User's Manual

QB-V850MINI, QB-V850MINIL

On-Chip Debug Emulator

User's Manual

Renesas Electronics
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- If power was turned on while connection to the USB interface cable or target system was in an unsatisfactory state.
- If the USB interface cable, the connection cable, or the like was bent or pulled excessively.
- 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.

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[MEMO]

INTRODUCTION

Readers

This manual is intended for users who wish to perform debugging using the QB-V850MINI and QB-V850MINIL (hereafter collectively referred to as MINICUBE).
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 MINICUBE.

Organization

This manual is divided into the following sections.

- Overview
- Names and functions of hardware
- On-chip debugging
- Debugging with in-circuit method
- Self-testing
- Cautions

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-V850MINI
→Read this manual according to the **CONTENTS**. The mark <R> shows major revised points. The revised points can be easily searched by copying an "<R>" in the PDF file and specifying it in the "Find what:" field.

To know the manipulations, command functions, and other software-related settings of the MINICUBE.
→See the user's manual of the debugger (supplied with the QB-V850MINI) 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 (system provided by the user). This includes the target program and the hardware provided by the user.
On-chip debug unit	This is a circuit in the device that is used for on-chip debugging.
OCD	An acronym that stands for on-chip debug. This is the debugging that is performed with the real device mounted on the target system.
DCU	An acronym that stands for debug control unit. This is a unit in the microcontroller that is used for on-chip debugging.
MINICUBE®	Generic name for Renesas Electronics' high-performance/compact in-circuit emulator. Used in reference to both QB-V850MINI and QB-V850MINIL.
V850MINI self-check board	This means the self-check board included with the QB-V850MINI.
V850MINIL self-check board	This means the self-check board included with the QB-V850MINIL.
Self-check board	General term used for both the V850MINI self-check board and the V850MINIL self-check board.

Related Documents

Please use the following documents in combination with this manual**.**

The related documents listed below may include preliminary versions. However, preliminary versions are not marked as such.

<R>

○ **Documents Related to Development Tools (User's Manuals)**

Document Name		Document Number
QB-V850MINI, QB-V850MINIL On-Chip Debug Emulator		This manual
CA850 Ver. 3.20 C Compiler Package	Operation	U18512E
	C Language	U18513E
	Assembly Language	U18514E
	Link Directives	U18515E
ID850QB Ver. 3.40 Integrated Debugger	Operation	U18604E
SM+ System Simulator	Operation	U18601E
	User Open Interface	U18212E
RX850 Ver. 3.20 Real-Time OS	Basics	U13430E
	Installation	U17419E
	Technical	U13431E
	Task Debugger	U17420E
RX850 Pro Ver. 3.20 Real-Time OS	Basics	U13773E
	Installation	U17421E
	Technical	U13772E
	Task Debugger	U17422E
AZ850 Ver. 3.30 System Performance Analyzer		U17423E
PM+ Ver. 6.00 Project Manager		U17178E

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 OVERVIEW

The MINICUBE is an emulator to be connected to a target device with an on-chip debug unit to efficiently debug hardware and software.

1.1 Features

○ USB connection

The MINICUBE can be connected to the host machine via the USB interface (1.1/2.0).
Since it operates on power supplied via USB, an external power supply is unnecessary.

○ On-chip debugging

Debugging is possible with the target microcontroller mounted on the target system.
Programs can be downloaded (programming) to the flash memory by using the flash self programming function of the microcontroller.

<R> ○ N-Wire interface, Nexus interface

Using a JTAG- and Nexus-compliant and Nexus interface, the QB-V850MINI can be used generally for V850E2M, V850E2, V850E1 and V850ES microcontrollers with the on-chip debug unit.
The MINICUBE is a successor of the IE-V850E1-CD-NW (PCMCIA type), so that the debugging environment for the IE-V850E1-CD-NW can be ported as is to the QB-V850MINI.
Note that the IE-V850E1-CD-NW cannot be used with V850E2M microcontrollers.

○ Inclusion of self-check board

Using the self-check board that is supplied with the MINICUBE can perform self-testing for faults.
The self-check board can also be used as the debug adapter for the V850ES/KJ1(+), V850ES/KG1(+), V850ES/KF1(+), and V850ES/KE1(+).

1.2 Before Using QB-V850MINI

Be sure to confirm the package contents listed in this chapter before using the MINICUBE.

To utilize this document effectively, familiarize yourself with the usage purposes of the MINICUBE described in this chapter.

1.2.1 Package contents

When purchasing MINICUBE, be sure to check that all the items listed in the packing specifications are included. These items may differ depending on the region, but the MINICUBE package usually contains the items shown below. If there are missing or damaged items, please contact a Renesas Electronics sales representative or a Renesas Electronics distributor. Note that the items in the QB-V850MINI package differ from those in the QB-V850MINIL package.

Figure 1-1. Package Contents of QB-V850MINI

QB-V850MINI

USB cable

OCD cable

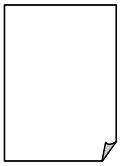
Self check board

KEL adapter

KEL connector

ID850QB Disk

Accessory Disk



Setup manual

Figure 1-2. Package Contents of QB-V850MINIL

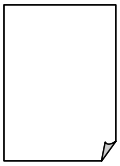
QB-V850MINI

USB cable

OCD cable

Self check board

16-pin conversion adaptor
(for V850E2M)



Setup manual

1.2.2 Checking purpose for using QB-V850MINI

There are mainly three purposes for using the MINICUBE.

The system must be configured appropriately according to each usage purpose of the MINICUBE, so check the following and refer to the relevant chapter.

- To debug the target device mounted on the target system
  See **CHAPTER 3 ON-CHIP DEBUGGING**.

- To debug V850ES/Kx1+ with in-circuit method
  See **CHAPTER 4 DEBUGGING WITH IN-CIRCUIT METHOD**.

- To perform self-testing for faults in MINICUBE
  See **CHAPTER 5 SELF-TESTING**.

1.3 Supported Devices

See the following MINICUBE Web site or document for the devices supported by the MINICUBE.

MINICUBE Web site:

http://www2.renesas.com/micro/en/development/asia/v850/minicube.html

Document:

Document name: Notes on Using QB-V850MINI and QB-V850MINIL.

Remark The above-mentioned document is posted on the MINICUBE Web site.

1.4 Specifications

This section describes MINICUBE hardware specifications and specifications for the debug function when using the ID850QB integrated debugger.

Table 1-1. Hardware Specifications

Classification	Item		Specifications
<R>	MINICUBE main unit	Operating power supply	5 V (USB-bus powered type) 500 mA (Max.) Note
		Operating clock	Clock mounted in MINICUBE
		Operating environment	Temperature: 0 to +40°C Humidity: 10 to 80% RH (no condensation)
		Storage environment	Temperature: −15 to +40°C Humidity: 10 to 80% RH (no condensation)
		External dimensions	88.5 × 56.5 × 26.1 mm (see **APPENDIX B EXTERNAL DIMENSIONS** for details)
		Weight	Approximately 90 g
	Host machine interface	Target host machine	PC98-NX Series, IBM PC/AT™ compatibles
<R>		Target OS	Windows 2000, Windows XP, Windows Vista
		USB	1.1, 2.0
		USB cable length	2,000 mm max.
		Current consumption	Approximately 350 mm
<R>	Target interface	Target device	Microcontroller with V850E2M, V850E2, V850E1, V850ES Series on-chip debug unit and microcontroller with Nx85ET core
		OCD cable length	200 mm
		Clock frequency	Equivalent to specifications supported by the target device
		Voltage range	2.0 to 5.5 V
<R>		Number of signals occupied for debugging	V850E2, V850E1, V850ES: 5 V850E2M: 6
		V850E2/V850E1/V850ES signals / V850E2M signals	
		DCK / TCK	Clock input
		DMS / TMS	Mode select input signal
		DDI / TDI	Data input signal
		DDO / TDO	Data output signal
		$\overline{\text{DRST}}$ / $\overline{\text{DRST}}$	On-chip debug mode setting signal
		- / RDY	Synchronous signals
		Number of signals used for flash memory writing	1
		FLMD0	Signal for writing to the flash memory Used when writing to the flash memory from the ID850QB
<R>		Number of signals for target power supply detection	1
		V_{DD}	Power supply to the target system Used for monitoring power supplied to the target system
<R>		Number of GND signal lines	– (depends on the target connector for OCD)
		GND	GND signal
		Number of signals for reset interface	1
		$\overline{\text{RESET}}$	Used for system reset

Note Not all hardware combinations of host machine, USB device, and USB hub are guaranteed to work.

CHAPTER 2 NAMES AND FUNCTIONS OF HARDWARE

This chapter describes the part names and functions of the MINICUBE and the self-check board.

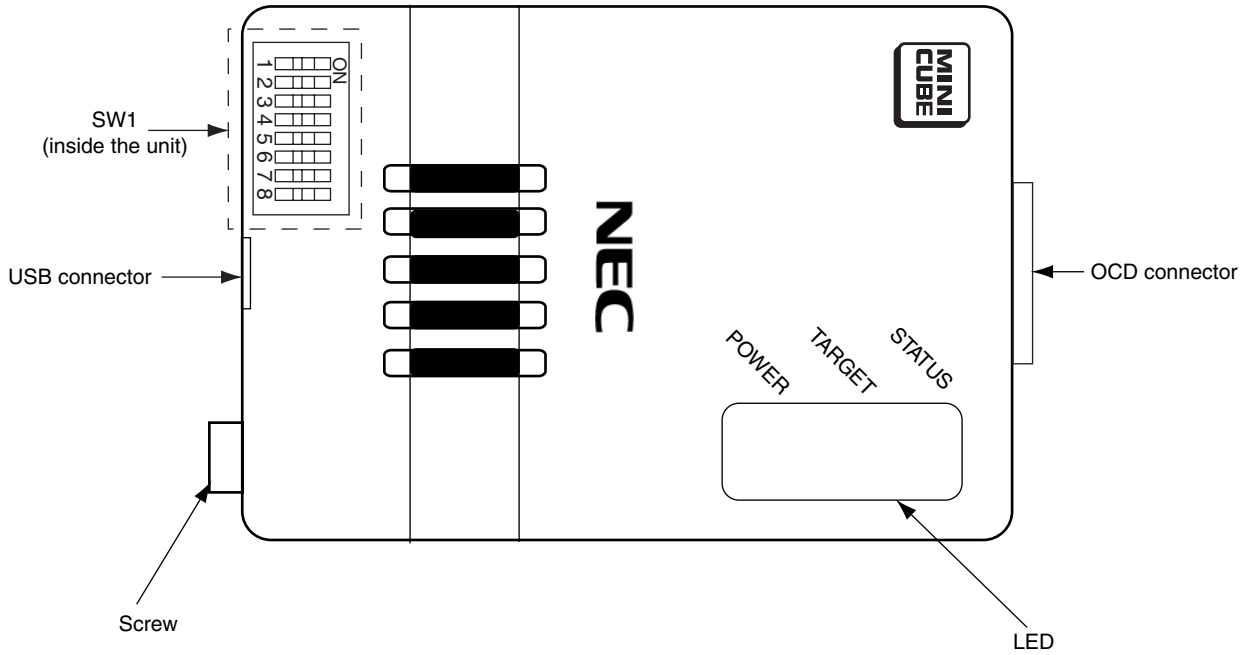
The part names described in this chapter are used throughout this document. This chapter provides an overview of the various functions. Reading it through, the reader will gain a basic grasp of the MINICUBE and the self-check board that will facilitate reading of subsequent chapters. Also check the hardware while reading this chapter: This way you may detect damage, if any, and this prevents adverse effects on the system.

2.1 Names of Parts in Main Unit

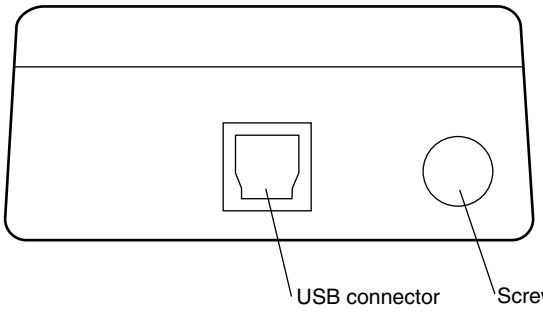
The part names and functions of the MINICUBE are described below.

Figure 2-1. Names of Parts in MINICUBE

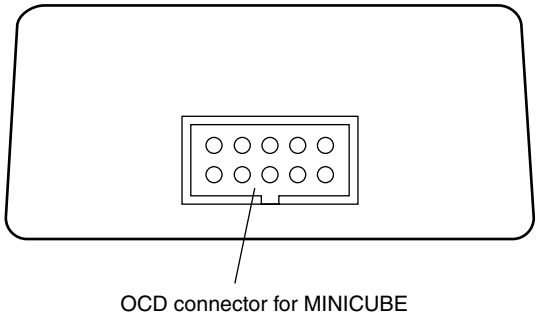
(a) Main unit (top view)



(b) Left side



(c) Right side



(1) SW1

Switches used for performing the initial settings for the MINICUBE. They are set to OFF by default.
Refer to **3.2.2 Switch settings** for details on the settings.

(2) USB connector

A connector used for connecting the USB interface cable.

(3) OCD connector

A connector used for connecting the OCD cable.

(4) Screw

A screw used for fixing the MINICUBE main unit.

(5) LED

The meanings of each LED are listed below.

Display Name	Lit/Extinguished	Meaning
POWER	Lit	The power supply to the MINICUBE is on.
	Extinguished	The power supply to the MINICUBE is off.
TARGET	Lit	The power supply to the target system is on.
	Extinguished	The power supply to the target system is off, or the target system is not connected to QB-V850MINI.
STATUS	Lit	The QB-V850MINI is running.
	Extinguished	The QB-V850MINI is in the break state, or the debugger is not active.
<R> OVER VOLTAGE (QB-V850MINIL only)	Lit	Overvoltage of 6.5 V or higher is being applied from the target system.
	Extinguished	Voltage is being applied normally from the target system.

2.2 Self-Check Board

<R> The part names and functions of the self-check board are described below.

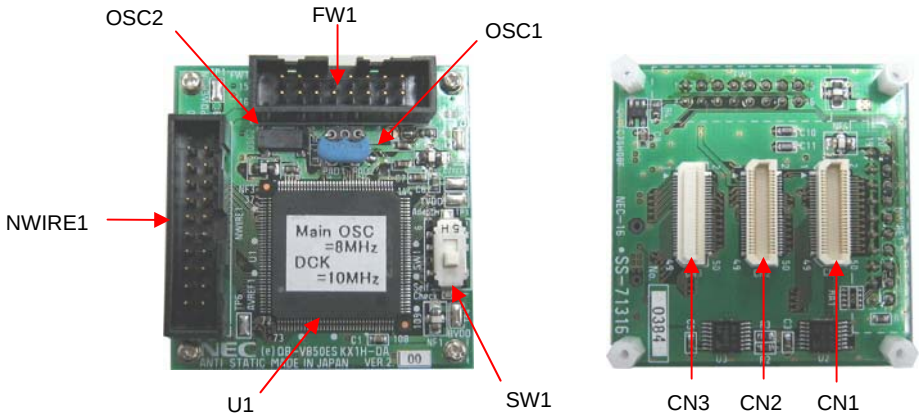
The self-check board included with the QB-V850MINI differs from the self-check board included with the QB-V850MINIL.

For details, see the following sections.

- Self-check board included with QB-V850MINI: See **2.2.1 QB-V850MINI self-check board**.
- Self-check board included with QB-V850MINI: See **2.2.2 QB-V850MINI self-check board**.

2.2.1 V850MINI self-check board

Figure 2-2. Part Names of V850MINI Self-Check Board



(1) NWIRE1

A connector used for connecting the MINICUBE (HIF3FC-20PA-2.54DSA: made by Hirose Electric Co., Ltd).

(2) FW1

<R> A connector used for connecting the flash memory programmer.

(3) SW1

A switch used to set connection or disconnection of the target system.

For in-circuit debugging: Set to “Adapter”.

For self-testing: Set to “Self Check”. (Default setting)

Refer to **4.3.4 Switch settings** for details on the settings.

(4) OSC1

A resonator board for the ceramic resonator that is used for the main clock. An 8 MHz resonator is mounted in a socket at shipment.

Refer to **4.3.3 Clock settings** when changing the main clock frequency.

(5) OSC2

A resonator for the subclock. A 32.768 kHz resonator is mounted at shipment.

The frequency cannot be changed.

(6) U1

V850ES/KJ1+ (The μPD70F3318YGJ) is mounted.

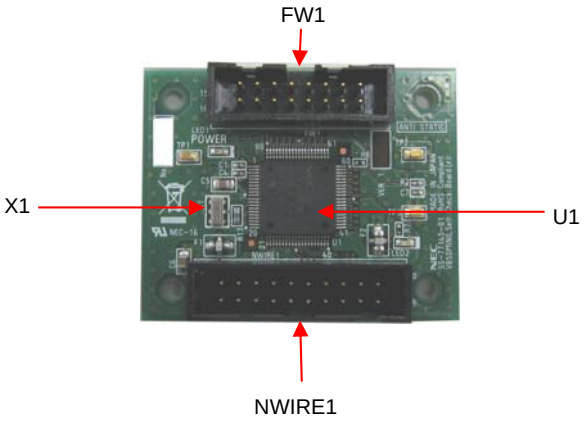
(7) CN1, CN2, CN3

Connectors used for connecting the MINICUBE to the target system.

An exchange adapter and a target connector are required separately.

<R> **2.2.2 V850MINIL self-check board**

Figure 2-2. Part Names of V850MINIL Self-Check Board



(1) NWIRE1

A connector used for connecting the MINICUBE.

(2) FW1

A connector used for connecting the flash memory programmer.

(3) X1

The main clock. A 5 kHz resonator is mounted at shipment.

(6) U1

V850ES/JF3-L (The μPD70F3736GK) is mounted.

CHAPTER 3 ON-CHIP DEBUGGING

This chapter describes how to use the QB-V850MINI when performing on-chip debugging (OCD).

On-chip debugging is a method to debug a microcontroller mounted on the target system. Since debugging is performed with the real device operating on the board, this method is suitable for field debugging.

<R> On the other hand, on-chip debugging takes up five or six function pins for communication with the host machine. Moreover, communication circuits must be mounted on the target system.

