RL78/G23

Third-Party Program Protection

Introduction

This application note describes the third-party program protection functionality of the RL78/G23.

As used here, the term “third-party program” refers to valuable software IP supplied in formats such as libraries. The security functions of the RL78/G23 can be employed to prevent unauthorized usage of such software IP.

Third-party program protection makes use of the following functions of the RL78/G23.

- Memory protection function (flash read protection)
- Unique ID

Contents

1. Overview

1.1 About This Application Note

This application note describes the third-party program (software IP) protection that can be implemented using the functions of the RL78/G23.

1.2 Background of Demand for Third-Party Program (Software IP) Protection

Software IP is subject to issues such as the following.

- Even when software IP is supplied in binary format, it can be duplicated and multiple copies can be used at the destination.
- Even when the software IP has been programmed to an MCU supplied as a finished product, it can be read from the flash memory and analyzed.

1.3 Possible Countermeasures

Some examples of countermeasures that can be implemented on the RL78/G23 to protect software IP are described below.

- Memory protection
  This approach prevents the software IP program code in the flash memory from being read.
  The memory protection function can be used to prohibit a specific area of the code flash from being read. By supplying MCUs with their software IP programmed in a read-prohibited area, strong protection is provided for the IP.
  ⇒ Refer to 2.1, Memory Protection (Flash Read Protection).
- Startup control
  This approach checks an ID programmed in the flash memory when the software IP is launched.
  This approach is suitable for cases where the developer supplies the software IP in binary format.
  ⇒ Refer to 2.2, Startup Control (Link to Unique ID).

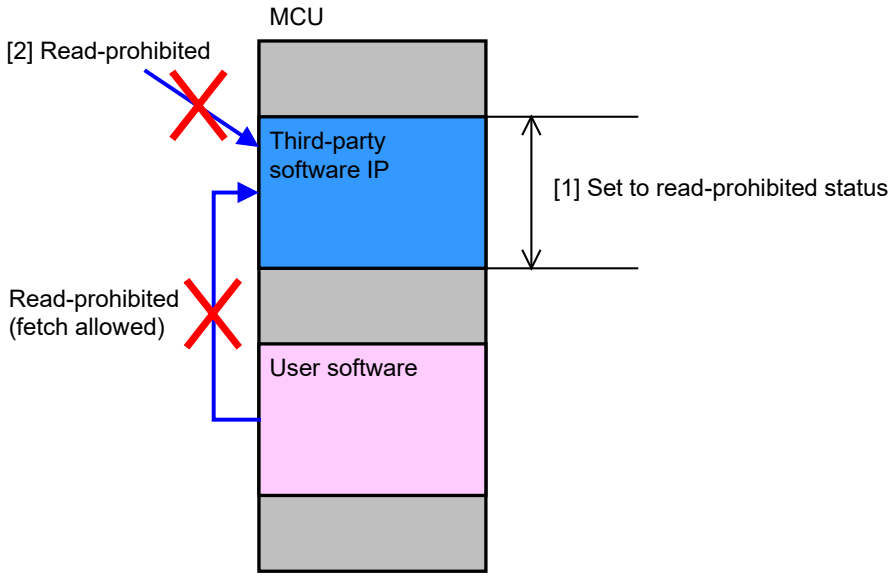
2. Third-Party Program (Software IP) Protection Use Cases

The RL78/G23 is provided with the security functions listed below. These functions can be used individually or in combination to protect software IP from unauthorized use.

- Memory protection function (flash read protection)
- Unique ID

2.1 Memory Protection (Flash Read Protection)

Flash read protection is a function that prevents specified areas of the code flash from being read by the CPU, DTC, or SMS. This function can be used to prohibit reading of software IP programmed in the code flash. Areas set to read-prohibited status can only be accessed by instruction fetches by the CPU. Note, however, that programs running from a read-prohibited area cannot themselves read read-prohibited data. It is therefore necessary that all data used by a program running from a read-prohibited area be located in an area that is not protected.



[1] The blocks in which the software IP is stored are designated as a read-prohibited area.
[2] The software IP can be run, but user software cannot read the software IP program code.
It also cannot be read using an external flash writer or the like.

Features: Prevents analysis or copying of software IP set to read-prohibited status. To prevent unauthorized use or re-use by the recipient of the software IP, it is necessary to supply MCUs with the software IP preprogrammed in a read-prohibited area of the flash memory.

