NEC

Preliminary User's Manual

QB-V850ERX3

(IECUBE for V850E/RG3)

Target Devices:
µPD70F3464
µPD70F3465
µPD70F3466
µPD70F3467
µPD70F3470
µPD70F3471
µPD70F3472

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NOTES FOR CMOS DEVICES

① VOLTAGE APPLICATION WAVEFORM AT INPUT PIN

Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (MAX) and V_{IH} (MIN) due to noise, etc., the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (MAX) and V_{IH} (MIN).

② HANDLING OF UNUSED INPUT PINS

Unconnected CMOS device inputs can be cause of malfunction. If an input pin is unconnected, it is possible that an internal input level may be generated due to noise, etc., causing malfunction. CMOS devices behave differently than Bipolar or NMOS devices. Input levels of CMOS devices must be fixed high or low by using pull-up or pull-down circuitry. Each unused pin should be connected to V_{DD} or GND via a resistor if there is a possibility that it will be an output pin. All handling related to unused pins must be judged separately for each device and according to related specifications governing the device.

③ PRECAUTION AGAINST ESD

A strong electric field, when exposed to a MOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop generation of static electricity as much as possible, and quickly dissipate it when it has occurred. Environmental control must be adequate. When it is dry, a humidifier should be used. It is recommended to avoid using insulators that easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors should be grounded. The operator should be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions need to be taken for PW boards with mounted semiconductor devices.

④ STATUS BEFORE INITIALIZATION

Power-on does not necessarily define the initial status of a MOS device. Immediately after the power source is turned ON, devices with reset functions have not yet been initialized. Hence, power-on does not guarantee output pin levels, I/O settings or contents of registers. A device is not initialized until the reset signal is received. A reset operation must be executed immediately after power-on for devices with reset functions.

⑤ INPUT OF SIGNAL DURING POWER OFF STATE

Do not input signals or an I/O pull-up power supply while the device is not powered. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Input of signals during the power off state must be judged separately for each device and according to related specifications governing the device.

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Introduction

Target Readers This manual is intended for users who design and develop application systems using the V850E/RG3.

Purpose The purpose of this manual is to describe the proper operation of the QB-V850ERX3, and its basic specifications.

Organization This manual is broadly divided into the following parts.

- Overview
- Setup procedure
- Cautions

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. This manual explains the basic setup procedure, so read this document before using the QB-V850ERX3.

To learn about the basic specifications and operation methods.

→ Read this manual in the order of the **CONTENTS**.

To learn about software settings such as operation methods and command functions.

→ Read the user's manual of the debugger that is used.

Legend Symbols and notation are used as follows:

Weight in data notation	:	Left is high-order column, right is low order column
Active low notation	:	$\overline{xxx}$ (pin or signal name is over-scored) or /xxx (slash before signal name)
Memory map address:	:	High order at high stage and low order at low stage
Note	:	Explanation of (Note) in the text
Caution	:	Item deserving extra attention
Remark	:	Supplementary explanation to the text
Numeric notation	:	Binary... xxxx or xxxB Decimal... xxxx Hexadecimal... xxxxH or 0x xxxx

Prefixes representing powers of 2 (address space, memory capacity)

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

M (mega): $2^{20} = 1024^2 = 1,048,576$

G (giga): $2^{30} = 1024^3 = 1,073,741,824$

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

Term	Meaning
Target device	Refers to the device targeted for emulation.
Target system	Refers to the system targeted for debugging. This includes the target program and the hardware created by the user. In the narrow sense, it means hardware only.

Related Documents When using this manual, refer to the following manuals.

The related documents 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
QB-V850ERX3 In-Circuit Emulator		This manual
CPDW9X/NT-CDR-V85X	GHS integrated development environment (PC, MS Windows based)	Ver.4.2.4 or - current version
V850 Series CPDW9X/NT-CDR-V85X Operating Precautions MULTI 2000 Integrated Development Environment	Customer Notification	DTOP0010V30 - current version
850eserv / Detailed information listing	Read Me File for 850ESERV	850eserv.txt - current version
IEQBUTL / IECUBE Utility	Read Me File for IECUBE Utility IEQBUTL	IEQBUTL_E2.03c.txt or - current version

Note: Download the documents from the **NEC Electronics (Europe) GmbH** web site.
URL: http://www.eu.necel.com/

General Cautions on handling this product

1. NEC Electronics' warranty does not cover the following cases:

    - When the QB-V850ERX3 is disassembled, reconstructed, or modified by the user
    - When the QB-V850ERX3 receives a heavy shock such as being dropped or falling down
    - When the QB-V850ERX3 is used with excessive voltage or is stored outside the guaranteed temperature range or guaranteed humidity range
    - When power is applied while the AC adapter, USB interface cable, or target system is not connected securely
    - When the AC adapter cable, USB interface cable, or extension probe is excessively twisted or stretched
    - When an AC adapter other than the one supplied with the QB-V850ERX3 is used
    - When water is spilled on the QB-V850ERX3

2. Cautions on safe use

    - The QB-V850ERX3 heats up (to approx. 50 to 60°C) when it operates for a long time. Take care not to receive injuries such as burns from a rise in the temperature.
    - Be very careful to avoid electric shocks. There is risk of electric shock if the product is used as described in item 1 above.

[MEMO]

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Chapter 1 Overview

The QB-V850ERX3 (IECUBE) is an in-circuit emulator used to emulate the V850E/RG3 devices. By using IECUBE, hardware and software can be debugged efficiently in system development.

In this manual, the basic setup procedure, hardware specifications, system specifications, and switch settings are described.
This document describes the QB-V850ERX3 as IECUBE.

Figure 1-1: IECUBE

1.1 Hardware Specifications

The IECUBE for V850E/RG3 will support both devices version : the umbrella supports two IO-buffer areas, one for 3.3V and one for 5.0V. Depending on the used exchange adapters, either 5V buffers are active or 3V.
The QB-V850ERX3-ZZZ-EE full in-circuit emulator emulates the following devices:

- (RG3-F512-3V) µPD70F3464, µPD70F3465,µPD70F3466
- (RG3-F768-3V) µPD70F3467
- (RG3-F512-5V) µPD70F3470 µPD70F3471 µPD70F3472

Table 1-1: QB-V850ERX3 Hardware Specifications

Item		Specification
Target device		V850E/RG3 • (RG3-F512-3V) µPD70F3464, µPD70F3465, µPD70F3466 • (RG3-F768-3V) µPD70F3467 • (RG3-F512-5V) µPD70F3470, µPD70F3471, µPD70F3472
Target system interface voltage (unit: V)		MV_{DD5} = 3.0 V ~ 5.5 V, DV_{DD5} = 3.0 V ~ 5.5 V, BV_{DD5} = 3.0 V ~ 5.5 V, AV_{DD} = 3.2 V ~ 5.5 V, SMV_{DD5} = 3.2 V ~ 5.5 V, V_{DD5} = 3.2 V ~ 5.5 V, V_{SS5} = BV_{SS5} = DV_{SS5} = SMV_{SS5} = MV_{SS5} =AV_{SS} = 0 V
Maximum operating frequency		80 MHz
Clock Function		8Mhz and 16Mhz selectable on IO-board. Default setting 8 MHz
Operating temperature range		0 to 40°C (without condensation)
Storage temperature range		-15 to 60°C (without condensation)
Package dimensions		See below
Power consumption	AC adapter for IECUBE	15 V, 1 A
	Target system power supply	Lower than that of target device
Weight		475 g - 537 g
Host interface		USB interface (1.1 and 2.0)

1.2 System Specifications

The QB-V850ERX3 function will be realized with the Rx3 umbrella device, which is a special debug device for the Rx3 device family. Compared to a standard IECUBE structure, the QB-V850ERX3-IO with the Rx3 umbrella on it will replace the –EM and –IO board function on one board.
New Exchange Adapter's are required : the interface to the 3V or 5V buffer of the Rx3 umbrella device is realized by the related EA-adapter. The target adapter is identical to the standard V850 IECUBE family adapter line.
For the target function emulation, the Rx3 umbrella provides the function/pins of the Rx3 device for 3.3V and alternative for 5.0V.

