

CUSTOMER NOTIFICATION

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CP (K), O

# **IE-780148-NS-EM1**

## **Preliminary User's Manual**

**5th edition, November 2003**

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## Revision History

	Page	Description
1st	–	Newly created (SUD-TT-0068-1-E)
2nd (SUD-TT-0068-2-E)	p. 6	Addition of 4.1, 4.2, 4.3, 4.4, 4.5 to CHAPTER 4
	p. 9	Addition of NP-64GB-TQ to Table 1-1 and change of conversion socket name
	p. 11	Addition of Ring-OSC to system clock in Basic Specifications
	p. 12	Deletion of regulator switch (SW3) and addition of LED2
	p. 13	Correction of $\mu$ PD780134 to $\mu$ PD780143
	p. 17	Change of “6-8 shorted” to “oscillator” in Table 3-3 Settings of Subsystem Clock
	p. 18	Change of “6-8 shorted” to “32.768 kHz oscillator” on subsystem clock parts board
	pp. 18 to 21	Deletion of Outline of Clock
	p. 21	Modification of description on TMH1
	p. 22	Deletion of regulator switch (SW3) and addition of LED2
	p. 23	Modification of Table 3-4 under Setting of multiplication circuit and deletion of (2) Regulator settings
	p. 24	Addition of description on LED2
	pp. 28, 32, 36, 40, 44	Modification of resistor value in equivalent circuit diagram Addition of JP1 and JP2
	p. 46	Modification of CHAPTER 5 RESTRICTIONS
	p. 47	Addition of CHAPTER 6 CAUTIONS
	p. 49	Correction of NP-44GB/H44GB to NP-44GB/44GB-TQ/H44GB-TQ
pp. 53, 54	Correction of NP-H64GB/64GK/64GK-TQ to NP-64GB-TQ/H64GB-TQ/64GK/H64GK-TQ/64GC/64GC-TQ/H64GC-TQ	
3rd (SUD-TT-0068-3-E)	p. 6	Addition of 3.9 to CHAPTER 3
	pp. 9, 10, 12 to 14, 57, 58	Addition of probe conversion board for 78K0/KF1
	p. 12	Deletion of JP3, addition of LED3
	p. 16	Change of “oscillator” to “6-8 shorted” in Table 3-3 Settings of Subsystem Clock
	p. 21	Deletion of JP3, addition of LED3
	p. 25	Addition of 3.9 LCD2 and LCD3
	pp. 28, 32, 36, 40, 44	Addition of reset mask circuit
	p. 46	Deletion of descriptions of restrictions
p. 47	Deletion of descriptions of cautions	
4th (SUD-DT-03-0131-1-E)	p. 2	Modification of disclaimer
	p. 9	Change of YQ-GUIDE to YSGUIDE in Table 1-1
	p. 16	Addition of note
	p. 46	Modification of descriptions of restrictions
	p. 47	Modification of descriptions of cautions
5th (SUD-DT-03-0131-2-E)	Throughout	Addition of target devices in line with support of 78K0/Kx1+
	p. 22	Addition of jumper settings for 12 MHz
	CHAPTER 4	Modification of emulation device
p. 23	Addition of descriptions of 78K0/Kx1+ mask options	

## 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 ( $\mu$ PD780103 Subseries):  $\mu$ PD780101, 780102, 780103, 78F0103
- 78K0/KC1 ( $\mu$ PD780114 Subseries):  $\mu$ PD780111, 780112, 780113, 780114, 78F0114
- 78K0/KD1 ( $\mu$ PD780124 Subseries):  $\mu$ PD780121, 780122, 780123, 780124, 78F0124
- 78K0/KE1 ( $\mu$ PD780138 Subseries):  $\mu$ PD780131, 780132, 780133, 780134, 780136, 780138, 78F0134, 78F0138
- 78K0/KF1 ( $\mu$ PD780148 Subseries):  $\mu$ PD780143, 780144, 780146, 780148, 78F0148
- 78K0/KB1+ ( $\mu$ PD780103 Subseries):  $\mu$ PD78F0101H, 78F0102H, 78F0103H
- 78K0/KC1+ ( $\mu$ PD780114 Subseries):  $\mu$ PD78F0112H, 78F0113H, 78F0114H
- 78K0/KD1+ ( $\mu$ PD780124 Subseries):  $\mu$ PD78F0122H, 78F0123H, 78F0124H
- 78K0/KE1+ ( $\mu$ PD780138 Subseries):  $\mu$ PD78F0132H, 78F0133H, 78F0134H, 78F0136H, 78F0138H
- 78K0/KF1+ ( $\mu$ PD780148 Subseries):  $\mu$ PD78F0148H

### 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. When using the IE-78K0-NS in combination with the IE-78K0-NS-PA, it is functionally equal to the IE-78K0-NS-A. In such a case, therefore, read the IE-78K0-NS-A in this document as IE-78K0-NS + IE-78K0-NS-PA.

IE-78K0S-NS(-A) User's Manual
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- Basic specifications
- System configuration
- External interface functions

IE-780148-NS-EM1 User's Manual
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- General
- Part names
- 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 (the real chip) that is the target of 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 IE-78K0-NS or IE-78K0-NS-A and the 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

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## 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.

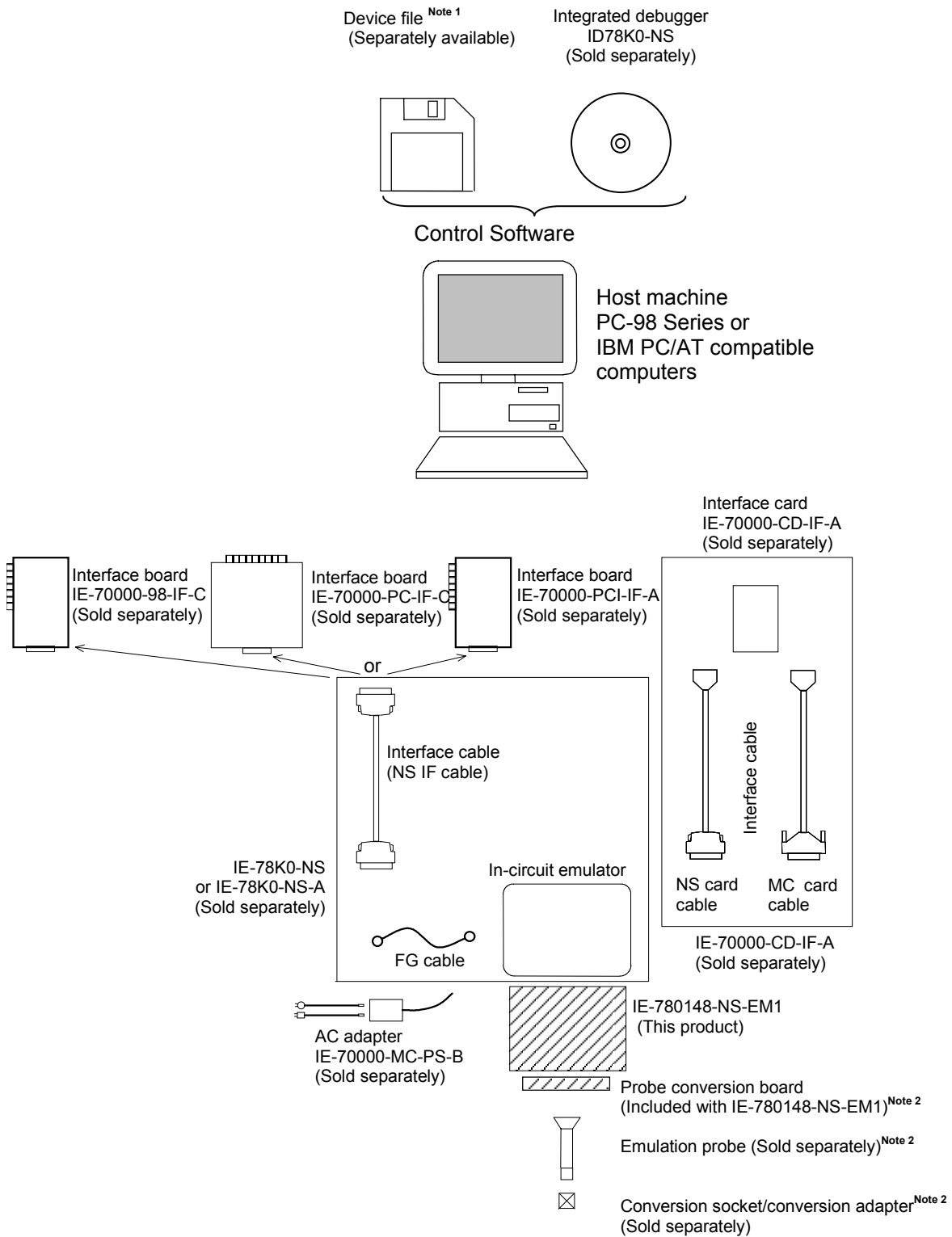
This chapter describes the IE-780148-NS-EM1 system configuration and basic specifications.

- Target device
  - 78K0/KB1 ( $\mu$ PD780103 Subseries):  $\mu$ PD780101, 780102, 780103, 78F0103
  - 78K0/KC1 ( $\mu$ PD780114 Subseries):  $\mu$ PD780111, 780112, 780113, 780114, 78F0114
  - 78K0/KD1 ( $\mu$ PD780124 Subseries):  $\mu$ PD780121, 780122, 780123, 780124, 78F0124
  - 78K0/KE1 ( $\mu$ PD780138 Subseries):  $\mu$ PD780131, 780132, 780133, 780134, 780136, 780138, 78F0134, 78F0138
  - 78K0/KF1 ( $\mu$ PD780148 Subseries):  $\mu$ PD780143, 780144, 780146, 780148, 78F0148
  - 78K0/KB1+ ( $\mu$ PD780103 Subseries):  $\mu$ PD78F0101H, 78F0102H, 78F0103H
  - 78K0/KC1+ ( $\mu$ PD780114 Subseries):  $\mu$ PD78F0112H, 78F0113H, 78F0114H
  - 78K0/KD1+ ( $\mu$ PD780124 Subseries):  $\mu$ PD78F0122H, 78F0123H, 78F0124H
  - 78K0/KE1+ ( $\mu$ PD780138 Subseries):  $\mu$ PD78F0132H, 78F0133H, 78F0134H, 78F0136H, 78F0138H
  - 78K0/KF1+ ( $\mu$ PD780148 Subseries):  $\mu$ PD78F0148H

### 1.1 System Configuration

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

**Figure 1-1. System Configuration**





**Notes 1.** The device file is as follows.

$\mu$ SxxxxDF780103: 78K0/KB1, 78K0/KB1+

$\mu$ SxxxxDF780114: 78K0/KC1, 78K0/KC1+

$\mu$ SxxxxDF780124: 78K0/KD1, 78K0/KD1+

$\mu$ SxxxxDF780138: 78K0/KE1, 78K0/KE1+

$\mu$ SxxxxDF780148: 78K0/KF1, 78K0/KF1+

2. Refer to Table 1-1 for details of the probe conversion board, emulation probe and conversion socket/conversion adapter.

**Table 1-1. List of Emulation Probes, Conversion Sockets, and Conversion Adapters**

Package	Probe Conversion Board	Emulation Probe <sup>Note 1</sup>	Conversion Socket/ Conversion Adapter
80-pin QFP (14 × 14)	78014X PROBE Board	NP-80GC	EV-9200GC-80
		NP-80GC-TQ	TGC-080SBP <sup>Note 2</sup>
		NP-H80GC-TQ	
80-pin TQFP (12 × 12)		NP-80GK	TGK-080SDP <sup>Note 2</sup>
		NP-H80GK-TQ	
64-pin TQFP (12 × 12)	78013X PROBE Board	NP-64GK	TGK-064SBP <sup>Note 2</sup>
		NP-H64GK-TQ	
64-pin LQFP (14 × 14)		NP-64GC	EV-9200GC-64
		NP-64GC-TQ	TGC-064SAP <sup>Note 2</sup>
		NP-H64GC-TQ	
64-pin LQFP (10 × 10)		NP-64GB-TQ	TGB-064SDP <sup>Note 2</sup>
		NP-H64GB-TQ	
52-pin LQFP (10 × 10)	78012X PROBE Board	NP-H52GB-TQ	TGB-052SBP <sup>Note 2</sup>
44-pin LQFP (10 × 10)	78011X PROBE Board	NP-44GB	EV-9200G-44
		NP-44GB-TQ	TGB-44SAP <sup>Note 2</sup>
		NP-H44GB-TQ	
30-pin SSOP (300 mil)	78010X PROBE Board	NP-30MC	YSPACK30BK + NSPACK30BK + YSGUIDE <sup>Note 2</sup>

