# AT91MEC01 Memory Extension Card

# User Guide

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# Section 1
# Overview

## 1.1 Scope

The AT91MEC01 Memory Extension Card can connect to any AT91 ARM® Thumb® MCU evaluation board. The AT91MEC01 increases the memory capacity of the platform, adding 2M bytes of SRAM and 3M bytes of Flash on the external bus of the AT91 microcontrollers.

The AT91MEC01 mounted on an AT91EB40 and configured to boot from either the AT49BV1604 or the AT49BV8011 allows the user to evaluate the AT91F40816 or the AT91FR4081 respectively.

This guide decribes how to use the AT91MEC01, and describes the AT49BV1604 and AT49BV8011 Flash downloaders:

- Section 1 provides an overview.
- Section 2 describes how to set up the memory board.
- Section 3 details the memory maps.
- Section 4 contains references to the Flash downloaders.
- Section 5 describes the configuration links.
- Section 6 features the schematics for the AT91MEC01.

## 1.2 Deliverables

The AT91MEC01 is delivered with a connector that connects the card to the AT91 evaluation boards, and a CD-ROM that contains, in particular, a software toolkit and the documentation to program the Flash devices on the board.

To use the card and its software, the user needs to provide a host computer and a debugging system.

An AT91 evaluation board is also necessary.

## 1.3 System Requirements

The host computer must run the debugger in the ARM Software Development Toolkit, version 2.5 or higher.

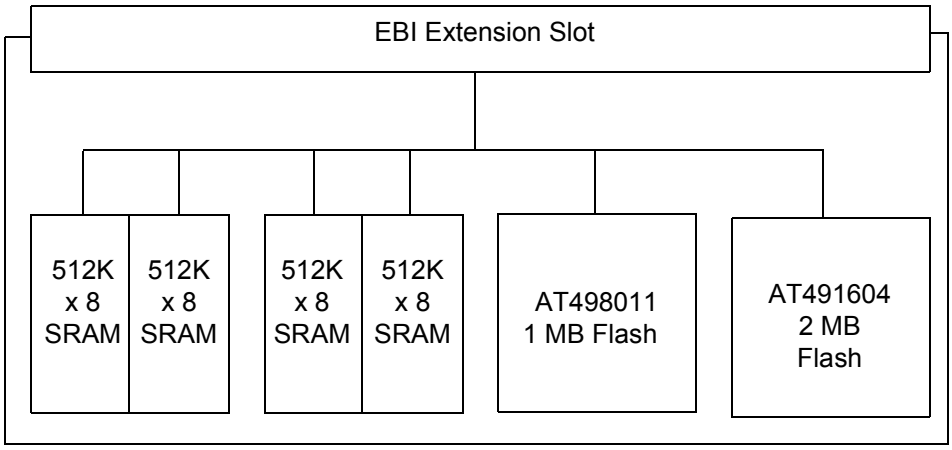
If an earlier version of the Software Development Toolkit is being used, it is strongly recommended that you upgrade to the most recent version. Other software toolkits for the ARM, available from third parties, are not covered in this guide. If a third-party toolkit is being used, use this guide alongside the documentation supplied with the toolkit.

## 1.4 The AT91MEC01

The card has four memory banks, made up from six memory devices soldered on the card:

- An AT49BV1604-11TC – with 2M bytes of Flash, two memory planes enabling simultaneous read/write
- An AT49BV8011-11TC – with 1M byte of Flash, two memory planes enabling simultaneous read/write, one dedicated pin for Ready/Busy signal
- Four 512K x 8 SRAM devices – with 15 ns access time, for a total of 2M bytes of 0 wait state Thumb instruction fetch address space (in nominal conditions)

***Figure 1-1.*** Memory Extension Card 01 Block Diagram



# Section 2

# Setting Up the AT91MEC01

## 2.1 Electrostatic Warning

The AT91MEC01 is shipped in protective anti-static packaging. The board must not be subjected to high electrostatic potentials. A grounding strap or similar protective device should be worn when handling the board. Avoid touching the component pins or any other metallic element.

