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April 1st, 2010
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RENESAS

USER'S MANUAL

Phase-out/Discontinued

IE-78098-R-EM

EMULATION BOARD

Document No. EEU-1473
(O. D. No. EEU-933)
Date Published April 1994 P
Printed in Japan

USER'S MANUAL

NEC

Phase-out/Discontinued

IE-78098-R-EM

EMULATION BOARD

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.

IEBus™ is a trademark of NEC Corporation.

INTRODUCTION

Outline: IE-78098-R-EM is connected to IE-78000-R to debug the uPD78098 Series 8-bit single-chip microcomputers.

Readers: This manual is intended for engineers who debug a uPD78098 Series system with IE-78000-R and IE-78098-R-EM.
IE-78000-R can emulate the uPD78098 Series. Therefore, the engineers who read this manual are required to have sufficient knowledge regarding the uPD78098 Series functions and applications, and debugger.

Organi-: zation To use IE-78000-R, read the manual supplied with IE-78098-R-EM (this manual), the manual supplied with IE-78000-R, and the manuals supplied with the screen debugger (Introduction and Reference manuals).

IE-78098-R-EM
User's Manual

(supplied with IE-78098-R-EM)
Functional outline
Connecting IE-78098-R-EM
Connecting emulation probe

IE-78000-R
User's Manual
(EEU-810)

(supplied with IE-78000-R)
Basic specifications
System configuration
External interface function

SD78K0
Screen debugger
User's Manual
Beginner's Guide
(EEU-852)

SD78K0
Screen debugger
User's Manual
Reference
(EEU-816)

(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-78098-R-EM.

How to read this manual:

- To understand the basic specifications, read CHAPTER 1 GENERAL.
- To connect IE-78098-R-EM, read CHAPTER 2 INSTALLATION and the 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: *: Footnote
Note: Points to be noted
Remarks: Supplement

Table of Contents

CHAPTER 1 GENERAL

IE-78098-R-EM is an emulation board for the IE-78000-R development system for NEC's uPD78098 Series 8-bit single-chip microcomputers. By combining this board with an optional IE-78000-R with an emulation probe, the uPD78098 Series can be efficiently emulated.

1.1 Features

The IE-78098-R-EM features, when it is connected to IE-78000-R, are as follows:

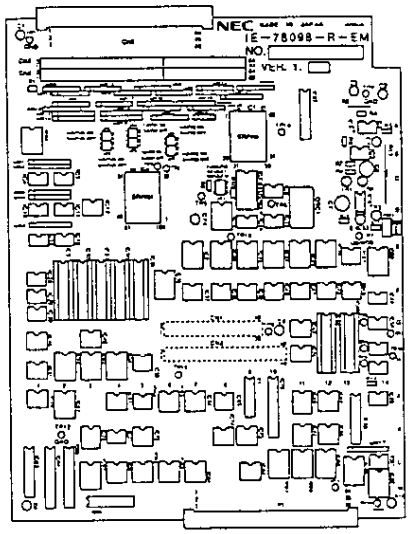
(1) Emulates the peripheral functions (such as I/O ports) for the target device
(2) Traces the I/O port status during emulation
(3) Connection of the mask option resistor, switching of the P07/XT1 pin, and selection of the CPU to be emulated can be controlled by the software.
(4) Low-voltage operation (3.0 to 6.0 V)

1.2 Unpacking

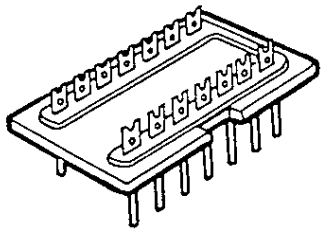
The IE-78098-R-EM shipping carton contains the following accessories, as well as IE-78098-R-EM. On unpacking, confirm that these items are present.

		Qty
(1)	IE-78098-R-EM	1
(2)	Component block (w/cover)	2
(3)	Screw	5
(4)	User's manual (this manual)	1

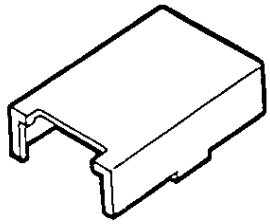
(1) IE-78098-R-EM



(2) Component block*



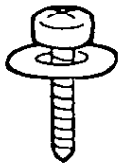
Component block cover



*: The component block is supplied with the cover shown on the right.

Fig. 1-1 IE-78098-R-EM Accessories (1/2)

(3) Screw



(4) User's manual
(this manual)

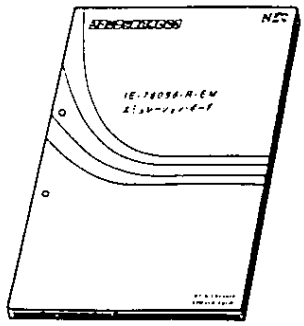


Fig. 1-1 IE-78098-R-EM Accessories (2/2)

