

## Migrating from AT32F413 to AT32F415

### Introduction

This migration guide is written to help users with the analysis of the steps required to migrate from an existing AT32F413 series to AT32F415 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 AT32F413 series to AT32F415 series, users have to analyze the hardware and software migration.

Applicable products:

Part numbers	AT32F415xx
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## 1 Similarities and differences between AT32F415 and AT32F413

The AT32F415 series microcontrollers are basically compatible with the AT32F413 series and provide many enhanced features, some of which are slightly different from the AT32F413 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, define the alternate function of the pins
- Compiler tools: identical, for example, Keil, IAR

### 1.2 Overview of differences

**Table 1. Differences between AT32F415 and AT32F413**

	AT32F415	AT32F413
Floating Point Unit (FPU)	NA	Support
System clock	Max frequency 150 MHz, APB1 75 MHz, APB2 75 MHz	Max frequency 200 MHz, APB1 100 MHz, APB2 100 MHz
Startup	600 $\mu$ s	8 ms
Wake up from Standby mode	600 $\mu$ s	3.6 ms
Flash memory	WTCYC depends on the main frequency	Zero-wait state and non-zero-wait state
SRAM size	Fixed 32 KB	Extentable up to 64 KB
External SPI Flash	NA	Support external SPI Flash (SPIM)
Boot Memory	One-time programmable user application area	Not support
Flash memory half-word write time	40 $\mu$ s	50 $\mu$ s
Flash memory page erase time	6.4 ms	50 ms (AT32F413xC) 40 ms (AT32F413xB/x8)
Flash memory mass erase time	8 ms	800 ms
sLib settings	Support. Refer to AT32F415 Reference Manual and sLib User Guide.	Support. Refer to AT32F413 Reference Manual and sLib User Guide.
Advanced timers	1	2
RTC	Enhanced versions, with subsecond precision and hardware calendar	General version
Battery powered register	20 sets of 32-bit battery powered registers	42 sets of 16-bit battery powered registers
CAN interface	1	2
USB	USB2.0 OTG, support FS/LS master mode and FS device mode	USB2.0, with FS device mode only
ADC	1	2
Comparator	2	NA

	AT32F415	AT32F413
Power consumption at Deepsleep mode	680 $\mu$ A (Voltage regulator is in low-power mode)	490 $\mu$ A
Power consumption at Standby mode	3.6 $\mu$ A	9.9 $\mu$ A

## 2 Hardware migration

The migration from AT32F415 and AT32F413 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 AT32F415 versus AT32F413. The subsection presents the behavior of the AT32F415.

#### 3.1.1 USB module

- OTG FS, supports master and device modes

#### 3.1.2 ERTC module

- Enhanced real-time clock (ERTC)

#### 3.1.3 CMP module

- Embeds a CMP (comparator) module.

### 3.2 Functional differences

This section describes the functional differences in terms of peripherals between AT32F415 and AT32F413. The behavior of the AT32F415 is detailed in subsections.

#### 3.2.1 High frequency PLL settings

- AT32F415 embeds a PLL that can output up to 150 MHz clock

#### 3.2.2 Flash memory wait cycle settings (WTCYC)

- Zero-wait Flash memory. WTCYC can be configured according to the clock frequency.

#### 3.2.3 FPU ARM® 32-bit Cortex®-M4F

- No FPU (Floating Point Unit)

#### 3.2.4 System memory extended as main memory area

- Boot loader area can be configured as a general user application and data area to act as main memory extension area.

#### 3.2.5 Security library (sLib)

- The security library (sLib) has been optimized, with slight difference in terms of settings.

#### 3.2.6 Internal memory cannot be expanded

- Internal memory (SRAM size) is fixed 32 KB and cannot be altered.

#### 3.2.7 SPIM interface is not supported

- SPIM extension is not supported.

## 4 Revision history

Table 2. Document revision history

Date	Revision	Changes
2022.02.28	2.0.0	Initial release



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