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RENESAS

User's Manual

IE-178098-NS-EM1

Emulation Board

Target Device

μPD178078 Subseries μPD178098 Subseries
μPD178F098

Document No. U14013EJ2V0UM00 (2nd edition)
Date Published February 2000 N CP(K)

Printed in Japan

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J99.1

Major Revisions in This Edition

Page	Description
p.33	Addition of **3.5 Jumper Settings on IE-78K0-NS**
p.43	Addition of **APPENDIX B REVISION HISTORY**

The mark ⋆ shows major revised points.

[MEMO]

INTRODUCTION

Product Overview

The IE-178098-NS-EM1 is designed to be used with the IE-78K0-NS to debug the following target devices that belong to the 178K Series of 8-bit single-chip microcontrollers.

- μPD178078 Subseries: μPD178076, 178078
- μPD178098 Subseries: μPD178096, 178098
- μPD178F098

Target Readers

This manual is intended for engineers who will use the IE-178098-NS-EM1 with the IE-78K0-NS 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-178098-NS-EM1, refer to not only this manual (supplied with the IE-178098-NS-EM1) but also the manual that is supplied with the IE-78K0-NS.

IE-78K0-NS User's Manual	IE-178098-NS-EM1 User's Manual
• Basic specifications • System configuration • External interface functions	• 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-178098-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 to be emulated (real chip).
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 and the IE-178098-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 Number	
	English	Japanese
IE-78K0-NS	U13731E	U13731J
IE-178098-NS-EM1	This manual	U14013J
ID78K0-NS Integrated Debugger Reference Windows™ Based	U12900E	U12900J
μPD178078, 178098 Subseries	U12790E	U12790J

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

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LIST OF TABLES

[MEMO]

CHAPTER 1 GENERAL

The IE-178098-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 178K Series of 8-bit single-chip microcontrollers.

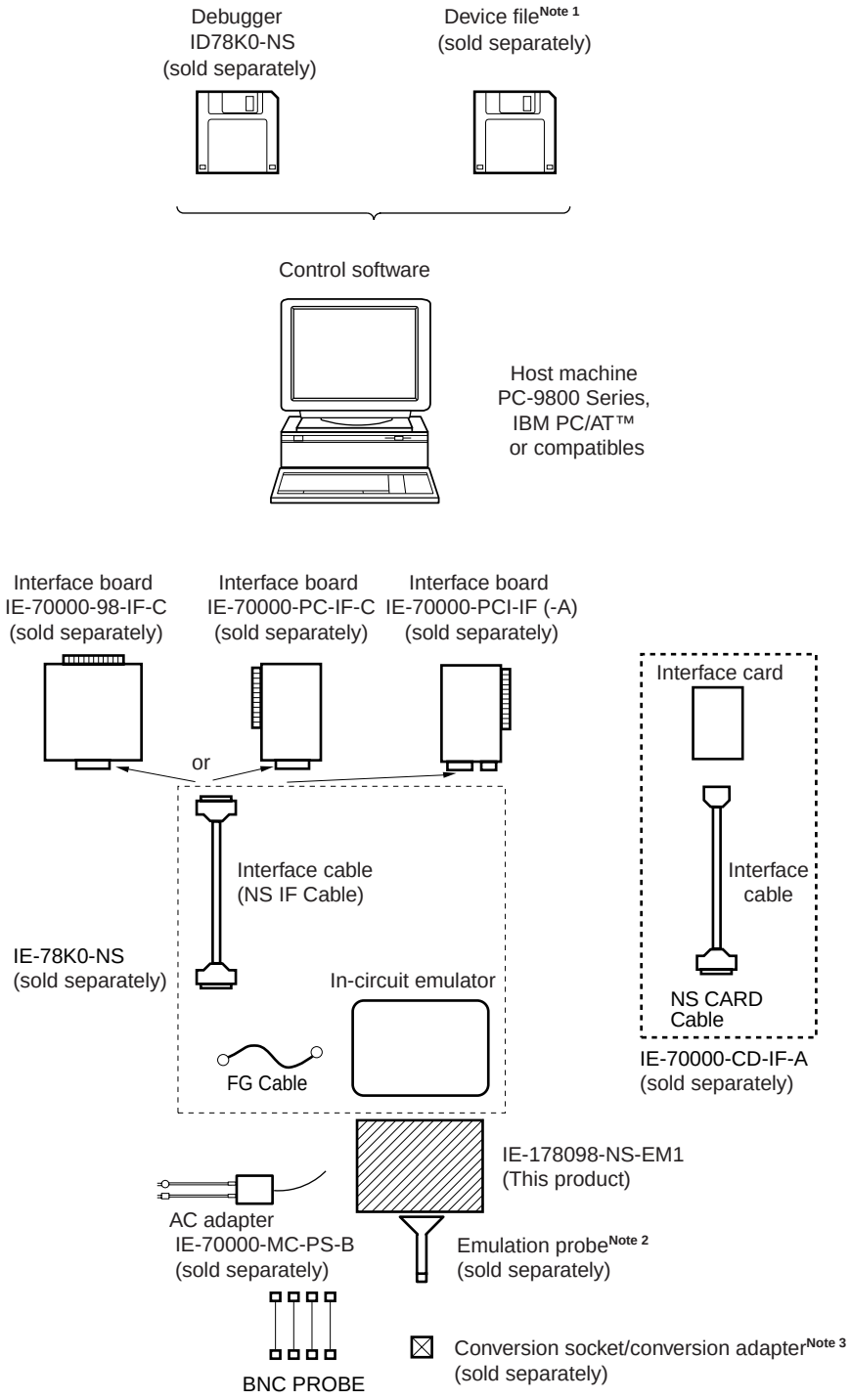
This chapter describes the IE-178098-NS-EM1's system configuration and basic specifications.

- Target device
  - μPD178078 Subseries
  - μPD178098 Subseries
  - μPD178F098

1.1 System Configuration

Figure 1-1 illustrates the IE-178098-NS-EM1's system configuration.

Figure 1-1. System Configuration



Notes 1. The device file is as follows, in accordance with the subseries.

μS××××DF178098: μPD178078, 178098 Subseries

2. The emulation probe is as follows, in accordance with the package.

NP-100GF: 100-pin plastic QFP (GF-3BA type)

The NP-100GF is a product of Naito Densei Machida Mfg. Co., Ltd.

