NEC

User's Manual

IE-780338-NS-EM1

Emulation Board

Target Devices
μPD780318 Subseries
μPD780328 Subseries
μPD780338 Subseries

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[MEMO]

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- 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-780338-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.

- μPD780318 Subseries: μPD780316, 780318
- μPD780328 Subseries: μPD780326, 780328
- μPD780338 Subseries: μPD780336, 780338, 78F0338

Target Readers   This manual is intended for engineers who will use the IE-780338-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 usage methods and to be knowledgeable about debugging.

Organization   When using the IE-780338-NS-EM1, refer to not only this manual (supplied with the IE-780338-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

- Basic specifications
- System configuration
- External interface functions

IE-780338-NS-EM1 User's Manual

- General
- Part names
- Installation
- Differences between target devices and target interface circuits
- Restrictions and cautions on use

Purpose   This manual is intended to give users an understanding of the various debugging functions that can be performed when using the IE-780338-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 IE-78K0-NS or IE-78K0-NS-A and the IE-780338-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

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-780338-NS-EM1 Emulation Board	This manual
ID78K Series Integrated Debugger Ver. 2.30 or Later Operation Windows™ Based	U15185E
μPD780318, 780328, 780338 Subseries	U14701E

Caution   **The documents listed above are subject to change without notice. Be sure to use the latest documents when designing.**

CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1 GENERAL

The IE-780338-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-780338-NS-EM1's system configuration and basic specifications.

- Target devices
  - μPD780318 Subseries
  - μPD780328 Subseries
  - μPD780338 Subseries

1.1 System Configuration

Figure 1-1 illustrates the IE-780338-NS-EM1's system configuration.

Figure 1-1. System Configuration

Debugger
ID78K0-NS
(sold separately)

Device file[Note 1]
(available separately)

Control software

Host machine
PC-9800 series
or IBM PC/AT™
or compatibles

Interface board
IE-70000-98-IF-C
(sold separately)

Interface board
IE-70000-PC-IF-C
(sold separately)

Interface board
IE-70000-PCI-IF-A
(sold separately)

or

Interface card

Interface
cable

NS CARD
Cable

MC CARD
Cable

IE-70000-CD-IF-A
(sold separately)

Interface cable
(NS IF Cable)

IE-78K0-NS
or
IE-78K0-NS-A
(sold separately)

In-circuit emulator

FG Cable

FG Cable

IE-780338-NS-EM1
(this product)

AC adapter
IE-70000-MC-PS-B
(sold separately)

Emulation probe[Note 2]
(sold separately)

Conversion connector[Note 3]
(sold separately)

Notes 1. The device file is as follows.

μS$\times\times\times$DF780338: μPD780318, 780328, 780338 Subseries

The device file can be downloaded from the web site of NEC Electron Devices

(http://www.ic.nec.co.jp/micro/).

2. The emulation probe SWEX-120SE-1 and conversion connectors NQPACK120SE, YQPACK120SE, and YQ-GUIDE are products of TOKYO ELETECH CORPORATION.

For further information, contact Daimaru Kogyo, Ltd.

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

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

The correspondence between the emulation probe and conversion connectors that are sold separately   is shown in the Table 1-1.

Table 1-1. Correspondence Between Emulation Probe and Conversion Connectors

Package	Emulation Probe	Conversion Connector
120-pin plastic QFP (GC type)	SWEX-120SE-1 (Probe length: 303 mm)	NQPACK120SE YQPACK120SE YQ-GUIDE

1.2 Hardware Configuration

Figures 1-2 and 1-3 show the IE-780338-NS-EM1's position in the basic hardware configuration.

Figure 1-2. Basic Hardware Configuration (Using IE-78K0-NS)
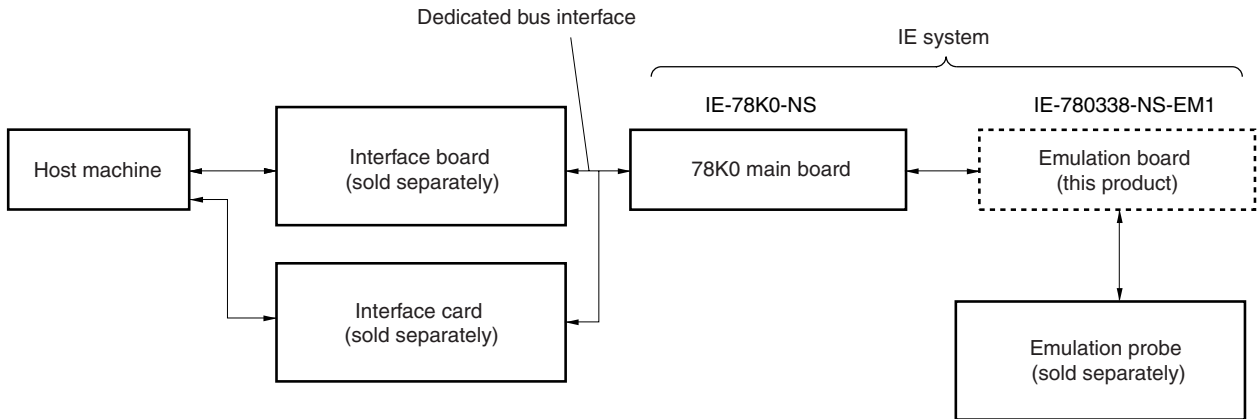
Figure 1-3. Basic Hardware Configuration (Using IE-78K0-NS-A)
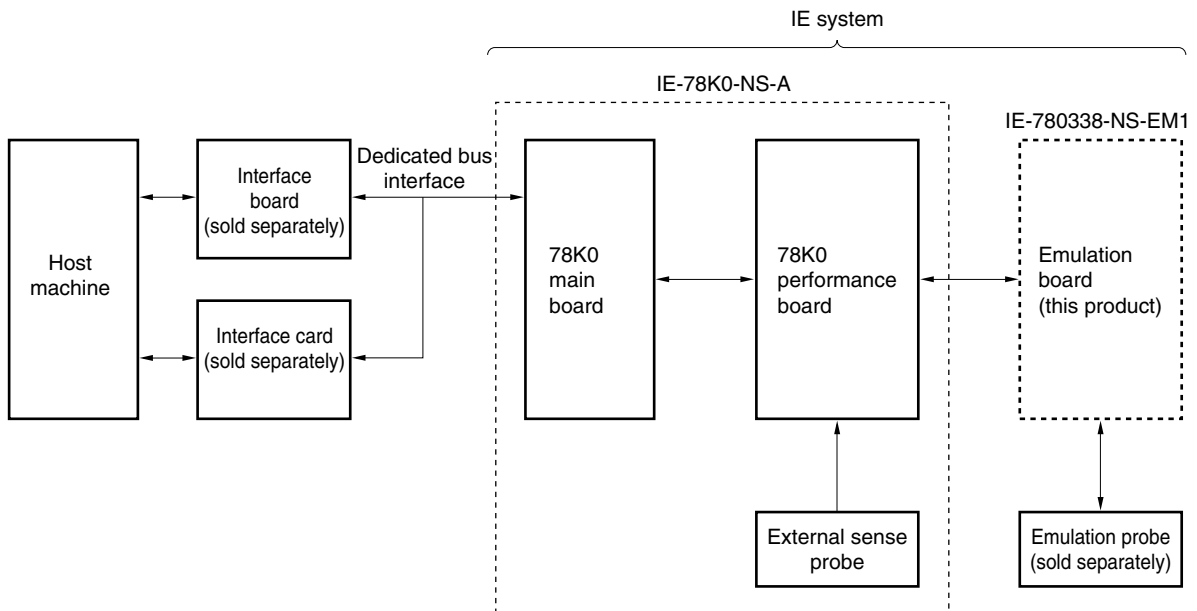
1.3 Basic Specifications

The IE-780338-NS-EM1's basic specifications are listed in Table 1-2.

Table 1-2. Basic Specifications

Parameter	Description
Target device	μPD780318, 780328, 780338 Subseries
System clock	10.0 MHz
Main system clock supply	External: Clock input from the target system via an emulation probe Internal: Clock mounted on the emulation board (10.0 MHz) or mounted on the parts board by the user
Subsystem clock supply	External: Input from the target system via an emulation probe Internal: Mounted on the emulation board (32.768 kHz) or mounted on the parts board by the user
Low voltage support	V_{DD} = 1.8 to 5.5 V (same as the target device)

This chapter introduces the parts of the IE-780338-NS-EM1 main unit.

The packing box contains the emulation board (IE-780338-NS-EM1), FG cable, packing list, user's manual, and guarantee card.