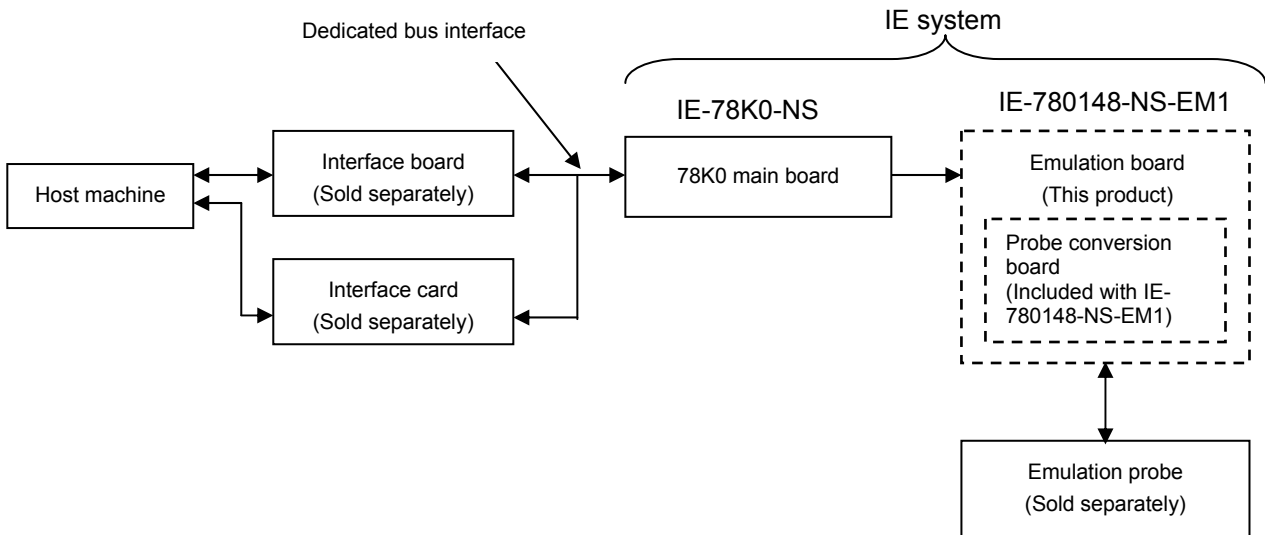
**Notes 1.** Made by Naito Densai Machida Mfg. Co., Ltd.

2. Made by Tokyo Eletech Corp.

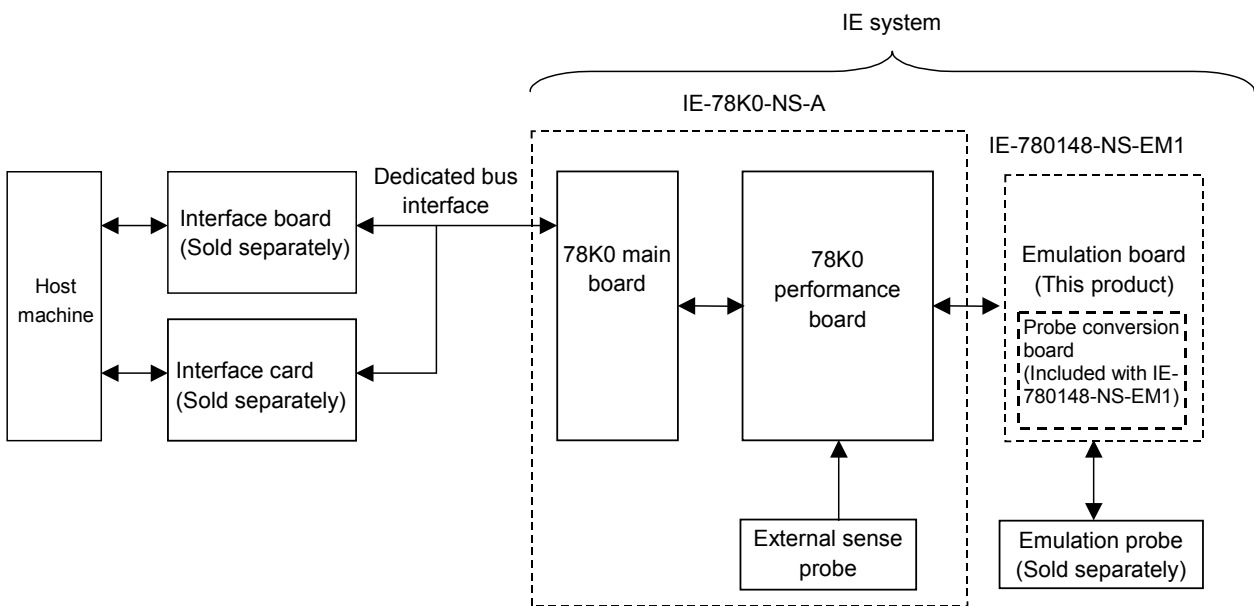
## 1.2 Hardware Configuration

The IE-780148-NS-EM1's position is shown below.

**Basic Hardware Configuration (When IE-78K0-NS Is Used)**



**Basic Hardware Configuration (When IE-78K0-NS-A Is Used)**



### 1.3 Basic Specifications

**Table 1-2. Basic Specifications**

Parameter	Description
Target device	<ul style="list-style-type: none"> <li>• 78K0/KB1 (<math>\mu</math>PD780103 Subseries): <math>\mu</math>PD780101, 780102, 780103, 78F0103</li> <li>• 78K0/KC1 (<math>\mu</math>PD780114 Subseries): <math>\mu</math>PD780111, 780112, 780113, 780114, 78F0114</li> <li>• 78K0/KD1 (<math>\mu</math>PD780124 Subseries): <math>\mu</math>PD780121, 780122, 780123, 780124, 78F0124</li> <li>• 78K0/KE1 (<math>\mu</math>PD780138 Subseries): <math>\mu</math>PD780131, 780132, 780133, 780134, 780136, 780138, 78F0134, 78F0138</li> <li>• 78K0/KF1 (<math>\mu</math>PD780148 Subseries): <math>\mu</math>PD780143, 780144, 780146, 780148, 78F0148</li> <li>• 78K0/KB1+ (<math>\mu</math>PD780103 Subseries): <math>\mu</math>PD78F0101H, 78F0102H, 78F0103H</li> <li>• 78K0/KC1+ (<math>\mu</math>PD780114 Subseries): <math>\mu</math>PD78F0112H, 78F0113H, 78F0114H</li> <li>• 78K0/KD1+ (<math>\mu</math>PD780124 Subseries): <math>\mu</math>PD78F0122H, 78F0123H, 78F0124H</li> <li>• 78K0/KE1+ (<math>\mu</math>PD780138 Subseries): <math>\mu</math>PD78F0132H, 78F0133H, 78F0134H, 78F0136H, 78F0138H</li> <li>• 78K0/KF1+ (<math>\mu</math>PD780148 Subseries): <math>\mu</math>PD78F0148H</li> </ul>
System clock	<ul style="list-style-type: none"> <li>• Ring-OSC: 240 kHz</li> <li>• Main system clock: 10.0 MHz max. (78K0/Kx1) 12.0 MHz max. (78K0/Kx1+)</li> <li>• Subsystem clock: 32.768 kHz (not provided for the <math>\mu</math>PD78010x, 78F0103, and 78F010xH)</li> </ul>
Clock supply	<p>Internal: Mounted on the emulation board</p> <p>External: Pulse input</p>
Low voltage support	$V_{DD} = 2.5$ to $5.5$ V (lower than 2.5 V is not supported)

## CHAPTER 2 PART NAMES

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

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

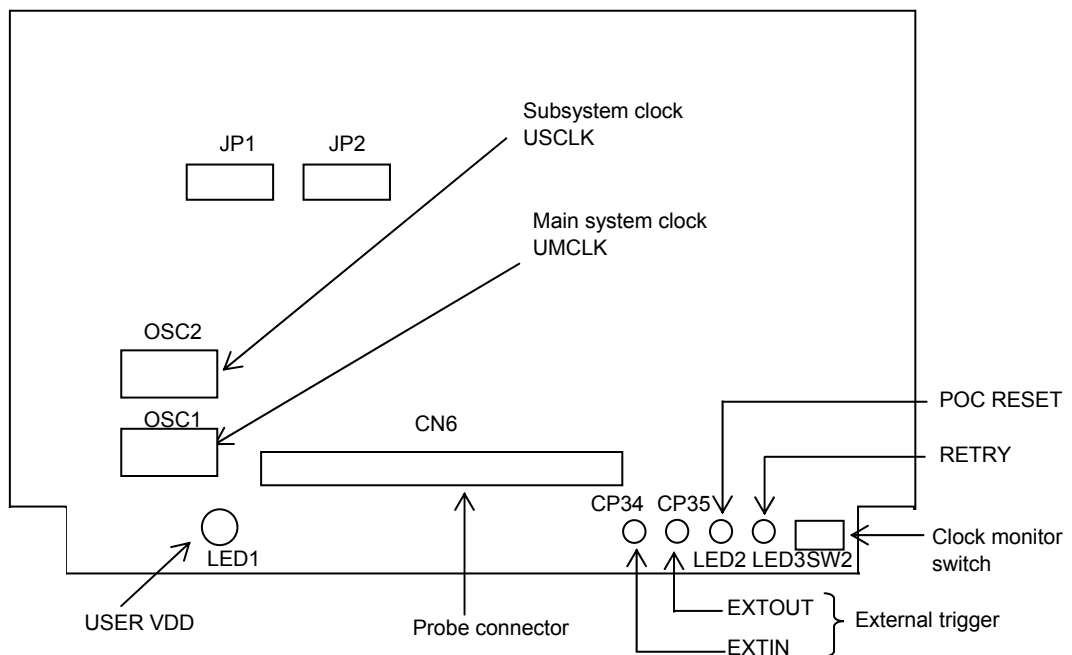
If there are any missing or damaged items, please contact an NEC Electronics sales representative.

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

### 2.1 Names of Parts on Board

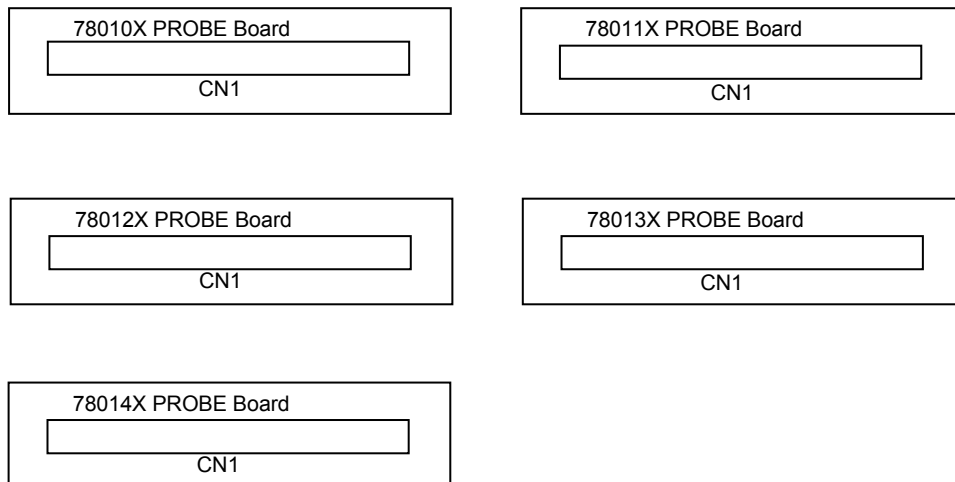
#### (1) Emulation board IE-780148-NS-EM1

<IE-780148-NS-EM1>



#### (2) Probe conversion boards (five boards)

<Each PROBE 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 and emulation probe. Mode setting methods are also described.

**Caution** Connecting or removing parts 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

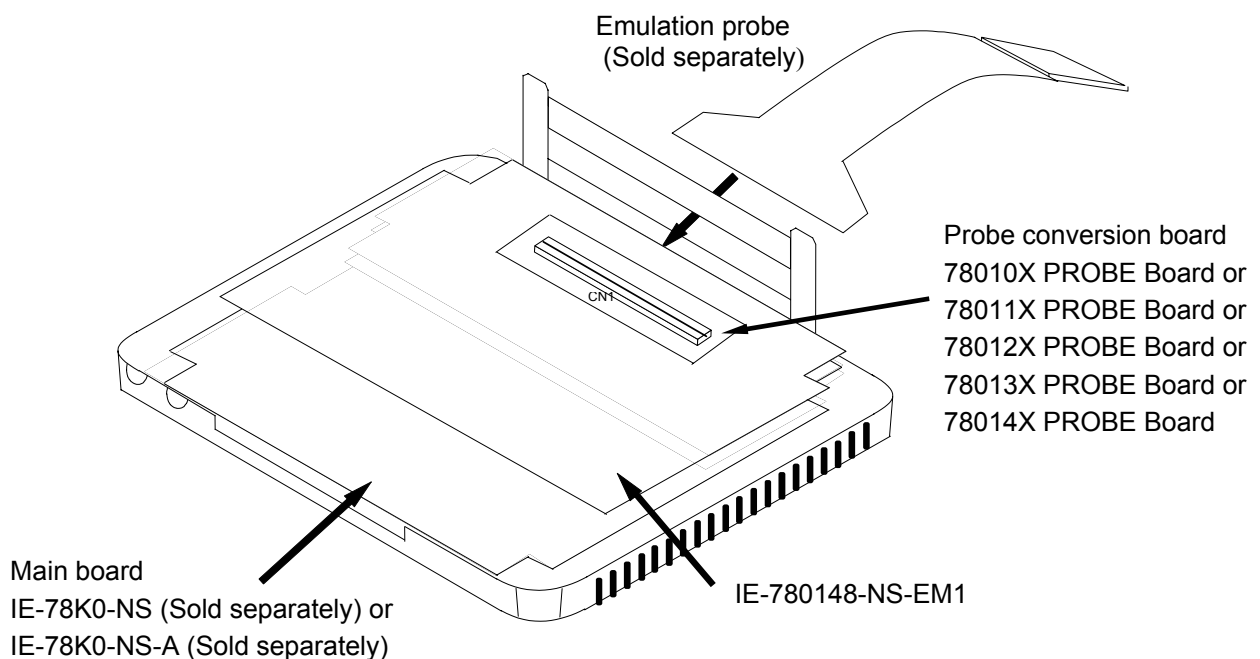
Connect CN2 of the probe conversion board to CN6 of the IE-780148-NS-EM1.

