RZ/N2L Group

CN032-7 Industry Gateway Solution Hardware Manual

R12UM0057EC0100
Rev.1.00
Jun.28, 2024

Abstract

This document describes the specifications of the CN032-7 Industry Gateway Solution equipped with the MPU of the RZ/N2L group manufactured by Renesas Electronics. We provide an environment for evaluating RZ/N2L without the need for customers to prepare their own hardware.

Target Device

RZ/N2L Group

Related Document

- RZ/N2L Group User's Manual: Hardware

Contents

1. Overview

1.1 Industry Gateway Solution Overview

CN032-7 Industry Gateway Solution is a solution for industry Profinet PLC coupler with DI/DO systems equipped with Renesas Electronics' RZ/N2L and related products.

It shows the capability and feature of RZ/N2L for multi-protocol support as references for applications.

1.2 Hardware Block Image

The CN032-7 Industry Gateway Solution block image is shown in Figure 1-1.

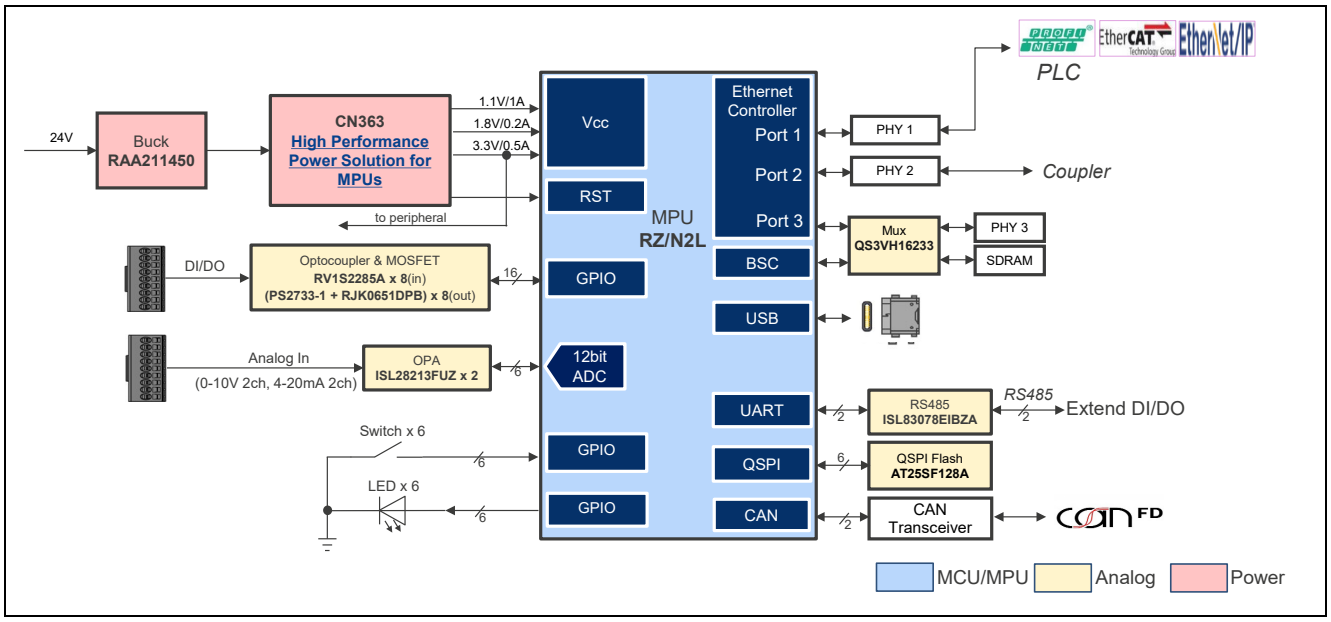

Figure 1-1 Industry Gateway Solution Block

The CN032-7 Industry Gateway Solution image is shown in Figure 1-2.

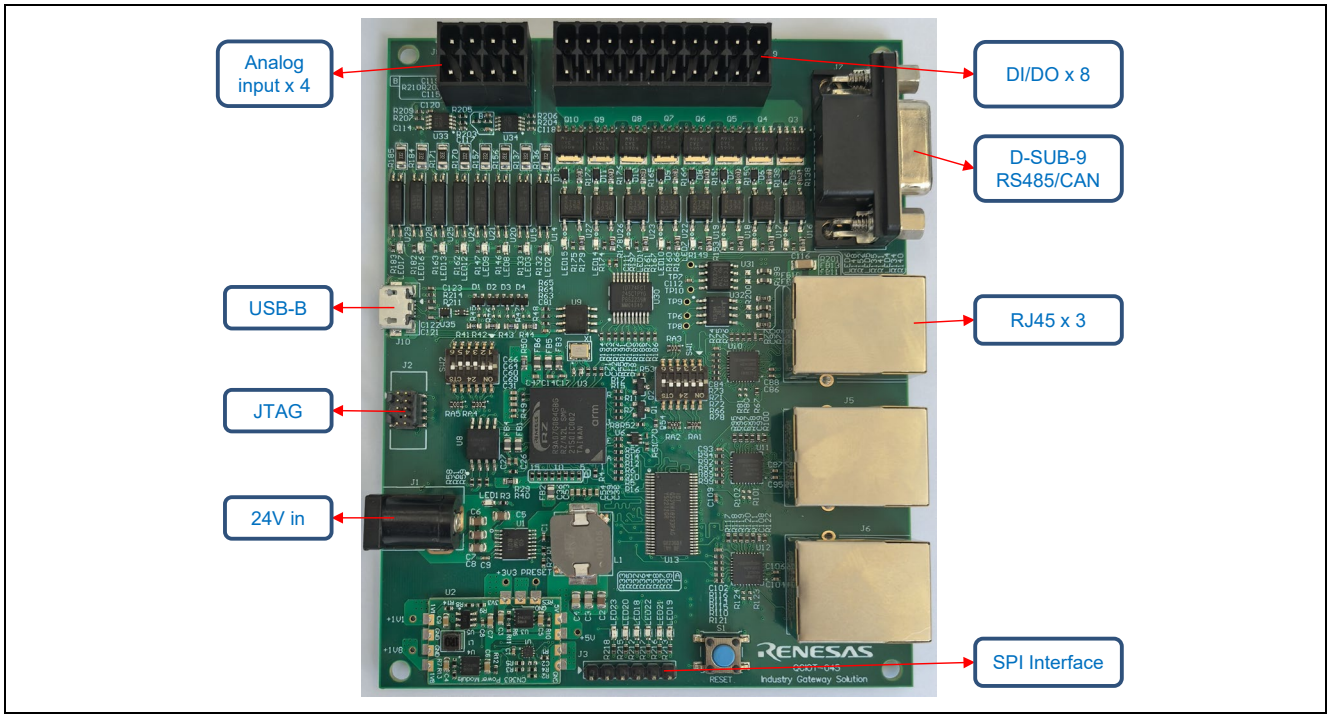

Figure 1-2 Industry Gateway Solution Image

2. General Specifications

Table 2-1 Specification's summary

Items		Description
CPU	Series	RZ/N2L Single Arm Cortex®-R52
	Package	R9A07G084M04: 225-pin FBGA
	Clock	Up to 400MHz
	ATCM/BTCM	128KB/128KB
	System RAM	1.5MB
SDRAM		W9825G6KH-6
QSPI Flash		128MBIT, AT25SF128A-SHB-T (Renesas)
EEPROM		16KBIT, R1EX24016ASAS (Renesas)
Power In		24V DC
Interfaces		JTAG (10-PIN)
		Ethernet port x 3
		Micro USB x 1
		RS485 x 1
		CAN x 1
		SPI x 1
		Digital input x 8, Digital output x 8,
		Analog input x 4 (0-10V 2-ch, 4-20mA 2-ch)

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
Industry gateway solution board	90(W)×112(D)×1.6(T)	NO include protrusions, NO include component height

The main parts in Industry Gateway Solution description are shown in Figure 2-1.

