Thank you for using the RL78/G23 simulator. This document describes restrictions on and points for caution regarding the simulator. Read this document before using the product.

Contents

Chapter 1. Target Devices and Supported Simulation Functions ................................................................. 2

Chapter 2. Changes ................................................................................................................................... 3
  2.1 Improvements to the RL78/G23 simulator .......................................................................................... 3

Chapter 3. Points for Caution ..................................................................................................................... 4
  3.1 Differences in behavior between the target devices and the simulator .................................................. 4
  3.2 Usage of simulation functions ............................................................................................................. 12

Revision History ......................................................................................................................................... 14
Chapter 1. Target Devices and Supported Simulation Functions

The RL78/G23 simulator supports the following target devices.

<table>
<thead>
<tr>
<th>Device group</th>
<th>Device name</th>
<th>*Simulation of current drawn is only supported for the following devices.</th>
</tr>
</thead>
<tbody>
<tr>
<td>RL78/G23</td>
<td>128 pins R7F100GSx (x = J, K, L, N)</td>
<td>- 64-pin: R7F100GLx (x = F, G),</td>
</tr>
<tr>
<td></td>
<td>100 pins R7F100GPx (x = G, H, J, K, L, N)</td>
<td>- 52-pin: R7F100GJx (x = F, G),</td>
</tr>
<tr>
<td></td>
<td>80 pins R7F100GMx (x = G, H, J, K, L, N)</td>
<td>- 48-pin: R7F100GGx (x = F, G),</td>
</tr>
<tr>
<td></td>
<td>64 pins R7F100GLx (x = F, G, H, J, K, L, N)</td>
<td>- 44-pin: R7F100GFx (x = F, G),</td>
</tr>
<tr>
<td></td>
<td>52 pins R7F100GJx (x = F, G, H, J, K, L, N)</td>
<td>- 40-pin: R7F100GEx (x = F, G),</td>
</tr>
<tr>
<td></td>
<td>48 pins R7F100GGx (x = F, G, H, J, K, L, N)</td>
<td>- 36-pin: R7F100GCx (x = F, G),</td>
</tr>
<tr>
<td></td>
<td>44 pins R7F100GFx (x = F, G, H, J, K, L, N)</td>
<td>- 32-pin: R7F100GBx (x = F, G),</td>
</tr>
<tr>
<td></td>
<td>40 pins R7F100GEx (x = F, G, H, J)</td>
<td>- 30-pin: R7F100GAx (x = F, G),</td>
</tr>
<tr>
<td></td>
<td>36 pins R7F100GCx (x = F, G, H, J)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>32 pins R7F100GBx (x = F, G, H, J)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>30 pins R7F100GAx (x = F, G, H, J)</td>
<td></td>
</tr>
</tbody>
</table>

As well as CPU instructions, the RL78/G23 simulator is capable of simulating the following items in the target devices.

- Peripheral modules such as timers, the serial array unit, the serial interface, and SNOOZE mode sequencer
- Virtual target board (simulation via the [I/O panel] window)
- MCU pin signal waveforms (simulation via the [Timing chart] window)
- Current drawn (only for some devices)
Chapter 2. Changes

This chapter describes changes from V1.00.00 to V1.01.00 of the RL78/G23 simulator.

2.1 Improvements to the RL78/G23 simulator

2.1.1 UART loopback function of the serial array unit
   The simulator now supports simulation of the UART loopback function of the serial array unit.
   The UART loopback function operates when bits among 0 to 3 (ULBS0 to ULBS3) of the UART loopback select register are set to 1.

2.1.2 Conversion time of the A/D converter
   The simulator now supports the conversion start delay and interrupt output delay components of the A/D conversion time.

2.1.3 Input signal select registers for the logic and event link controller (ELCL)
   Setting "0001_1110B" in an input signal select register n of the ELCL (ELISELn; n = 6 to 11) selected the subsystem clock X frequency (fSx). However, the behavior has been improved so that the low-speed peripheral clock frequency (fSxp) is selected to match the specifications of the target devices.
Chapter 3. Points for Caution

This section lists points for caution on using the RL78/G23 simulator. These points for caution are in the following two categories.

