User's Manual

E8a Emulator

Additional Document for User's Manual
R0E00008AKCE00EP33

Renesas Microcomputer Development Environment System
740 Family / 38000/740 Series
Notes on Connecting the 38D5, 38D2, 3803L and 3804L

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Contents

This user's manual is applicable to the E8a emulator software V.1.02 Release 00 or later.

Section 1 Inside the E8a Emulator User's Manual

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

(1) E8a Emulator User's Manual
The E8a Emulator User's Manual describes the hardware specifications and how to use the emulator debugger.

- E8a emulator hardware specifications
- Connecting the E8a emulator to the host computer or user system
- Operating the E8a emulator debugger
- Tutorial: From starting up the E8a emulator debugger to debugging

(2) E8a Additional Document for User's Manual
The E8a Additional Document for User's Manual describes content dependent on the MCUs and precautionary notes.

- MCU resources used by the E8a emulator
- Example of the E8a emulator connection or interface circuit necessary for designing the hardware
- Notes on using the E8a emulator
- Setting the E8a emulator debugger during startup

Section 2 E8a Emulator Specifications

Table 2.1 shows the E8a emulator specifications for the 38D5, 38D2, 3803L and 3804L Groups.

Table 2.1 E8a Emulator Specifications for the 38D5, 38D2, 3803L and 3804L Groups

Target MCUs	740 Family 38D5, 38D2, 3803L and 3804L Groups
Available operating modes	Single-chip mode
Break functions	- Address match break, 2 points - PC break points (maximum 255 points) - Forced break
Trace functions	None
Flash memory programming function	Available
User interface	Clock-synchronized serial
MCU resources to be used	- ROM size: 600h bytes (1536 bytes) - RAM size: 50h bytes (80 bytes) - Stack 5 bytes - Address match interrupt
Emulator power supply	Unnecessary (USB bus powered, power supplied from the PC)
Interface with host machine	USB (USB 1.1, full speed) * Also connectable to host computers that support USB 2.0
Power supply function	Can supply 3.3 V or 5.0 V to the user system (maximum 300 mA)
Power voltages	2.7 - 5.5 V

Table 2.2 shows the operating environment of the E8a emulator.

Table 2.2 Operating Environment

Temperatures	Active	: 10°C to 35°C
	Inactive	: –10°C to 50°C
Humidity	Active	: 35% RH to 80% RH, no condensation
	Inactive	: 35% RH to 80% RH, no condensation
Vibrations	Active	: maximum 2.45 m/s^2
	Inactive	: maximum 4.9 m/s^2
	Transportation	: maximum 14.7 m/s^2
Ambient gases	No corrosive gases	

Section 3 Connecting the E8a Emulator to the User System

Before connecting the E8a emulator to the user system, a connector must be installed in the user system so a user system interface cable can be connected. When designing the user system, refer to Figure 4.1 “E8a Connecting Connector Pin Assignments” and Figures 5.1 to 5.12 “Example of an E8a Connection”.
Before designing the user system, be sure to read the E8a Emulator User’s Manual and related device hardware manuals.

Table 3.1 shows the recommended connector for the E8a emulator.

Table 3.1 Recommended Connector

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

Connect E8a connecting connector pins 2, 6, 10, 12 and 14 firmly to the GND on the user system board. These pins are used as an electric GND and monitor the connection of the user system connector. Note the pin assignments for the user system connector.

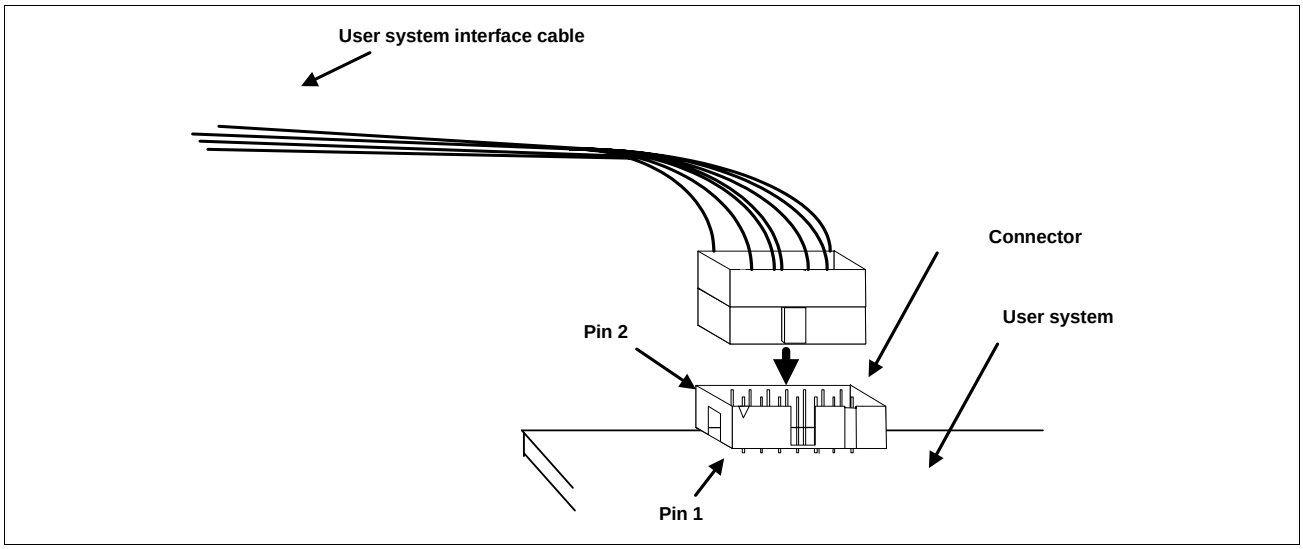


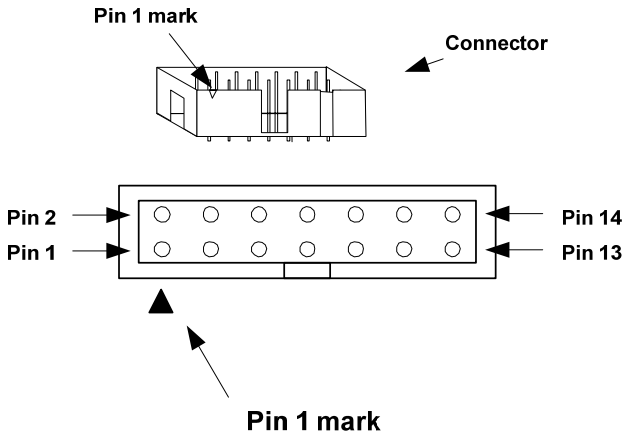
Figure 3.1 Connecting the User System Interface Cable with an E8a Connecting Connector

Notes:

1. Do not place any components within 3 mm area of the connector.
2. When using the E8a emulator as a programmer, connect it to the user system in the same way.

Section 4 E8a Connecting Connector Pin Assignments

Figure 4.1 shows the pin assignments for the E8a connecting connector.



Pin NO.	38D5 MCU signals	38D2 MCU signals	3803L,3804L MCU signals
1	P42 (SCLK1)	P31 (SCLK2)	P46 (SCLK1)
2	Vss	Vss	Vss
3	CNVss	CNVss	CNVss
4	NC	NC	NC
5	NC	NC	NC
6	Vss	Vss	Vss
7	P41 (TxD)	P32 (TxD2)	P45 (TxD1)
8	Vcc	Vcc	Vcc
9	P43 ($\overline{\text{SRDY1}}$)	P30 ($\overline{\text{SRDY2}}$)	P47 ($\overline{\text{SRDY1}}$)
10	Vss	Vss	Vss
11	P40 (RxD)	P33 (RxD2)	P44 (RxD1)
12	Vss	Vss	Vss
13	$\overline{\text{RESET}}$	$\overline{\text{RESET}}$	$\overline{\text{RESET}}$
14	Vss	Vss	Vss

Figure 4.1 E8a Connecting Connector Pin Assignments

Note:
Pin 14 is used for checking the connection between the E8a and the user system, and pins 6 and 10 are connected to the internal circuit. These pins are not directly connected to the Vss inside the E8a. Make sure pins 2, 6, 10, 12 and 14 are all connected to the Vss.

Section 5 Examples of E8a Connections

(1) Connection example of the 38D5

Figure 5.1 shows a connection example of the 38D5. When using the emulator as a programmer, the connection specification between the E8a and the MCUs is the same as shown in Figure 5.1.

