To our customers,

Old Company Name in Catalogs and Other Documents

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April 1st, 2010
Renesas Electronics Corporation

RENESAS

Notice

RENESAS

User's Manual

IE-780148-NS-EM1

Emulation Board

Target Devices

μPD780103 Subseries   μPD780138 Subseries

μPD780114 Subseries   μPD780148 Subseries

μPD780124 Subseries

[MEMO]

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Some information contained in this document may vary from country to country. Before using any NEC Electronics product in your application, please contact the NEC Electronics office in your country to obtain a list of authorized representatives and distributors. They will verify:

- Device availability

- Ordering information

- Product release schedule

- Availability of related technical literature

- Development environment specifications (for example, specifications for third-party tools and components, host computers, power plugs, AC supply voltages, and so forth)

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INTRODUCTION

Product Overview   The IE-780148-NS-EM1 is designed to be used with the IE-78K0-NS or IE-78K0-NS-A to debug the following target devices that belong to the 78K/0 Series of 8-bit single-chip microcontrollers.

- 78K0/KB1 (μPD780103 Subseries): μPD780101, 780102, 780103, 78F0103
- 78K0/KC1 (μPD780114 Subseries): μPD780111, 780112, 780113, 780114, 78F0114
- 78K0/KD1 (μPD780124 Subseries): μPD780121, 780122, 780123, 780124, 78F0124
- 78K0/KE1 (μPD780138 Subseries): μPD780131, 780132, 780133, 780134, 780136, 780138, 78F0134, 78F0138
- 78K0/KF1 (μPD780148 Subseries): μPD780143, 780144, 780146, 780148, 78F0148
- 78K0/KB1+ (μPD780103 Subseries): μPD78F0101H, 78F0102H, 780103H
- 78K0/KC1+ (μPD780114 Subseries): μPD78F0112H, 78F0113H, 780114H
- 78K0/KD1+ (μPD780124 Subseries): μPD78F0122H, 78F0123H, 780124H
- 78K0/KE1+ (μPD780138 Subseries): μPD78F0132H, 78F0133H, 780134H, 78F0136H, 78F0138H
- 78K0/KF1+ (μPD780148 Subseries): μPD78F0148H

Target Readers   This manual is intended for engineers who will use the IE-780148-NS-EM1 with the IE-78K0-NS or IE-78K0-NS-A to perform system debugging.

Engineers who use this manual are expected to be thoroughly familiar with the target device's functions and use methods and to be knowledgeable about debugging.

Organization   When using the IE-780148-NS-EM1, refer to not only this manual (supplied with the IE-780148-NS-EM1) but also the manual that is supplied with the IE-78K0-NS or IE-78K0-NS-A.

The IE-78K0-NS used in combination with the IE-78K0-NS-PA is functionally equivalent to the IE-78K0-NS-A. Therefore, as necessary, read IE-78K0-NS + IE-78K0-NS-PA for IE-78K0-NS-A in this document.

IE-78K0-NS or IE-78K0-NS-A User's Manual	IE-780148-NS-EM1 User's Manual
• General	• General
• Part names	• Part names
• Installation	• Installation
	• Differences between target devices and target interface circuits

Purpose   This manual's purpose is to explain various debugging functions that can be performed when using the IE-780148-NS-EM1.

Terminology   The meanings of certain terms used in this manual are listed below.

Term	Meaning
Emulation device	This is a general term that refers to the device in the emulator that is used to emulate the target device. It includes the emulation CPU.
Emulation CPU	This is the CPU block in the emulator that is used to execute user-generated programs.
Target device	This is the device that is the target for emulation.
Target system	This includes the target program and the hardware provided by the user. When defined narrowly, it includes only the hardware.
IE system	This refers to the combination of the in-circuit emulator (IE-78K0-NS or IE-78K0-NS-A) and emulation board (IE-780148-NS-EM1).

Conventions   Data significance: Higher digits on the left and lower digits on the right
Note: Footnote for item marked with **Note** in the text
Caution: Information requiring particular attention
Remark: Supplementary information

How to Read This Manual   It is assumed that the readers of this manual have general knowledge in the fields of electrical engineering, logic circuits, and microcontrollers.

To understand the overall functions of the IE-780148-NS-EM1
→ Read this manual according to the **CONTENTS**.

Related Documents   The related documents (user's manuals) indicated in this publication may include preliminary versions. However, preliminary versions are not marked as such.

Document Name	Document No.
IE-78K0-NS In-Circuit Emulator	U13731E
IE-78K0-NS-A In-Circuit Emulator	U14889E
IE-780148-NS-EM1 Emulation Board	This manual
ID78K0-NS Ver. 2.52 Integrated Debugger Operation	U16488E
78K0/KB1 8-Bit Single-Chip Microcontroller	U15836E
78K0/KC1 8-Bit Single-Chip Microcontroller	U16227E
78K0/KD1 8-Bit Single-Chip Microcontroller	U16315E
78K0/KE1 8-Bit Single-Chip Microcontroller	U16228E
78K0/KF1 8-Bit Single-Chip Microcontroller	U15947E
78K0/KB1+ 8-Bit Single-Chip Microcontroller	U16846E
78K0/KC1+ 8-Bit Single-Chip Microcontroller	Under preparation
78K0/KD1+ 8-Bit Single-Chip Microcontroller	Under preparation
78K0/KE1+ 8-Bit Single-Chip Microcontroller	Under preparation
78K0/KF1+ 8-Bit Single-Chip Microcontroller	U16819E

Caution   **The related documents listed above are subject to change without notice. Be sure to use the latest version of each document for designing.**

CONTENTS

CHAPTER 1 GENERAL

   The IE-780148-NS-EM1 is a development tool for efficient debugging of hardware or software when using one of the following target devices that belong to the 78K/0 Series of 8-bit single-chip microcontrollers.
   This chapter describes the IE-780148-NS-EM1's system configuration and basic specifications.

- Target devices
   - 78K0/KB1, 78K0/KB1+: μPD780103 Subseries
   - 78K0/KC1, 78K0/KC1+: μPD780114 Subseries
   - 78K0/KD1, 78K0/KD1+: μPD780124 Subseries
   - 78K0/KE1, 78K0/KE1+: μPD780138 Subseries
   - 78K0/KF1, 78K0/KF1+: μPD780148 Subseries

1.1 System Configuration

Figure 1-1 illustrates the IE-780148-NS-EM1's system configuration.

Figure 1-1. System Configuration
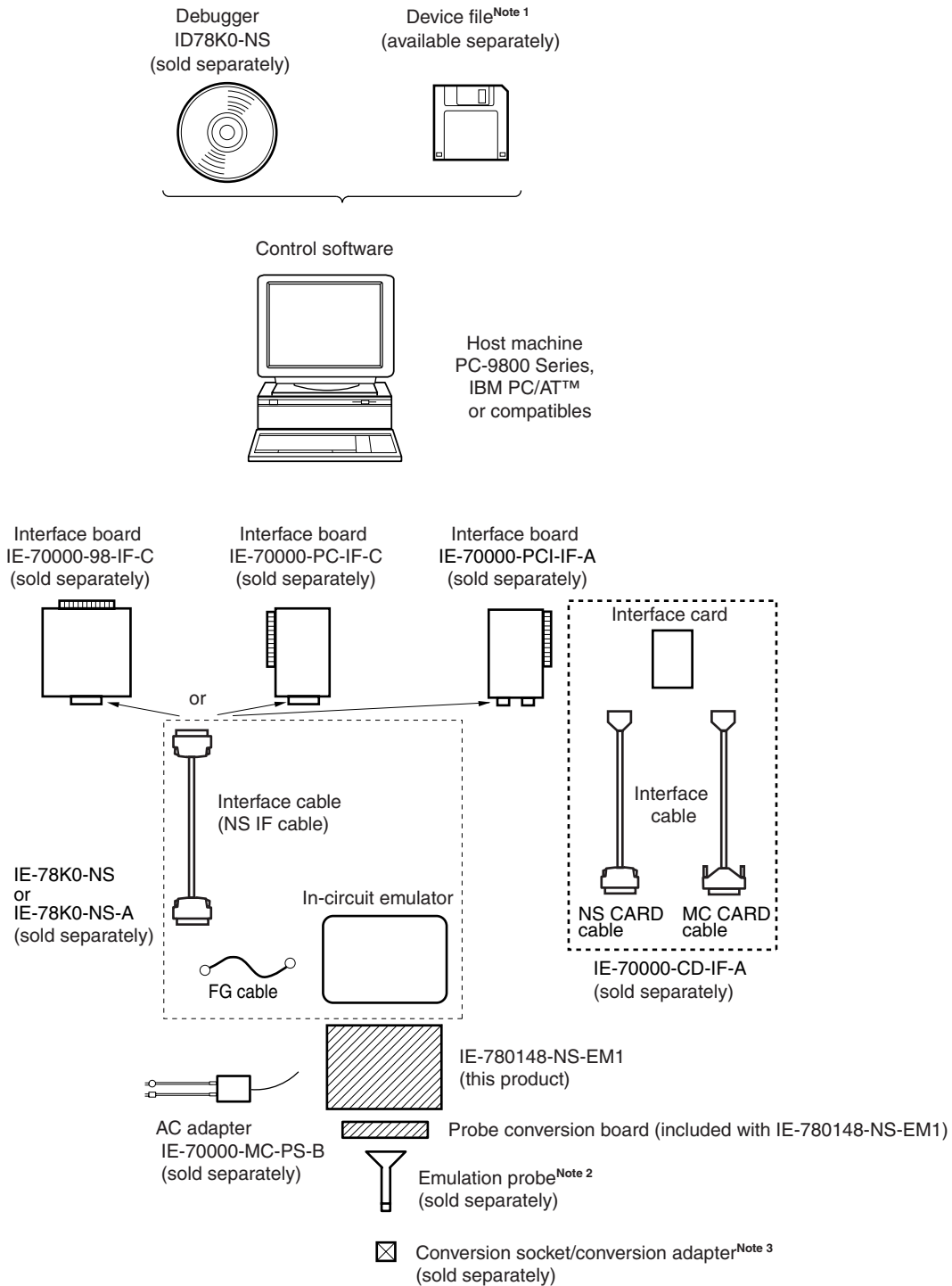
Notes 1. The device file is as follows.

μS$\times\times\times\times$DF780103: 78K0/KB1, 78K0/KB1+

μS$\times\times\times\times$DF780114: 78K0/KC1, 78K0/KC1+

μS$\times\times\times\times$DF780124: 78K0/KD1, 78K0/KD1+

μS$\times\times\times\times$DF780138: 78K0/KE1, 78K0/KE1+

μS$\times\times\times\times$DF780148: 78K0/KF1, 78K0/KF1+

The device file can be downloaded from the website of NEC Electronics

(http://www.necel.com/micro/)

2. The emulation probes NP-80GC, NP-80GC-TQ, NP-H80GC-TQ, NP-80GK, NP-H80GK-TQ, NP-64GK, NP-H64GK-TQ, NP-64GC, NP-64GC-TQ, NP-H64GC-TQ, NP-64GB, NP-H64GB-TQ, NP-H52GB-TQ, NP-44GB, NP-44GB-TQ, NP-H44GB-TQ, and NP-30MC are products of Naito Densei Machida Mfg. Co., Ltd.

For further information, contact Naito Densei Machida Mfg. Co., Ltd. (TEL: +81-45-475-4191)

3. The conversion adapters TGC-080SBP, TGK-080SDW, TGC-064SBW, TGC-064SAP, TGB-064SDP, TGB-052SBP, TGB-044SAP, and YSPACK30BK + NSPACK30BK + YSGUIDE are products of TOKYO ELETECH CORPORATION.

For further information, contact Daimaru Kogyo Co., Ltd.

Tokyo Electronics Department (TEL: +81-3-3820-7112)

Osaka Electronics Department (TEL: +81-6-6244-6672)

Table 1-1. Correspondence Between Emulation Probe and Conversion Socket/Conversion Adapter

Package	Probe Conversion Board	Emulation Probe	Conversion Socket/Conversion Adapter
80-pin plastic QFP (GC type)	78014X PROBE Board	NP-80GC	EV-9200GC-80
		NP-80GC-TQ	TGC-080SBP
		NP-H80GC-TQ	
80-pin plastic TQFP (GK type)		NP-80GK	TGK-080SDW
		NP-H80GK-TQ	
64-pin TQFP (12 x 12 mm)	78013X PROBE Board	NP-64GK	TGK-064SBW
		NP-H64GK-TQ	
64-pin LQFP (14 x 14 mm)		NP-64GC	EV-9200GC-64
		NP-64GC-TQ	TGC-064SAP
		NP-H64GC-TQ	
64-pin LQFP (10 x 10 mm)		NP-64GB	TGB-064SDP
		NP-H64GB-TQ	
52-pin TQFP (10 x 10 mm)	78012X PROBE Board	NP-H52GB-TQ	TGB-052SBP
44-pin TQFP (10 x 10 mm)	78011X PROBE Board	NP-44GB	EV-9200G-44
		NP-44GB-TQ	TGB-044SAP
		NP-H44GB-TQ	
30-pin SSOP (300 mil)	78010X PROBE Board	NP-30MC	YSPACK30BK + NSPACK30BK + YSGUIDE

1.2 Hardware Configuration

Figure 1-2 shows the IE-780148-NS-EM1's position in the basic hardware configuration.

Figure 1-2. Basic Hardware Configuration
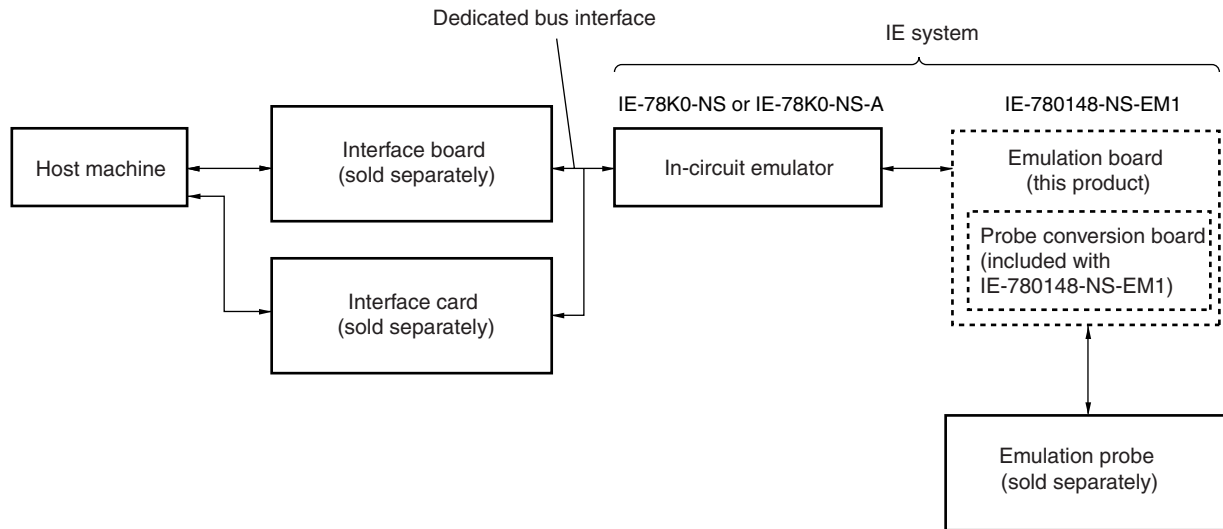
1.3 Basic Specifications

The IE-780148-NS-EM1's basic specifications are listed in Table 1-2.

Table 1-2. Basic Specifications

Item	Description
Target device	78K0/KB1 (μPD780103 Subseries): μPD780101, 780102, 780103, 78F0103 78K0/KC1 (μPD780114 Subseries): μPD780111, 780112, 780113, 780114, 78F0114 78K0/KD1 (μPD780124 Subseries): μPD780121, 780122, 780123, 780124, 78F0124 78K0/KE1 (μPD780138 Subseries): μPD780131, 780132, 780133, 780134, 780136, 780138, 78F0134, 78F0138 78K0/KF1 (μPD780148 Subseries): μPD780143, 780144, 780146, 780148, 78F0148 78K0/KB1+ (μPD780103 Subseries): μPD78F0101H, 78F0102H, 78F0103H 78K0/KC1+ (μPD780114 Subseries): μPD78F0112H, 78F0113H, 78F0114H 78K0/KD1+ (μPD780124 Subseries): μPD78F0122H, 78F0123H, 78F0124H 78K0/KE1+ (μPD780138 Subseries): μPD78F0132H, 78F0133H, 78F0134H, 78F0136H, 78F0138H 78K0/KF1+ (μPD780148 Subseries): μPD78F0148H
System clock	Ring-OSC: 240 kHz Main system clock: MAX. 10.0 MHz (when emulating 78K0/Kx1) MAX. 12.0 MHz (when emulating 78K0/Kx1+) Subsystem clock: 32.768 kHz (no subsystem clock for μPD78010x, μPD78F0103, μPD78F0103H, and μPD78F010xH)
Clock supply	External: Pulse input Internal: Mounted on the emulation board
Low voltage support	2.5 to 5.5 V (less than 2.5 V is not supported)

CHAPTER 2   PART NAMES

This chapter introduces the parts of the IE-780148-NS-EM1 main unit.

The packing box contains the emulation board (IE-780148-NS-EM1), probe conversion board, two jumper pins, packing list, user's manual, and guarantee card.

If there are any missing or damaged items, please contact an NEC Electronics sales representative.

Fill out and return the guarantee card that comes with the main unit.

2.1 Parts of Main Unit

Figure 2-1. IE-780148-NS-EM1 Part Names
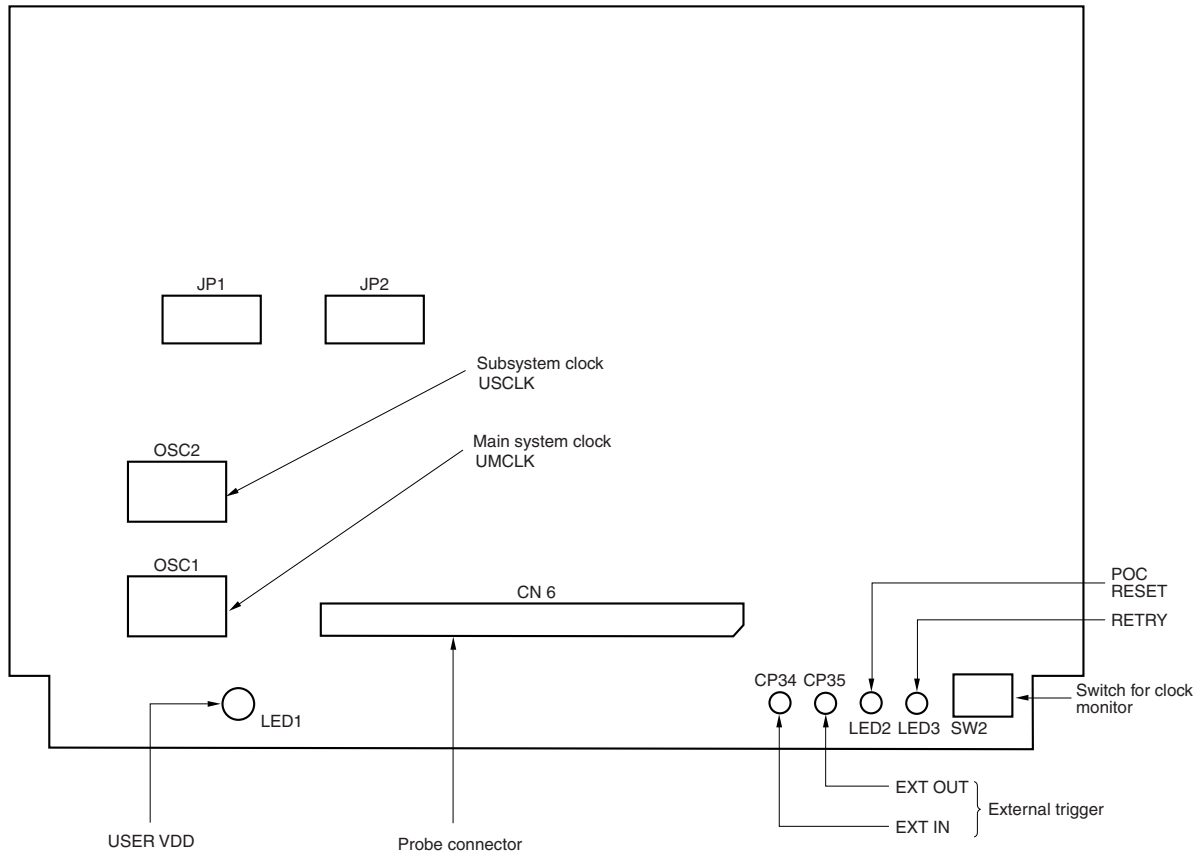
Figure 2-2. Probe Conversion Board
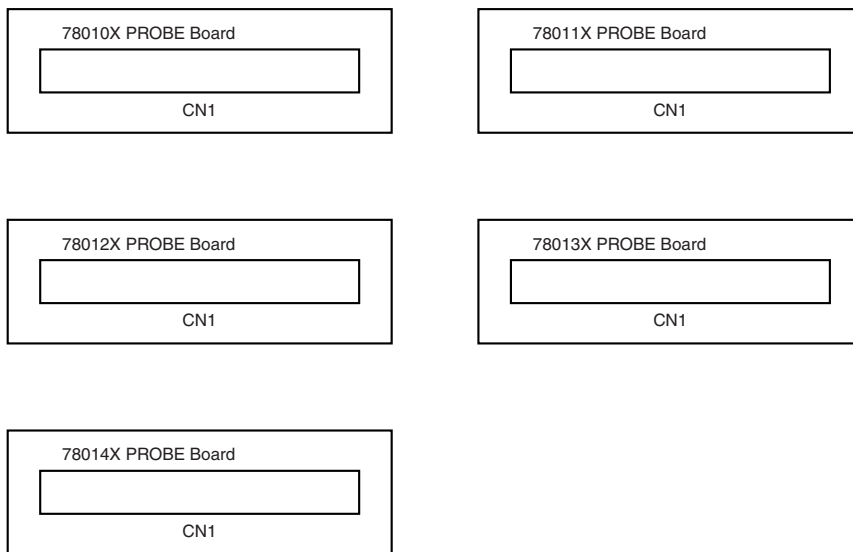
CHAPTER 3   INSTALLATION

This chapter describes methods for connecting the IE-780148-NS-EM1 to the IE-78K0-NS or IE-78K0-NS-A, emulation probe, etc. Mode setting methods are also described.

Caution   **Connecting or removing components to or from the target system, or making switch or other setting changes must be carried out after the power supply to both the IE system and the target system has been switched OFF.**

3.1 Connection

(1) Connection with IE-78K0-NS or IE-78K0-NS-A main unit

See the **IE-78K0-NS User's Manual (U13731E)** for a description of how to connect the IE-780148-NS-EM1 to the IE-78K0-NS.

See the **IE-78K0-NS-A User's Manual (U14889E)** for a description of how to connect the IE-780148-NS-EM1 to the IE-78K0-NS-A.

(2) Connection with emulation probe

Use the probe conversion board corresponding to the used emulation probe.

Connect CN2 of the probe conversion board to CN6 of the IE-780148-NS-EM1 when using the probe conversion board.

Connect CN1 of the probe conversion board to the emulation probe.

Use the probe conversion board corresponding to the target device listed in Table 3-1.

Caution **Incorrect connection may damage the IE system.**
Be sure to read the emulation probe's user's manual for a detailed description of the connection method.

Figure 3-1. Connection of Emulation Probe

Emulation probe
(sold separately)

Probe conversion board
78010X PROBE Board,
78011X PROBE Board,
78012X PROBE Board,
78013X PROBE Board,
78014X PROBE Board

CN1

IE-780148-NS-EM1

Main board of
IE-78K0-NS (sold separately) or
IE-78K0-NS-A (sold separately)
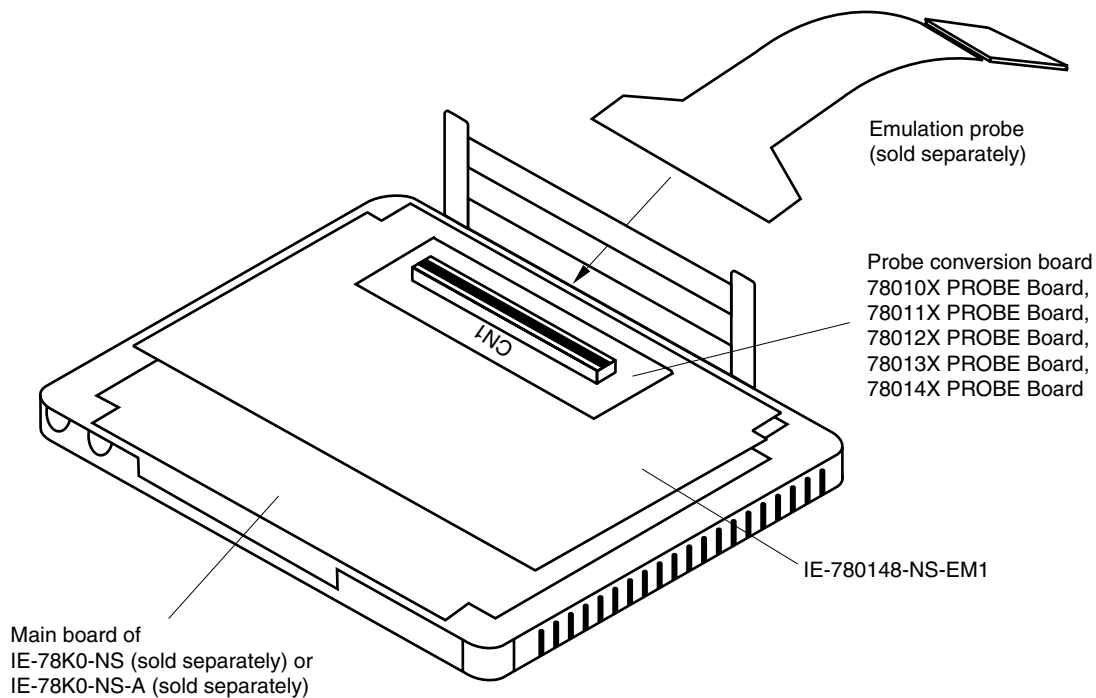
Table 3-1. Correspondence Between Target Device and Probe Conversion Board

Target Device	Probe Conversion Board to Be Used
μPD780101, 780102, 780103, 78F0103, 78F0101H, 78F0102H, 78F0103H	78010X PROBE Board
μPD780111, 780112, 780113, 780114, 78F0114, 78F0112H, 78F0113H, 78F0114H	78011X PROBE Board
μPD780121, 780122, 780123, 780124, 78F0124, 78F0122H, 78F0123H, 78F0124H	78012X PROBE Board
μPD780131, 780132, 780133, 780134, 780136, 780138, 78F0134, 78F0138, 78F0132H, 78F0133H, 78F0134H, 78F0136H, 78F0138H	78013X PROBE Board
μPD780143, 780144, 780146, 780148, 78F0148, 78F0148H	78014X PROBE Board

3.2 Clock Settings

3.2.1 Overview of clock settings

The main system clock to be used during debugging can be selected from (1) to (4) below. The subsystem clock to be used during debugging can be selected from (1) to (3) below.

