

AT91SAM9260-EK SAM-BA Recovery

1. Introduction

On the AT91SAM9260-EK revA board based on the 32-bit ARM® Thumb® based AT91SAM9260 microcontroller, both DataFlash® and NAND Flash are present. After power up, the chip looks for a valid application in the DataFlash then in the NANDFlash.

If there is a wrong image programmed in NAND Flash or in DataFlash, the board can become non-responsive even to [SAM-BA™](#).

There are three ways to solve the problem:

- Connect a DataFlash card containing a small application that erases the Flash correctly.
- Erase the Flash using a JTAG device.
- Remove resistors to disable the DataFlash and NAND Flash chip selects.

To prevent an incorrect image from being programmed into the Flash memory, it is highly recommended to use the [AT91Bootstrap](#) application to setup the system after power up cycle. This application integrates a recovery procedure activated when BP4 button is pressed.

2. Boot Sequence on the AT91SAM9260-EK

The Boot Program integrates different programs permitting download and/or upload into the different memories of the product.

- First, it initializes the Debug Unit serial port (DBGU) and the USB Device Port.
- Then the DataFlash Boot program is executed. It looks for a sequence of eight valid ARM exception vectors in a DataFlash connected to the SPI. All these vectors must be B-branch or LDR load register instructions except for the sixth vector. This vector is used to store the size of the image to download.
- If a valid sequence is found, code is downloaded into the internal SRAM. This is followed by a remap and a jump to the first address of the SRAM.
- If no valid ARM vector sequence is found, the DataFlash Boot program is executed on the second chip select.
- If no valid ARM vector sequence is found, NAND Flash Boot program is then executed. First, it looks for a boot.bin file in the root directory or in the FIRMWARE directory of a FAT12/16 formatted NAND Flash. If such a file is found, code is downloaded into the internal SRAM. This is followed by a remap and a jump to the first address of the SRAM.
 - If the NAND Flash is not formatted, the NAND Flash Boot program looks for a sequence of eight valid ARM



