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RENESAS

Preliminary User's Manual

IE-703228-G1-EM1

Emulation Board

Target Device
V850ES/PM1

Document No. U16879EJ1V0UM00 (1st edition)
Date Published March 2004 N CP(K)

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- Product release schedule
- Availability of related technical literature
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J04.1

INTRODUCTION

Target Readers

This manual is intended for users who design and develop application systems using the V850ES/PM1 microcontroller.

Purpose

The purpose of this manual is to describe the basic specifications of the IE-703228-G1-EM1 and its proper operation.

Organization

This manual is broadly divided into the following parts.

- Outline
- Part names and functions
- Setup procedure
- Cautions
- Restrictions

How to Read This Manual

It is assumed that the reader of this manual has general knowledge in the fields of electrical engineering, logic circuits, and microcontrollers. Use the IE-703228-G1-EM1 connected to the in-circuit emulator (IE-V850ES-G1). This manual describes the basic setup procedures and switch settings of the IE-703228-G1-EM1 and IE-V850ES-G1. For the part names, functions, and configuration parts of the IE-V850ES-G1, refer to the **IE-V850ES-G1 User's Manual (U16313E)** provided separately.

To learn about the basic specifications and operation
→Read this manual in the order listed in **CONTENTS**.

To learn software settings such as the operation methods, command functions, etc., of the IE-V850ES-G1 or IE-703228-G1-EM1
→Read the user's manual of the debugger (sold separately) that is used.

Conventions

Note:	Footnote for item marked with **Note** in the text
Caution:	Information requiring particular attention
Remark:	Supplementary information
Numeral representation:	Binary ··· ×××× or ××××B
	Decimal ··· ××××
	Hexadecimal ··· ××××H

Prefix representing a power of 2 (address space, memory capacity):

K (kilo): $2^{10} = 1024$

M (mega): $2^{20} = 1024^2$

Terminology

The meanings of terms used in this manual are listed below.

Target device	This is the device to be emulated.
Target system	The system (user-built system) to be debugged. This includes the target program and hardware configured by the user.
Emulation CPU	The CPU that executes the program created by the user in the emulator.

Related Documents When using this manual, refer to the following manuals.
The related documents (user's manuals) indicated in this publication may include preliminary versions. However, preliminary versions are not marked as such.

Documents Related to Development Tools (User's Manuals)

Document Name		Document Number
IE-V850ES-G1 (In-Circuit Emulator for V850ES)		U16313E
IE-703228-G1-EM1 (Emulation Board for V850ES/PM1)		This manual
V850ES/PM1 Hardware		U16237E
CA850 Ver.2.50 C Compiler Package	Operation	U16053E
	C Language	U16054E
	Assembly Language	U16042E
PM Plus Ver. 5.10		U16559E
ID850 Ver.2.50 Integrated Debugger	Operation Windows™ based	U16217E
SM850 Ver.2.50 System Simulator	Operation Windows based	U16218E
SM850 Ver.2.00 or Later System Simulator	External Part User Open Interface Specifications	U14873E
RX850 Ver.3.13 or Later Real-Time OS	Basics	U13430E
	Installation	U13410E
	Technical	U13431E
RX850 Pro Ver.3.13 Real-Time OS	Basics	U13773E
	Installation	U13774E
	Technical	U13772E
RD850 Ver.3.01 Task Debugger		U13737E
RD850 Pro Ver.3.01 Task Debugger		U13916E
AZ850 Ver.3.10 System Performance Analyzer		U14410E
PG-FP4 Flash Memory Programmer		U15260E

Caution The related documents listed above are subject to change without notice. Be sure to use the latest version of each document for designing.

CONTENTS

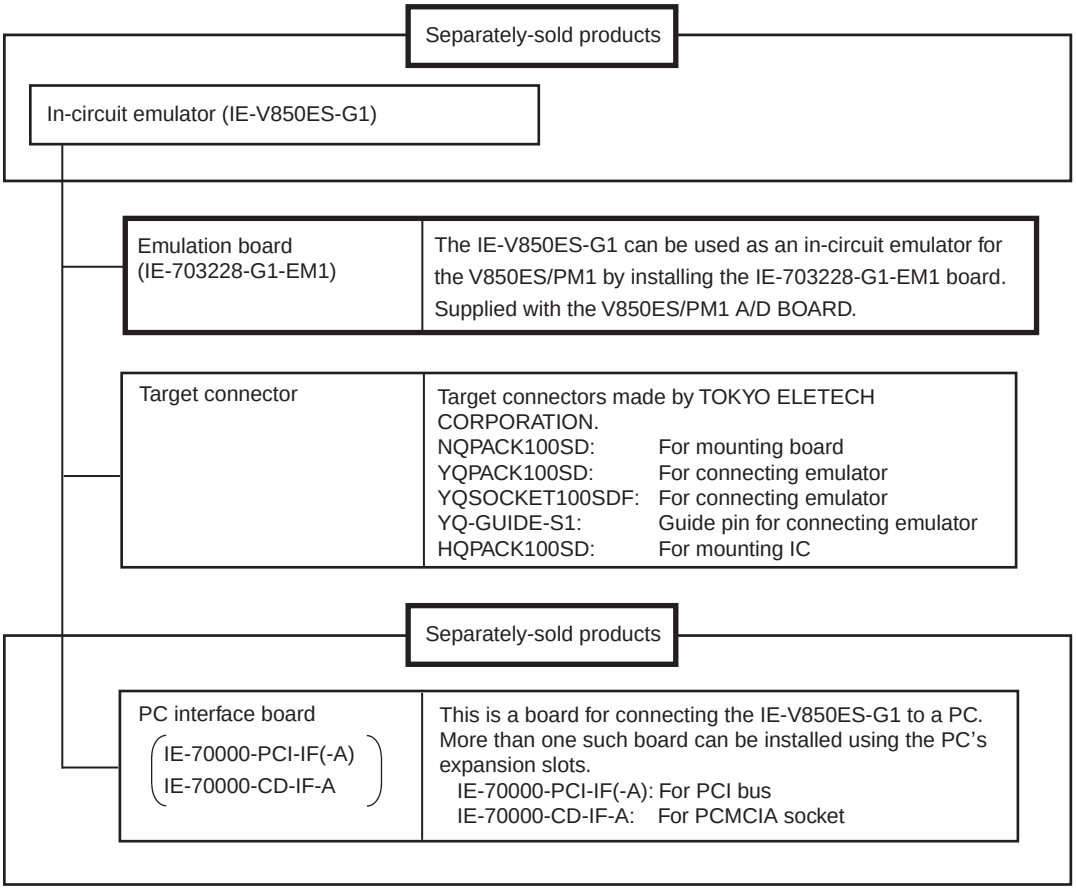
CHAPTER 1 OUTLINE

The IE-703228-G1-EM1 is an emulation board for the IE-V850ES-G1 in-circuit emulator.

Connected to the IE-V850ES-G1, the IE-703228-G1-EM1 can be used for efficient hardware and software debugging during system development using the V850ES/PM1.

This manual describes the basic setup procedure and the switch settings of the IE-V850ES-G1 when connected to the IE-703228-G1-EM1. For the part names and functions of the IE-V850ES-G1, refer to the separate **IE-V850ES-G1 User's Manual (U16313E)**.

1.1 Product Configuration



1.2 Features (When Connected to IE-V850ES-G1)

- Maximum operating frequency: 20 MHz (3.0 to 3.6 V)
- The following pins can be masked.
  NMI, $\overline{\text{WAIT}}$, $\overline{\text{RESET}}$
- The external dimensions of the IE-703228-G1-EM1 are listed below.

Item		Value
External dimensions	Height	35 mm
	Width	205 mm
	Depth	140 mm

1.3 Function Specifications (When Connected to IE-V850ES-G1)

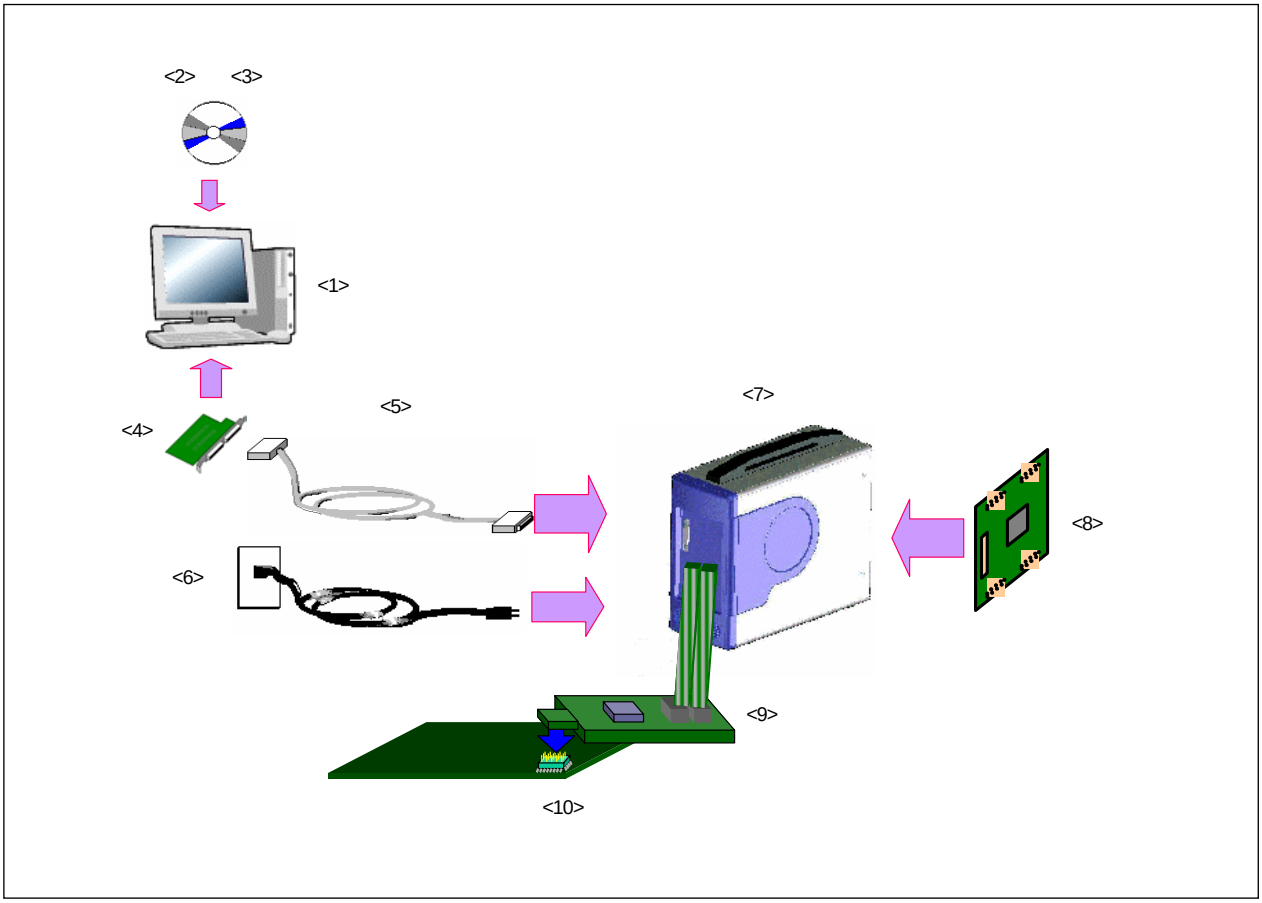
Item		Specification
Emulation memory capacity	For internal ROM	1 MB (Max.)
	For user memory	4 MB
Execution/pass detection coverage memory capacity	Internal ROM	256 KB
	External memory	1 MB
Memory access detection coverage memory capacity	External memory	1 MB
Branch destination entry count calculation coverage memory capacity	Internal ROM	256 KB
	External memory	1 MB
Trace memory capacity		168 bits × 32 K frames
Time measurement function		Internal timers × 3
External logic probe		8-bit external trace possible
		Trace/break event setting possible
Break function		Event break
		Step execution break
		Forced break
		Fail-safe break • Illegal access to peripheral I/O • Access to guard area • Write to ROM area

Caution Some functions may not be supported depending on the debugger that is used.

