

RH850/U2B Group

Option Byte and Reset Vector Programming

Introduction

This document is intended to provide option bytes setting information to operate [RH850/U2B](#) group in user mode and how to program option bytes and reset vector.

The aim of this document and software is to provide supplemental information for the function of RH850/U2B. It is not intended to implement in the design for mass production.

There is no guarantee to update this document and software to reflect the latest manual, errata, technical update and development environment. You are fully responsible for the incorporation or any other use of the information in this document in the design of your product or system, and refer to the latest manual, errata, technical update and development environment.

The document is based on the Green Hills sample project for the “[dr7f70254x_p](#)” from the Green Hills MULTI Device-Support-Package (RH850/U2B GHS-DF-Package (V1.40_1)). This sample project can be directly used together with the RH850/U2B10 target board [Y-RH850-U2B10-TB-RAA271084](#).

Target Device:

- RH850/U2B Group

Target development environment:

Integrated development environment (**MULTI**) from **Green Hills** Software Corp:

- Product: IDE for V800, Version: 2024.1.4 (v 8.1.4)
- Target: V800/RH850
- Device file: [dr7f70254x_p.dvf \(or other U2B derivate\)](#)
- EXEC file: RH850G4 Executor V1.09.00.01 [22 Feb 2024]
- 850eserv2 Version: [V2.072\(x64\)](#)

Renesas Flash Programmer:

- Renesas Flash Programmer V3.20.00 ([Renesas Flash Programmer \(Programming GUI\) | Renesas](#))

Reference document:

- RH850/U2B Group User’s Manual: Hardware
- The Hardware User’s Manual provides information about functional and electrical behavior of the RH850/U2B.
- At the release time of this application note the following manual version is available: [RH850/U2B User’s Manual \(Rev.1.20\): R01UH0923EJ0120](#)

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1. Quick Start for GHS MULTI

This is a quick start guide in case you want to add the option byte configuration functionality with the `opbt_u2b.c` file to your project.

If you're using the sample project, the `opbt_u2b.c` file is already included, the necessary modifications to the linker description file and the options for the target board [Y-RH850-U2B10-TB-RAA271084](#) are already in place. In this case, you can skip steps 1–4.

1. Add "**opbt_u2b.c**" file to GHS project (the file can be found in the sample project) → (3)
2. Select product and set option bytes in "`opbt_u2b.c`" → (4)
3. In the GHS Multi build options (right click on *sources.gpj*) set the value of the "**Special Data Area**" option to "**No Special Data Area**" (or modify the "*sources.gpj*" file directly "**-nothreshold**") → (5.1)
4. Modify the linker file → (5.2)
5. Type the command "**target FLASHEXTRA config1 on**" command in the MULTI debugger command pane to enable the "Configuration Setting Area" → (6)
6. Compile and download

2. About Option Bytes and Reset Vector

Option bytes can be used to set a static configuration for the RH850/U2B behavior. This is the same for the reset vector. All can be programmed to a special part of the flash memory.

The main part of this project is one C-source code file including all user modifiable bit definitions of the option bytes and reset vector.

A minor **modification** must be made to the **linker file** to place the data at a certain address.

3. Where to Set Option Bytes and Reset Vector

The C-source code file is included in this working project and can be found here:

```
\src\ opbt_u2b.c
```

The generated constant data can be used to download it together with the code in a debugger to RH850/U2B. It can also be used to create a hex file, which can be programmed to the special flash area via an external programmer like the E2 Programmer with "Renesas Flash Programmer (RFP)" or the PG-FP6 programmer.

A constant array "**R_opbt[64]**" starting with the reset vector and followed by all option bytes is defined and declared. The array has a size of 64 words (32-Bit) or 256 bytes.

Note:

In the RH850/U2B series, the option byte setting values are different for each product, so please set the corresponding value. For the details of option bytes, please refer to the RH850/U2B Hardware User's Manual.

4. How to Set Option Bytes

To select the right product, you may just select the necessary definition by commenting/un-commenting the pre-defined definitions. So, for all available configurations, the default option bytes are defined as 32-bit hexadecimal values within the C-source file.

The default bit-values within this file are defined for RH850/U2B10 in **performance configuration** without **GTM support**.

If another RH850/U2B variant is needed, the bit-definitions must be adapted manually.

The configurations of the option bytes can either be set by 32-bit hexadecimal values

```
e.g. define R_U2B_OPBTn 0x...
```

or by bit-values, which are described in detail in the device hardware user's manual.

The selection of using either the default 32-bit hexadecimal values or the individual bit-definitions can be made by

- `#define R_OPBT_USES_BITS` or
- `#define R_OPBT_USES_HEX`

The default 32-bit hexadecimal values are defined depending on the product (R_OPBT_U2B24/20/10/6 (FCC)):

- #define R_OPBT_U2B24 or
- #define R_OPBT_U2B20 or
- #define R_OPBT_U2B10 or
- #define R_OPBT_U2B6

Performance or safety CPU configuration:

- #define R_OPBT_G4MH_PERFORMANCE or
- #define R_OPBT_G4MH_SAFETY

GTM support or GTM unsupported:

- #define R_OPBT_GTM_SUPPORT or
- #define R_OPBT_GTM_NOT_SUPPORTED

5. How to Build the Project

5.1 Set Build Options

The file opbt_u2b.c should be compiled with option "**-nothreshold**". The constant data in this file does not need any memory model, as it is not used by the CPU.

