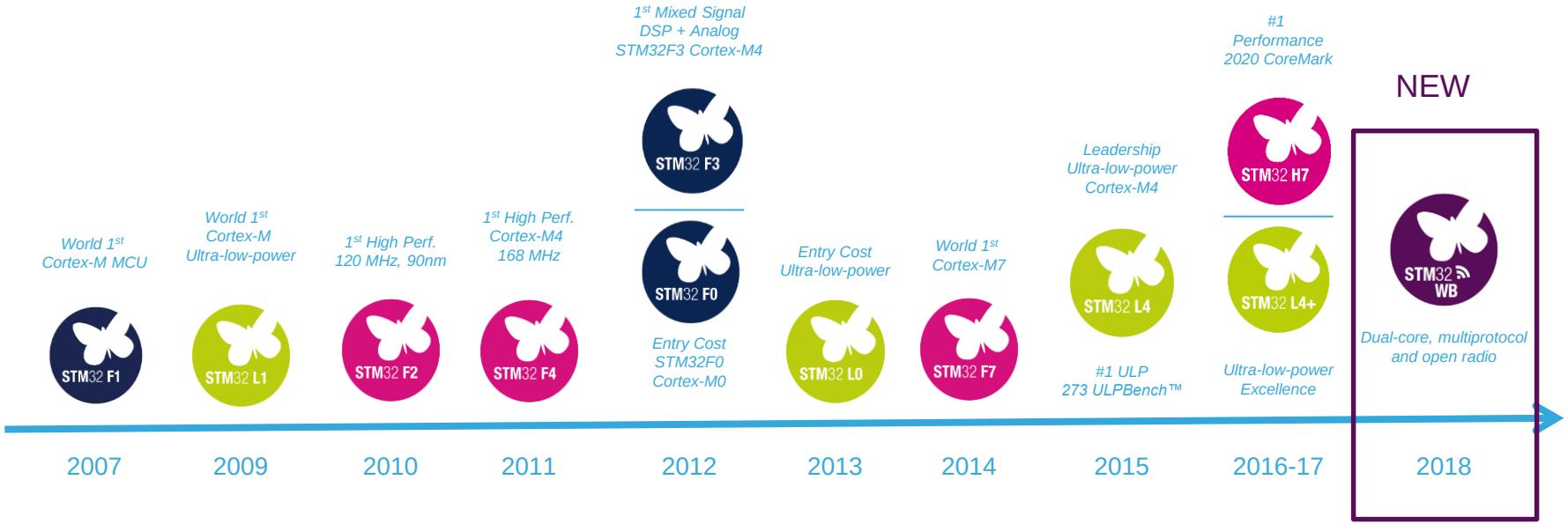
Key Milestones To Remember



STM32 Business Milestones

More than
40,000 customers

2007
First samples
STM32F1

2012
100 Million STM32
Shipped in one year

2013
1 Billion STM32
Shipped since 2007

2016
2 Billion STM32
Shipped since 2007

2017
32 x STM32 per second ! (*)

2018
3 Billion
STM32 shipped
since 2007

Wireless offer
introduction
with STM32WB

(*) 32 x 3600 x 24 x 365 = 1 Billion Units per year

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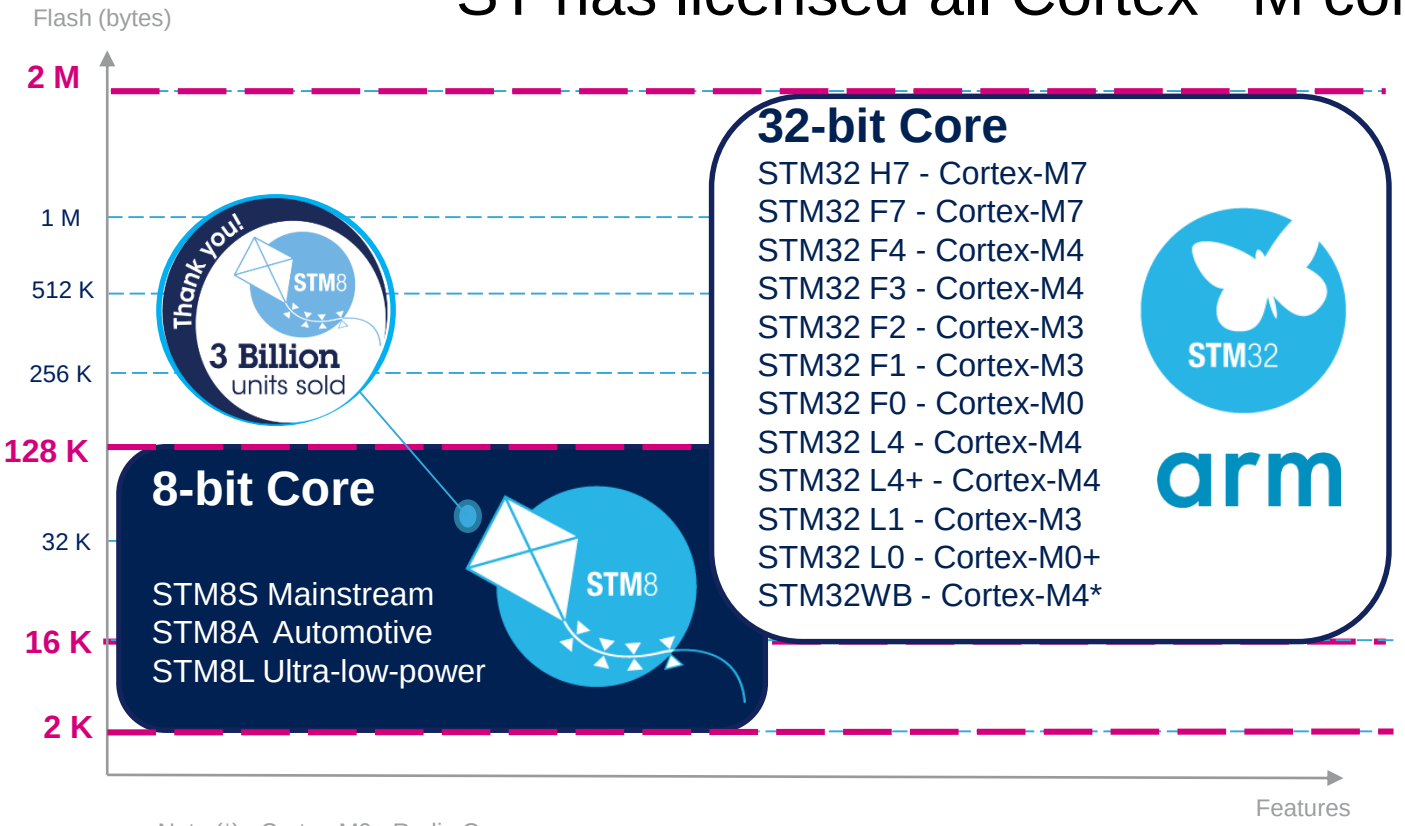
MCUs portfolio TODAY

