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# SuperH™ Family E10A Emulator

Additional Document for User's Manual

SH7615 E10A HS7615KCM02HE

Renesas Microcomputer

Development Environment

System

SuperH™ Family / SH7600 Series

Specific Guide for the SH7615

E10A Emulator



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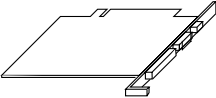
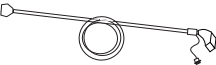
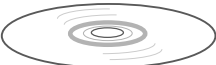


# Section 1 Connecting the Emulator with the User System

## 1.1 Components of the Emulator

The SH7615 E10A emulator supports the SH7615. Table 1.1 lists the components of the emulator.

**Table 1.1 Components of the Emulator (HS7615KCM01H or HS7615KCI01H)**

Classification	Component	Appearance	Quantity	Remarks
Hardware	Card emulator	 (PCMCIA)	1	HS7615KCM01H (PCMCIA: 14-pin type): Depth: 85.6 mm, Width: 54.0 mm, Height: 5.0 mm, Mass: 27.0 g
		or  (PCI)		HS7615KCI01H (PCI: 14-pin type): Depth: 144.0 mm, Width: 105.0 mm, Mass: 93.0 g
	User system interface cable		1	HS7615KCM01H (PCMCIA: 14-pin type): Length: 80 cm, Mass: 33.0 g  HS7615KCI01H (PCI: 14-pin type): Length: 150 cm, Mass: 86.0 g
Software	SH7615 E10A emulator setup program, SuperH™ Family E10A Emulator User's Manual, and Specific Guide for the SH7615 E10A Emulator		1	HS7615KCM01SR,  HS0005KCM01HJ, HS0005KCM01HE,  HS7615KCM02HJ, and HS7615KCM02HE (provided on a CD-R)

## 1.2 Connecting the E10A Emulator with the User System

To connect the E10A emulator (hereinafter referred to as the emulator), the H-UDI port connector must be installed on the user system to connect the user system interface cable. When designing the user system, refer to the recommended circuit between the H-UDI port connector and the MCU. In addition, read the E10A emulator user's manual and hardware manual for the related device.

Table 1.2 shows the type number of the emulator and the corresponding connector type.

**Table 1.2 Type Number and Connector Type**

Type Number	Connector
HS7615KCM01H, HS7615KCI01H	14-pin connector

## 1.3 Installing the H-UDI Port Connector on the User System

Table 1.3 shows the recommended H-UDI port connector for the emulator.

**Table 1.3 Recommended H-UDI Port Connectors**

Connector	Type Number	Manufacturer	Specifications
14-pin connector	2514-6002	Minnesota Mining & Manufacturing Ltd.	14-pin straight type

Note: Do not place any components within 3 mm of the H-UDI port connector.

## 1.4 Pin Assignments of the H-UDI Port Connector

Figures 1.1 shows the pin assignments of the H-UDI port connector.

Note: Note that the pin number assignments of the H-UDI port connector shown on the following page differ from those of the connector manufacturer.

Pin No.	Signal	Input/Output*1	SH7615 Pin No.
1	TCK	Input	30
2*2	/TRST	Input	32
3	TDO	Output	28
4 and 11	Not connected	—	—
5	TMS	Input	31
6	TDI	Input	29
7*2	/RES	Output	8
8 to 10 and 12 to 13	GND	—	—
14*3	GND	Output	—

- Notes:
1. Input to or output from the user system.
  2. The slash (/) means that the signal is active-low.
  3. The emulator monitors the GND signal of the user system and detects whether or not the user system is connected.

