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April 1<sup>st</sup>, 2010  
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April 1, 2003

# SH7410 Evaluation Chip Board (HS7410EBH82H) for the E8000 Emulator User's Manual

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## READ FIRST

- **READ this user's manual before using this evaluation chip board (hereafter referred to as the EV-chip board) for Hitachi microcomputer HD6437410.**
- **KEEP the user's manual handy for future reference.**

**Do not attempt to use the EV-chip board until you fully understand its mechanism.**

### **EV-Chip Board:**

Throughout this document, the term "EV-chip board" shall be defined as the following products produced only by Hitachi, Ltd. excluding all subsidiary products.

- EV-chip board
- Device control board

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

### **Purpose of the EV-Chip Board:**

This EV-chip board is a software and hardware development tool for systems employing the Hitachi microcomputer HD6437410 (hereafter referred to as SH7410). The E8000 emulator and the user system can be connected through the EV-chip board. This EV-chip board must only be used for the above purpose.

### **Improvement Policy:**

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### **Target User of the EV-Chip Board:**

This EV-chip board 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 EV-chip board 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 EV-chip board.

**HITACHI**

## **LIMITED WARRANTY**

Hitachi warrants its EV-chip boards to be manufactured in accordance with published specifications and free from defects in material and/or workmanship. Hitachi, at its option, will repair or replace any EV-chip boards returned intact to the factory, transportation charges prepaid, which Hitachi, upon inspection, determine to be defective in material and/or workmanship. The foregoing shall constitute the sole remedy for any breach of Hitachi's warranty. See the Hitachi warranty booklet for details on the warranty period. This warranty extends only to you, the original Purchaser. It is not transferable to anyone who subsequently purchases the EV-chip board from you. Hitachi is not liable for any claim made by a third party or made by you for a third party.

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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 EV-chip board are therefore not all inclusive. Therefore, you must use the EV-chip board safely at your own risk.

# SAFETY PAGE

## READ FIRST

- **READ** this user's manual before using this EV-chip board.
- **KEEP** the user's manual handy for future reference.

Do not attempt to use the EV-chip board until you fully understand its mechanism.

## DEFINITION OF SIGNAL WORDS

**DANGER** indicates an **imminently** hazardous situation which, **if not avoided**, will result in **DEATH** or **SERIOUS INJURY** to you or other people.

**WARNING** indicates a **potentially** hazardous situation which, **if not avoided**, could result in **DEATH** or **SERIOUS INJURY** to you or other people.

**CAUTION** indicates a hazardous situation which, **if not avoided**, may result in **minor or moderate injury** to you or other people, or may result in **damage to the machine** or **loss of the user program**. It may also be used to alert against unsafe usage.

**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 EV-chip board or will result in **PERSONAL INJURY**. The **USER PROGRAM** will be **LOST**.

1. Always switch **OFF** the emulator and user system before connecting or disconnecting any **CABLES** or **PARTS**.
2. Always before connecting, make sure that pin 1 on both sides is correctly aligned.

## Warnings on EV-Chip Board Usage

Warnings described below apply as long as you use the EV-chip board. Be sure to read and understand the warnings below before using the EV-chip board. Note that these are the main warnings, not the complete list.



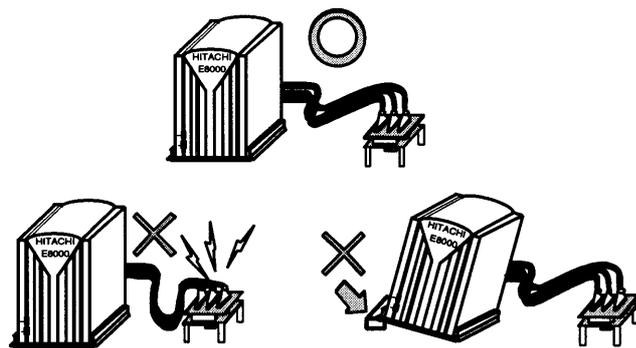
### WARNING

Always switch **OFF** the emulator and user system before connecting or disconnecting any **CABLES** or **PARTS**. Failure to do so will result in a **FIRE HAZARD** and will damage the user system and the EV-chip board or will result in **PERSONAL INJURY**. The **USER PROGRAM** will be **LOST**.



### WARNING

Place the emulator station and EV-chip board so that the cable is not bent or twisted. A bent or twisted cable will impose stress on the user interface leading to connection or contact failure. Make sure that the emulator station is placed in a secure position so that it does not move during use nor impose stress on the user interface.



## Preface

This manual describes how to connect and operate the EV-chip board. The EV-chip board incorporates an evaluation chip for connection to a user system that uses the SH7410 with the E8000 emulator.

Read and understand Sec. 3, "Preparation before Use" of the E8000 Emulator User's Manual before using this EV-chip board.

### **CAUTION**

**The EV-chip board is only for connection to a user system that uses the SH7410 with the E8000 emulator. It cannot be used for user systems that target other devices.**

