EC2232G2B01
Datasheet

V1.0

Revision History

Date	Version	Note
March 2025	V1.0	First edition

Table of contents

1. System Description

1.1 Overview

CCU (Central Compute Unit) is a central computing platform.

The CCU (Central Control Unit) is the control unit for the vehicle's control network or CAN bus-based network. It is capable of controlling the gearbox's shifting mechanism based on the vehicle's driving mode and the driver's behavior requirements.

During vehicle operation, the CCU receives input signals from the driver, such as pedal signals, vehicle speed signals, gear position signals, and other input signals. It coordinates the motor, battery pack, and other auxiliary systems to meet the driving torque requirements. Additionally, it performs functions such as fault diagnosis and handling, vehicle status monitoring, and driving mode transitions.

1.1.1 Functionality

EC2232G2B01 mainly has the following functions:

Table 1 EC2232G2B01 Features

Feature
1 - key signal (KEYON)
3 - wake-up signals (A+, WAKE1, WAKE2)
2 - Power Supply Voltage (BATT)
5 - 5V output (maximum current 100mA)
12 - CAN communication interface (supports CAN flashing/CANFD): CANA-CAND supports any frame/specific frame wake-up
6 - analog signal input port (0 – 5V)
17 - digital signal input ports: 2 active-high, 15 active-low
4 - low-side driver outputs
3 - LIN communication interface: support host mode
4 – 100BASE-T1 automotive ethernet
1 - 100BASE-TX standard ethernet

1.1.2 Mechanical

The housing of CCU is formed by aluminum die-casting and assembled with silicone rubber. There is no special treatment or plating on the outside of the housing, no sharp burrs and sharp edges. The nominal dimensions of the CCU housing are as follows (excluding the female end of the CCU connector, in mm):

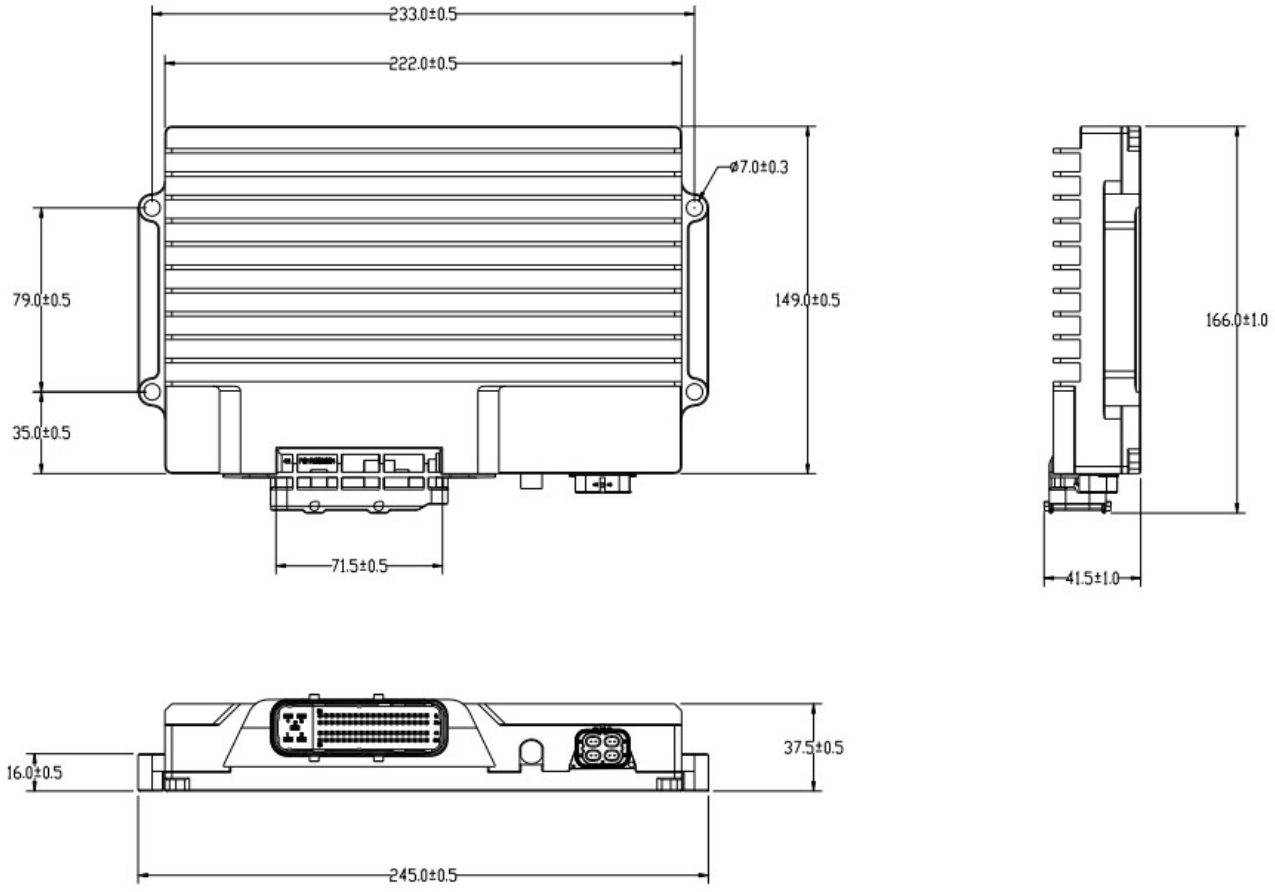


Figure 1 CCU Housing Dimensions

The housing appearance is as follows:

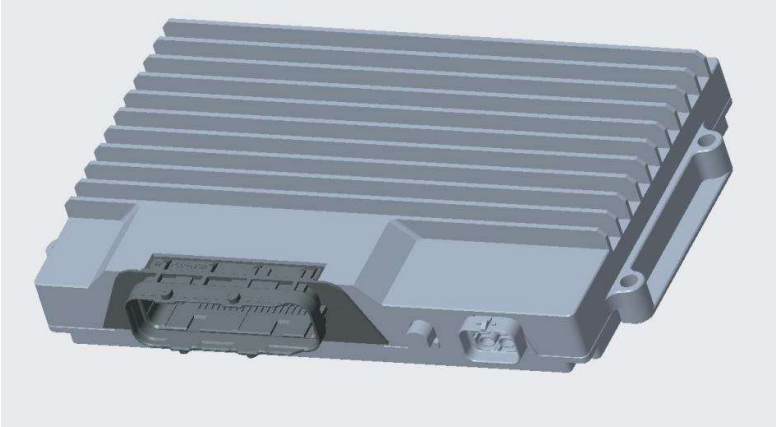


Figure 2 CCU Housing Appearance

The screwdriver head used for disassembling the housing: Torx T15. The product identification label is affixed to the VCU housing, which contains the product identification code, customer information, date, batch number, serial number, etc.

1.1.3 Connectors

VCU uses the world-renowned "Tyco" brand connector, which is a qualified product that meets automotive safety standards and has 81 pins. The specific models of the connectors are shown in the following table.

Table 2 Connector Information

#	Name	Part Number	Supplier	Link
1	PCB pin header	BS832	BS	
2	81P sheath	368290-1	TE	https://www.te.com.cn/chn-zh/product-368290-1.html#scetion-pdp-related-info-compatible
3	Terminal (wire diameter 0.2-0.35)	5-928999-1	TE	https://www.te.com.cn/chn-zh/product-5-928999-1.html
4	Terminal (wire diameter 0.5-0.75)	5-963715-1	TE	https://www.te.com.cn/chn-zh/product-5-963715-1.html
5	Terminal (wire diameter 0.75-1.0)	927771-3	TE	https://www.te.com.cn/chn-zh/product-927771-3.html
6	Terminal (wire diameter 1.5-2.5)	927768-3	TE	https://www.te.com.cn/chn-zh/product-927768-3.html

The connector is shown in the figure below:

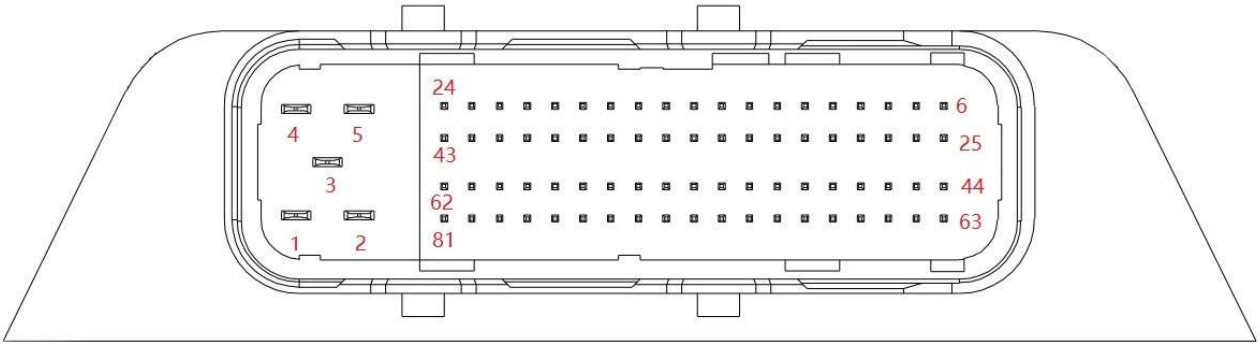


Figure 3 Connector and Pin Distribution Diagram

1.1.4 Processor Specifications

Table 3 Processor Specs

Feature	Detail
Micro Control Core	S32G274A
Maximum Frequency	400MHz
QSPI	64M
SRAM	8M
Floating Point Capability	Yes
SPI	50 Mbit/s
EMMC	≥8G
DDR4	≥1G

1.1.5 Recommended Software

Controller Model	EC2232G2B01
Main Chip	S32G274A
Integrated Development Environment	S32_Design_Studio_and_Configuration_Tools_3_5_3_D2306
EcoCoder Version	EcoCoder-v2.9.16 R2 or above
EcoFlash Version	EcoFlash-v1.1.6.7 or above
EcoCAL Version	EcoCAL-v2.1.8.3 or above

1.1.6 Power Supply

EC2232G2B01 requires 2 continuous power supplies (pin 4 and pin 4), and the CCU is awakened and powered on by the key switch (pin 35).

