

To our customers,

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April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

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SH7018 Series TFP-100B  
User System Interface Cable  
(HS7018EWN61H) for E6000 Emulator  
User's Manual

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## READ FIRST

- **READ** this user's manual before using this user system interface cable.
- **KEEP** the user's manual handy for future reference.

**Do not attempt to use the user system interface cable until you fully understand its mechanism.**

### **User System Interface Cable:**

Throughout this document, the term "user system interface cable" shall be defined as the following product produced only by Hitachi, Ltd. excluding all subsidiary products.

- User system interface cable (HS7018EWN61H)

The user system or a host computer is not included in this definition.

### **Purpose of the User System Interface Cable:**

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### **Target User of the User System Interface Cable:**

This user system interface cable should only be used by those who have carefully read and thoroughly understood the information and restrictions contained in the user's manual. Do not attempt to use the user system interface cable until you fully understand its mechanism.

It is highly recommended that first-time users be instructed by users that are well versed in the operation of the user system interface cable.

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## **Figures:**

Some figures in this user's manual may show items different from your actual system.

## **Limited Anticipation of Danger:**

Hitachi cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this user's manual and on the user system interface cable are therefore not all inclusive. Therefore, you must use the user system interface cable safely at your own risk.

# SAFETY PAGE

## READ FIRST

- **READ** this user's manual before using this user system interface cable.
- **KEEP** the user's manual handy for future reference.

Do not attempt to use the user system interface cable until you fully understand its mechanism.

## DEFINITION OF SIGNAL WORDS



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.



**DANGER** indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



**WARNING** indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



**CAUTION** indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.



**CAUTION** used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

**NOTE** emphasizes essential information.

# **WARNING**

**Observe the precautions listed below. Failure to do so will result in a FIRE HAZARD and will damage the user system and the emulator product or will result in PERSONAL INJURY. The USER PROGRAM will be LOST.**

- 1. Do not repair or remodel the emulator product by yourself for electric shock prevention and quality assurance.**
- 2. Always switch OFF the E6000 emulator and user system before connecting or disconnecting any CABLES or PARTS.**
- 3. Always before connecting any CABLES, make sure that pin 1 on both sides are correctly aligned.**
- 4. If cables are connected incorrectly, the power pins will be short circuited in the following way:**

90° rotation	180° rotation	270° rotation
25 (Vss) — 100 (Vcc)	15 (Vcc) — 65 (Vss)	30 (Vcc) — 55 (Pvcc)
55 (Pvcc) — 30 (Vcc)	39 (Vcc) — 89 (Vss)	74 (Vcc) — 99 (Avcc)
99 (Avcc) — 74 (Vcc)		100 (Vcc) — 25 (Vss)

# Preface

Thank you for purchasing this user system interface cable (HS7018EWN61H) for the Hitachi's original microcomputer SH7018 series.

The HS7018EWN61H is a user system interface cable that connects an SH7010 series E6000 emulator (HS7010EPI60H; hereinafter referred to as the emulator) to the IC socket for a TFP-100B package for the SH7018 series MCU on the user system.

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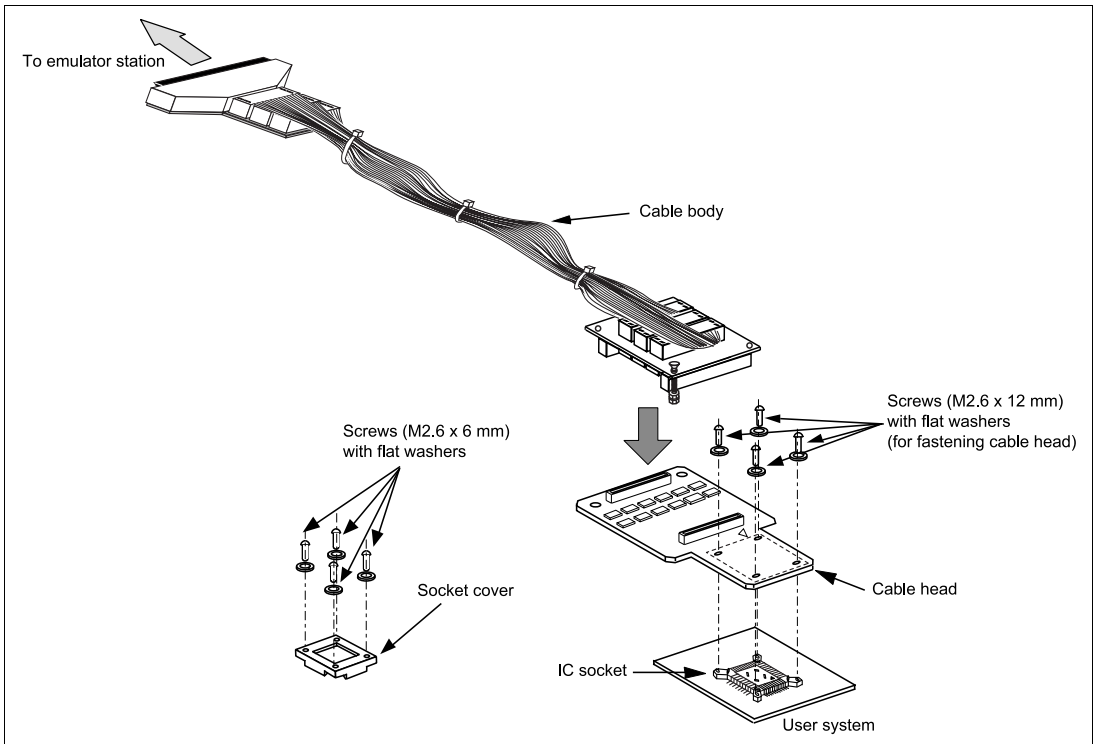
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## Section 1 Configuration

# CAUTION

**Use an IC149-100-054-B51 socket (manufactured by YAMAICHI ELECTRONICS Co., Ltd.) for the TFP-100B package IC socket on the user system.**

Figure 1 shows the configuration of the HS7018EWN61H user system interface cable for the TFP-100B package.