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

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

**Caution** Incorrect connection may damage the IE system. For more details on connection, see the user's manual for each emulation probe.

<Connection of Emulation Probe and Probe Conversion Board>



**Table 3-1. Target Device and Corresponding Probe Conversion Board**

Target Device	Probe Conversion Board to Be Used
$\mu$ PD780101, 780102, 780103, 78F0103, 78F0101H, 78F0102H, 78F0103H	78010X PROBE Board
$\mu$ PD780111, 780112, 780113, 780114, 78F0114, 78F0112H, 78F0113H, 78F0114H	78011X PROBE Board
$\mu$ PD780121, 780122, 780123, 780124, 78F0124, 78F0122H, 78F0123H, 78F0124H	78012X PROBE Board
$\mu$ PD780131, 780132, 780133, 780134, 780136, 780138, 78F0134, 78F0138, 78F0132H, 78F0133H, 78F0134H, 78F0136H, 78F0138H	78013X PROBE Board
$\mu$ PD780143, 780144, 780146, 780148, 78F0148, 78F0148H	78014X PROBE Board

## 3.2 Clock Settings

### 3.2.1 Outline of clock settings

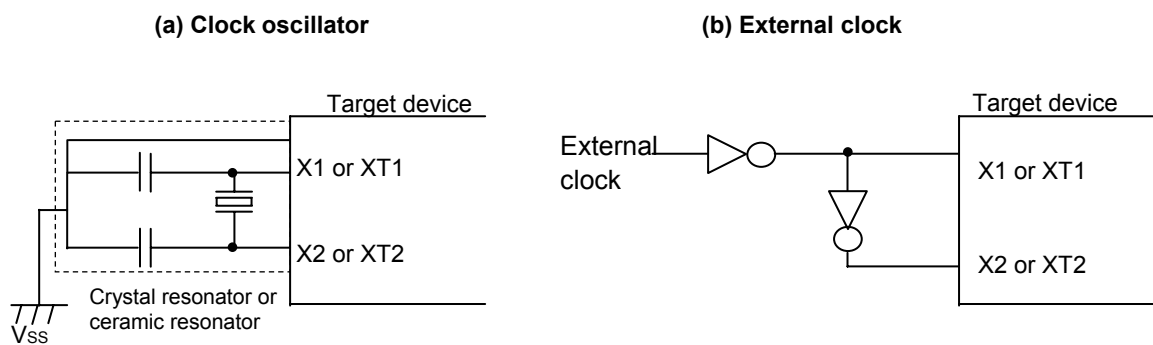
The system clock to be used during debugging can be selected from (1) to (3) below.

- (1) Clock already mounted on emulation board
- (2) Clock mounted by user
- (3) Clock input from the target system

“(3) Clock input from the target system” can be selected only when the target system shown in part (b) of Figure 3-1 includes an external clock. If the target system shown in part (a) of Figure 3-2 includes a clock oscillator, refer to **3.2.2 (1) Clock already mounted on emulation board** or **3.2.2 (2) Clock mounted by user**.

**Caution** An abnormal main system clock supply will cause the IE system to hang up.

Figure 3-1. Target System Clock Oscillator



### 3.2.2 Main system/subsystem clock settings

The settings of the main system clock are shown in Table 3-2.

**Table 3-2. Settings of Main System Clock**

Frequency of Main System Clock Used		SFR (MCM0)	IE-780148-NS-EM1 Parts Board (UMCLK)	Integrated Debugger (ID78K0-NS) <small>Note 2</small> CPU Clock Source Selection
(1) Clock already mounted on emulation board	10.0 MHz	1	Oscillator	Internal
(2) Clock mounted by user	Other than 10.0 MHz		Oscillator assembled or prepared by user	
(3) Clock input from the target system			Oscillator (not used)	External
(4) Ring-OSC <small>Note 1</small>	240 kHz	0	Oscillator (not used)	Internal or external

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

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

The settings of the subsystem clock are shown in Table 3-3.

**Table 3-3. Settings of Subsystem Clock**

Frequency of Subsystem Clock Used		IE-780148-NS-EM1 Parts Board (USCLK)	IE-78K0-NS(-A) (G-780009 Board) JP8
(1) Clock that is already mounted on emulation board	32.768 kHz	6-8 shorted <small>Note</small>	1-2 shorted
(2) Clock that is mounted by user	Other than 32.768 kHz	Oscillator assembled or prepared by user	3-4 shorted
(3) Clock input from the target system		Oscillator (not used)	

**Note** In the Ver.1.x board, the oscillator is mounted on the parts board (USCLK).

In the Ver.2.x board, the oscillator is mounted on the board, so short 6-8.

See the IE-78K0-NS User's Manual (U13731E) or the IE-78K0-NS-A User's Manual (U14899E) for details of the JP8 position on the IE-78K0-NS(-A).

The IE-780148-NS-EM1's factory settings are those listed above under "when using clock already mounted on emulation board".

The main system/subsystem clock settings of (1) to (4) are individually described in the following pages.



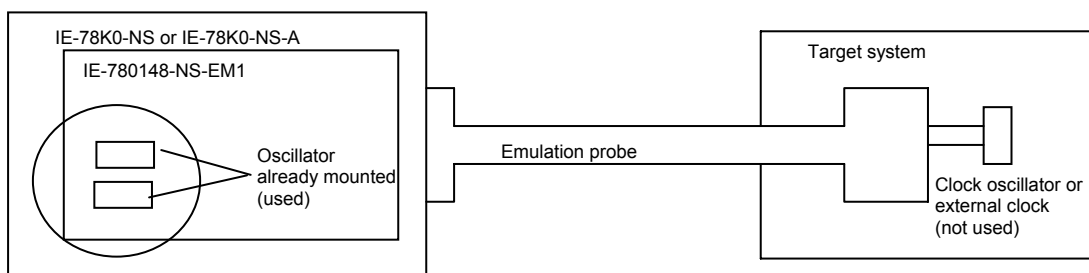
**(1) When using clock already mounted on emulation board**

When the IE-780148-NS-EM1 is shipped, a 10.0 MHz crystal oscillator and a 32.768 kHz are already mounted on the UMCLK socket and emulation board, respectively.

When using the factory-set mode settings, there is no need to make any other hardware settings.

A setting outline is shown in Figure 3-2. When starting the integrated debugger (ID78K0S-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 debugger is activated, if the special function register MCM0 is changed to 1, the CPU operating clock is switched from the Ring-OSC to the clock already mounted on the emulation board.

**Figure 3-2. When Using Clock Already Mounted on Emulation Board**



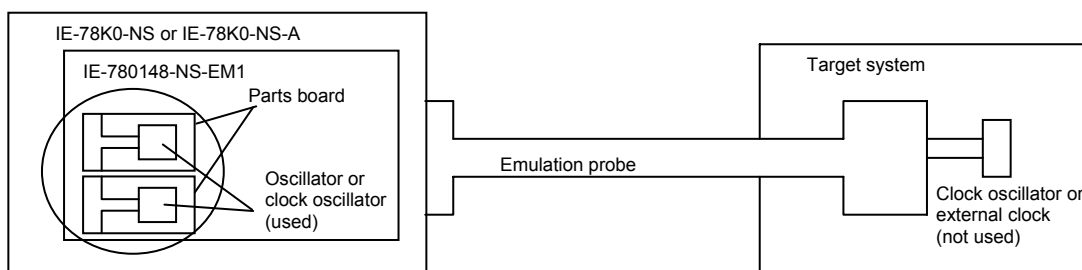
**Remark** The clock that is supplied by the IE-780148-NS-EM1’s oscillator (encircled in the figure) is used.

**(2) When using clock mounted by user**

Remove the crystal oscillator already mounted on the emulation board (UMCLK: 10.0 MHz) or parts board (USCLK) and mount the parts board (oscillator) that includes the oscillator or resonator to be used. This is effective when debugging with a clock with a different frequency from the clock already mounted (main system clock: 2.0 to 10.0 MHz, subsystem clock: 32 to 38.5 kHz).

A setting outline is shown in Figure 3-3. The settings of either (a) or (b) described in the following pages are required, 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 debugger is activated, if the special function register MCM0 is changed to 1, the CPU operating clock is switched from the Ring-OSC to the clock mounted on by user.

**Figure 3-3. When Using Clock Mounted by User (Main System Clock)**

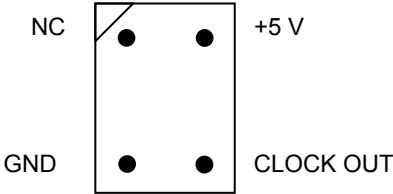


**Remark** The clock that is supplied by the IE-780148-NS-EM1’s oscillator (encircled in the figure) is used.

**(a) When using a crystal oscillator**

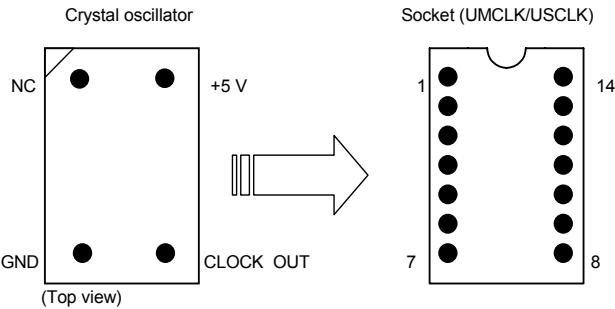
- ◆ Necessary items
  - Crystal oscillator (with pin configuration as shown in Figure 3-4)

**Figure 3-4. Crystal Oscillator (Main System Clock)**



<Procedure>

- <1> Prepare the IE-780148-NS-EM1.
- <2> Remove the crystal oscillator or parts board from the socket (marked UMCLK or USCLK) on the IE-780148-NS-EM1.
- <3> Mount the new crystal oscillator in the socket from which the oscillator was removed in <2> above (UMCLK or USCLK). At this time, insert the oscillator into the socket aligning the pins as indicated below.



Crystal Oscillator Pin	Socket Pin No.
NC	1
GND	7
CLOCK OUT	8
+5 V	14

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

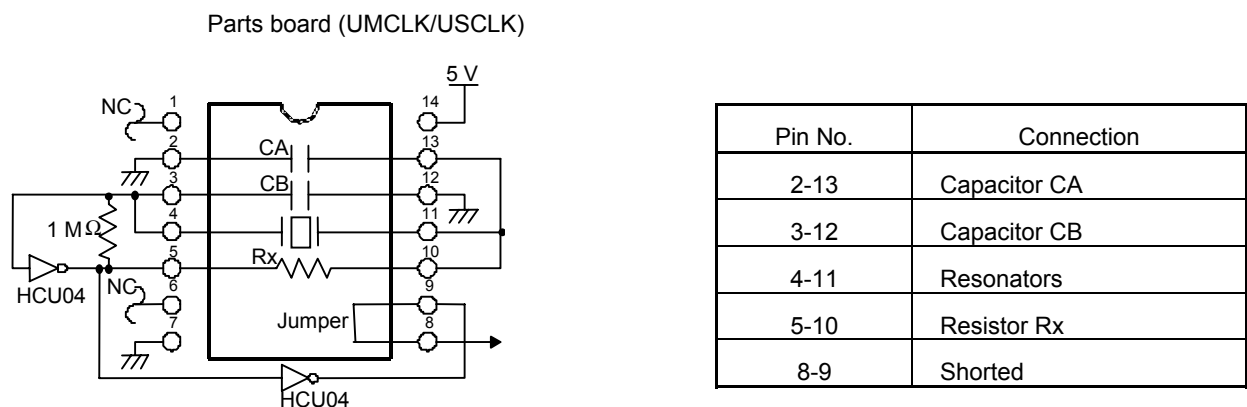
**(b) When using a ceramic or crystal resonator**

## ◆ Necessary items

- Parts board
- Ceramic or crystal resonator
- Resistor Rx
- Capacitor CA
- Capacitor CB
- Solder kit

## &lt;Procedure&gt;

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

**Figure 3-5. Connections on Parts Board**

**Remark** NC: No Connection

- <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 (<1> above) to the socket (UMCLK or USCLK) 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 mounted in the UMCLK or USCLK socket on the emulation board is wired as shown in Figure 3-5 above.

