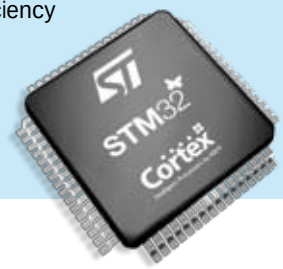
The STM32 key benefits

- Leading-edge architecture with the latest Cortex-M3 core from ARM
- Excellent real-time behaviour
- Outstanding power efficiency
- Superior and innovative peripherals
- Maximum integration
- Easy development, fast time to market



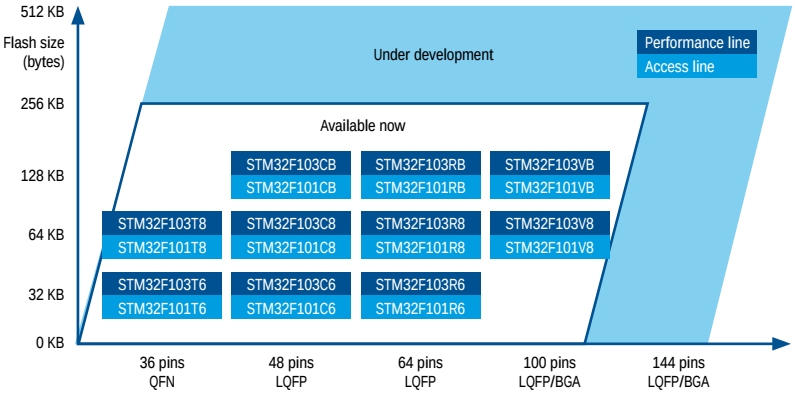
STM32, the optimal platform choice

The STM32 is an optimal choice to support many applications with the same platform:

- From reduced memory and pin requirements to larger needs
- From performance demanding to battery operated
- From simple cost-sensitive to complex high-value

The high level of pin-to-pin, peripheral and software compatibility across the family gives you full flexibility. You can upgrade to a higher or downgrade to a lower memory size, or use different packages without changing your initial layout or software.

STM32F10x portfolio



72 MHz Cortex-M3 CPU – wide selection of devices:

- 6 Kbyte to 20 Kbyte SRAM
- Two lines: Performance and Access
- Pin-to-pin, software and peripheral compatibility across family
- 2.0 to 3.6 V power supply/ 5 V tolerant I/Os
- -40 to +85 °C or up to 105 °C operating temperature range

