STM32L4 MCU series
Ultra-low-power with performance
Key advantages of STM32L4 series

+ **ULP leader and performance booster**
  ST thought the STM32L4 architecture to reach 100 MIPS based on its ARM Cortex-M4 core with FPU and ST ART Accelerator™ at 80 MHz while keeping best-in-class, ultra-low-power (ULP) figures.

+ **Innovation**
  Innovative peripherals are embedded to optimize the BOM cost.

+ **Integration and safety**
  1 MB of Flash and 320-Kbyte of SRAM with safety and security features, smart and numerous peripherals, advanced and low power analog circuits in packages as small as 2.58 x 3.07 mm.

+ **Great Investment**
  Great Investment This new STM32 member benefits from the pin-to-pin compatibility of the STM32 family and the STM32 Ecosystem.
Ultra-low-power and flexibility
FlexPowerControl

STM32L4 is optimized to reduce power consumption and increase flexibility

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

- 28uA/MHz using external SMPS
  Dedicated $V_{12}$ to the core (down to 1.05 V)

- Down to 200 nA keeping 16 Kbytes of SRAM active in Standby mode

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

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

- Down to 8 nA for I/O wake-up with additional Shutdown mode

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

- 2 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)

- Internal oscillator from 100 kHz to 48 MHz
  ($\pm 0.25\%$ int. clock accuracy over voltage/temperature with LSE)
## Ultra-low-power modes

### Best power consumption numbers with full flexibility

<table>
<thead>
<tr>
<th>Wake-up time</th>
<th>( V_{\text{BAT}} )</th>
<th>( V_{\text{BAT}} )</th>
<th>Tamper detection: 2 I/Os, RTC</th>
</tr>
</thead>
<tbody>
<tr>
<td>250 ( \mu s )</td>
<td>2 nA / 200 nA*</td>
<td></td>
<td>Wake-up sources: reset pin, 5 I/Os, RTC</td>
</tr>
<tr>
<td>14 ( \mu s )</td>
<td>8 nA / 200 nA*</td>
<td></td>
<td>Wake-up sources: + BOR, IWDG</td>
</tr>
<tr>
<td>Standby</td>
<td>34 nA / 280 nA*</td>
<td></td>
<td>Wake-up sources: + all I/Os, PVD, LCD, COMPs, I²C, LPUART, LPTIM</td>
</tr>
<tr>
<td>Standby + 8-Kbyte RAM</td>
<td>200 nA / 440 nA*</td>
<td></td>
<td>Wake-up sources: + all I²C, UART</td>
</tr>
<tr>
<td>5 ( \mu s )</td>
<td>720 nA / 950 nA*</td>
<td></td>
<td>Wake-up sources: any interrupt or event</td>
</tr>
<tr>
<td>4 ( \mu s )</td>
<td>3.2 ( \mu A ) / 3.4 ( \mu A )*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 cycles</td>
<td>Sleep</td>
<td>8 ( \mu A/\text{MHz} ) ** / 20 ( \mu A/\text{MHz} ) **</td>
<td></td>
</tr>
<tr>
<td>Run at 24 MHz</td>
<td>Run at 80 MHz</td>
<td>28 ( \mu A/\text{MHz} ) ** / 79 ( \mu A/\text{MHz} ) **</td>
<td></td>
</tr>
<tr>
<td>Stop 1 (full retention)</td>
<td>Standby + 8-Kbyte RAM</td>
<td>200 nA / 440 nA*</td>
<td></td>
</tr>
<tr>
<td>4 ( \mu s )</td>
<td>Stop 2 (full retention)</td>
<td>720 nA / 950 nA*</td>
<td></td>
</tr>
<tr>
<td>5 ( \mu s )</td>
<td>Standby</td>
<td>34 nA / 280 nA*</td>
<td></td>
</tr>
<tr>
<td>Wake-up sources: + all I/Os, PVD, LCD, COMPs, I²C, LPUART, LPTIM</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: * without RTC / with RTC  
** with external SMPS
STM32L4 takes off like a rocket

From 0 to 48 MHz in less than 5 µs
From 0 to 80 MHz in less than 20 µs

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dhrystone</td>
<td>100</td>
</tr>
<tr>
<td>ULPBENCH</td>
<td>447 ULPMark-CP</td>
</tr>
<tr>
<td>ULPBENCH</td>
<td>167 ULPMark-PP</td>
</tr>
<tr>
<td>COREMARK</td>
<td>273</td>
</tr>
</tbody>
</table>

STM32L4

RUN 48 MHz

RUN 80 MHz

< 5 µs!

