User's Manual

E2 Emulator, E2 Emulator Lite

Additional Document for User's Manual

(Notes on Connection of RISC-V MCU Devices)

Supported Devices:

R9A02G021

Renesas Electronics
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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.

Table of Contents

Terminology

Some specific words used in this user's manual are defined below.

Host machine

This means a personal computer used to control the emulator.

User system

This means a user's application system in which the MCU to be debugged is used.

User program

This means the program to be debugged.

Programming software

In this document, this indicates the Renesas Flash Programmer that can be used with the E2 or E2 Lite.

Emulator

In this document, this refers to the E2 or E2 Lite.

1. Overview

1.1 Overview of E2 Emulator and E2 Emulator Lite

In this document, we describe ‘E2 Emulator’ as ‘E2’ and ‘E2 Emulator Lite’ as ‘E2 Lite’.

The E2 and E2 Lite are on-chip debugging emulators for Renesas' mainstream MCUs.

The E2 Lite is highly affordable development tools providing basic debugging functions. The E2 handles high-speed downloading at up to twice the rate of the E2 Lite. In addition, the E2 can supply power that is adjustable from 1.8 V to 5.0 V at 0.1-V intervals. As a development tool, the E2 allows more advanced debugging than the E2 Lite. The E2 and E2 Lite can also serve as a Flash Programmer.

1.2 Configuration of E2/E2 Lite Manuals

The E2/E2 Lite manual consists of the following.

- E2 Emulator User’s Manual
- E2 Emulator Lite User’s Manual
- E2 Emulator, E2 Emulator Lite Additional Document for User’s Manual

Be sure to read each user’s manual before using the E2 or E2 Lite.

(1) E2 emulator user’s manual

The E2 emulator user’s manual has the following contents:

— Components of the E2
— E2 hardware specification
— Connection to the E2 and the host machine and user system

(2) E2 Emulator Lite user’s manual

The E2 Emulator Lite user’s manual has the following contents:

— Components of the E2 Lite
— E2 Lite hardware specification
— Connection to the E2 Lite and the host machine and user system

(3) E2 Emulator, E2 Emulator Lite Additional Documents for User's Manual (Notes on Connection of RISC-V MCU Devices) (this document)

The E2 Emulator, E2 Emulator Lite Additional Documents for User's Manual (Notes on Connection of RISC-V MCU Devices) describes information necessary for hardware design such as connection examples and interface circuits.

(4) Renesas Flash Programmer Flash memory programming software User’s Manual

The Renesas Flash Programmer Flash memory programming software User’s Manual describes the specifications of the software and the method of operation for the Renesas Flash Programmer.

- For the debugging configuration of the E2 or E2 Lite emulator debugger, refer to the help system for the e^2 studio.

1.3 Preparation

Obtain an integrated development environment (IDE) and other required software from links at the following URL and install them on the host machine.

https://www.renesas.com/development-tools

1.4 Supported Devices

Table 1.1 Supported Device List

Supported Device	E2		E2 Lite	
	cJTAG I/F	SCI	cJTAG I/F	SCI
R9A02G021	DBG	PRG	DBG	PRG

* DBG: Can be used for debugging, PRG: Can be used for flash programming

2. Designing the User System

2.1 Connecting the Emulator with the User System

To connect the emulator, a connector for the user system interface cable must be mounted on the user system.

When designing the user system, read this section of this manual and the *User's Manual: Hardware* for the given MCU.

2.2 Installing the Connector on the User System

Table 2.1 and Table 2.2 list the recommended connectors and user system interface cables for the emulator, respectively.

Table 2.1 Recommended Connectors

Connector	Type Number	Manufacturer	Specifications
20-pin (1.27-mm pin pitch) connector	FTSH-110-01-L-DV-K	Samtec	20-pin surface-mount technology (SMT) straight type
20-pin (1.27-mm pin pitch) connector	FTSH-110-01-L-DV-007-K (Connector without pin 7)	Samtec	20-pin surface-mount technology (SMT) straight type
10-pin (1.27-mm pin pitch) connector	FTSH-105-01-L-DV-K	Samtec	10-pin SMT straight type
10-pin (1.27-mm pin pitch) connector	FTSH-105-01-L-DV* (without a marking for matching the position of the connector; keying shroud)	Samtec	10-pin SMT straight type
10-pin (1.27-mm pin pitch) connector	FTSH-105-01-L-DV-007-K (Connector without pin 7)	Samtec	10-pin SMT straight type

Note: When using a connector without a guide marking (keying-shroud type), take care with regard to the direction for insertion of the cable.

Table 2.2 User System Interface Cables

Cable Type	Type Number	E2	E2 Lite
20-pin to 20-pin cable* (for the 20-pin (1.27-mm pin pitch) connector)	RTE0T00020KCAC0000J	Comes with the product	Separately sold
20-pin to 10-pin cable (for the 20-pin (1.27-mm pin pitch) connector)	RTE0T00020KCAC1000J	Separately sold	Separately sold

Note: The 20-pin to 20-pin cable can be connected to the guideless 10-pin (1.27-mm pin pitch) connector; when doing so, however, check the pin assignments and take care with regard to the direction for insertion of the cable.

Only connect the emulator after confirming that there are no mismatches of alignment on the user system port connector. Incorrect connection will result in the host machine, the emulator, and the user system emitting smoke or catching fire.

2.2.1 Connecting the User System Interface Cable to the 20-Pin Connector

Figure 2.1 shows how to connect the user system interface cable to the 20-pin connector.

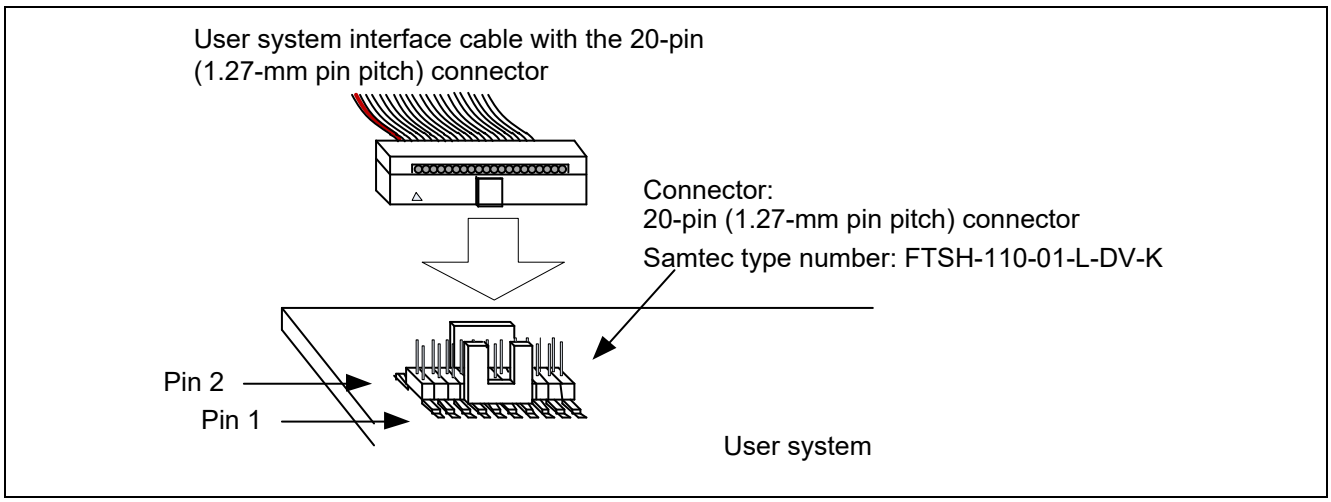


Figure 2-1 Connecting the User System Interface Cable to the 20-Pin Connector

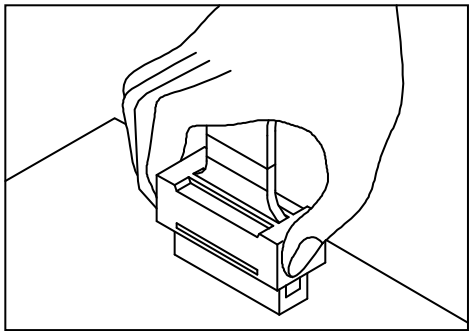
CAUTION

Notes on connector insertion and removal:

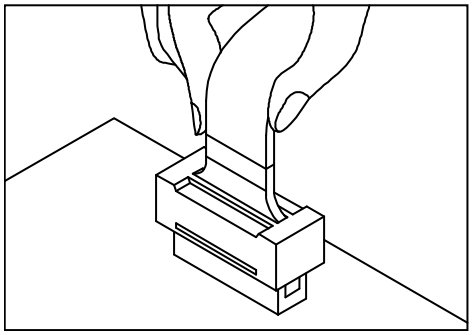
When connecting or disconnecting the user-system interface cable and the emulator or user system, grasp the connector cover at the end of the cable. Pulling the cable itself will damage the wiring.

