User's Manual

RX26T Group

MCB-RX26T Type C User's Manual

Renesas RX Family
RX200 Series

Renesas Electronics
www.renesas.com

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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 C User's Manual

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1. Overview

MCB-RX26T Type C 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 (RTK0EMXE30C00000BJ) x1
2. USB Cable x1
3. Screw x4
4. Standoff x4

(1) CPU Board

(2) USB Cable

(3) Screw
(4) Standoff

Figure 2-1 Product contents

3. Product Order Information

Product number to order MCB-RX26T Type C : RTK0EMXE30C00000BJ

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.		RTK0EMXE30C00000BJ
Compatible inverter board		RTK0EM0000B12020BJ
External view		 Note: The actual product may differ from this photo.
Mounted MCU	Product group	RX26T group
	Product No.	R5F526TACDFM
	CPU maximum operating frequency	120MHz
	Bit count	32 bit
	Package / Pin count	LFQFP / 64 pin
	ROM	256KB
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 x2, 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

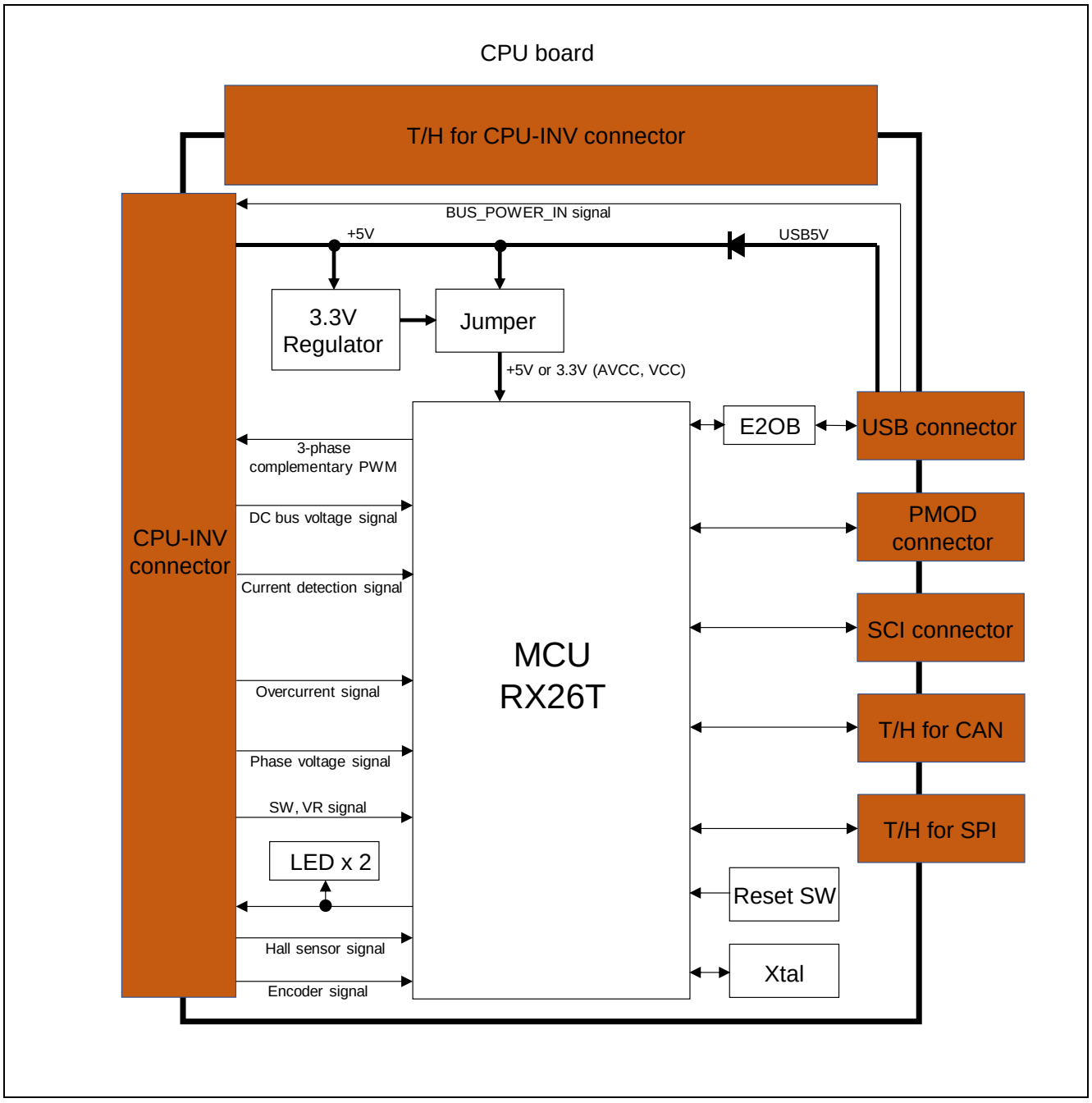

