RZ/T2M Group, RZ/N2L Group

CN032 AC Servo Solution Hardware Manual

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Abstract

This document describes the specifications of the CN032 AC Motor Solution equipped with the MPU of the RZ/T2M group or RZ/N2L group manufactured by Renesas Electronics. We provide an environment for evaluating RZ/T2M or RZ/N2L without the need for customers to prepare their own hardware.

Target Device

RZ/T2M Group

RZ/N2L Group

Related Document

- CN032 AC Servo Solution: Hardware Manual (this manual)
- CN032 AC Servo Solution: Firmware Manual
- CN032 AC Servo Solution: Startup Guide (for Motion Control Utility)
- CN032 AC Servo Solution: Startup Guide (for EtherCAT)

- RZ/T2M Group User's Manual: Hardware
- RZ/N2L Group User's Manual: Hardware

Contents

1. Overview

1.1 AC Servo Solution Overview

CN032 AC Servo Solution kit is a solution for Servo motor drive systems equipped with Renesas Electronics' RZ/T2M or RZ/N2L and related products. CN032 AC Servo Solution consists of two boards, a controller board equipped with RZ/T2M or RZ/N2L (hereinafter referred to as the controller board) and an inverter board.

It shows the capability and feature of RZ/T2M or RZ/N2L for network communication module and motor control as references for applications.

1.2 Hardware Block Image

The CN032 AC Servo Solution block image is shown in Figure 1-1.

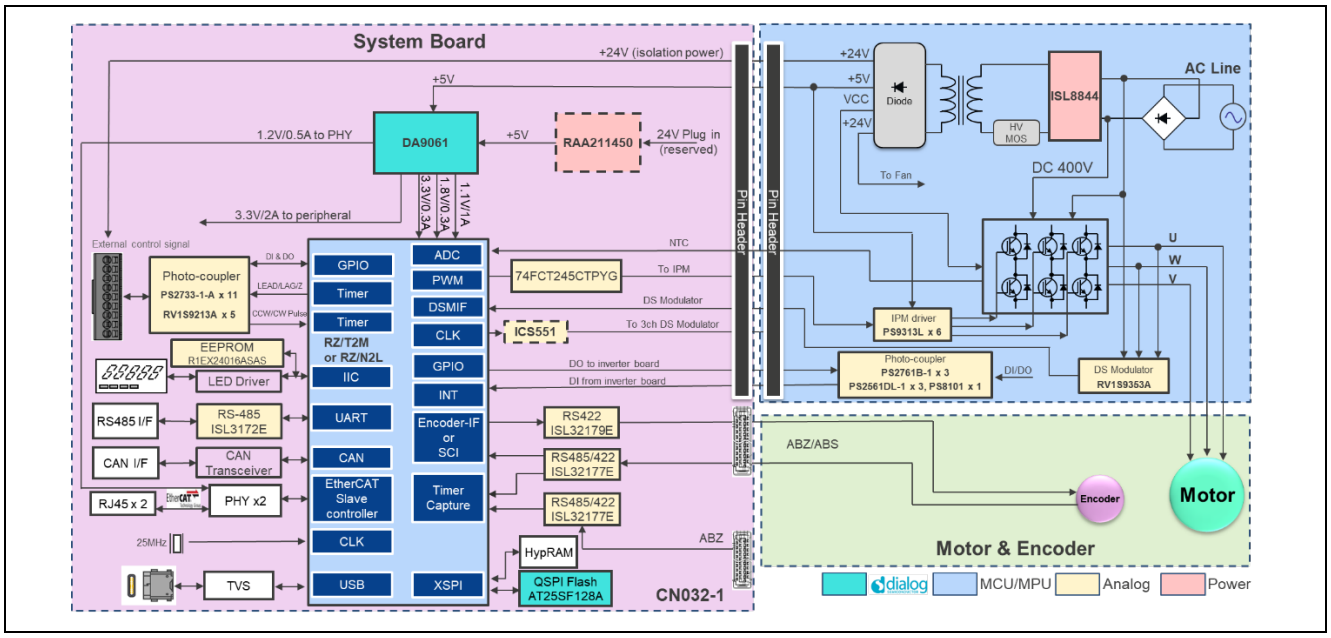

Figure 1-1 AC Servo Solution

The CN032 AC Servo Solution image is shown in Figure 1-2.

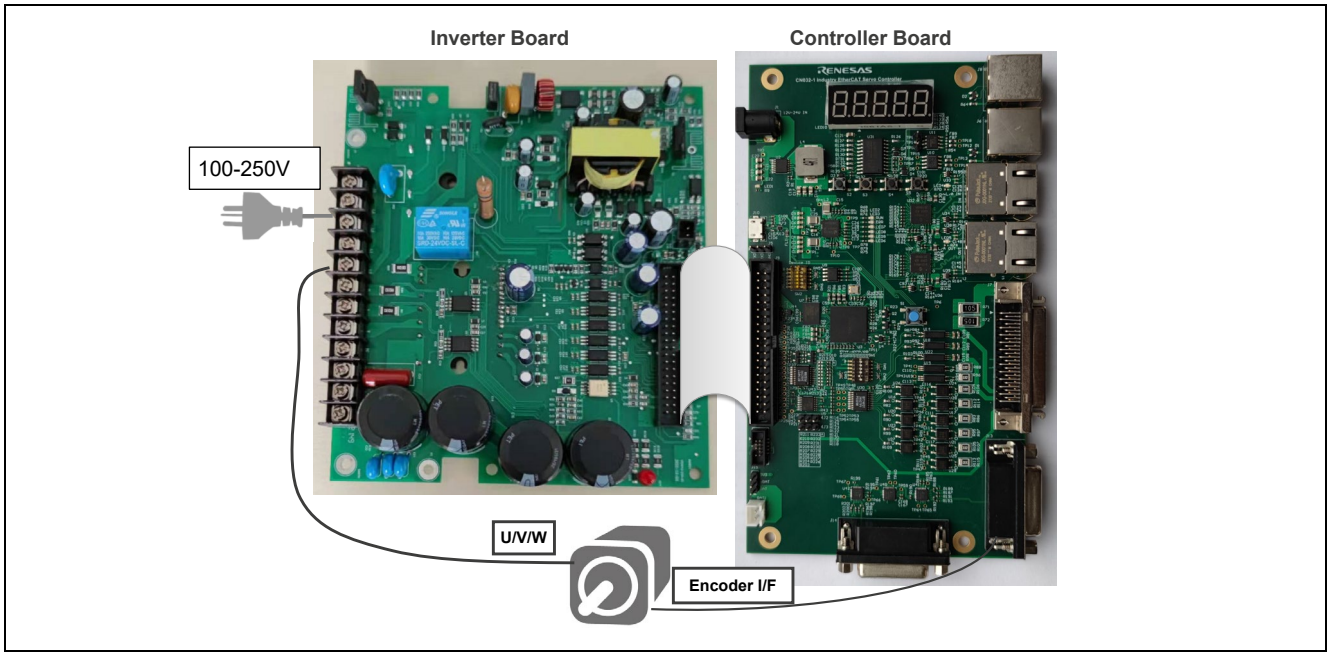

Figure 1-2 AC Servo Solution

2. General Specifications

Table 2-1 Specification's summary

Items		Description	
		AC Servo Solution Kit (RZ/T2M)	**AC Servo Solution Kit (RZ/N2L)**
CPU	Series	RZ/T2M Dual Arm Cortex®-R52	RZ/N2L Single Arm Cortex®-R52
	Package	R9A07G075M24: 225-pin FBGA	R9A07G084M04: 225-pin FBGA
	Clock	Up to 800MHz	Up to 400MHz
	ATCM/BTCM	512KB/64KB	128KB/128KB
	System RAM	2MB	1.5MB
IPM		PSS15S93E6 from Mitsubishi, 600V/15A	
QSPI Flash		128MBIT, AT25SF128A-SHB-T (Renesas)	
Hyper RAM		64MBIT, S27KL0641DABHI020 (Cypress Semiconductor)	
EEPROM		16KBIT, R1EX24016ASAS (Renesas)	
Power In		100-250V AC, 1.5A max consumption	
Interfaces		JTAG (10-PIN)	
		Ethernet port x 2	
		Micro USB x 1	
		RS485 x 1	
		CAN x 1	
		UART x 1	
		Digital input x 8, Digital output x 8	
		Display 5-bit eight-segment LED, Key x 4	
		Encoder Interface x2 (Support absolute encoder using ENCIF pins and incremental encoder)	Encoder Interface x2 (Support absolute encoder*1 using SCI pins and incremental encoder)

*1 AC Servo Solution Kit (RZ/N2L) supports Tamagawa encoder only.

Table 2-2 Environmental specifications

Item	Specification	Remarks
Operating temperature limit	0~40°C	At normal temperature
Operating humidity range	80% or less	No condensation

Table 2-3 Board size

Item	Specification	Remarks
Controller board	176(W)×100(D)×1.6(T)	NO include protrusions, NO include component height
Inverter board	150(W)×130(D)×1.6(T)	NO include protrusions, NO include component height

The main parts in Controller Board description are shown in Figure 2-1.