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Application Note

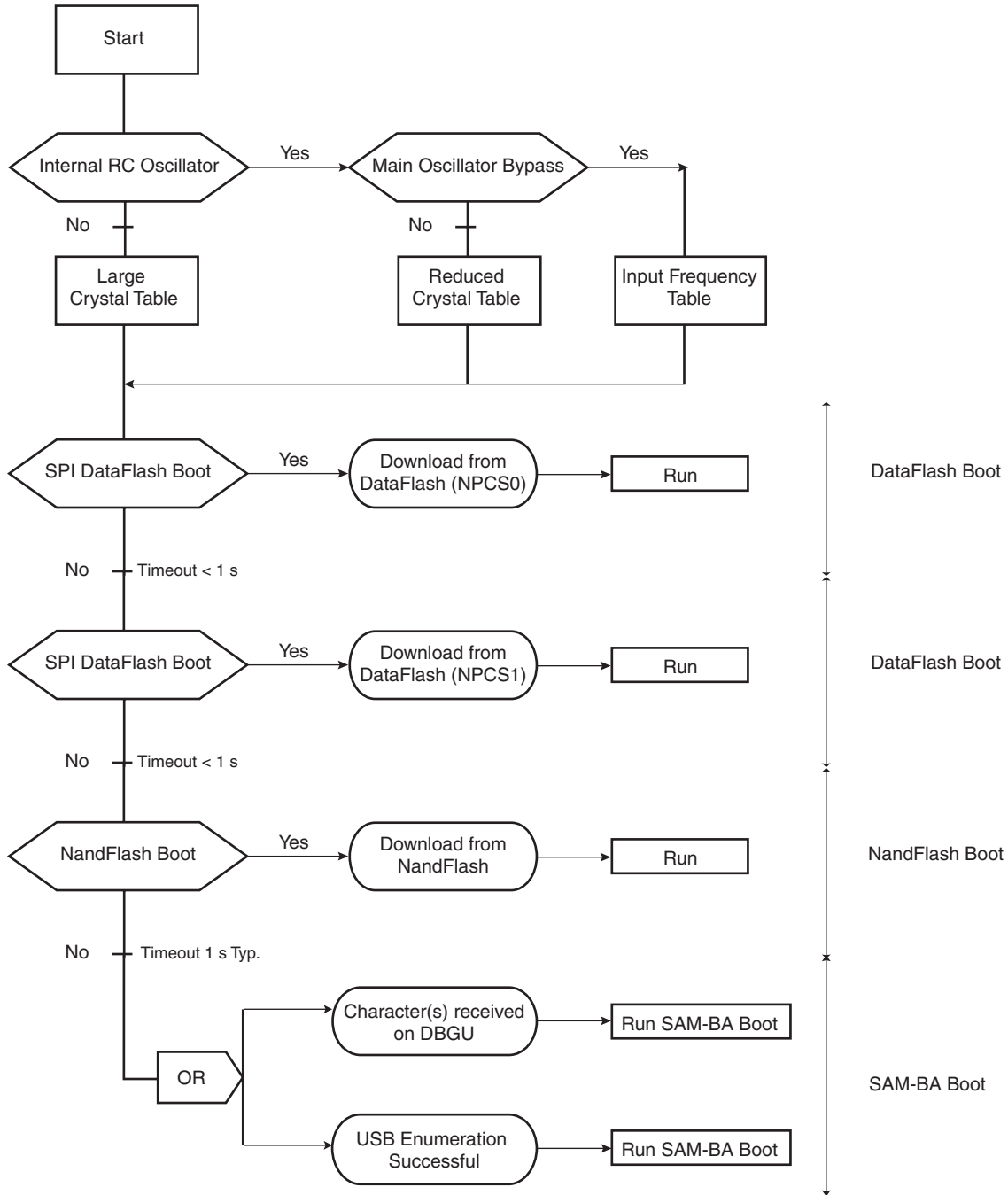


exception vectors. If such a sequence is found, code is downloaded into the internal SRAM. This is followed by a remap and a jump to the first address of the SRAM.

- If no valid ARM vector sequence is found, SAM-BA Boot is then executed. It waits for transactions either on the USB device, or on the DBGU serial port.

The AT91SAM9260 Boot ROM sequence is shown in [Figure 2-1](#).

Figure 2-1. Boot Program Algorithm Flow Diagram



3. Keeping Access to SAM-BA Boot for Firmware Upgrade

The standard AT91SAM9260-EK comes with a DataFlash connected to CS1 and a NAND Flash. Due to the boot sequence described in the previous chapter, in a situation where the customer has programmed an unwanted or bogus image in NAND Flash or DataFlash, the board can become non-responsive even to SAM-BA. Since the AT91SAM9260 detects an image with valid exception vectors in the DataFlash, the NAND Flash or a formatted NAND Flash, it never reaches the SAM-BA Boot monitor.

The AT91SAM9260-EK revA does not offer an easy way (jumpers) to disable the CS of these memories.

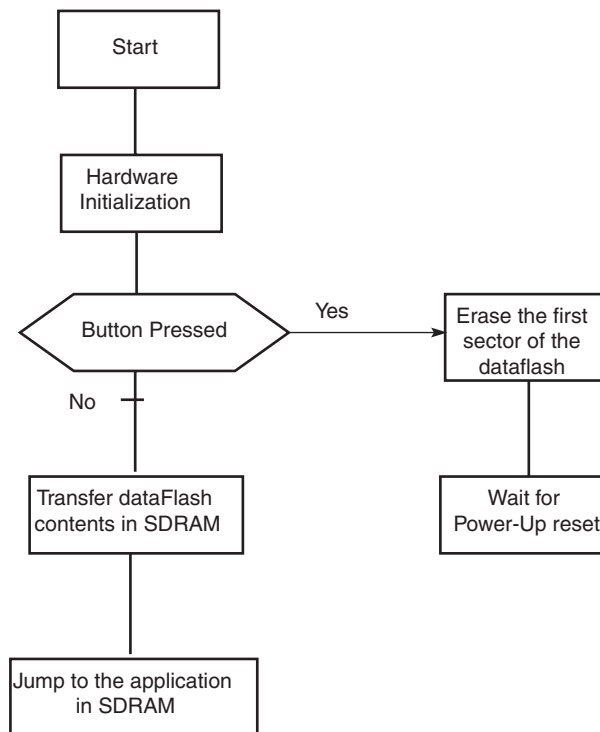
An easy software workaround that offers an unconditional access to the SAM-BA Boot monitor consists in adding a recovery procedure in the bootstrap sequence. This recovery procedure can be invoked when a button of the AT91SAM9260-EK revA is pressed after power-up.

