User's Manual

RA2T1 Group

MCB-RA2T1 User's Manual

Renesas RA Family
RA2 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 RA Family

MCB-RA2T1 User's Manual

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1. Overview

MCB-RA2T1 is a CPU board for motor control evaluation. By using this product in combination with an inverter board, motor control using RA2T1 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.
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 (RTK0EMA810C00000BJ) x1
2. Screw x4
3. Standoff x4



(1) CPU board



(2) Screw
(3) Standoff

Figure 2-1 Product contents

3. Product Order Information

Product number to order MCB-RA2T1 : RTK0EMA810C00000BJ

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.		RTK0EMA810C00000BJ
Compatible inverter board		RTK0EM0000B12020BJ
External view		 Note: The actual product may differ from this photo.
Mounted MCU	Product group	RA2T1 group
	Product No.	R7FA2T1074CFL
	CPU maximum operating frequency	64MHz
	Bit count	32 bit
	Package / Pin count	LQFP / 48pin
	ROM / RAM	64KB / 8KB
MCU input clock		8MHz (Generate with on-chip 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		J-Link-OB (Onboard debugger circuit)
Connector		• Inverter board connector (1 pair) • USB connector for J-Link OB • SCI connector for Renesas Motor Workbench communication
Switch		MCU reset switch
LED		User-controllable LED x2, Power LED x1
Board size		50 mm (W) x 109 mm (L)
Operating temperature		Room temperature
Operating humidity		No condensation allowed
EMC Directive		EN61326-1:2021 EMI：Class A EMS：Industrial electromagnetic environment