Also, be aware that the user-system interface cable has the direction in which it must be inserted. If the cable is connected in the wrong direction, it may be damaged.

Correct example



Incorrect example



2.3 Pin Assignments of the Connector on the User System

2.3.1 20-Pin and 10-Pin Connector Specifications

Figure 2-2 shows the specifications of the 20-pin and 10-pin (1.27-mm pitch) connectors.

Table 2.3 show the pin assignments for the cJTAG interface connections, respectively.

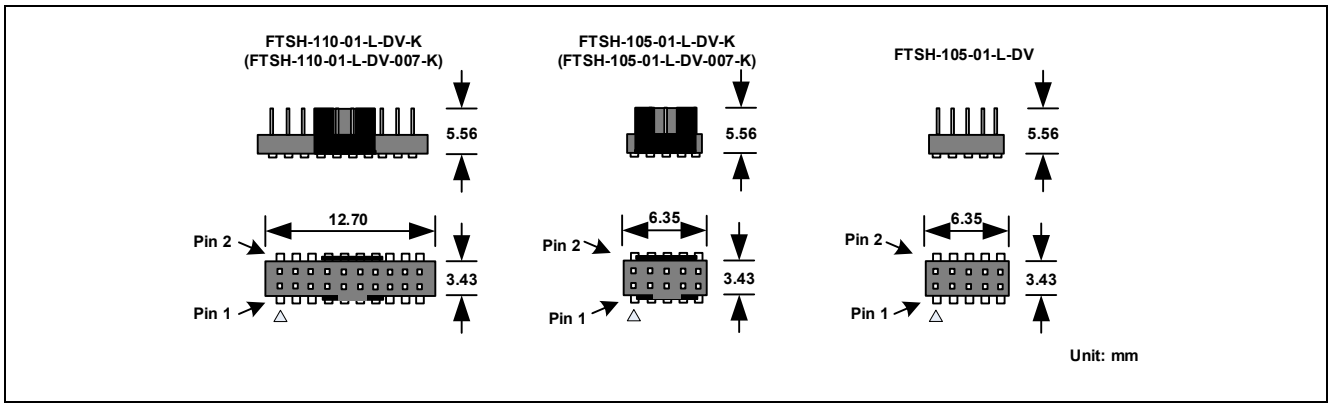


Figure 2-2 20-Pin and 10-Pin Connector Specifications

Table 2.3 Pin Assignments for cJTAG Interface Connection

Pin No.	Signal	Direction*1	Note
1	VCC	–	Power supply
2	TMSC	I/O	For cJTAG
3	GND	–	
4	TCKC	Input	For cJTAG
5	GND	–	
6	TxD0 (P302)	Output	For SCI
7	NC	–	
8	RxD0 (P303)	Input	For SCI
9	UCON	–	Connect this signal to ground on the user system. It is used to confirm the connection between the emulator and user system.
10	RES	I/O	User system reset
11*2	NC	–	
12*2	NC	–	
13*2	NC	–	
14*2	NC	–	
15*2	GND	–	
16*2	NC	–	
17*2	GND	–	
18*2	NC	–	
19*2	GND	–	
20*2	NC	–	

Notes: 1. Input to or output from the user system.
"Input" refers to input from the emulator to the user system and "output" refers to output from the user system to the emulator.
2. If a 10-pin connector is mounted on the user system, pins 11 to 20 are not used.

2.4 Recommended Circuit between the Connector and the MCU

This section shows recommended circuits for connection between the connector and the MCU. For details on the handling of signals, refer to section 2.5, Notes on Connection.

2.4.1 cJTAG Interface Connection

Figure 2.3 shows a recommended circuit for connection through the only cJTAG interfaces.

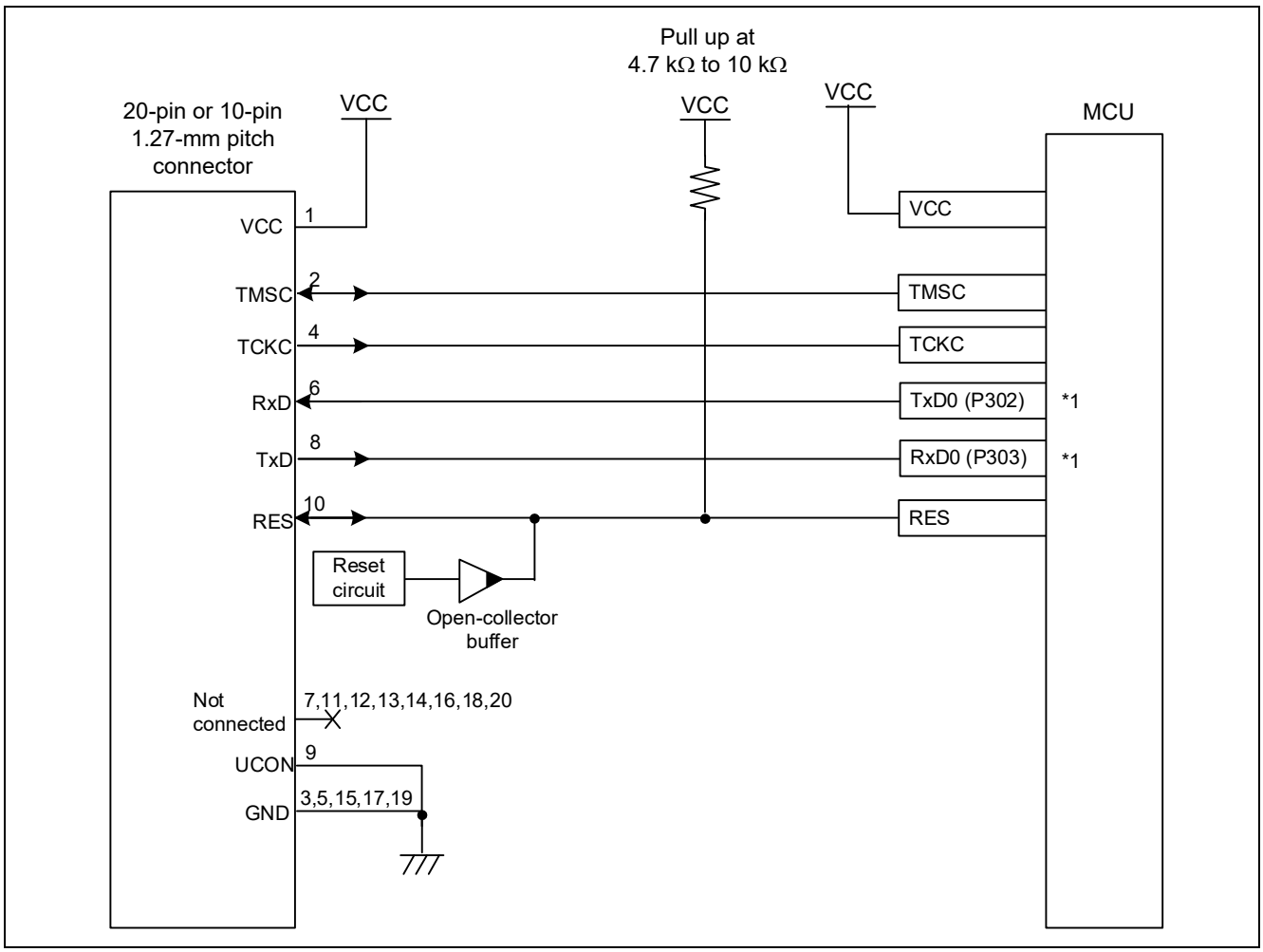


Figure 2-3 Example of a Connection through cJTAG Interfaces

Note: The specifications may differ with the target MCU. Confirm the specifications of pins used for flash programming in the user's manual for the given MCU.

2.5 Notes on Connection

Wiring patterns between the connector and the MCU must be as short as possible (within 50 mm is recommended). Do not connect the signal lines between the connector and MCU to other signal lines on the board.

For the handling of pins while the emulator is not in use, refer to the *User's Manual: Hardware* for the given MCU.

2.5.1 RES Pin

The emulator uses the RES pin.

