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Renesas Electronics Corporation

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User's Manual

M34570T-MCU

User's Manual

MCU Board for PC4504 Emulator System

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Rev.1.00 2003.09

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\SUPPORT\Product-name\SUPPORT.TXT

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Preface

This user's manual describes the specifications of the M34570T-MCU emulator board for Renesas 4570 group of 4-bit single-chip microcomputers. M34570T-MCU is an MCU board for the PC4504 emulator. For the PC4504 emulator main unit and the M3T-PD45 emulator debugger, refer to each user's manual.

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 (80-wire half-pitch cable or 40-wire 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 5. Precautions to be Taken When Debugging".

  (1) Reset condition

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

  (3) Internal ROM and RAM 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 M34570T-MCU is +3.0 V or +5.0 V. Therefore the target's supply voltage should be in the range of +3.0V ±10% or 5.0V ±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.

MEMO

2. Handling Precautions

When using the M34570T-MCU board, pay attention to the following:

(1) About the emulator

To use the M34570T-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. Setup" in the PC4504 System User's Manual.

(3) Emulator debugger

When using the M34570T-MCU board to debug your program, you need the M3T-PD45 emulator debugger (sold separately). Be sure to use the data file for 4570 group included with the M3T-PD45 emulator debugger.

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

Table 2.1 lists the registers that can be operated from M3T-PD45 for 4514 group MCUs. The "O" mark in the table means that the register can be operated; the "X" mark means that the register can not 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	W5	O	O
X	O	O	C2	X	O
Y	O	O	S1	O	O
Z	O	O	PU0	O	O
D	O	O	K0	O	O
E	O	O	MR	O	O
SP	O	X	R1	X	O
V1	O	O	R2	X	O
V2	O	O	R3L	X	O
I1	O	O	R3H	X	O

(5) About the system clock frequency

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

- 3V: $X_{IN} \leq 1.0$MHz
- 5V: $X_{IN} \leq 2.0$MHz

MEMO

3. Contents of the M34570T-MCU Package

3.1 Things to Check When Unpacking

Table 3.1 shows the contents of the M34570T-MCU package. When unpacking your M34570T-MCU package, check to see that all of these components are included.

Table 3.1 Contents of M34570T-MCU

Item	Product name	Quantity
1	M34570T-MCU	1
2	80-wire half-pitch cable (40cm)	1
3	40-wire normal-pitch cable (10cm)	1
4	2-wire cable for external trigger signal (50cm)	1
5	PCA4029 pitch converter board	1
6	OSC-2 oscillator circuit board (J1 connector mounted)	1
7	M34570T-MCU English user's manual (this manual)	1
8	M34570T-MCU Japanese user's manual	1

*1 M34570T-MCU has an oscillator circuit board OSC-2 (for 4.19MHz) that is incorporated when shipped from the factory. In addition, it comes with an oscillator circuit board OSC-2, with only a connector J1 mounted.

*2 Keep the packaging carton and cushion material of the M34570T-MCU to transport it for repair or for other purposes in the future.

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

3.2 Other Necessary Products

To bring forward programs development on the 4570 group of 4-bit microcomputers, 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: PCA7425

MEMO

4. M34570T-MCU

4.1 Outline

By using with the PC4504 emulator main unit, M34570T-MCU can make up an emulator system which can be operated by a personal computer.

Figure 4.1 shows the development support system configuration.

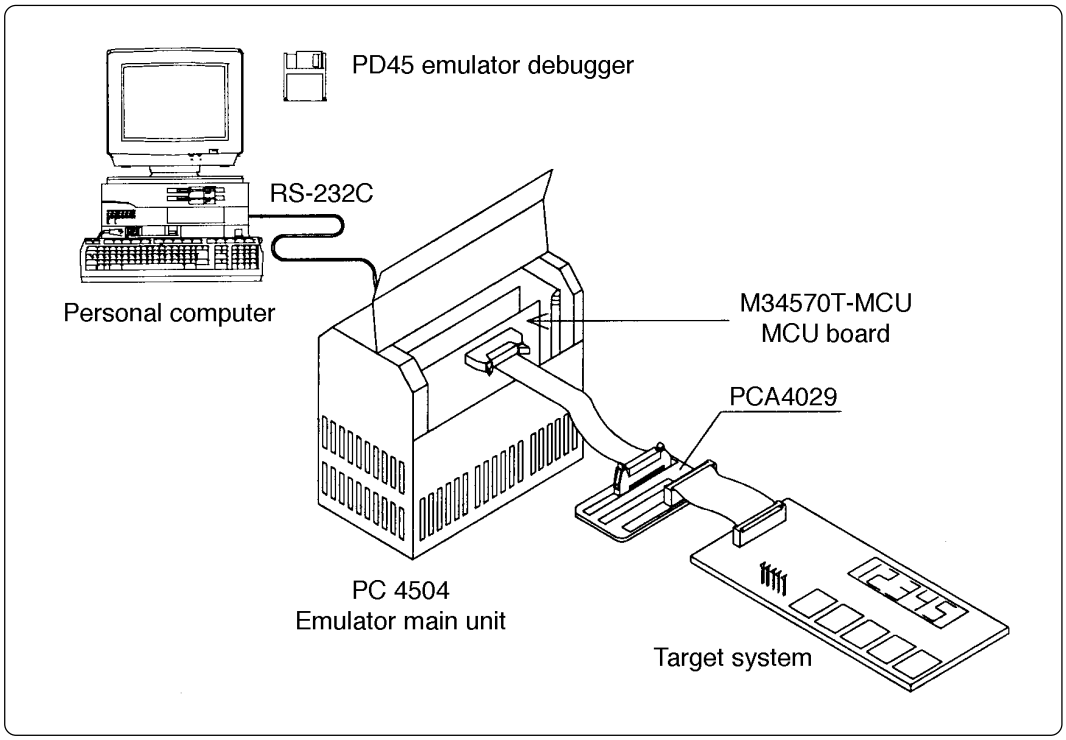

Figure 4.1 Development support system configuration

4.2 Specifications

Table 4.1 lists specifications of M34570T-MCU.

