To our customers,

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April 1st, 2010
Renesas Electronics Corporation

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User's Manual

E8/E8a Emulator
Additional Document for User's Manual
Notes on Connecting the H8/38076RF,
H8/38086RF, and H8/38776F

Renesas Microcomputer Development
Environment System
H8 Family / H8/300H Super Low Power
Series

R0E000080KCE00EP11

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Contents

Note: This manual applies to the following product versions of the E8 or E8a emulator software.

Table   E8/E8a Emulator Software

E8a Emulator V.1.00 Release 00 or later
(H8 Tiny/Super Low Power E8a Emulator V.1.00.00 or later)*
E8 Emulator V.2.10 Release 00 or later
(H8 Tiny/Super Low Power E8 Emulator V.1.05.00 or later)*

Note: This is a revision of the debugger.

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Section 1   Inside the E8/E8a Emulator User's Manual

The E8 or E8a emulator (hereafter referred to as E8/E8a in this document) manual consists of two documents: the E8/E8a User's Manual and the E8/E8a Additional Document for User's Manual (this document). Be sure to read BOTH documents before using the E8/E8a emulator.

(1) E8/E8a Emulator User's Manual

The E8/E8a Emulator User's Manual describes the hardware specifications and how to use the emulator debugger.

—— E8/E8a emulator hardware specifications

—— Connecting the E8/E8a emulator to the host computer or user system

—— Operating the E8/E8a emulator debugger

—— Tutorial: From starting up the E8/E8a emulator debugger to debugging

(2) E8/E8a Additional Document for User's Manual

The E8/E8a Additional Document for User's Manual describes content dependent on the MCUs and precautionary notes.

—— Example of the E8/E8a emulator connection or interface circuit necessary for designing the hardware

—— Notes on using the E8/E8a emulator

—— Setting the E8/E8a emulator debugger during startup

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Section 2   Connecting the Emulator with the User System

Before connecting an E8/E8a emulator (hereafter referred to as emulator) with the user system, a connector must be installed in the user system so that a user system interface cable can be connected. When designing the user system, refer to the connector and recommended circuits shown in this manual.
Before designing the user system, be sure to read the E8/E8a emulator user's manual and the hardware manual for related MCUs.

Table 2.1 shows the recommended connector for the emulator.

Table 2.1   Recommended Connector

Type Number	Manufacturer	Specifications
2514-6002	3M Limited	14-pin straight type

Connect pins 2, 4, 6, 10, 12, and 14 of the user system connector to GND firmly on the PCB. These pins are used as electrical GND and to monitor the connection of the user system connector. Note the pin assignments of the user system connector.
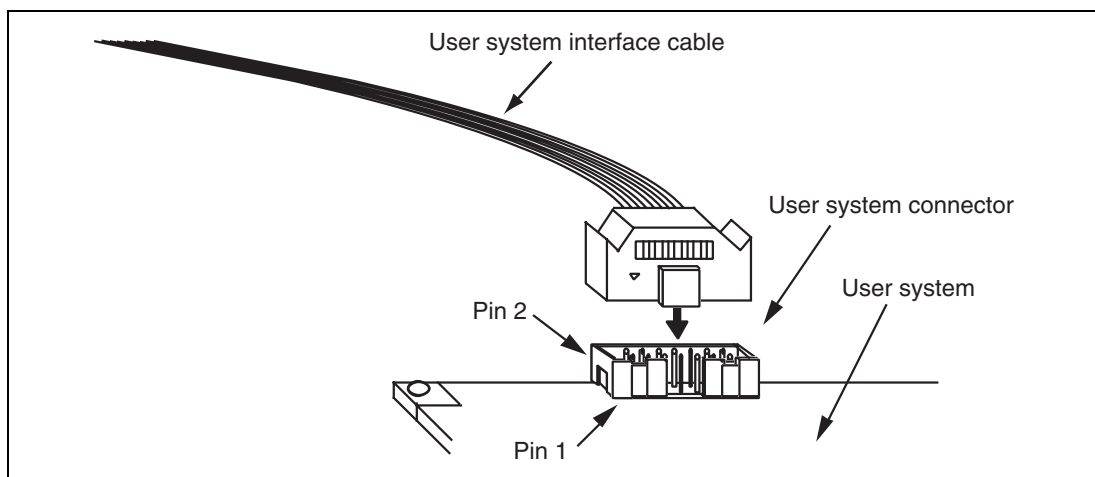

Figure 2.1   Connecting the User System Interface Cable to the User System

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Notes: 1. The pin number assignments of the 14-pin connector differ from those of the E10A-USB emulator; however, the physical location is the same.

2. Do not place any components within 3 mm of the connector.

3. When the emulator is used in the [Program Flash] mode, connect the emulator similarly to the user system.

Section 3   Pin Assignments of the E8/E8a Connector
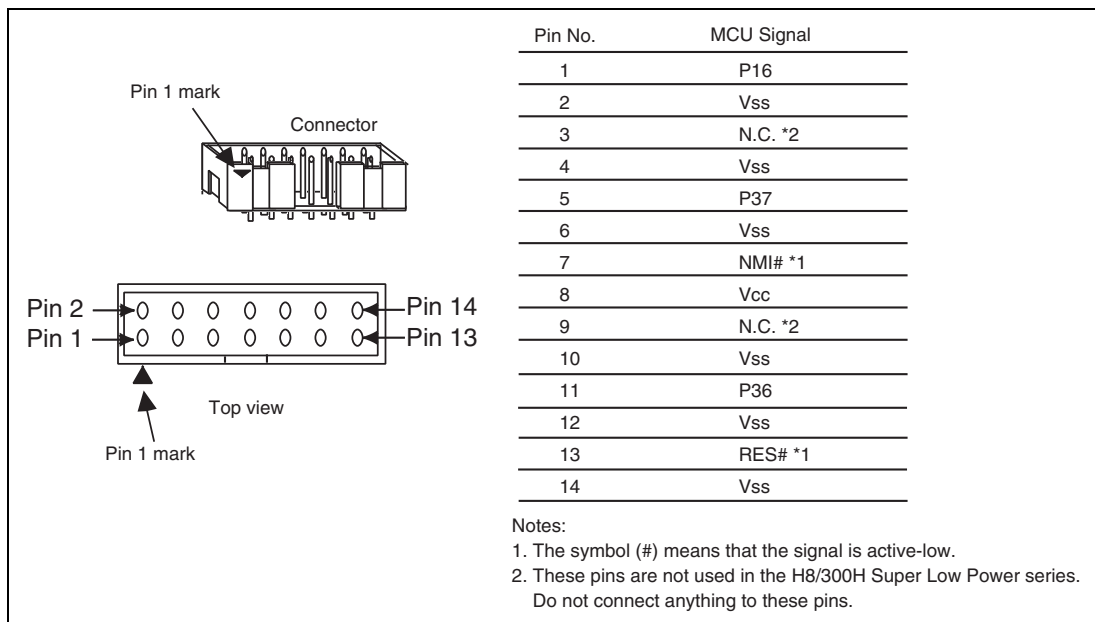
Figure 3.1 shows the pin assignments of the connector.