Figure 4-1 CPU board block diagram

4.3 Board Layout

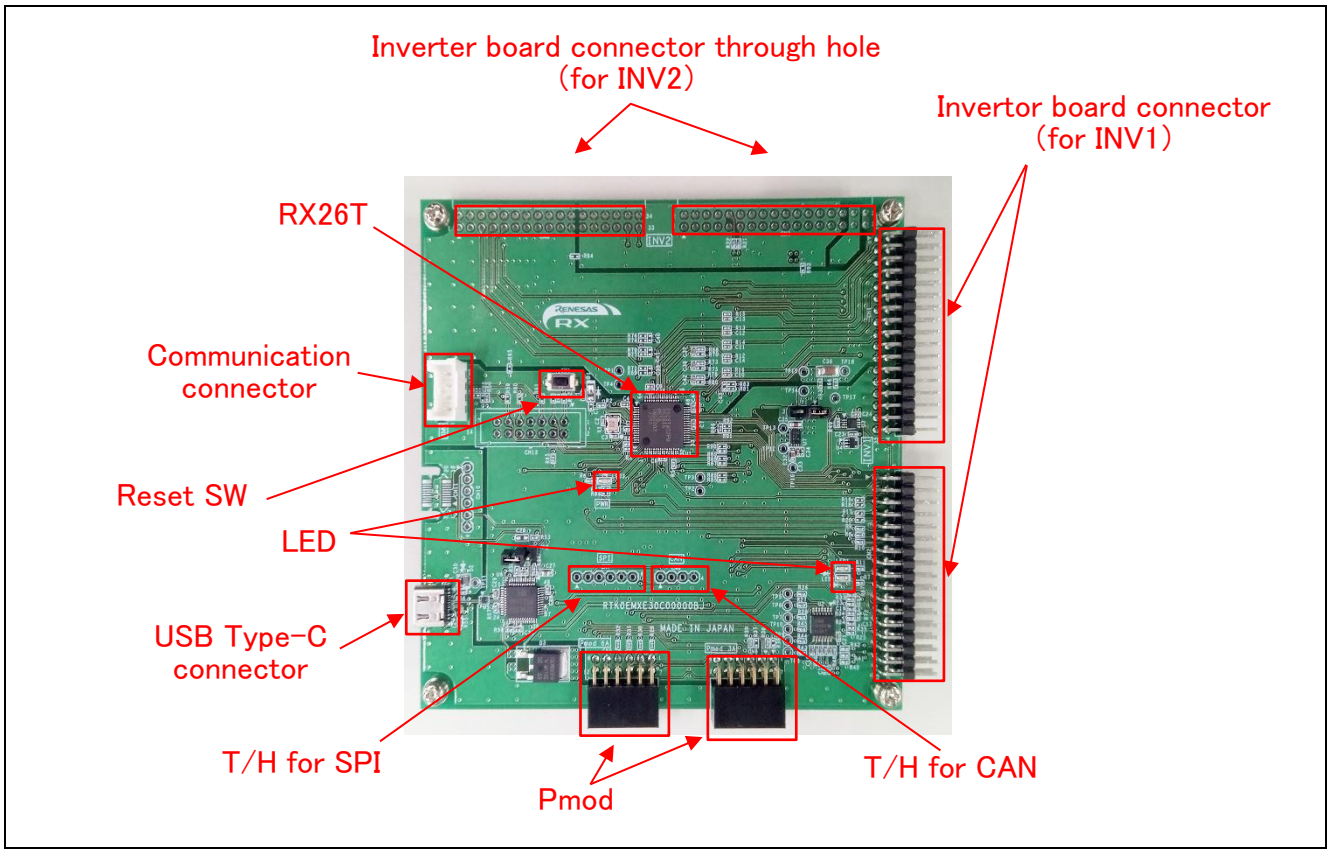

Figure 4-2 CPU Board Layout

4.4 Standoffs and Screws

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

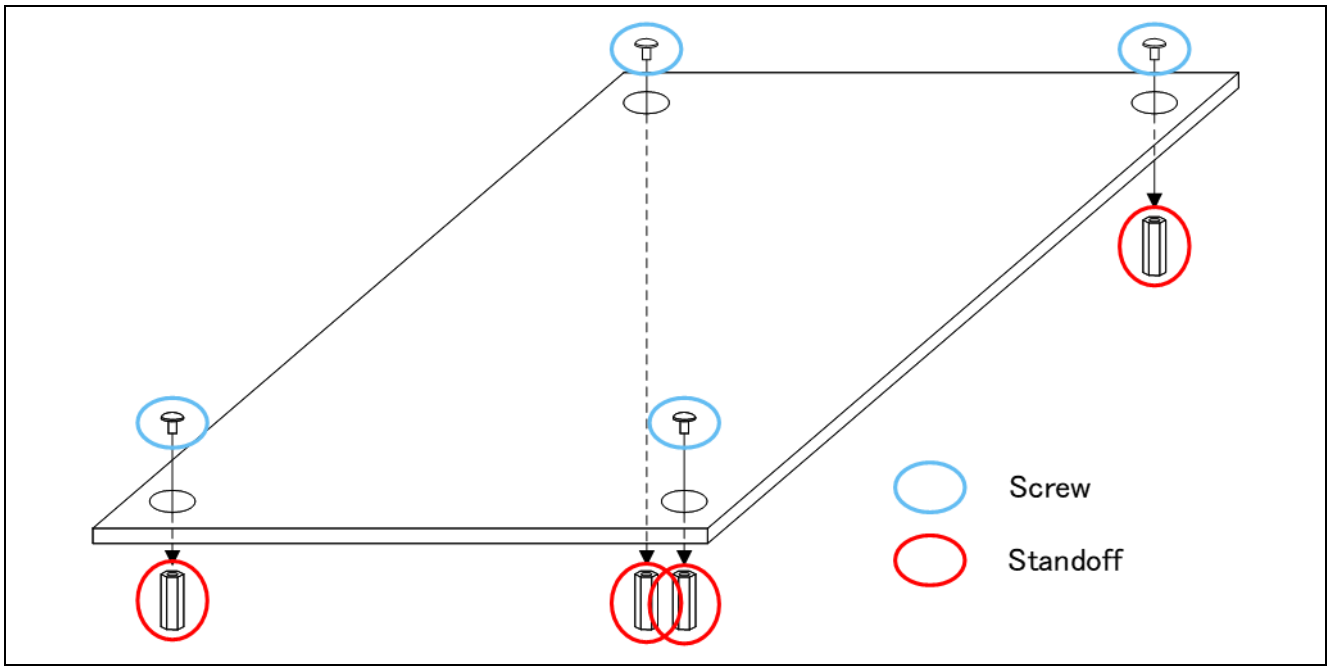

Figure 4-3 Standoffs and Screws assembly

4.5 Jumper pin setting

Default settings and functions of the jumper pins (JP1,JP2) and jumper resistor, LPF 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	MCU operation voltage	N/A	5V	3.3V	1-2 short
2	On board debugger	Enabled	Disabled	N/A	1-2 short

