ARM®-based 32-bit Cortex®-M4 MCU+FPU with 256 to 1024 KB Flash, sLib, USBFS, Ethernet, 17 timers, 3 ADCs, 21 communication interfaces

Feature

- **Core: ARM® 32-bit Cortex®-M4 CPU with FPU**
  - 240 MHz maximum frequency, with a memory protection unit (MPU), single-cycle multiplication and hardware division
  - Floating point unit (FPU) and
  - DSP instructions
- **Memories**
  - 256 to 1024 KBytes of internal Flash memory
  - sLib: configurable part of main Flash set as a libruary area with code excutable but secured, non-readable
  - SPIM interface: Extra interfacing up to 16 Mbytes of the external SPI Flash (as instruction/data memory)
  - Up to 96+128 KBytes of SRAM
  - External memory controller (XMC) with 16-bit data bus. Supports multiplexed PSRAM/NOR and NAND memories
- **XMC as LCD parallel interface, compatible with 8080/6800 modes**
- **Power control (PWC)**
  - 2.6 to 3.6 V application supply
  - Power on reset (POR), low voltage reset (LVR), and power voltage monitoring (PVM)
  - Sleep, Deepsleep, and Standby modes
  - V_{BAT} supply for LEXT, RTC, and forty-two 16-bit battery powered registers (BPR)
- **Clock and reset management (CRM)**
  - 4 to 25 MHz crystal (HEXT)
  - 48 MHz internal factory-trimmed clock (HICK), accuracy 1 % at T_A = 25 °C and 2.5 % at T_A = -40 to +105 °C, with automaitc clock calibration (ACC)
  - 40 kHz internal clock (LICK)
  - 32 kHz crystal (LEXT)
- **Analog**
  - 3 x 12-bit 2 MSPS A/D converters, up to 16 input channels
  - Temperature sensor
  - 2 x 12-bit D/A converters
- **DMA: 14-channel DMA controller**
- **Debug mode**
  - Serial wire debug (SWD) and JTAG interfaces
  - Cortex®-M4 Embedded Trace Macrocell (ETM™)
- **Up to 80 fast GPIOs**
  - all mappable on 16 external interrupts (EXINT)
  - almost all 5 V-tolerant
- **Up to 17 timers (TMR)**
  - Up to 2 x 16-bit motor control PWM advanced timers with dead-time generator and emergency brake
  - Up to 8 x 16-bit + 2 x 32-bit timers, each with 4 IC/OC/PWM or puLEXT counter and quadrature encoder input
  - 2 x 16-bit basic timers to drive the DAC
  - 2 x watchdog timers (general WDT and windowed WWDT)
  - SysTick timer: a 24-bit downcounter
- **Up to 21 communication interfaces**
  - Up to 3 x I^2C interfaces (SMBus/PMBus)
  - Up to 8 x USARTs (ISO7816 interface, LIN, IrDA capability, modem control)
  - Up to 4 x SPIs (50 Mbit/s), all with I^2S interface multiplexed, I^2S2/I^2S3 support full-duplex
  - Up to 2 x CAN interface (2.0B Active)
  - USB 2.0 full speed interface supporting crystal-less
  - Up to 2 x SDIO interfaces
  - 10/100M Ethernet MAC with dedicated DMA and SRAM (4 KBytes): IEEE1588 hardware support, MII/RMII available
- **CRC calculation unit, 96-bit unique ID (UID)**
- **Operating temperatures: -40 to +105 °C**
- **Packages**
  - LQFP100 14 x 14 mm
  - LQFP64 10 x 10 mm

Table 1. Device summary

Internal Flash	Part number
1024 KBytes	AT32F407RGT7, AT32F407VGT7
512 KBytes	AT32F407RET7, AT32F407VET7
256 KBytes	AT32F407RCT7, AT32F407VCT7

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1 Descriptions

The AT32F407 incorporates the high-performance ARM® Cortex®-M4 32-bit RISC core operating at 240 MHz. The Cortex®-M4 core features a Floating point unit (FPU) single precision which supports all ARM single-precision data processing instructions and data type. It also implements a full set of DSP instructions and a memory protection unit (MPU) which enhances application security.

The AT32F407 incorporates high-speed embedded memories (up to 1024 KBytes of internal Flash memory, 96+128 KBytes of SRAM), the extensive external SPI Flash (up to 16 MBytes addressing capability), and enhanced GPIOs and peripherals connected to two APB buses. Any block of the embedded Flash memory can be protected by the "sLib", functioning as a security area with code-excutable only.

The AT32F407 offers three 12-bit ADC, two 12-bit DAC, eight general-purpose 16-bit timers plus two general-purpose 32-bit timers, and up to two PWM timers for motor control. It supports standard and advanced communication interfaces: up to three I^2Cs, four SPIs (all multiplexed as I^2Ss), two SDIOs, eight USARTs/UARTs, an USBFS, two CANs, and an Ethernet MAC.

The AT32F407 operates in the -40 to +105 °C temperature range, from a 2.6 to 3.6 V power supply. A comprehensive set of power-saving mode allows the design of low-power application.

The AT32F407 offers devices in different package types. Depending on the different packages, the pin-to-pin is completely compatible among devices, and also the software and functionality. Only different sets of peripherals are included.

Table 2. AT32F407 features and peripheral counts

Part Number		AT32F407xxT7					
		RC	RE	RG	VC	VE	VG
CPU frequency (MHz)		240					
Int. Flash[1][2]	ZW (KBytes)	256	256	256	256	256	256
	NZW (KBytes)	0	256	768	0	256	768
	Total (KBytes)	256	512	1024	256	512	1024
SRAM[2] (KBytes)		96 + 128					
Timers	Advanced	2			2		
	32-bit general-purpose	2			2		
	16-bit general-purpose	8			8		
	Basic	2			2		
	SysTick	1			1		
	WDT	1			1		
	WWDT	1			1		
	RTC	1			1		
Communication	I²C	3			3		
	SPI/I²S	4/4 (2 full-duplex)			4/4 (2 full-duplex)		
	USART + UART	4 + 4			4 + 4		
	SDIO	2			2		
	USBFS device	1			1		
	CAN	2			2		
	Ethernet MAC	1			1		
Analog	12-bit ADC numbers/channels	3					
		16			16		
	12-bit DAC numbers	2					
XMC		1[3]			1		
SPIM[4]		1 ch / up to 16 MB					
GPIO		51			80		
Operating temperatures		-40 to +105 °C					
Packages		LQFP64 10 x 10 mm			LQFP100 14 x 14 mm		

(1) ZW = zero wait-state, up to SYSCLK 240 MHz
NZW = non-zero wait-state
(2) The internal Flash and SRAM sizes are configurable with user's Option bytes. Take the AT32F407VGT7 as an example, on which the Flash/SRAM can be configured into two options below:
- ZW: 256 KBytes, NZW: 768 KBytes, SRAM: 96 KBytes;
- ZW: 128 KBytes, NZW: 896 KBytes, SRAM: 224 KBytes.
(3) For LQFP64 package, XMC only supports the LCD panel with 8-bit mode.
(4) SPIM = External SPI Flash memory extension, for both program execution and data storage with encryption capability.