User's Manual

# RA6T3 Group

## MCB-RA6T3 User's Manual

Renesas RA Family
RA6 Series



Renesas Electronics
www.renesas.com

Rev 1.00 May 23, 2023

## 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.

## Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.
2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.
3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
4. You shall be responsible for determining what licenses are required from any third parties, and obtaining such licenses for the lawful import, export, manufacture, sales, utilization, distribution or other disposal of any products incorporating Renesas Electronics products, if required.
5. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.
6. Renesas Electronics products are classified according to the following two quality grades: “Standard” and “High Quality”. The intended applications for each Renesas Electronics product depends on the product’s quality grade, as indicated below.
   "Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; industrial robots; etc.
   "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.

   Unless expressly designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems; surgical implantations; etc.), or may cause serious property damage (space system; undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user’s manual or other Renesas Electronics document.
7. No semiconductor product is absolutely secure. Notwithstanding any security measures or features that may be implemented in Renesas Electronics hardware or software products, Renesas Electronics shall have absolutely no liability arising out of any vulnerability or security breach, including but not limited to any unauthorized access to or use of a Renesas Electronics product or a system that uses a Renesas Electronics product. RENESAS ELECTRONICS DOES NOT WARRANT OR GUARANTEE THAT RENESAS ELECTRONICS PRODUCTS, OR ANY SYSTEMS CREATED USING RENESAS ELECTRONICS PRODUCTS WILL BE INVULNERABLE OR FREE FROM CORRUPTION, ATTACK, VIRUSES, INTERFERENCE, HACKING, DATA LOSS OR THEFT, OR OTHER SECURITY INTRUSION (“Vulnerability Issues”). RENESAS ELECTRONICS DISCLAIMS ANY AND ALL RESPONSIBILITY OR LIABILITY ARISING FROM OR RELATED TO ANY VULNERABILITY ISSUES. FURTHERMORE, TO THE EXTENT PERMITTED BY APPLICABLE LAW, RENESAS ELECTRONICS DISCLAIMS ANY AND ALL WARRANTIES, EXPRESS OR IMPLIED, WITH RESPECT TO THIS DOCUMENT AND ANY RELATED OR ACCOMPANYING SOFTWARE OR HARDWARE, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE.
8. When using Renesas Electronics products, refer to the latest product information (data sheets, user’s manuals, application notes, “General Notes for Handling and Using Semiconductor Devices” in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Unless designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not subject to radiation resistance design. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, such as safety design for hardware and software, including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult and impractical, you are responsible for evaluating the safety of the final products or systems manufactured by you.
10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. You are responsible for carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.
12. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.
13. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
14. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.

(Note1) “Renesas Electronics” as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.
(Note2) “Renesas Electronics product(s)” means any product developed or manufactured by or for Renesas Electronics.

(Rev.5.0-1 October 2020)


## Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,
Koto-ku, Tokyo 135-0061, Japan
www.renesas.com


## Trademarks

Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.


## Contact information

For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit:
www.renesas.com/contact/.

Renesas RA Family

# MCB-RA6T3 User's Manual

## Contents



## Figure of contents

## Table of contents

# 1. Overview

MCB-RA6T3 is a CPU board for motor control evaluation. By using this product in combination with an inverter board, motor control using RA6T3 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 (RTK0EMA330C00000BJ) x1
2. USB Cable x1
3. Screw x4
4. Standoff x4