- Differences in behavior between the target devices and the simulator due to simulator specifications
- Usage of simulation functions (operations in and configuration of the GUI windows)

3.1 Differences in behavior between the target devices and the simulator

3.1.1 Peripheral functions not supported by the simulator

The simulator is not capable of simulating the following peripheral functions of the target devices.

- Simplified I2C interface of the serial array unit
- Regulator
- Power-on-reset circuit
- Voltage detector
- Flash self-programming
- Operation state control
- Capacitive touch sensing unit (CTSU2L)
- Security function

3.1.2 Peripheral I/O redirection register (PIOR)

The peripheral I/O redirection register (PIOR) can be manipulated by a program or debugger operations to re-assign specific multiplexed pin functions to alternative port pins in the same way as on the actual device. Note, however, that the assignment of serial interface functions to port pins must not be changed since doing so will disable normal connections through the [Serial] window.

After re-assigning a given pin function by using the PIOR, be sure to select the name of the port pin you are currently using in the [Select Pin] dialog box of the simulator GUI.

3.1.3 Special function registers (SFRs) for controlling port functions

The following SFRs which control port functions are not simulated.

Although read/write access for each register can proceed normally, the operation does not change even though the value is changed.

- Output current control enable register (CCDE)
- Output current select registers (CCSx)
- 40-mA port output control register (PTDC)
3.1.4 Oscillation stabilization time for the clock generator

Since the simulator does not simulate the clock oscillator oscillation stabilization time, stabilization always takes no time. When the oscillation is started, the OSTC register is set to one of the following values (i.e. not incremented).

<table>
<thead>
<tr>
<th>OSTS Setting</th>
<th>OSTC Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x0 : 2⁰/fx</td>
<td>0x80</td>
</tr>
<tr>
<td>0x1 : 2ⁱ/fx</td>
<td>0xc0</td>
</tr>
<tr>
<td>0x2 : 2¹⁰/fx</td>
<td>0xe0</td>
</tr>
<tr>
<td>0x3 : 2¹¹/fx</td>
<td>0xf0</td>
</tr>
<tr>
<td>0x4 : 2¹³/fx</td>
<td>0xf8</td>
</tr>
<tr>
<td>0x5 : 2¹⁵/fx</td>
<td>0xfc</td>
</tr>
<tr>
<td>0x6 : 2¹⁷/fx</td>
<td>0xfe</td>
</tr>
<tr>
<td>0x7 : 2¹⁸/fx</td>
<td>0xff</td>
</tr>
</tbody>
</table>

The following figure illustrates this operation.

In the target device, oscillation by the X1 clock starts after operation has passed through states (1) to (4). In the simulator, states (1) through (4) are skipped and oscillation instantly starts.

![Diagram](Diagram)
Therefore, pay attention to the code that waits for oscillation stabilization.
There is no problem if a program is created under the condition that execution proceeds after the oscillation stabilization wait period when the OSTC register value becomes the maximum value, or when the OSTC register value exceeds the specified value, but if a program is created under the condition that execution proceeds after the oscillation stabilization wait period when the OSTC register value becomes a value other than the maximum value, execution will enter an endless loop.
The following shows examples of code that causes and does not cause problems.
The examples are when the OSTS is set to 0x07.

Correct code example (1)    Correct code example (2)    Example of code that may cause problems
while(OSTC != 0xff)         while(OSTC <= 0xf0)         while(OSTC != 0xff)    
{                                 {                            }                     
NOP();/* wait */                 NOP();/* wait */                 NOP();/* wait */     
}                                 }                            

3.1.5 SFRs (CMC, OSMC, HIOTRM, MIOTRM, and LIOTRM) in the clock generator

The following SFRs which belong to the clock generator are not simulated. Although read/write access for each register can proceed normally, the operation does not change even if the value is changed.
- Bits 0, 1, and 2 (AMPH, AMPHS0, and AMPHS1) of the clock operating mode control register (CMC)
- Bit 0 (HIPREC) of the subsystem clock supply mode control register (OSMC)
- High-speed on-chip oscillator trimming register (HIOTRM)
- Middle-speed on-chip oscillator trimming register (MIOTRM)
- Low-speed on-chip oscillator trimming register (LIOTRM)

Note: In the simulator, the HIPREC bit is fixed to 0. However, if the STOP instruction is executed, the RL78/G23 will enter the STOP mode.
The operation in initialization of the EXCLKS, OSCSELS, XTSEL, AMPHS1, and AMPHS0 bits of the clock operation mode control register (CMC) differs between the target device and the simulator.

