RENESAS

M34551T2-MCU

MCU Board for PC4504 Emulator System

User's Manual

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\SUPPORT\Product-name\SUPPORT.TXT

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Contents

Preface

This user's manual describes the specifications of the M34551T2-MCU emulator board for Renesas 4551 and 4555 groups of 4-bit single-chip microcomputers.

The M34551T2-MCU is the MCU board for the PC4504 emulator.

For the PC4504 emulator main unit and the M3T-PD45 emulator debugger, refer to their user's manuals.

To use the product properly

Precautions for Safety

- In both this User's Manual and on the product itself, several icons are used to insure proper handling of this product and also to prevent injuries to you or other persons, or damage to your properties.

- The icons' graphic images and meanings are given in "Chapter 1. Precautions for Safety". Be sure to read this chapter before using the product.

1. Precautions for Safety

In both the user's manual and on the product itself, several icons are used to insure proper handling of this product and also to prevent injuries to you or other persons, or damage to your properties.

This chapter describes the precautions which should be taken in order to use this product safely and properly. Be sure to read this chapter before using this product.

1.1 Safety Symbols and Meanings

⚠ **WARNING** If the requirements shown in the "WARNING" sentences are ignored, the equipment may cause serious personal injury or death.

⚠ **CAUTION** If the requirements shown in the "CAUTION" sentences are ignored, the equipment may malfunction.

IMPORTANT It means important information on using this product.

In addition to the three above, the following are also used as appropriate.

△ means WARNING or CAUTION.

   Example: ⚡ **CAUTION AGAINST AN ELECTRIC SHOCK**

⊘ means PROHIBITION.

   Example: 🚫 **DISASSEMBLY PROHIBITED**

● means A FORCIBLE ACTION.

   Example: 🔌 **UNPLUG THE POWER CABLE FROM THE RECEPTACLE.**

The following pages describe the symbols "WARNING", "CAUTION", and "IMPORTANT".

⚠ WARNING

Warning for Installation:

- Do not set this product in water or areas of high humidity. Make sure that the main unit does not get wet. Spilling water or some other liquid into the main unit can cause an unrepairable damage.

Warning for Use Environment:

- This equipment is to be used in an environment with a maximum ambient temperature of 35 °C. Care should be taken that this temperature is not exceeded.

⚠ CAUTION

Cautions to be Taken for This Product:

- Do not disassemble or modify this product. Disassembling or modifying this product can cause damage. Disassembling and modifying the product will void your warranty.

- Use caution when handling the main unit. Be careful not to apply a mechanical shock.

- Do not pull the emulator probe (100-pin half-pitch cable or 50-pin normal-pitch cable) to disconnect from the emulator main unit.

- Do not use inch-size screws for this equipment. The screws used in this equipment are all ISO (meter-size) type screws. When replacing screws, use same type screws as equipped before.

IMPORTANT

Notes on Differences between Actual MCU and Emulator:

- Emulator operation differs from emulation of a mask MCU, as listed below. For details refer to "Chapter 6. Precautions to be Taken When Debugging".

    (1) Reset condition

    (2) Initial values of internal resource data at power-on

    (3) Internal RAM and ROM capacities, etc.

    (4) Electrical characteristics

    (5) Operation in the power-down mode

    (6) Operation of the watchdog timer function

- Therefore, always be sure to evaluate your system with an evaluation MCU (onetime version). Also, be sure to perform board-mounted evaluation with ES (Engineering Sample) version MCU to make final confirmation of device operation before starting mask production.

Note on the Target System:

- The operating voltage of the M34551T2-MCU is +3.0 V or +5.0 V. Therefore the target's supply voltage should be in the range of +3.0 V ±10 % or 5.0 V ±10 %.

Notes on Connecting the Target System:

- When connecting the emulator probe, be careful to the wrong connection.

- When connecting the emulator probe, be careful to the warp of the cable. The warp may cause breaking the wire.

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2. Handling Precautions

When using the M34551T2-MCU board, pay attention to the following:

(1) About the emulator

To use the M34551T2-MCU board, you always need to install it on the PC4504 emulator main unit.

(2) About the MCU board installation

Before installing (and removing) the MCU board, always be sure to power off the PC4504 emulator main unit and unplug its power cord from the outlet. For details on how to install and remove the MCU board, see "Chapter 2. Set-up" in the PC4504 System User's Manual.

(3) Emulator debugger

When using the M34551T2-MCU board to debug your program, you need to have the M3T-PD45 emulator debugger (sold separately). You need also the data file for 4551/4555 Group included with M3T-PD45.

(4) Registers that can be operated from M3T-PD45

Table 2.1 lists the registers that can be operated from the M3T-PD45. The "O" in the table means that the register can be operated; the "X" means that the register cannot be operated.

Table 2.1 Registers that can be operated from M3T-PD45

Register	Reference	Modification	Register	Reference	Modification
PC	O	O	W1	O	O
CY	O	O	W2	O	O
A	O	O	W3	O	O
B	O	O	C1	O	O
X	O	O	C2	X	O
Y	O	O	CR	O	O
Z	O	O	PU0	O	O
D	O	O	RLC	O	O
E	O	O	MR	O	O
SP	O	X	R1	X	O
V1	O	O	L1	X	O
V2	O	O	L2	X	O
I1	O	O			

(5) About the system clock frequency

When setting both bit 3 and bit 0 in the MR clock control register to "0" (high-speed mode, system clock = f(X_{IN})), the system clock frequency should be in the following ranges.

- $V_{DD} = 3.0$ V: $X_{IN} \leq 1.0$ MHz

- $V_{DD} = 5.0$ V: $X_{IN} \leq 2.0$ MHz

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3. Contents of the M34551T2-MCU Package

3.1 Things to Check When Unpacking

Table 3.1 shows the contents of the M34551T2-MCU package. When unpacking your M34551T2-MCU package, check to see that all the following components are included.

Table 3.1 Contents of M34551T2-MCU

Item	Product name	Quantity
1	M34551T2-MCU*1	1
2	100-wire half-pitch cable (40 cm)	1
3	50-wire normal-pitch cable (10 cm)	1
4	2-wire cable for external trigger signal (50 cm)	1
5	PCA4029 pitch converter board	1
6	M34551E8FP (MCU for replacement)*2	1
7	OSC-2 oscillator circuit board (J1 connector mounted)*3	1
8	Power code*4	1
9	Rubber legs*4	4
10	M34551T2-MCU English user's manual (this manual)	1
11	M34551T2-MCU Japanese user's manual	1

*1 "M34551T-MCU" is printed on the board.

*2 M34551T2-MCU is shipped from the factory with the M34555M4-002FP mounted as an evaluation MCU. If using with the 4551 Group, replace the evaluation MCU with the M34551E8FP (included).

*3 The M34551T2-MCU is equipped with the OSC-2 oscillator circuit board for 4.0 MHz when shipped from the factory. The OSC-2 oscillator circuit board mounted with only J1 connector for clock frequency alteration is included with the product.

*4 The power cable and rubber legs are used when using the M34551T2-MCU as an evaluation board.

*5 Keep the packaging carton and cushion material of the M34551T2-MCU to transport it for repair or for other purposes in the future.

*6 If you find any item missing or faulty, or any suggestion, contact your local distributor.

3.2 Other Necessary Products

To bring forward program development on the 4551/4555 Group, the products given below are necessary in addition to those contained in the package above. Get them separately to be ready when necessary.

    (1) Emulator main unit: PC4504
    (2) Emulator debugger: M3T-PD45
    (3) Programming adapter: PCA7414 (for M34551E8FP)

  * An evaluation MCU is not provided for 4555 Group.

MEMO

4. M34551T2-MCU

4.1 Outline

By using with the PC4504 emulator main unit, the M34551T2-MCU can make up an emulator system which can be operated by a personal computer.

