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| CUSTOMER NOTIFICATION |
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| U17534EJ1V0UM00 |
| Apr 27th, 2005 |
| Tadayoshi Mori, Manager Automotive Systems Division 4th Systems Operations Unit NEC Electronics Corporation (Created by Takashi Fuchigami) |

CP(K), O

QB-78K0FX1

(IECUBE for 78K0/Fx1+)

User's Manual

Target Device:

78K0/FC1+

78K0/FE1+

78K0/FF1+

[MEMO]

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- Ordering information
- Product release schedule
- Availability of related technical literature
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INTRODUCTION

| | | |
|--------------------------------|---|---|
| Readers | This manual is intended for users who wish to perform debugging using the QB-78K0FX1. 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-78K0FX1. | |
| Organization | This manual is divided into following parts. <ul style="list-style-type: none">• General• Setup procedure• Settings at product shipment• Differences between target device and target interface circuit• Cautions• Restrictions | |
| How to Read This Manual | <p>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.</p> <p>To understand the overall functions and usages of the QB-78K0FX1 → Read this manual according to the CONTENTS.</p> <p>To know the manipulations, command functions, and other software-related settings of the QB-78K0FX1 → See the user's manual of the debugger (supplied with the QB-78K0FX1) to be used.</p> | |
| Conventions | Note: Caution: Remark: Numeric representation: Prefix indicating power of 2 (address space, memory capacity): | Footnote for item marked with Note in the text Information requiring particular attention Supplementary information Binary ... xxxx or xxxxB Decimal ... xxxx Hexadecimal ... xxxxH K (kilo): $2^{10} = 1,024$ M (mega): $2^{20} = 1,024^2$ |

Terminology

The meanings of the terms used in this manual are described in the table below.

| Term | 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. |
| 78K0Fx1+ | Generic name indicating 78K0/FC1+, 78K0/FE1+, 78K0/FF1+. |

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.

Documents Related to Development Tools (User's Manuals)

| Document Name | | Document Number |
|---|------------------------------|-----------------|
| QB-78K0FX1 In-Circuit Emulator | | This manual |
| RA78K0 Assembler Package Ver. 3.70 | Operation | U17015E |
| | Language | U17014E |
| | Structured Assembly Language | U11789E |
| CC78K0 C Compiler Ver. 3.60 | Operation | U17017E |
| | Language | U17016E |
| ID78K0-QB Ver. 2.81 Integrated Debugger | Operation | U16996E |
| PM plus Ver. 5.20 | | U16934E |

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**.

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CHAPTER 1 GENERAL

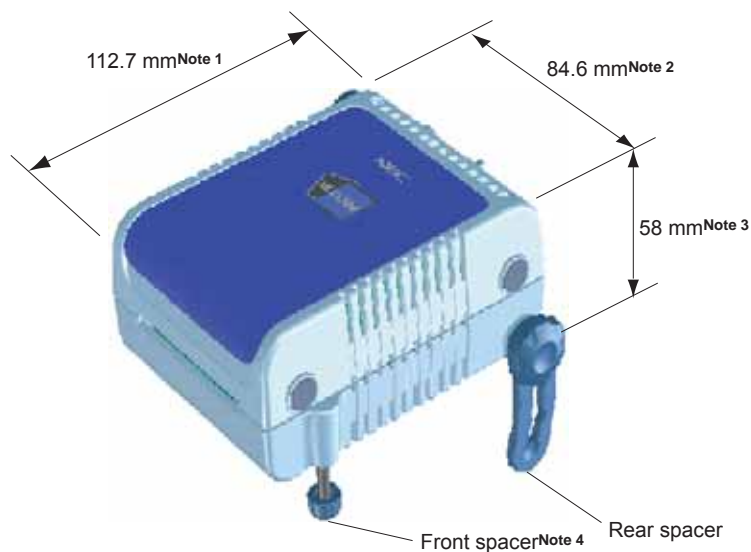
The QB-78K0FX1 is an in-circuit emulator for emulating the 78K0/Fx1+.

Hardware and software can be debugged efficiently in the development of systems in which the 78K0/Fx1+ is used. This manual describes basic setup procedures, hardware specifications, system specifications, and how to set switches.

1.1 Hardware Specifications

Table 1-1. QB-78K0FX1 Hardware Specifications

| Parameter | | Specification |
|-----------------------------|----------------------------|--|
| Target device | | 78K0/FC1+, 78K0/FE1+, 78K0/FF1+ |
| Operating voltage | | 3.7 to 5.5 V |
| Operating frequency | Main system clock | V _{DD} = 4.0 to 5.5 V: 16 MHz V _{DD} = 3.7 to 4.0 V: 12 MHz |
| | Subsystem clock | 32.768 kHz |
| | Ring-OSC | TYP.240KHz (120KHz ~ 480KHz) |
| 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-78K0FX1 | 15 V, 1 A |
| | Target system power supply | Same level as target device |
| Weight | | 382 g |
| Host interface | | USB interface (1.1, 2.0) |



- 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-78K0FX1 system specifications.

Table 1-2. QB-78K0FX1 System Specifications

| Parameter | | Specification |
|-----------------------------------|----------------------------------|--|
| Emulation memory capacity | | 64 KB |
| 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, timeout 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 | 128K 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 μ s) |
| | 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, timeout break function |
| Other functions | | Mapping function, event function, coverage function, snapshot function, DMM function, stub function, power-off emulation function, pin mask function |

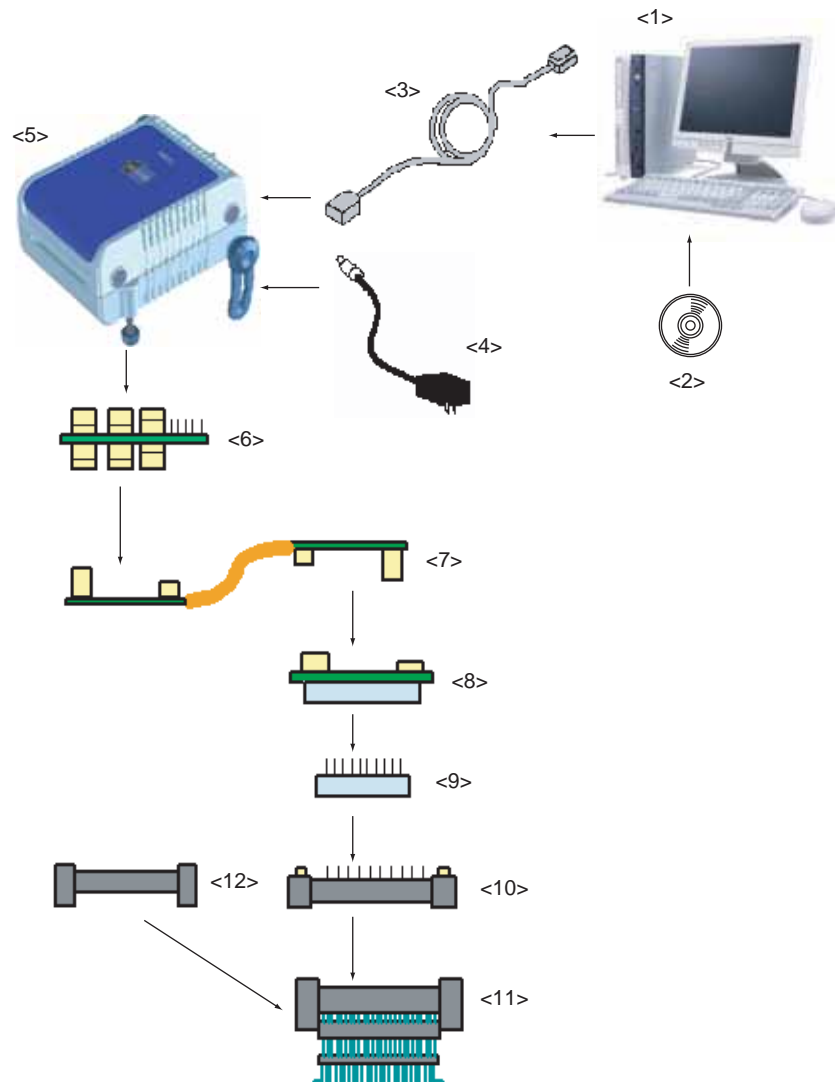
1.3 System Configuration

This section shows the system configuration when using the QB-78K0FX1 connected to a PC (PC-9821 series, PC/ATTM compatible). Connection is possible even without optional products.

Table 1-3. Devices Subject to Emulation by 78K0Fx1

| Series Name (Common Name) | Package | Device Name |
|------------------------------|---------------------|---------------------------------------|
| | | Flash Memory Version |
| FC1+ Series | 44-pin QFP (GB) | μ PD78F0871, μ PD78F0872, μ PD78F0873 |
| | 48-pin QFP (GA) | μ PD78F0877, μ PD78F0878, μ PD78F0879 |
| FE1+ Series | 64-pin QFP (GB,GK) | μ PD78F0874, μ PD78F0875 |
| FF1+ Series | 80-pin QFP (GK, GC) | μ PD78F0876 |

Figure 1-1. System Configuration



| | |
|------------------------------------|--|
| <1> Host machine: | PC-9821 series, PC/AT compatible can be used |
| <2> ID78K0-QB Disk/Accessory Disk: | Debugger, USB drivers, manual, etc. |
| <3> USB interface cable: | Cable connecting QB-78K0FX1 to host machine |
| <4> AC adapter: | Can support 100 to 240 V by replacing AC plug |
| <5> QB-78K0FX1: | This product |
| <6> 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 |

Remarks 1. Obtain device files from the NEC Electronics website.

http://www.necel.com/micro/index_e.html

2. Refer to **1.4 Package Contents** for the purchase forms of the above products.

Table 1-5. Check Pin Adapters

| Package | Check Pin Adapter |
|---------|-------------------|
| Common | QB-144-CA-01 |

Table 1-6. Exchange Adapters

| Package | Exchange Adapter |
|---------|------------------|
| 80GC | QB-80GC-EA-01T |
| 80GK | QB-80GK-EA-01T |
| 64GB | QB-64GB-EA-03T |
| 64GK | QB-64GK-EA-03T |
| 48GA | QB-48GA-EA-01T |
| 44GB | QB-44GB-EA-02T |

Table 1-7. Emulation Probes

| Package | Emulation Probe |
|---------|-----------------|
| Common | QB-80-EP-01T |

Table 1-8. YQ Connectors

| Package | YQ Connector |
|---------|----------------|
| 80GC | QB-80GC-YQ-01T |
| 80GK | QB-80GK-YQ-01T |
| 64GB | QB-64GB-YQ-01T |
| 64GK | QB-64GK-YQ-01T |
| 48GA | QB-48GA-YQ-01T |
| 44GB | QB-44GB-YQ-01T |

Table 1-9. Spacer Adapters

| Package | Spacer Adapter |
|---------|----------------|
| 80GC | QB-80GC-YS-01T |
| 80GK | QB-80GK-YS-01T |
| 64GB | QB-64GB-YS-01T |
| 64GK | QB-64GK-YS-01T |
| 48GA | QB-48GA-YS-01T |
| 44GB | QB-44GB-YS-01T |

Table 1-10. Target Connectors

| Package | Target Connector |
|---------|------------------|
| 80GC | QB-80GC-NQ-01T |
| 80GK | QB-80GK-NQ-01T |
| 64GB | QB-64GB-NQ-01T |
| 64GK | QB-64GK-NQ-01T |
| 48GA | QB-48GA-NQ-01T |
| 44GB | QB-44GB-NQ-01T |

Table 1-11. Mount Adapters

| Package | Target Connector |
|---------|------------------|
| 80GC | QB-80GC-HQ-01T |
| 80GK | QB-80GK-HQ-01T |
| 64GB | QB-64GB-HQ-01T |
| 64GK | QB-64GK-HQ-01T |
| 48GA | QB-48GA-HQ-01T |
| 44GB | QB-44GB-HQ-01T |

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-78K0FX1 packing box. Please check the contents.

Products supplied with QB-78K0FX1-ZZZ

- 1: QB-78K0FX1
- 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: User registration
- 6: PG-FPL
- 7: ID78K0-QB Disk (CD-ROM)
- 8: Accessory Disk (CD-ROM)
- 9: Setup Manual

Products supplied with QB-78K0FX1-T80GC

- 1 to 9
- 10: Emulation probe QB-80-EP-01T
- 11: Exchange adapter QB-80GC-EA-01T
- 12: YQ connector QB-80GC-YQ-01T
- 13: Target connector QB-80GC-NQ-01T

Products supplied with QB-78K0FX1-T80GK

- 1 to 9
- 10: Emulation probe QB-80-EP-01T
- 11: Exchange adapter QB-80GK-EA-01T
- 12: YQ connector QB-80GK-YQ-01T
- 13: Target connector QB-80GK-NQ-01T

Products supplied with QB-78K0FX1-T64GB

- 1 to 9
- 10: Emulation probe QB-80-EP-01T
- 11: Exchange adapter QB-64GB-EA-03T
- 12: YQ connector QB-64GB-YQ-01T
- 13: Target connector QB-64GB-NQ-01T

Products supplied with QB-78K0FX1-T64GK

- 1 to 9
- 10: Emulation probe QB-80-EP-01T
- 11: Exchange adapter QB-64GK-EA-03T
- 12: YQ connector QB-64GK-YQ-01T
- 13: Target connector QB-64GK-NQ-01T

Products supplied with QB-78K0FX1-T48GA

1 to 9

- 10: Emulation probe QB-80-EP-01T
- 11: Exchange adapter QB-48GA-EA-01T
- 12: YQ connector QB-48GA-YQ-01T
- 13: Target connector QB-48GA-NQ-01T

Products supplied with QB-78K0FX1-T44GB

1 to 9

- 10: Emulation probe QB-80-EP-01T
- 11: Exchange adapter QB-44GB-EA-02T
- 12: YQ connector QB-44GB-YQ-01T
- 13: Target connector QB-44GB-NQ-01T

The following products are sold as single items.

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

CHAPTER 2 SETUP PROCEDURE

This chapter explains the QB-78K0FX1 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** for clock board positions.

Clock settings

The internal clock board is mounted at shipment.

If using the internal clock, modification of the settings are unnecessary.

If modification is necessary, see **2.2 Removal of Acrylic Board** and **2.3 Clock Settings**.



Software settings

See **2.4 Software Settings**.



Mounting and connecting connectors

See **2.5 Mounting and Connecting Connectors**.



Connection of QB-78K0FX1 to target system

See **2.6 Connection of QB-78K0FX1 to Target System**.



Connection of USB interface cable and AC adapter

See **2.8 Connection of USB Interface Cable and AC adapter**.