Table 4-3 Jumper resistor and LPF setting of CPU board

resistors & capacitors	Function in use							Default setting *3
	INV1	INV2	HV INV	IPS *1	Encoder	Pmod	Smart driver *2	
R67	-	-	-	-	short	-	-	short
R69	-	open	-	short	-	-	-	open
R71	-	short	-	open	-	-	-	open
C38	-	220pF	-	DNF	-	-	-	DNF
R72	-	-	-	-	short	-	-	short
R74	-	open	-	short	-	-	-	open
R76	-	short	-	open	-	-	-	open
C40	-	220pF	-	DNF	-	-	-	DNF
R77	-	open	-	short	-	-	-	short
R79	-	short	-	open	-	-	-	open
C41	-	220pF	-	DNF	-	-	-	DNF
R81	-	open	-	short	-	-	-	short
R83	-	short	-	open	-	-	-	open
C43	-	220pF	-	DNF	-	-	-	DNF
R85	-	open	-	-	short	-	-	short
R86	-	short	-	-	open	-	-	open
R87	-	open	-	-	short	-	-	short
R88	-	short	-	-	open	-	-	open
R89	-	open	short	-	-	-	short	short
R90	-	short	open	-	-	-	open	open
R91	-	open	short	-	-	-	short	short
R92	-	short	open	-	-	-	open	open
R68	680Ω	-	open	-	-	-	-	680Ω
R70	open	-	680Ω	-	-	-	-	open
R73	680Ω	-	open	-	-	-	-	680Ω
R75	open	-	680Ω	-	-	-	-	open
R78	680Ω	-	open	-	-	-	-	680Ω
R80	open	-	680Ω	-	-	-	-	open
R82	-	-	-	-	-	open	-	short
R84	-	-	-	-	-	short	-	open

- : Can be either open (DNF) or short
DNF : Unmounted
INV1 : an inverter board connected to CN1 and CN2
INV2 : an inverter board connected to CN3 and CN4
HV INV : a high voltage inverter board with PFC connected to CN1 and CN2

*1 Inductive position sensor.
*2 3-phase smart gate driver.
*3 INV1, Encoder and Smart driver are available