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## Section 1 Components

### 1.1 EV-Chip Board Components

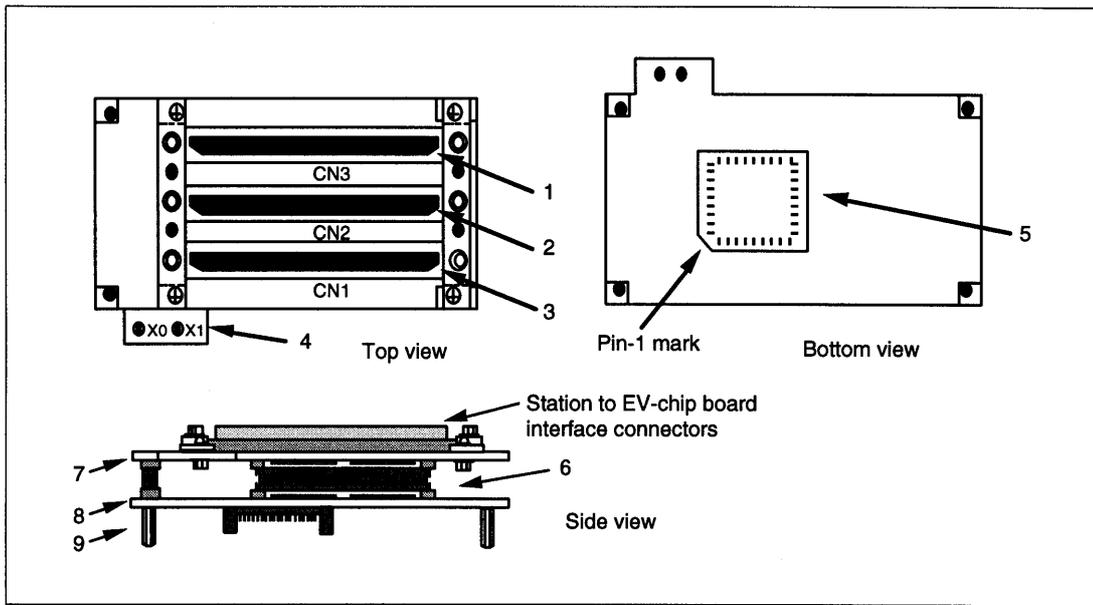
Table 1.1 lists the product components of the EV-chip board (HS7410EBH82H: 176-pin QFP IC socket type). Check all the components after unpacking. If any components are missing, contact the Hitachi salesperson who sold this EV-chip board.

**Table 1.1 EV-chip Board Components**

<b>Item</b>	<b>Quantity</b>	<b>Remarks</b>
EV-chip board (HS7410EBH82H)	1	Consists of two boards. <ul style="list-style-type: none"><li>• HS7410PWB20H (for connecting to the E8000 station)</li><li>• HS7410PWB30H (IC socket QFP-176)</li></ul>
IC socket	1	NQPACK176SD manufactured by TOKYO ELETECH CORPORATION
IC socket cover	1	HQPACK176SD manufactured by TOKYO ELETECH CORPORATION. For mounting the SH7410.
Screws (for the IC socket)	4	M2 x 6 mm for mounting the MCU
Screws (for the IC socket)	4	M2 x 10 mm for attaching the EV-chip board
Spacers	4	13 mm for attaching the EV-chip board.
Screws (for the spacers)	4	M3 x 6 mm for attaching the EV-chip board. Four flat washers and four spring washers
Guide pins	3	For positioning the IC socket
Specific screwdriver	1	Screwdriver for fixing the IC socket
Nuts	4	

## 1.2 Component Names

The component names of the EV-chip board are described below.



**Figure 1.1 EV-Chip Board**

- |  |  |
|--|--|
| 1. Station to EV-chip board interface connector CN3: | For trace cable 3 which connects the E8000 station to the EV-chip board.         |
| 2. Station to EV-chip board interface connector CN2: | For trace cable 2 which connects the E8000 station to the EV-chip board.         |
| 3. Station to EV-chip board interface connector CN1: | For trace cable 1 which connects the E8000 station to the EV-chip board.         |
| 4. Crystal oscillator terminals:                     | For installing a crystal oscillator to be used as a clock source for the SH7410. |
| 5. User-system connector:                            | For connecting the user system.  |
| 6. Board connector:                                  | For connecting HS7410PWB20H and HS7410PWB30H.                                    |
| 7. HS7410PWB20H:                                     | Includes connectors for interfacing with the E8000 station.                      |
| 8. HS7410PWB30H:                                     | Includes connectors for interfacing with the user system.                        |
| 9. Spacer  |  |

## Section 2 Preparation before Use

### 2.1 Preparing the User System

Table 2.1 lists the user interface pin assignment of the 176-pin QFP IC socket (NQPACK176SD manufactured by TOKYO ELETECH CORPORATION) when the target MCU is the SH7410.

**Table 2.1 Pin Assignment of the 176-Pin QFP IC Socket**

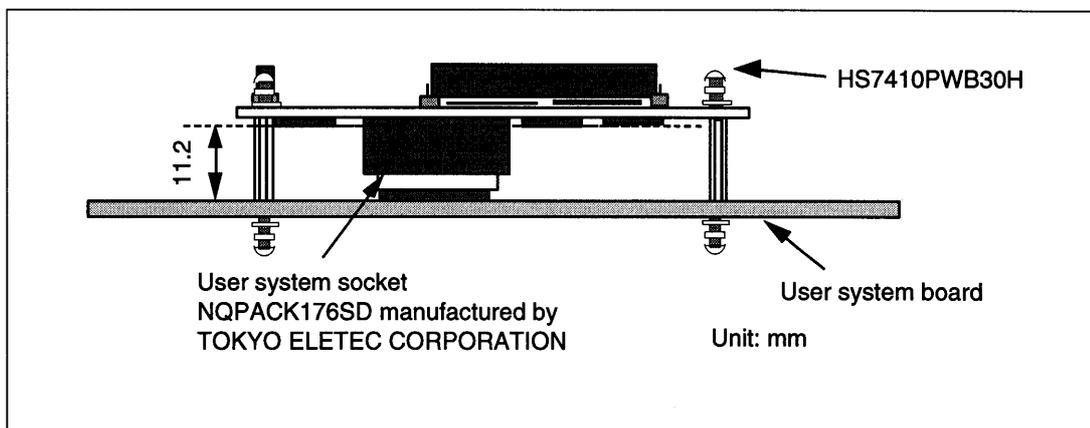
Pin No.	Pin Name	Pin No.	Pin Name	Pin	Pin Name
1	SCK0	32	ASEMD0	63	GND15
2	TXD0/PB9	33	GND17	64	GND14
3	RXD0/PB10	34	GND	65	CAS 2N
4	SCK1/PB11	35	MD4	66	VCC15
5	TXD1/PB12	36	MD3	67	VCC14
6	GND20	37	MD2	68	CAS 3N
7	RXD1/PB13	38	MD1	69	A0
8	VCC20	39	MD0	70	A1
9	STS0/PB14	40	DREQ0N	71	A2
10	STCK0/PB15	41	DREQ1N	72	A3
11	STxD0/PA0	42	DACK0	73	A4
12	SRS0/PA1	43	DACK1	74	GND13
13	SRCK0/PA2	44	IVECFN	75	A5
14	SRxD0/PA3	45	BREQN	76	VCC13
15	STS1/PA4	46	BACKN	77	A6
16	STCK1/PA5	47	WE0N	78	A7
17	VCC19	48	WE1N	79	A8
18	STXD1/PA6	49	WE2N	80	A9
19	GND19	50	GND16	81	A10
20	SRS1/PA7	51	WE3N	82	A11
21	SRCK1/PA8	52	VCC16	83	VCC12
22	VCC18	53	RDN	84	A12
23	SRXD1/PA9	54	WAITN	85	GND12
24	STS2/PA10	55	CS0N	86	A13
25	GND18	56	CS1N	87	A14
26	STCK2/PA11	57	CS2N/RAS2N	88	A15
27	STXD2/PA12	58	CS3N/RAS3N/CEN	89	A16
28	SRS2/PA13	59	RDWR	90	A17
29	SRCK2/PA14	60	BSN	91	A18
30	SRXD2/PA15	61	CAS0N/RFSHN	92	VCC11
31	VCC17	62	CAS1N	93	A19