4.2 Block diagram

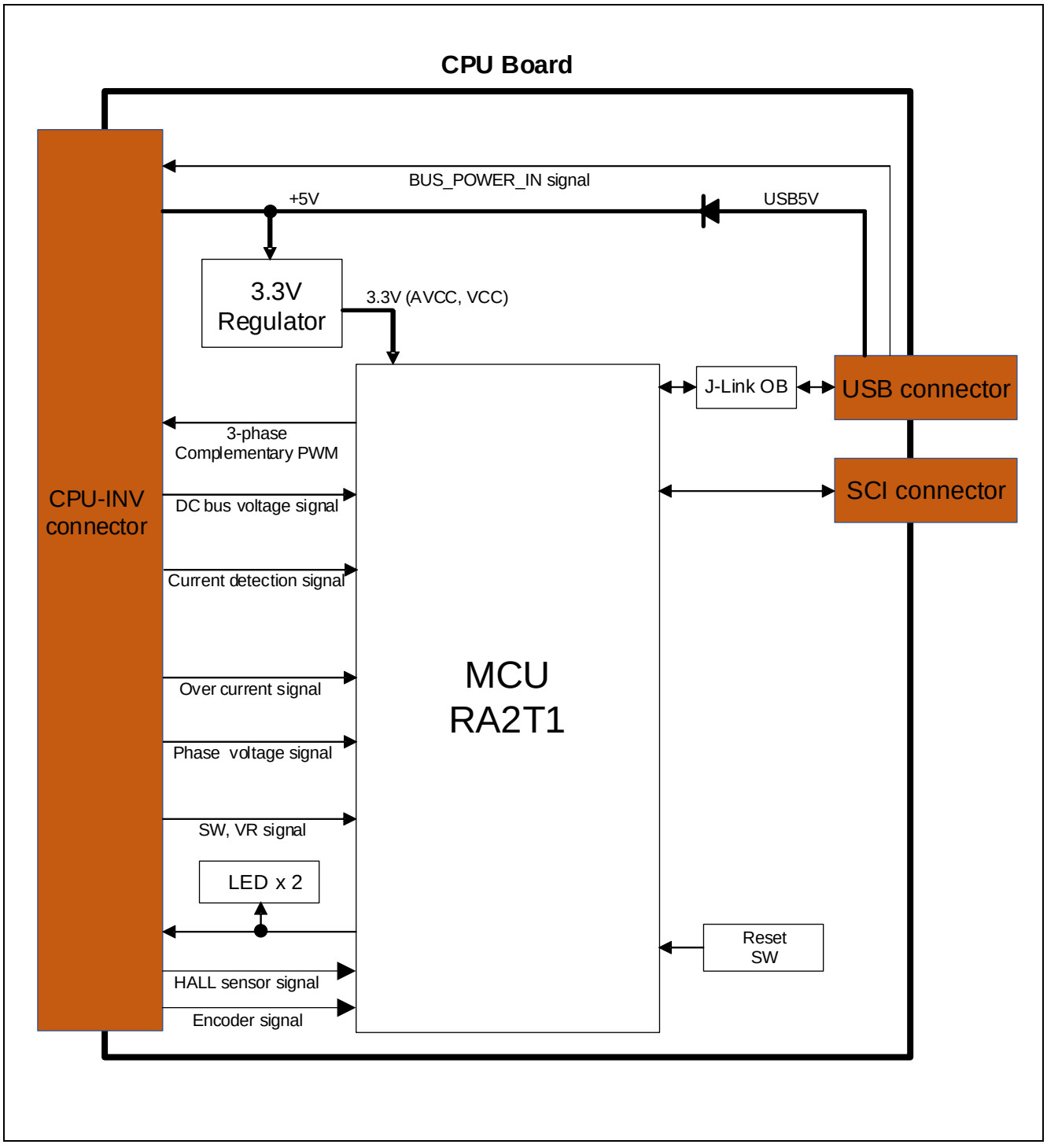


Figure 4-1 CPU board block diagram

4.3 Board Layout

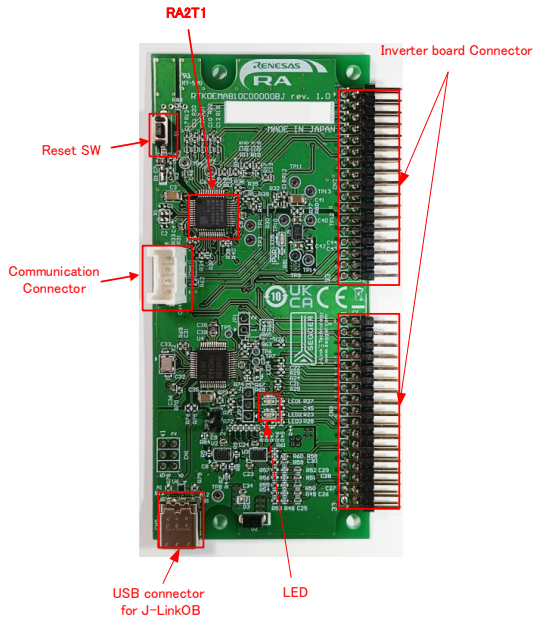


Figure 4-2 CPU Board Layout

4.4 Standoffs and Screws

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

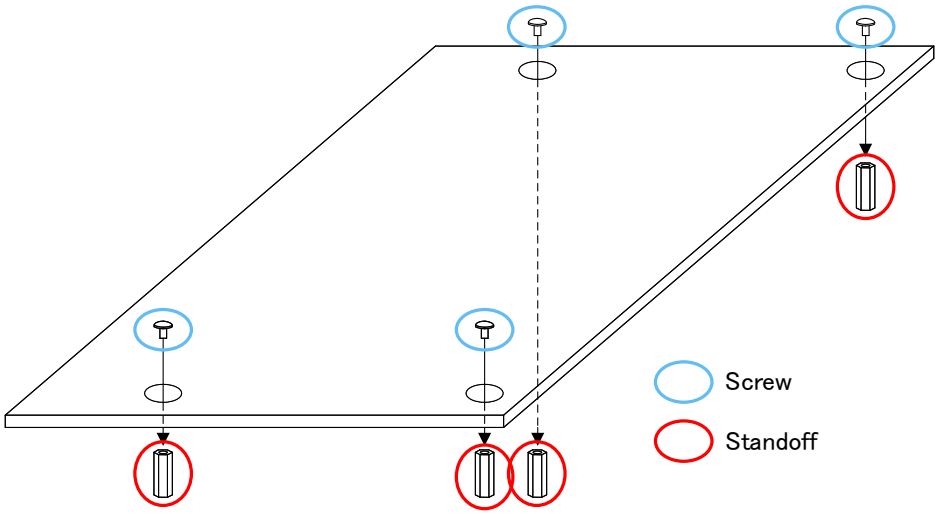


Figure 4-3 Standoffs and Screws assembly

4.5 Jumper pin setting

