STM32L and STM8L MCU families

EnergyLite

STMicroelectronics

Ultra-low-power EnergyLite™ 32-bit and 8-bit microcontrollers

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Content

STMicroelectronics ultra-low-power EnergyLite™ microcontroller platform

STMicroelectronics has identified an optimal balance between high performance and ultra-low power, through different modes, in order to optimize the energy consumed by your applications over their whole life.

Commitment to ultra-low power

Lower power consumption is increasingly required in all types of market applications. Several parameters are driving this demand: new national and international norms to reduce power consumption, the increasing number of battery-powered applications, development of new green technologies, or simply the need to be environmentally friendly.

To better serve this market, STMicroelectronics is developing a platform of ultra-low-power MCUs

as a natural extension to the existing successful STM8S and STM32F families.

This platform for the 8-bit STM8L and 32-bit STM32L MCUs is based on a proprietary 130 nm ultra-low-leakage process technology.

The STM8L and STM32L offer specific features for ultra-low-power applications, such as advanced ultra-low-power modes, optimized dynamic run consumption and specific

safety features. The balance between high performance and ultra-low power using different modes ensures optimal energy consumption, whatever your application, and this throughout its life.

ST's commitment to ultra-low power is total, with ongoing development of future technologies and devices that will complement the existing portfolio of ultra-low-power MCUs to give our customers access to a new level of power saving.

8/32-bit ultra-low-power range

STMicroelectronics' ultra-low-power portfolio includes a full range of 8-bit and 32-bit MCUs, and so addresses most applications requiring reduced current consumption, from ultra-simple, cost-optimized feature needs to complex, high-performance requirements.
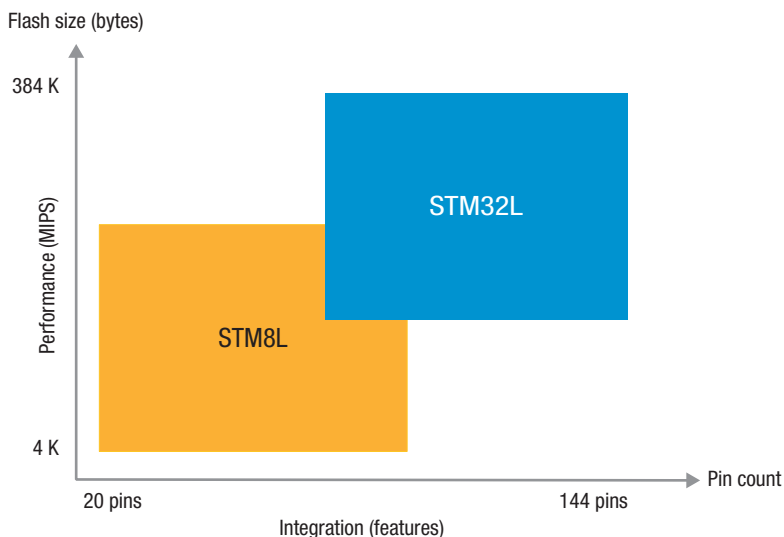
Key features

- Platform for 8-bit STM8L and 32-bit STM32L MCUs
- ST 130 nm ultra-low-leakage process technology – speed and power consumption are independent of MCU power supply
- Ultra-low-power modes: down to 300 nA
- Ultra-low voltage supply: 1.65 to 3.6 V
- Advanced analog functions down to 1.8 V
- Fast wake up
- On-board security and safety features for critical applications
- 33.3 DMIPS at 32 MHz (STM32L) and up to 16 MIPS at 16 MHz (STM8L)

Ultra-low-power product lines

Common core peripherals and architecture:

Multiple communication peripherals USART, SPI, I²C
Multiple timers
Internal 16 MHz and 38 kHz RC oscillators
2x watchdogs
Reset circuitry POR/PDR
2x comparators
Touch sensing

Feature-rich 32-bit solution: STM32L151/152/162 line

| ARM POWERED 32 MHz Cortex-M3 CPU | Up to 384-Kbyte Flash / Dual bank / RWW | Up to 48-Kbyte SRAM | BOR PVD | Main osc. input 1-24 MHz | Up to 12-Kbyte data EEPROM | RTC with 32 kHz osc. | Up to 12 channel DMA | 12-bit ADC (1 µs) 2x12-bit DAC | LCD 8x40 4x44 | AES 128-bit | ULP MSI | MPU ETM | USB FS | SDIO | FSMC | 3x op-amps |

Feature-rich 8-bit solution: STM8L151/152/162 line

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| STM8 core @ 16 MHz | Up to 64-Kbyte Flash | Up to 4-Kbyte SRAM | BOR PVD | Main osc. input 1-16 MHz | Up to 2-Kbyte data EEPROM | RTC with 32 kHz osc. | Up to 4 channel DMA | 12-bit ADC (1 µs) 12-bit DAC | LCD 8x40 4x44 | AES 128-bit |

Entry level 8-bit solution: STM8L101 line

| STM8 core @ 16 MHz | Up to 8-Kbyte Flash* | Up to 1.5-Kbyte SRAM |

Abbreviations:
BOR: Brown-out reset
ETM: Embedded trace unit
MPU: Memory protection unit
MSI: Multi-speed internal oscillator
Osc.: Oscillator
POR: Power-on reset
PDR: Power-down reset
PVD: Programmable voltage detector
ULP: Ultra-low-power
RTC: Real-time clock
AES: Advanced encryption standard

Note:
* Embedded EEPROM in the Flash

Ultra-low-power portfolio

Flash size (bytes)

Flash size	20 pins TSSOP/QFN	28 pins QFN/WLCSP	32 pins LQFP/QFN	48 pins LQFP/QFN	64 pins LQFP/BGA	80¹/100 pins BGA²	132 pins BGA	144 pins LQFP
384 K					STM32L152RD / STM32L151RD	STM32L152/162VD / STM32L151VD	STM32L152/162QD / STM32L151QD	STM32L152/162ZD / STM32L151ZD
256 K					STM32L152RC / STM32L151RC	STM32L152VC / STM32L151VC	STM32L152QC / STM32L151QC	STM32L152ZC / STM32L151ZC
128 K				STM32L152CB / STM32L151CB	STM32L152RB / STM32L151RB	STM32L152VB / STM32L151VB		
				STM32L152C8 / STM32L151C8	STM32L152R8 / STM32L151R8	STM32L152V8 / STM32L151V8		
64 K				STM8L152C8 / STM8L151C8	STM8L152/162R8 / STM8L151R8	STM8L152/162M8 / STM8L151M8		
				STM32L152C6 / STM32L151C6	STM32L152R6 / STM32L151R6			
32 K			STM8L152K6 / STM8L151G6	STM8L152C6 / STM8L151C6	STM8L152R6 / STM8L151R6			
16 K		STM8L151G4	STM8L152K4 / STM8L151K4	STM8L152C4 / STM8L151C4				
8 K	STM8L151F3 / STM8L101F3	STM8L151G3 / STM8L101G3	STM8L151K3 / STM8L101K3	STM8L151C3				
4 K	STM8L151F2 / STM8L101F2	STM8L151G2 / STM8L101G2	STM8L151K2					

Pin count

Notes:
1. 80 pins for STM8L15x/16x only
2. BGA100 on STM32L15x up to 128 Kbytes only

