SuperVCU185

SV82399A

Datasheet

V 1.2

Revision History

Date	Version	Description
01/2024	V 1.0	First release
05/2024	V1.1	Updates for Sample Units
05/2024	V1.2	

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Chapter 1 General Information

1.1 Introduction

VCU (Vehicle Control Unit) is the master controller for electric and hybrid vehicles.
The core functions include power on/off management, power system management, drive mode management, drive and brake control, auxiliary management, fault diagnosis, etc.
VCU is the main control unit for vehicle control network or CAN network.

1.1.1 **Functionality**

SV82399A has the following functions:

Table 1.1.1.1 SV82399A Features

Feature
1 Key switch (KEYON)
2 Hardwire wakeup (WAKE_INPUT_1, WAKE_INPUT_2)
1 Power power (BATT_SYSTEM)
4 5V outputs
6 CAN Bus ports: CANA supports random frame wake up, CANB supports specific frame wake up
2 LIN Bus port: LIN2 is configurable as master slave, supports wake up
4 RTD inputs
4 Hall inputs
2 VR sensor inputs
4 SENT inputs
2 10/100Mbps automotive Ethernet port
4 H-bridge outputs: Configurable as 4 Peak Hold or 8 high side outputs and 8 low side outputs
26 Digital signal inputs: 4 channels can be configured as rescue mode, 4 channels have HW pull-up/pull down resistors and configurable as active-high or active-low, 12 channels can be SW configured as active-high or active-low, 6 channels can be SW configured as active-low.
30 Analog signal inputs: 30 channels have pull-up resistors and configurable as 0-32V inputs (pull up to BATT) or 0-5V inputs (pull up to 5V), 30 channels have pull down resistor, 0-32V inputs (supports 12/24V system)
8 Frequency signal inputs
20 High-side driver outputs: All can be configured as Pulse-Width-Modulation (PWM) outputs
16 Low-side driver outputs: All can be configured as Pulse-Width-Modulation (PWM) outputs

1.1.2 **Mechanical Properties**

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

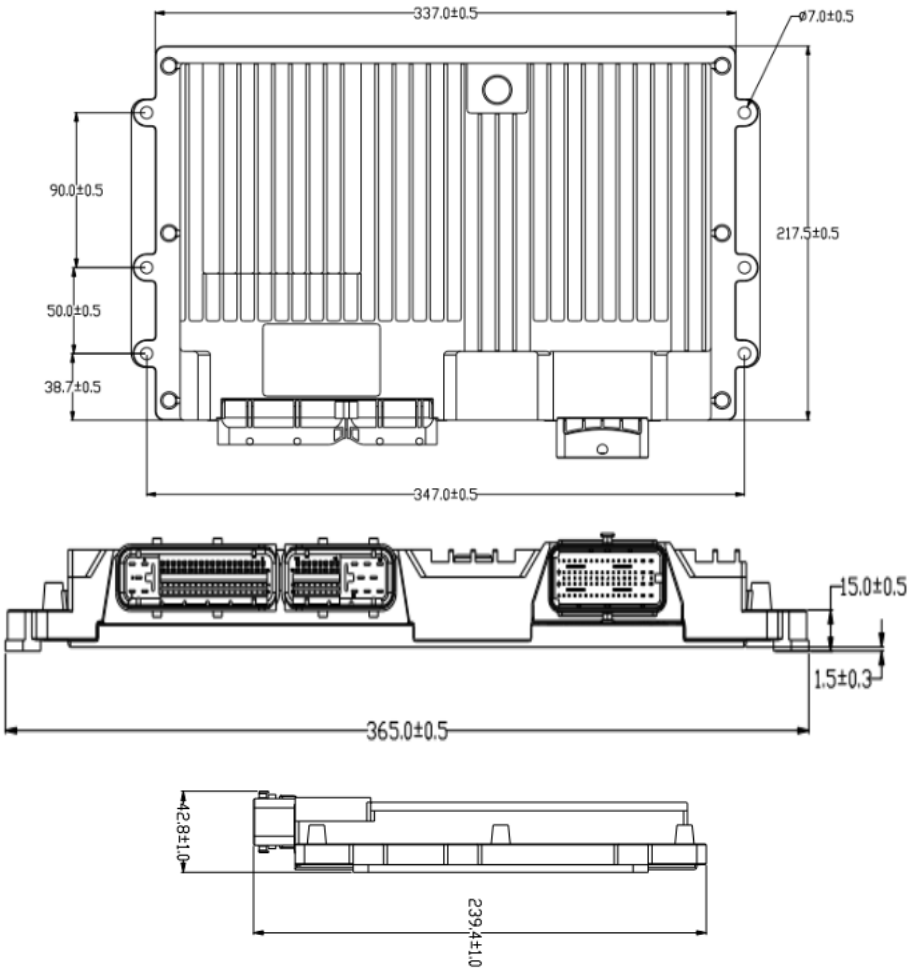


Figure 1 VCU Housing Size

The appearance of the housing is as follows:

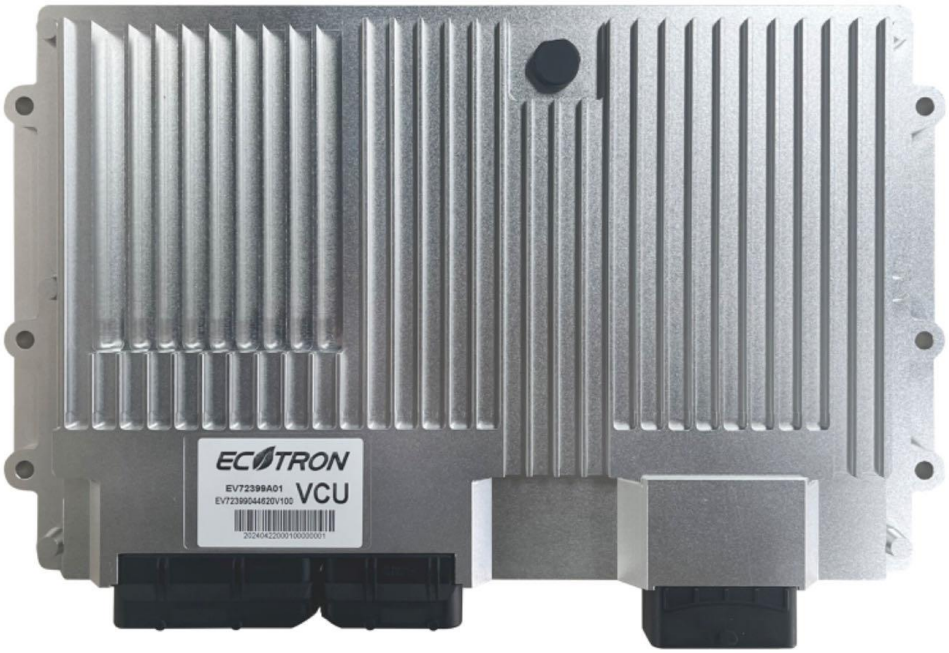


Figure 2 VCU Housing Appearance

Please use Torx T15 screwdriver to disassemble and assemble the housing.

1.1.3 **Connector Kits**

Ecotron VCU, shown below, uses automotive grade connectors from TE and Aptiv, which meet the automotive safety requirements. TE connectors have 121 pins, Aptiv connectors have 64 pins. The specific models of the connector kits are shown in the table below.

Table 1.1.3.1 121 Pin 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	TE	https://www.te.com/usa-en/product-5-968220-1.html
9	Terminal (wire diameter 0.5-0.75)	5-968221-1（968221-1）	TE	https://www.te.com.cn/chn-zh/product-5-968221-1.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.cn/chn-zh/product-964273-2.html

Table 1.1.3.2 64 Pin Connector Info

#	Name	Part number	Supplier	URL
1	PCB Pin Seat	F932300	Aptiv (formerly Delphi)	
2	Big Terminal	PPI0001484	Aptiv (formerly Delphi)	
3	Small Terminal	PPI0000489	Aptiv (formerly Delphi)	
4	64P Cover Assembly	PPI0001501	Aptiv (formerly Delphi)	
5	64P TPA	PPI0001526	Aptiv (formerly Delphi)	

Connector’s Pin distribution is shown below:

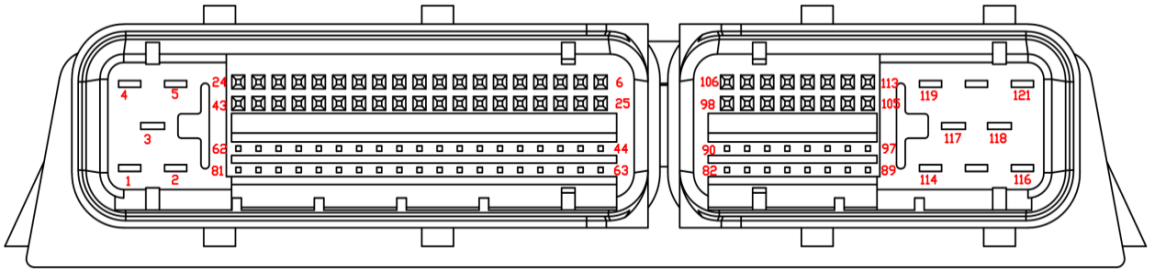


Figure 3 121 Pin Connector Distribution Diagram

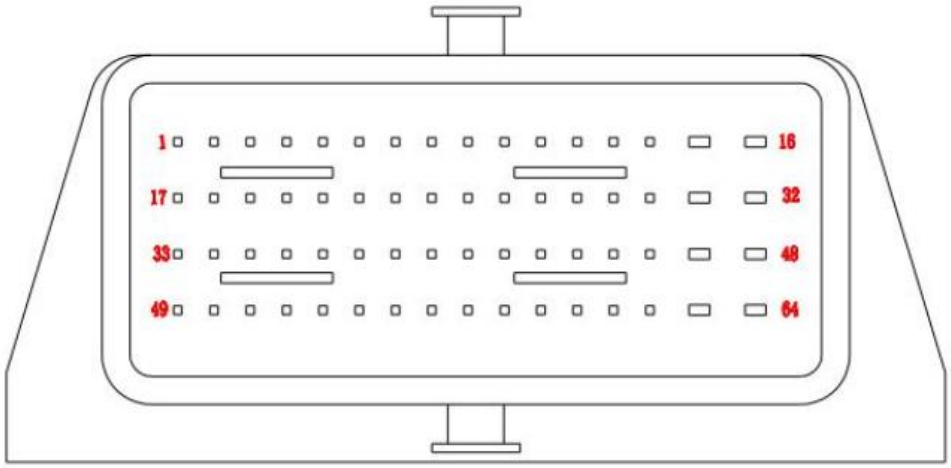


Figure 4 64 Pin Connector Distribution Diagram

1.1.4 **Micro-Chip Specs**

Table 1.1.4.1 Micro-Chip Specs

Feature	**Detail**
Micro Control Core	32-bit SAK-TC399XP-256F300S BD
Maximum Frequency	300MHz
Flash	16MB
SRAM	2.9M
Floating Point Capability	Yes

1.1.5 **Power Supply**

SV82399A requires 1 channel of continuous power supplies (pin10 from 121Pin connectors) and the VCU is powered on through the KEYON switch (pin6 from 64Pin connectors).