1.3 IE-78098-R-EM Appearance and Names for Respective Parts

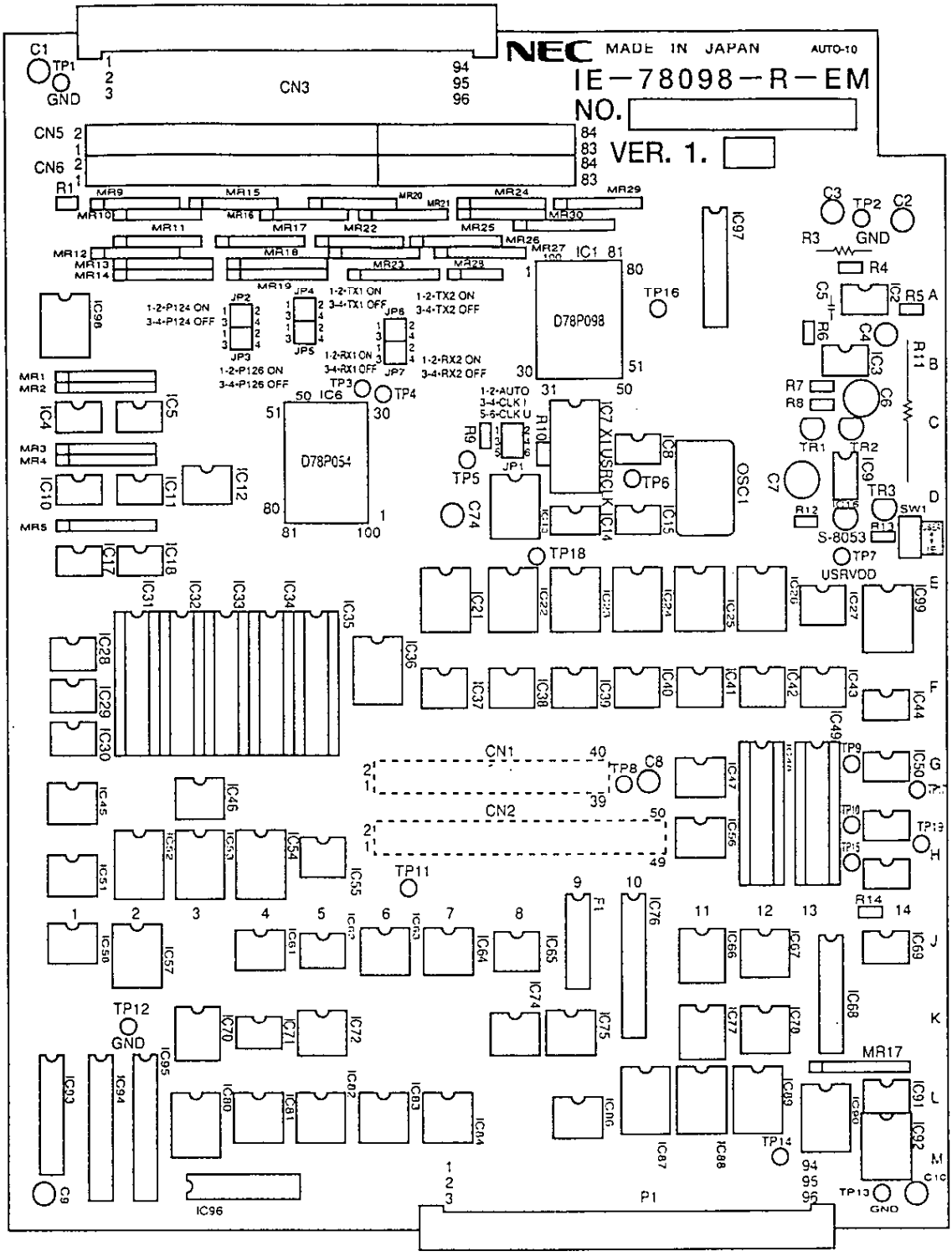


Table 1-1 Respective Part Names

Name	Function
CN1	Break board connector
CN2	
CN3	Emmulation prove connector
CN5	Connector board connector (for 80 pin)
CN6	
P1	Main bus connector

1.4 Target Device

Devices that can be emulated by IE-78000-R with IE-78098-R-EM are as follows:

Table 1-2 Target Device

Series	Target Device
uPD78098 series (under development)	uPD78094 uPD78095 uPD78096 uPD78P098

1.5 Emulation Probe

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

Table 1-3 Emulation Probe and Target Device

Emulation Prove	Package	Target Device
EP-78230GC-R	80-pin plastic QFP (□ 14 mm)	uPD78094GC-xxx-3B9 uPD78095GC-xxx-3B9 uPD78096GC-xxx-3B9 uPD78P098GC-3B9
	80-pin ceramic WQFN (LCC with window) (□ 14 mm)	uPD78P098KK-T

1.6 Notes on Correct Use of IE-78098-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 using IE-78098-R-EM and IE-78000-R, the target device operations slightly differ from those for the actual device. (Refer to CHAPTER 3 DIFFERENCES BETWEEN 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) Ports described in page 7 and 13 cannot be traced as port pins.

(7) 3.0V to 6.0V must be supplied to the target system as V_{DD}.

(8) Be sure to turn off the power to the IE-78000-R before setting JP1 that switches between the on-board 6-MHz clock and the component block clock.

(9) 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 pull-up resistors are connected to port 12 via software, pull-up resistors are connected to P124 and P125 even when the IEBus controller is used.

CHAPTER 2 INSTALLATION

This chapter describes the procedure for installing the uPD78098 Series development system with the IE-78098-R-EM connected to the following:

- Break board installed in IE-78000-R (IE-78000-R-BK)
- IE-78000-R
- Connector board and emulation probe (optional)

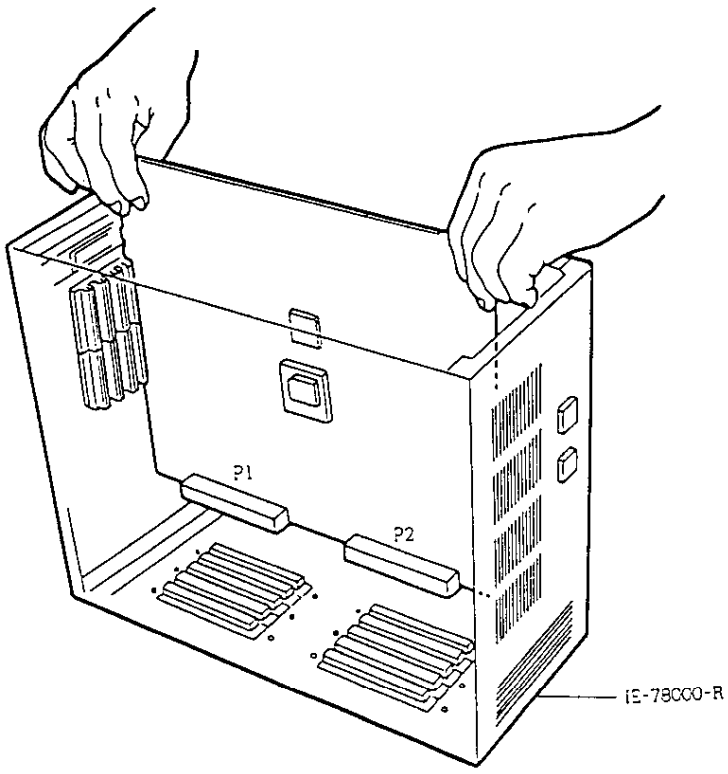
Before connecting these boards and probe, be sure to turn off the power to IE-78000-R and the target system.
For connecting the emulation probe to the target system, refer to CHAPTER 5 CONNECTING TARGET SYSTEM for the IE-78000-R User's Manual.

Connect IE-78098-R-EM, break board, IE-78000-R, connector board, 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-78098-R-EM to the break board.
Connect connectors CN1 and CN2 on IE-78098-R-EM to mating connectors CN1 and CN2 on the break board. Secure the connectors with the screws supplied as accessories.