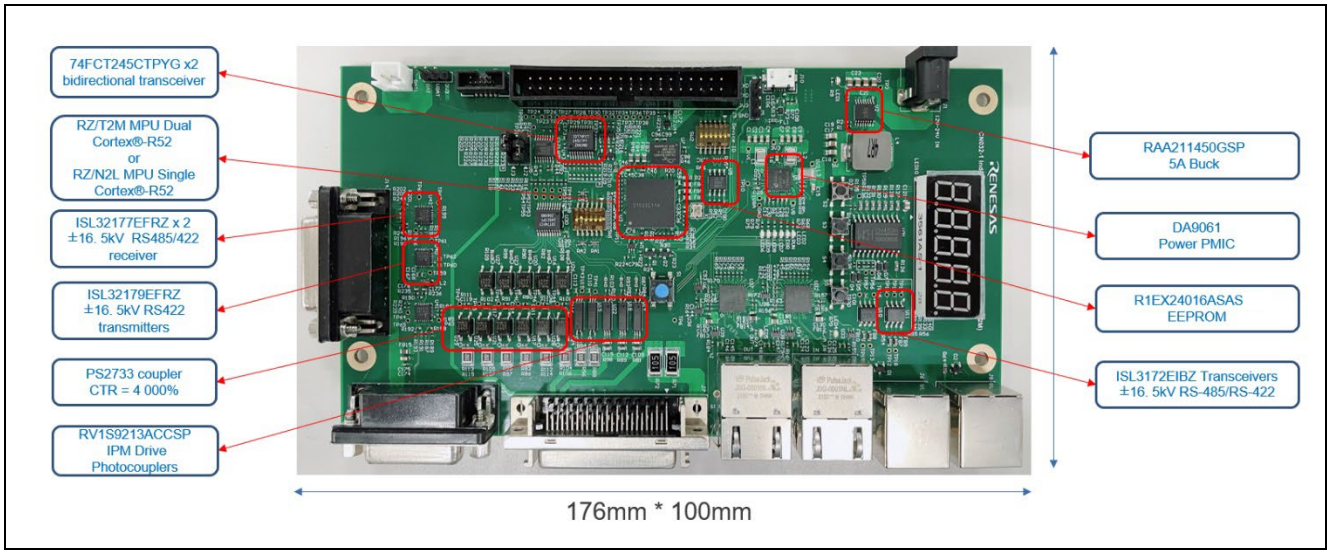

Figure 2-1 Controller board

The Inverter Board image is shown in Figure 2-2.

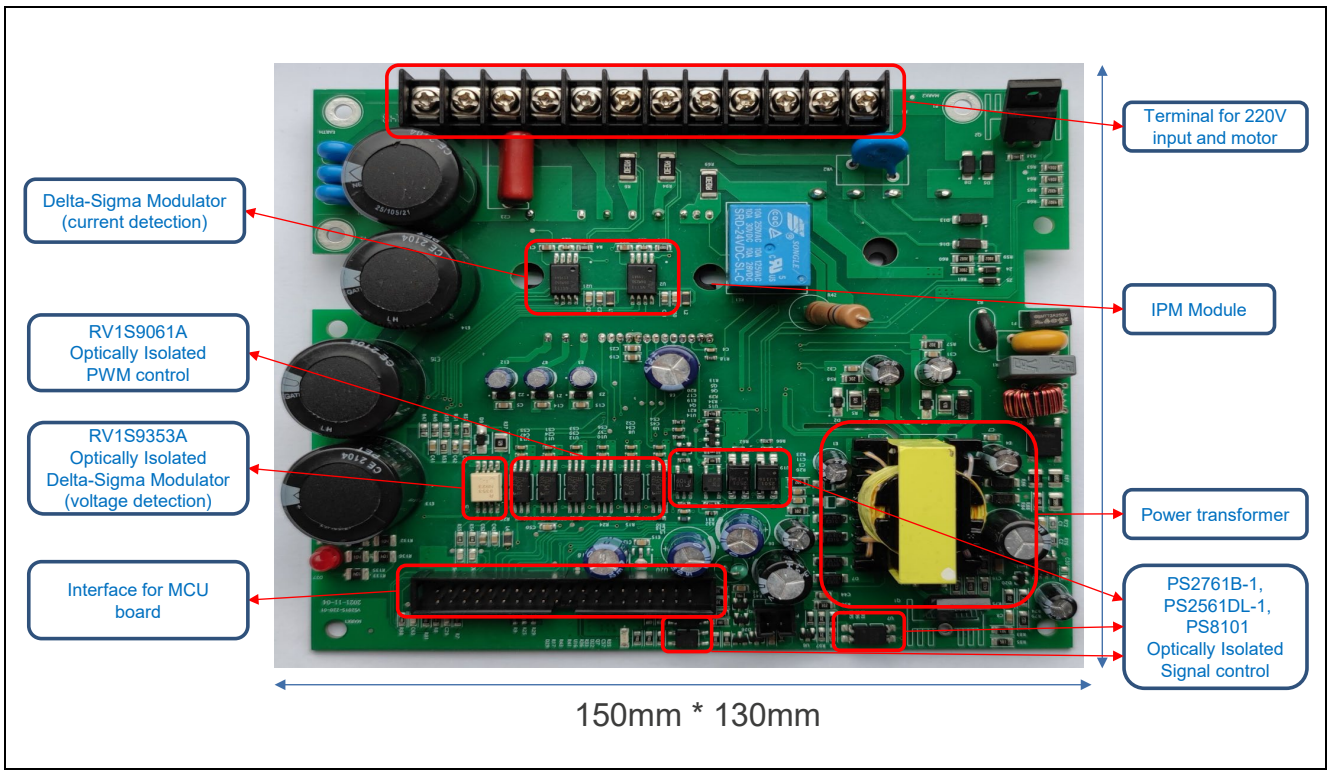

Figure 2-2 Inverter board

3. Interface Description

3.1 Power Supply

Inverter board can be inputted from 100V to 250V AC, and it provides 5V to Controller board for power supply. The main power supply for Controller board consists of 5V, 3.3V, 1.8V, 1.2V, 1.1V. The PMIC power supply 1.1V/1.8V/3.3V (MCU/peripheral) and 1.2V for PHY Core.

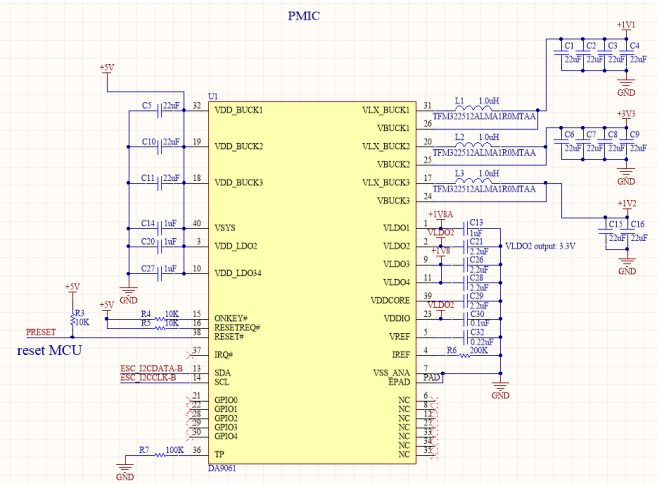

Figure 3-1 PMIC

Here is the Power on/off sequence and timing supplied from PMIC.

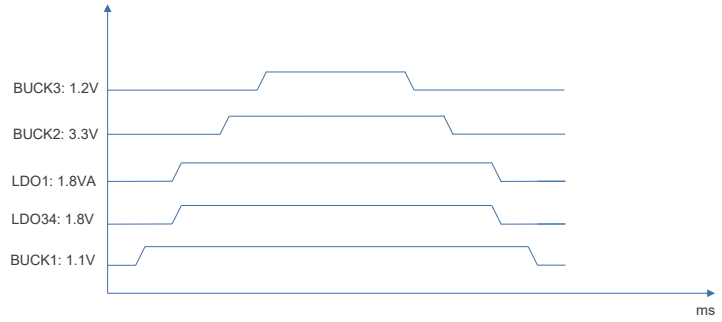

Figure 3-2 Power On/Off Sequence from PMIC

Controller board can be inputted from 12 to 24V DC from DC jack. It can be supply 5V DC from a power source other than the 5V DC power supply from the inverter board.

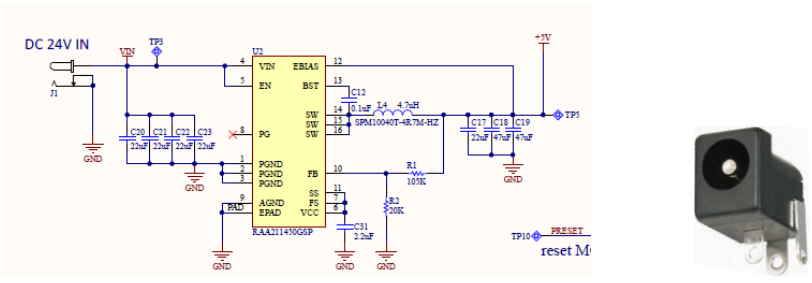

Figure 3-3 12-24V DC power supply of controller board

3.2 JTAG

Cortex 10 pin 0.05" JTAG Connector Pinout
The 10 pin cable is Samtec, part number FFSD-05-D-12.00.01-N

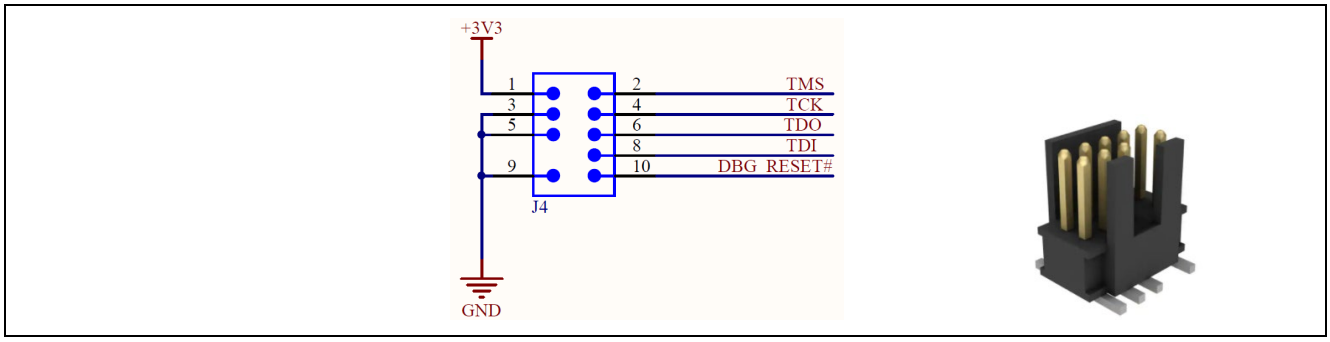

Figure 3-4 JTAG Interface

3.3 Jumper Setting

3.3.1 V/W PWM signal select

PWM signal for V/W phase is generated by using GPT or MTU3 output signal. There are 2 jumpers should be connected to set the PWM timer for motor PWM control in Controller board, that depend on software specification.