SV82399A power fuse: Recommend connecting pin10 with a 5A fuse in series.

1.1.6 **BootLoader**

The SV82399A bootloader supports UDS protocol by factory default.

Chapter 2 Interface Description

2.1 Pin Definition

Table 2.1.1 121pin definition

Signal name	PIN	Function	Interface description	Notes
Power supply				
BATT_SYSTEM	10	power supply	The power supply 12V/24V	9-32V
BATT-HS1	3	High side 1-10 operation voltage	Voltage 9-32V	
BATT-HS1	4	High side 1-10 operation voltage	Voltage 9-32V	
BATT-HS2	2	High side 10-20 operation voltage	Voltage 9-32V	
BATT-HS2	81	High side 10-20 operation voltage	Voltage 9-32V	
BATT-HB1	116	H-bridge 1, 2 operation voltage	Voltage 9-32V	
BATT-HB1	118	H-bridge 1, 2 operation voltage	Voltage 9-32V	
BATT-HB2	115	H-bridge 3, 4 operation voltage	Voltage 9-32V	
BATT-HB2	117	H-bridge 3, 4 operation voltage	Voltage 9-32V	
GND	1 5 29 114 119 120 121	Ground	Power ground	
GND	37 71 83 89	Ground	Signal ground	
5V3_101	101	5V sensor voltage 1	5V power supply for external sensor	Single channel output 5V±1%, the maximum sum of single channels is 250mA
5V4_109	109	5V sensor voltage 2	5V power supply for external sensor	Single channel output 5V±1%, maximum sum of channels 250mA
5V5_93	93	5V sensor voltage 3	5V power supply for external sensor	Single channel output 5V±1%, the maximum sum of single channels is 250mA
5V6_86	86	5V sensor voltage 4	5V power supply for external sensor	Single channel output 5V±1%, maximum sum of channels 250mA
CAN communication interface				
CAN_1_H_72	72	CAN_1_H_72	Contains 120 Ohm terminating resistor, Support any frame wake-up, support CAN flashing	
CAN_1_L_53	53	CAN_1_L_53		

CAN_2_H_52	52	CAN_2_H_52	Contains 120 Ohm terminal resistor, Support specific frame wake-up, support CAN flashing	
CAN_2_L_33	33	CAN_2_L_33		
CAN_3_H_70	70	CAN_3_H_70	Contains 120 Ohm terminating resistor, Support CAN flashing	
CAN_3_L_51	51	CAN_3_L_51		
CAN_4_H_32	32	CAN_4_H_32	Contains 120 Ohm terminating resistor, Support CAN flashing	
CAN_4_L_13	13	CAN_4_L_13		
CAN_5_H_31	31	CAN_5_H_31	Contains 120 Ohm terminating resistor, Support CAN flashing	
CAN_5_L_12	12	CAN_5_L_12		
CAN_6_H_68	68	CAN_6_H_68	Contains 120 Ohm terminating resistor, Support CAN flashing	
CAN_6_L_50	50	CAN_6_L_50		
CAN_SHILD1	73	CAN shielded wire		
CAN_SHILD2	69	CAN shielded wire		
CAN_SHILD3	49	CAN shielded wire		
LIN communication interface				
LIN1_BUS_11	11			
LIN2_BUS_30	30			
Automotive Ethernet communication interface				
Q5050_P1_MDIP_111	111	Automotive Ethernet communication P	Automotive Ethernet interface	
Q5050_P1_MDIN_110	110	Automotive Ethernet Communication N	Automotive Ethernet interface	
Q5050_P2_MDIP_102	102	Automotive Ethernet communication P	Automotive Ethernet interface	
Q5050_P2_MDIN_94	94	Automotive Ethernet Communication N	Automotive Ethernet interface	
SENT signal input				
SENT1_48	48	SENT signal input 01	0~0.5V is logic level 0 4.1~5V is logic level 1	
SENT2_67	67	SENT signal input 02	0~0.5V is logic level 0 4.1~5V is logic level 1	
SENT3_09	09	SENT signal input 03	0~0.5V is logic level 0 4.1~5V is logic level 1	
SENT4_28	28	SENT signal input 04	0~0.5V is logic level 0 4.1~5V is logic level 1	
Frequency input				
IPWM6_95	95	Frequency input 6	frequency signal input	Frequency input range 1Hz-30KHz
IPWM8_87	87	Frequency input 8	frequency signal input	Frequency input range 1Hz-30KHz
Digital signal input				
DI01_47	47	Digital input 01	Software configurable to active low	
DI02_66	66	Digital input 02	Software configurable to active low	
DI03_08	8	Digital input 03	Software configurable to active low	
DI04_27	27	Digital input 04	Software configurable to active low	

DI05_46	46	Digital input 05	Software configurable to active low	
DI06_65	65	Digital input 06	Software configurable to active low	
DI07_07	07	Digital input 07	Software configurable for active low or active high	
DI08_26	26	Digital input 08	Software configurable for active low or active high	
DI09_45	45	Digital input 09	Software configurable for active low or active high	
DI10_64	64	Digital input 10	Software configurable for active low or active high	
DI11_06	06	Digital input 11	Software configurable for active low or active high	
DI12_25	25	Digital input 12	Software configurable for active low or active high	
DI13_44	44	Digital input 13	Software configurable for active low or active high	
DI14_63	63	Digital input 14	Software configurable for active low or active high	
DI15_106	106	Digital input 15	Software configurable for active low or active high	
DI16_98	98	Digital input 16	Software configurable for active low or active high	
DI17_90	90	Digital input 17	Software configurable for active low or active high	
DI18_82	82	Digital input 18	Software configurable for active low or active high	
DI19_91	91	Digital input 19	The default is active high, hardware reserves a pull-up resistor.	
DI20_99	99	Digital input 20	The default is active high, hardware reserves a pull-up resistor.	
DI21_107	107	Digital input 21	The default is active high, hardware reserves a pull-up resistor.	
DI22_108	108	Digital input 22	The default is active high, hardware reserves a pull-up resistor.	
DI23_100_ZJ	100	Digital input 23	Rescue mode	
DI24_92_ZJ	92	Digital input 24	Rescue mode	
DI25_84_ZJ	84	Digital input 25	Rescue mode	
DI26_85_ZJ	85	Digital input 26	Rescue mode	
Output signal				
HS01_62	62	High side driver output 01	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
HS02_80	80	High side driver output 02	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
HS03_43	43	High side driver output 03	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
HS04_61	61	High side driver output 04	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
HS05_42	42	High side driver output 05	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
HS06_24	24	High side driver output 06	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
HS07_41	41	High side driver output 07	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
HS08_23	23	High side driver output 08	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
HS09_40	40	High side driver output 09	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz

HS10_22	22	High side driver output 10	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
HS11_21	21	High side driver output 11	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
HS12_59	59	High side driver output 12	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
HS13_39	39	High side driver output 13	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
HS14_20	20	High side driver output 14	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
HS15_38	38	High side driver output 15	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
HS16_19	19	High side driver output 16	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
HS17_60	60	High side driver output 17	Rated 1A, peak 2A	Configurable PWM output, frequency range 1Hz-20KHz
HS18_79	79	High side driver output 18	Rated 1A, peak 2A	Configurable PWM output, frequency range 1Hz-20KHz
HS19_75	75	High side driver output 19	Rated 1A, peak 2A	Configurable PWM output, frequency range 1Hz-20KHz
HS20_74	74	High side driver output 20	Rated 1A, peak 2A	Configurable PWM output, frequency range 1Hz-20KHz
LS01_17	17	Low side driver output 01	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
LS02_57	57	Low side driver output 02	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
LS03_18	18	Low side driver output 03	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
LS04_77	77	Low side driver output 04	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
LS05_58	58	Low side driver output 05	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
LS06_56	56	Low side driver output 06	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
LS07_76	76	Low side driver output 07	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
LS08_78	78	Low side driver output 08	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
LS09_14	14	Low side driver output 09	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
LS010_54	54	Low side driver output 10	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
LS011_15	15	Low side driver output 11	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
LS012_55	55	Low side driver output 12	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
LS013_34	34	Low side driver output 13	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
LS014_35	35	Low side driver output 14	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
LS015_16	16	Low side driver output 15	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
LS016_36	36	Low side driver output 16	Rated 3A, peak 6A	Configurable PWM output, frequency range 1Hz-20KHz
H3_A_H_88	88	H-bridge output	Voltage 9V-32V	

H3_B_L_96	96	H-bridge output	Voltage 9V-32V	
H3_B_H_97	97	H-bridge output	Voltage 9V-32V	
H3_A_L_103	103	H-bridge output	Voltage 9V-32V	
H4_A_H_104	104	H-bridge output	Voltage 9V-32V	
H4_B_H_105	105	H-bridge output	Voltage 9V-32V	
H4_B_L_112	112	H-bridge output	Voltage 9V-32V	
H4_A_H_113	113	H-bridge output	Voltage 9V-32V	