(1) Clock that is already mounted on emulation board
(2) Clock that is mounted by user
(3) Pulse input from target system
(4) Ring-OSC

If the target system includes a clock oscillator, select either **(1) Clock that is already mounted on emulation board, (2) Clock that is mounted by user**, or **(4) Ring-OSC**. For the clock oscillator, a resonator is connected to the target device and the target device's internal oscillator is used. An example of the external circuit is shown in part (a) of Figure 3-2. During emulation, the oscillator that is mounted on the target system is not used. Instead, the clock that is mounted on the emulation board installed in the IE-78K0-NS or IE-78K0-NS-A is used.

If the target system includes an external clock, select either **(1) Clock that is already mounted on emulation board**, **(2) Clock that is mounted by user**, **(3) Pulse input from target system**, or **(4) Ring-OSC**. For the external clock, a clock signal is supplied from outside of the target device and the target device's internal oscillator is not used. An example of the external circuit is shown in part (b) of Figure 3-2.

Caution　**The IE system will hang up if the main system clock is not supplied normally. Moreover, be sure to input a rectangular wave as the clock from the target. There is no need to supply a clock to the X2 and XT2 pins. Also, even if a crystal resonator is connected directly to X1 (for the main system clock) or XT1 (for the subsystem clock), the target device will not operate.**

Figure 3-2. External Circuits Used as System Clock Oscillator

(a) Clock oscillator　　　　　　　　**(b) External clock**
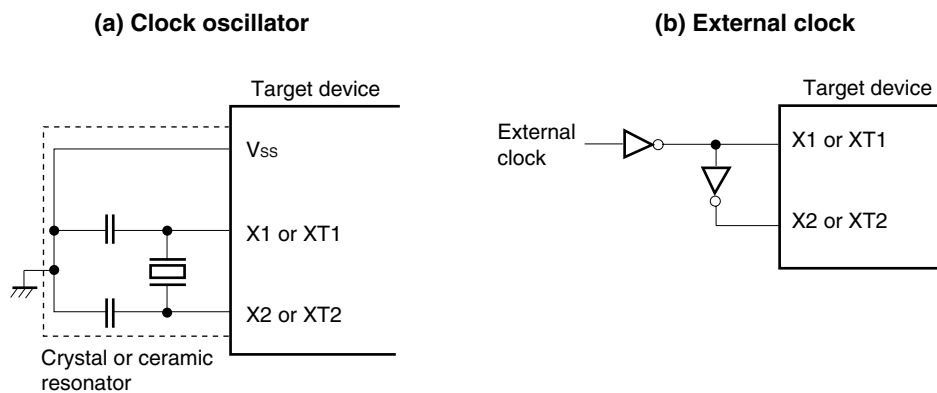
(1) Clock that is already mounted on emulation board

(a) For main system clock
A crystal oscillator (UMCLK) is already mounted on the emulation board. Its frequency is 10.0 MHz.

Figure 3-3. When Using Clock That Is Already Mounted on Emulation Board (Main System Clock)
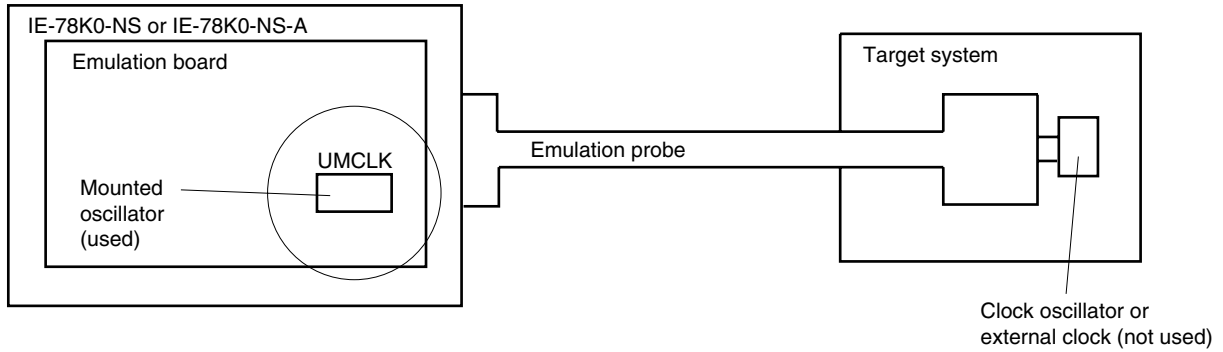
> **Remark** The clock that is supplied by the IE-780148-NS-EM1's oscillator (encircled in the figure) is used.

(b) For subsystem clock
A crystal resonator (USCLK) is already mounted on the emulation board. Its frequency is 32.768 kHz.

Figure 3-4. When Using Clock That Is Already Mounted on Emulation Board (Subsystem Clock)
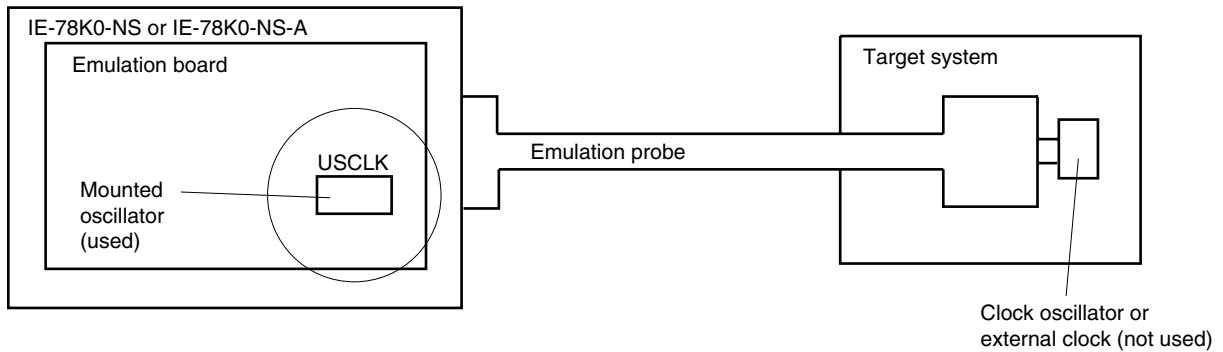
> **Remark** The clock that is supplied by the IE-780148-NS-EM1's resonator (encircled in the figure) is used.

(2) Clock that is mounted by user

The user is able to mount any clock supported by the set specifications on the IE-780148-NS-EM1.

(a) For main system clock

Remove the crystal oscillator (UMCLK) that is already mounted on the emulation board, and mount either the parts board on which the resonator to be used is mounted or an oscillator. This method is useful when using a different frequency from that of the pre-mounted clock.

Figure 3-5. When Using User-Mounted Clock (Main System Clock)
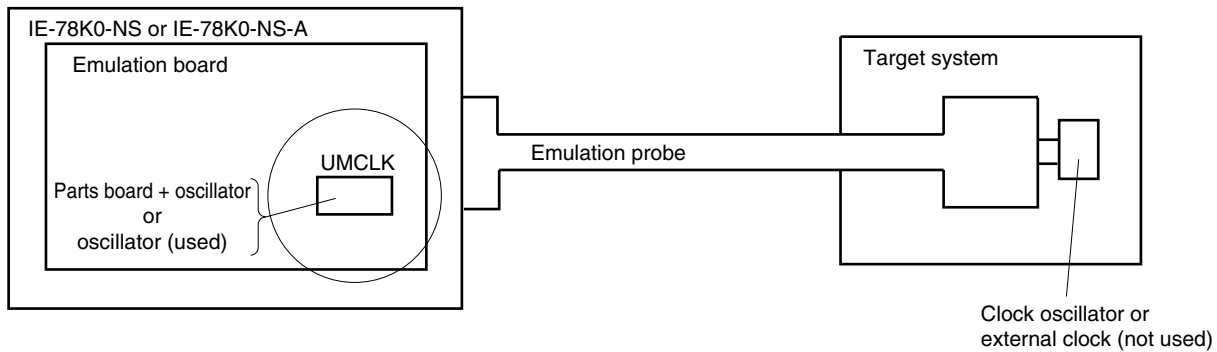
Remark The clock that is supplied by the IE-780148-NS-EM1's resonator or oscillator (encircled in the figure) is used.

(b) For subsystem clock

Mount the resonator to be used on the parts board (USCLK) that is already mounted on the emulation board. Alternatively, remove the parts board and mount an oscillator.

Figure 3-6. When Using User-Mounted Clock (Subsystem Clock)
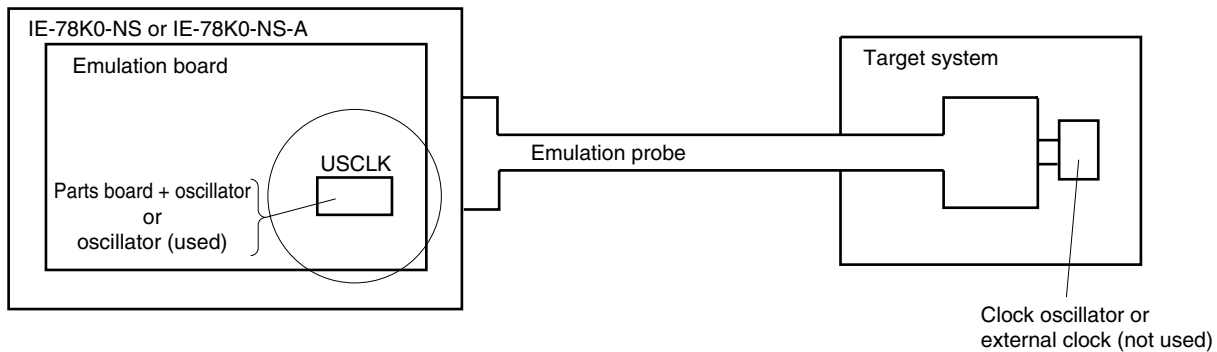
Remark The clock that is supplied by the IE-780148-NS-EM1's resonator or oscillator (encircled in the figure) is used.

(3) Pulse input from target system

The external clock on the target system can be used via an emulation probe.

Figure 3-7. When Using External Clock
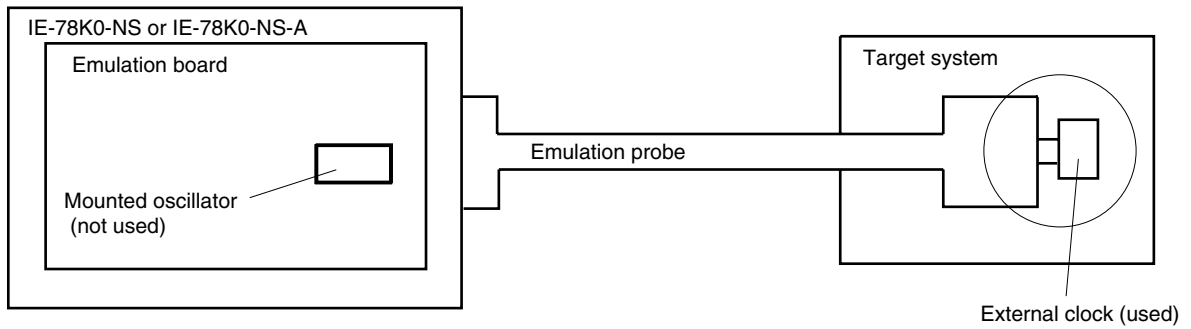
Remark   The clock supplied by the target system's external clock (encircled in the figure) is used.

(4) Ring-OSC

Ring-OSC on the emulation board can be used.

Figure 3-8. When Using Ring-OSC
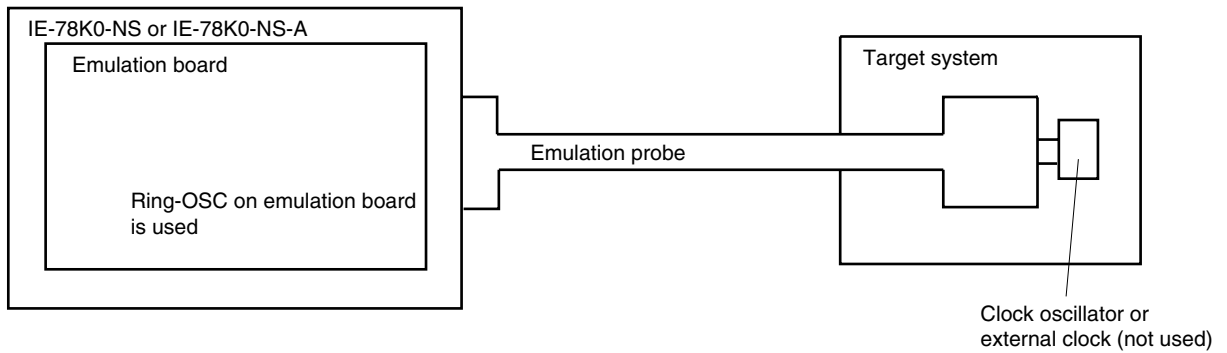
3.2.2 Main system clock settings

Table 3-2. Main System Clock Settings

Frequency of Main System Clock		SFR Register MCM0	IE-780148-NS-EM1 UMCLK Socket	CPU Clock Source Selection[Note 2] (ID78K0-NS)
(1) When using clock that is already mounted on emulation board	10.0 MHz	1	Oscillator	Internal
(2) When using clock mounted by user	Other than 10.0 MHz		Oscillator assembled by user	
(3) When inputting pulse from target system			Oscillator (not used)	External
(4) When using Ring-OSC[Note 1]	240 kHz	0		Internal or external

Notes 1. The IE-780148-NS-EM1 operates with the Ring-OSC clock when the integrated debugger is started and immediately after reset.

2. Select the source clock for the main system clock when the integrated debugger is started. After that, do not change the setting.

(1) When using clock that is already mounted on emulation board

When the IE-780148-NS-EM1 is shipped, a 10.0 MHz crystal oscillator is already mounted in the IE-780148-NS-EM1's UMCLK socket. When using the factory-set mode settings, there is no need to make any other hardware settings.

When starting the integrated debugger (ID78K0-NS), open the configuration dialog box and select "Internal" in the area (Clock) for selecting the CPU's clock source (this selects the emulator's internal clock).

After the integrated debugger is started, if the SFR register MCM0 is changed to 1, the CPU operating clock is switched from Ring-OSC to the clock already mounted on the emulation board.

(2) When using clock mounted by user

Perform the settings described under either (a) or (b), depending on the type of clock to be used.

When starting the integrated debugger (ID78K0-NS), open the configuration dialog box and select "Internal" in the area (Clock) for selecting the CPU's clock source (this selects the emulator's internal clock).

After the integrated debugger is started, if the SFR register MCM0 is changed to 1, the CPU operating clock is switched from Ring-OSC to the clock mounted by user.

(a) When using a ceramic resonator or crystal resonator

- Items to be prepared
  - Parts board
  - Ceramic resonator or crystal resonator
  - Resistor Rx
  - Capacitor CA
  - Capacitor CB
  - Solder kit

<Steps>

<1> Solder the target ceramic resonator or crystal resonator and resistor Rx, capacitor CA, and capacitor CB (all with suitable oscillation frequencies) as shown below.

Figure 3-9. Connections on Parts Board (When Using Main System Clock or User-Mounted Clock)

Parts board (UMCLK)
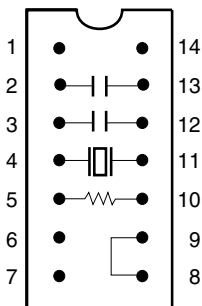
Pin No.	Connection
2-13	Capacitor CA
3-12	Capacitor CB
4-11	Ceramic resonator or crystal resonator
5-10	Resistor Rx
8-9	Shorted

Circuit diagram
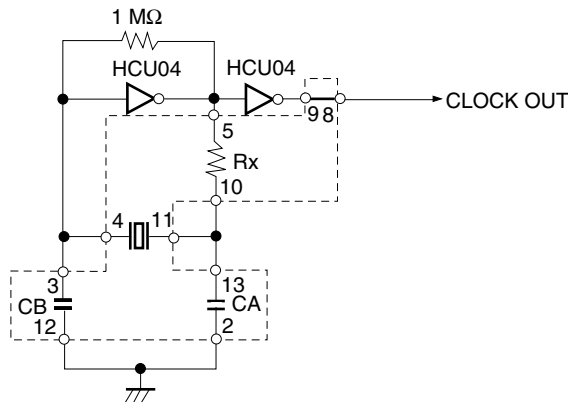
Remark   The sections enclosed in broken lines indicate parts that are attached to the parts board.

<2> Prepare the IE-780148-NS-EM1.

<3> Remove the crystal oscillator that is mounted in the IE-780148-NS-EM1's UMCLK socket.

<4> Connect the parts board (from <1> above) to the UMCLK socket from which the crystal oscillator was removed. Check the pin 1 mark to make sure the board is mounted in the correct direction.

<5> Make sure that the parts board is wired as shown in Figure 3-9 above.

<6> Install the IE-780148-NS-EM1 in the IE-78K0-NS or IE-78K0-NS-A.

The above steps configure the following circuit and enable supply of the clock from the mounted resonator to the emulation device.
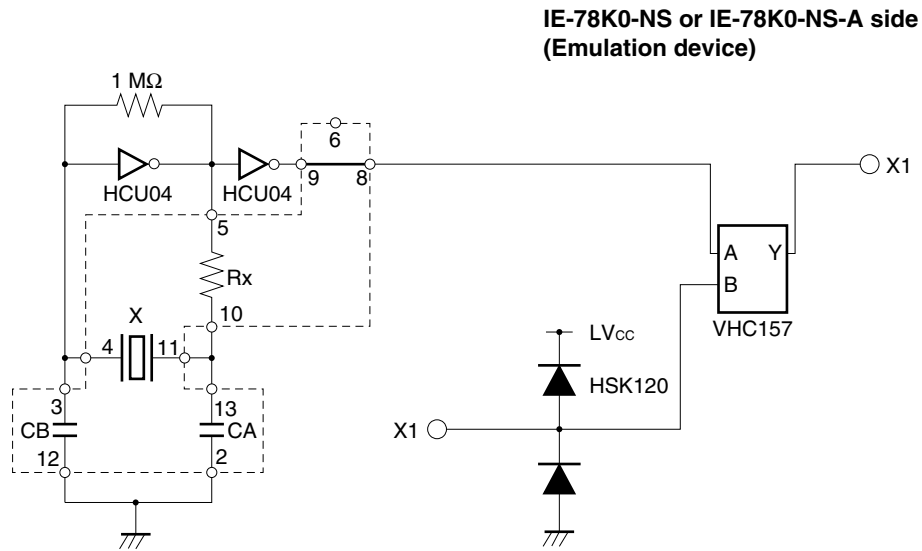
Remark The sections enclosed in broken lines indicate parts that are attached to the parts board.

(b) When using a crystal oscillator

- Items to be prepared
  - Crystal oscillator (see pins shown in Figure 3-10)

Figure 3-10. Crystal Oscillator (When Using Main System Clock or User-Mounted Clock)

```
NC  ●        ●  Vcc




GND ●        ●  CLOCK OUT
```
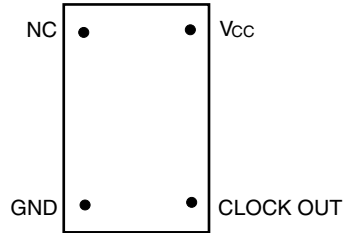
<Steps>
<1> Prepare the IE-780148-NS-EM1.
<2> Remove the crystal oscillator that is mounted in the IE-780148-NS-EM1's UMCLK socket.
<3> Mount the crystal oscillator prepared by the user in the UMCLK socket from which the crystal oscillator was removed in <2> above. Insert the crystal oscillator into the socket aligning the pins as shown in the figure below.

Figure 3-11. Pin Alignment of Crystal Oscillator and Socket
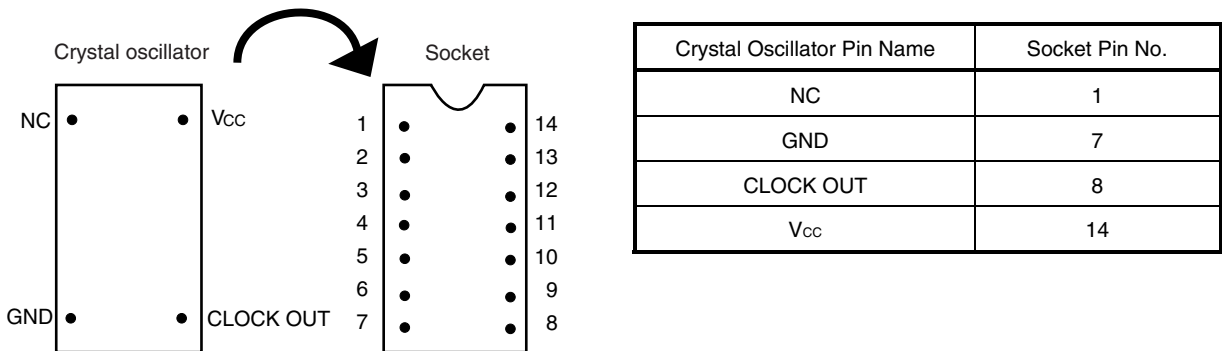
Crystal Oscillator Pin Name	Socket Pin No.
NC	1
GND	7
CLOCK OUT	8
Vcc	14

<4> Install the IE-780148-NS-EM1 in the IE-78K0-NS or IE-78K0-NS-A.

The above steps configure the following circuit and enable supply of the clock from the mounted resonator to the emulation device.
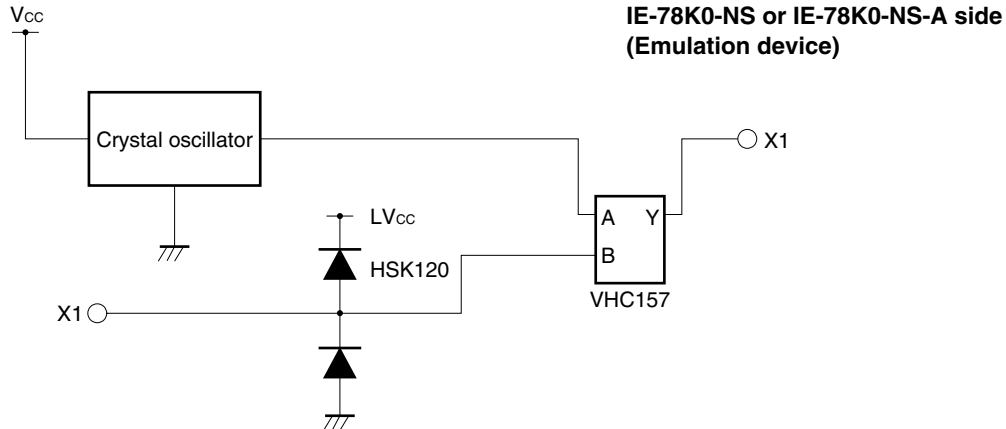
(3) When inputting pulse from target system

No hardware settings are required for this situation.

When starting the integrated debugger (ID78K0-NS), open the configuration dialog box and select "External" in the area (Clock) for selecting the CPU's clock source (this selects the user's clock).

After the integrated debugger is started, if "X1orRC" is selected for the mask option SystemClock in the Mask Option dialog box and the SFR register MCM0 is changed to 1, the CPU operating clock is switched from Ring-OSC to the external clock.

(4) When using Ring-OSC

Ring-OSC (240 kHz) is selected as the CPU operating clock when the IE system is activated.

See **3.2.2 (1)** to **(4)** when changing the setting.

Caution   Use of the peripheral functions, except for the following cases, is prohibited when Ring-OSC is selected as the CPU operating clock (MCM0 = 0).

- **When watchdog timer is used**
- **When clock monitor is used**
- **TMH1 (When $fosc/2^7$ is selected for the count clock (CKS12 = 1, CKS11 = 0, CKS10 = 1))**
- **When peripheral function that uses an external clock as the operating clock is used**

3.2.3 Subsystem clock settings

Table 3-3. Subsystem Clock Settings

Frequency of Subsystem Clock to Be Used		IE-780148-NS-EM1	IE-78K0-NS or IE-78K0-NS-A
		USCLK Socket	JP8
(1) When using clock (XT1) that is already mounted on emulation board	32.768 kHz	6 and 8 shorted[Note]	Short 1 and 2 side
(2) When using clock mounted by user	Other than 32.768 kHz	Oscillator assembled by user	
(3) When inputting pulse from target system or when target device is 78K0/KB1 or 78K0/KB1+ (μPD780103 Subseries)		Not used	Short 3 and 4 side

Note   For the Ver. 1.x board, the oscillator is mounted on the parts board (USCLK).
For the Ver. 2.x board, short 6 and 8 because the oscillator is mounted on the board.

