User's Manual

RA8T1 Group

MCB-RA8T1 User's Manual

Renesas RA Family
RA8 Series

Renesas Electronics
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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-RA8T1 User's Manual

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1. Overview

MCB-RA8T1 is a CPU board for motor control evaluation. By using this product in combination with an inverter board, motor control using RA8T1 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 (RTK0EMA5K0C00000BJ) x1
2. USB Cable x1
3. Screw x4
4. Standoff x4

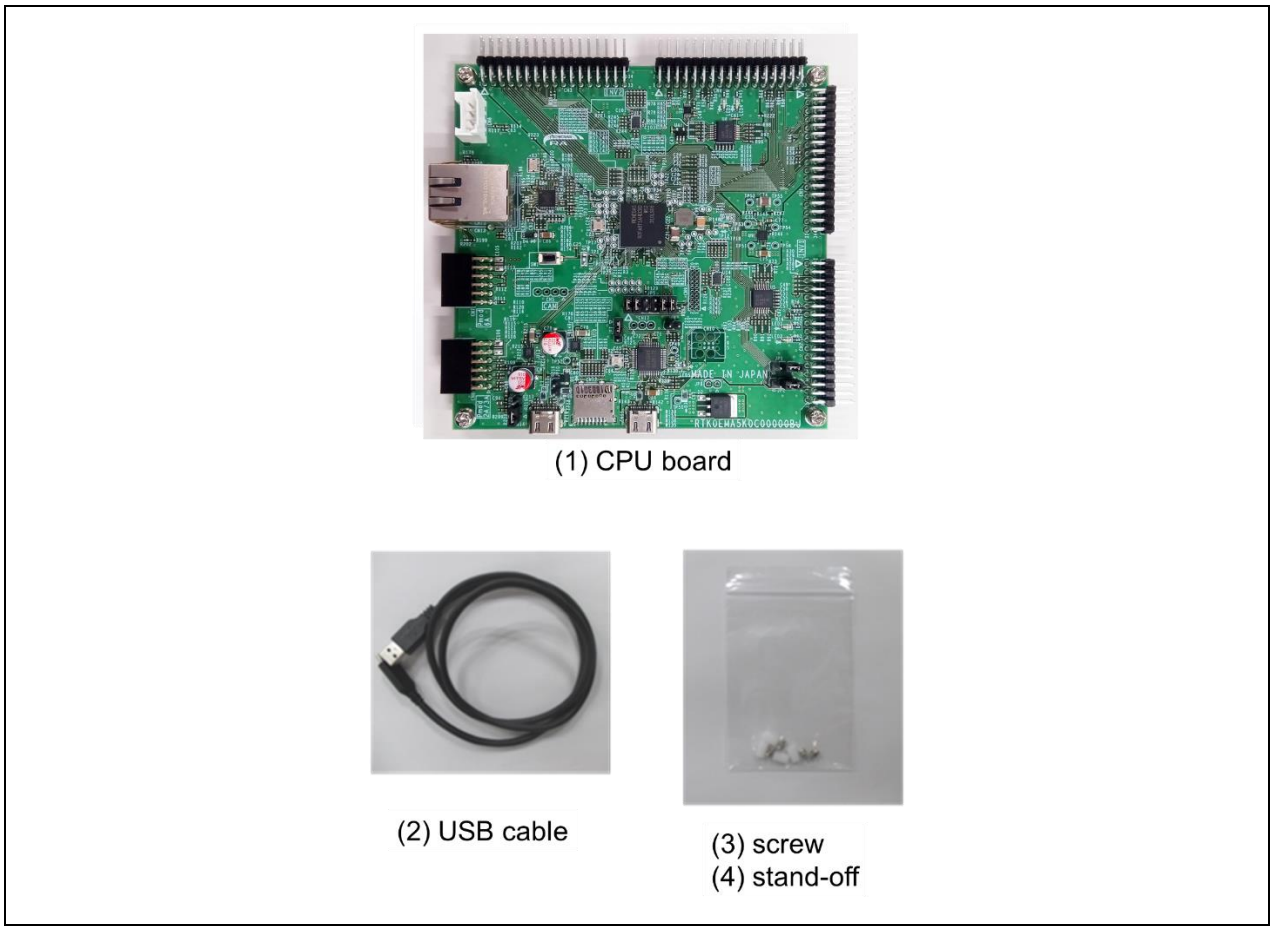

Figure 2-1 Product contents

3. Product Order Information

Product number to order MCB-RA8T1 : RTK0EMA5K0C00000BJ

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.		RTK0EMA5K0C00000BJ
Compatible inverter board		RTK0EM0000B12020BJ
External view		 Note: The actual product may differ from this photo.
Mounted MCU	Product group	RA8T1 group
	Product No.	R7FA8T1AHECBD
	CPU maximum operating frequency	480MHz
	Bit count	32 bit
	Package / Pin count	BGA / 224 pin
	ROM / RAM	2MB / 1MB
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		J-Link-OB (Onboard debugger circuit)
Connector		• Inverter board connector (2 pair) • USB connector for J-Link OB • USB connector for RA8T1 • SCI connector for Renesas Motor Workbench communication • Through hole for CAN communication • 20 pin through hole for Arm debugger • Pmod connectors (Type6A + Type2A/3A) • Ethrnet connector • microSD card connector
Switch		MCU reset switch
LED		User-controllable LED x4, Power LED x1
Board size		109 mm (W) x 109 mm (L)
Operating temperature		Room temperature
Operating humidity		No condensation allowed
EMC Directive		EN61326-1:2021 EMI : Class A EMS : Basic Electromagnetic environment

