EH2275A02

- Main Microprocessor
  - Infineon Aurix TC275
  - 200MHz
  - 4M Flash
  - 472K SRAM
  - Float Point Capability
  - Dual Core Safety Check
- Inputs
  - 22 Analog Inputs
  - 13 Digital Inputs
  - 2 Frequency Inputs
  - 1 Wake-up Input
- Outputs
  - 10 High-side Drivers
  - 26 Low-side Drivers (7 of which could be configured as PWM outputs)
- 9V~32V Operating Voltage
- Communication
  - 4 CAN 2.0B (CANA supports random frame wake-up, CANB, CANC, CAND support ISO CANFD)
  - 2 FlexRay
  - 1 LIN
- Sensor 5V Supply: 9 channels
- Environmental
  - Operating temperature: -40°C to 110°C
  - ISO16750 Compliant
- Simulink Model Based Design
- Hardware Watchdog

Date	Version	Note
Oct 05, 2020	V1.0	Initial version
Mar 03, 2021	V1.1	Temperature update Updated the part No. of connector parts

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Chapter 1 General Information

1.1 HCU Introduction

Hybrid Control Unit, or HCU, is the master controller of a hybrid vehicle. HCU receives 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, runs fault diagnosis and determines the overall vehicle drivability.

1.2 HCU Features

ISO26262 Oriented Design ASIL-D Safety Level	EH2275A02 has an Infineon TC275 microcontroller on board. Two of three independent 32-bit TriCore CPUs are used for a redundant hardware design, and 3-level safety monitoring software is implemented to meet the ASIL-D safety standards, while at the same time maximize the performance. *Please refer to Infineon official file *AURIX™ – TC275T/TC277T Product Brief*
Basic Software (BSW)	Ecotron HCU comes with the Basic Software (BSW) pre-programmed, supporting all typical input/output drivers for vehicle controls.
Model Based Design Production Code Generation Tool	The BSW is encapsulated as Simulink library block sets, called “EcoCoder”. User could leverage model-based design tool to quickly build control strategy with BSW and Simulink generic blocks. With one-click in Simulink, you can get the executable file and A2L data description file.
CAN Bus-Based Programming	EcoFlash is a CAN bus-based programming tool. Users could re-program the executable into HCU conveniently.
CAN Calibration Protocol (CCP)	Ecotron HCU supports the in-house calibration tool, EcoCAL, and can be compatible with INCA, CANape, or other CCP-based calibration tools.

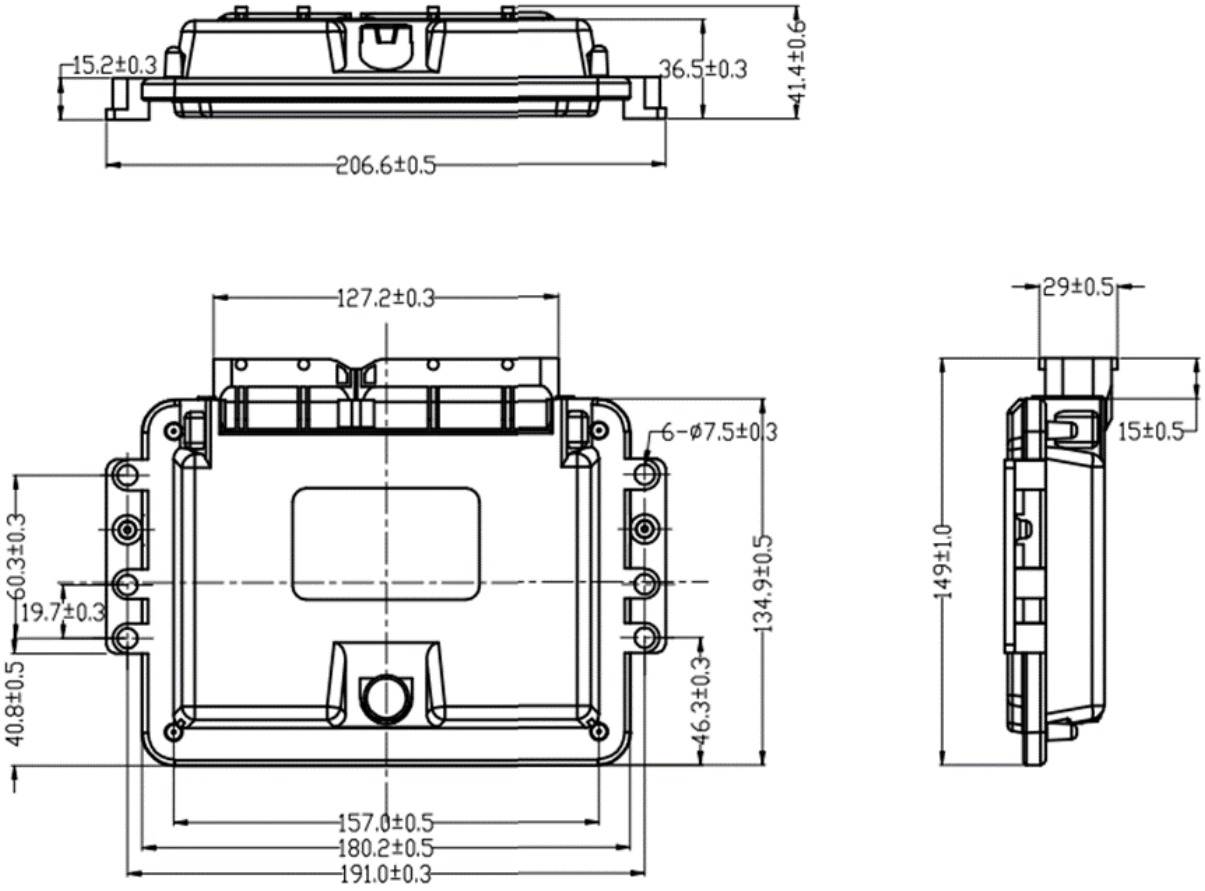
Chapter 2 Hardware

2.1 Specifications

Supply Voltage	**DC 12V/24V (9V~32V)**
Working Temperature	-40°C~110 °C
Humidity	0~95%, no condensation
Storage Temperature	-45°C~125 °C
Sleep Mode Current	<1mA
Protection Level	IP67
Mechanical Shock	50g
Expected Life	10 years
Electric Performance	ISO16750, ISO7637 compliance
EMC	CISPR25 compliance
Dimensions	207×150×42mm
Weight	≤700g
Housing	Die-casting aluminum
Rated Power Consumption	3W (without any loads)

2.2 Mechanical Dimensions

The nominal size of the HCU shell (not including the female end of the HCU connector):



Unit: mm

2.3 Chip Resources

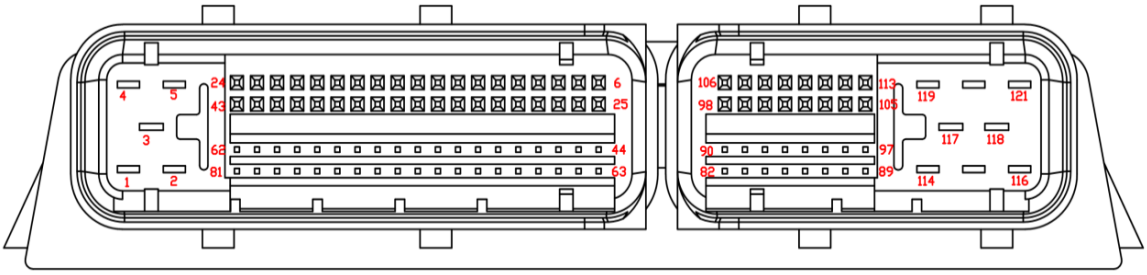
Micro Control Core	32-bit SAK-TC275TP-64F200W
Maximum Frequency	200MHz
Flash	4M
SRAM	472K
Floating Point Capability	Yes

2.4 Power Supply

EH2275A02 requires four continuous power supplies (pin1, pin3, pin119 and pin120), and the HCU can be powered on by the key switch (pin24).