Jumper	GPT	MTU3 (default)
J2	2-3 short	1-2 short
J3	1-2 short	2-3 short

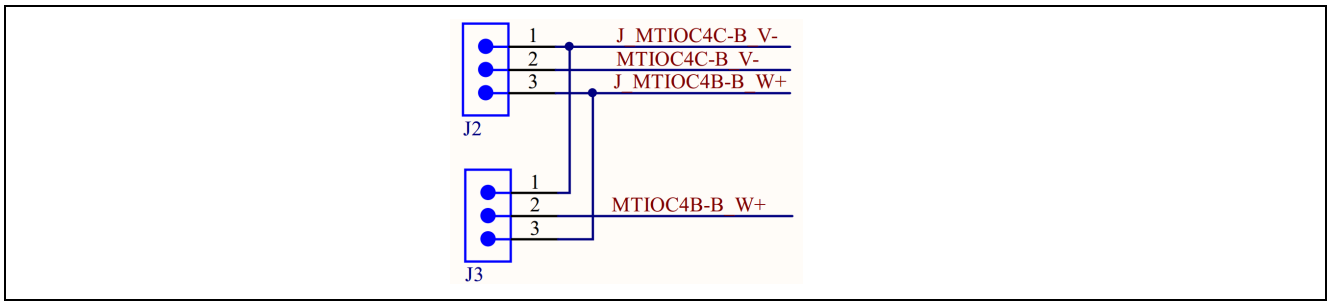

Figure 3-5 Jumper setting for V/W PWM signal

3.3.2 Encoder power supply

The encoder can be supplied the external power. If it needs the external power, power supply can be selected from 3.3V power or the external battery (VBAT).

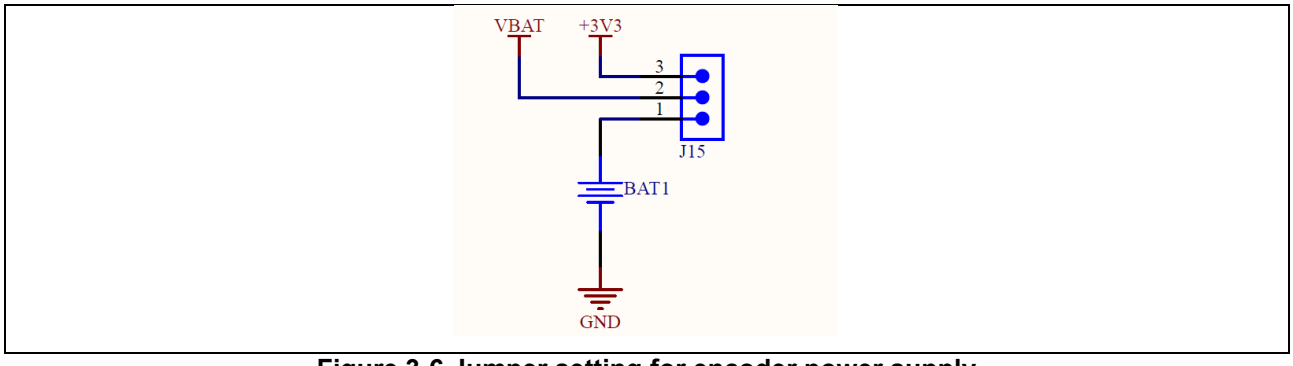

Figure 3-6 Jumper setting for encoder power supply

3.4 Dip Switch

3.4.1 Mode Switch

Selection of Operating Mode for Each Combination of Levels of Mode Setting Pins (MD2, MD1 and MD0)

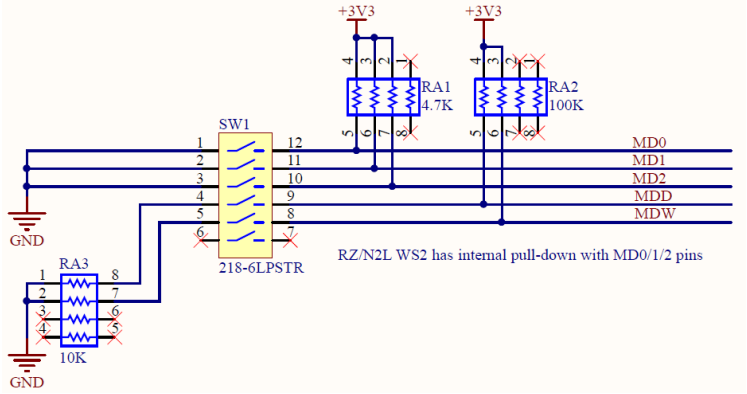

Figure 3-7 Operating Mode

Selection of Operating Mode for Each Combination of Levels of Mode Setting Pins (MD2, MD1 and MD0)

MD2	MD1	MD0	Operating Mode
0	0	0	xSPI0 boot mode (x1 boot Serial flash)
0	0	1	xSPI0 boot mode (x8 boot Serial flash)
0	1	0	16-bit bus boot mode (NOR flash)
0	1	1	32-bit bus boot mode (NOR flash)
1	0	0	xSPI1 boot mode (x1 boot Serial flash)
1	0	1	SCI (UART) boot mode
1	1	0	USB boot mode
1	1	1	Setting prohibited

Selection of JTAG Authentication by Hash

MDD	JTAG Mode
0	Normal mode JTAG Authentication by Hash is disabled.
1	JTAG Authentication by Hash mode

Selection of ATCM wait cycle

MDW	ATCM wait cycle
0	0 wait Valid for CPU operating frequency equal to or less than 400 MHz.
1	1 wait

Selection of Operating Voltage of IO domain 0 to 4 (MDV4, MDV3, MDV2, MDV1 and MDV0) with 3.3V by pull high when MCU reset.

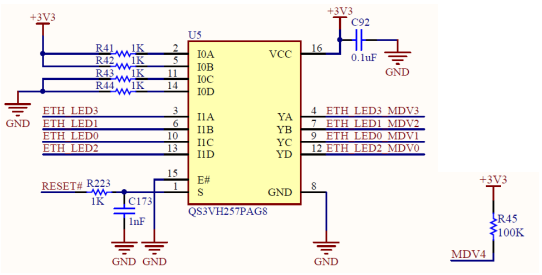

Figure 3-8 Operating Voltage

3.4.2 EtherCAT-ID Setting Switch

A board specific EtherCAT ID can optionally be set.

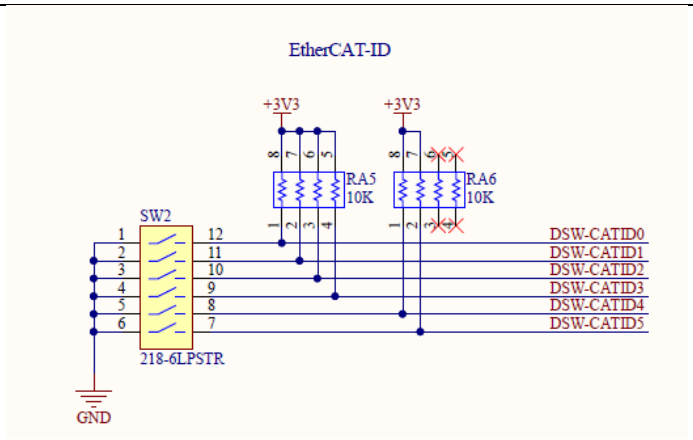

Figure 3-9 EtherCAT-ID setting switch

3.5 LEDs

There are 9 LEDs in the controller board. Please see below for the assignment.

