

STM32 MCU family

32-bit Flash microcontrollers powered by
ARM® Cortex™ -M processor



STM32  Releasing your **creativity**

May 2010

Welcome to the world of STM32

Releasing your creativity

The STM32 family of 32-bit Flash microcontrollers based on ARM Cortex™-M processor is built to offer new degrees of freedom to MCU users. It brings a complete 32-bit product range that combines high-performance, real-time, low-power and low-voltage operation, while maintaining full integration and ease of development.

It eases migration from the 16-bit world thanks to its high level of feature integration, its easy-to-use architecture, its low-power capability and cost-effectiveness.






The STM32 family helps you create new applications and design in the innovations you have been long dreaming about.

STMicroelectronics is a lead partner in developing Cortex-M cores and, with the STM32, offers a comprehensive portfolio of advanced MCUs that we are committed to extending in capability, price range and features to cover the needs of microcontroller convergence.

STM32 key benefits

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



| | | | | |
|--|--|---|--|---|
| <p>Real-time performance Cortex™ Intelligent Processors by ARM</p>  <p>Leading edge architecture Excellent real-time behavior</p> | <p>Outstanding power efficiency</p>  <p>Sub μA RTC, low voltage low-power modes</p> | <p>Superior and innovative peripherals</p>  <p>USB OTG, Ethernet, dual CAN, ADC 12-bit, advanced timers</p> | <p>Maximum integration</p>  <p>Reset circuitry clocks, oscillators, PLL regulator RTC, watchdog</p> | <p>Extensive tools and software</p>  <p>Various IDE, starter kits, libraries, RTOS and stacks</p> |
| <p>Future proof design</p> | <p>Environment friendly, suits low-power operation</p> | <p>Address all your needs and beyond</p> | <p>Cost and space saving</p> | <p>More time for innovation</p> |



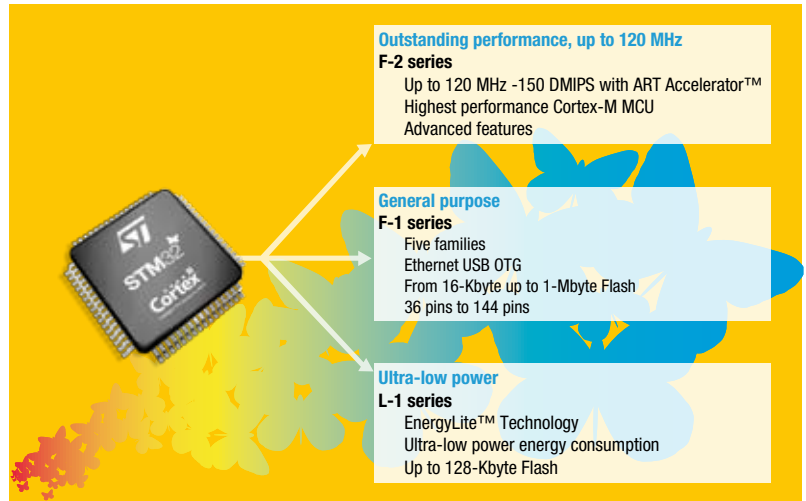
**STM32 platform
more than 130 compatible devices**

STM32, a solid foundation for growth

The STM32 platform is a strong foundation on which we grow our portfolio. With new products addressing new applications, the complete STM32 product family now comprises three series, each dedicated to a specific segment.