For further information, contact Naito Densei Machida Mfg. Co., Ltd. (TEL: +81-44-822-3813)

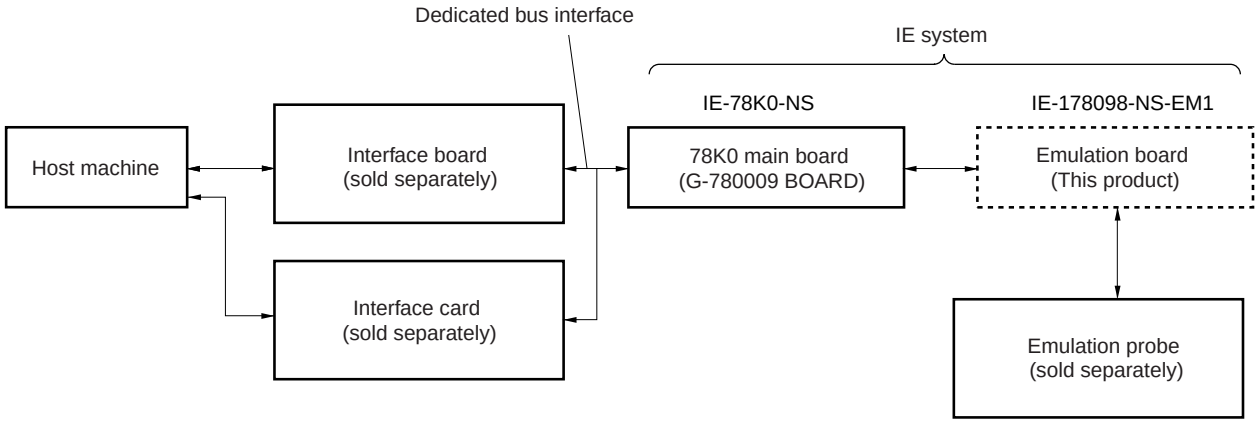
3. The conversion socket/conversion adapter are as follows, in accordance with the package.

EV-9200GF-100: 100-pin plastic QFP (GF-3BA type)

1.2 Hardware Configuration

Figure 1-2 shows the IE-178098-NS-EM1's position in the basic hardware configuration.

Figure 1-2. Basic Hardware Configuration



1.3 Basic Specifications

The IE-178098-NS-EM1's basic specifications are listed in Table 1-1.

Table 1-1. Basic Specifications

Parameter	Description
Supervisor	V40™ (Operation frequency 16.0 MHz)
Target Device	μPD178078, 178098 Subseries, 178F098
System clock	6.3 MHz
Clock supply	External: Input via an emulation probe from the target system Internal: Mounted on the emulation probe (6.3 MHz) or mounted on the board by the user
Emulation memory capacity	64 KB
Mapping unit	Internal ROM: 4 KB (Maximum 60 KB) Internal high-speed RAM: 64 bytes (Maximum 1 KB) Internal low-speed RAM: 128 bytes (Maximum 32 KB)
Emulation function	Real-time execution Break execution Step execution
RAM monitor	Space: Entire memory space Timing: Data access
Event detection	Program execution detection Bus event detection External trigger detection External trigger output
Event integration	Bus counter Trace qualify condition Delay condition Trigger condition
Break source	Event break Manual break Command break Fail-safe break
Real-time trace	Trace sources: All traces Qualify trace Trace capacity: 64 bits × 8 K Trace contents: Address, data, status
Execution time measurement	Maximum: 4 min. 28 sec. Resolution: 62.5 ns
Target interface	Prepare the probe according to the shape of the target device
Host interface	Dedicated bus interface
Host machine	PC-9800 series, IBM PC/AT or compatibles
Power supply	DC 5 V

[MEMO]

CHAPTER 2 PART NAMES

This chapter introduces the parts of the IE-178098-NS-EM1 main unit.

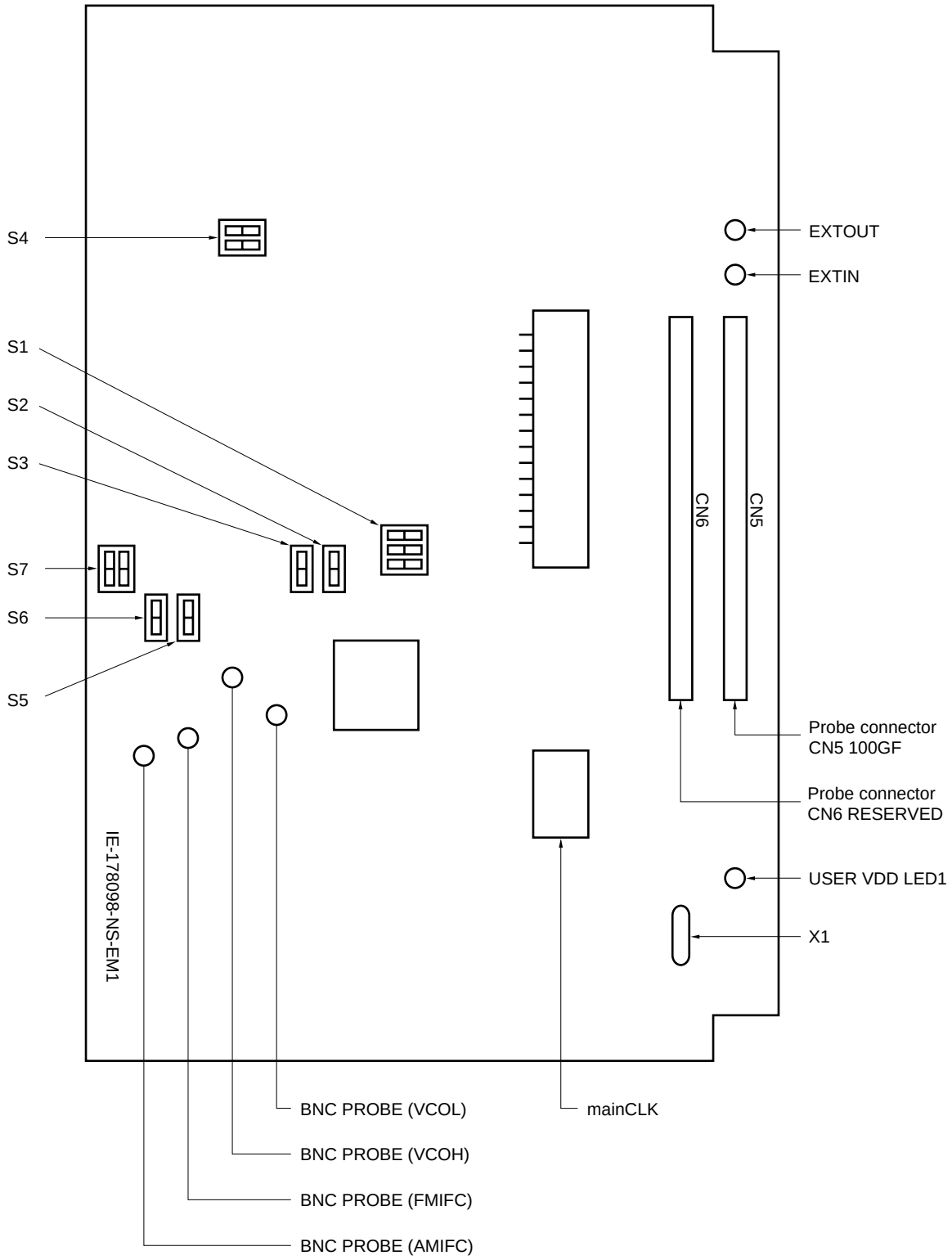
The packing box contains the emulation board (IE-178098-NS-EM1), packing list, user's manual, and guarantee card.

