EV2274A

- Micro control unit
  - NXP MPC5744
  - ISO26262 ASIL-D integrity level
  - 200MHz
  - 2.5M Flash
  - 384K SRAM
  - Float Point Capability
- (SBC) MC33CFS6500 microprocessor
- Inputs
  - 15 Analog Inputs
  - 21 Digital Inputs
  - 4 Frequency Inputs
  - 3 Wake-up Inputs
- OTP: 12KB, 10KB Optional
- Outputs
  - 10 High-Side Drivers (2 of which could be configured as PWM outputs)
  - 18 Low Side Drivers (4 of which could be configured as PWM outputs)
- 9-32V Operating Voltage
- Communication
  - 3 CAN 2.0B
- Sensor 5V Supply: 5 channels
- Environmental
  - Operating temperature: -40°C to +110°C
  - ISO16750 Compliant
- Simulink Model Based Design

Date	Version	Note
	V1.0	
Nov. 11, 2019	V1.6	Section 3.1 Parts update Section 4.7 Bootloader Reset
May 11, 2020	V1.7	Contact info update
Feb 02, 2021	V2.0	Updated connector part number
Mar 31, 2021	V2.1	Temperature update Updated the part No. of connector parts
Jun 17, 2021	V2.2	Format optimization
Sep 28, 2021	V2.3	Format Update

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Table of Contents

Chapter 1 General Information

1.1 Introduction

VCU (Vehicle Control Unit) is the master controller for electric vehicles.
VCU receives the sensors and driver input signals, including pedal inputs, vehicle speed signals, and other inputs, manages the system energy, commands the driver demanded torque to powertrain, coordinates vehicle components, achieves fault diagnosis, and determines the overall vehicle drivability.
VCU plays a critical and supervisory role in the vehicle control network, or CAN bus-based network.

1.1.1 **Functionality**

EV2274A has the following functions:

Table 1 EV2274A Features

Feature
1 Key switch (KEYON)
2 Hardwire wakeup (DI21, DI22)
4 Power supply (BATT)
5 5V Outputs
3 CAN Bus ports: CANA support wake up at any frame, CANB support wake up at specific frame
1 LIN Bus port: support wake up
14 Digital signal inputs: 7 channels active high, 7 channels active low
15 Analog signal inputs: 5 channels of 0-5V voltage input, 2 channels of 0-5V resistance input, and 8 channels of 0-32V voltage input
4 Frequency signal inputs
10 High-side driver outputs: 2 configurable as PWM outputs
18 Low-side driver outputs: 4 configurable as PWM outputs
Hardware watchdog
Default minimum task period: 1ms, can be customized and modified according to customer needs

1.1.2 **Material**

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

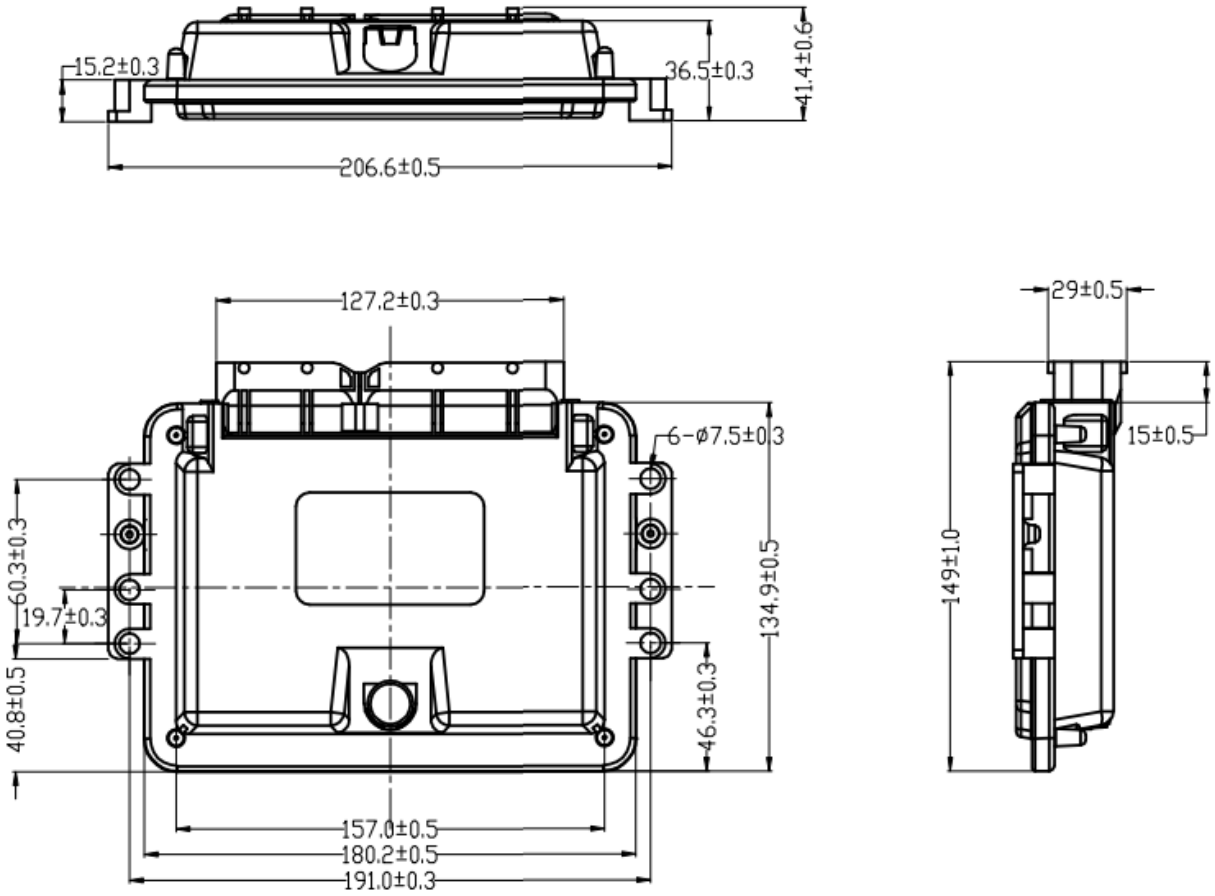


Figure 1 VCU Shell Size

The appearance of the shell is as follows:

Figure 2 VCU Shell Appearance

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

1.1.3 **Harness Connector**

VCU uses the world-renowned “TE connectivity” brand connector, which is a qualified product that meets the automotive safety level and has 121 pins. The specific models of the connectors are as follows.

Table 2 Harness Connector Info

#	Name	Part number	Supplier	URL
1	PCB Pin Seat	1746979-1	TE	https://www.te.com/usa-en/product-1746979-1.html
2	81P Housing	1473244-1	TE	https://www.te.com/usa-en/product-1473244-1.html
3	40P Housing	1473252-1	TE	https://www.te.com/usa-en/product-1473252-1.html
4	81P Cover Assembly	1473247-1	TE	https://www.te.com/usa-en/product-1473247-1.html
5	40P Cover Assembly	1473255-1	TE	https://www.te.com/usa-en/product-1473255-1.html
6	81P TPA	368382-1	TE	https://www.te.com/usa-en/product-368382-1.html
7	40P TPA	368388-1	TE	https://www.te.com/usa-en/product-368388-1.html
8	Terminal (wire diameter 0.2-0.35)	5-968220-1 （968220-1）	TE	https://www.te.com/usa-en/product-5-968220-1.html (https://www.te.com/usa-en/product-968220-1.html)
9	Terminal (wire diameter 0.5-0.75)	5-968221-1 （968221-1）	TE	https://www.te.com/usa-en/product-5-968221-1.html (https://www.te.com/usa-en/product-968221-1.html)
10	Terminal (wire diameter 0.75-1.0)	964286-2	TE	https://www.te.com/usa-en/product-964286-2.html
11	Terminal (wire diameter 1.5-2.5)	964273-2	TE	https://www.te.com/usa-en/product-964273-2.html