If there are any missing or damaged items, please contact an NEC 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-780338-NS-EM1 Part Names

User's Manual U16214EJ1V0UM
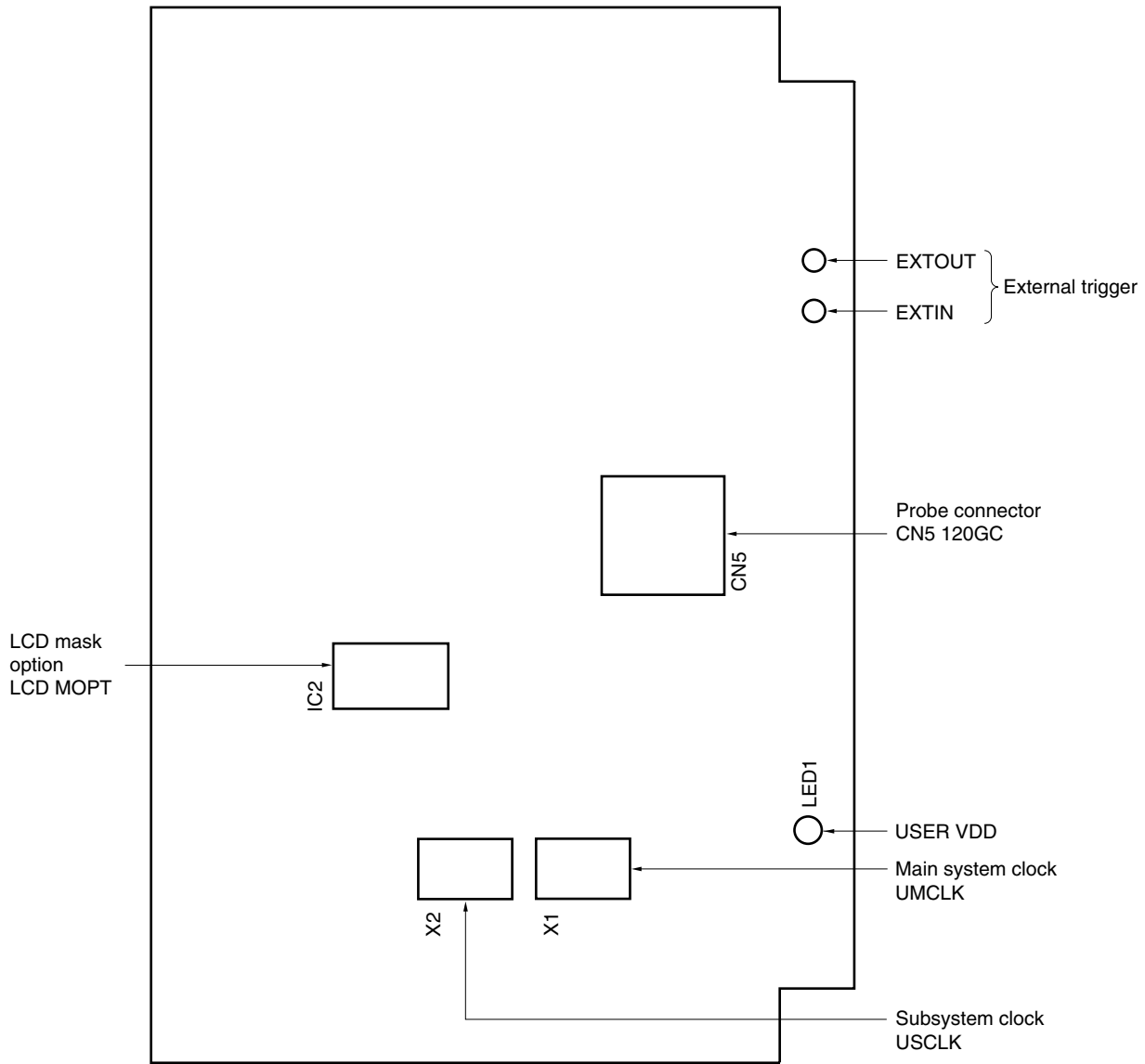
This chapter describes methods for connecting the IE-780338-NS-EM1 to the IE-78K0-NS or IE-78K0-NS-A, emulation probe, etc. Mode setting methods are also described.

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-780338-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-780338-NS-EM1 to the IE-78K0-NS-A.

(2) Connection with emulation probe

The following shows how to connect the emulation probe to the IE-780338-NS-EM1.

On this board, connect the emulation probe SWEX-120SE-1 to CN5.

> **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.**

<1> Unfasten one of the screws at the bottom of the connector on the IE system side of the emulation probe SWEX-120SE-1, and connect and screw on the tip of the FG cable.

Figure 3-1. Connection Between FG Cable and Emulation Probe

FG cable (supplied with IE-780338-NS-EM1)

Connection connector to IE-780338-NS-EM1

Emulation probe SWEX-120SE-1 (sold separately)
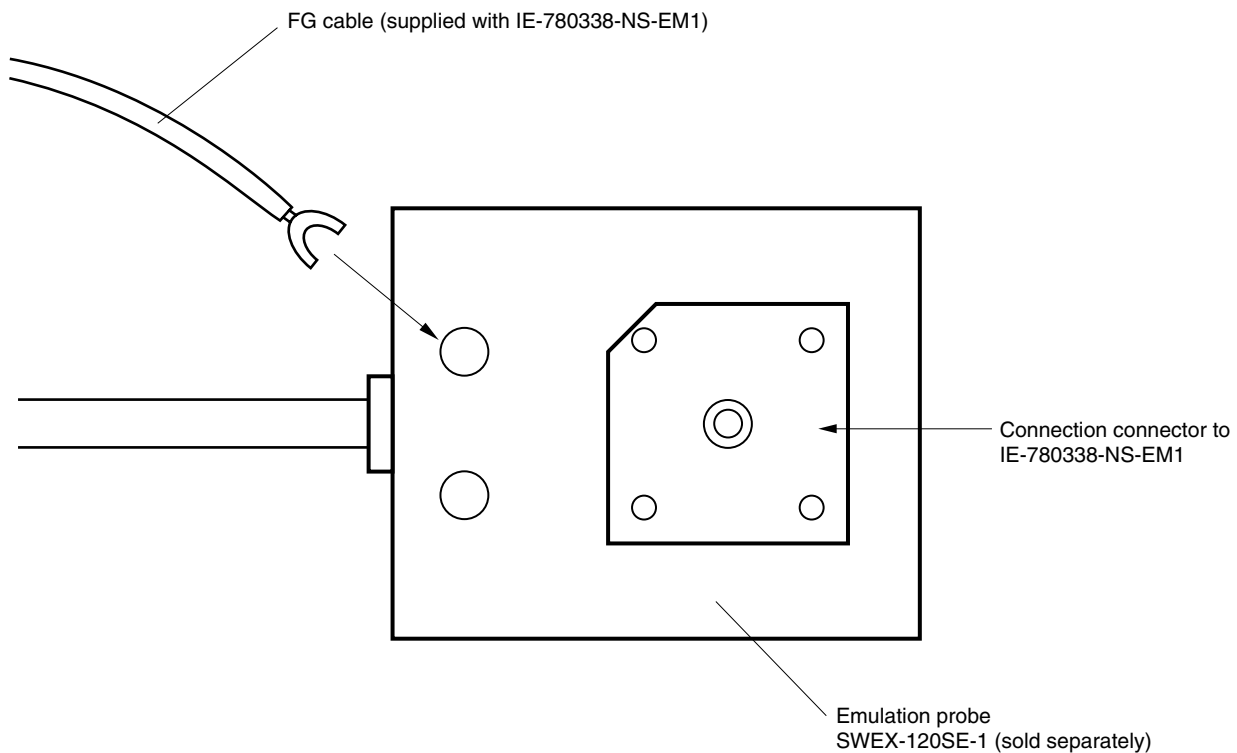
<2> Connect the emulation probe SWEX-120SE-1 to CN5 of the IE-780338-NS-EM1.

Figure 3-2. Emulation Probe Connection
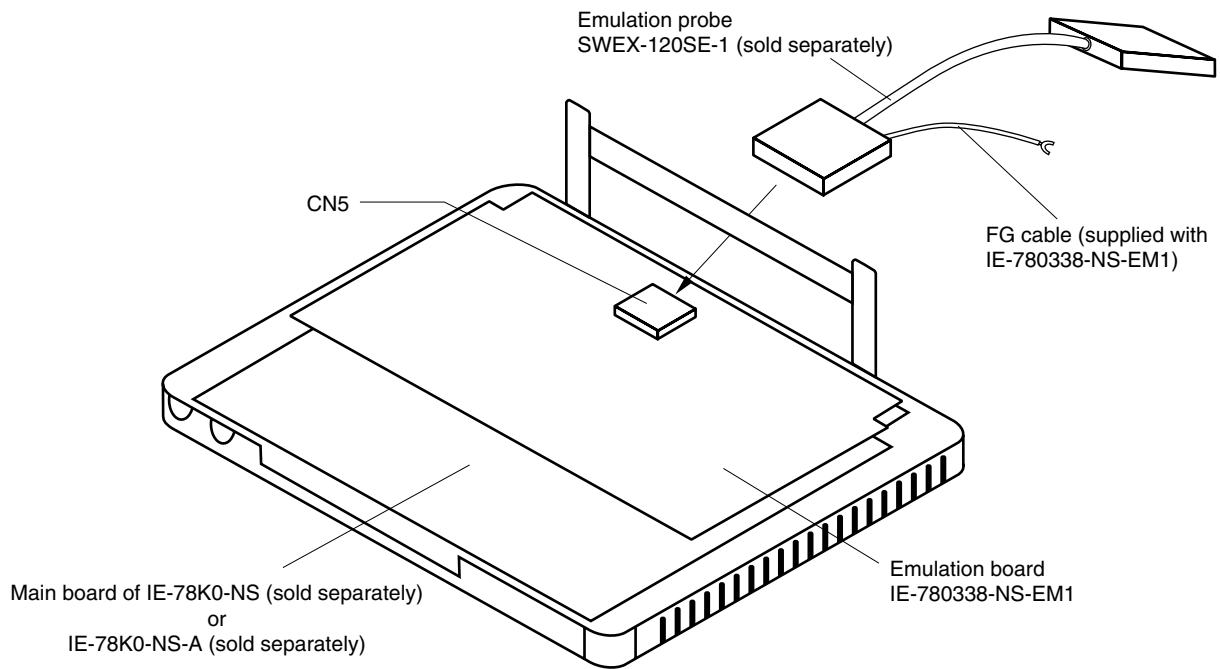
<3> Unfasten one of the screws on the metal board on the probe side of the IE-78K0-NS or IE-78K0-NS-A and connect and screw on the tip of the FG cable.