**Table 2.1 Pin Assignment of the 176-Pin QFP IC Socket (cont)**

Pin No.	Pin Name	Pin No.	Pin Name	Pin No.	Pin Name
94	GND11	122	D31	150	D9
95	A20	123	D30	151	D8
96	A21	124	D29	152	D7
97	A22	125	D28	153	VCC4
98	A23	126	D27	154	VCC3
99	TDO	127	VCC7	155	D6
100	VCC10	128	D26	156	GND4
101	TDI	129	GND7	157	GND3
102	GND10	130	D25	158	D5
103	TMS	131	D24	159	D4
104	PLLGNL	132	D23	160	D3
105	PLLCAP	133	D22	161	D2
106	PLLVCC	134	D21	162	D1
107	EXTAL	135	D20	163	VCC2
108	XTAL	136	VCC6	164	D0
109	TRSTN	137	D19	165	GND2
110	VCC9	138	GND6	166	FTI0/FTOB0/PB0
111	VCC8	139	D18	167	FTOA0/PB1
112	TCK	140	D17	168	FTC0/PB2
113	GND9	141	D16	169	FTI1/PB3/FTOB1
114	GND8	142	D15	170	VCC1
115	CLK	143	D14	171	FTOA1/PB4
116	NMI	144	D13	172	GND1
117	RSTN	145	VCC5	173	FTC1/PB5
118	IRQ0	146	D12	174	FTI2/PB6/FTOB2
119	IRQ1	147	GND5	175	FTOA2/PB7
120	IRQ2	148	D11	176	FTC2/PB8
121	IRQ3	149	D10		



Comply with the user system component height restriction shown in Figure 2.2 within the external frame of the EV-chip board shown in Figure 2.1.



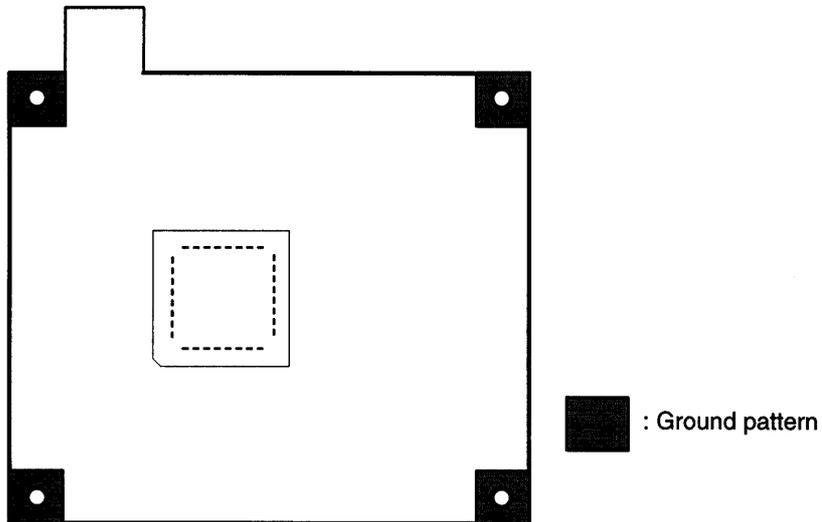
**Figure 2.2 Component Height Restriction**



## WARNING

The screw holes of the EV-chip board for attaching the board are connected to the GND of the board. Confirm that the spacers, nuts, or washers of the EV-chip board do not make contact with the patterns or components other than the GND on the user system.

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



Bottom view of the HS7410PWB30H

## Section 3 Connecting the EV-Chip Board to the User System

### 3.1 Connecting the HS7410PWB30H to the User System

#### 3.1.1 Installing the QFP-176 Package IC Socket

This EV-chip board is designed exclusively for the supplied IC socket (type number: NQPACK176SD) manufactured by TOKYO ELETECH CORPORATION. Therefore, it cannot be used with other IC sockets.

- Positioning the IC socket

Position the IC socket with the supplied guide pins, as shown in figure 3.1. Apply an epoxy adhesive to the tips of the four protrusions on the bottom surface of the IC socket to bond the IC socket to the user system board.