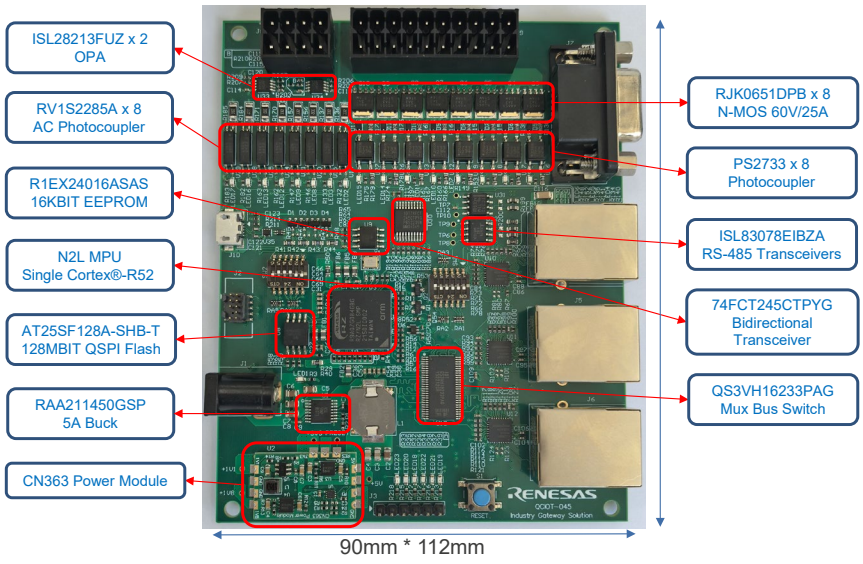

Figure 2-1 Industry Gateway Solution (front)

The Industry Gateway Solution image (back) is shown in Figure 2-2.

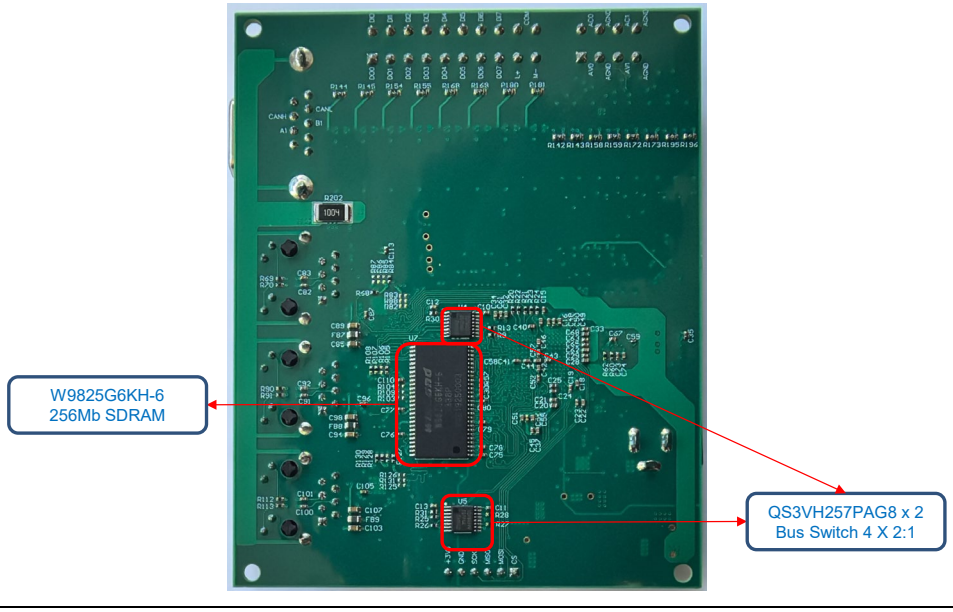

Figure 2-2 Industry Gateway Solution (back)

3. Interface Description

3.1 Power Supply

The Industry Gateway Solution board is powered by external 24V DC, with an 4.5V~42V, 5A, DC/DC Synchronous Step-Down Regulator RAA211450GSP and CN363 Power Module.

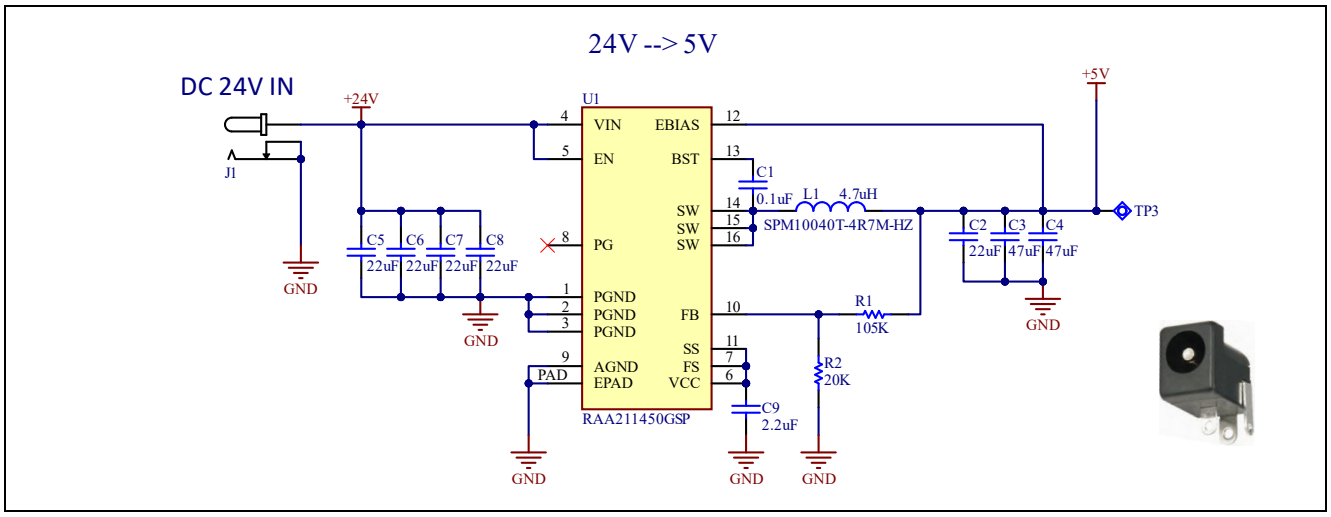

Figure 3-1 24V DC Power Supply

The CN363 Power Module provides a simple and low-cost power tree for RZ/N2L with programmable device GreenPAK, this module also can be used in other related MPU with low cost and flexible.

The CN363 Power Module supplies 1.1V/1.8V/3.3V (MCU/peripheral) with Stamp hole package.