Figure 3-3. Connection Between FG Cable and In-Circuit Emulator
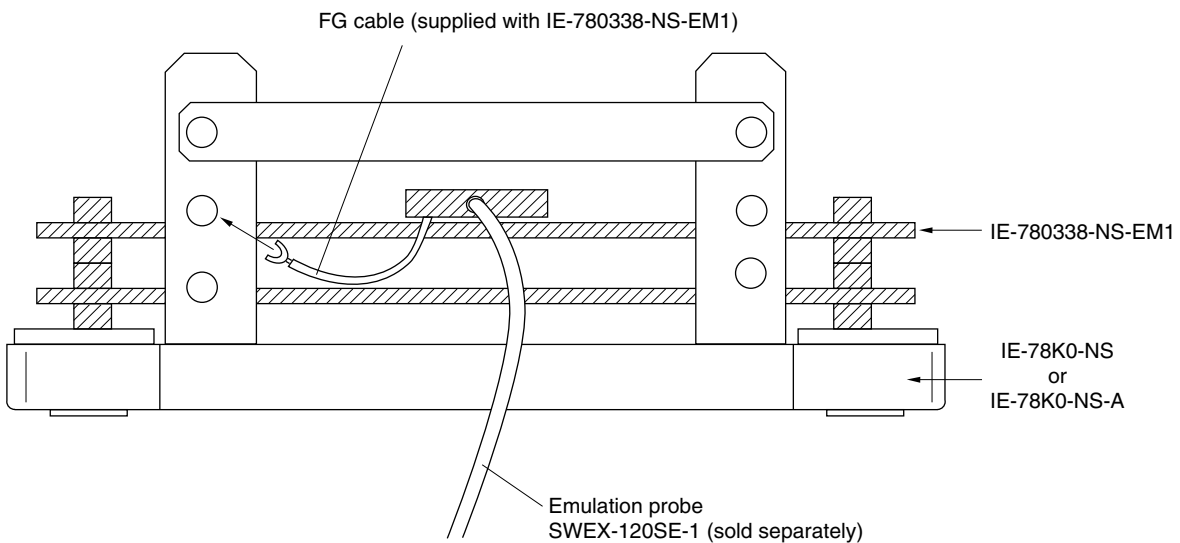
3.2 Clock Settings

3.2.1 Overview of clock settings

The main system and subsystem clocks 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) External clock

If the target system includes an internal clock, select either **(1) Clock that is already mounted on emulation board** or **(2) Clock that is mounted by user**. For an internal clock, 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 3-4. During emulation, the resonator that is mounted on the target system is not used. Instead, the clock that is mounted on the emulation board connected to the IE-78K0-NS or IE-78K0-NS-A is used.

If the target system includes an external clock, select **(3) External clock**.

For an external clock, a clock signal is supplied from outside 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 3-4.

Caution   **The IE system will be hung-up if the main system clock is not supplied normally. Moreover, be sure to input a rectangular wave as the clock from the target. The IE system does not operate if the crystal resonator is directly connected to X1 (main system clock) and XT1 (subsystem clock).**

Figure 3-4. External Circuits Used as System Clock Oscillator

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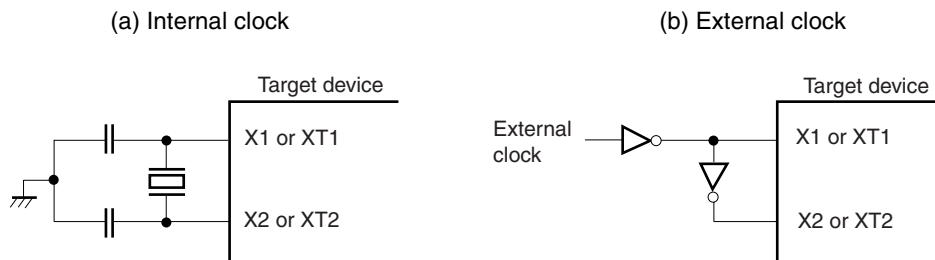
(1) Clock that is already mounted on emulation board

(a) For main system clock

A crystal oscillator (X1) is already mounted on the emulation board. Its frequency is 10.0 MHz.

Figure 3-5. When Using Clock That Is Already Mounted on Emulation Board (Main System Clock)
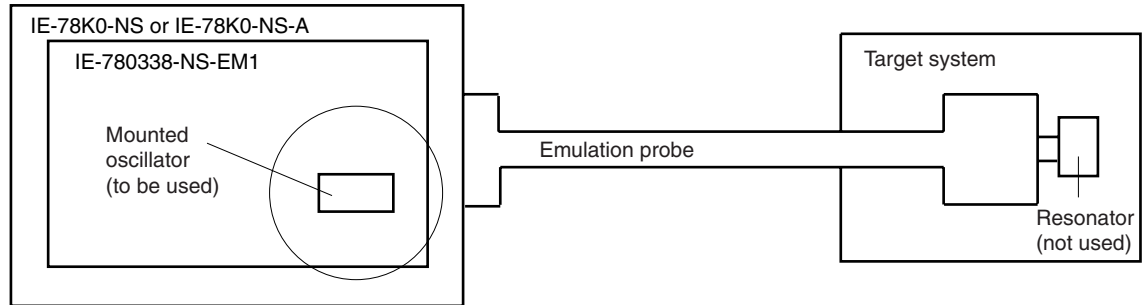
Remark   The clock that is supplied by the IE-780338-NS-EM1's oscillator (encircled in the figure) is used.

(b) For subsystem clock

A crystal resonator (XT1) is already mounted on the emulation board. Its frequency is 32.768 kHz.

Figure 3-6. When Using Clock That Is Already Mounted on Emulation Board (Subsystem Clock)
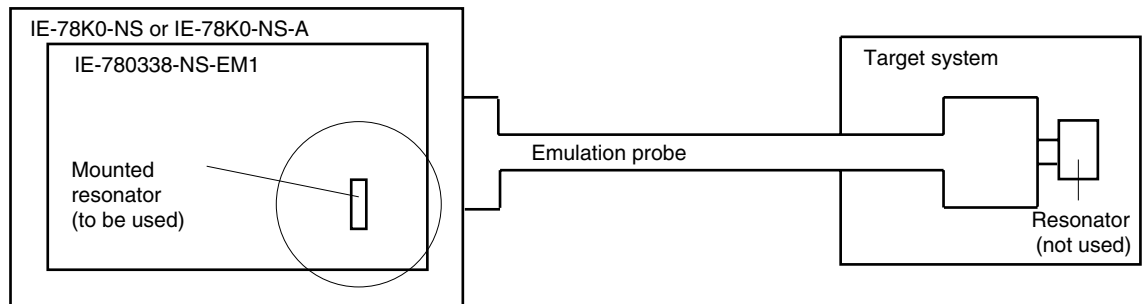
Remark   The clock that is supplied by the IE-780338-NS-EM1's resonator (encircled in the figure) is used.

(2) Clock that is mounted by user

The user is able to mount any clock supported by the set specifications on the IE-780338-NS-EM1.

(a) For main system clock

Remove the crystal oscillator (X1) 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 3-7. When Using User-Mounted Clock (Main System Clock)
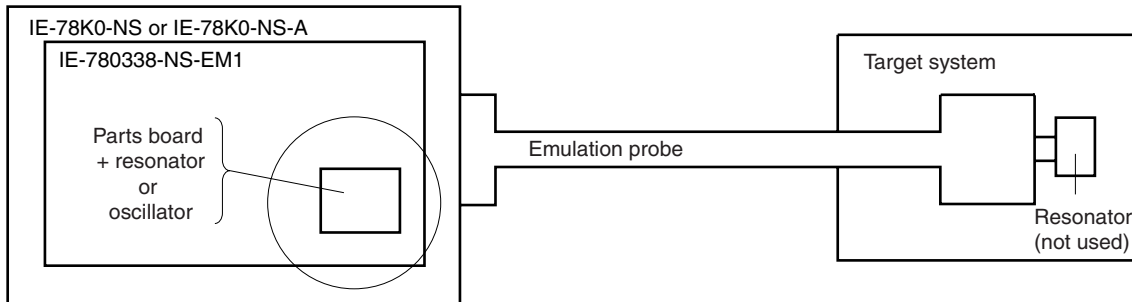
Remark The clock that is supplied by the IE-780338-NS-EM1's resonator or oscillator (encircled in the figure) is used.

(b) For subsystem clock

Mount the resonator to be used on the parts board (X2) that is already mounted on the emulation board. Alternatively, remove the parts board and mount an oscillator.

