

RZ/A3M

How to use Flash Writer to boot from Serial NAND Flash

Introduction

This application note describes how to use Flash Writer and the steps to boot the RZ/A3M from Serial NAND Flash and start the stored application.

Supported Kit

EK-RZ/A3M

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1. Outline

This application note describes how to use Flash Writer and the steps to boot the RZ/A3M from Serial NAND Flash and start the stored application.

EK-RZ/A3M is equipped with a Serial NAND Flash (W25N01GVZEIG: 128MB, 3.3V, Winbond). In this document, the application starts from this Flash Memory. In addition, a Loader Program (IPL) is needed to run the application. You can write applications and Loader Program to Serial NAND Flash using the included Flash Writer.

1.1 Flash Writer

Flash Writer is used to write data to a serially connected Serial Flash Memory. In this document, Flash Writer is used to write Loader Program and application to the Serial NAND Flash. Flash Writer can be executed using **Boot Mode 5** (Booting from SCIF download).

The supplied Flash Writer is intended for the EK-RZ/A3M only and cannot be used in other environments.

1.2 Application boot procedure

1.2.1 Boot Mode

In this document, **Boot Mode 7** (Booting from the 3.3-V Single or Quad serial NAND flash memory connected to the SPI multi I/O bus space) is used to boot from Serial NAND Flash (W25N01GVZEIG: 128MB, 3.3V, Winbond) on EK-RZ/A3M. After booting, it starts Loader Program stored in the Serial NAND Flash.

Serial NAND Flash may degrade due to frequent memory access, resulting in bad blocks that cannot be accessed correctly. To address this issue, MPU repeats the process of determining whether a user-written Loader Program has been successfully read from Serial NAND Flash and, if not, reading Loader Program written in the next block. Therefore, the same Loader Program must be written to the first four blocks of Serial NAND Flash in case of a read failure (Figure 1.1). If the first four blocks contain Bad Block, writing to that block is omitted (Figure 1.2). Note that the application image is always written from the fourth physical block.

For more information about the boot process, see **4. Boot Mode** of [RZ/A3M Group User's Manual: Hardware](#).

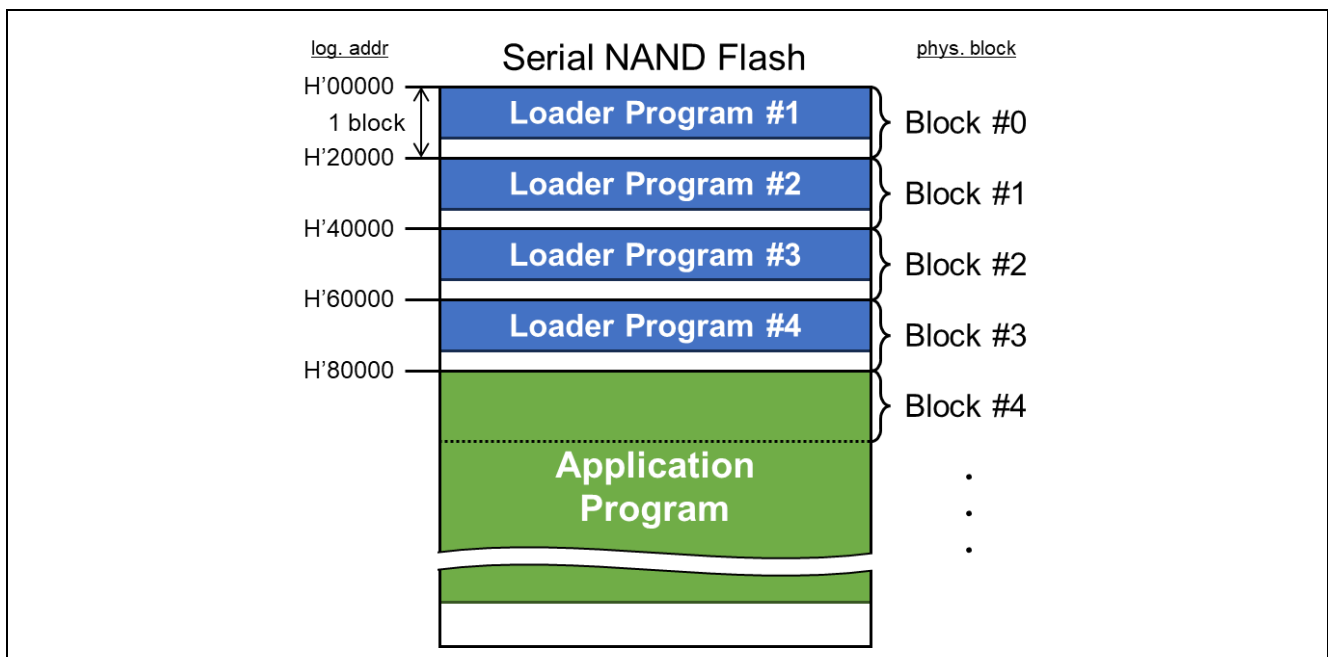


Figure 1.1 Conceptual diagram of Serial NAND Flash when there is no Bad Block in the first 4 blocks

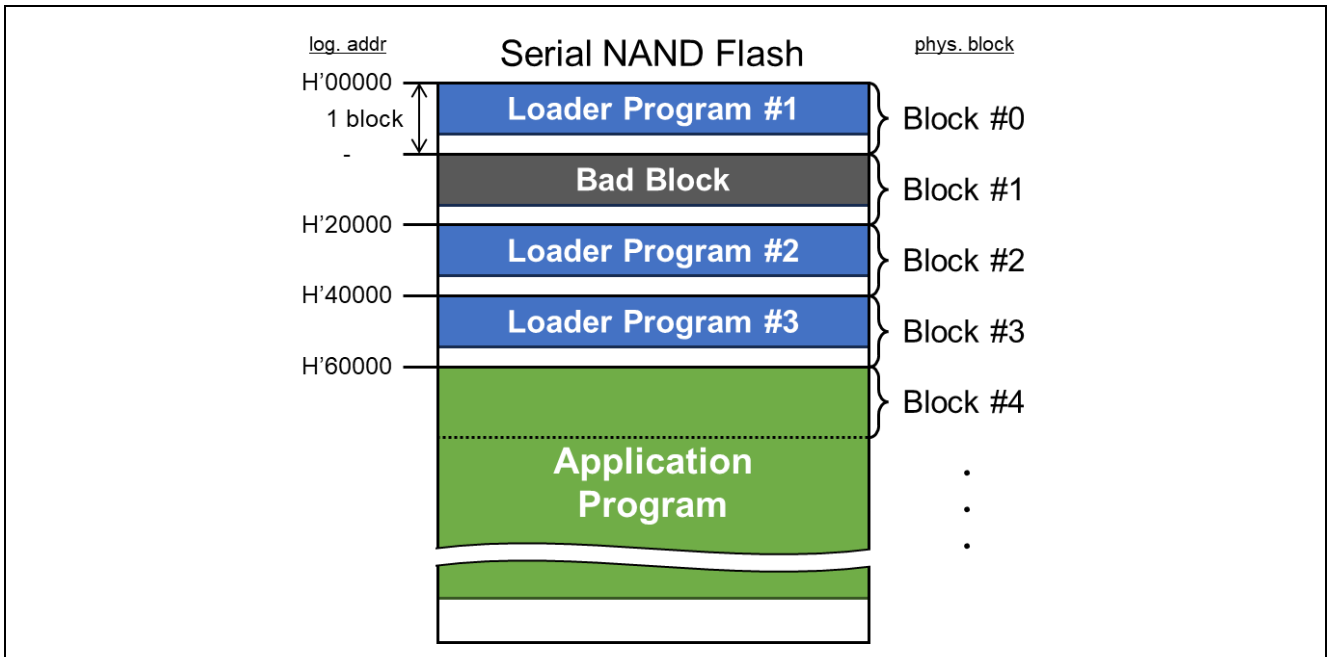


Figure 1.2 Conceptual diagram of Serial NAND Flash when there is one Bad Block in the first 4 blocks

1.2.2 Initial Program Loader

Initial Program Loader (IPL) is a Loader Program for running applications written to Serial Flash Memory. See [Initial Program Loader-Application Note](#) for more information.