Harness connector is shown below：

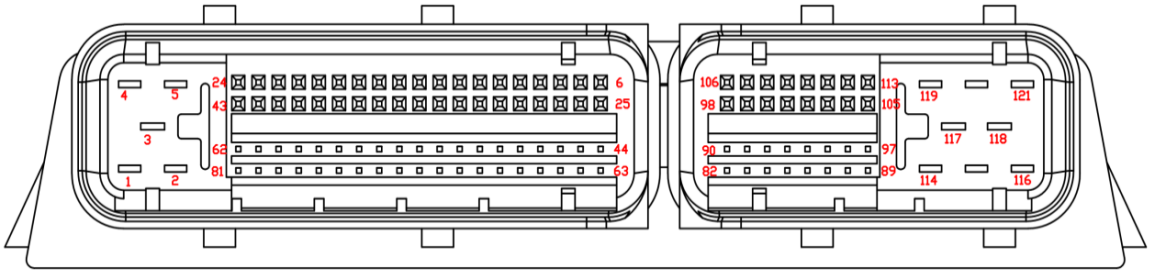


Figure 3 Harness Connector and Pin Distribution Diagram

1.1.4 **Chip Information**

Table 3 Chip Info

Feature	**Detail**
Micro Control Core	32-bit NXP SPC5744P
Maximum Frequency	200MHZ
Flash	2.5MB
SRAM	384KB
SPI Serial EEPROM	64KB
Floating Point Capability	Yes
SBC Microprocessor	MC33CFS6500

1.1.5 **Power Supply**

EV2274A requires 4 channels of continuous power supplies (pin1, pin3, pin116, and pin 119), and the VCU is powered on through the key switch (pin59).
Two 5A fuses, one in series with pin1 and pin3, and the other in series with pin116 and pin119 are recommended for EV2274A power supply.

1.2 System Block Diagram

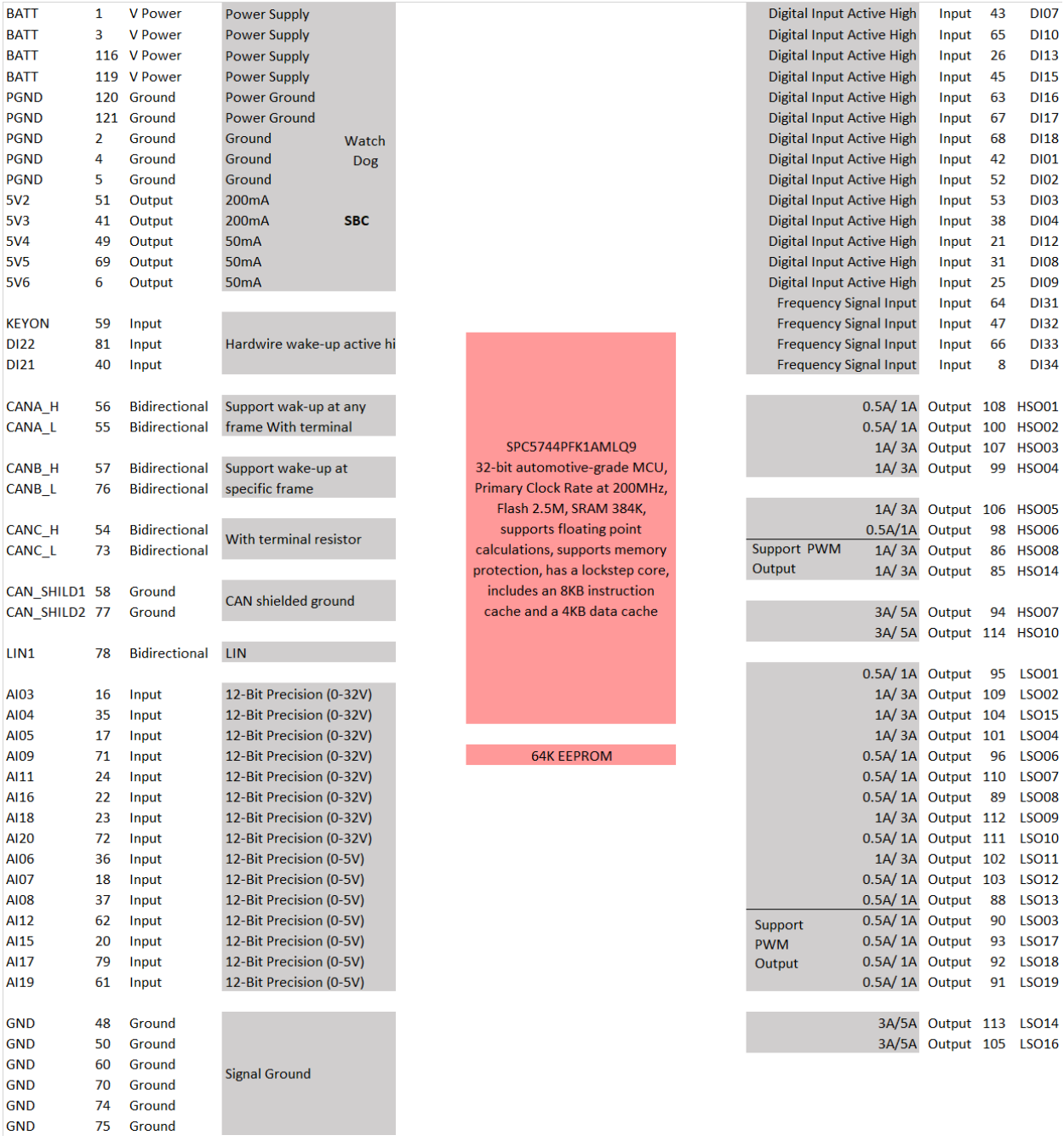


Figure 4 System Block Diagram

Chapter 2 Interface Description

2.1 Pin Definition

Table 4 Pin Definition

Signal Name	PIN	Function	Interface Description	Note
Power Supply				
BATT	1 3 116 119	Power Supply	Power Supply 12V/24V	9-32V
5V2	51	5V Sensor Supply 2	External Sensor 5V Power Supply	5V ± 2%, Maximum 200mA
5V3	41	5V Sensor Supply 3	External Sensor 5V Power Supply	5V ± 2%, Maximum 200mA
5V4	49	5V Sensor Supply 4	External Sensor 5V Power Supply	5V ± 2%, Maximum 50mA
5V5	69	5V Sensor Supply 5	External Sensor 5V Power Supply	5V ± 2%, Maximum 50mA
5V6	6	5V Sensor Supply 6	External Sensor 5V Power Supply	5V ± 2%, Maximum 50mA
PGND	2 4 5 120 121	Ground	Power Ground	
GND	48 50 60 70 74 75	Signal Ground	External 5V Sensor Ground	
Analog Input				
AI03	16	Analog Input 03	Analog Signal Input 0~32V	12-Bit Precision
AI04	35	Analog Input 04	Analog Signal Input 0~32V	12-Bit Precision
AI05	17	Analog Input 05	Analog Signal Input 0~32V	12-Bit Precision
AI09	71	Analog Input 09	Analog Signal Input 0~32V	12-Bit Precision
AI11	24	Analog Input 11	Analog Signal Input 0~32V	12-Bit Precision
AI16	22	Analog Input 16	Analog Signal Input 0~32V	12-Bit Precision
AI18	23	Analog Input 18	Analog Signal Input 0~32V	12-Bit Precision
AI06	36	Analog Input 06	Analog Signal Input 0~5V	12-Bit Precision
AI07	18	Analog Input 07	Analog Signal Input 0~5V	12-Bit Precision
AI08	37	Analog Input 08	Analog Signal Input 0~5V	12-Bit Precision
AI12	62	Analog Input 12	Analog Signal Input 0~5V	12-Bit Precision
AI15	20	Analog Input 15	Analog Signal Input 0~5V	12-Bit Precision
AI17	79	Analog Input 17	Analog Signal Input 0~5V	12-Bit Precision
AI19	61	Analog Input 19	Analog Signal Input 0~5V	12-Bit Precision
High Voltage Interlock Signal				

