R8C/3MK Group

USB-to-Serial Communication Conversion Demo Board

R0K5R8C3MDU30BR Instruction Manual

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Introduction

This document is an instruction manual for the R0K5R8C3MDU30BR that enables USB-to-Serial communication conversion using the USB Peripheral function and serial communication function in R8C/3MK Group MCUs.

Target Device

R8C/3MK Group

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1. Preface

This document provides hardware setting instructions, operating instructions and usage notes for the R0K5R8C3MDU30BR to enable USB-to-Serial communication conversion using the USB Peripheral function and serial communication function in R8C/3MK Group MCUs.

Before using the demo board, please refer to ”7.1 Bundled Accessories Confirmation” to confirm you have all accessories bundled with the demo board package. If you have any questions concerning the demo board, please contact the closest Renesas Electronics Corp., Renesas Solutions Corp., or Renesas Electronics Sales Corp. office.

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2. Important

Before using this product, be sure to read this instruction manual carefully. Keep this manual, and refer to it when you have questions about this product.

Product:

"Product" in this document collectively refers to the following products manufactured by Renesas Electronics Corporation

(1) R8C/3MK Group USB - to - Serial Communication Conversion Demo Board R0K5R8C3MDU30BR

"Product" herein encompasses neither the customer's user system nor the host machine.

Purpose of use of the product:

This product is a demonstration board to use USB - to -Serial Communication function with R8C/3MK Group MCU. Be sure to use this product correctly according to said purpose of use. Please avoid using this product other than for its intended purpose of use.

For those who use this product:

This product can only be used by those who have carefully read this instruction manual and know how to use it. Use of this product requires basic knowledge of electric circuits, logical circuits, and MCUs.

When using this product:

(1)In no event shall Renesas Electronics Corporation be liable for any consequence arising from the use of this product.

(2)Renesas Electronics Corporation strives to provide workarounds for and correct trouble with products malfunctions, with some free and some incurring charges. However, this does not necessarily mean that Renesas Electronics Corporation guarantees the provision of a workaround or correction under any circumstances.

(3)This product covered by this document has been developed on the assumption that it will be used for evaluation in laboratories. Therefore, it does not fall within the scope of applicability of the Electrical Appliance and Material Safety Law and protection against electromagnetic interference when used in Japan.

(4)Renesas Electronics Corporation cannot predict all possible situations and possible cases of misuse that carry a potential for danger. Therefore, the warnings in this instruction manual and the warning labels attached to this product do not necessarily cover all such possible situations and cases. The customer is responsible for correctly and safely using this product.

(5)The product covered by this document has not been through the process of checking conformance with UL or other safety standards and IEC or other industry standards. This fact must be taken into account when the product is taken from Japan to some other country.

(6)This product is a product used for development and an evaluation stage. It cannot include in a user's product and cannot mass-produce.

(7)Even if it is the case where fault is in the device carried in this product, it does not exchange for the fault repair article of a device.

(8)Operation with all USB host devices cannot be guaranteed. And Connection to all serial communication devices cannot be guaranteed.

(9)The Application Notes of this product are all references, and no one to guarantee the operation.

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Usage restrictions:

This product has been developed as a means of supporting system development by users. Therefore, do not use it as an embedded device in other equipment. Also, do not use it to develop systems or equipment for use in the following fields.

(1) Transportation and vehicular

(2) Medical (equipment that has an involvement in human life)

(3) Aerospace

(4) Nuclear power control

(5) Undersea repeaters

If you are considering the use of this product for one of the above purposes, please be sure to consult your local distributor.

About product changes:

We are constantly making efforts to improve the design and performance of our product. Therefore, the specification or design of the product, or this user's manual, may be changed without prior notice.

About rights:

(1) We assume no responsibility for any damage or infringement on patent rights or any other rights arising from the use of any information, products or circuits presented in this user's manual.

(2) The information or data in this user's manual does not implicitly or otherwise grant a license to patent rights or any other rights belonging to Renesas or to a third party.

(3) This user's manual and this product are copyrighted, with all rights reserved by Renesas. This user's manual may not be copied, duplicated or reproduced, in whole or part, without prior written consent from Renesas.

About diagrams:

Some diagrams in this user's manual may differ from the objects they represent.

Warranty:

Renesas will exchange this board free of charge only due to manufacturing defects.

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3. Precautions for Safety

3.1 Definitions of Signal Words

This chapter describes the precautions which should be taken in order to use this product safely and properly. Be sure to read and understand this chapter before using this product.

Contact us if you have any questions about the precautions described here.

This chapter describes the precautions which should be taken in order to use this product safely and properly. Be sure to read this chapter before using this product.

⚠ WARNING	WARNING indicates a potentially dangerous situation that will cause death or heavy wound unless it is avoided.
⚠ CAUTION	CAUTION indicates a potentially dangerous situation that will cause a slight injury or a medium-degree injury or property damage unless it is avoided.

In addition to the two above, the following are also used as appropriate to indicate additional precautions.

[Notice] Point out the attention for the malfunction by wrong setting.

△means WARNING or CAUTION.

Example:  CAUTION AGAINST AN ELECTRIC SHOCK

⃠ means PROHIBITION.

Example:  DISASSEMBLY PROHIBITED

●means A FORCIBLE ACTION.

Example:  UNPLUG THE POWER CABLE FROM THE RECEPTACLE.

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3.2 Warning

⚠ WARNING

Warnings for Power Supply:



This product CAN NOT use external power supply from header pins. The demo board may incur damage.

Do not touch the plug of the power cable when your hands are wet. This may cause electric shock.

Power and Ground terminals are also on the rear surface of this product. They should Not be in contact with a conductive material directly.



When installing this equipment, insure that a reliable ground connection is maintained.



If you smell a strange odor, hear an unusual sound, or see smoke coming from this product, then disconnect power immediately Do not use this as it is because of the danger of electric shock and/or fire. In this case, contact your local distributor.

Before setting up this product and connecting it to other devices, turn off power or remove a power cable to prevent injury or product damage.

Warnings to Be Taken for Handling:



Do not break down this product. Breaking down the product will void your warranty.

Warning for Installation:



Do not set this product in water or areas of high humidity. Make sure that the product does not get wet. Spilling water or some other liquid into the product may cause un-repairable damage.

Warning for Use temperature:



This equipment is to be used in an environment with a maximum ambient temperature of 35°C.

Care should be taken that this temperature is not exceeded.

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3.3 Caution

⚠CAUTION

Cautions to Be Taken for Handling This Product:

Use caution when handling the product. Be careful not to apply a mechanical shock.

Do not touch the connector pins of this product directly. Static electricity may damage the internal circuits.

When attaching and removing the cable, hold the plug of the cable and do not pull on the cable. Do not pull this product by the communications interface cable. Excessive flexing or force may break conductors.

When you connect an external board to this product through test pins, be careful not to short signal lines or between power line and ground. If this product is revised by the user, operation cannot be guaranteed.

Note on Transporting the Product:

When sending your product, use the packing box and cushioning material supplied with the product when it was delivered to you and specify caution in handling (handling as precision equipment). If packing of your product is not complete, it may be damaged during transportation. When you pack your product in a bag, make sure to use the conductive plastic bag supplied with the product. If you use a different bag, it may lead to further trouble with your product due to static electricity.

Caution to Be Taken for Disposal:

Penalties may be applicable for incorrect disposal of this waste, in accordance with your national legislation.

European Union regulatory notices:

The WEEE (Waste Electrical and Electronic Equipment) regulations put responsibilities on producers for the collection and recycling or disposal of electrical and electronic waste. Return of WEEE under these regulations is applicable in the European Union only. This equipment (including all accessories) is not intended for household use. After use the equipment cannot be disposed of as household waste, and the WEEE must be treated, recycled and disposed of in an environmentally sound manner.

Renesas Electronics Europe GmbH can take back end of life equipment, register for this service at “http://www.renesas.eu/weee”.

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4. Demo Board Functions

With the MCU and the board circuits, this demo board can be used for the following.

USB-to-UART communication conversion function (program already written to MCU)
USB-to-UART/USB-to-I^2C/USB-SSU communication conversion function (provided via downloading module)
Rewrite internal program ROM via USB (downloader program already written to MCU)
Supports bus-powered (regulator from 5V to 3.3V) system power supply

5. Related Documents

Please refer to the following manuals and application note as needed when using the demo board.

- R8C/3MU Group, R8C/MK Group Users Manual Hardware Version
  Download from here:
  http://www.renesas.com/products/mpumcu/r8c/Documentation.jsp

- R8C/USB Group USB Downloader (r01an0703ej_r8cusbfdl.pdf)
  Please contact your Renesas sales or representative office to obtain this document.

- Renesas USB Device USB Peripheral Communications Devices Class Driver (PCDC)
  (r01an0555ej_r8cusbpcdc.pdf)
  Please contact your Renesas sales or representative office to obtain this document.

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6. Demo Board Description

6.1 Demo Board Specification

Figure 1 and Figure 2 show external views of the front and back of the demo board.

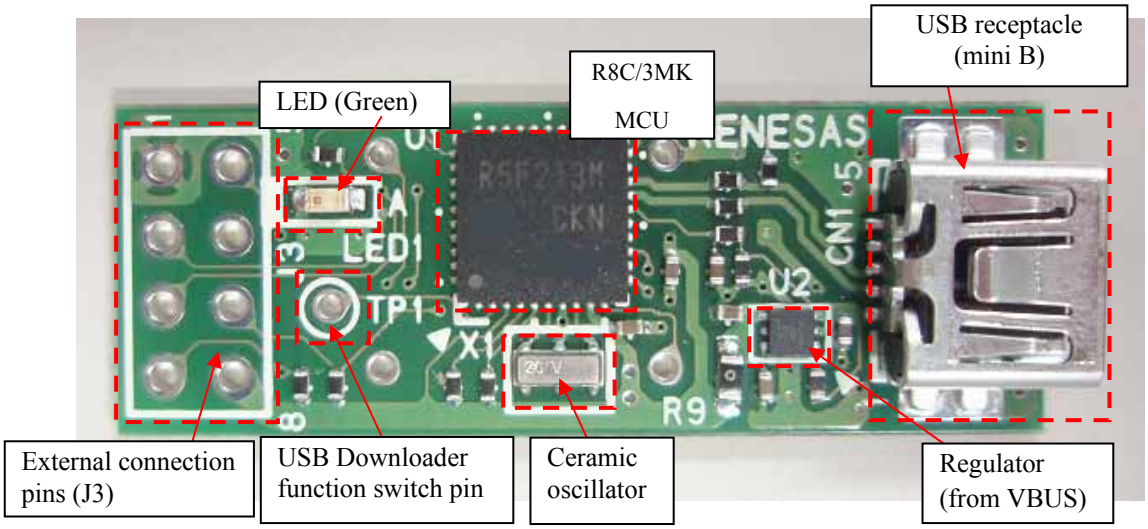


Figure 1 R0K5R8C3MDU30BR Board (Top View)

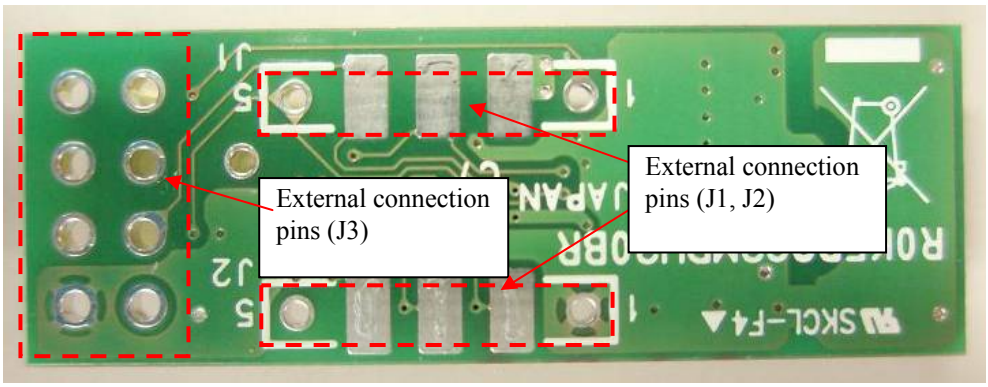


Figure 2 R0K5R8C3MDU30BR External View (back)

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Table 1 shows the key components embedded on the demo board. Please refer to "Appendix 3. Component List" for a detailed description of all components. Table 2 shows the operating environment, power specifications and dimensions of the demo board.