Figure 1-2: Debug unit

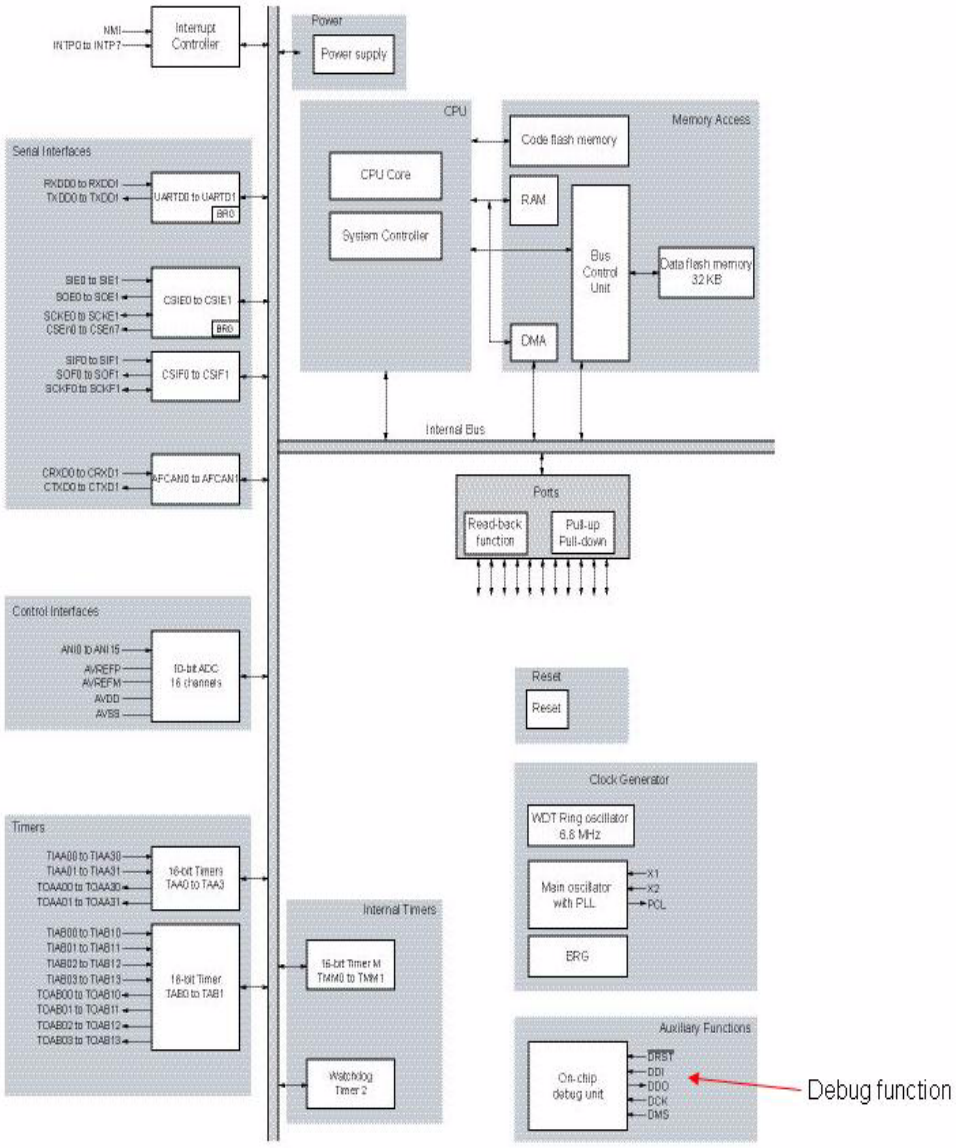


Table 1-2: QB-V850ERX3 System Specifications

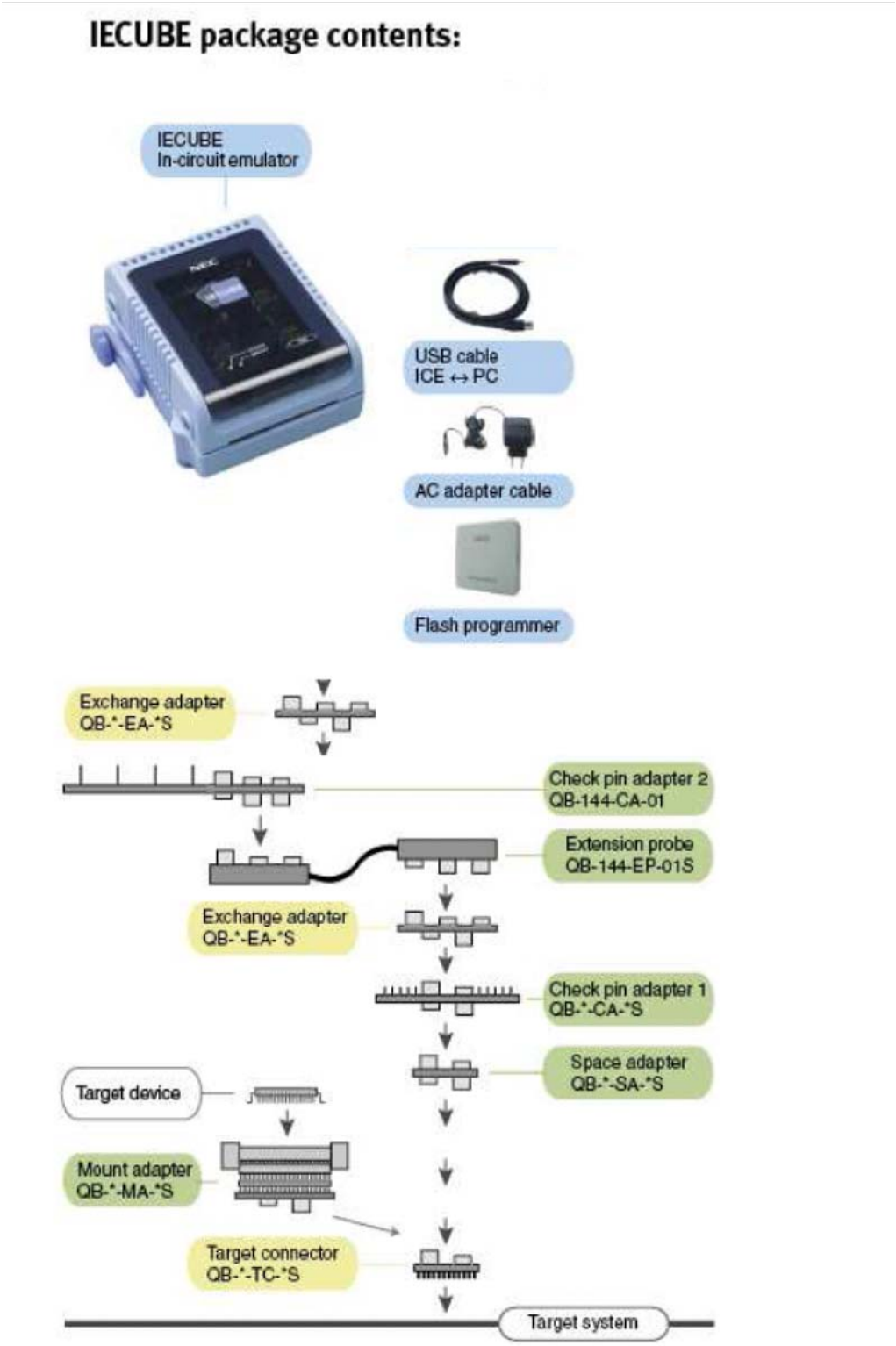
Function		Specification
Emulation	Internal ROM	1 Mbyte (Maximum)
Memory capacity	Internal RAM	60 Kbyte (Maximum)
	External memory	16Mbyte (Maximum) on MM-board
Program execution function	Real-time execution function	Go, Start From Here, Go & Go, Come Here, Restart, Return Out
	Non-real-time execution function	Step In, Next Over, Slow Motion
Break function	Hardware break	Execution: 10 points Access: 6 points
	Software break	2000 points (debugger related)
	Fail-safe break	Non-map, I/O illegal, write protect
	Other	Trace full break, Manual Break, Timer Over Flow Break
Trace function	Trace data type	Branch source PC, branch destination PC, all PCs, all execution data, access data, access address, R/W status, time stamp, DMA point (start/end)
	Trace mode	Speed Priority, Trace Priority
	Trace event	Delay trigger, section, qualify
	Memory capacity	256k frames
Real-time RAM monitor function		256 bytes × 8 points
Time measurement function	Measurement clock	Measurement-dedicated clock or CPU clock
	Measurement target	Program execution start to end Start event to end event
	Maximum measurement time	About 195 hours (when measurement-dedicated clock is used)
	Minimum resolution	20 ns
	Number of timers used for measurement	8
	Measurement result	Execution time (execution start to end) Max., min., Average, pass count (between events)
	Other	Timer overflow break function (1 point)
Coverage function		Optional (under development)
Other functions		Mapping function, event function, register manipulation function, memory manipulation function