4.2 Block diagram

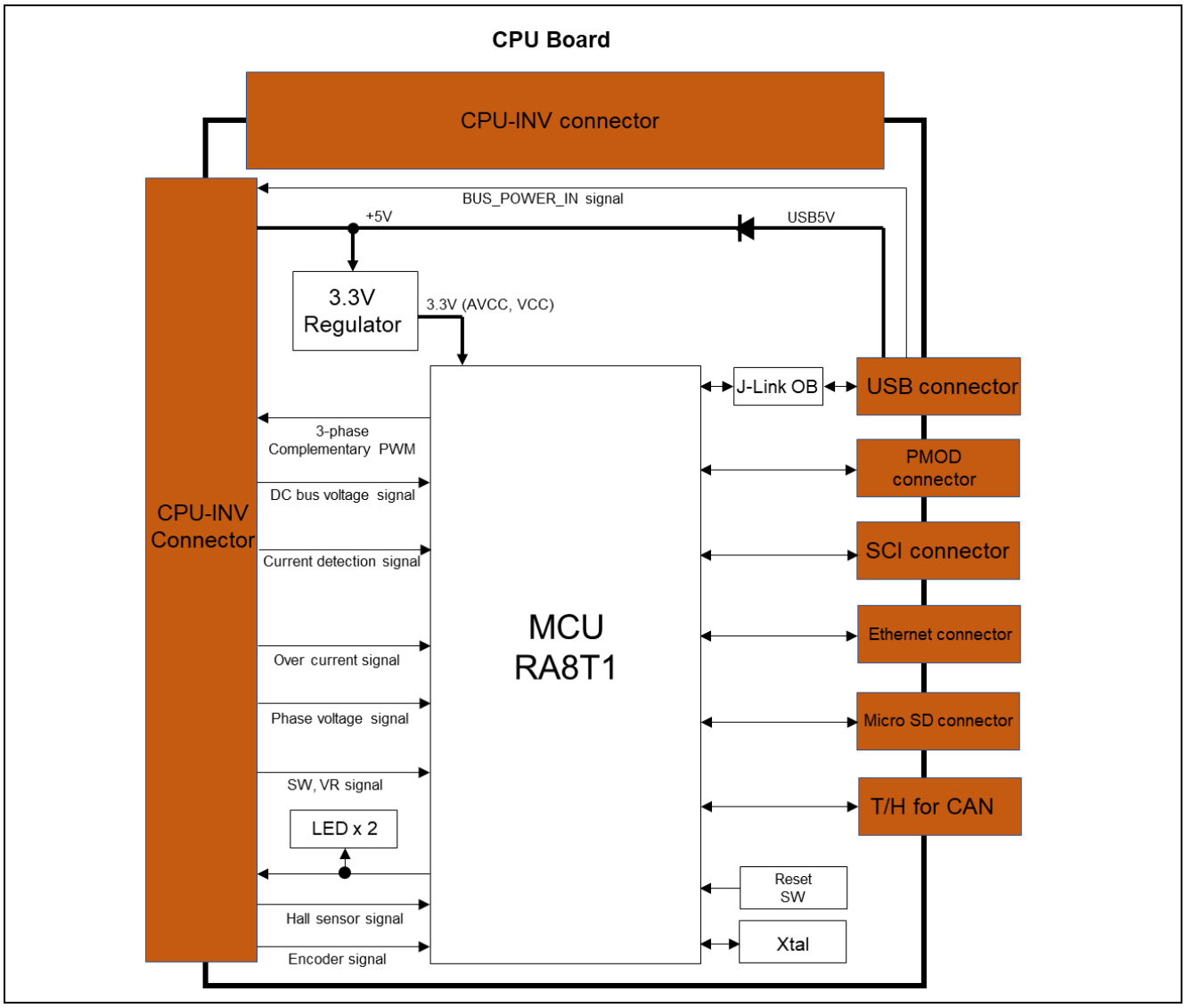

Figure 4-1 CPU board block diagram

4.3 Board Layout

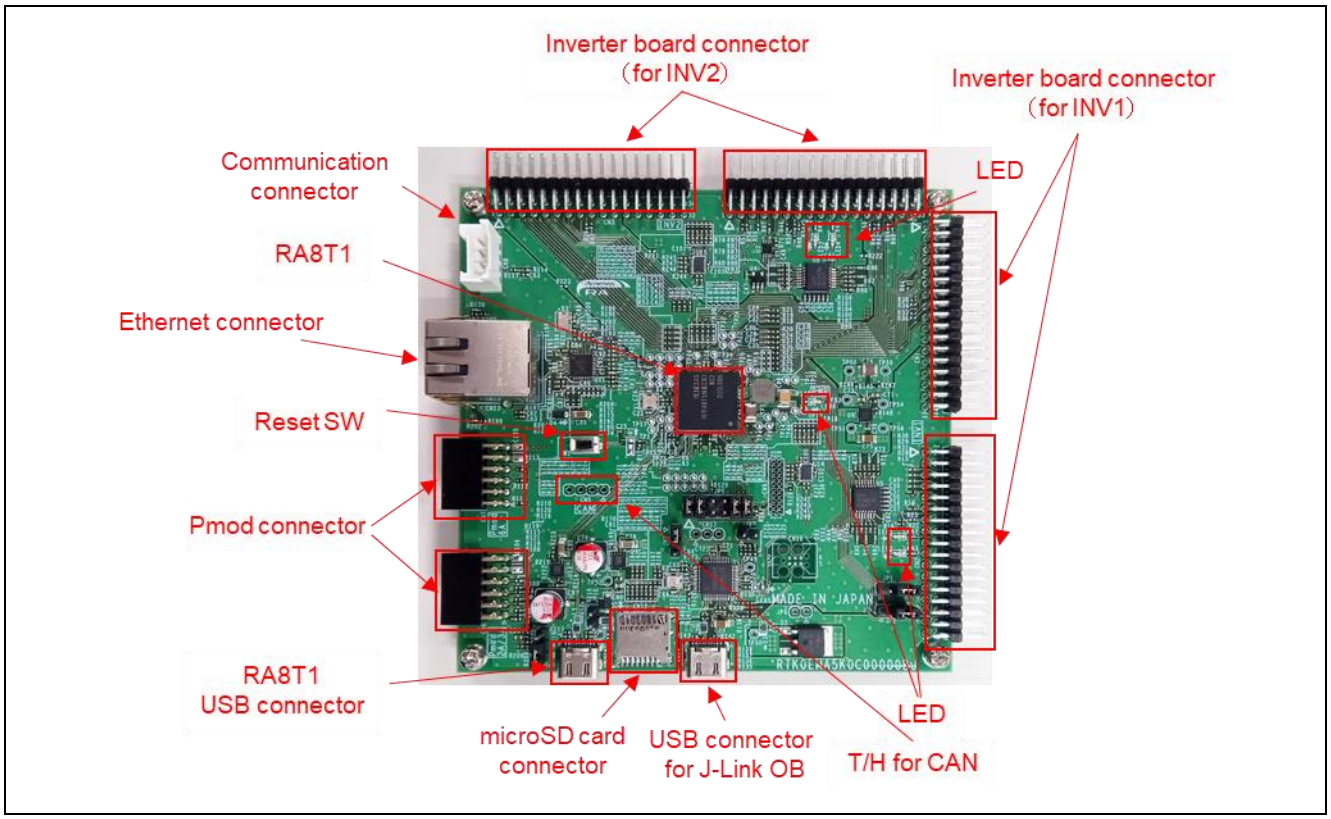

Figure 4-2 CPU Board Layout

4.4 Standoffs and Screws

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

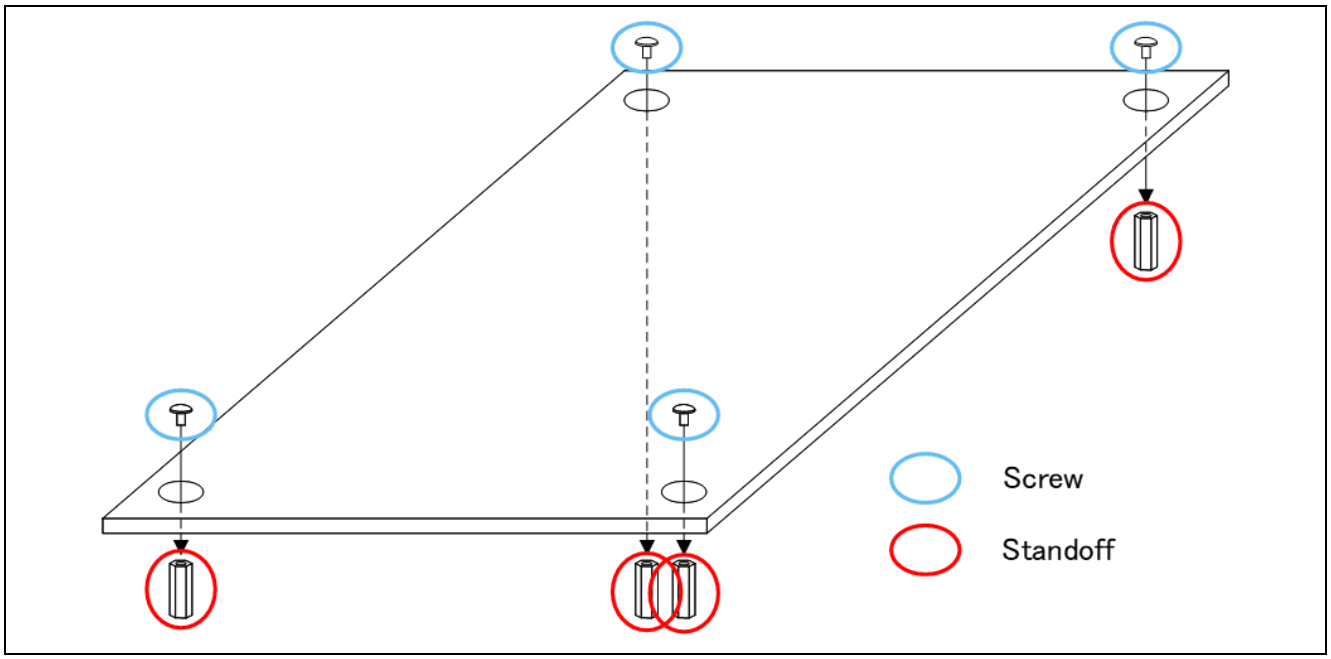

Figure 4-3 Standoffs and Screws assembly

4.5 Jumper pin setting

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

Table 4-2 Jumper pins/registers setting of CPU board for INV1/INV2

resisters & Jumpers	Function in use												Default setting *3
	INV1						INV2						
	INV1	HV INV1	IPS *1	Encoder	Smart driver *2	PWM Single GreenPAK use	INV2	HV INV2	IPS *1	Encoder	Smart driver *2	PWM Single GreenPAK use	
JP1	-	-	1-2	2-3	-	-	-	-	-	-	-	-	2-3
JP2	-	-	1-2	2-3	-	-	-	-	-	-	-	-	2-3
R38	short	DNF	-	-	-	-	-	-	-	-	-	-	short
R34	DNF	short	-	-	-	-	-	-	-	-	-	-	DNF
R44	short	-	-	-	-	-	-	DNF	-	-	-	-	short
R40	DNF	-	-	-	-	-	-	short	-	-	-	-	DNF
R33	short	DNF	-	-	-	-	-	-	-	-	-	-	short
R36	DNF	short	-	-	-	-	-	-	-	-	-	-	DNF
R60	-	-	-	-	-	-	short	-	DNF	short	-	-	short
