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USER'S MANUAL

RENESAS

Phase-out/Discontinued

IE-178018-R-EM

EMULATION BOARD

Document No. U10668EJ2V0UM00 (2nd edition)
Date Published April 1996
Printed in Japan

This product is designed to be used in a commercial or industrial district. If it is used in a residential district or in an area in the vicinity of a residential district, radio and TV receivers in the district may be affected.
Use this product correctly by carefully reading its User's Manual.

Major Revised Point in this Version

Page	Contents
Throughout	Target devices have been added. μPD178004, 178006 (under development)

The mark ★ shows major revised points.

INTRODUCTION

Outline IE-178018-R-EM is connected with IE-78000-R to debug the μPD178018 Subseries 8-bit single-chip microcontrollers.

Readers This manual is intended for engineers who employ the μPD178018 Subseries, and debug systems with IE-78000-R and IE-178018-R-EM.
IE-78000-R can emulate the μPD178018 Subseries. Therefore, the engineers who read this manual are required to be familiar with the functions and usages of the μPD178018 Subseries, and have sufficient knowledge on debugger.

Organization To use IE-78000-R, read the manual supplied with IE-178018-R-EM (this manual), the manual supplied with IE-78000-R, and the manuals supplied with the screen debugger (Introduction and Reference manuals).

IE-178018-R-EM User's Manual	IE-78000-R User's Manual
(Supplied with IE-178018-R-EM)	(Supplied with IE-78000-R)
Functional outline	Basic specifications
Connecting IE-178018-R-EM	System configuration
Connecting emulation probe	External interface function

SD78K/0 Screen Debugger User's Manual Introduction	SD78K/0 Screen Debugger User's Manual Reference
(Supplied with screen debugger)	
Basic use of IE-78000-R	Functional outline
	Command description
	Menu description

Purpose

This manual describes basic specifications and correct connections for IE-178018-R-EM.

How to read this manual

- To understand the basic specifications, read **CHAPTER 1 GENERAL**.
- To connect IE-178018-R-EM, read **CHAPTER 2 INSTALLATION** and **IE-78000-R User's Manual**.

Terms

The following terms are used throughout this manual:

Term	Meaning
Emulation Device	Device emulating the target device in the emulator. Includes the emulation CPU.
Emulation CPU	CPU executing the user-developed program in the emulator.
Target Device	Device to be emulated (actual chip).
Target Program	Program to be debugged (user-developed program).
Target System	System to be debugged (user-developed system). Includes the target program and user-developed hardware. Narrowly, means the hardware only.

Legend

Note : Points to be noted
Caution : Important information
Remark : Supplement

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[MEMO]

CHAPTER 1 GENERAL

IE-178018-R-EM is an emulation board for the IE-78000-R development system for NEC's μPD178018 Subseries 8-bit single-chip microcontrollers. By combining this board with an optional IE-78000-R with an emulation probe, the μPD178018 Subseries can be efficiently emulated.

1.1 Features

The IE-178018-R-EM features, when it is connected to IE-78000-R, are as follows:

(1) Can emulate the peripheral functions (such as I/O ports) for the target device
(2) Can trace the I/O port status during emulation

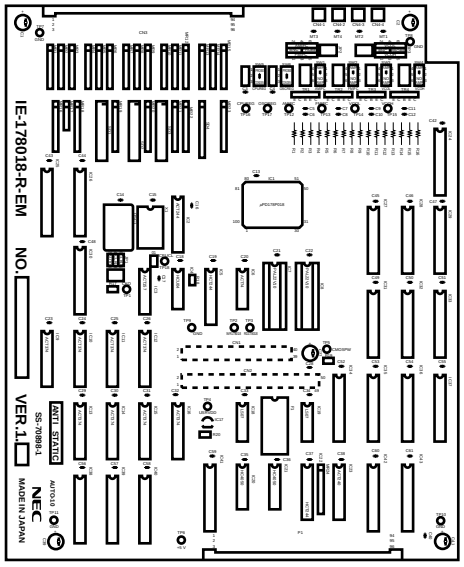
1.2 IE-178018-R-EM Product Configuration

The IE-178018-R-EM contains the following. On unpacking, confirm that these items are provided.

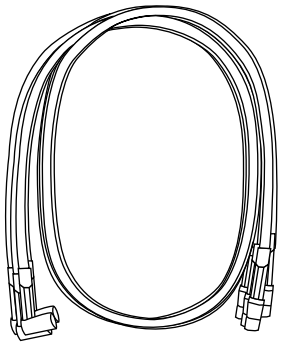
(1)	IE-178018-R-EM	1
(2)	Coaxial cable (for PLL pin output)	4
(3)	Screw	5
(4)	User's manual (this manual)	1
(5)	BNC connector	4

Figure 1-1. IE-178018-R-EM Product Configuration List

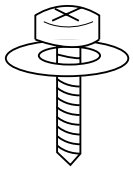
(1) IE-178018-R-EM



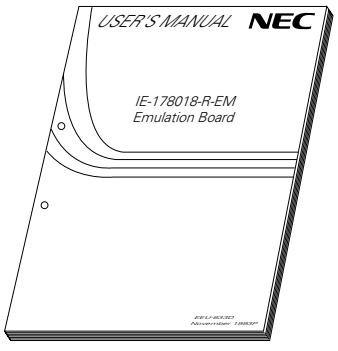
(2) Coaxial cable (for PLL pin output, 4 cables)



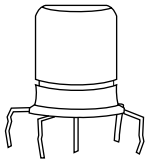
(3) Screw (5)



(4) User's Manual (this manual)



(5) BNC connector (4)