1.4 System Configuration

The system configuration when using the IE-703228-G1-EM1 connected to the IE-V850ES-G1, which itself is connected to a PC (PC-9800 series or PC/AT™ compatible) is shown below.

Figure 1-1. System Configuration



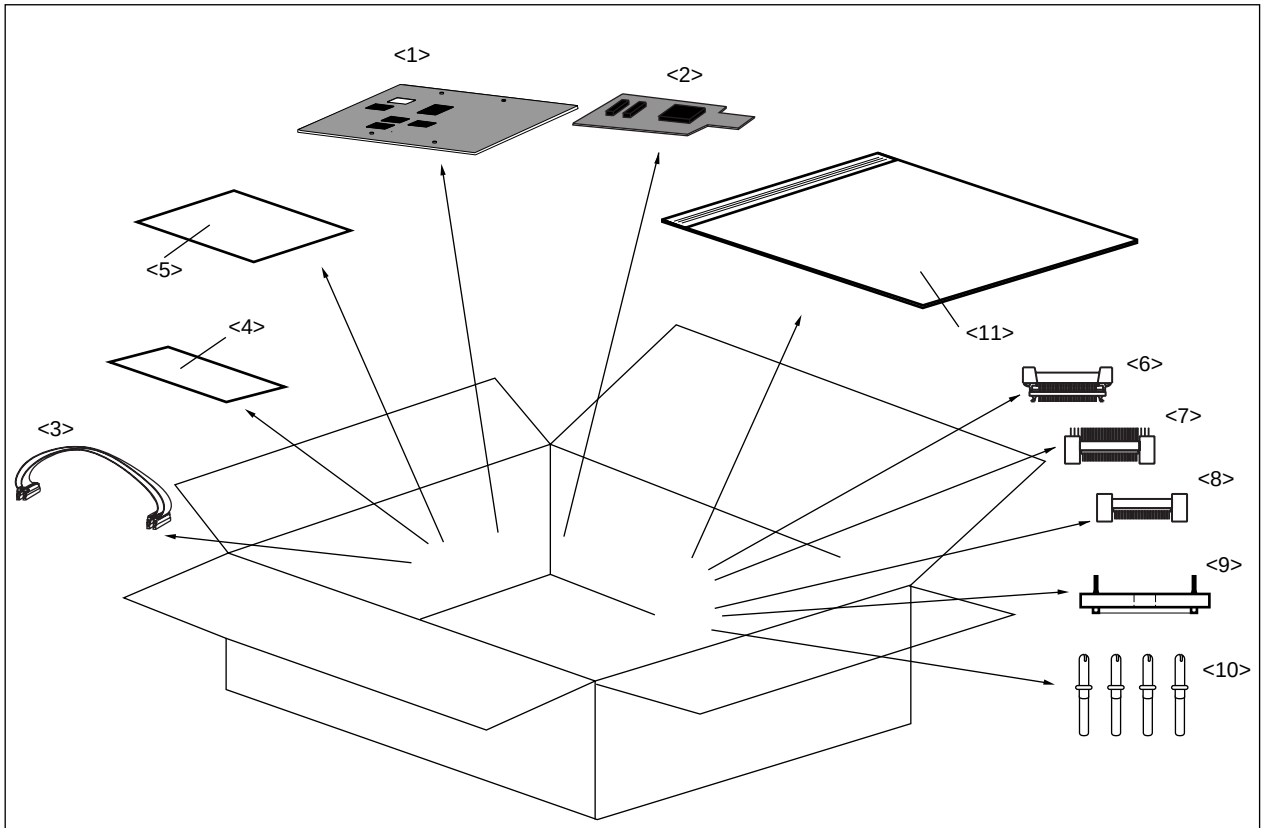
Remark <1>: PC (PC-9800 series or PC/AT compatible)
<2>: Debugger (sold separately)
<3>: Device file (obtained separately)[Note]
<4>: PC interface board (IE-70000-PCI-IF(-A), IE-70000-CD-IF-A: Sold separately)
<5>: PC interface cable (supplied with IE-V850ES-G1: Sold separately)
<6>: Power supply cable (supplied with IE-V850ES-G1: Sold separately)
<7>: IE-V850ES-G1 (sold separately)
<8>: Emulation board (this product)
<9>: V850ES/PM1 A/D BOARD (supplied with this product)
<10>: Conversion socket (supplied with this product)

Note The device file can be downloaded from the NEC Electronics website. (URL: http://www.necel.com/micro)

1.5 Contents in Carton

The IE-703228-G1-EM1 package contains the IE-703228-G1-EM1 emulation board, a guarantee card, a packing list, this manual, and an accessory bag. Check whether the accessory bag contains the items listed below. If you find any missing or damaged items, contact an NEC Electronics sales representative or distributor.

Figure 1-2. Contents in Carton



<1> IE-703228-G1-EM1 × 1
<2> V850ES/PM1 A/D BOARD × 1
<3> Flat cable × 2
<4> Guarantee card × 1
<5> Packing list × 1
<6> NQPACK100SD × 1
<7> YQPACK100SD × 1
<8> HQPACK100SD × 1
<9> YQSOCKET100SDF × 1
<10> YQ-GUIDE-S1 × 4
<11> Accessory bag × 1

Check whether the accessory bag contains this manual, the packing list (× 1), and sems screws (× 6).

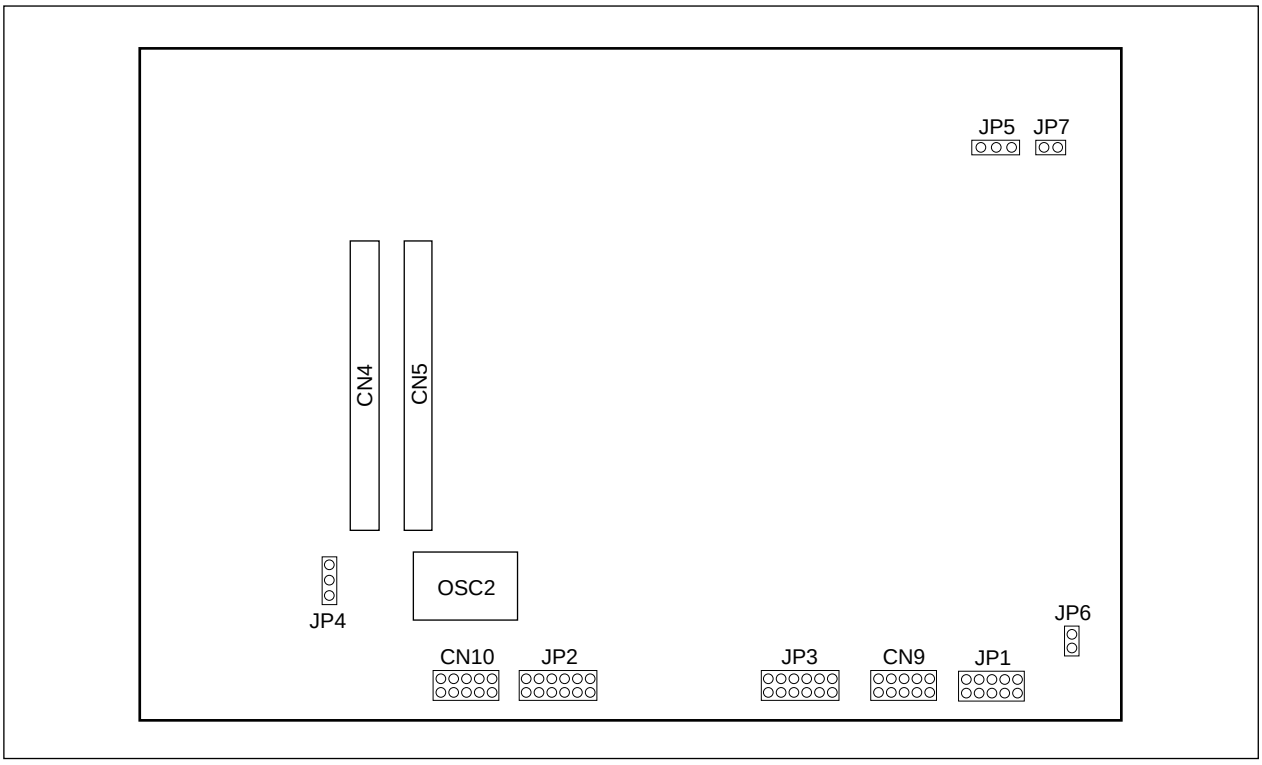
CHAPTER 2 PART NAMES AND FUNCTIONS

This chapter describes the part names and functions of the IE-703228-G1-EM1.

For the part names and functions of the IE-V850ES-G1, refer to the **IE-V850ES-G1 User's Manual (U16313E)**.

2.1 Part Names and Functions of IE-703228-G1-EM1

Figure 2-1. Part Names of IE-703228-G1-EM1



(1) OSC2

This is the socket for mounting the oscillator for the main clock.
(For details, refer to **3.3 Clock Settings**.)

(2) JP1

Unused.
Use it with the settings at shipment (all open).

(3) JP2

Unused.
Use it with the settings at shipment (1 and 2 shorted).

(4) JP3

Unused.
Use it with the settings at shipment (1 and 2 shorted).

(5) JP4

Unused.
Use it with the settings at shipment (2 and 3 shorted).

(6) JP5

Unused.
Use it with the settings at shipment (2 and 3 shorted).

(7) JP6

Unused.
Use it with the settings at shipment (open).

(8) JP7

Unused.
Use it with the settings at shipment (open).

