STM32L4+ MCU series

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

STM32 L4+

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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.

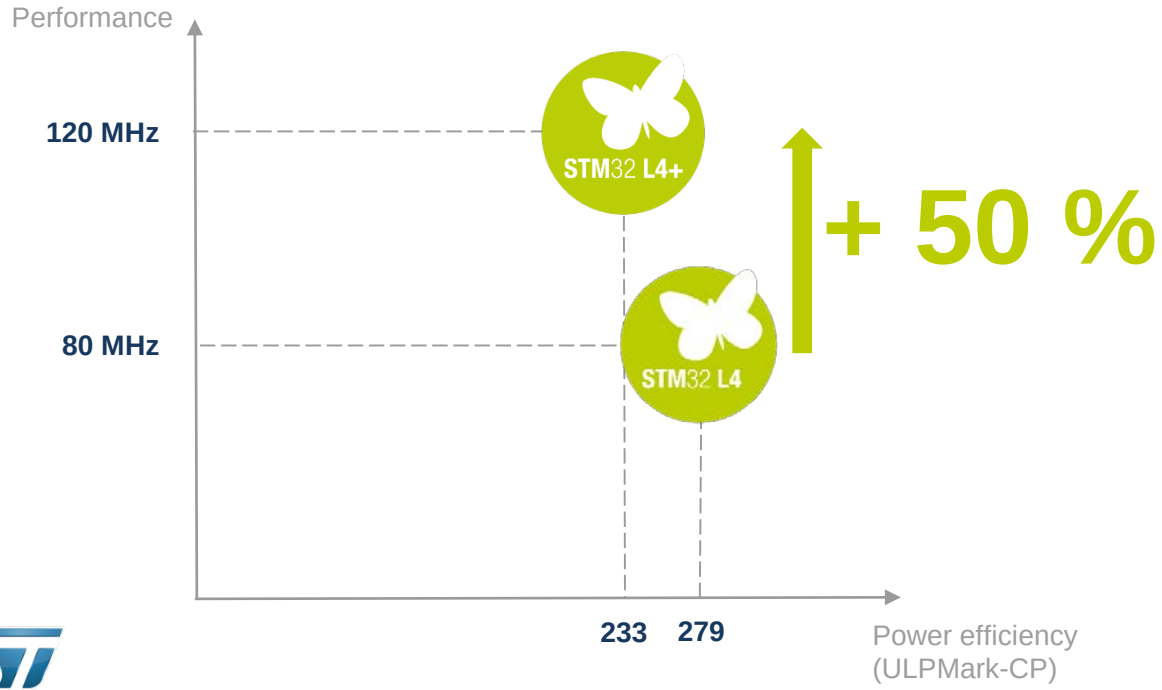
- **More Graphics and Innovation** Enhanced graphics acceleration and innovative peripherals are embedded to optimize the BOM cost.