Table 4.1 M34570T-MCU Specifications

<table>
<tr><td>Applicable MCUs</td><td colspan="4">M34570MX-XXXFP, M34570EXFP</td></tr>
<tr><td>Evaluation MCU</td><td colspan="4">M34570E8FP (mounted)</td></tr>
<tr><td rowspan="2">Maximum operating clock frequency</td><td>3V</td><td colspan="3">Medium-speed mode: 4.19MHz
High-speed mode: 1.0MHz</td></tr>
<tr><td>5V</td><td colspan="3">Medium-speed mode: 4.19MHz
High-speed mode: 2.0MHz</td></tr>
<tr><td>Target system voltage</td><td colspan="4">3V or 5V</td></tr>
<tr><td>Power supply</td><td colspan="4">Supplied by the PC4504's internal power supply (+5V, +12V)</td></tr>
<tr><td rowspan="5">Port emulation</td><td>Port</td><td>Output type</td><td>Direction</td><td>Device used</td></tr>
<tr><td>D_0 to D_5</td><td rowspan="3">N-channel open drain</td><td>output</td><td rowspan="3">Input: 74HC541
Output: 74LS06</td></tr>
<tr><td>$P0_0$ to $P0_3$</td><td rowspan="2">Input/output</td></tr>
<tr><td>$P1_0$ to $P1_3$</td></tr>
<tr><td>$P2_0$ to $P2_1$</td><td>-</td><td>Input</td><td>Input: 74HC08</td></tr>
<tr><td>Board dimensions</td><td colspan="4">233 (L) x 135 (W) x 26 (H) mm</td></tr>
<tr><td>Operating temperature</td><td colspan="4">5 to 35°C (non-condensing)</td></tr>
<tr><td>Product configuration</td><td colspan="4">M34570T-MCU
80-wire half-pitch cable
40-wire normal-pitch cable
External trigger cable
PCA4029
OSC-2 (for changing frequencies)</td></tr>
</table>

*1 M34570T-MCU has an oscillator circuit board OSC-2 (for 4.19MHz) that is incorporated when shipped from the factory. In addition, it comes with an oscillator circuit board OSC-2, with only a connector J1 mounted.

*2 M34570T-MCU operates at the medium-speed mode (instruction-clock f (X_{IN})/12) immediately after a RESET is released.

4.3 Description of Switches

The M34570T-MCU board has three switches. Figure 4.2 shows the positions of these switches. Tables 4.2 list the functions of the switches. Shown in Table 4.2 is the preset switch positions that are set before the MCU board is shipped from the factory.