(9) CN9

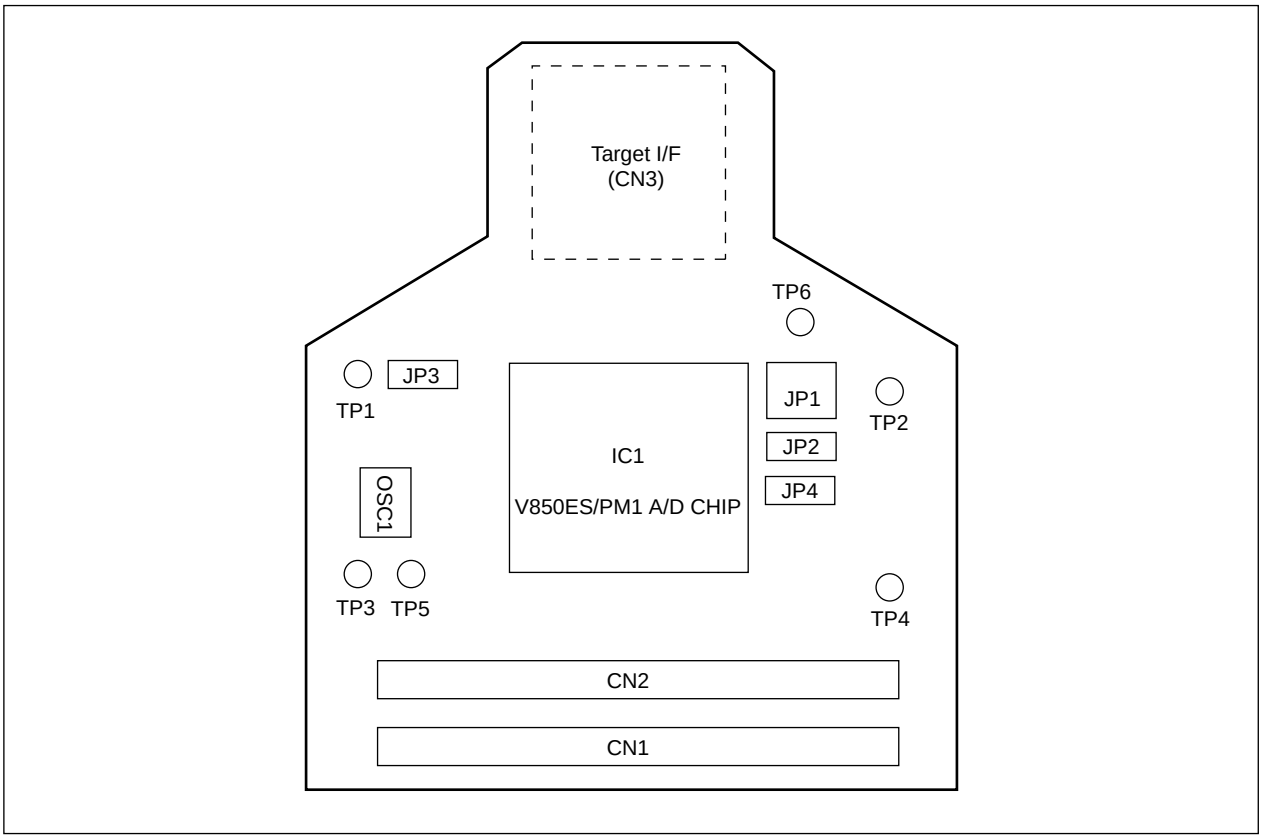
Unused.
Use it with the settings at shipment (all open).

(10) CN10

Unused.
Use it with the settings at shipment (all open).

2.2 Part Names and Functions of V850ES/PM1 A/D BOARD

Figure 2-2. Part Names of V850ES/PM1 A/D BOARD



(1) OSC1

This is the oscillator for the subclock.

The frequency cannot be changed. It is fixed to 32.768 kHz.

(2) Target I/F (CN3)

This is the interface for inserting the conversion socket on the target system.

(3) JP1

Unused.

Use it with the settings at shipment (1 and 2 shorted, 3 and 4 shorted).

(4) JP2

This is the jumper for selecting whether AV_{DD} of the V850ES/PM1 is supplied from the target system or the emulator. Set JP2 as follows.

Table 2-1. JP2 Settings

	JP2 Settings	Remark
When target system is connected	2 and 3: Shorted (setting at shipment)	AV_{DD} is supplied from target system
When emulator is used standalone	1 and 2: Shorted	AV_{DD} is supplied inside the emulator

(5) JP3

This is the jumper for shipment testing. Always use it left open.

(6) JP4

This is the jumper for selecting whether AV_{REFIN} and AV_{REFOUT} are connected in the emulator or not.
Set JP4 as follows.

Table 2-2. JP4 Settings

	JP4 Settings	Remark
When target system is connected	1 and 2: Open (setting at shipment)	AV_{REFIN} and AV_{REFOUT} are not connected in the emulator
When emulator is used standalone	1 and 2: Shorted	AV_{REFIN} and AV_{REFOUT} are connected in the emulator

(7) TP1 to TP6

These are test pins for observing the waveforms.

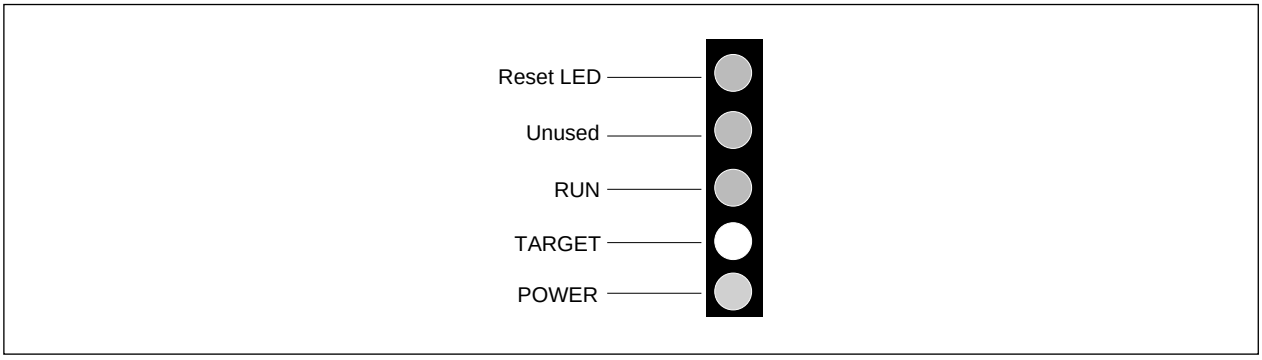
TP1: V_{SS}/EV_{SS}
TP2: V_{SS}/EV_{SS}
TP3: V_{SS}/EV_{SS}
TP4: V_{SS}/EV_{SS}
TP5: XT1
TP6: AV_{SS}

Remark V_{SS} and EV_{SS} are common in the emulator.

2.3 LEDs Controlled by IE-703228-G1-EM1

Some of the LEDs mounted in the IE-V850ES-G1 are controlled by the IE-703228-G1-EM1.
For the LEDs that are controlled by the IE-V850ES-G1, refer to the **IE-V850ES-G1 User's Manual (U16313E)**.

Figure 2-3. LEDs Controlled by IE-703228-G1-EM1



(1) Reset LED

The status of the $\overline{\text{RESET}}$ signal input from the target system is indicated as follows.

Lit (ON): The target system is connected and the $\overline{\text{RESET}}$ signal is active (GND level).

Unlit (OFF): Either the target system is not connected, or the $\overline{\text{RESET}}$ signal is inactive (V_{DD} level).

(2) Unused

This LED is always unlit.

(3) RUN

This LED is lit during user program execution.

Lit (during RUN): Lit while the user program is being executed.

Unlit (during BREAK): The execution of the user program is stopped (during break).

Remark The TARGET LED is judged as ON (TARGET LED is lit) when the voltages of both the V_{DD} and EV_{DD} pins on the target board are 2.2 V or more.

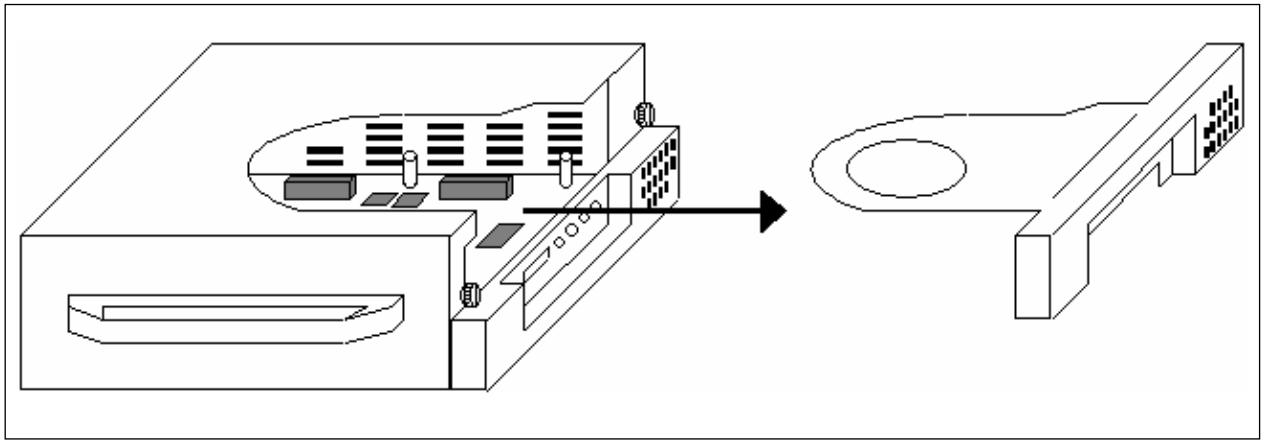
CHAPTER 3 SETUP PROCEDURE

This chapter describes how to connect the IE-703228-G1-EM1 to related products and how to replace the resonator.

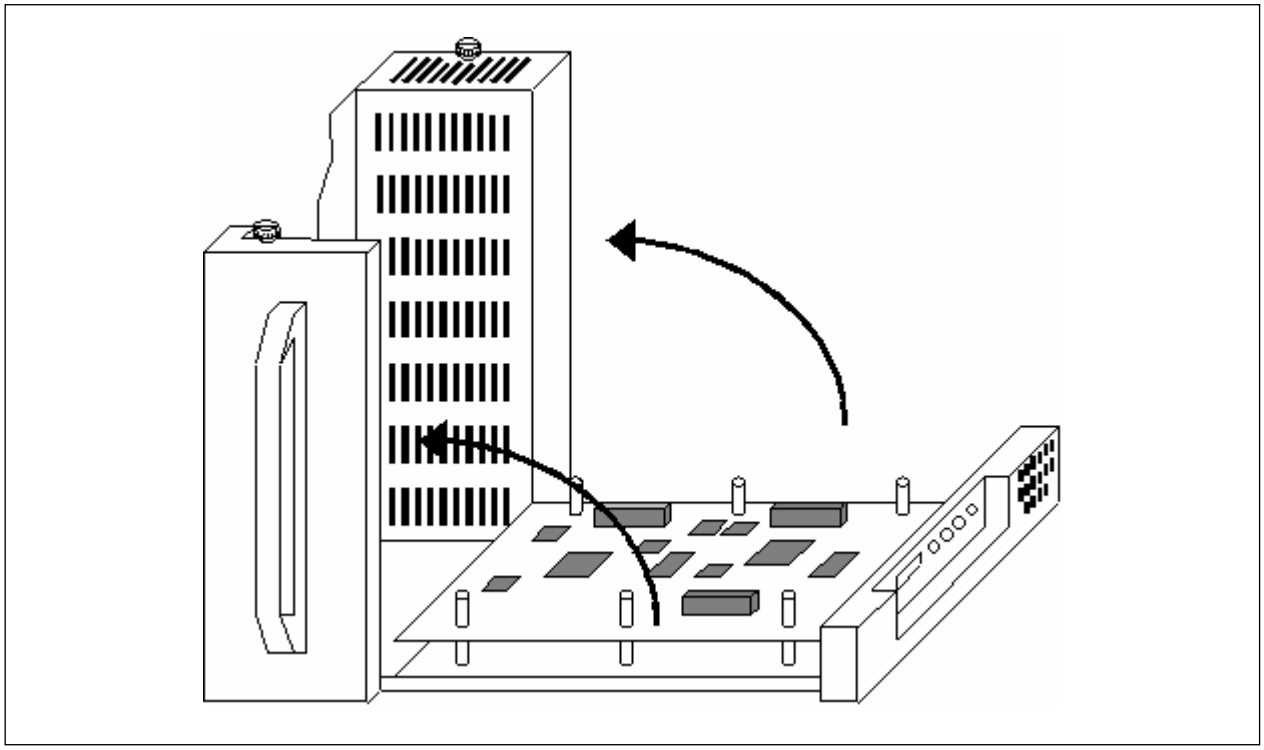
3.1 Connecting IE-V850ES-G1 and IE-703228-G1-EM1

The following shows the procedure to connect the IE-V850ES-G1 and IE-703228-G1-EM1.