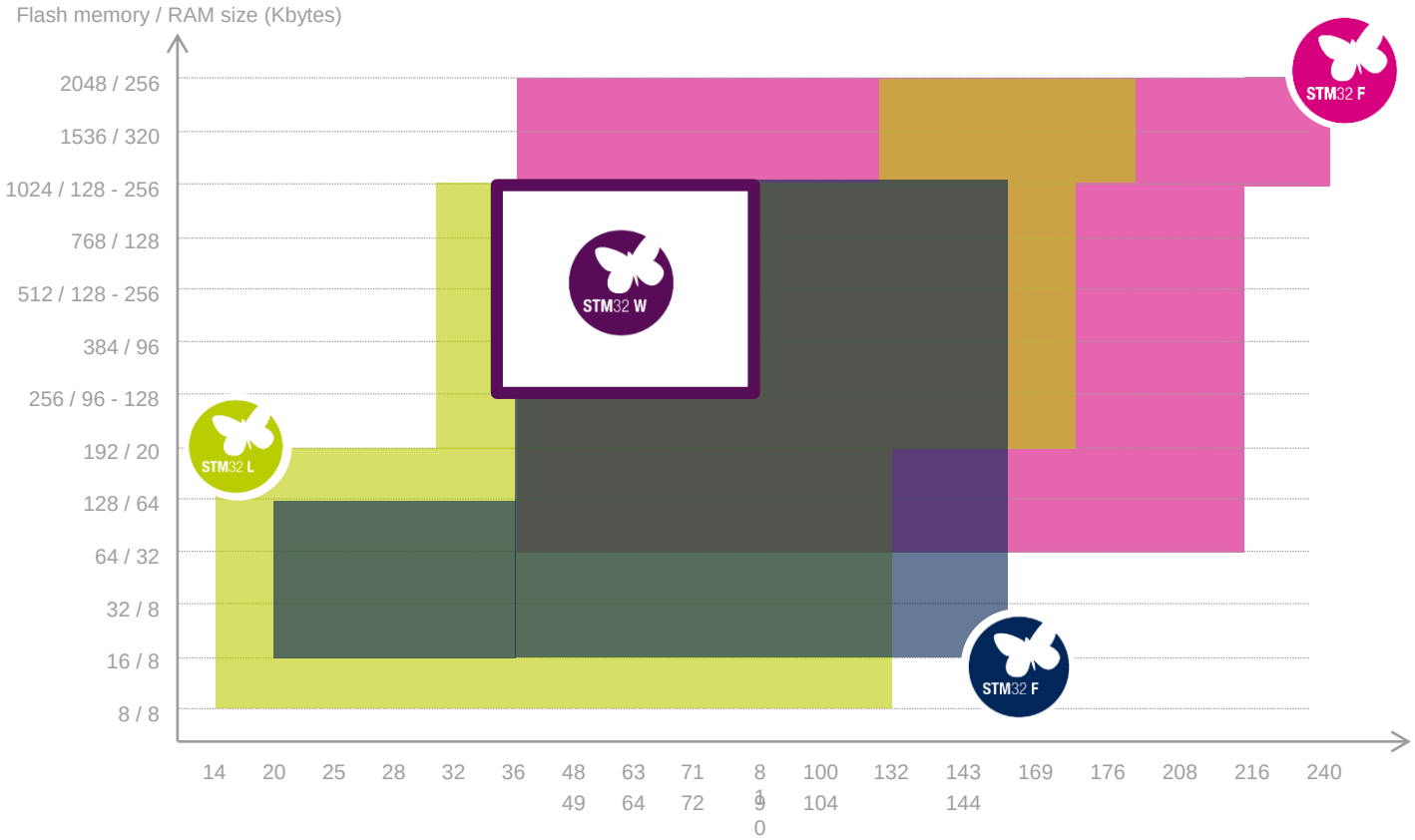
ST has licensed all Cortex®-M cores



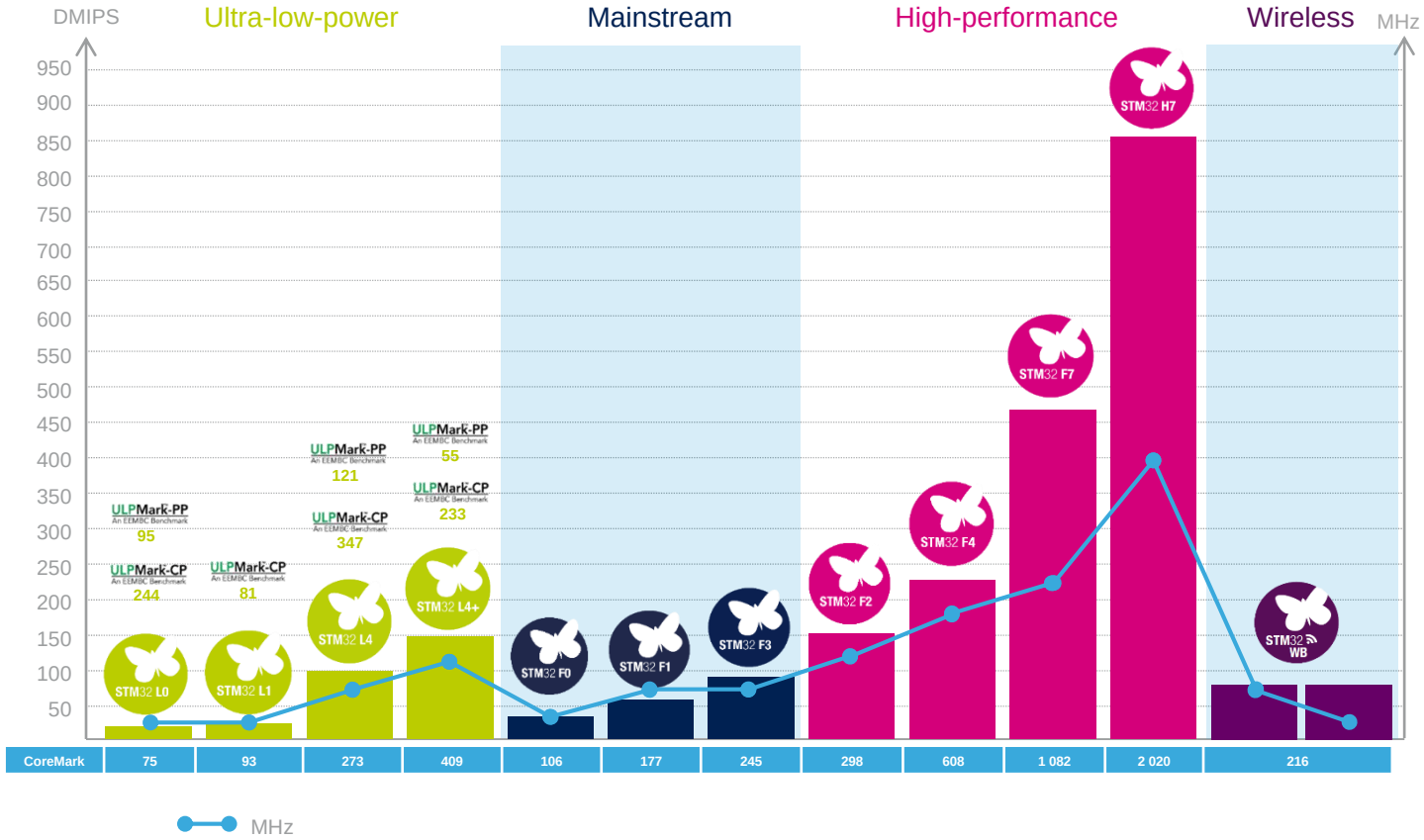
Note (*) : Cortex-M0+ Radio Co-processor