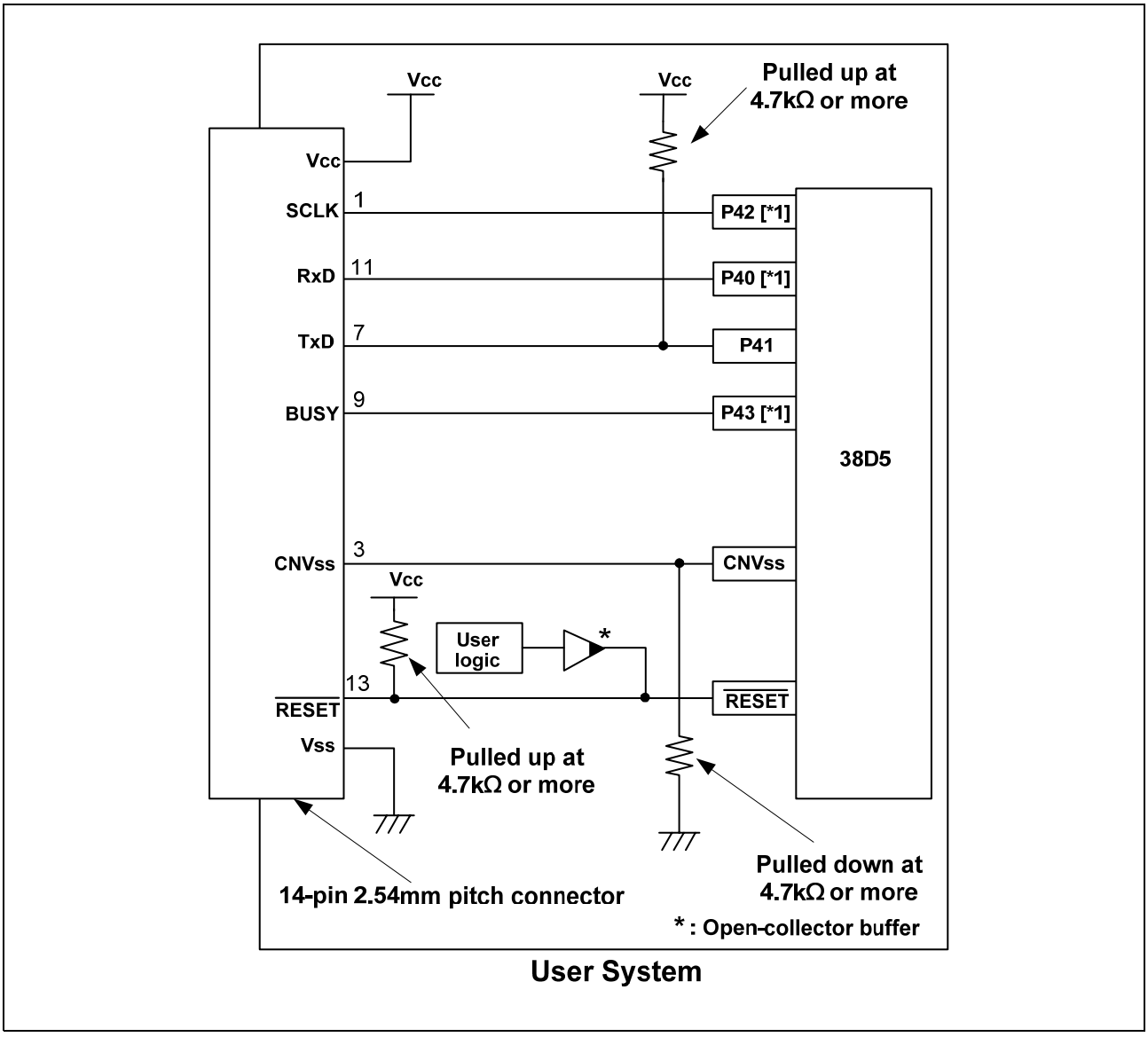


Figure 5.1 Example of an E8a Connection (38D5)

Note:

1. For details on setting pins P40, P42 and P43, refer to “Points to Remember for the 38D5” on page 6.

Points to Remember for the 38D5

1. Pins P40, P41, P42 and P43 are used exclusively by the E8a emulator. Connect the E8a emulator to the MCU pins. For P41, pull up an MCU pin and then connect it to the emulator. Pull up or down on P40, P42 and P43 according to the MCU pin state after disconnecting the E8a emulator. P43 may be in a Hiz state while the E8a emulator is active. Therefore, set the pin resistance value so the voltage cannot be at the midpoint potential, depending on the voltage dividing of the resistance inside the E8a emulator (Figure 5.13).

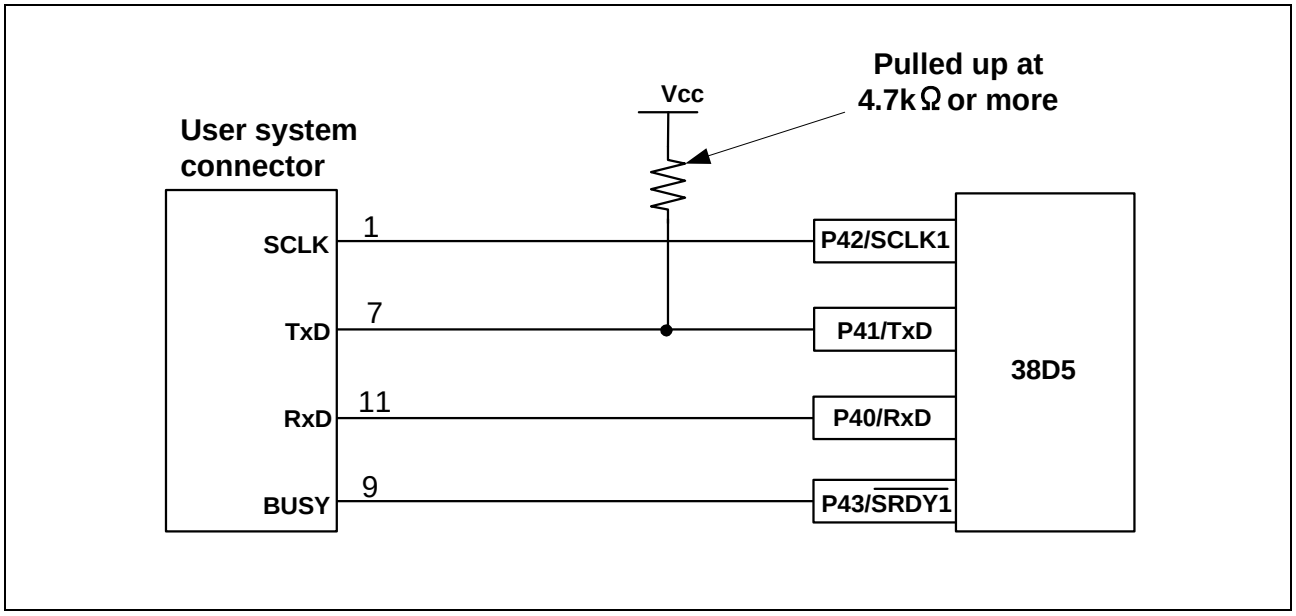


Figure 5.2 E8a Emulator and MCU Connection

2. The E8a emulator uses the CNVss pin for MCU control. Pull down the E8a emulator and MCU pins and connect the E8a emulator.

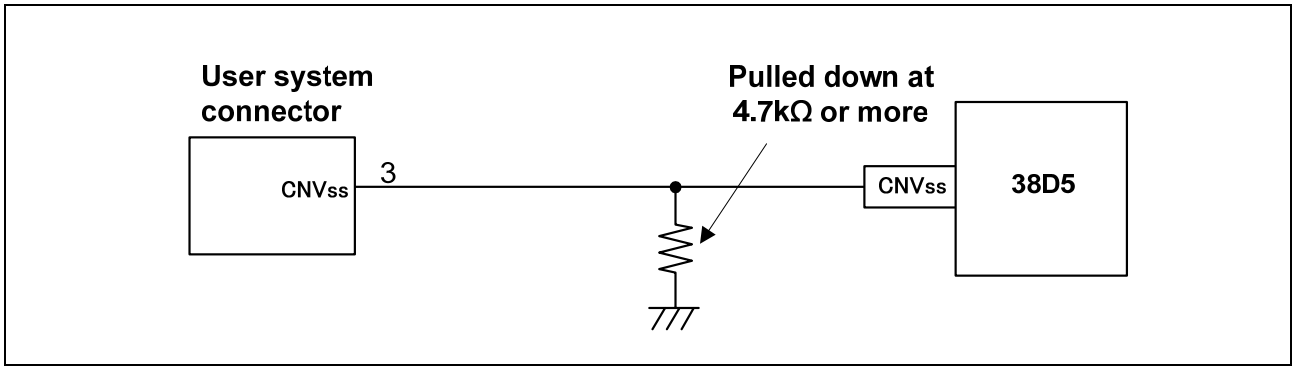


Figure 5.3 E8a Emulator and CNVss Pin Connection

3. The $\overline{\text{RESET}}$ pin is used by the E8a emulator. Therefore, use an open-collector output buffer or a CR reset circuit as the reset circuit for the user system. The recommended pull-up value is 4.7 kΩ or more. The MCU can be reset by outputting “L” from the E8a emulator. However, if the reset IC output is “H”, the user system reset circuit cannot be set to “L”. As such, the E8a emulator will not operate normally.