Figure 3-8. When Using User-Mounted Clock (Subsystem Clock)
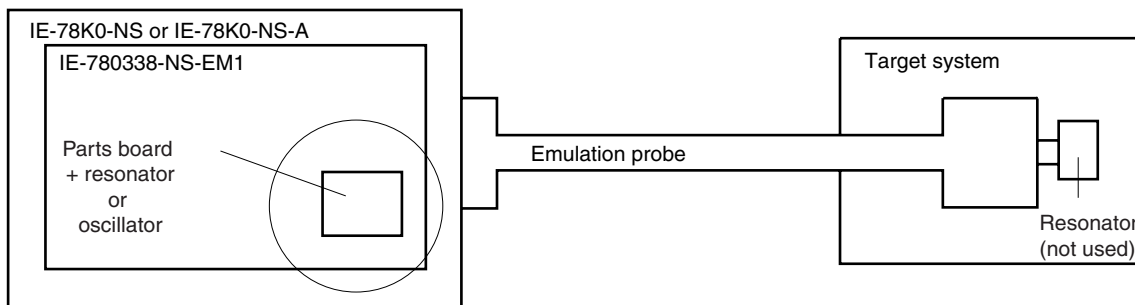
Remark The clock that is supplied by the IE-780338-NS-EM1's resonator or oscillator (encircled in the figure) is used.

(3) External clock

An external clock connected to the target system can be used via an emulation probe.

Figure 3-9. When Using an External Clock
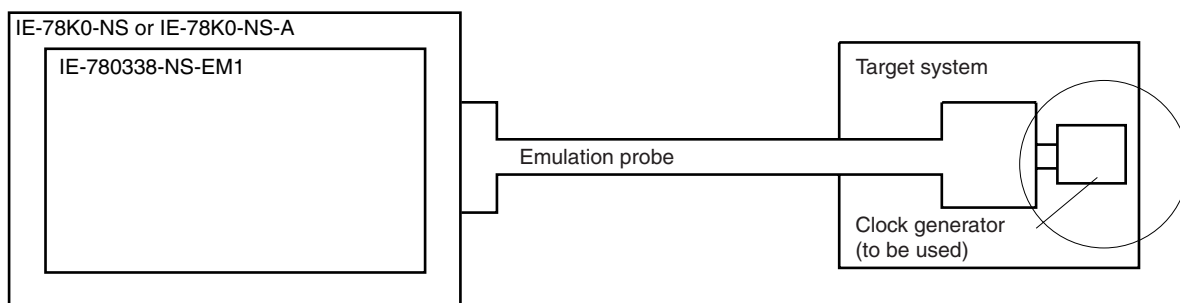
Remark The clock supplied by the target system's clock generator (encircled in the figure) is used.

3.2.2 Main system clock settings

Table 3-1. Main System Clock Settings

Frequency of Main System Clock		IE-780338-NS-EM1	CPU Clock Source
		X1 Socket	Selection (ID78K0-NS)
When using clock that is already mounted on emulation board	10.0 MHz	Oscillator used	Internal
When using clock mounted by user	Other than 10.0 MHz	Oscillator assembled by user	
When using external clock		Oscillator (not used)	External

Caution **When using an external clock, open the configuration dialog box when starting the integrated debugger (ID78K0-NS) and select "External" in the area (Clock) for selecting the CPU clock source (this selects the user clock).**

Remark When the IE-780338-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-780338-NS-EM1 is shipped, a 10.0 MHz crystal oscillator is already mounted in the IE-780338-NS-EM1's X1 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 clock source (this selects the emulator internal clock).

(2) When using clock mounted by user

Execute 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 clock source (this selects the emulator internal clock).

(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 frequency) as shown below.

Figure 3-10. Connections on Parts Board (When Using Main System Clock or User-Mounted Clock)

Parts board (X1)
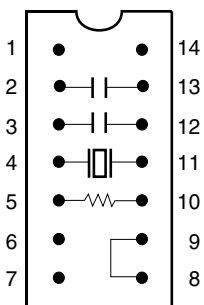
Pin No.	Connection
2-13	Capacitor CA
3-12	Capacitor CB
4-11	Ceramic resonator or crystal resonator
5-10	Resistor Rx
8-9	Shorted

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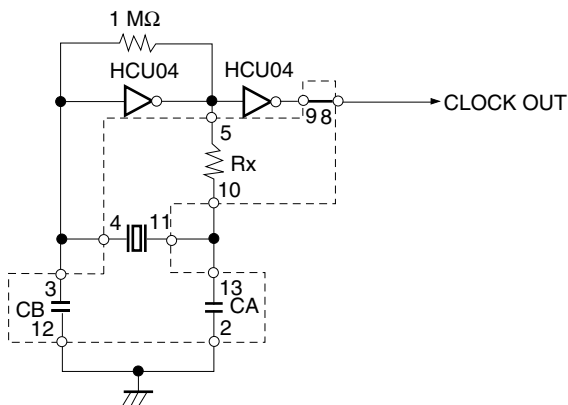
Remark The sections enclosed in broken lines indicate parts that are attached to the parts board.

<2> Prepare the IE-780338-NS-EM1.

<3> Remove the crystal oscillator that is mounted in the IE-780338-NS-EM1's X1 socket.

<4> Connect the parts board (from <1> above) to the X1 socket from which the crystal oscillator was removed in <3> above. 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 3-10 above.

<6> Connect the IE-780338-NS-EM1 to 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.

IE-78K0-NS or IE-78K0-NS-A side
(Emulation device)
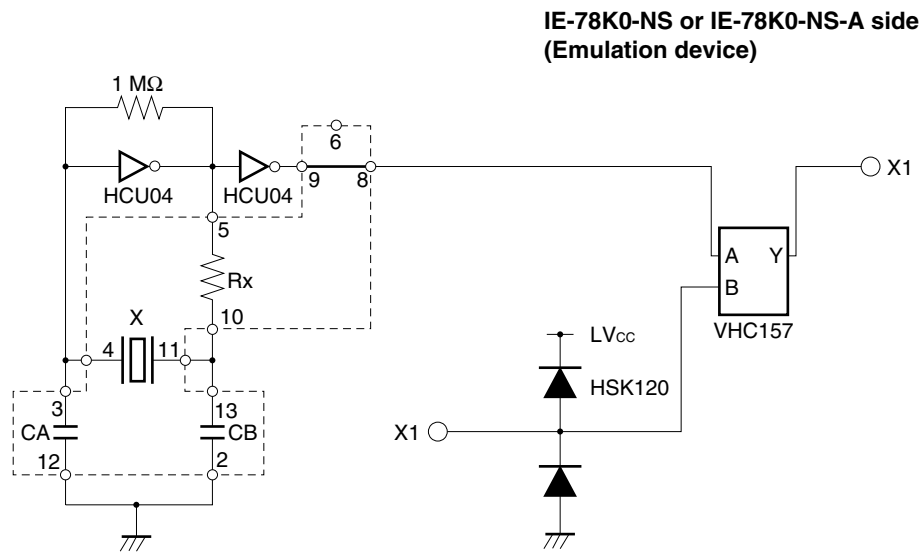
Remark   The sections enclosed in broken lines indicate parts that are attached to the parts board.

(b) When using a crystal oscillator

● Items to be prepared
  ● Crystal oscillator (see pinouts shown in Figure 3-11)

Figure 3-11. Crystal Oscillator (When Using Main System Clock or User-Mounted Clock)

NC ● ● Vcc

GND ● ● CLOCK OUT
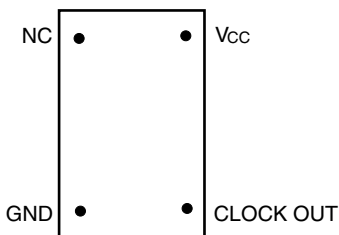
<Steps>
<1> Prepare the IE-780338-NS-EM1.
<2> Remove the crystal oscillator that is mounted in the IE-780338-NS-EM1's X1 socket.
<3> Mount the crystal oscillator prepared by the user in the X1 socket from which the crystal oscillator was removed in <2> above. Insert the crystal oscillator pin into the socket aligning the pins as shown in the figure below.

Figure 3-12. Pin Alignment of Crystal Oscillator and Socket
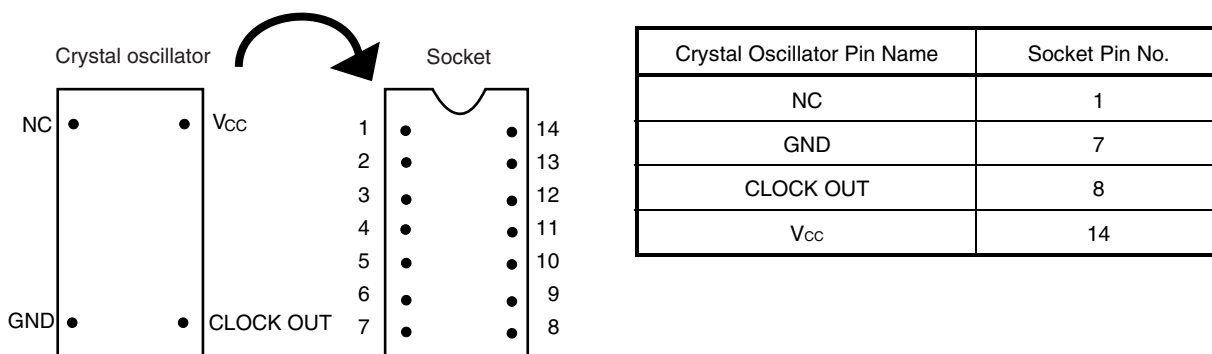
Crystal oscillator
NC ● ● Vcc
GND ● ● CLOCK OUT

Socket
1 ● ● 14
2 ● ● 13
3 ● ● 12
4 ● ● 11
5 ● ● 10
6 ● ● 9
7 ● ● 8

Crystal Oscillator Pin Name	Socket Pin No.
NC	1
GND	7
CLOCK OUT	8
Vcc	14

<4> Connect the IE-780338-NS-EM1 to the IE-78K0-NS or IE-78K0NS-A.

