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RENESAS

User's Manual

QB-78K0RIX3

In-Circuit Emulator

Target Devices

78K0R/KC3-L
78K0R/KD3-L
78K0R/KE3-L
78K0R/IB3
78K0R/IC3
78K0R/ID3
78K0R/IE3

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[MEMO]

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[MEMO]

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 connection to the AC adapter, USB interface cable, or 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
- If this product is connected to the target system when there is a potential difference between the GND of this product and GND of the target system.
- If the connectors or cables are plugged/unplugged while this product is in the power-on state.
- If excessive load is applied to the connectors or sockets (As for handling, please see **2.5 Mounting and Connecting Connectors)**.
- If a metal part of the power switch, cooling fan, or another such part comes in contact with an electrostatic charge.
- If the product is used or stored in an environment where an electrostatic or electrical noise is likely to occur.

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**.
- The AC adapter supplied with the product is exclusively for this product, so do not use it with other products.

INTRODUCTION

Readers

This manual is intended for users who wish to perform debugging using the QB-78K0RIX3[Note]. The readers of this manual are assumed to be familiar with the device functions and usage, and to have knowledge of debuggers.

Note The previous product name of the QB-78K0RIX3 was QB-78K0RKX3L. There are no differences in performance, depending on the product name.

Purpose

This manual is intended to give users an understanding of the basic specifications and correct usage of the QB-78K0RIX3.

Organization

This manual is divided into the following sections.

- General
- Setup procedure
- Settings at product shipment
- Cautions
- Characteristics of target interface

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-78K0RIX3
→Read this manual in the order of the **CONTENTS**.

To know the manipulations, command functions, and other software-related settings of the QB-78K0RIX3
→See the user's manual of the debugger (supplied with the QB-78K0RIX3) to be used.

Conventions

Note:	Footnote for item marked with **Note** in the text
Caution:	Information requiring particular attention
Remark:	Supplementary information
Numeric representation:	Binary ... xxxx or xxxxB
	Decimal ... xxxx
	Hexadecimal ... xxxxH
Prefix indicating power of 2 (address space, memory capacity):	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.
78K0R/Kx3-L	Generic name indicating 78K0R/KC3-L, 78K0R/KD3-L and 78K0R/KE3-L Note.
78K0R/Ix3	Generic name indicating 78K0R/IB3, 78K0R/IC3, 78K0R/ID3 and 78K0R/IE3.
IECUBE™	Generic name for NEC Electronics' high-performance/compact in-circuit emulator.

Note The target devices are the μPD78F1007, μPD78F1008, and μPD78F1009.

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-78K0RIX3 In-Circuit Emulator		This manual
RA78K0R Ver. 1.20 Assembler Package	Operation	U18547E
	Language	U18546E
CC78K0R Ver. 2.00 C Compiler	Operation	U18549E
	Language	U18548E
ID78K0R-QB Ver. 3.20 Integrated Debugger	Operation	U17839E
PM+ Ver. 6.30 Project Manager		U18416E

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.

CONTENTS

CHAPTER 1 GENERAL

The QB-78K0RIX3 is an in-circuit emulator for emulating the 78K0R/Kx3-L, 78K0R/Ix3.

Hardware and software can be debugged efficiently in the development of systems in which the 78K0R/Kx3-L, 78K0R/Ix3 is used. This manual descries basic setup procedures, hardware specifications, system specifications, and how to set switches.

1.1 Hardware Specifications

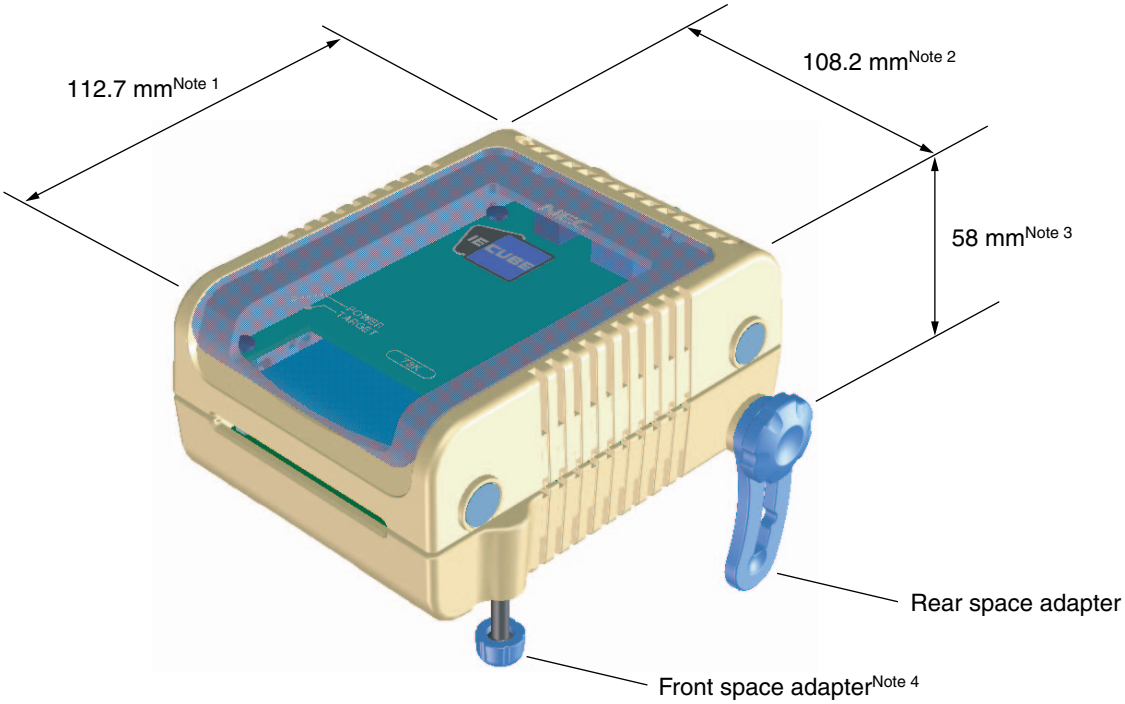
Table 1-1. QB-78K0RIX3 Hardware Specifications

Parameter		Specification	
		78K0R/Kx3-L	78K0R/Ix3
Target device		78K0R/KC3-L, 78K0R/KD3-L, 78K0R/KE3-L[Note 1]	78K0R/IB3, 78K0R/IC3, 78K0R/ID3, 78K0R/IE3
Operating voltage		1.8 to 5.5 V	
Operating frequency[Note 2]	High-speed system clock	2.7 V ≤ V_{DD} ≤ 5.5 V: 2 to 20 MHz 1.8 V ≤ V_{DD} < 2.7 V: 2 to 5 MHz	2.7 V ≤ V_{DD} ≤ 5.5 V: 2 to 20 MHz
	Internal high-speed oscillation clock	2.7 V ≤ V_{DD} ≤ 5.5 V: 1 MHz/8 MHz 1.8 V ≤ V_{DD} < 2.7 V: 1 MHz/4 MHz[Note 3]	2.7 V ≤ V_{DD} ≤ 5.5 V: 8 MHz/20 MHz
	Subsystem clock	1.8 V ≤ V_{DD} ≤ 5.5 V: 32.768 MHz	2.7 V ≤ V_{DD} ≤ 5.5 V: 32.768 MHz
Operating temperature range		0 to 40°C (No condensation)	
Storage temperature range		−15 to 60°C (No condensation)	
External dimensions		See the following figure	
Power consumption	AC adapter for QB-78K0RIX3	Output: DC15 V, 1 A Input: AC100 to 240 V	
	Target system power supply	Voltage: 1.8 to 5.5 V Current: V_{DD} approx. 1.8 mA MAX., AV_{REF} approx. 50 mA MAX.	
Weight		Approx. 480 g	
Host interface		USB interface (1.1, 2.0)	

Notes 1. The target devices are the μPD78F1007, μPD78F1008, and μPD78F1009.

2. The error is within ±0.5%. This, however, does not apply to errors with the oscillator and the clock system of the target board.

3. Use 4 MHz by using the SFR to divide 8 MHz by two. (Operation at 8 MHz is not possible, because operation at 5 MHz or more is not guaranteed at 2.7 V or less.)



Notes 1. Does not include projection of power switch

2. Includes projection of screw that fixes rear space adapter

3. Rear space adapter can adjust the height from 30 mm (longest) to 0 mm (shortest)

4. Front space adapter can adjust the height from 20 mm (longest) to 5 mm (shortest)

1.2 System Specifications

This section shows the QB-78K0RIX3 system specifications.

Table 1-2. QB-78K0RIX3 System Specifications

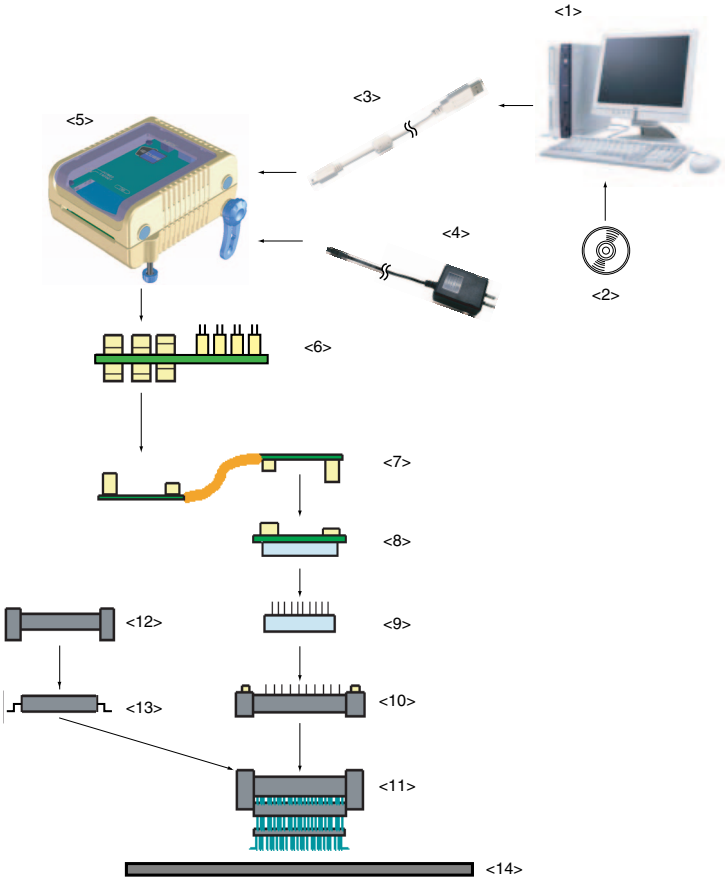
Parameter		Specification
Emulation memory capacity	Internal ROM	512 KB (MAX.)
	Internal RAM	61.75 KB (MAX.)
Program execution functions	Real-time execution function	Go, Start from Here, Come Here, Restart, Return Out, Ignore break points and Go
	Non-real-time execution function	Step In, Next Over, Slowmotion, Go & Go
Memory manipulation		Available (initialize, copy, compare)
Register manipulation		Available (general-purpose registers, control registers, SFRs)
Disassemble function		Available
Local variable view		Local variables
Watch data view		Local variables, global variables, or else
Stack trace view		Available
Break functions	Event break	Execution: 8 points Access: 8 points
	Software break	2000 points
	Pre-execution break	4 to 8 points[Note]
	Fail-safe break	Non-map, write protect, SFR illegal access, stack overflow, or else
	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, time tag
	Trace modes	Unconditional trace, section trace, qualify trace, delay trigger trace
	Trace functions	Non-stop, full stop, full break, delay trigger stop, delay trigger break
	Memory capacity	128K frames
Real-time RAM monitoring function		All internal RAM spaces
Time measurement functions	Measurement clock	60 MHz
	Measurement objects	Start through end of program execution Start event through end event
	Maximum measurement time	Approx. 40 hours and 43 minutes (Resolution: 17 ns)
	Number of timers for measurement	Start through end of program execution: 1 Start event through end event: 2
	Measurement results	Execution time (start through end of execution) Maximum, minimum, average, total, pass count (between events)
	Other	Timer overflow break function, timeout break function
Other functions		Command functions set in the console, mapping function, event function, coverage function, snapshot function, DMM function, power-off emulation function, pin mask function, flash self programming emulation function

Note The number of breaks that can be set varies depending on the location where the break is set.

1.3 System Configuration

This section shows the system configuration when using the QB-78K0RIX3 connected to a PC (PC/AT™ compatible). Connection is possible even without optional products.