Legend:
■ STM8L (production/sampling): 151 without LCD, 152 with LCD et 162 with LCD and AES 128-bit
■ STM32L (production/sampling): 151 without LCD, 152 with LCD et 162 with LCD and AES 128-bit
☐ Available in Q4/2011

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Features and benefits

Features	Benefits
Ultra-low-power proprietary 130 nm technology	Speed and power consumption independent of MCU power supply, ultra-low leakage
Ultra-low-power design (clock gating, low-power Flash with power-off capability, voltage scaling)	Reduced overall run and low-power mode current consumption by turning off clocks of unused peripherals or Flash Optimized power consumption in run mode according to the performance required
Very low consumption/performance ratio	Very low power consumption over time to give energy saving and extended battery life
Sub 1 µA hardware RTC and AWU system unit	Ultra-low-power modes for applications requiring regular wake up
Sub-second hardware RTC	Precise synchronization in RF networks, sensors and alarms
Fine-grain calibration accuracy down to +/- 2 ppm	Very high efficiency of RTC calibration within a 10 s time frame; compliant with latest Chinese regulations
HW anti-tamper filters	Ultra-low-power debounce circuitry
Range of low-power modes (up to 6)	Suitable for many applications from complete switch off to continuous monitoring at ultra-low frequency
Advanced and flexible clock system (multiple internal and external clock sources)	Switch and adjust frequency and clock sources on the fly depending on application needs
Direct memory access on board (up to 12-channel DMA)	Autonomy for peripherals, independent from core; can switch off Flash memory and CPU (large current consumption contributors) while keeping peripherals active
Ultra-fast wake-up from lowest low-power mode	Fast switching from static and dynamic power modes
Power supply V_{DD} min: 1.65 V	Fitting applications supplied with external 1.8 V +/-10% regulator
Analog functional down to 1.8 V, programming down to 1.65 V	Full functionality over the complete V_{DD} range
Ultra-low-power and ultra-safe features (POR, PDR, BOR, PVD, unique ID, backup clock, Flash protection, Flash with error code correction (ECC), dual watchdog, and more)	Integrated safety and security for applications; user data confidentiality/ reliability

Targeted applications

■ Medical
- Glucose meters
- Insulin pumps
- Diabetes care
- Blood pressure monitors
- Cholesterol electronic monitors
- Patient monitoring
- Heart monitors

■ Metering
- Electricity meters
- Gas meters
- Water meters
- Scales
- Heat meters

■ GP portable devices
- Mobile accessories
- 3D mouse and remote controls
- Gaming
- GPS watches
- Sports equipment
- Games and toys

■ Alarm systems
- Central processor units
- Wired sensors
- Wireless sensors
- Door locks

STM8L ultra-low-power MCU family

The STM8L family combines high performance and ultra-low power consumption using a new proprietary ultra-low leakage process and optimized architecture. This family is available in four different lines, making the STM8L an optimal family to support many applications with special care on power savings.
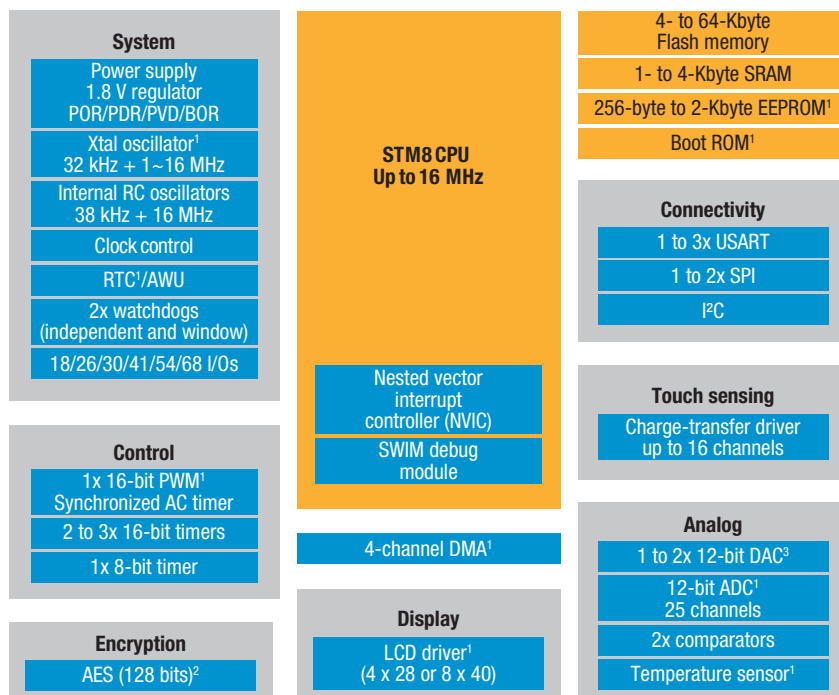
STM8L family description

Upgrade to a higher or downgrade to a lower memory size or use a different package across lines without changing your initial design or software.

- STM8 16 MHz CPU
- 4 to 64 Kbytes of embedded Flash, up to 4 Kbytes of SRAM and up to 2 Kbytes of EEPROM
- Four lines: pin-to-pin, software and peripheral compatibility
- Supply voltage: 1.65 to 3.6 V
- Up to four ultra-low-power modes: down to 350 nA with SRAM and context retention
- Run mode dynamic consumption down to 150 µA/MHz
- State-of-the-art digital and analog peripherals
- -40 to +85 °C, or up to 125 °C operating temperature range
- Free touch-sensing library

STM8L enriches ultra-low-power platform and STM8 portfolio

The STM8L is part of both our ultra-low-power platform and the STM8 portfolio. The STM8L microcontroller, powered by the STM8 core, complements the STM8 portfolio with lower overall power consumption, new ultra-low-power modes (low-power run, low-power wait), and new peripherals (RTC, LCD, comparators and 12-bit ADC).

STM8L block diagram

System
- Power supply 1.8 V regulator POR/PDR/PVD/BOR
- Xtal oscillator[1] 32 kHz + 1~16 MHz
- Internal RC oscillators 38 kHz + 16 MHz
- Clock control
- RTC[1]/AWU
- 2x watchdogs (independent and window)
- 18/26/30/41/54/68 I/Os

Control
- 1x 16-bit PWM[1] Synchronized AC timer
- 2 to 3x 16-bit timers
- 1x 8-bit timer

Encryption
- AES (128 bits)[2]

STM8 CPU Up to 16 MHz

- Nested vector interrupt controller (NVIC)
- SWIM debug module

- 4-channel DMA[1]

Display
- LCD driver[1] (4 x 28 or 8 x 40)

- 4- to 64-Kbyte Flash memory
- 1- to 4-Kbyte SRAM
- 256-byte to 2-Kbyte EEPROM[1]
- Boot ROM[1]

Connectivity
- 1 to 3x USART
- 1 to 2x SPI
- I²C

Touch sensing
- Charge-transfer driver up to 16 channels

Analog
- 1 to 2x 12-bit DAC[3]
- 12-bit ADC[1] 25 channels
- 2x comparators
- Temperature sensor[1]

Notes:
1. STM8L15x/16x
2. STM8L16x only
3. STM8L from 16 Kbytes to 64 Kbytes

Abbreviations:
AWU: Auto wake up from halt
BOR: Brown-out reset
I²C: Inter integrated circuit
AES: Advanced encryption standard
PDR: Power-down reset
POR: Power-on reset
PVD: Programmable voltage detector
RTC: Real-time clock
SPI: Serial peripheral interface
USART: Universal sync/async receiver transmitter

Four different product lines

- The **STM8L101** is the entry point for the ultra-low-power 8-bit portfolio. It is cost optimized and offers a high level of integration in an ultra-small footprint.
- The **STM8L151** is the feature-rich 8-bit solution. It has more Flash, SRAM and peripherals on board, with external crystal/clock capability, more analog features, a real-time clock and enhanced reset, EEPROM with true RWW, DMA, fast ADC and DAC.
- The **STM8L152** has an additional segment LCD driver compared to the STM8L151.
- The **STM8L162** has an additional 128-bit encryption (AES) feature compare to the STM8L152.