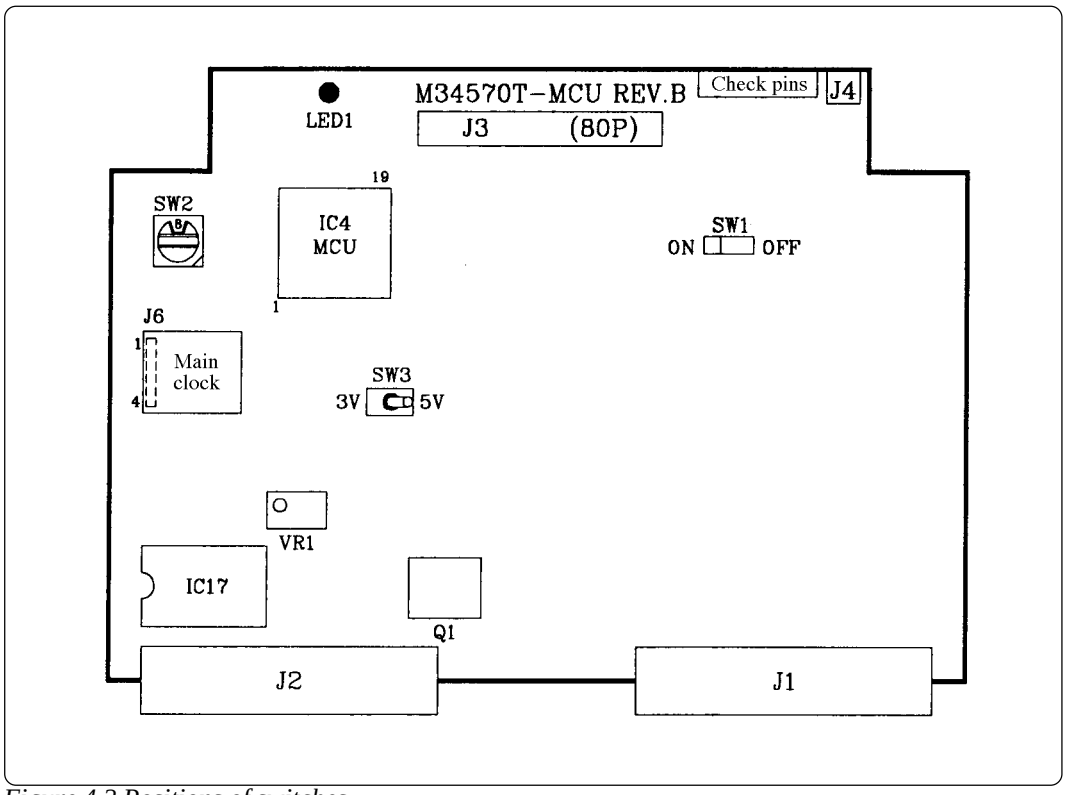

Figure 4.2 Positions of switches

Table 4.2 Functions of switches

	Label	Switch position	Description	Factory-setting
SW1	OFF	ON OFF	Does not connect the V_{DD} of the M34570T-MCU to the V_{DD} of the target system.	OFF
	ON	ON OFF	Connects the V_{DD} of the M34570T-MCU to the V_{DD} of the target system.	
SW2	ROMSIZE		Set the MCU's ROM size. • Set "4" (M4) • Set "8" (M8) • Set "D" (MD)	8
SW3	5V	3V 5V	Operates the target MCU at +5V.	5V
	3V	3V 5V	Operates the target MCU at +3V.	

4.4 Description of Connectors

The M34570T-MCU board has five connectors. Table 4.3 lists the functions of these connectors. Figure 4.3 shows the positions of connectors on the MCU board.

Table 4.3 Connectors

Connector	Function
J1	Connects the evaluation MCU bus.
J2	Connects the monitor CPU bus.
J3	Connects the target system. (80-pin)
J4	Connects the external trigger signal. (2-pin)
J6	Connects the oscillator circuit board. (4-pin)

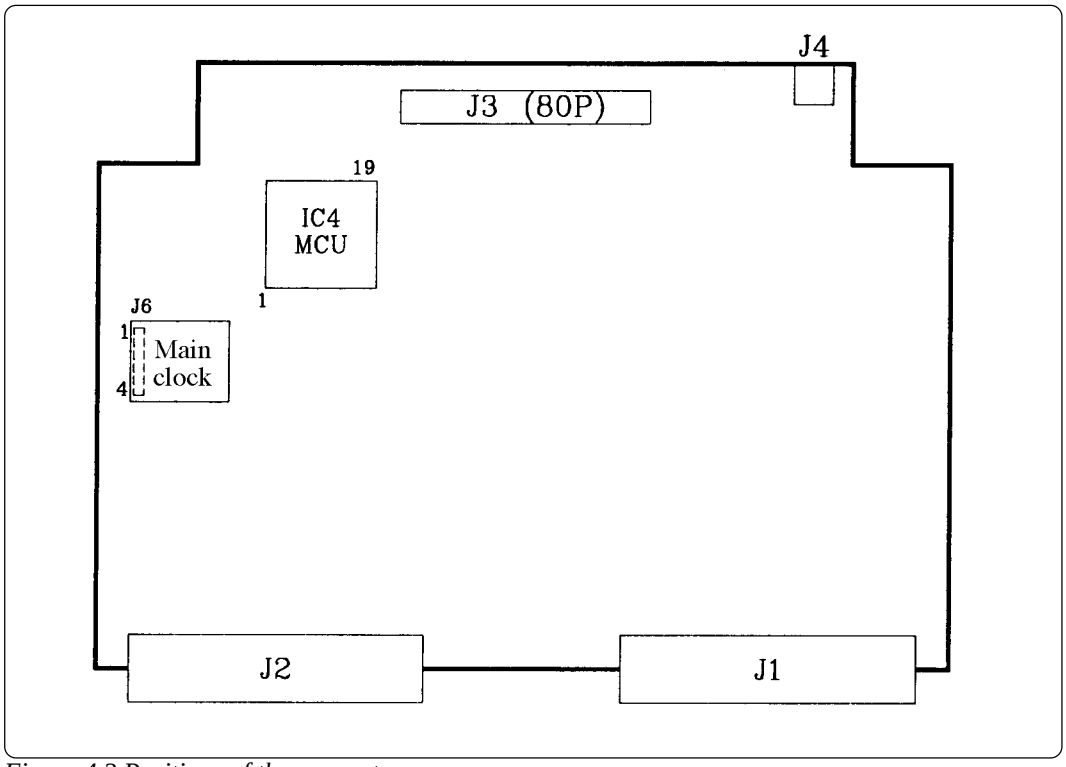

Figure 4.3 Positions of the connectors

(1) Connector J3

Table 4.4 lists the pin assignments of the 80-wire half-pitch connector (J3) for connecting the PCA4029. And Figure 4.4 shows the connector J3 pin layout.

Table 4.4 Pin assignments of the 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	ED2	O	1	ED1	O
2	GND		2	GND		2	ED3	O	2	ED0	O
3	GND		3	GND		3	ED4	O	3	EP13	I/O
4	GND		4	GND		4	ED5	O	4	EP12	I/O
5	GND		5	GND		5	D6	O	5	EP11	I/O
6	GND		6	GND		6	D7	O	6	EP10	I/O
7	GND		7	GND		7	D8	O	7	EPO3	I/O
8	GND		8	GND		8	D9/TOUT	O	8	EPO2	I/O
9	GND		9	GND		9	EP20	I	9	EPO1	I/O
10	GND		10	GND		10	P21/INT	I	10	EPO0	I/O
11	GND		11	GND		11	ERESET*	I	11	P43	I
12	GND		12	GND		12	CNVSS	-	12	P42	I
13	GND		13	GND		13	XOUT	-	13	P41	I
14	GND		14	GND		14	XIN	-	14	P40	I
15	GND		15	GND		15	VSS	-	15	P33	I/O
16	GND		16	GND		16	VDCE	I	16	P32	I/O
17	GND		17	GND		17	VDD	-	17	P31	I/O
18	GND		18	GND		18	CARR	O	18	P30	I/O
19	GND		19	GND		19	NC	-	19	NC	-
20	GND		20	GND		20	NC	-	20	NC	-

Note: "I" in the direction column denotes "Input"; "O" denotes "Output"; "I/O" denotes "Input/output"; "-" denotes "Not connected".