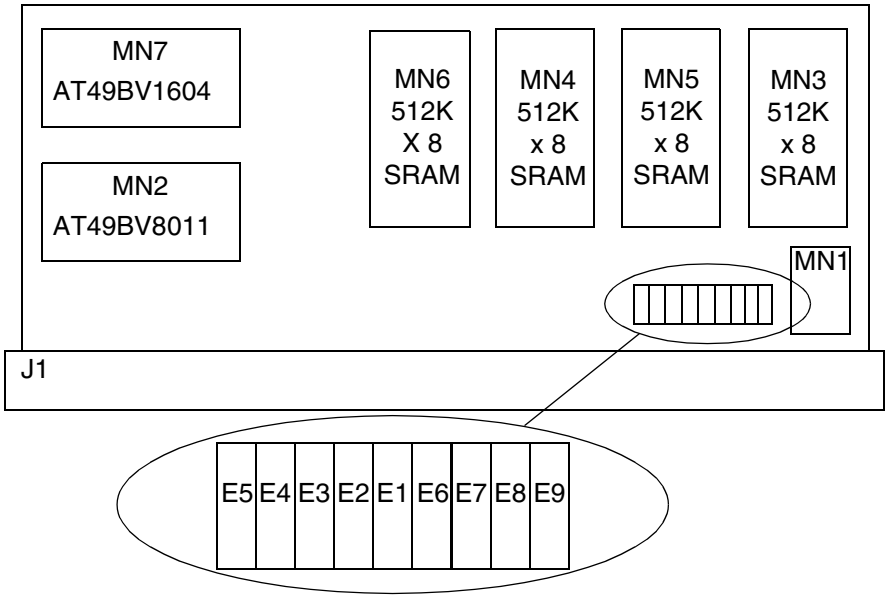
## 2.2 Requirements

Requirements in order to set up the AT91MEC01 are:

- the host computer running the ARM Software Development Toolkit (a time-limited evaluation copy is provided with the CD-ROM)
- any AT91 ARM Thumb MCU evaluation board
- a suitable connection between the host and the evaluation board
- DC power supply capable of supplying 7.5V to 9V @ 1 A (not supplied)

## 2.3 Layout

***Figure 2-1.*** Layout of the AT91MEC01



## 2.4 Jumper Settings

When E2 is closed, the AT49BV1604 (MN7) is selected by NCS0.

When E3 is closed, the AT49BV1604 (MN7) is selected by NCS2.

When E4 is closed, the AT49BV8011 (MN2) is selected by NCS0.

When E5 is closed, the AT49BV8011 (MN2) is selected by NCS3.

The two 1MB SRAM banks are connected to active high or low chip select lines 4 and 5.

E6 connects the active low NCS4 line to the first SRAM bank.

E7 connects the active high CS4 line to the first SRAM bank.

E8 connects the active low NCS5 line to the second SRAM bank.

E9 connects the active high CS5 to the second SRAM bank.

The E1 link connects the AT49BV8011 (MN2) Ready/Busy signal to the line MCKO signal of the EBI extension slot. If the Ready/Busy feature is not used, it is strongly recommended that you open the E1 link.

The use of the Ready/Busy signal requires the MCKO signal, multiplexed with a PIO signal on the MCU to be configured in PIO input mode. This capability is, however, not available on the EB55.

The links E3, E5, E7 and E9 are closed by default.

## 2.5 Connecting the Card to an AT91 Evaluation Board

See Figure 2-2.