Switching power on and off

See **2.9 Switching Power On and Off**

2.1 Names and Functions of Hardware

Figure 2-1. Names of Parts of QB-78K0FX1

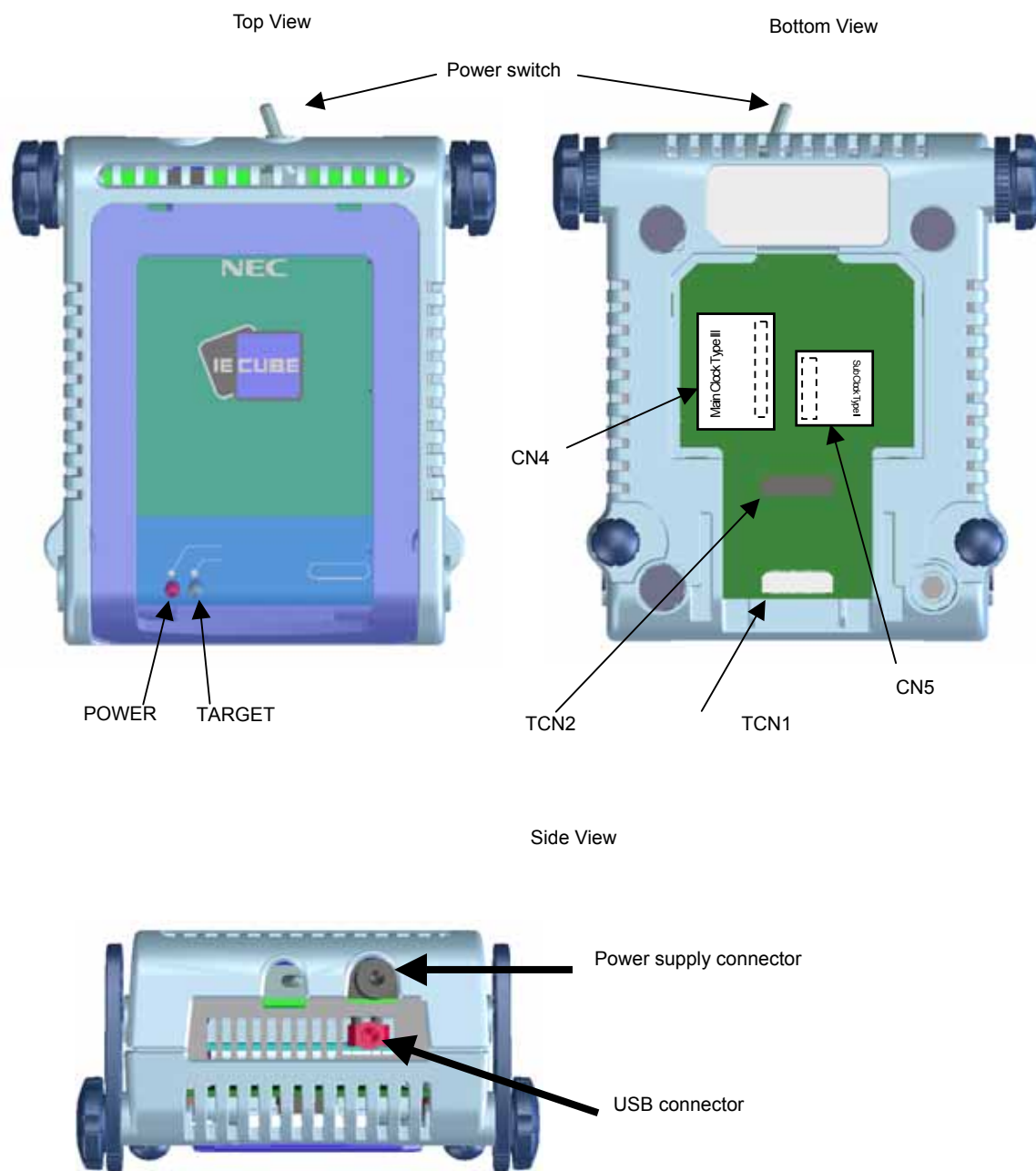
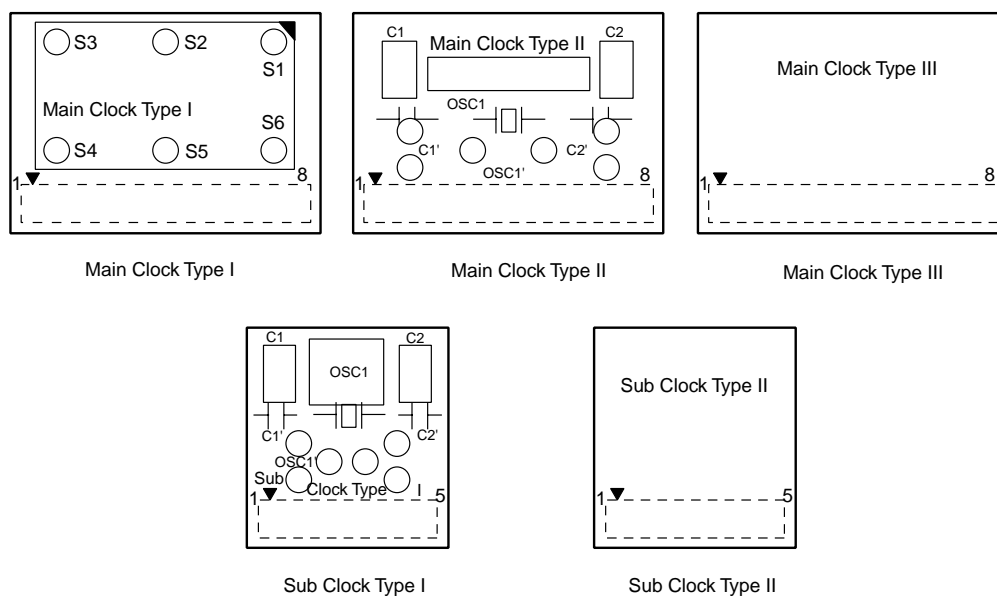


Figure 2-2. Clock Board



(1) TCN1, TCN2

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

(2) CN4

CN4 (Main clock board connector) is the connector for mounting the main clock board. Main Clock Type III is mounted at shipment.

(3) CN5

CN5 (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-78K0FX1 is switched on.

| LED State | QB-78K0FX1 State |
|-----------|--|
| Lit | Power switch ON |
| Not lit | Power switch OFF or AC adapter not connected to QB-78K0FX1 |
| 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

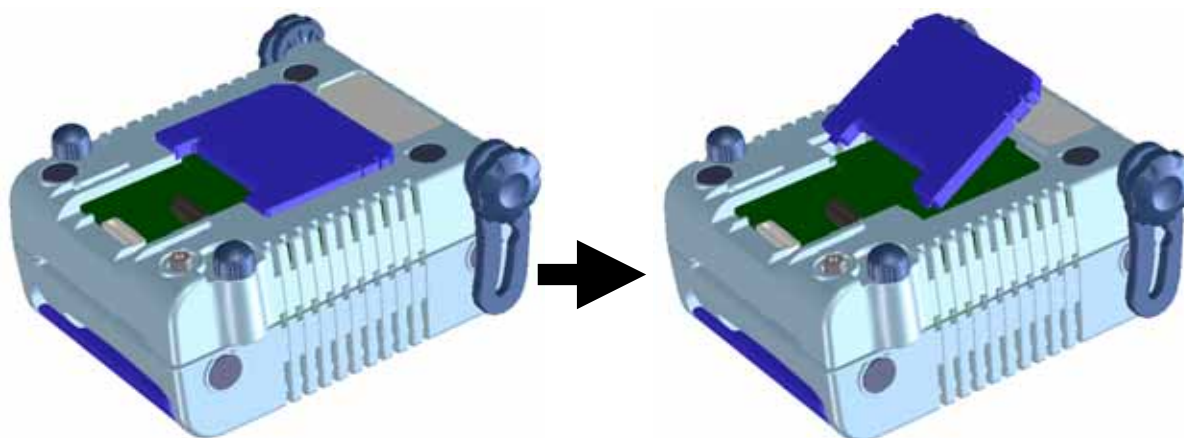
This is the power switch of the QB-78K0FX1.

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-78K0FX1 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**.

Main system clock

- (1) Mount the clock board in CN4 and use the internally generated clock
- (2) Mount the clock board in CN4 and use an externally input clock
- (3) Mount the oscillator clock board in CN4 and generate the clock from the clock board
- (4) Mount the oscillation circuit clock board in CN4 and generate the clock from the clock board

Subsystem 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 oscillation circuit clock board in CN5 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 | CN4 | Remarks |
|--|--|----------------------------|
| (1) Mount clock board in CN4 and use internally generated clock | Mount Main Clock Type III in CN4. | Mounted in CN4 at shipment |
| (2) Mount clock board in CN4 and use externally input clock | Mount Main Clock Type III in CN4. | Mounted in CN4 at shipment |
| (3) Mount oscillator clock board in CN4 and generate clock from clock board | Mount Main Clock Type I on which oscillator is mounted in CN4. | |
| (4) Mount oscillation circuit clock board in CN4 and generate clock from clock board | Mount Main Clock Type II on which oscillation circuit is assembled in CN4. | |

Remark Settings other than the above are prohibited.

Table 2-2. Hardware Settings When Setting Subsystem Clock

| Type of Clock to Use | CN5 | Remarks |
|--|---|----------------------------|
| (1) Mount clock board in CN5 and use internally generated clock | Mount Sub Clock Type II in CN5 | Mounted in CN5 at shipment |
| (2) Mount clock board in CN5 and use externally input clock | Mount Sub Clock Type II in CN5 | Mounted in CN5 at shipment |
| (3) Mount oscillation circuit clock board in CN5 and generate clock from clock board | Mount Sub Clock Type I on which oscillation circuit is assembled in CN5 | |

Remark Settings other than the above are prohibited.

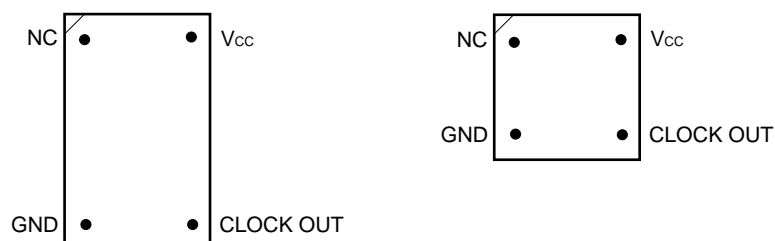
2.3.3 Main system clock

(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)



Top View

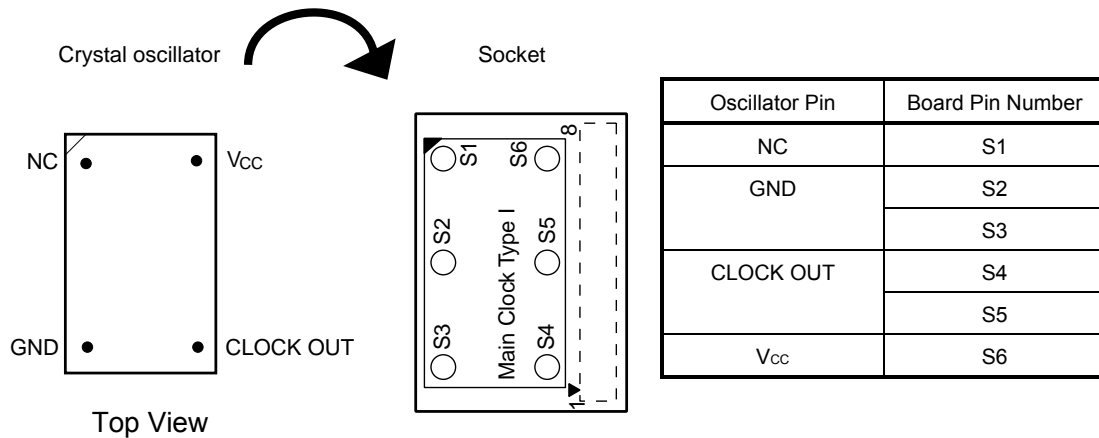
<Procedure>

<1> Prepare the QB-78K0FX1 and Main Clock Type I. Remove the clock board that is mounted in the CN4 socket on the QB-78K0FX1.

When removing the clock board, do so carefully, since the pins of the CN4 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 (Main System Clock)



<3> Fit Main Clock Type I prepared in <2> in the CN4 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)

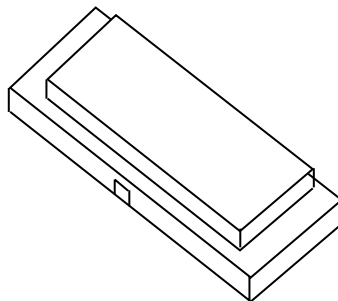
(a) When using 3-pin type resonator

◆ 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>

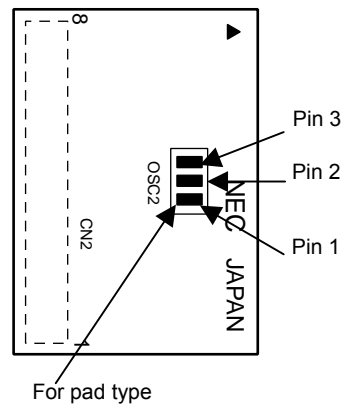
<1> Prepare the QB-78K0FX1 and Main Clock Type II. Remove the clock board that is mounted in the CN4 socket on the QB-78K0FX1.

When removing the clock board, do so carefully, since the pins of the CN4 socket bend easily.

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

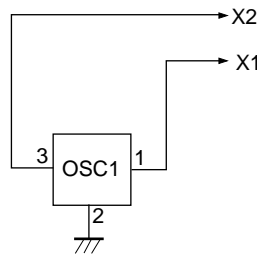
Figure 2-7. Connection to Main Clock Type II (Main System Clock: 3-Pin)

Main Clock Type II (Back)



| Pin Number | Connection |
|------------|--|
| OSC2 | Ceramic resonator or crystal resonator |

Circuit Diagram



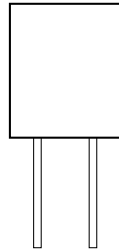
<3> Fit Main Clock Type II of <2> in the CN4 socket from which the clock board was removed in <1>.

(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)



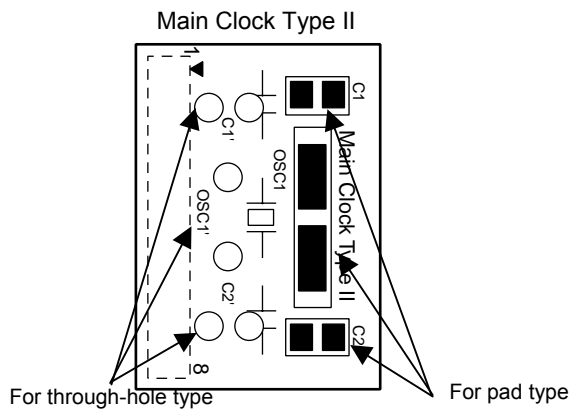
<Procedure>

<1> Prepare the QB-78K0FX1 and Main Clock Type II. Remove the clock board that is mounted in the CN4 socket on the QB-78K0FX1.

When removing the clock board, do so carefully, since the pins of the CN4 socket bend easily.

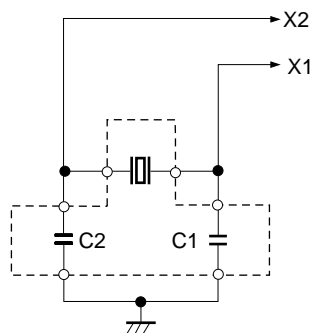
<2> Solder the ceramic resonator or crystal resonator used in OSC1 of Main Clock Type II and capacitor C1 and capacitor C2 conforming with its oscillation frequency as follows. When soldering, use either through-hole types or pad types.

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 |

Circuit Diagram



<3> Fit Main Clock Type II of <2> in the CN4 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 CN4 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 C2 |
| • Capacitor C1 | • Soldering tool set |

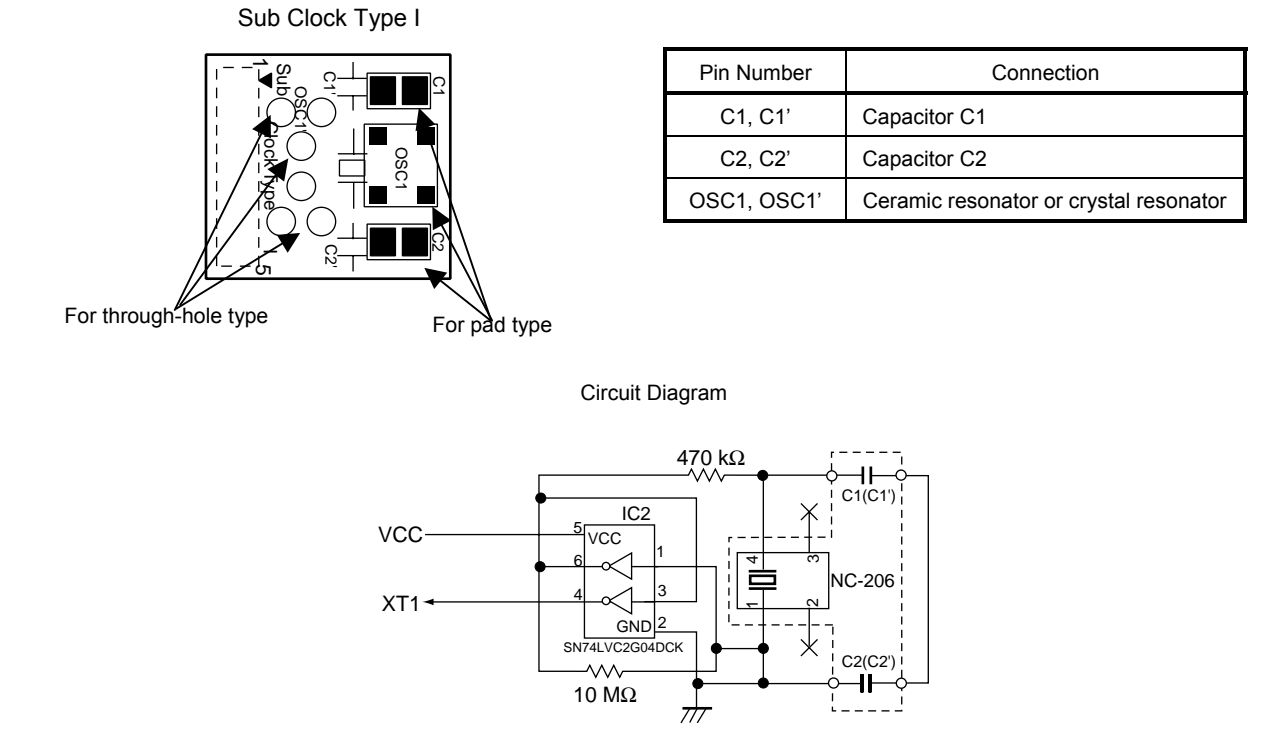
Note The resonator used is assumed to be NC-206 (by Kyushu Dentsu Co., Ltd.).