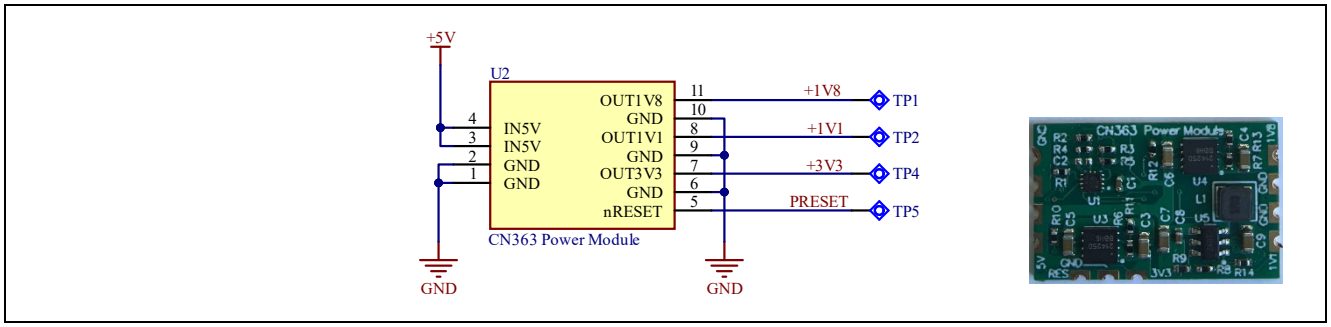

Figure 3-2 CN363 Power Module

RZ/N2L is a new generation Ethernet communication MPU, which need power on/off sequence. here is the Power on/off sequence and timing supplied from CN363 Power Module.

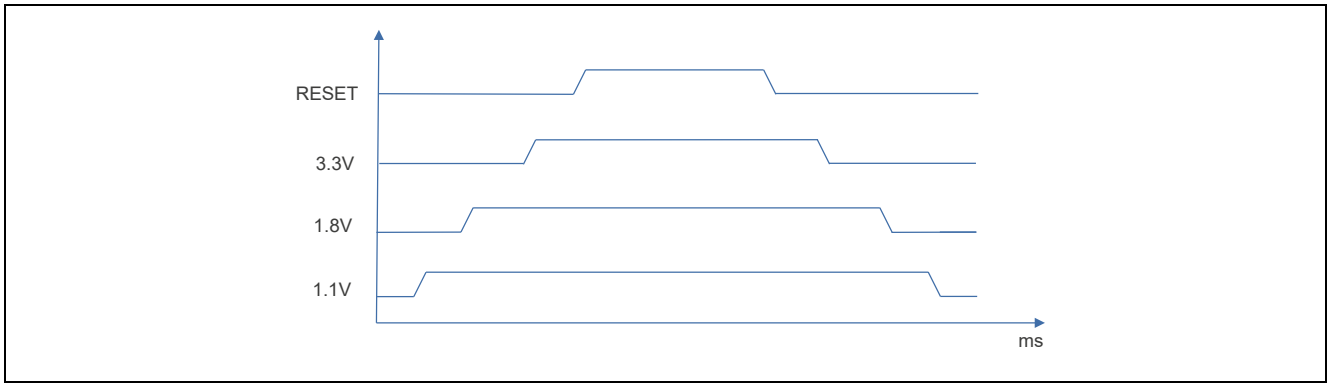

Figure 3-3 Power On/Off Sequence from CN363 Power Module

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

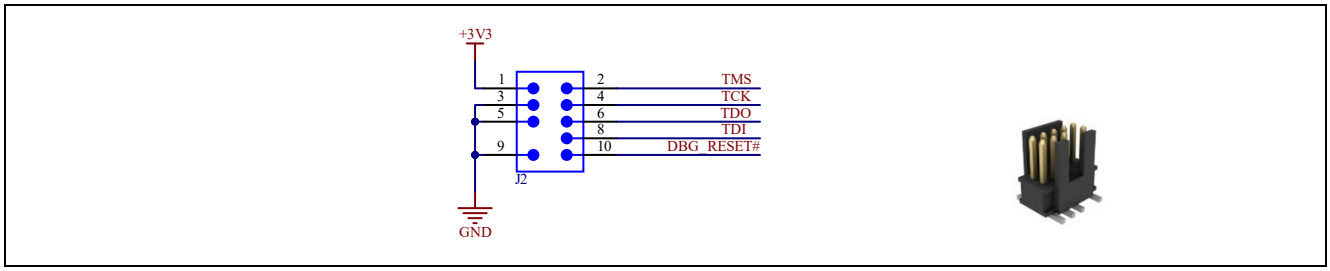

Figure 3-4 JTAG Interface

3.3 Dip Switch

3.3.1 Mode Switch

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

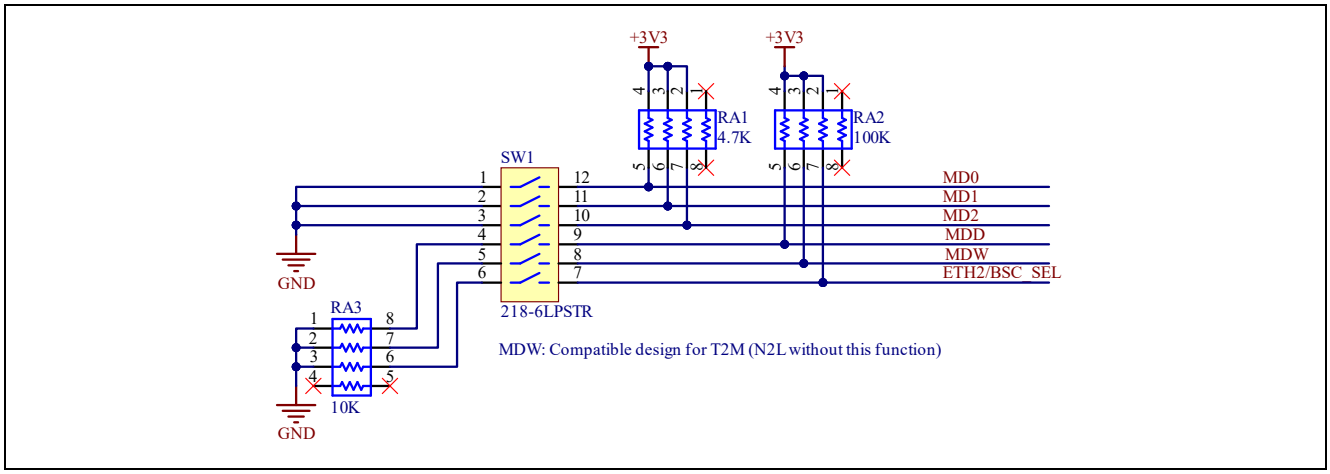

Figure 3-5 Operating Mode

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: Compatible design for RZ/T2M (RZ/N2L without this function)).

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

Selection of bus switch channel for Ethenet2 or BSC

ETH2/BSC_SEL	Function pins select
0	Ethenet2
1	BSC

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.

