

USER'S MANUAL

NEC

IE-784038-R-EM1
I/O EMULATION BOARD

This device is a Class I information processing device (an information processing device for use in a commercial or industrial area). It complies with the standards set by the Conference on the Voluntary Control of Radio Interference (VCCI), which are intended to prevent radio wave interference in commercial and industrial areas. If used in a residential area or area adjacent to such as area, it may interfere with radio and television receivers. Please comply with the user's manual and handle this device appropriately.

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INTRODUCTION

General Product Description:

The IE-784038-R-EM1 board connects to the IE-784000-R-EM board, and these insert into the IE-784000-R cabinet. The IE-784038-R-EM1 board is used to debug the μ PD784038/ μ PD784038Y subseries **Note** of 16/8-bit single-chip microcontrollers.

Note μ PD784038 subseries : μ PD784031, μ PD784035, μ PD784036, μ PD784037, μ PD784038, and μ PD78P4038
 μ PD784038Y subseries : μ PD784031Y, μ PD784035Y, μ PD784036Y, μ PD784037Y, μ PD784038Y, and μ PD78P4038Y

Remark The μ PD784038 and μ PD784038Y subseries are under development.

Target users: This manual is intended for engineers who plan to develop a system containing the μ PD784038/ μ PD784038Y subseries 16/8-bit single-chip microcontroller and want to debug the system using IE-784000-R and IE-784000-R-EM in combination with the IE-784038-R-EM1. In addition, it is also intended for engineers who wish to use other in-circuit emulators by providing them with the same functions as the IE-784000-R. Therefore, this manual assumes that the readers will be well-versed in the functions and methods of using the μ PD784038/ μ PD784038Y subseries of microcontrollers and have the expertise of those who do debugging.

Objectives: The objectives of this manual are to provide an understanding of the methods of connecting the IE-784038-R-EM1 to the IE-784000-R-EM and the IE-784000-R as well as the methods of making settings when debugging the μ PD784038/ μ PD784038Y subseries of microcontrollers.

Organization: The manuals describing how to use the IE-784000-R are the manual that comes with the IE-784038-R-EM1 (this manual) and the manual that comes with the IE-784000-R.

IE-784038-R-EM1 User's Manual	IE-784000-R User's Manual
System configuration	Basic specifications
External interface functions to the IE-784000-R	System configuration Connection methods

How to read this manual:

To obtain a general understanding of the IE-784038-R-EM1 functions, read this manual in the same sequence as the table of contents.

For an understanding of the specifications, read the general description in **CHAPTER 1**.

To examine the settings for connecting the IE-784038-R-EM1 to the IE-784000-R and debugging the μ PD784038/ μ PD784038Y subseries devices, read the installation procedures in **CHAPTER 2**.

Terminology:

The special terms used in the manual are defined in the following table:

Term	Definition
Emulation device	A generic term for devices in the emulator that are to be emulated. This includes the emulation CPU.
Emulation CPU	The CPU portion of the emulator that executes the user-created program.
Target device	The device whose operation is emulated (the actual device).
Target program	The program that is to be debugged (a user-created program).
Target system	The system that is the subject of debugging (a user-created system). This includes the target program and the hardware created by the user. The narrow definition refers only to the hardware.

Legend:

- (1) The term “**Note**” placed in the text indicates that an explanation will be provided somewhere below.
- (2) The term “**Caution**” indicates an explanation that the reader should pay particular attention to.
- (3) The term “**Remark**” indicates that a supplemental explanation of the text will be provided.

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[MEMO]

CHAPTER 1 GENERAL DESCRIPTION

The IE-784038-R-EM1 is the I/O emulation board for the μ PD784038/ μ PD784038Y subseries 16/8-bit single-chip microcontroller.

The IE-784038-R-EM1 and emulation probe (EP-78230GC-R/EP-78054GK-R) can be used in combination with the IE-784000-R and IE-784000-R-EM for the efficient debugging and operational confirmation of systems using the μ PD784038/ μ PD784038Y subseries of microcontrollers.

1.1 Characteristics

The characteristics of the IE-784038-R-EM1 when combined with the IE-784000-R-EM and the IE-784000-R are as follows:

- (1) The peripheral functions (I/O ports, etc.) of the μ PD784038/ μ PD784038Y subseries devices can be emulated.
- (2) A CPU operation clock can be provided.

1.2 Packing List

The IE-784038-R-EM1 board consists of the components indicated below. Be sure to check the content of the package.

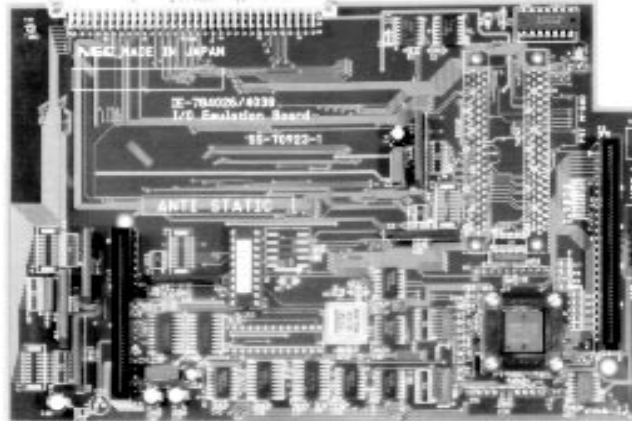
- (1) One IE-784038-R-EM1 board
- (2) One user's manual (this manual)

Caution The dedicated devices (peripheral emulation devices) for emulating the peripheral functions (I/O ports, etc.) of the target device are on the IE-784038-R-EM1.

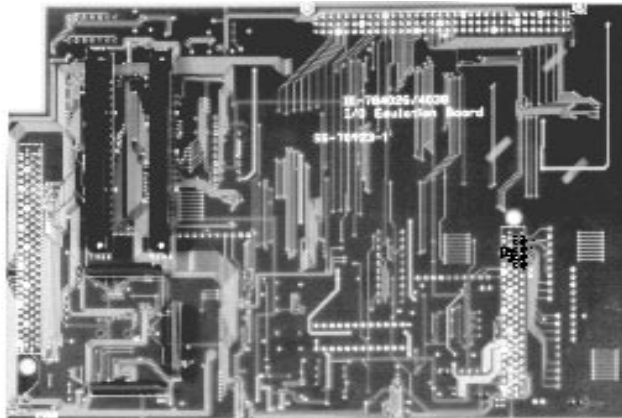
Figure 1-1. IE-784038-R-EM1 Board Configuration

(1) IE-784038-R-EM1

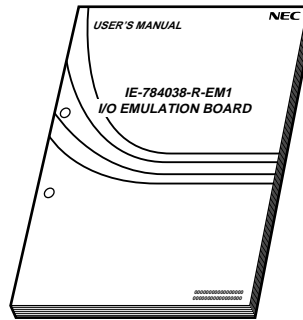
Front



Back



(2) User's manual (this manual)



1.3 Name of Components

Table 1-1 shows the names of the components, for instance, the connectors.