Table 1 R0K5R8C3MDU30BR Key Components Specifications

Item		Specification
MCU		R5F213MCKNNP (R8C/3MK Group) Program ROM: 128KB Data Flash ROM: 4KB RAM: 10KB
External clock		Ceramic oscillator(12MHz): CSTCE12M0GH5L-**R0 (Murata Mfg.)
USB	Functions	Peripheral function supporting MCU built-in USB 2.0-compliant Full-speed
	Receptacle	Mini B: UX60SC-MB-5ST (Hirose)
Power supply regulator		MIC5353-3.3YMT (Micrel)

Table 2 R0K5R8C3MDU30BR Power Supply, Dimensions, Environment Specifications

Item	Specification
Usage Environment Conditions	Temperature: 5 to 35℃ Humidity level: no condensation Surrounding gas: no corrosive gas
Operating Voltage and Supply Source	Power supply voltage: 3.3V Power supply source: USB VBUS (3.3V conversion via the regulator) Power and Ground terminals are also on the rear surface of this product. They should Not be in contact with a conductive material directly. This product CAN NOT use external power supply from J1, J2 and J3. Because of collision between the external power supply and the power from USB VBUS, possibly causing damage to the external serial device, the USB Host device, and the demo board.
External Dimensions	34mm X 12mm (excluding protrusions, cords, etc.)

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6.2 Function Overview

Figure 3shows the functional block diagram for the demo board, followed by a brief description of each function.

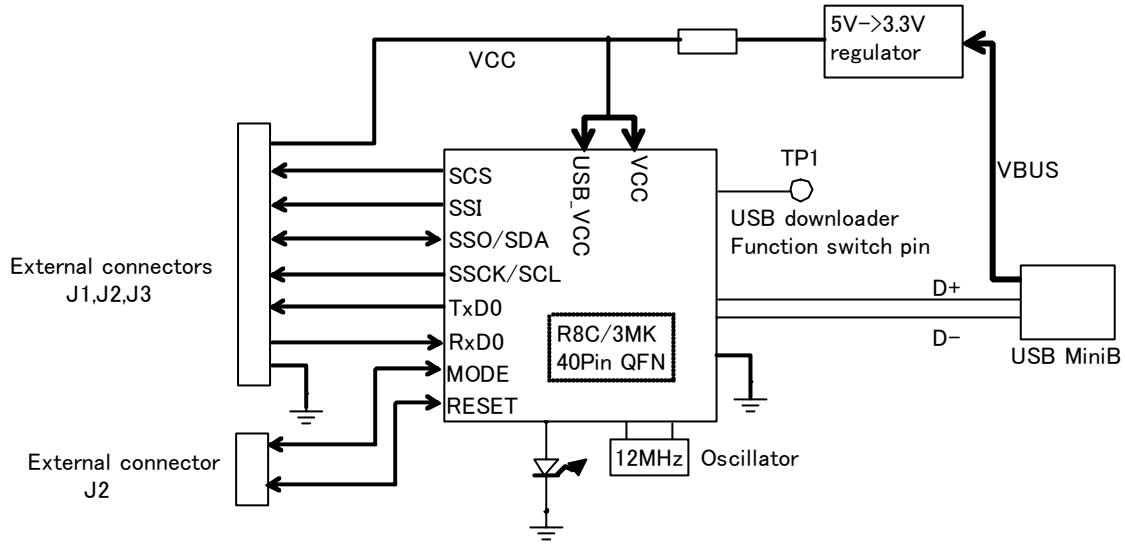


Figure 3 R0K5R8C3MDU30BR Functional Block Diagram

6.2.1 USB Peripheral

The demo board mounts a mini-B receptacle so that the MCU's built-in USB module can be used as a Peripheral device. The board also mounts a ceramic oscillator as the built-in USB's external oscillating device.

6.2.2 External Serial Communication Device Connector

The demo board has connectors (J1, J2, J3) on the front left edge and back surface for connection to external serial communication devices with header pins. Pins drawn out to J1, J2, and J3 are UART (TxD0, RxD0), SSU/I^2C (SCS, SSI, SSO/SDA, SSCK/SCL), and power supply/GND, as shown in Figure 3. For detailed instructions on how to attach the header pin to J3, see "7.2 Header Pin Attachment"; for details concerning connection with the external serial communication device, see "7.3 External Serial Device Connection."

6.2.3 Power Supply

The demo board can be powered from USB VBUS (bus-powered).The board includes a power regulator for converting the VBUS power (5V) to 3.3V.

Do not supply power from an external serial communications device. Doing so may cause damage due to a collision with the VBUS power supply.

6.2.4 USB Downloader

The demo board includes a USB downloader function as a method of rewriting the user program in the MCU built-in flash ROM area. When power is supplied to the demo board, this function automatically will be started while the function switch pin (TP1) is connected to GND. For more details on how to use this function, please refer to "8.2 USB Downloader Function."

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7. Setting up the Demo Board

7.1 Bundled Accessories Confirmation

Please confirm that you have all bundled accessories before using this demo board. Figure 4 shows a picture of the board and the header pin; Table 3 lists all accessories and corresponding quantities that come with the demo board package. The header pin is for use with J3; please mount on the board as needed. The system definition (Inf) file and the upgrade application software (mot) are provided as electronic data, and can be downloaded from Renesas web site (for more details, please see Release Note). Please refer to "8.Operating Instructions" to check the usage of these files.

Table 3 Bundled Accessories & Quantity

Component Name	QTY
Circuit Board (R0K5R8C3MDU30BR)	1
2.54-mm pitch, 2-row right angle Header pin (J3)	1
Release Note (English/Japanese)	1
System definitions file (CDC_demo.inf)	1
Upgrade application software (pcdcfw.mot)	1
Instruction Manual (this document)	1

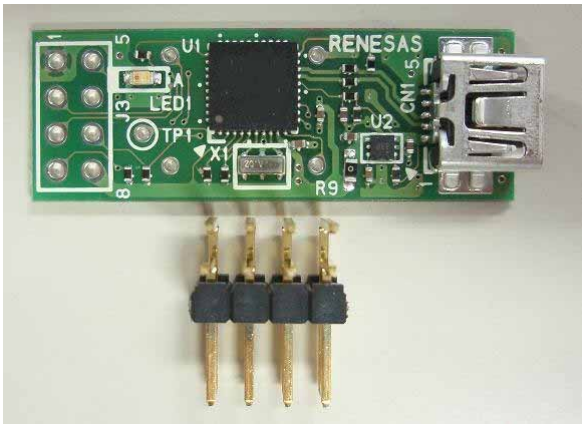


Figure 4 Circuit Board and Header Pin (for J3)

Do not supply power from an external serial communications device. Doing so may cause damage due to a collision with the VBUS power supply.

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7.2 Header Pin Attachment

Attach the right angle section of the bundled header pin (FFC-8LBMEP1B, Honda Tsushin Kogyo) to the holes (J3) on the left edge of the board as shown in Figure 5. Figure 6shows an attachment example. A user-provided header pin can also be attached to J3; the required dimensions are 2.54-mm pitch, 2-row, 8-pin header pin.

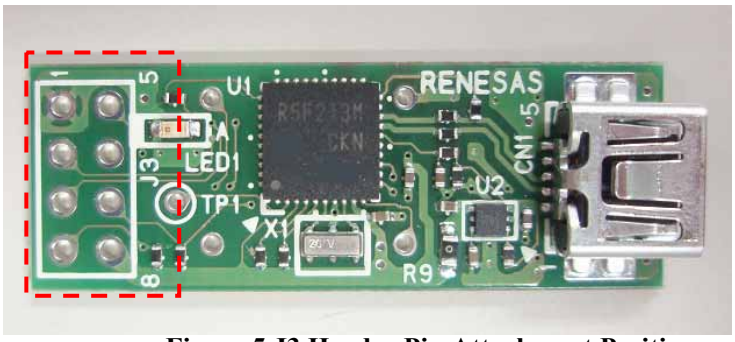


Figure 5 J3 Header Pin Attachment Position

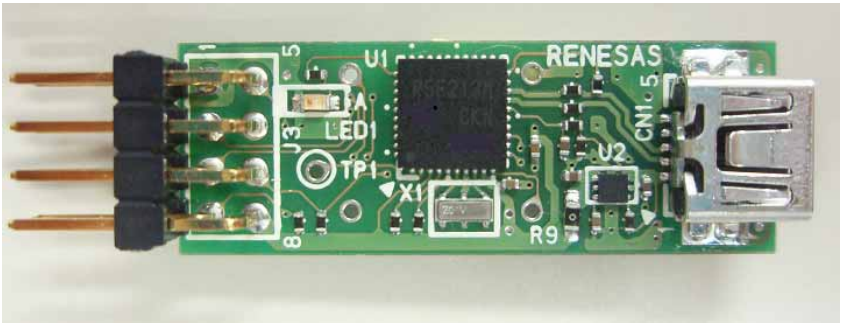


Figure 6 Example of Bundled Header Pin Attached to J3

7.3 External Serial Communications Device Connection

The demo board uses J1, J2, and J3 as connectors for external serial communications devices. Figure 7 and Figure 8 show the positioning of the signal lines and power supply/GND connected through for J1, J2 and J3. Table 4 shows the relation of the connector pin No. and the MCU functions. Refer to “Appendix 1 Circuit Diagram” for more details about the MCU wiring.

Power and Ground terminals are also on the rear surface of this product.
They should Not be in contact with a conductive material directly.