Refer to **3.4 Designing Target System Circuits** for information on designing target system circuits. Also refer to the user's manual for the target device.

Refer to **3.5 Target Connectors for OCD** for the target connectors for OCD that can be mounted on the target board.

3.1 System Configuration

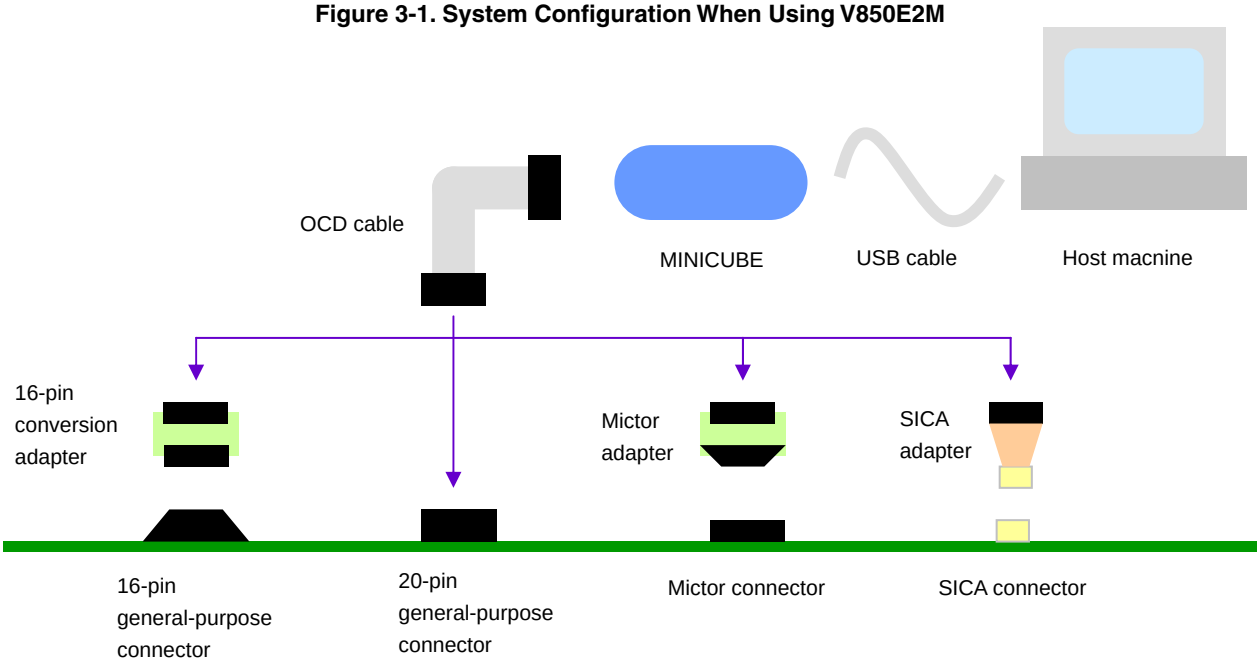
This section describes the system configuration for performing on-chip debugging.

<R> The system configuration differs depending on whether debugging is being performed in a V850E2M environment or in a V850E2, V850E1, or V850ES environment. For the former, see **3.1.1 System configuration in V850EM environment**, and for the latter, see **3.1.2 System configuration in V850E2, V850E1, or V850ES environment**.

<R> 3.1.1 System configuration in V850EM environment

The system configuration when using the V850E2M is shown below. The components used for connection can be selected to suit the features of the system being used.

Figure 3-1. System Configuration When Using V850E2M



Common parts

- Host machine: For software tool operation
- USB cable: Connects the host machine to the MINICUBE main unit.
- MINICUBE main unit: On-chip debug emulator main unit.
- OCD cable: Connects MINICUBE to the target system.

Connection parts

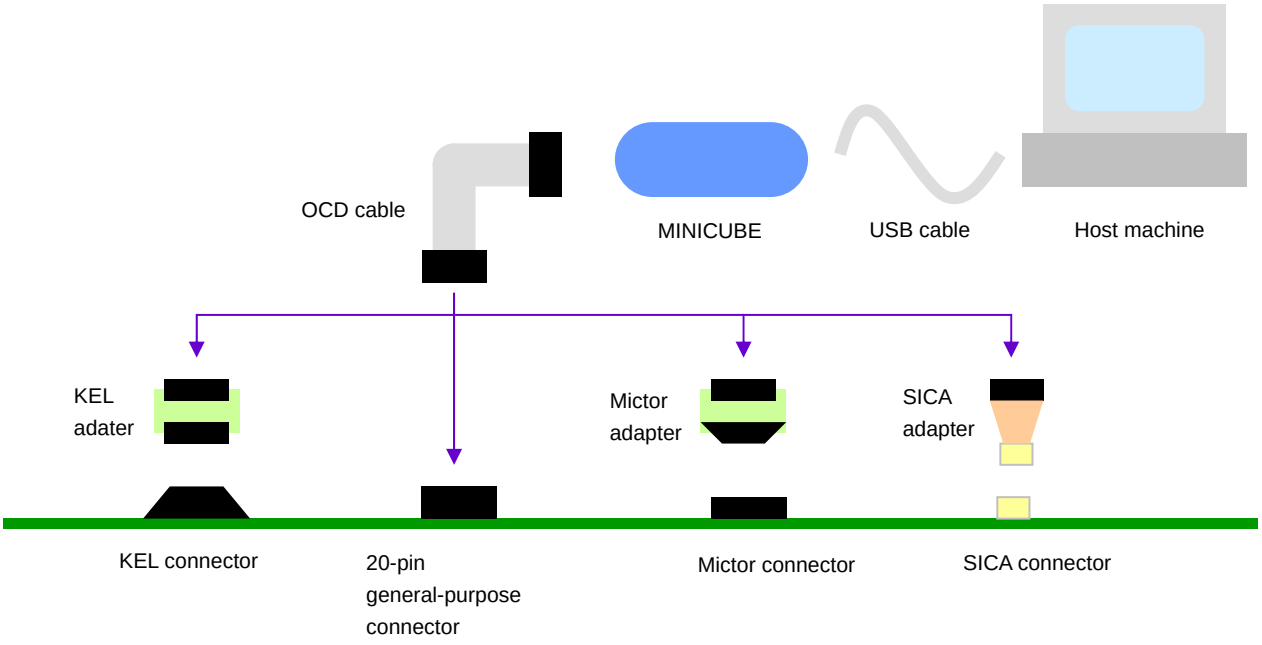
- 16-pin conversion adapter: Used to connect the OCD cable to a 16-pin general-purpose connector.
  Included with the QB-V850MINIL but not with the QB-V850MINI.
- 16-pin general-purpose connector: A 16-pin male connector with a pitch of 2.54 mm. Sold separately.
- 20-pin general-purpose connector: A 20-pin male connector with a pitch of 2.54 mm. Sold separately.
- Mictor adapter: Used to connect the OCD cable to a Mictor connector. Sold separately.
- Mictor connector: A connector that supports a high-speed interface. Sold separately.
  A debugging tool with tracing capability sold by a Renesas Electronics partner company can also be connected to this connector.
- SICA adapter: Used to connect the OCD cable to an SICA connector. Sold separately.
- SICA connector: A small, space-saving connector. Sold separately.

<R>

3.1.2 System configuration in V850E2, V850E1, or V850ES environment

The system configuration when using the V850E2, V850E1, or V850ES is shown below. The components used for connection can be selected to suit the features of the system being used.

Figure 3-2. System Configuration When Using V850E2, V850E1, or V850ES



Common parts

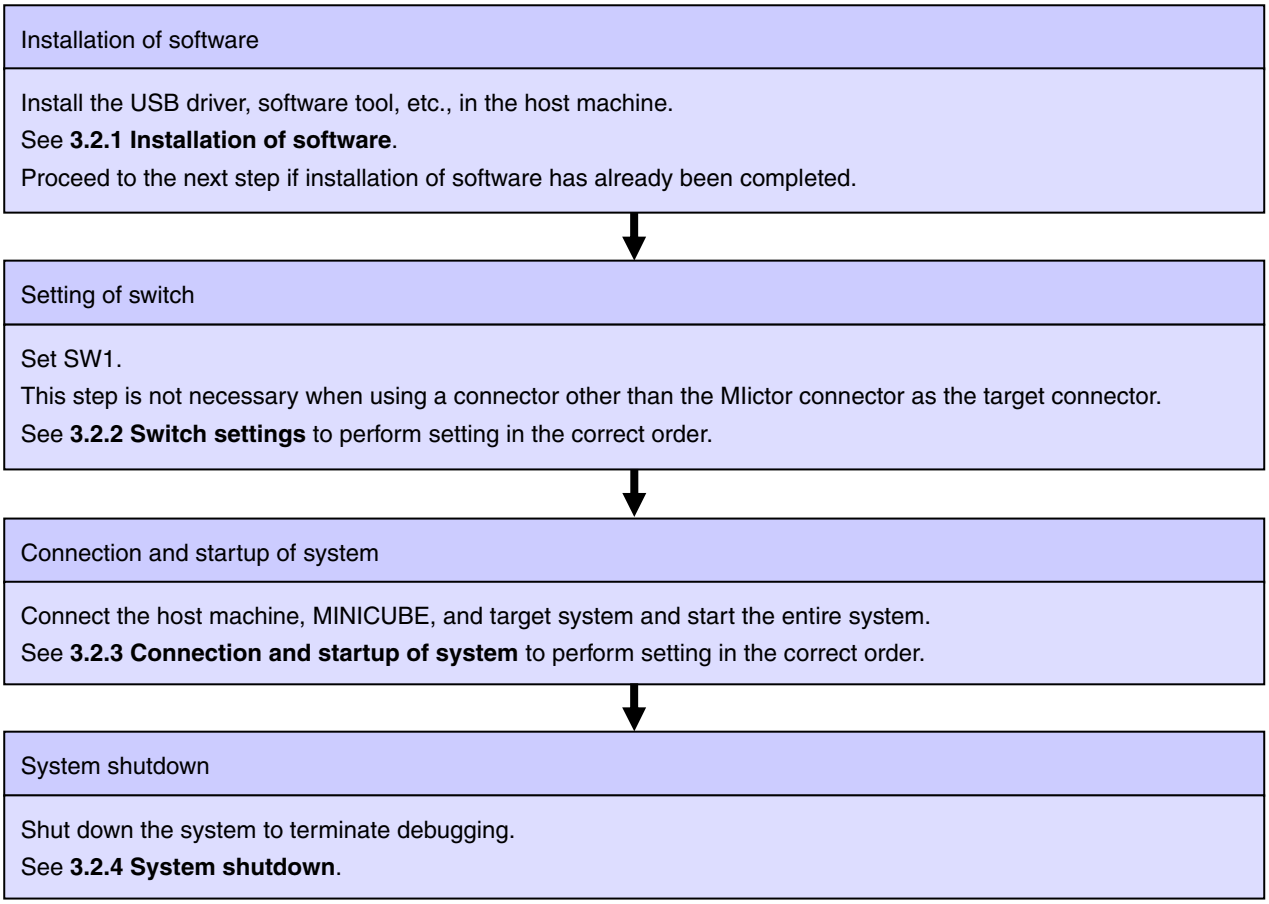
- Host machine: For software tool operation
- USB cable: Connects the host machine to the MINICUBE main unit.
- MINICUBE main unit: On-chip debug emulator main unit.
- OCD cable: Connects MINICUBE to the target system.

Connection parts

- KEL adapter: Used to connect the OCD cable to a KEL connector.
  Included with the QB-V850MINI but not with the QB-V850MINIL.
- KEL connector: Standard connector for V850E2, V850E1, or V850ES. Sold separately.
  Included with the QB-V850MINI but not with the QB-V850MINIL.
- 20-pin general-purpose connector: A 20-pin male connector with a pitch of 2.54 mm. Sold separately.
- Mictor adapter: Used to connect the OCD cable to a Mictor connector. Sold separately.
- Mictor connector: A connector that supports a high-speed interface. Sold separately.
  A debugging tool with tracing capability sold by a Renesas Electronics partner company can also be connected to this connector.
- SICA adapter: Used to connect the OCD cable to an SICA connector. Sold separately.
- SICA connector: A small, space-saving connector. Sold separately.

3.2 Setup Procedure

This section describes the MINICUBE setup procedure to operate the MINICUBE normally. Perform setup using the following procedure.



3.2.1 Installation of software

<R> Install the following software tool in the host machine before setting up the hardware. Refer to the “Setup manual” supplied with the MINICUBE for the procedures.

- USB driver
- Debugger
- Device file

3.2.2 Switch settings

Set SW1. SW1 is mounted inside the MINICUBE main unit. Loosen the screw, open the cover, and then set SW1.

Change the SW1 setting only when all the following conditions are satisfied; otherwise, use the MINICUBE with the default setting (all “OFF”).

- A Mictor connector is used as the target connector.
- A Renesas Electronics partner company’s emulator that supports the trace interface is used together with the MINICUBE.
- Pin 20 of the Mictor connector is used as TRCCE (trace compression enable input).

When all the above conditions are satisfied, set SW1 as follows.

Table 3-1. SW1 Setting (When Conditions Are Satisfied)

SW1 Number	Setting	Remark
1 to 7	OFF	Default setting. Any other settings are prohibited.
8	ON	Setting to turn off the power supply to the self-check board

3.2.3 Connection and startup of system

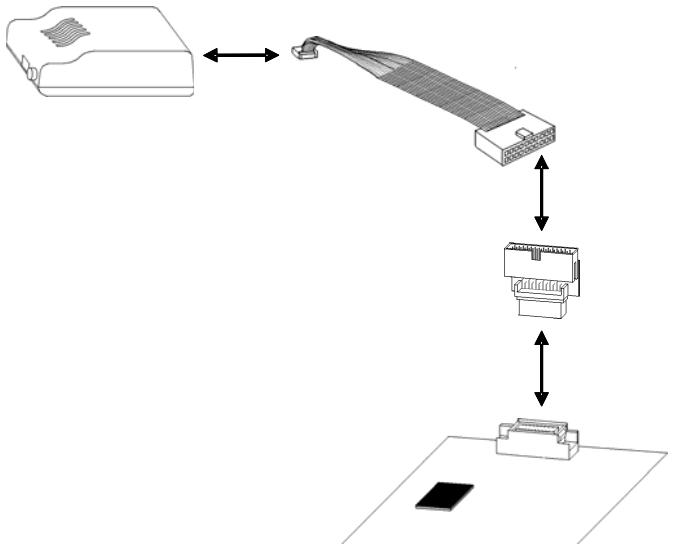
Connect and start the system in the following order.

(1) Connecting MINICUBE to target system

Connect the MINICUBE to the target system using the adapter and target connector. Refer to the system configuration diagrams shown in Figure 3-1 and Figure 3-2 for the adapter and target connector to be used.

Caution Perform connection while the power to the target system is off.

Figure 3-3. Connecting MINICUBE to Target System

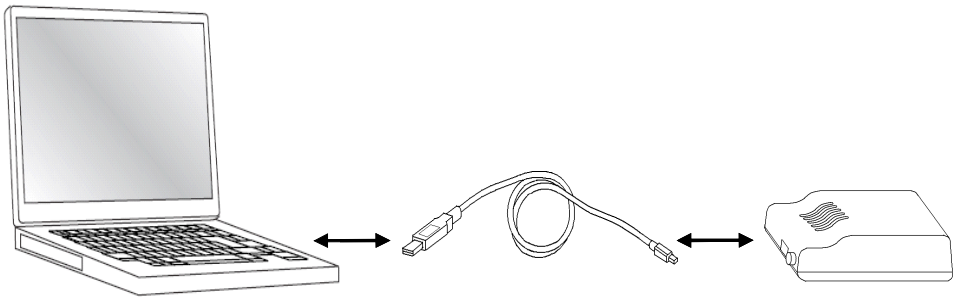


(2) Connecting MINICUBE to host machine

Connect the MINICUBE to the host machine using a USB interface cable. After performing this connection, confirm that the POWER LED on the MINICUBE is lit.

Caution Perform connection while the power to the target system is off.

Figure 3-4. Connecting MINICUBE to Host Machine



(3) Power application to target system

Apply the power to the target system. After power application, confirm that the TARGET LED on the MINICUBE is lit.

<R> When using the QB-V850MINIL, if the yellow LED is on, it means that an overvoltage may be being applied. Check the target system's power supply and make sure that an appropriate voltage is being applied.

<R> **(4) Running the software**

Start up and run the software as described in the supplied user's manual.

3.2.4 System shutdown

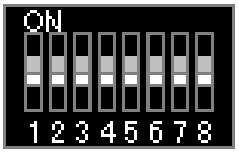
Terminate debugging and shutdown the system in the following order.

<R> (1) Terminate the the software tool.

(2) Turn off the power to the target system.

(3) Disconnect the USB cable from the host machine.

3.3 Default Setting

Item	Setting	Description
SW1		All of switches 1 to 8 are set to OFF by default. Refer to **3.2.2 Switch settings** for how to set the switches.

<R> 3.4 Designing Target System Circuits when Using V850E2M

To debug the target system with the MINICUBE connected, a circuit to connect the MINICUBE is required on the target system.

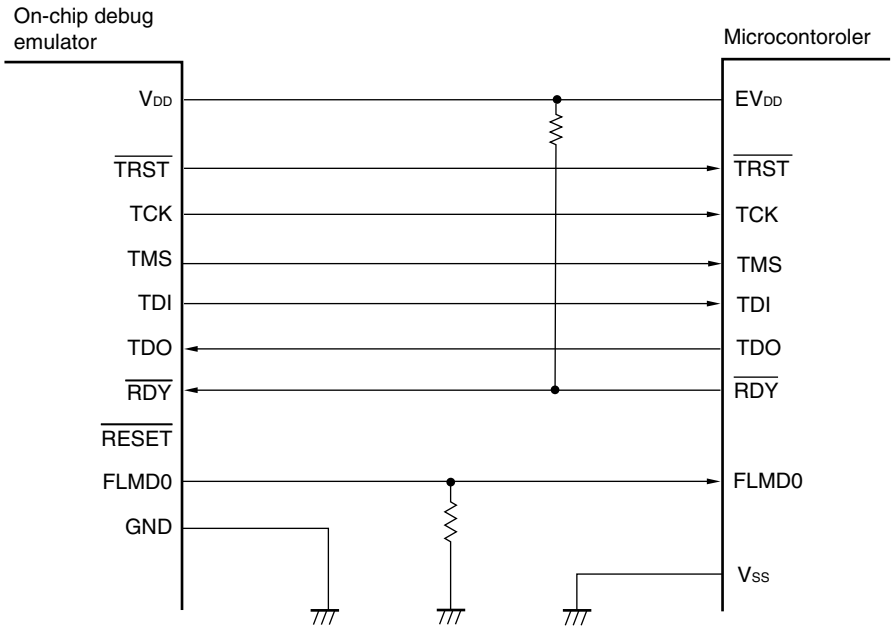
This section presents information required for circuit design. Read this information together with the information described in the user's manual of the target device.