[Target device]
EXCLKS, OSCSELS, XTSEL, AMPHS1, and AMPHS0 bits are only initialized by a power-on reset and retain their values following resetting by other reset sources.

[Simulator]
The bits are initialized by the following reset sources.
- External reset input via the _RESET pin
- Internal reset due to detection of a program malfunction by the watchdog timer

3.1.6 Operating clock of the timer array unit
Do not specify an operating clock that runs at or below 233 Hz. If the operating clock for the timer array unit runs at or below 233 Hz, then the timer array unit will not work properly (it will behave as if operating with a clock that is faster than the one selected).
3.1.7 Noise filter of the timer array unit
Although the target device’s timer array unit has a function to turn the noise filters on and off in order to reduce noise from the timer input pins, the simulator does not simulate this function since there is no noise in the simulator’s signals. That is, whether filtering is on or off makes no difference to the behavior.

3.1.8 1-Hz pin output of the real-time counter
If the waveform of the RTC1HZ pin is checked in the [Timing chart] window to use the 1-Hz pin output of the real-time counter, the output waveform frequency becomes 32.768 KHz.
In this case, proceed on the assumption that 1 Hz output is being produced without problems.

3.1.9 SFRs (RTCC0, RTCC1, and SUBCUD) of the realtime clock (RTC)
The operation of realtime clock control register 0 (RTCC0), realtime clock control register 1 (RTCC1), and the time error correction register (SUBCUD) of the realtime clock (RTC) differs between the target device and the simulator.
[Target device]
The registers are cleared to 00H in response to an internal reset by the power-on reset circuit.
[Simulator]
The registers are cleared to 00H in response to resetting by the following reset sources.
- External reset input via the _RESET pin
- Internal reset due to detection of a program malfunction by the watchdog timer

3.1.10 Interval interrupts generated by the watchdog timer
The timing of the generation of interval interrupts by the watchdog timer differs between the target device and the simulator.
[Target device]
When 75% + 1/4fIL of overflow time is reached
[Simulator]
When 75% of overflow time is reached

3.1.11 Clock used in the serial array unit
Do not specify a clock that is 233 Hz or lower in the following cases. If the following clock of the serial array unit is 233 Hz or lower, then the serial array unit will not operate correctly (it will behave as if operating via a clock that is faster than the one selected).
- Operating clock (fMCK) is 233Hz or lower.
- Transfer clock setting by dividing the operation clock (fMCK ÷ (SDRmn[15:9] + 1)) is 233Hz or lower.

3.1.12 Noise filter of the serial array unit
Although the target device's serial array unit has a function to turn the noise filter on and off in order to reduce noise on the input pin, the simulator does not simulate this function since there is no noise in the simulator’s signals. That is, whether filtering is on or off makes no difference to the behavior.
3.1.13 SDRmn registers of the serial array unit
The values read from the seven higher-order bits of the serial data registers (SDRmn) during serial operation differ between the target device and the simulator.

[Target device]
0 is read.

[Simulator]
The value read is that at the time serial operation starts.

3.1.14 Input switch control register (ISC) of the serial array unit
When ISC2 to ISC7 bits of the input switch control register (ISC) are not set for normal operation, CSI communications are disabled in the [Serial] window. To enable CSI communications in the [Serial] window, clear the bits to 0.

3.1.15 IICA serial interface
IICA supports pin waveform generation and the communications through the [Serial] window. The following functions are not supported.
- Digital filter
- Arbitration
- Detection of transmission errors
- Communication reservation

3.1.16 Reset
The behavior differs as follows if a reset signal is input from the RESET pin.

[Target device]
The MCU is reset when the RESET pin goes low. Release from the reset state proceeds when the RESET pin goes high.