Device summary

Part number		Program memory type	Prog. (Bytes)	RAM (Bytes)	Timer functions		Serial interface	I/Os (High current)	Packages	Supply voltage
		Flash			12 or 16-bit (IC/OC/PWM)	Others				
STM32 (ARM Cortex-M3) - 32-bit microcontrollers										
36 pins	STM32F101T6	•	32 K	6 K	2x16-bit (8/8/8)	2xWDG, RTC, 24-bit down counter	1xSPI/1xI²C/2xUSART*	26(26)	QFN36	2 to 3.6 V
	STM32F101T8	•	64 K	10 K	3x16-bit (12/12/12)		2xSPI/2xI²C/3xUSART*	26(26)	QFN36	2 to 3.6 V
48 pins	STM32F101C6	•	32 K	6 K	2x16-bit (8/8/8)		1xSPI/1xI²C/2xUSART*	36(36)	LQFP48	2 to 3.6 V
	STM32F101C8	•	64 K	10 K	3x16-bit (12/12/12)		2xSPI/2xI²C/3xUSART*	36(36)	LQFP48	2 to 3.6 V
	STM32F101CB	•	128 K	16 K	3x16-bit (12/12/12)		2xSPI/2xI²C/3xUSART*	36(36)	LQFP48	2 to 3.6 V
64 pins	STM32F101R6	•	32 K	6 K	2x16-bit (8/8/8)		1xSPI/1xI²C/2xUSART*	51(51)	LQFP64	2 to 3.6 V
	STM32F101R8	•	64 K	10 K	3x16-bit (12/12/12)		2xSPI/2xI²C/3xUSART*	51(51)	LQFP64	2 to 3.6 V
	STM32F101RB	•	128 K	16 K	3x16-bit (12/12/12)		2xSPI/2xI²C/3xUSART*	51(51)	LQFP64	2 to 3.6 V
100 pins	STM32F101V8	•	64 K	10 K	3x16-bit (12/12/12)		2xSPI/2xI²C/3xUSART*	80(80)	LQFP100	2 to 3.6 V
	STM32F101VB	•	128 K	16 K	3x16-bit (12/12/12)		2xSPI/2xI²C/3xUSART*	80(80)	LQFP100	2 to 3.6 V
36 pins	STM32F103T6	•	32 K	10 K	3x16-bit (12/12/14)		1xSPI/1xI²C/2xUSART*/USB/CAN	26(26)	QFN36	2 to 3.6 V
	STM32F103T8	•	64 K	20 K	4x16-bit (16/16/18)		2xSPI/2xI²C/3xUSART*/USB/CAN	26(26)	QFN36	2 to 3.6 V
48 pins	STM32F103C6	•	32 K	10 K	3x16-bit (12/12/14)		1xSPI/1xI²C/2xUSART*/USB/CAN	36(36)	LQFP48	2 to 3.6 V
	STM32F103C8	•	64 K	20 K	4x16-bit (16/16/18)		2xSPI/2xI²C/3xUSART*/USB/CAN	36(36)	LQFP48	2 to 3.6 V
	STM32F103CB	•	128 K	20 K	4x16-bit (16/16/18)		2xSPI/2xI²C/3xUSART*/USB/CAN	36(36)	LQFP48	2 to 3.6 V
64 pins	STM32F103R6	•	32 K	10 K	3x16-bit (12/12/14)		1xSPI/1xI²C/2xUSART*/USB/CAN	51(51)	LQFP64	2 to 3.6 V
	STM32F103R8	•	64 K	20 K	4x16-bit (16/16/18)		2xSPI/2xI²C/3xUSART*/USB/CAN	51(51)	LQFP64	2 to 3.6 V
	STM32F103RB	•	128 K	20 K	4x16-bit (16/16/18)		2xSPI/2xI²C/3xUSART*/USB/CAN	51(51)	LQFP64	2 to 3.6 V
100 pins	STM32F103V8	•	64 K	20 K	4x16-bit (16/16/18)		2xSPI/2xI²C/3xUSART*/USB/CAN	80(80)	LQFP100/BGA100	2 to 3.6 V
	STM32F103VB	•	128 K	20 K	4x16-bit (16/16/18)		2xSPI/2xI²C/3xUSART*/USB/CAN	80(80)	LQFP100/BGA100	2 to 3.6 V

*(IrDA/ISO7816/LIN master/slave)

Applications

Industrial:
- PLC
- Inverters
- Printers, scanners
- Industrial networking

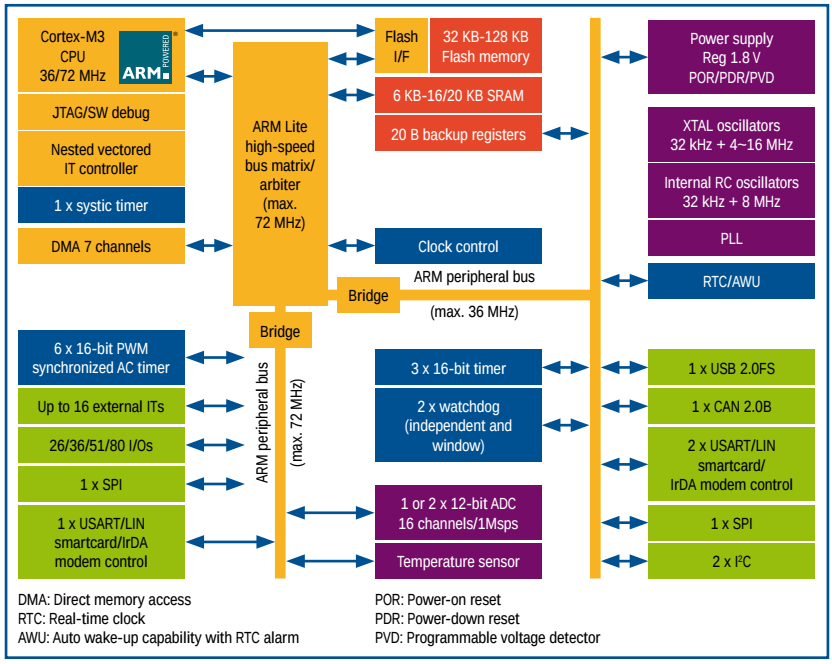
Building and security:
- Alarm systems
- Video intercom
- HVAC