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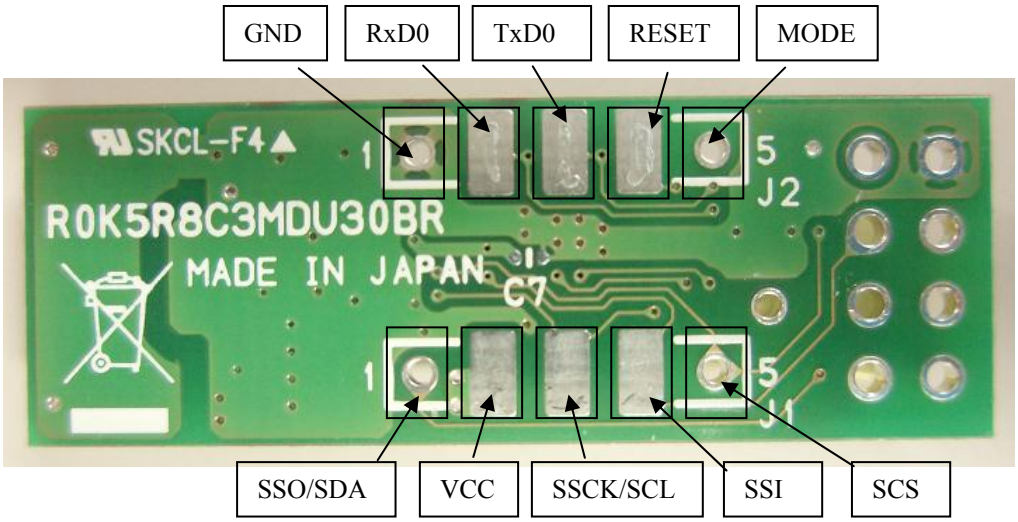


Figure 7 Positioning of Signal Lines and Power Supply/GND Connected to J1/J2

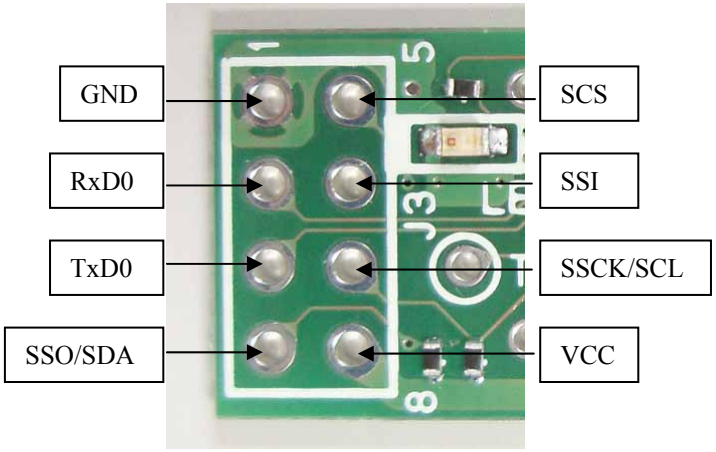


Figure 8 Positioning of Signal Lines and Power Supply/GND Connected to J3

Table 4 Relation of connector pin No. and MCU functions

Terminal name	J1 pin	J2 pin	J3 pin	UART	I^2C	SSU
GND	-	1	1	GND	GND	GND
RxD0	-	2	2	RxD0	-	
TxD0	-	3	3	TxD0	-	
SSO/SDA	1	-	4	-	SDA	SSO
SCS	5	-	5	-	-	SCS
SSI	4	-	6	-	-	SSI
SSCK/SCL	3	-	7	-	SCL	SSCK
VCC	2	-	8	VCC	VCC	VCC
RESET	-	4	-	-	-	-
MODE	-	5	-	-	-	-

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8. Operating Instructions

Application software for USB-to-Serial communication conversion has been installed in the MCU flash ROM mounted on this demo board. The serial driver at shipping is UART function. You can use USB-to-UART conversion.

This product also implements the downloader function via USB to update application software. If the user updates the upgrade USB-to-serial communication conversion application software released individually (Refer to 8.3), it is possible to communicate not only the UART device but also the I^2C devices or the 4-wire bus communication device (hereinafter called SSU device) to SSU in the R8C/3MK MCU.

As shown in Figure 9, if TP1 of this product is open when power is turned on, the application runs as the USB-to-serial communication conversion function. When TP1 is short to “GND”, the USB download function is enabled. Refer to ”7.3 External Serial Device Connection” for the detail about the connection with the external serial communication device.

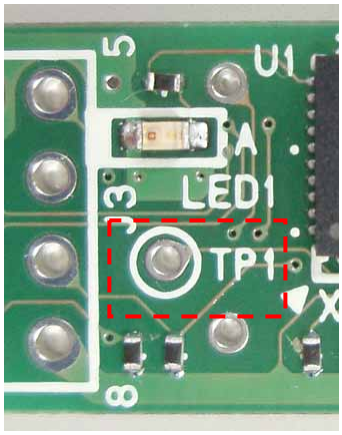


Figure 9 Close-up of TP1 on Circuit Board

8.1 USB-to-UART Communication Conversion Function (pre-installed version)

. Application software for USB–to-UART communication conversion has been installed at shipping. Figure 10 shows the switching sequence between the USB-to-UART communication conversion function and USB downloader function

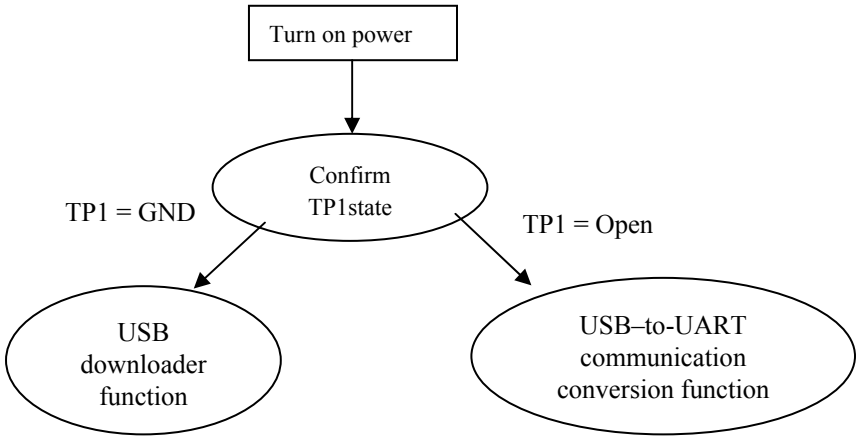


Figure 10 USB-to-UART Communication Function / USB Downloader Function Switching Sequence

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The following outlines the process until communication is achieved using the terminal software on the PC. For more details, refer to the application note titled “Renesas USB Device USB Peripheral Communications Devices Class Driver (PDCD).”

1) Connection to USB Host (PC)

(1) Connect the demo board to the USB Host (PC) using the USB cable (A-miniB).

(System definition file (CDC_Demo.inf) is required for the initial connection.)

(2) Confirm the COM number (Windows: device manager)

2) Start up Terminal Software

(1) Enter the confirmed COM number in the terminal software.

(2) Set the communication speed

Set baud rate from 4800bps to57600bps.

(3) Set all other parameters for serial port

Set the following setting

Data length: 8 bits; parity: none; stop bit: 1 bit; flow control: none

The example of data communication with a RS232C transceiver as an external UART device is shown in Figure 11. Figure 12 shows the example of the setting parameters for serial port on the terminal software.

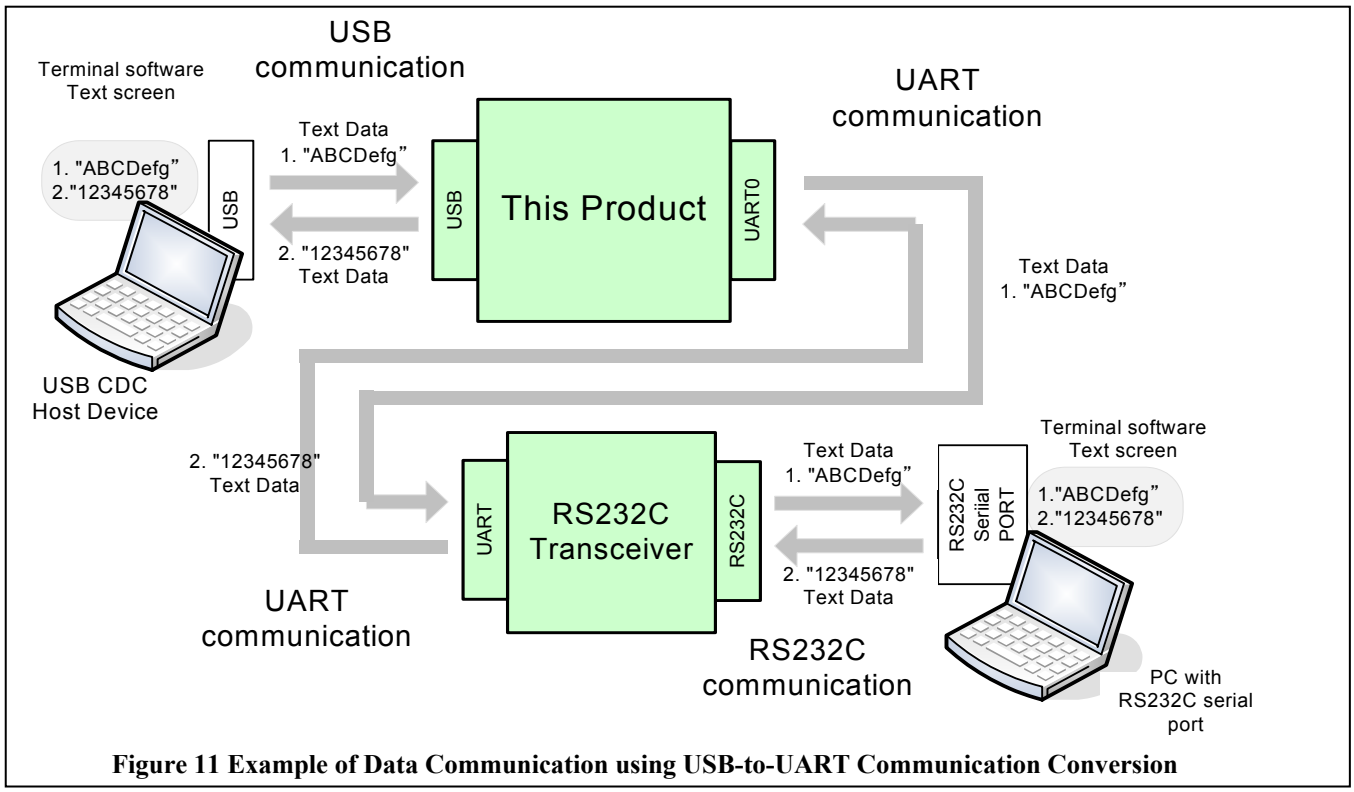


Figure 11 Example of Data Communication using USB-to-UART Communication Conversion

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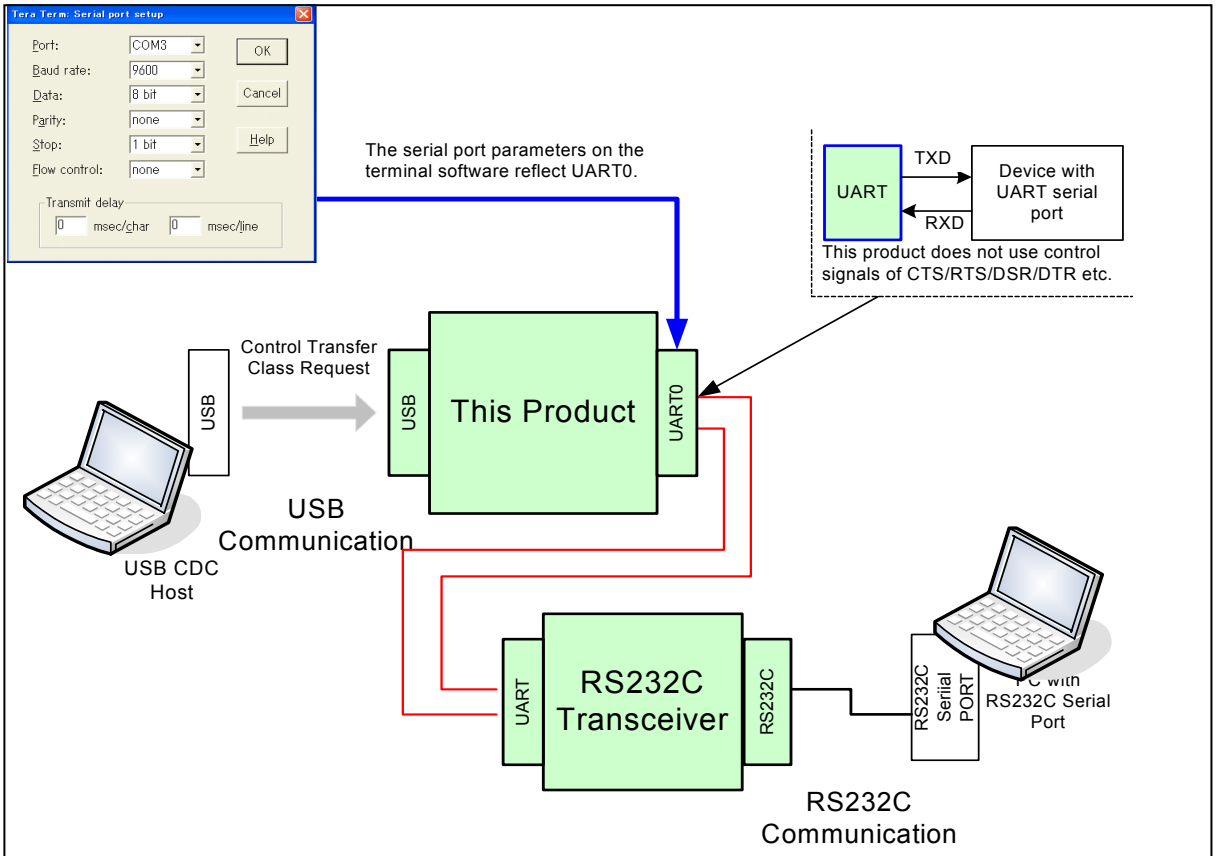


Figure 12 Example of setting the serial port parameters on the terminal software

8.2 USB Downloader Function

When the demo board is turned on while the USB downloader function switch pin (TP1) is grounded (GND), the USB downloader program is started up. In this function, the user can write a Motorola S Format (mot) file to the MCU internal flash ROM. The following outlines the sequence until the internal program has been updated. For more details, refer to the application note titled "R8C/USB Group USB Downloader."