[Simulator]
The MCU is not reset when the RESET pin goes low. The simulator is reset momentarily and then released when the RESET pin goes high.

3.1.17 Reset control flag register (RESF)
The simulator only supports the WDTRF bit of the reset control flag register (RESF). The simulator is not capable of simulating the operations of the other bits (TRAP, RPERF, IAWRF, and LVIRF). Only the default values of these bits are indicated. The reset control flag register (RESF) of the target device is automatically cleared in the case of access to SFRs other than the RESF register after it has been read with an 8-bit memory manipulation instruction, but is not cleared in the simulator.
3.1.18 A/D converter

When no voltage is being applied to the VDD or AVREFP pin, the default reference voltage of the A/D converter is 5.0 V.

To change the reference voltage, input the desired voltage values for VDD and AVREFP via the [Signal Data Editor] window.

The temperature sensor output voltage is always 1.05 V.

3.1.19 Wait time for selecting the reference voltage on the positive side of the A/D converter

The simulator does not support the reference voltage discharge time, reference voltage stabilization wait time (A), or reference voltage stabilization wait time (B). These times are handled as 0 clock cycles so simulation proceeds without them.

3.1.20 Clock output/buzzer output controller

When f_MAIN is selected as an output clock, the [Timing chart] window does not show the clock waveform of the PCLBUZn signal.

When f_MAIN/2 or a slower signal is selected as an output clock, the [Timing chart] window shows the clock waveform.

3.1.21 Executing illegal instructions

If an illegal instruction (instruction code: 0xFF) is executed, the target device will be reset, but the simulator will go into an endless loop (the illegal instruction will be executed repeatedly).

3.1.22 Digital filters of the remote control signal receiver (REMC)

The simulator does not simulate the digital filters of the remote control signal receiver (REMC).

3.1.23 Times taken for data transfer by the data transfer controller (DTC)

The times taken for data transfer by the data transfer controller (DTC) differ between the target device and the simulator.

[Target device]
- A response time is required from detection of a DTC activation source until data transfer starts.
- A waiting time is required for access to extended special function registers (2nd SFRs).
- The DTC puts the data transfer on hold when the CPU executes any instruction that holds the DTC pending.
- Access to the data bus by the CPU is put on hold during DTC transfer.

[Simulator]
- Data transfer starts immediately after detection of a DTC activation source.
- No waiting time is required even for access to extended special function registers (2nd SFRs).
- The DTC does not put the data transfer on hold even when the CPU executes any instruction that should hold the DTC pending.
- Access to the data bus by the CPU is not put on hold even during DTC transfer.
3.1.24 Repeat mode of the data transfer controller (DTC)

If any of the conditions listed below is satisfied while the data transfer controller (DTC) is in repeat mode, the DTC ignores activation sources and will thus fail to transfer data.

- A DTC transfer count register j (DTCTj) is set to 00H (number of transfers: 256 times).
- A DTC block size register j (DTBLSj) is set to 00H (block size: 256 or 512 bytes).
- A DTC control register j (DTCCRj) is used to set the transfer data size to 16 bits and the corresponding DTC block size register j (DTBLSj) is used to set the block size to 256 bytes or more.

3.1.25 D/A converter

When no voltage value is set for the VDD pin, the default reference voltage of the D/A converter is 5.0 V. To change the reference voltage, specify the desired voltage value for the VDD pin via the [Signal Data Editor] window or some other means.

3.1.26 Reference voltage of the comparators (CMP)

When no voltage value is set for the VDD pin, the simulator generates the reference voltage on the assumption that 5 V is being input to the VDD pin. To change the reference voltage, specify the desired voltage value for the VDD pin via the [Signal Data Editor] window or some other means.

3.1.27 Digital filters in the comparators (CMP)

The simulator does not simulate the digital filters in the comparators (CMP).

