STM32L4 MCU series
Excellence in **ultra-low-power** with **performance**
Key advantages of STM32L4 series

1. **ULP leader and performance booster** ST has built a new architecture to reach best-in-class, ultra-low-power figures thanks to its high flexibility. Moreover, the performance of the STM32L4 series adds a new dimension to the ultra-low-power world. It delivers 100 DMIPS based on its ARM Cortex-M4 core with FPU and ST ART Accelerator™ at 80 MHz.

2. **Innovation** To address a large market range, its architecture implements several innovations and embeds smart peripherals.

3. **Integration and safety** 1 Mbyte of Flash memory and 128 Kbytes of SRAM with safety and security features, smart and numerous peripherals, advanced and low-power analog circuits in packages as small as 3.8 x 4.4 mm.

4. **Great Investment** This new STM32 member benefits from the pin-to-pin compatibility of the STM32 family and the STM32 development ecosystem.
Leader in ultra-low-power for power supply < 2.8 V

On competition devices: discontinuity due to DC/DC no longer functional when voltage decreases

No external coil and capacitor required for STM32L4

The higher the better!
Ultra-low-power and flexibility

STM32L4 is based on a new 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 360 nA keeping 32 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 30 nA for I/O wake-up**
  with additional Shutdown mode

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

- **4 nA $V_{BAT}$ mode with charging capability**
  Automatic switch to maintain power for RTC and backup registers

- **USB capable with 32 kHz crystal oscillator**
  (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)

STM32L4 is an ultra-low-power leader and performance booster.

STM32L4 is based on a new platform optimized to reduce power consumption and increase flexibility.
# Ultra-low-power modes

## Best power consumption numbers with full flexibility

<table>
<thead>
<tr>
<th>Wake-up time</th>
<th>250 µs</th>
<th>14 µs</th>
<th>14 µs</th>
<th>5 µs</th>
<th>4 µs</th>
<th>6 cycles</th>
</tr>
</thead>
<tbody>
<tr>
<td>VBAT</td>
<td>4 nA / 300 nA*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shutdown</td>
<td>30 nA / 330 nA*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standby</td>
<td>130 nA / 430 nA*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standby + 32-Kbyte RAM</td>
<td>360 nA / 660 nA*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stop 2 (full retention)</td>
<td>1.1 µA / 1.4 µA*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STOP 1 (full retention)</td>
<td>7.3 µA / 7.6 µA*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stop 1 (full retention)</td>
<td></td>
<td>35 µA / MHz</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Run at 24 MHz</td>
<td></td>
<td></td>
<td></td>
<td>100 µA / MHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Run at 80 MHz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>112 µA / MHz</td>
</tr>
</tbody>
</table>

**Note:** * without RTC / with RTC

- 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: + all I²C, UART
- Wake-up sources: any interrupt or event

ULP leader and performance booster
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 $f_{\text{MAX}}$)
Providing more performance

Do not compromise on performance with STM32L4

- **Up to 80 MHz/ 100 DMIPS** with 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
Smart peripherals

**Metering**

**Digital Filter for Sigma Delta Modulators**
8 x parallel inputs with up to 24-bit data output resolution

**V\(_{\text{BAT}}\) with RTC**
for battery backup
240 nA in V\(_{\text{BAT}}\) 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

**STM32L4**

**Electricity/Gas/Water Smart Meter**

**LCD Display**
88x40 or 4x44 with step-up converter

**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

**Innovation**
Smart peripherals
Fitness tracker - Wristband

STM32L4

Digital Filter for Sigma Delta Modulators
with PDM (Pulse Density Modulation)
microphone input support

I²C
3x I²C FM+(1 Mbit/s), SMBus/PMBus

Batch Acquisition Mode (BAM)

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

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

USB
USB OTG 2.0 full-speed, LPM and BCD

SAI
2x serial audio interfaces

SWP
Single wire protocol master interface (SWPMI)

STM32L4

Innovation
Motor Control:
- 2x 16-bit advanced motor-control timers
- 3x 12-bit ADCs: 5 MSPS, with up to 16-bit with hardware oversampling, 200 μA/MSPS

