User's Manual

RX26T Group

MCB-RX26T Type A User's Manual

Renesas RX Family
RX200 Series

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General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Precaution against Electrostatic Discharge (ESD)

   A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.
2. Processing at power-on

   The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power reaches the level at which resetting is specified.
3. Input of signal during power-off state

   Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.
4. Handling of unused pins

   Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.
5. Clock signals

   After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.
6. Voltage application waveform at input pin

   Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (Max.) and V_{IH} (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (Max.) and V_{IH} (Min.).
7. Prohibition of access to reserved addresses

   Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.
8. Differences between products

   Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

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Renesas RX Family

MCB-RX26T Type A User's Manual

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1. Overview

MCB-RX26T Type A is a CPU board for motor control evaluation. By using this product in combination with an inverter board, motor control using RX26T can be easily performed.

1.1 Presupposition and precautions of this document

1. Experience of using tools: This document assumes that the user has used terminal emulation program of Integrated Development Environment (IDE) such as e2 studio before.
2. Knowledge about the development subject: This document assumes that the user has a basic knowledge to modify the sample project regarding MCU and embedded system.
3. Before using this product, wear an antistatic wrist strap. If you touch this product with static charge on your body, a device failure may occur, or operation may become unstable
4. All screen shots provided in this document is for reference. Actual screen displays may differ depending on the software and development tool version which you use.

2. Product Contents

This kit consists of the following parts.

1. CPU Board (RTK0EMXE70C00000BJ) x1
2. USB Cable x1
3. Screw x4
4. Standoff x4

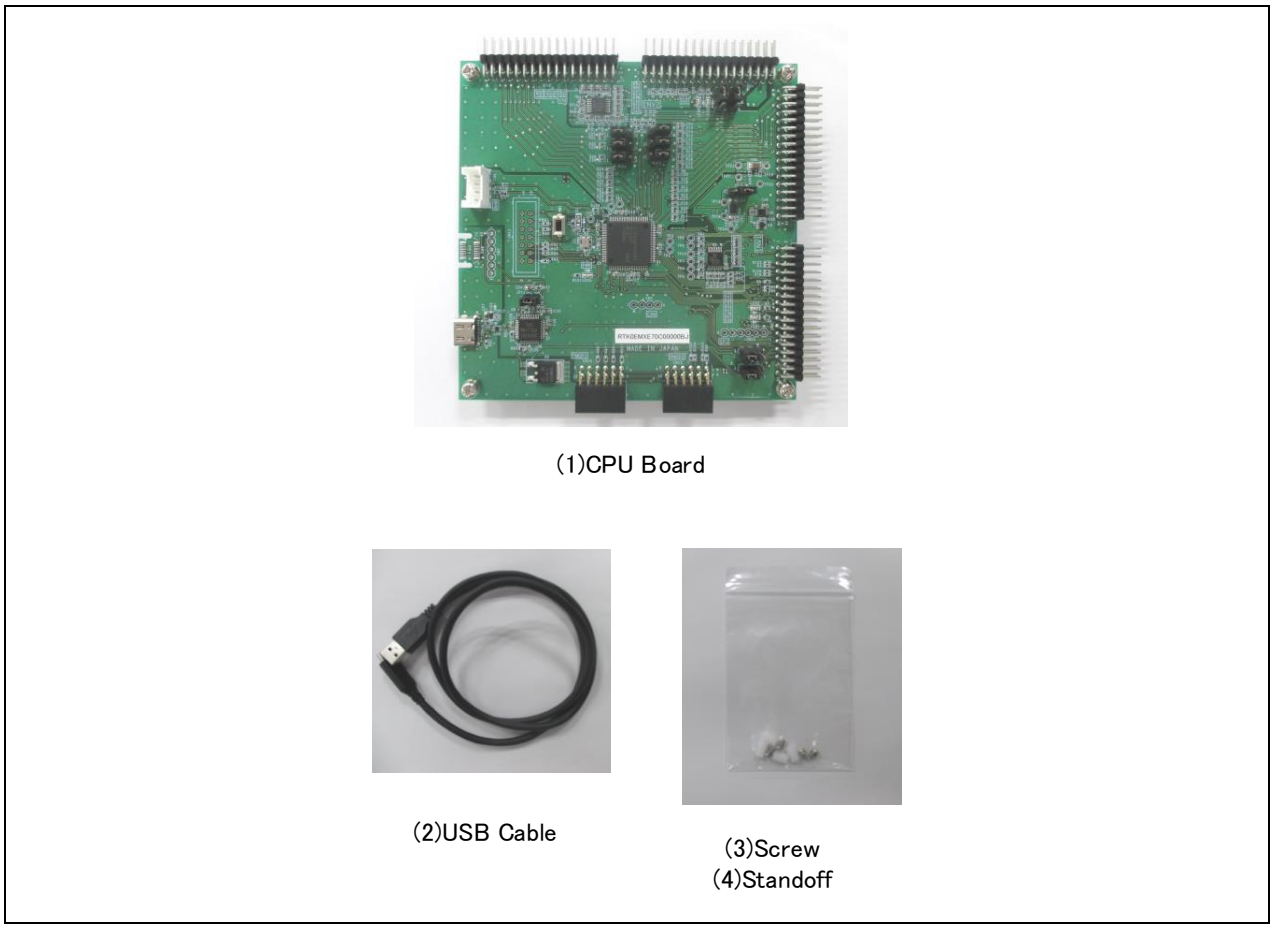


Figure 2-1 Product contents

3. Product Order Information

Product number to order MCB-RX26T Type A : RTK0EMXE70C00000BJ

4. Hardware Configuration and Default Setting

4.1 Hardware configuration

The specifications of the CPU board are shown below.