1) Connection to USB Host (PC)

Connect this demo board to the USB Host (PC) using the USB cable (A-miniB).

(System definition file (CDC_Demo.inf) is required for the initial connection.)

(2) Confirm the COM number (Windows: device manager)

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2) Start up Terminal Software

(1) Enter the confirmed COM number in the terminal software. As this function enables serial communication, you do not need to set the communication speed, data length, etc.

(2) Nothing can be displayed immediately after startup, so you will need to display the operating menu with the M[CR] command.

If communications are running properly, the information in Figure 13 will be displayed on the screen.

```
Renesas USB Flash Sample
Press Command
M[CR] - Menu Display(these)
E [CR] - Erase Flash ROM
W[CR] - Write User Program
G[CR] - Go User Program
```

Figure 13 Terminal Software Display using M[CR] Command

3) Erase flash ROM data on the MCU

(1) Enter E[CR] command to start the flash ROM erase.

The “Erase complete” display shown in Figure 14 indicates the erase has been completed.

```
Erase Flash ROM start…
Erase complete
```

Figure 14 Terminal Software Display when MCU Flash ROM Data Erase is Complete

4) Write program

(1) Enter W[CR] command to send the target Motorola S Format file from the Terminal software. When the display shown in Figure 15 appears on screen, the Write process has been completed.

```
Please send a mot file
Write complete
```

Figure 15 Terminal Software Display after Program Write Completion

5) Restart program

After the program has been rewritten, the following two methods can be used to restart the program.

1) Enter the G[CR] Command

2) Remove the USB cable and power up the demo board with TP1 left open.

.

The program writing will be failure if this demo board is unplugged from PC when the program writing is executing. Please execute the program writing processing described in “8.2 USB Downloader Function” again, if the program writing is failure."

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8.3 USB-to-Serial Communication Conversion Function (the upgrade version)

After this upgrade application software is installed by using the USB downloader, it is possible to connect not only the UART device but also the I^2C devices or the SSU device.

Figure 16shows the switching sequence between the USB-to-Serial communication conversion function and USB downloader function.

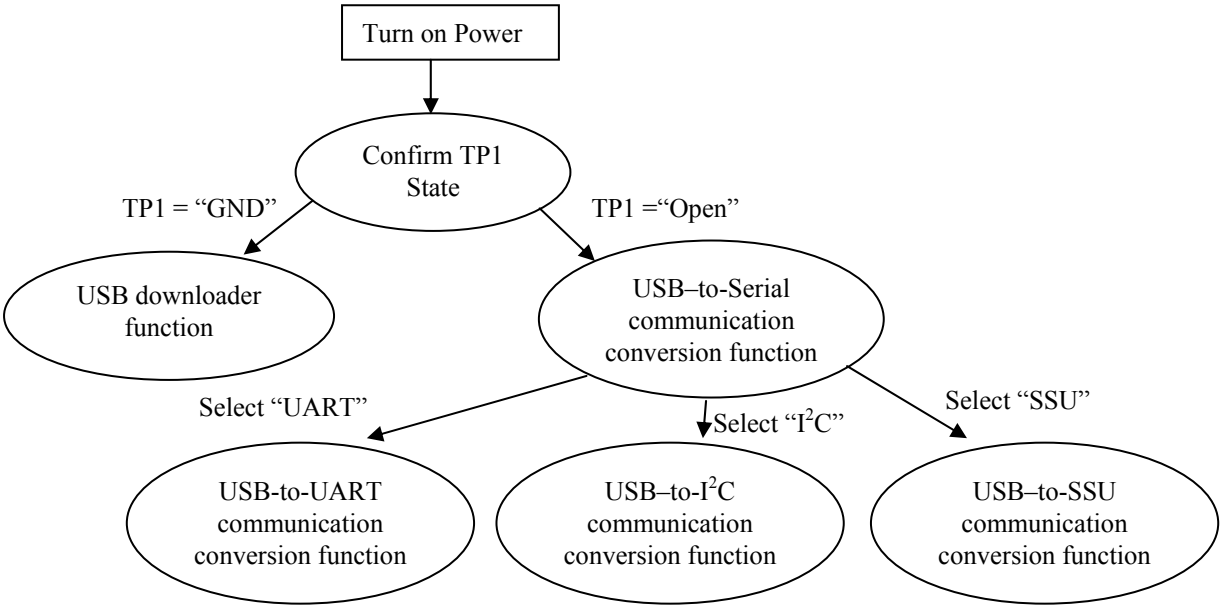


Figure 16 USB–to-Serial Communication Function/USB Downloader Function Switching Sequence USB

The following outlines the process until communication is achieved using the terminal software on the PC.

1) Connection to USB Host (PC)

(1) Connect the demo board to the USB Host (PC) using the USB cable (A-miniB).

(System definition file (CDC_Demo.inf) is required for the initial connection.)

(2) Confirm the COM number (Windows: device manager)

2) Start up Terminal Software

(1) Enter the confirmed COM number in the terminal software. For the first step is selecting serial function (UART ,SSU or I^2C) , you do not need to set the communication speed, data length, etc.

(2) The text shown in Figure 17 will be displayed in terminal software.

```
Do you select URT Demo ?
Do you select IIC Demo ?
Do you select SSU Demo ?
```

Figure 17 Display of Selecting the Serial Device on the Terminal Software

The display shown in Figure 17 means the following.

URT Demo : USB-to-UART communication conversion

IIC Demo : USB-to-I^2C communication conversion (Refer to Chapter 9)

SSU Demo : USB-to-SSU communication conversion (Refer to Chapter 10)

3) Selecting the serial function

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(1)You input the following command from the terminal software, and select the serial function.

"U" Command : USB-to-UART communication conversion

"I" Command : USB-to-I^{2}C communication conversion

"S" Command : USB-to-SSU communication conversion

When the display shows "OK You select XXX Demo!", the demo selection is done.

Figure 18 shows selecting the UART demo, Figure 19 shows selecting the I^{2}C demo and Figure 20 shows selecting the SSU demo.

OK You select URT Demo !

Figure 18 Display of Selecting USB-to-UART Communication Conversion

OK You select IIC Demo !

Figure 19 Display of Selecting USB-to-I^{2}C Communication Conversion

OK You select SSU Demo !

Figure 20 Display of Selecting USB-to-SSU Communication Conversion

4) Outline of USB-to-UART communication conversion

(1) Enter the COM number in the terminal software.

(2) Set the communication speed

Set baud rate from 600bps to115200bps

(3) Set all other parameters for serial port

Set the following for the program in the demo board.

Data length: 8 bits; parity: none; stop bit: 1 bit; flow control: none

In the case of sending large-volume data from USB Host at low communication speed, it is possible to overflow the USB receive block in this product. Avoiding this issue, you may set the flow control in the application software of USB Host side to pause and restart USB communication. When sending large-volume data at the following speed, you enable the flow control and set the transmit delay parameter in the application software of USB Host side.

2400bps, 1200bps	Flow Control: "Hardware", Transmit delay parameter: more than 1ms/char
600bps	Flow Control: "Hardware", Transmit delay parameters: more than 20ms/char and more than 20ms/line

The example of data communication is shown Figure 11. Figure 12shows the example of the setting parameters for serial port on the terminal software.

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5) Outline of USB-to-I^{2}C communication conversion

(1) Enter the confirmed COM number in the terminal software. As this function does not control UART function, you do not need to set the communication speed, data length, etc.

(2) This demo board can communicate the external I^{2}C devices at 400kHz clock,

(3)The parameters in the I^{2}C communication are the following.

This product can operate only as I^{2}C master device (You can communicate with I^{2}C slave devices)

Data length: 9bit (including acknowledge bit)

Wait insertion: No wait states (Data and the acknowledge bit are transferred consecutively).

(4)This product can communicate with the external I^{2}C devices according the I^{2}C demo communication protocol.

Figure 21 shows the example of the data communication with the LCD module and the temperature sensor as the external I^{2}C devices.

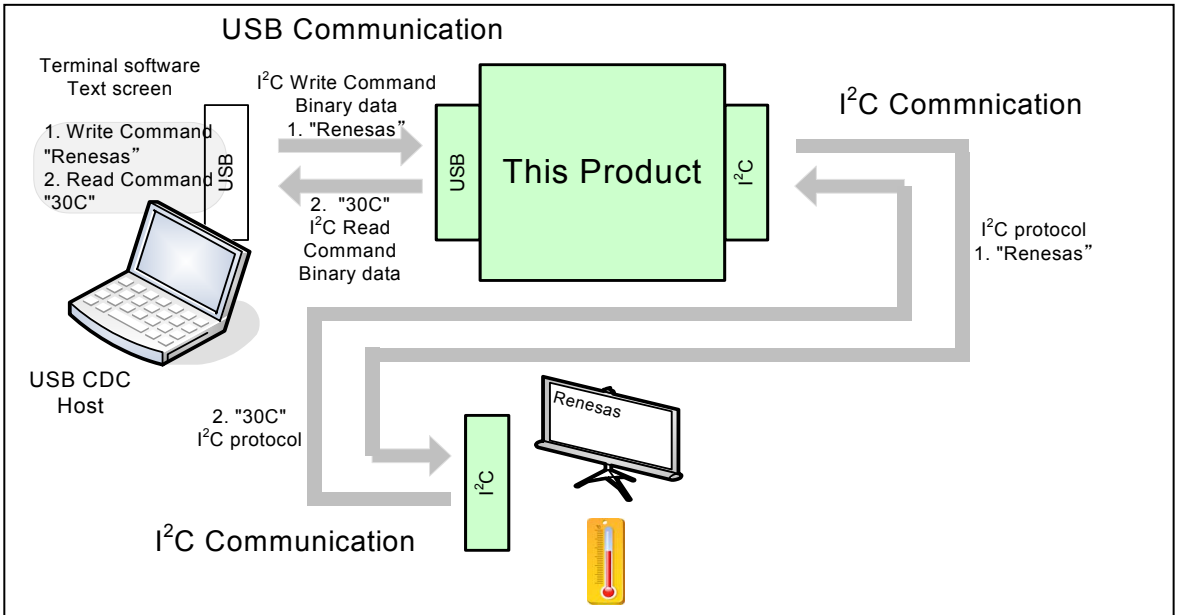


Figure 21 Example of Data Communication using USB-to-I^{2}C Communication Conversion

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6) Outline of USB-to-SSU communication conversion

(1) Enter the confirmed COM number in the terminal software. As this function does not control UART function, you do not need to set the communication speed, data length, etc.