2 Interface Description

2.1 Pin Definition

Signal name	PIN	Function	Interface Description	Remark
Power supply				
BATT	4 5	power supply	Power supply: 12V/24V	9-32V
5V1	2	5V sensor voltage 2	5V power supply for external sensor	5V±2%, max. 100mA
5V2	81	5V sensor voltage 3	5V power supply for external sensor	5V±2%, max. 100mA
5V3	62	5V sensor voltage 4	5V power supply for external sensor	5V±2%, max. 100mA
5V4	43	5V sensor voltage 5	5V power supply for external sensor	5V±2%, max. 100mA
5V5	24	5V sensor voltage 6	5V power supply for external sensor	5V±2%, max. 100mA
PGND	1 3	Ground	Power Ground	
GND	42 80	Signal ground	External sensor ground	
Analog Input				
AI01	56	Analog Input 01	Analog signal input 0~5V	Voltage type, 12-bit accuracy
AI02	55	Analog Input 02	Analog signal input 0~5V	Voltage type, 12-bit accuracy
AI03	53	Analog Input 03	Analog signal input 0~5V	Voltage type, 12-bit accuracy
AI04	32	Analog Input 04	Analog signal input 0~5V	Voltage type, 12-bit accuracy
AI05	69	Analog Input 05	Analog signal input 0~5V	Voltage type, 12-bit accuracy
AI06	48	Analog Input 06	Analog signal input 0~5V	Voltage type, 12-bit accuracy
Power-on signal				
KEYON	35	Key input signal	Digital signal input 0~BATT	Wake-up threshold＞9V
A+	71	Wake-up signal	Digital signal input 0~BATT	Wake-up threshold＞9V
WAKE1	67	Wake-up signal	Digital signal input 0~BATT	Wake-up threshold＞9V
WAKE2	47	Wake-up signal	Digital signal input 0~BATT	Wake-up threshold＞9V
Digital Input				
DI01	58	Digital Input 01	Digital signal input 0~BATT	Active-Low
DI02	77	Digital Input 02	Digital signal input 0~BATT	Active-Low
DI03	57	Digital Input 03	Digital signal input 0~BATT	Active-Low
DI04	76	Digital Input 04	Digital signal input 0~BATT	Active-Low
DI 05	75	Digital Input 05	Digital signal input 0~BATT	Active-Low
DI 06	16	Digital Input 06	Digital signal input 0~BATT	Active-Low
DI07	72	Digital Input 07	Digital signal input 0~BATT	Active-Low
DI08	73	Digital Input 08	Digital signal input 0~BATT	Active-Low
DI 09	54	Digital Input 09	Digital signal input 0~BATT	Active-Low

DI 10	34	Digital Input 10	Digital signal input 0~BATT	Active-Low
DI11	74	Digital Input 11	Digital signal input 0~BATT	Active-Low
DI12	15	Digital Input 12	Digital signal input 0~BATT	Active-Low
DI 13	49	Digital Input 13	Digital signal input 0~BATT	Active-Low
DI 14	68	Digital Input 14	Digital signal input 0~BATT	Active-Low
DI15	52	Digital Input 15	Digital signal input 0~BATT	Active-Low
DI16	13	Digital Input 16	Digital signal input 0~BATT	Active-High
DI17	70	Digital Input 17	Digital signal input 0~BATT	Active-High
Output signal part				
LSO01	23	Low side driver output 01	Rated 1A, peak 2A	Four-way shared peak current 1A
LSO02	22	Low side driver output 02	Rated 1A, peak 2A	
LSO03	21	Low side driver output 03	Rated 1A, peak 2A	
LSO04	20	Low side driver output 04	Rated 1A, peak 2A	
Serial communication interface part				
CANA_H	79	CANA_H	Includes 120Ohm terminal resistor	Support any frame/specific frame wake-up, support CANFD, support CAN flashing
CANA_L	60	CANA_L		
CANB_H	38	CANB_H	Includes 120Ohm terminal resistor	Support any frame/specific frame wake-up, support CANFD, support CAN flashing
CANB_L	19	CANB_L		
CANC_H	33	CANC_H	Includes 120Ohm terminal resistor	Support any frame/specific frame wake-up, support CANFD, support CAN flashing
CANC_L	14	CANC_L		
CAND_H	31	CAND_H	Includes 120Ohm terminal resistor	Support any frame/specific frame wake-up, support CANFD, support CAN flashing
CAND_L	11	CAND_L		
CANE_H	30	CANE_H	Includes 120Ohm terminal resistor	Support CANFD, support CAN flashing
CANE_L	10	CANE_L		
CANF_H	29	CANF_H	Includes 120Ohm terminal resistor	Support CANFD, support CAN flashing
CANF_L	9	CANF_L		
CANG_H	28	CANG_H	Includes 120Ohm terminal resistor	Support CANFD, support CAN flashing
CANG_L	8	CANG_L		
CANH_H	27	CANH_H	Includes 120Ohm terminal resistor	Support CANFD, support CAN flashing
CANH_L	7	CANH_L		
CANI_H	26	CANI_H	Includes 120Ohm terminal resistor	Support CANFD, support CAN flashing
CANI_L	6	CANI_L		
CANJ_H	59	CANJ_H	Includes 120Ohm terminal resistor	Support CANFD, support CAN flashing
CANJ_L	39	CANJ_L		
CANK_H	37	CANK_H	Includes 120Ohm terminal resistor	Support CANFD, support CAN flashing
CANK_L	18	CANK_L		
CANL_H	36	CANL_H	Includes 120Ohm terminal	Support CANFD, support CAN

CANL_L	17	CANL_L	resistor	flashing
CAN_SHILD1	61	CAN shielded wire		
CAN_SHILD2	25	CAN shielded wire		
LIN1	41	LINBUS		Only supports host mode
LIN2	78	LINBUS		
LIN3	40	LINBUS		

