



life.augmented

STM32L series

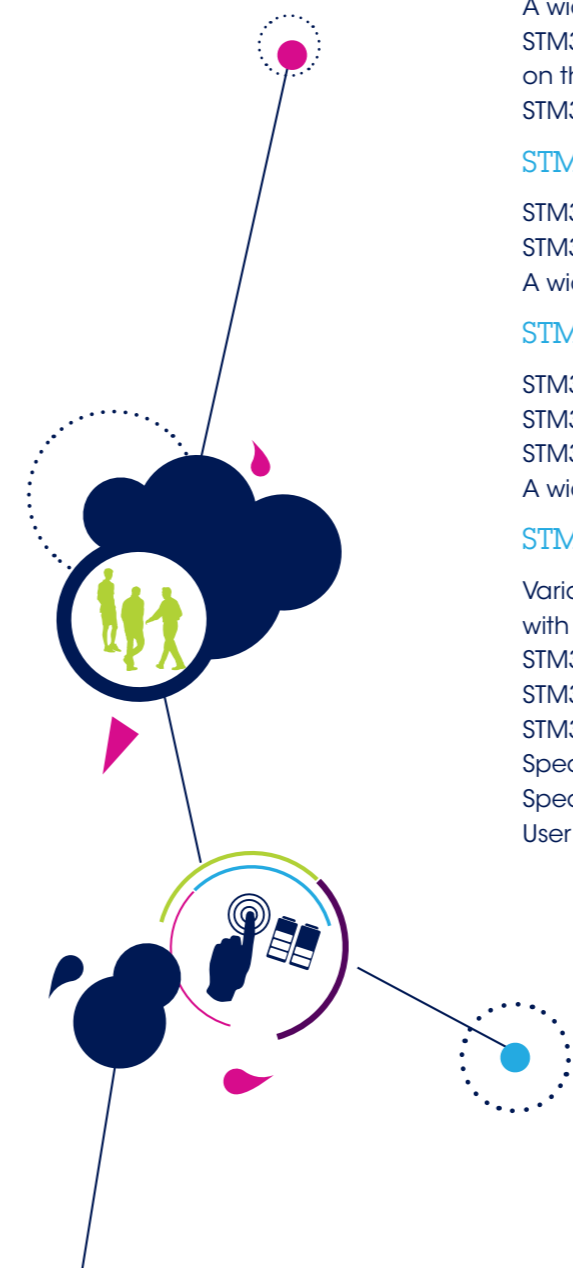
Ultra-low-power 32-bit MCUs Releasing your creativity





Content

STM32 and ultra-low-power	4
9 product series – more than 40 product lines	4
STM32L: Ultra-low-power 32-bit MCU series.....	5
STM32 ULP series	6
3 product series – 11 product lines: a unique offer	6
More memory, performance, peripherals and packages	6
STM32L4 series	10
STM32L4 Product lines.....	10
STM32L4 Ultra-low-power.....	10
A wide portfolio in full production	11
STM32L4 devices offer the lowest power consumption values on the market (25 °C).....	11
STM32L4 On-line training	11
STM32L1 series	12
STM32L1 Product lines.....	12
STM32L1 Ultra-low-power.....	12
A wide, fully-deployed portfolio	13
STM32L0 series	14
STM32L0 Product lines.....	14
STM32L0 Ultra-low-power.....	14
STM32L0 - World champion at high temperature (125 °C).....	14
A wide portfolio in full production	15
STM32L ecosystem	16
Various types of development boards enable you to get started with STM32L products.....	16
STM32 Nucleo.....	17
STM32 Nucleo expansion boards.....	17
STM32L Wireless connectivity solutions: LoRaWAN™	17
Specific focus on STM32L series	18
Specific offers for STM32L series.....	19
User recommendations	19



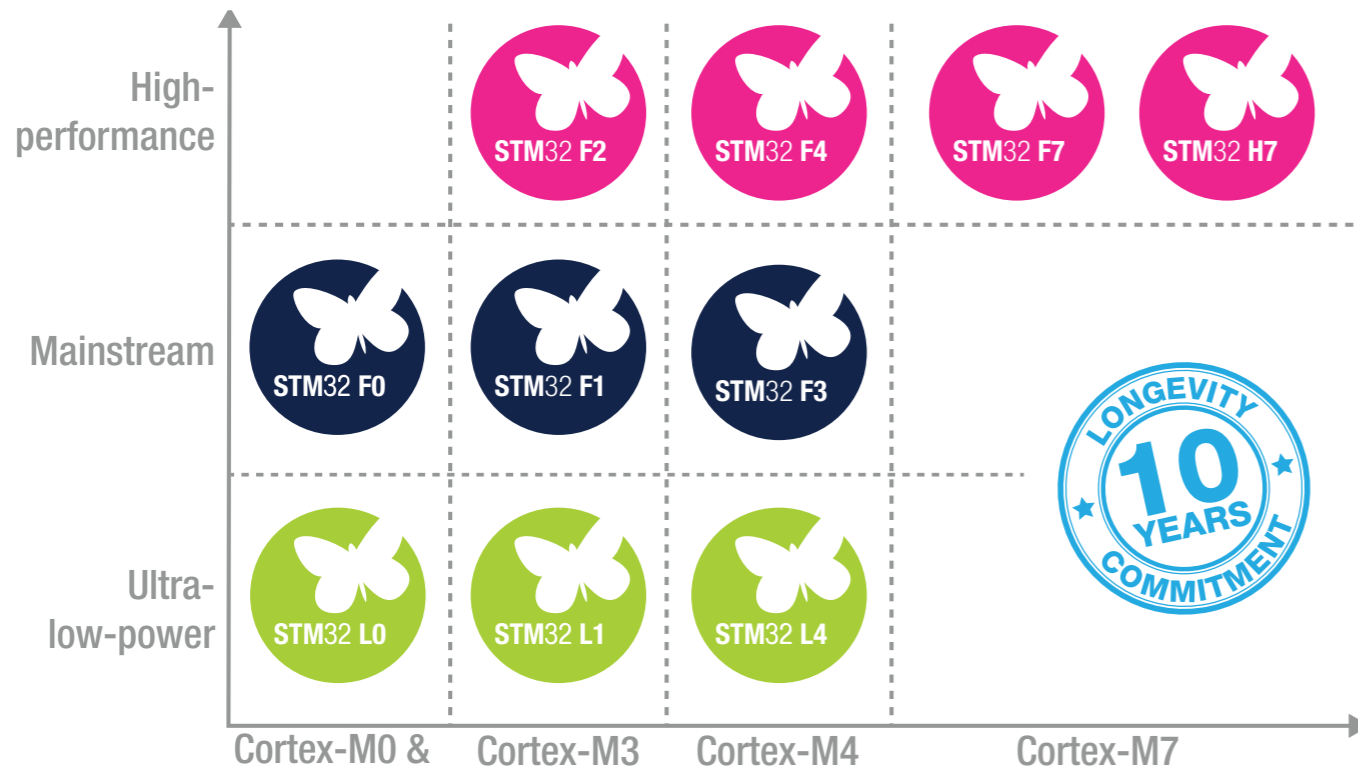


STM32 and ultra-low-power

By choosing an STM32 microcontroller for your embedded application, you gain from our market-leading expertise in MCU architecture, technology, multi-source manufacturing and long-term supply.

9 PRODUCT SERIES – MORE THAN 40 PRODUCT LINES

The STM32 portfolio offers an extraordinary variety of options including ARM® Cortex®-M cores (M0, M0+, M3, M4, and M7), giving developers flexibility to find the perfect match for their application. Particular attention is paid to make it easy to switch from one device to another. The compatibility of binaries combined with the similar pinout assignment, proliferation of hardware IPs and higher-level programming languages greatly facilitates the work of developers.



STM32L: ULTRA-LOW-POWER 32-BIT MCU SERIES

ST's ultra-low-power MCU platform is based on a proprietary ultra-low-leakage technology.