Pin No.	MCU Signal
1	P16
2	Vss
3	N.C. *2
4	Vss
5	P37
6	Vss
7	NMI# *1
8	Vcc
9	N.C. *2
10	Vss
11	P36
12	Vss
13	RES# *1
14	Vss

Notes:
1. The symbol (#) means that the signal is active-low.
2. These pins are not used in the H8/300H Super Low Power series.
   Do not connect anything to these pins.

Figure 3.1   Pin Assignments of the Connector

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Section 4   Example of Emulator Connection

Figure 4.1 shows an example of emulator connection to the MCU.
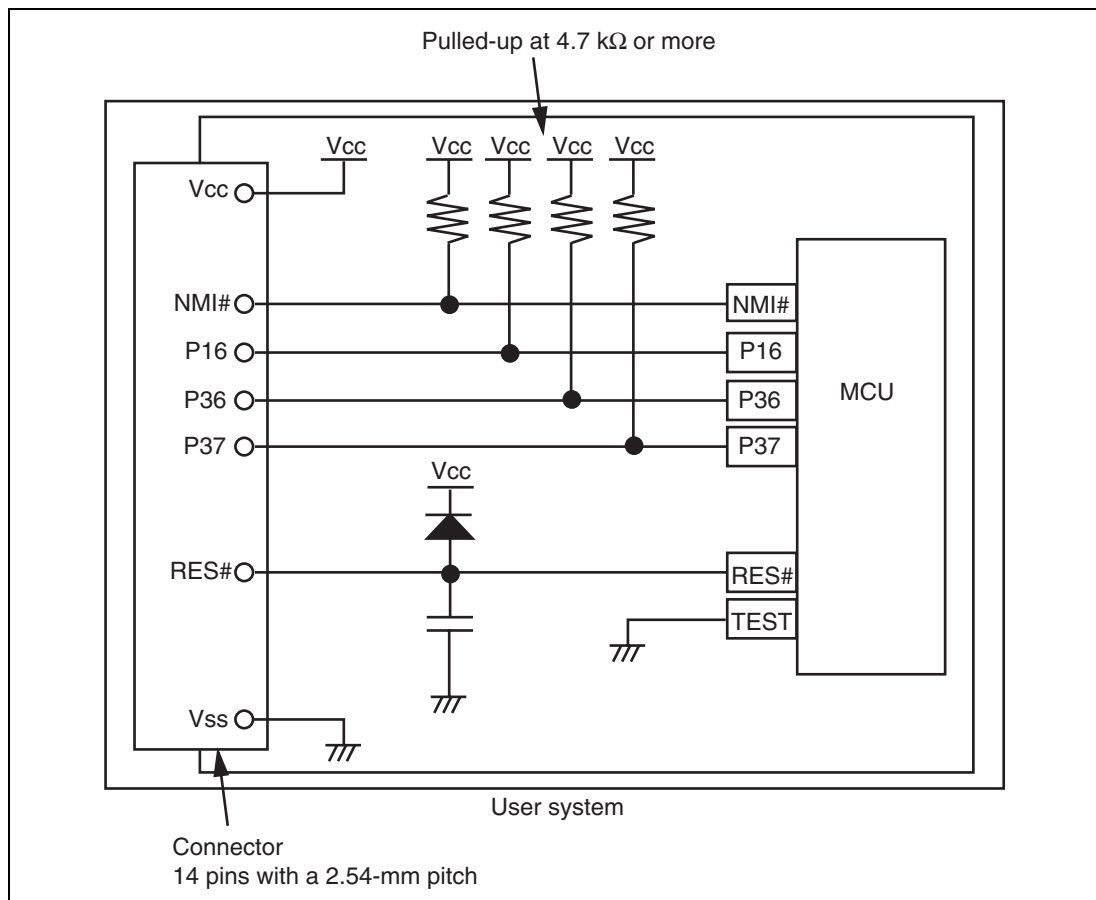

Figure 4.1   Example of Emulator Connection

Notes: 1. P16, P36, and P37 pins are used by the emulator. Pull up and connect the emulator and MCU pins.
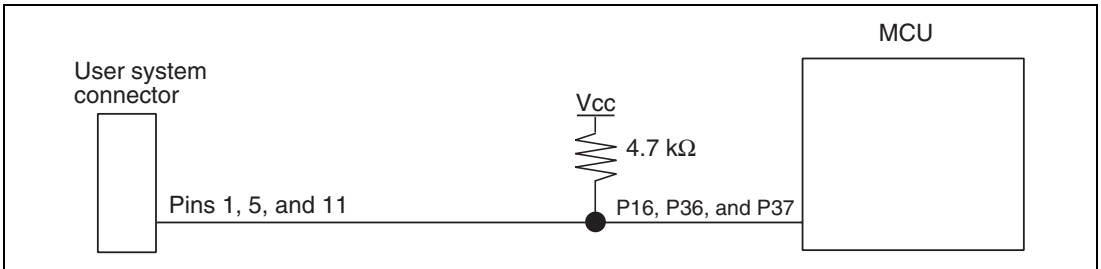