More choice with STM32 series

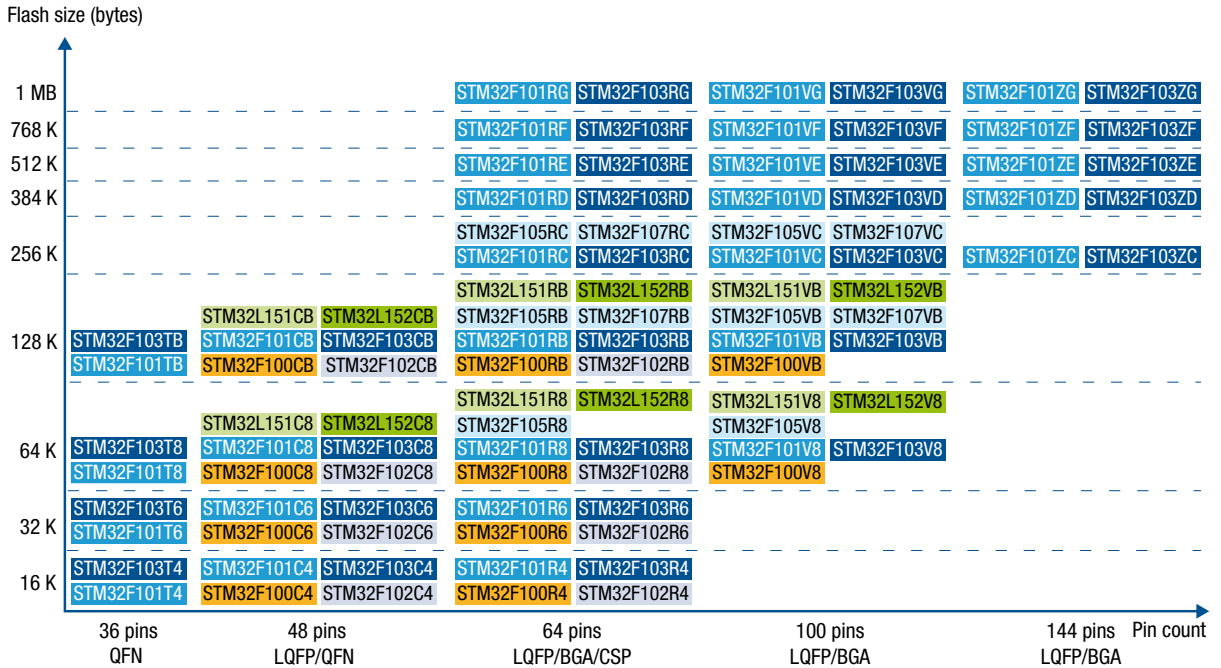
- The general purpose F-1 series addresses a wide range of applications, from the lowest price-sensitive design to the computing intensive, high memory footprint.
- Get the highest performance with the F-2 series for computing intensive application and advanced connectivity. The F-2 series maintains the compatibility with the F-1 series.
- Design ultra-low-power applications with the L-1 series for those who are power conscious and seek the absolute lowest energy consumption. The L-1 series maintains the compatibility with the F-1 series.



STM32, the optimal platform choice

The STM32 is the optimal choice to support many applications with the same platform. All product lines in the three series are pin-to-pin and software compatible, making it easy to upgrade to higher or downgrade to lower memory size. Numerous applications may be addressed using the sole STM32 platform.

STM32 portfolio



STM32 F-1 series

Connectivity line USB Access line Value line Performance line Access line

STM32 L-1 series

STM32L152 STM32L151

STM32 product lines

Common core peripherals and architecture

| |
|---|
| Communication peripherals: USART, SPI, I ² C |
| Multiple general purpose timers |
| Integrated reset and brown-out warning |
| Multiple DMA |
| 2x watchdogs Real-time clock |
| Integrated regulator, PLL and clock circuit |
| External memory interface (EMI) |
| Dual 12-bit DAC |
| Main oscillator and 32 kHz oscillator |
| Low-speed and high-speed internal RC oscillators |
| -40 °C +85 °C and up to 105 °C operating temperature range |
| Low voltage 2.0 to 3.6 V or 1.65 to 3.6 V (L-1 series) 5.0 V tolerant I/Os |
| Temperature sensor |



F-1 series - Connectivity line STM32F105/STM32F107

| | | | | | | | | | |
|----------------------|---------------------|-----------------------|-----------------------|------------------|----------------|--------------|----------------------------------|--------------------|--|
| 72 MHz Cortex-M3 CPU | Up to 64-Kbyte SRAM | Up to 256-Kbyte Flash | 2 x 12-bit ADC (1 µs) | 3-phase MC timer | USB 2.0 OTG FS | 2 x CAN 2.0B | 2 x I ² S audio class | Ethernet IEEE 1588 | |
|----------------------|---------------------|-----------------------|-----------------------|------------------|----------------|--------------|----------------------------------|--------------------|--|