- **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

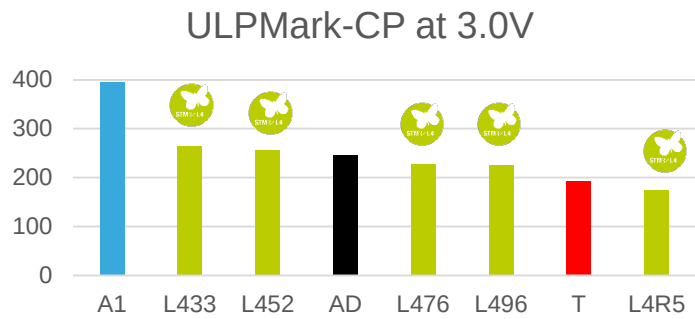


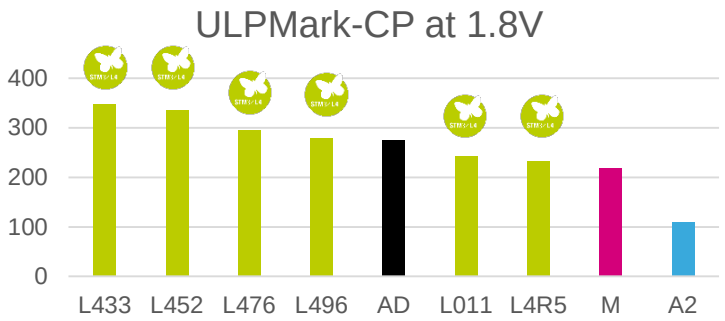
- **Up to 120** MHz/ **150 DMIPS** with ART Accelerator™
- **Up to 410** CoreMark Result
- ARM Cortex-M4 with DSP instructions and floating-point unit (FPU)
- 2 x DMA (14 channels)
- SPI up to 60 Mbit/s, OctoSPI up to 86 MHz USART up to 10 Mbit/s,

