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RENESAS

Preliminary User's Manual

QB-780822 for CAN ASSP3+

In-Circuit-Emulator

Target Device
µPD780821
µPD780822
µPD78F0822

Document No. U17172EE1V2UM00
Date Published September 2005

Printed in Germany

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- Product release schedule
- Availability of related technical literature
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Introduction

Target Readers

This manual is intended for users who wish to perform debugging using the QB-780822. The readers of this manual are assumed to be familiar with the device functions and usage, and to have knowledge of debuggers.

Purpose

This manual is intended to give users an understanding of the basic specifications and correct usage of the QB-780822.

Organization

This manual is divided into following parts.

- General
- Setup procedure
- Settings at product shipment
- Differences between target device and target interface circuit
- Cautions
- Restrictions

How to read this manual

It is assumed that the readers of this manual have general knowledge in the fields of electrical engineering, logic circuits, and microcontrollers.

This manual describes the basic setup procedures and how to set switches.

To understand the overall functions and usages of the QB-780822
Æ Read this manual according to the **CONTENTS**.

To know the manipulations, command functions, and other software-related settings of the QB-780822
Æ See the user's manual of the debugger (supplied with the QB-780822) to be 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 the terms used in this manual are described in the table below.

Terms	Meaning
Target device	This is the device to be emulated.
Target system	This is the system to be debugged. This includes the target program and the hardware provided by the user.
µPD78(F)0822/1	Generic name indicating µPD780821, µPD780822, µPD78F0822

Related Documents Please use the following documents in conjunction with this manual.
The related documents listed below may include preliminary versions. However, preliminary versions are not marked as such.

Document Name		Document Number
QB-780822 In-Circuit Emulator		This manual
ID78K0-QB Ver. 2.81 Integrated Debugger	Operation	U16996E
IAR ICC78000 C Compiler	Programming Guide	ICC78000
IAR A78000 Assembler	Programming Guide	A78000
IAR XLINK	XLINK Linker and XLIB Librarian	XLINK
IAR EMbedded Workbench	Interface Guide	EW78000

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

General Precautions for Handling This Product

1. Circumstances not covered by product guarantee

- If the product was disassembled, altered, or repaired by the customer
- If it was dropped, broken, or given another strong shock
- Use at overvoltage, use outside guaranteed temperature range, storing outside guaranteed temperature range
- If power was turned on while the AC adapter, USB interface cable, or connection to the target system was in an unsatisfactory state
- If the cable of the AC adapter, the USB interface cable, the emulation probe, or the like was bent or pulled excessively
- If an AC adapter other than the supplied product was used
- If the product got wet

2. Safety precautions

- If used for a long time, the product may become hot (50°C to 60°C). Be careful of low temperature burns and other dangers due to the product becoming hot.
- Be careful of electrical shock. There is a danger of electrical shock if the product is used as described above in **1 Circumstances not covered by product guarantee**.

[MEMO]

Table of Contents

List of Figures

List of Tables

Chapter 1 General

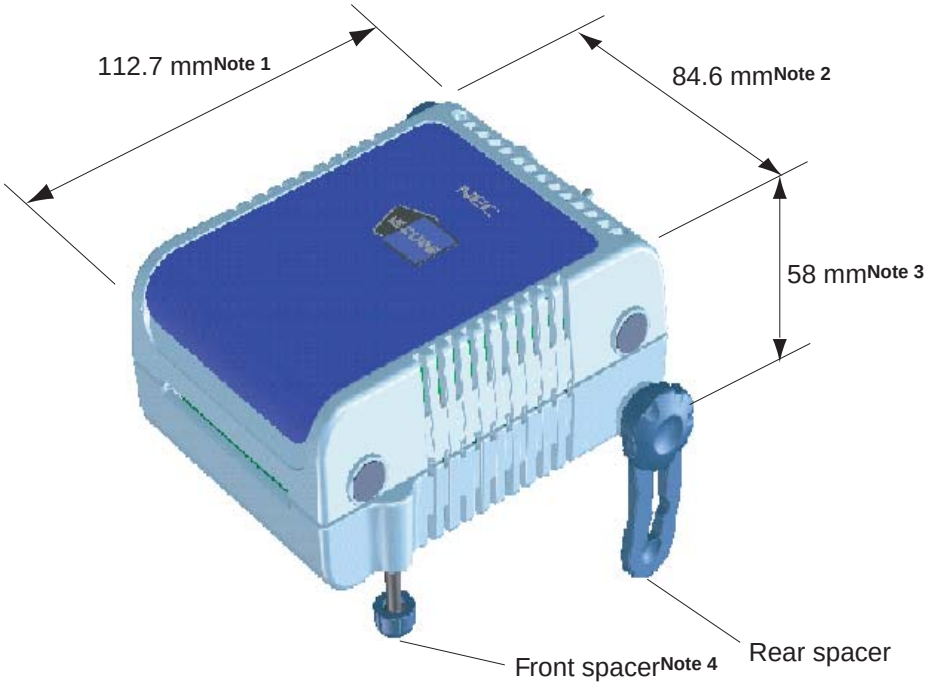
The QB-780822 is an in-circuit emulator for emulating the µPD78(F)0822/1.
Hardware and software can be debugged efficiently in the development of systems in which the µPD78(F)0822/1 is used. This manual descries basic setup procedures, hardware specifications, system specifications, and how to set switches.

1.1 Hardware Specifications

Table 1-1: QB-780822 Hardware Specifications

Parameter		Specification	
Target device		µPD78(F)0822/1	
Operating voltage	µPD78(F)0822/1	4.0 to 5.5 V	
Operating frequency	µPD78(F)0822/1	Main system clock	V_{DD} = 4.0 to 5.5 V: 16 MHz
		Subsystem clock	V_{DD} = 4.0 to 5.5 V: 32.768 kHz
		Ring clock	V_{DD} = 4.0 to 5.5 V: 240 kHz (Typ.)
Operating temperature range		0 to 40°C (No condensation)	
Storage temperature range		-15 to 60°C (No condensation)	
External dimensions		See figure below	
Power consumption	AC adapter for QB-780822	15 V, 1 A	
	Target system power supply	Same level as target device. Deviations based on emulation structure possible.	
Weight		382 g	
Host interface		USB interface (1.1, 2.0)	

Figure 1-1: QB-780822



Notes: 1. Does not include projection of power switch

2. Includes projection of screw that fixes rear spacer

3. Dimension when rear spacer is made shortest (88 mm when longest)

4. Front spacer can vary from 20 mm (longest) to 5 mm (shortest)

1.2 System Specifications

This section shows the QB-780822 system specifications.

Table 1-2: QB-780822 System Specifications

Parameter		Specification
Program execution functions	Real-time execution function	Go, Start from Here, Go & Go, Come Here, Restart, Return Out, Ignore break points and Go
	Non-real-time execution function	Step execution
Break functions	Event break	Execution: 8 points Access: Byte 8 points, word 2 points
	Software break	2000 points
	Pre-execution break	16 points
	Fail-safe break	Exists
	Other	Forcible break, trace full break, trace delay break, time-out break, timer overflow break
Trace functions	Trace data types	Program address, program data, access address, access data, status
	Trace modes	Full trace, section trace, qualify trace
	Trace functions	Delay function, full stop function
	Memory capacity	128 K frames
Real-time RAM monitoring function		All spaces
Time measurement functions	Measurement clock	50 MHz or CPU clock
	Measurement objects	Beginning through end of program execution Start event through end event
	Maximum measurement time	Approximately 24 hours (Resolution 41 µs)
	Minimum resolution	20 ns (Measurement time: 85 seconds)
	Number of timers for measurement	Start through end of program execution: 1 Start event through end event: 2
	Measurement results	Maximum, minimum, average, cumulative, number of passes (between events)
	Other	Timer overflow break function, time-out break function
Other functions		Mapping function, event function, coverage function, snapshot function, DMM function, stub function, power-off emulation function, pin mask function

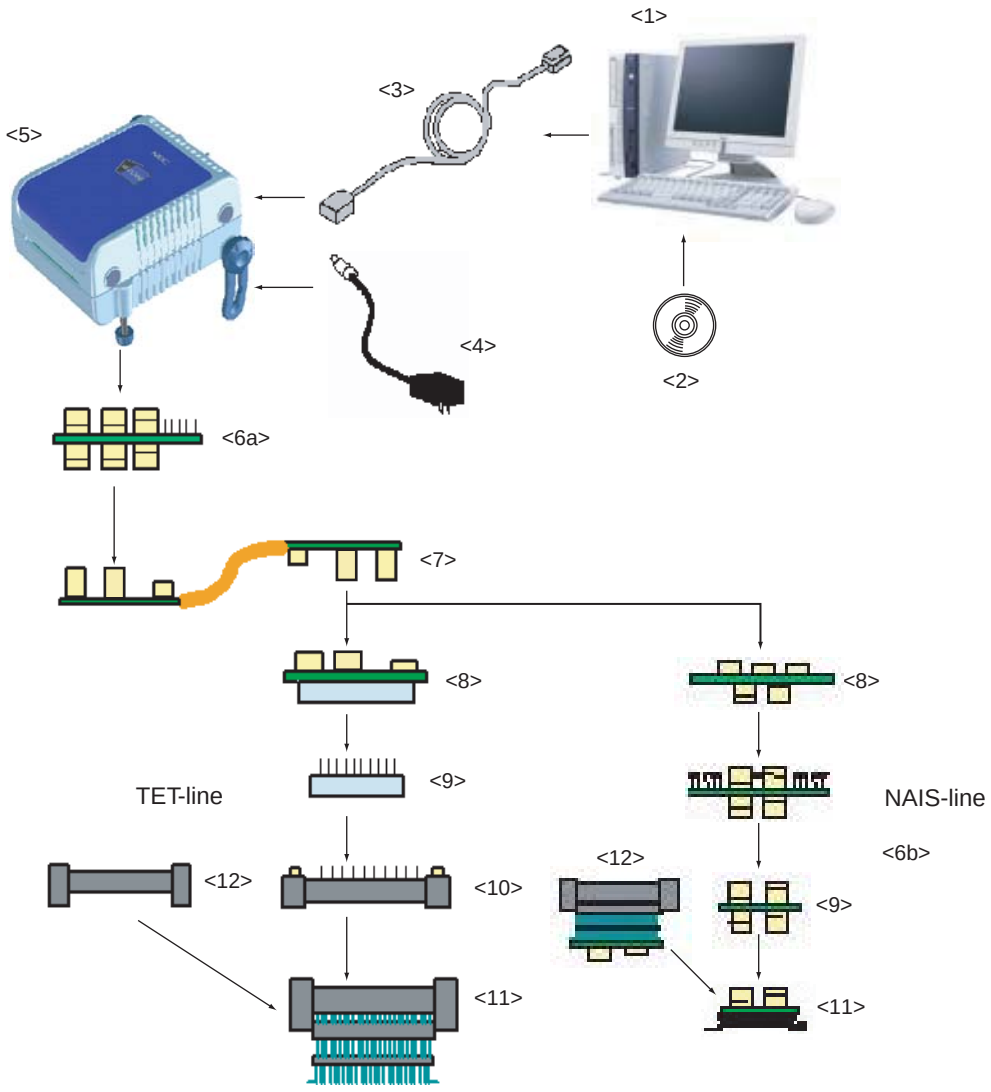
1.3 System Configuration

This section shows the system configuration when using the QB-780822 connected to a PC (PC-9821 series, PC/AT™ compatible). Connection is possible even without optional products.

Table 1-3: Devices Subject to Emulation by QB-780822

Series Name (Common Name)	Package	Device Name	
		Flash Memory Version	Mask ROM Version
CANASSP3+ Series	100-pin QFP (GC, GF)	µPD78F0822	µPD780822, µPD780821

Figure 1-2: System Configuration



<1> Host machine: PC-9821 series, PC/AT compatible can be used
<2> D78K0-QB Disk/Accessory Disk:**Note1** Debugger, USB drivers, manual, device files etc.
<3> USB interface cable: Cable connecting QB-780822 to host machine
<4> AC adapter: Can support 100 to 240 V by replacing AC plug
<5> QB-780822: This product

<6a, 6b> Check pin adapter: Adapter used when observing waveforms on oscilloscope
<7> Emulation probe: Flexible type of emulation probe
<8> Exchange adapter: Adapter that performs pin conversion
<9> Spacer adapter: Adapter for height regulation
<10> YQ connector: Connector that connects exchange adapter to target connector
<11> Target connector: Connector soldered to target system
<12> Mount adapter: Adapter for socket mounting target device

Notes: 1. Obtain these items from the NEC Electronics website.
http://www.ee.nec.de/products/micro/

2. Refer to **1.4 "Package Contents" on page 21** for the purchase forms of the above products.

3. Position <6> to <12> must be ordered separately,
where positions <6>, <8>, <10> and <11> are mandatory
where positions <7>, <9> and <12> are optional
for target interface connection.

4. There are two adapter lines available. One is based on the TET-line connectors, one is based on the NAIS-line connectors. For ordering refer to tables 1-4 to 1-10 for the correct order codes for each line (TET, NAIS connector vendor).

Caution: The two adapter-lines could not mixed up.

Table 1-4: Check Pin Adapters

Package	Check Pin Adapter TET-Line	Check Pin Adapter NAIS-Line
Common	QB-144GA-01	QB-100GC-CA-01S
Common	QB-144CA-01	QB-100GF-CA-01S

Table 1-5: Exchange Adapters

Package	Exchange Adapter TET-Line	Exchange Adapter NAIS-Line
100GC	QB-100GC-EA-02T	QB-100GC-EA-02S
100GF	QB-100GF-EA-02T	QB-100GF-EA-02S

Table 1-6: Emulation Probes

Package	Emulation Probe (both lines)
Common	QB-144-EP-01S

Table 1-7: YQ Connectors

Package	YQ Connector TET-Line	YQ Connector NAIS-Line
100GC	QB-100GC-YQ-01T	not required
100GF	QB-100GF-YQ-01T	not required

Table 1-8: Spacer Adapters

Package	Spacer Adapter TET-Line	Spacer Adapter NAIS-Line
100GC	QB-100GC-YS-01T	QB-100GC-SA-01S
100GF	QB-100GF-YS-01T	QB-100GF-SA-01S

Table 1-9: Target Connectors

Package	Target Connector TET-Line	Target Connector NAIS-Line
100GC	QB-100GC-NQ-01T	QB-100GC-TC-01S
100GF	QB-100GF-NQ-01T	QB-100GF-TC-01S

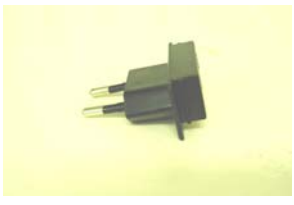
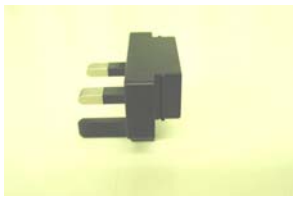
Table 1-10: Mount Adapters

Package	Target Connector TET-Line	Target Connector NAIS-Line
100GC	QB-100GC-HQ-01T	QB-100GC-MA-01S
100GF	QB-100GF-HQ-01T	QB-100GF-MS-01S

1.3.1 AC adapter

By replacing the AC plug, this product can support 100 to 240 V.

The following three types are included.

1.4 Package Contents

The following items have been placed in the QB-780822 packing box. Please check the contents.

Products supplied with QB-780822

1: QB-780822
2: AC adapter
3: USB interface cable
4: Clock board set

- Main Clock Type I
- Main Clock Type II
- Main Clock Type III (Mounted at shipment)
- Sub Clock Type I
- Sub Clock Type II (Mounted at shipment)

5: List of Contents
6: Readme
7: CE certification
8: PG-FPL

The following products are sold as single items.

- Emulation probe
- Exchange adapter
- YQ connector
- Target connector
- Check pin adapter
- Spacer adapter
- Mount adapter

[MEMO]

Chapter 2 Setup Procedure

This chapter explains the QB-780822 setup procedure.
Setup can be completed by performing installation setup in the order in which it appears in this chapter.
Perform setup along the lines of the following procedure.
See **2.1 ”Names and Functions of Hardware” on page 24** for clock board positions.

(1) Clock settings

The internal clock board is mounted at shipment.
If using the internal clock, modifications of the settings are unnecessary.
If modification is necessary, see **2.2 ”Removal of Acrylic Board” on page 27** and **2.3 ”Clock Settings” on page 27**.

(2) Software settings

See **2.4 ”Software Settings” on page 35**.

(3) Mounting and connecting connectors

See **2.5 ”Mounting and Connecting Connectors” on page 36**.

(4) Connection of QB-780822 for µPD78(F)0822/1 to target system

See **2.6 ”Connection of QB-780822 to Target System” on page 40**.

(5) Connecting USB interface cable and AC adapter

See **2.8 ”Connection of USB Interface Cable and AC Adapter” on page 45**.

(6) Switching power On and Off

See **2.9 ”Switching Power On and Off” on page 45**.