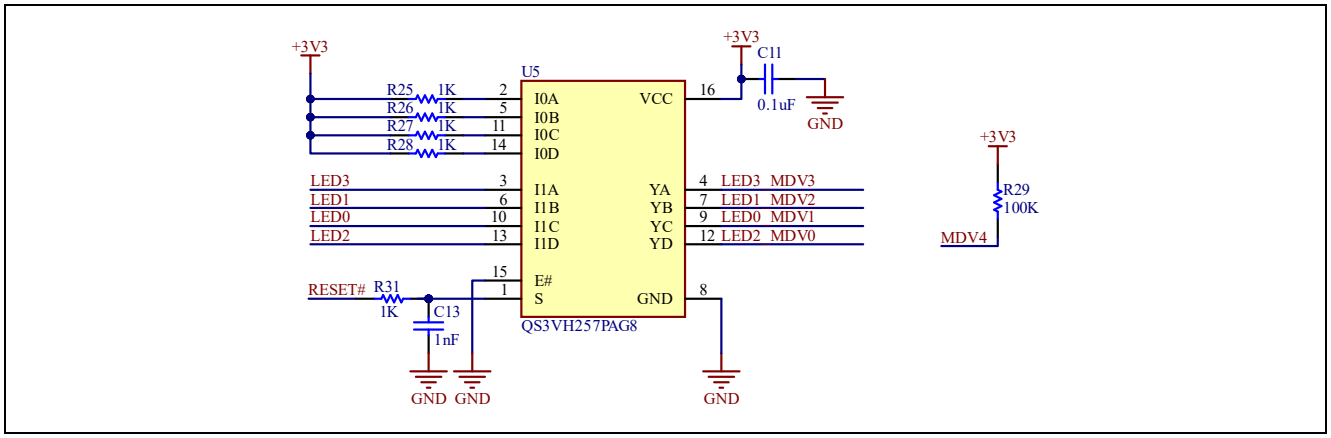

Figure 3-6 Operating Voltage

3.3.2 Device-ID Setting Switch

A board specific Device ID can optionally be set.

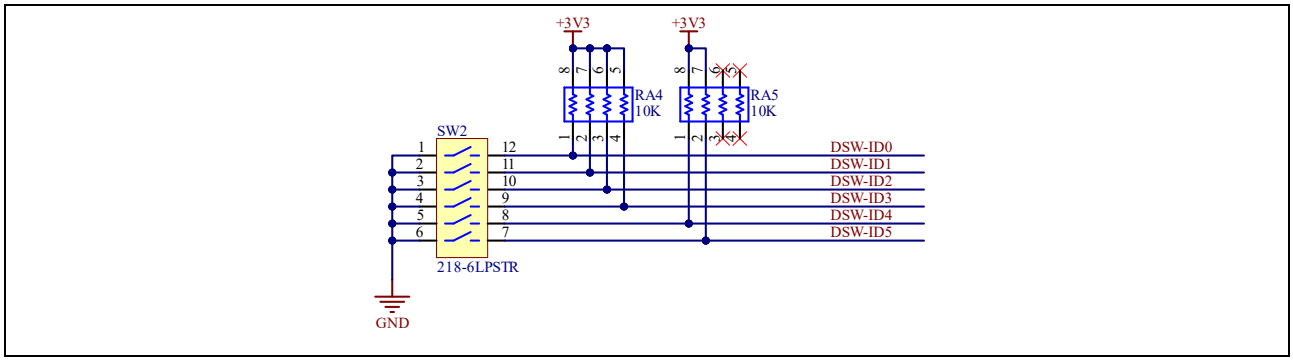

Figure 3-7 Device-ID setting switch

3.4 Ethenet Interface

There are 3 Ethenet channels in Industry Gateway Solution board.

Ethenet0 and Ethenet1 are used for PROFINET interface, EtherCAT and Ethernet/IP are also supported.

Ethenet2 is used for Ethernet/IP function, but it is disable when Ethenet0 and Ethenet1 are using as PROFINET function, since some control pins for Ethenet2 and Bus State Controller (BSC for external SDRAM) are reused, and SDRAM is nesessary for PROFINET function.

The part number of RJ45 is J00-0045NL.

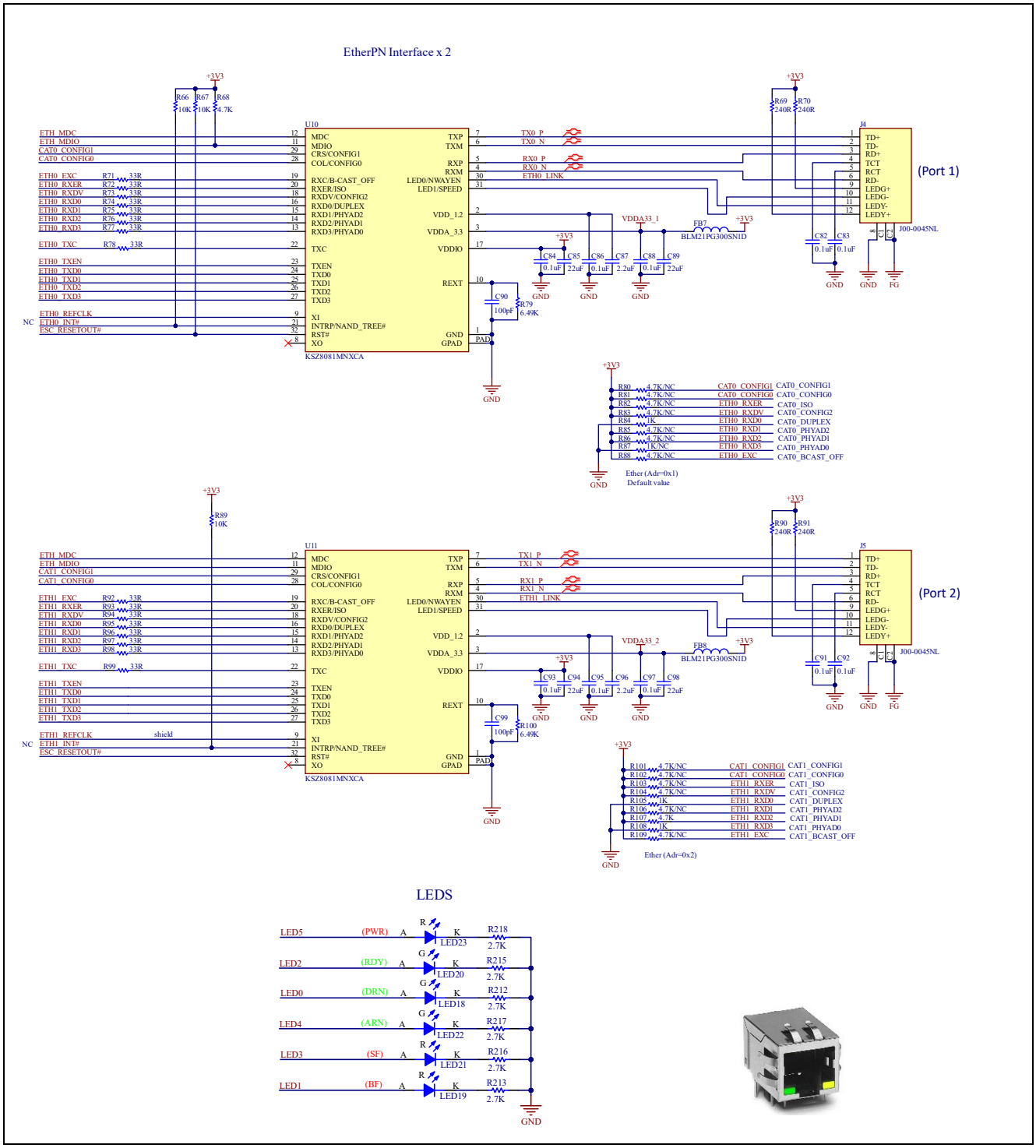

Figure 3-8 Ethenet Interface

3.5 LEDs

There are 23 LEDs in the Industry Gateway Solution board. Please see below for the assignment.