**Figure 1 HS7018EWN61H User System Interface Cable**

Table 1 lists the HS7018EWN61H components. Please make sure you have all of these components when unpacking.

**Table 1 HS7018EWN61H Components**

<b>No.</b>	<b>Component</b>	<b>Quantity</b>	<b>Remarks</b>
1	Cable body	1	
2	Cable head	1	
3	IC socket	1	For the TFP-100B package
4	Socket cover	1	For installing a TFP-100B-packaged MCU
5	Screws (M2.6 x 12 mm)	4	For fastening cable head (with four flat washers)
6	Screws (M2.6 x 6 mm)	4	For installing a TFP-100B-packaged MCU (with four flat washers)
7	Documentation	1	User's manual for HS7018EWN61H (this manual)

## Section 2 Environmental Conditions

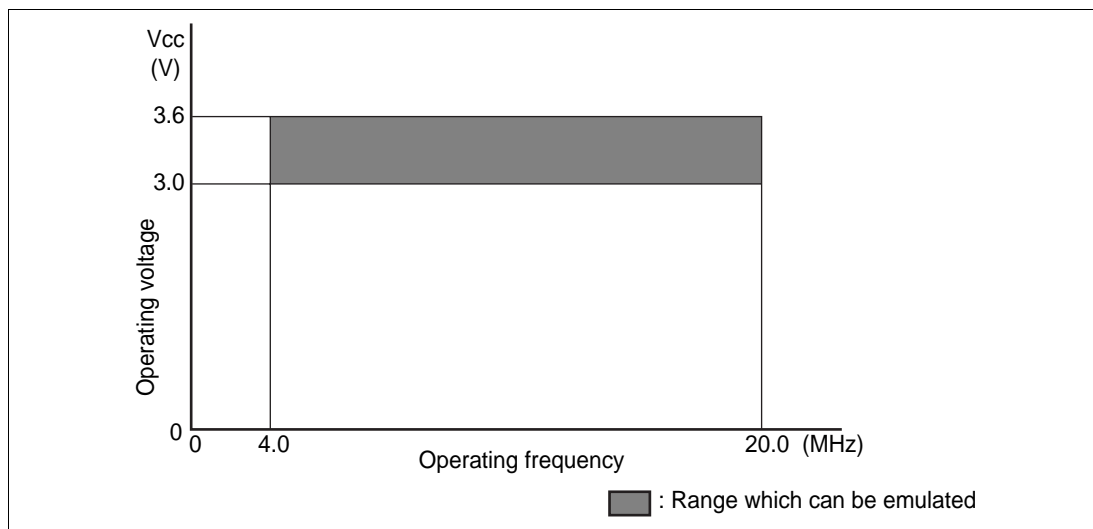
Maintain the conditions in table 2 when using the emulator.

**Table 2 Environmental Conditions**

Item	Specifications
Temperature	Operating: +10 to +35°C Storage: -10 to +35°C
Humidity	Operating: 35 to 80% RH, no condensation Storage: 35 to 80% RH, no condensation
Vibration	Operating: 2.45 m/s max. Storage: 4.9 m/s max. Transportation: 14.7 m/s max.
Ambient gases	There must be no corrosive gases present.

### 2.1 Setting Operating Voltage and Operating Frequency

Connecting the user system interface cable to the SH7010 series E6000 emulator enables emulation to be done using the user system operating voltage ( $V_{cc}$ : 3.0 to 3.6 V) Before determining the operating voltage and frequency of the user system, confirm the allowable range.



**Figure 2 Allowable Operating Range**



## Section 3 Product Specifications

The specifications of this product are shown in table 3.

**Table 3 Product Specifications**

<b>Item</b>	<b>Specifications</b>
Target processor	SH7018F
Package	TFP-100B
Function	Level limitation: This function keeps the output signal from 5-V emulator system equal to or less than power supply voltage of the user system (Vcc).
User-system operating conditions	Power supply voltage Vcc: 3.0 to 3.6 V, Pvc: 4.5 to 5.5 V A drop in the Vcc level of the user system is detected when the power supply voltage drops to 2.5 V or less.
Current consumption	Maximum of 50 mA.

### **Drop in Vcc Level Detection Function:**

When the user system interface cable is used, a drop is detected as follows:

When the power supply voltage (UVcc) of the user system is 2.5 V or less or when the power supply voltage (PVcc) for I/O circuits is 4.1 V or less, the Hitachi Debugging Interface (HDI) will detect a Vcc drop. In this case, a sufficient voltage may not be supplied to the user system; ensure that the specified voltage is supplied.

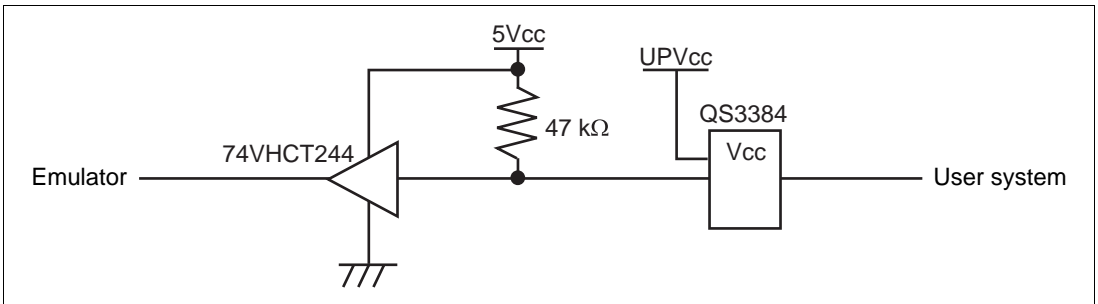
## Section 4 User Interface Specifications

The user system interface cable incorporates a level conversion circuit supporting a low-voltage circuit. Accordingly, when connecting the user system to the emulator, pay attention to the signal delays and the number of FANINs and FANOUTs.

