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User's Manual

SuperH™ Family E10A-USB Emulator

Additional Document for User's Manual Supplementary Information on Using the SH7606

Renesas Microcomputer Development Environment System
SuperH™ Family / SH7600 Series
E10A-USB for SH7606 HS7606KCU01HE

Renesas Electronics
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Rev.1.00 2005.11

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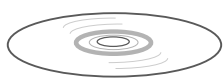
Section 1 Connecting the Emulator with the User System

1.1 Components of the Emulator

The E10A-USB emulator supports the SH7606. Table 1.1 lists the components of the emulator.

Table 1.1 Components of the Emulator

Classi-fication	Component	Appearance	Quan-tity	Remarks
Hard-ware	Emulator box		1	HS0005KCU01H: Depth: 65.0 mm, Width: 97.0 mm, Height: 20.0 mm, Mass: 72.9 g or HS0005KCU02H: Depth: 65.0 mm, Width: 97.0 mm, Height: 20.0 mm, Mass: 73.7 g
	User system interface cable		1	14-pin type: Length: 20 cm, Mass: 33.1 g
	USB cable		1	Length: 150 cm, Mass: 50.6 g
Soft-ware	E10A-USB emulator setup program, SuperH™ Family E10A-USB Emulator User's Manual, Supplementary Information on Using the SH7606*, and Test program manual for HS0005KCU01H and HS0005KCU02H		1	HS0005KCU01SR, HS0005KCU01HJ, HS0005KCU01HE, HS7606KCU01HJ, HS7606KCU01HE, HS0005TM01HJ, and HS0005TM01HE (provided on a CD-R)

Note: Additional document for the MPUs supported by the emulator is included. Check the target MPU and refer to its additional document.

1.2 Connecting the E10A-USB Emulator with the User System

To connect the E10A-USB 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-USB emulator user's manual and hardware manual for the related device.

Table 1.2 shows the type number of the emulator, the corresponding connector type, and the use of AUD function.

Table 1.2 Type Number, AUD Function, and Connector Type

Type Number	Connector	AUD Function
HS0005KCU01H, HS0005KCU02H	14-pin connector	Not available

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

Table 1.3 shows the recommended H-UDI port connectors 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: When designing the 14-pin connector layout on the user board, do not place any components within 3 mm of the H-UDI port connector.

1.4 Pin Assignments of the H-UDI Port Connector

Figure 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	SH7606 Pin No.	Note
1	TCK	Input	N10	
2*2	/TRST	Input	M11	
3	TDO	Output	N11	
4	N.C.	—	—	
5	TMS	Input	P11	
6	TDI	Input	R11	
7*2	/RES	Output	R12	
8	N.C.	—	—	
9*4	(GND)	—	—	
11	UVCC	Output	—	
10, 12, and 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.
4. The /ASEMODE pin must be 0 when the emulator is connected and 1 when the emulator is not connected, respectively.
(1) When the emulator is used: /ASEMODE = 0
(2) When the emulator is not used: /ASEMODE = 1
To allow the /ASEMODE pin to be GND by connecting the user system interface cable, connect pin 9 directly to the /ASEMODE pin. Do not ground the pin.

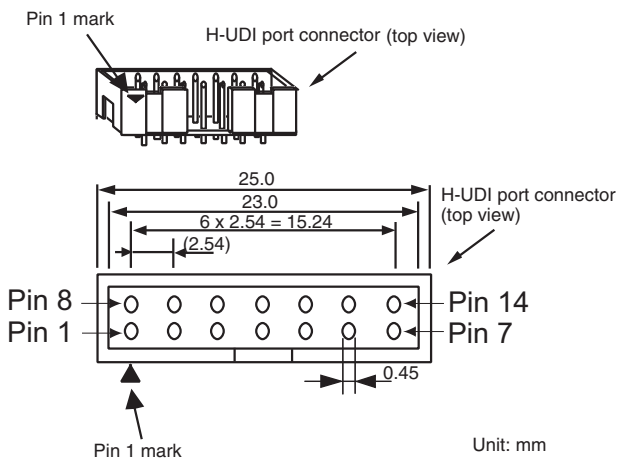


Figure 1.1 Pin Assignments of the H-UDI Port Connector (14 Pins)

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 for connection between the H-UDI port connector (14 pins) and the MPU when the emulator is in use.