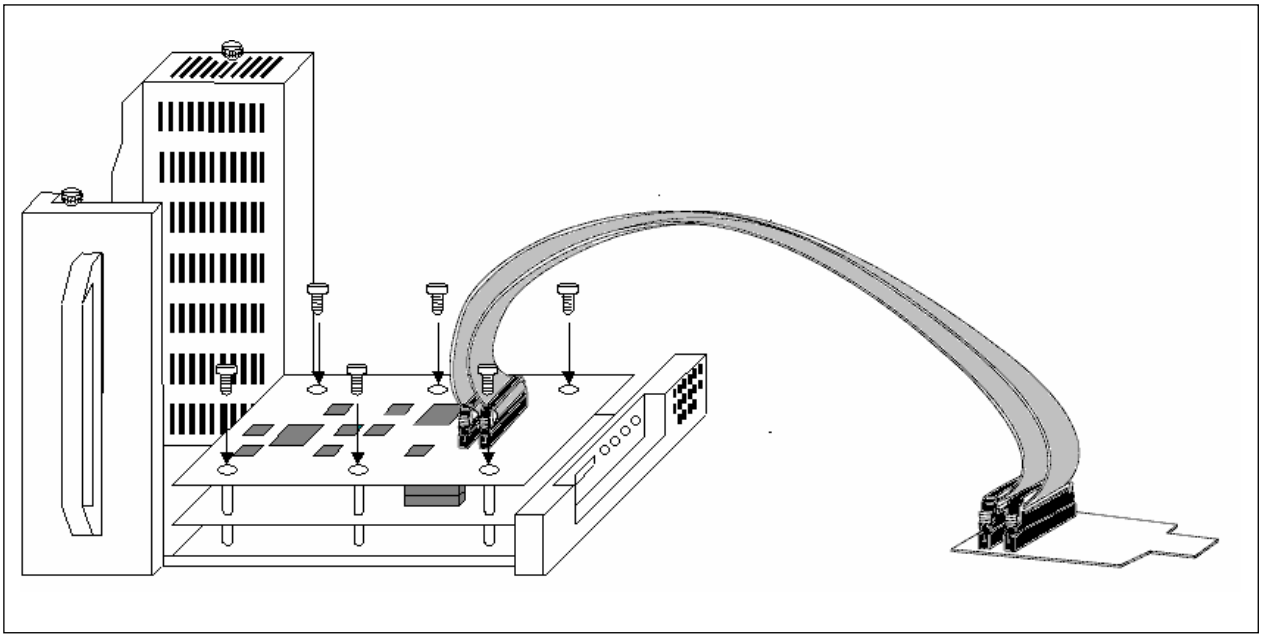
<1> Pull off the front cover of the IE-V850ES-G1.



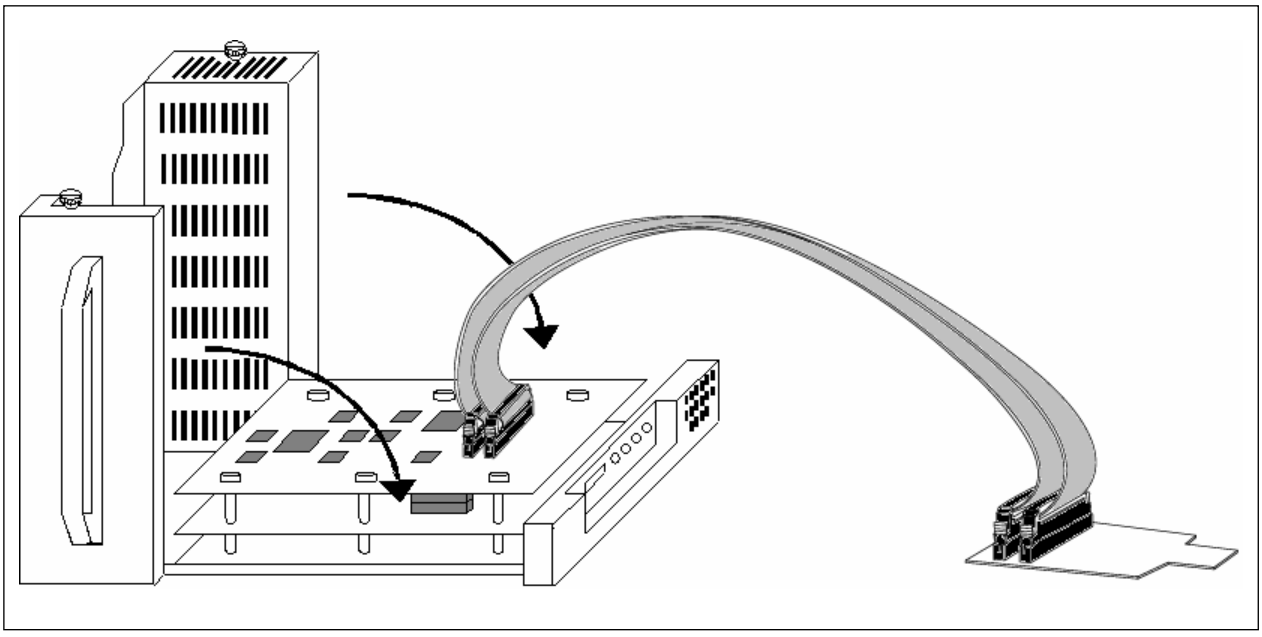
<2> Raise the frame of the IE-V850ES-G1 as shown.



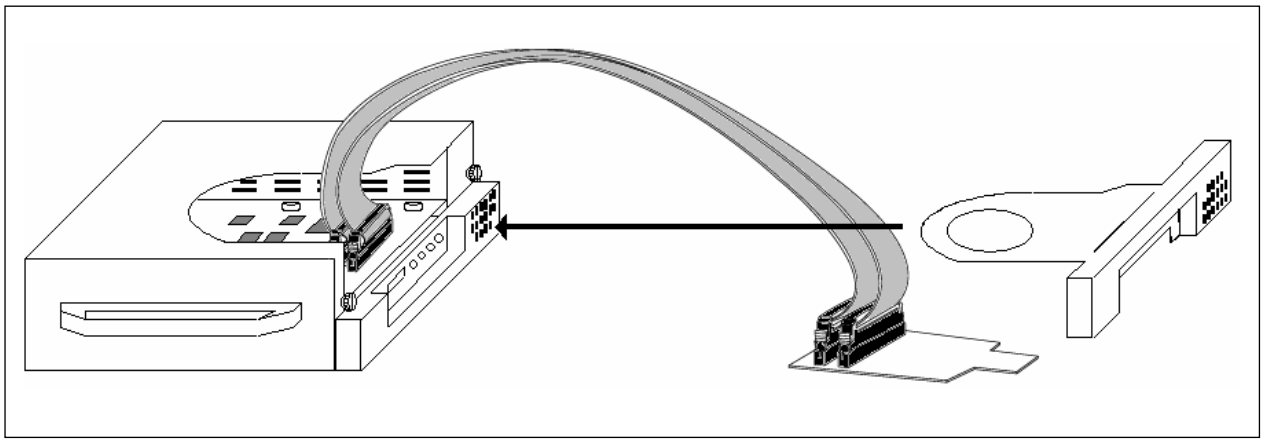
<3> Secure the IE-703228-G1-EM1 to the main board after inserting the cable into the IE-703228-G1-EM1. Insert three connectors so that the main board and the IE-703228-G1-EM1 are overlaid horizontally. Then, fasten the six cell spacers with the supplied screws.



<4> Slowly lower the frame of the IE-V850ES-G1.

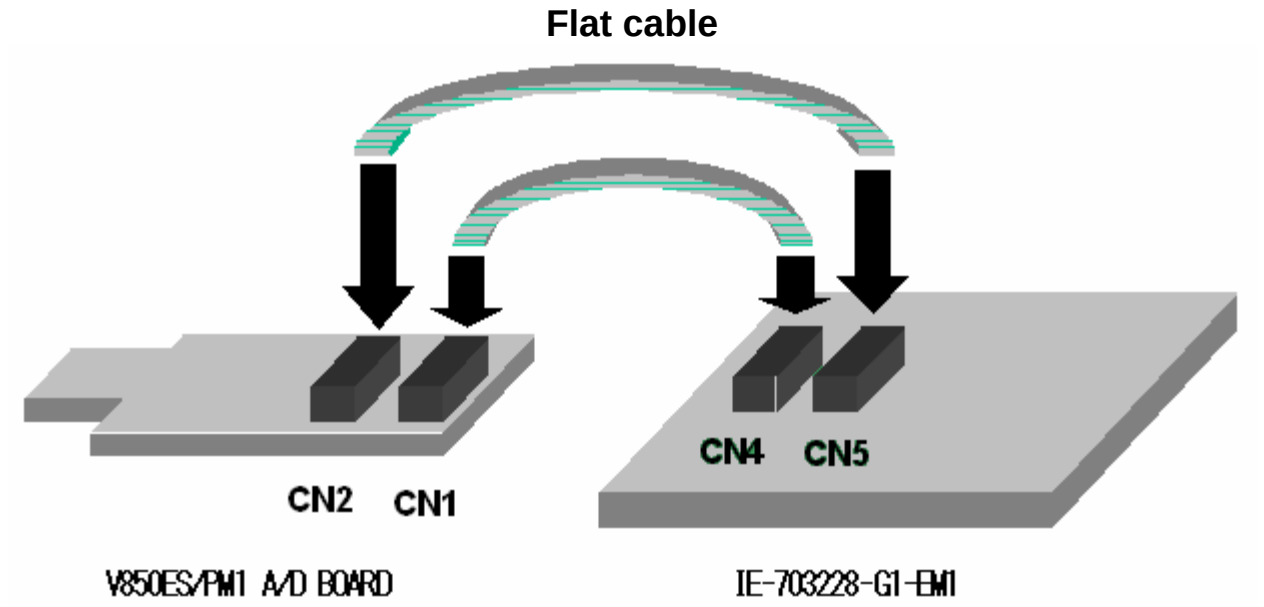


<5> Replace the front cover of the IE-V850ES-G1.



3.2 Connecting IE-703228-G1-EM1 and V850ES/PM1 A/D BOARD

Figure 3-1. Connecting IE-703228-G1-EM1 and V850ES/PM1 A/D BOARD



Connect CN1 and CN2 of the V850ES/PM1 A/D BOARD and CN4 and CN5 of the IE-703228-G1-EM1 as follows.