Table 2.1.2 64pin definition

signal name	PIN	Function	Interface description	Notes
Power supply				
GND	14 25 35 41 62	Ground	Signal Ground	
Frequency input				
IPWM1_01	01	Frequency input 1	frequency signal input	Frequency input range 1Hz-20KHz
IPWM2_02	02	Frequency input 2	frequency signal input	Frequency input range 1Hz-20KHz
IPWM3_17	17	Frequency input 3	frequency signal input	Frequency input range 1Hz-20KHz
IPWM4_18	18	Frequency input 4	frequency signal input	Frequency input range 1Hz-20KHz
IPWM5_33	33	Frequency input 5	frequency signal input	Frequency input range 1Hz-20KHz
IPWM7_49	49	Frequency input 7	frequency signal input	Frequency input range 1Hz-20KHz
Analog input				
AI01_38	38	Analog input 01	Analog signal input0~32V	Voltage type, 12 bits accuracy, Reserved pull-up resistor position
AI02_23	23	Analog input 02	Analog signal input 0~32V	Voltage type, 12 bits accuracy, Reserved pull-up resistor position
AI03_08	08	Analog input 03	Analog signal input 0~32V	Voltage type, 12 bits accuracy, Reserved pull-up resistor position
AI04_56	56	Analog input 04	Analog signal input 0~32V	Voltage type, 12 bits accuracy, Reserved pull-up resistor position
AI05_10	10	Analog input 05	Analog signal input 0~32V	Voltage type, 12 bits accuracy, Reserved pull-up resistor

				position
AI06_58	58	Analog input 06	Analog signal input 0~32V	Voltage type, 12 bits accuracy, Reserved pull-up resistor position
AI07_43	43	Analog input 07	Analog signal input 0~32V	Voltage type, 12 bits accuracy, Reserved pull-up resistor position
AI08_28	28	Analog input 08	Analog signal input 0~32V	Voltage type, 12 bits accuracy, Reserved pull-up resistor position
AI09_13	13	Analog input 09	Analog signal input 0~32V	Voltage type, 12 bits accuracy, Reserved pull-up resistor position
AI10_61	61	Analog input 10	Analog signal input 0~32V	Voltage type, 12 bits accuracy, Reserved pull-up resistor position
AI11_54	54	Analog input 11	Analog signal input 0~32V	Voltage type, 12 bits accuracy, Reserved pull-up resistor position
AI12_39	39	Analog input 12	Analog signal input 0~32V	Voltage type, 12 bits accuracy, Reserved pull-up resistor position
AI13_24	24	Analog input 13	Analog signal input 0~32V	Voltage type, 12 bits accuracy, Reserved pull-up resistor position
AI14_09	09	Analog input 14	Analog signal input 0~32V	Voltage type, 12 bits accuracy, Reserved pull-up resistor position
AI15_26	26	Analog input 15	Analog signal input 0~32V	Voltage type, 12 bits accuracy, Reserved pull-up resistor position
AI16_11	11	Analog input 16	Analog signal input 0~32V	Voltage type, 12 bits accuracy, Reserved pull-up resistor position
AI17_59	59	Analog input 17	Analog signal input 0~32V	Voltage type, 12 bits accuracy, Reserved pull-up resistor position
AI18_44	44	Analog input 18	Analog signal input 0~32V	Voltage type, 12 bits accuracy, Reserved pull-up resistor position
AI19_29	29	Analog input 19	Analog signal input 0~32V	Voltage type, 12 bits accuracy, Reserved pull-up resistor

				position
AI20_46	46	Analog input 20	Analog signal input 0~32V	Voltage type, 12 bits accuracy, Reserved pull-up resistor position
AI21_07	07	Analog input 21	Analog signal input 0~32V	Voltage type, 12 bits accuracy, Reserved pull-up resistor position
AI22_55	55	Analog input 22	Analog signal input 0~32V	Voltage type, 12 bits accuracy, Reserved pull-up resistor position
AI23_40	40	Analog input 23	Analog signal input 0~32V	Voltage type, 12 bits accuracy, Reserved pull-up resistor position
AI24_57	57	Analog input 24	Analog signal input 0~32V	Voltage type, 12 bits accuracy, Reserved pull-up resistor position
AI25_42	42	Analog input 25	Analog signal input 0~32V	Voltage type, 12 bits accuracy, Reserved pull-up resistor position
AI26_27	27	Analog input 26	Analog signal input 0~32V	Voltage type, 12 bits accuracy, Reserved pull-up resistor position
AI27_12	12	Analog input 27	Analog signal input 0~32V	Voltage type, 12 bits accuracy, Reserved pull-up resistor position
AI28_60	60	Analog input 28	Analog signal input 0~32V	Voltage type, 12 bits accuracy, Reserved pull-up resistor position
AI29_45	45	Analog input 29	Analog signal input 0~32V	Voltage type, 12 bits accuracy, Reserved pull-up resistor position
AI30_30	30	Analog input 30	Analog signal input 0~32V	Voltage type, 12 bits accuracy, Reserved pull-up resistor position
Power on signal				
KEYON_06	06	KeyOn input signal	Analog signal input 0~BATT/digital signal input0~BATT	12-bit accuracy, wake-up threshold >9V
WAKE_INPUT_1	22	wake-up signal	Digital signal input 0~BATT	Wake-up threshold＞9V
WAKE_INPUT_2	53	wake-up signal	Digital signal input 0~BATT	Wake-up threshold＞9V
RTD acquisition interface				
RTD01_03	03	RTD input 01		
RTD02_19	19	RTD input 02		

RTD03_34	34	RTD input 03		
RTD04_50	50	RTD input 04		
VR input interface				
VR1+	36	VR1+ input		
VR1-	51	VR1-input		
VR2+	20	VR2+ input		
VR2-	4	VR2-input		
Input interface				
Hall1_37	37	Hall input 01		
Hall2_21	21	Hall input 02		
Hall3_05	05	Hall input 03		
Hall4_52	52	Hall input 04		
Output signal				
H2_B_H_15	15	H-bridge output	Voltage 9V-32V	
H2_B_L_16	16	H-bridge output	Voltage 9V-32V	
H2_A_H_31	31	H-bridge output	Voltage 9V-32V	
H1_A_H_32	32	H-bridge output	Voltage 9V-32V	
H2_A_L_47	47	H-bridge output	Voltage 9V-32V	
H1_A_L_48	48	H-bridge output	Voltage 9V-32V	
H1_B_H_63	63	H-bridge output	Voltage 9V-32V	
H1_B_L_64	64	H-bridge output	Voltage 9V-32V	

2.2 Pin Description

2.2.1 **Analog Signal Input**

Description

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

Main difference:

- Resistance value of pull-up/pull-down resistor
- Pull-up voltage

Schematic

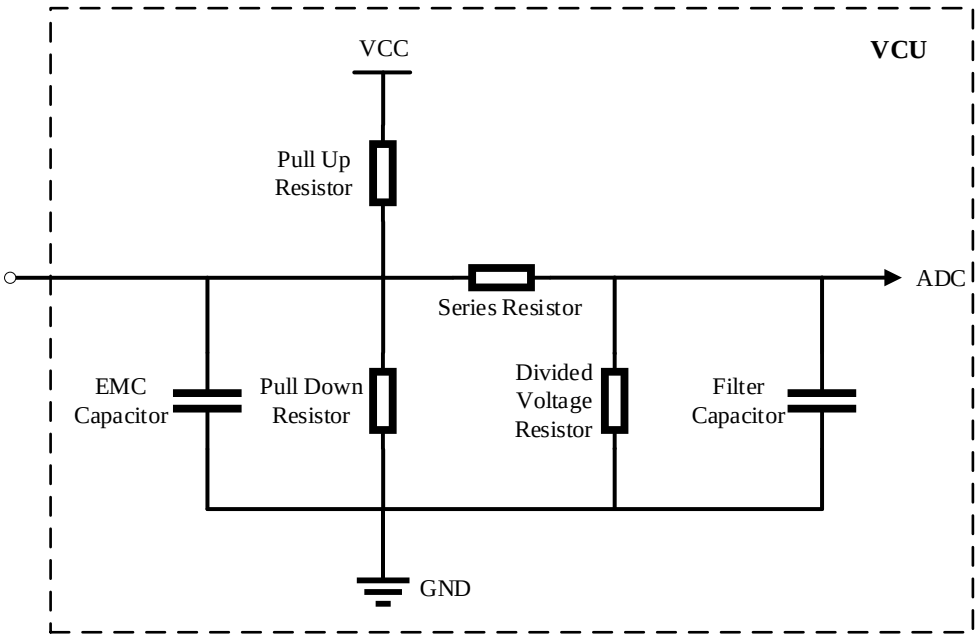


Figure 5 Schematic of Analog Signal Input Channel

Table 2.2.1.1 Analog Signal Input Channel Parameter

Note: 1) "--" means not installed. 2) U_B refers to power supply BATT voltage.

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	
38	AI01_38	100n	--	--	51K	22K	3.48K	1n	0V	32V	0V	32V	Hardware configurable for pull-up or pull-down
23	AI02_23	100n	--	--	51K	22K	3.48K	1n	0V	32V	0V	32V	Hardware configurable for pull-up or pull-down
08	AI03_08	100n	--	--	51K	22K	3.48K	1n	0V	32V	0V	32V	Hardware configurable for pull-up or pull-down
56	AI04_56	100n	--	--	51K	22K	3.48K	1n	0V	32V	0V	32V	Hardware configurable for pull-up or pull-down
10	AI05_10	100n	--	--	51K	22K	3.48K	1n	0V	32V	0V	32V	Hardware configurable for pull-up or pull-down
58	AI06_58	100n	--	--	51K	22K	3.48K	1n	0V	32V	0V	32V	Hardware configurable for pull-up or pull-down
43	AI07_43	100n	--	--	51K	22K	3.48K	1n	0V	32V	0V	32V	Hardware configurable for pull-up or pull-down
28	AI08_28	100n	--	--	51K	22K	3.48K	1n	0V	32V	0V	32V	Hardware configurable for pull-up or pull-down
13	AI09_13	100n	--	--	51K	22K	3.48K	1n	0V	32V	0V	32V	Hardware configurable for pull-up or pull-down
61	AI10_61	100n	--	--	51K	22K	3.48K	1n	0V	32V	0V	32V	Hardware configurable for pull-up or pull-down