The [AT91Bootstrap](#) library offers a mechanism to detect a button pressed after power-up, erase the DataFlash or the NAND Flash, and therefore invalidate the bogus code.

3.1 DataFlash Boot Recovery

Figure 3-1 shows the DataFlash recovery procedure in the board/at91sam9260ek/at91sam9260ek.c file.

Figure 3-1. DataFlash Recovery Procedure in the board/at91sam9260ek/at91sam9260ek.c File



The same algorithm can be implemented in a custom bootstrap application.

```

void df_recovery(AT91PS_DF pDf)
{
  #if (AT91C_SPI_PCS_DATAFLASH == AT91C_SPI_PCS1_DATAFLASH)

```

```

/* Configure PIOs */
const struct pio_desc bp4_pio[] = {
    {"BP4", AT91C_PIN_PA(31), 0, PIO_PULLUP, PIO_INPUT},
    {(char *) 0, 0, 0, PIO_DEFAULT, PIO_PERIPH_A},
};

/* Configure the PIO controller */
writel((1 << AT91C_ID_PIOA), PMC_PCER + AT91C_BASE_PMC);
pio_setup(bp4_pio);

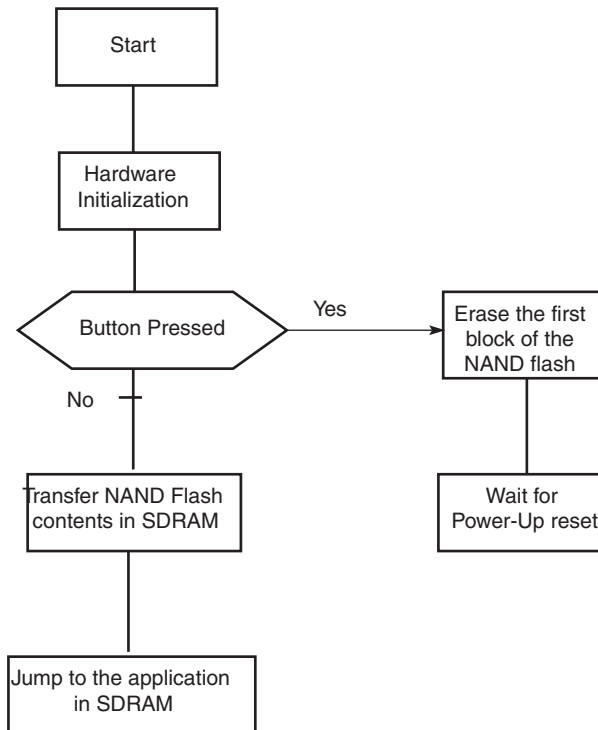
/* If BP4 is pressed during Boot sequence */
/* Erase NANDFlash block 0*/
if ( !pio_get_value(AT91C_PIN_PA(31)) )
    df_page_erase(pDf, 0);
#endif
}

```

3.2 NAND Flash Boot Recovery

Figure 3-2 shows NAND Flash recovery procedure in the board/at91sam9260ek/at91sam9260ek.c file.

Figure 3-2. NAND Flash Recovery Procedure in the board/at91sam9260ek/at91sam9260ek.c file



The same algorithm can be implemented in a custom bootstrap application.

```
static void nand_recovery(void)
{
    /* Configure PIOs */
    const struct pio_desc bp4_pio[] = {
        {"BP4", AT91C_PIN_PA(31), 0, PIO_PULLUP, PIO_INPUT},
        {(char *) 0, 0, 0, PIO_DEFAULT, PIO_PERIPH_A},
    };

    /* Configure the PIO controller */
    writel((1 << AT91C_ID_PIOA), PMC_PCER + AT91C_BASE_PMC);
    pio_setup(bp4_pio);

    /* If BP4 is pressed during Boot sequence */
    /* Erase NandFlash block 0*/
    if (!pio_get_value(AT91C_PIN_PA(31)) )
        AT91F_NandEraseBlock0();
}
```



4. SAM-BA Boot Recovery

If the customer has a wrong image programmed in NAND Flash or in DataFlash, the board can become non-responsive even to SAM-BA.