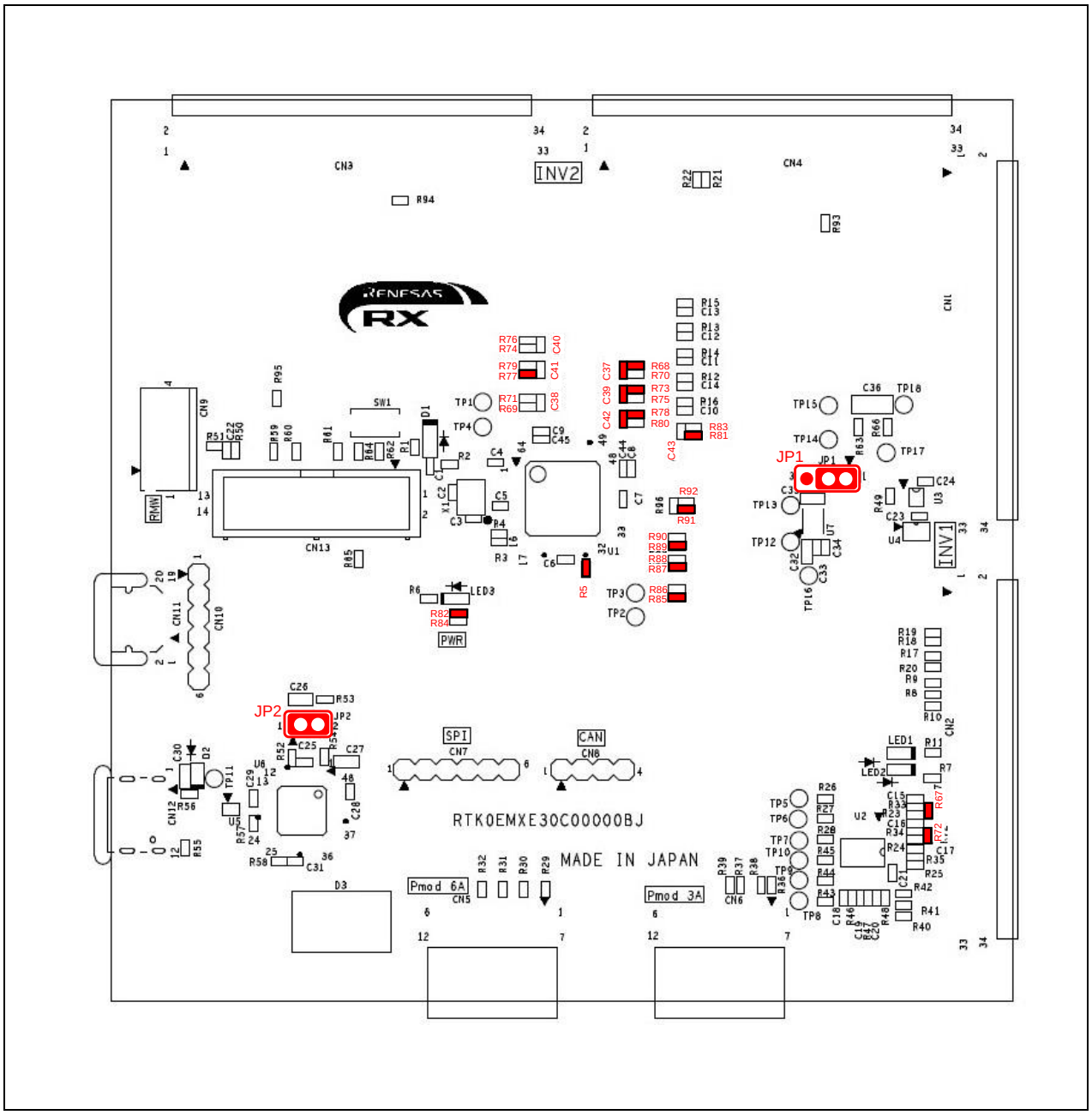

Figure 4-4 Default jumper pin and jumper resistor, LPF setting

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).

