Dear customer

ROHM Co., Ltd. ("ROHM"), on the 1st day of April, 2024,
has absorbed into merger with 100%-owned subsidiary of LAPIS Technology Co., Ltd.

Therefore, all references to "LAPIS Technology Co., Ltd.", "LAPIS Technology"
and/or "LAPIS" in this document shall be replaced with "ROHM Co., Ltd."
Furthermore, there are no changes to the documents relating to our products other than
the company name, the company trademark, logo, etc.

Thank you for your understanding.

ROHM Co., Ltd.
April 1, 2024

Dear customer

LAPIS Semiconductor Co., Ltd. ("LAPIS Semiconductor"), on the 1st day of October, 2020, implemented the incorporation-type company split (shinsetsu-bunkatsu) in which LAPIS established a new company, LAPIS Technology Co., Ltd. ("LAPIS Technology") and LAPIS Technology succeeded LAPIS Semiconductor's LSI business.

Therefore, all references to "LAPIS Semiconductor Co., Ltd.", "LAPIS Semiconductor" and/or "LAPIS" in this document shall be replaced with "LAPIS Technology Co., Ltd."

Furthermore, there are no changes to the documents relating to our products other than the company name, the company trademark, logo, etc.

Thank you for your understanding.

LAPIS Technology Co., Ltd.

October 1, 2020

EASE1000
User's Manual

2nd Edition

Issue Date: December 15, 2017

LAPIS Semiconductor Co., Ltd.

LAPIS Semiconductor Co.,Ltd.

2-4-8 Shinyokohama, Kouhoku-ku,
Yokohama 222-8575, Japan
http://www.lapis-semi.com/en/

Table of Contents

Revision History

Chapter1 PREFACE

For Safe and Correct Operation

This user's manual uses various terms and pictorial indications for you to use this product safely and correctly and to prevent harm to you and others and property damages. Their meanings and displays are as follows:

Meaning of term

⚠ **Warning**	Incorrect handling in defiance of this display may cause death or serious injury.
⚠ **Note**	Incorrect handling in defiance of this display may cause injury or property damage.

Example of pictorial indication

△ symbol indicates a risk and calls attention. In the picture, a specific note ("Electric shock hazard" in the left figure) is drawn.

● symbol forces an action and indicates the instruction. In the picture, a specific instruction ("Disconnect the power plug from outlet" in the left figure) is drawn.

○ symbol indicates a banned action. In the picture, a specific instruction ("No decomposition" in the left figure) is drawn.

Precautions

Be sure to read this page before using this product.

⚠ Warning	
● Do not use the product at a voltage other than specified one. It might cause fire or electric shock.	🚫
● In case of an abnormal state such as reeking or abnormal odor, rapidly disconnect the power plugs of EASE1000 and any other external powers from outlet. Leaving such situation as it might cause fire or electric shock.	
● Do not install the product in a wet or high-humidity environment. It might cause fire or electric shock.	🚫
● Do not place any object on the product. It might cause fire or electric shock.	🚫
● If you awake to any failure, use caution to rapidly disconnect the power plugs of EASE1000 and any other external powers from outlet. Leaving such situation as it might cause fire or electric shock.	

⚠ Note	
● Do not place the product on an unstable or slope place. It might cause falling and injury.	🚫
● Do not use the product in a place with excessive vibration, electromagnetical field, or corrosive gas. It might lead to loosened or disconnected connections of various cables, causing failures.	🚫
● Do not use the product under out of the operational temperature, direct sunlight, or dusty condition. It might cause fire or failure.	🚫
● Be sure to use the attached cables and accessories. Other items might cause fire or failure.	🚫
● Do not use the attached cables and accessories on other than this system. It might cause fire.	🚫

Be sure to read this page before using this product.

⚠ Note	
● Do not apply a voltage exceeding the 5.5V to the VTref pin of the EASE1000 Interface cable. It might cause fire or failure.	🚫
● The order of power ON and OFF needs extra attention. Incorrect order might cause fire or failure.	❗
● Be sure to turn off the EASE1000 before connecting or disconnecting it. Otherwise, it might cause fire or failure.	🚫
● Be sure to turn off the EASE1000 and the user application system before connecting or disconnecting them. Otherwise, it might cause fire or failure.	🚫

● The EASE1000 is an unfinished product and intended for research and development and for expert use in the research and development facility only.   The EASE1000 is not intended for use for volume production or parts thereof.
● Do not use the EASE1000 for the final check of target LSI of operation.
● The guarantee period to the initial failure of EASE1000 is one year.   The obstacle by the wrong usage and reconstruction etc. cannot be guarantee.
● The content specified herein is subject to change for improvement without notice.   Therefore, when using the EASE1000, the contents of the manual should check in the newest.

Description of Term

The following shows the terms used in this user's manual and their descriptions.

Term	Description
EASE1000	It is an on-chip emulator for microcontroller of Lapis Semiconductor. It has a function as a writer (hereinafter referred to as flash writer) to a LSI with built-in flash memory, as well as the on-chip emulator function.
DTU8 debugger	It is software to control the on-chip emulator function of EASE1000 and is a Windows application running on the PC.
MWU16 flash multi writer host program	It is software to control the flash multi writer function of EASE1000 and is a Windows application running on the PC.
Target system	It is a board having a LSI to be debugged by EASE1000 or whose flash memory to be written or erased.
Host PC	It is a PC with the DTU8 debugger, MWU16 flash multi writer host program, and USB driver installed.
USB cable	It is a cable to connect EASE1000 with the host PC.
Target LSI	It is LSI debugged by EASE1000.
EASE1000 interface cable	It is an interface cable to connect EASE1000 with the target system.

