

RX74N Group

MCB-RX74N Evaluation Board Manual

Renesas RX Family
RX700 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.

For Your Safety

Be sure to read the precautions and instructions in this manual before using this product.

Meaning of Notations

In this manual, items related to the safe use of the product are indicated as described below. The degree of injury to persons or damage to property that could result if the designated content in this manual is not followed is indicated as follows.

 Danger	Indicates content that, if not followed, could result in death or serious injury to the user, and which is highly urgent.
 Warning	Indicates content that, if not followed, could result in death or serious injury to the user.
 Caution	Indicates content that, if not followed, could result in injury to persons or physical damage.

Warnings Regarding Use of the Product

■ Danger Items

 Danger	
  	• The product should be used only by persons (users) having a thorough knowledge of electrical and mechanical components and systems, a full knowledge of the risks associated with handling them, and training in inverter motor control and handling motors, or equivalent skills. Users should be limited to persons who have carefully read the Caution Items contained in this manual. • The product contains high-temperature components that could be dangerous. Do not touch the product or cables while power is being supplied. • Carefully check to make sure that there are no pieces of conductive materials or dust adhering to the board, connectors, and cables. • Do not touch the motor while power is being supplied. • Ensure that the motor is insulated and placed in a stable location before supplying power.

■ Warning Items

 Warning	
	Always insert plugs, connectors, and cables securely, and confirm that they are fully inserted. Incomplete connections could cause fire, burns, electric shock, or injury.
	Use the power supply apparatus specified in the manual. Failure to do so could cause fire, burns, electric shock, injury, or malfunction.
	Disconnect the power supply and unplug all cables when the system will not be used for a period of time or when moving the system. Failure to do so could cause fire, burns, electric shock, or malfunction. This will protect the system against damage due to lightning.
	Use a mechanism (switch, outlet, etc.) located within reach to turn off (disconnect) the power supply. In case of emergency, it may be necessary to cut off the power supply quickly.
	In this product, the ground of the main power supply circuit is connected to the ground of the CPU board. When the user evaluates the product, be aware that the product and the measuring instruments may be damaged depending on the connection method of the measuring instruments.
	Turn off the power supply immediately if you notice abnormal odor, smoke, abnormal sound, or overheating. Continuing to use the system in an abnormal condition could cause fire, burns, or electric shock.
	Do Not Disassemble, Modify, or Repair! Doing so could cause fire, burns, electric shock, injury, or malfunction.
	Do not use the product for any purpose other than initial evaluation of motor control in a testing room or lab. Do not integrate the product or any part of it into other equipment. Do not insert or remove cables or connectors when the product is powered on. The product has no safety case. The user must cover the product for safety protection. Failure to observe the above could cause fire, electric shock, burns, or malfunction. The product may not perform as expected if used for other than its intended purpose.

■ Caution Items

 Caution	
	Caution – Hot! The motor gets hot. Touching it could cause high-temperature burns.
	Follow the procedure specified in the manual when powering the system on or off. Failure to do so could cause overheating or malfunction.
	Caution – Static Electricity Use the antistatic band. Failure to do so could cause malfunction or unstable motion.

Renesas RX Family

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1. Overview

MCB-RX74N is a CPU board for motor control evaluation. By using this product in combination with an inverter board, motor control using RX74N 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 e²studio before. ^{*1}
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.
5. The onboard debugger circuit on this product does not have electric isolation. ^{*1} For evaluations of motor drive operation, please use the communication board (MC-COM) to connect to the PC and use the Renesas Motor Workbench development support tool. Because the communication board is equipped with an isolator, isolation between the PC and this product is ensured. Furthermore, Renesas Motor Workbench allows variables to be read and written without stopping the MCU, enabling safe evaluation and debugging of motor drive operation. ^{*2}

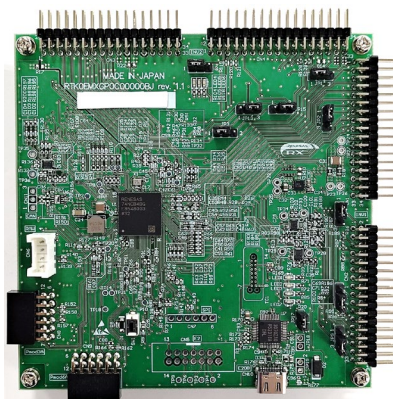
^{*1} When using the onboard debugger, this product and the PC share a common GND. In that case, supplying external power to the inverter board or driving the motor may damage the board or the PC.

^{*2} If the MCU is stopped by the debugger while the motor is running, the MOSFETs on the inverter board may remain ON (conducting state), which may result in damage to the motor or the inverter board.

2. Product Contents

This kit consists of the following parts.

1. CPU Board (RTK0EMXGP0C00000BJ) x1
2. Screw x4
3. Standoff x4



(1) CPU board



(2) Screw
(3) Stand-off

Figure 2-1 Product contents

3. Product Order Information

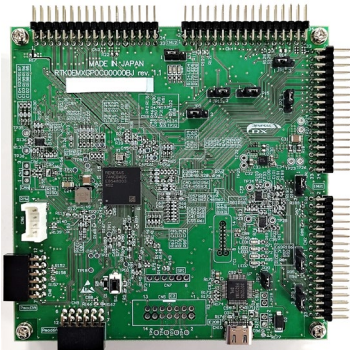
Product number for ordering item	Included item
RTK0EMXGP0C00000BJ (MCB-RX74N)	CPU Board (RTK0EMXGP0C00000BJ)
RTK0EM0000S04020BJ (MCI-LV-1)	Inverter Board (RTK0EM0000B12020BJ) Brushless DC Motor (R42BLD30L3)
RTK0EMXC90S00000BJ (MC-COM)	Communication board (RTK0EMXC90Z00000BJ) Communication cable USB cable

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.		RTK0EMXGP0C00000BJ
Compatible inverter board		RTK0EM0000B12020BJ
External view		 Note: The actual product may differ from this photo.
Mounted MCU	Product group	RX74N group
	Product No.	R5K574NCB4BG
	CPU maximum operating frequency	600MHz
	Bit count	32bit
	Package / Pin count	LFBGA / 176pin
	ROM / RAM	1MB / 1.5MB
MCU input clock		24MHz (Generate with external crystal oscillator)
Power supply		DC 5V 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		• USB connector for E2OB and power supply (Type-C) • External emulator connector * • Inverter board connector (2 pair) • SCI connector (for Renesas Motor Workbench communication) • SPI connector * • Pmod 3A connector • Pmod 6A connector • CAN connector *
Switch		Reset switch
LED		User controllable LED x6, Power LED x1
Board size		109mm (W) x 109mm (L)
Operating temperature		Room temperature
Operating humidity		No condensation allowed
EMC Directive		EN61326-1:2021 EMI : Class A EMS : Industrial electromagnetic environment

