# RL78/G13, 78K0/Kx2

## Migration Guide from 78K0 to RL78: Serial interface CSIA0 to Serial Array Unit

### Introduction

This application note describes how to migrate the serial interface CSIA0 of the 78K0/Kx2 to the serial array unit (SAU) of the RL78/G13.

### Target Device

RL78/G13, 78K0/Kx2

When using this application note with other Renesas MCUs, careful evaluation is recommended after making modifications to comply with the alternate MCU.

## Contents

**1. Functions of serial interface CSIA0 and Serial Array Unit** ..... 3

**2. Difference between Serial interface CSIA0 and Serial Array Unit** ..... 5

**3. Comparison between Registers** ..... 7

**4. Sample Code for Serial Array Unit** ..... 10

**5. Documents for Reference** ..... 10

**Revision History** ..... 11

# 1. Functions of serial interface CSIA0 and Serial Array Unit

Table 1.1 shows the functions of the serial interface CSIA0, and Table 1.2 shows the functions of the serial array unit (SAU).

Table 1.1 Functions of serial interface CSIA0

| Function | Explanation |
|---|---|
| 3-wire serial I/O mode | Clock synchronous communication function by 3 lines of serial clock (SCKA0) and serial data (SIA0, SOA0). |
| 3-wire serial I/O mode with automatic transmit/receive function | Clock synchronous communication function by 3 lines of serial clock (SCKA0) and serial data (SIA0, SOA0).<br>The processing time of data communication can be shortened in the 3-wire serial I/O mode because transmission and reception can be simultaneously executed. |

Table 1.2 Functions of Serial Array Unit

| Function | Explanation |
|---|---|
| 3-wire serial I/O | This is a clocked communication function that uses three lines: serial clock (SCK) and serial data (SI and SO) lines. |
| UART | This is a start-stop synchronization function using two lines: serial data transmission (TXD) and serial data reception (RXD) lines. |
| Simplified $I^2C$<br>(Only master function with a single master) | This is a clocked communication function to communicate with two or more devices by using two lines: serial clock (SCL) and serial data (SDA). |
| LIN Communication (Note) | LIN stands for Local Interconnect Network and is a low-speed (1 to 20 kbps) serial communication protocol designed to reduce the cost of an automobile network. |

Note. The LIN-bus is accepted in UART2 (channels 0 and 1 of unit 1)

Remarks1. For 78K0/Kx2, n = 0, 1 For RL78/G13, m: Unit number (m = 0, 1), n: Channel number (n = 0 to 3)

Remarks2. The functions incorporated and port functions to use are different depending on the product. For details, refer to the appropriate user's manuals (hardware).

The serial interface CSIA0 of the 78K0/Kx2 incorporates one channel of 3-line serial I/O (CSI). In the maser mode, it supports handshake pins (STB0 and BUSY0) for easy connection with peripheral ICs.

Figure 1.1 shows a block diagram of the serial interface CSIA0.

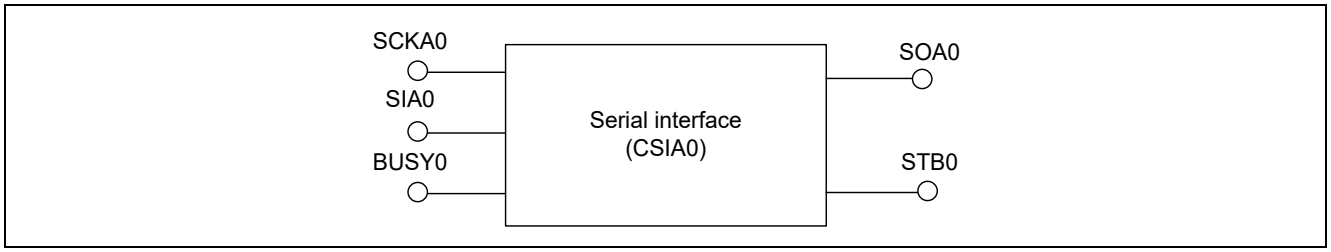


Figure 1.1 Block Diagram of Serial interface CSIA0

A single serial array unit (SAU) in the RL78/G13 has up to four serial channels. Each channel can achieve 3-wire serial (CSI), UART, and simplified I2C communication.

Figure 1.2 shows a CSI block diagram of the serial array unit 0 (SAU0) of the RL78/G13.