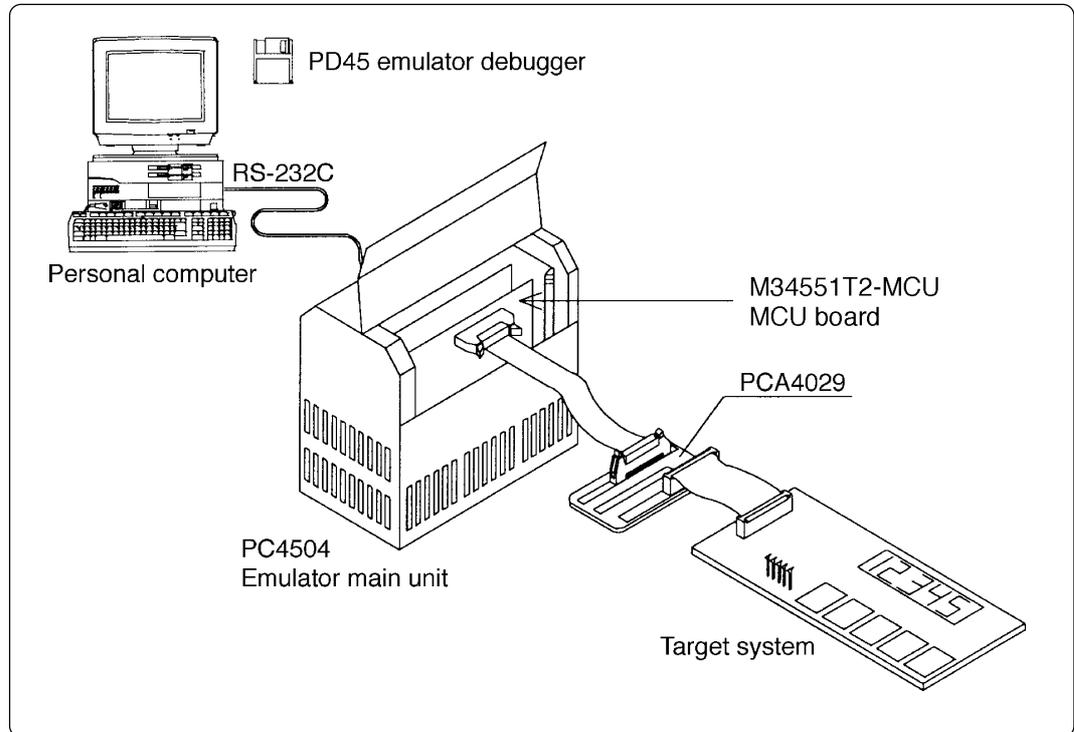Figure 4.1 shows the development support system configuration.

Figure 4.1 Development support system configuration

4.2 Specifications

Table 4.1 lists specifications of the M34551T2-MCU.

Table 4.1 M34551T2-MCU Specifications

Applicable MCUs	M34551MX-XXXFP			
	M34555MX-XXXFP			
Evaluation MCUs	M34551E8FP (included)			
	M34555M4-002FP (mounted)			
Maximum operating clock frequency	3 V	Medium-speed mode[*1]: 4.0 MHz High-speed mode: 1.0 MHz		
	5 V	Medium-speed mode[*1]: 8.0 MHz High-speed mode: 2.0 MHz		
	3 V / 5 V	XC clock: 32 kHz (using the crystal oscillator on the board)		
Target system voltage	3 V or 5 V			
Power supply	Supplied by the PC4504's internal power supply (+5 V, +12 V)			
Port emulation	Port	Output type	Direction	Devices used
	$P2_0$, $P2_1$ [*2]	-	Input	Input: 74HC4066
	$P1_0$ - $P1_3$	N-channel open drain	Input/output	Input: 74HC541 Output: 74LS06
	$P0_0$ - $P0_3$			
	D_0 - D_5			
Board dimensions	233 (L) x 135 (W) x 26 (H) mm			
Operating temperature	5 to 35 °C (non-condensing)			
Product configuration	M34551T2-MCU [*3] 100-wire half-pitch cable 50-wire normal-pitch cable External trigger cable PCA4029 M34551E8FP (for replacement) OSC-2 (for changing frequencies) [*4] Power code Rubber legs (4 pieces)			

*1 Operates in the medium-speed mode (instruction clock: f (X_{IN})/12) immediately after reset termination.

*2 Ports $P2_0$ and $P2_1$ are used with both SEG_{16} and SEG_{17}, and function as output ports when the segment output is selected.

*3 "M34551T-MCU" is printed on the board.

*4 The M34551T2-MCU has an oscillator circuit board OSC-2 (for 4.0 MHz) when shipped from the factory. In addition, it comes with an oscillator circuit board OSC-2, with only a connector J1 mounted.

4.3 Description of Switches

The M34551T2-MCU board has nine switches. Figure 4.2 shows the positions of these switches. Tables 4.2 and 4.3 list the functions of the switches and the preset switch positions that are set before the MCU board is shipped from the factory.
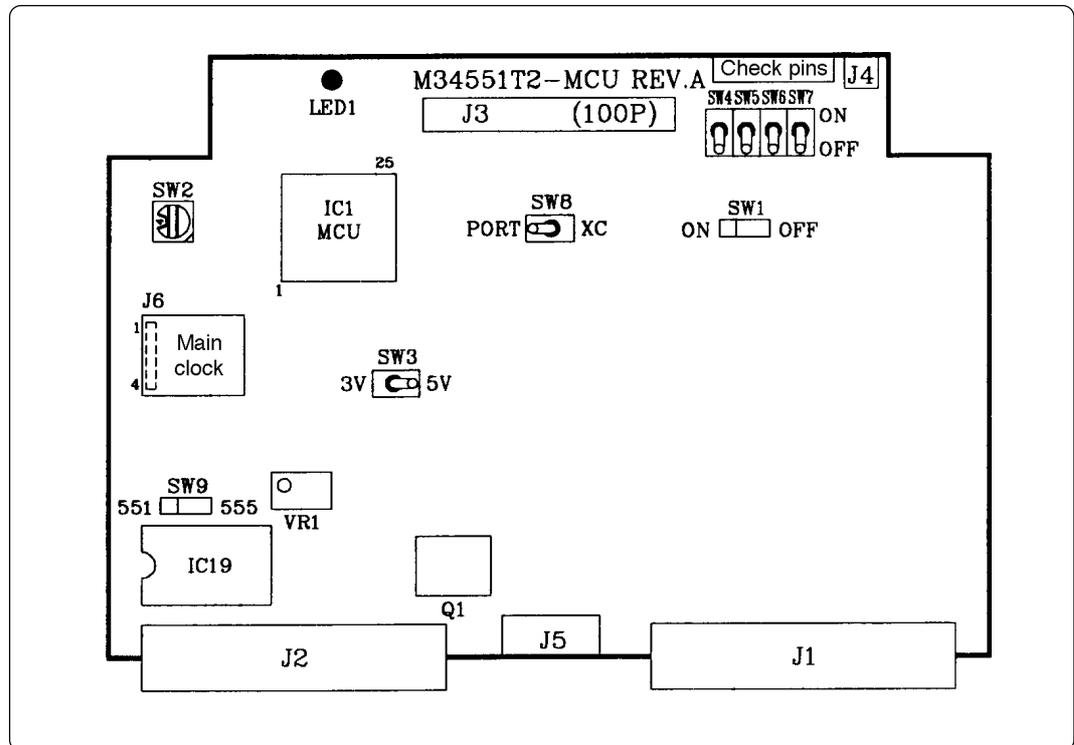
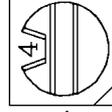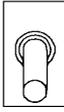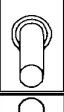*Figure 4.2 Positions of switches*
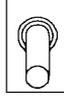
Table 4.2 Functions of switches (1/2)

	Label	Switch position	Description	Factory-setting
SW1	OFF	ON [○ ▨ ○ ○] OFF	Does not connect the V_{DD} of the M34551T2-MCU to the V_{DD} of the target system.	OFF
	ON	ON [▨ ○ ○ ○] OFF	Connects the V_{DD} of the M34551T2-MCU to the V_{DD} of the target system.	
SW2	ROMSIZE		Sets the MCU's ROM size. • M4, set SW2 to "4". • E8, set SW2 to "8".	4
SW3	5 V	3 V [⊂○] 5 V	Operates the target MCU at +5 V.	5 V
	3 V	3 V [○⊃] 5 V	Operates the target MCU at +3 V.	

Table 4.3 Functions of the switches (2/2)

	Label	Switch position	Description	Factory-setting
SW4	OFF		Does not connect the pullup resistor 68 kΩ to the port $P1_0$.	OFF
	ON		Connects the pullup resistor 68 kΩ to the port $P1_0$.	
SW5	OFF		Does not connect the pullup resistor 68 kΩ to the port $P1_1$.	OFF
	ON		Connects the pullup resistor 68 kΩ to the port $P1_1$.	
SW6	OFF		Does not connect the pullup resistor 68 kΩ to the port $P1_2$.	OFF
	ON		Connects the pullup resistor 68 kΩ to the port $P1_2$.	
SW7	OFF		Does not connect the pullup resistor 68 kΩ to the port $P1_3$.	OFF
	ON		Connects the pullup resistor 68 kΩ to the port $P1_3$.	
SW8	PORT	PORT □—○ XC	Uses the ports D_6 and D_7.	PORT
	XC	PORT ○—□ XC	Uses the sub-clock oscillator circuit.	
SW9	551	555 ○▓▓ 551	Operates the M34551T2-MCU for 4551 group.	555
	555	555 ▓▓○ 551	Operates the M34551T2-MCU for 4555 group.	

4.4 Description of Connectors

The M34551T2-MCU board has eight connectors. Table 4.4 lists the functions of these connectors. Figure 4.3 shows the positions of connectors on the MCU board.