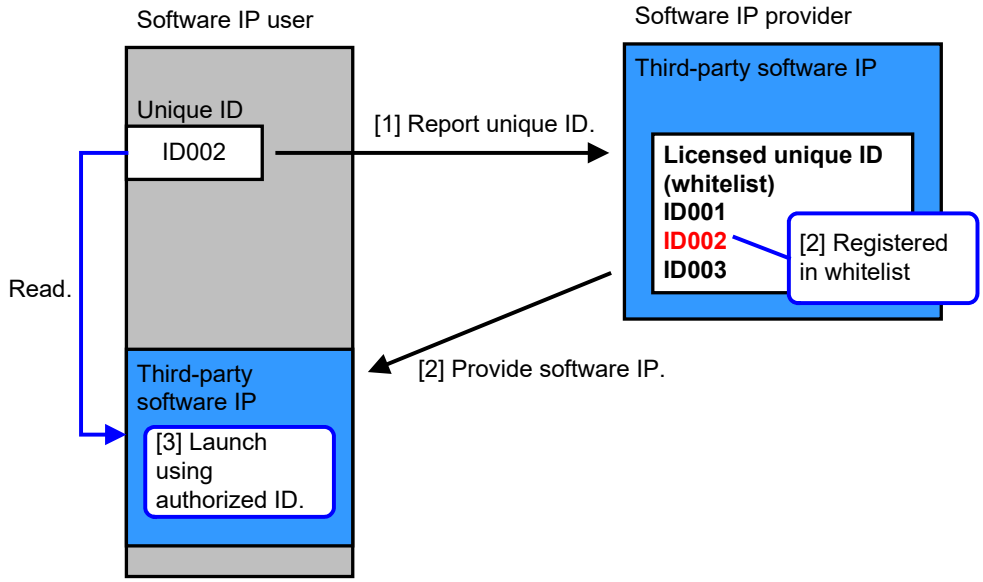
For information on how to set a memory area to read-prohibited status, refer to section 3, Memory Protection Setting Methods.

2.2 Startup Control (Link to Unique ID)

The unique ID is a unique value specific to the individual device that is stored in the flash memory when the MCU is manufactured.

By registering specific unique IDs within a software program, it is possible to limit the individuals who can run it.

In cases where the software license is dependent on the number of copies of the product, it is possible to maintain a list of licensed unique IDs within the software and thereby ensure that it can only be run on user products with licensed unique IDs.



[1] The software IP user reads the unique ID and reports it to the software IP provider.
[2] The software IP provider records the reported unique ID in a whitelist within the software IP and provides the software IP to the user.
[3] When the unique ID matches, the software IP runs.

Features: Prevents unauthorized use in cases where it not possible to prohibit copying of the software IP. If the software IP is copied to another MCU with a different unique ID, it will not run.

For information on reading the unique ID, refer to RL78/G23 Unique ID Read Driver (R20AN0615E).

3. Memory Protection Setting Methods

The following methods are available for making memory protection settings.

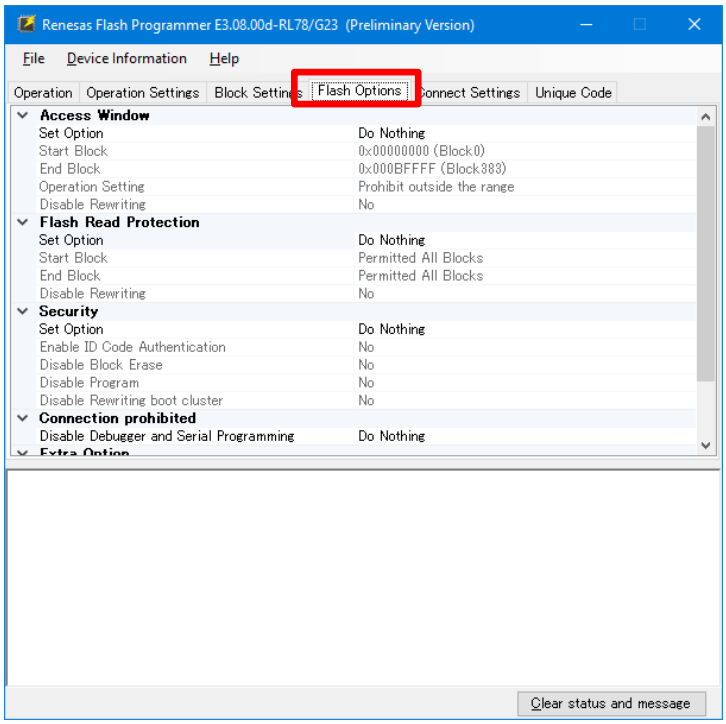
1. Making settings using a flash programmer
   (1) Renesas Flash Programmer (programming GUI)
   Information on enabling and disabling memory protection is provided in 3.1, Making Memory Protection Settings Using Renesas Flash Programmer.
   (2) PG-FP6 Flash Memory Programmer
   The FP6 Terminal programming GUI software can be used to enable and disable memory protection.
   (3) FL-PR6 Memory Flash Programmer
   The FP6 Terminal programming GUI software can be used to enable and disable memory protection.