<Procedure>

<1> Prepare the QB-78K0FX1 and Sub Clock Type I. Remove the clock board that is mounted in the CN5 socket on the QB-78K0FX1.

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 that is used in Sub Clock Type□ and capacitor C1 and capacitor C2 that conform to its oscillation frequency as follows.



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

<3> Fit Sub Clock Type I 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.

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

Sub Clock Type II 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 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-78K0FX1 and target system.

Make connections with both the QB-78K0FX1 and target system powered OFF.

The following abbreviations are used in this section.

- NQ: Target connector
- YQ: YQ connector
- EA: Exchange adapter
- HQ: Mount adapter
- CA: Check pin adapter
- YS: Spacer adapter

2.5.1 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 $\phi 1.0$ 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 $240^{\circ}\text{C} \times 20$ seconds or less
 Manual soldering $240^{\circ}\text{C} \times 10$ seconds or less (1 pin)

Caution Do not perform washing by flux immersion or vapor.

- (4) Take away the guide pins.

2.5.2 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 $M2 \times 10$ 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 $0.55\text{kg} \cdot \text{f} \cdot \text{cm}$ ($0.054\text{N} \cdot \text{m}$) Max. Too great tightening causes bad connections.
Screws for fitting to the NQ ($M2 \times 10$ mm/4) are included with the YQ.

2.5.3 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.

2.5.4 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: $\phi 2.3$ mm or $\phi 3.3$ mm). The $\phi 3.8$ mm or $\phi 4.3$ 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/>

2.5.5 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 molded part of the HQ (plastic part) and bend the mold into a bowed shape, making contact poor.
- (8) After soldering the NQ, do not perform washing by flux immersion or vapor.

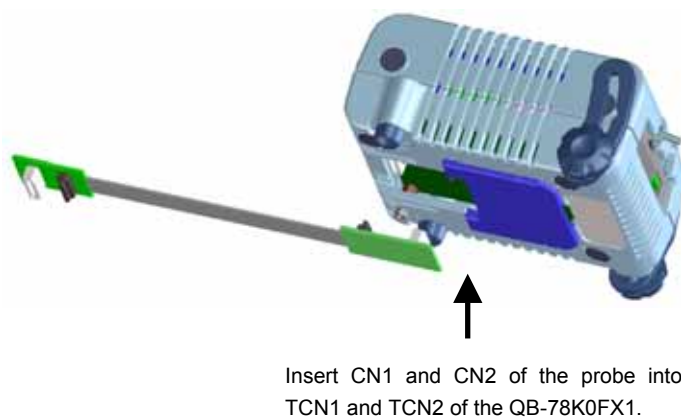
2.6 Connection of QB-78K0FX1 to Target System

If connecting the emulation probe (QB-80-EP-01T), connect it to the QB-78K0FX1 and the target system by the following procedure.

(a) Connection of emulation probe

Connect the emulation probe to the QB-78K0FX1.

Figure 2-11. Emulation Probe Connection Method

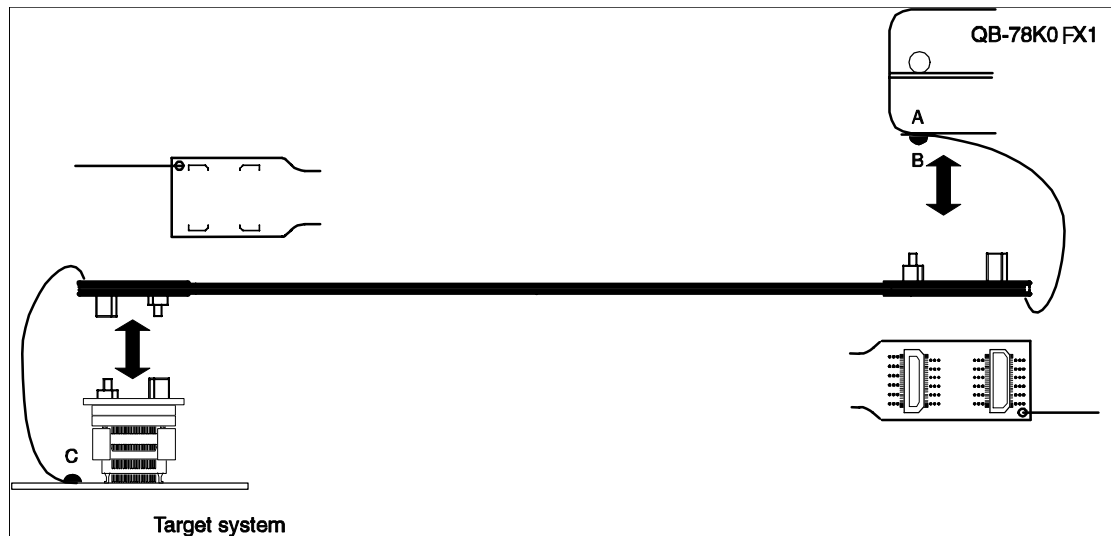


(b) Connection of emulation probe GND wire

There are 2 GND wires in the emulation probe. Connect them to the QB-78K0FX1 and target system.

- <1> Fasten the GND wire on the QB-78K0FX1 side of the emulation probe to the nut on the bottom of the QB-78K0FX1 using a #0 or #1 (+) precision driver (connection of B to A in Figure 2-12).
- <2> Next plug the connector on top of the emulation probe into the connector in the opening in the bottom of the QB-78K0FX1 from below being careful of the insertion direction.

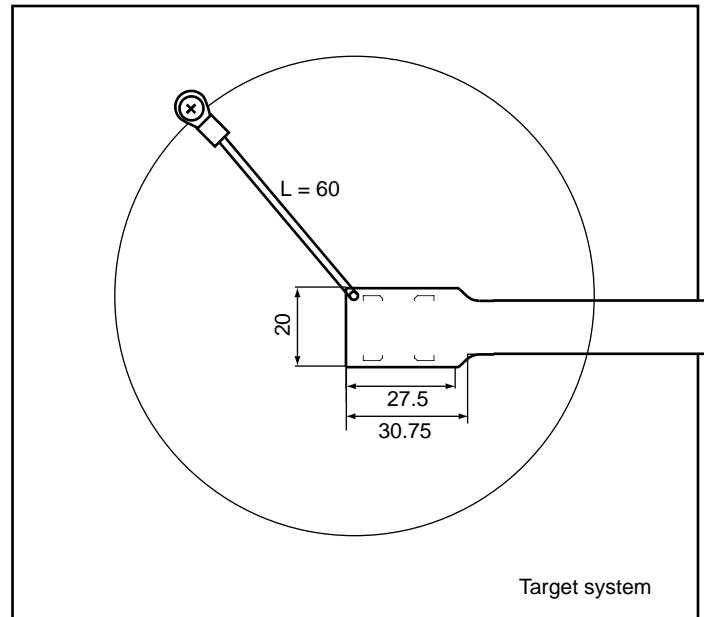
Figure 2-12. GND Wire



- <3> Connect the exchange adapter and emulation probe to the target connector.
- <4> Connect the GND wire on the target system side of the emulation probe to the target system GND. If a pin or screw is fastened to the target system GND, remove the transparent terminal cover on the end of the GND wire and fasten the Y terminal of the GND wire to the target system (C in Figure 2-12). If the GND on the target system is an exposed pad, likewise fasten the Y terminal to the pad on the target system by soldering (recommended soldering iron temperature setting: 300°C).

<5> Since the length of the GND wire below the head (insulated part) is approximately 60 mm, there must be a GND to which it can be connected in the range of an approximately 60 mm radius of the section of the target system for connecting the emulation probe, as shown in Figure 2-13.

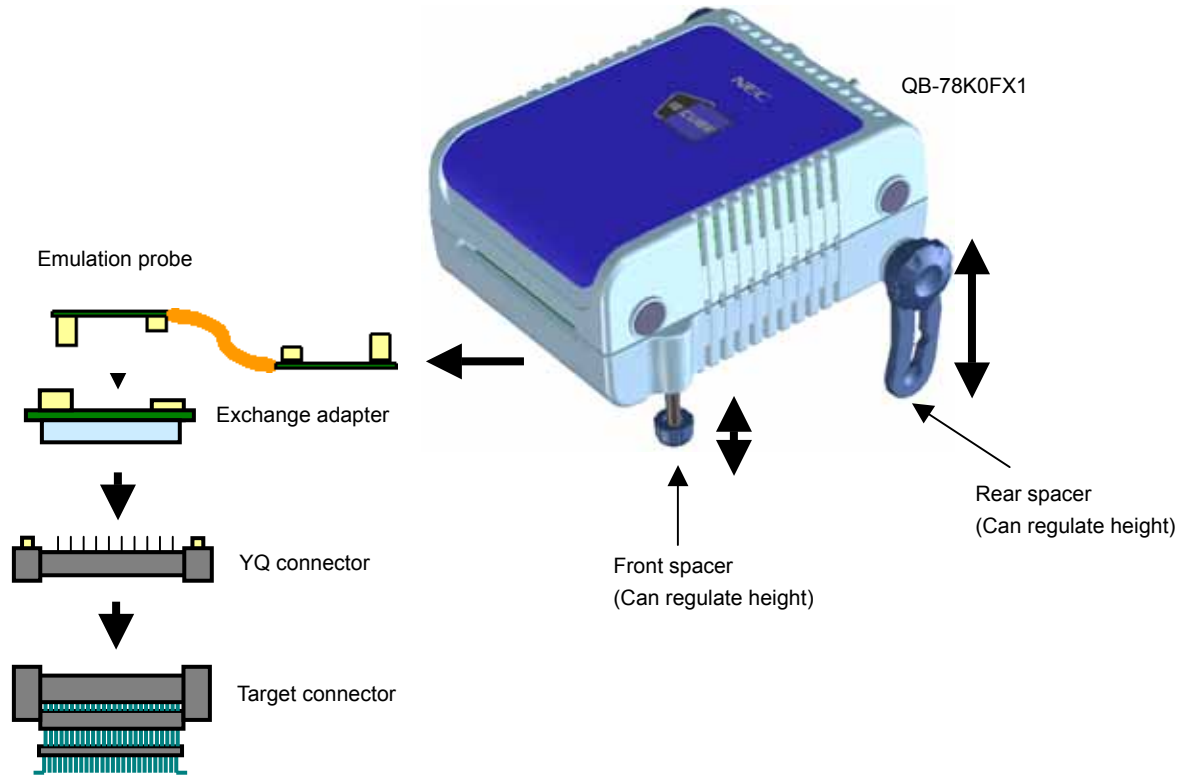
Figure 2-13. Where GND Wire Can Be Connected



(c) Ensuring isolation

When connecting the target system to the QB-78K0FX1 using an emulation probe, perform height regulation using the front spacer or rear spacer of the QB-78K0FX1 and ensure isolation from the target system.

Figure 2-14. Connection Using Emulation Probe



(d) 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-78K0FX1 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.

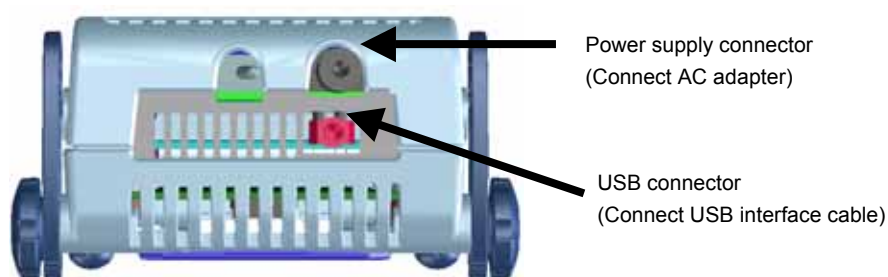
2.8 Connection of USB Interface Cable and AC Adapter

Plug the USB interface cable supplied with the QB-78K0FX1 into the USB connector of the host machine and also plug it into the USB connector on the rear of the QB-78K0FX1.

Plug the AC adapter supplied with the QB-78K0FX1 into a receptacle and plug it into the power supply connector on the rear of the QB-78K0FX1.

For QB-78K0FX1 connector positions, see **Figure 2-15**. There are three types of AC adapter plug. Use the one that has a suitable shape.

Figure 2-15. 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-78K0FX1 power on
- <2> Target system power on^{Note}
- <3> Debugger startup

- Switching power off

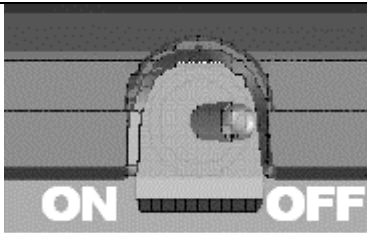
- <1> Debugger termination
- <2> Target system power off^{Note}
- <3> QB-78K0FX1 power off

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-78K0FX1 may fail.

CHAPTER 3 SETTINGS AT PRODUCT SHIPMENT

Table 3-1. Settings at Shipment

| Item | Setting | Remarks |
|--------------|---|-------------------------|
| CN4 | Main Clock Type III is mounted | |
| CN5 | Sub Clock Type II is mounted | |
| Power switch |  | Set to OFF at shipment. |

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-78K0FX1 and the signal lines of a target device

Although the target device is a CMOS circuit, the target interface circuit of the QB-78K0FX1 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-78K0FX1, the QB-78K0FX1 emulates just as if the actual target device were operating on the target system.

However, small differences arise because the QB-78K0FX1 actually is emulating.

- (1) Signals input and output by emulation CPU (μ PD78F0876)
- (2) Signals input and output by emulation CPU (FPGA)
- (3) Other signals

The circuits of the QB-78K0FX1 for the signals in (1) to (3) above are shown below by target device.

4.1 For 78K0FC1+ 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 (μ PD78F0876)

- P01-P00
- P17-P10
- P33-P30
- P73-P70
- P87-P80
- P120
- P130
- AV_{REF} , V_{DD} , EV_{DD}

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

- $\overline{P41}$ - $\overline{P40}$
- $\overline{P62}$ - $\overline{P60}$
- X1, XT1, \overline{RESET} , FLMD0

Note For the 78K0FB1+, the pin name is FLMD0.

