RZ/T2M Group, RZ/N2L Group

CN032 AC Servo Solution Hardware Manual (for RZ/T2M, RZ/N2L)

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.

<<Caution when handling the solution board>>
Don't touch the board while power is supplied because CN032 AC servo solution board contains high voltage circuits.

Target Device

RZ/T2M Group

RZ/N2L Group

Related Document

- CN032 AC Servo Solution Hardware Manual (for RZ/T2M, RZ/N2L) (this manual)

- CN032 AC Servo Solution Hardware Manual (for RZ/T2L)

- 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

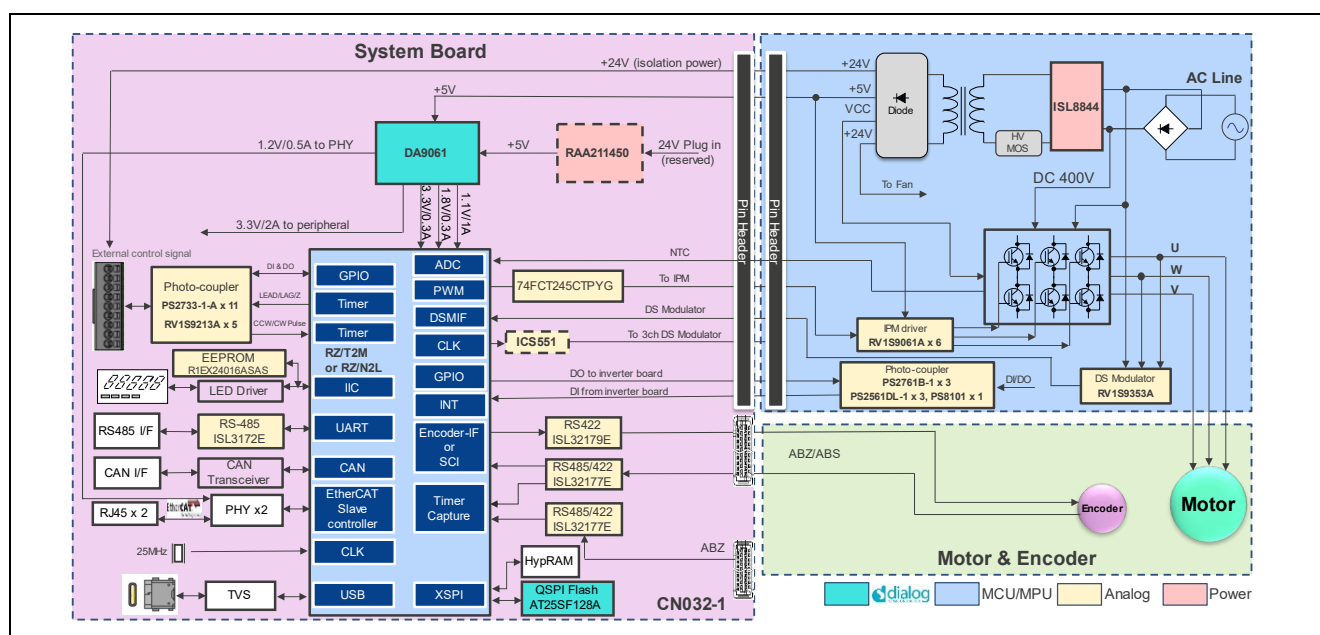The CN032 AC Servo Solution block image is shown in Figure 1-1.

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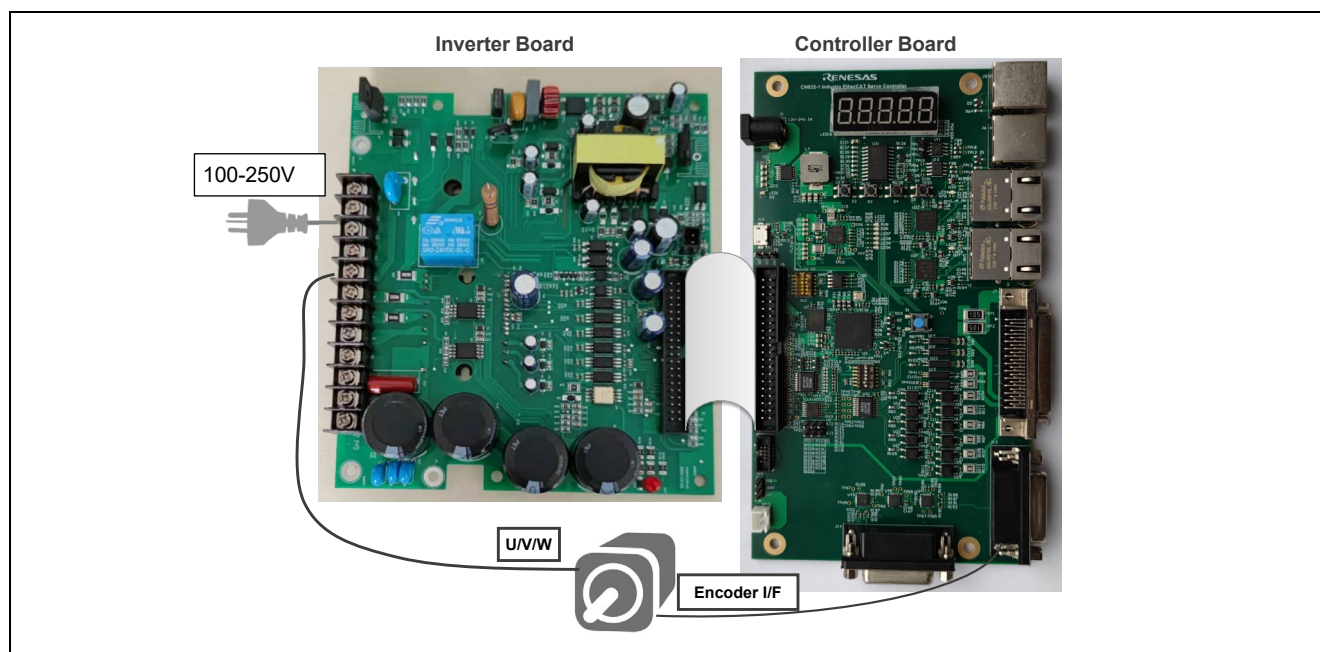
The CN032 AC Servo Solution image is shown in Figure 1-2.

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 x 2 (Support absolute encoder using ENCIF pins and incremental encoder)	Encoder Interface x 2 (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

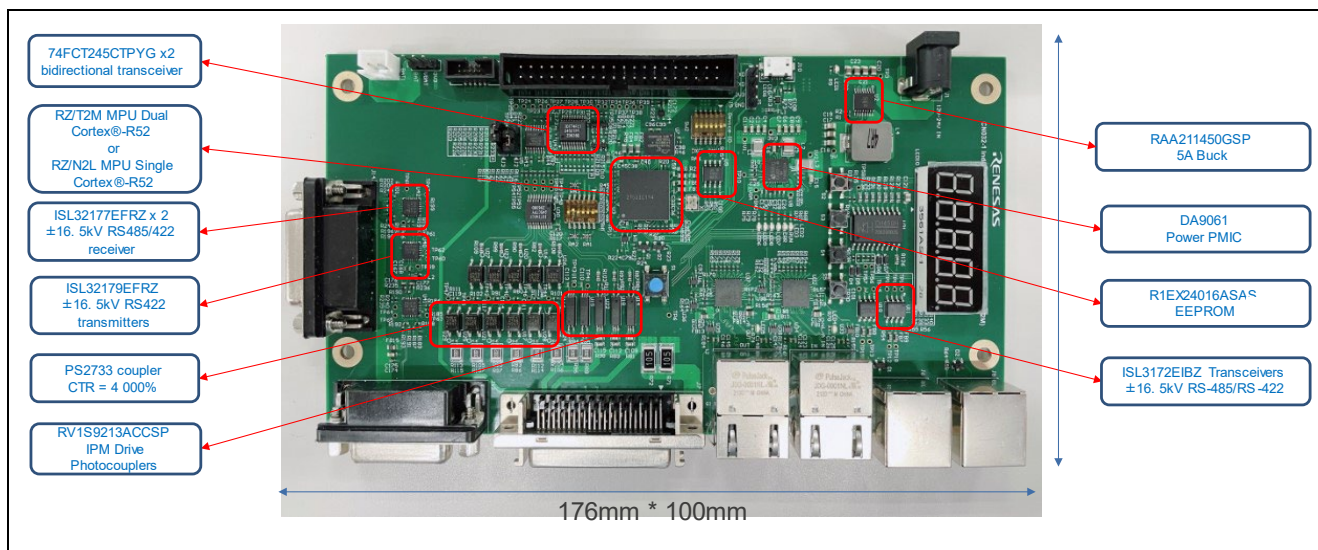The main parts in Controller Board description are shown in Figure 2-1.