If the user system includes a user logic reset circuit, the output signal from the reset circuit must be connected to the RES pin of the connector via an open-collector buffer as shown below. If there is no reset circuit, the RES pin from the connector must be directly connected to the RES pin of the MCU.

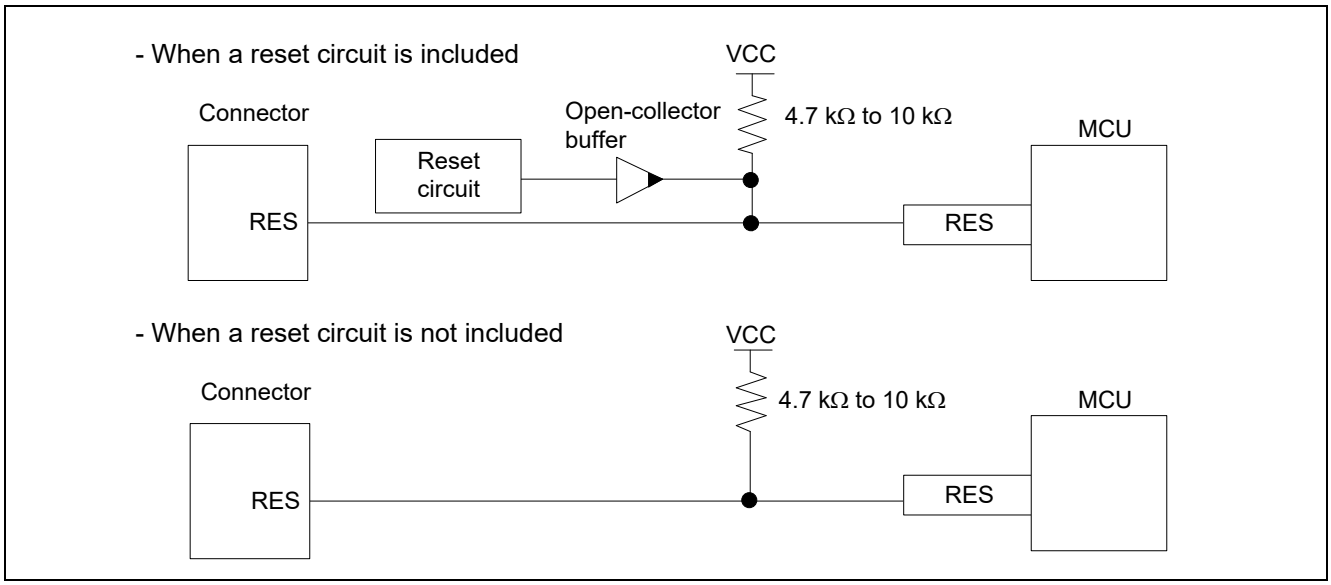


Figure 2-4 Connection of the RES Pin

The voltage on the RES line must satisfy the electrical characteristics of the device and rise in no more than 9 ms.

2.5.2 MD Pin

To proceed with serial programming by using a flash programmer, have the MCU start in UART (SAU) boot mode.

Install switches for switching the level of the MD pin on the user system as required (see Figure 2-5).

When you will be using the MD pin to select UART (SAU) boot mode, set the MD pin to the low level.

When you will be using the MD pin to select single-chip mode for the execution or debugging of a user program, set the MD pin to the high level.

Pull-up resistors are mounted on the MD pins of most MCUs. Refer to the *User's Manual: Hardware* for the given MCU to confirm whether a pull-up resistor is mounted on the MD pin of the MCU.

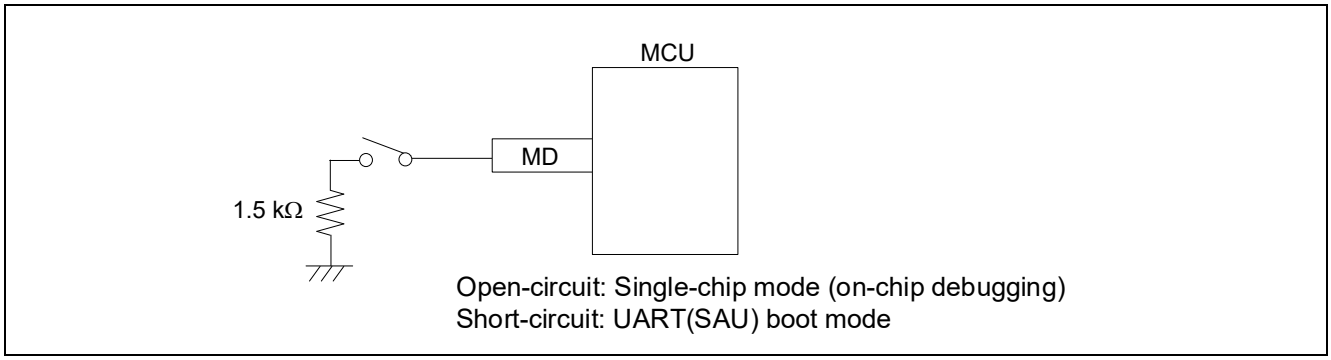


Figure 2-5 Connection of the MD Pin

2.5.3 GND

The pins of the connector marked "GND" must be at the same ground level as the VSS pin of the MCU.

2.5.4 VCC

Connect the VCC of the connector to the VCC (power supply) of the user system.

Use the emulator within the power supply voltage of 1.8 V to 5.5 V and within the operating voltage range of the MCU and cJTAG.

When power is supplied to the user system from other than the emulator, the E2/E2 Lite consumes the power supply for the last output and first input buffers of the emulator.

- E2: 3.3 V: approximately 20 mA, 5.0 V: approximately 40 mA
- E2 Lite: 3.3 V: approximately 20 mA, 5.0 V: approximately 40 mA

The E2/E2 Lite can supply power to a simple evaluation system.

- E2: Can supply power of 1.8 V to 5.0 V, up to 200 mA.
- E2 Lite: Can supply power of 3.3 V, up to 200 mA.

When using the power supply function of the E2 or E2 Lite, check the voltage that is actually being supplied to the user system since this depends on the environment.

Power supply from the E2/E2 Lite depends on the quality of the USB power supply of the host machine, and as such, precision is not guaranteed. When writing a program that requires reliability, do not use the power supply function of the E2/E2 Lite. Use a stable, separate power supply for the user system. As the software when writing a program in a mass-production process, use the Renesas Flash Programmer.

For details on the programming software, refer to the following:

Renesas Flash Programmer: https://www.renesas.com/RFP

When the MCU is changed to low power mode, the internal debugging circuit continues to run. This leads to the MCU drawing more electric current than is listed in the DC characteristics of the target MCU.

WARNING

Warning for Turning the Power On/Off:

When supplying power, ensure that there are no shorts between Vcc and GND. Only connect the E2/E2 Lite after confirming that there are no mismatches of alignment on the user system port connector. Incorrect connection will result in the host machine, the E2/E2 Lite, and the user system emitting smoke or catching fire.

2.5.5 RxD9 and TxD9 Pins (Flash Programming via an SCI)

When flash memory is programmed via an SCI, the RxD9 and TxD9 pins must be connected to the emulator. For MCUs in which the RxD9 and TxD9 pins can be allocated to multiple pins, check the *User's Manual: Hardware* for the given MCU to confirm which of the pins is used in boot mode.

2.6 Internal Circuits of the Emulator

2.6.1 Internal Circuits of the E2

Figure 2-6 and Figure 2-7 respectively show the internal circuits of product revisions C and D of the E2.

The alphabet at the end of the serial No. written on the E2 main unit indicates the product revision.