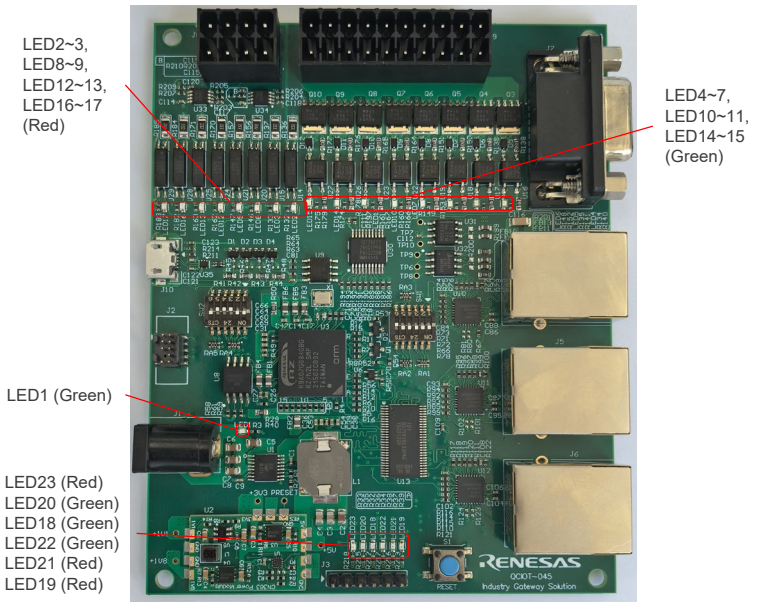

Figure 3-9 Board LEDs

Item	Circuit number	Color	Using
Power supply LED	LED1	Green	Input power: Light up
Profinet status LED	LED23	Red	Power indicator ON:Normal, Off: Abnormal
	LED20	Green	Profinet running status ON:Normal, Off: Abnormal
	LED18	Green	Digit communication status ON:Normal, Off: Abnormal
	LED22	Green	Analog communication status ON: Normal, Off: Abnormal
	LED21	Red	System failure ON: Abnormal, Off: Normal
	LED19	Red	Communication failure ON: Abnormal, Off: Normal
Digit input LED x 8	LED2~3, LED8~9, LED12~13, LED16~17	Red	Light up when the related digit input
Digit output LED x 8	LED4~7, LED10~11, LED14~15	Green	Light up when enable the related digit output

3.6 Option for Ethenet2/BSC

Since some control pins for Ethenet2 and SDRAM are reused, a Mux Bus Switch IC (QS3VH16233PAG) is used for these two functions switching, which control by dip switch SW1.

SDRAM is the default selection that using Bus State Controller (BSC).

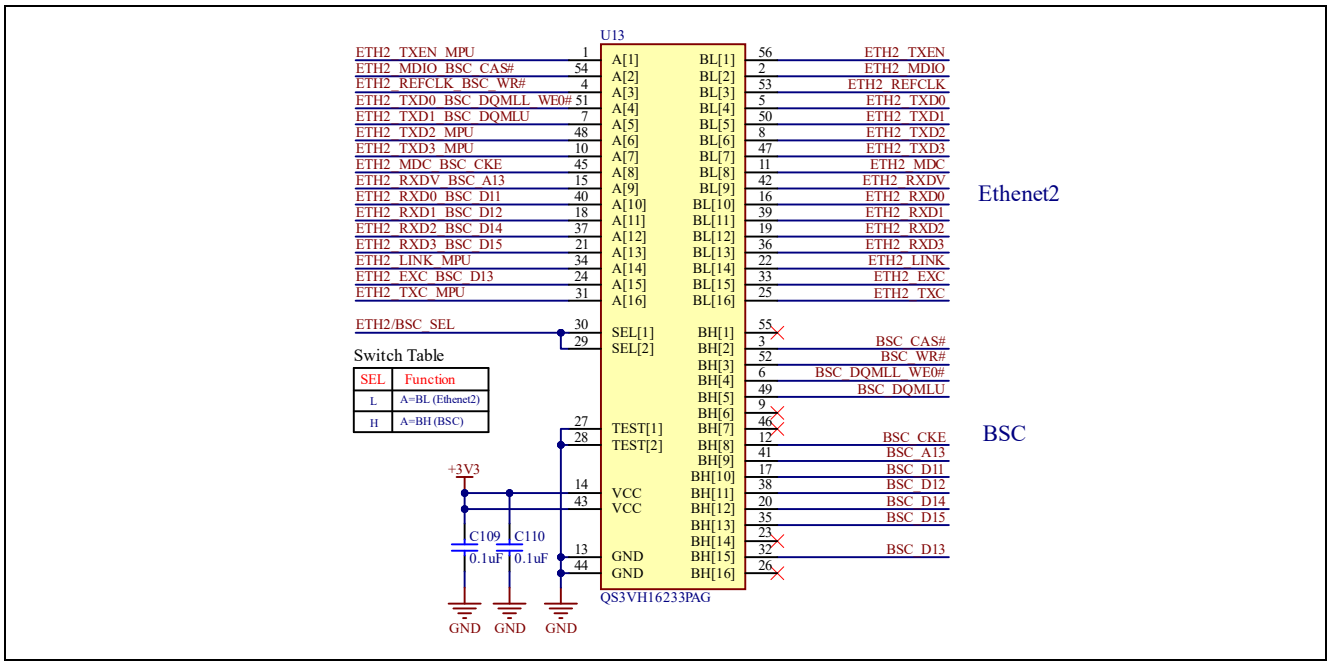

Figure 3-10 Option for Ethenet2/BSC

3.7 SPI Interfaces

The SPI function is reserved function for user, use 2.54mm 1x6 header.

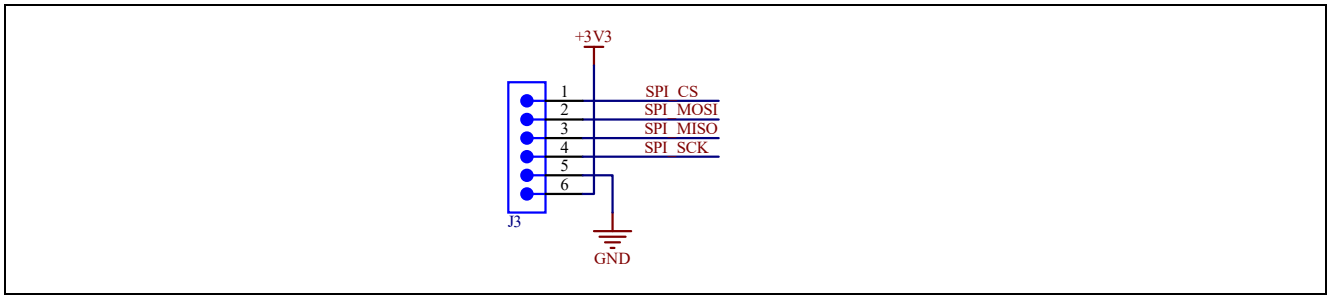

Figure 3-11 SPI Interface

3.8 RS485&CAN Interfaces

The user can use the CAN and RS485 function with D-Sub connector, part number 2311765-1.