AI20	72	High Voltage Interlock Signal Input	Analog Signal Input 0~32V	12-Bit Precision
HSO06	98	High Voltage Interlock Signal Output	High-Side Output 06	Rated 0.5A, Peak 1A
Power-On Signal				
KEYON	59	Key Input Signal	Digital Signal Input 0~BATT	
DI21	40	AC Charging Wake-Up Signal	Digital Signal Input 0~BATT	
DI22	81	DC Charging Wake-Up Signal	Digital Signal Input 0~BATT	
Digital Input				
DI07	43	Digital Input 07	Digital Signal Input 0~BATT	Active High
DI10	65	Digital Input 10	Digital Signal Input 0~BATT	Active High
DI13	26	Digital Input 13	Digital Signal Input 0~BATT	Active High
DI15	45	Digital Input 15	Digital Signal Input 0~BATT	Active High
DI16	63	Digital Input 16	Digital Signal Input 0~BATT	Active High
DI17	67	Digital Input 17	Digital Signal Input 0~BATT	Active High
DI18	68	Digital Input 18	Digital Signal Input 0~BATT	Active High
DI01	42	Digital Input 01	Digital Signal Input 0~BATT	Active Low
DI02	52	Digital Input 02	Digital Signal Input 0~BATT	Active Low
DI03	53	Digital Input 03	Digital Signal Input 0~BATT	Active Low
DI04	38	Digital Input 04	Digital Signal Input 0~BATT	Active Low
DI12	21	Digital Input 12	Digital Signal Input 0~BATT	Active Low
DI08	31	Digital Input 08	Digital Signal Input 0~BATT	Active Low
DI09	25	Digital Input 09	Digital Signal Input 0~BATT	Active Low
Frequency Input				
DI31/ SPEED1	64	Frequency Input 1	Frequency/Digital Signal 0~BATT	Frequency Input Range 20Hz-2KHz / Active High
DI32/ SPEED2	47	Frequency Input 2	Frequency/Digital Signal 0~BATT	Frequency Input Range 20Hz-2KHz / Active High
DI33/ SPEED3	66	Frequency Input 3	Frequency/Digital Signal 0~BATT	Frequency Input Range 20Hz-2KHz / Active Low
DI34/ SPEED4	8	Frequency Input 4	Frequency/Digital Signal 0~BATT	Frequency Input Range 20Hz-2KHz / Active Low
Output Signal				
HSO01	108	High-Side Output 01	Rated 0.5A, Peak 1A	
HSO02	100	High-Side Output 02	Rated 0.5A, Peak 1A	
HSO03	107	High-Side Output 03	Rated 1A, Peak 3A	
HSO04	99	High-Side Output 04	Rated 1A, Peak 3A	
HSO05	106	High-Side Output 05	Rated 1A, Peak 3A	
HSO07	94	High-Side Output 07	Rated 3A, Peak 5A	
HSO10	114	High-Side Output 10	Rated 3A, Peak 5A	
HSO08	86	High-Side Output 08	Rated 1A, Peak 3A	Can be configured as PWM output, frequency range 20Hz-2KHz
HSO14	85	High-Side Output 14	Rated 1A, Peak 3A	Can be configured as PWM output, frequency range

				20Hz-2KHz
LSO01	95	Low-Side Output 01	Rated 0.5A, Peak 1A	
LSO06	96	Low-Side Output 06	Rated 0.5A, Peak 1A	
LSO07	110	Low-Side Output 07	Rated 0.5A, Peak 1A	
LSO08	89	Low-Side Output 08	Rated 0.5A, Peak 1A	
LSO10	111	Low-Side Output 10	Rated 0.5A, Peak 1A	
LSO12	103	Low-Side Output 12	Rated 0.5A, Peak 1A	
LSO13	88	Low-Side Output 13	Rated 0.5A, Peak 1A	
LSO02	109	Low-Side Output 02	Rated 1A, Peak 3A	
LSO04	101	Low-Side Output 04	Rated 1A, Peak 3A	
LSO09	112	Low-Side Output 09	Rated 1A, Peak 3A	
LSO11	102	Low-Side Output 11	Rated 1A, Peak 3A	
LSO15	104	Low-Side Output 15	Rated 1A, Peak 3A	
LSO14	113	Low-Side Output 14	Rated 3A, Peak 5A	
LSO16	105	Low-Side Output 16	Rated 3A, Peak 5A	
LSO03	90	Low-Side Output 03	Rated 0.5A, Peak 1A	Can be configured as PWM output, frequency range 20Hz-2KHz
LSO17	93	Low-Side Output 17	Rated 0.5A, Peak 1A	Can be configured as PWM output, frequency range 20Hz-2KHz
LSO18	92	Low-Side Output 18	Rated 0.5A, Peak 1A	Can be configured as PWM output, frequency range 20Hz-2KHz
LSO19	91	Low-Side Output 19	Rated 0.5A, Peak 1A	Can be configured as PWM output, frequency range 20Hz-2KHz
Serial Communication Interface				
CANA_H	56	CANA_H	Include 120Ohm Terminal Resistance	Support Any Frame Wake-Up
CANA_L	55	CANA_L		
CANB_H	57	CANB_H	Not Include 120Ohm Terminal Resistance	Support Specific Frame Wake-Up
CANB_L	76	CANB_L		
CANC_H	54	CANC_H	Include 120Ohm Terminal Resistance	
CANC_L	73	CANC_L		
CAN_SHILD1	58	CAN Shielded Wire		
CAN_SHILD2	77	CAN Shielded Wire		
LIN1	78	LINBUS		Support Wake-Up
Internal Signal				
AI28	--	Collect Power Supply BATT Voltage	--	12-Bit Precision

Note: The high-side/low-side output current data is tested with standard loads and is only for reference. In real life, situations such as inrush current in load may cause misjudgment for fault diagnosis.

2.2 Pin Description

2.2.1 **Analog Signal Input**

Description

The analog input channel circuits have similar structures, including EMC capacitors, pull-up/pull-down resistors and first-order low-pass filter circuit.