STM32 today – platform effect

Select your fit product inside a wide, compatible portfolio



Broadest 32-bit MCU product portfolio



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5 reasons to choose an STM32

Real-time performance

STM32 Dynamic Efficiency ™, ART Accelerator™, Chrom-ART Accelerator™, Chrom-GRC™ CCM-SRAM, L1-Cache Multi-AHB bus matrix, Excellent real-time up to 200 MHz/ 428 DMIPS Zero-wait state execution performance from Flash

Outstanding power efficiency

< 1 µA RTC in V_{BAT} mode, ultra-low dynamic power consumption 90 µA/MHz, with lowest dynamic consumption. 1.65 to 3.6 V V_{DD}, 0.45 µA Stop mode and 0.3 µA Standby mode

Superior and innovative peripherals

USB-OTG High speed, Ethernet, CAN, DFSDM, HR timer, LCD-TFT controller, SRAM interface, crypto/hash processor, true RNG*, PGA, 16-bit ∑Δ ADC and 12-bit ADC (up to 5 MSPS), external memory interface, CEC, SAI, BAM, BLE, 802.15.4, Thread/OpenThread, ZigBee

Maximum integration

Reset circuitry, voltage regulator, internal RC oscillator, PLL, WLCSP packages

Extensive ecosystem

ARM + ST ecosystem (eval. boards, discovery kits, ,STM32 Nucleo evalutation board (mbed enabled) , STM32Cube™ and software libraries, RTOS)

More than 8**00 compatible devices**

Releasing your creativity

Note: *random number generator

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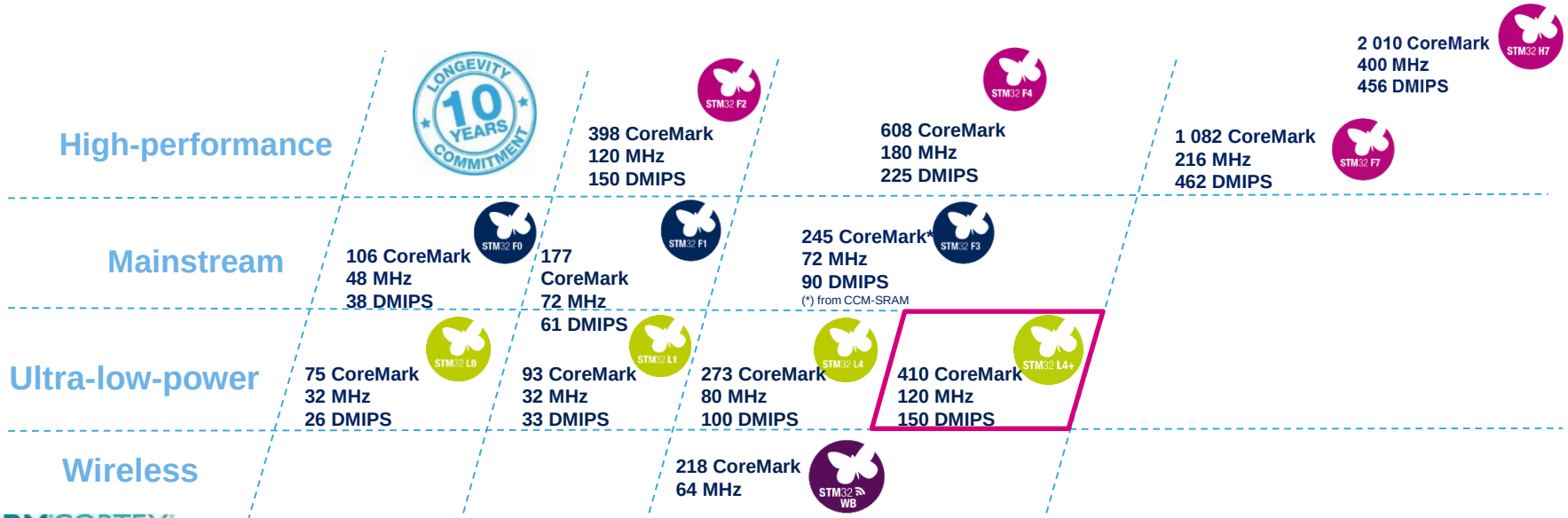
STM32L4+: continuity in STM32 portfolio

12 product series / more than 800 part numbers
STM32L4+ benefits from pin-to-pin compatibility across the family



ARM CORTEX Processor Technology

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Key messages of STM32 L4+ series

- **More performance and still ULP leader** ST has stretched the STM32L4 architecture to reach 150 MIPS based on its ARM Cortex-M4 core with FPU and ST ART Accelerator™ at 120 MHz while keeping best-in-class, ultra-low-power (ULP) figures.

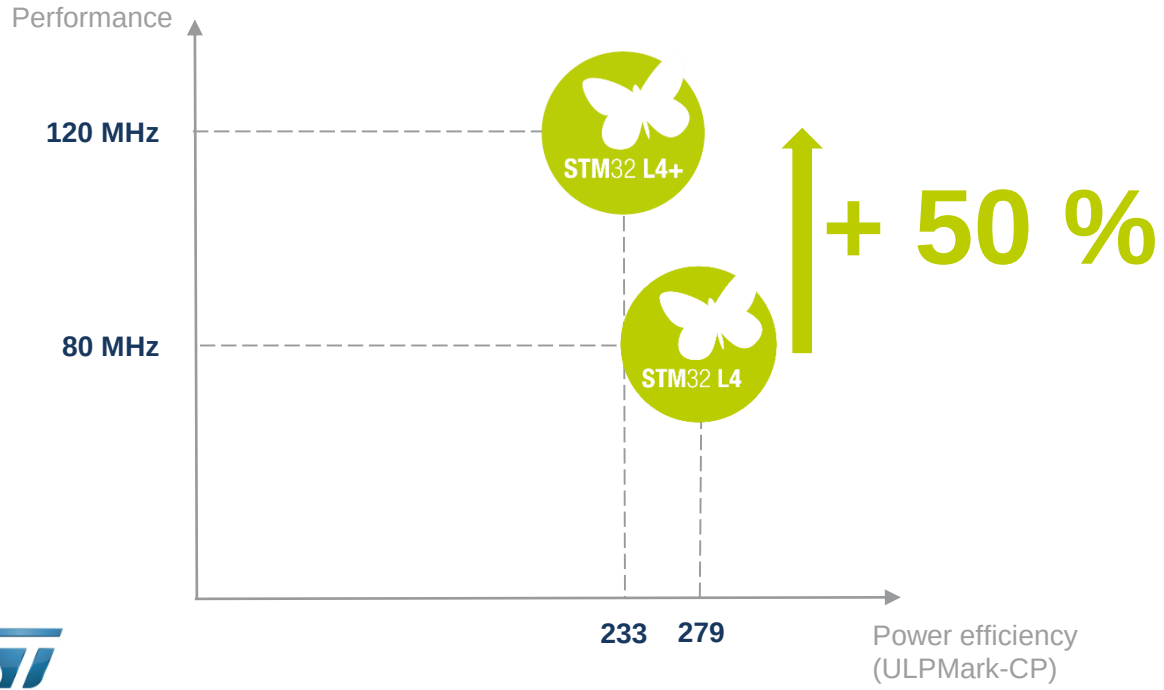
- **More Graphics and Innovation** Enhanced graphics acceleration and innovative peripherals are embedded to optimize the BOM cost.