Note that circuit design information when the target device is the V850E2, V850E1, or V850ES is described in **3.5 Designing Target System Circuits When Using V850E2, V850E1, or V850ES**.

3.4.1 Example of circuit design (for V850E2M only)

Figure 3-5 illustrates an example of the design of a target system circuit that is used to connect the MINICUBE. To determine the resistance of the resistors in the circuit, see the user's manual of the target device.

Figure 3-5. Circuit Connection Example



<R>

Signal Name	Outline of Signal
TCK	Clock for the debug control unit (DCU) in the target device
TMS	DCU mode selection signal
TDI	Data signal transmitted to DCU
TDO	Data signal transmitted from DCU
$\overline{\text{TRST}}$	DCU reset signal
$\overline{\text{RDY}}$	Synchronous signals
FLMD0	Flash programming mode setting signal
$\overline{\text{RESET}}$	System reset input signal
V_{DD}	Power supply (The QB-V850MINI uses this signal for detection of target system power supply)
GND	GND

<R> **3.4.2 Cautions on target system design (for V850E2M only)**

Note the following points when designing the target system circuits and the board.

(1) Keep the pattern length as short as possible.

(2) If V_{DD} is between 2.0 and 5.5 V, it is judged that target system power is being supplied, and the signals switch to being used as debug signals. If V_{DD} is not between 2.0 and 5.5 V, it is judged that the system has not been configured correctly, regardless of whether target system power is being supplied or not. In this case, the $\overline{\text{DRST}}$, DCK, DMS, DDI, FLMD0, and $\overline{\text{RESET}}$ pins become high impedance, regardless of the operating status of the debugger. To avoid this, be sure to input the voltage from the power supply pin on the target device directly to V_{DD}.

(3) The circuit for connecting FLMD0 varies when using flash self programming or using microcontrollers that do not have an on-chip flash memory. See **3.4.3 Connecting the FLMD0 signal (for V850E2M only)** for details.

(4) To reset the target device while the target system power supply is on, connect the $\overline{\text{RESET}}$ signal.
See **3. 4. 4 Connecting $\overline{\text{RESET}}$ (for V850E2M only)** for details.

3.4.3 Connecting the FLMD0 signal (for V850E2M only)

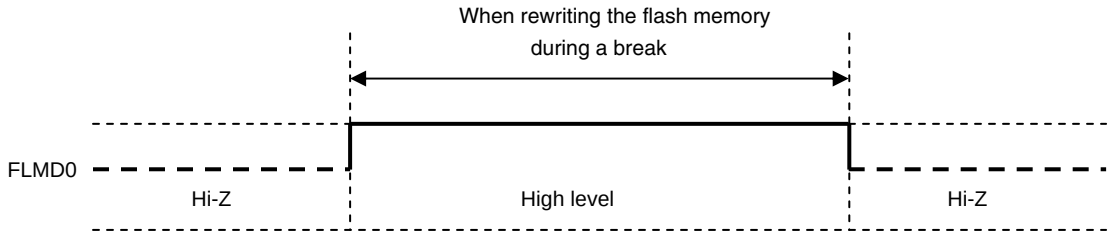
FLMD0 is the signal used to switch the system to flash programming mode. Control the status of FLMD0 on MINICUBE as follows in accordance with the status of the debugger.

Table 3-2. Status of FLMD0 Signal on MINICUBE

Debugger Status		Status of FLMD0
During a break	When writing to the flash memory[Note]	High-level (CMOS output)
	When not writing to the flash memory	High impedance
While the user-created program is executing		
Terminated		

Note When downloading a program or when writing in the Assemble or Memory window.

Figure 3-6. Timing of FLMD0 on MINICUBE



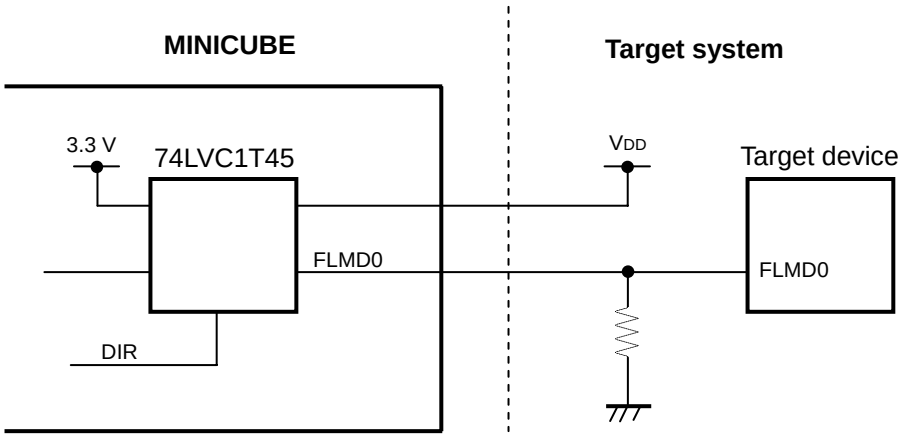
Handle the FLMD0 signal as shown in either (a) or (b) below. Whether the FLMD0 signal needs to be connected or not depends on the specifications of the target device.

(a) When not performing flash self programming

Connect the FLMD0 signal output from MINICUBE to the FLMD0 pin on the target device.

As long as there are no problems arising from the specifications of the target device, pull the signal down to low level. Determine the resistance value of the pull-down resistor by referring to the user's manual of the target device.

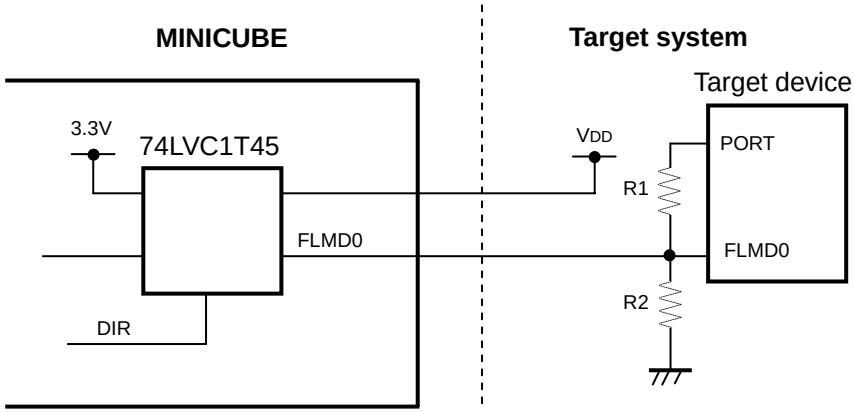
Figure 3-7. Example Connection of FLMD0 Pin When Used by MINICUBE



(b) When performing flash self programming

To use the FLMD0 pin as a port pin when performing flash self programming by using a user-created program, connect the FLMD0 signal as shown in Figure 3-8.

Figure 3-8. Example Connection of FLMD0 Pin When Performing Flash Self Programming



Remark The resistance of R2 must be at least 10 times the resistance of R1.

When leaving the FLMD0 signal output from MINICUBE open and connecting a port signal to FLMD0 on the target device, set the output of the port to high level in the SFR or other debugger window when writing to the flash memory during a break. When not writing to the flash memory, set the port output to low level or set the port to input mode.

3.4.4 Connecting the $\overline{\text{RESET}}$ signal (for V850E2M only)

To reset the target device while the target system power supply is on, connect the reset signal output from MINICUBE to the $\overline{\text{RESET}}$ pin on the target device. The $\overline{\text{RESET}}$ signal timing and an example connection circuit are shown below.

Figure 3-9. Timing of $\overline{\text{RESET}}$ on MINICUBE

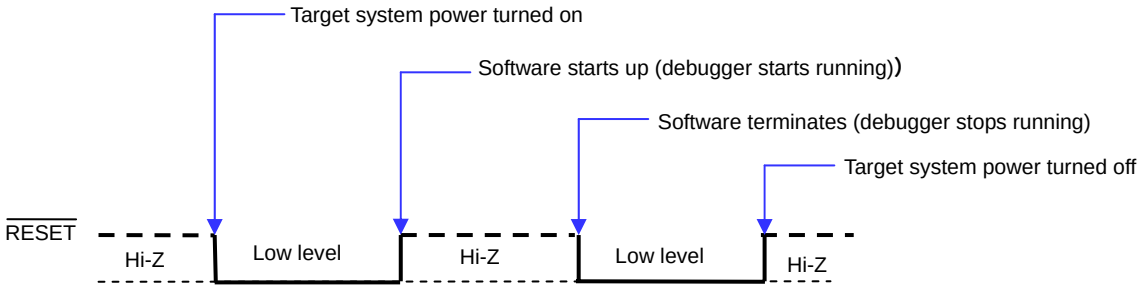
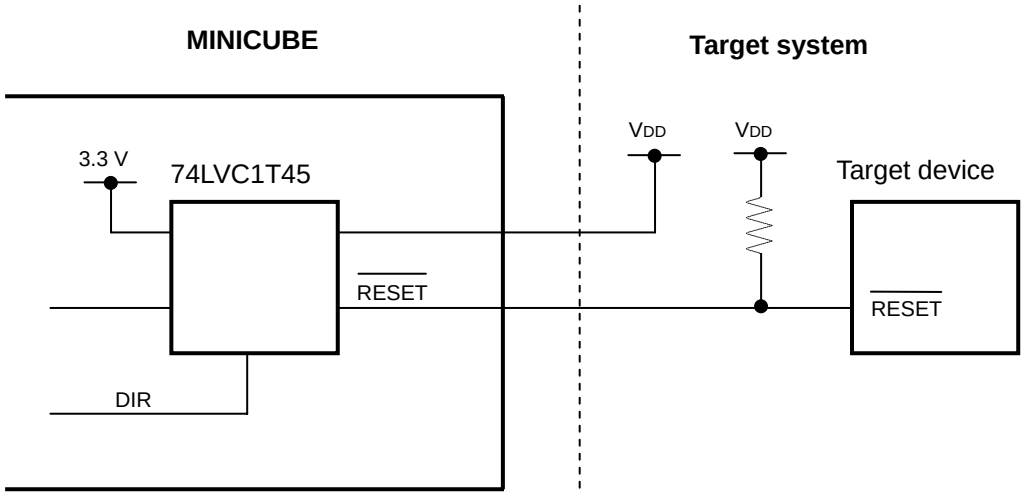


Figure 3-10. $\overline{\text{RESET}}$ Pin Connection Example



3.5 Designing Target System Circuits When Using V850E2, V850E1, or V850ES

To debug the target system with the MINICUBE connected, a circuit to connect the MINICUBE is required on the target system.

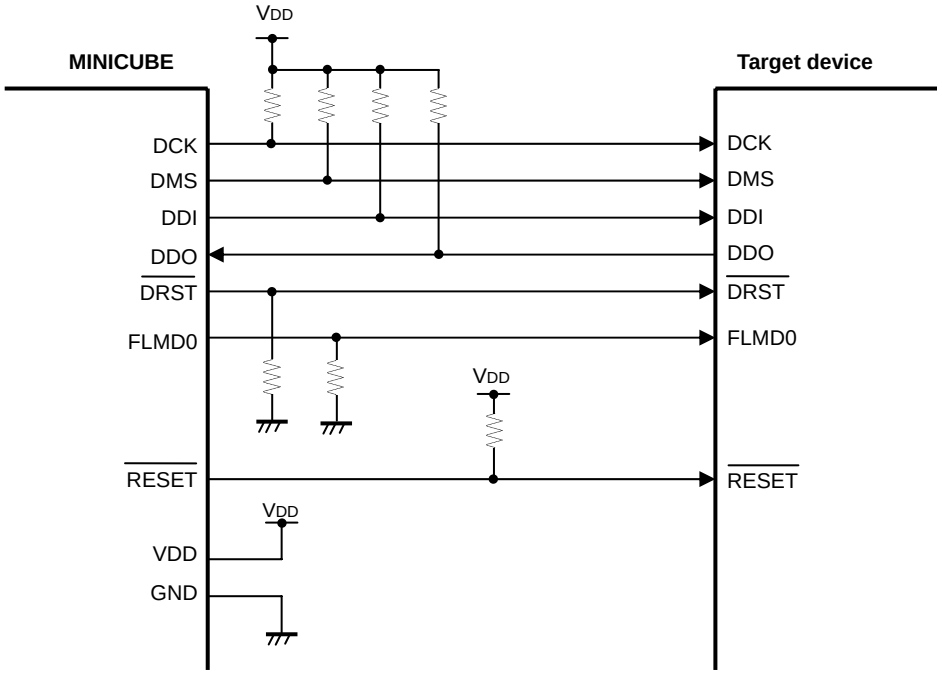
This section presents information required for circuit design. Read this information together with the information described in the user's manual of the target device.

Note that circuit design information when the target device is the V850E2, V850E1, or V850ES is described in **3.4 Designing Target System Circuits When Using V850E2M.**

3.5.1 Example of circuit design (for V850E2, V850E1, or V850ES)

Figure 3-11 illustrates an example of the design of a target system circuit that is used to connect the MINICUBE.

Figure 3-11. Circuit Connection Example



Signal Name	Outline of Signal
DCK	Clock for the debug control unit (DCU) in the target device
DMS	DCU mode selection signal
DDI	Data signal transmitted to DCU
DDO	Data signal transmitted from DCU
$\overline{\text{DRST}}$	DCU reset signal
FLMD0	Flash programming mode setting signal
$\overline{\text{RESET}}$	System reset input signal
V_{DD}	Power supply (The QB-V850MINI uses this signal for detection of target system power supply)
GND	GND

3.5.2 Cautions on target system design (for V850E2, V850E1, or V850ES)

Note the following points when designing the target system circuits and the board.

(1) Keep the pattern length as short as possible.

(2) If V_{DD} is between 2.0 and 5.5 V, it is judged that target system power is being supplied, and the signals switch to being used as debug signals. If V_{DD} is not between 2.0 and 5.5 V, it is judged that the system has not been configured correctly, regardless of whether target system power is being supplied or not. In this case, the $\overline{\text{DRST}}$, DCK, DMS, DDI, FLMD0, and $\overline{\text{RESET}}$ pins become high impedance, regardless of the operating status of the debugger. To avoid this, be sure to input the voltage from the power supply pin on the target device directly to V_{DD}.

(3) The circuit for connecting FLMD0 varies when using flash self programming or using microcontrollers that do not have an on-chip flash memory. See 3.5.3 (7) FLMD0 for details.

(4) To reset the target device while the target system power supply is on, connect the $\overline{\text{RESET}}$ signal. See **3. 5. 4 Connecting $\overline{\text{RESET}}$** for details.

3.5.3 Connecting the FLMD0 signal (for V850E2, V850E1, or V850ES)

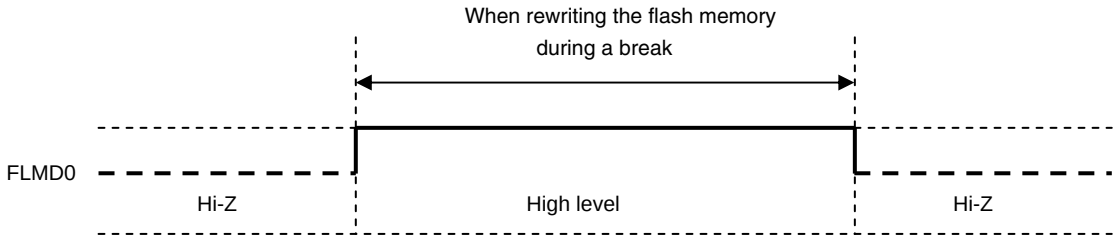
FLMD0 is the signal used to switch the system to flash programming mode. Control the status of FLMD0 on MINICUBE as follows in accordance with the status of the debugger.

Table 3-3. Status of FLMD0 Signal on MINICUBE

Debugger Status		Status of FLMD0
During a break	When writing to the flash memory[Note]	High-level (CMOS output)
	When not writing to the flash memory	High impedance
While the user-created program is executing		
Terminated		

Note When downloading a program or when writing in the Assemble or Memory window.

Figure 3-12. Timing of FLMD0 on MINICUBE



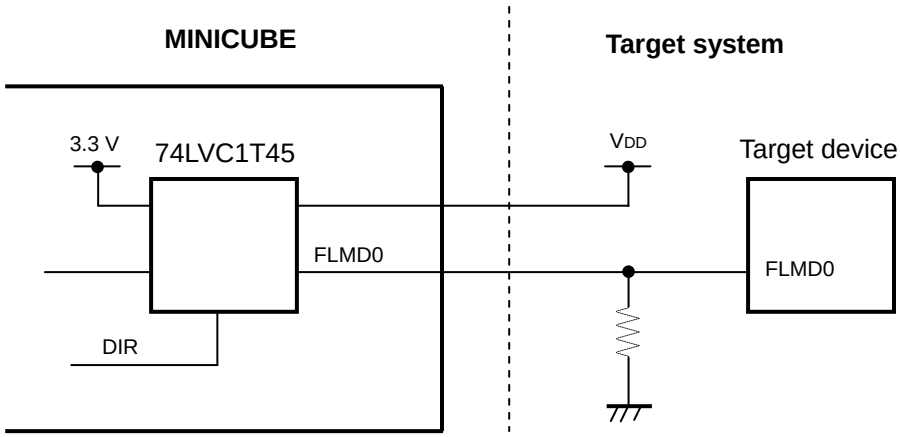
Handle the FLMD0 signal as shown in either (a) or (b) or (C) below. Whether the FLMD0 signal needs to be connected or not depends on the specifications of the target device.