### 4.1 User System Interface Circuit

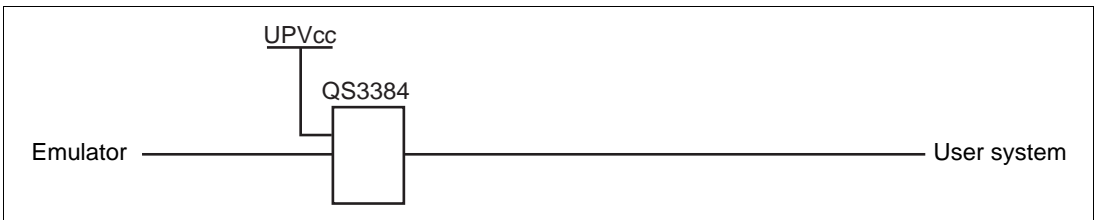
The user system interface circuit of the user system interface cable is shown below.

(1) NMI and  $\overline{\text{RES}}$



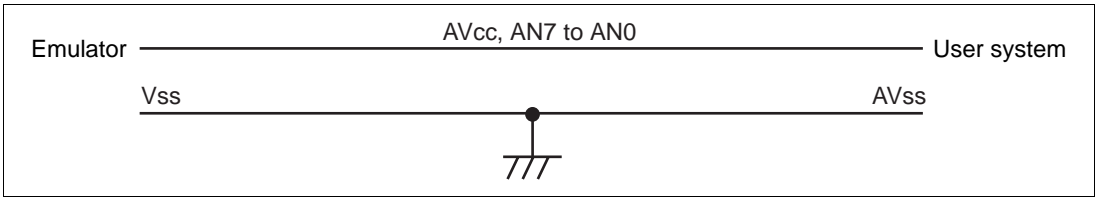
**Figure 3** User System Interface Circuit for NMI and  $\overline{\text{RES}}$

(2) PB8, PA5 to PA2, PD7 to PD0, PE2, and PE0



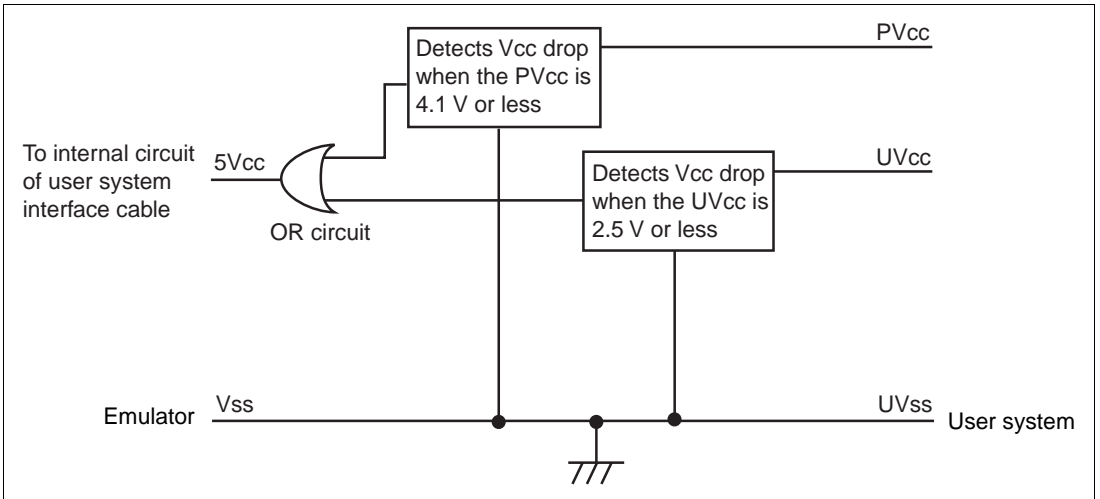
**Figure 4** User System Interface Circuit for PB8, PA5 to PA2, PD7 to PD0, PE2, and PE0

(3) AVcc, AVss, and AN7 to AN0



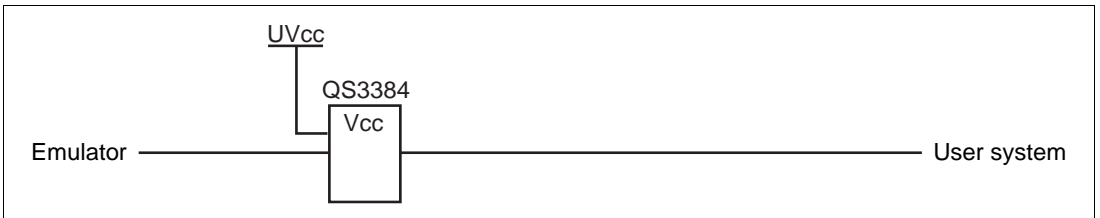
**Figure 5 User System Interface Circuit for AVcc, AVss, and AN7 to AN0**

(4) PVcc, Vcc and Vss



**Figure 6 User System Interface Circuit for Vcc and Vss**

(5) Other digital signals



**Figure 7 User System Interface Circuit for Other Digital Signals**

Note: 5Vcc, Uvcc, and Uvss represent Vcc and Vss on a user system. 5Vcc represents Vcc (5 V) generated in the user system interface cable.

## Section 5 Notes on Emulation

This user system interface cable supports the SH7018F. The following settings must be made prior to emulation.