Phase-out/Discontinued

1.3 IE-178018-R-EM Appearance and Part Names

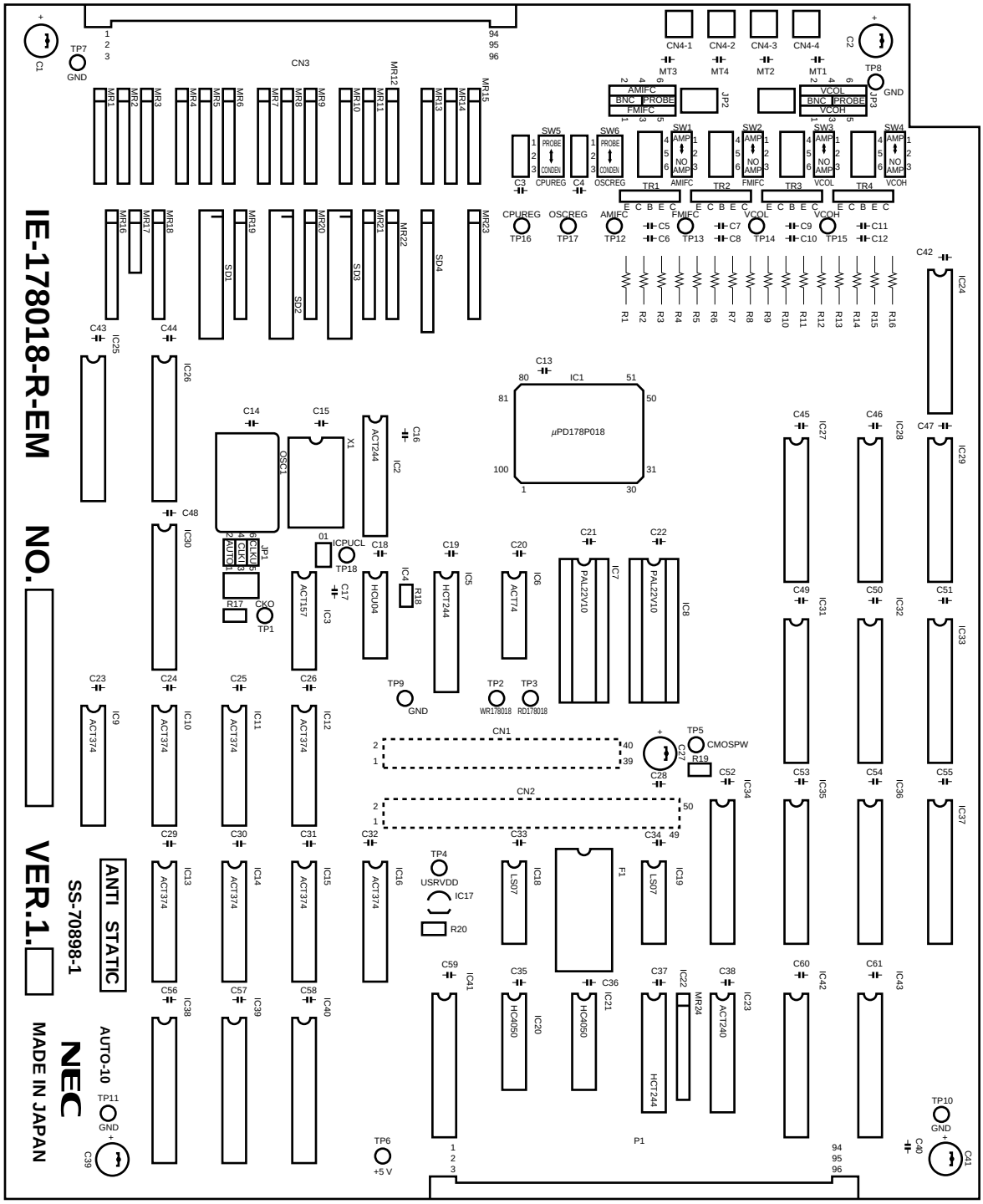


Table 1-1. IE-178018-R-EM Part Names

Name	Function
CN1	Break board connector
CN2	
CN3	Emulation probe connector
CN4	Coaxial cable connector
P1	Main bus connector

1.4 Target Device

Target devices that can be emulated by IE-78000-R with IE-178018-R-EM are as follows:

★ **Table 1-2. Target Devices**

Series Name	Target Devices
μPD178018 Subseries	μPD178004Note μPD178006Note μPD178016Note μPD178018Note μPD178P018Note

Note Under development

1.5 Emulation Probe

The emulation probe is optional. Select the one suited to your target device package.

★ **Table 1-3. Emulation Probe and Target Device**

Emulation Probe	Package	Target Devices
EP-78230GC-R	80-pin plastic QFP (14 × 14 mm)	μPD178004GC-×××-3B9Note μPD178006GC-×××-3B9Note μPD178016GC-×××-3B9Note μPD178018GC-×××-3B9Note μPD178P018GC-3B9Note
	80-pin ceramic WQFN (LCC with window) (14 × 14 mm)	μPD178P018KK-TNote

Note Under development

1.6 Notes on Use of IE-178018-R-EM

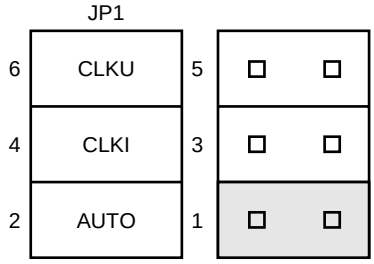
(1) Be sure to turn off the power to IE-78000-R and the target system before connecting or disconnecting IE-78000-R and the target system, and changing the setting of switches.
(2) When emulating the target device by combining IE-178018-R-EM and IE-78000-R, the target device operations slightly differ from those for the actual device. (Refer to **CHAPTER 3 DIFFERENCES FROM TARGET DEVICES**.)
(3) To input data through the external sense clip, maintain voltage at +15 V.
(4) To output data through the external sense clip, connect a pull-up resistor to the external sense clip on the target system, because the external sense clip has an open-collector output configuration.
(5) Be sure to connect the emulation probe ground clip to the target system signal ground line.
(6) Part 13 cannot be traced.
(7) 4.5 V to 5.5 V must be supplied to the target system as V_{DD}.
(8) The clock on the board is 4.5 MHz. Clock supply from the target system is not possible. As shown in Figure 1-2, the clock setting on the [Initial Value Settings] screen after the SD78K/0 is started should be fixed at "IE". Furthermore, as shown in Figure 1-3, the jumper switch (JP1) should be fixed at 1-2 shorted (AUTO).

Figure 1-2. SD78K/0 [Initial Value Settings] Screen

```
[Initial Value Settings]

Output specification                    [printer•file•printer&file]
  Output file name                      ____________________________________________
High-speed download                     [yes•no]
Register name setting                   [function name•absolute name]
Clock setting                           [IE•USER]
Internal ROM size (decimal)             64 (Kbytes)
Internal RAM size (decimal)             1024 (bytes)
Internal extended RAM size (decimal)    2048 (bytes)

Memory mapping (hexadecimal)            S   FE00, FEDF   __  ________________
                                        __  ____________   __  ________________
  __  ____________                      __  ____________   __  ________________
   ↑        ↑                           __  ____________   __  ________________
Type      Range                         __  ____________   __  ________________
(W/R/U/S)

Peripheral chip break mode setting      [non break•break]
```

Cautions 1. If the clock setting is changed from IE to USER, when starting program execution, malfunctioning or failure to operate may occur.
Therefore, fix the clock setting at IE.
2. The size of the internal ROM of the target device is maximum 60K bytes. However, since the screen debugger is specified in 8K-byte units, if the ROM size exceeds 56K bytes, set it to 64K bytes.

