STM32 F2 series
High-performance Cortex-M3 MCUs

32-bit Flash microcontrollers, 120 MHz/150 DMIPS
with ART Accelerator™ and advanced peripherals
STM32 F2 series

The STM32 F2 series complements our STM32 product portfolio by offering devices with close pin-to-pin compatibility, with more performance, more Flash and SRAM memories, and advanced peripherals such as a camera interface, crypto/hash processor, full/high speed USB-OTG, Ethernet, CAN, and external memory interface. These expand the number of addressable applications in the industrial, consumer, and medical segments.

Based on Cortex™-M3 running at 120 MHz, the STM32 F2 series allows a performance equivalent to zero-wait execution from Flash using the adaptive real-time ART Accelerator™ technology.

The STM32 F2 series includes devices with 128 Kbytes to 1 Mbyte of on-chip Flash memory, 64 Kbytes to 128 Kbytes of SRAM, and 15 communication interfaces.

LQFP64, LQFP100, LQFP144, WLCSP64 (< 4 x 4 mm), UFBGA176 and LQFP176 packages are available.

STM32 F2 block diagram

**System**
- Power supply
- 1.2 V regulator
- POR/POR/PVD
- 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)
- 51/82/114/140 I/Os
- Cyclic redundancy check (CRC)

**ART Accelerator™**
- ARM Cortex-M3 CPU 120 MHz
- Nested vector interrupt controller (NVIC)
- MPU
- JTAG/SW debug/ETM
- Multi-AHB bus matrix
- 16-channel DMA

**Crypto/hash processor**
- 3DES, AES 256
- SHA-1, MD5, HMAC
- True random number generator (RNG)

**Connectivity**
- Camera interface
- 3x SPI, 2x I²S, 3x I²C
- Ethernet MAC 10/100 with IEEE 1588
- 2x CAN 2.0B
- 1x USB 2.0 OTG FS/HS
- 1x USB 2.0 OTG FS
- SDIO
- 6x USART
- LIN, smartcard, IrDA, modem control

**Analog**
- 2-channel 2x 12-bit DAC
- 3x 12-bit ADC
- 24 channels / 2 MSPS
- Temperature sensor
- True random number generator (RNG)

**Applications**
- Industrial
- PLC
- Inverters
- Power meters
- Printers, scanners
- Industrial networking
- Building and security
- Alarm systems
- Access control
- HVAC
- Medical
- High-end glucose meters
- Power meters
- Battery-operated applications
- Appliances
- Motor drive
- Application control
- Consumer
- PC peripherals, gaming
- Digital cameras, GPS platforms
- Home audio

Notes:
1. HS requires an external PHY connected to the ULPI interface
2. Crypto/hash processor on STM32F217 and STM32F215
STM32 F2 series product lines

Common core peripherals and architecture:

- 6x USART, 3x SPI, 3x PC
- 2x CAN
- Multiple 16-bit and 32-bit timers
- 2x advanced timers
- Dual DAC
- FSMC
- 2x PS
- MPU
- ETM with JTAG fuse security
- Main 4-26 MHz oscillator
- Internal 16 MHz and 32 kHz RC oscillators
- Real-time clock
- 4-Kbyte battery backed up SRAM
- 2x watchdogs
- Reset circuitry
- Up to 16-channel DMA
- 80 % GPIO ratio, up to 60 MHz
- 3x 12-bit ADC (2 MSPS)
- Temperature sensor
- 1.7 to 3.6 V \( V_{DD} \)

Notes:
1. HS requires an external PHY connected to ULPI interface
2. Crypto/hash processor on STM32F217 and STM32F215
3. 1.7 V for WLCSP64 package only and 1.8 V for all other packages

Abbreviations:
- FSMC: Flexible static memory controller
- RNG: Random number generator

STM32 F2 series portfolio

Flash size (bytes)

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<th>Pin count</th>
<th>128 K</th>
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Note:
* STM32F205RG and STM32F205RE only

Legend:
- STM32F207: Ethernet, 2x USB OTG, camera interface
- STM32F205: 1x USB OTG FS/HS, crypto/hash processor
STM32 F2 key features

Real-time performance
- Cortex-R4F Core
- Multi-AHB bus matrix, Excellent real-time
- 120 MHz/150 DMIPS zero-wait state execution performance from Flash

Outstanding power efficiency
- RTC in $V_{DD}$, mode, ultra-low dynamic power consumption
- 1.7 to 3.6 $V_{DD}$

Superior and innovative peripherals
- USB-OTG High Speed, camera interface, Ethernet, CAN, crypto/hash processor, external memory interface

Maximum integration
- 1-Mbyte Flash, 128-Kbyte SRAM, 512 OTP bytes, 4-Kbyte backup SRAM, reset circuitry, voltage regulator, internal RC oscillator, PLL

Extensive tools and software
- Various IDE starter kits, libraries, RTOS and stacks

STM32 F2 series, over 50 part numbers, a new addition to the STM32 platform now counting over 250 compatible devices

Unleashing the full performance of the core beyond the embedded Flash speed is an art.