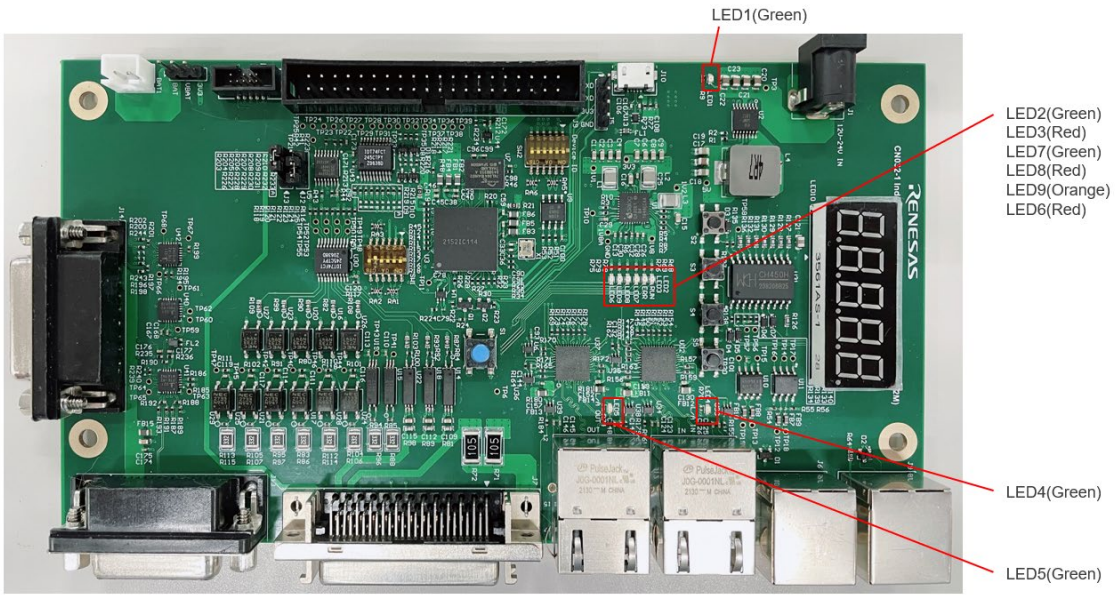

Figure 3-10 Controller board LED

No.	Item		Circuit number	Color	Using
1	Power supply LED	VIN	LED1	Green	Input power: Light up
2	ESC status LED	ETH_LED0	LED2	Green	RUN
3		ETH_LED1	LED3	Red	ERR
4		ETH_LED2	LED4	Green	L/A IN
5		ETH_LED3	LED5	Green	L/A OUT
6	General purpose LED	LED4_ENCIF08	LED6	Red	H: Light on/L: Light off
7		LED5	LED7	Green	H: Light on/L: Light off
8		LED6_ENCIF10	LED8	Red	H: Light on/L: Light off
9		LED7_ENCIF11	LED9	Orange	H: Light on/L: Light off

3.6 Encoder Interfaces

There are 2 encoder interfaces in the controller board, please see below for the connection.

Parts number	Type	Description
J13	Absolute Encoder	Support Absolute Encoder or Incremental Encoder. Alternative
	Incremental Encoder	
J14	Incremental Encoder	-

The 15 pin D-SUB, part number D15S13A4GV00LF.

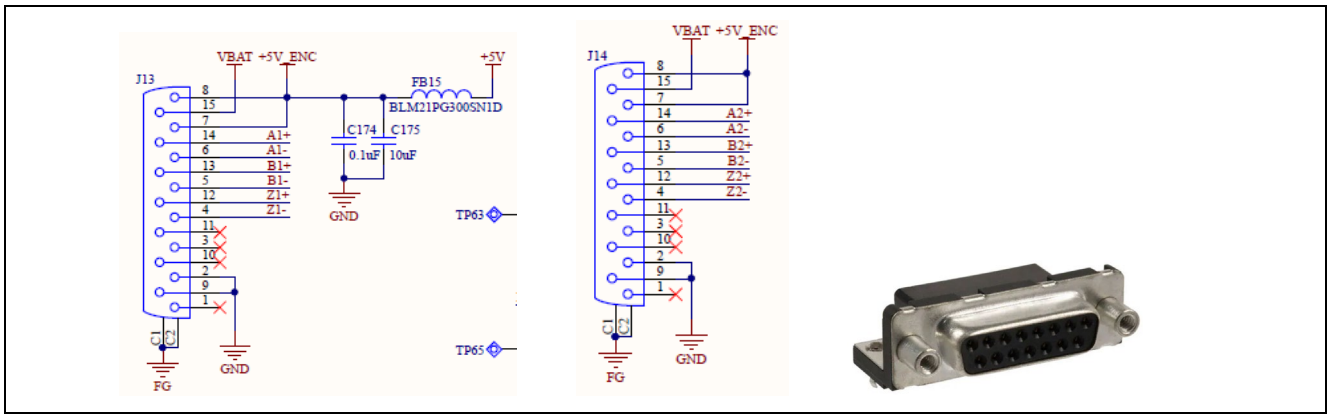

Figure 3-11 Encoder Interface

There are the receiver IC and the transmitter IC for communication with encoder.

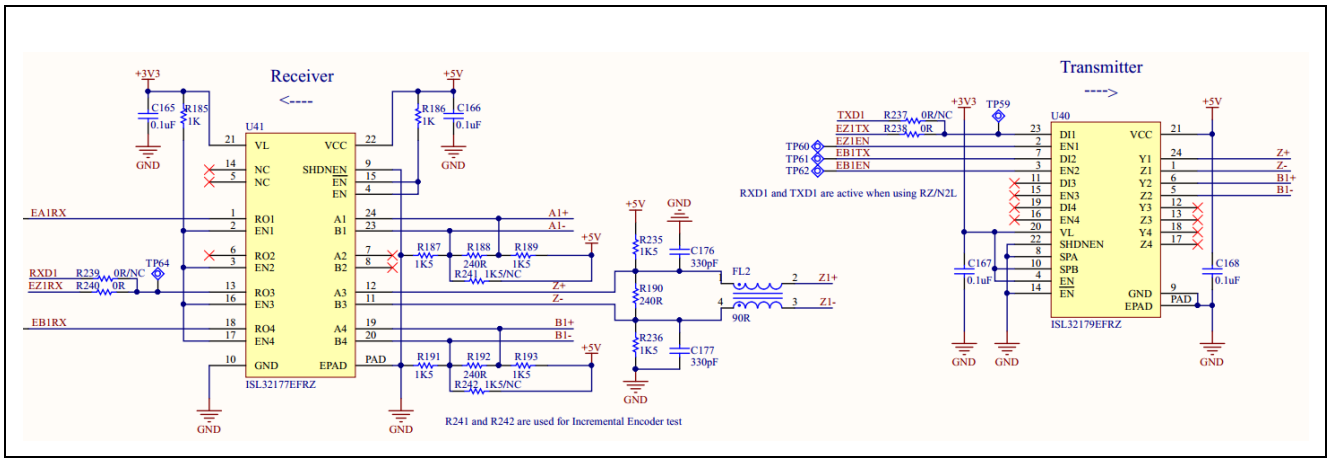

Figure 3-12 Encoder Circuit

The following resistor implementation is different between the Controller boards with RZ/T2M and RZ/N2L. When R238 and R240 are soldered, an encoder signal is inputted to the encoder IF. Whereas, when R237 and R239 are soldered, the signal is inputted to SCI.

Resistor	Controller board (RZ/T2M)	Controller board (RZ/N2L)
R237	NC	Soldered
R238	Soldered	NC
R239	NC	Soldered
R240	Soldered	NC

3.7 UART Interfaces

The UART function can be used to control motor by Renesas PC GUI.

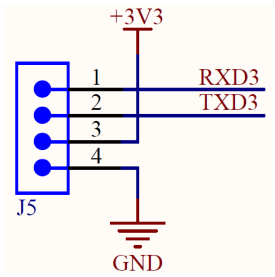

Figure 3-13 UART Interface

3.8 EtherCAT Interface

There are 2 EtherCAT interface in this system, another one is omitted in the below picture. The part number of RJ45 is J0G-0001NL.

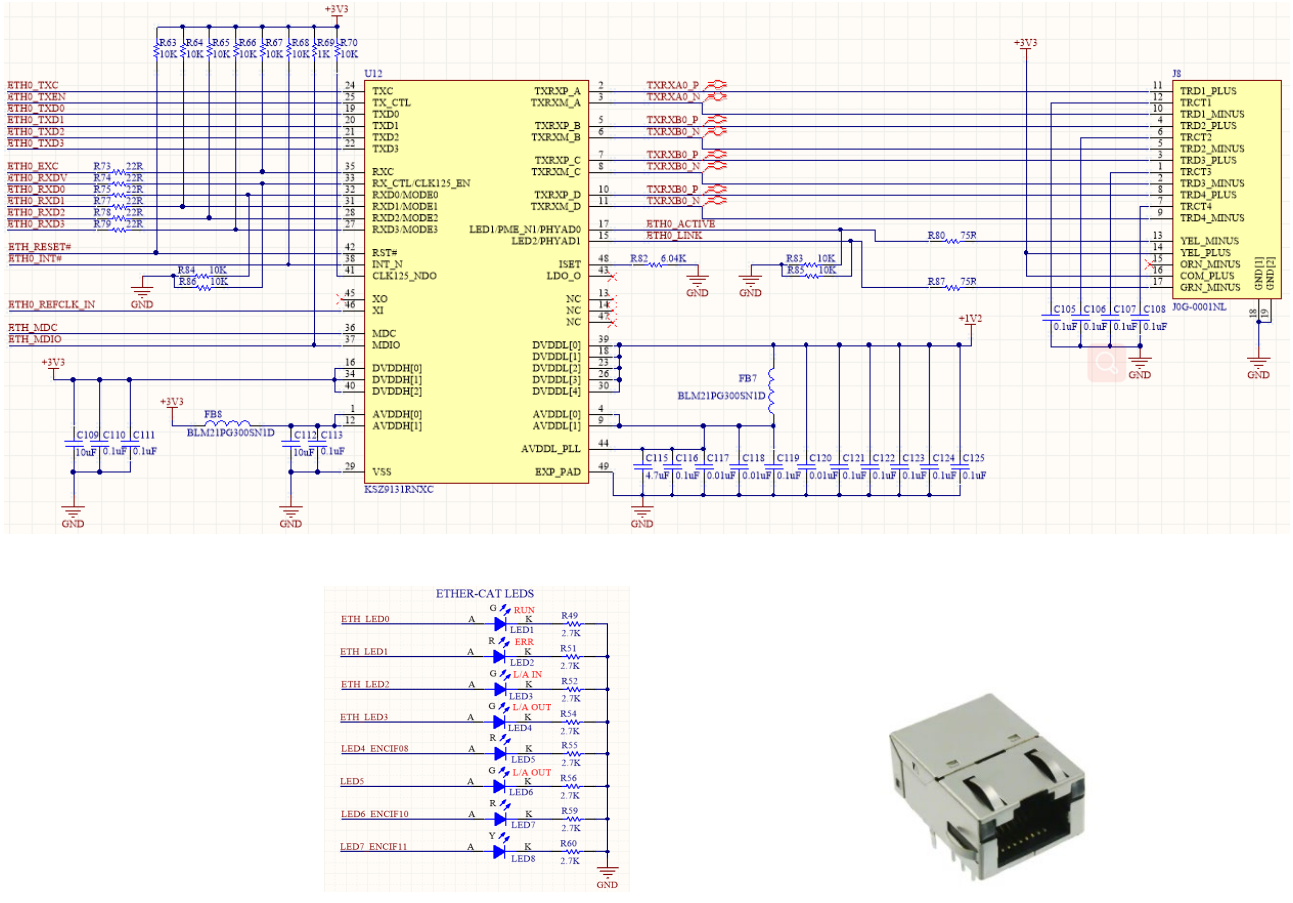

Figure 3-14 EtherCAT Interface

3.9 RS485&CAN Interfaces

The user can use the CAN and RS485 function with RJ45 connector, which only has physical connection function. There are 2 same RJ45 connector that used for products interconnection, part number MTJ-889X1-FSE.