2. Operating Environment

Table 2.1 shows the operating environment, and Table 2.2 shows the software deliverables included in this document.

Table 2.1 Operating Environment

Item	Contents
MPU	RZ/A3M
Target Board	EK-RZ/A3M (RTK9EKZA3MS10001B)
Serial NAND Flash	W25N01GVZEIG (128MB, 3.3V Winbond)
RZ/A Flexible Software Package (FSP)	V3.6.0 or later
Host PC	Windows10 (64bit) installed PC
Terminal Software	Tera Term v4.98 ^{Note1}

Note 1: Operation is not confirmed after v5.xx.

Table 2.2 Software Deliverables

Item	Contents	Note
Flash Writer	Flash_Writer_SCIF_EK_RZA3M.mot	Only for EK-RZ/A3M

3. How to use the Flash Writer

This chapter describes how to use Flash Writer and how to write Loader Program and any applications to Serial NAND Flash.

3.1 Preparing the Loader Program and the Application

An application to run can be created using RZ/A Flexible Software Package (FSP) version V3.6.0 or later. For more information, see [RZ/A Getting Started with Flexible Software Package](#). In this example, a Blinky Project will be created based on the introduction in this document.

1. Create a new project. Refer to **4.3 Creating a New Project for Blinky** of [RZ/A Getting Started with Flexible Software Package](#). In this case, select "EK-RZ/A3M NAND Boot (Exec with DDR SDRAM)" in Board selection window.

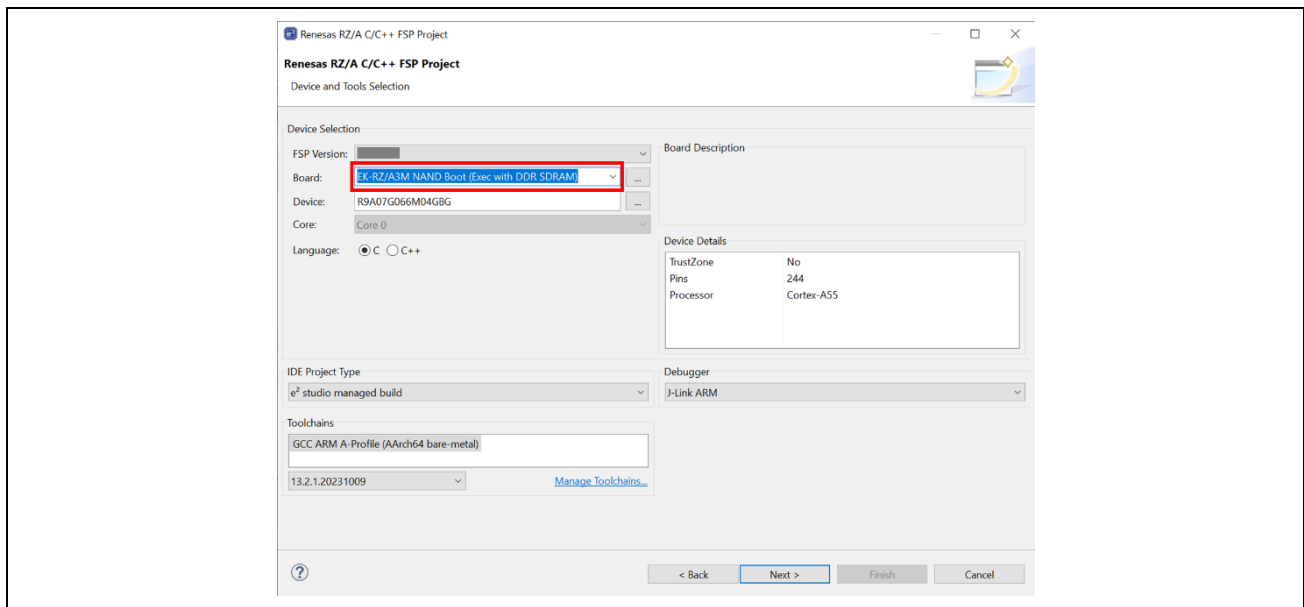


Figure 3.1 Board Selection

2. Build the project. See **4.4 Build the Blinky Project** of [RZ/A Getting Started with Flexible Software Package](#).
3. After the build is completed, confirm that files shown in Table 3.1 are generated.

Table 3.1 Generated Files

No.	Category	Location	File Name
1	Loader Program	(ProjectName)/ipl	rza3m_ek_nand_ipl_debug.srec
2	Loader Program	(ProjectName)/ipl	rza3m_ek_nand_ipl.srec
3	Application	(ProjectName)/Debug	(Project Name).srec

3.2 Launching the Flash Writer

- Set the SW4,5 of EK-RZ/A3M according to Figure 3.2. For more information about the switch settings, see **4.3.4 Board Configuration Switch Settings** of [EK-RZ/A3M User's Manual](#).
 - SW4-5: Select QSPI Flash (NOR or NAND) you want to use. Here, select "NAND".
 - SW5-1,5-2: Select Boot Mode. Here, select **Boot Mode 5** (Booting from SCIF download). Using **Boot Mode 5**, MPU is booted from programs downloaded through SCIF.

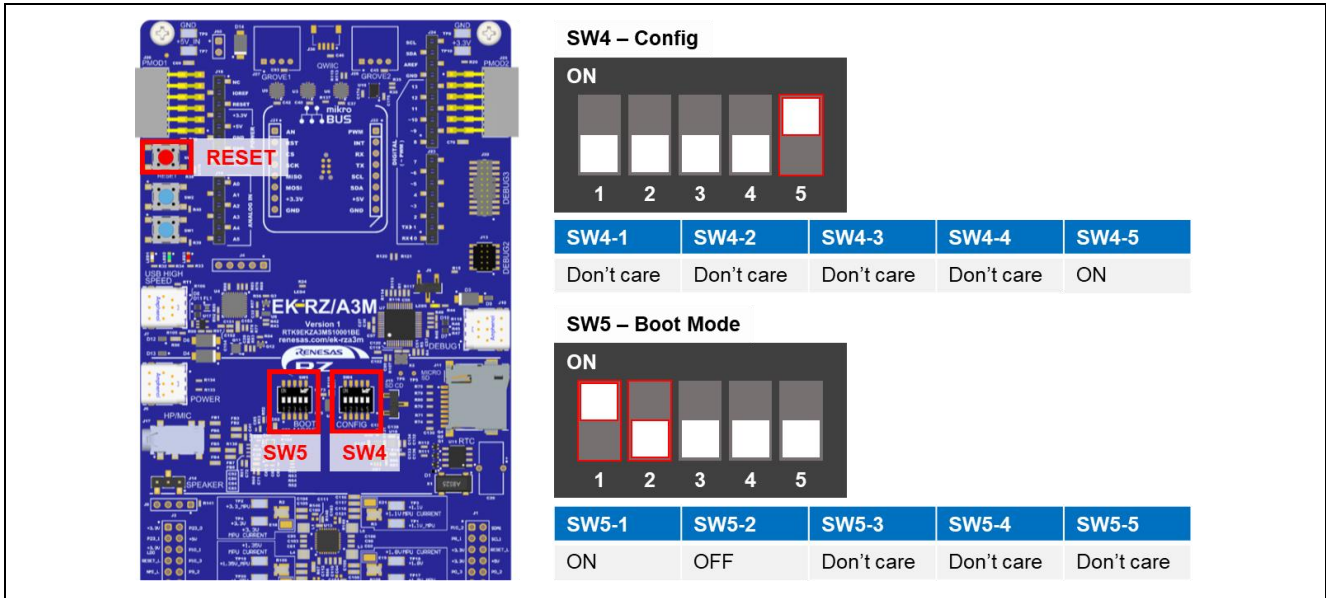


Figure 3.2 Setting of SW4,5

- Connect J10 and PC.

