RZ/T2M Group

RZ/T2M Motor Solution Board Hardware Manual

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Abstract

This document describes the specifications of the RZ/T2M motor solution board equipped with the MPU of the RZ/T2M group manufactured by Renesas Electronics. We provide an environment for evaluating RZ/T2M without the need for customers to prepare their own hardware.

Target Device

RZ/T2M Group

Contents

1. Overview

1.1 RZ/T2M Motor Solution Board Overview

The RZ/T2M Motor Solution Board (hereinafter referred to as the RZ/T2M Motor Board) is a solution board for motor drive systems equipped with Renesas Electronics' RZ/T2M and related products. This board is equipped with RX72N manufactured by Renesas Electronics, and it is also possible to equip the functional safety software. The RZ/T2M motor board consists of two boards, an RZ/T2M motor controller board (hereinafter referred to as the controller board) and an inverter board.

1.2 Board appearance

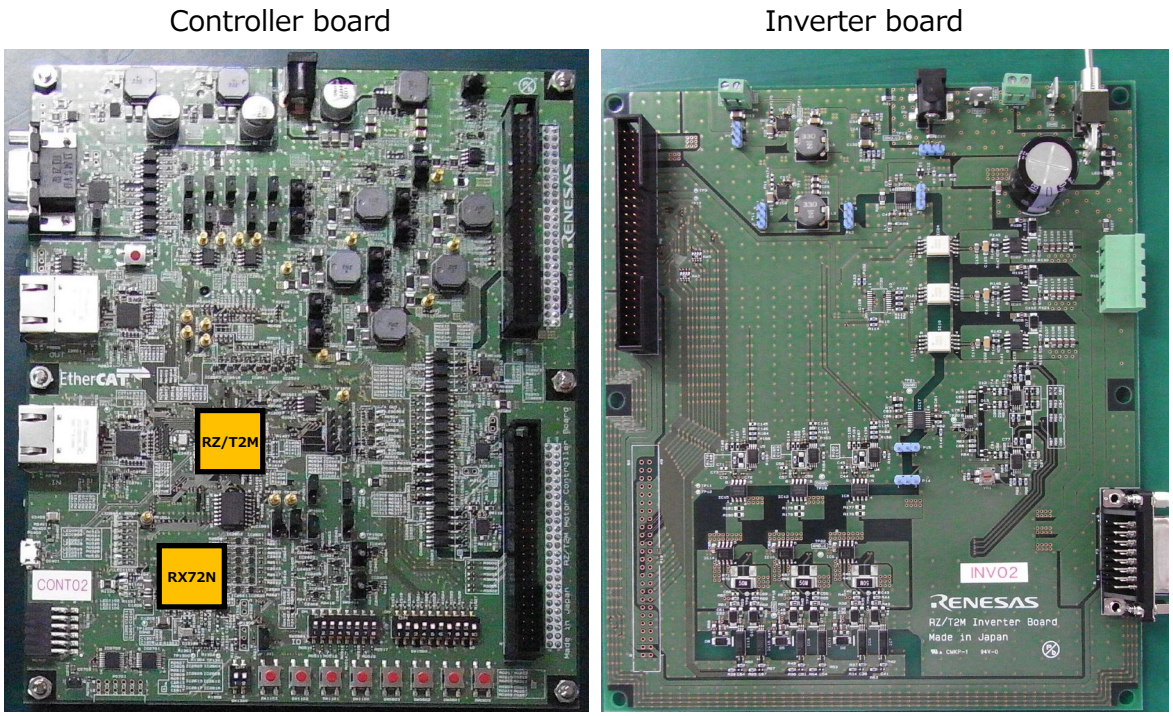


Figure 1.1 Overview configuration of motor solution board

1.3 Block Diagram

Figure 1.2 is shown a block diagram of the controller board and inverter board.

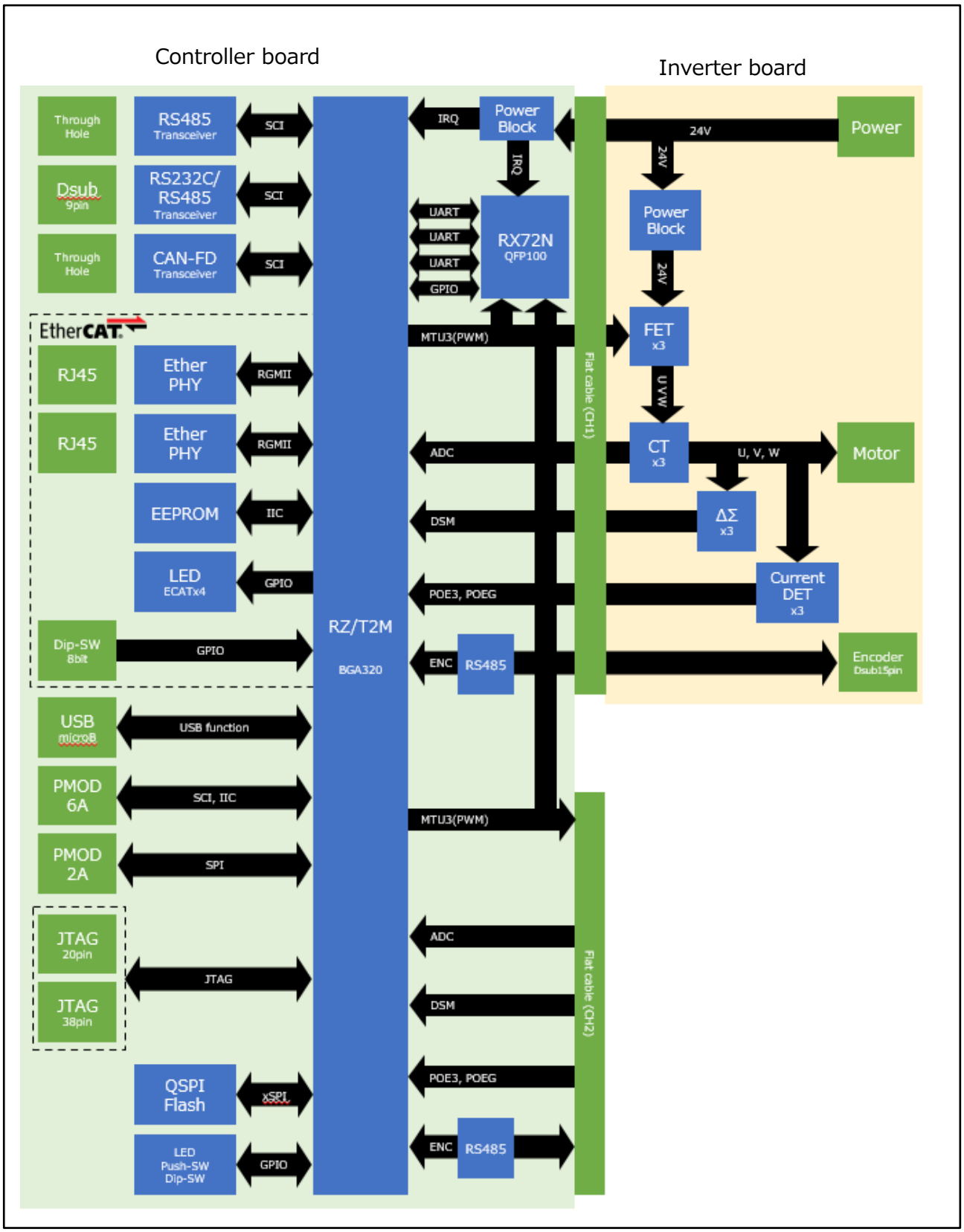


Figure 1.2 Block diagram of motor solution board

2. General specifications

2.1 Electrical specifications

Table 2.1 Electrical specifications

Item	Specification	Remarks
Rated voltage	DC24V	DC24V±5% (DC22.8~25.2V)
Power supply connector	Select one of the following on the inverter board ・FASTON Terminal ・Terminal block ・Center plus DC jack	
Internal current consumption	3A or less	Excluding external motors and encoders
Status LED (Power)	Red	

* When using only the controller board, supply 24V DC from the center plus DC jack (P1701) of the controller board.

* When supplying 24V DC to each of the inverter board and the control board, switch the jumper (P1) of the inverter board to the 2nd to 3rd short side before use (do not supply 24V DC to the control board).

2.2 Environmental specifications

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

2.3 Board Size

Table 2.3 Board size

Item	Specification	Remarks
Controller board	170(W)×200(D)×1.6(T)	NO include protrusions, NO include component height
Inverter board	170(W)×200(D)×1.6(T)	NO include protrusions, NO include component height

2.4 External interface, communication specifications

Table 2.4 RS485(Fieldbus) communication specifications

Item	Specification	Remarks
Communication method	RS485 (half duplex)	~20Mbps
Communication control IC	RZ/T2M	
Transceiver	ISL3178E from Renesas	
Termination resistor	Available (140Ω)	
External interface	3pin Through Hole	P0900

Table 2.5 RS232C/RS485 communication specifications

Item	Specification	Remarks
Communication method	RS485 (half duplex) RS232C	RS485: ~20Mbps RS232C: ~650kbps
Communication control IC	RZ/T2M	
Transceiver	ISL41387IRZ from Renesas	
Termination resistor	Not Available	Pin header not implemented
External interface	D-Sub 9pin	P0800

* To switch between RS485 / RS232C, use the jumper (JP0801) on the controller board before turning on the power.
* If you need a terminating resistor, mount a pin header (P0800).

