

## R-IN32M3 Series

R01AN4601EJ0316

Rev.3.1.6

Jul 31, 2019

Driver/Middleware Set for R-IN32M3 TESSERA Board Release Note

### Summary

Thank you for using Driver/Middleware Set for R-IN32M3 board manufactured by Tessa Technology Inc.

This document describes the package contents and operating environment of this product.

Please be sure to read before use.

For details on how to use each sample software, middleware etc, please refer to the related documents below.

### Related documents

R18UZ0013EJ****	R-IN32M3-EC Development Tools Startup Manual
R18UZ0024EJ****	R-IN32M3-CL Development Tools Startup Manual
R18UZ0011EJ****	R-IN32M3 Series Programming Manual (OS edition)
R18UZ0009EJ****	R-IN32M3 Series Programming Manual (Driver edition)

Last four digits of document number (described as \*\*\*\*) indicate version information of each document.

Please download the latest document from our web site and refer to it.

### Contents

1. Introduction .....	2
2. Package contents .....	2
3. Folder structure .....	3
4. Operating environment .....	4
5. Change history .....	5
6. Website and Support.....	12

## 1. Introduction

Driver/Middleware Set for R-IN32M3 board manufactured by Tessera Technology Inc. is a software package that collects various sample applications, libraries, middleware, peripheral function drivers that can be used for developing applications using R-IN32M3-EC/-CL.

## 2. Package contents

The sample applications, libraries, middleware, and peripheral function drivers included in this package are shown below.

- Sample application

No.	Sample application name
1	CAN sample
2	EEP writer
3	EtherCAT
4	EtherCAT SSC
5	Interval timer sample
6	OS sample
7	OS-less sample
8	Version get sample

- Library

No.	Library name
1	HW-RTOS library

- Middleware

No.	Middleware name
1	EEPROM control
2	Parallel flash ROM control
3	Serial flash ROM control

- Peripheral function driver

No.	Driver name
1	CAN
2	CSI
3	DMAC
4	IIC
5	Serial Flash MEMC
6	Timer (32bit timer TAUJ2)
7	UART
8	WDT

- Flash loader (for IAR EWARM)

No.	Flash loader name
1	FlashRIN32M3_NOR
2	FlashRIN32M3_SerialFlash

### 3. Folder structure

Folder structure of this package is shown below.

```
TOP
|
+-- IAR_flashloader << Flash loader for IAR EWARM >>
|   +-- flashloader
|   +-- src
|
+-- r-in32m3_samplesoft
    +-- CMSIS << Cortex Microcontroller Software Interface Standard >>
    |   +-- include
    |
    +-- Device << Device dependent files >>
        +-- Renesas
            +-- RIN32M3 << R-IN32M3 dependent files >>
                +-- Include << Include directory >>
                +-- Library << Library directory >>
                +-- Source << Source directory >>
                    |
                    +-- Driver << Driver directory >>
                    +-- Middleware << Middleware directory >>
                    +-- Project << Project directory >>
                    | |
                    | +-- can_sample
                    | +-- eep_writer
                    | +-- EtherCAT
                    | +-- EtherCAT_SSC
                    | +-- interval_timer
                    | +-- os_sample
                    | +-- osless_sample
                    | +-- version_get_sample
                    |
                    +-- Templates << Startup file and others >>
                        +-- ARM << Arm compiler dependent files >>
                        +-- GCC << GCC compiler dependent files >>
                        +-- IAR << IAR compiler dependent files >>
```

## 4. Operating environment

The operating environment of this package is shown below.

- Target device
  - R-IN32M3-EC
  - R-IN32M3-CL
  
- Target board
  - TS-R-IN32M3-EC (Tessera Technology Inc.)
  - TS-R-IN32M3-CEC (Tessera Technology Inc.)
  - TS-R-IN32M3-CL (Tessera Technology Inc.)
  