### 5.1 Setting Internal ROM

Set 32 kbytes for internal ROM size. Even when 32 kbytes is set for this emulator, a 256-kbytes area is effective. However, since the flash memory capacity of the SH7018 is 160 kbytes, programming must be performed so that the 160-kbytes capacity is not exceeded.

### 5.2 Setting Pin Function Controller

Since the initial register values when the emulator is used differ from those of the SH7018F, as shown in table 4, the initial settings must be made by the user program.

**Table 4 Pin Function Controller Settings**

Register name	Symbol	Address	Initial Value when Emulator is Used	Initial Value for SH7018F
Port A control register L2	PACRL2	H'FFFF838E H'FFFF838F	H'0140	H'0000
Port B control register 1	PBCR1	H'FFFF8398 H'FFFF8399	H'000A	H'0000
Port B control register 2	PBCR2	H'FFFF839A H'FFFF839B	H'A000	H'0000

Note that the initial values of the pin function for the emulator differ from those of the SH7018F, as shown in table 5 (initial values are shaded).

**Table 4 Pin Function Controller Settings**

Pin No.	Emulator	SH7018F
28	PB6/IRQ4/A18/BACK	<del>PB6</del> /A18
29	PB7/IRQ5/A19/BREQ	<del>PB7</del> /A19
31	PB9/IRQ7/A21/ADTRQ	<del>PB9</del> /IRQ7/A21
46	PB8/IRQ6/A20/WAIT	<del>PB8</del> /IRQ6/A20/WAIT
48	PA4/TXD1	<del>PA4</del> /TXD1
49	PA3/RXD1	<del>PA3</del> /RXD1

## Section 6 Connection Procedures

### 6.1 Connecting User System Interface Cable to Emulator Station

#### **WARNING**

**Observe the precautions listed below. Failure to do so will result in a FIRE HAZARD and will damage the user system and the emulator product or will result in PERSONAL INJURY. The USER PROGRAM will be LOST.**

- 1. Always switch OFF the user system and the emulator product before the USER SYSTEM INTERFACE CABLE is connected to or removed from any part. Before connecting, make sure that pin 1 on both sides are correctly aligned.**
- 2. The user system interface cable dedicated to the emulator must be used.**

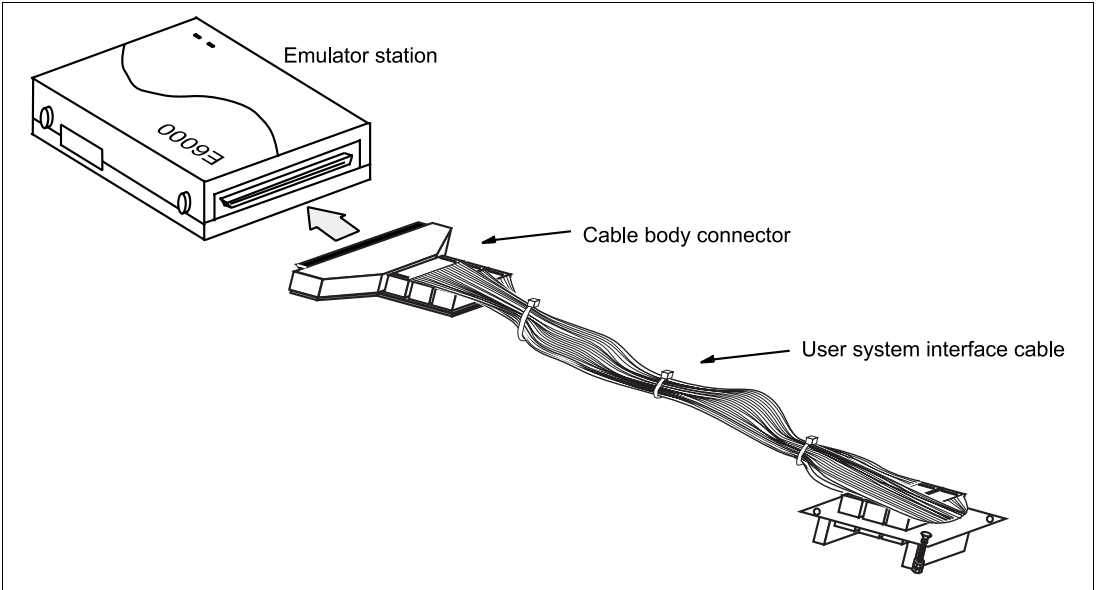
To connect the cable body to the emulator station, follow the instructions below.

1. Make sure the user system and emulator station are turned off.

#### **CAUTION**

**When connecting or removing the user system interface cable, apply force only in the direction suitable for connection or removal, while making sure not to bend or twist the cable or connectors. Otherwise, the connectors will be damaged.**

2. After making sure the direction of the cable body connector is correct, firmly insert the cable body connector into the emulator station socket (figure 8).



**Figure 8 Connecting User System Interface Cable to Emulator Station**

## 6.2 Connecting User System Interface Cable to User System

### **WARNING**

**Always switch OFF the user system and the emulator product before the USER SYSTEM INTERFACE CABLE is connected to or removed from any part. Before connecting, make sure that pin 1 on both sides are correctly aligned. Failure to do so will result in a FIRE HAZARD and will damage the user system and the emulator product or will result in PERSONAL INJURY. The USER PROGRAM will be LOST.**

To connect the cable head to the user system, follow the instructions below.

### 6.2.1 Installing IC Socket

After checking the location of pin 1 on the IC socket, apply epoxy resin adhesive to the bottom of the IC socket for a TFP-100B package, and fasten it to the user system before soldering.

### 6.2.2 Soldering IC Socket

After fastening, solder the IC socket for a TFP-100B package to the user system. Be sure to completely solder the leads so that the solder slopes gently over the leads and forms solder fillets. (Use slightly more solder than the MCU.)