Caution: Some of the functions may not be supported, depending on the debugger used.

1.3 System Configuration

The system configuration when connecting the QB-V850ERX3 to a PC (PC98 series or PC/AT compatible) is shown below. USB interface that enables communication based on USB (Ver1.1 or Ver2.0). The target connection usable is shown in the picture below.

Figure 1-3: Typical System Configuration



1.4 Order code of target adapter

Table 1: Order code of adapters

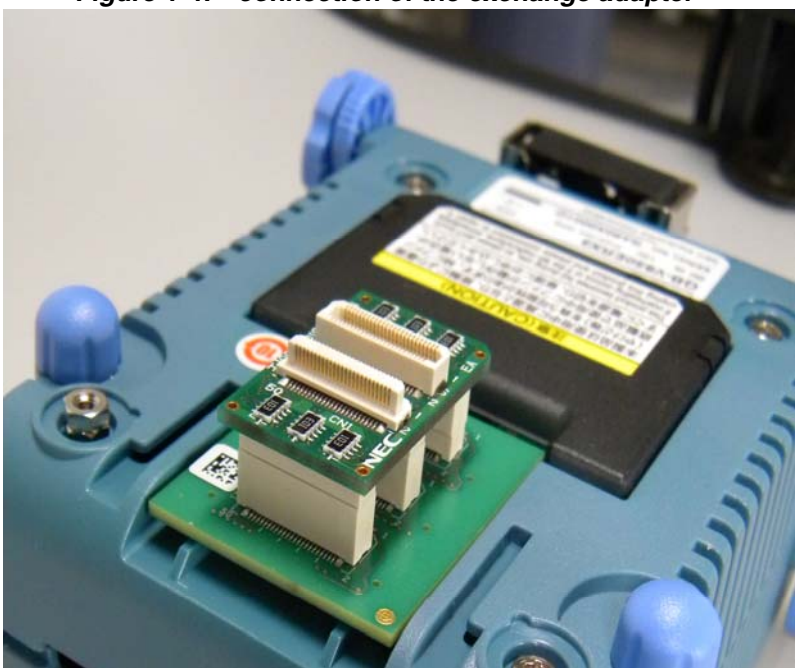
Adapter	Order code	
Exchange Adapter 3V/5V	QB-V850ERX3-EA-5V or QB-V850ERX3-EA-3V[Note]	mandatory
Exchange adapter	QB-100GC-EA-01S (sold separately)	mandatory
Target connector	QB-100GC-TC-01S (sold separately)	mandatory
Emulation probe	QB-144-EP-02S (sold separately)	optional
Check pin adapter	QB-144-CA-01S (sold separately)	optional
Check pin adapter	QB-100-CA-01S (sold separately)	optional
Space adapter	QB-100-SA-01S (sold separately)	optional

Note: This is part of package content

Table 2: Order code of device adapter

Device adapter	Order code	
Mount Adpater	QB-100GC-MA-01S (sold separately)	optional

Figure 1-4: connection of the exchange adapter



On the previous figure (Figure 1-4: on page 20) a default setup is shown: QB-V850ERX3-EA-5V & QB-100GC-EA-01S
Please observe the unique usage for each exchange adapter as follow

- "QB-V850ERX3-EA-5V use only for 5V devices
- "QB-V850ERX3-EA-3V use only for 3V devices

1.5 Packing Contents

The packing box of the QB-V850RX3-ZZZ-EE contains the following. Make sure that these items are included.

- Items included with QB-V850RX3-ZZZ-EE
  - (1) QB-V850ERX3 In Circuit Emulator
  - (2) AC adapter
  - (3) USB interface cable
  - (4) QB-MINI2 flash programmer
  - (5) Exchange adapter (3V & 5V type)
  - (6) Clock adapter (8MHz & 16MHz)
  - (6) Readme First
  - (7) Registration Card
  - (8) CE “Note”
  - (9) QB-V850RX3-ZZZ-EE package contents list

Chapter 2 IECUBE Setup Procedure

This chapter describes the procedure for setting up the QB-V850ERX3.
Perform setup using the following procedure.
See **2.1 "Names and Functions of Hardware" on page 24** for the positions of switches and clocks.

(1) Device selection

The different Power for the IO-interface is selected by hardware via an EA-adapter connection. Two EA-adapter are required for adapting the QB-V850ERX3-IO board to the target connector.
For the 3.3V or 5V I/O selection, each EA-adapter can be identified by a special pin. The selection is also checked by device file. If the device file selection does not match with the EA adapter, a message will appear. This is important to prevent damage of the IECUBE or target hardware by wrong voltage supply.

(2) Clock settings

A 16.000 MHz crystal is mounted at shipment for main clock.
The Ring clock is generated internally only.
There is no need to change the setting. When different type of crystal (e.g. same as on the target system) shall be used, follow instructions given in this manual.
See **2.2 "Removing Acrylic Board" on page 25** and **2.3 "Clock Settings" on page 26** when changing the crystal.

(3) Software setup

See **2.5 "Software Setup" on page 29**.