* Not implemented

4.2 Block diagram

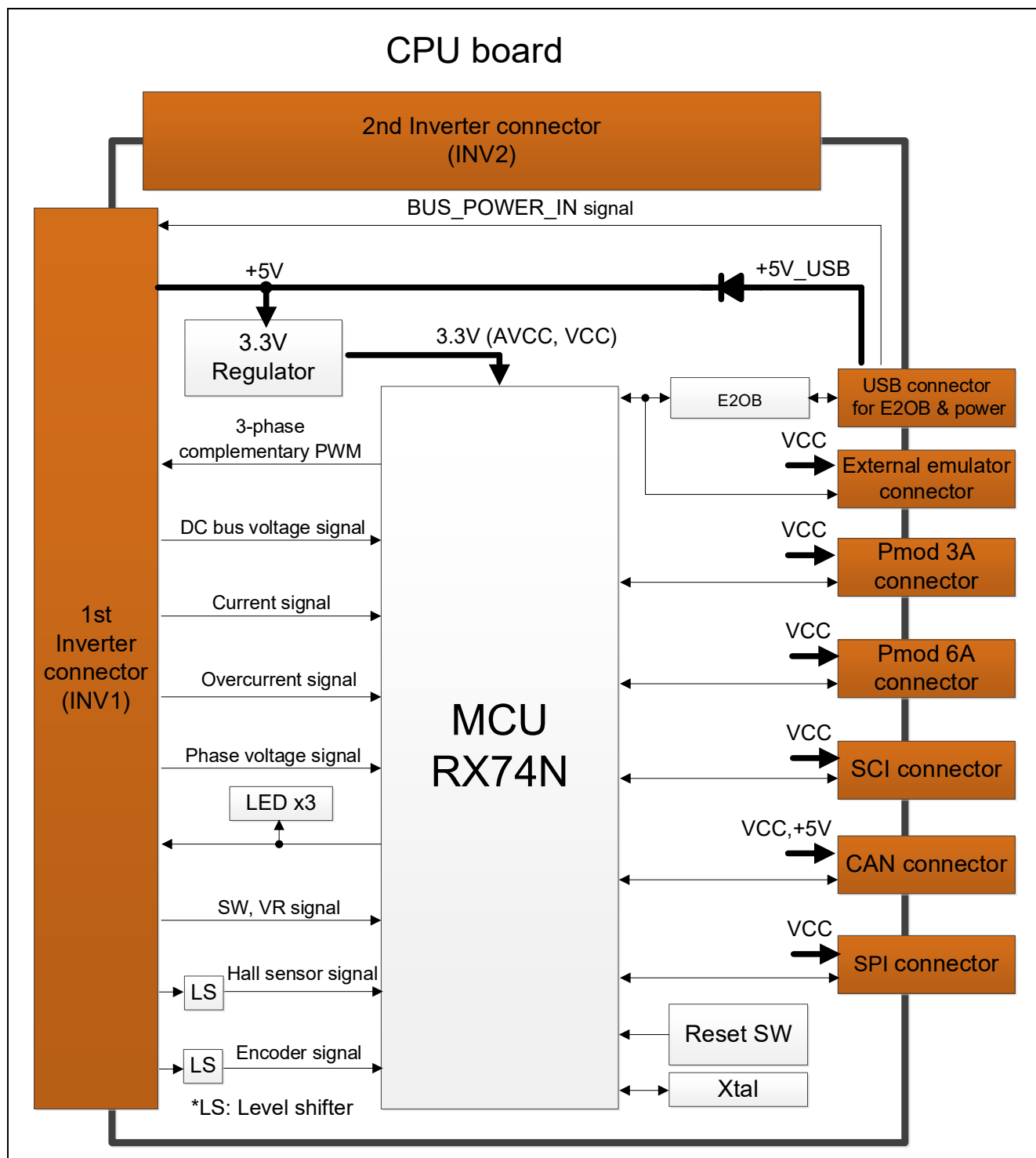


Figure 4-1 MCB-RX74N block diagram

4.3 Board Layout

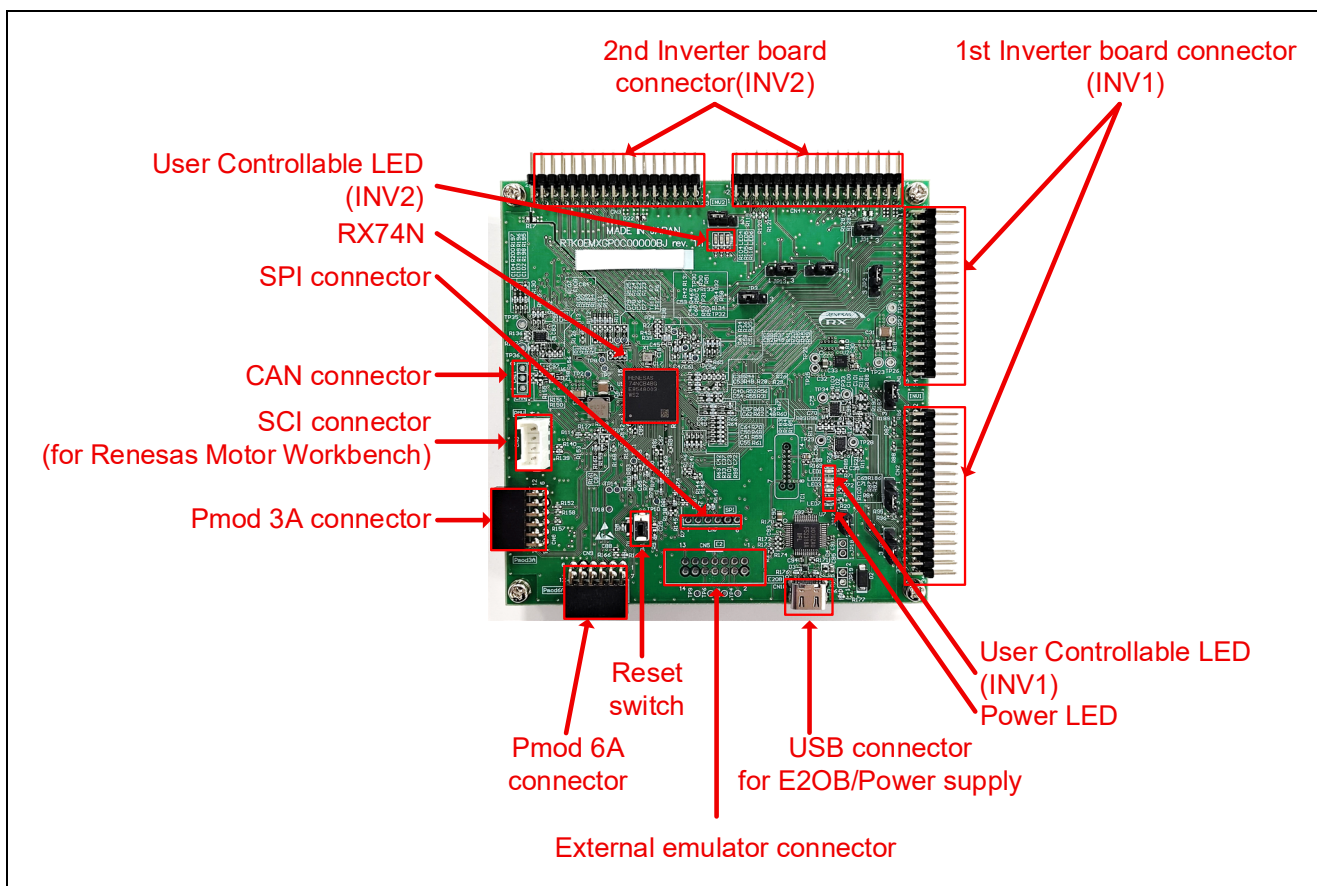


Figure 4-2 CPU Board Layout

4.4 Standoffs and Screws

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

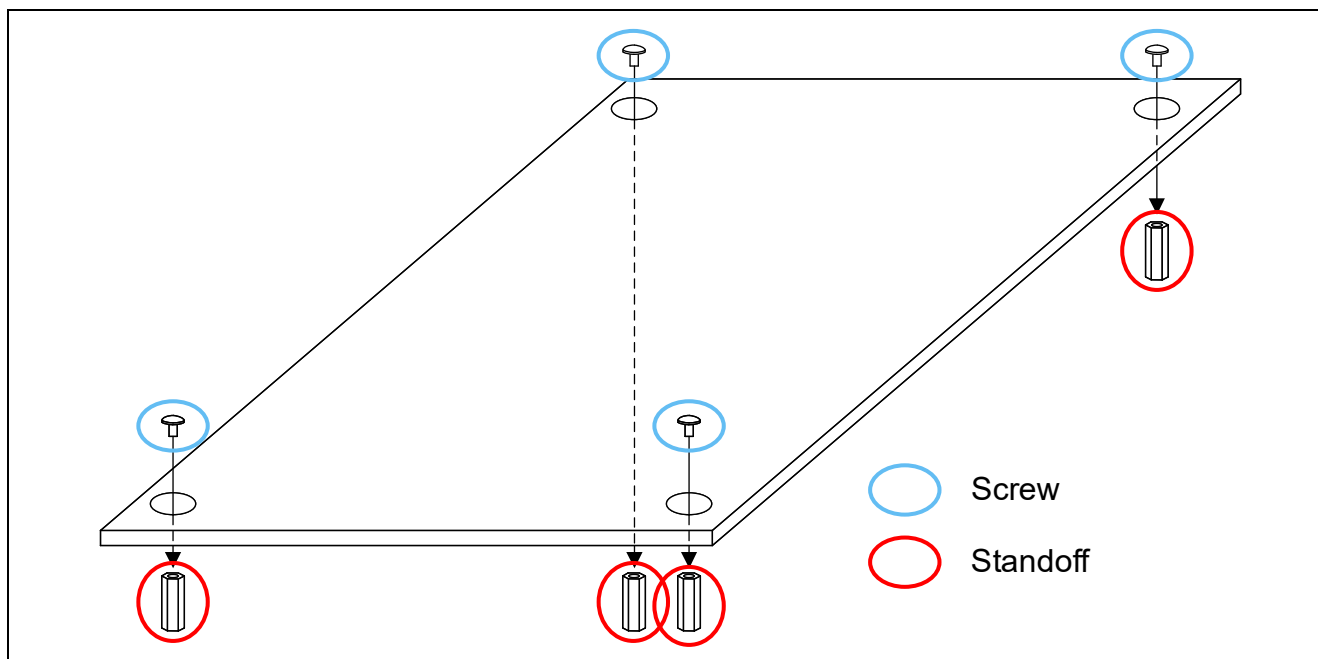


Figure 4-3 Standoffs and Screws assembly

4.5 Jumper pin setting

Default settings and functions of the jumper pins are as follows.

Table 4-2 Jumper pins setting of CPU board

Jumper pin	Default setting	Function
JP1	1-2 pin short	1-2 pin short : INV1 TEMPERATURE 2-3 pin short : INV1 IPS_B (with JP9)
JP2	1-2 pin short	1-2 pin short : INV1 V_VOLTAGE 2-3 pin short : INV1 IPS_A (with JP7)
JP3	1-2 pin short	1-2 pin short : INV2 V_VOLTAGE 2-3 pin short : INV2 IPS_B#
JP4	1-2 pin short	1-2 pin short : INV1 PFC_PWM2 2-3 pin short : INV1 MOSI
JP7	2-3 pin short	1-2 pin short : INV1 IPS_A (with JP2) 2-3 pin short : INV1 ENC_A