Main difference：

- Resistance of pull-up/pull-down resistor
- Pull-up voltage
- Filter time constant

Schematic

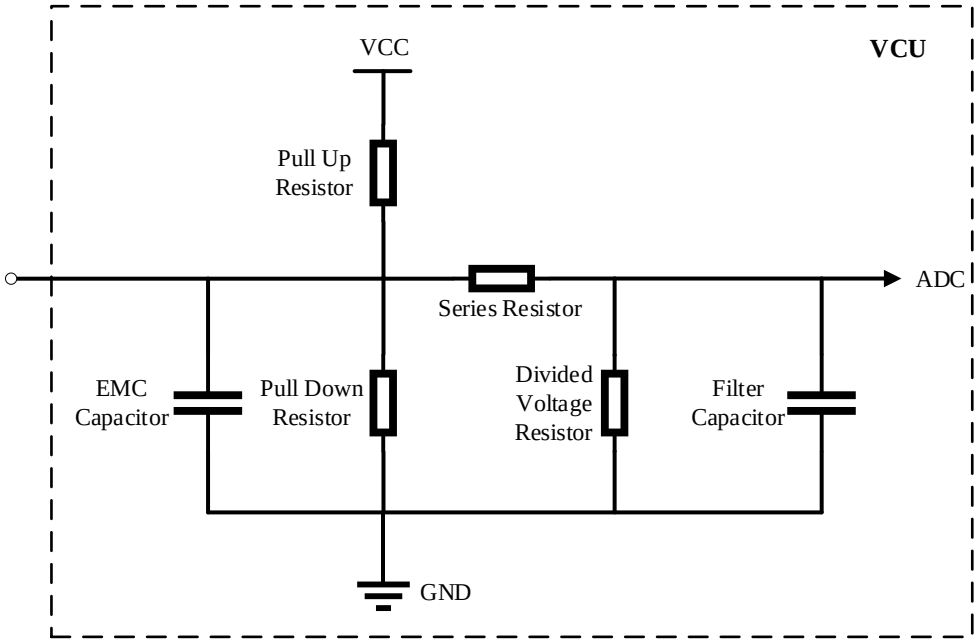


Figure 5 Schematic of Analog Signal Input Channel

Table 5 Analog Signal Input Channel Parameter

Note：1) "--" = Not installed 2) U_B = BATT voltage 3) AI28 gathers BATT voltage signal

Pin #	AI	EMC Capacitor	Pull Up Resistor		Pull down Resistor	Series Resistor	Divided Voltage Resistor	Filter Capacitor	Operation Range		Input Range		Conditions / Remarks
		(F)	to U_B (Ohm)	to 5V (Ohm)	to GND (Ohm)	(Ohm)	(Ohm)	(F)	V_{low}	V_{high}	Min	Max	
20	AI15	100n	--	--	--	22k	--	1n	0V	5V	0V	5V	
61	AI19	100n	--	--	--	22k	--	1n	0V	5V	0V	5V	
62	AI12	100n	--	--	--	22k	--	1n	0V	5V	0V	5V	
79	AI17	100n	--	--	--	22k	--	1n	0V	5V	0V	5V	
37	AI08	100n	--	--	--	22k	--	1n	0V	5V	0V	5V	

36	AI06	100n	--	10k	--	22k	--	1n	0V	5V	0V	5V	
18	AI07	100n	--	10k	--	22k	--	1n	0V	5V	0V	5V	
16	AI03	100n	--	--	--	22k	3.48k	1n	0V	32V	0V	32V	
35	AI04	100n	--	--	--	22k	3.48k	1n	0V	32V	0V	32V	
17	AI05	100n	--	--	--	22k	3.48k	1n	0V	32V	0V	32V	
71	AI09	100n	--	--	--	22k	3.48k	1n	0V	32V	0V	32V	
24	AI11	100n	--	--	--	22k	3.48k	1n	0V	32V	0V	32V	
22	AI16	100n	--	--	--	22k	3.48k	1n	0V	32V	0V	32V	
23	AI18	100n	--	--	--	22k	3.48k	1n	0V	32V	0V	32V	
72	AI20	100n	--	--	--	22k	3.48k	1n	0V	32V	0V	32V	
--	AI28	--	--	--	--	22k	3.48k	10n	0V	32V	0V	32V	

2.2.2 **Digital Signal Input**

Description

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

Main difference：

- Resistance of pull-up/pull-down resistor
- Selection of pull up/down resistor
- Filter time constant

Schematic

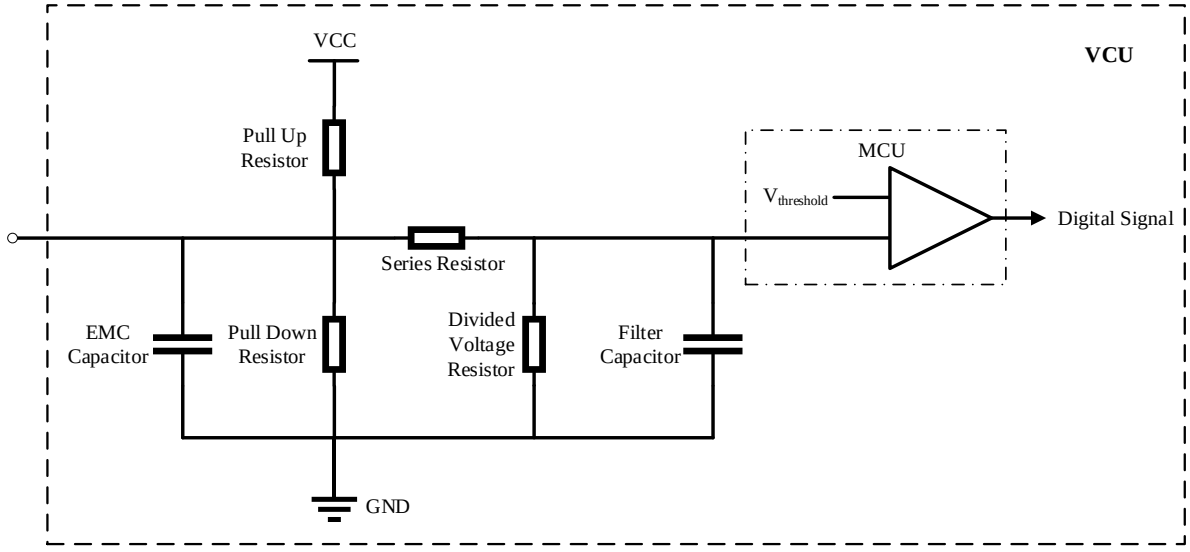


Figure 6 Schematic of Digital Signal Input Channel

Table 6 Digital Signal Input Channel Parameter

Note: 1) "--" = Not installed 2) U_B = BATT voltage 3) KEYON only for key signal, DI21, DI22 only for hardwire wake-up signal 4) Digital input DI31, DI32, DI33, DI34 can be configured as frequency input SPEED1, SPEED2, SPEED3, SPEED4

Pin #	DI	EMC Capacitor	Filter Capacitor	Pull Up Resistor		Pull Down Resistor	Series Resistor	Divided Voltage Resistor	Operation Threshold for Input Signal		Input Range		Conditions/ Remarks
		(F)	(F)	to U_B(Ohm)	to 5V(Ohm)	(Ohm)	(Ohm)	(Ohm)	V_{low}	V_{high}	Min	Max	
43	DI07	10n	100p	--	--	10k	100k	33k	5V	8.5V	0V	U_B	
65	DI10	10n	100p	--	--	10k	100k	33k	5V	8.5V	0V	U_B	
26	DI13	10n	100p	--	--	10k	100k	33k	5V	8.5V	0V	U_B	
45	DI15	10n	100p	--	--	10k	100k	33k	5V	8.5V	0V	U_B	
63	DI16	10n	100p	--	--	10k	100k	33k	5V	8.5V	0V	U_B	
67	DI17	10n	100p	--	--	10k	100k	33k	5V	8.5V	0V	U_B	
68	DI18	10n	100p	--	--	10k	100k	33k	5V	8.5V	0V	U_B	
42	DI01	10n	100p	10k	--	--	100k	33k	5V	8.5V	0V	U_B	
52	DI02	10n	100p	10k	--	--	100k	33k	5V	8.5V	0V	U_B	
53	DI03	10n	100p	10k	--	--	100k	33k	5V	8.5V	0V	U_B	
38	DI04	10n	100p	10k	--	--	100k	33k	5V	8.5V	0V	U_B	
21	DI12	10n	100p	10k	--	--	100k	33k	5V	8.5V	0V	U_B	
31	DI08	10n	100p	10k	--	--	100k	33k	5V	8.5V	0V	U_B	
25	DI09	10n	100p	10k	--	--	100k	33k	5V	8.5V	0V	U_B	
64	DI31	10n	100p	--	--	10k	100k	33k	5V	8.5V	0V	U_B	
47	DI32	10n	100p	--	--	10k	100k	33k	5V	8.5V	0V	U_B	
66	DI33	10n	100p	10k	--	--	100k	33k	5V	8.5V	0V	U_B	
8	DI34	10n	100p	10k	--	--	100k	33k	5V	8.5V	0V	U_B	
40	DI21	10n	100p	--	--	10k	100k	33k	5V	8.5V	0V	U_B	Wakeup Signal
81	DI22	10n	100p	--	--	10k	100k	33k	5V	8.5V	0V	U_B	Wakeup Signal
59	KEYON	10n	100p	--	--	10k	100k	33k	5V	8.5V	0V	U_B	Wakeup Signal