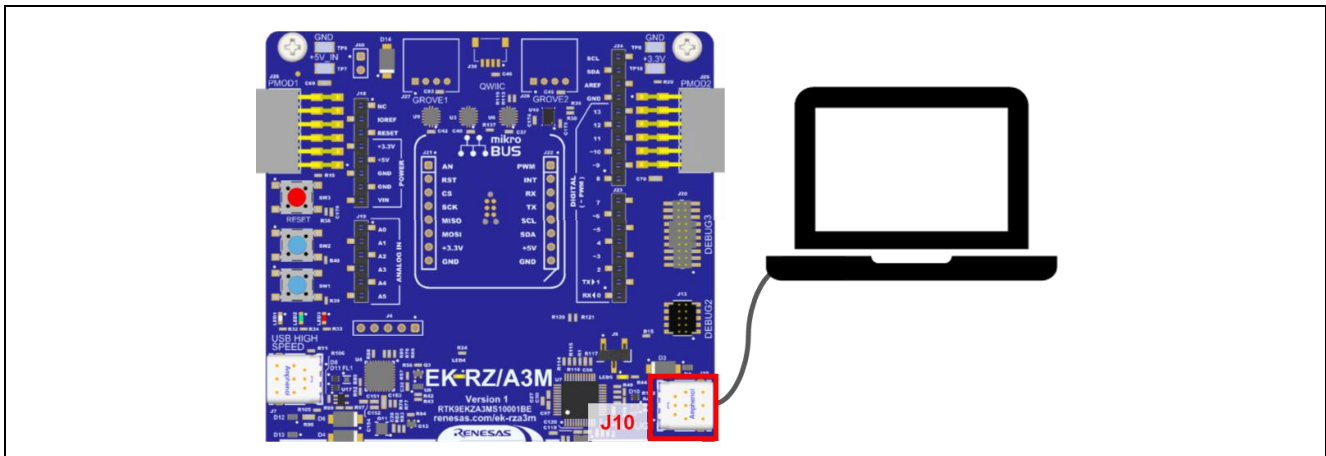


Figure 3.3 Connecting the Board to PC

- Check COM port number assigned to EK-RZ/A3M with the Device Manager and connect with Tera Term.

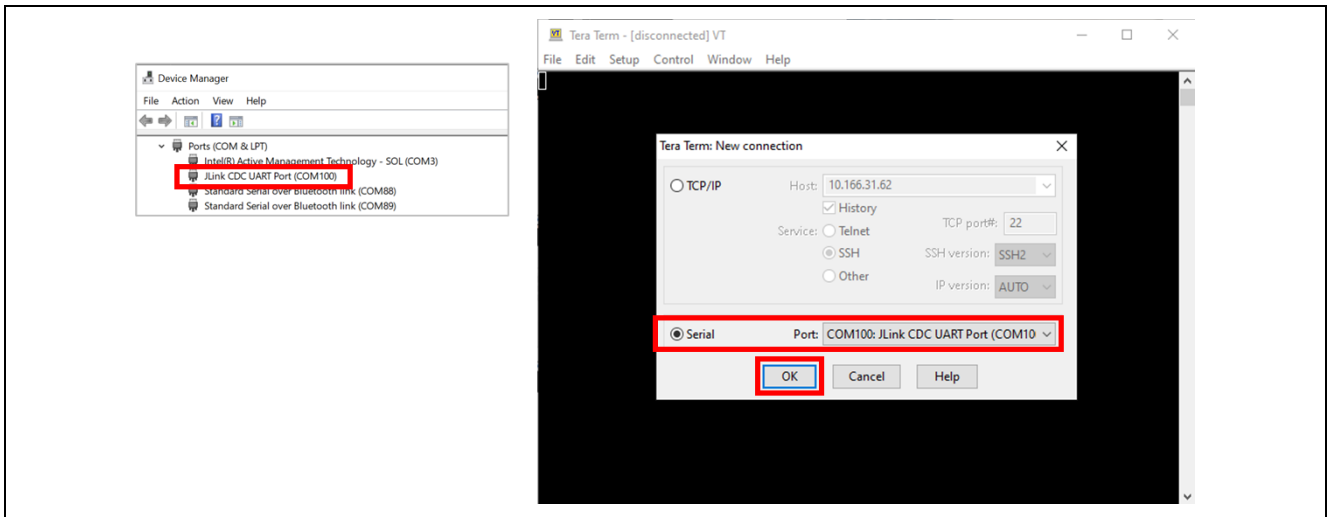


Figure 3.4 Serial connection of devices

- Set the serial port setting from [Setup]->[Serial port] according to Table 3.2.

Table 3.2 Communication Setting

Item	Value
Speed	115200
Data	8 bit
Parity	None
Stop bit	1 bit
Flow Control	None

- Set the terminal setting from [Setup]->[Terminal] according to Table 3.3.

Table 3.3 Terminal Setting

Item	Value
Line feed code-send	CR or CR+LF

- Pressing the reset button starts EK-RZ/A3M in SCIF Download Mode and outputs the console as shown in Figure 3.5.

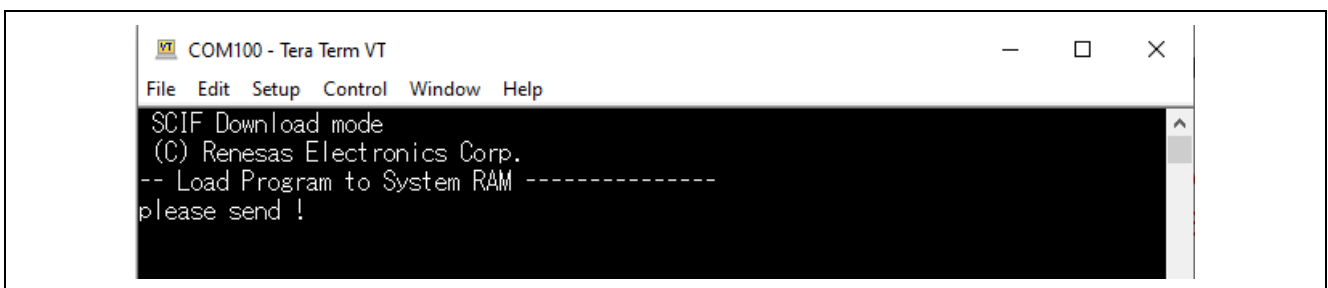


Figure 3.5 SCIF Download Mode

- When “**please send !**” is displayed on Tera Term, send the Flash Writer image. Drag and drop “**Flash_Writer_SCIF_EK_RZA3M.mot**” and press “OK” in the pop-up menu to start sending the file. When the transmission is completed, Flash Writer starts, and the console is output as shown in Figure 3.7.