Table 2.6 CAN-FD communication specifications

Item	Specification	Remarks
Communication method	CAN-FD	~5Mbps
Communication control IC	RZ/T2M	
Transceiver	TJA1042AT/3 from NXP	
External interface	3pin Through Hole	P0801

Table 2.7 Ethernet communication specifications

Item	Specification	Remarks
Communication protocol	EtherCAT®	
Communication control IC	RZ/T2M	
EtherCAT PHY	KSZ9131 from Microchip	
Communication method	IEEE802.3	1000BASE
Insulation method	Pulse transformer insulation	
Status LED	RUN (green), ERR (red), L / A IN (green), L / A OUT (green)	
External interface	RJ45 ×2	P2700, P2800
EEPROM	BR24T16FJ(2KB) from ROHM	

Table 2.8 USB communication specifications

Item	Specification	Remarks
Standard	USB2.0 Function	HS: ~480Mbps FS: ~12Mbps
Communication method	RZ/T2M	
External interface	USB micro-B	P0900

Table 2.9 Pmod Type 6A communication specifications

Item	Specification	Remarks
Communication protocol	IIC SCI (UART/SPI)	IIC: ~400kbps
Communication control IC	RZ/T2M	
External interface	Pin socket 12pin	P0700

Table 2.10 Pmod Type 2A communication specifications

Item	Specification	Remarks
Communication protocol	SPI	
Communication control IC	RZ/T2M	
External interface	12pin Through Hole	P0701

3. Specifications

3.1 Overview

Figure 3.1 is shown the overview configuration of the RZ/T2M motor solution board.
The controller board is equipped with MPU (RZ/T2M) to control the motor and each external interface, and is equipped with MCU (RX72N) to perform functional safety control.
The inverter board is equipped with a motor drive circuit, an encoder input circuit, and a voltage / current monitoring circuit.

Table 3.1 and Table 3.2 show an overview of each feature.

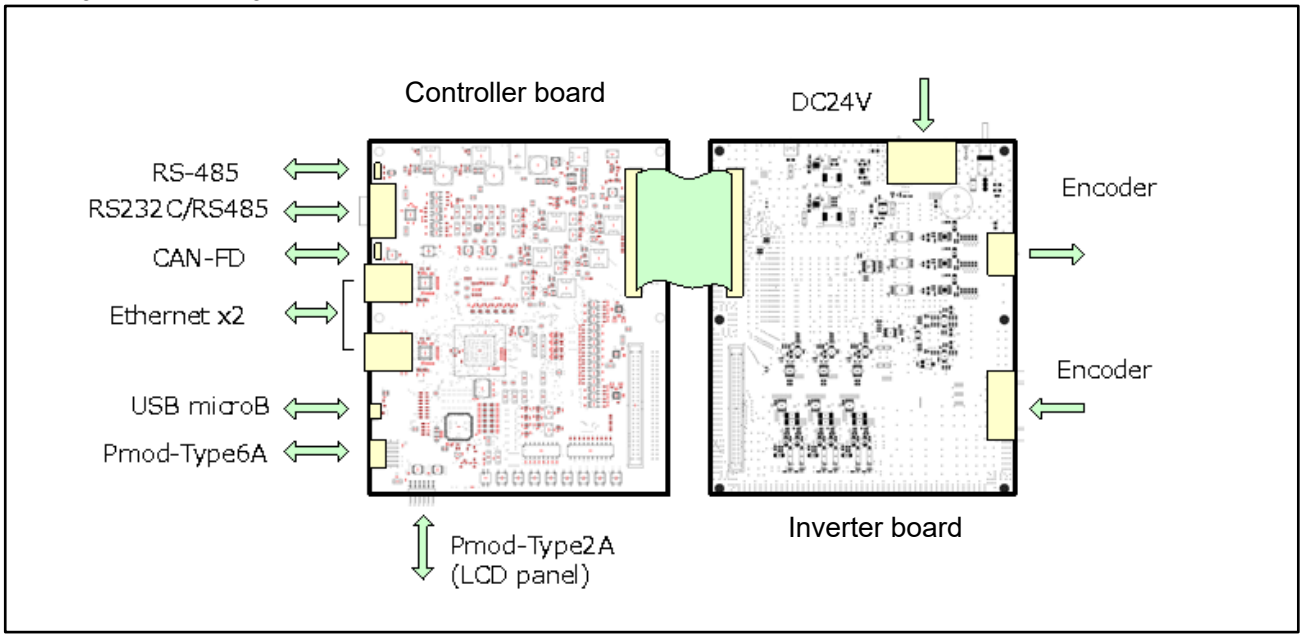


Figure 3.1 Overview configuration of RZ/T2M motor solution board

Table 3.1 Functional overview of RZ/T2M motor controller board

No	Item		Content	Remarks
1	MPU	Product Group	RZ/T2 Group	
2		CPU max. operating frequency	Dual Arm® Cortex®-R52 (max.operating frequency : CPU0:800MHz,CPU1:400MHz)	
3		Input power supply voltages	DC 3.3V/ DC 1.8V/ DC 1.1V	
4		Package / Pin count	FBGA (17mm)/320-pin	
5		Memory	xSPI Flash memory MX25L51245GMI (64MB) from Macronix	
6	MCU (For Functional Safety)	Product Group	RX72N Group	
7		CPU max. operating frequency	Single RXv3 (max operating frequency:240MHz)	
8		Input power supply voltage	DC 3.3V	
9		Package / Pin count	LFQFP (14mm)/100-pin	
10	Connectors		Inverter Board connectors x 2 (Motor 2ch)	LCD panel =RX72N Envision KIT.
11			USB micro-B connector x 1	
12			D-Sub9pin connector x 1 (RS-232C/ RS-485)	
13			CAN connector (CAN FD Transceiver) x 1 (Through holes)	
14			RS-485 connector x 1(Through holes)	
15			RJ45 connector x 2(EtherCAT/ Ethernet)	

No	Item		Content	Remarks
16			Pmod connector x 1	
17			LCD Panel connector x 1(Unimplemented)	
18			ARM JTAG connector x 1 (20 pins and 38 pins) (for RZ/T2)	
19			JTAG connector x 1 (for Functional Safety)	
20			DC jack x 1 (Power Supply)	
21	Switches	DIP switch(8bit) x 1	For Device ID	
22		Boot mode DIP switch x 1		
23	LEDs	General purpose LED x 8	Red x 4, Green x 4	
24		ESC status LED	EtherCAT Slave Controller status LED	
25		Power supply LED	RED	
26	Encoder I/F	Incremental encoder x 2		
27		Absolute encoder x 2 A-Format, EnDat2.2, BiSS-C, HIPERFACE DSL, FA-CODER etc		

Table 3.2 Inverter board function overview

No	Item	Content	Remarks
1	Operating input voltage	DC24V	DC24V±5%
2	Rated output current	2A	
3	Switching frequency	≧20kHz	
4	Dead time	≧2us	
5	Current detection method	CT: Current Transducer	
6		3 Shunt resistor method: ΔΣ Modulator	The shunt resisters are inserted in series to the three-phase line.
7	Shunt resistor	50mΩ	
8	Detection	Bus voltage detection	
9		Three-phase current detection	
10	Connectors	Controller board connectors x 2	Unmount ch2 connector
11		Motor connector	
12		Encoder connector (D-Sub15pin connector) x 1	
13		Power Supply connectors	FASTON terminal Terminal block DC jack
14	Switches	Current cutoff switch	Toggle switch
15	LEDs	LED for Inverter circuit control power supply	
16	Motors	PMSM/BLDC Motor x 1(DC24V, Current:2A)	

3.2 Various functions

3.2.1 Switches

Figure 3.2 is shown an overview of each switch. The functions are shown in Table 3.3 and Table 3.4

