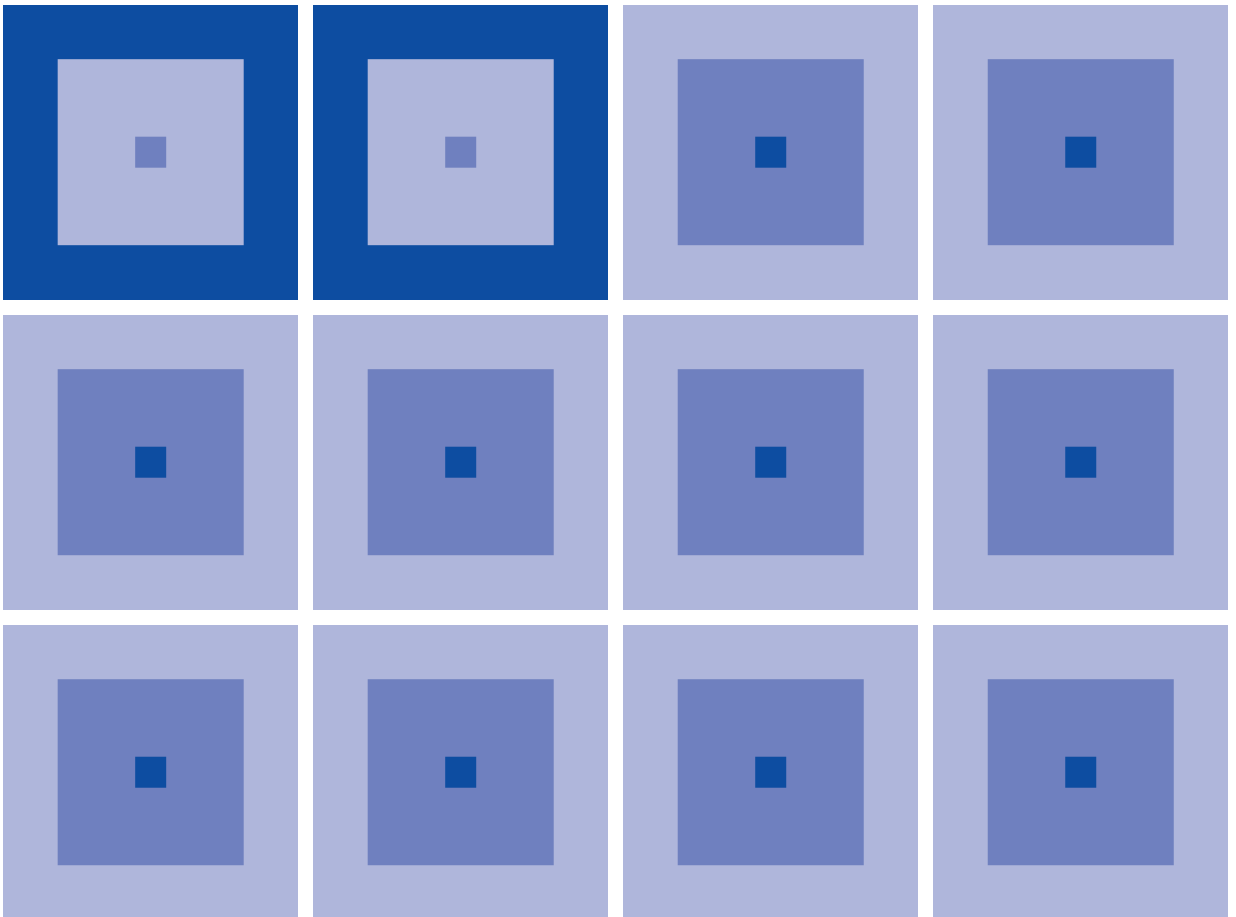


CMOS 16-BIT SINGLE CHIP MICROCOMPUTER

S5U1C17701T1100

Hardware Manual

(Software Evaluation Tool for S1C17701)