2. Making settings by self-programming
   Memory protection settings can be applied using the self-programming capability of the Renesas Flash Driver.
   For details, refer to the description of the API function R_RFD_SetExtraSoftwareReadProtectAreaReq() in the following manual.
   RL78 Family Renesas Flash Driver RL78 Type01 User's Manual

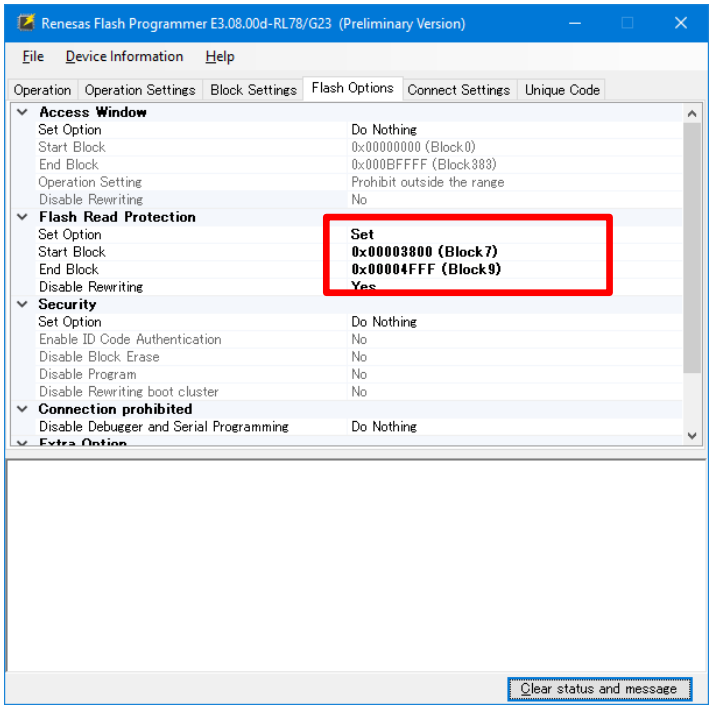
3.1 Making Memory Protection Settings Using Renesas Flash Programmer

3.1.1 Enabling Memory Protection

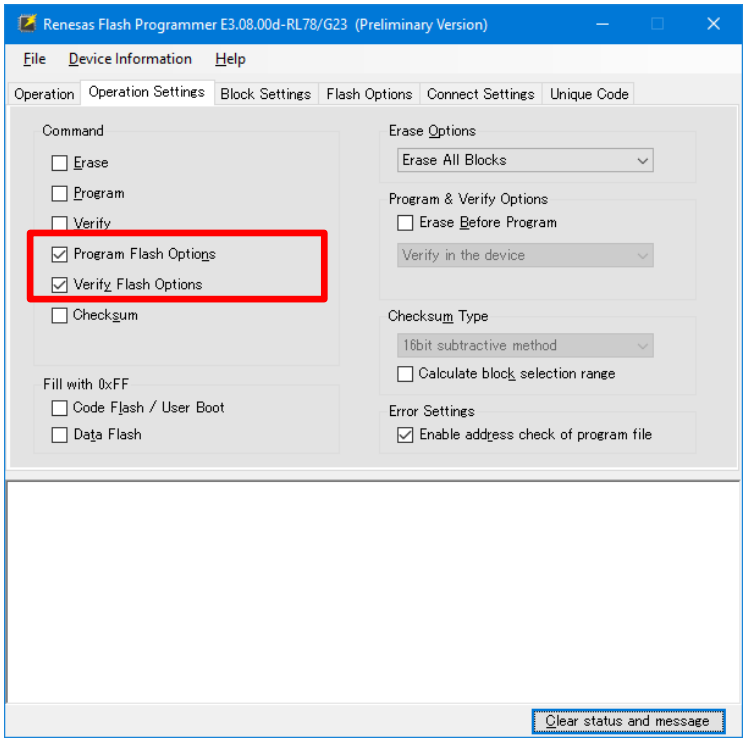
1. Launch Renesas Flash Programmer and select the **Flash Options** tab.