(a) When not performing flash self programming

Connect the FLMD0 signal output from MINICUBE to the FLMD0 pin on the target device.

As long as there are no problems arising from the specifications of the target device, pull the signal down to low level. Determine the resistance value of the pull-down resistor by referring to the user's manual of the target device.

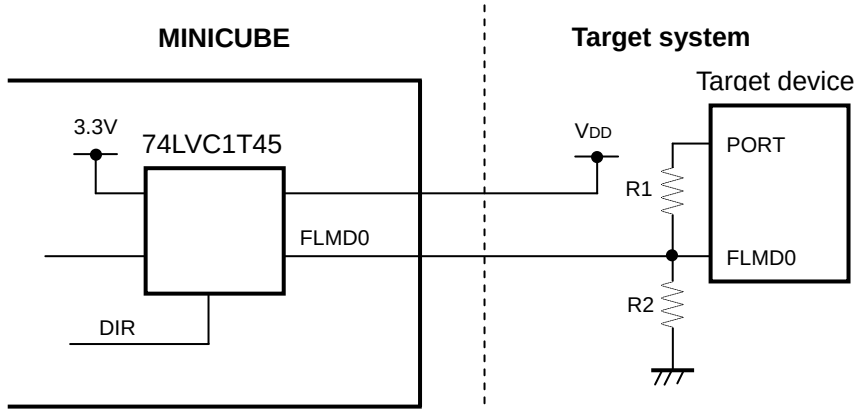
Figure 3-13. Example Connection of FLMD0 Pin When Used by MINICUBE



(b) When performing flash self programming

To use the FLMD0 pin as a port pin when performing flash self programming by using a user-created program, connect the FLMD0 signal as shown in Figure 3-8.

Figure 3-14. Example Connection of FLMD0 Pin When Performing Flash Self Programming



Remark The resistance of R2 must be at least 10 times the resistance of R1.

When leaving the FLMD0 signal output from MINICUBE open and connecting a port signal to FLMD0 on the target device, set the output of the port to high level in the SFR or other debugger window when writing to the flash memory during a break. When not writing to the flash memory, set the port output to low level or set the port to input mode.

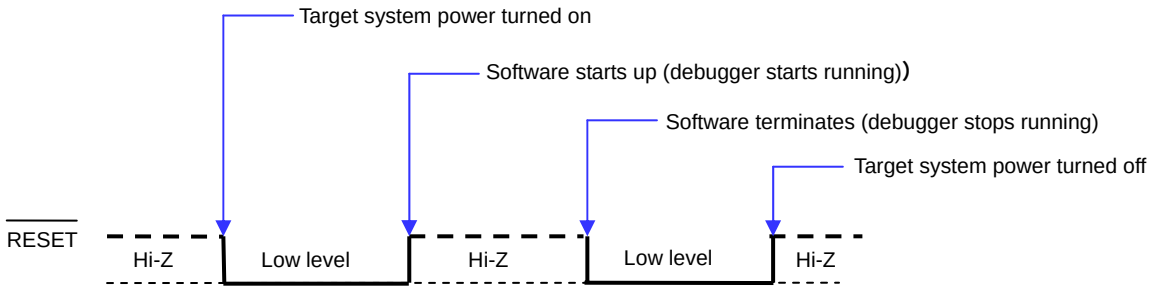
(c) When performing flash self programming

The FLMD0 pin is not required to be connected.

3.5.4 Connecting the $\overline{\text{RESET}}$ signal (for V850E2, V850E1, or V850ES)

This is the system reset input signal. The MINICUBE controls the $\overline{\text{RESET}}$ signal as follows.

Figure 3-15. Timing of $\overline{\text{RESET}}$ on MINICUBE



Connect the $\overline{\text{RESET}}$ signal as shown in Figure 3-13 if any of the conditions listed below is satisfied. At this time, make sure that the $\overline{\text{RESET}}$ signal does not conflict with the $\overline{\text{RESET}}$ signal generated on the target system. When none of the following conditions are satisfied, leave open the pin for the $\overline{\text{RESET}}$ signal that is output from the MINICUBE.

- The target device should be kept in the reset state before debugger startup or after debugger termination.
- The OCD signal pins (DCK, DDI, DDO, DMS, and $\overline{\text{DRST}}$) are alternate-function pins in the specifications of the target device, the OCD signal becomes inactive due to a reset by other than the $\overline{\text{RESET}}$ pin, and the OCD signals are not set to active in the startup routine.

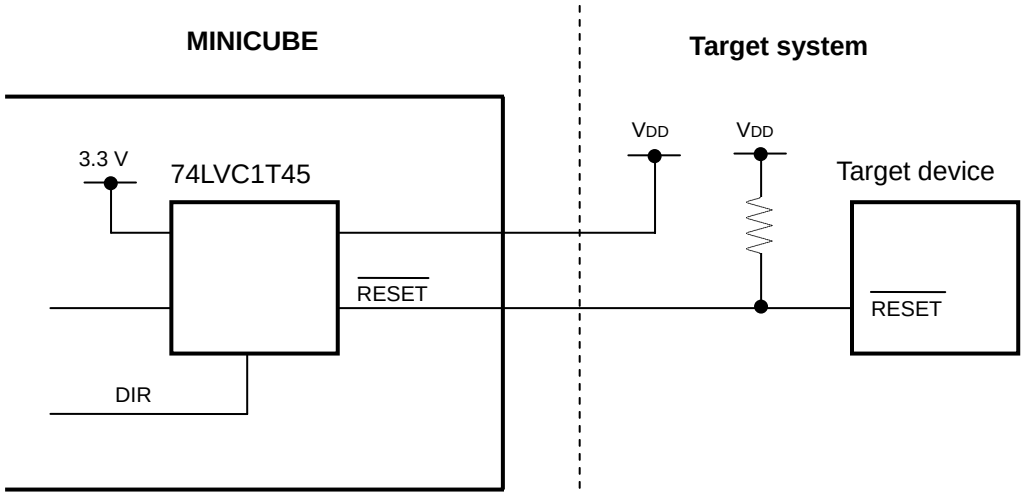
  For example, when using a device in which the pins that alternately function as the OCD signal pins are controlled by the OCDM0 register as shown below, the OCDM0 register is cleared to 0 upon reset by POC, so the OCD signals are not specified and as a result, on-chip debugging cannot be performed normally.

	7	6	5	4	3	2	1	0
OCDM	0	0	0	0	0	0	0	OCDM0

OCDM0	Specification of alternate-function pin for on-chip debug function
0	Use as port/peripheral function pin
1	Use as on-chip debug function pin

Remark Initial value At $\overline{\text{RESET}}$ pin input: OCDM0 = 1
After reset by POC: OCDM0 = 0
After internal reset (other than POC): The OCDM register holds the value before reset

Figure 3-16. $\overline{\text{RESET}}$ Pin Connection Example



3.6 Target Connectors for OCD

A target connector for OCD must be mounted on the target system in order to connect the MINICUBE to the target system. The target connector for OCD can be selected from the target connectors listed in the table below. The features of each target connector are described in the following sections.

<R> **Table 3-4. List of Target Connectors for OCD (Part Number and Manufacturer)**

Target Connector Name		Part Number	Manufacturer
KEL connector (cannot be used when using V850E2M)		8830E-026-170S (included with QB-V850MINI) 8830E-026-170L	KEL Corporation
	Adapter	QB-V850MINIL-AK1 (included with QB-V850MINI)	Renesas Electronics Corporation
Mictor connector		2-767004-2	Tyco Electronics AMP K.K.
	Adapter	QB-V850MINIL-AM1	Renesas Electronics Corporation
SICA connector		SICA2P20S05 (5 set)	Tokyo Eletech Corporation
	Adapter	SICA2012P (included with SICA2P20S)	Tokyo Eletech Corporation
2.54 mm pitch 16-pin general-purpose connector (cannot be used when using V850E2, V850E1, or V850ES)		HIF3FC-16PA-2.54DS HIF3FC-16PA-2.54DSA	Hirose Electronic Co., Ltd. (for example)
	Adapter	QB-V850MINIL-AG1 (inclued with QB-V850MINIL)	Renesas Electronics Corporation
2.54 mm pitch 20-pin general-purpose connector		HIF3FC-20PA-2.54DS HIF3FC-20PA-2.54DSA	Hirose Electronic Co., Ltd. (for example)
	Adapter	Not required	–

3.6.1 KEL connector (for V850E2, V850E1, or V850ES)

<R> A KEL connector is a target connector included with the QB-V850MINI but not with the QB-V850MINIL.

Note that the KEL connector cannot be used when using the V850E2M.

When using the KEL connector as the target connector for OCD, mount either of the following connectors on the target system.

<R>
- 8830E-026-170S: 26-pin straight type (included with QB-V850MINI)
- 8830E-026-170L: 26-pin right-angle type (sold separately)

Remark 8830E-026-170S and 8830E-026-170L are products of KEL Corporation. A conversion adapter is included with the QB-V850MINI.

Figure 3-17 and Table 3-5 show the pin assignment and the pin functions of the KEL connector, respectively. Input/output is indicated as seen from the target device.

Figure 3-17. KEL Connector Pin Assignment Diagram

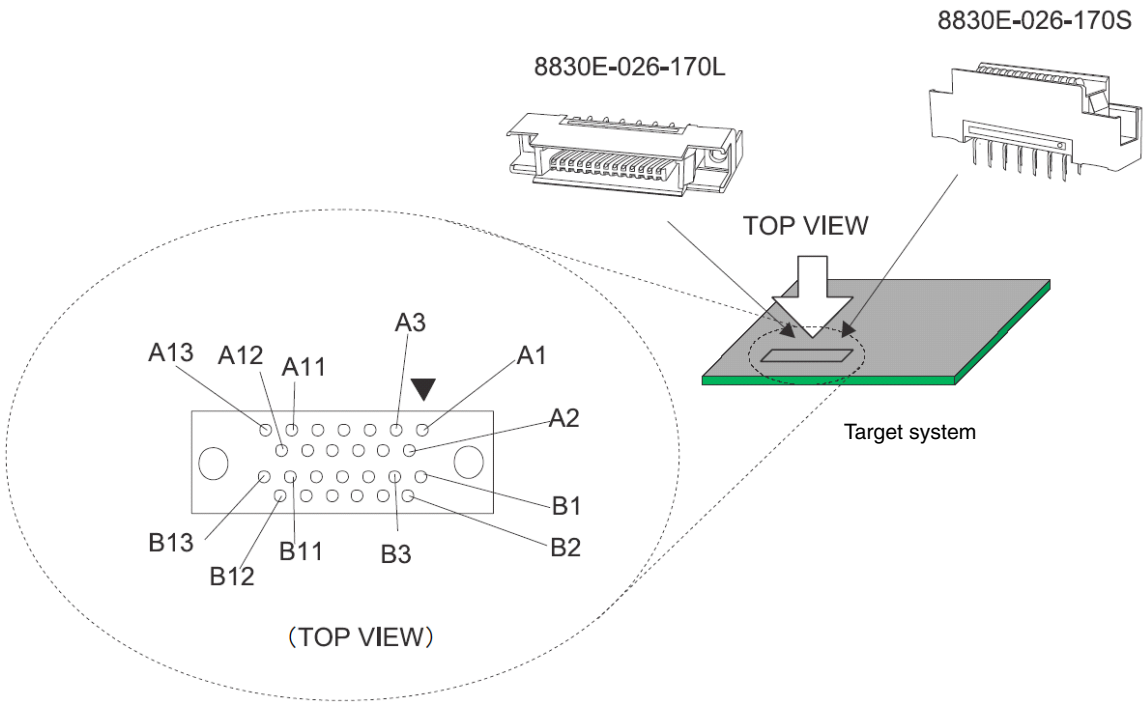


Table 3-5. KEL Connector Pin Functions (for V850E2, V850E1, or V850ES)

Pin No.	Signal Name	I/O[Note 1]	Description
A1 to A6	GND	–	Connect to GND
A7	DDI	IN	Data input
A8	DCK	IN	Clock input
A9	DMS	IN	Transfer mode selection input
A10	DDO	OUT	Data output
A11	$\overline{\text{DRST}}$	IN	Reset input to on-chip debug unit
A12	$\overline{\text{RESET}}$	IN	System reset input (leave open when not used)[Note 2]
A13	FLMD0	IN	Flash mode input (leave open when not used)[Note 3]
B1 to B10	GND	–	Connect to GND
B11	PORT0_IN	–	Connect to GND
B12	PORT1_IN	–	Connect to GND
B13	V_{DD}	–	Connect to V_{DD} for on-chip debugging (for target system power ON monitoring)

Notes 1. As seen from the target device

<R> **2.** Refer to **3.5.4 Connecting the $\overline{\text{RESET}}$ signal (for V850E2, V850E1, or V850ES)**.

<R> **3.** Refer to **3.5.3 Connecting the FLMD0 signal (for V850E2, V850E1, or V850ES)**.

3.6.2 Mictor connector

<R> The Mictor connector is conventionally supported as a target connector for OCD that supports the high-speed trace interface. When combining use of MINICUBE and an emulator with tracing capability sold by Renesas Eloctronics partner company, use the Mictor connector.

When using the Mictor connector as the target connector for OCD, mount the following connector on the target system.

- 2-767004-2: 38-pin type (sold separately)

Remark 2-767004-2 is a product of Tyco Electronics AMP K.K.

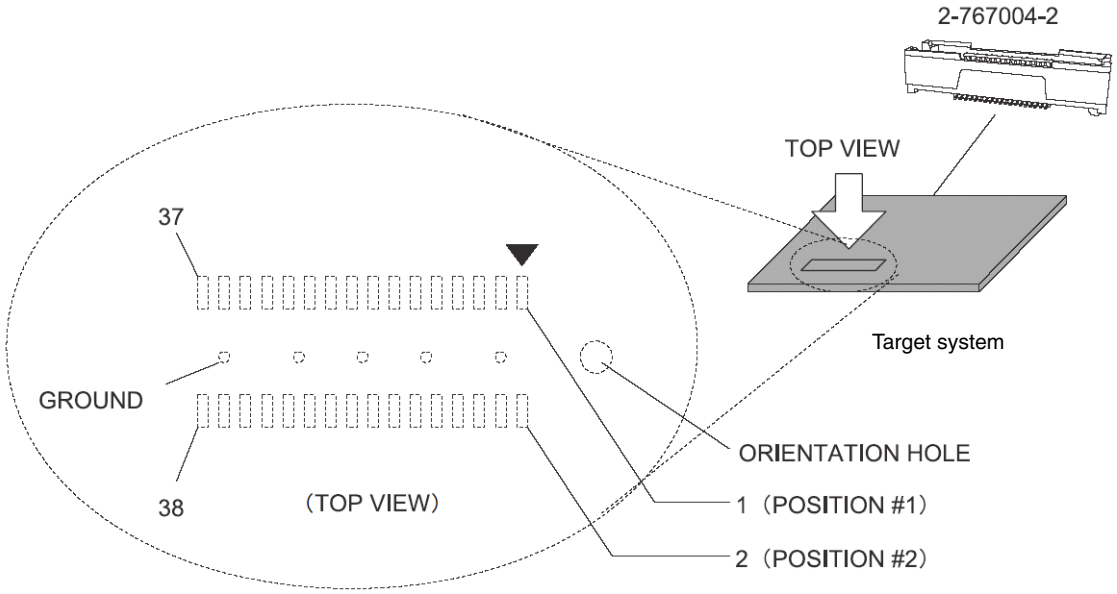
Either of the following adapter is required for connection with the emulator.

<R> • QB-V850MINIL-AM1 (sold separately)

Remark QB-V850MINIL-AM1 is products of Renesas Electronics Corporation

Figure 3-18 and Table 3-6 show the pin assignment and the pin functions of a target connector for OCD, respectively. Input/output is indicated as seen from the target device.

Figure 3-18. Mictor Connector Pin Assignment Diagram



<R>

Table 3-6. Mictor Connector Pin Functions (for V850E2M only)

Pin No.	Signal Name	I/O[Note 1]	Description
1 and 2	GND	–	Connect to GND
3	TCK	IN	Clock input
4	V_{DD}	–	Connect to V_{DD} for on-chip debugging (for target system power ON monitoring)
5	TMS	IN	Transfer mode selection input
6	$\overline{\text{TRST}}$	IN	Reset input to on-chip debug unit
7	TDI	IN	Data input
8	$\overline{\text{RESET}}$	IN	System reset input (leave open when not used)[Note 2]
9	TDO	OUT	Data output
10	FLMD0	IN	Flash mode input (leave open when not used)[Note 3]
11	RESERVE	–	Open
12	$\overline{\text{RDY}}$	OUT	Synchronous signals
13	RESERVE	–	Open
14	RESERVE	–	Open
15	RESERVE	–	Open
16	RESERVE	–	Open
17	RESERVE	–	Open
18	RESERVE	–	Open
19	RESERVE	–	Open
20	RESERVE	–	Open
21 to 36	RESERVE	–	Open
37, 38	GND	–	Connect to GND

Notes 1. As seen from the target device.

2. Refer to **3.4.4 Connecting the $\overline{\text{RESET}}$ signal (for V850E2M only)**.

3. Refer to **3.4.3 Connecting the FLMD0 signal (for V850E2M only)**.

Table 3-7. Mictor Connector Pin Functions (for V850E2, V850E1, V850ES)

Pin No.	Signal Name	I/O[Note 1]	Description
1 and 2	GND	–	Connect to GND
3	DCK	IN	Clock input
4	V_{DD}	–	Connect to V_{DD} for on-chip debugging (for target system power ON monitoring)
5	DMS	IN	Transfer mode selection input
6	$\overline{\text{DRST}}$	IN	Reset input to on-chip debug unit
7	DDI	IN	Data input
8	$\overline{\text{RESET}}$	IN	System reset input (leave open when not used)[Note 2]
9	DDO	OUT	Data output
10	FLMD0	IN	Flash mode input (leave open when not used)[Note 3]
11	N.C	–	Open (not connected)
12	RESERVE	–	Open
13	N.C	–	Open (not connected)
14	PORT0_IN	–	Connect to GND
15	N.C	–	Open (not connected)
16	PORT1_IN	–	Connect to GND
17	GND	–	Connect to GND
18	PORT2_IN	–	Connect to GND
19	GND	–	Connect to GND
20	POWER	–	Open[Note 4]
21 to 38	GND	–	Connect to GND

Notes 1. As seen from the target device.