Remark   When the IE-780148-NS-EM1 is shipped, the settings for "when using clock that is already mounted on emulation board" are preset.

(1) When using clock that is already mounted on emulation board
When the IE-780148-NS-EM1 is shipped, a 32.768 kHz crystal resonator and the parts board (USCLK) on which pins 6 and 8 are shorted are already mounted on the IE-780148-NS-EM1. Short the 1 and 2 side of the jumper (JP8) on the IE-78K0-NS or IE-78K0-NS-A. There is no need to make any other settings via the integrated debugger (ID78K0-NS).

(2) When using the clock mounted by user
Perform the settings described under either (a) or (b), depending on the type of clock to be used. Short the 1 and 2 side on the jumper (JP8) of the IE-78K0-NS or IE-78K0-NS-A.
For the jumper position, refer to the **IE-78K0-NS User's Manual (U13731E)** when using the IE-78K0-NS, and refer to the **IE-78K0-NS-A User's Manual (U14889E)** when using the IE-78K0-NS-A.
There is no need to make any other settings via the integrated debugger (ID78K0-NS).

(a) When using a ceramic resonator or crystal resonator

- Items to be prepared
  - Parts board
  - Ceramic resonator or crystal resonator
  - Resistor Rx
  - Capacitor CA
  - Capacitor CB
  - Solder kit

<Steps>
<1> Prepare the IE-780148-NS-EM1.
<2> Solder the ceramic resonator or crystal resonator, resistor Rx, capacitor CA, and capacitor CB (all with suitable oscillation frequencies) onto the parts board (USCLK) (as shown below).

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Figure 3-12. Connections on Parts Board (When Using Subsystem Clock or User-Mounted Clock)

Parts board (USCLK)
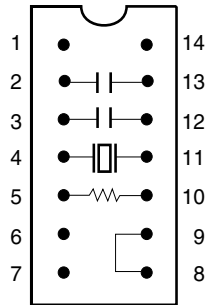
| Pin No.	Connection
2-13	Capacitor CA
3-12	Capacitor CB
4-11	Ceramic resonator or crystal resonator
5-10	Resistor Rx
8-9	Shorted

Circuit diagram
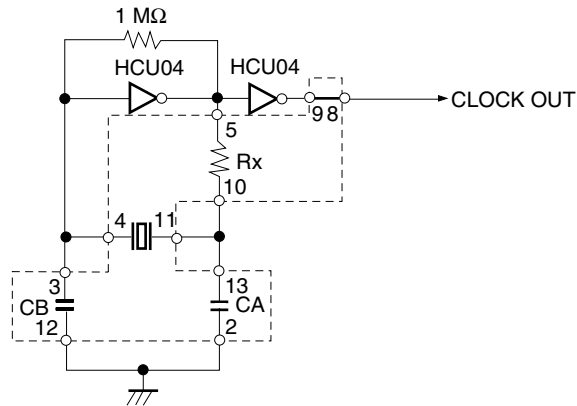
Remark The sections enclosed in broken lines indicate parts that are attached to the parts board.

<3> Make sure that the parts board (USCLK) is wired as shown in Figure 3-12.

<4> Remove the parts board that is mounted in the IE-780148-NS-EM1's USCLK socket.

<5> Connect the parts board from <2> above to the USCLK socket from which the parts board (from <4> above) was removed. Check the pin 1 mark to make sure the board is mounted in the correct direction.

<6> Install the IE-780148-NS-EM1 in the IE-78K0-NS or IE-78K0-NS-A.

The above steps configure the following circuit and enable supply of the clock from the mounted resonator to the emulation device.
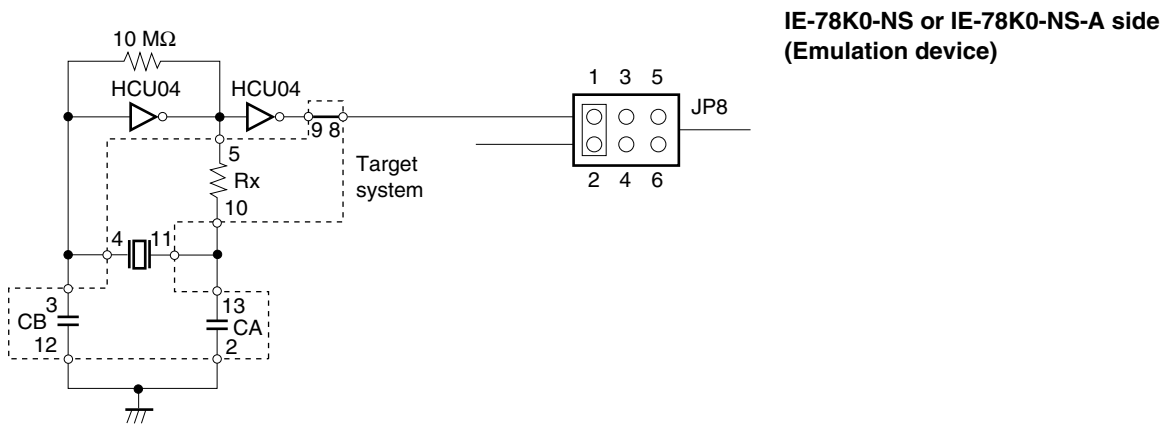

Remarks 1. The sections enclosed in broken lines indicate parts that are attached to the parts board.

2. JP8 is on the IE-78K0-NS or IE-78K0-NS-A.

(b) When using a crystal oscillator

- Items to be prepared
 - Crystal oscillator (see pinouts shown in Figure 3-13)

Figure 3-13. Crystal Oscillator (When Using Subsystem Clock or User-Mounted Clock)
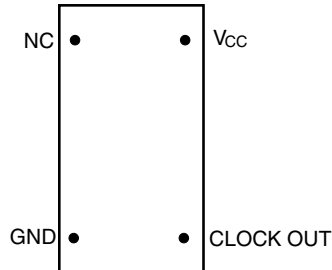

<Steps>
<1> Prepare the IE-780148-NS-EM1.
<2> Remove the parts board that is mounted in the IE-780148-NS-EM1's USCLK socket.
<3> Mount the crystal oscillator prepared by the user in the USCLK socket from which the parts board was removed in <2> above. Insert the crystal oscillator into the socket aligning the pins as shown in the figure below.

Figure 3-14. Pin Alignment of Crystal Oscillator and Socket
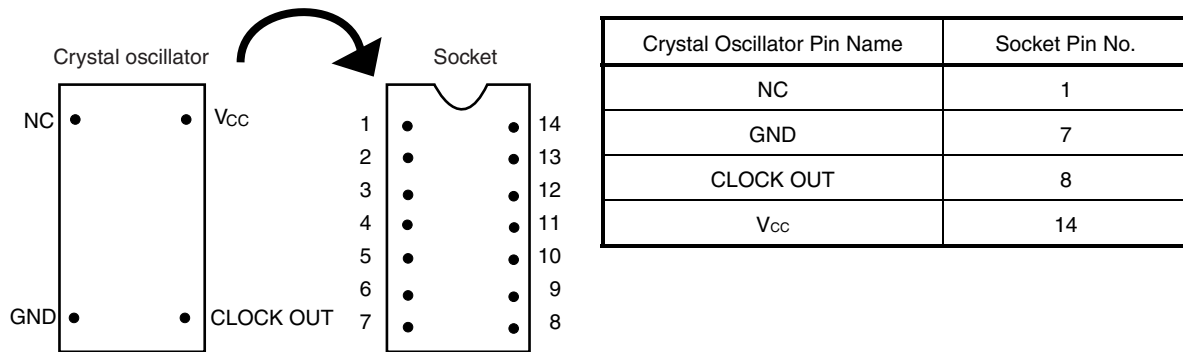
Crystal Oscillator Pin Name	Socket Pin No.
NC	1
GND	7
CLOCK OUT	8
V$_{CC}$	14

<4> Install the IE-780148-NS-EM1 in the IE-78K0-NS or IE-78K0-NS-A.

The above steps configure the following circuit and enable supply of the clock from the mounted oscillator to the emulation device.

IE-78K0-NS or IE-78K0-NS-A side (Emulation device)
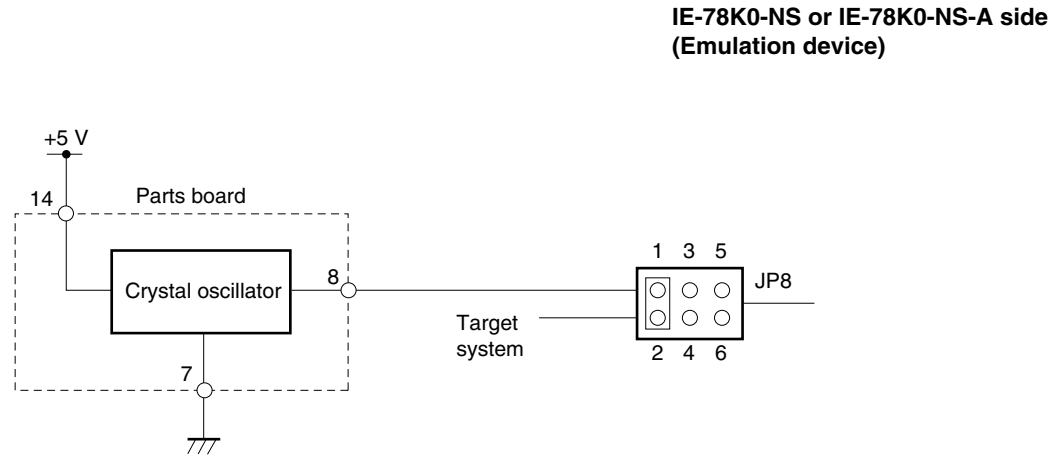
Remarks **1.** The sections enclosed in broken lines indicate the parts that are attached to the parts board.
2. JP8 is on the IE-78K0-NS or IE-78K0-NS-A.

(3) When inputting pulse from target system or when target device is 78K0/KB1 or 78K0/KB1+ (μPD780103 Subseries)
Short the 3 and 4 side on the jumper (JP8) of the IE-78K0-NS or IE-78K0-NS-A.
There is no need to make any settings via the integrated debugger (ID78K0-NS).

3.3 Mask Options

The following mask options are provided in the IE-780148-NS-EM1.

(a) For target device 78K0/Kx1
- Ring-OSC
- POC ON/OFF and detection voltage 2.85 V, 3.5 V
- P60 to P63 (no setting for μPD780101/102/103 and μPD78F0103 since they do not have this port)

Open the Mask Option dialog box in the integrated debugger by selecting [Mask Option] on the [Option] menu to set the mask options.
See the **ID78K0-NS Ver. 2.52 Integrated Debugger Operation User's Manual (U16488E)** for details of the settings.

- RINGMSK   NONMSK   Ring-OSC can be stopped by software
                                                   Watchdog timer can be stopped
                          MSK   Ring-OSC cannot be stopped by software
                                                     Watchdog timer cannot be stopped

- POC   ON   POC function ON
                          OFF   POC function OFF

• POCV   2.85 V   POC detection voltage 2.85 V

               3.5 V   POC detection voltage 3.5 V

• P60 to P63   ON   Pulled up by mask option resistor

               OFF   No mask option resistor

(b) For target device 78K0/Kx1+

    • Ring-OSC

Open the Mask Option dialog box in the integrated debugger by selecting [Mask Option] on the [Option] menu to set the mask options.

See the **ID78K0-NS Ver. 2.52 Integrated Debugger Operation User's Manual (U16488E)** for details of the settings.

• RINGMSK   NONMSK   Ring-OSC can be stopped by software

                        Watchdog timer can be stopped

               MSK   Ring-OSC cannot be stopped by software

                        Watchdog timer cannot be stopped

    Caution   **When emulating the 78K0/Kx1+, although "78K0Kx1plus" is displayed on the Mask Option dialog box, no setting is required.**

3.4 Emulation of POC and LVI Functions

When emulating the POC and LVI functions using the IE-780148-NS-EM1, supply a voltage of the same potential as the V_{DD} pin of the emulation device to TP1, because POC and LVI power supply detection is performed via input from TP1 on the G-780009 BOARD of the IE-78K0-NS or IE-78K0-NS-A, not from the V_{DD} pin of the target device.

See the **IE-78K0-NS User's Manual (U13731E)** or **IE-78K0-NS-A User's Manual (U14889E)** for details of the connection with TP1.

In addition, LED2 is provided for confirming a POC reset. For details, see **3.9 LED2 and LED3**.

3.5   External Trigger

To set an external trigger, connect the IE-780148-NS-EM1's check pins EXTOUT and EXTIN as shown below.

See the **IE-78K0-NS User's Manual (U13731E)** or **IE-78K0-NS-A User's Manual (U14889E)** for pin characteristics.

For the use methods, see the **ID78K0-NS Ver. 2.52 Operation User's Manual (U16488E)**.

(1) EXTOUT

The EXTOUT pin on the IE-780148-NS-EM1 outputs a low level for 1.3 μs when a break event occurs.

Caution   Connect a pull-up resistor on the target system because this is an open drain output.

(2) EXTIN

An event signal can be input from the EXTIN pin on the IE-780148-NS-EM1. Input a high-level pulse signal for 2 CPU operation clocks or more.

Figure 3-15. External Trigger Input Position
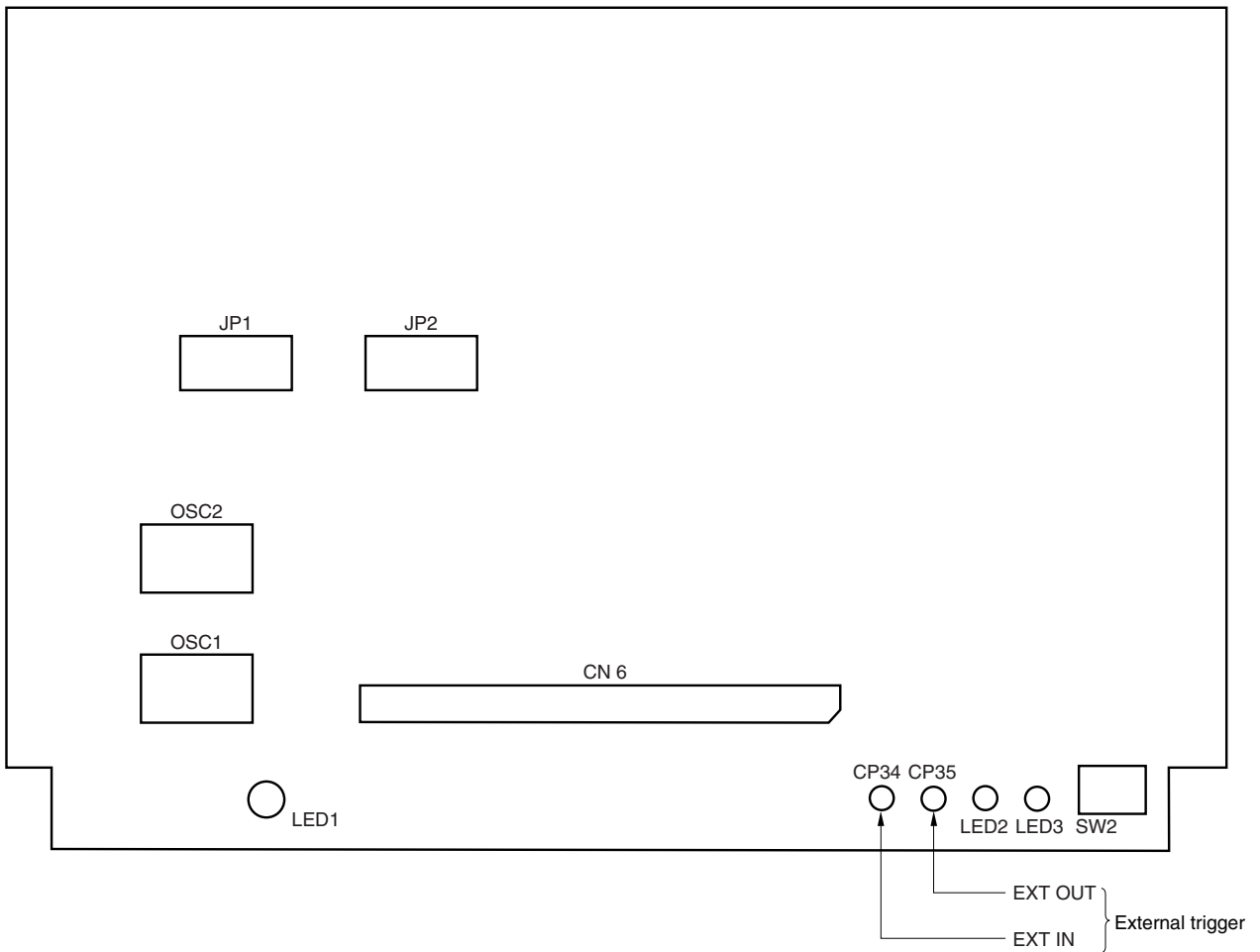
3.6 Jumper Settings on IE-780148-NS-EM1

Set the IE-780148-NS-EM1 jumpers as shown in the table below.

Setting of multiplication circuit
Change the settings of the multiplication circuit as shown in Table 3-4 according to the operating frequency of the main system clock.

Table 3-4. Settings of Multiplication Circuit

Main System Clock Frequency	JP1	JP2
2.0 MHz to less than 2.5 MHz	1 and 2 shorted	1 and 2 shorted
2.5 MHz to less than 3.5 MHz	3 and 4 shorted	3 and 4 shorted
3.5 MHz to less than 5.0 MHz	5 and 6 shorted	5 and 6 shorted
5.0 MHz to less than 6.5 MHz	7 and 8 shorted	7 and 8 shorted
6.5 MHz to less than 9 MHz	9 and 10 shorted	9 and 10 shorted
9 MHz to 10.0 MHz (shipment setting)	11 and 12 shorted	11 and 12 shorted
10 MHz to 12 MHz	9 and 10 shorted 11 and 12 shorted	9 and 10 shorted 11 and 12 shorted

Figure 3-16. Initial Settings of JP1 and JP2
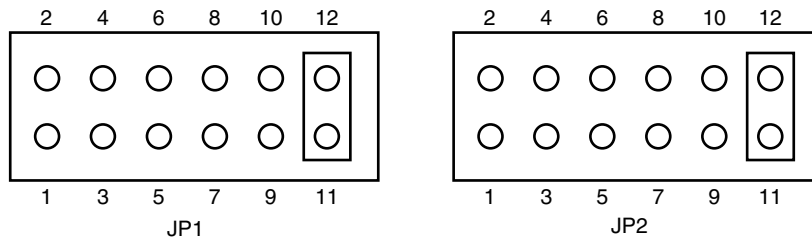
3.7 Switch for Clock Monitor

A switch for clock monitor emulation (SW2) is mounted on the IE-780148-NS-EM1 board.
Emulation for when the clock is stopped can be performed by pressing SW2.

3.8   Jumper Settings on IE-78K0-NS

When using the IE-780148-NS-EM1 in combination with the IE-78K0-NS, set the jumpers on the IE-78K0-NS as shown below.

For details of these jumper positions, refer to the **IE-78K0-NS User's Manual (U13731E)** or **IE-78K0-NS-A User's Manual (U14889E)**.

Caution   An incorrect jumper setting may damage the device.

Table 3-5. Jumper Settings on IE-78K0-NS or IE-78K0-NS-A

(a) Target device is 78K0/KB1 and 78K0/KB1+ (μPD780103 Subseries)

	JP2	JP3	JP4	JP6	JP7	JP8
Setting	2 and 3 shorted	1 and 2 shorted	1 and 2 shorted	3 and 4 shorted	3 and 4 shorted	3 and 4 shorted

(b) Target device is other than 78K0/KB1 and 78K0/KB1+ (μPD780103 Subseries)

	JP2	JP3	JP4	JP6	JP7	JP8
Setting	2 and 3 shorted	1 and 2 shorted	1 and 2 shorted	3 and 4 shorted	3 and 4 shorted	1 and 2 shorted[Note 1] or 3 and 4 shorted[Note 2]

Notes 1. The subsystem clock is selected as the internal clock.
     2. The subsystem clock is selected as the external clock.

Table 3-6. Jumper Settings on IE-78K0-NS-A G-78K0H Option Board

	JP2
Setting	2 and 3 shorted

3.9 LED2 and LED3

The lighting specifications of LED2 (POC RESET) and LED3 (RETRY) are as follows.

LED2 (POC RESET)

This is an LED for confirming a POC reset.

LED2 is lit during the reset shown below. Do not set a break when LED2 is lit; otherwise the integrated debugger ID78K0-NS will hang up.

• Internal reset by comparing the power supply voltage and detection voltage of the POC circuit
• Internal reset by comparing the power supply voltage and detection voltage of the low-voltage detector (LVI)
• Clock monitor reset by pressing the switch for clock monitor emulation (SW2)

LED3 (RETRY)

This is an LED for confirming wait (retry) occurrence.

LED3 is lit when a wait occurs. The wait shown in LED3 is a wait that occurs during repetitive access due to an access conflict between the CPU bus and the peripheral bus of the internal system bus, similar to the target device specifications.

3.10 Low-Voltage Emulation Setting

When the target system is operating on low voltage, supply the same voltage as the target system to the TP1 terminal pin on the main board (G-780009 board) of the IE-78K0-NS or IE-78K0-NS-A (this is unnecessary when target system is operating on 5 V).

Set the supply voltage of the target system to between 2.5 to 5.5 V.

Caution   To emulate at 4.5 V or lower, first start at 5 V, and then lower the target system voltage.

Table 3-7. Supply Voltage and Maximum Current Consumption

Supply Voltage to TP1	Maximum Current Consumption of TP1
2.5 to 5.5 V	300 mA

Figure 3-17. Main Board (G-780009 Board) of IE-78K0-NS or IE-78K0-NS-A

TP1

GND V$_{CC}$

Dedicated bus interface connector
(HOST-I/F)
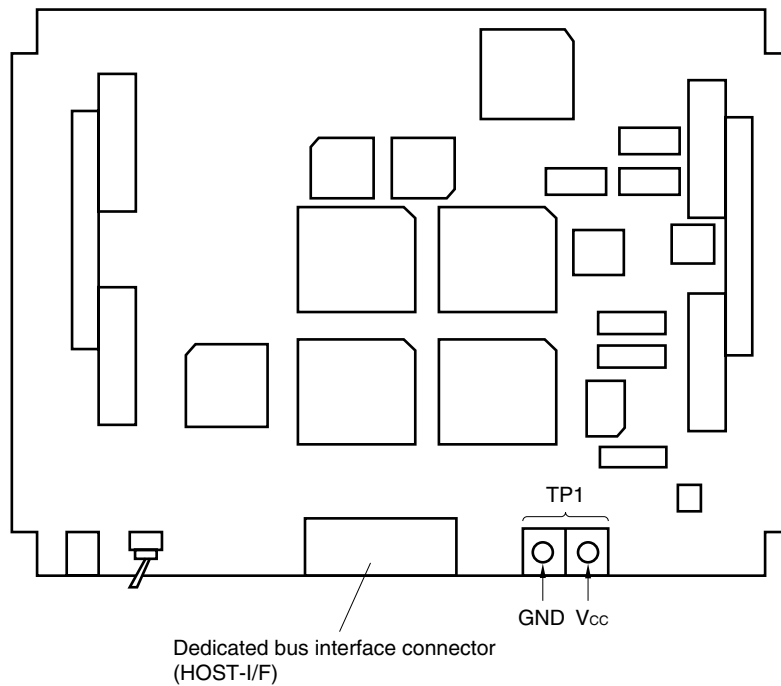
CHAPTER 4 DIFFERENCES BETWEEN TARGET DEVICES AND TARGET INTERFACE CIRCUITS

This chapter describes differences between the target device's signal lines and the signal lines of the IE-780148-NS-EM1's target interface circuit.

Although the target device is a CMOS circuit, the IE-780148-NS-EM1's target interface circuit consists of emulation circuits such as an emulation CPU, TTL, and CMOS-IC.

When the IE system is connected with the target system for debugging, the IE system performs emulation so as to operate as the actual target device would operate in the target system.

However, some minor differences exist since the operations are performed via the IE system's emulation.

(1) Signals input or output from the emulation CPU (μPD78F0148H)
(2) Signals input or output from the emulation CPU (μPD780009A)
(3) Other signals

The IE-780148-NS-EM1's circuit is used in each target device as follows for signals listed in (1) to (3) above.

4.1 When Emulating 78K0/KB1 and 78K0/KB1+

See **Figure 4-1 Equivalent Circuit of Emulation Circuit 1** for the signals listed in (1) to (3) below.

(1) Signals input or output from the emulation CPU (μPD78F0148H)

- P03 to P00
- P17 to P10
- P23 to P20
- P33 to P30
- P120
- P130
- AV$_{REF}$

(2) Signals input or output from the emulation CPU (μPD780009A)

None

(3) Other signals

- X1, X2, $\overline{\text{RESET}}$, V$_{DD}$, V$_{SS}$, AV$_{SS}$, IC/V$_{PP}$[Note]

Note In the case of 78K0/KB1+, the pin name is FLMD0.

