# Migrating from AT32F403 to AT32F413

## Introduction

This migration guide is written to help users with the analysis of the steps required to migrate from an existing AT32F403 series to AT32F413 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 AT32F413 series, users have to analyze the hardware and software migration.

Applicable products：

| Part numbers | AT32F413xx |
|---|---|

# Contents

# List of tables

# 1 Similarities and differences between AT32F413 and AT32F403

The AT32F413 series microcontrollers are basically compatible with the AT32F403 series and provide many enhanced features, except for minor differences 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 & 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 AT32F413 and AT32F403**

|  | AT32F413 | AT32F403 |
|---|---|---|
| Startup | 8 ms | 20 ms |
| Reset | 3.6 ms | 8.2 ms |
| Wake up from Standby mode | 3.6 ms | 150 ms |
| Main memory size | Up to 256 KB | Up to 1024 KB |
| SRAM size | Extended up to 64 KB | Extended up to 224 KB |
| Flash memory 16-bit write time | 50 µs | 30 µs |
| Flash memory sector erase time | 50 ms (AT32F413xC) 40 ms (AT32F413xB/x8) | 40 ms |
| Flash memory mass erase time | 800 ms | 5s (AT32F403xC) 10s (AT32F403xE) 20s (AT32F403xG) |
| Security library | Support | NA |
| Run mode | 28.4 mA @ 72 MHz | 33.7 mA @ 72 MHz |
| Power consumption at Sleep mode | 23.9 mA @ 72 MHz | 24.7 mA @ 72 MHz |
| Power consumption at Deepsleep mode | 490 uA | 1 mA |
| Power consumption at Standby mode | 9.9 uA | 10.4uA |
| VBAT independent supply | Support | NA |

# 2 Hardware migration

The migration from AT32F403 to 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 AT32F413 versus AT32F403. The subsection presents the behavior of the AT32F413.

### 3.1.1    High frequency PLL settings

- AT32F413 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 AT32F413, for it has been guaranteed by hardware.

- When the embedded PLL is greater than 108 MHz in AT32F413, the PLL settings are a bit different as AT32F413 needs use auto clock frequency switch feature.

### 3.1.2    Internal memory size extension

- The internal memory extension features supported by AT32F413 are different from those of AT32F403. For AT32F413 series, the internal memory can be 16 KB, 32KB or 64 KB.

### 3.1.3    Security library

- Security library is supported.

### 3.1.4    DMA flexible mapping request feature

- DMA1/DMA2 has flexible mapping request feature each.

# 4 Revision history

**Table 2. Document revision history**

| Date | Revision | Changes |
|------|----------|---------|
| 2022.02.28 | 2.0.0 | Initial release |
| 2022.10.19 | 2.0.1 | Added *3.1.4 DMA flexible mapping request feature* |

**IMPORTANT NOTICE – PLEASE READ CAREFULLY**

Purchasers are solely responsible for the selection and use of ARTERY's products and services, and ARTERY assumes no liability whatsoever relating to the choice, selection or use of the ARTERY products and services described herein.

No license, express or implied, to any intellectual property rights is granted under this document. If any part of this document deals with any third party products or services, it shall not be deemed a license grant by ARTERY for the use of such third party products or services, or any intellectual property contained therein, or considered as a warranty regarding the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

Unless otherwise specified in ARTERY's terms and conditions of sale, ARTERY provides no warranties, express or implied, regarding the use and/or sale of ARTERY products, including but not limited to any implied warranties of merchantability, fitness for a particular purpose (and their equivalents under the laws of any jurisdiction), or infringement of any patent, copyright or other intellectual property right.

Purchasers hereby agrees that ARTERY's products are not designed or authorized for use in: (A) any application with special requirements of safety such as life support and active implantable device, or system with functional safety requirements; (B) any air craft application; (C) any automotive application or environment; (D) any space application or environment, and/or (E) any weapon application. Purchasers' unauthorized use of them in the aforementioned applications, even if with a written notice, is solely at purchasers' risk, and is solely responsible for meeting all legal and regulatory requirement in such use.

Resale of ARTERY products with provisions different from the statements and/or technical features stated in this document shall immediately void any warranty grant by ARTERY for ARTERY products or services described herein and shall not create or expand in any manner whatsoever, any liability of ARTERY.