Figure 2-1 Controller board

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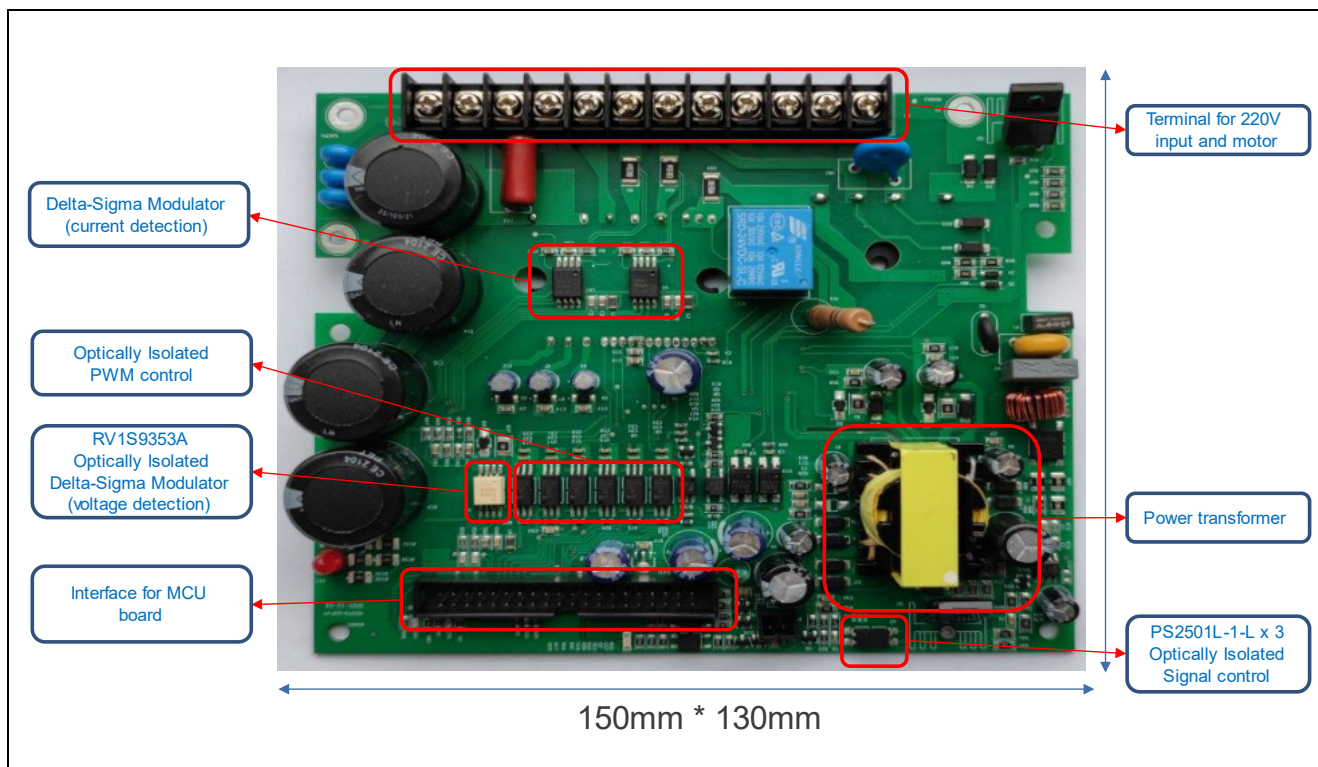
Figure 2-2 Inverter board

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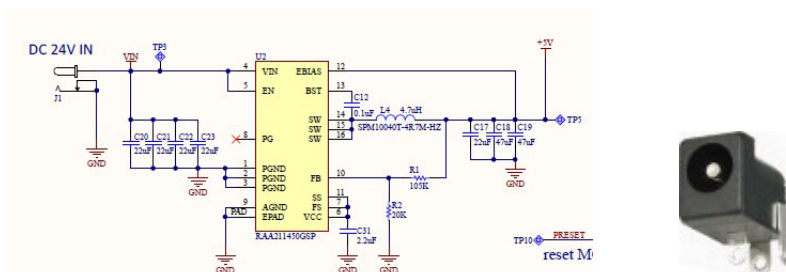
Figure 3-3 12-24V DC power supply of controller board

3.2　JTAG

Cortex 10 pin 0.05" JTAG Connector Pinout
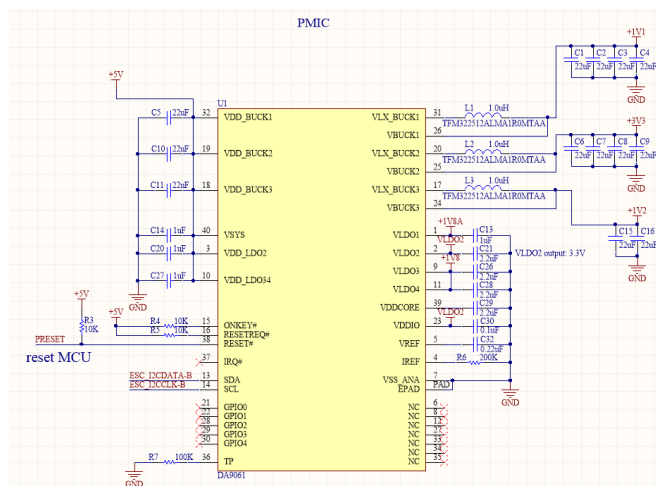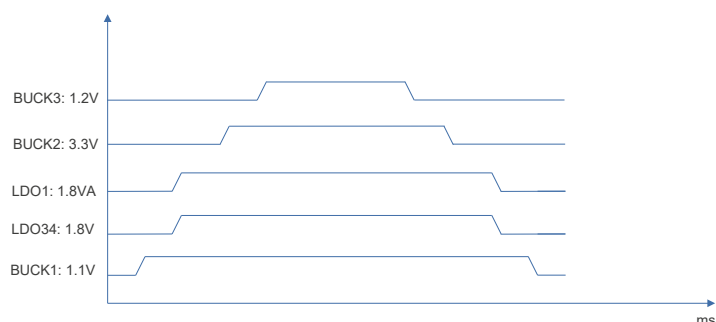The 10 pin cable is Samtec, part number FFSD-05-D-12.00.01-N
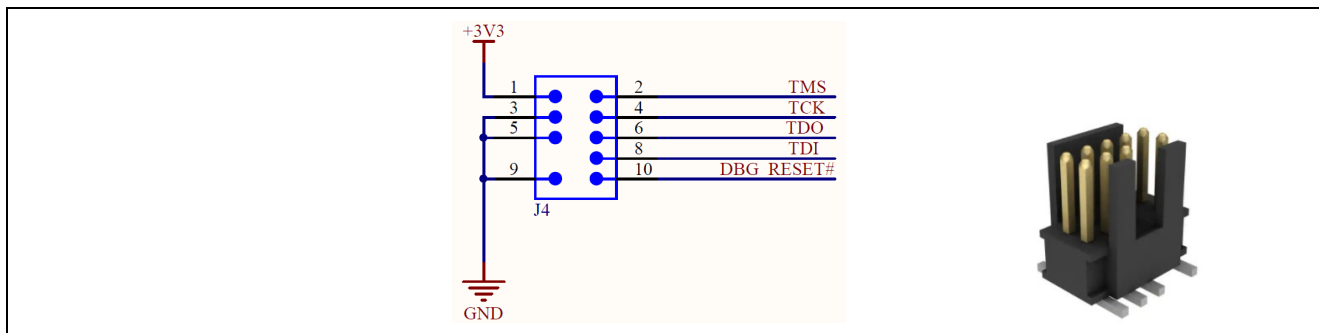
Figure 3-4 JTAG Interface

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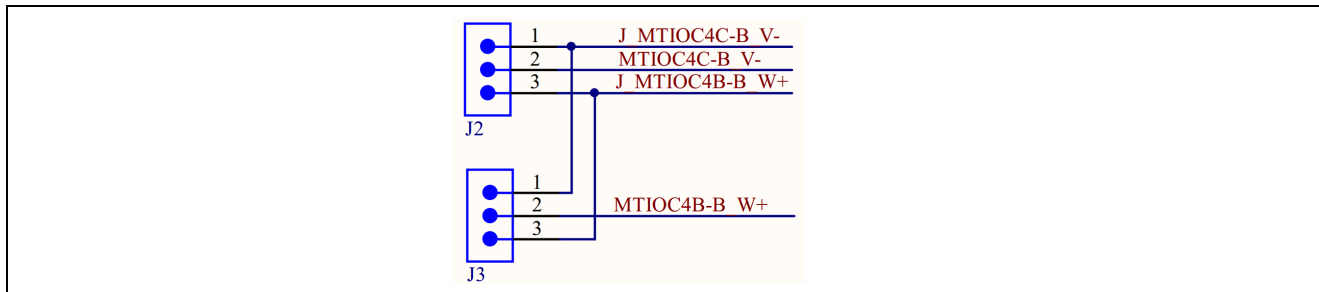
Figure 3-5 Jumper setting for V/W PWM signal

