STM32L4+ MCU series excellence in ultra-low-power with more performance
Key messages of STM32L4+ 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 4.62 x 4.14 mm.

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

- Up to 120 MHz/150 DMIPS with ART Accelerator™
- Up to 409 CoreMark Result
- Arm® Cortex®-M4 with DSP instructions and floating-point unit (FPU)
- 2 x DMA (14 channels)
- SPI up to 60 Mbit/s, Octo-SPI up to 86 MHz USART up to 10 Mbit/s
<table>
<thead>
<tr>
<th>Wake-up time</th>
<th>$V_{BAT}$</th>
<th>Tamper detection: 3 I/Os, RTC</th>
</tr>
</thead>
<tbody>
<tr>
<td>250 µs</td>
<td>3 nA / 300 nA*</td>
<td>Wake-up sources: reset pin, 5 I/Os, RTC</td>
</tr>
<tr>
<td>14 µs</td>
<td>22 nA / 180 nA*</td>
<td>Wake-up sources: + BOR, IWDG</td>
</tr>
<tr>
<td>14 µs</td>
<td>42 nA / 190 nA*</td>
<td>Wake-up sources: + all I/Os, PVD, LCD, COMPs, I²C, LPUART, LPTIM</td>
</tr>
<tr>
<td>5 µs</td>
<td>242 nA / 390 nA*</td>
<td>Wake-up sources: + all I²C, UART</td>
</tr>
<tr>
<td>6 cycles</td>
<td>5 µs</td>
<td>Wake-up sources: any interrupt or event</td>
</tr>
</tbody>
</table>

| Sleep                | 13 µA/MHz **  |
| Run up to 120 MHz    | Down to 43 µA/MHz ** |

Note: * without RTC / with RTC  
** with external SMPS
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
  1. MIPI-DSI Controller for high pixel density, low pin count and low EMI displays
  2. LCD-TFT Controller for mid resolution displays
  3. Parallel display interface for low resolution displays
Enhanced graphics capabilities

1. Chrom-ART Accelerator™
2. Large choice of display interfaces
   • Integration and resource optimization
     • Chrom-GRC™ memory optimization for round displays
3. 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 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
300 nA in $V_{\text{BAT}}$ 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
Smart peripherals
fitness tracker - wristband

STM32L4+

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

Batch Acquisition Mode (BAM)

Sensors

STM32L4+

fitness tracker wristband

Display

USB OTG 2.0 full-speed, LPM and BCD

SAI
2x serial audio interfaces

FSMC
Parallel interface to TFT SPI
Direct connection
Chrom-ART Accelerator™
Graphic Acceleration
Chrom-GRC™
SRAM needs reduction

USB

Codec

OPAMP
2x op amp with built-in PGA

ADC
2× 12-bit ADC 5 MSPS, up to 16-bit with hardware oversampling, 200 μA/MSPS

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

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

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

USB

Codec

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

ADC
2× 12-bit ADC 5 MSPS, up to 16-bit with hardware oversampling, 200 μA/MSPS

OPAMP
2x op amp with built-in PGA

USB

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

3x I²C FM+(1 Mbit/s), SMBus/PMBus
STM32L4+

Electricity/Gas
Water
Smart Meter

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

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)

I²C
3x I²C FM+(1 Mbit/s), SMBus/PMBus

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

Smart peripherals
industrial sensors
High integration level with high memory size in small packages

<table>
<thead>
<tr>
<th>Connectivity</th>
<th>ARM® Cortex®-M4 CPU</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>120 MHz</td>
</tr>
<tr>
<td></td>
<td>FPU</td>
</tr>
<tr>
<td></td>
<td>MPU</td>
</tr>
<tr>
<td></td>
<td>ETM</td>
</tr>
<tr>
<td></td>
<td>DMA</td>
</tr>
<tr>
<td></td>
<td>ART Accelerator™</td>
</tr>
<tr>
<td>Digital</td>
<td>Up to 2-Mbyte Flash</td>
</tr>
<tr>
<td></td>
<td>with ECC</td>
</tr>
<tr>
<td></td>
<td>Dual Bank</td>
</tr>
<tr>
<td></td>
<td>Chrom-ART Accelerator™</td>
</tr>
<tr>
<td></td>
<td>Chrom-GRC™</td>
</tr>
<tr>
<td></td>
<td>640-Kbyte RAM</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>I/Os</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Up to 114 I/Os</td>
</tr>
<tr>
<td></td>
<td>Touch-sensing</td>
</tr>
<tr>
<td></td>
<td>controller</td>
</tr>
<tr>
<td></td>
<td>Camera interface</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Display</th>
<th>MIPI-DSI 2-lane</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TFT-LCD Controller</td>
</tr>
</tbody>
</table>

| 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    |

<table>
<thead>
<tr>
<th>Analog</th>
<th>1 x 12-bit ADC, 2 x DAC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 x Comparators</td>
</tr>
<tr>
<td></td>
<td>2 x Op amps</td>
</tr>
<tr>
<td></td>
<td>1 x Temperature sensor</td>
</tr>
</tbody>
</table>