3.1.28 Response time of the comparators

Since the simulator does not simulate the response time of the comparators, the response time is always 0 second. This does not change even if the speed of the comparators is changed in the comparator output control register (COMPOCR).

3.1.29 SFRs (WKUPMD and PSMCR) for the standby function

The following SFRs which control standby functions are not simulated. Although read/write access for each register can proceed normally, the operation does not change even if the value is changed.

- Bit 0 (FWKUP) of the standby mode release setting register (WKUPMD)
- Bit 0 (RAMSDS) and bit 1 (RAMSDMD) of the memory power reduction control register (PSMCR)
3.1.30 Safety functions

The simulator does not support the following safety functions.
- Flash memory CRC operation function (high-speed CRC, general-purpose CRC)
- Flash memory guard function
- RAM parity error detection
- RAM guard function
- SFR guard function
- Illicit memory access detection
- Guard function of invalid memory access detection control register (IAWCTL)

3.1.31 Power supply for battery backup (VBAT)

The simulator does not simulate the power supply for battery backup (VBAT).

3.1.32 Output signals from the logic and event link controller (ELCL)

When any among fCLK, fHP, fIMP, or fSXP is selected as an input signal for the logic and event link controller (ELCL) and this leads to the frequency of the clock in the logic cell block being higher than that of the main clock, the output signals of the ELCL may not be correctly displayed in the simulator GUI or in the [Virtual Board] panel.

3.1.33 Values calculated for current drawn when the ELCL is selected as the operating clock of UARTAn

With the simulator, when the ELCL is selected as the operating clock of UARTAn, the current value for UARTAn is 0 uA.

3.1.34 Values calculated for current drawn when an event input from the ELCL is selected as the counter clock of the 32-bit interval timer

With the simulator, when an event input from the ELCL is selected as the counter clock of the 32-bit interval timer, the current value for the 32-bit interval timer is 0 uA.
3.2 Usage of simulation functions

3.2.1 Simulation speed
The simulation speed of RL78/G23 simulator depends on the number of operating peripheral functions.
If many peripheral functions are operating, the simulation speed becomes from several to ten times slower
than the actual device. Note
With the use of only a few, or even no peripheral functions, the simulation speed may become faster than
the actual device.
Note: The measurement environment for simulation speed is as follows.
CPU: 3.20 GHz (Quad-Core); memory: 8 Gbytes; OS: Windows10 64-bit edition

3.2.2 Pin waveforms in the [Timing chart] window
The maximum length of a pin waveform is 4096 signal-level changing points. After reaching this maximum
length, the data will be overwritten from the oldest value. If this length is not sufficient, use the following
methods.
- Reduce the number of registered pins
- Stop the user program at the place where you want to confirm the waveform by using a breakpoint

3.2.3 Controlling windows
The following keyboard operations are not available in the simulator windows ([Signal Data Editor], [I/O
panel], and [Serial]).
- Navigation via tab or arrow keys (←, ↑, →, ↓)
- Deletion via the Del or Backspace keys
- Cut & paste and other operations via the Ctrl + C, V, X, A, or Z keys.
Perform the above operations as follows.
- Navigation: Navigate by using the mouse.
- Deletion: Right-click and perform the action from the context menu.
- Cut & paste, etc.: Right-click and perform the action from the context menu.
3.2.4 Closing the [Simulator GUI] window

The [Simulator GUI] window can only be closed by disconnecting from the debugging tool, or by closing CS+ in proper manner. The [X] button cannot be used.

Additionally, although it appears that the [X] button can be pressed if Aero is enabled in Windows, pressing this button will not close the [Simulator GUI] window.

3.2.5 Disconnecting the debug tool

CS+ may be closed if the debugging tool is disconnected while any of the following dialog boxes is open from the [Simulator GUI] window. Be sure that the following dialog boxes have been closed before disconnecting the simulator.