Notes: 1. Do not connect anything to the N.C. pins of the H-UDI port connector.

2. The /ASEMODE pin must be 0 when the emulator is connected and 1 when the emulator is not connected, respectively.
   (1) When the emulator is used: /ASEMODE = 0
   (2) When the emulator is not used: /ASEMODE = 1
   Figure 1.2 shows an example of a circuit that allows the /ASEMODE pin to be GND (0) whenever the emulator is connected by using the user system interface cable. When the /ASEMODE pin is changed by switches, etc., ground pin 9. Do not connect this pin to the /ASEMODE pin.
3. When a network resistance is used for pull-up, it may be affected by a noise. Separate TCK from other resistances.
4. The pattern between the H-UDI port connector and the MPU must be as short as possible. Do not connect the signal lines to other components on the board.
5. When the power supply of the user system is turned off, supplying VccQ of the user system to the UVCC pin reduces the leakage current from the emulator to the user system. A level shifter that is activated by the internal power supply or user power supply (changed by the switch) is installed in the interface circuit of the emulator. If the user power is supplied to the UVCC pin, the level shifter is not activated as long as no user power is supplied. When the power supply of the user system is turned off, no current flows from the user interface. The I/O voltage level of the user system interface can be the same as that of the VccQ. To operate the emulator with low voltage (lower than 3.3 V), the VccQ must be supplied to the UVCC pin. Make the emulator's switch settings so that the VccQ will be supplied (SW2 = 1 and SW3 = 1) (as shown in figure 1.2).
6. The resistance value shown in figure 1.2 is recommended.
7. For the pin processing in cases where the emulator is not used, refer to the hardware manual of the related MPU.

When the circuit is connected as shown in figure 1.2, the switches of the emulator are set as SW2 = 1 and SW3 = 1. For details, refer to section 3.8, Setting the DIP Switches, in the SuperH™ Family E10A-USB Emulator User's Manual.