R62	-	-	-	-	-	-	DNF	-	short	DNF	-	-	DNF
R63	-	-	-	-	-	-	short	-	DNF	short	-	-	short
R67	-	-	-	-	-	-	short	-	DNF	-	-	-	short
R69	-	-	-	-	-	-	DNF	-	short	-	-	-	DNF
R64	-	-	-	-	-	-	short	-	DNF	short	-	-	short
R66	-	-	-	-	-	-	DNF	-	short	DNF	-	-	DNF
R68	-	-	-	-	-	-	short	-	DNF	short	-	-	short
R22	short	DNF	-	-	DNF	-	-	-	-	-	-	-	short
R23	DNF	short	-	-	short	-	-	-	-	-	-	-	DNF
R54	-	-	-	-	-	-	short	DNF	-	-	DNF	-	short
R56	-	-	-	-	-	-	DNF	short	-	-	short	-	DNF
R42	-	-	-	-	-	-	short	DNF	-	-	-	-	short
R39	-	-	-	-	-	-	DNF	short	-	-	-	-	DNF
R50	-	short	-	-	DNF	-	-	short	-	-	DNF	-	DNF
R51	-	DNF	-	-	short	-	-	DNF	-	-	short	-	short

Table 4-3 Jumper pins/registers setting of CPU board for board interface

resisters & Jumpers	Function in use						Default setting *3
	Pmod2A	Pmod3A	SD card	ARM Debugger			
				Only 10pin connector	20pin connector for Trace	On Board Debugger	
JP5	-	open	-	1-2 3-4 9-10 11-12	1-2 3-4 9-10 11-12	-	short
JP6	-	-	-	short	short	open	open
R115,R116.R118	short	DNF	-	-	-	-	short
R119,R120,R121	DNF	short	-	DNF	DNF	-	DNF
R160,R162,R164, R167,R169	-	-	short	-	DNF	-	short