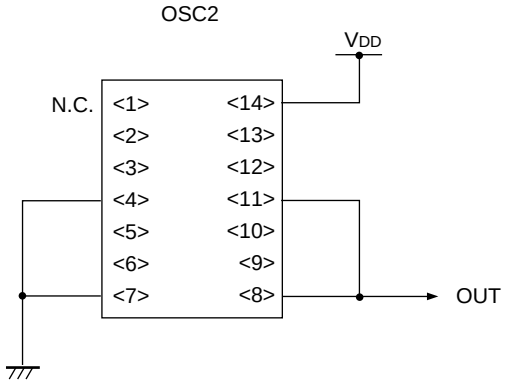
V850ES/PM1 A/D BOARD: CN1 ⟷ IE-703228-G1-EM1: CN4
V850ES/PM1 A/D BOARD: CN2 ⟷ IE-703228-G1-EM1: CN5

3.3 Clock Settings

At shipment, a 20 MHz crystal oscillator (8-pin type) is mounted.

To change the main clock frequency, replace the oscillator mounted in OSC2 on the IE-703228-G1-EM1 with an oscillator of the desired frequency.

32.768 kHz is supplied from the V850ES/PM1 A/D BOARD for the subclock. The subclock frequency cannot be changed.

Item	Setting
OSC2 (main clock)	The main clock is mounted on OSC2 of the IE-703228-G1-EM1 board. When the product is shipped, a 20 MHz crystal oscillator (8-pin type) is mounted. The following shows the OSC2 circuit. When using an 8-pin type or 14-pin type crystal oscillator, use it aligned with the position of pin 1 (N.C.).  **Remark** <1> to <14> are the pin numbers of OSC2.
OSC1 (subclock)	32.768 kHz (fixed) is supplied from the V850ES/PM1 A/D BOARD for the subclock. The frequency cannot be changed.

This product does not support clock oscillation by the resonator on the target system.

Therefore, the operation between the resonator on the target system and the oscillator in the target device cannot be emulated using this product.

CHAPTER 4 CAUTIONS

The following must be observed when using the IE-703228-G1-EM1.

4.1 Connection with Target System

Turn off power to the IE-V850ES-G1 before connecting the IE-703228-G1-EM1 to the target system.

4.2 Turning ON/OFF Power

Start or terminate the emulator in the following order.

- Starting: Turn on emulator's power → Turn on target's power → Start debugger
- Terminating: Terminate debugger → Turn off target's power → Turn off emulator's power

4.3 Characteristics of Target Interface

The target interface (signals connecting the in-circuit emulator and the target system) functionally operates as if an actual device is connected, however, the characteristics may be different than those of the actual device. The target interface of the IE-703228-G1-EM1 is one of those shown in Figures 4-1 to 4-14. The target interface processing of each target device is shown in Table 4-1.

Figure 4-1. Equivalent Circuit A

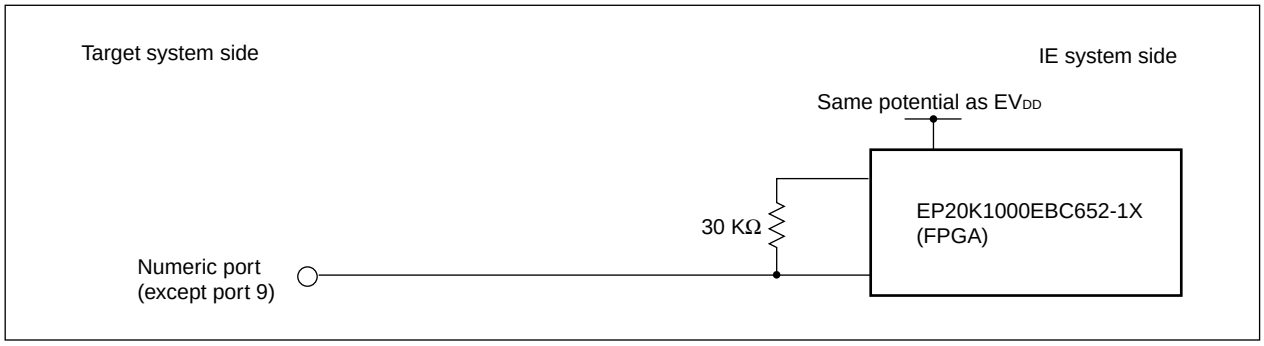


Figure 4-2. Equivalent Circuit B

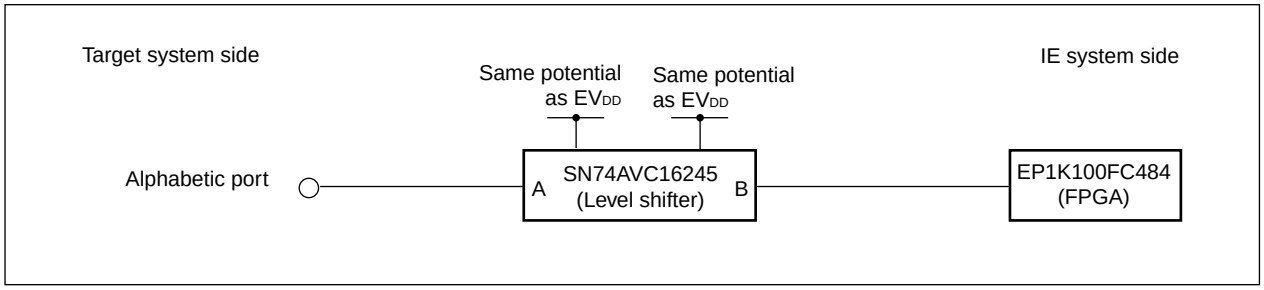


Figure 4-3. Equivalent Circuit C

Remark n: 00, 01, 10, 11, 20, 21, 30, 31, 40, 41, 50, 51

Figure 4-4. Equivalent Circuit D

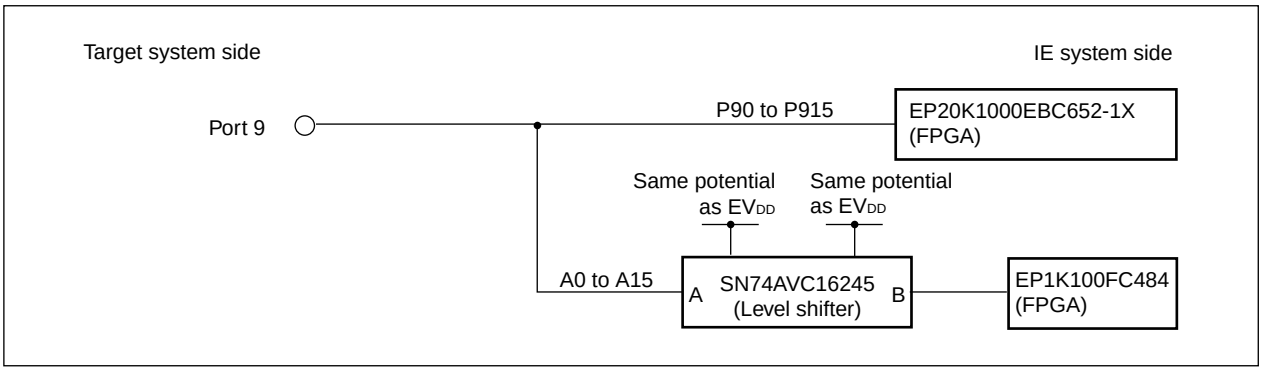
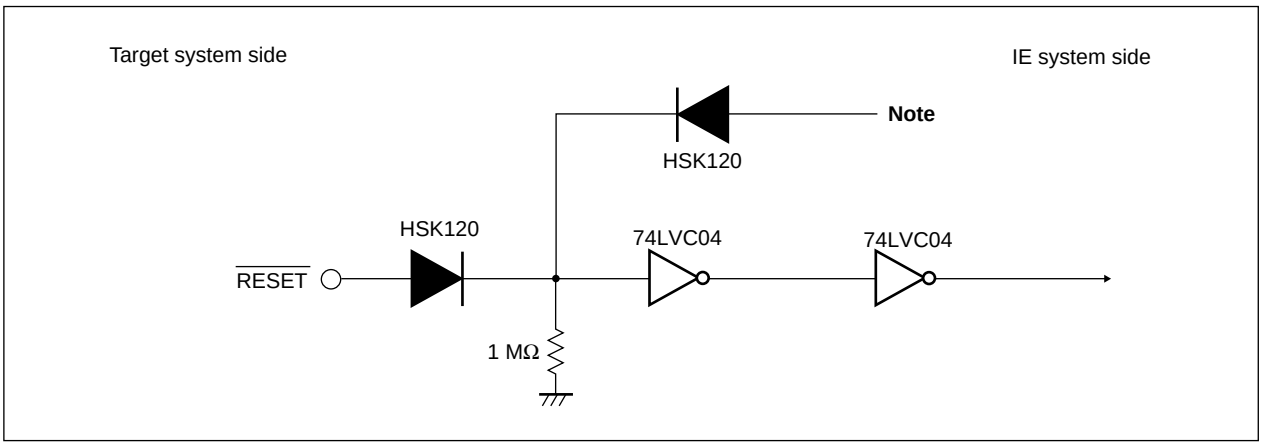


Figure 4-5. Equivalent Circuit E



Note A low level is applied only when the target system is connected and the target's power is turned on. In other cases, a high level is applied.