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

CAN Bus
(2.0B Active)

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

I/Os
Up to 114 GPIOs

STM32L4

LCD Display
8×40 or 4×44 with step-up converter

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

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

I²C
3x I²C FM+(1 Mbit/s), SMBus/PMBus

SMART PERIPHERALS
Industrial Sensors
10
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

- Quad-SPI for data and execution in place

- 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

- Single Wire Protocol interface for smartcards
Analog Smart Peripherals

- 3 x 12-/16-bit ADCs (up to 5 MSPS)
  - Down to 20 µA (10 Ksps) with adaptive power consumption
  - 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
### High integration with high memory size in small packages

<table>
<thead>
<tr>
<th><strong>Parallel Interface</strong></th>
<th><strong>ARM® Cortex®-M4</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>FSMC 8-/16-bit</td>
<td>80 MHz FPU</td>
</tr>
<tr>
<td>(TFT-LCD, SRAM, NOR,</td>
<td>MPU</td>
</tr>
<tr>
<td>NAND)</td>
<td>ETM</td>
</tr>
<tr>
<td><strong>Display</strong></td>
<td><strong>Connectivity</strong></td>
</tr>
<tr>
<td>8 x 40 LCD driver</td>
<td>USB OTG,</td>
</tr>
<tr>
<td></td>
<td>1x SD/SDIO/MMC, 3 x</td>
</tr>
<tr>
<td></td>
<td>SPI, 3 x I²C, 1x</td>
</tr>
<tr>
<td></td>
<td>CAN, 1x Quad SPI,</td>
</tr>
<tr>
<td></td>
<td>5 x USART + 1 x ULP</td>
</tr>
<tr>
<td><strong>Timers</strong></td>
<td><strong>Digital</strong></td>
</tr>
<tr>
<td>17 timers including:</td>
<td>ART Accelerator™</td>
</tr>
<tr>
<td>2 x 16-bit advanced</td>
<td>Up to 1-Mbyte Dual</td>
</tr>
<tr>
<td>motor control timers</td>
<td>Bank Flash memory</td>
</tr>
<tr>
<td>2 x ULP timers</td>
<td>with ECC</td>
</tr>
<tr>
<td>7 x 16-bit-timers</td>
<td>128-Kbyte RAM</td>
</tr>
<tr>
<td>2 x 32-bit timers</td>
<td><strong>Analog</strong></td>
</tr>
<tr>
<td><strong>I/Os</strong></td>
<td>3 x 16-bit ADC, 2 x</td>
</tr>
<tr>
<td>Up to 114 I/Os</td>
<td>DAC, 2 x comparators,</td>
</tr>
<tr>
<td>Touch-sensing controller</td>
<td>2 x op amps</td>
</tr>
<tr>
<td></td>
<td>1 x temperature sensor</td>
</tr>
</tbody>
</table>

**Package size down to 4.4 x 3.8 mm**
Safety and security

Integrated safety and security features

**SAFETY**
- Brown-out reset in all modes
- Clock security system
- SRAM parity check
- Backup byte registers
- Supply monitoring
- Flash memory with ECC with status register (address)
- Dual watchdog

**SECURITY**
- Anti-tamper detection
- Memory Protection Unit (MPU)
- Read and Write Protection
- Unique ID
- AES-256 encryption
- JTAG fuse
- True random number generator
- Software IP protection

STM32 L4
STM32L4: continuity in STM32 portfolio

9 product series / more than 32 product lines
STM32L4 benefits from pin-to-pin compatibility across the family

- **High-performance**
  - 398 CoreMark
  - 120 MHz
  - 150 DMIPS

- **Mainstream**
  - 106 CoreMark
  - 48 MHz
  - 38 DMIPS

- **Ultra-low-power**
  - 75 CoreMark
  - 32 MHz
  - 26 DMIPS

- **Cortex-M0**
- **Cortex-M0+**
- **Cortex-M3**
- **Cortex-M4**
- **Cortex-M7**

**ARM® Cortex® Processor Technology**

10-year Commitment to Longevity

Great investment
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
- 16 to 192 Kbytes of Flash, 20 Kbytes of SRAM