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).
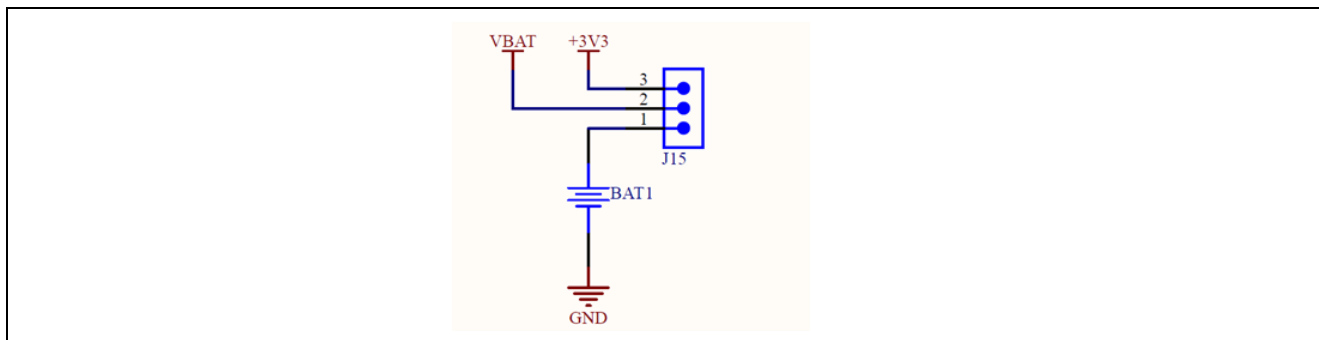
Figure 3-6 Jumper setting for encoder power supply

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)
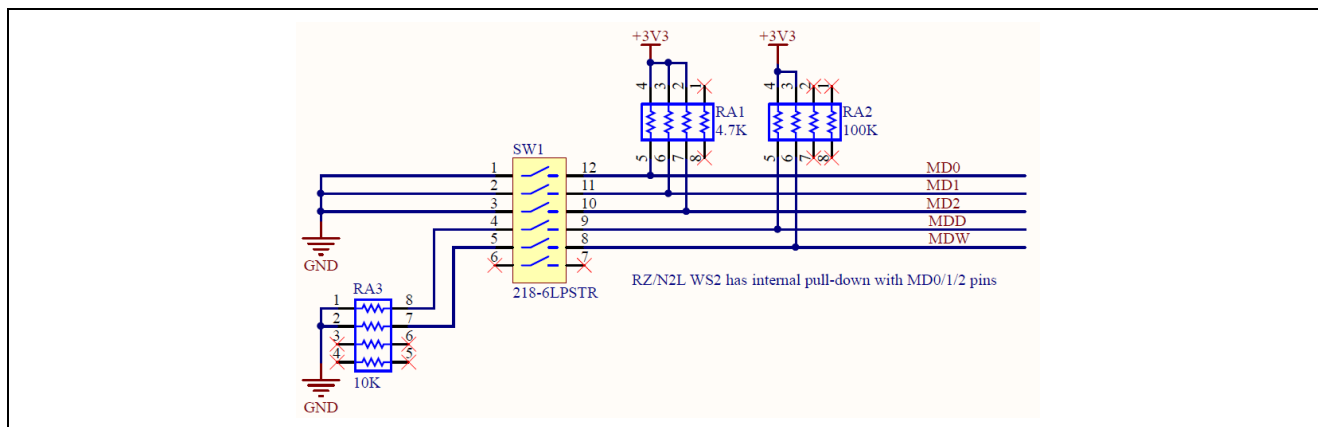
Figure 3-7 Operating Mode

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 400MHz.
1	1 wait

Note) Function in gray font above are not supported.

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.
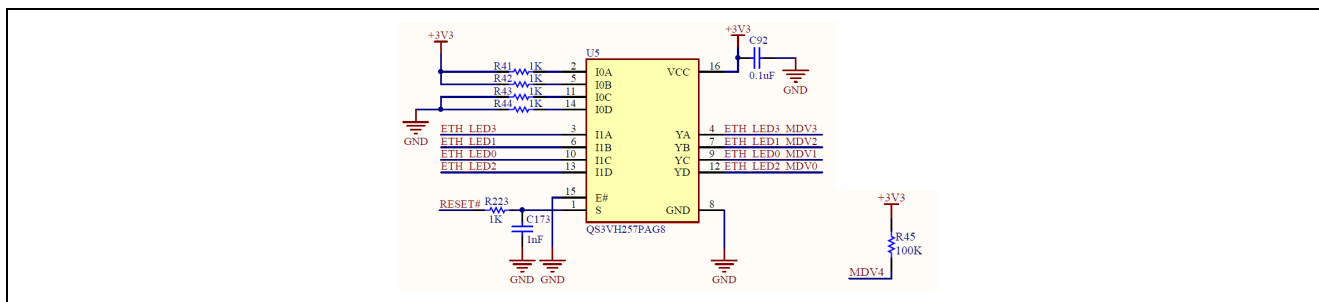
Figure 3-8 Operating Voltage

3.4.2 EtherCAT-ID Setting Switch

A board specific EtherCAT ID can optionally be set.
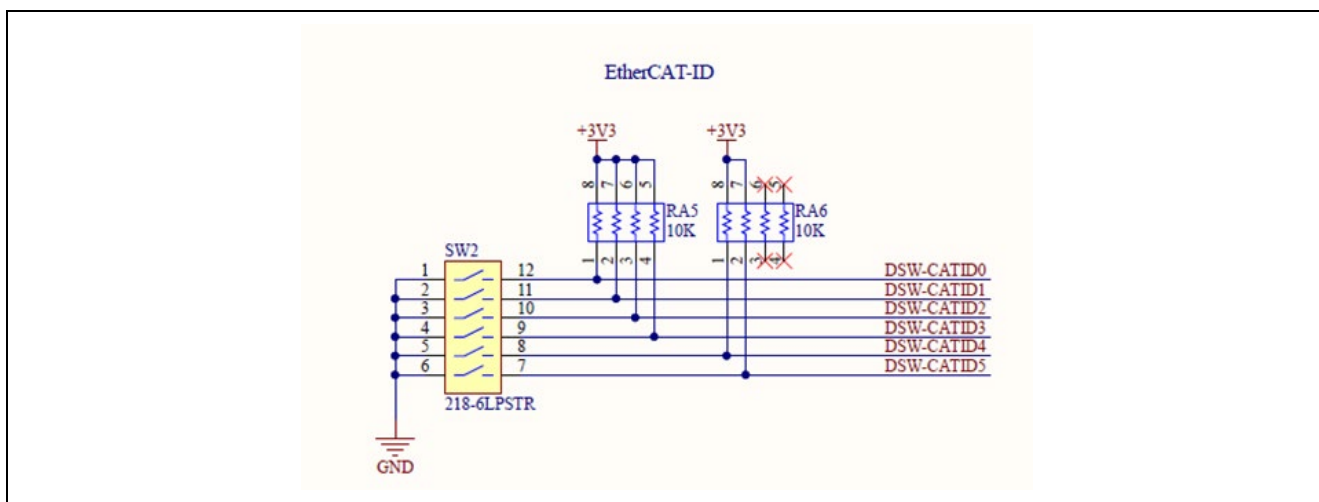
Figure 3-9 EtherCAT-ID setting switch

3.5   LEDs

There are 9 LEDs in the controller board. Please see below for the assignment.
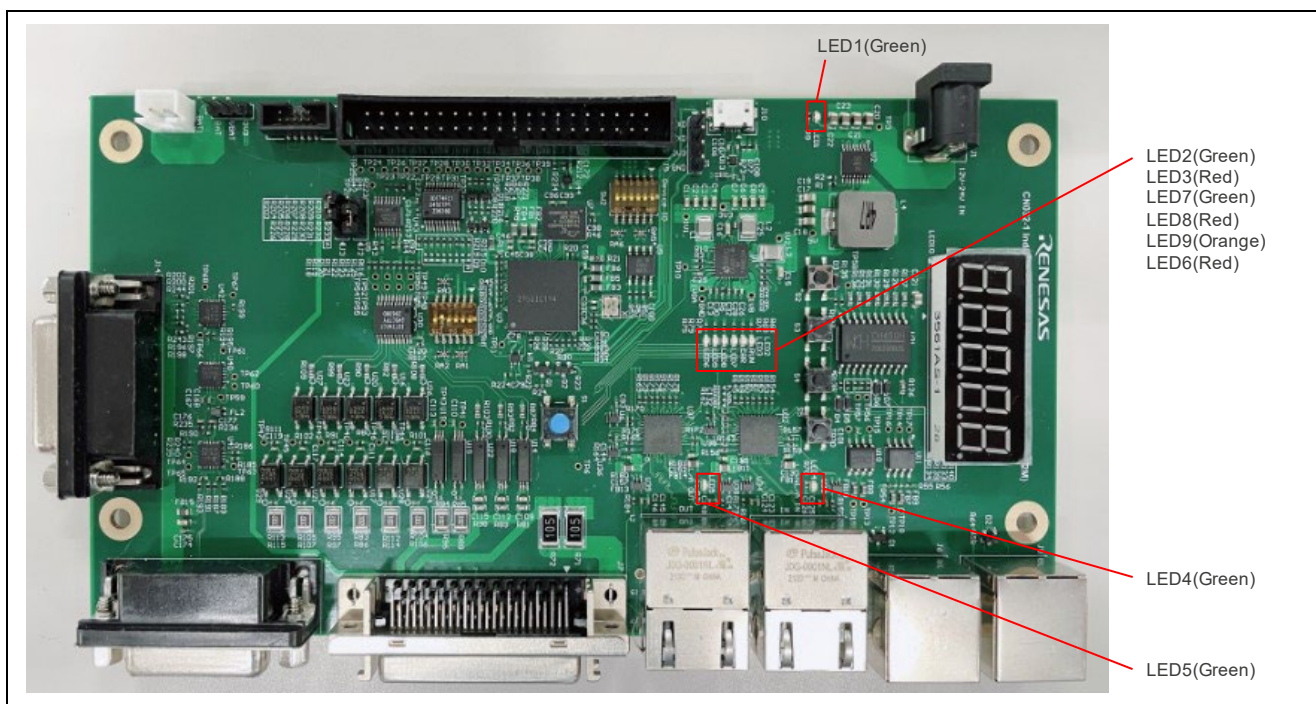
Figure 3-10 Controller board LED