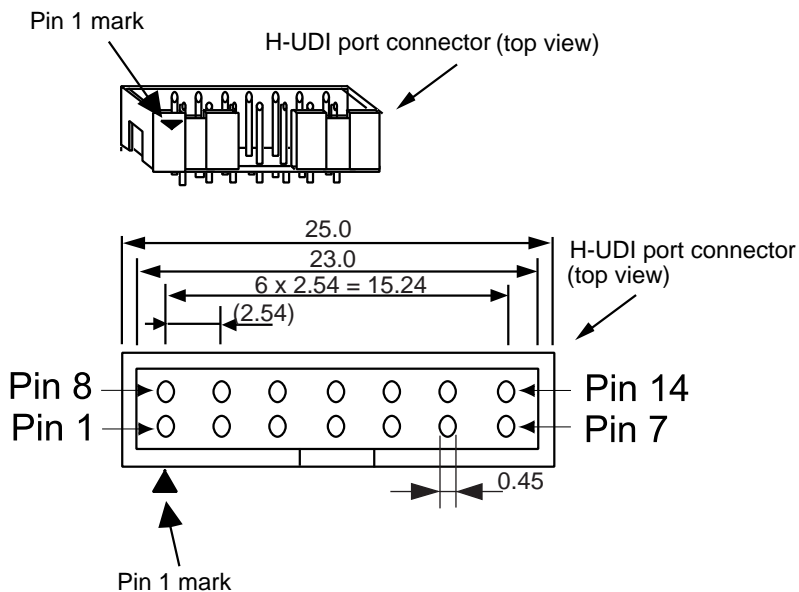


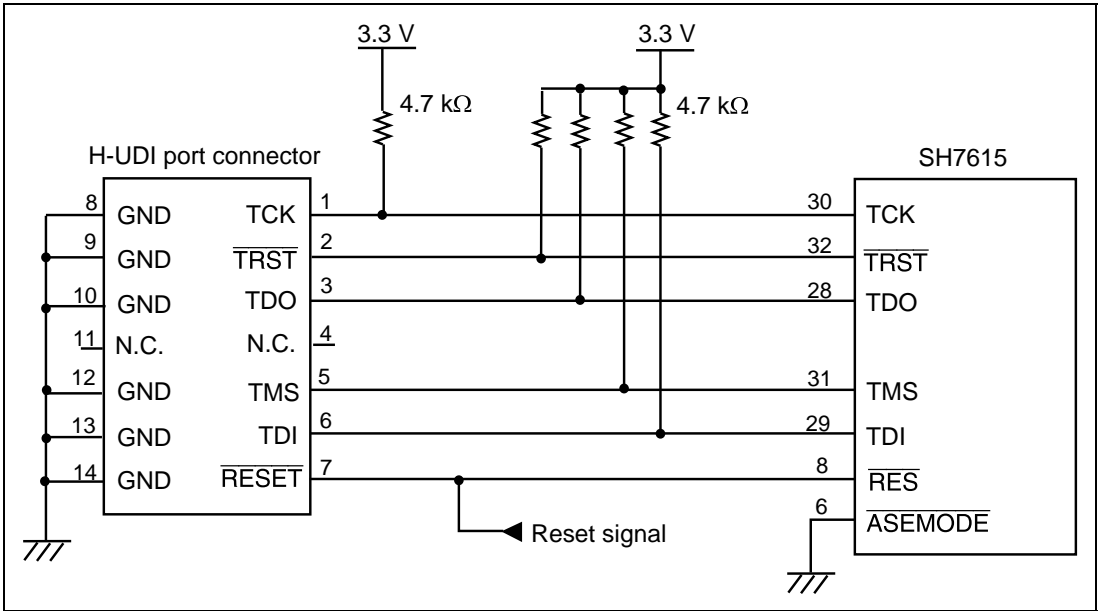
Figure 1.1 Pin Assignments of the H-UDI Port Connector

## 1.5 Recommended Circuit between the H-UDI Port Connector and the MPU

### 1.5.1 Recommended Circuit

Figure 1.2 shows a recommended circuit between the H-UDI port connector and the MPU.

- Notes:
1. Do not connect anything to the N.C. pins of the H-UDI port connector.
  2. The processing of the /ASEMODE pin differs depending on whether the emulator is used or not. As the emulator does not control this pin, it must be controlled by a switch on the board.
    - (1) When the emulator is used: /ASEMODE = low (ASE mode)
    - (2) When the emulator is not used: /ASEMODE = high (normal mode)
  3. The reset signal in the user system is input to the /RES pin of the MPU. Connect this signal to the H-UDI port connector as the output from the user system.
  4. When a network resistance is used for pull-up, it may be affected by a noise. Separate TCK from other resistances.
  5. The pattern between the H-UDI connector and the MPU must be as short as possible. Do not connect the signal lines to other components on the board.
  6. The resistance values shown in figure 1.2 are recommended.
  7. For the pin processing in cases where the emulator is not used, refer to the hardware manual of the related MPU.