Table 1-1. IE-784038-R-EM1 Component Names

Name	Function
CN1	Emulation probe connector
PJ1 PJ2	Emulation board connector
TGCN1 TGCN2	Not used
IC9	Peripheral emulation device mounting socket

Remark Emulation probe: EP-78230GC-R, EP-78054GK-R

1.4 Target Devices

The following devices of the μ PD784038/ μ PD784038Y subseries can be emulated by using the IE-784000-R-EM and the IE-784000-R in combination with the IE-784038-R-EM1:

μ PD784038 subseries	μ PD784038Y subseries
• μ PD784031	• μ PD784031Y
• μ PD784035	• μ PD784035Y
• μ PD784036	• μ PD784036Y
• μ PD784037	• μ PD784037Y
• μ PD784038	• μ PD784038Y
• μ PD78P4038	• μ PD78P4038Y

1.5 Emulation Probe

The emulation probe is sold separately.

Part Number

EP-78230GC-R (for 80-pin QFP : 14 × 14 mm)
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EP-78054GK-R (for 80-pin TQFP : 12 × 12 mm)

1.6 Precautions

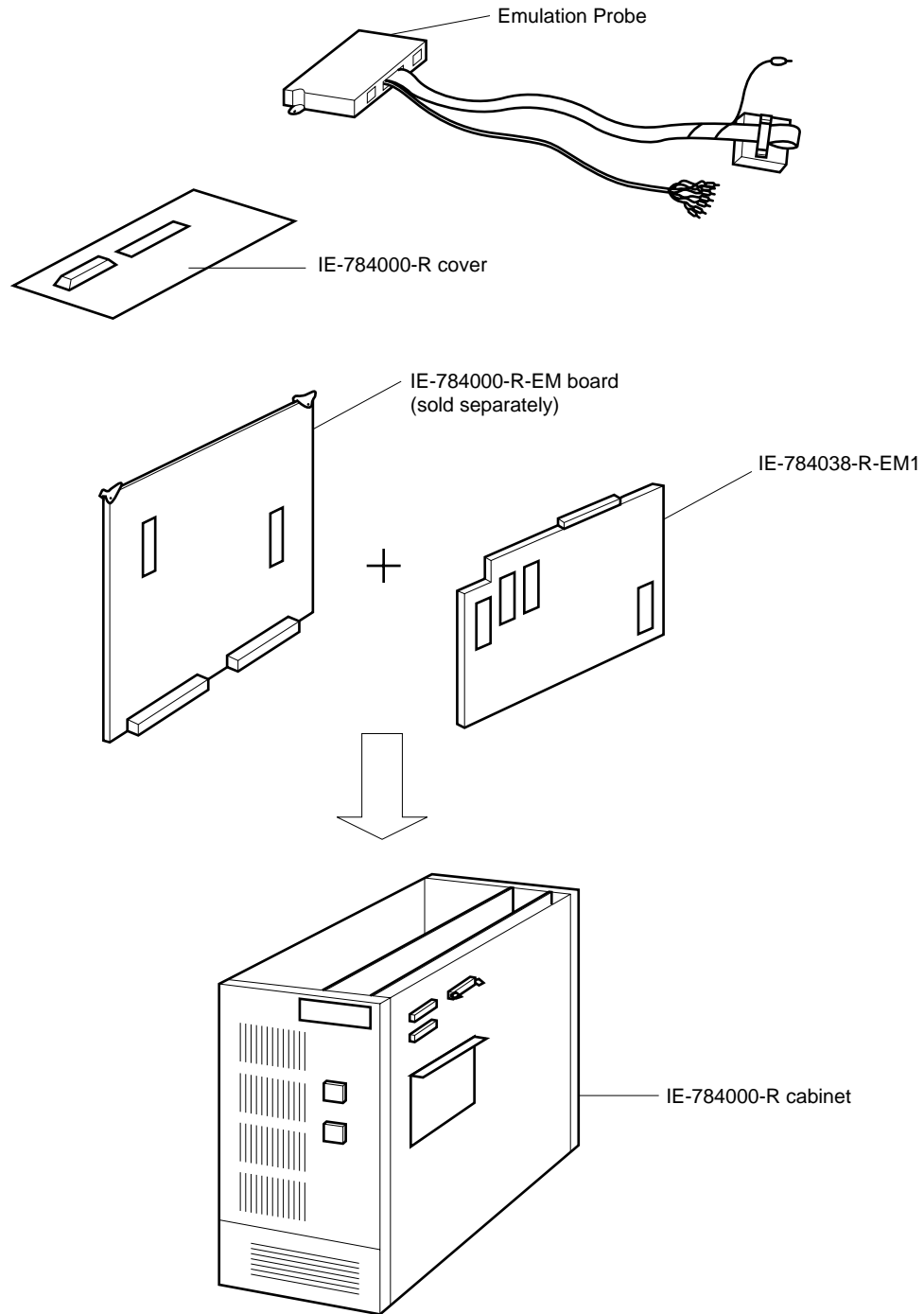
- (1) Turn the IE-784000-R and the target system power supplies off when connecting or disconnecting the IE-784038-R-EM1, IE-784000-R, IE-784000-R-EM or the target system.
- (2) Be aware that there are differences in the pin characteristics when the IE-784038-R-EM1 is connected to the IE-784000-R and IE-784000-R-EM to emulate the target device. (See the section concerning the differences with the target device in **CHAPTER 5**.)
- (3) Connect the IE-784038-R-EM1 appropriately to the IE-784000-R-EM.
- (4) Insert the IE-784000-R-EM appropriately in the IE-784000-R cabinet.

CHAPTER 2 INSTALLATION PROCEDURES

2.1 Insertion in the IE-784000-R

Figure 2-1 shows a conceptual drawing for setting up the IE-784000-R.

Figure 2-1. IE-784000-R Installation



<1> Setting the user clock

Refer to the section on the user clock setting in **CHAPTER 3**.

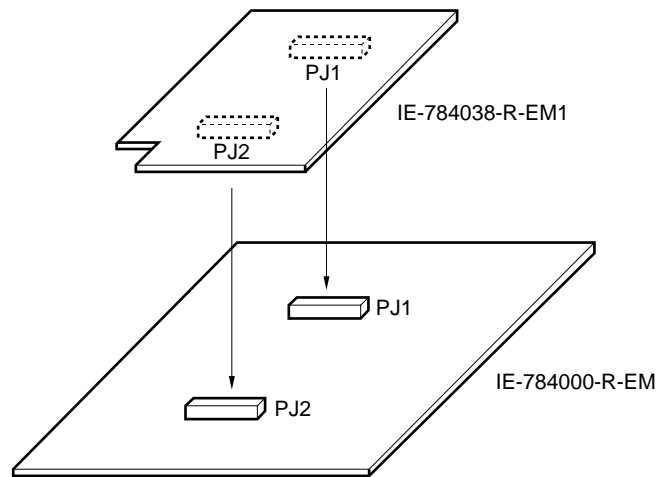
<2> Jumper switch confirmation

Confirm that the IE-784038-R-EM1 jumper switch is open by referring to the section on jumper switch settings in **APPENDIX C**.