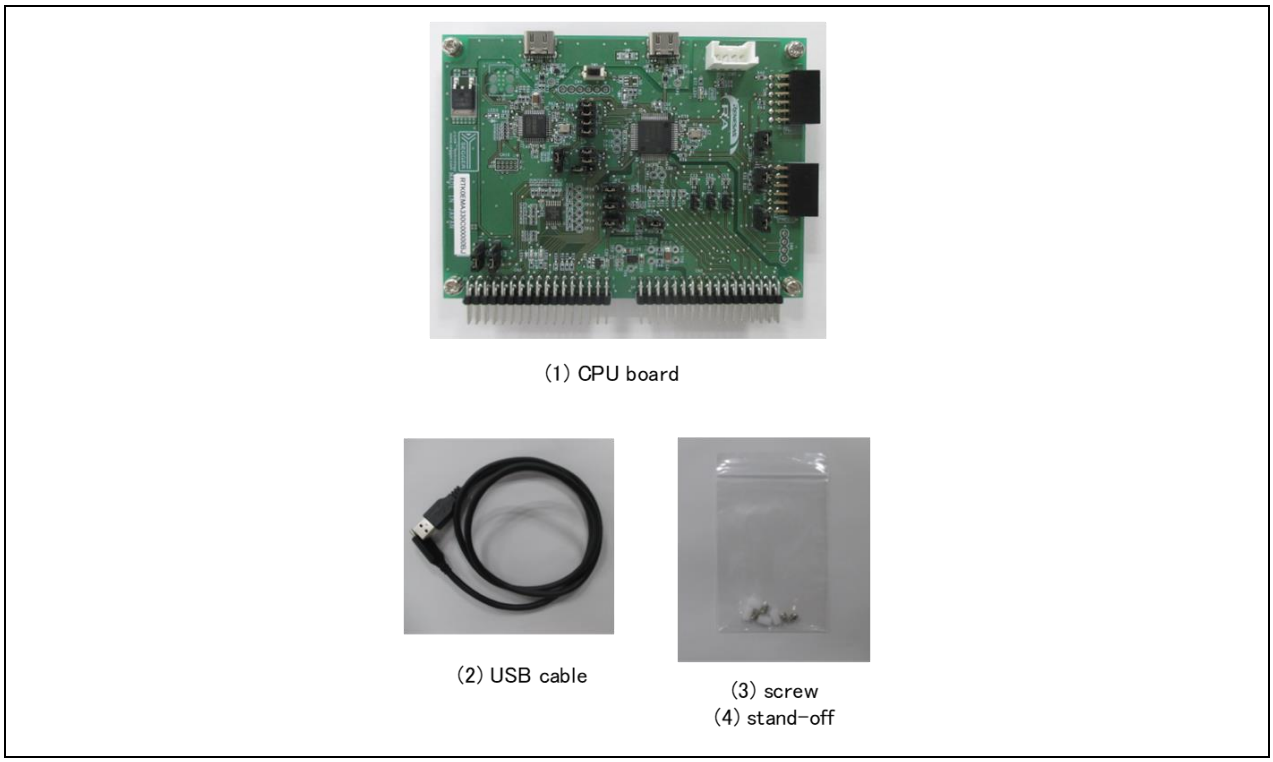


**Figure 2-1 Product contents**

# 3. Product Order Information

Product number to order MCB-RA6T3 : RTK0EMA330C00000BJ

# 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. | | RTK0EMA330C00000BJ |
| Compatible inverter board | | RTK0EM0000B12020BJ |
| External view | |  <br>Note: The actual product may differ from this photo. |
| Mounted MCU | Product group | RA6T3 group |
| | Product No. | R7FA6T3BB3CFM |
| | CPU maximum operating frequency | 200MHz |
| | 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<br>Select one way automatically from the below<br>• Power is supplied from compatible inverter board<br>• Power is supplied from USB connector |
| Debugger | | J-Link-OB (Onboard debugger circuit) |
| Connector | | • Inverter board connector<br>• USB connector for J-Link OB<br>• USB connector for RA6T3<br>• SCI connector for Renesas Motor Workbench communication<br>• Through hole for CAN communication<br>• 10 pin through hole for Arm debugger<br>• PMOD connectors |
| Switch | | MCU reset switch |
| LED | | User-controllable LED x2, Power LED x1 |
| Board size | | 85 mm (W) x 109 mm (L) |
| Operating temperature | | Room temperature |
| Operating humidity | | No condensation allowed |
| EMC Directive | | EN61326-1:2021<br>EMI：Class A<br>EMS：Basic Electromagnetic environment |