**Broad-range foundation**

STM32 L1

- Cortex-M3 at 32 MHz
- Operating range: 1.65 to 3.6V
- Wide choice of memory sizes
- 3 product lines, USB, LCD, AES, Rich Analog
- True EEPROM, Dual-bank Flash (RWW)
- 32 to 512 Kbytes of Flash, 80 Kbytes of SRAM

**High-performance advanced analog**

STM32 L4

- Cortex-M4 w/ FPU at 80 MHz
- 1.71 to 3.6V
- High-performance, advanced analog circuits
- 3 product lines, 5-MSPS ADC, PGA, Compar., DAC, Op Amp, USB OTG, LCD, AES
- 256 Kbytes to 1 Mbyte
- 128 Kbytes of SRAM

Great investment
STM32L4 completes the ultra-low-power family

More performance

STM32L4
100 DMIPS
273 CoreMark

STM32L1
33 DMIPS
93 CoreMark

STM32L0
26 DMIPS
75 CoreMark

More memory and pin counts

Flash size (bytes)

1 M
512 K
384 K
256 K
192 K
128 K
64 K
32 K
16 K
8 K

Pins

14
20
25
32
48
63
64
100
132
144

More packages

WLCSP
QFN
BGA
TSSOP
LQFP

Great investment
## STM32L4 series

<table>
<thead>
<tr>
<th>Product line</th>
<th>Flash Memory (KB)</th>
<th>RAM (KB)</th>
<th>Memory I/F</th>
<th>2 x Op amps</th>
<th>2 x Comp</th>
<th>4x / 8-ch Sigma Delta Interface</th>
<th>16-bit ADC (5 MSPS)</th>
<th>USB 2.0 OTG FS</th>
<th>Segment LCD Driver</th>
<th>128/256-bit AES</th>
</tr>
</thead>
<tbody>
<tr>
<td>STM32L476 USB OTG &amp; LCD</td>
<td>256 to 1024</td>
<td>128</td>
<td>SDIO FSMC</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>3</td>
<td>●</td>
<td>Up to 8x40</td>
<td>●</td>
</tr>
<tr>
<td>STM32L486 USB OTG &amp; LCD &amp; AES</td>
<td>1024</td>
<td>128</td>
<td>SDIO FSMC</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>3</td>
<td>●</td>
<td>Up to 8x40</td>
<td>●</td>
</tr>
</tbody>
</table>

**ARM® Cortex®-M4 (DSP + FPU) - 80 MHz**

- ART Accelerator™
- USART, SPI, I²C
- Quad-SPI
- 16 and 32-bit timers
- SAI + audio PLL
- SWP
- 1x CAN

- 2x 12-bit DAC
- Temperature sensor

- Low voltage 1.71 to 3.6 V
- \( V_{BAT} \) Mode
- Unique ID
- Capacitive Touch sensing

**Great investment**
STM32L4 portfolio

Legend:
- With 128/256-bit AES hardware encryption
- Without encryption

Flash memory / RAM size (bytes)

1 M / 128 K
- STM32L486RG
- STM32L476RG
- STM32L476RE
- STM32L476RC

512 K / 128 K
- STM32L486JG
- STM32L476JG
- STM32L476JE

256 K / 128 K
- STM32L486VC
- STM32L476ME

Pin count
- LQFP64 (10x10x1.4 mm)
- WLCSP72 (4.4x3.8x0.585 mm)
- WLCSP81 (4.4x3.8x0.585 mm)
- LQFP100 (14x14x1.4 mm)
- UFBGA132 (7x7x0.6 mm)
- LQFP144 (20x20x1.4 mm)
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

Great investment
STM32L4 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
Summary 4 Keys of STM32 L4 series

1. ULP leader and performance booster
2. Innovation
3. Integration and safety
4. Great Investment