Chapter 2 General Description

2. General Description

2.1 Product Overview

EASE1000 is an on-chip emulator for Microcontroller (hereinafter referred to as target LSI) of Lapis Semiconductor.

In combination with the DTU8 debugger, it provides the on-chip debug function.

Having the flash writer function as well, EASE1000 can be used as a flash writer in combination with the MWU16 flash multi writer host program.

Target LSI which can be used by EASE1000 is ML62Q1000 series, ML610Q100, and ML620Q000.
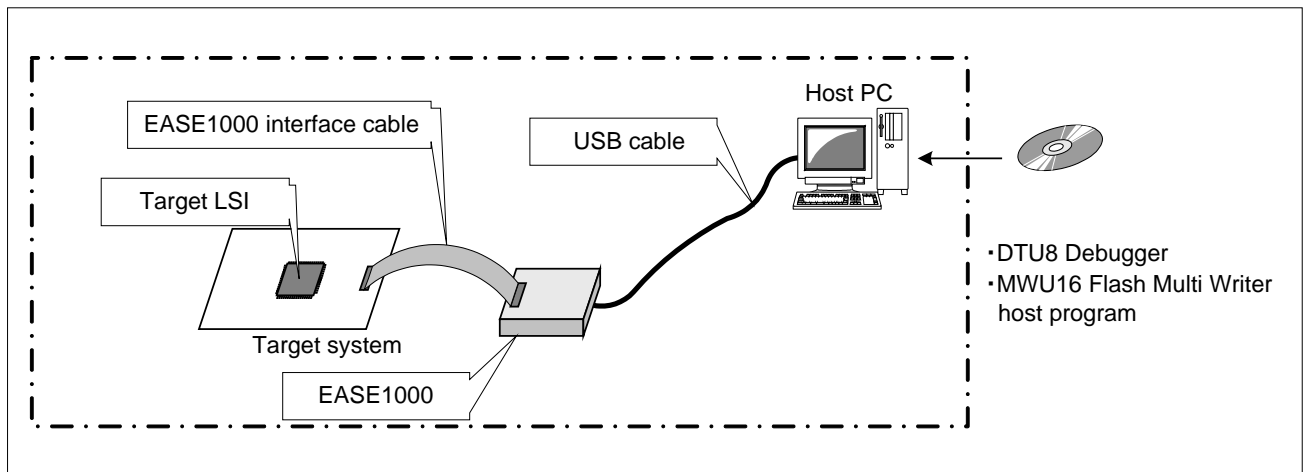
Figure 2-1   EASE1000 System Diagram

2.2 EASE1000 Components

The following shows the EASE1000 components.

Hardware

EASE1000 — This is the main component of EASE1000 on-chip emulator.

Manuals

EASE1000 User's manual — Manual that describes the EASE1000 on-chip emulator (this manual)

Accessories

USB cable — Cable used to connect the EASE on-chip emulator to a host computer.

EASE1000 Interface cable — Cable used to connect the EASE1000 on-chip emulator to a Target system
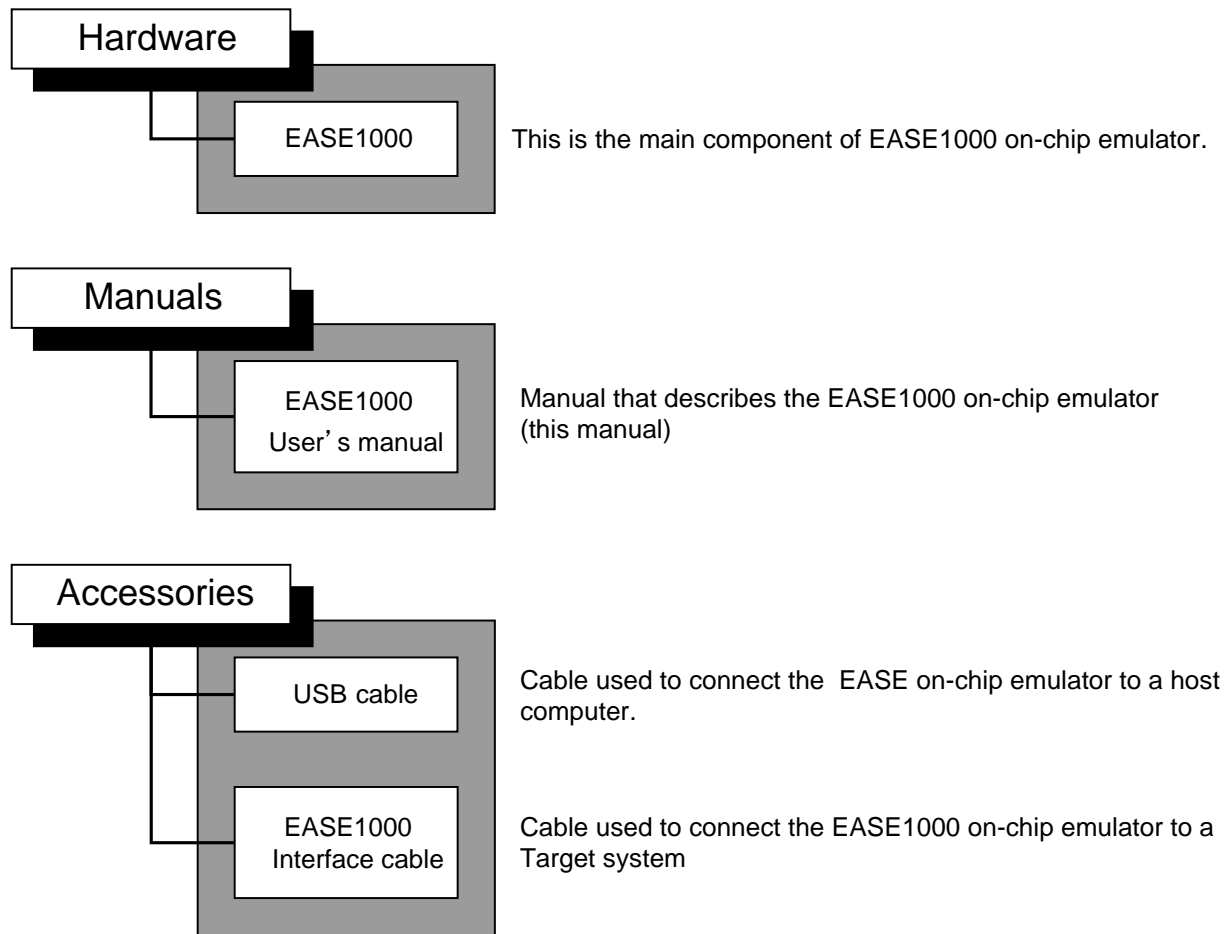
Figure 2-2　EASE1000 Components