54	AI11_54	100n	--	--	51K	22K	3.48K	1n	0V	32V	0V	32V	Hardware configurable for pull-up or pull-down
39	AI12_39	100n	--	--	51K	22K	3.48K	1n	0V	32V	0V	32V	Hardware configurable for pull-up or pull-down
24	AI13_24	100n	--	--	51K	22K	3.48K	1n	0V	32V	0V	32V	Hardware configurable for pull-up or pull-down
09	AI14_09	100n	--	--	51K	22K	3.48K	1n	0V	32V	0V	32V	Hardware configurable for pull-up or pull-down
26	AI15_26	100n	--	--	51K	22K	3.48K	1n	0V	32V	0V	32V	Hardware configurable for pull-up or pull-down
11	AI16_11	100n	--	--	51K	22K	3.48K	1n	0V	32V	0V	32V	Hardware configurable for pull-up or pull-down
59	AI17_59	100n	--	--	51K	22K	3.48K	1n	0V	32V	0V	32V	Hardware configurable for pull-up or pull-down
44	AI18_44	100n	--	--	51K	22K	3.48K	1n	0V	32V	0V	32V	Hardware configurable for pull-up or pull-down
29	AI19_29	100n	--	--	51K	22K	3.48K	1n	0V	32V	0V	32V	Hardware configurable for pull-up or pull-down
46	AI20_46	100n	--	--	51K	22K	3.48K	1n	0V	32V	0V	32V	Hardware configurable for pull-up or pull-down
07	AI21_07	100n	--	--	51K	22K	3.48K	1n	0V	32V	0V	32V	Hardware configurable for pull-up or pull-down
55	AI22_55	100n	--	--	51K	22K	3.48K	1n	0V	32V	0V	32V	Hardware configurable for pull-up or pull-down
40	AI23_40	100n	--	--	51K	22K	3.48K	1n	0V	32V	0V	32V	Hardware configurable for pull-up or pull-down
57	AI24_57	100n	--	--	51K	22K	3.48K	1n	0V	32V	0V	32V	Hardware configurable for pull-up or pull-down
42	AI25_42	100n	--	--	51K	22K	3.48K	1n	0V	32V	0V	32V	Hardware configurable for pull-up or pull-down
27	AI26_27	100n	--	--	51K	22K	3.48K	1n	0V	32V	0V	32V	Hardware configurable for pull-up or pull-down
12	AI27_12	100n	--	--	51K	22K	3.48K	1n	0V	32V	0V	32V	Hardware configurable for pull-up or pull-down
60	AI28_60	100n	--	--	51K	22K	3.48K	1n	0V	32V	0V	32V	Hardware configurable for pull-up or pull-down
45	AI29_45	100n	--	--	51K	22K	3.48K	1n	0V	32V	0V	32V	Hardware configurable for pull-up or pull-down
30	AI30_30	100n	--	--	51K	22K	3.48K	1n	0V	32V	0V	32V	Hardware configurable for pull-up or pull-down
--	5V3_101	100n	--	--	--	22K	22K	1n	0V	5V	0V	5V	Through 1 of 8 analog selection
--	5V4_109	100n	--	--	--	22K	22K	1n	0V	5V	0V	5V	

--	5V5_93	100n	--	--	--	22K	22K	1n	0V	5V	0V	5V	switch for AN68_Y1 acquisition
--	5V6_86	100n	--	--	--	22K	22K	1n	0V	5V	0V	5V	
--	CAN_5V0	--	--	--	--	22K	22K	1n	0V	5V	0V	5V	
--	MCU_3V3	--	--	--	--	22K	22K	1n	0V	3.3V	0V	3.3V	
--	MCU_5V	--	--	--	--	22K	22K	1n	0V	5V	0V	5V	
--	1V8	--	--	--	--	22K	22K	1n	0V	1.8V	0V	1.8V	
--	2V5	--	--	--	--	22K	22K	1n	0V	2.5V	0V	2.5V	Through 1 of 8 analog selection switch for AN69_Y2 acquisition
--	1V0	--	--	--	--	22K	22K	1n	0V	1V	0V	1V	
--	3V3_1	--	--	--	--	22K	22K	1n	0V	3.3V	0V	3.3V	
--	3V3_2	--	--	--	--	22K	22K	1n	0V	3.3V	0V	3.3V	
--	5V0	100n	--	--	--	22K	22K	1n	0V	5V	0V	5V	
--	VSENT_5V	100n	--	--	--	22K	22K	1n	0V	5V	0V	5V	
--	BATT_HSO_Class1	--	--	--	--	99.8K	10K	1n	0V	32V	0V	32V	
--	BATT_HSO_Class2	--	--	--	--	99.8K	10K	1n	0V	32V	0V	32V	
--	BATT_HB_Class1	100n	--	--	--	99.8K	16K	1n	0V	32V	0V	32V	AN32_W9
--	BATT_HB_Class2	100n	--	--	--	99.8K	16K	1n	0V	32V	0V	32V	Through 1 of 8 analog selection switch for AN67_AA1 acquisition
--	BATT2	100n	--	--	--	99.8K	10K	1n	0V	32V	0V	32V	
--	KEYON_06	--	--	--	--	99.8K	16K	1n	0V	32V	0V	32V	
--	ID1	--	--	20K	--	--	5.1K	1n	0V	5V	0V	5V	1
--	ID2	--	--	--	--	--	5.1K	1n	0V	5V	0V	5V	0

2.2.2 **Digital Signal Input**

Description

The digital input channel circuits have the same 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

Schematic

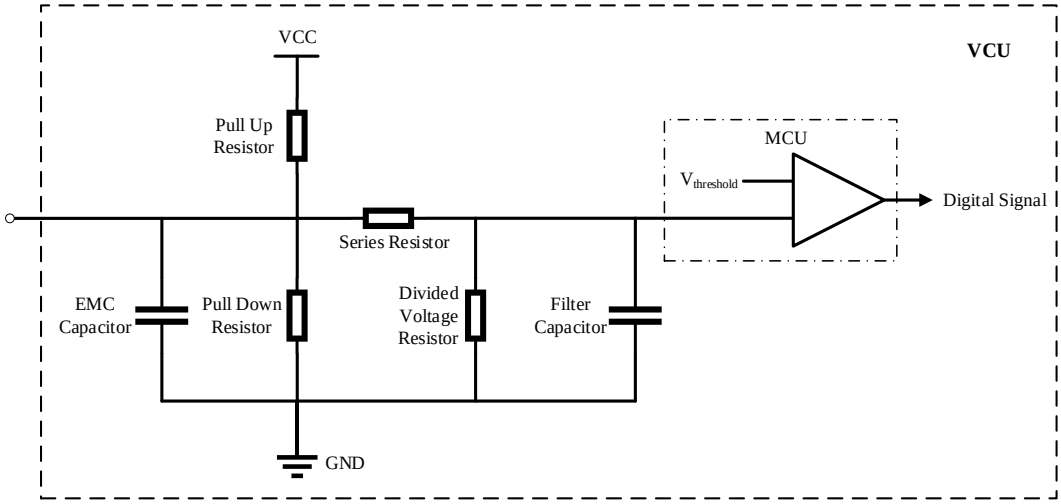


Figure 6 Schematic of Digital Signal Input Channel

Table 2.2.2.1 Digital Signal Input Channel Parameter

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	
47	DI01_47	100n	--	--	--	100R	--	--	--	4V	0V	32V	
66	DI02_66	100n	--	--	--	100R	--	--	--	4V	0V	32V	
8	DI03_08	100n	--	--	--	100R	--	--	--	4V	0V	32V	
27	DI04_27	100n	--	--	--	100R	--	--	--	4V	0V	32V	
46	DI05_46	100n	--	--	--	100R	--	--	--	4V	0V	32V	
65	DI06_65	100n	--	--	--	100R	--	--	--	4V	0V	32V	
07	DI07_07	100n	--	--	--	100R	--	--	--	4V	0V	32V	
26	DI08_26	100n	--	--	--	100R	--	--	--	4V	0V	32V	
45	DI09_45	100n	--	--	--	100R	--	--	--	4V	0V	32V	
64	DI10_64	100n	--	--	--	100R	--	--	--	4V	0V	32V	
06	DI11_06	100n	--	--	--	100R	--	--	--	4V	0V	32V	
25	DI12_25	100n	--	--	--	100R	--	--	--	4V	0V	32V	
44	DI13_44	100n	--	--	--	100R	--	--	--	4V	0V	32V	
63	DI14_63	100n	--	--	--	100R	--	--	--	4V	0V	32V	
106	DI15_106	100n	--	--	--	100R	--	--	--	4V	0V	32V	
98	DI16_98	100n	--	--	--	100R	--	--	--	4V	0V	32V	
90	DI17_90	100n	--	--	--	100R	--	--	--	4V	0V	32V	
82	DI18_82	100n	--	--	--	100R	--	--	--	4V	0V	32V	
91	DI19_91	100n	--	--	10K	100K	33K	100p	5.58V	9.31V	0V	32V	
99	DI20_99	100n	--	--	10K	100K	33K	100p	5.58V	9.31V	0V	32V	
107	DI21_107	100n	--	--	10K	100K	33K	100p	5.58V	9.31V	0V	32V	
108	DI22_108	100n	--	--	10K	100K	33K	100p	5.58V	9.31V	0V	32V	
100	DI23_100_ZJ	100n	--	--	10K	100K	33K	100p	5.58V	9.31V	0V	32V	Rescue mode
92	DI24_92_ZJ	100n	--	--	10K	100K	33K	100p	5.58V	9.31V	0V	32V	Rescue mode

84	DI25_84_ZJ	100n	--	--	10K	100K	33K	100p	5.58V	9.31V	0V	32V	Rescue mode
85	DI26_85_ZJ	100n	--	--	10K	100K	33K	100p	5.58V	9.31V	0V	32V	Rescue mode
06	KEYON_06	10n	--	--	10K	99.8K	33K	100P	5.58V	9.31V	0V	32V	
22	WAKE_INPUT_1	10n	--	--	10K	99.8K	33K	100P	5.58V	9.31V	0V	32V	
52	WAKE_INPUT_2	10n	--	--	10K	99.8K	33K	100P	5.58V	9.31V	0V	32V	
--	Q5050_INH	10n	--	--	10K	100K	33K	100P	5.58V	9.31V	0V	32V	
--	CAN_INH1	10n	--	--	10K	100K	33K	100P	5.58V	9.31V	0V	32V	
--	CAN_INH2	10n	--	--	10K	100K	33K	100P	5.58V	9.31V	0V	32V	
--	LIN_INH	10n	--	--	10K	100K	33K	100P	5.58V	9.31V	0V	32V	

Note:

1) "--" denotes Not installed.

2) U_B denotes BATT voltage.