## 4.2 Block diagram

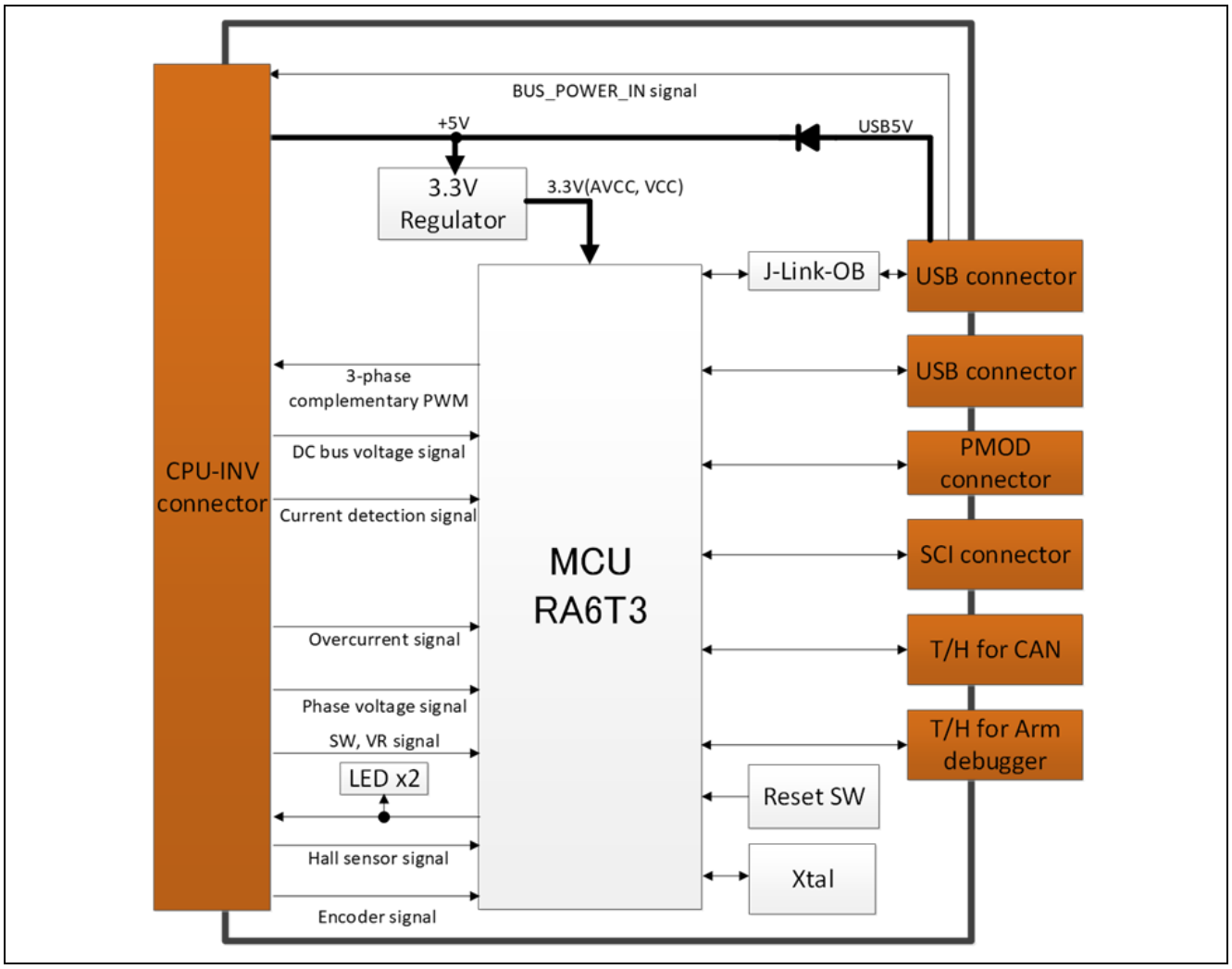


**Figure 4-1 CPU board block diagram**

## 4.3 Board Layout

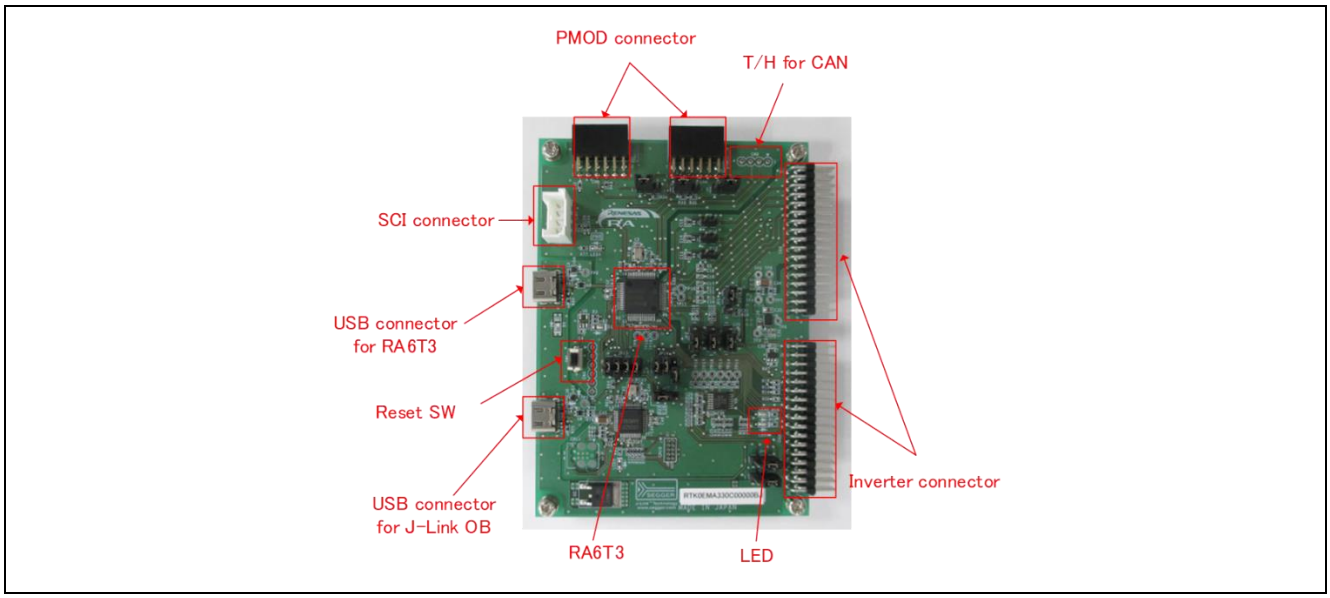


**Figure 4-2 CPU Board Layout**

## 4.4 Standoffs and Screws

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

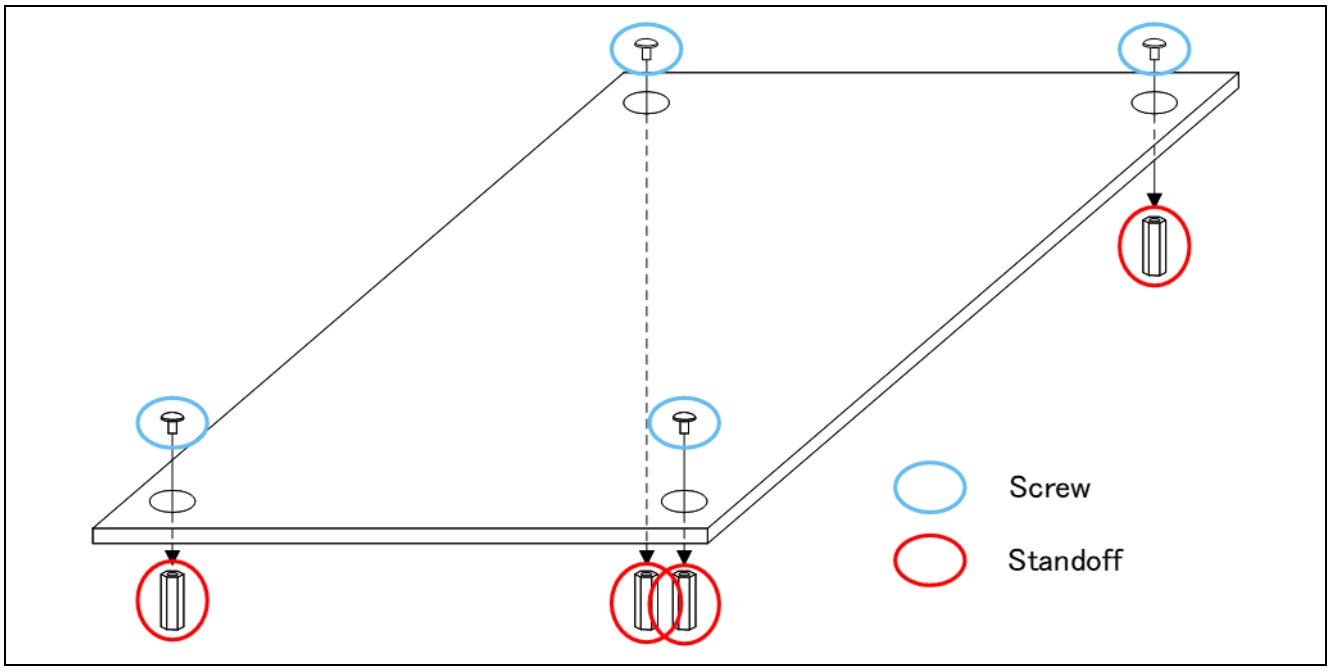


**Figure 4-3 Standoffs and Screws assembly**

## 4.5 Jumper pin setting

Default settings and functions of the jumper pins (JP1~JP17) 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 | N/A | VU | IPS | 1-2 short |
| 2 | IPS/HALL select | N/A | HALL | IPS | 1-2 short |
| 3 | IPS/HALL select | N/A | HALL | IPS | 1-2 short |
| 4 | IPS/HALL select | N/A | HALL | IPS | 1-2 short |