2.3 Appearance

The following shows the appearance diagram of EASE1000 and description of each part. In this description, a component surrounded by brackets is the name printed on the case.
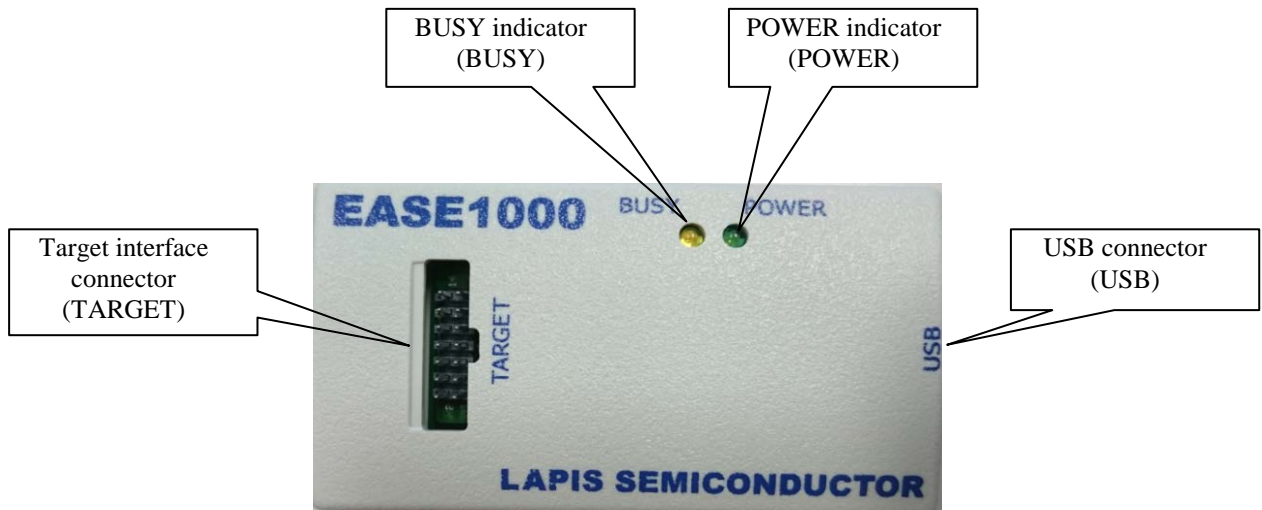
Figure 2-3   EASE1000 Appearance (Top View)

- **Target interface connector (TARGET)**

    A connector to connect EASE1000 with the target system. Connect the supplied EASE1000 interface cable.

- USB connector (USB)

    A connector (Type-B mini) to connect EASE1000 with the host PC. Connect the supplied USB cable.

- POWER indicator (POWER)

    An LED to indicate the EASE1000 state. It lights up or blinks in green.

    For the relationship between the indicator light state and EASE1000 state, see "4.3 Indicator".

- BUSY indicator (BUSY)

    An LED to indicate the EASE1000 state. It lights up or blinks in yellow.

    For the relationship between the indicator light state and EASE1000 state, see "4.3 Indicator ".

2.4 Terms of Use

EASE1000 should be used in an environment which meets the following conditions.

Terms of use for EASE1000	
Parameter	**Description**
Power supply	USB VBUS output (5 V, 500 mA) on the host PC
Usage environment	Temperature: 5 to 40 °C Relative humidity: 30 to 80% (no condensation)
Target LSI Positive power supply (VTref) voltage	Target LSI operation voltage 1.6 to 5.5 V

For an operating environment for software running on the host PC, see the following documents.

- DTU8 User's Manual

- MWU16 Flash Multi Writer Host Program User's Manual

When using EASE1000 as an on-chip emulator or flash writer, the power supply output from EASE1000 to the target LSI is as follows:

Output power supply of EASE1000	
Parameter	**Description**
Power supply for target LSI (3.3VOUT)	3.3 V (typ)/100 mA (max)

The power supply for the target LSI is output after debugging with target LSI by DTU8 debugger or when MWU16 Flash Multi Writer Host Program is in a plug state.

2.5 Target System Requirements

The target system connected with EASE1000 must meet the following requirements.