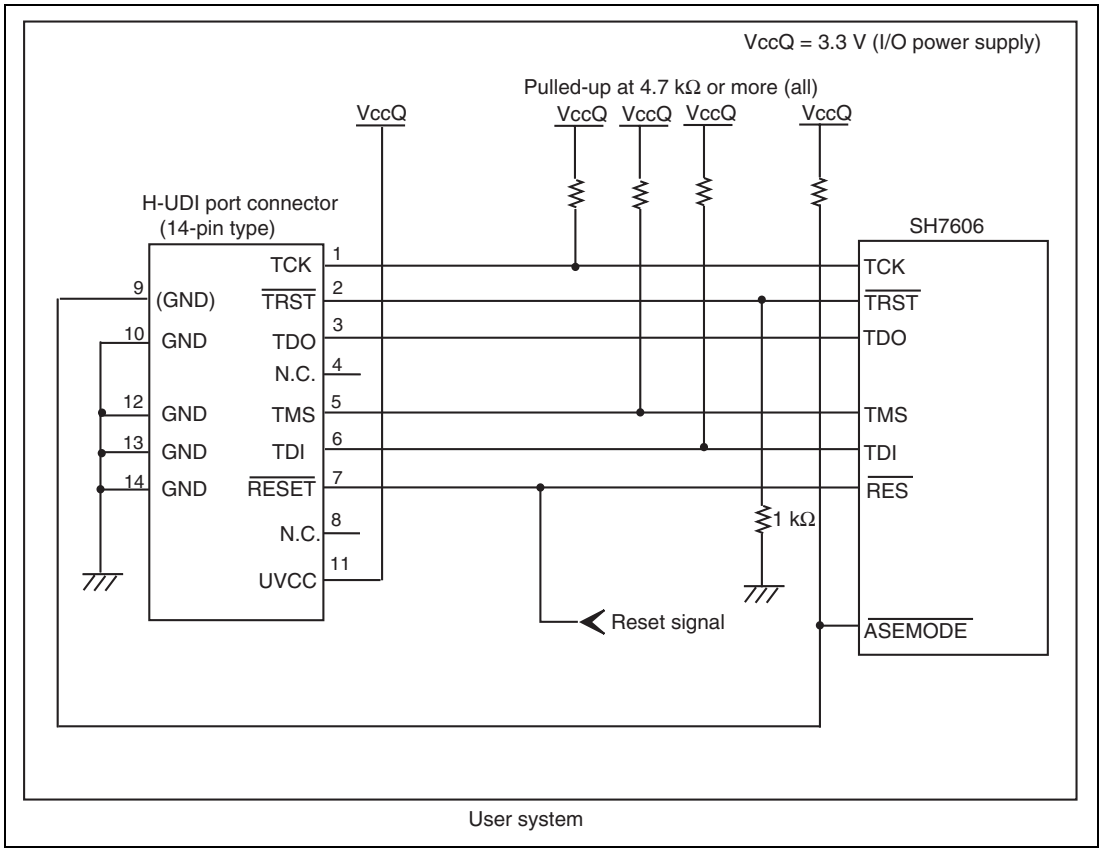


Figure 1.2 Recommended Circuit for Connection between the H-UDI Port Connector and MPU when the Emulator is in Use

Section 2 Specifications of the Software when Using the SH7606

2.1 Differences between the SH7606 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 SH7606 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

Register	Emulator at Link Up
R0 to R14	H'00000000
R15 (SP)	SP in the vector address
PC	PC in the vector address
SR	H'000000F0
GBR	H'00000000
VBR	H'00000000
MACH	H'00000000
MACL	H'00000000
PR	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 SH7606 has sleep and standby states.
   The sleep and standby states are switched using the SLEEP instruction. When the emulator is used, only the sleep state can be cleared with either the normal clearing function or with the [STOP] button, and a break will occur.

Note: The memory must not be accessed or modified in sleep state.

4. Reset Signals

   The SH7606 reset signals are only valid during emulation started with clicking the GO or STEP-type button. If these signals are input from the user system in command input wait state, they are not sent to the SH7606.

Note: Do not break the user program when the /RES or /WAIT signal is being low. A TIMEOUT error will occur. If the /WAIT signal is fixed to low during break, a TIMEOUT error will occur at memory access.

5. 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)
   OS: Windows® 2000
   JTAG clock: 5 MHz (TCK clock)

   When a one-byte memory is read from the command-line window, the stopping time will be about 40 ms.

6. 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 SuperH™ Family E10A-USB 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.

7. 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.

8. UBC

   When [User] is specified in the [UBC mode] list box in the [Configuration] dialog box, the UBC can be used in the user program.
   Do not use the UBC in the user program as it is used by the emulator when [EML] is specified in the [UBC mode] list box of the [Configuration] dialog box.

9. Loading Sessions

   Information in [JTAG clock] of the [Configuration] dialog box cannot be recovered by loading sessions. Thus the TCK value will be 2.5 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.

2.2 Specific Functions for the Emulator when Using the SH7606

The SH7606 does not support the following functions:

- MMU-related functions (The SH7606 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
- Profiler function
- Performance measurement function
- AUD trace function

2.2.1 Break Condition Functions

In the emulator, three break conditions can be set (Break Condition 1,2,3). Table 2.3 lists the items that can be specified for each.

Table 2.3 Types of Break Conditions

Break Condition Type	Description
Address bus condition (Address)	Breaks when the SH7606 address bus value or the program counter value matches the specified value.
Data bus condition (Data)	Breaks when the SH7606 data bus value matches the specified value. Byte, word, or longword can be specified as the access data size.
Bus state condition (Bus State)	There are two bus state condition settings: Read/Write condition: Breaks when the SH7606 RD or RDWR signal level matches the specified condition. Bus state condition: Breaks when the operating state in an SH7606 bus cycle matches the specified condition. Types of buses that can be specified are listed below. • L-bus (CPU-ALL): Indicates an instruction fetch and data access, including a hit to the cache memory. • L-bus (CPU-Data): Indicates a data access by the CPU, including a hit to the cache memory. • I-bus (CPU.DMA): Indicates a CPU cycle when the cache memory is not hit, and a data access by the DMA.
Internal I/O break condition	Breaks when the SH7606 accesses the internal I/O.
Count	Breaks when the conditions set are satisfied the specified number of times.