Low power:
- Glucose meters
- Power meters
- Battery operated applications

Appliances:
- Motor drive
- Application control

Consumer:
- PC peripherals, gaming
- Digital camera, GPS platforms

STM32F10x block diagram



STM32, more choice with two complete lines

The Performance line, STM32F103, operates at 72 MHz, with more on-chip RAM and peripherals. The Access line, STM32F101, operates at 36 MHz. Both lines are pin-to-pin and software-compatible, and offer the same embedded Flash options.

The Performance line takes the 32-bit MCU world to new levels of performance and energy efficiency.

With its Cortex-M3 core at 72 MHz, it is able to perform high-end computation. Its peripheral set brings superior control and connectivity.

The Access line is the entry point of the STM32 family. It has the power of the 32-bit MCU but at a 16-bit MCU cost. Its peripheral set offers excellent connectivity and control.

STM32F10x: first two product lines

Both lines include up to:

- Up to 128 KB Flash
- 3 x USART
- 2 x SPI
- 2 x I²C
- 3 x 16-bit timers
- Main osc. 4-16 MHz
- Internal 8 MHz RC and 32 kHz RC
- Real-time clock
- 2 x watchdogs
- Reset circuitry Power on/down reset Voltage detector
- 7-channel DMA
- 80% GPIO ratio

+

Performance line STM32F103

72 MHz CPU	Up to 20 KB SRAM	2 x 12-bit ADC (1 µs) Temperature sensor	USB 2.0 FS	CAN 2.0 B	PWM timer

Access line STM32F101

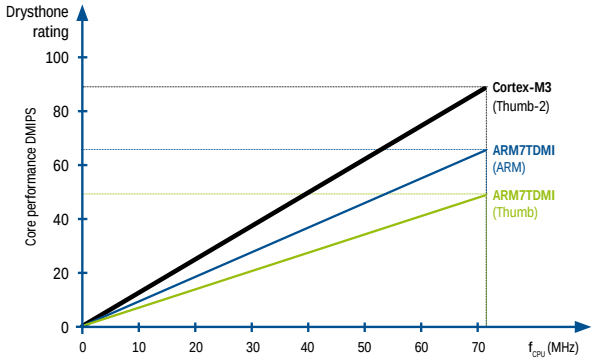
36 MHz CPU	Up to 16 KB SRAM	1 x 12-bit ADC (1 µs) Temperature sensor

STM32 key benefits

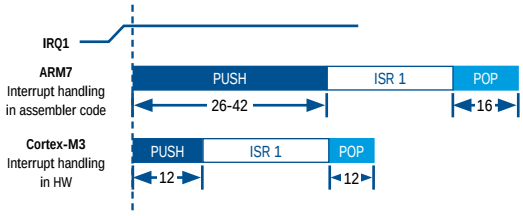
Leading-edge architecture with Cortex-M3 core

- Harvard architecture
- 1.25 DMIPS/MHz and 0.19 mW/MHz
- Thumb-2 instruction set brings 32-bit performance with 16-bit code density
- Single cycle multiply and hardware division
- Embedded, fast interrupt controller is now inside the core allowing:
  - Excellent real-time behaviour
  - Low latency down to six CPU cycles inter-interrupt
  - Six CPU cycles wake-up time from low-power mode
- Up to 35% faster and up to 45% less code than ARM7TDMI®