2.2 Pin Description

2.2.1 Analog Signal Input

Schematic

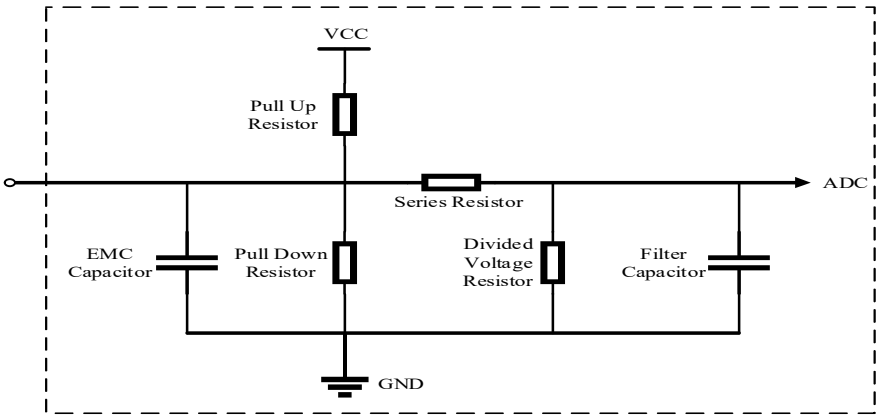


Figure 4 Schematic diagram of analog input channel

Table 2.2.1 Analog input channel parameter table

Note: 1) "--" means not installed. 2) U_B means BATT voltage. 3) KEYON is only used as a key signal.

Pin #	AI	EMC Capacitor	Pull Up Resistor		Pull down Resistor	Series Resistor	Divided Voltage Resistor	Filter Capacitor	Operation Range		Input Range		Rate	Conditions / Remarks
		(F)	to U_B (Ohm)	to 5V (Ohm)	to GND (Ohm)	(Ohm)	(Ohm)	(F)	V_{low}	V_{high}	Min	Max		
56	AI01	100n	--	10K	--	68K	--	1n	0V	5V	0V	5V	1	
55	AI02	100n	--	10K	--	68K	--	1n	0V	5V	0V	5V	1	
53	AI03	100n	--	10K	--	68K	--	1n	0V	5V	0V	5V	1	
32	AI04	100n	--	10K	--	68K	--	1n	0V	5V	0V	5V	1	
69	AI05	100n	--	10K	--	68K	--	1n	0V	5V	0V	5V	1	
48	AI06	100n	--	10K	--	68K	--	1n	0V	5V	0V	5V	1	
--	AI28	100n	--	10K	--	68K	3.48K	1n	0V	5V	0V	5V	1	

2.2.2 Digital signal input

Functional Description

The digital input channel circuits have the same structure, including EMC capacitors, pull-up / pull-down resistors, voltage divider resistors and a first-order low-pass filter circuit.

Main differences:

- Pull-up/pull-down resistor value
- Pull-up/pull-down selection

Schematic

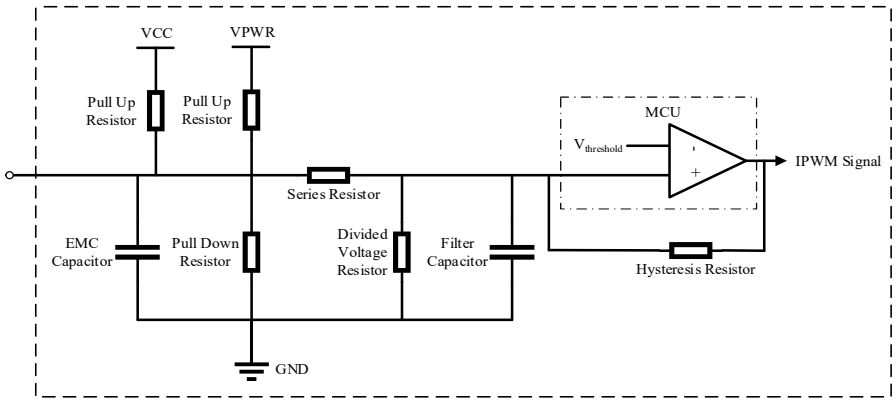


Figure 5 Schematic diagram of digital input channel

Table 2.2.2 Digital input channel parameter table

Note: 1) "--" means not installed. 2) U_B means the power BATT voltage. 3) KEYON, A+, WAKE1, and WAKE2 are only used as wake-up signals.

DI #	EMC Cap.	Filter Cap.	Pull Up Resistor to UB	Pull Up Resistor to 5V	Pull Down Resistor	Serial Resistor	Divided Voltage Resistor	Operation Threshold for Input Signal		Input Range		Conditions/ Remarks
	(F)	(F)	(Ohm)	(Ohm)	(Ohm)	(Ohm)	(Ohm)	V_{low}	V_{high}	min	max	
DI01	100p	--	--	10K	--	100k	--	0.75V	3.25V	0V	32V	
DI02	100p	--	--	10K	--	100k	--	0.75V	3.25V	0V	32V	
DI03	100p	--	--	10K	--	100k	--	0.75V	3.25V	0V	32V	
DI04	100p	--	--	10K	--	100k	--	0.75V	3.25V	0V	32V	
DI05	100p	--	--	10K	--	100k	--	0.75V	3.25V	0V	32V	
DI06	100p	-	--	10K	--	100k	--	0.75V	3.25V	0V	32V	
DI07	100p	--	--	10K	--	100k	--	0.75V	3.25V	0V	32V	
DI08	100p	--	--	10K	--	100k	--	0.75V	3.25V	0V	32V	
DI09	100p	--	--	10K	--	100k	--	0.75V	3.25V	0V	32V	
DI10	100p	--	--	10K	--	100k	--	0.75V	3.25V	0V	32V	
DI11	100p	--	--	10K	--	100k	--	0.75V	3.25V	0V	32V	
DI12	100p	--	--	10K	--	100k	--	0.75V	3.25V	0V	32V	
DI13	100p	--	--	10K	--	100k	--	0.75V	3.25V	0V	32V	
DI14	100p	--	--	10K	--	100k	--	0.75V	3.25V	0V	32V	
DI15	100p	--	--	10K	--	100k	--	0.75V	3.25V	0V	32V	