- Development environment
  - Compiler
    - Arm : RealView Developer Suite
    - Mentor Graphics : Sourcery G++ Lite
    - IAR : Embedded Workbench for Arm
  - Debugger
    - DTS Insight : microVIEW-PLUS
    - IAR : Embedded Workbench for Arm
  - ICE
    - DTS Insight : adviceLUNA
    - IAR : I-jet / JTAGjet-Trace / J-Link / J-Trace

- Flash loader for IAR Embedded Workbench for Arm

A flash loader for IAR EWARM is included in this package. If flash writing can not be performed with the IAR EWARM standard flash loader, please update to the flash loader of this package.

The Serial Flash supported by the flash loader of this package is as follows.

Cypress Semiconductor	S25FL032P	S25FL064P	
Micron Technology	M25P16		
Winbond Electronics	W25X80BV	W25X40BV	W25X20BV
	W25X10BV	W25Q32JV-DTR	
Macronix International	MX25L3233F		

Please refer to "R-IN32M3-CL Development Tools Startup Manual 2.3 Updates of the IAR Flash Loader program of IAR systems" for the update method. The flash loader can be used with IAR EWARM Version 7.80.4 or later.

If you are using Serial Flash other than the above, please create a flash loader file with the included source file.

Source file: "r-in32m3\_samplesoft\IAR\_flashloader\src\FlashRIN32M3\_SerialFlash"

## 5. Change history

Version	Changes
V3.1.6 (Mar 20, 2019)	<p>Package Version : 3.1.6 Driver Version : 1.0.4 HWOS Version : 2.0.3</p> <p>[Changes-1] Include\RIN32M3_CL.h Include\RIN32M3_EC.h Source\Driver\wdt\wdt.c</p> <p>- Correction of inconsistencies with the user manual</p>
V3.1.5 (Nov 27, 2018)	<p>Package Version : 3.1.5 Driver Version : 1.0.3 HWOS Version : 2.0.3</p> <p>[Changes-1] Source\Driver\iic\iic.c</p> <p>- Modify setting the high/low level width of SCLn.</p> <p>[Changes-2] Source\Project\EtherCAT\main.c Source\Project\EtherCAT_SSC\RenesasSDK\main.c</p> <p>- Add condition of EEPROM check.</p> <p>[Changes-3] Source\Project\EtherCAT_SSC\RenesasSDK\main.c Source\Project\EtherCAT_SSC\RenesasSDK\kernel_cfg.h Source\Project\EtherCAT_SSC\RenesasSDK\kernel_cfg.c Source\Project\EtherCAT_SSC\RenesasSDK\renesashw.c</p> <p>- Change EtherCAT Interrupt process from HW-ISR to software ISR</p> <p>[Changes-4] Source\Project\EtherCAT_SSC\RenesasSDK\renesashw.h Source\Project\EtherCAT_SSC\RenesasSDK\renesashw.c</p> <p>- Delete obsolete SSC function</p> <p>[Changes-5] Source\Project\EtherCAT\ESI\EEPROM.bin Source\Project\EtherCAT\ESI\Renesas R-IN32M3.xml Source\Project\EtherCAT_SSC\CONFIG\Renesas_R-IN32M3-EC.xml</p> <p>- Modify ESC configuration value of SII</p> <p>[Changes-6] IAR_flashloader\flashloader\Renesas\FlashRIN32M3_NOR.mac IAR_flashloader\flashloader\Renesas\FlashRIN32M3_SerialFlash.mac IAR_flashloader\flashloader\Renesas\FlashRIN32M3_SerialFlash.out</p>