Figure 1-1. System Configuration



<1> Host machine : IBM PC/AT compatible can be used
<2> ID78K0R-QB Disk/Accessory Disk : Debugger, USB drivers, manual, etc.
<3> USB interface cable : Cable connecting QB-78K0RIX3 to host machine
<4> AC adapter : Support input AC100 to 240 V
<5> QB-78K0RIX3 : This product
<6> Check pin adapter (optional) : Adapter used for monitoring waveforms with oscilloscope
<7> Emulation probe : High-characteristic FPC type emulation probe
<8> Exchange adapter : Adapter that performs pin conversion
<9> Space adapter (optional) : Adapter used for height adjustment
<10> YQ connector : Connector that connects exchange adapter to target connector
<11> Target connector : Connector soldered to target system
<12> Mount adapter (optional) : Adapter used for mounting target device into socket
<13> Device : Target device
<14> Target system

Remarks 1. Obtain device files from the NEC Electronics website.
http://www.necel.com/micro/ods/eng/
2. Refer to **1.5 Package Contents** for the purchase forms of the above products.
3. As for handling of connectors, refer to **2.5 Mounting and Connecting Connectors**.

1.4 System Configuration for Each Target Device

The following table lists the system configuration for each target device of the QB-78K0RIX3.

Table 1-3. Adapters and Connectors for Each Target Device

Target Device	Package	Exchange Adaptor	Space Adaptor	YQ Connector	Target Connector	Mount Adaptor
78K0R/KC3-L	44GB	QB-44GB-EA-04T	QB-44GB-YS-01T	QB-44GB-YQ-01T	QB-44GB-NQ-01T	QB-44GB-HQ-01T
	48GA	QB-48GA-EA-04T	QB-48GA-YS-01T	QB-48GA-YQ-01T	QB-48GA-NQ-01T	QB-48GA-HQ-01T
78K0R/KD3-L	52GB	QB-52GB-EA-04T	QB-52GB-YS-01T	QB-52GB-YQ-01T	QB-52GB-NQ-01T	QB-52GB-HQ-01T
78K0R/KE3-L	64F1	QB-64FC-EA-01T Note1	–Note2	–Note2	QB-64FC-NQ-01T Note1	–Note2
	64GA	QB-64GA-EA-01T	QB-64GA-YS-01T	QB-64GA-YQ-01T	QB-64GA-NQ-01T	QB-64GA-HQ-01T
	64GB	QB-64GB-EA-04T	QB-64GB-YS-01T	QB-64GB-YQ-01T	QB-64GB-NQ-01T	QB-64GB-HQ-01T
	64GK	QB-64GK-EA-04T	QB-64GK-YS-01T	QB-64GK-YQ-01T	QB-64GK-NQ-01T	QB-64GK-HQ-01T
78K0R/IB3	30MC	QB-30MC-EA-05T	QB-30MC-YS-01T	QB-30MC-YQ-01T	QB-30MC-NQ-01T	QB-30MC-HQ-01T
78K0R/IC3	38MC	QB-38MC-EA-03T	QB-38MC-YS-01T	QB-38MC-YQ-01T	QB-38MC-NQ-01T	QB-38MC-HQ-01T
	44GB	QB-44GB-EA-04T	QB-44GB-YS-01T	QB-44GB-YQ-01T	QB-44GB-NQ-01T	QB-44GB-HQ-01T
	48GA	QB-48GA-EA-04T	QB-48GA-YS-01T	QB-48GA-YQ-01T	QB-48GA-NQ-01T	QB-48GA-HQ-01T
78K0R/ID3	52GB	QB-52GB-EA-04T	QB-52GB-YS-01T	QB-52GB-YQ-01T	QB-52GB-NQ-01T	QB-52GB-HQ-01T
78K0R/IE3	64GB	QB-64GB-EA-04T	QB-64GB-YS-01T	QB-64GB-YQ-01T	QB-64GB-NQ-01T	QB-64GB-HQ-01T
	64GK	QB-64GK-EA-04T	QB-64GK-YS-01T	QB-64GK-YQ-01T	QB-64GK-NQ-01T	QB-64GK-HQ-01T

Notes 1. Under development

2. The 64F1 is not provided with a space adapter, a YQ connector, or a mount adaptor.

Table 1-4. Common Probe and Adapter

Name	Part Number
Check pin adapter	QB-144-CA-01
Emulation probe	QB-80-EP-01T

The adapter and connector for each device are sold separately. An exchange adapter, a YQ connector, a target connector, and an emulation probe are included, depending on the order product name. For details, refer to **1.5 Package Contents**.

Remark For the package drawings of the connector, adapter, and probe, refer to the following URL.
http://www.necel.com/micro/en/development/asia/Emulator/IE/iecube.html

1.5 Package Contents

The included products are described for each order product name.

Products supplied with QB-78K0RIX3-ZZZ

1: QB-78K0RIX3
2: AC adapter
3: USB interface cable (2 meters)
4: Online user registration card (warranty card and software contract in one)
5: ID78K0R-QB Disk (CD-ROM)
6: Accessory Disk (CD-ROM)
7: IECUBE Setup Manual (Japanese/English)
8: Packing list
9: QB-MINI2

Products supplied with QB-78K0RIX3-T30MC

1 to 9
10: Emulation probe QB-80-EP-01T
11: Exchange adapter QB-30MC-EA-05T
12: YQ connector QB-30MC-YQ-01T
13: Target connector QB-30MC-NQ-01T

Products supplied with QB-78K0RIX3-T38MC

1 to 9
10: Emulation probe QB-80-EP-01T
11: Exchange adapter QB-38MC-EA-03T
12: YQ connector QB-38MC-YQ-01T
13: Target connector QB-38MC-NQ-01T

Products supplied with QB-78K0RIX3-T44GB

1 to 9
10: Emulation probe QB-80-EP-01T
11: Exchange adapter QB-44GB-EA-04T
12: YQ connector QB-44GB-YQ-01T
13: Target connector QB-44GB-NQ-01T

Products supplied with QB-78K0RIX3-T48GA

1 to 9
10: Emulation probe QB-80-EP-01T
11: Exchange adapter QB-48GA-EA-04T
12: YQ connector QB-48GA-YQ-01T
13: Target connector QB-48GA-NQ-01T

Products supplied with QB-78K0RIX3-T52GB

1 to 9
10: Emulation probe QB-80-EP-T01T
11: Exchange adapter QB-52GB-EA-04T
12: YQ connector QB-52GB-YQ-01T
13: Target connector QB-52GB-NQ-01T

Products supplied with QB-78K0RIX3-T64F1

1 to 9
10: Emulation probe QB-80-EP-01T
11: Exchange adapter QB-64FC-EA-01T Note1
12: YQ connector – Note2
13: Target connector QB-64FC-NQ-01T Note1

Products supplied with QB-78K0RIX3-T64GA

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

Products supplied with QB-78K0RIX3-T64GB

1 to 9
10: Emulation probe QB-80-EP-01T
11: Exchange adapter QB-64GB-EA-04T
12: YQ connector QB-64GB-YQ-01T
13: Target connector QB-64GB-NQ-01T

Products supplied with QB-78K0RIX3-T64GK

1 to 9
10: Emulation probe QB-80-EP-01T
11: Exchange adapter QB-64GK-EA-04T
12: YQ connector QB-64GK-YQ-01T
13: Target connector QB-64GK-NQ-01T

Notes 1. Under development

2. The QB-78K0RIX3-T64F1 is not provided with a YQ connector.

CHAPTER 2 SETUP PROCEDURE

This chapter explains the QB-78K0RIX3 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 positions.

Clock settings

Hardware settings are not required if the clock internally generated from the emulator is used.

If an oscillator must be mounted, 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**.

↓

Connecting QB-78K0RIX3 to target system

See **2.6 Connecting QB-78K0RIX3 to Target System**.

↓

Connecting USB interface cable and AC adapter

See **2.8 Connecting USB Interface Cable and AC Adapter**.

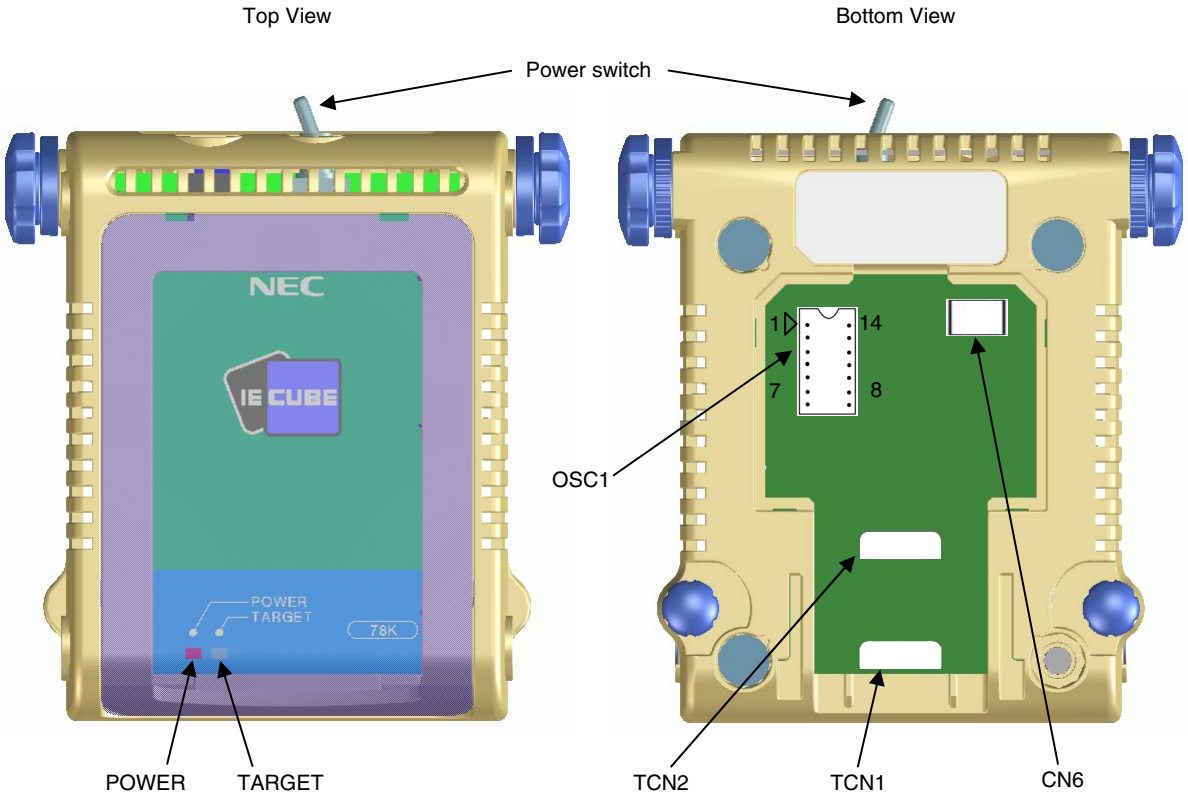
↓

Switching power on and off

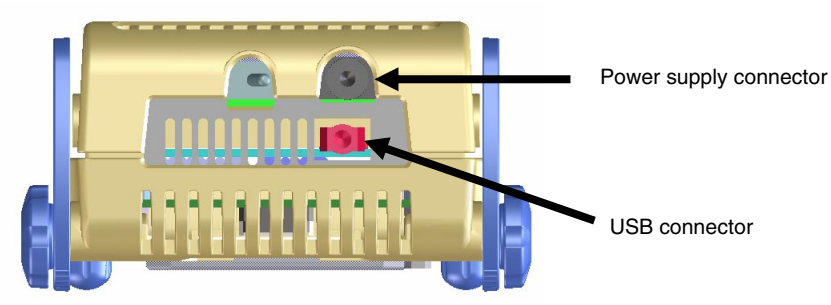
See **2.9 Switching Power On and Off**.

2. 1 Names and Functions of Hardware

Figure 2-1. Names of Parts of QB-78K0RIX3



Side View



(1) TCN1, TCN2

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

(2) OSC1

This is a socket for mounting the oscillator.

(3) CN6

This is a connector for the shipment inspection. It is not something that the user will need.

(4) POWER (Red LED)

This is an LED that shows whether the power supply of the QB-78K0RIX3 is switched on.