STM32L0 (ARM® Cortex®-M0+), STM32L1 (Cortex-M3), STM32L4 (Cortex-M4) and STM8L (8-bit proprietary core) series represent a large range of microcontrollers addressing devices supplied from batteries or through energy harvesting and help ensure an optimized cost/performance ratio for all kinds of low-power applications. With the industry's lowest current variation between -40 and +125°C, this ultra-low-power platform has outstandingly

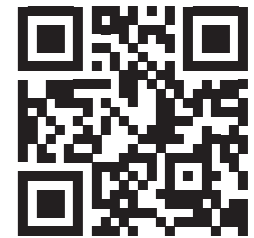
low current consumption at elevated temperatures.

The MCUs reach the industry's lowest power consumption of 350 nA in Stop mode (with SRAM retention), while maintaining a wakeup time as low as 3.5 µs.

The new STM32L4 series is the convergence of ultra-low power consumption and high performance providing 273 CoreMark® / 217 ULPBench™ with FPU and DSP instructions, more memory (up to 1 Mbyte of Flash memory) and innovative features.

STM32 selector guide

Free mobile and desktop application to find the right STM32 MCU.



www.st.com/stm32l






www.st.com/stm32finder



STM32 ULP series

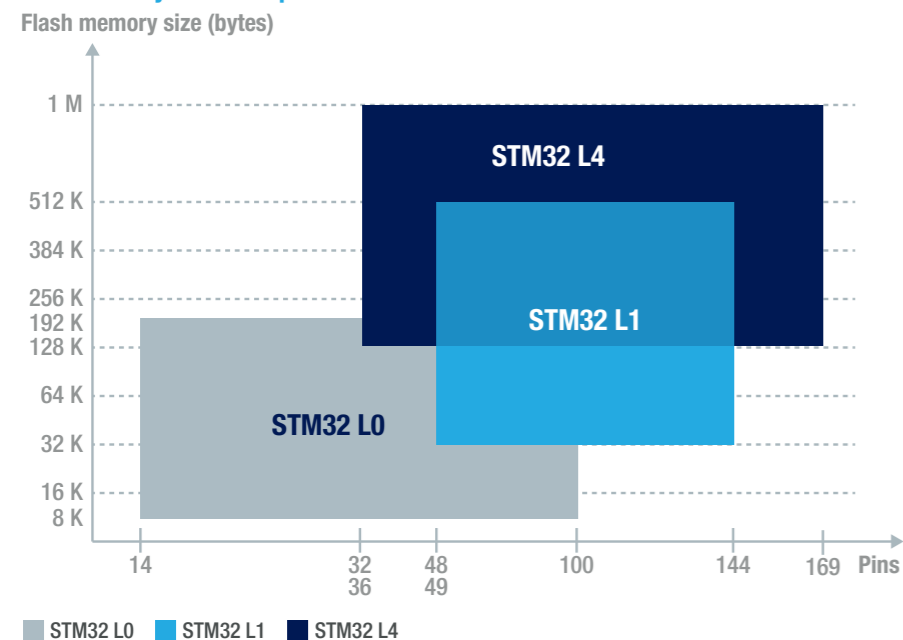
From cost smart up to high performance, there is an STM32L series to match all your memory, analog or peripheral needs.

3 PRODUCT SERIES – 11 PRODUCT LINES: A UNIQUE OFFER

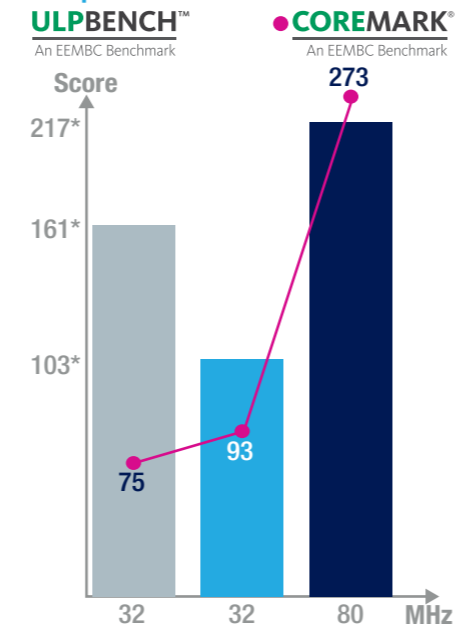
 <p>STM32 L0 COST-SMART ULP CHAMPION</p> <p>Cortex-M0+ at 32 MHz 1.65 to 3.6 V 8/16-bit applications Wide range of pin-counts</p>	 <p>STM32 L1 BROAD-RANGE FOUNDATION</p> <p>Cortex-M3 at 32 MHz 1.65 to 3.6 V Wide choice of memory sizes</p>	 <p>STM32 L4 HIGH-PERFORMANCE ADVANCED ANALOG</p> <p>Cortex-M4 w/ FPU at 80 MHz 1.71 to 3.6 V High-performance, advanced analog circuits</p>
<p>3 product lines Cost-effectiveness Smaller packages USB, LCD, Analog, AES 8 to 192 Kbytes of Flash memory 20 Kbytes of SRAM 6 Kbytes of EEPROM</p>	<p>3 product lines USB, LCD, AES, Rich Analog, Dual-bank Flash memory (RWW) 32 to 512 Kbytes of Flash memory 80 Kbytes of SRAM 16 Kbytes of EEPROM</p>	<p>5 product lines 5-MSPS ADC, PGA, Compar., DAC, Op Amp, USB OTG, LCD, AES 128 Kbytes to 1 Mbyte of Flash memory. Up to 320 Kbytes of SRAM</p>

MORE MEMORY, PERFORMANCE, PERIPHERALS AND PACKAGES

More memory sizes and pin-counts








More performances

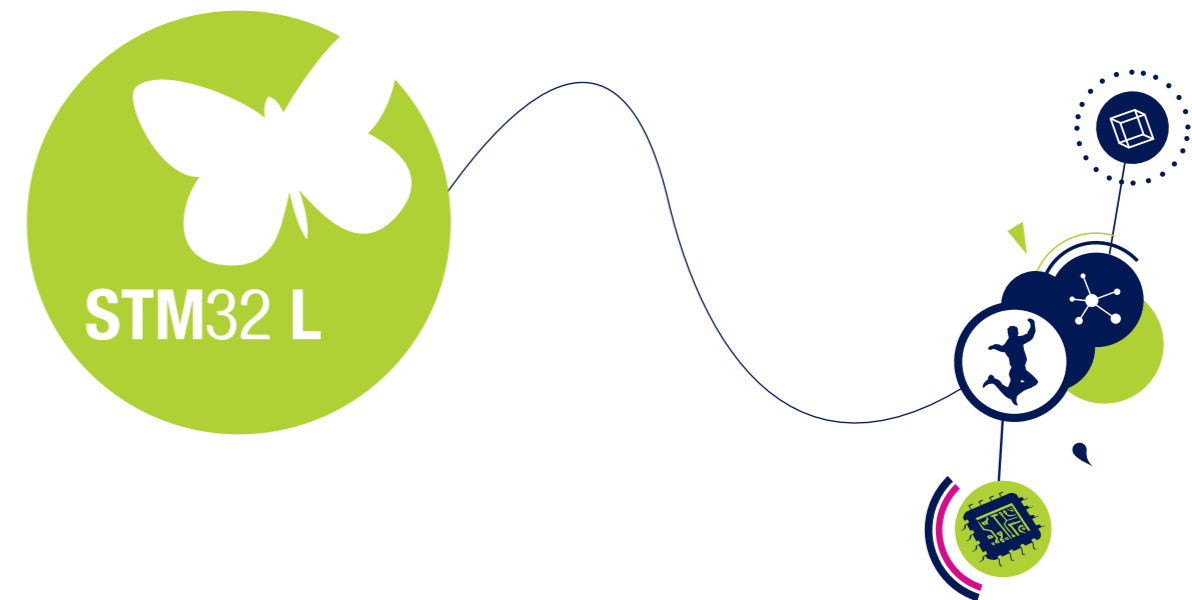


(*) using external DC/DC converter.
ULPBench score without DC/DC converter:
135 for STM32L0 series, 81 for STM32L1 series,
and 217 for STM32L4 series.