No.	Item		Silk name	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.
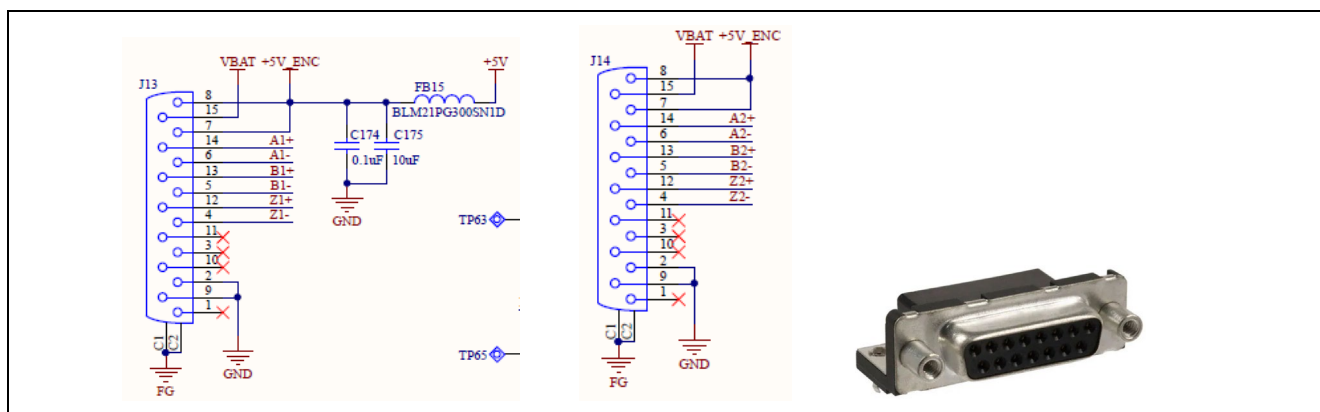
Figure 3-11 Encoder Interface

There are the receiver IC and the transmitter IC for communication with encoder.
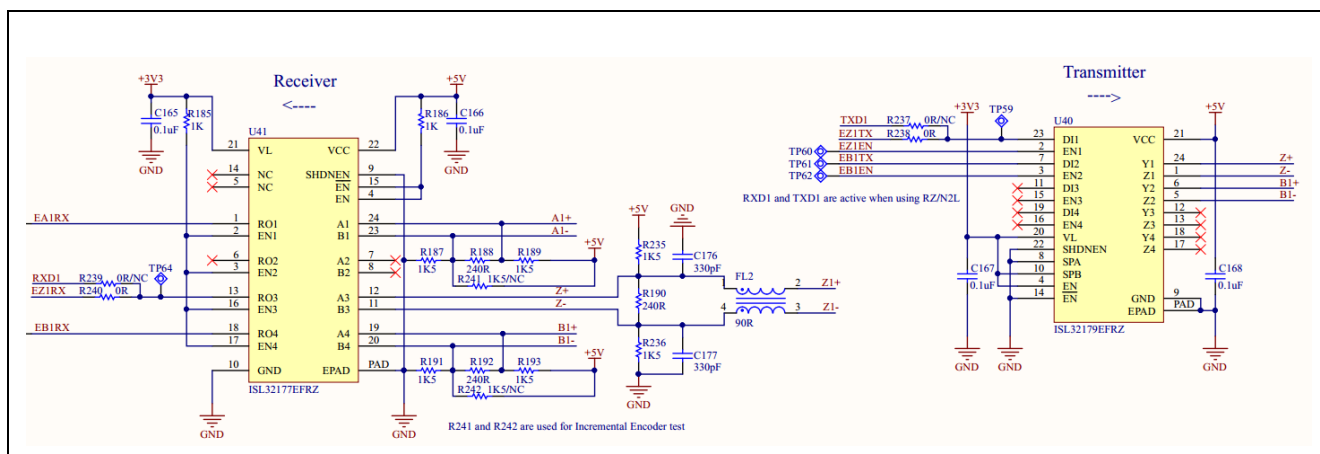
Figure 3-12 Encoder Circuit

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.
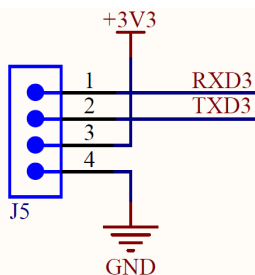
Figure 3-13 UART Interface

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.
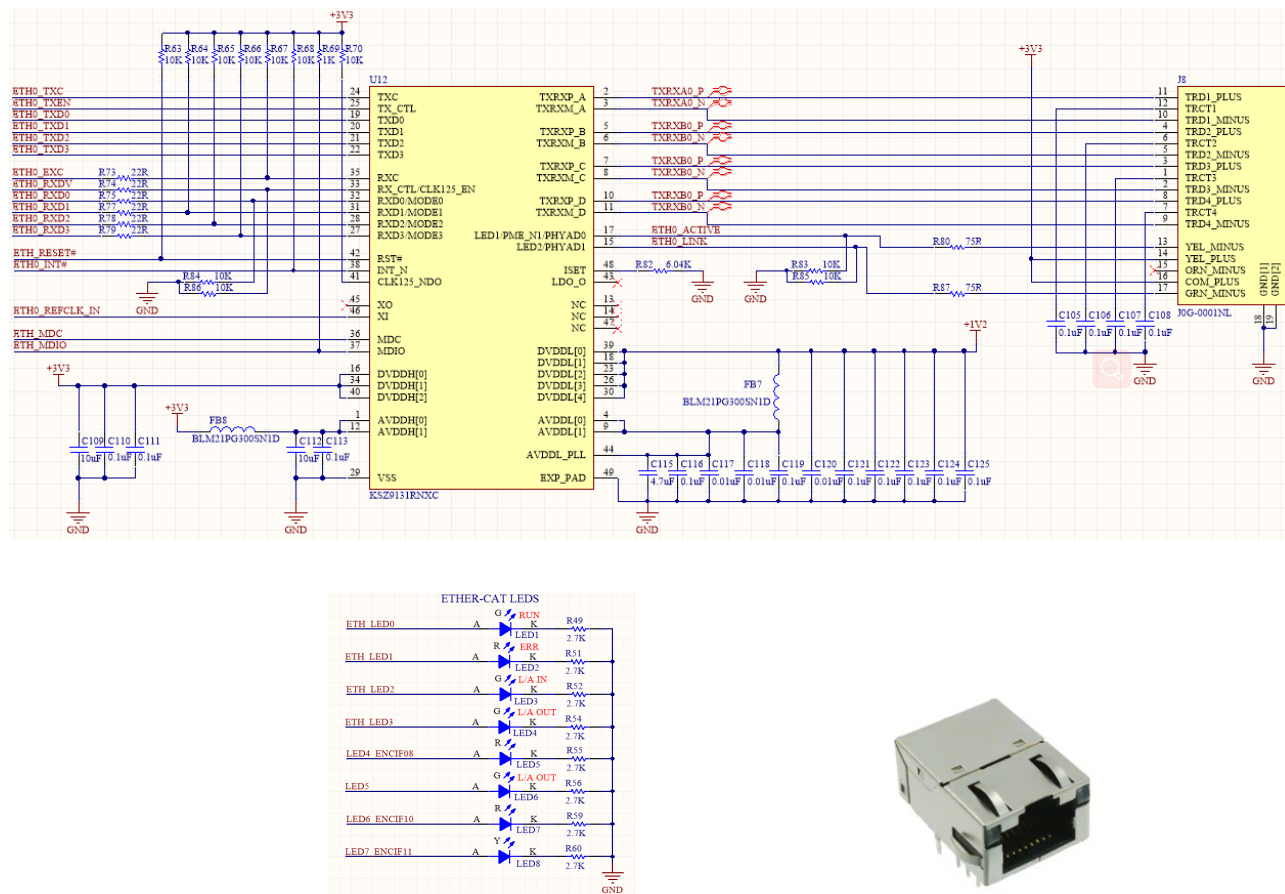
Figure 3-14 EtherCAT Interface