F-1 series - Performance line STM32F103

| | | | | | | | | | |
|----------------------|---------------------|---------------------|-------------------------|------------------|---------------|----------|----------------------|------|--|
| 72 MHz Cortex-M3 CPU | Up to 96-Kbyte SRAM | Up to 1-Mbyte Flash | 2/3 x 12-bit ADC (1 µs) | 3-phase MC timer | USB FS device | CAN 2.0B | 2 x I ² S | SDIO | |
|----------------------|---------------------|---------------------|-------------------------|------------------|---------------|----------|----------------------|------|--|

F-1 series - USB Access line STM32F102

| | | | | | | | | | |
|----------------------|---------------------|-----------------------|-------------------|---------------|--|--|--|--|--|
| 48 MHz Cortex-M3 CPU | Up to 16-Kbyte SRAM | Up to 128-Kbyte Flash | 12-bit ADC (1 µs) | USB FS device | | | | | |
|----------------------|---------------------|-----------------------|-------------------|---------------|--|--|--|--|--|

F-1 series - Access line STM32F101

| | | | | | | | | | |
|----------------------|---------------------|---------------------|-------------------|--|--|--|--|--|--|
| 36 MHz Cortex-M3 CPU | Up to 80-Kbyte SRAM | Up to 1-Mbyte Flash | 12-bit ADC (1 µs) | | | | | | |
|----------------------|---------------------|---------------------|-------------------|--|--|--|--|--|--|

F-1 series - Value line STM32F100

| | | | | | | | | | |
|----------------------|--------------------|-----------------------|---------------------|------------------|-----|--|--|--|--|
| 24 MHz Cortex-M3 CPU | Up to 8-Kbyte SRAM | Up to 128-Kbyte Flash | 12-bit ADC (1.2 µs) | 3-phase MC timer | CEC | | | | |
|----------------------|--------------------|-----------------------|---------------------|------------------|-----|--|--|--|--|

L-1 series - STM32L151/2

| | | | | | | | | | | |
|----------------------|---------------------|-----------------------|-------------------|---------------|-----------------|----------|---------|-----------------|------------|-----------------|
| 32 MHz Cortex-M3 CPU | Up to 16-Kbyte SRAM | Up to 128-Kbyte Flash | 12-bit ADC (1 µs) | USB FS device | Data EEPROM 4 K | LCD 8x40 | ULP MSI | Brown out reset | Comparator | Voltage scaling |
|----------------------|---------------------|-----------------------|-------------------|---------------|-----------------|----------|---------|-----------------|------------|-----------------|

ULP: Ultra-low-power
 MSI: Multi speed internal oscillator
 RNG: Random number generator
 CEC: Consumer electronic control
 SDIO: Secure digital input output

Applications

- Industrial
 - PLC
 - Inverters
 - Printers, scanners
 - Industrial networking
 - Solar inverters
- Building and security
 - Alarm systems
 - Access control
 - HVAC
 - Power meters
- Medical
 - Glucose meters
 - Portable medical care
 - VPAP, CPAP
 - Patient monitoring
- Appliances
 - 3-phase motor drives
 - Application control
 - User interfaces
 - Induction cooking
- Consumer
 - Home audio
 - Gaming
 - PC peripherals
 - Digital cameras, GPS

STM32 F-1 series block diagram

This block diagram shows all the available peripherals. For exact product content, please refer to the device summary.