STM8L: power-saving features and benefits

The STM8L lines embed up to 4 different ultra-low-power modes to offer users a high level of flexibility for their applications. In addition, the dynamic run consumption has been optimized.

Supply monitoring and resets

- Full reset circuitry, supply monitoring
  - Power-on reset/power-down reset, permanently enabled (zero power)
  - Brown-out detection (BOR) can be on or off in low-power mode
  - Programmable voltage detection can be on or off
- Extended battery lifetime down to 1.65 V
- BOR complies with all V_{DD} rise/fall times, so no constraints on power supply shape

Up to four ultra-low-power modes

The following modes are ideal for applications that need constant monitoring with a sub 6 µA budget.

- **Low-power run mode**: the CPU is still running. Execution is done from RAM with a low-speed oscillator (RTC or internal). Consumption is less than 6 µA typical.
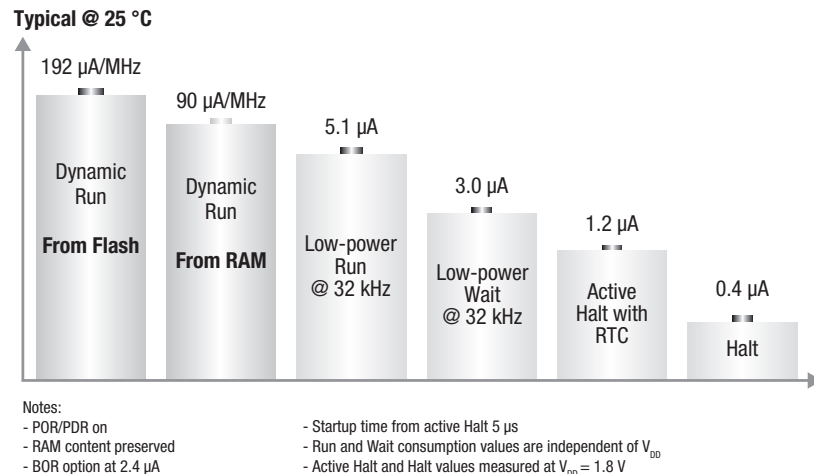- **Low-power wait**: offers the capability to keep the RTC and a few other peripherals active (such as the timer) with a consumption of about 3 µA typical.
  The Flash is switched off and the regulator is put in ultra-low-power mode, the CPU clock is stopped, the RTC and peripherals can be activated.

The following modes are ideal for applications that need low-power modes with sub 1.2 µA budget.

- **Active halt mode**: the CPU, main clocks and peripherals are off. The RTC can be still running. Wake up can be done through an interrupt on the peripherals. SRAM and context are kept.
- **Halt mode**: the CPU, main clocks and peripherals are off, the RTC is off, SRAM and context are kept.

STM8L15x consumption values

Typical @ 25 °C

192 µA/MHz — Dynamic Run **From Flash**
90 µA/MHz — Dynamic Run **From RAM**
5.1 µA — Low-power Run @ 32 kHz
3.0 µA — Low-power Wait @ 32 kHz
1.2 µA — Active Halt with RTC
0.4 µA — Halt

Notes:
- POR/PDR on
- RAM content preserved
- BOR option at 2.4 µA
- Startup time from active Halt 5 µs
- Run and Wait consumption values are independent of V_{DD}
- Active Halt and Halt values measured at V_{DD} = 1.8 V

STM8L ultra-low power consumption values

Operating mode	STM8L101	STM8L15x/STM8L16x	
	Typ 1.8 V – 3.3 V, 25 °C	Typ 1.8 V, 25 °C	Typ 3.0 V, 25 °C
Run from Flash mode	150 µA/MHz	192 µA/MHz	192 µA/MHz
Run from RAM mode	75 µA/MHz	90 µA/MHz	90 µA/MHz
Low-power Run from RAM	n.a	5.1 µA	5.1 µA
Low-power Wait	n.a	3.0 µA	3.0 µA
Active Halt with RTC	n.a	1.2 µA	1.35 µA
Active Halt with AWU	0.8 µA	1 µA	1 µA
Halt mode	0.35 µA	0.4 µA	0.4 µA

Touch-sensing library (STM8-TOUCH-LIB) for STM8L

STMicroelectronics' touch-sensing software library is a complete, free-of-charge source-code solution to transform any 8-bit STM8L microcontroller into a capacitive touch-key controller. This library controls the embedded charge transfer hardware driver, offers advanced filtering algorithms and touch-key management in various user cases. Designers can combine the touch-sensing function with multiple configurations (touch keys, wheels, sliders) and the traditional MCU features (communication, LED control, beeper, LCD control).

An evaluation board (STMT/8L-EV1) based on the STM8L device is available to discover the touch-sensing library.

STM8AL* automotive 8-bit ultra-low-power

The STM8AL30x is the entry point for the automotive ultra-low-power 8-bit portfolio. It is cost optimized and offers a high level of integration in an ultra-small 20-pin footprint. The STM8AL31x is the feature-rich 8-bit solution. It has more Flash, SRAM and peripherals on board, with external crystal/clock capability, more analog features, a real-time clock and enhanced reset, EEPROM with true RWW, DMA, fast ADC and DAC. The STM8AL3L has an additional segment LCD driver.

Note: * Available in Q4/2011

STM8L device summary

Part number[1,3]	Package	Flash size (Kbytes)	Internal RAM size (Kbytes)	Data EEPROM (Bytes)	8-bit (IC/OC/PWM)	16-bit (IC/OC/PWM)	Others	ADC DAC	Comparator	I/Os (high current)	Serial interface	Supply voltage (V)	Lowest power mode (µA)	Run mode (per MHz) (µA)	Display controller (LCD)
					Timer functions								**Supply current (Icc)**		

