How to Upgrade an AT91FR4081-based System to an AT91FR40162-based System

Background

The AT91FR4081 and AT91FR40162 are members of the Atmel AT91 16/32-bit microcontroller family which is based on the ARM7TDMI™ processor core.

This Application Note outlines the hardware and software operations necessary to upgrade an AT91FR4081-based system to an AT91FR40162-based system.

Hardware Requirements

Microcontroller Replacement

The AT91FR4081 and the AT91FR40162 are not pin-to-pin compatible. The AT91FR4081 is packaged in a 120-ball BGA package (17 x 11 mm, 1 mm Ball Pitch), whereas the AT91FR40162 is packaged in a 121-ball BGA package (10 x 10 mm, 0.8 mm Ball Pitch). Therefore, the footprint must be changed when installing the AT91FR40162 in the place of the AT91FR4081 in the application.

The AT91FR40162 has two types of power supply lines (VDDIO and VDDCORE), whereas the AT91FR4081 has a unique type of power supply line (VDD).

The Boot Mode Select input pin is managed differently by the AT91FR4081 and the AT91FR40162. Refer to Table 1 for details.

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Software Compatibility

As the architecture of the AT91FR4081 is not fully compatible with the architecture of the AT91FR40162, care should be taken when porting a program written for an AT91FR4081-based system on the same system built with an AT91FR40162.

Microcontroller Differences

The embedded microcontrollers are different: the AT91R40807 is embedded in the AT91FR4081 and the AT91R40008 in the AT91FR40162. The differences between the two microcontrollers are summarized in Table 1.

Table 1. Differences between the Microcontrollers Embedded in the AT91FR4081 and the AT91FR40162

Features	AT91FR4081	AT91FR40162
Microcontroller datasheet	AT91FR4081 Datasheet, lit number 1386	AT91FR40162 Datasheet, lit number 2632
Power supply lines	V_{DD}: 1.8V to 3.6V	V_{DDCORE}: 1.65V to 1.95V V_{DDIO}: 2.7V to 3.6V
Frequency range	Up to 33 MHz at V_{DD} = 3.0V, 85°C	Up to 70 MHz at V_{DDCORE} = 1.65V, 85°C
Boot Mode Select effects at reset	0: Boot from the internal 32-bit extended SRAM 1: Boot from an external 16-bit memory on NCS0	0: Boot from an external 8-bit memory on NCS0 1: Boot from an external 16-bit memory on NCS0
Internal SRAM memory	8K bytes of primary internal SRAM (address 0x0 after remap), 128K bytes of extended internal SRAM, write protected after reset (0x0010 0000)	256K bytes of internal SRAM (address 0x0 after remap)

Flash Memory Differences

The embedded Flash memories in the AT91FR4081 and the AT91FR40162 are not identical. The differences between the two Flash memories are summarized in Table 2.

Table 2. Differences between the Flash Memories Embedded in the AT91FR4081 and the AT91FR40162

Features	AT91FR4081	AT91FR40162
Memory datasheet	AT49BV/LV8011(T) 8-megabit (512K x 16/1M x 8) 3-volt Only Flash Memory Datasheet	AT49BV/LV1604/1614A(T) 2-Mbyte (1M x 16/2M x 8) 3-volt Only Flash Memory Datasheet
Memory capacity	512K words of 16 bits	1M words of 16 bits
Memory organization	- Memory Plane A:Four 4K-word, two 8K-word and two 16K-word Sectors - Memory Plane B: Fourteen 32K-word Sectors	- Memory Plane A: Eight 4K-word and seven 32K-word Sectors - Memory Plane B: Twenty-four 32K-word Sectors
Sector erase architecture	- Fourteen 32K-word Sectors with Individual Write Lockout - Two 16K-word Sectors with Individual Write Lockout - Two 8K-word Sectors with Individual Write Lockout - Four 4K-word Sectors with Individual Write Lockout	- Thirty-one 32K-word Sectors with Individual Write Lockout - Eight 4K-word Sectors with Individual Write Lockout
Device Code	0x00CB	0x00C0 (Additional device code = 0x00C8)
Command Definition	All command definitions are different, refer to the relevant datasheet for details	

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