LED State	QB-78K0RIX3 State
Lit	Power switch ON
Not lit	Power switch OFF or AC adapter not connected to QB-78K0RIX3
Blinking	Internal error occurred (Contact an NEC Electronics sales representative or distributor)

(5) TARGET (Green LED)

This is an LED that shows whether 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

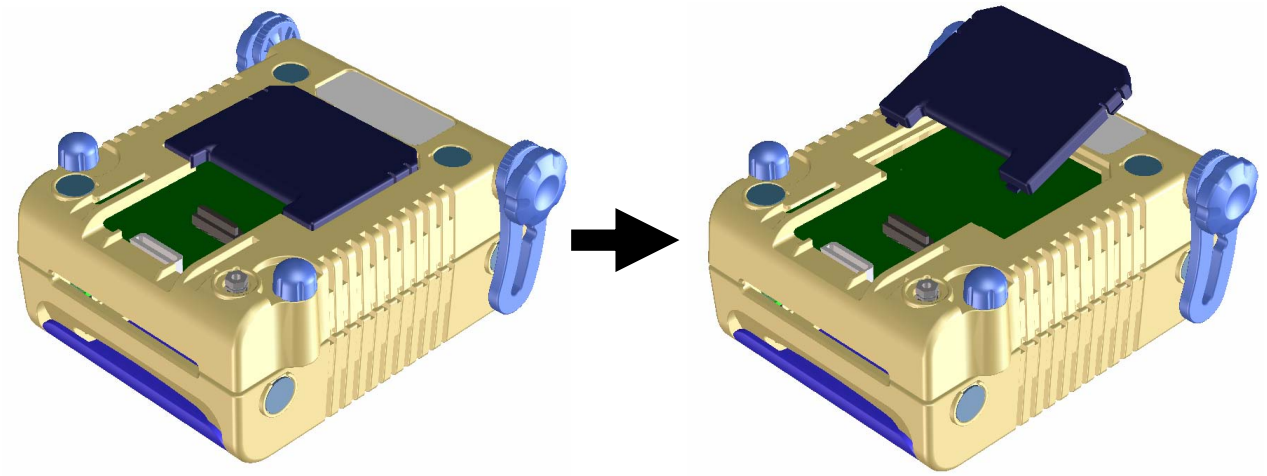
This is the power switch of the QB-78K0RIX3.

It is OFF at shipment.

2. 2 Removal of Acrylic Board

To modify the clock setting, the acrylic board on the bottom of the QB-78K0RIX3 must be removed. The acrylic board can be removed by lifting it up.

Figure 2-2. Acrylic Board Removal Method



2. 3 Clock Settings

2.3.1 Overview of clock settings

The following four types of clock settings are available.

Each clock setting is listed below.

Clock Used	Clock Supply	Debugger Setting (in Configuration Dialog)
(1) High-speed system clock[Note 1] (X1 oscillator or External input)	(a) When the clock generated within the emulator is used	System
	(b) When the clock is supplied from the target system	External
	(c) When the oscillator (OSC1) mounted onto the emulator is used	Clock Socket
(2) Internal high-speed oscillation clock	Uses the clock internally generated from the emulator	–
(3) Subsystem clock[Note 2] (XT1 oscillator)	(a) When the clock generated within the emulator is used	System
	(b) When the clock is supplied from the target system	External

Notes 1. First, select “System” in the debugger settings (refer to (a) When the clock generated within the emulator is used, in (1) High-speed system clock).

If there is no clock that can be selected, follow the descriptions below.

- If the target system clock can supply a square wave for the emulator:
  Select “External” in the debugger settings (refer to (b) When the clock is supplied from the target system, in (1) High-speed system clock).
- If the target system clock cannot supply a square wave for the emulator:
  Mount onto the emulator the oscillator of the clock to be used and select “Clock Socket” in the debugger settings (refer to (c) When the oscillator (OSC1) mounted onto the emulator is used, in (1) High-speed system clock).

2. First, select “System” in the debugger settings (refer to (a) When the clock generated within the emulator is used, in (3) Subsystem clock).

If there is no clock that can be selected, it can be supplied from the target system clock. A square wave, however, must be supplied (refer to (b) When the clock is supplied from the target system, in (3) Subsystem clock).

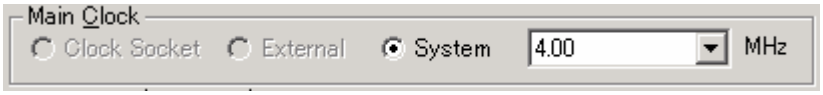
Oscillation with the resonator on the target system is not supported. Therefore, the in-circuit emulator cannot emulate the oscillation operation of the clock on the target system.

(1) High-speed system clock

The clock settings are listed below.

Table 2-1. Settings for High-Speed System Clock

Type of Clock to Be Used	OSC1	Debugger Setting
(a) When the clock generated within the emulator is used	–	System
(b) When the clock is supplied from the target system[Note]	–	External
(c) When the oscillator (OSC1) mounted onto the emulator is used	Oscillator mounted	Clock Socket



Note This setting is not possible when TARGET LED is not lit.

Remarks 1. Settings other than the above are prohibited.

2. Selection of (a) or (b) is possible regardless of whether the oscillator is not mounted in the OSC1socket.

(a) When the clock generated within the emulator is used

Select the “System” in the debugger and select the desired frequency from the drop-down list.

The following frequencies are selectable.

2.00, 3.00, 3.57, 4.00, 4.19, 4.91, 5.00, 6.00, 8.00, 8.38, 10.00, 12.00, 16.00, 20.00 [MHz]

(b) When the clock is supplied from the target system

Select the “External” in the debugger. The clock input from the target system is then used.

Oscillation with the resonator on the target system is not supported. To input a clock from the target system, input to the clock pin (X2) the square-wave signal with the same voltage potential as that of the target device supply voltage (V_{DD}). Inputting the inverted signal to X1 is not necessary.

The selectable frequencies are same as those of the target device.

(c) When the oscillator (OSC1) mounted onto the emulator is used

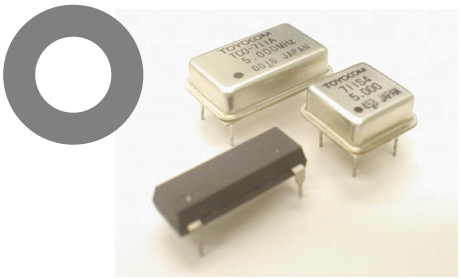
Mount an oscillator in the OSC1 socket in the emulator and then select the “Clock socket” in the debugger. The clock generated from the oscillator mounted on the emulator is used.

The selectable frequencies are same as those of the target device.

As an oscillator[Note] to be mounted in the OSC1 socket in the emulator, use the one that satisfies the following specifications.

- Supply voltage: 5 V
- Output level: CMOS

Note An oscillator that uses a resonator cannot be used.



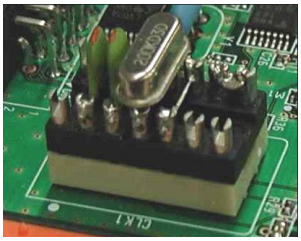
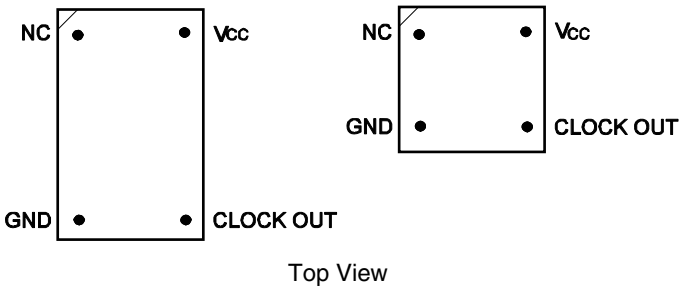
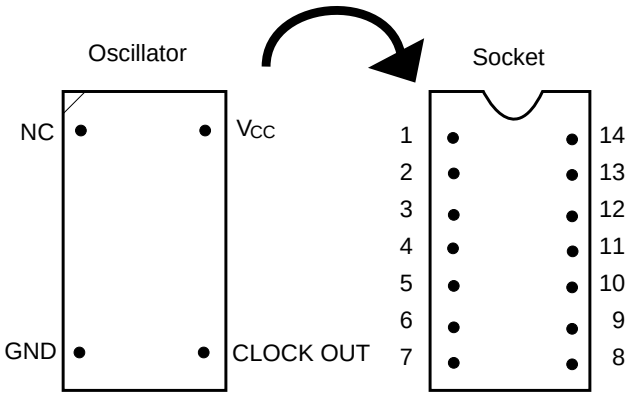


Figure 2-3. Oscillator Shape



Top View

Figure 2-4. Mapping of Oscillator to Socket



Oscillator	OSC1 Pin Number
NC	1
GND	4
	7
CLOCK OUT	8
	11
VCC	14

Remark Insert the oscillator into the socket, take care for the pin 1 position.

(2) Internal high-speed oscillation clock

The debugger setting is not necessary.

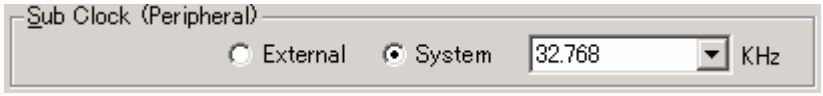
The use of the internal high-speed oscillation clock can be specified in the user program.

(3) Subsystem clock

The clock settings are listed below.

Table 2-2. Settings for Subsystem Clock

Type of Clock to Be Used	Debugger Setting
(a) When the clock generated within the emulator is used	System
(b) When the clock is supplied from the target system[Note]	External



Note This setting is not possible when TARGET LED is not lit.

Remark Settings other than above are prohibited.

(a) When the clock generated within the emulator is used

Select the “System” in the debugger and select “32.768” [kHz] as the frequency from the drop-down list.

32.768 [kHz]

Remark “38.400” [kHz] can also be selected from the list, but do not select this frequency; it is not supported by the device.

(b) When the clock is supplied from the target system

Select the “External” in the debugger. The clock input from the target system is then used.

Oscillation with the resonator on the target system is not supported. To input a clock from the target system, input to the clock pin (XT2) the square-wave signal with the same voltage potential as that of the target device supply voltage (V_{DD}). Inputting the inverted signal to XT1 is not necessary.

The selectable frequencies are same as those of the target device.

2. 4 Software Settings

For details, see the **ID78K0R-QB Ver. 3.20 Integrated Debugger Operation User's Manual** (U17839E).

2. 5 Mounting and Connecting Connectors

This section describes the methods of connecting the QB-78K0RIX3 and target system.

Make connections with both the QB-78K0RIX3 and target system powered OFF.

The following abbreviations are used in this section:

- TC: Target connector
- YQ: YQ connector
- EA: Exchange adapter
- MA: Mount adapter
- CA: Check pin adapter
- SA: Space adapter

2.5.1 Mounting TC to 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 TC and adhere the TC to the user board (clean the surface of the target system board using alcohol or the like). If alignment of target system pads to TC leads is difficult, align them as in (2).

(2) Align by inserting the guide pins for alignment for the TC (NQGUIDE) through the pin holes on the top of the TC. Accessory holes are ϕ1.0 mm non-through holes in two or three places.
(For hole positions, see the particular TC drawing.)

(3) Solder after fitting the MA to the TC. This is to prevent troubles such as flux or solder splashing and adhering to the TC contact pins when soldering.

- Soldering conditions	Solder reflow	260°C × 10 seconds or less
	Manual soldering	350°C × 5 seconds or less (1 pin)

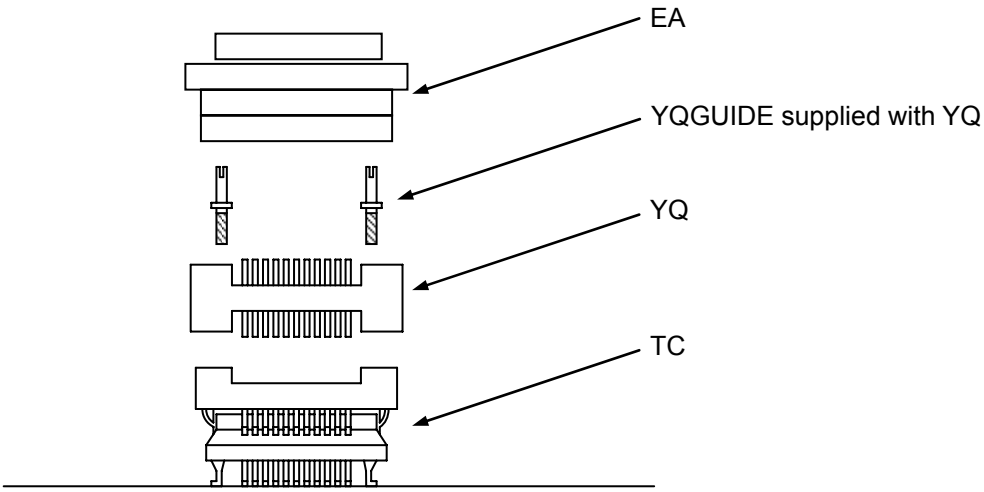
Caution Do not perform washing by flux immersion or vapor.