	<p>- Modify flash lodear for IAR Embedded Workbench. It corresponds to the following board. TS-R-IN32M3-EC TS-R-IN32M3-CEC TS-R-IN32M3-CL R-IN32M3-EC Board Lite</p> <p>* This files can be used EWARM version 7.80 or upper version.</p>
V3.1.4 (Jun 16, 2017)	<p>Package Version : 3.1.4 Driver Version : 1.0.2 HWOS Version : 2.0.3</p> <p>[Changes-1] Include/RIN32M3_EC.h Include/system_RIN32M3.h Source/Project/EtherCAT_SSC/CONFIG/Renesas_R-IN32M3-EC.xml Source/Project/EtherCAT_SSC/RenesasSDK/kernel_cfg.c Source/Project/EtherCAT_SSC/RenesasSDK/kernel_id.h Source/Project/EtherCAT_SSC/RenesasSDK/main.c Source/Project/EtherCAT_SSC/RenesasSDK/renesashw.c Source/Project/EtherCAT_SSC/RenesasSDK/renesashw.h Source/Project/EtherCAT/ESI/Renesas R-IN32M3.xml Source/Project/EtherCAT/main.c</p> <p>- Support DC mode and Error LED pattern.</p>
V3.1.3 (Oct 28, 2016)	<p>Package Version : 3.1.3 Driver Version : 1.0.2 HWOS Version : 2.0.3</p> <p>[Changes-1] /Library/IAR/libos.a: /Library/ARM/libos.a: /Library/GCC/libos.a: /Include/kernel.h /Include/system_RIN32M3.h:</p> <p>- Modification of OS library and corresponding files.</p>
V3.1.2 (Mar 11, 2016)	<p>Package Version : 3.1.2 Driver Version : 1.0.2 HWOS Version : 2.0.2</p> <p>[Changes-1] /Include/RIN32M3_EC.h /Include/RIN32M3_CL.h /Include/can/* /Source/Driver/can/* /Source/Project/can_sample</p> <p>- Add CAN controler driver and CAN sample software.</p> <p>[Changes-2] /Library/IAR/libos.a: /Library/ARM/libos.a:</p>

	<p>/Library/GCC/libos.a:</p> <p>- Modification of OS library</p>
<p>V3.1.1 (Dec 28, 2015)</p>	<p>Package Version : 3.1.1 Driver Version : 1.0.1 HWOS Version : 2.0.1</p> <p>[Changes-1] /Include/csi/csi.h /Source/Driver/csi/csi.c</p> <p>The Initial mode is added at Reception/Transmission mode of CSI function. The default setting of this mode is set Initial mode.</p>
<p>V3.1.0 (Nov 30, 2015)</p>	<p>Package Version : 3.1.0 Driver Version : 1.0.0 HWOS Version : 2.0.1</p> <p>The following type name of products correspond with "Revision 2" and the other type name of products with "Revision 1"</p> <p>- Revision 2 R-IN32M3-EC : MC-10287BF1-HN4-M1-A / MC-10287BF1-HN4-A R-IN32M3-CL : UPD60510BF1-HN4-A / UPD60510BF1-HN4-M1-A</p> <p>[Changes-1] /Include/RIN32M3_EC.h /Include/RIN32M3_CL.h</p> <p>following registers are added from "Revision 2" Please refer the "R-IN32M3 Series User's Manual Peripheral Functions"</p> <p>ETHSW10HDEN : ETHER SWITCH 10Mbps Half duplex mode setting register CPUBUSMD : CPU Bus mode register</p> <p>[Changes-2] /Templates/ARM/startup_RIN32M3.c /*.ld</p> <p>Mapping file(*.ld) and startup routine (startup_RIN32M3.c) for ARM are updated. Before: The common area is assigned for stack and Heap. After: Dedicated area is assigned for Heap. Especially for GCC, please use mapping file and startup routine for same Revision.</p> <p>[Changes-3] There are two types of mapping files and startup routine in this sample software. One is for "Revision 1" (CPU access area limitation *notice) The other is for "Revision 1" (no limitation)</p> <p>Mapping file for Revision 1 /Source/Templates/IAR/rev1 /Source/Templates/GCC/rev1 /Source/Templates/ARM/rev1 Each Project.</p>