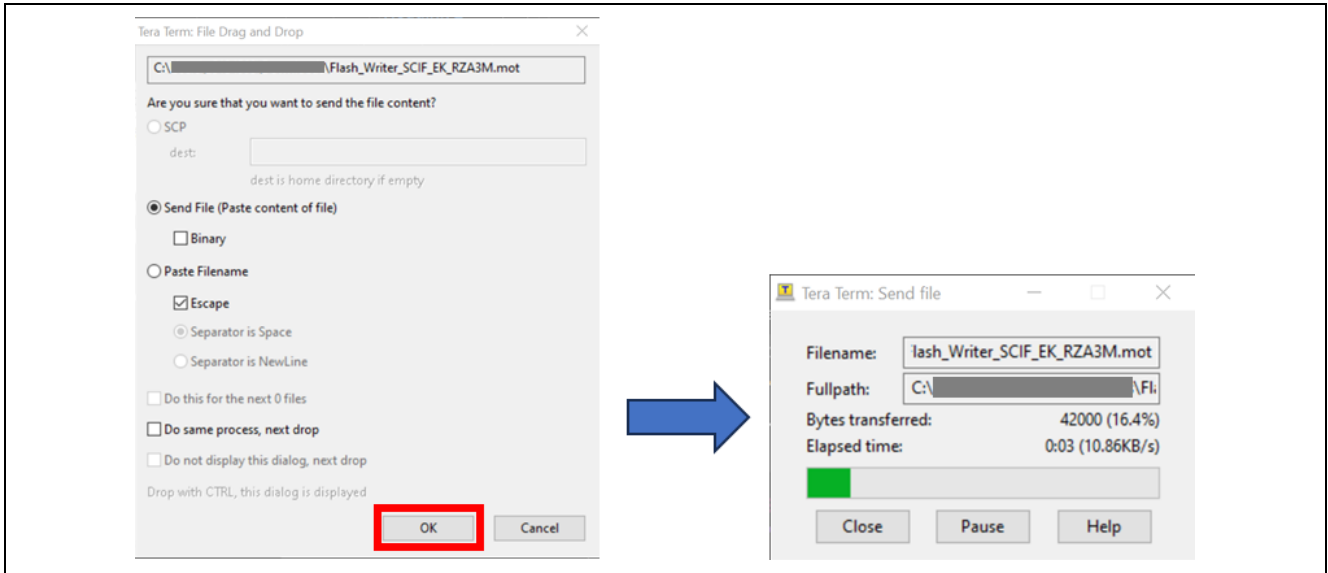


Figure 3.6 Sending the Flash Writer

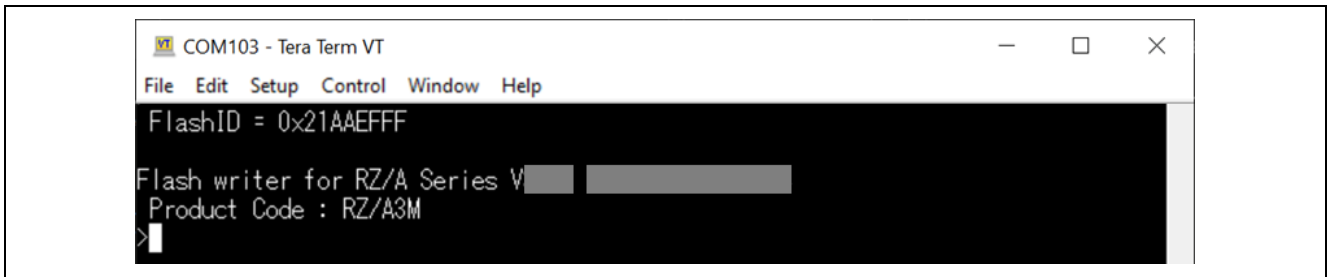


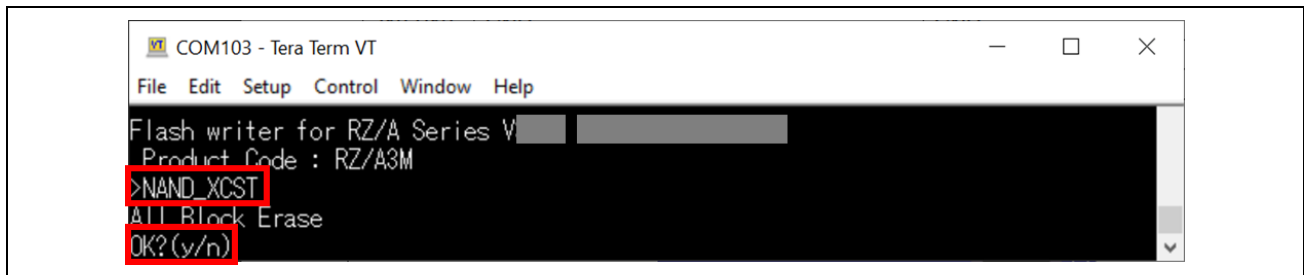
Figure 3.7 Launching the Flash Writer

3.3 Writing to the Serial NAND Flash

In the following, Flash Writer commands are used to erase and write data to Serial NAND Flash. Finally, Serial NAND Flash layout should match Figure 1.1 or Figure 1.2.

3.3.1 Preparation

1. Use the “**NAND_XCST**” command to perform a full erase of the data. After entering the command, type “**y**” to execute the full erase.

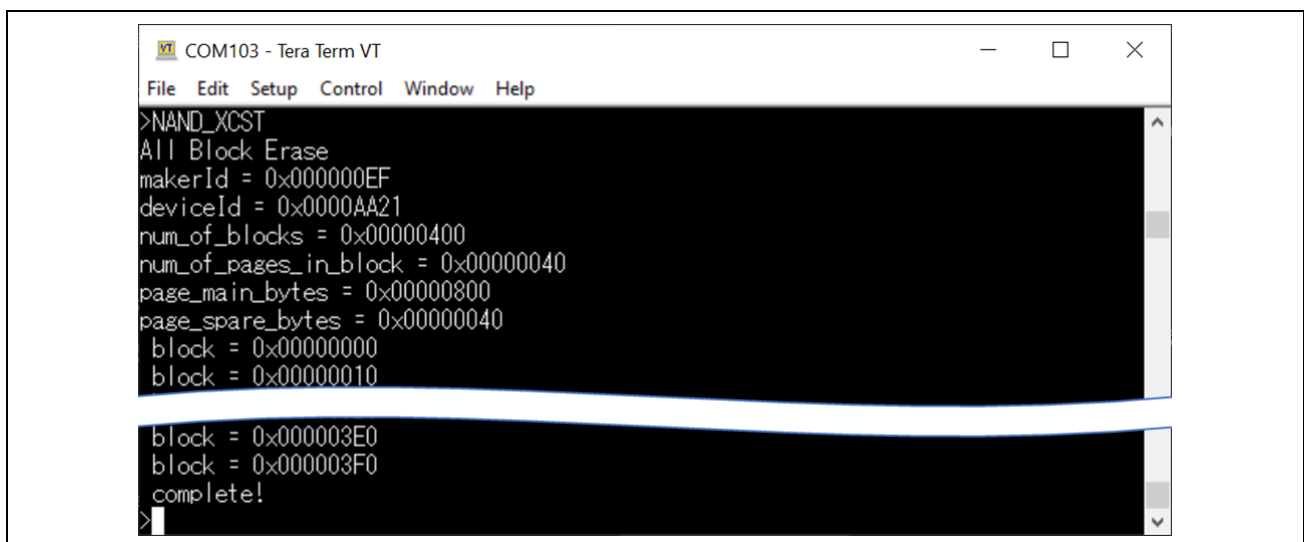


```

COM103 - Tera Term VT
File Edit Setup Control Window Help
Flash writer for RZ/A Series V
Product Code : RZ/A3M
>NAND_XCST
All Block Erase
OK? (y/n)

```

Figure 3.8 "NAND_XCST" command (1)



```

COM103 - Tera Term VT
File Edit Setup Control Window Help
>NAND_XCST
All Block Erase
makerId = 0x000000EF
deviceId = 0x0000AA21
num_of_blocks = 0x00000400
num_of_pages_in_block = 0x00000040
page_main_bytes = 0x00000800
page_spare_bytes = 0x00000040
block = 0x00000000
block = 0x00000010
block = 0x000003E0
block = 0x000003F0
complete!
>

```

Figure 3.9 "NAND_XCST" command (2)

2. Check the number of bad blocks contained in the first four blocks of the Serial NAND Flash. The number of bad blocks can be checked using the “**NAND_XIBB**” command. After entering the command, type “**y**” and the block number of bad blocks will be displayed. For example, if “**BAD BLOCK: block = 0x00000001**” is displayed, it means Block #1 is bad block. If there are bad blocks in the first four blocks, the following message will be shown. Note that bad blocks outside the first four blocks do not affect the subsequent procedures.
 - BAD BLOCK: block = 0x00000000 → Block #0 is Bad Block
 - BAD BLOCK: block = 0x00000001 → Block #1 is Bad Block
 - BAD BLOCK: block = 0x00000002 → Block #2 is Bad Block
 - BAD BLOCK: block = 0x00000003 → Block #3 is Bad Block

```

COM103 - Tera Term VT
File Edit Setup Control Window Help
>NAND_XIBB
spi_nand_Open/IsBadBlock/Close
OK?(y/n)

```

Figure 3.10 "NAND_XIBB" command (1)

```

COM103 - Tera Term VT
File Edit Setup Control Window Help
>NAND_XIBB
spi_nand_Open/IsBadBlock/Close
makerId = 0x000000EF
deviceId = 0x0000AA21
num_of_blocks = 0x00000400
num_of_pages_in_block = 0x00000040
page_main_bytes = 0x00000800
page_spare_bytes = 0x00000040
BAD BLOCK: block = 0x00000002
BAD BLOCK: block = 0x000002F8
BAD BLOCK: block = 0x000002FB
BAD BLOCK: block = 0x000002FE
BAD BLOCK: block = 0x00000301
complete!