Table 4-4 Jumper registers setting of CPU board for PWM Single channel

resistors	Function in use				Default setting *3
	INV1		INV2		
	PWM Single GreenPAK(U14) use	GreenPAK(U14) Programming	PWM Single GreenPAK(U15) use	GreenPAK(U15) Programming	
R224,R225,R226, R227,R228,R229	DNF	-	-	-	short
R248,R249,R250, R251,R252,R253	short	-	-	-	DNF
R236,R237	DNF	short	DNF	DNF	DNF
R230,R231,R232, R233,R234,R235	-	-	DNF	-	short
R254,R255,R256, R257,R258,R259	-	-	short	-	DNF
R238,R239	DNF	DNF	DNF	short	DNF

- : depend on other setting
DNF : Do Not Fit, do not mount.
INV1 : connected inverter board to CN1,CN2
INV2 : connected inverter board to CN3,CN4
HV INV1 : connected Hi-voltage inverter board with PFC function to CN1,CN2
HV INV2 : connected Hi-voltage inverter board with PFC function to CN3,CN4

*1 Inductive position sensor. For example, IPS2200 on INV1/2
*2 3-phase smart gate driver. For example, RAA227063 on INV1/2
*3 INV1, INV2, Encoder , Onboard Debugger, SD card, Pmod2A, are available

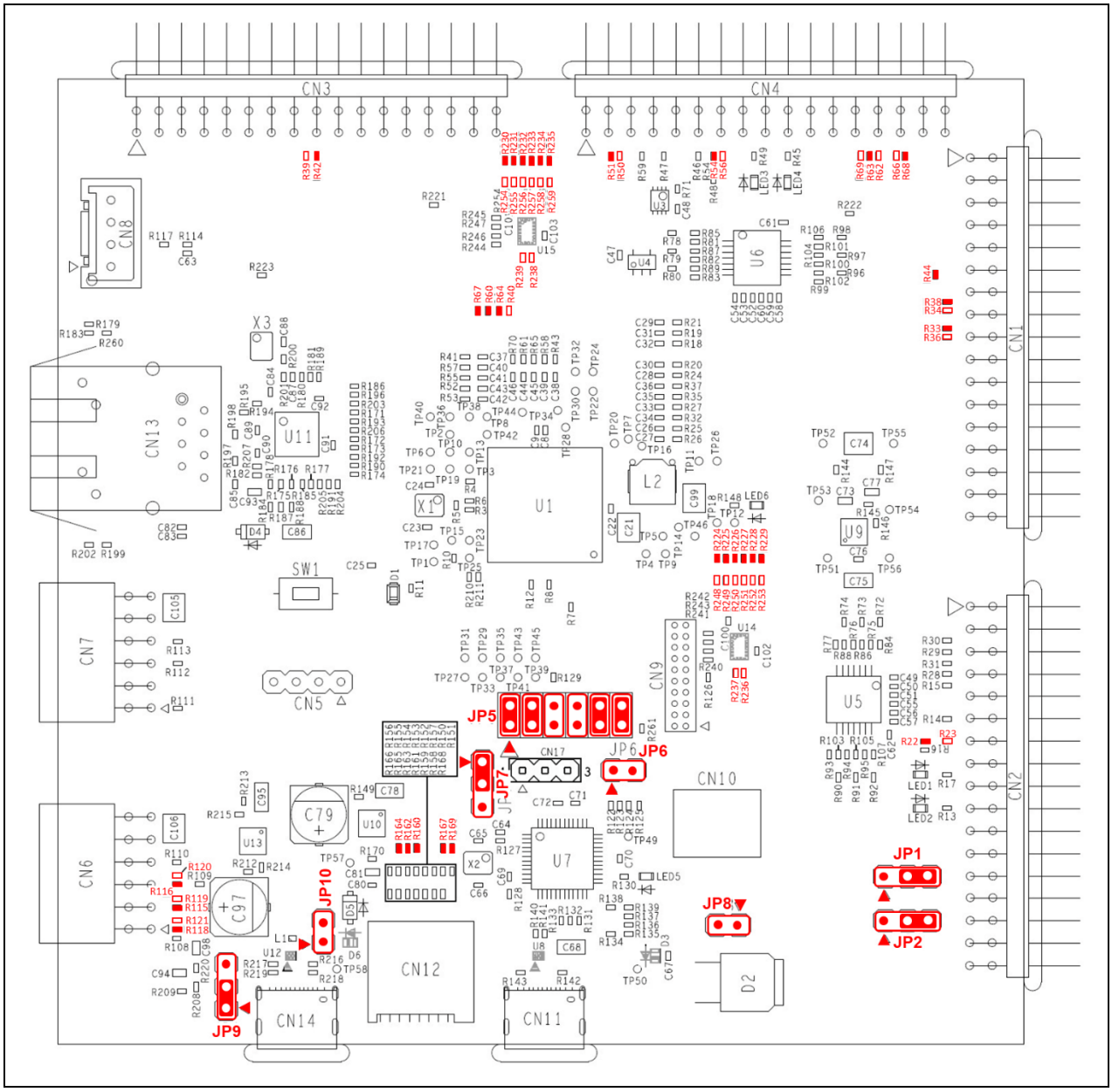

Figure 4-4 Default jumper pin/register setting of CPU board

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).