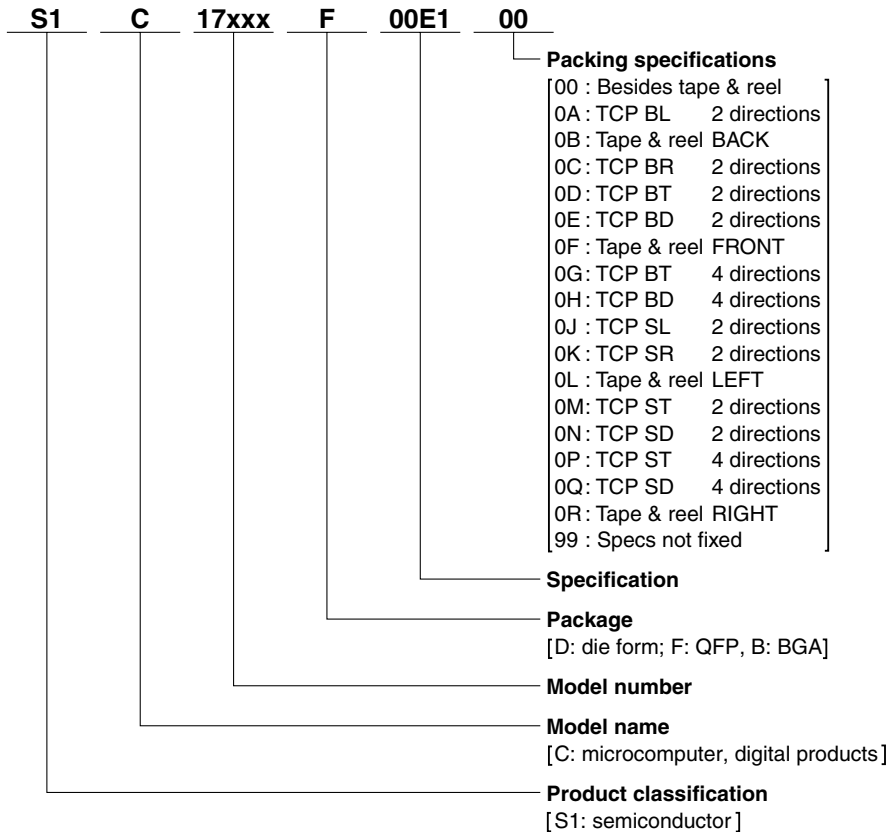


NOTICE

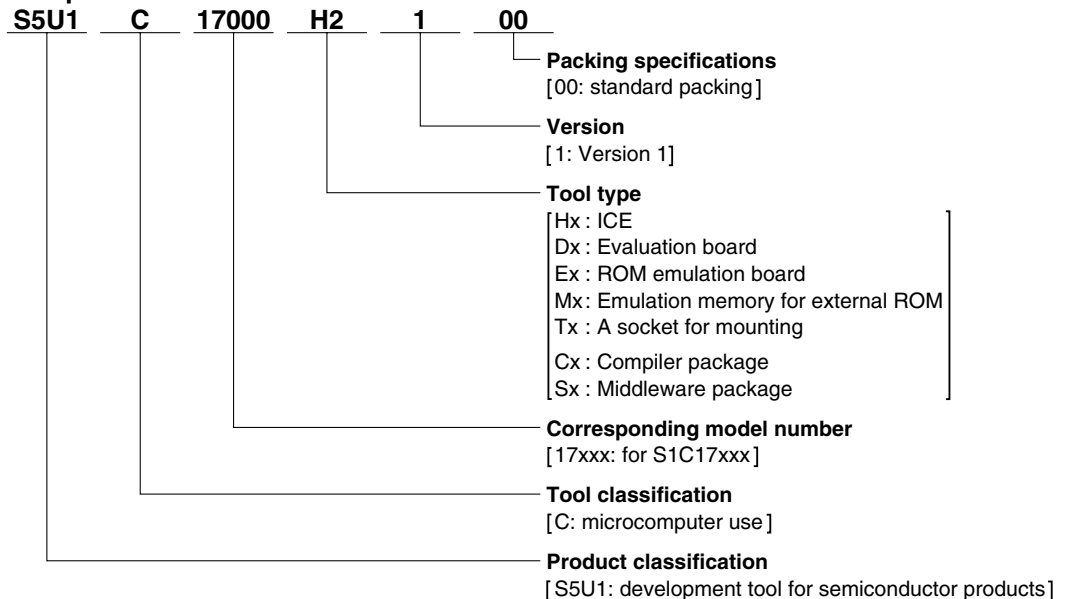
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Configuration of product number

Devices



Development tools



- Contents -

1 Features	1
2 Components Included with Package	2
3 Name and Function of Each Part	3
3.1 Part Names	3
3.2 Dimensions of the Boards	4
3.2.1 Dimensions of the CPU Board	4
3.2.2 Dimensions of the ICD Board	4
3.3 Prime Constituents of the Boards	5
3.4 Function of Each Part.....	6
3.4.1 ICD Board	6
3.4.2 CPU Board.....	6
4 Block Diagram	7
5 Operating Condition and Startup Procedure	8
5.1 Simple Software Development Environment	8
5.2 Standalone Operation of SVT17701	11
5.3 ICD Board Firmware Update Procedure	11
6 Differences between ICD Board and ICD Mini	12
7 I/O Ports	13
8 Key Input Circuit on the CPU Board	14
9 Infrared LED/Detecting Unit	15
10 LCD Panel	16
11 Serial Ports	17
12 Extended Interface	18
12.1 JICD Connector.....	18
12.2 JEX Connector	19
12.3 JRIF Connector	20
12.4 Switching the SPI Port Connector	21
13 Warning Concerning the Use of Materials	22

1 Features

S5U1C17701T1100 (Software eValuation Tool for S1C17701; hereinafter referred to as SVT17701) is an evaluation board for the SEIKO EPSON MCU S1C17701. The SVT17701 consists of two circuit boards: CPU board and ICD board. By connecting these boards, the SVT17701 allows the user to debug the application software without an ICD or other debugging tools. In addition, it provides extended interfaces such as a serial ports allowing the user to connect an expansion board.

<CPU board>

CPU	S1C17701
Input power voltage	+3.3 V (DC) (supplied through the ICD interface or a CR2032 coin cell can be used)
CPU input clock	OSC1: 32.768 kHz OSC3: 8 MHz
On-board functions/devices	<ul style="list-style-type: none"> • STN LCD panel (display size: 32 commons × 56 segments, black & white) • Infrared LED/detecting unit • Key input circuit (four keys available) • Reset switch • Extended interface connectors (P, UART, SPI and I²C ports) • ICD board connector

<ICD board>

CPU interface	USB 1.1
Power voltage	USB bus power (On-board regulator output voltage: +3.3 V)
On-board functions/devices	<ul style="list-style-type: none"> • Status indicator LED • Reset switch • CPU board connector

2 Components Included with Package

The following shows the components included with the S5U1C17701T1100 package:

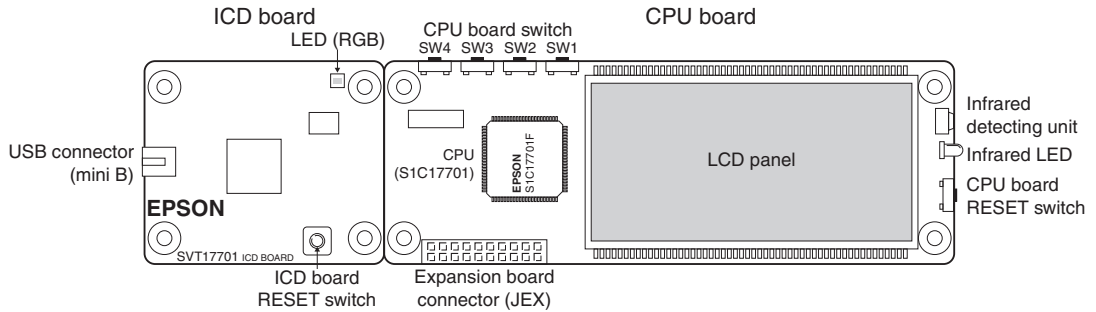
- (1) SVT17701 CPU board (main unit) 1
- (2) ICD board..... 1
- (3) USB cable..... 1
- (4) Coin cell (CR2032 / 3 V) 1
- (5) User registration card English/Japanese, 1 each
- (6) Warranty card English/Japanese, 1 each
- (7) Usage precautions English/Japanese, 1 each

3 Name and Function of Each Part

The following shows the name and function of each part.