Figure 1-3. Jumper Switch (JP1) Setting



Caution Fix the JP1 switch at 1-2 shorted (AUTO).

Remark The shading indicates the selected switch position.

(9) Be sure to turn on power to the IE-78000-R first, and then to the target system. Turn off power to the target system first, and then to the IE-78000-R.

(10) When you emulate the target device by using IE-178018-R-EM, use the screen debugger Ver. 2.0 or above.

CHAPTER 2 INSTALLATION

This chapter describes the procedure for installing the μPD178018 Subseries development system with the IE-178018-R-EM connected to the following:

- Break board installed in IE-78000-R (IE-78000-R-BK)
- IE-78000-R
- Emulation probe (EP-78230GC-R) (optional)

Before connecting or disconnecting the board and probe, be sure to turn off the power to IE-78000-R and the target system.

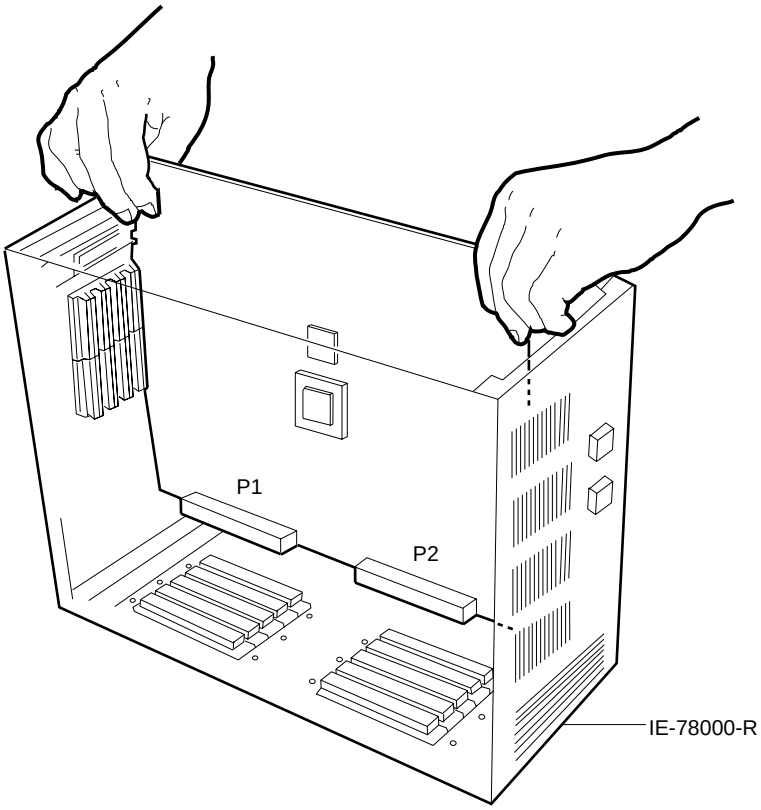
For connecting the emulation probe to the target system, refer to **CHAPTER 5 CONNECTING TARGET SYSTEM** in the **IE-78000-R User's Manual**.

Connect IE-178018-R-EM, break board, IE-78000-R, and emulation probe as follows:

(1) Remove the six screws from the top cover of IE-78000-R and remove the cover.

(2) Disconnect cables J1 and J2 connecting the control/trace board (IE-78000-R-CS-A) and break board.

(3) Pull the card pullers at both edges of the break board toward you, to pull out the break board from the slot.



(4) Connect IE-178018-R-EM to the break board.
Connect connectors CN1 and CN2 on IE-178018-R-EM to connectors CN1 and CN2 on the break board.
Secure the connectors with the screws supplied.

Caution Be sure to connect CN1 and CN2 securely.

(5) Connect IE-178018-R-EM to the slot for the main board for the IE-78000-R's housing (connect the break board to the second slot from the right, and IE-178018-R-EM to the third slot from the right).

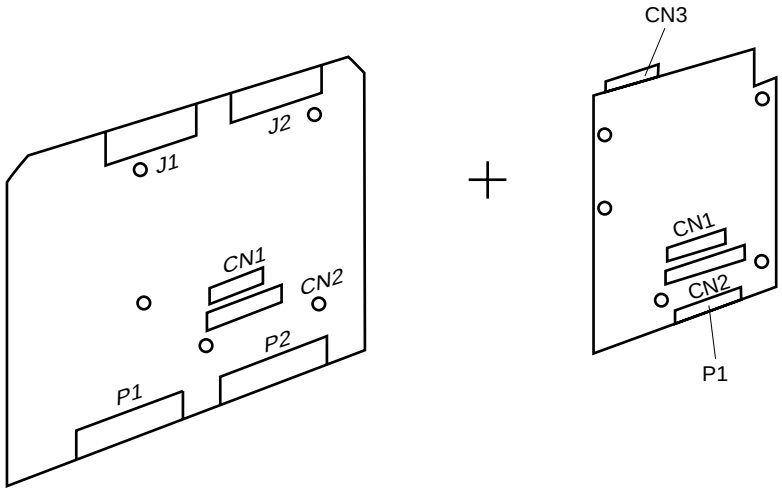
(6) Connect cables J1 and J2 as before.

(7) Confirm the positions for the boards. Attach the top cover.

