User's Manual

E1/E20 Emulator

Additional Document for User's Manual (Notes on Connection for RH850/F1L)

Supported Devices:
RH850 Family RH850/F1L Series

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(2012.4)

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1. Outline

1.1 Features

E1/E20 Emulator is an on-chip debug emulator with flash programming function, which is used for debugging and programming a program to be embedded in on-chip flash memory microcontrollers. This product can debug with the target microcontroller connected to the target system, and can write programs to the on-chip flash memory of microcontrollers.

1.2 Cautions on Using E20 Emulator

The functions used for debugging of the RH850 family by using the E20 are the same as in the E1 emulator. Large trace function, characteristic functions of the E20 emulator, cannot be used.

1.3 Configuration of Manuals

Documentation for the E1/E20 emulator manual is in two parts: the E1/E20 Emulator User's Manual and the E1/E20 Emulator Supplementary Document for the User's Manual (this manual). Different versions of the latter correspond to different sets of MCUs. Be sure to read both of the manuals before using the E1/E20 emulator (hereinafter referred to as "the emulator").

(1) The E1/E20 emulator user's manual has the following contents:

- Components of the emulators
- Emulator hardware specification
- Connection to the emulator and the host computer and user system

(2) The E1/E20 Emulator Supplementary Document for the User's Manual has the following contents:

- For use in hardware design, an example of connection and the interface circuit required to connect the emulator.
- Notes on using the emulator

2. Designing the User System

To connect the E1/E20 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 hardware manual for the MCUs.

2.1 Installing the Connector on the User System

Table 2-1 shows the recommended connectors for the E1 and E20 emulators.

Table 2-1 Recommended Connectors

	Type Number	Manufacturer	Specification
14-pin Connector	7614-6002	Sumitomo 3M Limited	14-pin straight type (Japan)
	2514-6002	3M Limited	14-pin straight type (other countries)

Figures 2-1 show examples of the connection between a user system interface cable of the 14-pin type. Do not mount other components with a height exceeding 10 mm within 5 mm of the connector on the user system. 38-pin connection of the E20 is not supported. To use the E20, use the 38-pin/14-pin conversion adapter [R0E000200CKA00] that comes with the E20 for connection.

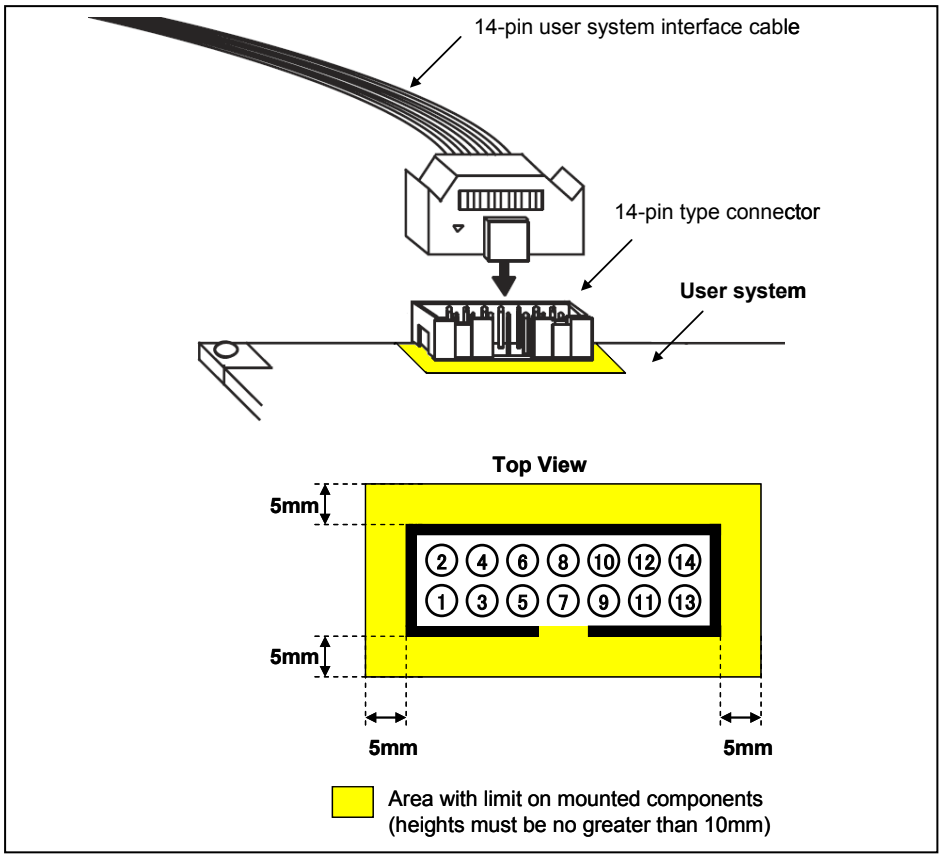


Figure 2-1 Connecting the User System Interface Cable to the 14-pin Connector of the E1/E20 Emulator