3.1 Part Names

<Face>



<Back>

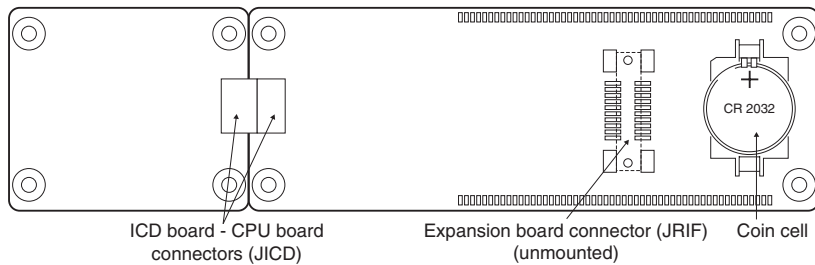
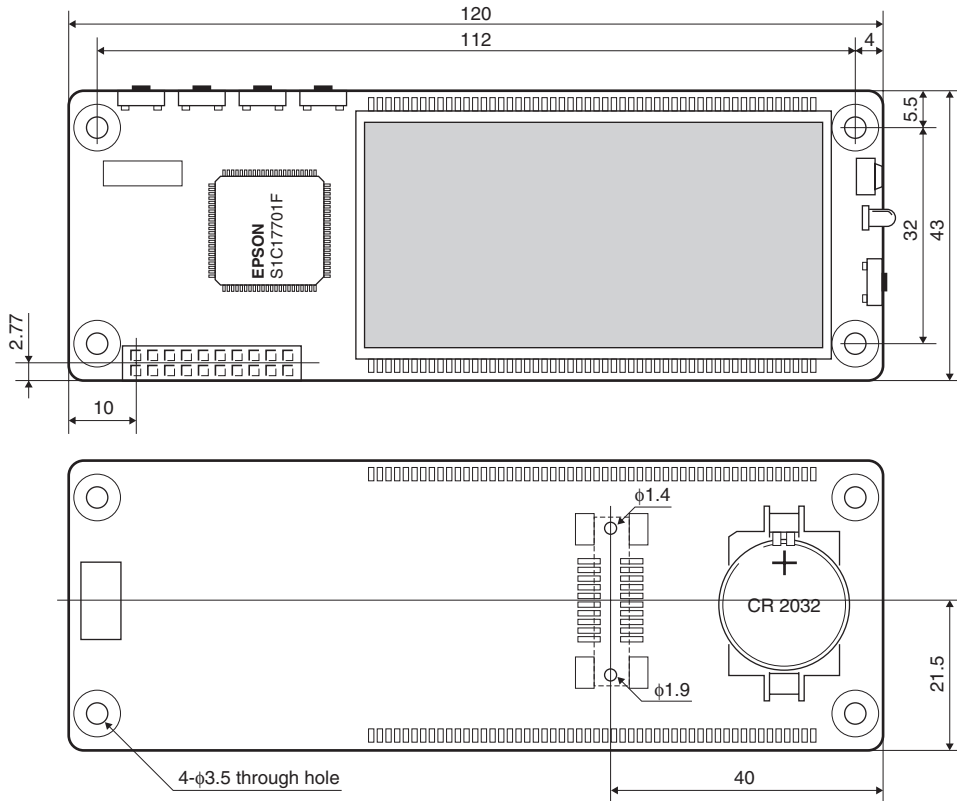


Figure 3.1.1 Part Names

3.2 Dimensions of the Boards

3.2.1 Dimensions of the CPU Board

Below is a dimensional drawing of the CPU board:

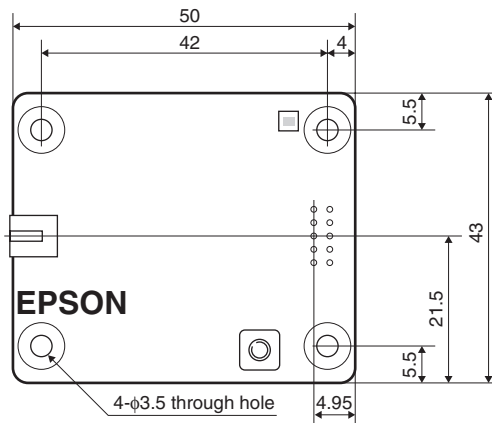


Unit: mm Material: FR4 Thicknesses of the board: 1.6 mm

Figure 3.2.1.1 Dimensions of the CPU Board

3.2.2 Dimensions of the ICD Board

Below is a dimensional drawing of the ICD board:



Unit: mm Material: FR4 Thicknesses of the board: 1.6 mm

Figure 3.2.2.1 Dimensions of the ICD Board

3.3 Prime Constituents of the Boards

<CPU board>

CPU	S1C17701	SEIKO EPSON CORP.
Crystal resonator (32.768 kHz)	FC-255	SEIKO EPSON CORP.
Crystal resonator (8 MHz)	MA-406	SEIKO EPSON CORP.
Infrared LED	LN69	Panasonic
Infrared detecting unit	GPIUX311QS	SHARP
LCD panel	TSC2B0090	TRULY
CPU board switches (SW1 to SW4)	SKQTLCE010	ALPS
CPU board reset switch (SW5)	SKQTLCE010	ALPS
Battery holder	1060	KEYSTONE
Expansion board connector (JEX)	SLW-110-01-G-D	SAMTEC
Expansion board connector (JICD)	PS-10SD-D4T1-1	JAE

<ICD board>

USB connector (mini B)	54819-0572	Molex
LED (RGB)	598-9920-307F	Dialight
ICD board reset switch (SW1)	SKRAAKE010	ALPS

3.4 Function of Each Part

3.4.1 ICD Board

The ICD board is a hardware tool (emulator) to develop S1C17701 software with efficiency. It controls communication between the PC and the target IC (S1C17701) on the CPU board and provides a simple software development environment for the S1C17701. See Chapter 6 for differences on the functions from the development tool ICD Mini (S5U1C17001H) that supports all models embedded with the S1C17 Core.

Note: The ICD board is provided as a part of the SVT17701 functions. It cannot be connected to a board other than the SVT17701 CPU board.

ICD board RESET switch

Pressing the RESET switch (SW1) on the ICD board restarts the firmware on the ICD board and outputs the target reset signal (#RESET_OUT) to the CPU board. When the CPU board is physically connected to the ICD board, the communication is established. If the CPU board is not connected physically, the ICD board enters connection wait status.

ICD board LED

The LED indicates the ICD board and target statuses in different colors.

- (blue) Indicates power on status (before the initial connection with the target is established).
- (green) Indicates that the target is in debug mode.
- (red) Indicates that the target is not connected or connected incorrectly.
Or the target is executing a user program.

3.4.2 CPU Board

The CPU board is a simple target evaluation board that contains a S1C17701 as the target CPU, an LCD panel and remote control transmitter/receiver modules. The CPU board can be used for developing and evaluating software to control these functions. Also it has an on-board battery drive circuit using a coin cell.

CPU board RESET switch

Pressing the CPU board RESET switch (SW5) resets the CPU board.

Coin cell

A coin cell (CR2032) holder is mounted on the backside of the CPU board. When the CPU board is used on a standalone basis, power is supplied from the coin cell. When the CPU board is connected to the ICD board, the CPU board automatically switches the power source from the coin cell to the ICD board and turns off the power supply from the coin cell using the on-board power switch circuit.

* Inserting/removing coin cell

Insert a coin cell to the holder located on the backside of the CPU board with its + sides facing upward.