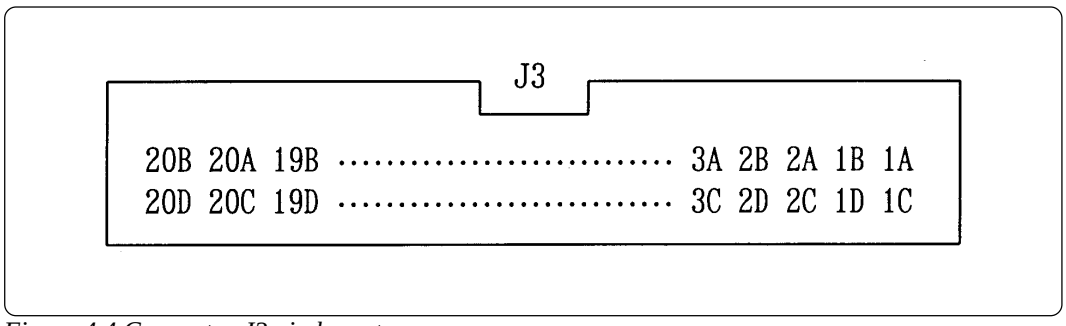

Figure 4.4 Connector J3 pin layout

(2) Connector J4

Use the 2-wire cable for external trigger signals (included) for the connector J4 (for external trigger signals). Connect the black clip of the external trigger cable to GND, and use the white clip for external trigger signal input. External signals are used as external trigger breaks, or event input of trace points by an external trigger. Table 4.5 lists the pin assignments of the connector J4.

Table 4.5 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. Table 4.6 lists the pin assignments of the connector J6. Figure 4.5 shows the pin layout of the connector J6. For the 4.19MHz operation with the oscillator circuit board OSC-2, see Figure 4.6.

When changing the frequency of the oscillator, use the oscillator circuit board OSC-2 (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 manufacturer of the oscillator.

Table 4.6 Pin assignments of connector J6

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

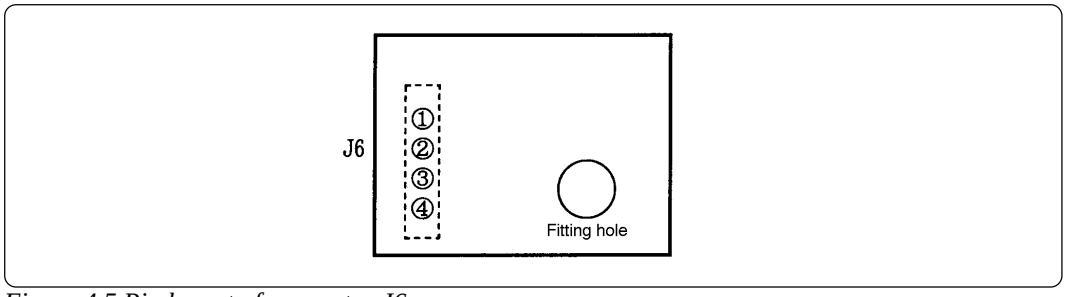

Figure 4.5 Pin layout of connector J6

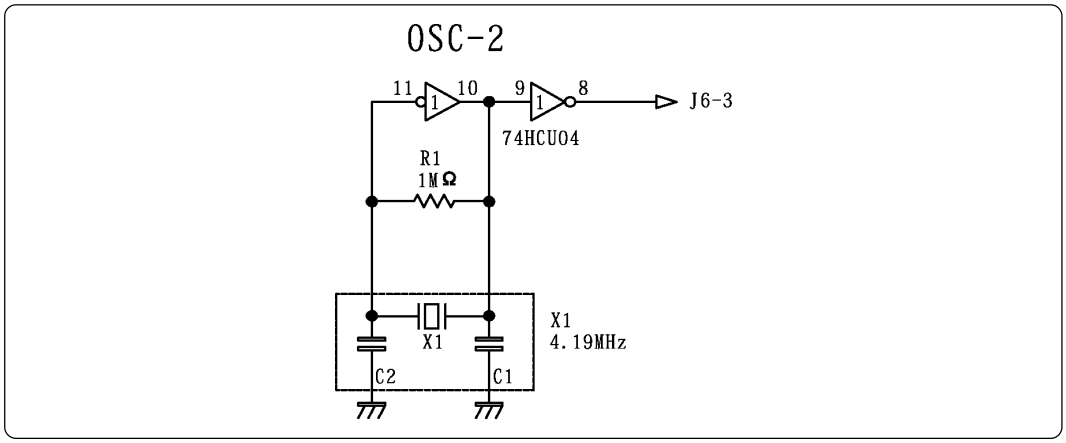

Figure 4.6 Circuit diagram of OSC-2 (4.19MHz)

4.5 Connection to the Target System

When connecting the M34570T-MCU board to the target system:

Use the 40-wire normal-pitch cable (included) to connect the 40-pin dual-in-line pins on the target system. Following products are required for connection to the target system.