- **More Integration** 2 MB of Flash and 640 KB of SRAM with safety and security features, smart and numerous peripherals, advanced and low power analog circuits in packages as small as 5.2 x 5.2 mm.

- **Great Investment** This new STM32 member benefits from the pin-to-pin compatibility of the STM32 family and the STM32 Ecosystem.

Providing **more performance**

Stretching the performance and still excellent in Power consumption

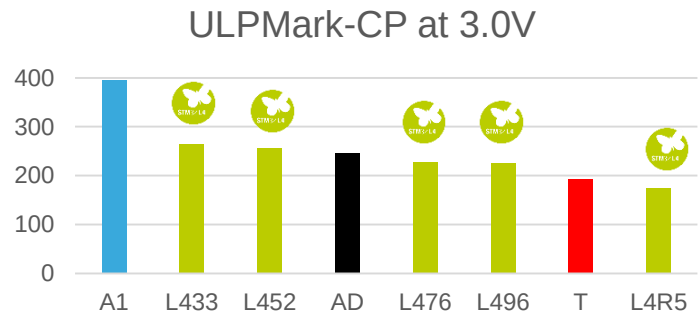


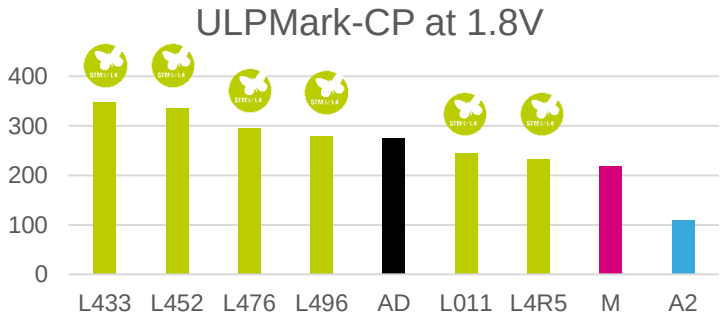
- **Up to 120** MHz/ **150 DMIPS** with ART Accelerator™
- **Up to 410** CoreMark Result
- ARM Cortex-M4 with DSP instructions and floating-point unit (FPU)
- 2 x DMA (14 channels)
- SPI up to 60 Mbit/s, OctoSPI up to 86 MHz USART up to 10 Mbit/s,

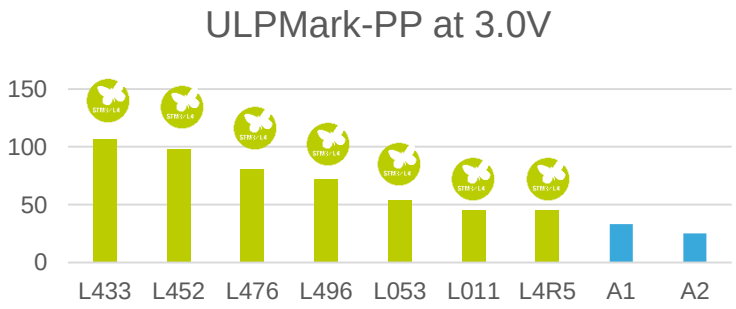
More performance and still ULP leader

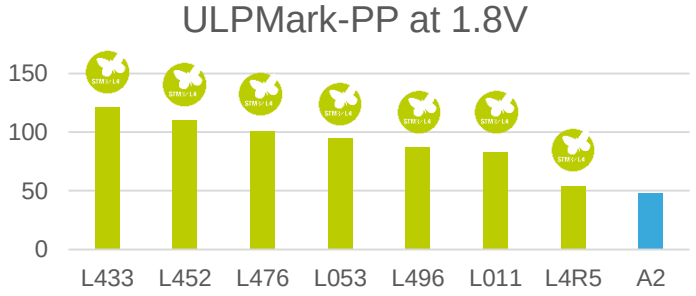
Ultra-low-power leader

EEMBC ULPBench leader









+ More performance and still ULP leader

Ultra-low-power modes

Best power consumption numbers with full flexibility

Wake-up time			
250 µs	VBAT	3 nA / 300 nA*	Tamper detection: 3 I/Os, RTC
14 µs	Shutdown	33 nA / 300 nA*	Wake-up sources: reset pin, 5 I/Os, RTC
14 µs	Standby	125 nA / 480 nA*	Wake-up sources: + BOR, IWDG
5 µs	Standby + 64-Kbyte RAM	500 nA / 800 nA*	Wake-up sources: + all I/Os, PVD, LCD, COMPs, I²C, LPUART, LPTIM
5 µs	Stop 2 (retention: 256-Kbyte RAM)	2.5 µA / 2.9 µA*	Wake-up sources: any interrupt or event
6 cycles	Stop 2 (full retention: 640-Kbyte RAM)	3.9 µA / 4.3 µA*	
	Sleep	13 µA / MHz**	
	Run up to 120 MHz	Down to 43 µA / MHz**	

ULPBENCH™ An EEMBC Benchmark 233 ULPMark-CP

ULPBENCH™ An EEMBC Benchmark 54.1 ULPMark-PP

Note : * without RTC / with RTC
** with external SMPS

+ More performance and still ULP leader

Ultra-low-power and flexibility

FlexPowerControl

STM32L4+ keeps the advantages of the great STM32L4 platform optimized to reduce power consumption and increase flexibility

External level shifter no longer needed
Separate V_{DD} supplies (down to 1.08 V)

Down to 33 nA for I/O wake-up
with additional Shutdown mode

RTC available for all power modes
(from Active down to V_{BAT})

Down to 500 nA keeping 64 Kbytes of SRAM active in Standby mode

3 nA V_{BAT} mode with charging capability
Automatic switch to maintain power for RTC and backup registers

USB crystal-less capable
(Dedicated crystal oscillator is no longer needed for USB functions)

Wake up MCU with any peripheral
(Communication I/Fs, analog circuits, timers …)

I/O level kept in low-power modes
Optimization of system consumption

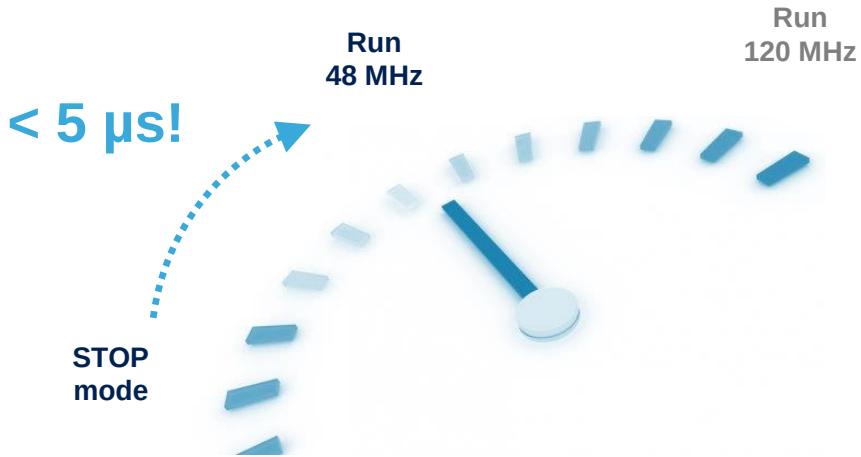
Internal oscillator from 100 kHz to 48 MHz
(±0.25% int. clock accuracy over voltage/temperature with LSE)