Figure 4.2   Connection of Emulator and P16, P36, and P37 Pins

2. The NMI# signal is used for forced break control by the emulator. Connect the emulator and MCU pins directly. In debugging without forced break control, change the mode with the High-performance Embedded Workshop. Then, when the user logic is connected with the open-collector output buffer, the NMI# pin can be used in the user system (however, at power-on, the NMI# pin is used by the emulator).
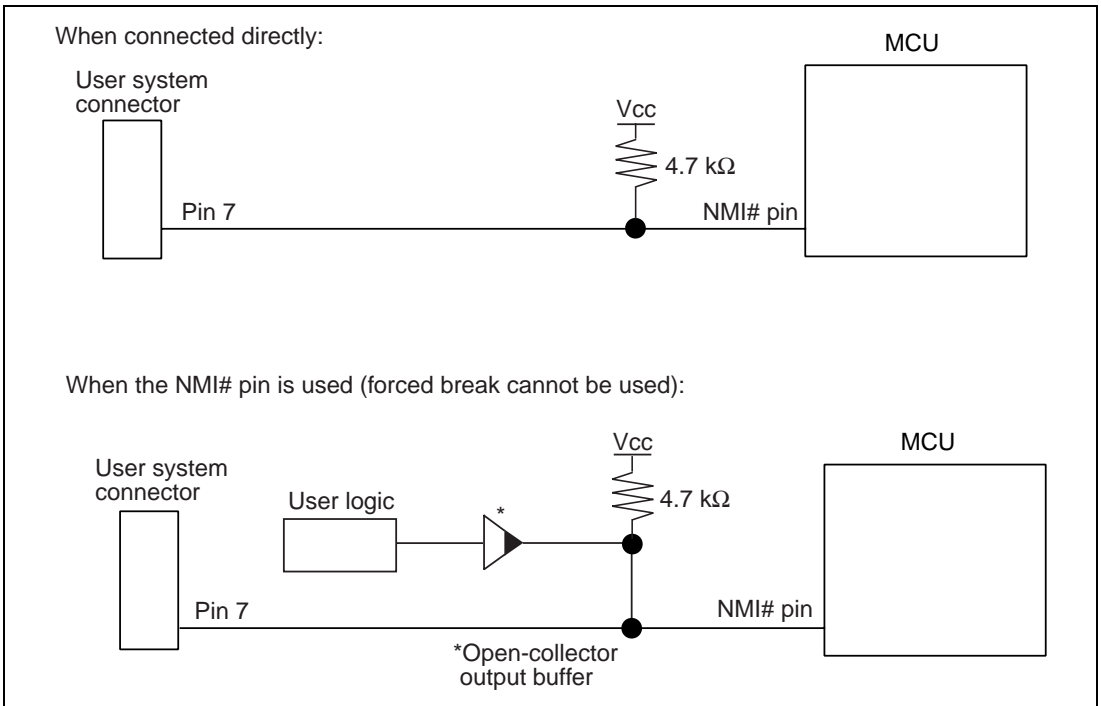

Figure 4.3   Connection of Emulator and NMI# Pin

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3. The RES# pin is used by the emulator. Create the following circuit so that reset input can be accepted from the emulator.
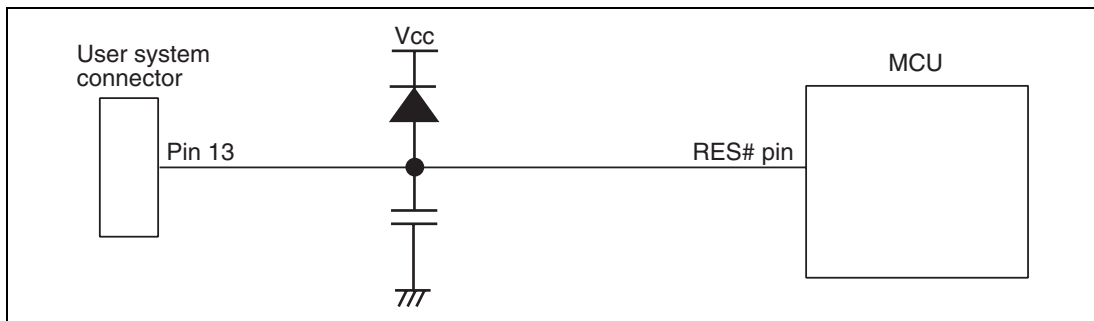

Figure 4.4   Example of a Reset Circuit

4. Connect Vss and Vcc with the Vss and Vcc of the MCU, respectively (within the guaranteed range of the microcomputer).
When the power-supply mode is used, the power is supplied to the user system. Check that the power consumption or voltage of the user system is within the available range of E8/E8a and avoid a problem such as closing of the power-supply circuit.

5. Connect nothing with N.C.

6. When the emulator is connected to the user system, ground the TEST pin of the MCU.
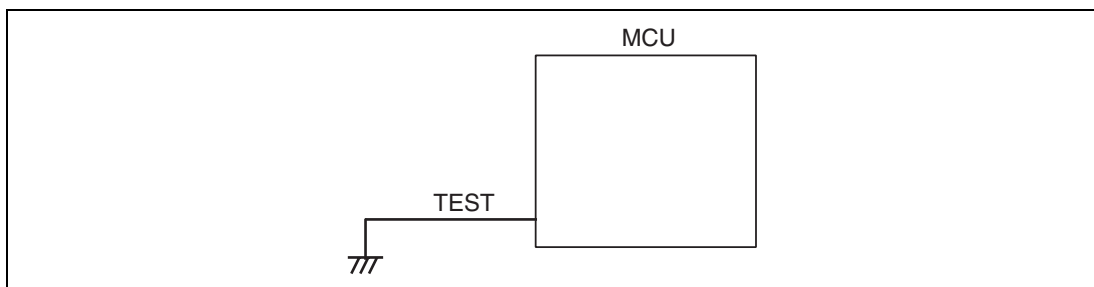

Figure 4.5   Emulator and the TEST Pin

Note: When the emulator is connected, ADTRG#, which is also used as the TEST pin, cannot be used.