### 6.2.3 Inserting Cable Head

## CAUTION

**Check the location of pin 1 before inserting.  
If the IC socket is not connected properly, the power-supply pins will be shorted as shown below.**

90° rotation	180° rotation	270° rotation
25 (Vss) — 100 (Vcc)	15 (Vcc) — 65 (Vss)	30 (Vcc) — 55 (Pvcc)
55 (Pvcc) — 30 (Vcc)	39 (Vcc) — 89 (Vss)	74 (Vcc) — 99 (Avcc)
99 (Avcc) — 74 (Vcc)		100 (Vcc) — 25 (Vss)

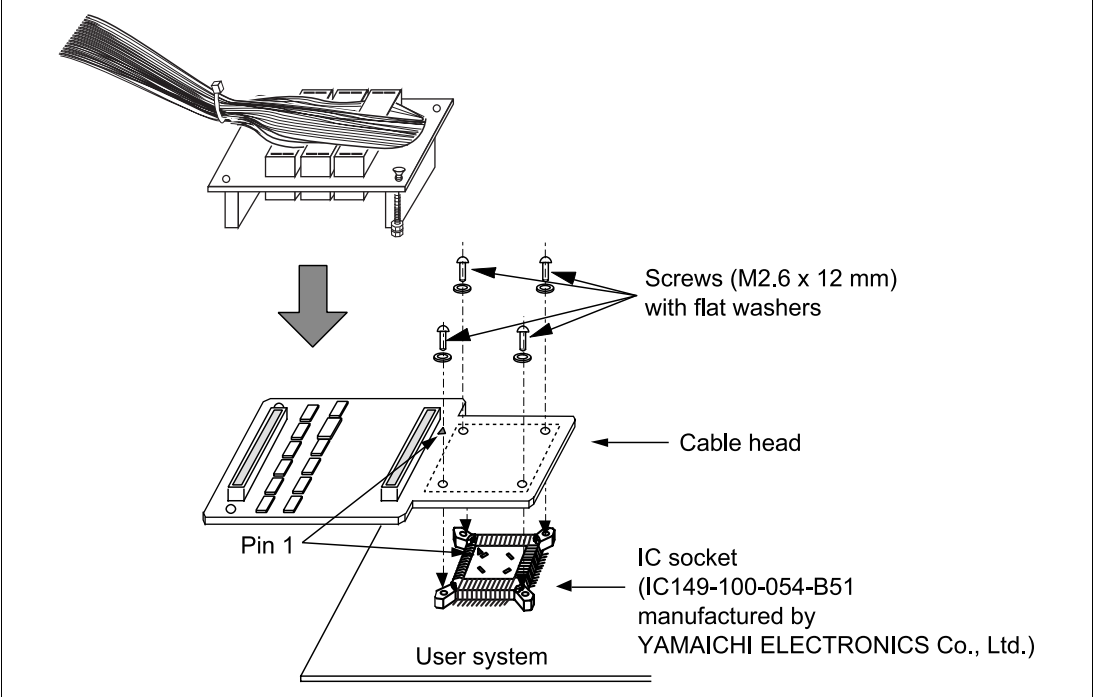
Align pin 1 on the IC socket for a TFP-100B package on the user system with pin 1 on the user system interface cable head, and insert the user system interface cable head into the IC socket on the user system, as shown in figure 9.

### 6.2.4 Fastening Cable Head

## CAUTION

- 1. Use a Philips-type screwdriver whose head matches the screw head.**
- 2. The tightening torque must be 0.294 N•m or less.  
If the applied torque cannot be accurately measured, stop tightening when the force required to turn the screw becomes significantly greater than that needed when first tightening. If a screw is tightened too much, the screw head may break or an IC socket contact error may be caused by a crack in the IC socket solder.**
- 3. If the emulator does not operate correctly, cracks might have occurred in the solder. Check conduction with a tester and re-solder the IC socket if necessary.**

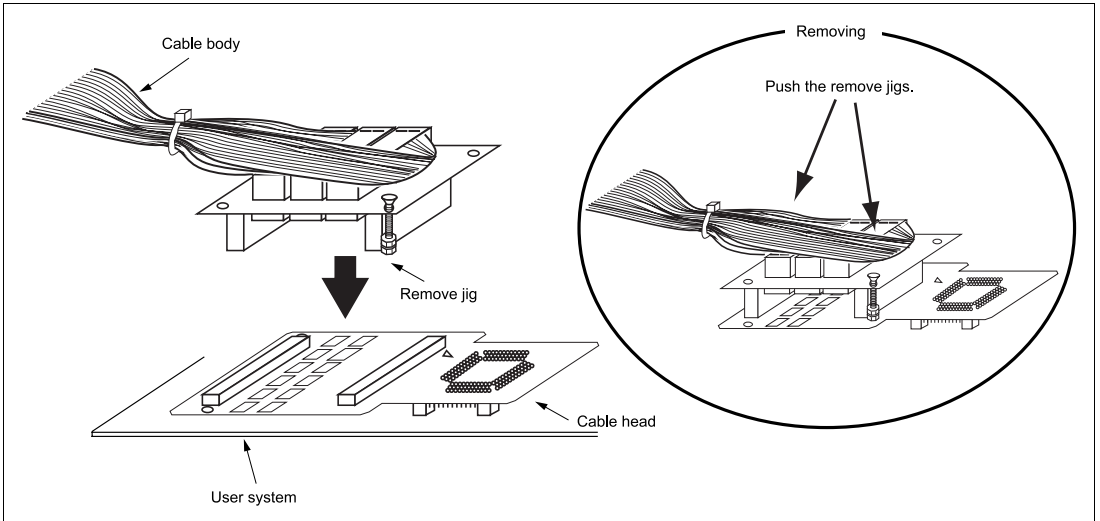
Fasten the user system interface cable head to the IC socket for a TFP-100B package on the user system with the four screws (M2.6 x 12 mm; with four flat washers) provided. Each screw should be tightened a little at a time, alternating between screws on opposing corners. Take special care, such as manually securing the IC socket soldered area, to prevent the soldered IC socket from being damaged by overtightening the screws or twisting the components.