+ More performance and still ULP leader

Efficient run and fast wake-up

Ready for Launch Control ? From 0 to 48 MHz in less than 5 µs

- Thanks to our internal oscillator (MSI) used at start-up (programmable from 100 kHz to 48 MHz)
- PLL wake-up time < 15 µs (needed to reach f_{MAX})
- No inrush current

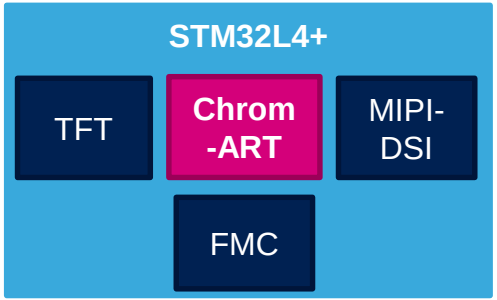


Enhanced Graphics Capabilities

- Chrom-ART Accelerator™
  - 2D Graphic accelration
  - Allowing **enhanced** graphic while releasing the core capabilities for real time processing

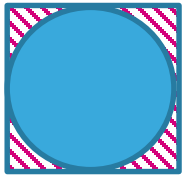
Enhanced Graphics Capabilities

- Chrom-ART Accelerator™
- Large choice of display interfaces
  - MIPI-DSI Controller for high pixel density, low pin count and low EMI displays
  - LCD-TFT Controller for mid resolution displays
  - Parallel display interface for low resolution displays

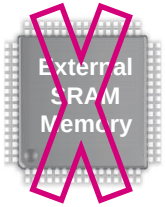


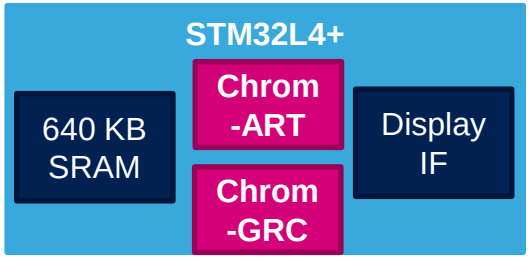
Enhanced Graphics Capabilities

- Chrom-ART Accelerator™
- Large choice of display interfaces
- Integration and ressources optimization
  - **Chrom-GRC™** memory optimization for round displays
  - large internal SRAM allowing
    - BOM cost and power cosumption optimization
    - Support of up to 400x400 24 bpp MIPI-DSI round displays
    - Support of up to 4', WQVGA 16 bpp TFT displays with no external memory



20% Memory saving





+ More Graphics and Innovation

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Digital Smart Peripherals

- Peripherals running in Stop mode
  - Low-power UART can wake up the system if a programmed byte or start bit is detected (with no loss of the first bit)
  - I²C can wake up system when address is detected
  - Low-power timer can count time or events or generate signals
- 2x Octo SPI for data and execution in place
  - External Flash and SRAM support
  - Single, dual, quad and Octo SPI and Hyperbus
- Digital Filter for Sigma Delta Modulator
  - For connection to external sigma delta modulator (e.g.: STPMS2)
  - Up to 4 filters, 8 multiplexed channels
  - Also supports digital microphone MEMs (PDM to PCM conversion and filtering performed by HW)
- Peripheral clock independent from main system clock

Analog Smart Peripherals

- 12/16-bit ADC (up to 5 Msps)
  - Adaptive power consumption (200µA/Msps)
  - HW oversampling
  - Single and differential inputs
- 2x Op amps with built-in PGA
- 2 x 12-bit DACs (1 Msps)
  - Low-power Sample and Hold modes available in Stop mode
- 2x Comparators
  - Low-power modes, works in Stop mode
- Internal voltage reference
  - Programmable 2.048 or 2.5 V
  - Can be used for external components

Smart peripherals

Metering

Digital **F**ilter for **S**igma **D**elta **M**odulators
8 x parallel inputs
with up to 24-bit data
output resolution

V_{BAT} with RTC
for battery backup
300 nA in V_{BAT} mode
for RTC and
32x 32-bit backup registers

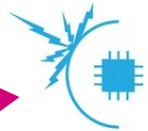
TRNG & AES
for Security
128-/256-bit AES
key encryption hardware
accelerator

FSMC
External memory interface
for static memories supporting SRAM,
PSRAM, NOR and NAND

STM32L4+

Electricity/Gas
/Water
Smart Meter

LCD Display
SPI, Parallel or TFT Interface



Anti Tamper pin
3 x tamper pins
for battery domain

SPI / UART/ SDIO for Wireless
3x SPIs (4x SPIs with the Quad SPI)
6x USARTs (ISO 7816, LIN, IrDA, modem)
1 x SDIO

I/Os Up to 114 fast I/Os for buttons & relays

+ More Graphics and Innovation

Fitness tracker - Wristband

Digital **F**ilter for **S**igma **D**elta **M**odulators
with PDM (Pulse Density Modulation) microphone input support

Display
FSMC
Parallel interface to TFT
SPI
Up to 60 MHz speed
MIPI DSI
Direct connection
Chrom-ART
Graphic Acceleration
Chrom-GRC
SRAM needs reduction

Sensors

I²C
3x I²C FM+(1 Mbit/s), SMBus/PMBus

Batch **A**cquisition **M**ode (BAM)

USB
USB OTG 2.0 full-speed, LPM and BCD

SPI / UART
3x SPIs (4x SPIs with the Quad SPI)
6x USARTs (ISO 7816, LIN, IrDA, modem)

OPAMP
2x op amp with built-in PGA

DAC
2x 12-bit DAC, low-power sample and hold

ADC
3× 12-bit ADC 5 MSPS, up to 16-bit with hardware oversampling, 200 µA/MSPS

SAI
2x serial audio interfaces

+ More Graphics and Innovation

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Smart Peripherals
Industrial Sensors

Motor Control :
2x 16-bit advanced
motor-control timers
12-bit ADCs: 5 MSPS,
with up to 16-bit with hardware oversampling,
200 µA/MSPS

Display
TFT controller, or SPI or FSMC

CAN Bus
(2.0B Active)

STM32L4+

High temperature
from -40°C
up to + **125°C**

TRNG & AES
for Security
128/256-bit AES
key encryption hardware accelerator

SPI / UART
3x SPIs (4x SPIs with the
Octo SPI)
6x USARTs (ISO 7816, LIN,
IrDA, modem)

FSMC
External memory interface
for static memories supporting
SRAM, PSRAM, NOR and NAND

I/Os
Up to 114 GPIOs

I²C
3x I²C FM+(1 Mbit/s), SMBus/PMBus

High integration

High integration with high memory size in small packages

Parallel Interface
FSMC 8-/16-bit
(TFT-LCD, SRAM, NOR, NAND)