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⚠ **WARNING**

   In the power-supply mode, connect the emulator after checking that the power-supply circuit on the user system is not closed or the pin number assignments of the user system connector is correct.
   Failure to do so will result in a FIRE HAZARD and will damage the host computer, the emulator, and the user system.

7. Figures 4.6 and 4.7 show the interface circuit in the E8 and E8a emulators, respectively. Use these figures as references when determining the pull-up resistance value.

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User system connector

Power-supply circuit
(only used for the power-supply mode)

Vcc

8

100 kΩ x 3

1 MΩ

100 kΩ

Emulator control circuit

74LVC125A

22 Ω

P16

1

74LVC125A

22 Ω

P36

11

74LVC125A

22 Ω

NMI#

7

74LVC125A (3.3 V)

74LVC125A (3.3 V)

22 Ω

P37

5

74LVC125A (3.3 V)

22 Ω

RES#

13

3.3 V

100 kΩ

2CS2462LC

100 kΩ

Notes: 1. This figure omits the test circuits and pin numbers 3, 4, 9, and 14 for the user connector that are not used when H8/Tiny series is connected.
2. The power of 74LVC125A is supplied from Vcc in the user connector (or in the power-supply circuit during power-supply mode).
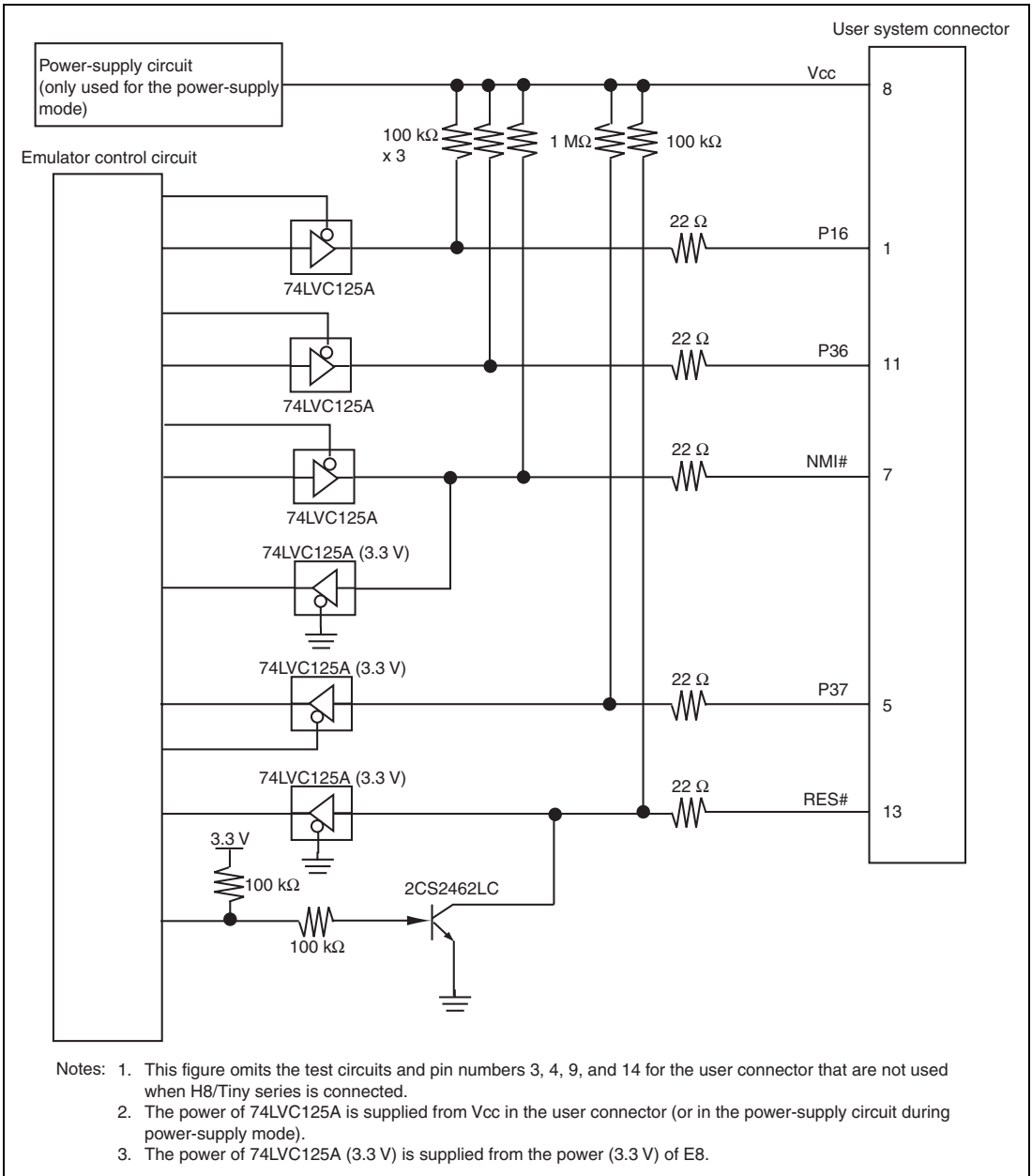3. The power of 74LVC125A (3.3 V) is supplied from the power (3.3 V) of E8.