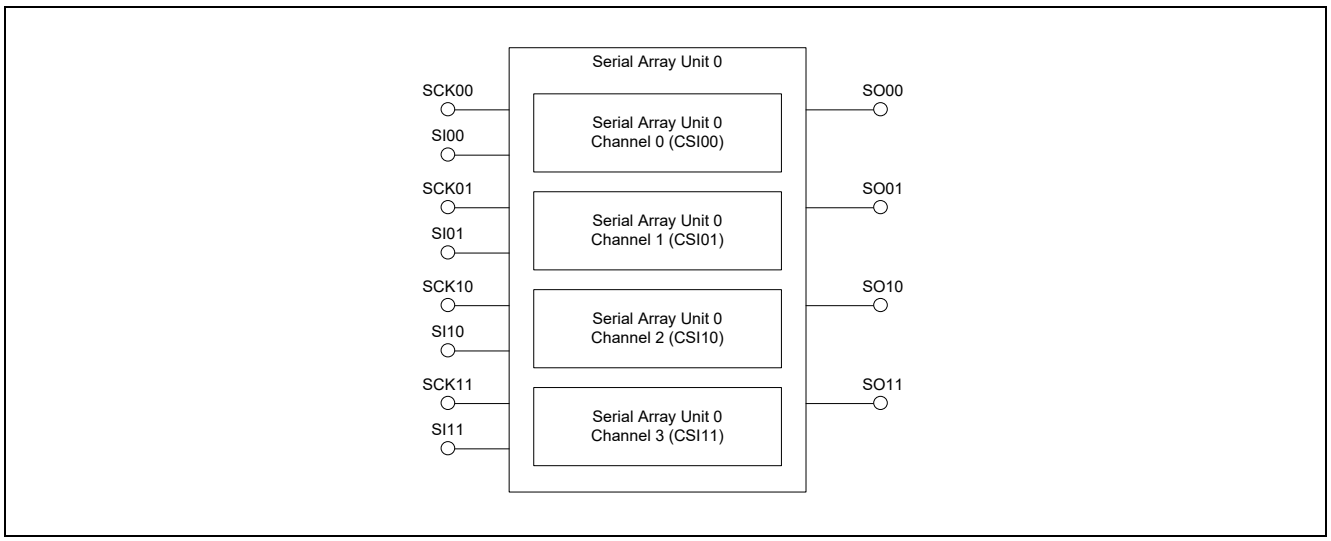


Figure 1.2 Block Diagram of Serial Array Unit 0 (SAU0) CSI

Table 1.3 shows the SAU functions corresponding to the Serial interface CSIA0.

Table 1.3 Correspondence between Functions

| 78K0/Kx2<br>Serial interface CSIA0 | RL78/G13<br>Serial Array Unit (SAU) |
|---|---|
| 3-wire serial I/O mode | 3-wire serial I/O |
| 3-wire serial I/O mode with automatic transmit/receive function | 3-wire serial I/O |
| - | UART |
| - | Simplified $I^2C$ |

The 3-wire serial I/O mode and 3-wire serial I/O mode with automatic transmit/receive function of the serial interface CSIA0 correspond to the 3-wire serial I/O of the SAU.

## 2. Difference between Serial interface CSIA0 and Serial Array Unit

Table 2.1 and Table 2.2 shows the differences between the serial interface CSIA0.

Table 2.1 Difference between Serial interface CSIA0 (1/2)