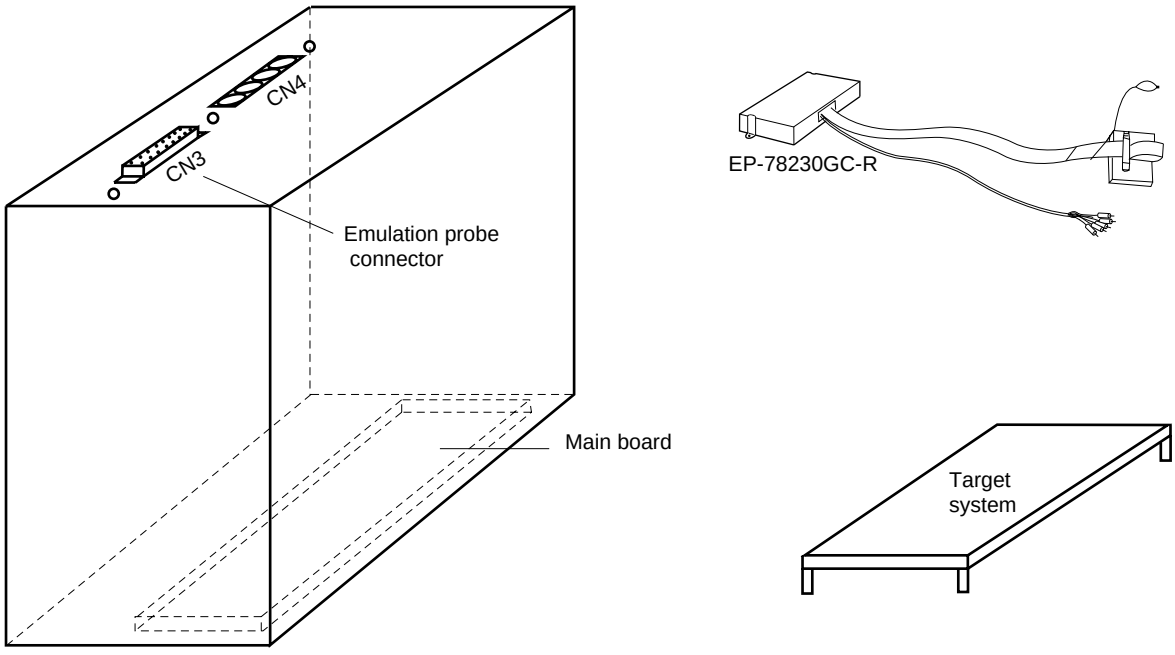
(8) Connect connector CN3 on top of IE-178018-R, to the connector on the emulation probe (EP-78230GC-R). Secure the connectors with screws.

Caution The connector board provided with the EP-78230GC-R should not be used.

IE-78000-R-BK **IE-178018-R-EM**



Emulation probe



IE-78000-R housing

CHAPTER 3 DIFFERENCES FROM TARGET DEVICES

When emulating the target device in combination of IE-178018-R-EM and IE-78000-R, the operations for the target device slightly differ from actual operation of the target device. This chapter describes these differences.

3.1 Target Interface Circuit

The target interface circuit allows the device to operate in the same manner as the target device on the IE-78000-R. It consists of an emulation device and various gates (ICs, such as CMOS and TTL).

To debug the target system connected to IE-78000-R, emulation is carried out by the target interface circuit in IE-78000-R, as if the actual target device were operating on the target system.

Individual target devices consist of CMOS LSIs. The target interface circuit emulation device also consists of CMOS LSIs. Therefore, the DC and AC characteristics for the target interface circuit are almost the same as those for the target device (V_{DD} = 4.5 V to 5.5 V operation).

However, the DC and AC characteristics for the target interface circuit are different from those for the target device, when the emulation device signals are input/output through gates.

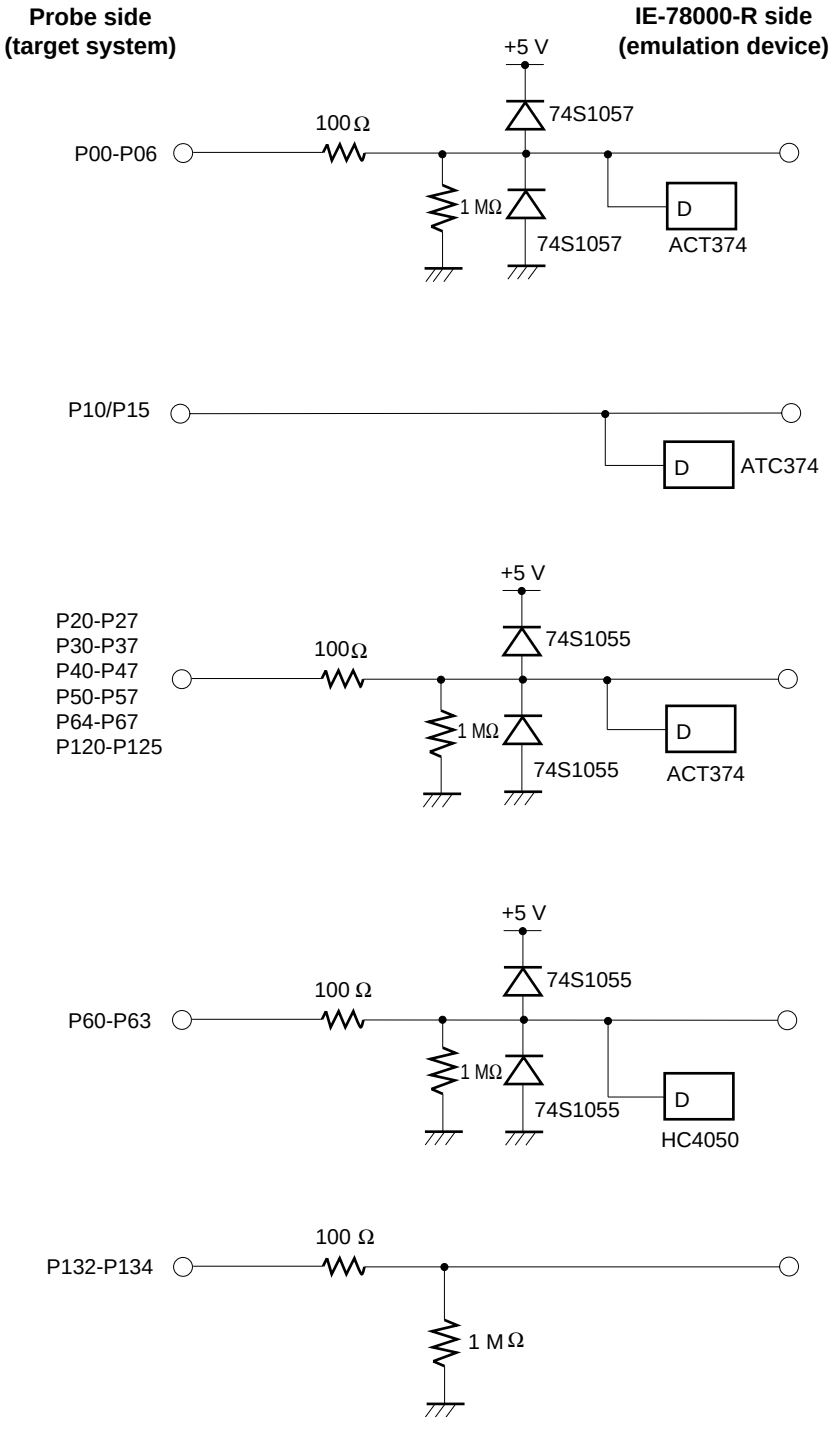
Note that, a gate delay time (whose duration varies, depending on the gate) occurs each time the signal goes through a gate. This is responsible for the differences in the AC characteristics.