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

### (3) Clock input from the target system

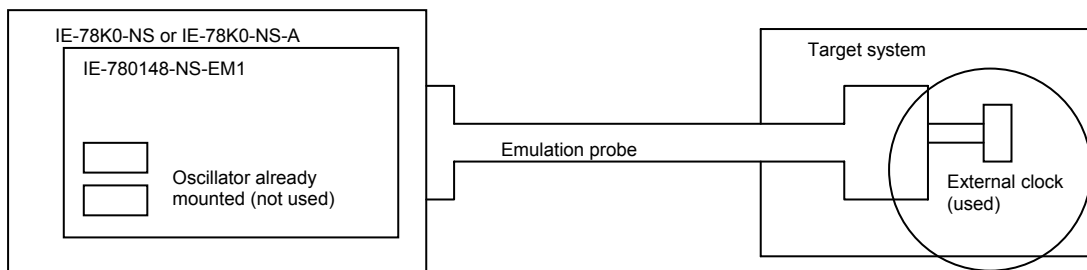
The external clock pulse signal on the target system is used via an emulation probe. There is no need to make any other hardware settings for the main system clock. For the subsystem clock, set JP8 of the IE-78K0-NS(-A) to 3-4 shorted.

A setting outline is shown in Figure 3-6. 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 clock).

MCM0 is changed to 1, the CPU operating clock is switched from the Ring-OSC to the clock input from the target system.

**Caution** The clock input from the target system should be a rectangular wave.

**Figure 3-6. When Using Clock Input from Target System (Main System Clock)**



**Remark** The external clock that is supplied by the target system (encircled in the figure) is used.

### (4) When using Ring-OSC

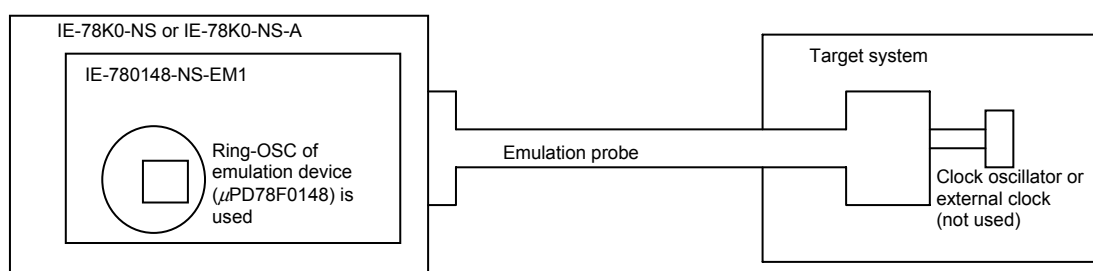
When the IE system is activated, Ring-OSC (240 kHz) is selected as the CPU operating clock. The special-function register MCM0 is used to switch between Ring-OSC and the main system clock described in 3.2 (1) to (3).

A setting outline is shown in Figure 3-7.

**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  $f_{osc}/2^7$  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

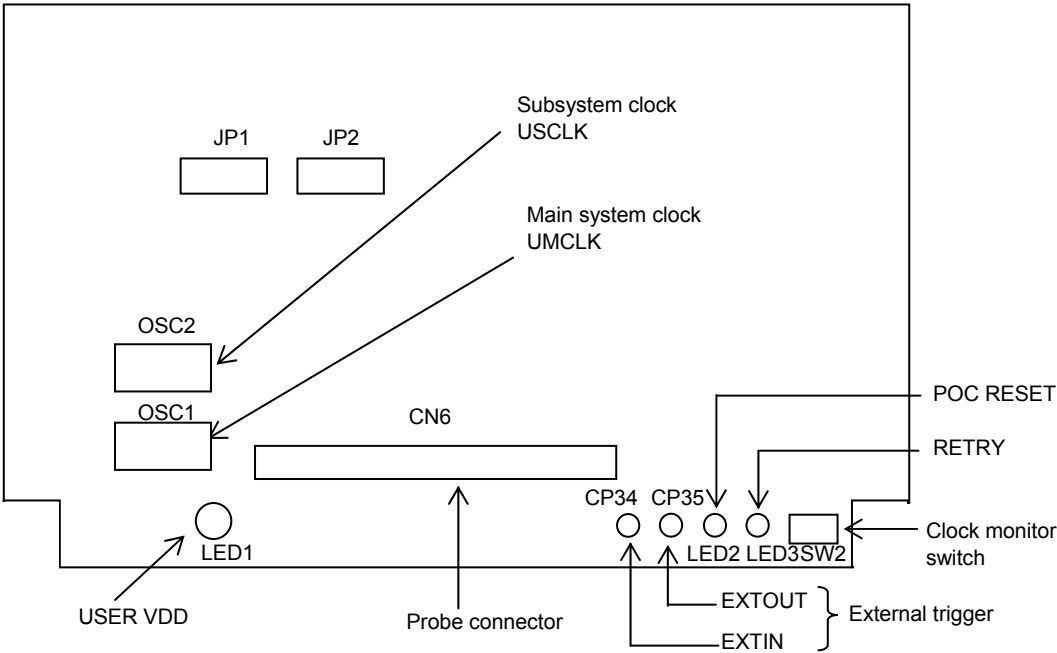
**Figure 3-7. When Using Ring-OSC (Main System Clock)**



### 3.3 External Trigger

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

See the ID78K Series Integrated Debugger Ver.2.30 or Later Operation User's Manual (U15181E) for descriptions of usage. See the IE-78K0-NS User's Manual (U13731E) or IE-78K0-NS-A User's Manual (U14889E) for descriptions of pin characteristics.



### 3.4 Jumper Settings of IE-780148-NS-EM1

Refer to the following table for the IE-780148-NS-EM1 jumper settings.

#### 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	1-2 shorted	1-2 shorted
2.5 MHz to less than 3.5 MHz	3-4 shorted	3-4 shorted
3.5 MHz to less than 5.0 MHz	5-6 shorted	5-6 shorted
5.0 MHz to less than 6.5 MHz	7-8 shorted	7-8 shorted
6.5 MHz to less than 9 MHz	9-10 shorted	9-10 shorted
9 MHz to 10.0 MHz (factory setting)	11-12 shorted	11-12 shorted
10 MHz to 12 MHz <sup>Note</sup>	9-10 shorted 11-12 shorted	9-10 shorted 11-12 shorted

**Note** Use the jumpers supplied with the IE-780148-NS-EM1.

### 3.5 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.

### 3.6 Settings of Mask Options

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

[When target device is 78K0/Kx1]

- Ring-OSC
- POC ON/OFF and detection voltage 2.85 V, 3.5 V
- P60 to P63 (these ports are not provided in the  $\mu$ PD780101, 780102, 780103, and 78F0103)

Set the mask options in the integrated debugger.

Open the mask option window from [Option] → [Mask Option] and set the mask options.

Refer to the ID78K Series Integrated Debugger Ver.2.30 or later Operation User's Manual (U15185E) for details of the settings.

- |              |         |  |
|--------------|---------|--|
| • RINGMSK    | NONMSK: | Ring-OSC can be stopped by software<br>Watchdog timer stop enabled     |
|              | MSK:    | Ring-OSC cannot be stopped by software<br>Watchdog timer stop disabled |
| • 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  |

[When target device is 78K0/Kx1+]

- Ring-OSC

Set the mask options in the integrated debugger.

Open the mask option window from [Option] → [Mask Option] and set the mask options.

Refer to the ID78K Series Integrated Debugger Ver.2.30 or later Operation User's Manual (U15185E) for details of the settings.

- |           |         |  |
|-----------|---------|--|
| • RINGMSK | NONMSK: | Ring-OSC can be stopped by software<br>Watchdog timer stop enabled     |
|           | MSK:    | Ring-OSC cannot be stopped by software<br>Watchdog timer stop disabled |

**Caution When emulating the 78K0/Kx1+, “78K0Kx1plus” is displayed in the mask option window, but this does not need to be set.**

### 3.7 Emulation of POC and LVI Functions

When emulating the POC and LVI using the IE-780148-NS-EM1, supply a voltage of the same potential as the VDD pin of the emulation device to TP1, because POC and LVI supply voltage 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 VDD pin of the target device.

Refer to 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. See 3.9 for details.

### 3.8 Jumper Settings of IE-78K0-NS and IE-78K0-NS-A

When using the IE-780148-NS-EM1, set the jumpers of the IE-78K0-NS or IE-78K0-NS-A as shown below.

Refer to the IE-78K0-NS User's Manual (U13731E) or IE-78K0-NS-A User's Manual (U14889E) for details of jumper positions.

**Table 3-5. Jumper Settings of IE-78K0-NS and IE-78K0-NS-A**

**a. When target device is 78K0/KB1 or 78K0/KB1+ ( $\mu$ PD780103 Subseries)**

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

**b. When target device is other than 78K0/KB1 or 78K0/KB1+ ( $\mu$ PD780103 Subseries)**

	JP2	JP3	JP4	JP6	JP7	JP8
Setting	2-3 shorted	1-2 shorted	1-2 shorted	3-4 shorted	3-4 shorted	1-2 shorted *1 or 3-4 shorted *2

\*1 Selects the subsystem clock as the internal clock

\*2 Selects the subsystem clock as the external clock

**Table 3-6. Jumper Setting of IE-78K0-NS-A G-78K0H OPTION Board**

	J2
Setting	2-3 shorted



### 3.9 LED2 and LED3

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

#### LED2 (POC RESET)

An LED used to check the POC reset status.

LED2 is lit during the reset shown below. Do not perform 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 emulation switch SW2 on the clock monitor

#### LED3 (RETRY)

An LED used to check the wait (retry) status.

LED3 is lit during the wait status. The wait indicated by LED3 is the one that occurs when the in-circuit emulator is repeatedly accessed due to access conflict between the internal system CPU and peripheral buses, in the same manner as the target device specifications.

## CHAPTER 4 DIFFERENCES BETWEEN TARGET DEVICES AND TARGET INTERFACE CIRCUITS

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

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

At the time of debugging by connecting the IE system and the target system, the IE system performs the emulation as if the actual target device is operating on the target system, however, in reality, it is the IE system that performs the emulation, thus producing a slight differences.

- (a) Signals that are input/output from an emulation CPU  $\mu$ PD78F0148H
- (b) Signals that are input/output from an emulation CPU  $\mu$ PD780009A
- (c) Other signals

Regarding the signals in (a) to (c) above, the circuits of the IE system are shown below.