More packages

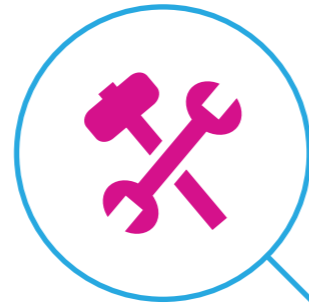
 <p>WLCSP WLCSP25 (~2x2 mm) WLCSP36 (~2x3 mm) WLCSP49 (~3x3 mm) WLCSP63 (~3x4 mm) WLCSP64 (~4x5 mm) WLCSP72 (~3x4 mm) WLCSP81 (~3x4 mm) WLCSP100 (~4x4 mm) WLCSP104 (~4x5 mm)</p>	 <p>QFN QFN20 (3x3 mm) QFN28 (4x4 mm) QFN32 (5x5 mm) QFN48 (7x7 mm)</p>	 <p>BGA BGA64 (5x5 mm) BGA100 (7x7 mm) BGA132 (7x7 mm) BGA169 (7x7 mm)</p>	 <p>TSSOP TSSOP14 (4.4x4.1 mm) TSSOP20 (4.4x6.6 mm)</p>	 <p>LQFP LQFP32 (7x7 mm) LQFP48 (7x7 mm) LQFP64 (10x10 mm) LQFP100 (14x14 mm) LQFP144 (20x20 mm)</p>
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Form factor



STM32 ULP MCUs are THE answer, whatever the application

- -40 to +125 °C temperature range
- 1.65 to 3.6 V power supply range
- RTC with anti-tamper at 0.95 ppm
- Safety with ECC on Flash, CRC, and parity bit on SRAM
- Independent dual-bank Flash memory and EEPROM (RWW)
- Internal RC \pm 1% accuracy over temperature and V_{DD}
- Wide package offer from 14 to 144 pins
- Full ARM® Cortex®-M0+/M3/M4 range offer



Power tools



Electricity smart meters

- Dynamic Efficiency 36 μ A/MHz
- FSMC for external memories
- LCD (4x52 or 8x48) for Display control
- TRNG and 256-bit AES for Security
- Digital filter for Sigma-Delta modulators
- V_{BAT} with RTC for Battery backup domain
- ARM® Cortex®-M4 at 80 MHz for computational power



- Down to 450 nA mode with RTC, 16 Kbytes of SRAM
- LP-UART, Pulse counter, 16-bit LP-Timer
- 3.5 μ s wakeup with 16 wakeup lines
- Dual-bank Flash memory (up to 1 Mbyte) for firmware upgrade
- Up to 16 Kbytes of true EEPROM for data login
- Built-in comparator and Op Amp with PGA
- PCROP, ECC, CRC, JTAG fuse for security purposes
- Full ARM® Cortex®-M0+/M3/M4 range offer



Gas/water meters



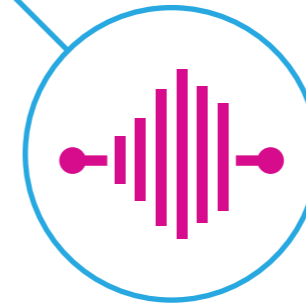
Fitness/Healthcare

- 8 nA Shutdown mode to extend battery life
- 1-Mbyte Flash memory to support advanced algorithms
- Dynamic Efficiency 36 μ A/MHz
- I²C FM+ for sensors and HS communication
- 12-/16-bit ADC Analog sensing and monitoring
- FS USB host for data transfer + device charging
- Full ARM® Cortex®-M0+/M3/M4 range offer

- 1.4 μ A Stop mode with 128 Kbytes of RAM+RTC
- 4 μ s wakeup time for fast system response
- USB 2.0 OTG for fast application processors
- 320 Kbytes of SRAM (including 64 Kbytes with parity bit)
- Down to 1.65 V full speed and feature capable
- I²C FM+, Fast SPI, Fast ADC for sensor acquisition
- ARM® Cortex®-M4 with FPU 100 DMIPS with ART Accelerator™



**Sensor hub
Mobile phone/Gaming**



**Audio and
Voice recognition**

- 28 nA Standby mode to extend battery life
- 4 to 14 μ s wakeup time for a better user experience
- Digital filter for Sigma Delta for MEMS microphone
- 12-bit ADC at 200 μ A / MSPS
- SAI / I2S for audio peripheral connections
- ARM® Cortex®-M4 at 80 MHz with 38 μ A/MHz at 100 DMIPS



STM32L4 series

Successfully meet all challenges

STM32L4 PRODUCT LINES

ARM® Cortex®-M4 (DSP + FPU) – 80 MHz	<ul style="list-style-type: none"> ART Accelerator™ USART, SPI, I²C Quad-SPI memory interface 16- and 32-bit timers SAI + audio PLL SWP 2x CAN 2x 12-bit DACs Temperature sensor Low voltage 1.71 to 3.6 V V_{BAT} mode Unique ID Capacitive touch sensing AES-256* - SHA-256** 	STM32 L4	Flash memory (KB)	RAM (KB)	Op Amp	Comp.	12-bit ADC 5 Msps 16-bit HW oversampling	USB2.0 FS Crystal-less	USB2.0 OTG FS	Segment LCD driver	
		Product line									
		STM32L4x1 Access	Up to 1024	Up to 128	•	•	•				
		STM32L4x2 USB FS	Up to 256	Up to 64	•	•	•	•			
		STM32L4x3 USB FS and LCD	Up to 256	Up to 64	•	•	•	•			Up to 8x40
		STM32L4x5 USB OTG	Up to 1024	Up to 128	•	•	•		•		
STM32L4x6 USB OTG and LCD	Up to 1024	Up to 320	•	•	•		•		Up to 8x40		

Note: * for STM32L486, STM32L443, STM32L442 and STM32L4A6 ** SHA-256 for L4A6

STM32L4 ULTRA-LOW-POWER

- ARM® Cortex®-M4 at 80 MHz with DSP + FPU, 100 DMIPS
- Dynamic run mode at 36 µA/MHz
- Down to 450 nA with 32 kHz RTC + 16 Kbytes of RAM + I/Os
- Down to 200 nA with 32 kHz RTC or 8 nA without RTC
- 12-/16-bit ADC with 5 MSPS, 200 µA/ MSPS, 1.65 V capable
- Operates at up to 125 °C

ULPBENCH™
An EEMBC Benchmark
217
(with external DC/DC))