(3) Other signals

- X2, XT2, NC, V_{SS} , EV_{SS} , AV_{SS}

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

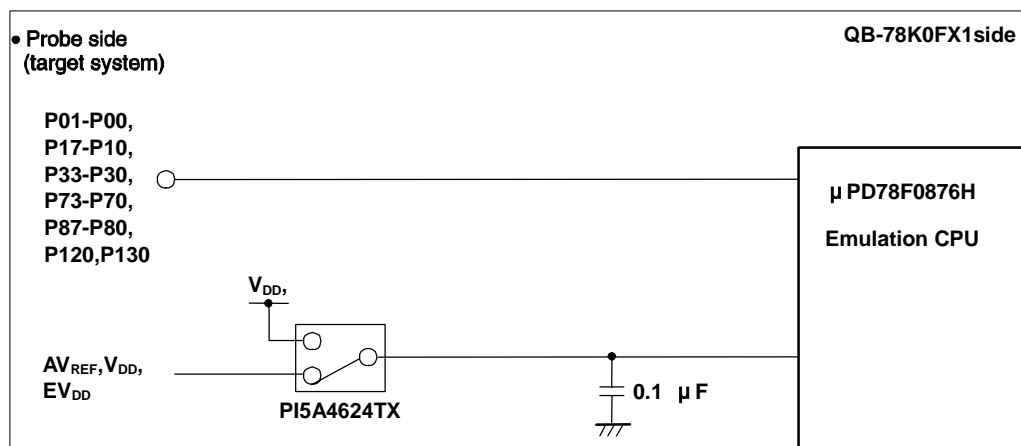
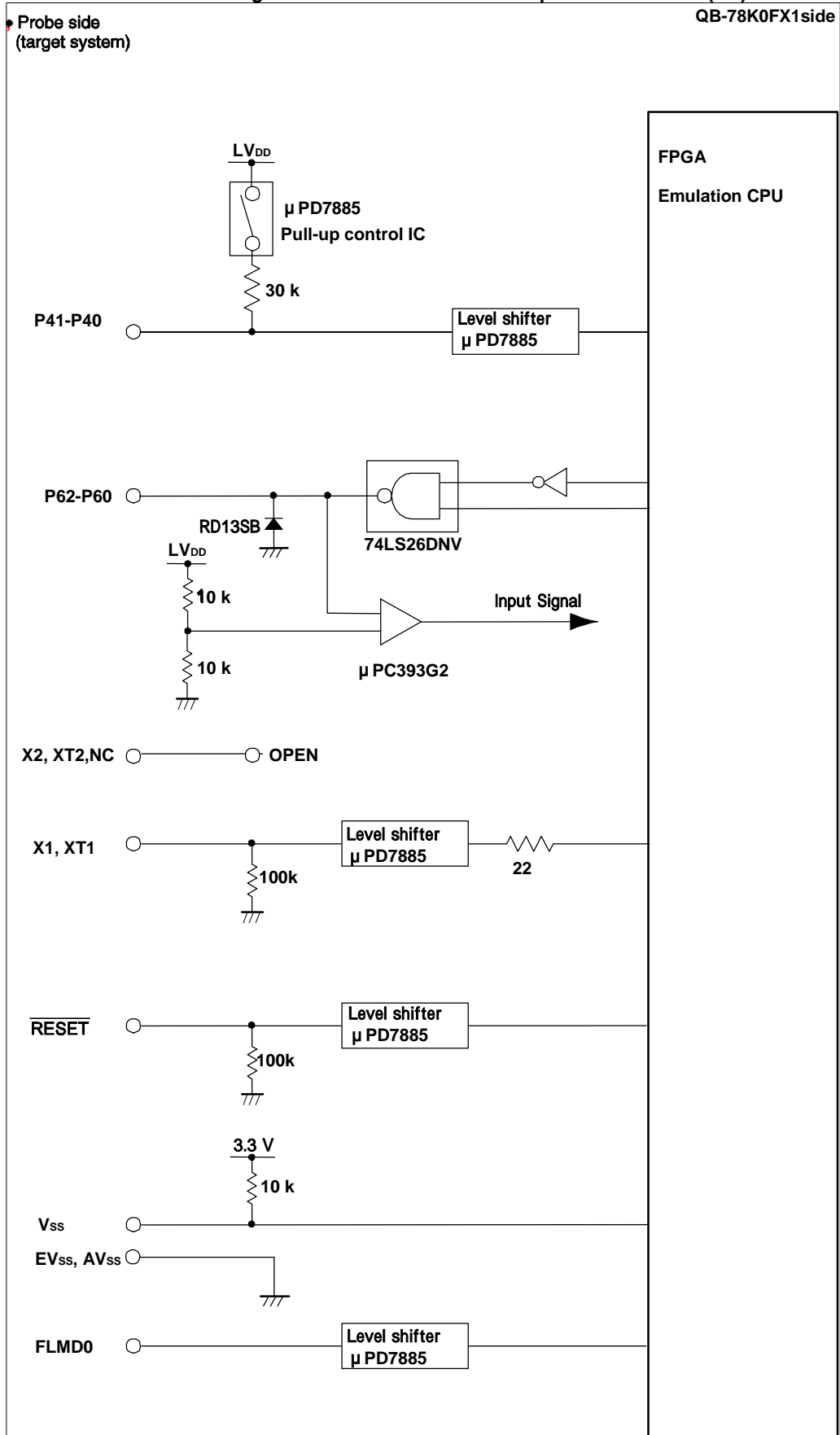


Figure 4-1. Emulation Circuit Equivalent Circuit 1 (2/2)



4.2 For 78K0/FE1+ Emulation

For the signals in (1) to (3) below, see **Figure 4-2 Emulation Circuit Equivalent Circuit 2.**

(1) Signals input and output by emulation CPU (μ PD78F0876)

- P01-P00
- P06-P05
- P17-P10
- P33-P30
- P76-P70
- P87-P80
- P93-P90
- P120
- P130-P132
- AV_{REF} , V_{DD} , EV_{DD}

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

- P43-P40
- P53-P50
- P63-P60
- X1, XT1, RESET, FLMD0

(3) Other signals

- X2, XT2, NC, V_{SS} , EV_{SS} , AV_{SS}

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

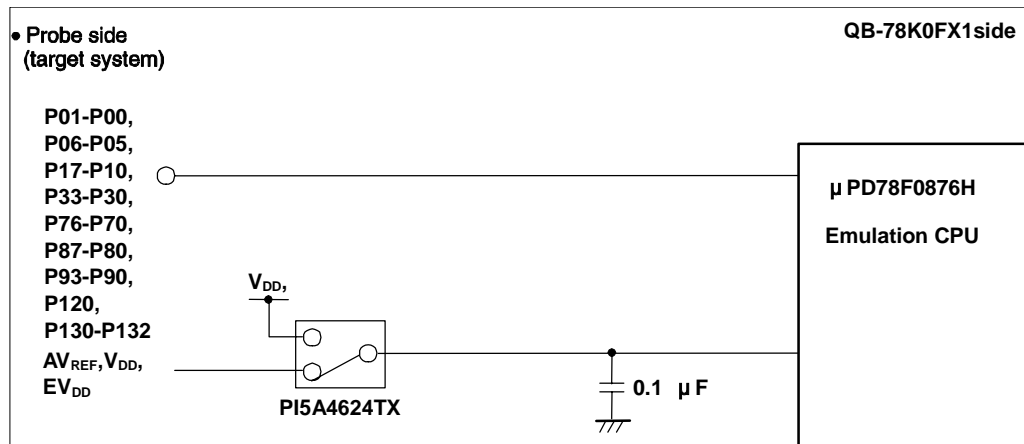
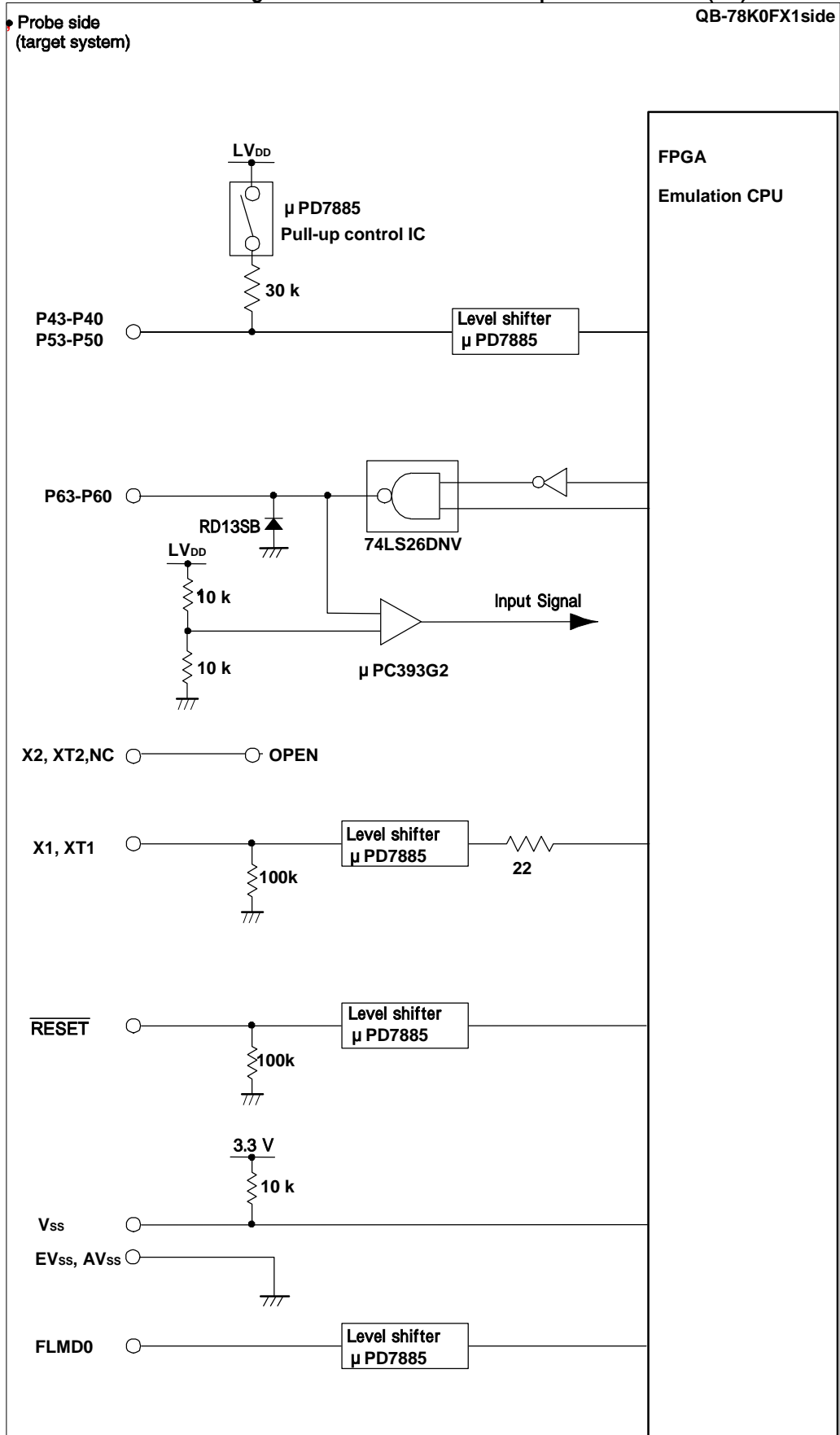


Figure 4-2. Emulation Circuit Equivalent Circuit 2 (2/2)



4.3 For 78K0/FF1+ Emulation

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

(1) Signals input and output by emulation CPU (μ PD78F0876)

- P01-P00
- P06-P05
- P17-P10
- P33-P30
- P76-P70
- P87-P80
- P97-P90
- P120
- P130-P132
- AV_{REF} , V_{DD} , EV_{DD}

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

- P47-P40
- P57-P50
- P67-P60
- X1, XT1, \overline{RESET} , FLMD0

(3) Other signals

- X2, XT2, NC, V_{SS} , EV_{SS} , AV_{SS}

Figure 4-3. Emulation Circuit Equivalent Circuit 3 (1/2)

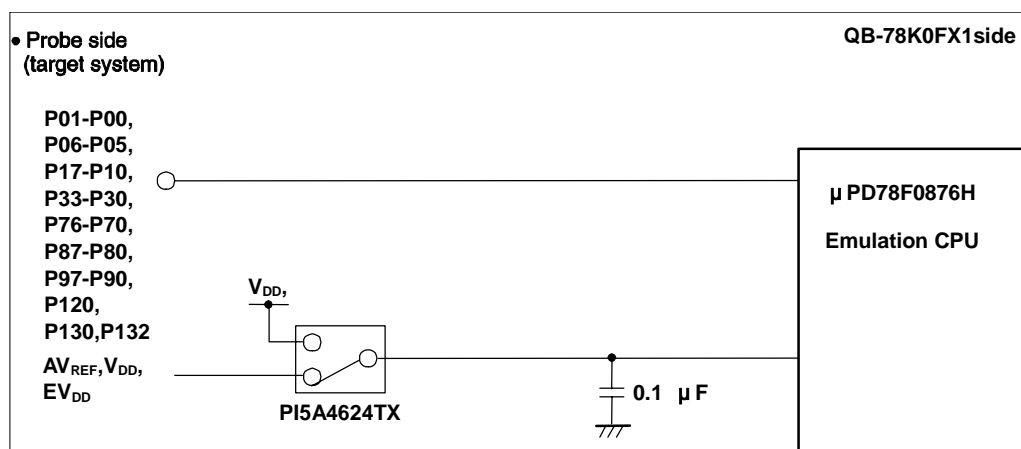
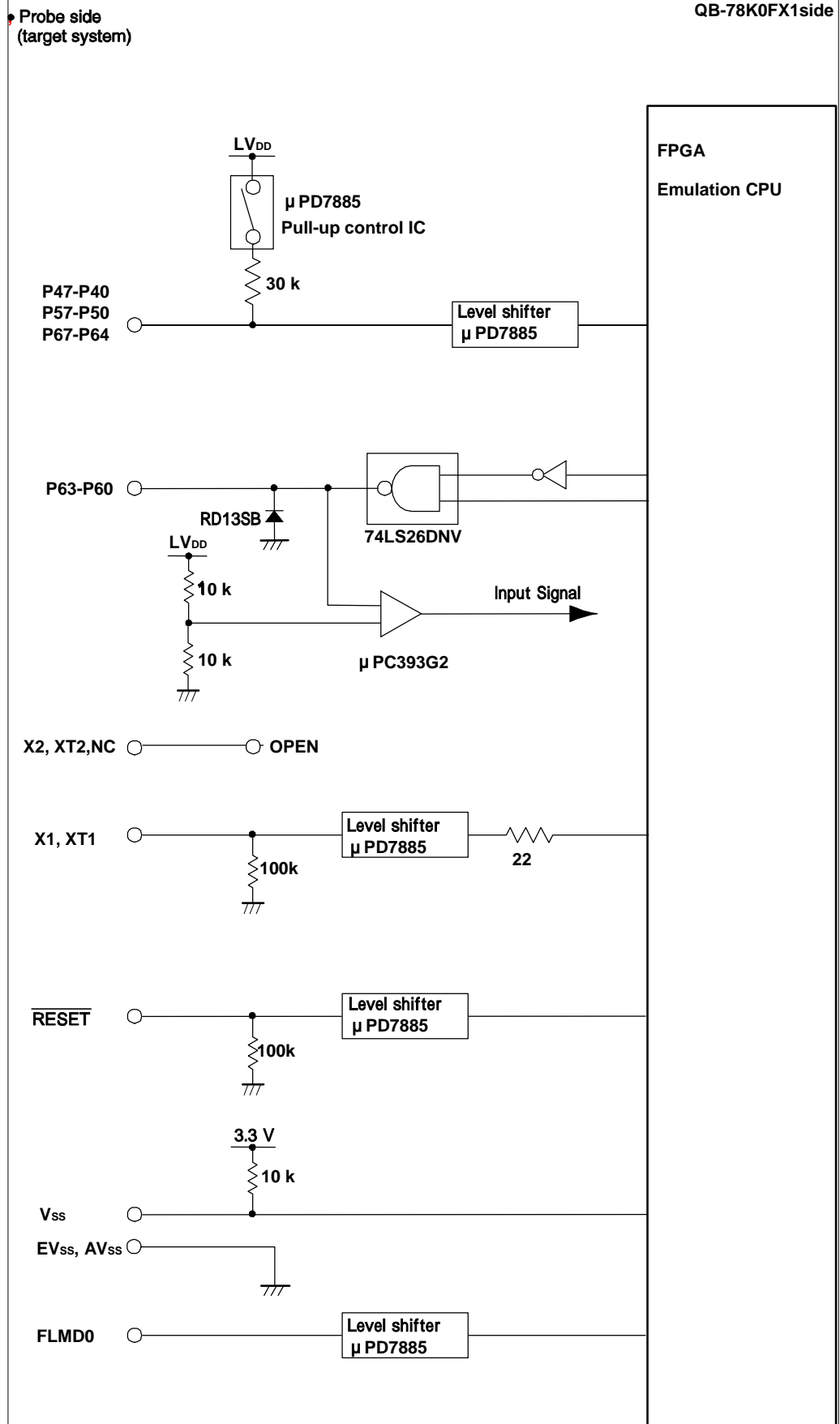


Figure 4-3. Emulation Circuit Equivalent Circuit 3 (2/2)



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.