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.
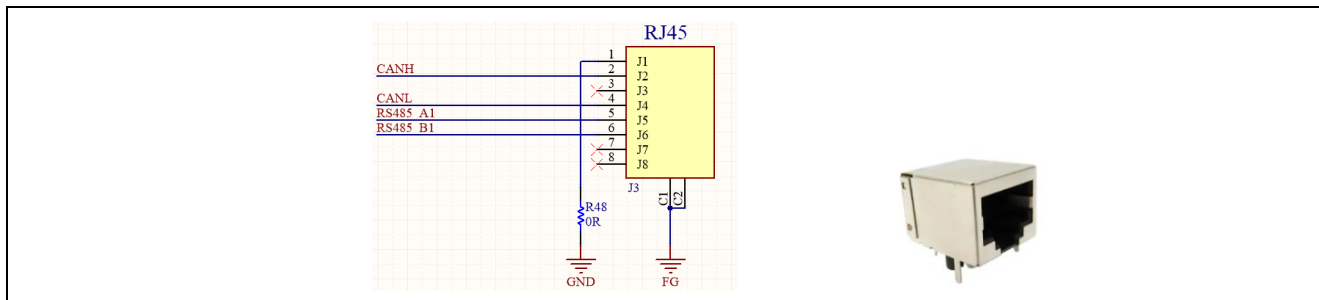
Figure 3-15 RS485&CAN Interface

3.10 USB Interface

The micro–B USB connector used for MCU works on USB boot mode, part number 10118192-0001LF.
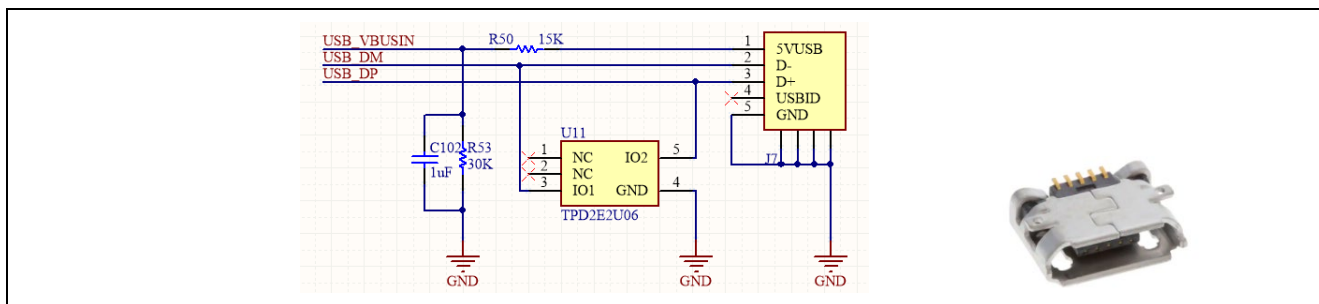
Figure 3-16 USB Interface

3.11 External Control Interface

The external control interface support 8 channel digital output and 8 channel digital input control, part number HL-SCSI50HB90. SCSI-50P connector can be used as a male terminal.
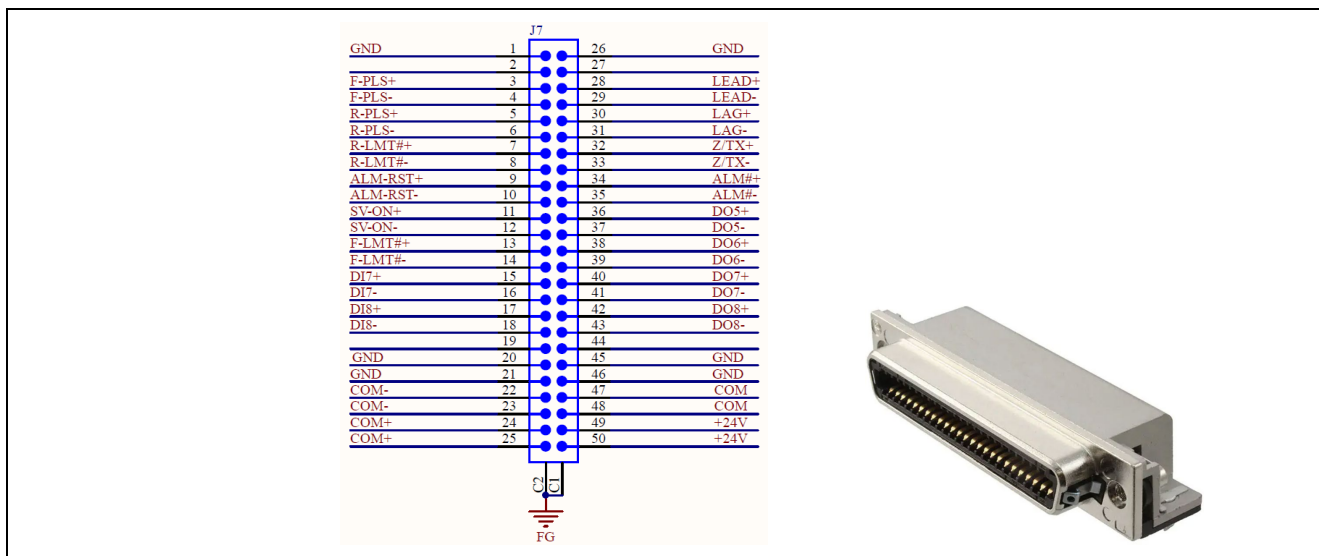
Figure 3-17 External Control Interfaces Interface

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.
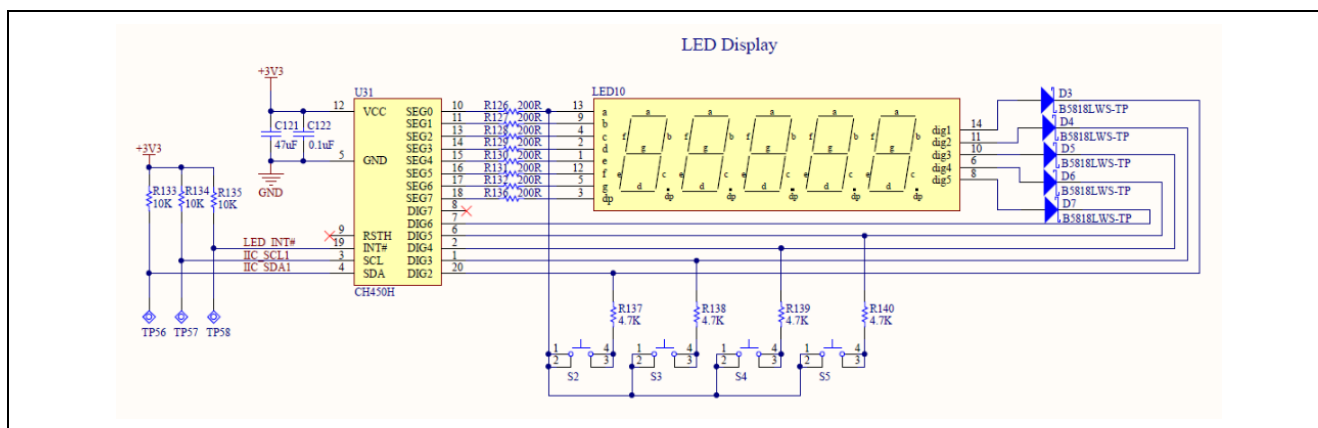
Figure 3-18 User Interface

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.