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

Package size down to 4.62 x 4.14 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 with ECC with status register (address)
- Dual watchdog

STM32L4+

SECURITY
- 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
- OTP Zone
STM32 MCUs: Continuity in the STM32 portfolio

- **STM32MP1**
  - 4158 CoreMark
  - 650 MHz Cortex-A7
  - 209 MHz Cortex-M4

- **STM32H7**
  - Up to 3224 CoreMark
  - Up to 550 MHz Cortex-M7
  - 240 MHz Cortex-M4

Mainstream MCUs

- **STM32F0**
  - 106 CoreMark
  - 48 MHz Cortex-M0

- **STM32G0**
  - 142 CoreMark
  - 64 MHz Cortex-M0+

- **STM32F1**
  - 177 CoreMark
  - 72 MHz Cortex-M3

- **STM32F2**
  - Up to 398 CoreMark
  - 120 MHz Cortex-M3

- **STM32F3**
  - 245 CoreMark
  - 72 MHz Cortex-M4

- **STM32F4**
  - Up to 608 CoreMark
  - 180 MHz Cortex-M4

- **STM32F5**
  - 1082 CoreMark
  - 216 MHz Cortex-M7

- **STM32F0**
  - 17 CoreMark
  - 48 MHz Cortex-M0+

- **STM32L1**
  - 93 CoreMark
  - 32 MHz Cortex-M3

- **STM32L4**
  - 273 CoreMark
  - 80 MHz Cortex-M4

- **STM32L4+**
  - 409 CoreMark
  - 120 MHz Cortex-M4

- **STM32L5**
  - 443 CoreMark
  - 110 MHz Cortex-M33

- **STM32L4+**
  - 409 CoreMark
  - 120 MHz Cortex-M4

- **STM32L5**
  - 443 CoreMark
  - 110 MHz Cortex-M33

- **STM32U5**
  - 651 CoreMark
  - 160 MHz Cortex-M33

Wireless MCUs

- **STM32WL**
  - 162 CoreMark
  - 48 MHz Cortex-M4

- **STM32WB**
  - 216 CoreMark
  - 64 MHz Cortex-M4

- **STM32WL**
  - 162 CoreMark
  - 48 MHz Cortex-M4

- **STM32WB**
  - 216 CoreMark
  - 64 MHz Cortex-M4

- **STM32WL**
  - 162 CoreMark
  - 48 MHz Cortex-M4

- **STM32WB**
  - 216 CoreMark
  - 64 MHz Cortex-M4

- **STM32L4**
  - 273 CoreMark
  - 80 MHz Cortex-M4

- **STM32L4+**
  - 409 CoreMark
  - 120 MHz Cortex-M4

- **STM32F4**
  - Up to 608 CoreMark
  - 180 MHz Cortex-M4

- **STM32F7**
  - 1082 CoreMark
  - 216 MHz Cortex-M7

- **STM32H7**
  - Up to 3224 CoreMark
  - Up to 550 MHz Cortex-M7
  - 240 MHz Cortex-M4

- **STM32F5**
  - 1082 CoreMark
  - 216 MHz Cortex-M7

- **STM32F3**
  - 245 CoreMark
  - 72 MHz Cortex-M4

- **STM32F2**
  - Up to 398 CoreMark
  - 120 MHz Cortex-M3

- **STM32F4**
  - Up to 608 CoreMark
  - 180 MHz Cortex-M4

- **STM32F7**
  - 1082 CoreMark
  - 216 MHz Cortex-M7

- **STM32H7**
  - Up to 3224 CoreMark
  - Up to 550 MHz Cortex-M7
  - 240 MHz Cortex-M4

Optimized for mixed-signal applications

Pin-to-pin compatibility across the whole STM32L4 family

Cortex-M0+ Radio co-processor

LONGEVITY COMMITMENT 10 YEARS
STM32L ULP portfolio

STM32L4+ completes the ultra-low-power subclass

Cost-smart ULP champion

**STM32L0**
- Cortex-M0+ at 32 MHz
  - 1.65 to 3.6V
- 8-/16-bit applications
- Wide range of pin-counts

**STM32L1**
- Cortex-M3 at 32 MHz
  - 1.65 to 3.6V
- Wide choice of memory sizes

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

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

Advanced security

**STM32L5**
- Cortex-M33 w/ FPU at 110 MHz
  - 1.71 to 3.6V
- Wide choice of memory sizes

STM32L0
- 3 product lines,
  - Cost-effective,
  - Smaller packages,
  - USB, LCD, Analog
- 8 to 192 Kbytes of Flash,
  - Up to 20 Kbytes of SRAM

STM32L1
- 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
- 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+
- 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
- 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