| Item | 78K0/Kx2<br>Serial interface<br>CSIA0 | RL78/G13<br>Serial Array Unit (SAU)<br>CSImn |
|---|---|---|
| Transfer data length | 8 bits | 7 bits / 8 bits |
| Maximum transfer rate | 1.67MHz | - During master communication<br>16MHz (CSI00 only) (Note1)<br>8MHz (CSImn) (Note2)<br>- During slave communication<br>4MHz |
| First bit specification | CSIMA0 register<br>DIR0 = 0: MSB first<br>DIR0 = 1: LSB first | SCRmn register<br>DIRmn = 0: MSB first<br>DIRmn = 1: LSB first |
| Selection of data and clock phase | None | SCRmn register<br>Combination of CKPmn and DAPmn bits |
| Disables operation | CSIMA0 register<br>CSIAE0 = 0 | STm register<br>STmn = 1 |
| Enables operation | CSIMA0 register<br>CSIAE0 = 1 | SSm register<br>SSmn = 1 |
| Setting of operation mode | CSIMA0 register<br>TXEA0 = 1, RXEA0 = 1:<br>Transmission/reception<br>TXEA0 = 1, RXEA0 = 0: Transmission only<br>TXEA0 = 0, RXEA0 = 1: Reception only | SCRmn register<br>TXEmn = 1, RXEmn = 1:<br>Transmission/reception<br>TXEmn = 1, RXEmn = 0: Transmission only<br>TXEmn = 0, RXEmn = 1: Reception only |
| Automatic communication operation | CSIMA0 register<br>ATE0 = 0:1-byte communication mode<br>ATE0 = 1: Automatic communication mode<br>ATM0 = 0: Single transfer mode<br>ATM0 = 1: Repeat transfer mode | None<br>(This can be implemented by using the CSImn and DMA controller.) |
| Buffer RAM | Yes (32 bytes) | None (This can be implemented by using a program and the DMA controller.) |
| Handshake function | Yes | None (This can be implemented by manipulating ports.) |
| Serial I/O shift register | SIOA0 register | Lower 8 bits of SDRmn register (SIOp) |
| Data transmission is started | 1-byte transfer mode<br>Write transmit data to SIOA0 register<br>Automatic communication mode<br>ATSTA0 bit of CSIT0 register is set to 1 | Write transmit data to SIOp register<br>(When TXEmn = 1) |

Note1. Target products G (Industrial applications) is 4MHz.

Note2. Target products G (Industrial applications) is 2MHz.

Remarks1. For 78K0/Kx2, n = 0, 1
For RL78/G13, m: Unit number (m = 0, 1), n: Channel number (n = 0 to 3),
p: CSI number (p = 00, 01, 10, 11, 20, 21,30, 31)

Remarks2. The functions incorporated and port functions to use are different depending on the product. For details, refer to the appropriate user's manuals (hardware).

Table 2.2 Difference between Serial interface CSIA0 (2/2)

| Item | 78K0/Kx2<br>Serial interface<br>CSIA0 | RL78/G13<br>Serial Array Unit (SAU)<br>CSImn |
|---|---|---|
| Data reception is started | 1-byte transfer mode<br>- Write transmit data to SIOA0 register<br>(When TXEA0 = 1, RXEA0 = 1)<br>- Write dummy data to SIOA0 register<br>(When TXEA0 = 0, RXEA0 = 1)<br>Automatic communication mode<br>ATSTA0 bit of CSIT0 register is set to 1 | - Write transmit data to SIOp register<br>(When TXEmn = 1, RXEmn = 1)<br>- Write FFH as dummy data to<br>SDRmn register<br>(When TXEmn = 0, RXEmn = 1) |
| Interrupt | Communication completion interrupt | SMRmn register<br>MDmn0 = 0: Transfer end interrupt<br>MDmn0 = 1: Buffer empty interrupt |
| Interrupt occurrence timing | 1-byte transfer mode<br>Transmission/reception completion<br>Automatic communication mode<br>- When the transfer of the range specified by the ADTP0 register is completed.<br>- Communication suspension: When 1-byte transfer is completed after bit 1 (ATSTP0) in the CSIT0 register is set to 1.<br>- Bit shift error: When 1-byte transfer is completed after bit 1 (ERRF0) of the CSIS0 register becomes 1 while bit 2 (ERRE0) is set to 1. | - MDmn0 = 0<br>After transfer of transmit/receive data is completed.<br>- MDmn0 = 1<br>When data is transferred from the SDRmn register to the shift register. |
| Communication status flag | CSIS0 register<br>TSF0 = 0: Communication is stopped.<br>TSF0 = 1: Communication is in progress. | SSRmn register<br>TSFmn = 0: Communication is stopped or suspended.<br>TSFmn = 1: Communication is in progress. |
| Buffer register status indication flag | None | SSRmn register<br>BFFmn = 0:<br>Valid data is not stored in the SDRmn register.<br>BFFmn = 1:<br>Valid data is stored in the SDRmn register. |
| Bit error detection flag | CSIS0 register<br>ERRF0 bit | None |
| Overrun error detection flag | None | SSRmn register<br>OVFmn = 0: No error occurs.<br>OVFmn = 1: An error occurs. |
| Serial data output pin | SOA0 pin | SOmn pin |
| Serial data input pin | SIA0 pin | SImn pin |
| Serial clock I/O pin | SCKA0 pin | SCKmn pin |
| Handshake pin | STB0 pin, BUSY0 pin | None |

Remarks1. For 78K0/Kx2, n = 0, 1
For RL78/G13, m: Unit number (m = 0, 1), n: Channel number (n = 0 to 3),
p: CSI number (p = 00, 01, 10, 11, 20, 21,30, 31)
Remarks2. The functions incorporated and port functions to use are different depending on the product. For details, refer to the appropriate user's manuals (hardware).