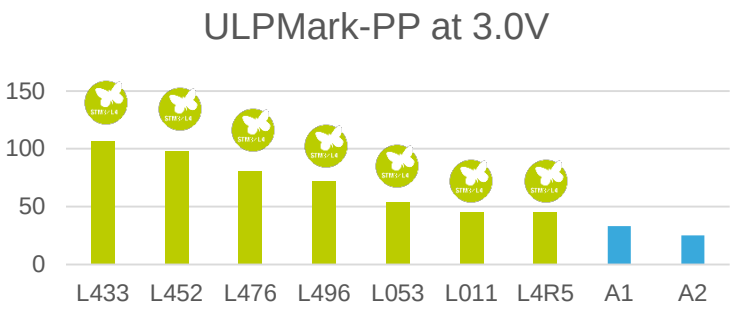
More performance and still ULP leader

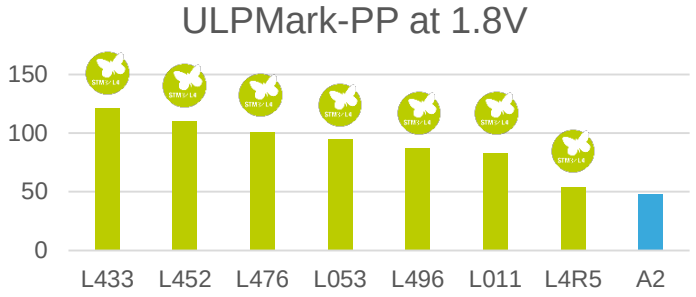
Ultra-low-power leader

EEMBC ULPBench leader





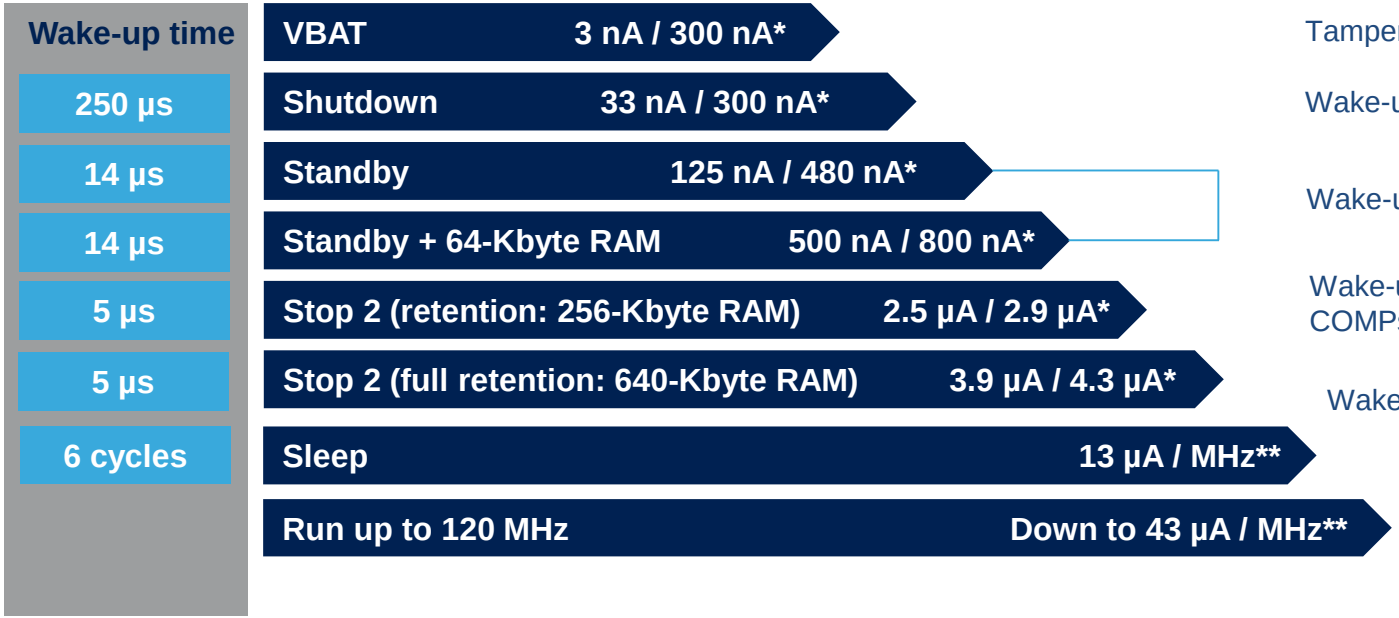




+ More performance and still ULP leader

Ultra-low-power modes

Best power consumption numbers with full flexibility



Tamper detection: 3 I/Os, RTC

Wake-up sources: reset pin, 5 I/Os, RTC

Wake-up sources: + BOR, IWDG

Wake-up sources: + all I/Os, PVD, LCD, COMPs, I²C, LPUART, LPTIM

Wake-up sources: any interrupt or event

ULPBENCH™ An EEMBC Benchmark 233 ULPMark-CP

ULPBENCH™ An EEMBC Benchmark 54.1 ULPMark-PP

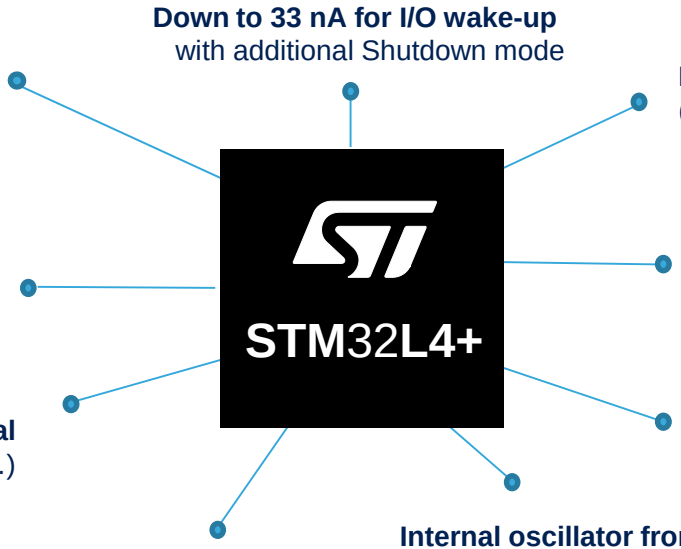
Note : * without RTC / with RTC
** with external SMPS

+ 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

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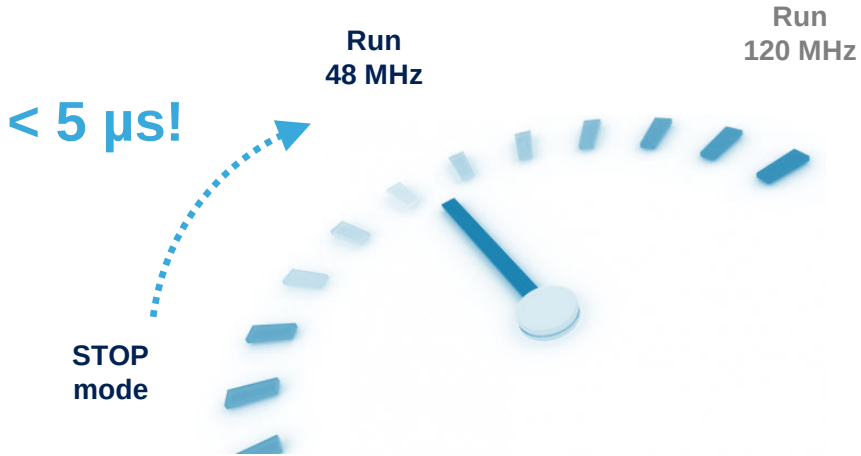
Efficient run and fast wake-up