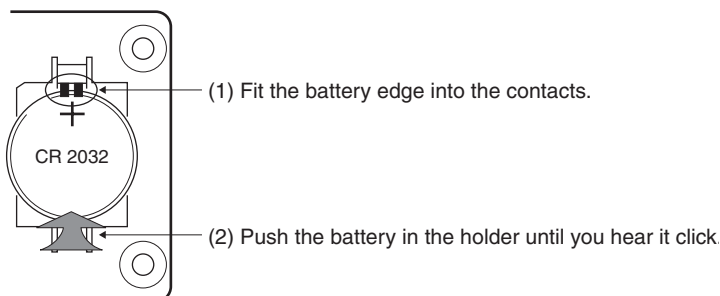


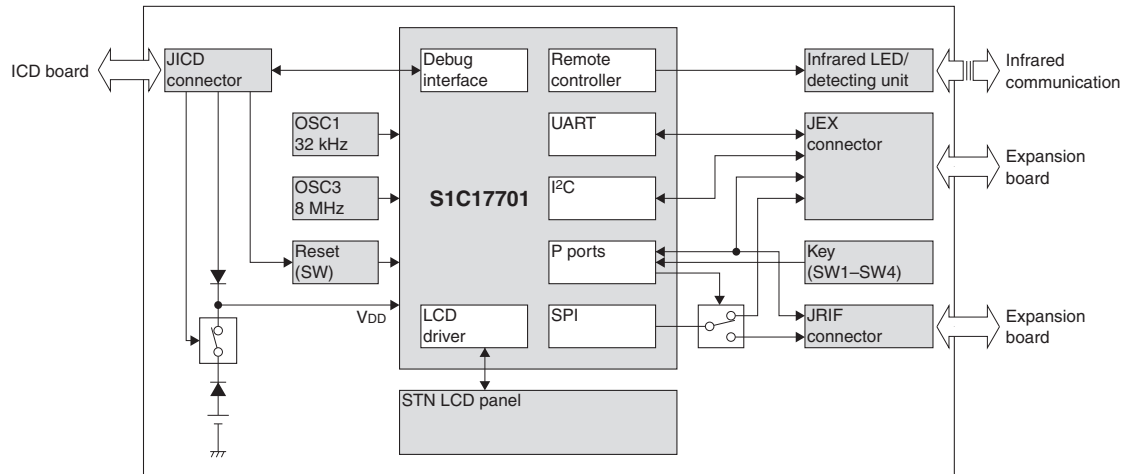
Figure 3.4.2.1 Inserting Coin Cell

If the battery is hard to remove, insert a narrow rod or something into the clearance between the battery and the holder and lift out the battery. At this time, be careful not to break the contacts of the holder and parts mounted on the board.

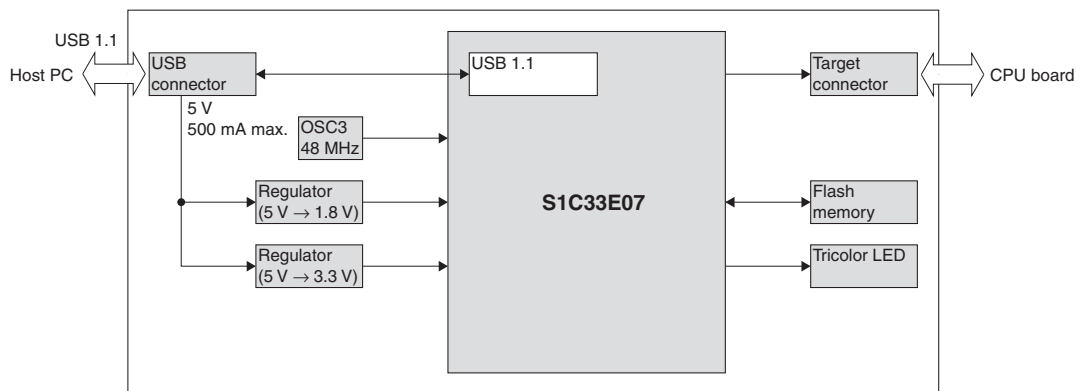
4 Block Diagram

The following shows the block diagrams of the CPU board and ICD board.

<CPU board>



<ICD board>



5 Operating Condition and Startup Procedure

The SVT17701 can operate according to the commands executed in the debugger on the PC by connecting it to the PC via the ICD board. Furthermore, the CPU board can be operated on a standalone basis without the ICD board or a PC being used. The following describes the connection and start up procedure of each operating condition.

5.1 Simple Software Development Environment

The SVT17701 provides an S1C17701 software simple development environment that uses the CPU board as the target by connecting it to the PC via the ICD board and using it with the S1C17 development tools (e.g. GNU17 IDE, compiler, and debugger included in the S5U1C17001C Package).

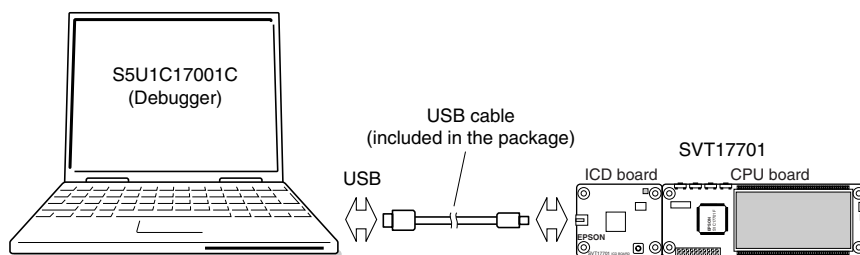


Figure 5.1.1 Simple Software Development Environment

Operations under simple software development environment

In this operating condition, the target CPU (S1C17701 on the CPU board) operates according to the commands executed in the debugger on the PC connected with the ICD board. The command executed in the debugger is sent to the ICD board through a USB and it is sent to the CPU board after the command is analyzed and converted into the debug signals for the S1C17701. In this environment, the target program can be downloaded from the debugger on the PC to the CPU board, and the program can be debugged by executing and suspending it using debug commands.

CPU operating mode

The target CPU (S1C17701 on the CPU board) suspends program execution and enters debug mode (break status) when the brk instruction is executed or a break interrupt from the ICD board occurs (e.g. caused by a forced break operation in the debugger). This mode allows executing commands in the debugger on the PC. The LED on the ICD board lights in green in debug mode. On the other hand, the status in which the target CPU is executing the target program is called normal mode. The LED on the ICD board lights in red in normal mode.

Operating power source

In this operating condition, power is supplied from a USB (bus power). Connecting the ICD board to the CPU board switches the power source to the USB power regardless of whether a coin cell is inserted to the CPU board or not.