JP9	2-3 pin short	1-2 pin short : INV1 IPS_B (with JP1) 2-3 pin short : INV1 ENC_B
JP10	1-2 pin short	1-2 pin short : INV2 PFC_PWM2 2-3 pin short : INV2 MOSI
JP13	2-3 pin short	1-2 pin short : INV2 IPS_A 2-3 pin short : INV2 ENC_A
JP15	2-3 pin short	1-2 pin short : INV2 IPS_B 2-3 pin short : INV2 ENC_B
JP17	1-2 pin short	1-2 pin open : On board debugger valid 1-2 pin short : On board debugger invalid *1

*1 For use in single-chip mode, or for use with emulators other than E2OB.

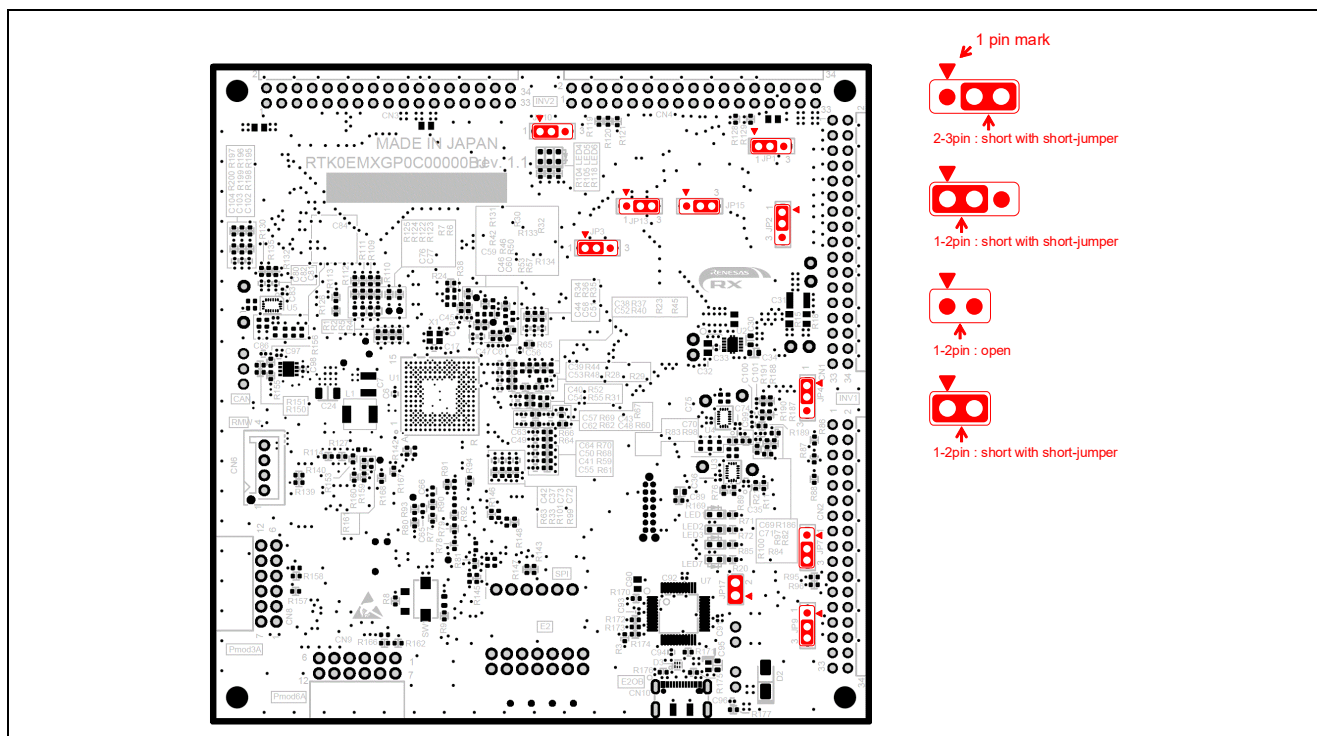


Figure 4-4 Default jumper pin setting of CPU board

4.6 Hardware Setup

4.6.1 Board Connection

Figure 4-5 and Figure 4-6 show connection examples 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).

When supplying the power from USB port, use a USB adapter capable of providing at least 1A output to ensure sufficient motor drive capability.