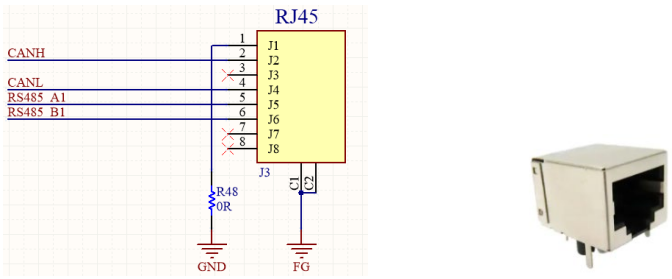

Figure 3-15 RS485&CAN Interface

3.10 USB Interface

The micro–B USB connector used for MCU works on USB boot mode, part number 10118192-0001LF.

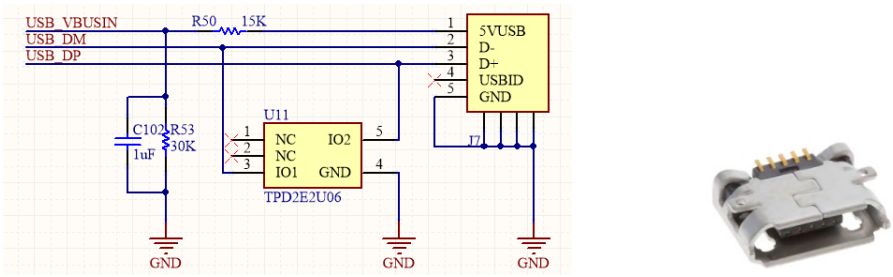

Figure 3-16 USB Interface

3.11 External Control Interface

The external control interface support 8 channel digital output and 8 channel digital input control, part number 6368355-1.

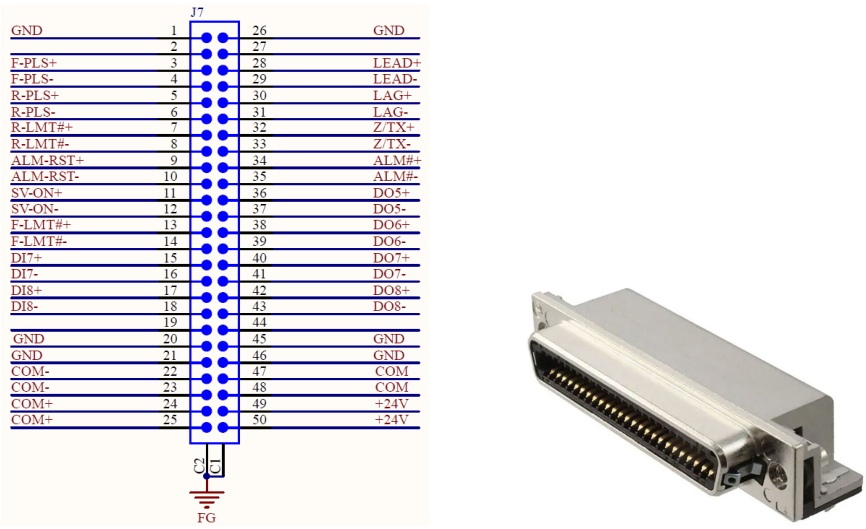

Figure 3-17 External Control Interfaces Interface

3.12 User Interface

A 5-bit eight-segment LED and 4 keys are used for user operation, which are control by driver IC CH450H.

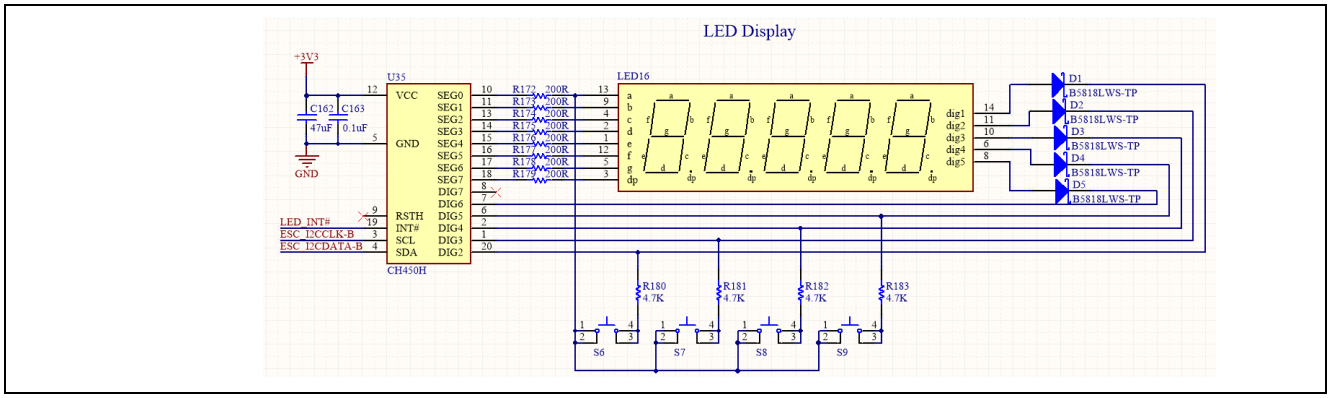

Figure 3-18 User Interface

3.13 Interface between Controller Board and Inverter Board

The system board gets 5V power supply from the inverter board through below interface. It makes motor control by U/V/W signals, 3 channels DS Modulator signal, and input/output signals.

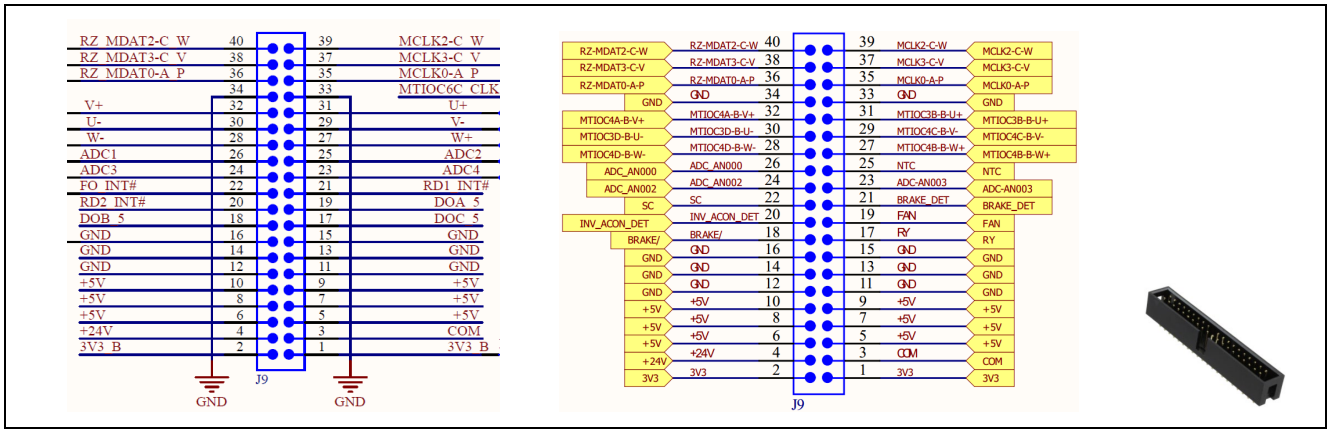

Figure 3-19 Power Board Interface

3.14 Inverter Board Interface

The inverter board need to be inputted 100-250V AC for motor power and controller power. L1/L2 is input to IPM for motor power, and LA/LB is input to transformer for controller power, they are dividual.

P/AGND also can input DC power for motor power, if don't input AC power from L1/L2.

PB is for brake control.

EARTH is for ground of 100-250V power and motor FG.

Pin2-8 and pin12 are the necessary input for achieving the motor servo control.