Connection and start-up procedure

The following shows the connection and start-up procedure to configure simple software development environment.

- (1) Install the ICD board to the CPU board by connecting their 10-pin JICD connectors.
- (2) Turn the PC on if it is turned off.
- (3) Connect between the ICD board and the PC using the USB cable.
- (4) The PC starts a wizard to install a USB driver. Install the USB driver for the ICD according to the wizard. (This installation is required only the first time the ICD board is connected to the PC.)
Refer to the “USB driver installation procedure” below for installing the USB driver.
- (5) Make sure that the LED on the ICD board lights in blue then it changes to green (target enters debug mode).

- (6) Launch the debugger on the PC and execute the target program. Check that the LED on the ICD board lights in red (target enters normal mode) while the target program is being executed.

Refer to the “S5U1C17001C Manual (S1C17 Family C Compiler Package)” for how to use the debugger and details of the debug commands.

Note: Be sure to avoid pulling out the USB cable between the PC and the ICD board while the debugger is running.

USB driver installation procedure

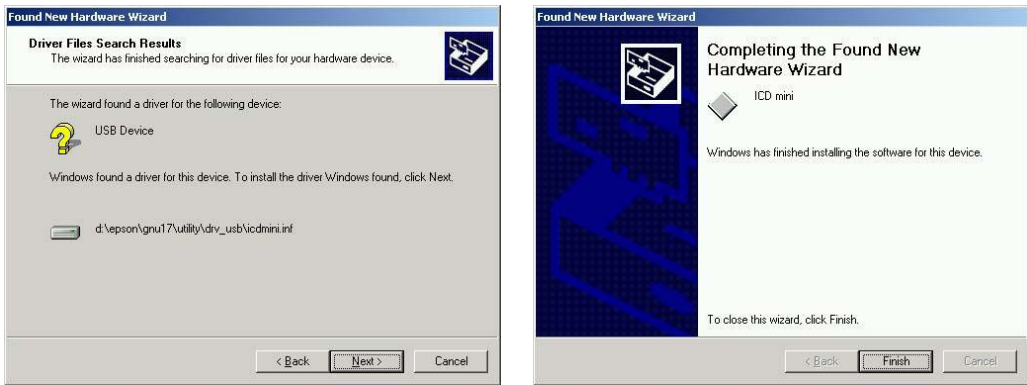
- (1) First time the SVT17701 is connected to the host computer with the USB cable, the dialog box shown below will be displayed.



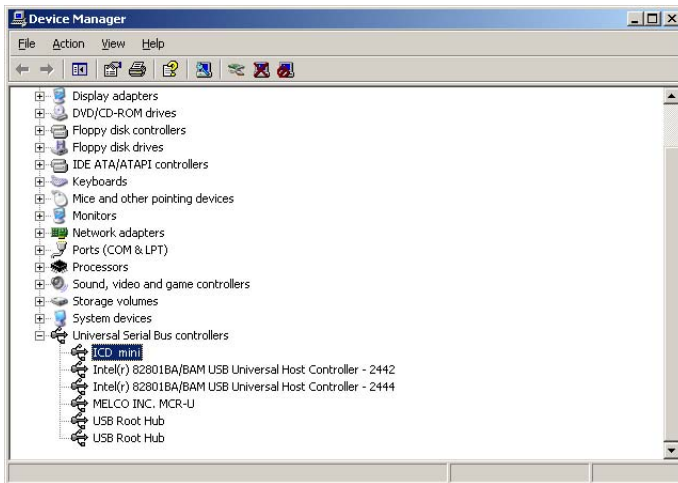
- (2) Install the USB driver by following the directions displayed by the wizard. Specify “C:\EPSON\gnu17\utility\drv_usb” as the USB driver directory.



5 OPERATING CONDITION AND STARTUP PROCEDURE



The device manager will be displayed as shown below when the USB driver has been installed correctly.



Note: If the window above is not displayed correctly, try to reinstall the USB driver.

5.2 Standalone Operation of SVT17701

The SVT17701 allows the CPU board to operate on a standalone basis without the ICD board or a PC being used.

Standalone operations

In this operating condition, the S1C17701 on the CPU board always operates in normal mode to execute the program written in the on-chip Flash memory. Therefore, the user program must be downloaded into the S1C17701 Flash memory in advance. (The S1C17701 Flash memory is programmed with a demonstration program prior to shipment of the SVT17701.)

Refer to the “S5U1C17001C Manual (S1C17 Family C Compiler Package)” for how to download a user program to the on-chip Flash memory.

Operating power source

In this operating condition, power is supplied from the coin cell (CR2032) on the CPU board.

Connection and start-up procedure

The following shows how to operate the SVT17701 on a standalone basis.

- (1) Turn the PC on if it is turned off.
- (2) Install the ICD board to the CPU board and connect between the ICD board and the PC using the USB cable.
- (3) Launch the debugger on the PC then download the user program into the S1C17701 Flash memory. Refer to the “S5U1C17001C Manual (S1C17 Family C Compiler Package)” for how to download a user program.
- (4) After terminating the debugger, pull the USB cable out to disconnect the ICD board from the PC.
- (5) Remove the ICD board from the CPU board, and insert a coin cell.
- (6) Push the RESET switch on the CPU board. The S1C17701 on the CPU board starts executing the user program that has been downloaded into the Flash memory.

5.3 ICD Board Firmware Update Procedure

The firmware on the SVT17701 ICD board can be updated using the debugger on the PC. Seiko Epson will provide the firmware updater as necessary. (The file extension of the updater file is “.sa.”)

The following shows a firmware update procedure:

Note: Before the firmware can be updated, the USB driver must be installed.

- (1) Connect the SVT17701 ICD board with the PC using the USB cable.
- (2) Press the RESET switch (SW1) on the ICD board.
- (3) Invoke the debugger from the command prompt.


```
>cd c:\EPSON\gnu17      (Specify the path to the directory where the gnu17 tools exist.)
>gdb
```
- (4) Enter the commands below when the debugger starts up.


```
(gdb) target icd usb
(gdb) c17 firmwareupdate path\filename.sa
      (Specify the updater file name for the “path\filename.sa.”)
```
- (5) The LED on the ICD board lights in green (●) when the firmware update process has completed.
- (6) Press the RESET switch on the ICD board to restart the firmware.

6 Differences between ICD Board and ICD Mini

Table 6.1 lists the functions of the S5U1C17001H (ICD Mini), which is a development tool for the S1C17 Family, and SVT17701 ICD board for comparison.