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

Table 4-2 Jumper pins setting of CPU board

Jumper pin	Default setting	Function
JP3	1-2pin open	1-2pin short : On board debugger invalid 1-2pin open : On board debugger valid

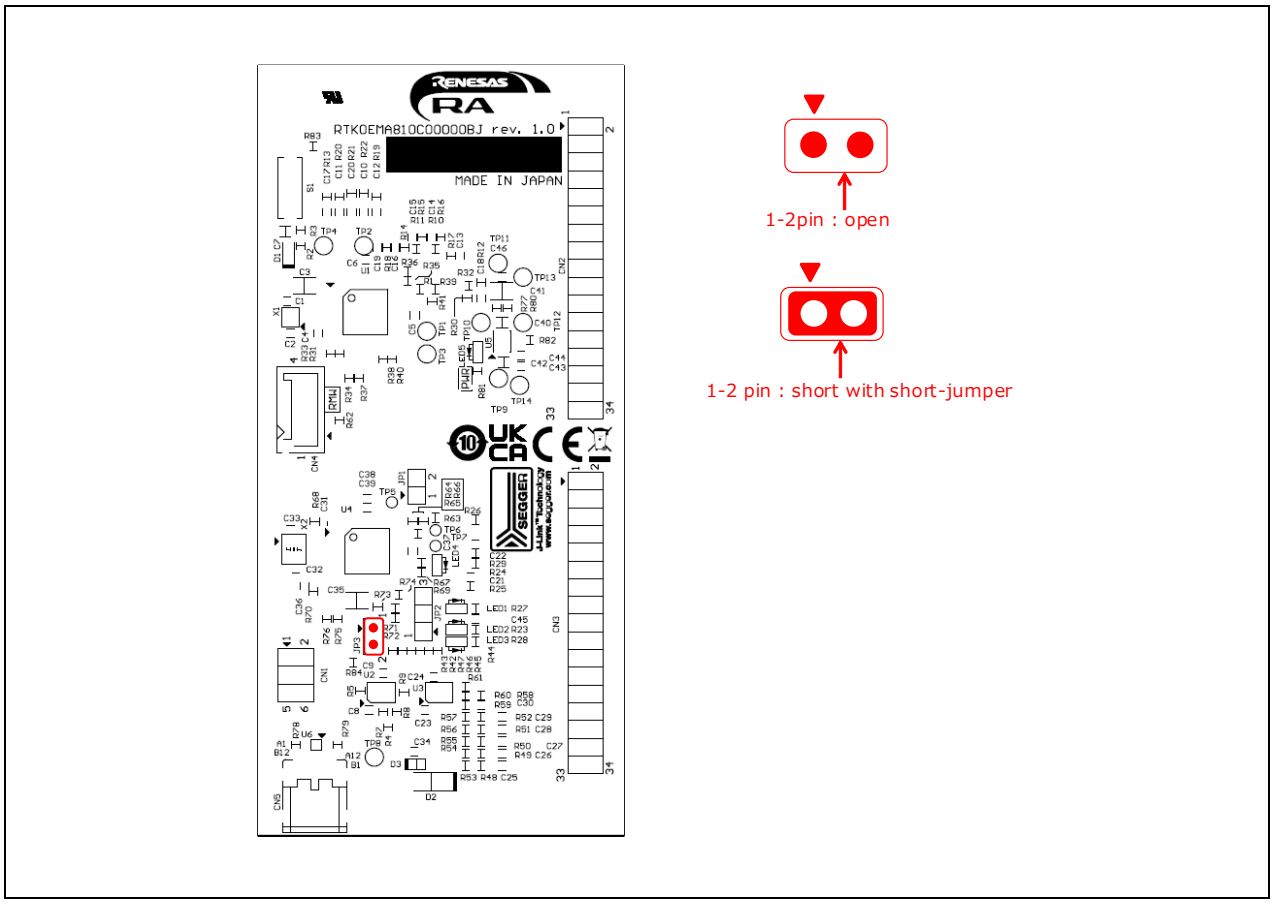


Figure 4-4 Default jumper pin setting of CPU board

4.6 Board Connection

Figure 4-5 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).