Figure 4-6. Equivalent Circuit F

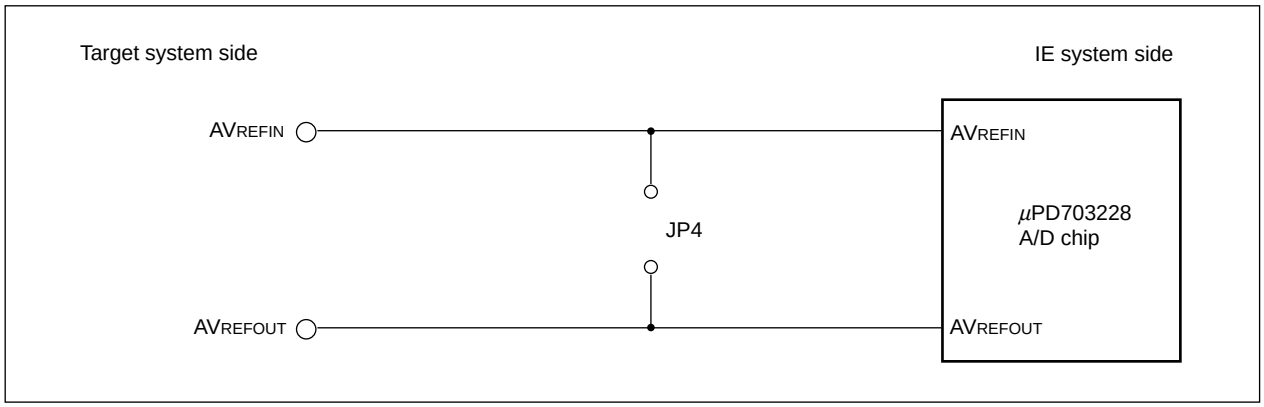


Figure 4-7. Equivalent Circuit G

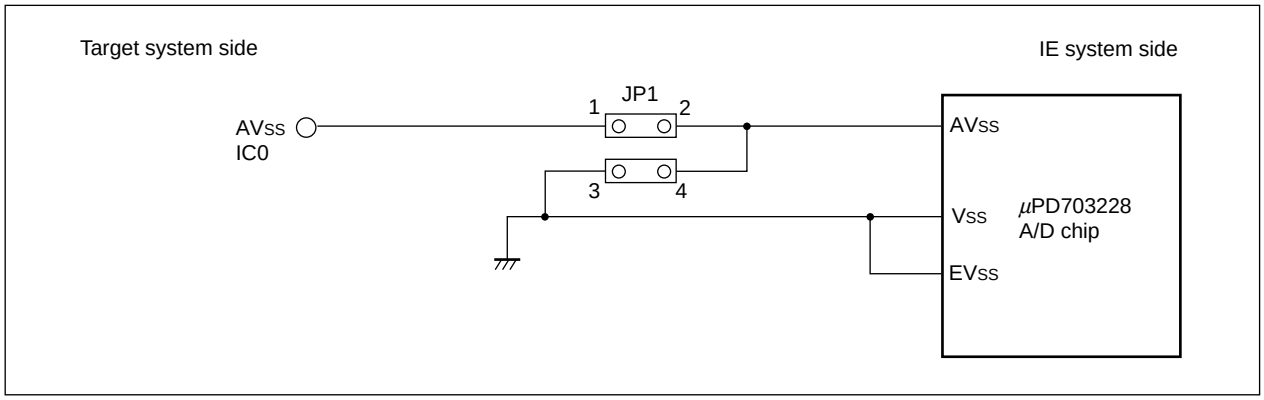


Figure 4-8. Equivalent Circuit H

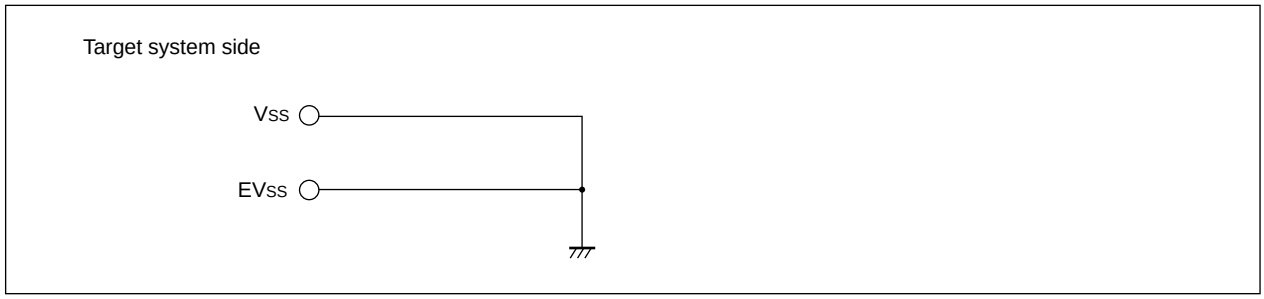


Figure 4-9. Equivalent Circuit I

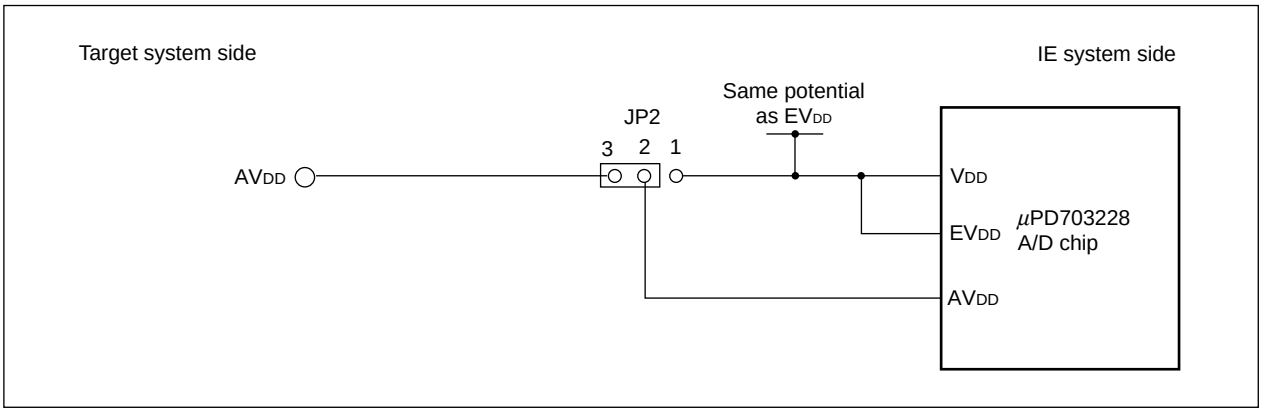


Figure 4-10. Equivalent Circuit J

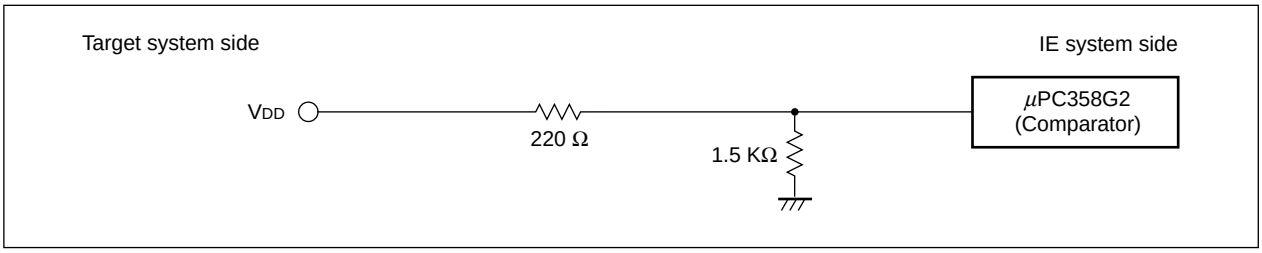


Figure 4-11. Equivalent Circuit K

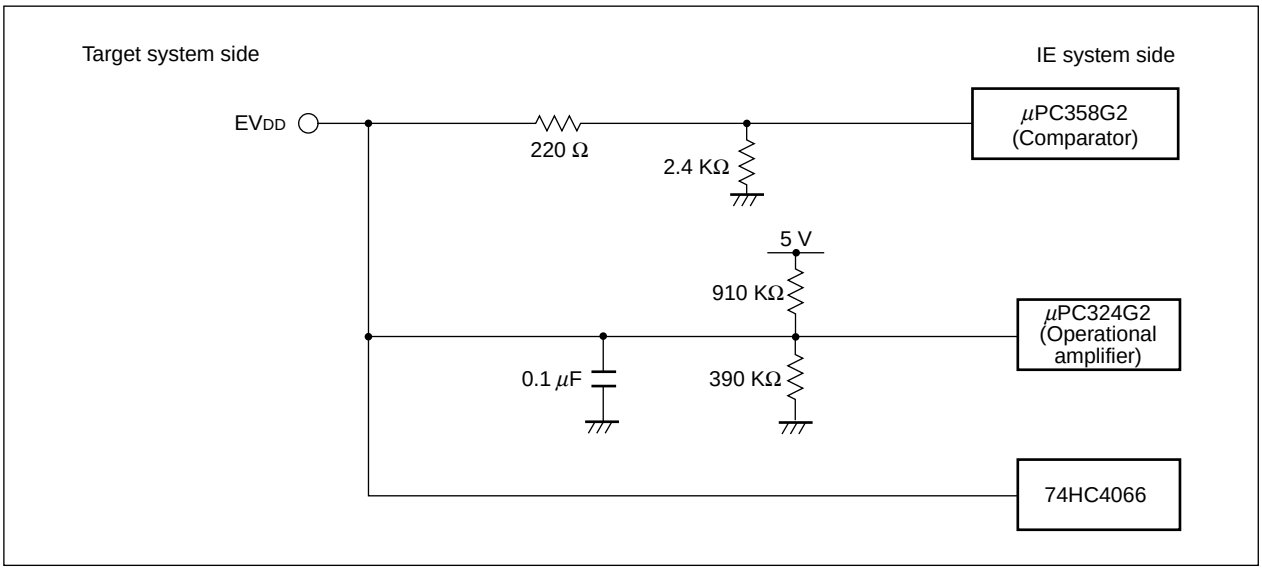


Figure 4-12. Equivalent Circuit L

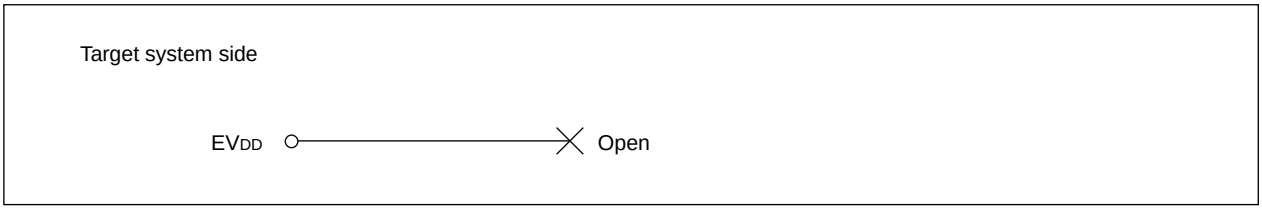


Figure 4-13. Equivalent Circuit M

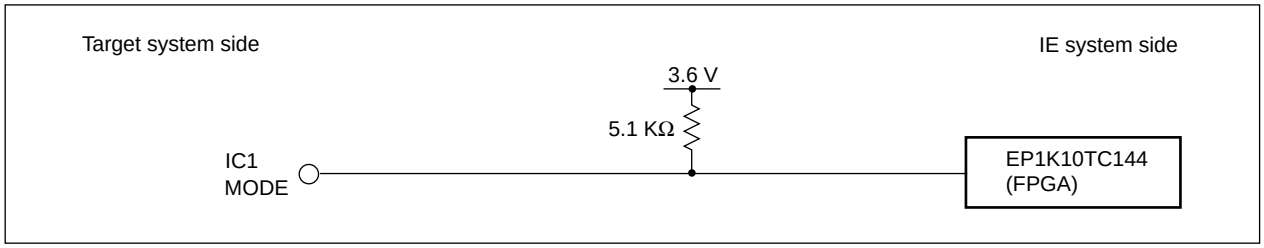


Figure 4-14. Equivalent Circuit N

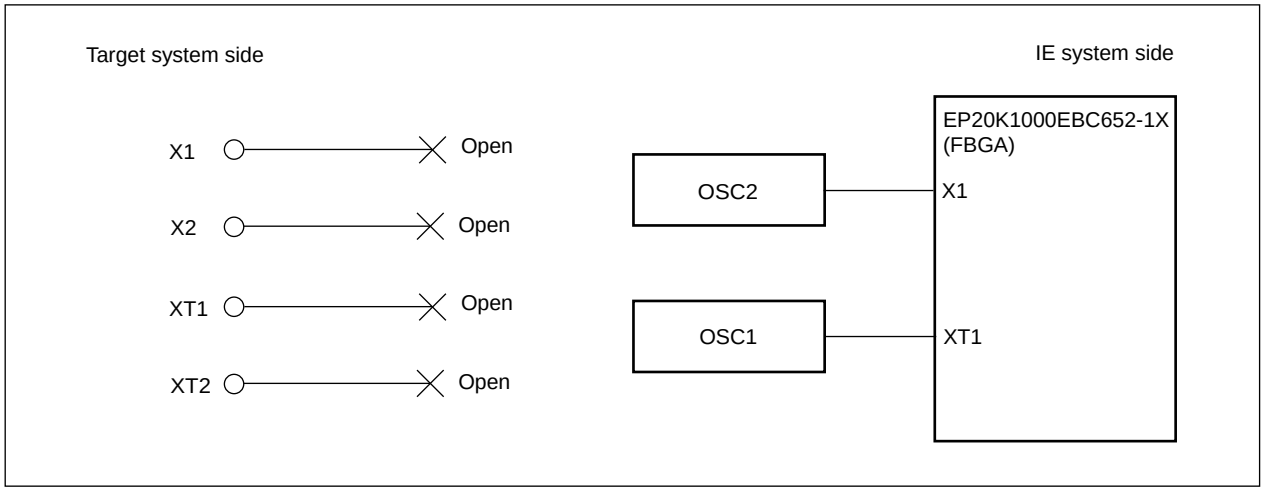


Table 4-1. Pin Correspondence List (1/3)