Table 6.1 Comparison between ICD Board and ICD Mini Functions

Product name	S5U1C17001H (ICD Mini)	S5U1C17701T1100 (SVT17701) ICD board
S1C cores supported	S1C17 Core	
Host interface	USB 1.1	
Data download rate	Approx. 65KB/s when DCLK = 40 MHz (Max.) *1 Approx. 50KB/s when DCLK = 20 MHz *1	
DCLK frequency to communicate with the target	4 kHz to 40 MHz	
Standalone Flash programmer function	Available	Unavailable
Firmware update function	Available	
Flash programming power voltage supply	Available	Unavailable
Target reset signal output	Available	
Target system I/O interface voltage	3.3 V, 1.8 V, or voltage (1.0 to 5.0 V) input from the target	3.3 V
Target system interface connector	4 pins	10 pins (reset signal included) *2
Flash programming power supply connector	4 pins	–

*1 The frequency assumes that the I/O voltage is 3.3 V. The maximum frequency may be lower than the spec value due to ambient noise, temperature condition, product type, and unevenness in quality.

*2 Can be connected to the CPU board only.

7 I/O Ports

Table 7.1 lists the S1C17701 ports and their destination on the SVT17701.

Table 7.1 List of I/O Port Functions

Port	I/O	Peripheral module	Signal name	Destination
P00	I	P	P00	SW1
P01	I	P	P01	SW2
P02	I	P	P02	SW3
P03	I	P	P03	SW4
P04	I	REMC	REMI	Remote controller receiver module
P05	O	REMC	REMO	Remote controller transmitter module
P06	I/O	P/T16	P06/EXCL2	Extended I/F (JEX connector)
P07	I/O	P/T16	P07/EXCL1	Extended I/F (JEX connector)
P10	I/O	P	P10	Extended I/F (JEX connector)
P11	I/O	P	P11	Extended I/F (JEX connector)
P12	I/O	P	P12	Extended I/F (JEX connector)
P13	I/O	P/OSC	P13/FOUT1	Extended I/F (JEX connector)
P14	I/O	P/I ² C	P14/SDA	Extended I/F (JEX connector)
P15	I/O	P/I ² C	P15/SCL	Extended I/F (JEX connector)
P16	O	P	P16	SPI port connector selector
P17	I/O	P/SPI	P17/#SPISS	Extended I/F (JRIF connector)
P20	I/O	P/SPI	P20/SDI	Extended I/F (JEX or JRIF connector)
P21	I/O	P/SPI	P21/SDO	Extended I/F (JEX or JRIF connector)
P22	I/O	P/SPI	P22/SPICLK	Extended I/F (JEX or JRIF connector)
P23	I/O	P/UART	P23/SIN	Extended I/F (JEX connector)
P24	I/O	P/UART	P24/SOUT	Extended I/F (JEX connector)
P25	I/O	P/UART	P25/SCLK	Extended I/F (JEX connector)
P26	I/O	P/T16E	P26/TOUT	Extended I/F (JEX connector)
P27	I/O	P/T16E	P27/EXCL3	Extended I/F (JRIF connector)
P30	I/O	P/OSC	P30/FOUT3	Extended I/F (JEX connector)
P31	O	DBG	DCLK	ICD I/F (JICD connector)
P32	O	DBG	DST2	ICD I/F (JICD connector)
P33	I/O	DBG	DSIO	ICD I/F (JICD connector)

See Chapter 12 for the extended interface and connectors.

8 Key Input Circuit on the CPU Board

The switches SW1–SW4 located on the SVT17701 CPU board are connected to the P00–P03 ports of the S1C17701 as shown in the figure below.

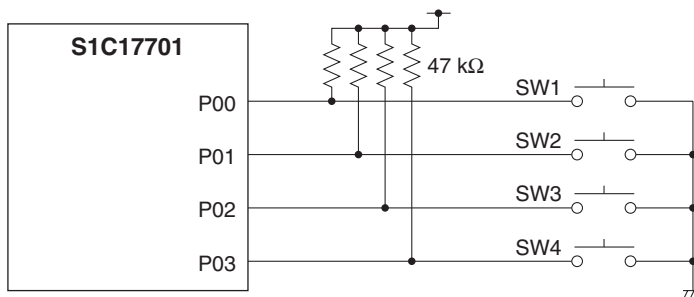


Figure 8.1 Key Input Circuit on the CPU Board

The input ports P00–P03 are pulled up through 47-kΩ resistors. The port input level is normally high (1) and it goes low (0) when the switch is pressed.

9 Infrared LED/Detecting Unit

The infrared LED and infrared detecting unit located on the CPU board are connected to the S1C17701 remote controller as shown in the figure below.

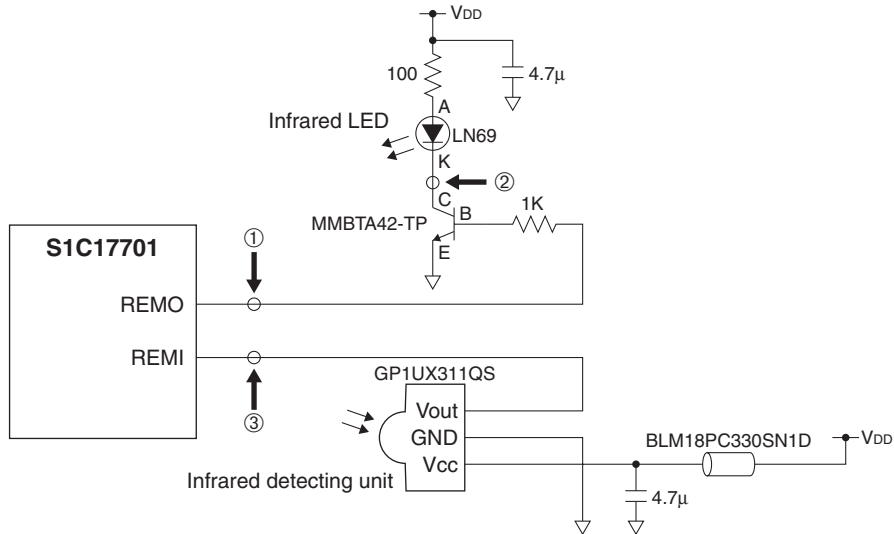
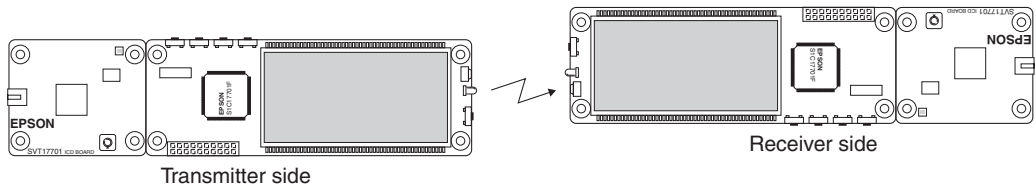


Figure 9.1 Infrared Remote Controller Transmitter/Receiver Circuit

Infrared remote controller transmit/receive waveforms

Using two SVT17701 units allows checking the transmit/receive operation by transmitting remote control waveforms from one and receiving them by another.