Figure 4-1. Equivalent Circuit of Emulation Circuit 1 (1/3)

Figure 4-1. Equivalent Circuit of Emulation Circuit 1 (2/3)

Figure 4-1. Equivalent Circuit of Emulation Circuit 1 (3/3)

Note   In the case of 78K0/KB1+, the pin name is FLMD0.

4.2   When Emulating 78K0/KC1 and 78K0/KC1+

See **Figure 4-2 Equivalent Circuit of Emulation Circuit 2** for the signals listed in (1) to (3) below.

(1)   Signals input or output from the emulation CPU (μPD78F0148H)

- P01 to P00
- P17 to P10
- P27 to P20
- P33 to P30
- P73 to P70
- P120
- P130
- AV_{REF}

(2)   Signals input or output from the emulation CPU (μPD780009A)

- P63 to P60

(3)   Other signals

- X1, X2, XT1, XT2, $\overline{RESET}$, V_{DD}, V_{SS}, EV_{DD}, EV_{SS}, AV_{SS}, IC/V_{PP}[Note]

    Note   In the case of 78K0/KC1+, the pin name is FLMD0.

Figure 4-2. Equivalent Circuit of Emulation Circuit 2 (1/3)

Figure 4-2. Equivalent Circuit of Emulation Circuit 2 (2/3)

Figure 4-2. Equivalent Circuit of Emulation Circuit 2 (3/3)

Note In the case of 78K0/KC1+, the pin name is FLMD0.

4.3   When Emulating 78K0/KD1 and 78K0/KD1+

See **Figure 4-3 Equivalent Circuit of Emulation Circuit 3** for the signals listed in (1) to (3) below.

(1)   Signals input or output from the emulation CPU (μPD78F0148H)

- P03 to P00
- P17 to P10
- P27 to P20
- P33 to P30
- P77 to P70
- P120
- P130
- P140
- AV_{REF}

(2)   Signals input or output from the emulation CPU (μPD780009A)

- P63 to P60

(3)   Other signals

- X1, X2, XT1, XT2, $\overline{\text{RESET}}$, V_{DD}, V_{SS}, EV_{DD}, EV_{SS}, REGC, AV_{SS}, IC/V_{PP}[Note]

Note   In the case of 78K0/KD1+, the pin name is FLMD0.

Figure 4-3. Equivalent Circuit of Emulation Circuit 3 (1/3)
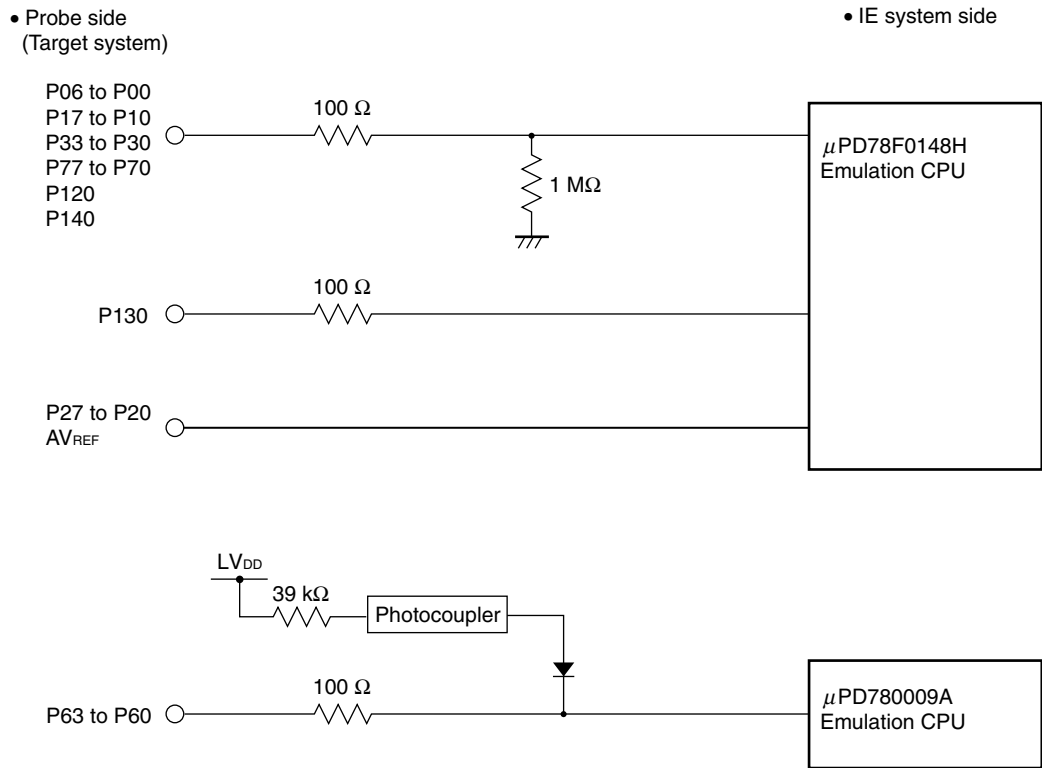
Figure 4-3. Equivalent Circuit of Emulation Circuit 3 (2/3)
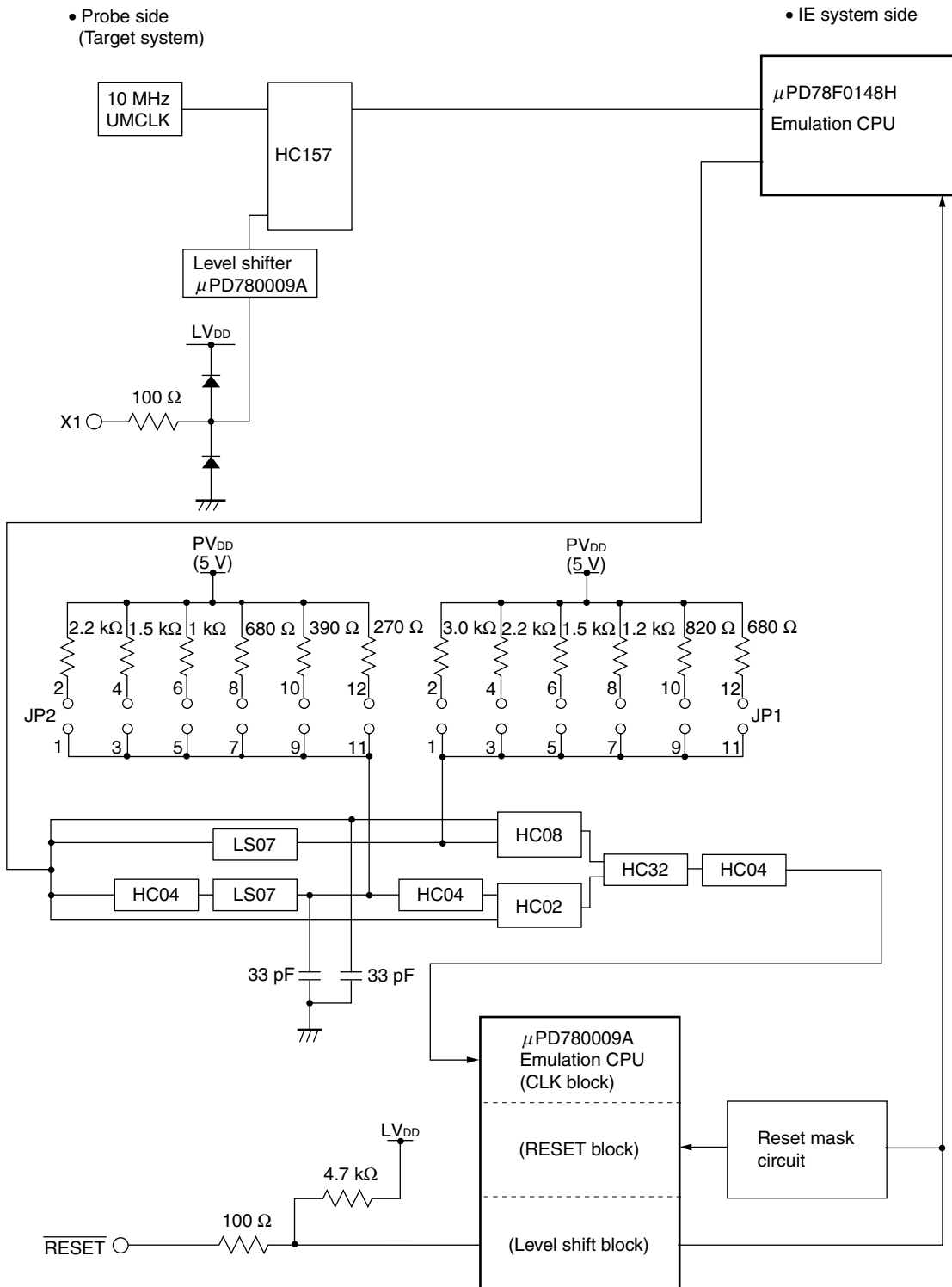
Figure 4-3. Equivalent Circuit of Emulation Circuit 3 (3/3)
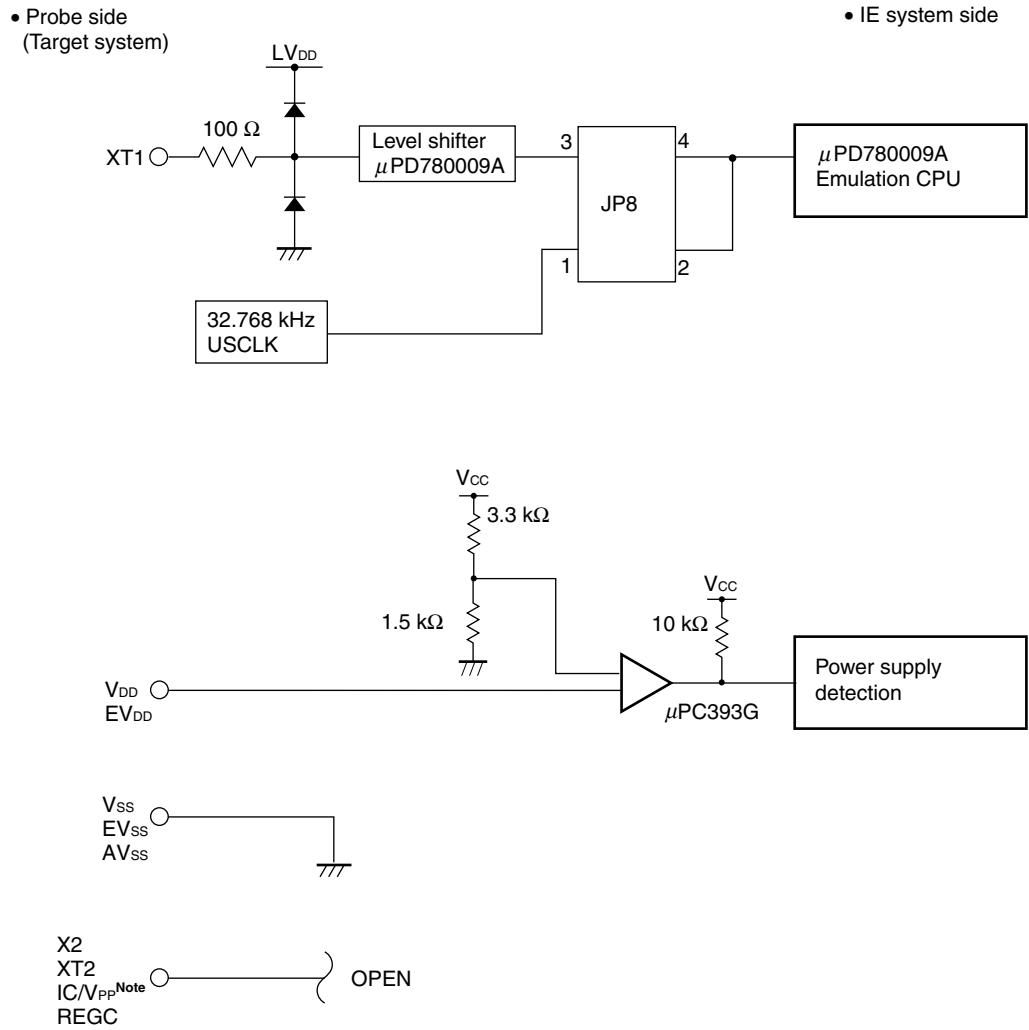
Note In the case of 78K0/KD1+, the pin name is FLMD0.

4.4 When Emulating 78K0/KE1 and 78K0/KE1+

See **Figure 4-4 Equivalent Circuit of Emulation Circuit 4** for the signals listed in (1) to (3) below.

(1) Signals input or output from the emulation CPU (μPD78F0148H)

- P06 to P00
- P17 to P10
- P27 to P20
- P33 to P30
- P77 to P70
- P120
- P130
- P141 to P140
- AV$_{REF}$

(2) Signals input or output from the emulation CPU (μPD780009A)

- P43 to P40
- P53 to P50
- P63 to P60

(3) Other signals

- X1, X2, XT1, XT2, $\overline{\text{RESET}}$, V$_{DD}$, V$_{SS}$, EV$_{DD}$, EV$_{SS}$, REGC, AV$_{SS}$, IC/V$_{PP}$[Note]

Note In the case of 78K0/KE1+, the pin name is FLMD0.

Figure 4-4. Equivalent Circuit of Emulation Circuit 4 (1/3)
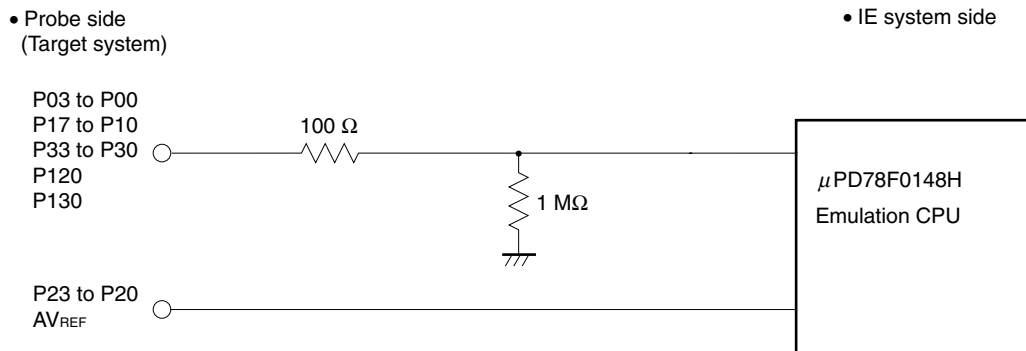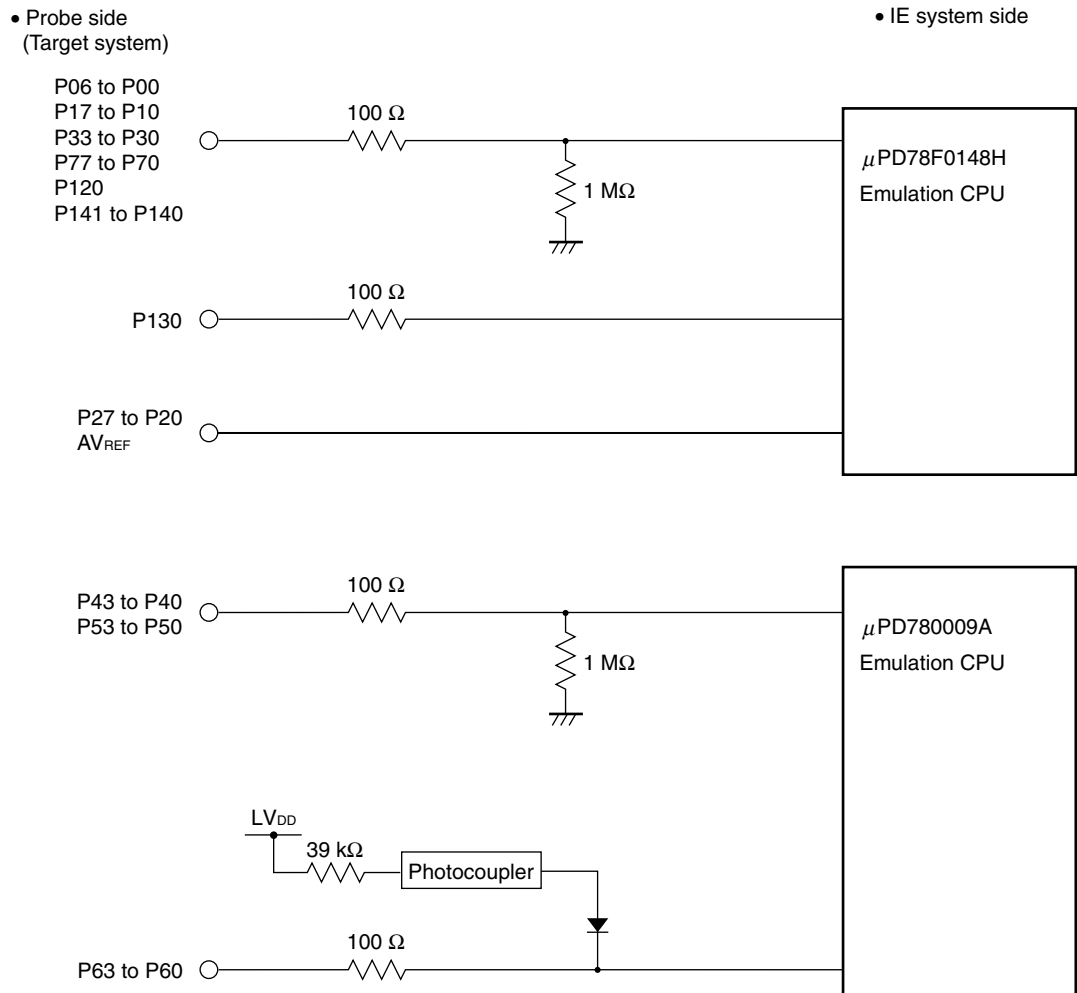
Figure 4-4. Equivalent Circuit of Emulation Circuit 4 (2/3)
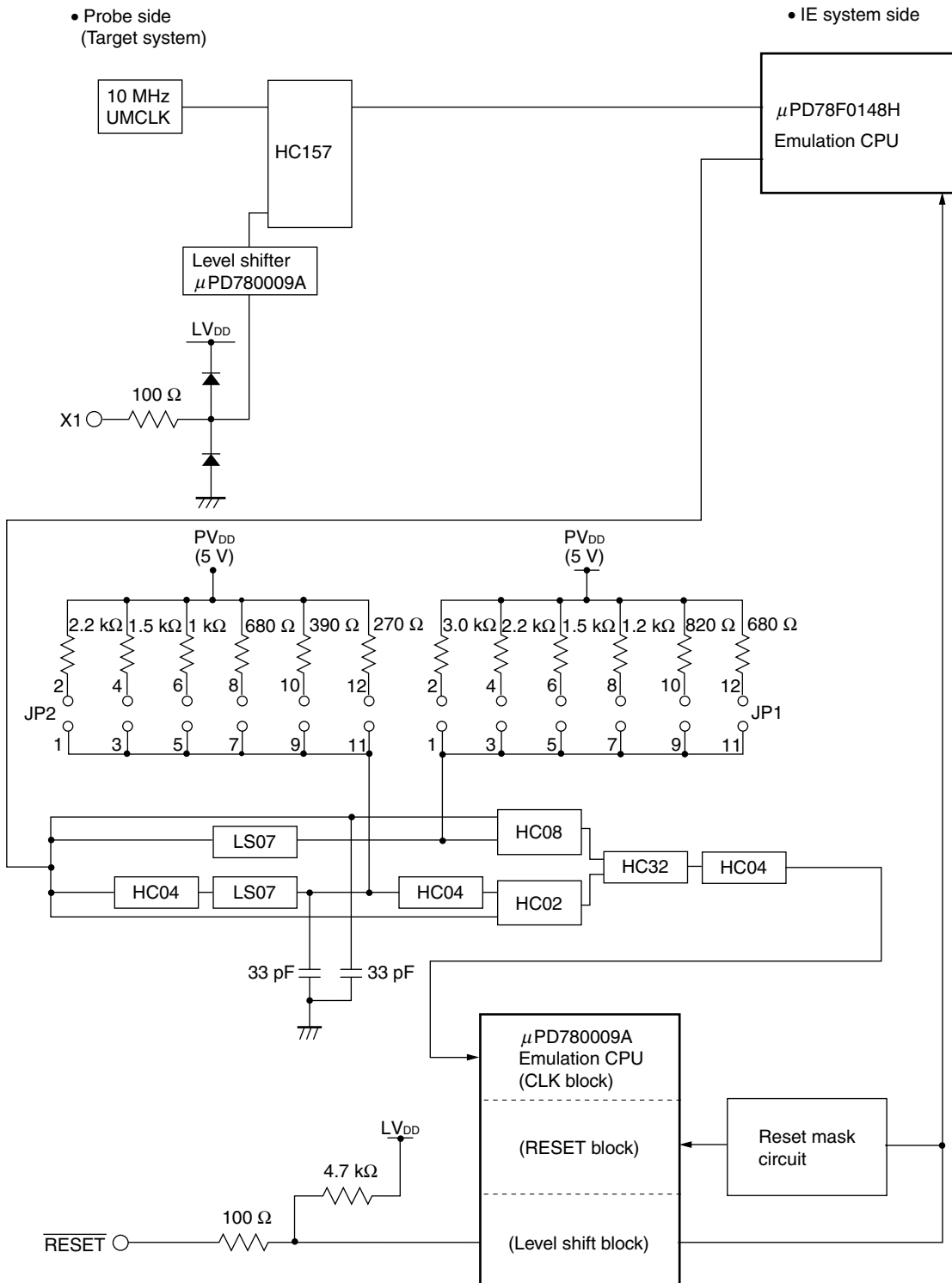
Figure 4-4. Equivalent Circuit of Emulation Circuit 4 (3/3)
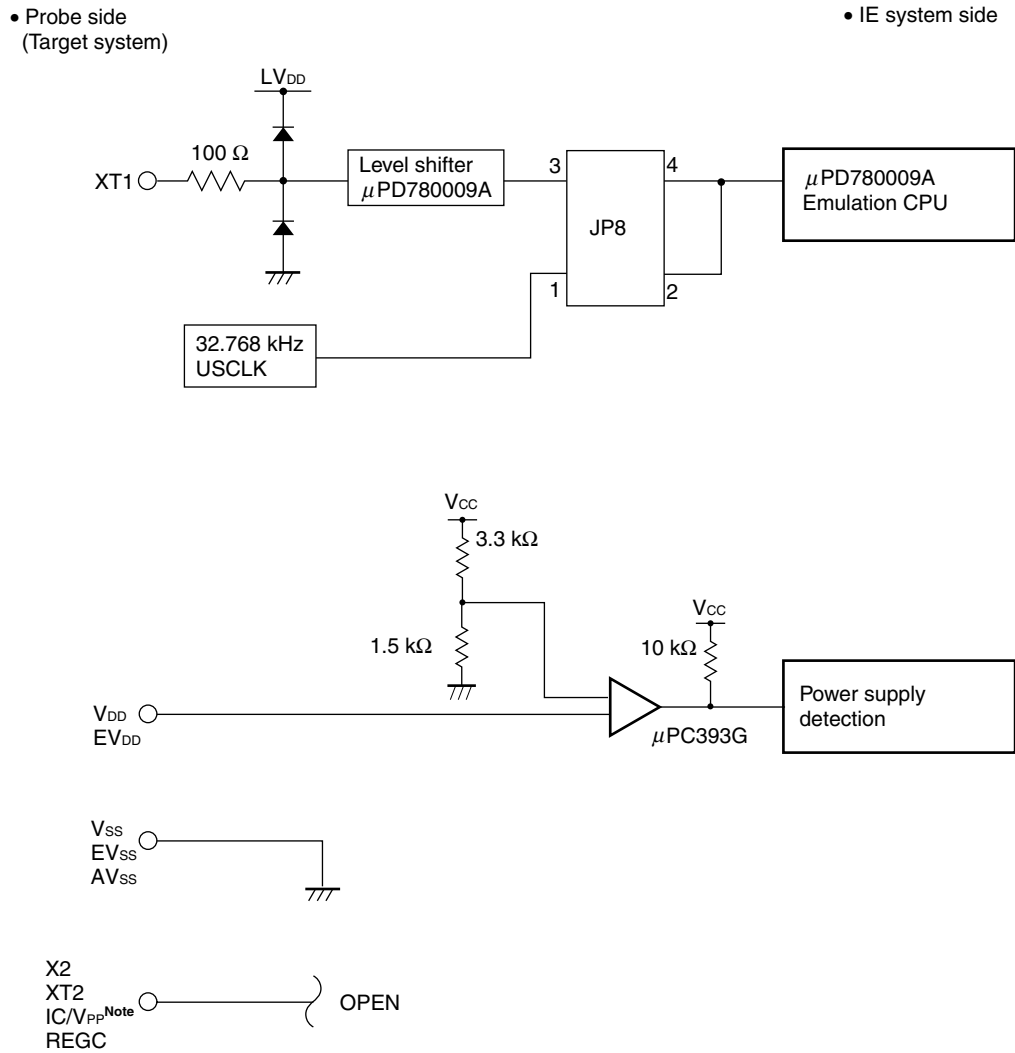
Note   In the case of 78K0/KE1+, the pin name is FLMD0.

4.5 When Emulating 78K0/KF1 and 78K0/KF1+

See **Figure 4-5 Equivalent Circuit of Emulation Circuit 5** for the signals listed in (1) to (3) below.

(1) Signals input or output from the emulation CPU (μPD78F0148H)

- P06 to P00
- P17 to P10
- P27 to P20
- P33 to P30
- P77 to P70
- P120
- P130
- P145 to P140
- AV_{REF}

(2) Signals input or output from the emulation CPU (μPD780009A)

- P47 to P40
- P57 to P50
- P67 to P60

(3) Other signals

- X1, X2, XT1, XT2, $\overline{RESET}$, V_{DD}, V_{SS}, EV_{DD}, EV_{SS}, REGC, AV_{SS}, IC/V_{PP}[Note]

Note In the case of 78K0/KF1+, the pin name is FLMD0.