### 4.1 Emulation of 78K0/KB1, 78K0/KB1+

(a) Signals that are input/output from emulation CPU  $\mu$ PD78F0148H

- P03 to P00
- P17 to P10
- P23 to P20
- P33 to P30
- P120
- P130
- AVREF

(b) Signals that are input/output from emulation CPU  $\mu$ PD780009A

None

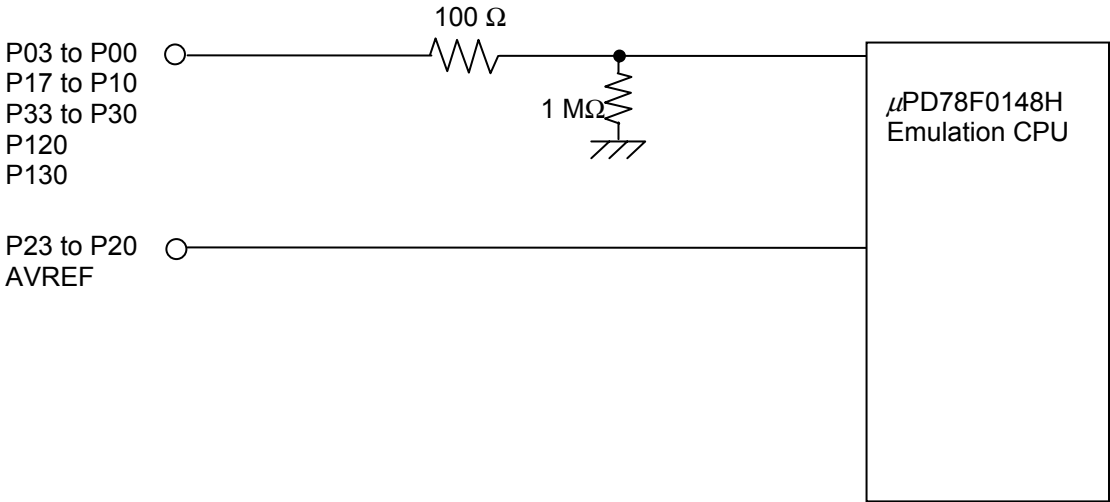
(c) Other signals

- X1, X2,  $\overline{\text{RESET}}$ , VDD, IC/VPP, VSS, AVSS

< Equivalent Circuit of Emulation Circuit >

• Probe

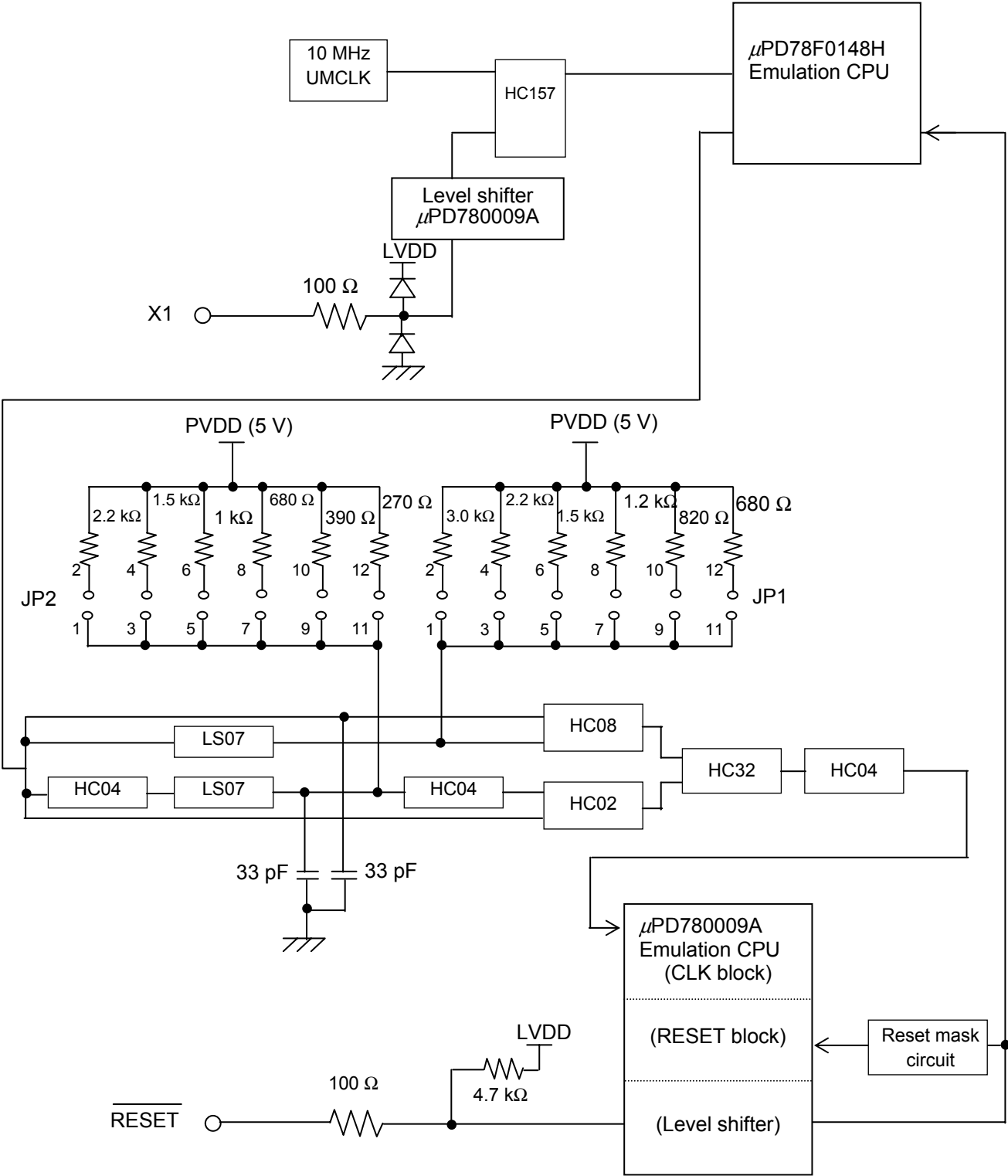
• IE system



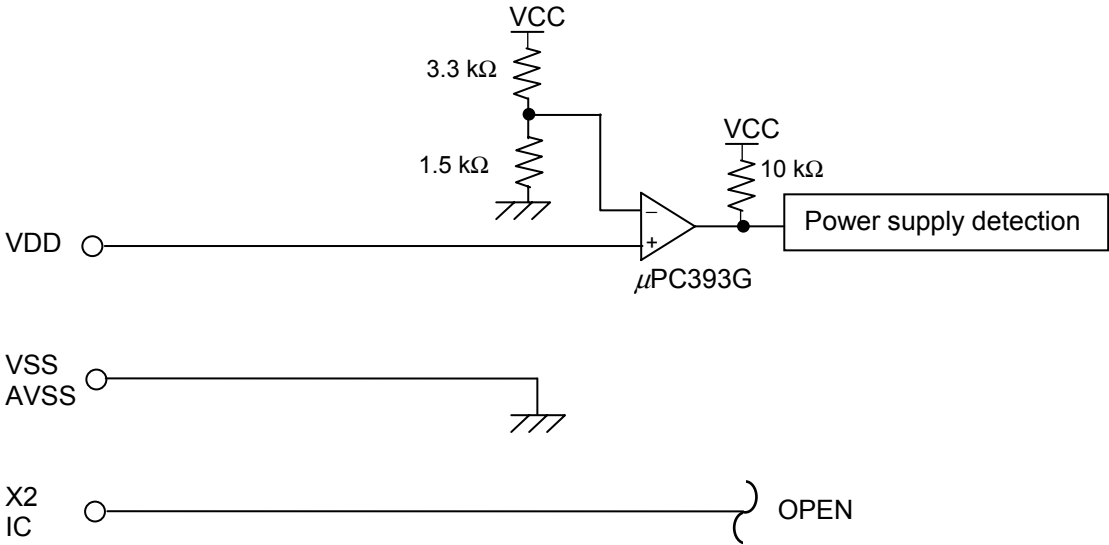
< Equivalent Circuit of Emulation Circuit >

• Probe

• IE system



< Equivalent Circuit of Emulation Circuit >



## 4.2 Emulation of 78K0/KC1, 78K0/KC1+

(a) Signals that are input/output from emulation CPU  $\mu$ PD78F0148H

- P01 to P00
- P17 to P10
- P27 to P20
- P33 to P30
- P73 to P70
- P120
- P130
- AVREF

(b) Signals that are input/output from emulation CPU  $\mu$ PD780009A

- P63 to P60

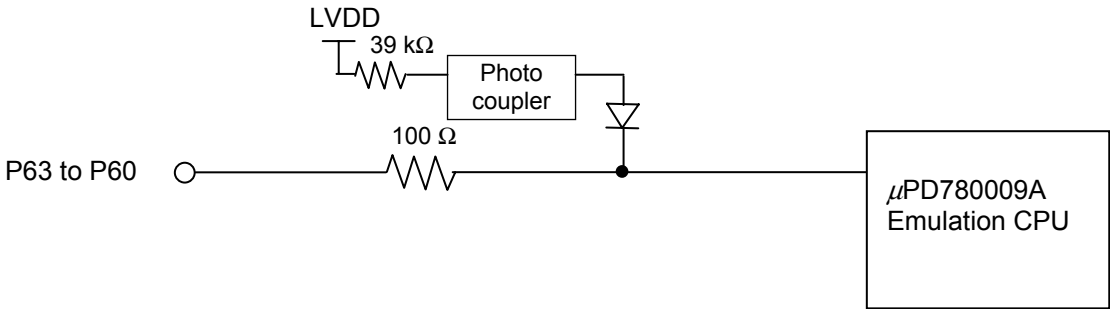
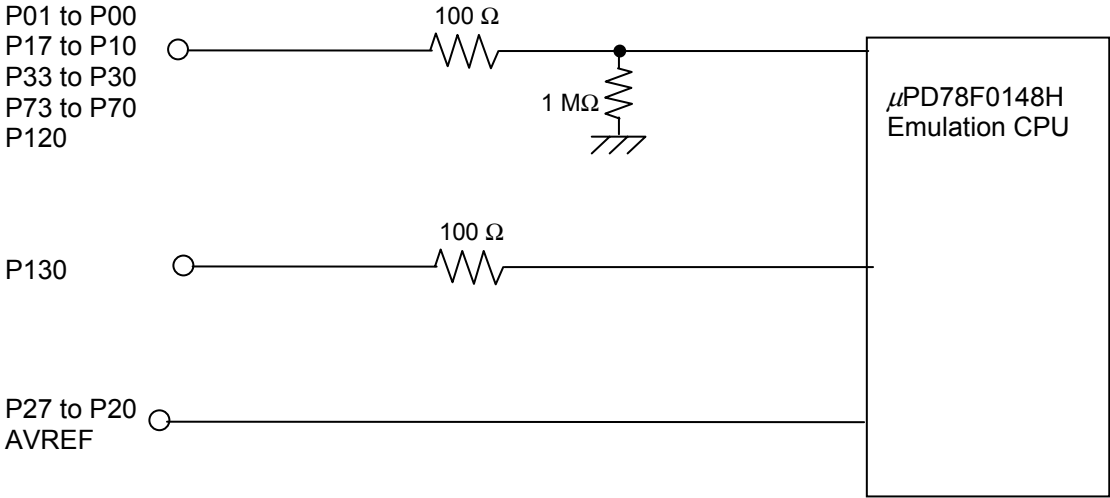
(c) Other signals

- X1, X2, XT1, XT2,  $\overline{\text{RESET}}$ , VPP/TEST, VDD, VSS, EVDD, EVSS, AVSS

