STM32L5 MCU series
Excellence in ultra-low-power with more security
Main Concerns for Embedded Design

- **Security**
  - Protection from hackers

- **Low power consumption**
  - Long life time, small battery size

- **Integration, size, performance**
  - Best fit versus the application requirements
First STM32 Based on Cortex-M33

STM32L5 is the answer

- More security with TrustZone and ST security implementation
  - HW to resist to Logical and board level attack
- Lower Power consumption
  - STM32 ultra-low-power technology
- Integration, Size, performance
  - More performance, high memory size and wide portfolio
Security: Type of Attacks

- **Logical attack**
  - Malicious code injection
  - Malware replacing genuine program
  - Man-in-the-middle attack

- **Board level attack**
  - Cloning attack
  - Fault injection
  - Side channel attack

- **Hardware Isolation**
- **Secure Key storage**
- **Encryption**
- **Authentication**
- **IP Protection**
- **Read-out Protection**
- **Active tampering**
- **Certified Crypto library**
Security: TrustZone for Isolation

ST implementation provides high granularity of isolation

- **Each** GPIO or peripheral, DMA channel, clock configuration register, ART or small part of Flash or SRAM can be configured as **Trusted or un-Trusted**

- **Full isolation** of trusted and non-trusted world
Security: TrustZone for Isolation

TrustZone provides full isolation

Example of IoT application implementation

Un-Trusted Application

STM32L5

Trusted Application

RF

Sensors
Security: TrustZone and Privileged

- More partitioning
- Possibility to separate the trusted and un-trusted area with privileged and un-privileged zone
- Strong granularity to define each part of memory or each peripheral, DMA channel as privileged or un-privileged
TrustZone: Example

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Un-Trusted & Privileged

Un-Trusted & Un-Privileged

Un-Privileged

RTOS

Secured Keys

Secured Boot

Secured data

Sensor IP

RF Stack

RF

Sensors
A Full Set of Security

**ENCRIPTION DECRIPTION AUTHENTIFICATION**

- AES-128/256 Encryption
- SHA-256 Authentication
- Public Key Acceleration (PKA): for RSA, Diffie-Hellmann or ECC (Elliptic Curve Cryptography)
  - Certified Crypto library
  - True Random Number Generator
  - Unique ID
  - OTP Zone

**MEMORY and IP PROTECTION**

- Active and static Anti-tamper detection
- Memory Protection Unit (MPU)
- Secure Boot
- Read and Write Protection
- HDP (Hide Protect)
- OTFDEC (On-the-fly decryption) on Octo SPI to protect external memory
- JTAG fuse
- TrustZone
- Unique Boot Entry
Extend the Battery Life Time

• STM32L5 reuses the STM32L4/L4+ technology achieving **best-in-class** power consumption

• STM32L5 integrates an optional **SMPS** (DC/DC buck voltage regulator) which can be enabled/disabled on the fly to optimize the energy.

• Proven by EEMBC test results: 
  - ULPBENCH™ 385 ULPMark-CP
  - ULPBENCH™ 60 ULPMark-PP
# Ultra-low-power Modes

**Best power consumption numbers with full flexibility**

<table>
<thead>
<tr>
<th>Wake-up time</th>
<th>$V_{BAT}$</th>
<th>Wake-up sources</th>
<th>Standby detection</th>
</tr>
</thead>
<tbody>
<tr>
<td>250 µs</td>
<td>3 nA / 225 nA*</td>
<td>+ all I/Os, RTC</td>
<td>3 I/Os, RTC</td>
</tr>
<tr>
<td>14 µs</td>
<td>33 nA / 300 nA*</td>
<td>reset pin, 5 I/Os, RTC</td>
<td>Wake-up sources: reset pin, 5 I/Os, RTC</td>
</tr>
<tr>
<td>14 µs</td>
<td>110 nA / 385 nA*</td>
<td>+ BOR, IWDG</td>
<td>Sleep sources: + all I/Os, PVD, COMPs, I²C, LPUART, LPTIM</td>
</tr>
<tr>
<td>5 µs</td>
<td>190 nA / 465 nA*</td>
<td>any interrupt or event</td>
<td></td>
</tr>
<tr>
<td>6 cycles</td>
<td>3 nA / 325 nA*</td>
<td>any interrupt or event</td>
<td></td>
</tr>
</tbody>
</table>

**Sleep**

- 38 µA / MHz

**Run up to 110 MHz**

- Down to 60 µA / MHz

**Note**: * without RTC / with RTC
More Performance

Better responsiveness of the application

• **New** Arm® Cortex®-M33 performance: +20% versus Cortex-M4
  
  1.5 DMIPS/MHz  
  3.88 CoreMark/MHz

  ➔

  165 DMIPS  
  427 CoreMark

• **New** ST ART Accelerator™: working both on internal and **external** Flash
  
  • 8 Kbytes of instruction cache
High Integration and Innovation

Large memory, USB Type-C™ w/ power delivery controller, CAN FD
Large Portfolio

7 packages, several options
STM32L ULP Portfolio

STM32L5 completes the ultra-low-power subclass

**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

**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

**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

**ULP With More performance**

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

- 3 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

**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, PKA
- 256 to 512 Kbytes of Flash, 256 Kbytes of SRAM
STM32L5 helps designers to answer to IoT challenges

- More security
- Lower power consumption
- Integration, size, performance