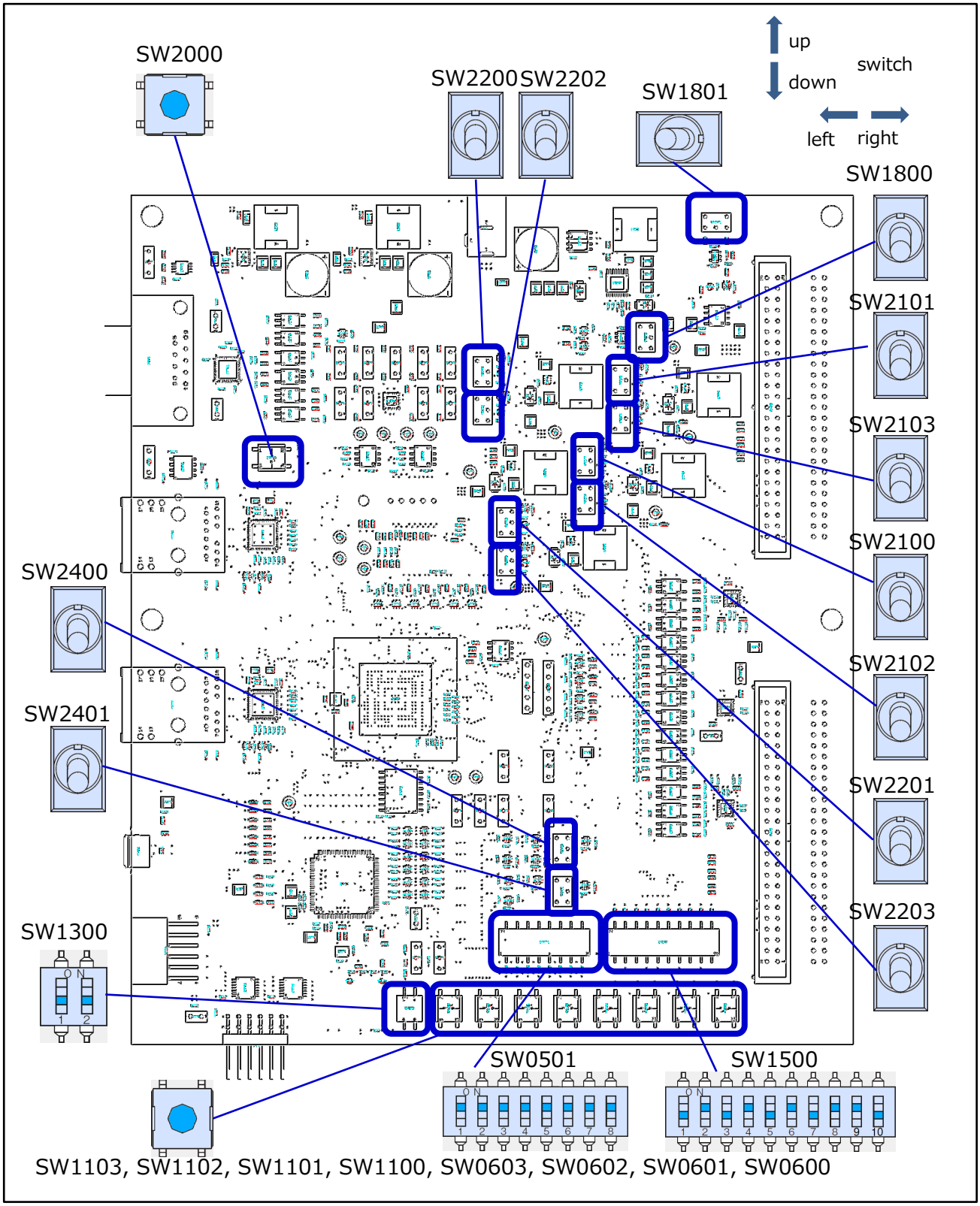


Figure 3.2 RZ/T2M motor controller board switch

Table 3.3 RZ/T2M Switch function of motor controller board

No	SW		Item	Content	Default (When shipment)
1	SW2000		Reset switch	ON: Reset	-
2	SW2200		RZ1.8V HVD toggle SW	Up: Test mode (RZ1.8V HVD Error) Down: Normal mode	Down
3	SW2202		RZ1.8V LVD toggle SW	Up: Test mode (RZ1.8V LVD Error) Down: Normal mode	Down
4	SW1801		5.0V LVD toggle SW	Right: Test mode (5.0V LVD Error) Left: Normal mode	Left
5	SW1800		5.0V HVD toggle SW	Up: Test mode (5.0V HVD Error) Down: Normal mode	Down
6	SW2101		RX3.3V HVD toggle SW	Up: Test mode (RX3.3V HVD Error) Down: Normal mode	Down
7	SW2103		RX3.3V LVD toggle SW	Up: Test mode (RX3.3V LVD Error) Down: Normal mode	Down
8	SW2100		RZ3.3V HVD toggle SW	Up: Test mode (RZ3.3V HVD Error) Down: Normal mode	Down
9	SW2102		RZ3.3V LVD toggle SW	Up: Test mode (RZ3.3V LVD Error) Down: Normal mode	Down
10	SW2201		RZ1.1V HVD toggle SW	Up: Test mode (RZ1,1V HVD Error) Down: Normal mode	Down
11	SW2203		RZ1.1V LVD toggle SW	Up: Test mode (RZ1,1V LVD Error) Down: Normal mode	Down
12	SW2400		RX_RXD5 toggle SW	Up: RX_RXD5=L Middle: RX_RXD5=H Down: RX_RXD5=RZ_TXD5	Down
13	SW2401		RZ_RXD5 toggle SW	Up: RZ_RXD5=L Middle: RZ_RXD5=H Down: RZ_RXD5=RX_TXD5	Down
14	SW0501 (Device ID)	1	CFG [7:0] DIP SW	ON: CFG0 =L/ OFF: CFG0 =H	ON
		2		ON: CFG1 =L/ OFF: CFG1 =H	ON
		3		ON: CFG2 =L/ OFF: CFG2 =H	ON
		4		ON: CFG3 =L/ OFF: CFG3 =H	ON
		5		ON: CFG4 =L/ OFF: CFG4 =H	ON
		6		ON: CFG5 =L/ OFF: CFG5 =H	ON
		7		ON: CFG6 =L/ OFF: CFG6 =H	ON
		8		ON: CFG7 =L/ OFF: CFG7 =H	ON
15	SW1500 (Boot mode)	1, 2	RZ/T2 DIP SW MD0	ON, OFF: MD0 =H OFF, ON: MD0 =L	1, 2=OFF, ON
		3, 4	RZ/T2 DIP SW MD1	ON, OFF: MD1 =H OFF, ON: MD1 =L	3, 4=OFF, ON
		5, 6	RZ/T2 DIP SW MD2	ON, OFF: MD2 =H OFF, ON: MD2 =L	5, 6=OFF, ON
		7, 8	RZ/T2 DIP SW MDD	ON, OFF: MDD =H OFF, ON: MDD =L	7, 8=OFF, ON
		9, 10	RZ/T2 DIP SW MDW	ON, OFF: MDW =H OFF, ON: MDW =L	9, 10=ON, OFF
16	SW1300	1, 2	RX72N DIP SW Mode	OFF, don't care: Single Chip Mode ON, OFF: SCI Boot Mode	1, 2=OFF, OFF
17	SW1103		RX72N tact SW SW3	ON: SW3 =L/ OFF: SW3= H	-
18	SW1102		RX72N tact SW SW2	ON: SW2 =L/ OFF: SW2= H	-
19	SW1101		RX72N tact SW SW1	ON: SW1 =L/ OFF: SW1= H	-
20	SW1100		RX72N reset SW	ON: MCU(RX72N) Reset	-
21	SW0603		RZ/T2 tact SW IRQ9	ON: IRQ9 =L/ OFF: IRQ9= H	-
22	SW0602		RZ/T2 tact SW IRQ7	ON: IRQ7 =L/ OFF: IRQ7= H	-
23	SW0601		RZ/T2 tact SW IRQ8	ON: IRQ8 =L/ OFF: IRQ8= H	-
24	SW0600		RZ/T2 tact SW NMI	ON: NMI =L/ OFF: NMI= H	-

Table 3.4 Inverter board switch function

No	SW	Item	Content	Default
1	SW1	In case of abnormality + 24V cut off switch	ON(Up): 24V ON/ OFF(Down): 24VCut off	ON(Up)

3.2.1.1 Selection of operation mode

The operation mode supported by this board is xSPI0 boot mode (x1 boot Serial flash) only (MD0 to MD2: All low settings).

Table 3.5 is shown the SW1500 setting.

Table 3.5 SW1500 Setting

1	2	3	4	5	6	7	8	9	10
OFF	ON	OFF	ON	OFF	ON	OFF	ON	ON	OFF

Select the operation mode before turning on the power.

3.2.2 **Jumpers**

Figure 3.3, Figure 3.4 show the outline of the jumper, Table 3.3, Table 3.4 show the function of the jumper.