Table 4-1 CPU board specification

item		Specification
Product name		CPU Board
Board part No.		RTK0EMXE70C00000BJ
Compatible inverter board		RTK0EM0000B12020BJ
External view		 Note: The actual product may differ from this photo.
Mounted MCU	Product group	RX26T group
	Product No.	R5F526TFCDFP
	CPU maximum operating frequency	120MHz
	Bit count	32 bit
	Package / Pin count	LFQFP / 100 pin
	ROM	512KB
MCU input clock		10MHz (Generate with external crystal oscillator)
Power supply		DC 5V,3.3V (selectable with jumper switch) Select one way automatically from the below • Power is supplied from compatible inverter board • Power is supplied from USB connector
Debugger		E2OB (Onboard debugger circuit)
Connector		• Inverter board connector • USB connector for E2 OB • SCI connector for Renesas Motor Workbench communication • Through hole for CAN communication • Through hole for SPI communication • PMOD connectors
Switch		MCU reset switch
LED		User-controllable LED x4, Power LED x1
Board size		109 mm (W) x 109 mm (L)
Operating temperature		Room temperature
Operating humidity		No condensation allowed
EMC Directive		EN61326-1:2021 EMI：Class A EMS：Basic Electromagnetic environment

4.2 Block diagram

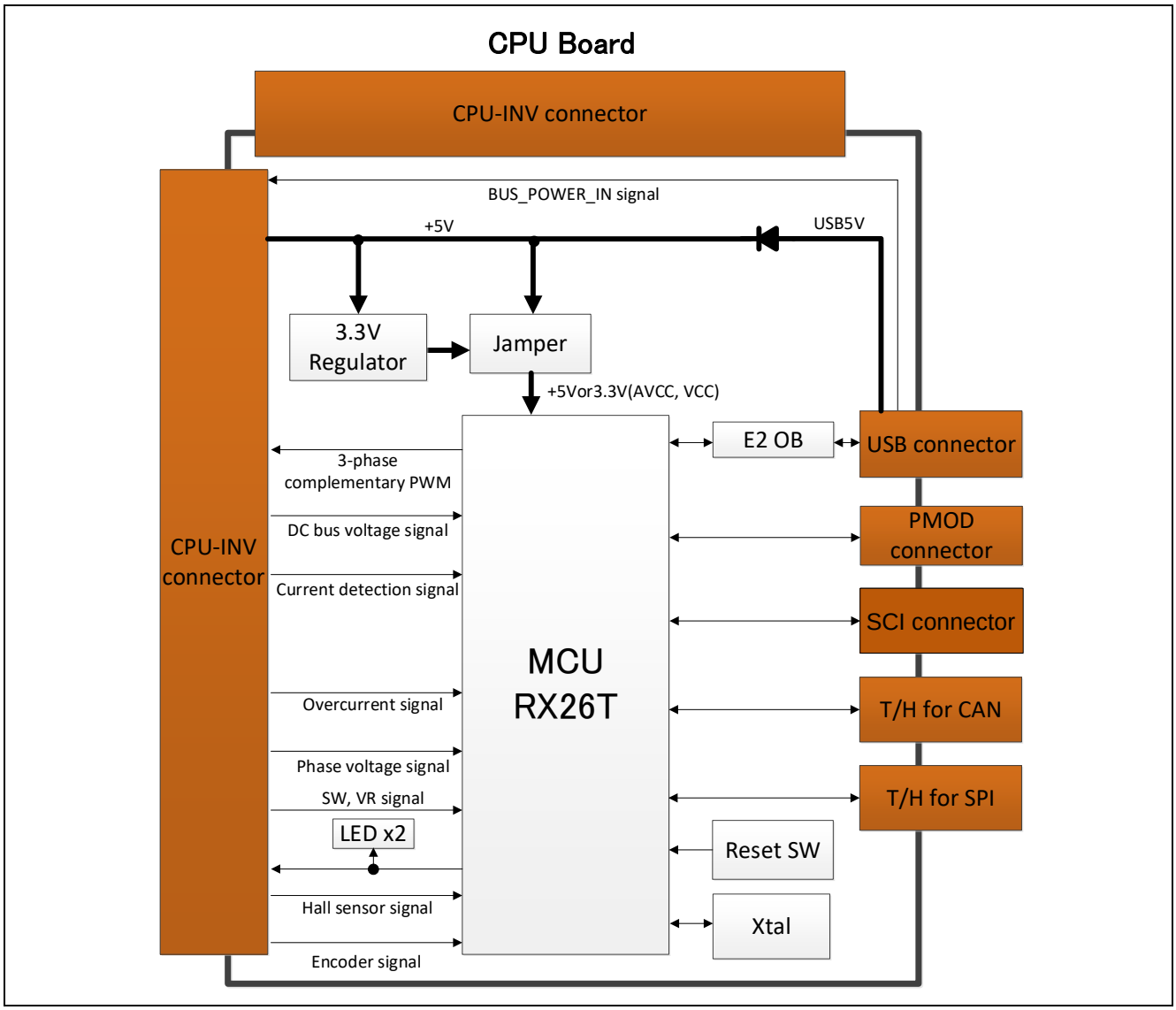


Figure 4-1 CPU board block diagram

4.3 Board Layout

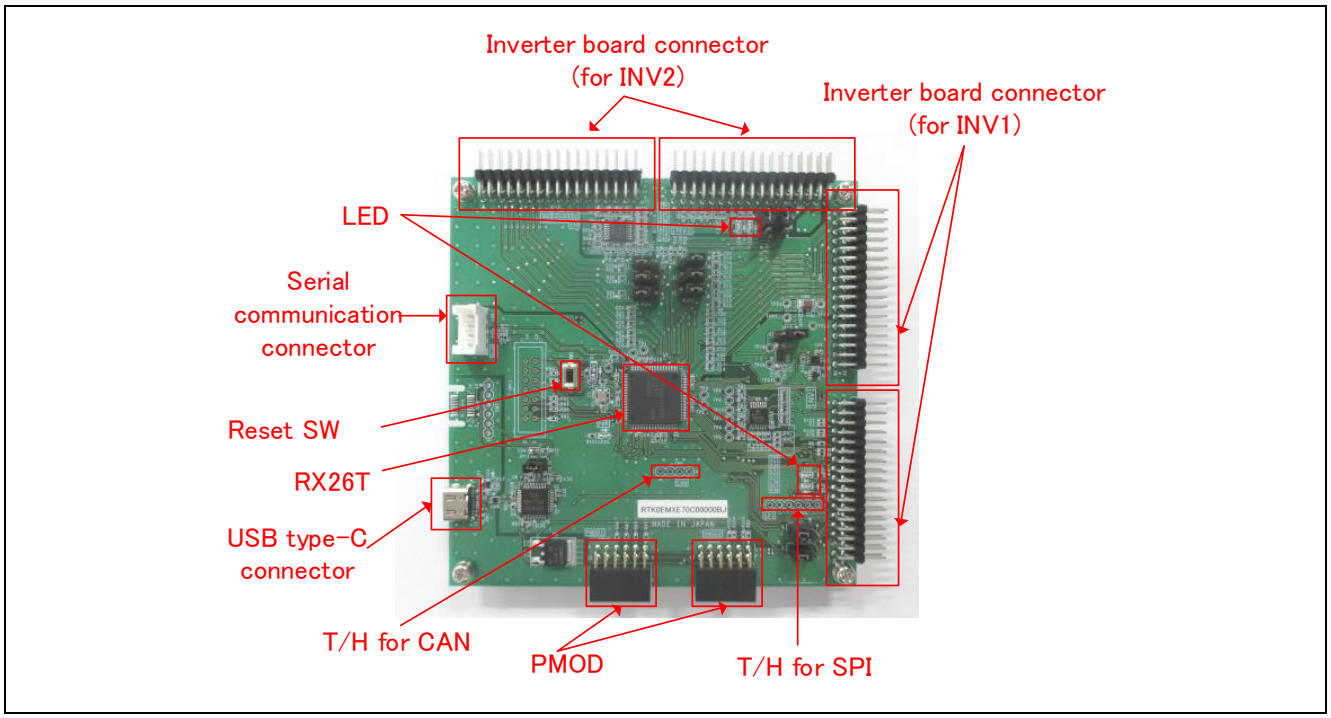


Figure 4-2 CPU Board Layout

4.4 Standoffs and Screws

Before using this product, assemble the included standoffs and screws as shown below.

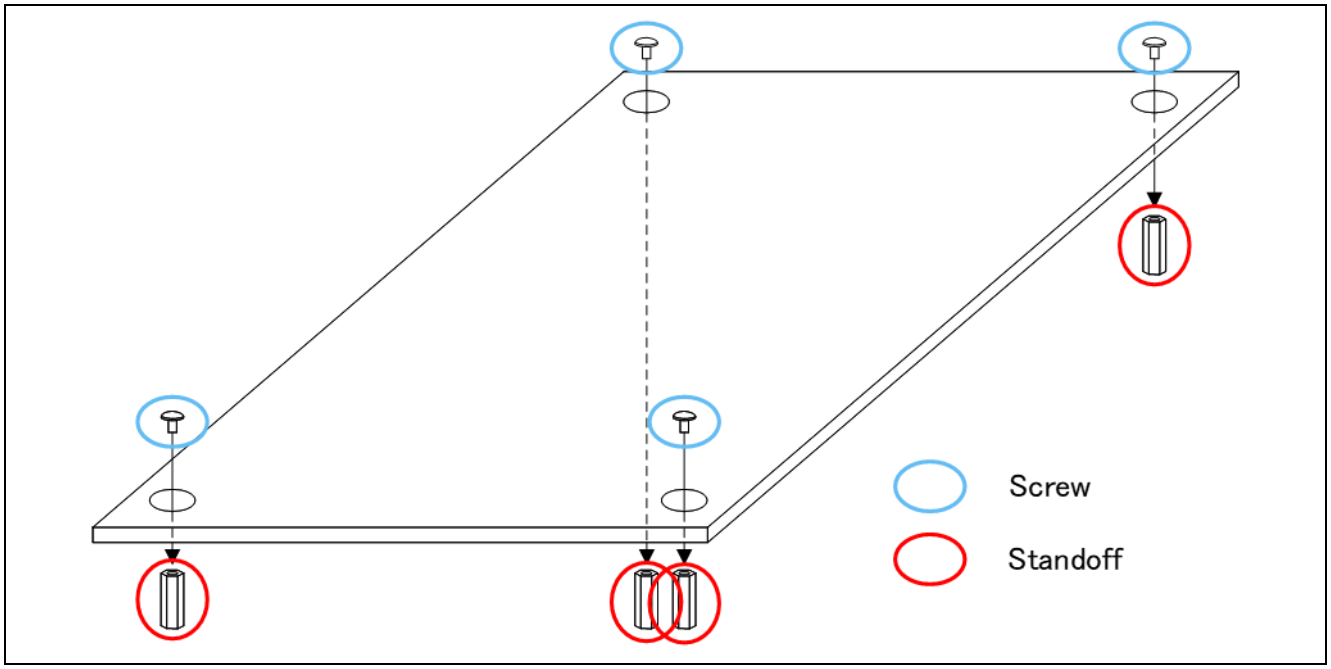


Figure 4-3 Standoffs and Screws assembly

4.5 Jumper pin setting

Default settings and functions of the jumper pins (JP1~JP12) are as follows.