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

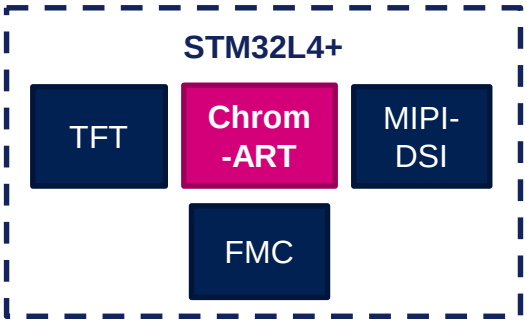
- Chrom-ART Accelerator™
  - 2D Graphic acceleration
  - Allowing **enhanced** graphic while releasing the core capabilities for real time processing

11% CPU Load
With chrom-ART Accelerator
and 84% CPU load without it

Enhanced Graphics Capabilities

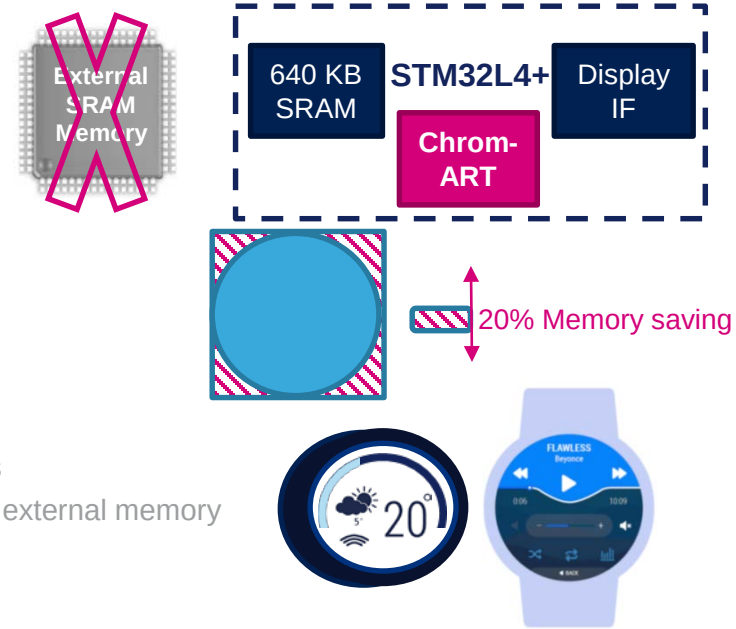
- Chrom-ART Accelerator™

- 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 consumption 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



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

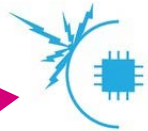
Digital **F**ilter for **S**igma **D**elta **M**odulators
8 x parallel inputs
with up to 24-bit data
output resolution

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

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

Sensors

I²C
3x I²C FM+(1 Mbit/s), SMBus/PMBus

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

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

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

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

CAN Bus
(2.0B Active)

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

I/Os
Up to 114 GPIOs

I²C
3x I²C FM+(1 Mbit/s), SMBus/PMBus

STM32L4+

Display
TFT controller, or SPI or FSMC

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

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

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+ More Graphics and Innovation