Note: Be sure to connect CN1 and CN2 securely.

(5) To use the user clock, mount the main system clock to the emulation board and the sub system clock to the break board by using the component block (refer to CHAPTER 3 SETTING USER CLOCK for IE-78000-R User's Manual).

(6) Set the oeprating voltage of the IE-78000-R by setting SW1 on the IE-78098-R-EM as follows:
- o To use the internal power supply of the IE-78000-R: IE
- o To use the power supply of the target system: USER

(7) Mount the connector board supplied with the optional emulation probe to the IE-78098-R-EM.

Connectors CN5 and CN6 of IE-78098-R-EM	⟷ Connect	Connectors CN3 and CN4 of connector board supplied with EP-78230GC-R

(8) Connect IE-78098-R-EM to the slot for the master board for the IE-78000-R's housing (connect the break board to the second slot from the right, and IE-78098-R-EM to the third slot from the right).

(9) Connect Cables J1 and J2.

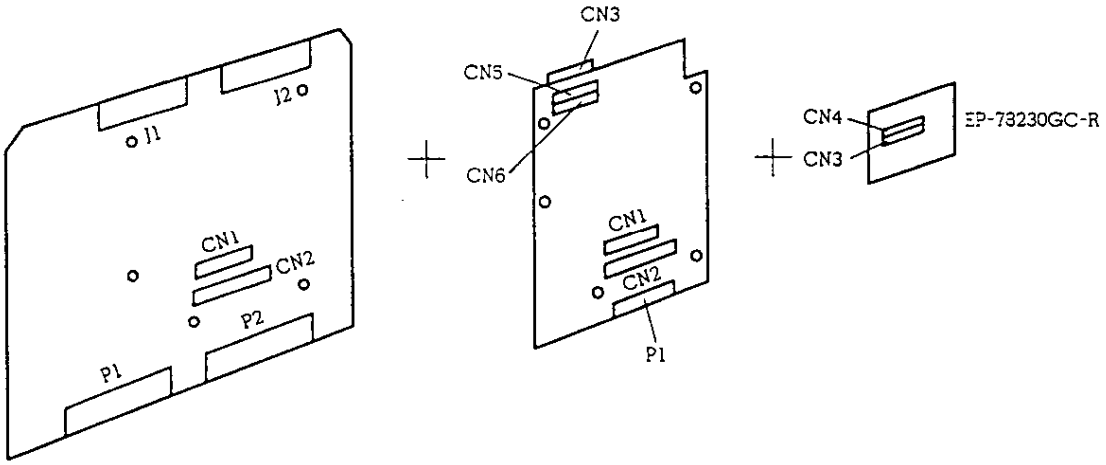
(10) Confirm the positions for the boards. Attach the top cover.

(11) Connect connector CN3 on top of IE-78000-R, to the mating connector on the emulation board. Secure the connector with screws.

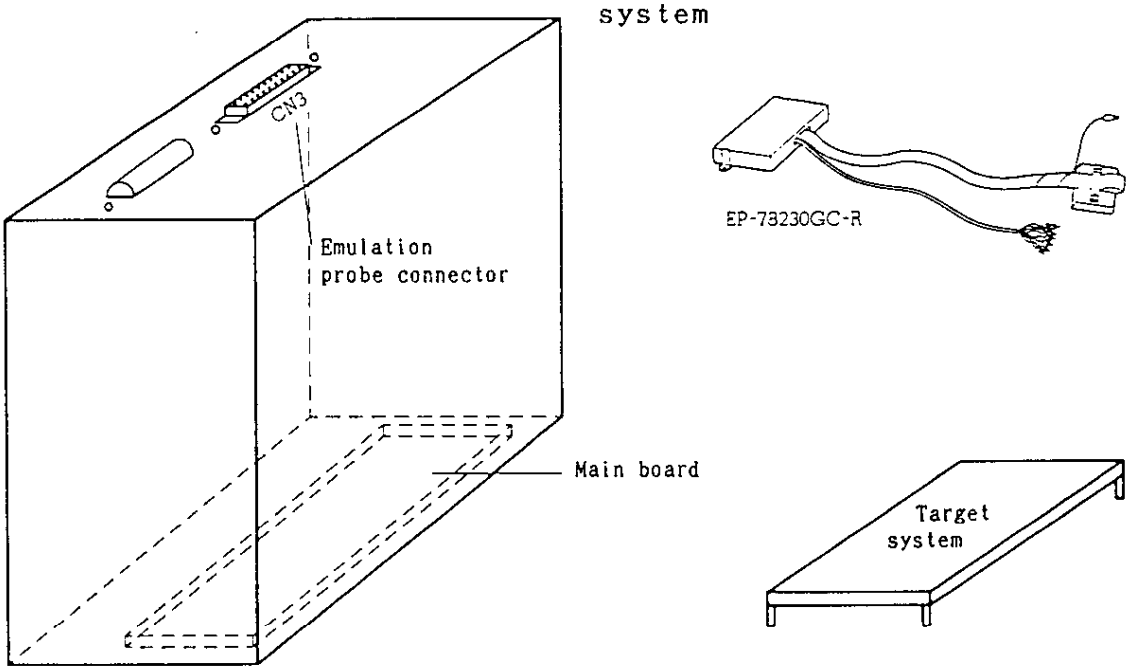
IE-78000-R-BK

IE-78098-R-EM

Connector board (supplied with emulation board)



Emulation probe for your target system



IE-78000-R housing

CHAPTER 3 DIFFERENCES BETWEEN TARGET DEVICES

When emulating the target device with IE-78098-R-EM and IE-78000-R, the operations for the target device slightly differ from those for the actual device. This chapter describes these differences.

3.1 Setting Mask Option

(1) P60-P63 are N-ch open-drain pins that can be internally connected to a pull-up resistor by a mask option and can withstand +15 V. Whether or not the pull-up resistor is connected can be specified by the configuration panel of the screen debugger.

(2) P07/XT1 pin is a port pin multiplexed with subsystem clock input. The function of this pin can be switched with the configuration panel of the screen debugger when the in-circuit emulator is used.

3.2 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} = 3V to 5V when operating).

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.

Note: When debugging by using IE-78000-R and IE-78098-R-EM after connecting IE-78000-R and the target system, 3V to 6V must be supplied to the target system (as the supply voltage V_{DD}).