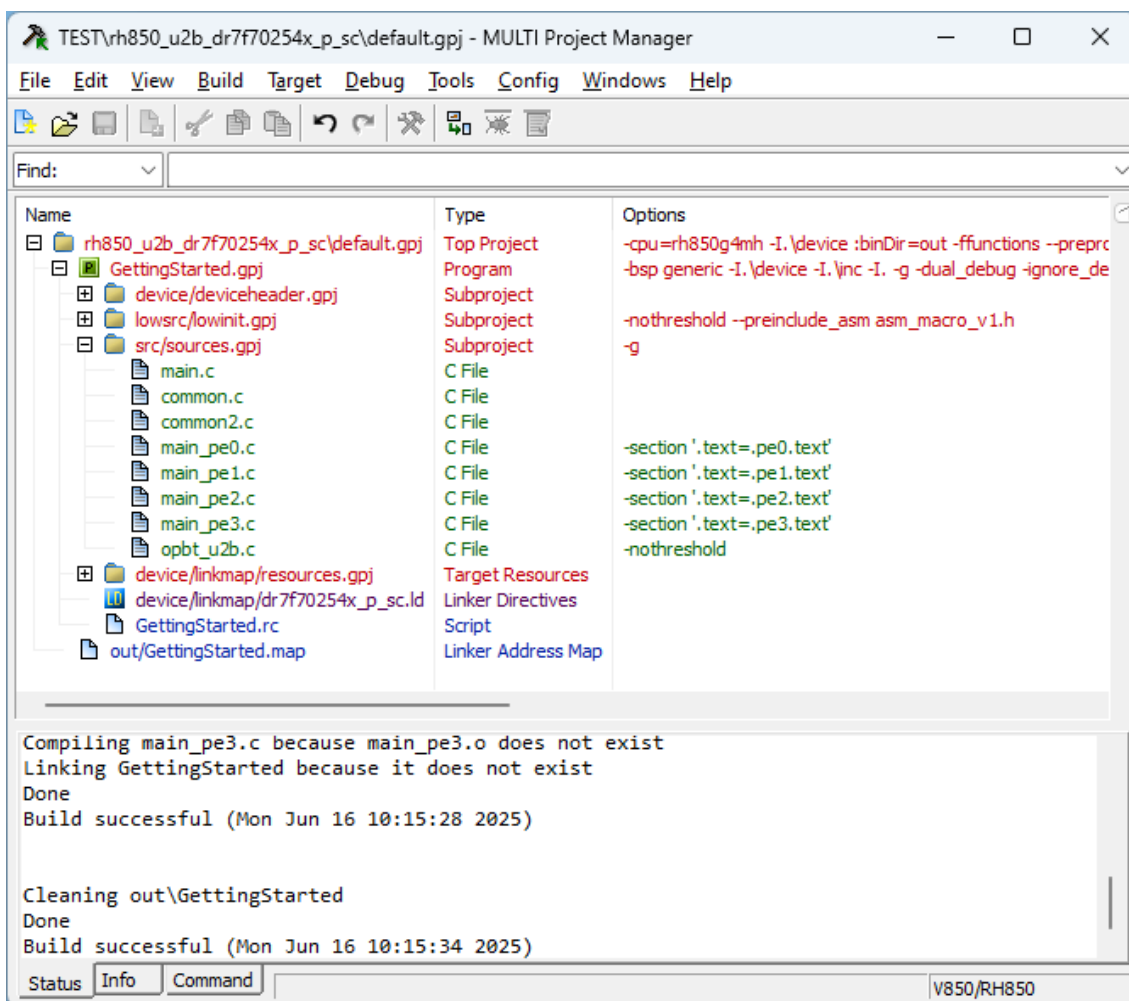


Figure 1: GHS MULTI - Sample project overview

The options can be set via right click on the sources.gpj file and select "Set Build Options..."

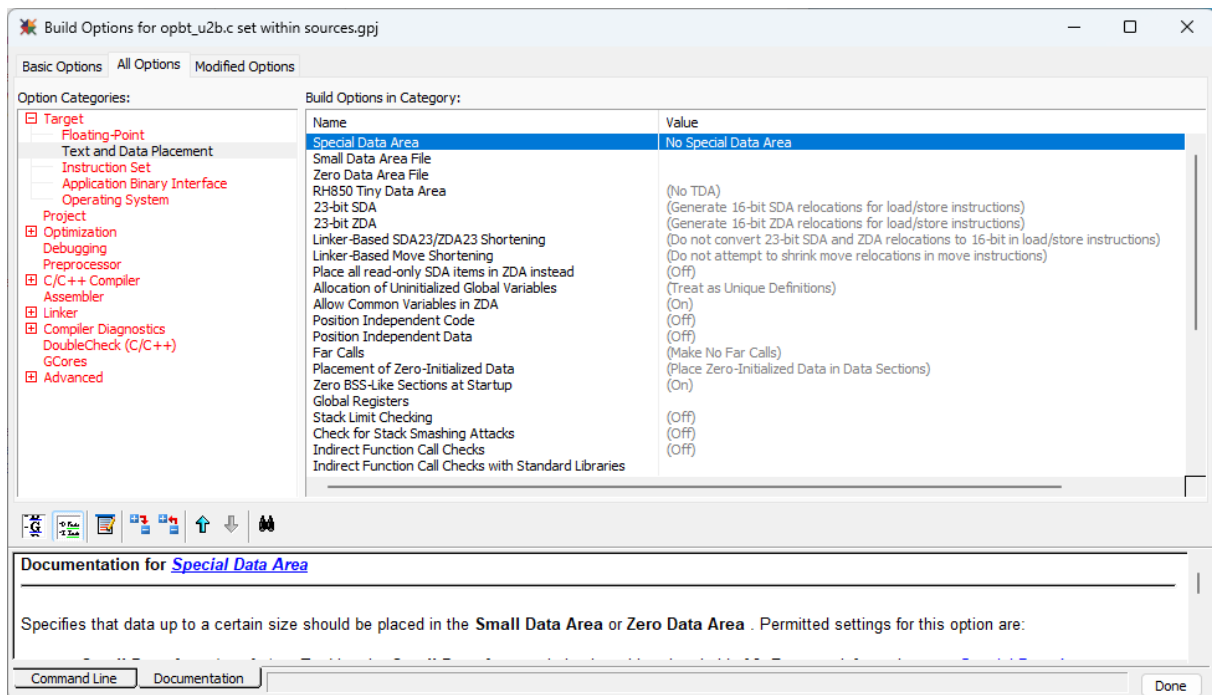


Figure 2: GHS MULTI | build options from "sources.gpj"