* The transmission/reception distance is about 3 m (reference value) assuming that the transmitter is placed directly opposite the receiver and there is no obstruction between the modules.

Figure 9.2 Remote Controller Transmission/Reception Using Two SVT17701

The transmit/receive waveforms (monitored at Points ①–③ in Figure 9.1) are shown in Figure 9.3.

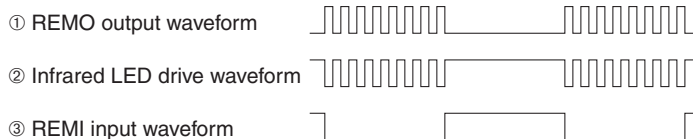


Figure 9.3 Infrared Remote Controller Transmit/Receive Waveforms

10 LCD Panel

The S1C17701 has a built-in dot-matrix LCD driver that is capable of driving a monochrome LCD panel with up to 32 commons (COM) × 56 segments (SEG). The CPU board contains an LCD panel for evaluating the driver. The LCD panel is connected to the COM and SEG pins of the S1C17701 as shown in the figure below.

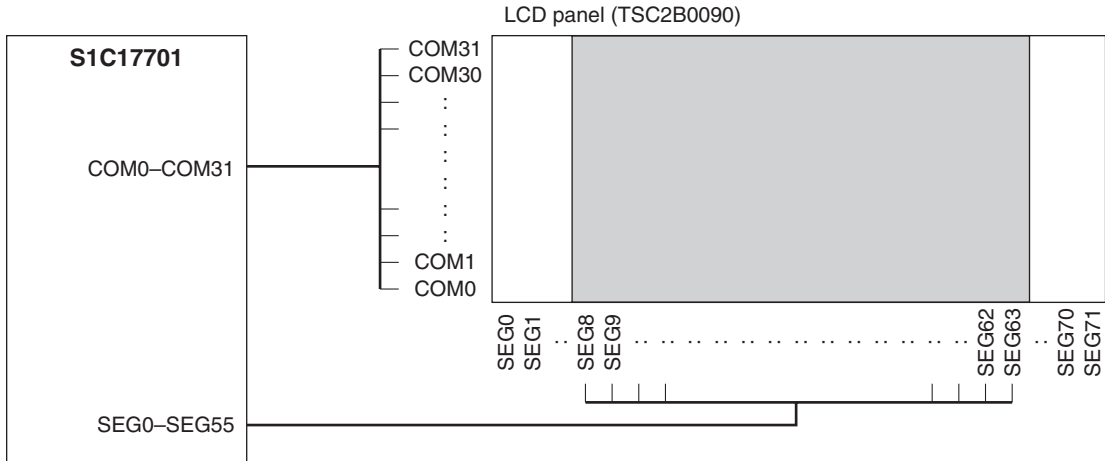


Figure 10.1 Connections of the LCD Panel

* The LCD panel on the CPU board has 32 common (COM) and 72 segment (SEG) pins, however, only 56 segments at the center are used for display.

Refer to the “Application notes”(TBD) for controlling the LCD panel.

11 Serial Ports

In the SVT17701, three types of S1C17701 on-chip serial interfaces (UART, SPI, I²C) are available.

Since the general-purpose I/O port pins are shared with the serial ports, the port functions must be switched with software to use them for serial ports. The I/O signals for the serial ports are connected to the extended interface connector.

Table 11.1 Serial Ports

Interface	Signal name (port pin)	I/O	Destination
SPI	SDI (P20)	I	Extended I/F (JEX pin 11 or JRIF pin 3)*
	SDO (P21)	O	Extended I/F (JEX pin 12 or JRIF pin 4)*
	SPICLK (P22)	I/O	Extended I/F (JEX pin 13 or JRIF pin 8)*
	#SPISS (P17)	I	Extended I/F (JRIF pin 6)
UART	SIN (P23)	I	Extended I/F (JEX pin 14)
	SOUT (P24)	O	Extended I/F (JEX pin 16)
	SCLK (P25)	I	Extended I/F (JEX pin 17)
I ² C	SDA (P14)	I/O	Extended I/F (JEX pin 9)
	SCL (P15)	I/O	Extended I/F (JEX pin 10)

* The destination connector is selected by the P16 port output value (see Section 12.4).

12 Extended Interface

The CPU board provides the extended interface connectors (JICD, JEX) to connect the ICD board and a user expansion board, and the traces (JRIF) for attaching an extension connector.

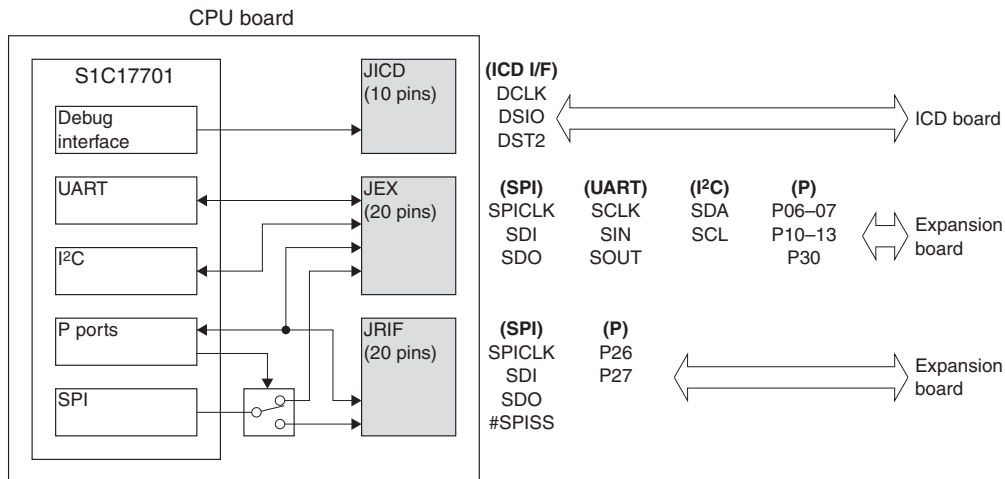


Figure 12.1 Extended Interface Connectors

12.1 JICD Connector

The JICD connector is used to connect the ICD board.