Table 4.4 Connectors

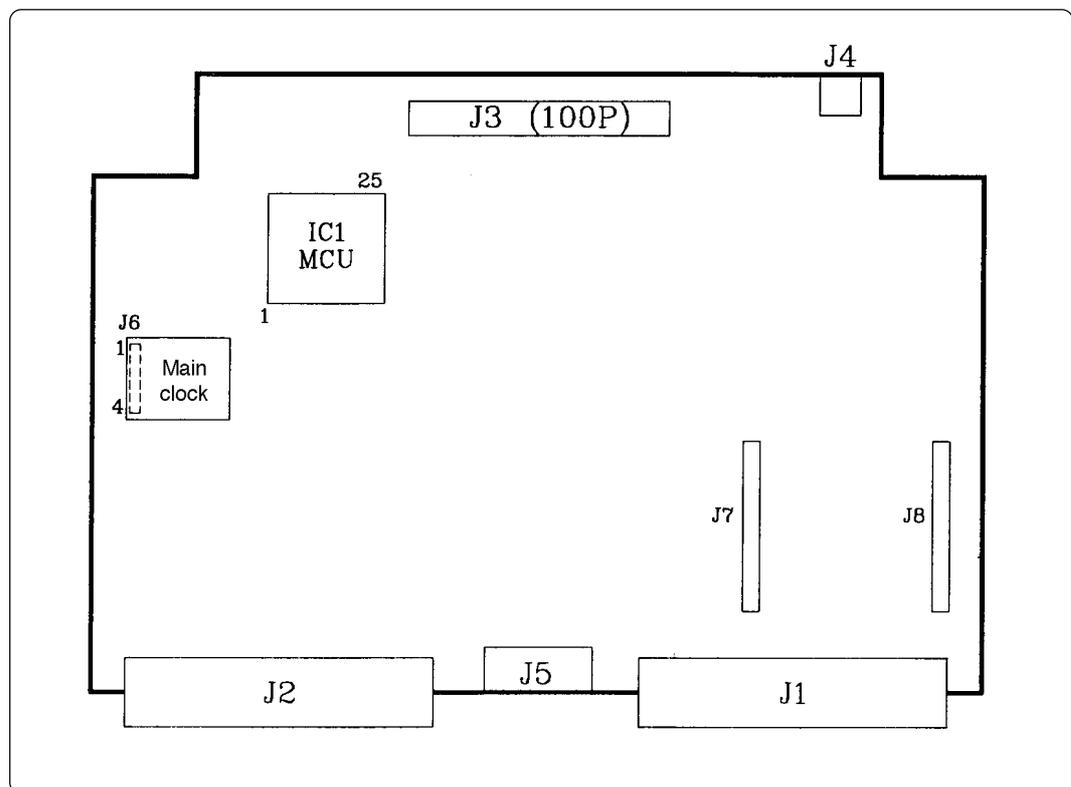| Connector	Function
J1	Connects the evaluation MCU bus.
J2	Connects the monitor CPU bus.
J3	Connects the target system. (100-pin)
J4	Connects the external trigger signal. (2-pin)
J5	Connects the evaluation board.
J6	Connects the oscillator circuit board. (4-pin)
J7, J8	Connects PCA7745.

Figure 4.3 Positions of connectors

(1) Connector J3

Table 4.5 lists the pin assignments of 100-wire half-pitch connector (J3) for connecting the PCA4029. And Figure 4.4 shows the connector J3 pin layout.

Table 4.5 Pin assignments of connector J3

Line A			Line B			Line C			Line D		
Pin No.	Signal	I/O	Pin No.	Signal	I/O	Pin No.	Signal	I/O	Pin No.	Signal	I/O
1	GND		1	GND		1	$EP2_2/SEG_{18}$	I/O	1	$EP2_1/SEG_{17}$	I/O
2	GND		2	GND		2	$EP2_3/SEG_{19}$	I/O	2	$EP2_0/SEG_{16}$	I/O
3	GND		3	GND		3	$EP0_0$	I/O	3	SEG_{15}	O
4	GND		4	GND		4	$EP0_1$	I/O	4	SEG_{14}	O
5	GND		5	GND		5	$EP0_2$	I/O	5	SEG_{13}	O
6	GND		6	GND		6	$EP0_3$	I/O	6	V_{SS}	
7	GND		7	GND		7	$EP1_0$	I/O	7	SEG_{12}	O
8	GND		8	GND		8	$EP1_1$	I/O	8	SEG_{11}	O
9	GND		9	GND		9	$EP1_2$	I/O	9	SEG_{10}	O
10	GND		10	GND		10	$EP1_3$	I/O	10	SEG_9	O
11	GND		11	GND		11	ED_0	O	11	SEG_8	O
12	GND		12	GND		12	ED_1	O	12	SEG_7	O
13	GND		13	GND		13	ED_2	O	13	SEG_6	O
14	GND		14	GND		14	ED_3	O	14	SEG_5	O
15	GND		15	GND		15	ED_4	O	15	SEG_4	O
16	GND		16	GND		16	ED_5/INT	I/O	16	SEG_3	O
17	GND		17	GND		17	CARR	O	17	SEG_2	O
18	GND		18	GND		18	V_{DD}		18	SEG_1	O
19	GND		19	GND		19	V_{SS}		19	SEG_0	O
20	GND		20	GND		20	X_{IN}	-	20	COM_3	O
21	GND		21	GND		21	X_{OUT}	-	21	COM_2	O
22	GND		22	GND		22	CNV_{SS}	-	22	COM_1	O
23	GND		23	GND		23	ED_6/X_{CIN}	I/O	23	COM_0	O
24	GND		24	GND		24	ED_7/X_{COUT}	O	24	ERESET*	I
25	GND		25	GND		25	NC	-	25	NC	-

Note: "I" denotes "Input"; "O" denotes "Output"; "I/O" denotes "Input/output"; "-" denotes "Not connected".
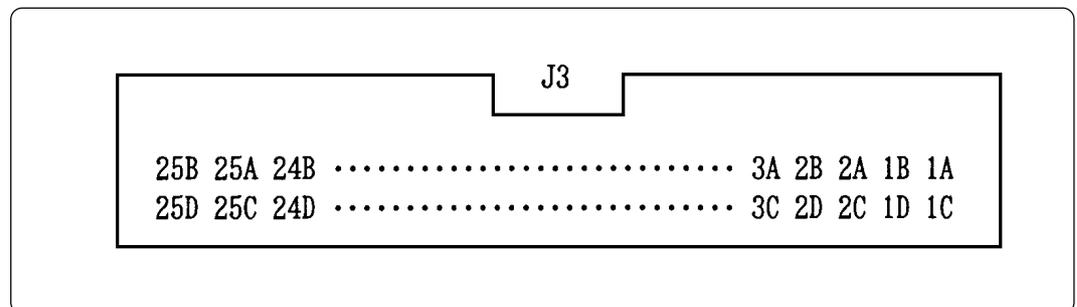
```
                                  J3
  25B 25A 24B ···························· 3A 2B 2A 1B 1A
  25D 25C 24D ···························· 3C 2D 2C 1D 1C
```

Figure 4.4 Connector J3 pin layout

(2) Connector J4

To use the external trigger signal as event input of trigger breaks or trace points, connect the 2-wire cable (for external trigger signal) included with your M34551T2-MCU board to the connector J4. Connect the black clip of the external trigger cable to GND, and use the white clip for external trigger signal input. Table 4.6 lists the pin assignments of the connector J4.

Table 4.6 Pin assignments of connector J4

Pin No.	Signal	Function
1	TRIG	External trigger signal input
2	GND	GND input

(3) Connector J6

The connector J6 is a connector used to connect an oscillator circuit board OSC-2. When changing the frequency of the oscillator, use the OSC-2 oscillator circuit board (only the connector J1 mounted) included.

When changing the frequency, the constants depend on the oscillator you use. It's advisable to refer to the values recommended by the manufacturers.

Table 4.7 lists the pin assignments of the connector J6. Figure 4.5 shows the pin layout of the connector J6. For the 4 MHz operation with an oscillator board OSC-2, see Figure 4.6.