<R> **2.** Refer to **3.5.4 Connecting the $\overline{\text{RESET}}$ signal (for V850E2, V850E1, or V850ES)**.

<R> **3.** Refer to **3.5.3 Connecting the FLMD0 signal (for V850E2, V850E1, or V850ES)**.

4. When the TRCCE signal (trace compression enable input) is connected as the trace interface for a Renesas Electronics partner company's emulator, the SW1 settings in the MINICUBE must be changed. Refer to **3.2.2 Switch settings** for details.

3.6.3 SICA connector

The SICA connector is a compact target connector. Use of this connector is effective in cases such as when a mounting area cannot be secured on the target system. Note that the SICA connector may not support Renesas Electronics partner company's emulators.

When using the SICA connector as the target connector for OCD, mount the following connector on the target system.

- SICA2P20S: 20-pin type (sold separately)

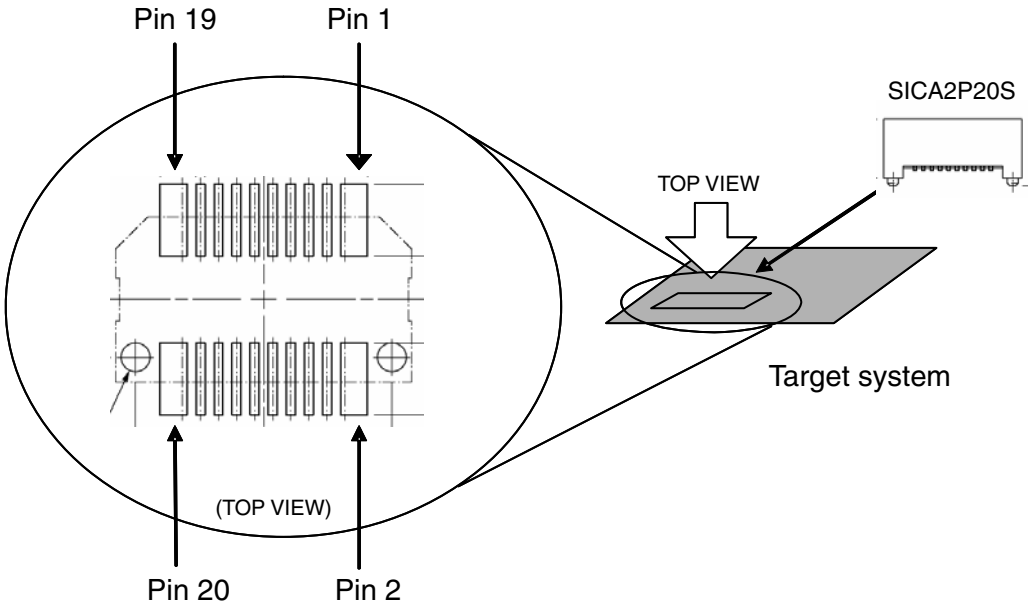
Remark SICA2P20S is a product of Tokyo Eletech Corporation. The ordering code is "SICA2P20S05", which is for a set of five units. Contact Tokyo Eletech Corporation to purchase this product.

The following adapter is required for connection with the emulator.

- SICA20I2P (sold separately)

Remark SICA20I2P is a product of Tokyo Eletech Corporation.

Figure 3-19. SICA Connector Pin Assignment Diagram



<R>

Table 3-8. SICA Connector Pin Functions (for V850E2M only)

Pin No.	Signal Name	I/O[Note 1]	Description
1	GND	–	Connect to GND
2	TCK	IN	Clock input
3	GND	–	Connect to GND
4	TMS	IN	Transfer mode selection input
5	GND	–	GND
6	TDI	IN	Data input
7	GND	–	Connect to GND
8	$\overline{\text{TRST}}$	IN	Reset input to on-chip debug unit
9	GND	–	Connect to GND
10	POWER	–	Open
11	GND	–	Connect to GND
12	$\overline{\text{RESET}}$	IN	System reset input (leave open when not used)[Note 2]
13	GND	–	Connect to GND
14	FLMD0	IN	Flash mode input (leave open when not used)[Note 3]
15	GND	–	Connect to GND
16	$\overline{\text{RDY}}$	–	Synchronous signals
17	GND	–	Connect to GND
18	DDO	OUT	Data output
19	GND	–	Connect to GND
20	V_{DD}	–	Connect to V_{DD} for on-chip debugging (for target system power ON monitoring)

Notes 1. As seen from the target device.

2. Refer to **3.4.4 Connecting the $\overline{\text{RESET}}$ signal (for V850E2M only)**.

3. Refer to **3.4.3 Connecting the FLMD0 signal (for V850E2M only)**.

Table 3-9. SICA Connector Pin Functions (for V850E2, V850E1, V850ES).

Pin No.	Signal Name	I/O[Note 1]	Description
1	GND	–	Connect to GND
2	DCK	IN	Clock input
3	GND	–	Connect to GND
4	DMS	IN	Transfer mode selection input
5	GND	–	GND
6	DDI	IN	Data input
7	GND	–	Connect to GND
8	$\overline{\text{DRST}}$	IN	Reset input to on-chip debug unit
9	GND	–	Connect to GND
10	RESERVE	–	Open
11	GND	–	Connect to GND
12	$\overline{\text{RESET}}$	IN	System reset input (leave open when not used)[Note 2]
13	GND	–	Connect to GND
14	FLMD0	IN	Flash mode input (leave open when not used)[Note 3]
15	GND	–	Connect to GND
16	RESERVE	–	Open
17	GND	–	Connect to GND
18	DDO	OUT	Data output
19	GND	–	Connect to GND
20	V_{DD}	–	Connect to V_{DD} for on-chip debugging (for target system power ON monitoring)

Notes 1. As seen from the target device.

<R> **2.** Refer to **3.5.4 Connecting the $\overline{\text{RESET}}$ signal (for V850E2, V850E1, or V850ES)**.

<R> **3.** Refer to **3.5.3 Connecting the FLMD0 signal (for V850E2, V850E1, or V850ES)**.

<R> **3.6.4 2.54 mm pitch 16-pin general-purpose connector (for V850E2M only)**

After attaching the 2.54 mm pitch 16-pin general-purpose connector, it can also be used to connect a separately sold flash memory programming tool. Note that the 2.54 mm pitch 16-pin general-purpose connector cannot be used when using the V850E2, V850E1, or V850ES.

Note that the 2.54 mm pitch 16-pin general-purpose connector may not support Renesas Electronics partner company's emulators.

The followings are examples of the 2.54 mm pitch 16-pin general-purpose connector.

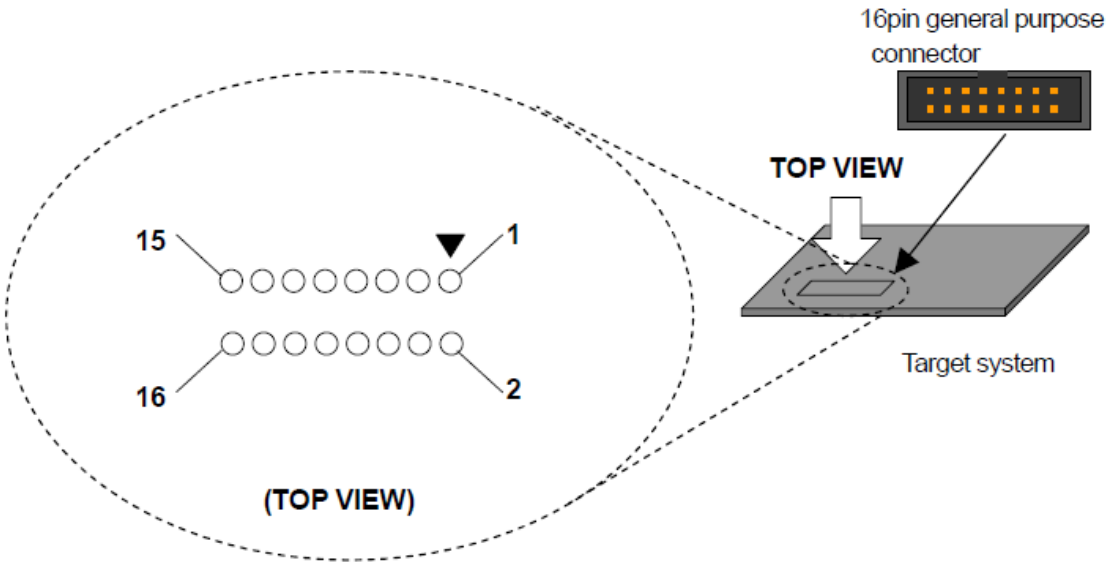
- HIF3FC-16PA-2.54DS (sold separately)
- HIF3FC-16PA-2.54DSA (sold separately)

Remark HIF3FC-16PA-2.54DS and HIF3FC-16PA-2.54DSA are products of Hirose Electronic Co., Ltd.

The following adapter is required when connecting an emulator:

- QB-V850MINIL-AG1 (included with the QB-V850MINIL but not with the QB-V850MINI)

Figure 3-20. 2.54 mm Pitch 16-pin General-Purpose Connector Pin Assignment Diagram



<R> **Table 3-10. 2.54 mm Pitch 16-pin General-Purpose Connector Pin Functions (for V850E2M only)**

Pin No.	Signal Name	I/O[Note 1]	Description
1	GND	–	Connect to GND
2	$\overline{\text{RESET}}$	IN	System reset input (leave open when not used)[Note 2]
3	TDO	OUT	Data output
4	VDD	–	Connect to V_{DD} for on-chip debugging (for target system power ON monitoring)
5	TDI	IN	Data input
6	RESERVE	–	Open
7	TCK	IN	Clock input
8	$\overline{\text{RDY}}$	–	Synchronous signals
9	$\overline{\text{TRST}}$	IN	Reset input to on-chip debug unit
10	RESERVE	–	Open
11	RESERVE	–	Open
12	TMS	IN	Transfer mode selection input
13	RESERVE	–	Open
14	FLMD0	IN	Flash mode input (leave open when not used)[Note 3]
15	For MINICUBE2	OUT	Signal of a separately sold QB-MINI2 (MINICUBE2) [Note 4]
16	POWER	–	Open

Notes 1. As seen from the target device.

2. Refer to **3.4.4 Connecting the $\overline{\text{RESET}}$ signal (for V850E2M only)**.

3. Refer to **3.4.3 Connecting the FLMD0 signal (for V850E2M only)**.

4. When using a separately sold QB-MINI2 (MINICUBE2) as the debug tool, connect this signal to the MINICUBE2. Refer to the MINICUBE2 User's Manual for detail on the connection. When using a MINICUBE2 as the programming tool, this signal is not required to be connected.

3.6.5 2.54 mm pitch 20-pin general-purpose connector

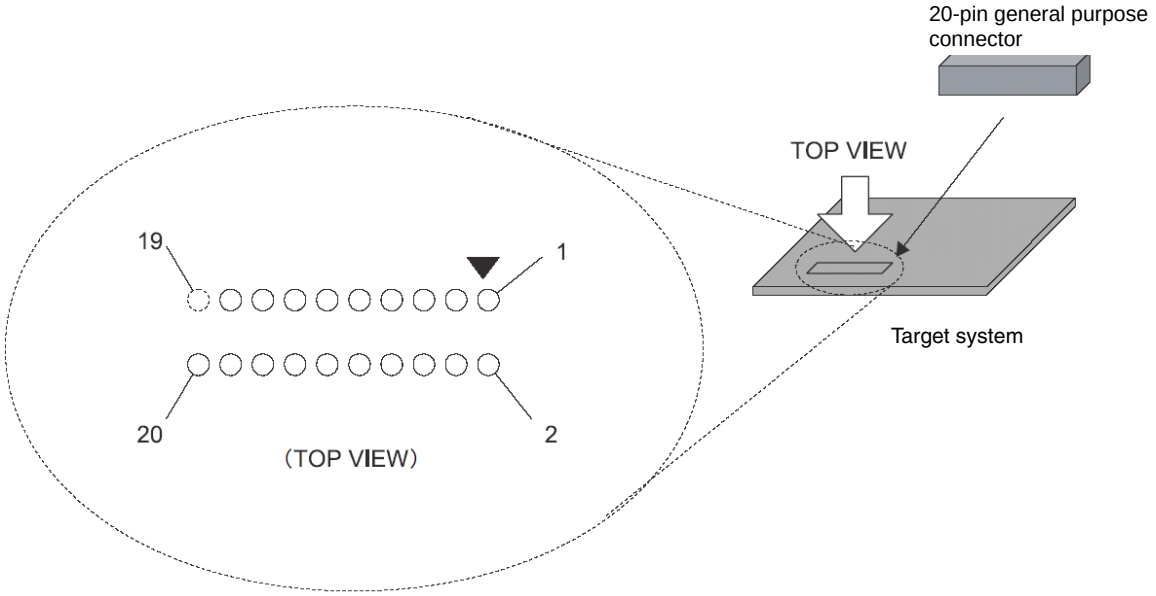
<R> A 2.54 mm pitch general-purpose connector do not need connection of adaptor. Note that 2.54 mm pitch 20-pin general-purpose connectors may not support Renesas Electronics partner company's emulators.

The followings are examples of the 2.54 mm pitch 20-pin general-purpose connector.

- HIF3FC-20PA-2.54DS (sold separately, right-angle type)
- HIF3FC-20PA-2.54DSA (sold separately, straight type)

Remark HIF3FC-20PA-2.54DS and HIF3FC-20PA-2.54DSA are products of Hirose Electronic Co., Ltd.

Figure 3-21. 2.54 mm Pitch General-Purpose Connector Pin Assignment Diagram



<R> **Table 3-11. 2.54 mm Pitch General-Purpose Connector Pin Functions (for V850E2M only)**

Pin No.	Signal Name	I/O[Note 1]	Description
1	GND	–	Connect to GND
2	TCK	IN	Clock input
3	GND	–	Connect to GND
4	TMS	IN	Transfer mode selection input
5	GND	–	GND
6	TDI	IN	Data input
7	GND	–	Connect to GND
8	$\overline{\text{TRST}}$	IN	Reset input to on-chip debug unit
9	GND	–	Connect to GND
10	POWER	–	Open
11	GND	–	Connect to GND
12	$\overline{\text{RESET}}$	IN	System reset input (leave open when not used)[Note 2]
13	GND	–	Connect to GND
14	FLMD0	IN	Flash mode input (leave open when not used)[Note 3]
15	GND	–	Connect to GND
16	$\overline{\text{RDY}}$	–	Synchronous signal
17	GND	–	Connect to GND
18	TDO	OUT	Data output
19	GND	–	Connect to GND
20	V_{DD}	–	Connect to V_{DD} for on-chip debugging (for target system power ON monitoring)

Notes 1. As seen from the target device.

2. Refer to **3.4.4 Connecting the $\overline{\text{RESET}}$ signal (for V850E2M only)**.

3. Refer to **3.4.3 Connecting the FLMD0 signal (for V850E2M only)**.

Table 3-12. 2.54 mm Pitch General-Purpose Connector Pin Functions (for V850E2, V850E1, V850ES)

Pin No.	Signal Name	I/O[Note 1]	Description
1	GND	–	Connect to GND
2	DCK	IN	Clock input
3	GND	–	Connect to GND
4	DMS	IN	Transfer mode selection input
5	GND	–	GND
6	DDI	IN	Data input
7	GND	–	Connect to GND
8	$\overline{\text{DRST}}$	IN	Reset input to on-chip debug unit
9	GND	–	Connect to GND
10	RESERVE	–	Open
11	GND	–	Connect to GND
12	$\overline{\text{RESET}}$	IN	System reset input (leave open when not used)[Note 2]
13	GND	–	Connect to GND
14	FLMD0	IN	Flash mode input (leave open when not used)[Note 3]
15	GND	–	Connect to GND
16	RESERVE	–	Open
17	GND	–	Connect to GND
18	DDO	OUT	Data output
19	GND	–	Connect to GND
20	V_{DD}	–	Connect to V_{DD} for on-chip debugging (for target system power ON monitoring)

Notes 1. As seen from the target device.

<R> **2.** Refer to **3.5.4 Connecting the $\overline{\text{RESET}}$ signal (for V850E2, V850E1, or V850ES)**.

<R> **3.** Refer to **3.5.3 Connecting the FLMD0 signal (for V850E2, V850E1, or V850ES)**.

CHAPTER 4 DEBUGGING WITH IN-CIRCUIT METHOD

This chapter describes how to use the QB-V850MINI for debugging with the in-circuit method.

In the in-circuit method, an emulator is connected in the position where the device is to be mounted.

<R> By using the V850MINI self-check board included with the QB-V850MINI or the separately sold QB-V850ESKX1H-
<R> DA, MINICUBE can be used to debug the target devices shown in 4.1 below. Note that the V850MINIL self-check board included with the QB-V850MINIL cannot be used for in-circuit emulation.

4.1 Target Devices

Debugging with the in-circuit method can be performed using the MINICUBE for the following target devices.

V850ES/KE1+, V850ES/KF1+, V850ES/KG1+, V850ES/KJ1+

V850ES/KE1[Note], V850ES/KF1[Note], V850ES/KG1[Note], V850ES/KJ1[Note]

Note One caution applies to debugging using the V850MINI self-check board included with the QB-V850MINI. See No. 23 in Table 6-1 for details.

This caution item is not applicable when using the QB-V850ESKX1-DA (sold separately).

Refer to the technical document for the QB-V850ESKX1-DA (ZUD-CD-04-0120) for details.

Consult a Renesas Electronics sales representative or distributor for how to obtain this document.