2.2 Pin Assignments of the Connector on the User System

Table 2-2 shows the pin assignments of the 14-pin connectors.

Table 2-2 Pin assignments of the connector (14-pin)

Pin No	Signal (#:Low active)			Input/ Output [Note3]
	LPD4pin (Debug)	2wireUART (Programming)	1wireUART (Programming)	
1	LPDCLK	—	—	Input
2 [Note1]	GND	GND	GND	—
3	—	—	—	—
4	—	FPMD0	FPMD0	Input
5	LPD0	FPDT	—	Output
6	—	—	—	—
7	LPDI0	FPDR	FPDR	Input/Output
8	TVDD	TVDD	TVDD	—
9	—	—	—	—
10	—	—	—	—
11	LPDCLKOUT	—	—	Output
12 [Note1]	GND	GND	GND	—
13 [Note2]	RESET_OUT#	RESET_OUT#	RESET_OUT#	Input
14 [Note1]	GND	GND	GND	—

Notes 1. Securely connect pins 2, 12, and 14 of the connector to GND of the user system. These pins are used for electrical grounding as well as for monitoring of connection with the user system by the E1/E20 emulator.

2. Securely connect pin 13.

3. Input to or output from the user system

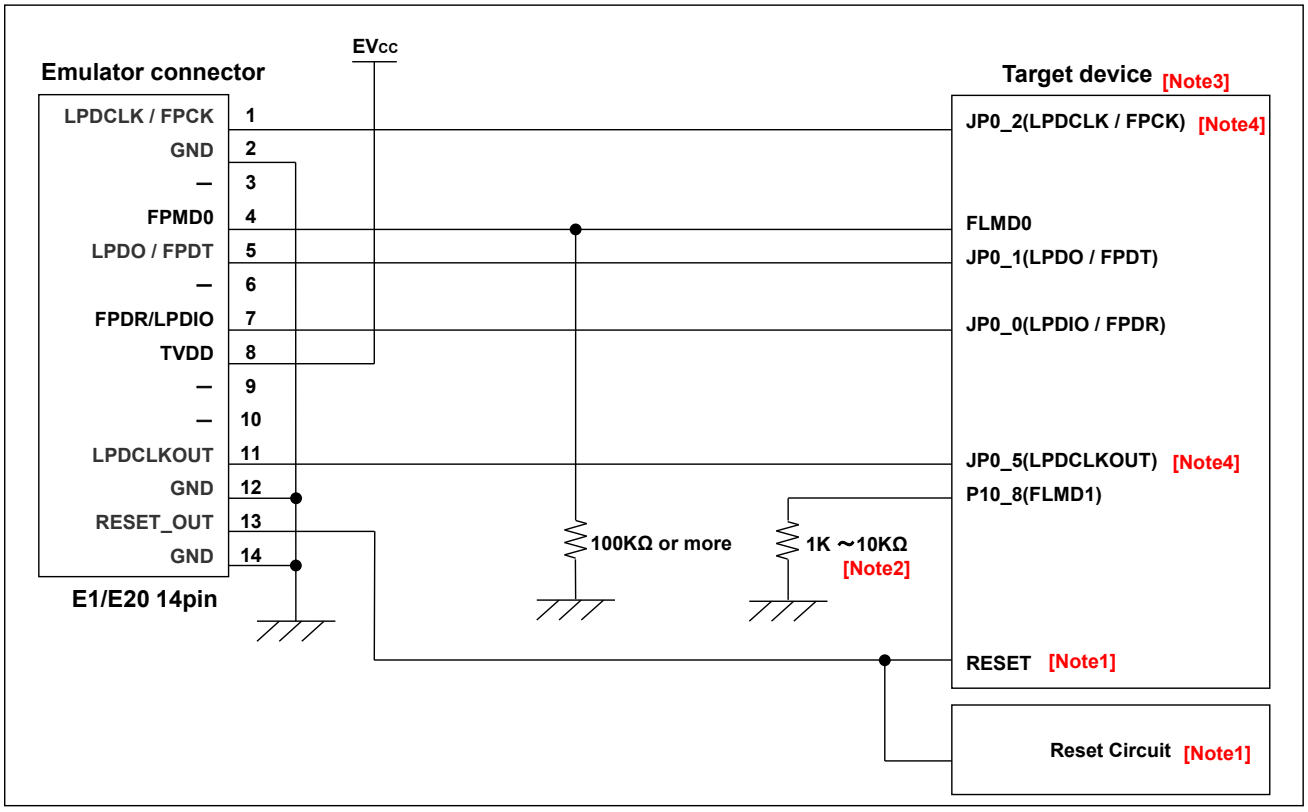
2.3 Recommended Circuit between the Connector and the MCU