Controller board side   Inverter board side
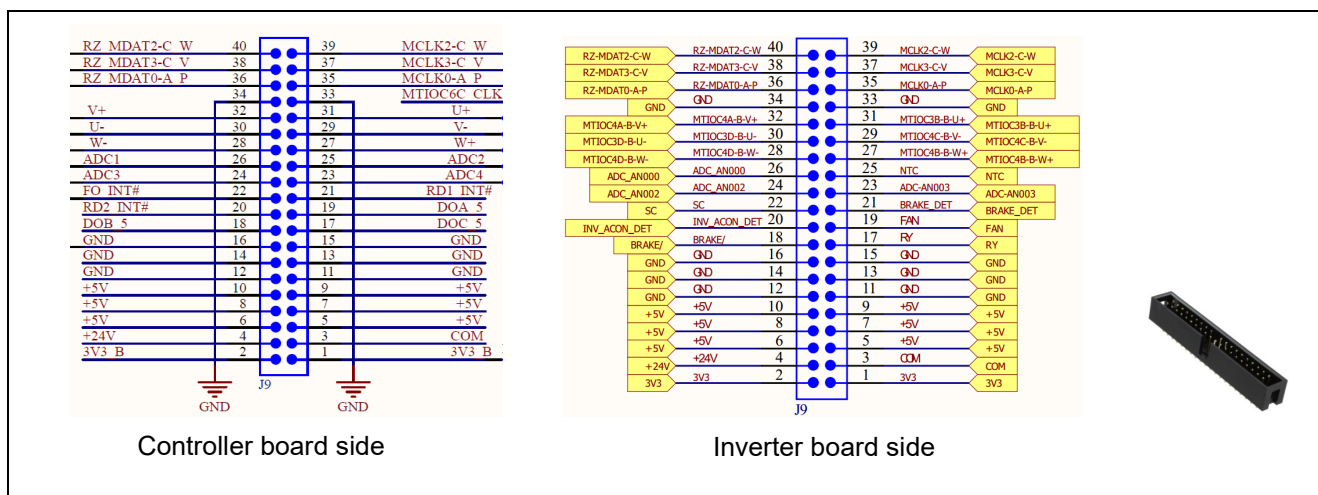
Figure 3-19 Power Board Interface

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.
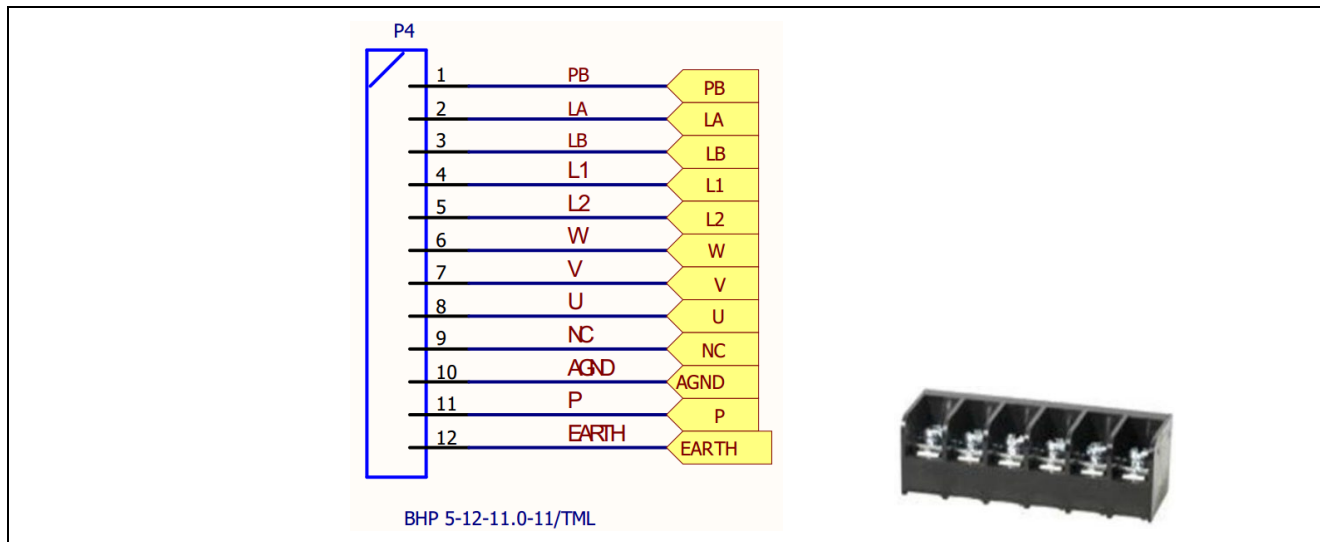
Figure 3-20 Inverter Board Interface

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
5-1	RS232 to USB converter, used to PC control by Renesas GUI
5-2	RS485 to USB converter, used to PC control by Renesas GUI
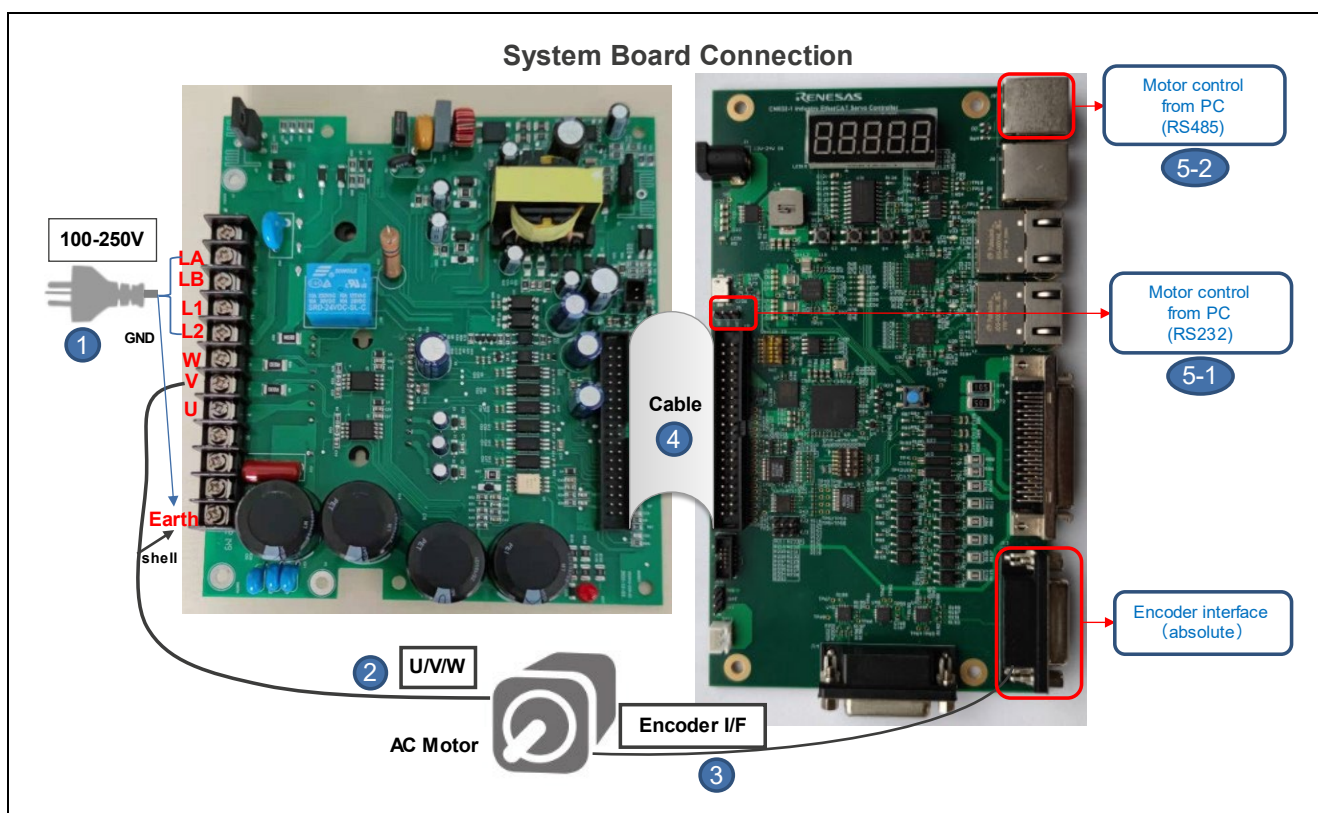
Figure 4-1 Connection Configuration

5. Detection Circuit

Table 5-1 is shown the current and voltage detection circuits mounted on the inverter board and the RZ/T2M or RZ/N2L 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 motor solution 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.
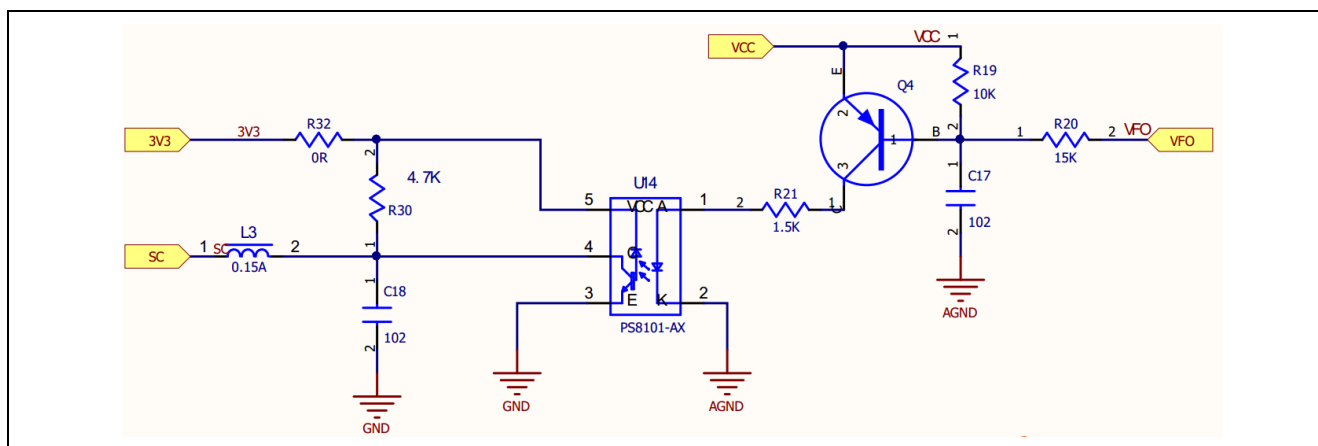
Figure 5-1 Fault Detection Circuit