Or directly in the "sources.gpj" File:

```

#!gbuild
[Subproject]
    -g
main.c
common.c
common2.c
main_pe0.c
    -section ".text"=".pe0.text"
main_pe1.c
    -section ".text"=".pe1.text"
main_pe2.c
    -section ".text"=".pe2.text"
main_pe3.c
    -section ".text"=".pe3.text"
opbt_u2b.c
    -nothreshold
  
```

Figure 3: Raw data of "sources.gpj" file

5.2 Linker File Modification

This array is placed by the linker into the **section ".OPBT"**. This linker section must be included in the linker file. It must point to the "Configuration Setting Area" beginning at address 0xFF321380. This address is the inactive / backside area of configuration data. The "Configuration Setting Area" is a shadow area of the active / frontside area. The active / frontside area is located at different addresses and cannot be changed directly. Only the inactive / backside area can be changed. It is used after the next reset.

Mandatory Linker File modification:

```

CONSTANTS
{ ...
OPTBYTE_START = 0xFF321380
OPTBYTE_SIZE = 256
...
}
MEMORY
{ ...
OPTBYTE : ORIGIN = OPTBYTE_START, LENGTH = OPTBYTE_SIZE
...
}
SECTIONS
{ ...
.OPBT align(4) :> OPTBYTE
...

```

Figure 4: mandatory additions in Linker File

6. How to Write Option Bytes to U2B with “Green Hills MULTI”

By default, writing to the configuration area (reset vector and option bytes) is disabled. You should enable the writing by executing the following command prior to the download of any code or data to the RH850/U2B. The command may be placed within a debugger script file or input at the cmd tab of MULTI window

target FLASHEXTRA config1 on

Execute the following command on the cmd tab of MULTI window to check if writing to the configuration area is enabled.

target FLASHEXTRA

Above command outputs a list of flash areas. It shows whether the config settings area 1 is enabled.

After executing the download to RH850/U2B in the debugger, the option bytes and reset vector are written to the "Configuration Setting Area" in the flash memory.

After a RH850/U2B reset, the new configuration becomes active.

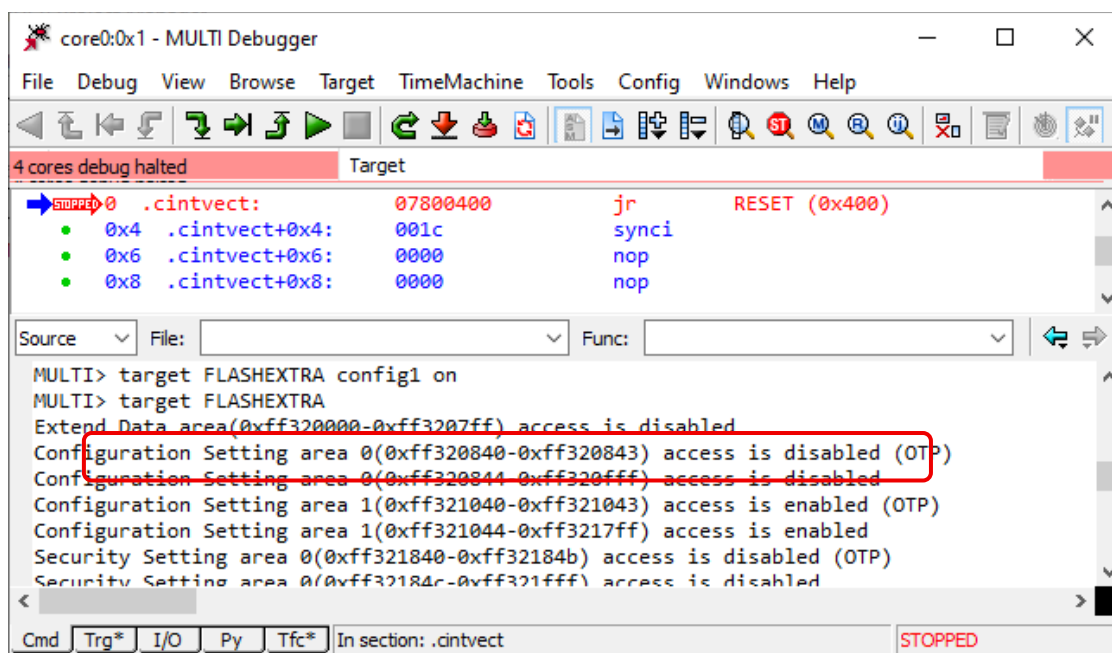


Figure 5: Successful enabled configuration settings area

7. How to write Option Bytes to RH850/U2B with “Renesas Flash Programmer”

Any external programmer, that is suitable for re-programming the internal flash of RH850/U2B, may also be used to program the new option bytes and reset vector. Renesas offers the free-of-charge "Renesas Flash Programmer (RFP)" GUI to be used with E2 Programmer or the stand-alone programmer PG-FP6.