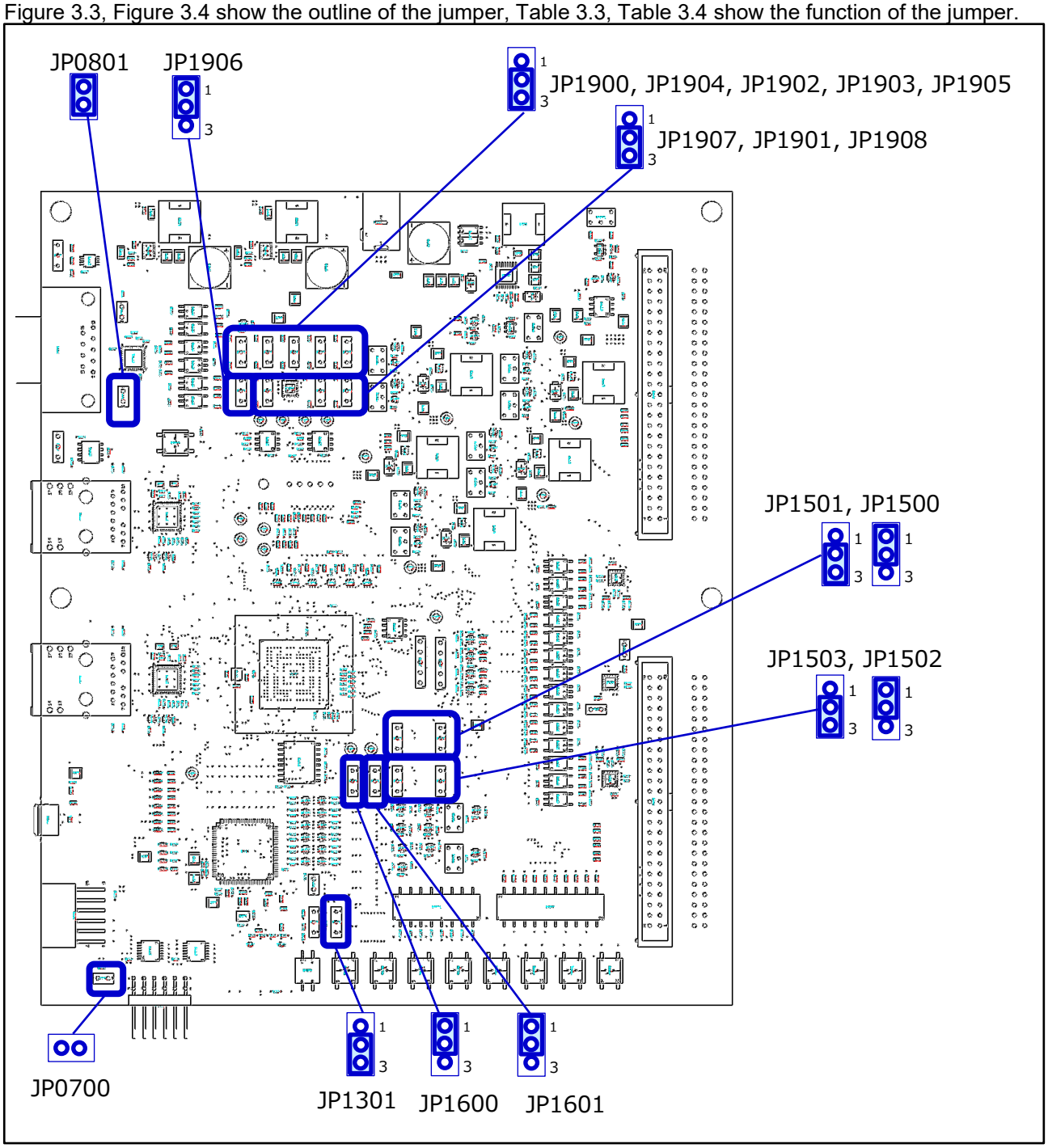


Figure 3.3 RZ/T2M motor controller board jumper

Table 3.6 RZ/T2MJumper function of motor controller board

No	JP	Item	Content	Default	Remarks
1	JP0801	RS232C/485	With jumper: RS232C no jumper: RS485	With Jumper	
2	JP1906	Power sequencer Drive power supply	Jumper1-2: 5V Jumper2-3: 3.3V	Jumper1-2	
3	JP1900	Power sequencer (DONA)	Jumper1-2: Reserved Jumper2-3: Normal mode	Jumper2-3	
4	JP1904	Power sequencer (DOFFA)	Jumper1-2: Reserved Jumper2-3: Normal mode	Jumper2-3	
5	JP1902	Power sequencer (DONC)	Jumper1-2: Reserved Jumper2-3: Normal mode	Jumper2-3	
6	JP1903	Power sequencer (DOND)	Jumper1-2: Reserved Jumper2-3: Normal mode	Jumper2-3	
7	JP1905	Power sequencer (DOFFB)	Jumper1-2: Reserved Jumper2-3: Normal mode	Jumper2-3	
8	JP1907	Power sequencer (DOFFC)	Jumper1-2: Reserved Jumper2-3: Normal mode	Jumper2-3	
9	JP1901	Power sequencer (DONB)	Jumper1-2: Reserved Jumper2-3: Normal mode	Jumper2-3	
10	JP1908	Power sequencer (DOFFD)	Jumper1-2: Reserved Jumper2-3: Normal mode	Jumper2-3	
11	JP1501 /JP1500	PWM_V- /W+ Swap	JP1501Jumper2-3, JP1500Jumper1-2: Normal mode	JP1501Jumper2-3	PWM_V- =H16Pin PWM_W+ =D2Pin
			JP1501Jumper1-2, JP1500Jumper2-3: Swap	JP1500Jumper1-2	PWM_V- =D2Pin PWM_W+ =H16Pin
12	JP1503 /JP1502	PWM_V2- /W2+Swap	JP1503Jumper2-3, JP1502Jumper1-2: Normal mode	JP1503Jumper2-3	PWM_V2- =G16Pin PWM_W2+ =G15Pin
			JP1503Jumper1-2, JP1502Jumper2-3: Swap	JP1502Jumper1-2	PWM_V2- =G15Pin PWM_W2+ =G16Pin
13	JP0700	PMOD Power supply	With Jumper: LCD Panel connector I/F Power supply No Jumper: Uses power from the counter board	No Jumper	
14	JP1301	RX72N Boot mode	Jumper1-2: Reserved Jumper2-3: Normal mode	Jumper2-3	
15	JP1600	POE_FOV Option	Jumper1-2: H5Pin (POE0#) Jumper2-3: H19Pin (GTETRGA)	Jumper1-2	POE_FOV=H5Pin
16	JP1601	POE_FOV2 Option	Jumper1-2: F18Pin (POE4#) Jumper2-3: J16Pin (GTETRGB)	Jumper1-2	POE_FOV2=F18Pin

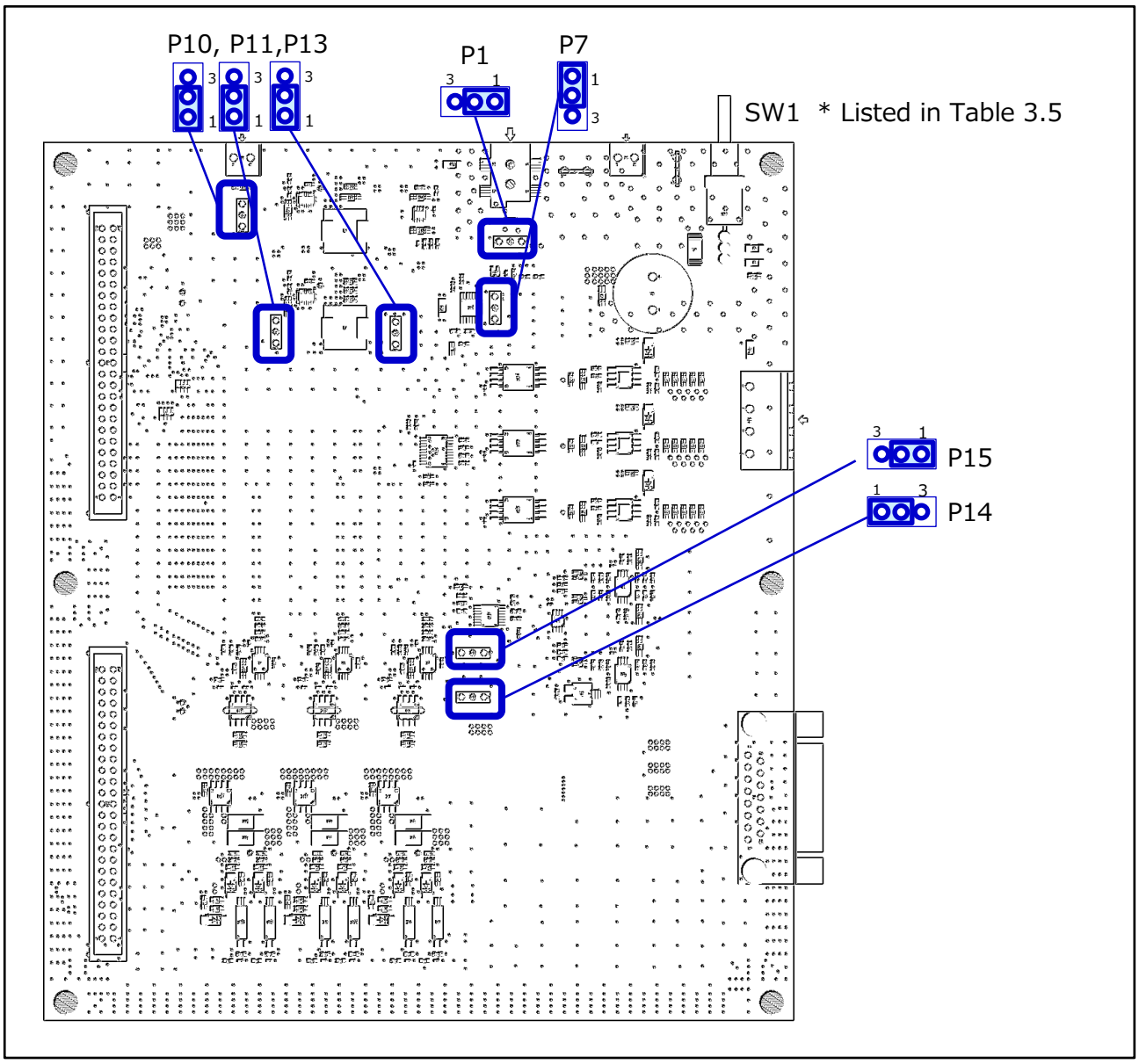


Figure 3.4 Inverter board jumper

Table 3.7 Inverter board jumper function

No	JP	Item	Content	Default	Remarks
1	P10/P11/P13	Gate driver power selection	P10Jumper1-2, P11Jumper1-2, P13Jumper1-2: Generates + 24V to + 15V on board	JP10Jumper1-2/JP11Jumper1-2	+15V
			P10Jumper2-3, P11Jumper2-3, P13Jumper2-3: Supply + 15V from the external (P9)	JP13Jumper1-2	
2	P1	Power supply to RZ / T2 motor controller board	Jumper1-2: Supply + 24V Jumper2-3: Do not supply + 24V	Jumper1-2	
3	P7	Bus voltage detection Insulated / non-insulated option	Jumper1-2: non-insulated Jumper2-3: Insulated	Jumper1-2	AD_BUS, Insulated by connect via insulated AMP
4	P15/P14	Overcurrent detection insulation / non-insulation option	P15Jumper1-2, P14Jumper1-2: Non-insulated /P15Jumper2-3, P14Jumper2-3: Insulated	JP15Jumper1-2 JP14Jumper1-2	Insulated by connect via insulated AMP

3.2.3 **LEDs**

Figure 3.5, Figure 3.6 show the LED overview of the controller board and inverter board, Table 3.8, Table 3.9 show the LED list of the controller board and inverter board.