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 Accelerator™

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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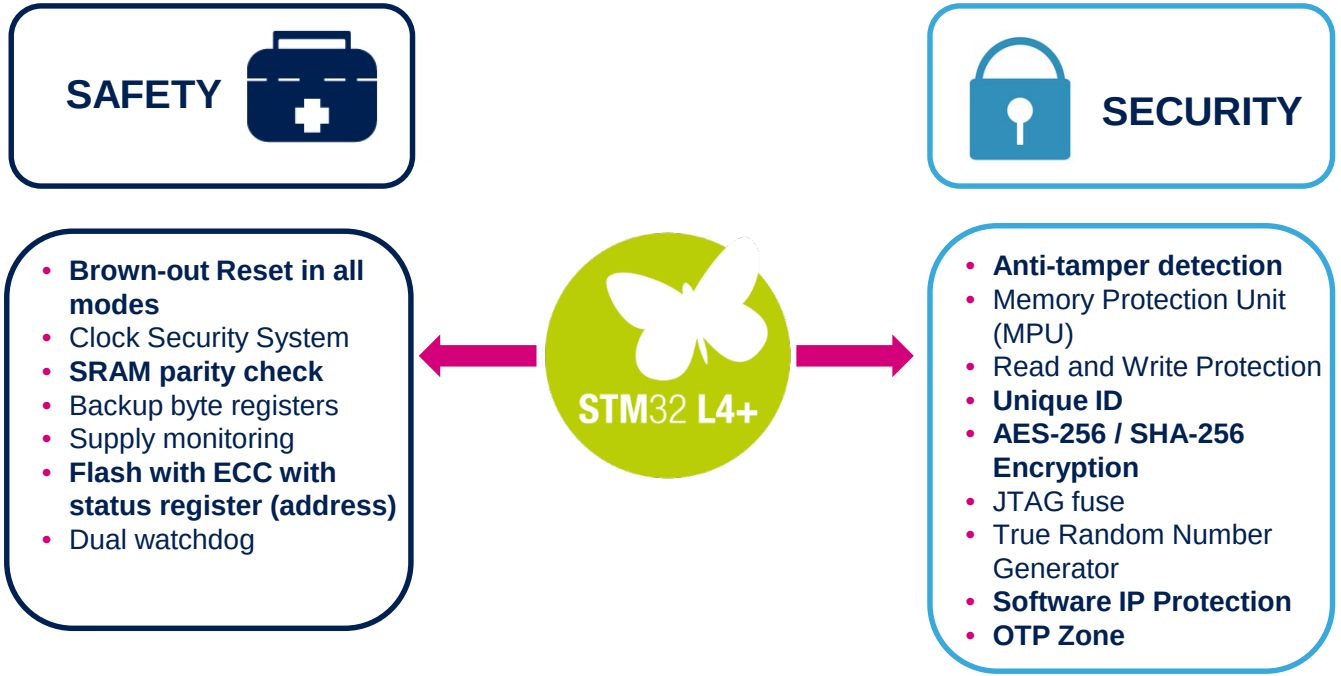
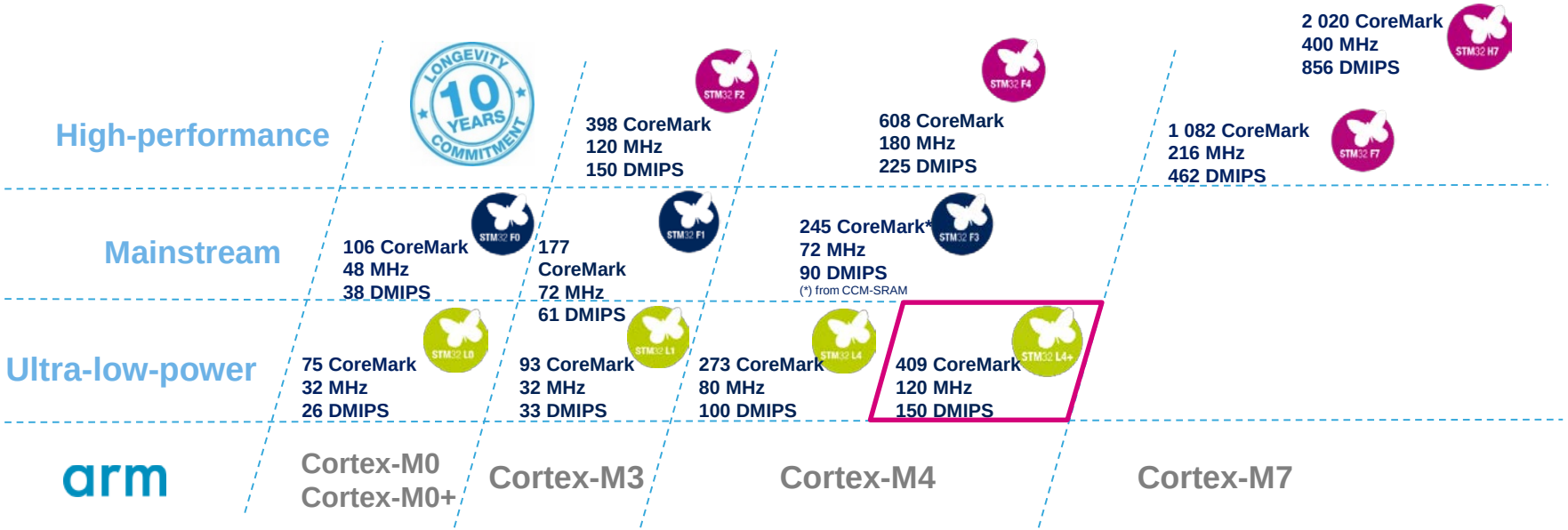
Safety and security