7.1 Ready to use RFP-Project for U2B10 Target Board

The sample project also includes a folder named “RFP_Project” where you can find a ready-to-use RFP-Project for the [Y-RH850-U2B10-TB-RAA271084](#) target board capable of writing the option bytes and the reset vector.

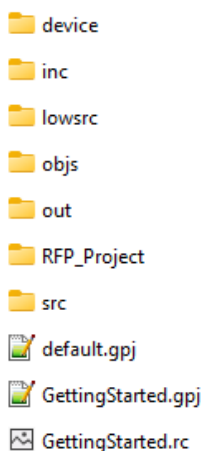


Figure 6: RFP project folder location

1. Start the Renesas Flash Programmer ([Renesas Flash Programmer \(Programming GUI\) | Renesas](#))
2. Open “U2B10_ConfigurationAreaSettings.rpj” with the Renesas Flash Programmer

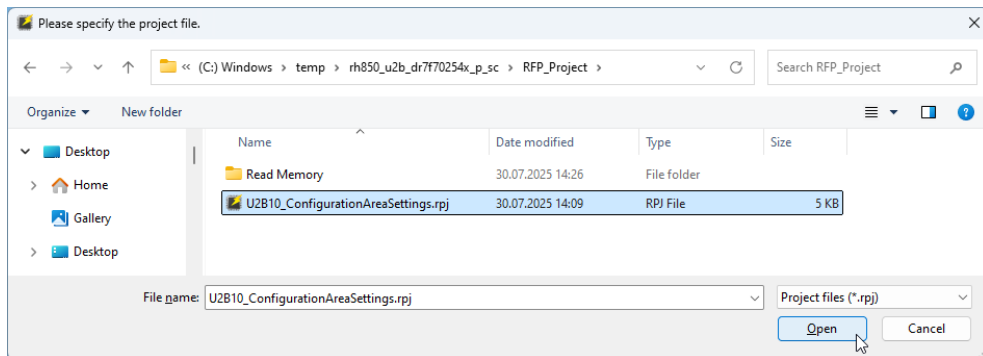


Figure 7: RFP-Project opening

3. Click on the “Start” button to execute the operation.

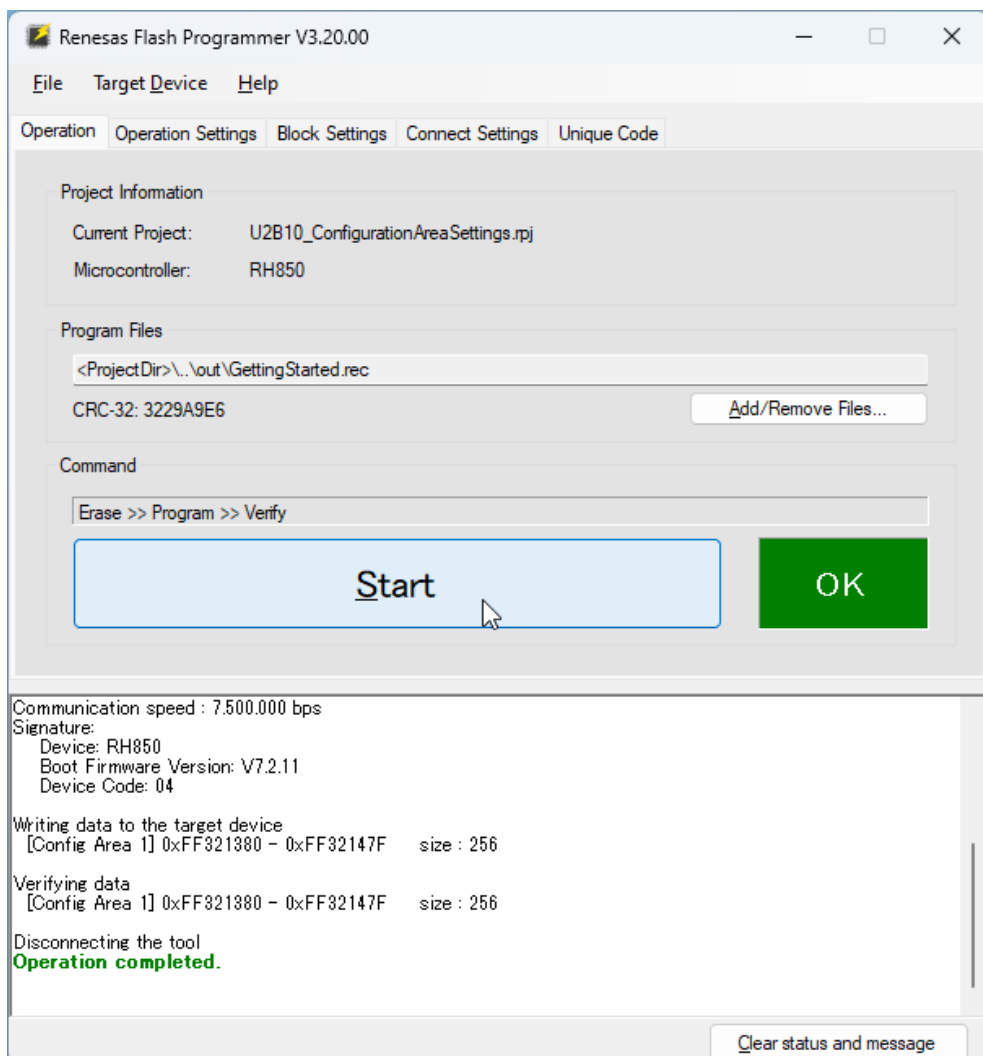


Figure 8: Operation execution (ready to use RFP-Project)

Now the configuration area should be written to the RH850/U2B.