Table 4.7 Pin assignments of connector J6

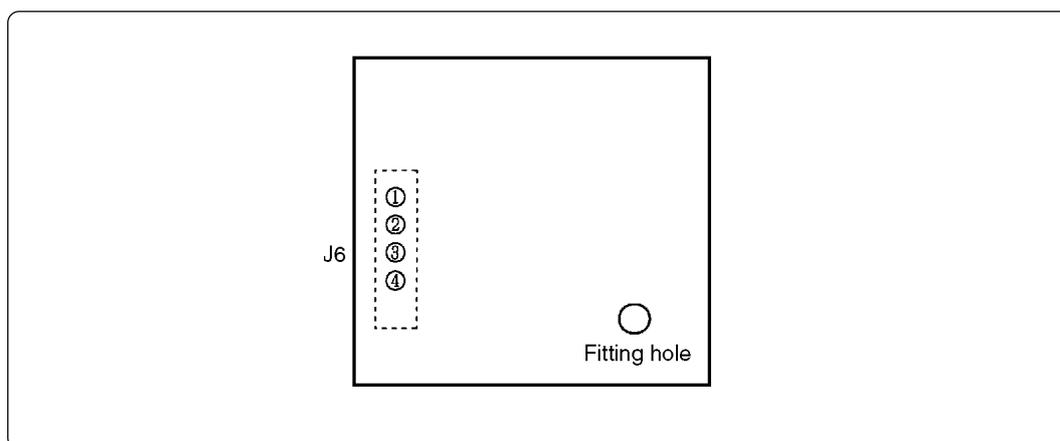| Pin No.	Signal	Function
1	V_{CC}	Power supply
2	GND	GND
3	CLK	Clock input
4	GND	GND

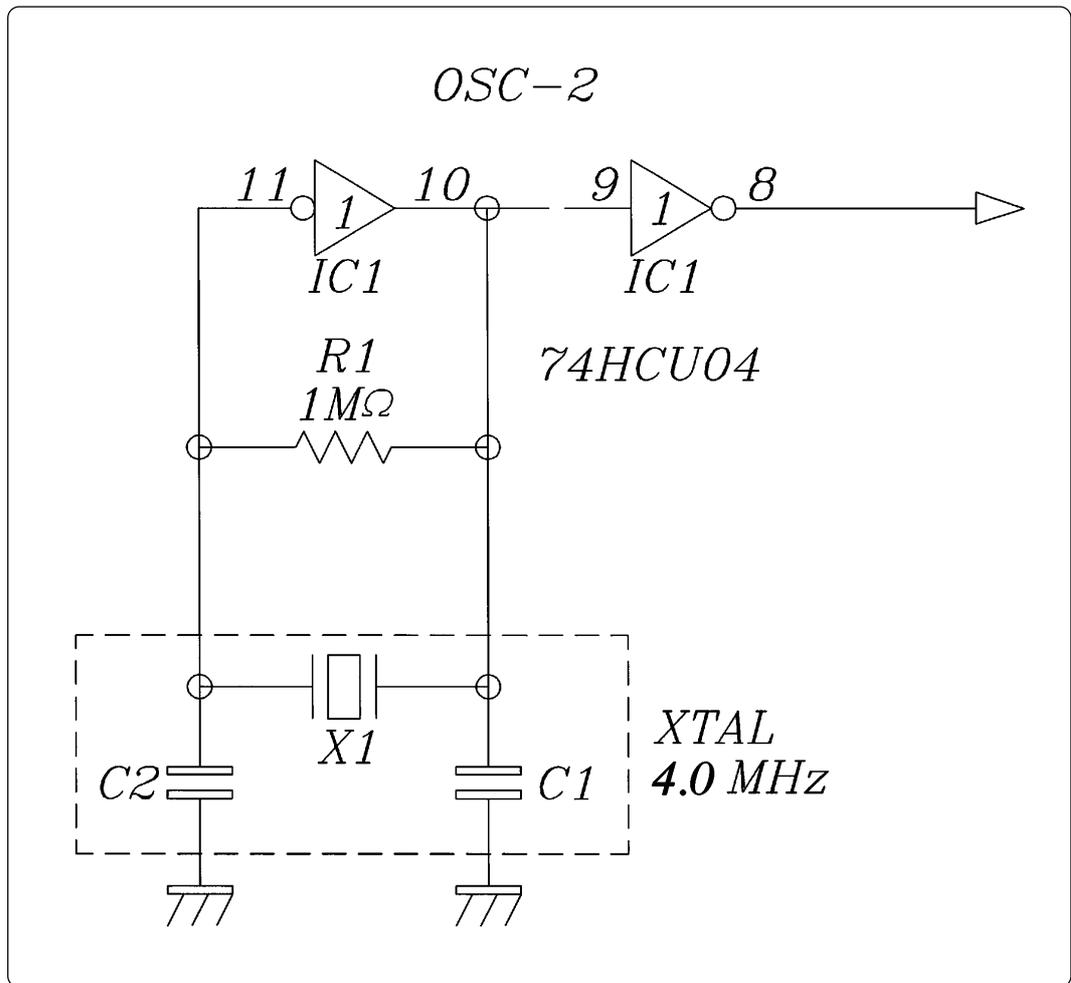
Figure 4.5 Pin layout of connector J6

Figure 4.6 Schematic circuit diagram of OSC-2 (4.0 MHz)

4.5 Connection to the Target System

When connecting the M34551T2-MCU board to the target system:

Connect the 50-wire normal-pitch cable included with the MCU board to the 50-pin dual-in-line pins on the target system. Following products are required for connection to the target system.

(1) 100-wire half-pitch cable (40 cm)
(2) PCA4029 pitch converter board
(3) 50-wire normal-pitch cable (10 cm)

Figure 4.7 depicts the M34551T2-MCU board connected to the target system using the 50-wire normal-pitch cable. Table 4.8 lists the connector signal assignments of the 50-wire normal-pitch cable. Figure 4.8 shows the pin layout of the 50-wire normal-pitch cable.
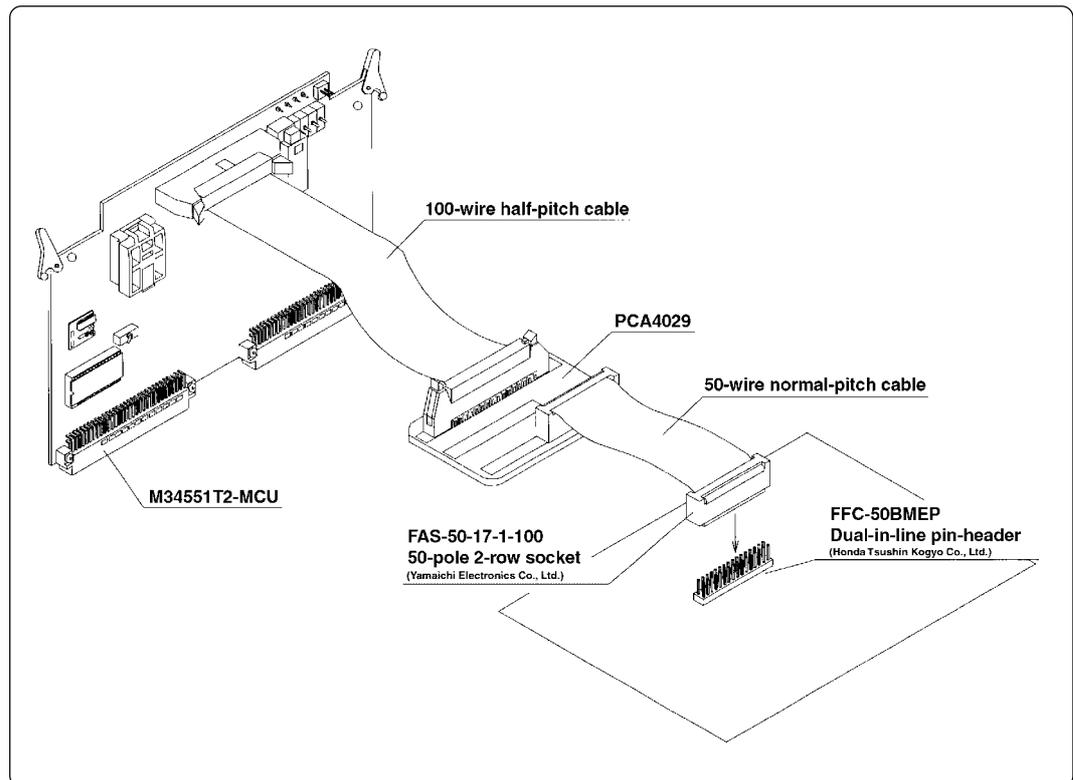