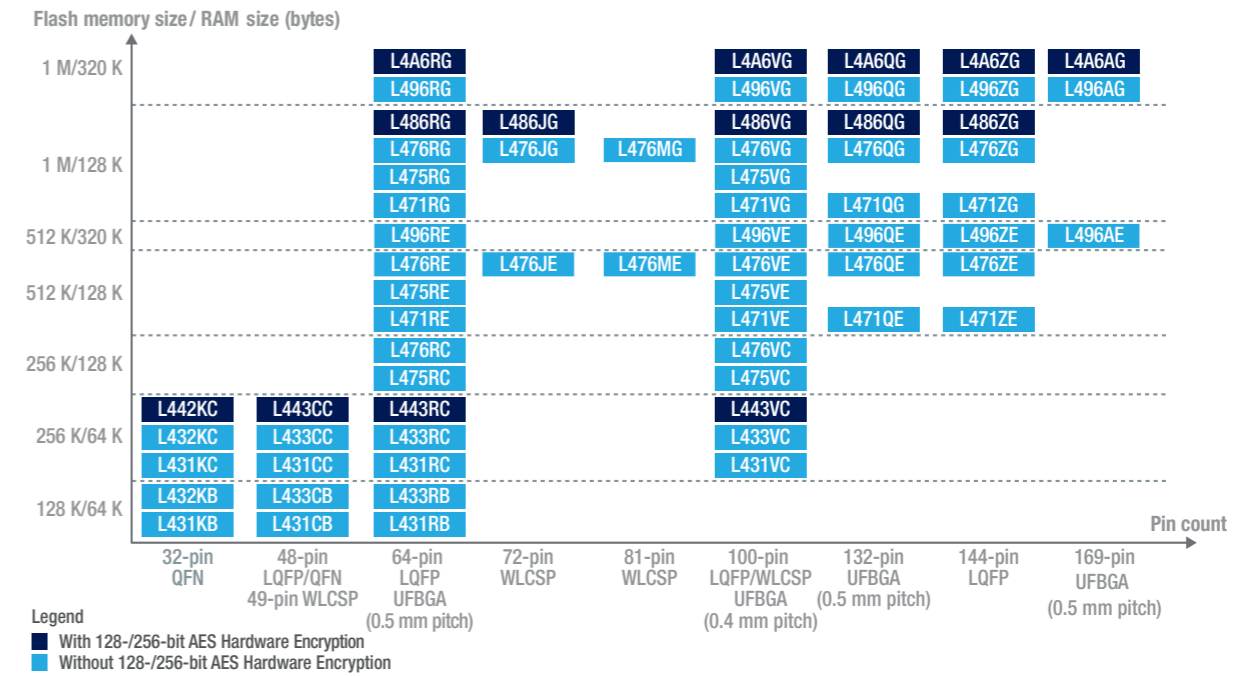
COREMARK®
An EEMBC Benchmark
273



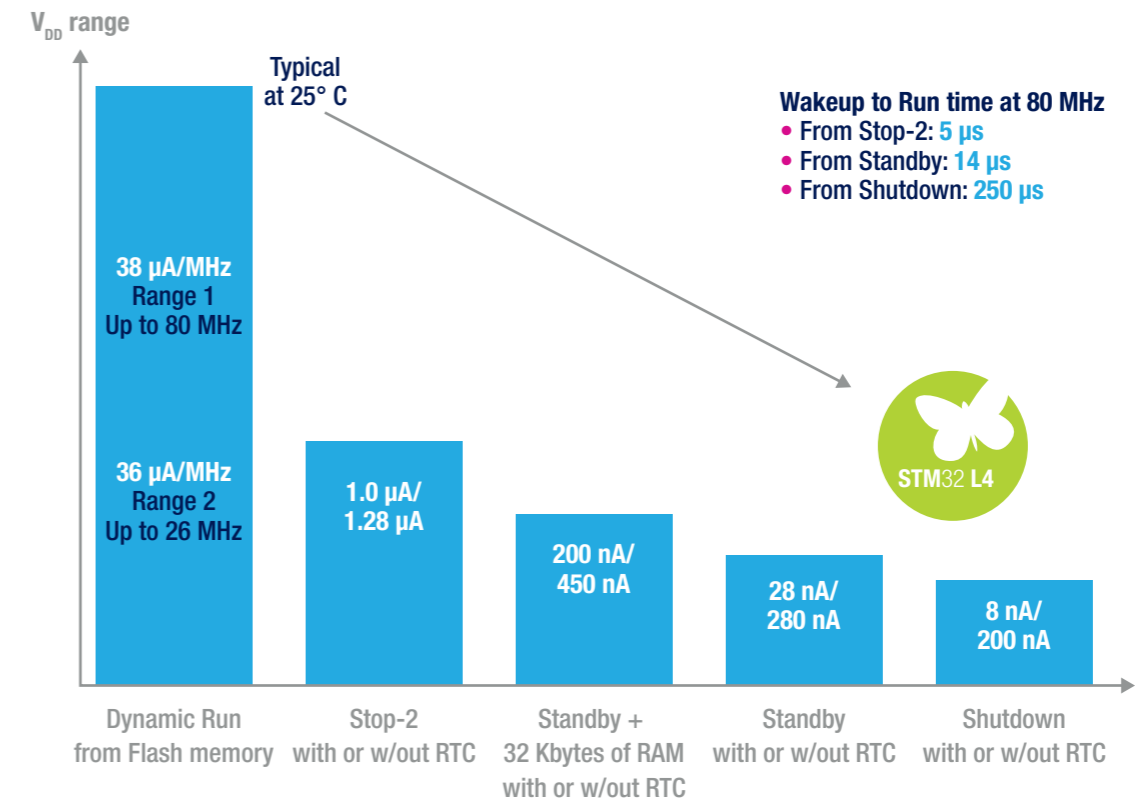

www.st.com/stm32l4



A WIDE PORTFOLIO IN FULL PRODUCTION



STM32L4 DEVICES OFFER THE LOWEST POWER CONSUMPTION VALUES ON THE MARKET (25 °C)


STM32L4 ON-LINE TRAINING
www.st.com/stm32l4-online-training



STM32L1 series

A market-proven solution

STM32L1 PRODUCT LINES

ARM® Cortex®-M3 (32 MHz with MPU) • Low voltage 1.65 to 3.6 V • Dynamic voltage scaling • 5 clock sources • Advanced RTC w/ calibration • Multiple USART, SPI, I²C • 16- and 32-bit timers • -40 to 85 °C oper. temp. Up to 105 °C in LP modes • 2 watchdogs • Brown-out Reset • Programmable voltage detector (PVD) • DMA • Reset circuitry POR/PDR • 12-bit ADC, 1 MSPS • 12-bit DAC	 Product line	Flash memory (KB)	RAM (KB)	EEPROM (KB)	Memory I/F	Op Amp	Comp.	Temp. sensor	Capacitive touch	Segment LCD driver	AES-128	
	STM32L100 Value line	32 to 256	4 to 16	2							Up to 8x28	
	STM32L151 STM32L152	32 to 512	16 to 80	4 to 16	SDIO FSMC	•	•	•	•		Up to 8x40	
	STM32L162	256 to 512	32 to 80	8 to 16	SDIO FSMC	•	•	•	•		Up to 8x40	•

STM32L1 ULTRA-LOW-POWER

- ARM® Cortex®-M3+ at 32 MHz, 33 DMIPS
- Dynamic run mode: down to 177 µA/MHz
- Stop with Full RAM retention 435 nA (1.3 µA with RTC)
- Standby mode + RTC: 900 nA with backup registers
- Standby mode: 280 nA with backup registers
- Dual-bank Flash memory and True embedded EEPROM
- Operates at up to 105 °C

ULPBENCH™
An EEMBC Benchmark

81
(without external DC/DC)

103
(with external DC/DC)