- Save As
- Message (e.g. Error)
- Open
- Parts Button Properties
- New
- Analog Button Properties
- Color
- Parts Key Properties
- Font
- Parts Level Gauge Properties
- Customize
- Parts Led Properties
- Loop
- Parts Segment LED Properties
- Select Pin
- Parts Matrix Led Properties
- Search Data
- Parts Buzzer Properties
- Format (UART)
- Pull up / Pull down
- Format (CSI)
- Entry Bitmap
- Format (IIC)
- Object Properties

3.2.6 [Serial] window

When using the [Serial] window as the data receiver for IICA, only ACK can be generated after receiving the data. NACK cannot be generated.

3.2.7 Simulation of current drawn

The following notes apply to the function of measuring current.
- The current is calculated roughly as that drawn by the MCU alone based on the typical values (TYP.) for the actual devices. Note that the current values other than for the MCU are not included.
- The number of change points of measurable current is 200,000. The program stops when the number exceeds 200,000.
### Revision History

<table>
<thead>
<tr>
<th>Rev.</th>
<th>Date</th>
<th>Description</th>
<th>Page</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00</td>
<td>Jun.08.21</td>
<td></td>
<td>-</td>
<td>First Edition</td>
</tr>
</tbody>
</table>
Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.

2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.

3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.

4. You shall be responsible for determining what licenses are required from any third parties, and obtaining such licenses for the lawful import, export, manufacture, sales, utilization, distribution or other disposal of any products incorporating Renesas Electronics products, if required.

5. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.

6. Renesas Electronics products are classified according to the following two quality grades: “Standard” and “High Quality”. The intended applications for each Renesas Electronics product depends on the product’s quality grade, as indicated below.

   "Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; industrial robots; etc.

   "High Quality": Transportation equipment (automobiles, trains, ships, etc.); aircraft control systems; key plant systems; military equipment; etc.

   Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user’s manual or other Renesas Electronics document.

7. No semiconductor product is absolutely secure. Notwithstanding any security measures or features that may be implemented in Renesas Electronics hardware or software products, Renesas Electronics shall have absolutely no liability arising out of any vulnerability or security breach, including but not limited to any unauthorized access to or use of a Renesas Electronics product or a system that uses a Renesas Electronics product. RENESAS ELECTRONICS DOES NOT WARRANT OR GUARANTEE THAT RENESAS ELECTRONICS PRODUCTS, OR ANY SYSTEMS CREATED USING RENESAS ELECTRONICS PRODUCTS WILL BE INVULNERABLE OR FREE FROM CORRUPTION, ATTACK, VIRUSES, INTERFERENCE, HACKING, DATA LOSS OR THEFT, OR OTHER SECURITY INTRUSION (“Vulnerability Issues”). RENESAS ELECTRONICS DISCLAIMS ANY AND ALL RESPONSIBILITY OR LIABILITY ARISING FROM OR RELATED TO ANY VULNERABILITY ISSUES. FURTHERMORE, TO THE EXTENT PERMITTED BY APPLICABLE LAW, RENESAS ELECTRONICS DISCLAIMS ANY AND ALL WARRANTIES, EXPRESS OR IMPLIED, WITH RESPECT TO THIS DOCUMENT AND ANY RELATED OR ACCOMPANYING SOFTWARE OR HARDWARE, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE.

8. When using Renesas Electronics products, refer to the latest product information (data sheets, user’s manuals, application notes, etc.). "General Notes for Handling and Using Semiconductor Devices" in the reliability handbook, etc., and ensure that usage conditions are within the ranges specified in the Renesas Electronics products. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.

9. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Unless designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems; surgical implantations; etc.), or may cause serious property damage (space system; undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user’s manual or other Renesas Electronics document.

10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, such as safety design for hardware and software, including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult and impractical, you are responsible for evaluating the safety of the final products or systems manufactured by you.

11. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.

12. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.

13. This document shall not be reproduced, duplicated or distributed in any form, in whole or in part, without prior written consent of Renesas Electronics.

14. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.

(Rev.5.0-1 October 2020)

Corporate Headquarters
TOYOSU FORESIA, 3-2-24 Toyosu,
Koto-ku, Tokyo 135-0061, Japan
www.renesas.com

Trademarks
Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.

Contact information
For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit:
www.renesas.com/contact/

© 2021 Renesas Electronics Corporation. All rights reserved.