Figure 4.6   Interface Circuit in the E8 Emulator (Reference)

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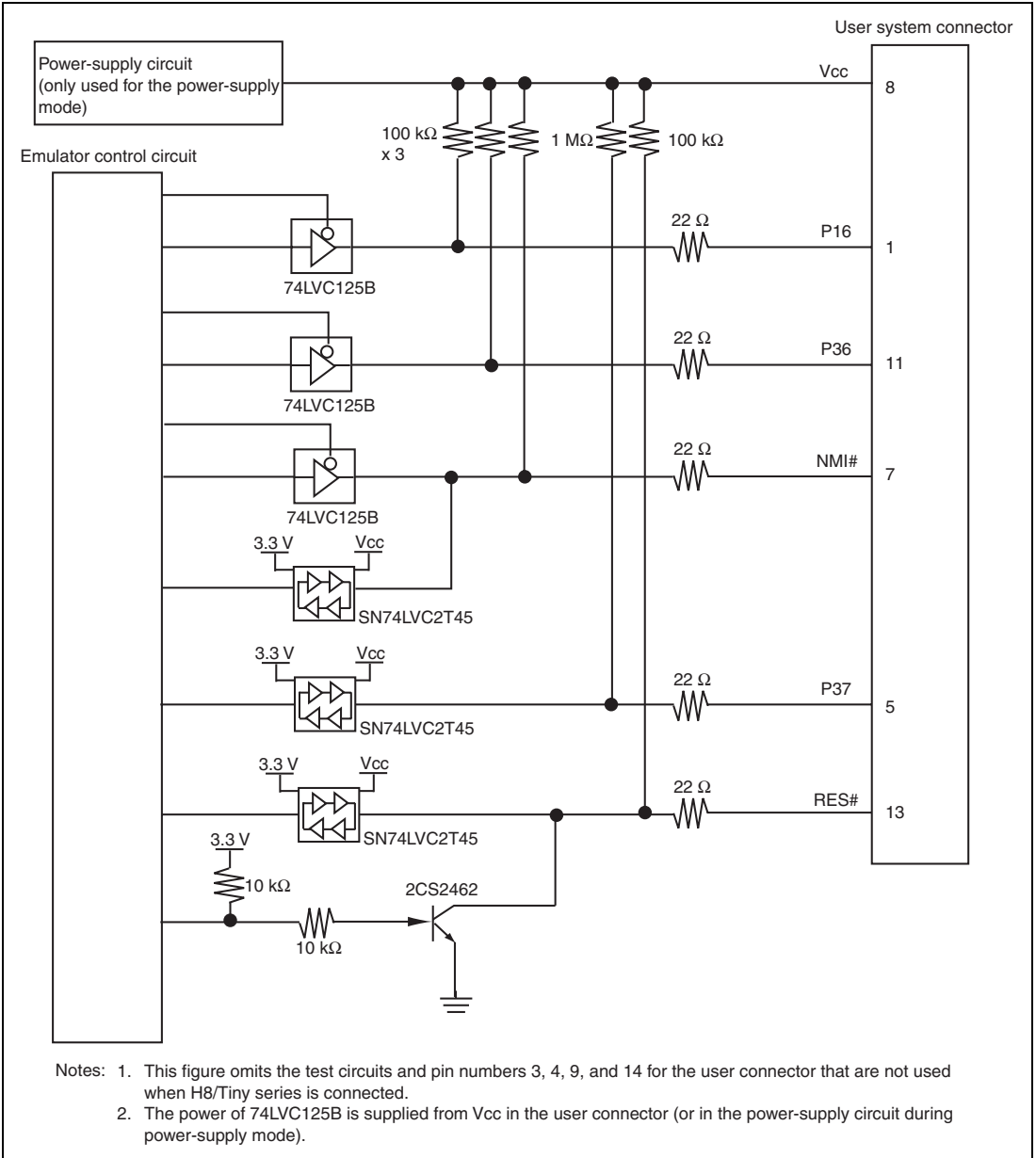
Figure 4.7   Interface Circuit in the E8a Emulator (Reference)

Notes: 1. This figure omits the test circuits and pin numbers 3, 4, 9, and 14 for the user connector that are not used
when H8/Tiny series is connected.
2. The power of 74LVC125B is supplied from Vcc in the user connector (or in the power-supply circuit during
power-supply mode).

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Section 5   Differences between the MCUs (H8/38076RF, H8/38086RF, and H8/38776F) and the Emulator

This section describes the differences between the emulator and MCU operations.

1. [Emulator Setting] Dialog Box
   The [Emulator Setting] dialog box is provided for setting the items that need to be set when the emulator starts up (settings are saved in the session).
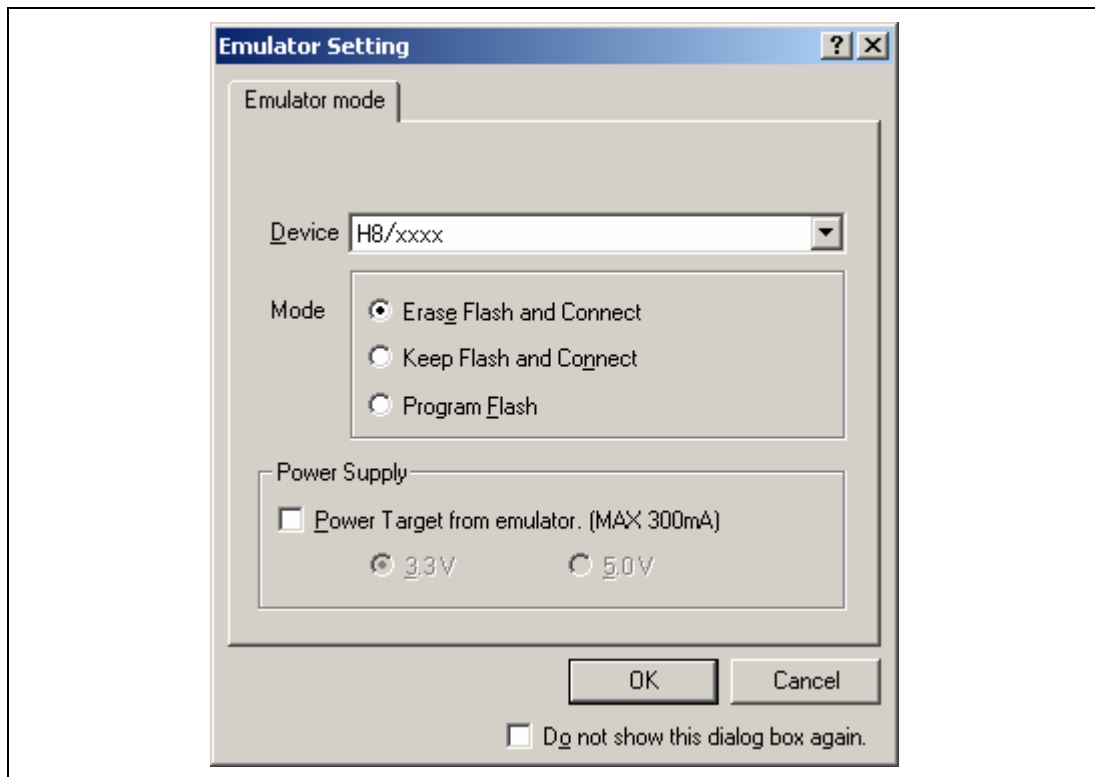