```

Figure 3.11 "NAND_XIBB" command (2) - When block #2 is bad block

3. Enter the "sup" (speed up) command to increase the serial communication speed and reduce the time required for file transmission. When "Scif Speed UP" is displayed, click [Setup]->[Serial port] and change the Speed to [921600] on the Serial port setup window.

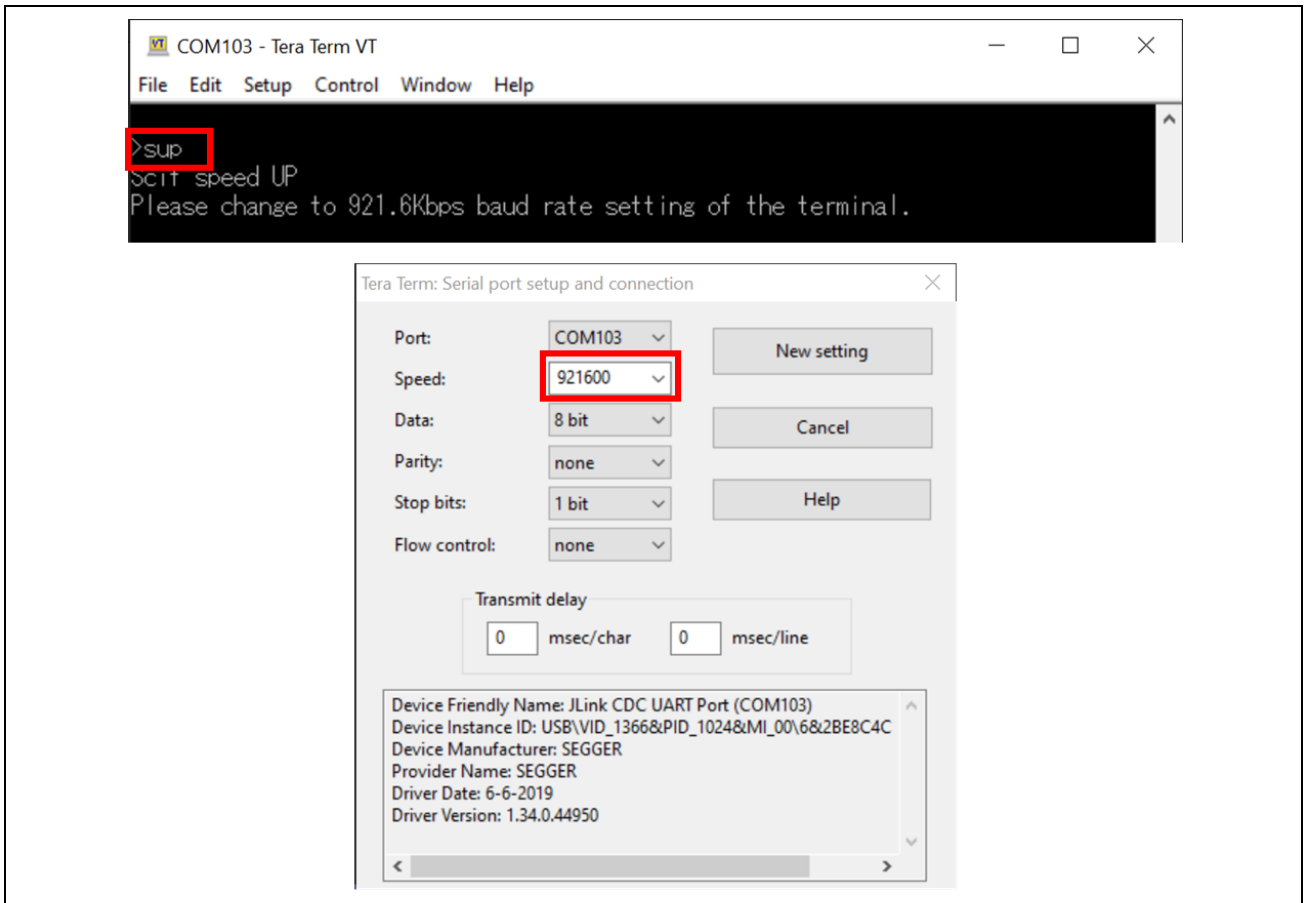


Figure 3.12 "sup" command

3.3.2 Writing the Loader Program

Here is the command sequence required to write the Loader Program to Serial NAND Flash. The “**Qspi Save Address**” varies depending on the number of times the Loader Program is written and the number of bad blocks contained in the first four blocks, since writing to any bad block is skipped. Refer to Table 3.4 through Table 3.8 and select the one corresponding to the number of bad blocks.

Then, select appropriate Loader Program for your purpose:

- rza3m_ek_nand_ipl_debug.srec
: If you aim to debug the application, choose this option. Once the Loader Program is written, see **4.5.3.1 Debug steps for Only init device mode** of [RZ/A Getting Started with Flexible Software Package](#) to debug the application.
- If you aim to just execute the application, choose this option. The application can be executed according to subsection 3.3.3 and section 3.4.

Table 3.4 "NAND_XLS2T" command - When there is no Bad Block in the first 4 blocks

Command Sequence	Command	Program Top Address	Qspi Save Address	Transmission file
1	NAND_XLS2T	H'20000000	H'00000	rza3m_ek_nand_ipl_debug.srec or rza3m_ek_nand_ipl.srec
2	Same as above	Same as above	H'20000	Same as above
3	Same as above	Same as above	H'40000	Same as above
4	Same as above	Same as above	H'60000	Same as above

Table 3.5 "NAND_XLS2T" command - When 1 Bad Block exists in the first 4 blocks

Command Sequence	Command	Program Top Address	Qspi Save Address	Transmission file
1	NAND_XLS2T	H'20000000	H'00000	rza3m_ek_nand_ipl_debug.srec or rza3m_ek_nand_ipl.srec
2	Same as above	Same as above	H'20000	Same as above
3	Same as above	Same as above	H'40000	Same as above

Table 3.6 "NAND_XLS2T" command - When 2 Bad Blocks exist in the first 4 blocks

Command Sequence	Command	Program Top Address	Qspi Save Address	Transmission file
1	NAND_XLS2T	H'20000000	H'00000	rza3m_ek_nand_ipl_debug.srec or rza3m_ek_nand_ipl.srec
2	Same as above	Same as above	H'20000	Same as above

Table 3.7 "NAND_XLS2T" command - When 3 Bad Blocks exist in the first four blocks

Command Sequence	Command	Program Top Address	Qspi Save Address	Transmission file
1	NAND_XLS2T	H'20000000	H'00000	rza3m_ek_nand_ipl_debug.srec or rza3m_ek_nand_ipl.srec

Here is an example of writing the Loader Program to Serial NAND Flash.

1. Execute the "NAND_XLS2T" command. Enter "y" for "OK? (y/n)".

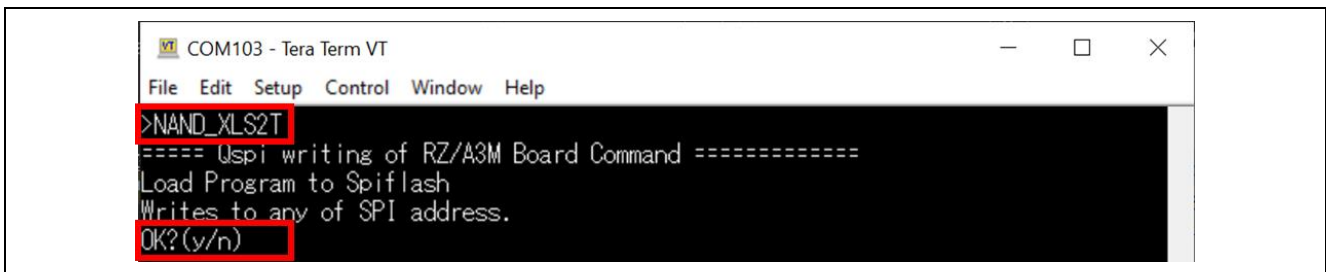


Figure 3.13 "NAND_XLS2T" command (1)

2. When "**Please Input Program Top Address**" is displayed on Tera Term, enter the value of Input Program Top Address described in Table 3.4 through Table 3.7, and press Enter.
3. When "**Please input Qspi Save Address**" is displayed on Tera Term, enter the value of Qspi Save Address described in Table 3.4 through Table 3.7, and press Enter.