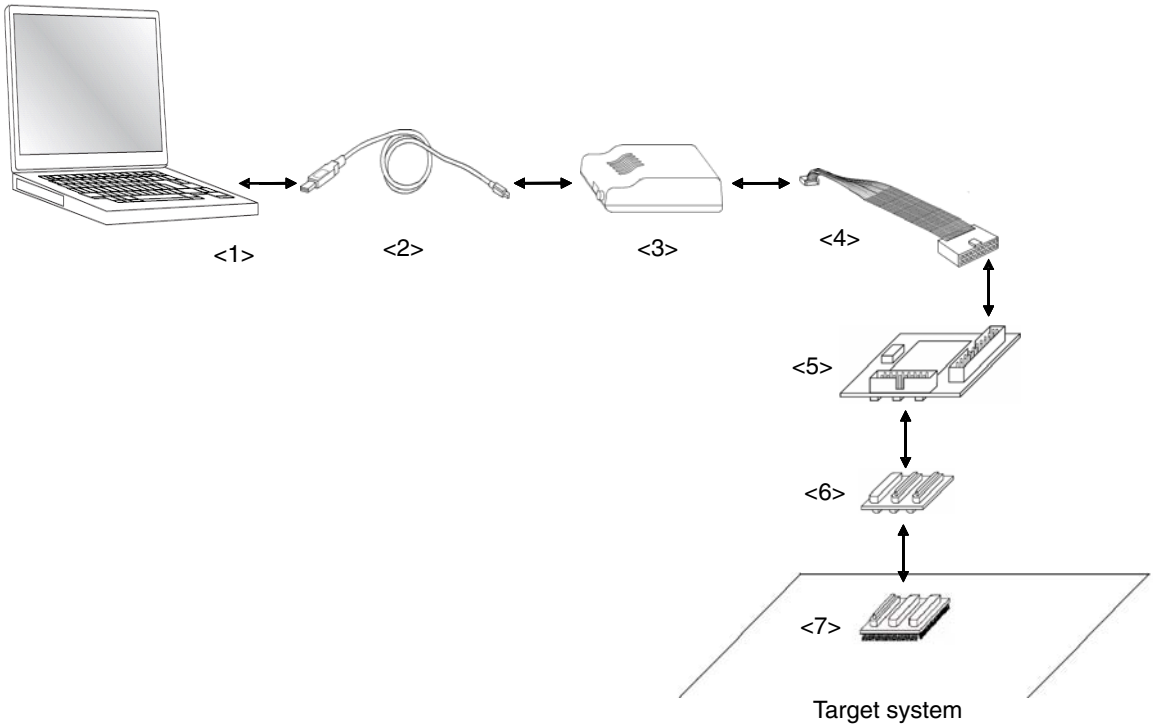
4.2 System Configuration

This section describes the system configuration for debugging with the in-circuit method.

4.2.1 Minimum system configuration

The system configuration shown in the following figure illustrates the minimum system configuration required for
<R> debugging with the in-circuit method. Note that items <6> and <7> in Figure 4-1 are not included with the QB-V850MINI. Note also that item <5> is included with the QB-V850MINI but not with the QB-V850MINIL.

<R> **Figure 4-1. Minimum System Configuration for Debugging with In-Circuit Method**

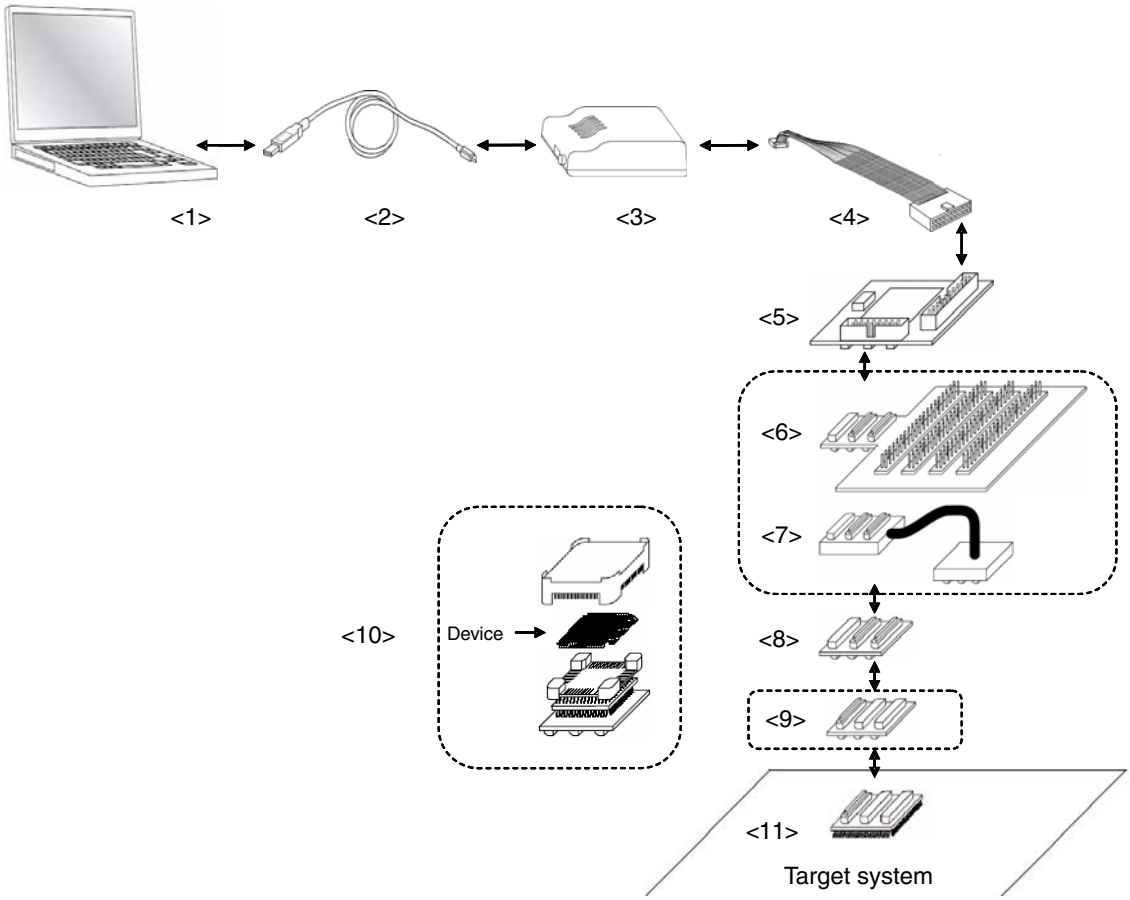


<1> Host machine: With USB ports
<2> USB cable (accessory)
<3> MINICUBE (this product)
<4> OCD cable (accessory)
<5> V850MINI Self-check board (included with the QB-V850MINI) or QB-V850ESKX1H-DA
<6> Exchange adapter (sold separately)
<7> Target connector (sold separately): A connector mounted on the target system.

4.2.2 System configuration when using optional products

The figure shown below illustrates the system configuration when using optional products. The items enclosed by dotted lines are the optional products. Applications of the optional products are described on this page. Refer to **4.2.3 List of optional product names** for the corresponding product names.

<R> **Figure 4-2. System Configuration with Optional Products**



<1> Host machine: With USB ports
<2> USB (accessory)
<3> MINICUBE (this product)
<4> OCD cable (accessory)
<5> V850MINI Self-check board (accessory) (included with the QB-V850MINI) or QB-V850ESKX1H-DA
<6> Check pin adapter (sold separately): An adapter used for monitoring waveforms with an oscilloscope, etc.
<7> Coaxial type extension probe (sold separately): A cable used to extend the distance between the emulator and target system.
<8> Exchange adapter (sold separately)
<9> Space adapter (sold separately): An adapter used to adjust the height.
<10> Mount adapter (sold separately): An adapter used to mount the device in the socket.
<11> Target connector (sold separately): A connector mounted on the target system.

4.2.3 List of optional product names

The tables below list the optional product names. On-chip debugging is also possible for the V850ES/KJ1 or V850ES/KJ1+.

The external dimensions of optional products are posted on the following Renesas Electronics webpage.

URL: http://www2.renesas.com/micro/en/development/asia/Emulator/IE/iecube.html

Table 4-1. List of Optional Product Names (1/2)

No.	Name	Target Device to Be Emulated			
		V850ES/KE1, V850ES/KE1+		V850ES/KF1, V850ES/KF1+	
		64-pin GB	64-pin GK	80-pin GC	80-pin GK
<6>	Check pin adapter	QB-144-CA-01			
<7>	Extension probe (coaxial type)	QB-144-EP-01S			
<8>	Exchange adapter	QB-64-EA-01S		QB-80GC-EA-02S	QB-80GK-EA-01S
<9>	Space adapter	QB-64-SA-01S		QB-80-SA-01S	
<10>	Mount adapter	QB-64GB-MA-01S	QB-64GK-MA-01S	QB-80GC-MA-01S	QB-80GK-MA-01S
<11>	Target connector	QB-64GB-TC-01S	QB-64GK-TC-01S	QB-80GC-TC-01S	QB-80GK-TC-01S

Table 4-1. List of Optional Product Names (2/2)

No.	Name	Target Device to Be Emulated		
		V850ES/KG1, V850ES/KG1+		V850ES/KJ1, V850ES/KJ1+
		100-pin GC	100-pin GF	144-pin GJ
<6>	Check pin adapter	QB-144-CA-01		
<7>	Extension probe (coaxial type)	QB-144-EP-01S		
<8>	Exchange adapter	QB-100GC-EA-01S	QB-100GF-EA-01S	QB-144GJ-EA-02S
<9>	Space adapter	QB-100-SA-01S		QB-144-SA-01S
<10>	Mount adapter	QB-100GC-MA-01S	QB-100GF-MA-01S	QB-144GJ-MA-01S
<11>	Target connector	QB-100GC-TC-01S	QB-100GF-TC-01S	QB-144GJ-TC-01S

4.3 Setup Procedure

This section describes the MINICUBE setup procedure to operate the QB-V850MINI normally. Perform setup using the following procedure.

Installation of software

Install the USB driver, software tool, etc., in the host machine.
See **4.3.1 Installation of software**.
Proceed to the next step if installation of software has already been completed.

↓

Setting of MINICUBE

Set the MINICUBE's SW1 to the default setting.
See **3.3 Default Setting** for the default settings of the MINICUBE.

↓

Setting of clock

At shipment, an 8 MHz resonator (ceramic resonator) is mounted as the main clock in OSC1 on the V850MINI self-check board.

↓

Setting of switch

The SW1 settings vary depending on the purpose of use of the V850MINI self-check board.
At shipment, SW1 is set to perform self-testing (self-check mode).
See **4.3.4 Switch settings** for details.

↓

Mounting of target connector

Mount the target connector on the target system.
See **4.3.5 Mounting of target connector**.
Proceed to the next step if the target connector is already mounted.

↓

Connection and startup of system

Connect the host machine, MINICUBE, V850MINI, self-check board, and target system and start the entire system.
See **4.3.6 Connection and startup of system** to perform setting in the correct order.

↓

System shutdown

Shut down the system to terminate debugging.
See **4.3.7 System shutdown** to shut down the system in the correct order.

4.3.1 Installation of software

Install the software tool in the host machine before setting up the hardware. Refer to the Setup Manual supplied with this product for the procedures.

4.3.2 Setting of MINICUBE

Set the MINICUBE to the default setting.

See **3.3 Default Setting** for the default settings of the MINICUBE.

4.3.3 Clock settings

The oscillation clock of the target device is set by the clock settings for the V850MINI self-check board.

Main clock oscillation frequency: The frequency can be changed by replacing the resonator mounted in OSC1.

Subclock oscillation frequency: The frequency is fixed to 32.768 kHz. Do not change the frequency.

This chapter explains how to set the main clock.

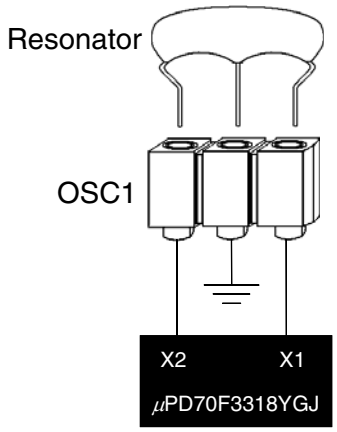
The main clock oscillation frequency is determined by the clock mounted in OSC1.

An 8 MHz ceramic resonator is mounted at shipment.

There is no need to change the setting when using an 8 MHz resonator.

When changing the setting, remove the 8 MHz resonator from the parts board of OSC1, and insert the relevant resonator, as shown in Figure 4-3.

Figure 4-3. OSC1 Setting



A 3-pin resonator with the capacitor can be inserted easily.

When using a resonator other than the 3-pin resonator, a resonator without the capacitor, or the oscillator, the oscillator must be configured in OSC1.

Refer to the user's manual of the target device for details on the oscillator.

4.3.4 Switch settings

For the V850MINI self-check board, two types of mode can be selected by setting SW1.

Set SW1 to “Adapter” when performing emulation with the in-circuit method to set the adapter mode.

Table 4-2. SW1 Setting (Self-Check Board)

SW1 Setting	Mode	Description
Adapter	Adapter mode	A setting to set the mode for performing debugging with in-circuit method. This is the default setting of SW1.
Self Check	Self-check mode	A setting to set the mode for performing self-testing. This setting is also used to set the mode for writing to the μPD70F3318YGJ on the V850MINI self-check board using a flash memory programmer. This mode is used to erase the on-chip flash memory when the debugger cannot be activated because the user has skipped setting of the security ID code.

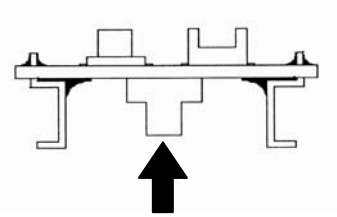
4.3.5 Mounting target connector

Mount the target connector on the target system in the following order.

(1) Apply cream solder to the foot pattern for mounting the IC on the target system.

(2) The target connector has a cylindrical projection in the center of the underside (Figure 4-4). Apply a two-component hardening type epoxy adhesive agent (a type that hardens in 15 to 30 minutes) sparingly to the underside of the projection to temporarily secure the connector at the specified location on the target system. Make sure that the position of pin 1 of the connector (where the corner is cut) matches the position of pin 1 on the target board.

Figure 4-4. Target Connector Projection Diagram



(3) Mount the target connector under the following conditions.

a. To mount the target connector by reflow: 245°C within 20 seconds (heating)

b. To mount the target connector by manual soldering: 320°C within 5 seconds (per pin)

Caution The flux splashing that takes place while the connector is being mounted often results in defective conduction. Be sure to cover the upper part of the connector with aluminum foil. Avoid flux cleaning since the connector has a structure in which flux solvent is likely to remain.

4.3.6 Connection and startup of system

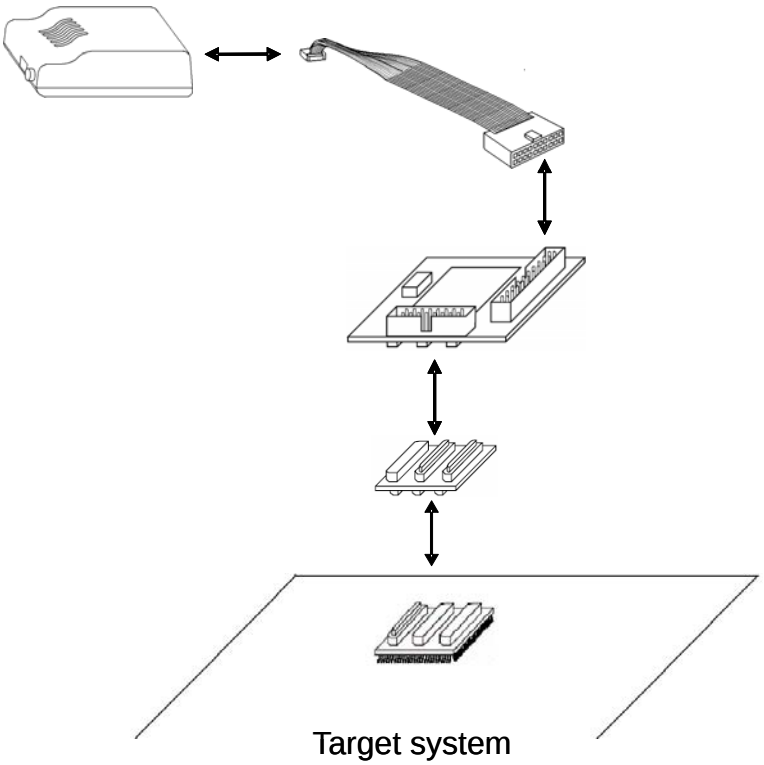
Connect and start the system in the following order.

(1) Connecting MINICUBE to target system

Connect the MINICUBE to the target system using the exchange adapter and target connector. Refer to the system configuration diagrams shown in Figures 4-1 and 4-2 for the connection of other optional products.

Caution Perform connection while the power to the target system is off.

Figure 4-5. Connecting MINICUBE to Target System

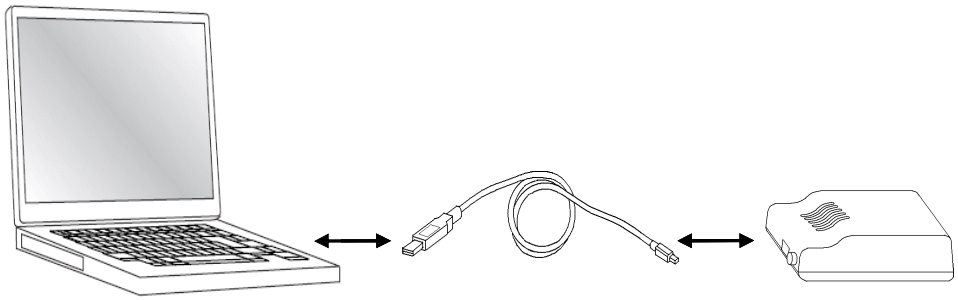


(2) Connecting MINICUBE to host machine

Connect the MINICUBE to the host machine using the USB interface cable. After performing this connection, confirm that the POWER LED on the MINICUBE is lit.

Caution Perform connection while the power to the target system is off.

Figure 4-6. Connecting MINICUBE to Host Machine



(3) Power application to target system

Apply the power to the target system. After power application, confirm that the TARGET LED on the MINICUBE is lit.

<R> **(4) Running the software**

Start up and run the software as described in the supplied user's manual.

4.3.7 System shutdown

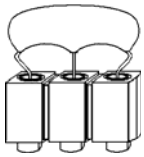
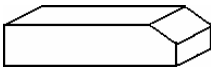
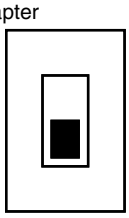
Terminate debugging and shutdown the system in the following order.

(1) Terminate the software.
(2) Turn off the power to the target system.
(3) Disconnect the USB cable from the host machine.