The product name and pin assignment of the connector are as follows:

CPU board connector (female): PS-10SD-D4T1-1 Japan Aviation Electronics Industry, Ltd. (JAE)
 ICD board connector (male): 9-103801-0 Tyco Electronics

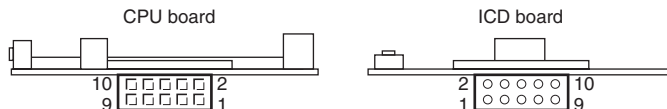


Figure 12.1.1 JICD Connector

Table 12.1.1 JICD Connector Pin Assignment

No.	Pin name	I/O	Description
1	DCLK	O	On-chip debugger clock output port
2	GND	-	Power ground *
3	GND	-	Power ground *
4	#RESET_OUT	I	Target reset signal input port
5	DSIO	I/O	On-chip debugger data input/output port
6	TGT_EN	I	Target enable signal input port
7	DST2	O	On-chip debugger status signal output port
8	N.C.	-	-
9	Vcc (+3.3V)	-	+3.3 V power supply pin
10	Vcc (+3.3V)	-	+3.3 V power supply pin

* Connecting all GND pins to the power ground is recommended.

Note: Be sure not to insert this connector in the opposite direction as both boards may be damaged. The LCD panel side of the CPU board and the USB connector side of the ICD board will be the same in correct direction as shown in the figure below.



Figure 12.1.2 Connecting the ICD Board and the CPU Board

12.2 JEX Connector

The JEX connector is used to connect a user expansion board.

The product name and pin assignment of the connector are as follows:

CPU board connector (female): SLW-110-01-G-D Samtec, Inc.

Recommended expansion board connector (male): TLW-110-06-G-D Samtec, Inc.

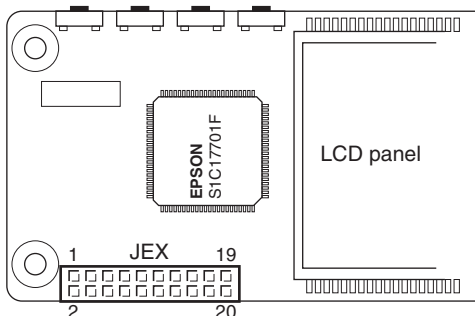


Figure 12.2.1 JEX Connector

Table 12.2.1 JEX Connector Pin Assignment

No.	Pin name	I/O	Description
1	GND	–	Power ground *
2	P06/EXCL2	I/O or I	I/O port or T16 clock input port
3	P07/EXCL1	I/O or I	I/O port or T16 clock input port
4	P10	I/O	I/O port
5	P11	I/O	I/O port
6	Vcc (+3.3 V)	–	+3.3 V power supply pin
7	P12	I/O	I/O port
8	P13	I/O	I/O port
9	P14/SDA	I/O	I/O port or I ² C data input/output port
10	P15/SCL	I/O	I/O port or I ² C clock input/output port
11	P20/SDI	I/O or I	I/O port or SPI data input port
12	P21/SDO	I/O or O	I/O port or SPI data output port
13	P22/SPICLK	I/O	I/O port or SPI external clock input/output port
14	P23/SIN	I/O or I	I/O port or UART data input port
15	GND	–	Power ground *
16	P24/SOUT	I/O or O	I/O port or UART data output port
17	P25/SCLK	I/O or I	I/O port or UART clock input port
18	P30/FOUT3	I/O or O	I/O port or divided OSC3 clock output port
19	N.C.	–	–
20	Vcc (+3.3 V)	–	+3.3 V power supply pin

* Connecting all GND pins to the power ground is recommended.

12.3 JRIF Connector

The JRIF connector (unmounted) is used to connect a user expansion board. There are only traces to attach a connector on the board. Attach a connector when using the SPI slave-select input or when using the external clock input and/or PWM output of the PWM & capture timer.

The product name and pin assignment of the connector are as follows:

Recommended CPU board connector (female): 8913-020-178MS-A-F KEL Corporation

Recommended expansion board connector (male): 8903-020-177S-A-F KEL Corporation

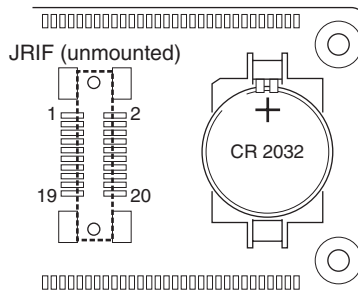


Figure 12.3.1 JRIF Connector

Table 12.3.1 JRIF Connector Pin Assignment

No.	Pin name	I/O	Description
1	N.C.	—	—
2	N.C.	—	—
3	P20/SDI	I/O or I	I/O port or SPI data input port
4	P21/SDO	I/O or O	I/O port or SPI data output port
5	GND	—	Power ground *
6	P17/#SPISS	I/O or I	I/O port or SPI slave-select input port
7	GND	—	Power ground *
8	P22/SPICLK	I/O	I/O port or SPI external clock input/output port
9	GND	—	Power ground *
10	N.C.	—	—
11	GND	—	Power ground *
12	N.C.	—	—
13	GND	—	Power ground *
14	N.C.	—	—
15	GND	—	Power ground *
16	P26/TOUT	I/O or O	I/O port or T16E PWM signal output port
17	P27/EXCL3	I/O or I	I/O port or T16E external clock input port
18	N.C.	—	—
19	Vcc (+3.3 V)	—	+3.3 V power supply pin
20	Vcc (+3.3 V)	—	+3.3 V power supply pin

* Connecting all GND pins to the power ground is recommended.

12.4 Switching the SPI Port Connector

The SPI input/output signals of the S1C17701 are connected to the JEX or JRIF connector via a switching IC as shown in the figure below. The P16 port of the S1C17701 is used to control the switching IC. The signals are connected to the JRIF connector when the P16 output is high level or connected to the JEX connector when the P16 output is low level. The #SPISS signal is connected to JRIF only regardless of the P16 output level.

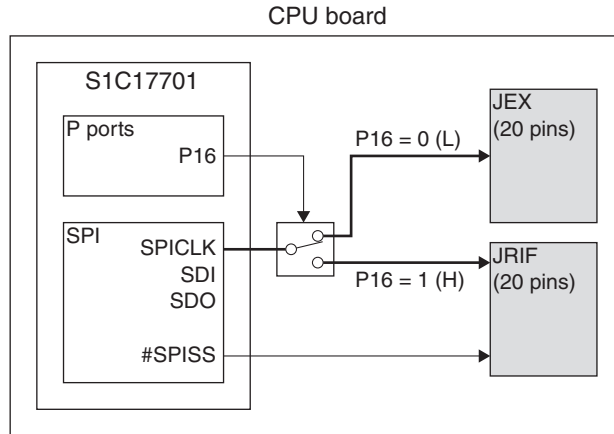


Figure 12.4.1 SPI Port Connector Select Circuit

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