Figure 4.7 Connecting the MCU board to the target system using dual-in-line pins

Table 4.8 50-wire normal-pitch cable pin assignments

| Pin No.	Signal	Pin No.	Signal
1	$EP2_2/SEG_{18}$	50	$EP2_1/SEG_{17}$
2	$EP2_3/SEG_{19}$	49	$EP2_0/SEG_{16}$
3	$EP0_0$	48	SEG_{15}
4	$EP0_1$	47	SEG_{14}
5	$EP0_2$	46	SEG_{13}
6	$EP0_3$	45	V_{SS}
7	$EP1_0$	44	SEG_{12}
8	$EP1_1$	43	SEG_{11}
9	$EP1_2$	42	SEG_{10}
10	$EP1_3$	41	SEG_9
11	ED_0	40	SEG_8
12	ED_1	39	SEG_7
13	ED_2	38	SEG_6
14	ED_3	37	SEG_5
15	ED_4	36	SEG_4
16	ED_5/INT	35	SEG_3
17	CARR	34	SEG_2
18	V_{DD}	33	SEG_1
19	V_{SS}	32	SEG_0
20	NC	31	COM_3
21	NC	30	COM_2
22	NC	29	COM_1
23	ED_6/NC	28	COM_0
24	ED_7/NC	27	ERESET*
25	NC	26	NC
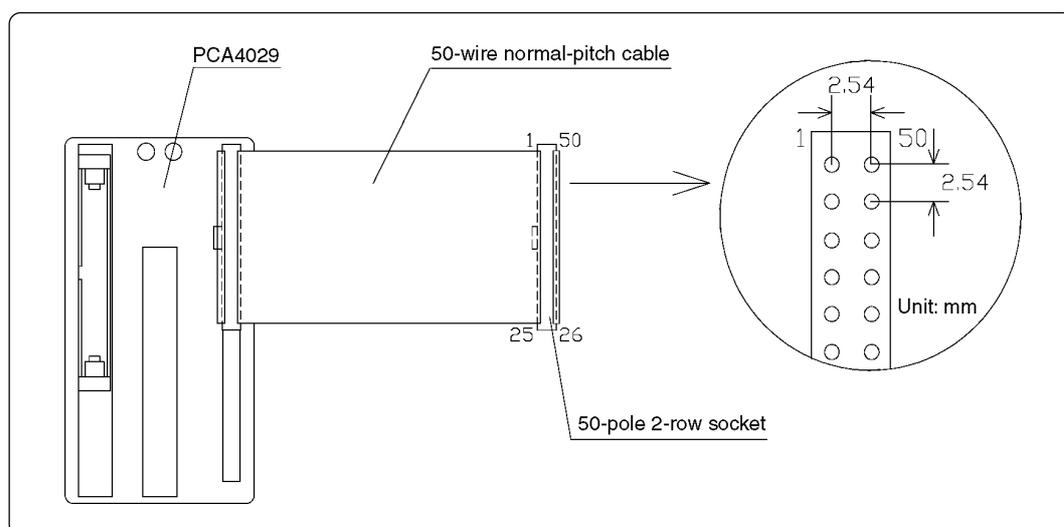
Figure 4.8 Pin layout of the 50-wire normal-pitch cable

Some signals connected to the target system are emulated on the M34551T2-MCU board. For details, see "Chapter 7. Connection Circuit Diagram".

• Pins connected directly to the target system (6 types, 24 lines)

    (1) SEG_0 - SEG_{15}
    (2) COM_0 - COM_3
    (3) CARR
    (4) D_6*
    (5) D_7*
    (6) V_{SS}

• Pins connected to the target system via emulation circuits, etc. (6 types, 20 lines)

    (1) $P0_0$ - $P0_3$
    (2) $P1_0$ - $P1_3$
    (3) $P2_0$ - $P2_3$
    (4) D_0 - D_5
    (5) RESET *
    (6) V_{DD}

• Pins not connected to the target system (5 types, 5 lines)

    (1) X_{IN}
    (2) X_{OUT}
    (3) CNV_{SS}
    (4) X_{CIN} *
    (5) X_{COUT} *

 * Not connected to the target system when the sub-clock is selected (switch SW8: "XC"). The external clock signal (32.768 kHz) is input to the X_{CIN} pin from the oscillator of the M34551T2-MCU board. And the X_{COUT} pin is not connected.

4.6 LED

Figure 4.9 shows the LED layout of the M34551T2-MCU. The LED lights in green when the power is supplied to the MCU board.
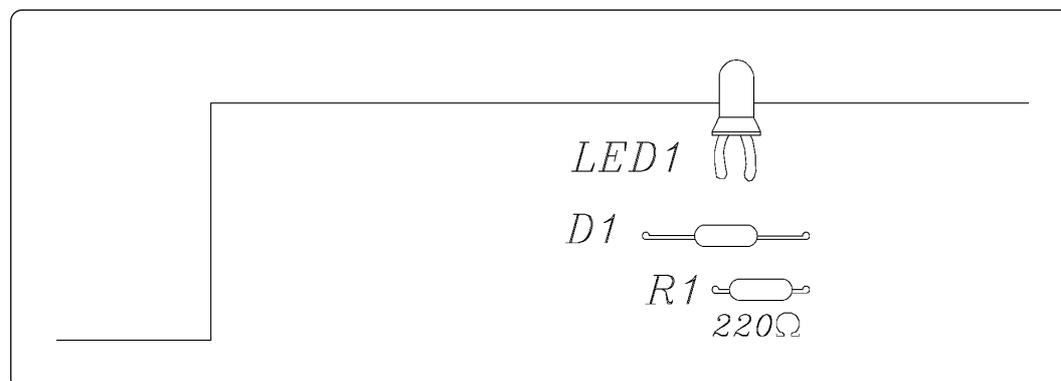

Figure 4.9 Layout of the LED

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5. Using as an Evaluation Board

Mounting the EPROM containing the program and supplying power enables the M34551T2-MCU to be used as an evaluation board. Use to evaluate the functions that cannot be evaluated with the evaluation MCU of the 4551 Group. Use an evaluation MCU (OTP version) for 4551 Group evaluation.

5.1 System Configuration

System configuration when using the M34551T2-MCU as an evaluation board is as shown in Figure 5.1.
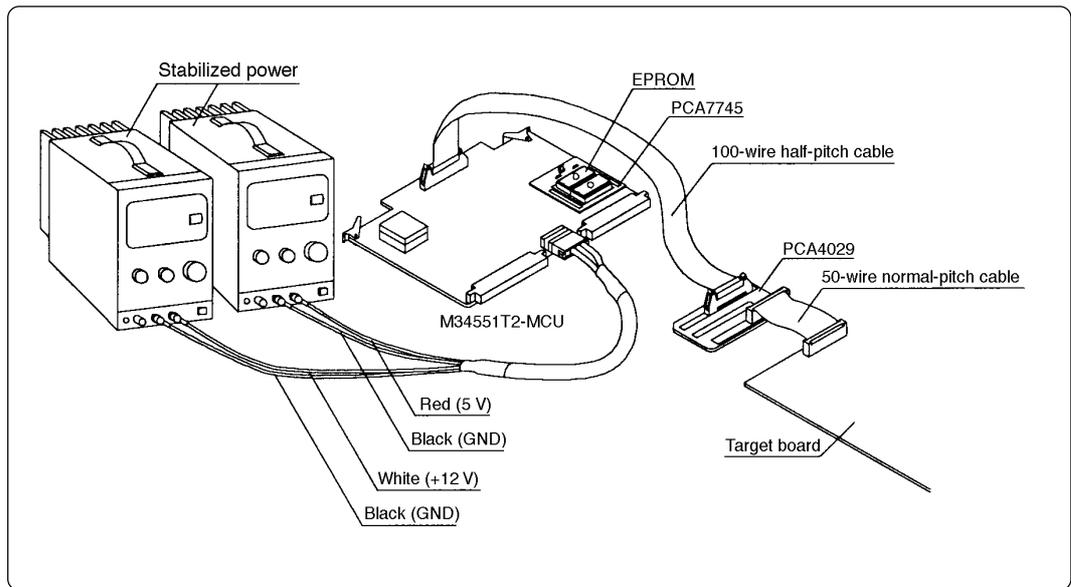

Figure 5.1 System configuration for using as evaluation board

5.2 Mounting the EPROM

Load HEX file data generated by ASM45 into the EPROM and mount in the IC socket on the PCA7745. Prepare two EPROM loaded with the same data, and mount them in the IC sockets on the PCA7745 while checking the position of pin No. 1 (High and Low side sequence differs for EPROM). Figure 5.2 shows the EPROM mounting position on the PCA7745.
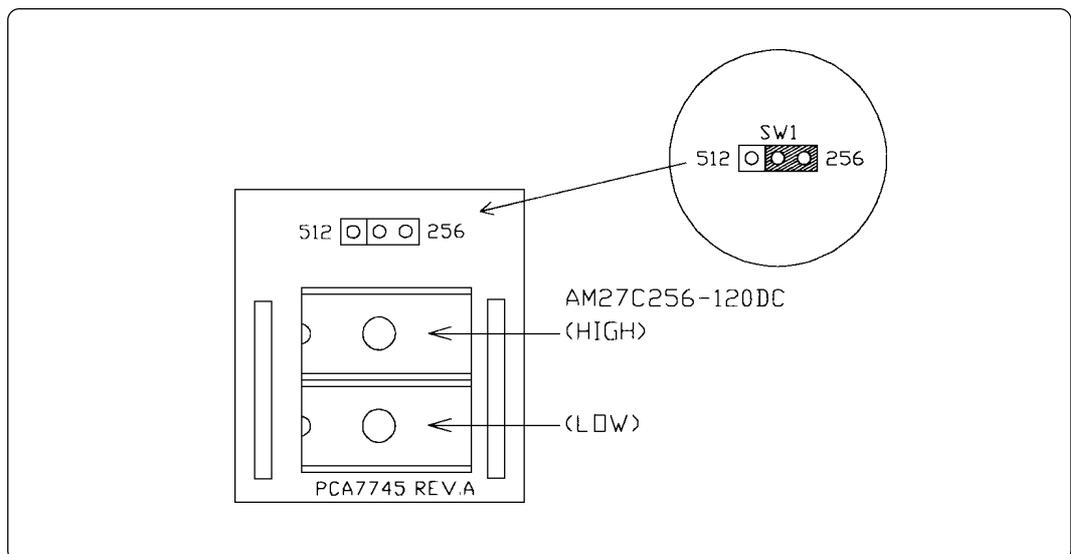