Part number[1,3]	Package	Flash size (Kbytes)	Internal RAM size (Kbytes)	Data EEPROM (Bytes)	8-bit (IC/OC/PWM)	16-bit (IC/OC/PWM)	Others	ADC DAC	Comparator	I/Os (high current)	Serial interface	Supply voltage (V)	Lowest power mode (µA)	Run mode (per MHz) (µA)	Display controller (LCD)
STM8L101 entry line – 16 MHz CPU															
STM8L101F2	TSSOP20 (7.8x4.4) Pitch 0.65, UFQFPN20 (3x3), Pitch 0.5	4	1.5	-	1x8-bit	2x16-bit (4/4/4)	IWD, AWU, beeper	-	2	18(16)	1xSPI, 1xI²C, 1xUSART, 1xIRTx	1.65 to 3.6	0.35	150	-
STM8L101F3	TSSOP20 (7.8x4.4) Pitch 0.65, UFQFPN20 (3x3), Pitch 0.5	8	1.5	Note 2	1x8-bit	2x16-bit (4/4/4)	IWD, AWU, beeper	-	2	18(16)	1xSPI, 1xI²C, 1xUSART, 1xIRTx	1.65 to 3.6	0.35	150	-
STM8L101G2	UFQFPN28 (4x4) Pitch 0.5	4	1.5	-	1x8-bit	2x16-bit (4/4/4)	IWD, AWU, beeper	-	2	26(24)	1xSPI, 1xI²C, 1xUSART, 1xIRTx	1.65 to 3.6	0.35	150	-
STM8L101G3	UFQFPN28 (4x4) Pitch 0.5	8	1.5	Note 2	1x8-bit	2x16-bit (4/4/4)	IWD, AWU, beeper	-	2	26(24)	1xSPI, 1xI²C, 1xUSART, 1xIRTx	1.65 to 3.6	0.35	150	-
STM8L101K3	LQFP32 (7x7) Pitch 0.8, UFQFPN32 (5x5), Pitch 0.5	8	1.5	Note 2	1x8-bit	2x16-bit (4/4/4)	IWD, AWU, beeper	-	2	30(28)	1xSPI, 1xI²C, 1xUSART, 1xIRTx	1.65 to 3.6	0.35	150	-
STM8L151 without LCD – 16 MHz CPU															
STM8L151C3	LQFP48 (7x7) Pitch 0.5, UFQFPN48 (7x7) Pitch 0.5	8	1	256	1x8-bit	2x16-bit (2/2/2)	2xWDG, AWU, RTC, beeper	27x12-bit -	2	41(389)	1xSPI, 1xI²C, 1xUSART (IrDA, ISO 7816)	1.65 to 3.6	0.35	195	-
STM8L151C4	LQFP48 (7x7) Pitch 0.5, UFQFPN48 (7x7) Pitch 0.5	16	2	1024	1x8-bit	3x16-bit (7/7/10)	2xWDG, AWU, RTC, beeper	25x12-bit 1x12-bit	2	41(39)	1xSPI, 1xI²C, 1xUSART (IrDA, ISO 7816)	1.8 to 3.6	0.4	195	-
STM8L151C6	LQFP48 (7x7) Pitch 0.5, UFQFPN48 (7x7), Pitch 0.5	32	2	1024	1x8-bit	3x16-bit (7/7/10)	2xWDG, AWU, RTC, beeper	25x12-bit 1x12-bit	2	41(39)	1xSPI, 1xI²C, 1xUSART (IrDA, ISO 7816)	1.8 to 3.6	0.4	195	-
STM8L151C8	LQFP48 (7x7) Pitch 0.5, UFQFPN48 (7x7) Pitch 0.5	64	4	2048	1x8-bit	4x16-bit (7/7/10)	2xWDG, AWU, RTC, beeper	25x12-bit 2x12-bit	2	41(39)	2xSPI, 1xI²C, 3xUSART (IrDA, ISO 7816)	1.65 to 3.6	0.4	195	-
STM8L151F2	TSSOP20 (7.8x4.4) Pitch 0.65, UFQFPN20 (3x3) Pitch 0.5	4	1	256	1x8-bit	2x16-bit (2/2/2)	2xWDG, AWU, RTC, beeper	10x12-bit -	2	18(16)	1xSPI, 1xI²C, 1xUSART (IrDA, ISO 7816)	1.65 to 3.6	0.35	195	-
STM8L151F3	TSSOP20 (7.8x4.4) Pitch 0.65, UFQFPN20 (3x3) Pitch 0.5	8	1	256	1x8-bit	2x16-bit (2/2/2)	2xWDG, AWU, RTC, beeper	10x12-bit -	2	18(16)	1xSPI, 1xI²C, 1xUSART (IrDA, ISO 7816)	1.65 to 3.6	0.35	195	-
STM8L151G2	UFQFPN28 (4x4) Pitch 0.5	4	1	256	1x8-bit	2x16-bit (2/2/2)	2xWDG, AWU, RTC, beeper	18x12-bit -	2	26(24)	1xSPI, 1xI²C, 1xUSART (IrDA, ISO 7816)	1.65 to 3.6	0.35	195	-
STM8L151G3	UFQFPN28 (4x4) Pitch 0.5	8	1	256	1x8-bit	2x16-bit (2/2/2)	2xWDG, AWU, RTC, beeper	18x12-bit -	2	26(24)	2xSPI, 1xI²C, 3xUSART (IrDA, ISO 7816)	1.65 to 3.6	0.35	195	-
STM8L151G4	UFQFPN28 (4x4), Pitch 0.5, WLCSP28 (2.9x1.8) Pitch 0.4	16	2	2048	1x8-bit	3x16-bit (7/7/8)	2xWDG, AWU, RTC, beeper	18x12-bit 1x12-bit	2	26(24)	1xSPI, 1xI²C, 1xUSART (IrDA, ISO 7816)	1.8 to 3.6	0.4	195	-
STM8L151G6	UFQFPN28 (4x4), Pitch 0.5, WLCSP28 (2.9x1.8) Pitch 0.4	32	2	1024	1x8-bit	3x16-bit (7/7/8)	2xWDG, AWU, RTC, beeper	18x12-bit 1x12-bit	2	26(24)	1xSPI, 1xI²C, 1xUSART (IrDA, ISO 7816)	1.8 to 3.6	0.4	195	-
STM8L151K3	UFQFPN32 (5x5) Pitch 0.5	8	1	256	1x8-bit	2x16-bit (2/2/2)	2xWDG, AWU, RTC, beeper	22x12-bit -	2	30(28)	1xSPI, 1xI²C, 1xUSART (IrDA, ISO 7816)	1.65 to 3.6	0.35	195	-