Integrated safety and security features



STM32L4+: continuity in STM32 portfolio

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



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+ Great investment

STM32L ULP portfolio

STM32L4+ completes the ultra-low-power family

Cost-smart ULP champion

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

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

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

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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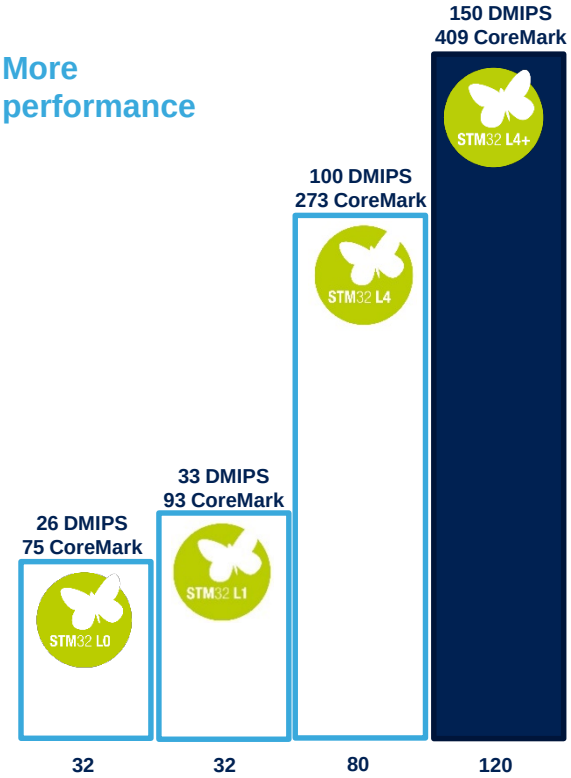
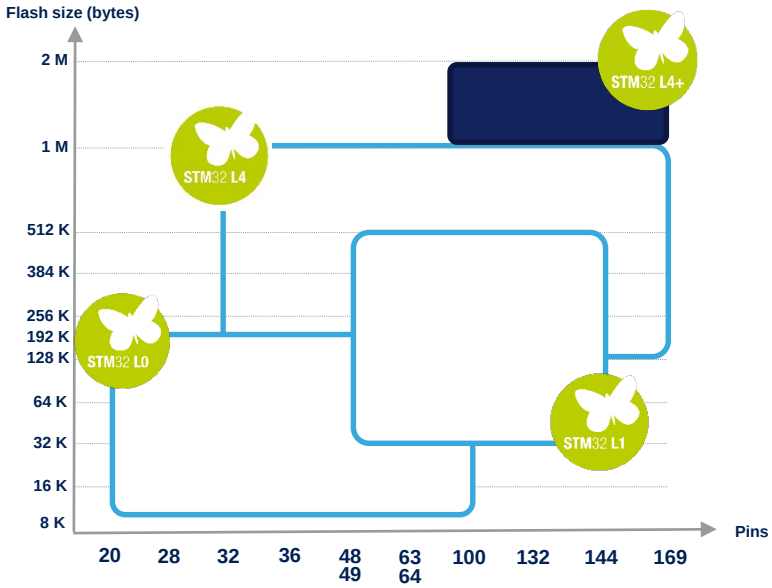
STM32L, a complete offer