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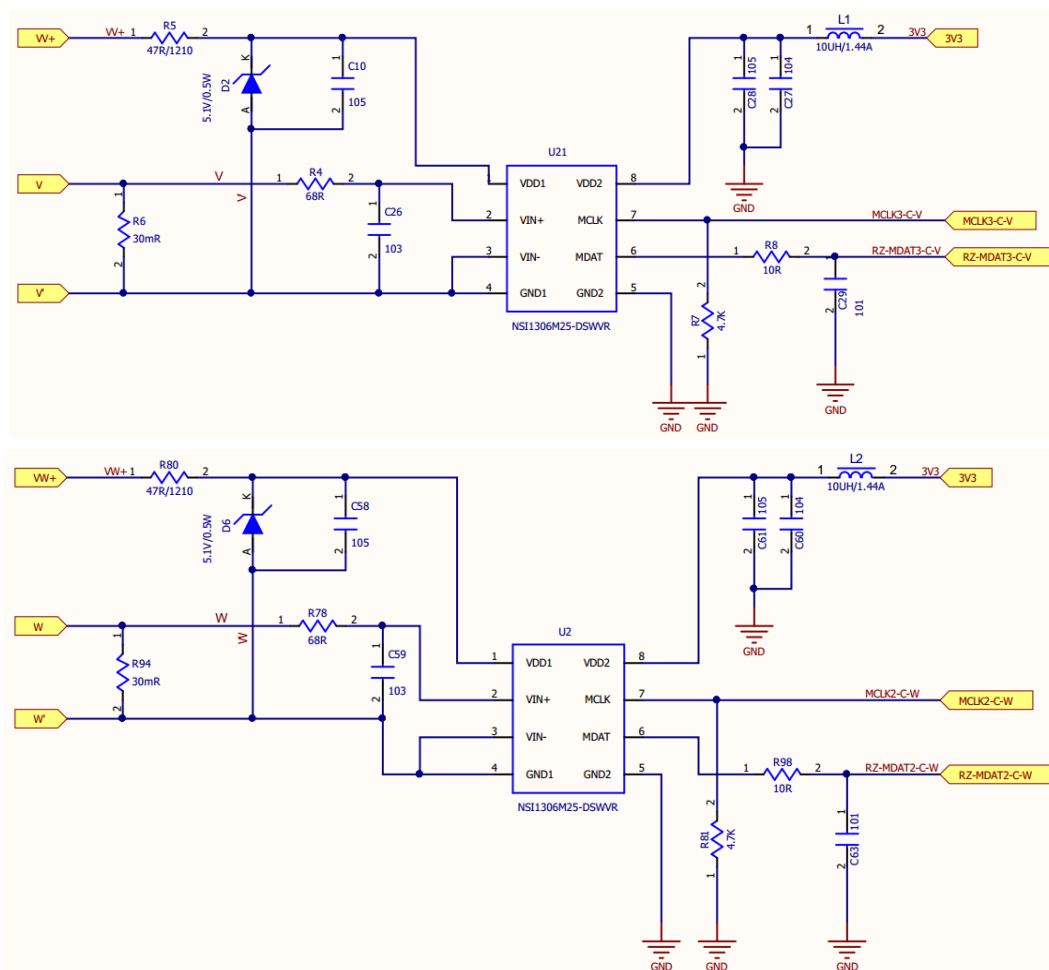
Figure 5-2 Current Detection Circuit (V/W)

5.3　Bus Voltage Detection Circuit (220V)

The bus voltage detection is realized through 1 channel Delta-Sigma Modulator.
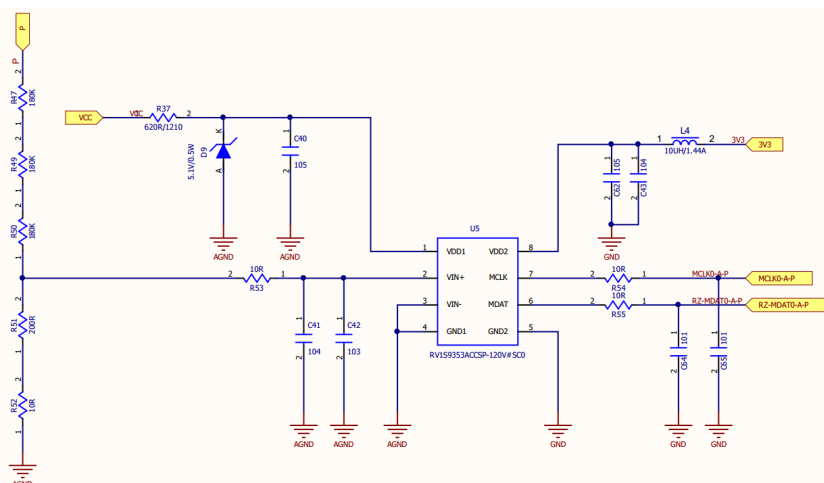
Figure 5-3 Bus Voltage Detection Circuit (220V)

6.   Precaution for operation

When using this kit, please kindly comply with the following 1 to 3:

1.   Use stable power supply with current 1[A] limit setting to inverter board.

2.   Do not use DC12-24[V] power supply jack to controller board.
     ※The power of controller is supplied from the inverter board.

3.   Even after turning off, please do not touch the inverter board when high voltage LED(D27) is on which could be about 3 minutes or more.

If motor malfunctions or makes noise during use, please turn off the power to the inverter board immediately.

If this malfunction symptom continues, please contact our sales office or agency.

7. MCU Pin Map

Table 6-1 Pin Map (1/5)

Pin number	Pin name	Signal name	Function
B13	AN000	ADC_AN000	-
C12	AN001	ADC_AN001	-
B14	AN002	ADC_AN002	-
C13	AN003	ADC_AN003	-
B12	AN100	NC	-
A14	AN101	NC	-
B11	AN102	NC	-
A13	AN103	NC	-
A12	AN104	NC	-
B10	AN105	NC	-
A11	AN106	NC	-
C9	AN107	NC	-
C14	AVCC18_TSU	-	-
P10	AVCC18_USB	-	-
R10	AVCC18_USB	-	-
G2	BSCANP	-	-
R7	EXTAL	-	-
R6	EXTCLKIN	NC	-
P5	MDX	GND	-
C4	P00_0	RZ_DO_CTL8	GPIO(output)
D5	P00_1	F-PLS	GPIO(input)
A3	P00_2	R-PLS	GPIO(input)
B3	P00_3	P00_3/CLK_EN	GPIO(output)
A4	P00_4	RZ_MCLK0-A_P	MCLK0
B4	P00_5	RZ_MDAT0-A_P	MDAT0
C3	P00_6	MTIOC3B-B_U+	MTIOC3B
D4	P00_7	MTIOC4A-B_V+	MTIOC4A
A2	P01_0	MTIOC4C-B_V-	MTIOC4C
D3	P01_1	MTIOC3D-B_U-	MTIOC3D
B2	P01_2	MTIOC4B-B_W+	MTIOC4B
C2	P01_3	MTIOC4D-B_W-	MTIOC4D
E4	P01_4	FO_INT#	POE0#
B1	P01_5	RZ_DO_CTL6	GPIO(output)
D2	P01_6	EZ1RX	ENCIF0
C1	P01_7	TP11	None
E3	P02_0	CANTX1	CANTX1
D1	P02_1	MDW	None
F3	P02_2	EZ2RX	MTIOC2A
E1	P02_3	CANRX1	CANRX1
F4	P02_4	TDO	SWD_TDO
F2	P02_5	TDI	SWD_TDI
F5	P02_6	TMS	SWD_TMS_SWDIO
F1	P02_7	TCK	SWD_TCK_SWCLK
G3	P03_0	LED4_ENCIF08	GPIO(output)

Table 6-2 Pin Map (2/5)