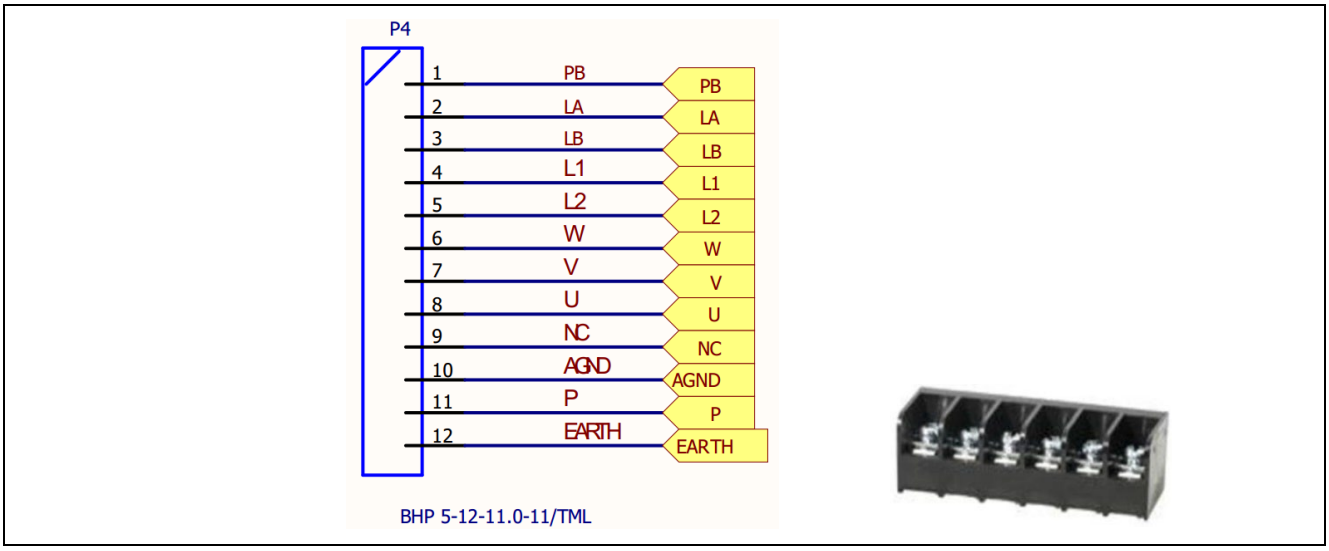

Figure 3-20 Inverter Board Interface

4. Controller Board, Inverter Board Connection Configuration

The connection configuration for CN032 AC Servo Solution image is shown in Figure 4-1.

The cables for the system launch should be connected.

Item	Cables
1	100-250V AC input, Three-wire, L/N/GND
2	Motor cable, U/V/W/shell
3	Encoder cable, D-SUB 15-pin
4	40-pin cable that connects Controller board with Inverter board
5	USB to UART converter, used to PC control by Renesas GUI

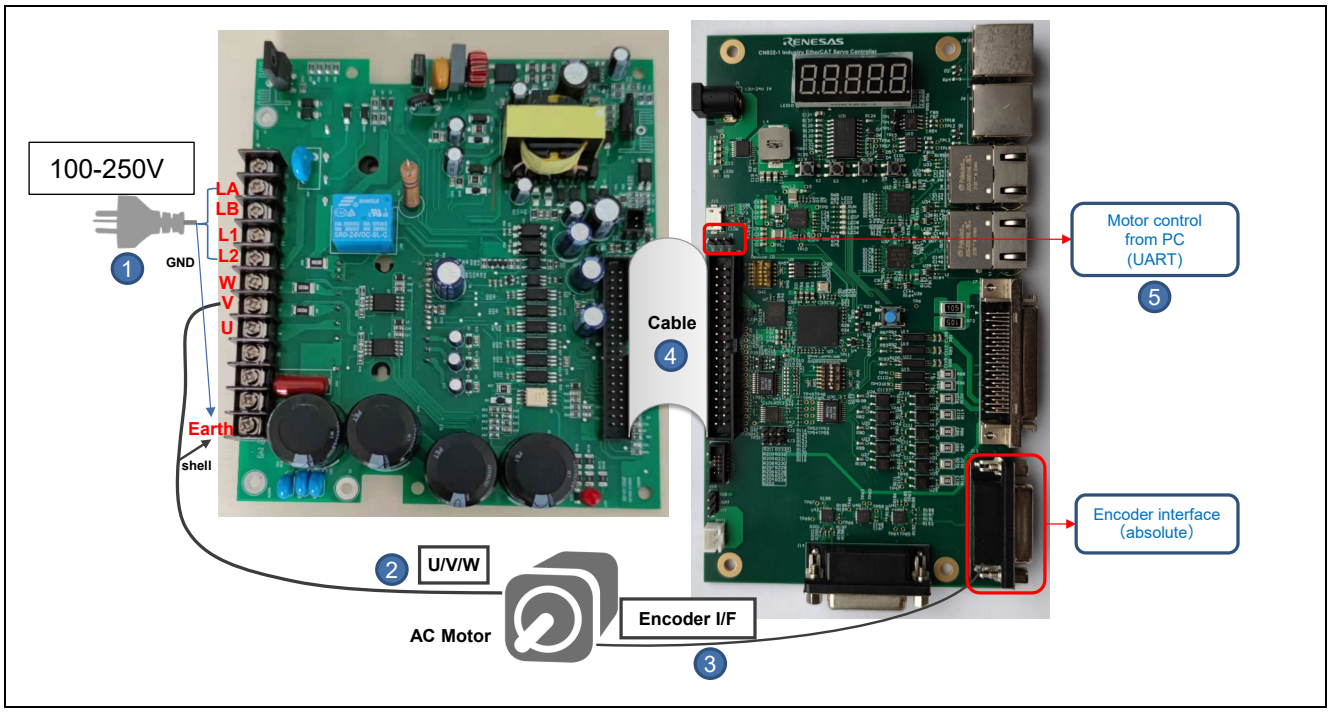

Figure 4-1 Connection Configuration

5. Detection Circuit

Table 5-1 is shown the current and voltage detection circuits mounted on the inverter board and the RZ/T2M connection destinations.

Table 5-1 List of detection circuits

No	Circuit	Pin Number	Function	Circuit diagram silk name
1	Fault detection circuit	P01_4	IRQ3-A	FO_INT#
2	Current detection circuit (V/W) (ΔΣ modulator)	P21_6	MDAT2	RZ_MDAT2-C_W
		P21_5	MCLK2	RZ_MCLK2-C_W
		P22_0	MDAT3	RZ_MDAT3-C_V
		P21_7	MCLK3	RZ_MCLK3-C_V
3	Busbar voltage detection circuit (220V) (ΔΣ modulator)	P00_5	MDAT0	RZ_MDAT0-A_P
		P00_4	MCLK0	RZ_MCLK0-A_P

5.1 Fault Detection Circuit

The fault detection circuit is used to detect short-circuit protection, under-voltage protection and over temperature protection by IPM module. The fault signal VFO outputs low level when SC, UV or OT protection works, which is open drain type. You can protect the RZ/T2M motor board and motor by monitoring fault signal VFO and forcing the PWM output to go into the Hi-Z state when the output is low.

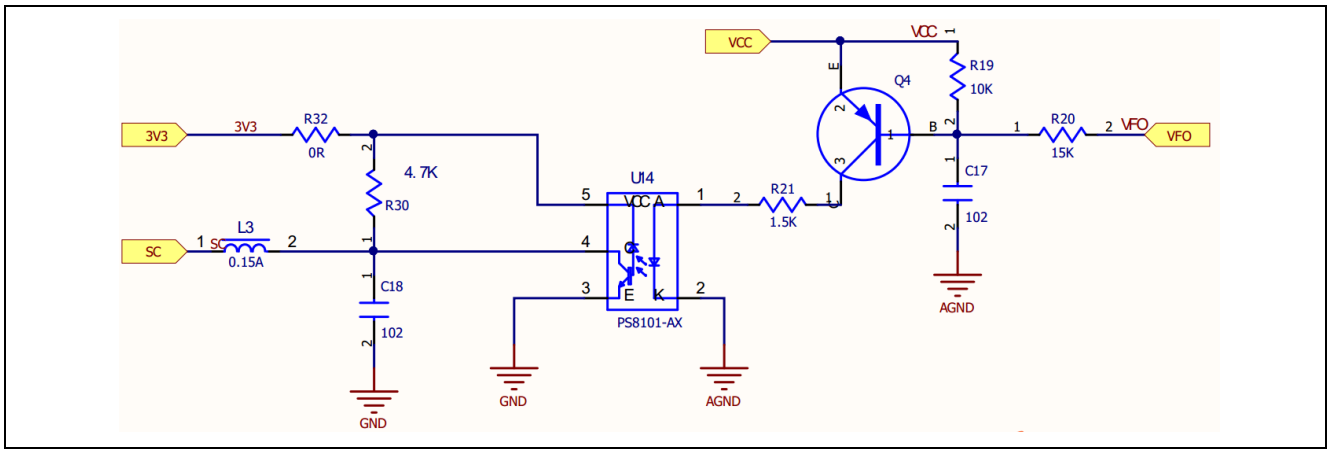

Figure 5-1 Fault Detection Circuit

5.2 Current Detection Circuit (V/W)

The Phase current detection (V/W) are realized through 2 channel Delta-Sigma Modulator. The Phase current (U) can be calculated by software.