2.1 Names and Functions of Hardware

Figure 2-1: Names of Parts of QB-780822

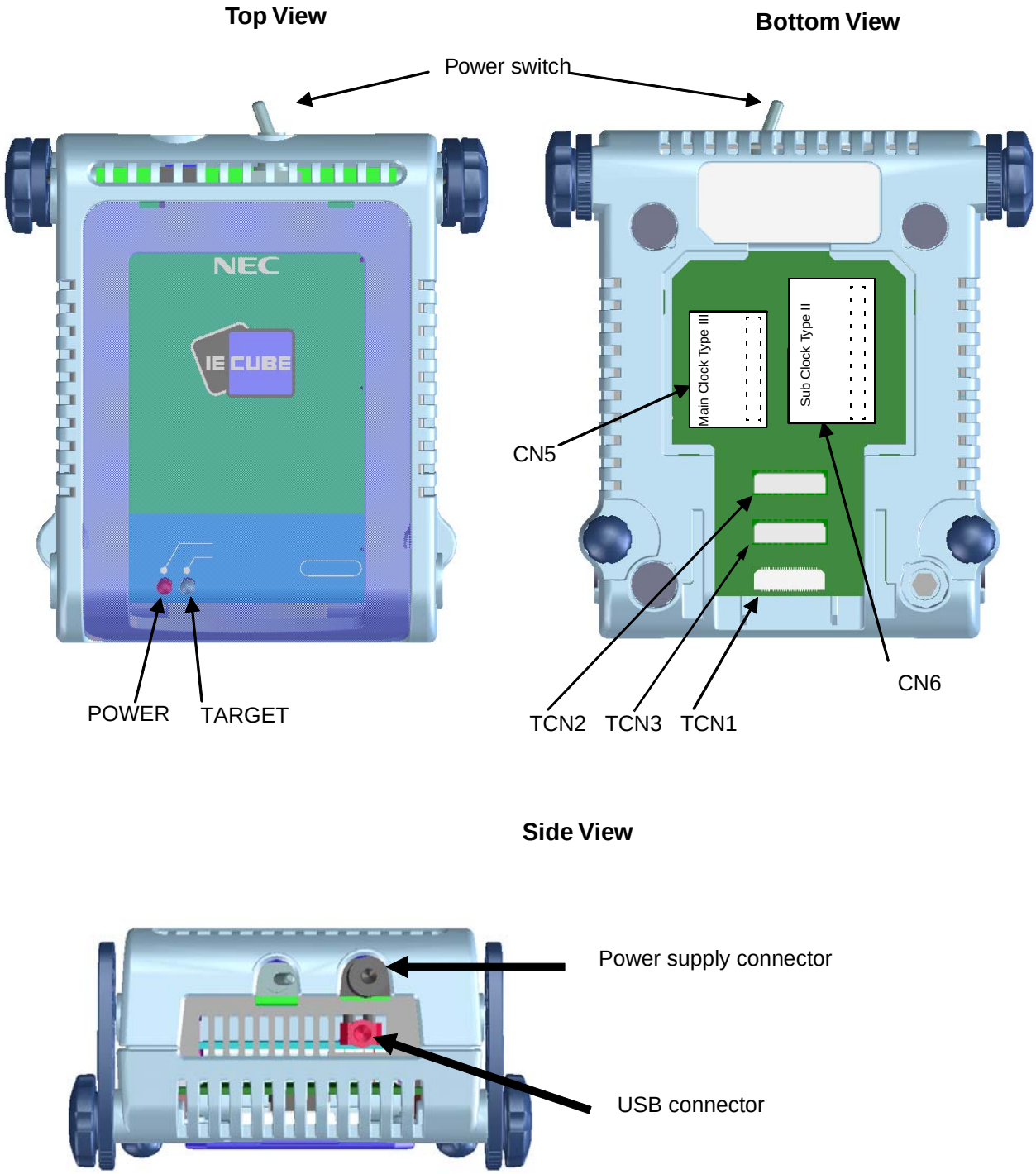
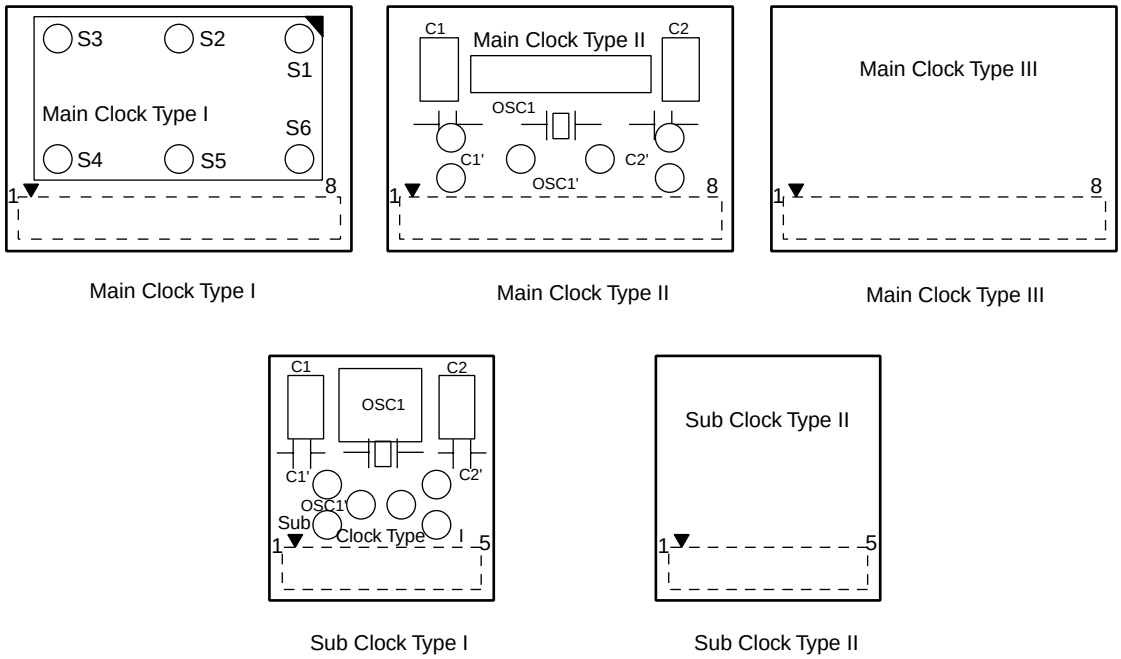


Figure 2-2: Clock Board



(1) TCN1, TCN2

These are connectors for connecting a check pin adapter or emulation probe.

(2) CN5

CN5 (Main clock board connector) is the connector for mounting the main clock board. Main Clock Type III is mounted at shipment.

(3) CN6

CN6 (Subclock board connector) is the connector for mounting the subclock board.
Sub Clock Type II is mounted at shipment.

(4) POWER (Red LED)

This is an LED that shows whether or not the power supply of the QB-780822 is switched on.

LED State	QB-780822 State
Lit	Power switch ON
Not lit	Power switch OFF or AC adapter not connected to QB-780822
Blinking	Internal error occurred (Contact an NEC Electronics sales representative or distributor)

(5) TARGET (Green LED)

This is an LED that shows whether or not the power supply of the target system is switched on.

LED State	Target System State
Lit	Target system power supply ON
Not lit	Target system power supply OFF or target system not connected

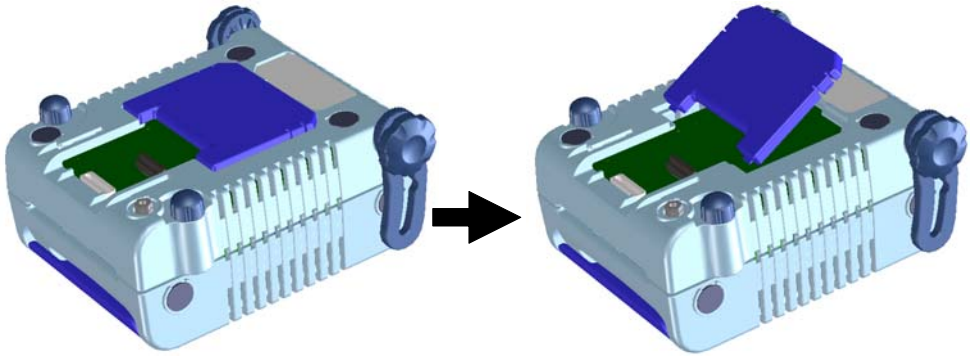
(6) Power switch

This is the power switch of the QB-780822.
It is OFF at shipment.

2.2 Removal of Acrylic Board

To modify the clock setup, the acrylic board on the bottom of the QB-780822 must be removed. The acrylic board can be removed by lifting it up.

Figure 2-3: Acrylic Board Removal Method



2.3 Clock Settings

2.3.1 Overview of clock settings

The following 7 types of clock settings are available.
For details, see **2.3.2 Clock setting methods**.

(1) Main system clock

(1) Mount the clock board in CN5 and use the internally generated clock
(2) Mount the clock board in CN5 and use an externally input clock
(3) Mount the oscillator clock board in CN5 and generate the clock from the clock board
(4) Mount the oscillation circuit clock board in CN5 and generate the clock from the clock board

(2) Subsystem clock

(1) Mount the clock board in CN6 and use the internally generated clock
(2) Mount the clock board in CN6 and use an externally input clock
(3) Mount the oscillation circuit clock board in CN6 and generate the clock from the clock board

2.3.2 Clock setting methods

This section shows the hardware settings when setting the clock.

Table 2-1: Hardware Settings When Setting Main System Clock

Type of Clock to Use	CN5	Remarks
(1) Mount clock board in CN5 and use internally generated clock	Mount Main Clock Type III in CN5	Mounted in CN5 at shipment
(2) Mount clock board in CN5 and use internally input clock	Mount Main Clock Type III in CN5	Mounted in CN5 at shipment
(3) Mount oscillator clock board in CN5 and generate clock from clock board	Mount Main Clock Type I on which oscillator is mounted in CN5	
(4) Mount oscillation circuit clock board in CN5 and generate clock from clock board	Mount Main Clock Type II on which oscillation circuit is assembled in CN5	not supported

Remark: Settings other than the above are prohibited.

Table 2-2: Hardware Settings When Setting Subsystem Clock

Type of Clock to Use	CN6	Remarks
(1) Mount clock board in CN6 and use internally generated clock	Mount Sub Clock Type II in CN6	Mounted in CN6 at shipment
(2) Mount clock board in CN6 and use internally input clock	Mount Sub Clock Type II in CN6	not supported
(3) Mount oscillator clock board in CN6 and generate clock from clock board	Mount Sub Clock Type I on which oscillation circuit is assembled in CN6	

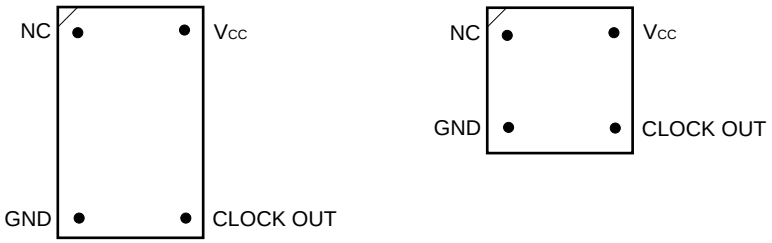
Remark: Settings other than the above are prohibited.

2.3.3 Main system clock

(1) For mounting Main Clock Type I (for oscillator use)

- Things to prepare
  - Oscillator (with pins as shown in Figure 2-4 and 5 V power supply)

Figure 2-4: Oscillator (Main System Clock)

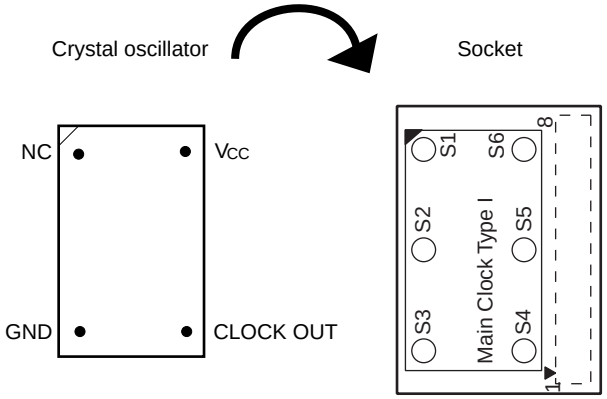


<Procedure>

<1> Prepare the QB-780822 and Main Clock Type I. Remove the clock board that is mounted in the CN5 socket on the QB-780822.
When removing the clock board, do so carefully, since the pins of the CN5 socket bend easily.

<2> Implement the prepared oscillator in Main Clock Type I. Carefully insert it in the direction of the number 1 pin mark.

Figure 2-5: Mapping of Oscillator to Main Clock Type I (Main System Clock)



Oscillator Pin	Board Pin Number
NC	S1
GND	S2
	S3
Clock out	S4
	S5
Vcc	S6

<3> Fit Main Clock Type I prepared in <2> in the CN5 socket from which the clock board was removed in <1>.

In the debugger, only the "Clock Board" button can be selected (others displayed in gray) at this time. For the frequency at this time, the clock of the oscillator that is mounted on the clock board is used.

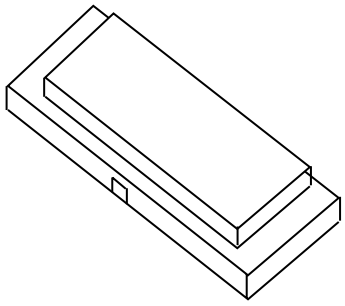
(2) For mounting Main Clock Type II (for oscillation circuit use)

(a) When using 3-pin type resonator

- Things to prepare
  - Ceramic resonator or crystal resonator[Note]
  - Soldering tool set

Note: CSTCE10M0G (by Murata Mfg. Co., Ltd.) is assumed.

Figure 2-6: Resonator (Main System Clock: 3-Pin)

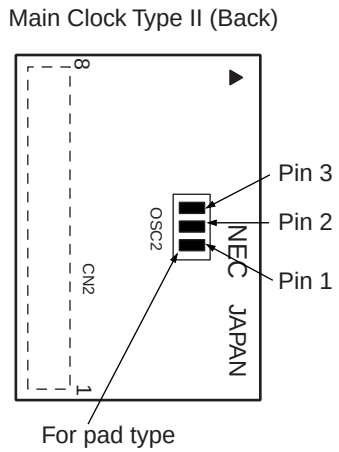


<Procedure>

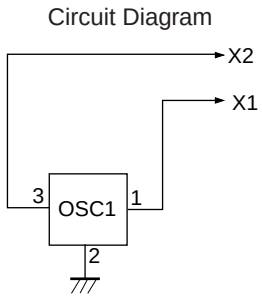
<1> Prepare the QB-780822 and Main Clock Type II. Remove the clock board that is mounted in the CN5 socket on the QB-780822.
When removing the clock board, do so carefully, since the pins of the CN5 socket bend easily.

<2> Solder the ceramic resonator or crystal resonator used in OSC1 of Main Clock Type II.

Figure 2-7: Connection to Main Clock Type II (Main System Clock: 3-Pin)



Pin Number	Connection
OSC2	Ceramic resonator or crystal resonator

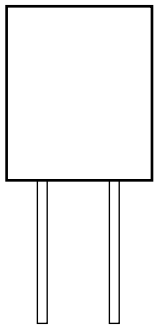


<3> Fit Main Clock Type II of <2> in the CN5 socket from which the clock board was removed in <1>.

(b) When using 2-pin type resonator

- Things to prepare
  - Ceramic resonator or crystal resonator
  - Capacitor C1
  - Capacitor C2
  - Soldering tool set

Figure 2-8: Resonator (Main System Clock: 2-Pin)

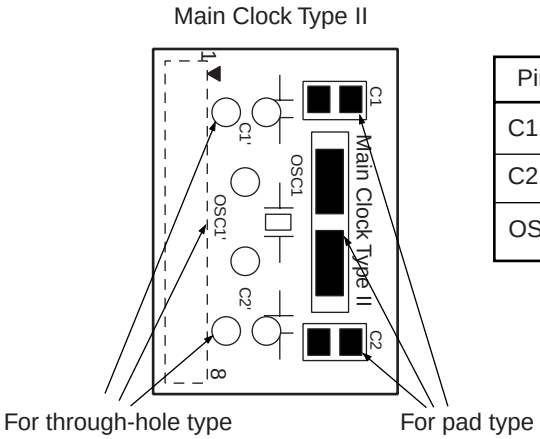


<Procedure>

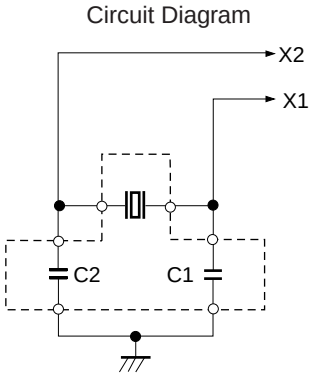
<1> Prepare the QB-780822 and Main Clock Type II. Remove the clock board that is mounted in the CN5 socket on the QB-780822.
When removing the clock board, do so carefully, since the pins of the CN5 socket bend easily.

<2> Solder the ceramic resonator or crystal resonator used in OSC1 of Main Clock Type II and capacitor C1 and capacitor C2 conforming with its oscillation frequency as follows. When soldering, use either through-hole types or pad types.

Figure 2-9: Connection to Main Clock Type II (Main System Clock: 2-Pin)



Pin Number	Connection
C1, C1'	Capacitor C1
C2, C2'	Capacitor C2
OSC1, OSC1'	Ceramic resonator or crystal resonator



<3> Fit Main Clock Type II of <2> in the CN5 socket from which the clock board was removed in <1>.

In the debugger, only the "Clock Board" button can be selected at this time (others are displayed in gray). For the frequency at this time, the clock of the oscillation circuit that is mounted on the clock board is used.

(3) For mounting Main Clock Type III (for internally generated clock or externally input clock use)

Main Clock Type III is fitted in the CN5 socket at shipment. If in the same state as at shipment, hardware settings are unnecessary.

In the debugger, only "External Clock" or "System Clock" can be selected at this time ("Clock Board" is displayed in gray). If "External Clock" is selected, a clock that is input from the target system is used. If "System Clock" is selected, select the desired frequency from the dialog menu.
If inputting an external clock, input a square wave of the same potential as the target device in the clock pin (X1, XT1) (input of inverse waveform to X2, XT2 is unnecessary).

2.3.4 Subsystem clock

(1) For mounting Sub Clock Type I (For oscillation circuit use)

- Things to prepare
  - Ceramic resonator or crystal resonator[Note]
  - Capacitor C1
  - Capacitor C2
  - Soldering tool set

Note: The resonator used is assumed to be NC-206 (by Kyushu Dentsu Co., Ltd.).

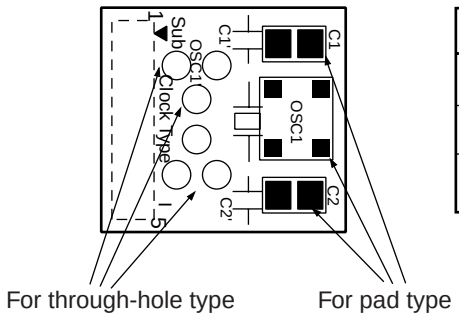
<Procedure>

<1> Prepare the QB-780822 and Sub Clock Type I. Remove the clock board that is mounted in the CN6 socket on the QB-780822.
When removing the clock board, do so carefully, since the pins of the CN6 socket bend easily.

<2> Solder the ceramic resonator or crystal resonator that is used in Sub Clock Type- and capacitor C1 and capacitor C2 that conform to its oscillation frequency as follows.