Target System requirements	
Item	**Description**
Interface connector	Must support the EASE1000 interface cable Must have a 14-pin 2.54 mm pitch connector (Compatible connector: HIF3FC-14PA-2.54DSA)
Target LSI Positive power supply (V_{DD}) voltage	1.6 to 5.5V (Note 1)
Power consumption (VTref)	10mA

■Note 1■

  - **Since the target LSI positive power supply is used for the internal circuit of EASE1000, its power consumption increases when EASE1000 is in use.**
    Use an appropriate amount of the target system positive power supply while considering the power consumed by EASE1000.
  - **Do not connect EASE1000 when measure the consumption current of a target system.**
    The on-chip debugging circuit in target LSI influences, and consumption current increases.

The following shows the power consumption of the VTref pin used inside EASE1000.

EASE1000 VTref pin power consumption (except for transient current)	
Target LSI positive power supply (V_{DD}) voltage	Power consumption (max)
+5.5V	10mA
+3.3V	2mA

2.5.1 Target System Circuit Configuration

This section describes the circuit configuration of the target system which is necessary to connect a target LSI with EASE1000.

A pin used to connect a target LSI with EASE1000 is different depending on the specifications of the target LSI. Use an appropriate pin according to the LSI user's manual.

2.5.1.1 ML62Q1000 series is connected as target LSI

The example of a circuit connected with EASE1000 using RESET_N pin and P00/TEST0 pin is shown below.
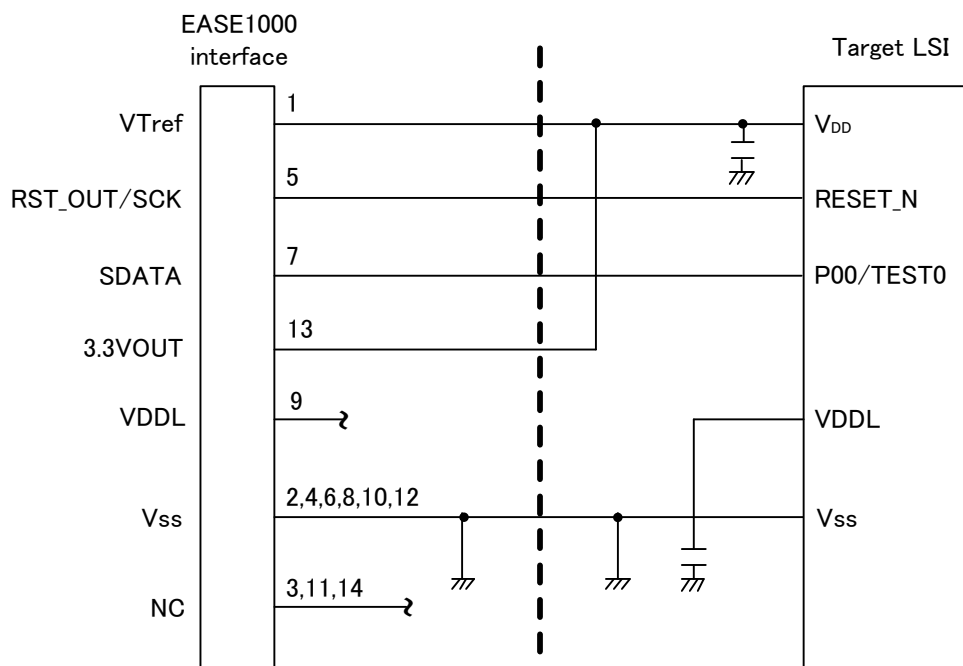
Figure 2-4   Recommended circuitry using RESET_N pin and P00/TEST0 pin

- Do not connect the parts which RESET_N pin is fixed to a High level.

  The pull-up resistance is connectable with RESET_N pin.

- When using P00/TEST0 pin, be sure to set P00 as an input mode by a application program.

  If P00 is set as an output mode, it becomes impossible to use EASE1000.

2.5.1.2 ML610Q100 or ML620Q000 is connected as target LSI

2.5.1.2.1 Recommended circuitry using RESET_N pin and TEST pin

The example of a circuit connected with EASE1000 using RESET_N pin and TEST pin is shown below.

- Do not connect the parts which RESET_N pin is fixed to a High level.

   The pull-up resistance is connectable with RESET_N pin.

- Do not connect any parts to TEST pin.
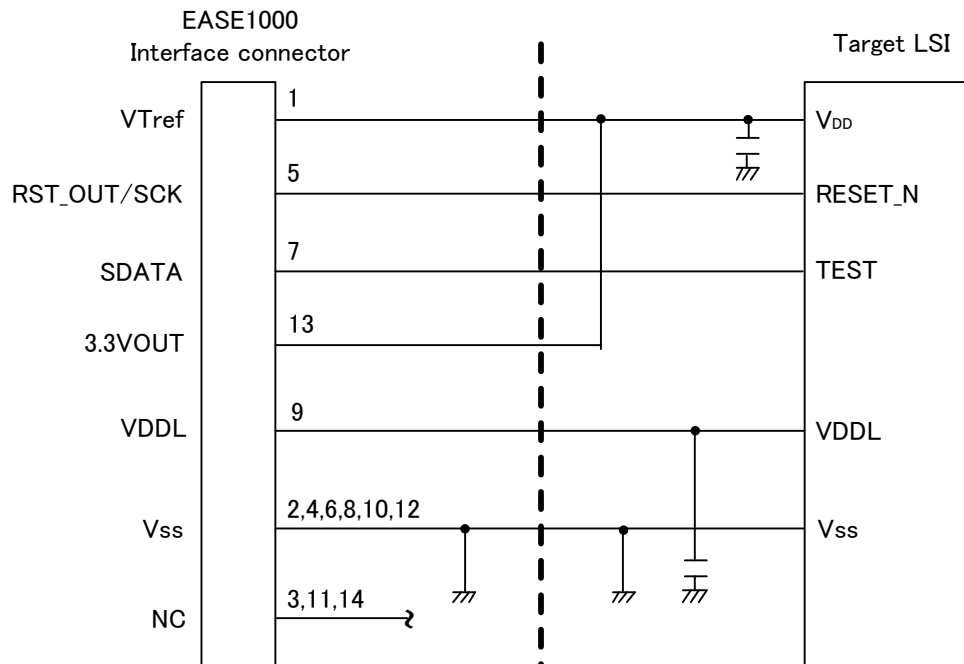
Figure 2-5 Recommended circuitry using RESET_N pin and TEST pin