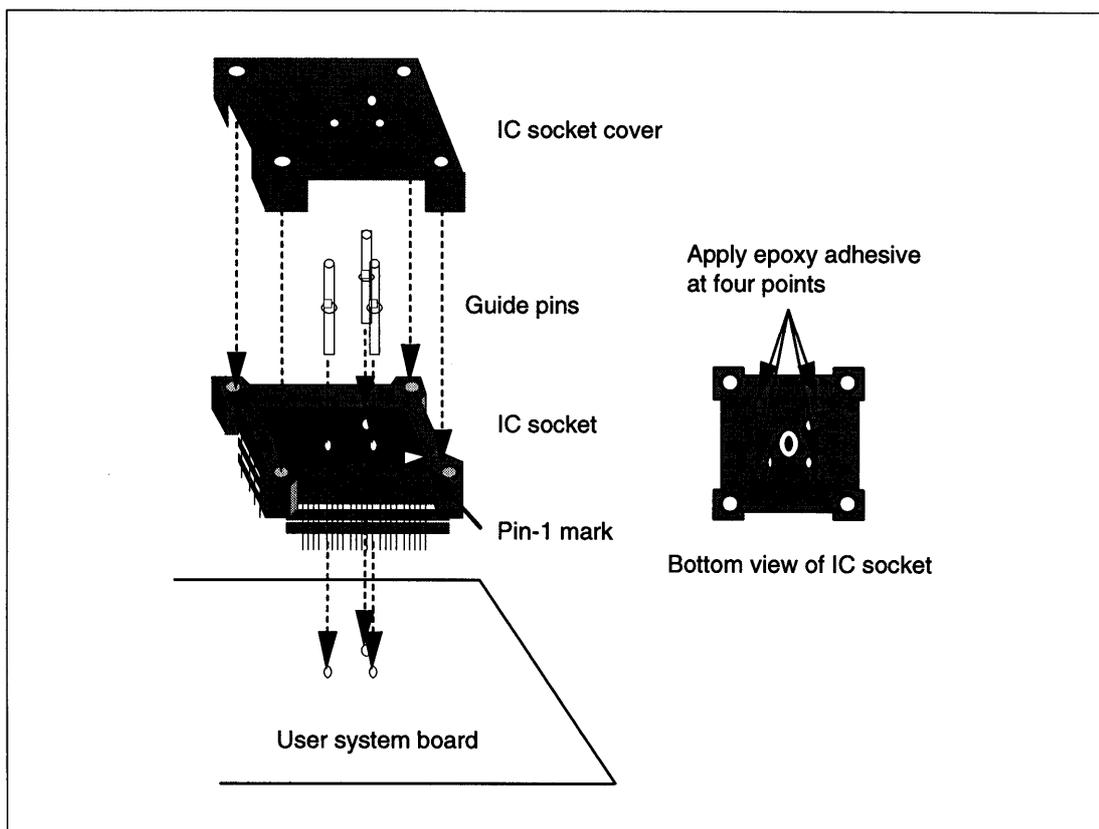


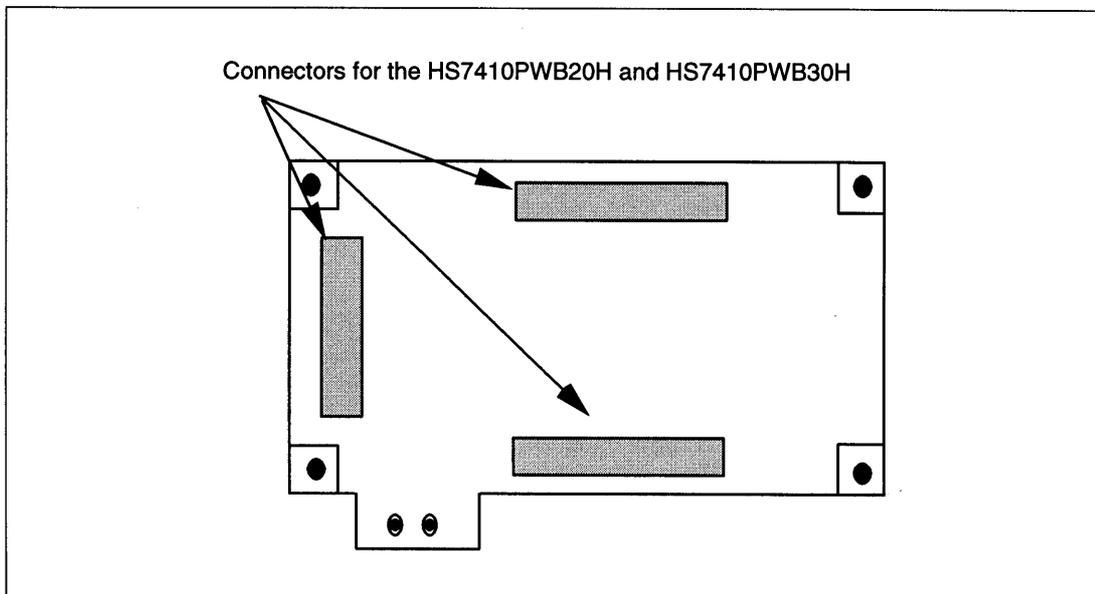
Figure 3.1 Positioning the IC Socket

- Soldering the IC socket

After the epoxy adhesive has hardened, solder the IC socket. At this time, install the cover on the IC socket to prevent flux or solder from adhering to the guide pins. Use more solder than usual so that a fillet is formed on the lead edge being soldered.

### 3.1.2 Connecting the HS7410PWB30H to the User System

1. At shipment, the HS7410PWB20H and HS7410PWB30H are connected to each other. Before connecting the EV-chip board to the user system, separate the HS7410PWB20H from the HS7410PWB30H. The HS7410PWB20H is connected to the HS7410PWB30H through three connectors as shown in figure 3.2.