<3> Connecting the IE-784038-R-EM1 to the IE-784000-R-EM

Connect the PJ1 and PJ2 connectors on the IE-784000-R-EM board to connectors PJ1 and PJ2 on the IE-784038-R-EM1 board.

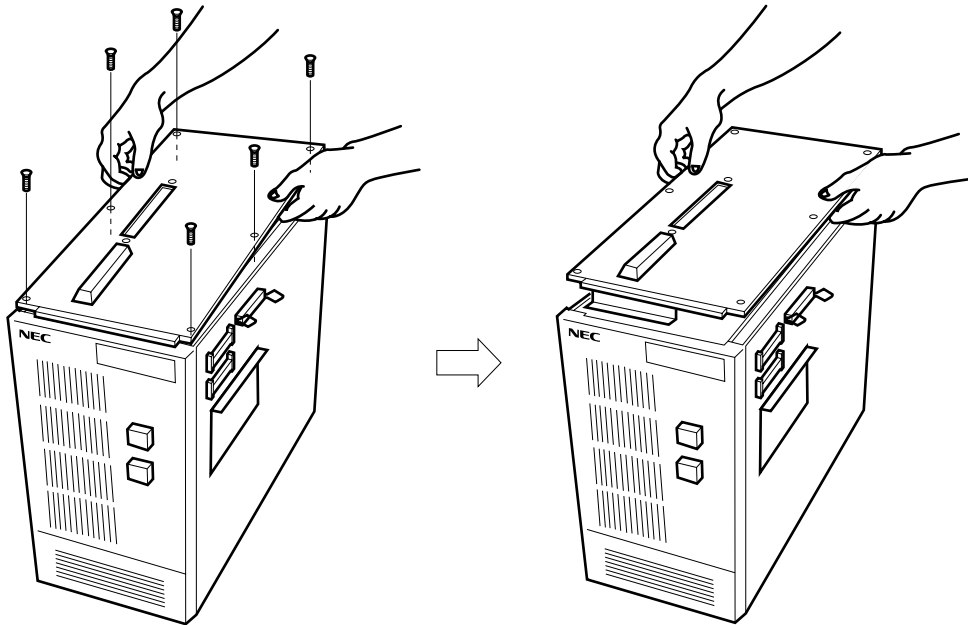
Figure 2-2. Connecting IE-784038-R-EM1 and IE-784000-R-EM



<4> Removing the top cover

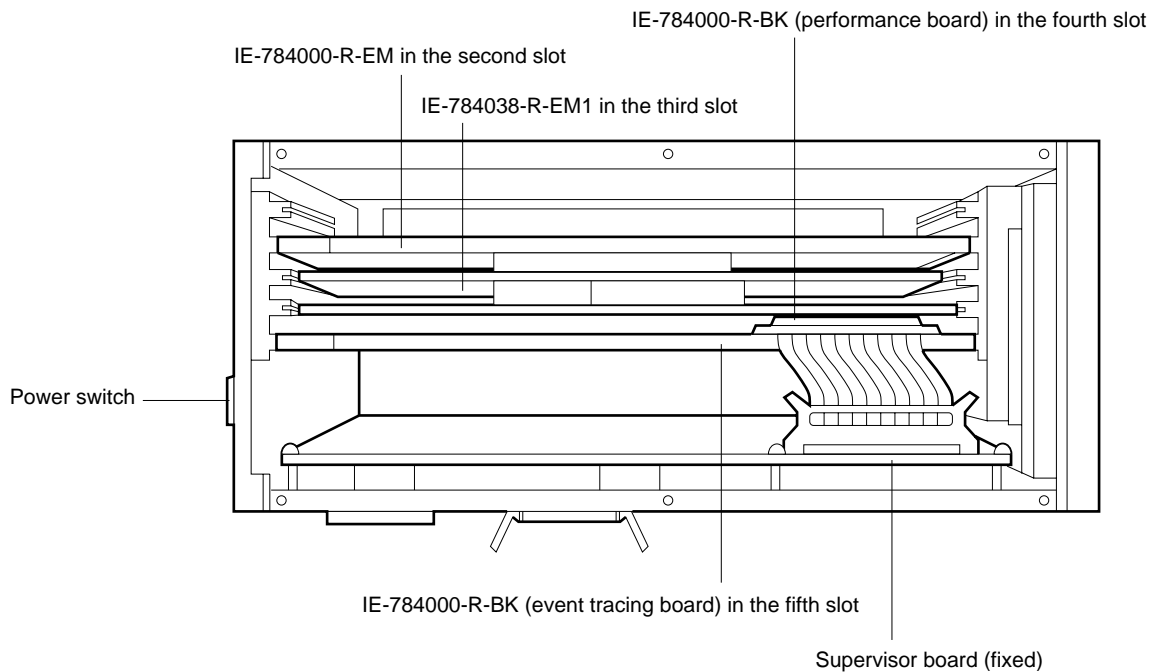
Remove the six screws from the top of the cabinet shown in **Figure 2-3**. Then remove the top cover.

Figure 2-3. Removing the Top Cover of the IE-784000-R



<5> Insert the IE-784000-R-EM and the IE-784038-R-EM1 into the second and third slots (see **Figure 2-4**) of the IE-784000-R, respectively. Then, replace the top cover and tighten it down with the screws.

Figure 2-4. Inserting the IE-784000-R-EM and IE-784038-R-EM1 Boards in the IE-784000-R



2.2 Connecting to the Target System

To connect the IE-784000-R and the target system, use the EP-78230GC-R or EP-78054GK-R emulation probe, which is sold separately.