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-178098-NS-EM1 Part Names



CHAPTER 3 INSTALLATION

This chapter describes methods for connecting the IE-178098-NS-EM1 to the IE-78K0-NS, emulation probe, etc. Mode setting methods are also described.

3.1 Connection

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

See the IE-78K0-NS User's Manual for a description of how to connect the IE-178098-NS-EM1 to the IE-78K0-NS.

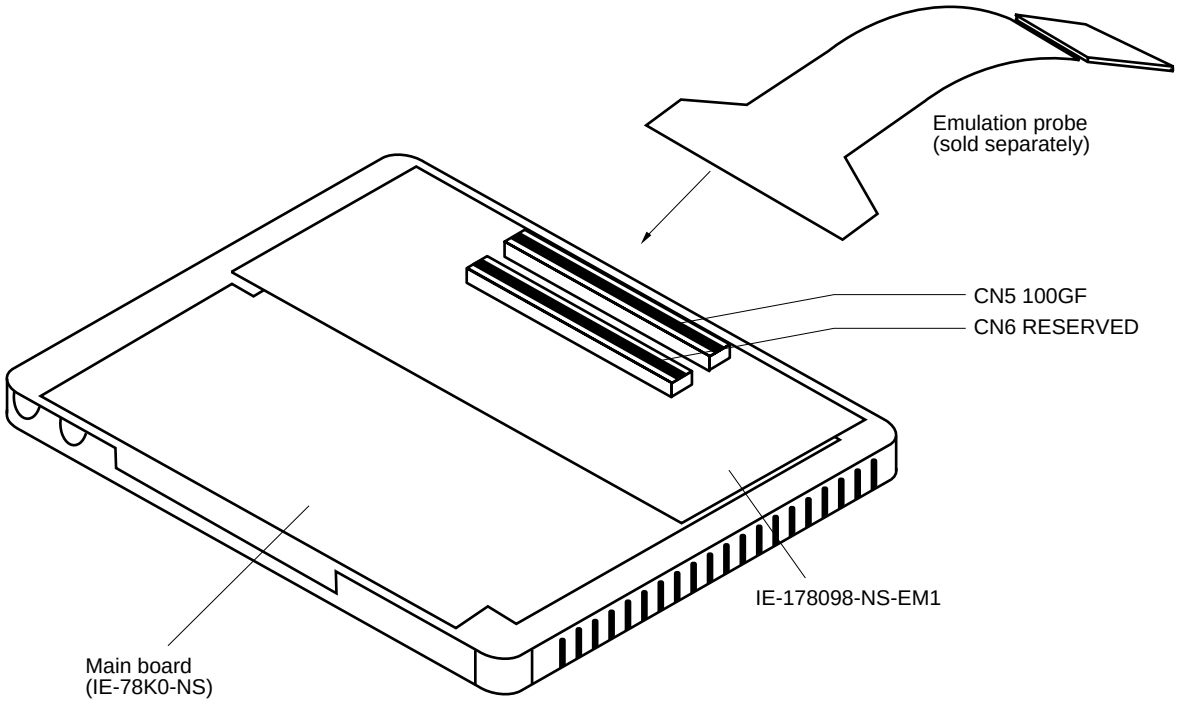
(2) Connection with emulation probe

See the IE-78K0-NS User's Manual for a description of how to connect an emulation probe to the IE-178098-NS-EM1.

On this board, connect the emulation probe to CN5.

Cautions 1. Incorrect connection may damage the ICE main unit.
Be sure to read the emulation probe's user's manual for a detailed description of the connection method.
2. Do not use CN6 as it is for extension.

Figure 3-1. Connection of Emulation Probe



(3) How to connect BNC PROBE

Connect the supplied BNC PROBE × 4 to the IE-178098-NS-EM1 and the target board.

The following four signals can be connected to the target board using the BNC PROBE.

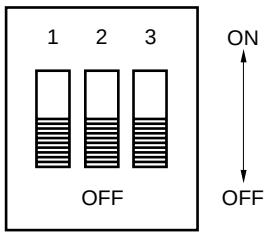
VCOL, VCOH, FMIFC, AMIFC

3.2 Switch Settings

(1) S1 setting

Set as follows in accordance with the target device.

Figure 3-2. S1 Setting



Target Device	S1-1	S1-2	S1-3
μPD178F098	OFF	OFF	OFF
RESERVED	OFF	ON	OFF
μPD178076, 178078, 178096, 178098	OFF	ON	ON
RESERVED	ON	OFF	OFF
RESERVED	ON	OFF	ON
RESERVED	ON	ON	OFF
RESERVED	ON	ON	ON

Remark The above figure shows the position at factory shipment.

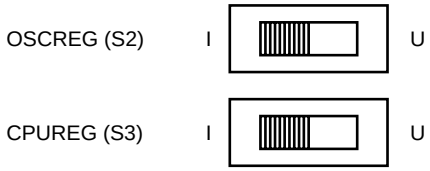
(2) S2 and S3 settings

S2 and S3 switch the capacitor connection for the regulator.

"I" side: Connect to the 0.1 μF in the ICE

"U" side: Connect to the capacitor in the target system

Figure 3-3. S2 and S3 Settings

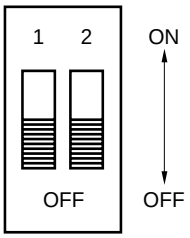


Remark The above figure shows the position at factory shipment.

(3) S4 setting

Always use S4 in the OFF position.

Figure 3-4. S4 Setting

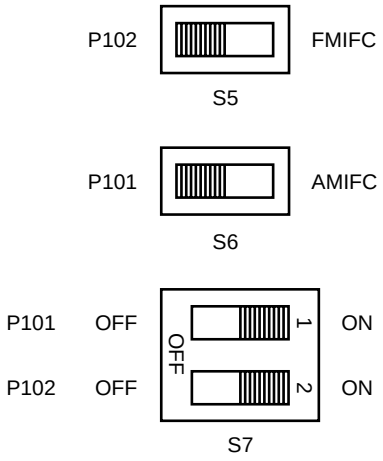


Remark The above figure shows the position at factory shipment.