2.5.1.2.2 Recommended circuitry using TEST1_N pin and TEST0 pin

The example of a circuit connected with EASE1000 using TEST1_N pin and TEST0 pin is shown below.

- Do not connect any parts to TEST1_N pin and TEST0 pin.

- EASE1000 controls reset of a target LSI, do not reset from a RESET_N pin during debugging.
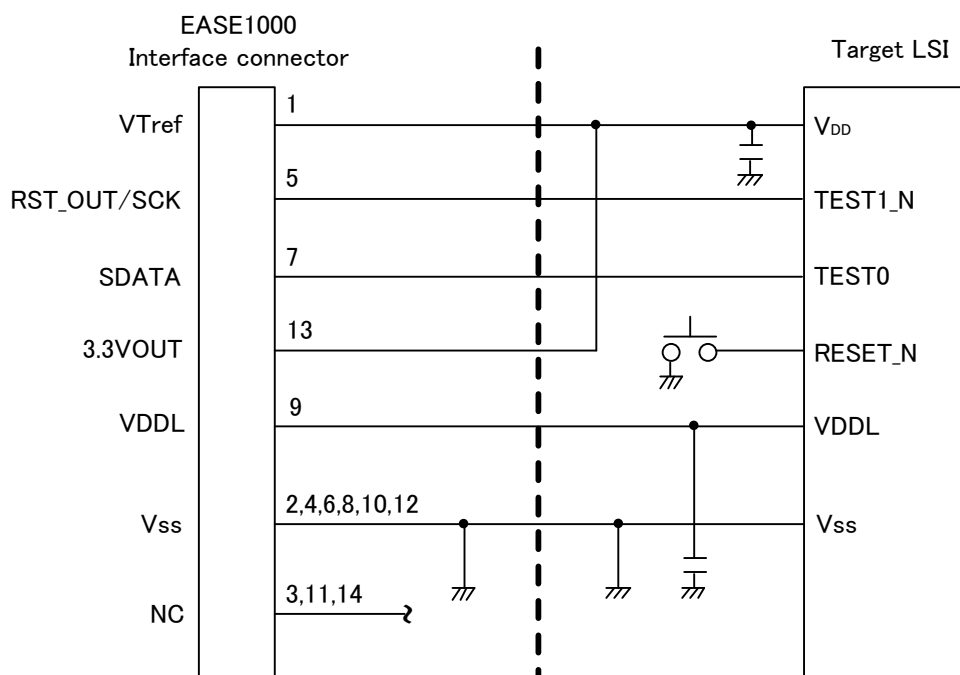
Figure 2-6 Recommended circuitry using TEST1_N pin and TEST0 pin

2.6 Supplying Target LSI V$_{DD}$

2.6.1 Supplying Target LSI V$_{DD}$ from EASE1000

EASE1000 has the pin (3.3VOUT) to output +3.3 V/100 mA (max) as a target LSI operation power supply.

When this power supply is used, the flash writer, on-chip debug emulator's application program download and software breakpoint functions are available even when the power supply voltage of the target system is set to a value outside the flash memory operation voltage range of the target LSI.
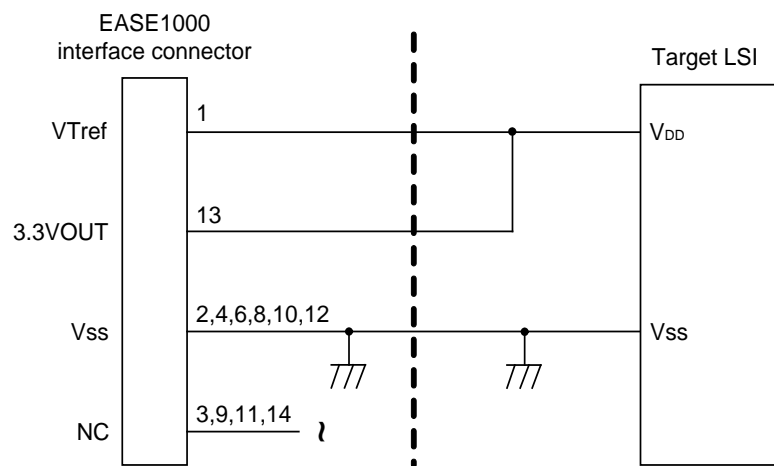
Figure 2-7   Target System Connection Example (3.3VOUT Used)

Note
When using the 3.3VOUT power supply of EASE1000, do not apply power of the target system to the V$_{DD}$ pin of the target LSI.
If both power supplies are connected, it may damage EASE 1000 or cause an electric shock or fire.