Figure 2-5. Connecting the EP-78230GC-R to the Target System

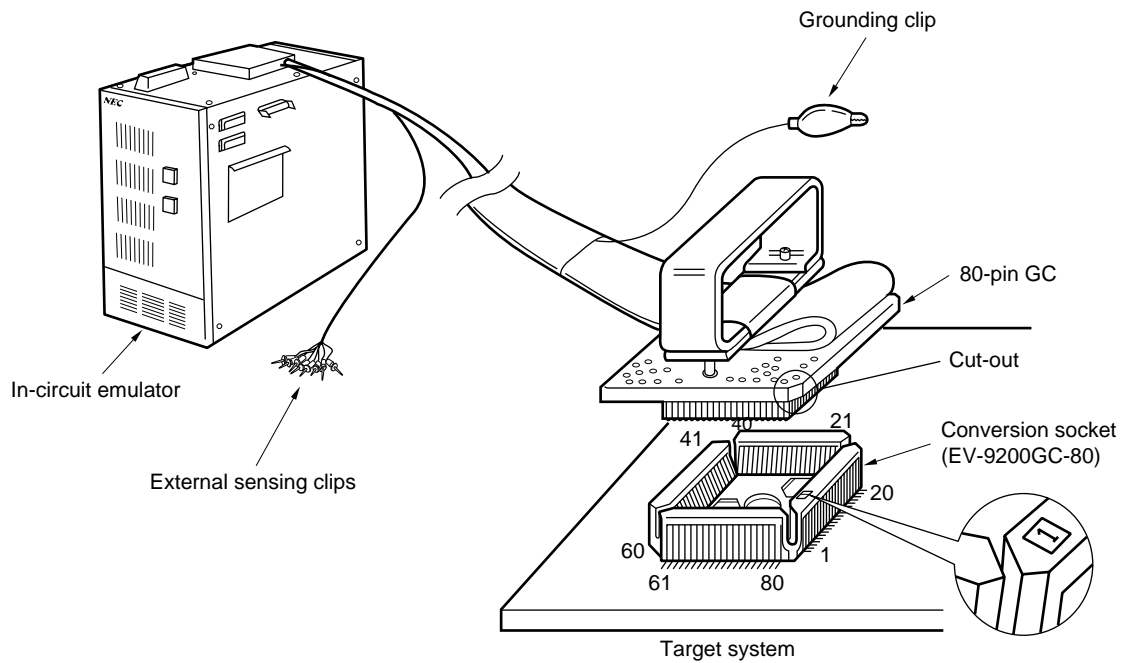
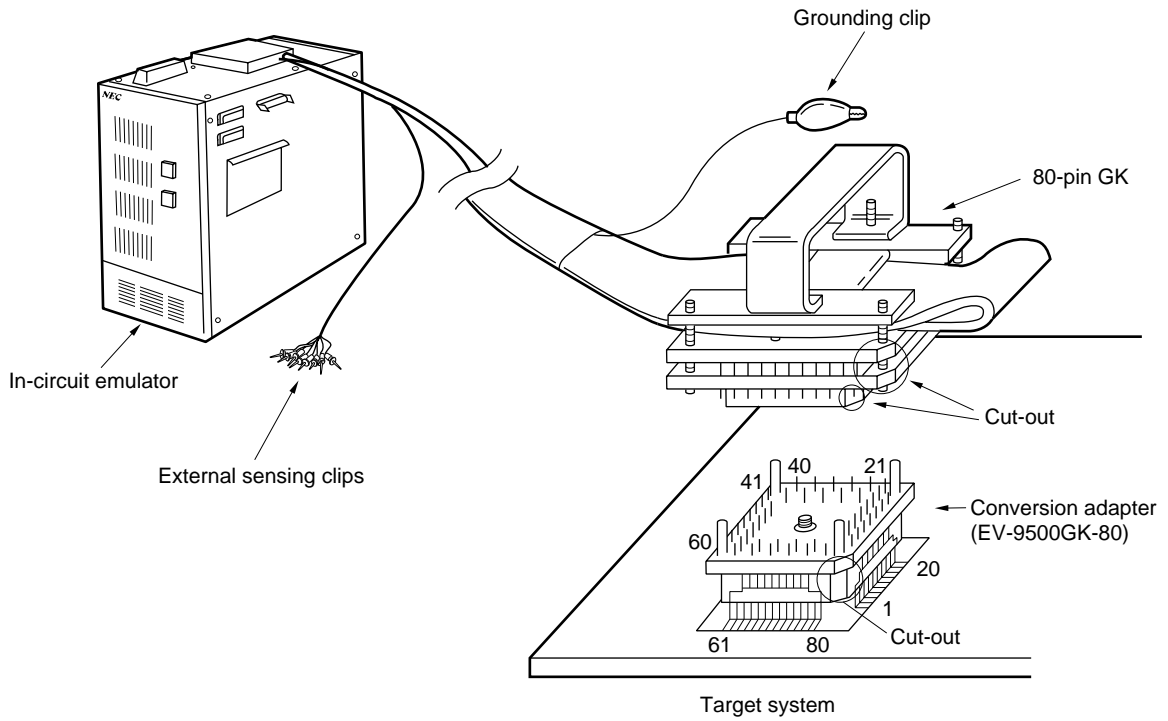


Figure 2-6. Connecting the EP-78054GK-R to the Target System



2.3 No Connection to the Target System

The IE-784000-R can be started up even when it is not connected to the target system.

[MEMO]

CHAPTER 3 SETTING THE USER CLOCK

In the case of the IE-784000-R, as long as the settings of the clock are not changed, the dedicated clock on the IE-784038-R-EM1 board will be supplied to the emulation device. When operating with the target system oscillating clock or with an optional clock, the clock IC socket (IC3 OPCK) must be selected and the debugger must be used to select the user-selected clock.

For the methods of making settings using the debugger, refer to the “**ID78K/4 Integrated Debugger User’s Manual**”. For operation with the target system oscillating clock or a clock with a user-specified frequency, refer to the appropriate sections in this chapter.

3.1 Setting the Operating Clock

Using the IE-784000-R, the following operating clock settings are possible:

(1) Operation with the dedicated clock on the IE-784038-R-EM1 board

When the debugger is used to select the clock within the emulator, the dedicated clock (32 MHz) on the emulator board will be supplied to the emulation device. This mode is entered after the IE-784000-R power is turned on.

(2) Operation with an optional clock on the IE-784038-R-EM1 board

A crystal oscillator of the same frequency as the clock supplied to the target device is inserted in the clock IC socket (IC3 OPCK) on the IE-784038-R-EM1 board. Then, the debugger is used to select the user clock settings, and an optional clock that is determined by the oscillator in the clock IC socket is supplied to the emulation device. (A maximum 32-MHz crystal oscillator can be used.) For details, refer to “**Installing the Crystal Oscillator**” in 3.2.

(3) Operation of the oscillating clock on the target system

By inserting the 74HC04 CMOS IC in the clock IC socket (IC3 OPCK) on the emulation board and using the debugger to select user clock settings, the square-wave clock supplied from the target system will be supplied to the emulation device. For details, refer to “**Supplying a Clock from the Target System**” in 3.3. For connection information, refer to “**INSTALLATION PROCEDURES**” in CHAPTER 2.

Caution It is prohibited to perform an emulation in which oscillation is obtained by directly connecting a crystal resonator or ceramic resonator into the X1 and X2 pins of the target device. When using a frequency other than 32 MHz, provide an oscillating frequency clock that is actually employed using the method in (2) above.