(4) S5, S6, and S7 settings

S5, S6, and S7 switch the IF counter and ports.

Figure 3-5. S5, S6, and S7 Settings



	S6	S7-1
Use as P101	P101 side	ON
Use as AMIFC	AMIFC side	OFF

	S5	S7-2
Use as P102	P102 side	ON
Use as FMIFC	FMIFC side	OFF

Remark The above figure shows the position at factory shipment.

3.3 Clock Settings

3.3.1 Overview of clock settings

The main system 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) External clock

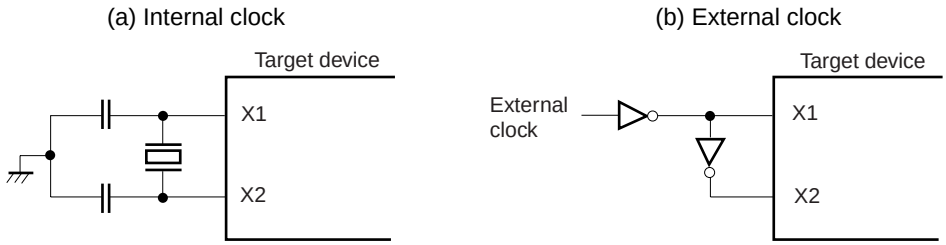
If the target system includes an internal clock, select either “(1) Clock that is already mounted on emulation board” or “(2) Clock that is mounted by user”. For an internal clock, a resonator is connected to the target device and the target device’s internal oscillator is used. An example of the external circuit is shown in part (a) of Figure 3-6. During emulation, the resonator that is mounted on the target system is not used. Instead, the clock that is mounted on the emulation board installed for the IE-78K0-NS 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 3-6.

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. There is no need to supply a clock to the X2 pin.

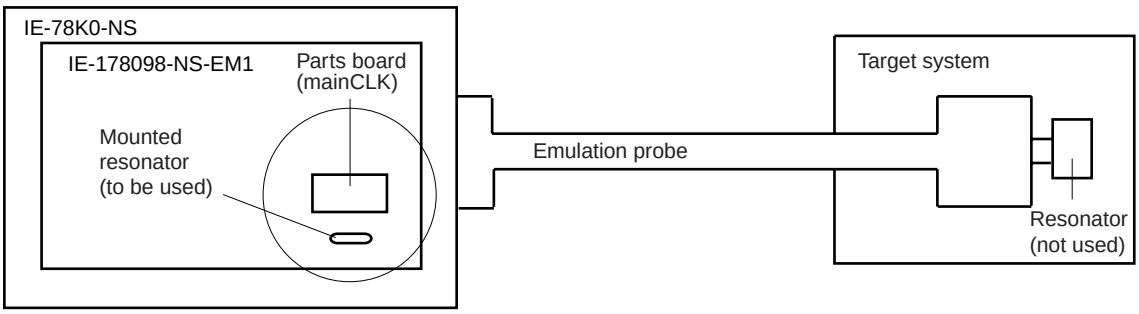
Figure 3-6. External Circuits Used as System Clock Oscillator



(1) Clock that is already mounted on emulation board

A crystal oscillator (X1) is already mounted on the emulation board. Its frequency is 6.3 MHz.
Note that 6 to 8 are shorted on the parts board.

Figure 3-7. When Using Clock That Is Already Mounted on Emulation Board

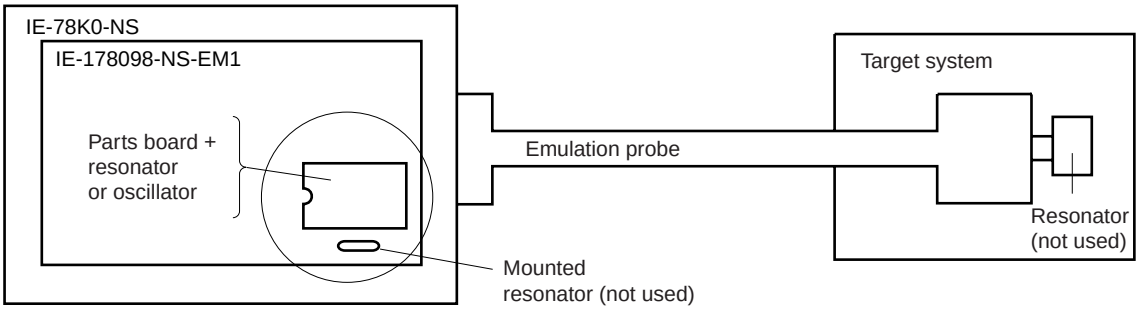


Remark The clock that is supplied by the IE-178098-NS-EM1's oscillator (encircled in the figure) is used.

(2) Clock that is mounted by user

The user is able to mount any clock supported by the set specifications on the IE-178098-NS-EM1. First mount the resonator on the parts board, then attach the parts board to the IE-178098-NS-EM1. This method is useful when using a different frequency from that of the premounted clock.

Figure 3-8. When Using User-Mounted Clock

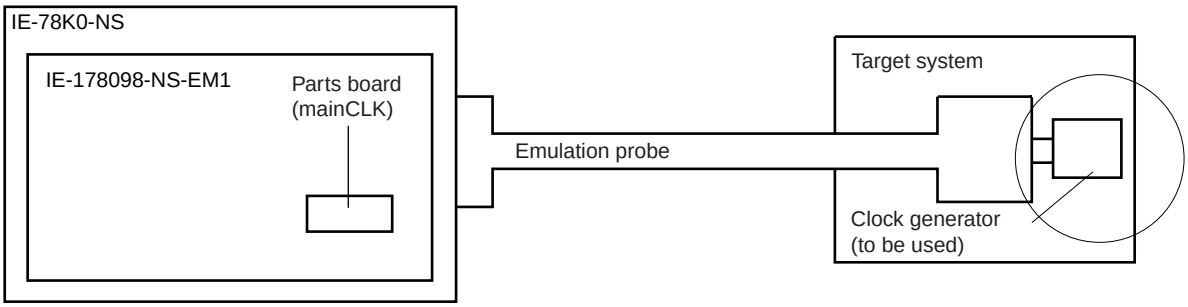


Remark The clock that is supplied by the IE-178098-NS-EM1's resonator (encircled in the figure) is used.

(3) External clock

An external clock connected to the target system can be used via an emulation probe.
Note that 6 to 8 are shorted on the parts board.