CHAPTER 6 RESTRICTIONS

About a restriction matter ,Please refer to QB-78K0FX1 Operating Precautions.

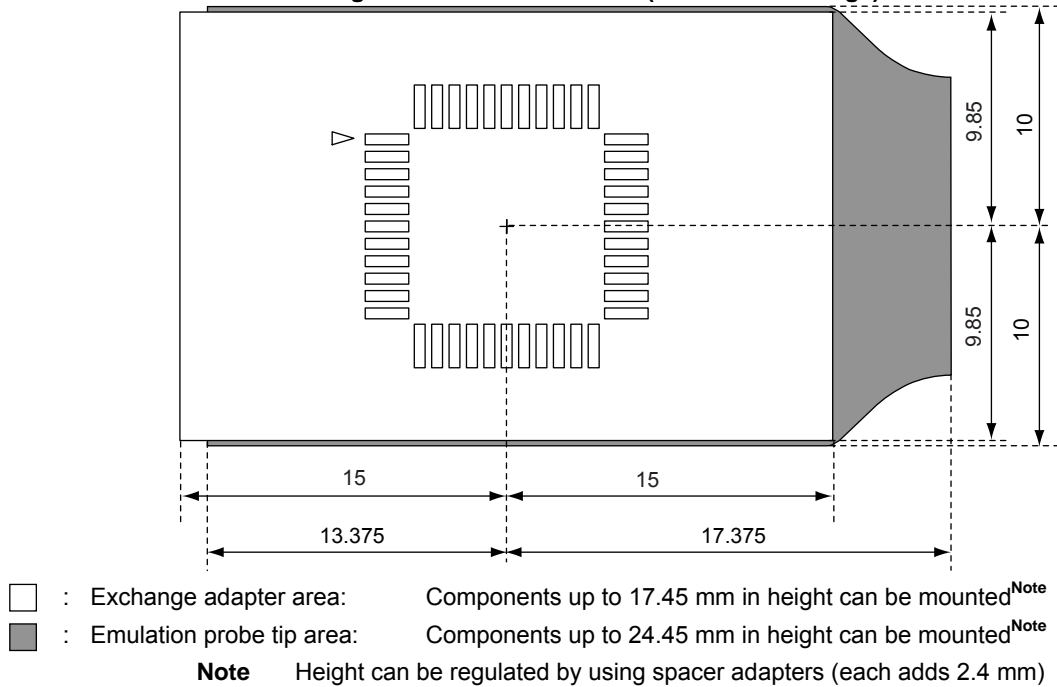
APPENDIX A NOTES ON TARGET SYSTEM DESIGN

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

(1) For 78K0FC1+

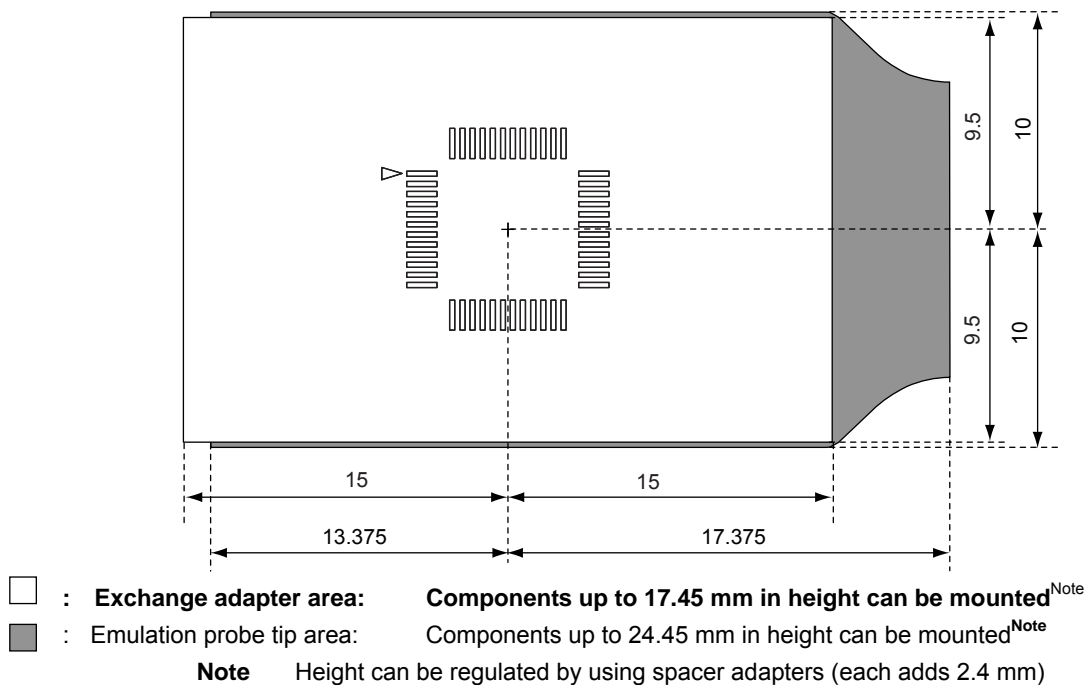
(a) For 44-pin GB package

Figure A-1. For 78K0/FC1+(44-Pin GB Package)



(b) For 48-pin GA package

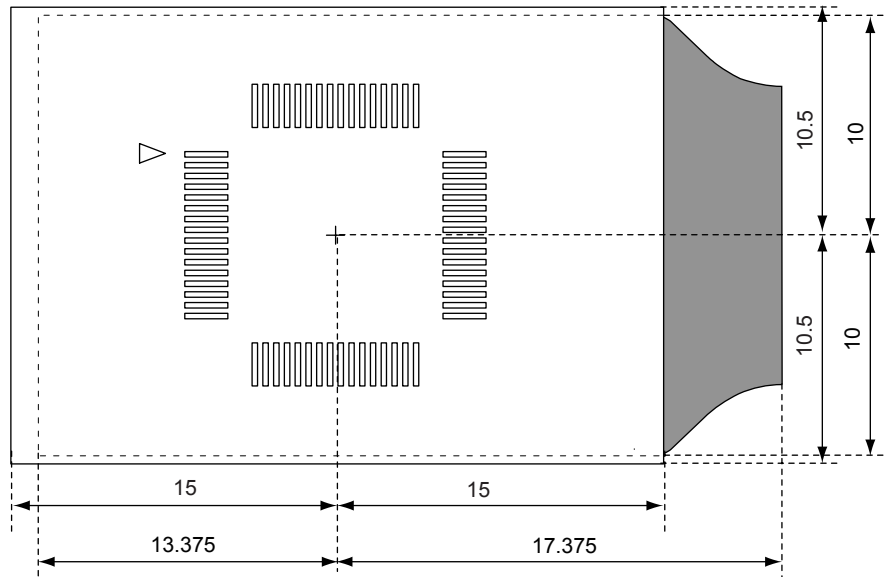
Figure A-2. For 78K0/FC1+(48-Pin GA Package)



(2) For 78K0/FE1+

(a) For 64-pin GB package

Figure A-3. For 78K0/FE1+ (64-Pin GB Package)



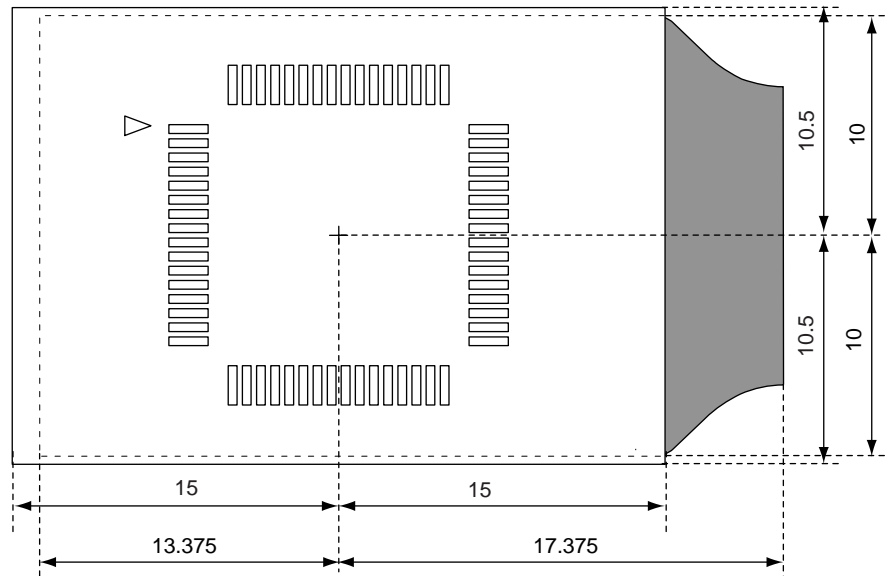
□ : Exchange adapter area: Components up to 17.45 mm in height can be mounted^{Note}

■ : Emulation probe tip area: Components up to 24.45 mm in height can be mounted^{Note}

Note Height can be regulated by using spacer adapters (each adds 2.4 mm)

(b) For 64-pin GK package

Figure A-4. For 78K0/FE1+ (64-Pin GK Package)



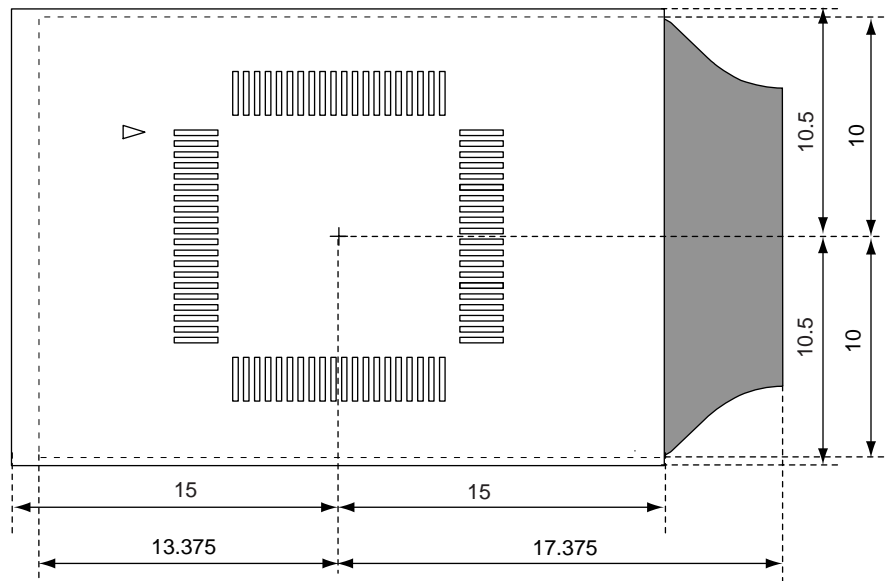
□ : Exchange adapter area: Components up to 17.45 mm in height can be mounted^{Note}

■ : Emulation probe tip area: Components up to 24.45 mm in height can be mounted^{Note}

Note Height can be regulated by using spacer adapters (each adds 2.4 mm)

(a) For 80-pin GK package

Figure A-5. For 78K0/FF1+ (80-Pin GK Package)



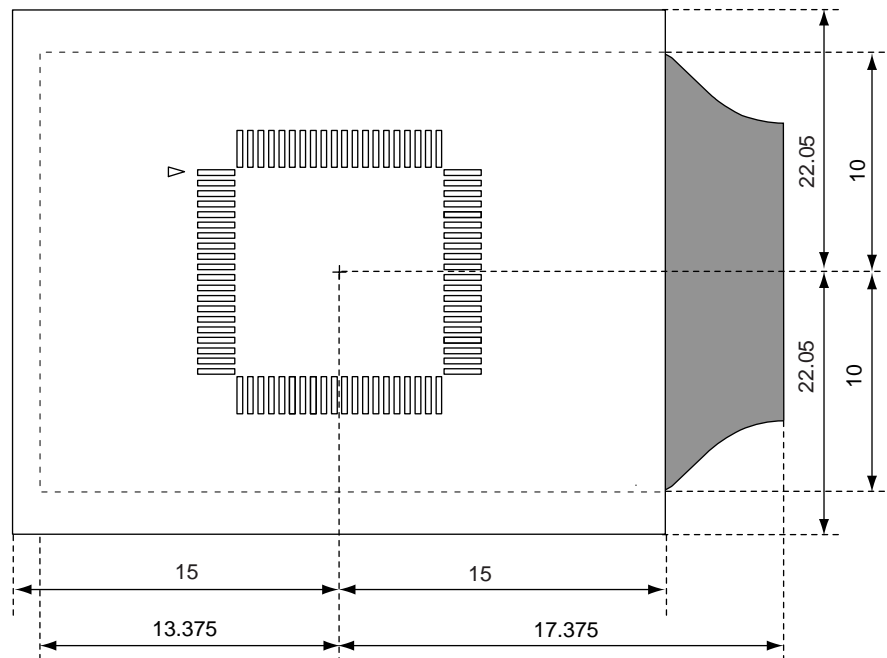
□ : Exchange adapter area: Components up to 17.45 mm in height can be mounted^{Note}

 : Emulation probe tip area: Components up to 24.45 mm in height can be mounted^{Note}

Note Height can be regulated by using spacer adapters (each adds 2.4 mm)

(b) For 80-pin GC package

Figure A-6. For 78K0/FF1+ (80-Pin GC Package)



□ : Exchange adapter area: Components up to 17.45 mm in height can be mounted^{Note}

■ : Emulation probe tip area: Components up to 24.45 mm in height can be mounted^{Note}

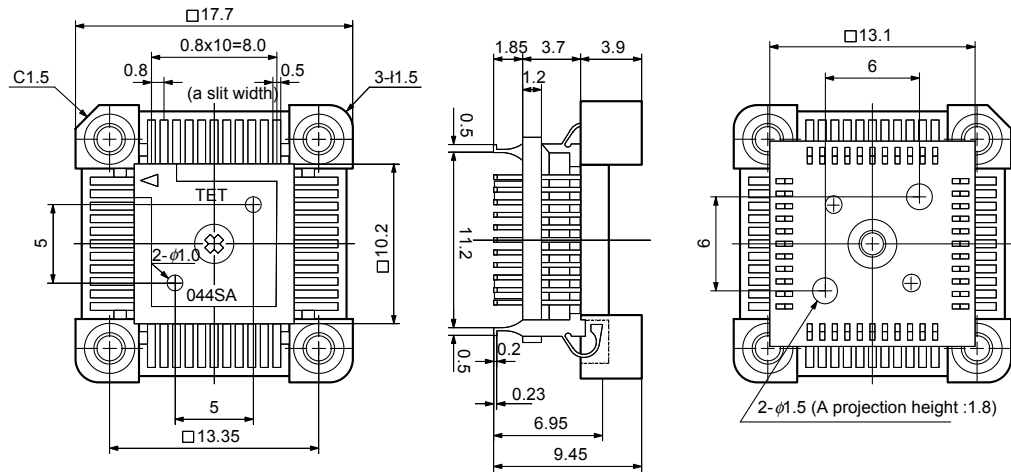
Note Height can be regulated by using spacer adapters (each adds 2.4 mm)

APPENDIX B PACKAGE DRAWINGS

B.1 Target Connectors

Figure B-1. Target Connector for 78K0/FC1+ (QB-44GB-NQ-01T)