Note: When U-RAM is accessed from the P0 space, the I-bus must be selected, and when accessed from the P2 space, the L-bus must be selected. When cache fill cycle is acquired, the I-bus must be selected.

Table 2.4 lists the combinations of conditions that can be set under Break Condition 1,2,3.

Table 2.4 Dialog Boxes for Setting Break Conditions

	Type				
Dialog Box	**Address Bus Condition (Address)**	**Data Bus Condition (Data)**	**Bus State Condition (Bus Status)**	**Count Condition (Count)**	**Internal I/O Break**
[Break Condition 1] dialog box	O	O	O	O	X
[Break Condition 2] dialog box	O	X	O	X	X
[Break Condition 3] dialog box	X	X	X	X	O

Note: O: Can be set in the dialog box.
X: Cannot be set in the dialog box.

2.2.2 Trace Functions

When the SH7606 is used, the trace functions listed in table 2.5 can be used.

Table 2.5 Trace Functions

Function	**Internal Trace**
Branch trace	Supported (four branches)
Range memory access trace	Not supported
Software trace	Not supported

Internal Trace Function: This function is activated by selecting the [Internal trace] radio button in the [Trace type] group box of the [Trace mode] page. This function traces and displays the branch instructions. The branch source address and branch destination address for the four latest branch instructions are displayed.

Notes: 1. If an interrupt is generated at the program execution start or end, including a step execution, the emulator address may be acquired. In such a case, the following message will be displayed. Ignore this address because it is not a user program address.

*** EML ***

2. If a completion-type exception occurs during exception branch acquisition, the next address to the address in which an exception occurs is acquired.

3. Trace information cannot be acquired for the following branch instructions:
   - The BF and BT instructions whose displacement value is 0
   - Branch to H'A0000000 by reset
4. When [User] is specified in the [UBC mode] list box in the [Configuration] window, the internal trace is not acquired. In this case, exit the [Trace] window.
5. When the SH7606 is used, the source code cannot be displayed on the [Trace] window.

2.2.3 Note on Using the JTAG Clock (TCK)

Set the JTAG clock (TCK) frequency to lower than the frequency of the SH7606 peripheral module clock (CKP).

The set value of the JTAG clock (TCK) is initialized by executing [Reset CPU] or [Reset Go].

2.2.4 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 of the specified address. Accordingly, it can be set only to the RAM areas in CS0 to CS6 and the internal RAM areas. However, a BREAKPOINT cannot be set to the following addresses:
   - ROM areas in CS0 to CS6
   - Areas other than the internal RAM
   - Areas other than CS0 to CS6
   - A slot instruction of a delayed branch instruction
3. During step operation, BREAKPOINTs are disabled.
4. Conditions set at Break Condition 2 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 2 is satisfied.
5. When execution resumes from the address where a BREAKPOINT is specified, single-step operation is performed at the address and execution is continued from the next PC value. Therefore, realtime operation cannot be performed.
6. When a BREAKPOINT is set to the slot instruction of a delayed branch instruction, the PC value becomes an illegal value. Accordingly, do not set a BREAKPOINT to the slot instruction of a delayed branch instruction.
7. 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.

8. 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.

2.2.5 Notes on Setting the [Break Condition] Dialog Box and BREAKCONDITION_SET Command

1. When [Go to cursor], [Step In], [Step Over], or [Step Out] is selected, the settings of Break Condition 2 are disabled.
2. Break Condition 2 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 2.
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. Note that a break occurs with a break satisfaction condition by an instruction that has been cancelled due to the generation of an exception.
6. Use the sequential break or count break with the L-bus condition. If such break is used with the I-bus condition, it will not operate correctly.
7. A break will not occur with the execution counts specified on the execution of the multi-step instruction.

2.2.6 Note on Setting the UBC_MODE Command

In the [Configuration] dialog box, if [User] is set while the [UBC mode] list box has been set, the STEP-type commands that use Break Condition 2 for implementation cannot be used.

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Colophon 4.0

SuperH™ Family E10A-USB Emulator
Additional Document for User's Manual Supplementary Information on Using the SH7606

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