3.2.1 Circuit inputting/outputting signal directly or via resistor to/from emulation device

(1) Signals related to port

This circuit interfaces the following signals:

- o Signal related to port 0
- o Signal related to port 1
- o Signal related to port 2
- o Signal related to port 3
- o Signal related to port 4
- o Signal related to port 5
- o Signal related to port 6
- o Signal related to port 7
- o Signal related to port 12
- o Signal related to port 13

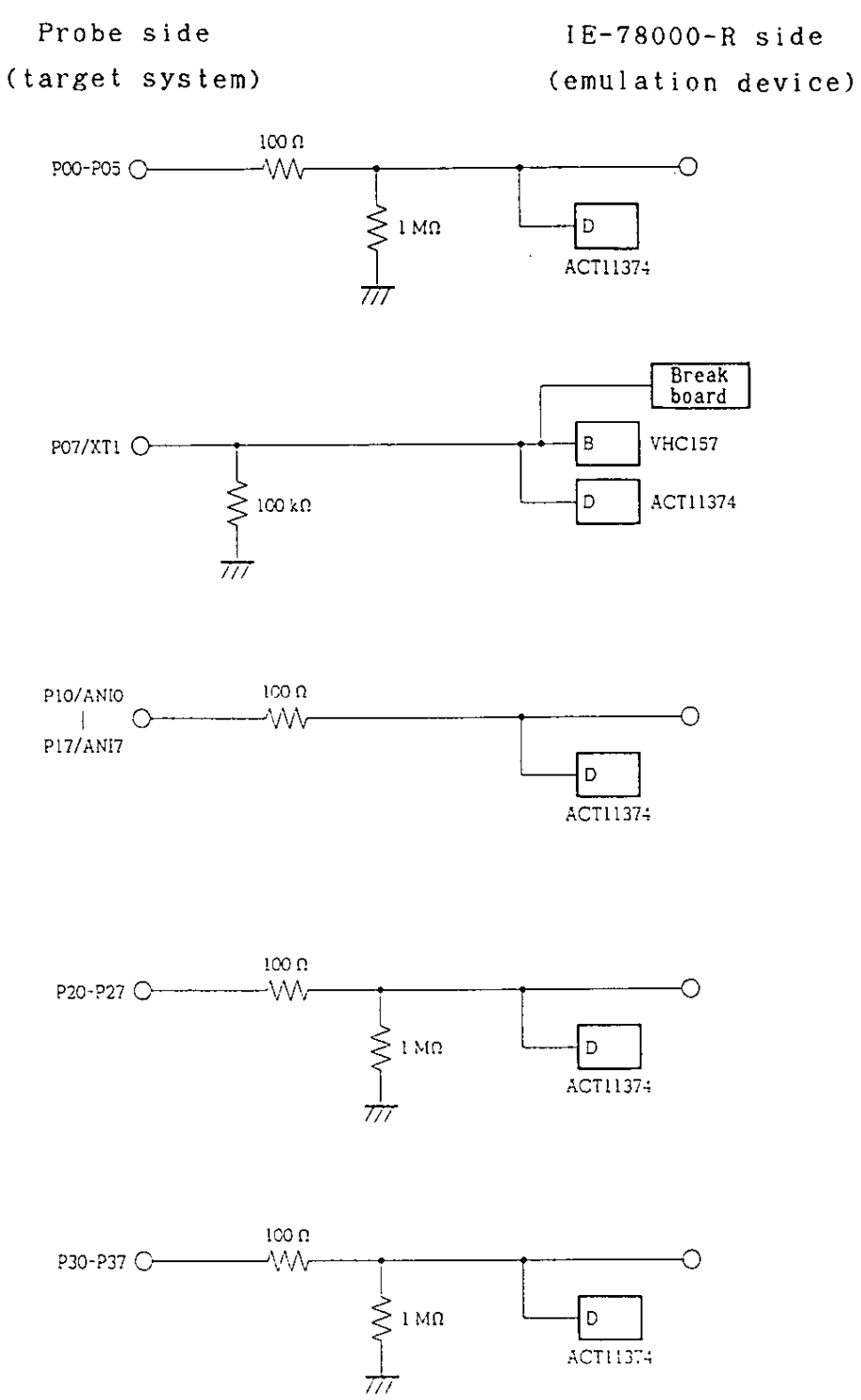


Fig. 3-1 Equivalent Emulation Circuit 1 (1/3)

Probe side
(target system)

IE-78000-R side
(emulation device)