	<p>Mapping file for Revision 2          /Source/Templates/IAR/rev2          /Source/Templates/GCC/rev2          /Source/Templates/ARM/rev2</p> <p>*notice Please refer below documentation  <a href="http://documentation.renesas.com/doc/products/mpumcu/tu/tnrina001be.pdf">http://documentation.renesas.com/doc/products/mpumcu/tu/tnrina001be.pdf</a></p>
V3.0.1 (Aug 31, 2015)	<p>Package Version : 3.0.1          Driver Version : 1.0.0          HWOS Version : 2.0.1</p> <p>[Changes-1]          /Library/IAR/libos.a:          /Library/ARM/libos.a:          /Library/GCC/libos.a:          /Include/kernel.h:          /Include/system_RIN32M3.h:</p> <p>- Modification of OS library and corresponding files.</p> <p>[Changes-2]          /EtherCAT/GCC/scat_boot_iram.ld          /EtherCAT_SSC/GCC/scat_boot_iram.ld          /os_sample/GCC/scat_boot_iram.ld</p> <p>- Remove unnecessary definition of linker file.</p>
V3.0.0 (May 11, 2015)	<p>[Changes-1]          /Library/IAR/libos.a:          /Library/ARM/libos.a:          /Library/GCC/libos.a:          /Include/itron.h:          /Include/kernel.h:          /Include/hwos/hwos_hwfn.h</p> <p>Modification of OS library and corresponding files.</p> <p>[Changes-2]          Linker file of EtherCAT, EtherCAT_SSC, os_sample project          Mapping avoidance to a specific address.</p> <p>[Changes-3]          /Source/Templates/GCC/startup_RIN32M3.c          -modify startup routine for GCC environment.</p> <p>[Changes-4]          /Include/system_RIN32M3.h:          /Source/Templates/system_RIN32M3.c:          Add getversion function.</p>
V2.1.5 (Feb 23, 2015)	<p>[Appended]          /Source/Project/EtherCAT_SSC/CONFIG/Renesas_R-IN32M3-EC.xml          - Append Configuration File for EtherCAT Slave Stack Code Tool; Version="5.11"</p>

	<p>[Changes] /Source/Project/EtherCAT_SSC/RenesasSDK/main.c - Change the include file for SSC Tool ver.5.11. If use SSC Tool ver.5.10, change the include path in main.c.</p>
V2.1.4 (Nov 25, 2014)	<p>[Appended] - Append MDK-ARM projects.</p> <p>[Changes-1] - "IAR_flashloader" supports serial flash device "M25P16" for "R-IN32M3-EC Lite" Board.</p> <p>[Changes-2] /Include/RIN32M3_EC.h: /Include/RIN32M3_CL.h: - Add statistics register in EtherSwitch.</p> <p>[Changes-3] /Include/RIN32M3_EC.h: /EtherCAT/main.c /EtherCAT_SSC/main.c - Change register name; 0x6A0(SIPPHYMD to PHYMD), 0x6A4(SIPPHYUS to PHYUS) - Add check PHY status before internal PHY reset.</p>
V2.0.1 (Aug 26, 2014)	<p>[Changes] /Source/Project/EtherCAT/ESI/Renesas R-IN32M3.xml: - Change the CoE Offline identify(0x1008).</p> <p>[Fixes] /Source/Project/EtherCAT/main.c: - Fix the AL Control event Mask Setting.</p>
V2.0.0 (Dec 26, 2013)	<p>[New] - Add "IAR_flashloader" for new board "TS-R-IN32M3-CL".</p> <p>[Changes] /Source/Library/*/libos.a: - Change the how to initialize stack pointer for boot loader use.</p> <p>/Source/Templates/system_RIN32M3.c: - Add WDT settings for R-IN32M3-CL. - Changed memory controller setting for several boards use.</p> <p>[Fixes] /Include/RIN32M3_EC.h: /Include/RIN32M3_CL.h: - Fix "CSIHnMCTL0" register address.</p>
V1.5.1 (Sep 20, 2013)	<p>[Fixes] /Source/Project/EtherCAT_SSC: - Fix linker configuration file, that doesn't use packing algorithm.</p> <p>/Source/Project/eep_writer: - Fix include paths.</p>
V1.5.0 (Sep 13, 2013)	<p>[Fixes] /Source/Project/EtherCAT_SSC:</p>