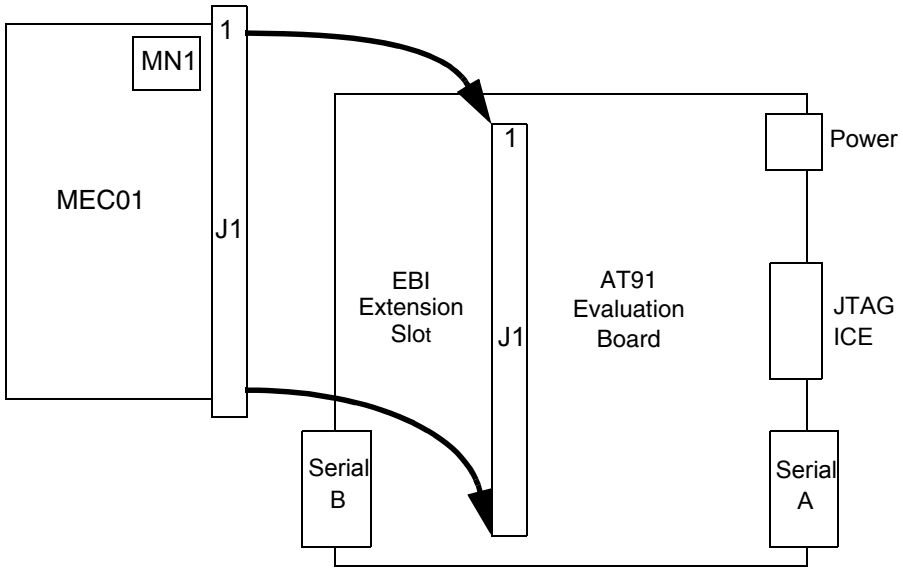
Solder the connector on the evaluation board.

Connect the plug on the EBI extension slot into the socket on the MEC01 AT91 evaluation board.

Match pin 1 on the MEC01 to the square connector located on the MN1 side of the J1 connector.

Pin 1 of the EBI extension slot is marked on the board.

***Figure 2-2.*** Connecting the AT91MEC01 to the AT91 Evaluation Board



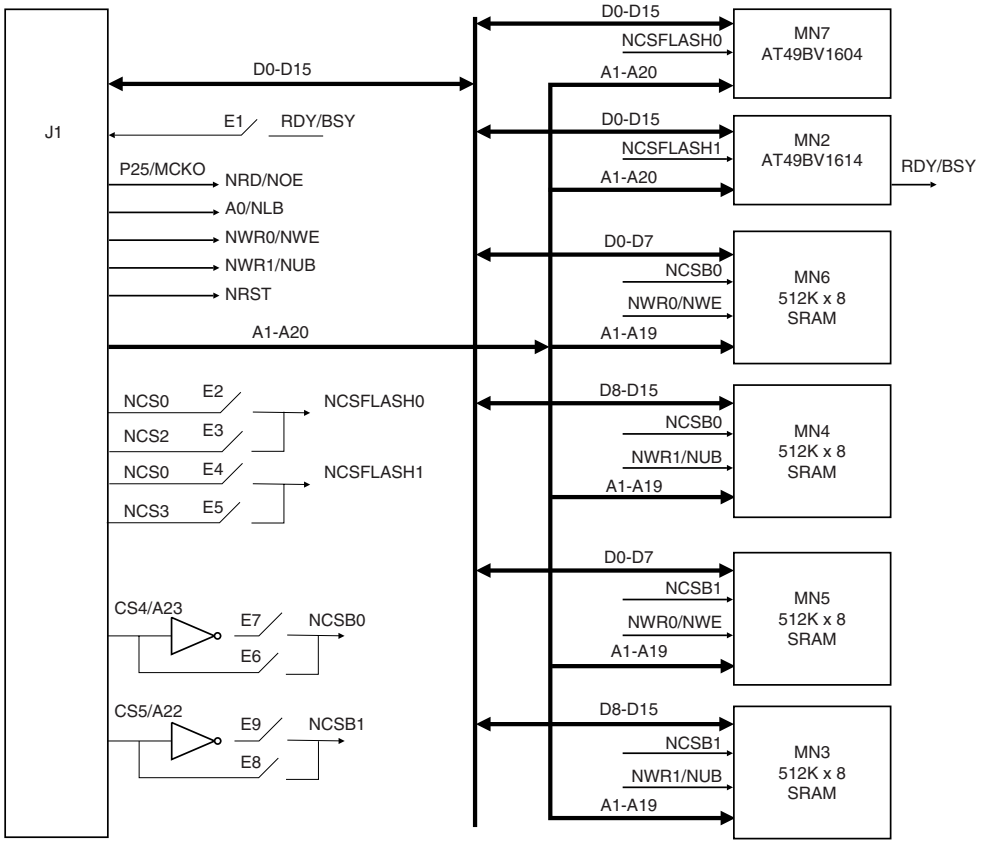
# Section 3

# Memory Mapping with AT91MEC01

## 3.1 Memory Organization

The memory banks on the AT91MEC01 are organized as shown in Figure 3-1.