This section describes recommended circuits for connection between the 14-pin connector and the MCU.

2.3.1 Recommended Circuit

There are 3 types of recommended circuit for each purpose. Select the relevant circuit for the purpose. Be sure to take into consideration the specifications of the target device as well as measures to prevent noise when designing your circuit.

Purpose	Figure
Debugging(LPD4pin) and programming(2wireUART)	Figure 2-2
Only debugging(LPD4pin)	
Only programming(2wireUART)	Figure 2-3
Only programming(1wireUART)	Figure 2-4



【Caution】Wiring patterns between the connector and the MCU must be as short as possible

Figure 2-2 Recommended Circuit (debugging(LPD4pin) and programming(2wireUART))

or

Recommended Circuit (Only debugging(LPD4pin))

[Note1] This circuit is designed assuming that RESET signal is output from the N-ch open-drain buffer. For details, refer to 2.3.2.

[Note2] This signal must be set at low level when resetting.

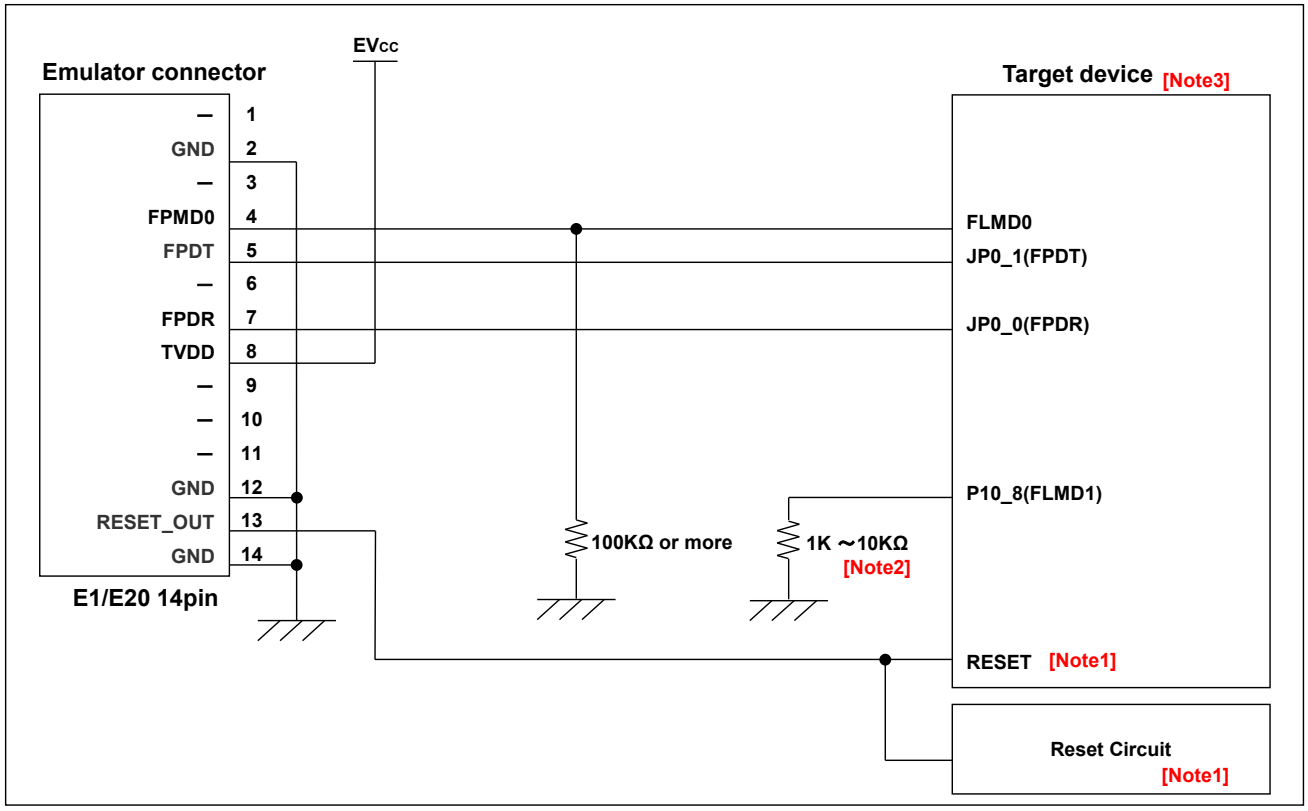
In case of using general port, it is necessary to carry out circuit design so that it may not be driven to a High level from the exterior when releasing of reset.