Figure 4-5. Equivalent Circuit of Emulation Circuit 5 (1/3)

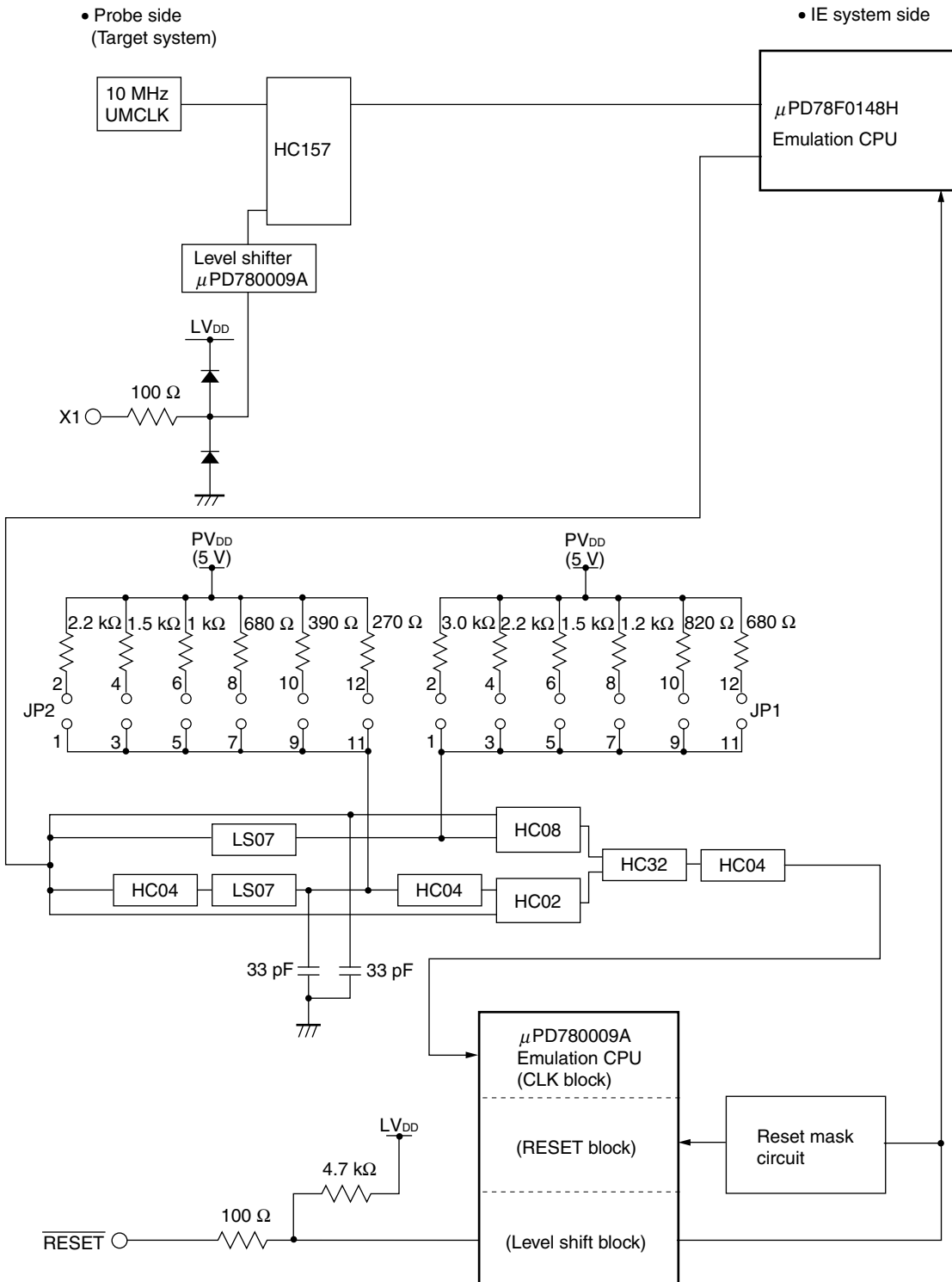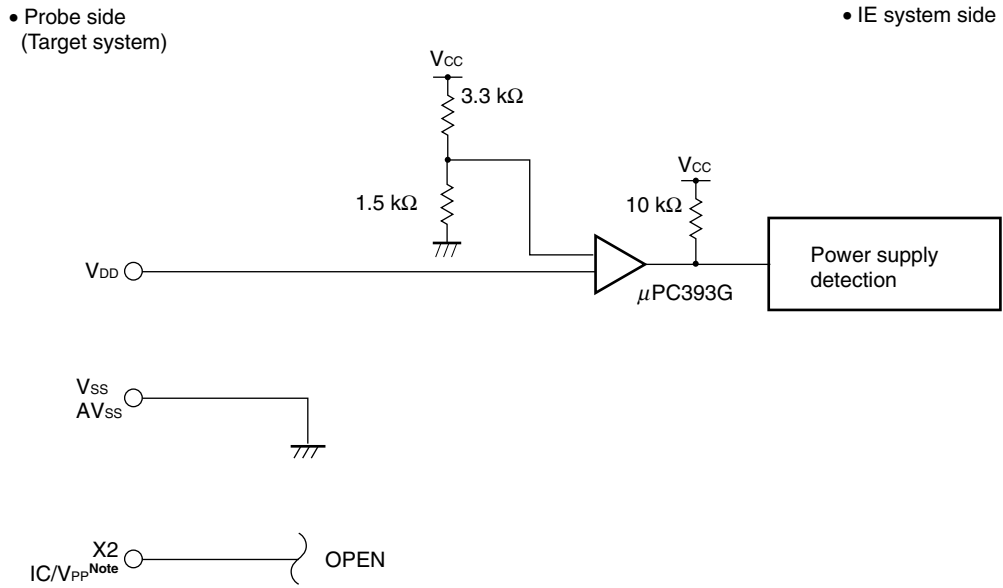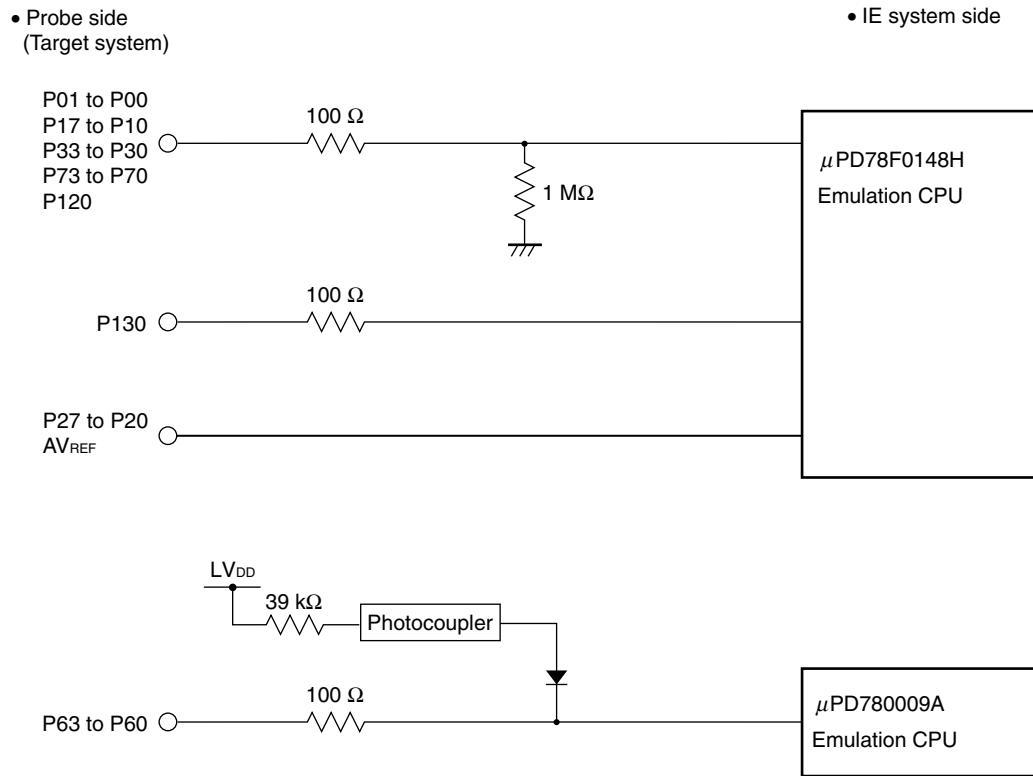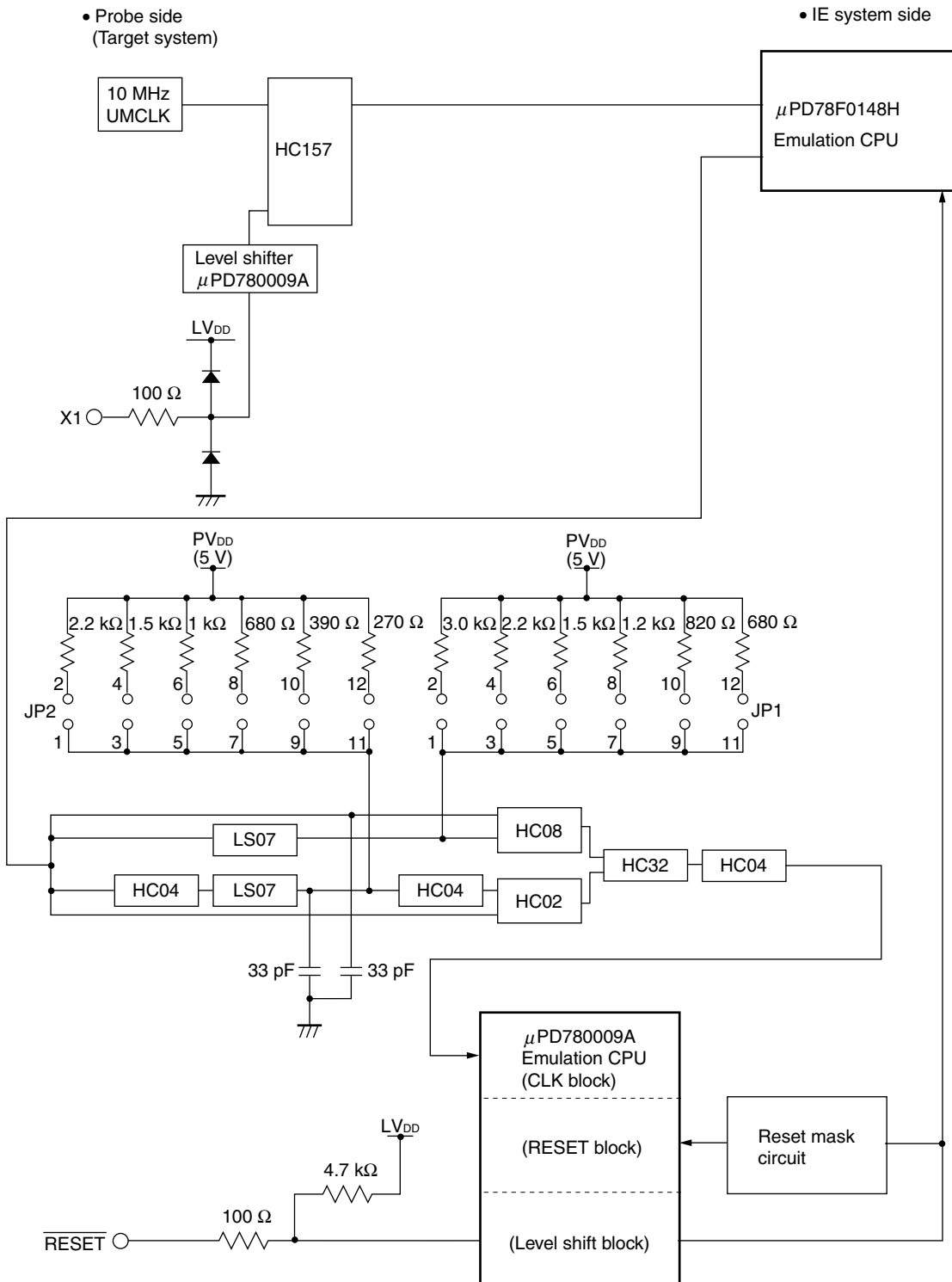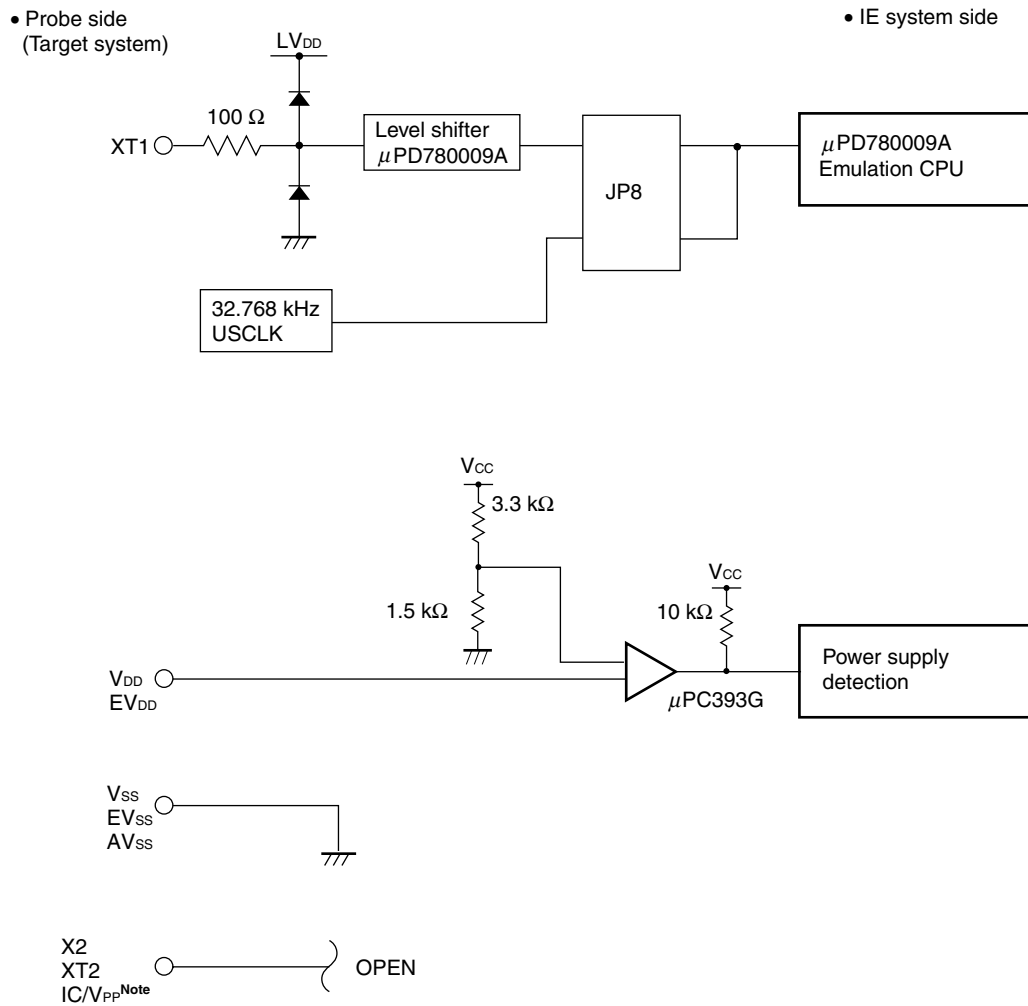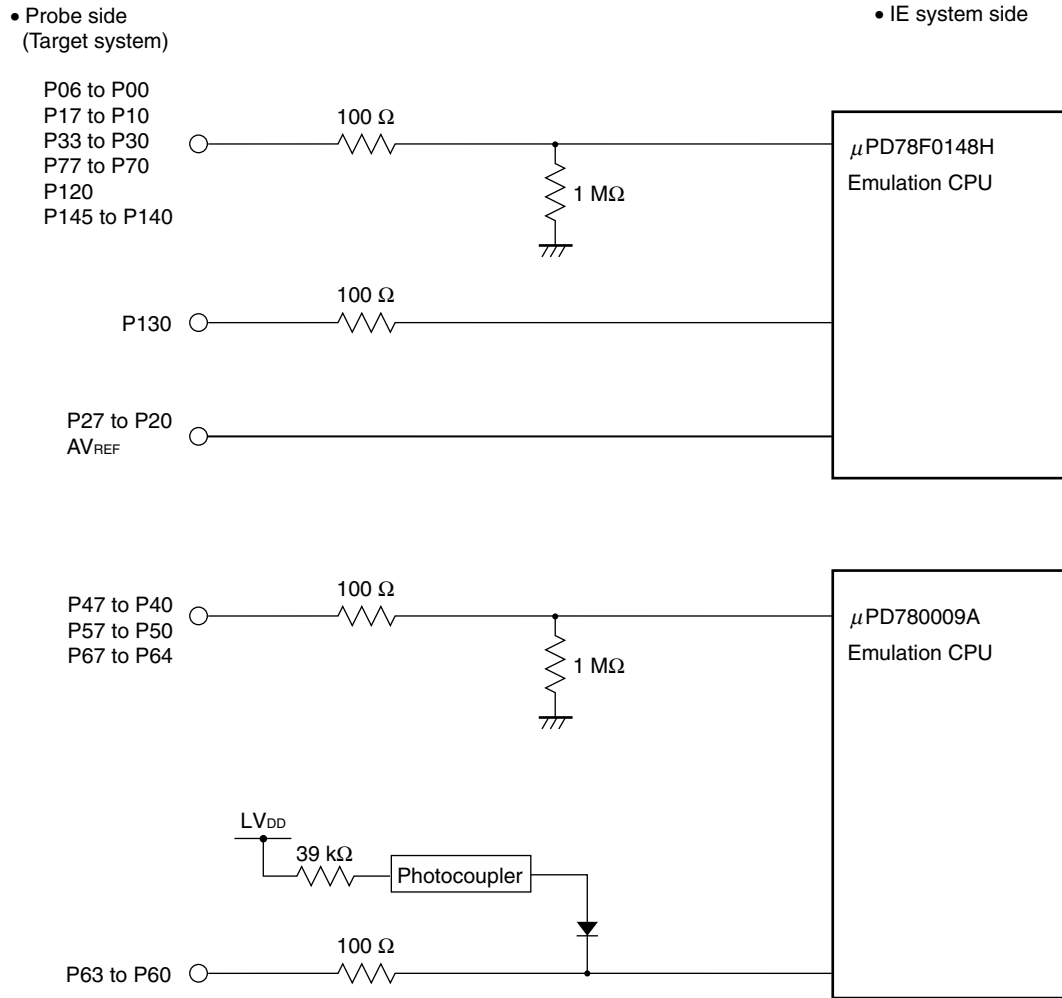**Figure 4-5. Equivalent Circuit of Emulation Circuit 5 (2/3)**
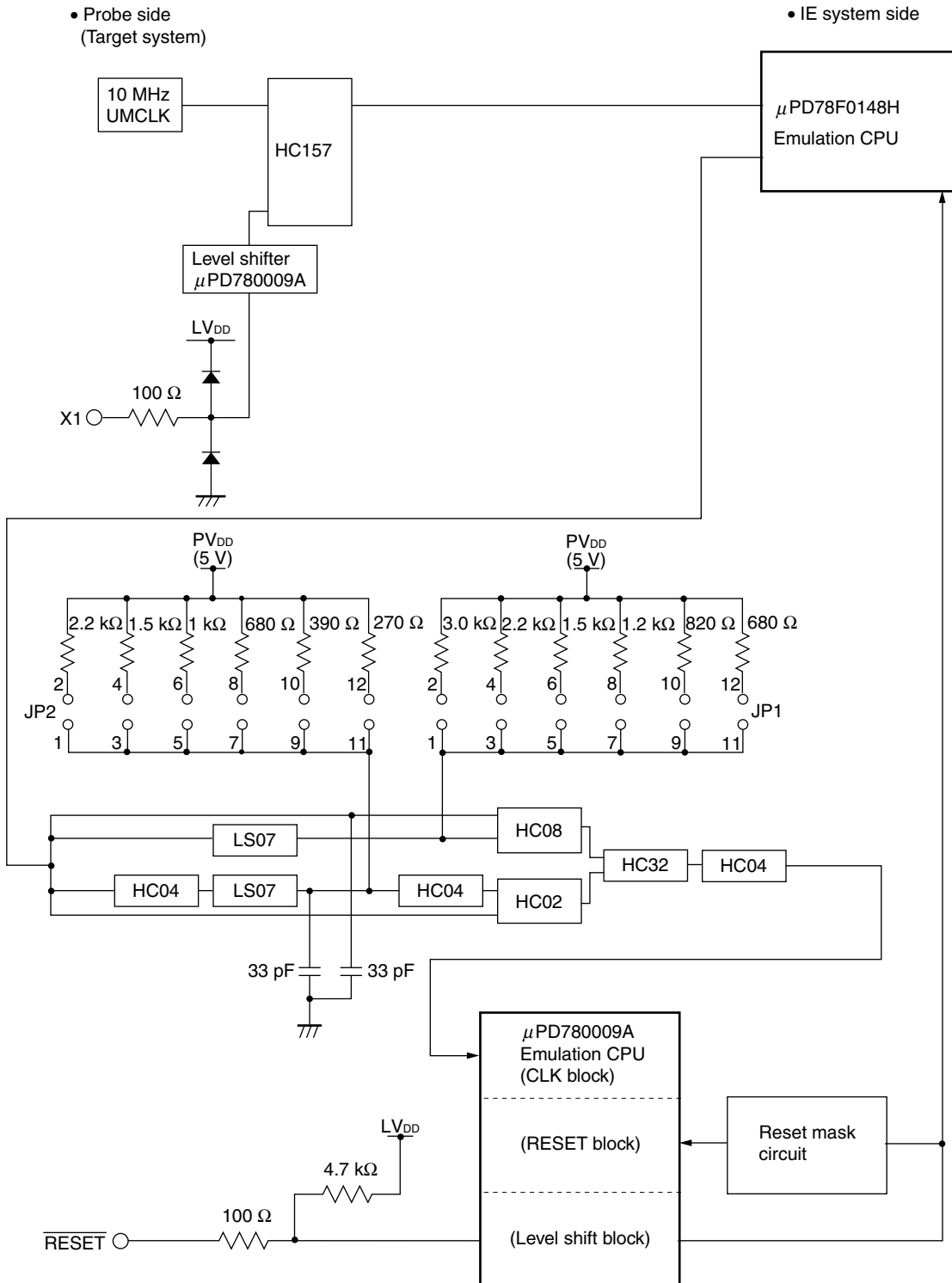
Figure 4-5. Equivalent Circuit of Emulation Circuit 5 (3/3)
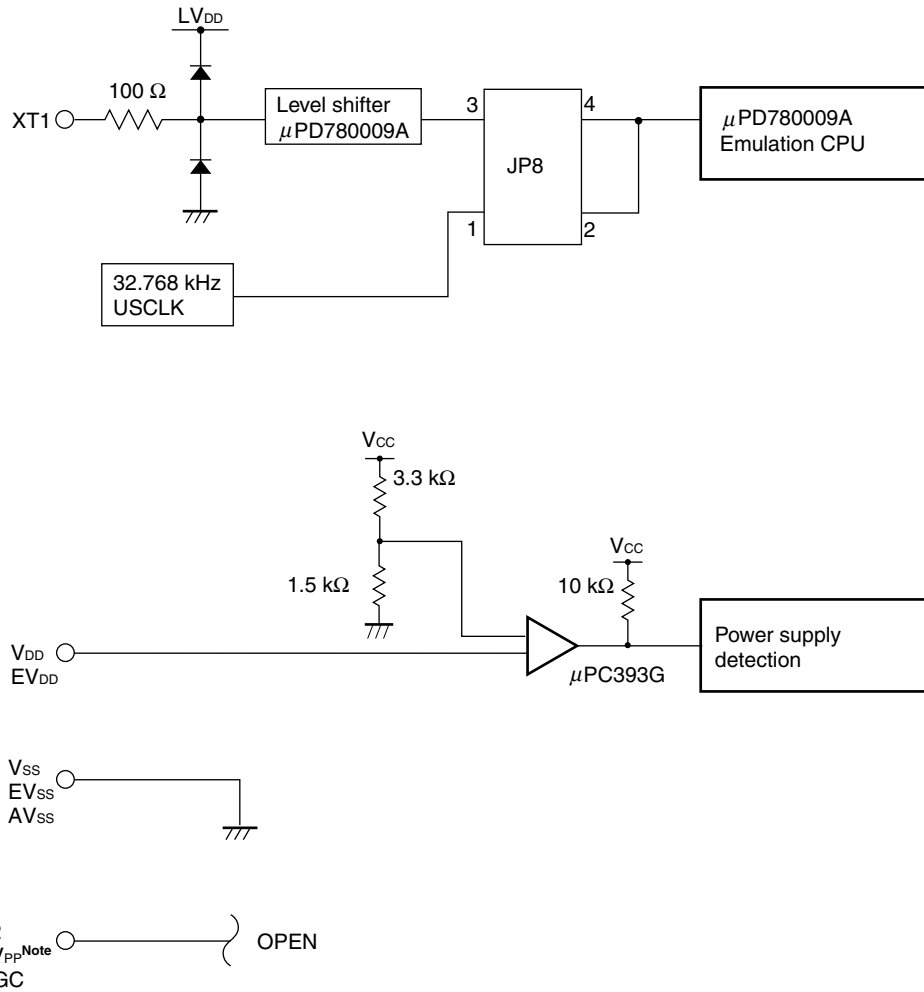
Note In the case of 78K0/KF1+, the pin name is FLMD0.