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STM8L device summary

Part number[1,3]	Package	Flash size (Kbytes)	Internal RAM size (Kbytes)	Data EEPROM (Bytes)	Timer functions 8-bit (IC/OC/PWM)	Timer functions 16-bit (IC/OC/PWM)	Timer functions Others	ADC DAC	Comparator	I/Os (high current)	Serial interface	Supply voltage (V)	Supply current (I_{cc}) Lowest power mode (µA)	Supply current (I_{cc}) Run mode (per MHz) (µA)	Display controller (LCD)
STM8L151K4	LQFP32 (7x7) Pitch 0.8, UFQFPN32 (5x5), Pitch 0.5, XQFN32 (5X5), Pitch 0.5	16	2	1024	1x8-bit	3x16-bit (7/7/10)	2xWDG, AWU, RTC, beeper	22x12-bit 1x12-bit	2	30(28)	1xSPI, 1xI²C, 1xUSART (IrDA, ISO 7816)	1.8 to 3.6	0.4	195	-
STM8L151K6	LQFP32 (7x7) Pitch 0.8, UFQFPN32 (5x5), Pitch 0.5	32	2	1024	1x8-bit	3x16-bit (7/7/10)	2xWDG, AWU, RTC, beeper	22x12-bit 1x12-bit	2	30(28)	1xSPI, 1xI²C, 1xUSART (IrDA, ISO 7816)	1.8 to 3.6	0.4	195	-
STM8L151M8	LQFP80 (14x14), Pitch 0.65	64	4	2048	1x8-bit	4x16-bit (9/9/12)	2xWDG, AWU, RTC, beeper	28x12-bit 2x12-bit	2	68(66)	2xSPI, 1xI²C, 3xUSART (IrDA, ISO 7816)	1.65 to 3.6	0.4	195	-
STM8L151R6	LQFP64 (10x10), Pitch 0.5	32	2	1024	1x8-bit	4x16-bit (9/9/12)	2xWDG, AWU, RTC, beeper	28x12-bit 2x12-bit	2	54(52)	2xSPI, 1xI²C, 3xUSART (IrDA, ISO 7816)	1.65 to 3.6	0.4	195	-
STM8L151R8	LQFP64 (10x10), Pitch 0.5	64	4	2048	1x8-bit	4x16-bit (9/9/12)	2xWDG, AWU, RTC, beeper	28x12-bit 2x12-bit	2	54(52)	2xSPI, 1xI²C, 3xUSART (IrDA, ISO 7816)	1.65 to 3.6	0.4	195	-
STM8L152 with LCD – 16 MHz CPU															
STM8L152C4	LQFP48 (7x7) Pitch 0.5, UFQFPN48 (7x7), Pitch 0.5	16	2	1024	1x8-bit	3x16-bit (7/7/10)	2xWDG, AWU, RTC, beeper	25x12-bit 1x12-bit	2	41(39)	1xSPI, 1xI²C, 1xUSART (IrDA, ISO 7816)	1.8 to 3.6	0.4	195	4x28
STM8L152C6	LQFP48 (7x7) Pitch 0.5, UFQFPN48 (7x7), Pitch 0.5	32	2	1024	1x8-bit	3x16-bit (7/7/10)	2xWDG, AWU, RTC, beeper	25x12-bit 1x12-bit	2	41(39)	1xSPI, 1xI²C, 1xUSART (IrDA, ISO 7816)	1.8 to 3.6	0.4	195	4x28
STM8L152C8	LQFP48 (7x7) Pitch 0.5, UFQFPN48 (7x7), Pitch 0.5	64	4	2048	1x8-bit	4x16-bit (9/9/12)	2xWDG, AWU, RTC, beeper	25x12-bit 2x12-bit	2	41(39)	2xSPI, 1xI²C, 3xUSART (IrDA, ISO 7816)	1.65 to 3.6	0.4	195	4x44 8x40
STM8L152K4	LQFP32 (7x7) Pitch 0.8, UFQFPN32 (5x5) Pitch 0.5	16	2	1024	1x8-bit	3x16-bit (7/7/10)	2xWDG, AWU, RTC, beeper	21x12-bit 1x12-bit	2	29(27)	1xSPI, 1xI²C, 1xUSART (IrDA, ISO 7816)	1.8 to 3.6	0.4	195	4x28
STM8L152K6	LQFP32 (7x7) Pitch 0.8, UFQFPN32 (5x5), Pitch 0.5	32	2	1024	1x8-bit	3x16-bit (7/7/10)	2xWDG, AWU, RTC, beeper	21x12-bit 1x12-bit	2	29(27)	1xSPI, 1xI²C, 1xUSART (IrDA, ISO 7816)	1.8 to 3.6	0.4	195	4x28
STM8L152M8	LQFP80 (14x14), Pitch 0.65	64	4	2048	1x8-bit	4x16-bit (9/9/12)	2xWDG, AWU, RTC, beeper	28x12-bit 2x12-bit	2	68(66)	2xSPI, 1xI²C, 3xUSART (IrDA, ISO 7816)	1.65 to 3.6	0.4	195	4x44 8x40
STM8L152R6	LQFP64 (10x10), Pitch 0.5	32	2	1024	1x8-bit	4x16-bit (9/9/12)	2xWDG, AWU, RTC, beeper	28x12-bit 2x12-bit	2	54(52)	2xSPI, 1xI²C, 3xUSART (IrDA, ISO 7816)	1.65 to 3.6	0.4	195	4x28
STM8L152R8	LQFP64 (10x10), Pitch 0.5	64	4	2048	1x8-bit	4x16-bit (9/9/12)	2xWDG, AWU, RTC, beeper	28x12-bit 2x12-bit	2	54(52)	2xSPI, 1xI²C, 3xUSART (IrDA, ISO 7816)	1.65 to 3.6	0.4	195	4x44 8x40
STM8L162 with LCD – 16 MHz CPU															
STM8L162M8	LQFP80 (14x14), Pitch 0.65	64	4	2048	1x8-bit	4x16-bit (9/9/12)	2xWDG, AWU, RTC, beeper	28x12-bit 2x12-bit	2	68(66)	2xSPI, 1xI²C, 3xUSART (IrDA, ISO 7816)	1.65 to 3.6	0.4	195	4x44 8x40
STM8L162R8	LQFP64 (10x10), Pitch 0.5	64	4	2048	1x8-bit	4x16-bit (9/9/12)	2xWDG, AWU, RTC, beeper	28x12-bit 2x12-bit	2	54(52)	2xSPI, 1xI²C, 3xUSART (IrDA, ISO 7816)	1.65 to 3.6	0.4	195	4x44 8x40

Notes:
1. Touch-sensing FW library available for all STM8L part numbers
2. Up to 2 Kbytes of EEPROM included in the 8 Kbytes of Flash
3. All part numbers have DMA with 4 channels except STM8L101 series

STM8L development tools

A complete set of hardware and software tools is available to help designers evaluate the STM8L features and to allow fast application development.

STM8L embedded firmware

STM8L firmware libraries: complete packages consisting of device drivers for all the standard device peripherals.

Each device driver includes a set of functions covering full peripheral functionality.

STM8 development and programming tools

Part number	Evaluation		In-circuit debugger	Emulator		Software	Programming tool	
	Evaluation board	Starter kit		STice system	Connection accessories		In-circuit programmer	3rd-party programmer
STM8L101	STM8L101-EVAL	-	ST-LINK/V2 STX-RLINK	STICE-SYS005	**Flex** CF/FP60 **Adapter** AD/QFN20J-Z01 AD/QFN28H-Z01 AD/QFN32A-Z01 AD/QFP32B-A04 AD/TSS020A-A01 **Socket** AS/QFN20JA AS/QFN28HA AS/QFN32AA AS/QFP32BC AS/TSS020AB **In-circuit debug/ Pgm adapter** AD-ICD/ICP	STVD STVP IAR EWSTM8 Raisonance RIDE Cosmic C compiler IAR C compiler Raisonance C compiler STM8-TOUCH-LIB STM-STUDIO	ST-LINK/V2 STX-RLINK Flasher Segger FlashRunner SMH Technologies WriteNow! Algocraft	Algocraft BP Microsystems Data I/O Dataman Elnec HI-LO Phyton RK-System Segger SMH Technologies System General Xeltek
STM8L15x STM8L16x	STM8L1526-EVAL STM8L1528-EVAL STM8L15LPBOARD STMT/8L-EV1	STM8L-DISCOVERY STM8L1526PRIMER	ST-LINK/V2 STX-RLINK	STICE-SYS009	**Flex** CF/FP60 CF/FP120 **Adapter** AD/QFN28H-Z01 AD/QFN32A-Z01 AD/QFN48B-Z02 AD/QFP32B-A04 AD/QFP48B-A04 AD/QFP64C-B03 AD/QFP80F-B02 **Socket** AS/QFN28HA AS/QFN32AA AS/QFN48BA AS/QFP32BC AS/QFP48BA AS/QFP64FC AS/QFP80FB **In-circuit debug/ Pgm adapter** AD-ICD/ICP	STVD STVP IAR EWSTM8 Raisonance RIDE Cosmic C compiler IAR C compiler Raisonance C compiler STM8-TOUCH-LIB STM-STUDIO	ST-LINK/V2 STX-RLINK Flasher Segger FlashRunner SMH Technologies WriteNow! Algocraft	Algocraft BP Microsystems Data I/O Dataman Elnec HI-LO Phyton RK-System Segger SMH Technologies System General Xeltek