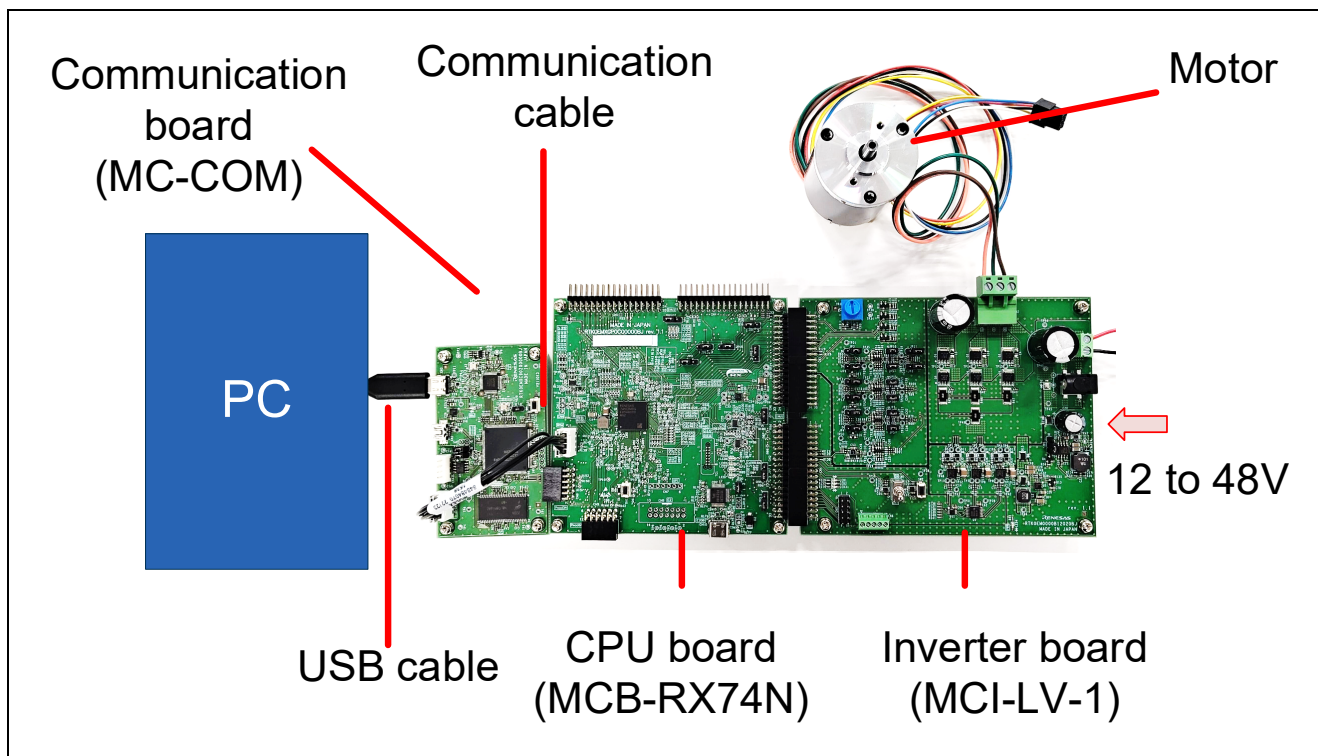


Figure 4-5 Board connection (from DC jack)

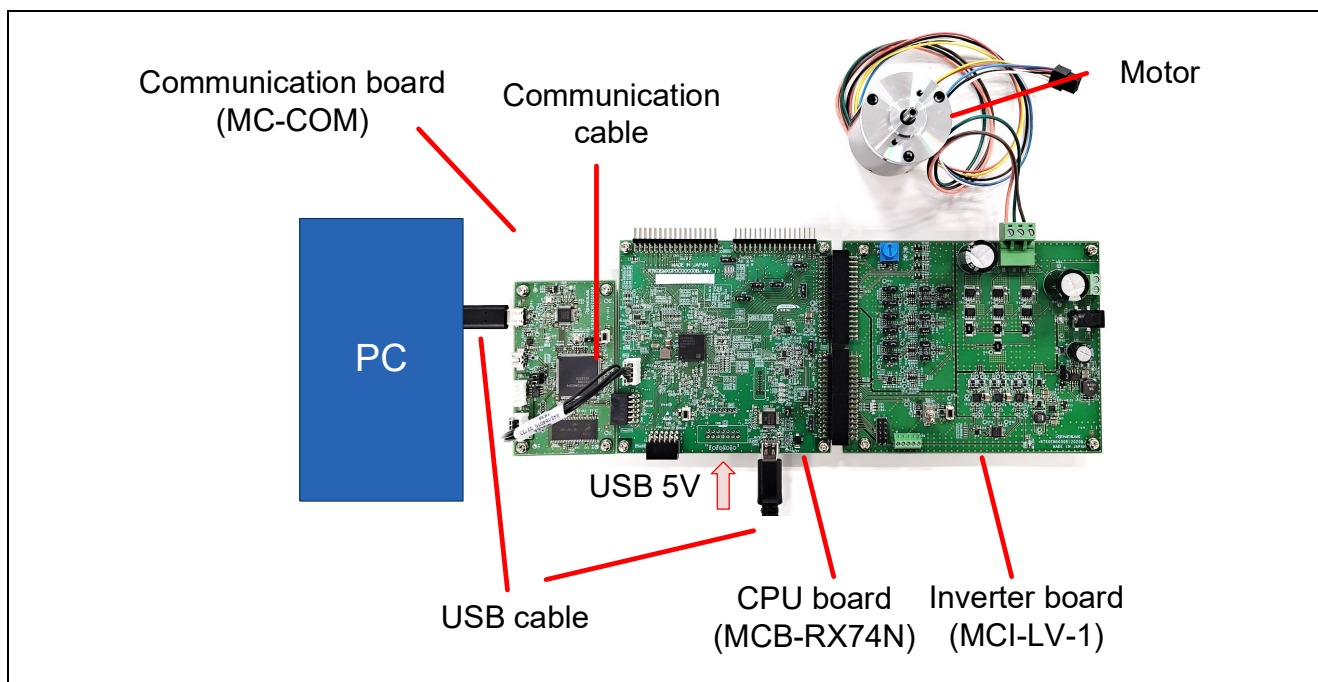


Figure 4-6 Power supply from USB connector

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 (CN10). 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. By supplying power, the 3.3V regulator operates, supplying 3.3V to VCC, and turns on LED7.

5.1.2 Onboard debugger

This product has the on-board debugger circuit, E2 On-Board (hereinafter called "E2OB"). You can write a program (firmware) of RX74N with it. When you write a program, open (remove) JP17 and connect the CPU board to PC with USB cable. E2OB operates as debugger equivalent to E2 emulator Lite. After writing a program, short JP17 for CPU board operation. E2OB become invalid, and it operates in single-chip mode. When using from Integrated Development Environment (e.g. e²studio) or flash programming tool (e.g. Renesas Flash Programmer), set the type of debugger (tool) to "E2 emulator Lite".

*When using the debugger, please make sure to carefully review the contents of "1.1 Presupposition and precautions of this document".