(4) Take away the guide pins.

2.5.2 Mounting YQ to TC

(1) After confirming that there are no broken or bent YQ contact pins, fit the YQ in the TC and fasten it using the supplied YQGUIDE (for the fastening method, see the next step, (2)). 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) Fasten YQ to the TC on the target system using the supplied YQGUIDE. Fasten the screws equally in the four corners using the supplied flat-blade screwdriver or a torque driver. The tightening torque of the YQGUIDE is 0.054 Nm (MAX.). Too great tightening causes bad connections.
However, four screws for fitting to the TC (M2 x 10 mm / 4 units) are included with the YQ.



2.5.3 Plugging EA into YQ

Match the pin 1 position of the YQ or SA (corner cuts match in both) to the pin 1 position of the EA and plug in.

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

As a tool when unplugging, insert some kind of thin non-conductive material such as a wooden stick between the YQ (SA) and EA and wiggle 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 TC, YQ, SA, and CA

(1) When taking the TC 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 TC, confirm that there are no bent pins.

(3) When screwing a YQ soldered to a board to the TC, fasten the screws in four places in turn using a #0 or #1 Phillips precision screwdriver 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 (four 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 SA removal, since there is a danger of YQ pins being bent or broken when prying and wiggling, remove them gradually using a flatbladed screwdriver from four directions. Moreover, to connect and use the YQ and SA, screw the YQ to the TC according to the YQGUIDE (included with the YQ) using a 2.3 mm flatbladed screwdriver and then connect it to the SA. Fix the torque at 0.054 Nm (MAX.). If even one place is overtightened, it may cause poor contact.

(5) For the TC, YQ, and SA, since there is a danger that washing fluid on the structure will remain in the connector, do not perform washing.

(6) TC, IC, and YQ cannot be used in combination.

(7) A TC/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 TC, YQ, and SA, see the NQPACK series technical materials at the website of Tokyo Eletech Corporation.

URL: http://www.tetc.co.jp/

(11) CA

The CA is an optional product for IECUBE, and can be used to measure the waveform between IECUBE and the target system.

Since the pins on the CA do not correspond to the pin layout in each device, the pin header cover must be mounted according to the device to be used. For mounting methods of the pin header cover, refer to **[Related Information]** on the following URL.

http://www.necel.com/micro/english/iecube/index.html

2.5.5 Precautions for mounting IC using TC and MA

(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 TC 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 TC. Also fit the MA.

(4) Put the supplied M2 x 6 mm screws in the four accessory holes of the MA and fasten the screws in opposite corners. At that time, use either the dedicated screwdriver that is supplied or a torque driver to fasten them equally in turn with a tightening torque of 0.054 Nm (MAX.). Since the contact is poor if tightening is too great, once you have lightly fastened the MA 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 MA too much may give rise to cracks in the molded part of the MA (plastic part) and bend the mold into a bowed shape, making contact poor.

(8) After soldering the TC, do not perform cleaning by flux immersion or vapor.

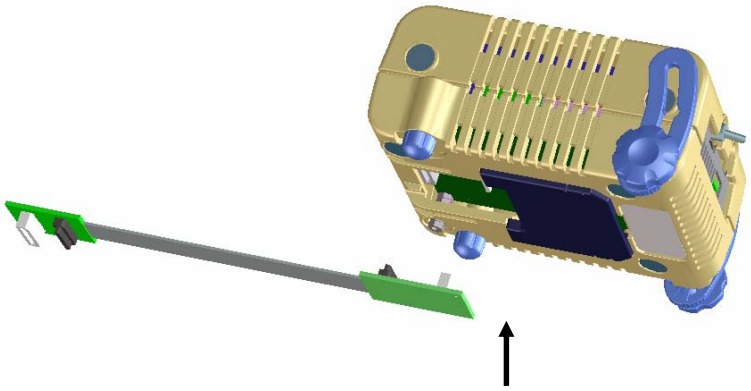
2. 6 Connecting QB-78K0RIX3 to Target System

If connecting the emulation probe (QB-80-EP-01T), connect it to the QB-78K0RIX3 and the target system by the following procedure.

(a) Connection of emulation probe to the QB-78K0RIX3

Connect the emulation probe to the QB-78K0RIX3, as shown below.

Figure 2-5. Connection of emulation probe to the QB-78K0RIX3



Insert CN1 and CN2 of the probe into TCN1 and TCN2 of the QB-78K0RIX3.

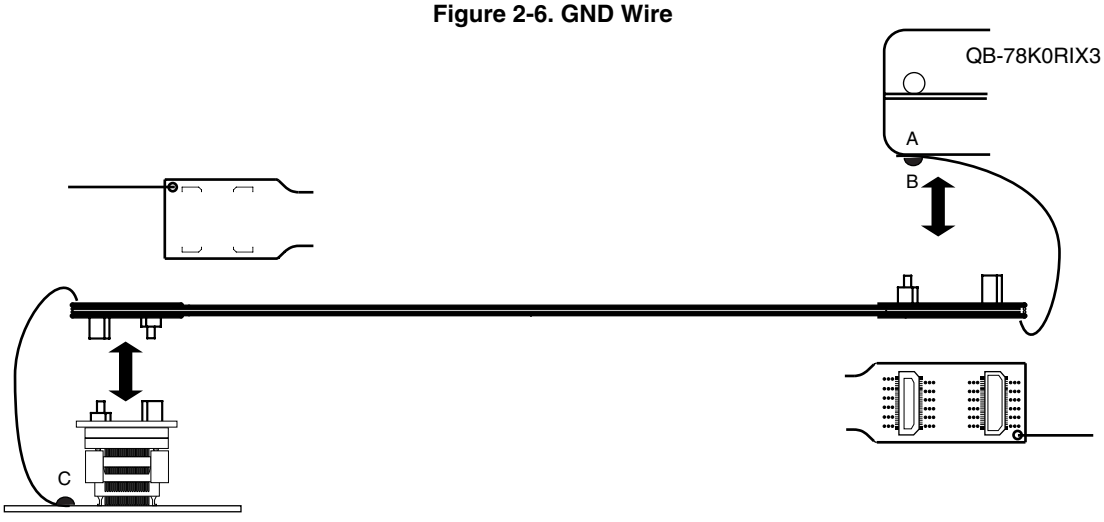
(b) Connection of emulation probe GND wire

There are two GND wires in the emulation probe. Connect them to the QB-78K0RIX3 and target system.

<1> Fasten the GND wire on the QB-78K0RIX3 side of the emulation probe to the nut on the bottom of the QB-78K0RIX3 using a #0 or #1 Phillips precision driver (connection of B to A in **Figure 2-6**).

<2> Next plug the connector on top of the emulation probe into the connector at the opening on the bottom of the QB-78K0RIX3 from below being careful of the insertion direction.

Figure 2-6. GND Wire



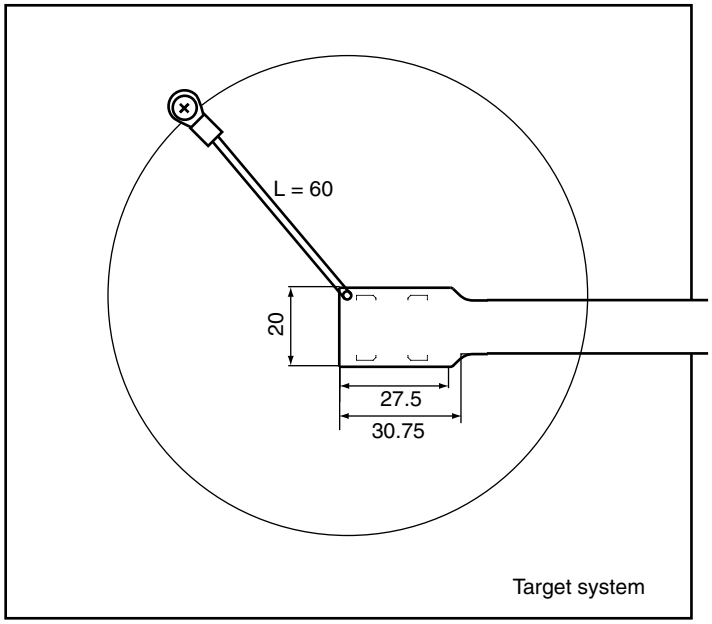
Target system

<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 2-6**). 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 to within the range of an approximately 60 mm radius section of the target system for connecting the emulation probe, as shown in **Figure 2-7**.

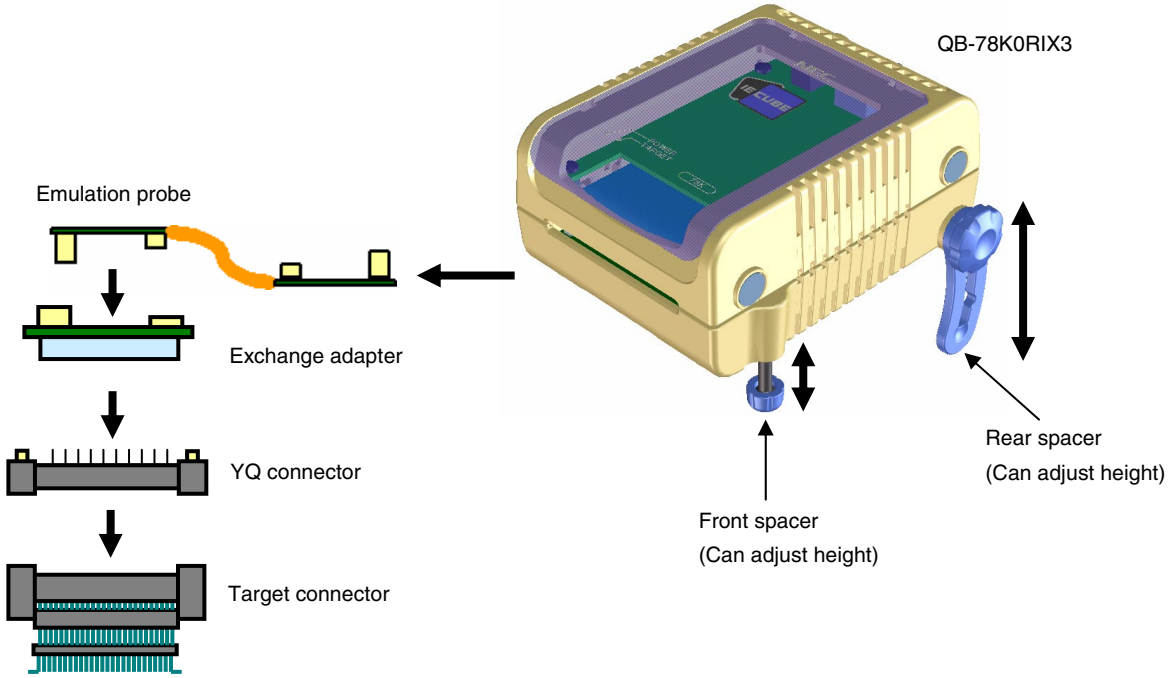
Figure 2-7. Where GND Wire Can Be Connected



(c) Ensuring isolation

When connecting the target system to the QB-78K0RIX3 using an emulation probe, perform height regulation using the front spacer or rear spacer of the QB-78K0RIX3 and ensure isolation from the target system.

Figure 2-8. Connection Using Emulation Probe



(d) Precautions related to 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-78K0RIX3 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 Notes on Power Supply and GND Pin Connection

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

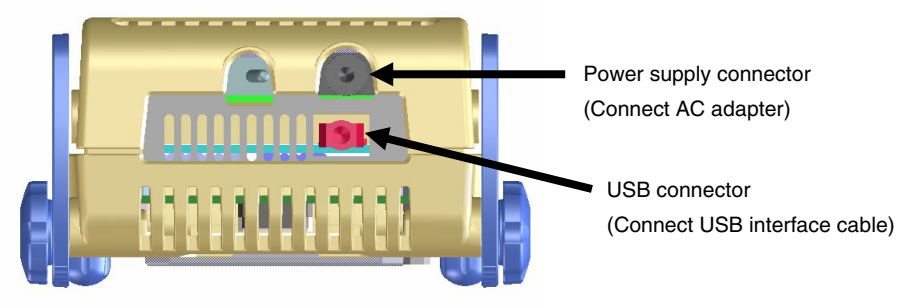
2. 8 Connecting USB Interface Cable and AC Adapter

Plug the USB interface cable supplied with the QB-78K0RIX3 into the USB connector of the host machine, and plug the other side into the USB connector on the rear of the QB-78K0RIX3.