Real-time performance
To free the full performance of the Cortex-M3 core, ST has developed a leading-edge 90 nm process and a unique technology, the adaptive real-time ART Accelerator™. The ART Accelerator uses an advanced prefetch queue and branch cache to offer a performance equivalent to zero-wait execution from embedded Flash memory.
Combined with ST’s 90 nm technology, the ART Accelerator achieves a linear performance up to 120 MHz, offering 150 DMIPS and 254 Coremark performance executing from Flash.

The acceleration mechanism is made possible using a prefetch queue, a branch cache and a smart arbitration mechanism.

- MCUs using less advanced accelerators or slower embedded Flash memories will impact execution performance as wait states occur.
- MCUs using faster Flash but no branch cache acceleration to achieve performance usually show higher power consumption as a result of more accesses to a power hungry Flash.

**ART Accelerator™ performance result**

![Graph showing performance results](image)

The 32-bit multi-AHB bus matrix allows concurrent execution and data transfers. It interconnects all masters and slaves and ensures seamless and efficient operation even when several high-speed peripherals are working simultaneously.

For example, the following may all be performed at the same time.

- The core accesses the Flash and 112-Kbyte SRAM block through the ART Accelerator
- The DMA2 controller transfers data from the camera interface located on the AHB2 peripheral bus to an LCD connected to the FSMC
- The USB OTG High Speed interface stores received data in the 16-Kbyte SRAM block
Outstanding power efficiency

188 µA/MHz, 22.5 mA at 120 MHz (executing EEMBC CoreMark V1.0 from Flash memory, with the ART Accelerator enabled and all peripherals off). Who said performance and dynamic power efficiency were incompatible! The key to such power efficiency in Run mode is twofold:

- ST’s 90 nm process allowing the CPU core to run at only 1.2 V
- The ART Accelerator reducing the number of accesses to Flash

Further contributing to the outstanding power efficiency:

- Advanced low-power modes and features such as battery back-up with RTC and 4-Kbyte back-up SRAM
- V_{cc} min down to 1.7 V on CSP package

Superior and innovative peripherals

The STM32 F2 series introduces new peripherals to the STM32 platform:

- Ethernet MAC 10/100 with IEEE 1588 v2 hardware support
- USB OTG with high speed support (external PHY required)
- Audio class architecture: I²S and USB peripherals with advanced PLL and data synchronization schemes
- Camera interface, 8- to 14-bit parallel, up to 48 Mbyte/s at 48 MHz
- Flexible static memory interface (FSMC) running at up to 60 MHz to expand memory space or support an LCD
- Crypto/hash processor: 3DES, AES 256/SHA-1, MD5, HMAC
- 3x SPI running at up to 30 Mbit/s, 6x USART running at up to 7.5 Mbit/s
- 3x 12-bit ADC, 2 MSPS and up to 6 MSPS in interleaved mode
- RTC with hardware calendar support
- True random number generator
- Fast GPIO (60 MHz toggling speed)

Maximum integration

The Flash and SRAM memories available in the product can accommodate advanced software stacks and user data, with no need for external memories.

In addition, 512 bytes of OTP memory make it possible to store critical user data such as Ethernet MAC addresses or cryptographic keys.

The reset circuitry and the internal RC oscillators make the STM32 F2 series a cost-optimized solution.

Extensive tools and SW

A complete range of high-end and low-cost tools is available to provide software and hardware development solutions.

ST provides an evaluation board allowing full access to the STM32 F2 series features such as external memories, Ethernet, the two USB OTG connectors, touchscreen TFT display, CMOS camera audio output and exchange audio PLL. The board provides connection to all I/Os and all peripherals available in the chip. The order codes are: STM3220G-EVAL (board with STM32F207IGH6 chip, no encryption support) and STM3221G-EVAL1 (board with STM32F217IGH6 chip, encryption support).

For a quick start with the STM32 F2 series, starter kits are available from IAR and Keil, along with an EvoPrimer from Raisonance. Respective order codes are STM3220G-SK/IAR, STM3220G-SK/KEI and STM3220G-PRIMER.

Java for STM32

With the STM32 F2 series, start developing embedded applications in Java. Benefit from the highly-optimized STM32 Java virtual machine to increase software engineering productivity.

Order code: STM3220G-JAVA

Note:

1. Contact your local ST sales office.
## Device summary

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<td>-40 to +85 or -40 to +105</td>
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<td>114(114)</td>
<td>1.8 to 3.6</td>
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<td>1.8 to 3.6</td>
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<td>1.8 to 3.6</td>
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<td>188</td>
<td>-40 to +85 or -40 to +105</td>
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</tbody>
</table>

Notes:
1. HS requires an external PHY connected to ULPI interface
2. Crypto/hash processor on STM32F217 and STM32F215
3. 1.7 V min on WLCSP64 package only, 1.8 V min on other packages

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