3.2 Installing the Crystal Oscillator

◇ **Procedures:**

- <1> Ready an IE-784038-R-EM1 board.
- <2> For shipment, the 74HC04 is inserted in the IE-784038-R-EM1 clock IC socket (IC3 OPCK). Remove it.
- <3> Install the crystal oscillator (max. 32 MHz) to the clock IC socket (IC3 OPCK) on the IE-784038-R-EM1. Insert the pins of the crystal oscillator into the clock IC socket as indicated in the table below.

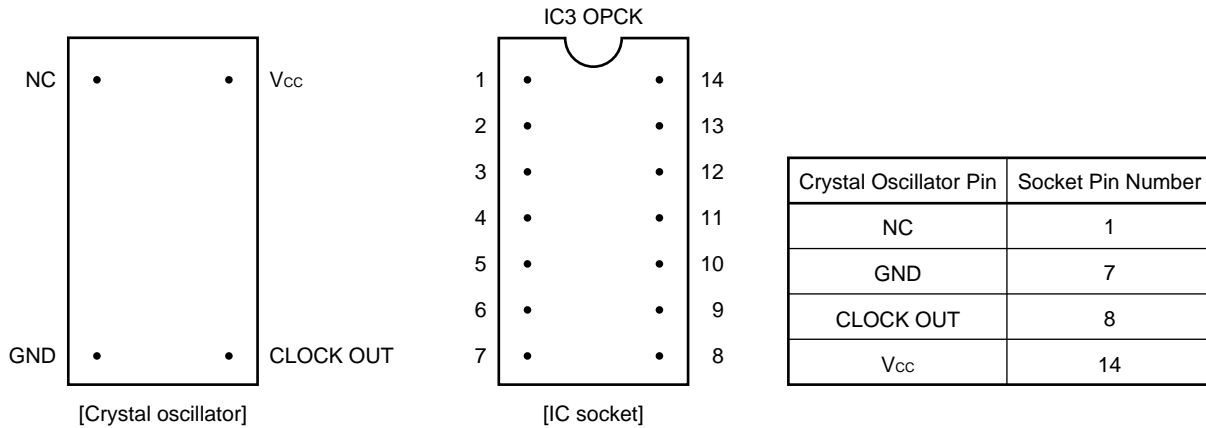
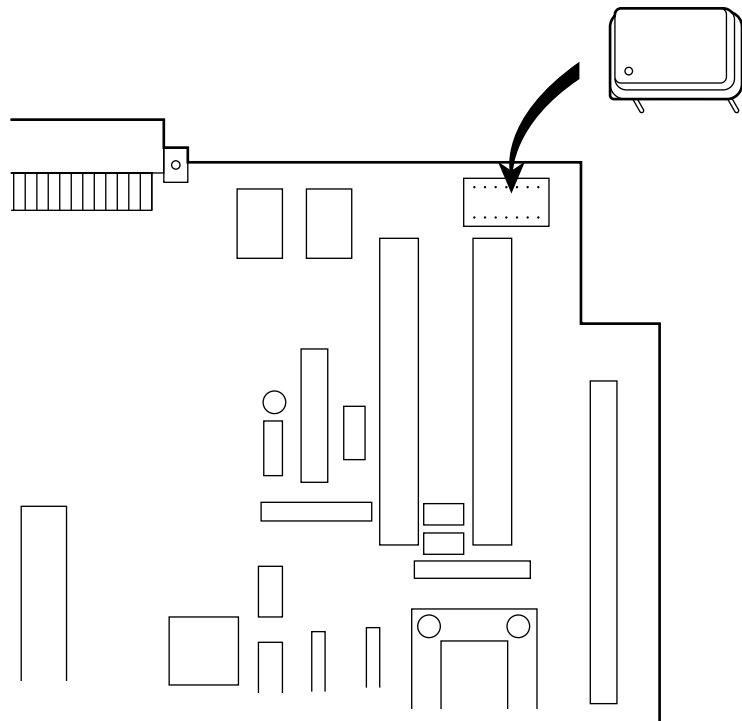
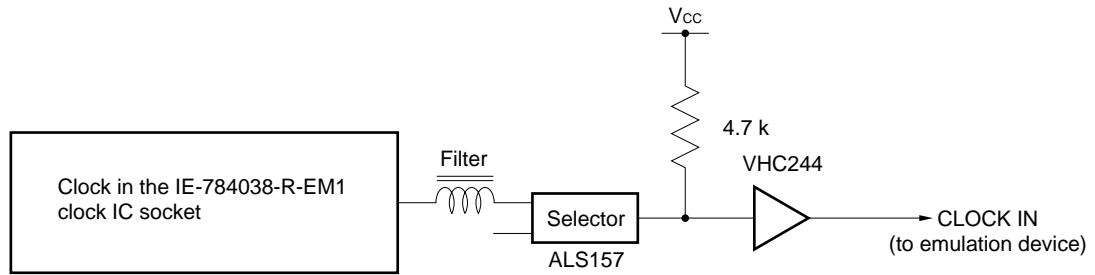


Figure 3-1. Clock IC Location on the IE-784038-R-EM1 Board



When the user clock setting is selected using the debugger, the following circuit will be formed and a clock will be supplied from the crystal oscillator to the emulation device in the IE-784000-R-EM.

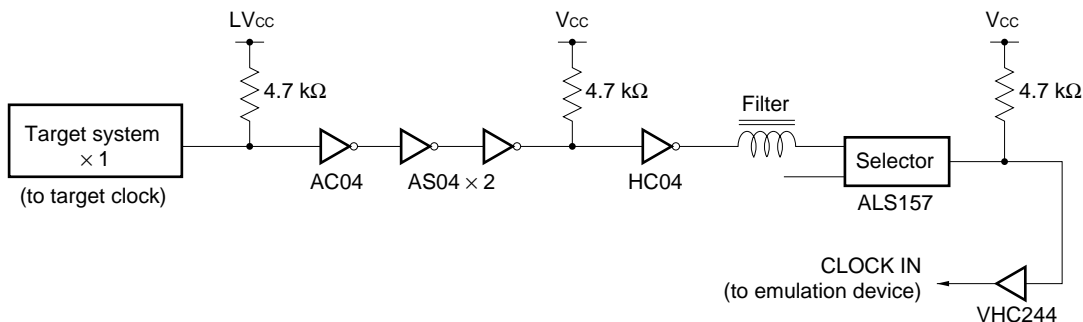
Figure 3-2. IE-784038-R-EM1 Clock Supply Diagram



3.3 Supplying a Clock from the Target System

The 74HC04 CMOS IC is inserted in the IE-784038-R-EM1 clock IC socket (IC3 OPCK) for shipment. If the user clock setting is selected using the debugger, the following circuit will be formed and a clock will be supplied from the target system to the IE-784000-R-EM emulation devices.

Figure 3-3. IE-784038-R-EM1 Clock Supply Diagram



Caution A clock cannot be supplied from a crystal resonator or a ceramic resonator that is connected to the X1 and X2 pins of the target system.