< Equivalent Circuit of Emulation Circuit >

• Probe

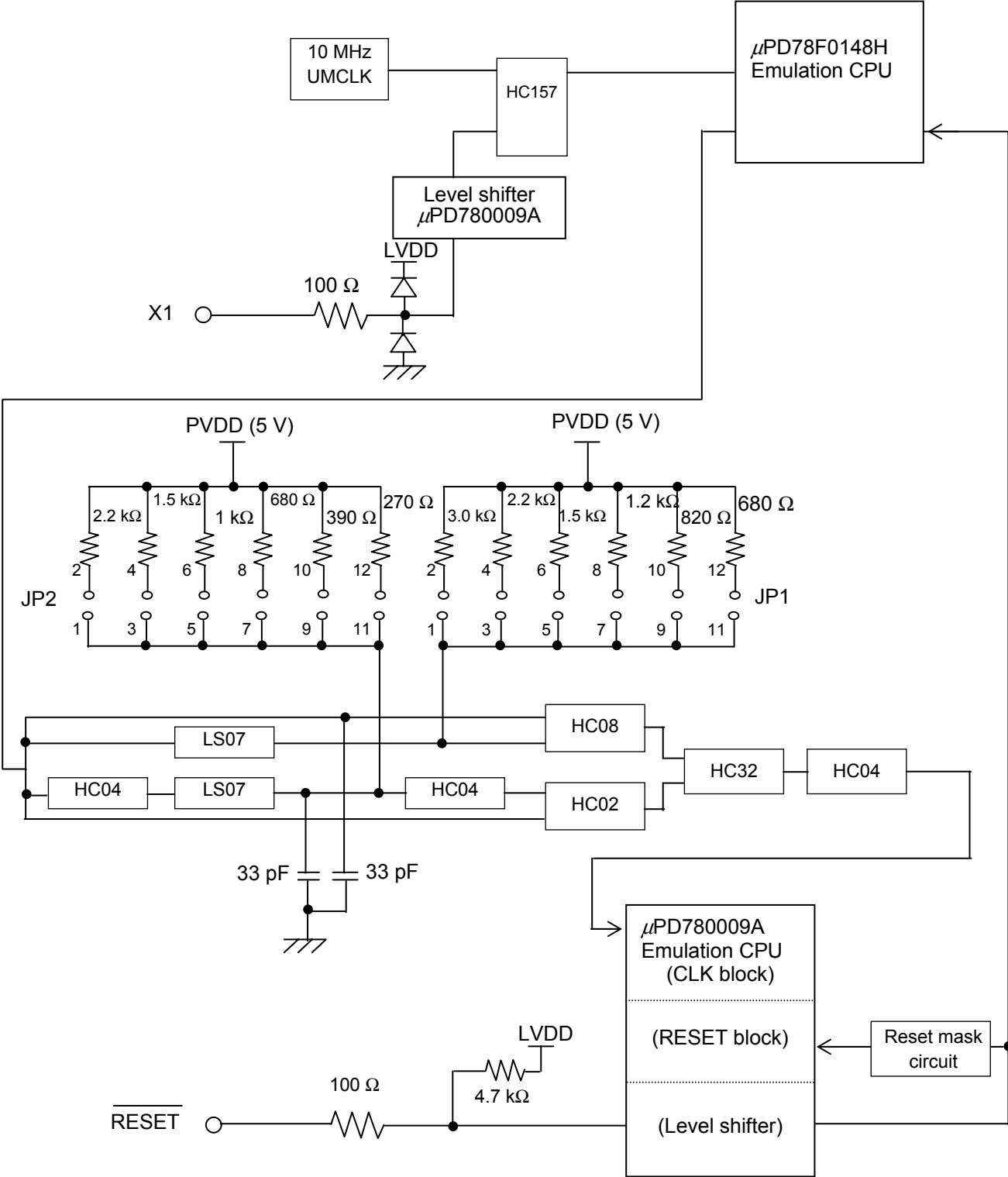
• IE system



< Equivalent Circuit of Emulation Circuit >

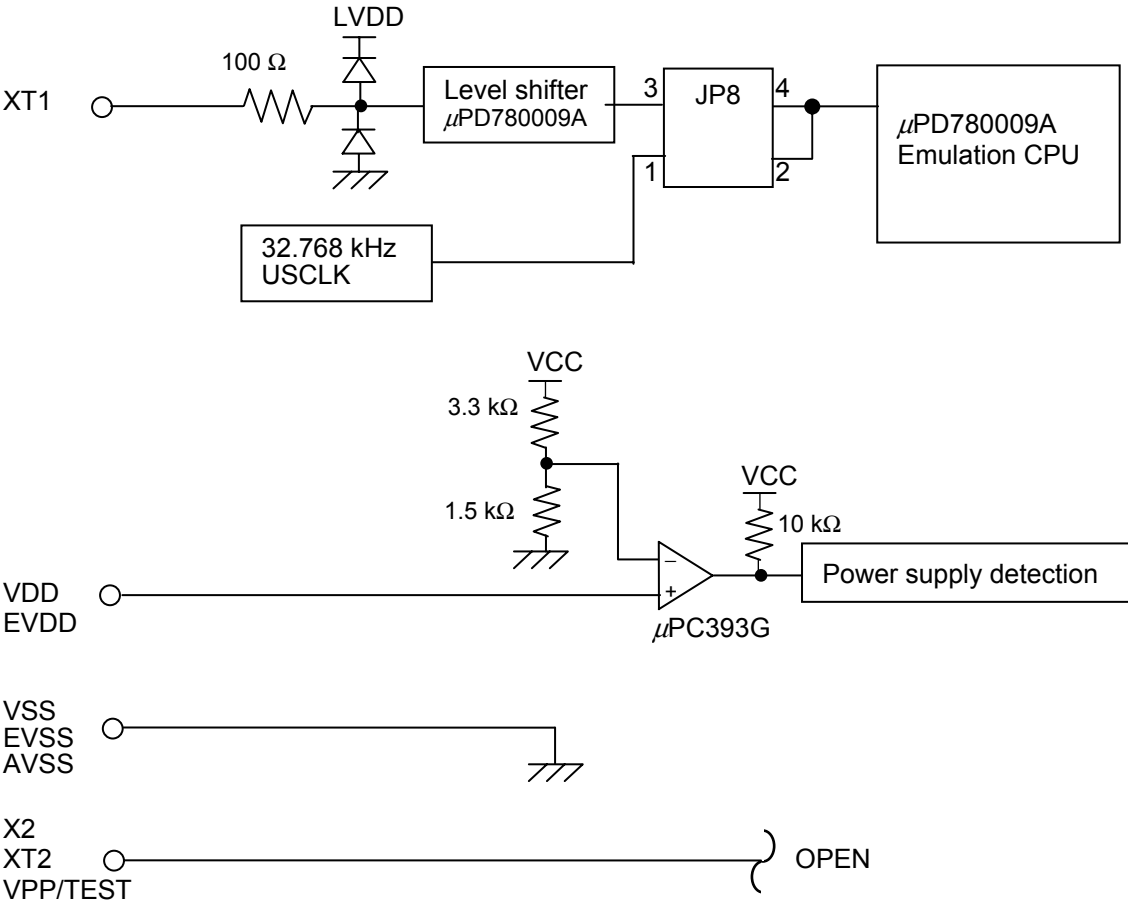
• Probe

• IE system





< Equivalent Circuit of Emulation Circuit >



### 4.3 Emulation of 78K0/KD1, 78K0/KD1+

(a) Signals that are input/output from emulation CPU  $\mu$ PD78F0148H

- P03 to P00
- P17 to P10
- P27 to P20
- P33 to P30
- P77 to P70
- P120
- P130
- P140
- AVREF

(b) Signals that are input/output from emulation CPU  $\mu$ PD780009A

- P63 to P60

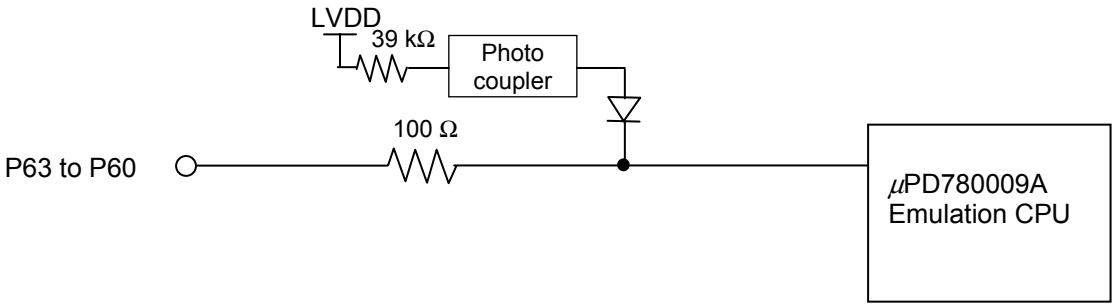
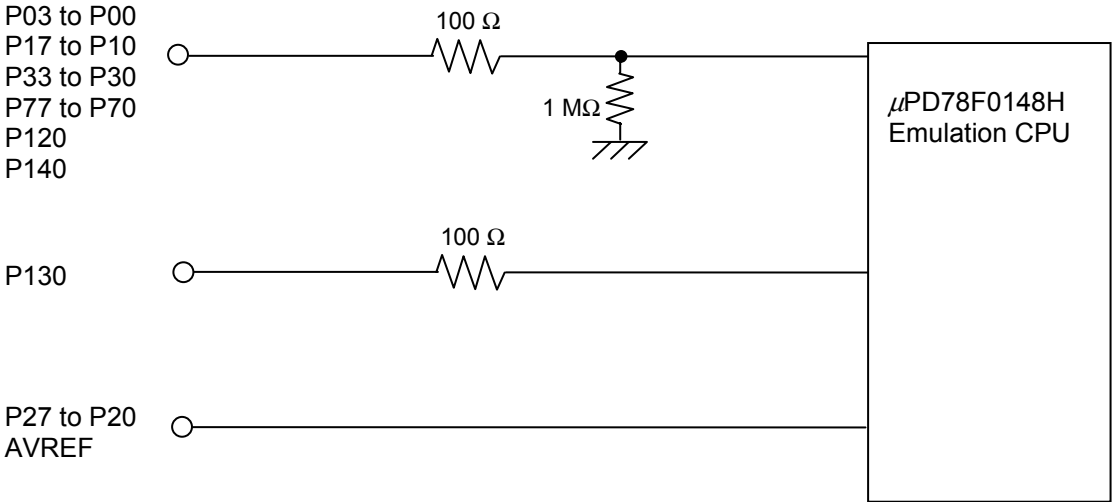
(c) Other signals

- X1, X2, XT1, XT2,  $\overline{\text{RESET}}$ , VPP/TEST, VDD, VSS, EVDD, EVSS, REGC, AVSS

< Equivalent Circuit of Emulation Circuit >

• Probe

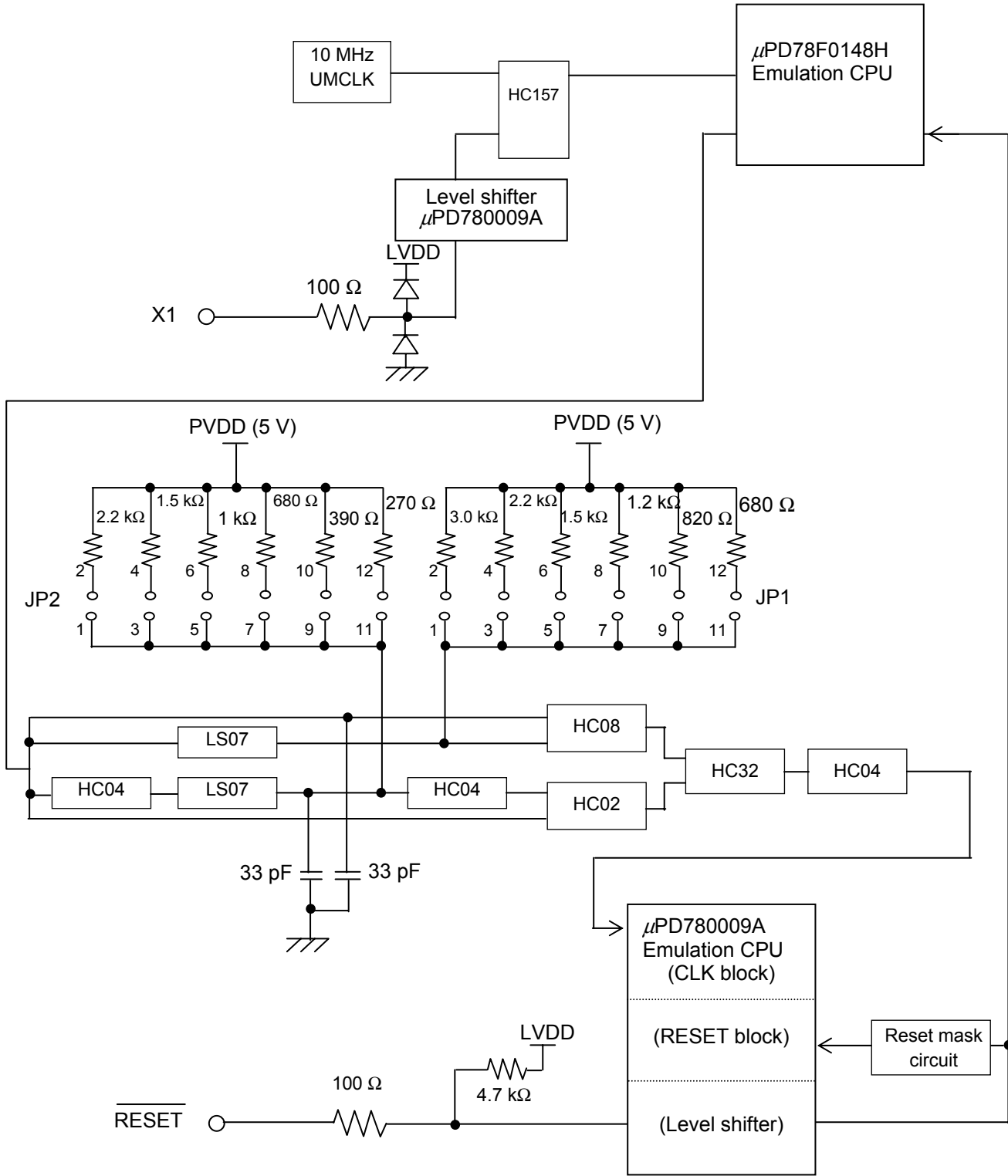
• IE system



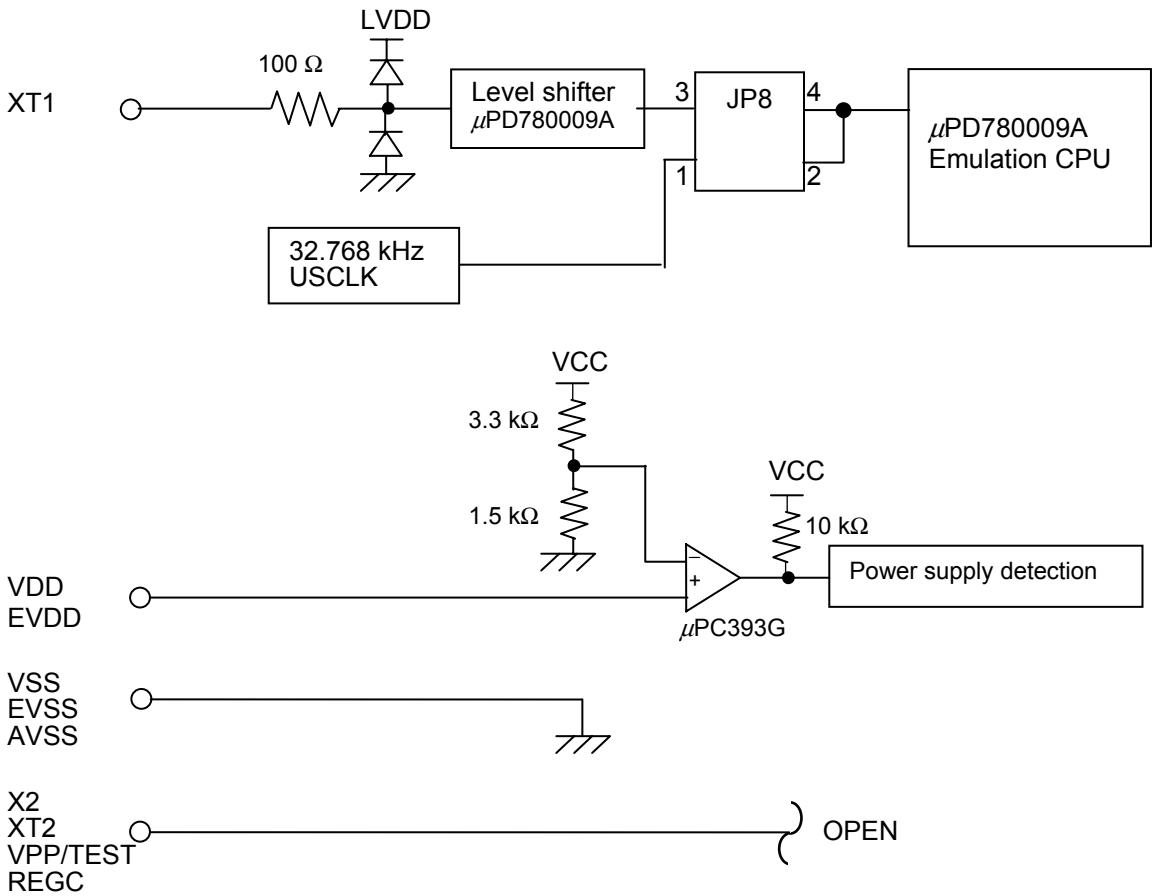
< Equivalent Circuit of Emulation Circuit >