(a) Package drawing



(b) Foot pattern

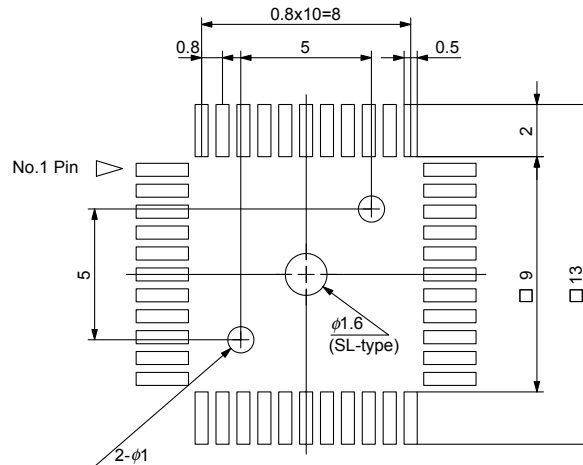
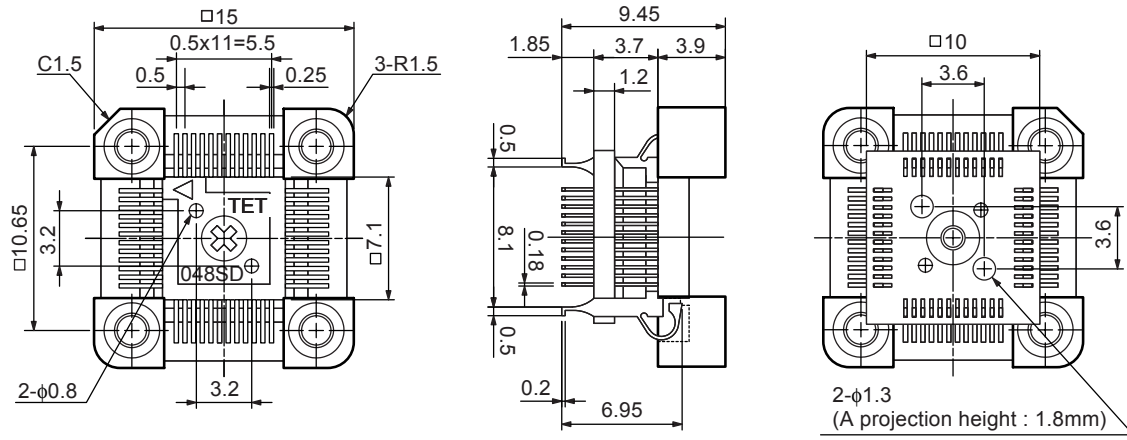
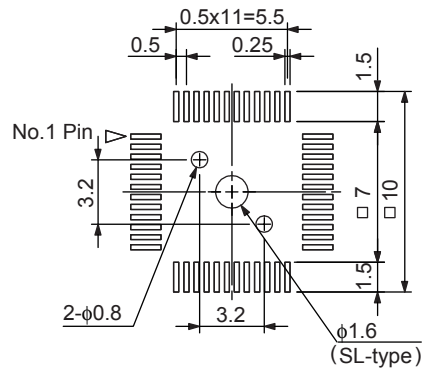


Figure B-2. Target Connector for 78K0/FC1+ (QB-48GA-NQ-01T)

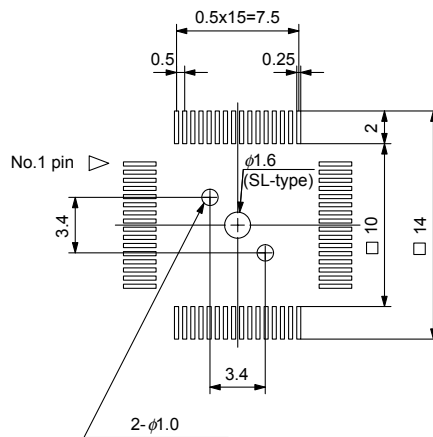
(a) Package drawing



(b) Foot pattern



(a) Package drawing

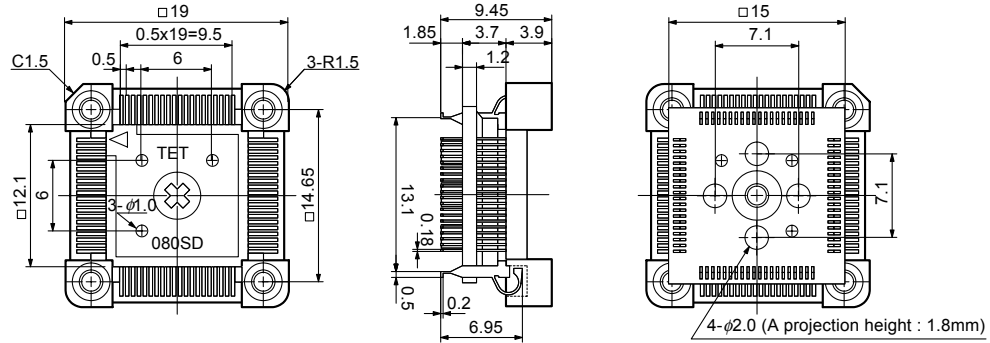


(a) Package drawing



Figure B-5. Target Connector for and 78K0/FF1+ (QB-80GK-NQ-01T)

(a) Package drawing



(b) Foot pattern

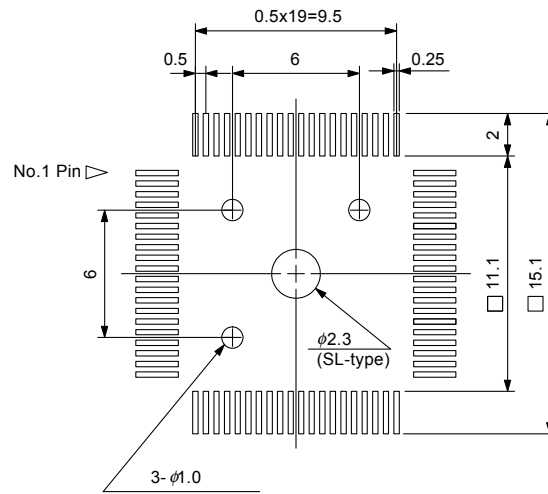
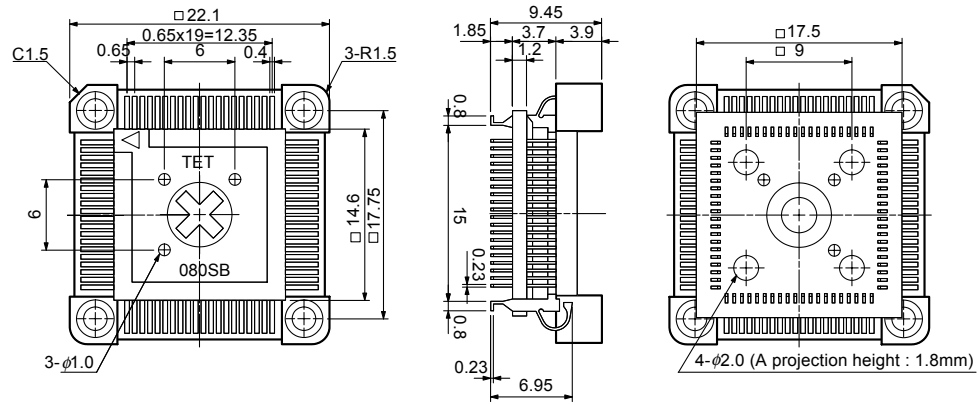
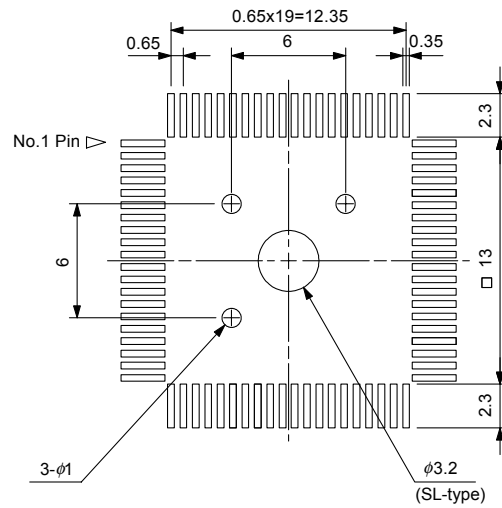


Figure B-6. Target Connector for 78K0/FF1+ (QB-80GC-NQ-01T)

(a) Package drawing



(b) Foot pattern



B.2 Exchange Adapters

Figure B-7. Exchange Adapter for 78K0/FC1+ (QB-44GB-EA-02T)

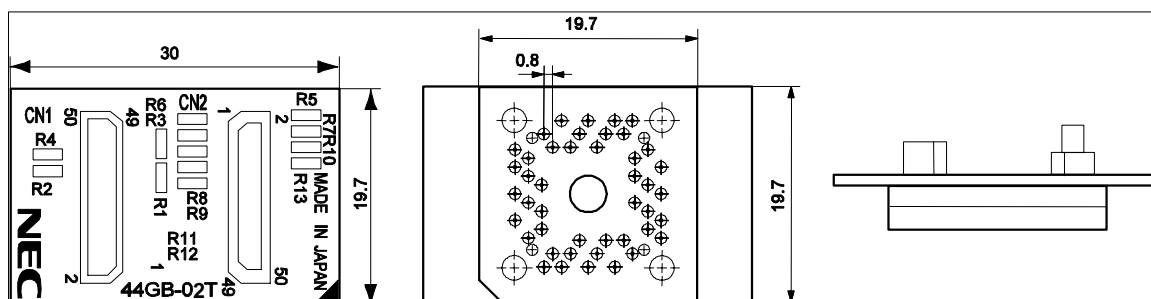


Figure B-8. Exchange Adapter for 78K0/FC1+ (QB-48GA-EA-01T)

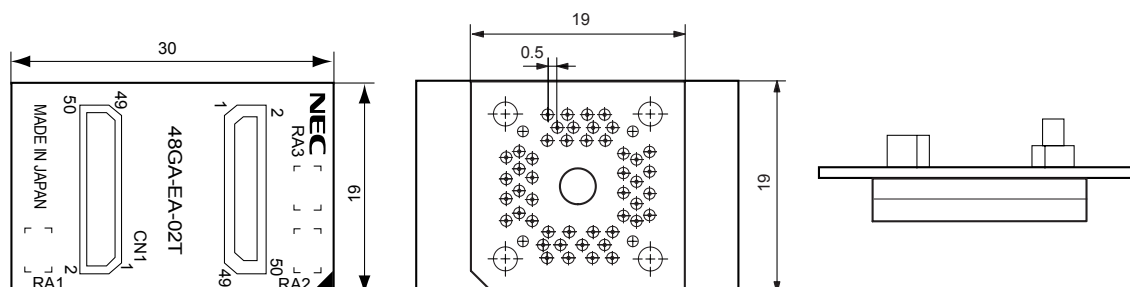


Figure B-9. Exchange Adapter for 78K0/FE1+ (QB-64GB-EA-03T)

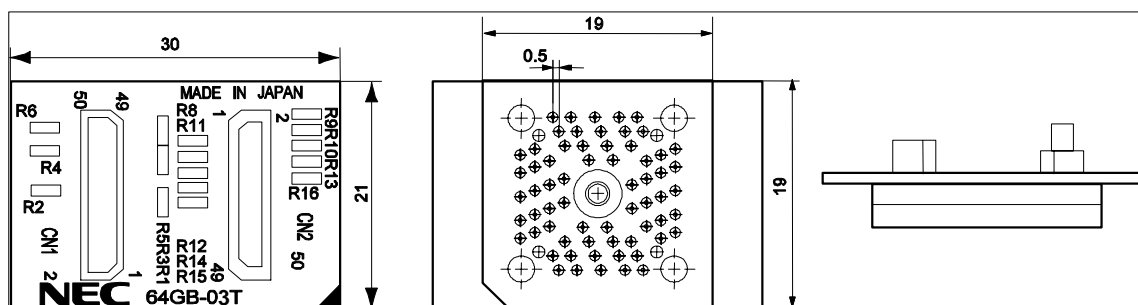


Figure B-10. Exchange Adapter for 78K0/FE1+ (QB-64GK-EA-03T)

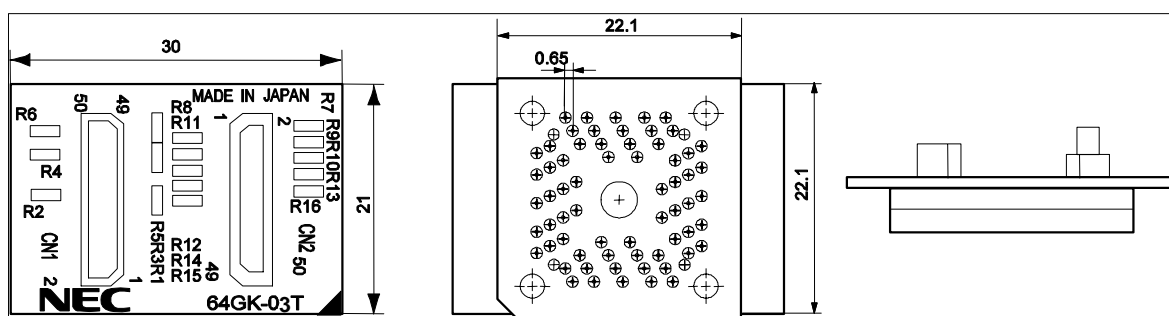


Figure B-11. Exchange Adapter for 78K0/FF1+ (QB-80GK-EA-01T)

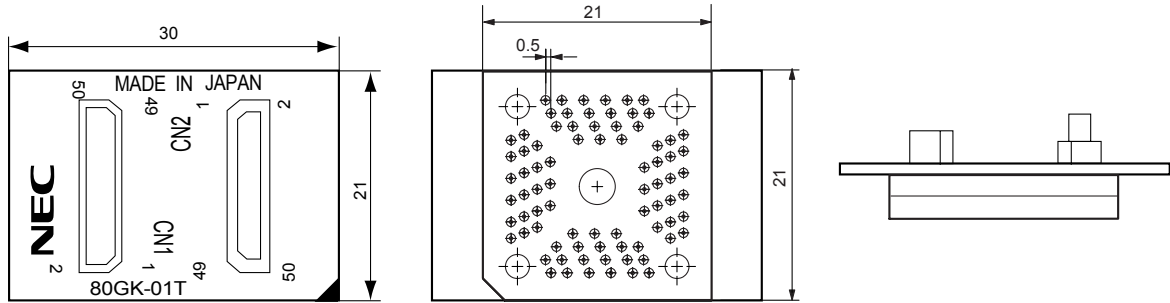
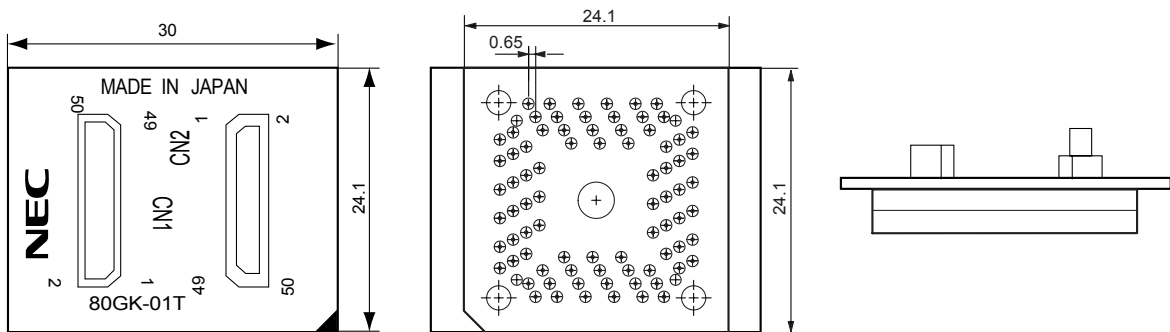


Figure B-12. Exchange Adapter for 78K0/FF1+ (QB-80GC-EA-01T)



B.3 YQ Connectors

Figure B-13. YQ Connector for 78K0/FC1+ (QB-44GB-YQ-01T)

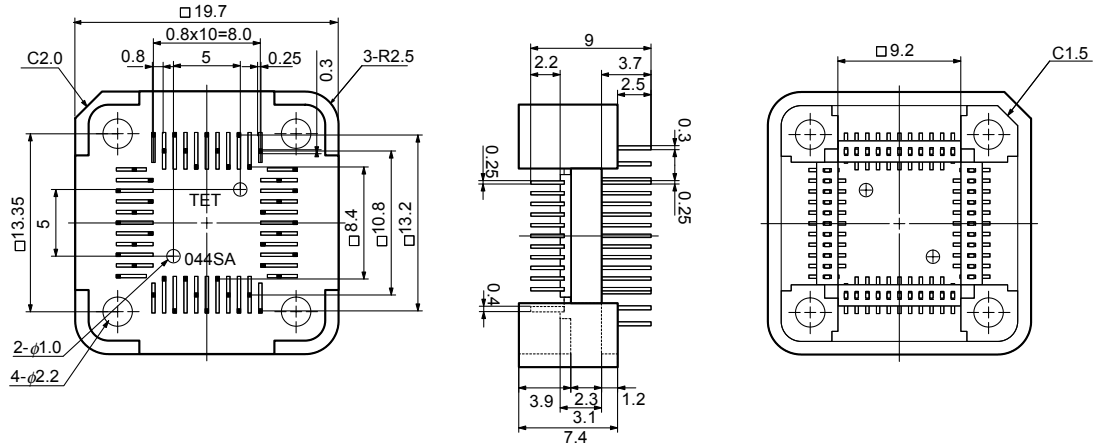


Figure B-14. YQ Connector for 78K0/FC1+ (QB-48GA-YQ-01T)