Table 4-2 Jumper pin setting of CPU board

JP No.	Function	Setting (function in use)			Default setting
		open	1-2 short	2-3 short	
1	IPS/VU select (INV1)	N/A	VU	IPS	1-2 short
2	IPS/VV select (INV1)	N/A	VV	IPS	1-2 short
3	IPS/VW select (INV1)	N/A	VW	IPS	1-2 short
4	IPS/VU select (INV2)	N/A	VU	IPS	1-2 short
5	IPS/VV select (INV2)	N/A	VV	IPS	1-2 short
6	IPS/VW select (INV2)	N/A	VW	IPS	1-2 short
7	IPS/ENC select (INV1)	N/A	IPS	ENC	2-3 short
8	IPS/ENC select (INV1)	N/A	IPS	ENC	2-3 short
9	IPS/ENC select (INV2)	N/A	IPS	ENC	2-3 short
10	IPS/ENC select (INV2)	N/A	IPS	ENC	2-3 short
11	Debugger connection	Enabled	Disabled	N/A	1-2 short
12	MCU operation voltage	N/A	5V	3.3V	1-2 short

IPS : Inductive Position Sensor
ENC : Encoder

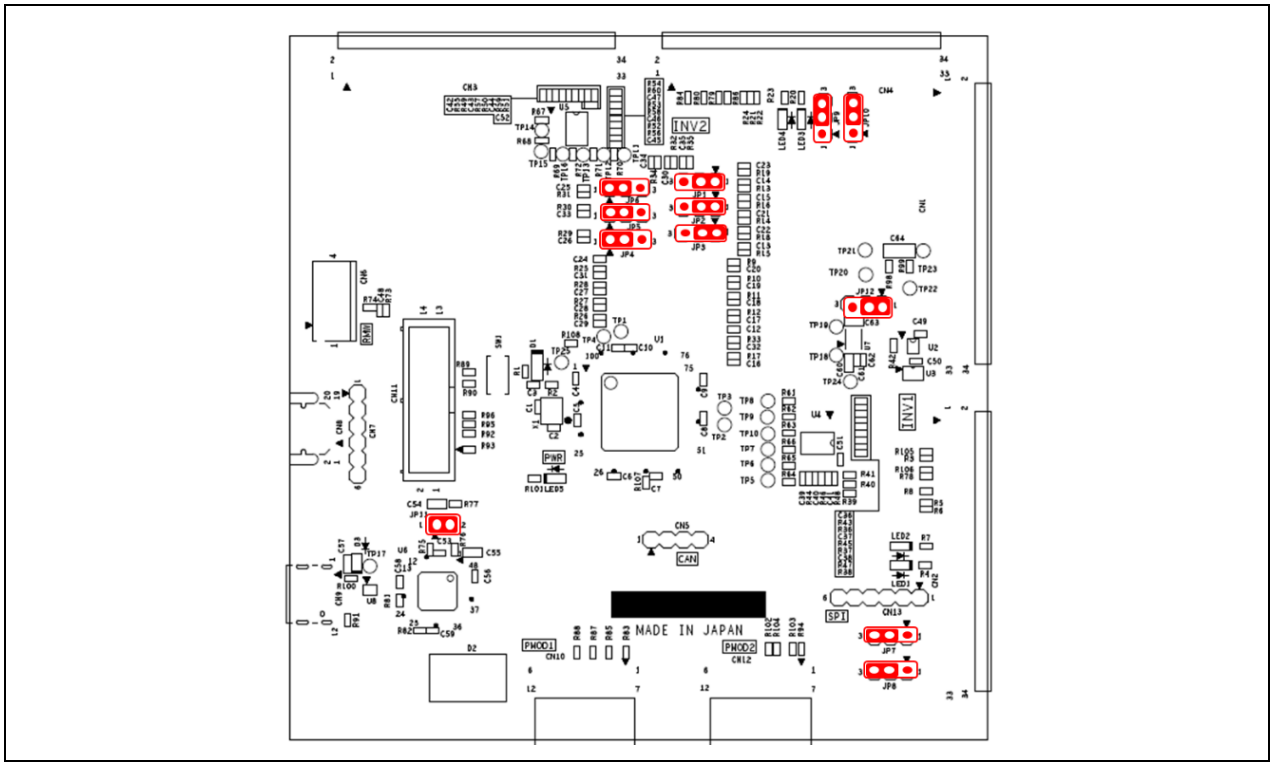


Figure 4-4 Default jumper pin setting

4.6 Hardware Setup

Figure 4-5 show a connection example when using this product with the inverter board kit (product name: MCI-LV-1, model name: RTK0EM0000S04020BJ) and the communication board (product name: MC-COM, model name: RTK0EMXC90S00000BJ).