Plug the AC adapter supplied with the QB-78K0RIX3 into a receptacle and plug the other side into the power supply connector on the rear of the QB-78K0RIX3.

For QB-78K0RIX3 connector positions, see **Figure 2-9**.

Figure 2-9. Connector Positions



2. 9 Switching Power On and Off

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

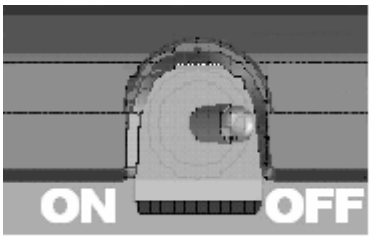
- Switching power on	- Switching power off
<1> QB-78K0RIX3 power on	<1> Debugger termination
<2> Target system power on[Note]	<2> Target system power off[Note]
<3> Debugger startup	<3> QB-78K0RIX3 power off

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

Caution If the wrong sequence was used for the operation, the target system or QB-78K0RIX3 may fail.

CHAPTER 3 SETTINGS AT PRODUCT SHIPMENT

Table 3-1. Settings at Shipment

Item	Setting	Remarks
OSC1	Not mounted	Oscillator can be mounted[Note].
Power switch		Set to OFF at shipment.

Note The oscillation circuit using an oscillation cannot be used.

CHAPTER 4 CAUTIONS

○ Target system voltage during a break

Do not decrease the voltage of the target system during a break.

A reset that is generated by the low-voltage detector (LVI) or by power-on-clear (POC) during a break may cause an incorrect operation of the debugger or communication errors.

○ Power-on-clear (POC) voltage values

The power-on-clear (POC) voltage values differ from the voltage value of the target device.

Table 4-1. Power-on-Clear (POC) Voltage Values

Item		MIN	TYP	MAX
Target device	VPOR	1.52 V	1.61 V	1.70 V
	VPDR	1.50 V	1.59 V	1.68 V
IECUBE	VPOR	–	1.65 V	–
	VPDR	–	1.55 V	–

○ TTL input buffer characteristics

When the port input mode register (PIM) is used to set the input to a pin that can set a TTL buffer to the TTL level, the high-level input voltage characteristics differ between the target device and emulator. For details, refer to **Table 4-2**.

The following pins can be set as a TTL buffer.

Target pins: P31, P32, P71, P72, P74, P75

Table 4-2. High-Level Input Voltage Characteristics

Item	Conditions	MIN
Target device	$4.0\ V \le V_{DD} \le 5.5\ V$	2.2 V
	$2.7\ V \le V_{DD} < 4.0\ V$	2.0 V
	$1.8\ V \le V_{DD} < 2.7\ V$	1.6 V
IECUBE[Note]	$1.8\ V \le V_{DD} \le 5.5\ V$	2.0 V

Note If VDD is 2.0 V or less, use CMOS input.

○ Motor control pins (only for 78K0R/Ix3)

When timer pins are used to control the motor, feedback cannot be applied during a CPU stop (break), which may adversely affect the motor.

To avoid this, the QB-78K0RIX3 is provided with a function that sets the timer pins to high impedance during a CPU stop (open-break function).

The following pins are subject to the open-break function. For the settings of the open-break function, refer to the Expansion Window in the **ID78K0R-QB Ver.3.20 Integrated Debugger Operation User's Manual (U17839E)**.

Note that, when the open-break function is used, the program cannot be executed again, because the motor is stopped during the break. Execute the program again after resetting the CPU.

Target pins: 6-phase PWM output function

TO02, TO03, TO04, TO05, TO06, TO07

Triangular-wave PWM output function

TO02, TO03, TO06, TO07

○ AD converter scan mode

When a break is performed for the A/D converter in the scan mode, the A/D converter does not stop, even during the break. It therefore becomes unclear which value stored in the conversion result registers is the conversion result of which ANI pin.

When a break is performed for the A/D converter in the scan mode, do not execute the program again. (Reset the CPU first.)

○ Characteristics of target interface

Functionally, the target interface (the signal connecting the in-circuit emulator and target system) operates as if an target device were connected, but the specifications may differ from those of an target device. For the target interface of this product, refer to **APPENDIX A CHARACTERISTICS OF TARGET INTERFACE**.

APPENDIX A CHARACTERISTICS OF TARGET INTERFACE

The target interface (signals connecting the in-circuit emulator and target system) operate, in terms of function, as if an actual device were connected. The characteristics, however, may be different from those of the actual device.

The target interface of this product is one of the following shown in **Figure A-1**. **Table A-1** shows the processing of each target interface.

Figure A-1. Equivalent Circuit of Target Interface (1/9)

- Target side - In-Circuit Emulator

Equivalent circuit A

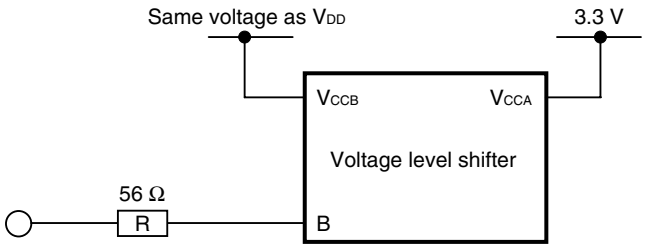


Figure A-1. Equivalent Circuit of Target Interface (2/9)

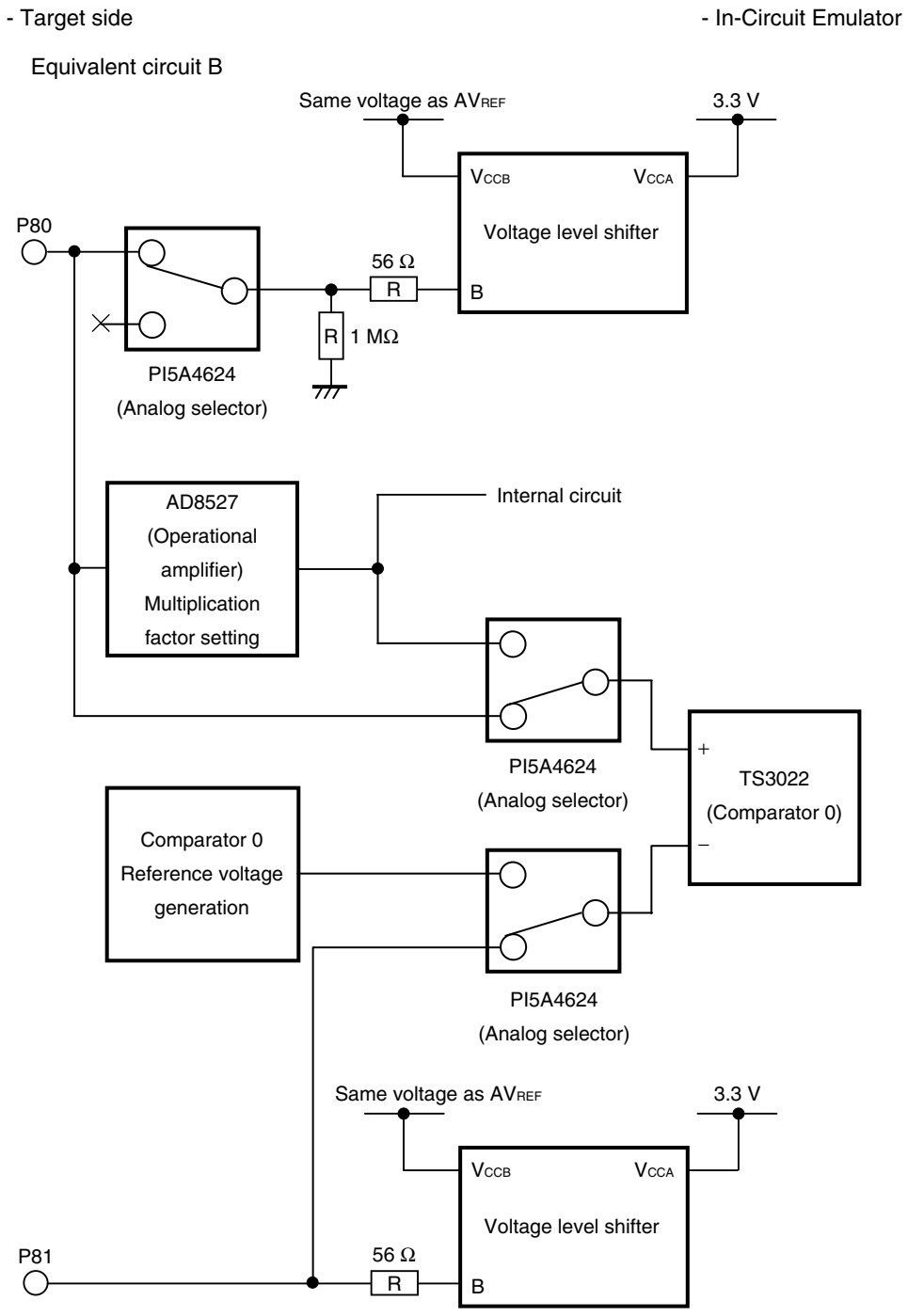


Figure A-1. Equivalent Circuit of Target Interface (3/9)

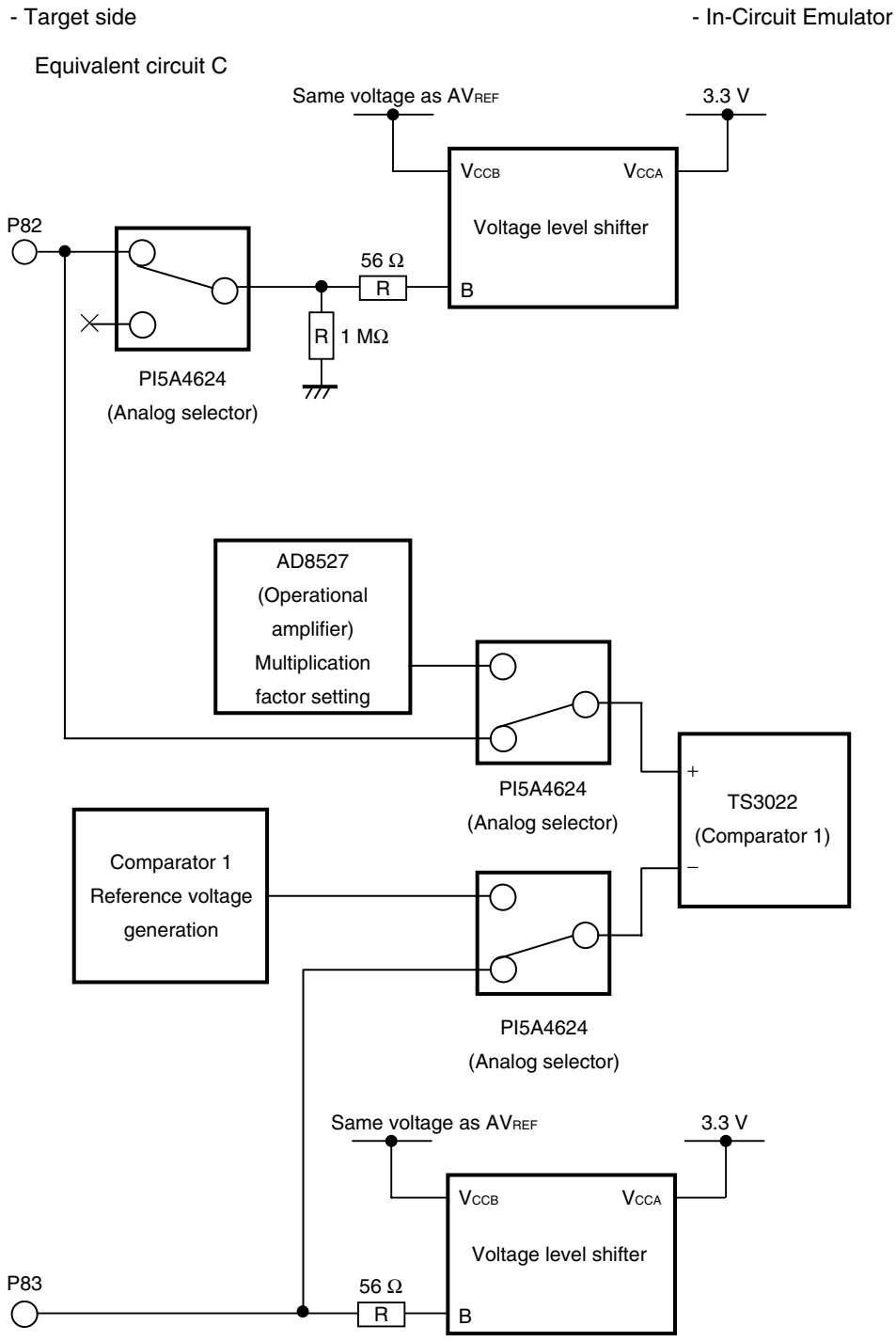
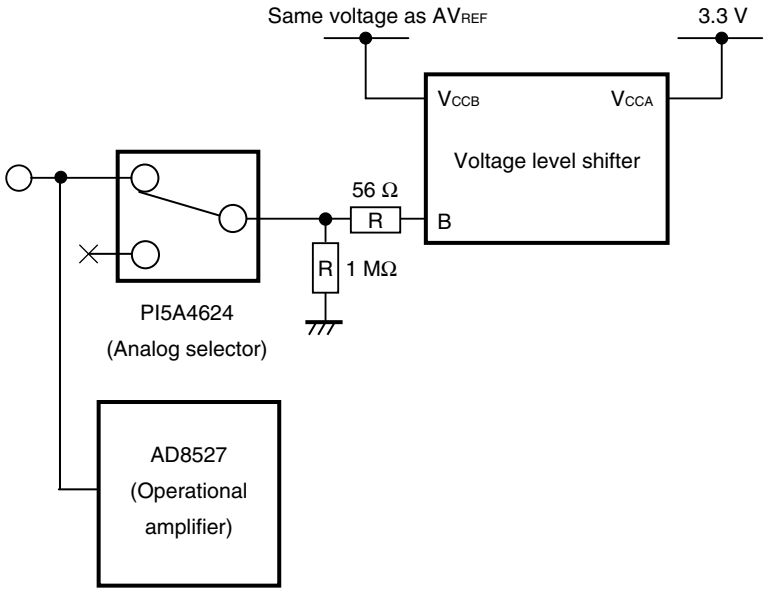