(4) Connecting IECUBE to target system

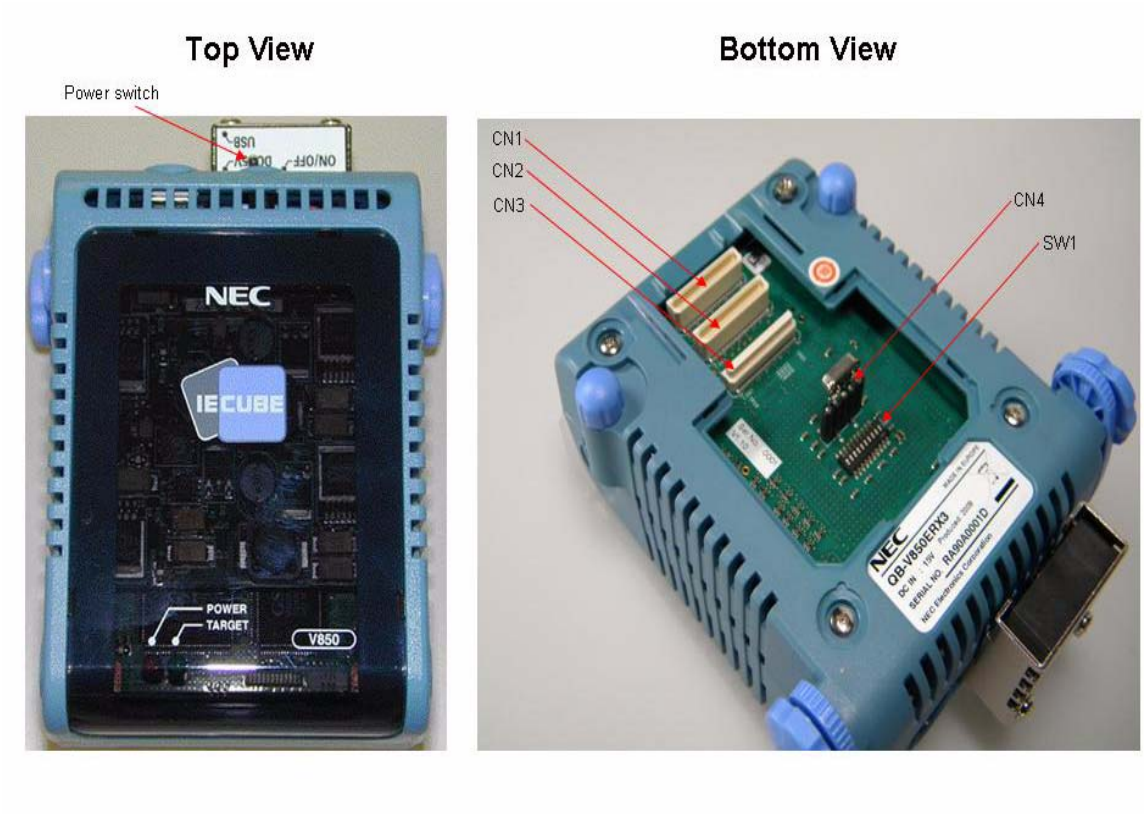
See **2.6 "Connecting IECUBE to Target System" on page 30**.

(5) Power application/shutdown

See **2.7 "Power Application/Shutdown" on page 30**.

2.1 Names and Functions of Hardware

Figure 2-1: Names and Functions in QB-V850ERX3



(1) CN1, CN2, CN3

These are connectors used to connect the exchange adapter or extension probe.

(2) Clock adapter board connector (for clock) CN4

This is a clock connector used for mounting the crystal.
A 16 MHz crystal and capacitors, that configure an oscillator circuit are mounted at shipment.
(See **2.3 "Clock Settings" on page 26** for details.)

(3) SW1

This is a switch whose setting should be set in case of special emulation.
It is set to default at shipment.
(See **2.4 "Target IECUBE Settings" on page 28** for details.)

(4) POWER (red LED)

This is an LED that indicates whether or not the power to IECUBE is on.

LED Status	IECUBE Status
Lit	The power supply is on.
Extinguished	The power supply is off, or the AC adapter is not connected to IECUBE.
Blinking	An error has occurred internally. (Contact an NEC Electronics sales representative or distributor.)

(5) TARGET (green LED)

This is an LED that indicates whether or not the power to the target system is on.

LED Status	Target System Status
Lit	The power supply to the target system is on.
Extinguished	The power supply to the target system is off, or the target system is not connected.

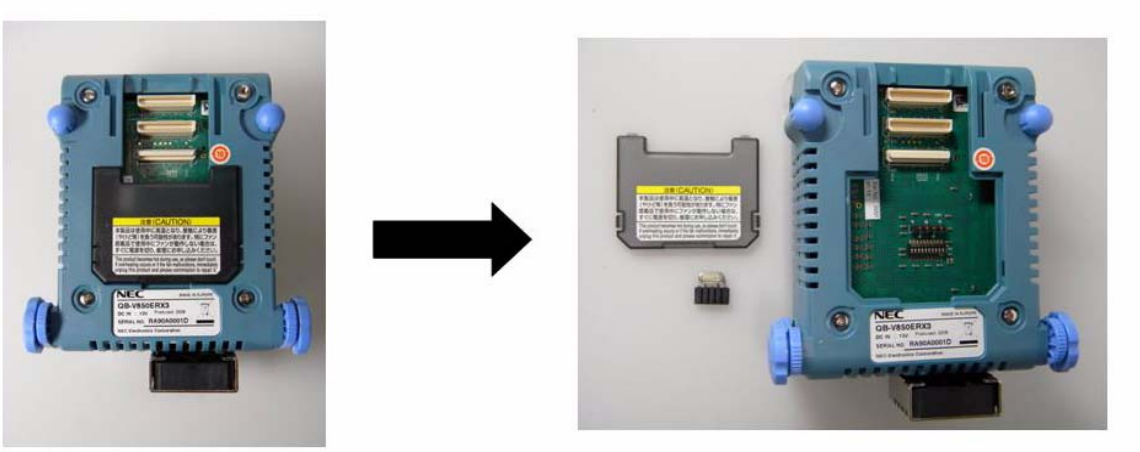
(6) Power supply switch

This is a power switch for IECUBE. This switch is turned off at shipment.

2.2 Removing Acrylic Board

Remove the acrylic board on the bottom surface of IECUBE before changing the settings of jumpers or clocks.
The acrylic board can be removed by pulling it up.

Figure 2-2: Removing Acrylic Board



2.3 Clock Settings

2.3.1 Overview of clock settings

Note: Default setting at shipment: clock adapter board is plugged in.There is no need to change the clock settings for standard use. Only in case of special setting required by customer this is described herewith.

The default setting is mounted with an 16.000MHz crystal. To make the adapatation to 16MHz, the crystal has to be changed.