**Figure 1.2 Recommended Circuit for Connection between the H-UDI Port Connector and MPU**



# Section 2 Specifications of the SH7615 E10A Emulator's Software

## 2.1 Differences between the SH7615 and the Emulator

1. When the emulator system is initiated, it initializes the general registers and part of the control registers as shown in table 2.1. The initial values of the actual SH7615 registers are undefined. When the emulator is initiated from the workspace, a value to be entered is saved in a session.

**Table 2.1 Register Initial Values at Emulator Link Up**

<b>Register</b>	<b>Emulator at Link Up</b>
R0 to R14	H'00000000
R15 (SP)	Value of the SP in the vector address table
PC	Value of the PC in the vector address table
SR	H'000000F0
GBR	H'00000000
VBR	H'00000000
MACH	H'00000000
MACL	H'00000000
PR	H'00000000
RS	H'00000000
RE	H'00000000
MOD	H'00000000
A0G, A1G	H'00000000
A0, A1	H'00000000
X0, X1	H'00000000
Y0, Y1	H'00000000
M0, M1	H'00000000
DSR	H'00000000

2. The emulator uses the H-UDI; do not access the H-UDI.

### 3. Low-Power States (Sleep and Standby)

For low-power consumption, the SH7615 has sleep and standby modes.

The sleep and standby modes are switched using the SLEEP instruction. The sleep mode can be cleared by either normal clearing or by the satisfaction of a break condition (including BREAK key input), and the user program breaks. The standby mode can be cleared with the normal clearing function, and after the standby mode is cleared, the user program operates correctly. Note that, however, if a command has been entered in standby mode, no commands can be used from the emulator after the standby mode is cleared. The states cannot be canceled by the [STOP] button.

Notes: 1. After the sleep mode is cleared by a break, execution restarts at the instruction following the SLEEP instruction.

2. If the memory is accessed or modified in sleep mode, the sleep mode is cleared and execution starts at the instruction following the SLEEP instruction.

### 4. /RES Signal

The SH7615 /RES signal is only valid during user program execution started with clicking the GO or STEP-type button. If this signal is enabled on the user system in command input wait state, it is not sent to the SH7615.

Note: Do not start user program execution or access the memory while the control input signal (/RES, /WAIT, or /BRLS) is being low. A TIMEOUT error will occur.

### 5. Direct Memory Access Controller (DMAC)

The DMAC operates even when the emulator is used. When a data transfer request is generated, the DMAC executes DMA transfer.

Note: If the DMAC transfer is in the burst mode and the transfer size is 4 Mbytes or more, a TIMEOUT error will occur.

### 6. Memory Access during User Program Execution

When a memory is accessed from the memory window, etc. during user program execution, the user program is resumed after it has stopped in the emulator to access the memory. Therefore, realtime emulation cannot be performed.

The stopping time of the user program is as follows:

Environment:

Host computer: 650 MHz (Pentium® III)

SH7615: 50 MHz (CPU clock)

JTAG clock: 7.5 MHz

When a one-byte memory is read from the command-line window, the stopping time will be about 32 ms.



## 7. Memory Access during User Program Break

The emulator can download the program for the flash memory area (refer to section 6.22, Download Function to the Flash Memory Area, in the Debugger Part of the SuperH™ Family E10A Emulator User's Manual). Other memory write operations are enabled for the RAM area. Therefore, an operation such as memory write or BREAKPOINT should be set only for the RAM area.

## 8. Cache Operation during User Program Break

When cache is enabled, the emulator accesses the memory by the following methods:

At memory write: Writes through the cache, then writes to the memory.

At memory read: Does not change the cache write mode that has been set.

Therefore, when memory read or write is performed during user program break, the cache state will be changed.

## 9. Loading Sessions

Information in [JTAG clock] of the [Configuration] dialog box cannot be recovered by loading sessions. Thus the TCK value will be as follows:

When HS7615KCI01H is used: TCK = 4.125 MHz

When HS7615KCM01H is used: TCK = 3.75 MHz

## 10. [IO] Window

- Display and modification

Do not change values of the User Break Controller because it is used by the emulator.

