

Migrating from AT32F403 to AT32F403A

Introduction

This migration guide is written to help users with the analysis of the steps required to migrate from an existing AT32F403 series to AT32F403A series device. It puts together the most important information and lists the vital aspects that need to be taken into account.

To move an application from AT32F403 series to AT32F403A series, users have to analyze the hardware and software migration.

Applicable products:

Part numbers	AT32F403Axx
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1 Similarities and differences between AT32F403A and AT32F403

The AT32F403A series microcontrollers are basically compatible with the AT32F403 series and provide many enhanced features, some of which are slightly different from the AT32F403 series. The differences between them are detailed in this document.

1.1 Overview of similarities

- Pin definition: The same package has the same pin definition. For extended peripherals, the alternate function of pins are defined
- Addressing space: Memory and registers have the same logical addresses, except I2C3 and CAN2. Extended peripherals occupy the reserved space of AT32F403 series.
- Compiler tools: identical, for example, Keil, IAR

1.2 Overview of differences

Table 1. Differences between AT32F403A and AT32F403

	AT32F403A	AT32F403
Package	QFN48, LQFP48/64/100	QFN48, LQFP48/64/100/144
System clock	Max frequency 240 MHz, both APB1 and APB2 are 120 MHz	Max frequency 200 MHz, both APB1 and APB2 are 100 MHz
Startup	13 ms	20 ms
Reset	8 ms	8.2 ms
Wake up from Standby mode	8 ms	150 ms
Flash memory 16-bit write time	50 μ s	30 μ s
Flash memory sector erase time	50 ms	40 ms
Flash memory mass erase time	0.8 s (AT32F403AxC) 1.4 s (AT32F403AxE) 2.8 s (AT32F403AxG)	5s (AT32F403xC) 10s (AT32F403xE) 20s (AT32F403xG)
Security library (sLib)	Support	NA
Extended USART and UART	Support USART6/UART7/UART8	Not support USART6/UART7/UART8
I ² S support	I ² S available on 48-pin package Support I ² S2/3 full-duplex	I ² S unavailable on 48-pin package Not support full-duplex I ² S
Extended CAN2	Support CAN2	Not support CAN2
Simultaneous use of CAN and USB	Support	NA
Extended 48 MHz HICK supports USB peripheral	Support	NA
HICK auto clock calibration (ACC)	Support	NA

	AT32F403A	AT32F403
XMC	<ol style="list-style-type: none"> 1. Not support CF card and SRAM 2. 2 chip select 3. Not support external interrupts 4. 64-pin packages support 8-bit LCD parallel interface 	<ol style="list-style-type: none"> 1. Support CF card and SRAM 2. 4 chip select 3. Support 2 external interrupts 4. Not support
Flash memory CRC check	Support	NA
High-speed GPIO	GPIO is on AHB bus	GPIO is on APB bus
Advanced timer TMR15	Not support	Support
Number of DMA channels	Flexible mapping supports 14 channels	12 channels
Ambient temperature T_A	-40°C~+105°C	-40°C~+85°C
Run mode	37.1 mA @ 72 MHz	33.7 mA @ 72 MHz
Power consumption at Sleep mode	31.8 mA @ 72MHz	24.7 mA @ 72 MHz
Power consumption at Deepsleep mode	1.4 mA	1 mA
Power consumption at Standby mode	5.7 uA	10.4 uA
V _{BAT} independent supply	Support	NA

2 Hardware migration

The migration from AT32F403 and AT32F403A series is very simple as they are pin-to-pin compatible basically.

3 Software migration

3.1 Functional enhancement

This section describes the enhanced peripheral features of AT32F403A versus AT32F403. The subsection presents the behavior of the AT32F403A.

3.1.1 High frequency PLL settings

- AT32F403A embeds a PLL that can output up to 240 MHz clock. The PLL settings are the same as AT32F403.
- AT32F403A has an auto clock frequency switch feature, making it a bit different from AT32F403 in terms of clock configuration procedure.
- For AT32F403, software latency is needed to wait until the HEXT and PLL become stable. This step can be skipped for AT32F403A, for it has been guaranteed by hardware.
- When the embedded PLL is greater than 108 MHz in AT32F403A, the PLL settings are a bit different, for AT32F403A needs use auto clock frequency switch feature.

3.1.2 Security library

- Security library is supported.

3.1.3 Main clock output and prescaler extension

- Clock output (CLKOUT) supports CLKOUT prescaler to obtain CLKOUT/2, CLKOUT/4...CLKOUT/512
- HEXT prescaler supports /3, /4, /5 output
- Main clock output (CLKOUT) supports LEXT, LICK, PLLCLK/4, USB48M, ADCCLK output

3.1.4 SPIM mapping feature

- SPIM_IO0 and SPIM_IO01 pins are remappable.

3.1.5 I²S full-duplex mode

- Add two modules (I2S2_ext and I2S3_ext) supporting I2S full-duplex mode

3.1.6 Extended USART and UART

- Support USART6/UART7/UART8

3.1.7 CAN2 support

- Support CAN2

3.1.8 Simultaneous use of CAN and USB

- CAN and USB can be used at the same time.
- CAN manages its individual 512-byte SRAM space
- USB also has its individual SRAM space, and the disabled CAN space can be assigned to USB

3.1.9 48 MHz HICK supports USB peripheral

- 48 MHz clock can be used for the USB peripheral.

3.1.10 HICK auto clock calibration (ACC)

- Add HICK auto clock calibration (HICK ACC) module

3.1.11 64-pin package supports XMC

- 64-pin package supports XMC

3.1.12 Flash memory CRC check

- Flash memory CRC check is supported.

3.1.13 High-speed GPIO

- AT32F403A optimizes GPIO by putting GPIO clock on the AHB bus.

3.1.14 DMA flexible mapping request feature

- DMA1/DMA2 supports flexible mapping requests each.

3.2 Functional differences

This section describes the functional differences related to peripherals between AT32F403A and AT32F403. The behavior of the AT32F403A is detailed in subsections.

3.2.1 I²C3 usage differences

The configuration to define clock enable/reset for I2C3 is different, so is the peripheral base addresses of I2C3, as show in Table 2.

Table 2. CAN2 and I²C3 differences

Device	RCC peripheral clock enable		RCC peripheral clock reset		Peripheral base address	
	CAN2	I ² C3	CAN2	I ² C3	CAN2	I ² C3
AT32F403	-	APB1EN[26]	-	APB1RST[26]	-	0x4000_6800
AT32F403A	APB1EN[26]	APB2EN[23]	APB1RST[26]	APB2RST[23]	0x4000_6800	0x4001_5C00

3.2.2 XMC usage differences

In terms of the largest packages available, the AT32F403A offers the largest 100-pin package, and the AT32F403 144-pin package. This cause some differences in XMC functions between AT32F403 and AT32F403A in case of their respective largest package.

Table 3. XMC functional differences

MCU	Address/data lines alternate function	Bank support	Memory support
AT32F403	Non-multiplexed / multiplexed mode support	Bank: support bank1/2/3/4	SRAM/PSRAM/NOR FLASH/NAND FLASH/PC card
AT32F403A	Multiplexed mode only	Bank: support bank1/2	Multiplexed PSRAM/multiplexed NOR FLASH

4 Revision history

Table 4. Document revision history

Date	Revision	Changes
2022.02.28	2.0.0	Initial release
2022.10.19	2.0.1	Added 3.2.2 XMC usage differences

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