(1) Use the 16.000 MHz crystals mounted on the clock board on IECUBE as the internal clock for the V850E/RG3 3.3V derivate.
(2) Mount a 8.000 MHz types of crystals onto the clock board on IECUBE. This configuration is used for the V850E/RG3 5V derivate.
(3) The clock input from target system without using clock board one IECUBE is not recommended**Note**

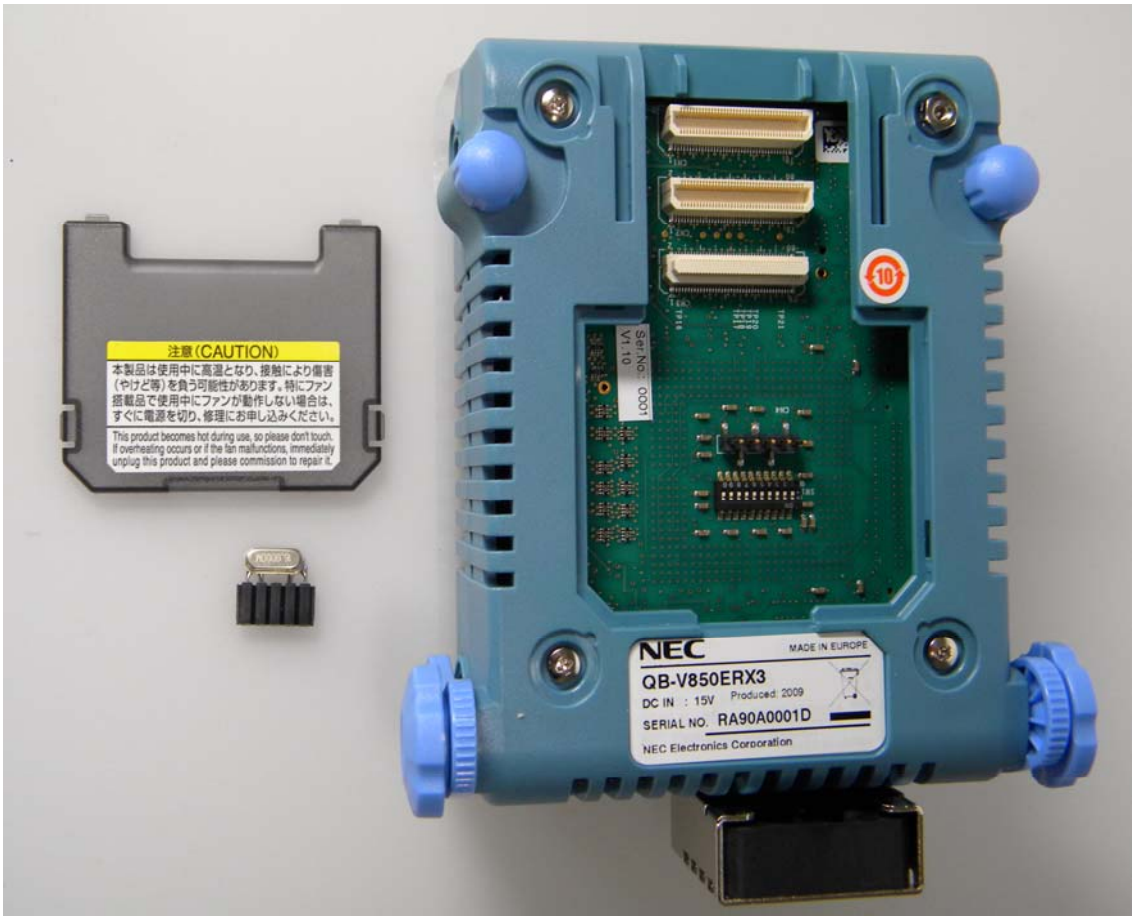
The different settings are done with different crystals (8 or 16MHz) via the CN4. This is a single row connector of 2.54mm. The default is assembled with 8MHz crystal / 10pF ceramic capacitors.

Note: The IECUBE does not support clock input from the target system. The function by using target system clock is not guaranteed.

2.3.2 How to change crystal

<1> Remove the clock adapter board. Be careful not to damage IECUBE. Resolder the parts of X1 and X2 by another type. Plug in clock adapter board again.

Figure 2-3: Clock Adapter Board - Parts Assembling



The connection is done as follow

Pin	1	2	3	4	5
Signal	GND	X1	GND	X2	GND
Capacitor	x	x		x	x
Crystal		x		x	

2.4 Target IECUBE Settings

The SW1 is set to a reserved configuration. Please do not change the setting shown in the below table to avoid any function trouble with the IECUBE.

Position	1	2	3	4	5	6	7	8	9	10
On										
Off	x[note]	x[note]	x[note]	x[note]	x[note]	x[note]	x[note]	x[note]	x[note]	x[note]

Notes: 1. The setting is reserved

2.5 Software Setup

2.5.1 When a debugger other than ID850QB (such as Multi) is used

The GHS Multi version should be V4.2.3 or later (check for actual patches and updates).
A preliminary device file including a header file is supplied e.g. df3472.800; Version E2.00a or later;

For connection to the IECUBE, please use actual files.

- 850eserv2.exe; Version V2.005 or later
- EX850G32.dll; Version V1.85c or later (version for Rx3)

For the connection of the emulator, use the following command line as an example:

connect 850eserv2 -iecube -id ffffffffffffffffffff -ip=C:\GHS\multi516C\v850e -df=df3472.800 -noiop;

The flash mask option are identical to the device

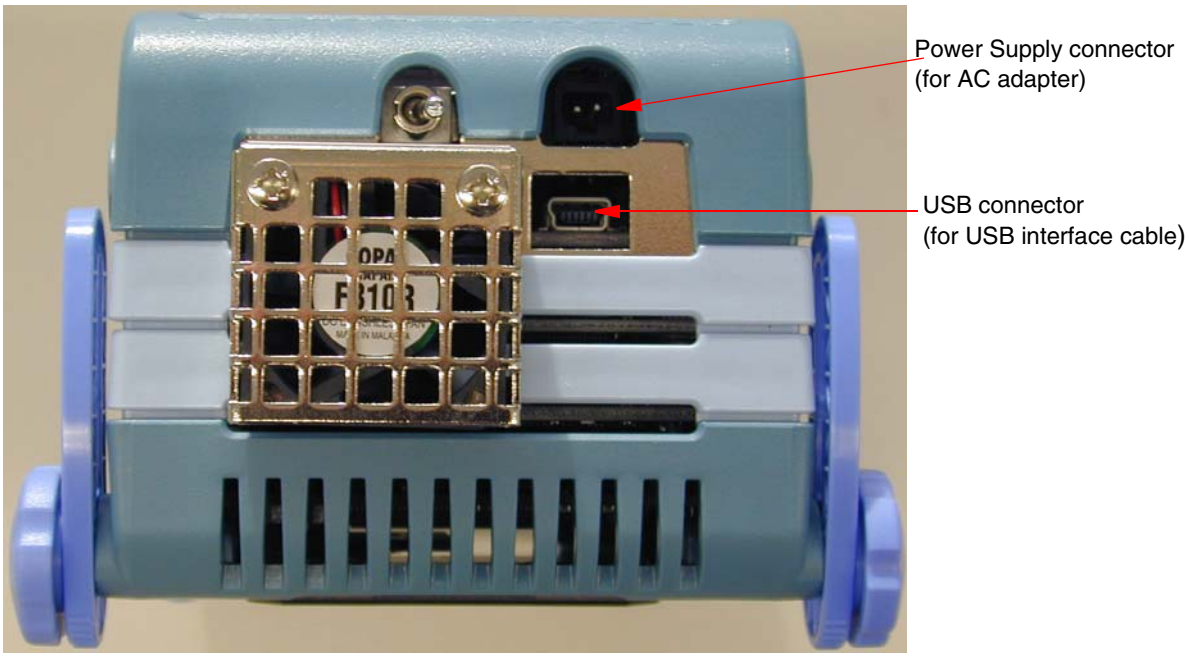
e.g. #define OPTION_BYTE 0x3C,0x7C,0x3C,0x7C,0x3C,0x7C -- 80MHz

2.6 Connecting IECUBE to Target System

2.6.1 Connecting USB Interface Cable and AC Adapter

Connect the computer and IECUBE using the USB interface cable supplied with IECUBE.
Insert the power supply connector on the rear side of IECUBE and insert the AC adapter plug supplied with IECUBE in the outlet. See Figure 2-4 for the connector position of IECUBE.
The AC adapter can support voltages from 100 V to 240 V by exchanging the AC plug. A 100 V AC plug is mounted at shipment. To use IECUBE with 220 V or 240 V, exchange the AC plug for one that supports 220 V or 240 V (both included with IECUBE).