## 3. Comparison between Registers

Table 3.1 to Table 3.3 compares the registers for the 78K0/Kx2 Serial interface CSIA0 and the registers for the RL78/G13 Serial Array Unit used as CSImn.

Table 3.1 Comparison between Registers (1/3)

| Item | 78K0/Kx2 | RL78/G13 |
|---|---|---|
| Clock supply to serial array unit | None | PER0 register<br>SAUmEN bit |
| Disables operation | CSIMA0 register<br>CSIAE0 bit | STm register<br>STmn bit |
| Enables operation | CSIMA0 register<br>CSIAE0 bit | SSm register<br>SSmn bit |
| Transmit operation enable/disable | CSIMA0 register<br>TXEA0 bit | SCRmn register<br>TXEmn bit |
| Receive operation enable/disable | CSIMA0 register<br>RXEA0 bit | SCRmn register<br>RXEmn bit |
| First bit specification | CSIMA0 register<br>DIR0 bit | SCRmn register<br>DIRmn bit |
| Master/slave mode specification | CSIMA0 register<br>MASTER0 bit | SMRmn register<br>CCSmn bit |
| Base clock selection | CSIS0 register<br>CKS00 bit | SMRmn register<br>CKSmn bit, CCSmn bit |
| Selection of base clock divisor | BRGCA0 register<br>BRGCA01 bit, BRGCA00 bit | SPSm register<br>PRSmk3 - PRSmk0 bit<br>Upper 7 bits of SDRmn register |
| Strobe output enable/disable (When Master mode) | CSIS0 register<br>STBE0 bit | None |
| Busy signal detection enable/disable (When Master mode) | CSIS0 register<br>BUSYE0 bit | None |
| Busy signal active level setting | CSIS0 register<br>BUSYLV0 bit | None |
| Bit error detection enable/disable | CSIS0 register<br>ERRE0 bit | None |
| Bit error detection flag | CSIS0 register<br>ERRF0 bit | None |
| Transfer status detection flag | CSIS0 register<br>TSF0 bit | SSRmn register<br>TSFmn bit |

Remarks1. For RL78/G13, m: Unit number (m = 0, 1), n: Channel number (n = 0 to 3),
p: CSI number (p = 00, 01, 10, 11, 20, 21,30, 31)
Remarks2. The functions incorporated and port functions to use are different depending on the product. For details, refer to the appropriate user's manuals (hardware).

Table 3.2 Comparison between Registers (2/3)

| Item | 78K0/Kx2 | RL78/G13 |
|---|---|---|
| Automatic communication operation enable/disable | CSIMA0 register<br>ATE0 bit | None |
| Automatic communication mode specification | CSIMA0 register<br>ATM0 bit | None |
| Automatic data transfer stop | CSIT0 register<br>ATSTP0 bit | None |
| Automatic data transfer start | CSIT0 register<br>ATSTA0 bit | None |
| Automatic data transfer address point | ADTP0 register | None |
| Automatic Data Transfer Interval | ADTI0 register | None |
| Automatic data transfer address count | ADTC0 register | None |
| Selection of data phase | None | SCRmn register<br>DAPmn bit |
| Selection of clock phase | None | SCRmn register<br>CKPmn bit |
| Start trigger selection | None | SMRmn register<br>Set STSmn bit to 0 |
| Controls inversion of level of receive data of channel n in UART mode | None | SMRmn register<br>Set SISmn bit to 0 |
| Setting of operation mode of channel n | None | SMRmn register<br>Set MDmn2 bit to 0, MDmn1 bit to 0 |
| Selection of interrupt source of channel n | None | SMRmn register<br>MDmn0 bit |
| Mask control of error interrupt signal | None | SCRmn register<br>EOCmn bit |
| Setting of parity bit in UART mode | None | SCRmn register<br>Set PTCmn1 bit to 0, PTCmn0 bit to 0 |
| Setting of stop bit in UART mode | None | SCRmn register<br>Set SLCmn1 bit to 0, SLCmn0 bit to 0 |
| Setting of data length in CSI and UART modes | None | SCRmn register<br>DLSmn1 bit, DLSmn0 bit |