Figure 5.1   [Emulator Setting] Dialog Box

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To keep the [Emulator Setting] dialog box closed next time the emulator is started, check "Do not show this dialog box again." at the bottom of the [Emulator Setting] dialog box. You can open the [Emulator Setting] dialog box using either one of the following methods:

— After the emulator gets started, select Menu - [Setup] -> [Emulator] -> [Emulator Setting...].
— Start the emulator while holding down the Ctrl key.
— After the emulator gets started and an error occurred, restart the emulator.

When you check "Do not show this dialog box again.", the emulator doesn't supply power to the user system. To use this check box, start the emulator after turning on the power.

2. Emulator Mode

The selection of the device, the specification of the mode, and the setting of the power supply are done in the [Emulator mode] page of the [Emulator Setting] dialog box.

— Device

Select the device name in use from the [Device] combo box. The following items are selected in the [Mode] group box.

— Modes

- Erase Flash and Connect

This mode is used when there is no emulator program in the flash memory of the target device. In this mode, data of the flash memory of the target device is erased when the emulator is activated. Select this item when the emulator is firstly activated, the version of the emulator's software is updated, or the ID code is changed.

- Keep Flash and Connect

This mode is used when there is an emulator program in the flash memory of the target device. Enter the ID code specified above ('Erase Flash and Connect'). If an incorrect code is entered, all the programs on the flash memory will be erased.

Note: When the emulator gets started in this mode after selecting "Do not show this dialog box again.", the initial values of the ID code are '00E8' and '0E8a', respectively, for the E8 and E8a emulators. If you use the ID code other than the initial value, do not use "Do not show this dialog box again.".

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- Program Flash

  This mode is used when the emulator is used for programming the flash memory. Debugging the program is disabled. To download the load module, register it in the workspace.

Note: In the H8/Tiny or H8/Super Low Power device, the ID code is not entered in the Program Flash mode.

— Power Supply

  When [Power Target from emulator. (MAX 300mA)] is checked, power will be supplied to the user system up to 300 mA. Then select 3.3 V or 5.0 V according to the power voltage of the user system.

3. Emulator Activation and ID Code

  In the H8/Tiny- or H8/Super Low Power-series MCU, the [System Clock] and [ID Code] dialog boxes are set when the emulator is activated.

  — Setting the system clock

  Enter the clock value input to the board in use. The initial value differs in each MCU.
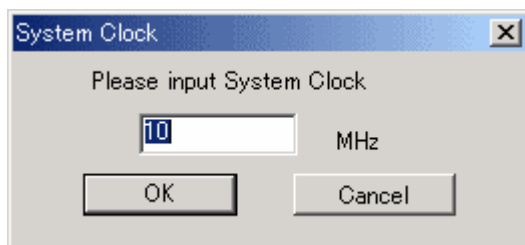

Figure 5.2   [System Clock] Dialog Box

— Setting the ID code

  When the emulator is activated in the [Erase Flash and Connect] mode, enter any hexadecimal four-digit ID code to be set (except for H'FFFF). The initial value is H'00E8.[*] When the emulator is activated in the [Keep Flash and Connect] mode, enter the correct ID code. If an incorrect ID code is entered, all the contents of the flash memory will be erased. In this case, restart the emulator in the [Erase Flash and Connect] mode.
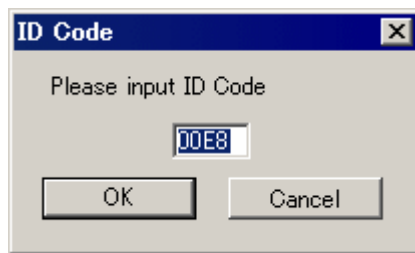
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Figure 5.3 [ID Code] Dialog Box

Note: For the E8a emulator, the initial value is H'0E8a.

4. When the emulator system is initiated, it initializes the general registers and part of the control registers as shown in table 5.1.

Table 5.1 Register Initial Values at Emulator Power-On

Register	Initial Value
PC	Reset vector value in the vector address table
ER0 to ER6	H'0000
ER7 (SP)	H'FF80
CCR	H'80

5. Low-Power Mode

   During a user program break, the CPU operating frequency is forced to a system clock (φ) for high-speed operation.

6. RES# Signal

   The MCU signals are only valid during user program execution started with clicking the GO or STEP-type button. During a user program break, the RES# signal is not sent to the MCUs.

Note: Do not start user program execution or access the memory while control input signal (RES#) is being low. A TIMEOUT error will occur.

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7. System Control Register

In the emulator, the internal I/O registers can be accessed from the [IO] window. However, be careful when accessing the system control register. The emulator saves the register value of the system control register at a break and returns the value when the user program is executed. Since this is done during a break, do not rewrite the system control register in the [IO] window.

8. Memory Access during Emulation

If the memory contents are referenced or modified during emulation, realtime emulation cannot be performed because the user program is temporarily halted.