Figure 2-4: Connector Position



2.7 Power Application/Shutdown

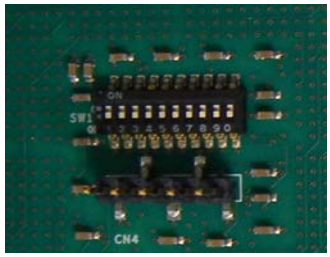
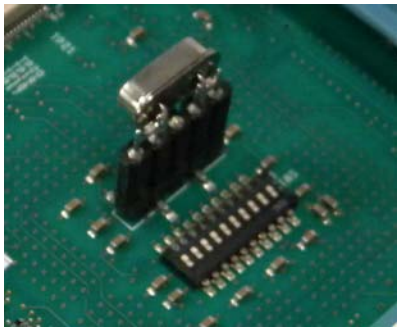
Be sure follow the sequence shown below when activating or terminating the emulator; **otherwise the target system or IECUBE may be damaged**.

- When activating the emulator:
  Apply power to IECUBE → Apply power to the target system[Note] → Activates the debugger.
- When terminating the emulator:
  Terminate the debugger → Shut down power to the target system → Shut down power to IECUBE.

Note: This step is not required when the target system is not connected.

Chapter 3 List of Factory Settings

Table 3-1: List of Factory Settings

Item	Settings	Remark
SW1		See **2.4 "Target IECUBE Settings" on page 28** for details. For QB-V850RX3-ZZZ-EE factory setting changed. See 2.4
CN4		The clock adapter board is plugged on CN8. See **2.3 "Clock Settings" on page 26** for details.
Power supply switch		This switch is turned off at shipment.

[MEMO]

Chapter 4 Differences Between Target Device and IECUBE

This chapter explains the differences on using the IECUBE to the V850E/RG3 devices.

4.1 Differences to device functions

4.1.1 Interface pins, electrical characteristics

The electrical characteristic of the pins differ on these pins, not emulated directly by the peripheral emulation chip.

(1) Ports

- emulated by Rx3 umbrella (emulation chip)

(2) Clock

- XT1, XT2, X1, X2 not used

(3) Power :

- internal supply in standalone mode (no target connected)
- External supply on AVDD, BVDD, VDD

On both modes, the power consumption might differ to the device.

(4) Ground

- there is a common ground used
- One ground pin (VSS30/pin13) will be used for target connection detection. A pull up of 10K is used

(5) RESETZ

A pull down of 47K is used. The input characteristic differs from the microntroller.

(6) FLMD0

Not used.

(7) REGCx

Not used.

The electrical characteristic of all signals will be different to the device. This is based on the PCB wiring, all used connectors and the target probe wiring. These results in an additional load on all pins and therefore the characteristic and the timing of the signals will be influenced. This should be taken into consideration by using the ICE on the target board.

4.1.2 Functions different emulated

(1) iRAM

The content of the iRAM will be unchanged after a RESET/Power off/on.
This behaviour may differ from the real device. In the real device the content of the iRAM may change after a RESET/Power off/on.

(2) RESETZ1/ RESETZ0

In Rx3 umbrella chip, the target reset input pins RESETZ0 (RESETZ of 3V i/f) and RESETZ1 (RESETZ of 5V i/f) does not latch the operation mode. In Rx3 umbrella chip, external target resets can be masked by extended DCU register function.

(3) Break function

Break can not be used during the self programming under debug.

(4) REGC

This pin is not connected to target hardware

4.1.3 Functions not supported

- ROM correction
- OCDM register function is not used in Rx3 umbrella device. The debug i/f is always enabled independent of OCDM register settings.
- External Flash programming : External Flash programming is not supported by the IECUBE.

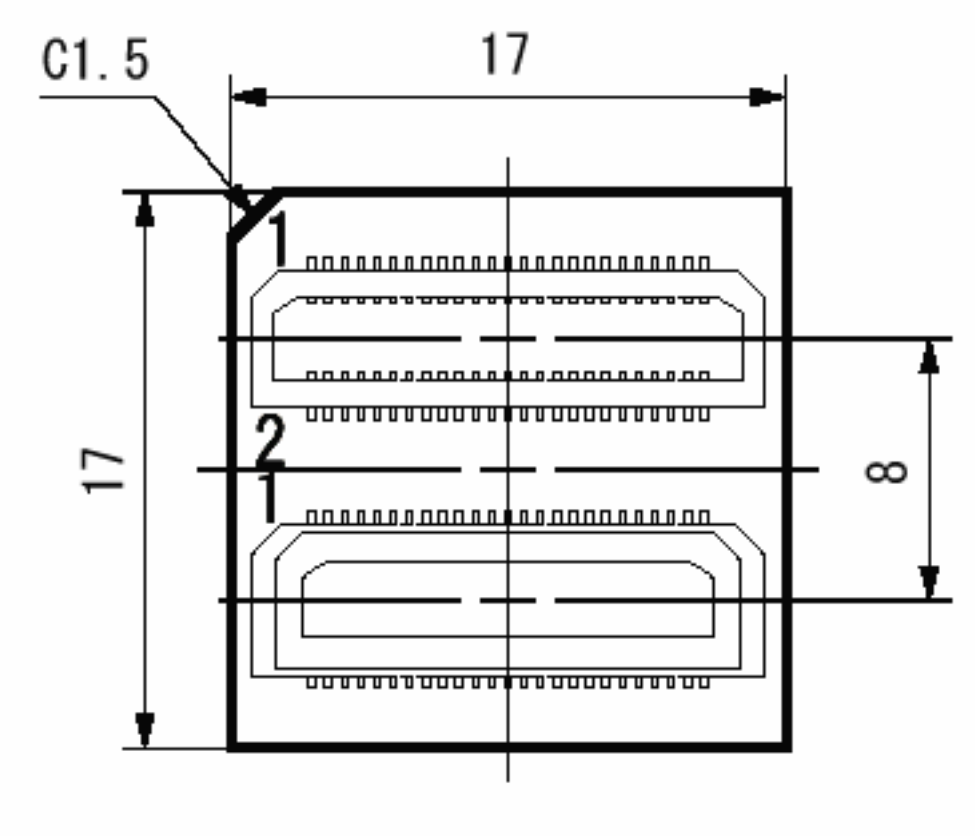
4.2 Download of the software for debug

The download for program code might be longer than a standard IECUBE, because it uses the flash of the emulation device and not the RAM as the standard IECUBE. For timing programmation, please refer to the datasheet of the device.