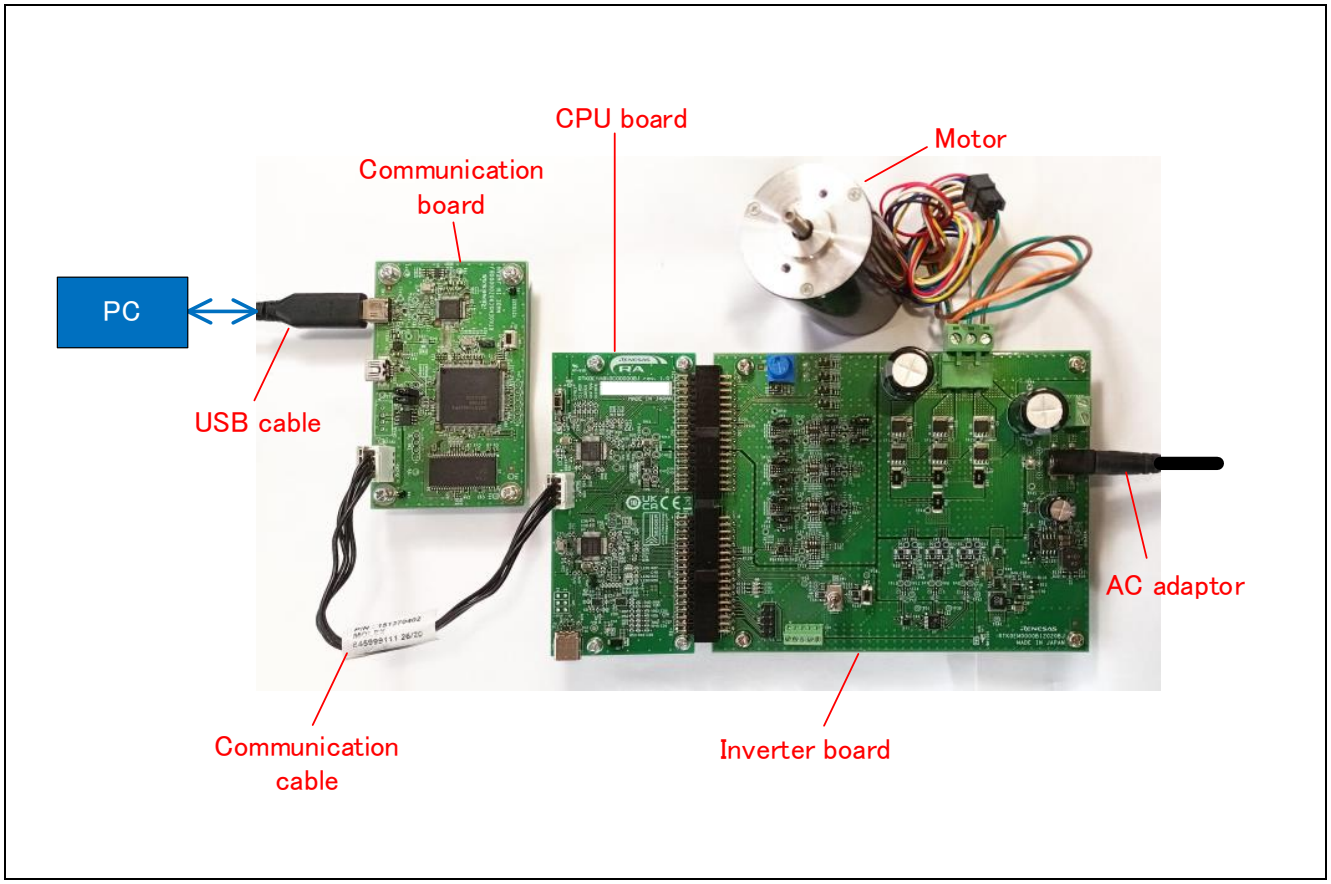


Figure 4-5 Board connection example

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 (CN5). 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.