Therefore, design the target system, giving thorough consideration to these points.

Caution When connecting IE-78000-R to the target system for debugging, 4.5 V to 5.5 V must be supplied to IE-78000R and IE-178018-R-EM as the supply voltage (V_{DD}) of the target system.

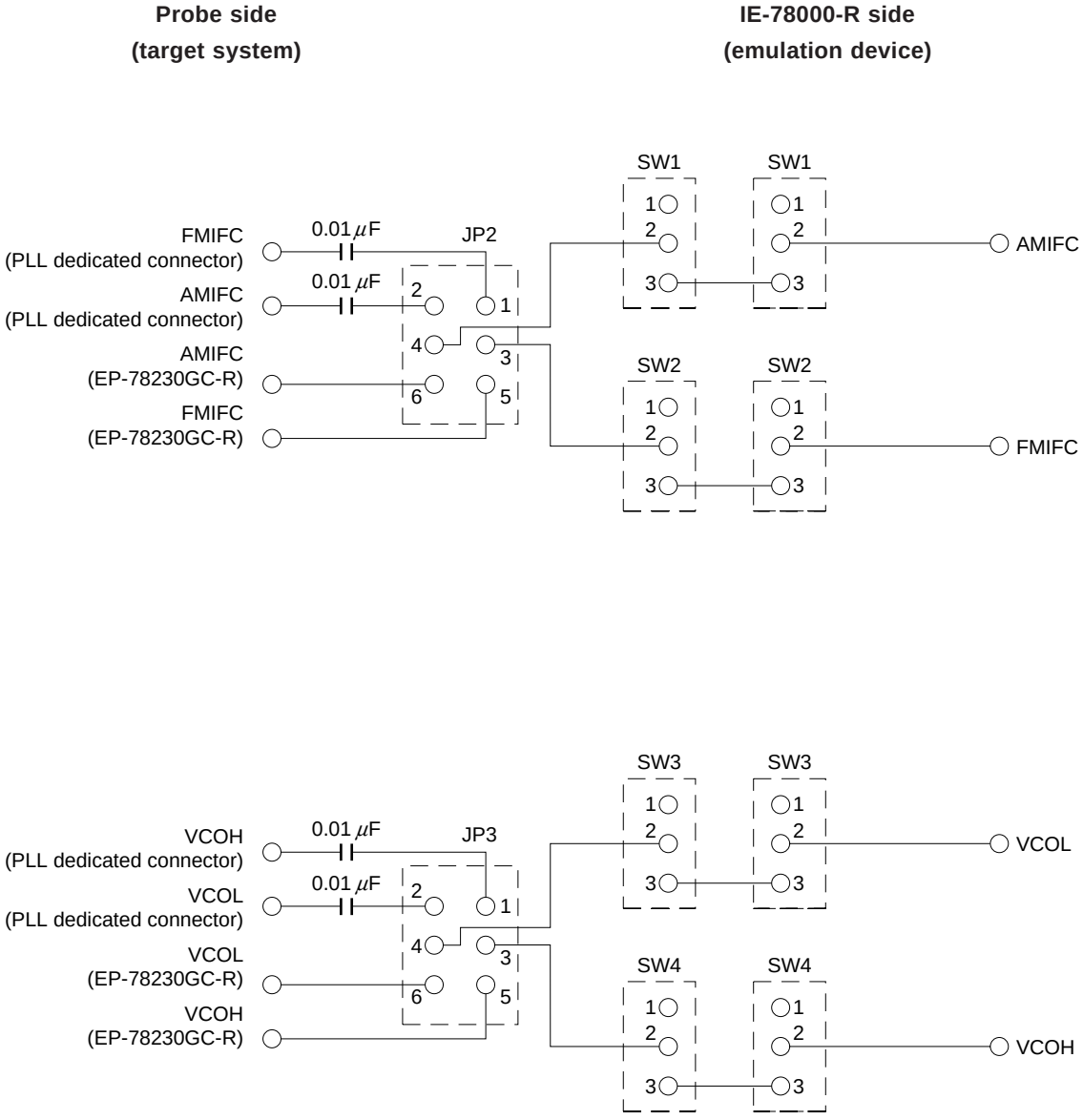
(1) Port-related signals

Figure 3-1. Equivalent Emulation Circuit 1



(2) PLL-related signals

Figure 3-2. Equivalent Emulation Circuit 2



(3) Other signals

Figure 3-3. Equivalent Emulation Circuit 3

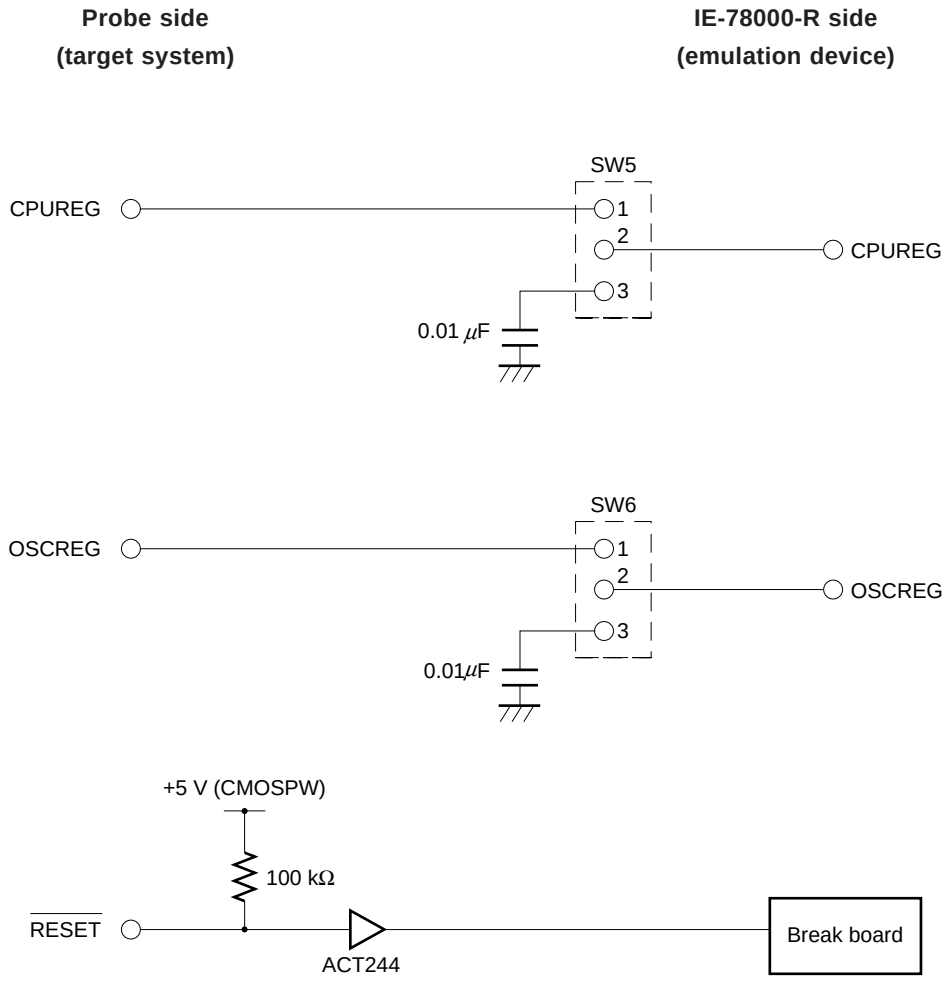


Table 3-1. Pin Connections in Emulation Circuit

Probe Pin Name	Pin Connections in Emulation Circuit
V_{DD}PORT V_{DD}PLL	The supply voltage inside the emulation board is supplied to these pins. The supply voltage of the target system is not used. Leave them open.
EO0 EO1	These are connected directly to the target system via an emulation probe.
V_{PP}	This pin is connected to GND inside the emulation board.

CHAPTER 4 SWITCH SETTINGS

This chapter explains the settings of the jumper switches and slide switches.

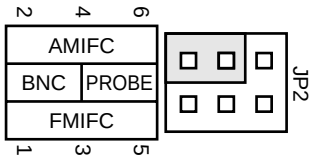
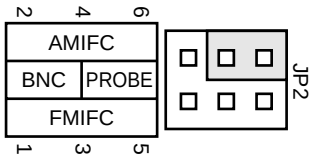
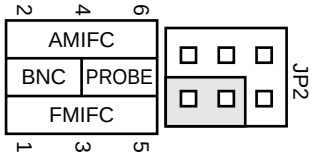
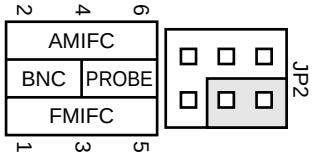
4.1 Jumper Switches (JP2, JP3)

JP2 and JP3 set the emulation probes to be used for pins AMIFC, FMIFC, VCOL and VCOH.