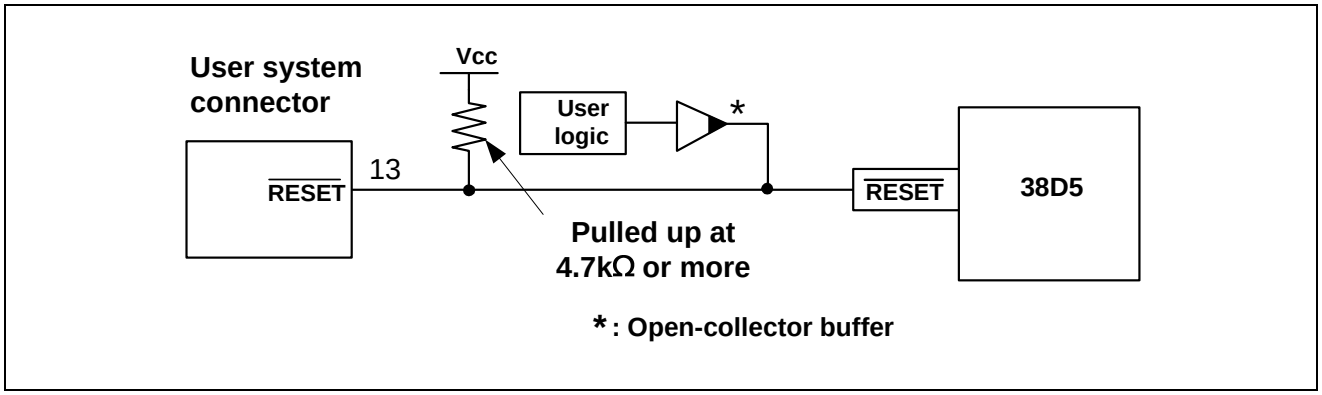


Figure 5.4 Example of a Reset Circuit

4. Connect Vss and Vcc to the Vss and Vcc of the MCU, respectively.
5. Do not connect anything to the N.C. pin.
6. The amount of voltage input to Vcc must be within the specified range of the MCU.
7. Pin 14 is used for checking the connection between the E8a and the user system, and pins 6 and 10 are connected to the internal circuit. These pins are not directly connected to the Vss inside the E8a. Make sure pins 2, 6, 10, 12 and 14 are all connected to the Vss.

(2) Connection example of the 38D2

Figure 5.5 shows a connection example of the 38D2. When using the emulator as a programmer, the connection specification between the E8a and the MCUs is the same as shown in Figure 5.5.

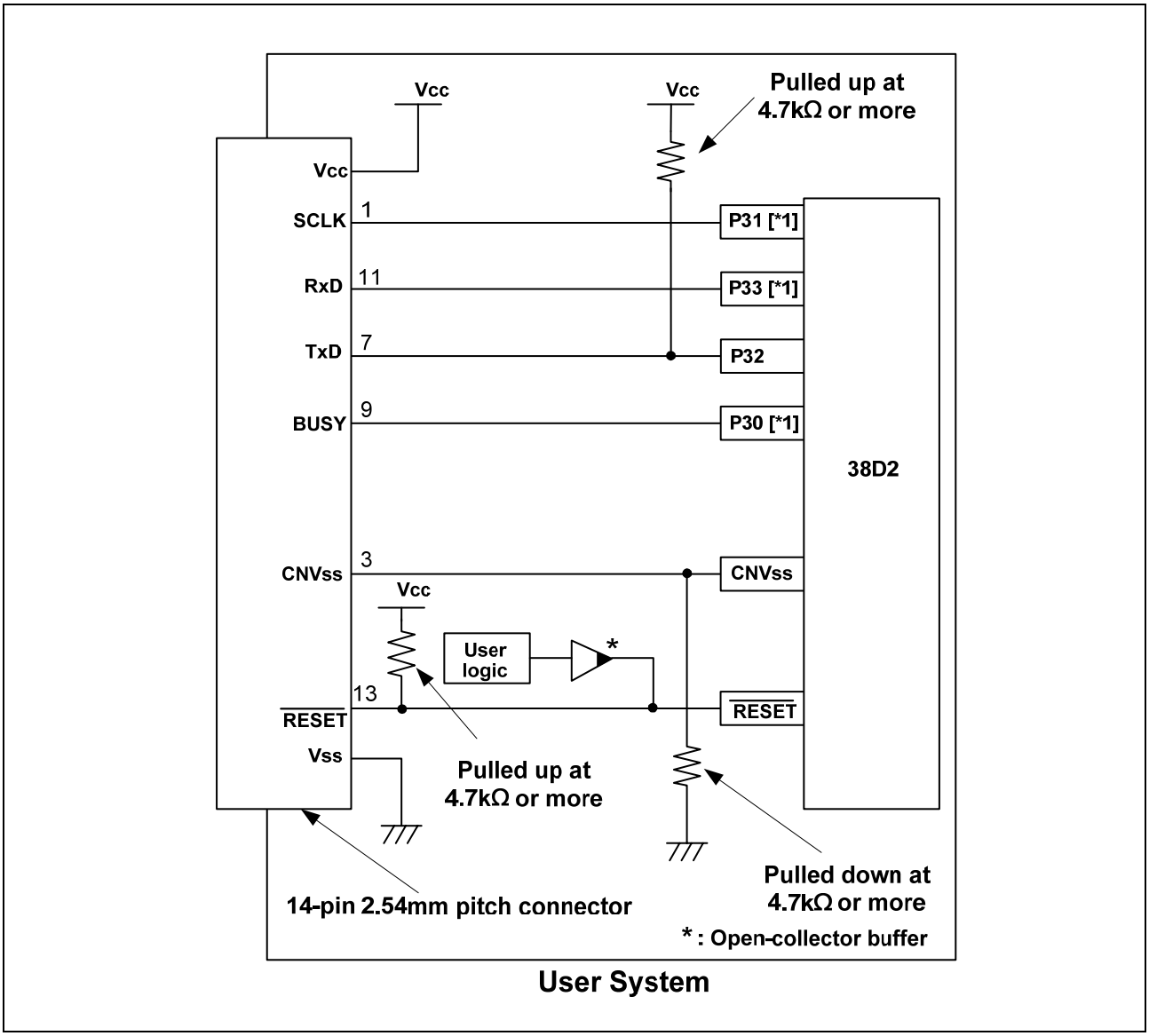


Figure 5.5 Example of an E8a Connection (38D2)

Note:

1. For details on setting pins P30, P31 and P33, refer to “Points to Remember for the 38D2” on page 9.

Points to Remember for the 38D2

1. Pins P30, P31, P32 and P33 are used exclusively by the E8a emulator. Connect the E8a emulator to the MCU pins. For P32, pull up an MCU pin and then connect it to the emulator. Pull up or down on P30, P31 and P33 according to the MCU pin state after disconnecting the E8a emulator. P30 may be in a Hiz state while the E8a emulator is active. Therefore, set the pin resistance value so the voltage cannot be at the midpoint potential, depending on the voltage dividing of the resistance inside the E8a emulator (Figure 5.13).