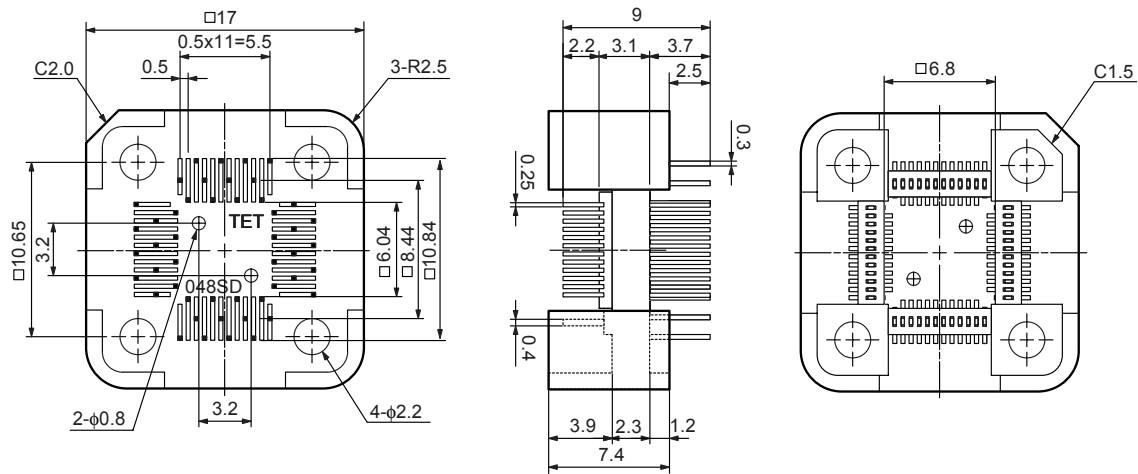


Figure B-15. YQ Connector for 78K0/FE1+ (QB-64GB-YQ-01T)

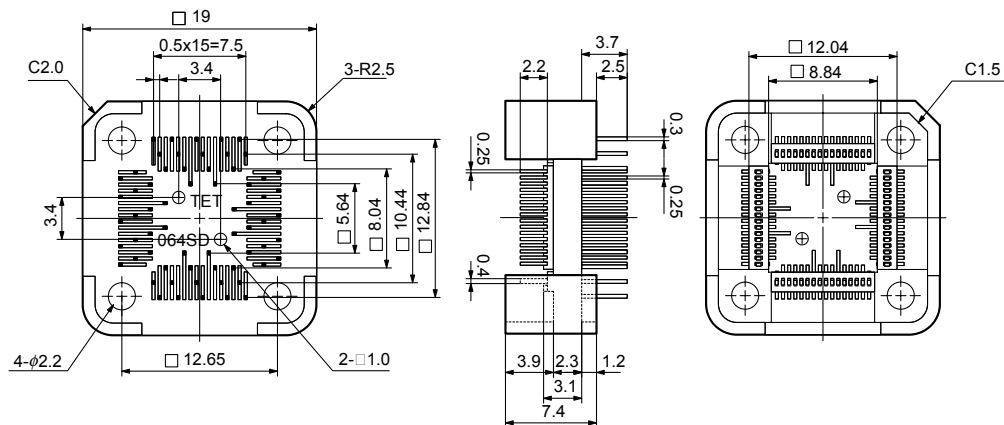


Figure B-16. YQ Connector for 78K0/FE1+ (QB-64GK-YQ-01T)

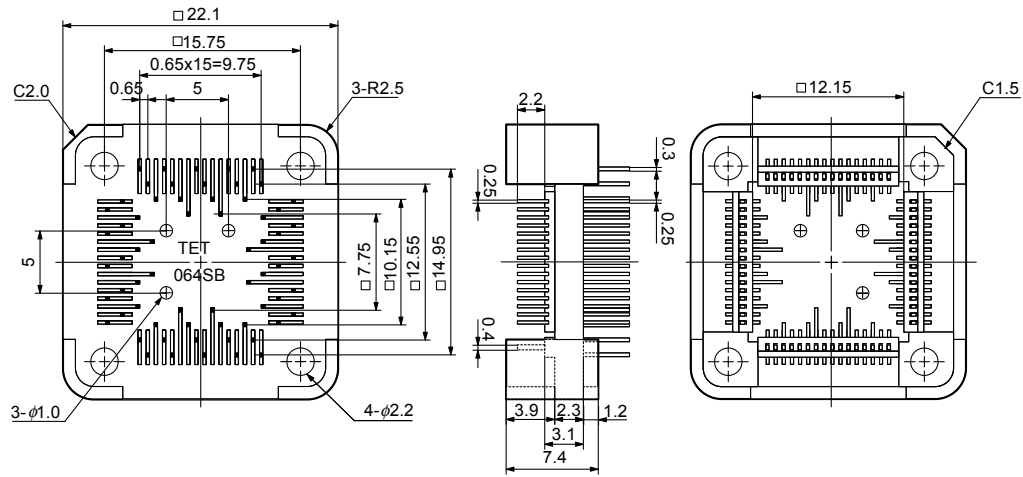


Figure B-17. YQ Connector for 78K0/FF1+ (QB-80GK-YQ-01T)

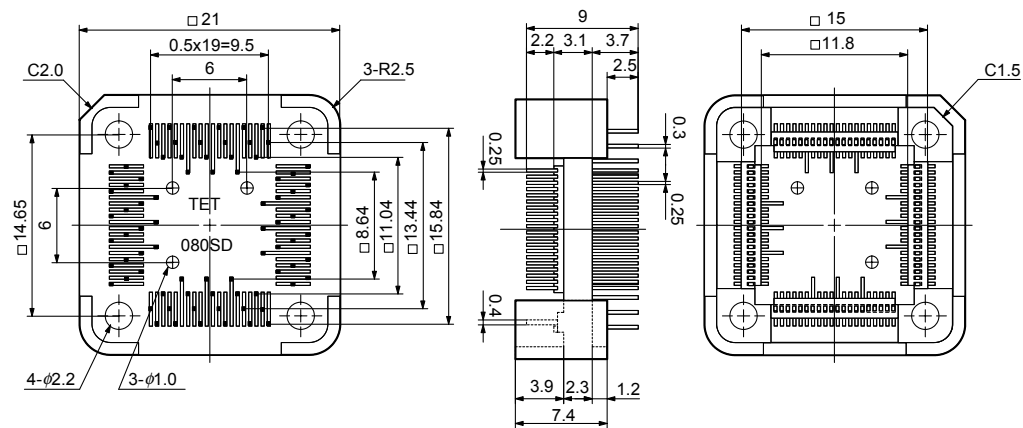
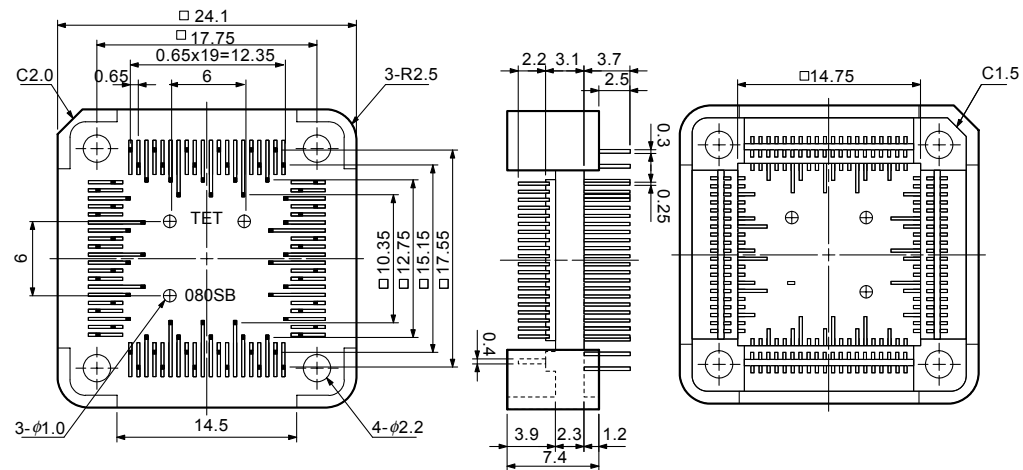


Figure B-18. YQ Connector for 78K0/FF1+ (QB-80GC-YQ-01T)



B.4 Mount Adapters

Figure B-19. Mount Adapter for 78K0/FC1+ (QB-44GB-HQ-01T)

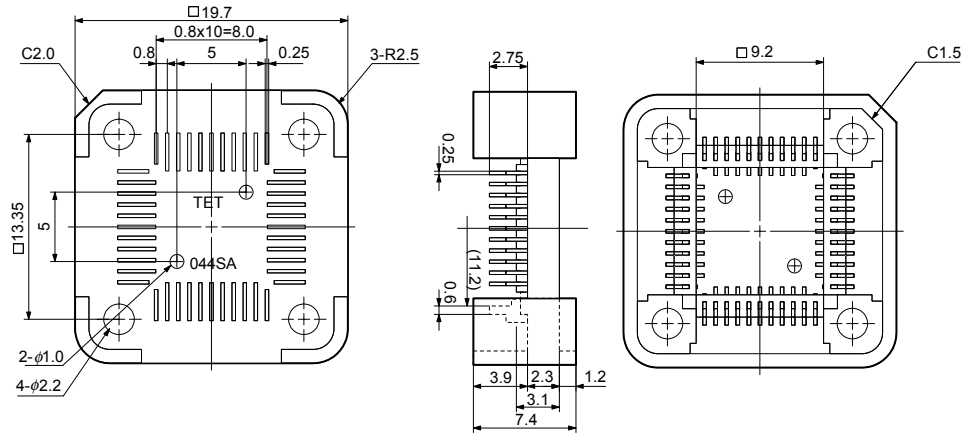


Figure B-20. Mount Adapter for 78K0/FC1+ (QB-48GA-HQ-01T)

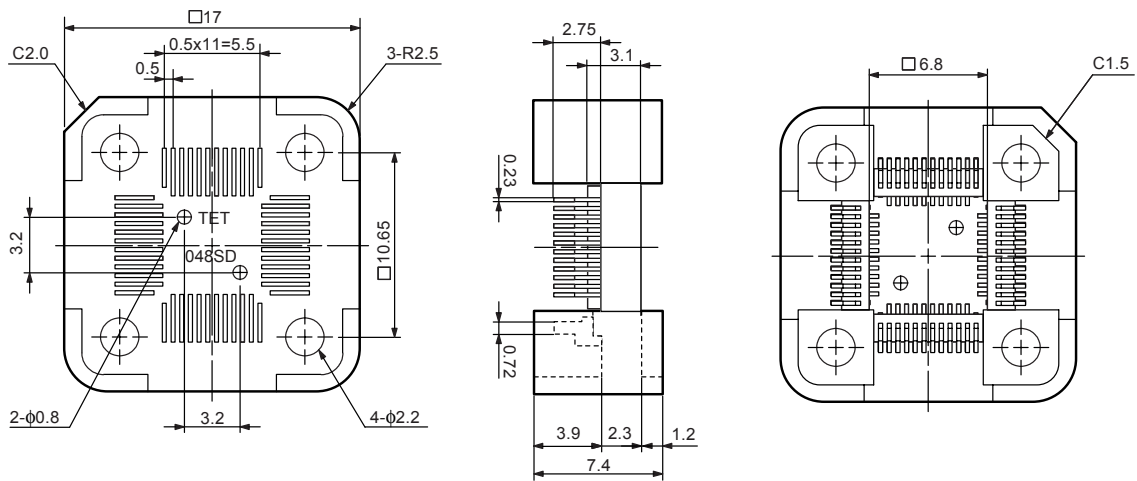


Figure B-21. Mount Adapter for 78K0/FE1+ (QB-64GB-HQ-01T)

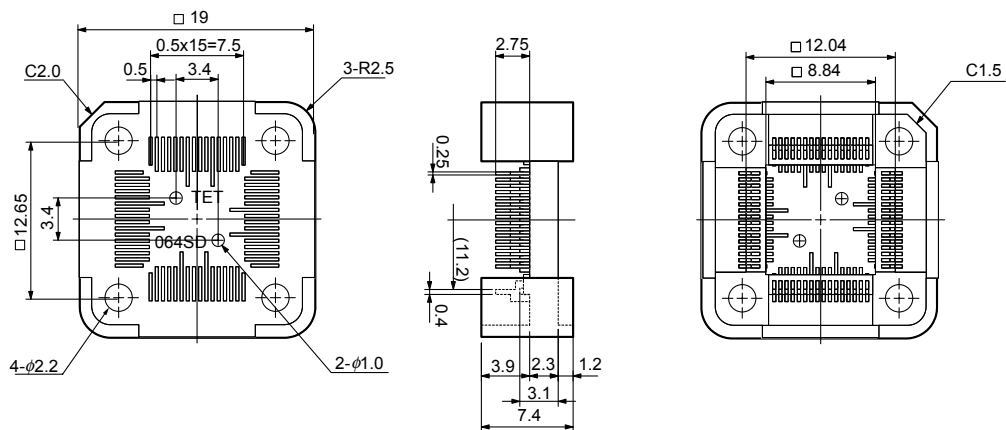


Figure B-22. Mount Adapter for 78K0/FE1+ (QB-64GK-HQ-01T)

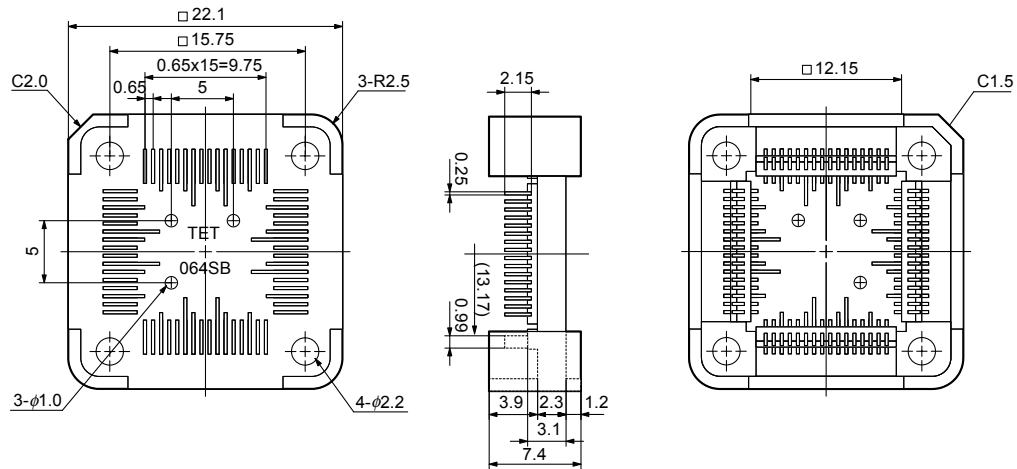


Figure B-23. Mount Adapter for 78K0/FF1+ (QB-80GK-HQ-01T)