For each Watchdog Timer register, there are two registers to be separately used for write and read operations.

**Table 2.2 Watchdog Timer Register**

Register Name	Usage	Register
WTCSR(W)	Write	Watchdog timer control/status register
WTCNT(W)	Write	Watchdog timer counter
WTCSR(R)	Read	Watchdog timer control/status register
WTCNT(R)	Read	Watchdog timer counter

- The watchdog timer operates only when the user program is executed. Do not change the value of the frequency change register in the [IO] window or [Memory] window.
- The internal I/O registers can be accessed from the [IO] window. After the I/O-register definition file is created, the MPU's specification may be changed. If each I/O register in the I/O-register definition file differs from addresses described in the hardware manual, change the I/O-register definition file according to the description in the hardware manual. The I/O-register definition file can be customized depending on its format. Note that, however, the emulator does not support the bit-field function.

- Verify

In the [IO] window, the verify function of the input value is disabled.

## 11. Illegal Instructions

If illegal instructions are executed by STEP-type commands, the emulator cannot go to the next program counter.

## 12. Interrupts

While the emulator is executing the user program, any interrupt to the SH7615 can be used. While the emulator is waiting for command input, interrupts are not processed. However, if an edge sensitive interrupt occurs in command input wait state, the emulator holds the interrupt and executes the interrupt processing routine when the GO command is entered.

13. When accessing the reserved memory area, use the [Memory] window; do not use other windows.

## 2.2 Specific Functions for the SH7615 E10A Emulator

The SH7615 E10A emulator does not support the following function:

- MMU-related functions (The SH7615 does not mount the MMU.)
  - VPMAP-related command
  - Virtual and Physical specification in the [Configuration] window
  - Virtual and Physical specification on the command-line function
  - Virtual and Physical specification in the [Breakpoint] window
  - LDTLB instruction execution break function
  - MEMORYAREA\_SET command
- AUD trace function
- Internal I/O access break function
- UBC\_MODE command (The UBC function cannot be used while the emulator is being used.)
- UBC\_MODE specification in the [Configuration] window or on the command line
- Profiler function
- Performance measurement function

### 2.2.1 Emulator Driver Selection

Table 2.3 shows drivers which are selected in the [E10A Driver Details] dialog box.

**Table 2.3 Type Number and Driver**

Type Number	Driver
HS7615KCM01H	E10A PC Card Driver 3
HS7615KCI01H	E10A PCI Card Driver 3

### 2.2.2 Break Condition Functions

In the emulator, four break conditions can be set (Break Condition 1,2,3,4). Table 2.4 lists the items that can be specified for each.

**Table 2.4 Types of Break Conditions**

Break Condition Type	Description
Address bus condition (Address)	Breaks when the SH7615 address bus value matches the specified value.
Data bus condition (Data)	Breaks when the SH7615 data bus value matches the specified value. Byte, word, or longword can be specified as the access data size.
Read or write condition (Read or Write)	Breaks in the read or write cycle.
Access type condition	Breaks when the bus cycle is the specified cycle.
Count condition	Breaks when the conditions set are satisfied the specified number of times.

Table 2.5 lists the combinations of conditions that can be set under Break Condition 1,2,3,4.

**Table 2.5 Dialog Boxes for Setting Hardware Break Conditions**

Dialog Box	Condition			
	Address Bus Condition ([Address] page)	Data Condition ([Data] page)	Access Type Condition, Read or Write Condition ([Bus state] page)	Count Condition ([Count] page)
[Break Condition 1,2] dialog box	○	○	○	○
[Break Condition 3,4] dialog box	○	X	○	X

Note: ○: Can be set by checking the radio button in the dialog box.  
 X: Cannot be set in the dialog box.

Table 2.6 lists the combinations of conditions that can be set under BREAKCONDITION\_SET commands.

**Table 2.6 Commands for Setting Software Breakpoints**

Channel	Condition			
	Address Bus Condition (<addropt> option)	Data Condition (<dataopt> option)	Access Type Condition (<accessopt> option), Read or Write Condition (<r/wopt> option)	Count Condition (<Countopt> option)
Break Condition 1,2	○	○	○	○
Break Condition 3,4	○	X	○	X

Note: ○: Can be set by the BREAKCONDITION\_SET command.  
 X: Cannot be set by the command.