2.6.1 Outputting Target System Power Supply to Target LSI V$_{DD}$

The following shows a circuit configuration example for the case of outputting the target system power supply to the target LSI V$_{DD}$ without using 3.3VOUT of EASE1000.
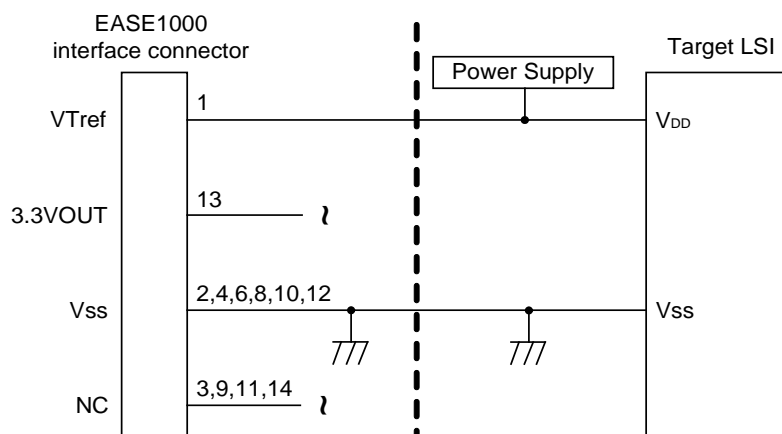
Figure 2-8   Target System Connection Example (3.3VOUT Not Used)

2.7 Target System Board Layout

The following shows a recommended board layout of the EASE1000 interface connector in the target system.
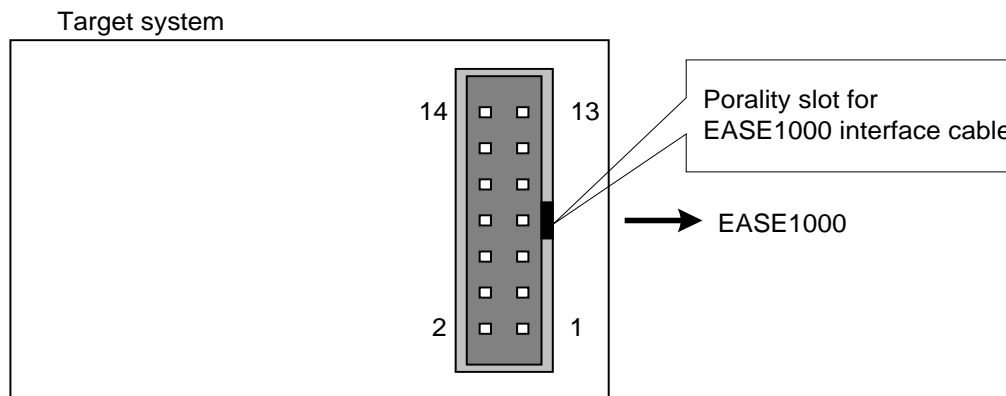
Figure 2-9   EASE1000 Interface Connector Recommended Board Layout

Also, design the pin assignment of the EASE1000 interface connector according to the following table.

Table 1   List of EASE1000 Interface Connector Pins

Pin No.	EASE1000 pin name	Description
1	VTref	Target LSI positive power supply
2	Vss	Target LSI negative power supply
3	N.C.	Unused (This should be left unconnected.)
4	Vss	Target LSI negative power supply
5	RST_OUT/SCK	Target LSI system reset signal/communication clock
6	Vss	Target LSI negative power supply
7	SDATA	Target LSI communication data
8	Vss	Target LSI negative power supply
9	VDDL	Target LSI VDDL supply
10	Vss	Target LSI negative power supply
11	N.C.	Unused (This should be left unconnected.)
12	Vss	Target LSI negative power supply
13	3.3VOUT	3.3V output pin
14	N.C	Unused (This should be left unconnected.)

2.7.1 Notes of Target System Board Layout

The following shows the notes of target system board layout

- The length of a cable connecting EASE1000 with the target system (EASE1000 interface cable) is approximately 15 cm. Locate the EASE1000 interface connector at the end of PCB if possible in order to make the cable between the EASE1000 interface connector and target LSI as short as possible.
  (Compatible connector: HIF3FC-14PA-2.54DSA)

- It is recommended that the wiring connected to RST_OUT/SCK and SDATA be shielded with Vss

Chapter 3 Start

3 START

3.1 Starting EASE1000

This section describes how to start EASE1000.

For the following software running on the host PC, see the appropriate user's manual.

    - DTU8 User's Manual

    - MWU16 Flash Multi Writer Host Program User's Manual

3.1.1 Starting Procedure

Start EASE1000 according to the following procedure.

(1) Connect EASE1000 with the target system through the supplied EASE1000 interface cable.

(2) Connect EASE1000 with the host PC though the supplied USB cable.

    EASE1000 is USB bus-powered. When the USB cable is connected to EASE1000, EASE1000 is turned on, and the POWER indicator on EASE1000 lights up in green.

(3) Turn on the target system.