(2) This demo board can communicate the external SSU device at 250kHz clock.

(3)The parameters in the SSU communication are the following.

This product can operate only as SSU master device (You can communicate with SSU slave device)

Data length: 8bit

Data transfer direction: MSB-first

SSCK clock phase: Change data at odd edge (Download data at even edge)

(4)This product can communicate with the external SSU device according the SSU demo communication protocol.

Figure 22shows the example of the data communication with the EEPROM as the external SSU devices.

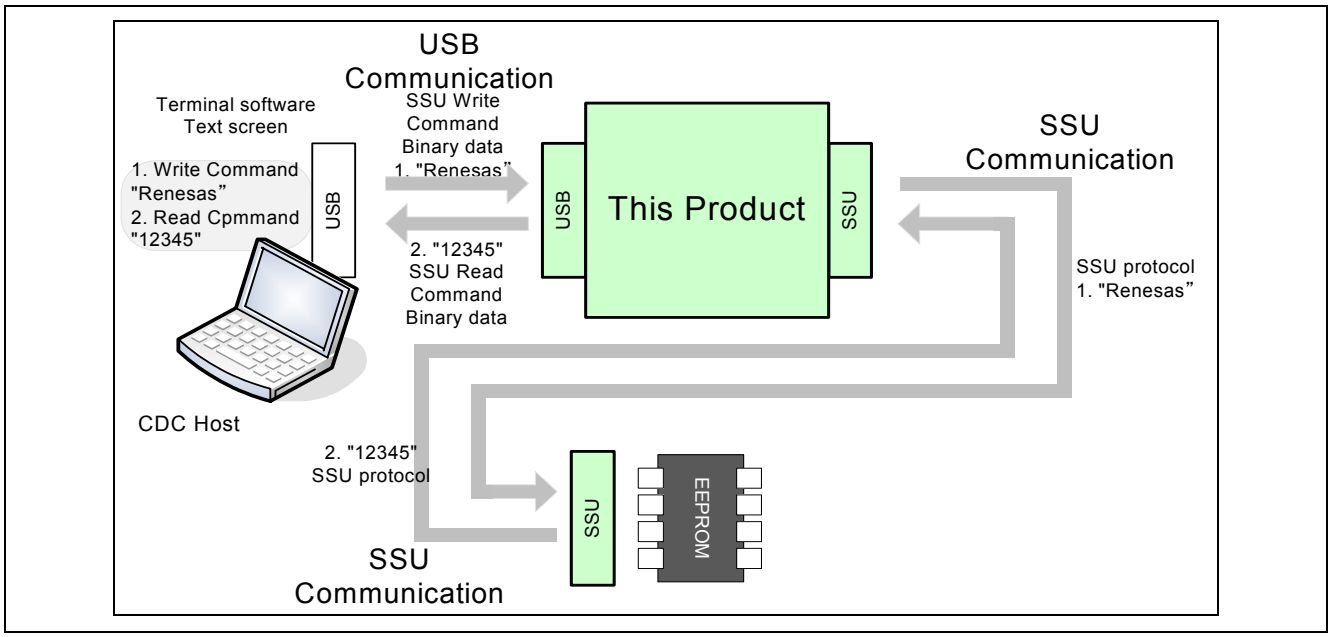


Figure 22 Example of Data Communication using USB-to-SSU Communication Conversion

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9. I²C demo communication protocol

9.1 USB Packet Specification

9.1.1 Structure of Command Packet

The command packet for controlling I²C device consists of five bytes. Figure 23 shows the structure of command packet.

The structure of Command Packet

OUT	Control 0x01	DevAdr 0x02	RegAdr 0x03	Len(Lower) 0x64	Len(Upper) 0x00	ACK

Figure 23 Structure of Command Packet

Each field

1) Control : operation type (1 byte in binary format)
   0x00: Write Access
   0x01: Read Access
   For the value other than the above, this product responses the error code (0xFFyy : yy is control field in the error condition) as a command error.

2) DevAdr: Device address of I²C devices (1 byte in binary format)
   0x00-0x7F
   This field consists of 7bits in binary format, this product does Not perform an error judgment.

3) RegAdr: Register / Control / Memory Address of I²C devices (1bytes in binary format)
   0x00-0xFF
   This field consists of 7bits in binary format, and this product does not perform an error judgment.
   The meaning of this field depends on the connected I²C device.

4) Len : Length of Data Packet (2bytes in binary format)
   0x0000-0xFFFF
   This field consists of 2 bytes in binary format. And this product does not perform an error judgment.

   The byte order of this field is little endian (the first is lower byte, and the second is upper byte)
   When you enter 0x0000 to this field, you can access 65536 bytes continuously.

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9.1.2 Structure of Data Packet

The data length is n bytes according to the connected I²C device. The maximum of the data length is the value of the Len field of the command packet. When the data length is more than 64bytes, the data is divided into multiple data packets. Figure 24 shows the structure of the data packet.

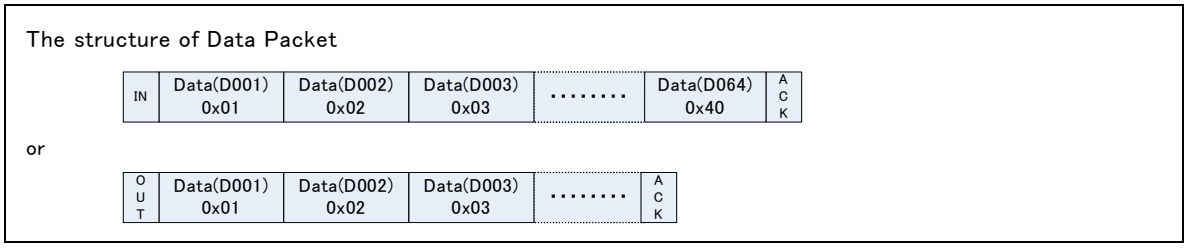


Figure 24 Structure of Data Packet

Data : Data body (n bytes in binary format)

The range of n is from 1 to 65536 bytes

The field consists of n bytes in binary format, and this product does not perform an error judgment

In the case of Write Access:

This product can continue receiving data from USB host until the USB data length is equal to Len field of packet command or USB short packet is received.

If the total length of command packet and data packet is less or equal 64bytes, you can send a combined packet. (The detail is refer to 9.1.3)

In the case of Read Access:

This product keeps on sending data to USB Host until the USB data length is equal to Len field of packet command.

9.1.3 Structure of Combined Packet

If the data length is less or equal 59bytes, you can combine command packet and data packet. Figure 25 shows the structure of combined packet.

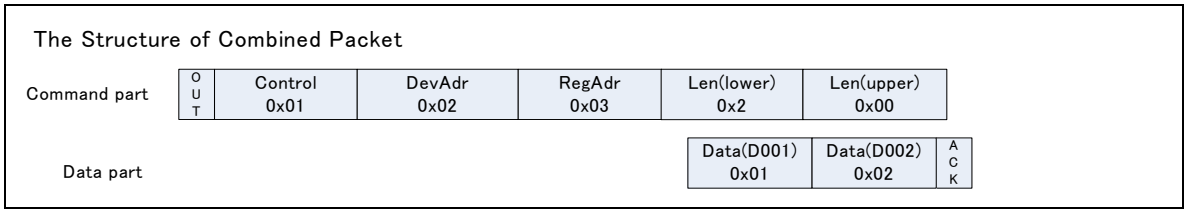


Figure 25 Structure of Combined Packet

9.1.4 Other rules

1) Error : Response of error condition
   0xFEFF : Command Packet Error
   0xFFyy : Command Error (yy is the control field in error condition)
2) Bus mastership during the data writing
   The I²C bus holds low level between each packet. This product does not release the mastership by the end of writing all data.
3) The length of the command packet
   When the length of command packet is less than 5bytes, this product judges an error packet and sends an error reply.
   When the length of command packet is more than 5bytes, this product judges a combined packet.

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9.2 Specification of USB -to - I²C Protocol Conversion

9.2.1 Protocol conversion of Read Access

When you read data from I²C devices, you enter the "Read Access" command to the virtual COM port, and receive data packet from the virtual COM port. Figure 26 shows the protocol conversion of the Read Access.

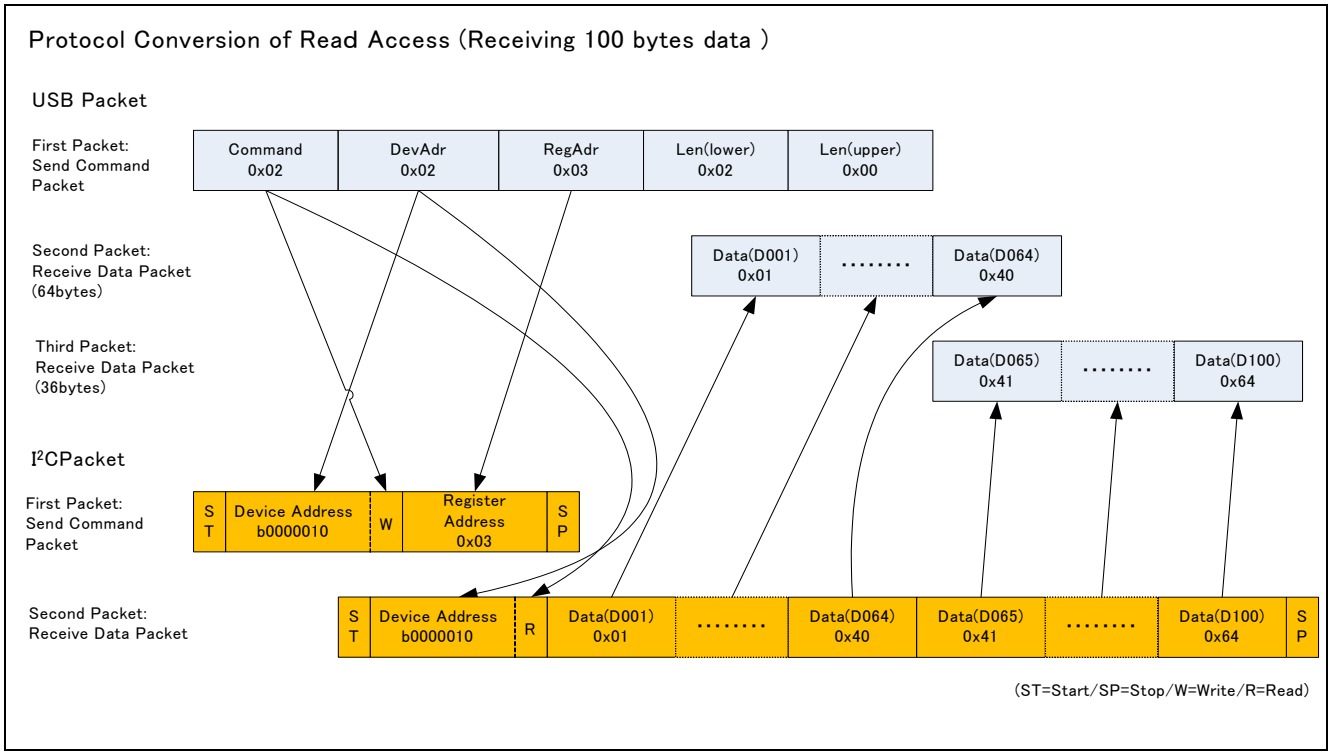


Figure 26 Protocol Conversion of Read Access

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9.2.2 Protocol Conversion of Write Access

When you write data to the I²C devices, you send the "Write Access" command packet to the virtual COM port, and send data packet continuously. Figure 27 shows the protocol conversion of Write Access. If the data packet length is short (less than 59bytes), you can combined command packet and data packet to "combined packet".