Display
DSI MIPI
LCD TFT Controller

Timers
17 timers including:
2 x 16-bit advanced motor control timers
2 x ULP timers
7 x 16-bit-timers
2 x 32-bit timers

I/Os
Up to 136 I/Os
Touch-sensing controller

Cortex-M4
120 MHz
FPU
MPU
ETM

DMA

ART Accelerator™

Chrom-ART™

Up to
2-Mbyte Flash
with ECC
Dual Bank

640-Kbyte RAM

Connectivity
USB OTG Crystal less,
1x SD/SDIO/MMC, 3 x SPI,
4 x I²C, 1x CAN, 2 x Octo SPI,
5 x USART + 1 x ULP UART

Digital
AES (256-bit), SHA (256-bit),
TRNG, 2 x SAI, DFSDM (8 channels),
Camera I/F, Chrom-GRC™

Analog
1 x 16-bit ADC, 2 x DAC,
2 x comparators, 2 x op amps
1 x temperature sensor

Package size down to 5.24 x 5.24 mm

+ More Integration

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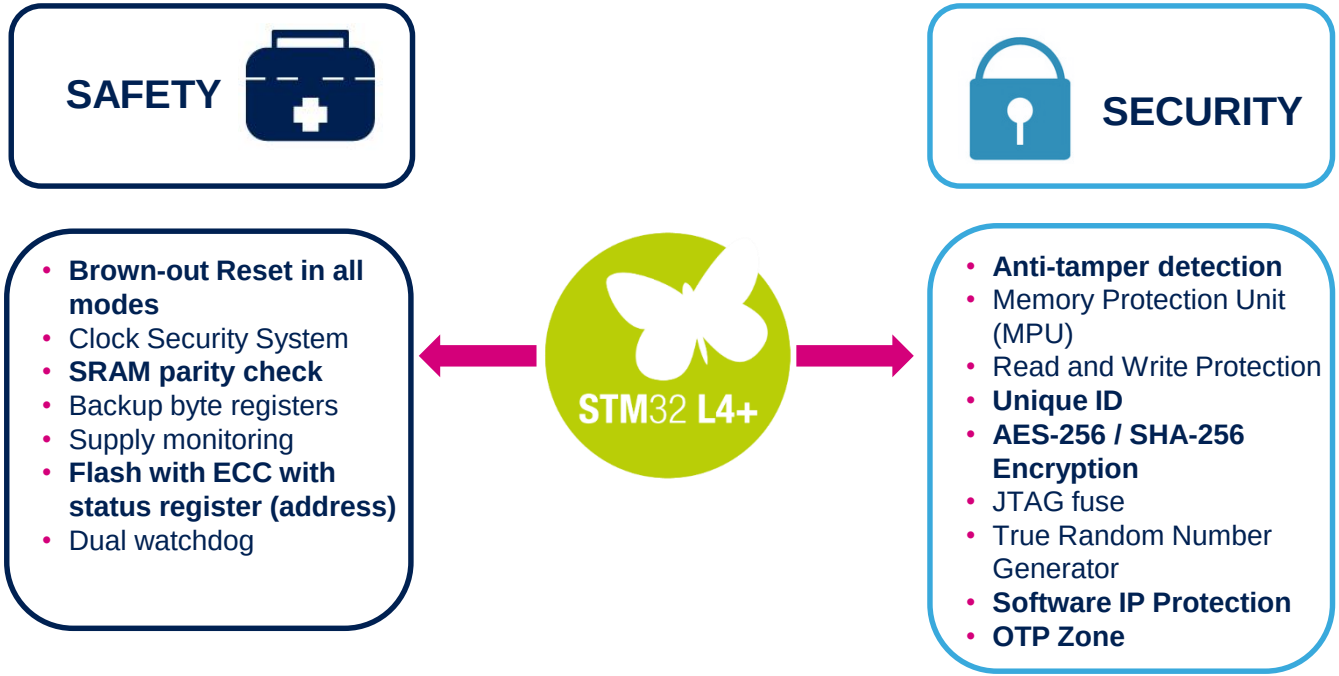
Safety and security

Integrated safety and security features



+ More Integration

STM32L ULP portfolio

STM32L4+ completes the ultra-low-power family

Cost-smart ULP champion

STM32 L0

Cortex-M0+ at 32 MHz
1.65 to 3.6V
8/16-bit applications
Wide range of pin-counts

3 product lines,
Cost-effective,
Smaller packages,
USB, LCD, Analog
8 to 192 Kbytes of Flash,
20 Kbytes of SRAM

Broad-range foundation

STM32 L1

Cortex-M3 at 32 MHz
1.65 to 3.6V
Wide choice of memory sizes

3 product lines,
USB, LCD, AES,
Rich Analog
True EEPROM,
Dual-bank Flash memory (RWW),
32 to 512 Kbytes of Flash,
80 Kbytes of SRAM

ULP with Performance

STM32 L4

Cortex-M4 w/ FPU at 80 MHz
1.71 to 3.6V
Performance,
advanced analog circuits

5 product lines,
5-MSPS ADC,
PGA, Compar.,
DAC, Op Amp, USB OTG, LCD, AES
128 to 1 Mbyte of Flash
Up to 320 Kbytes of SRAM

ULP with More Performance

STM32 L4+

Cortex-M4 w/ FPU at 120MHz
1.71 to 3.6V
More performance,
advanced analog circuits

3 product lines,
5-MSPS ADC,
PGA, Compar.,
DAC, Op Amp, USB OTG, Graphics, AES
1 to 2 Mbyte of Flash
640 Kbytes of SRAM

\+ Great investment

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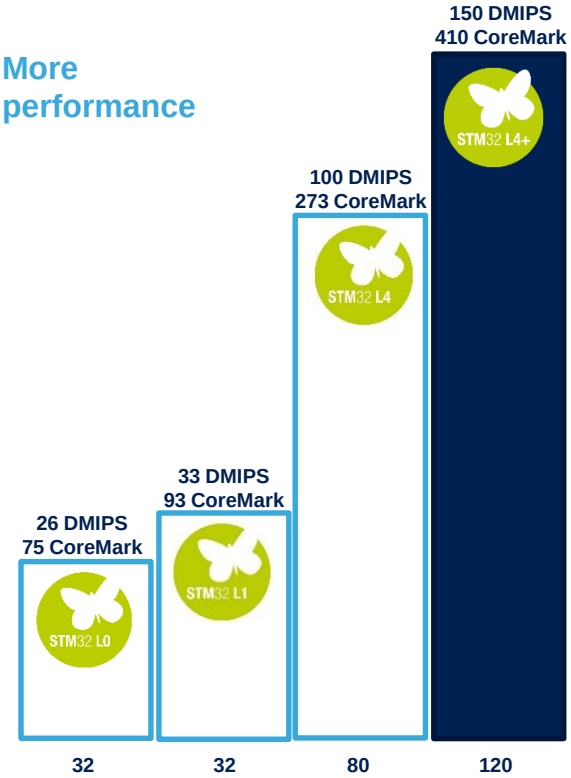
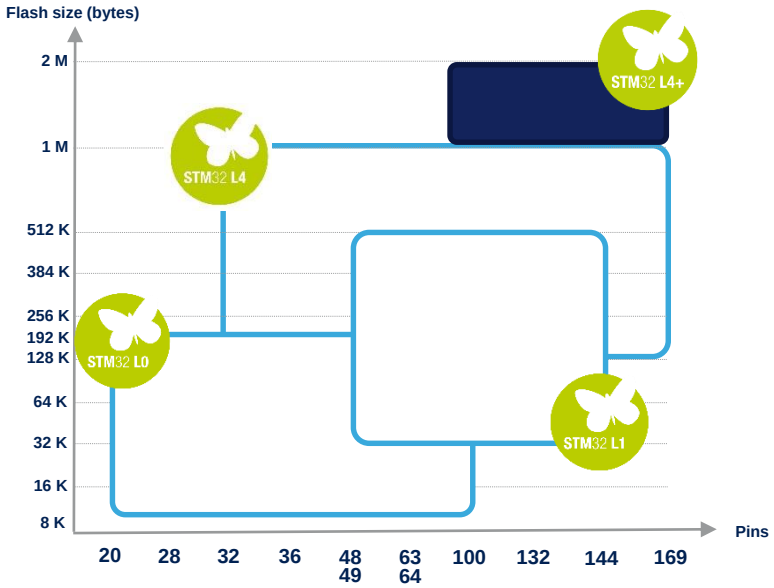
STM32L, a complete offer