| 5 | IPS/ENC select | N/A | IPS | ENC | 2-3 short |
| 6 | IPS/ENC select | N/A | IPS | ENC | 2-3 short |
| 7 | Reset control for RA6T3 | by SW1 | by JLOB or SW1 | Reset | 1-2 short |
| 8 | IU sensing | CSA | PGA | N/A | open |
| 9 | PMOD Type2A/6A select | N/A | Type 2A | Type 6A | 1-2 short |
| 10 | PMOD Type2A/6A select | N/A | Type 2A | Type 6A | 1-2 short |
| 11 | PMOD Type2A/6A select | N/A | Type 6A | Type 2A | 2-3 short |
| 12 | IV sensing | CSA | PGA | N/A | open |
| 13 | IW sensing | CSA | PGA | N/A | open |
| 14 | Debugger connection | Not connected | Connected (1-2, 3-4 short) | N/A | 1-2, 3-4 short |
| 15 | UART connection | PMOD | VCOM port (1-2, 3-4, 5-6, 7-8 short) | N/A | 1-2, 3-4, 5-6, 7-8 short |
| 16 | MD port pull-down | open | Pull-down | N/A | open |
| 17 | Enable/disable JLOB | Enabled | Disabled | N/A | open |

CSA : with current sensing amplifier on inverter board
PGA : with programmable gain amplifier in MCU
IPS : Inductive Position Sensor
ENC : Encoder
HALL : HALL sensor

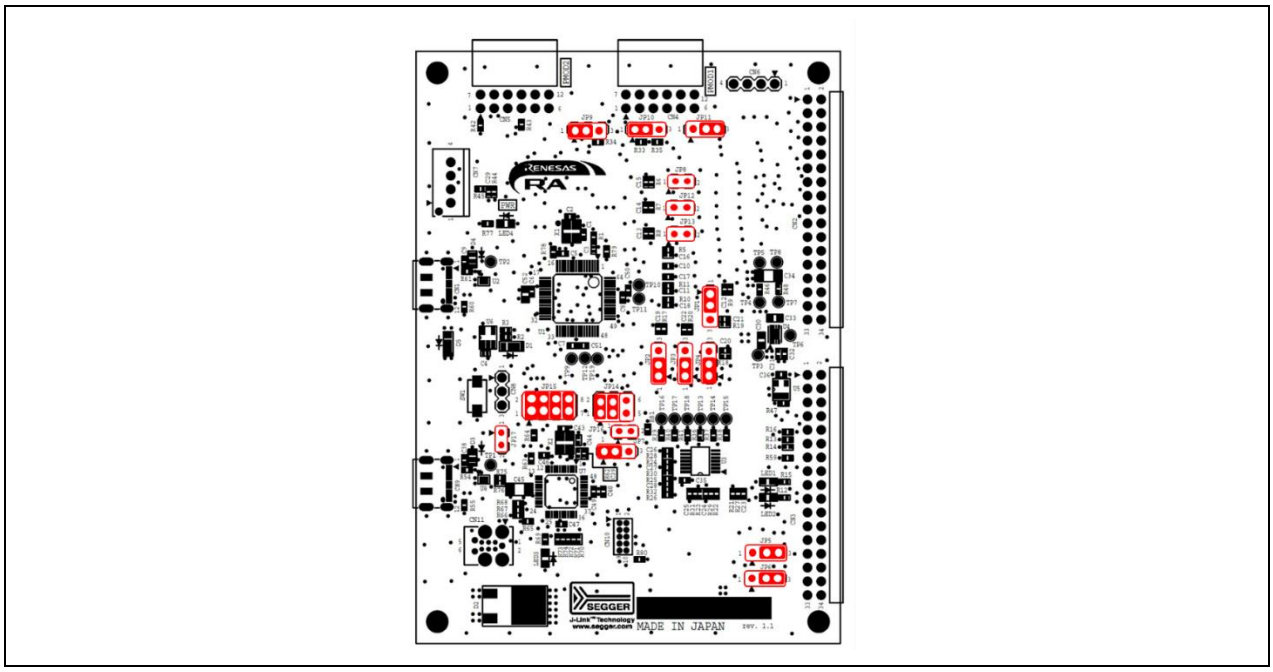


**Figure 4-4 Default jumper pin setting of CPU board**

## 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). Note that if the communication board (product name: MC-COM, model name: RTK0EMXC90S00000BJ) is not used, be sure to make an isolated connection between the PC and CPU board via a USB isolator or similar device to prevent PC damage.