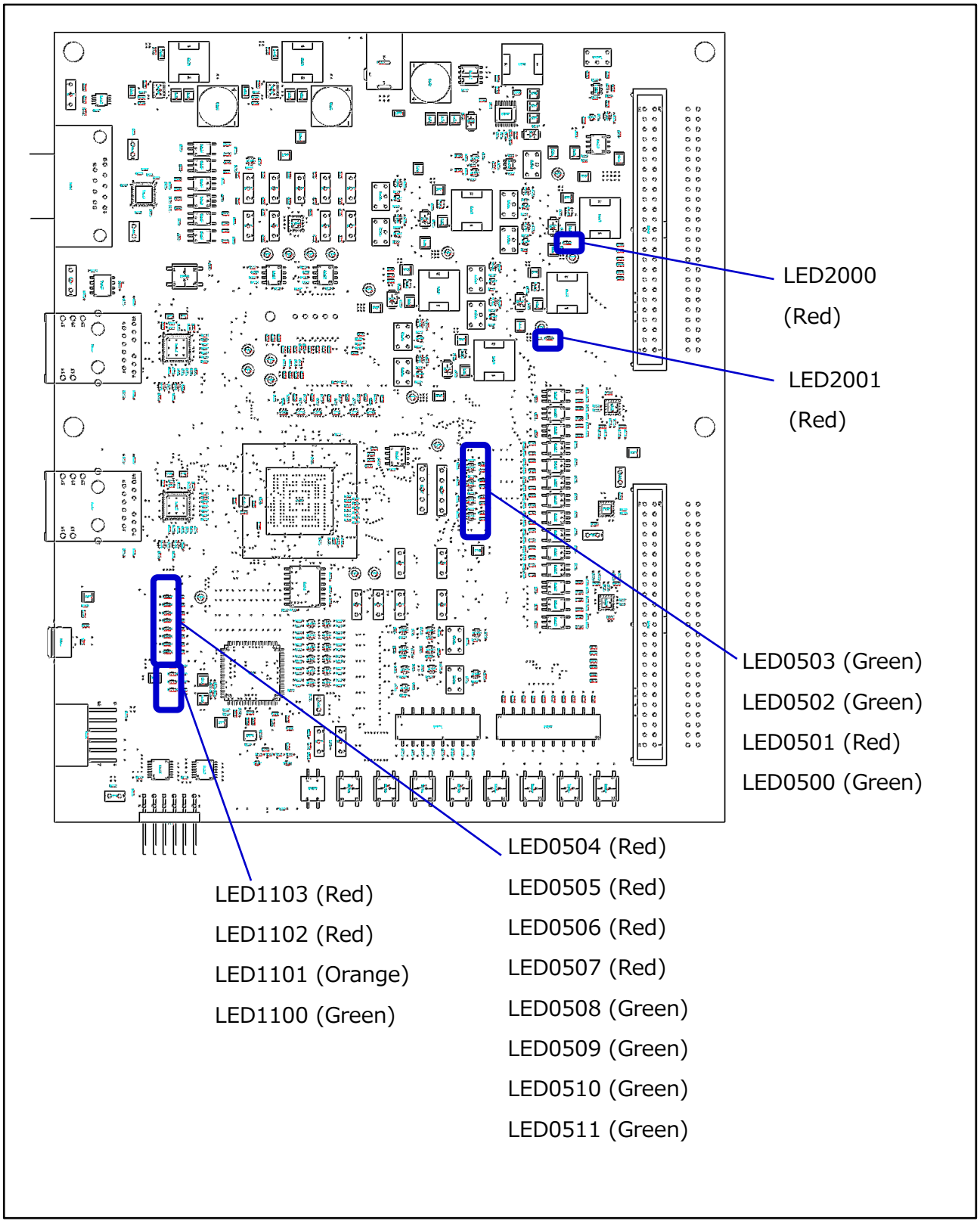


Figure 3.5 RZ/T2M Motor controller board LED

Table 3.8 RZ/T2M LED list of motor controller board

No	Item		Circuit number	Color	Using
1	Power supply LED	VDD3.3V_RX	LED2000	Red	VDD3.3V_RX Energized: Lights up
2		VDD3.3V_RZ	LED2001	Red	VDD3.3V_RZ Energized: Lights up
3	ESC status LED	ETH_LED3	LED0503	Green	L/A OUT
4		ETH_LED2	LED0502	Green	L/A IN
5		ETH_LED1	LED0501	Red	ERR
6		ETH_LED0	LED0500	Green	RUN
7	General purpose LED (RZ/T2)	GPLED5	LED0504	Red	H: Light on/L: Light off
8		GPLED1	LED0505	Red	H: Light on/L: Light off
9		GPLED2	LED0506	Red	H: Light on/L: Light off
10		GPLED6	LED0507	Red	H: Light on/L: Light off
11		GPLED3	LED0508	Green	H: Light on/L: Light off
12		GPLED7	LED0509	Green	H: Light on/L: Light off
13		GPLED4	LED0510	Green	H: Light on/L: Light off
14		GPLED8	LED0511	Green	H: Light on/L: Light off
15	General purpose LED (RX72N)	LED3	LED1103	Red	L: Light on/H: Light off
16		LED2	LED1102	Red	L: Light on/H: Light off
17		LED1	LED1101	Orange	L: Light on/H: Light off
18		LED0	LED1100	Green	L: Light on/H: Light off

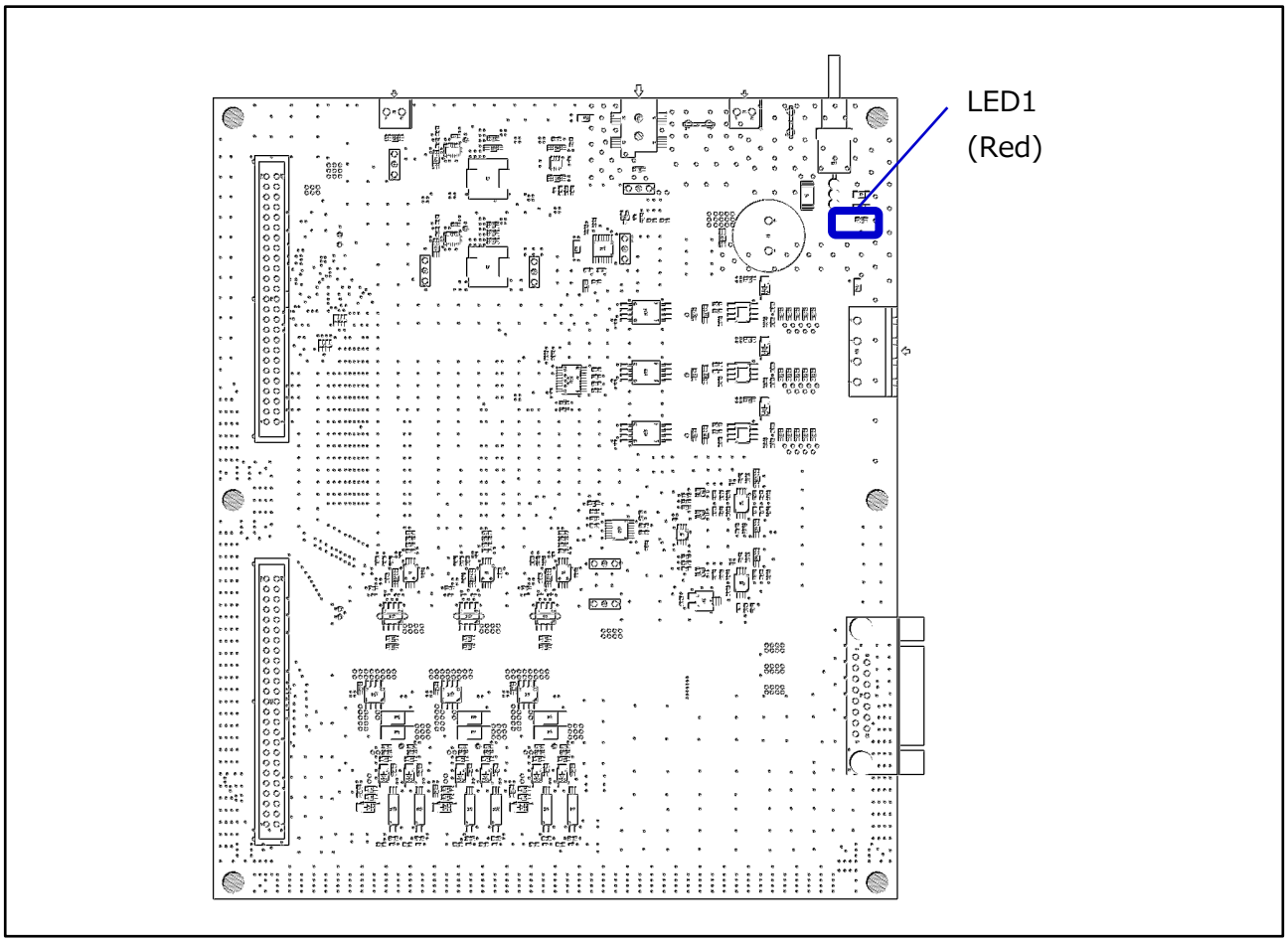


Figure 3.6 Inverter board LED

Table 3.9 Inverter board LED list

No	Item		Circuit number	Color	Using
1	Power supply LED	M+24V	LED1	Red	M+24V Energized: Lights up

3.2.4 Connectors

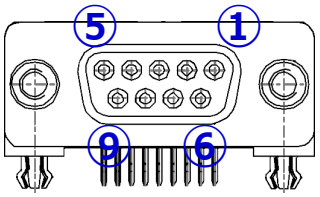
3.2.4.1 Controller board

■RS-485
[Through holes] (P0900)

No	Name	I/O
1	RS485_N	I/O
2	RS485_P	I/O
3	ISO_GND1	-

■RS-232C/ RS-485 (D-Sub9pin) (P0800)

FCI D09S13A4GV00LF

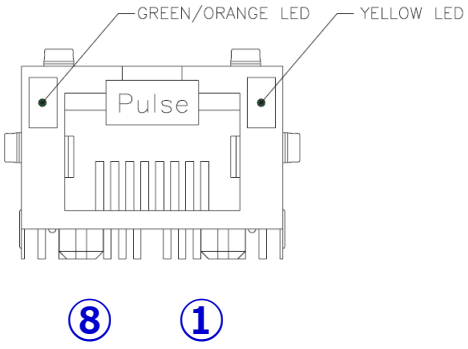


No	Name	I/O
1	RS422_TX_P	O
2	RS422_TX_N	O
3	RS422_RX_N	I
4	RS422_RX_P	I
5	ISO_GND1	-
6	NC	-
7	NC	-
8	NC	-
9	NC	-

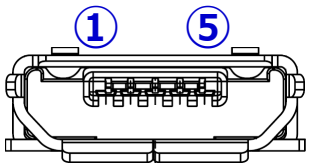
■CAN (CAN FD Transceiver)
[Through holes] (P0801)

No	Name	I/O
1	CAN_H	I/O
2	CAN_L	I/O
3	DGND	-

■RJ45 connector (EtherCAT/ Ethernet) (P2700/P2800)
Pulse J0G-0001NL

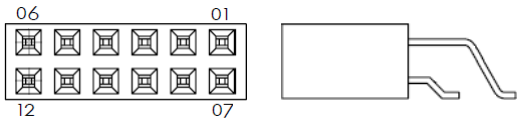


■USB Micro B (P0400)
FCI 10118192-0001LF



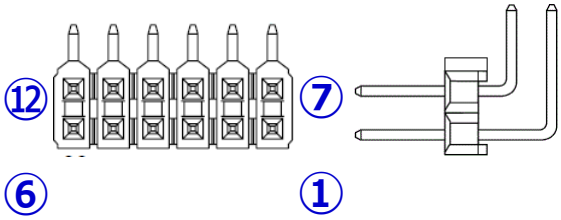
No	Name	I/O
1	USB_VBUS	I
2	USB_DM	I/O
3	USB_DP	I/O
4	USBID	I
5	DGND	-

■Pmod-Type 6A (P0700)
SAMTEC SMH-106-02-L-D



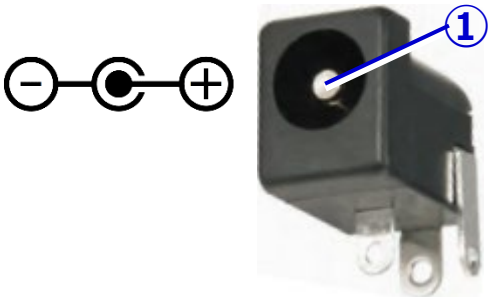
No	Name	I/O	No	Name	I/O
1	INT_6A_RZ	I/O	7	RTS0#_SS0#	I/O
2	RESET_6A_RZ	I/O	8	TXD0_MOSI0	O
3	SCL0	O	9	RXD0_MISO0	I
4	SDA0	I/O	10	PM7_SCK0	I/O
5	DGND	-	11	DGND	-
6	VDD3.3V_RZ	-	12	VDD3.3V_RZ	-

■Pmod- Type 2A (P0701) [Through holes]
SAMTEC TSW-106-25-L-D-RA



No	Name	I/O	No	Name	I/O
1	SSL30	O	7	INT_2A_RZ	I/O
2	MOSI3	O	8	RESET_2A_RZ	I/O
3	MISO3	I	9	PMOD_PG_4_RZ	I/O
4	RSPCK3	O	10	PMOD_PG_7_RZ	I/O
5	DGND	-	11	DGND	-
6	VDD3.3V_RZ	-	12	VDD3.3V_RZ	-

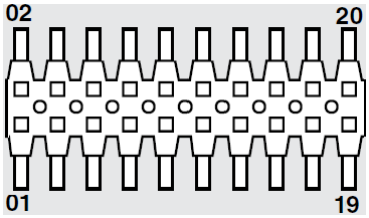
■DC24V DC Power Jack (P1701)
Kycon KLDX-0202-A



No	Name	I/O
1	DC24V	I
2	GND	-

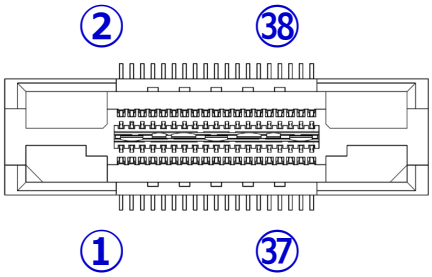
Caution: When supplying 24V DC from the inverter board, do not apply 24V DC to this connector.