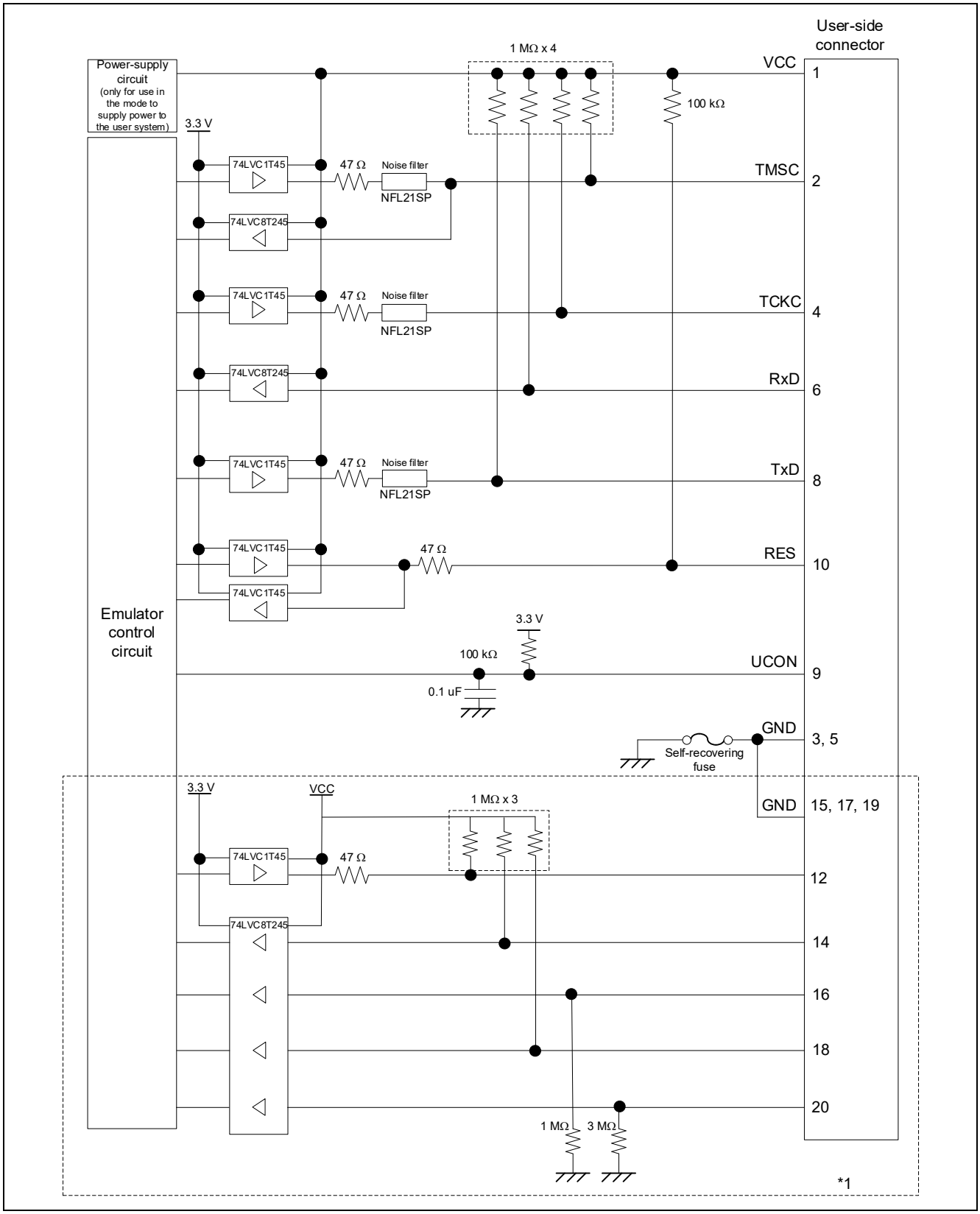


Figure 2-6 Internal Circuits of the E2 (Rev. C)

Note: If a 10-pin connector is mounted on the user system, pins 11 to 20 are not used.

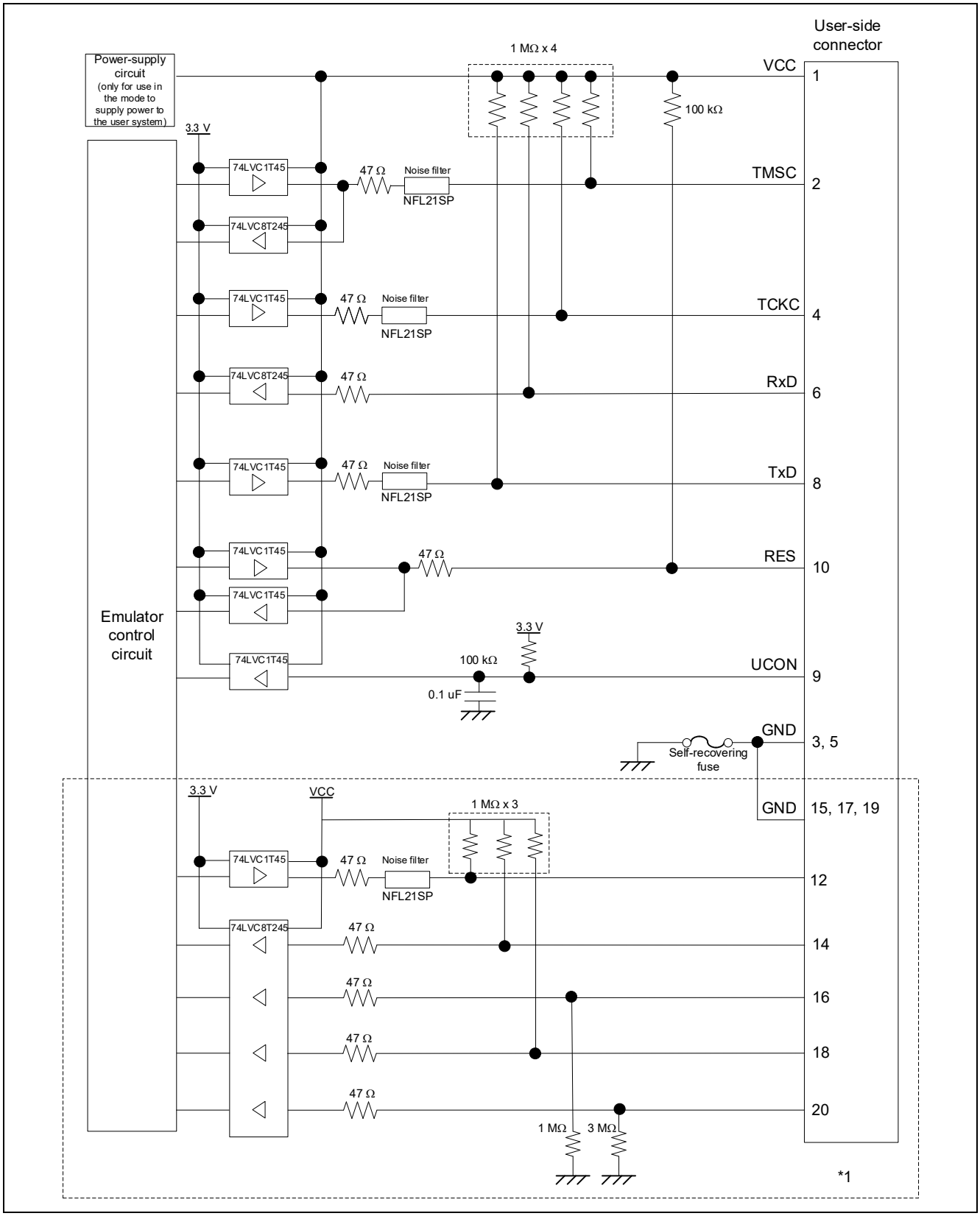


Figure 2-7 Internal Circuits of the E2 (Rev. D)

Note: If a 10-pin connector is mounted on the user system, pins 11 to 20 are not used.

2.6.2 Internal Circuits of the E2 Lite

Figure 2-8 shows the internal circuits of the E2 Lite.