3) DI01-DI18 are integrated chip resources

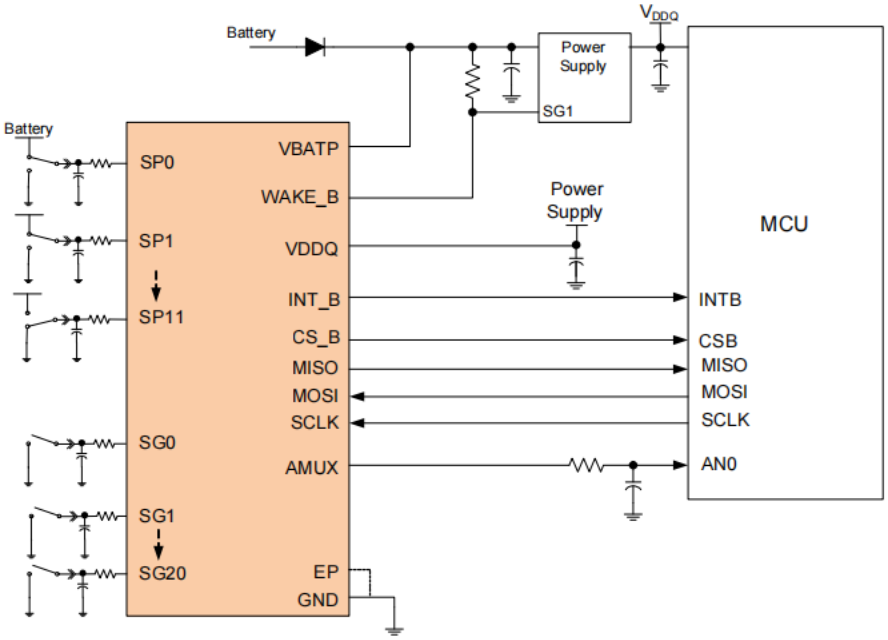


Figure 7 Integrated chip input channels diagram

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

Schematic

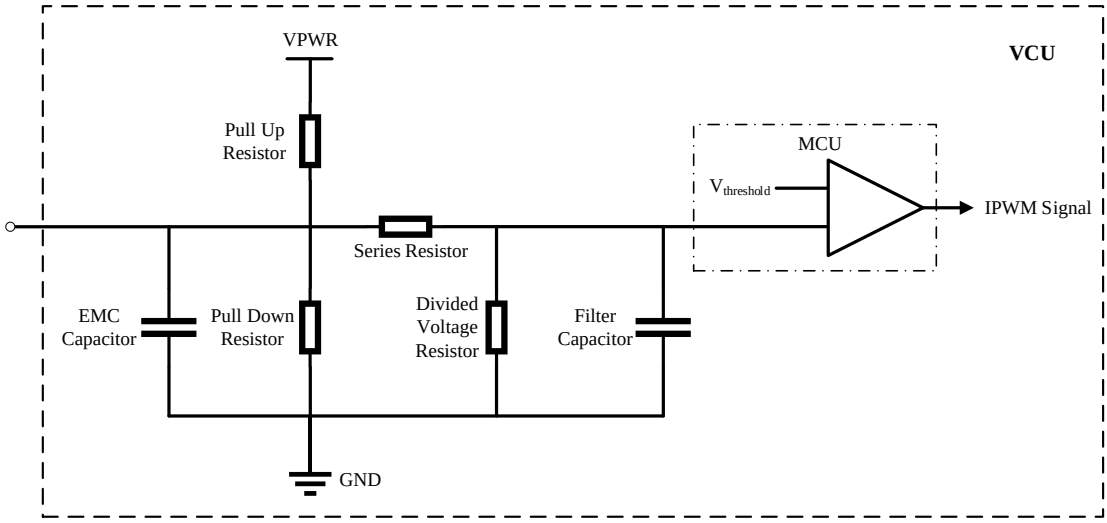


Figure 8 Schematic Diagram of Frequency Signal Input Channel

Table 2.2.3.1 Frequency Signal Input Channel Parameter

Pin #	Description	EMC Cap..	Filter Cap..	Pull Up Resistor to UB	Pull Up Resistor to 5V	Pull Down Resistor	Serial Resistor	Divided Voltage Resistor	Hysteresis Resistor	Operation Threshold for Input Signal		Input Range	
		(F)	(F)	(Ohm)	(Ohm)	(Ohm)	(Ohm)	(Ohm)	(Ohm)	Vlow	Vhigh	min	max
01	IPWM1_01	1n	10p	--	1K	--	45.3K	--	91K	0.75-1.25V	2.75-3.25V	0 V	32V
02	IPWM2_02	1n	10p	--	1K	--	45.3K	--	91K	0.75-1.25V	2.75-3.25V	0 V	32V
17	IPWM3_17	1n	10p	--	1K	--	45.3K	--	91K	0.75-1.25V	2.75-3.25V	0 V	5V
18	IPWM4_18	1n	10p	--	1K	--	45.3K	--	91K	0.75-1.25V	2.75-3.25V	0 V	5V
33	IPWM5_33	1n	10p	--	1K	--	45.3K	--	91K	0.75-1.25V	2.75-3.25V	0 V	5V
95	IPWM6_95	1n	10p		1K		45.3K		91K	0.75-1.25V	2.75-3.25V	0 V	5V
49	IPWM7_49	1n	10p		1K		45.3K		91K	0.75-1.25V	2.75-3.25V	0 V	5V
87	IPWM8_87	1n	10p	--	1K	--	45.3K	--	91K	0.75-1.25V	2.75-3.25V	0 V	5V

Note:

1) "--" denotes Not installed.

2) U_B denotes BATT voltage.

2.2.4 **Low-side Driver**

Description

The low-side driver is a switch for driving peripheral devices controlled by SPI or GPIO signals. All low-side drive channels have a fault diagnosis function.

Main difference:

- Current value
- PWM Capability

Schematic

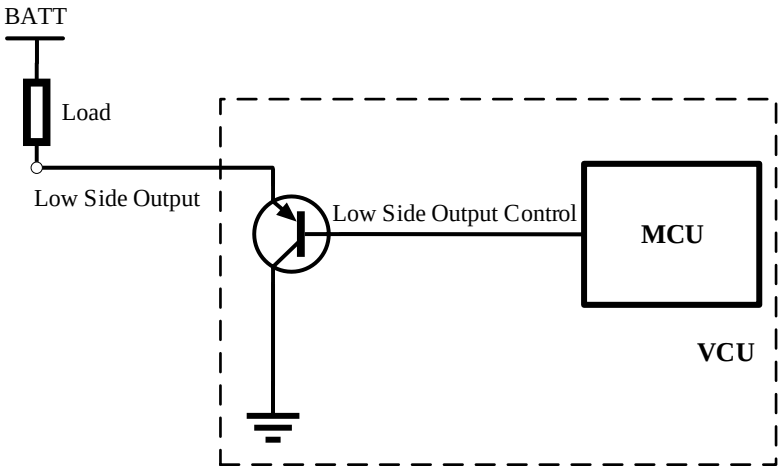


Figure 9 Schematic Diagram of Low-Side Driver Channel

Table 2.2.4.1 Low-Side Driver Channel Parameter

Pin #	Description	EMC Capacitor	Output Current	Free Wheeling Diode	Conditions / Remarks
			Max		
17	LS01_17		Max 6A Rated 3A	Yes	
57	LS02_57		Max 6A Rated 3A	Yes	
18	LS03_18		Max 6A Rated 3A	Yes	
77	LS04_77		Max 6A Rated 3A	Yes	
58	LS05_58		Max 6A Rated 3A	Yes	
56	LS06_56		Max 6A Rated 3A	Yes	
76	LS07_76		Max 6A Rated 3A	Yes	
78	LS08_78		Max 6A Rated 3A	Yes	
14	LS09_14		Max 6A Rated 3A	Yes	
54	LS010_54		Max 6A Rated 3A	Yes	
15	LS011_15		Max 6A Rated 3A	Yes	
55	LS012_55		Max 6A Rated 3A	Yes	
34	LS013_34		Max 6A Rated 3A	Yes	
35	LS014_35		Max 6A Rated 3A	Yes	
16	LS015_16		Max 6A Rated 3A	Yes	
36	LS016_36		Max 6A Rated 3A	Yes	

Note:

1. "--" denotes Not installed
2. Pin10 has to be connected to BATT to guarantee low-side outputs working normally.

Table 2.2.4.2 Fault diagnosis of low-side driver

Low-Side Driver Channel	**Fault**	
	Disable	**Enable**

LS01_17,LS02_57,LS03_18,LS04_77,LS05_58 ,LS06_56,LS07_76,LS08_78,LS09_14,LS010_54,LS011_15,LS012_55,LS013_34 ,LS014_35,LS015_16,LS016_36	•Short to ground	•Short to power

2.2.5 High-side Driver

Description

Controlled by GPIO, the high-side driver can be used as a switch for driving peripheral devices. All high-side driver channels have a fault diagnosis function.

Main difference:

- Current value
- PWM Capability
- Leakage current
- With or without freewheeling diode

Schematic

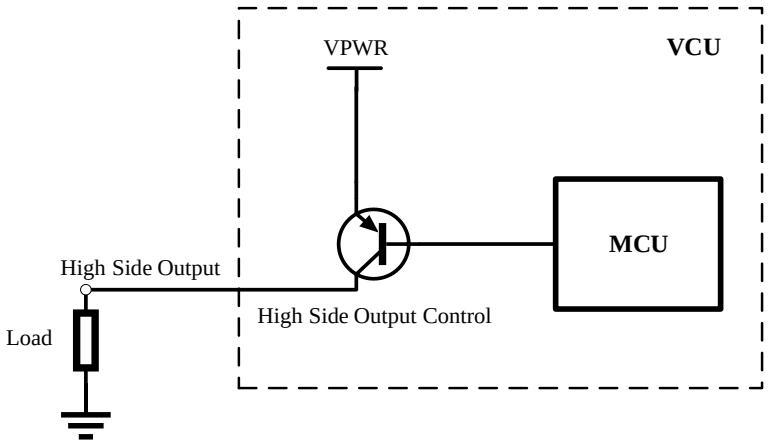


Figure 10 Schematic Diagram of High-Side Driver Channel

Table 2.2.5.1 High-Side Driver Channel Parameter

Pin #	Description	EMC Capacitor	Output current	Leakage Current	Free Wheeling Diode	Conditions / Remarks
			Max(A)	Max(uA)		
62	HS01_62	10nF/50V	Max 6A Rated 3A		Yes	
80	HS02_80	10nF/50V	Max 6A Rated 3A		Yes	
43	HS03_43	10nF/50V	Max 6A Rated 3A		Yes	
61	HS04_61	10nF/50V	Max 6A Rated 3A		Yes	
42	HS05_42	10nF/50V	Max 6A Rated 3A		Yes	
24	HS06_24	10nF/50V	Max 6A		Yes	