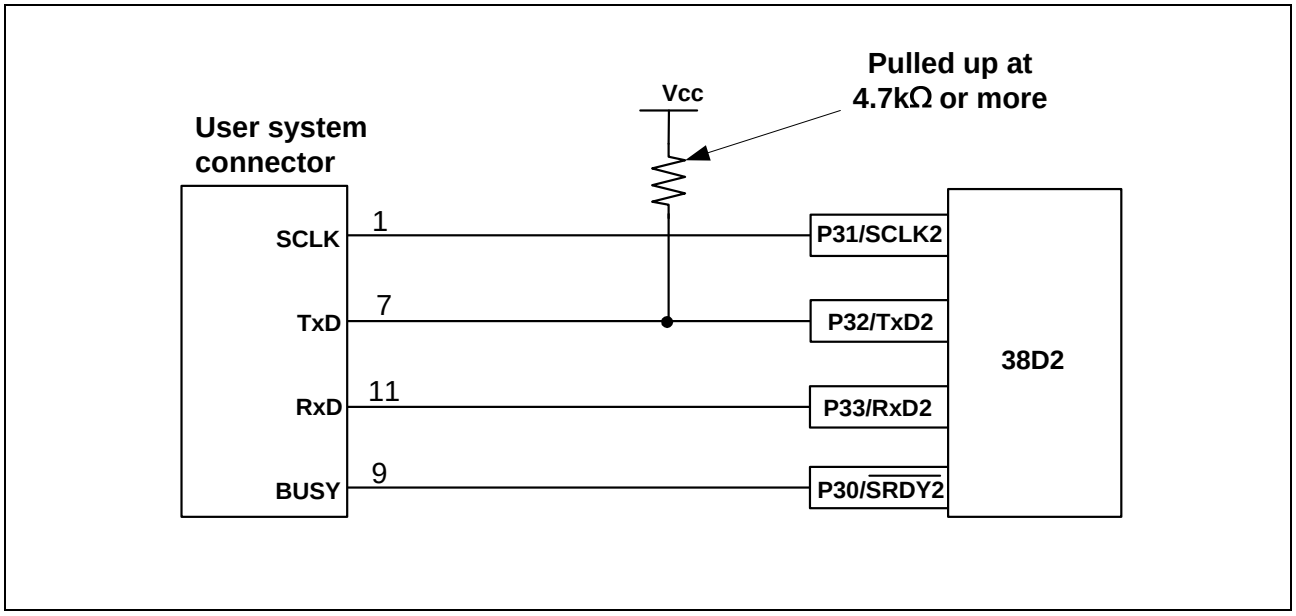


Figure 5.6 E8a Emulator and MCU Connection

2. The E8a emulator uses the CNVss pin for MCU control. Pull down the E8a emulator and MCU pins and connect the E8a emulator.

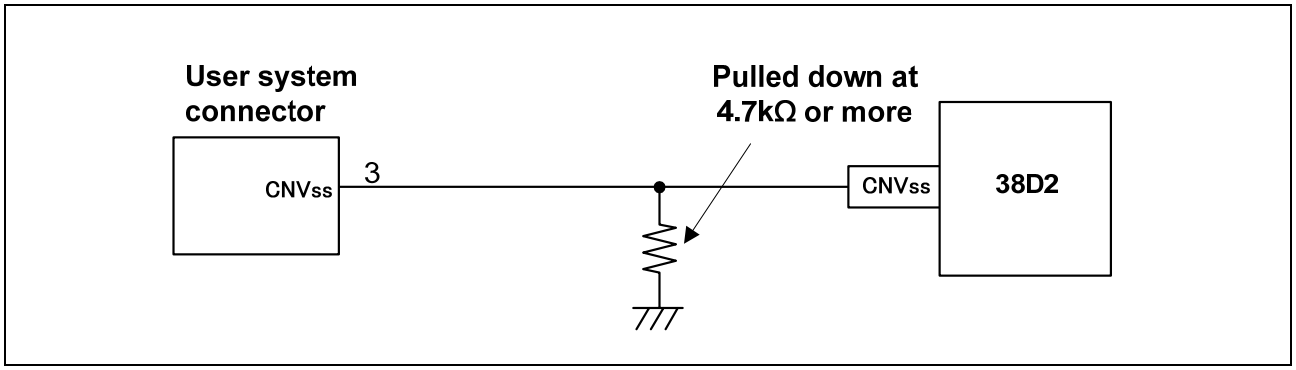


Figure 5.7 E8a Emulator and CNVss Pin Connection

3. The $\overline{\text{RESET}}$ pin is used by the E8a emulator. Therefore, use an open-collector output buffer or a CR reset circuit as the reset circuit for the user system. The recommended pull-up value is 4.7 kΩ or more. The MCU can be reset by outputting “L” from the E8a emulator. However, if the reset IC output is “H”, the user system reset circuit cannot be set to “L”. As such, the E8a emulator will not operate normally.

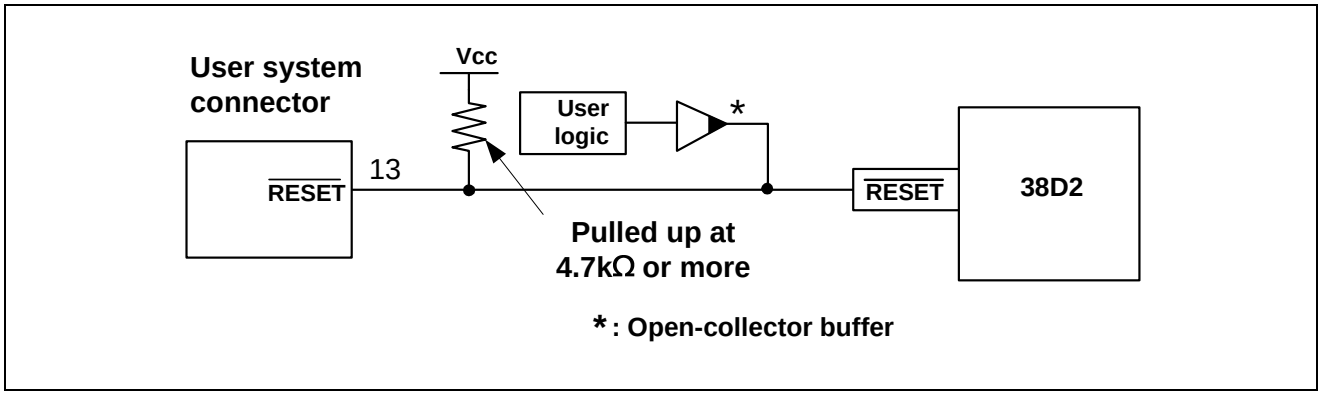


Figure 5.8 Example of a Reset Circuit

4. Connect Vss and Vcc to the Vss and Vcc of the MCU, respectively.
5. Do not connect anything to the N.C. pin.
6. The amount of voltage input to Vcc must be within the specified range of the MCU.
7. Pin 14 is used for checking the connection between the E8a and the user system, and pins 6 and 10 are connected to the internal circuit. These pins are not directly connected to the Vss inside the E8a. Make sure pins 2, 6, 10, 12 and 14 are all connected to the Vss.

(3) Connection example of the 3803L and 3804L

Figure 5.9 shows a connection example of the 3803L and 3804L. When using the emulator as a programmer, the connection specification between the E8a and the MCUs is the same as shown in Figure 5.9.