Regarding the power supply fuse, Ecotron recommends customers to use a 5A fuse in series with pin1 and pin3, and a 5A fuse in series with pin119 and pin120.

Chapter 3 Connector and Pinouts



Socket connector and pin distribution diagram

3.1 Connector

EH2275A02 uses the automotive rated connector, made by Tyco Electronics, which meets the automotive safety requirements. The following table lists parts of the connector. Customers can buy their own connector parts to make the harness, or they can ask Ecotron to buy for them.

No.	Name	Part Number	Supplier	Link
1	ECU 121P HDR ASSY-PBT	1746979-1	TE	1746979-1 : MQS Automotive Headers | TE Connectivity
2	MQS REC 81P ASSY	1473244-1	TE	1473244-1 : AMP Automotive Housings | TE Connectivity
3	MQS 81P LEVER(R) ASSY	1473247-1	TE	1473247-1 : AMP Automotive Connector Caps & Covers | TE Connectivity
4	MQS RETAINER HSG FOR 81P	368382-1	TE	368382-1 : MQS Other Automotive Connector Accessories | TE Connectivity
5	40POS MIXED MQS REC SEALED	1473252-1	TE	1473252-1 : AMP Automotive Housings | TE Connectivity
6	MQS 40P LEVER(L) ASSY	1473255-1	TE	1473255-1 : MQS Automotive Connector Caps & Covers | TE Connectivity

7	MQS RETAINER HSG FOR 40P	368388-1	TE	368388-1 : MQS Automotive Connector Locks & Position Assurance | TE Connectivity
8	MQS0,63 Sn rec CB unseal. 0,2-0,35	5-968220-1	TE	5-968220-1 : MQS Automotive Terminals | TE Connectivity
9	MQS0,63 Sn rec CB unseal. 0,5-0,75	5-968221-1	TE	5-968221-1 : MQS Automotive Terminals | TE Connectivity
10	JPT A REC 2.8 Contact SWS Sn	964286-2	TE	964286-2 : AMP TIMER, RECEPTACLE AND TAB | TE Connectivity
11	JPT A REC 2.8 Contact SWS Sn Terminal Transmits 25 – 40 A (Power)	964273-2	TE	964273-2 : AMP TIMER, RECEPTACLE AND TAB | TE Connectivity
12	SINGLE WIRE SEAL FOR J.P.T.CON	828904-1	TE	828904-1 : AMP Automotive Seals & Cavity Plugs | TE Connectivity
13	SINGLE-WIRE-SEAL(5MM HOLE)	828905-1	TE	828905-1 : AMP Automotive Seals & Cavity Plugs | TE Connectivity
14	2,5MM CAVITY PLUG FOR 5,4MM DI	828922-1	TE	828922-1 : AMP Automotive Seals & Cavity Plugs | TE Connectivity
15	CAVITY PLUG(ECU 40P&81P ASSY)	936054-1	TE	936054-1 : Automotive Seals & Cavity Plugs | TE Connectivity

3.2 Pinout Table

Name	PIN	Function	Description	Notes
Power Supply				
BATT	1 3	Power supply	DC 12V/24V power	9V~32V
	119 120	Power of HSOs, LSOs, DIs DC 12V/24V power		
5V2	16 22 38	5V sensor supply 2		Maximum current: 50mA each channel Voltage supply: 5V±1%
5V3	19 35 41	5V sensor supply 3		Maximum current: 50mA each channel Voltage supply: 5V±1%
5V4	53 56 59	5V sensor supply 4		Maximum current: 50mA each channel Voltage supply: 5V±1%
PGND	4 5 96 97 88 89	Ground	Power ground	
GND	17 20 23 36 39 42 54 57 60 74 76 78	5V sensor ground		
Analog Inputs				
AI01	15	Analog input 01	Analog Input 0~5V	Voltage type A/D resolution: 12bit
AI02	18	Analog input 02	Analog Input 0~5V	Voltage type A/D resolution: 12bit
AI03	21	Analog input 03	Analog Input 0~5V	Voltage type A/D resolution: 12bit

AI04	34	Analog input 04	Analog Input 0~5V	Voltage type A/D resolution: 12bit
AI05	37	Analog input 05	Analog Input 0~5V	Voltage type A/D resolution: 12bit
AI06	40	Analog input 06	Analog Input 0~5V	Voltage type A/D resolution: 12bit
AI08	55	Analog input 08	Analog Input 0~5V	Voltage type A/D resolution: 12bit
AI09	58	Analog input 09	Analog Input 0~5V	Voltage type A/D resolution: 12bit
AI07	52	Analog input 07	Analog Input 0~5V	Resistance type A/D resolution: 12bit
AI11	61	Analog input 11	Analog Input 0~5V	Resistance type A/D resolution: 12bit
AI12	73	Analog input 12	Analog Input 0~5V	Resistance type A/D resolution: 12bit
AI13	75	Analog input 13	Analog Input 0~5V	Resistance type A/D resolution: 12bit
AI14	77	Analog input 14	Analog Input 0~5V	Resistance type A/D resolution: 12bit
AI15	79	Analog input 15	Analog Input 0~5V	Resistance type A/D resolution: 12bit
AI17	47	Analog input 17	Analog Input 0~32V	Voltage type A/D resolution: 12bit
AI18	29	Analog input 18	Analog Input 0~32V	Voltage type A/D resolution: 12bit
AI19	10	Analog input 19	Analog Input 0~32V	Voltage type A/D resolution: 12bit
AI20	28	Analog input 20	Analog Input 0~32V	Voltage type A/D resolution: 12bit
AI21	12	Analog input 21	Analog Input 0~32V	Voltage type A/D resolution: 12bit
AI22	30	Analog input 22	Analog Input 0~32V	Voltage type A/D resolution: 12bit
AI23	67	Analog input 23	Analog Input 0~32V	Voltage type A/D resolution: 12bit
High Voltage Interlock Signal				
AI16	43	HVIL input	Analog Input 0~32V	Voltage type A/D resolution: 12bit
HSO06	90	HVIL output	Continuous 0.4A Peak 0.5A	High level signal