STM8L101 LCD board: STEVAL-IAS003V1
STM8L101 low-power demonstrator with software driven LCD. Featuring 1.25 µA consumption at 36 kHz refresh rate with a 3-digit LCD glass driven by software, this tool highlights the optimized power consumption with the STM8L101. It is also provided at a very low cost.
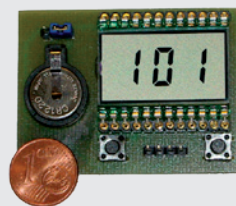
STM8L15x low-power board: STM8L15LPBOARD
Ultra-low-power and low-cost board for STM8L15x to demonstrate the different low-power modes and functionalities and provide a means to measure current sourced by the battery while paused in each of the modes.

STM8L101-EVAL, STM8L1526-EVAL and STM8L1528-EVAL
Evaluation boards with respectively the STM8L101K3, the STM8L152C6 or STM8L152M8, implementing the full range of device peripherals and features.

STMT/8L-EV1
The board manages 10 keys, 1 wheel and 1 slider. The user can easily evaluate the touch-sensing software features and performances, and display or change parameters through an LCD display interface.

STM8L-DISCOVERY
The STM8L-Discovery kit is the cheapest and quickest way to discover the STM8L and its low-power capabilities. It includes a 6-digit LCD display, 2 LEDs, 1 user button, current measurement and the embedded debugger ST-LINK.

STM8L1526PRIMER
Play, explore and develop applications on the EvoPrimer STM8L with Raisonance toolset, free demos and an online community at www.stm8circle.com to stimulate creative designs.

www.BDTIC.com/ST

STM32L ultra-low-power MCU family

The STM32L MCU family, based on the Cortex™-M3 core, extends the ultra-low-power portfolio in performance, features, memory size and package pin count. The STM32L family combines very high performance and ultra-low power consumption, using optimized architecture and our proprietary ultra-low leakage process, shared with the STM8L family. The STM32L family is available in three different lines, so optimizing the STM32F family for many applications requiring performance with special care on power savings.

STM32L family description

- ARM Cortex-M3 32 MHz CPU
- 32 to 384 Kbytes of embedded Flash, up to 48 Kbytes of SRAM and up to 12 Kbytes of data EEPROM
- Three lines: pin-to-pin, software and peripheral compatibility
- Pin-to-pin compatibility with STM32F series (except V_{BAT} not present on the STM32L)
- Ultra-low energy consumption: down to 180 µA/DMIPS from Flash
- Supply voltage: 1.65 to 3.6 V
- Six ultra-low-power modes: down to 300 nA
- Ultra-low-power dynamic modes: low-power run down to 9 µA; low-power sleep down to 4.9 µA with one timer
- Economical Run mode consumption down to 230 µA/MHz from Flash at zero-wait state with dynamic voltage scaling (3 ranges)
- Rich set of high-end analog and digital peripherals
- -40 to +85 °C operating temperature range
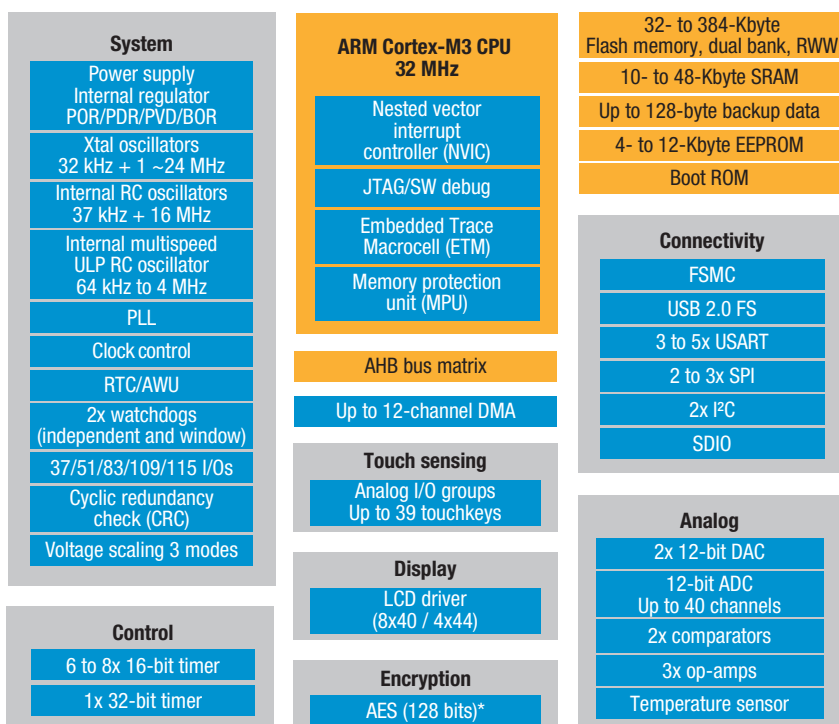
STM32L enriches ultra-low-power platform and STM32 portfolio

The STM32L15x/STM32L16x extend both our ultra-low-power platform and the STM32 portfolio. The STM32L microcontroller, powered by the ARM Cortex-M3, offers more features and performance compared to the STM8L. It complements the STM32 portfolio with lower overall power consumption, new ultra-low-power modes (low-power run, low-power sleep), new peripherals (LCD, comparators), and new ultra-low-power architecture (voltage scaling, ultra-low-power MSI oscillator). The pin-to-pin compatibility between the STM32L and STM32F gives greater flexibility to the application designer and supports a strategy based on a unique platform.

The STM32L152 has an additional LCD-segment driver compared to the STM32L151.

The STM32L162 embeds a 128-bit AES.