Chapter 5 Connector Package Drawings

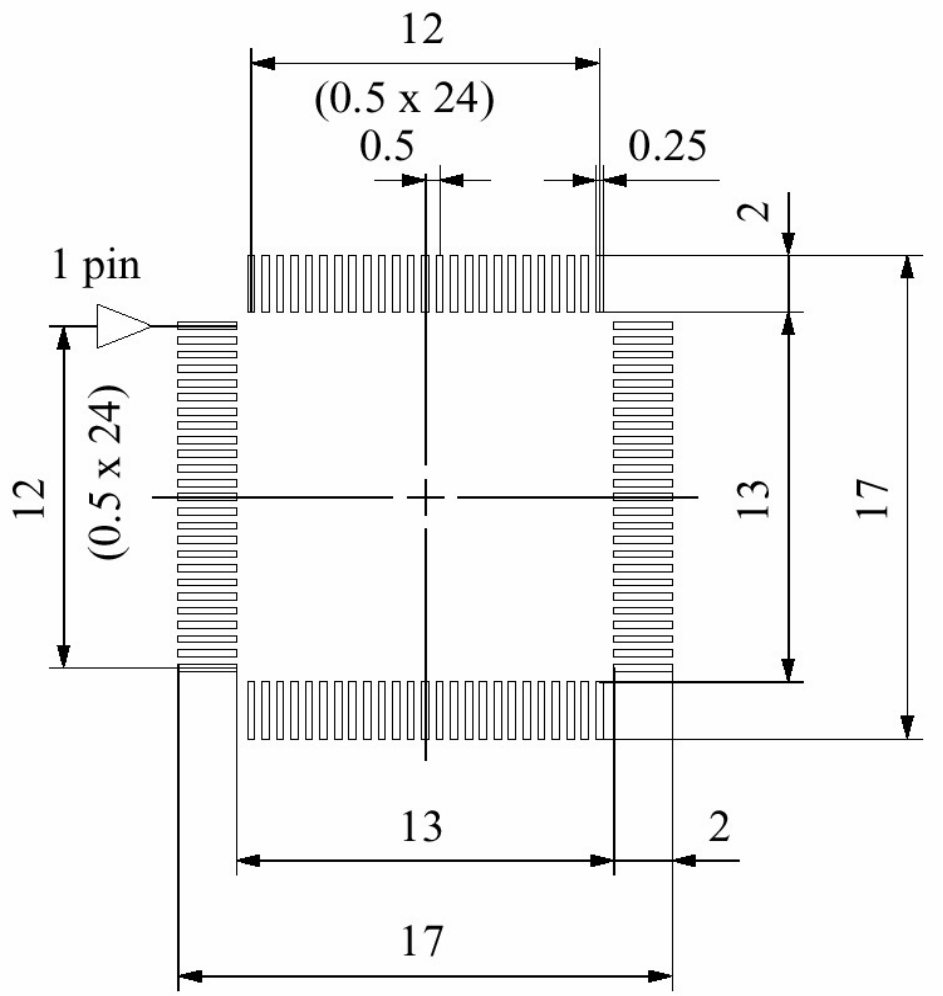
5.1 Target Connector

Figure 5-1: Target Connector for 100-pin



5.2 Foot Patterns of Target Connectors

Figure 5-2: Foot Pattern of Target Connector for 100-pin



5.3 Exchange Adapter

Figure 5-3: Exchange Adapter for 100-pin top view

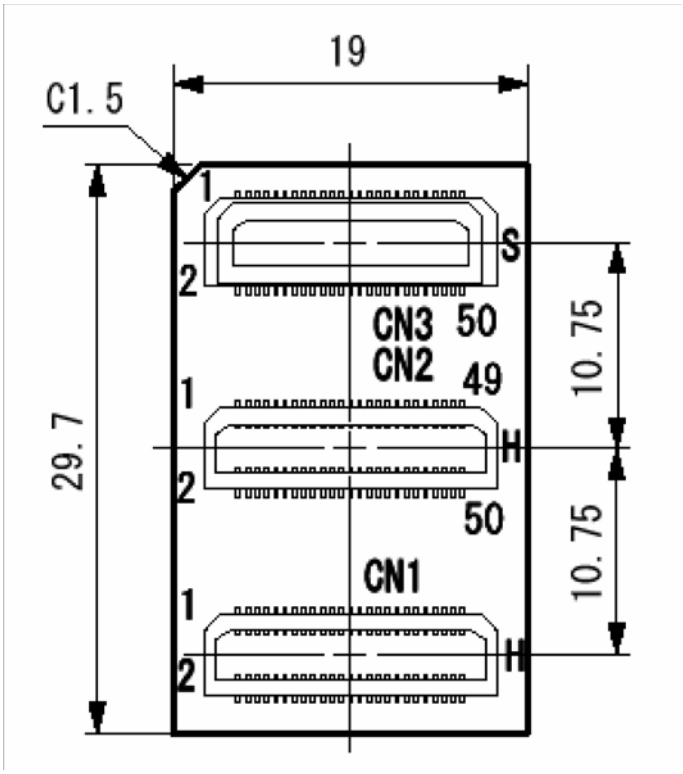
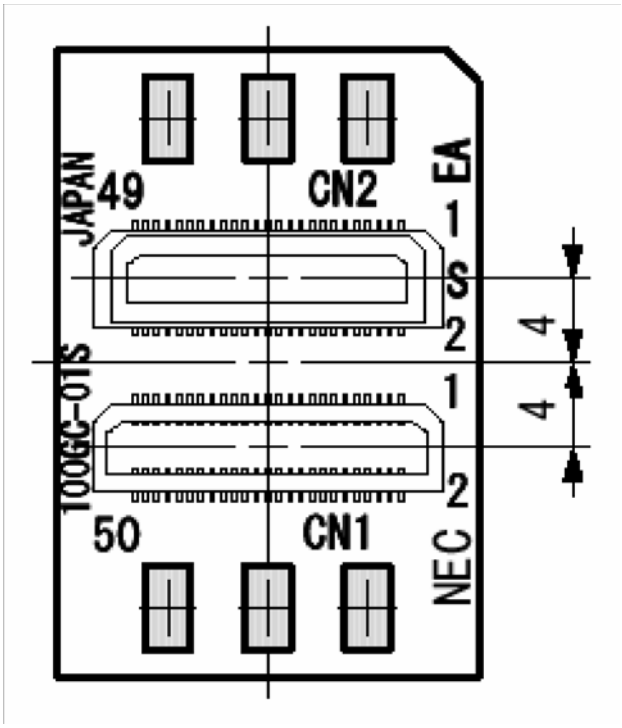