Power-on Signal				
KEYON/AI27	24	HCU key switch	Analog Input 0~BATT	A/D resolution: 12bit Wake-up threshold>9V
WAKEUP	27	Wake-up input	Digital Input 0~BATT	Wake-up threshold>9V
Digital Inputs				
DI11	31	Digital input 11	Digital Input 0~BATT	Active high (It is recommended to reserve 1 pin, in order to prevent entering rescue mode by mistakes).
DI12	68	Digital input 12	Digital Input 0~BATT	
DI00	66	Digital input 00	Digital Input 0~BATT	Active low
DI01	33	Digital input 01	Digital Input 0~BATT	Active low
DI02	11	Digital input 02	Digital Input 0~BATT	Active low
DI03	70	Digital input 03	Digital Input 0~BATT	Active low
DI04	50	Digital input 04	Digital Input 0~BATT	Active low
DI05	14	Digital input 05	Digital Input 0~BATT	Active low
DI06	69	Digital input 06	Digital Input 0~BATT	Active low
DI07	32	Digital input 07	Digital Input 0~BATT	Active low
DI08	49	Digital input 08	Digital Input 0~BATT	Active low
DI09	48	Digital input 09	Digital Input 0~BATT	Active low
DI10	13	Digital input 10	Digital Input 0~BATT	Active low
Frequency Inputs				
SPEED1	71	Frequency input 1	Frequency input	Input frequency range: 1Hz-2KHz
SPEED2	51	Frequency input 2	Frequency input	Input frequency range: 1Hz-2KHz
Output Signals				
HSO01	108	High-side driver 01	Continuous 1.5A, Peak 2.0A	
HSO02	107	High-side driver 02	Continuous 1.5A, Peak 2.0A	
HSO03	110	High-side driver 03	Continuous 1.5A, Peak 2.0A	
HSO04	109	High-side driver 04	Continuous 1.5A, Peak 2.0A	
HSO05	82	High-side driver 05	Continuous 0.4A, Peak 0.5A	
HSO07	98	High-side driver 07	Continuous 0.4A, Peak 0.5A	
HSO08	106	High-side driver 08	Continuous 0.4A, Peak 0.5A	
HSO09	62	High-side driver 09	Continuous 0.4A, Peak 0.5A	
HSO10	2	High-side driver 10	Continuous 0.4A, Peak 0.5A	
LSO01	114	Low-side driver 01	Continuous 1.5A, Peak 2.0A	
LSO02	121	Low-side driver 02	Continuous 1.5A, Peak 2.0A	

LSO03	117	Low-side driver 03	Continuous 1.5A, Peak 2.0A	
LSO04	115	Low-side driver 04	Continuous 1.5A, Peak 2.0A	
LSO05	116	Low-side driver 05	Continuous 1.5A, Peak 2.0A	
LSO06	118	Low-side driver 06	Continuous 1.5A, Peak 2.0A	
LSO07	112	Low-side driver 07	Continuous 0.8A, Peak 1.0A	
LSO08	113	Low-side driver 08	Continuous 0.8A, Peak 1.0A	
LSO09	105	Low-side driver 09	Continuous 0.8A, Peak 1.0A	
LSO10	95	Low-side driver 10	Continuous 0.8A, Peak 1.0A	
LSO11	111	Low-side driver 11	Continuous 0.8A, Peak 1.0A	
LSO12	87	Low-side driver 12	Continuous 0.8A, Peak 1.0A	
LSO13	84	Low-side driver 13	Continuous 0.4A, Peak 0.5A	
LSO14	92	Low-side driver 14	Continuous 0.4A, Peak 0.5A	
LSO15	91	Low-side driver 15	Continuous 0.4A, Peak 0.5A	
LSO16	83	Low-side driver 16	Continuous 0.4A, Peak 0.5A	
LSO21	100	Low-side driver 21	Continuous 0.16A, Peak 0.2A	Can be configured as PWM output, frequency range 1Hz~2KHz
LSO22	103	Low-side driver 22	Continuous 0.16A, Peak 0.2A	Can be configured as PWM output, frequency range 1Hz~2KHz
LSO23	85	Low-side driver 23	Continuous 0.16A, Peak 0.2A	Can be configured as PWM output, frequency range 1Hz~2KHz
LSO24	93	Low-side driver 24	Continuous 0.16A, Peak 0.2A	Can be configured as PWM output, frequency range 1Hz~2KHz
LSO25	101	Low-side driver 25	Continuous 0.16A, Peak 0.2A	Can be configured as PWM output, frequency range 1Hz~2KHz
LSO26	104	Low-side driver 26	Continuous 0.16A, Peak 0.2A	
LSO27	99	Low-side driver 27	Continuous 0.16A, Peak 0.2A	
LSO28	102	Low-side driver 28	Continuous 0.16A, Peak 0.2A	
LSO29	94	Low-side driver 29	Continuous 0.16A, Peak 0.2A	Can be configured as PWM output, frequency range 1Hz~2KHz
LSO30	86	Low-side driver 30	Continuous 0.16A, Peak 0.2A	Can be configured as PWM output, frequency range 1Hz~2KHz

Communication				
CANA_H	64	CANA_H	Built-in 120 Ω terminating resistor	Support random frame CAN wake-up
CANA_L	65	CANA_L		
CANB_H	25	CANB_H	Built-in 120 Ω terminating resistor	Support ISO CANFD
CANB_L	26	CANB_L		
CANC_H	7	CANC_H	Built-in 120 Ω terminating resistor	Support ISO CANFD
CANC_L	8	CANC_L		
CAND_H	45	CAND_H	Built-in 120 Ω terminating resistor	Support ISO CANFD
CAND_L	46	CAND_L		
LIN1	9	LINBUS		
FlexRayA_P	63	FlexRayA P	Built-in 120 Ω terminating resistor	
FlexRayA_N	44	FlexRayA N		
FlexRayB_P	80	FlexRayB P	Built-in 120 Ω terminating resistor	
FlexRayB_N	81	FlexRayB N		
Internal Signal				
AI28		Power supply BATT voltage measuring		A/D resolution: 12bit

3.3 Function Description

3.3.1 Analog Input

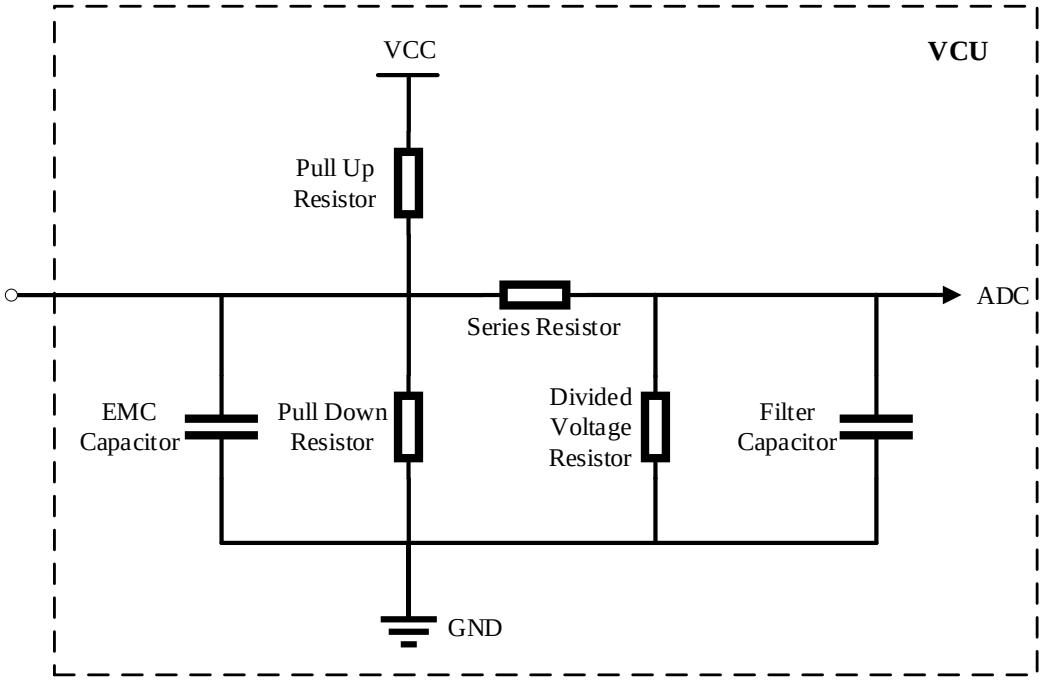
Function Description

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

The main differences are:

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

Schematic Diagram



Note: 1. "--" means not soldered; 2. U_B means power supply BATT voltage; 3. AI28 collects BATT voltage signal; 4. KEYON is only used as key signal

Pin #	AI	EMC Cap.	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	
15	AI01	--	--	--	100k	4.7k	--	100n	0	5V	0	5V	
18	AI02	--	--	--	100k	4.7k	--	100n	0	5V	0	5V	
21	AI03	--	--	--	100k	4.7k	--	100n	0	5V	0	5V	

34	AI04	--	--	--	100k	4.7k	--	100n	0	5V	0	5V	
37	AI05	--	--	--	100k	4.7k	--	100n	0	5V	0	5V	
40	AI06	--	--	--	100k	4.7k	--	100n	0	5V	0	5V	
55	AI08	--	--	--	100k	4.7k	--	100n	0	5V	0	5V	
58	AI09	--	--	--	100k	4.7k	--	100n	0	5V	0	5V	
52	AI07	--	--	10k	--	4.7k	--	100n	0	5V	0	5V	
61	AI11	--	--	10k	--	4.7k	--	100n	0	5V	0	5V	
73	AI12	--	--	10k	--	4.7k	--	100n	0	5V	0	5V	
75	AI13	--	--	10k	--	4.7k	--	100n	0	5V	0	5V	
77	AI14	--	--	10k	--	4.7k	--	100n	0	5V	0	5V	
79	AI15	--	--	10k	--	4.7k	--	100n	0	5V	0	5V	
43	AI16	--	--	--	100k	100k	16k	100n	0	32V	0	32V	
47	AI17	--	--	--	100k	100k	16k	100n	0	32V	0	32V	
29	AI18	--	--	--	100k	100k	16k	100n	0	32V	0	32V	
10	AI19	--	--	--	100k	100k	16k	100n	0	32V	0	32V	
28	AI20	--	--	--	100k	100k	16k	100n	0	32V	0	32V	
12	AI21	--	--	--	100k	100k	16k	100n	0	32V	0	32V	
30	AI22	--	--	--	100k	100k	16k	100n	0	32V	0	32V	
67	AI23	--	--	--	100k	100k	16k	100n	0	32V	0	32V	
24	KEYON/AI27	--	--	--	100k	100k	16k	100n	0	32V	0	32V	
--	AI28	--	--	--	100k	100k	16k	100n	0	32V	0	32V	

3.3.2 Digital Input

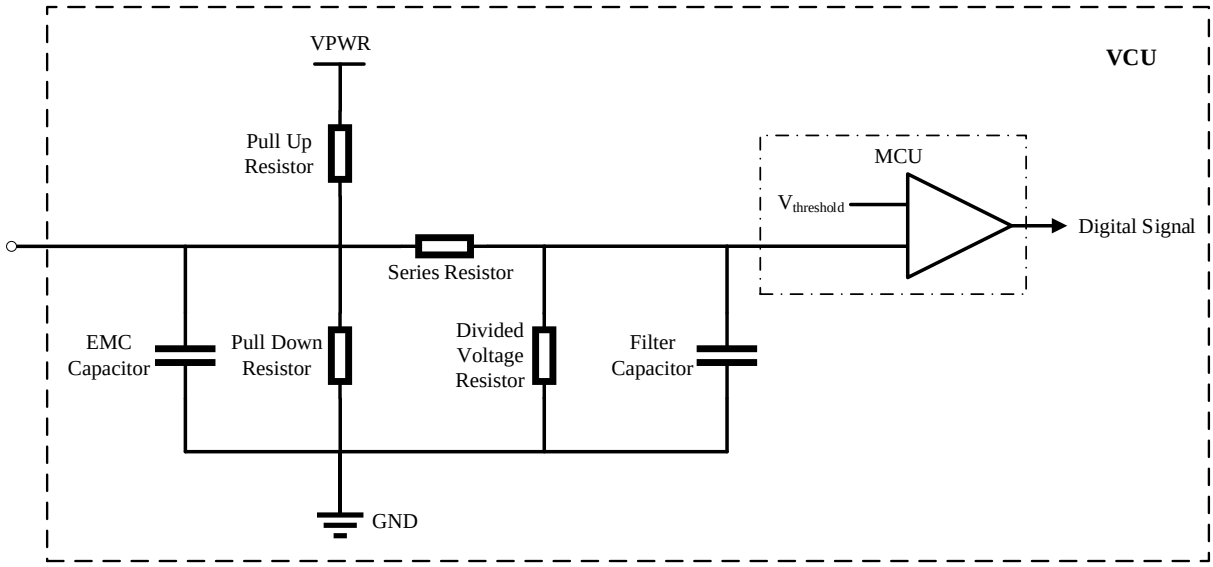
Function Description

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

The main differences are:

- Resistance of pull-up/pull-down resistor
- Choose Pull-up/Pull down

Schematic Diagram



Note: 1. "--" means not welded. 2. Pin 119 and pin 120 must be connected to normal power (power supply) for the digital channel to work normally. 3. DI11, DI12 port: it is recommended to reserve a port not to use it to prevent entering rescue mode by mistake.

Pin #	Description	EMC Cap.	Filter Cap.	Pull Up Resistor to VPWR	Pull Down Resistor	Serial Resistor	Divided Voltage Resistor	Operation Threshold for Input Signal		Input Range		Conditions/ Remarks
		(F)	(F)	(Ohm)	(Ohm)	(Ohm)	(Ohm)	V_{low}	V_{high}	min	max	
66	DI00	--	10n	137k	--	100k	51k	3V	8V	0	32V	
33	DI01	--	10n	137k	--	100k	51k	3V	8V	0	32V	
11	DI02	--	10n	137k	--	100k	51k	3V	8V	0	32V	
70	DI03	--	10n	137k	--	100k	51k	3V	8V	0	32V	
50	DI04	--	10n	137k	--	100k	51k	3V	8V	0	32V	
14	DI05	--	10n	137k	--	100k	51k	3V	8V	0	32V	
69	DI06	--	10n	137k	--	100k	51k	3V	8V	0	32V	
32	DI07	--	10n	137k	--	100k	51k	3V	8V	0	32V	
49	DI08	--	10n	137k	--	100k	51k	3V	8V	0	32V	
48	DI09	--	10n	137k	--	100k	51k	3V	8V	0	32V	
13	DI10	--	10n	137k	--	100k	51k	3V	8V	0	32V	
31	**DI11**	--	10n	--	100k	100k	33k	4V	9V	0	32V	
68	**DI12**	--	10n	--	100k	100k	33k	4V	9V	0	32V	