• Probe

• IE system



< Equivalent Circuit of Emulation Circuit >



#### 4.4 Emulation of 78K0/KE1, 78K0/KE1+

(a) Signals that are input/output from emulation CPU  $\mu$ PD78F0148H

- P06 to P00
- P17 to P10
- P27 to P20
- P33 to P30
- P77 to P70
- P120
- P130
- P141 and P140
- AVREF

(b) Signals that are input/output from emulation CPU  $\mu$ PD780009A

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

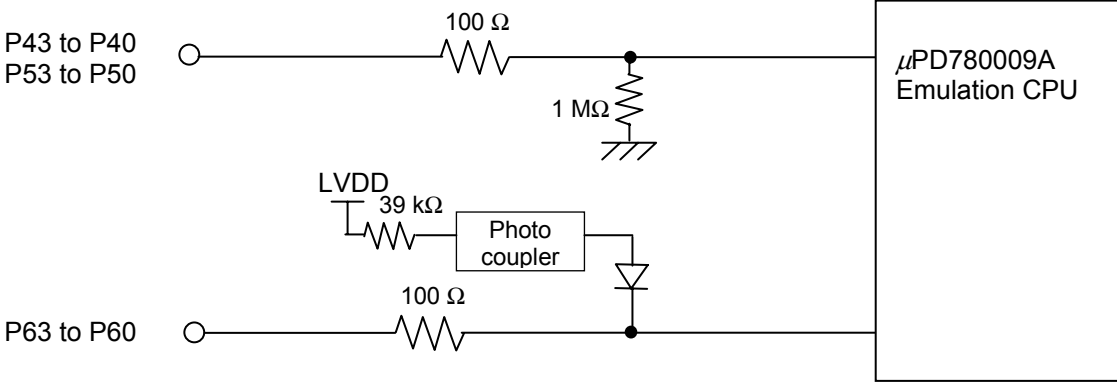
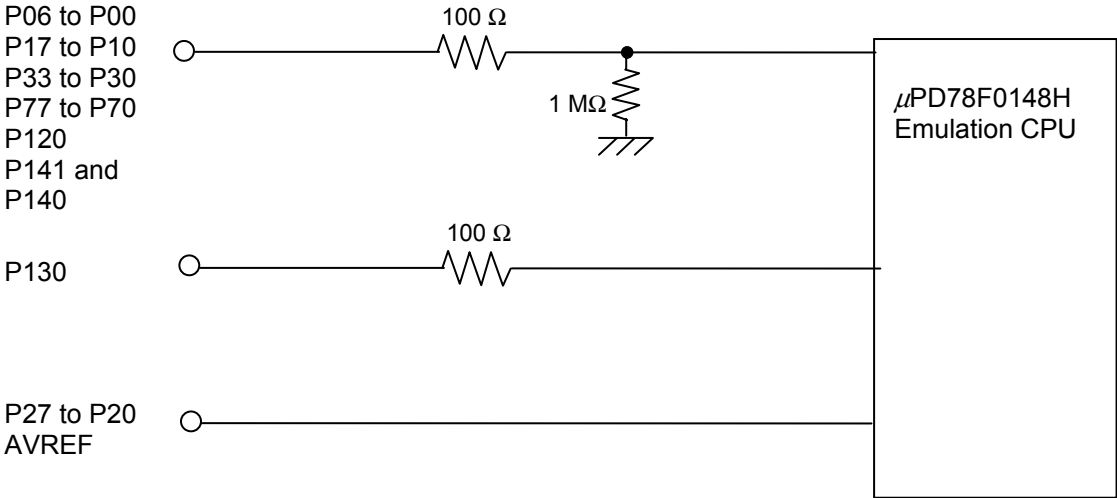
(c) Other signals

- X1, X2, XT1, XT2,  $\overline{\text{RESET}}$ , VPP/TEST, VDD, VSS, EVDD, EVSS, REGC, AVSS

< Equivalent Circuit of Emulation Circuit >

• Probe

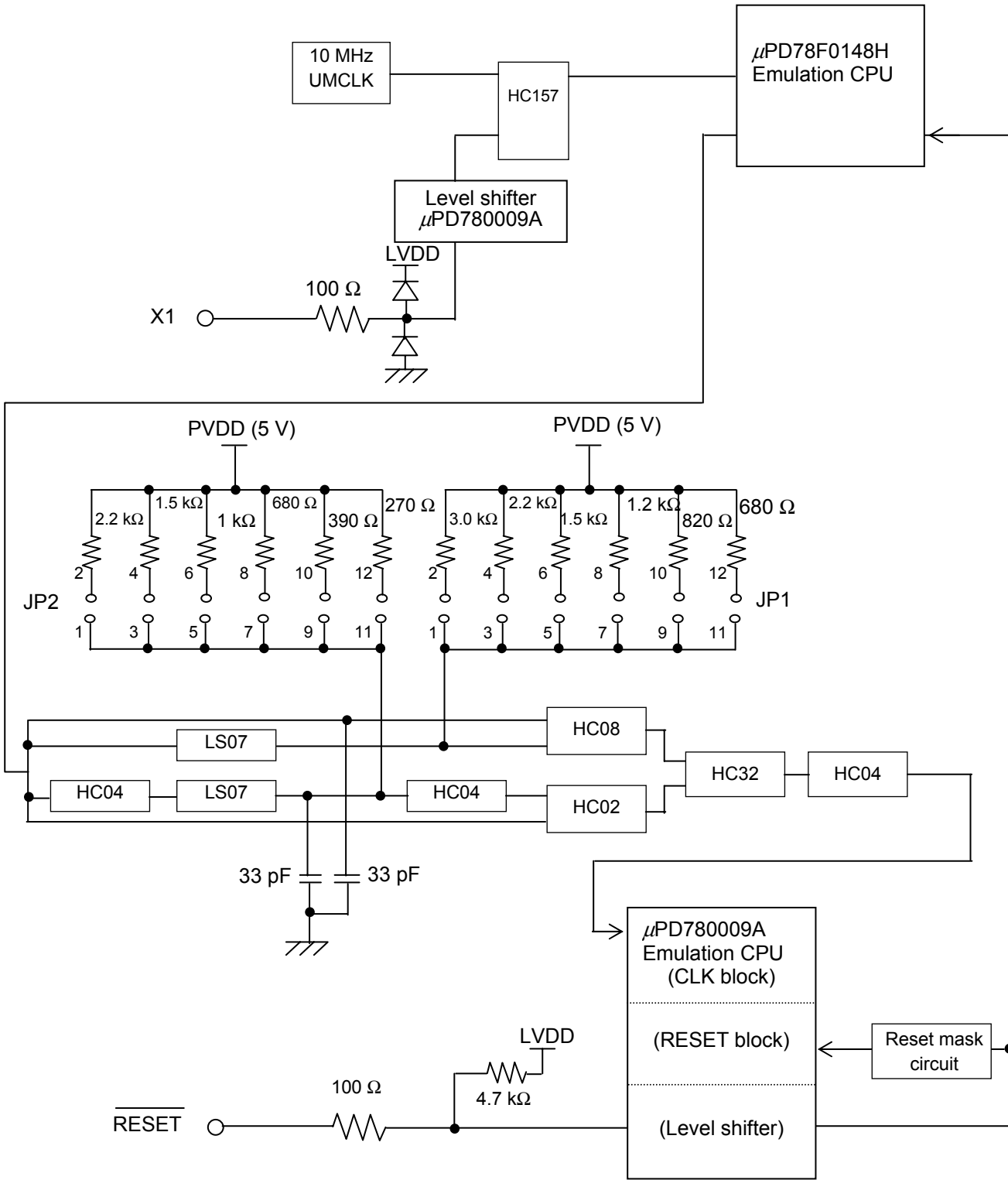
• IE system



< Equivalent Circuit of Emulation Circuit >

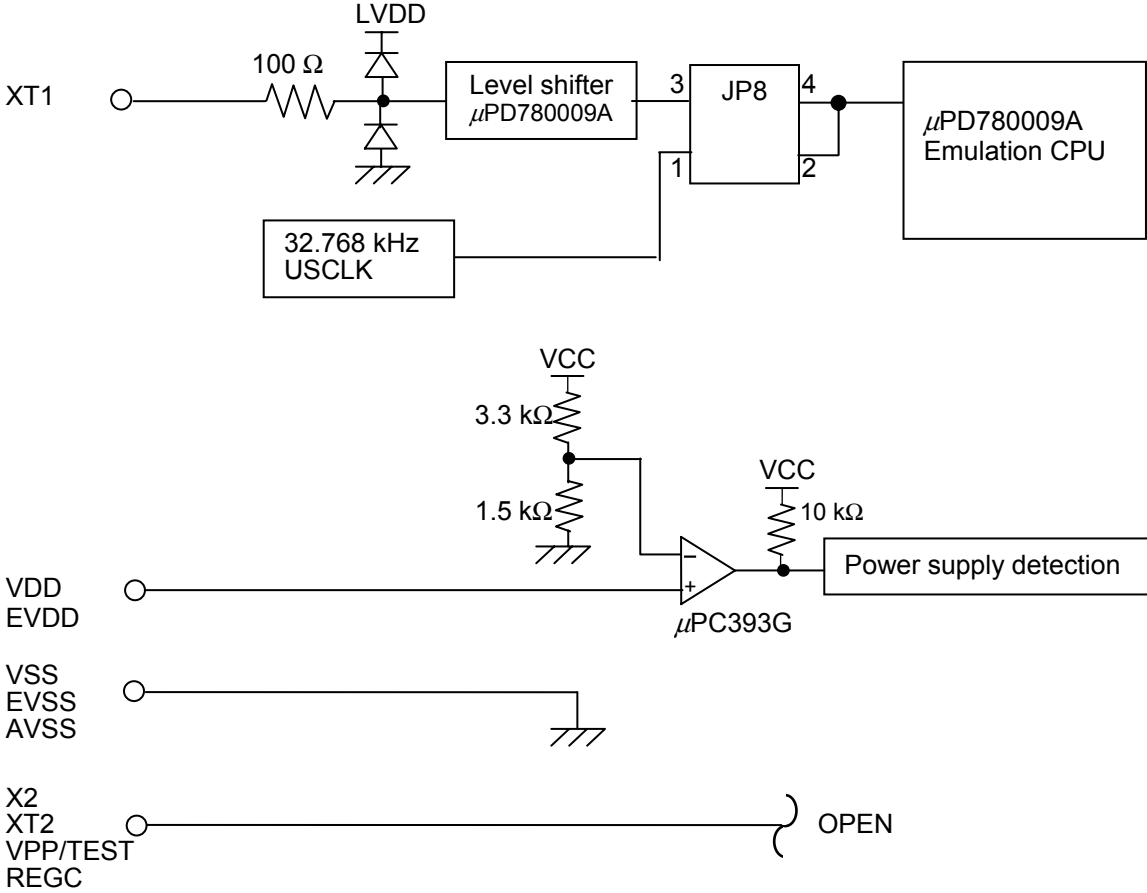
• Probe

• IE system





< Equivalent Circuit of Emulation Circuit >



#### 4.5 Emulation of 78K0/KF1, 78K0/KF1+

(a) Signals that are input/output from emulation CPU  $\mu$ PD78F0148H

- P06 to P00
- P17 to P10
- P27 to P20
- P33 to P30
- P77 to P70
- P120
- P130
- P145 to P140
- AVREF