Figure A-1. Equivalent Circuit of Target Interface (4/9)

- Target side - In-Circuit Emulator

Equivalent circuit D



Equivalent circuit E

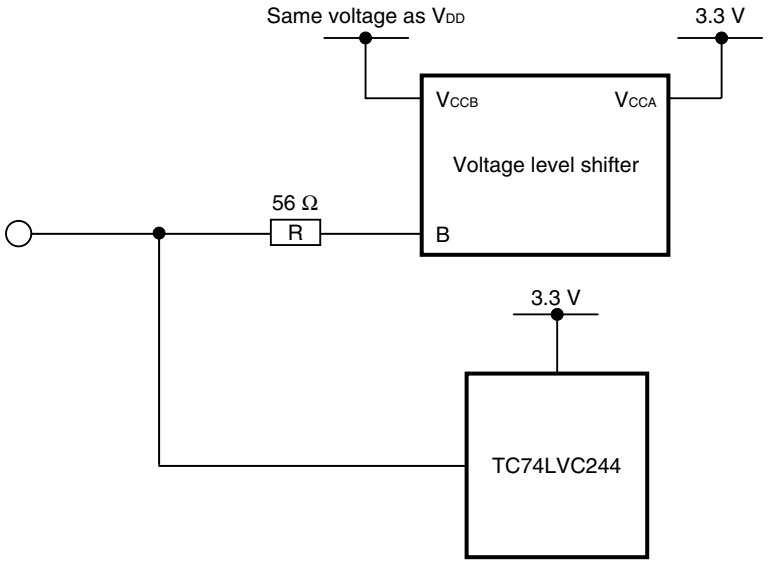
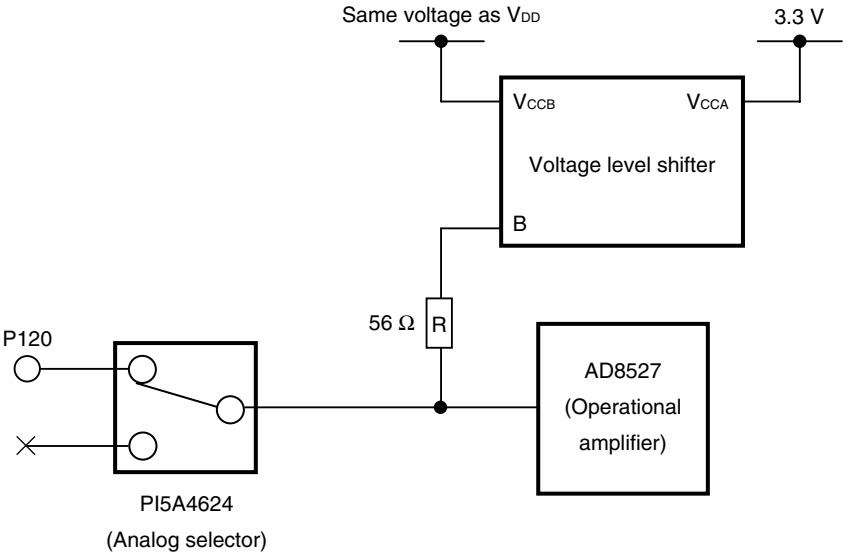


Figure A-1. Equivalent Circuit of Target Interface (5/9)

- Target side - In-Circuit Emulator

Equivalent circuit F



Equivalent circuit G

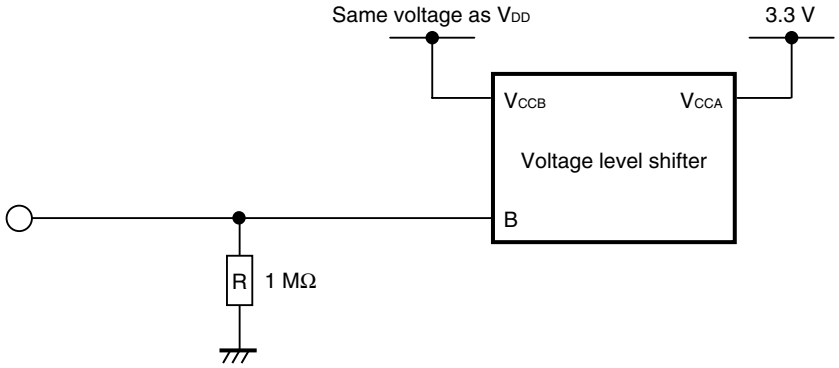


Figure A-1. Equivalent Circuit of Target Interface (6/9)

- Target side - In-Circuit Emulator

Equivalent circuit H

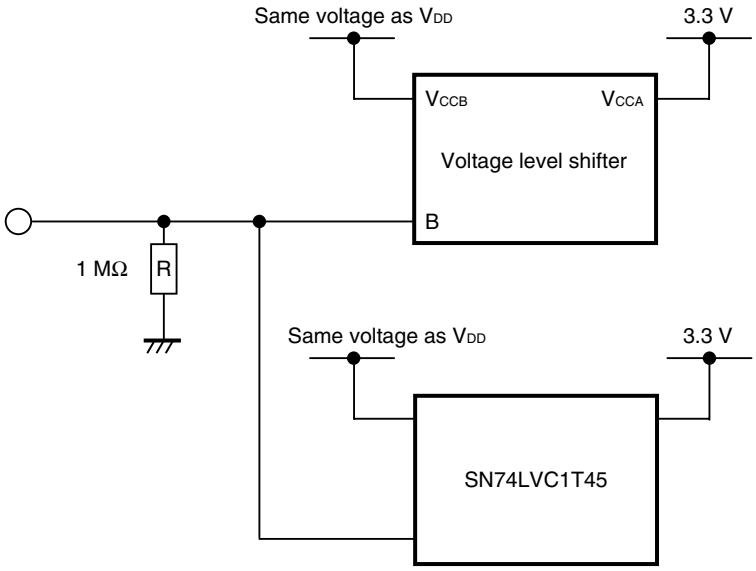
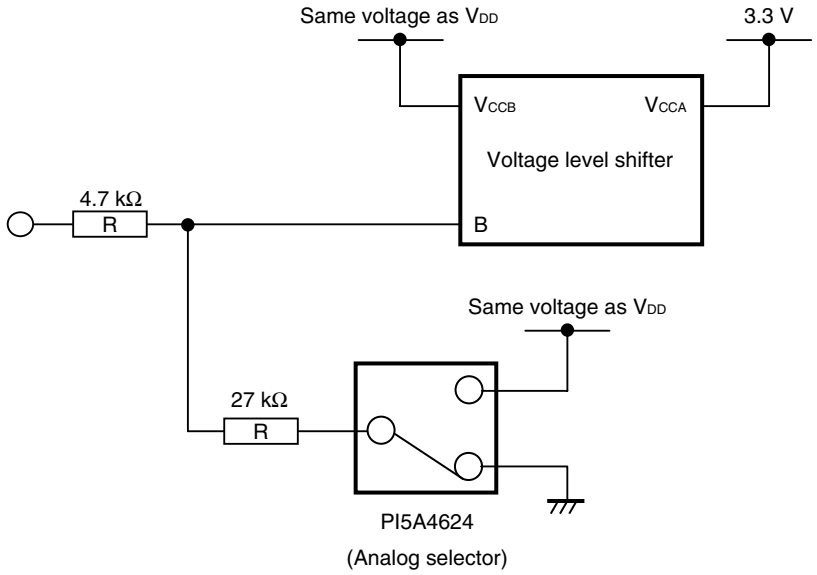


Figure A-1. Equivalent Circuit of Target Interface (7/9)

- Target side

- In-Circuit Emulator

Equivalent circuit I



Equivalent circuit J

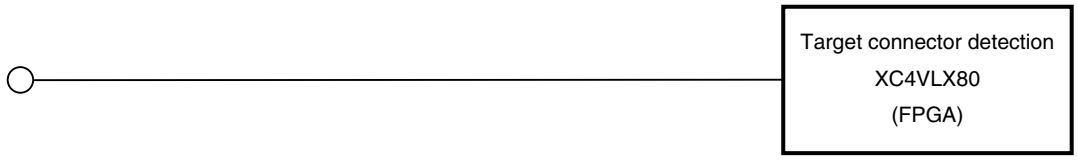
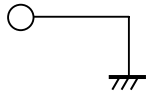


Figure A-1. Equivalent Circuit of Target Interface (8/9)

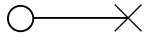
- Target side

- In-Circuit Emulator

Equivalent circuit K



Equivalent circuit L



Open

Equivalent circuit M

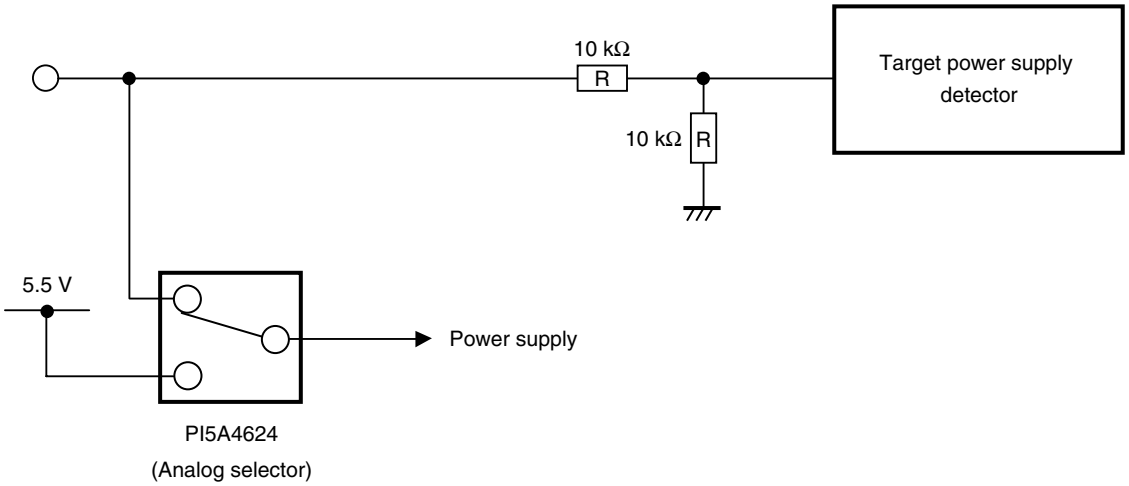
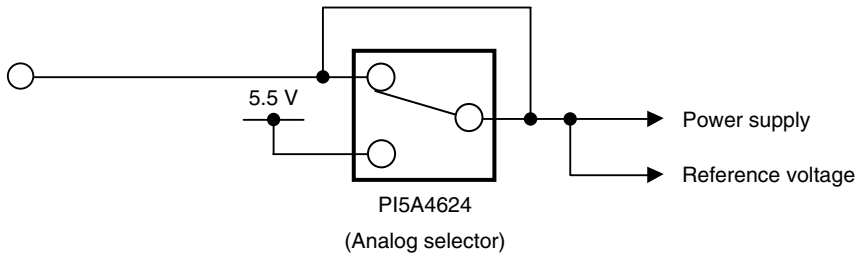