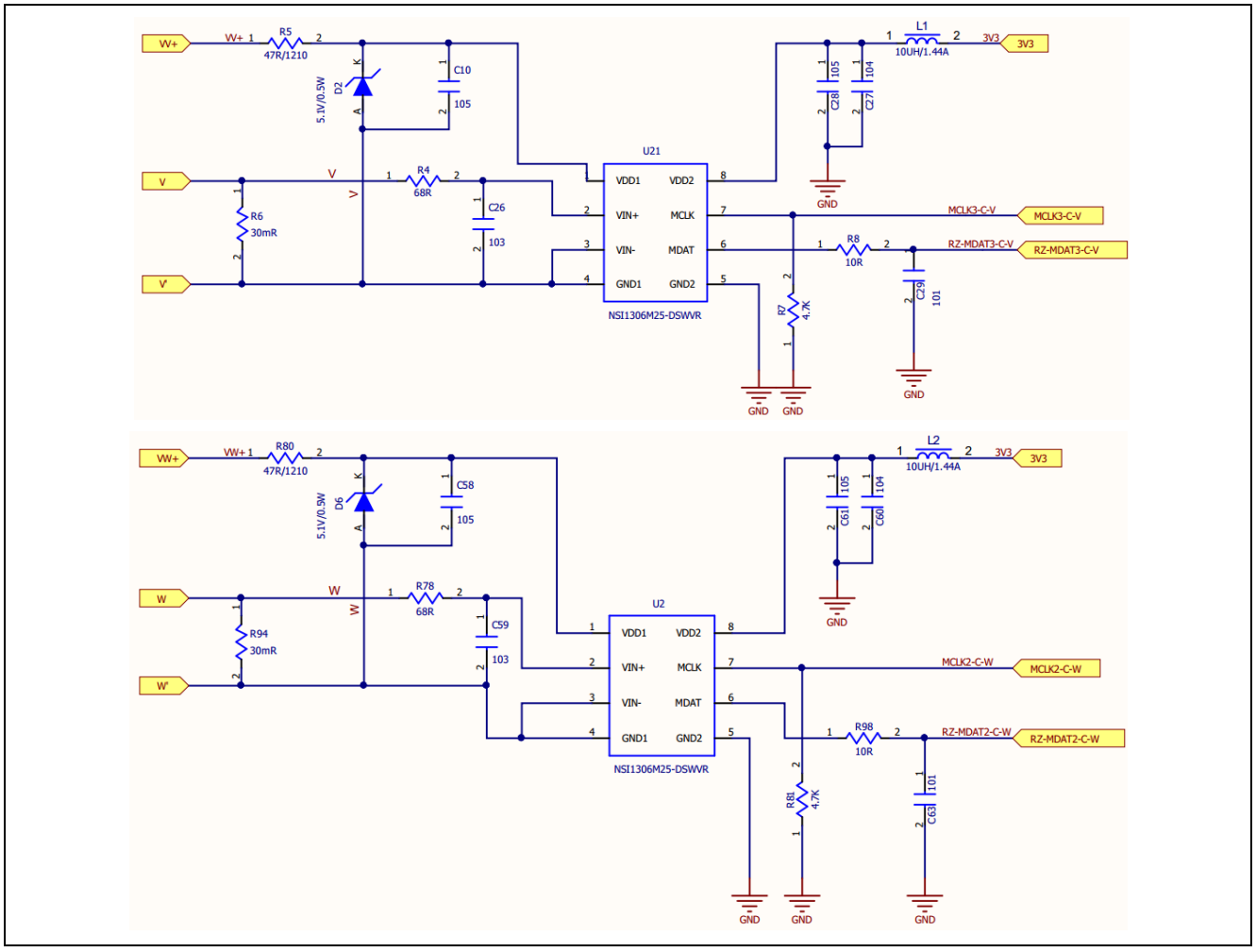

Figure 5-2 Current Detection Circuit (V/W)

5.3 Bus Voltage Detection Circuit (220V)

The bus voltage detection is realized through 1 channel Delta-Sigma Modulator.

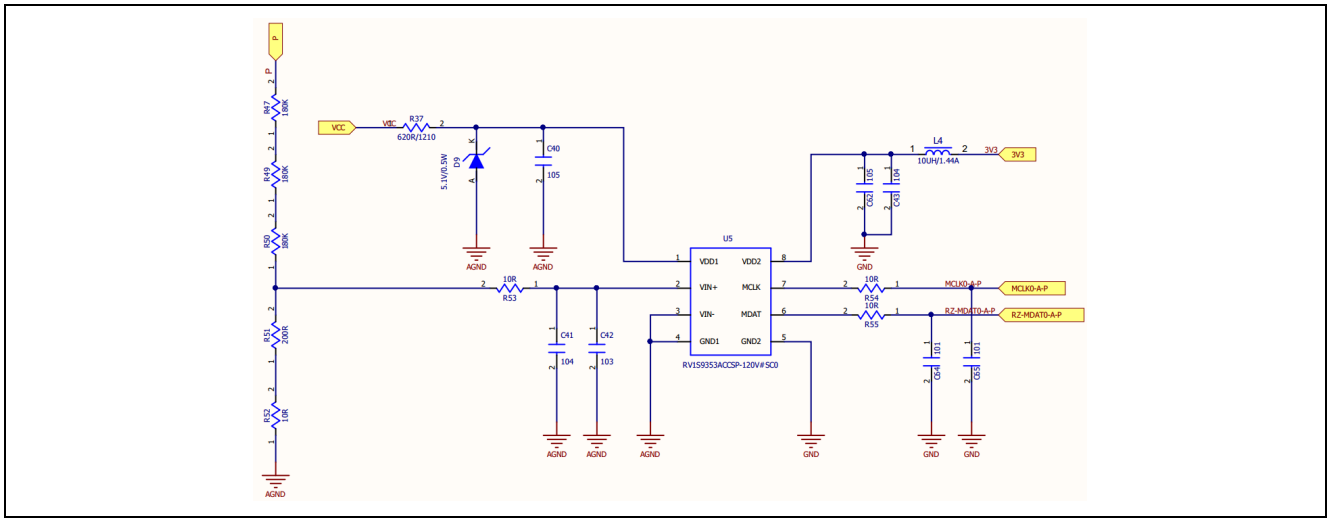

Figure 5-3 Bus Voltage Detection Circuit (220V)

6. MCU Pin Map

Table 6-1 Pin Map (1/5)

225	BGA 225	Pin Name	Signal name
175	C4	P00_0	Digital output 8
174	D5	P00_1	F-PLS Signal input (MTIC5V)
177	A3	P00_2	R-PLS Signal input (MTIC5V)
178	B3	P00_3	CLK enable
179	A4	P00_4	DS Modulator 1(MCLK0-A)
180	B4	P00_5	DS Modulator 1(MDAT0-A)
181	C3	P00_6	U+ (MTIOC3B-B)
182	D4	P00_7	V+ (MTIOC4A-B)
183	A2	P01_0	V- (MTIOC4C-B)
1	D3	P01_1	U- (MTIOC3D-B)
2	B2	P01_2	W+ (MTIOC4B-B)
3	C2	P01_3	W- (MTIOC4D-B)
4	E4	P01_4	FO_INT# (IRQ3)
5	B1	P01_5	Digital output 6
7	D2	P01_6	Encoder1-EZ1RX (MTIOC1A/GTIOC11A)
9	C1	P01_7	TP11
8	E3	P02_0	CANTX1
10	D1	P02_1	Mode setting (MDW)
13	F3	P02_2	Encoder2-EZ2RX (MTIOC8A/GTIOC8A)
12	E1	P02_3	CANRX1
14	F4	P02_4	JTAG (TDO)
15	F2	P02_5	JTAG (TDI)
16	F5	P02_6	JTAG (TMS)
17	F1	P02_7	JTAG (TCK)
18	G3	P03_0	LED4 (ENCIF08)
20	G1	P03_5	NC
22	G4	P03_6	Digital input 4 (IRQ8)
21	G5	P03_7	Digital input 5 (IRQ9)
23	H1	P04_0	RXD3
24	H2	P04_1	TXD3
25	H4	P04_4	LED6 (ENCIF10)
26	H3	P04_5	Mode setting (MD0)
27	H5	P04_6	Mode setting (MD1)
29	J1	P04_7	Mode setting (MD2)
28	J5	P05_0	LED7 (ENCIF11)
31	J2	P05_1	Digital input 6 (IRQ13)
30	J4	P05_2	Digital input 7 (IRQ14)
32	J3	P05_3	Digital input 8 (IRQ15)
35	K1	P05_4	NC
34	K2	P05_5	ETH1_LINK
36	K3	P05_6	ETH1_INT# (IRQ12)
38	M1	P05_7	ETH1_TXD2
37	L2	P06_0	ETH1_TXD3
39	L3	P06_1	ETH1_REFCLK

Table 6-2 Pin Map (2/5)

225	BGA 225	Pin Name	Signal name
40	M2	P06_2	ETH1_TXD1
41	K4	P06_3	ETH1_TXD0
42	N1	P06_4	ETH1_TXC
43	N2	P06_5	ETH1_TXEN
44	L4	P06_6	ETH1_RXD0
45	M3	P06_7	ETH1_RXD1
46	P1	P07_0	ETH1_RXD2
47	N3	P07_1	ETH1_RXD3
48	P2	P07_2	ETH1_RXDV
49	M4	P07_3	ETH1_EXC
50	R2	P07_4	USB_VBUSIN
53	N4	P08_4	ETH0_RXD3
54	P3	P08_5	ETH0_RXDV
56	M5	P08_6	ETH0_EXC
57	N5	P08_7	ETH_MDC
58	P4	P09_0	ETH_MDIO
59	R3	P09_1	ETH0_REFCLK
60	N6	P09_2	ETH0_INT# (IRQ0)
61	R4	P09_3	ETH0_TXD3
62	M6	P09_4	ETH0_TXD2
63	N7	P09_5	ETH0_TXD1
64	M7	P09_6	ETH0_TXD0
65	L7	P09_7	ETH0_TXC
66	N8	P10_0	ETH0_TXEN
67	M8	P10_1	ETH0_RXD0
68	L8	P10_2	ETH0_RXD1
69	L9	P10_3	ETH0_RXD2
70	M9	P10_4	ETH0_LINK
89	N11	P12_4	DSW-CATID0
90	L10	P13_2	ESC_I2CCLK-B
91	N12	P13_3	ESC_I2CDATA-B
92	L12	P13_4	ESC_RESETOUT#
94	M12	P13_5	Encoder1-EA1RX (MTCLKA)
95	M13	P13_6	Encoder1-EB1RX (MTCLKB)
96	M11	P13_7	Encoder2-EA2RX (MTCLKC)
97	L13	P14_0	Encoder2-EB2RX (MTCLKD)
98	L14	P14_1	DSW-CATID2
99	K12	P14_2	LED_INT# (IRQ6)
100	M14	P14_3	DSW-CATID3
101	J13	P14_4	XSPI0_DS
102	J12	P14_5	XSPI0_CKN
103	K13	P14_6	XSPI0_CKP
104	M15	P14_7	XSPI0_IO0
105	L11	P15_0	XSPI0_IO1
106	K14	P15_1	XSPI0_IO2
107	K15	P15_2	XSPI0_IO3