9. The emulator communicates with the MCUs by using the NMI#, RES#, P16, P36, and P37 pins. These pins cannot be used, however, the NMI# pin can be used by changing the setting of the [NMI signal] group box in the [Configuration] dialog box.

10. Sum Data Displayed in the Program Flash Mode

Sum data, which is displayed in the 'Program Flash' mode, is a value that data in the whole ROM areas has been added by byte (including data in the dedicated ROM area for the emulator).

11. Note on Executing the User Program

The set value is rewritten since the emulator uses flash memory and watchdog timer registers during programming (Go, Step In, Step Out, or Step Over) of the flash memory.

12. The power consumed by the MCU can reach several milliamperes. This is because the user power supply drives ICs to make the communication signal level match the user-system power-supply voltage. The power consumed rises little during user program execution since the emulator does not perform communication; it rises more during a break.

13. Program Area for the Emulator

Do not access a part of areas in the flash memory or the internal RAM since the emulator program uses these areas. If the contents of the program area for the emulator are changed, the emulator will not operate normally. In this case, restart the emulator with the Erase Flash and Connect mode.

Table 5.2 Program Area for the E8/E8a Emulator

MCU Name	Program Area
H8/38076RF	Emulator ROM: H'C000 to H'CFFF
H8/38086RF	Internal RAM: H'F380 to H'F77F
H8/38776F	Vector, etc.: H'0002 to H'00097, H'CFF8 to H'CFF9

14. The emulator uses a two-word stack pointer for values stored on a user program break. Therefore, the stack area must accept two-word addresses.

15. Do not use an MCU that has been used for debugging.
    If the flash memory is rewritten many times, data may be lost due to retention problems after the emulator has been left for a few days and the data will be erased. If an error message is displayed, exchange the MCU for a new one.

16. Forced Break Function
    When the NMI# signal is used for a forced break in the emulator, the vector address of NMI# is rewritten by the emulator program. An error will occur if a file in the host computer and the flash memory contents are verified. Do not use the flash memory contents as the ROM data for the mask ROM after it has been saved.

17. Setting the Usage of the NMI# Signal
    In the [Configuration] dialog box, when the NMI# signal is changed as it is used in the user program, the vector address of NMI# is not recovered. Reload the user program.

18. Address Break Release Function
    In the [Configuration] dialog box, when the address break is changed as it is used in the user program, Break Condition 2 is disabled in this emulator.

19. Hardware Break Functions
    - In the H8/38076RF, H8/38086RF, H8/38776F E8/E8a emulator, conditions of Break Condition 1,2 can be set. Table 5.3 lists the items that can be specified.

Note: When the address break is used in the user program, Break Condition 2 is disabled.

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Table 5.3   Hardware Break Condition Specification Items

Items	Description
Address bus condition	Breaks when the MCU address bus value matches the specified value.
Data bus condition	Breaks when the MCU data bus value matches the specified value. High or low byte or word can be specified as the access data size.
Read or write condition	Breaks in the read or write cycle.

Table 5.4 lists the combinations of conditions that can be set in the [Break condition] dialog box.

Table 5.4   Conditions Set in [Break condition] Dialog Box

	Condition		
Dialog Box	Address Bus Condition	Data Condition	Read or Write Condition
[Break condition 1]	O	O	O
[Break condition 2]	O	O	O

Note: O: Can be set by checking the radio button in the dialog box.

Table 5.5 lists the combinations of conditions that can be set by the BREAKCONDITION_ SET command.

Table 5.5   Conditions Set by BREAKCONDITION_SET Command

	Condition		
Channel	Address Bus Condition (<addropt> option)	Data Condition (<dataopt> option)	Read or Write Condition (<r/wopt> option)
Break condition 1	O	O	O
Break condition 2	O	O	O

Note: O: Can be set by the BREAKCONDITION_SET command.

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- Notes on Setting the Break Condition

1. When [Step In], [Step Over], or [Step Out] is selected, the settings of Break Condition are disabled.

2. The settings of Break Condition are disabled when an instruction to which a BREAKPOINT has been set is executed.

3. When step over function is used, the settings of BREAKPOINT and Break Condition are disabled.

4. Do not make any setting that satisfies both Break Condition 2 and the BREAKPOINT or Break Condition 1. Otherwise, the break cause of Break Condition 2 is retained and a break will occur by executing no instruction when the user program execution is resumed.

5. When Break Condition 2 is satisfied, the emulator uses the latest one branch of the branch trace information.

6. Break Condition 2 causes no break when it has a conflict with a reset.

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20. Items Set in the [Configuration] Dialog Box