If the 74HC04 is removed for some reason, such as a change in the operating clock, make the setting as indicated below:

◇ **Procedures:**

- <1> Ready an IE-784038-R-EM1.
- <2> Insert a 74HC04 in the IE-784038-R-EM1 clock IC socket (IC3 OPCK) paying close attention so that the number 1 pin marks match.

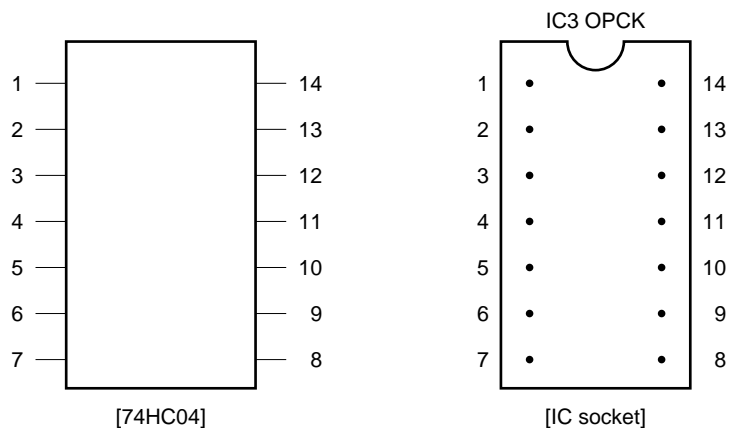
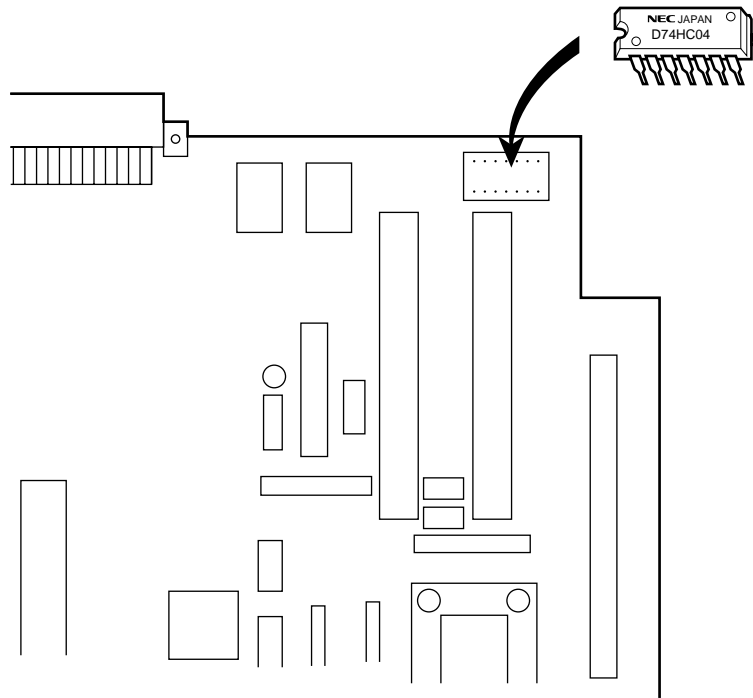


Figure 3-4. Clock IC Location on the IE-784038-R-EM1 Board



[MEMO]

CHAPTER 4 STARTUP

As for the method of startup, after connecting the board to the host computer, refer to the **'ID78K4 Integrated Debugger User's Manual'**.

If the startup does not go well, make confirmation by referring to this document or the **IE-784000-R User's Manual**.

[MEMO]

CHAPTER 5 DIFFERENCES BETWEEN THE IN-CIRCUIT EMULATOR AND THE TARGET DEVICE

Because this in-circuit emulator emulates through the emulation CPU and the peripheral emulation devices, there are differences in pin characteristics.

Figure 5-1. Equivalent Circuits of the Port Pin Emulation Circuits (1 of 3)

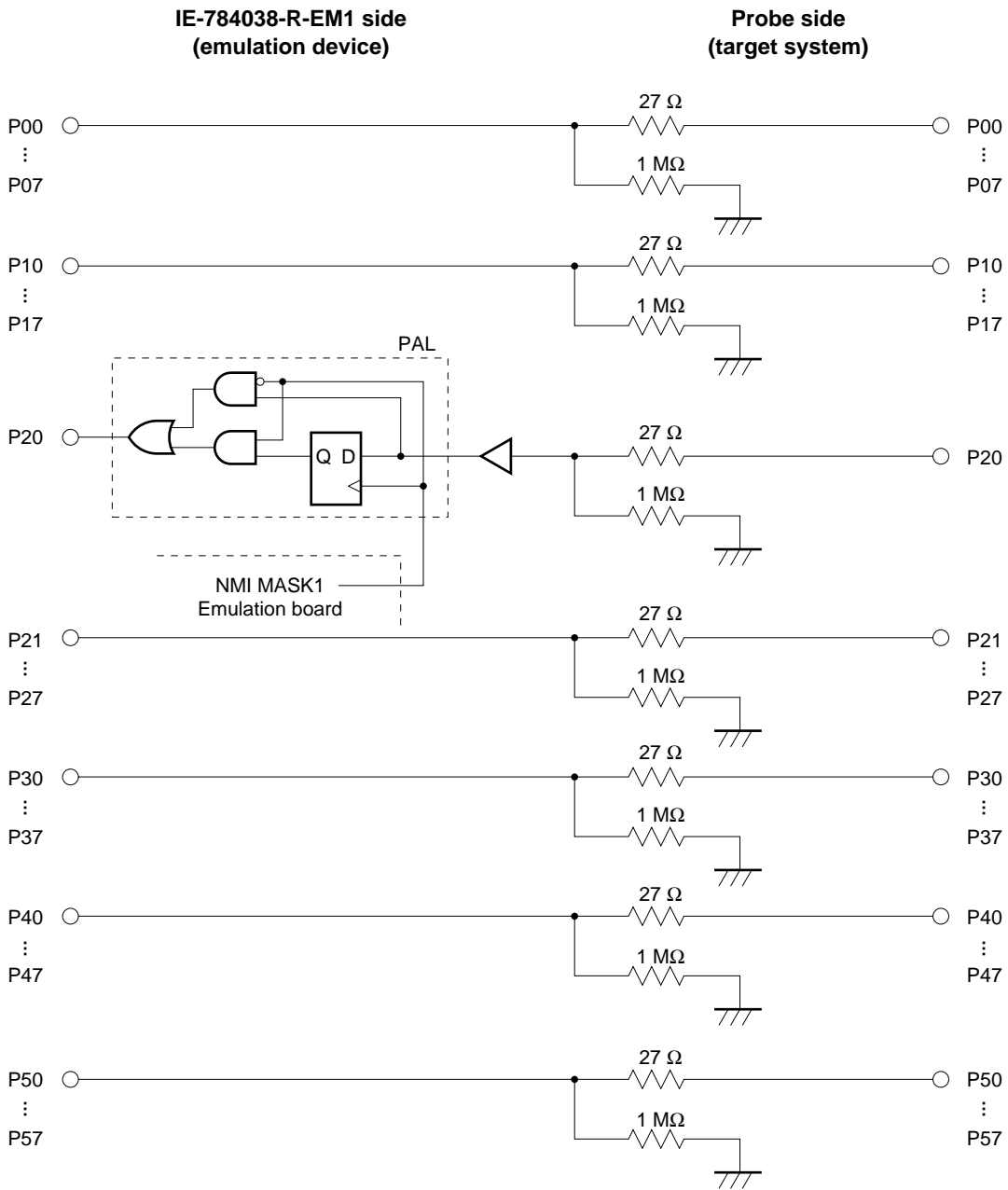


Figure 5-1. Equivalent Circuits of the Port Pin Emulation Circuits (2 of 3)