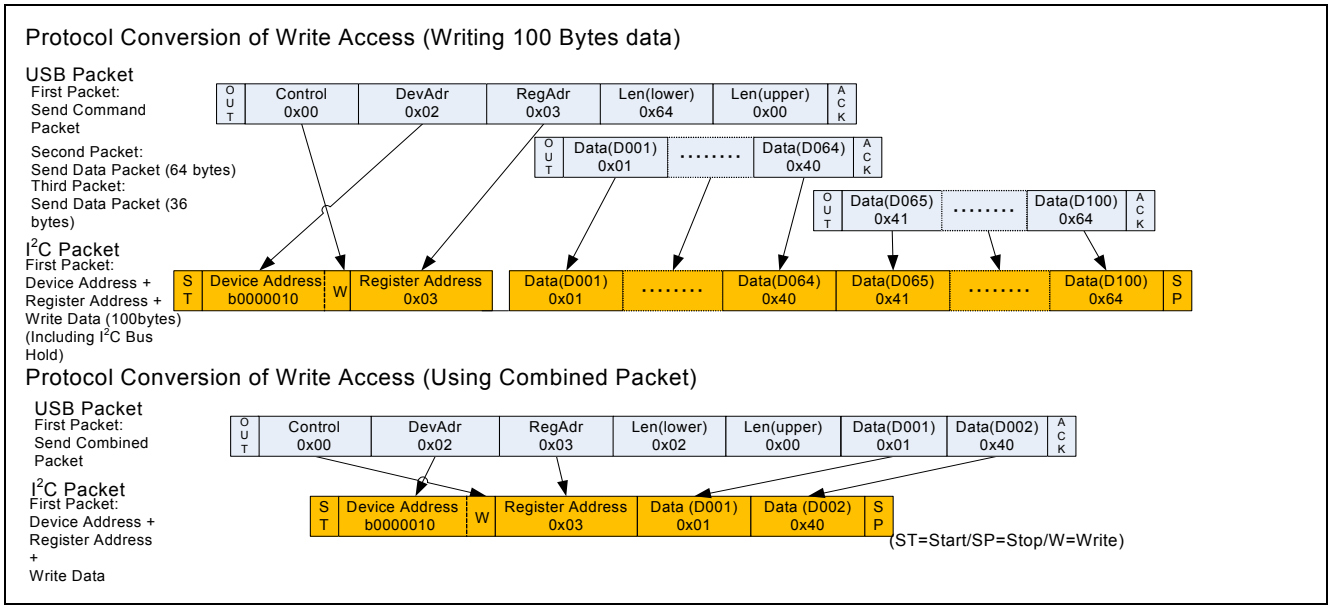


Figure 27 Protocol Conversion of Write Access

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9.3 Example of Command Script

Figure 28 shows the example of memory read and write access between this product and the EEPROM made by Renesas Electronics

```
Examples of Read Access / Write Access (I2C Device :R1EX24008ASAS0A)

; Select I2C Demo
send 'I'
pause 1

; Write Access (USB Command Packet and USB Data Packet separately)
; Write '1234567890abcdef' to Register Address "0x00".
send $00 $50 $00 $10 $00
send $31 $32 $33 $34 $35 $36 $37 $38 $39 $30 'abcdef'

; Write Access (Combined Packet)
; Write 'ghijklmnopqrstuv' to Register Address "0x10".
send $00 $50 $10 $10 $00 'ghijklmnopqrstuv'

; Read Access
; Read 16 bytes data from Register Address "0x00"
send $01 $50 $00 $10 $00
pause 1

; Read Access
; Read 16 bytes data  from Register Address "0x10".
send $01 $50 $10 $10 $00
pause 1

;End
beep
```

Figure 28 Example of Read / Write Command

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10. SSU demo communication protocol

10.1 USB Packet Specification

10.1.1 Structure of Command Packet

The structure of Command Packet for SSU demo has the following two types.

1) Control Command consisted of 5 bytes
2) Memory Read/Write Command consisted of 7bytes

Figure 29 shows the Control Command consisted of 5 bytes

The Command Packet of 5-byte composition

OUT	Control	Dummy	Instruction	Len(Lower)	Len(Upper)	ACK
	0x00	0x00	0x03	0x64	0x00	

Figure 29 the Control Command consisted of 5bytes

Figure 30 shows the Memory Read/Write Command consisted of 7 bytes

Memory Read/Write Command consisted of 7 bytes

OUT	Control	Dummy	Instruction	Address(Lower)	Address(Upper)	Len(Lower)	Len(Upper)	ACK
	0x20	0x00	0x03	0x64	0x00	0x64	0x00	

Figure 30 Memory Read/Write Command consisted of 7 bytes

The following shows the content of each field in the command packet.

1) Control：operation type (1byte in binary format)
   0x00: Write Access (Control command consisted of 5 bytes)
   0x01: Read Access (Control command consisted of 5 bytes)
   0x20: Memory Write (Memory Write command consisted of 7 bytes)
   0x21: Memory Read (Memory Read command consisted of 7 bytes)
   0x30: Instruction Write (Control command consisted of 5 bytes)
   For the value other than the above, this product responses the error code (0xFFyy : yy is control field in the error condition) as a command error.
2) Dummy：Reserved (1byte in binary format)
   Set to 0x00 for Reservation
3) Instruction：Instruction of SSU device (1byte in binary format)
   0x00-0x7F
   This field consists of 1 byte in binary format. And this product does not perform an error judgment.
4) Address：Memory Read/Write Address (2bytes in binary format)
   0x0000-0xFFFF
   This field consists of 2 bytes in binary format. And this product does not perform an error judgment.
   The byte order of this field is little endian (the first is lower byte, and the second is upper byte)
   This field only exists in the Memory Read/Write command consisted of 7 bytes.
5) Len：Length of Data Packet (2bytes in binary format)
   0x0000-0xFFFF
   This field consists of 2 bytes in binary format. And this product does not perform an error judgment.
   The byte order of this field is little endian (the first is lower byte, and the second is upper byte)
   When you enter 0x0000 to this field, you can access 65536 bytes continuously.

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10.1.2 The Structure of Data Packet

The data length is n bytes according to the connected SSU device. The maximum of the data length is the value of the Len field of the command packet. When the data length is more than 64bytes, the data is divided into multiple data packets. Figure 31 shows the structure of Data packet.

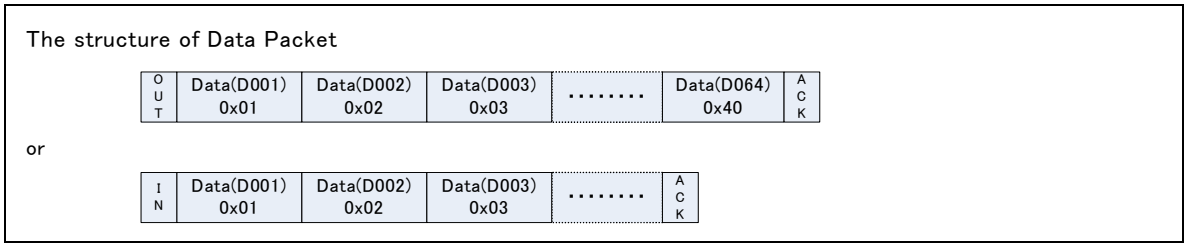


Figure 31 The structure of Data Packet

Data：Data body (n bytes in binary format)

The range of n is from 1 to 65536 bytes.

The field consists of n bytes in binary format, and this product does not perform an error judgment.

In the case of Write Access:

This product can continue receiving data from USB host until the USB data length is equal to Len field of packet command or USB short packet is received.

If the total length of command packet and data packet is less or equal 64bytes, you can send a combined packet. (The detail is refer to 10.1.3)

In the case of Read Access:

This product keeps on sending data to USB Host until the USB data length is equal to Len field of packet command.

10.1.3 Structure of Combined Packet

If the data length is less or equal 59bytes, you can combine command packet and data packet.

Figure 32shows the structure of combined packet.

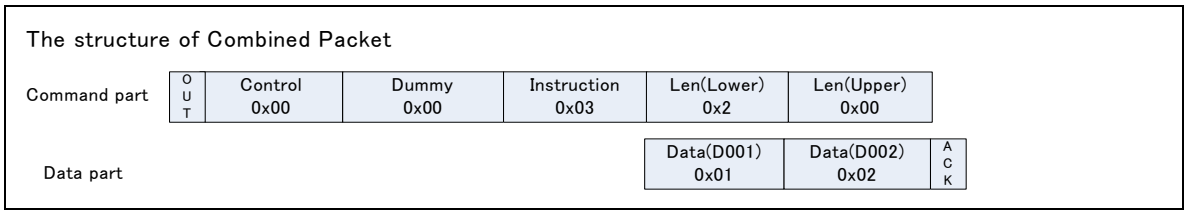


Figure 32 The structure of Combined Packet

10.1.4 Other rules

1) Error : Response of error condition
   0xFEFF ： Command Packet Error
   0xFFyy : Command Error (yy is the control field in error condition)
2) Bus mastership during the data writing
   The SCS signal holds low level between each packet. This product does not release the mastership by the end of writing all data.
3) The length of the command packet
   When the length of control command packet is less than 5bytes, this product judges an error packet and sends an error reply.
   When the length of Write Access command packet is more than 5bytes, this product judges the packet as a combined packet.
   When the length of Memory Read/Write command packet is other than 7 bytes, this product judges an error packet and sends an error reply.

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10.2 Specification of USB-to-SSU Protocol Conversion

10.2.1 Protocol conversion of Read Access

When you read data from SSU device, you enter the “Read Access” command to the virtual COM port, and receive data packet from the virtual COM port. Figure 26shows the protocol conversion of the Read Access.

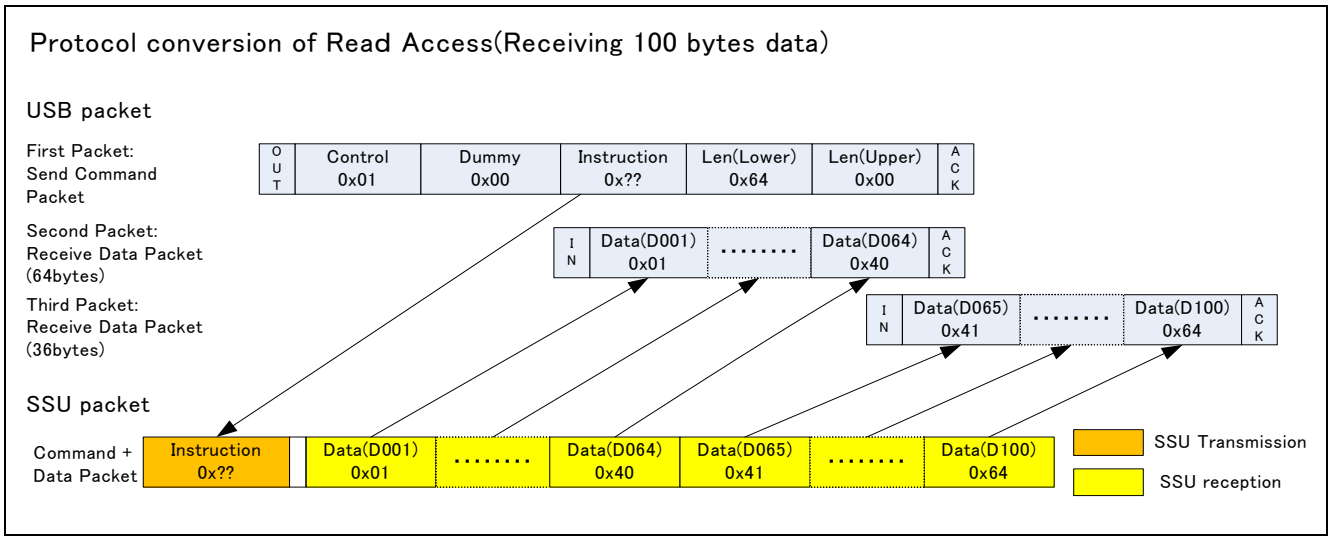


Figure 33 Protocol Conversion of Read Access

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10.2.2 Protocol Conversion of Write Access

When you write data to the SSU device, you send the "Write Access" command packet to the virtual COM port, and send data packet continuously. Figure 34 shows the protocol conversion of Write Access. If the data packet length is short (less than 59bytes), you can combined command packet and data packet to "combined packet".