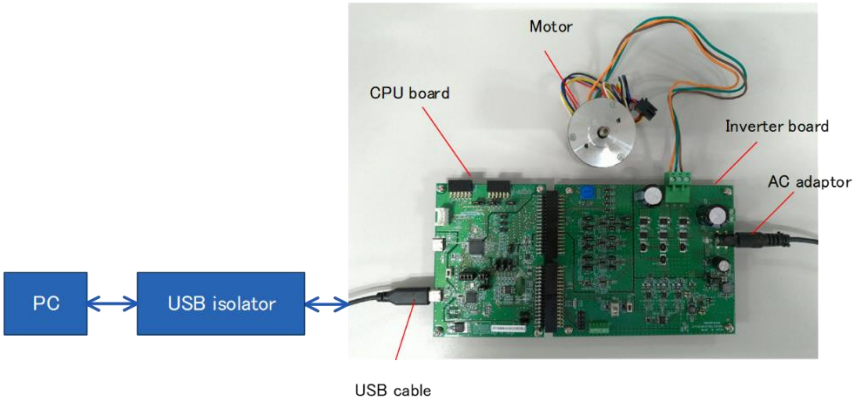


**Figure 4-5 Board connection (using VCOM port)**

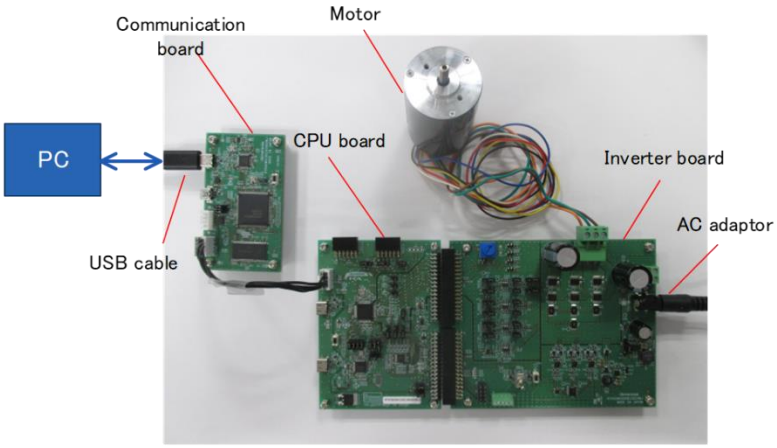


**Figure 4-6 Board connection (using communication board)**

# 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 (CN9). 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 RA6T3 with it. When you write a program, connect the CPU board to PC with USB cable. J-Link-OB operates as debugger equivalent to J-Link. If connecting from Integrated Development Environment or flash programing tool (e.g. J-Flash Lite by SEGGER), set the type of debugger (tool) to “J-Link”.

### 5.1.3 J-Link Virtual COM Port

This product supports J-Link Virtual COM Port. To enable this function, short 1-2, 3-4, 5-6, and 7-8 pins of JP15. By connecting to a PC with USB connector (CN9), a virtual COM port via USB is available.

### 5.1.4 USB I/F

This product has a USB connector (CN1) for the USB Full-Speed module in RA6T3.

### 5.1.5 Inverter board connector

An inverter board can be connected to this board with CN2 and CN3. The pin assignments of the connectors are shown in Table 5-1, Table 5-2. Note that these tables show default connection setting for the ports with jumper switches.

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

| Pin No. | Pin Function | RA6T3 Pin | Pin No. | Pin Function | RA6T3 Pin |
|---|---|---|---|---|---|
| 1 | NC | - | 2 | AGND | - (AVSS) |
| 3 | VPN | P004/AN004 | 4 | AGND | - (AVSS) |
| 5 | IU | P000/AN000 | 6 | PGAVSS | P003/PGAVSS000 |
| 7 | IV | P001/AN001 | 8 | NC | - |
| 9 | IW | P002/AN002 | 10 | NC | - |
| 11 | VU | P500/AN016 | 12 | VV | P014/AN012 |
| 13 | VW | P013/AN011 | 14 | AGND | - (AVSS) |
| 15 | NC | - | 16 | NC | - |
| 17 | VR | P005/AN005 | 18 | AGND | - (AVSS) |
| 19 | AVCC | - (AVCC) | 20 | AVCC | - (AVCC) |
| 21 | AGND | - (AGSS) | 22 | AGND | - (AVSS) |
| 23 | VCC | - (VCC) | 24 | VCC | - (VCC) |
| 25 | GND | - (VSS) | 26 | GND | - (VSS) |
| 27 | UN | P408/GTIOC1B_B | 28 | GND | - (VSS) |
| 29 | UP | P409/GTIOC1A_B | 30 | GND | - (VSS) |
| 31 | VN | P102/GTIOC2B_A | 32 | GND | - (VSS) |
| 33 | VP | P103/GTIOC2A_A | 34 | GND | - (VSS) |