Cortex-M3 performance versus ARM7TDMI



Cortex-M3 interrupt versus ARM7TDMI



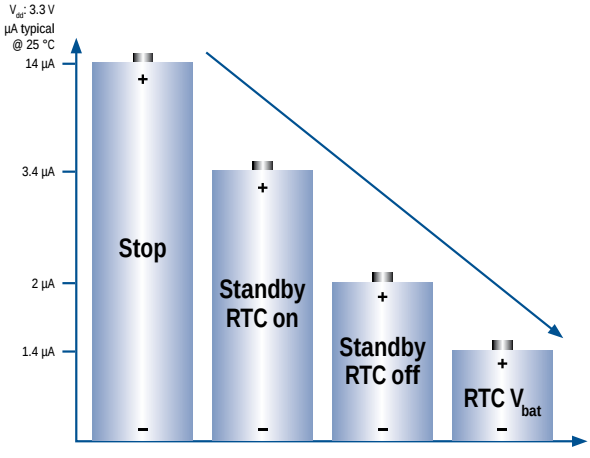
Outstanding power efficiency

High performance does not mean high power consumption. We have taken special care to address three main energy requirements driven by the market:

- High dynamic power efficiency in running mode
- Extremely low power when the application is in standby
- Low-voltage capability for direct battery operation

In run mode, executing from Flash at full 72 MHz CPU speed, the STM32 has a current consumption as low as 27 mA.

STM32F10x: Low power



In standby mode, current consumption is as low as 2 µA typical, with reset circuitry active. Finally, its 2.0 V to 3.6 V power supply enables its use for battery operated applications.

The STM32 has three different low power modes and a versatile clocking scheme so that users can optimize power consumption versus performance.

The STM32 also embeds a real-time clock (RTC) running either from a 32 kHz quartz oscillator or an internal RC. The RTC has a separate power domain, with an embedded switchover to run either from a dedicated coin cell battery or from the main supply. Its typical current consumption is 1.4 µA at 3.3 V. It embeds 20 bytes for data backup. Start-up time from low-power modes is lower than 7 µs typical from stop mode, and 55 µs typical from standby mode and reset.

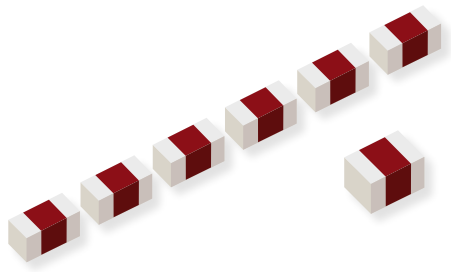
- Low voltage **2.0 V to 3.6 V** operation
- 27 mA in run mode from Flash at 72 MHz
- Startup time from stop **< 7 µs**
  Startup time from standby **55 µs**

- **Reset circuitry always active**

High level of integration

- Built-in supervisor reduces need for external components:
  - Power-on reset, low voltage detect, brown-out detect, watchdog timer with independent clock
- One main crystal drives entire system:
  - Inexpensive 4-16 MHz crystal drives CPU, USB and all peripherals
  - Embedded PLL generates multiple frequencies
  - Optional 32 kHz crystal for RTC
- Embedded factory trimmed 8 MHz RC can be used as main clock
- Additional low-frequency RC for RTC or watchdog
- Only 7 external passive components required for base system on LQFP100 package

7 power capacitors only!



Superior and innovative peripherals

The STM32 benefits from a dual advanced peripheral bus (APB) architecture, one of which is a high-speed APB (up to CPU frequency). Peripherals have been connected on this bus to increase peripheral speed:

The need for speed	
USB	12 Mbit/s
USART	up to 4.5 Mbit/s
SPI	18 MHz master and slave
I²C	400 kHz
GPIO	18 MHz maximum toggle
PWM timer	72 MHz clock input

Motor control

The STM32 Performance line embeds timers and ADC features that are perfectly suited to three-phase brushless motor control. The advanced control PWM timer offers:

- Six outputs
- Dead-time generation
- Edge-aligned and center-aligned waveforms
- Emergency stop and synchronization capability with the dual ADC, synchronization capability with other timers
- Programmable smoke inhibit feature to protect registers against unwanted writing
- Encoder input
- Hall effect sensors interface
- Total vector control loop: 21 µs in sensorless mode