	<ul style="list-style-type: none"> <li>- Fix invalid access before the base address pointer is set.</li> </ul> <p>/Source/Library/*/libos.a:</p> <ul style="list-style-type: none"> <li>- Fix the type of variable for mailbox driver.</li> <li>- Fix volatile variables.</li> <li>- Fix the return value of check of get_tid/iget_tid when interrupt context is used.</li> <li>- Fix the way to call SVC instruction for IAR and GCC.</li> <li>- Fix the return value of prcv_mbx when TA_MPR1 attribute is selected.</li> </ul> <p>[Changes]</p> <p>/Include/system_RIN32M3.h:</p> <ul style="list-style-type: none"> <li>- Chaned UART channel from 0 to 1 for evaluation board (2nd edition).</li> </ul> <p>/Source/Driver/hwos:</p> <ul style="list-style-type: none"> <li>- Remove source codes for HW-RTOS drivers.</li> </ul> <p>/Source/Templates/IAR:</p> <ul style="list-style-type: none"> <li>- Merge vectors_M.c to cstartup_M.c.</li> <li>- Remove device configuration files for EWARM, RIN32M3.ddf, RIN32M3.mac, RIN32M3.xml.</li> </ul> <p>/Source/Project/EtherCAT_SSC:</p> <ul style="list-style-type: none"> <li>- Available to ARM and GCC.</li> </ul> <p>Others:</p> <ul style="list-style-type: none"> <li>- Remove IAR_FlashWriter.</li> <li>- Add compile option "--c99" to ARM compiler, and "-std=gnu99" to GCC compiler.</li> </ul>
<p>V1.1.4 (Jul 26, 2013)</p>	<p>[New]</p> <p>/Source/Project/EtherCAT_SSC:</p> <ul style="list-style-type: none"> <li>- Created for Slave Stack Code tools user.</li> </ul> <p>[Fixes]</p> <p>/Source/Templates/GCC/startup_RIN32M3.c:</p> <ul style="list-style-type: none"> <li>- Fixed the problem of uninitialized variable reference in case memory copy size is under 3 bytes.</li> </ul> <p>/Source/Project/EtherCAT:</p> <ul style="list-style-type: none"> <li>- Delete setting of non-exist port.</li> </ul> <p>/Source/Driver/hwos:</p> <p>/Source/Library/*/libos.a:</p> <ul style="list-style-type: none"> <li>- Fix max ID check.</li> <li>- Fix the return value of dis_dsp/ena_dsp during CPU lock state.</li> <li>- Fix mutex ID check in del_mtx.</li> <li>- Fix the return value of cre_sem, when invalid maxsemcnt is selected.</li> <li>- Fix the return value of cre_mtx, when invalid attribute is selected.</li> <li>- Fix the return value of pol_flg, when invalid wait mode is selected.</li> </ul> <p>All:</p> <ul style="list-style-type: none"> <li>- Comment headder are fixed.</li> </ul> <p>[Changes]</p> <p>/Source/Middleware/eeprom:</p>

	<ul style="list-style-type: none"><li>- Delete doxygen files in "eeprom" directory.</li></ul> <p>/Source/Driver/timer:</p> <ul style="list-style-type: none"><li>- One count timer function is enabled.</li></ul> <p>All:</p> <ul style="list-style-type: none"><li>- Change some descriptions in Makefile.</li></ul>
V1.0.0 (Apr 08, 2013)	First release

## 6. Website and Support

Renesas Electronics Website

<http://www.renesas.com/>

Inquiries

<http://www.renesas.com/contact/>

All trademarks and registered trademarks are the property of their respective owners.

## Revision history

Revision	Date	Page	Changes
3.1.6	Jul 31 2019	-	Update to package V 3.1.6
3.1.5	Dec 27 2018	-	First edition

## 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. 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 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. Unused pins should be handled as described under Handling of Unused Pins in the manual.