			Rated 3A			
41	HS07_41	10nF/50V	Max 6A Rated 3A		Yes	
23	HS08_23	10nF/50V	Max 6A Rated 3A		Yes	
40	HS09_40	10nF/50V	Max 6A Rated 3A		Yes	
22	HS10_22	10nF/50V	Max 6A Rated 3A		Yes	
21	HS11_21	10nF/50V	Max 6A Rated 3A		Yes	
59	HS12_59	10nF/50V	Max 6A Rated 3A		Yes	
39	HS13_39	10nF/50V	Max 6A Rated 3A		Yes	
20	HS14_20	10nF/50V	Max 6A Rated 3A		Yes	
38	HS15_38	10nF/50V	Max 6A Rated 3A		Yes	
19	HS16_19	10nF/50V	Max 6A Rated 3A		Yes	
60	HS17_60	10nF/50V	Max 6A Rated 3A		Yes	
79	HS18_79	10nF/50V	Max 6A Rated 3A		Yes	
75	HS19_75	10nF/50V	Max 6A Rated 3A		Yes	
74	HS20_74	10nF/50V	Max 6A Rated 3A		Yes	

Note:

1. "--" denotes Not installed
2. **The total load of all high-side drive channels does not exceed 30A.**
3. Pin10 must be connected to BATT power;
   When using HS1-HS10: pins3, 4 must be connected to BATT-HS1,
   When using HS11-HS20: pins2, 81 must be connected to BATT-HS2,
   Then high side channels can work properly.

Table 2.2.5.2 Fault Diagnosis of High-side Driver

High-side driver channel	**Fault**	
	Disable	**Enable**
HS01, HS02, HS03, HS04, HS05, HS06, HS07, HS08, HS09, HS10, HS11, HS012, HS13, HS14, HS15, HS16, HS17, HS18, HS19, HS20	•Short to power supply	•Short to ground

2.2.6 CAN Bus

Description

CAN interface is used for communication between VCU and other vehicle electronic controllers. Communication speed is up to 1Mbit/s.

Schematic

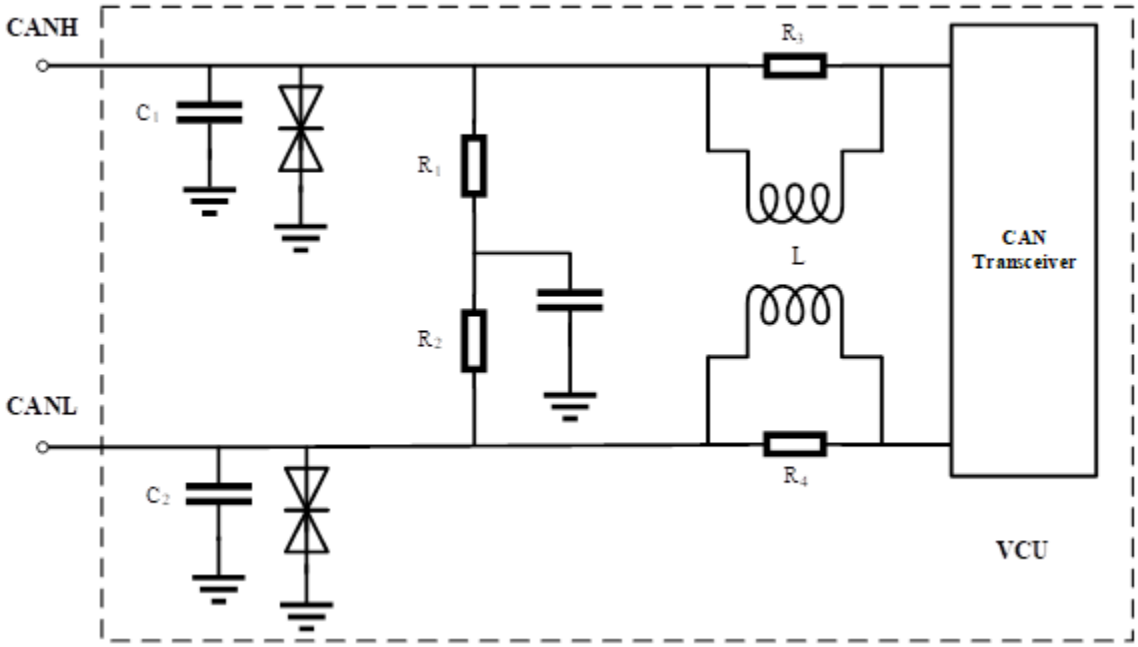


Figure 11 CAN Bus Schematic

Table 2.2.6.1 CAN Bus interface

Pin#	Description	Capacitor C1	R1, R2 (Ohm)	Choke L	Conditions/Remarks
72	CAN_1_H_72	47pF/100V	60R4	Yes	Support CAN any frame wake-up function
53	CAN_1_L_53		60R4		
52	CAN_2_H_52	47pF/100V	60R4	Yes	Support CAN any frame wake-up function
33	CAN_2_L_33		60R4		
70	CAN_3_H_70	47pF/100V	60R4	Yes	Support CAN2.0A/B
51	CAN_3_L_51		60R4		
32	CAN_4_H_32	47pF/100V	60R4	Yes	Support CAN2.0A/B
13	CAN_4_L_13		60R4		
31	CAN_5_H_31	47pF/100V	60R4	Yes	Support CAN2.0A/B
12	CAN_5_L_12		60R4		
68	CAN_6_H_68	47pF/100V	60R4	Yes	Support CAN2.0A/B
50	CAN_6_L_50		60R4		
73	CAN_SHILD1		CAN shielded wire		
69	CAN_SHILD2		CAN shielded wire		
49	CAN_SHILD3		CAN shielded wire		

2.2.7 LIN Bus

Description

LIN (Local Interconnect Network) bus supports master/slave node communication mode, with short-to-power protection feature.

Schematic

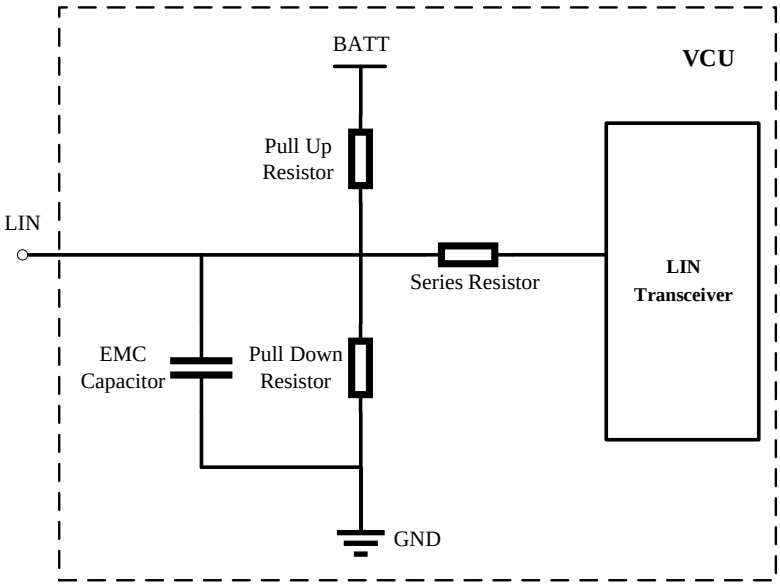


Figure 12 LIN Bus Schematic

Table 2.2.7.1 LIN Bus Parameter

Pin #	LIN	EMC Capacitor	Pull Up Resistor	Pull Down Resistor	Series Resistor	Conditions/Remarks
			to UB (Ohm)	to GND (Ohm)	(Ohm)	
11	LIN1_BUS_11	1nF/100V	1K	--	--	--
30	LIN2_BUS_30	Configurable 1nF/100V or 220Pf/100V	1K	--	--	Configurable master and slave, with wake-up function

2.2.8 5V Output

Description

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

- 4 Channels of sensor 5V power supply output
- Reverse polarity protection, short circuit protection, over-temperature protection

Table 2.2.8.1 5V Sensor Power Output Parameter

Pin #	Description	Imax(mA)	Output Voltage
101	5V sensor voltage 1	Sum of single channel maximum 250mA	Single output 5V±1%
109	5V sensor voltage 2	Sum of single channel maximum 250mA	Single output 5V±1%
93	5V sensor voltage 3	Sum of single channel maximum 250mA	Single output 5V±1%
86	5V sensor voltage 4	Sum of single channel maximum 250mA	Single output 5V±1%

2.2.9 **H-Bridge**

Description

H-bridge is a DC motor control driver that allows the connected load or output channels' voltage/current to be reversed. All channels have fault diagnosis functions.

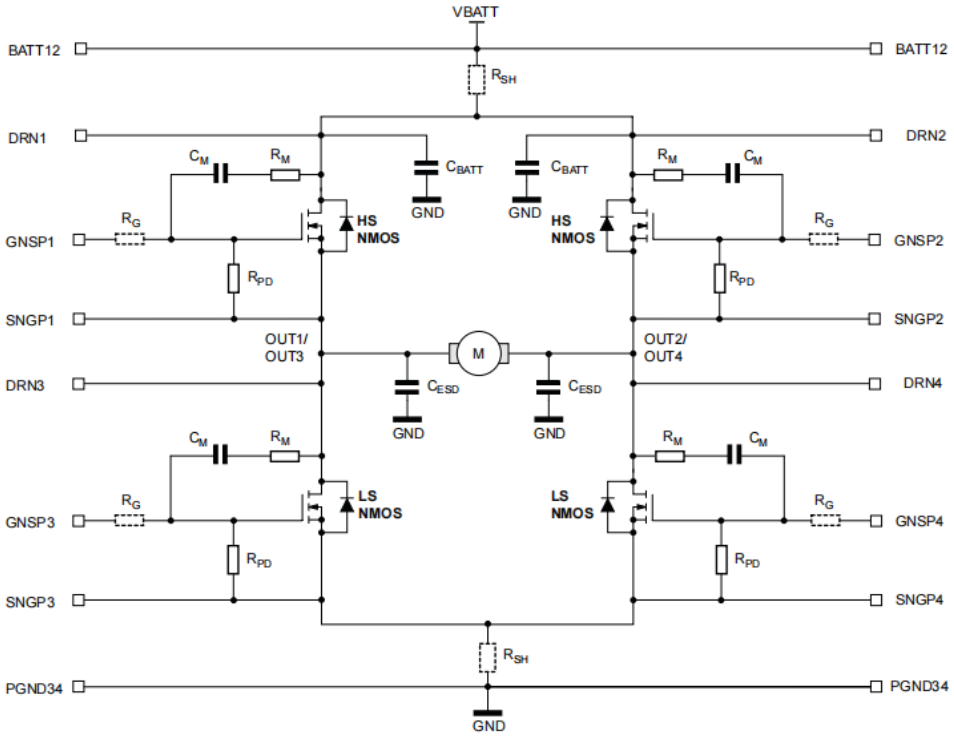


Figure 13 H-bridge diagram

Note:

1)"--" means not installed.