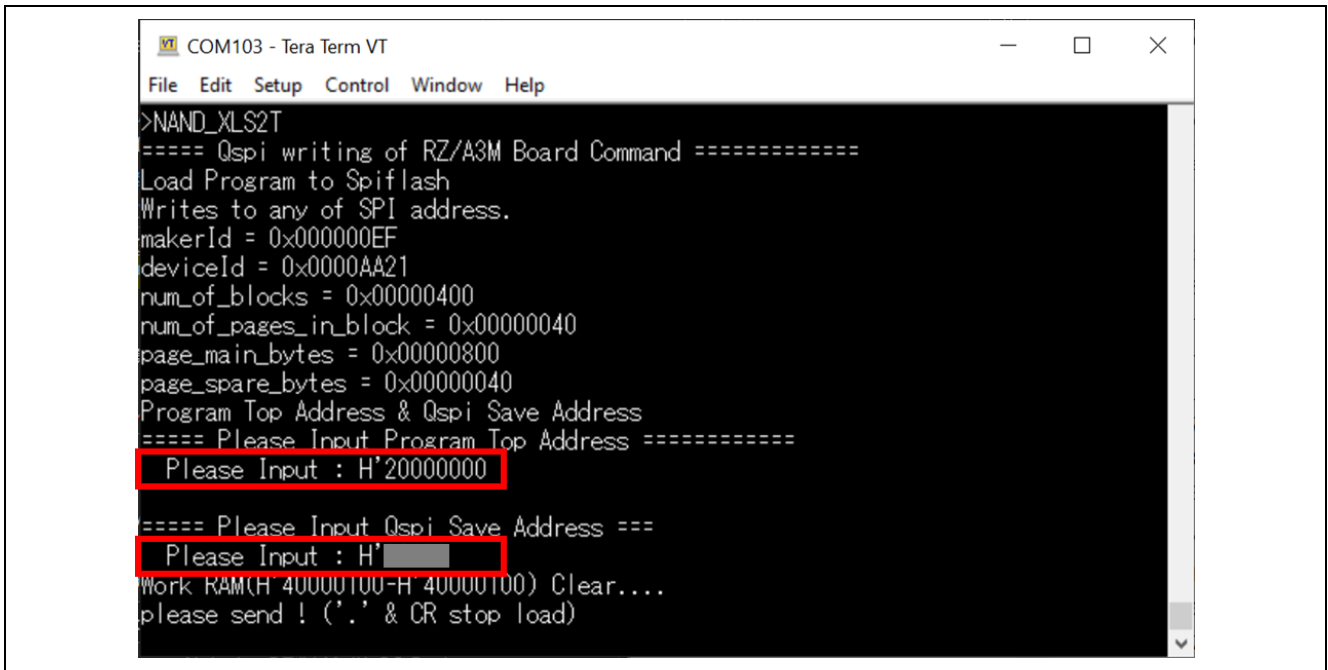


Figure 3.14 "NAND_XLS2T" command (2)

- When "please send !" is displayed on Tera Term, drag and drop the Loader Program image.

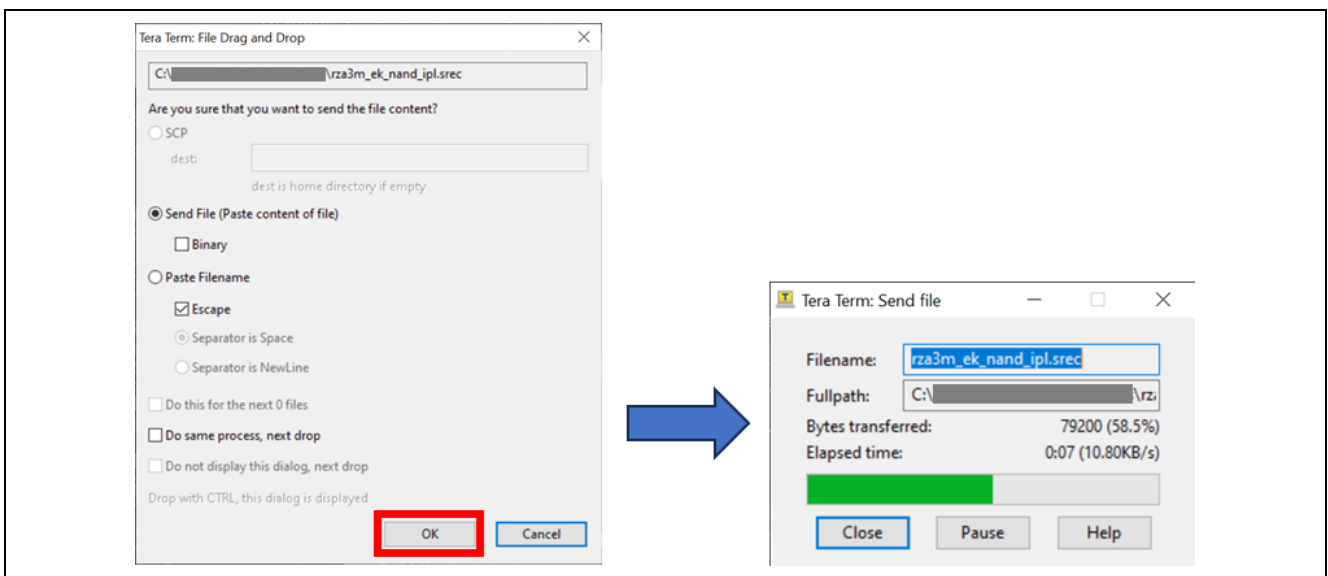


Figure 3.15 Sending the Loader Program

- Then, the Loader Program will be written to the Serial NAND Flash, and "complete!:spi_nand_Close" will be displayed on Tera Term.

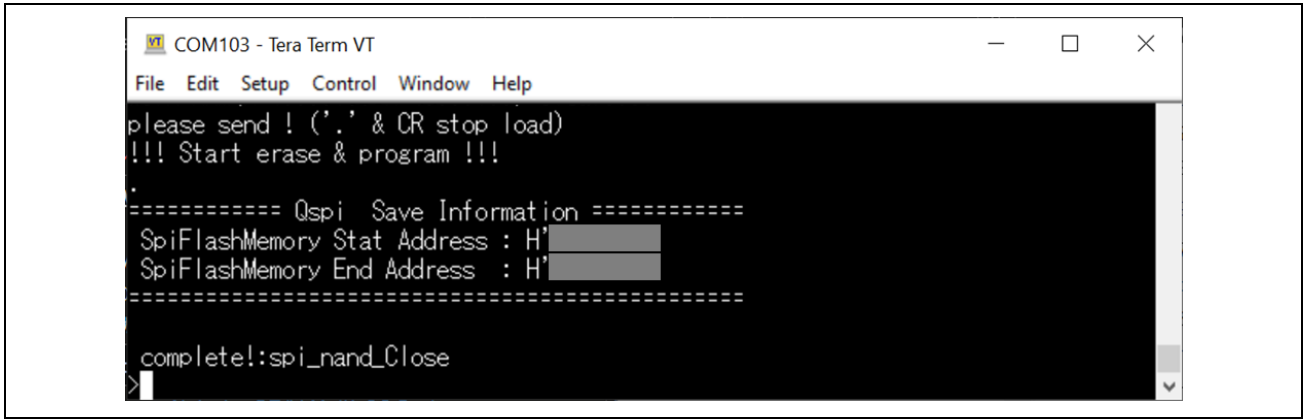


Figure 3.16 "NAND_XLS2T" command (3)

3.3.3 Writing the Applications

Here is the command required to write the application to Serial NAND Flash. The "Qspi Save Address" varies depending on the number of bad blocks contained in the first four blocks. Refer to Table 3.8 through Table 3.11 and select the one corresponding to the number of bad blocks.