7.2 Creating a New RFP-Project

In case another RH850/U2B from the RH850/U2B group is used other than the RH850/U2B10 included in the [Y-RH850-U2B10-TB-RAA271084](#) target board follow the steps below to create a new RFP-Project.

1. Start the Renesas Flash Programmer ([Renesas Flash Programmer \(Programming GUI\) | Renesas](#))
2. Left-Click on “File” and “New Project...”

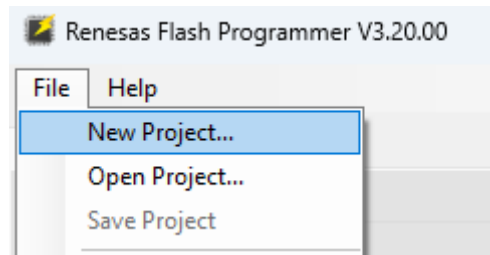


Figure 9: Creating a new RFP project

3. Select “RH850/U2x” in the “Microcontroller” drop-down-menu, choose a “project name” and “Project Folder” and click on “Connect”

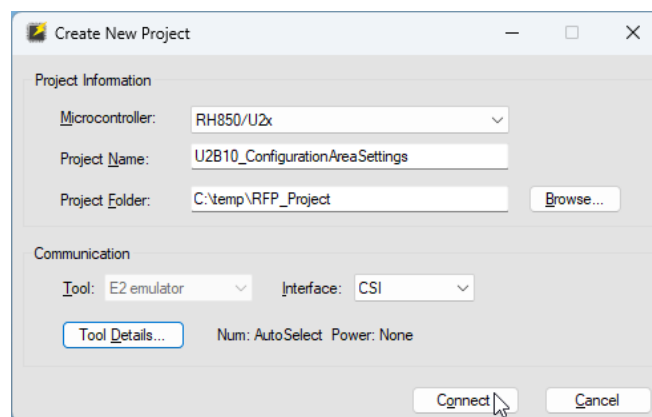


Figure 10: Configuration of a new RFP project

If the RH850/U2B uses the 3.3V or 5.0V from the E2 emulator configurations can be set under “Tool Details...”

4. Click on the “OK” button for the authentication code.

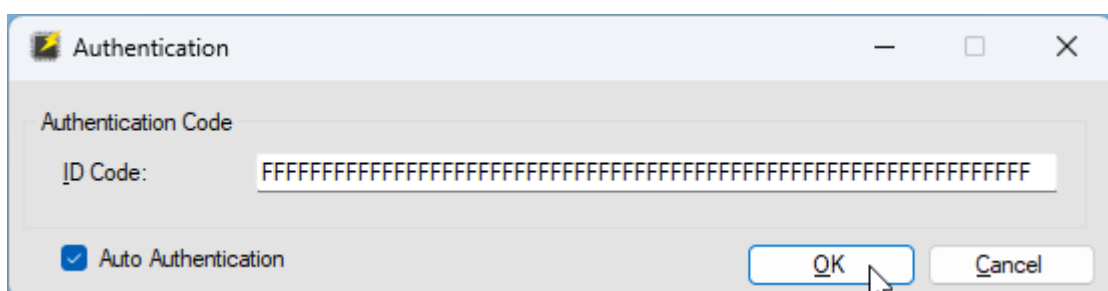


Figure 11: Authentication setting window

- Set the main clock and click on the “OK” button

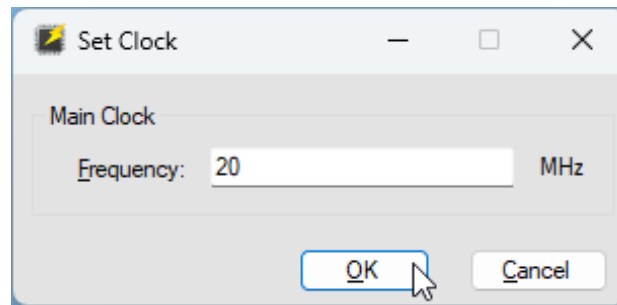


Figure 12: Main clock setting

- Click on “Add/Remove files...” to add a program file.