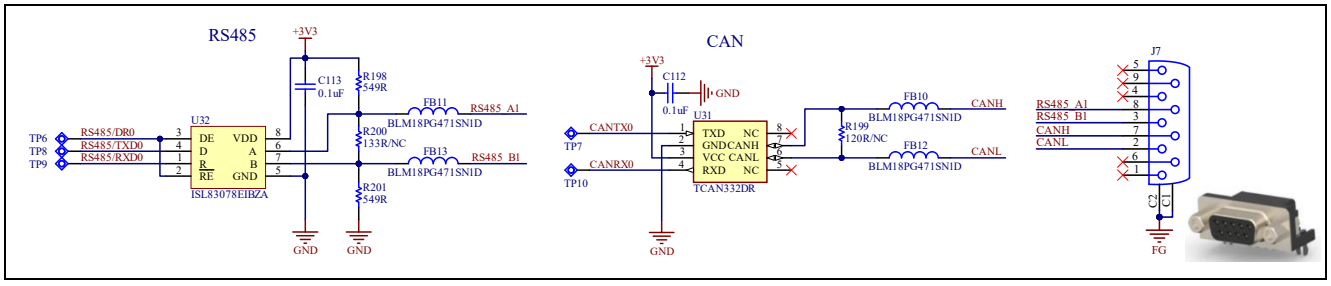

Figure 3-12 RS485&CAN Interface

3.9 USB Interface

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

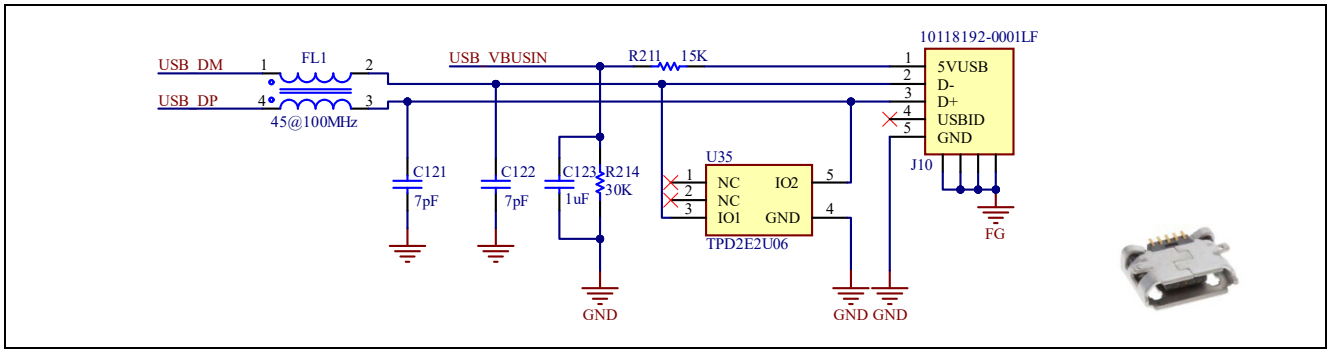

Figure 3-13 USB Interface

3.10 DI/DO Interface

Industry Gateway Solution board supports 8-channel Digit Input (DI) and 8-channel Digit Output (DO) control, the interface part number is 1787289.

For 8-channel DI, it supports input signal type both PNP and NPN, the input rated voltage is 24V DC. Each channel has a red LED indicator. If the LED is ON, there is an input signal, if the LED is OFF, there is no input signal.

For 8-channel DO, it supports output signal type NPN, the output rated voltage is 24V DC. Each channel has a green LED indicator. If the LED is ON, the output load is active and the voltage is 0V. If the LED is OFF, the output load is disable.

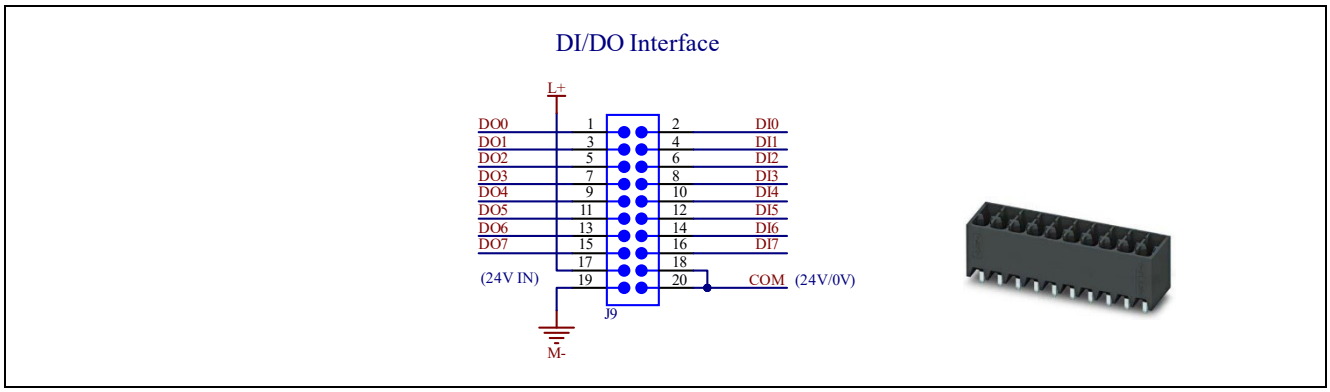

Figure 3-14 DI/DO Interface

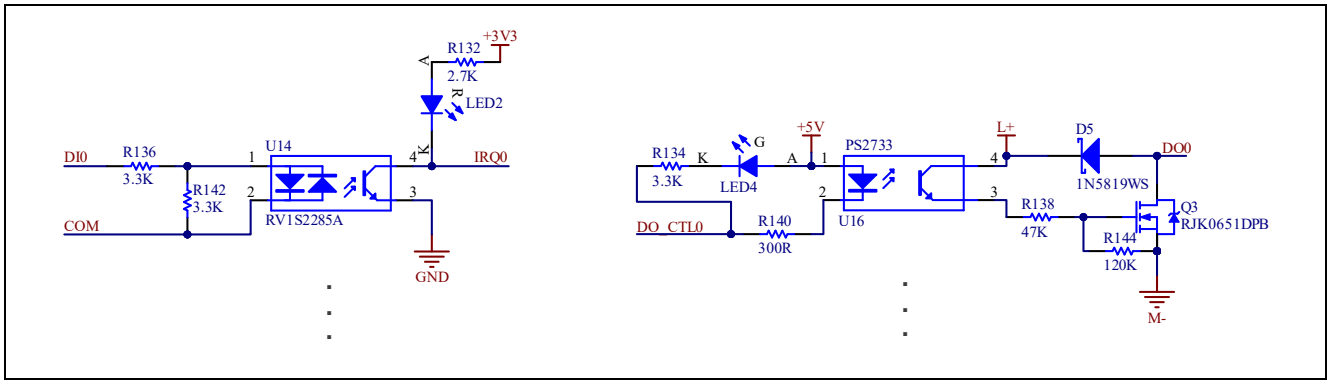

Figure 3-15 DI/DO Circuitry

3.11 ADI Interface

Industry Gateway Solution board supports 2-channel voltage type analog input (0-10V) and 2-channel current type analog input (4-20mA), the ADC resolution is 12-bit. The interface part number is 1787221.