(b) Signals that are input/output from emulation CPU  $\mu$ PD780009A

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

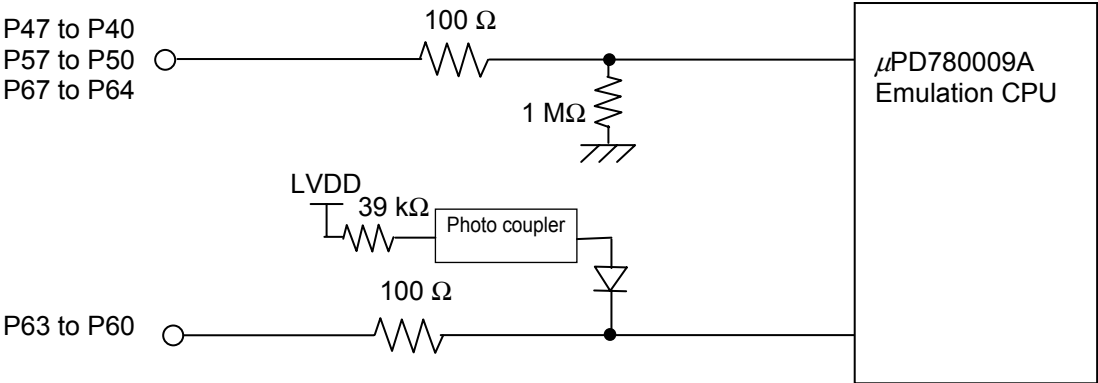
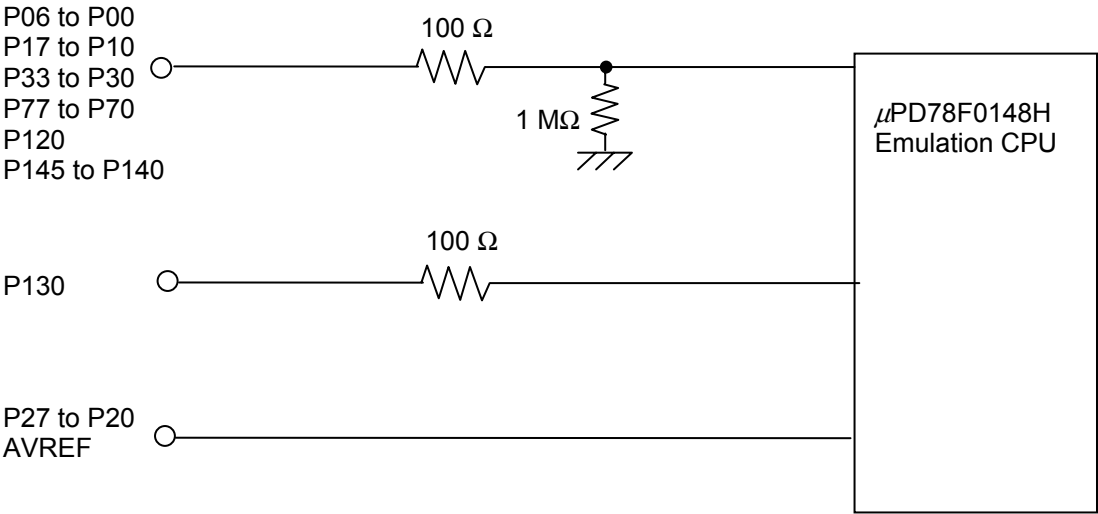
(c) Other signals

- X1, X2, XT1, XT2,  $\overline{\text{RESET}}$ , VPP/TEST, VDD, VSS, EVDD, EVSS, REGC, AVSS

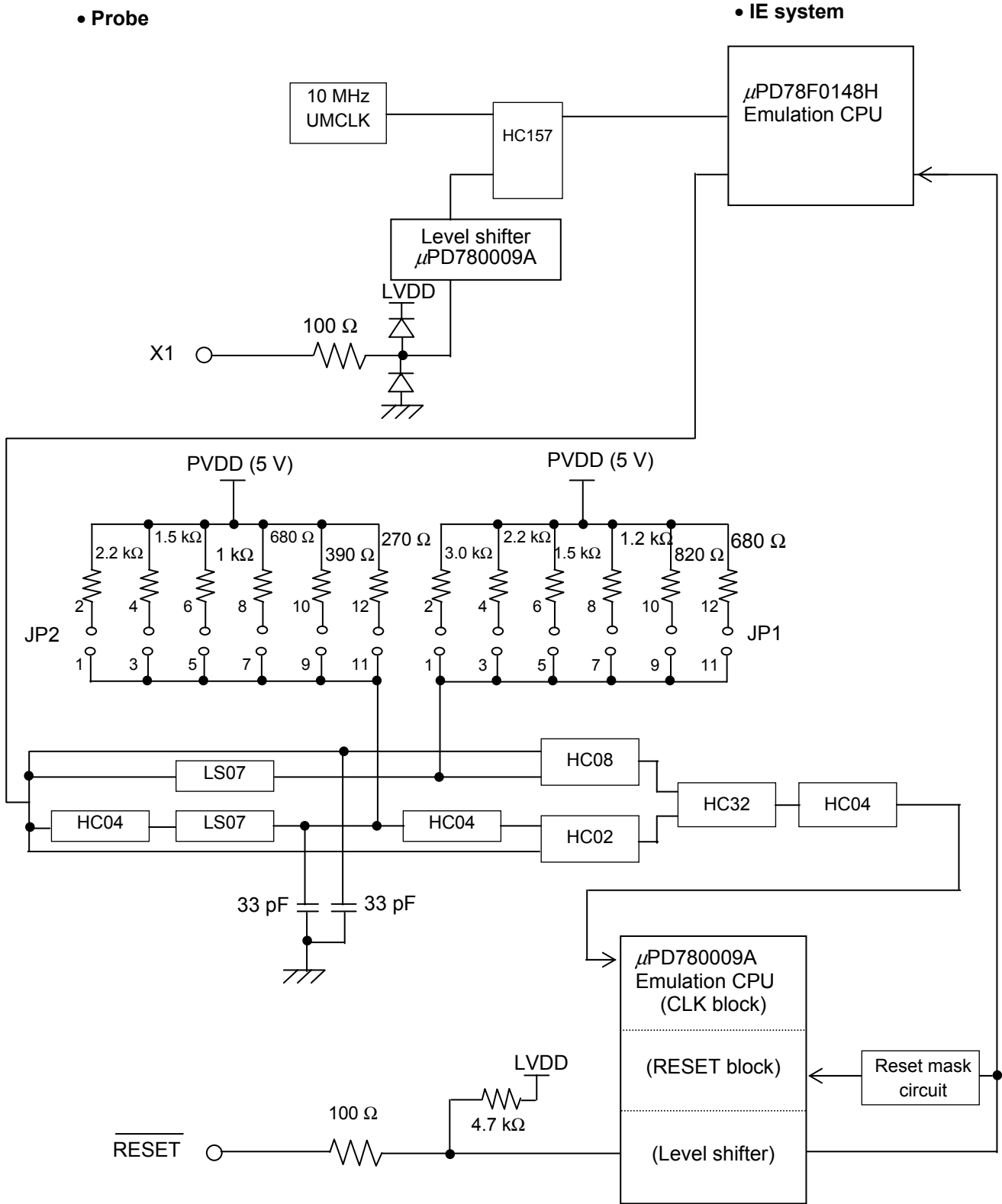
< Equivalent Circuit of Emulation Circuit >

• Probe side

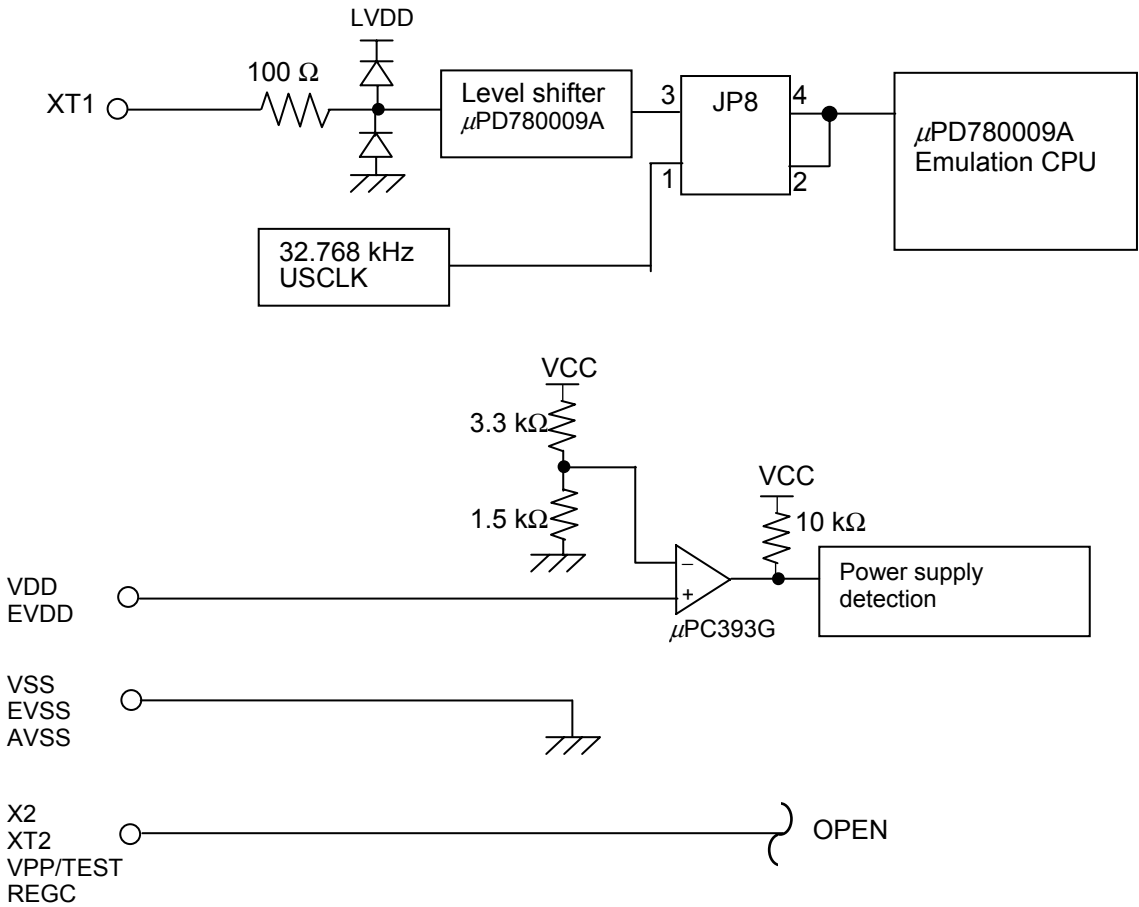
• IE system



< Equivalent Circuit of Emulation Circuit >



< Equivalent Circuit of Emulation Circuit >



## **CHAPTER 5 RESTRICTIONS**

See the document “IE-780148-NS-EM1 Operating Precautions” included with IE-780148-NS-EM1.

## **CHAPTER 6 CAUTIONS**

See the document “IE-780148-NS-EM1 Operating Precautions” included with IE-780148-NS-EM1.

**APPENDIX A EMULATION PROBE PIN CORRESPONDENCE TABLE****Table A-1. Pin Correspondence 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 refer to the pin number of the target system.
  2. The numbers in the 78010X PROBE Board CN1 column refer to the 78010X PROBE Board pin to be connected to the NP-30MC.
  3. The numbers in the IE-780148 EM1 CN6 column refer to the IE-780148-NS-EM1 pin to be connected to the 78010X PROBE Board.



**Table A-2. Pin Correspondence of 78011X PROBE Board + NP-44GB/44GB-TQ/H44GB-TQ**

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
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 refer to the pin number of the target system.
  2. The numbers in the 78011X PROBE Board CN1 column refer to the 78011X PROBE Board pin to be connected to the emulation probe.
  3. The numbers in the IE-780148 EM1 CN6 column refer to the IE-780148-NS-EM1 pin to be connected to the 78011X PROBE Board.

**Table A-3. Pin Correspondence of 78012X PROBE Board + NP-H52GB-TQ**

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
31	22	10
32	28	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 refer to the pin number of the target system.
  2. The numbers in the 78012X PROBE Board CN1 column refer to the 78012X PROBE Board pin to be connected to the emulation probe.
  3. The numbers in the IE-780148 EM1 CN6 column refer to the IE-780148-NS-EM1 pin to be connected to the 78012X PROBE Board.

**Table A-4. Pin Correspondence of 78013X PROBE Board + NP-64GB-TQ/H64GB-TQ/64GK/  
64GK-TQ/64GC/64GC-TQ/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

**Table A-4. Pin Correspondence of 78013X PROBE Board + NP-64GB-TQ/H64GB-TQ/64GK/  
64GK-TQ/64GC/64GC-TQ/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 refer to the pin number of the target system.
  2. The numbers in the 78013X PROBE Board CN1 column refer to the 78013X PROBE Board pin to be connected to the emulation probe.
  3. The numbers in the IE-780148 EM1 CN6 column refer to the IE-780148-NS-EM1 pin to be connected to the 78013X PROBE Board.

**Table A-5. Pin Correspondence of 78014X PROBE Board  
+ NP-80GC/80GC-TQ/H80GC-TQ/80GK/H80GK-TQ (1/2)**

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
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

**Table A-5. Pin Correspondence of 78014X PROBE Board  
+ NP-80GC/80GC-TQ/H80GC-TQ/80GK/H80GK-TQ (2/2)**

Emulation Probe Device Side	78014X PROBE Board CN1	IE-780148-NS-EM1 CN6
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
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 refer to the pin number of the target system.
  2. The numbers in the 78014X PROBE Board CN1 column refer to the 78014X PROBE Board pin to be connected to the emulation probe.
  3. The numbers in the IE-780148 EM1 CN6 column refer to the IE-780148-NS-EM1 pin to be connected to the 78014X PROBE Board.