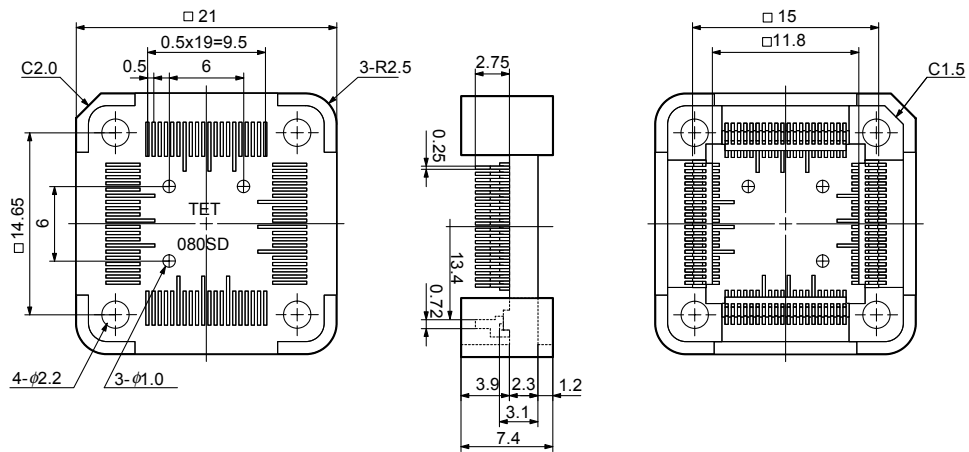
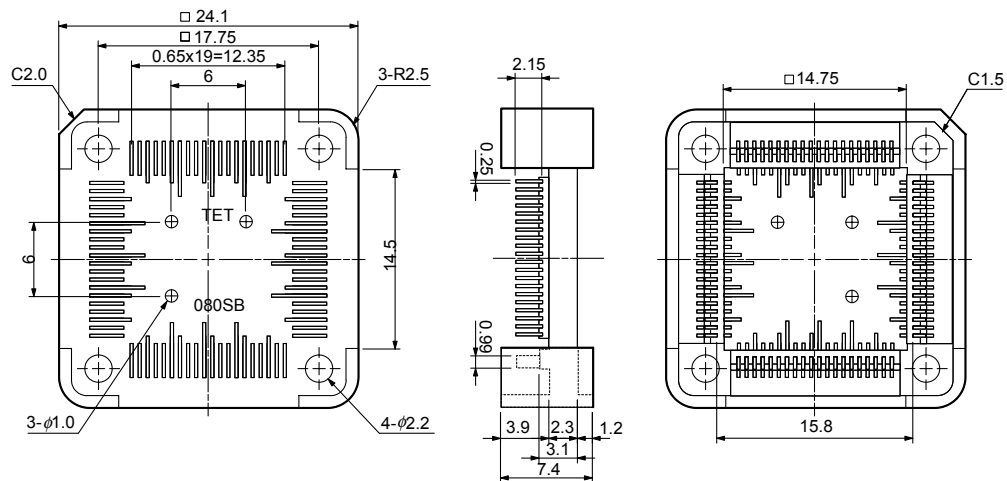
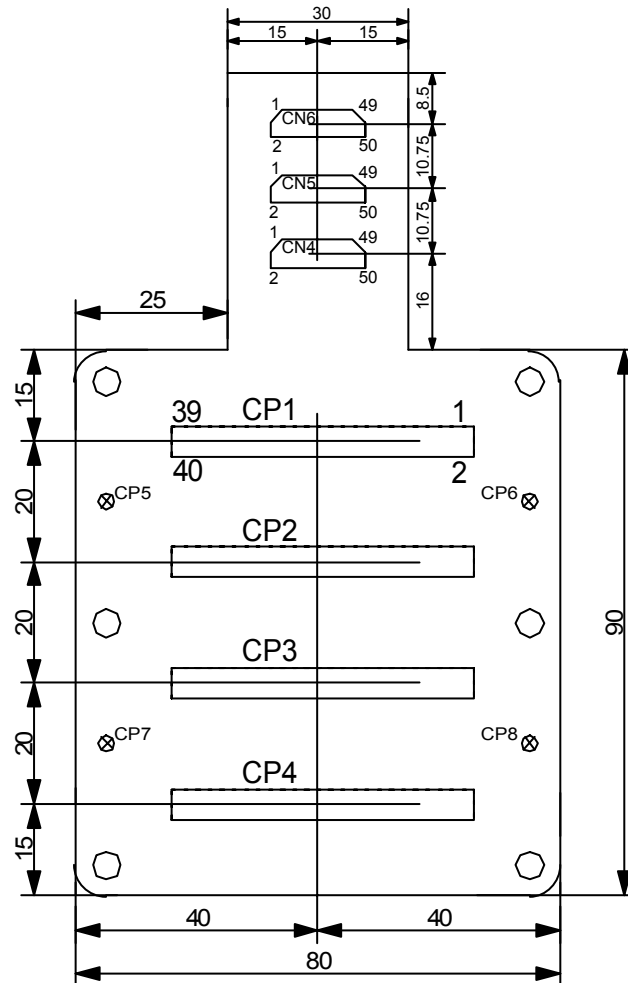


Figure B-24. Mount Adapter for 78K0/FF1+ (QB-80GC-HQ-01T)



B.5 Check Pin Adapter

Figure B-25. Check Pin Adapter (QB-144-CA-01)



B.6 Spacer Adapters

Figure B-26. Spacer Adapter for 78K0/FC1+ (QB-44GB-YS-01T)

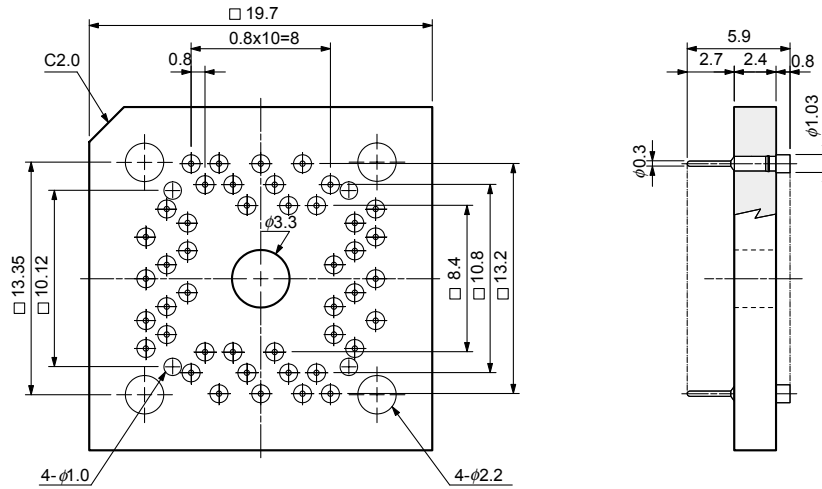


Figure B-27. Spacer Adapter for 78K0/FC1+ (QB-48GA-YS-01T)

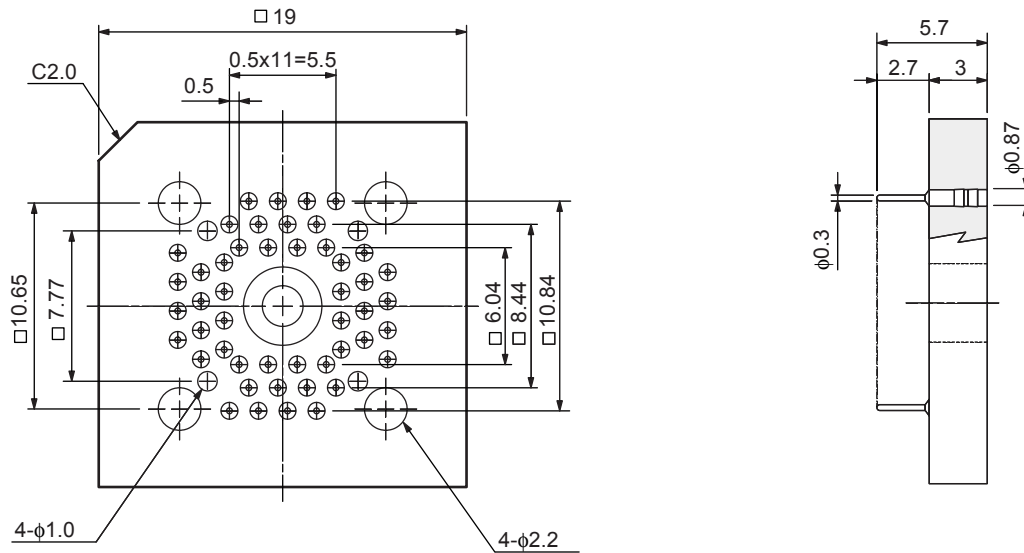


Figure B-28. Spacer Adapter for 78K0/FE1+ (QB-64GB-YS-01T)

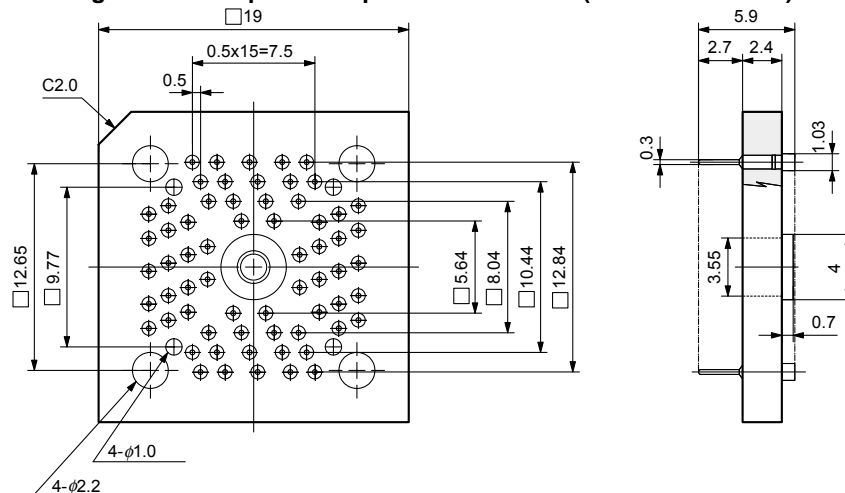


Figure B-29. Spacer Adapter for 78K0/FE1+ (QB-64GK-YS-01T)

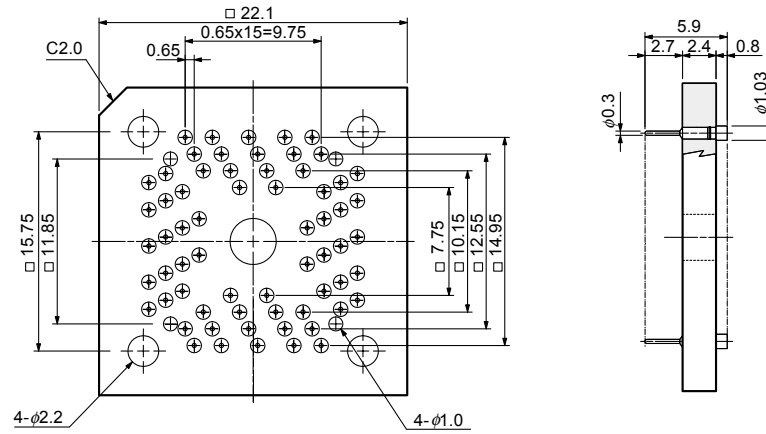


Figure B-30. Spacer Adapter for 78K0/FF1+ (QB-80GK-YS-01T)

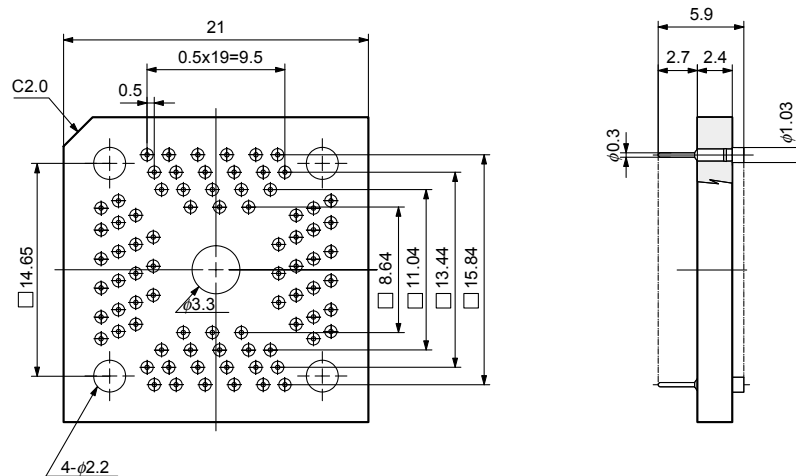
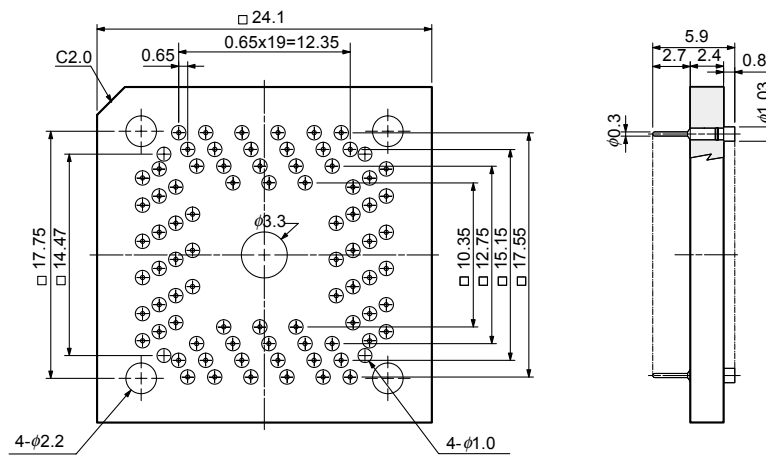
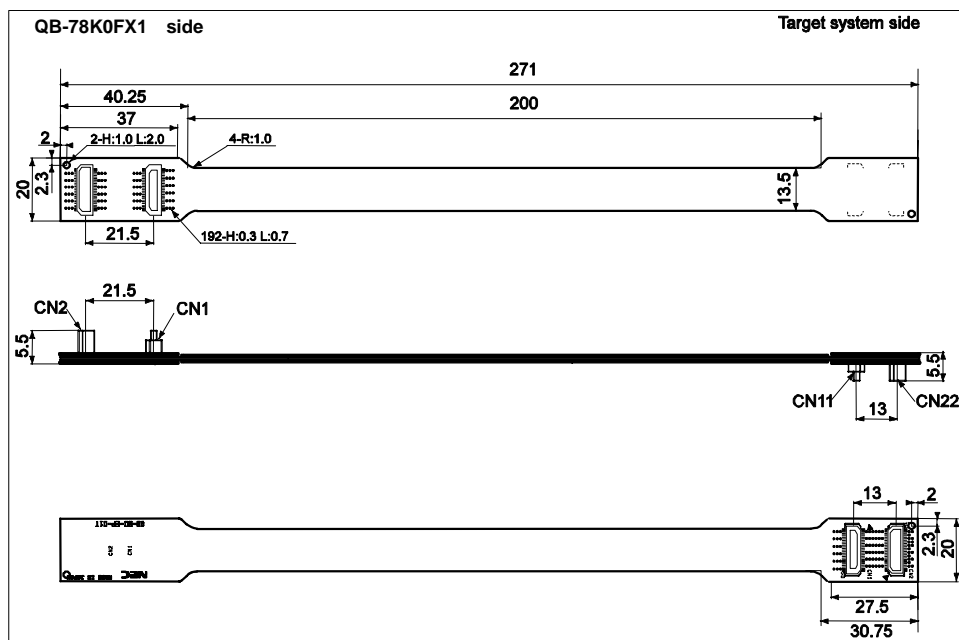


Figure B-31. Spacer Adapter for 78K0/FF1+ (QB-80GC-YS-01T)



B.7 Emulation Probe

Figure B-32. Emulation Probe (QB-80-EP-01T)



B.8 Clock Board

Figure B-33. Clock Board (1/2)

(a) Main clock board

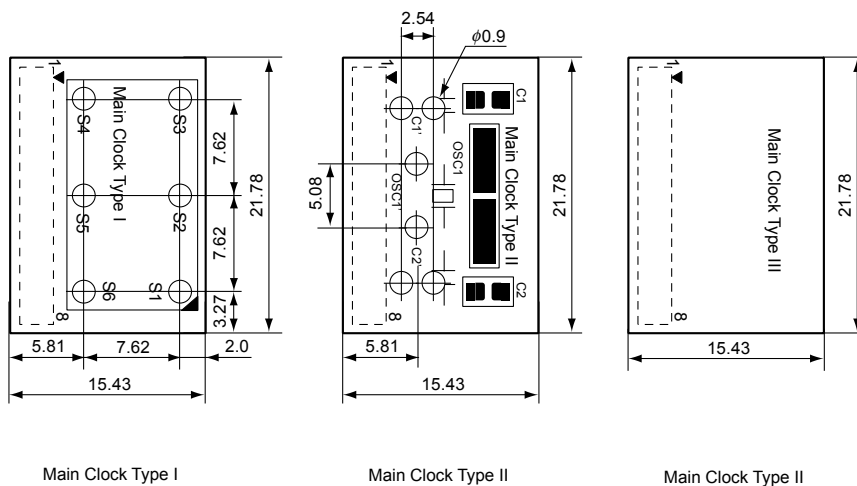


Figure B-34. Clock Board (2/2)

(b) Subclock board