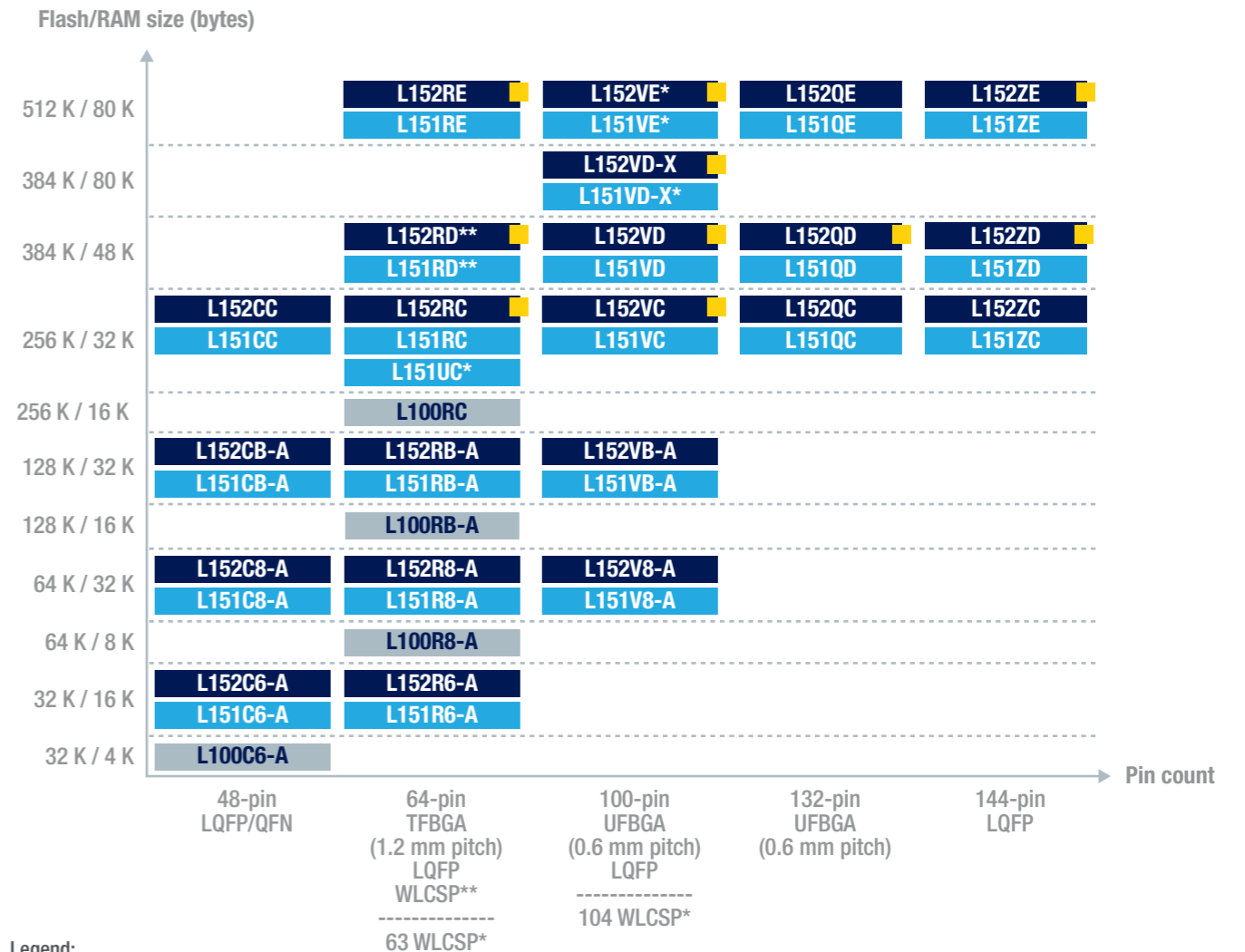
COREMARK®
An EEMBC Benchmark

93



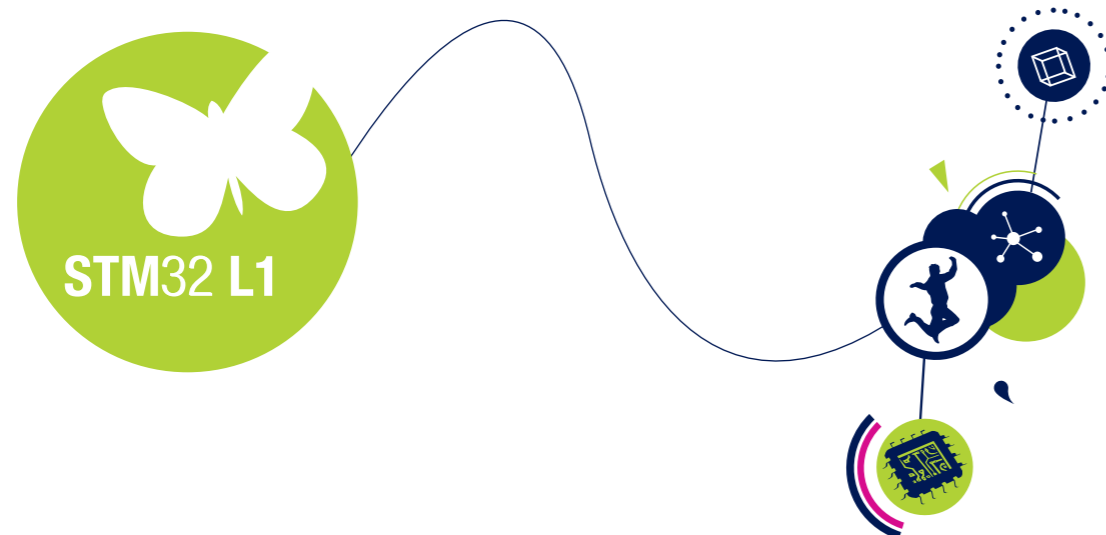
www.st.com/stm32l1

A WIDE, FULLY-DEPLOYED PORTFOLIO



Legend:

- STM32L100: Value line
- STM32L151: USB 2.0 FS + Advanced analog and peripherals
- STM32L152: STM32L151 + LCD
- STM32L162: STM32L152 + 128-bit AES





STM32LO series

A tiny consumption budget for a wide application range

STM32LO PRODUCT LINES

ARM® Cortex®-M0+ (32 MHz with MPU)	• Low voltage 1.65 to 3.6V	Flash (KB)	RAM (KB)	EEPROM (KB)	12-bit ADC 1.14 MSPS	LP ¹ UART	LP ¹ 16-bit timer	12-bit DAC	Touch sense	True RNG	USB 2.0 FS Crystal-less	Segment LCD Driver
	• -40 to 125°C oper. temp.											
	• 14 to 100 pins											
	• Dynamic voltage scaling											
	• 5 clock sources											
• Advanced RTC w/ calibration												
• Multiple USART, SPI, I ² C	Product											
• Multiple 16-bit timers	STM32L0x1 Access	Up to 192	Up to 20	Up to 6	•	•	•					
• 5V tolerant I/Os	STM32L0x2 USB	Up to 192	Up to 20	Up to 6	•	•	•	•	•	•	•	
• 2 watchdogs	STM32L0x3 USB & LCD	Up to 192	Up to 20	Up to 6	•	•	•	•	•	•	•	Up to 4x52 or 8x48
• Programmable voltage detector (PVD)												
• Reset circuitry POR/PDR												
• Brown-out Reset												
• DMA												
• Comparators												
• Temperature sensor												
• AES-128												

Note 1: Low-power peripherals available in ultra-low-power modes

STM32LO ULTRA-LOW-POWER

- ARM® Cortex®-M0+ at 32 MHz
- Dynamic run mode down to 49 µA/MHz
- Stop mode with RAM + LTC (low-power time clock): 420 nA
- Wakeup: 5 µs (Flash memory)
- 12-/16-bit ADC: 1 MSPS, 240 µA, 1.65 V capable
- Unique ID / 128-bit AES / Flash Proprietary Stack protection
- Operates at up to 125 °C

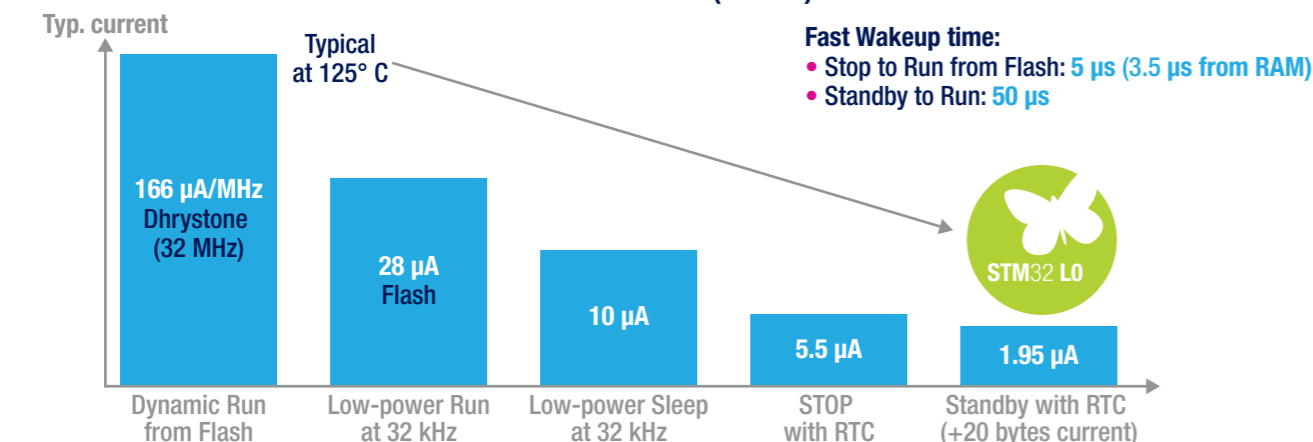
ULPBENCH™
An EEMBC Benchmark
135
(without external DC/DC)
161
(with external DC/DC)