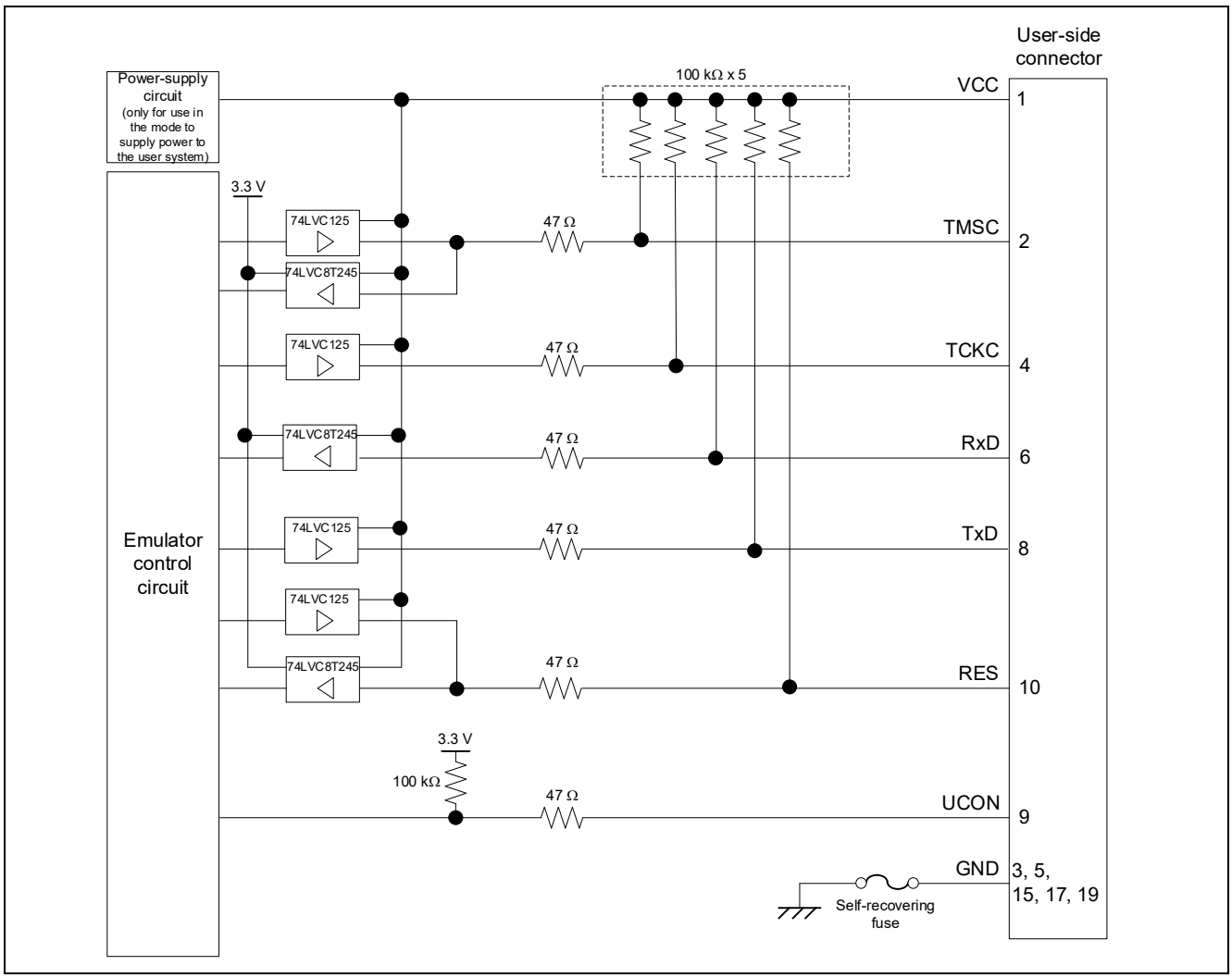


Figure 2-8 Internal Circuits of the E2 Lite

3. Notes on Usage

3.1 Turning the Power On/Off

Turn the power of the emulator and the user system following the procedure below.

3.1.1 When a Separate Power Supply is Used for the User System

<When using the emulator>

(1) Check that the power is off.
Check that the user system is turned off.
(2) Connect the user system.
Connect the emulator and the user system with a user-system interface cable.
(3) Connect the host machine and turn on the emulator.
Connect the emulator and the host machine with a USB interface cable. The E2/E2 Lite is turned on by connecting the USB interface cable.
(4) Launch the emulator debugger or programming software.
Launch the emulator debugger or programming software.
(5) Turn on the user system.
Turn on the user system.
(6) Connect the emulator debugger or programming software to the emulator.
Connections may vary depending on software.

<When finished using the emulator>

(1) Disconnect the emulator from the emulator debugger or programming software.
Disconnections may vary depending on software.
(2) Turn off the user system.
Turn off the user system.
(3) Close the emulator debugger or programming software.
Close the emulator debugger or programming software.
(4) Turn off the emulator and disconnect the emulator.
Disconnect the USB interface cable from the emulator. The E2/E2 Lite is turned off by disconnecting from the USB interface cable.
(5) Disconnect the user system.
Disconnect the user-system interface cable from the user system.

CAUTION

Notes on the User System Power Supply:

While the power of the user system is on, do not turn off the host machine or unplug the USB interface cable.
The user system may be damaged due to leakages current.

3.1.2 When Power is Supplied to the User System from the Emulator

<When using the emulator>

(1) Connect the user system.
Connect the emulator and the user system with a user-system interface cable.
(2) Connect the host machine and turn on the emulator.
Connect the emulator and the host machine with a USB interface cable, then turn on the emulator.
(3) Launch the emulator debugger.
Launch the emulator debugger and select the setting of power supply to the user system.
Under [Power] on the [Connection Settings] tabbed page, select [Yes] for [Power Target From The Emulator (MAX 200mA)]. Refer to section 3.3, Notes on Using the Emulator Debugger, for how to open the [Debug Configurations] window.

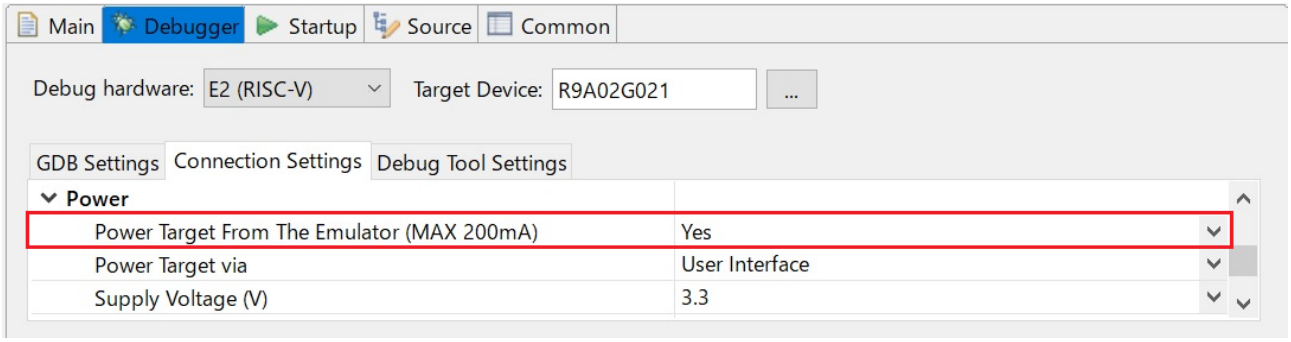


Figure 3-1 Setting for Supplying Power

(4) Connect the emulator debugger or programming software to the emulator.
Connections may vary depending on software.

<When finished using the emulator>

(1) Disconnect the emulator from the emulator debugger or programming software.
Disconnections may vary depending on software.
(2) Close the emulator debugger or programming software.
Close the emulator debugger or programming software.
(3) Turn off the emulator and disconnect the emulator.
Disconnect the USB interface cable from the emulator, then turn off the emulator.
(4) Disconnect the user system.
Disconnect the user-system interface cable from the user system.

3.2 Power Supply Function of the E2/E2 Lite

The E2/E2 Lite can supply power to a simple evaluation system.

- E2: Can supply power of 1.8 V to 5.0 V, up to 200 mA.
- E2 Lite: Can supply power of 3.3 V, up to 200 mA.

When using the power supply function of the E2 or E2 Lite, check the voltage that is actually being supplied to the user system since this depends on the environment.

3.3 Notes on Using the Emulator Debugger

This section describes how to set the [Debug Configurations] window of the e² studio. To open the [Debug Configurations] window, click on [Run] → [Debug Configurations…] or the downward-pointing arrow next to the icon→ [Debug Configurations…].