3.3.3 Frequency Inputs

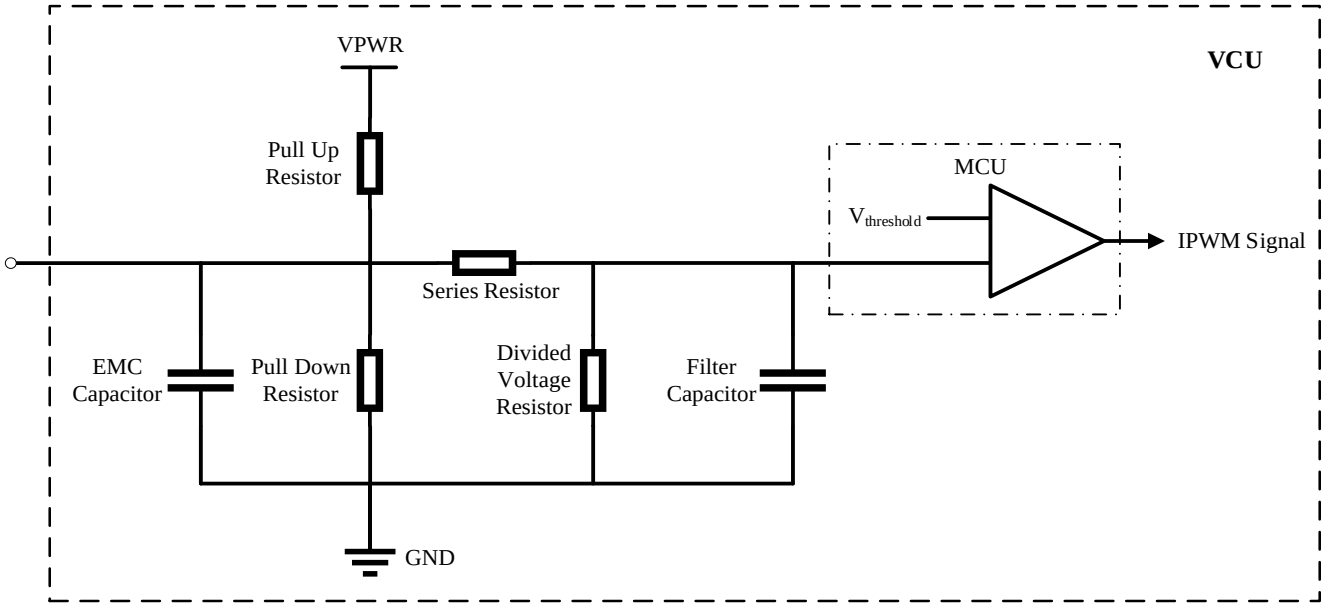
Function Description

The frequency input channel circuit has the same structure, including EMC capacitors, pull-up/pull-down resistors and a first-order low-pass filter circuit.

The main differences are:

- Resistance of pull-up/pull-down resistor
- Choose Pull-up/Pull down

Schematic Diagram



Note: 1. "--" means not welded. 2. Pin 119 and pin 120 must be connected to normal power (power supply) for the digital channel to work normally.

Pin #	Description	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	
		(F)	(F)	(Ohm)	(Ohm)	(Ohm)	(Ohm)	(Ohm)	V_{low}	V_{high}	min	max
71	SPEED1	--	47p	--	--	100k	100k	3k	4V	9V	0	32V
51	SPEED2	--	47p	137k	--	--	100k	51k	3V	8V	0	32V

Note: 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=10, pulse input offset=5V):

Frequency signal input channel frequency and duty cycle reference value table

Input Frequency	Measuring Frequency	Input Duty Cycle	Measuring Duty Cycle	Input Duty Cycle	Measuring Duty Cycle	Input Duty Cycle	Measuring Duty Cycle
100Hz	100Hz	10.0%	9.92%	50.0%	49.92%	90.0%	89.92%
1000Hz	1000Hz	10.0%	9.67%	50.0%	49.60%	90.0%	90.32%
2000Hz	2000Hz	10.0%	9.12%	50.0%	49.38%	90.0%	90.32 %

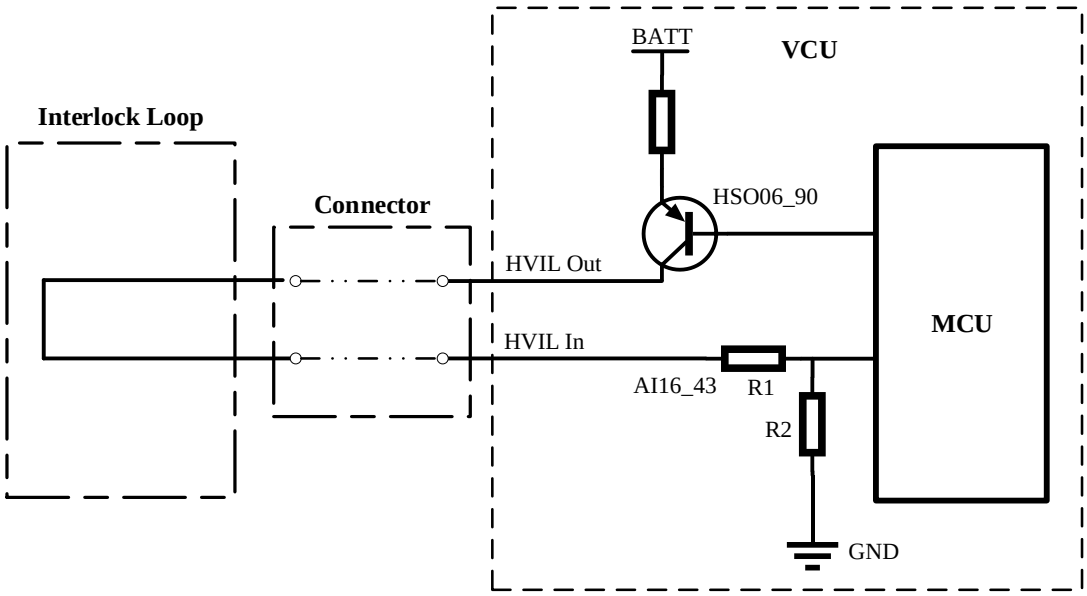
3.3.4 High Voltage Interlock Interface

Function Description

In the vehicle high-voltage interlock inspection loop, the HCU can output a high-level signal to the loop through the 90-pin high-side channel. At the same time, the HCU detects the feedback signal in the loop through the 43-pin analog input channel, and detects the safety and integrity of the entire vehicle loop based on this signal.

If the high-voltage interlock interface is not used, pin 90 can be used as a normal high-side drive output channel, and pin 43 can be used as a 0-32V analog input channel.