V850ES/PM1 Pin No.	Target Interface Name (V850ES/PM1 Pin Name)	Processing in In-Circuit Emulator
1	P34/$\overline{SCK1}$	Equivalent circuit A
2	P33/SO1	Equivalent circuit A
3	P32/SI1	Equivalent circuit A
4	P31/TXD0	Equivalent circuit A
5	P30/RXD0	Equivalent circuit A
6	P10/PWM0	Equivalent circuit A
7	P11/TO00/PWM1	Equivalent circuit A
8	P12/TO01/PWM2	Equivalent circuit A
9	P13/TO20/PWM3	Equivalent circuit A
10	P14/TO21/TI21	Equivalent circuit A
11	V_{DD}	Equivalent circuit J
12	V_{SS}	Equivalent circuit H
13	X1	Equivalent circuit N
14	X2	Equivalent circuit N
15	$\overline{RESET}$	Equivalent circuit E
16	XT1	Equivalent circuit N
17	XT2	Equivalent circuit N
18	EV_{SS}	Equivalent circuit H
19	EV_{DD}	Equivalent circuit L
20	P90/A0	Equivalent circuit D
21	P91/A1	Equivalent circuit D
22	P92/A2	Equivalent circuit D
23	P93/A3	Equivalent circuit D
24	P94/A4	Equivalent circuit D
25	P95/A5	Equivalent circuit D
26	P96/A6	Equivalent circuit D
27	P97/A7	Equivalent circuit D
28	P98/A8/TI030	Equivalent circuit D
29	P99/A9/TI031	Equivalent circuit D
30	P910/A10/TI020	Equivalent circuit D
31	P911/A11/TI021	Equivalent circuit D
32	P912/A12/TI010	Equivalent circuit D
33	P913/A13/TI011	Equivalent circuit D
34	P914/A14/TI000	Equivalent circuit D
35	P915/A15/TI001	Equivalent circuit D
36	P20/TO02	Equivalent circuit A
37	P21/TO03	Equivalent circuit A
38	EV_{SS}	Equivalent circuit H
39	EV_{DD}	Equivalent circuit L
40	PCM1/CLKOUT	Equivalent circuit B

Table 4-1. Pin Correspondence List (2/3)

V850ES/PM1 Pin No.	Target Interface Name (V850ES/PM1 Pin Name)	Processing in In-Circuit Emulator
41	PCM0/$\overline{\text{WAIT}}$	Equivalent circuit B
42	PDH0/A16	Equivalent circuit B
43	PDH1/A17	Equivalent circuit B
44	PDH2/A18	Equivalent circuit B
45	PCT0/$\overline{\text{WR0}}$	Equivalent circuit B
46	PCT1/$\overline{\text{WR1}}$	Equivalent circuit B
47	PCT4/$\overline{\text{RD}}$	Equivalent circuit B
48	PDL0/D0	Equivalent circuit B
49	PDL1/D1	Equivalent circuit B
50	PDL2/D2	Equivalent circuit B
51	PDL3/D3	Equivalent circuit B
52	PDL4/D4	Equivalent circuit B
53	PDL5/D5	Equivalent circuit B
54	PDL6/D6	Equivalent circuit B
55	PDL7/D7	Equivalent circuit B
56	PDL8/D8	Equivalent circuit B
57	PDL9/D9	Equivalent circuit B
58	PDL10/D10	Equivalent circuit B
59	PDL11/D11	Equivalent circuit B
60	PDL12/D12	Equivalent circuit B
61	PDL13/D13	Equivalent circuit B
62	PDL14/D14	Equivalent circuit B
63	PDL15/D15	Equivalent circuit B
64	EV_{SS}	Equivalent circuit H
65	EV_{DD}	Equivalent circuit K
66	PCS0/$\overline{\text{CS0}}$	Equivalent circuit B
67	PCS1/$\overline{\text{CS1}}$	Equivalent circuit B
68	PCS2/$\overline{\text{CS2}}$	Equivalent circuit B
69	P40/SI0	Equivalent circuit A
70	P41/SO0	Equivalent circuit A
71	P42/$\overline{\text{SCK0}}$	Equivalent circuit A
72	P43/RXD1	Equivalent circuit A
73	P44/TXD1	Equivalent circuit A
74	P45/INTP101/TO10	Equivalent circuit A
75	P46/INTP111/TO11	Equivalent circuit A
76	P03/INTP2/TI20	Equivalent circuit A
77	P02/INTP1	Equivalent circuit A
78	P01/INTP0	Equivalent circuit A
79	P00/NMI	Equivalent circuit A
80	MODE	Equivalent circuit M

Table 4-1. Pin Correspondence List (3/3)

V850ES/PM1 Pin No.	Target Interface Name (V850ES/PM1 Pin Name)	Processing in In-Circuit Emulator
81	AV_{DD}	Equivalent circuit I
82	ANI00	Equivalent circuit C
83	ANI01	Equivalent circuit C
84	ANI20	Equivalent circuit C
85	ANI21	Equivalent circuit C
86	ANI40	Equivalent circuit C
87	ANI41	Equivalent circuit C
88	AV_{REFIN}	Equivalent circuit F
89	AV_{REFOUT}	Equivalent circuit F
90	ANI51	Equivalent circuit C
91	ANI50	Equivalent circuit C
92	ANI31	Equivalent circuit C
93	ANI30	Equivalent circuit C
94	ANI11	Equivalent circuit C
95	ANI10	Equivalent circuit C
96	IC0	Equivalent circuit G
97	AV_{SS}	Equivalent circuit G
98	IC1	Equivalent circuit M
99	P36/INTP110/TI11/TCLR11	Equivalent circuit A
100	P35/INTP100/TI10/TCLR10	Equivalent circuit A

CHAPTER 5 RESTRICTIONS

The IE-703228-G1-EM1 has the following restrictions.

5.1 Clock Generator

(1) Resonator to be connected
Oscillation by the resonator on the target system is not supported. Therefore, clock oscillation operation on the target system cannot be emulated with the in-circuit emulator.

(2) Emulation of oscillation stabilization time after reset has been released
In the target device for emulation, oscillation stabilization time is inserted after reset has been released; however, it is not inserted in the in-circuit emulator.

(3) Operation clock after reset
In the target device for emulation, the operation clock after reset is $f_{XX}/8$; however, there may be a period in which the clock is not initialized to $f_{XX}/8$ with the in-circuit emulator (depending on the timing of reset release).

5.2 Timing of Setting/Releasing Standby Mode

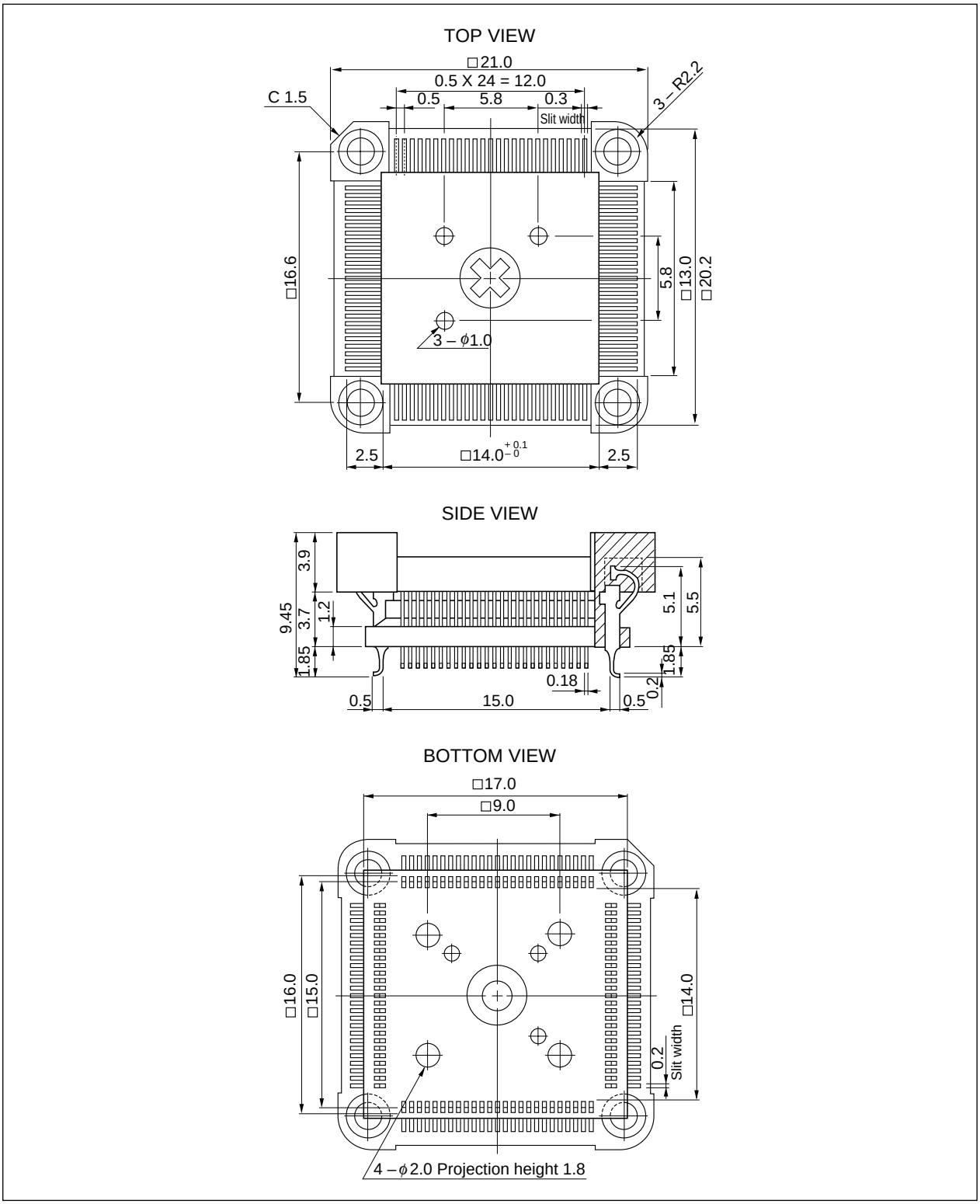
The timing of setting/releasing the standby mode is different between the target device and the in-circuit emulator.
The difference is within 1 clock when standby mode is set, and 2 or 3 clocks when it is released.

5.3 Operation During Break

In the in-circuit emulator, peripheral functions operate during a break, so there may be a difference between the operations of the in-circuit emulator and target device.
(However, while the in-circuit emulator is in the break status, the counter of the watchdog timer stops.)