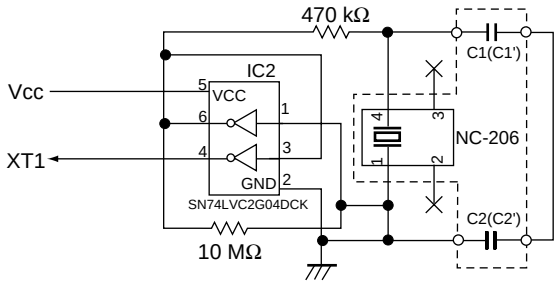
Figure 2-10: Connection to Sub Clock Type I (Subsystem Clock)

Sub Clock Type I



Pin Number	Connection
C1, C1'	Capacitor C1
C2, C2'	Capacitor C2
OSC1, OSC1'	Ceramic resonator or crystal resonator

Circuit Diagram



Remark: Places surrounded by broken lines indicate portions installed on the parts board.

<3> Fit Sub Clock Type I of <2> in the CN6 socket from which the clock board was removed in <1>.

In the debugger, only the "Clock Board" button can be selected at this time (others are displayed in gray). For the frequency at this time, the clock of the oscillation circuit that is mounted on the clock board is used.

(2) For mounting Sub Clock Type II (for internally generated clock or externally input clock use)

Sub Clock Type II is fitted in the CN6 socket at shipment. If in the same state as at shipment, hardware settings are unnecessary.
In the debugger, only "External Clock" or "System Clock" can be selected at this time ("Clock Board" is displayed in gray). If "External Clock" is selected, a clock that is input from the target system is used. If "System Clock" is selected, select the desired frequency from the dialog menu.
If inputting an external clock, input a square wave of the same potential as the target device to the clock pin (X1, XT1) (input of inverse waveform to X2, XT2 is unnecessary).

2.4 Software Settings

For details, see the **ID78K0-QB Ver. 2.81 Integrated Debugger Operation User's Manual (U16996E)**.

2.5 Mounting and Connecting Connectors

This section describes the methods of connecting the QB-780822 and target system.
Make connections with both the QB-780822 and target system powered OFF.
The following abbreviations are used in this section.**Note**

- NQ: (TC) Target connector
- YQ: (--) YQ connector
- EA: (EA) Exchange adapter
- HQ: (MA) Mount adapter
- CA: (CA) Check pin adapter
- YS: (SA) Spacer adapter

Note: For TET based adapter line see chapter 2.5.1
For NAIS based adapter line see chapter 2.5.2

2.5.1 TET based adapter line

(1) Mounting NQ in target system

<1> Thinly apply a two-component epoxy adhesive (hardening time at least 30 minutes) to the ends of the four projections on the base of the NQ and adhere the NQ to the user board (clean the surface of the user board using alcohol or the like). If alignment of user board pads to NQ leads is difficult, align them as in (2).
<2> Align by inserting the guide pins for alignment for the NQ (NQ-Guide) through the pin holes on the top of the NQ. Accessory holes are ö1.0 mm non-through holes in 2 or 3 places.
(For hole positions, see the particular NQ drawing.)
<3> Solder after fitting the HQ to the NQ. This is to prevent troubles such as flux or solder splashing and adhering to the NQ contact pins when soldering.

Soldering conditions	Solder reflow	240°C × 20 seconds or less
	Manual soldering	240°C ×10 seconds or less (1 pin)

Caution: Do not perform washing by flux immersion or vapor.

<4> Take away the guide pins.

(2) Mounting YQ on NQ

<1> After confirming that there are no broken or bent YQ contact pins, fit the YQ in the NQ and fasten the screw. If repeatedly inserting and removing, be sure to inspect the YQ pins before fitting. If pins are bent, correct them using something thin and flat such as the edge of a knife.
<2> Accessory holes are needed in prescribed positions in 4 places in the board for connecting the YQ. Fasten the YQ to the NQ on the user board using the supplied M2 × 10 mm screws. The thickness of a board corresponding to these screws is 1.0 to 2.0 mm. Fasten the screws equally in the four corners using a No. 1 or No. 0 precision (+) driver or torque driver. The tightening torque of the screws is 0.55kg • f • cm (0.054N • m) Max. Too great tightening causes bad connections.
Screws for fitting to the NQ (M2 × 10 mm/4) are included with the YQ.

(3) Plugging EA into YQ

Match the No. 1 pin position of the YQ or YS (C cuts match in both) to the No. 1 pin position of the EA and plug in.

- When plugging or unplugging, press on the NQ, YQ, and YS with a finger so that there is no force on the NQ.
- When plugging or unplugging, be careful of the direction of rocking.

As a tool when unplugging, insert a bamboo skewer or the like between the YQ (YS) and EA and rock while slowly unplugging. Be careful since the connector will be damaged if this is done in the wrong direction.

(4) Precautions for handling NQ, YQ, YS

<1> When taking the NQ from the box, press down on the body and take out the sponge first.
<2> Since the pins of the YQ are thin and easily bent, be careful. When inserting it in the NQ, confirm that there are no bent pins.
<3> When screwing a YQ soldered to a board to the NQ, fasten the screws in four places in turn using a No. 0 or No. 1 (+) precision driver or torque driver after tentatively tightening them. Fix the torque at 0.054 Nm (Max.). If just one place is overtightened, it may cause poor contact. Moreover, a board being connected to the YQ must have accessory holes in prescribed positions (4 places: ϕ2.3 mm or ϕ3.3 mm). The ϕ3.8 mm or ϕ4.3 mm that is the screw head size is an area where wiring is prohibited.
<4> In YQ and YS removal, since there is a danger of YQ pins being bent or broken when prying and rocking, remove them gradually using a (–) driver from four directions. Moreover, to connect and use the YQ and YS, screw the YQ to the NQ according to the YQGUIDE (sold separately) using a 2.3 mm (–) driver and then connect it to the YS. Fix the torque at 0.054 Nm (Max.). If even one place is overtightened, it may cause poor contact.
<5> For the NQ, YQ, and YS, since there is a danger that washing fluid on the structure will remain in the connector, do not perform washing.
<6> NQ, IC, and YQ cannot be used in combination.
<7> An NQ/YQ system cannot be used in an environment of vibrations or shocks.
<8> It is assumed that this product will be used in system development and evaluation. Moreover, when used in Japan, Electrical Appliance and Material Control Law and electromagnetic disturbance countermeasures have not been applied.
<9> Since there are rare cases of shape change if the box is left for a long time in a place where it is 50°C or higher, for safekeeping, store it in a place where it is no higher than 40°C and direct sunlight does not hit it.
<10> For details about handling the NQ, YQ, and YS, see the NQPACK series technical materials at the website of Tokyo Eletech Corporation.
Tokyo Eletech Corporation website: **http://www.tetc.co.jp/**

(5) Precautions on mounting NQ and IC

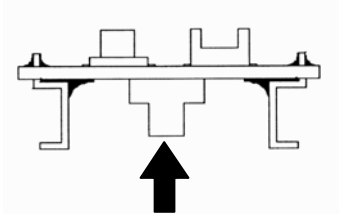
<1> Confirm that there is no weld flash in the resin (sealant part) of the IC. If there is weld flash, remove it using a knife or the like.
<2> Confirm that there is no weld flash breaking or bending of IC leads. In particular, confirm the planarity of IC leads. If there is abnormality in the planarity, correct that portion.
<3> Viewing the NQ contact pins from the top, if there are foreign bodies on them, remove them using a brush or the like.
After confirming (1) to (3), fit the IC to the NQ. Also fit the HQ.
<4> Put the supplied M2 × 6 mm screws in the 4 accessory holes of the HQ and fasten the screws in opposite corners. At that time, use either the dedicated screw driver that is supplied or a torque driver to fasten them equally in turn with a tightening torque of MAX.
0.55 kg • f (0.054 Nm). Since the contact is poor if tightening is too great, once you have lightly fastened the HQ screws, tighten them again.
<5> Depending on the use environment, when starting up a device that has been left for a long time, starting it may be difficult. In this case, loosen the screws slightly and then retighten them.
<6> If startup still is difficult after (5) above, check (1) to (3) again.
<7> Tightening the screws of the HQ too much may give rise to cracks in the moulded part of the HQ (plastic part) and bend the mould into a bowed shape, making contact poor.
<8> After soldering the NQ, do not perform washing by flux immersion or vapour.

2.5.2 NAIS based adapter line

(1) Mounting target connector (TC) on target system

<1> Apply cream solder to the foot pattern for mounting the IC on the target system.
<2> TC has a cylindrical projection in the center of the underside (Figure 2-11). Apply a two-component hardening type epoxy adhesive agent (a type that hardens in 15 to 30 minutes) sparingly to the underside of the projection to temporarily secure the connector at the specified location on the target system. Make sure that the position of pin 1 of the connector (where the corner is cut) matches the position of pin 1 on the target board.
<3> TC mounting conditions
(a) To mount TC by reflow: 245°C × 20 seconds max. (heating)
(b) To mount TC by manual soldering: 320°C × 5 seconds max. (per pin)

Figure 2-11: TC Projection Diagram



<4> Note on flux splashing
The flux splashing that takes place while the connector is being mounted often results in defective conduction. Be sure to cover the upper part of the connector with aluminium foil.

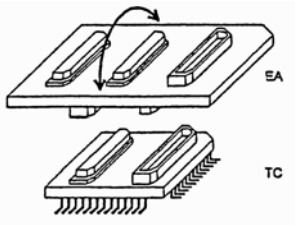
Caution: Do not clean the flux because the structure of the connector easily allows cleaner to enter.

(2) Inserting exchange adapter (EA) in TC

<1> Insert EA, MA, CA, or SA in target connector (TC) so that the position of pin 1 (where the corner is cut) on each board matches.

(a) When TC is inserted or removed, hold TC with your fingers so that no excessive force is applied to the connector.
(b) Remove or insert the adapter in the correct direction. (Figure 2-12)
Use a bamboo spit or similar object as a tool to remove the connector. Insert the tool between TC and EA and remove TC in the correction direction as shown in Figure 2-12. If force is applied
to the connector in the wrong direction, the connector will be damaged.

Figure 2-12: How to Insert/Remove EA and TC



(3) General cautions on using TC, EA, MA, CA, and SA

<1> Causes of faulty contact of connector

(a) If flux gets inside TC when it is mounted
Thoroughly clean the flux with a solvent such as alcohol. Cleaning must be performed at least 5 to 6 times. If conduction is still not stable, repeat cleaning.
(b) If waste gets inside the connector
If waste, such as threads, gets inside the connector, defective conduction occurs. Remove any waste with a brush.
(c) Cautions on using CA and SA
When CA and SA are inserted, a very small amount of delay and capacitance occur in the signal propagation. Thoroughly evaluate these points after CA and SA are connected to the target system.

<2> Note on inserting or removing connector

(a) Be sure to hold the lower (mating) connector or board with your fingers when inserting or removing the connector.
(b) Be sure to insert or remove the connector in the correct direction (so that the positions match). If the connector is inserted in a position that does not match the board direction, the connector may be damaged.
(c) When disconnecting the connector, use a thin bamboo or wooded stick as a leverage to protect the socket from being damaged. Do not remove the connector all at once, but do so little by little, shifting the leverage from one place to another.
If only a metallic object such as a screwdriver is available as a leverage, wrap its tip in a soft cloth.

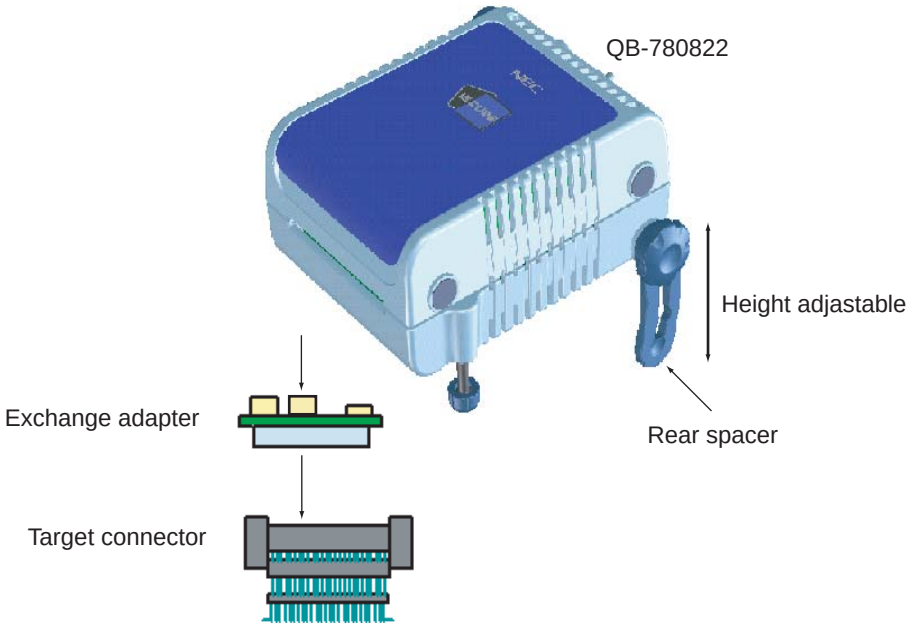
2.6 Connection of QB-780822 to Target System

If connecting the emulation probe (QB-144-EP-01S), connect it to the QB-780822 and the target system by the following procedure.

2.6.1 Connection without using extension probe (QB-144-EP-01S)

QB-780822 for µPD78(F)0822/1 can be connected to the target system without using the extension probe.
When connecting QB-780822 for µPD78(F)0822/1 and the target system, adjust the height of QB-780822 for µPD78(F)0822/1 using the rear spacer so that no stress is applied to the exchange adapter and target connector.
In addition, take care to maintain insulation with the target system.

Figure 2-13: Connection without using Extension Probe



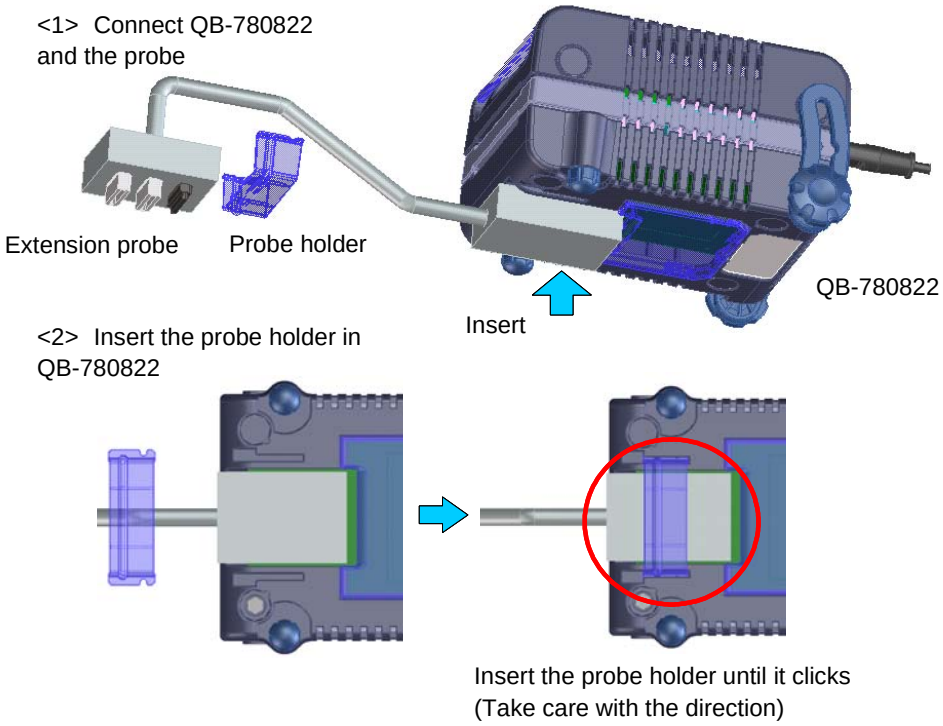
2.6.2 Connection using extension probe (QB-144-EP-01S)

When using the extension probe (QB-144-EP-01S), connect QB-780822 for µPD78(F)0822/1 and the target system using the following procedure.

(1) Connecting probe holder

Use the probe holder (included with QB-780822 for µPD78(F)0822/1) for connecting the extension probe to QB-780822 for µPD78(F)0822/1. How to connect is shown below.

Figure 2-14: How to use Probe Holder



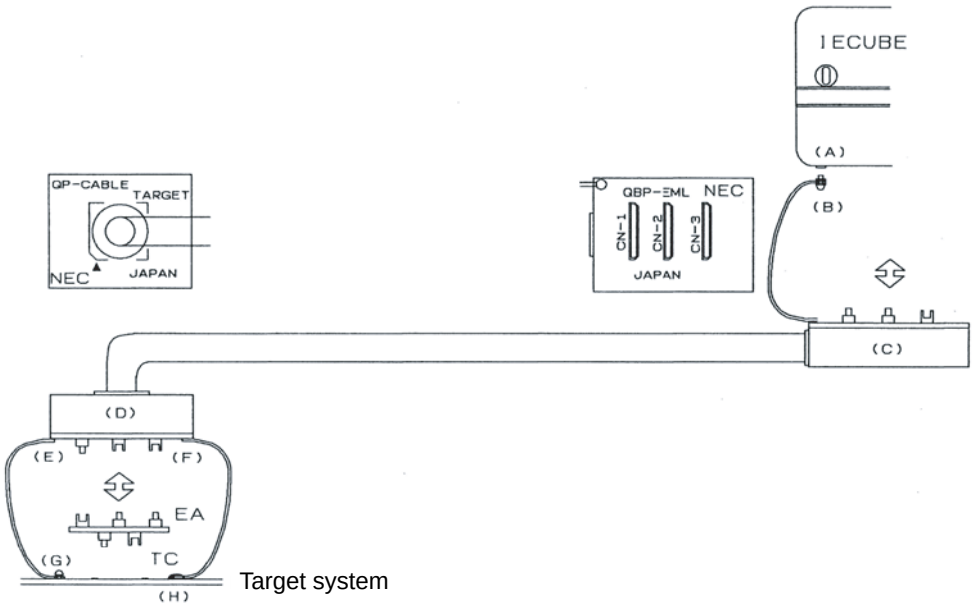
(2) Connecting extension probe GND lines

The extension probe has three GND lines. Connect these lines to QB-780822 for µPD78(F)0822/1 and the target system using the following procedure.