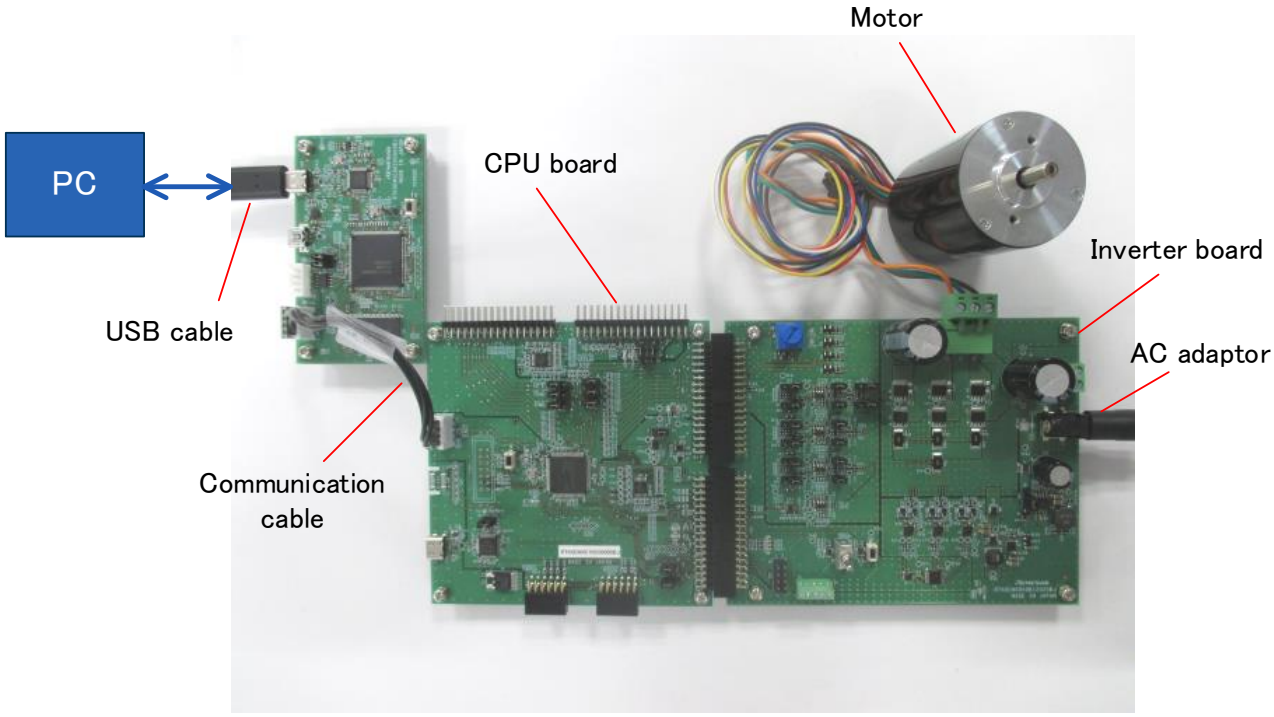


Figure 4-5 Board connection example

5. CPU Board Specification

This section describes the specification of the CPU Board.

5.1 Functions

5.1.1 Power supply

When not connected to the inverter board, power should be supplied from the USB connector. When connecting to the inverter board, power supply from the USB connector or from the inverter board will be automatically selected. USB power supply has priority. The MCU operation voltage can be selected at either 5 V or 3.3 V for this product. The operation voltage is switched with JP12 as shown in Table 4-2.

5.1.2 On-board debugger

This product has the on-board debugger circuit, E2 On-Board (hereinafter called “E2OB”). You can write a program (firmware) of RX26T with it. When you write a program, open (remove) JP11 and connect the CPU board to PC with USB cable. E2OB operates as debugger equivalent to E2 emulator Lite. If connecting from Integrated Development Environment or flash programing tool (e.g. Renesas Flash Programmer), set the type of debugger (tool) to “E2 emulator Lite”.
After writing a program, short JP11 for CPU board operation.