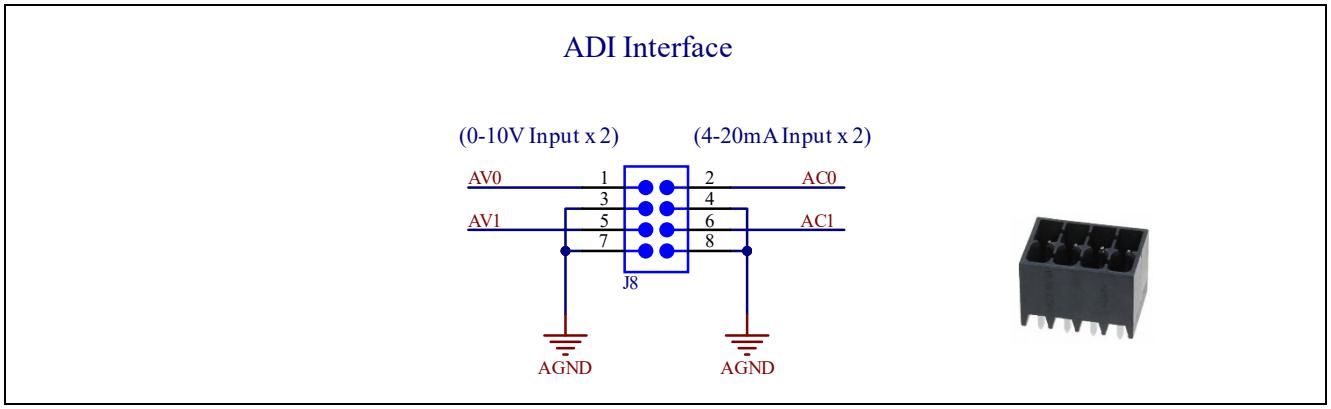

Figure 3-16 ADI Interface

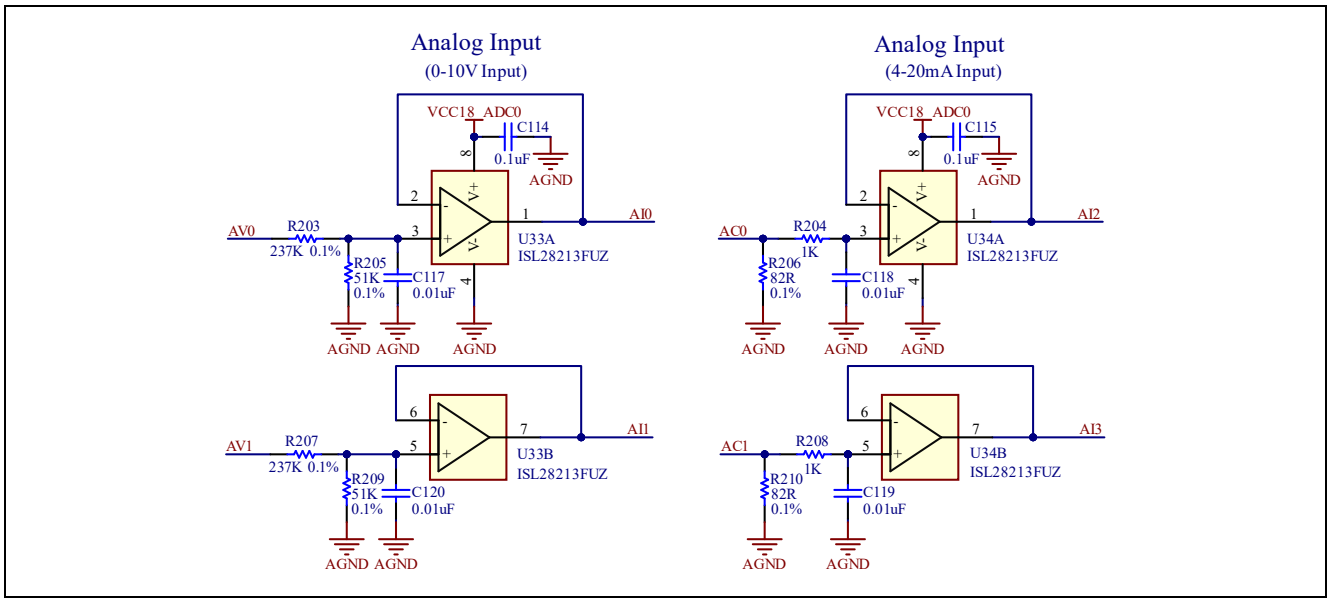

Figure 3-17 ADI Circuitry

4. MCU Pin Map

Table 4-6 Pin Map (1/5)

No.	Pin Name	Signal Name	Function
B13	AN000	ADC_AN000	Voltage type analog input 0
C12	AN001	ADC_AN001	Voltage type analog input 1
B14	AN002	ADC_AN002	Curent type analog input 0
C13	AN003	ADC_AN003	Curent type analog input 1
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	ETH2_RXD3_BSC_D15	ETH2_RXD3 / BSC_D15
D5	P00_1	ETH2_RXDV_BSC_A13	ETH2_RXDV / BSC_A13
A3	P00_2	ETH2_TXEN	ETH2_TXEN_TXCTL
B3	P00_3	ETH2_REFCLK_BSC_WR#	ETH2_REFCLK / BSC_WR#
A4	P00_4	ETH2_RXER	ETH2_RXER
B4	P00_5	ETH2_LINK	ESC_PHYLINK2
C3	P00_6	ETH2_TXC	ETH2_TXCLK_TXC
D4	P00_7	BSC_RAS#	BSC_RAS#
A2	P01_0	ETH2_MDIO_BSC_CAS#	ETH2_MDIO_BSC_CAS#
D3	P01_1	ETH2_MDC_BSC_CKE	ETH2_MDC_BSC_CKE
B2	P01_2	ETH2_TXD3	ETH2_TXD3
C2	P01_3	ETH2_TXD2	ETH2_TXD2
E4	P01_4	ETH2_TXD1_BSC_DQMLU	ETH2_TXD1 / BSC_DQMLU
B1	P01_5	ETH2_TXD0_BSC_DQMLL_WE0#	ETH2_TXD0 / BSC_DQMLL_WE0#
D2	P01_6	-	None
C1	P01_7	CANRX0	CANRX0
E3	P02_0	IRQ4	Digit input 2
D1	P02_1	MDW	Mode setting (MDW)
F3	P02_2	CANTX0	CANTX0
E1	P02_3	BSC_A15	BSC_A15
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	BSC_A14	BSC_A14

Table 4-7 Pin Map (2/5)