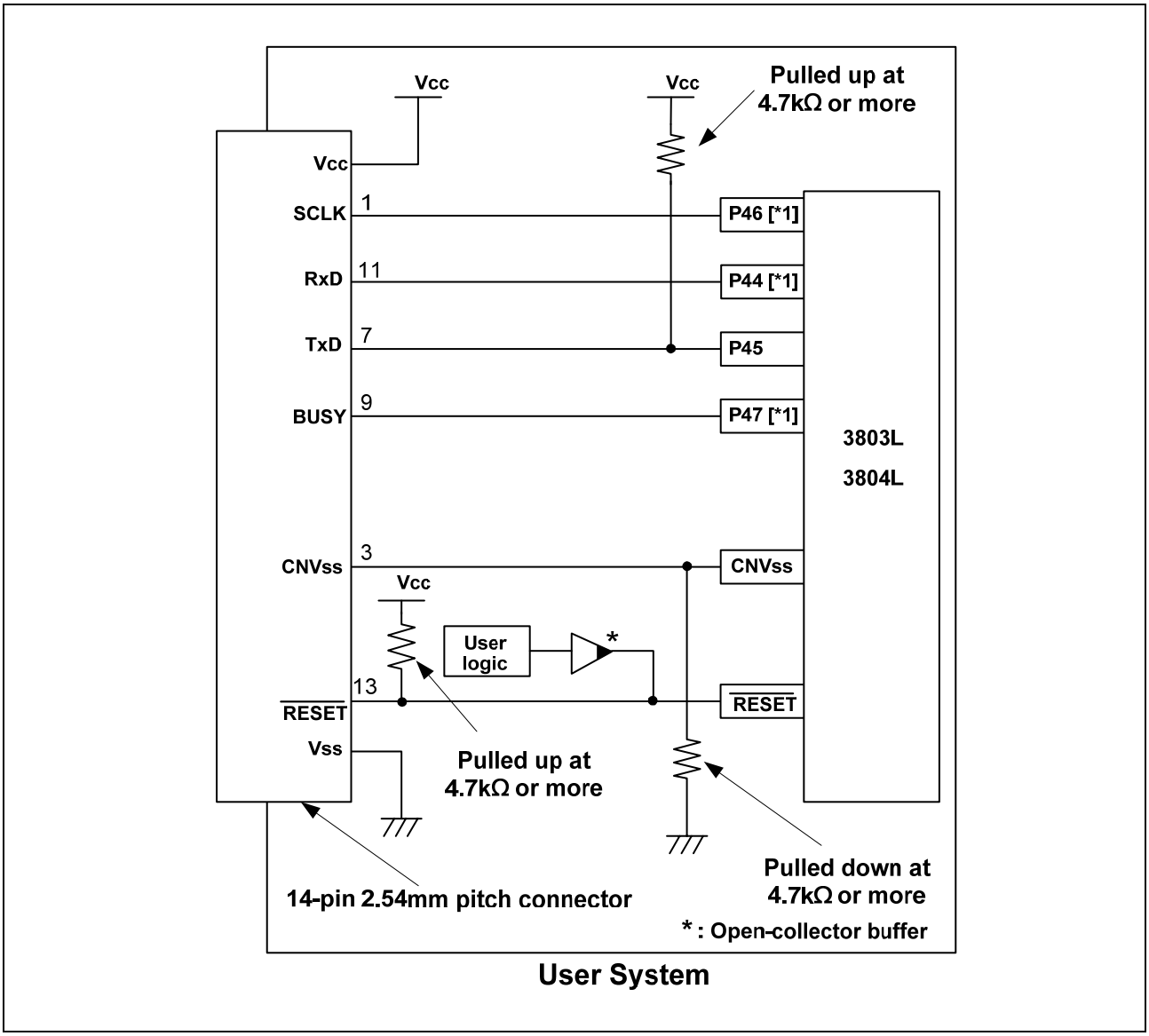


Figure 5.9 Example of an E8a Connection (3803L and 3804L)

Note:

1. For details on setting pins P44, P46 and P47, refer to “Points to Remember for the 3803L and 3804L” on page 12.

Points to Remember for the 3803L and 3804L

1. Pins P44, P45, P46 and P47 are used exclusively by the E8a emulator. Connect the E8a emulator to the MCU pins. For P45, pull up an MCU pin and then connect it to the emulator. Pull up or down on P44, P46 and P47 according to the MCU pin state after disconnecting the E8a emulator. P47 may be in a Hiz state while the E8a emulator is active. Therefore, set the pin resistance value so the voltage cannot be at the midpoint potential, depending on the voltage dividing of the resistance inside the E8a emulator (Figure 5.13).

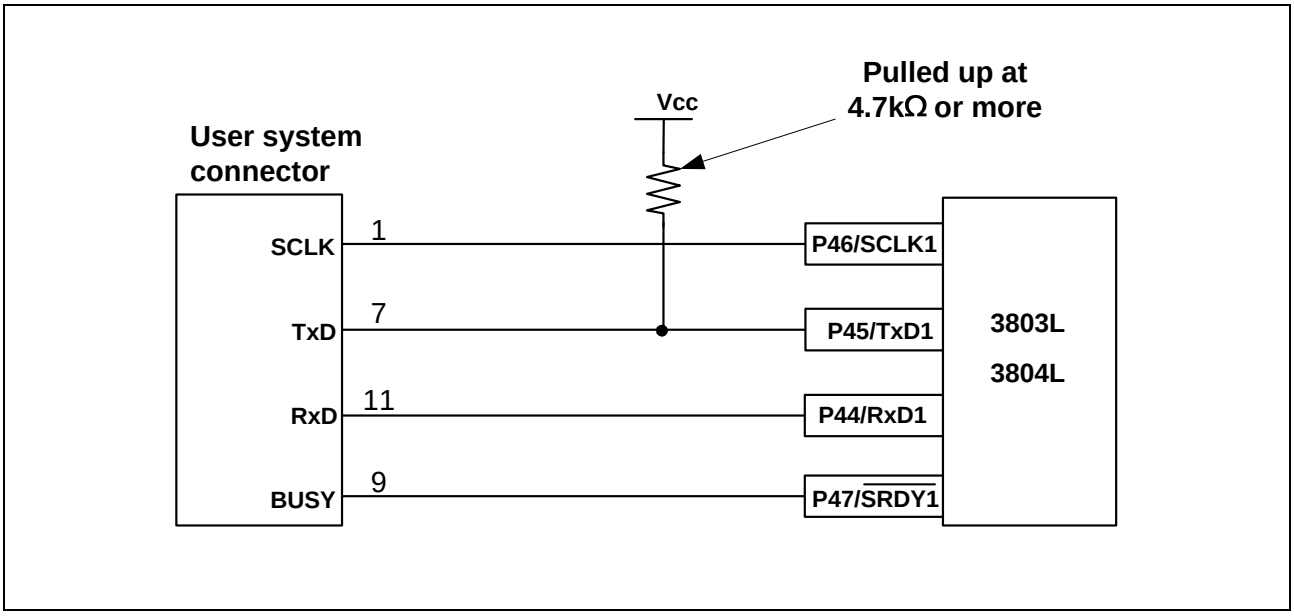


Figure 5.10 E8a Emulator and MCU Connection

2. The E8a emulator uses the CNVss pin for MCU control. Pull down the E8a emulator and MCU pins and connect the E8a emulator.

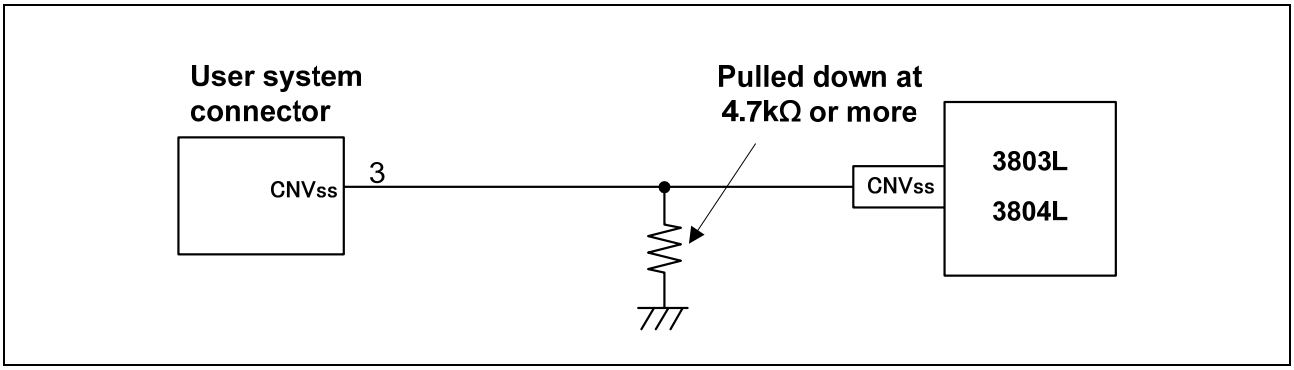


Figure 5.11 E8a Emulator and CNVss Pin Connection

3. The $\overline{\text{RESET}}$ pin is used by the E8a emulator. Therefore, use an open-collector output buffer or a CR reset circuit as the reset circuit for the user system. The recommended pull-up value is 4.7 kΩ or more. The MCU can be reset by outputting “L” from the E8a emulator. However, if the reset IC output is “H”, the user system reset circuit cannot be set to “L”. As such, the E8a emulator will not operate normally.