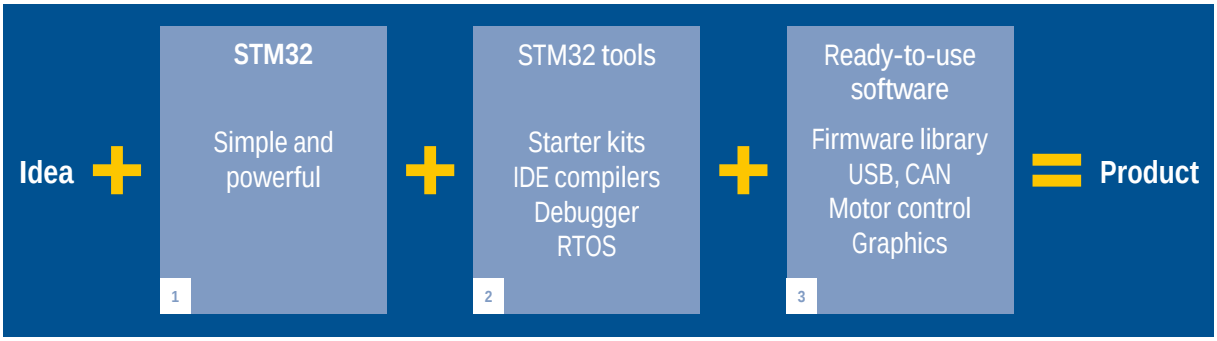
The dual ADC architecture allows dual sample and hold capability with 12-bit resolution, 1 µs conversion time. The dual ADC is controlled by two independent sequencers with discontinuous mode, multiple trigger sources, and channel-by-channel programmable sampling time.

This dedicated set of peripherals combined with the high performance of the Cortex-M3 core allows your software to shorten the total vector control loop to 21 µs (sensorless mode, three-phase PMSM motor). The CPU load is below 25% at 10 kHz current sampling frequency, allowing the STM32 to perform other tasks than motor control in the application.

Supporting tools include the STM32 motor control starter kit (STM3210B-MCKIT), a complete hardware platform and ready-to-run demo based on the STM32 motor control firmware library. It allows rapid feature evaluation and easy implementation of sensor and sensorless vector-based motor control for three-phase PMSM and AC induction motors.

STM32 easy development, fast time to market

From ideas to reality. As easy as 1, 2, 3



STM32 firmware library

The STM32 firmware library provides easy access to all features of the standard device peripherals of the STM32. This free software package provides drivers for all standard device features and peripherals, from GPIO and timers to CAN, I^2C, EMI, SPI, UART, ADC and more.

The fully documented and tested C source code requires only basic knowledge of C programming, is compatible with any C compiler for ARM core-based microcontrollers, and is MISRA C-compliant (latest rules).

The STM32 library shares the same API with the STR7 and STR9 libraries.

USB developer kit

The USB developer kit facilitates USB implementation in a full range of applications by providing a complete, USB-certified firmware package that allows developers to painlessly develop any flavor of USB firmware including:

- Control transfer with generic device management tasks
- Interrupt transfer with HID mouse/joystick demo
- Bulk transfer with mass storage demo
- Isochronous transfer with voice speaker/microphone demo



The kit implements DFU for firmware updates on USB, and Virtual COM (CDC class) for emulation of an RS232 interface on USB.

STM32 motor control firmware library for vector drive

Optimized and documented C firmware libraries for control of both PMSM and AC induction brushless motors in vector mode (FOC) are provided for free upon request.

These modular libraries support both types of motors in standalone mode using ST hardware. The source files are provided free of charge and are MISRA C (latest rules)-compliant, which helps for compliancy with IEC60730.

Internet support

The latest news, downloads and documentation for STM32 microcontrollers can be found at: www.st.com/stm32

Here, you will also find:

- A complete selection guide for ST microcontrollers and development tools
- Downloads of free software and documentation
- Microcontroller and application-specific online forums and FAQs

For further information about a specific third-party tool, please visit the website of the relevant third-party tool supplier.