DI16	100p	--	--	--	10K	100k	--	0.75V	3.25V	0V	32V	
DI17	100p	--	--	--	10K	100k	--	0.75V	3.25V	0V	32V	
KEYON	100p	--	--	--	10K	100k	--	0.75V	3.25V	0V	32V	
A+	100p	--	--	--	10K	100k	--	0.75V	3.25V	0V	32V	
WAKE1	100p	--	--	--	10K	100k	--	0.75V	3.25V	0V	32V	
WAKE2	100p	--	--	--	10K	100k	--	0.75V	3.25V	0V	32 V	

2.2.3 Low-side driver

Functional Description

Low-side driver is a low side switch controlled by SPI and GPIO.

Main differences:

- Different drive current
- Whether there is PWM function

Schematic

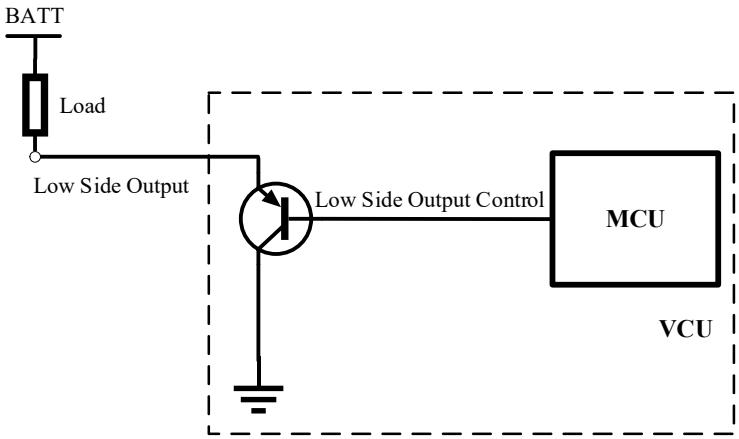


Figure 9 Schematic diagram of low-side drive channel

Table 2.2.5 Low-side drive channel parameter table

Pin #	LSO	EMC Capacitor (F)	Output Current Max	Free Wheeling Diode	Conditions / Remarks
23	LSO01	--	1A	No	
22	LSO02	--	1A	No	
21	LSO03	--	1A	No	
20	LSO04	--	1A	No	

Note :

1) " -- " means not installed.
2) Before using all low-side drive channels, you need to use the module in the **"Power Control Output Power Supply Output Control Module" chapter of** the "EcoCoder Instruction Manual" to set **PWR12V_DRVP to 1.**
3) **The total load of all low-side driver channels does not exceed 5A .**

2.2.4 CAN bus

Functional Description

CAN The interface circuit is used for communication between the CCU and other on-board electronic controllers, with a communication speed of up to 1 Mbit/s . Both support CAN flashing.