**Figure 9 Connecting User System Interface Cable to User System**

## 6.2.5 Fastening Cable Body

Connect the cable body to the cable head.



**Figure 10 Fastening Cable Body**

### 6.3 Recommended Dimensions for User System Mount Pad

Figure 6 shows the recommended dimensions for the mount pad (footprint) for the user system with an IC socket for a TFP-100B package (IC149-100-054-B51: manufactured by YAMAICHI ELECTRONICS Co., Ltd.). Note that the dimensions in figure 5 are somewhat different from those of the actual chip's mount pad.

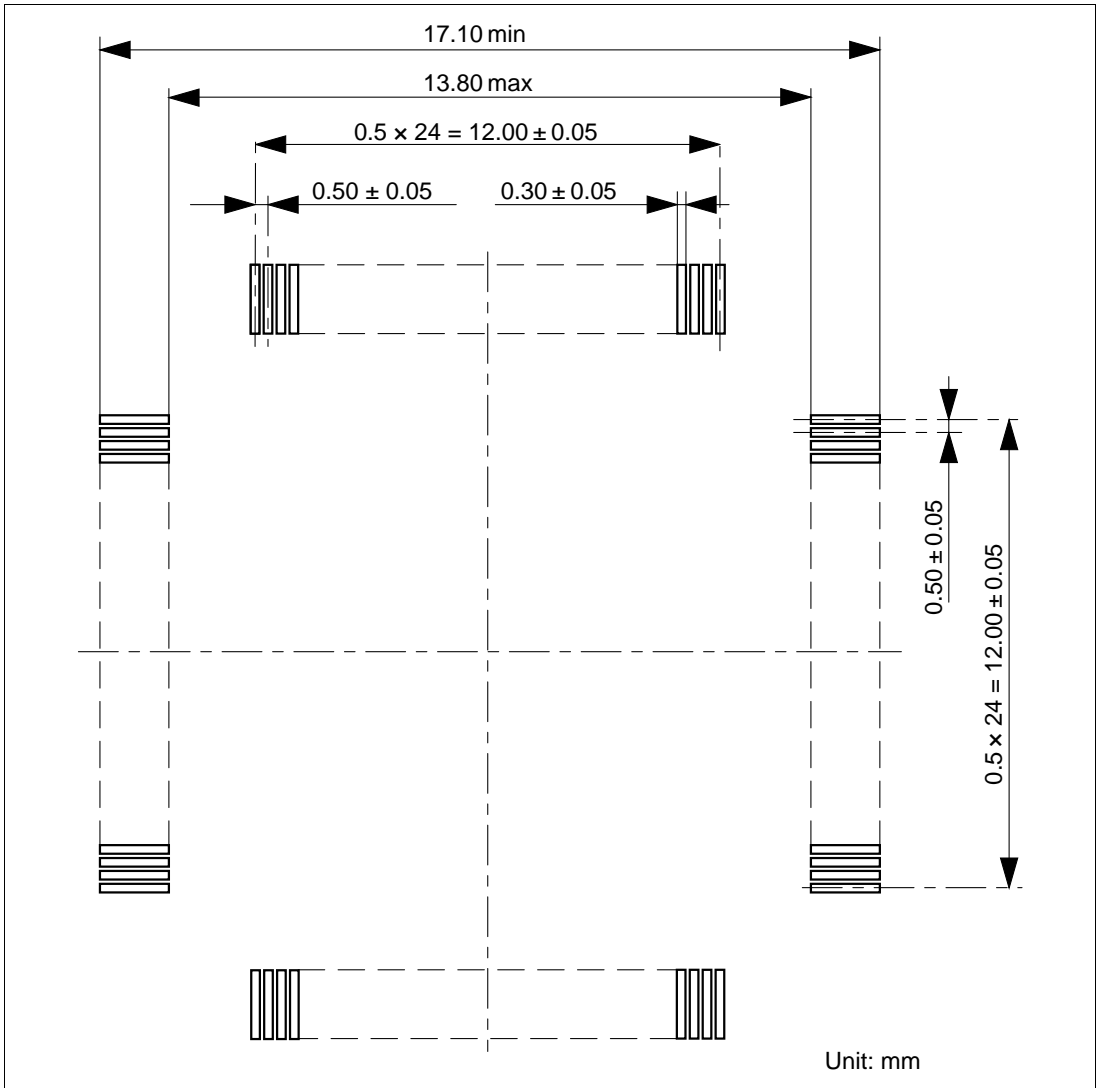
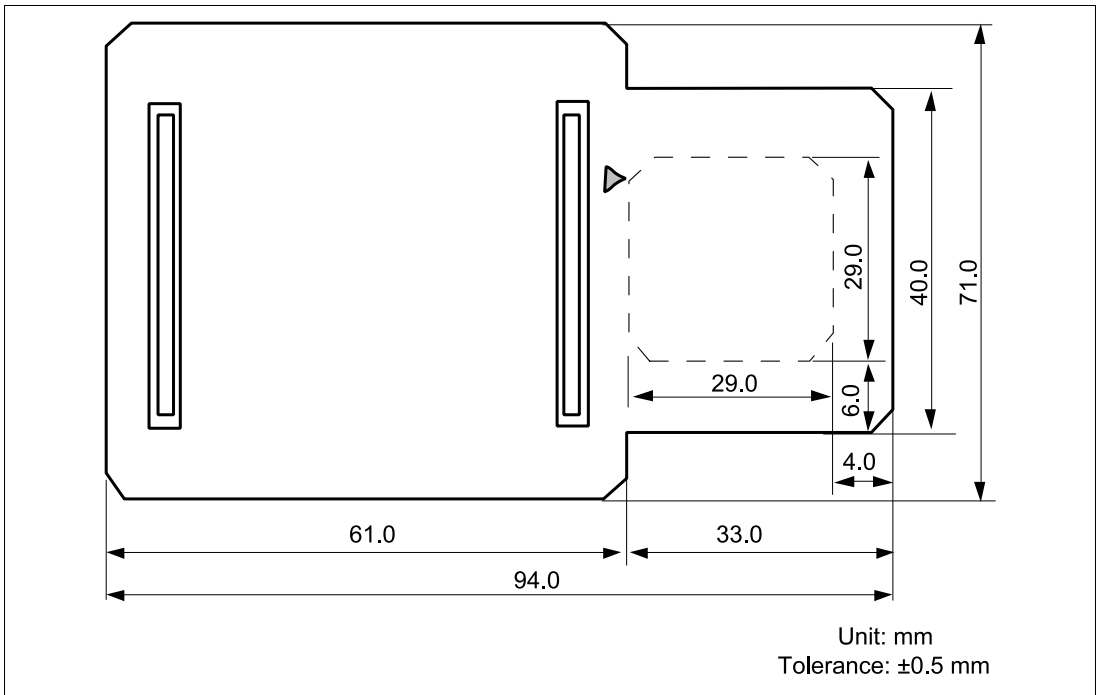