Development tools

A complete range of high-end and low-cost development tools is available, including complete development tool solutions, easy-to-use starter kits, and embedded operating systems, all tailored to the STM32 ARM Cortex-M3-based MCUs.

Third-party development solutions

Choose from a full range of development solutions that offer start-to-finish control of application development from a single environment. Third-parties offer solutions with a development environment, C/C++ compiler and in-circuit emulator for the STM32 and other ARM core-based devices.

Supplier	Description
Altium/Tasking www.tasking.com	EDE development environment, Tasking VX compiler, debugging/programming via JTAG
Green Hills Software www.ghs.com	Multi development environment, GHS C/C++ compiler and Green Hills probe (USB or Ethernet/JTAG)
Hitex www.hitex.com	HiTOP5 development environment, Tasking VX compiler and Tantino (USB/JTAG)
IAR www.iar.com	EWARM development environment, IAR C/C++ compiler and J-Link (USB/JTAG)
Keil www.keil.com	RealView MDK with uVision3 software, ARM C/C++ compiler and ULINK (USB/JTAG)
Raisonance www.raisonance.com	RIDE development environment with GNU C/C++ compiler and RLink (USB/JTAG)
Rowley www.rowley.co.uk	CrossWorks with CrossStudio software, GNU C/C++ compiler and CrossConnect (JTAG)

For information about compatibility with other tools, refer to the relevant third-party internet site.

Operating systems

A range of portable royalty-free, small-footprint operating systems to meet a variety of application constraints from low cost to high security.

RTOS supplier	RTOS
CMX Systems: www.cmx.com	CMX-RTX
www.FreeRTOS.org	FreeRTOS
IAR: www.iar.com	PowerPac
Keil: www.keil.com	ARTX-ARM
Micrium: www.micrium.com	µC/OS-II
Segger: www.segger.com	embOS

Low-cost and application-specific starter kits



Using the STM32 Primer, play, explore and develop applications on a low-cost, innovative development platform with the Raisonance toolset, free demos and an online community at **www.stm32circle.com**, to stimulate creative embedded designs. Evaluate STM32 performance in real time, with the STM32-PerformanceStick, DashBoard device performance evaluation GUI, sample applications and unlimited Hitex software toolset.

Part number	Description
STM3210B-PRIMER	Raisonance STM32 Primer with RIDE (debug up to 32 Kbytes of code), GNU C/C++ compiler, and a fun, stimulating learning and development platform with MEMS-based controls and integrated RLink (USB/JTAG)
STM3210B-PFSTICK	STM32-PerformanceStick with integrated debugging/ programming via USB, unlimited Hitex HiTOP5 and Tasking VX compiler and DashBoard GUI
STM3210B-SK/HIT	Hitex kit with unlimited HiTOP5, Tasking VX compiler, STM32-PerformanceStick with integrated debugging/ programming via USB, extension I/O board with peripheral evaluation features, DashBoard GUI
STM3210B-SK/IAR	IAR Embedded Workbench for ARM (for up to 32 Kbytes of code), IAR C/C++ compiler, J-Link (USB/JTAG), evaluation board
STM3210B-SK/KEIL	Keil RealView MDK with uVision 3 (for up to 16 Kbytes of code), ARM C/C++ compiler, ULINK (USB/JTAG), evaluation board
STM3210B-SK/RAIS	Raisonance REva kit with RIDE (debug up to 32 Kbytes of code), GNU C/C++ compiler, modular evaluation hardware with integrated RLink (USB/JTAG)
STM3210B-MCKIT	ST motor control starter kit with complete sensor and sensorless libraries, motor control GUI, evaluation hardware platform for vector drive of three-phase PMSM and induction motors, plus Segger J-Link debugger for host PC interface

Evaluation board STM3210B-EVAL



Complete hardware evaluation platform with the STM32F103, implementing the full range of device peripherals and features.

For more information, visit **www.st.com/stm32**

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Order code: BRSTM320807

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