If you select "rza3m_ek_nand_ipi_debug.srec" in the last subsection, you don't need to follow these procedures.

Table 3.8 "NAND_XLS2T" command - When there is no Bad Block in the first 4 blocks

Command Sequence	Command	Program Top Address	Qspi Save Address	Transmission file
1	NAND_XLS2T	H'20080000	H'80000	(Project name) srec

Table 3.9 "NAND_XLS2T" command - When 1 Bad Block exists in the first 4 blocks

Command Sequence	Command	Program Top Address	Qspi Save Address	Transmission file
1	NAND_XLS2T	H'20080000	H'60000	(Project name) srec

Table 3.10 "NAND_XLS2T" command - When 2 Bad Blocks exist in the first 4 blocks

Command Sequence	Command	Program Top Address	Qspi Save Address	Transmission file
1	NAND_XLS2T	H'20080000	H'40000	(Project name) srec

Table 3.11 "NAND_XLS2T" command - When 3 Bad Blocks exist in the first 4 blocks

Command Sequence	Command	Program Top Address	Qspi Save Address	Transmission file
1	NAND_XLS2T	H'20080000	H'20000	(Project name) srec

Here is an example of writing the IPL to NAND Flash.

1. Execute the "NAND_XLS2T" command. Enter "y" for "OK? (y/n)".

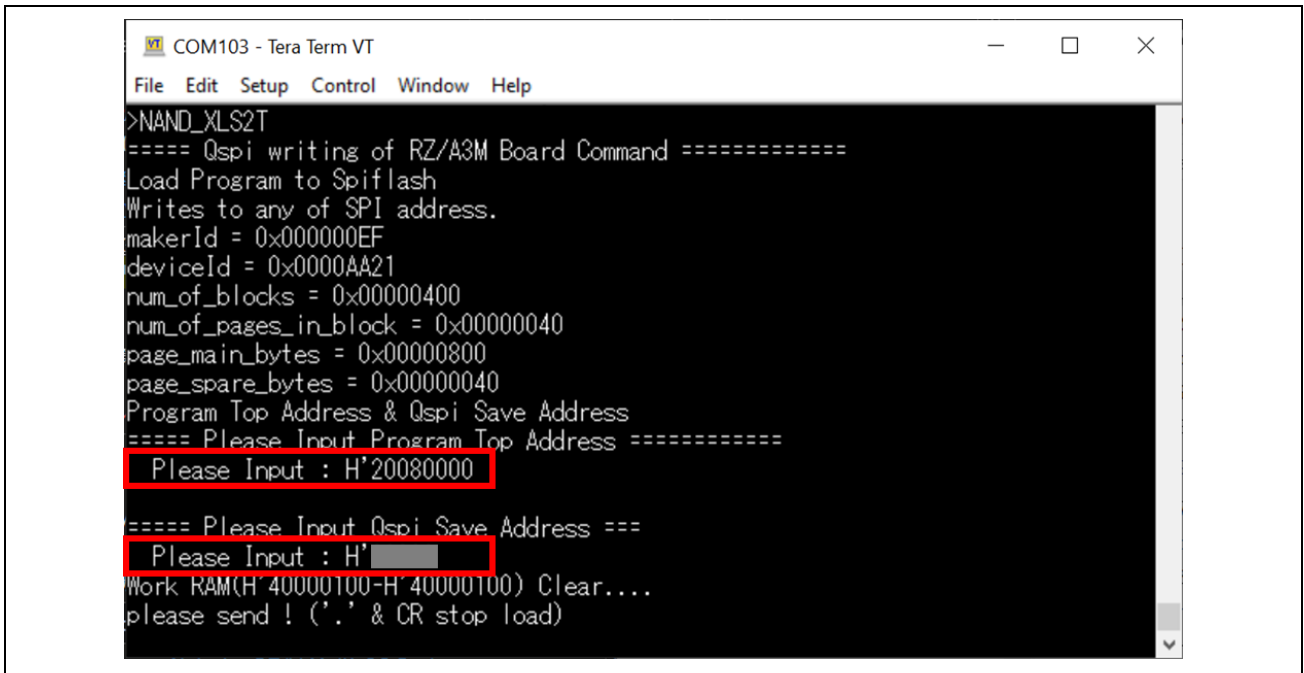


Figure 3.19 Command"NAND_XLS2T" (2)

4. When "please send !" is displayed on Tera Term, drag and drop "(Project name).srec".

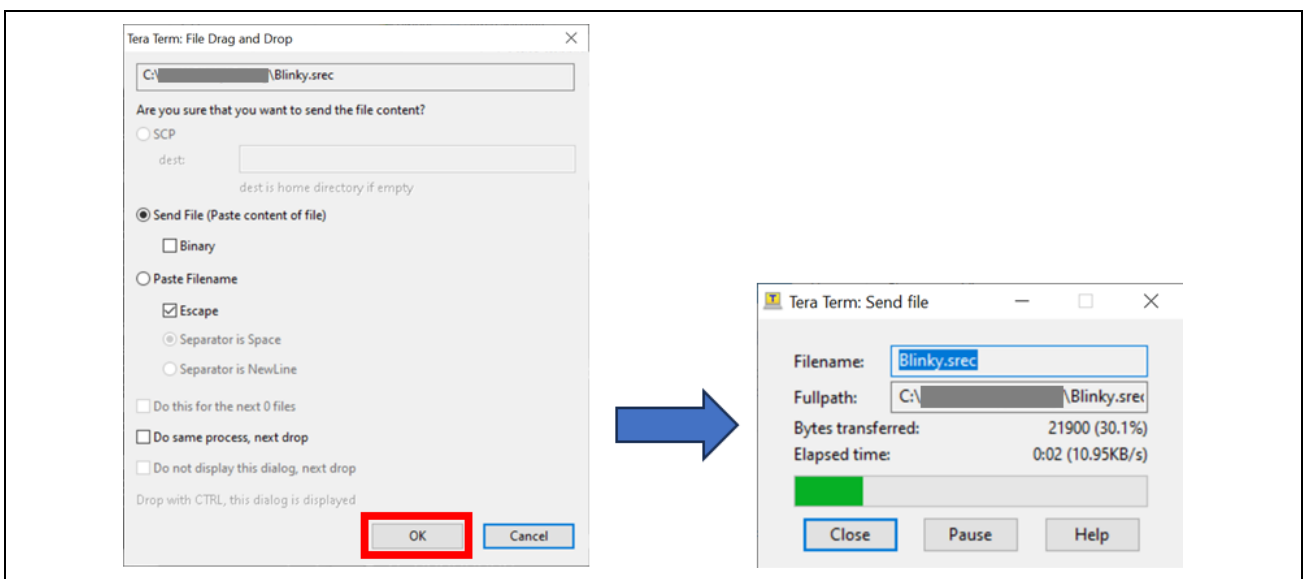


Figure 3.20 Sending the application

5. Then, the application will be written to the Serial NAND Flash, and "complete!:spi_nand_Close" will be displayed on Tera Term.

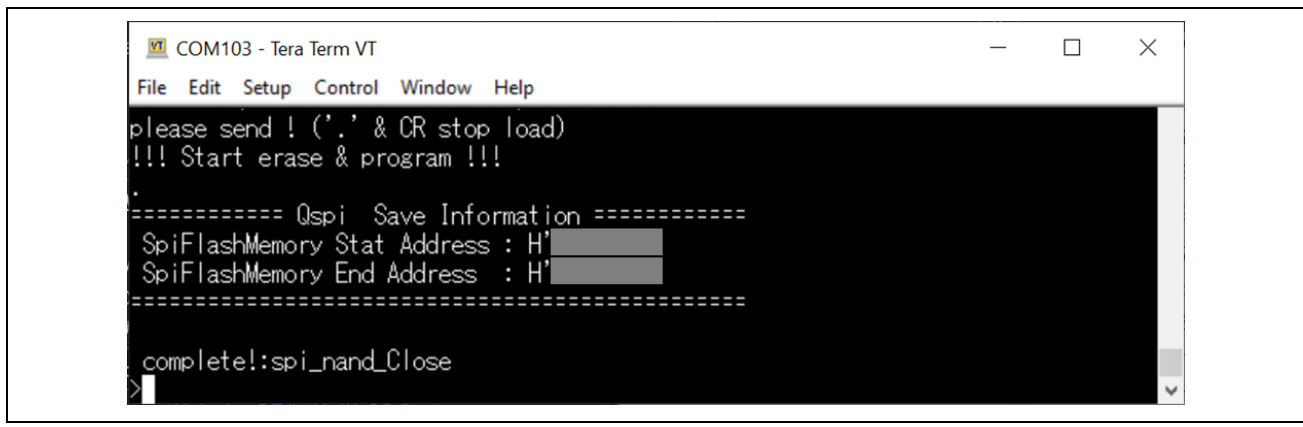


Figure 3.21 Command"NAND_XLS2T" (3)

3.4 Running the application

This section describes how to run the application in case "rza3m_ek_nand_ipl.srec" is selected in subsection 3.3.2.