■ARM JTAG connector (P0401)
20 pins, for RZ/T2
SAMTEC FTSH-110-01-F-DV-007-K



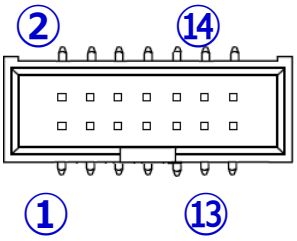
No	Name	I/O	No	Name	I/O
1	VDD3.3V_RZ	-	2	S_SWDIO_TMS	I
3	DGND	-	4	S_SWCLK_TCK	I
5	DGND	-	6	S_TDO	O
7	NC	-	8	S_TDI	I
9	DGND	-	10	DBG_RESET#	I/O
11	VDD5V_SW	-	12	1.65V	O
13	VDD5V_SW	-	14	1.65V	O
15	DGND	-	16	TRST#	I
17	DGND	-	18	NC	-
19	DGND	-	20	NC	-

■ARM JTAG connector (P0402)
38 pins, for RZ/T2
TE Connectivity 2-5767004-2



No	Name	I/O	No	Name	I/O
1	NC	-	2	NC	-
3	NC	-	4	NC	-
5	DGND	-	6	TRACE_CLK	O
7	DGND	-	8	DBGACK	-
9	DBG_RESET#	I/O	10	EXTTRG	-
11	S_TDO	O	12	VTREF	-
13	1.65V	O	14	VTSUPPLY	O
15	S_SWCLK_TCK	I	16	TRACE_D7	I/O
17	S_SWDIO_TMS	I	18	TRACE_D6	I/O
19	S_TDI	I	20	TRACE_D5	I/O
21	TRST#	I	22	TRACE_D4	I/O
23	DGND	-	24	TRACE_D3	I/O
25	DGND	-	26	TRACE_D2	I/O
27	DGND	-	28	TRACE_D1	I/O
29	DGND	-	30	DGND	-
31	DGND	-	32	DGND	-
33	DGND	-	34	VDD3.3V_RZ	-
35	DGND	-	36	TRACE_CTL	O
37	DGND	-	38	TRACE_D0	I

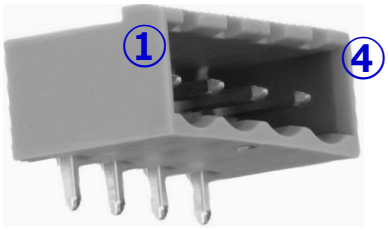
■JTAG connector (P1300)
for RX72N (Functional Safety)
SAMTEC HTST-107-01-T-DV



No	Name	I/O	No	Name	I/O
1	TCK/FINEC	I	2	DGND	-
3	EMU-TRSTN	I	4	EMLE	I/O
5	EMU-TDO_TXD	O	6	NC	-
7	MD_FINED	I/O	8	VDD3.3V_RX	-
9	EMU-TMS	I	10	EMU-UB	I/O
11	EMU-TDI_RXD	I	12	DGND	-
13	RESN	I/O	14	DGND	-

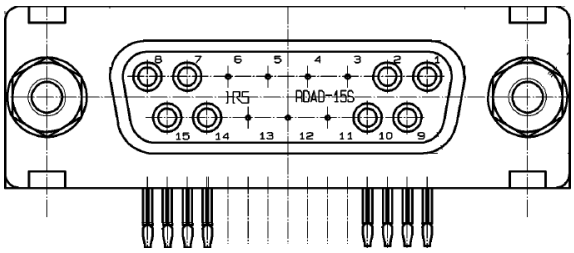
3.2.4.2 **Inverter board**

■Motor connection connector (P16)
1757268 from phoenix contact



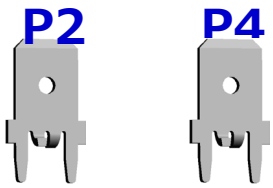
No	Name	I/O
1	MOT_U	O
2	MOT_V	O
3	MOT_W	O
4	SHIELD	-

■For encoder connection (P3)D-Sub15pin
RDAD-15S-LNA (4-40)(55) from Hirose:



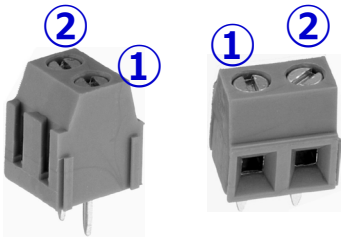
No	Name	I/O	No	Name	I/O
1	NC	-	9	ISO_GND2	-
2	ISO_GND2	-	10	NC	-
3	NC	-	11	NC	-
4	Z-	I	12	Z+	I
5	B-	I	13	B+	I
6	A-	I	14	A+	I
7	5V1A	O	15	3.3V1A	O
8	5V1A	O			

■+24V (P2/P4) FASTON terminal
connectivity 63824-1 from TE



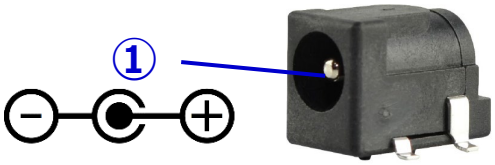
No	Name	I/O
P2	+24V	I
P4	GND_C	-

■+24V (P5) Terminal block
691214310002 from Würth Elektronik



No	Name	I/O
1	+24V	I
2	GND_C	-

■+24V (P6) DC Power Jack
PJ-002AH-SMT-TR from Cuidevices



No	Name	I/O
1	+24V	I
2	GND_C	-

4. Controller board, inverter board connection configuration

By connecting the RZ/T2M motor controller board and the inverter board, it is possible to expand the controlled motor to 1 channel and 2 channel. Table 4.1 is shown a list of controller board and inverter board connection configurations.

Table 4.1 Controller board, inverter board connection configuration list

No	Constitution	Motor	Connection	Jumper	remarks
1	Constitution1 (Standard configuration)	1ch	Connect P2900 and P8 with a flat cable	Default	
2	Constitution2	1ch	Connect P2901 and P8 (B to B connection)	Default	
3	Constitution3	2ch	Connect P2901 and P12 (inverter board A)	Default	Inverter board A / B has different mounting parts
			Connect P3001 and P8 (inverter board B)		