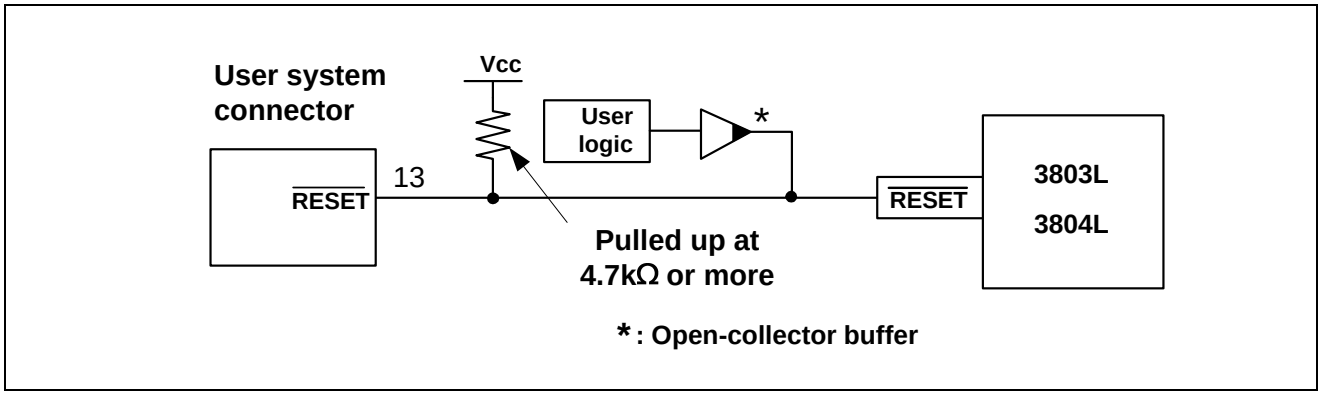


Figure 5.12 Example of a Reset Circuit

4. Connect Vss and Vcc to the Vss and Vcc of the MCU, respectively.
5. Do not connect anything to the N.C. pin.
6. The amount of voltage input to Vcc must be within the specified range of the MCU.
7. Pin 14 is used for checking the connection between the E8a and the user system, and pins 6 and 10 are connected to the internal circuit. These pins are not directly connected to the Vss inside the E8a. Make sure pins 2, 6, 10, 12 and 14 are all connected to the Vss.

(4) Interface circuit inside the E8a emulator

Figure 5.13 shows the interface circuit in the E8a emulator. Use this figure as a reference when determining the pull-up resistance value.

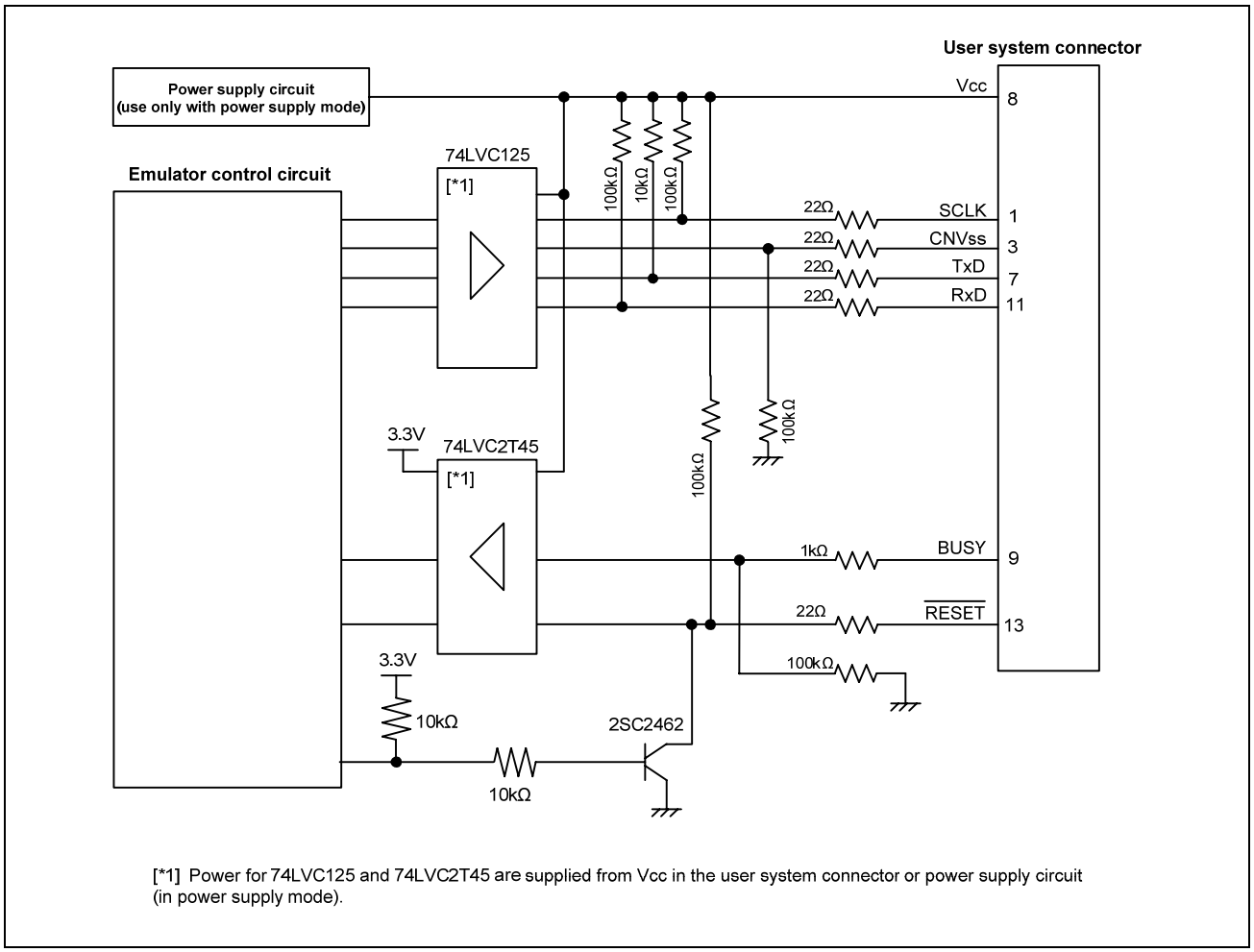


Figure 5.13 Interface Circuit inside the E8a Emulator (For Reference)

Section 6 Notes on Using the E8a Emulator

1. Program area for the E8a emulator
   Table 6.1 lists the program areas allotted for the E8a emulator. Do not change this area allocation.

Table 6.1 Program Area for the E8a Emulator

Group	ROM Area		RAM Size	Program Area for E8a Emulator		
	Programming Area	Data Area		Vector Area	ROM Area	RAM Area
38D5	58 KB	2 KB	2 KB	FFDCh - FFDDh, FFE8h - FFE9h, FFFCh - FFFDh	1000h - 15FFh	7F0h - 83Fh
38D2	58 KB	2 KB	2 KB	FFDCh - FFDDh, FFE4h - FFE5h, FFFCh - FFFDh	1000h - 15FFh	7F0h - 83Fh
3803L	58 KB	2 KB	2 KB	FFDCh - FFDDh, FFF6h - FFF7h, FFFCh - FFFDh	1000h - 15FFh	7F0h - 83Fh
3804L	58 KB	2 KB	2 KB	FFDCh - FFDDh, FFF6h - FFF7h, FFFCh - FFFDh	1000h - 15FFh	7F0h - 83Fh

2. I Flag Setup
   (1) Setup in the user program
   In the user program, avoid setting I flag to “1” (interrupt disabled). [*1]

   Note:
   1. In cases where I flag is “1” (interrupt disabled), it is impossible to use the following functions effectuated by serial I/O 1 receive interrupt:
      - Memory reference and memory rewriting during user program execution
      - Automatic watch window update during user program execution
      - User program stop by STOP button

      Note that PC break and address match break can be used even when I flag is “1” (interrupt disabled) since these breaks are not affected by I flag.

3. After a reset is released, the E8a emulator initializes the general registers and some of the flag registers as shown in Table 6.2.

Table 5.3 E8a Emulator Register Initial Values

Status	Register	Initial Value
After a reset is released	PC	Reset vector value in the vector address table
	A, X and Y	00h
	S	FFh
	PS	00h

4. The E8a emulator communicates with the MCU by using the RxD, TxD, SCLK, BUSY, $\overline{\text{RESET}}$ and CNVss pins.

5. The E8a emulator uses up to 5 bytes of the stack pointer during a user program break. Therefore, set aside 5 bytes for the stack area.

6. SFRs used by the E8a emulator program

   As the SFRs listed in Tables 6.3, 6.4 and 6.5 are used by the E8a emulator program, do not change any of these values. If these values are changed, the E8a emulator cannot control the MCU. These registers are not initialized by selecting [Debug] -> [Reset CPU] or by using the RESET command. If register contents are referred to, a value that has been set in the E8a emulator program will be read out.