2.2.3 **Frequency Signal Input**

Description

The frequency input channel circuits have similar structures, including EMC capacitors, pull-up/pull-down resistors, voltage divider resistors and a first-order low-pass filter circuit.

Main difference：

- Resistance of pull-up/pull-down resistor
- Pull-up or pull-down
- Filter time constant

Schematic

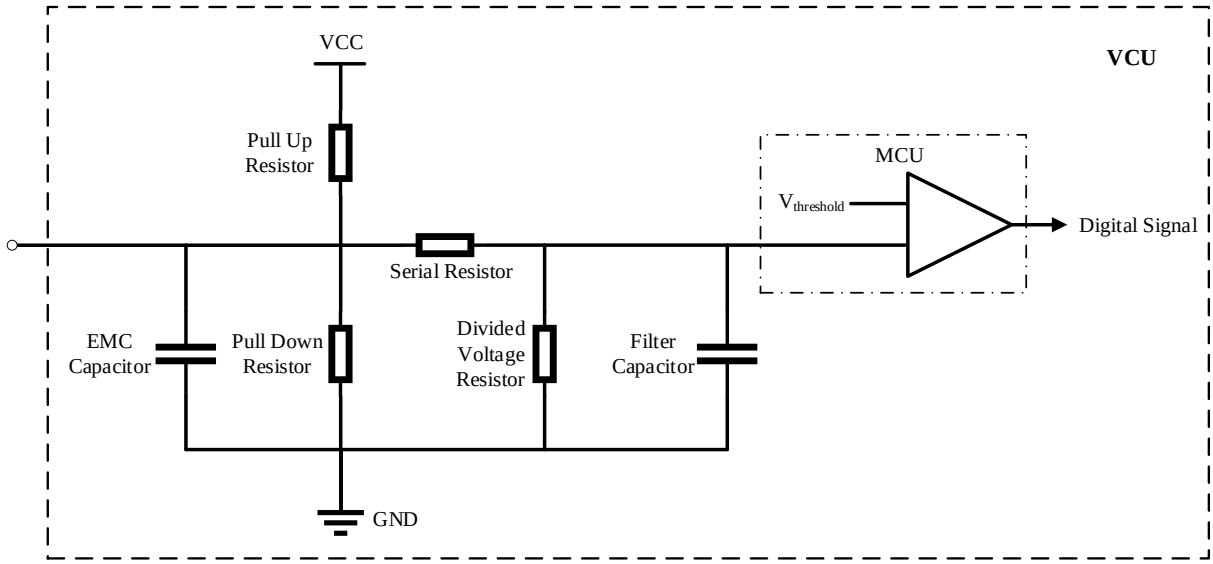


Figure 7 Schematic Diagram of Frequency Signal Input Channel

Table 7 Frequency Signal Input Channel Parameter

Pin #	SPEED	EMC Capacitor	Filter Capacitor	Pull Up Resistor		Pull Down Resistor	Series Resistor	Divided Voltage Resistor	Operation Threshold for Input Signal		Input Range	
		(F)	(F)	to U_B(Ohm)	to 5V(Ohm)	(Ohm)	(Ohm)	(Ohm)	V_{low}	V_{high}	Min	Max
64	SPEED1	10n	100p	--	--	10k	100k	33k	5V	8.5V	0V	U_B
47	SPEED2	10n	100p	--	--	10k	100k	33k	5V	8.5V	0V	U_B
66	SPEED3	10n	100p	10k	--	--	100k	33k	5V	8.5V	0V	U_B
8	SPEED4	10n	100p	10k	--	--	100k	33k	5V	8.5V	0V	U_B

Note:

1) "--" = Not installed.
2) U_B = BATT voltage.
3) Frequency input SPEED1, SPEED2, SPEED3, SPEED4 can be configured as digital input DI31, DI32, DI33, DI34.
4) The frequency and duty cycle reference values of the frequency signal input channel are shown in the following table (test conditions: BATT=12V, pulse input amplitude=10V, pulse input offset=5V):

Table 8 Frequency Signal Input Channel Frequency and Duty Cycle Reference Value

Input Frequency	Detection frequency	Input duty cycle	Detection duty cycle	Input duty cycle	Detection duty cycle	Input duty cycle	Detection duty cycle
100Hz	100Hz	10.0%	9.91%	50.0%	49.96%	90.0%	89.90%
1000Hz	1000Hz	10.0%	9.52%	50.0%	49.60%	90.0%	89.52%
2000Hz	2000Hz	10.0%	9.12%	50.0%	49.12%	90.0%	89.12%

2.2.4 High Voltage Interlock

Description

In vehicle's high-voltage interlock inspection circuit, the VCU can output a high-level signal to the circuit through the 98-pin high-side channel. At the same time, the VCU detects the feedback signal in the circuit through the 72-pin analog input channel to check the security and integrity of the vehicle circuit.

If the high-voltage interlock is not used, the 98-pin can be used as a normal high-side output channel, and the 72-pin can be used as a 0-32V analog input channel.

Schematic

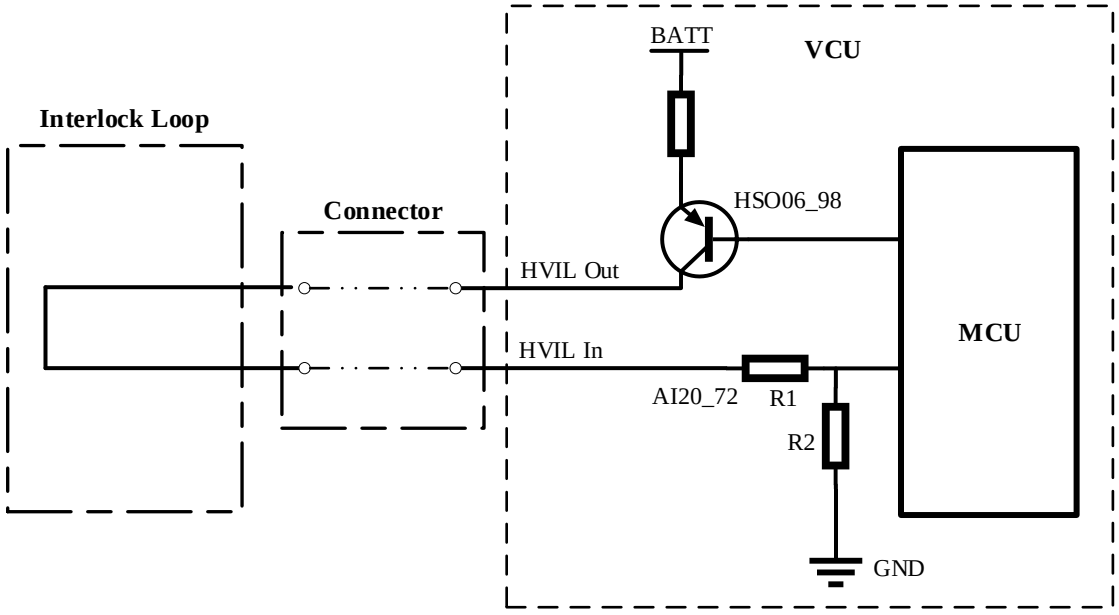


Figure 8 Schematic Diagram of High Voltage Interlock

Table 9 High Voltage Interlock Parameter

Pin #	HVIL	Resistor (Ohm) R2/(R1+R2)	Conditions / Remarks
98	HVIL_Out: HVIL signal output	--	HSO06
72	HVIL_In: HVIL signal feedback	3.48k/(22k+3.48k)	AI20

2.2.5 **Low-side Driver**

Description

The low-side driver is a low-side switch controlled by SPI and GPIO. All of it channels have fault diagnosis function.