- 80-wire half-pitch cable (40cm)
- PCA4029 pitch converter board
- 40-wire normal-pitch cable (10cm)

Figure 4.7 depicts the M34570T-MCU board connected to the target system using the 40-wire normal-pitch cable. Table 4.7 lists the connector signal assignments of the 40-wire normal-pitch cable. Figure 4.8 shows the pin layout of the 40-wire normal-pitch cable.

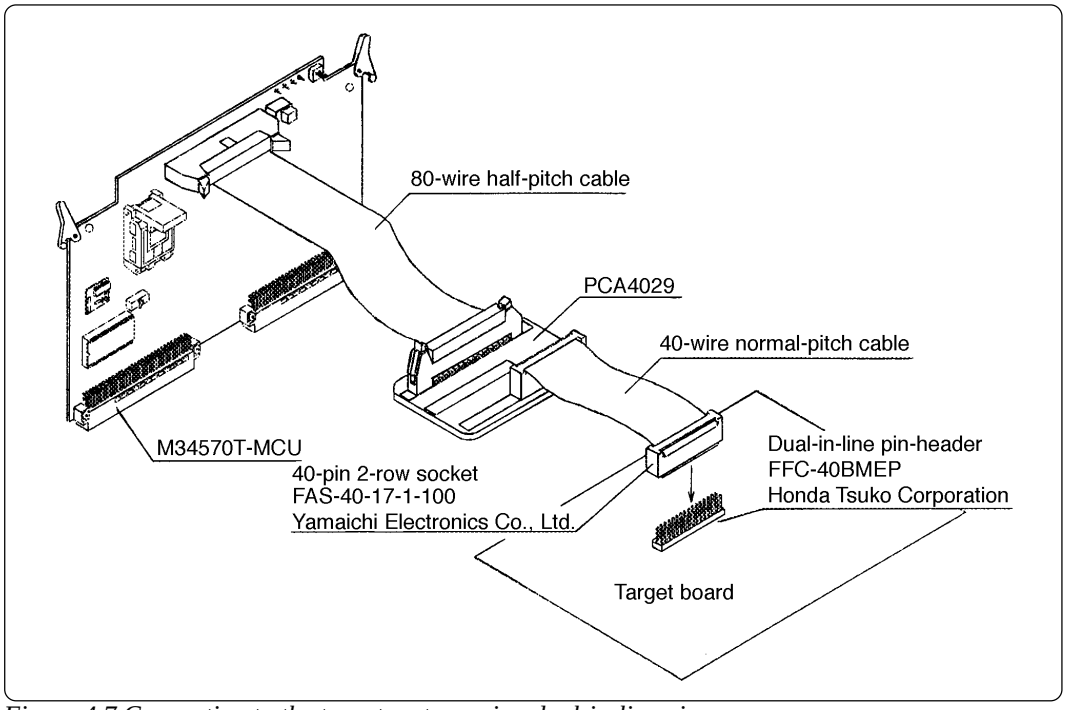

Figure 4.7 Connection to the target system using dual-in-line pins

Table 4.7 40-wire normal-pitch cable pin assignments

Pin No.	Signal	Pin No.	Signal
1	ED_2	40	ED_1
2	ED_3	39	ED_0
3	ED_4	38	$EP1_3$
4	ED_5	37	$EP1_2$
5	D_6	36	$EP1_1$
6	D_7	35	$EP1_0$
7	D_8	34	EPO_3
8	D_9/TOUT	33	EPO_2
9	$EP2_0$	32	EPO_1
10	$P2_1$/INT	31	EPO_0
11	ERESET*	30	$P4_3$
12	CNVSS	29	$P4_2$
13	XOUT	28	$P4_1$
14	XIN	27	$P4_0$
15	VSS	26	$P3_3$
16	VDCE	25	$P3_2$
17	VDD	24	$P3_1$
18	CARR	23	$P3_0$
19	NC	22	NC
20	NC	21	NC

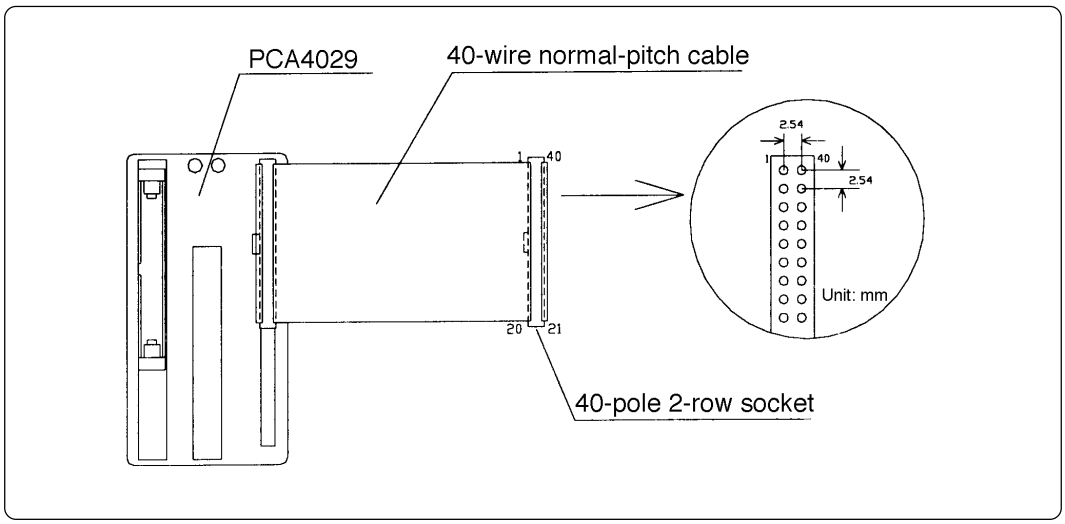

Figure 4.8 Pin layout of 40-wire normal-pitch cable

Some signals connected to the target system are emulated on the M34570T-MCU board. For details, see "Chapter 6. Connection Circuit Diagram".