Schematic

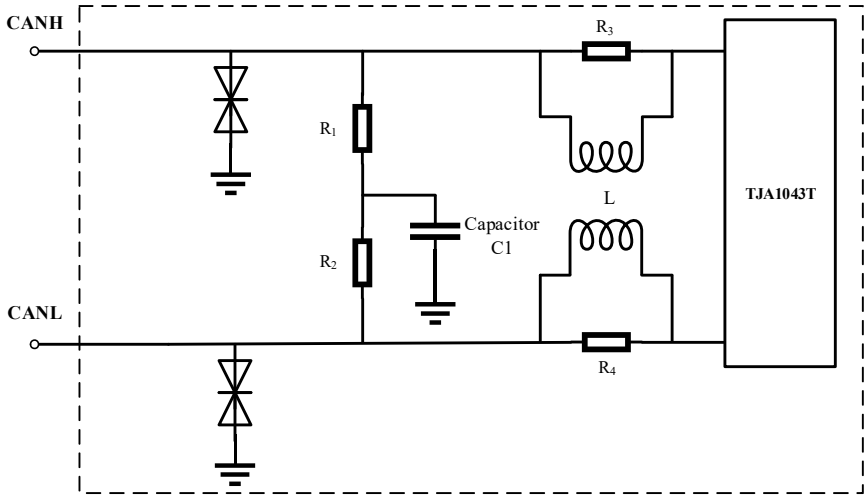


Figure 7 CAN bus schematic diagram

Table 2.2. 4 CAN interface parameter table

Pin #	Description	Capacitor C 1	R1, R2 (Ohm)	Choke L	Conditions / Remarks
CANA_H	79	100nF/100V	60	Yes	Support CAN arbitrary frame/specific frame wake-up , support CANFD, support CAN flashing
CANA_L	60		60		
CANB_H	38	100nF/100V	60	Yes	Support CAN arbitrary frame/specific frame wake-up , support CANFD, support CAN flashing
CANB_L	19		60		
CAN C_H	33	100nF/100V	60	Yes	Support CAN arbitrary frame/specific frame wake-up , support CANFD, support CAN flashing
CAN C_L	14		60		
CAN D_H	31	100nF/100V	60	Yes	Support CAN arbitrary frame/specific frame wake-up , support CANFD, support CAN flashing
CAN D_L	11		60		
CAN E_H	30	100nF/100V	60	Yes	Support CANFD, support CAN flashing
CAN E_L	10		60		
CAN F_H	29	100nF/100V	60	Yes	Support CANFD, support CAN flashing
CAN F_L	9		60		
CAN G_H	28	100nF/100V	60	Yes	Support CANFD, support CAN flashing
CAN G_L	8		60		
CAN H_H	27	100nF/100V	60	Yes	Support CANFD, support CAN flashing
CAN H_L	7		60		
CAN I_H	26	100nF/100V	60	Yes	Support CANFD, support CAN flashing
CAN I_L	6		60		
CAN J_H	59	100nF/100V	60	Yes	Support CANFD, support CAN flashing

CAN J_L	39		60		
CAN K_H	37	100nF/100V	60	Yes	Support CANFD, support CAN flashing
CAN K_L	18		60		
CAN L_H	36	100nF/100V	60	Yes	Support CANFD, support CAN flashing
CAN L_L	17		60		

2.2.6 LIN bus interface

Functional Description

LIN (Local Interconnect Network) bus supports master node communication mode and has power short-circuit protection function.

Schematic

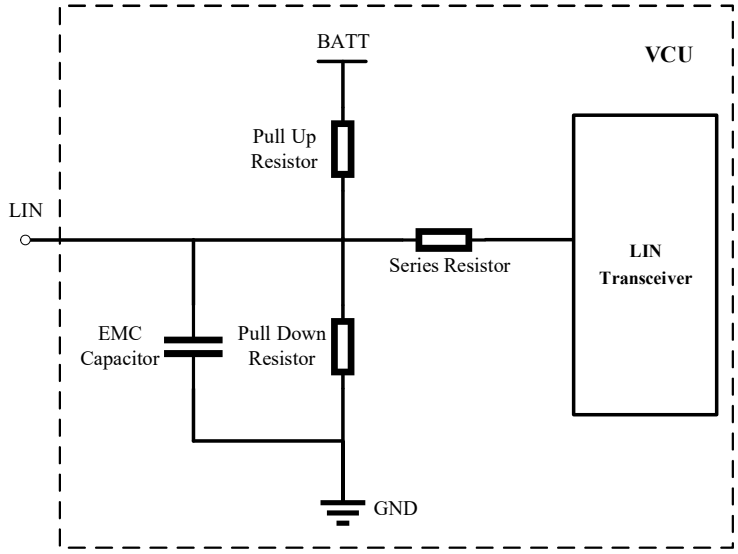


Figure 10 LIN interface schematic diagram

Table 14 LIN interface parameter table

LIN #	EMC Capacitor (F)	Pull Up Resistor to U_B (Ohm)	Pull Down Resistor to GND (Ohm)	Series Resistor (Ohm)	Conditions / Remarks
LIN1	1n	1k	- -	- -	Only supports host mode
LIN 2	1n	1k	- -	- -	
LIN 3	1n	1k	- -	- -	

2.2.7 5V voltage output

Functional Description

The 5V voltage output channel can provide 5V power supply voltage for external sensors and has

the following functions:

- 5 -way sensor 5V power supply output
- Reverse connection protection , short circuit protection, over temperature protection

Table 2.2.5 5V sensor power supply output parameter table

Pin #	Description	Imax(mA)	Output Voltage
2	5V supply voltage 1	1 0 0	Single output 5V ±2 %
81	5V supply voltage 2	1 0 0	Single output 5V ±2 %
62	5V supply voltage 3	1 0 0	Single output 5V ±2 %
43	5V supply voltage 4	1 0 0	Single output 5V ±2 %
twenty four	5V supply voltage 5	1 0 0	Single output 5V ±2 %

2.2.8 In-vehicle Ethernet & general Ethernet

Functional Description

1. The SJA1110 is an automotive Ethernet switch that provides a scalable solution for all automotive applications and is optimized for automotive use cases such as gateways, I camera links, driver assistance systems, and backbone networks.

2. KSZ9031 is a 100BASE-T compliant Ethernet PHY optimized for automotive use cases such as gateways, IP camera links, driver assistance systems, and backbone networks