[Note3] Pin name differs according to the data sheet of MCU.

Refer to those the data sheet of MCU to find an actual pin name.

[Note4] Add a grounded guard ring to the pattern between the connector and the MCU.

Do not arrange these signal lines in parallel with or across other high-speed signal lines.



【Caution】Wiring patterns between the connector and the MCU must be as short as possible

Figure 2-3 Recommended Circuit (only programming(2wireUART))

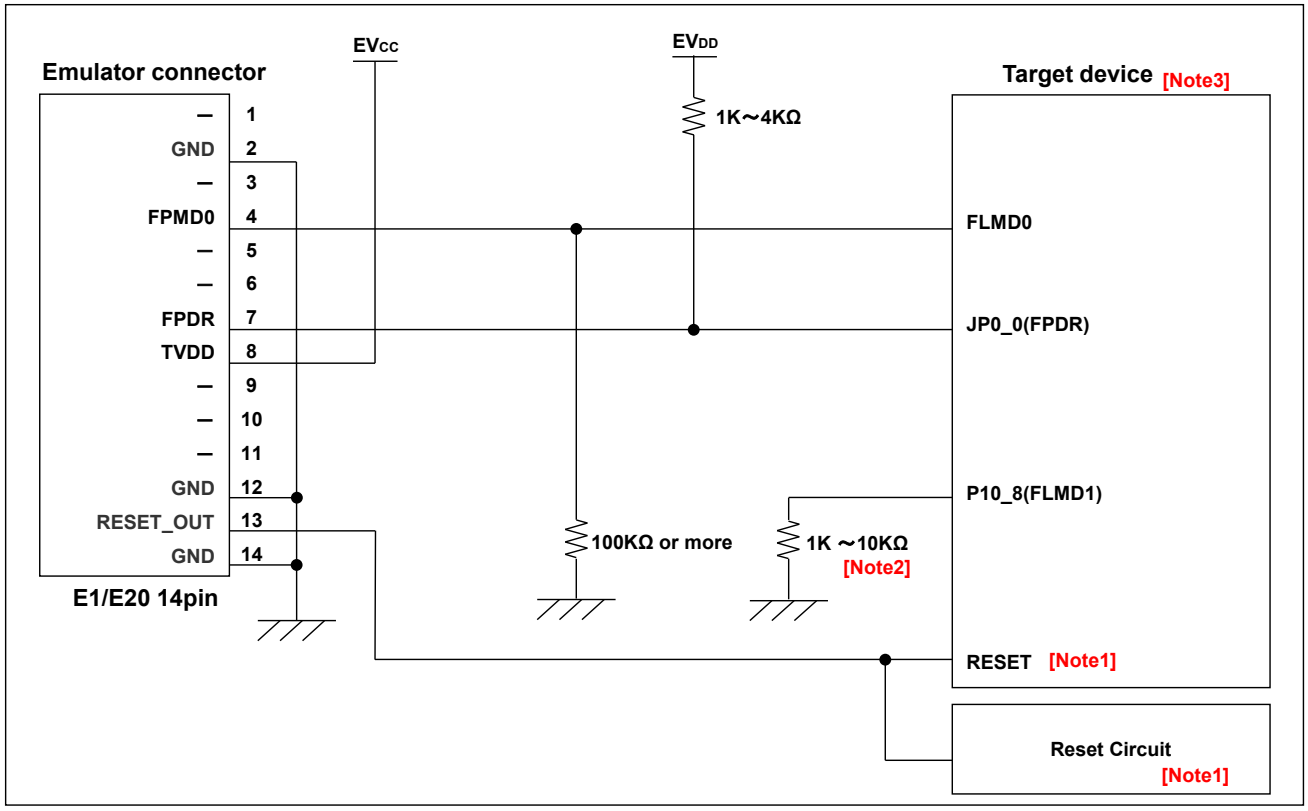
[Note1] This circuit is designed assuming that RESET signal is output from the N-ch open-drain buffer. For details, refer to 2.3.2.