• Pins connected directly to the target system (5 types, 15 lines)

(1) $P3_0$ to $P3_3$

(2) $P4_0$ to $P4_3$

(3) CARR

(4) D_6 to D_9

(5) V_{SS}

(6) VDCE

• Pins connected to the target system via emulation circuits etc. (6 types, 18 lines)

(1) $P0_0$ to $P0_3$

(2) $P1_0$ to $P1_3$

(3) $P2_0$ to $P2_1$

(4) D_0 to D_5

(5) RESET*

(6) V_{DD}

• Pins not connected to the target system (3 types, 3 lines)

(1) X_{IN}

(2) X_{OUT}

(3) CNV_{SS}

4.6 LED

Figure 4.9 shows the LED layout of M34570T-MCU. The LED lights in green when the power is supplied to the MCU board.

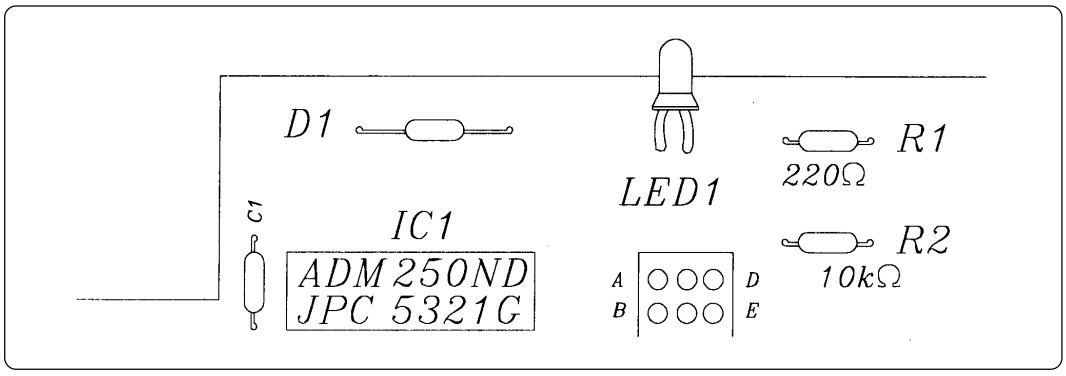

Figure 4.9 Layout of LED

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5. Precautions to be Taken When Debugging

5.1 Reset

The M34570T-MCU uses a 74AC14 for its RESET signal input buffer, so that its electrical characteristics differ from those of the actual chip. Table 5.1 lists the RESET signal input characteristics of the M34570T-MCU.

Table 5.1 RESET signal input characteristics

Item	Symbol	Voltage	Minimum	Maximum
H-level threshold voltage	V_P	V_{CC}=3.0V	-	2.2V
		V_{CC}=4.5V	-	3.2V
		V_{CC}=5.5V	-	3.9V
L-level threshold voltage	V_N	V_{CC}=3.0V	0.5V	-
		V_{CC}=4.5V	0.9V	-
		V_{CC}=5.5V	1.1V	-
Hysteresis voltage	V_H	V_{CC}=3.0V	0.3V	1.2V
		V_{CC}=4.5V	0.4V	1.4V
		V_{CC}=5.5V	0.5V	1.6V

5.2 System Clock

Depending on the supply voltage and operation mode, use one of the following frequencies for the system clock:

- Supply voltage 5V: 4.2MHz or less (medium-speed mode)
  1.0MHz or less (high-speed mode)
- Supply voltage 3V: 4.2MHz or less (medium-speed mode)
  2.0MHz or less (high-speed mode)

To change this clock frequency to suit that of the target system, use the oscillator circuit board OSC-2 (included) with the necessary parts attached.

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

5.3 Real-time Capability of Timer

The PC4504 and M34570T-MCU have their internal clock operating even during emulation, so that the timer values keep changing.

Example: (1) When single-stepping the program

(2) When registers or internal RAM are referenced or modified

5.4 Watchdog Timer

The M34570T-MCU does not have an operational watchdog timer. Therefore, use an evaluation MCU (OTP version) to verify the operation associated with a watchdog timer.

The M34570T-MCU outputs a signal whose waveform is shown below from the check pin TP5 during WRST instruction execution cycles. This signal allows you to check the initialization cycle of a watchdog timer.