Figure 5.2 EPROM mounting position on the PCA7745

5.3 Mounting the Rubber Legs

Mount the rubber legs (included) in the four corners of the board if using the M34551T2-MCU board as an evaluation board. Figure 5.3 shows the positions of the mounting holes and method of mounting the rubber legs. When mounting them, securely fasten the screws with a screwdriver, etc. Using the board without the rubber legs could result in damage of the M34551T2-MCU board and target system due to a short, etc.
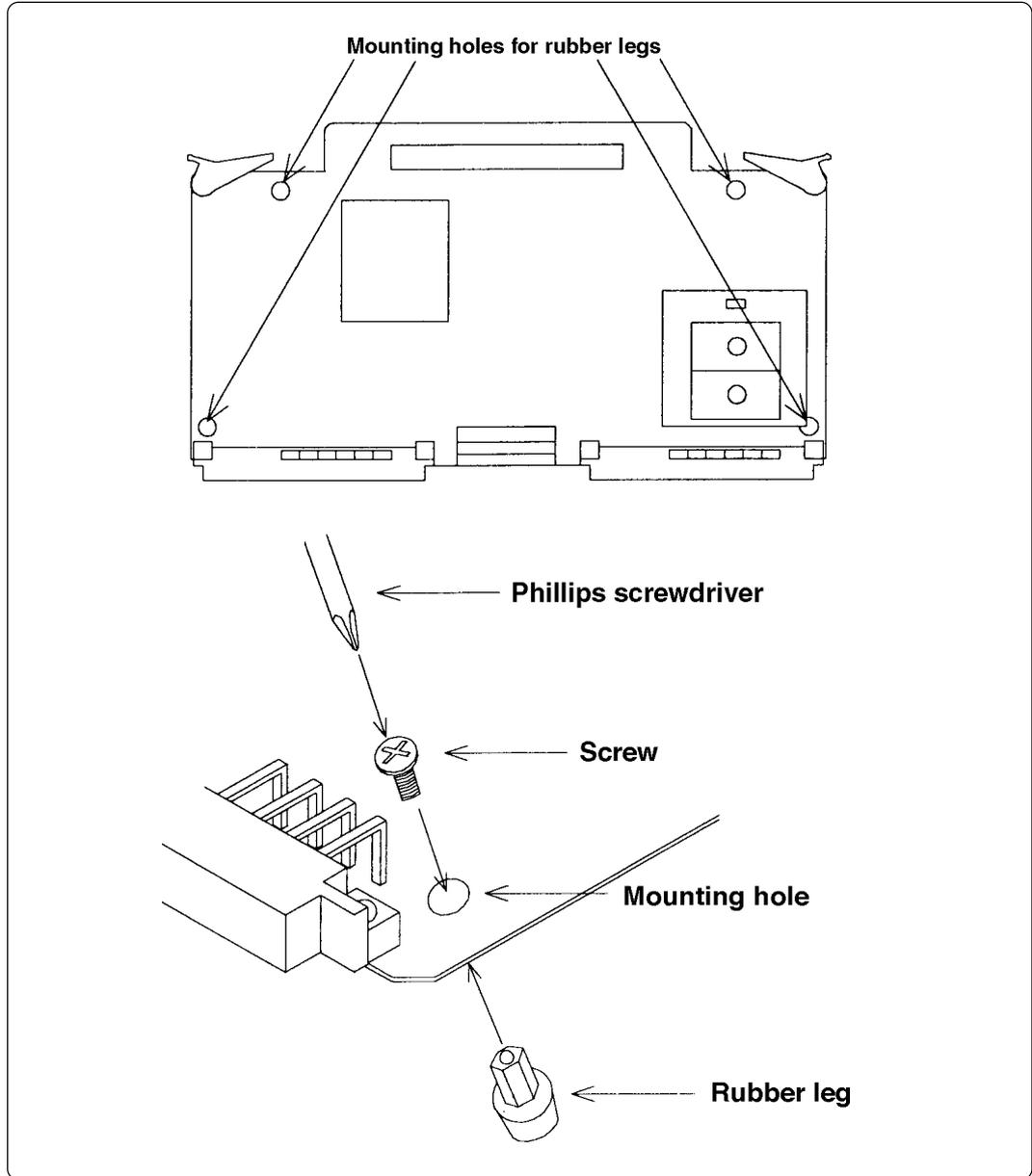

Mounting holes for rubber legs

Phillips screwdriver

Screw

Mounting hole

Rubber leg

Figure 5.3 Positions of the mounting holes and method of mounting the rubber legs

5.4 Switch Settings

The PCA7745 board is equipped with switch SW1 for setting the ROM type. Set switch SW1 according to the type of EPROM to be used as shown in Table 5.1.

Table 5.1 Setting switch SW1 on PCA7745

Setting	Device
256	M5M27C2566AK
512	M5M27C512ALK

5.5 Connection to the Target System

For method of connecting the MCU board to the target system when using this product as an evaluation board, refer to "4.5 Connecting the MCU board to the Target System".

5.6 Connection to the External Power Source

If using the M34551T2-MCU board as an evaluation board, you must supply power from an external source. Use a power source capable of delivering +5 V or +12 V. Table 5.2 gives the pin positions for the external power source input cable.

Table 5.2 Pin positions for the external power source input cable

Pin No.	Color	Function
1	Red	Input (+5 V)
2	Black	GND
3	White	Input (+12 V)
4	-	Not used

5.7 Turning the Power On

After checking connection of the target system and external power source for the evaluation board, turn the target system and external power supply on. And turn on the power to each equipment following the procedure below successively.

(1) Turn on the target system.
(2) Turn on the external power source for the evaluation board.

Also, follow steps (1) and (2) when powering off.

(1) Turn off the target system.
(2) Turn off the external power source for the evaluation board.

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6. Precautions to Be Taken When Debugging

6.1 Reset

The M34551T2-MCU uses 74AC14 for the reset signal input buffer, and electrical characteristics therefore differ from those of an actual chip.

Table 6.1 lists the $\overline{\text{RESET}}$ signal input characteristics on the M34551T2-MCU.

Table 6.1 $\overline{\text{RESET}}$ signal input characteristics

Item	Symbol	Voltage	Min.	Max.
H-level threshold voltage	V$_P$	Vcc=3.0 V	-	2.2 V
		Vcc=4.5 V	-	3.2 V
		Vcc=5.5 V	-	3.9 V
L-level threshold voltage	V$_N$	Vcc=3.0 V	0.5 V	-
		Vcc=4.5 V	0.9 V	-
		Vcc=5.5 V	1.1 V	-
Hysteresis voltage	V$_H$	Vcc=3.0 V	0.3 V	1.2 V
		Vcc=4.5 V	0.4 V	1.4 V
		Vcc=5.5 V	0.5 V	1.6 V

6.2 System Clock

Use the product within the range of MCU specifications and within the frequency range given in Table 6.2 in accordance with power source voltage and operation mode.

Table 6.2 Maximum operating frequencies of the M34551T2-MCU

Voltage	Mode	Maximum operating frequency
3 V	Medium-speed mode	Up to 4.0 MHz
	High-speed mode	Up to 1.0 MHz
5 V	Medium-speed mode	Up to 8.0 MHz
	High-speed mode	Up to 2.0 MHz

Use components required for the OSC-2 oscillator circuit board (included) if changing frequency in accordance with the target system.

For details about the oscillation circuit constants, consult the manufacturer of your oscillator.

6.3 Real-time Capability of Timer

Since the clock on the MCU board is active even during emulation, its timer values are modified.

Examples:

(1) When single-stepping instructions
(2) When referencing or modifying registers or the internal RAM

6.4 Watchdog Timer

The watchdog timer does not operate on the M34551T2-MCU board. Use an evaluation MCU (OTP version) to verify the watchdog timer-related operations.

6.5 Pullup Transistors

Since the P1 port of the M34551T2-MCU contains emulation circuits, you cannot control the pullup transistors using the pullup control register PU0. When you want to use the internal pullup transistors, turn on switches SW4 to SW7 to activate the pullup resistors of the M34551T2-MCU. The port P1's resistance value of the pullup resistor is 68 kΩ by the settings (SW4 to SW7).

And the port P0's (M34551T2-MCU) resistance value of the pullup register is 68 kΩ.