[Note2] This signal must be set at low level when resetting.

In case of using general port, it is necessary to carry out circuit design so that it may not be driven to a High level from the exterior when releasing of reset.

[Note3] Pin name differs according to the data sheet of MCU.

Refer to those the data sheet of MCU to find an actual pin name.



【Caution】Wiring patterns between the connector and the MCU must be as short as possible

Figure 2-4 Recommended Circuit (only programming(1wireUART))

[Note1] This circuit is designed assuming that RESET signal is output from the N-ch open-drain buffer. For details, refer to 2.3.2.

[Note2] This signal must be set at low level when resetting.

In case of using general port, it is necessary to carry out circuit design so that it may not be driven to a High level from the exterior when releasing of reset.

[Note3] Pin name differs according to the data sheet of MCU.

Refer to those the data sheet of MCU to find an actual pin name.

2.3.2 Regarding Connection of RESET

The connection of reset is necessary.Connect the RESET signal as shown in Figure 2-4. When use E1/E20 emulator, it change RESET_OUT signal automatically into a Low output and a Hi-Z state.

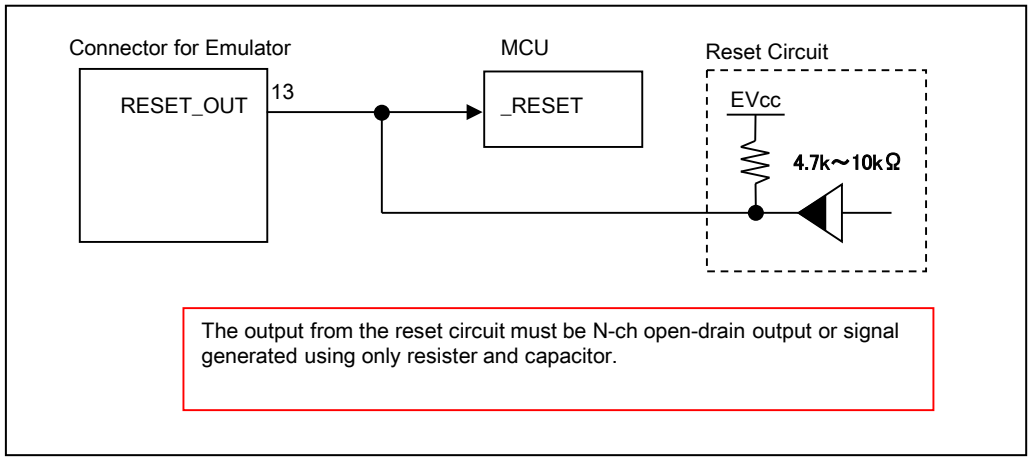


Figure 2-4 Reset circuit connection

2.3.3 About EV_{CC}

Connect the EV_{CC} of the connector to the EV_{CC} (power supply) of the user system.

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

When power is supplied to the user system from other than the emulator, E1/E20 emulator consumes the power supply for the last output and first input buffers of the emulator.

E1 emulator : 3.3V approximately 20mA , 5.0V approximately 40mA

E20 emulator:3.3V approximately 40mA , 5.0V approximately 100mA

The E1 emulator can supply power to user system. Up to 200 mA current can be supplied.

When using the power supply function of the E1 emulator, check the voltage supplied to the user system. Particularly, when the 5.0V supply option is selected, the voltage may drop 0.5V or more since it depends on the USB VBUS power supply voltage.

Power supply from the E1 emulator 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 E1 emulator. Use a stable, separate power supply for the user system. When writing a program for mass production processes, use the Flash Development Toolkit or the Renesas Flash Programmer.
For details on the flash programming software, refer to
http://www.renesas.com/products/tools/flash_prom_programming/ .

⚠ WARNING

Warning for Turning the Power On/Off:

When supplying power, ensure that there are no shorts between Vcc and GND. Only connect the E1 or E20 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.