(4) Start the software on the host PC.
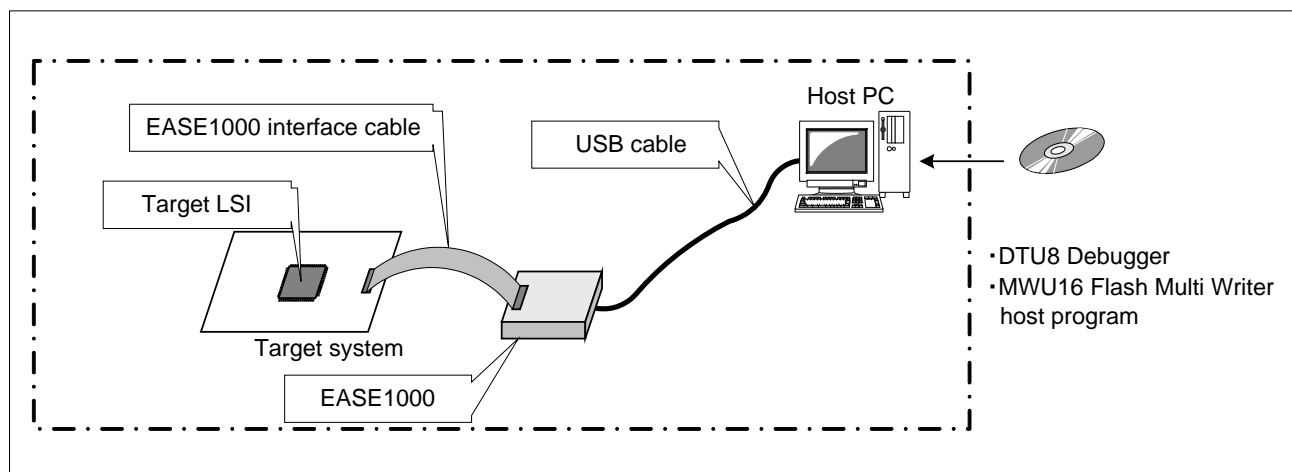
Figure 3-1   EASE1000 System Diagram

⚠️ **Note**
Be sure to start according to the starting procedure.
Failing to obey the procedure may damage EASE 1000 or the target system, or cause an electric shock or fire.

⚠️ **Note**
Be sure to use the cables attached to EASE 1000.
Using different cables may damage EASE 1000 or the target system, or cause an electric shock or fire.

3.1.2 Removal Procedure

    (1) Close the software on the host PC.

    (2) Turn off the target system.

    (3) Disconnect the USB cable from EASE1000.

    (4) Disconnect the EASE1000 interface cable between EASE1000 and the target system.

Note
Be sure to disconnect according to the disconnecting procedure.
Failing to obey the procedure may damage EASE 1000 or the target system, or cause an electric shock or fire.

Chapter 4 FUNCTIONS

4 Functions

4.1 On-chip debug function

Connecting EASE1000 with a target LSI and using the DTU8 debugger provides the on-chip debug function.

・ Application program download/display/change

・ CPU status (register, Flash memory/Data memory, SFR) display/change

・ Emulation (real time emulation function, step emulation function)

・ Various Break

4.2 Flash writer function

Connecting EASE1000 with a target LSI and using the MWU16 flash multi writer host program provides the flash writer function.

4.3 Indicator

The indicator mounted on EASE1000 notifies of the EASE1000 status.

The following shows the relationship between the EASE1000 state and indicator light state.

Table 4-1　Relationship Table between EASE1000 State and Indicator Light State

EASE1000 state	Indicator type	Indicator light state
Idle state	POWER	On
	BUSY	Off
Emulating	POWER	On
	BUSY	On
Writing flash memory	POWER	On
	BUSY	On
Updating firmware	POWER	Blink (Approximately 0.25-second interval)
	BUSY	On
VTref abnormal voltage detection	POWER	On
	BUSY	Blink (Approximately 0.5-second interval)
Device driver recognition failure	POWER	Blink (Approximately 0.5-second interval)
	BUSY	Blink (Approximately 0.5-second interval)
Command execution error	POWER	Blink (Approximately 0.5-second interval)
	BUSY	Off
Communication error with target LSI	POWER	Blink (Approximately 0.5-second interval)
	BUSY	Blink (Approximately 0.5-second interval, reversed)
Firmware binary error	POWER	Blink (Approximately 0.25-second interval)
	BUSY	Blink (Approximately 0.25-second interval)
EASE1000 failure	POWER	Off
	BUSY	Off

The following describes the above EASE1000 states.

Table 4-2   State explanation of EASE1000

Idle state	Indicates the command reception waiting state from the software on the host PC to EASE1000.
Emulating	Indicates that EASE1000 is emulation state.
Writing flash memory	Indicates that flash memory writing to the target LSI is in progress.
VTref abnormal voltage detection:	Indicates that the voltage level of the target LSI positive power supply (VTref) is out of the guaranteed operation range of EASE1000. Check if there are any problems with the connection with the target system or the power supply output state.
Device driver recognition failure	Indicates that installation of the EASE1000 device driver was not recognized on the host PC when the USB cable was connected with EASE1000 (EASE1000 is powered on). Install the device driver according to the dialog box that appears on the host PC.
Command execution error	Indicates that the command response from the target LSI to EASE1000 was abnormal. Check if there are any problems with the connection with the target system or the command execution order.
Communication error with target LSI	Indicates that EASE1000 does not communicate with the target LSI correctly. Check if there are any problems with the connection with the target system.
Firmware binary error	Indicates that the data of control firmware of EASE1000 is corrupt. Update the firmware. If the error still occurs, contact your dealer or our sales representative.
Updating firmware	Indicates that the control firmware of EASE1000 is being updated. After update, EASE1000 is automatically restarted.
EASE1000 failure	Indicates that EASE1000 is broken. Rapidly disconnect the USB cable of EASE1000 and any other external powers from outlet. Leaving such situation as it might cause fire or electric shock. If there is no problem with the connection with the target system or USB cable, contact your dealer or our sales representative.

Chapter 5 Notes on Use of EASE1000

5 Notes on Use of EASE1000

5.1 Notes on Debug

(1) About the execution cycle at the wait mode.

On wait mode, STEP execution may differ from the execution cycle of Go- execution.