The above steps configure the following circuit and enable supply of the clock from the mounted resonator to the emulation device.
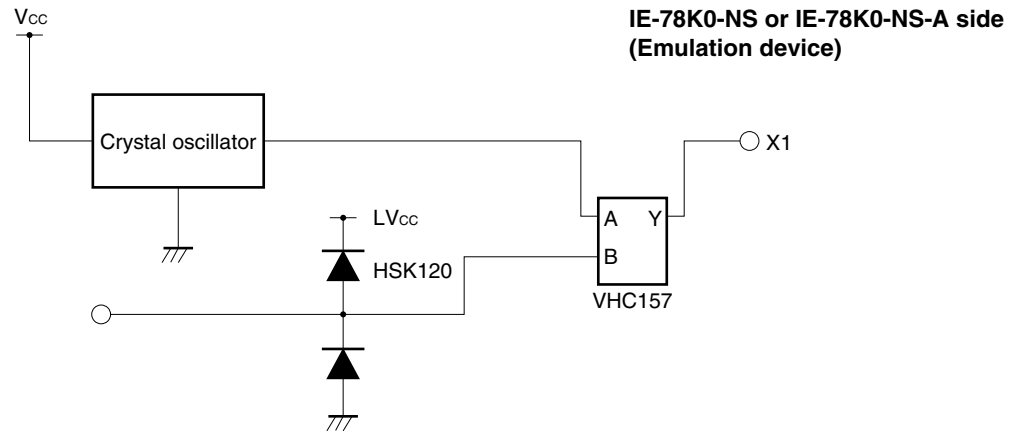
(3) When using external clock

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 clock source (this selects the user clock).

3.2.3 Subsystem clock settings

Table 3-2. Subsystem Clock Settings

Frequency of Subsystem Clock to Be Used		IE-780338-NS-EM1	IE-78K0-NS or IE-78K0-NS-A
		X2 Socket	JP8
When using clock (XT1) that is already mounted on emulation board	32.768 kHz	6 to 8 shorted	1 to 2 side shorted
When using clock mounted by user	Other than 32.768 kHz	Oscillator assembled by user	
When using external clock		Not used	3 to 4 side shorted

Caution Jumper JP8, which is used to select the board's clock or an external clock, should be set only after turning off the power of the IE-78K0-NS or IE-78K0-NS-A.

Remark When the IE-780338-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-780338-NS-EM1 is shipped, a 32.768 kHz crystal resonator (XT1) and the parts board (X2) on which pins 6 and 8 are shorted are already mounted on the IE-780338-NS-EM1. Short the 1 to 2 side on the jumper (JP8) of 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

Execute the settings described under either (a) or (b), depending on the type of clock to be used. Short the 1 to 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-780338-NS-EM1.
<2> Solder the ceramic resonator or crystal resonator, resistor Rx, capacitor CA, and capacitor CB (all with suitable oscillation frequency) onto the parts board (X2) (as shown below).

Figure 3-13. Connections on Parts Board (When Using Subsystem Clock or User-Mounted Clock)

Parts board (X2)
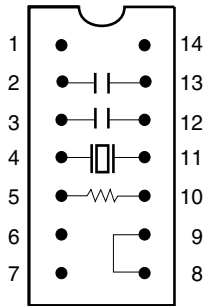
| Pin No.	Connection
2-13	Capacitor CA
3-12	Capacitor CB
4-11	Ceramic resonator or crystal resonator
5-10	Resistor Rx
8-9	Short

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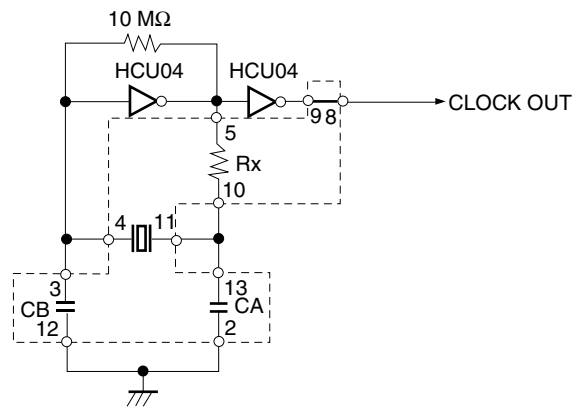
Remark The sections enclosed in broken lines indicate parts that are attached to the parts board.

<3>   Make sure that the parts board (X2) is wired as shown in Figure 3-13.

<4>   Remove the parts board that is mounted in the IE-780338-NS-EM1's X2 socket.

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

<6>   Connect the IE-780338-NS-EM1 to 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.
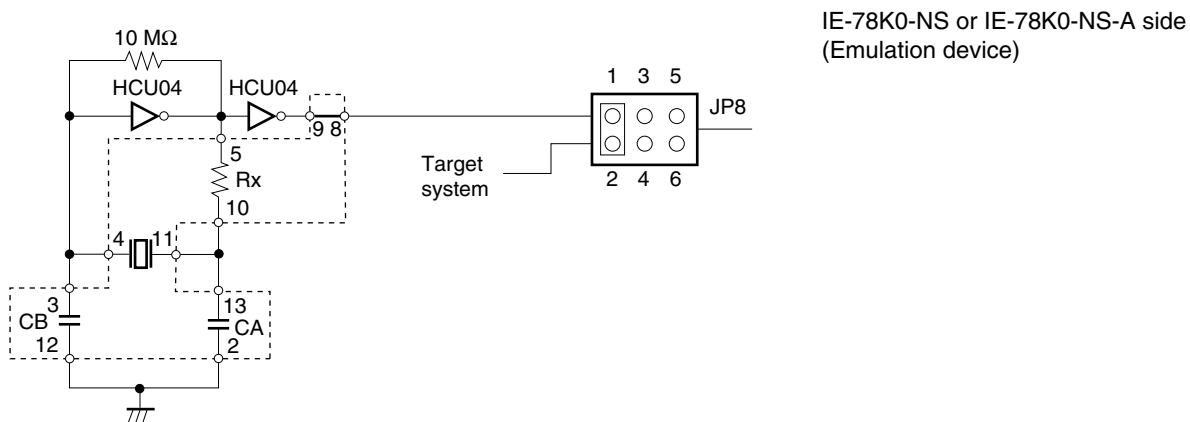
Remarks 1. The sections enclosed in broken lines indicate parts that are attached to the parts board.
           2. There is JP8 on the IE-78K0-NS or IE-78K0-NS-A.

(b) When using a crystal oscillator

- Items to be prepared
  - Crystal oscillator (see pinouts shown in Figure 3-14)

Figure 3-14. Crystal Oscillator (When Using Subsystem Clock or User-Mounted Clock)

<Steps>
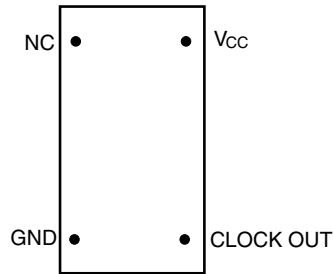
<1> Prepare the IE-780338-NS-EM1.

<2> Remove the parts board that is mounted in the IE-780338-NS-EM1's X2 socket.

<3> Mount the crystal oscillator prepared by the user in the X2 socket from which the parts board was removed in <2> above. Insert the crystal oscillator pin into the socket aligning the pins as shown in the figure below.

Figure 3-15. Pin Alignment of Crystal Oscillator and Socket
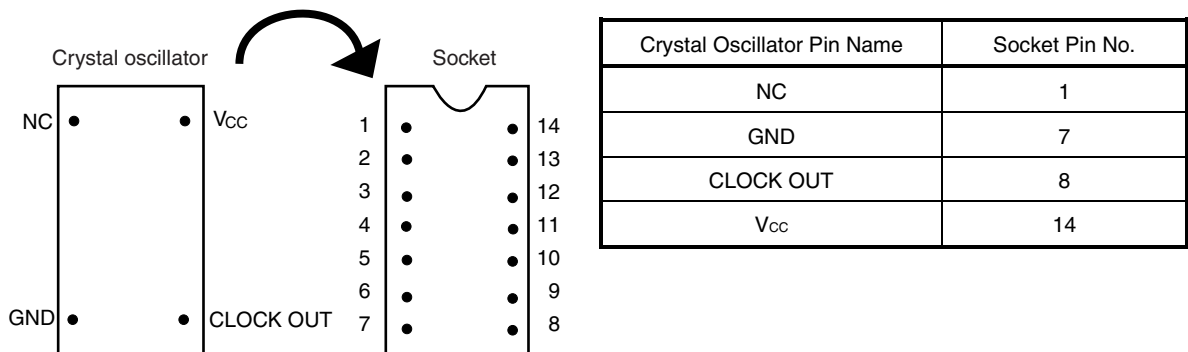
Crystal Oscillator Pin Name	Socket Pin No.
NC	1
GND	7
CLOCK OUT	8
V_{CC}	14

<4> Connect the IE-780338-NS-EM1 to the IE-78K0-NS or IE-78K0-NS-A.