Caution If the above order is not observed, the MINICUBE or the self-check board may be damaged.

4.4 Default Settings (V850MINI Self-check board)

Table 4-3. Default Settings of Self-Check Board

Item	Setting	Description
OSC1		An 8 MHz resonator is mounted at shipment. There is no need to change the setting when using an 8 MHz resonator as is. When changing the setting, refer to **4.3.3 Clock settings** for details.
OSC2		A 32.768 kHz resonator is mounted at shipment. Do not change the frequency.
SW1	Adapter  Self Check	SW1 is set to “Self Check” by default. Refer to **4.3.4 Switch settings** for how to set the switches.

4.5 Cautions on Using Sockets

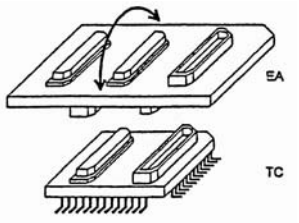
This section describes cautions on using sockets such as the target connector and exchange adapter.
The following symbols are used in this section.

- TC: Target connector
- EA: Exchange adapter
- MA: Mount adapter
- CA: Check pin adapter
- SA: Space adapter
- EP: Extension probe

4.5.1 Cautions on inserting/removing sockets

- When inserting an adapter such as EA, MA, or SA in TC, insert it so that the position of pin 1 (where the corner is cut) on each adapter matches. Be sure to insert the connectors in the correct direction (so that the positions match).
- Remove or insert the sockets in the correct direction (see **Figure 4-7**).
- Be sure to hold the lower (mating) connector or board with your fingers when inserting or removing a socket.
- Use a bamboo spit or similar object as a tool to remove the connector. Insert the tool between TC and EA and remove TC in the correction direction as shown in Figure 4-7. If force is applied to the connector in the wrong direction, the connector will be damaged. If only a metallic object such as a screwdriver is available as leverage, wrap its tip in a soft cloth.

Figure 4-7. How to Insert/Remove a Socket



4.5.2 Causes of faulty contact of connectors and countermeasures for them

Possible causes of faulty connector contact and countermeasures are listed below.

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

4.6 Recovery of Security ID

This section describes how to recover from the case where the software tool cannot be activated because the user forgot the ID code or has skipped setting of the ID code, when using the V850MINI self-check board.

Perform the following steps to recover from the above cases.

(1) Remove the V850MINI self-check board from the target system.
(2) Set SW1 on the V850MINI self-check board to “Self Check”.
(3) Connect the flash memory programmer to the FW1 connector on the self-check board.

Caution To avoid signal conflicts, do not connect the MINICUBE to the self-check board when the flash memory programmer is connected.
Do not supply the clock from the flash memory programmer during writing/erasure.
(Use OSC1 on the self-check board as a clock for writing.)

(4) Enter the settings for the flash memory programmer.
Figure 4-8 shows setting examples when using the PG-FPL as the flash memory programmer.
(5) Perform a chip erase operation.
After the chip erasure, the security ID is set to “0xFFFFFFFFFFFFFFFFFFFF”.

Figure 4-8. Example of Settings for PG-FPL (1/2)

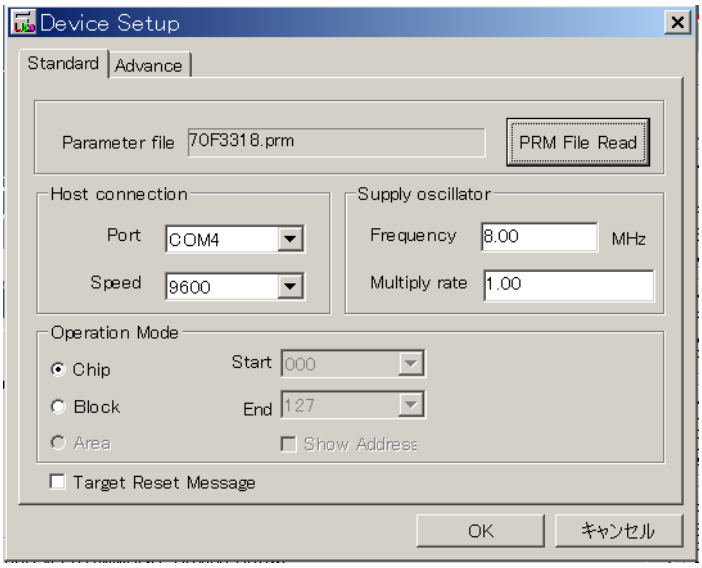
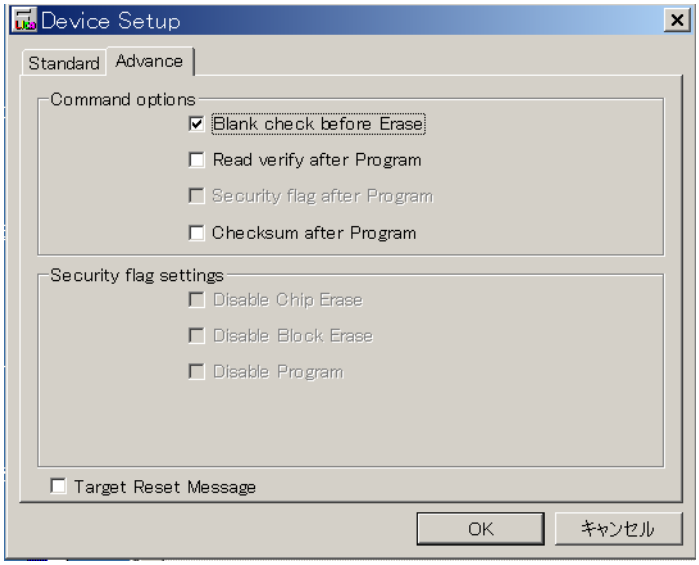


Figure 4-8. Example of Settings for PG-FPL (2/2)



CHAPTER 5 SELF-TESTING

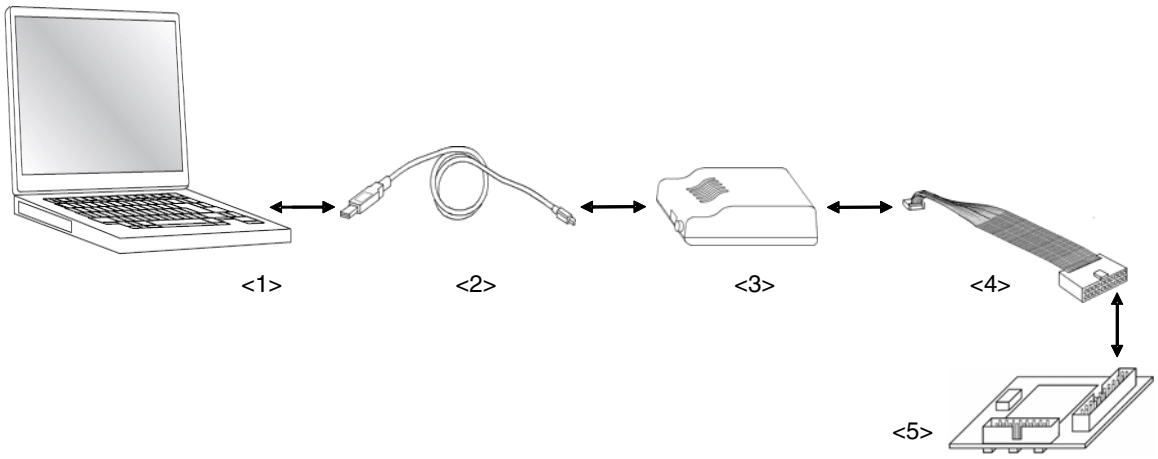
This chapter describes how to perform self-testing of the MINICUBE.

When the debugger does not operate normally, this function can be used to determine whether the cause lies in the MINICUBE, or in other hardware.

<R> 5.1 System Configuration

Figure 5-1 illustrates the system configuration for performing self-testing.

Figure 5-1. System Configuration for Self-Testing



<1> Host machine: With USB ports
<2> USB interface cable (accessory)
<3> MINICUBE (this product)
<4> OCD cable (accessory)
<5> Self-check board (accessory)

5.2 Setup Procedure

This section describes the MINICUBE setup procedure to operate the MINICUBE normally. Perform setup using the following procedure.

<R>

Installation of software

Install the USB driver, software tool, etc., in the host machine.
See **5.2.1 Installation of software**.
Proceed to the next step if installation of software has already been completed.

↓

Setting of MINICUBE

Set the MINICUBE's SW1 to the default setting.
See **3.3 Default Setting** for the default settings of the MINICUBE.

↓

Setting of self-check board

Set the self-check board to the default setting.
See **4.4 Default Settings** for the default settings of the V850MINI self-check board.

↓

Connection and startup of system

Connect the host machine, MINICUBE, and target system and start the entire system.
See **5.2.4 Connection and startup of system** to perform setting in the correct order.

↓

System shutdown

Terminate self-testing and shut down the system.
See **5.2.5 System shutdown**.

5.2.1 Installation of software

Install the following software in the host machine before setting up the hardware. Refer to the “Setup manual” supplied with the QB-V850MINI for the procedures.

<R> When using the ID850QB,MULTI(made by Green hills software Co., Ltd).,

The required device file is shown below. This file differs depending on which self-check board is being used. A device file does not have to be installed when using CubeSuite.

- V850MINIL self-check board: DF703736
- V850MINI self-check board: DF703318

The device file can be downloaded from the following website:
http://www2.renesas.com/micro/en/ods/

5.2.2 Setting of MINICUBE

Set the MINICUBE to the default setting when performing self-testing.

See **3.3 Default Setting** for the default settings of the MINICUBE.

5.2.3 Setting of self-check board

Set the self-check board to the default setting when performing self-testing.

See **4.4 Default Settings (V850MINI Self-check board)** for the default settings.

5.2.4 Connection and startup of system

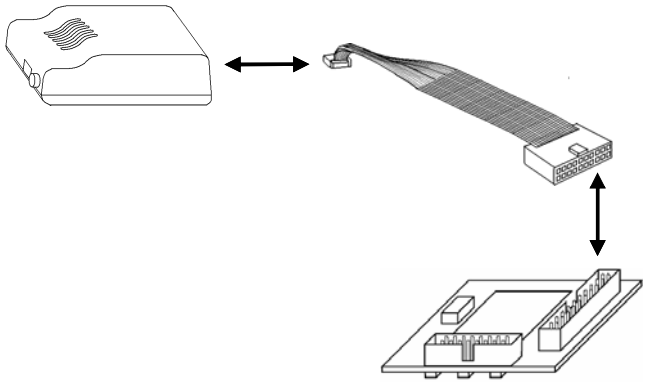
Connect and start the system in the following order.

(1) Connecting MINICUBE to self-check board

Connect the MINICUBE to the V850MINI self-check board using the OCD cable.

Caution Do not connect the MINICUBE to the host machine at this time.

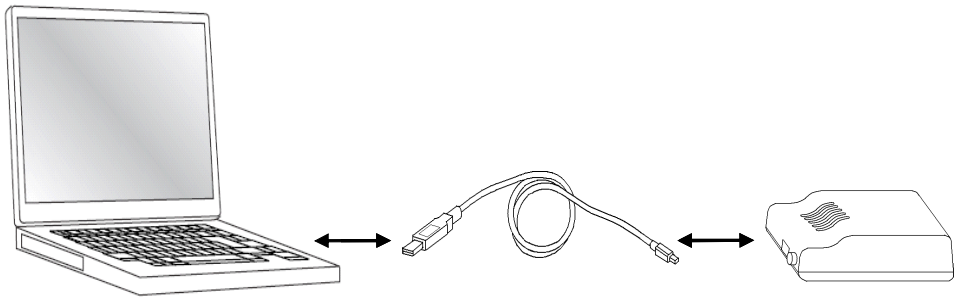
Figure 5-2. Connecting MINICUBE to Self-Check Board



(2) Connecting MINICUBE to host machine

Connect the MINICUBE to the host machine using the USB interface cable. After performing this connection, confirm that LEDs (POWER and TARGET) on the MINICUBE are lit.

Figure 5-3. Connecting MINICUBE to Host Machine



(3) Startup of N-Wire Checker

<R> If CubeSuite has been installed, N-Wire Checker can be started up by clicking Start → NEC Electronics CubeSuite → Emulator Utilities → V850 → N-Wire Checker.

Refer to the following table for the settings to be specified in the main dialog box.

After specifying these settings, proceed according to the instructions in the N-Wire Checker user's manual.

When using V850MINIL self-check board	Specify **DF3736.800** Select **5.000** for **Main OSC**. Select the **ID code** check box and input the security code specified at addresses 0x70 to 0x79. Select **IE-V850E1-CD-NW/QB-V850MINI (DCK=20 MHz)**.
When using V850MINI self-check board	Specify **DF3318Y.800** Select **8.000** for **Main OSC**. Select the **ID code** check box and input the security code specified at addresses 0x70 to 0x79. At shipment, the debugger can be activated by inputting “FFFFFFFFFFFFFFFFFFFF”.Select **IE-V850E1-CD-NW/QB-V850MINI (DCK=10 MHz)**.

5.2.5 System shutdown

Terminate self-testing and shutdown the system in the following order.

(1) Terminate the N-Wire Checker.

(2) Disconnect the USB cable from the host machine.

Caution If the above order is not observed, the MINICUBE or the self-check board may be damaged.

CHAPTER 6 CAUTIONS

This chapter lists cautions on using the MINICUBE.
Caution items are classified in the following three categories, so refer to the relevant items.

[OCD] Cautions for performing on-chip debugging
[IE] Cautions for performing debugging with in-circuit method
[SC] Cautions for performing self-testing

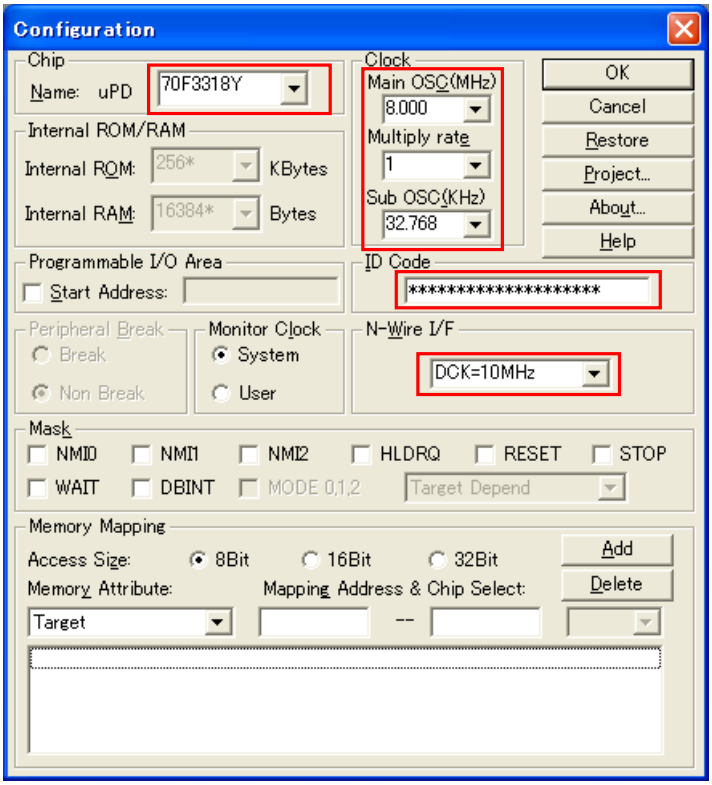
Table 6-1. List of Cautions (1/2)

No.	Classification	Caution
1	**[OCD]**	Use of target devices used for on-chip debugging as mass production products is not guaranteed. Guarantee for the case where only downloading of a program is performed but debugging is not performed is planned.
2	**[OCD]**	In a target device that incorporates an OCD unit, some of the target interface signal pins for OCD may have alternate functions. The alternate functions of these pins cannot be used during on-chip debugging.
3	**[OCD]**, **[IE]**	When erasure and write are prohibited by setting the security flag for the flash memory, programs cannot be downloaded via the debugger.
4	**[OCD]**, **[IE]**	If DMA transfer to the internal RAM is performed while a program is being downloaded to the flash memory, downloading of the program may not be performed normally because the integrated debugger uses the internal RAM during program downloading.
5	**[OCD]**, **[IE]**	Do not use the ROM correction function or else unexpected breaks will occur.
6	**[OCD]**	Since the initial value of the ASID register in the V850E1 Series is undefined, set the ASID register to 00H via the reset routine. Initialization of the V850ES Series is not required.
7	**[OCD]**	The current consumption in the target device increases during debugging compared with that in normal operation mode, because the OCD unit of the target device operates during debugging.
8	**[OCD]**	The break function may malfunctions when a reset occurs during RUN (program execution), depending on the target device. See the documents of the target device (user's manual, restriction notification, etc.).
9	**[OCD]**	The I/O buffer (port pin) may enter the reset status depending on the target device when a reset is input from the pin, even if reset is masked by the mask function. See the documents of the target device (user's manual, restriction notification, etc.).
10	**[OCD]**	No break occurs in an interrupt service routine for an interrupt acknowledged during self programming, even if an event breakpoint has been set.
11	**[OCD]**, **[IE]**	When using the self programming function, set the debugger so that the clock for the peripheral macros does not stop during breaks; otherwise, the flash memory may be damaged.
12	**[OCD]**, **[IE]**	When using the self programming function, do not set software breaks to the ROM area; otherwise, an unexpected break may occur.
13	**[OCD]**	With the V850E1 Series, a forced break may be executed via the debugger operation during flash self writing. After a forced break, reexecute the program via the debugger or reset the CPU.