**Figure 3.2 Top View of the HS7410PWB30H**

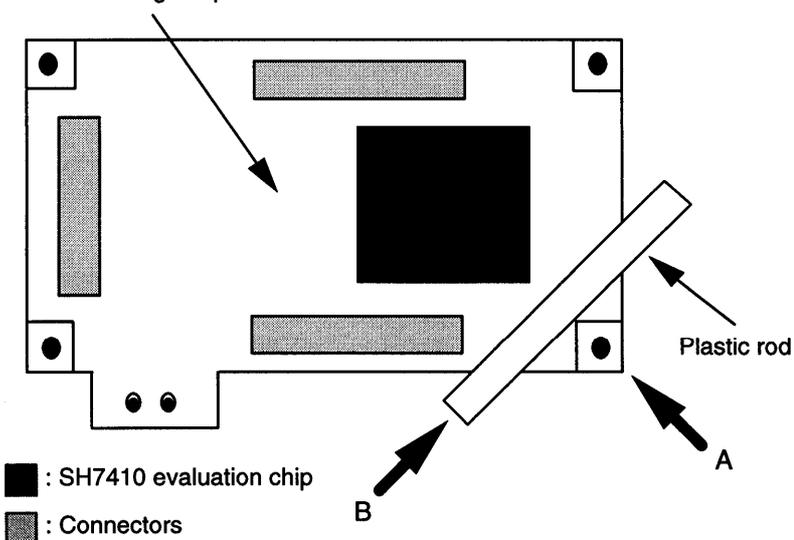
Insert the plastic rod between the HS7410PWB20H and HS7410PWB30H, and lever them apart. Alternately between the four corners of the EV-chip board, gradually force the HS7410PWB20H and HS7410PWB30H apart.

## CAUTION

The following figure shows the position of the SH7410 evaluation chip and connectors between the HS7410PWB20H and HS7410PWB30H. Insert the plastic rod in the A direction as shown in the figure. If the plastic rod is inserted in the B direction, wiring patterns and IC leads on the board will be damaged.

Forcefully loosening only one connector applies unusual force to other connectors, thus damaging the connectors and causing contact failures.

Pay attention to the IC and wiring patterns on the EV-chip board when inserting the plastic rod.

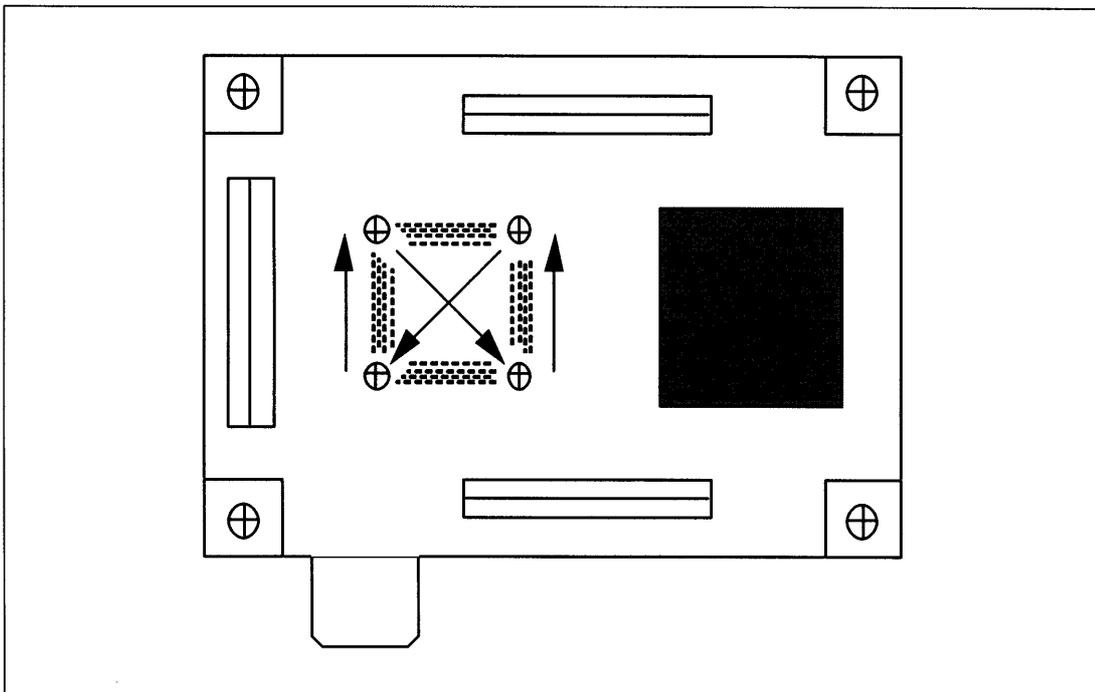


2. Attach the spacers on the HS7410PWB30H, and install the HS7410PWB30H onto the user system after checking the pin-1 location of the IC socket.
3. Affix the IC socket with screws by using the supplied screwdriver. Stop tightening each screw when the tightening force greatly increases (an approximate target is 0.098 N•m when the torque can be set). If the screw is tightened more forcibly than necessary, the screw threads in the IC socket may be damaged or a contact failure may occur due to a solder crack on the IC socket.

## CAUTION

**When tightening the screws for the IC socket, use the supplied screwdriver.**

4. Attach the HS7410PWB30H to the IC socket on the user system with four screws (M2 x 10 mm). Gradually tighten the screws alternately in a figure-8 pattern (see figure 3.3). Never forcibly tighten only one screw. Otherwise, a contact failure will occur or performance will be degraded. When tightening the screws, hold the IC socket so that it does not twist.



**Figure 3.3** Screw-Tightening Sequence (Top View of the HS7410PWB30H)

5. Affix the HS7410PWB30H to the user system with the appropriate screws and nuts.

## CAUTION

1. Before connecting the EV-chip board to the user system, check the location of pin 1 on both sides.
2. If a malfunction occurs during operation, a crack may have occurred in the soldered section of the IC socket. Check the electric conduction with a tester and resolder the cracked section.