31

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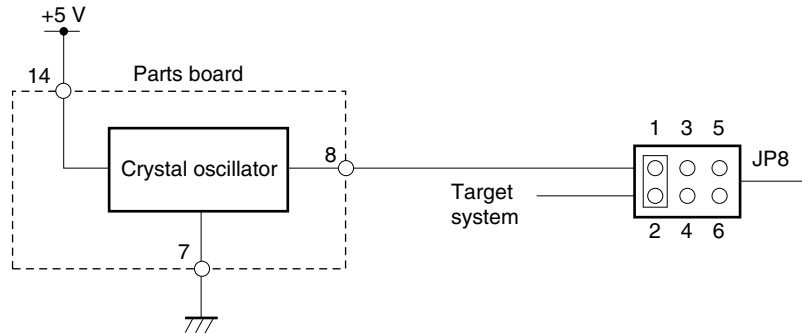
Remarks 1. The sections enclosed in broken lines indicate the parts that are attached to the parts board.
2. There is JP8 on the IE-78K0-NS or IE-78K0-NS-A.

(3) When using an external clock
Short the 3 to 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 Option Setting

3.3.1 LCD booster

When shipped, an LCD drive booster is mounted on the parts board in the LCD MOPT (IC2) socket of the IE-780338-NS-EM1.

To change the LCD drive booster, mount the resistors or capacitors necessary for the parts board or others provided with this product in the LCD MOPT socket.

Figure 3-16 shows the LCD drive booster.

Caution   The booster on the target system cannot be used.

Figure 3-16. LCD MOPT Socket (IC2)
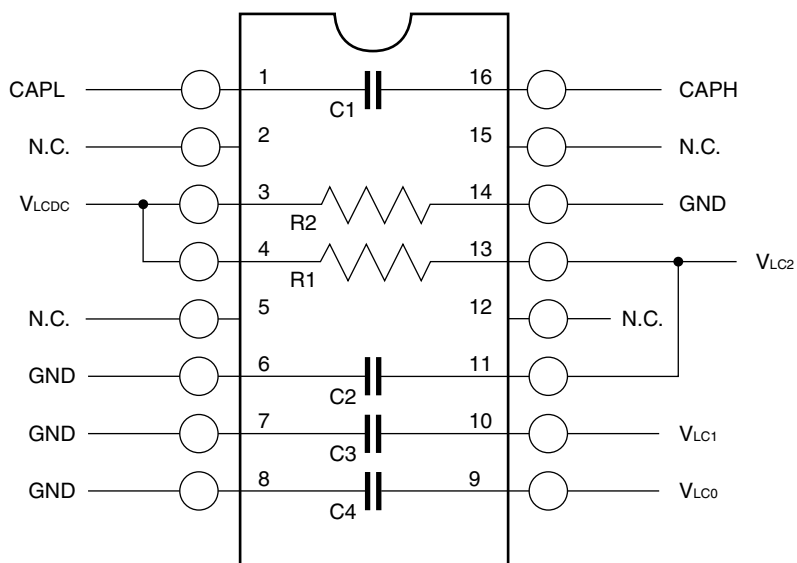
Connection Pins	Part Used	Parts Board at Shipment
1-16	Capacitor C1	0.47 μF
3-14	Resistor R2	2 MΩ
4-13	Resistor R1	1 MΩ
6-11	Capacitor C2	0.47 μF
7-10	Capacitor C3	0.47 μF
8-9	Capacitor C4	0.47 μF

3.4 External Trigger

Connect the external trigger to the IE-780338-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, and the **ID78K Series Integrated Debugger Ver. 2.30 or Later Operation (Windows Based) User's Manual (U15185E)** for the usage methods.

Figure 3-17. External Trigger Input Position
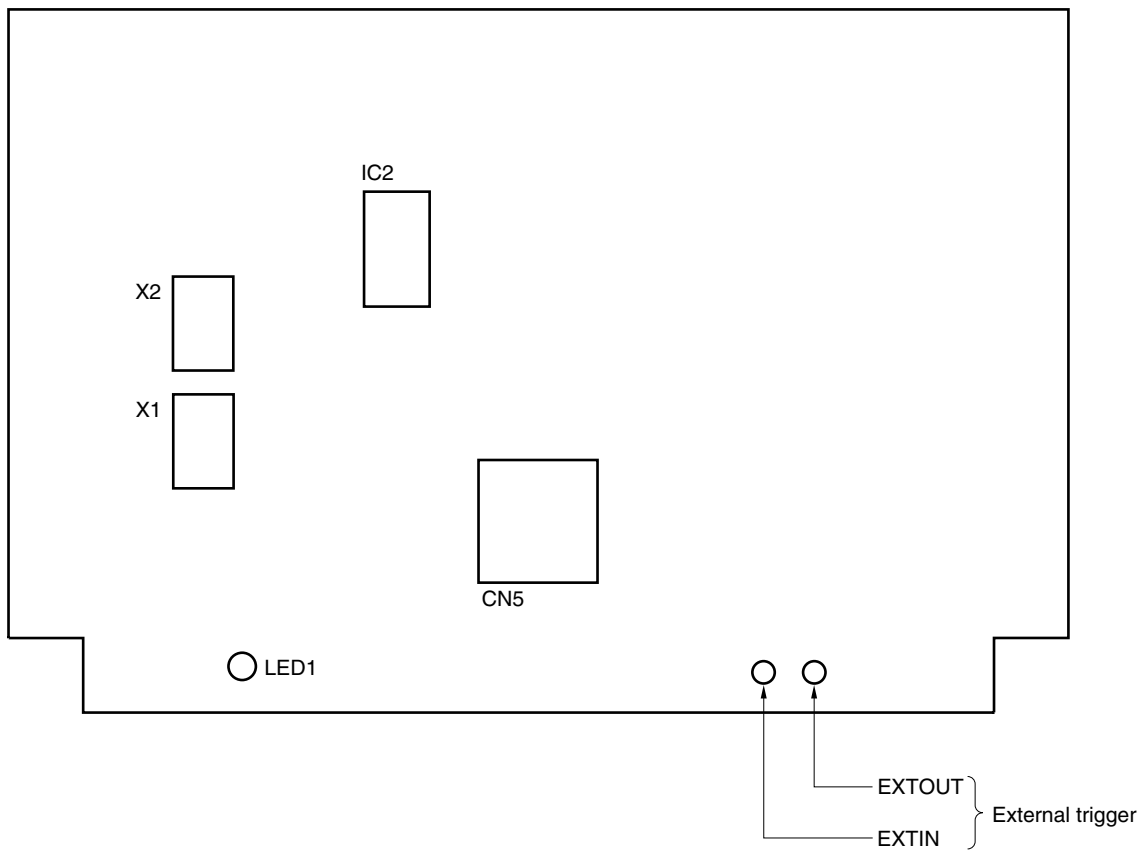
3.5 Jumper Settings on IE-78K0-NS

When using the IE-780338-NS-EM1 in combination with the IE-78K0-NS, set the jumper on the IE-78K0-NS as shown below.

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

Caution If the jumpers are set incorrectly, the board may be damaged.

Table 3-3. Jumper Settings on IE-78K0-NS

	JP2	JP3	JP4	JP6	JP7	JP8
Setting	2 to 3 shorted	1 to 2 shorted	1 to 2 shorted	3 to 4 shorted	1 to 2 shorted	**Note**

Note The settings for the JP8 are as follows.

   1-2 shorted: Internal selection of subsystem clock

   3-4 shorted: External selection of subsystem clock

3.6 Jumper Settings on IE-78K0-NS-A

When using the IE-780338-NS-EM1 in combination with the IE-78K0-NS-A, set the jumper on the IE-78K0-NS-A as shown below.

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

Caution If the jumpers are set incorrectly, the board may be damaged.

Table 3-4. Jumper Settings on IE-78K0-NS-A G-780009 Board

	JP2	JP3	JP4	JP6	JP7	JP8
Setting	2 to 3 shorted	1 to 2 shorted	1 to 2 shorted	3 to 4 shorted	1 to 2 shorted	**Note**

Note The settings for the JP8 are as follows.

   1-2 shorted: Internal selection of subsystem clock

   3-4 shorted: External selection of subsystem clock

Table 3-5. Jumper Settings on IE-78K0-NS-A G-78K0H Option Board

	JP2
Setting	2 to 3 shorted

3.7 Low-Voltage Emulation Settings

When the target system is operating on low voltage, supply the same supply voltage as the target system to the TP1 terminal pin on the main board of the IE-78K0-NS or IE-78K0-NS-A (G-780009 Board) (this processing is not necessary when the target system is operating at 5 V).

At that time, set the voltage supplied to the target system to between 1.8 and 5.5 V.

Caution When emulating at 4.5 V or lower, first start up at 5 V and then lower the target system voltage.

Table 3-6. Supply Voltage and Maximum Current Consumption During Low-Voltage Emulation

Voltage Supplied to TP1	Maximum Current Consumption of TP1
1.8 to 5.5 V	300 mA

Figure 3-18. Main Board of IE-78K0-NS or IE-78K0-NS-A (G-780009 Board)

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-780338-NS-EM1's target interface circuit.

Although the target device is a CMOS circuit, the IE-780338-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 (μPD780009A)
(2) Signals input or output from the emulation CPU (μPD78F0338)
(3) Other signals

The IE-780338-NS-EM1's circuit is used as follows for signals listed in (1) to (3) above.

(1) Signals input or output from the emulation CPU (μPD780009A)
See **Figure 4-1 Equivalent Circuit of Emulation Circuit 1**.

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

(2) Signals input or output from the emulation CPU (μPD78F0338)
See **Figure 4-2 Equivalent Circuit of Emulation Circuit 2**.