Figure A-1. Equivalent Circuit of Target Interface (9/9)

- Target side - In-Circuit Emulator

Equivalent circuit N



Equivalent circuit O

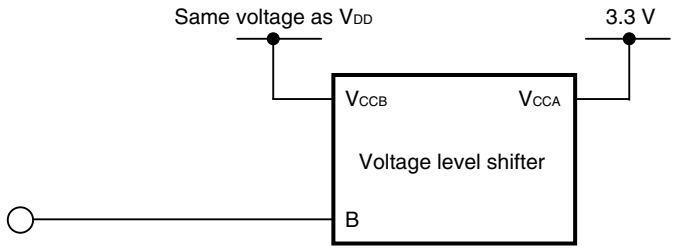


Table A-1. Target Interface Combinations (1/15)

KC3-L (44GB) Pin Number	Pin Name in Target Device (78K0R/KC3-L)	Equivalent Circuit
1	P41/TOOL1	A
2	P40/TOOL0	A
3	$\overline{\text{RESET}}$	G
4	P124/XT2	G
5	P123/XT1	O
6	FLMD0	I
7	P122/X2/EXCLK	H
8	P121/X1	O
9	REGC	L
10	V_{SS}	J
11	V_{DD}	M
12	P30/SO10/TXD1	A
13	P31/SI10/RXD1/SDA10/INTP1	E
14	P32/$\overline{\text{SCK10}}$/SCL10/INTP2	E
15	P75/KR5/$\overline{\text{SCK00}}$	E
16	P74/KR4/SI00/RXD0	E
17	P73/KR3/SO00/TXD0	A
18	P72/KR2/$\overline{\text{SCK01}}$/INTP6	E
19	P71/KR1/SI01/INTP5	E
20	P70/KR0/SO01/INTP4	A
21	P52/RTC1HZ/SLTI/SLTO	A
22	P51/TI07/TO07	A
23	P50/TI06/TO06	A
24	P13/TI05/TO05	A
25	P12/TI04/TO04/RTCDIV/RTCCL	A
26	P11/TI03/TO03	A
27	P10/TI02/TO02	A
28	P83/CMP1M	C
29	P82/CMP1P/INTP7	C
30	P81/CMP0M	B
31	P80/CMP0P/INTP3/OAI	B
32	AV_{REF}	N
33	AV_{SS}	K
34	P151/ANI9	D
35	P150/ANI8	D
36	P27/ANI7	D
37	P26/ANI6	D
38	P25/ANI5	D
39	P24/ANI4	D
40	P23/ANI3	D
41	P22/ANI2	D
42	P21/ANI1	D
43	P20/ANI0	D
44	P120/INTP0/EXLVI	F

Table A-1. Target Interface Combinations (2/15)

KC3-L (48GA) Pin Number	Pin Name in Target Device (78K0R/KC3-L)	Equivalent Circuit
1	P60/SCL0	O
2	P61/SDA0	O
3	P30/SO10/TXD1	A
4	P31/SI10/RXD1/SDA10/INTP1	E
5	P32/$\overline{\text{SCK10}}$/SCL10/INTP2	E
6	P75/KR5/$\overline{\text{SCK00}}$	E
7	P74/KR4/SI00/RXD0	E
8	P73/KR3/SO00/TXD0	A
9	P72/KR2/$\overline{\text{SCK01}}$/INTP6	E
10	P71/KR1/SI01/INTP5	E
11	P70/KR0/SO01/INTP4	A
12	P52/RTC1HZ/SLTI/SLTO	A
13	P51/TI07/TO07	A
14	P50/TI06/TO06	A
15	P13/TI05/TO05	A
16	P12/TI04/TO04/RTCDIV/RTCCL	A
17	P11/TI03/TO03	A
18	P10/TI02/TO02	A
19	P83/CMP1M	C
20	P82/CMP1P/INTP7	C
21	P81/CMP0M	B
22	P80/CMP0P/INTP3/OAI	B
23	AV_{REF}	N
24	AV_{SS}	K
25	P152/ANI10	D
26	P151/ANI9	D
27	P150/ANI8	D
28	P27/ANI7	D
29	P26/ANI6	D
30	P25/ANI5	D
31	P24/ANI4	D
32	P23/ANI3	D
33	P22/ANI2	D
34	P21/ANI1	D
35	P20/ANI0	D
36	P140/PCLBUZ0	A
37	P120/INTP0/EXLVI	F
38	P41/TOOL1	A
39	P40/TOOL0	A
40	$\overline{\text{RESET}}$	G
41	P124/XT2	G
42	P123/XT1	O
43	FLMD0	I
44	P122/X2/EXCLK	H
45	P121/X1	O
46	REGC	L
47	V_{SS}	J
48	V_{DD}	M

Table A-1. Target Interface Combinations (3/15)

KD3-L (52GB) Pin Number	Pin Name in Target Device (78K0R/KD3-L)	Equivalent Circuit
1	P140/PCLBUZ0	A
2	P120/INTP0/EXLVI	F
3	P41/TOOL1	A
4	P40/TOOL0	A
5	$\overline{\text{RESET}}$	G
6	P124/XT2	G
7	P123/XT1	O
8	FLMD0	I
9	P122/X2/EXCLK	H
10	P121/X1	O
11	REGC	L
12	V_{SS}	J
13	V_{DD}	M
14	P60/SCL0	O
15	P61/SDA0	O
16	P30/SO10/TXD1	A
17	P31/SI10/RXD1/SDA10/INTP1	E
18	P32/$\overline{\text{SCK10}}$/SCL10/INTP2	E
19	P77/KR7	A
20	P76/KR6	A
21	P75/KR5/$\overline{\text{SCK00}}$	E
22	P74/KR4/SI00/RXD0	E
23	P73/KR3/SO00/TXD0	A
24	P72/KR2/$\overline{\text{SCK01}}$/INTP6	E
25	P71/KR1/SI01/INTP5	E
26	P70/KR0/SO01/INTP4	A
27	P52/RTC1HZ/SLTI/SLTO	A
28	P51/TI07/TO07	A
29	P50/TI06/TO06	A
30	P13/TI05/TO05	A
31	P12/TI04/TO04/RTCDIV/RTCCL	A
32	P11/TI03/TO03	A
33	P10/TI02/TO02	A
34	P83/CMP1M	C
35	P82/CMP1P/INTP7	C
36	P81/CMP0M	B
37	P80/CMP0P/INTP3/OAI	B
38	AV_{REF}	N
39	AV_{SS}	K
40	P152/ANI10	D
41	P151/ANI9	D
42	P150/ANI8	D
43	P27/ANI7	D
44	P26/ANI6	D
45	P25/ANI5	D
46	P24/ANI4	D
47	P23/ANI3	D

Table A-1. Target Interface Combinations (4/15)

KD3-L (52GB) Pin Number	Pin Name in Target Device (78K0R/KD3-L)	Equivalent Circuit
48	P22/ANI2	D
49	P21/ANI1	D
50	P20/ANI0	D
51	P01/TO00	A
52	P00/TI00	A

Table A-1. Target Interface Combinations (5/15)

KE3-L (64F1) Pin Number	Pin Name in Target Device (78K0R/KE3-L)	Equivalent Circuit
A1	P17	A
A2	P16	A
A3	P15/TI07/TO07	A
A4	P53	A
A5	P70/KR0/SO01/INTP4	A
A6	P72/KR2/$\overline{\text{SCK01}}$/INTP6	E
A7	P61/SDA0	O
A8	EV_{DD}	M
B1	P14/TI06/TO06	A
B2	P13/TI05/TO05	A
B3	P12/TI04/TO04/RTCDIV/RTCCL	A
B4	P52/RTC1HZ/SLTI/SLTO	A
B5	P71/KR1/SI01/INTP5	E
B6	P73/KR3/SO00/TXD0	A
B7	V_{DD}	M
B8	EV_{SS}	K
C1	P82/CMP1P/TMOFF1/INTP7	C
C2	P83/CMP1M	C
C3	P11/TI03/TO03	A
C4	P51	A
C5	P74/KR4/SI00/RXD0	E
C6	P60/SCL0	O
C7	V_{SS}	J
C8	P121/X1	O
D1	P80/CMP0P/TMOFF0/INTP3/OAI	B
D2	P81/CMP0M	B
D3	P10/TI02/TO02	A
D4	P50	A
D5	P75/KR5/$\overline{\text{SCK00}}$	E
D6	P40/TOOL0	A
D7	REGC	L
D8	P122/X2/EXCLK	H
E1	P153/ANI11	D
E2	P152/ANI10	D
E3	P77/KR7	A
E4	P76/KR6	A
E5	P30/SO10/TXD1	A
E6	P41/TOOL1	A
E7	$\overline{\text{RESET}}$	G
E8	FLMD0	I
F1	P151/ANI9	D
F2	P150/ANI8	D
F3	P23/ANI3	D
F4	P20/ANI0	D
F5	P31/SI10/RXD1/SDA10/INTP1	E
F6	P43	A
F7	P42	A
F8	P123/XT1	O

Table A-1. Target Interface Combinations (6/15)

KE3-L (64F1) Pin Number	Pin Name in Target Device (78K0R/KE3-L)	Equivalent Circuit
G1	AV_{REF}	N
G2	P27/ANI7	D
G3	P24/ANI4	D
G4	P21/ANI1	D
G5	P32/$\overline{SCK10}$/SCL10/INTP2	E
G6	P00/TI00	A
G7	P140/PCLBUZ0	A
G8	P124/XT2	G
H1	AV_{SS}	K
H2	P26/ANI6	D
H3	P25/ANI5	D
H4	P22/ANI2	D
H5	P33	A
H6	P01/TO00	A
H7	P141/PCLBUZ1	A
H8	P120/INTP0/EXLVI	F

Table A-1. Target Interface Combinations (7/15)

KE3-L (64GK, GB, GA) Pin Number	Pin Name in Target Device (78K0R/KE3-L)	Equivalent Circuit
1	P120/INTP0/EXLVI	F
2	P43	A
3	P42	A
4	P41/TOOL1	A
5	P40/TOOL0	A
6	$\overline{\text{RESET}}$	G
7	P124/XT2	G
8	P123/XT1	O
9	FLMD0	I
10	P122/X2/EXCLK	H
11	P121/X1	O
12	REGC	L
13	V_{SS}	J
14	EV_{SS}	K
15	V_{DD}	M
16	EV_{DD}	M
17	P60/SCL0	O
18	P61/SDA0	O
19	P30/SO10/TXD1	A
20	P31/SI10/RXD1/SDA10/INTP1	E
21	P32/$\overline{\text{SCK10}}$/SCL10/INTP2	E
22	P33	A
23	P77/KR7	A
24	P76/KR6	A
25	P75/KR5/$\overline{\text{SCK00}}$	E
26	P74/KR4/SI00/RXD0	E
27	P73/KR3/SO00/TXD0	A
28	P72/KR2/$\overline{\text{SCK01}}$/INTP6	E
29	P71/KR1/SI01/INTP5	E
30	P70/KR0/SO01/INTP4	A
31	P53	A
32	P52/RTC1HZ/SLTI/SLTO	A
33	P51	A
34	P50	A
35	P17	A
36	P16	A
37	P15/TI07/TO07	A
38	P14/TI06/TO06	A
39	P13/TI05/TO05	A
40	P12/TI04/TO04/RTCDIV/RTCCL	A
41	P11/TI03/TO03	A
42	P10/TI02/TO02	A
43	P83/CMP1M	C
44	P82/CMP1P/INTP7	C
45	P81/CMP0M	B
46	P80/CMP0P/INTP3/OAI	B
47	AV_{REF}	N