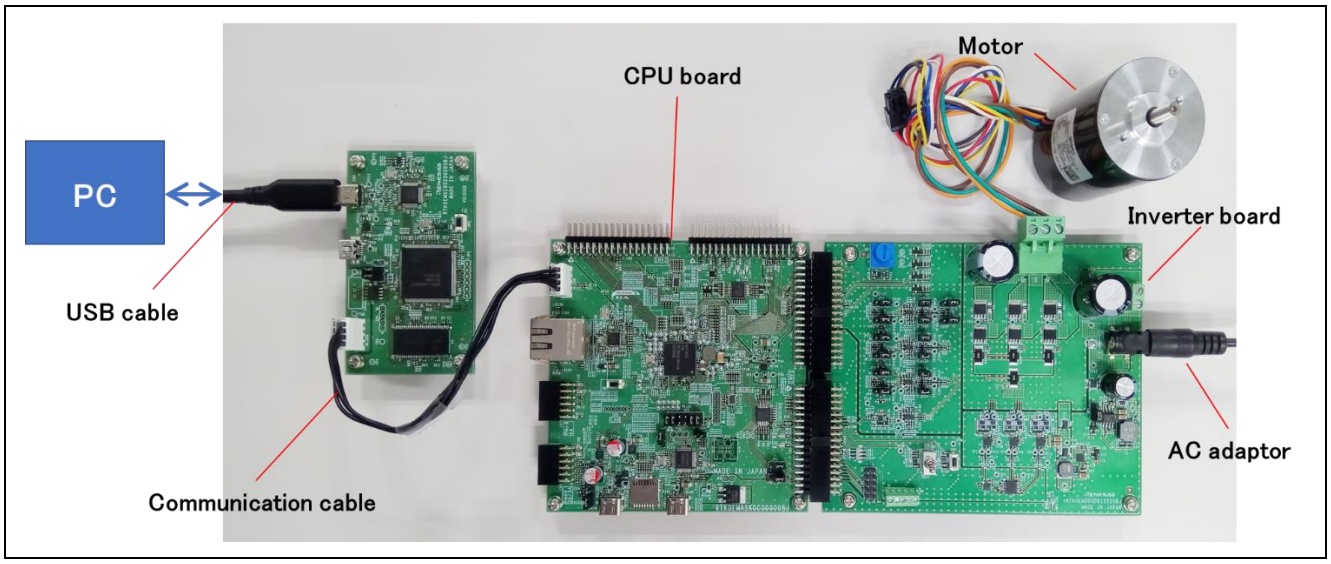

Figure 4-5 Board connection example

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 (CN11). 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 RA8T1 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(e.g. e2studio) or flash programing tool (e.g. J-Flash Lite by SEGGER), set the type of debugger (tool) to “J-Link”.

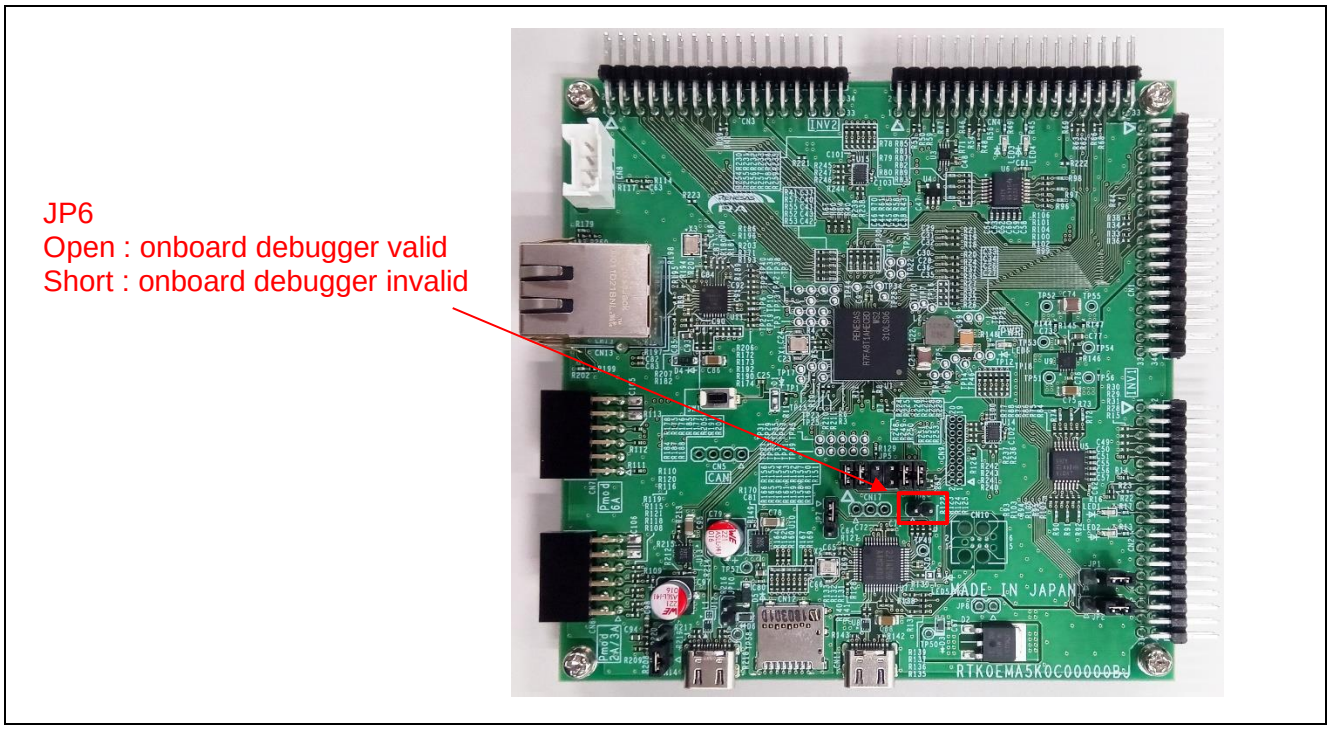

Figure 5-1 Jumper setting of JP6

5.1.3 J-Link Virtual COM Port

This product supports J-Link Virtual COM Port. By connecting to a PC with USB connector (CN11), a virtual COM port via USB is available.

5.1.4 USB I/F

This product has a USB connector (CN14) for the USB Full-Speed module in RA8T1.

5.1.5 Inverter board connector

Two inverter boards can be connected to this board with CN1 and CN2, and the 2nd inverter board is connected with CN3 and CN4. The pin assignments of the connectors are shown in in Table 5-1, Table 5-2,Table 5-3,Table 5-4. Note that these tables show default connection setting for the ports with jumper switches.