APPENDIX A EMULATION PROBE PIN ASSIGNMENT TABLE

Table A-1. Pin Assignment of 78014X PROBE Board + NP-80GC, NP-80GC-TQ, NP-H80GC-TQ, NP-80GK, NP-H80GK-TQ (1/3)

Emulation Probe Device Side	78014X PROBE Board CN1	IE-780148-NS-EM1 CN6
1	114	114
2	113	113
3	108	108
4	107	107
5	104	104
6	103	103
7	100	100
8	99	99
9	94	94
10	93	93
11	30	30
12	29	29
13	24	24
14	23	23
15	20	20
16	19	19
17	16	16
18	15	15
19	10	10
20	9	9
21	37	37
22	43	43
23	44	44
24	47	47
25	48	48
26	51	51
27	52	52
28	57	57

Remarks 1. The numbers in the Emulation Probe Device Side column indicate the corresponding pin number on the target system side tip.
2. The numbers in the 78014X PROBE Board CN1 column refer to the 78014X PROBE Board pin (78014X PROBE Board side) to be connected to the emulation probe.
3. The numbers in the IE-780148 EM1 Board CN6 column refer to the IE-780148-NS-EM1 pin (IE-780148-NS-EM1 side) to be connected to the 78014X PROBE Board.

Table A-1. Pin Assignment of 78014X PROBE Board + NP-80GC, NP-80GC-TQ, NP-H80GC-TQ, NP-80GK, NP-H80GK-TQ (2/3)

Emulation Probe Device Side	78014X PROBE Board CN1	IE-780148-NS-EM1 CN6
29	58	58
30	59	59
31	60	60
32	55	55
33	56	56
34	49	49
35	50	50
36	45	45
37	46	46
38	41	41
39	42	42
40	35	35
41	8	8
42	7	7
43	14	14
44	13	13
45	18	18
46	17	17
47	22	22
48	21	21
49	28	28
50	27	27
51	92	92
52	91	91
53	98	98
54	97	97
55	102	102
56	101	101

Remarks 1. The numbers in the Emulation Probe Device Side column indicate the corresponding pin number on the target system side tip.
   2. The numbers in the 78014X PROBE Board CN1 column refer to the 78014X PROBE Board pin (78014X PROBE Board side) to be connected to the emulation probe.
   3. The numbers in the IE-780148 EM1 Board CN6 column refer to the IE-780148-NS-EM1 pin (IE-780148-NS-EM1 side) to be connected to the 78014X PROBE Board.

Table A-1. Pin Assignment of 78014X PROBE Board + NP-80GC, NP-80GC-TQ, NP-H80GC-TQ, NP-80GK, NP-H80GK-TQ (3/3)

Emulation Probe Device Side	78014X PROBE Board CN1	IE-780148-NS-EM1 CN6
57	106	106
58	105	105
59	112	112
60	111	111
61	83	83
62	77	77
63	78	78
64	73	73
65	74	74
66	69	69
67	70	70
68	63	63
69	64	64
70	61	61
71	62	62
72	65	65
73	66	66
74	71	71
75	72	72
76	75	75
77	76	76
78	79	79
79	80	80
80	85	85

Remarks 1. The numbers in the Emulation Probe Device Side column indicate the corresponding pin number on the target system side tip.

2. The numbers in the 78014X PROBE Board CN1 column refer to the 78014X PROBE Board pin (78014X PROBE Board side) to be connected to the emulation probe.

3. The numbers in the IE-780148 EM1 Board CN6 column refer to the IE-780148-NS-EM1 pin (IE-780148-NS-EM1 side) to be connected to the 78014X PROBE Board.

Table A-2. Pin Assignment of 78013X PROBE Board + NP-64GB, NP-H64GB-TQ, NP-64GK, NP-H64GK-TQ, NP-64GC, NP-64GC-TQ, NP-H64GC-TQ (1/2)

Emulation Probe Device Side	78013X PROBE Board CN1	IE-780148-NS-EM1 CN6
1	108	114
2	107	113
3	104	99
4	103	94
5	100	93
6	99	30
7	94	29
8	93	24
9	30	23
10	29	20
11	24	19
12	23	16
13	20	108
14	19	107
15	16	104
16	15	103
17	43	100
18	44	51
19	47	52
20	48	48
21	51	47
22	52	44
23	57	43
24	58	37
25	59	9
26	60	10
27	55	15
28	56	56
29	49	55
30	50	58
31	45	57
32	46	59

Remarks 1. The numbers in the Emulation Probe Device Side column indicate the corresponding pin number on the target system side tip.

2. The numbers in the 78013X PROBE Board CN1 column refer to the 78013X PROBE Board pin (78013X PROBE Board side) to be connected to the emulation probe.

3. The numbers in the IE-780148 EM1 Board CN6 column refer to the IE-780148-NS-EM1 pin (IE-780148-NS-EM1 side) to be connected to the 78013X PROBE Board.

Table A-2. Pin Assignment of 78013X PROBE Board + NP-64GB, NP-H64GB-TQ, NP-64GK, NP-H64GK-TQ, NP-64GC, NP-64GC-TQ, NP-H64GC-TQ (2/2)

Emulation Probe Device Side	78013X PROBE Board CN1	IE-780148-NS-EM1 CN6
33	14	60
34	13	41
35	18	42
36	17	35
37	22	8
38	21	7
39	28	14
40	27	13
41	92	98
42	91	97
43	98	102
44	97	101
45	102	83
46	101	77
47	106	78
48	105	73
49	77	74
50	78	69
51	73	70
52	74	63
53	69	64
54	70	61
55	63	62
56	64	65
57	61	66
58	62	71
59	65	72
60	66	75
61	71	76
62	72	79
63	75	80
64	76	85

Remarks **1.** The numbers in the Emulation Probe Device Side column indicate the corresponding pin number on the target system side tip.

2. The numbers in the 78013X PROBE Board CN1 column refer to the 78013X PROBE Board pin (78013X PROBE Board side) to be connected to the emulation probe.

3. The numbers in the IE-780148 EM1 Board CN6 column refer to the IE-780148-NS-EM1 pin (IE-780148-NS-EM1 side) to be connected to the 78013X PROBE Board.

Table A-3. Pin Assignment of 78012X PROBE Board + NP-H52GB-TQ (1/2)

Emulation Probe Device Side	78012X PROBE Board CN1	IE-780148-NS-EM1 CN6
1	118	114
2	114	113
3	108	99
4	104	94
5	100	93
6	94	30
7	30	29
8	29	24
9	24	23
10	20	20
11	16	19
12	10	16
13	6	108
14	33	107
15	37	104
16	43	103
17	47	100
18	51	51
19	57	48
20	59	47
21	55	44
22	49	56
23	45	55
24	41	58
25	35	57
26	31	59
27	4	60
28	8	43
29	14	37
30	18	9

Remarks 1. The numbers in the Emulation Probe Device Side column indicate the corresponding pin number on the target system side tip.

2. The numbers in the 78012X PROBE Board CN1 column refer to the 78012X PROBE Board pin (78012X PROBE Board side) to be connected to the emulation probe.

3. The numbers in the IE-780148 EM1 Board CN6 column refer to the IE-780148-NS-EM1 pin (IE-780148-NS-EM1 side) to be connected to the 78012X PROBE Board.

Table A-3. Pin Assignment of 78012X PROBE Board + NP-H52GB-TQ (2/2)

Emulation Probe Device Side	78012X PROBE Board CN1	IE-780148-NS-EM1 CN6
31	22	10
32	18	15
33	92	8
34	91	7
35	98	14
36	102	13
37	106	74
38	112	69
39	116	70
40	87	63
41	83	64
42	77	61
43	73	62
44	69	65
45	63	66
46	61	71
47	65	72
48	71	75
49	75	76
50	79	79
51	85	80
52	89	85

Remarks 1. The numbers in the Emulation Probe Device Side column indicate the corresponding pin number on the target system side tip.

2. The numbers in the 78012X PROBE Board CN1 column refer to the 78012X PROBE Board pin (78012X PROBE Board side) to be connected to the emulation probe.

3. The numbers in the IE-780148 EM1 Board CN6 column refer to the IE-780148-NS-EM1 pin (IE-780148-NS-EM1 side) to be connected to the 78012X PROBE Board.

Table A-4. Pin Assignment of 78011X PROBE Board + NP-44GB, NP-44GB-TQ, NP-H44GB-TQ (1/2)

Emulation Probe Device Side	78011X PROBE Board CN1	IE-780148-NS-EM1 CN6
1	104	114
2	103	113
3	100	99
4	99	94
5	94	30
6	93	29
7	30	24
8	29	23
9	24	20
10	23	19
11	20	16
12	47	108
13	48	107
14	51	104
15	52	103
16	57	100
17	58	48
18	59	56
19	60	55
20	55	58
21	56	57
22	49	59
23	18	60
24	17	47
25	22	44
26	21	43
27	28	37
28	27	9
29	92	10
30	91	15

Remarks 1. The numbers in the Emulation Probe Device Side column indicate the corresponding pin number on the target system side tip.
2. The numbers in the 78011X PROBE Board CN1 column refer to the 78011X PROBE Board pin (78011X PROBE Board side) to be connected to the emulation probe.
3. The numbers in the IE-780148 EM1 Board CN6 column refer to the IE-780148-NS-EM1 pin (IE-780148-NS-EM1 side) to be connected to the 78011X PROBE Board.

Table A-4. Pin Assignment of 78011X PROBE Board + NP-44GB, NP-44GB-TQ, NP-H44GB-TQ (2/2)

Emulation Probe Device Side	78011X PROBE Board CN1	IE-780148-NS-EM1 CN6
31	98	14
32	97	13
33	102	64
34	73	61
35	72	62
36	69	65
37	70	66
38	63	71
39	64	72
40	61	75
41	62	76
42	65	79
43	66	80
44	71	85

Remarks 1. The numbers in the Emulation Probe Device Side column indicate the corresponding pin number on the target system side tip.

2. The numbers in the 78011X PROBE Board CN1 column refer to the 78011X PROBE Board pin (78011X PROBE Board side) to be connected to the emulation probe.

3. The numbers in the IE-780148 EM1 Board CN6 column refer to the IE-780148-NS-EM1 pin (IE-780148-NS-EM1 side) to be connected to the 78011X PROBE Board.

Table A-5. Pin Assignment of 78010X PROBE Board + NP-30MC

Emulation Probe Device Side	78010X PROBE Board CN1	IE-780148-NS-EM1 CN6
1	58	107
2	56	104
3	49	103
4	55	100
5	19	99
6	18	30
7	22	94
8	62	29
9	65	24
10	66	23
11	92	8
12	91	7
13	98	14
14	97	13
15	21	15
16	99	10
17	63	9
18	64	37
19	70	43
20	69	44
21	72	47
22	102	48
23	71	16
24	94	76
25	93	79
26	30	80
27	29	85
28	24	114
29	23	113
30	20	108

Remarks 1. The numbers in the Emulation Probe Device Side column indicate the corresponding pin number on the target system side tip.

2. The numbers in the 78010X PROBE Board CN1 column refer to the 78010X PROBE Board pin (78010X PROBE Board side) to be connected to NP-30MC.

3. The numbers in the IE-780148 EM1 Board CN6 column refer to the IE-780148-NS-EM1 pin (IE-780148-NS-EM1 side) to be connected to the 78010X PROBE Board.

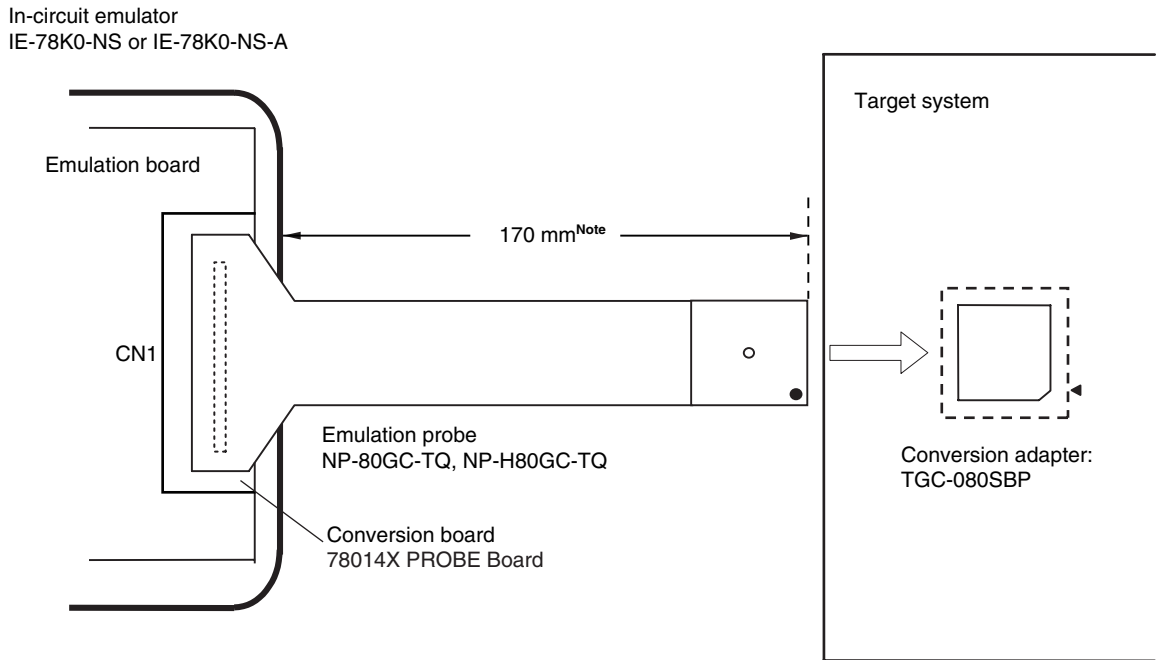# APPENDIX B NOTES ON TARGET SYSTEM DESIGN

The following shows a diagram of the connection conditions between the emulation probe and conversion adapter. Design your system making allowances for conditions such as the shape of parts mounted on the target system, as shown below.

Among the products described in this appendix, NP-80GC-TQ, NP-H80GC-TQ, NP-80GK, NP-H80GK-TQ, NP-64GK, NP-H64GK-TQ, NP-64GC-TQ, NP-H64GC-TQ, NP-64GB-TQ, NP-H64GB-TQ, NP-H52GB-TQ, NP-44GB-TQ, NP-H44GB-TQ, and NP-30MC are products of Naito Densei Machida Mfg. Co., Ltd., and TGC-080SBP, TGK-064SBW, TGC-064SAP, TGB-064SDP, TGB-052SBP, TGB-044SAP, YSPACK30BK, NSPACK30BK, and YSGUIDE are products of TOKYO ELETECH CORPORATION.

Table B-1. Distance Between IE System and Conversion Adapter

Emulation Probe	Conversion Adapter	Distance Between IE System and Conversion Adapter
NP-80GC-TQ	TGC-080SBP	170 mm
NP-H80GC-TQ		370 mm
NP-80GK	TGK-080SDW	170 mm
NP-H80GK-TQ		370 mm
NP-64GK	TGK-064SBW	170 mm
NP-H64GK-TQ		370 mm
NP-64GC-TQ	TGC-064SAP	170 mm
NP-H64GC-TQ		370 mm
NP-64GB	TGB-064SDP	170 mm
NP-H64GB-TQ		370 mm
NP-H52GB-TQ	TGB-052SBP	370 mm
NP-44GB-TQ	TGB-044SAP	170 mm
NP-H44GB-TQ		370 mm
NP-30MC	YSPACK30BK + NSPACK30BK + YSGUIDE	150 mm

Figure B-1. Distance Between IE System and Conversion Adapter (80GC)

In-circuit emulator
IE-78K0-NS or IE-78K0-NS-A

Emulation board

Target system

170 mm**Note**

CN1

Emulation probe
NP-80GC-TQ, NP-H80GC-TQ

Conversion board
78014X PROBE Board

Conversion adapter:
TGC-080SBP

Note   Distance when using NP-80GC-TQ. This is 370 mm when using NP-H80GC-TQ.

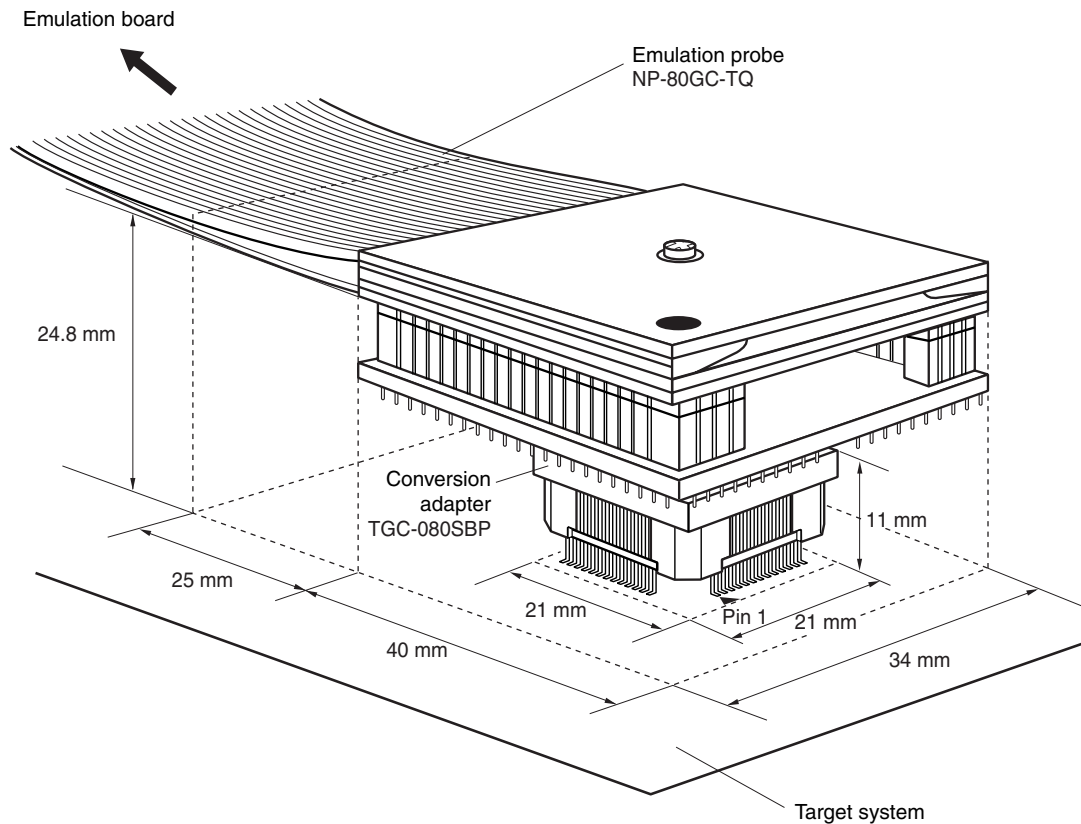**Figure B-2. Connection Conditions of Target System (When Using NP-80GC-TQ)**

Emulation board

Emulation probe
NP-80GC-TQ

24.8 mm

Conversion
adapter
TGC-080SBP

11 mm

25 mm

21 mm

Pin 1

21 mm

40 mm

34 mm

Target system

Figure B-3. Connection Conditions of Target System (When Using NP-H80GC-TQ)

Emulation board

Emulation probe
NP-H80GC-TQ

25.3 mm

Conversion
adapter
TGC-080SBP

11 mm

25 mm

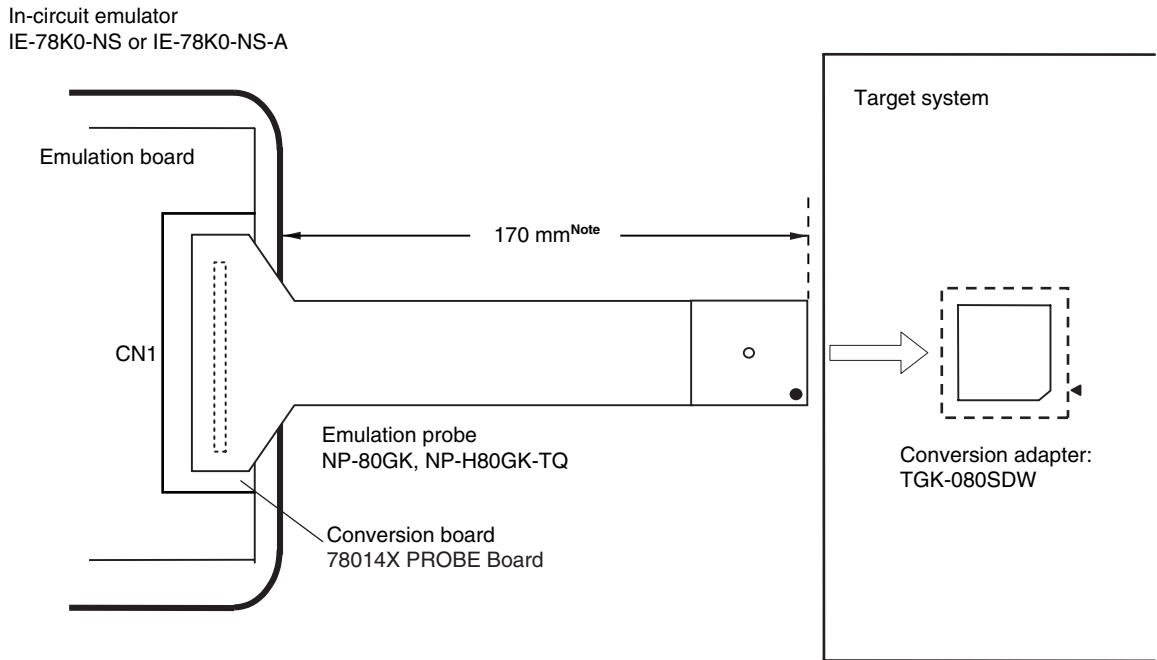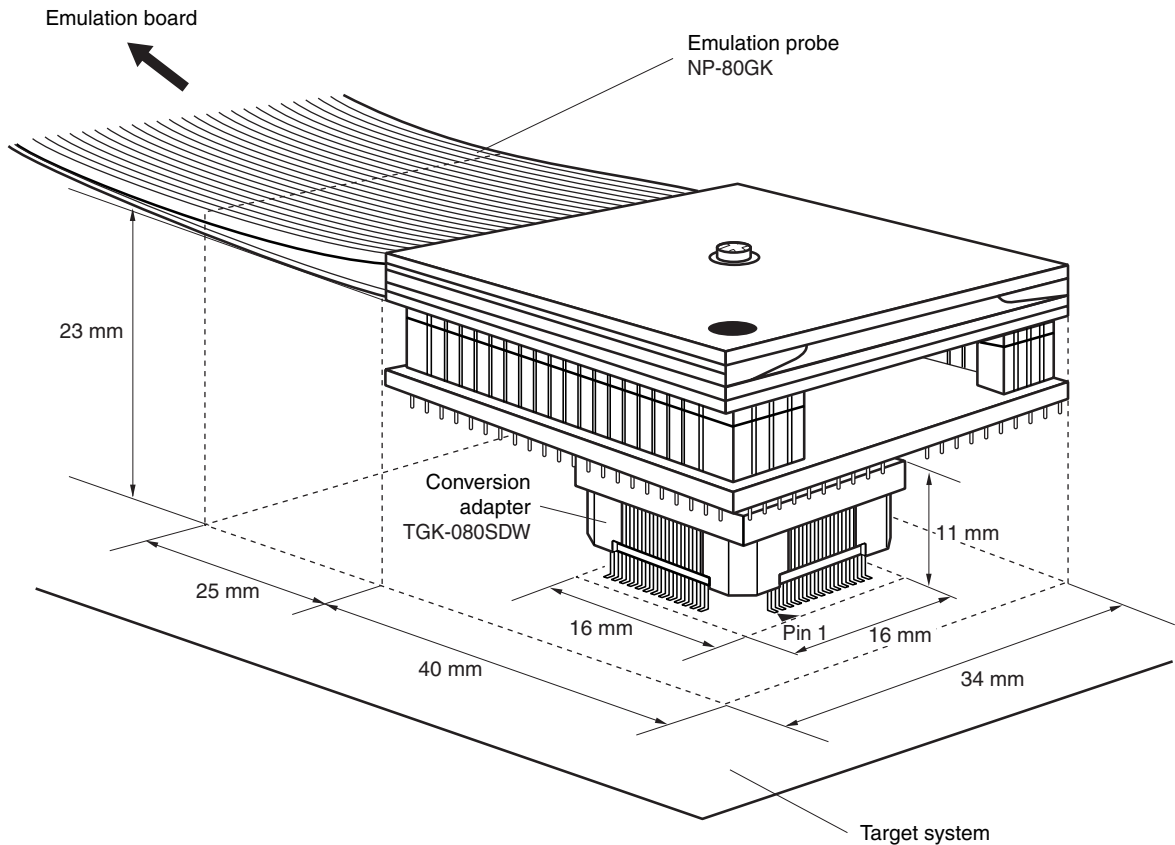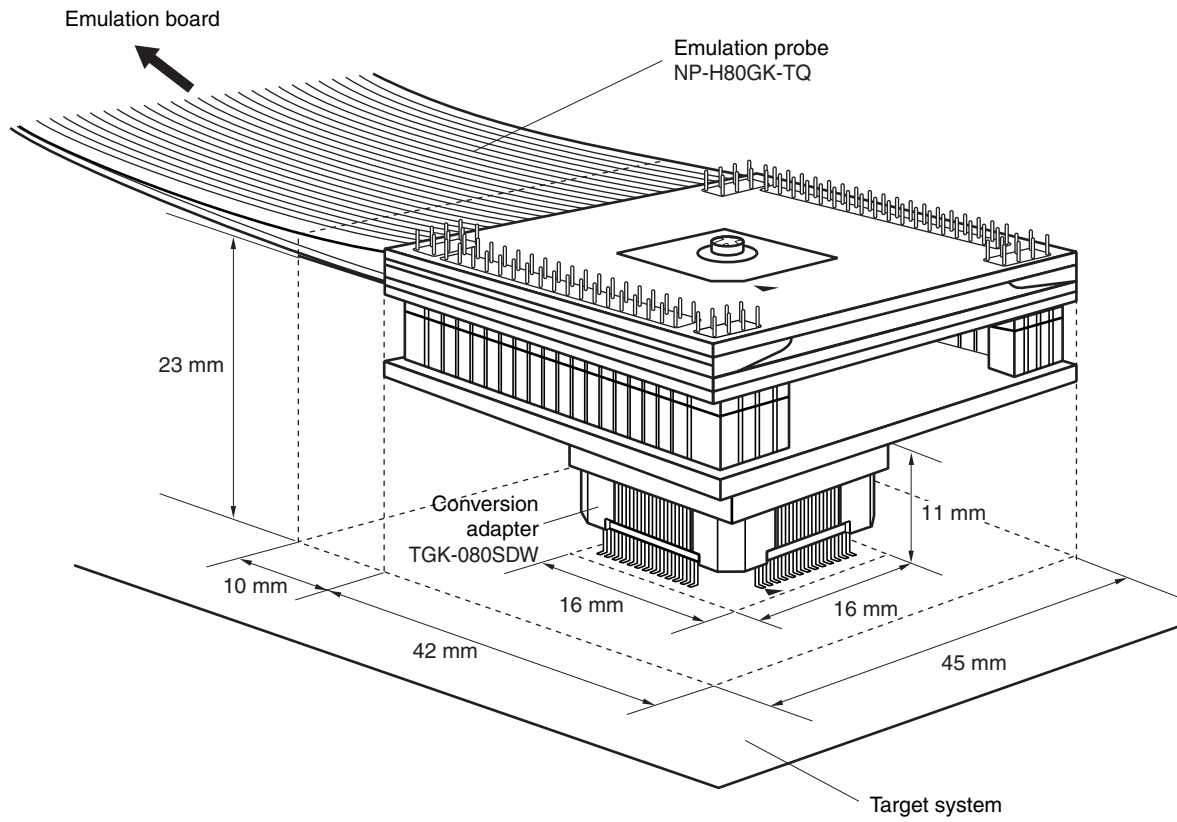21 mm