In this situation, it is still possible to recover by erasing or disabling the DataFlash or the NAND Flash.

4.1 Hardware Recovery

It is possible to disable the Chip Select of the DataFlash and the Chip Enable of the NAND Flash by removing discrete components on the AT91SAM9260-EK revA board.

The soldered DataFlash can be disabled on the AT91SAM9260-EK board by removing the R40 0 Ohm resistor. Location: Component side, next to the DataFlash (MN9) device.

The soldered DataFlash can be disabled on the AT91SAM9260-EK board by removing the R36 0 Ohm resistor. Location: Solder side, opposite from the NAND Flash (MN6A1) device.

Even if this hardware operation is simple, when several recoveries are necessary, software recovery solutions should be preferred.

4.2 Software Recovery

At91bootstrap-recovery is a small application which erases the first sector of the NAND Flash or the DataFlash.

```
=====
DATAFLASH Card Recovery
=====
Select the Media to erase:
1 - Dataflash (CS1)
2 - Nand flash
-I- AT45DB321B detected
-I- Success: Page 0 of the dataflash is erased.
-I- Remove the dataflash card and reset.
```

This application can be flashed in a DataFlash card. In this case when the DataFlash card is detected on CS0 after power-up, the AT91Boot-ROM loads the At91bootstrap-recovery in the internal SRAM and launches it. This recovery DataFlash card can be used several times during the development process.

This application can also be loaded in internal SRAM using an ICE interface.

4.2.1 Compiling AT91bootstrap-recovery

4.2.1.1 Linux

At91bootstrap-recovery has been compiled and tested under Linux using the following GNU ARM binary distribution which can be downloaded from the following URL: <http://www.gnuarm.org>

GCC-3.4 toolchain: binutils-2.15, gcc-3.4.3-c-c++-java, newlib-1.12.0, insight-6.1, tar.bz2 (or newer)

Once your toolchain is installed, install at91bootstrap-recovery sources in a directory and cd into it.

4.2.1.2 Windows

Please refer to the application note [Using Open Source Tools for AT91SAM7 Cross Development](#).

4.2.1.3 Compilation

Go into the project directory

```
> cd board/at91sam9260ek/dataflash-recovery
> make
```

The resulting binary image size must be less than 4 Kbytes as it is the AT91SAM9260 internal available SRAM size.

4.2.2 Flashing AT91bootstrap-recovery in a DataFlash Card Using SAM-BA

It may be useful to flash the AT91bootstrap-recovery binary in a DataFlash card to prepare a solution when a wrong image has been programmed in NAND or in DataFlash. This solution is not possible when the AT91SAM9260EK rev A has already been programmed. The DataFlash card must be programmed before any other programming operation is carried out on the DataFlash or NAND Flash soldered on the AT91SAM9260-EK.

It is also possible to use another AT91SAM evaluation kit to program the DataFlash card.

- Connect the AT91SAMxxx-EK to the host PC using USB link.
- Start SAM-BA.
- Select the DataFlash AT45 DB/DCB frame set.
- Select the “Enable DataFlash on CS0” script and execute it.
- Select the “Send Boot File” script and execute it.
- Select the dataflash-recovery_at91sam9260ek.bin.

At the end of the programming operation, the DataFlash card is ready.

4.2.3 Loading AT91bootstrap-recovery in SRAM Using an ICE Interface

4.2.3.1 Using SAM-ICE™

Connect the AT91SAM9260-EK to the host PC using a SAM-ICE.

- Start SAM-BA and select \jlink\ARM0.
- Select the SRAM frame set.
- Select the dataflash-recovery_at91sam9260ek.bin in the “Send File Name” field.
- Check that the address is 0x200000.
- Enter the following command in the TCL script frame go 0x200000



4.2.3.2 *Using Other ICE Interfaces*

Connect the AT91SAM9260-EK to the host PC using an ICE interface.

- Load the dataflash-recovery_at91sam9260ek.bin at the address 0x200000.
- Set the PC to 0x200000.
- Resume the execution.

5. Revision History

Table 5-1.

Document Ref.	Comments	Change Request Ref.
6281A	First issue	



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