- P05 to P00
- P17 to P10
- P25 to P20
- P34 to P30
- P73 to P70
- P87 to P80
- P97 to P90
- P120
- ANI8, ANI9, AV_{REF1}, AV_{REF0}, AV_{SS0}
- S23 to S0
- COM3 to COM0

(3) Other signals
See **Figure 4-3 Equivalent Circuit of Emulation Circuit**.

- V_{DD1}, V_{DD0}
- V_{SS1}, V_{SS0}
- X2, XT2
- V_{PP}
- CAPL, CAPH, V_{LCDC}, V_{LC2}, V_{LC1}, V_{LC0}
- $\overline{RESET}$
- X1
- XT1

Caution   The same applies to the connection of alternate-function pins as no circuits exist in the IE system.

Figure 4-1. Equivalent Circuit of Emulation Circuit 1
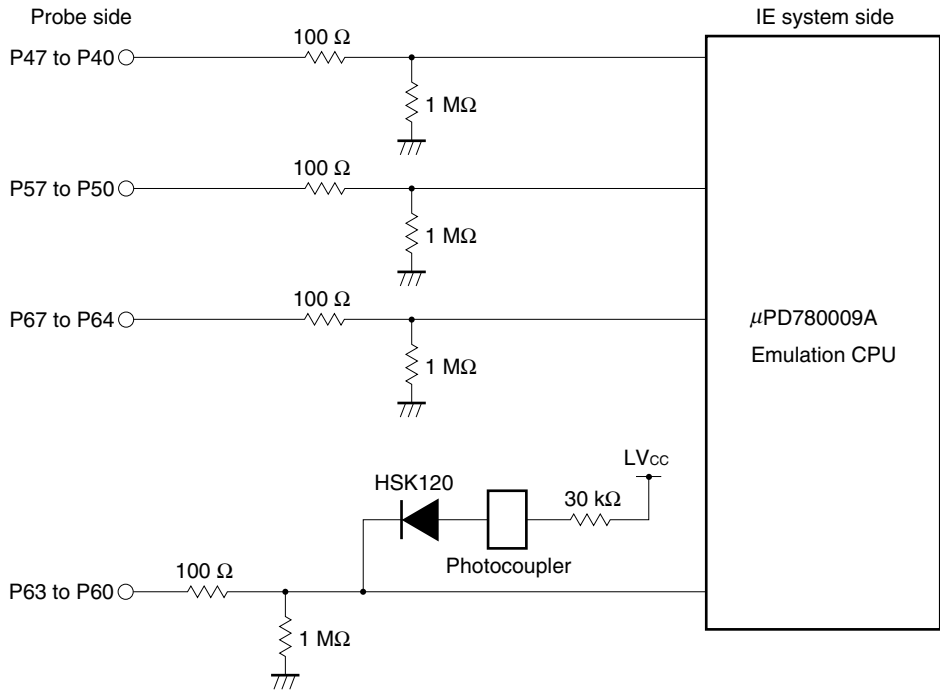
Figure 4-2. Equivalent Circuit of Emulation Circuit 2

Figure 4-3. Equivalent Circuit of Emulation Circuit 3

Probe side

IE system side
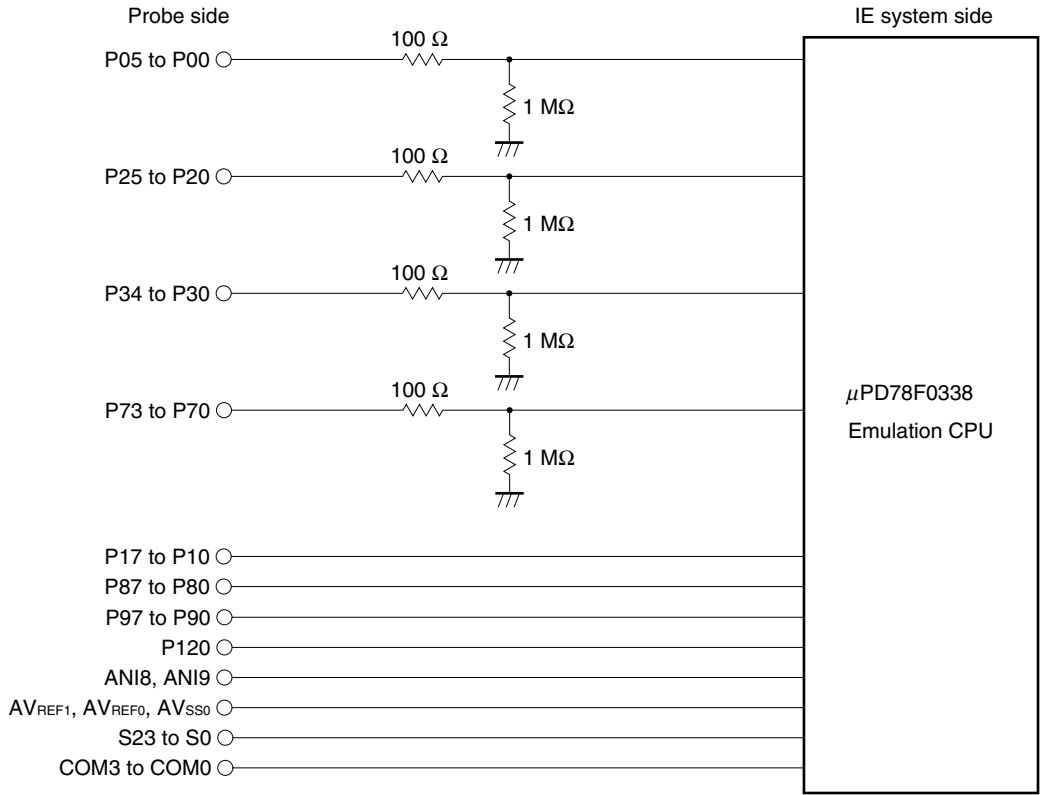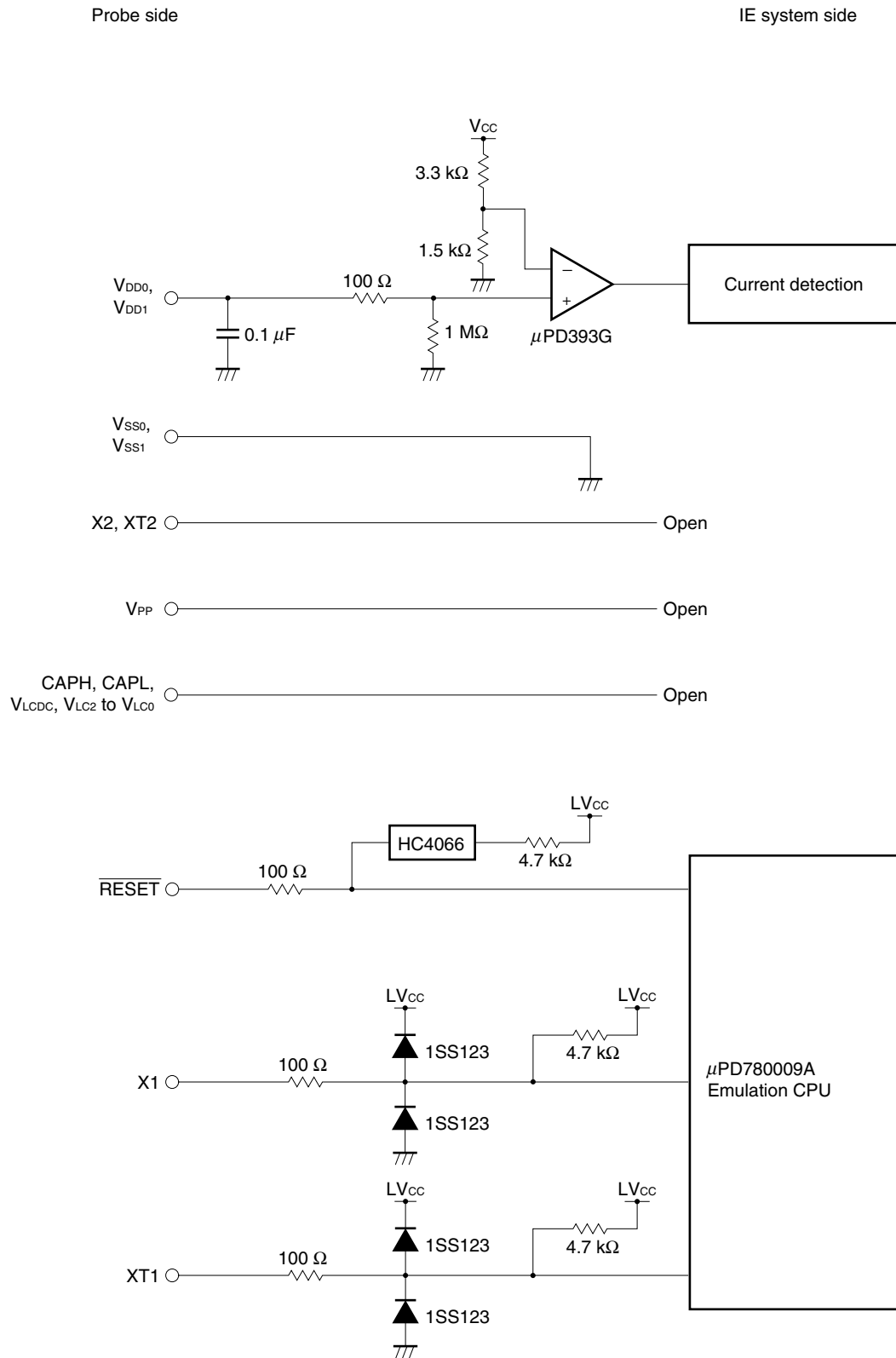
CHAPTER 5 RESTRICTIONS AND CAUTIONS ON USE

This chapter lists the restrictions and cautions on use of the IE-780338-NS-EM1.