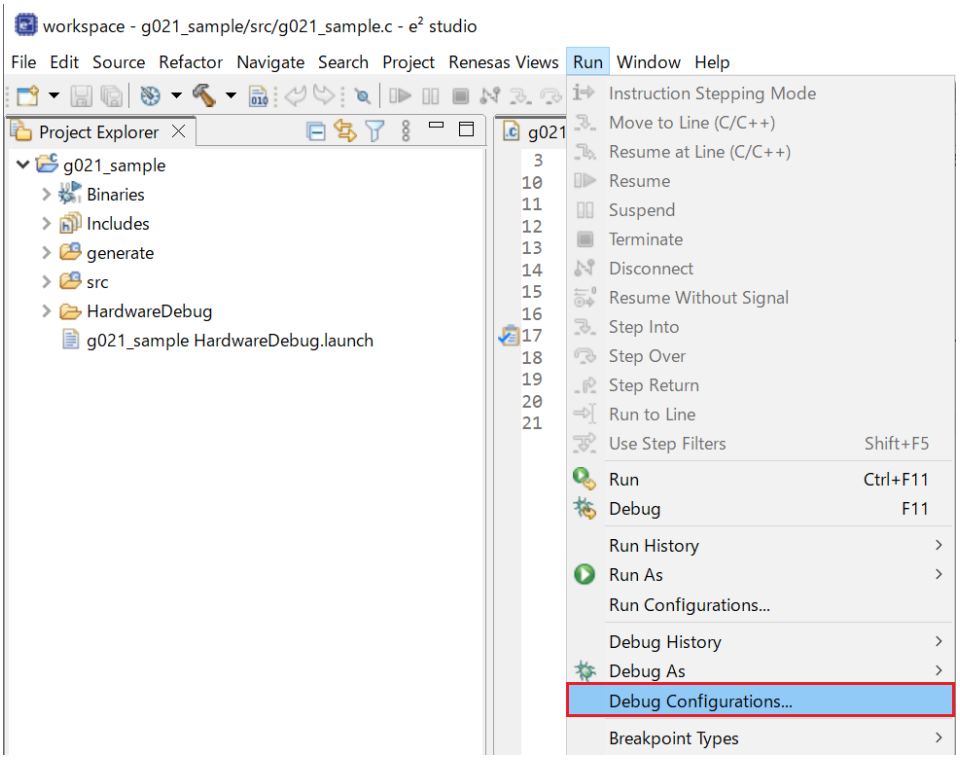


Figure 3-2 Opening the [Debug Configurations] Window

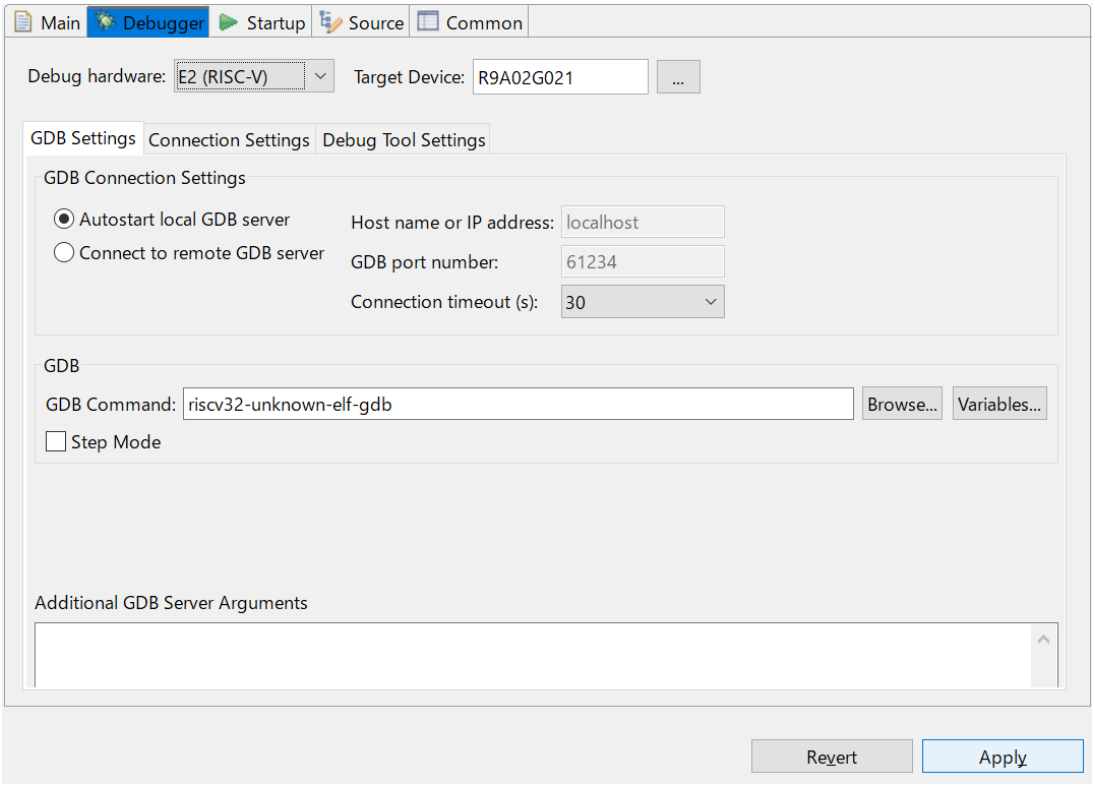


Figure 3-3 [Debug Configurations] Window

3.3.1 Notes on Connecting the Emulator Debugger

(1) Reset state

During connecting to the emulator debugger, the emulator maintains the low-level output on the RES# pin of the MCU and places the MCU in the OCD mode.

(2) Startup mode

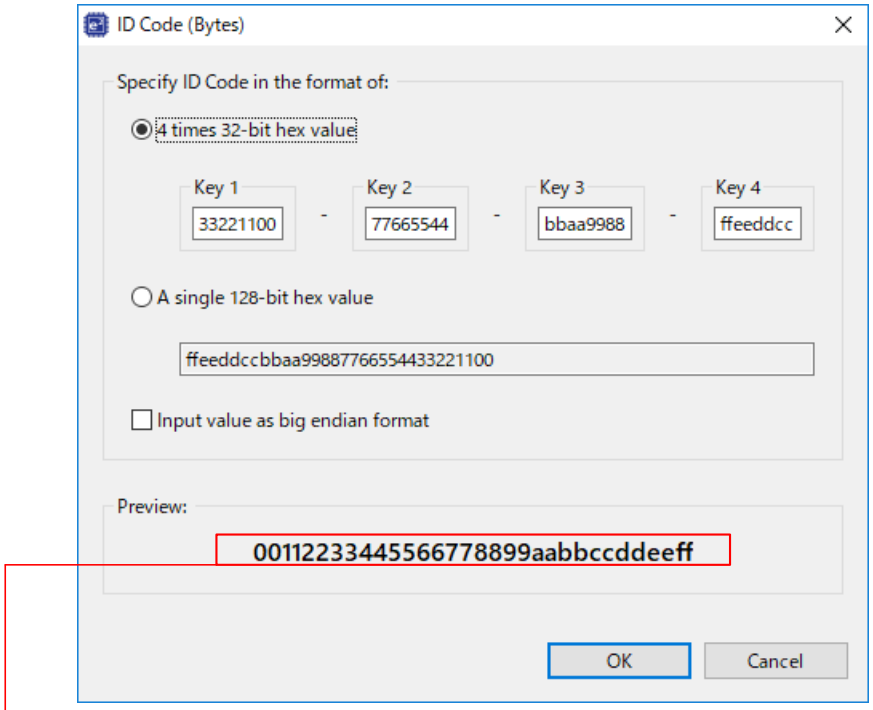
When the emulator debugger is connected, handle the pins on the user system so that the startup mode of the MCU is single-chip mode.

In single-chip mode, the MD pin is at the high level. Correct connection of the emulator debugger is not possible in SCI boot mode.

(3) Debugging after rewriting ID code

If the ID code (OSIS register) has been rewritten, enter the new ID code.

Here, the ID code to be entered means the value to be entered in [ID Code (Bytes)] under [Connection] on the [Connection Settings] tabbed page.



For example, when the following values have been secured, enter 00112233445566778899aabbccddeeff.

```
const unsigned long __OSISreg[4] = {
    0x33221100,
    0x77665544,
    0xbbaa9988,
    0xffeeddcc
};
```

Figure 3-4 Setting of [ID Code (Bytes)]

(4) Entering the ALeRASE command for ID code (For other than RA8 family)

If an ALeRASE command (FFFFFFFFFFFFFFFFFF45534152654C41) is entered in [ID Code (Bytes)] under [Connection] on the [Connection Settings] tabbed page, the code flash memory, the data flash memory and option-setting memory will be erased when the emulator debugger is connected.

For details on entering the ALeRASE command, refer to E2/E2 Lite (RA) Connection Settings in the help system for the e^2 studio.

For the conditions under which the ALeRASE command is usable, refer to the *User's Manual: Hardware* for the given MCU. If the ALeRASE command is entered then the emulator debugger is connected while the command is not usable on the MCU, an error message “Failed to erase all flash memory by the ID for erasing all flash memory.” is displayed and the connection process is suspended.

(5) Connection speed

The speed for the connection of the emulator to the target board is specified within the following upper-limit values.