Schematic Diagram



Pin #	Description	Resistor (Ohm)	Conditions / Remarks
		R2/(R1+R2)	
90	HVIL_OFT: HVIL signal output	--	HSO06
43	HVIL_IFT: HVIL signal feedback	16K/(100K+16K)	AI16

3.3.5 Low-side Drivers

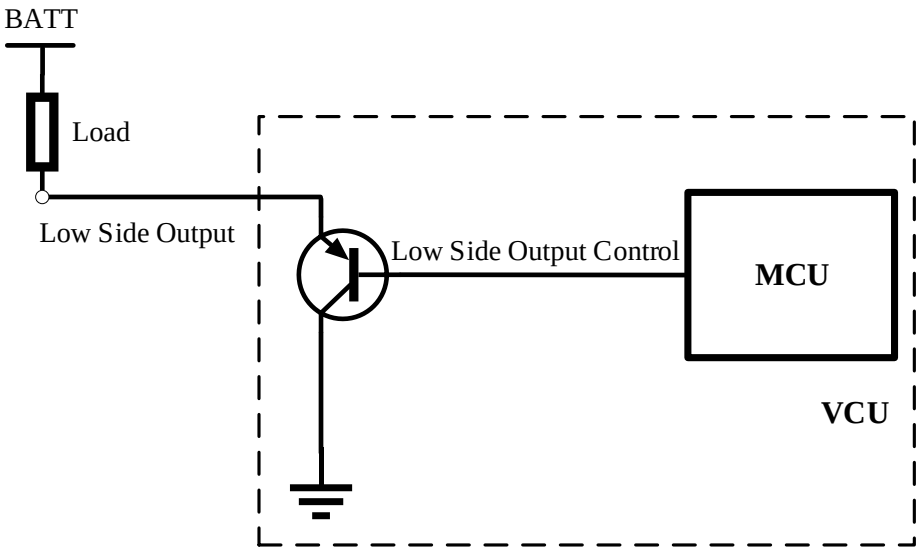
Function Description

The low-side drive can be used as a switch for driving peripheral devices, and all low-side drive channels have a fault diagnosis function.

The main differences are:

- Different drive current
- With or without PWM function

Schematic Diagram



Note: 1. "--" means not welded. 2. Pin 119 and pin 120 must be connected to normal power (power supply) for the digital channel to work normally. **3. The total load of all low-side drive channels cannot exceed 5A.**

Pin #	Description	EMC Capacitor	Output Current	Free Wheeling Diode	Conditions / Remarks
		(F)	Max		
114	LSO01	--	2A	No	
121	LSO02	--	2A	No	
117	LSO03	--	2A	No	
115	LSO04	--	2A	No	
116	LSO05	--	2A	No	
118	LSO06	--	2A	No	
112	LSO07	--	1A	No	
113	LSO08	--	1A	No	
105	LSO09	--	1A	No	
95	LSO10	--	1A	No	
111	LSO11	--	1A	No	
87	LSO12	--	1A	No	
84	LSO13	10n/50	0.5A	No	
92	LSO14	10n/50	0.5A	No	
91	LSO15	10n/50	0.5A	No	
83	LSO16	10n/50	0.5A	No	
100	LSO21	--	0.2A	No	OPWM Configurable
103	LSO22	--	0.2A	No	OPWM Configurable
85	LSO23	--	0.2A	No	OPWM Configurable
93	LSO24	--	0.2A	No	OPWM Configurable
101	LSO25	--	0.2A	No	OPWM Configurable
104	LSO26	--	0.2A	No	
99	LSO27	--	0.2A	No	
102	LSO28	--	0.2A	No	
94	LSO29	--	0.2A	No	OPWM Configurable
86	LSO30	--	0.2A	No	OPWM Configurable

Fault Diagnosis of Low-side Drive

Low-side drive channel	Fault Diagnosis	
	Disable	Enable
LSO01, LSO02, LSO03, LSO04, LSO06, LSO07, LSO08, LSO09, LSO10, LSO11, LSO12, LSO13, LSO14, LSO15, LSO16	• No load • Short circuit to ground	• Short circuit to the power supply
LSO21, LS022, LSO23, LSO24, LS025, LSO26, LSO27, LS028, LSO29, LSO30	• Short circuit to ground	• Short circuit to the 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 functions. When the channel is enabled, if a channel is short-circuited to the power supply, the channel 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 LSO21-30 is configured as OPWM, the accuracy 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).

Frequency and duty cycle accuracy reference value when low-side drive channel is configured with OPWM

Set frequency	Actual output frequency	Set duty cycle	Actual output frequency	Set duty cycle	Actual output frequency	Set duty cycle	Actual output frequency
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%

3.3.6 High-side Drivers

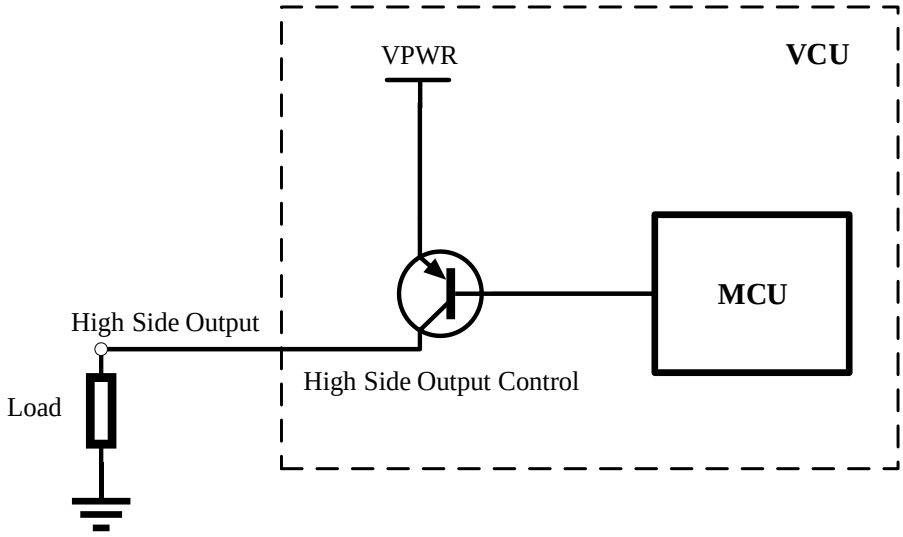
Function Description

The high-side drive can be used as a switch for driving peripheral devices, and all high-side drive channels have a fault diagnosis function.

The main differences are:

- Drive current
- With or without PWM function
- Leakage current
- With or without freewheeling diode

Schematic Diagram



Note: 1. "--" means not welded. 2. Pin 119 and pin 120 must be connected to normal power (power supply) for the digital channel to work normally. **3. The total load of all low-side drive channels cannot exceed 5A.**

High-side drive channel parameter table

Pin #	Description	EMC Capacitor	Output current	Leakage Current	Free Wheeling Diode	Conditions / Remarks
		(F)	Max(A)	Max(uA)		
108	HSO01	--	2	0.01	Yes	
107	HSO02	--	2	0.01	Yes	
110	HSO03	--	2	0.01	Yes	
109	HSO04	--	2	0.01	Yes	
82	HSO05	10n/50	0.5	0.5	Yes	
90	HSO06	10n/50	0.5	0.5	Yes	
98	HSO07	10n/50	0.5	0.5	Yes	
106	HSO08	10n/50	0.5	0.5	Yes	
62	HSO09	10n/50	0.5	0.5	Yes	
2	HSO10	10n/50	0.5	0.5	Yes	

Fault Diagnosis of Low-side Drive

High-side drive channel	Fault Diagnosis	
	Disable	**Enable**
HSO01, HSO02, HSO03, HSO04	• No load	• Short circuit to the ground
HSO05, HSO06, HSO07, HSO08, HSO09, HSO10	• Short circuit to power supply	• Short circuit to the ground

Note:

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

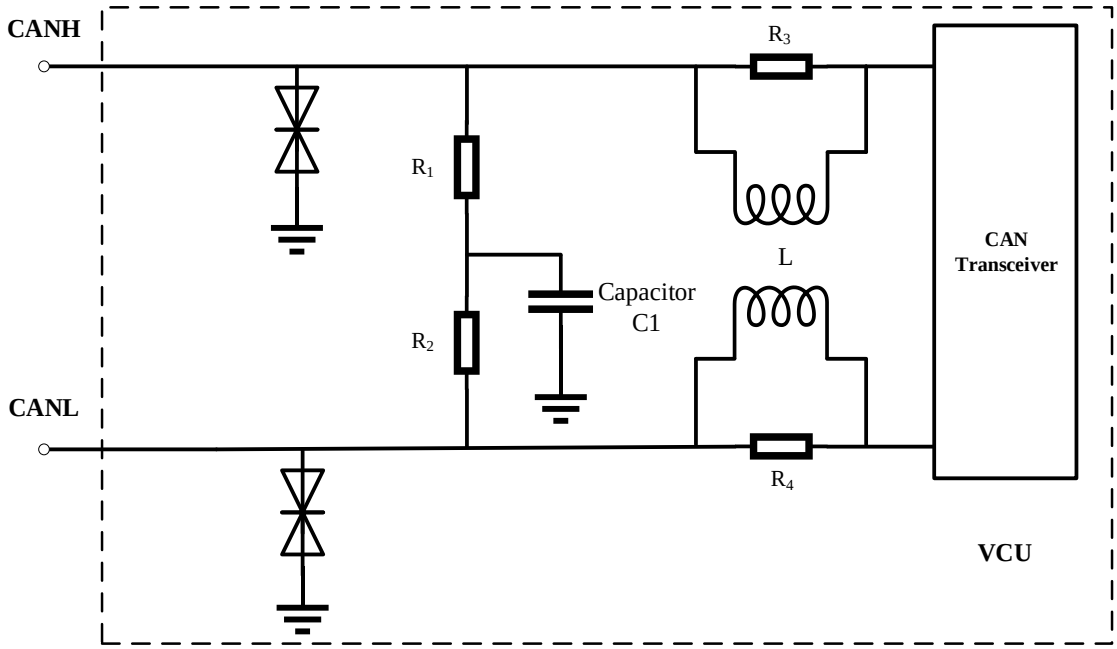
2. High-side drive channels have short circuit protection functions. When the channel is enabled, if a channel is short-circuited to ground, the channel will automatically activate the short-circuit protection function. This function may cause the channel to have a fault code jump phenomenon in this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

3.3.7 CAN

Function Description

The CAN (Controller Area Network) interface circuit is used for the communication between the HCU and other vehicle electronic controllers, and the communication speed can reach up to 1 Mbit/s. The CANA channel is integrated in the power chip and supports any frame wake-up function. CANB, CANC, CAND support ISO CANFD.

Schematic Diagram



CAN interface parameter table

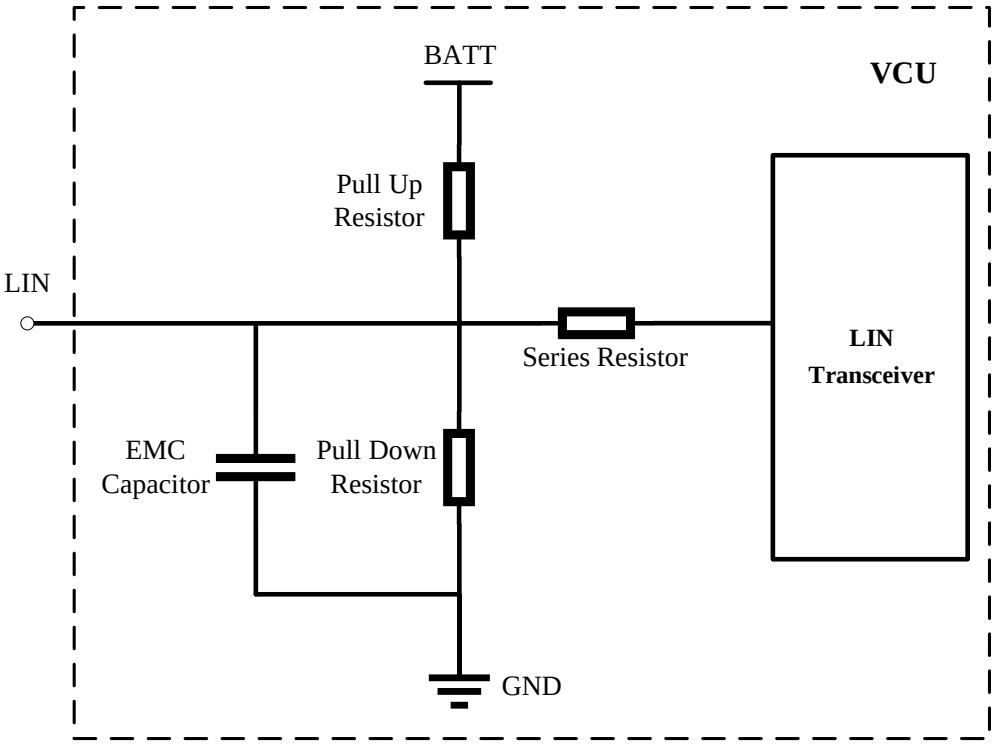
Pin #	Description	Capacitor C1	R1, R2 (Ohm)	Choke L	Conditions / Remarks
64	CANA H	4.7nF/50	60	Yes	Support CAN2.0A/B, support CAN any frame wake-up function
65	CANA L		60		
25	CANB H	4.7nF/50	60	Yes	Support CAN2.0A/B, support CAN any frame wake-up function
26	CANB L		60		
7	CANC H	4.7nF/50	60	Yes	Support CAN2.0A/B, support CAN any frame wake-up function
8	CANC L		60		
45	CAND H	4.7nF/50	60	Yes	Support CAN2.0A/B, support CAN any frame wake-up function
46	CAND L		60		

3.3.8 LIN

Function Description

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

Schematic Diagram



LIN interface parameter table

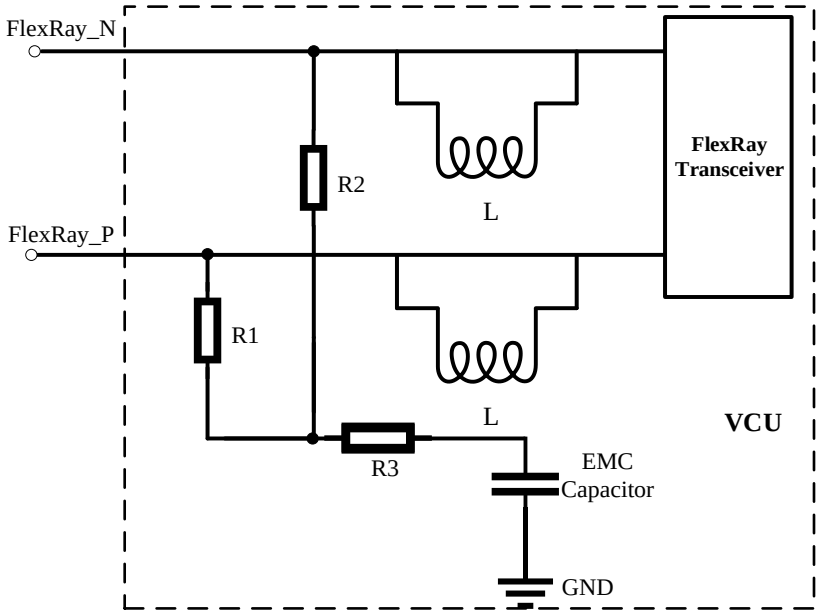
Pin #	LIN	EMC Capacitor	Pull Up Resistor	Pull Down Resistor	Series Resistor	Conditions / Remarks
		(F)	to U_B (Ohm)	to GND (Ohm)	(Ohm)	
9	LIN1	1n/50	1k	--	--	--

3.3.9 FlexRay

Function Description

FlexRay is a high-speed, deterministic, and fault-tolerant bus technology for automobiles. It combines event triggering and time triggering, and has the characteristics of efficient network utilization and system flexibility.