6.6 Port I/O Timing

(1) Port input timing

Port input timings are the same as with the actual MCUs.

(2) Port output timing

When using the M34551T2-MCU, output timings are different from those of the actual MCUs for the following ports that are configured with port emulation circuits:

- Ports $P0_0$ to $P0_3$
- Ports $P1_0$ to $P1_3$
- Ports D_0 to D_5

With the actual MCUs, changes occur at the beginning of the T3 state of an output instruction. With the M34551T2-MCU, changes occur at the beginning of the T2 state of the next output instruction. Figure 6.1 shows the port output timings of the M34551T2-MCU.

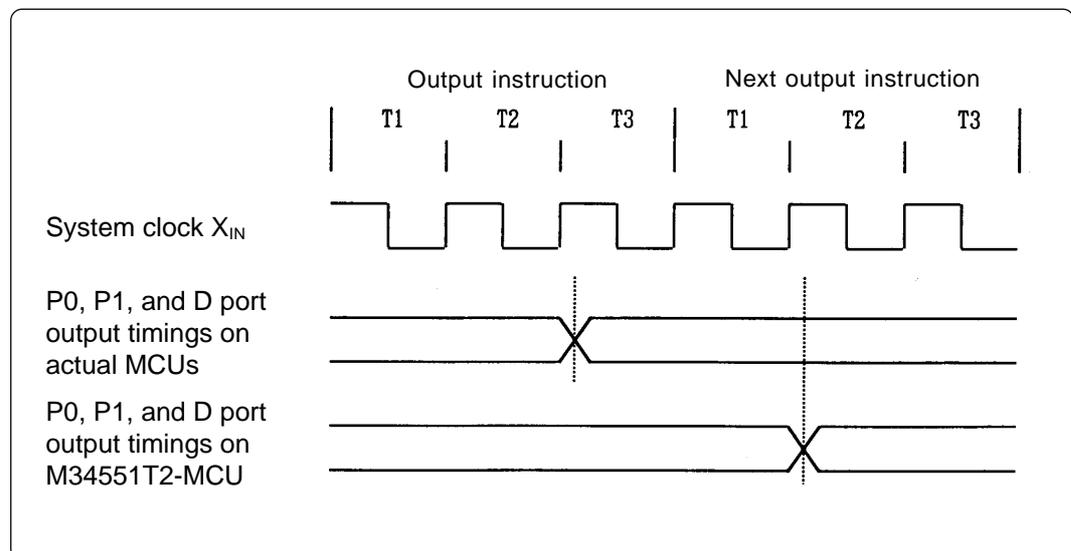For the other ports, the output timings are the same as with the actual MCUs.

Figure 6.1 P0, P1 and D port output timings

6.7 Characteristics of I/O Ports

Characteristics of Ports P0, P1, P2, D_0 to D_7 of the M34551T2-MCU differ from those of actual MCU, because the M34551T2-MCU have emulation circuit. Table 6.3 shows characteristics of the emulation ports.

Table 6.3 Characteristics of emulation ports

| Port	I/O	Device	Item	Voltage	Min.	Max.	Remarks
P0, P1	Input	74HC541	V_{IH}	Vcc=2.0 V	1.5 V	-	
				Vcc=4.5 V	3.15 V	-	
			V_{IL}	Vcc=2.0 V	-	0.5 V	
				Vcc=4.5 V	-	1.35 V	
	Output	74LS06	I_{OH}	Vcc=4.75 V	-	250 μA	V_{OH}=MAX
			I_{OL}		-	40 mA	
			V_{OL}		-	0.4 V	I_{OL}=16 mA
					-	0.7 V	I_{OL}=MAX
P2	Input/ Output	74HC4066	R_{ON}	Vcc=2.0 V	160 Ω	-	$V_{I/O}$=Vcc to GND $I_{I/O}$≤1 mA
				Vcc=4.5 V	70 Ω	130 Ω	
					96 Ω	200 Ω	$V_{I/O}$=Vcc or GND $I_{I/O}$≤1 mA
			$\triangle R_{ON}$	Vcc=4.5 V	10 Ω	-	$V_{I/O}$=Vcc to GND $I_{I/O}$≤1 mA
D_5	Input	74HC541	V_{IH}	Vcc=2.0 V	1.5 V	-	
				Vcc=4.5 V	3.15 V	-	
			V_{IL}	Vcc=2.0 V	-	0.5 V	
				Vcc=4.5 V	-	1.35 V	
D_5 - D_0	Output	74LS06	I_{OH}	Vcc=4.75 V	-	250 μA	V_{OH}=MAX
			I_{OL}		-	40 mA	
			V_{OL}		-	0.4 V	I_{OL}=16 mA
					-	0.7 V	I_{OL}=MAX

6.8 Power-down Mode

The power-down mode of the M34551T2-MCU operates differently from that of the actual MCUs.
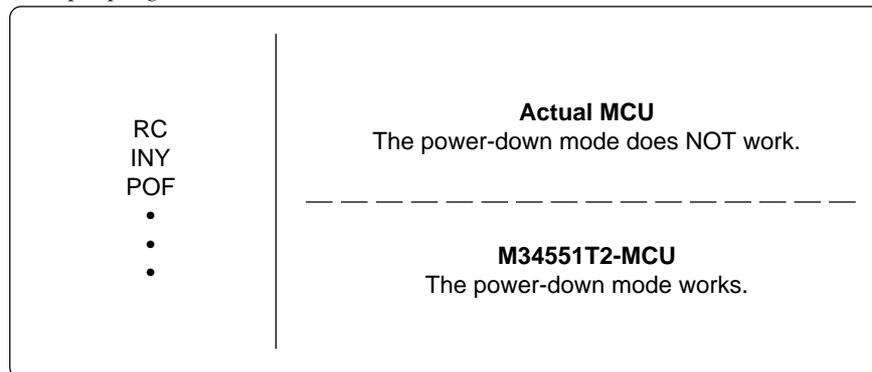
(1) Power-down operation of the M34551T2-MCU

While with the actual MCUs the power-down mode works by the "EPOF" and "POF" instructions, with the M34551T2-MCU the power-down mode works only by the "POF" instruction.

With the M34551T2-MCU, the "EPOF" instruction is invalid.

Example program 6.1

```
RC
INY
EPOF
POF
 •
 •
```

Actual MCU
The power-down mode works.

— — — — — — — — — — — — — — — — —

M34551T2-MCU
The power-down mode works.

Example program 6.2

```
RC
INY
POF
 •
 •
 •
```

Actual MCU
The power-down mode does NOT work.

— — — — — — — — — — — — — — — — —
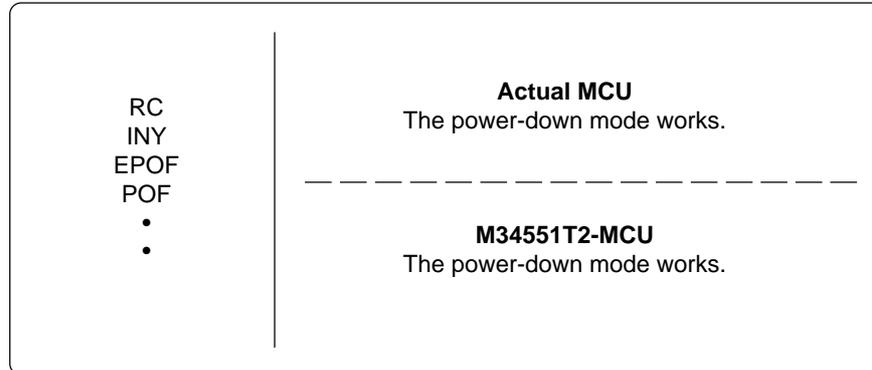
M34551T2-MCU
The power-down mode works.

6.9 Program Execution (G, GB)

The PC4504 and the M34551T2-MCU's hardware is subject to the following restrictions with respect to the operation of the program execution commands (G and GB).

(1) Continuous description of instructions

Hardware breakpoints set in a continuous description of instructions following one after another do not cause a break to occur in the continuous description of instructions. A break occurs only after fetching the address where the continuous description of instructions is discontinued. (See Program example 6.3.)

However, a break does occur even in a continuous description of instructions when an external trigger break or forced break is encountered. For execution to be resumed in this case, you need to make sure that the execution start address is next to the continuous description of instructions. (See Program example 6.4.)

Program example 6.3

	LA	0	
POINT:	LA	1	; Continuous description of instructions
	LA	2	
POINT+2:	XAM	3	

If a break is set at POINT, execution is halted immediately before the XAM institution at address POINT+2.

Program example 6.4

	LA	0	
POINT:	LA	1	; Continuous description of instructions
POINT+1:	LA	2	
POINT+2:	XAM	3	

If a forced or external trigger break is applied at POINT, execution is halted at POINT+1. When resuming program execution after the break, make sure that the start address is at POINT+2, an address immediately after the continuous description of instructions is discontinued.