COREMARK®
An EEMBC Benchmark
75

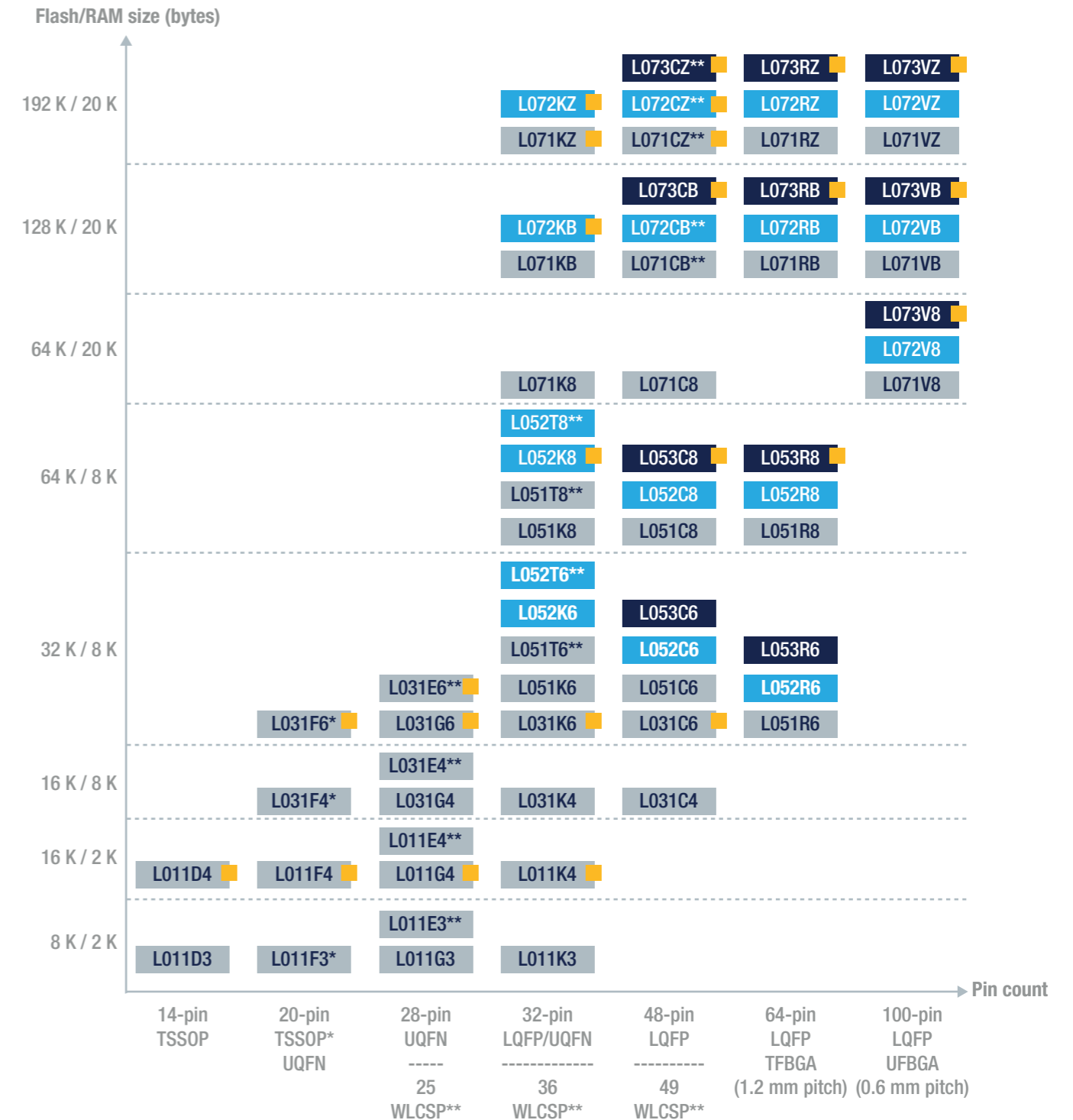


www.st.com/stm32lo

STM32LO - WORLD CHAMPION AT HIGH TEMPERATURE (125 °C)



A WIDE PORTFOLIO IN FULL PRODUCTION



Legend

- STM32L0x1: Access line
- STM32L0x2: USB 2.0 FS
- STM32L0x3: STM32L0x2 + LCD
- 128-bit AES hardware encryption
- + Advanced analog and peripherals

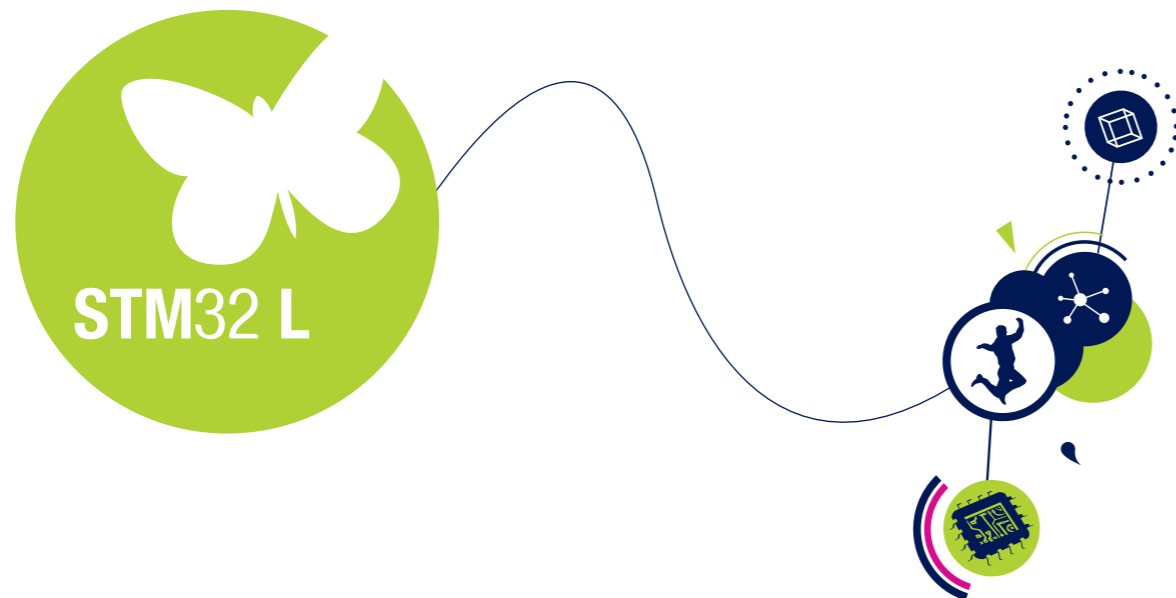
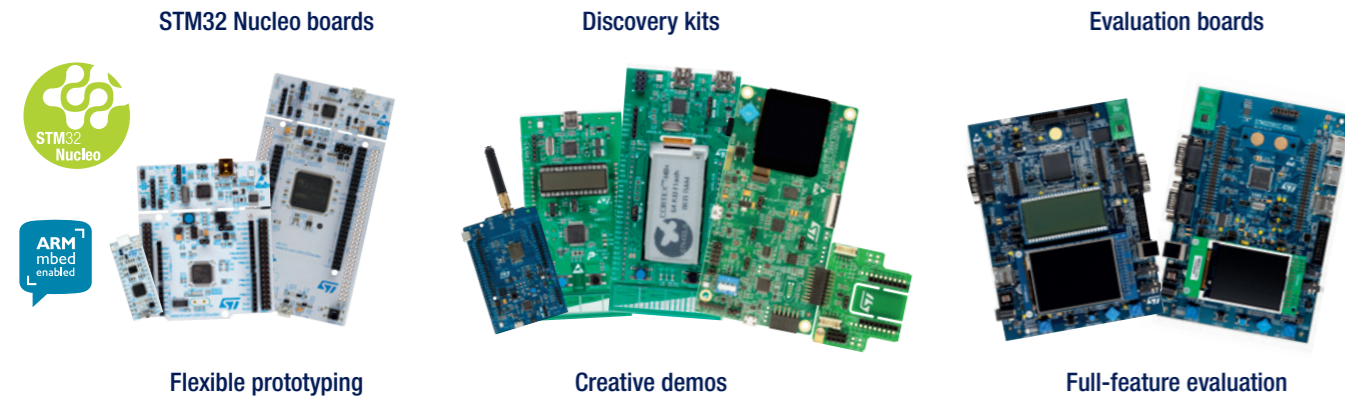
STM32L ecosystem