2) The total H-bridge output load does not exceed 40A.

3) Pin 10 must be connected to BATT power

When H bridge1 2 are using, 116 118 pins must be connected to BATT-HB1,

When H bridge3 4 are using, 115 117 pins must be connected to BATT-HB2,

Then H bridge can work normally.

Table 2.2.9.1 H-bridge output parameter table

	Continuous Current	MAX Current	Output Frequency	Conditions/Remarks
H2_A_H_31	10A			When not using H-bridge, it's configurable as 1 Peak Hold or 1 high-side or 1 low-side output
H2_B_L_16				
H2_B_H_15				When not using H-bridge, it's configurable as 1 Peak Hold or 1 high-side or 1 low-side output
H2_A_L_47				
H1_A_H_32				When not using H-bridge, it's configurable as 1 Peak Hold or 1 high-side or 1 low-side output
H1_B_L_64				
H1_B_H_63				When not using H-bridge, it's configurable as 1 Peak Hold or 1 high-side or 1 low-side output
H1_A_L_48				
H3_A_H_88				When not using H-bridge, it's configurable as 1 Peak Hold or 1 high-side or 1 low-side output
H3_B_L_96				
H3_B_H_97				When not using H-bridge, it's configurable as 1 Peak Hold or 1 high-side or 1 low-side output
H3_A_L_103				
H4_A_H_104				When not using H-bridge, it's configurable as 1 Peak Hold or 1 high-side or 1 low-side output
H4_B_L_112				
H4_B_H_105				When not using H-bridge, it's configurable as 1 Peak Hold or 1 high-side or 1 low-side output
H4_A_H_113				

2.2.10 **Automotive Ethernet**

Description

2 channels of automotive Ethernet interface, used to connect the physical network of various electrical devices in the vehicle. The Ethernet interface uses an automotive Ethernet PHY transceiver that complies with the IEEE 100BASE-T1 standard, meets IP67 protection level, and can meet some special requirements in the automotive environment.

Schematic

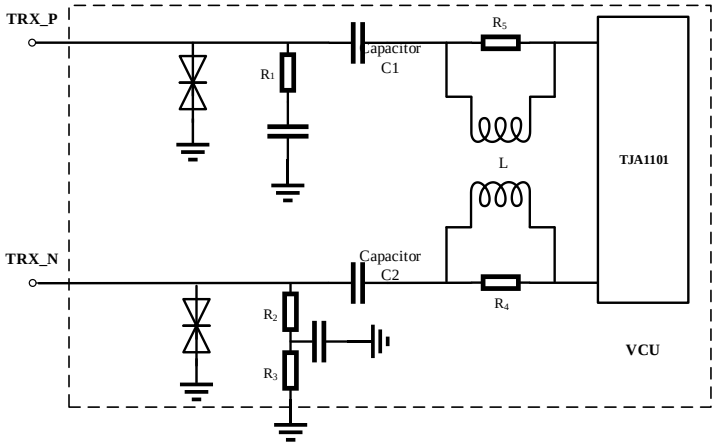


Figure 14 Automotive Ethernet Schematic

Table 2.2.10.1 Automotive Ethernet Parameter

Pin #	Description	Capacitor C1,C2	R1, R2 (Ohm)	R3(Ohm)	Conditions / Remarks
102	Q5050_P2_MDIP_102	100nF/100V	1K	100K	
94	Q5050_P2_MDIN_94				
111	Q5050_P1_MDIP_111				
110	Q5050_P1_MDIN_110				

2.2.11 **SENT Input**

Description

SENT (Single Edge Nibble Transmission) is a new standard (SAE J2716) for communication between automotive sensors and ECUs launched by SAE. The protocol is simple and has many advantages.

The SENT bus is a digital signal transmission protocol with higher transmission accuracy and speed. The logic level of the SENT bus is 4.75V-5.25V.

Schematic:

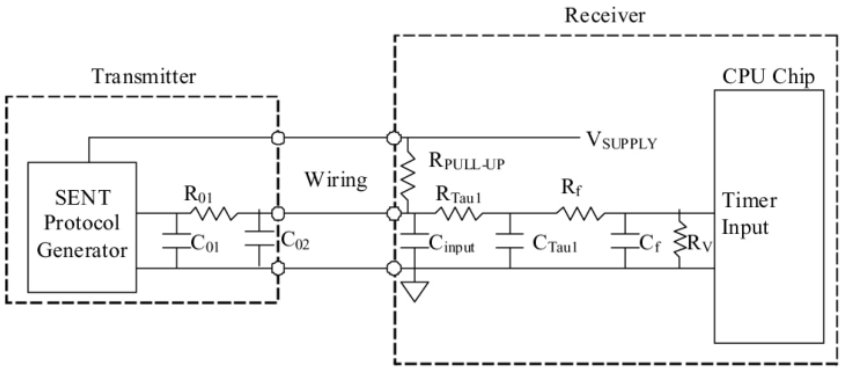


Figure 15 SENT system interface circuit topology

Table 2.2.11.1 SENT signal input parameter table

Pin#	Description	Capacitor Cinput(F)	Resistance Rpull-up(K)	Capacitor CTaul(F)	Resistance RTaul(K)	Capacitor Cf(F)	Resistance Rf(K)	Resistance Rv(K)	Conditions/Remarks
48	SENT1_48	100p	51	2.2n	0.56	100p	10	16	0~0.5V is logic level 0 4.1~5V is logic level 1
67	SENT2_67	100p	51	2.2n	0.56	100p	10	16	
09	SENT3_09	100p	51	2.2n	0.56	100p	10	16	
28	SENT4_28	100p	51	2.2n	0.56	100p	10	16	

2.2.12 **RTD Input**

Description

RTD input channel circuit have the same structure, including pull-ups/pull-down resistors, and feedback resistors.

Main difference:

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

Schematic:

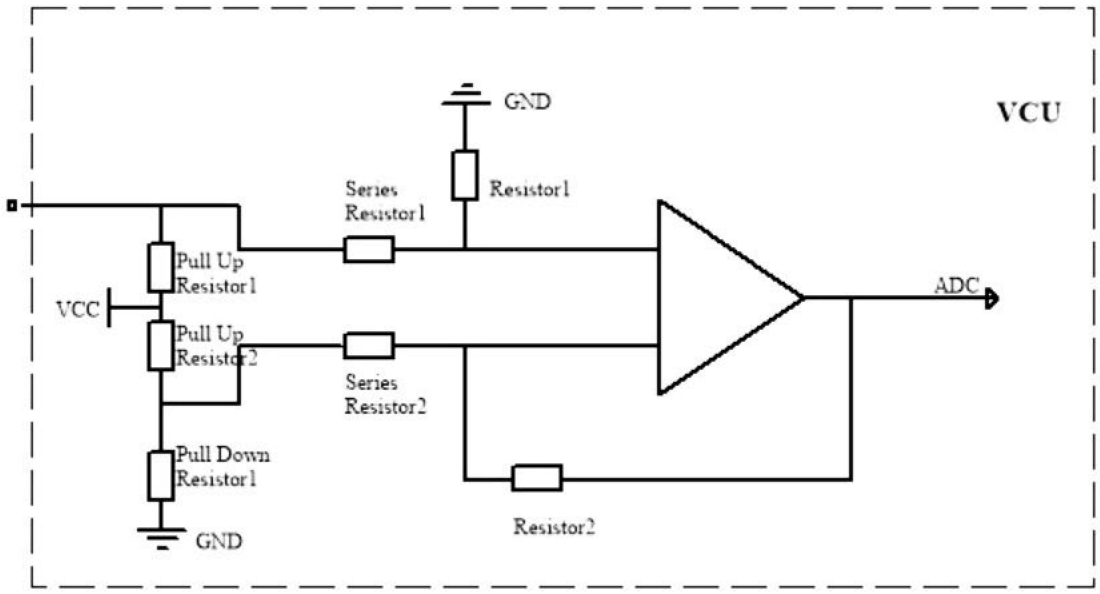


Figure 16 RTD input channel schematic diagram

Table 2.2.12 RTD input channel parameter table

Note: 1)“--” means Not installed

Pin#	Description	Pull Up Resistor1 to 5V	Pull Up Resistor2 to 5V	Pull Down Resistor1	Serial Resistor1	Serial Resistor2	Resistor1	Resistor2	Conditions/Remarks
		(Ohm)	(Ohm)	(Ohm)	(Ohm)	(Ohm)	(Ohm)	(Ohm)	
3	RTD01_3	2K	2K	845R	15K	15K	300K	300K	
19	RTD02_19	2K	2K	845R	15K	15K	300K	300K	
34	RTD03_34	2K	2K	845R	15K	15K	300K	300K	
50	RTD04_50	2K	2K	845R	15K	15K	300K	300K	

2.2.13 **Hall Input**

Description

Frequency input channel circuit have the same structure, including EMC capacitor, pull-up/pull-down resistor, voltage divider resistor and first-order low-pass filter circuit.