STM32L block diagram

System
- Power supply Internal regulator POR/PDR/PVD/BOR
- Xtal oscillators 32 kHz + 1 ~24 MHz
- Internal RC oscillators 37 kHz + 16 MHz
- Internal multispeed ULP RC oscillator 64 kHz to 4 MHz
- PLL
- Clock control
- RTC/AWU
- 2x watchdogs (independent and window)
- 37/51/83/109/115 I/Os
- Cyclic redundancy check (CRC)
- Voltage scaling 3 modes

Control
- 6 to 8x 16-bit timer
- 1x 32-bit timer

ARM Cortex-M3 CPU 32 MHz
- Nested vector interrupt controller (NVIC)
- JTAG/SW debug
- Embedded Trace Macrocell (ETM)
- Memory protection unit (MPU)

- AHB bus matrix
- Up to 12-channel DMA

Touch sensing
- Analog I/O groups Up to 39 touchkeys

Display
- LCD driver (8x40 / 4x44)

Encryption
- AES (128 bits)*

- 32- to 384-Kbyte Flash memory, dual bank, RWW
- 10- to 48-Kbyte SRAM
- Up to 128-byte backup data
- 4- to 12-Kbyte EEPROM
- Boot ROM

Connectivity
- FSMC
- USB 2.0 FS
- 3 to 5x USART
- 2 to 3x SPI
- 2x I²C
- SDIO

Analog
- 2x 12-bit DAC
- 12-bit ADC Up to 40 channels
- 2x comparators
- 3x op-amps
- Temperature sensor

Note:
* STM32L16x only

Abbreviations:
AWU:	Auto wake up from halt	PDR:	Power down reset	RTC:	Real time clock
BOR:	Brown out reset	POR:	Power on reset	SPI:	Serial peripheral interface
I²C:	Inter integrated circuit	PVD:	Programmable voltage detector	USART:	Universal sync/async receiver transmitter

STM32L: power-saving features and benefits

The STM32L lines propose 6 different ultra-low-power modes to offer users a high level of flexibility depending on their application. In addition, the dynamic run consumption has been optimized.

Up to six ultra-low-power modes

- **Low-power run mode**: the CPU is still running. Execution is done from RAM with a low-speed oscillator (RTC or internal). Consumption is 9 μA typical.
- **Low-power sleep mode**: offers the possibility of keeping the RTC and a few other peripherals active (such as the timer) with a consumption of 4.9 μA typical with one timer activated. The Flash is switched off and the regulator is put into ultra-low-power, the CPU is stopped, the RTC and peripherals can be activated.

The 2 modes above are ideal for applications that need constant monitoring.

- **Stop modes (2 modes)**: the CPU, main clocks and peripherals are off. The RTC can be on or off (2 modes). Wake up can be done through an interrupt on the peripherals. SRAM and context are kept.
- **Standby modes (2 modes)**: the CPU, main clocks and peripherals are off. The RTC can be on or off (2 modes). Backup registers are preserved. Wake up can be done through wake-up pins.

Supply monitoring and resets

- Full reset circuitry, supply monitoring
  - Power-on reset/power-down reset, permanently enabled (zero power)
  - Brown-out detection (BOR) can be on or off in low-power modes
  - Programmable voltage detection can be on or off
- Extended battery lifetime down to 1.65 V
- BOR complies with all V_{DD} rise/fall times, so no constraints on power supply shape. When BOR is not activated, the STM32L starts at V_{DD} = 1.65 V.

STM32L consumption values (64- to 128-Kbyte only)

Typical @ 25 °C
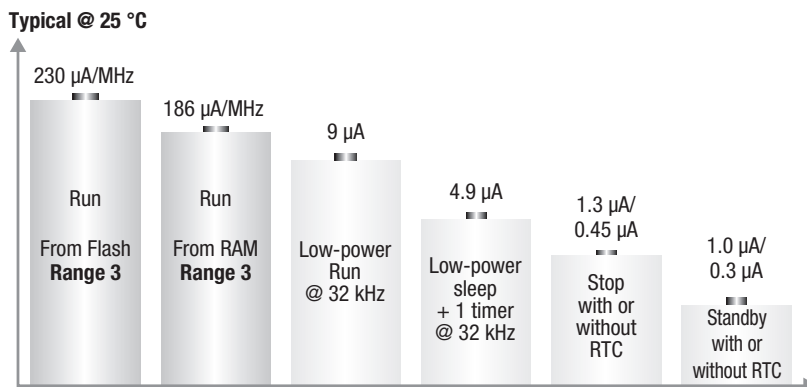
Notes:
- POR/PDR on
- RAM content preserved
- BOR option at 2.4 μA
- Startup time from Stop 8 μs
- Run and Sleep consumption value are independent of V_{DD}
- Stop and standby values measured at V_{DD} = 1.8 V
- Low-power Run and Low-power Sleep are measured with Flash off

STM32L ultra-low power consumption values (64 to 128 Kbytes only)

Operating mode	STM32L15x	
	Typ 1.8 V, 25 °C	Typ 3 V, 25 °C
Run from Flash mode 1, 2, 3	286, 265, 230 μA/MHz	286, 265, 230 μA/MHz
Run from RAM mode 1, 2, 3	270, 218, 186 μA/MHz	270, 218, 186 μA/MHz
Low-power Run from RAM	9 μA	9 μA
Low-power Sleep + 1 timer	4.9 μA	4.9 μA
Stop with RTC	1.3 μA	1.6 μA
Stop without RTC	0.45 μA	0.50 μA
Standby with RTC	1.0 μA	1.3 μA
Standby without RTC	0.3 μA	0.3 μA

Touch-sensing library (STM32-TOUCH-LIB) for STM32L

STMicroelectronics' touchsensing software library is a complete, free-of-charge sourcecode solution to transform any 32-bit STM32L microcontroller into a capacitive touch-key controller. This library controls the embedded charge transfer hardware driver, offers advanced filtering algorithms and touchkey management in various user cases. Designers can combine the touch-sensing function with multiple configurations (touch keys, wheels, sliders) and the traditional MCU features (communication, LED control, beeper, LCD control).