<1> Fix a GND line of the extension probe to the nut on the bottom surface of QB-780822 for µPD78(F)0822/1 using a #0 or #1 precision cross-headed screwdriver. (Connection of **A** and **B** in Figure 2-15)

<2> Insert the connector on the top surface of the extension probe in the connector at the bottom opening of QB-780822 for µPD78(F)0822/1 from the lower side. Take care with the direction. (Connection of **C** and QB-780822 for µPD78(F)0822/1 in Figure 2-15)

Figure 2-15: Connection of GND Lines



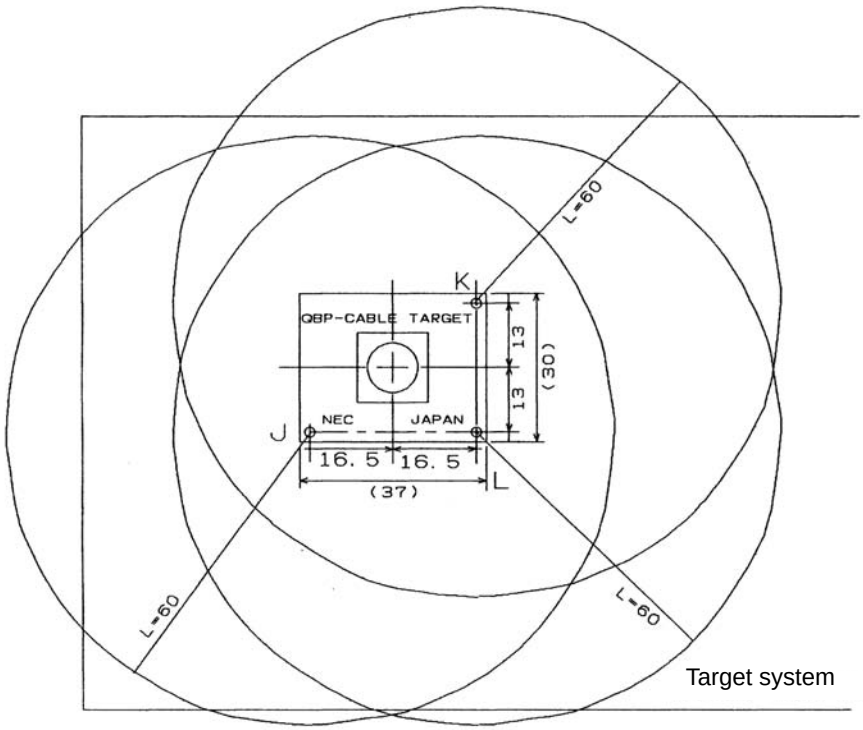
<3> Connect the exchange adapter and extension probe to the target connector.

<4> Connect two GND lines of the extension probe on the target system side to the GND block of the target system. If the pin or screw is fixed on the GND block of the target system, remove the transparent pin cover at the top of the GND line and fix the Y-branch pin of the GND line to the target system (**G** in Figure 2-15). In the same manner, if the GND pad on the target system is exposed, fix the Y-branch pin to the pad on the target system by soldering (**H** in Figure 2-15). (Recommended iron temperature: 300°C)

<5> If there is only one GND connector on the target system, connect one side and cut off the other GND lines using nippers, or leave it as is without removing the pin cover.

<6> The length of the GND line shank (insulation block) is approximately 60 mm. Therefore, as shown in Figure 2-16, at least one connectable GND is necessary within a radius of approximately 60 mm from the three locations on the extension probe at which the target system is connected. The GND lines on the emulation probe are soldered at the position of **J** and **K** in Figure 2-16. When soldering the GND line at the position of **L**, remove a GND line soldered at **J** or **K** and solder it at **L**.

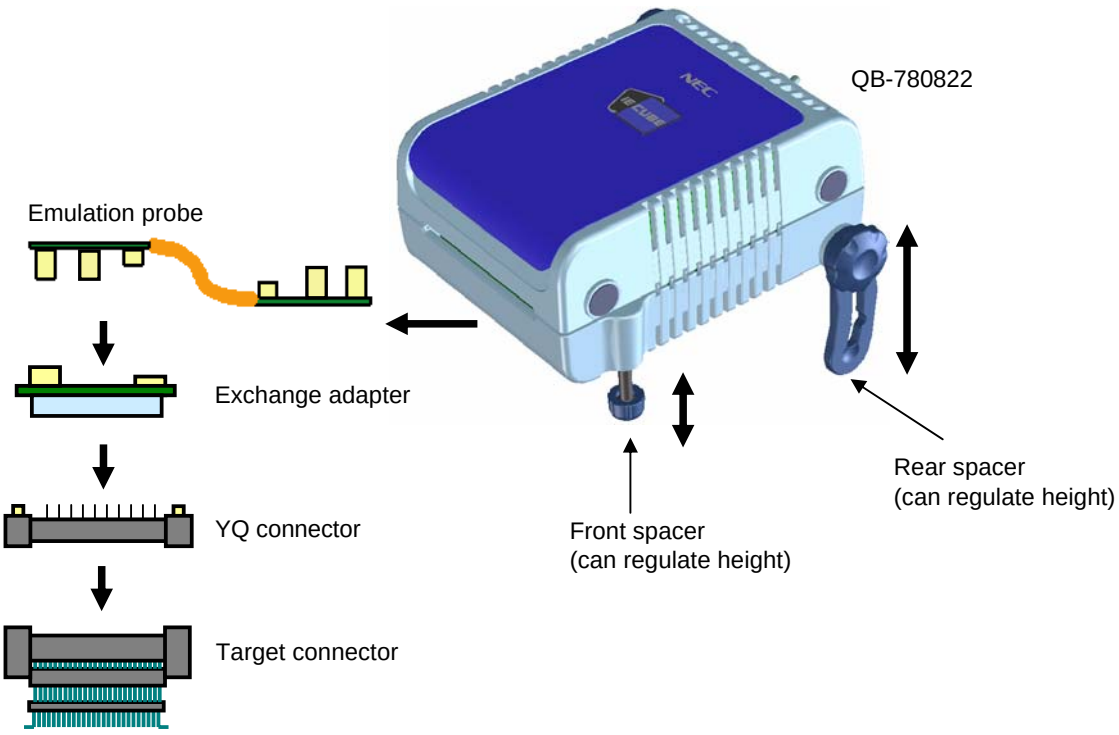
Figure 2-16: Location at which GND Line can be connected



2.6.3 Ensuring isolation

When connecting the target system to the QB-780822 using an emulation probe, perform height regulation using the front spacer or rear spacer of the QB-780822 and ensure isolation from the target system.

Figure 2-17: Connection Using Emulation Probe



2.6.4 Precautions related to emulation probe

The following precautions pertain to using the emulation probe.

<1> Be careful that stress of the emulation probe is not placed on the target connector. Moreover, when removing the emulation probe, remove it slowly while pressing down on the exchange adapter with a finger so that there is no stress on the target connector.

<2> Be sure to connect the GND wire of the emulation probe to the QB-780822 and the target system. If it cannot be connected, the impedance of the cable is unstable and could bring about lowering of signal transmission characteristics or distortion of the output waveform for an input waveform.

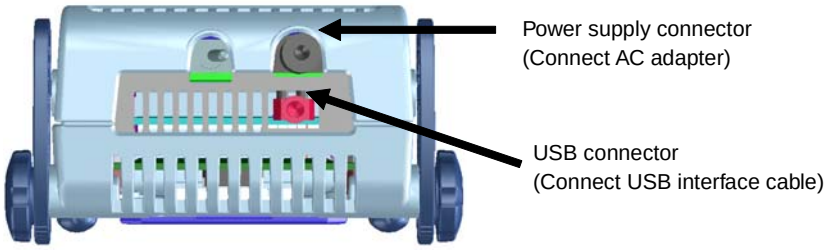
2.7 Power Supply and GND Pin Connection Precautions

For power supplies and GND pins of the target device, be sure to connect all pins to each power supply or GND.

2.8 Connection of USB Interface Cable and AC Adapter

Plug the USB interface cable supplied with the QB-780822 into the USB connector of the host machine and also plug it into the USB connector on the rear of the QB-780822.
Plug the AC adapter supplied with the QB-780822 into a receptacle and plug it into the power supply connector on the rear of the QB-780822.
For QB-780822 connector positions, see **Figure 2-18**. There are three types of AC adapter plug. Use the one that has a suitable shape.

Figure 2-18: Connector Positions



2.9 Switching Power On and Off

Be sure to switch the power on and off according to the following procedures.

- Switching power on

<1> QB-780822 power on
<2> Target system power on**Note**
<3> Debugger startup

- Switching power off

<1> Debugger termination
<2> Target system power off**Note**
<3> QB-780822 power off

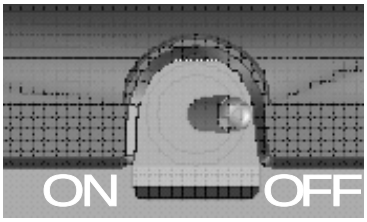
Note: In the procedures, <2> is unnecessary if the target system is not connected.

Caution: If there is a mistake in the order, the target system or QB-780822 may fail.

[MEMO]

Chapter 3 Settings at Product Shipment

Table 3-1: Settings at Shipment

Item	Setting	Remarks
CN5	Main Clock Type III is mounted	
CN6	Sub Clock Type II is mounted	
Power switch		Set to OFF at shipment.

[MEMO]

Chapter 4 Differences Between Target Interface Circuit and Target Device

This chapter explains the differences between the signal lines of a target interface circuit of the QB-780822 and the signal lines of a target device
Although the target device is a CMOS circuit, the target interface circuit of the QB-780822 consists of an emulation circuit that depends on the emulation CPU, TTL, CMOS-IC, or other.
When the target system is debugged by connecting it to the QB-780822, the QB-780822 emulates just as if the actual target device were operating on the target system.
However, small differences arise because the QB-780822 actually is emulating.

(1) Signals input and output by emulation CPU (µPD78F0822A)

(2) Signals input and output by emulation CPU (FPGA)

(3) Other signals

The circuits of the QB-780822 for the signals in (1) to (3) above are shown below by target device.

4.1 For µPD780822 Subseries Emulation

For the signals in (1) to (3) below, see **Figure 4-1 Emulation Circuit Equivalent Circuit 1**.

(1) Signals input and output by emulation CPU (µPD78F0822A)

- P03 to P00
- P17 to P10 - load of FET switch in parallel
- P27 to P20
- P33 to P30
- P77 to P70
- P87 to P80
- P97 to P90 - load of two emulation CPU in parallel (only P90)
- P105 to P100 - load of two emulation CPU in parallel
- P113 to P110 - load of two emulation CPU in parallel
- P147 to P140
- P157 to P150
- P120
- P130
- V_{DD0},V_{DD1},V_{DD2}
- SMV_{DD0},SMV_{DD1}
- COM0,COM1,COM2,COM3,VLCD
- AV_{REF}, AV_{DD}

(2) Signals input and output by emulation CPU (FPGA)

- X1, XT1,$\overline{\text{RESET}}$, IC/V_{PP}**Note**

Note: For the µPD78(F)0822/1, the pin name is FLMD0.

(3) Other signals

- X2, XT2, V_{SS0}, V_{SS1}, V_{SS2}, AV_{SS}, SMV_{SS0}**Note**, SMV_{SS1}

Note: The pin SMV_{SS0} is not connected to Ground. It is used for target board detection.

Figure 4-1: Emulation Circuit Equivalent Circuit 1 (1/2)

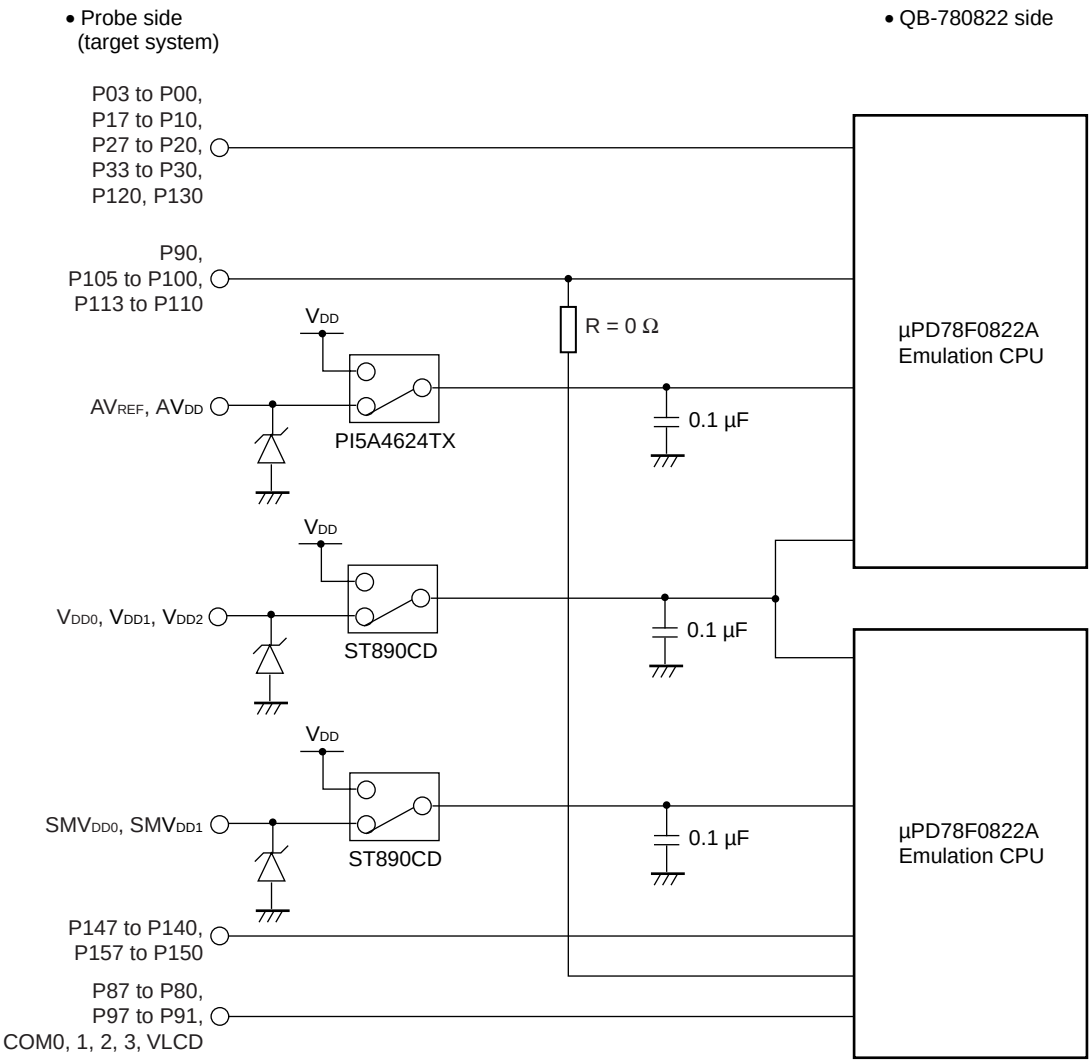
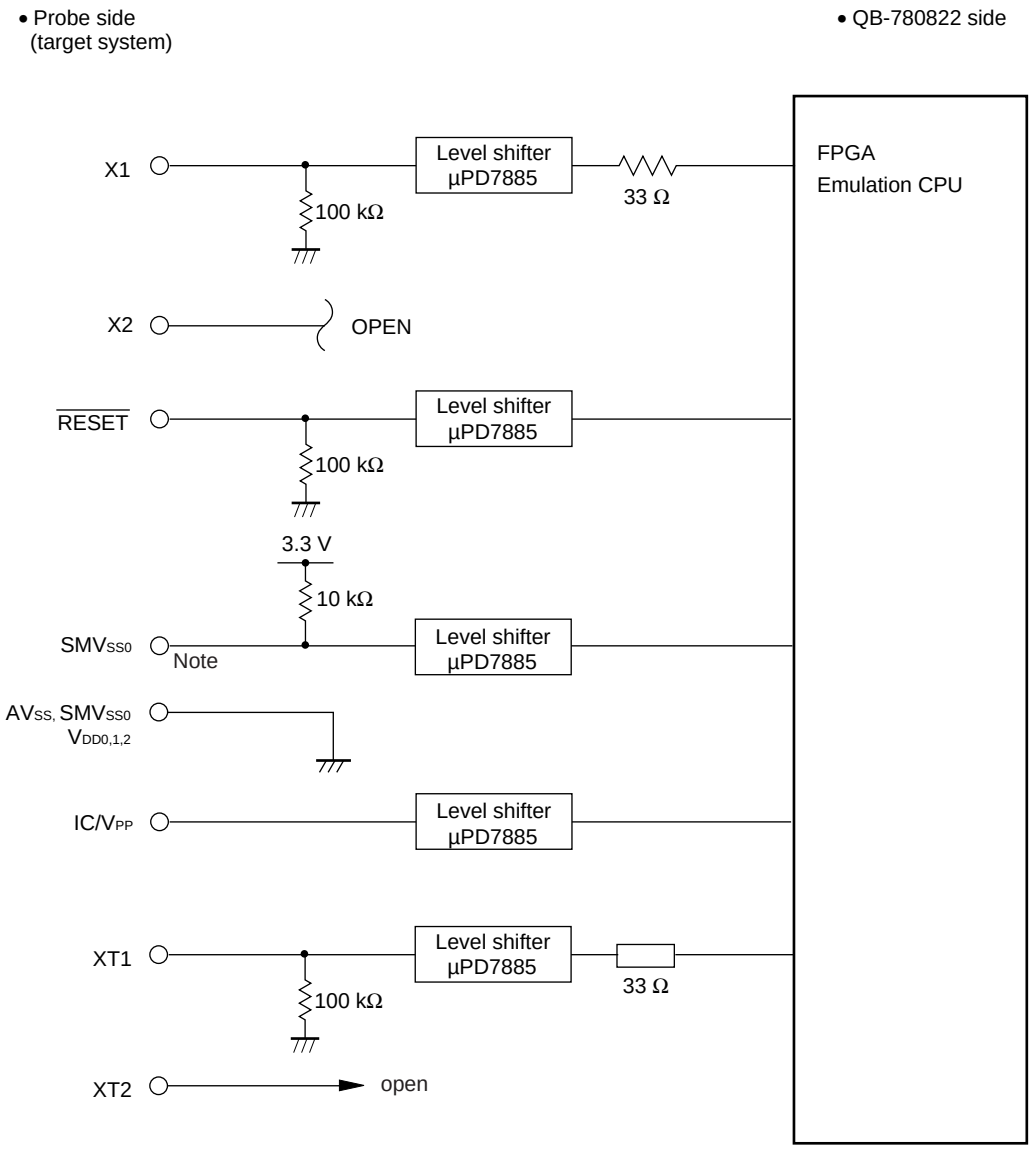


Figure 4-1: Emulation Circuit Equivalent Circuit 1 (2/2)



Note: SMV_{SS0} is not connected to common GND.