1. Disconnect the power once and set the SW4,5 of EK-RZ/A3M as shown in Figure 3.22. For more information about the switch settings, see **4.3.4 Board Configuration Switch Settings** of [EK-RZ/A3M User's Manual](#).
 - SW4-5: Select QSPI Flash (NOR or NAND) you want to use. Here, select "NAND".
 - SW5-1,5-2: Select Boot Mode of MPU. Here, select **Boot Mode 7** (Booting from the 3.3-V Single or Quad serial NAND flash memory connected to the SPI multi I/O bus space).

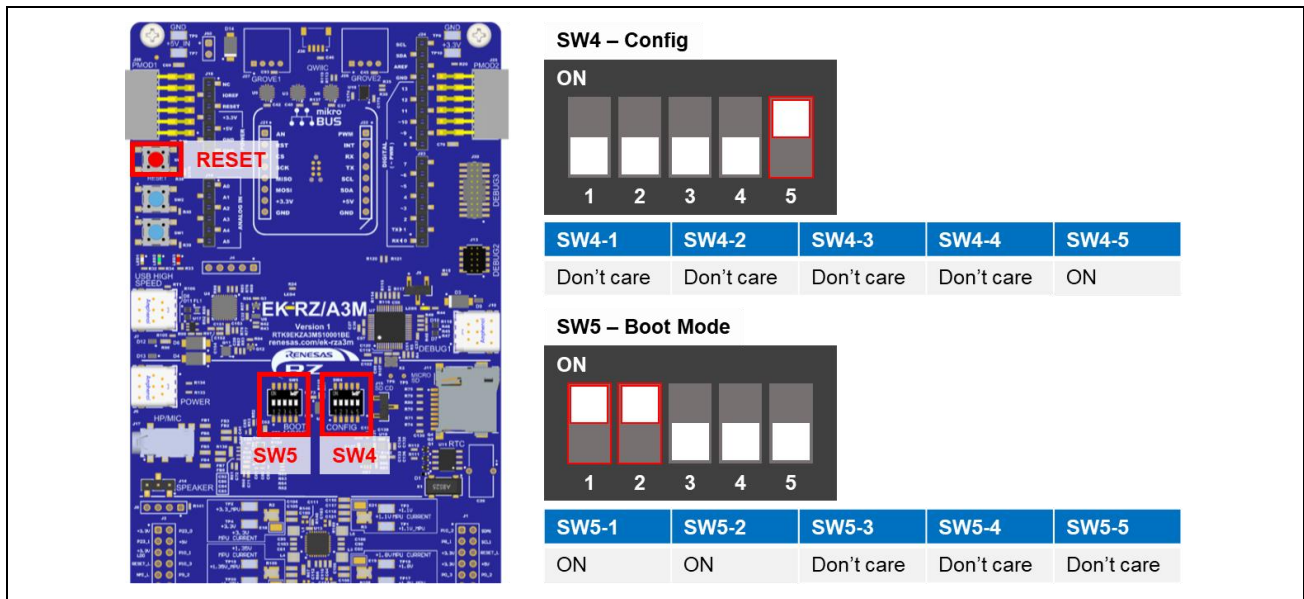


Figure 3.22 SW4,5 setting diagram

2. Turn on the power again.
3. Check that Tera Term communication/terminal settings are as shown in Table 3.2 and Table 3.3, and then press the RESET switch.
4. The application runs. When Blinky Project created in Section 3.1 is written, LED1 ~ 3 of EK-RZ/A3M blinks. (Figure 3.23)

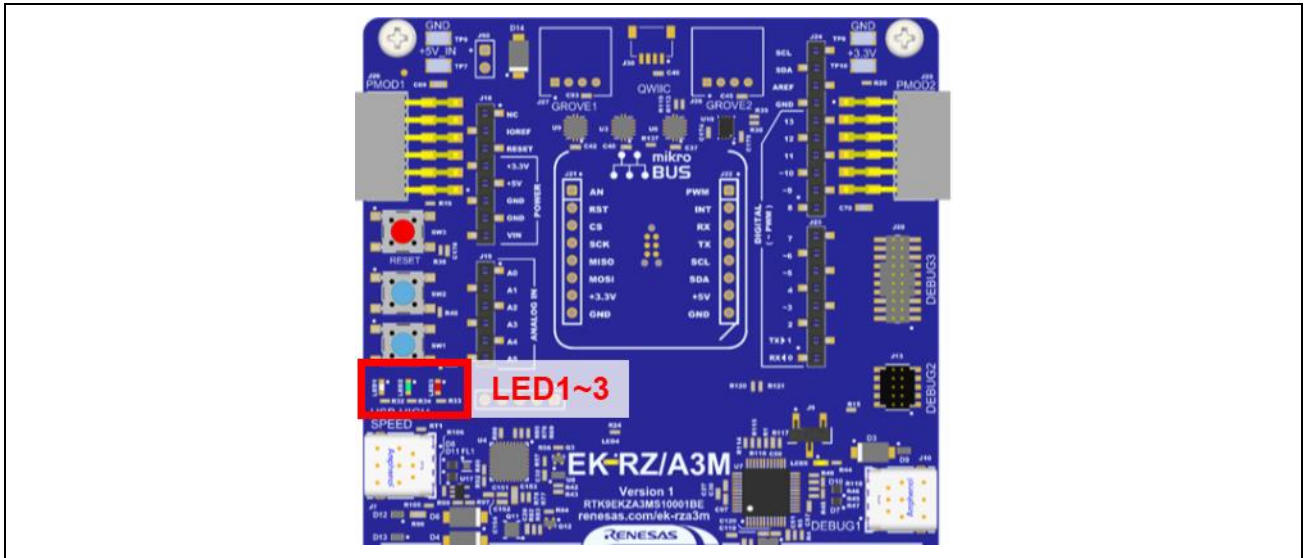


Figure 3.23 LED Blinking (Blinky Project)

3.5 Flash Writer Commands List

The commands available in Flash Writer are listed in Table 3.12.

Table 3.12 Flash Writer Commands

Number	Command	Function	Input
1	NAND_XDUMP	Dumps data in the specified area (block or page). The dumped data also includes the information written in the spare area.	Physical Block No : Specify the block number. Page Offset No : Specify the page number.
2	NAND_XIBB	Detects Bad Block in Serial NAND Flash.	None
3	NAND_XCST	Erase all Good Block in Serial NAND Flash.	None
4	NAND_XLS2T	Writes an image in S-record format.	Program Top Address : Specify the starting address of the program in srec file. Qspi Save Address : Specify the top address to write to.

4. References

- [RZ/A3M Group User's Manual: Hardware](#)
- [EK-RZ/A3M User's Manual](#)
- [Initial Program Loader - Application Note](#)
- [RZ/A Getting Started with Flexible Software Package](#)

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	2025.9.24	-	Initial Release
1.01	2025.11.28	-	Minor modification

General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Precaution against Electrostatic Discharge (ESD)

A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity.

Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.

2. Processing at power-on

The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power reaches the level at which resetting is specified.

3. Input of signal during power-off state

Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.

4. Handling of unused pins

Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.

5. Clock signals

After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.

6. Voltage application waveform at input pin

Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (Max.) and V_{IH} (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (Max.) and V_{IH} (Min.).

7. Prohibition of access to reserved addresses

Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.

8. Differences between products

Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

Notice

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