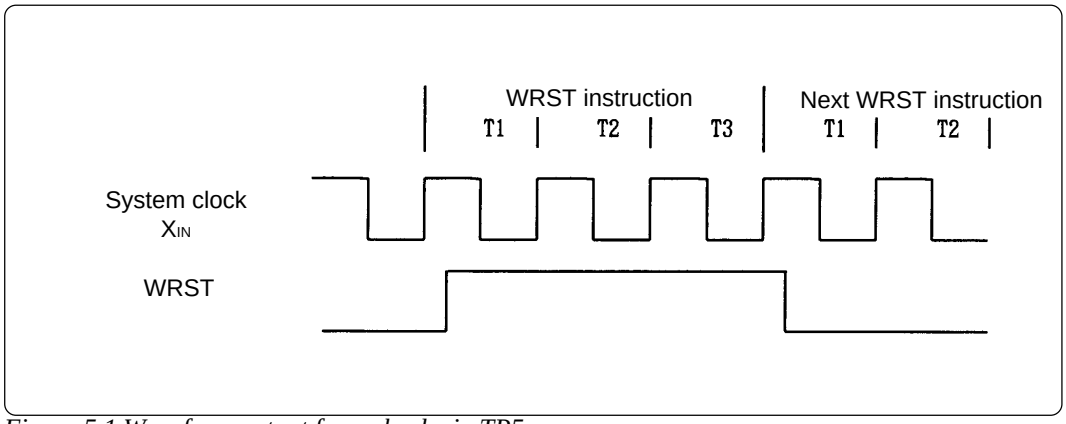

Figure 5.1 Waveform output from check pin TP5

5.5 Low-voltage Detection

Because the power to the evaluation MCU of M34570T-MCU is supplied from the M34570T-MCU, low-voltage cannot be detected. To evaluate the operation associated with low-voltage detection, use an evaluation MCU (OTP version).

5.6 P0, P1 Port Pullup

Port P0 and P1's (M34570T-MCU) resistance value of the pullup register is 68kΩ.

5.7 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 M34570T-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 M34570T-MCU, changes occur at the beginning of the T2 state of the next output instruction. Figure 5.2 shows the port output timings of the actual MCUs and M34570T-MCU. For the other ports, the output timings are the same as with the actual MCUs.

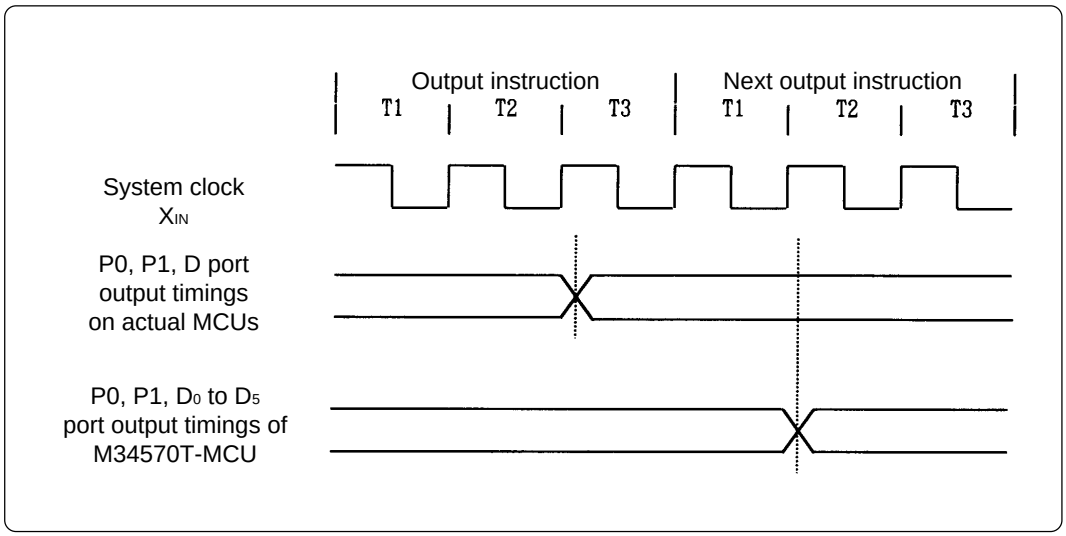

Figure 5.2 P0, P1 and D port output timings

5.8 Power-down Mode

In the power-down mode, the M34570T-MCU operates differently from the actual chip of each MCU.

(1) Power-down operation of M34570T-MCU

Although the actual chip of each MCU is placed in the power-down mode by executing a combination of EPOF and POF instructions, the M34570T-MCU is placed in the power-down mode by only the POF instruction.

In the M34570T-MCU, the EPOF instruction does not have any effect.

Program example 5.1

```
RC
INY
EPOF
POF
•
•
```

Actual MCU
The power-down mode works.

M34570T-MCU
The power-down mode works.

Program example 5.2

```
RC
INY
POF
•
•
•
```

Actual MCU
The power-down mode does NOT work.

M34570T-MCU
The power-down mode works.

5.9 Program Execution (G, GB)

The PC4504 and M34570T-MCU's hardware are 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 5.3)

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 5.4)

Program example 5.3

```
                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 instruction at address POINT+2.

Program example 5.4

```
                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)

When a skip instruction skips the next instruction, a breakpoint set in the skipped instruction does not cause execution to halt. (See Program examples 5.5 and 5.6)

Program example 5.5

```
                RC                          SC
                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 5.6

```
                RC                          ; Skip instructions
                INY
POINT:          TABP
                LA      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.

5.10 External Trigger

(1) External trigger signal input timing

The latch timing of the external trigger signal is shown in Figure 5.3.