— cJTAG (E2): 8250 kHz

— cJTAG (E2 Lite): 1000 kHz fixed

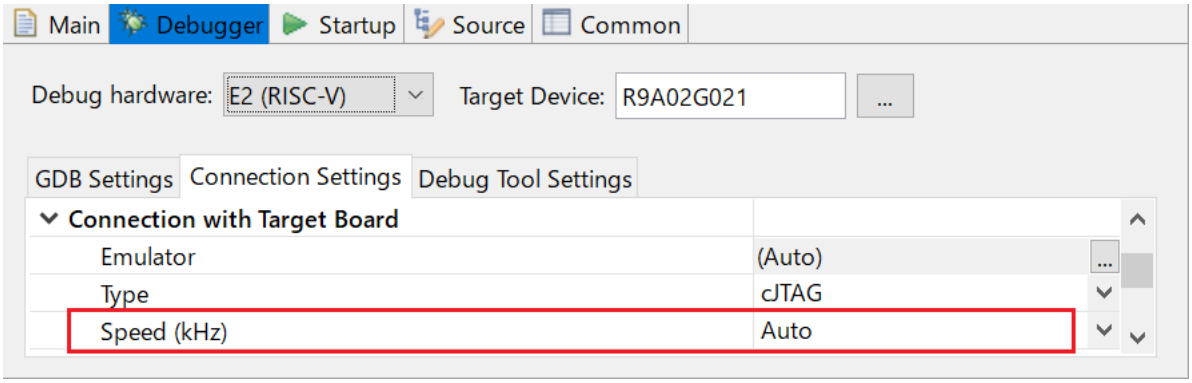


Figure 3-5 Setting the Connection Speed

When [Auto] is selected, the maximum connectable speed will automatically be set.

3.3.2 Notes on a Debugging Operation that Involves Reprogramming of Flash Memory

A “debugging operation that involves reprogramming of flash memory” refers to the following operations of the emulator debugger.

- Downloading data to flash memory
- Using software break functions in flash memory
  (a) Setting and canceling breakpoints
  (b) Executing or step-executing programs from a breakpoint
  (c) Using the “Run to Line” function from the state where a break was set

(1) Program for reprogramming flash memory

Since the emulator debugger enables a debugging operation that involves reprogramming of flash memory, the emulator writes the program for reprogramming flash memory to the on-chip SRAM and executes the program to reprogram the flash memory. After the flash memory has been reprogrammed, the emulator debugger restores the on-chip SRAM to its initial state.

(2) Destination for allocation of the program for reprogramming flash memory

By default, the program for reprogramming the flash memory is allocated to the 4-Kbyte space from the address where the SRAM0 area starts (or the address where the SRAMHS area starts for devices that do not include an SRAM0 area). If the default allocation destination is not available due to the security settings or DMAC/DTC transfer*, enter the start address of an available space in the on-chip RAM in units of 1000h bytes against [Work RAM Start Address] under [Flash] on the [Debug Tool Settings] tabbed page for the emulator debugger.

Note: The DMAC or DTC will continue to operate even during a break. Take care that a transfer source or destination for the DMAC or DTC is not within the address range of the working RAM where the program is to be allocated.

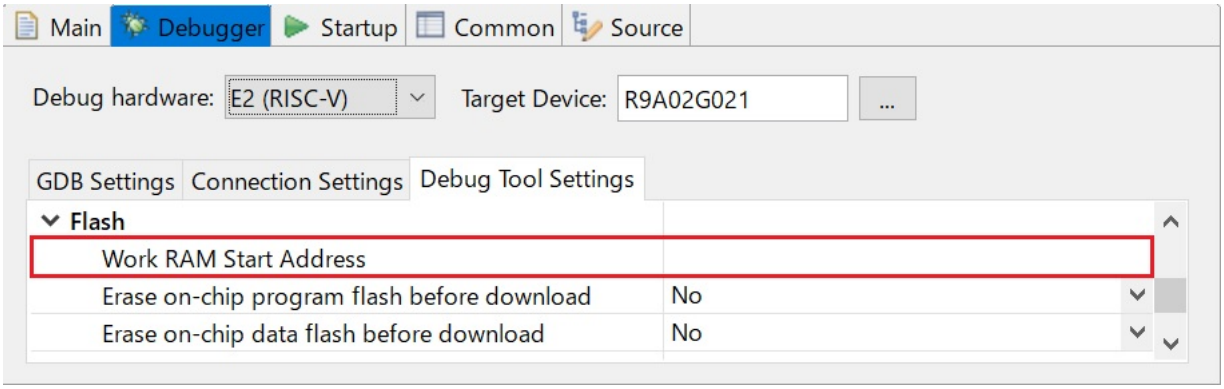


Figure 3-6 Setting of [Work RAM Start Address]

(3) Interrupts and resets during execution of the program for reprogramming flash memory

Interrupts other than non-maskable interrupts are to be masked while the program for reprogramming flash memory is being executed. Also, so that the program for reprogramming flash memory is correctly executed, all interrupt source flags which have been set before executing the program are cleared.

If a non-maskable interrupt occurs, the emulator continues running the program for reprogramming flash memory. If a reset occurs while the program for reprogramming flash memory is being executed, the emulator shows an error message and stops processing. Since doing so may damage the contents of flash memory, do not apply a reset while the program is running.

(4) Conditions for downloading data to flash memory being available

When the MCU satisfies all the following conditions, the downloading of data to flash memory can proceed.

(a) The code flash memory of the MCU is in read mode.

(b) The frequency of the system clock (ICLK) of the MCU is 1 MHz or higher.*

(c) The MCU is in middle-speed or high-speed mode.*

Note: For [Clock] in the [Connection Settings] tabbed page of the emulator debugger, when [Yes] is selected for [Permit Clock Source change on writing on-chip Flash Memory], conditions (b) and (c) can be excluded.

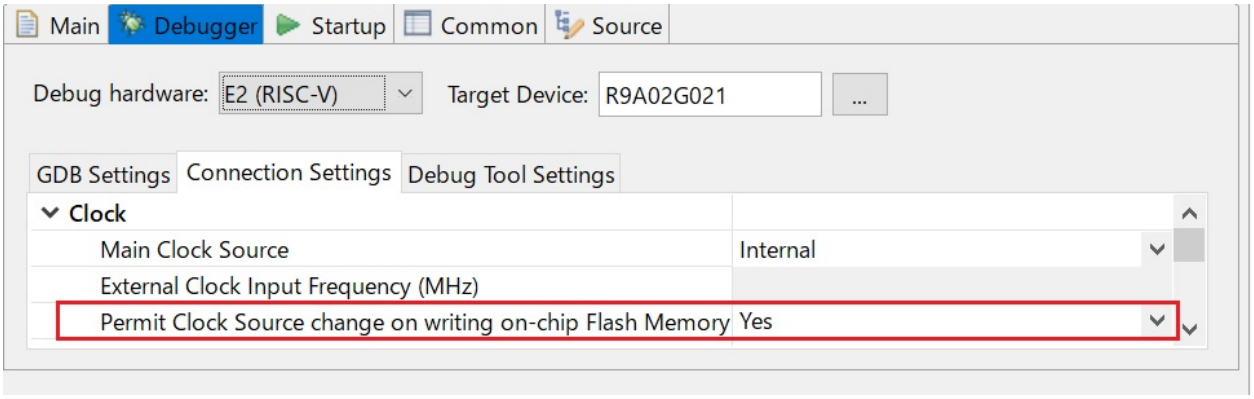


Figure 3-7 Setting of [Permit Clock Source change on writing on-chip Flash Memory]

If data are downloaded to flash memory while any condition is not satisfied, the emulator shows an error message and stops processing. In such a case, restart downloading of data to flash memory after the CPU has been reset or reconnect the emulator debugger after reviewing its settings.

(5) Access window function

When the access window function of the MCU is to be used, only reprogram the flash memory in the area specified for access.

(6) Flash read protection function

The flash read protection function must not be enabled during debugging. Fetching from the areas set for flash read protection is possible but reading is not. If reading from such an area is attempted, values read will all be 0x00. If programming proceeds or a software break is set in an area specified for flash read protection during debugging, the entire block which included that area may be initialized to 0x00. In particular, if the ID code (OSIS) area is protected by flash read protection, programming or setting of a software break will lead to the ID code (OSIS) area being initialized to 0x00 and debugging of the device becoming impossible.

(7) Conditions for using software breaks in flash memory

When the MCU satisfies all the following conditions, the software break function for flash memory is enabled.

(a) The code flash memory of the MCU is in read mode.

(b) The frequency of the system clock (ICLK) of the MCU is 1 MHz or higher.*

(c) The MCU is in middle-speed or high-speed mode.*

(d) For [Break] in the [Debug Tool Settings] tabbed page, [Yes] is selected for [Use Flash Breakpoints].