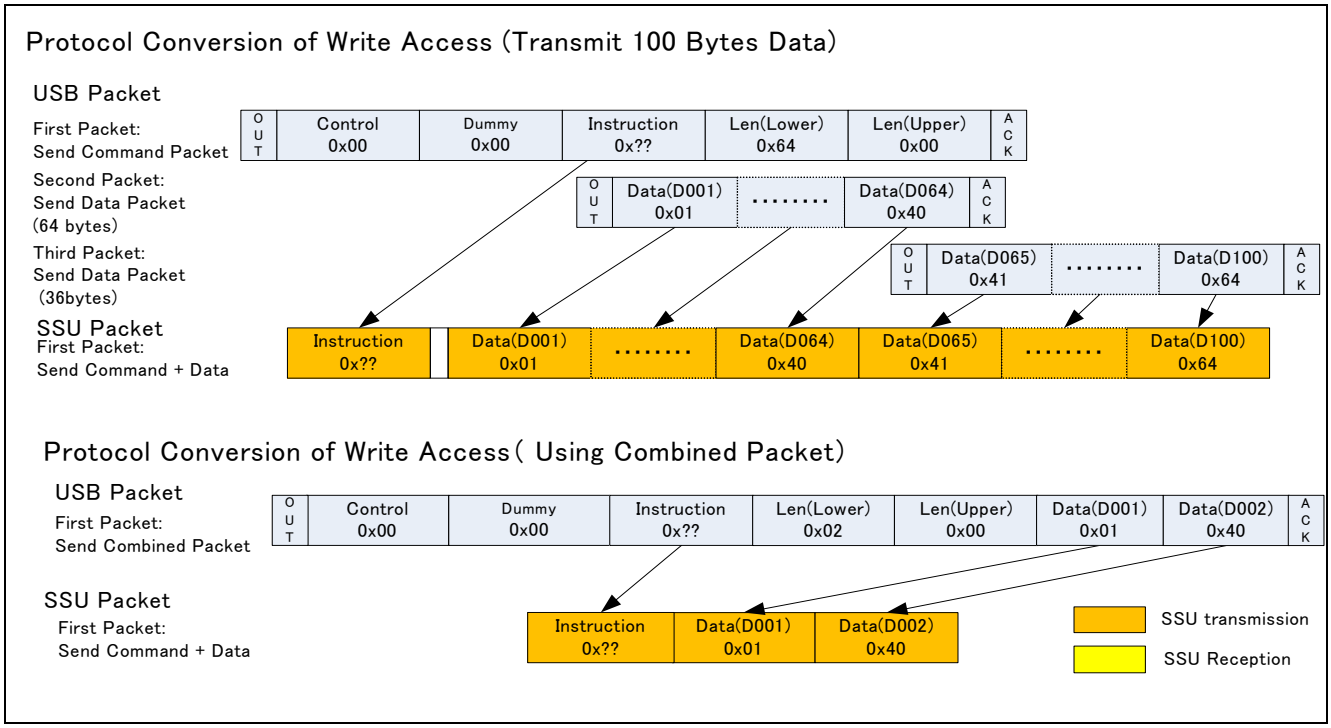


Figure 34 Protocol Conversion of Write Access

10.2.3 Protocol Conversion of Memory Read

When you indicate address and read data from SSU device, you enter the "Memory Read" command to the virtual COM port, and receive data packet from the virtual COM port. Figure 35 shows the protocol conversion of the Memory Read.

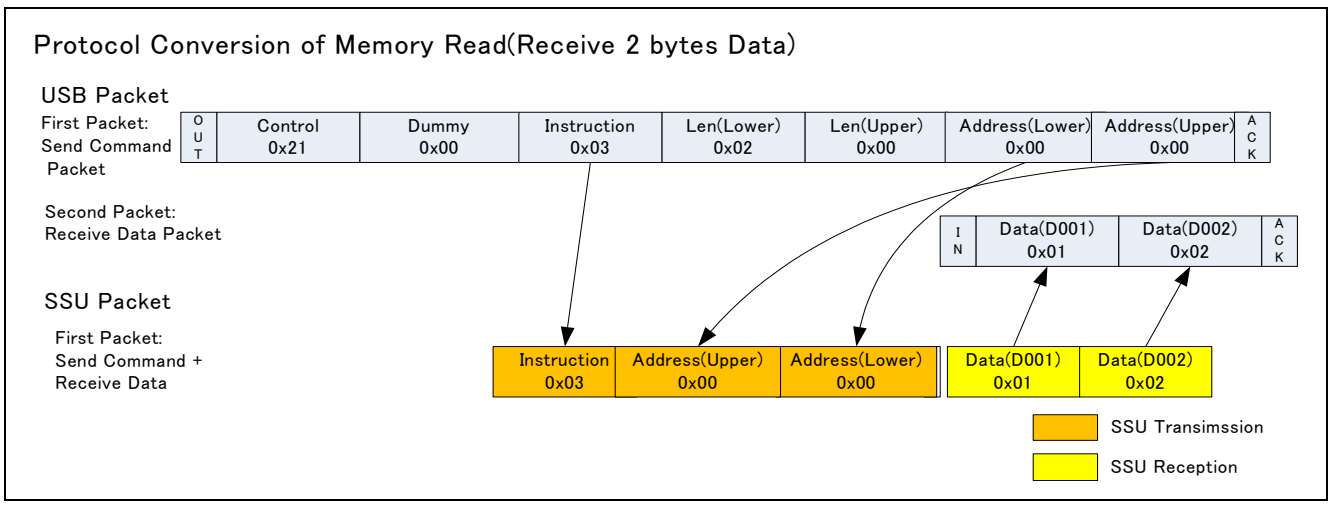


Figure 35 Protocol Conversion of Memory Read Memory

10.2.4 Protocol Conversion of memory Write

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When you indicate address and write data to the SSU device, you send the “Write Access” command packet to the virtual COM port, and send data packet continuously. Figure 36 shows the protocol conversion of Write Access. If the data packet length is short (less than 59bytes), you can combined command packet and data packet to “combined packet”.

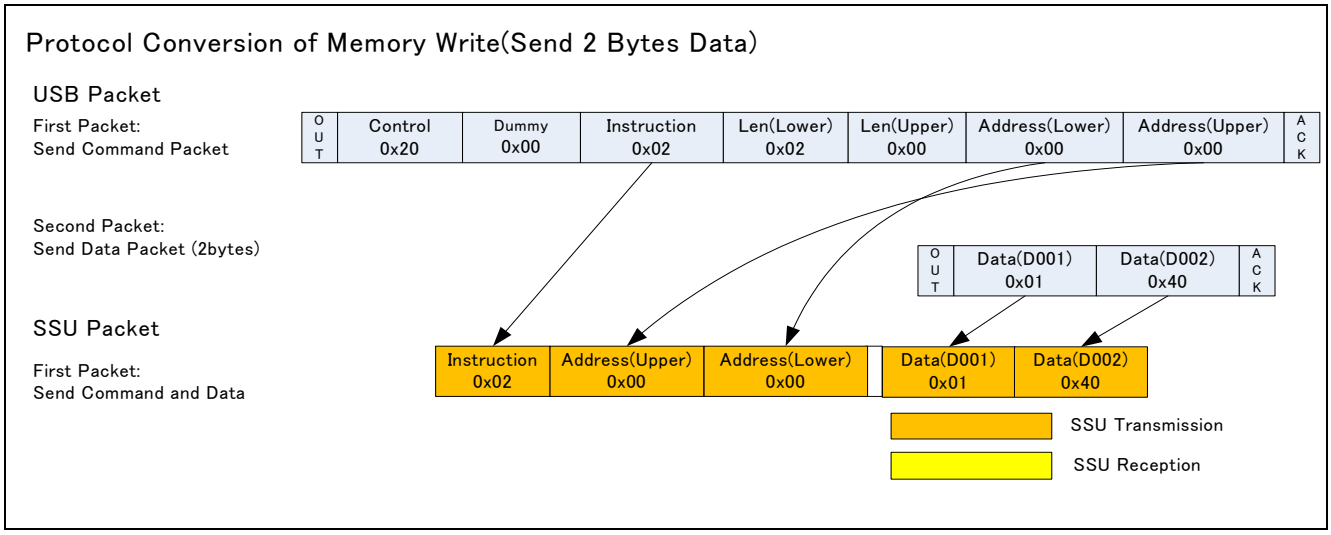


Figure 36 Protocol Conversion of Memory Write

10.2.5 Protocol Conversion of Instruction Write

When you write 1 byte data (Instruction) to the SSU device, you send the “Instruction Write” command packet to the virtual COM port. Figure 37 shows the protocol conversion of Instruction Write

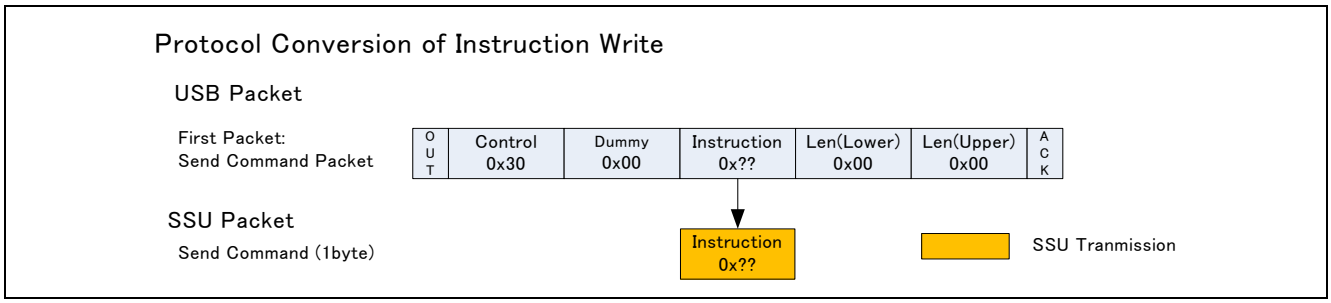


Figure 37 Protocol Conversion of Instruction Write

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10.3 The Example of Command Script

Figure 38 shows the example of memory read and Memory write between this product and the 8Kbit EEPROM made by Renesas Electronics

```
Example of Memory Read / Memory Write (SSU Device: R1EX25008ASA00A)

; Select SSU Demo
send 'S'
pause 1

; Write Enable(Instruction Write command)
send $30 $00 $06 $00 $00

; Memory Write
; Write '1234567890abcdef' to Memory Address 0x00.
send $20 $00 $02 $10 $00 $00 $00
send '1234567890abcdef'

; Write Enable(Instruction Write Command)
send $30 $00 $06 $00 $00

; Memory Write
; Write 'ghijklmnopqrstuv' to Memory Address 0x10.
send $20 $00 $02 $10 $00 $10 $00
send 'ghijklmnopqrstuv'

; Memory Read
; Read 16 bytes data from Memory Address 0x00.
send $21 $00 $03 $10 $00 $00 $00
pause 1

; Memory Read
; Read 16 bytes data from Memory Address.
send $21 $00 $03 $10 $00 $10 $00
pause 1

;End
beep
```