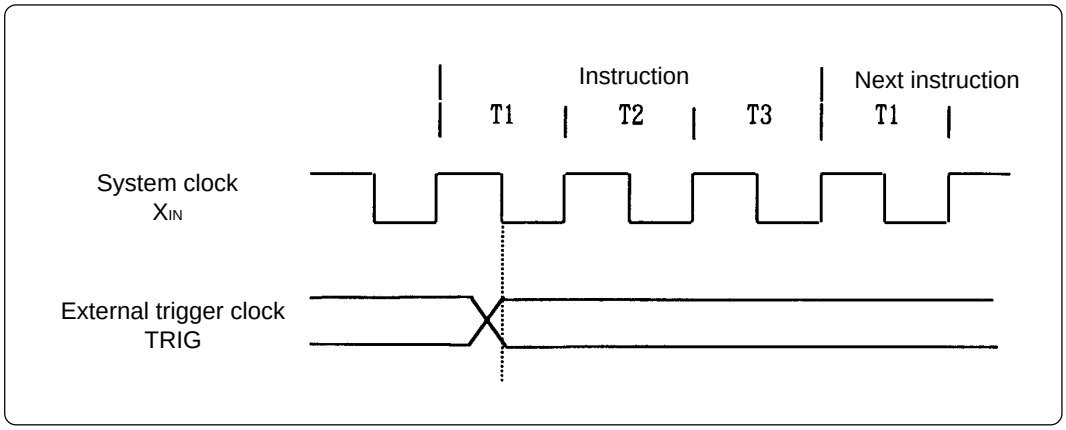

Figure 5.3 Latch timing of external trigger signal

(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 signals are shown in Table 5.2 below. See the table before using external trigger signals.

Table 5.2 External trigger signal input characteristics

Item	Symbol	Voltage	Maximum	Minimum
H-level input voltage	V_{IH}	V_{CC}=2.0V	-	1.5V
		V_{CC}=4.5V	-	3.15V
L-level input voltage	V_{IL}	V_{CC}=2.0V	0.5V	-
		V_{CC}=4.5V	1.35V	-

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6. Connection Circuit Diagram

Figure 6.1 shows the connection circuit diagram of M34570T-MCU. This circuit diagram depicts the M34570T-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.

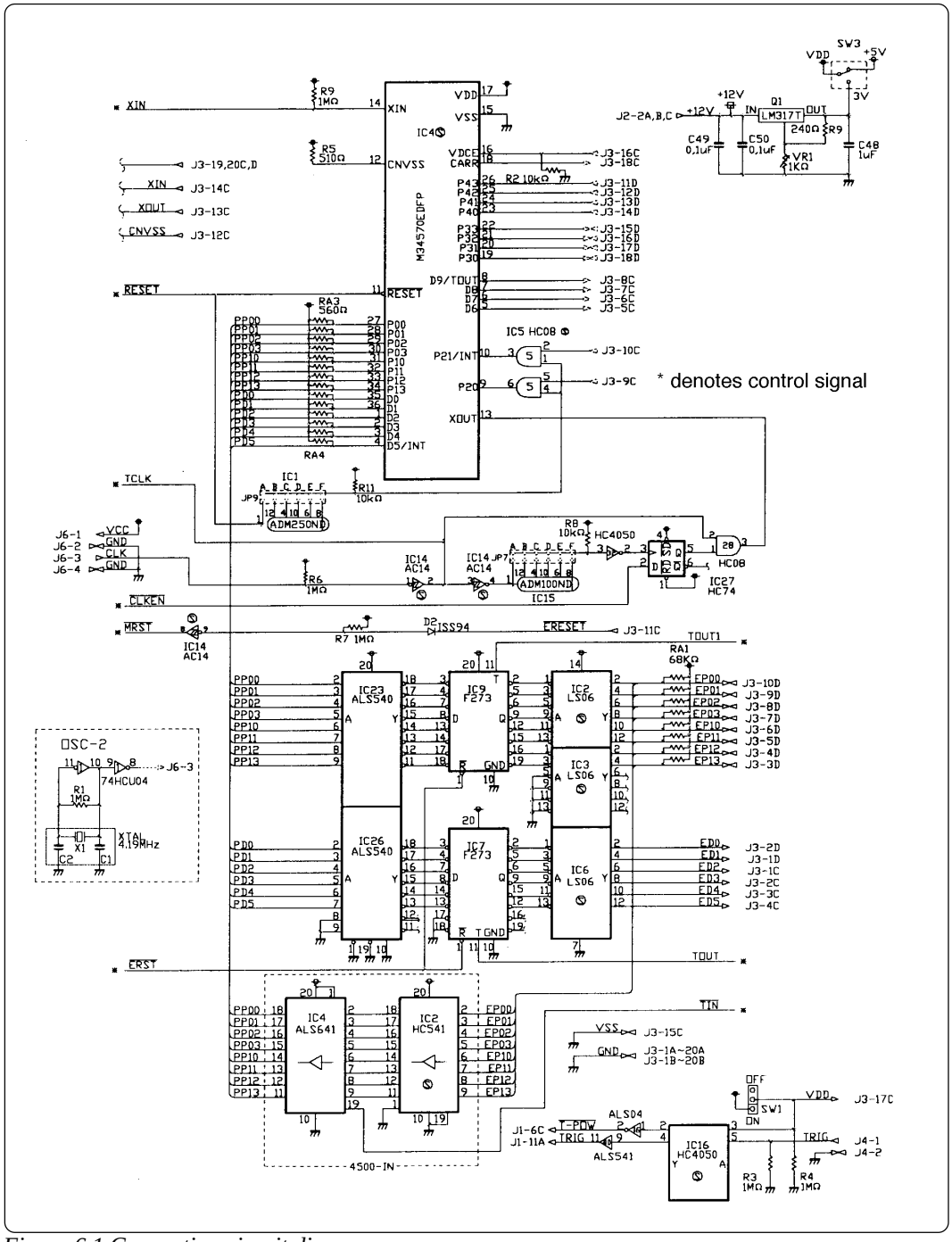

Figure 6.1 Connection circuit diagram

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.

M34570T-MCU User's Manual

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M34570T-MCU
User's Manual

Renesas Electronics Corporation
1753, Shimonumabe, Nakahara-ku, Kawasaki-shi, Kanagawa 211-8668 Japan

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