STOP mode
Providing more performance

- Up to 80 MHz/ 100 DMIPS with Chrom-ART Accelerator™
- Up to 273 CoreMark result
- Arm® Cortex®-M4 with FPU and DSP instructions
- 2x DMA (14 channels)
- SPI up to 40 Mbit/s, USART 10 Mbit/s
Digital Filter for Sigma Delta Modulators
8 x parallel inputs with up to 24-bit data output resolution

V_{BAT} with RTC for battery backup
200 nA in V_{BAT} mode for RTC and
32 x 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

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

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

LCD Display
SPI, Parallel or TFT Interface

STM32L4
Electricity/Gas / Water Smart Meter
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

STM32L4
Electricity/Gas/Water Smart Meter

Display
FSMC - Parallel interface to TFT
SPI - Up to 40 MHz speed

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)

I2C
3x I2C FM+(1 Mbit/s), SMBus/PMBus

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

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

STM32L4
Electricity/Gas/Water Smart Meter

Display
FSMC - Parallel interface to TFT
SPI - Up to 40 MHz speed

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)

I2C
3x I2C FM+(1 Mbit/s), SMBus/PMBus

I/Os
Up to 114 fast I/Os for buttons & relays
High integration level with high memory size in small packages

Package size down to 2.58 x 3.07 mm
Integrated safety and security features

- Brown-out Reset in all modes
- Clock Security System
- SRAM parity check
- Backup byte registers
- Supply monitoring
- Flash with ECC with status register (address)
- Dual watchdog

- Anti-tamper detection
- Memory Protection Unit (MPU)
- Read and Write Protection
- Unique ID
- AES-256 / SHA-256 Encryption
- JTAG fuse
- True Random Number Generator
- Software IP Protection
STM32L4: continuity in the STM32 portfolio

STM32L4: Optimized for mixed-signal applications Cortex-M0+ Radio co-processor

STM32H7
3224 CoreMark
240 MHz Cortex-M4
480 MHz Cortex-M7
1082 CoreMark
216 MHz

STM32L4
273 CoreMark
80 MHz
161 CoreMark
48 MHz

STM32L5
443 CoreMark
110 MHz

STM32F2
398 CoreMark
120 MHz

STM32F4
608 CoreMark
180 MHz

STM32F3
245 CoreMark
72 MHz

STM32F1
177 CoreMark
72 MHz

STM32F0
106 CoreMark
48 MHz

STM32G0
142 CoreMark
64 MHz

STM32G1
182 CoreMark
64 MHz

STM32F1
177 CoreMark
72 MHz

STM32L0
75 CoreMark
32 MHz

STM32L1
93 CoreMark
32 MHz

STM32L5
443 CoreMark
110 MHz

STM32L4
273 CoreMark
80 MHz
161 CoreMark
48 MHz

STM32L4+
409 CoreMark
120 MHz

STM32WB
216 CoreMark
64 MHz

STM32WL
161 CoreMark
48 MHz

STM32F0
106 CoreMark
48 MHz

STM32G0
142 CoreMark
64 MHz

STM32F1
177 CoreMark
72 MHz

STM32F2
398 CoreMark
120 MHz

STM32F4
608 CoreMark
180 MHz

STM32F3
245 CoreMark
72 MHz

STM32F1
177 CoreMark
72 MHz

STM32L0
75 CoreMark
32 MHz

STM32L1
93 CoreMark
32 MHz

STM32L5
443 CoreMark
110 MHz

STM32L4
273 CoreMark
80 MHz
161 CoreMark
48 MHz

STM32L4+
409 CoreMark
120 MHz

STM32WB
216 CoreMark
64 MHz

STM32WL
161 CoreMark
48 MHz

STM32F0
106 CoreMark
48 MHz

STM32G0
142 CoreMark
64 MHz

STM32F1
177 CoreMark
72 MHz

STM32F2
398 CoreMark
120 MHz

STM32F4
608 CoreMark
180 MHz

STM32F3
245 CoreMark
72 MHz

STM32F1
177 CoreMark
72 MHz

STM32L0
75 CoreMark
32 MHz

STM32L1
93 CoreMark
32 MHz

STM32L5
443 CoreMark
110 MHz

STM32L4
273 CoreMark
80 MHz
161 CoreMark
48 MHz

STM32L4+
409 CoreMark
120 MHz

STM32WB
216 CoreMark
64 MHz
STM32L ULP portfolio

STM32L4 completes the ultra-low-power family

**STM32L0**
- 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, Up to 20 Kbytes of SRAM

**STM32L1**
- 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, Up to 80 Kbytes of SRAM

**STM32L4**
- ULP With performance
- Cortex-M4 w/ FPU at 80 MHz
- 1.71 to 3.6V
- High-performance, advanced analog circuits
- 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