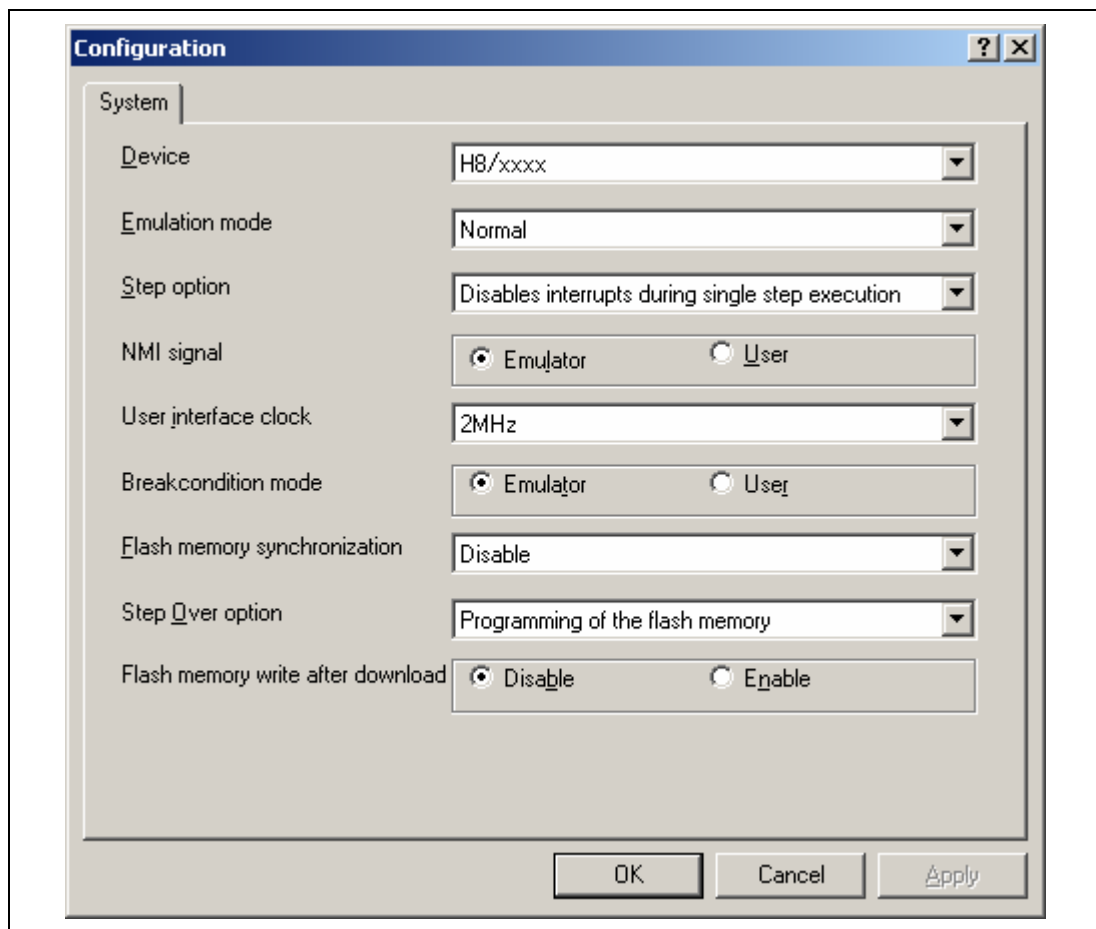The emulator operation conditions are set in the [Configuration] dialog box.

Figure 5.4   [Configuration] Dialog Box ([System] Page)

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Items that can be displayed in this dialog box are listed below.

[Device] combo box	Displays the MCU name.
[Emulation mode] combo box	Selects the emulation mode at user program execution.
	Select Normal to perform normal emulation.
	Select No break to disable PC breakpoint or break condition settings during emulation.
[Step option] combo box	Sets the step interrupt option.
	Disable interrupts during single step execution: Disables interrupts[*1] during step execution.
	Enable interrupts during single step execution: Enables interrupts[*1] during step execution.
[NMI signal] group box	Sets the use of the NMI# signal.
	When used as a forced break in the emulator, select Emulator. In this case, the NMI# signal cannot be used. The contents of the NMI# vector address are rewritten by the emulator program. When used in the user program, select User. In this case, the forced break cannot be used. Before user program execution, set the breakpoints or break conditions for the exception processing and generate exceptions to halt the program.
[User interface clock] combo box	Displays the transfer clock of the user interface.
[Breakcondition mode] group box	Sets the address break release function.
	When the address break function is not used in the user program, select Emulator. In this case, the hardware break and step functions can be used. The contents of the vector address are rewritten by the emulator program to satisfy the break conditions.
	When the address break is used in the user program, select User. In this case, the hardware break function (Break Condition 2) cannot be used.
[Flash memory synchronization] combo box	Selects whether or not the contents of the flash memory are acquired by the emulator when the user program is stopped or the position where the PC break is set is put back as the original code.
	When the flash memory is not programmed by the user program, its contents need not be acquired by the emulator.

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If there is no problem with the state that the program in the flash memory has been replaced as the PC break code, the position where the PC break is set needs not be put back as the original code.

Disable: Read or program is not performed for the flash memory except when the emulator is activated, the flash memory area is modified, and the settings of the PC break to the flash memory area are changed.

PC to flash memory: When the user program is stopped, the specified PC break code is replaced as the original instruction. Select this option if there is a problem with the state that the program in the flash memory has been replaced as the PC break code.

Flash memory to PC: When the user program is stopped, the contents of the flash memory are read by the emulator. Select this option if the flash memory is reprogrammed by the user program.

PC to flash memory, Flash memory to PC:
When the user program is stopped, the contents of the flash memory are read by the emulator and the specified PC break code is replaced as the original instruction. Select this option if the flash memory is reprogrammed by the user program and there is a problem with the state that the program in the flash memory has been replaced as the PC break code.

[Step Over option] combo box   Enables or disables programming of the flash memory while executing step operation.

Programming of the flash memory: Uses a software break for step operation (e.g. Step Over) and enables programming of the flash memory.

No Programming of the flash memory: Uses Break Condition for step operation (e.g. Step Over) and disables programming of the flash memory[*2].

[Flash memory write after download] group box   Enables or disables programming of the flash memory after downloading the program.

Disable: Disables programming of the flash memory after downloading the program.

Enable: Enables programming of the flash memory after downloading the program.

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Notes: 1. Includes interrupts in a break.

    2. When Step Over is performed after selecting [No Programming of the flash memory] for [Step Over option], the instruction that follows a JSR, BSR, or TRAPA instruction will also be executed. If there are consecutive JSR, BSR, or TRAPA instructions, execution proceeds until it reaches an instruction that is not JSR, BSR, or TRAPA. (When there are consecutive function calls in C language, the program steps all of these functions.)

21. Initializing the Internal I/O Register with the Reset_CPU Function

Be sure to initialize the internal I/O registers shown below by the user program since they are not initialized by selecting [Debug] – [Reset CPU] or using the RESET command.

Table 5.6   Registers Not Initialized

MCU Name	Register Not Initialized
H8/38076RF H8/38086RF H8/38776F	SYSCR1, SYSCR2, IEGR, INTM, IENR2, IENR1, IRR1, IRR2, IWPR, CKSTPR1, CKSTPR2

E8/E8a Emulator
Additional Document for User's Manual
Notes on Connecting the H8/38076RF, H8/38086RF, and
H8/38776F

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