Schematic

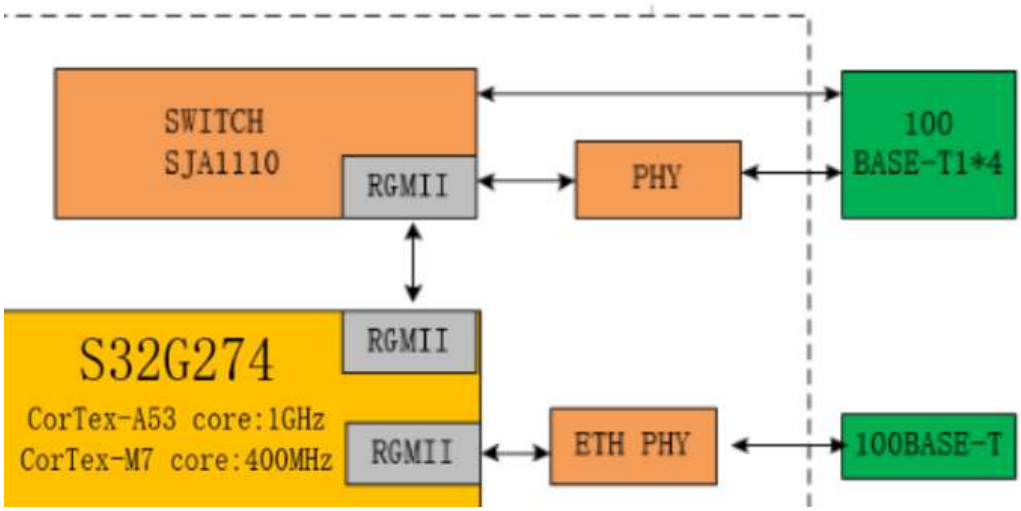
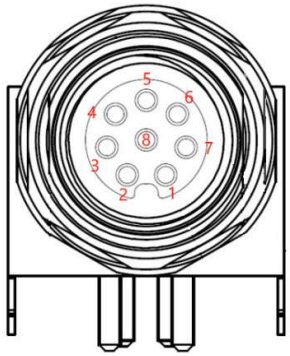


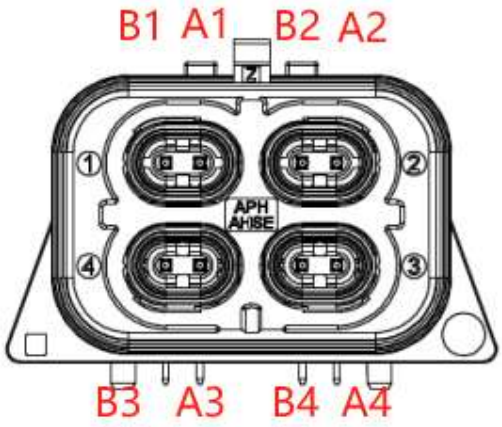
Figure 11 Schematic diagram of vehicle-mounted Ethernet
Ordinary Ethernet



Board connector model: M8-L-S8

Signal name	PIN	Interface Description	Remark
GND	1	RS232 ground signal	
RS232_TX	2	RS232 Receive	
RS232_RX	3	RS232 Transmit	
Reserved	4		
MDI1_P	5		100M ordinary Ethernet
MDI1_N	6		100M ordinary Ethernet
MDI0_P	7		100M ordinary Ethernet
MDI0_N	8		100M ordinary Ethernet

Automotive Ethernet



Connector model: E3SW4Z-BMR131-S 00 CODE Z

Signal name	PIN	Interface Description	Remark
100BASE-T1_P	A1	100M In-vehicle Ethernet1	
100BASE-T1_N	B1	100M In-vehicle Ethernet1	
100BASE-T2_P	A2	100M In-vehicle Ethernet 2	
100BASE-T2_N	B2	100M In-vehicle Ethernet 2	
100BASE-T3_P	A3	100M In-vehicle Ethernet 3	
100BASE-T3_N	B3	100M In-vehicle Ethernet 3	
100BASE-T4_P	A4	100M In-vehicle Ethernet 4	
100BASE-T4_N	B4	100M In-vehicle Ethernet 4	

3. Technical performance

3.1 Electrical characteristics parameters

project	Design Specifications
Operating voltage	DC 12V/24V (9~32V)
Operating temperature	-40 ℃ ~85 ℃
Operating humidity	0~95%, no condensation
Storage temperature	-40 ℃ ~85 ℃
Quiescent Current	≤3 mA
Rated power consumption	3W (excluding load power)
Protection level	IP67
Weight	≤ 1300 g
Controller Dimensions	166 × 245 × 37 mm
Material	Die-cast aluminum
Housing	Equipped with waterproof breathable valve, good heat dissipation

3.2 Electrical performance standards

project	standard
Overvoltage (high temperature)	ISO 16750-2
Jump voltage	ISO 16750-2
AC voltage superposition test	ISO 16750-2
Supply voltage ramp down and ramp up	ISO 16750-2
The supply voltage drops momentarily	ISO 16750-2
Reset performance for voltage sag	ISO 16750-2
Startup Features	ISO 16750-2
Reverse voltage	ISO 16750-2
Reference Ground and Supply Offsets	ISO 16750-2
Open circuit experiment-single line open circuit	ISO 16750-2
Open circuit experiment-multi-line open circuit	ISO 16750-2
Short circuit protection	ISO 16750-2
Withstand voltage	ISO 16750-2
Insulation resistance	ISO 16750-2

3.3 Environmental Standards

Test Project	Test standards
Waterproof (IP67)	IEC/EN 60529
Dustproof (IP67)	ISO 20653
Salt spray leakage function and corrosion test	ISO 16750-4
Mechanical vibration shock test	ISO 16750-3
Vibration test	ISO 16750-3
Drop test	ISO 16750-3
Temperature shock	ISO 16750-4
Electrical operation at cyclic ambient temperature	ISO 16750-4
High and low temperature operation experiment	ISO 16750-4
High and low temperature experiments	ISO 16750-4
Temperature and humidity cycle	ISO 16750-4
Constant temperature and humidity	ISO 16750-4

3.4 EMC test standards

Test Project	Test standards
Narrowband measurement test	ECE-R10
Wideband measurement test	ECE-R10
Conducted emission test	ECE-R10
Electromagnetic radiation immunity test	ECE-R10
Transient immunity test	ECE-R10
Electrostatic discharge test	ECE-R10

4. Installation requirements

It is recommended to install the CCU in the cabin. If the vehicle manufacturer wants to install the VCU at another location, the alternative installation location should be evaluated by Ecotron's engineers and the vehicle manufacturer's engineers.