STM32L device summary

Part number[1]	Package	Flash size (Kbytes)	Internal RAM size (Kbytes)	Data EEPROM (Bytes)	Timer functions 16-bit (IC/OC/PWM)	Others	ADC DAC	Comparator	I/Os (high current)	Serial interface	Supply voltage (V)	Supply current (I_{CC}) Lowest power mode (µA)	Run mode (per MHz) (µA)	Display controller (LCD)
STM32L151 without LCD – 32 MHz CPU														
STM32L151C8	LQFP48 (7x7), VFQFPN48 (7x7)	64	10	4096	8x16-bit (16/16/16)	SysTick, 2xWDG, RTC	16x12-bit 2x12-bit	2	37(37)	2xSPI, 2xI²C, 3xUSART (IrDa, ISO 7816), 1xUSB	1.65 to 3.6	0.27	230	-
STM32L151CB	LQFP48 (7x7), VFQFPN48 (7x7)	128	16	4096	8x16-bit (16/16/16)	SysTick, 2xWDG, RTC	16x12-bit 2x12-bit	2	37(37)	2xSPI, 2xI²C, 3xUSART (IrDa, ISO 7816), 1xUSB	1.65 to 3.6	0.27	230	-
STM32L151R8	LQFP64 (10x10), TFBGA64 (5x5)	64	10	4096	8x16-bit (16/16/16)	SysTick, 2xWDG, RTC	20x12-bit 2x12-bit	2	51(51)	2xSPI, 2xI²C, 3xUSART (IrDa, ISO 7816), 1xUSB	1.65 to 3.6	0.27	230	-
STM32L151RB	LQFP64 (10x10), TFBGA64 (5x5)	128	16	4096	8x16-bit (16/16/16)	SysTick, 2xWDG, RTC	20x12-bit 2x12-bit	2	51(51)	2xSPI, 2xI²C, 3xUSART (IrDa, ISO 7816), 1xUSB	1.65 to 3.6	0.27	230	-
STM32L151V8	LQFP100 (14x14), UFBGA100 (7x7)	64	10	4096	8x16-bit (16/16/16)	SysTick, 2xWDG, RTC	24x12-bit 2x12-bit	2	83(83)	2xSPI, 2xI²C, 3xUSART (IrDa, ISO 7816), 1xUSB	1.65 to 3.6	0.27	230	-
STM32L151VB	LQFP100 (14x14), UFBGA100 (7x7)	128	16	4096	8x16-bit (16/16/16)	SysTick, 2xWDG, RTC	24x12-bit 2x12-bit	2	83(83)	2xSPI, 2xI²C, 3xUSART (IrDa, ISO 7816), 1xUSB	1.65 to 3.6	0.27	230	-
STM32L152 with LCD – 32 MHz CPU														
STM32L152C8	LQFP48 (7x7), VFQFPN48 (7x7)	64	10	4096	8x16-bit (16/16/16)	SysTick, 2xWDG, RTC	16x12-bit 2x12-bit	2	37(37)	2xSPI, 2xI²C, 3xUSART (IrDa, ISO 7816), 1xUSB	1.65 to 3.6	0.27	230	4x16
STM32L152CB	LQFP48 (7x7), VFQFPN48 (7x7)	128	16	4096	8x16-bit (16/16/16)	SysTick, 2xWDG, RTC	16x12-bit 2x12-bit	2	3737	2xSPI, 2xI²C, 3xUSART (IrDa, ISO 7816), 1xUSB	1.65 to 3.6	0.27	230	4x16
STM32L152R8	LQFP64 (10x10), TFBGA64 (5x5)	64	10	4096	8x16-bit (16/16/16)	SysTick, 2xWDG, RTC	20x12-bit 2x12-bit	2	51(51)	2xSPI, 2xI²C, 3xUSART (IrDa, ISO 7816), 1xUSB	1.65 to 3.6	0.27	230	4x32, 8x28
STM32L152RB	LQFP64 (10x10), TFBGA64 (5x5)	128	16	4096	8x16-bit (16/16/16)	SysTick, 2xWDG, RTC	20x12-bit 2x12-bit	2	51(51)	2xSPI, 2xI²C, 3xUSART (IrDa, ISO 7816), 1xUSB	1.65 to 3.6	0.27	230	4x32, 8x28
STM32L152V8	LQFP100 (14x14), UFBGA100 (7x7)	64	10	4096	8x16-bit (16/16/16)	SysTick, 2xWDG, RTC	24x12-bit 2x12-bit	2	83(83)	2xSPI, 2xI²C, 3xUSART (IrDa, ISO 7816), 1xUSB	1.65 to 3.6	0.27	230	4x44, 8x40
STM32L152VB	LQFP100 (14x14), UFBGA100 (7x7)	128	16	4096	8x16-bit (16/16/16)	SysTick, 2xWDG, RTC	24x12-bit 2x12-bit	2	83(83)	2xSPI, 2xI²C, 3xUSART (IrDa, ISO 7816), 1xUSB	1.65 to 3.6	0.27	230	4x44, 8x40

Note:
1. Touch-sensing FW library available for all part numbers

www.BDTIC.com/ST

STM32L development tools

A complete set of hardware and software tools is available to help designers evaluate the STM32L features and to allow fast application development.

STM32 development and programming tools

Device	Evaluation		Development environment available from ST	C/C++ compiler	3rd-party development environment	RTOS and stack software	Programmer
	Evaluation board	Starter kit					
STM32L	STM32L152-EVAL	STM32L15PRIMER STM32L-DISCOVERY STM32L152-SK/IAR	STM-STUDIO STX-PRO/RAIS	ARM GNU GreenHills IAR Keil Altium/Tasking	Aiji System Altium/Tasking ARM Ashling Atollic Embest Green Hills Software Hitex IAR iSYSTEM Keil Lauterbach Nohau PLS Raisonance Rowley Signum	CMX eCosCentric Express Logic freeRTOS GreenHills HCC-Embedded Keil Micrium Micro Digital Port Quadros Segger uClinux Wittenstein High Integrity Systems	**From ST:** ST-LINK/V2 STX-RLINK **Third-parties:** Algocraft BP Microsystems Dataman Data I/O Elnec Hitex Leap PLS Raisonance RK-System Segger SMH Technologies Systems General Xeltec

STM32L embedded firmware

STM32L firmware library: complete package consisting of device drivers for all the standard device peripherals.

Each device driver includes a set of functions covering full peripheral functionality.

STM32L Class B norm certification self-test routines: a full set of ready to-use self-test routines for home-appliance certification under EN/IEC 60335-1 Class B norm (functional safety).

STM32 USB Libraries: Complete firmware packages for USB, slave and host, with many covered classes.

S**TM32 Continua Certified Solution**: Software bricks to build up your Continua medical solution. Provided bricks are USB PHDC class (Personal Health Device Class), Base Framework protocol, Glucose Agent and Thermometer Agent. Further agents can be implemented on demand.

Evaluation boards

STM32L-DISCOVERY
The STM32L-Discovery kit is the cheapest and quickest way to discover the STM32L and its low-power capabilities. It includes a 6-digit LCD display, one touch-sensing slider, 2 LEDs, 1 user button, current measurement and the embedded debugger ST-LINK/V2.

STM32L152-EVAL
Evaluation board with the STM32L152, implementing the full range of device peripherals and features.

Third-party development solutions

Choose from a full range of solutions that offer start-to-finish control of application development from a single environment that includes development environment, C/C++ compiler and in-circuit emulator. Contact ST sales office for availability.

Third-party directory

Company name	URL
Aiji System	www.aijisystem.com
Algocraft	www.algocraft.com
Altium/Tasking	www.tasking.com
ARM	www.arm.com
Ashling	www.ashling.com
Atollic	www.atollic.com
AVIX	www.avix-rt.com
BP Microsystems	www.bpmicro.com
CMX Systems	www.cmx.com
Data I/O	www.data-io.com
Dataman	www.dataman.com
eCosCentric	www.ecoscentric.com
Elnec	www.elnec.com
Embest	www.embedinfo.com
EUROS	www.euros-embedded.com
Express Logic	www.rtos.com
freeRTOS	www.freertos.org
GNU	gcc.gnu.org
Green Hills Software	www.ghs.com
HCC-Embedded	www.hcc-embedded.com
HI-LO	www.hilosystems.com.tw
Hitex	www.hitex.com
IAR	www.iar.com
Insem	www.insem.co.kr
iSYSTEM	www.isystem.com
Keil	www.keil.com
Lauterbach	www.lauterbach.com
Leap	www.leap.com.tw
Micrium	www.micrium.com
Micro Digital	www.smxrtos.com
Nohau	www.icetech.com
osCAN	www.vector-informatik.com
Phyton	www.phyton.com
PLS	www.pls-mc.com
Port	www.epl-tools.com
PXROS	www.hightec-rt.com
Quadros	www.quadros.com
Raisonance	www.raisonance.com
RK-System	www.rk-system.com.pl
Rowley	www.rowley.co.uk
Segger	www.segger.com
Signum	www.signum.com
SMH Technologies	www.smh-tech.com
System General	www.sg.com
uClinux	www.uclinux.org
Wittenstein High Integrity Systems	www.highintegritysystems.com
Xeltek	www.xeltek.com
µC/OS-II Micrium	www.micrium.com