### 2.2.3 Trace Functions

The trace function in the emulator uses the branch-instruction trace function in the SH7615. It displays the branch-source and branch-destination addresses, the mnemonic, operand, and trace information can be acquired in realtime.

Notes: 1. The trace information on the four latest branch instructions can be acquired. This includes the information when execution branches from the emulator program to the user program. Therefore, when four or more branches occur, the four latest branch instructions are acquired; when three or less branches occur, the information on the branch from the emulator program to the user program is displayed.

2. The emulator address may be displayed in the [Trace] window at the last address when the user program is stopped. In such a case, the following message will be displayed. Ignore this address because it is not a user-program-related address.

\*\*\* EML \*\*\*

## 2.2.4 Notes on Using the JTAG Clock (TCK)

1. Set the JTAG clock (TCK) frequency to lower than the frequency of the SH7615 peripheral module clock (CKP).
2. Do not set the following values for the JTAG clock (TCK):  
When HS7615KCM01H is used: 15 MHz  
When HS7615KCI01H is used: 16.5 MHz

## 2.2.5 Notes on Setting the [Breakpoint] Dialog Box

1. When an odd address is set, the next lowest even address is used.
2. A BREAKPOINT is accomplished by replacing instructions. Accordingly, it can be set only to the RAM area. However, a BREAKPOINT cannot be set to the following addresses:
  - An address whose memory content is H'0000
  - An area other than RAM
  - An area of address H'40000000 and the followings
  - An instruction in which Break Condition 4 is satisfied
  - A slot instruction of a delayed branch instruction
  - A lower 16-bit address of the 32-bit DSP instruction
3. During step operation, BREAKPOINTS are disabled.
4. Conditions set at Break Condition 4 are disabled when an instruction to which a BREAKPOINT has been set is executed. Do not set a BREAKPOINT to an instruction in which Break Condition 4 is satisfied.
5. When execution resumes from the breakpoint address after the program execution stops at the breakpoint, single-step operation is performed at the address before execution resumes. Therefore, realtime operation cannot be performed.
6. When a BREAKPOINT is set to the slot instruction of a delayed branch instruction, the exceptions of the illegal slot instruction occur although the program does not stop. Accordingly, do not set a BREAKPOINT to the slot instruction of a delayed branch instruction.
7. If a BREAKPOINT is set at a part of the repeating instructions where the BRA instruction cannot be set, it is handled as the general illegal instruction. In addition, because of the instruction restriction in the repeating loop, a break may or may not occur. Before and after the start or end of the loop, interrupts may not be accepted.
8. Settings of BREAKPOINT and Break Condition 1,2,3,4 are invalid while the STEP OVER function is being used.

9. When a BREAKPOINT is set to the cacheable area, the cache block containing the BREAKPOINT address is filled immediately before and after user program execution.
10. If an address of a BREAKPOINT cannot be correctly set in the ROM or flash memory area, a mark ● will be displayed in the [BP] area of the address on the [Editor] or [Disassembly] window by refreshing the [Memory] window, etc. after Go execution. However, no break will occur at this address. When the program halts with the break condition, the mark ● disappears.

### **2.2.6 Notes on Setting the [Break Condition] Dialog Box and BREAKCONDITION\_SET Command**

1. When [Step In], [Step Over], or [Step Out] is selected, the settings of Break Condition 4 are disabled.
2. Break Condition 4 is disabled when an instruction to which a BREAKPOINT has been set is executed. Accordingly, do not set a BREAKPOINT to an instruction which satisfies Break Condition 4.
3. When a Break Condition is satisfied, emulation may stop after two or more instructions have been executed.
4. If a PC break address condition is set to the slot instruction after a delayed branch instruction, user program execution cannot be terminated before the slot instruction execution; execution stops before the branch destination instruction.
5. Settings of BREAKPOINT and Break Condition 1,2,3,4 are disabled while the STEP OVER function is being used.

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# SuperH™ Family E10A Emulator Additional Document for User's Manual



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