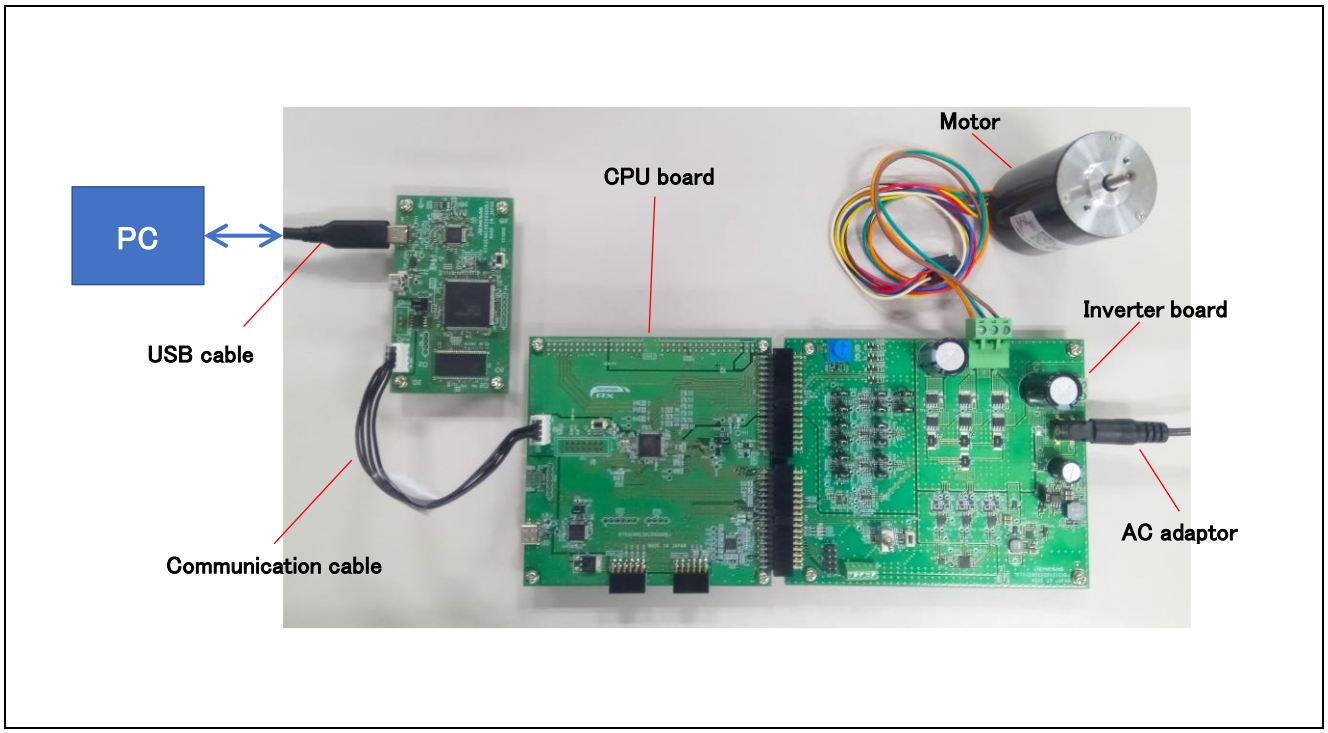

Figure 4-5 Board connection example

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 JP1 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) JP2 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 JP2 for CPU board operation.