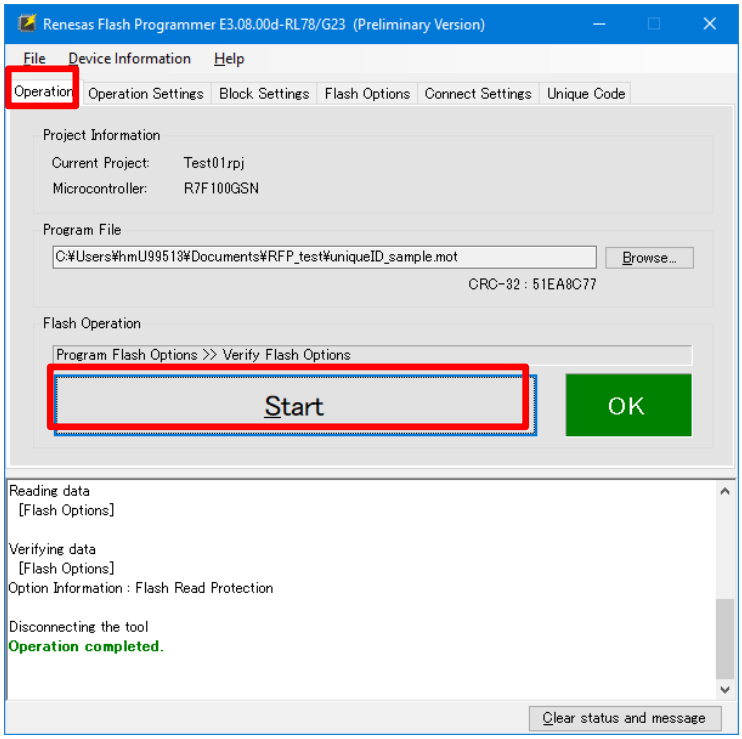
2. Under **Flash Read Protection**, enter the following settings.
   Set Option: [Do Nothing] → [Set]
   Start Block: Select the start block.
   End Block: Select the end block.



3. Select the **Operation Settings** tab and check the boxes next to the following items.
   ☑ **Program Flash Options**
   ☑ **Verify Flash Options**

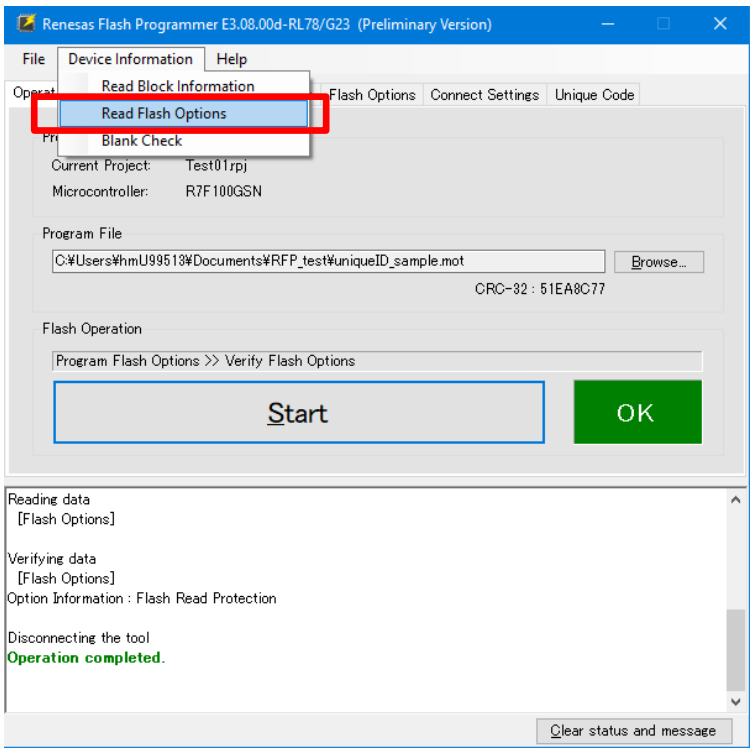


4. After confirming that the settings are correct, select the **Operation** tab and click the **Start** button.

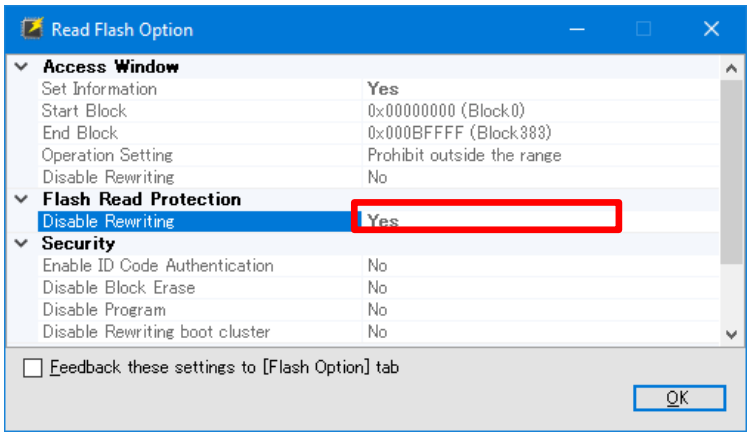


3.1.2 Confirming the Memory Protection Setting

On the **Device Information** menu, select **Read Flash Option**.