STM324+ 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 0.26 μA

- STM32L4+
  - 32-bit Arm® Cortex®-M4 + FPU at 120 MHz
  - From 512 Kbytes up to 2 Megabytes of Flash memory
  - Low-power modes + RAM + RTC 0.36 μA

- STM32L4
  - 32-bit Arm® Cortex®-M4 + FPU at 80 MHz
  - From 64 Kbytes to 1 Mbyte of Flash memory
  - Low-power modes + RAM + RTC 0.34 μA

- STM32L1
  - 32-bit Arm® Cortex®-A73 at 32 MHz
  - From 22 to 512 Kbytes of Flash memory
  - Low-power modes + RAM + RTC 1.2 μA

- STM32L0
  - 32-bit Arm® Cortex®-M0+ at 32 MHz
  - From 0 to 128 Kbytes of Flash memory
  - Low-power modes + RAM + RTC 0.67 μA

- STM32L
  - 8-bit STM8 score at 16 MHz
  - From 2 to 64 Kbytes of Flash memory
  - Low-power HAL mode 0.3 μA

Graph showing Flash memory size and number of pins for various STM32L series.
## STM32L4+ MCU series
32-bit Arm® Cortex®-M4 (DSP + FPU) – 120 MHz

<table>
<thead>
<tr>
<th>Product line</th>
<th>Flash (KB)</th>
<th>RAM (KB)</th>
<th>Memory I/F</th>
<th>Op-Amp</th>
<th>Comp.</th>
<th>Sigma Delta Interface</th>
<th>12-bit ADC</th>
<th>USB2.0 OTG</th>
<th>TFT Display Interface</th>
<th>Crypto-Accelerator™</th>
<th>MIPI-DSI</th>
<th>AES 128/256-bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>STM32L4R9</td>
<td>1024 to 2048</td>
<td>640</td>
<td>SDIO FSMC</td>
<td>2</td>
<td>2</td>
<td>8x ch</td>
<td>1</td>
<td>w</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>STM32L4S9</td>
<td>1024 to 2048</td>
<td>640</td>
<td>SDIO FSMC</td>
<td>2</td>
<td>2</td>
<td>8x ch</td>
<td>1</td>
<td>●</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>STM32L4R7</td>
<td>1024 to 2048</td>
<td>640</td>
<td>SDIO FSMC</td>
<td>2</td>
<td>2</td>
<td>8x ch</td>
<td>1</td>
<td>●</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>STM32L4S7</td>
<td>2048</td>
<td>640</td>
<td>SDIO FSMC</td>
<td>2</td>
<td>2</td>
<td>8x ch</td>
<td>1</td>
<td>●</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>STM32L4R5</td>
<td>1024 to 2048</td>
<td>640</td>
<td>SDIO FSMC</td>
<td>2</td>
<td>2</td>
<td>8x ch</td>
<td>1</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>STM32L4S5</td>
<td>2048</td>
<td>640</td>
<td>SDIO FSMC</td>
<td>2</td>
<td>2</td>
<td>8x ch</td>
<td>1</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>STM32L4P5</td>
<td>512 to 1024</td>
<td>320</td>
<td>SDIO FSMC</td>
<td>2</td>
<td>2</td>
<td>4 ch</td>
<td>2</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>STM32L4P5</td>
<td>1024</td>
<td>320</td>
<td>SDIO FSMC</td>
<td>2</td>
<td>2</td>
<td>4 ch</td>
<td>2</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
</tbody>
</table>

- USART, SPI, I2C
- 2x Quad SPI
- 16- and 32-bit timers
- SA1 + audio PLL
- CAN
- Camera I/F
- ART Accelerator™
- Chrom ART Accelerator™
- 2x 12-bit DACs
- Temperature sensor
- Low voltage 1.71 to 3.6V
- VBAT mode
- Unique ID
- Capacitive touch-sensing
STM32L4+ portfolio

Flash memory / RAM size (bytes)

- 2 M / 640 K
- 1 M / 640 K
- 1 M / 320 K
- 512 K / 320 K

Pin count

Legend:
- STM32L4R9/S9
- STM32L4R5/S5
- STM32L4R7/S7
- STM32L4P5/Q5
- With 128-/256-bit AES Hardware Encryption
STM32L4+ ecosystem

**HARDWARE TOOLS**
- STM32 Nucleo boards
  - Flexible prototyping
- Discovery kits
  - Key feature prototyping
- Evaluation board
  - Full feature evaluation

**SOFTWARE TOOLS**
- STMicroelectronics
- github.com/STMicroelectronics
- wiki.st.com/stm32mcu

STM32Cube adds major enhancements to boost software development
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
STM32 graphic ecosystem

3 Recommended Software Solutions

- **STemWin**: Entry Solution
  - FREE

- **TouchGFX**: Advanced Solutions
  - FREE

- **Embedded Wizard**:
Summary
4 keys of STM32L4+ series

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

/STM32

community.st.com

http://www.st.com/STM32L4+

Online training

MOOC
Thank you