**STM32L4+**
- ULP with more performance
- Cortex-M4 w/ FPU at 120 MHz
- 1.71 to 3.6V
- Wide choice of memory sizes
- 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

**STM32L5**
- Advanced security
- Cortex-M33 w/ FPU at 110 MHz
- 1.71 to 3.6V
- Wide choice of memory sizes
- 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
STM32L, a complete offer

STM32L4+ completes the ultra-low-power family

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

STM32L5
- 32-bit Arm® Cortex®-M33 + FPU at 110 MHz
- From 256 to 512 Kbyte of Flash memory
- Low power modes + RAM + RTC: 0.05 μA

STM32L4+
- 32-bit Arm® Cortex®-M4 + FPU at 120 MHz
- From 512 Kbytes up to 2 Mbytes of Flash memory
- Low power modes + RAM + RTC: 0.096 μA

STM32L4
- 32-bit Arm® Cortex®-M4 + FPU at 110 MHz
- From 64 Kbytes to 1 Mbyte of Flash memory
- Low power modes + RAM + RTC: 0.34 μA

STM32L1
- 32-bit Arm® Cortex®-M3 at 32 MHz
- From 22 to 512 Kbytes of Flash memory
- Low power modes + RAM + RTC: 1.2 μA

STM32L0
- 8-bit STM8 core at 16 MHz
- From 2 to 64 Kbytes of Flash memory
- Low power Halt mode: 0.1 μA

STM32L Plus family
- Flash memory size (bytes)
- Pins

STM32L0
- STM32L1
- STM32L4
- STM32L4+
- STM32L5
<table>
<thead>
<tr>
<th>Product line</th>
<th>Flash (KB)</th>
<th>RAM (KB)</th>
<th>Memo - ry I/F FSMC</th>
<th>Op-Amp</th>
<th>CAN</th>
<th>Sigma Delta Interface</th>
<th>12-bit ADC 5 Mips 16-bit HW oversampling</th>
<th>DAC</th>
<th>SCI</th>
<th>USB2.0 OTG</th>
<th>USB Device</th>
<th>Segment LCD</th>
<th>Driver</th>
<th>STM32LART™ Accelerator</th>
</tr>
</thead>
<tbody>
<tr>
<td>STM32L496**</td>
<td>512 to 1024</td>
<td>320</td>
<td>• 2 2 8x ch</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>Up to 8x40</td>
<td></td>
<td></td>
<td>Up to 8x40</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STM32L476*</td>
<td>256 to 1024</td>
<td>128</td>
<td>• 2 1 8x ch</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>Up to 8x40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STM32L475</td>
<td>256 to 1024</td>
<td>128</td>
<td>• 2 1 8x ch</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STM32L433*</td>
<td>128 to 256</td>
<td>64</td>
<td>1 1 2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>Up to 8x40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STM32L452*</td>
<td>256 to 512</td>
<td>160</td>
<td>1 1 4x ch</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STM32L432*</td>
<td>128 to 256</td>
<td>64</td>
<td>1 1 1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STM32L412*</td>
<td>64 to 128</td>
<td>40</td>
<td>1 1 2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STM32L471</td>
<td>512 to 1024</td>
<td>128</td>
<td>• 2 1 8x ch</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STM32L461</td>
<td>256 to 512</td>
<td>160</td>
<td>1 1 4x ch</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STM32L431</td>
<td>128 to 256</td>
<td>64</td>
<td>1 1 1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: * HW crypto/hash functions are available on STM32L496, STM32L443, STM32L462, STM32L442 and STM32L422 - ** on STM32L4A6
STM32L4 portfolio
STM32L4 ecosystem

HARDWARE TOOLS

<table>
<thead>
<tr>
<th>STM32 Nucleo boards</th>
<th>Discovery kits</th>
<th>Evaluation board</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexible prototyping</td>
<td>Key feature prototyping</td>
<td>Full feature evaluation</td>
</tr>
</tbody>
</table>

SOFTWARE TOOLS

wiki.st.com/stm32mcu
github.com/STMicroelectronics
STM32L4/L4+ ecosystem

EMBEDDED SOFTWARE

- Open-source TCP/IP stack (lwIP)
- 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)
- Touch-sensing library
- Dozens of 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
Summary
4 keys of STM32 L4 series

- More performance and still ULP leader
- More Graphics and Innovation
- More Integration
- Great Investment
Releasing your creativity

/STM32

community.st.com

www.st.com/STM32L4

STM32L4 Online training

STM32L4 MOOC
Thank you