Main difference：

- Driving current
- With or without PWM function

Schematic

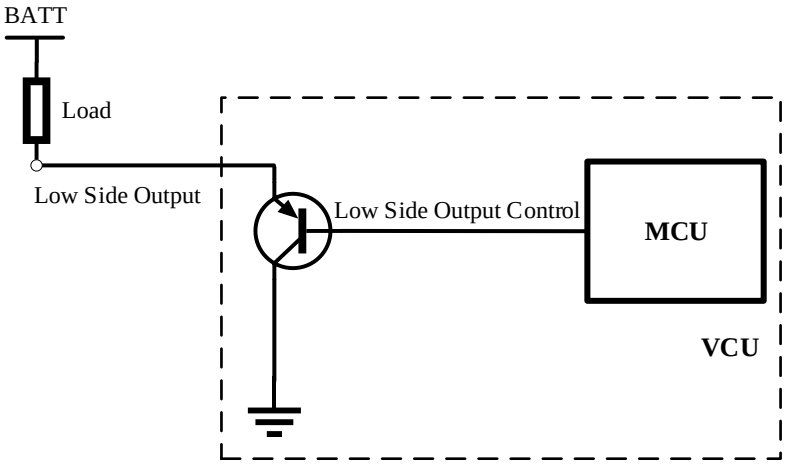


Figure 9 Schematic Diagram of Low-Side Driver Channel

Table 10 High-Side Driver Channel Parameter

Pin #	LSO	EMC Capacitor	Output Current	Free Wheeling Diode	Conditions / Remarks
		(F)	Max		
95	LSO01	--	1A	No	
96	LSO06	--	1A	No	
110	LSO07	--	1A	No	
89	LSO08	--	1A	No	
111	LSO10	--	1A	No	
103	LSO12	--	1A	No	
88	LSO13	--	1A	No	
109	LSO02	--	3A	No	
101	LSO04	--	3A	No	
112	LSO09	--	3A	No	
102	LSO11	--	3A	No	
104	LSO15	--	3A	No	
113	LSO14	--	5A	Yes	
105	LSO16	--	5A	Yes	
90	LSO03	100p	1A	No	OPWM Configurable
93	LSO17	100p	1A	No	OPWM Configurable
92	LSO18	100p	1A	No	OPWM Configurable
91	LSO19	100p	1A	No	OPWM Configurable

Note：

1. “--” = Not installed
2. Before using, all low-side driver channels need to use the module in chapter 3.10.9 of the "EcoCoder User Manual" to set **PWR12V_DRVP to 1**.
3. **The total load of all low-side driver channels should not exceed 5A.**

Fault diagnosis of low-side driver

Low-Side Driver Channel	Fault	
	Disable	Enable
LSO01、LSO02、LSO03、LSO04、LSO06、LSO07、LSO08、LSO09、LSO10、LSO11、LSO12、LSO13、LSO14、 LSO15、LSO16、LSO17、LS018、LSO19	•No load •Short to ground	•Short to power supply

Note：

1) Please refer to Chapter 3.8 of "EcoCoder Instruction Manual" for the usage of the fault diagnosis function.

2) The low-side drive channels have short-circuit protection. When it is enabled, if a channel is short-circuited to the ground, it will automatically activate the short-circuit protection function. This function may cause the channel to have a fault code jump phenomenon in this case, which is normal.

3) When LSO03 and LSO17-19 are configured as OPWM, the reference values of frequency and duty cycle are shown in the following table (test conditions: BATT = 12V, load = 24Ohm, duty cycle is all calculated as positive duty cycle).

Table 11 LSO OPWM Frequency and Duty Cycle Reference Value

Set Frequency	Output Frequency	Set Duty Cycle	Output Duty Cycle	Set Duty Cycle	Output Duty Cycle	Set Duty Cycle	Output Duty Cycle
100Hz	100Hz	10.0%	9.6%	50.0%	49.6%	90.0%	89.6%
1000Hz	1000Hz	10.0%	10.4%	50.0%	50.4%	90.0%	90.4%
2000Hz	2000Hz	10.0%	10.8%	50.0%	50.6%	90.0%	90.8%

2.2.6 High-side Driver

Description

The high-side driver is a high-side switch controlled by GPIO. All of its channels have fault diagnosis function.

Main difference：

- Driving current
- With or without PWM function
- Current leakage
- With or without freewheeling diode

Schematic

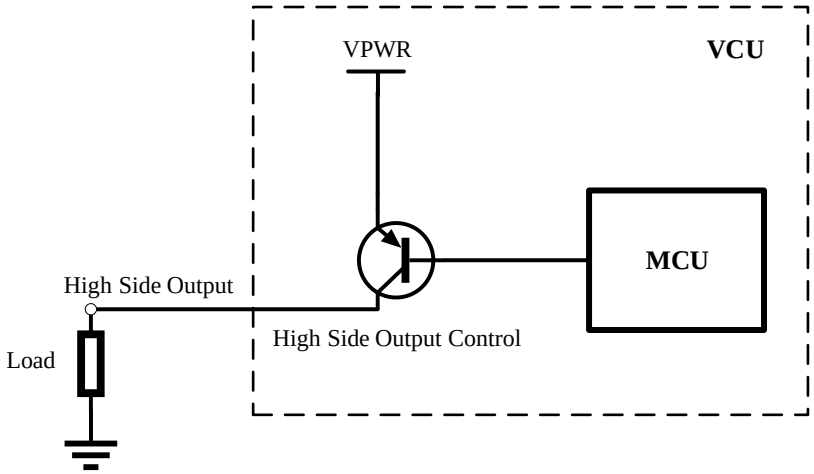


Figure 10 Schematic Diagram of High-Side Driver Channel

Table 12 High-Side Driver Channel Parameter

Pin #	HSO	EMC Capacitor	Output current	Leakage Current	Free Wheeling Diode	Conditions / Remarks
		(F)	Max (A)	Max (μA)		
108	HSO01	10n	1	5	No	
100	HSO02	10n	1	5	No	
98	HSO06	10n	1	5	No	
107	HSO03	10n	3	5	No	
99	HSO04	10n	3	5	No	
106	HSO05	10n	3	5	No	
94	HSO07	10n	5	10	No	
114	HSO10	10n	5	10	No	
86	HSO08	10n	3	5	No	OPWM Configurable
85	HSO14	10n	3	5	No	OPWM Configurable

Note：

1. Before using, all high-side driver channels need to use the module in chapter 3.10.9 of the "EcoCoder User Manual" to set **PWR12V_DRVP to 1**.
2. **The total load of all high-side driver channels should not exceed 5A.**

Fault diagnosis of high-side driver

High-side driver channel	Fault	
	Disable	**Enable**
HSO01、HSO02、HSO03、HSO04、HSO05、HSO06、HSO07、HSO08、HS010、HSO14	•Short to power supply	•No load •Short to ground •Short to power supply

Note：

1) Please refer to Chapter 3.8 of "EcoCoder Instruction Manual" for the usage of the fault diagnosis function.