2.3.4 Isolators for the E1 Emulators

For a debugging environment where there is a GND gap between the user system and host PC, use the isolator for the E1 emulator (R0E000010ACB20) that are separately available from Renesas.

3. Specifications

Specifications are below table.

Large Item	Middle Item	Small Item	Specification
Hardware Common	Target host machine		Computer equipped with a USB port OS is due to the software tool.
	User system interface		14-pin connector
	Host machine interface		USB2.0 (Full speed/ High speed)
	Connection to the user system		Connection by the provided user-system interface cable
	Power supply function (E1 Emulator used)		3.3 V or 5.0 V, set in software tool, can be supplied to the user system(with current up to 200 mA).
	Power supply for the emulator		No need (the host computer supplies power through the USB)
Related debugging	Break	Software break	ROM area :2000 points RAM area : Unavailable
		Hardware break	12 points (commonly used by execution and access)
		Forced break	Available
	Event	Number of events	4 points (commonly used by execution and access)
		Available function	Hardware break, Trace
		Combination of events	OR, sequential
	Trace (Only when device with trace function is used)	Size	Branch only: 2k to 4k branch Data trace only: 1k～2k cycles
		Trace data	Branch, Data access cycle
		Start/Stop condition	From run to break, Event condition setting
		Data trace condition	Event condition
	Performance measurement	Measurement item	From run to break
		Performance	32bit Counter(1 section)
	Pseudo Real-time RAM monitor		Available Note1
	Direct memory modification		Available Note1
	Debugging console		Unavailable
	Downloading to external flash memory		Available (Depends on Software)
	Hot plug-in		Unavailable
	IO break		Available Note2
	Security		16-byte ID code authentication
	Connection I/F		LPD4pin
Related programming	Security setting		Available
	Connection I/F		2wireUART, 1wireUART

Note1: Occupying a bus (Cycle steal).

Note2: The function to stop peripheral IO operation in the break is called peripheral break function.

Able to set whether to execute the peripheral break or not on emulator debugger.

Refer to the debugger manual in use for how to set.

Refer to the MCU manual in use for selecting whether to execute the peripheral break or not.

4. Notes on Usage

Make sure to notes on usage in this section.

4.1 Lists

Table 4-1 Lists of notes on usage

No	Item
1	Handling of device that was used for debugging
2	Regarding device current consumption
3	Regarding the power to the target system
4	Regarding the alternate functions of OCD contact pins
5	Regarding degug I/F
6	Regarding Initialization of RAM areas
7	Regarding during break
8	Regarding step over functuion
9	Regarding step function
10	Regarding trace function
11	Regarding power save mode
12	Writing quality of flash programming
13	Turning the Power On/Off

4.2 Details

No.1 Handling of device that was used for debugging

Description: Do not use MCU's that were used in debugging in mass-production. We do not guarantee the number of times the flash memory in such a device can be programmed. A software error occurs when programming of the flash memory is no longer possible. In such a case, replace the device.

No.2 Regarding device current consumption

Description: The target device consumes more power during debugging than in normal operation since the debugging functions are operating.

No.3 Regarding the power to the target system

Description: Do not turn the power to the target system off during debugging.

No.4 Regarding the alternate functions of OCD contact pins

Description: The alternate functions of OCD contact pins cannot be used during on-chip debugging.

No.5 Regarding degug I/F

Description: The E1/E20 emulator only supports LPD4pin interface.

When OPJTAG1 and 0 bits of Option Byte 0 Register are set as "11" (JTAG:Blank chip is JTAG I/F), emulator debugger operates as follows.

a. When connecting E1/E20 emulator

Emulator debugger rewrites Option Byte 0 Register to "01" (LPD4pin).

Therefore, OPJTAG1 and 0 bits of Option Byte 0 Register are "01" (LPD4pin) during emulator debugger operation.

b. When disconnecting E1/E20 emulator

OPJTAG1 and 0 bits of Option byte 0 Register can be changed with emulator debugger.

- Rewrites OPJTAG1 and 0 bits of Option Byte 0 Register to "11" (JTAG).
- Keeps OPJTAG1 and 0 bits of Option Byte 0 Register value as "01" (LPD4pin).

When you disconnect E1/E20 emulator, keeping OPTJTAG1 and 0 bits of Option Byte 0 Register to "01" is recommended.

In case of the power supply of target system is turned off because of abnormal end of emulator debugger, Option Byte 0 Register "OPTJTAG1,0" keeps "01" (LPD) without rewriting.To change Option Byte 0 Register to "11" (JTAG), please do this at the end of E1/E20 emulator.