The precautions for CCU installation:

1) The CCU and the wiring harness should be installed firmly and reliably without any looseness. Avoid supporting the wiring harness through the CCU. At the same time, the layout of the CCU wiring harness should prevent and protect all wires in the wiring harness from damage due to wear and overheating;
2) Avoid installing it in places where dust easily accumulates. Large amounts of dust accumulation will affect the reliability of the CCU.
3) Keep away from any environment where the temperature of the housing may exceed 85°C. Position, and at the same time prevent the heat released by surrounding parts from radiating to the CCU;
4) Avoid installing the CCU in locations that are prone to oil, moisture, or splashing of water.
5) the CCU being subjected to additional mechanical vibration and external force impact due to its installation position and fixing method should be avoided. The CCU should not be installed at the resonance point of the vehicle body.
6) Avoid installing the CCU in locations where it may come into contact with batteries or other areas where acidic or alkaline solutions may seep out, or near the CCU power terminals.
7) The CCU should be installed with the connector facing downward in both horizontal and vertical positions, maintaining a certain angle to prevent water from flowing in from the connector. In the horizontal direction, the recommended installation angle is -170° to -10°, as shown in Figure 9 below. In the vertical direction, the recommended installation angle is -170°~ -10°, as shown in Figure 10 below.

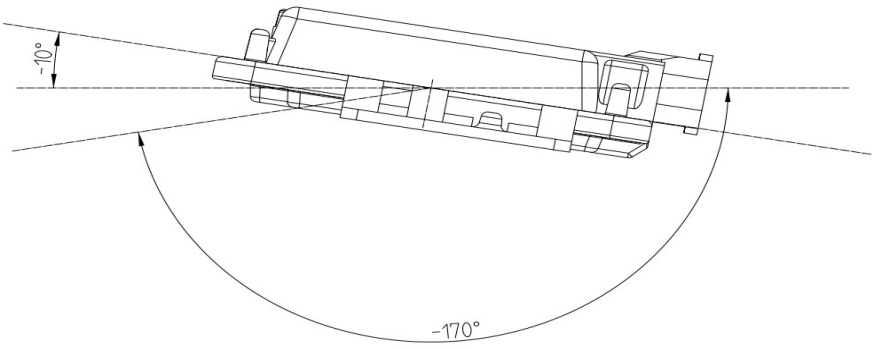
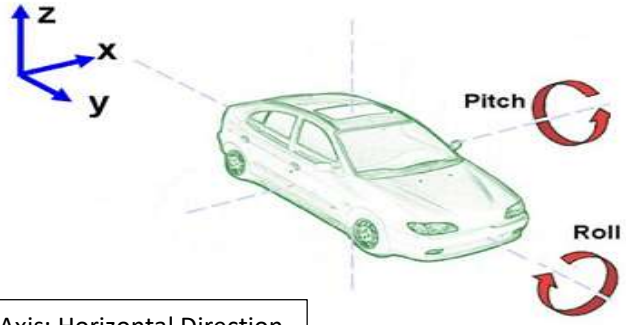


Figure 9 Horizontal installation angle



Z Axis: Horizontal Direction
X Y Axes: Vertical Direction

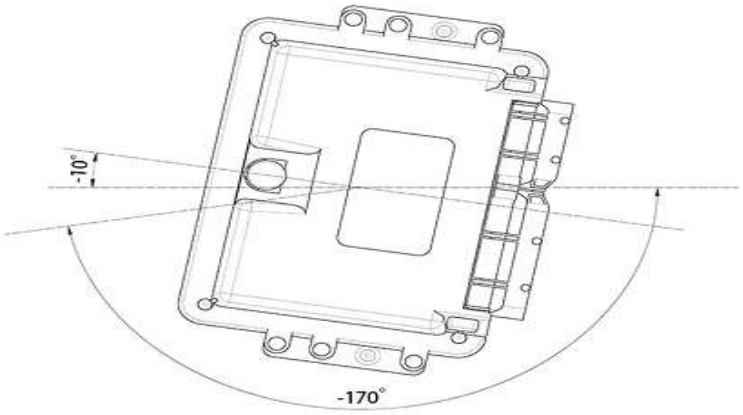


Figure 10 Vertical installation angle

Ecotron recommends using the six mounting holes on the CCU for installation. It is recommended to use metal materials such as aluminum alloys for the mounting bracket. The housing should have a reliable electrical connection with the vehicle body through the bracket. If other materials are used, the customer must ensure that they can meet the requirements of CCU for vibration, heat dissipation, temperature, EMC, etc. If there is any deviation, it needs to be confirmed with Ecotron.

The CCU connects to the ground through the vehicle's body. The specific requirement is to directly connect the ground wire in the wiring harness to the vehicle's body and ensure reliable electrical connections.

Mechanical installation suggestions: (users can change according to the vehicle)

1. Recommended specifications for installation fixing screws: M6 nuts, screws M6*25 or so.

2. Recommended torque for installation tightening: 7N*M.

3. Recommended size and parameters of the anti-vibration pads required for installation: inner diameter 6mm, outer diameter 20mm, thickness 15mm