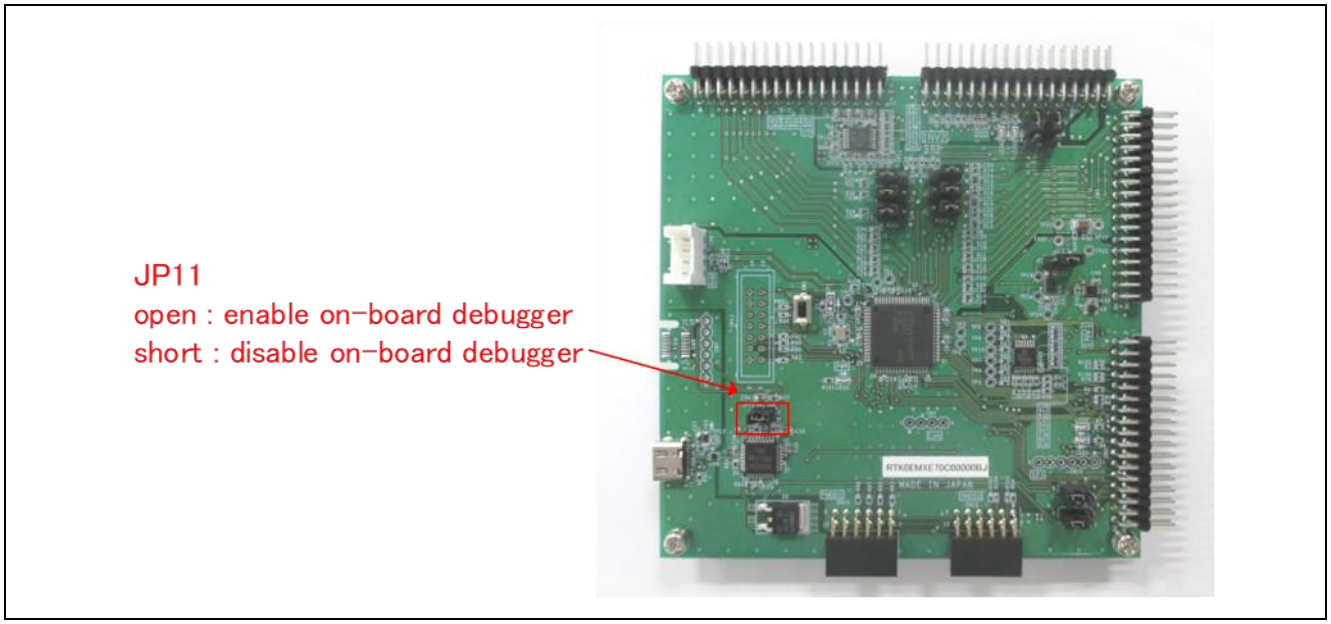


Figure 5-1 JP11 setting

5.1.3 Inverter board connector

Max 2 inverter boards can be connected to this product. 1st inverter board is connected with CN1 and CN2, and 2nd inverter board is connected with CN3 and CN4. The pin assignments of the connectors are shown in Table 5-1, Table 5-2, Table 5-3, Table 5-4.

Table 5-1 1st inverter board connector (CN1) pin assignment

Pin No.	Pin Function	RX26T Pin	Pin No.	Pin Function	RX26T Pin
1	NC	-	2	AGND	- (AVSS)
3	VPN	P43/AN003	4	AGND	- (AVSS)
5	IU	P40/AN000	6	NC	-
7	IV	P41/AN001	8	NC	-
9	IW	P42/AN002	10	NC	-
11	VU	P51/AN205	12	VV	P52/AN200
13	VW	P53/AN201	14	AGND	- (AVSS)
15	NC	-	16	NC	-
17	VR	P50/AN204	18	AGND	- (AVSS)
19	AVCC	- (AVCC)	20	AVCC	- (AVCC)
21	AGND	- (AVSS)	22	AGND	- (AVSS)
23	VCC	- (VCC)	24	VCC	- (VCC)
25	GND	- (VSS)	26	GND	- (VSS)
27	UN	P76/GTIOC2B	28	GND	- (VSS)
29	UP	P73/GTIOC2A	30	GND	- (VSS)
31	VN	P75/GTIOC1B	32	GND	- (VSS)
33	VP	P72/GTIOC1A	34	GND	- (VSS)

Table 5-2 1st inverter board connector (CN2) pin assignment

Pin No.	Pin Function	RX26T Pin	Pin No.	Pin Function	RX26T Pin
1	WN	P74/GTIOC0B	2	GND	- (VSS)
3	WP	P71/GTIOC0A	4	GND	- (VSS)
5	DRV_SCK	P91/RSPCK1	6	DRV_RXD	P93/MOSI1
7	DRV_TXD	P92/MISO1	8	DRV_CS	PA2/SSLA1
9	BUS_POWER_IN	-	10	INV_CONNECTED	-
11	SAFE_LOCK	-	12	OC#	P70/GTETRGB
13	DRV_nFault	PA5	14	DRV_EN	PB14/GTIOC1A
15	CON_MOT_SEL	PA3	16	SW1	P23
17	SW2	P22	18	LED1	P21
19	LED2	P20	20	NC	-
21	HALL_U	P30/IRQ7	22	HALL_V	P27/IRQ15
23	HALL_W	P24/IRQ4	24	SIO_SDA	PB2/SDA
25	SCK_SCL	PB1/SCL	26	CSN_IRQN/ENC_Z	P31/MTIOC0A
27	IPS_A ENC_A	P53/AN201 P33/MTCLKA	28	IPS_A#/ENC_A#	P52/AN200
29	IPS_B ENC_B	P51/AN205 P32/MTCLKB	30	IPS_B#//ENC_B#	P54/AN202
31	GND	- (VSS)	32	GND	- (VSS)
33	+5V	-	34	+5V	-

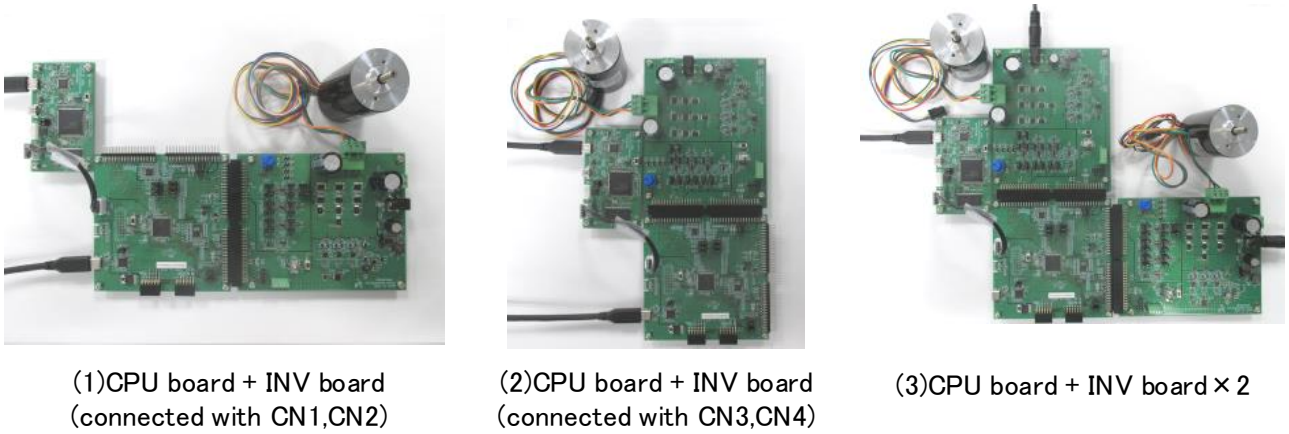
Table 5-3 2nd inverter board connector (CN3) pin assignment