Table 6.3 SFRs Used by the E8a Emulator Program (38D5)

Address	Register	Symbol	Bit	Notes on using the E8a emulator
0018h	Transmit 1/receive 1 buffer register	TB1/RB1	All bits	[*1]
0019h	Serial I/O 1 status register	SIO1STS	All bits	[*1]
001Ah	Serial I/O 1 control register	SIO1CON	All bits	[*1]
001Bh	UART1 control register	UART1CON	All bits	[*1]
0008h	Port P4 data register	P4	Bits 0, 1, 2 and 3	[*2]
0009h	Port P4 direction register	P4D	Bits 0, 1, 2 and 3	[*2]
003Dh	Interrupt request register 2	IREQ2	Bit 1	[*2]
003Fh	Interrupt control register 2	ICON2	Bit 1	[*2]

Table 6.4 SFRs Used by the E8a Emulator Program (38D2)

Address	Register	Symbol	Bit	Notes on using the E8a emulator
001Dh	Transmit 2/receive 2 buffer register	TB2/RB2	All bits	[*1]
001Eh	Serial I/O 2 status register	SIO2STS	All bits	[*1]
001Fh	Serial I/O 2 control register	SIO2CON	All bits	[*1]
0FF1h	UART2 control register	UART2CON	All bits	[*1]
0006h	Port P3 data register	P3	Bits 0, 1, 2 and 3	[*2]
0007h	Port P3 direction register	P3D	Bits 0, 1, 2 and 3	[*2]
003Dh	Interrupt request register 2	IREQ2	Bit 3	[*2]
003Fh	Interrupt control register 2	ICON2	Bit 3	[*2]

Table 6.5 SFRs Used by the E8a Emulator Program (3803L and 3804L)

Address	Register	Symbol	Bit	Notes on using the E8a emulator
0018h	Transmit 1/receive 1 buffer register	TB1/RB1	All bits	[*1]
0019h	Serial I/O 1 status register	SIO1STS	All bits	[*1]
001Ah	Serial I/O 1 control register	SIO1CON	All bits	[*1]
001Bh	UART1 control register	UART1CON	All bits	[*1]
0008h	Port P4 data register	P4	Bits 4, 5, 6 and 7	[*2]
0009h	Port P4 direction register	P4D	Bits 4, 5, 6 and 7	[*2]
003Dh	Interrupt request register 1	IREQ1	Bit 2	[*2]
003Fh	Interrupt control register 1	ICON1	Bit 2	[*2]

Notes:
1. Do not change this register value.
2. Do not change the value of the bits listed in the column to the left. When operating this register, make changes using the bit operation instructions to avoid changing the bit values.

7. Interrupts used by the E8a emulator program

   The BRK instruction interrupt and serial I/O 1 receive interrupt are used by the E8a emulator program. Therefore, make sure the user program does not use any of these interrupts.

8. Watchdog timer operation

   Do not operate the watchdog timer.

9. Flash memory ID code

   This MCU function prevents the Flash memory from being read out by anyone other than the user. The ID code in Table 6.6 written to the flash memory of the MCU must match the ID code displayed in the Figure 6.1 [ID Code verification] dialog box at debugger startup, otherwise the debugger cannot be launched. Note that when the ID code is FFh, FFh, FFh, FFh, FFh, FFh, FFh, the ID code is regarded as undefined. In this case, the ID code is automatically authenticated and the [ID Code verification] dialog box is not displayed.
   In ‘Program Flash’ mode, the contents of the user program are input into the ID code area. When debugging in other modes, FFh, FFh, FFh, FFh, FFh, FFh, FFh is written into the ID code area regardless of the contents of the downloaded user program.

Table 6.6 ID Code Storage Area of 38D5, 38D2, 3803L and 3804L

Address	Description
FFD4h	First byte of ID code
FFD5h	Second byte of ID code
FFD6h	Third byte of ID code
FFD7h	Fourth byte of ID code
FFD8h	Fifth byte of ID code
FFD9h	Sixth byte of ID code
FFDAh	Seventh byte of ID code

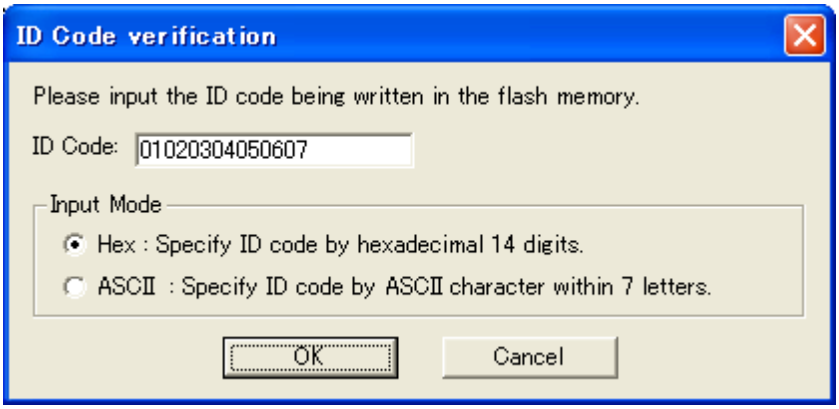


Figure 6.1 [ID Code verification] Dialog Box

10. Operation clock during a user program halt

    While the user program halts, the E8a emulator program changes the main clock divide-by-N value to operate.

11. Reset

    The reset vector is used by the E8a emulator program. If the MCU is reset while executing the user program, control is transferred to the E8a emulator program and the user program is forced to stop.

12. Memory access during emulation execution

    When referring to or modifying the memory contents, the user program is temporarily halted. For this reason, a real-time emulation cannot be performed.

13. When the E8a emulator does not supply power to the user system, it consumes the power voltage of the user system from several mA to more than 10 mA. This is because the user power supply drives 74LVC125, 74LVC1T45 and 74LVC2T45 to make the communication signal level match the user system power supply voltage.

14. When debugging, the Flash memory is frequently rewritten by the E8a emulator. Therefore, do not use an MCU that has been used for debugging in products. Also, as the E8a emulator program is written to the MCU while debugging, do not save the contents of the MCU Flash memory which were used for debugging nor use them as the ROM data for products.

15. Reserved area

    The addresses not specified in the Hardware Manual are reserved area. Do not change the contents. Otherwise, the E8a emulator cannot control the MCU.

16. Debugging in stop mode or wait mode

    When debugging in stop mode or wait mode, do not operate windows until the program stops at the breakpoint by setting the breakpoint at the line of the program which will be executed after the stop mode or wait mode is cancelled. In addition, disable the automatic update in the watch window or fix the display in the memory window before running the program so memory accesses do not occur during an execution. When the program is forcibly stopped, or the memory is referred to or modified in stop or wait mode, the stop or wait mode will be cancelled.

17. Peripheral I/Os during a halt

    During a user program halt, interrupts are not accepted although peripheral I/Os continue to run. For example, a timer interrupt is not accepted although the timer continues to count when a user program is stopped by a break after the timer started.

18. “Go to cursor” function

    The “Go to cursor” function is actualized using an address match break. Therefore, when you execute the “Go to cursor” command, all the address match breaks and hardware breaks you set become invalid, while all the PC breaks remain valid.

19. Note on PC break point

    When downloading a user program after modifying it, the set address of PC break may not be corrected normally depending on the modification. Therefore, break points other than the set PC breaks may shift. After downloading a user program, check the setting of PC breaks in the event point window and reset it.

20. Note on debugging in CPU rewrite mode

    When debugging in CPU rewrite mode, do not rewrite the FLASH area. If this area is rewritten, the E8a emulator cannot control the MCU.

21. Notes on the E8a emulator power supply

    When writing a program with the E8a emulator for mass production processes, the program requires reliability, so do not use the E8a emulator power supply function. Supply power separately to the user system according to the allowable voltage for MCU writing. Voltage supplied from the E8a emulator depends on the quality of the USB power supply of the PC, and as such, precision is not guaranteed. Note that when debugging the system which operates the MCU with a dual power supply, power cannot be supplied from the E8a.

Section 7 Debugger Setting

1. [Emulator Setting] dialog box

The [Emulator Setting] dialog box is provided for setting items that need to be set when the debugger is launched. The contents set from this dialog box (excluding [Power Supply] group box items) also become valid the next time the debugger is launched.