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

| Pin No. | Pin Function | RA6T3 Pin | Pin No. | Pin Function | RA6T3 Pin |
|---|---|---|---|---|---|
| 1 | WN | P112/GTIOC3B_A | 2 | GND | - (VSS) |
| 3 | WP | P111/GTIOC3A_A | 4 | GND | - (VSS) |
| 5 | DRV_SCK | P302/RSPCKA_A | 6 | DRV_RXD | P207/MOSIA_A |
| 7 | DRV_TXD | P206/MISOA_A | 8 | DRV_CS | P301/SSLA0_A |
| 9 | BUS_POWER_IN | - | 10 | INV_CONNECTED | - |
| 11 | SAFE_LOCK | - | 12 | OC# | P104/GTETRGB_B |
| 13 | DRV_nFault | P400 | 14 | DRV_EN | P403 |
| 15 | CON_MOT_SEL | P407 | 16 | SW1 | P304 |
| 17 | SW2 | P200 | 18 | LED1 | P113 |
| 19 | LED2 | P106 | 20 | NC | - |
| 21 | HALL_U | P008/IRQ12DS | 22 | HALL_V | P006/IRQ11_DS |
| 23 | HALL_W | P015/IRQ13_A | 24 | SIO_SDA | P206/SDA0_C |
| 25 | SCK_SCL | P205/SCL0_C | 26 | CSN_IRQN/ENC_Z | P105/GTETRGA_C |
| 27 | IPS_A<br>ENC_A | P500/AN016<br>P101/GTIOC5A_D | 28 | IPS_A# | P008/AN008 |
| 29 | IPS_B<br>ENC_B | P006/AN006<br>P100/GTIOC5B_D | 30 | IPS_B# | P015/AN013 |
| 31 | GND | - (VSS) | 32 | GND | - (VSS) |
| 33 | +5V | - | 34 | +5V | - |

### 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 5-3.

**Table 5-3 SCI connector (CN7) pin assignment**

| Pin No. | Pin Function | RA6T3 Connection Pin |
|---|---|---|
| 1 | GND | - |
| 2 | MCU RXD | P410/RXD0_B |
| 3 | MCU TXD | P411/TXD0_B |
| 4 | VCC | - |

### 5.1.7 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.

### 5.1.8 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**

| RA6T3 port | | LED1 | LED2 |
|---|---|---|---|
| P113 | Output HIGH | OFF | - |
| | Output LOW | ON | - |
| P106 | Output HIGH | - | OFF |
| | Output LOW | - | ON |

### 5.1.9 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 5-5.

**Table 5-5 CAN communication pin assignment (CN6)**

| Pin No. | RA6T3 pin |
|---|---|
| 1 | VCC |
| 2 | P401/CTX0_B |
| 3 | P402/CRX0_B |
| 4 | VSS |

### 5.1.10 PMOD

This product has two connectors for PMOD module connection. Pin assignments are shown in Table 5-6 and Table 5-8. CN4 is for both PMOD Type 2A/6A. Type 2A/6A can be switched by JP9,10 and 11. See Table 5-7 for settings.

**Table 5-6 PMOD Type 2A/6A connector pin assignment (CN4)**

| No. | RA6T3 port | No. | RA6T3 port |
|---|---|---|---|
| 1 | P301_SSLA0/<br>P110_IRQ3_A | 7 | P400 |
| 2 | P207_MOSIA | 8 | P403 |
| 3 | P206_MISOA_A/<br>P205_SCL0 | 9 | P407 |
| 4 | P302_RSPCKA_A/<br>P206_SDA0_C | 10 | P208 |
| 5 | VSS | 11 | VSS |
| 6 | VCC | 12 | VCC |

**Table 5-7 PMOD Type 2A/6A connector jumper setting (CN4)**

| JP No | RA6T3 port | | |
|---|---|---|---|
| | Open | 1-2 short | 2-3 short |
| 9 | N/A | Type2A | Type6A |
| 10 | N/A | Type2A | Type6A |
| 11 | N/A | Type6A | Type2A |
| 15 | PMOD | VCOM port<br>(1-2, 3-4, 5-6, 7-8 short) | N/A |