(1) Connect the in-circuit emulator to products with the following control code.

In-Circuit Emulator	Corresponding Control Code
IE-78K0-NS	L or higher
IE-78K0-NS-A	E or higher

(2) Switching the number of the key returns (KRSEL register (FF8FH)) cannot be emulated.

(3) To emulate port 8 of the μPD780316, 780318, 780326, 780328, 780336, or 780338, set PF8 and PM8 as follows only once after reset, in the same way as to port 8 of the μPD78F0338.

SFR Name	Set Value
PM8	00H
PF8	FFH

(4) To emulate port 9 of the μPD780316, 780318, 780326, 780328, 780336, or 780338, set PF9 and PM9 as follows only once after reset, in the same way as to port 9 of the μPD78F0338.

SFR Name	Set Value
PM9	00H
PF9	FFH

(5) The ROM correction function cannot be emulated.

APPENDIX A EMULATION PROBE PIN ASSIGNMENT TABLE

Table A-1. SWEX-120SE-1 Pin Assignments (1/2)

Emulation Probe	CN5 Pin No.	Emulation Probe	CN5 Pin No.
1	1	35	35
2	2	36	36
3	3	37	37
4	4	38	38
5	5	39	39
6	6	40	40
7	7	41	41
8	8	42	42
9	9	43	43
10	10	44	44
11	11	45	45
12	12	46	46
13	13	47	47
14	14	48	48
15	15	49	49
16	16	50	50
17	17	51	51
18	18	52	52
19	19	53	53
20	20	54	54
21	21	55	55
22	22	56	56
23	23	57	57
24	24	58	58
25	25	59	59
26	26	60	60
27	27	61	61
28	28	62	62
29	29	63	63
30	30	64	64
31	31	65	65
32	32	66	66
33	33	67	67
34	34	68	68

Remarks 1. The SWEX-120SE-1 is product of TOKYO ELETECH CORPORATION.

2. The numbers in the "Emulation Probe" column indicate the corresponding pin number on the emulation probe tip.

Table A-1. SWEX-120SE-1 Pin Assignments (2/2)

Emulation Probe	CN5 Pin No.	Emulation Probe	CN5 Pin No.
69	69	95	95
70	70	96	96
71	71	97	97
72	72	98	98
73	73	99	99
74	74	100	100
75	75	101	101
76	76	102	102
77	77	103	103
78	78	104	104
79	79	105	105
80	80	106	106
81	81	107	107
82	82	108	108
83	83	109	109
84	84	110	110
85	85	111	111
86	86	112	112
87	87	113	113
88	88	114	114
89	89	115	115
90	90	116	116
91	91	117	117
92	92	118	118
93	93	119	119
94	94	120	120

Remarks 1. The SWEX-120SE-1 is product of TOKYO ELETECH CORPORATION.
2. The numbers in the "Emulation Probe" column indicate the corresponding pin number on the emulation probe tip.

APPENDIX B CAUTIONS ON DESIGNING TARGET SYSTEM

Figures B-1 and B-2 show the conditions when connecting the emulation probe to the conversion connector. Follow the configuration below and consider the shape of parts to be mounted on the target system when designing a system.

In the product names described in this appendix, SWEX-120SE-1, NQPACK120SE, YQPACK120SE, and YQ-GUIDE are products of TOKYO ELETECH CORPORATION.

Figure B-1. Distance Between In-Circuit Emulator and Conversion Socket

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

Target system

Emulation board
IE-780338-NS-EM1

303 mm

CN5

Emulation probe
SWEX-120SE-1

Conversion connector
NQPACK120SE,
YQPACK120SE,
YQ-GUIDE
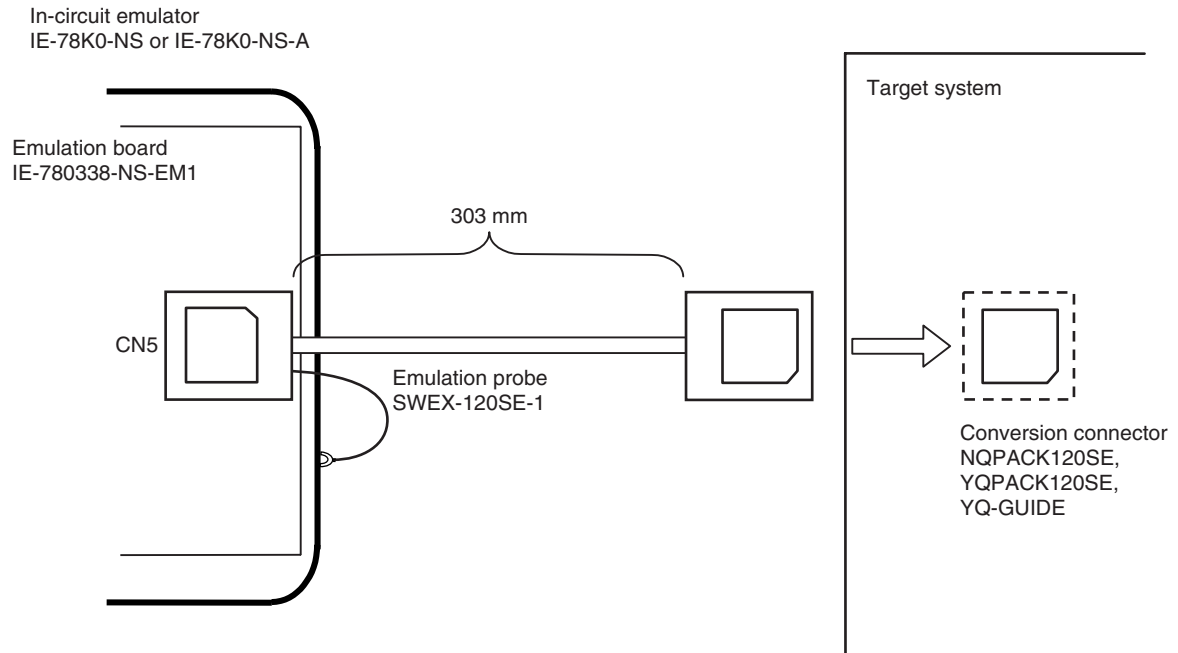
Figure B-2. Connection Conditions of Target System

Emulation board
IE-780338-NS-EM1

Emulation probe
SWEX-120SE-1

Conversion connector
NQPACK120SE,
YQPACK120SE,
YQ-GUIDE

33 mm

23 mm   23 mm

48.5 mm   38.5 mm

Target system
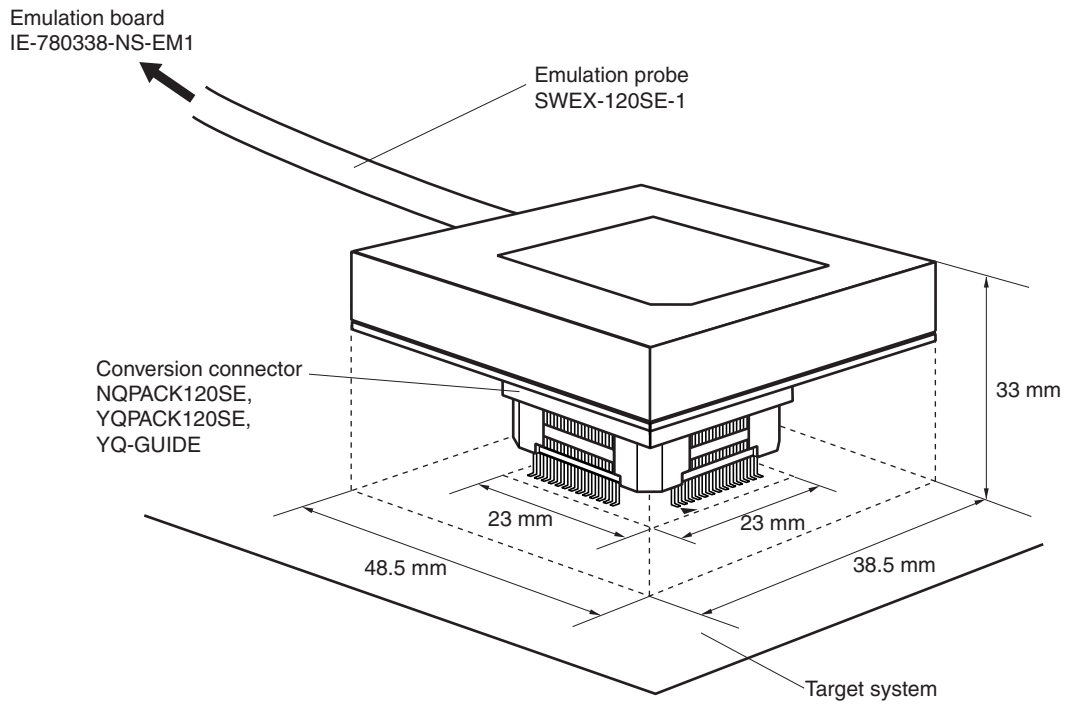
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