Table 6-3 Pin Map (3/5)

225	BGA 225	Pin Name	Signal name
108	K11	P15_3	XSPI0_IO4
109	H13	P15_4	XSPI0_IO5
110	J14	P15_5	XSPI0_IO6
112	H12	P15_6	XSPI0_IO7
111	J15	P15_7	XSPI0_CS0
113	G13	P16_0	XSPI0_CS1
114	H11	P16_1	Encoder1-EZ1TX (ENCIF02)
115	H14	P16_2	Encoder1-EZ1EN (ENCIF03)
116	G12	P16_3	Encoder1-EB1TX (ENCIF04)
117	H15	P16_5	RS485 (TXD0)
118	G11	P16_6	RS485 (RXD0)
119	G14	P16_7	RS485 (D/R)
121	F12	P17_0	Mode setting (MDD)
120	F14	P17_3	DSW-CATID4
124	F13	P17_4	Digital output 1 (LEAD)
123	F15	P17_5	Digital output 3 (Z-TX)
122	G15	P17_6	Encoder1-EB1EN
125	E15	P17_7	Digital output 2 (LAG)
126	E14	P18_0	DSW-CATID1
127	D15	P18_1	RD1_INT# (IRQ10)
128	D14	P18_2	Output control C for Power Board
129	E13	P18_3	Output control A for Power Board
130	E12	P18_4	R-LMT#
131	D13	P18_5	Output control B for Power Board
132	C15	P18_6	RD2_INT# (IRQ11, Reserved)
134	B15	P19_0	Mode setting (MDV4)
155	B9	P20_1	LED2 / Mode setting (MDV0)
156	D8	P20_2	LED0 / Mode setting (MDV1)
157	D9	P20_3	LED1 / Mode setting (MDV2)
158	A9	P20_4	LED3 / Mode setting (MDV3)
159	B8	P21_1	SCL1
160	C8	P21_2	SDA1
161	A8	P21_3	DS Modulator (MTIOC6C_CLK)
162	E7	P21_4	NC
163	C7	P21_5	DS Modulator 2 (MCLK2-C)
164	D7	P21_6	DS Modulator 2 (MDAT2-C)
165	B7	P21_7	DS Modulator 3 (MCLK3-C)
166	A7	P22_0	DS Modulator 3 (MDAT3-C)
167	A6	P22_1	LED5
168	C6	P22_2	DSW-CATID5
169	B6	P22_3	Digital output 4 (ALM#)
170	D6	P23_7	Digital output 5
171	A5	P24_0	RXD1
172	B5	P24_1	Digital output 7
173	C5	P24_2	TXD1
136	B13	AN000	Reserved

Table 6-4 Pin Map (4/5)

225	BGA 225	Pin Name	Signal name
137	C12	AN001	Reserved
138	B14	AN002	Reserved
139	C13	AN003	Reserved
144	B12	AN100	Reserved
145	A14	AN101	Reserved
146	B11	AN102	Reserved
147	A13	AN103	Reserved
151	A12	AN104	Reserved
152	B10	AN105	Reserved
153	A11	AN106	Reserved
154	C9	AN107	Reserved
135	C14	AVCC18_TSU	Connect to +1V8
88	P10	AVCC18_USB	Connect to +1V8
19	G2	BSCANP	Connect to GND
73	R7	EXTAL	25M CRYSTAL IN
71	R6	EXTCLKIN	NC
51	P5	MDX	Connect to GND
52	P6	RES#	RESET#
11	E2	TRST#	NC
83	P13	USB_DM	USB_DM
84	R13	USB_DP	USB_DP
86	P15	USB_RREF	USB_RREF
143	E11	VCC18_ADC0	Connect to +1V8
150	E9	VCC18_ADC1	Connect to +1V8
77	P9	VCC18_PLL0	Connect to +1V8
78	N9	VCC18_PLL1	Connect to +1V8
81	P11	VCC18_USB	Connect to +1V8
55	L6	VCC1833_0	Connect to +3V3
33	K5	VCC1833_1	Connect to +3V3
176	E5	VCC1833_2	Connect to +3V3
93	J11	VCC1833_3	Connect to +3V3
133	M10	VCC1833_4	Connect to +3V3
6	L5	VCC33	Connect to +3V3
82	R11	VCC33_USB	Connect to +3V3
72	P7	VDD	Connect to +1V1
141	C11	VREFH0	Connect to +1V8
148	C10	VREFH1	Connect to +1V8
74		VSS	Connect to GND
76		VSS	Connect to GND
79		VSS	Connect to GND
140		VSS	Connect to GND
149		VSS	Connect to GND
142	D12	VSS_ADC	Connect to GND
80		VSS_USB	Connect to GND
85		VSS_USB	Connect to GND
87		VSS_USB	Connect to GND

Table 6-5 Pin Map (5/5)

225	BGA 225	Pin Name	Signal name
75	R8	XTAL	25M CRYSTAL IN
184		VSS	Connect to GND
185		VSS	Connect to GND
186		VSS	Connect to GND
187		VSS	Connect to GND
188		VCC33	Connect to +3V3
189		VCC33	Connect to +3V3
190		VDD	Connect to +1V1
191		VDD	Connect to +1V1
192		VSS	Connect to GND
193		VDD	Connect to +1V1
194		VDD	Connect to +1V1
195		VDD	Connect to +1V1
196		VDD	Connect to +1V1
197		VSS	Connect to GND
198		VSS	Connect to GND
199		VSS	Connect to GND
200		VDD	Connect to +1V1
201		VDD	Connect to +1V1
202		VSS	Connect to GND
203		VSS	Connect to GND
204		VSS	Connect to GND
205		VDD	Connect to +1V1
206		VDD	Connect to +1V1
207		VSS	Connect to GND
208		VSS	Connect to GND
209		VSS	Connect to GND
210		VDD	Connect to +1V1
211		VDD	Connect to +1V1
212		VDD	Connect to +1V1
213		VDD	Connect to +1V1
214		VSS	Connect to GND
215		VSS	Connect to GND
216		VSS	Connect to GND
217		VCC33	Connect to +3V3
218		VSS	Connect to GND
219		VSS_USB	Connect to GND
220		VSS_USB	Connect to GND
221		VSS	Connect to GND
222	R10	AVCC18_USB	Connect to +1V8
223		VSS_USB	Connect to GND
224		VSS	Connect to GND
225		VSS	Connect to GND

7. BOM List for Renesas Key Parts

Renesas provides the complete design files for this AC Servo Solution application, includes SCH, PCB, BOM, etc.

Here are the Renesas Key parts used in this system, for more information, please refer to the related files from Renesas.

BOM List from Controller Board

Designator	Description	Manufacturer	Mfg Part Number	Quantity
U1	PMIC for Applications Requiring up to 6 A	Renesas	DA9061-00AM1	1
U2	4.5V to 42V, 5A, DC/DC Synchronous Step-Down Regulator	Renesas	RAA211450GSP#HA0	1
U3	Renesas RZ-T2M MCU	Renesas	R9A07G075M24GBA	1
U5	IC BUS SWITCH 4 X 2:1 16TSSOP	Renesas	QS3VH257PAG8	1
U8	IC FLASH 128MBIT SPI/QUAD 8SOIC	Renesas	AT25SF128A-SHB-T	1
U9	IC EEPROM 16KBIT I2C 400KHZ 8SOP	Renesas	R1EX24016ASAS	1
U11	IC TRANSCEIVER HALF 1/1 8SOIC	Renesas	ISL3172EIBZ	1
U12	IC CLK BUFFER 1:4 160MHZ 8SOIC	Renesas	551MILF	1
U14, U15, U18, U19, U22	OPTO COUPLER IN 5PIN SSOP	Renesas	RV1S9213ACCSP-10YV#	5
U16, U17, U20, U21, U23, U24, U25, U26, U27, U28, U29	OPTOISOLATOR 2.5KV DARL 4SMD	Renesas	PS2733-1-A	11
U30, U43	IC TXRX NON-INVERT 5.25V 20SSOP	Renesas	74FCT245CTPYG	2
U40	IC DRIVER 4/0 24QFN	Renesas	ISL32179EFRZ	1
U41, U42	IC RECEIVER 0/4 24QFN	Renesas	ISL32177EFRZ	2

BOM List from Inverter Board

Designator	Description	Manufacturer	Mfg Part Number	Quantity
U3, U7, U19	OPTOISOLATOR 5KV TRANS 4SMD	Renesas	PS2561DL-1	3
U5	DELTA-SIGMA MODULATOR (OPTOCPLR)	Renesas	RV1S9353A	1
U8, U9, U10, U11, U12, U13	15Mbps IPM Drive Photocouplers	Renesas	RV1S9061A	6
U14	OPTOISO 3.75KV PUSH PULL 6SO	Renesas	PS8101-AX	1
U15, U16, U17	OPTOISOLATOR 3.75KV TRANS 4SOP	Renesas	PS2761B-1	3

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Jun.7, 2022	–	First Edition issued
2.00	Aug.9, 2022	1,3-5,10 7 9 18-23	Description for AC Servo Solution (RZ/N2L) added. Description of Encoder power supply added. Description of EtherCAT-ID Setting Switch added. Typo fixed.

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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