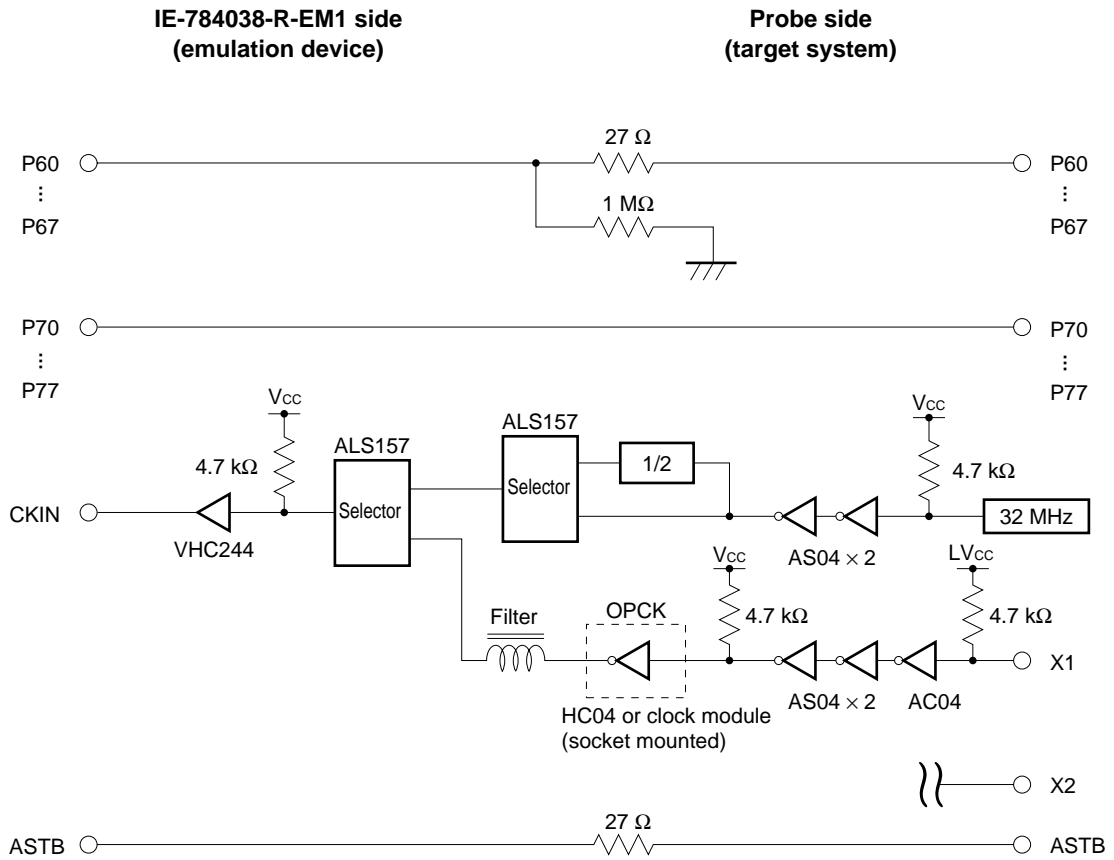
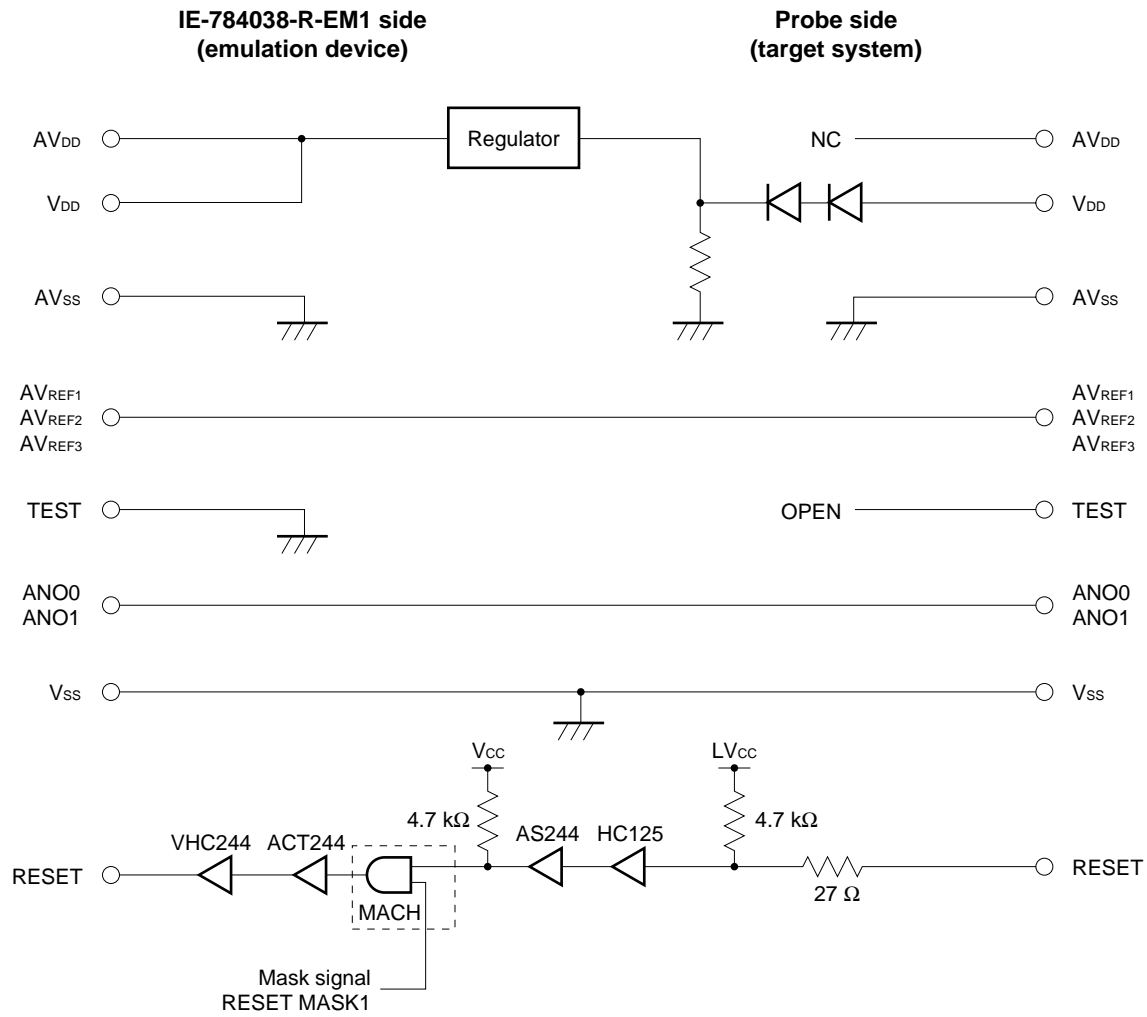