4.1 Constitution1(Motor:1ch,Flat cable connection)

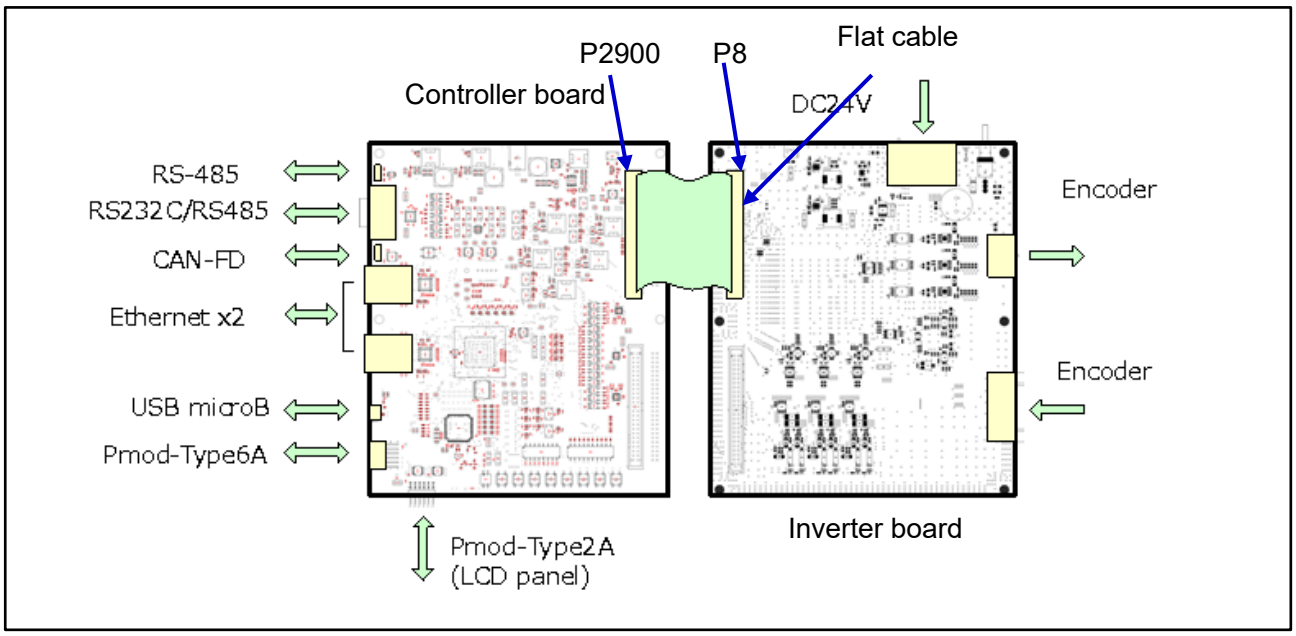


Figure 4.1 Constitution1

4.2 Constitution2 (Motor:1ch, B to B connection)

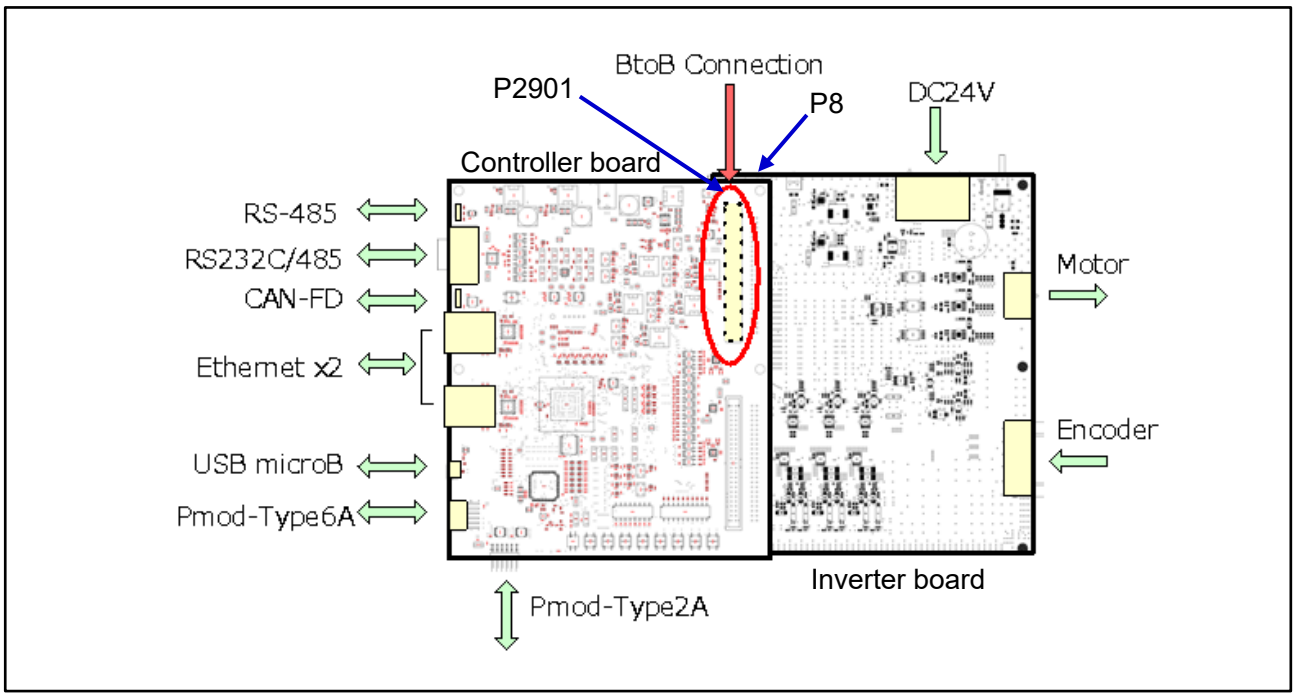
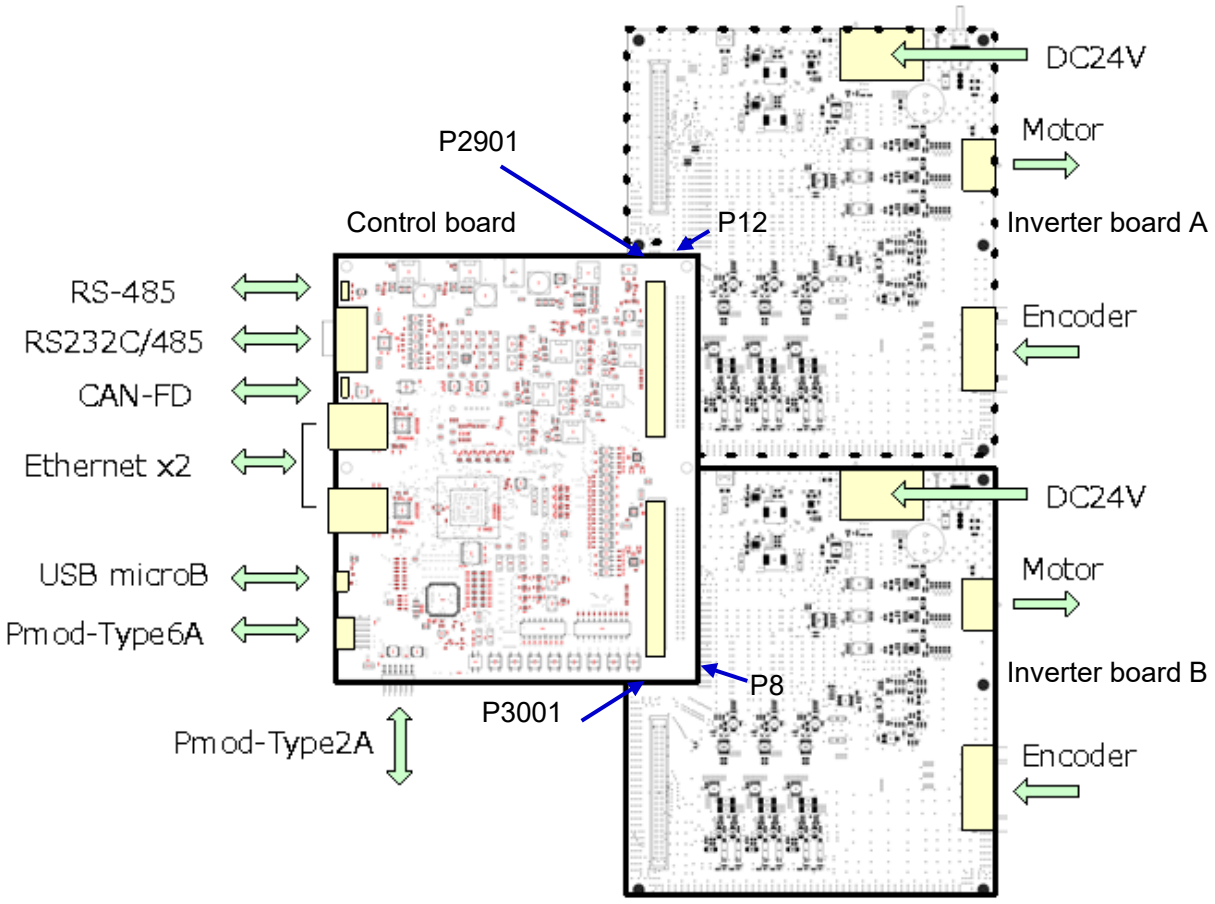


Figure 4.2 Constitution2

4.3 Constitution3(Motor:2ch, B to B connection)



* For this configuration, connect a connector equivalent to the connector connected to P8 of inverter board A to P12.
* For power supply, supply 24V DC to each of inverter board A and inverter board B.

Figure 4.3 Constitution3

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	Overcurrent detection circuit	H5	IRQ3-A	POE_FOV_RZ
		F18	IRQ2-C	POE_FOV2_RZ
2	Current detection circuit 1 (Current Transducer)	B17	AN000	AD_IU1_RZ
		C16	AN001	AD_IV1_RZ
		A18	AN002	AD_IW1_RZ
		F13	AN100	AD_IU2_RZ
		B16	AN101	AD_IV2_RZ
		E13	AN102	AD_IW2_RZ
3	Current detection circuit 1 (ΔΣ modulator)	G5	MDAT0	DSM_MDAT0_RZ
		G6	MCLK0	DSM_MCLK0_RZ
		A6	MDAT1	DSM_MDAT1_RZ
		E3	MCLK1	DSM_MCLK1_RZ
		E9	MDAT2	DSM_MDAT2_RZ
		K2	MCLK2	DSM_MCLK2_RZ
		B6	MDAT3	DSM_MDAT3_RZ
		M6	MCLK3	DSM_MCLK3_RZ
		C4	MDAT4	DSM_MDAT4_RZ
		B3	MCLK4	DSM_MCLK4_RZ
		P15	MDAT5	DSM_MDAT5_RZ
		C3	MCLK5	DSM_MCLK5_RZ
4	Busbar voltage detection circuit (24V)	E16	AN003	AD_BUS1_RZ
		A17	AN103	AD_BUS2_RZ

5.1 Overcurrent detection circuit

The overcurrent detection circuit in Figure 5.1 is used to detect overcurrent from the shunt resistance of each of the U, V, and W phases.

The overcurrent detection circuit determines that the current is overcurrent when any one of the currents flowing in the U, V, and W phases exceeds the threshold value.

The threshold is determined by the volume resistor VR1 and is set to full clockwise in the initial state.

Table 5.2 is shown the relationship between the volume resistor VR1 and the overcurrent detection current value. Adjust the volume resistor VR1 according to the application and set the threshold value.

If the current value is within the threshold range, the terminal POE_FOVx outputs High, and when an overcurrent is detected, it outputs Low. You can protect the RZ/T2M motor board and motor by monitoring terminal POE_FOVx and forcing the PWM output to go into the Hi-Z state when the output is low.