Chapter 5 Cautions

Observe the following cautions.

- Do not turn off the target power supply during a break (power supply can be turned off only during RUN).
- Even when using the product without connecting a target system, connect and use the emulation probe and exchange adapter.

If the product is used without connecting the emulation probe and exchange adapter, a warning window is displayed but use is possible.

[MEMO]

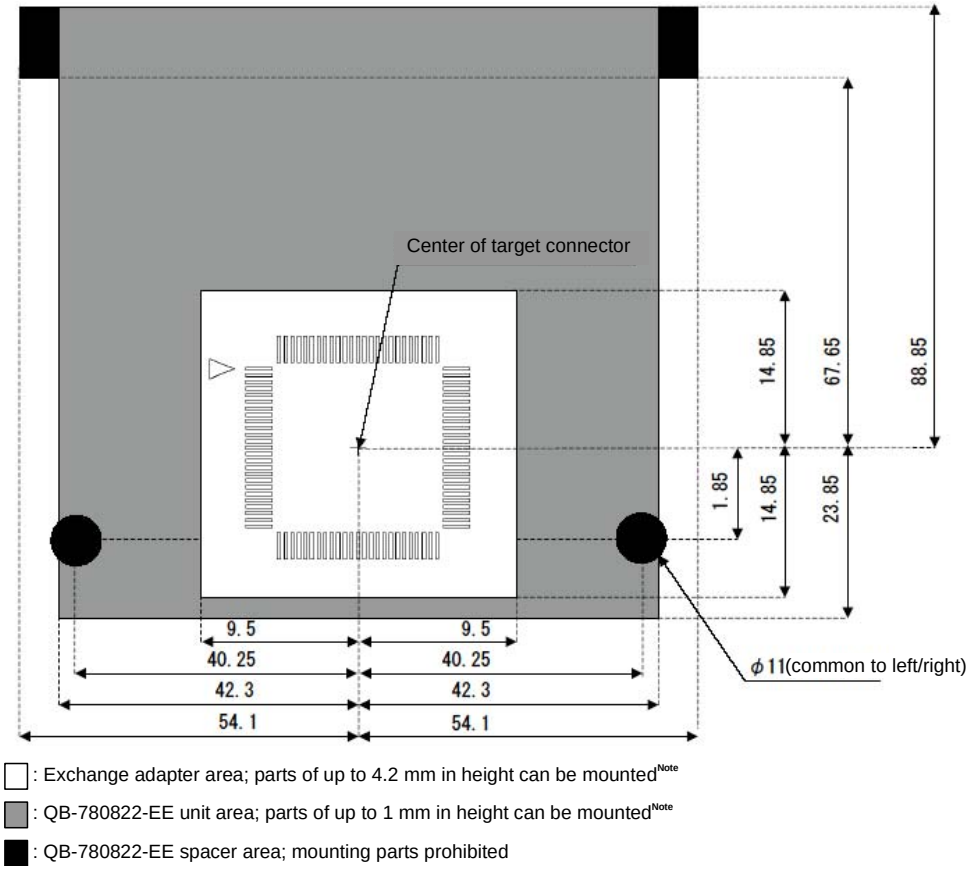
Appendix A Notes On Target System Design

This section shows areas on the target system where component mounting is prohibited and areas where there are component mounting height restrictions.

A.1 When Extension Probe Is Not Used

(1) For 100-pin GC package

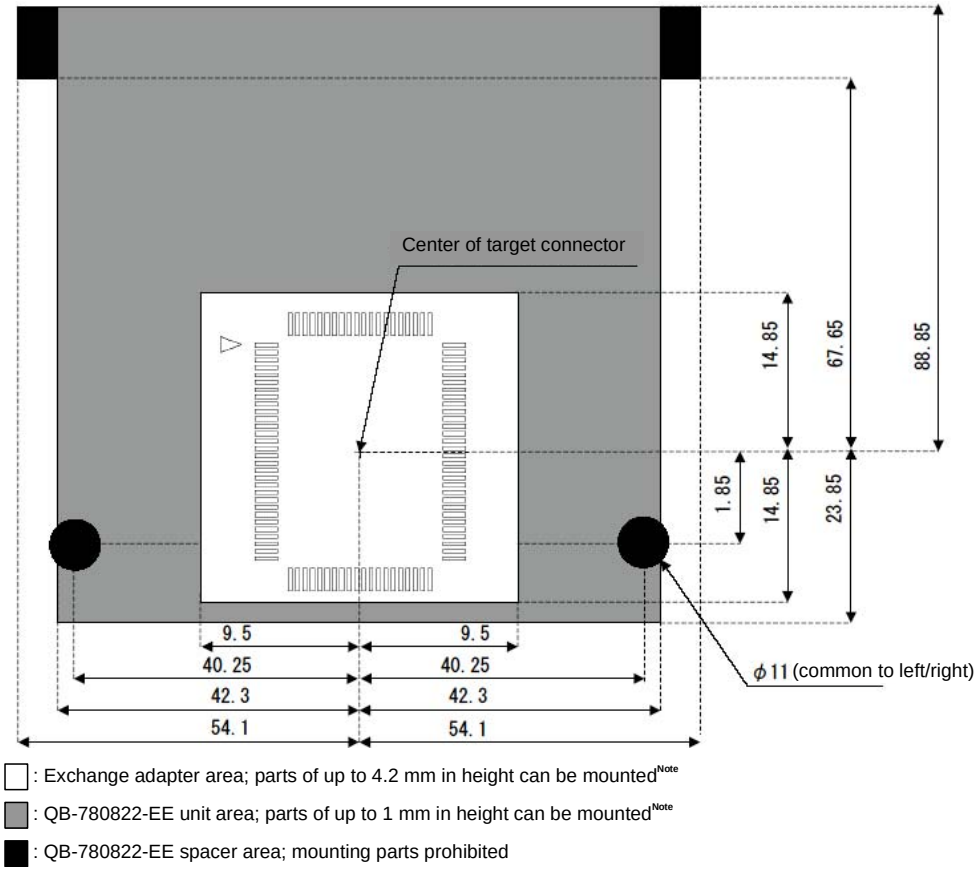
Figure A-1: For 100-pin GC package



Note: Height can be regulated by using spacer adapters (each adds 2.4 mm on TET-line)
Height can be regulated by using spacer adapters (each adds 5.6 mm on NAIS-line)

(2) For 100-pin GF package

Figure A-2: For 100-pin GF package

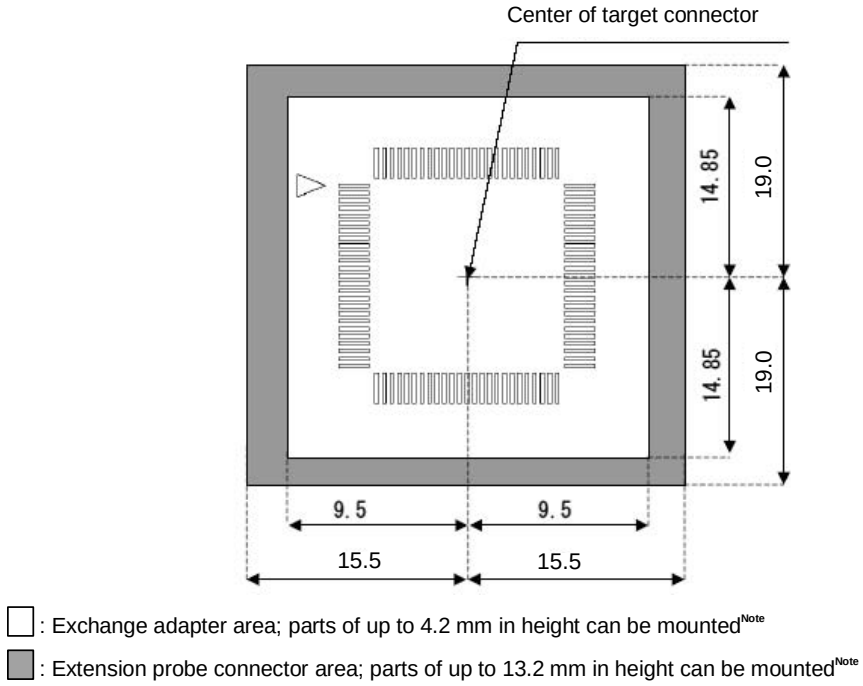


Note: Height can be regulated by using spacer adapters (each adds 2.4 mm on TET-line)
Height can be regulated by using spacer adapters (each adds 5.6 mm on NAIS-line)

A.2 When Extension Probe Is Used

(1) For 100-pin GC package

Figure A-3: For 100-pin GC package



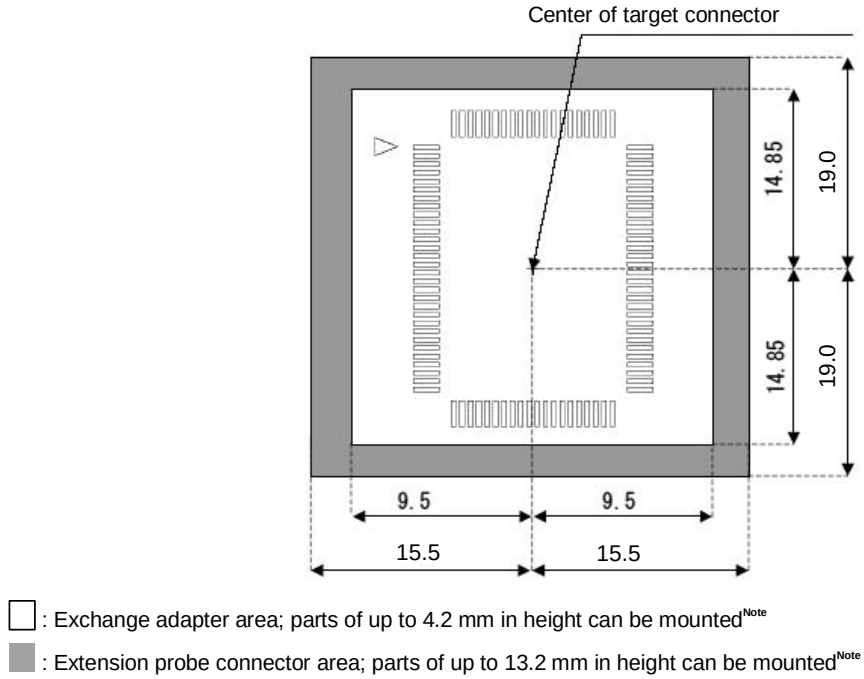
□ : Exchange adapter area; parts of up to 4.2 mm in height can be mounted[Note]

■ : Extension probe connector area; parts of up to 13.2 mm in height can be mounted[Note]

Note: Height can be regulated by using spacer adapters (each adds 2.4 mm on TET-line)
Height can be regulated by using spacer adapters (each adds 5.6 mm on NAIS-line)

(2) For 100-pin GF package

Figure A-4: For 100-pin GF package



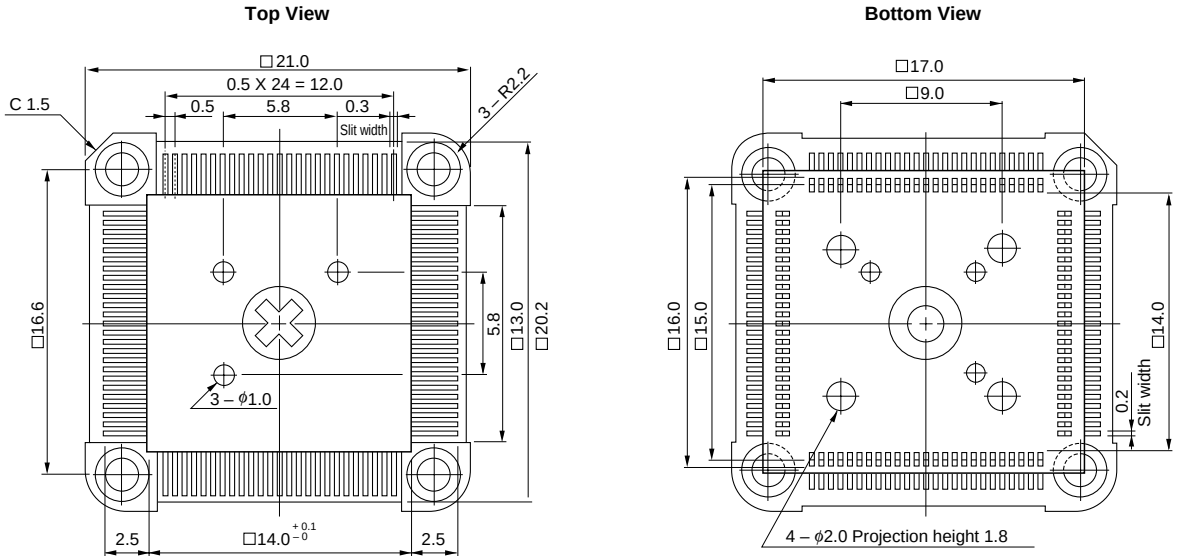
Note: Height can be regulated by using spacer adapters (each adds 2.4 mm on TET-line)
Height can be regulated by using spacer adapters (each adds 5.6 mm on NAIS-line)

Appendix B Package Drawings TET Line

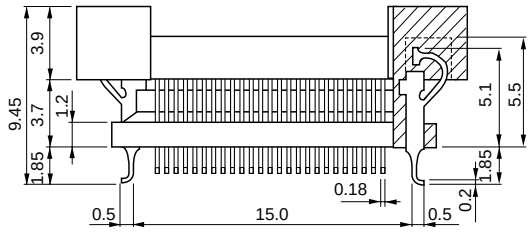
B.1 Target Connectors

Figure B-1: Target Connector for 100-pin QFP GC-package

(a) Package drawing



Side View



(b) Foot pattern

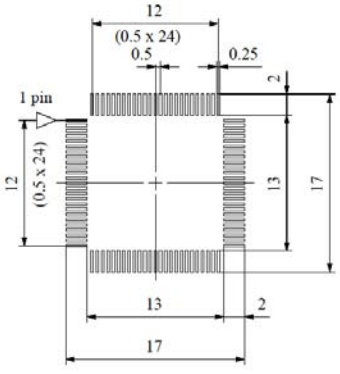
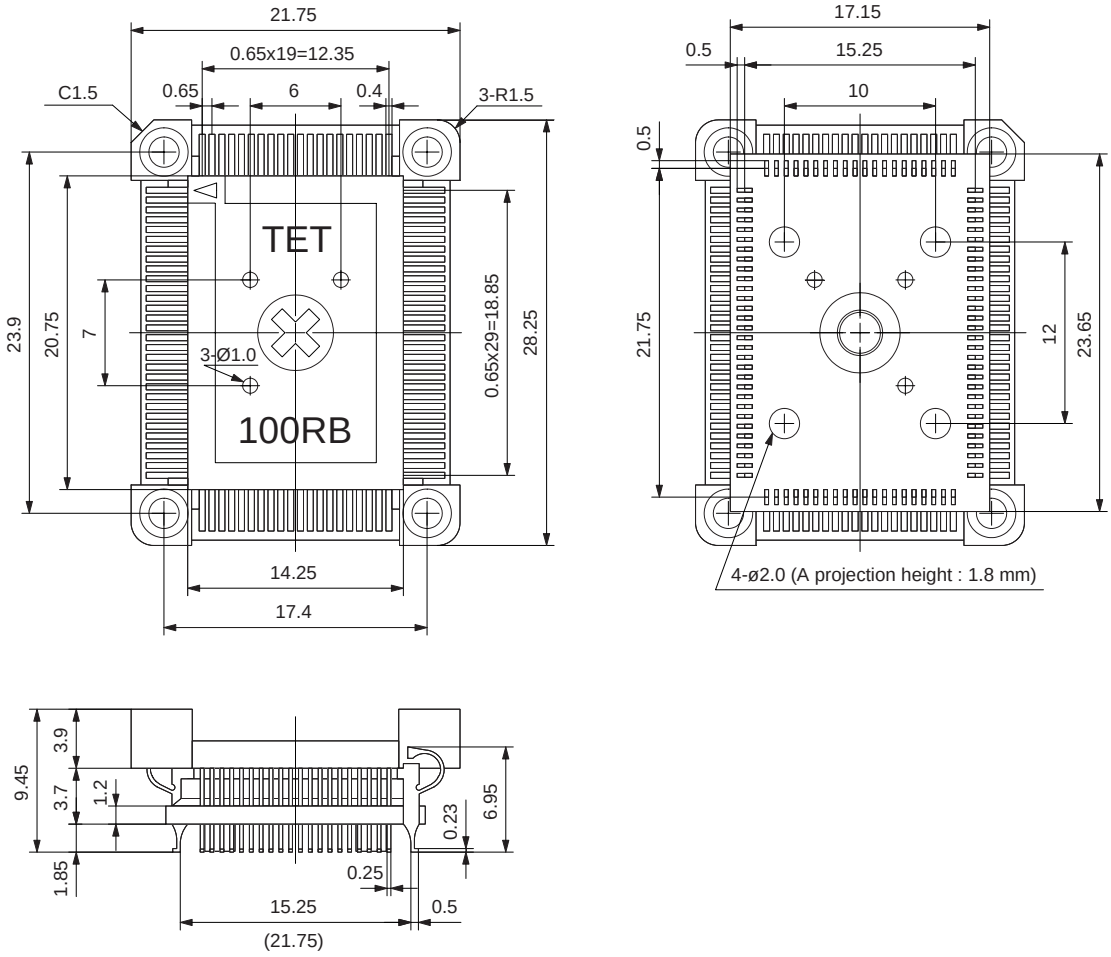
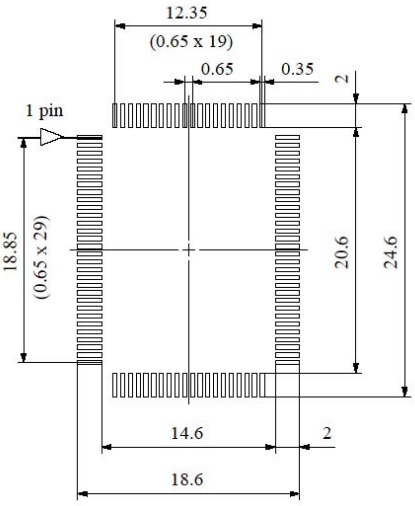