2) When HSO08 and HSO14 are configured as OPWM, the reference values of frequency and duty cycle are shown in the following table (test conditions: BATT = 12V, load = 24Ohm, duty cycle is all calculated as positive duty cycle).

Table 13 HSO OPWM Frequency And Duty Cycle Reference Value

Set Frequency	Output frequency	Set duty cycle	Output duty cycle	Set duty cycle	Output duty cycle	Set duty cycle	Output duty cycle
100Hz	100Hz	10.0%	10.4%	50.0%	50.4%	90.0%	90.4%
1000Hz	1000Hz	10.0%	11.2%	50.0%	51.2%	90.0%	91.2%
2000Hz	2000Hz	10.0%	11.2%	50.0%	52.8%	90.0%	92.8%

2.2.7 CAN Bus

Description

CAN interface circuit is used for communication between VCU and other vehicle electronic controllers, and the communication speed can reach 1Mbit/s. CANA interface is integrated in the power chip. CANA supports any frame wake-up function, and CANB supports a specific frame wake-up function.

Schematic

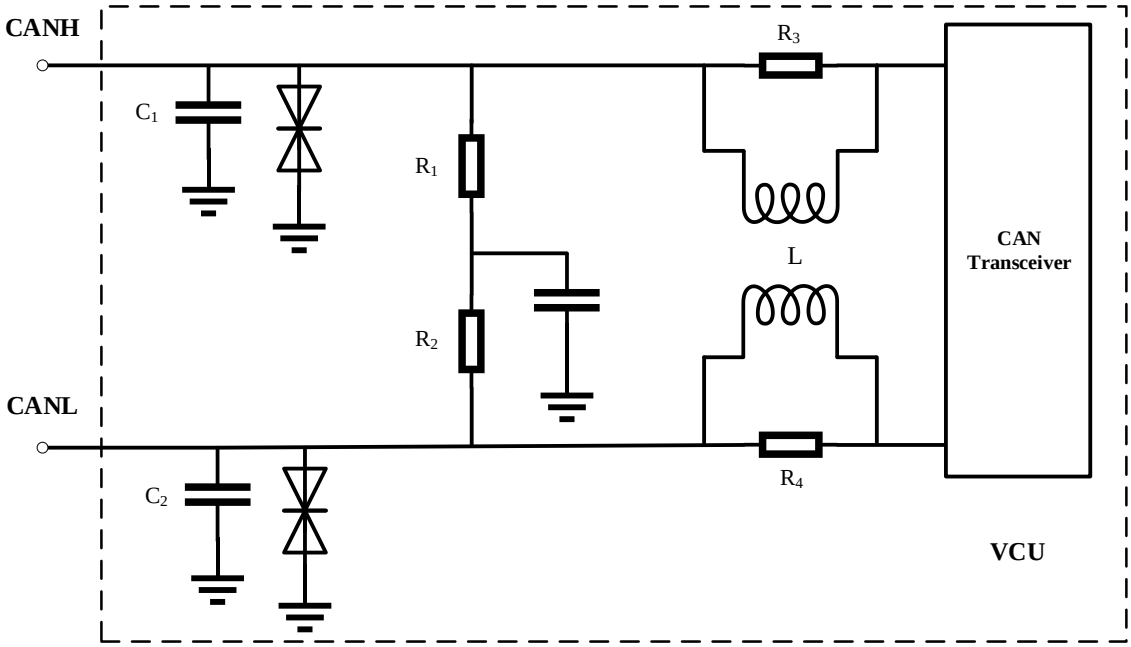


Figure 11 CAN Bus Schematic

Table 14 CAN Bus Parameter

Pin #	CAN	EMC Capacitor C_1, C_2 (F)	R_1, R_2 (Ohm)	Choke L	Conditions / Remarks
56	CANA H	47p	60	Yes	Support ISO11898-5, support CAN wake-up function in any frame
55	CANA L	47p	60		
57	CANB H	47p	--	Yes	Support ISO11898-5, support CAN specific frame wake-up
76	CANB L	47p	--		
54	CANC H	47p	60	Yes	Support ISO11898-5
73	CANC L	47p	60		

2.2.8 LIN Bus

Description

LIN (Local Interconnect Network) bus supports master/slave node communication mode. LIN bus has the function of short-circuit protection to the power supply and supports wake-up function.

Schematic

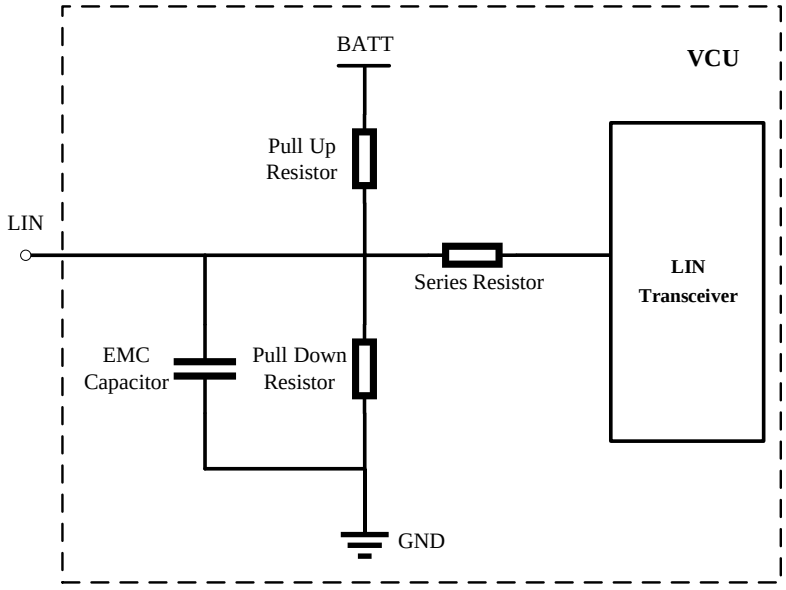


Figure 12 LIN Bus Schematic

Table 15 LIN Bus Parameter

Pin #	LIN	EMC Capacitor (F)	Pull Up Resistor to U_B (Ohm)	Pull Down Resistor to GND (Ohm)	Series Resistor (Ohm)	Conditions / Remarks
78	LIN1	10n	6.1k	--	--	

2.2.9 **5V Output**

Description

The 5V voltage output channel can provide 5V power supply voltage for external sensors and has the following functions:

- Accurate 5V output for internal IC power supply
- 5 Channels of sensor 5V power supply output
- Invert connection protection, short circuit protection, over-temperature protection

Table 16 5V Sensor Power Output Parameter

Pin #	Supply Voltage	I_{max}(mA)	Output Voltage
51	5V supply voltage 2	200	5V±2%
41	5V supply voltage 3	200	5V±2%
49	5V supply voltage 4	50	5V±2%
69	5V supply voltage 5	50	5V±2%
6	5V supply voltage 6	50	5V±2%

2.2.10 **OTP**

Description

OTP (One Time Programmable) is a memory type of MCU. OTP means after the program is burned into the MCU, it cannot be changed and erased. The OTP area of EV2274A is 12KB, 2K of them have been occupied by the factory flashing product identification code. Thus, users have 10K OTP area to use.