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.

3.3.2 Main system clock settings

Table 3-1. Main System Clock Settings

Frequency of Main System Clock		IE-178098-NS-EM1 Parts Board (mainCLK)	CPU Clock Source Selection (ID)
When using clock that is already mounted on emulation board	6.3 MHz	6 to 8 shorted	Internal
When using clock mounted by user	Other than 6.3 MHz	Oscillator assembled by user	
When using external clock		6 to 8 shorted	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's clock source (this selects the user's clock).

Remark The IE-178098-NS-EM1's factory settings are those listed above under "when using clock that is already mounted on emulation board".

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

When the IE-178098-NS-EM1 is shipped, a 6.3 MHz crystal resonator (X1) is already mounted on the IE-178098-NS-EM1. When using the factory-set mode settings (6 to 8 are shorted on the parts board), 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).

(2) When using clock mounted by user

The settings described under either (a) or (b) 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).

(a) When using a ceramic resonator or crystal resonator

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

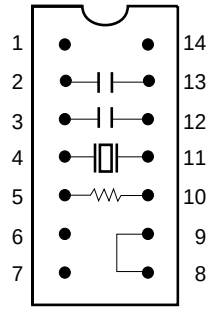
<Steps>

<1> Prepare the IE-178098-NS-EM1.

<2> Solder the target ceramic resonator or crystal resonator, resistor Rx, capacitor CA, and capacitor CB (all with suitable oscillation frequency) onto the parts board that is mounted in the IE-178098-NS-EMI’s socket (as shown below).

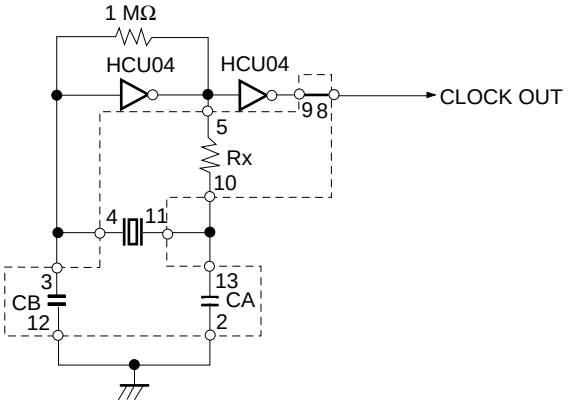
Figure 3-10. Connections on Parts Board (When Using Main System Clock or User-Mounted Clock)

Parts board (mainCLK)



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

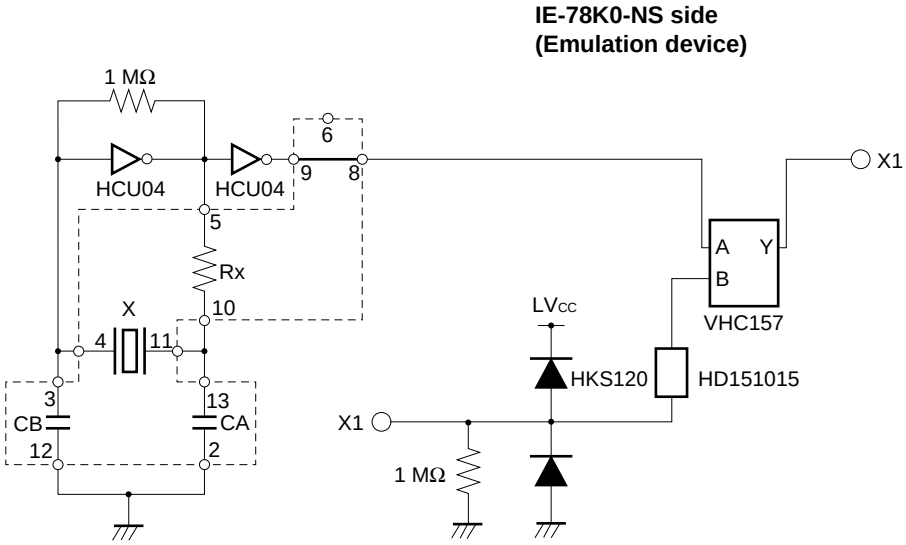


Remark The sections enclosed in broken lines indicate parts that are attached to the parts board.

<3> Make sure that the parts board is wired as shown in Figure 3-10.

<4> Install the IE-178098-NS-EM1 in the IE-78K0-NS.

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

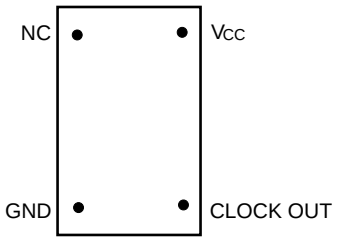


Remark The sections enclosed in broken lines indicate parts that are attached to the parts board.

(b) When using a crystal oscillator

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

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



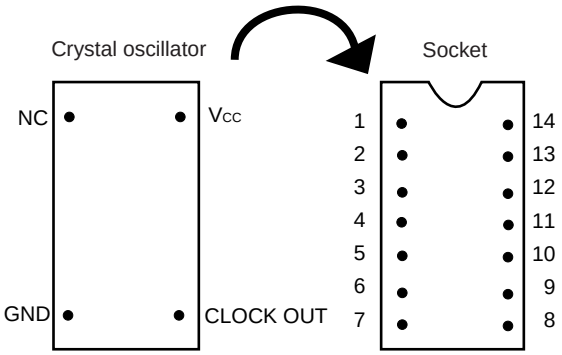
<Steps>

<1> Prepare the IE-178098-NS-EM1.

<2> Remove the parts board that is mounted in the IE-178098-NS-EM1's socket (the socket marked as mainCLK).

<3> Connect the prepared crystal oscillator to the socket (mainCLK) from which the parts board was removed. Insert the crystal oscillator pin into the socket aligning the pins as shown in the figure below.

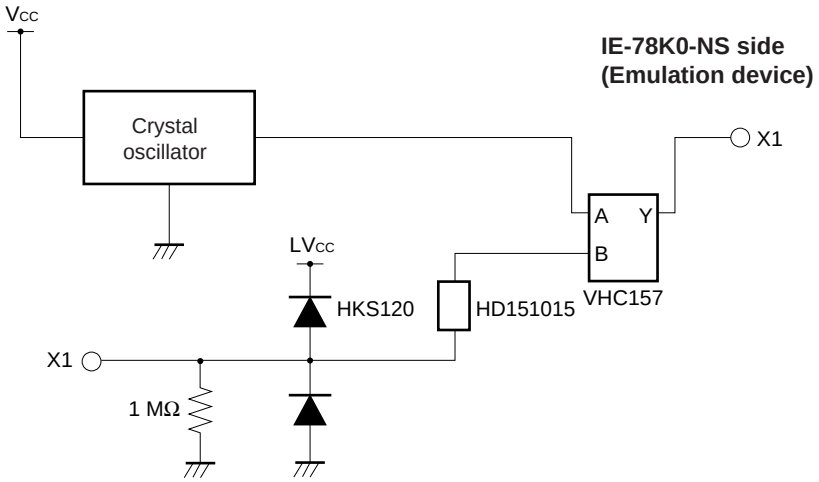
Figure 3-12. Pin Alignment of Crystal Oscillator and Socket



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

<4> Install the IE-178098-NS-EM1 in the IE-78K0-NS.