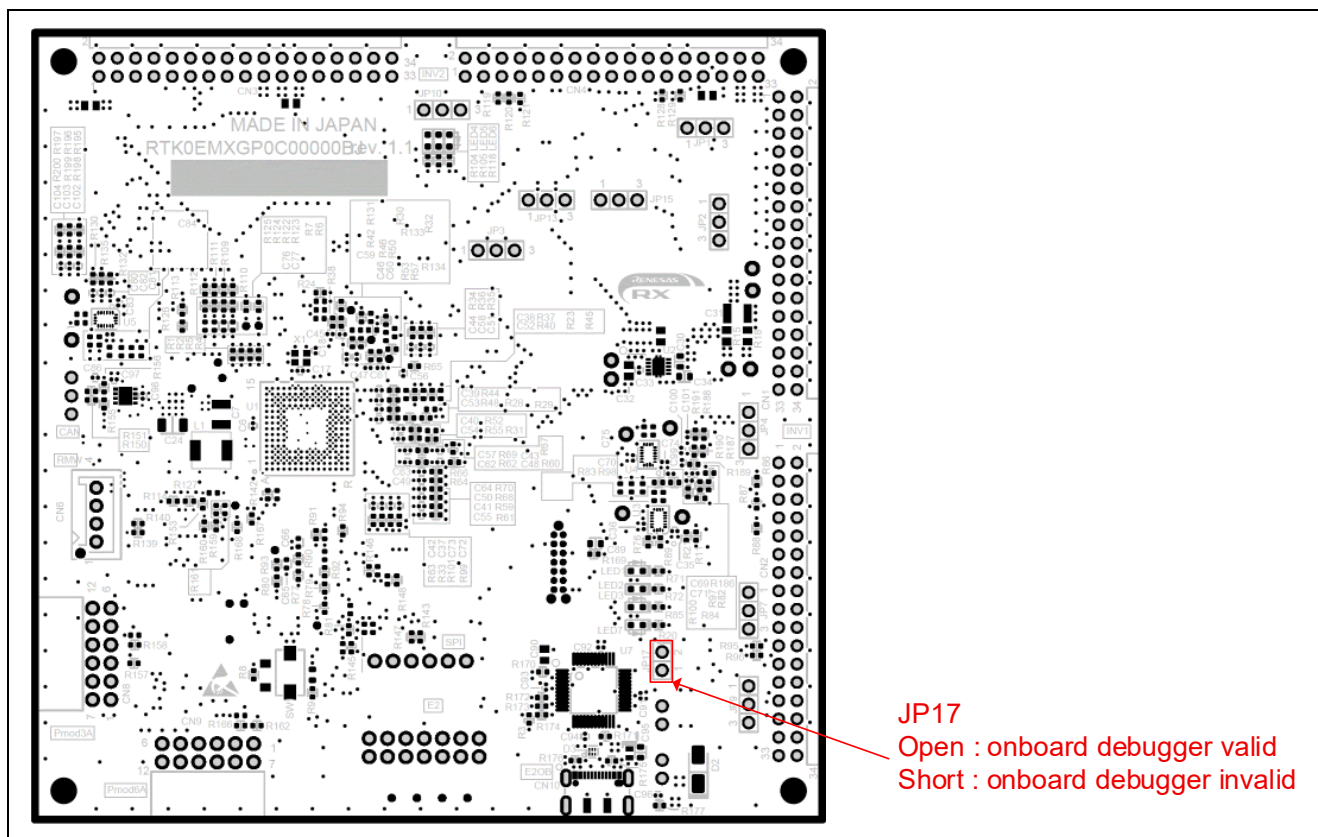


Figure 5-1 Jumper setting of JP17

5.1.3 External emulator connector

This product E2OB circuit, but external emulators such as E2 or E2-Lite can also be used.

The pin assignments of the external emulator connector are shown in Table 5-1.

**When using the debugger, please make sure to carefully review the contents of "1.1 Presupposition and precautions of this document".*

Table 5-1 External emulator connector (CN5) pin assignment

Pin No.	Emulator	RX74N pin	Pin No.	Emulator	RX74Npin
1	TCK	P301/TCK	2	GND	- (VSS)
3	TRST#	- (NC)	4	EMLE	- (NC)
5	TDO	P302/TDO/TXD001-A	6	NC	- (NC)
7	MD/FINED	P315/MD/FINED	8	VCC	- (VCC)
9	TMS	P300/TMS	10	UD	- (NC)
11	TDI	P303/TDI/RXD001-A	12	GND	- (VSS)
13	RES#	RES#	14	GND	- (VSS)

5.1.4 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.

5.1.5 Inverter board connector circuit

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 inverter board connectors are shown in Table 5-2, Table 5-3, Table 5-4, Table 5-5.

Table 5-2 1st Inverter board connector (CN1) pin assignment

Pin No.	Pin Function	RX74N Pin	Pin No.	Pin Function	RX74N Pin
1	TEMPERATURE	PD06/AN030	2	AGND	- (AVSS)
3	VDC (BUS_VOLTAGE)	P414/AN014	4	AGND	- (AVSS)
5	IU (U_CURRENT/ 1-SHUNT_CURRENT)	P400/AN000	6	IU (U_CURRENT (G)/ 1-SHUNT_CURRENT (G))	(P401/AN001) *1
7	IV (V_CURRENT)	P402/AN002	8	IV (V_CURRENT (G))	(P403/AN003) *1
9	IW (W_CURRENT)	P404/AN004	10	IW (W_CURRENT (G))	(P405/AN005) *1
11	VU (U_VOLTAGE)	PD02/AN026	12	VV (V_VOLTAGE)	PD03/AN027
13	VW (W_VOLTAGE)	PD04/AN028	14	AGND	- (AVSS)
15	VAC (VPFC)	P415/AN015	16	IPFC1	P406/AN006
17	VR/IPFC2	P407/AN007	18	AGND	- (AVSS)
19	AVCC	- (AVCC)	20	AVCC	- (AVCC)
21	AGND	- (AVSS)	22	AGND	- (AVSS)
23	VCC	- (VCC)	24	VCC	- (VCC)
25	DGND	- (VSS)	26	DGND	- (VSS)
27	PWM_UL	PE01/GTIOC7B	28	DGND	- (VSS)
29	PWM_UH	PE00/GTIOC7A	30	DGND	- (VSS)
31	PWM_VL	PE03/GTIOC8B	32	DGND	- (VSS)
33	PWM_VH	PE02/GTIOC8A	34	DGND	- (VSS)

*1 Exclusively assigned by jumper register setting

*2 Available functions are limited depending on the inverter board type.

IPS : Inductive Position Sensor

PFC : Power Factor Correction

ENC : Encoder

Table 5-3 1st Inverter board connector (CN2) pin assignment

Pin No.	Pin Function	RX74N Pin	Pin No.	Pin Function	RX74N Pin
1	PWM_WL	PE05/GTIOC9B	2	DGND	- (VSS)
3	PWM_WH	PE04/GTIOC9A	4	DGND	- (VSS)
5	DRV_SCK (SCK)	P601/RSPCK0-D	6	PWM_PFC2	P706/GTIOC13A *1
				DRV_RXD (MOSI)	(P602/MOSI0-D) *1
7	DRV_TXD (MISO)	P603/MISO0-D	8	DRV_CS (CS)	PA00/SSL01-B
9	BUS_POWER_IN1	-	10	INV_CONNECTED	PA01/GPIO/IRQ11
11	SAFE_INTERLOCK	P704/GPIO/IRQ12	12	OC (INVERTER)	P607/GTETRGA/IRQ15
13	OC (PFC)	PE07/GPIO/IRQ7	14	PWM_PFC1/ DRV_EN	P705/GTIOC12B
15	RELAY_IN/ CON_MOT_SEL	P700/GPIO	16	SW1	PA02/GPIO/IRQ10
17	SW2/ OVER_TEMPERATURE	PE06/GPIO/IRQ6	18	LED1	P702/GPIO
19	LED2	P703/GPIO	20	LED3	P701/GPIO
21	HALL_U	PA06/GPIO/IRQ14	22	HALL_V	P604/GPIO/IRQ4
23	HALL_W	P605/GPIO/IRQ13	24	IPS_SIO_SDA (SDA)	PC01/SDA00-C
25	IPS_SCK_SCL (SCL)	PC00/SCL00-C	26	IPS_CSN_IRQN/ ENC_Z	P606/GTETRGA/IRQ14
27	IPS_A	(PD03/AN027) *1	28	IPS_A#	PD05/AN029
	ENC_A	PB00/GTIOC14A *1			
29	IPS_B	(PD06/AN030) *1	30	IPS_B#	PD07/AN031
	ENC_B	PB01/GTIOC14B *1			
31	5V_GND	- (VSS)	32	5V_GND	- (VSS)
33	+5V	-	34	+5V	-

*1 Exclusively assigned by jumper register setting

*2 Available functions are limited depending on the inverter board type.

Table 5-4 2nd Inverter board connector (CN3) pin assignment

Pin No.	Pin Function	RX74N Pin	Pin No.	Pin Function	RX74N Pin
1	TEMPERATURE	P006/AN022	2	AGND	- (AVSS)
3	VDC (BUS_VOLTAGE)	P007/AN023	4	AGND	- (AVSS)
5	IU (U_CURRENT/ 1-SHUNT_CURRENT)	P401/AN001 ^{*1} (P000/AN016) ^{*1} (P402/AN002) ^{*1}	6	IU (U_CURRENT (G)/ 1-SHUNT_CURRENT (G))	(P001/AN017) ^{*1} (P403/AN003) ^{*1}
7	IV (V_CURRENT)	P403/AN003 ^{*1} (P002/AN018) ^{*1}	8	IV (V_CURRENT (G))	(P003/AN019)
9	IW (W_CURRENT)	P405/AN005 ^{*1} (P004/AN020) ^{*1}	10	IW (W_CURRENT (G))	(P005/AN021)
11	VU (U_VOLTAGE)	P900/AN032	12	VV (V_VOLTAGE)	P901/AN033
13	VW (W_VOLTAGE)	P902/AN034	14	AGND	- (AVSS)
15	VAC (VPFC)	P903/AN035	16	IPFC1	PD00/AN024
17	VR/IPFC2	PD01/AN025	18	AGND	- (AVSS)
19	AVCC	- (AVCC)	20	AVCC	- (AVCC)
21	AGND	- (AVSS)	22	AGND	- (AVSS)
23	VCC	- (VCC)	24	VCC	- (VCC)
25	DGND	- (VSS)	26	DGND	- (VSS)
27	PWM_UL	P203/GTIOC4B	28	DGND	- (VSS)
29	PWM_UH	P202/GTIOC4A	30	DGND	- (VSS)
31	PWM_VL	P205/GTIOC5B	32	DGND	- (VSS)
33	PWM_VH	P204/GTIOC5A	34	DGND	- (VSS)

^{*1} Exclusively assigned by jumper register setting

^{*2} Available functions are limited depending on the inverter board type.