No.6 Regarding Initialization of RAM areas

Description: All RAM areas must be initialized in 4-byte units through the user program. Otherwise the program does not run normally due to ECC errors while the emulator is not in use (even if the program runs normally while the emulator is in use) because part of the local RAM is used for downloading in the flash memory during debugging. ROMization is also required because any data downloaded from the emulator debugger to the RAM before program execution is initialized.

For details, refer to the CC-RH user's manual.

When starting the emulator system, Global RAM area and Local RAM areas are initialized to H'00000000. For this reason, there are the following restrictions.

- The initial value of RAM on the emulator shortly after starting the emulator system differs from that of the device shortly after a reset.
- The ECC error caused by uninitialized RAM does not occur.

No.7 Regarding during break

Description: Do not generate a reset by a pin reset while the program is stopped (during break). In case of occurring reset, the emulator debugger may hang. Even if the reset mask is set on the emulator debugger, hang up may happen too.

No.8 Regarding step over functuion

Description: When the program is stepped over from either of the lines listed below, execution stops within the assembler module that is the branch destination. The behavior of the emulator is the same as in the case of stepping in.

(a) Call of the assembler module

(b) Return from a function to the assembler module

No.9 Regarding step function

Description: When interrupt or exception occurs during step execution, or CALLT is executed by step, next instruction is executed too.

No.10 Regarding trace function (When using debug MCU board or device with trace function.)

Description: There are limitations of trace function listed below.

- When priority on tracing is given to data, the facility to stop tracing is not usable. To use this facility, give priority to speed
- Write data pushed by the PUSHSP instruction are not included in trace data.
- In the case of section trace, for example, the instruction immediately before the fetched instruction that actually caused tracing to start is included in trace data.

No.11 Regarding power save mode

Description: when used of power save mode, there are limitations listed below.

- For debugging of a program by the E1 emulator, ensure that WUFMSK0[31]=0x0 in the program.
- The power supply to Iso area is not stopped in DEEPSTOP mode when debugging (RAM value is held).
- When setting for transiting to DEEPSTOP mode shortly after a reset, communication between E1 emulator and the device may become incorrect. Because the device transits to DEEPSTOP mode before establishing communication with E1 emulator.
  For this reason, when debugging the program which transit to DEEPSTOP mode shortly after a reset, please insert wait signal for 50ms or more* between a reset signal and before DEEPSTOP protocol.

*: Communication provision term depends on the host PC and operation frequency of the device.

No.12 Writing quality of flash programming

Description: To improve the writing quality, fully understand, verify, and evaluate the following items before using E1 emulator.

- Circuits are designed as described in the user's manuals for the device and E1/E20 emulator.
- The device, E1/E20 emulator and the software are used as described in each user's manual.
- The power supplied to the target system is stable.

No.13 Turning the Power On/Off

Description: Turn the power of the E1 or E20 emulator and the user system following the procedure below.

- When a Separate Power Supply is used for the User System

<When using the emulator>

(1) Check the power is off.
Check that the user system is turned off. When using the E20 emulator, check its power switch is 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 E1 emulator is turned on by connecting the USB interface cable. When using the E20 emulator, turn on its power switch.

(4) Turn on the user system.
Turn on the user system.

(5) Launch the emulator debugger.
Launch the emulator debugger.

<When finished using the emulator>

(1) Close the emulator debugger.
Close the emulator debugger.

(2) Turn off the user system.
Turn off the user system.

(3) Turn off the emulator and disconnect the emulator.
When using the E20 emulator, turn off its power switch. Disconnect the USB interface cable from the E1 or E20 emulator. The E1 emulator is turned off by disconnecting from the USB interface cable.

(4) Disconnecting 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, unplug the USB interface cable, or turn off the power switch of the E20 emulator.
The user system may be damaged due to leakages current.

- When Power is supplied to the User System from the Emulator (E1 emulator)

<When using the emulator>

(1) Check 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, then turn on the emulator.

(4) Launch the emulator debugger.
Launch the emulator debugger and select the setting of power supply to the user system.

<When finished using the emulator>

(1) Close the emulator debugger.
Close the emulator debugger.

(2) Turn off the emulator and disconnect the emulator.
Disconnect the USB interface cable from the emulator, then turn off the emulator.