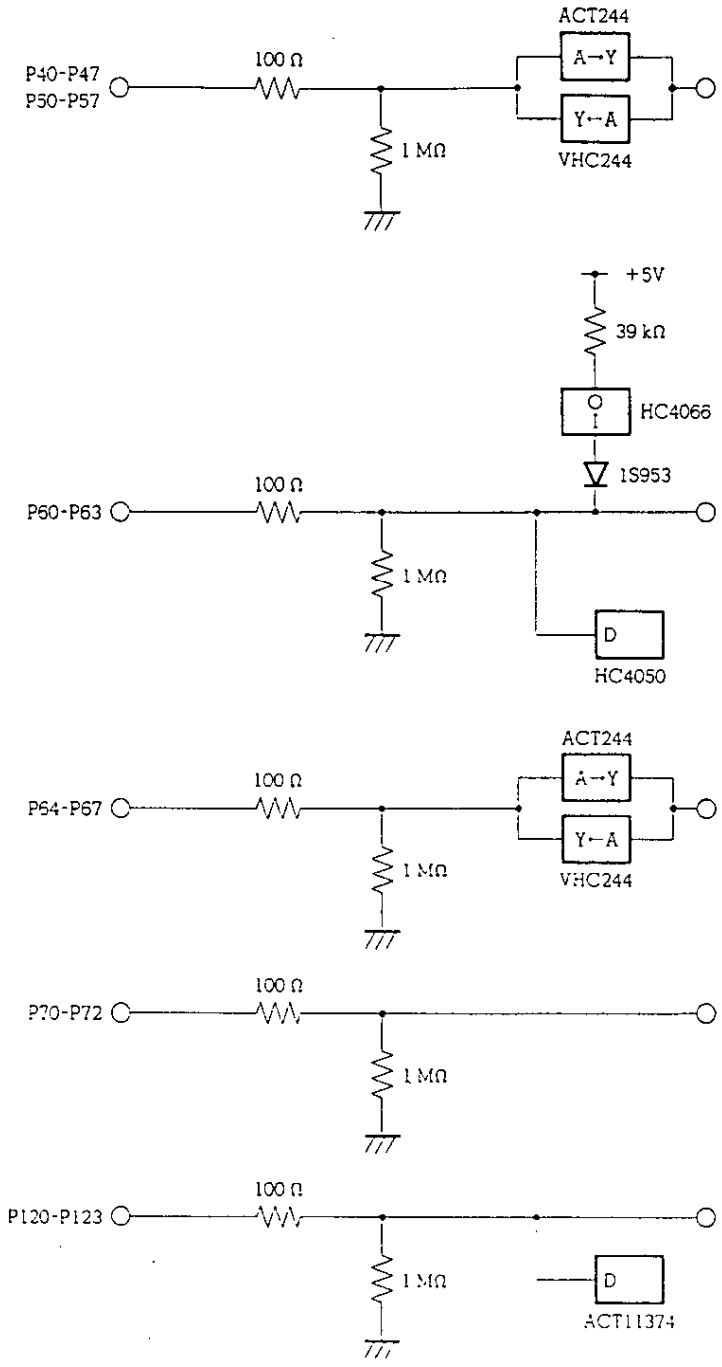


Fig. 3-1 Equivalent Emulation Circuit 1 (2/3)

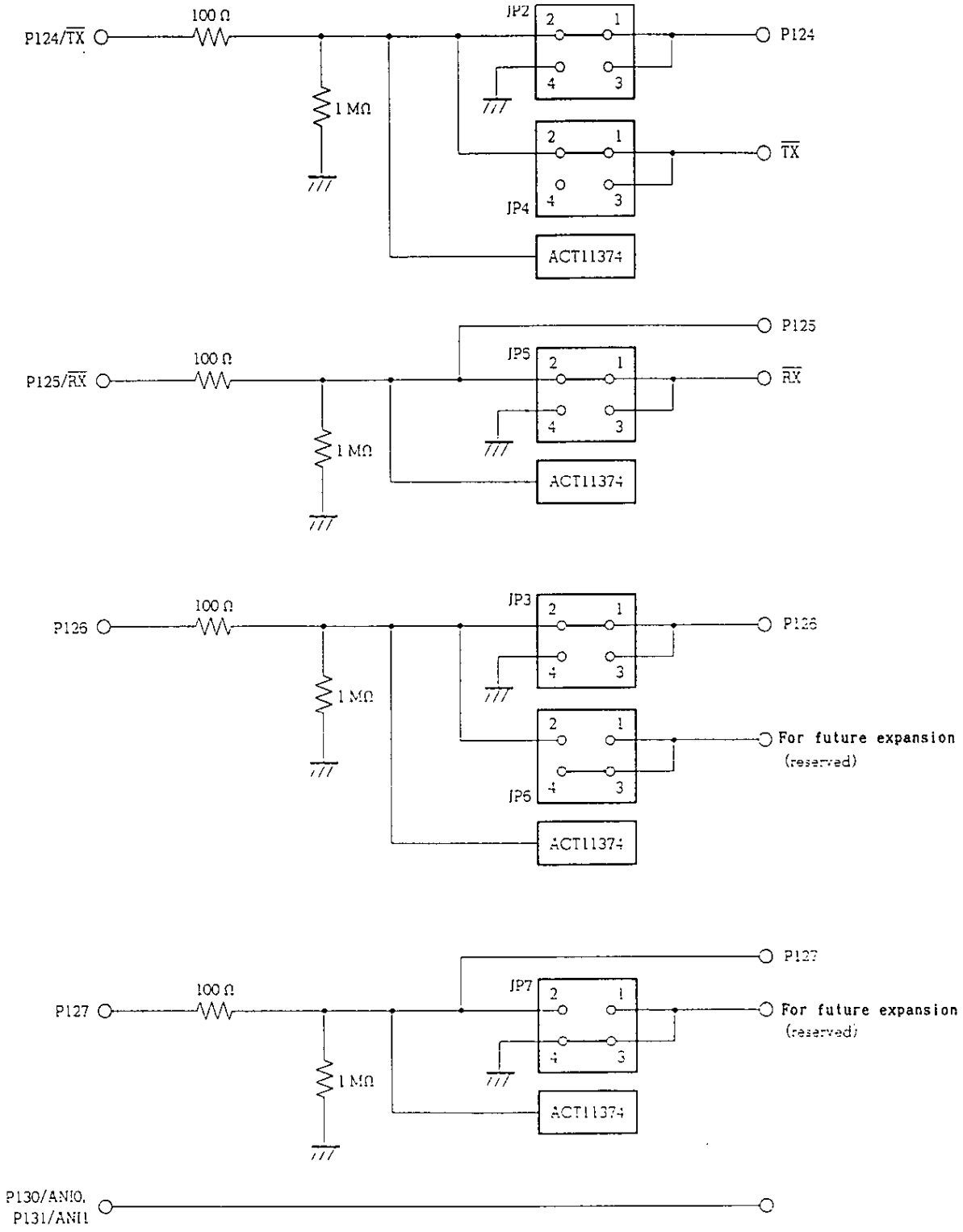


Fig. 3-1 Equivalent Emulation Circuit 1 (3/3)

(2) Analog signals

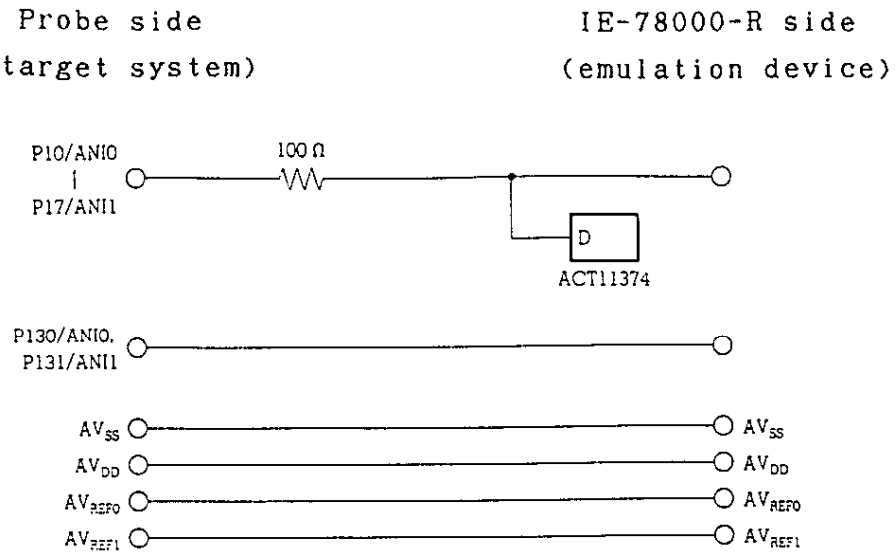


Fig. 3-2 Equivalent Emulation Circuit 2

(3) Setting the P12 jumper

(a) Setting P124/$\overline{TX}$

Use of P124/$\overline{TX}$		JP2	JP4
Used as normal port pin (when the IEBus controller is not used)		1-2 shorted	1-2 shorted
When the IEBus controller is used	When P12 is not pulled up via software		
	When P12 is pulled up via software*	3-4 shorted	