Figure 11 Recommended Dimensions for Mount Pad

## 6.4 Dimensions for User System Interface Cable Head

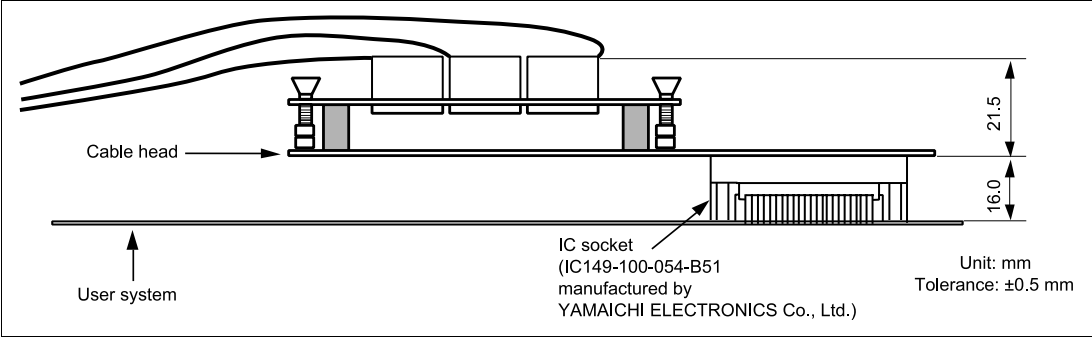
The dimensions for the user system interface cable head are shown in figure 12.



**Figure 12 Dimensions for User System Interface Cable Head**

# 6.5 Resulting Dimensions after Connecting User System Interface Cable

The resulting dimensions, after connecting the user system interface cable head to the user system, are shown in figure 13.



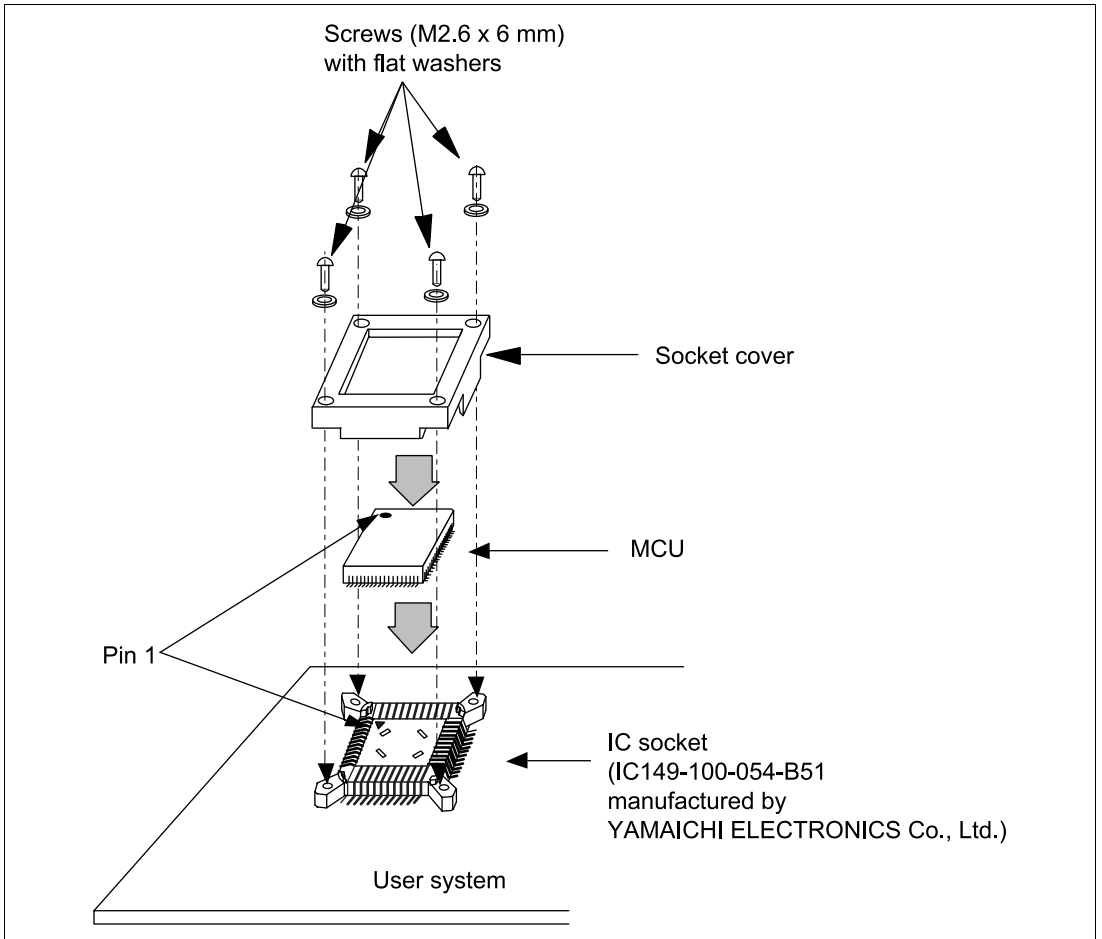
**Figure 13 Resulting Dimensions after Connecting User System Interface Cable**