Figure 5-1. Equivalent Circuits of the Port Pin Emulation Circuits (3 of 3)



APPENDIX A PRODUCT SPECIFICATIONS

Part number : IE-784038-R-EM1
Operating temperature : 10°C to 40°C (without condensation)
Humidity : 10% to 80% (without condensation)
Storage temperature : -15°C to +45°C (without condensation)
Power supply : +3.0 V to +5.5 V (supplied from the IE-784000-R)
Printed circuit board dimensions : 305 mm × 149 mm
Connectors :

PJ1	Emulation board connector
PJ2	
CN1	Emulation probe connector

[MEMO]

APPENDIX B CN1 AND EMULATION PROBE PINS

The following table shows the correspondence between CN1 and emulation probe pins.

Table B-1. CN1 and Emulation Probe (EP-78230GC-R/EP-78054GK-R) Pin Correspondence

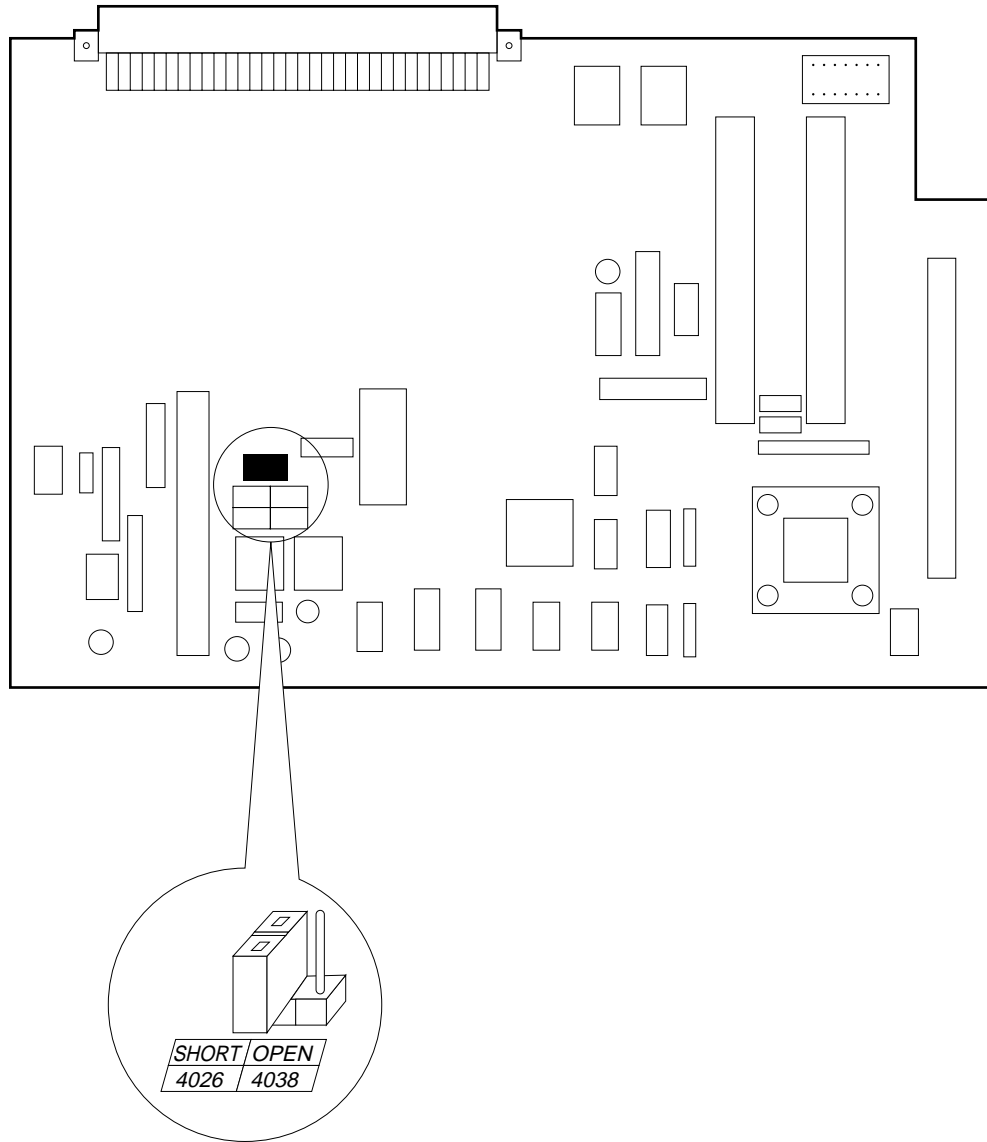
CN1 Pin No.	Emulation probe	CN1 Pin No.	Emulation probe	CN1 Pin No.	Emulation probe	CN1 Pin No.	Emulation probe
1	GND	25	15	49	34	73	61
2	GND	26	16	50	33	74	NC
3	EXT0	27	17	51	32	75	NC
4	EXT1	28	18	52	31	76	70
5	EXT2	29	19	53	41	77	69
6	EXT3	30	20	54	42	78	68
7	EXT4	31	21	55	43	79	67
8	EXT5	32	NC	56	44	80	66
9	EXT6	33	NC	57	45	81	65
10	EXT7	34	30	58	46	82	64
11	1	35	29	59	47	83	63
12	2	36	28	60	48	84	62
13	3	37	27	61	49	85	80
14	4	38	26	62	50	86	79
15	5	39	25	63	51	87	78
16	6	40	24	64	52	88	77
17	7	41	23	65	53	89	76
18	8	42	22	66	54	90	75
19	9	43	40	67	55	91	74
20	10	44	39	68	56	92	73
21	11	45	38	69	57	93	72
22	12	46	37	70	58	94	71
23	13	47	36	71	59	95	GND
24	14	48	35	72	60	96	GND

[MEMO]

APPENDIX C JUMPER SWITCH SETTINGS

Set the jumper switch leaving open.

IE-784038-R-EM1



[MEMO]

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