STM32L4+ completes the ultra-low-power family

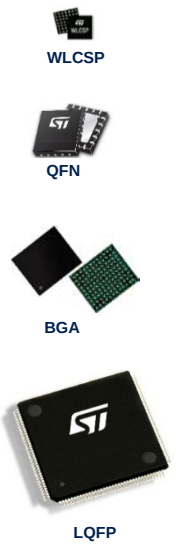
More performance



More memory and pin counts



More packages



+ Great investment

STM32L4+ series

Arm® Cortex®-M4 (DSP + FPU) – 120 MHz

- ART Accelerator™
- USART, SPI, I²C
- 2 x Quad-SPI
- 16 and 32-bit timers
- SAI + audio PLL
- CAN
- Camera IF
- Chrom-ART Accelerator™
- 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	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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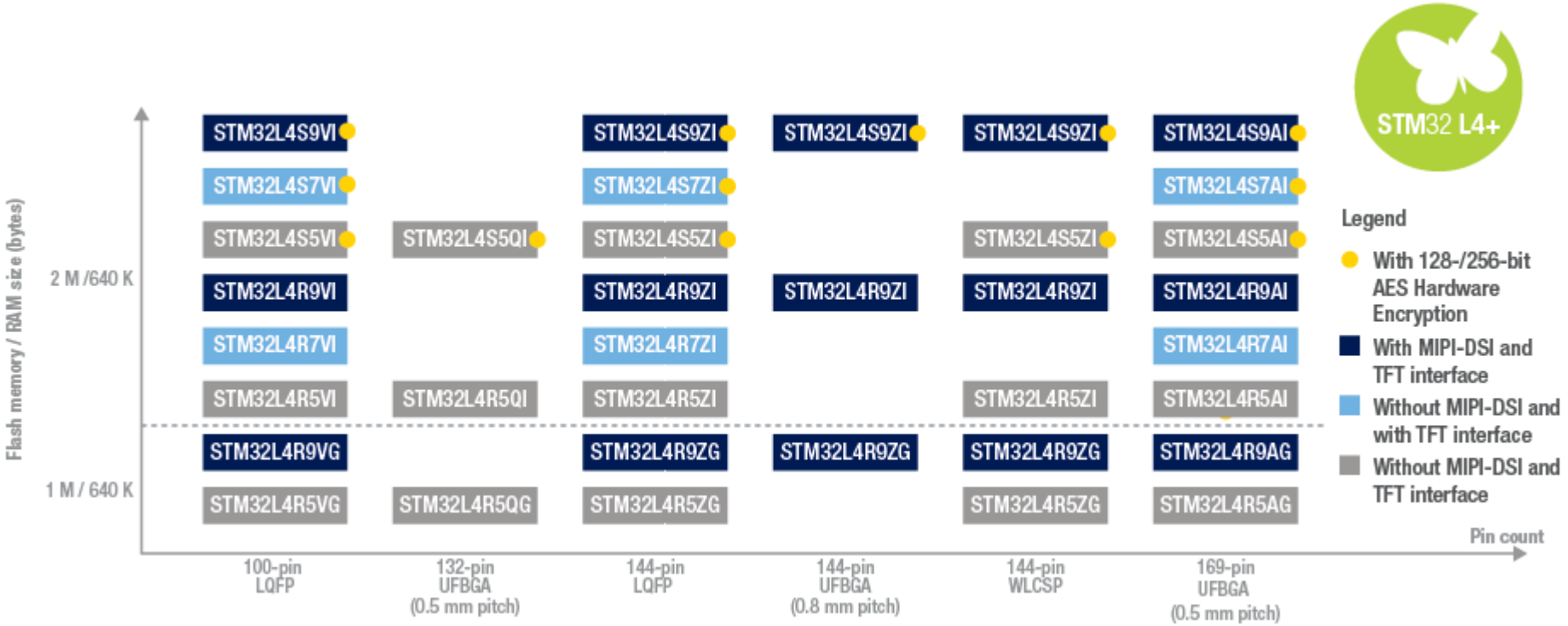
+ Great investment