Pin No.	Pin Function	RX26T Pin	Pin No.	Pin Function	RX26T Pin
1	NC	-	2	AGND	- (AVSS)
3	VPN	P47/AN103	4	AGND	- (AVSS)
5	IU	P44/AN100	6	NC	-
7	IV	P45/AN101	8	NC	-
9	IW	P46/AN102	10	NC	-
11	VU	P60/AN206	12	VV	P61/AN207
13	VW	P62/AN208	14	AGND	- (AVSS)
15	NC	-	16	NC	-
17	VR	P55/AN203	18	AGND	- (AVSS)
19	AVCC	- (AVCC)	20	AVCC	- (AVCC)
21	AGND	- (AVSS)	22	AGND	- (AVSS)
23	VCC	- (VCC)	24	VCC	- (VCC)
25	GND	- (VSS)	26	GND	- (VSS)
27	UN	P92/GTIOC4B	28	GND	- (VSS)
29	UP	P95/GTIOC4A	30	GND	- (VSS)
31	VN	P91/GTIOC5B	32	GND	- (VSS)
33	VP	P94/GTIOC5A	34	GND	- (VSS)

Table 5-4 2nd inverter board connector (CN4) pin assignment

Pin No.	Pin Function	RX26T Pin	Pin No.	Pin Function	RX26T Pin
1	WN	P90/GTIOC6B	2	GND	- (VSS)
3	WP	P93/GTIOC6A	4	GND	- (VSS)
5	DRV_SCK	P91/RSPCK1	6	DRV_RXD	P93/MOSI1
7	DRV_TXD	P92/MISO1	8	DRV_CS	P94/SSLA0
9	BUS_POWER_IN	-	10	INV_CONNECTED	-
11	SAFE_LOCK	-	12	OC#	P01/GTETRGA
13	DRV_nFault	P96	14	DRV_EN	P95/GTIOC4A
15	CON_MOT_SEL	P90	16	SW1	PE1
17	SW2	P82	18	LED1	P65
19	LED2	P64	20	NC	-
21	HALL_U	PE4/IRQ1	22	HALL_V	PE3/IRQ2
23	HALL_W	PE2/IRQ0	24	SIO_SDA	PB2/SDA
25	SCK_SCL	PB1/SCL	26	CSN_IRQN/ENC_Z	PE5/MTIOC9D
27	IPS_A ENC_A	P62/AN208 P11/MTCLKC	28	IPS_A#/ENC_A#	P61/AN207
29	IPS_B ENC_B	P60/AN206 P10/MTCLKD	30	IPS_B#/ENC_B#	P63/AN209
31	GND	- (VSS)	32	GND	- (VSS)
33	+5V	-	34	+5V	-

Figure 5-1 show a connection example when using this product with the inverter board and the communication board.



(1)CPU board + INV board (connected with CN1,CN2)

(2)CPU board + INV board (connected with CN3,CN4)

(3)CPU board + INV board × 2

Figure 5-1 Board connection of CPU board, INV board and COM board

5.1.4 Serial communication

For serial communication using Renesas Motor Workbench, the CPU board has SCI connector. Pin assignment for SCI connector is listed in Table 5-5.

Table 5-5 SCI connector (CN6) pin assignment

Pin No.	Pin Function	RX26T Connection Pin
1	GND	-
2	MCU RXD	P80/RXD6
3	MCU TXD	P81/TXD6
4	VCC	-

5.1.5 Reset circuit

This product has a reset circuit to enable power-on reset or external reset on MCU. Push the tact switch (SW1) to externally reset MCU.

5.1.6 LED

This product has 4 controllable LEDs, so that they can be used for program debug and the system. LED switches on when output from the corresponding port is “LOW” and switches off when output is “HIGH”. Pin assignment for corresponding LEDs is listed in Table 5-6.

Table 5-6 LED pin assignment

RX26T pin output		LED1	LED2	LED3	LED4
P21	HIGH	OFF	-	-	-
	LOW	ON	-	-	-
P20	HIGH	-	OFF	-	-
	LOW	-	ON	-	-
P65	HIGH	-	-	OFF	-
	LOW	-	-	ON	-
P64	HIGH	-	-	-	OFF
	LOW	-	-	-	ON

5.1.7 CAN Communication

This product has through holes for CAN communication. Note that CAN driver is not equipped. Pin assignment for CAN communication connector is listed in Table 5-7.

Table 5-7 CAN communication pin assignment (CN5)

Pin No.	RX26T pin
1	VCC
2	PA0/CTX0_B
3	PA1/CRX0_B
4	VSS

5.1.8 SPI Communication

This product has through holes for SPI communication. Pin assignment for SPI communication connector is listed in Table 5-8.

Table 5-8 SPI communication pin assignment (CN13)

Pin No.	RX26T pin
1	PA2/SSLA1
2	P93/MOSI1
3	P92/MISO1
4	P91/RSPCK1
5	VSS
6	VCC

5.1.9 PMOD

This product has two connectors for PMOD module connection. Pin assignments are shown in Table 5-9 and Table 5-10.