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

Pin No.	Pin Function	RA8T1Pin	Pin No.	Pin Function	RA8T1 Pin
1	NC	-	2	AGND	- (AVSS)
3	VPN	P008/AN008	4	AGND	- (AVSS)
5	IU	P004/AN000	6	NC	-
7	IV	P005/AN001	8	NC	-
9	IW	P006/AN002	10	NC	-
11	VU	P011/AN106 (*)	12	VV	P010/AN005 (*)
13	VW	P015/AN105 (*)	14	AGND	- (AVSS)
15	VPFC	P015/AN105 (*)	16	IPFC	P010/AN005 (*)
17	VR	P014/AN007	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	P609/GTIOC5B	28	GND	- (VSS)
29	UP	P115/GTIOC5A	30	GND	- (VSS)
31	VN	P114/GTIOC2B	32	GND	- (VSS)
33	VP	P113/GTIOC2A	34	GND	- (VSS)

(*) Exclusively assigned by jumper register setting

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

Pin No.	Pin Function	RA8T1Pin	Pin No.	Pin Function	RA8T1 Pin
1	WN	P112/GTIOC3B	2	GND	- (VSS)
3	WP	P300/GTIOC3A	4	GND	- (VSS)
5	DRV_SCK	P102/RSPCKB	6	DRV_RXD	P101/MOSIB
7	DRV_TXD	P100/MISOB	8	DRV_CS	P106/SSLB3
9	BUS_POWER_IN	-	10	INV_CONNECTED	PA08
11	SAFE_LOCK	P612	12	OC#	P613/GTETRGA (*)
13	OC#	P613/GTETRGA (*)	14	DRV_EN	P410
15	Relay	PA11	16	SW1	PA15
17	SW2	PA13	18	LED1	PA12
19	LED2	PA14	20	NC	-
21	HALL_U	P907/IRQ10	22	HALL_V	P905/IRQ8
23	HALL_W	P906/IRQ9	24	SIO_SDA	P206/SDA1
25	SCK_SCL	P205/SCL1	26	ENC_Z	P615/GTETRGC
27	IPS_A ENC_A	P502/AN019 (*) P903/GTIOC11A (*)	28	IPS_A#	P500/AN121
29	IPS_B ENC_B	P501/AN120 (*) P904/GTIOC11B (*)	30	IPS_B#	P812/AN122
31	GND	- (VSS)	32	GND	- (VSS)
33	+5V	-	34	+5V	-

(*) Exclusively assigned by jumper register setting

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

Pin No.	Pin Function	RA8T1Pin	Pin No.	Pin Function	RA8T1 Pin
1	NC	-	2	AGND	- (AVSS)
3	VPN	P000/AN100	4	AGND	- (AVSS)
5	IU	P513/AN016	6	NC	-
7	IV	P001/AN101	8	NC	-
9	IW	P002/AN102	10	NC	-
11	VU	P003/AN104 (*)	12	VV	P806/AN018 (*)
13	VW	P805/AN017 (*)	14	AGND	- (AVSS)
15	VPFC	P011/AN106 (*)	16	IPFC	P009/AN006 (*)
17	VR	P009/AN006 (*)	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	P803/GTIOC12B	28	GND	- (VSS)
29	UP	P802/GTIOC12A	30	GND	- (VSS)
31	VN	P602/GTIOC7B	32	GND	- (VSS)
33	VP	P603/GTIOC7A	34	GND	- (VSS)

(*) Exclusively assigned by jumper register setting

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

Pin No.	Pin Function	RA8T1Pin	Pin No.	Pin Function	RA8T1 Pin
1	WN	P600/GTIOC6B	2	GND	- (VSS)
3	WP	P601/GTIOC6A	4	GND	- (VSS)
5	DRV_SCK	P102/RSPCKB	6	DRV_RXD	P101/MOSIB (*) P105/GTIOC1A (*)
7	DRV_TXD	P100/MISOB	8	DRV_CS	P104/SSLB1
9	BUS_POWER_IN	-	10	INV_CONNECTED	P810
11	SAFE_LOCK	P809	12	OC#	P804/GTETRGD (*)
13	OC#	P804/GTETRGD (*)	14	DRV_EN	P808
15	Relay	P605	16	SW1	P604
17	SW2	P504	18	LED1	P606
19	LED2	PA06	20	NC	-
21	HALL_U	PA10/IRQ4	22	HALL_V	P801/IRQ12
23	HALL_W	PA09/IRQ5	24	SIO_SDA	P206/SDA1
25	SCK_SCL	P205/SCL1	26	ENC_Z	P614/GTETRGB
27	IPS_A ENC_A	P003/AN104 (*) P610/GTIOC4A (*)	28	VV	P806/AN018 (*)
29	IPS_B ENC_B	P805/AN017 (*) P611/GTIOC4B (*)	30	IPS_B#	P007/AN004
31	GND	- (VSS)	32	GND	- (VSS)
33	+5V	-	34	+5V	-

(*) Exclusively assigned by jumper register setting

The connection for CPU board and inverter board is shown in Figure 5-2. Please refer to 4.6.2 for the power supply method.

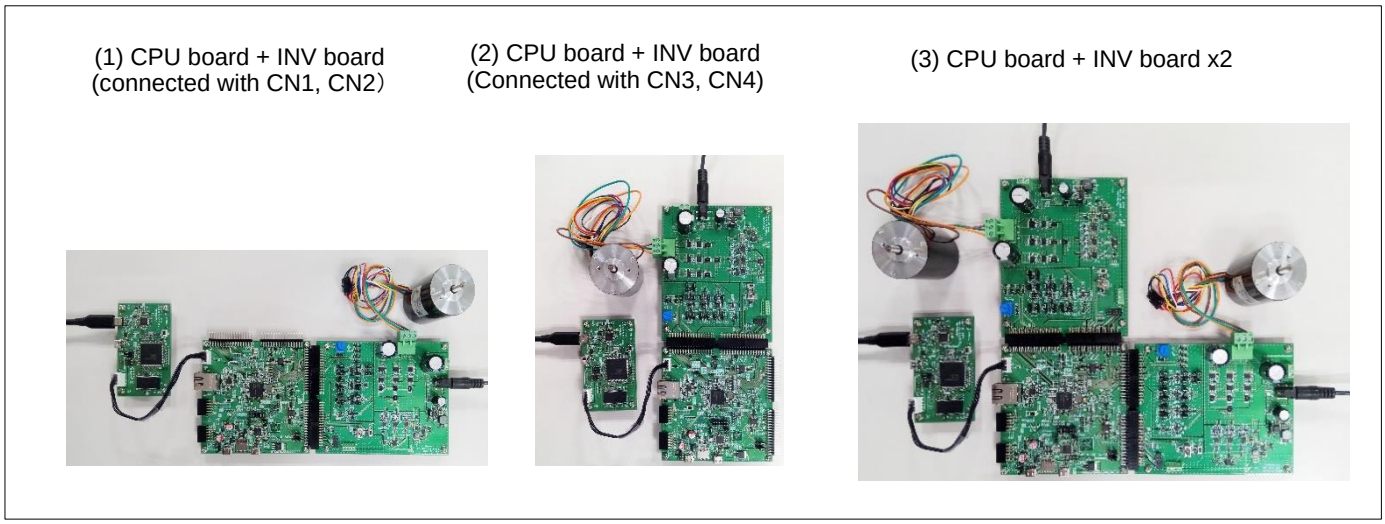

Figure 5-2 Connection for CPU board and inverter board

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 5-5.