Figure B-2: Target Connector for 100-pin QFP GF-package

(a) Package drawing



(b) Foot pattern



B.2 Exchange Adapters

Figure B-3: Exchange Adapter for 100-pin QFP GC-package

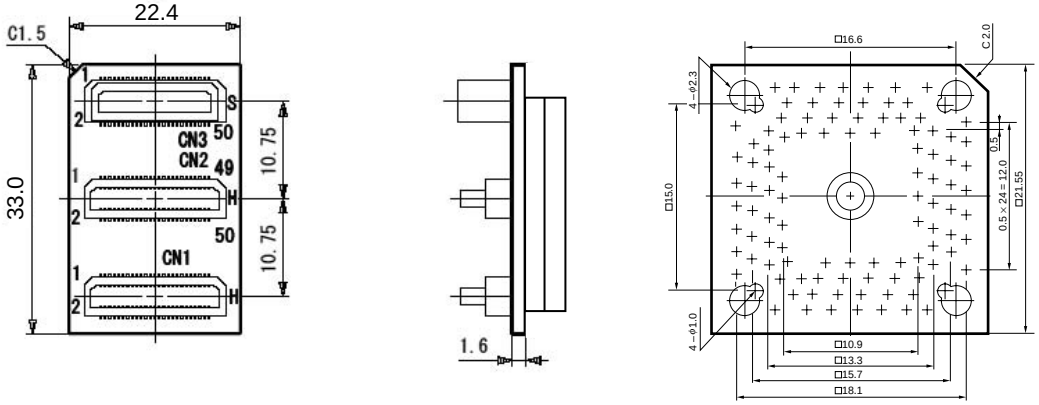
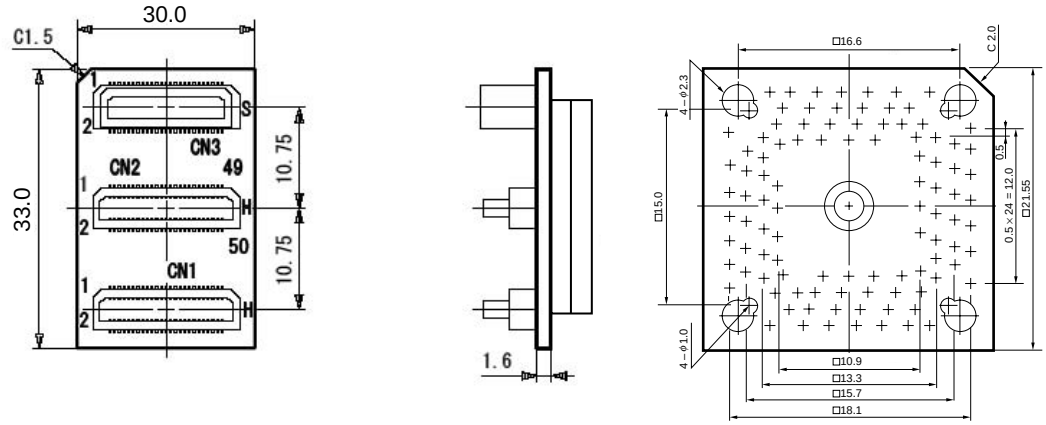


Figure B-4: Exchange Adapter for 100-pin QFP GF-package



B.3 YQ Connectors

Figure B-5: YQ Connector for 100-pin QFP GC-package

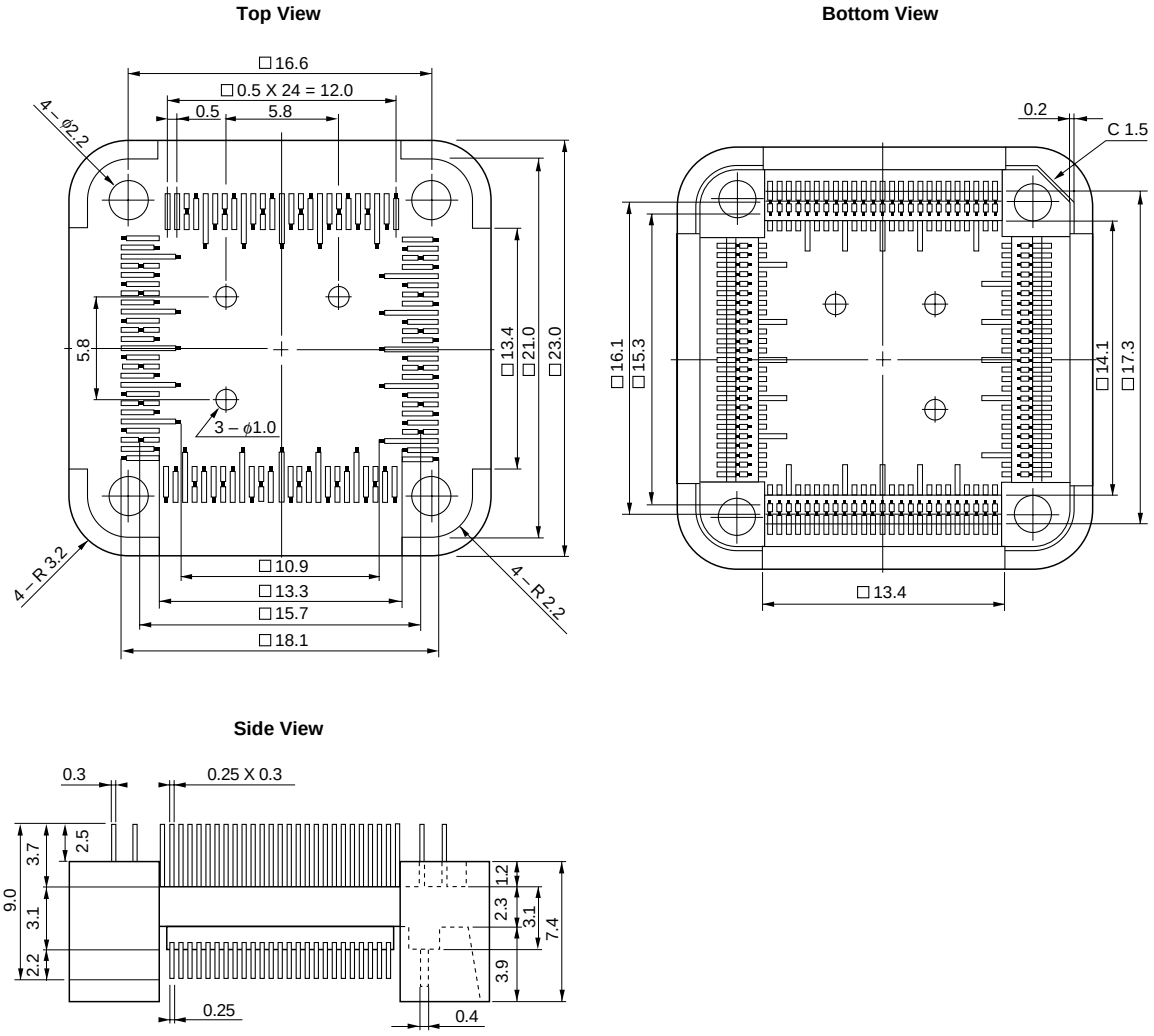
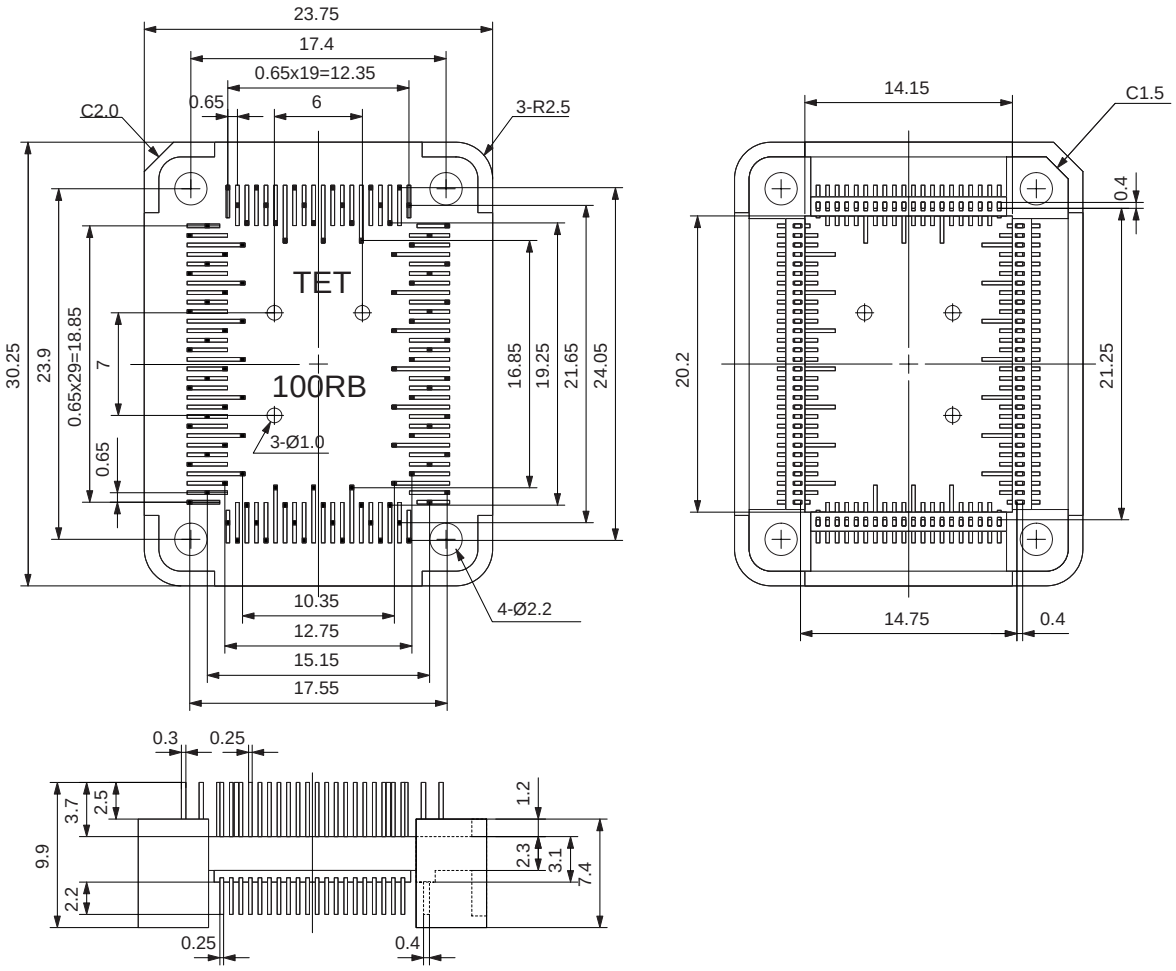


Figure B-6: YQ Connector for 100-pin QFP GF-package



B.4 Mount Adapters

Figure B-7: Mount Adapter for 100-pin QFP GC-package

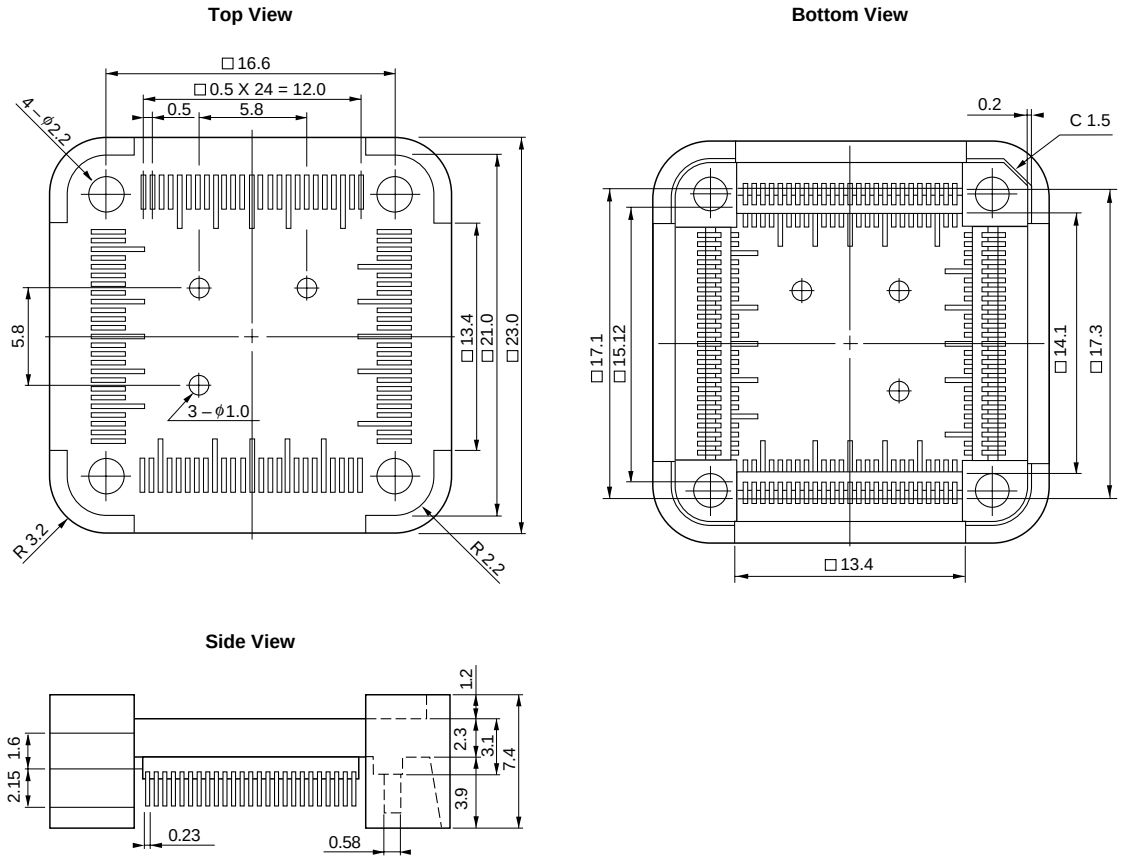
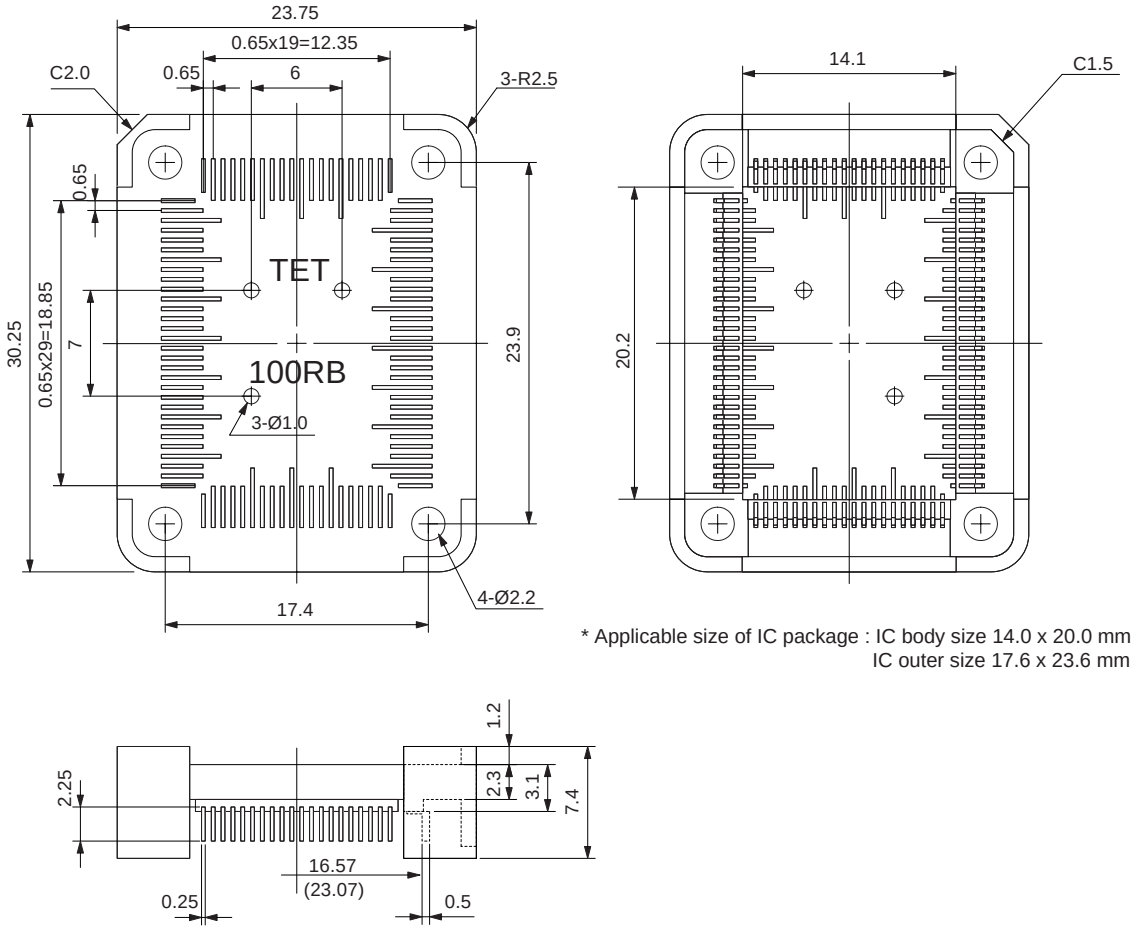