- EP-78230GC-R
- PLL dedicated probe (coaxial cable provided)

Table 4-1 shows the settings of JP2 and JP3.

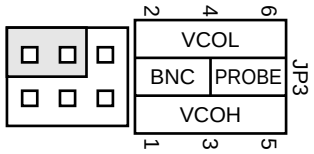
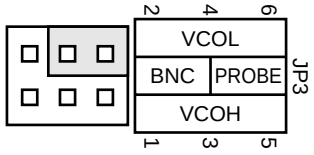
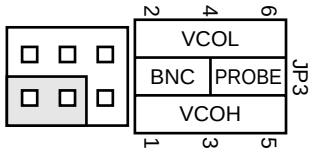
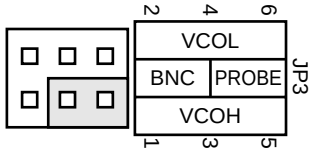
Table 4-1. Settings of JP2 and JP3 (1/2)

Switch Number	Pin Name	Jumper Switch Settings		Probe Used
JP2	AMIFC		2-4 shorted[Note]	PLL dedicated probe (coaxial cable)
			4-6 shorted	EP-78230GC-R
	FMIFC		1-3 shorted[Note]	PLL dedicated probe (coaxial cable)
			3-5 shorted	EP-78230GC-R

Note Factory setting

Remark The shading indicates the switch position to select.

Table 4-1. Settings of JP2 and JP3 (2/2)

Switch Number	Pin Name	Jumper Switch Settings		Probe Used
JP3	VCOL		2-4 shorted[Note]	PLL dedicated probe (coaxial cable)
			4-6 shorted	EP-78230GC-R
	VCOH		1-3 shorted[Note]	PLL dedicated probe (coaxial cable)
			3-5 shorted	EP-78230GC-R

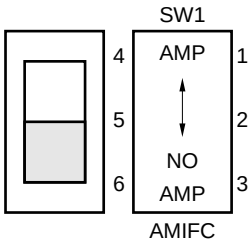
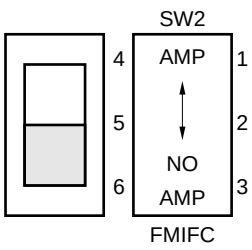
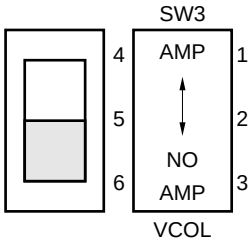
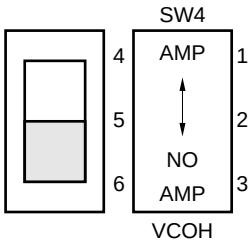
Note Factory setting

Remark The shading indicates the switch position to select.

4.2 Slide Switches (SW1, SW2, SW3, SW4)

Table 4-2 shows the factory settings of SW1, SW2, SW3 and SW4. Please use the board with the switches SW1, SW2, SW3, and SW4 with their factory settings.