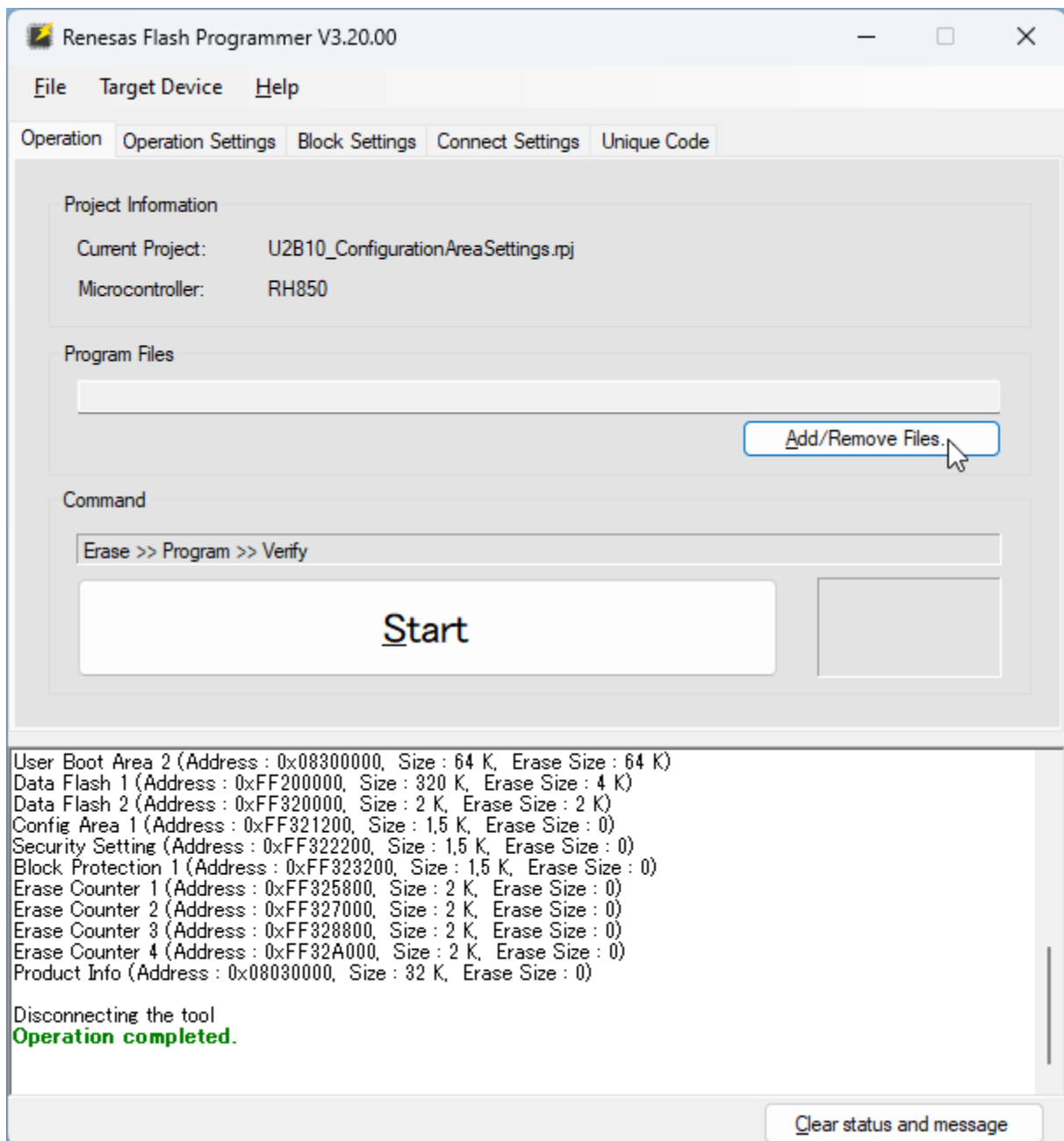


Figure 13: Add a program file

7. Select a suitable file which includes the configuration area settings

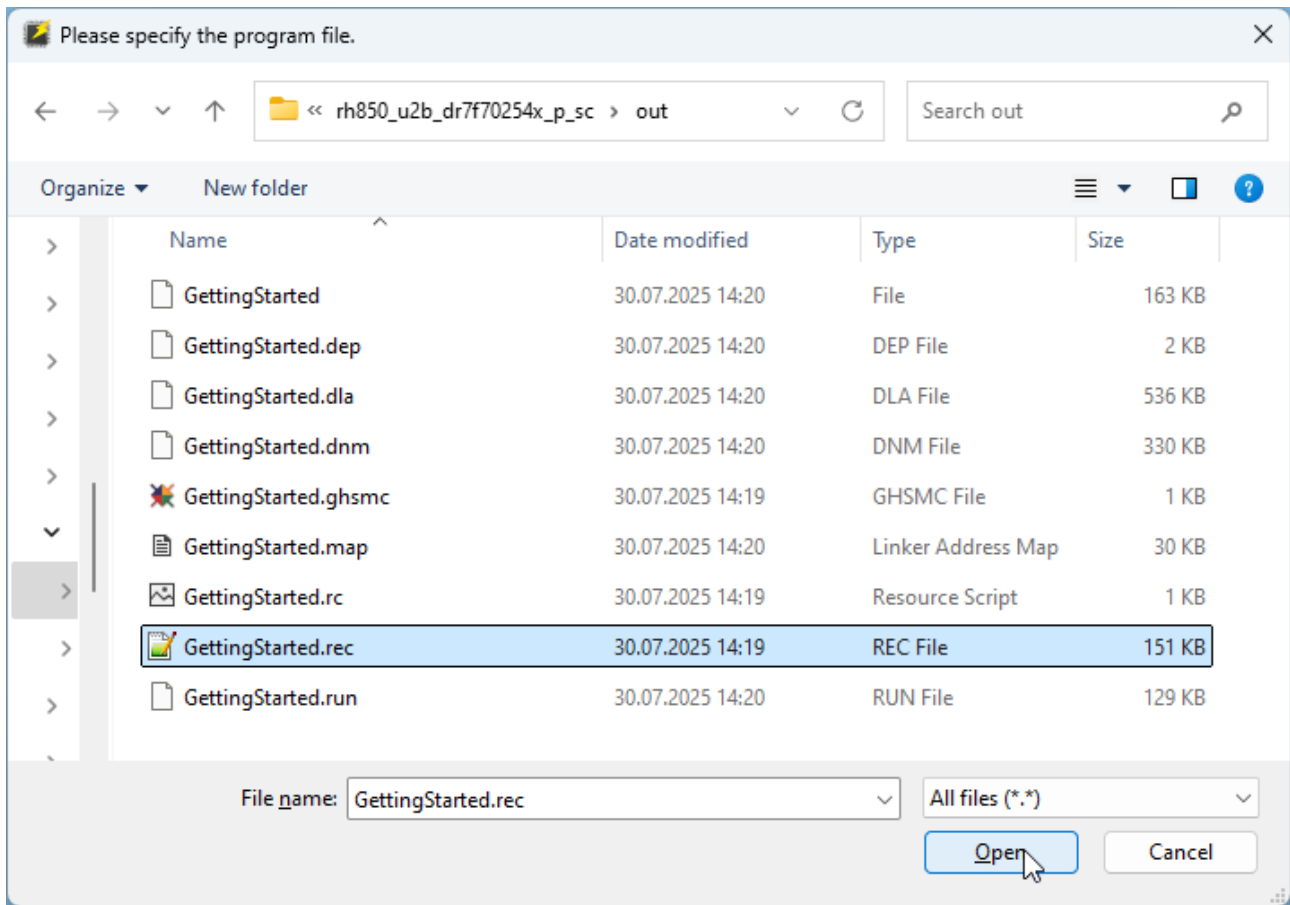


Figure 14: Opening a program file dialog

8. Click the “OK” button.

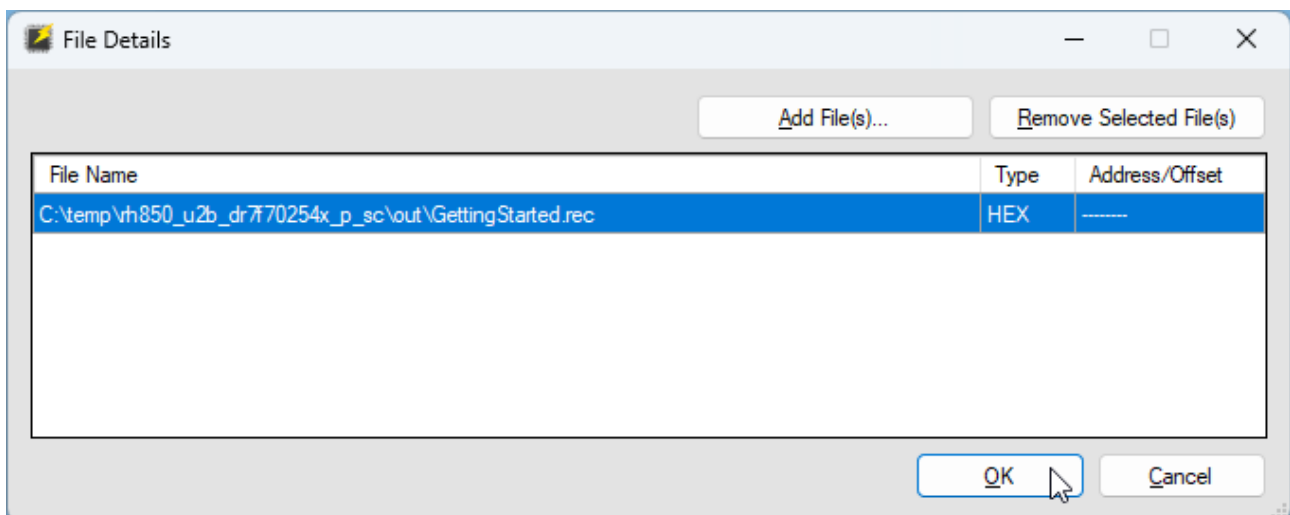


Figure 15: Accept file details window