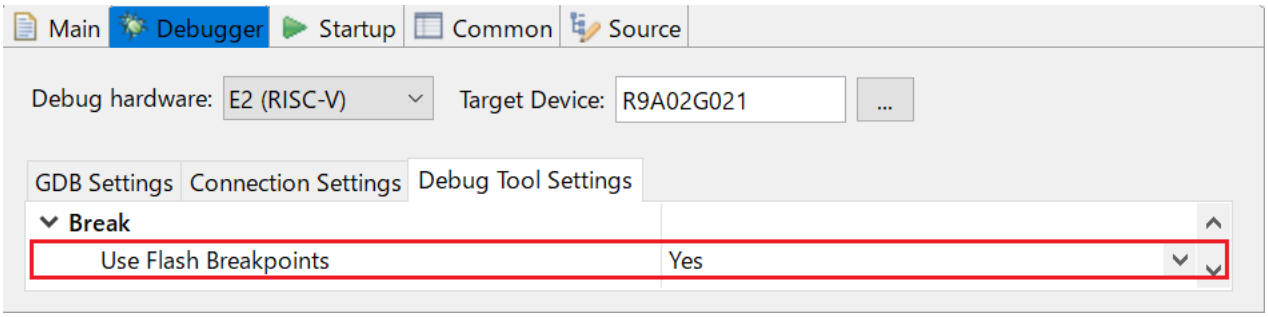


Figure 3-8 Setting of [Use Flash Breakpoints]

Note: For [Clock] in the [Connection Settings] tabbed page of the emulator debugger, when [Yes] is selected for [Permit Clock Source change on writing on-chip Flash Memory], conditions (b) and (c) can be excluded.

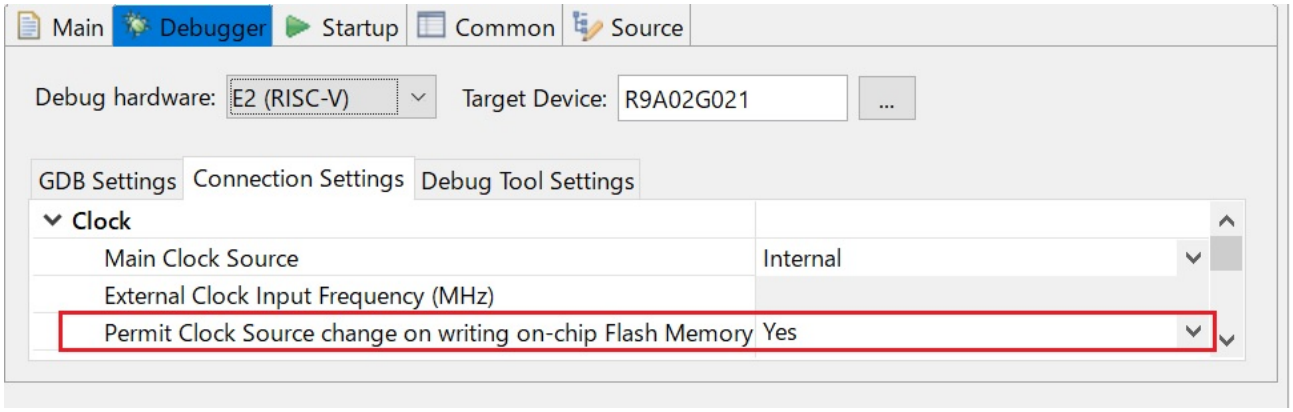


Figure 3-9 Setting of [Permit Clock Source change on writing on-chip Flash Memory]

If the software break function is used with any condition not satisfied, the emulator shows an error message. In such a case, use the hardware break or confirm that conditions (a) to (d) above are satisfied.

(8) Flash memory I/O register

After a debugging operation that involves reprogramming of flash memory, the value of the flash memory I/O register is rewritten by the emulator debugger.

3.3.3 Note on Using Software Breaks in the On-Chip SRAM

(1) Overwriting of software breakpoints by user programs

If a software breakpoint is overwritten by a user program, the program will not stop even if it runs through the address. In such a case, set the software breakpoint after the target on-chip SRAM has been rewritten by the program.

3.3.4 Notes on Using Software Breaks (Common to the On-Chip SRAM and Flash Memory)

(1) Reading an address where a software breakpoint has been set

Do not read an address where a user program has set a software breakpoint. Doing so may cause the program to operate in a different way from in the normal state.

(2) Viewing memory in the [Memory] view

During execution of the user program, if a range of memory in which a software breakpoint has been set is displayed in the [Memory] view of the emulator debugger, the value (ebreak instruction code) that is shown is different from that in the actual program data.

(3) Removal of software breakpoints when the emulator debugger is to be disconnected

When the emulator debugger is to be disconnected, remove all software breakpoints that have been set. At this time, reset the CPU since the emulator debugger is certain to reprogram the flash memory.

3.3.5 Note on Peripheral I/O Registers Occupied by the Debugger

(1) Peripheral I/O registers occupied by the debugger

The emulator debugger occupies the following peripheral I/O registers during debugging. Do not change the values of these registers, since continued debugging might not be possible after having done so.

- Debug stop control register (DBGSTOPCR)
- System control OCD control register (SYOCDCR)

3.3.6 Notes on Low-Power Modes

(1) Debugging in software standby or snooze mode

In software standby or snooze mode, the emulator debugger does not have access to the system bus of the MCU. While the user program is being executed or during mode transitions of the MCU, setting and viewing of the memory or peripheral I/O registers and setting and changing breakpoints are not possible.

(2) Forcibly stopping a program in software standby or snooze mode

When a program is forcibly stopped in software standby or snooze mode, proceed with the following operation. The operation leads to release from software standby or snooze mode.

— Using [Suspend] of the emulator debugger stops the MCU at the next instruction after the WFI instruction which led to the mode transition. When [Suspend] is to be used, for [Connection] on the [Connection Settings] tabbed page of the emulator debugger, select [Yes] for [Low Power Handling].

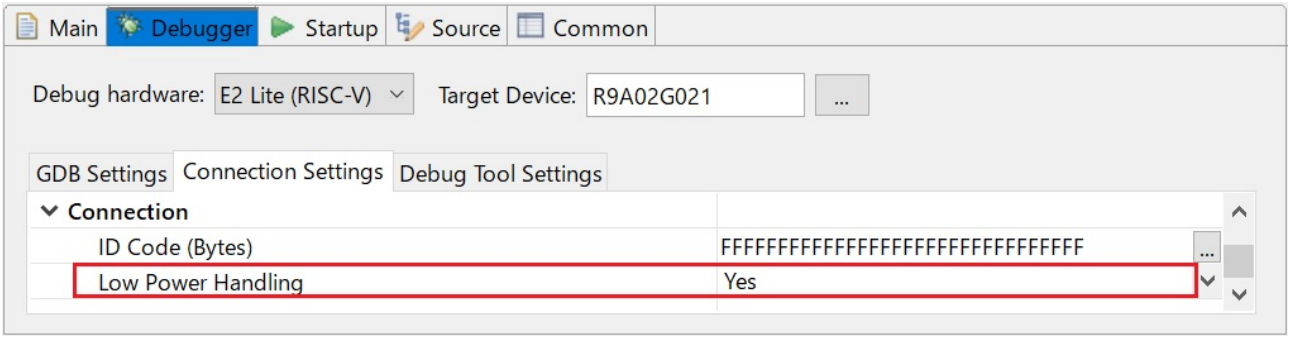


Figure 3-10 Setting of [Low Power Handling]

3.3.7 Current Drawn during Debugging

Since the debugging circuits within the MCU are always active during connection of the emulator debugger, the MCU draws more current than in the actual user system. Take care on this point when attempting to measure the current drawn in the user system.

3.4 MCUs that are Used in Debugging

After debugging with the emulator, if the MCU is disconnected from the emulator and run on its own, correct operation cannot be guaranteed. To operate the MCU on its own, use the programming software to re-program the MCU.

MCUs that are connected to the emulator and used in debugging are placed under stress by repeated programming of flash memory during emulation. Do not use MCUs that were used in debugging in mass-production for end users.

3.5 Final Evaluation of the User Program

Before entering the mass-production phase, be sure to perform a final evaluation of the program which has been written to the flash ROM by the programming software, without the emulator connected.

Revision History	E2 Emulator, E2 Emulator Lite Additional Document for User's Manual (Notes on Connection of RISC-V MCU Devices)

Rev.	Date	Description	
		Page	Summary
1.00	Mar.25.2024	—	First Edition issued.

E2 Emulator, E2 Emulator Lite
Additional Document for User's Manual
(Notes on Connection of RISC-V MCU Devices)

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