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

STM32 platform
more than 130 compatible devices
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**

Flash size (bytes)

- 1 MB
- 768 K
- 512 K
- 384 K
- 256 K
- 128 K
- 64 K
- 32 K
- 16 K

**STM32 F-1 series**
- Connectivity line
- USB Access line
- Value line
- Performance line
- Access line

**STM32 L-1 series**
- STM32L152
- STM32L151

**STM32 portfolio diagram**

- Outstanding performance, up to 120 MHz
  - F-2 series
  - Up to 120 MHz - 150 DMIPS with ART Accelerator™
  - Highest performance Cortex-M MCU
  - Advanced features
- General purpose
  - F-1 series
  - Five families
  - Ethernet USB OTG
  - From 16-Kbyte up to 1-Mbyte Flash
  - 36 pins to 144 pins
- Ultra-low power
  - L-1 series
  - EnergyLite™ Technology
  - Ultra-low power energy consumption
  - Up to 128-Kbyte Flash
STM32 product lines
Common core peripherals and architecture

STM32 F-1 series - Connectivity line STM32F105/STM32F107
- 72 MHz Cortex-M3 CPU
- Up to 64-Kbyte SRAM
- Up to 256-Kbyte Flash
- 12-bit ADC (1 µs)
- 8-channel MC timers
- USB 2.0 OTG FS
- 2 x CAN 2.0B
- 2 x i²S audio class
- Ethernet IEEE 1588

STM32 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 timers
- USB FS device
- CAN 2.0B
- 2 x i²S
- SDIO

STM32 F-1 series - Access line STM32F102
- 48 MHz Cortex-M3 CPU
- Up to 16-Kbyte SRAM
- 12-bit ADC (1 µs)
- Up to 32-bit ADC (1 µs)
- USB FS device

STM32 F-1 series - Value line STM32F100
- 48 MHz Cortex-M3 CPU
- Up to 8-Kbyte SRAM
- 12-bit ADC (1 µs)
- 3-phase MC timer
- CEC

STM32 L-1 series - STM32L151/2
- 32 MHz Cortex-M3 CPU
- Up to 16-Kbyte SRAM
- Up to 256-Kbyte Flash
- 12-bit ADC (1 µs)
- Up to 256-Kbyte Flash
- Up to 1-Mbyte Flash
- Up to 128-Kbyte Flash

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

<table>
<thead>
<tr>
<th>Interface</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB FS</td>
<td>12 Mbit/s</td>
</tr>
<tr>
<td>USART</td>
<td>Up to 4.5 Mbit/s</td>
</tr>
<tr>
<td>SPI</td>
<td>Up to 18 Mbit/s</td>
</tr>
<tr>
<td>I^C</td>
<td>I^C 400 kHz</td>
</tr>
<tr>
<td>GPIO</td>
<td>Up to 18 MHz</td>
</tr>
<tr>
<td>3-phase MC timer</td>
<td>PWM timer 72 MHz clock input</td>
</tr>
<tr>
<td>SDIO</td>
<td>SDIO up to 48 MHz</td>
</tr>
<tr>
<td>PS</td>
<td>From 8 kHz to 96 kHz sampling frequencies</td>
</tr>
</tbody>
</table>

#### The need for analog

<table>
<thead>
<tr>
<th>Interface</th>
<th>Speed (Conversion Time)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADC</td>
<td>1 µs conversion time (1 MSPS)</td>
</tr>
<tr>
<td>DAC</td>
<td>2-channel, 12-bit</td>
</tr>
</tbody>
</table>

#### The need for connectivity

<table>
<thead>
<tr>
<th>Interface</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dual CAN</td>
<td>Up to 2 independent CAN</td>
</tr>
<tr>
<td>Ethernet</td>
<td>10/100 Mbit/s MAC with hardware IEEE 1588</td>
</tr>
<tr>
<td>USB OTG</td>
<td>Full speed host, device or OTG</td>
</tr>
<tr>
<td>CEC bus</td>
<td>Consumer electronic control for consumer devices</td>
</tr>
<tr>
<td>Flexible static memory interface</td>
<td>4 independent banks, 8/16 bit data bus up to 60 MHz, supports SRAM, PSRAM, NAND and NOR Flash, parallel graphic LCD</td>
</tr>
</tbody>
</table>

### Outstanding power efficiency

**STM32F10x typical current**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Current (µA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stop</td>
<td>14</td>
</tr>
<tr>
<td>Standby</td>
<td>3.4</td>
</tr>
<tr>
<td>Standby RTC on</td>
<td>2</td>
</tr>
<tr>
<td>Standby RTC off</td>
<td>0.9</td>
</tr>
<tr>
<td>RTC VBAT</td>
<td></td>
</tr>
</tbody>
</table>

**STM32L15x typical current consumption**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Current (µA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Run</td>
<td>230 @ 25 °C</td>
</tr>
<tr>
<td>Run</td>
<td>186 @ 32 kHz</td>
</tr>
<tr>
<td>Low-power Run</td>
<td>10.4 µA</td>
</tr>
<tr>
<td>Low-power Run @ 32 kHz</td>
<td>6.1 µA</td>
</tr>
<tr>
<td>Stop with or without RTC</td>
<td>1.0 µA/0.27 µA</td>
</tr>
<tr>
<td>Standby with or without RTC</td>
<td>1.3 µA/0.43 µA</td>
</tr>
</tbody>
</table>

**Notes:**
- Run and Sleep consumption value independent of VDD
- Stop and standby values measured at VDD = 1.8 V
- These values are preliminary

### 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 compliance 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

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 μA/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 μA with RTC and full RAM retention
- Enhanced security and safety features
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

<table>
<thead>
<tr>
<th>Part number</th>
<th>Featured product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>STM3210B-SK/HIT</td>
<td>STM32F103RBT6</td>
<td>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</td>
</tr>
<tr>
<td>STM3210B-SK/IAR</td>
<td>STM32F103RBT6</td>
<td>IAR Embedded Workbench for ARM (for up to 32 Kbytes of code), IAR C/C++ compiler, J-Link (USB/JTAG), evaluation board</td>
</tr>
<tr>
<td>STM3210B-SK/KEIL</td>
<td>STM32F103RBT6</td>
<td>Keil RealView MDK with uVision 3 (for up to 16 Kbytes of code), ARM C/C++ compiler, ULINK (USB/JTAG), evaluation board</td>
</tr>
<tr>
<td>STM3210B-MCKIT</td>
<td>STM32F103RBT6</td>
<td>Raisonance REva kit with RiDE (debug up to 32 Kbytes of code), GNU C/C++ compiler, modular evaluation hardware with integrated RLink (USB/JTAG)</td>
</tr>
<tr>
<td>STM3210B-MCKIT</td>
<td>STM32F103RBT6</td>
<td>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</td>
</tr>
</tbody>
</table>

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 sensored and sensorless mode and AC induction motors in sensored 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