## Section 7 Installing the MCU to the User System

### **CAUTION**

- 1. Check the location of pin 1 before inserting.**
- 2. Use a Philips-type screwdriver whose head matches the screw head.**
- 3. The tightening torque must be 0.294 N•m or less. If the applied torque cannot be accurately measured, stop tightening when the force required to turn the screw becomes significantly greater than that needed when first tightening. If a screw is tightened too much, the screw head may break or an IC socket contact error may be caused by a crack in the IC socket solder.**
- 4. If the MCU does not operate correctly, cracks might have occurred in the solder. Check conduction with a tester and re-solder the IC socket if necessary.**

Check the location of pin 1 before inserting the MCU into the IC socket on the user system, as shown in figure 14. After inserting the MCU, fasten the socket cover with the provided four screws (M2.6 x 6 mm; with four flat washers). Take special care, such as manually securing the IC socket soldered area, to prevent the IC socket from being damaged by overtightening the screws or twisting the components.



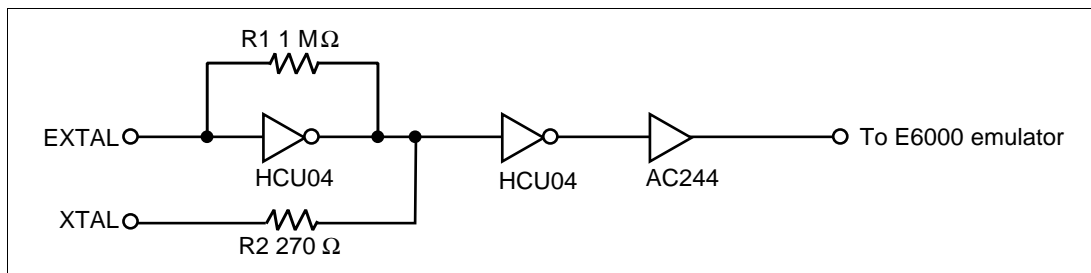
**Figure 14** Installing MCU to User System



## Section 8 Verifying Operation

1. When using the E6000 emulator for the SH series, turn on the emulator according to the procedures described in the SH Series E6000 Emulator User's Manual (HS7000EPI60HE).
2. Verify the user system interface cable connections by accessing the external memory and ports to check the bus states of the pins with the MEMORY\_FILL command (emulator command). If an error is detected, recheck the soldered IC socket and the location of pin 1.
3. The emulator connected to this user system interface cable supports two kinds of clock sources as the MCU clock: an emulator internal clock and an external clock on the user system. For details, refer to the Emulator Supplementary Information (HS7010EPI60HE).
  - To use the emulator internal clock  
Select the clock in the emulator station as the system clock ( $\phi$ ), by using the CLOCK command (emulator command).
  - To use the external clock on the user system  
Select the target clock (Target) as the system clock ( $\phi$ ), by using the CLOCK command (emulator command). Supply the external clock from the user system to the emulator by inputting the external clock from the EXTAL terminal (pin 68) on the cable head (operates at 4 to 20 MHz) or connecting a crystal oscillator to the EXTAL and XTAL terminals (the frequency must be 4 to 20 MHz). For details, refer to section 4, Clock Pulse Generator (CPG), in the SH7010 Series Hardware Manual.

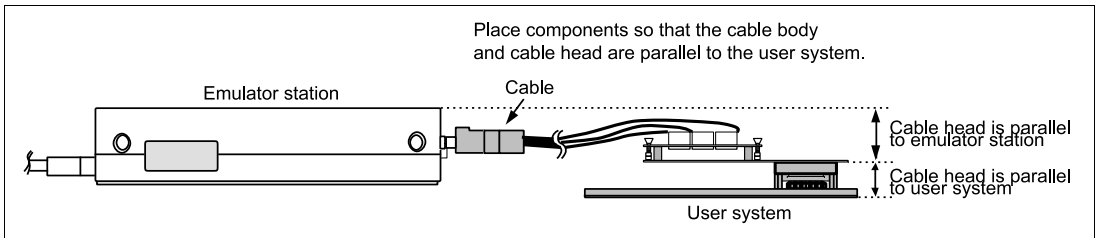
Figure 15 shows the oscillator circuit on the user system interface cable.



**Figure 15 System Clock Oscillator**

## Section 9 Notice

1. Make sure that pin 1 on the user system IC socket is correctly aligned with pin 1 on the cable head before inserting the cable head into the user system IC socket.
2. The dimensions of the recommended mount pad for the user system IC socket are different from those of the MCU.
3. This user system interface cable is specifically designed for the HS7010EPI60H emulator. Do not use this cable with any other emulator station.
4. To prevent breaking of wires in the cable body, do not place heavy or sharp metal objects on the user system interface cable.
5. While the emulator station is connected to the user system with the user system interface cable, force must not be applied to the cable head. Place the emulator station, user system interface cable, and user system as shown in the example in figure 15.



**Figure 16 User System Interface Cable Location Example**