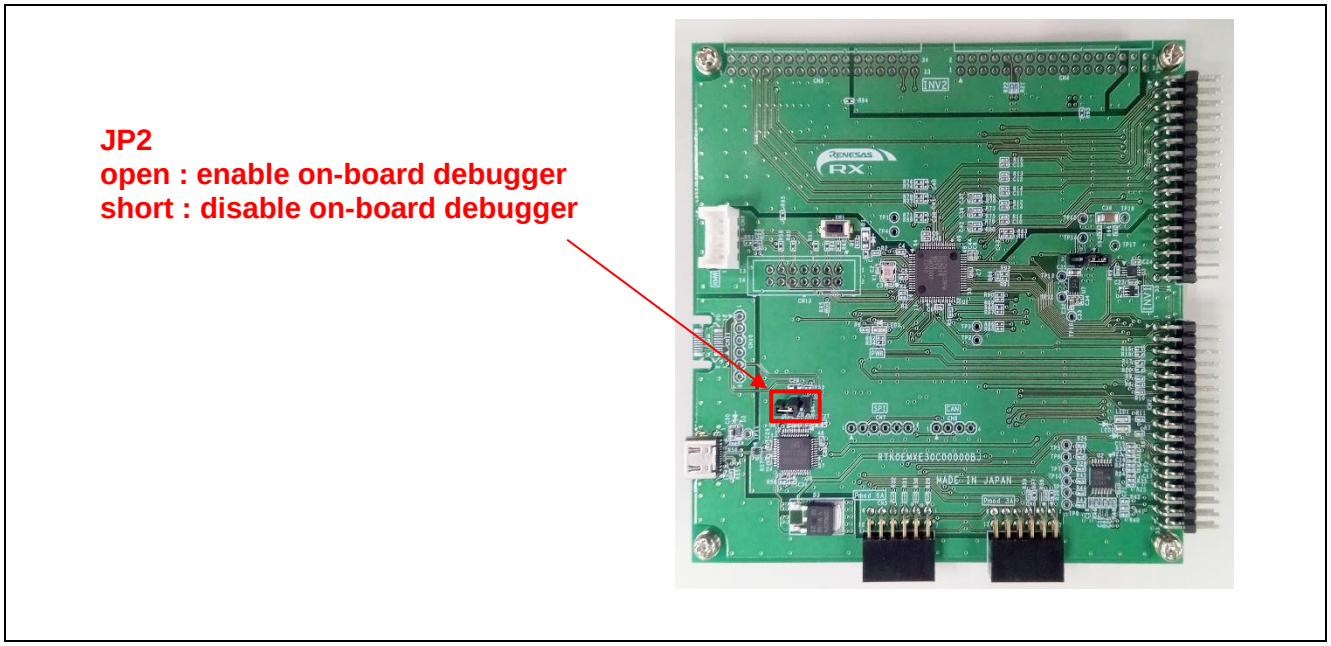

Figure 5-1 JP2 setting

5.1.3 Inverter board connector

Max 2 inverter boards can be connected to this product. This product has connecter for 1st inverter board, and through holes for 2nd inverter board. 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	HV Temperature	P46/AN006 (*)	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	P44/AN004 (*)	12	VV	P45/AN005 (*)
13	VW	P46/AN006 (*)	14	AGND	- (AVSS)
15	VPFC	P44/AN004 (*)	16	NC	-
17	VR / IPFC2	P47/AN206	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	P74/GTIOC0B	28	GND	- (VSS)
29	UP	P71/GTIOC0A	30	GND	- (VSS)
31	VN	P75/GTIOC1B	32	GND	- (VSS)
33	VP	P72/GTIOC1A	34	GND	- (VSS)

(*) selected with jumper resister

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

Pin No.	Pin Function	RX26T Pin	Pin No.	Pin Function	RX26T Pin
1	WN	P76/GTIOC2B	2	GND	- (VSS)
3	WP	P73/GTIOC2A	4	GND	- (VSS)
5	DRV_SCK	PB3/RSPCKA	6	DRV_RXD	PB0/MOSIA
7	DRV_TXD	PB4/MISOA	8	DRV_CS	PD6/SSLA0
9	BUS_POWER_IN	-	10	INV_CONNECTED	-
11	SAFE_LOCK	-	12	OC#	P96/GTETRGB
13	DRV_nFault	P70/GTETRGA (*)	14	DRV_EN	P22
15	CON_MOT_SEL	P90 (*)	16	SW1	P21
17	SW2	P20	18	LED1	P65
19	LED2	PB5 (*)	20	NC	-
21	HALL_U	P11/IRQ1	22	HALL_V	P00/IRQ2
23	HALL_W	PE2/IRQ0	24	SIO_SDA	PB2/SDA
25	SCK_SCL	PB1/SCL	26	CSN_IRQN/ENC_Z	P01/GTETRGC
27	IPS_A ENC_A	P52/AN200 (*) P94/GTIOC5A (*)	28	IPS_A#	P53/AN201 (*)
29	IPS_B ENC_B	P54/AN202 (*) P91/GTIOC5B (*)	30	IPS_B#	P64/AN210 (*)
31	GND	- (VSS)	32	GND	- (VSS)
33	+5V	-	34	+5V	-

(*) selected with jumper resister

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	P64/AN210 (*)	4	AGND	- (AVSS)
5	IU	P52/AN200 (*)	6	NC	-
7	IV	P53/AN201 (*)	8	NC	-
9	IW	P54/AN202 (*)	10	NC	-
11	NC	-	12	NC	-
13	NC	-	14	AGND	- (AVSS)
15	NC	-	16	NC	-
17	NC	-	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	P90/GTIOC6B (*)	28	GND	- (VSS)
29	UP	P93/GTIOC6A	30	GND	- (VSS)
31	VN	P91/GTIOC5B (*)	32	GND	- (VSS)
33	VP	P94/GTIOC5A (*)	34	GND	- (VSS)

(*) selected with jumper resister

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

Pin No.	Pin Function	RX26T Pin	Pin No.	Pin Function	RX26T Pin
1	WN	P92/GTIOC4B	2	GND	- (VSS)
3	WP	P95/GTIOC4A	4	GND	- (VSS)
5	NC	-	6	NC	-
7	NC	-	8	NC	-
9	BUS_POWER_IN	-	10	INV_CONNECTED	-
11	SAFE_LOCK	-	12	OC#	P70/GTETRGA (*)
13	NC	-	14	NC	-
15	NC	-	16	NC	-
17	NC	-	18	NC	-
19	NC	-	20	NC	-
21	NC	-	22	NC	-
23	NC	-	24	NC	-
25	NC	-	26	NC	-
27	NC	-	28	NC	-
29	NC	-	30	NC	-
31	GND	- (VSS)	32	GND	- (VSS)
33	+5V	-	34	+5V	-

(*) selected with jumper resister

Figure 5-2 show a connection example when using this product with the inverter board and the communication board. When using INV2, mount CN3 and CN4, and mount jumper resistors and LPF according to "4.5 Jumper Settings".