Table A-1. Target Interface Combinations (8/15)

KE3-L (64GK, GB, GA) Pin Number	Pin Name in Target Device (78K0R/KE3-L)	Equivalent Circuit
48	AV_{SS}	K
49	P153/ANI11	D
50	P152/ANI10	D
51	P151/ANI9	D
52	P150/ANI8	D
53	P27/ANI7	D
54	P26/ANI6	D
55	P25/ANI5	D
56	P24/ANI4	D
57	P23/ANI3	D
58	P22/ANI2	D
59	P21/ANI1	D
60	P20/ANI0	D
61	P01/TO00	A
62	P00/TI00	A
63	P141/PCLBUZ1	A
64	P140/PCLBUZ0	A

Table A-1. Target Interface Combinations (9/15)

IB3 (30MC) Pin Number	Pin Name in Target Device (78K0R/IB3)	Equivalent Circuit
1	P23/ANI3	D
2	P22/ANI2	D
3	P21/ANI1	D
4	P20/ANI0	D
5	P120/INTP0/EXLVI	F
6	$\overline{\text{RESET}}$	G
7	FLMD0	I
8	P122/X2/EXCLK/INTP5	H
9	P121/X1/INTP4	O
10	REGC	L
11	V_{SS}	J
12	V_{DD}	M
13	P30/SO10/TXD1/TO11	A
14	P31/SI10/RXD1/SDA10/INTP1/TI09	E
15	P32/$\overline{\text{SCK10}}$/SCL10/INTP2	E
16	P41/TOOL1	A
17	P40/TOOL0	A
18	P51/TI07/TO07	A
19	P50/TI06/TO06	A
20	P13/TI05/TO05	A
21	P12/TI04/TO04	A
22	P11/TI03/TO03/RXD0	A
23	P10/TI02/TO02/TXD0	A
24	P83/CMP1M	C
25	P81/CMP0M	B
26	P80/CMP0P/TMOFF0/INTP3/OAI	B
27	AV_{REF}	N
28	AV_{SS}	K
29	P25/ANI5	D
30	P24/ANI4	D

Table A-1. Target Interface Combinations (10/15)

IC3 (38MC) Pin Number	Pin Name in Target Device (78K0R/IC3)	Equivalent Circuit
1	P23/ANI3	D
2	P22/ANI2	D
3	P21/ANI1	D
4	P20/ANI0	D
5	P120/INTP0/EXLVI	F
6	$\overline{\text{RESET}}$	G
7	P124/XT2	G
8	P123/XT1	O
9	FLMD0	I
10	P122/X2/EXCLK/INTP5	H
11	P121/X1/INTP4	O
12	REGC	L
13	V_{SS}	J
14	V_{DD}	M
15	P30/SO10/TXD1/TO11	A
16	P31/SI10/RXD1/SDA10/INTP1/TI09	E
17	P32/$\overline{\text{SCK10}}$/SCL10/INTP2	E
18	P73/TXD0/TO10	A
19	P72/INTP6/RXD0	E
20	P41/TOOL1	E
21	P40/TOOL0	A
22	P52/SLTI/SLTO	A
23	P51/TI07/TO07	A
24	P50/TI06/TO06	A
25	P13/TI05/TO05	A
26	P12/TI04/TO04	A
27	P11/TI03/TO03	A
28	P10/TI02/TO02	A
29	P83/CMP1M	C
30	P82/CMP1P/TMOFF1/INTP7	C
31	P81/CMP0M	B
32	P80/CMP0P/TMOFF0/INTP3/OAI	B
33	AV_{REF}	N
34	AV_{SS}	K
35	P27/ANI7	D
36	P26/ANI6	D
37	P25/ANI5	D
38	P24/ANI4	D

Table A-1. Target Interface Combinations (11/15)

IC3 (44GB) Pin Number	Pin Name in Target Device (78K0R/IC3)	Equivalent Circuit
1	P41/TOOL1	A
2	P40/TOOL0	A
3	$\overline{\text{RESET}}$	G
4	P124/XT2	G
5	P123/XT1	O
6	FLMD0	I
7	P122/X2/EXCLK	H
8	P121/X1	O
9	REGC	L
10	V_{SS}	J
11	V_{DD}	M
12	P30/SO10/TXD1/TO11	A
13	P31/SI10/RXD1/SDA10/INTP1/TI09	E
14	P32/$\overline{\text{SCK10}}$/SCL10/INTP2	E
15	P75/$\overline{\text{SCK00}}$/TI11	E
16	P74/SI00/RXD0/TI10	E
17	P73/SO00/TXD0/TO10	A
18	P72/$\overline{\text{SCK01}}$/INTP6	E
19	P71/SI01/INTP5	E
20	P70/SO01/INTP4	A
21	P52/SLTI/SLTO	A
22	P51/TI07/TO07	A
23	P50/TI06/TO06	A
24	P13/TI05/TO05	A
25	P12/TI04/TO04	A
26	P11/TI03/TO03	A
27	P10/TI02/TO02	A
28	P83/CMP1M	C
29	P82/CMP1P/TMOFF1/INTP7	C
30	P81/CMP0M	B
31	P80/CMP0P/TMOFF0/INTP3/OAI	B
32	AV_{REF}	N
33	AV_{SS}	K
34	P151/ANI9	D
35	P150/ANI8	D
36	P27/ANI7	D
37	P26/ANI6	D
38	P25/ANI5	D
39	P24/ANI4	D
40	P23/ANI3	D
41	P22/ANI2	D
42	P21/ANI1	D
43	P20/ANI0	D
44	P120/INTP0/EXLVI	F

Table A-1. Target Interface Combinations (12/15)

IC3 (48GA) Pin Number	Pin Name in Target Device (78K0R/IC3)	Equivalent Circuit
1	P60/SCL0	A
2	P61/SDA0	A
3	P30/SO10/TXD1/TO11	A
4	P31/SI10/RXD1/SDA10/INTP1/TI09	E
5	P32/$\overline{\text{SCK10}}$/SCL10/INTP2	E
6	P75/$\overline{\text{SCK00}}$/TI11	E
7	P74/SI00/RXD0/TI10	E
8	P73/SO00/TXD0/TO10	A
9	P72/$\overline{\text{SCK01}}$/INTP6	E
10	P71/SI01/INTP5	E
11	P70/SO01/INTP4	A
12	P52/SLTI/SLTO	A
13	P51/TI07/TO07	A
14	P50/TI06/TO06	A
15	P13/TI05/TO05	A
16	P12/TI04/TO04	A
17	P11/TI03/TO03	A
18	P10/TI02/TO02	A
19	P83/CMP1M	C
20	P82/CMP1P/TMOFF1/INTP7	C
21	P81/CMP0M	B
22	P80/CMP0P/TMOFF0/INTP3/OAI	B
23	AV_{REF}	N
24	AV_{SS}	K
25	P152/ANI10	D
26	P151/ANI9	D
27	P150/ANI8	D
28	P27/ANI7	D
29	P26/ANI6	D
30	P25/ANI5	D
31	P24/ANI4	D
32	P23/ANI3	D
33	P22/ANI2	D
34	P21/ANI1	D
35	P20/ANI0	D
36	P140/PCLBUZ0	A
37	P120/INTP0/EXLVI	F
38	P41/TOOL1	A
39	P40/TOOL0	A
40	$\overline{\text{RESET}}$	G
41	P124/XT2	G
42	P123/XT1	O
43	FLMD0	I
44	P122/X2/EXCLK	H
45	P121/X1	O
46	REGC	L
47	V_{SS}	J
48	V_{DD}	M

Table A-1. Target Interface Combinations (13/15)

ID3 (52GB) Pin Number	Pin Name in Target Device (78K0R/ID3)	Equivalent Circuit
1	P140/PCLBUZ0	A
2	P120/INTP0/EXLVI	F
3	P41/TOOL1	A
4	P40/TOOL0	A
5	$\overline{\text{RESET}}$	G
6	P124/XT2	G
7	P123/XT1	O
8	FLMD0	I
9	P122/X2/EXCLK	H
10	P121/X1	O
11	REGC	L
12	V_{SS}	J
13	V_{DD}	M
14	P60/SCL0	O
15	P61/SDA0	O
16	P30/SO10/TXD1/TO11	A
17	P31/SI10/RXD1/SDA10/INTP1/TI09	E
18	P32/$\overline{\text{SCK10}}$/SCL10/INTP2	E
19	P77	A
20	P76	A
21	P75/$\overline{\text{SCK00}}$/TI11	E
22	P74/SI00/RXD0/TI10	E
23	P73/SO00/TXD0/TO10	A
24	P72/$\overline{\text{SCK01}}$/INTP6	E
25	P71/SI01/INTP5	E
26	P70/SO01/INTP4	A
27	P52/SLTI/SLTO	A
28	P51/TI07/TO07	A
29	P50/TI06/TO06	A
30	P13/TI05/TO05	A
31	P12/TI04/TO04	A
32	P11/TI03/TO03	A
33	P10/TI02/TO02	A
34	P83/CMP1M	C
35	P82/CMP1P/TMOFF1/INTP7	C
36	P81/CMP0M	B
37	P80/CMP0P/TMOFF0/INTP3/OAI	B
38	AV_{REF}	N
39	AV_{SS}	K
40	P152/ANI10	D
41	P151/ANI9	D
42	P150/ANI8	D
43	P27/ANI7	D
44	P26/ANI6	D
45	P25/ANI5	D
46	P24/ANI4	D
47	P23/ANI3	D
48	P22/ANI2	D
49	P21/ANI1	D
50	P20/ANI0	D
51	P01/TO00	A
52	P00/TI00	A

Table A-1. Target Interface Combinations (14/15)

IE3 (64GK, GB) Pin Number	Pin Name in Target Device (78K0R/IE3)	Equivalent Circuit
1	P120/INTP0/EXLVI	F
2	P43	A
3	P42	A
4	P41/TOOL1	A
5	P40/TOOL0	A
6	$\overline{\text{RESET}}$	G
7	P124/XT2	G
8	P123/XT1	O
9	FLMD0	I
10	P122/X2/EXCLK	H
11	P121/X1	O
12	REGC	L
13	V_{SS}	J
14	EV_{SS}	K
15	V_{DD}	M
16	EV_{DD}	M
17	P60/SCL0	O
18	P61/SDA0	O
19	P30/SO10/TXD1/TO11	A
20	P31/SI10/RXD1/SDA10/INTP1	E
21	P32/$\overline{\text{SCK10}}$/SCL10/INTP2	E
22	P33	A
23	P77	A
24	P76	A
25	P75/$\overline{\text{SCK00}}$/TI11	E
26	P74/SI00/RXD0/TI10	E
27	P73/SO00/TXD0/TO10	A
28	P72/$\overline{\text{SCK01}}$/INTP6	E
29	P71/SI01/INTP5	E
30	P70/SO01/INTP4	A
31	P53	A
32	P52/SLTI/SLTO	A
33	P51	A
34	P50	A
35	P17/TI09/TO09	A
36	P16/TI08/TO08	A
37	P15/TI07/TO07	A
38	P14/TI06/TO06	A
39	P13/TI05/TO05	A
40	P12/TI04/TO04	A
41	P11/TI03/TO03	A
42	P10/TI02/TO02	A
43	P83/CMP1M	C
44	P82/CMP1P/TMOFF1/INTP7	C
45	P81/CMP0M	B
46	P80/CMP0P/TMOFF0/INTP3/OAI	B
47	AV_{REF}	N
48	AV_{SS}	K
49	P153/ANI11	D
50	P152/ANI10	D

Table A-1. Target Interface Combinations (15/15)

IE3 (64GK, GB) Pin Number	Pin Name in Target Device (78K0R/IE3)	Equivalent Circuit
51	P151/ANI9	D
52	P150/ANI8	D
53	P27/ANI7	D
54	P26/ANI6	D
55	P25/ANI5	D
56	P24/ANI4	D
57	P23/ANI3	D
58	P22/ANI2	D
59	P21/ANI1	D
60	P20/ANI0	D
61	P01/TO00	A
62	P00/TI00	A
63	P141/PCLBUZ1	A
64	P140/PCLBUZ0	A

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