Pin 1

21 mm

42 mm

45 mm
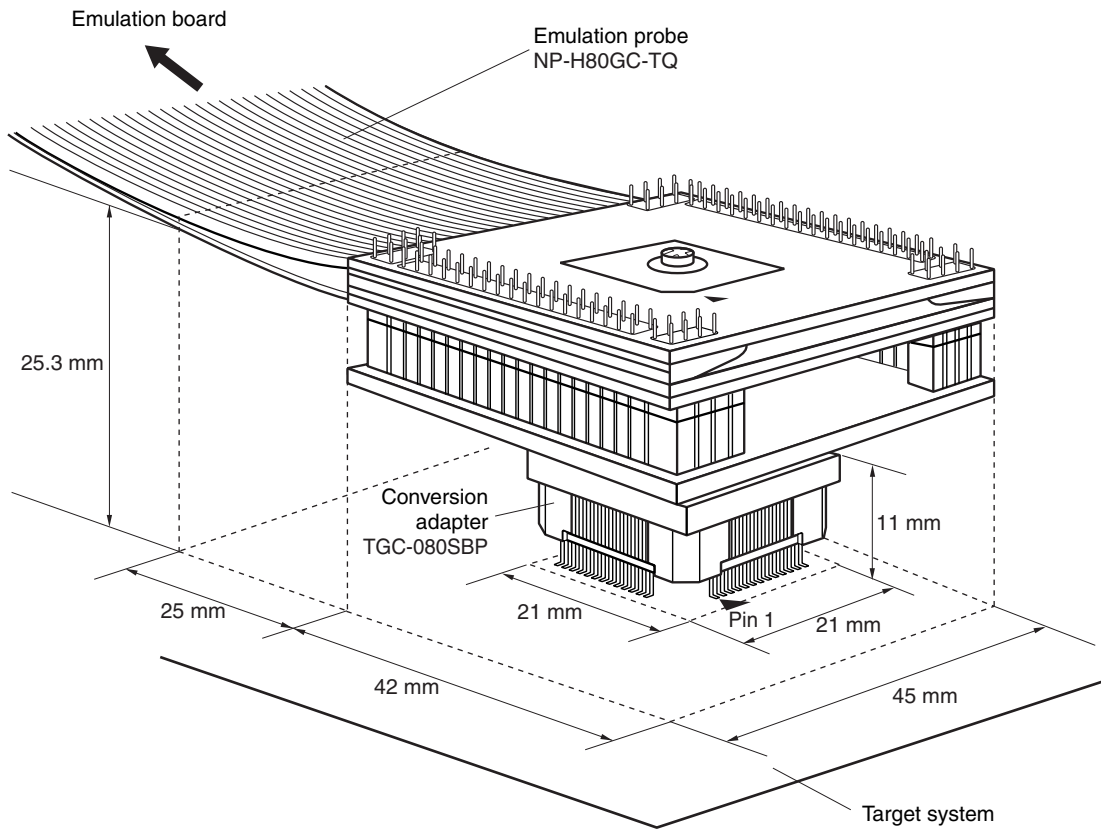
Target system

Figure B-4. Distance Between IE System and Conversion Adapter (80GK)

Note   Distance when using NP-80GK. This is 370 mm when using NP-H80GK-TQ.

Figure B-5. Connection Conditions of Target System (When Using NP-80GK)

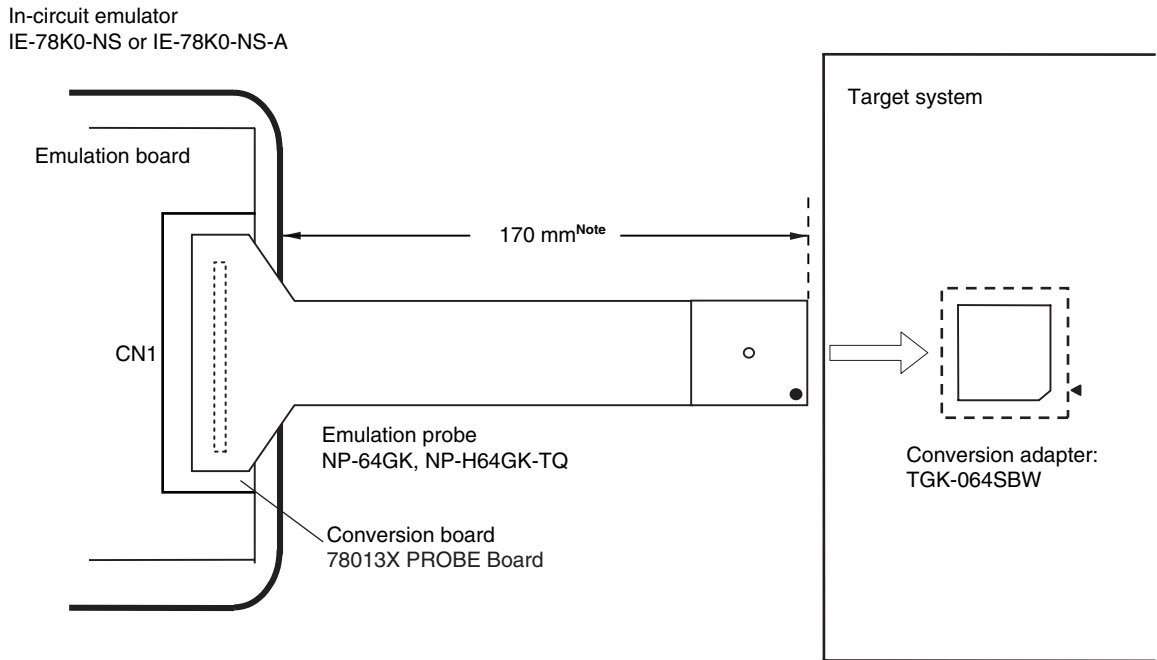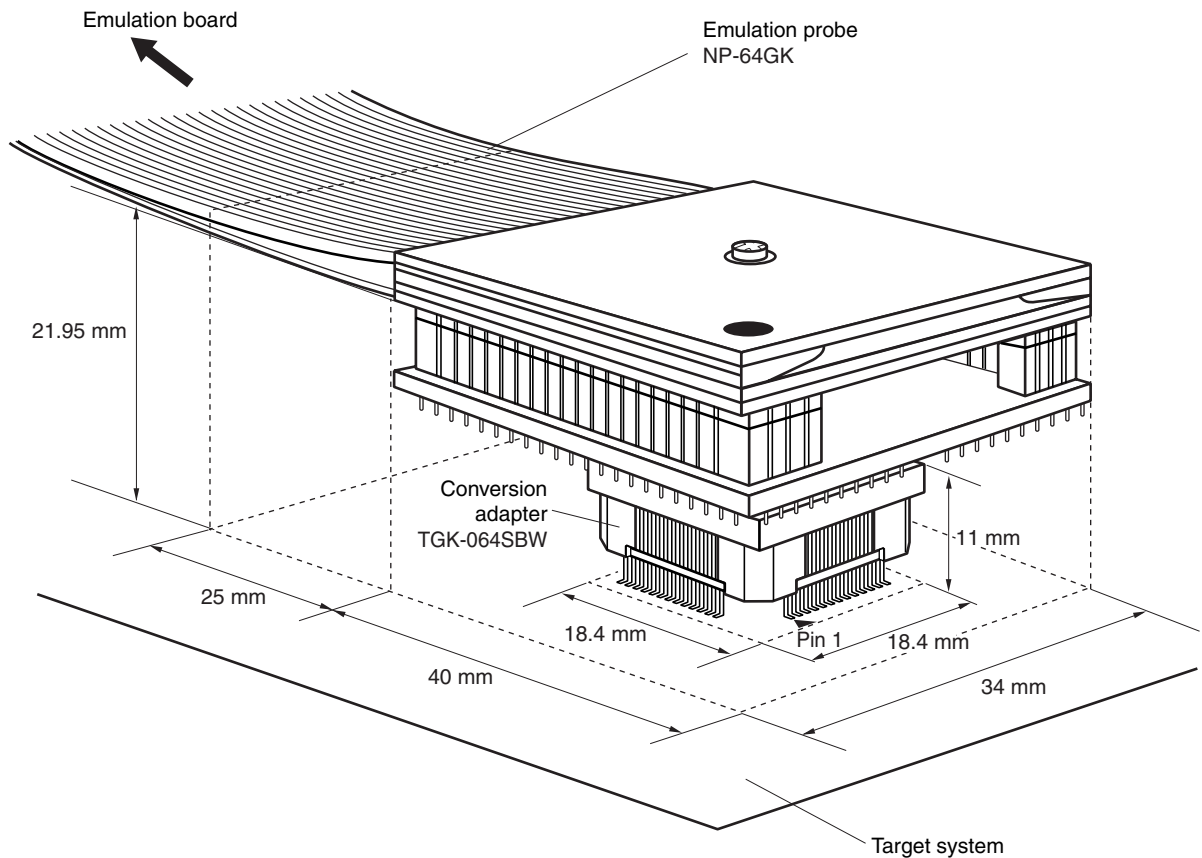**Figure B-6. Connection Conditions of Target System (When Using NP-H80GK-TQ)**

Figure B-7. Distance Between IE System and Conversion Adapter (64GK)

In-circuit emulator
IE-78K0-NS or IE-78K0-NS-A

Emulation board

CN1

170 mm**Note**

Target system

Emulation probe
NP-64GK, NP-H64GK-TQ

Conversion board
78013X PROBE Board

Conversion adapter:
TGK-064SBW

Note   Distance when using NP-64GK. This is 370 mm when using NP-H64GK-TQ.

Figure B-8. Connection Conditions of Target System (When Using NP-64GK)

Emulation board

Emulation probe
NP-64GK

21.95 mm

Conversion
adapter
TGK-064SBW

11 mm

25 mm

18.4 mm

Pin 1

18.4 mm

40 mm

34 mm

Target system

Figure B-9. Connection Conditions of Target System (When Using NP-H64GK-TQ)

Emulation board

Emulation probe
NP-H64GK-TQ

21.95 mm

Conversion
adapter
TGK-064SBW

11 mm

23 mm

18.4 mm

Pin 1

18.4 mm
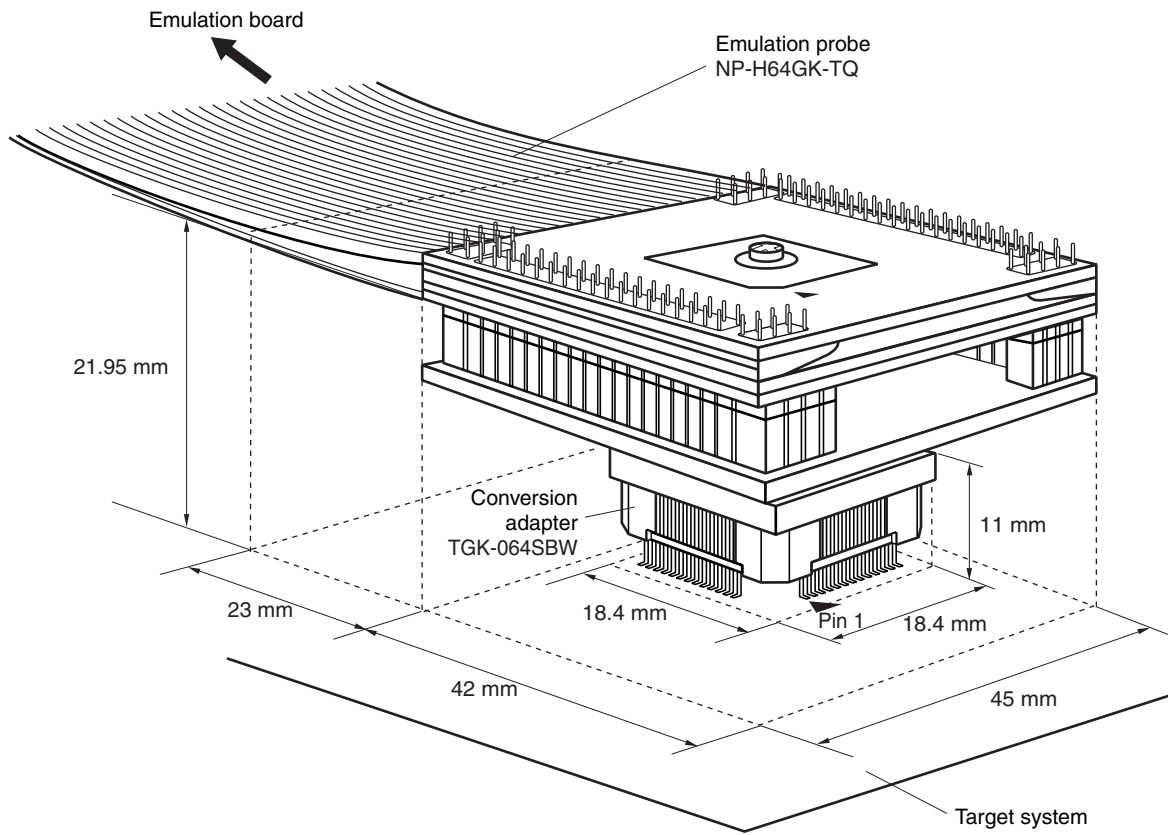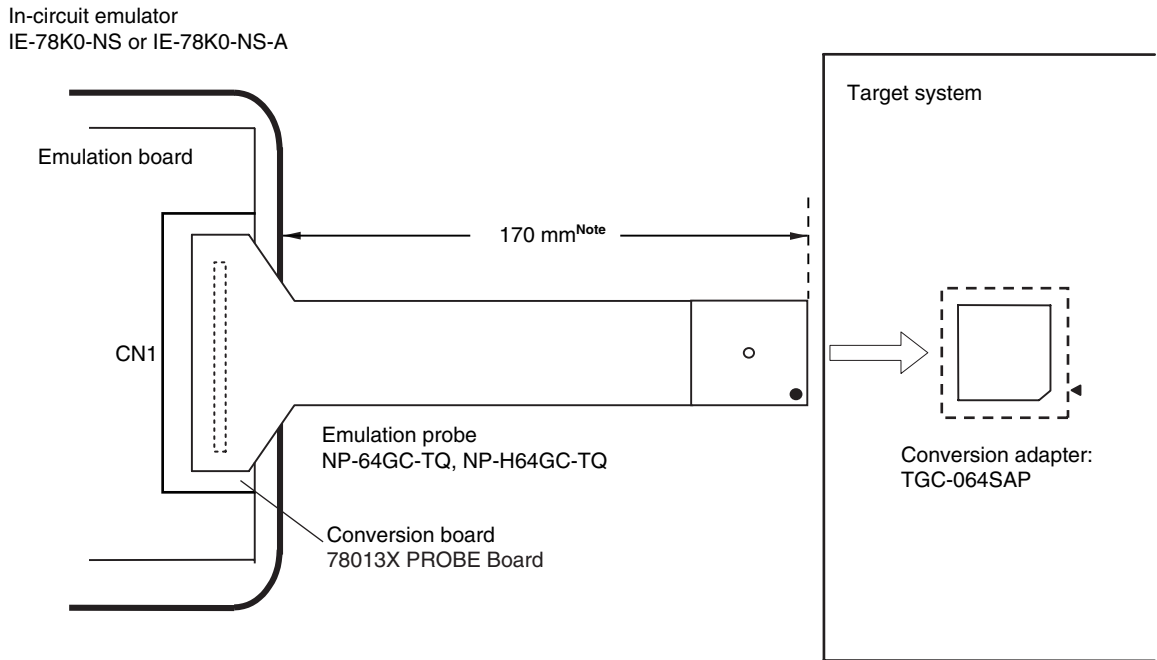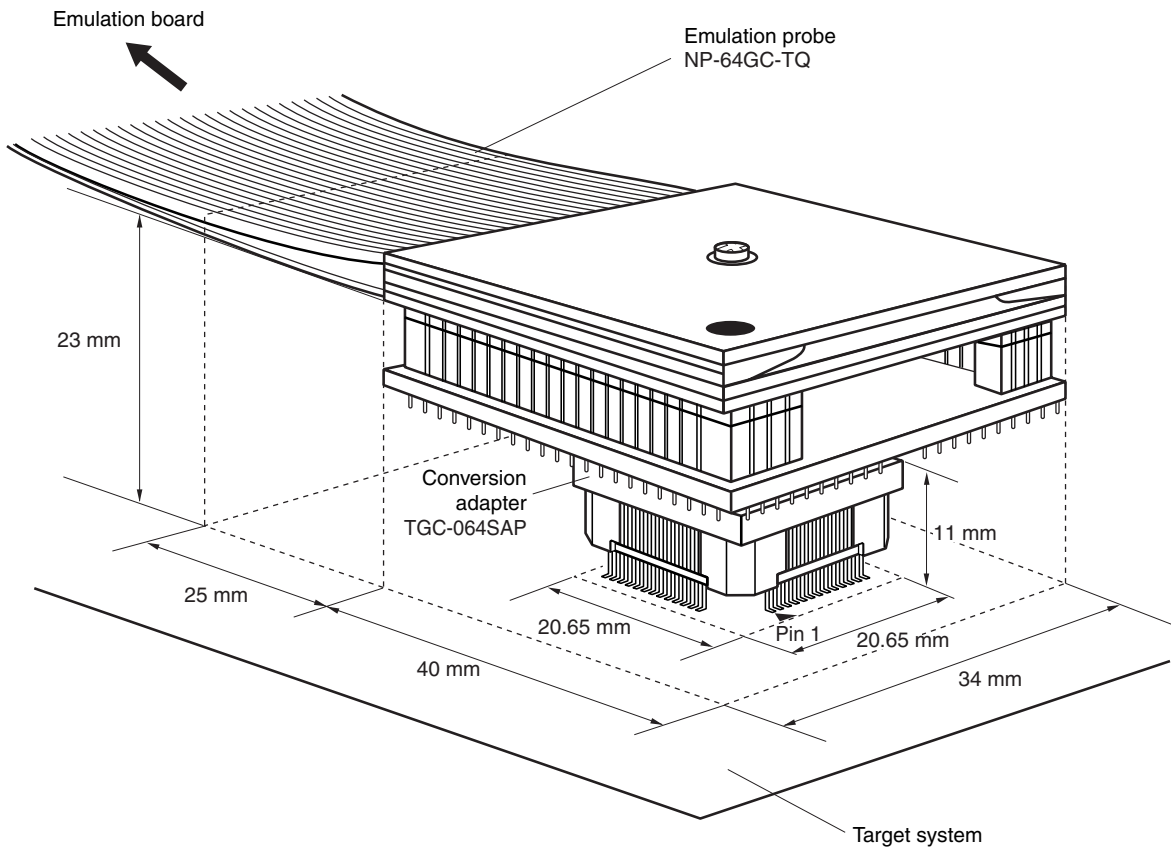
42 mm

45 mm

Target system

Figure B-10. Distance Between IE System and Conversion Adapter (64GC)

Note   Distance when using NP-64GC-TQ. This is 370 mm when using NP-H64GC-TQ.

Figure B-11. Connection Conditions of Target System (When Using NP-64GC-TQ)