Pin number	Pin name	Signal name	Function
G1	P03_5	NC	None
G4	P03_6	ALM_RST	GPIO(input)
G5	P03_7	SV_ON	GPIO(input)
H1	P04_0	RXD3	RXD3
H2	P04_1	TXD3	TXD3
H4	P04_4	LED6_ENCIF10	GPIO
H3	P04_5	MD0	None
H5	P04_6	MD1	None
J1	P04_7	MD2	None
J5	P05_0	LED7_ENCIF11	GPIO(output)
J2	P05_1	F_LMT#	GPIO(input)
J4	P05_2	RZ_DI7	GPIO(input)
J3	P05_3	RZ_DI8	GPIO(input)
K1	P05_4	NC	None
K2	P05_5	ETH1_LINK	ESC_PHYLINK1
K3	P05_6	ETH1_INT#	IRQ12
M1	P05_7	ETH1_TXD2	ETH1_TXD2
L2	P06_0	ETH1_TXD3	ETH1_TXD3
L3	P06_1	ETH1_REFCLK	ETH1_REFCLK
M2	P06_2	ETH1_TXD1	ETH1_TXD1
K4	P06_3	ETH1_TXD0	ETH1_TXD0
N1	P06_4	ETH1_TXC	ETH1_TXCLK_TXC
N2	P06_5	ETH1_TXEN	ETH1_TXEN_TXCTL
L4	P06_6	ETH1_RXD0	ETH1_RXD0
M3	P06_7	ETH1_RXD1	ETH1_RXD1
P1	P07_0	ETH1_RXD2	ETH1_RXD2
N3	P07_1	ETH1_RXD3	ETH1_RXD3
P2	P07_2	ETH1_RXDV	ETH1_RXDV_CRSDC_RXCTL
M4	P07_3	ETH1_EXC	ETH1_RXCLK_REF_CLK_RXC
R2	P07_4	USB_VBUSIN	USB_VBUSIN
N4	P08_4	ETH0_RXD3	ETH0_RXD3
P3	P08_5	ETH0_RXDV	ETH0_RXDV_CRSDV_RXCTL
M5	P08_6	ETH0_EXC	ETH0_RXCLK_REF_CLK_RXC
N5	P08_7	ETH_MDC	ESC_MDC
P4	P09_0	ETH_MDIO	ESC_MDIO
R3	P09_1	ETH0_REFCLK	ETH0_REFCLK
N6	P09_2	ETH0_INT#	IRQ0
R4	P09_3	ETH0_TXD3	ETH0_TXD3
M6	P09_4	ETH0_TXD2	ETH0_TXD2
N7	P09_5	ETH0_TXD1	ETH0_TXD1
M7	P09_6	ETH0_TXD0	ETH0_TXD0
L7	P09_7	ETH0_TXC	ETH0_TXCLK_TXC
N8	P10_0	ETH0_TXEN	ETH0_TXEN_TXCTL
M8	P10_1	ETH0_RXD0	ETH0_RXD0
L8	P10_2	ETH0_RXD1	ETH0_RXD1
L9	P10_3	ETH0_RXD2	ETH0_RXD2

Table 6-3 Pin Map (3/5)

Pin number	Pin Name	Signal name	Function
M9	P10_4	ETH0_LINK	ESC_PHYLINK0
N11	P12_4	DSW-CATID0	GPIO(input)
L10	P13_2	ESC_I2CCLK-B	ESC_I2CCLK
N12	P13_3	ESC_I2CDATA-B	ESC_I2CDATA
L12	P13_4	ESC_RESETOUT#	ESC_RESETOUT#
M12	P13_5	EA1RX	MTCLKA
M13	P13_6	EB1RX	MTCLKB
M11	P13_7	EA2RX	MTCLKC
L13	P14_0	EB2RX	MTCLKD
L14	P14_1	DSW-CATID2	GPIO(input)
K12	P14_2	LED_INT#	IRQ6
M14	P14_3	DSW-CATID3	GPIO(input)
J13	P14_4	XSPI0_DS	XSPI0_DS
J12	P14_5	XSPI0_CKN	XSPI0_CKN
K13	P14_6	XSPI0_CKP	XSPI0_CKP
M15	P14_7	XSPI0_IO0	XSPI0_IO0
L11	P15_0	XSPI0_IO1	XSPI0_IO1
K14	P15_1	XSPI0_IO2	XSPI0_IO2
K15	P15_2	XSPI0_IO3	XSPI0_IO3
K11	P15_3	XSPI0_IO4	XSPI0_IO4
H13	P15_4	XSPI0_IO5	XSPI0_IO5
J14	P15_5	XSPI0_IO6	XSPI0_IO6
H12	P15_6	XSPI0_IO7	XSPI0_IO7
J15	P15_7	XSPI0_CS0	XSPI0_CS0
G13	P16_0	XSPI0_CS1	XSPI0_CS1
H11	P16_1	EZ1TX	ENCIF02
H14	P16_2	EZ1EN	ENCIF03
G12	P16_3	EB1TX	ENCIF04
H15	P16_5	RS485/TXD0	TXD0
G11	P16_6	RS485/RXD0	RXD0
G14	P16_7	RS485/DR	GPIO(output)
F12	P17_0	MDD	None
F14	P17_3	DSW-CATID4	GPIO(input)
F13	P17_4	LEAD	GPIO(output)
F15	P17_5	Z/TX	GPIO(output)
G15	P17_6	EB1EN	ENCIF8
E15	P17_7	LAG	GPIO(output)
E14	P18_0	DSW-CATID1	GPIO(input)
D15	P18_1	RD1_INT#	IRQ10
D14	P18_2	DOC	GPIO(output)
E13	P18_3	DOA	GPIO(output)
E12	P18_4	R-LMT#	IRQ1
D13	P18_5	DOB	GPIO(output)
C15	P18_6	RD2_INT#	IRQ11
B15	P19_0	MDV4	None
B9	P20_1	ETH_LED2_MDV0	ESC_LINKACT0

Table 6-4 Pin Map (4/5)

Pin number	Pin Name	Signal name	Function
D8	P20_2	ETH_LED0_MDV1	ESC_LEDRUN
D9	P20_3	ETH_LED1_MDV2	ESC_LEDERR
A9	P20_4	ETH_LED3_MDV3	ESC_LINKACT1
B8	P21_1	IIC_SCL1	IIC_SCL1
C8	P21_2	IIC_SDA1	IIC_SDA1
A8	P21_3	MTIOC6C_CLK	MTIOC6C
E7	P21_4	NC	None
C7	P21_5	RZ_MCLK2-C_W	MCLK2
D7	P21_6	RZ_MDAT2-C_W	MDAT2
B7	P21_7	RZ_MCLK3-C_V	MCLK3
A7	P22_0	RZ_MDAT3-C_V	MDAT3
A6	P22_1	LED5	GPIO(output)
C6	P22_2	DSW-CATID5	GPIO(input)
B6	P22_3	ALM#	GPIO(output)
D6	P23_7	RZ_DO_CTL5	GPIO(output)
A5	P24_0	RXD1	SCI1_RXD
B5	P24_1	RZ_DO_CTL7	GPIO(output)
C5	P24_2	TXD1	SCI1_TXD
P6	RES#	RESET#	-
E2	TRST#	NC	-
P13	USB_DM	USB_DM	-
R13	USB_DP	USB_DP	-
P15	USB_RREF	USB_GND	-
E11	VCC18_ADC0	-	-
E9	VCC18_ADC1	-	-
P9	VCC18_PLL0	-	-
N9	VCC18_PLL1	-	-
P11	VCC18_USB	-	-
L6	VCC1833_0	-	-
K5	VCC1833_1	-	-
E5	VCC1833_2	-	-
J11	VCC1833_3	-	-
M10	VCC1833_4	-	-
E6	VCC33	-	-
E8	VCC33	-	-
F11	VCC33	-	-
L5	VCC33	-	-
R11	VCC33_USB	-	-
F6	VDD	-	-
F8	VDD	-	-
F9	VDD	-	-
F10	VDD	-	-
G6	VDD	-	-
G10	VDD	-	-
H6	VDD	-	-
H10	VDD	-	

Table 6-5 Pin Map (5/5)

Pin number	Pin Name	Signal name	Funcction
J6	VDD	-	-
J10	VDD	-	-
K6	VDD	-	-
K7	VDD	-	-
K8	VDD	-	-
K10	VDD	-	-
P7	VDD	-	-
C11	VREFH0	-	-
C10	VREFH1	-	-
A1	VSS	-	-
A10	VSS	-	-
A15	VSS	-	-
D10	VSS	-	-
D11	VSS	-	-
D12	VSS	-	-
E10	VSS	-	-
F7	VSS	-	-
G7	VSS	-	-
G8	VSS	-	-
G9	VSS	-	-
H7	VSS	-	-
H8	VSS	-	-
H9	VSS	-	-
J7	VSS	-	-
J8	VSS	-	-
J9	VSS	-	-
K9	VSS	-	-
L1	VSS	-	-
L15	VSS	-	-
N10	VSS	-	-
N14	VSS	-	-
P8	VSS	-	-
R1	VSS	-	-
R5	VSS	-	-
R9	VSS	-	-
R15	VSS	-	-
N13	VSS_USB	-	-
N15	VSS_USB	-	-
P12	VSS_USB	-	-
P14	VSS_USB	-	-
R12	VSS_USB	-	-
R14	VSS_USB	-	-
R8	XTAL	-	-

8. 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	DA9061-16AM1	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	Description for AC Servo Solution (RZ/N2L) added.
		7	Description of Encoder power supply added.
		9	Description of EtherCAT-ID Setting Switch added.
		18-23	Typo fixed.
2.10	Sep.30, 2022	1	Caution when handling the solution board added
3.00	Feb.28, 2023	1	Description of Hardware manual (for RZ/T2L) added.
		16	Description of RS485 communication added.
		other	Typo fixed.
3.01	Dec.12, 2023	13	Parts number of External Control Interface corrected.
		19	Precaution added.
		other	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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