Superior and innovative peripherals

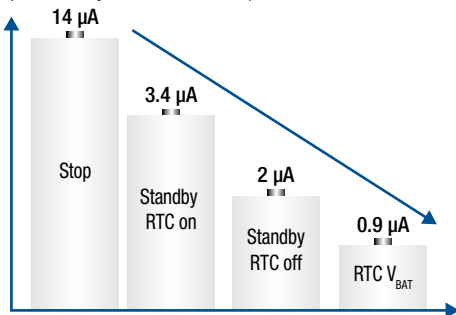
| The need for speed | |
|----------------------------------|---|
| USB FS | 12 Mbit/s |
| USART | Up to 4.5 Mbit/s |
| SPI | Up to 18 Mbit/s |
| I ² C | I ² C 400 kHz |
| GPIO | Up to 18 MHz |
| 3-phase MC timer | PWM timer 72 MHz clock input |
| SDIO | SDIO up to 48 MHz |
| I ² S | From 8 kHz to 96 kHz sampling frequencies |
| The need for analog | |
| ADC | 1 μ s conversion time (1 MSPS) |
| DAC | 2-channel, 12-bit |
| The need for connectivity | |
| Dual CAN | Up to 2 independent CAN |
| Ethernet | 10/100 Mbit/s MAC with hardware IEEE 1588 |
| USB OTG | Full speed host, device or OTG |
| CEC bus | Consumer electronic control for consumer devices |
| Flexible static memory interface | 4 independent banks, 8/16 bit data bus up to 60 MHz, supports SRAM, PSRAM, NAND and NOR Flash, parallel graphic LCD |

Outstanding power efficiency

STM32F10x typical current

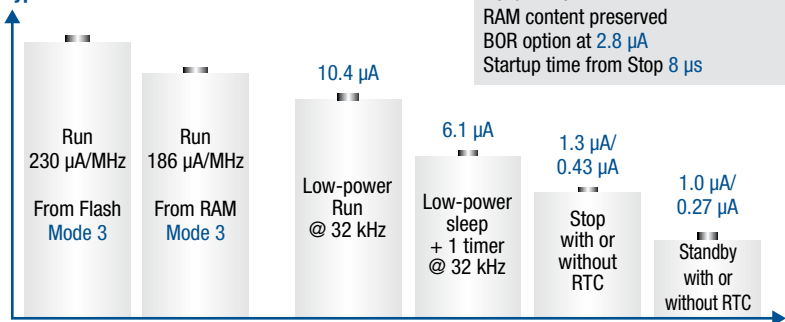
Typical current

(on 128-Kbyte device @ 25 °C)



STM32L15x typical current consumption

Typical @ 25 °C



Notes:

- Run and Sleep consumption value independent V_{DD}
- Stop and standby values measured at V_{DD} = 1.8 V
- These values are preliminary

POR/PDR on
RAM content preserved
BOR option at 2.8 μ A
Startup time from Stop 8 μ s

Motor control

The STM32 is perfectly suited to three-phase brushless motor control:

- Advanced PWM timer, fast ADC, high-performance core
- Free motor control firmware libraries supporting AC induction motor (sensored) and PMSM motor (sensorless, Hall-sensor or encoder) vector control
- Class B compliancy with the EN/IEC 60335-1 norm
- STM3210B-MCKIT full developer kit for vector drives



STM32 Value line

32-bit microcontrollers give greater choice for cost-sensitive applications

The STM32 Value line complements our STM32 Cortex-M microcontroller product portfolio by offering a low-cost product line that is pin-to-pin compatible with the whole STM32 portfolio. The line brings new features such as new 16-bit timers and CEC function to expand the range of applications addressed in consumer, appliance and industrial segments.

Based on the ARM Cortex-M core running at up to 24 MHz, the STM32 Value line offers an excellent cost-performance-peripherals trade-off.

The STM32 Value line provides all the essential features that make it the perfect choice to develop cost-effective applications traditionally addressed by 16-bit microcontrollers.



STM32 Connectivity line

Superior connectivity and superior audio support

The STM32 Connectivity line makes networking economical for a wide range of products, with its embedded Ethernet MAC with dedicated DMA and IEEE 1588 precision time protocol hardware support.

The USB 2.0 OTG peripheral makes the STM32 Connectivity line a turnkey solution to add a USB device, host or OTG function to a product. In addition, the line brings a dual CAN making it the MCU of choice for CAN gateways. The two audio class I²S of the STM32 Connectivity line, combined with the embedded USB OTG peripheral, address requirements of most audio applications.



STM32 F-2 series

The F-2 series brings more performance, memory and advanced peripherals

- New technologies: 90 nm process, advanced real-time (ART) accelerator
- More performance: Zero-wait execution at 120 MHz/150 DMIPS
- Outstanding dynamic power: 22.5 mA at 120 MHz



Full sample availability in Q4/2010

STM32 L-1 series

STM32L ultra-low-power MCU family

The STM32L15x enriches ST's ultra-low-power EnergyLite™ platform and the STM32 portfolio.