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

Pin No.	Pin Function	RX74N Pin	Pin No.	Pin Function	RX74N Pin
1	PWM_WL	P207/GTIOC6B	2	DGND	- (VSS)
3	PWM_WH	P206/GTIOC6A	4	DGND	- (VSS)
5	DRV_SCK (SCK)	P601/RSPCK0-D	6	PWM_PFC2	P103/GTIOC13B *1
				DRV_RXD (MOSI)	(P602/MOSI0-D) *1
7	DRV_TXD (MISO)	P603/MISO0-D	8	DRV_CS (CS)	PC02/SSL03-A
9	BUS_POWER_IN2	-	10	INV_CONNECTED	P310/GPIO/IRQ18
11	SAFE_INTERLOCK	PF01/GPIO/IRQ1	12	OC (INVERTER)	P312/GTETRGD/IRQ20
13	OC (PFC)	P107/GPIO/IRQ31	14	PWM_PFC1 DRV_EN	P100/GTIOC12A
15	RELAY_IN/ CON_MOT_SEL	PF00/GPIO	16	SW1	P106/GPIO/IRQ30
17	SW2/ OVER_TEMPERATURE	P800/GPIO/IRQ8	18	LED1	P805/GPIO
19	LED2	P804/GPIO	20	LED3	P304/GPIO
21	HALL_U	PB03/GPIO/IRQ3	22	HALL_V	P102/GPIO/IRQ2
23	HALL_W	P305/GPI/IRQ0 (NMI)	24	IPS_SIO_SDA (SDA)	PC01/SDA00-C
25	IPS_SCK_SCL (SCL)	PC00/SCL00-C	26	IPS_CSN_IRQN/ ENC_Z	P311/GTETRGC/IRQ19
27	IPS_A	(P001/AN017) *1	28	IPS_A#	P003/AN019
	ENC_A	P802/GTIOC1A *1			
29	IPS_B	(P005/AN021) *1	30	IPS_B#	P901/AN033
	ENC_B	P803/GTIOC1B *1			
31	5V_GND	- (VSS)	32	5V_GND	- (VSS)
33	+5V	-	34	+5V	-

*1 Exclusively assigned by jumper register setting

*2 Available functions are limited depending on the inverter board type.

5.1.6 Serial communication

For serial communication using Renesas Motor Workbench, the CPU board has SCI connector. Pin assignment for SCI connector is listed in Table 5-6.

Table 5-6 SCI connector (CN6) pin assignment

Pin No.	Pin Function	RX74N Connection Pin
1	GND	- (VSS)
2	MCU RXD	PB06/RXD009-A
3	MCU TXD	PB07/TXD009-A
4	VCC	- (VCC)

5.1.7 SPI Communication

This product has through holes for SPI communication. Pin assignment for SPI communication connector is listed in Table 5-7.

Table 5-7 SPI connector (CN7) pin assignment

Pin No.	Pin Function	RX74N Connection Pin
1	CS	P600/SSL00-D
2	MOSI	P602/MOSI0-D
3	MISO	P603/MISO0-D
4	SCK	P601/RSPCK0-D
5	DGND	- (VSS)
6	VCC	- (VCC)

5.1.8 Pmod

This product has two connectors for connecting Pmod modules. The pin assignments are listed in Table 5-8, Table 5-9.

Table 5-8 Pmod 3A connector (CN8) pin assignment

Pin No.	Pin Function	RX74N Connection Pin	Pin No.	Pin Function	RX74N Connection Pin
1	CTS	P501/CTS002#	7	GPIO/INT	PC05/GPIO/IRQ5
2	TXD	P502/TXD002-C	8	GPIO	PC07/GPIO
3	RXD	P503/RXD002-C	9	GPIO	PC06/GPIO
4	RTS	P500/CTS002#/RTS002#	10	GPIO	PC04/GPIO
5	DGND	- (VSS)	11	DGND	- (VSS)
6	VCC	- (VCC)	12	VCC	- (VCC)

Table 5-9 Pmod 6A connector (CN9) pin assignment

Pin No.	Pin Function	RX74N Connection Pin	Pin No.	Pin Function	RX74N Connection Pin
1	NC/INT	PG01/GPIO/IRQ9	7	GPIO	PA07/GPIO
2	NC/RESET	PG00/GPIO	8	GPIO	PB05/GPIO
3	SCL (I3C/I2C)	PC00/SCL00-C	9	GPIO	PA05/GPIO
4	SDA (I3C/I2C)	PC01/SDA00-C	10	GPIO	PA04/GPIO
5	DGND	- (VSS)	11	DGND	- (VSS)
6	VCC	- (VCC)	12	VCC	- (VCC)

5.1.9 CAN communication

This product has connectors for CAN communication. The pin assignments for the CAN connector is listed in Table 5-10. Note that the CAN connector and CAN driver are not mounted, so users need to mount them when using this circuit.

Table 5-10 CAN connector (CN11), CAN Driver (U6) pin assignment

CAN driver		CAN connector		RX74N Connection Pin
Pin No.	Pin Function	Pin No.	Pin Function	
1	TXD	-	-	P104/CTX2
2	DGND	2	VSS	- (VSS)
3	VCC (+5V)	-	-	-
4	RXD	-	-	P105/CRX2
5	VIO	-	-	- (VCC)
6	CANL	3	CANL	-
7	CANH	1	CANH	-
8	STB	-	-	P801/GPIO
9	DGND	2	VSS	- (VSS)

5.1.10 User controllable LED

This product has several LEDs for use in program debugging and system applications. Pin assignment for user controllable LEDs are listed in Table 5-11, Table 5-12.

Table 5-11 User controllable LED (INV1) pin assignment

RX74N Pin		LED1 (Orange)	LED2 (Orange)	LED3 (Orange)
P702/GPIO	Output HIGH	OFF	-	-
	Output LOW	ON	-	-
P703/GPIO	Output HIGH	-	OFF	-
	Output LOW	-	ON	-
P701/GPIO	Output HIGH	-	-	OFF
	Output LOW	-	-	ON

Table 5-12 User controllable LED (INV2) pin assignment

RX74N Pin		LED4 (Orange)	LED5 (Orange)	LED6 (Orange)
P805/GPIO	Output HIGH	OFF	-	-
	Output LOW	ON	-	-
P804/GPIO	Output HIGH	-	OFF	-
	Output LOW	-	ON	-
P304/GPIO	Output HIGH	-	-	OFF
	Output LOW	-	-	ON

5.1.11 Test points

The CPU board has several test points to monitor various signals. They are marked in Figure 5-2 and summarized in Table 5-13.