Table 4-2. Factory Settings of SW1, SW2, SW3 and SW4

Switch Number	Pin Name	Slide Switch Settings	
SW1	AMIFC		2-3 shorted
SW2	FMIFC		2-3 shorted
SW3	VCOL		2-3 shorted
SW4	VCOH		2-3 shorted

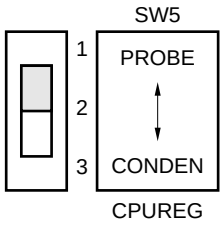
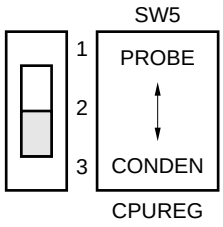
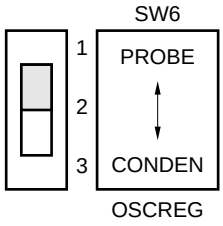
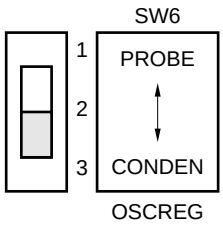
Remark The shading indicates the switch position at time of shipping.

4.3 Slide Switches (SW5, SW6)

SW5 and SW6 set whether the capacitor on the target system or the capacitor mounted on the emulation board is used.

Table 4-3 shows the settings of SW5 and SW6.

Table 4-3. Settings of SW5 and SW6

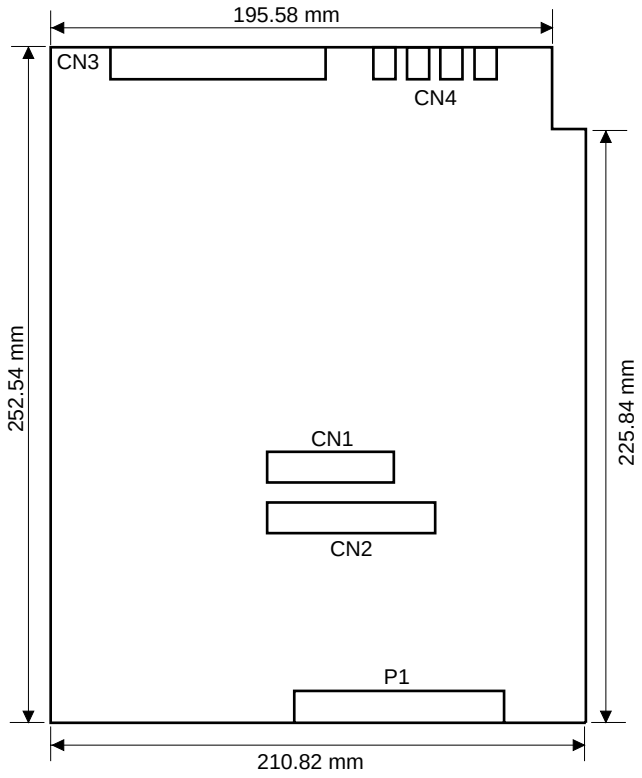
Switch Number	Pin Name	Slide Switch Settings		Capacitor
SW5	CPUREG		1-2 shorted[Note]	Use the capacitor on the target system.
			2-3 shorted	Use the capacitor mounted on the emulation board.
SW6	OSCREG		1-2 shorted[Note]	Use the capacitor on the target system.
			2-3 shorted	Use the capacitor mounted on the emulation board.

Note Factory setting

Remark The shading indicates the switch position to select.

APPENDIX A IE-178018-R-EM PRODUCT SPECIFICATIONS

Product name	: IE-178018-R-EM			
Peripheral emulation device	: μPD178P018			
Operating temperature	: 0 to 50 °C			
Humidity	: 10 to 80 % RH (without condensation)			
Storage temperature	: –15 to +60 °C			
Power requirements	: Power source capacity	DC	0.6 A (MAX.)	+5 V
			38.2 mA (MAX.)	+5 V (CMOSPW)
Board dimensions	:			



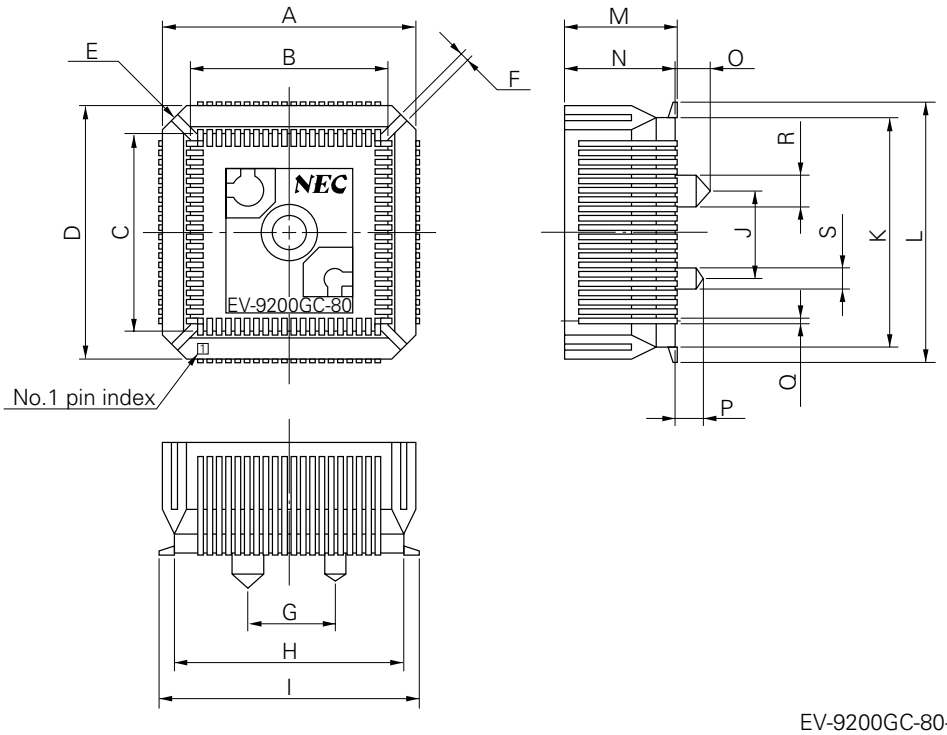
Connector : Connector on IE-178018-R-EM board

CN1	Break board connector
CN2	
CN3	Emulation probe connector
CN4	Coaxial cable connector
P1	Main bus connector

[MEMO]