STM32L4+ completes the ultra-low-power family

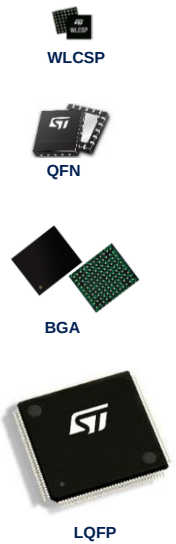
More performance



More memory and pin counts



More packages



+ Great investment

STM32L4+ series

Cortex®-M4 (DSP + FPU) – 120 MHz

- ART Accelerator™
- USART, SPI, I²C
- 2 xQuadSPI
- 16 and 32-bit timers
- SAI + audio PLL
- CAN
- Camera IF
- Chrom-ART
- 2x 12-bit DAC
- Temperature sensor
- Low voltage 1.71V to 3.6V
- Vbat Mode
- Unique ID
- Capacitive Touch sensing

Product line	FLASH (KB)	RAM (KB)	Memory I/F	2 x Op-Amp	2 x Comp.	8ch / 4x Sigma Delta Interface	12- bit ADC 5 Msps 16 bit HW oversampling	USB2.0 OTG FS	MIPI DSI	TFT Display Interface	Chrom-GRC™	AES 128/256-bit
STM32L4R5/S5 - Access lines												
STM32L4R5 USB OTG	2048 to 1024	640	SDIO FSMC	●	●	●	1	●				
STM32L4S5 USB OTG & AES	2048	640	SDIO FSMC	●	●	●	1	●				●
STM32L4R7/S7 with TFT interface												
STM32L4R7 USB OTG & TFT Interface	2048 to 1024	640	SDIO FSMC	●	●	●	1	●		●	●	
STM32L4S7 USB OTG & TFT Interface & AES	2048	640	SDIO FSMC	●	●	●	1	●		●	●	●
STM32L4R9/S9 with MIPI-DSI and with TFT interface												
STM32L4R9 USB OTG & MIPI DSI	2048 to 1024	640	SDIO FSMC	●	●	●	1	●	●	●	●	
STM32L4S9 USB OTG & MIPI DSI & AES	2048	640	SDIO FSMC	●	●	●	1	●	●	●	●	●

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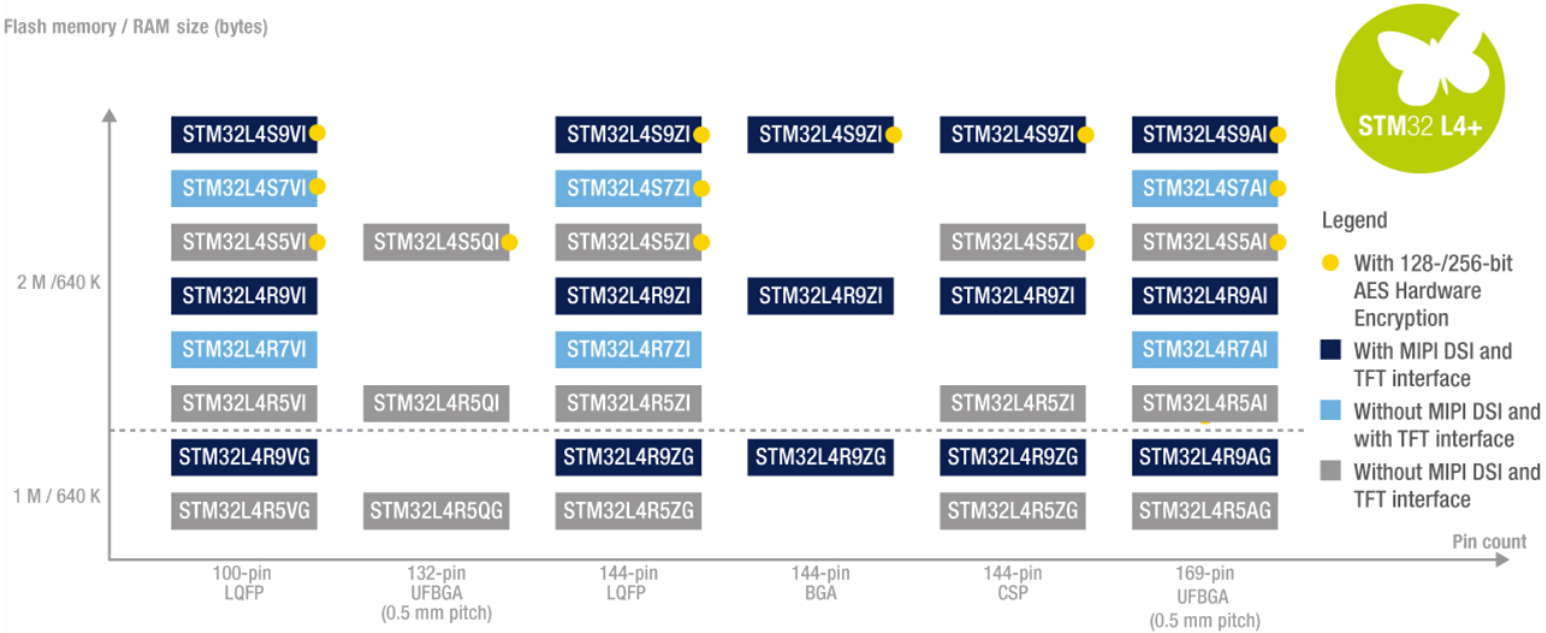
STM32L4+ portfolio