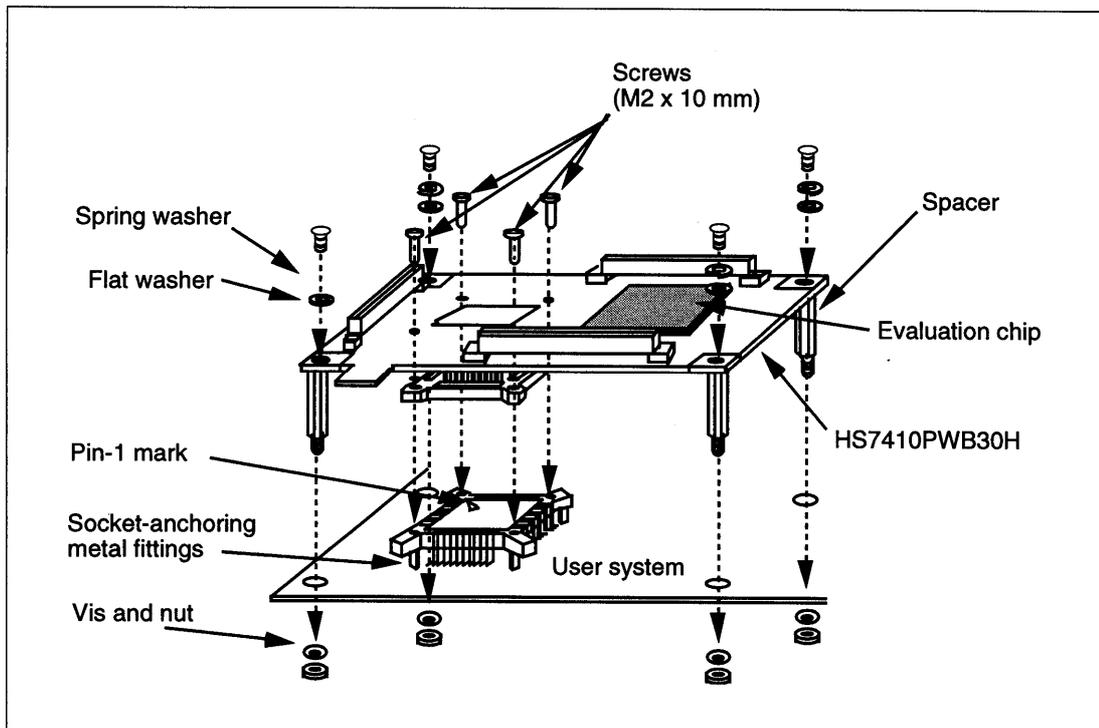


Figure 3.4 Connecting the HS7410PWB30H to the User System

### 3.2 Connecting the Trace Cables



#### **WARNING**

**Always switch OFF the emulator and user system before connecting or disconnecting any CABLES or sockets. Failure to do so will result in a FIRE HAZARD and will damage the user system and the emulator or will result in PERSONAL INJURY. The USER PROGRAM will be LOST.**

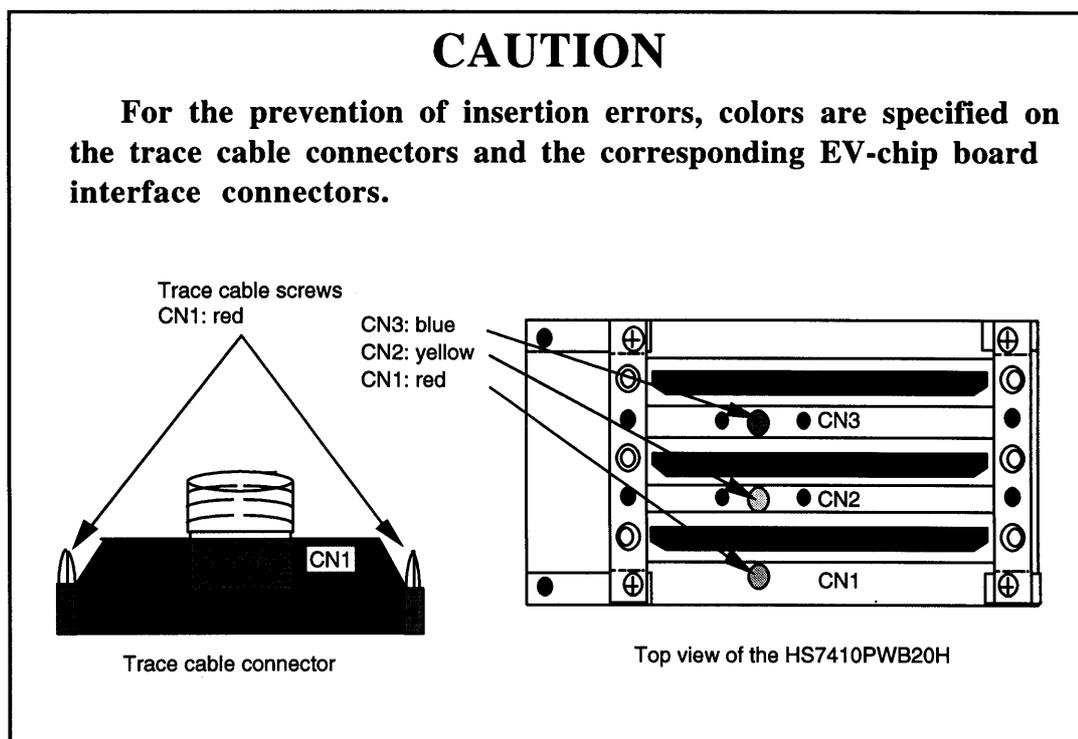
#### 3.2.1 Connecting the Trace Cables to the E8000 Station

Before connecting the trace cables to the HS7410PWB20H, connect the trace cables to the E8000 station.

**Note:** At shipment, trace cables CN2 and CN3 to be connected to the E8000 station are bound into a bundle, and trace cables CN1, CN2, and CN3 to be connected to the EV-chip board are bound into a bundle to prevent an insertion error. For more information on connecting the EV-Chip board to the E8000 station, refer to section 3.2.2, Connecting the EV-Chip Board, in the SH7410 E8000 Emulator User's Manual.