No.	Pin Name	Signal Name	Function
G1	P03_5	BSC_A12	BSC_A12
G4	P03_6	BSC_A11	BSC_A11
G5	P03_7	BSC_A10	BSC_A10
H1	P04_0	BSC_A9	BSC_A9
H2	P04_1	BSC_CKIO	BSC_CKIO
H4	P04_4	BSC_A8	BSC_A8
H3	P04_5	MD0_BSC_A7	Mode setting (MD0) / BSC_A7
H5	P04_6	MD1_BSC_A6	Mode setting (MD1) / BSC_A6
J1	P04_7	MD2_BSC_A5	Mode setting (MD2) / BSC_A5
J5	P05_0	BSC_A4	BSC_A4
J2	P05_1	BSC_A3	BSC_A3
J4	P05_2	BSC_A2	BSC_A2
J3	P05_3	BSC_A1	BSC_A1
K1	P05_4	IRQ12	Digit input 7
K2	P05_5	ETH1_LINK	ESC_PHYLINK1
K3	P05_6	ETH1_RXER	ETH1_RXER
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_RXER	ETH0_RXER
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 4-8 Pin Map (3/5)

No.	Pin Name	Signal Name	Function
M9	P10_4	ETH0_LINK	ESC_PHYLINK0
N11	P12_4	DSW-ID0	GPIO (input)
L10	P13_2	ESC_I2CCLK-B	ESC_I2CCLK-B
N12	P13_3	ESC_I2CDATA-B	ESC_I2CDATA-B
L12	P13_4	ESC_RESETOUT#	ESC_RESETOUT#
M12	P13_5	DSW-ID1	GPIO (input)
M13	P13_6	DSW-ID2	GPIO (input)
M11	P13_7	DSW-ID3	GPIO (input)
L13	P14_0	DSW-ID4	GPIO (input)
L14	P14_1	DSW-ID5	GPIO (input)
K12	P14_2	IRQ6	Digit input 3
M14	P14_3	NC	None
J13	P14_4	NC	None
J12	P14_5	BSC_CS3#	BSC_CS3#
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	RZ_DO_CTL0	Digit output 0
H13	P15_4	RZ_DO_CTL1	Digit output 1
J14	P15_5	LED5	GPIO (output)
H12	P15_6	SPI_CS	SPI_CS
J15	P15_7	XSPI0_CS0	XSPI0_CS0
G13	P16_0	SPI_MOSI	SPI_MOSI
H11	P16_1	SPI_MISO	SPI_MISO
H14	P16_2	SPI_SCK	SPI_SCK
G12	P16_3	IRQ7	Digit input 4
H15	P16_5	RS485/TXD0	TXD0
G11	P16_6	RS485/RXD0	RXD0
G14	P16_7	RS485/DR0	GPIO (output)
F12	P17_0	MDD	Mode setting (MDD)
F14	P17_3	LED4	GPIO (output)
F13	P17_4	RZ_DO_CTL2	Digital output 2
F15	P17_5	RZ_DO_CTL3	Digital output 3
G15	P17_6	RZ_DO_CTL6	Digital output 6
E15	P17_7	RZ_DO_CTL4	Digital output 4
E14	P18_0	RZ_DO_CTL5	Digital output 5
D15	P18_1	IRQ10	Digit input 5
D14	P18_2	RZ_DO_CTL7	Digital output 7
E13	P18_3	IRQ0	Digit input 0
E12	P18_4	IRQ1	Digit input 1
D13	P18_5	NC	NC
C15	P18_6	IRQ11	Digit input 6
B15	P19_0	MDV4	Mode setting (MDV4)
B9	P20_1	LED2_MDV0	GPIO (output) / Mode setting (MDV0)

Table 4-9 Pin Map (4/5)

No.	Pin Name	Signal Name	Function
D8	P20_2	LED0_MDV1	GPIO (output) / Mode setting (MDV1)
D9	P20_3	LED1_MDV2	GPIO (output) / Mode setting (MDV2)
A9	P20_4	LED3_MDV3	GPIO (output) / Mode setting (MDV3)
B8	P21_1	BSC_D0	BSC_D0
C8	P21_2	BSC_D1	BSC_D1
A8	P21_3	BSC_D2	BSC_D2
E7	P21_4	BSC_D3	BSC_D3
C7	P21_5	BSC_D4	BSC_D4
D7	P21_6	BSC_D5	BSC_D5
B7	P21_7	BSC_D6	BSC_D6
A7	P22_0	BSC_D7	BSC_D7
A6	P22_1	BSC_D8	BSC_D8
C6	P22_2	BSC_D9	BSC_D9
B6	P22_3	BSC_D10	BSC_D10
D6	P23_7	ETH2_RXD0_BSC_D11	ETH2_RXD0 / BSC_D11
A5	P24_0	ETH2_RXD1_BSC_D12	ETH2_RXD1 / BSC_D12
B5	P24_1	ETH2_EXC_BSC_D13	ETH2_EXC / BSC_D13
C5	P24_2	ETH2_RXD2_BSC_D14	ETH2_RXD2 / BSC_D14
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 4-10 Pin Map (5/5)

No.	Pin Name	Signal Name	Function
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	-	-

5. BOM List for Renesas Key Parts

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

Here are the Renesas Key parts used in Industry Gateway Solution board, for more information, please refer to the related files from Renesas.

BOM List from Industry Gateway Solution Board

Designator	Description	Manufacturer	Mfg Part Number	Quantity
Q3, Q4, Q5, Q6, Q7, Q8, Q9, Q10	MOSFET N-CH 60V 25A LFPAK	Renesas	RJK0651DPB	8
U1	4.5V to 42V, 5A, DC/DC Synchronous Step-Down Regulator	Renesas	RAA211450GSP#HA0	1
U2	Renesas Power Module	Renesas	CN363 Power Module	1
U3	Renesas RZ-N2L MCU	Renesas	R9A07G084M04GBG#AC0	1
U4, U5	IC BUS SWITCH 4 X 2:1 16TSSOP	Renesas	QS3VH257PAG8	2
U8	IC FLASH 128MBIT SPI/QUAD 8SOIC	Renesas	AT25SF128A-SHB-T	1
U9	IC EEPROM 16KBIT I2C 400KHZ 8SOP	Renesas	R1EX24016ASAS	1
U13	IC MUX/DEMUX 2 X 16:8 56TSSOP	Renesas	QS3VH16233PAG	1
U14, U15, U20, U21, U24, U25, U28, U29	OPTO COUPLER IN 4PIN SSOP	Renesas	RV1S2285ACCSP-10YC#SC0	8
U16, U17, U18, U19, U22, U23, U26, U27	OPTOISOLATOR 2.5KV DARL 4SMD	Renesas	PS2733-1-A	8
U30	IC TXRX NON-INVERT 5.25V 20SSOP	Renesas	74FCT245CTPYG	1
U32	IC TRANSCEIVER HALF 1/1 8SOIC	Renesas	ISL83078EIBZA	1
U33, U34	IC OPAMP GP 2 CIRCUIT 8MSOP	Renesas	ISL28213FUZ	2

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Jun.28, 2024	–	First Edition issued

General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Precaution against Electrostatic Discharge (ESD)
   A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.
2. Processing at power-on
   The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power reaches the level at which resetting is specified.
3. Input of signal during power-off state
   Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.
4. Handling of unused pins
   Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.
5. Clock signals
   After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.
6. Voltage application waveform at input pin
   Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (Max.) and V_{IH} (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (Max.) and V_{IH} (Min.).
7. Prohibition of access to reserved addresses
   Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.
8. Differences between products
   Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

Notice

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

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

(Note1) “Renesas Electronics” as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.

(Note2) “Renesas Electronics product(s)” means any product developed or manufactured by or for Renesas Electronics.

(Rev.5.0-1 October 2020)

Corporate Headquarters

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

Trademarks

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

Contact information

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