- High-performance ARM Cortex™-M3: up to 33 DMIPS
- Ultra-low energy consumption: down to 185 μ A/DMIPS
- Power supply: 1.65 to 3.6 V
- 6 ultra-low-power modes including new low-power run and low-power sleep
- Stop mode at 1.3 μ A with RTC and full RAM retention
- Enhanced security and safety features



Full sample availability in Q4/2010

Development tools

STMicroelectronics' STM32 family of 32-bit ARM Cortex™-M-core-based microcontrollers are supported by a complete range of high-end and low-cost evaluation, software, debugging and programming tools.

This complete line includes third-party solutions that come complete with C/C++ compiler, integrated development environment and in-circuit debugger/programmer featuring a JTAG application interface. Developers can also explore and start applications easily with any of a range of affordable, easy-to-use starter kits.

The superb combination of a state-of-the-art and efficient library of software drivers and extensive support for all major tool providers offers a fast route to best-fit and an optimized development process.

Promotion kits

Play, explore and develop applications on the **STM32 Primer** and **Primer 2** with Raisonance toolset, free demos and an online community at www.stm32circle.com to stimulate creative designs.

Evaluate STM32 performance in real time with the innovative **STM32-PerformanceStick** and the networking features of the STM32 Connectivity line with **STM32-ComStick**. These kits include an integrated debugging/programming capability via USB and unlimited Hitex HiTOP5 and Tasking VX C compiler.



The **STM32 Value Discovery (STM32VLDISCOVERY)** kit is the cheapest and quickest way to discover the STM32. Based on the STM32 Value line, this quick-start evaluation board includes the ST-LINK debugger and is delivered with IDE from Keil, IAR and Atollic. This low-cost evaluation kit will satisfy hobbyists, first-time developers and students. Available in Q2 2010.

Starter kits

| Part number | Featured product | Description |
|--|---|--|
| STM3210B-SK/HIT STM3210E-SK/HIT | STM32F103RBT6 | 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 STM3210C-SK/IAR STM3210E-SK/IAR | STM32F103RBT6 STM32F107RCT6 STM32F103RET6 | 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 STM3210C-SK/KEIL STM3210E-SK/KEIL | STM32F103RBT6 STM32F107RCT6 STM32F103RET6 | 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 STM3210C-SK/RAIS | STM32F103RBT6 STM32F107RCT6 | 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 | STM32F103RBT6 | ST motor-control starter kit with complete sensor and sensorless libraries, evaluation hardware platform for vector drive of three-phase PMSM and induction motors, plus Segger J-Link for host PC interface |

Evaluation board for STM32

Several hardware platforms from a range of third-party tool developers, and open-platform evaluation boards from ST implement the complete range of device peripherals for STM32 devices.

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

STM32 embedded firmware

STM32 firmware library: Complete set of device drivers for all the standard device peripherals.

STM32 USB developer kit: Complete firmware package for USB slave interface.

DSP Software Library: DSP (digital signal processor) software library including digital filters and FFT.

STM32 Speech Codec Software Library: Speech codec software to compress/decompress speech data.

STM32 self-test routines Class B norm certification: Complete software for EN/IEC 60335-1 Class B norm.

STM32 motor control software: Complete 3-phase motor-control library supporting PMSM motors in sensed and sensorless mode and AC induction motors in sensed mode, and a patented single-shunt algorithm. This software is included in the STM32 motor control starter kit.

STM32 Spirit Audio Engine: This professional audio engine from the leading technology company Spirit is a high-quality and fully-supported solution. It removes the hurdles associated with open source solutions, and insures a fast development with professional results for audio applications. The solution supports the popular MP3 and WMA key formats, supported by a set of must-have add-ons such as a channel mixer, standalone 3-band parametric equalizer and loudness control.

Development tools, operating systems, solution stacks and more

Choose from a full range of development solutions from lead suppliers that deliver start-to-finish control of application development from a single integrated development environment. Access a variety of royalty-free, small-footprint operating systems and a wealth of off-the-shelf stacks from numerous third-party suppliers.

For detailed information, see www.st.com/stm32tools



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