(3) Disconnecting the user system.
Disconnect the user-system interface cable from the user system.

5. Internal Circuits of the Emulator

The internal interface circuit related to the communication interface between the E1/E20 Emulator and user system is shownbelow. Please use it as a reference when determining parameters in board design.

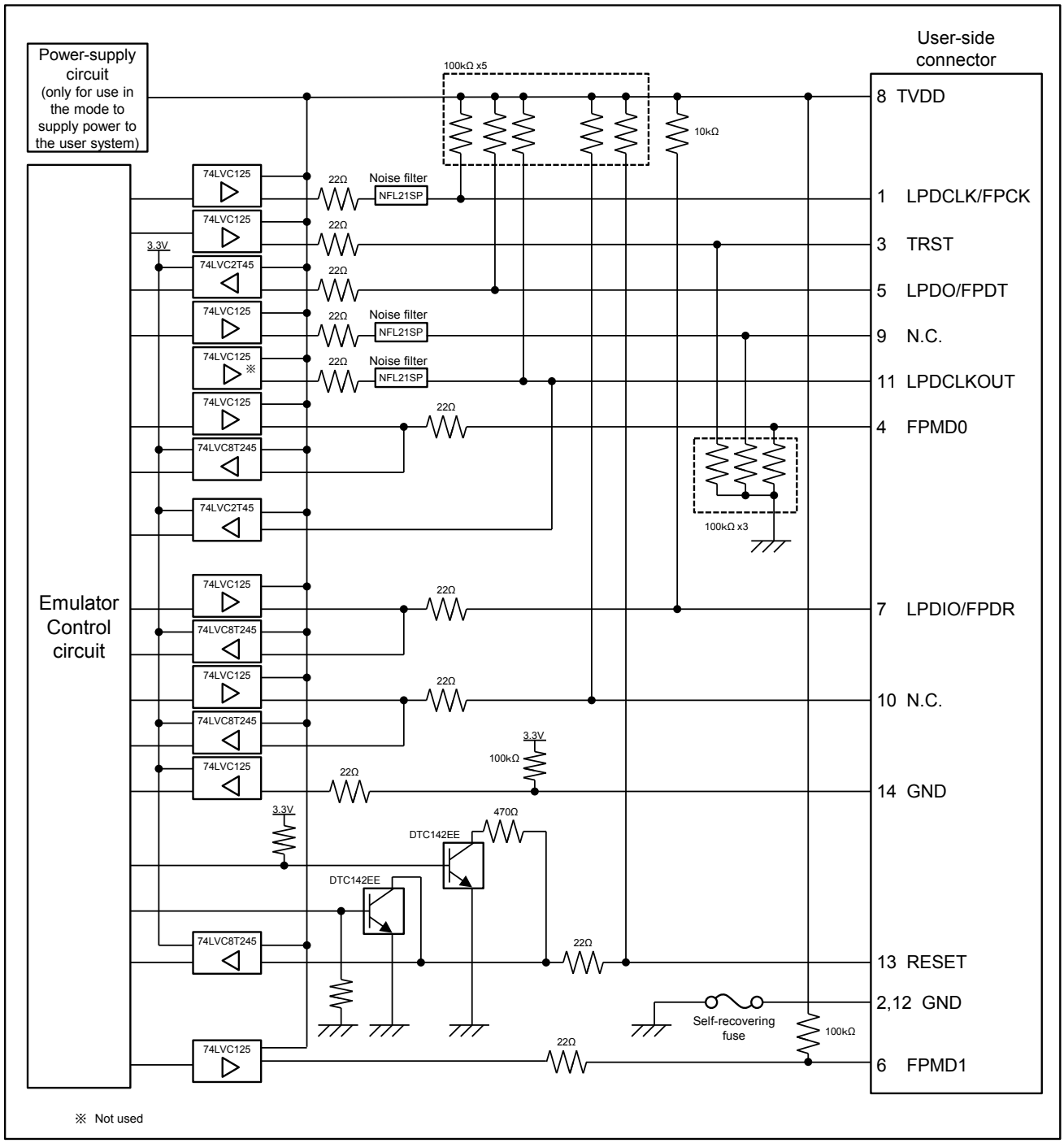


Figure A Interface Circuits in E1/E20 Emulator(LPD4pin)

E1/E20 Emulator
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Colophon 3.0

E1/E20 Emulator

Additional Document for User's Manual (Notes on Connection for RH850/F1L)

Renesas Electronics Corporation

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