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

When using factory-set mode settings (6 to 8 are shorted on the parts board), there is no need to make any other hardware settings.

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).

3.4 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 of the IE-78K0-NS (this is unnecessary when TP1 is 5 V). For details, refer to IE-78K0-NS User's Manual (U13731E).

- Maximum current consumption of TP1
  100 mA (1.8 V) to 300 mA (5.0 V)

★ 3.5 Jumper Settings on IE-78K0-NS

When using the IE-178098-NS-EM1, set the jumpers on the IE-78K0-NS as shown in Table 3-2.
For details of these jumper settings, refer to the **IE-78K0-NS User's Manual (U13731E)**.

Table 3-2. 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	1 to 2 shorted

[MEMO]

CHAPTER 4 DIFFERENCES BETWEEN TARGET DEVICES AND TARGET INTERFACE CIRCUITS

This chapter describes the differences between the target device's signal lines and the signal lines of the IE-178098-NS-EM1's target interface circuit.

Although the target device is a CMOS circuit, the IE-178098-NS-EM1's target interface circuit consists of emulators 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 directly input to or output from the evaluation chip and peripheral I/O chip
(2) Signals input from the target system via a gate
(3) Signals related to PLL
(4) Other signals

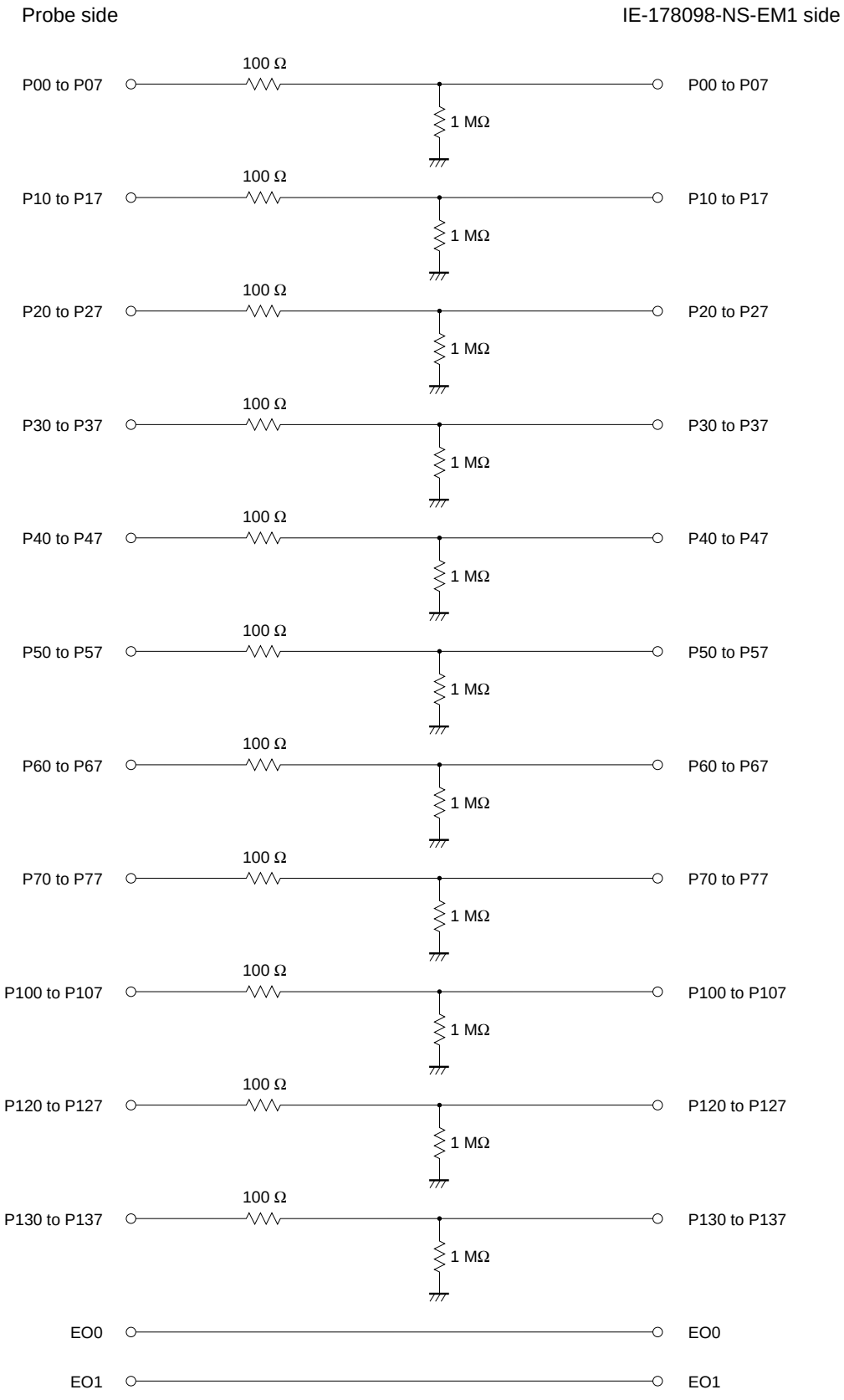
The following is an explanation of the signals listed in (1) to (4) above, as they relate to the IE system's circuit.

(1) Signals directly input to or output from the evaluation chip and peripheral I/O chip.

The following signals perform the same operations as in the μPD178078, μPD178098 Subseries, and μPD178F098. For signals related to ports, a 1 MΩ pull-down resistor and a 100 Ω resistor are inserted in series.