Table 5-5 SCI connector (CN8) pin assignment

Pin No.	Pin Function	RA8T1 Connection Pin
1	GND	-
2	MCU RXD	P715/RXD4
3	MCU TXD	P714/TXD4
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 4 controllable LEDs, so that they can be used for program debug and the system. LED switches “ON” when output from the corresponding port is “LOW” and switches “OFF” when output is “HIGH”. Pin assignment for corresponding LEDs is listed in Table 5-6.

Table 5-6 LED pin assignment

RA8T1 port		LED1	LED2	LED3	LED4
PA12	Output HIGH	OFF	-	-	-
	Output LOW	ON	-	-	-
PA14	Output HIGH	-	OFF	-	-
	Output LOW	-	ON	-	-
P606	Output HIGH	-	-	OFF	-
	Output LOW	-	-	ON	-
PA06	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 5-7.

Table 5-7 CAN communication pin assignment (CN5)

Pin No.	RA8T1 pin
1	VCC
2	P415/CTX1
3	P414/CRX1
4	VSS

5.1.10 Pmod

This product has two connectors for Pmod module connection. Pin assignments are shown in Table 5-8 and Table 5-9.

Table 5-8 Pmod Type 2A/3A connector pin assignment (CN6)

Pin No.	RA8T1 port	Pin No.	RA8T1 port
1	P204_SSLA0 (P210_CTS) (*)	7	P708
2	P202_MOSIA (P209_TXD9) (*)	8	P412
3	P313_MISOA (P208_RXD9) (*)	9	P411
4	P203_RSPCKA	10	P902
5	VSS	11	VSS
6	VCC	12	VCC

(*) default setting is Pmod 2A, select 3A with jumper register. 3A assignment is in brackets.

Table 5-9 Pmod Type 6A connector pin assignment (CN7)

Pin No.	RA8T1 port	Pin No.	RA8T1 port
1	P908_IRQ11	7	P712
2	P710	8	P413
3	P205_SCL1	9	P207
4	P206_SDA1	10	P315
5	VSS	11	VSS
6	VCC	12	VCC

5.2 RA8T1 pin function list

Table 5-10 RA8T1 pin function list

Pin No.	RA8T1 pin function	Signal function
A2	P301/SD0DAT3	SDHI
A3	P304/SD0DAT0/TDATA3	SDHI,ARM debugger
A4	P306/SD0CD/TDATA1	SDHI,ARM debugger
A5	P308/SD0CLK/TCLK	SDHI,ARM debugger
A6	P905/IRQ8	INV1 HALL_V
A7	P909	TP43
A8	VCL2	system
A9	RES	ARM debugger
A10	P314	TP27
A11	P202/MOSIA	Pmod2A
A12	P204/SSLA0	Pmod2A
A13	VCC_USB	GND
A14	USB_DP	USB
A15	P413	Pmod2A,Pmod3A(GPIO)
B1	P609/GTIOC5B	INV1 PWM_UL
B2	P112/GTIOC3B	INV1 PWM_WL
B3	P302/SD0DAT2	SDHI
B4	P305/SD0WP/TDATA2	SDHI,ARM debugger
B5	P307/SD0CMD/TDATA0	SDHI,ARM debugger
B6	P311	SDHI
B7	P907/IRQ10	INV1 HALL_U
B8	P200	TP35
B9	P901	TP31
B10	P313/MISOA	Pmod2A
B11	P203/RSPCKA	Pmod2A,Pmod3A
B12	P205/SCL1	Pmod6A
B13	VSS_USB	GND
B14	USB_DM	USB
B15	P408/USB_VBUSEN	USB
C1	PA14	INV1 LED2
C1	P114/GTIOC2B	INV1 PWM_VL
C3	P113/GTIOC2A	INV1 PWM_VH
C4	P303/SD0DAT1	SDHI
C5	P915	ARM debugger
C6	P309/RXD3	ARM debugger
C7	P906/IRQ9	INV1 HALL_W
C8	P908/IRQ11	Pmod6A
C9	P903/GTIOC11A	INV1 ENC_A
C10	P900	TP29
C11	P315	Pmod2A,Pmod3A(GPIO)
C12	VSS2	GND
C13	P207	Pmod2A,Pmod3A(GPIO)
C14	P415/CTX1	CAN
C15	P412	Pmod6A(GPIO)
D1	P611/GTIOC4B	INV2 ENC_B
D2	PA12	INV1 LED1
D3	P115/GTIOC5A	INV1 PWM_UH
D4	PA11	Smart Driver (INV1 SEL)/HV1_Relay
D5	P300/GTIOC3A	INV1 PWM_WH
D6	P310/TXD3	ARM debugger
D7	P312/CTS_RTS3	ARM debugger
D8	SWDIO	ARM debugger
D9	P904/GTIOC11B	INV1 ENC_B
D10	P902	Pmod6A(GPIO)
D11	P206/SDA1	Pmod6A