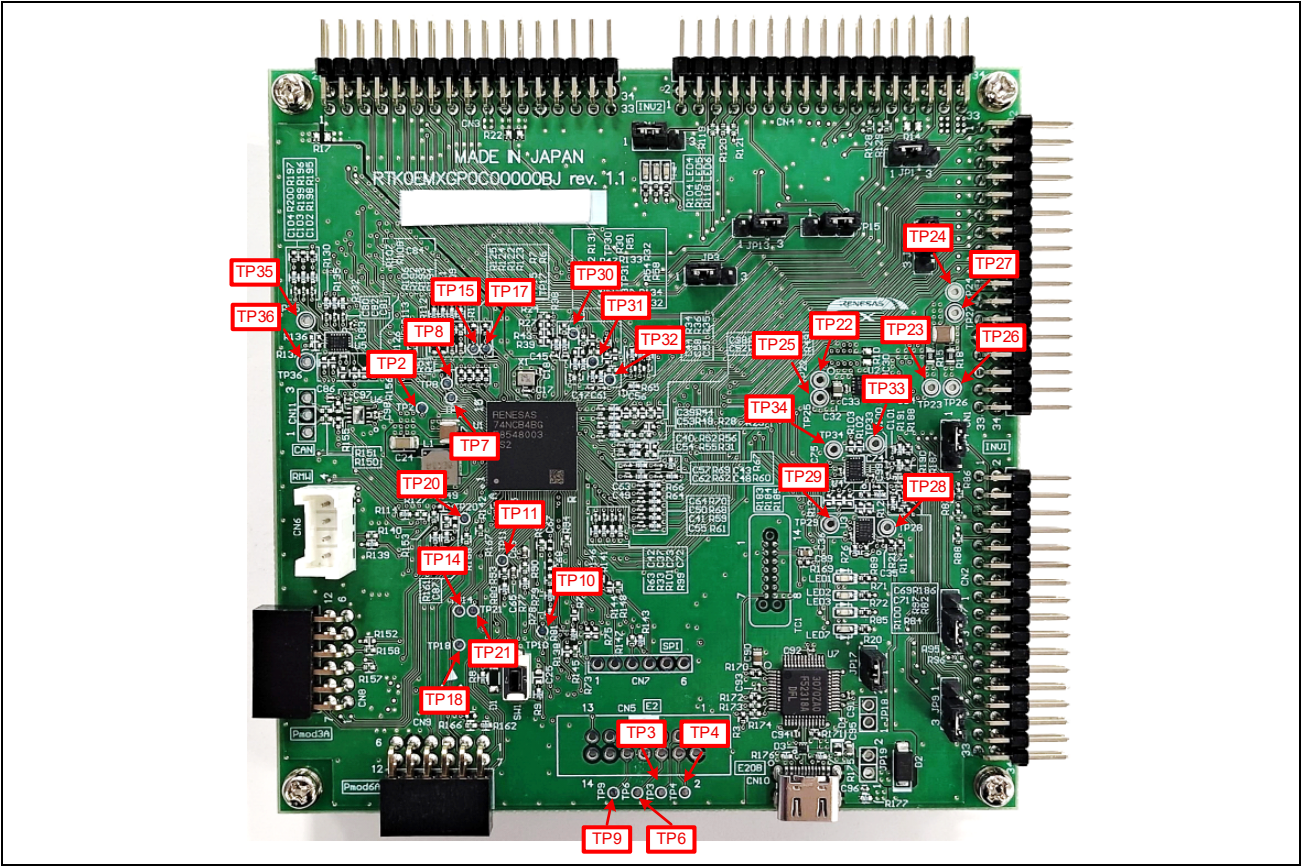


Figure 5-2 Test points

Table 5-13 Test points

No.	Signal name	Description
TP2	P101/GPIO	P101/GPIO
TP3	-	CN5-3pin
TP4	-	CN5-4pin
TP6	-	CN5-6pin
TP7	P200/GPIO	P200/GPIO
TP8	P201/GPIO	P201/GPIO
TP9	-	CN5-10pin
TP10	P707/GPIO	P707/GPIO
TP11	PA03/GPIO	PA03/GPIO
TP14	PB02/GPIO	PB02/GPIO
TP15	P309/XCIN/EXCIN	P309/XCIN/EXCIN
TP17	P308/XCOUT	P308/XCOUT
TP18	PB04/GPIO	PB04/GPIO
TP20	PC03/GPIO	PC03/GPIO
TP21	PG02/GPIO	PG02/GPIO
TP22	+5V	+5V supply
TP23	VCC	Digital Power
TP24	AVCC	Analog Power
TP25	5V_GND	Ground for +5V
TP26	VSS	Digital Ground
TP27	AVSS	Analog Ground
TP28	SCL_U3	U3 SCL
TP29	SDA_U3	U3 SDA
TP30	INV2_IPS_A	INV2_IPS_A
TP31	INV2_IPS_A#	INV2_IPS_A#
TP32	INV2_IPS_B	INV2_IPS_B
TP33	SCL_U4	U4 SCL
TP34	SDA_U4	U4 SDA
TP35	SCL_U5	U5 SCL
TP36	SDA_U5	U5 SDA

5.1.12 Pin function list

Table 5-14 RX74N pin function list

Pin number	Pin function	Board function
A01	PC01/I3C_SDA0_C	PMOD6A_PIN4_I3C_SDA
A02	PC03/GPIO	TP20_GPIO
A03	PC05/IRQ5	PMOD3A_PIN7_INT
A04	PC07/GPIO	PMOD3A_PIN8_RST_GPIO
A05	P801/GPIO	CAN_DRIVER_PIN8_STB
A06	P503/RXD2_C	PMOD3A_PIN3_UART_RXD
A07	VLO	VLO
A08	VSS_DCDC	VSS_DCDC
A09	VCC_DCDC	VCC_DCDC
A10	P102/IRQ2	INV2_HALL_V
A11	P106/IRQ30-DS	INV2_SW1
A12	P200/GPIO	TP7_GPIO
A13	P805/GPIO	INV2_LED1
A14	P301/TCK	DEBUGGER_TCK
A15	P302/TDO	DEBUGGER_TDO
B01	PC00/I3C_SCL0_C	PMOD6A_PIN3_I3C_SCL
B02	PC02/SSLA3_A	INV2_SPI_CS
B03	PC04/GPIO	PMOD3A_PIN10_GPIO
B04	PC06/GPIO	PMOD3A_PIN9_GPIO
B05	P803/GTIOC1B	INV2_ENC_B
B06	P502/TXD2_C	PMOD3A_PIN2_UART_TXD
B07	VLO	VLO
B08	VSS_DCDC	VSS_DCDC
B09	VCC_DCDC	VCC_DCDC
B10	P103/GTIOC13B	INV2_PWM_PFC1
B11	P107/IRQ31-DS	INV2_OC(PFC)
B12	P201/GPIO	TP8_GPIO
B13	P804/GPIO	INV2_LED2
B14	P300/TMS	DEBUGGER_TMS
B15	P303/TDI	DEBUGGER_TDI
C01	PB06/RXD9_A	RMW_PIN2_UART_RXD
C02	PB07/TXD9_A	RMW_PIN3_UART_TXD
C03	P802/GTIOC1A	INV2_ENC_A
C04	VCC	VCC
C05	P500/CTS_RTS2#_C	PMOD3A_PIN4_UART_CTS_RTS#
C06	P501/CTS2#_C	PMOD3A_PIN1_UART_CTS#
C07	VLO	VLO
C08	VCC_DCDC	VCC_DCDC
C09	VCC	VCC
C10	P100/GTIOC12A	INV2_PWM_PFC2
C11	P104/CTX2_A	CAN_DRIVER_PIN1_CTX
C12	P205/GTIOC5B	INV2_PWM_VL
C13	P304/GPIO	INV2_LED3
C14	P202/GTIOC4A	INV2_PWM_UH
C15	P203/GTIOC4B	INV2_PWM_UL
D01	PB04/GPIO	TP18_GPIO
D02	PB05/GPIO	PMOD6A_PIN8_GPIO
D03	PG01/IRQ9	PMOD6A_PIN1_INT
D04	P800/IRQ8	INV2_SW2/THERMAL_ERROR
D05	VCC	VCC
D06	VSS	VSS
D07	VCL	VCL
D08	P101/GPIO	TP2_GPIO
D09	VSS	VSS
D10	VCL	VCL
D11	P105/CRX2_A	CAN_DRIVER_PIN4_CRX