- Signals related to port 0
- Signals related to port 1
- Signals related to port 2
- Signals related to port 3
- Signals related to port 4
- Signals related to port 5
- Signals related to port 6
- Signals related to port 7
- Signals related to port 10
- Signals related to port 12
- Signals related to port 13
- EO0 signal
- EO1 signal

Figure 4-1. Equivalent Circuit 1 of Emulator



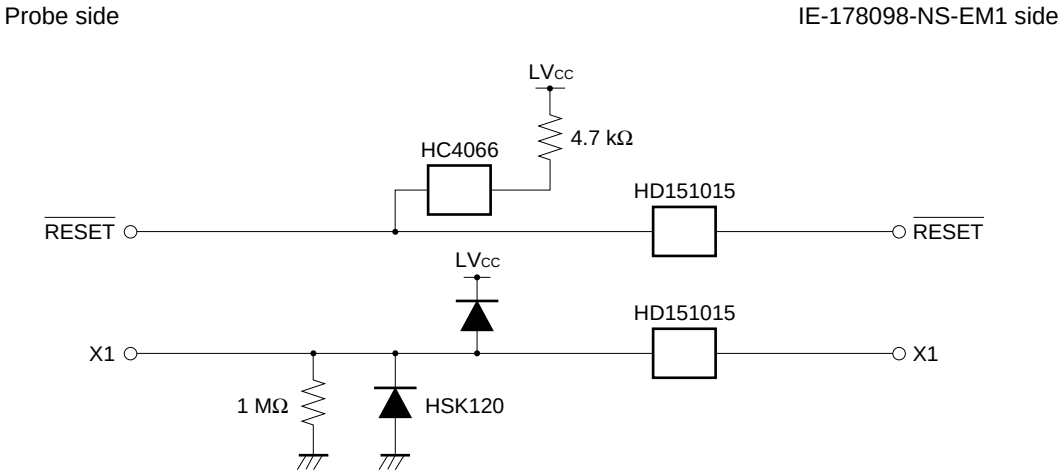
(2) Signals input from the target system via a gate

Since the following signals are input via a gate, their timing shows a delay compared to that of the μPD178078, 178098 Subseries, and μPD178F098. Their AC characteristics and DC characteristics are therefore different from the μPD178078, 178098 Subseries, and μPD178F098, making it necessary to observe a stricter timing design than in the case of the the μPD178078, 178098 Subseries, and μPD178F098.

- $\overline{\text{RESET}}$ signal
- Signals related to clock input

In all the signals input from the target system, the $\overline{\text{RESET}}$ signal, and signals related to clock input are input to the evaluation chip via a logic IC. The DC characteristics are therefore different from the μPD178078, 178098 Subseries, and μPD178F098. The AC characteristics are also different because of the delayed signal timing caused by the gate.

Figure 4-2. Equivalent Circuit 2 of Emulator



(3) Signals related to PLL

- AMIFC
- FMIFC
- VCOH
- VCOL
- REGOSC
- REGCPU
- V_{DD}PLL
- GNDPLL

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

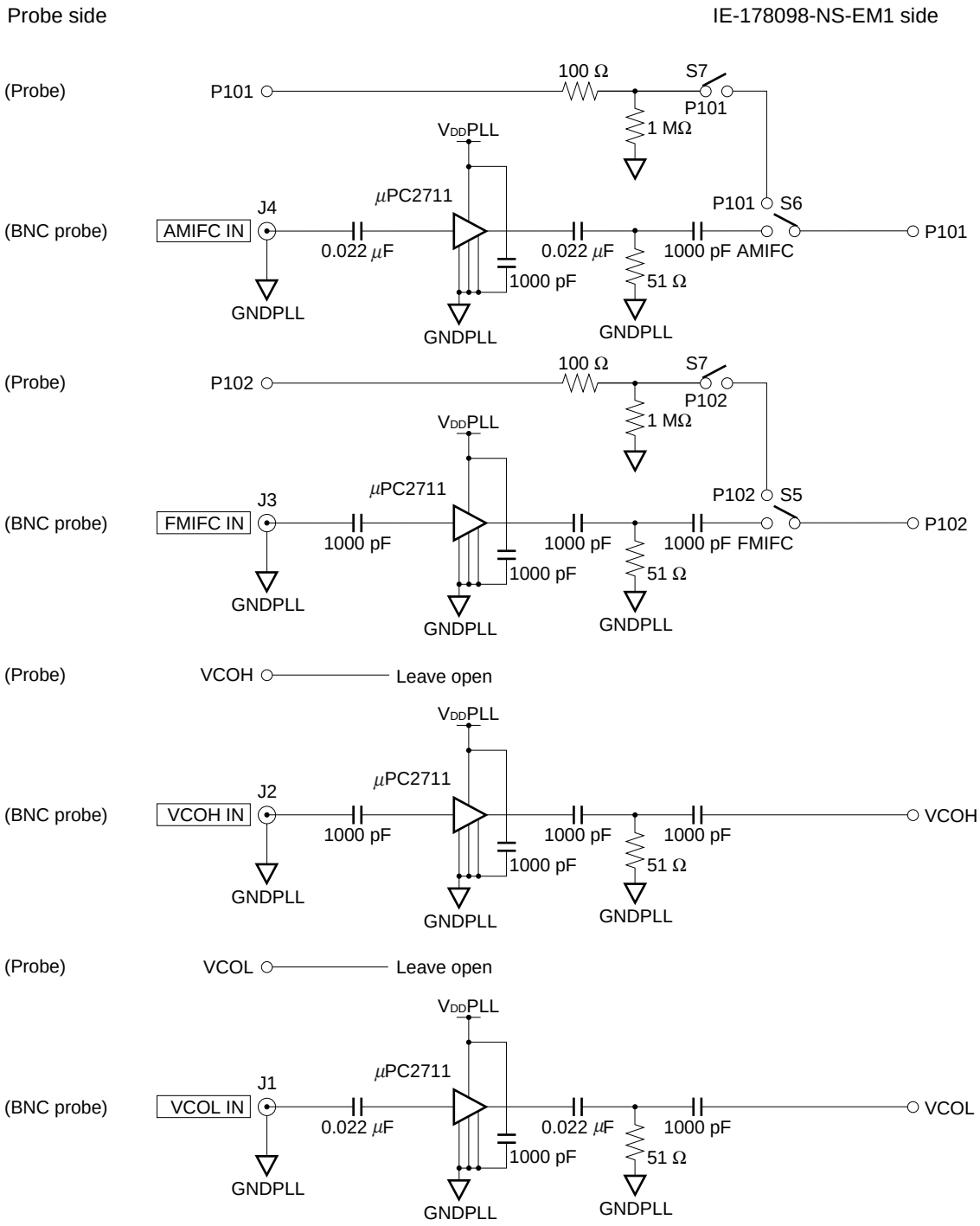
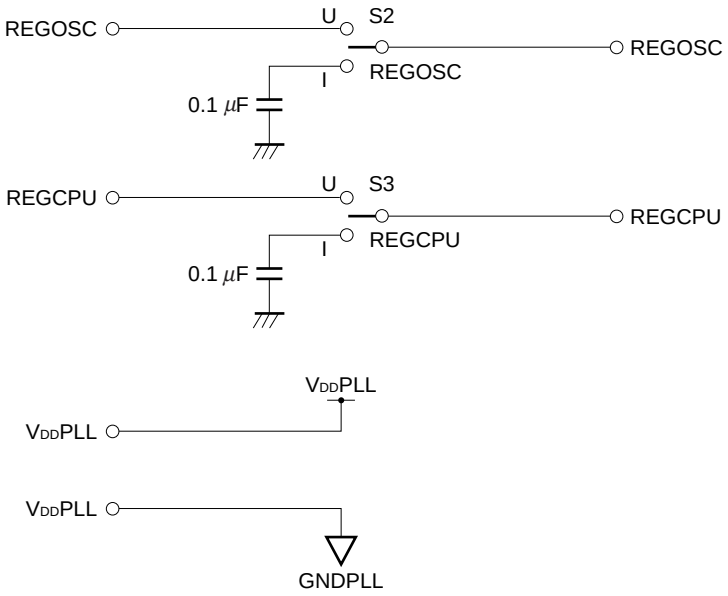