(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 5-2 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 (CN9) pin assignment

Pin No.	Pin Function	RX26T Connection Pin
1	GND	-
2	MCU RXD	PD5/RXD1
3	MCU TXD	PD3/TXD1
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 2 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
P65	HIGH	OFF	-
	LOW	ON	-
PB5	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 (CN8)

Pin No.	RX26T pin
1	VCC
2	P92/CTX0
3	P93/CRX0
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 (CN7)

Pin No.	RX26T pin
1	PD6/SSLA0
2	PB0/MOSIA
3	PB4/MISOA
4	PB3/RSPCKA
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 (CN6)

No.	RX26T port	No.	RX26T port
1	PD6_CTS1#	7	PD7_IRQ8
2	PD4_TXD12	8	PB5
3	PB6_RXD12	9	P95
4	PB4_MISOA	10	P93
5	VSS	11	VSS
6	VCC	12	VCC

Table 5-10 Pmod Type 6A connector pin assignment (CN5)

No.	RX26T port	No.	RX26T port
1	PD7_IRQ8	7	PD4
2	PB5	8	PB6
3	PB1_SCL	9	P95
4	PB2_SDA	10	P93
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	EMLE	Emulator
2	IRQ2	HALL_V
3	VCL	-
4	MD	Emulator
5	GTETRGC/(IRQ4)	ENC_Z / CSN_IRQN
6	RES#	Emulator
7	XTAL	Crystal
8	VSS	-
9	EXTAL	Crystal
10	VCC	-
11	IRQ0	HALL_W
12	TRST#/PD7/IRQ8	Emulator / INT
13	TMS/SSLA0/CTS1#	Emulator / UART / SPI
14	TDI/RXD1	Emulator / UART
15	TCK/TXD12/PD4	Emulator / UART
16	TDO/TXD1	Emulator / UART
17	RXD12/PB6	UART
18	PB5	RESET/LED2
19	PB4/MISOA	UART / SPI
20	RSPCKA	SPI
21	SDA	I2C
22	SCL	I2C
23	MOSIA/TMO0	SPI
24	VCC	-
25	GTETRGB/POE4#	OC#
26	VSS	-
27	P95/GTIOC4A	GPIO
28	GTIOC5A	ENC_A
29	P93/CRX0/GTIOC6A	GPIO / CRX
30	CTX0/GTIOC4B	CTX
31	GTIOC5B	ENC_B
32	P90/GTIOC6B	CON_MOT_SEL
33	GTIOC2B/MTIOC4D	WN
34	GTIOC1B/MTIOC4C	VN
35	GTIOC0B/MTIOC3D	UN
36	GTIOC2A/MTIOC4B	WP
37	GTIOC1A/MTIOC4A	VP
38	GTIOC0A/MTIOC3B	UP
39	GTERTGA/POE0#/IRQ5	nFault
40	VCC	-
41	VSS	-
42	P22/TMO4	DRV_EN
43	P21	SW1
44	P20/IRQ7	SW2
45	P65	LED1
46	AN210	IPS_B#
47	AVCC	-
48	AVSS	-
49	AN202	IPS_B
50	AN201	IPS_A#
51	AN200	IPS_A
52	AN206	VR
53	AN006	VW
54	AN005	VV
55	AN004	VU
56	AN003	VDC

Pin number	RX26T pin function	Signal function
57	AN002	IW
58	AN001	IV
59	AN000	IU
60	NC	-
61	AVCC	-
62	AVSS	-
63	NC	-
64	IRQ1	HALL_U

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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