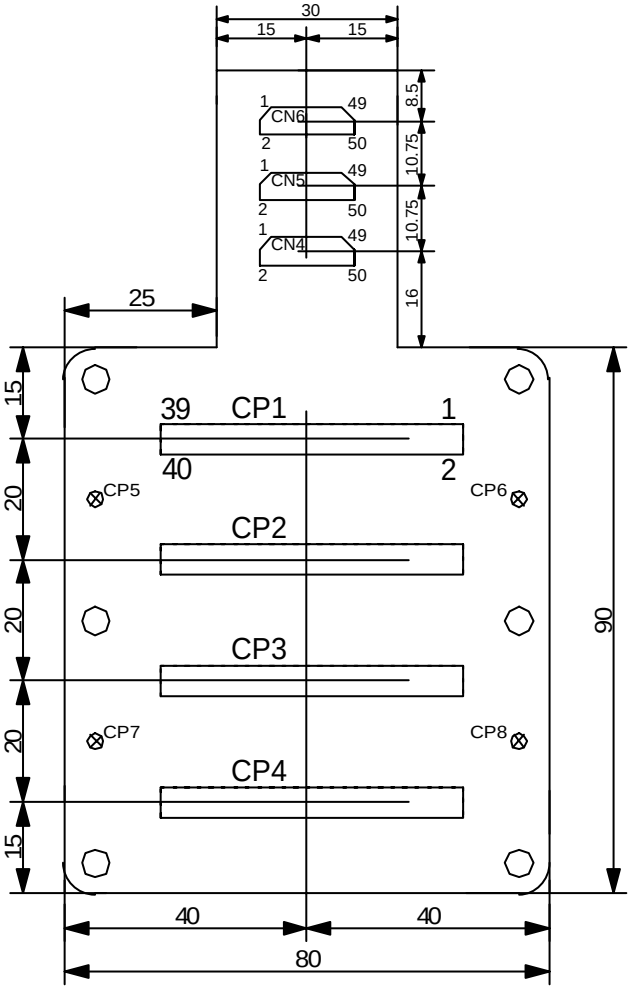
Figure B-8: Mount Adapter for 100-pin QFP GF-package



* Applicable size of IC package : IC body size 14.0 x 20.0 mm
IC outer size 17.6 x 23.6 mm

2.5 Check Pin Adapter

Figure B-9: Check Pin Adapter 144-pin QFP



2.6 Spacer Adapters

Figure B-10: Spacer Adapter for 100-pin QFP GC-package

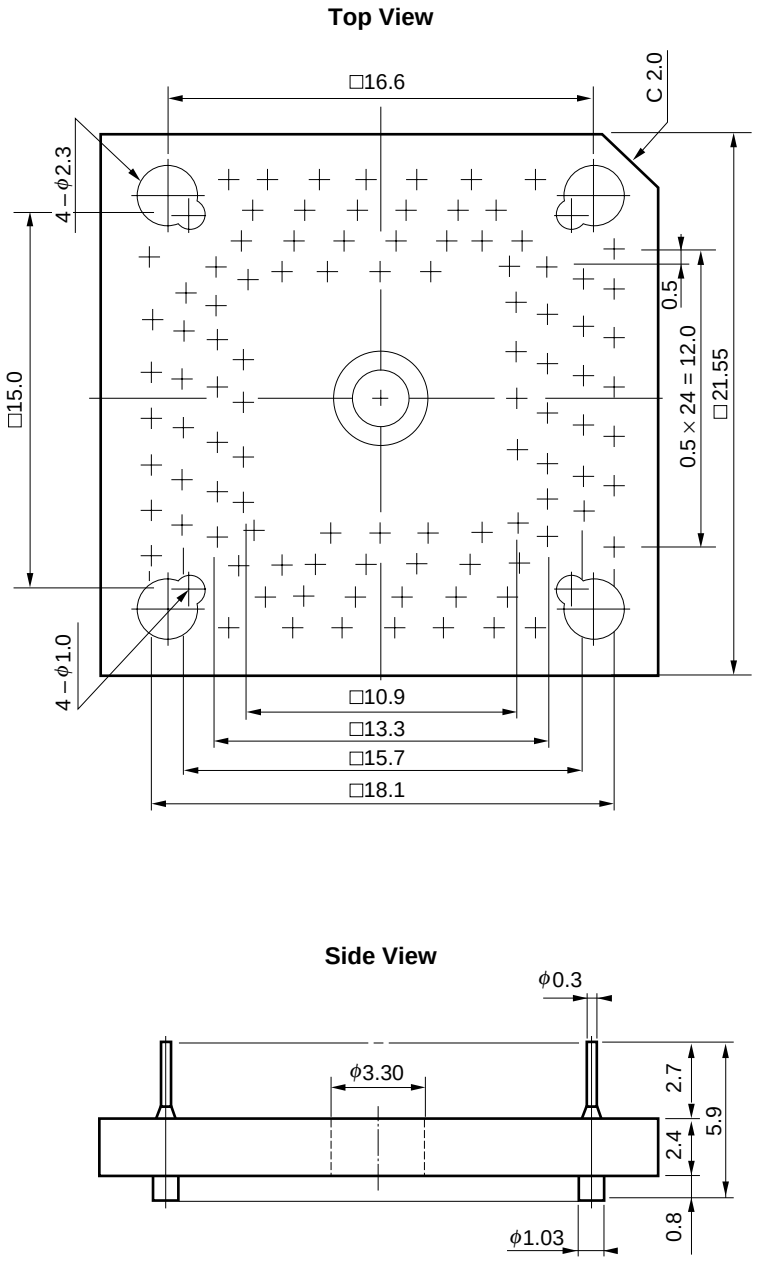
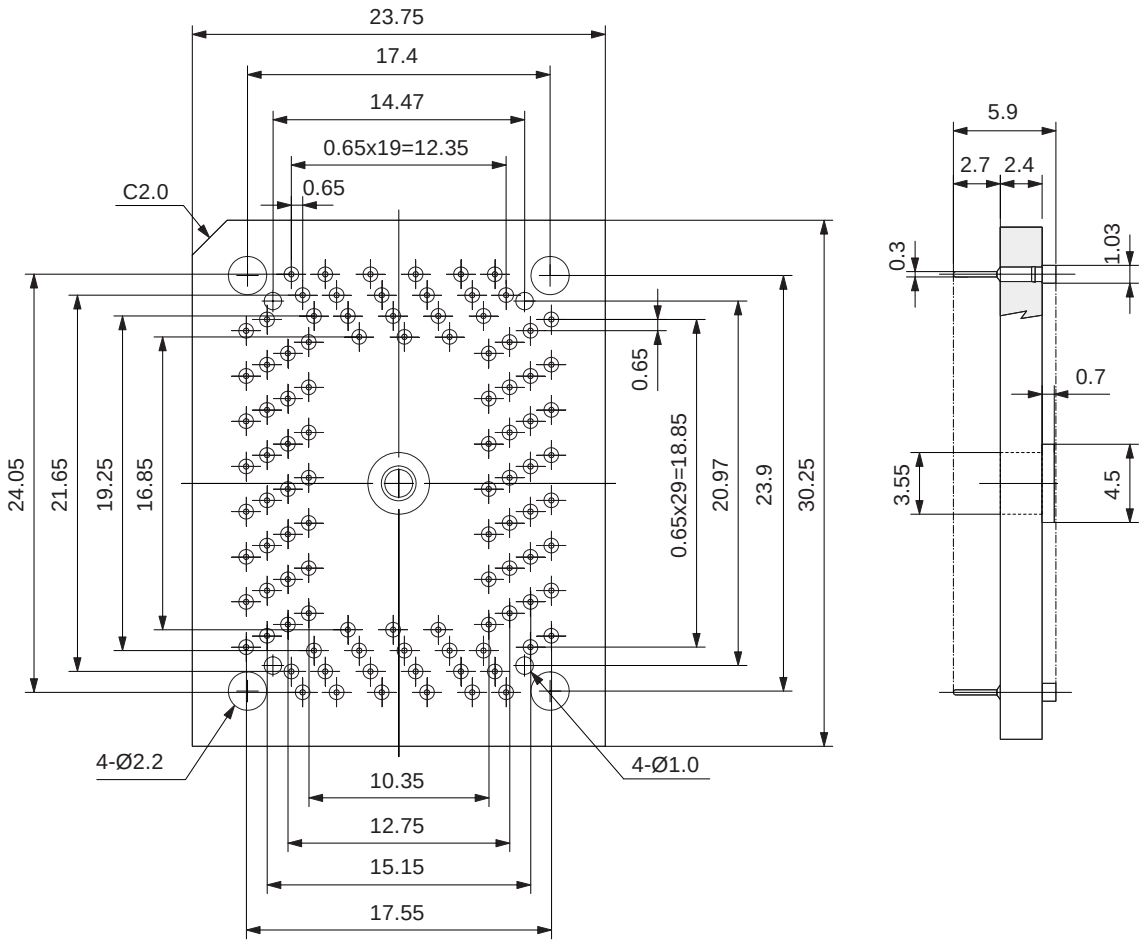
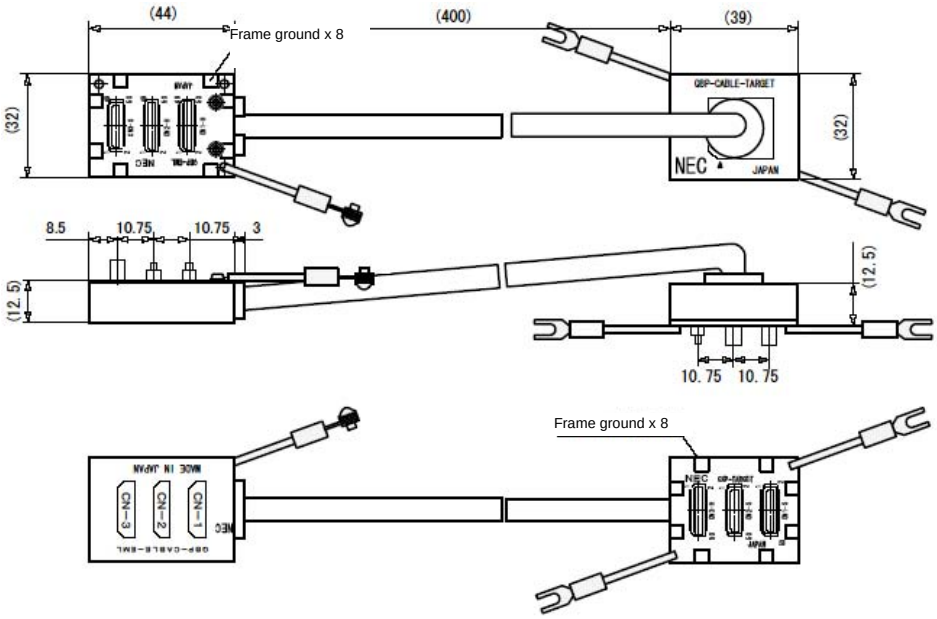


Figure B-11: Spacer Adapter for 100-pin QFP GF-package



B.7 Emulation Probe

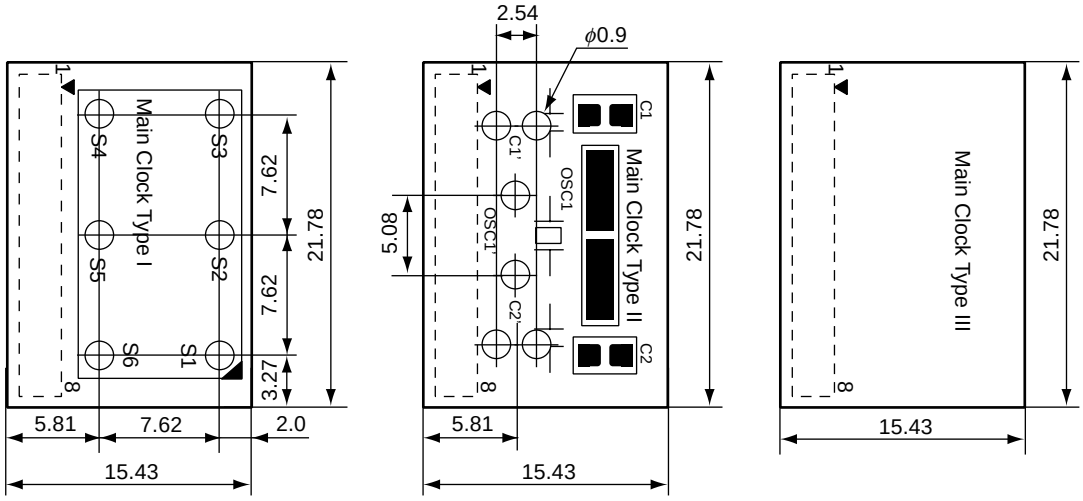
Figure B-12: Emulation Probe 144-pin



B.8 Clock Board

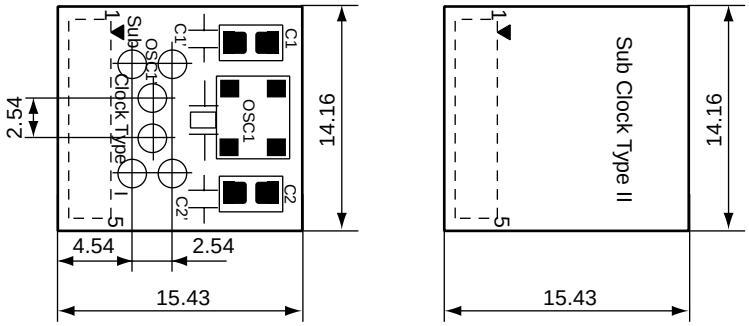
Figure B-13: Clock Board

(a) Main clock board



Main Clock Type I | Main Clock Type II | Main Clock Type II

(b) Sub Clock board



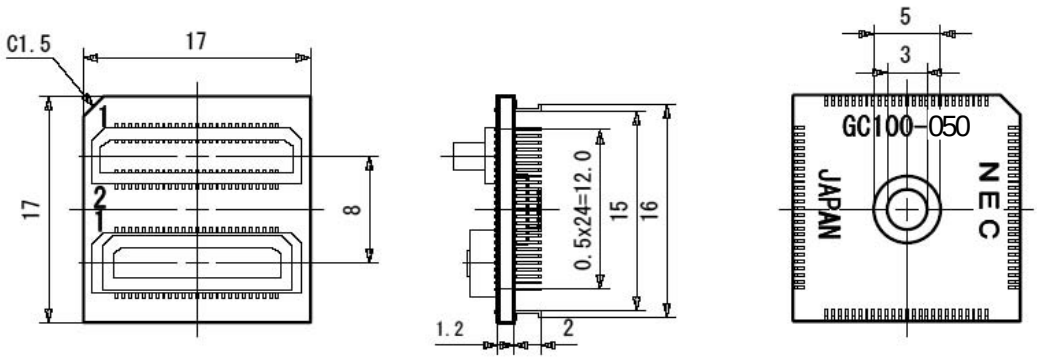
Sub Clock Type I | Sub Clock Type II

Appendix C Package Drawings NAIS Line

C.1 Target Connectors

Figure C-1: Target Connector for 100-pin QFP GC-package

(a) Package drawing



(b) Foot pattern

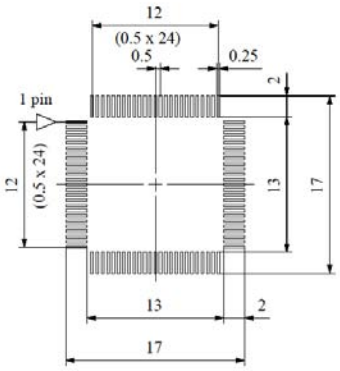
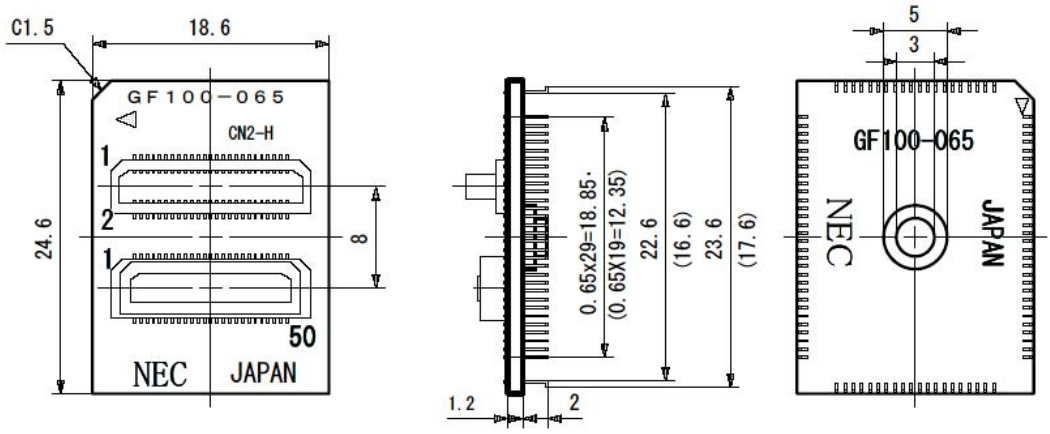
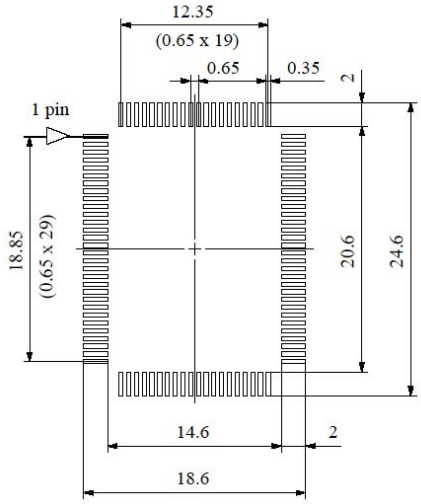