Figure 4-3. Equivalent Circuit 3 of Emulator (2/2)

Probe side IE-178098-NS-EM1 side



(4) Other signals

- V_{DD} pin

  When the emulation CPU is operating at 5 V, its power is supplied from the IE-178098-NS-EM1, and when operating at low-voltage, its power is supplied from the low-voltage pin (TP1) in the IE-78K0-NS. The V_{DD} pin of the target system is only used to control the LED (TV_{CC}) in the IE-178098-NS-EM1 that monitors the input of the target system's power supply.
- V_{SS} pin

  The V_{SS} pin is connected to GND in the IE-178098-NS-EM1.
- V_{PP}/IC pin

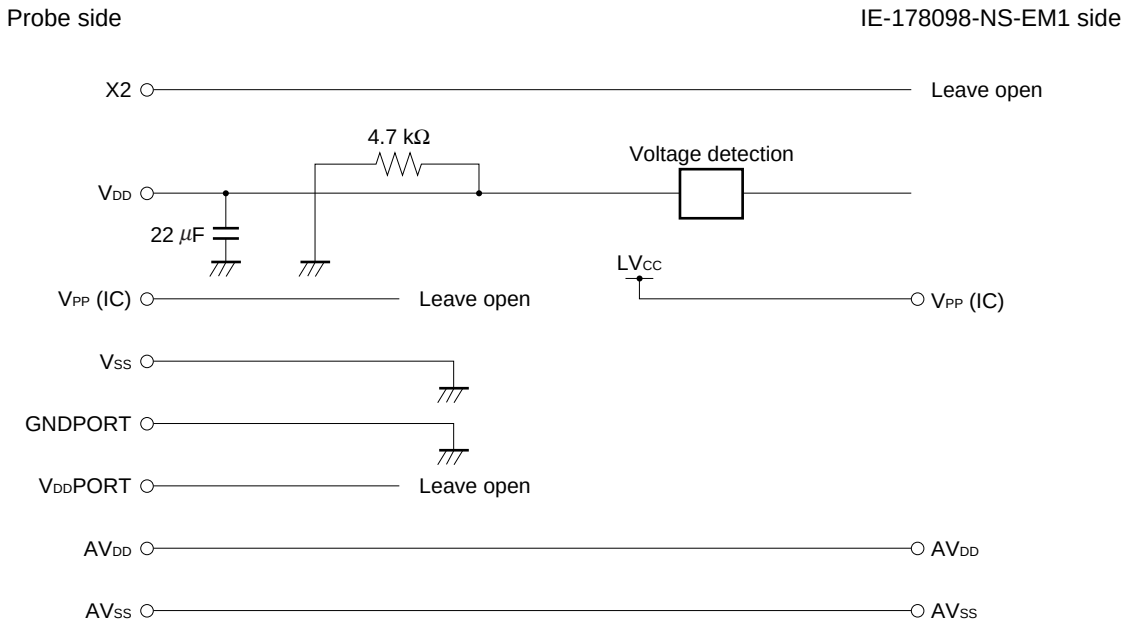
  The V_{PP}/IC pin is not used in the IE-178098-NS-EM1.
- X2 pin

  The X2 pin is not used in the IE-178098-NS-EM1.
- GNDPORT pin

  The GNDPORT pin is connected to GND into the IE-178098-NS-EM1.
- V_{DD}PORT pin

  The V_{DD}PORT pin is not used in the IE-178098-NS-EM1.
- AV_{DD} pin
- AV_{SS} pin

Figure 4-4. Equivalent Circuit 4 of Emulator



APPENDIX A EMULATION PROBE PIN ASSIGNMENT TABLE

Table A-1. NP-100GF Pin Assignments (1/2)

Emulation Probe	CN1 Pin No.	Emulation Probe	CN1 Pin No.
1	116	35	104
2	115	36	103
3	87	37	100
4	88	38	99
5	83	39	94
6	84	40	93
7	77	41	30
8	78	42	29
9	73	43	24
10	74	44	23
11	69	45	20
12	70	46	19
13	63	47	16
14	64	48	15
15	61	49	10
16	62	50	9
17	65	51	6
18	66	52	5
19	71	53	33
20	72	54	34
21	75	55	37
22	76	56	38
23	79	57	43
24	80	58	44
25	85	59	47
26	86	60	48
27	89	61	51
28	90	62	52
29	118	63	57
30	117	64	58
31	114	65	59
32	113	66	60
33	108	67	55
34	107	68	56

Remarks 1. The NP-100GF is a product of Naito Densei Machida Mfg. Co., Ltd.

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

Table A-1. NP-100GF Pin Assignments (2/2)

Emulation Probe	CN1 Pin No.	Emulation Probe	CN1 Pin No.
69	49	85	18
70	50	86	17
71	45	87	22
72	46	88	21
73	41	89	28
74	42	90	27
75	35	91	92
76	36	92	91
77	31	93	98
78	32	94	97
79	4	95	102
80	3	96	101
81	8	97	106
82	7	98	105
83	14	99	112
84	13	100	111

Remarks 1. The NP-100GF is a product of Naito Densei Machida Mfg. Co., Ltd.

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

★

APPENDIX B REVISION HISTORY

The following shows the major revisions up to now.

Edition	Major Revisions from Previous Edition	Revised Chapters
2nd	Addition of **3.5 Jumper Settings on IE-78K0-NS**	**CHAPTER 3**
	Addition of **REVISION HISTORY**	**APPENDIX B**

[MEMO]

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