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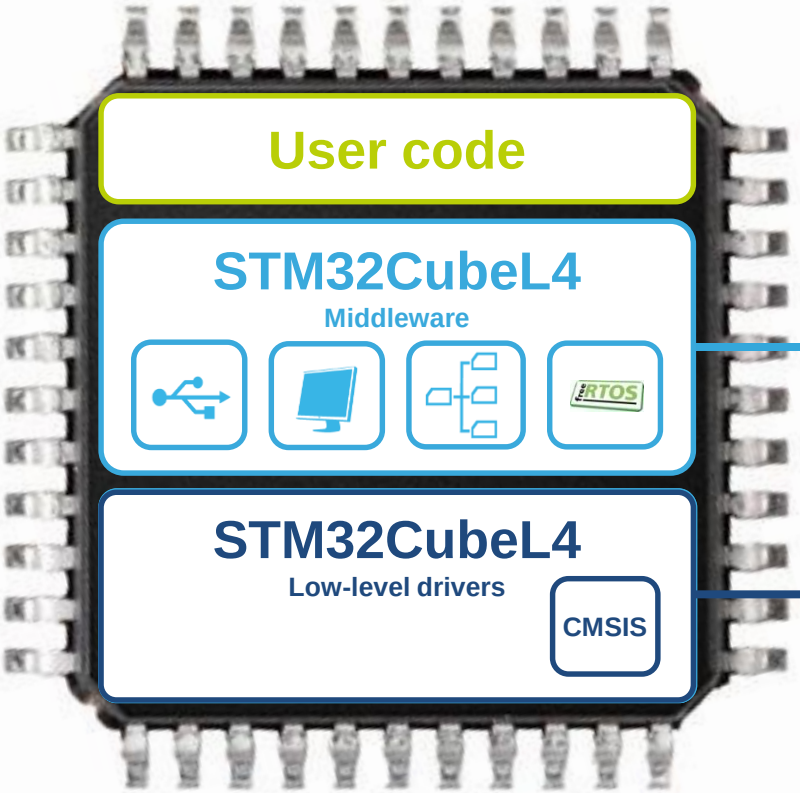
+ Great investment

STM32L4/L4+ ecosystem



EMBEDDED SOFTWARE

- USB host and device library from ST
- STemWin graphical stack library from ST and Segger
- Open-source FAT file system (FatFs)
- Open-source real-time OS (FreeRTOS)
- Numerous examples

- STM32L4 Hardware Abstraction Layer (HAL) portable APIs
- **High-performance, light-weight low-layer (LL) APIs**
- High coverage for most STM32 peripherals
- Production-ready and fully qualified
- Dozens of usage examples
- Open-source BSD license

+ Great investment

STM32 Graphic ecosystem

3 Recommended Software Solutions

STemWin FREE

TouchGFX

Embedded Wizard

Entry Solution

Advanced Solutions

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+ Great investment

4 Keys of STM32 L4 + series

- + More performance and still ULP leader
- + More Graphics and Innovation
- + More Integration
- + Great Investment

STM32 Ecosystem

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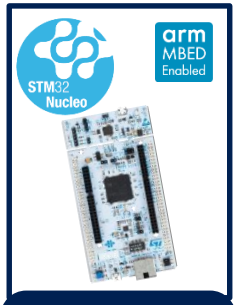
Hardware Development Tools

STM32 & STM8 1 MILLION BOARDS SOLD

Press release is available here



	STM32 Nucleo	Discovery kits	Evaluation boards	3rd parties
Typical use case	Flexible prototyping, Community	Prototyping, Creative demos	Full feature evaluation	From full evaluation to open hardware
Extension possibilitie	+ + +	+ +	+ + +	
Connectivity	Arduino™ ST Morpho	ST	ST	

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STM32 Nucleo ODE platform

Hardware

STM32 Nucleo Development boards

Software

STM32 Cube MCU package

Expansion

STM32 Nucleo expansion boards from ST and third parties

STM32 Cube Expansion package

Multiple IDE support

ARDUINO, ac6, SysProgs, TASKING, IAR SYSTEMS, RAISONANCE, EMPROG, SEGGER, Rowley Associates, atollic, arm MBED, CooCox, arm KEIL, iSYSTEM

NEW Ecosystem

STM32 Motor Control SDK v5.0

Plug-and-spin with STM32Cube

New STM32 Software Development Kit from STMicroelectronics Makes Motor-Control Design Faster and Easier

Explore new STM32 Motor Control SDK5.0 here

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Information and Sharing

Get connected to STM32 world !

st.com

ST MCU Finder

community.st.com

- facebook.com/stm32
- youtube.com/STonlineMedia
- twitter.com/@ST_World
- linkedin.com/stmicroelectronics
- 21IC
- YouKu

Information — MCU Selection — Community — Social Media

+ Local trainings / Technical Support
+ Local Sales forces / Distributors

STM32 Education
Learn more

-> STM32 Education is now available here

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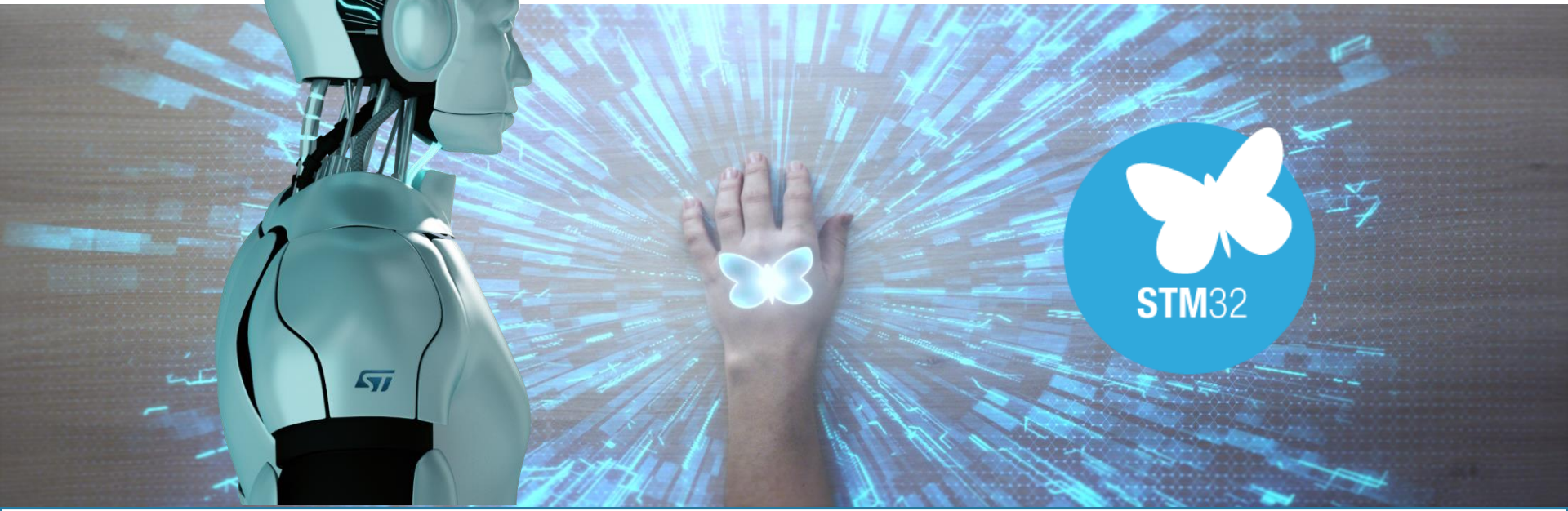
Releasing your creativity with the STM32



/STM32 @ST_World community.st.com

Famous video here

www.st.com/stm32

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