Main difference:

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

Schematic:

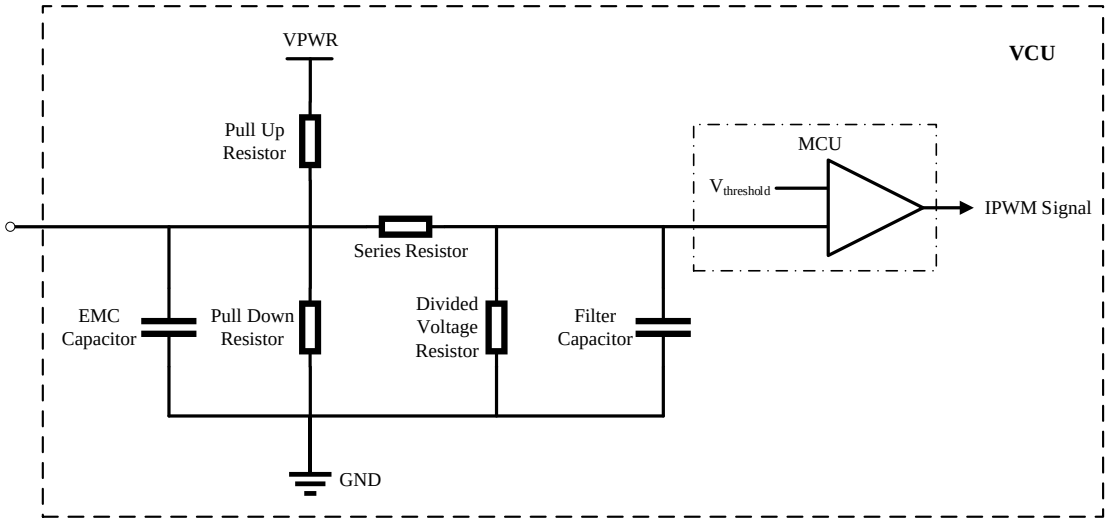


Figure 17 Hall input channel schematic diagram

Table 2.2.13.1 Hall input channel parameter table

Note: 1) "--" denotes Not installed. 2) U_B denotes BATT voltage.

Pin#	Description	EMC Cap..	Filter Cap..	Pull Up Resistor to UB	Pull Up Resistor to 5V	Pull Down Resistor	Serial Resistor	Divided Voltage Resistor	Conditions/Remarks
		(F)	(F)	(Ohm)	(Ohm)	(Ohm)	(Ohm)	(Ohm)	
37	Hall1_37	10n	100p	10k	--	--	100k	33k	Reserved pull-up 5V and pull down position
21	Hall2_21	10n	100p	10k	--	--	100k	33k	Reserved pull-up 5V and pull down position
05	Hall3_05	10n	100p	10k	--	--	100k	33k	Reserved pull-up 5V and pull down position
52	Hall4_52	10n	100p	10k	--	--	100k	33k	Reserved pull-up 5V and pull down position

2.2.14 **VR Input**

Description

2 channels VR input, used to determine when to start injection and ignition, etc.

Schematic:

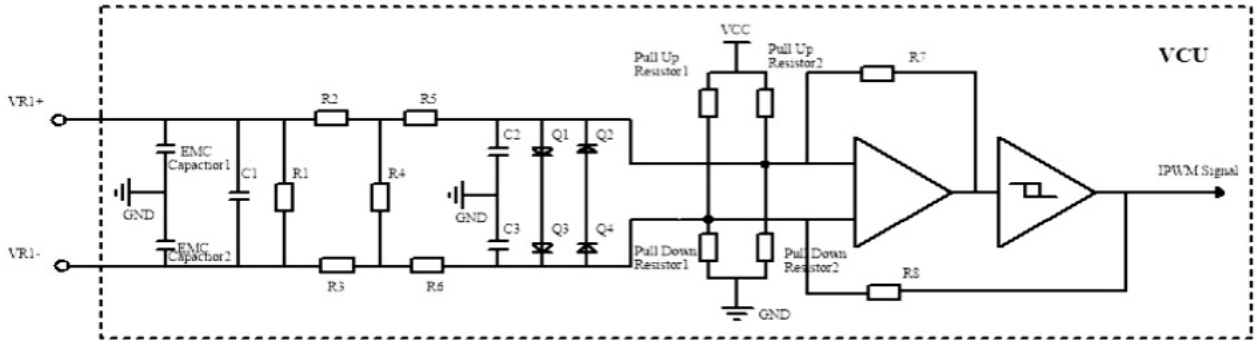


Figure 17 VR input channel schematic diagram

Table 2.2.13.1 VR input channel parameter table

Note: 1) "--" denotes Not installed. 2) U_B denotes BATT voltage.

Pin#	Description	EMC Cap1.	EMC Cap2..	C1	R1	R2	R3	R4	R5	R6	C2	C3	Pull Up Resistor1	Pull Up Resistor2	Pull Down Resistor1	Pull Down Resistor2	R7	R8	Conditions/Remarks
		(F)	(F)	(F)	(Ohm)	(Ohm)	(Ohm)	(Ohm)	(Ohm)	(Ohm)	(Ohm)	(Ohm)	(Ohm)	(Ohm)	(Ohm)	(Ohm)	(Ohm)	(Ohm)	
36	VR1+	100p	100p	10k	51K	16K	16K	6.8K	1K	1K	1n	1n	220K	100K	100K	220K	100K	100K	
51	VR1-	100p	100p	10k	51K	16K	16K	6.8K	1K	1K	1n	1n	220K	100K	100K	220K	100K	100K	
20	VR2+	100p	100p	10k	51K	16K	16K	6.8K	1K	1K	1n	1n	220K	100K	100K	220K	100K	100K	
4	VR2-	100p	100p	10k	51K	16K	16K	6.8K	1K	1K	1n	1n	220K	100K	100K	220K	100K	100K	

2.2.15 **RTC**

The RTC communicates with the MCU through SPI. When the main power supply fails and is interrupted, it can switch to the backup battery to maintain accurate timing.

2.2.16 **Gyroscope**

The gyro sensor communicates through SPI at a rate of 8Mbps to read the sensor status and perform corrections.

2.2.17 **EEPROM**

The CAV25512YE-GT3 chip is selected to communicate with the MCU through SPI, and the maximum rate supports 10Mhz.

Chapter 3 Technical Performance

3.1 Electrical Characteristics

Item	Design Specifications
Operating Voltage	DC 12V/24V (9~32V)
Operating Temperature	-40℃~105℃
Working Humidity	0~95%, no condensation
Storage Temperature	-40℃~85℃
Quiescent Current	8mA
Rated Power Consumption	3.7W(Load Power not included)
Protection Level	IP67
Weight	
Controller Size	
Material	Die cast aluminum
Housing	Equipped with waterproof and breathable valve, good heat dissipation

3.2 Electrical Performance Standard

Item	Test Standard
Overvoltage (high temperature)	ISO 16750-2
Trip voltage	ISO 16750-2
AC voltage superposition test	ISO 16750-2
Supply voltage drops and rises slowly	ISO 16750-2
Instantaneous drop in supply voltage	ISO 16750-2
Reset performance against voltage dips	ISO 16750-2
Start features	ISO 16750-2
Reverse voltage	ISO 16750-2
Reference ground and supply offset	ISO 16750-2
Open circuit experiment-single channel open circuit	ISO 16750-2
Open circuit experiment-multi-channel 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

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, the corresponding installation location should be evaluated by engineers from both Ecotron and the OEM.

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 housing 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.

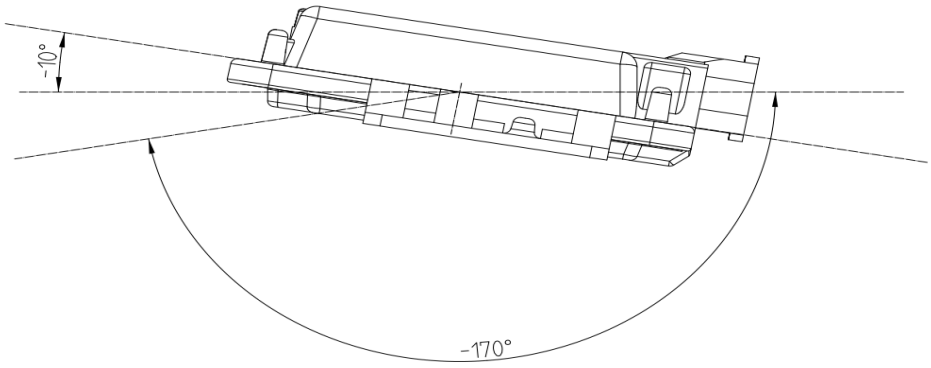
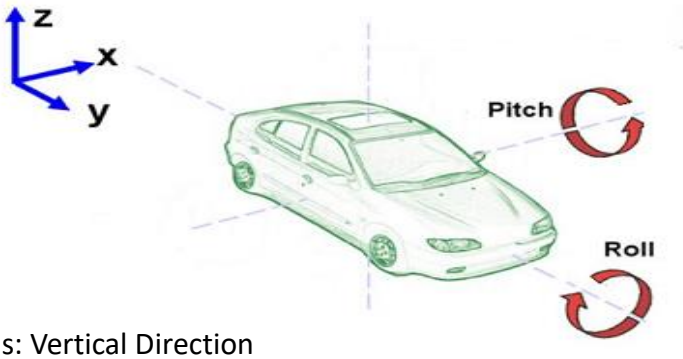


Figure 13 Horizontal Installation Angle



Z Axis: Vertical Direction
X Y Axes: Horizontal Direction

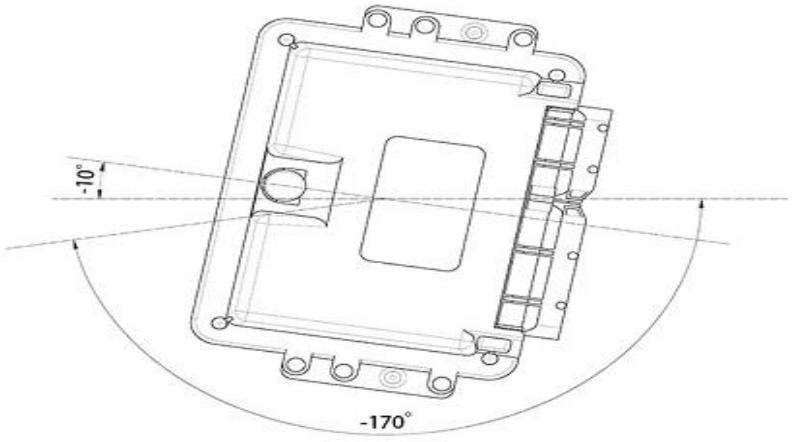


Figure 14 Vertical Installation Angle

Ecotron recommends using the six mounting holes on the VCU for installation. 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 connects to 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.

Suggestions for mechanical installation: (users can change it according to the vehicle)
1. Suggested specifications for installing fixing screws: M6 nuts, screws M6*25 or so.
2. Recommended torque for installation and tightening: 7 N-m.
3. The size and parameters of the anti-seismic pads that need to be installed are recommended: inner diameter 6mm, outer diameter 20mm, thickness 15mm.