Figure 5-4: Exchange Adapter for 100-pin bottom view



5.4 Mounting Adapter

Figure 5-5: Top view Mounting Adapter for 100-pin

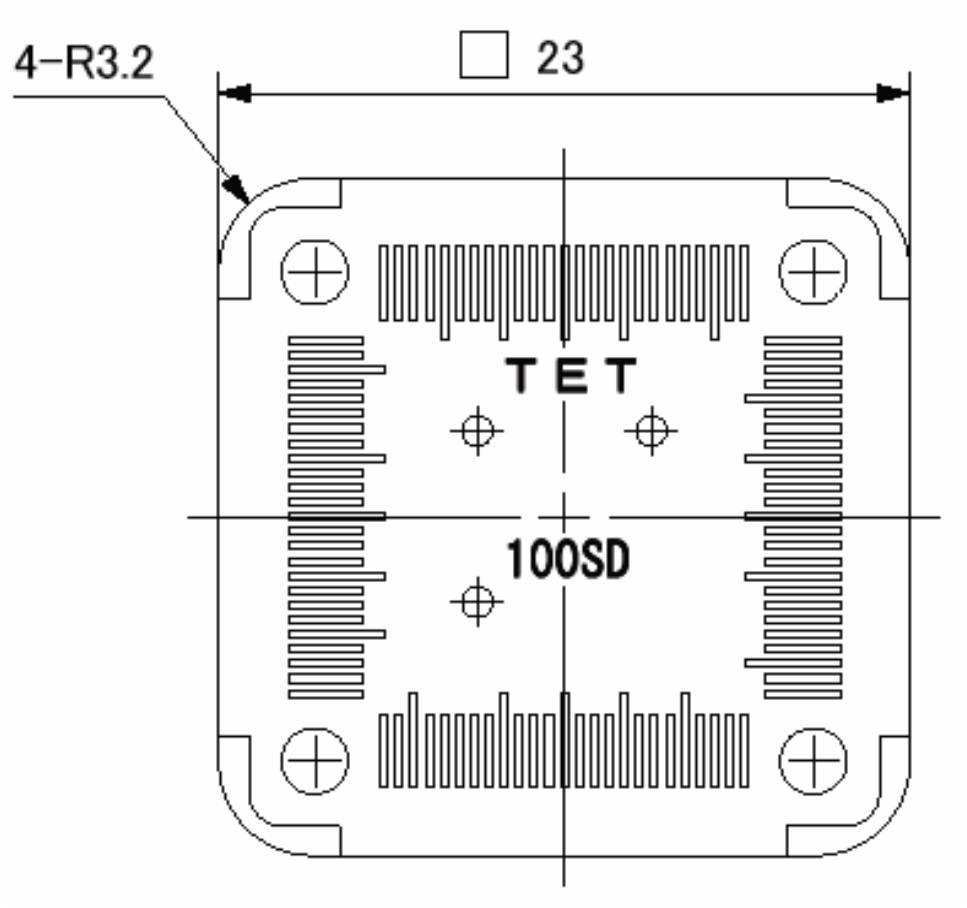


Figure 5-6: Side view Mounting Adapter for 100-pin

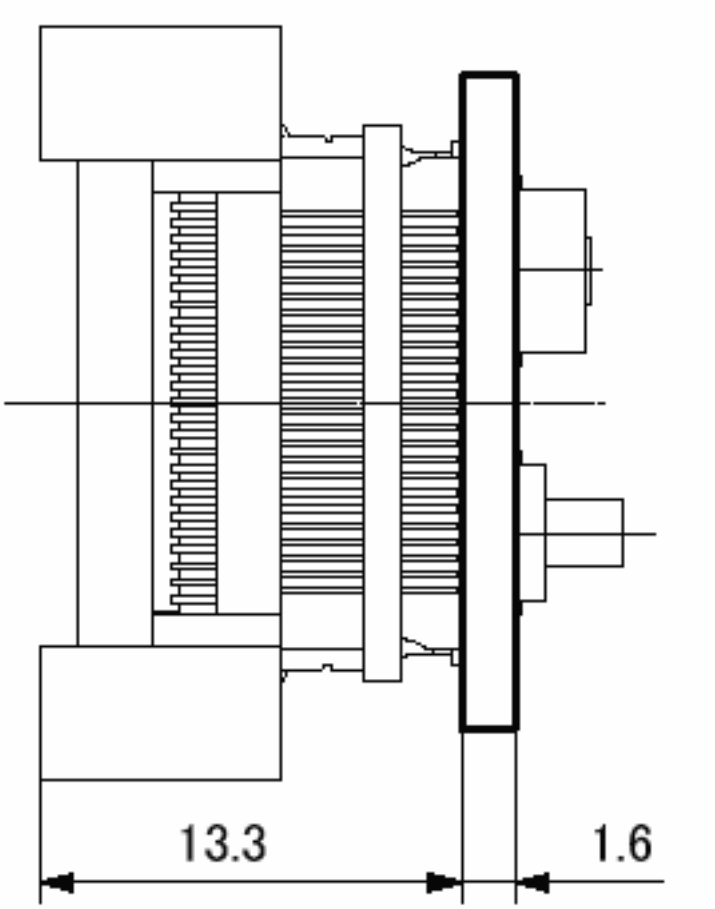
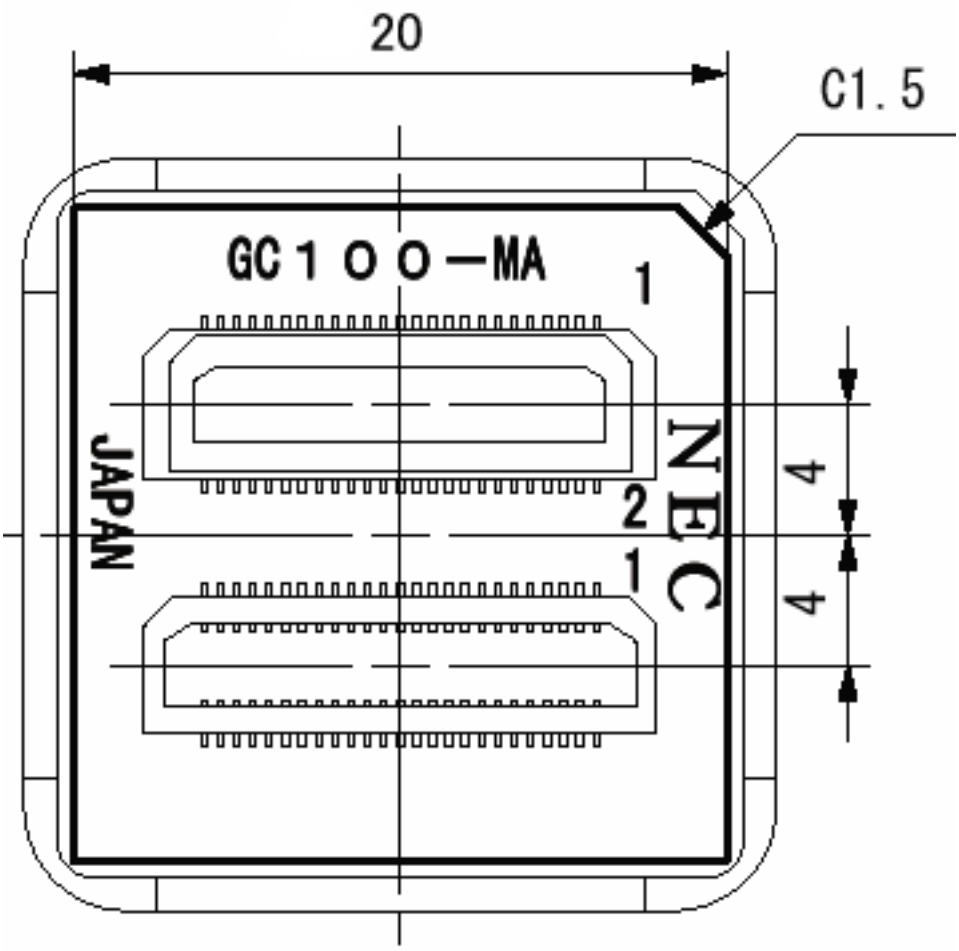


Figure 5-7: Bottom view Mounting Adapter for 100-pin



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