STM32L4+ portfolio



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+ Great investment

STM32L4+ ecosystem

HARDWARE TOOLS

STM32 Nucleo

Flexible prototyping

Discovery kit

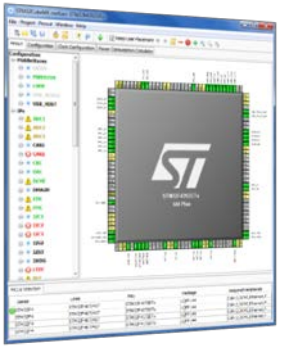
Key feature prototyping

Evaluation board

Full feature evaluation

SOFTWARE TOOLS

STM32CubeMX featuring code generation and power consumption calculation



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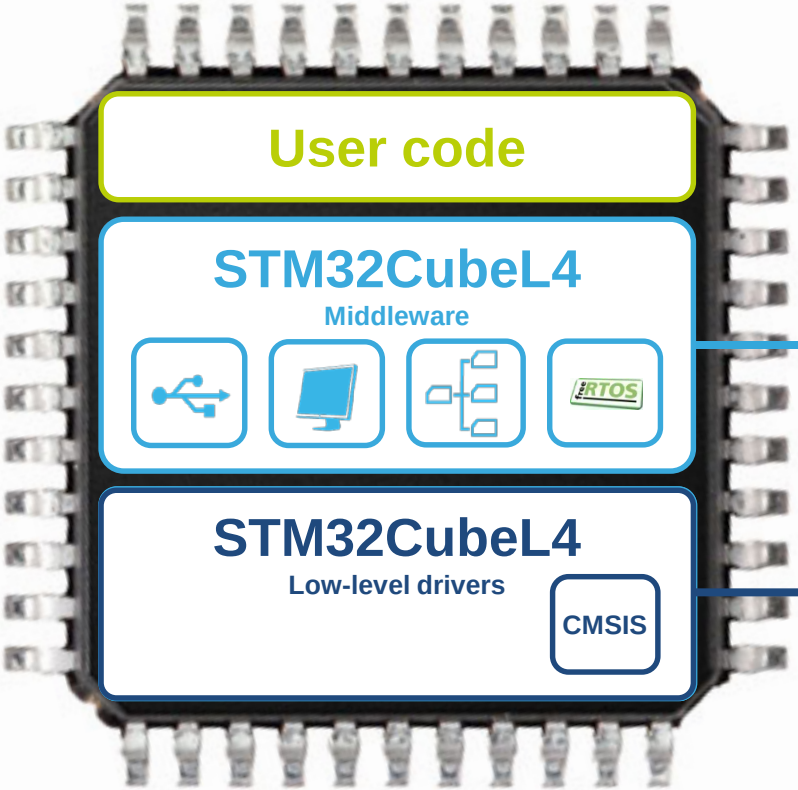
+ Great investment

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

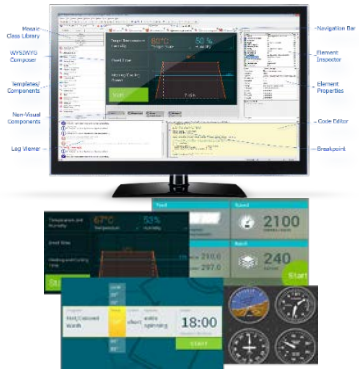
STM32 Graphic ecosystem

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

Thank you

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