Figure 38 Example of Command Script

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11. Circuit Diagram

See attached document. (Appendix 1)

12. Parts Layout Diagram

See attached document. (Appendix 2)

13. Parts List

See attached document. (Appendix 3)

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Website and Support

Renesas Electronics Website
http://www.renesas.com/

USB Device Page
http://www.renesas.com/en/usb

Inquiries
http://www.renesas.com/contact/

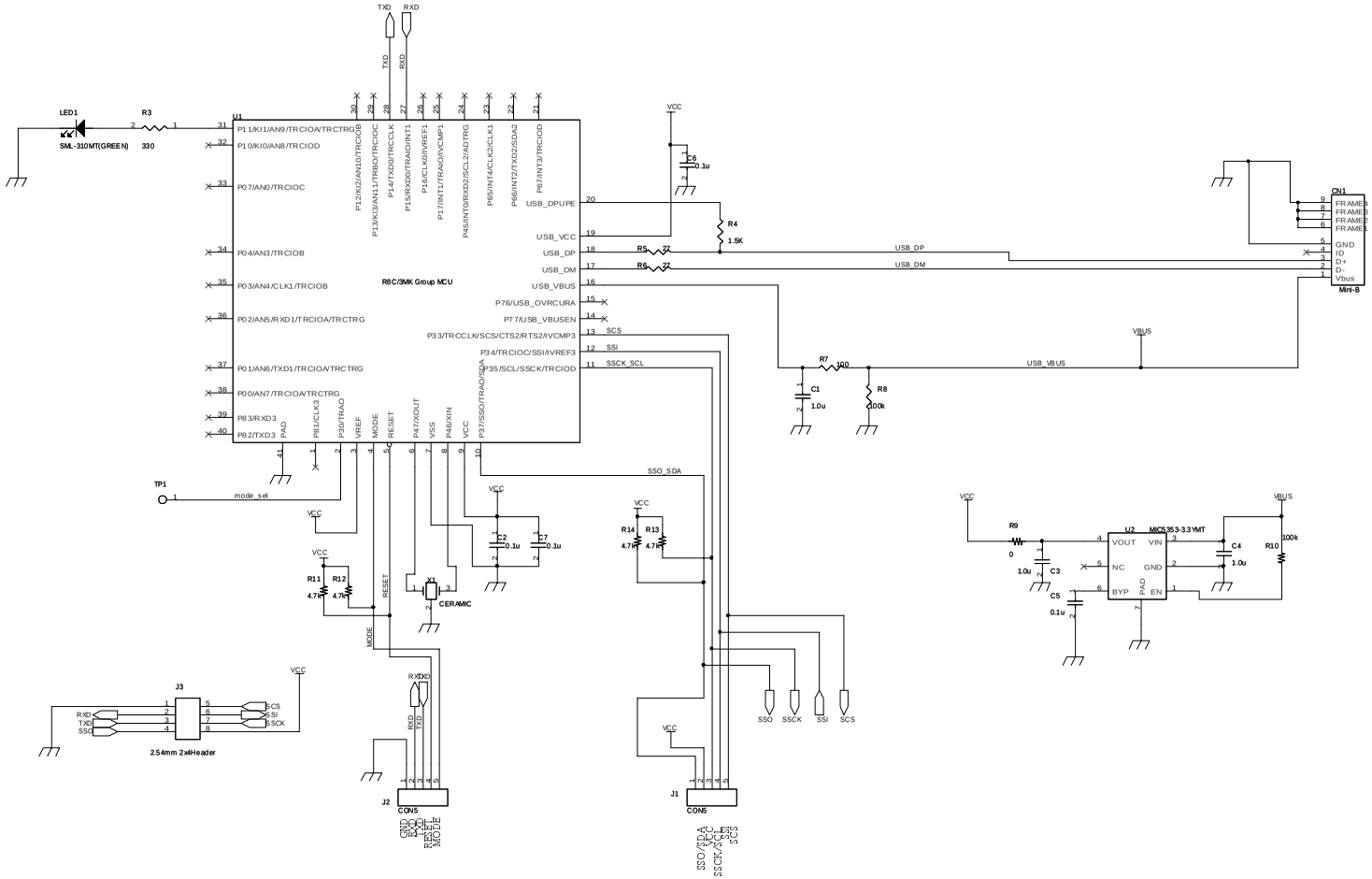
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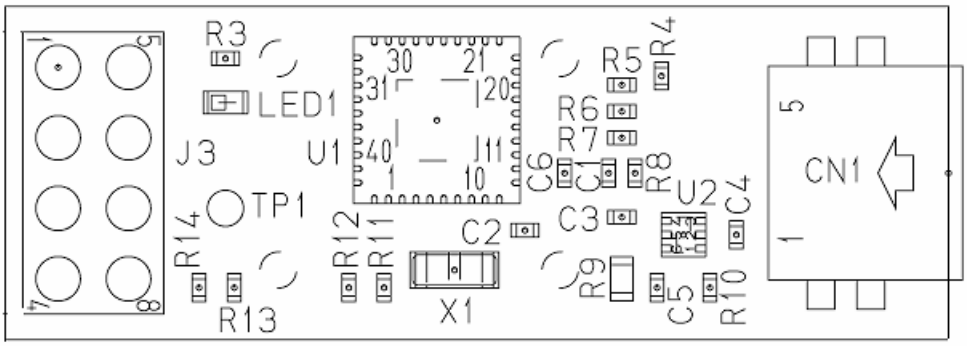
Appendix 1 Circuit Diagram



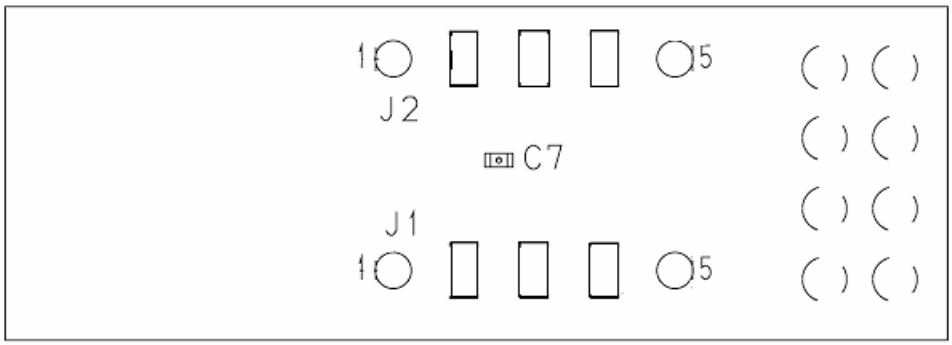
Title	R0K5R8C3MDU30BR	
Size	Document Number D-R0K5R8C3MDK3UBR_C	Rev
Date:	Sheet 1 of 1	

Appendix2: Parts Layout Diagram

1. Front Surface



2. Rear Surface



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Appendix3: Parts List

		Title	R0K5R8C3MDU30BR Parts List

No.	Component Name		Component Specification			Qty/set	Notes
	Type	Symbol on Board	Product Number (specification)	Manufacture	Mount/ unmount		
1	CPU	U1	R5F213MCKNNP	Renesas Electronics		1	6x6mm 40pin QFN
2	Regulator	U2	MIC5353-3.3YMT	MICREL		1	3.3V 500mA
3	USB Mini B Socket	CN1	UX60SC-MB-5ST	Hirose		1	
4	LED	LED1	SML-310MT	ROHM		1	Green
5	Oscillator	X1	CSTCE12M0GH5L-**R0	Murata		1	12MHz
6	Header Pin	J1,J2	HQS-2-8-5P	Mac8	unmount	0	
7	Header Pin	J3	FFC-8LBMEP1B	HONDA	unmount	0	
8	Chip Monolithic Ceramic Capacitor	C1,C3,C4	C1005X5R1C105K	TDK		3	1.0uF 16V
9	Chip Monolithic Ceramic Capacitor	C2,C5,C6	GRM155B11A104KA01D	Murata		3	0.1uF 16V
10	Chip Monolithic Ceramic Capacitor	C7	GRM155B11A104KA01D	Murata	unmount	0	0.1uF 16V
11	Thick Film Resistor	R3	MCR01MZPJ331	ROHM		1	330
12	Thick Film Resistor	R4	MCR01MZPJ152	ROHM		1	1.5k
13	Thick Film Resistor	R5,R6	MCR01MZPJ270	ROHM		2	27
14	Thick Film Resistor	R7	MCR01MZPF1000	ROHM		1	100
15	Thick Film Resistor	R8,R10	MCR01MZPF1003	ROHM		2	100k
16	Thick Film Resistor	R9	MCR03EZPJ000	ROHM		1	0
17	Thick Film Resistor	R11,R12,R13,R14	MCR01MZPJ472	ROHM		4	4.7k
18	PCB	-	R0K5R8C3MDU30BR	SANYO KOGYO		1	
*							

Revision Record

Rev.	Date	Description	
		Page	Summary
1.00	Mar 21.12	-	First edition issued

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General Precautions in the Handling of MPU/MCU Products

The following usage notes are applicable to all MPU/MCU products from Renesas. For detailed usage notes on the products covered by this manual, refer to the relevant sections of the manual. If the descriptions under General Precautions in the Handling of MPU/MCU Products and in the body of the manual differ from each other, the description in the body of the manual takes precedence.

1. Handling of Unused Pins
   Handle unused pins in accord 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 one with a different type number, confirm that the change will not lead to problems.
   — The characteristics of MPU/MCU in the same group but having different type numbers may differ because of the differences in internal memory capacity and layout pattern. When changing to products of different type numbers, implement a system-evaluation test for each of the products.

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Renesas Electronics America Inc.
2880 Scott Boulevard Santa Clara, CA 95050-2554, U.S.A.
Tel: +1-408-588-6000, Fax: +1-408-588-6130

Renesas Electronics Canada Limited
1101 Nicholson Road, Newmarket, Ontario L3Y 9C3, Canada
Tel: +1-905-898-5441, Fax: +1-905-898-3220

Renesas Electronics Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K
Tel: +44-1628-585-100, Fax: +44-1628-585-900

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

Renesas Electronics (China) Co., Ltd.
7th Floor, Quantum Plaza, No.27 ZhiChunLu Haidian District, Beijing 100083, P.R.China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.
Unit 204, 205, AZIA Center, No.1233 Lujiazui Ring Rd., Pudong District, Shanghai 200120, China
Tel: +86-21-5877-1818, Fax: +86-21-6887-7858 / -7898

Renesas Electronics Hong Kong Limited
Unit 1601-1613, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2886-9318, Fax: +852 2886-9022/9044

Renesas Electronics Taiwan Co., Ltd.
7F, No. 363 Fu Shing North Road Taipei, Taiwan, R.O.C.
Tel: +886-2-8175-9600, Fax: +886 2-8175-9670

Renesas Electronics Singapore Pte. Ltd.
1 harbourFront Avenue, #06-10, keppel Bay Tower, Singapore 098632
Tel: +65-6213-0200, Fax: +65-6278-8001

Renesas Electronics Malaysia Sdn.Bhd.
Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510

Renesas Electronics Korea Co., Ltd.
11F., Samik Lavied' or Bldg., 720-2 Yeoksam-Dong, Kangnam-Ku, Seoul 135-080, Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5141

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