**Table 5-8 PMOD Type 3A connector pin assignment (CN5)**

| No. | RA6T3 port | No. | RA6T3 port |
|---|---|---|---|
| 1 | P303_CTS9 | 7 | P400 |
| 2 | P109_TXD9 | 8 | P403 |
| 3 | P110_RXD9 | 9 | P407 |
| 4 | P301_CTS_RTS_D | 10 | P208 |
| 5 | VSS | 11 | VSS |
| 6 | VCC | 12 | VCC |

## 5.2 RA6T3 pin function list

**Table 5-9 RA6T3 pin function list**

| Pin number | RA6T3 pin function | Signal function |
|---|---|---|
| 1 | P400 / (IRQ0_A) | PMOD |
| 2 | CTX0_B | CAN |
| 3 | CRX0_B | CAN |
| 4 | P403 / (IRQ14DS) | PMOD |
| 5 | VCL0 | Power |
| 6 | - | - |
| 7 | - | - |
| 8 | VSS | GND |
| 9 | XTAL | Crystal |
| 10 | EXTAL | Crystal |
| 11 | VCC | Power |
| 12 | TXD0_B | RMW communication |
| 13 | RXD0_B | RMW communication |
| 14 | GTIOC1A_B | U-phase upper arm |
| 15 | GTIOC1B_B | U-phase lower arm |
| 16 | P407 | PMOD |
| 17 | VSS_USB | Power |
| 18 | USB_DM | USB |
| 19 | USB_DP | USB |
| 20 | VCC_USB | Power |
| 21 | MOSIA_A | PMOD Type2A(SPI) |
| 22 | MISOA_A / (SDA0_C) | PMOD Type2A(SPI) / (PMOD Type6A(I2C)) |
| 23 | SCL0_C | PMOD Type6A(I2C) |
| 24 | P208 | PMOD |
| 25 | RES# | ARM debugger |
| 26 | MD | ARM debugger |
| 27 | P200 | SW2 |
| 28 | P304 | SW1 |
| 29 | CTS9_D | PMOD Type3A(UART) |
| 30 | RSPCKA_A | PMOD Type2A(SPI) |
| 31 | SSLA0_A / (CTS_RTS9_D) | PMOD Type2A(SPI) / (PMOD Type3A(UART)) |
| 32 | SWCLK | ARM debugger |
| 33 | SWDIO | ARM debugger |
| 34 | TXD9_B | PMOD Type3A(UART) |
| 35 | RXD9_B / (IRQ3_A) | PMOD Type3A(UART) / (PMOD Type6A(I2C)) |
| 36 | GTIOC3A_A | W-phase upper arm |
| 37 | GTIOC3B_A | W-phase lower arm |
| 38 | P113 | LED1 |
| 39 | VCC | Power |
| 40 | VSS | Power |
| 41 | P107 | - |
| 42 | P106 | LED2 |
| 43 | GTETRGA_C / (IRQ0_B) | Encoder Z-phase |
| 44 | GTETRGB_B | Over current detection |
| 45 | GTIOC2A_A | V-phase upper arm |
| 46 | GTIOC2B_A | V-phase lower arm |
| 47 | GTIOC5A_D | Encoder A-phase |
| 48 | GTIOC5B_D | Encoder B-phase |
| 49 | AN016 | U-phase voltage sensing / IPS_A |
| 50 | IRQ12DS / (AN008) | HALL sensor U-phase / (IPS_A#) |
| 51 | IRQ11DS / (AN006) | HALL sensor V-phase / (IPS_B) |
| 52 | IRQ13_A / (AN013) | HALL sensor W-phase / (IPS_B#) |
| 53 | AN012 | V-phase voltage sensing |
| 54 | AN011 | W-phase voltage sensing |
| 55 | PGAVSS000 | PGAGND for current sensing |
| 56 | AVCC0 | Power |

| Pin number | RA6T3 pin function | Signal function |
|---|---|---|
| 57 | AVSS0 | Power |
| 58 | VREFL0 | Power |
| 59 | VREFH0 | Power |
| 60 | AN005 | VR input |
| 61 | AN004 | Bus voltage sensing |
| 62 | AN002 | W phase current sensing |
| 63 | AN001 | V phase current sensing |
| 64 | AN000 | U phase current sensing |

Note: Jumper switching is required to use the functions in parentheses.

# 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 | MCB-RA6T3 User's Manual |
|---|---|

| Rev. | Date | Description | |
|---|---|---|---|
| | | Page | Summary |
| 1.00 | May 23, 2023 | - | First edition |

MCB-RA6T3 User's Manual

Publication Date: Rev 1.00 May 23, 2023

Published by: Renesas Electronics Corporation

# MCB-RA6T3 User's Manual

Renesas Electronics Corporation

R12UZ0116EJ0100