### 2. Processing at Power-on

The state of the product is undefined at the moment 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 moment 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 moment 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 moment when power is supplied until the power reaches the level at which resetting has been specified.

### 3. Prohibition of Access to Reserved Addresses

Access to reserved addresses is prohibited.

- The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.

### 4. Clock Signals

After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has 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. Moreover, 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.

### 5. Differences between Products

Before changing from one product to another, i.e. to a product with a different part number, confirm that the change will not lead to problems.

- The characteristics of Microprocessing unit or Microcontroller unit products in the same group but having a different part number may differ in terms of the 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.

- Arm® and Cortex® are registered trademarks of Arm Limited (or its subsidiaries) in the EU and/or elsewhere. All rights reserved.
- Ethernet is a registered trademark of Fuji Xerox Co., Ltd.
- Additionally all product names and service names in this document are a trademark or a registered trademark which belongs to the respective owners.

## 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.  
(Note 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.  
(Note 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

(Rev.4.0-1 November 2017)



### SALES OFFICES

Renesas Electronics Corporation

<http://www.renesas.com>

Refer to "<http://www.renesas.com/>" for the latest and detailed information.

**Renesas Electronics Corporation**  
TOYOSU FORESIA, 3-2-24 Toyosu, Koto-ku, Tokyo 135-0081, Japan

**Renesas Electronics America Inc.**  
1001 Murphy Ranch Road, Milpitas, CA 95035, U.S.A.  
Tel: +1-408-432-8888, Fax: +1-408-434-5351

**Renesas Electronics Canada Limited**  
8251 Yonge Street, Suite 8309 Richmond Hill, Ontario Canada L4C 9T3  
Tel: +1-905-237-2004

**Renesas Electronics Europe GmbH**  
Arcadiastrasse 10, 40472 Düsseldorf, Germany  
Tel: +49-211-6503-0, Fax: +49-211-6503-1327

**Renesas Electronics (China) Co., Ltd.**  
Room 101-T01, Floor 1, Building 7, Yard No. 7, 8th Street, Shangdi, Haidian District, Beijing 100085, China  
Tel: +86-10-8235-1156, Fax: +86-10-8235-7679

**Renesas Electronics (Shanghai) Co., Ltd.**  
Unit 301, Tower A, Central Towers, 555 Langao Road, Putuo District, Shanghai 200333, China  
Tel: +86-21-2226-0888, Fax: +86-21-2226-0899

**Renesas Electronics Hong Kong Limited**  
Unit 1601-1611, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong  
Tel: +852-2265-8688, Fax: +852-2886-9022

**Renesas Electronics Taiwan Co., Ltd.**  
13F, No. 363, Fu Shing North Road, Taipei 10543, Taiwan  
Tel: +886-2-8175-9600, Fax: +886-2-8175-9670

**Renesas Electronics Singapore Pte. Ltd.**  
80 Bendemeer Road, Unit #06-02 Hyflux Innovation Centre, Singapore 339949  
Tel: +65-6213-0200, Fax: +65-6213-0300

**Renesas Electronics Malaysia Sdn.Bhd.**  
Unit No 3A-1 Level 3A Tower 8 UOA Business Park, No 1 Jalan Pengaturcara U1/51A, Seksyen U1, 40150 Shah Alam, Selangor, Malaysia  
Tel: +60-3-5022-1288, Fax: +60-3-5022-1290

**Renesas Electronics India Pvt. Ltd.**  
No.777C, 100 Feet Road, HAL 2nd Stage, Indiranagar, Bangalore 560 038, India  
Tel: +91-80-67208700

**Renesas Electronics Korea Co., Ltd.**  
17F, KAMCO Yangjae Tower, 262, Gangnam-daero, Gangnam-gu, Seoul, 06265 Korea  
Tel: +82-2-558-3737, Fax: +82-2-558-5338