STM32F401/10/11/12/13
High-performance Access lines

STILL AN STM32F4!
The STM32F4 Access lines, made of STM32F401, STM32F410, STM32F411, STM32F412 and STM32F413³ MCUs, are the entry level devices of the STM32F4 series that target cost-conscious applications. They are the right proposal when you reach the limits of your Cortex-M0+/ M3 designs and look for more performance and integration. These lines implement STM32 Dynamic Efficiency™ technology and solve the challenge of offering less dynamic power and more performance with high integration and lower cost.

With a new Batch Acquisition Mode (BAM) that optimizes power consumption during sensor data batching, the STM32F4 Access lines take Dynamic Efficiency to a new level.

PERFORMANCE
Up to 100 MHz fCPU delivering 125 DMIPS/339 CoreMark performance executing from Flash memory, with 0-wait states using ST’s ART Accelerator™.
The DSP instructions and the floating point unit enhance the overall processing.

POWER EFFICIENCY
ST’s 90-nm process, ART Accelerator and dynamic power scaling enables the current consumption when executing from Flash memory to be as low as 89 µA/MHz. In Stop mode, the power consumption can be as low as 6 µA.

INTEGRATION
STM32F4 Access lines devices carry from 128 Kbytes to 1.5 Mbyte of Flash memory and up to 320 Kbytes of SRAM.
Available packages range from 36 to 144 pins.
- 10x USARTs up to 12.5 Mbits/s
- Up to 5x SPI (mixed with I²S) up to 50 Mbit/s
- Up to 4x FC up to 1 Mbits/s
- 1x SDIO up to 48 MHz and available on all packages¹
- 1x USB 2.0 OTG full speed¹
- Up to 2x full-duplex and 3x simplex I²S up to 32-bit/192 kHz
- Up to 3x CAN (2.0B Active)
- 12-bit ADC reaching 2.4 MSPS
- Up to 2x 12-bit DAC²
- True random number generator²
- Up to 18x 16- and 32-bit timers running at up to 100 MHz
- Flexible external static memory controller with up to 16-bit data bus: SRAM, PSRAM, NOR Flash memory³
- Dual mode Quad-SPI interface³
- LCD parallel interface, 8080/6800 modes³
- Up to 6x PDM interfaces, stereo microphone support³

Notes:
1. except STM32F410
2. on STM32F410, F412 and F413
3. on STM32F412 and F413
4. STM32F423: HW AES encryption (128-/256-bit version)

www.st.com/stm32f4
STM32F423 BLOCK DIAGRAM

**SYSTEM**
- Power supply (1.2 V regulator)
- POR/PDR/PVD/BOR
- Xtal oscillators (32 kHz + 4 ~26 MHz)
- Internal RC oscillators (32 kHz + 16 MHz)
- PLL
- Clock control
- RTC/AWU
- SysTick timer
- 2x watchdogs (independent and window)
- Up to 114 I/Os
- Cyclic redundancy check (CRC)
- 96-bit unique ID

**ART Accelerator™**

**Up to 1.5-Mbyte Flash memory**
- 320-Kbyte SRAM
- 80-byte backup registers
- 512-byte OTP

**AHB-Lite bus matrix**

**APB bus**

**16-channel DMA with Enhanced Batch Acquisition Mode (BAM+)**

**True random number generator (TRNG)**

**Arm® Cortex®-M4 CPU**
- 100 MHz

**Floating point unit (FPU)**

**Nested vector interrupt controller (NVIC)**

**Memory Protection Unit (MPU)**

**JTAG/SW debug/ETM**

**PLL**

**2x watchdogs (independent and window)**

**Cyclic redundancy check (CRC)**

**Xtal oscillators (32 kHz + 4 ~26 MHz)**

**SysTick timer**

**10x 20-bit timer**

**2x 16-bit motor control PWM synchronized AC timer**

**Encryption**
- AES (128-/256-bit)

**Analog**
- 2x DAC
- Temperature sensor

**Connectivity**
- 4x I²C (SMBus/PMBus)
- 4x USART, 6x UART
- LIN, smartcard, IrDA, modem control
- 5x SPI or 5x PS (2x FD / 3x HD)
- USB 2.0 OTG FS (LPM)
- Dual Quad-SPI
- 3x CAN 2.0B
- FMC 16-bit (NOR only)
- 1x DFSDM 4 ch / 2 filters
- Beamforming enhanced
- 1x SAI (Serial audio interface)

**Control**
- 10x 16-bit timer
- 2x 16-bit motor control PWM synchronized AC timer
- 2x 32-bit timer
- 1x LP timer

**Software Tools**

In addition to the wide set of partners and Arm® ecosystem solutions, the STM32F4 Access lines benefit from dedicated tools and software including STM32CubeF4 embedded software (HAL, Low-Layer APIs and CMSIS (CORE, DSP, RTOS), and a set of USB, TCP/IP, file system, RTOS, and graphic middleware components) with examples running on STM32 Nucleo, discovery kits and evaluation boards.

**STM32F4 ACCESS LINES**

<table>
<thead>
<tr>
<th>Product lines</th>
<th>FCP (MHz)</th>
<th>Flash (Kbytes)</th>
<th>RAM (KB)</th>
<th>Run current (μA/MHz)</th>
<th>ST/B (μA)</th>
<th>Small package (mm)</th>
<th>FSAC/DFSDM/PSRAM/LPRC</th>
<th>OSB</th>
<th>CAN 2.0B</th>
<th>DAC</th>
<th>TRNG</th>
<th>LMA Batch Acquisition Mode</th>
<th>USB 2.0 OTG FS</th>
</tr>
</thead>
<tbody>
<tr>
<td>STM32F401</td>
<td>84</td>
<td>128 to 512</td>
<td>up to 96</td>
<td>Down to 128</td>
<td>Down to 10</td>
<td>Down to 3x3</td>
<td>•</td>
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<tr>
<td>STM32F410</td>
<td>100</td>
<td>64 to 128</td>
<td>32</td>
<td>Down to 89</td>
<td>Down to 6</td>
<td>Down to 2.55x 2.579</td>
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<tr>
<td>STM32F411</td>
<td>100</td>
<td>256 to 512</td>
<td>128</td>
<td>Down to 100</td>
<td>Down to 12</td>
<td>Down to 3.034x 3.22</td>
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<td>STM32F412</td>
<td>100</td>
<td>512 to 1024</td>
<td>256</td>
<td>Down to 112</td>
<td>Down to 18</td>
<td>Down to 3.653x 3.651</td>
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<tr>
<td>STM32F413</td>
<td>100</td>
<td>1024 to 1536</td>
<td>320</td>
<td>Down to 115</td>
<td>Down to 18</td>
<td>Down to 3.951x 4.039</td>
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Notes:
1. Link Power Management
2. The same devices are also found with embedded HW AES encryption (128-/256-bit) named STM32F423