APPENDIX B DIMENSIONS AND RECOMMENDED BOARD MOUNTING PATTERN OF EV-9200GC-80

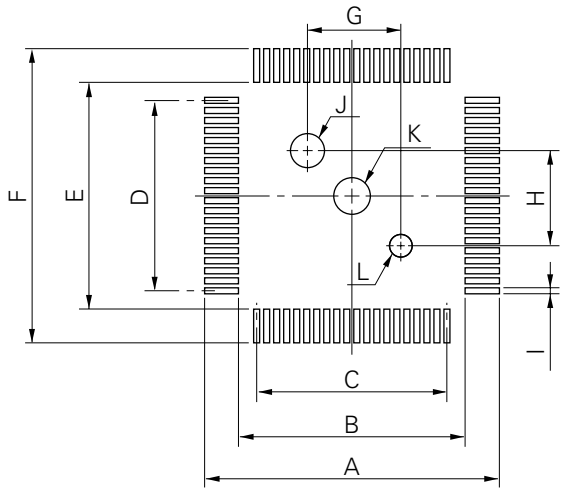
Figure B-1. Dimensions of EV-9200GC-80 (reference) (unit in mm)



EV-9200GC-80-G0

ITEM	MILLIMETERS	INCHES
A	18.0	0.709
B	14.4	0.567
C	14.4	0.567
D	18.0	0.709
E	4-C 2.0	4-C 0.079
F	0.8	0.031
G	6.0	0.236
H	16.0	0.63
I	18.7	0.736
J	6.0	0.236
K	16.0	0.63
L	18.7	0.736
M	8.2	0.323
O	8.0	0.315
N	2.5	0.098
P	2.0	0.079
Q	0.35	0.014
R	ϕ2.3	ϕ0.091
S	ϕ1.5	ϕ0.059

Figure B-2. Recommended Board Mounting Pattern of EV-9200GC-80 (reference)



EV-9200GC-80-P0

ITEM	MILLIMETERS	INCHES
A	19.7	0.776
B	15.0	0.591
C	$0.65\pm0.02\times19=12.35\pm0.05$	$0.026^{+0.001}_{-0.002}\times0.748=0.486^{+0.003}_{-0.002}$
D	$0.65\pm0.02\times19=12.35\pm0.05$	$0.026^{+0.001}_{-0.002}\times0.748=0.486^{+0.003}_{-0.002}$
E	15.0	0.591
F	19.7	0.776
G	6.0 ± 0.05	$0.236^{+0.003}_{-0.002}$
H	6.0 ± 0.05	$0.236^{+0.003}_{-0.002}$
I	0.35 ± 0.02	$0.014^{+0.001}_{-0.001}$
J	$\phi2.36\pm0.03$	$\phi0.093^{+0.001}_{-0.002}$
K	$\phi2.3$	$\phi0.091$
L	$\phi1.57\pm0.03$	$\phi0.062^{+0.001}_{-0.002}$

Caution Dimensions of mount pad for EV-9200 and that for target device (QFP) may be different in some parts. For the recommended mount pad dimensions for QFP, refer to SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL (IEI-1207).

APPENDIX C PIN CORRESPONDENCE OF EMULATION PROBE

EP-78230GC-R

CN3 Pin No.	Emulation Probe	CN3 Pin No.	Emulation Probe	CN3 Pin No.	Emulation Probe	CN3 Pin No.	Emulation Probe
1	GND	**25**	15	**49**	34	**73**	61
2	GND	**26**	16	**50**	33	**74**	NC
3	EXT0	**27**	17	**51**	32	**75**	
4	EXT1	**28**	18	**52**	31	**76**	70
5	EXT2	**29**	19	**53**	41	**77**	69
6	EXT3	**30**	20	**54**	42	**78**	68
7	EXT4	**31**	21	**55**	43	**79**	67
8	EXT5	**32**	NC	**56**	44	**80**	66
9	EXT6	**33**		**57**	45	**81**	65
10	EXT7	**34**	30	**58**	46	**82**	64
11	1	**35**	29	**59**	47	**83**	63
12	2	**36**	28	**60**	48	**84**	62
13	3	**37**	27	**61**	49	**85**	80
14	4	**38**	26	**62**	50	**86**	79
15	5	**39**	25	**63**	51	**87**	78
16	6	**40**	24	**64**	52	**88**	77
17	7	**41**	33	**65**	53	**89**	76
18	8	**42**	32	**66**	54	**90**	75
19	9	**43**	40	**67**	55	**91**	74
20	10	**44**	39	**68**	56	**92**	73
21	11	**45**	38	**69**	57	**93**	72
22	12	**46**	37	**70**	58	**94**	71
23	13	**47**	36	**71**	59	**95**	GND
24	14	**48**	35	**72**	60	**96**	

Remark The meanings of the symbols and figures in the emulation probe column are as follows:

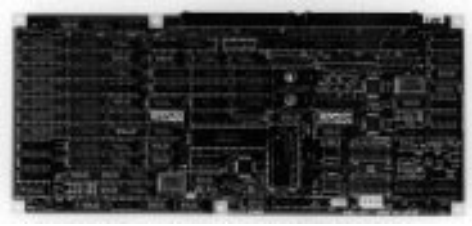
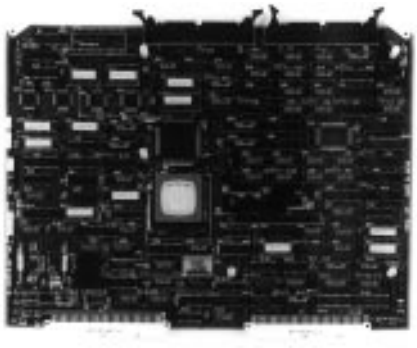
GND : Ground clip
EXT0-EXT7 : External sense clip 1-8
1-80 : Emulation probe pin numbers
NC : No connection

[MEMO]

APPENDIX D SYSTEM CONFIGURATION

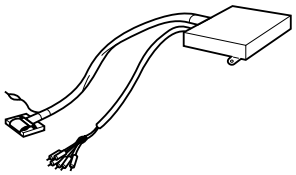
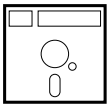
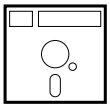
The IE-78000-R system configuration is shown on the following pages:

Table D-1. IE-78000-R System Configuration (1/2)

Target Device	Housing and Control/Trace Board	Break Board
μPD178018 Subseries	 78K Series common housing (w/power supply)  IE-78000-R-CS-A (78K Series common control/trace board)	 IE-78000-R-BK (78K/0 Series common break board)

Caution μPD178018 Subseries is under development.

Table D-1. IE-78000-R System Configuration (2/2)

Emulation Board (Optional)	Emulation Probe (Optional)	Screen Debugger (Optional)	Device File (Optional)
 IE-178018-R-EM	 EP-78230GC-R (Accessory: EV-9200GC-80 (1))	 SD78K0 (with ROM)	 DF178018

Caution DF178018 is under development.

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