***Figure 3-1.*** Memory Organization



## 3.2 Configuring the AT91 Evaluation Board EBI

The EBI must be programmed to support the AT91MEC01, and integrate the additional memory into the microcontroller address space.

The base addresses of the memory banks can be configured as the user requires. In the setup below, the base address of Flash 0 (AT49BV1604) is 0x0300 0000, the Flash 1 base address is 0x0400 0000, and both SRAM banks are mapped contiguously from address 0x0500 0000.

The number of wait states is calculated using a system clock at 25 MHz. If a different system clock frequency is used, the number of wait states should be changed in order to optimize the microcontroller performance.

### 3.2.1 MCU Chip Select Registers 0 and 1

NCS0 selects the boot non-volatile memory. NCS1 selects the external SRAM of the AT91 evaluation board. The values of NCS0 and NCS1 must not be changed.

### 3.2.2 MCU Chip Select Register 2

NCS2 selects Flash 0 when the E3 link is closed. It is programmed with the value 0x0300 24B5.

This configuration enables the EBI and selects a 4 MB bank at address 0x0300 0000 with a 16-bit data bus with byte write access that has six wait states and two data float time cycles.

### 3.2.3 MCU Chip Select Register 3

NCS3 selects Flash 1 when the E5 link is closed. It is programmed with the value 0x0400 24B5.

This configuration enables the EBI, and selects a 4 MB bank at address 0x0400 0000 with a 16-bit data bus with byte write access that has six wait states and two data float time cycles.

### 3.2.4 MCU Chip Select Registers 4 and 5

CS4 and CS5 select the SRAM banks. Depending on the activity of these lines, the links E6 and E8 or E7 and E9 must be closed. In the cases of the EB01, EB42 or EB63, CS4 and CS5 are multiplexed with address lines and are active high. This requires that links E7 and E9 be closed. In the case of the EB55, CS4 and CS5 are active low. This requires that links E6 and E8 be closed.

In the example configuration, CS4 must be programmed with value 0x0500 2021. CS5 must be programmed with the value 0x0510 2021.

This configuration enables CS4 and CS5, and selects a 1 MB bank with a 16-bit data bus and byte select access that has one wait state and no data float time.

This creates a contiguous 2 MB SRAM bank from address 0x0500 0000.

### 3.2.5 MCU Memory Control Register

Except for the EB55, the ALE field of the Memory Control Register must be programmed with 0x6. This enables the pins A20/CS7 to be driven as the address lines, and the pins A23/CS4 to be driven as chip select lines.

## 3.3 Configuring the EBI to Boot from Flash 0 or 1

In order to boot from either Flash memory on the AT91MEC01, all devices connected to NCS0 on the AT91 evaluation board must be disabled. To do this:

- On the AT91EB01, desolder the U3 Flash (or cut the chip select of this device and tie it high).
- On the AT91EB63, make sure the E3 link is open by cutting the wire.
- On the AT91EB42 and AT91EB55, make sure the CB9 link is open by cutting the wire.
- On the AT91MEC01, enable the required Flash with NCS0 by closing link E2 for Flash 0 or link E4 for Flash 1.