Table 5-9 PMOD Type 3A connector pin assignment (CN12)

No.	RX26T port	No.	RX26T port
1	PB4_CTS11#	7	PD2
2	PB5_TXD11	8	PD1
3	PB6_RXD11	9	PD0
4	PB0_RTS11#	10	PE0
5	VSS	11	VSS
6	VCC	12	VCC

Table 5-10 PMOD Type 6A connector pin assignment (CN10)

No.	RX26T port	No.	RX26T port
1	PB3_IRQ9	7	PD2
2	PB7	8	PD1
3	PB1_SCL	9	PD0
4	PB2_SDA	10	PE0
5	VSS	11	VSS
6	VCC	12	VCC

5.2 RX26T pin function list

Table 5-11 RX26T pin function list

Pin number	RX26T pin function	Signal function
1	MTIOC9D / IRQ0	ENC_Z (INV2) / IPS_IRQN
2	EMLE	Emulator
3	VSS	
4	-	-
5	VCL	
6	MD/FINED	E2_on board/Emulator
7	GTETRGA	Overcurrent (INV2)
8	IRQ1	HALL_U (INV2)
9	IRQ2	HALL_V (INV2)
10	RES#	E2_on board/Emulator
11	XTAL	Crystal
12	VSS	
13	EXTAL	Crystal
14	VCC	
15	IRQ0	HALL_W (INV2)
16	PE1	SW1 (INV2)
17	PE0	PMOD(GPIO)
18	TRST#	Emulator
19	TMS	Emulator
20	TDI	Emulator
21	TCK	Emulator
22	TDO	Emulator
23	PD2	PMOD(GPIO)
24	PD1	PMOD(GPIO)
25	PD0	PMOD(GPIO)
26	PB7	PMOD Type6A(I2C)
27	RXD11	PMOD Type3A(UART)
28	TXD11	PMOD Type3A(UART)
29	VCC	
30	CTS11#	PMOD Type3A(UART)
31	VSS	
32	IRQ9	PMOD Type6A(I2C)
33	SDA	PMOD Type6A(I2C) / IPS_SDA
34	SCL	PMOD Type6A(I2C) / IPS_SCL
35	RTS11#	PMOD Type3A(UART)
36	PA5	Smart Driver(nFault) (INV1)
37	PA4	Smart Driver(EN) (INV1)
38	PA3	Smart Driver(SEL) (INV1)
39	SSLA1	Smart Driver (INV1)
40	CRX0	CAN
41	CTX0	CAN
42	VCC	
43	P96	Smart Driver(nFault) (INV2)
44	VSS	
45	GTIOC4A / P95	U-upper (INV2) / Smart Driver(EN) (INV2)
46	GTIOC5A / SSLA0	V-upper (INV2) / Smart Driver (INV2)
47	GTIOC6A / MOSI1(C)	W-upper (INV2) / Smart Driver (INV1,INV2)
48	GTIOC4B / MISO1(C)	U-lower (INV2) / Smart Driver (INV1,INV2)
49	GTIOC5B / RSPCK1	V-lower (INV2) / Smart Driver (INV1,INV2)
50	GTIOC6B / P90	W-lower (INV2) / Smart Driver(SEL) (INV2)
51	GTIOC2B	U-upper (INV1)
52	GTIOC1B	V-upper (INV1)
53	GTIOC0B	W-upper (INV1)
54	GTIOC2A	U-lower (INV1)
55	GTIOC1A	V-lower (INV1)
56	GTIOC0A	W-lower (INV1)

Pin number	RX26T pin function	Signal function
57	GTETRGB	Overcurrent (INV1)
58	MTCLKA	ENC_A (INV1)
59	MTCLKB	ENC_B (INV1)
60	VCC	
61	MTIOC0A / IRQ6	ENC_Z (INV1) / IPS_IRQN
62	VSS	
63	IRQ7	HALL_U (INV1)
64	IRQ15	HALL_V (INV1)
65	IRQ4	HALL_W (INV1)
66	P23	SW1 (INV1)
67	P22	SW2 (INV1)
68	P21	LED1 (INV1)
69	P20	LED2 (INV1)
70	P65	LED1 (INV2)
71	P64	LED2 (INV2)
72	VREFH2	
73	VREFL2	
74	AN209	IPS_B# (INV2)
75	AN208	VW / IPS_B (INV2)
76	AN207	VV / IPS_A# (INV2)
77	AN206	VU / IPS_A (INV2)
78	AN203	VR (INV2)
79	AN202	IPS_B# (INV1)
80	AN201	VW / IPS_B (INV1)
81	AN200	VV / IPS_A# (INV1)
82	AN205	VU / IPS_A (INV1)
83	AN204	VR (INV1)
84	AN103	VBUS (INV2)
85	AN102	IW (INV2)
86	AN101	IV (INV2)
87	AN100	IU (INV2)
88	AN003	VBUS (INV1)
89	AN002	IW (INV1)
90	AN001	IV (INV1)
91	AN000	IU (INV1)
92	AVCC	
93	VREFH01	
94	VREFL01	
95	AVSS	
96	P82	SW2 (INV2)
97	TXD6	RMW
98	RXD6	RMW
99	MTCLKC	ENC_A (INV2)
100	MTCLKD	ENC_B (INV2)

6. Design and Manufacture Information

You can obtain information on the design and manufacture of this product from renesas.com.

7. Website and Support

In order to learn, download tools and documents, apply technical support for RX family MCU and its kit, visit the below Web site.

· RX Product Information renesas.com/rx

· Renesas Support renesas.com/support

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