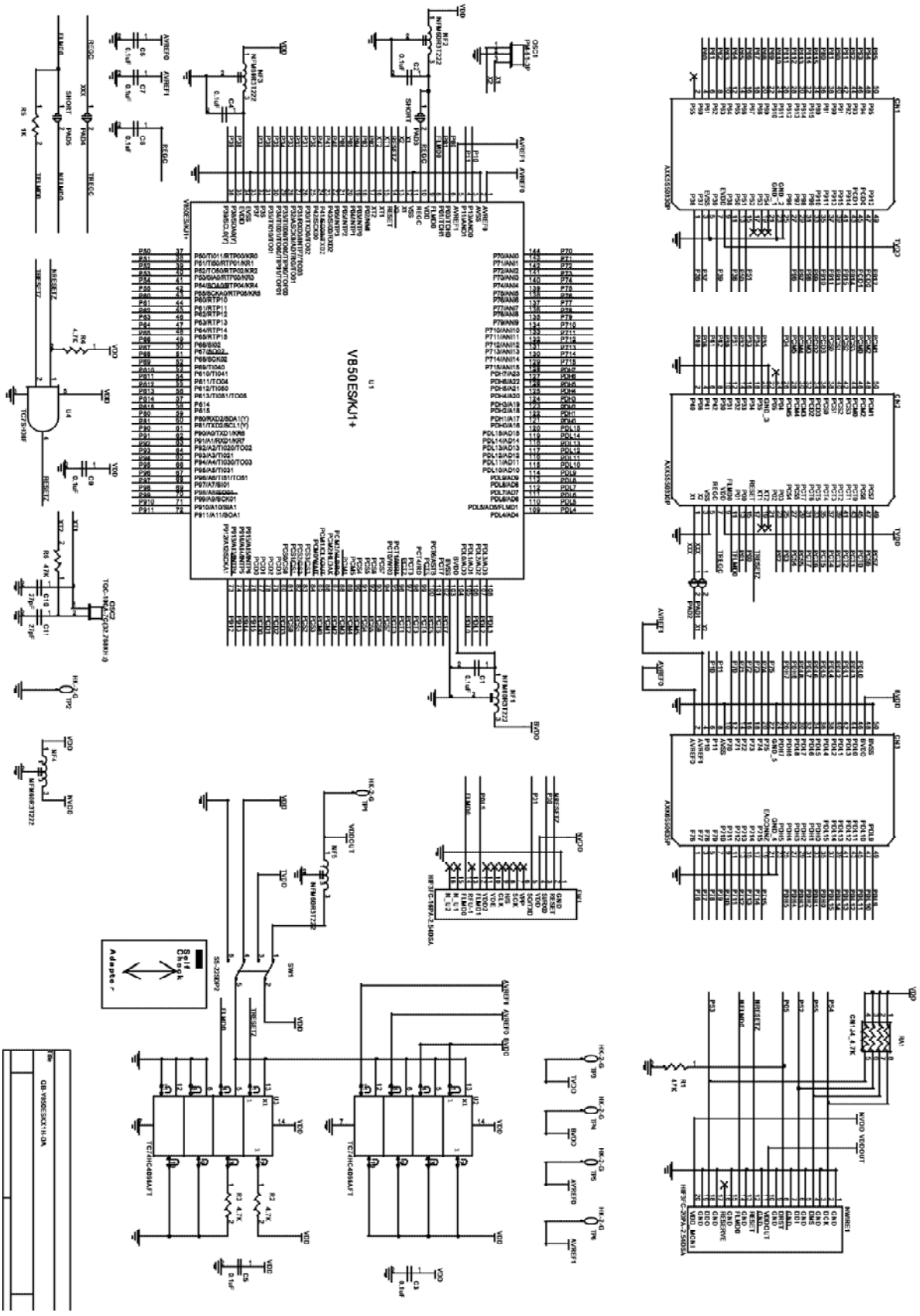
Table 6-1. List of Cautions (2/2)

No.	Classification	Caution
14	**[IE]**	V_{DD} and EV_{DD} are shorted on the self-check board. Therefore, be sure to input the same voltage level to V_{DD} and EV_{DD}.
15	**[IE]**	The P05, P52, P53, P54, and P55 pins are used for connecting the on-chip debug emulator, so these ports cannot be used.
16	**[IE]**	The X1, X2, XT1, and XT2 pins are not connected to the target system. Consequently, the oscillation circuit in the target system cannot be used.
17	**[IE]**	Do not apply a high voltage (5.5 V or higher) to the V_{PP} pin; otherwise, the MINICUBE may be damaged.
18	**[IE]**	The REGC pin is not connected to the target system. The REGC pin is connected to V_{DD} inside the emulator.
19	**[IE]**	The MINICUBE and the flash memory programmer cannot be connected at the same time.
20	**[IE]**	The MINICUBE outputs a high-level signal to the FLMD0 pin while a program is being downloaded. (The MINICUBE output becomes the high-impedance state when no program is being downloaded.) Note the FLMD0 pin connection on the target system side.
21	**[IE]**	When the flash memory programmer is connected, no clock can be supplied from the programmer. Use a clock on the self-check board (8 MHz at shipment) for writing or erasing data from the flash memory programmer.
22	**[IE]**	Note the following points concerning the settings in the Configuration screen when the debugger is activated. • “Chip” area Select the device to be used. • “Clock” area Set as follows. - Main OSC: Input a frequency of the resonator mounted in OSC1 with the socket (Input “8” when using OSC1 with the default setting). - Multiply rate: Input the maximum multiplication rate of the frequency used for the resonator mounted in OSC1 with the socket. - Sub OSC: Input “32.768”. • “ID Code” area Input the security code that has been set at addresses 0x70 to 0x79. At shipment, the debugger can be activated by inputting “FFFFFFFFFFFFFFFFFFFF”. • “N-Wire I/F” area Be sure to select “DCK=10MHz”. The debugger may not operate if “DCK=20MHz” is selected. Figure 6-1 shows the screen image for the above settings.
23	**[IE]**	The P00 pin outputs a low-level signal during a reset. Exercise care when performing emulation of the V850ES/KE1, V850ES/KF1, V850ES/KG1, or V850ES/KJ1.
24	**[SC]**	Do not connect the target system when performing self-testing.

Figure 6-1. Image of Configuration Screen for Caution No. 22



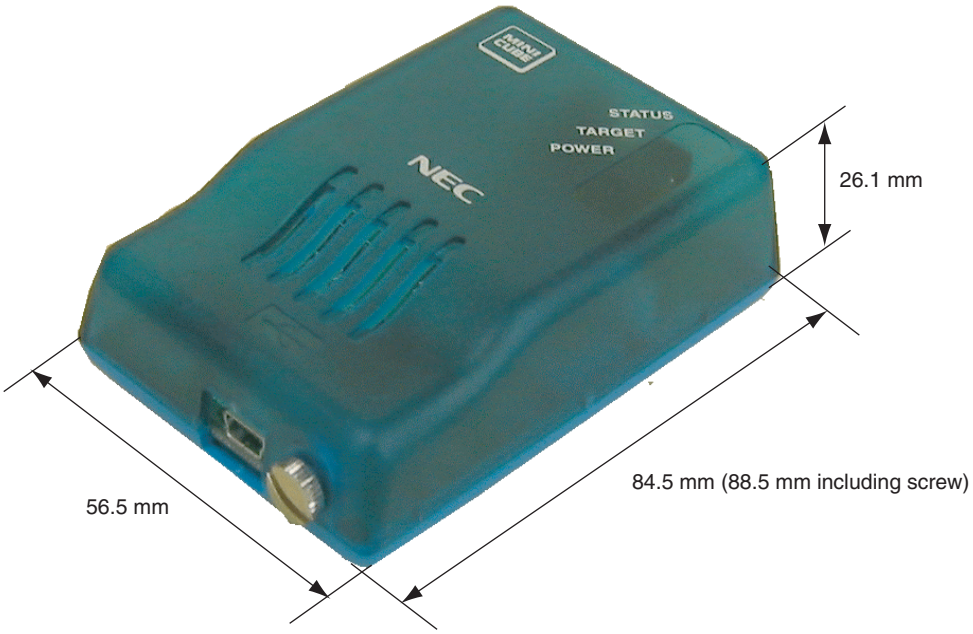
APPENDIX A V850MINI SELF-CHECK BOARD CIRCUIT DIAGRAMS



APPENDIX B EXTERNAL DIMENSIONS

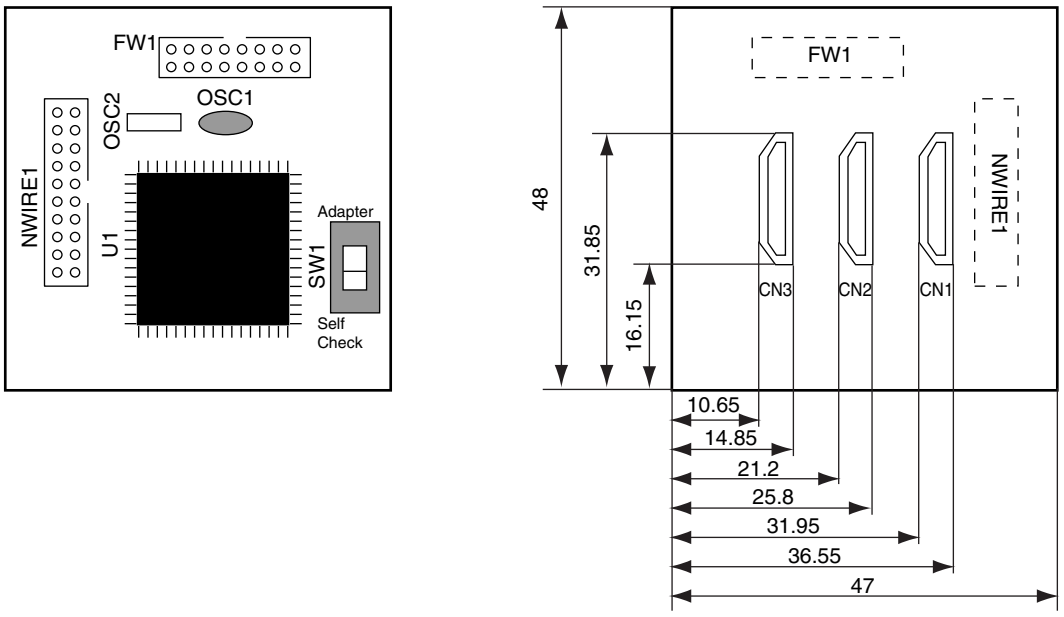
B.1 MINICUBE

Figure B-1. MINICUBE



B.2 V850MINI Self-Check Board

Figure B-2. V850MINI Self-Check Board



Top View

Bottom View

(Unit: mm)

B.3 Target Connectors (for OCD)

The external dimensions described in this section are the dimensions required for the target connector (for OCD) (unit: mm). Refer to the dimension diagrams supplied by each connector manufacturer when designing boards.

The external dimension diagrams of optional products to be used for emulation with the in-circuit method are posted on the following Renesas Electronics webpage.

URL: http://www2.renesas.com/micro/en/development/asia/Emulator/IE/iecube.html

Figure B-3. KEL Connector (8830E-026-170S)

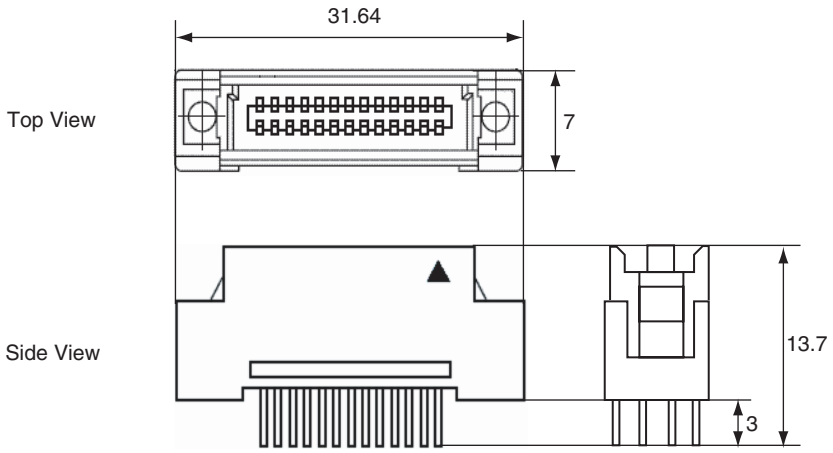


Figure B-4. KEL Connector (8830E-026-170L)

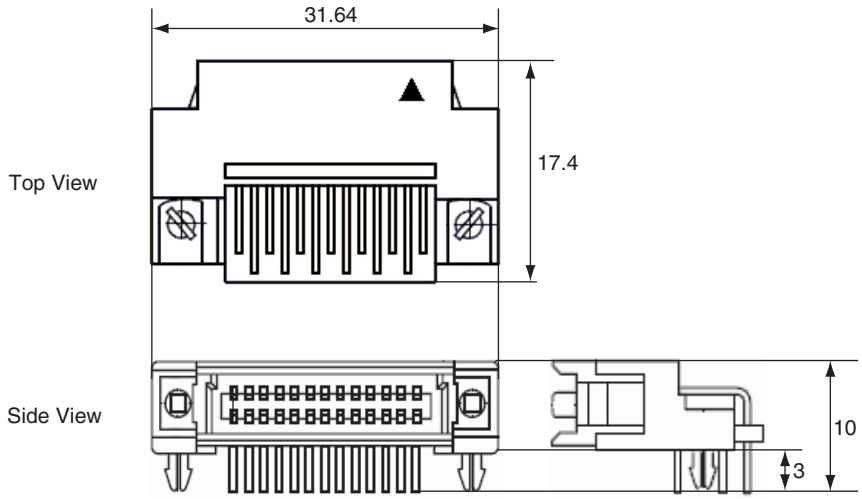


Figure B-5. Mictor Connector (2-767004-2)

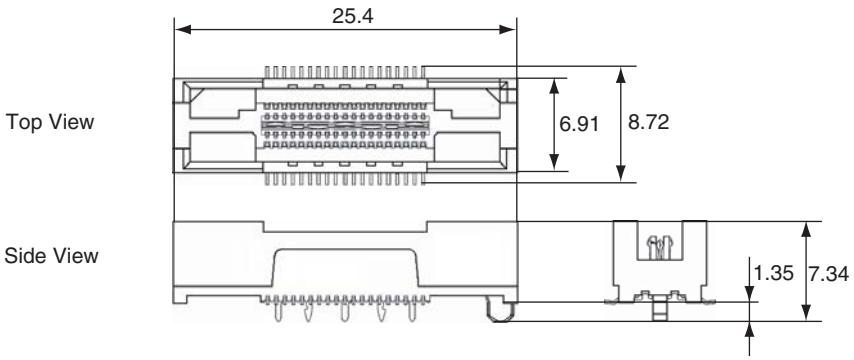
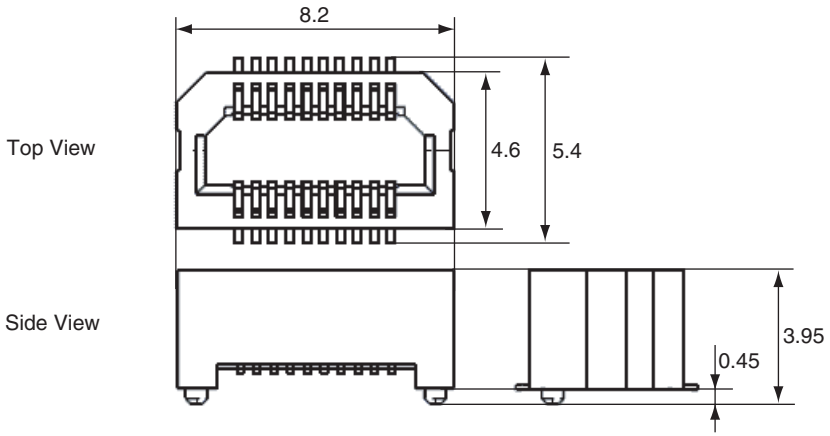


Figure B-6. SICA Connector (SICA2P20S)



<R>

APPENDIX C REVISION HISTORY

Revisions up to the previous edition are shown below. The “Applied to” column indicates the chapter in each edition to which the revision was applied.

Edition	Description	Applied to
2nd edition	Change of **Documents Related to Development Tools (User’s Manuals)** in **INTRODUCTION**	**INTRODUCTION**
	Addition of **1.3 Supported Devices**	**CHAPTER 1 OVERVIEW**
	Change of **Table 1-2 Debug Function Specifications** in **1.4 Specifications**	
	Change of **3.4.2 Cautions on target system design**	**CHAPTER 3 ON-CHIP DEBUGGING**
	Change of **3.4.3 (1) DCK**	
	Change of **3.4.3 (7) (a) When not performing flash self programming**	
	Change of **3.4.3 (7) (b) When performing flash self programming**	
	Addition of **3.4.3 (7) (c) When the target device is not provided with an on-chip flash memory**	
	Change of **Table 3-3. List of Target Connectors for OCD (Part Number and Manufacturer)** in **3.5 Target Connectors for OCD**	
	Addition of **APPENDIX D REVISION HISTORY**	**APPENDIX D REVISION HISTORY**
3rd edition	Addition of **1.1 Features**	**CHAPTER 1 OVERVIEW**
	Change of **1.4 Specifications**	
	Change of **2.1 Names of Parts in Main Unit**	**CHAPTER 2 NAMES AND FUNCTIONS OF HARDWARE**
	Change of **2.2 Self-Check Board**	
	Addition of **2.2.2 V850MINIL self-check board**	
	Change of **CHAPTER 3 ON-CHIP DEBUGGING**	**CHAPTER 3 ON-CHIP DEBUGGING**
	Change of **3.1 System Configuration**	
	Change of **3.2 Setup Procedure**	
	Addition of **3.4 Designing Target System Circuits when Using V850E2M**	
	Change of **3.5 Designing Target System Circuits When Using V850E2, V850E1, or V850ES**	
	Change of **3.6 Target Connectors for OCD**	
	Change of **CHAPTER 4 DEBUGGING WITH IN-CIRCUIT METHOD**	**CHAPTER 4 DEBUGGING WITH IN-CIRCUIT METHOD**
	Change of **4.2 System Configuration**	
	Change of **4.3.6 Connection and startup of system**	
	Change of **5.1 System Configuration**	**CHAPTER 5 SELF-TESTING**
	Change of **5.2 Setup Procedure**	
	Change of **CHAPTER 6 CAUTIONS** (Deletion of No.25)	**CHAPTER 6 CAUTIONS**
	Deletion **APPENDIX C INTERNAL ROM/FLASH MEMORY SECURITY FUNCTION** of the previous edition	**APPENDIX C INTERNAL ROM/FLASH MEMORY SECURITY FUNCTION** of the previous edition
3rd edition (Modified version)	Change of **Figure 3-5. Circuit Connection Example**	**CHAPTER 3 ON-CHIP DEBUGGING**

QB-V850MINI, QB-V850MINIL User's Manual

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