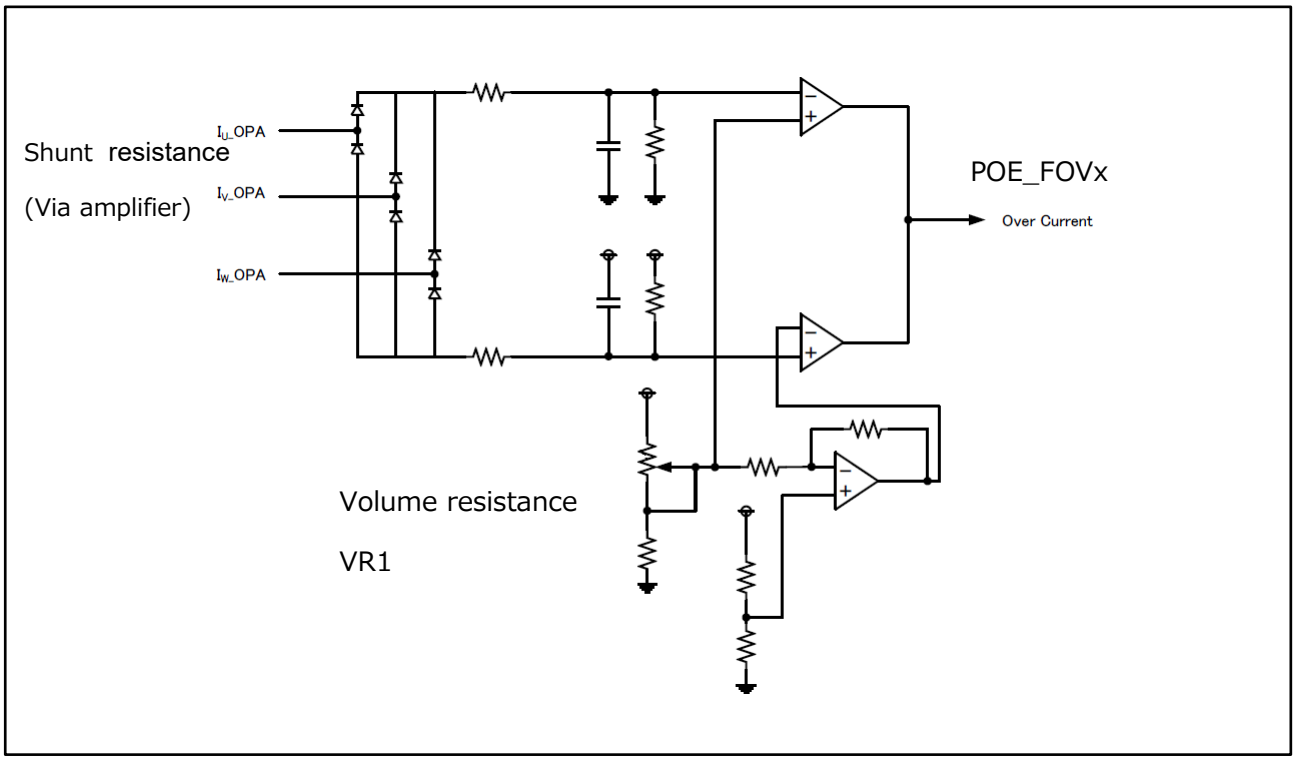


Figure 5.1 Outline of overcurrent detection circuit

Table 5.2 Volume resistor VR1 and overcurrent detection current value

Volume resistance value [Ω]	Overcurrent detection current value [A]
0(Full clockwise)	±12 A
10k(Full counterclockwise)	±2 A

5.2 Current detection circuit 1(Current Transducer)

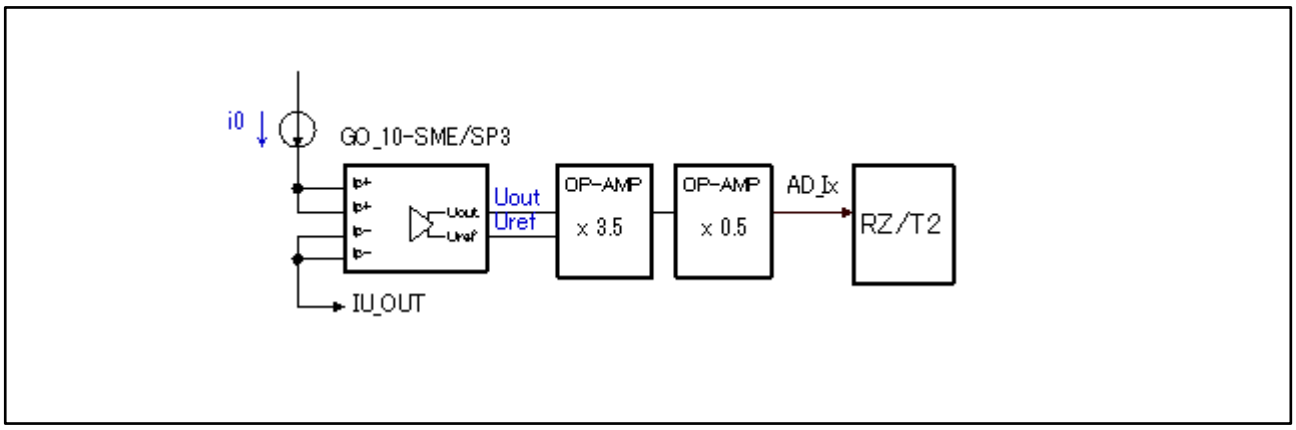


Figure 5.2 Current Transducer circuit

■Current calculation formula by Current Transducer circuit

CT sensitivity = 0.05 [V / A]

V(AD_Ix) = (0.05[V/A] x i0[A] x 3.5 + 1.65[V]) x 0.5
= 0.0875[V/A] x i0[A] +0.825[V]

RZ/T2M A/D converter Resolution:12bit (VCC18_ADC0/1=1.8[V])
1LSB (A/D converter value) =1.8[V] / 0.00875[V/A] /4095 = 5.024[mA]

Current detection range:
i0[A] = (V(AD_Ix) – 0.825[V]) / 0.0875[V/A]
i0[A] = -0.825[V] / 0.0875[V/A] = -9.429[A] (V(AD_Ix) = 0V)
i0[A] = (1.8[V] – 0.825[V]) / 0.0875[V/A] = 11.143[A] (V(AD_Ix) = 1.8V)

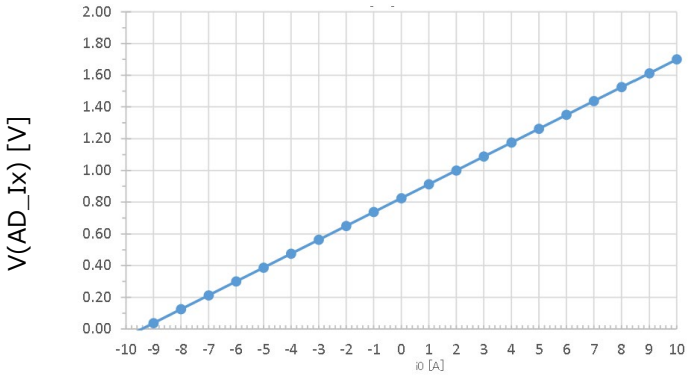


Figure 5.3 Current detection circuit 1 characteristics

5.3 Current detection circuit 2(ΔΣ Modulator)

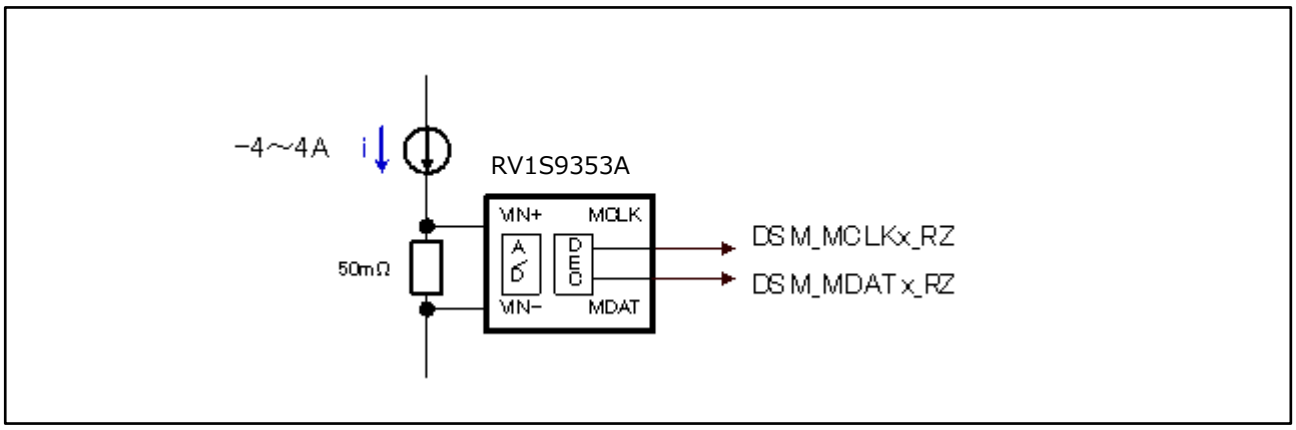


Figure 5.4 ΔΣ Modulator circuit

5.4 Bus voltage detection circuit

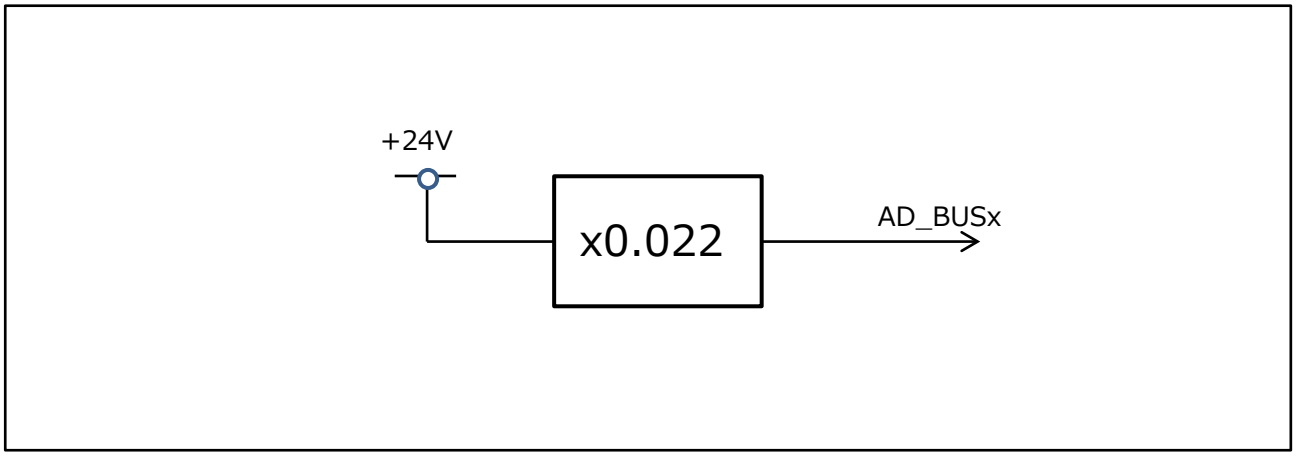


Figure 5.5 Bus voltage detection circuit

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	2021.7.31	–	Preliminary
1.01	2022.8.26	P.1	Modify error

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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