*: In the actual device, the internal pull-up resistor is automatically disconnected when IECM0=1(the IEBus controller is in use). With the emulator, however, the internal pull-up resistor is not disconnected even when IECM0 = 1; therefore, be sure to set JP2 when the IEBus controller is used.

(b) Setting P125/$\overline{RX}$

Use of P125/$\overline{RX}$	JP5
- (Always set as indicated at right)*	1-2 shorted

*: In the actual device, the internal pull-up resistor is automatically disconnected when IECM0 = 1 (the IEBus controller is in use). With the emulator, however, the internal pull-up resistor is not disconnected even when IECM0 = 1.

(c) Setting P126

Use of P126	JP3	JP6
- (Always set as indicated at right)	1-2 shorted	3-4 shorted

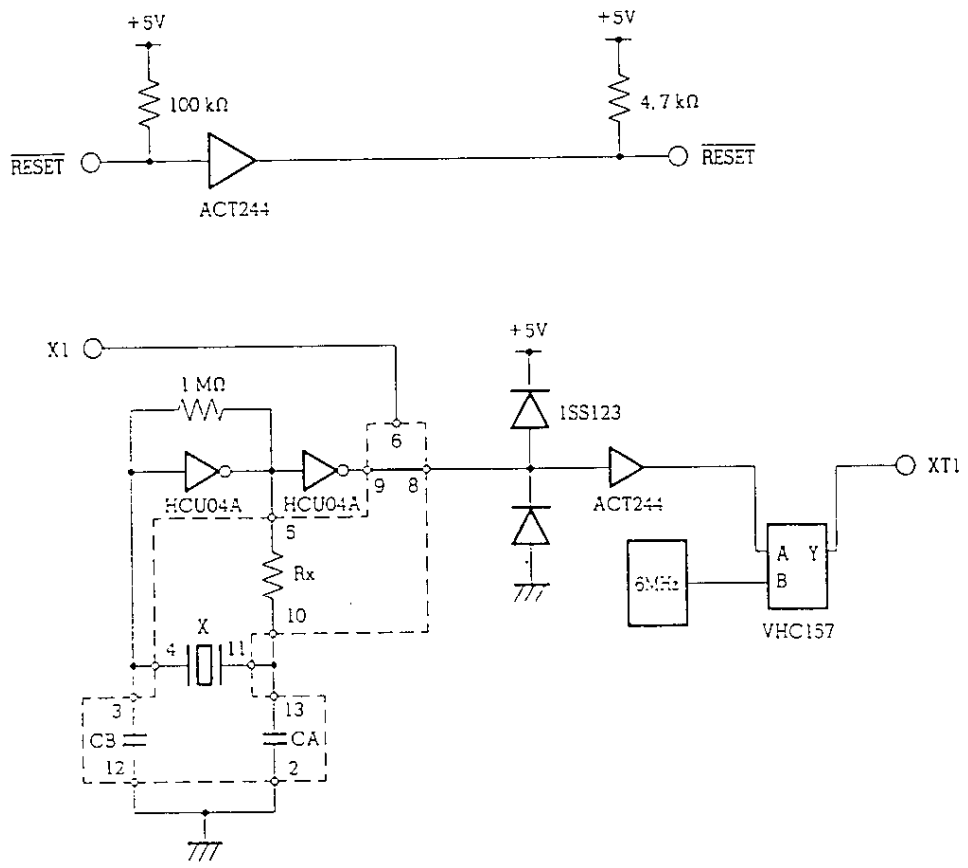
(d) Setting P127

Use of P127	JP7
- (Always set as indicated at right)	3-4 shorted

3.2.2 Circuit inputting signal via gate to emulation device

This circuit interfaces the following signals:

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



Remarks: The component enclosed by the dotted line are to be mounted on the component block.

Fig. 3-3 Equivalent Emulation Circuit 3

Setting clock is shown below.

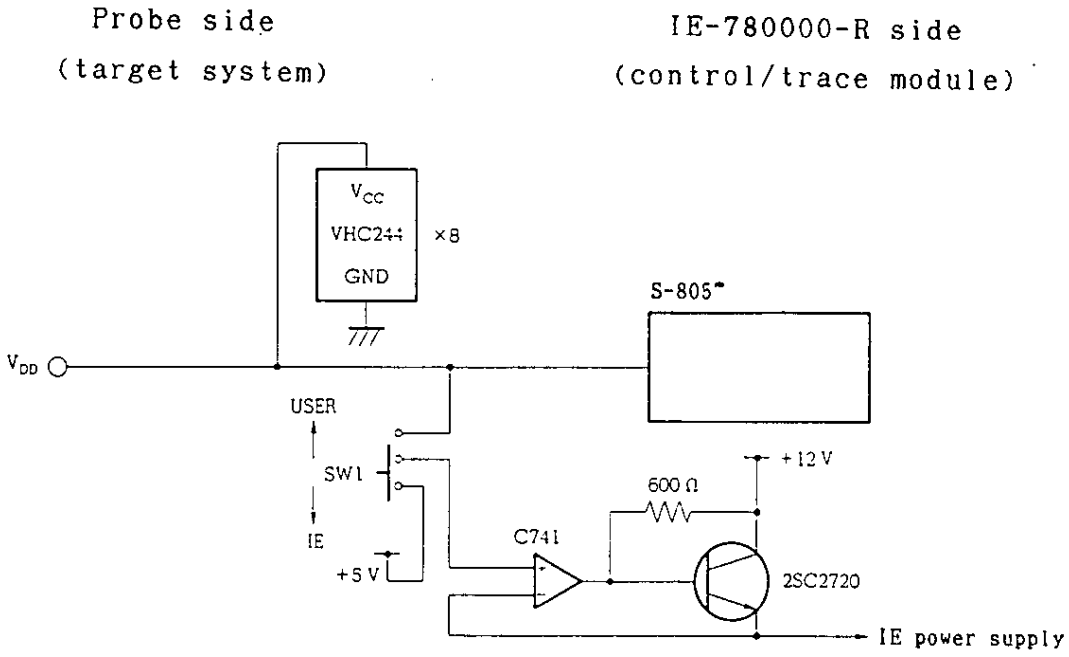
Main system clock frequency		Component block X1 (MAIN) on IE-78000-R-BK	IE-78098-R-EM		Clock setting
			Component block X1 (USRCLK)	JP1	
6.0 MHz	To use oscillator circuit on IE-78098-R-EM	6-8 shorted	6-8 shorted	1-2 shorted (AUTO)	IE
Other than 6.0 MHz	To use oscillator circuit on IE-78098-R-EM	6-8 shorted	Assemble oscillator circuit	1-2 shorted (AUTO)	USER
Other than 6.0 MHz	To input main system clock from emulation probe	6-8 shorted	6-8 shorted	1-2 shorted (AUTO)	USER