STM32 hardware tools

www.st.com/stm32hardwaretools

VARIOUS TYPES OF DEVELOPMENT BOARDS ENABLE YOU TO GET STARTED WITH STM32L PRODUCTS

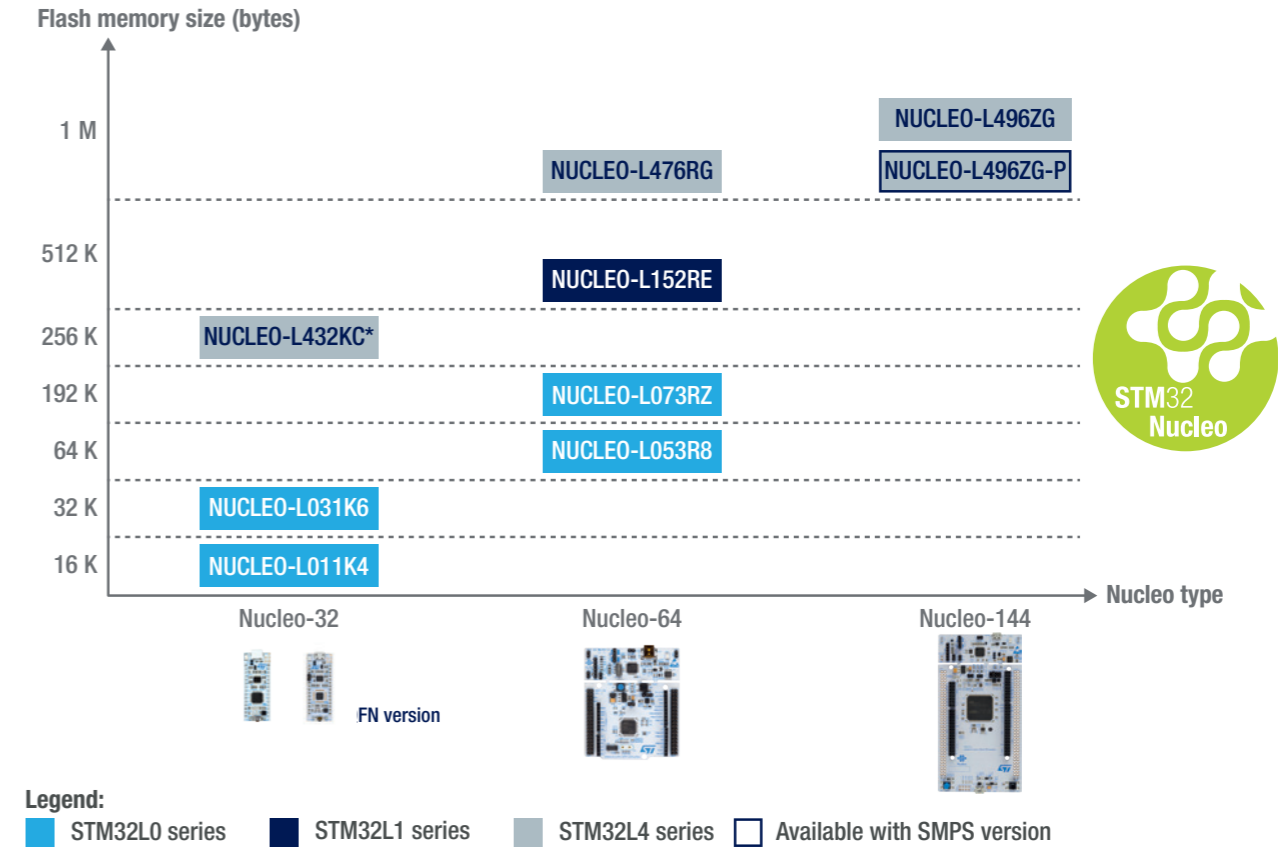
- STM32 Nucleo boards provide an affordable and flexible way for anyone to try out new ideas and build prototypes with a wide choice of specialized expansion boards.
- The Discovery kits enable users to seamlessly explore key low-power features of STM32L products, while the evaluation boards let you evaluate all MCU functions and peripherals.
- All these development boards include an integrated debugger/programmer as well as a comprehensive software library with examples that help developers take advantage of STM32L capabilities.



STM32 NUCLEO

- Open platform with 1 MCU and integrated debugger/programmer
- 2 types of connectors for unlimited expansion capabilities :
 - Arduino Uno Rev3 connectors on Nucleo-64, Arduino Nano on Nucleo-32
 - ST morpho connectors for direct access to all MCU I/Os
- Support for multiple IDEs and ARM® mbed™ online tools

Portfolio

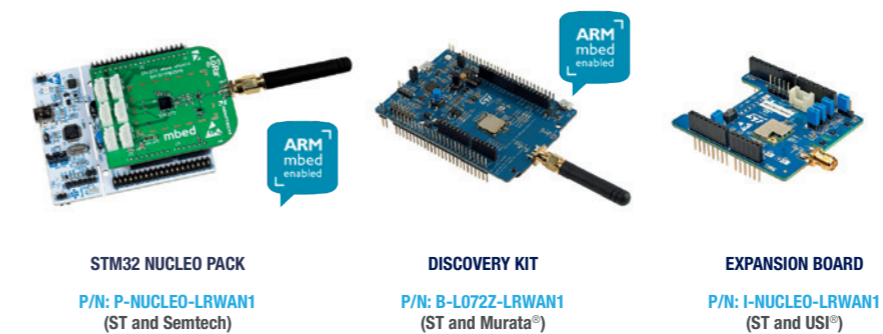


STM32 NUCLEO EXPANSION BOARDS

www.st.com/x-nucleo

STM32 Nucleo development boards can easily be expanded through a variety of add-on boards. These expansion boards open the door to any type of application leveraging the appropriate mix of performance/peripherals/power within the comprehensive STM32 family. Each expansion board integrates the necessary components to implement specialized features of a chosen application, and comes with complementary STM32 software modules.

STM32 Nucleo expansion boards from ST and third parties

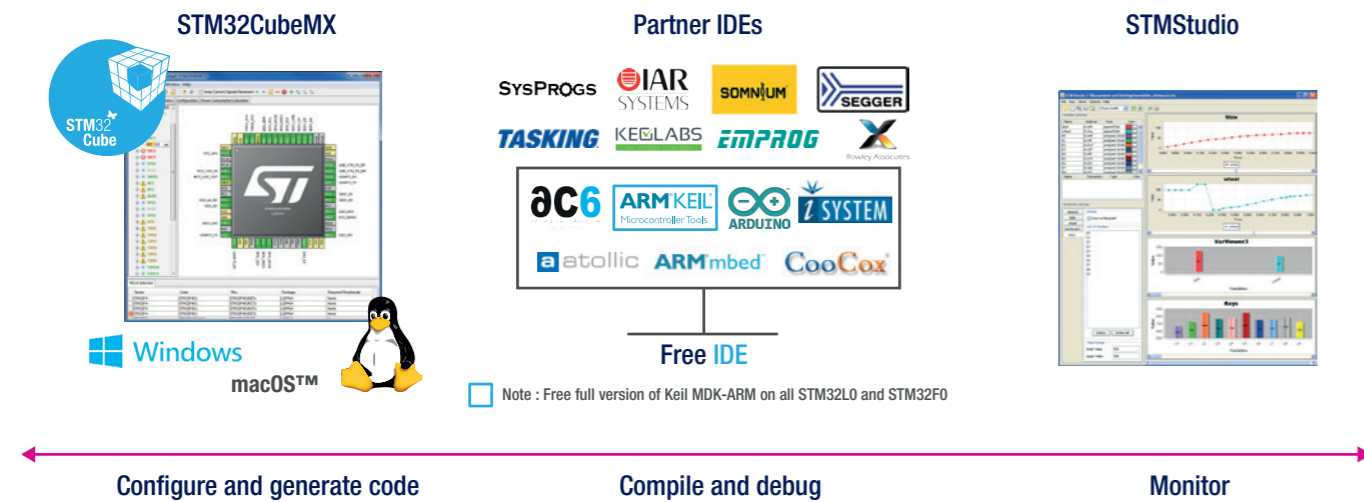


STM32L WIRELESS CONNECTIVITY SOLUTIONS: LoRa® LoRaWAN™

www.st.com/stm32-lrwan
 As a strong player on LPWAN, ST offers up to 3 affordable and easy-to-use sets of hardware tools dedicated to the evaluation and development of LoRa® solutions which combined with the LoRaWAN software expansion package for STM32Cube (I-CUBE-LRWAN) is the quickest way to build a LoRaWAN end-node device. Check out the STM32 LoRa® Discovery kit (B-L072Z-LRWAN1), the STM32 expansion board (I-NUCLEO-LRWAN1) and the STM32 Nucleo pack (P-NUCLEO-LRWAN1).