5.1.2 Onboard debugger

This product has the onboard debugger circuit, J-Link On-Board (hereinafter called “J-Link-OB”). You can write a program (firmware) of RA2T1 with it. When you write a program, open the jumper of JP3 and connect the USB connector(CN5) on the CPU board to PC with USB cable. J-Link-OB operates as debugger equivalent to J-Link. If connecting from Integrated Development Environment(e.g. e2studio) or flash programing tool (e.g. J-Flash Lite by SEGGER), set the type of debugger (tool) to “J-Link”.

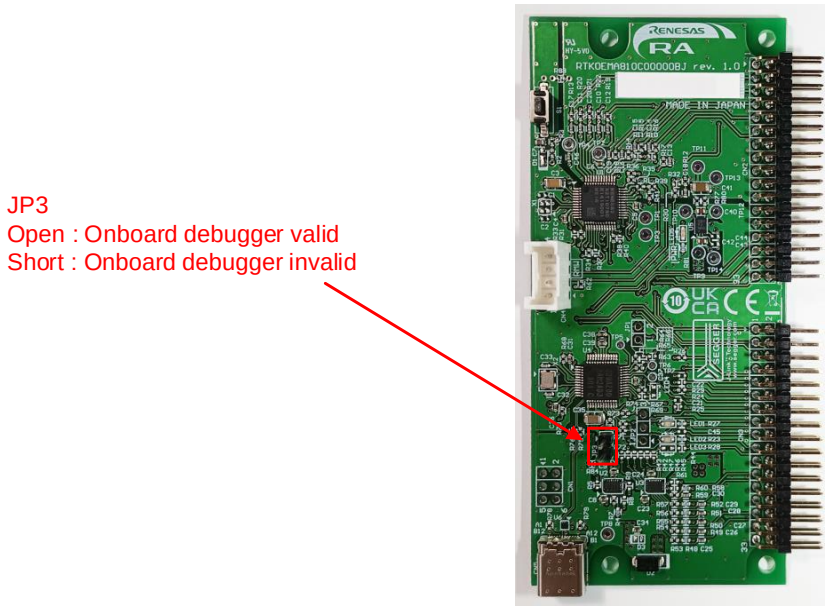


Figure 5-1 Jumper setting of JP3

5.1.3 J-Link Virtual COM Port

This product supports J-Link Virtual COM Port. By connecting to a PC with USB connector (CN5), a virtual COM port via USB is available.

5.1.4 Inverter board connector

This board can connect to the inverter board with CN2 and CN3. The pin assignments of the connectors are shown in Table 5-1, Table 5-2.

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

Pin No.	Pin Function	RA2T1Pin	Pin No.	Pin Function	RA2T1 Pin
1	HVtemp	P103/AN019 (*)	2	AGND	- (AVSS)
3	VPN	P000/AN008	4	AGND	- (AVSS)
5	IU	P013/AN000	6	NC	-
7	IV	P014/AN001	8	NC	-
9	IW	P015/AN002	10	NC	-
11	VU	P102/AN020	12	VV	P012/AN007
13	VW	P011/AN006	14	AGND	- (AVSS)
15	VPFC	P001/AN009	16	IPFC	P002/AN010
17	VR	P010/AN005	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	P407/GTIOC0B	28	GND	- (VSS)
29	UP	P208/GTIOC0A	30	GND	- (VSS)
31	VN	P110/GTIOC2B	32	GND	- (VSS)
33	VP	P109/GTIOC2A	34	GND	- (VSS)