# Section 4

# Using the Flash Downloader

## 4.1 Deliverables

The CD-ROM delivered with the AT91 memory extension card contains the following shown in Table 4-1:

***Table 4-1.*** Deliverables

| Folder Name | Contents | Description |
|---|---|---|
| Tutorial | Memory Extension Board.ppt | How to connect and check memory extension card (MEC01) |
| | download_flash_at49.ppt | How to download an application software program to the MEC01 Flash devices |
| Software\Tools\ Flash_AT91 | download_flash_at49.c | C source code for Flash downloader |
| | erase_at49.c | C source code for Flash eraser |
| | download_flash_at49.prj | Flash Downloader Project file for Flash downloader for ARM Software Development Toolkit, V2.5 and Aspex |
| | mec_map (no extension, script file) | The script file for the ARM SDT V2.5 debugger that enables AT91MEC01 memory mapping |
| | program (no extension, script file) | An example |

## 4.2 Installation and Use

The following files are available in the tutorial folder:

- **Memory Extension Board.ppt**: explains how to connect and check the memory extension card.
- **download_flash_at49.ppt**: explains how to download an application software program to the MEC01 Flash devices.

# Section 5

# Appendix A – Links

## 5.1 AT91MEC01 Link Description

The following table explains the links for the AT91MEC01.

***Table 5-1.*** Link Descriptions

| Link Name | Position | Description |
|---|---|---|
| E1 | Open | The microcontroller cannot read the Ready/Busy signal from Flash 1. |
| | Closed | The microcontroller reads the Ready/Busy signal from Flash 1 on pin MCKO. |
| E2 | Open | NCS0 deselects Flash 0. |
| | Closed | NCS0 selects Flash 0. E3 and E4 must be open. |
| E3 | Open | NCS2 deselects Flash 0. |
| | Closed | NCS2 selects Flash 0. E2 must be open. |
| E4 | Open | NCS0 deselects Flash 1. |
| | Closed | NCS0 selects Flash 1. E2 and E5 must be open. |
| E5 | Open | NCS3 deselects Flash 1. |
| | Closed | NCS3 selects Flash 1. E4 must be open. |
| E6 | Open | NCS4(1) deselects SRAM bank 0. |
| | Closed | NCS4(1) selects SRAM bank 0. E7 must be open. |
| E7 | Open | CS4/A23(1) deselects SRAM bank 0. |
| | Closed | CS4/A23(1) selects SRAM bank 0. E6 must be open. |
| E8 | Open | NCS5(1) deselects SRAM bank 1. |
| | Closed | NCS5(1) selects SRAM bank 1. E9 must be open. |
| E9 | Open | CS5/A22(1) deselects SRAM bank 1. |
| | Closed | CS5/A22(1) selects SRAM bank 1. E8 must be open. |

Note: 1. On certain variants of the AT91 series, the chip select signals 4 and 5 are called CS4/A23 and CS5/A22 (active high); on others, they are called NCS4 and NCS5 (active low).

# Section 6

# Appendix B – Schematics

The following schematics are appended:

Figure Figure 6-1 AT91MEC01 PCB Layout

Figure Figure 6-2 AT91MEC01 EBI Connector and Flash

Figure Figure 6-3 AT91MEC01 SRAM Banks

***Figure 6-1.*** AT91MEC01 PCB Layout

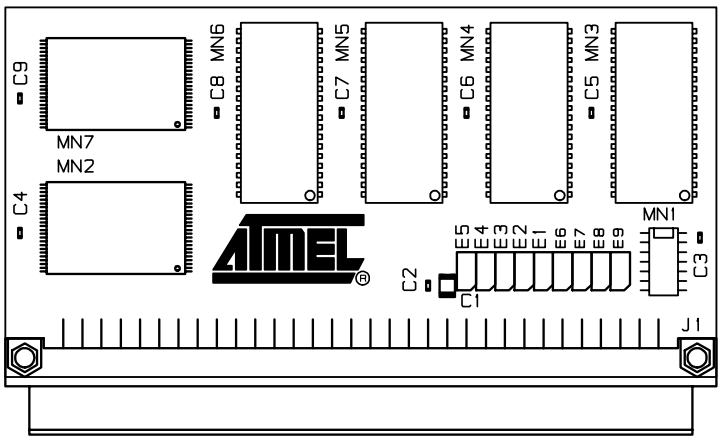