### 3.2.2 Connecting the Trace Cables to the EV-Chip Board

Align the trace cables with the station to EV-chip board interface connectors CN1, CN2, and CN3 on the EV-chip board. Confirm that each trace cable connected to a connector on the E8000 station is also connected to its corresponding station to EV-chip board interface connector on the EV-chip board. For the prevention of insertion errors, colors are specified on the trace cable connectors and the corresponding EV-chip board interface connectors (CN1: red, CN2: yellow, CN3: blue).



Tighten the screws to connect the trace cable connectors to the station to EV-chip board interface connectors while holding the HS7410PWB20H securely.

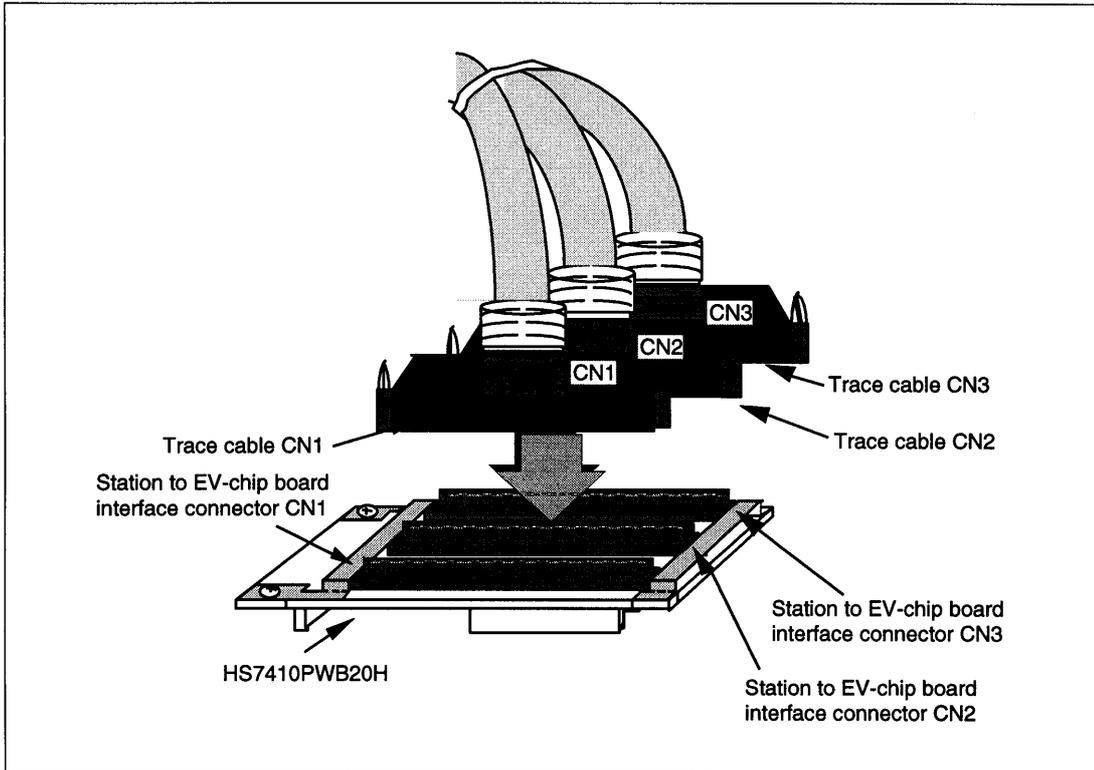


Figure 3.5 Connecting Trace Cables to the EV-Chip Board



## WARNING

**Make sure the connector shapes and numbers are correctly matched when connecting the trace cables to the station to EV-chip board interface connectors. Failure to do so will result in a FIRE HAZARD.**

### **3.3 Connecting the HS7410PWB20H and HS7410PWB30H**

Figure 3.6 shows the connection of the HS7410PWB20H and HS7410PWB30H.

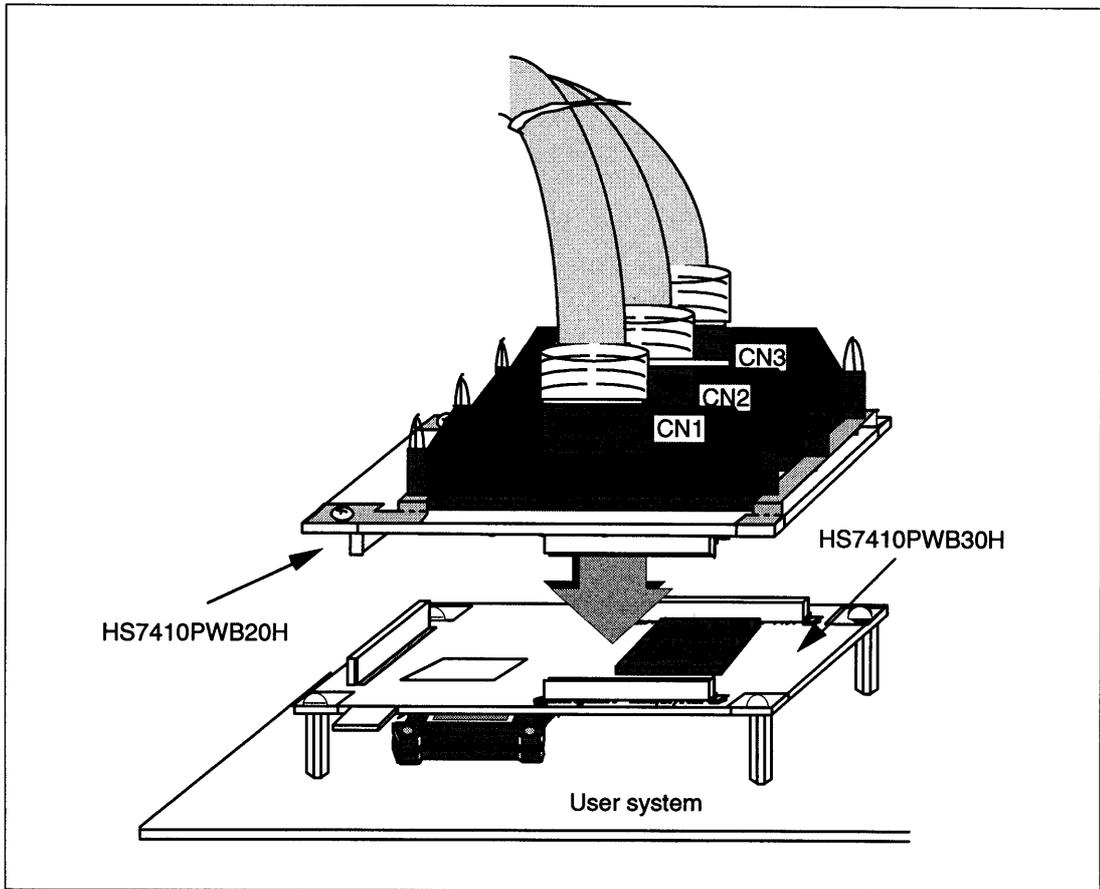
Check the location of the connectors that are to be connected on the HS7410PWB20H and HS7410PWB30H. Align the connectors on the HS7410PWB20H with those on the HS7410PWB30H according to their numbers, and connect them while holding the HS7410PWB30H securely. Gradually tighten the screws alternately and repeatedly in a diagonal line on the HS7410PWB20H.