9. Select the “Config Area 1” in the “Block Settings” tab to allow rewriting this section.

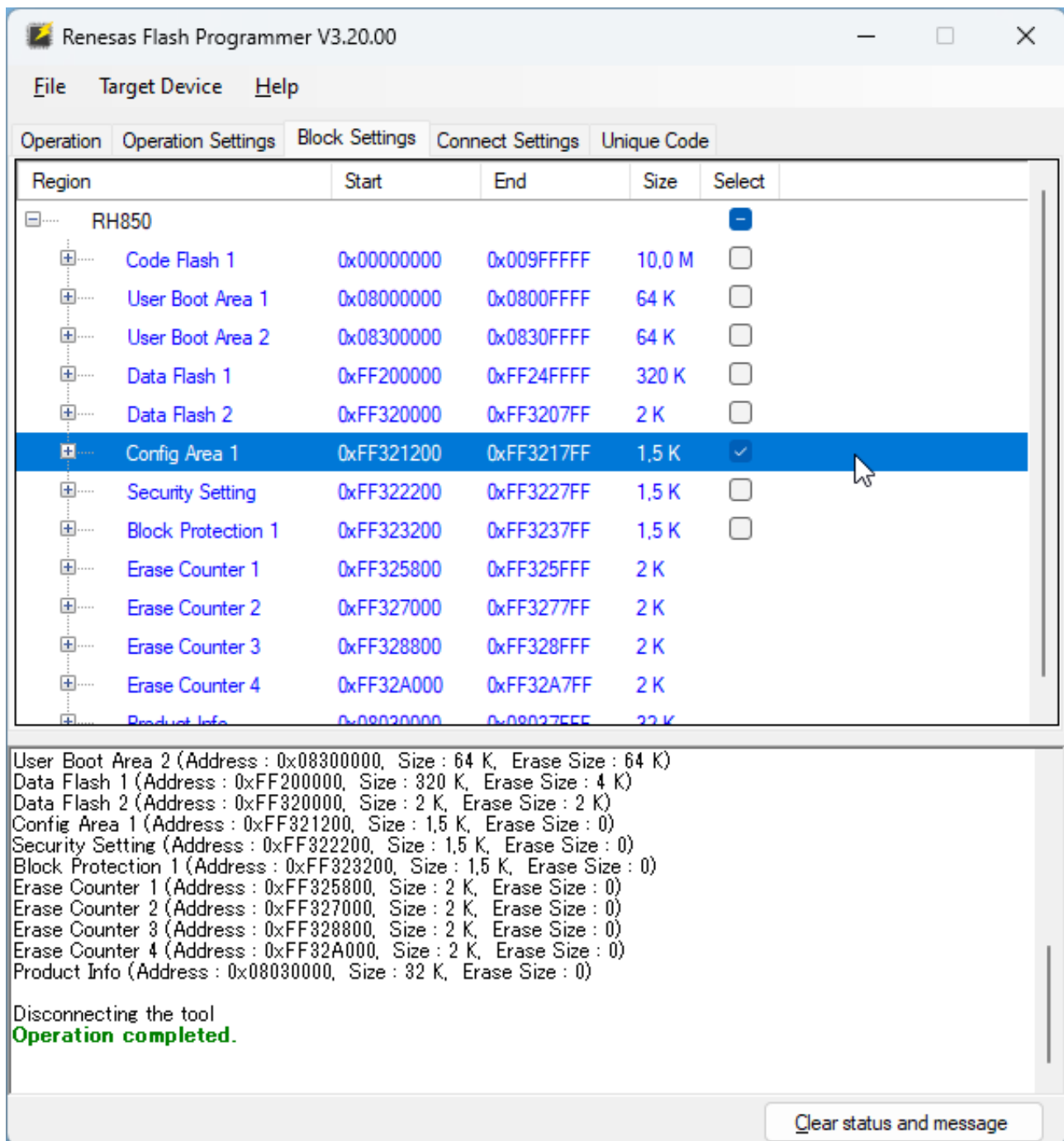


Figure 16: Select block settings for a new RFP project

10. Click on the “Start” button to execute the operation.

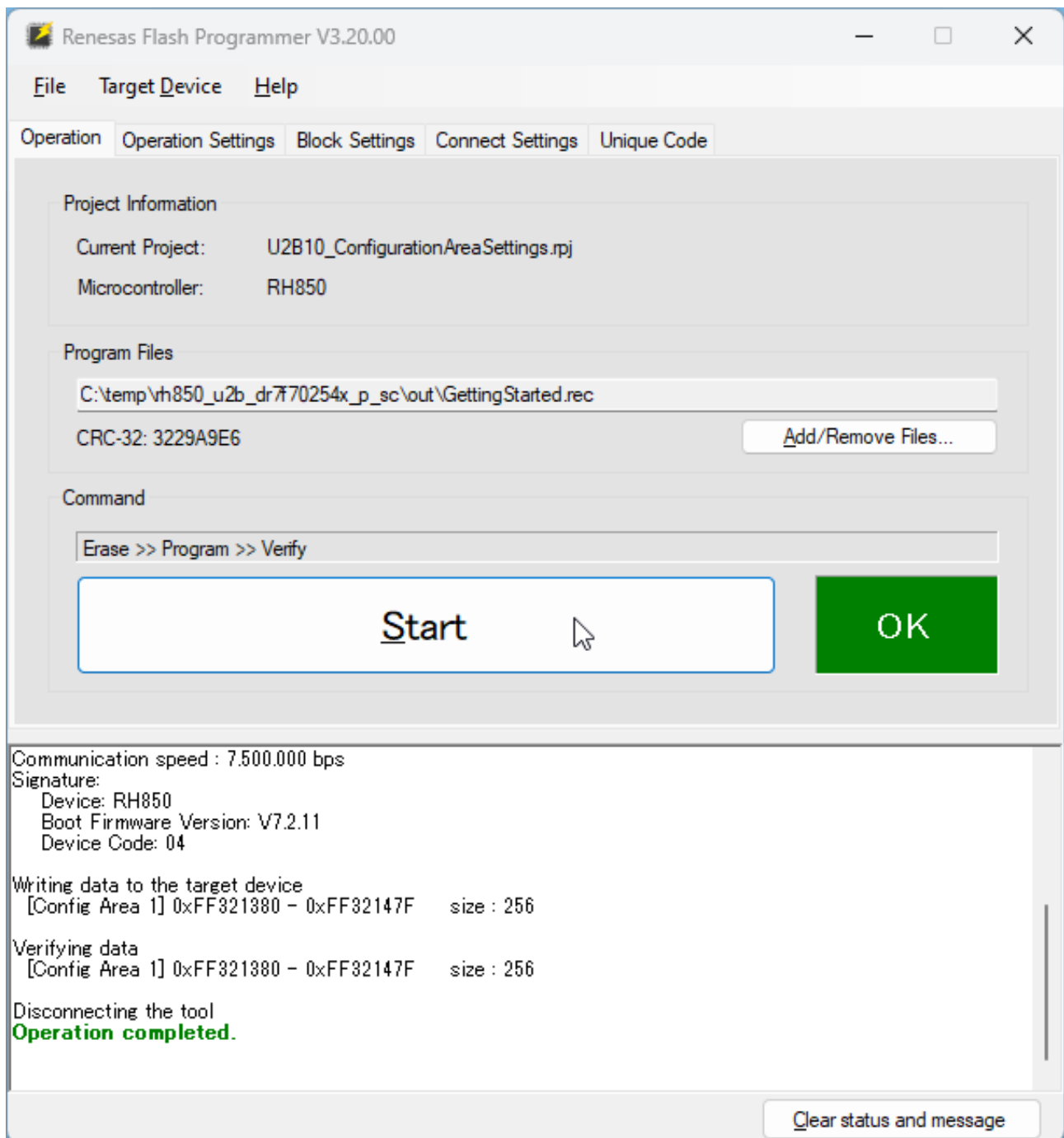


Figure 17: Operation execution of a new RFP project

Now the configuration area should be written to the RH850/U2B.

8. Revision History

Rev.	Date	Description	
		Page	Summary
1.00	18.08.2025		Initial version
1.01	21.08.2025	1	Fixed some typing errors

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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.).

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(Rev.5.0-1 October 2020)

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