STM32 software development tools

www.st.com/stm32softwaretools



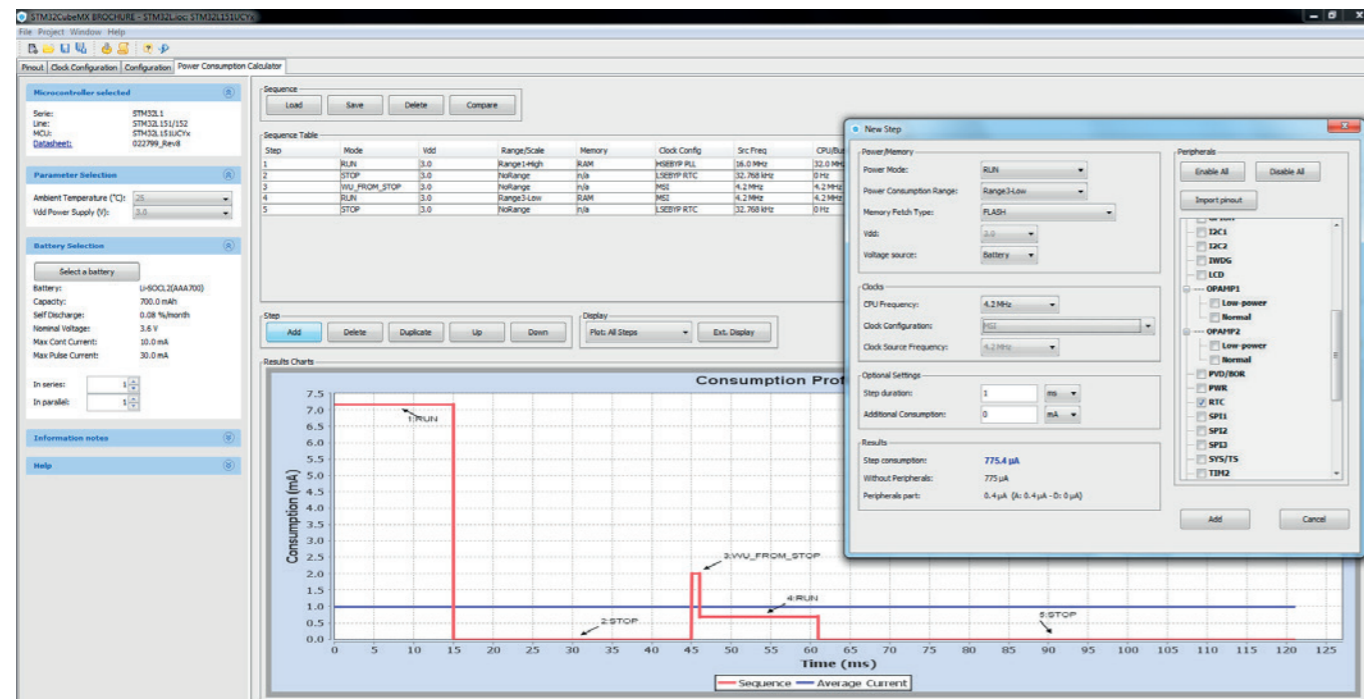
ST proposes a 3-step approach for standard development in C:

- 1/ Configure the microcontroller using the STM32CubeMX tool and optionally generate code depending on user choices
- 2/ Develop the application, compile and debug, using a free or commercial integrated development environment (IDE) from a partner such as: IAR, Keil*, AC6, Atollic, Coocox, Emprog, iSystem, Keolabs, Rowley, Segger, Tasking.
- 3/ Monitor the application while it is running without being intrusive with STMStudio.

*Free full version of Keil MDK-ARM on all STM32L0

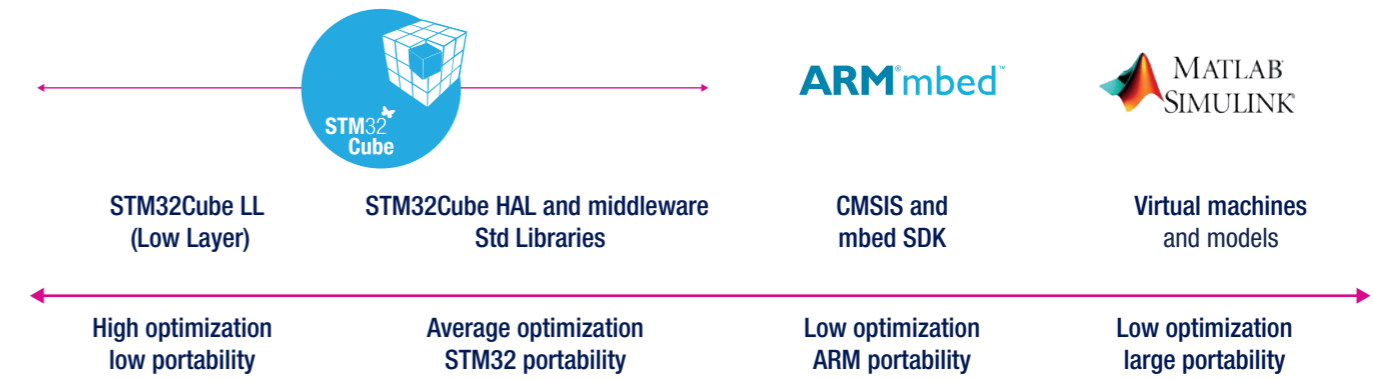
SPECIFIC FOCUS ON STM32L SERIES

Build your own chip configuration, select the battery type or configure your own, define a sequence of steps representing your application, and use the STM32CubeMX Power Consumption Calculator wizard to determine power consumption and battery life results.



STM32 embedded software

www.st.com/stm32embeddedsoftware



The ST's embedded software for the STM32 microcontroller family offers 4 different combinations of portability and optimization criteria:

- STM32Snippets: a collection of highly optimized code examples using direct register access
- Standard Peripheral Library: ensures portability at STM32 series level; for example, easy portability within the STM32L1 series
- STM32Cube embedded software: ensures portability at STM32 family level; facilitating application re-use from one STM32 MCU to another
 - The HAL hardware abstraction layer, enabling portability between different STM32 devices via standardized API calls
 - The Low-Layer (LL) APIs, a light-weight, optimized, expert oriented set of APIs designed for both performance and runtime efficiency
- CMSIS Driver and mbed abstraction layer: microcontroller abstraction for any Cortex-M-based microcontroller
- Solutions beyond the microcontroller world: STM32Java, .Net Micro framework, or MATLAB/Simulink

SPECIFIC OFFERS FOR STM32L SERIES

Product	STM32 L0	STM32 L1	STM32 L4
STM32Snippets	Now	Not Available	Not Available
Standard Peripheral Library	Not Available	Now	Not Available
STM32Cube HAL	Now	Now	Now
STM32Cube LL	Now	Now	Now

USER RECOMMENDATIONS

- STM32L1 users:
 - If only STM32L1 MCUs are required, the Standard Peripheral Library ensures a good portability level between all STM32L1 devices. STM32Cube is still highly recommended for new designs (order code: STSW-STM32077)
- STM32 portability needs:
 - STM32Cube HAL is the best answer when a high level of portability is required (order codes: STM32CubeL0, STM32CubeL1 and STM32CubeL4)
- STM32 optimization needs:
 - STM32Cube LL APIs allow user control down to the register level, thus minimizing software overhead and allowing for power consumption optimization (order codes: STM32CubeL0, STM32CubeL1 and STM32CubeL4)
 - For STM32L0 users, STM32Snippets allow users to control the hardware with minimal software overhead therefore optimizing power consumption. STM32Cube is still highly recommended for new designs (order code: STM32SnippetsL0)



www.st.com/stm32embeddedsoftware

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