Note: Before setting JP1 that switches between the on-board 6-MHz clock and component clock, turn off the power to the IE-78000-R.

3.2.3 Circuit inputting signal to control/trace module

This circuit interfaces the following signals:

o VDD signal

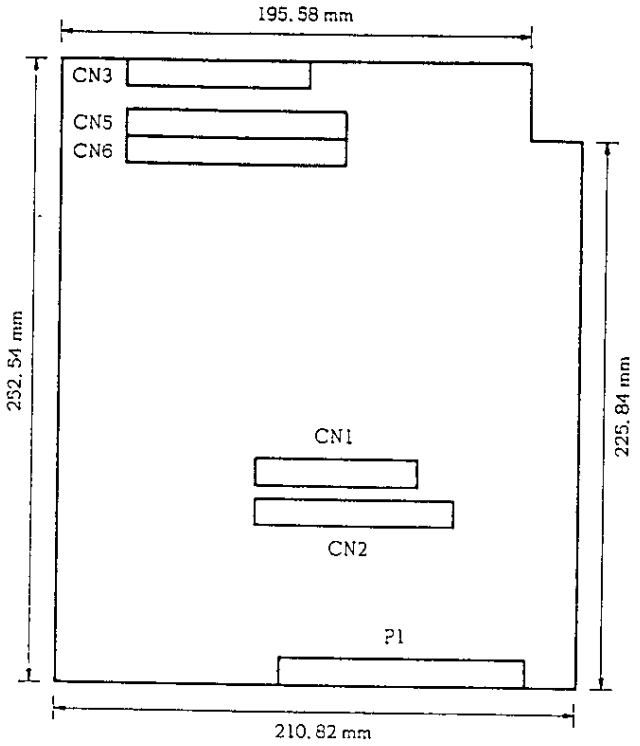


*: S-805 is a Seiko Instruments Inc. IC.

Fig. 3-4 Equivalent Emulation Circuit 4

APPENDIX A IE-78098-R-EM PRODUCT SPECIFICATIONS

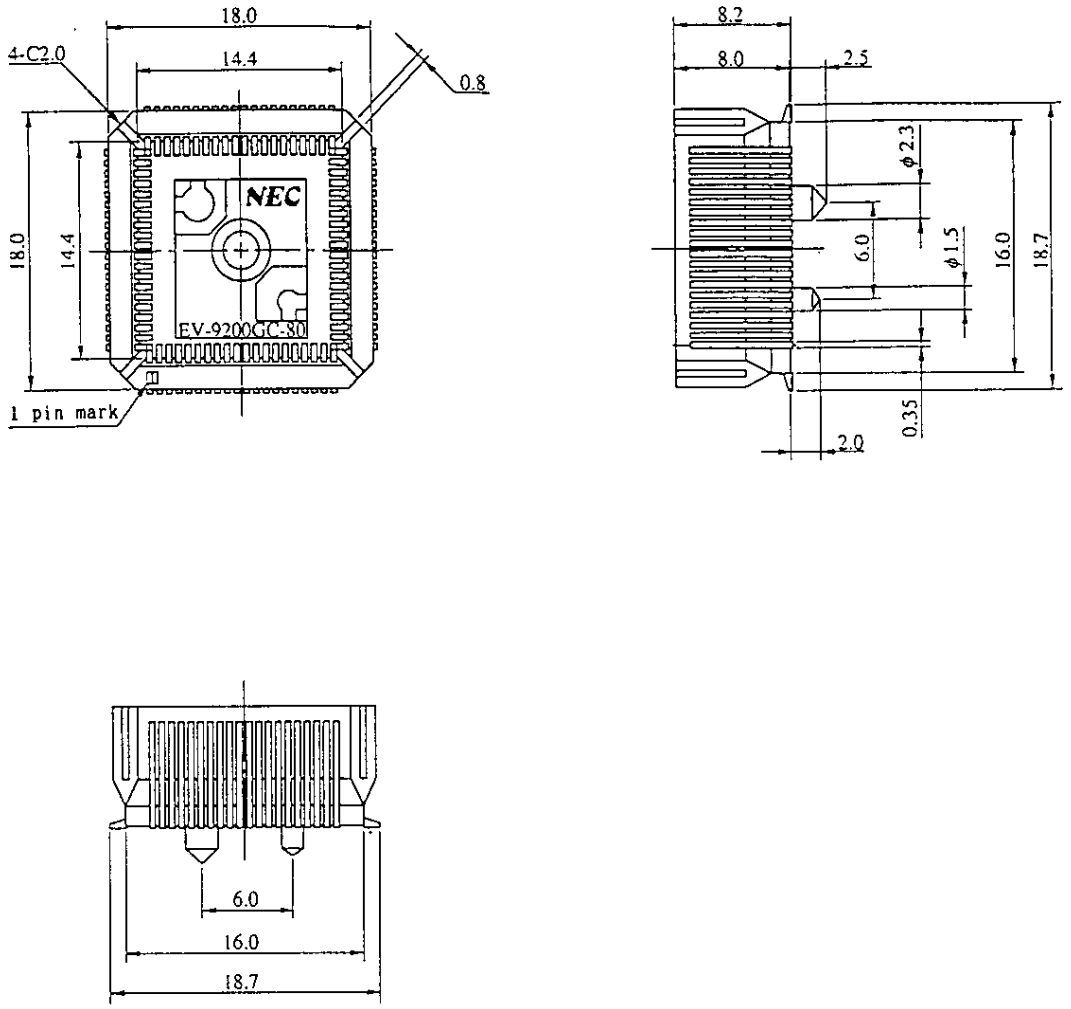
Product name	: IE-78098-R-EM
Peripheral emulation device	: uPD78P054, 78P098
Operating temperature	: 0 to 50°C
Humidity	: 10 to 80% RH (without condensation)
Storage temperature	: -15 to +60°C
Power requirements	: DC 2.0 A (max.) 10.0W +5V
	3.8 mA (max.) 0.05W +12V
Board dimensions	:



Connector : Connector on IE-78098-R-EM board

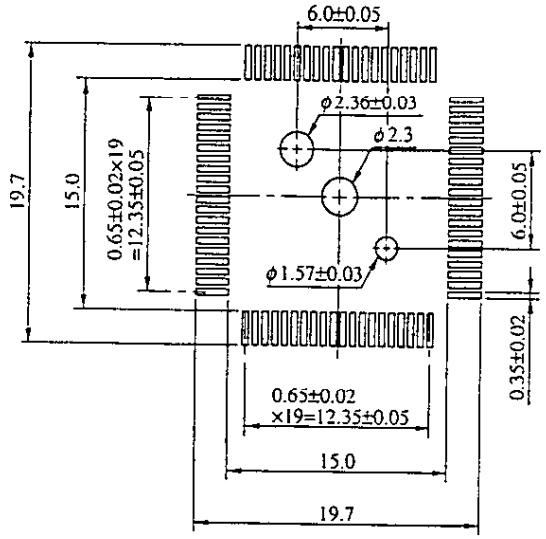
CN1	Break board connector
CN2	
CN3	Emulation prove connector
CN5	Connector board connector (for 80 pin)
CN6	
P1	Main bus connector

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



EV-9200GC-80-G0

Fig. B-1 Dimensions of EV-9200GC-80



EV-9200GC-80-P0

Note: The mounting pads on the EV-9200 and the mounting pads on the target device (for QFP) have slightly different dimensions. For the dimensions of the mounting pad for QFP, refer to "Semiconductor Device Mounting Manual (IEI-616).

Fig. B-2 Recommended Board Mounting Pattern of EV-9200GC-80

APPENDIX C PIN CONFIGURATION OF EMULATION PROVE

EP-78230GC-R

CN1 Pin No.	Emulation Prove	CN1 Pin No.	Emulation Prove	CN1 Pin No.	Emulation Prove	CN1 Pin No.	Emulation Prove
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	

Remarks: The meanings of the symbols and numerals in the column under the heading "Emulation Prove" are as follows:

GND : Ground clip (GND)

EXT0-EXT7: External sense clip

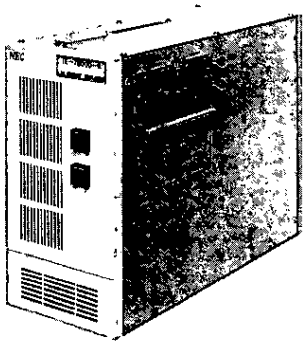
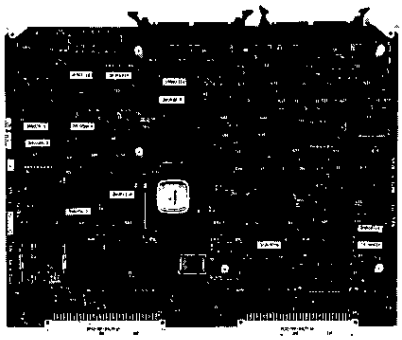
1-80 : Emulation prove pin numbers

NC : No Connection

APPENDIX D SYSTEM CONFIGURATION

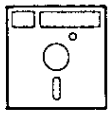
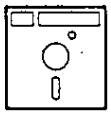
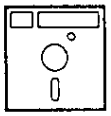
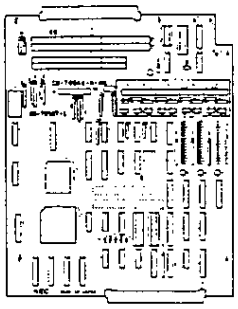
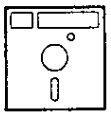
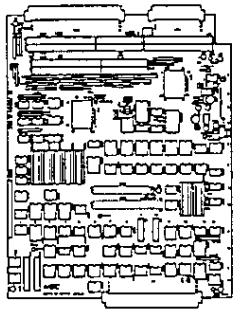
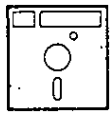
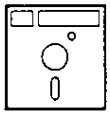
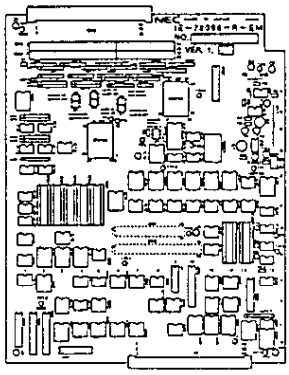
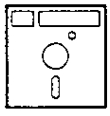
The IE-78000-R system configuration is shown on the following pages:

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

Target Device	Housing and Control/Trace Board	Break board
μPD78002 Series μPD78002Y Series μPD78014 Series μPD78014Y Series μPD78044 Series μPD78054 Series μPD78064 Series μPD78098 Series	 78K Series 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)

Note: uPD78098 series 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-78014-R-EM	 EP-78240GC-R (Accessory: EV-9200GC-64) EP-78240CW-R	 SD78K0 (with ROM)	 DF78002  DF78014
 IE-78044-R-EM	 (Accessory: EV-9200G-80) EP-78130GF-R		 DF78044
 IE-78064-R-EM	 EP-78230GC-R (Accessory: EV-9200GC-80) EP-78054GK-R (Accessory: EV-9500GK-80)		 DF78054
	 EP-78064GC-R (Accessory: EV-9500GC-100) EP-78064GF-R (Accessory: EV-9200GF-100)		 DF78064
 IE-78098-R-EM	 (Accessory: EV-9200GC-80) EP-78230GC-R		 DF78098

Note: EV9500GC-100, DF78054, DF78064, DF78098 are under development.

Phase-out/Discontinued