***Figure 6-2.*** AT91MEC01 EBI Connector and Flash

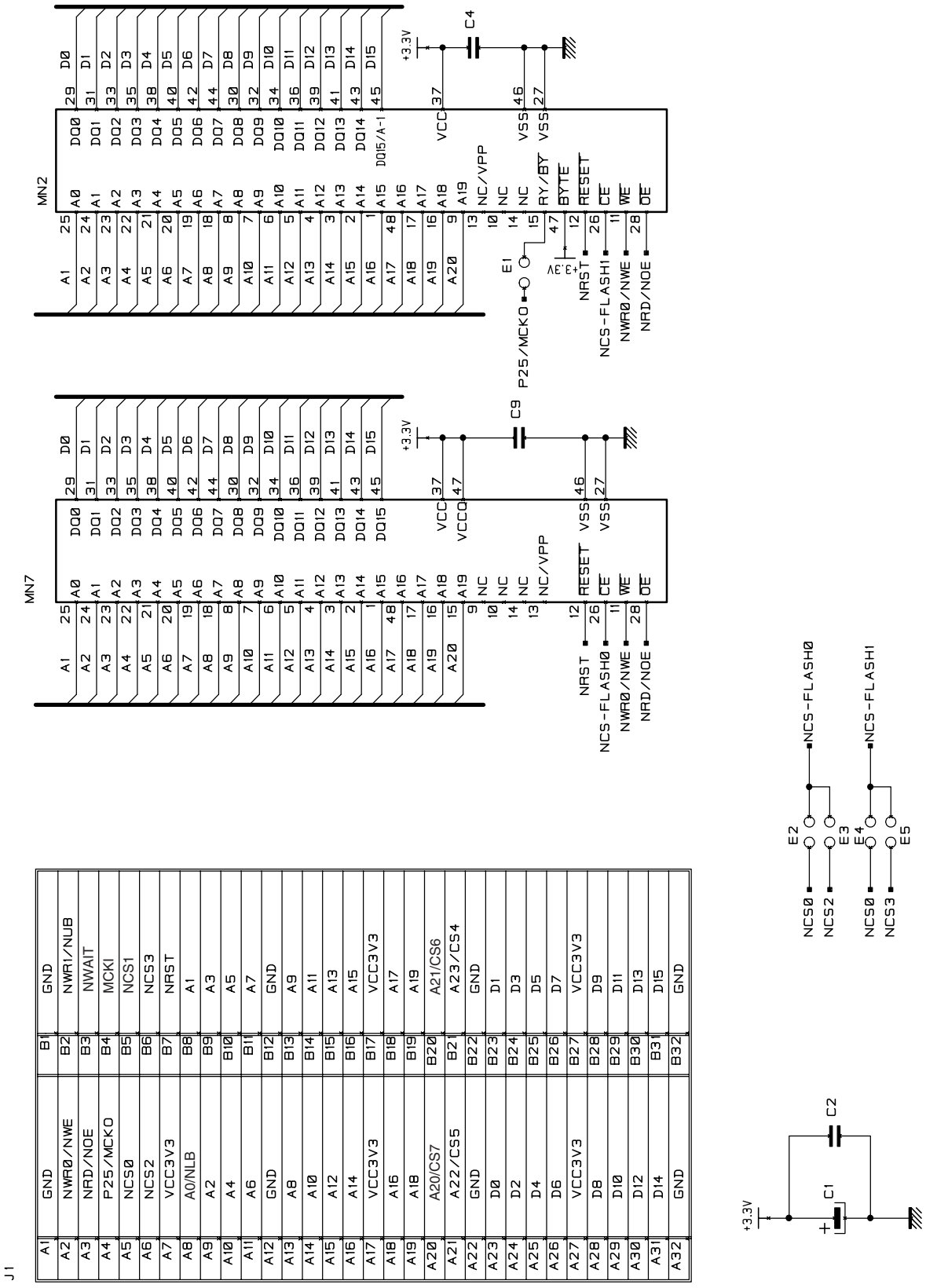
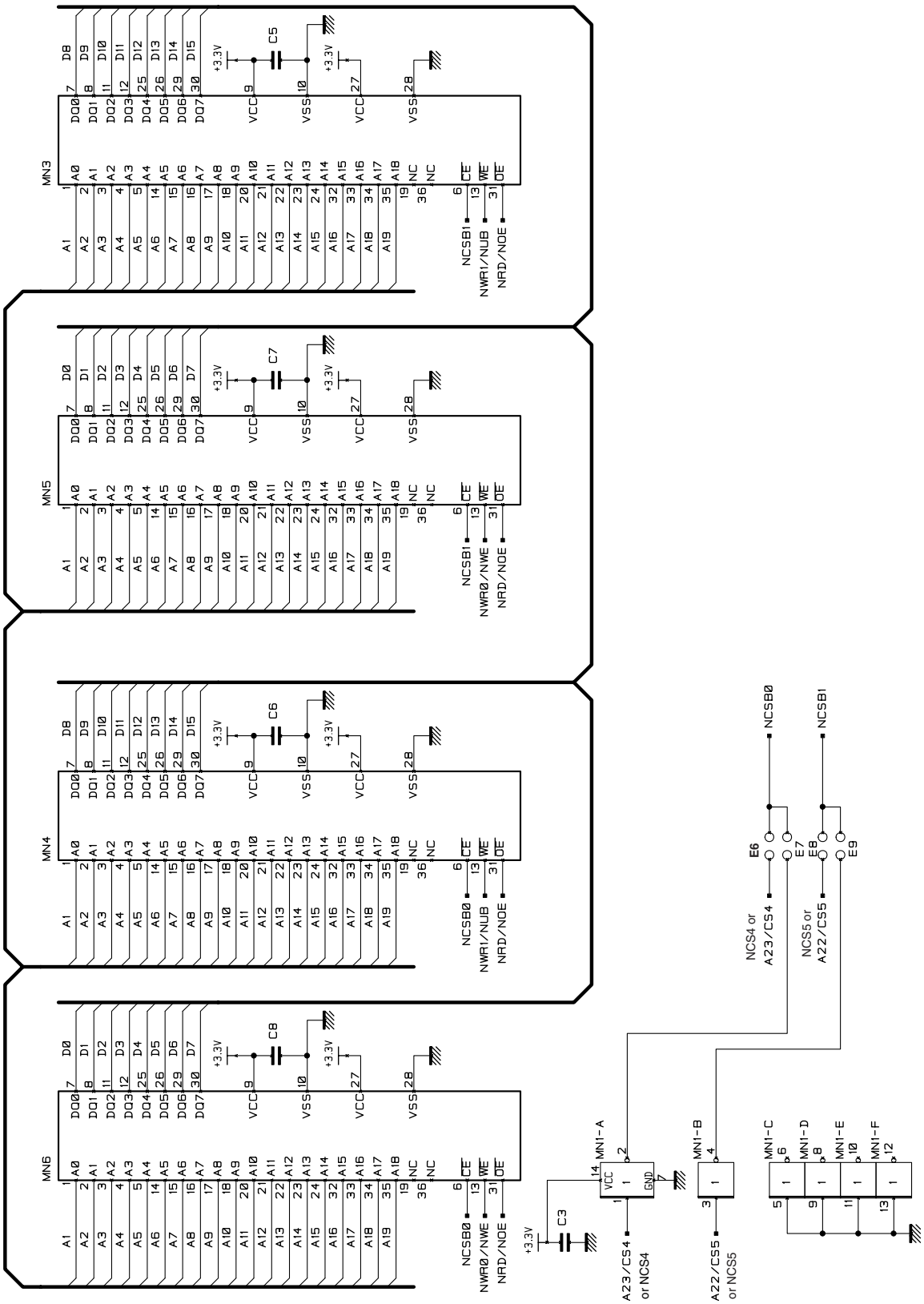


***Figure 6-3.*** AT91MEC01 SRAM Banks



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