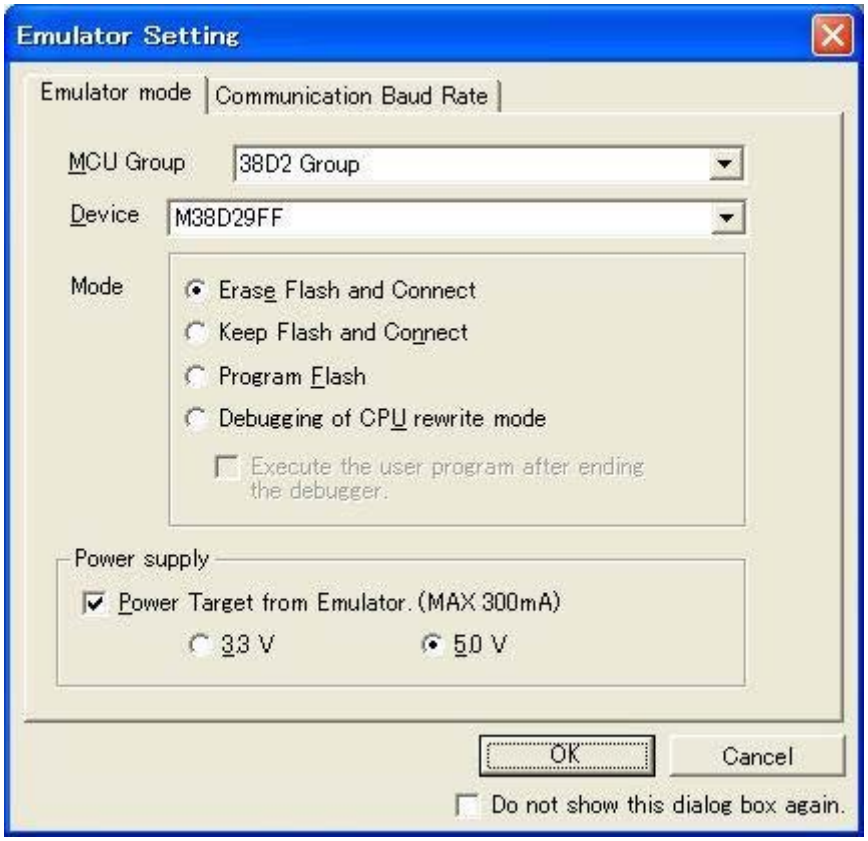


Figure 7.1 [Emulator Setting] Dialog Box

If you check “Do not show this dialog box again.” at the bottom of the [Emulator Setting] dialog box, the [Emulator Setting] dialog box will not be displayed the next time the debugger is launched. You can open the [Emulator Setting] dialog box using one of the following methods:

- After the debugger is launched, select Menu -> [Setup] -> [Emulator] -> [Emulator Setting...].
- Hold down the Ctrl key while launching the debugger.

When “Do not show this dialog box again.” is checked, the E8a does not supply power to the user system.

2. [Emulator mode] tab

Device selection, mode specification and power supply setting are made from the [Emulator mode] tab of the [Emulator Setting] dialog box.

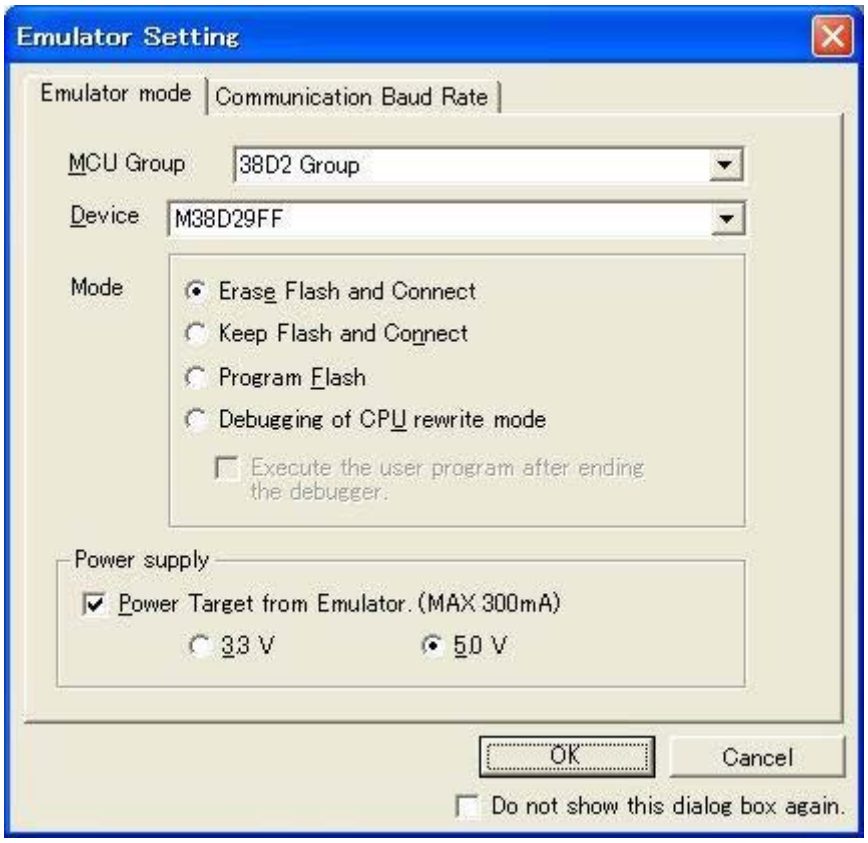


Figure 7.2 [Emulator mode] Tab

[MCU Group]

Select the name of the MCU group to be used from the [MCU Group] drop-down list.

[Device]

Select the type of MCU to be used from the [Device] drop-down list.

[Mode]

- Erase Flash and Connect
  When starting the debugger, the E8a emulator erases the Flash memory data for the MCUs and simultaneously writes the E8a emulator program.
- Keep Flash and Connect
  When launching the debugger, the E8a emulator retains the Flash memory data for the MCUs. Note that the area for the E8a emulator program and the vector area used by the E8a emulator will change.
- Program Flash
  The E8a emulator starts as a simple programmer. When downloaded, the E8a writes only the user program (E8a emulator program is not written). Therefore, the program cannot be debugged in this mode.
- Debugging of CPU rewrite mode
  Select this setting when debugging the program which rewrites the CPU. In this mode, the following debug operation which rewrites the Flash memory cannot be executed.
  - Setting the PC break points
  - Changing the memory contents in the Flash memory area

  In this mode, when starting the debugger, the E8a emulator erases the Flash memory data for the MCUs and simultaneously writes the E8a emulator program.

  When [Execute the user program after ending the debugger.] is selected, with the E8a emulator connected to the user system, the user program is executed at the same time the debugger is terminated. This check box setting is available only when the [Program Flash] mode is selected.

[Power supply]

When supplying power to the user system from the E8a, click the [Power Target from Emulator. (MAX 300mA)] check box.

3. [Communication Baud Rate] Tab

   Select communication baud rate between the E8a and MCU in the [Communication Baud Rate] tab. 500000bps (default setting) should be selected.

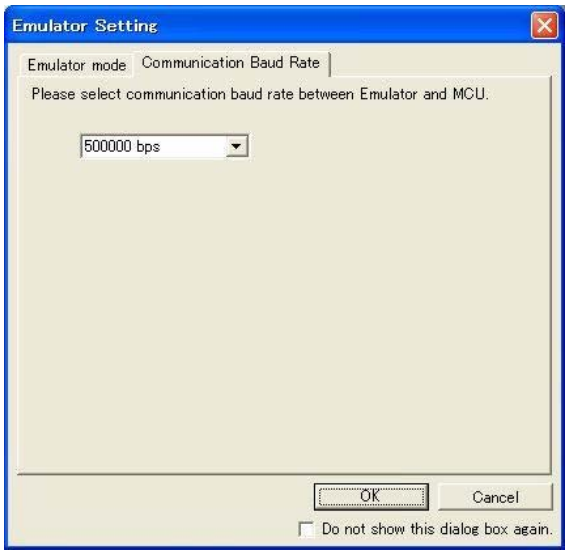


Figure 7.3 [Communication Baud Rate] Tab

Section 8 Applicable Tool Chain

With the 740 Family E8a emulator, you can debug a module created by the inhouse tool chain listed in Table 8.1 below.

Table 8.1 Applicable Tool Chain

Tool chain	M3T-SRA74 V.4.10 Release 02 or later M3T-ICC740 V1.01 Release 01 or later

E8a Emulator (R0E00008AKCE00)
Additional Document for User's Manual
Notes on Connecting the 38D5, 38D2, 3803L and 3804L

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