Figure C-2: Target Connector for 100-pin QFP GF-package

(a) Package drawing



(b) Foot pattern



C.2 Exchange Adapters

Figure C-3: Exchange Adapter for 100-pin QFP GC-package

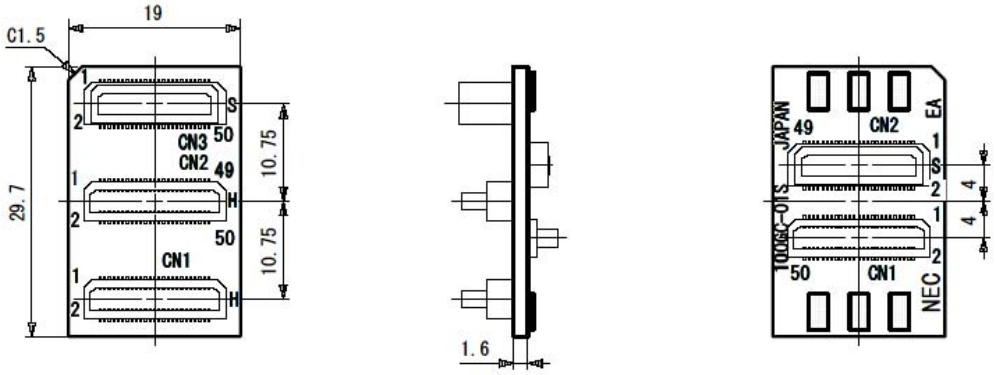
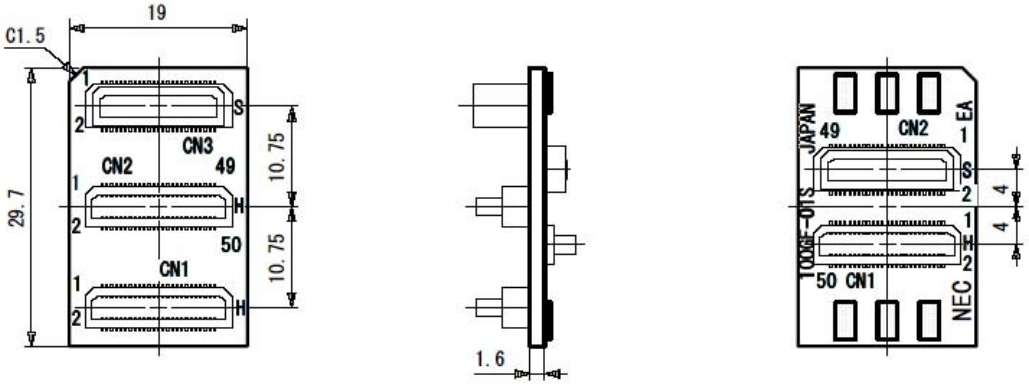


Figure C-4: Exchange Adapter for 100-pin QFP GF-package



C.3 Mount Adapters

Figure C-5: Mount Adapter for 100-pin QFP GC-package

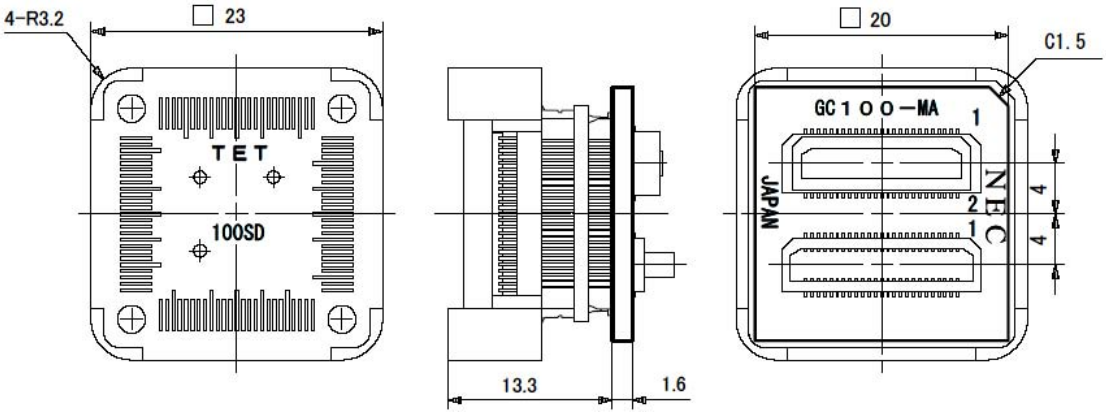
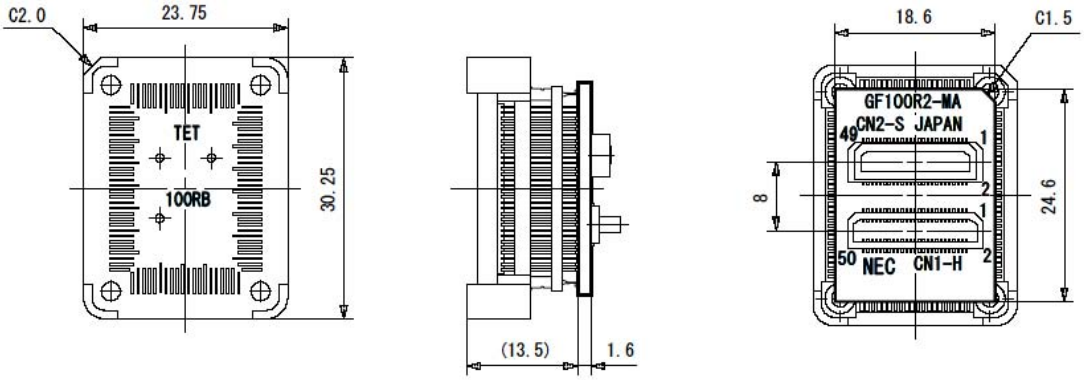
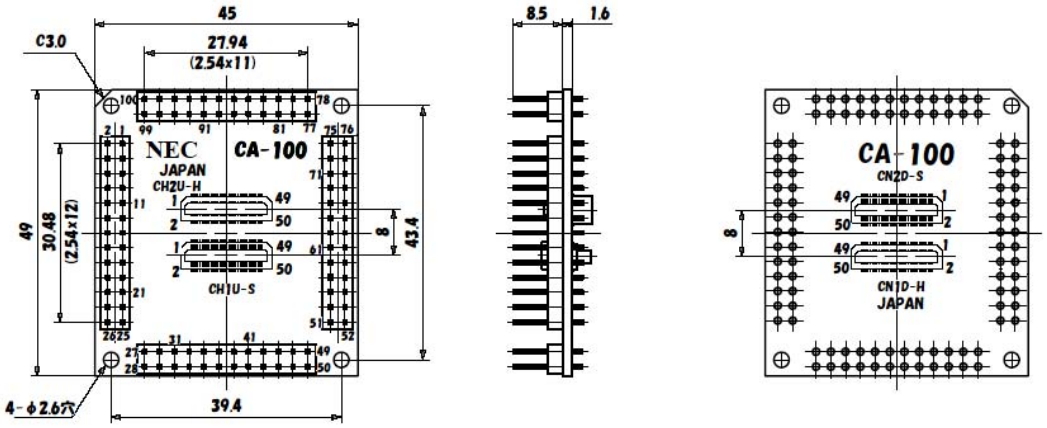


Figure C-6: Mount Adapter for 100-pin QFP GF-package



C.4 Check Pin Adapter

Figure C-7: Check Pin Adapter 100-pin QFP



C.5 Spacer Adapters

Figure C-8: Spacer Adapter for 100-pin QFP GC-package

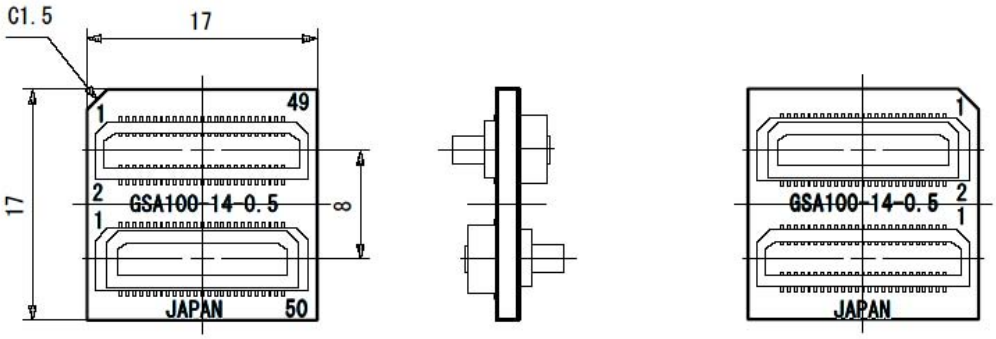
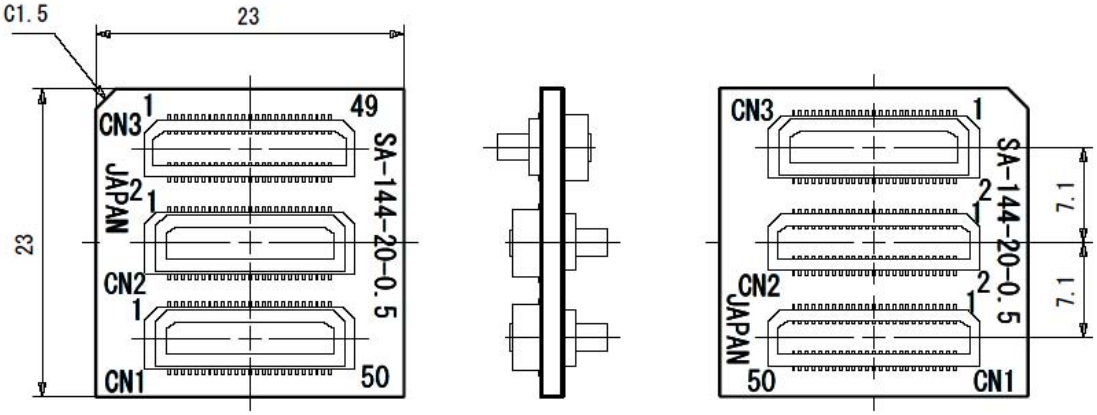
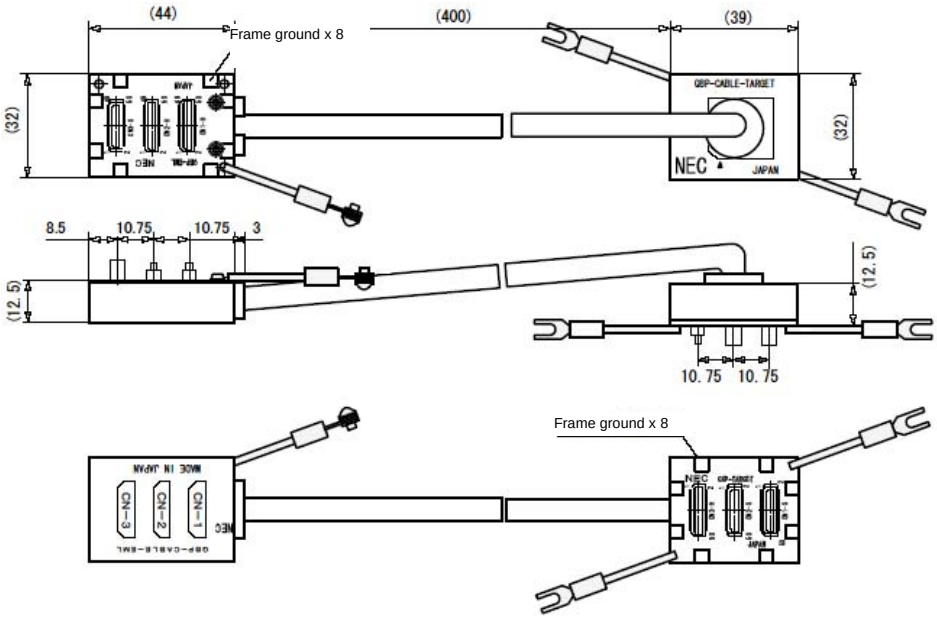


Figure C-9: Spacer Adapter for 100-pin QFP GF-package



C.6 Emulation Probe

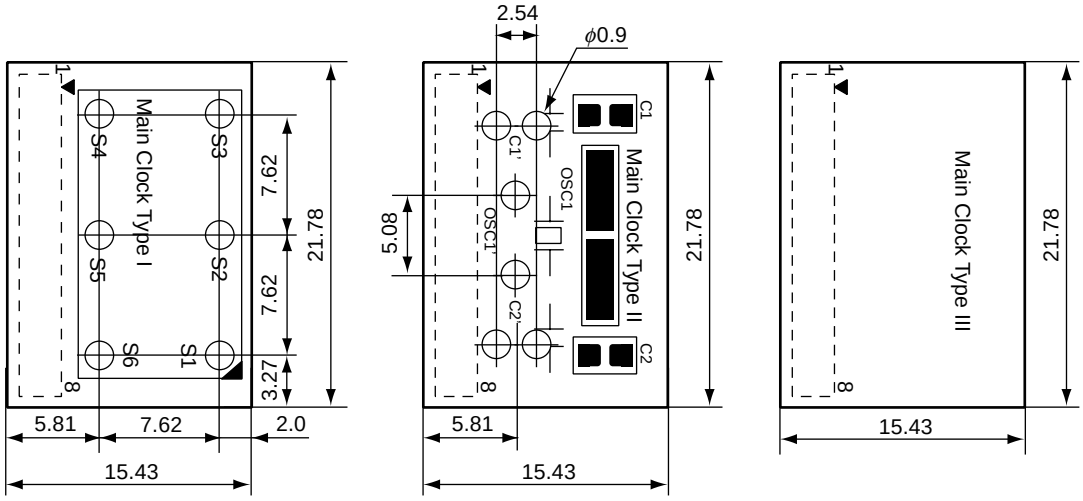
Figure C-10: Emulation Probe 144-pin



C.7 Clock Board

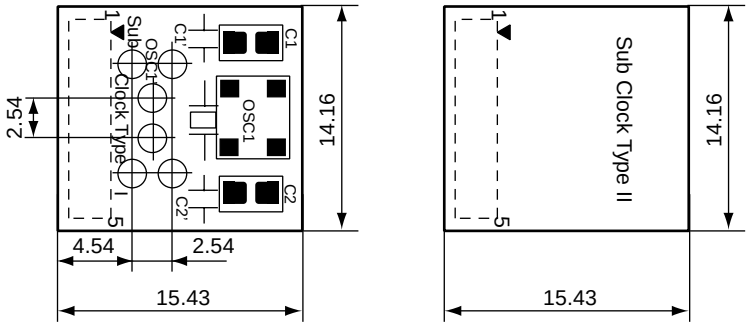
Figure C-11: Clock Board

(a) Main clock board



Main Clock Type I | Main Clock Type II | Main Clock Type II

(b) Sub Clock board



Sub Clock Type I | Sub Clock Type II

Appendix D Target Interface Definition

D.1 Target interface definition on TCN1-3[Note]

The table shows the definition of the TCN1-3 connector on the emulation board and the related pin on the target device (100-pin QFP).

CN	Device	CN	Device	CN	Device
TCN1.01	31	TCN3.01	12	TCN2.01	94
TCN1.02	42	TCN3.02	22	TCN2.02	1
TCN1.03	32	TCN3.03	13	TCN2.03	93
TCN1.04	-	TCN3.04	21	TCN2.04	5
TCN1.05	33	TCN3.05	11	TCN2.05	-
TCN1.06	-	TCN3.06	23	TCN2.06	3
TCN1.07	36	TCN3.07	10	TCN2.07	-
TCN1.08	-	TCN3.08	24	TCN2.08	4
TCN1.09	34	TCN3.09	9	TCN2.09	-
TCN1.10	-	TCN3.10	25	TCN2.10	-
TCN1.11	35	TCN3.11	8	TCN2.11	2
TCN1.12	-	TCN3.12	26	TCN2.12	100
TCN1.13	37	TCN3.13	7	TCN2.13	-
TCN1.14	-	TCN3.14	27	TCN2.14	99
TCN1.15	38	TCN3.15	6	TCN2.15	-
TCN1.16	-	TCN3.16	28	TCN2.16	98
TCN1.17	39	TCN3.17	14	TCN2.17	-
TCN1.18	-	TCN3.18	29	TCN2.18	97
TCN1.19	40	TCN3.19	15	TCN2.19	-
TCN1.20	-	TCN3.20	30	TCN2.20	96
TCN1.21	41	TCN3.21	16	TCN2.21	-
TCN1.22	-	TCN3.22	-	TCN2.22	95
TCN1.23	-	TCN3.23	17	TCN2.23	-
TCN1.24	-	TCN3.24	20	TCN2.24	-
TCN1.25	-	TCN3.25	18	TCN2.25	92
TCN1.26	-	TCN3.26	19	TCN2.26	-
TCN1.27	49	TCN3.27	-	TCN2.27	91
TCN1.28	-	TCN3.28	-	TCN2.28	-
TCN1.29	50	TCN3.29	-	TCN2.29	90
TCN1.30	-	TCN3.30	-	TCN2.30	79
TCN1.31	51	TCN3.31	-	TCN2.31	89
TCN1.32	-	TCN3.32	64	TCN2.32	78
TCN1.33	52	TCN3.33	68	TCN2.33	88
TCN1.34	-	TCN3.34	-	TCN2.34	77
TCN1.35	53	TCN3.35	-	TCN2.35	87
TCN1.36	-	TCN3.36	-	TCN2.36	76
TCN1.37	54	TCN3.37	67	TCN2.37	86
TCN1.38	-	TCN3.38	59	TCN2.38	75
TCN1.39	56	TCN3.39	-	TCN2.39	85
TCN1.40	43	TCN3.40	60	TCN2.40	73
TCN1.41	58	TCN3.41	-	TCN2.41	84
TCN1.42	44	TCN3.42	-	TCN2.42	72
TCN1.43	57	TCN3.43	66	TCN2.43	83
TCN1.44	45	TCN3.44	-	TCN2.44	74
TCN1.45	-	TCN3.45	65	TCN2.45	82
TCN1.46	46	TCN3.46	61	TCN2.46	71
TCN1.47	-	TCN3.47	-	TCN2.47	81
TCN1.48	47	TCN3.48	63	TCN2.48	70
TCN1.49	55	TCN3.49	-	TCN2.49	80
TCN1.50	48	TCN3.50	62	TCN2.50	69

Note: TCN1 50pins Axk5s50330p (connector vendor NAIS, counter part usable Axk6s50635)
TCN2 50pins Axk6s50635 (connector vendor NAIS, counter part usable Axk5s50330p)
TCN3 50pins Axk5s50330p (connector vendor NAIS, counter part usable Axk6s50635)

The counter parts of the TCN1-3 could be used of same type. For different height or ordering contact the connector vendor directly.
This is only an information for customer specific adaptation, in case of not using the NEC adapter line.

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