APPENDIX PACKAGE DRAWINGS

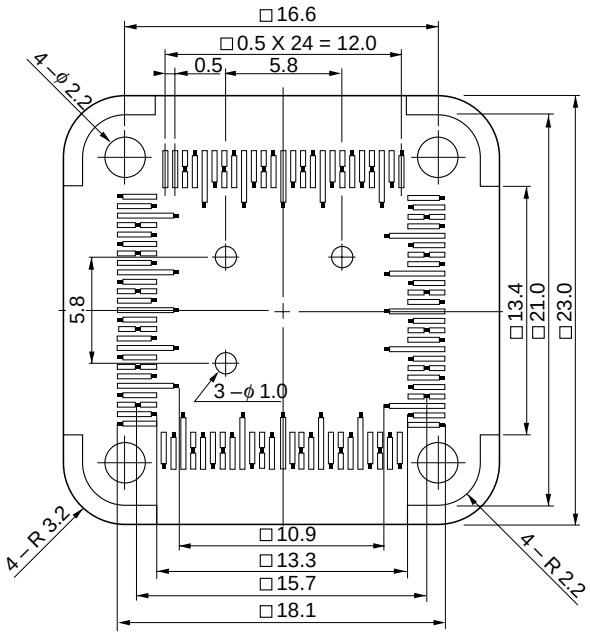
(1) NQPACK100SD (unit: mm)



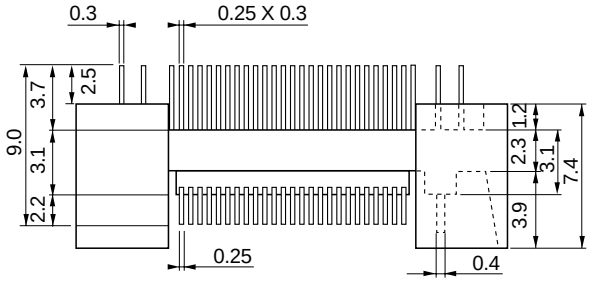
Remark NQPACK100SD is a product of TOKYO ELETECH CORPORATION.

(2) YQPACK100SD (unit: mm)

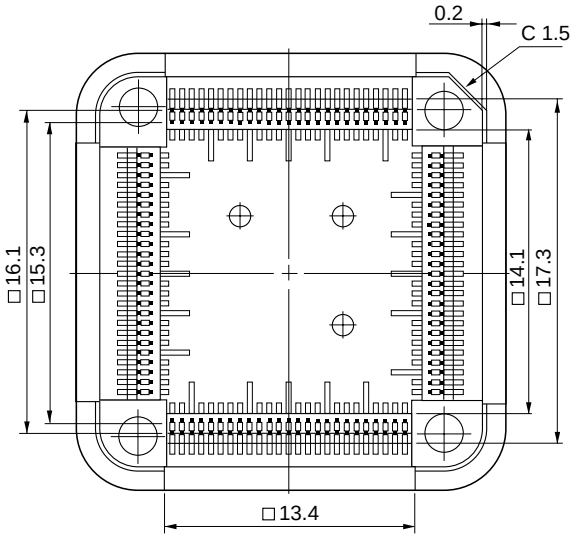
TOP VIEW



SIDE VIEW

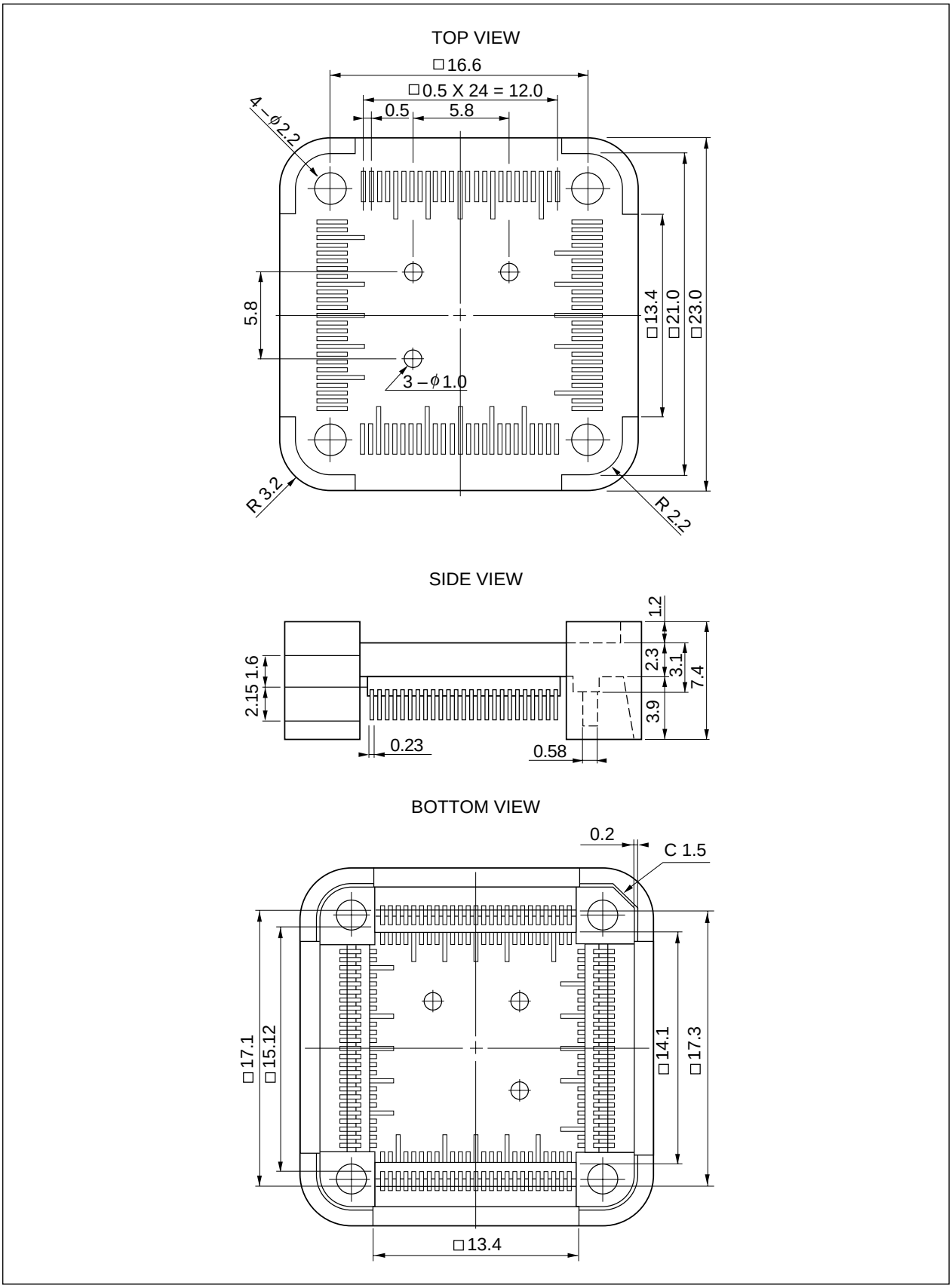


BOTTOM VIEW



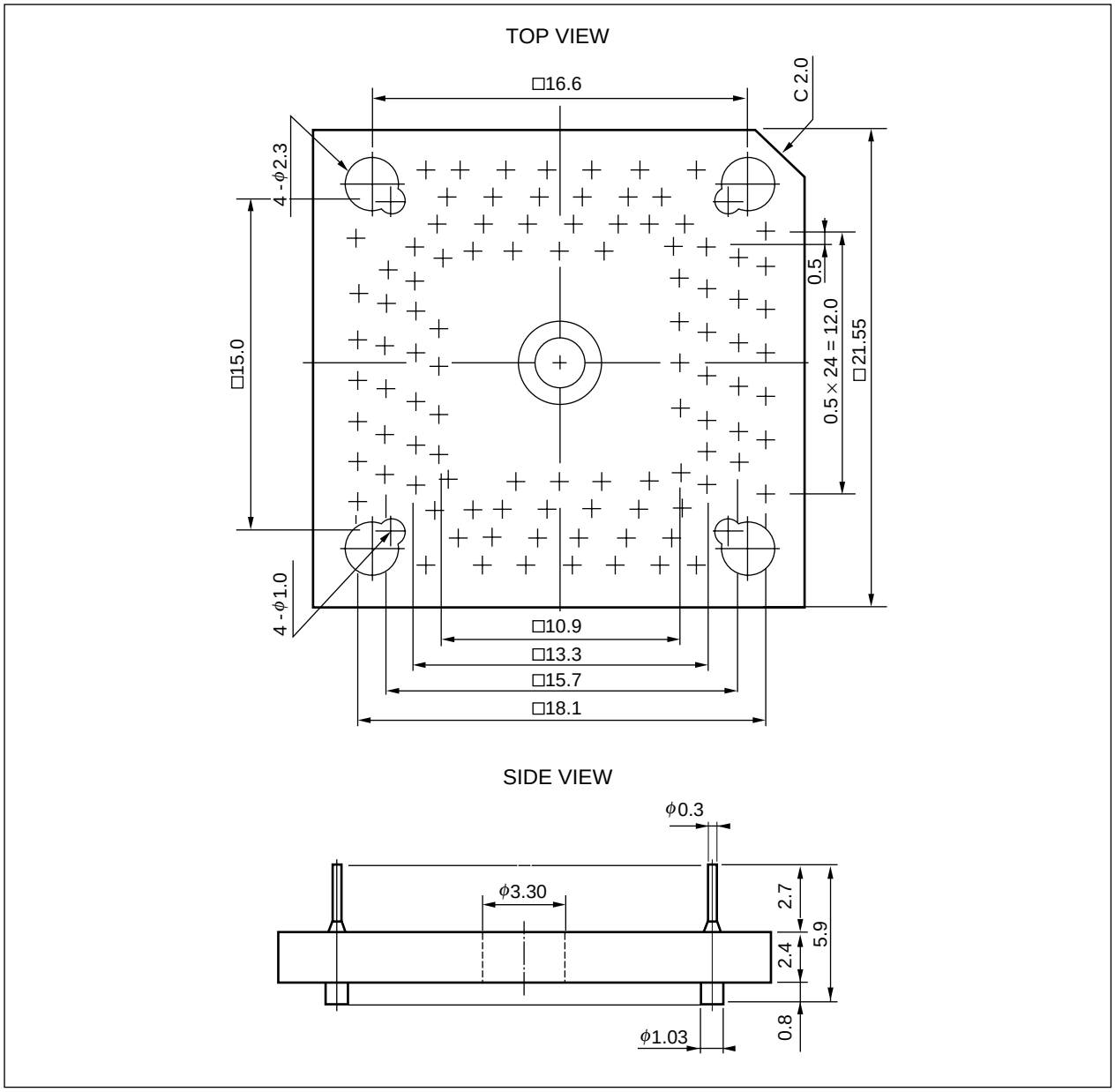
Remark YQPACK100SD is a product of TOKYO ELETECH CORPORATION.

(3) HQPACK100SD (unit: mm)



Remark HQPACK100SD is a product of TOKYO ELETECH CORPORATION.

(4) YQSOCKET100SDF (unit: mm)



Remark YQSOCKET100SDF is a product of TOKYO ELETECH CORPORATION.