The final check of an application program should use Go-execution.

(2) About the RAM Match Break

・The timing of RAM Match Break is after executing a maximum of 3 instruction from the instruction which read/write access of RAM.

・The RAM Match Break of DSR (0F000H) cannot choose.

(3) About the peripheral operation during Break

The operation of the following peripheral stops during Break.

An interrupt request will be in a suspension state and an interrupt will generate it after an emulation start.

The peripheral which operation stops during a break

- I^2C master module

- I^2C bus unit (master / slave)

- Serial unit (SIO / UART)

- General timer

- Functional timer

- External interrupts (A stop of a sampling clock)

- Low-speed time base counter

- DMA controller

- Analog module　(CMP / DAC / AD converter / VLS)

- Buzzer

- CRC

(4) About STOP / STOP-D / HALT / HALT-D

The state of STOP / STOP-D / HALT / HALT-D will become invalid the Force break is used in the state of STOP / STOP-D / HALT / HALT-D.

The state of　STOP / STOP-D / HALT / HALT-D is canceled by break when Break-point is set up immediately after the instruction which sets up STOP / STOP-D / HALT / HALT-D.

(5) About Real-Time-Watch

The Real-Time-Watch of DSR (0F000H) cannot choose.

(6) About change of the register value of DTU8 debugger

・When high-speed clock operation is chosen for target LSI, the FHWUPT register cannot be changed in the SFR window of DTU8 debugger..

・When following peripheral is changed by DTU8 debugger, it is set as LSI before an emulation start.

- CPU register: R0, R1, EA, PSW

- SFR: DSR, FCON

(7) About the status window of execution time

The accuracy of Timer displayed in the status window of DTU8 is 100us units. The maximum time which can be measured is 119 hours. If the maximum time is exceeded, a count will be continued from 0us.

The value of Timer is measured by the timer of EASE1000. Therefore, it differs from the execution time of LSI. When a measurement period is short, an error of measurement becomes large.

Timer value = Execution time of LSI $\pm$ 0.2 % + 300us

5.2 About the 3.3VOUT pin

The specification of the 3.3VOUT pin is 3.3V/100mA.

When using the 3.3VOUT pin with the target system, do not exceed the range of specification.

Using exceeding specification, may damage the target system or EASE1000.

5.3 About Usage Environment

EASE1000 may be affected by the external environment of the host PC, USB cable, EASE1000 interface cable, and the target system. Please check the operation in the specific customer environment before use.

5.4 About Flash Writing

Confirm before using EASE1000 as a flash writer that the target LSI power supply voltage (V_{DD}) is within the range of the flash memory operating condition.

Also, confirm that the application program operates normally after writing.

5.5 About Cables

Be sure to use the USB cable and EASE1000 interface cable supplied as EASE1000 accessories. The operation is not guaranteed if a cable other than the EASE1000 accessories is used.

Note
Be sure to use the cables attached to EASE1000.
Using different cables may damage EASE1000 or the target system, or cause an electric shock or fire.

Chapter 6 Appendices

6. Appendices

6.1 Form information

6.1.1 EASE1000

Item	Description
Outside dimension	50 (W)×17(H)×90(D)[mm]
Weight	50g

6.1.2 EASE1000 Interface cable

Item	Description
Cable length	150[mm]
Connector form	2.54mm pitch 14 pins Two-row socket

6.1.3 USB cable

Item	Description
Cable length	100[cm]
Connector form	host side : USB Type-A
	EASE1000 side : USB Type-B mini

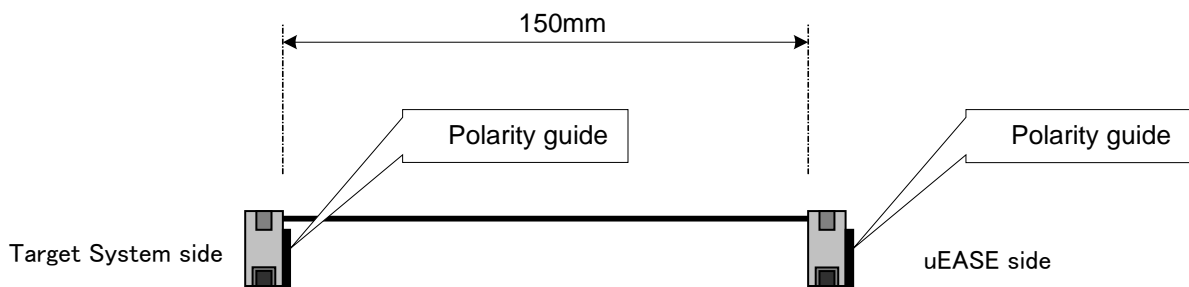## 6.2 EASE1000 Interface Cable Appearance

Figure 6-1   EASE1000 Interface Cable Appearance

6.3 Update of Firmware

Please refer to the "Firmware update of EASE1000" section of "U8/U16 Development Tools release notes".

Revision History

Revision History

Document No.	Date	Page		Description
		Previous Edition	Current Edition	
FEXTEASE1000-01	September 15, 2016	-	-	First Edition
FEXTEASE1000-02	December 15,2017	-	2-1	The discription about target LSI can be used by EASE1000 is added
		-	2-7	Connection example to EASE1000 is added
		-	2-8	Connection example to EASE1000 is added
		2-8	2-10	Table1 is changed
		-	5-2	Addition of 5.1 Notes on Debug (7) section.
		6-1	6-1	The weight of EASE1000 is modified
		-	6-3	Addition of 6.3 Update of Firmware section