#### **CAUTION**

**Forcefully tightening only one screw will damage the connectors. Also, this will apply stress to the soldered QFP sockets on the user system and cause cracks in the solder.**

#### **CAUTION**

**The connector and socket structures prevent the connectors from being inserted in the wrong direction. If the connectors cannot be fully inserted or force is required, pin 1 on the connector and pin 1 on the socket may not be aligned correctly. Forcible insertion will apply stress to the soldered sockets on the user system and cause cracks in the solder. Recheck the location of pin 1 on both sides and re-insert the connector.**



**Figure 3.6** Connecting the HS7410PWB20H and HS7410PWB30H

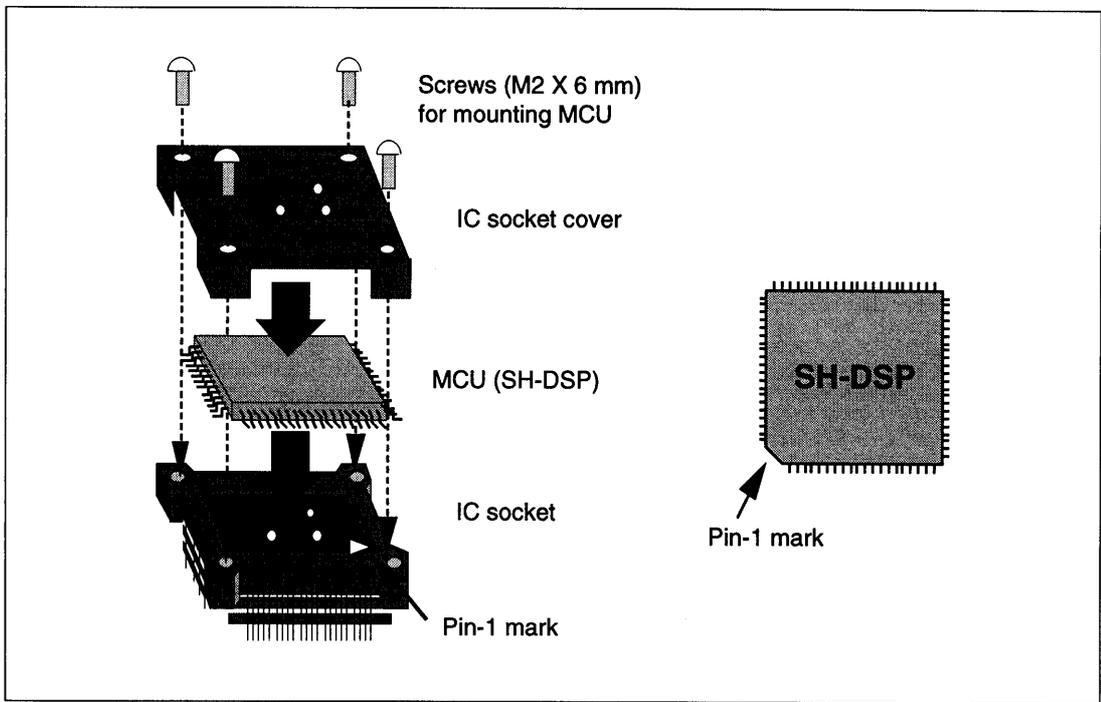
## Section 4 Mounting the SH7410

### 4.1 Mounting the SH7410 on the User System

When mounting the SH7410 on the user system, position the SH7410 on the IC socket after checking the direction of pin 1, and tighten the four screws (M2 x 6 mm) on the IC socket cover, as shown in figure 4.1. When tightening the screws, hold the IC socket so that it does not twist.

#### **CAUTION**

- 1. Before mounting the SH7410 on the user system, check the location of pin 1 on both sides.**
- 2. Use the supplied screwdriver to tighten the screw.**
- 3. Set the tightening torque to 0.98 kgf·cm (0.098 N·m) or lower. If the torque cannot be set, stop tightening the screw as soon as the tightening force greatly increases. If the screw is tightened more forcibly than necessary, the screw threads in the IC socket may be damaged or a contact failure may occur due to a solder crack on the IC socket.**
- 4. If an electric conduction error occurs during operation, a crack may have occurred in the soldered section of the IC socket. Check the electric conduction with a tester and resolder the cracked section.**



**Figure 4.1 Mounting the SH7410**