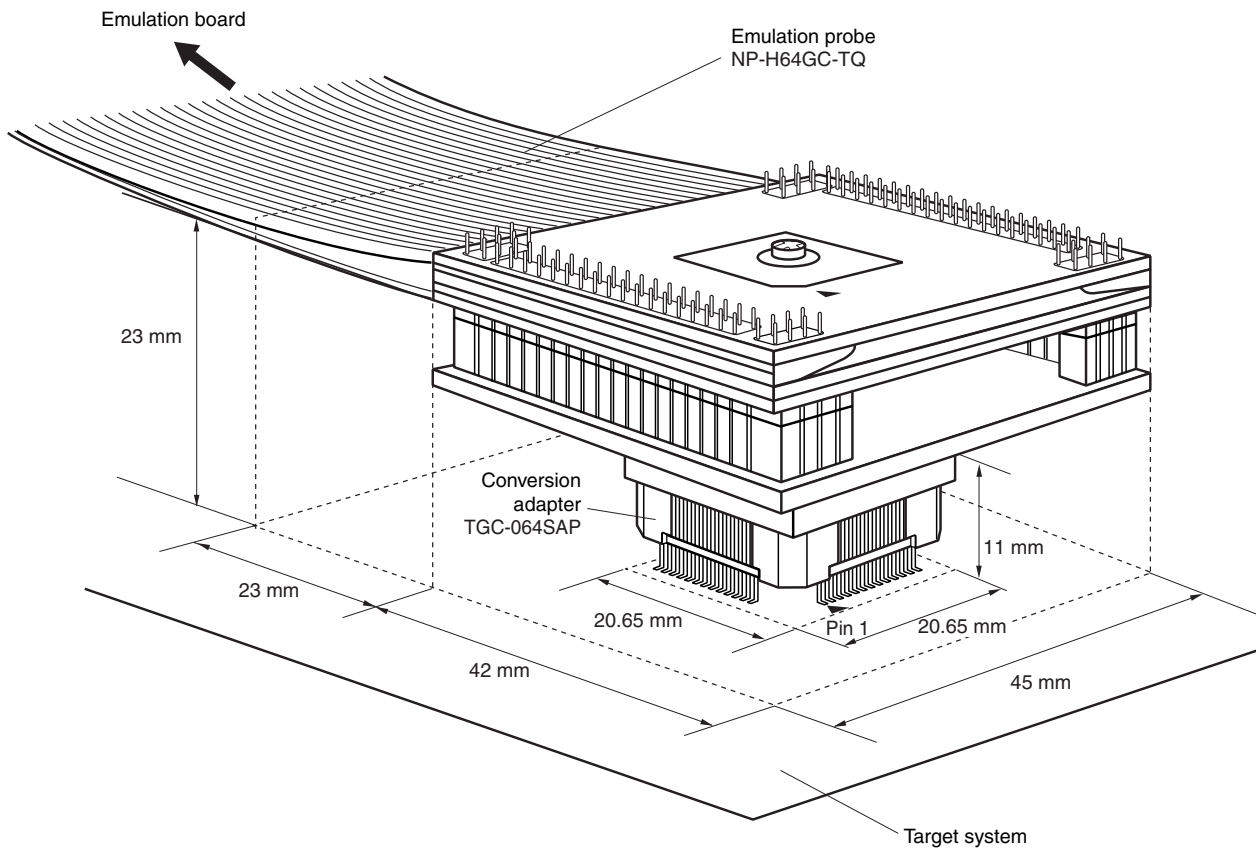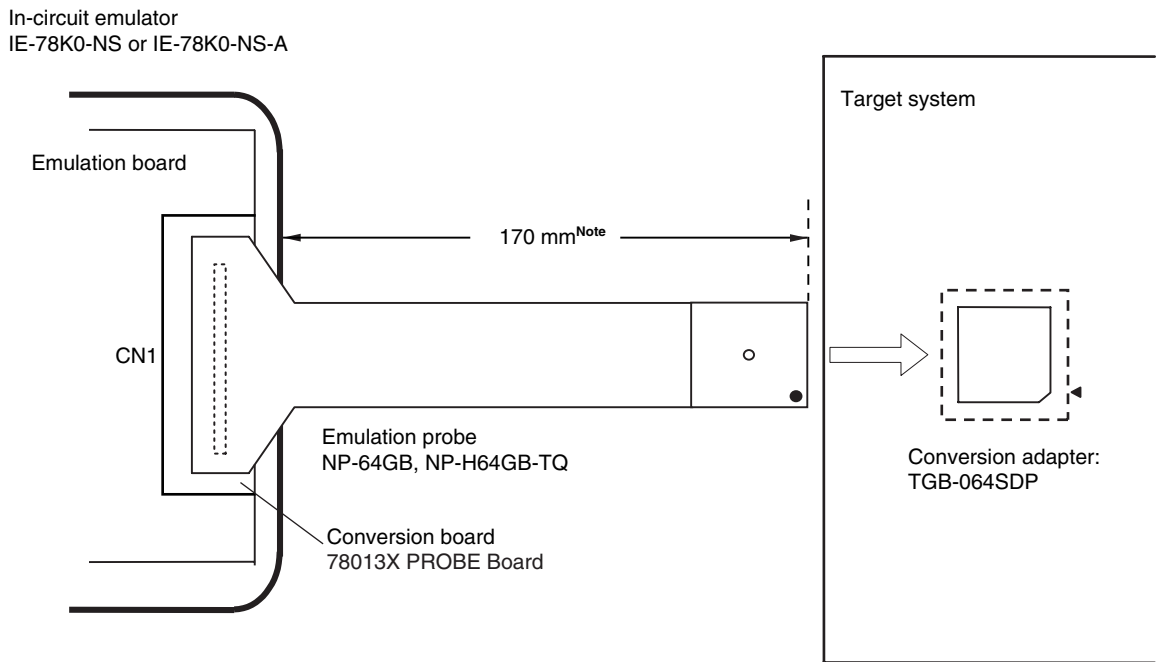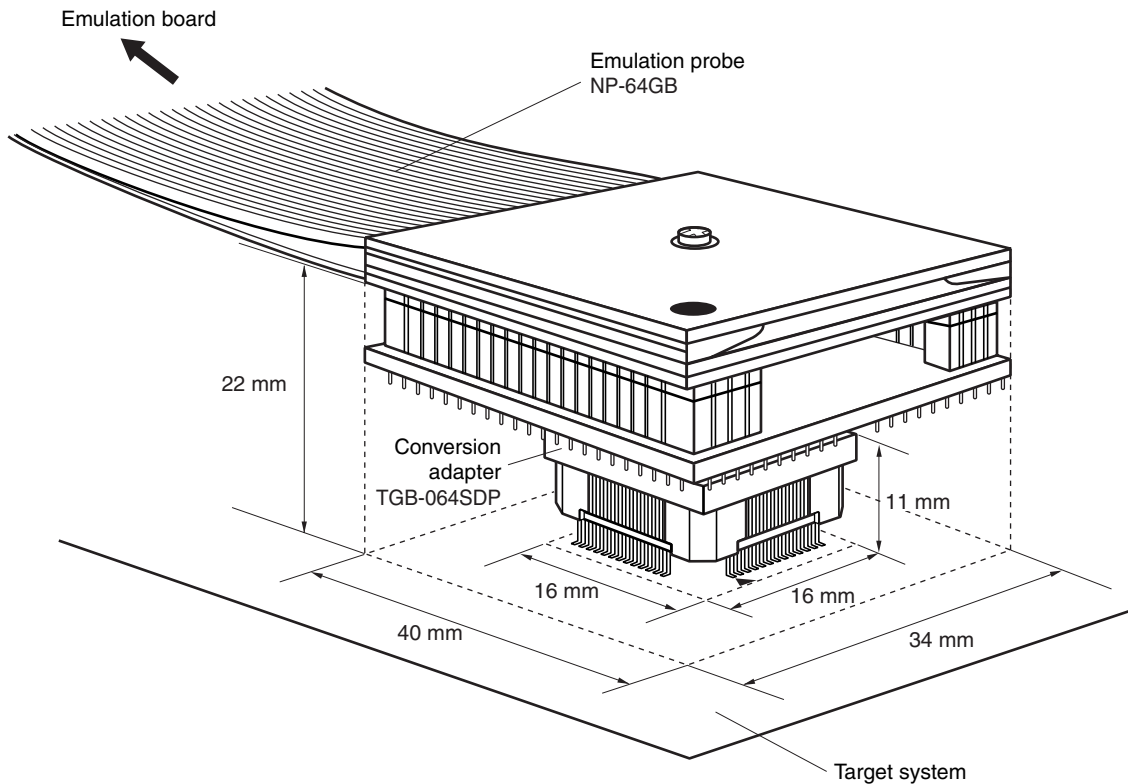**Figure B-12. Connection Conditions of Target System (When Using NP-H64GC-TQ)**

Emulation board

Emulation probe
NP-H64GC-TQ

23 mm

Conversion
adapter
TGC-064SAP

11 mm

23 mm

20.65 mm

Pin 1

20.65 mm

42 mm

45 mm

Target system

Figure B-13. Distance Between IE System and Conversion Adapter (64GB)

In-circuit emulator
IE-78K0-NS or IE-78K0-NS-A

Emulation board

170 mm**Note**

CN1

Emulation probe
NP-64GB, NP-H64GB-TQ

Conversion board
78013X PROBE Board

Target system

Conversion adapter:
TGB-064SDP

Note Distance when using NP-64GB-TQ. This is 370 mm when using NP-H64GB-TQ.

Figure B-14. Connection Conditions of Target System (When Using NP-64GB)

Emulation board

Emulation probe
NP-64GB

22 mm

Conversion
adapter
TGB-064SDP

11 mm

16 mm

16 mm

40 mm

34 mm

Target system

Figure B-15. Connection Conditions of Target System (When Using NP-H64GB-TQ)

Emulation board

Emulation probe
NP-H64GB-TQ

21.4 mm

Conversion
adapter
TGB-064SDP

11 mm

16 mm

16 mm
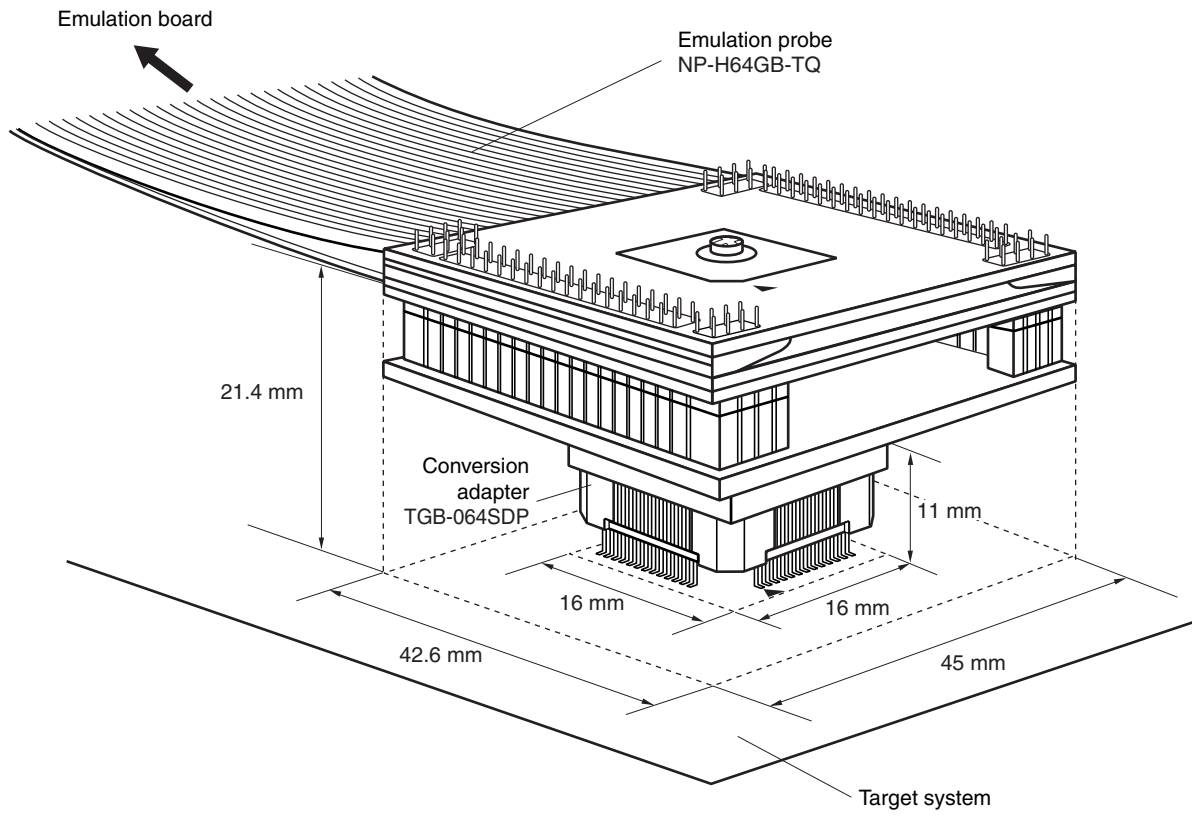
42.6 mm

45 mm

Target system

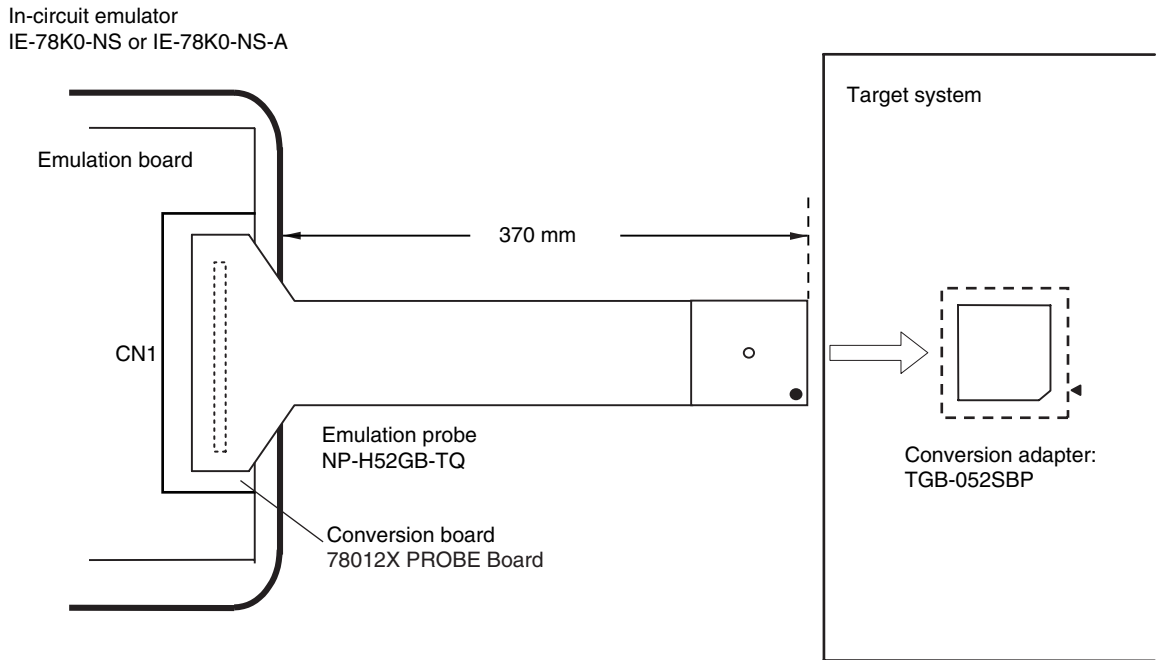**Figure B-16. Distance Between IE System and Conversion Adapter (52GB)**

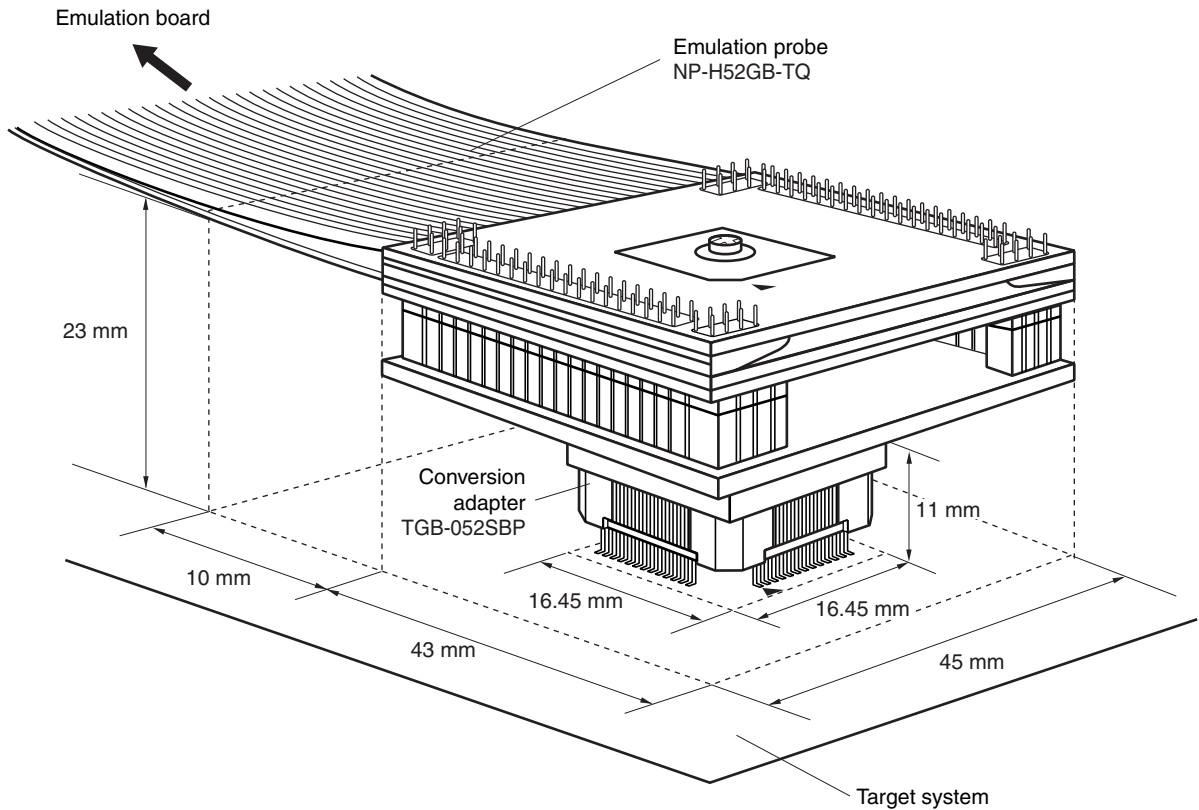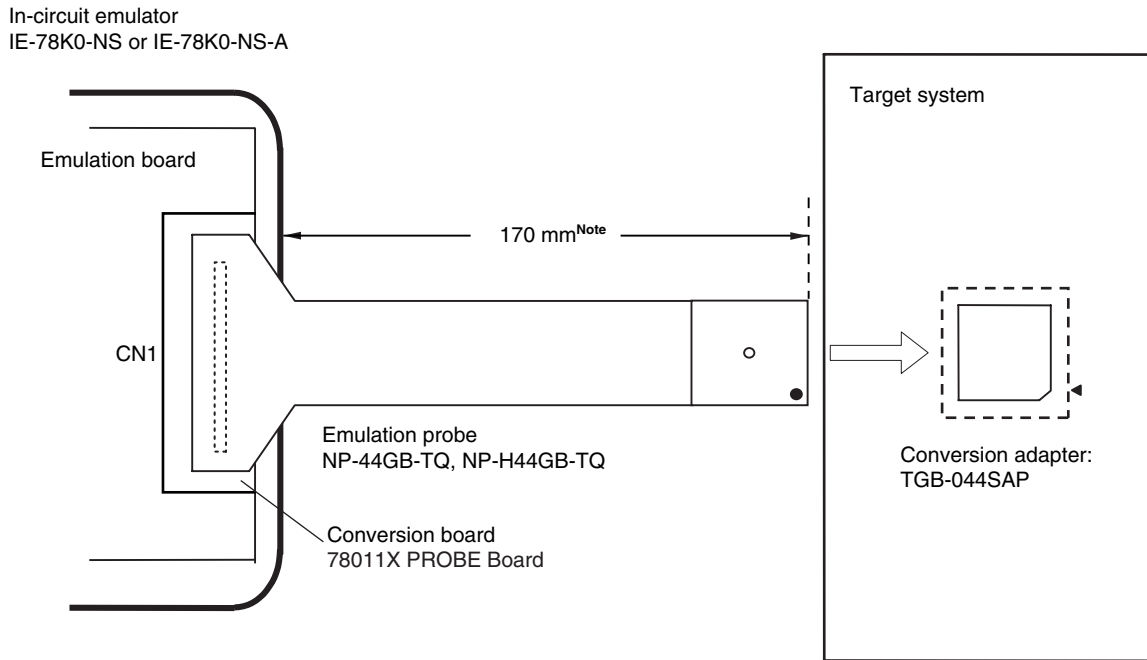**Figure B-17. Connection Conditions of Target System (When Using NP-H52GB-TQ)**

Figure B-18. Distance Between IE System and Conversion Adapter (44GB)

Note   Distance when using NP-44GB-TQ. This is 370 mm when using NP-H44GB-TQ.

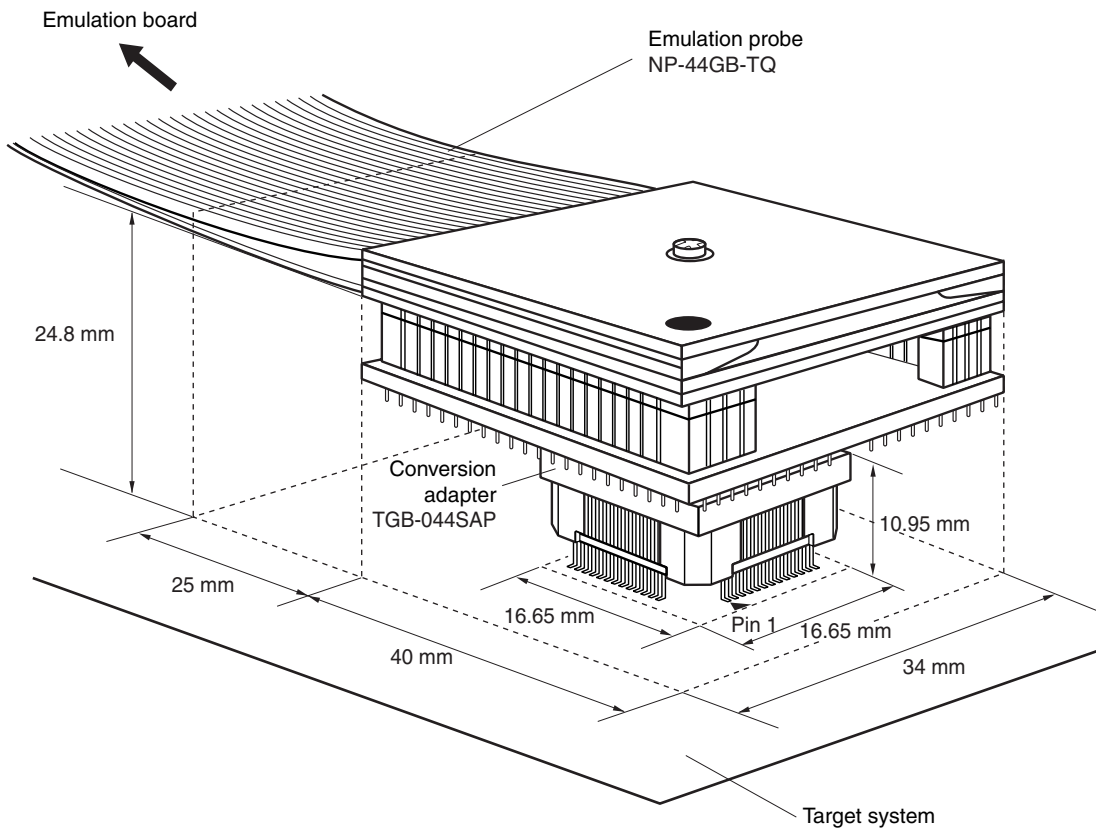**Figure B-19. Connection Conditions of Target System (When Using NP-44GB-TQ)**

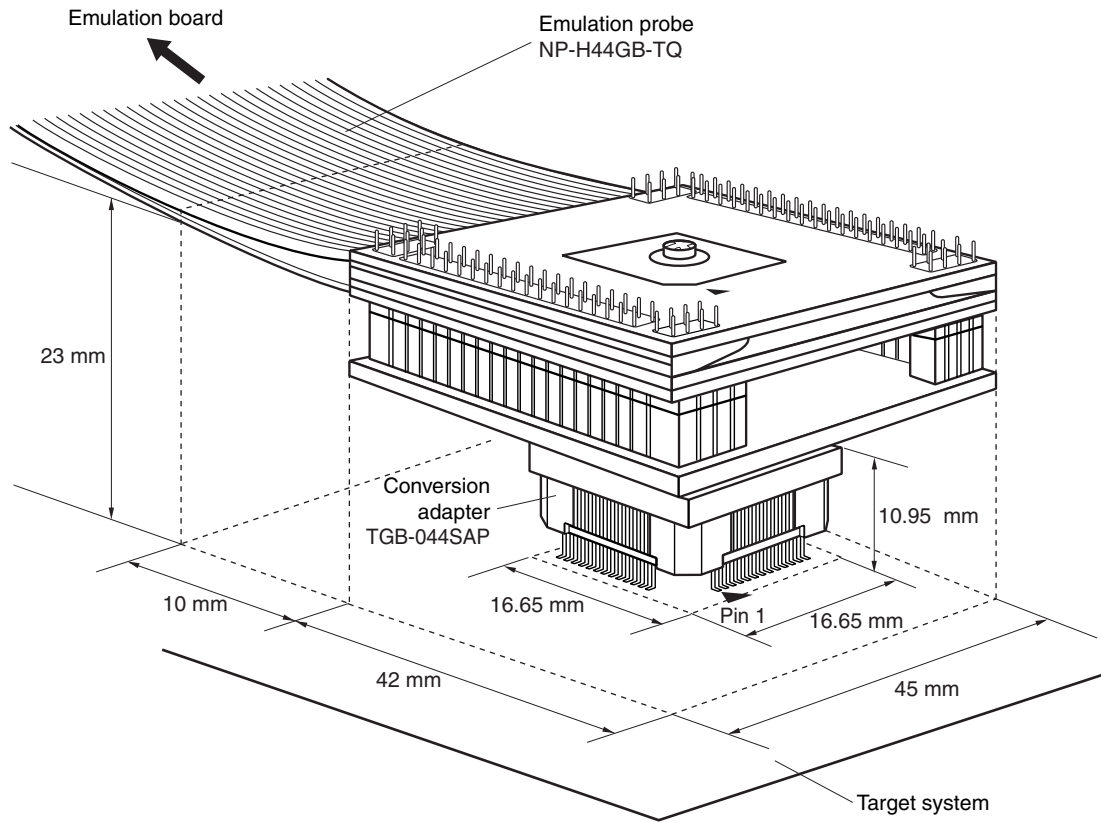**Figure B-20. Connection Conditions of Target System (When Using NP-H44GB-TQ)**

Emulation board

Emulation probe
NP-H44GB-TQ

23 mm

Conversion
adapter
TGB-044SAP

10.95 mm

10 mm

16.65 mm

Pin 1

16.65 mm

42 mm

45 mm

Target system

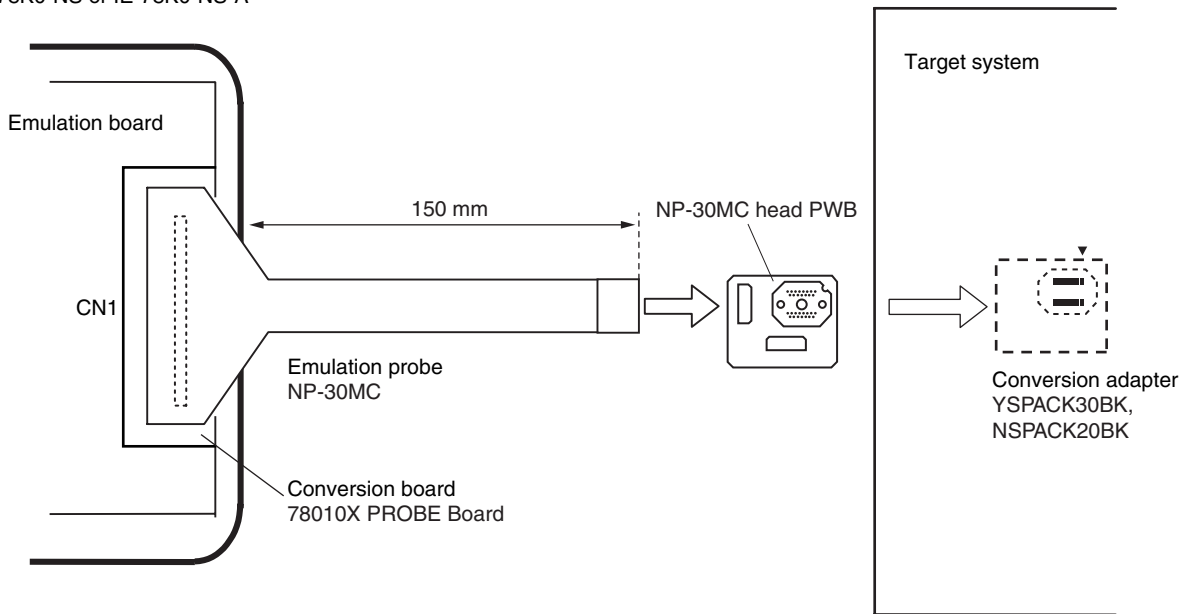**Figure B-21. Distance Between IE System and Conversion Adapter (30MC)**

Figure B-22. Connection Conditions of Target System (When Using NP-30MC)