(*) Exclusively assigned by jumper register setting

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

Pin No.	Pin Function	RA2T1Pin	Pin No.	Pin Function	RA2T1 Pin
1	WN	P112/GTIOC1B	2	GND	- (VSS)
3	WP	P111/GTIOC1A	4	GND	- (VSS)
5	NC	-	6	PWMPFC2	P401/GTIOC3B (*)
7	NC	-	8	NC	-
9	BUS_POWER_IN	-	10	INV_CONNECTED	P403
11	SAFE_LOCK	P200	12	OCINV	P302/GTETRGA
13	OCPFC	P301/GTETRGB (*)	14	PWMPFC1	P400/GTIOC3A (*)
15	Relay	P207	16	SW1	P402
17	SW2	P104	18	LED1	P913
19	LED2	P914	20	LED3	P915
21	HALL_U	P206/IRQ0	22	HALL_V	P409/IRQ6
23	HALL_W	P408/IRQ7	24	NC	-
25	NC	-	26	ENC_Z	P301/GTETRGB (*)
27	ENC_A	P400/GTIOC3A (*)	28	NC	-
29	ENC_B	P401/GTIOC3B (*)	30	NC	-
31	GND	- (VSS)	32	GND	- (VSS)
33	+5V	-	34	+5V	-

(*) Exclusively assigned by jumper register setting

5.1.5 Serial communication

For serial communication using Renesas Motor Workbench, the CPU board has SCI connector. Pin assignment for SCI connector is listed in Table 5-3.

Table 5-3 SCI connector (CN4) pin assignment

Pin No.	Pin Function	RA2T1 Connection Pin
1	GND	-
2	MCU RXD	P100/RXD0
3	MCU TXD	P101/TXD0
4	VCC	-

5.1.6 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.

5.1.7 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 5-4.

Table 5-4 LED pin assignment

RA2T1 port		LED1	LED2	LED3(DNF)
P913	Output HIGH	OFF	-	-
	Output LOW	ON	-	-
P914	Output HIGH	-	OFF	-
	Output LOW	-	ON	-
P915	Output HIGH	-	-	(OFF)
	Output LOW	-	-	(ON)

5.2 RA2T1 pin function list

Table 5-5 RA2T1 pin function list

Pin No.	RA2T1 pin function	Signal function
1	P400/GTIOC3A	PFCPWM1/ENCA
2	P401/GTIOC3B	PFCPWM2/ENCB
3	VCL1	System
4	P402	SW1
5	P403	INV CONNECTED
6	VSS1	GND
7	P213/XTAL	External clock
8	P212/EXTAL	External clock
9	VCC1	VCC
10	P409/IRQ6	HALL_V
11	P408/IRQ7	HALL_W
12	P407/GTIOC0B	UN
13	P915	LED3
14	P914	LED2
15	P913	LED1
16	P208/GTIOC0A	UP
17	P207	Relay
18	P206/IRQ0	HALL_U
19	RES#	Reset
20	P201/MD	ARM debugger
21	P200	SAFE LOCK
22	P302/GTETRGA	OC INV
23	P301/GTETRGB	OCPFC/ENCZ
24	P300/SWCLK	ARM debugger
25	P108/SWDIO	ARM debugger
26	P109/GTIOC2A	VP
27	P110/GTIOC2B	VN
28	P111/GTIOC1A	WP
29	P112/GTIOC1B	WN
30	VCC2	VCC
31	VSS2	GND
32	P104/IRQ1	SW2/Overtemp
33	P103/CTS0/AN019	VCOM/HVtemp
34	P102/AN020	VU
35	P101/TXD0	SCI
36	P100/RXD0	SCI
37	P500	VCOM
38	P015/AN002	IW
39	P014/AN001	IV
40	P013/AN000	IU
41	P012/AN007	VV
42	AVCC0	AVCC
43	AVSS0	AGND
44	P011/AN006	VW
45	P010/AN005	IPFC2/VR
46	P002/AN010	IPFC1
47	P001/AN009	VPFC
48	P000/AN008	VPN

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 RA family MCU and its kit, visit the below Web site.

· RA Product Information renesas.com/ra

· Renesas Support renesas.com/support

Revision History

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		Page	Summary
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