Confirm that **Flash Read Protection** is set to **Yes**.

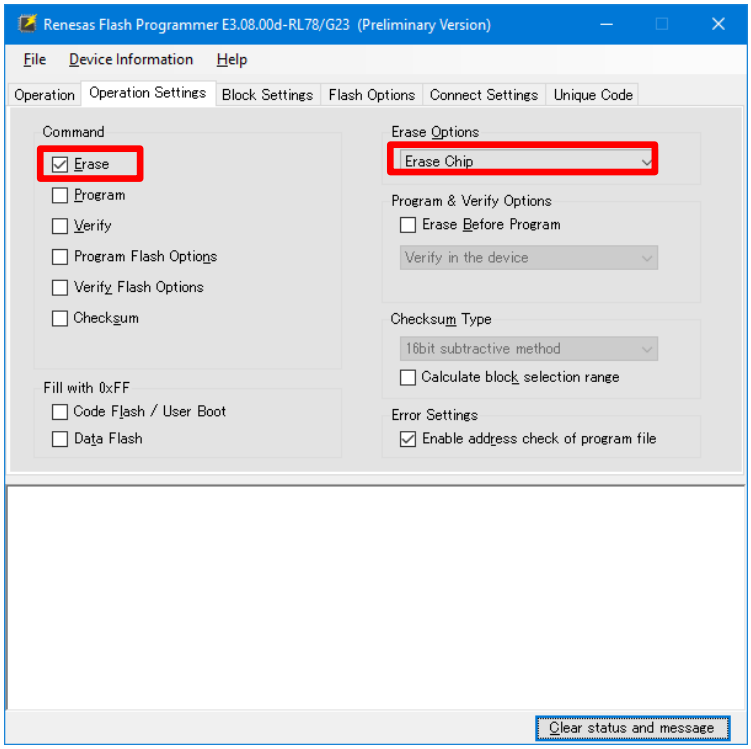


3.1.3 Disabling Memory Protection

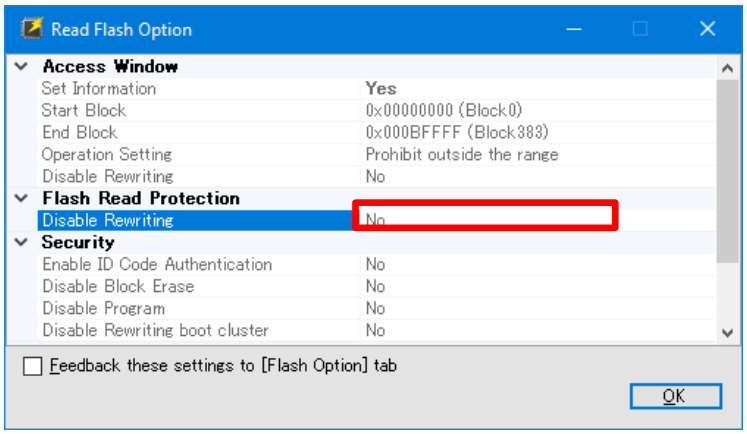
It is necessary to erase the chip to disable flash read protection. The flash option is cleared when the chip is erased.

Enter the following settings to erase the chip.

Check the box next to ☑ **Erase** and under **Erase Options** select **Erase Chip** to erase the chip.



Confirm that **Disable Rewriting** is set to **No**.



4. Related Application Notes

Application notes related to this application note are listed below. Consult them in conjunction with this document.

1. RL78 Family Renesas Flash Driver RL78 Type01 User's Manual (R20UT4830EJ)
2. RL78/G23 Unique ID Read Driver (R20AN0615E).

5. Reference Documents

RL78/G23 Group User's Manual: Hardware (R01UH0896E)

RL78 Family User's Manual: Software (R01US0015E)

Technical Update/Technical News

(The latest information can be downloaded from the Renesas Electronics website.)

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Apr. 13, 2021	—	First edition issued

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.

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