Remarks1. For RL78/G13, m: Unit number (m = 0, 1), n: Channel number (n = 0 to 3),
p: CSI number (p = 00, 01, 10, 11, 20, 21,30, 31)
Remarks2. The functions incorporated and port functions to use are different depending on the product. For details, refer to the appropriate user's manuals (hardware).

Table 3.3 Comparison between Registers (3/3)

| Item | 78K0/Kx2 | RL78/G13 |
|---|---|---|
| Clear trigger of framing error flag | None | SIRmn register<br>FECTmn (not used) |
| Clear trigger of parity error flag | None | SIRmn register<br>PECTmn (not used) |
| Clear trigger of overrun error flag | None | SIRmn register<br>OVCTmn bit |
| Buffer register status indication flag | None | SSRmn register<br>BFFmn bit |
| Framing error detection flag | None | SSRmn register<br>FEFmn (not used) |
| Parity/ACK error detection flag | None | SSRmn register<br>PEFmn (not used) |
| Overrun error detection flag | None | SSRmn register<br>OVFmn bit |
| Indication of operation enable/stop status | None | SEm register<br>SEmn bit |
| Serial output enable/stop | None | SOEm register<br>SOEmn bit |
| Clock output value setting when operation is disabled | None | SOm register<br>CKOmn bit |
| Data output value setting when operation is disabled | None | SOm register<br>SOmn bit |
| Selects inversion of the level of the transmit data | None | SOLm register<br>Set SOLmn bit to 0 |
| Selection of whether to enable or disable the generation of communication error interrupts in the SNOOZE mode | None | SSCm register<br>SSECm bit |
| Setting of the SNOOZE mode | None | SSCm register<br>SWCm bit |
| Switching channel 7 input of timer array unit | None | ISC register<br>Set ISC1 bit to 0 |
| Switching external interrupt (INTP0) input | None | ISC register<br>Set ISC0 bit to 0 |
| Use of noise filter | None | NFEN0 register<br>Set SNFENn0 bit to 0 |

Remarks1. For RL78/G13, m: Unit number (m = 0, 1), n: Channel number (n = 0 to 3),
p: CSI number (p = 00, 01, 10, 11, 20, 21,30, 31)
Remarks2. The functions incorporated and port functions to use are different depending on the product. For details, refer to the appropriate user's manuals (hardware).

## 4. Sample Code for Serial Array Unit

The sample code for Serial Array Unit is explained in the following application notes.

- RL78/G13 Serial Array Unit for 3-Wire Serial I/O (Master Transmission/Reception) CC-RL (R01AN2547)
- RL78/G13 Serial Array Unit for 3-Wire Serial I/O (Slave Transmission/Reception) CC-RL (R01AN2711)
- RL78/G13 DMA Controller (3-Wire Serial I/O Sequential Reception) CC-RL (R01AN2800)
- RL78/G13 Low-power Consumption Operation (CSI in SNOOZE Mode) CC-RL (R01AN2762)

## 5. Documents for Reference

User's Manual:

- RL78/G13 User's Manual: Hardware (R01UH0146)
- 78K0/Kx2 User's Manual: Hardware (R01UH0008)

The latest versions can be downloaded from the Renesas Electronics website.

Technical Update/Technical News:

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

## Revision History

| Rev. | Data | Description | |
|---|---|---|---|
| | | Page | Summary |
| 1.00 | Jul.31, 2019 | - | 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.

# 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 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.
5. 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.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.

   Unless expressly 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.
6. When using Renesas Electronics products, refer to the latest product information (data sheets, user’s manuals, application notes, “General Notes for Handling and Using Semiconductor Devices” in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. 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.
7. 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 subject to radiation resistance design. 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.
8. 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 carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
9. 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.
10. 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.
11. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.

(Note1) “Renesas Electronics” as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.

(Note2) “Renesas Electronics product(s)” means any product developed or manufactured by or for Renesas Electronics.

(Rev.4.0-1 November 2017)

## 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/.