Chapter 3 Technical Performance

3.1 Electrical Characteristics

Item	Design Specifications
Operating Voltage	DC 12 V / 24v (9~32v)
Operating Temperature	-40 °C ~85 °C
Working Humidity	0~95%, No Condensation
Storage Temperature	-40 °C ~85 °C
Quiescent Current	<1mA
Rated Power Consumption	3 W (Not Including Load)
Protection Level	IP67
Weight	≤ 700g
Controller Size	207×150×42mm
Material	Die-Cast Aluminum
Shell	Equipped With Waterproof Breathable Valve, Good Heat Dissipation

3.2 Electrical Performance Standard

Item	Test Standard
Direct Current Supply Voltage	ISO 16750-2
Overvoltage (12V, High Temperature)	ISO 16750-2
Slow Decrease and Increase of Supply Voltage	ISO 16750-2
Superimposed Alternating Voltage	ISO 16750-2
Reversed Voltage	ISO 16750-2
Low Voltage Reset Features	ISO 16750-2
Low Voltage Start Features	ISO 16750-2
Open Circuit Tests – Single Line Interruption	ISO 16750-2
Open Circuit Tests – Multiple Line Interruption	ISO 16750-2
Short Circuit Protection	ISO 16750-2
Withstand Voltage	ISO 16750-2
Insulation Resistance	ISO 16750-2

3.3 Environmental Standards

Item	Test Standard
Waterproof (IP67)	IEC/EN 60529
Dustproof (IP67)	ISO 20653
Salt Spray Leakage Function and Corrosion Test	ISO 16750-4
Mechanical Shock Test	ISO 16750-3
Vibration Test	ISO 16750-3
Drop Test	ISO 16750-3
Temperature Shock	ISO 16750- 4
Electrical Operation at Circulating Ambient Temperature	ISO 16750-4
High and Low Temperature Operation Experiment	ISO 16750-4
High and Low Temperature Experiment	ISO 16750-4
Temperature and Humidity Cycle	IEC 60068-2-30
Constant Temperature and Humidity	ISO 16750-4

3.4 EMC Test Standard

Item	Test Standard
Voltage Transient Emissions Test	ISO7637-2
Conducted Emission (CE-V)	CISPR25
Conducted Emission (CE-C)	CISPR25
Radiation Emission (RE-ALSE)	CISPR25
Radiation Immunity Experiment (I/O)-ICC	ISO7637-3
Radiation Immunity Experiment (BCI-Substitution Method)	ISO11452-4
Radiation Immunity Experiment (RI)	ISO11452-2
Low Frequency Magnetic Field Immunity	ISO11452-8
ESD	GMW3097

Chapter 4 Installation Requirements

It is recommended to install the VCU in the cockpit. If the OEM wants to assemble the VCU in another location, Ecotron's engineers and the OEM's engineers should evaluate the corresponding installation location together.

The precautions for VCU installation are as follows：

1. The VCU and wiring harness installation should be firm and reliable, and there should be no looseness. Avoid supporting the wiring harness by VCU. At the same time, the arrangement of the VCU wiring harness should prevent and protect all wires in the wiring harness from damage due to wear and to overheat.
2. Try to avoid installing in places where dust is easy to gather. A large amount of dust accumulation will affect the reliability of VCU work.
3. VCU should keep away from the location where the temperature of the shell itself may exceed 85°C. At the same time, it is necessary to prevent the surrounding parts from releasing heat to the VCU.
4. Avoid installing the VCU in locations where oil, moisture, and water droplets are likely to splash on it.
5. Avoid the possibility of additional mechanical shock and external impact due to the installation position and fixing method of the VCU and avoid installing the VCU at the resonance point of the car body.
6. Avoid installing the VCU where it may come into contact with the battery or other parts that are prone to seepage of acid and alkaline solutions and near the VCU power terminal.
7. VCU should be installed in the horizontal and vertical position according to the connector downwards and maintain a certain angle to prevent water from entering the connector. In the horizontal direction, the recommended installation angle is -170° to -10°, as shown in Figure 13 below. In the vertical direction, the recommended installation angle is -170°~ -10°, as shown in Figure 14 below.

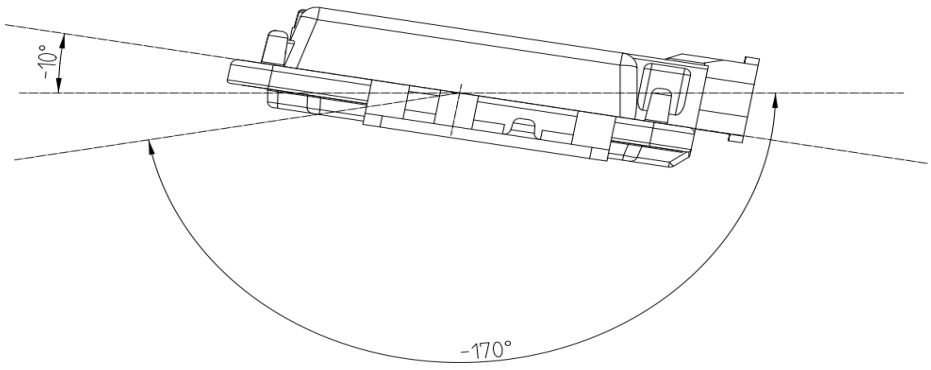
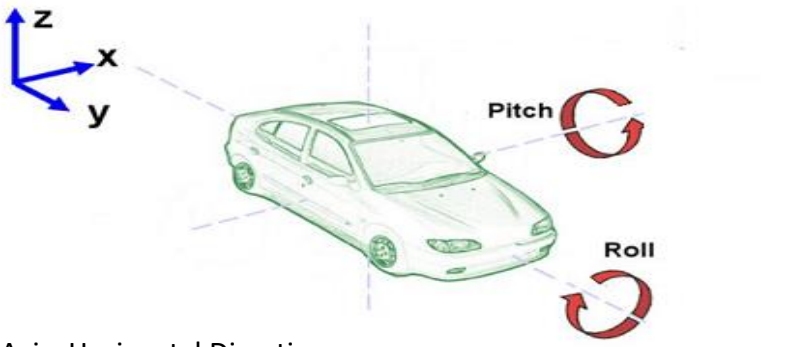


Figure 13 Horizontal Installation Angle



Z Axis: Horizontal Direction
X Y Axes: Vertical Direction

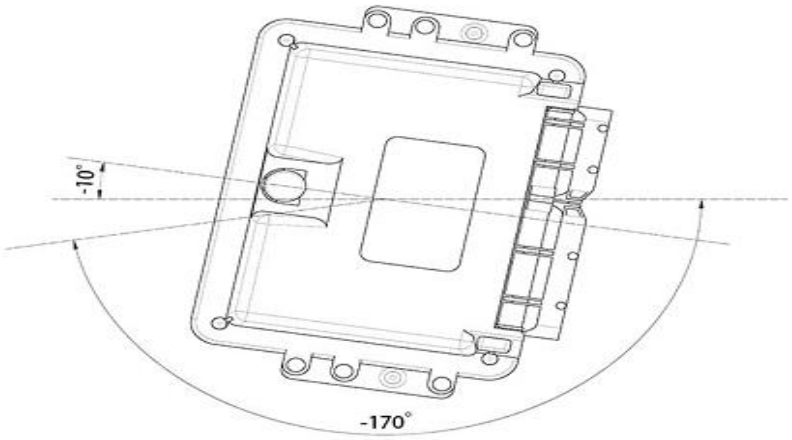


Figure 14 Vertical Installation Angle

Ecotron recommends using the six installation points on the VCU for installation and fixation. It is recommended to use metal materials such as aluminum alloy 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 VCU for vibration, heat dissipation, temperature, EMC, etc. If there is any deviation, it needs to be confirmed with Ecotron.

The VCU system adopts 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.