(2) Skip instructions (e.g. SNZP, INY, DEY, SZB, SEAM, SZC and RTS)

In cases when a skip instruction skips the next instruction, a breakpoint set in the skipped instruction does not cause execution to halt. (See Program examples 6.5 and 6.6)

Program example 6.5

	RC				RC	
	SZC				SZC	
POINT:	TABP			POINT:	TABP	
POINTA:	TAM	0		POINTA:	TAM	0
	•				•	
	•				•	

A breakpoint set at address POINT causes execution to halt immediately before address POINTA in only the case of the instruction shown on the right side.

Program example 6.6

	RC	; Skip instruction
	INY	
POINT:	TABP	
	TAM 0	
	•	
	•	

If a break with pass count is set at address POINT, the count is taken and execution is halted only when the instruction at address POINT is executed.

6.10 External Trigger

(1) External trigger input timing

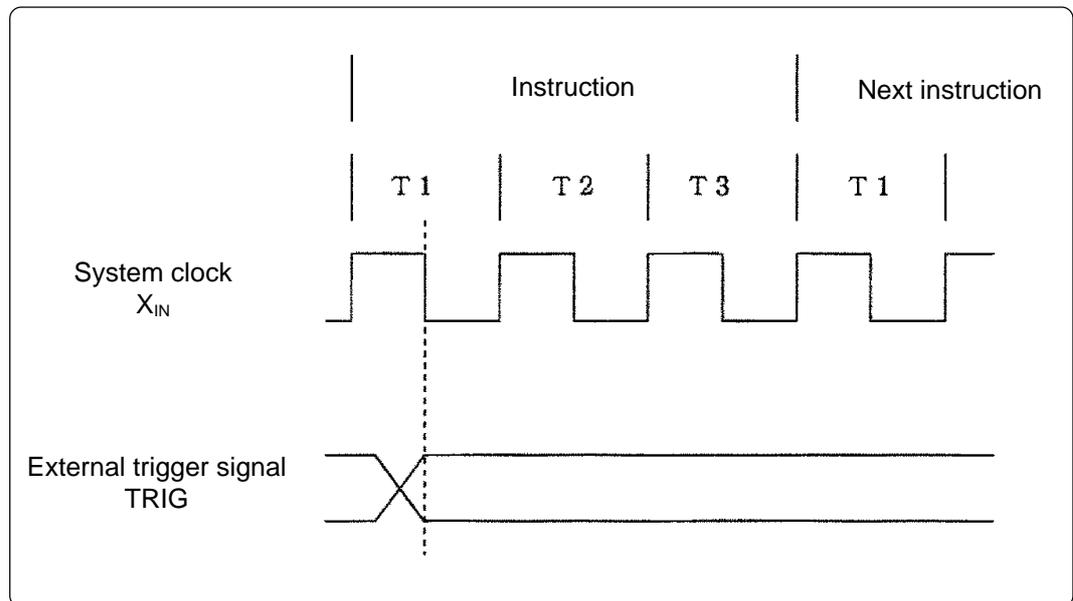The latch timing of the external trigger is shown in Figure 6.2.

Figure 6.2 Latch timing of the external trigger signal

(2) External trigger signal input characteristics

Trigger breaks work according to the condition (leading edge/trailing edge) of signals input from the external trace cable. The external trigger signals of the trace points and the external trigger signals of the break points use the same signals.

The input characteristics of the external trigger are shown in the Table 6.4 below.

Table 6.4 External trigger input characteristics

Item	Symbol	Voltage	Max.	Min.
H-level input Voltage	V_{IH}	$V_{cc} = 2.0$ V	-	1.5 V
		$V_{cc} = 4.5$ V	-	3.15 V
L-level input voltage	V_{IL}	$V_{cc} = 2.0$ V	0.5 V	-
		$V_{cc} = 4.5$ V	1.35 V	-

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7. Connection Circuit Diagram

Figure 7.1 shows the M34551T2-MCU connection circuit diagram. This circuit diagram depicts the M34551T2-MCU connection centering on circuits connected to the target system. Emulator control blocks and other similar circuits that are not connected to the target system are omitted in this diagram.
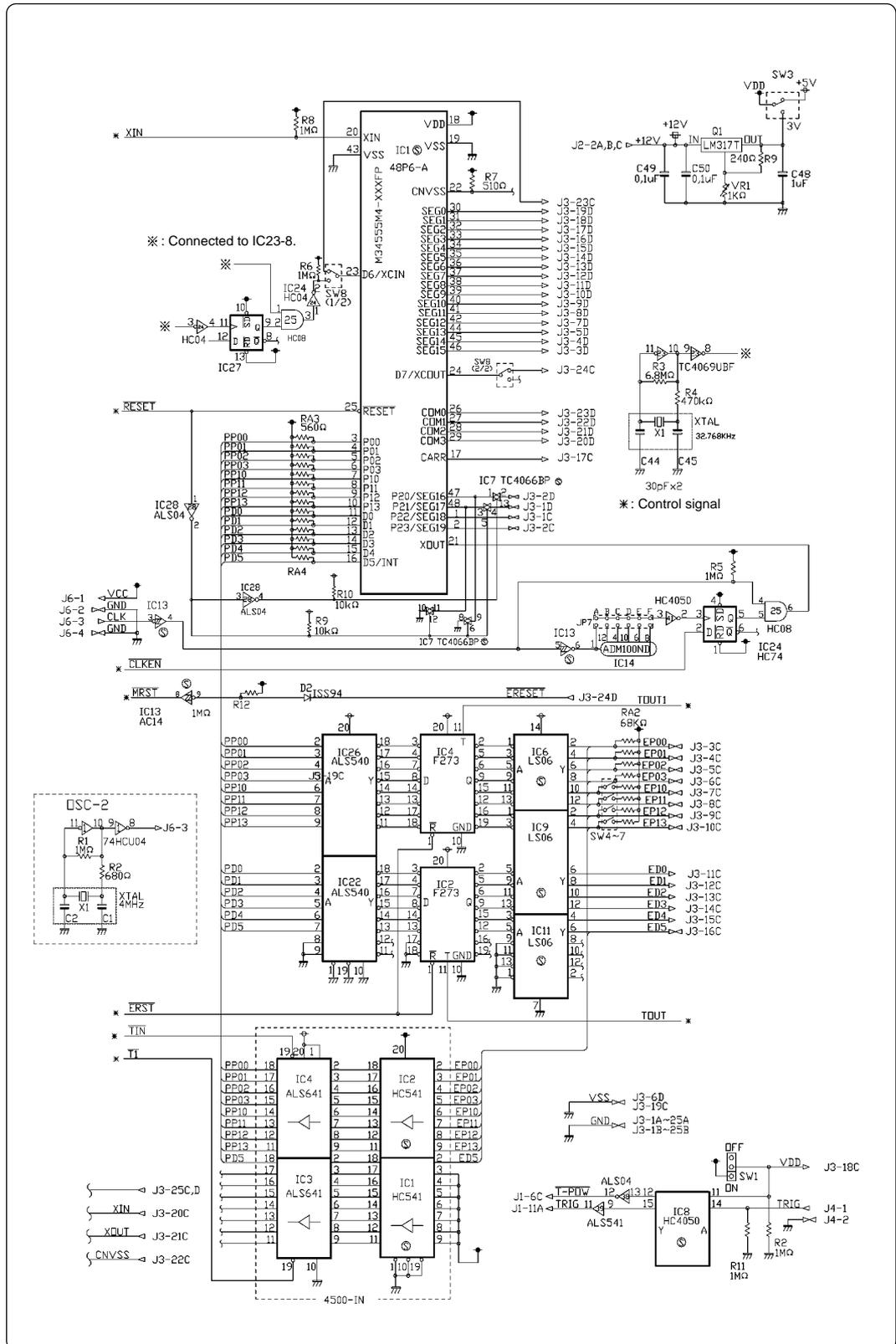

Figure 7.1 Connection circuit diagram

Appendix A. How to Request for Repair

If your product is found faulty, follow the procedure below to send your product for repair.

Customer

▼

Fill in the Repair Request Sheet included with this product, then send it along with this product for repair to your local distributor. Make sure that information in the Repair Request Sheet is written in as much detail as possible to facilitate repair.

Distributor

▼

After checking the contents of fault, the distributor should please send the faulty product along with the Repair Request Sheet to Renesas Solutions Corp.

Renesas Solutions

When the faulty product is repaired, it will be returned to the customer at the earliest convenience.

⚠ CAUTION

Note on Transporting the Product:

- When sending your product for repair, use the packing box and cushion material supplied with this product when delivered to you and specify handling caution for it to be handled as precision equipment. If packing of your product is not complete, it may be damaged during transportation. When you pack your product in a bag, make sure to use conductive polyvinyl supplied with this product (usually a blue bag). When you use other bags, they may cause a trouble on your product because of static electricity.

M34551T2-MCU User's Manual

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