Pin No.	RA8T1 pin function	Signal function
D12	P407/USB_VBUS	USB
D13	P411	Pmod6A(GPIO)
D14	P410/GTIOC9B	Smart Driver (INV1 EN)/HV1_PWM_PFC
D15	P414/CRX1	CAN
E1	PA09/IRQ5	INV2 HALL_W
E2	P613/GTETRGA	INV1 OverCurrent/Smart Driver (INV1 nFault)/HV1_OC_PFC
E3	P615/GTETRGC	INV1 ENC_Z
E4	P610/GTIOC4A	INV2 ENC_A
E5	PA13	INV1 SW2
E6	P911	TP39
E7	P910	TP41
E8	P913	TP33
E9	P201/MD	ARM debugger
E10	P211/SWCLK	ARM debugger
E11	P409/USB_OVRCURA	USB
E12	P712	Pmod2A,Pmod3A(GPIO)
E13	P708	Pmod6A(GPIO)
E14	P710	Pmod6A(GPIO)
E15	P709	TP1
F1	VCL3	system
F2	PA10/IRQ4	INV2 HALL_U
F3	P612	INV1 Safe Lock
F4	P614/GTETRGB	INV2 ENC_Z
F5	PA15	INV1 SW1
F6	P914	TP45
F7	P912	TP37
F8	P208/TDI/RXD9	ARM debugger, Pmod3A
F9	P209/TDO/TXD9	ARM debugger, Pmod3A
F10	P711	TP25
F11	P715/RXD4	RMW
F12	VCC2	VCC
F13	VCC_USBHS	GND
F14	USBHS_DM	NC
F15	USBHS_DP	NC
G1	VCC_DCDC1	VCC
G2	VCC_DCDC2	VCC
G3	PA08	INV1 Inverter Connected
G4	PA03	TP9
G5	PA07	TP4
G6	VCL5	system
G7	VSS10	GND
G8	VSS3	GND
G9	VCC3	VCC
G10	P714/TXD4	RMW
G11	P713	TP23
G12	VCC1	VCC
G13	USBHS_RREF	NC
G14	VSS_USBHS2	GND
G15	VSS_USBHS1	GND
H1	VLO1	system
H2	VLO2	system
H3	PA01	PWMOE#_1
H4	PA00	TP12
H5	PA05	TP5
H6	VCL6	system
H7	VSS11	GND
H8	VSS4	GND
H9	VCC4	VCC
H10	PB04	TP15

Pin No.	RA8T1 pin function	Signal function
H11	PB05	TP17
H12	VSS1	GND
H13	AVCC_USBHS	VCC
H14	XTAL	24MHz
H15	EXTAL	24MHz
J1	VSS_DCDC	GND
J2	VSS8	GND
J3	VCC8	VCC
J4	P607	TP14
J5	P813	TP46
J6	VCC5	VCC
J7	VSS5	GND
J8	VSS8	GND
J9	VCC7	VCC
J10	PB02	TP3
J11	PB06	TP19
J12	PB07	TP21
J13	VSS9	GND
J14	XCOUT	NC
J15	XCIN	XCIN
K1	P107	TP16
K2	P106/SSLB3	Smart Driver (INV1 CS)
K3	P600/GTIOC6B	INV2 PWM_WL
K4	P601/GTIOC6A	INV2 PWM_WH
K5	P605	Smart Driver (INV2 SEL)/HV2_Relay
K6	PA02	TP11
K7	P503	TP24
K8	P505	TP26
K9	P511	TP44
K10	P704/RMII0RXER_	Ether
K11	P707	TP8
K12	P704/RMII0RXER_	Ether
K13	P706	TP6
K14	VBATT	VCC
K15	VCL1	system
L1	P104/SSLB1	Smart Driver (INV2 CS)
L2	P103	TP18
L3	P105/GTIOC1A	HV2_InterleavePWM_PFC
L4	P602/GTIOC7B	INV2 PWM_VL
L5	PA06	INV2 LED2
L6	PA04	TP7
L7	P507	TP28
L8	P509	TP32
L9	P009/AN006	INV2 VR /INV2 IPFC
L10	P404	TP2
L11	P703/RMII0RXD1	Ether
L12	P701/REF50CK0	Ether
L13	P702/RMII0RXD0	Ether
L14	PB00	TP10
L15	PB01	Ether
M1	P102/RSPCKB	Smart Driver (SCK)
M2	P101/MOSIB/GTIOC8A	Smart Driver (MOSI)/HV1_InterleavePWM_PFC
M3	P800	TP20
M4	P603/GTIOC7A	INV2 PWM_VH
M5	P606	INV2 LED1
M6	P811	TP22
M7	P508	TP30
M8	P010/AN005	INV1 VV /INV1 IPFC
M9	P011/AN106	INV1 VU /INV2 VPFC

Pin No.	RA8T1 pin function	Signal function
M10	P007/AN004	INV2 IPS_B#
M11	P805/AN017	INV2 VW/INV2 IPS_B
M12	P402/ET0MDIO	Ether
M13	P406/RMII0TXD1	Ether
M14	P700/RMII0TXD0	Ether
M15	PB03	TP13
N1	P100/MISOB	Smart Driver (MISO)
N2	P801/IRQ12	INV2 HALL_V
N3	P803/GTIOC12B	INV2 PWM_UL
N4	P604	INV2 SW1
N5	P504	INV2 SW2
N6	P506	PWMOE#_2
N7	P510	TP34
N8	AVCC0	AVCC
N9	AVSS0	AGND
N10	P005/AN001	INV1 IV
N11	P806/AN018	INV2 VV/INV2 IPS_A#
N12	P807	TP36
N13	P512	TP40
N14	P403/ET0/LINKSTA	Ether
N15	P405/RMII0TXDEN	Ether
P1	P802/GTIOC12A	INV2 PWM_UH
P2	P804/GTETRGD	INV2 OC/Smart Driver (INV2 nFault)/HV2_OC_PFC
P3	VCC6	VCC
P4	P810	INV2 Inverter Connected
P5	P500/AN121	INV1 IPS_A#
P6	P502/AN019	INV1 IPS_A
P7	P014/AN007	INV1 VR/INV1 IPFC
P8	VREFL	AGND
P9	VREFL0	AGND
P10	P004/AN000	INV1 IU
P11	P003/AN104	INV2 VU/INV2 IPS_A
P12	P001/AN101	INV2 IV
P13	P011/AN106	INV2 IU
P14	P514	TP42
P15	P401/ET0MDC	Ether
R1	P808/GTIOC13B	Smart Driver (INV2 EN)/HV2_PWM_PFC
R2	P809	INV2 Safe Lock
R3	VSS6	GND
R4	P812/AN122	INV1 IPS_B#
R5	P501/AN120	INV1 IPS_B
R6	VCL4	system
R7	P015/AN105	INV1 VW
R8	VREFH	AVCC
R9	VREFH0	AVCC
R10	P008/AN008	INV1 VDC
R11	P006/AN002	INV1 IW
R12	P002/AN102	INV2 IW
R13	P000/AN100	INV2 VDC
R14	P515	TP38
R15	P400/IRQ0	Ether

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

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