Pin number	Pin function	Board function
D12	VCC	VCC
D13	P204/GTIOC5A	INV2 PWM_VH
D14	PF00/GPIO	INV2 RELAY_IN/CON_MOT_SEL
D15	PF01/IRQ1	INV2 SAFE_LOCK
E01	PB02/GPIO	TP14_GPIO
E02	PB03/IRQ3	INV2 HALL_U
E03	PG00/GPIO	PMOD6A_PIN2_RST_GPIO
E04	VSS	VSS
E12	VSS	VSS
E13	P206/GTIOC6A	INV2 PWM_WH
E14	VSS	VSS
E15	VCC_USB	VCC_USB
F01	PB00/GTIOC14A	INV1 ENC_A
F02	PB01/GTIOC14B	INV1 ENC_B
F03	PG02/GPIO	TP21_GPIO
F04	VCL	VCL
F12	VCL	VCL
F13	AVSS_USBHS	AVSS_USBHS
F14	USBHS_DP	USBHS_DP
F15	USBHS_DM	USBHS_DM
G01	PA06/IRQ14	INV1 HALL_U
G02	PA07/GPIO	PMOD6A_PIN7_GPIO
G03	P706/GTIOC13A	INV1 PWM_PFC1/DRV_EN
G04	VCC	VCC
G12	AVCC_USBHS	AVCC_USBHS
G13	USBHS_RREF	USBHS_RREF
G14	VSS_USBHS	VSS_USBHS
G15	VCC_USBHS	VCC_USBHS
H01	PA04/GPIO	PMOD6A_PIN10_GPIO
H02	PA05/GPIO	PMOD6A_PIN9_GPIO
H03	P707/GPIO	TP10_GPIO
H04	VSS	VSS
H12	P207/GTIOC6B	INV2 PWM_WL
H13	VSS	VSS
H14	P306/EXTAL	EXTAL
H15	P307/XTAL	XTAL
J01	PA02/IRQ10	INV1 SW1
J02	PA03/GPIO	TP11_GPIO
J03	P705/GTIOC12B	INV1 PWM_PFC2
J04	VCL	VCL
J12	VCL	VCL
J13	P305/GPI/NMI/IRQ0	INV2 HALL_W
J14	VSS	VSS
J15	VCC	VCC
K01	PA00/SSLA1_B	INV1 SPI_CS
K02	PA01/IRQ11	INV1 INV_CONNECTED
K03	P702/GPIO	INV1 LED1
K04	VCC	VCC
K12	VSS	VSS
K13	P310/IRQ18	INV2 INV_CONNECTED
K14	P309/XCIN/EXCIN	TP15_GPI
K15	P308/XCOUT	TP17_GPI
L01	P700/GPIO	INV1 RELAY_IN/CON_MOT_SEL
L02	P701/GPIO	INV1 LED3
L03	P703/GPIO	INV1 LED2
L04	P704/IRQ12	INV1 SAFE_LOCK
L12	P312/GTETRGD/IRQ20	INV2 OC(INV)
L13	P311/GTETRGC/(IRQ19)	INV2 ENC_Z/IPS_CSN
L14	VCC	VCC

Pin number	Pin function	Board function
L15	VBATT/VCC	VBATT/VCC
M01	PE07/IRQ7	INV1 OC(PFC)
M02	PE03/GTIOC8B	INV1 PWM_VL
M03	PD04/AN028	INV1 VW(W_VOLTAGE)
M04	PD06/AN030	INV1 TEMPERATURE/IPS_B
M05	VSS	VSS
M06	VCL	VCL
M07	VCC2	VCC2
M08	VSS	VSS
M09	VCL	VCL
M10	P407/AN007	INV1 VR/IPFC2
M11	P404/AN004	INV1 IW(W_CURRENT)
M12	P315/MD/FINED	DEBUGGER_MD
M13	RES#	RES#
M14	P001/AN017	ADC_AN017/INV2 IPS_A
M15	P000/AN016	ADC_AN016
N01	PE05/GTIOC9B	INV1 PWM_WL
N02	PE04/GTIOC9A	INV1 PWM_WH
N03	P607/GTETRGB/IRQ15	INV1 OC(INV)
N04	P604/IRQ4	INV1 HALL_V
N05	PD07/AN031	INV1 IPS_B#
N06	PD05/AN029	INV1 IPS_A#
N07	VCC2	VCC2
N08	VSS	VSS
N09	VCL	VCL
N10	P406/AN006	INV1 IPFC1
N11	P405/AN005	INV2 IW(W_CURRENT)
N12	P415/AN015	INV1 VAC(VPFC)
N13	P414/AN014	INV1 VDC(BUS_VOLTAGE)
N14	P003/AN019	ADC_AN019/INV2 IPS_A#
N15	P002/AN018	ADC_AN018
P01	PE01/GTIOC7B	INV1 PWM_UL
P02	PE02/GTIOC8A	INV1 PWM_VH
P03	P606/GTETRGA/(IRQ14)	INV1 ENC_Z/IPS_CSN
P04	P603/MISOA_D	SPI_PIN3_SPI_MISO
P05	P601/RSPCKA_D	SPI_PIN4_SPI_SCLK
P06	PD03/AN027	INV1 VV(V_VOLTAGE)/IPS_A
P07	PD00/AN024	INV2 IPFC1
P08	P902/AN034	INV2 VW(W_VOLTAGE)
P09	P900/AN032	INV2 VU(U_VOLTAGE)
P10	AVSS0	AVSS0
P11	VREFL0	VREFL0
P12	P402/AN002	INV1 IV(V_CURRENT)
P13	P400/AN000	INV1 IU(U_CURRENT)
P14	P005/AN021	ADC_AN021/INV2 IPS_B
P15	P004/AN020	ADC_AN020
R01	PE00/GTIOC7A	INV1 PWM_UH
R02	PE06/IRQ6	INV1 SW2/THERMAL_ERROR
R03	P605/IRQ13	INV1 HALL_W
R04	P602/MOSIA_D	SPI_PIN2_SPI_MOSI
R05	P600/SSLA0_D	SPI_PIN1_SPI_CS
R06	PD02/AN026	INV1 VU(U_VOLTAGE)
R07	PD01/AN025	INV2 VR/IPFC2
R08	P903/AN035	INV2 VAC(VPFC)
R09	P901/AN033	INV2 VV(V_VOLTAGE)/IPS_B#
R10	AVCC0	AVCC0
R11	VREFH0	VREFH0
R12	P403/AN003	INV2 IV(V_CURRENT)
R13	P401/AN001	INV2 IU(U_CURRENT)

Pin number	Pin function	Board function
R14	P007/AN023	INV2 VDC(BUS_VOLTAGE)
R15	P006/AN022	INV2 TEMPERATURE

6. Regulatory information

This product meets the following standards. Refer to “General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products” of this Evaluation Board Manual for the precautions.

6.1 EMC Directive



This product is herewith confirmed to comply with the requirements set out in the Council Directives on the Approximation of the laws of the Member States relating to Electromagnetic Compatibility Directive 2014/30/EU.



This product is in conformity with the following relevant UK Statutory Instrument(s) (and its amendments): 2016 No. 1091 Electromagnetic Compatibility Regulations 2016.

Warning – This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures to correct this interference.

6.2 Material Selection, Waste, Recycling and Disposal Standards

- China SJ/T 11364-2014, 10-year environmental protection use period.
- WEEE Directive (2012/19/EU) & The Waste Electrical and Electronic Equipment Regulations 2013



The WEEE (Waste Electrical and Electronic Equipment) regulations put responsibilities on producers for the collection and recycling or disposal of electrical and electronic waste. Return of WEEE under these regulations is applicable in the UK and European Union.

This product (including all accessories) is not intended for household use. After use the product cannot be disposed of as household waste, and the WEEE must be treated, recycled and disposed of in an environmentally sound manner.

Renesas Electronics Europe GmbH can take back end of life product. Register for this service at;

<https://www.renesas.com/form/weee-questionnaire>

7. Design and Manufacture Information

The design resources for the MCB-RX74N (schematics, PCB layout data, BOM, etc.) and software development tools (Renesas Motor Workbench, QE for Motor, sample code, application note, etc.) are available for download from the following website: [renesas.com/mcb-rx74n](https://www.renesas.com/mcb-rx74n)

8. 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](https://www.renesas.com/rx)
- Renesas Support [renesas.com/support](https://www.renesas.com/support)

Revision History

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		Page	Summary
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