Schematic Diagram



FlexRay interface parameter table

Note: 1. "--" means not welded.

Pin #	FlexRay	EMC Capacitor	R1	R2	R3	Conditions / Remarks
		(F)	(Ohm)	(Ohm)	(Ohm)	
63	FlexRayA_P	10n/50	60	60	0	--
44	FlexRayA_N					
80	FlexRayB_P	10n/50	60	60	0	--
81	FlexRayB_N					

3.3.10 5V Sensor Power Supply

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

Pin #	Description	Imax(mA)	Output Voltage
16 22 38	5V supply voltage 2	Maximum current: 150mA	Voltage supply: 5V±1%
19 35 41	5V supply voltage 3	Maximum current: 150mA	Voltage supply: 5V±1%
53 56 59	5V supply voltage 4	Maximum current: 150mA	Voltage supply: 5V±1%

5V sensor power output parameter table

Chapter 4 Technical Performance

4.1 Electrical Characteristic Parameters

Subject	Design Specifications
Operating Voltage	DC 12V/24V (9V~32V)
Operating Temperature	-40°C~110°C
Working Humidity	0~95%, no condensation
Storage Temperature	-45°C~125°C
Quiescent Current	<1mA
Rated Power Consumption	3W (not including load power)
Protection Level	IP67
Weight	≤700g
Controller Size	207×150×36mm
Material	Die-cast aluminum
Shell	Equipped with waterproof breathable valve, good heat dissipation

4.2 Electrical Performance Tests Standards

Subject	Test Standard
DC Supply Voltage	ISO 16750-2
Overvoltage (12V, High Temperature)	ISO 16750-2
Slow Drop and Rise of Supply Voltage	ISO 16750-2
AC Voltage Superposition Test	ISO 16750-2
Reverse Voltage	ISO 16750-2
Low Voltage Reset Feature	ISO 16750-2
Low Voltage Starting Characteristics	ISO 16750-2
Open Circuit Experiment-single Wire Interrupt	ISO 16750-2
Open Circuit Experiment-multi-line Interrupt	ISO 16750-2
Short Circuit Protection	ISO 16750-2
Withstand Voltage	ISO 16750-2
Insulation Resistance	ISO 16750-2

4.3 Environmental Standards

Subject	Test Requirement
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

4.4 EMC Test Standards

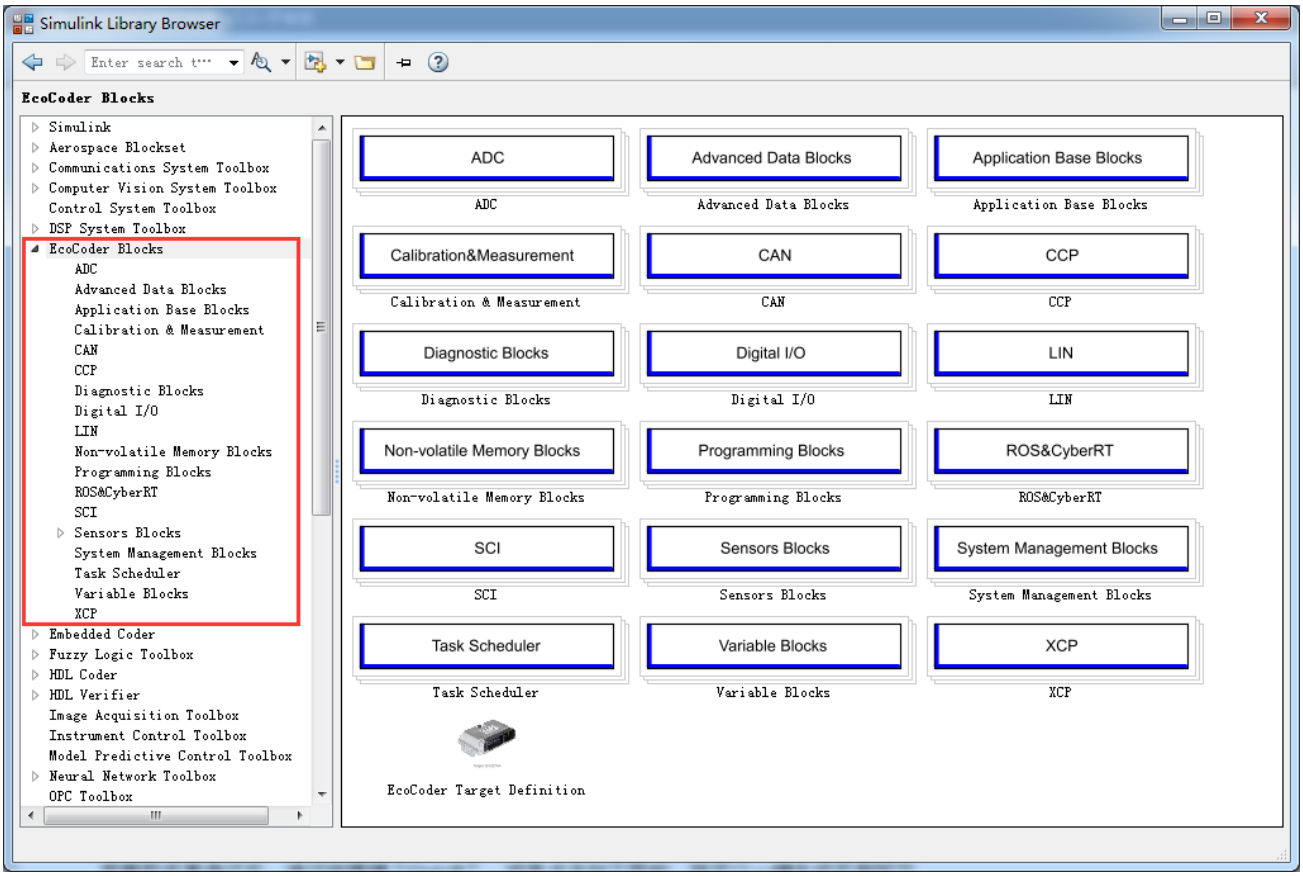
Subject	Test Requirement
Transient Conduction Emission	ISO7637-2
Conducted Emission Experiment CE-V	CISPR25
Conducted Emission Experiment CE-C	CISPR25
Radiated Emission Experiment RE-ALSE Method	CISPR25
Radiation Immunity Experiment (I/O)-ICC Method	ISO7637-3
Radiated Immunity Experiment BCI-Substitution Method	ISO11452-4
Radiation Immunity Experiment RI	ISO11452-2
Low Frequency Magnetic Field Immunity	ISO11452-8
Electrostatic Discharge ESD	GMW3097

Chapter 5 Software Tools

5.1 Prototype/Production Code Generation – EcoCoder

EcoCoder is an enhanced auto-code generation library sitting on top of the generic Matlab/Simulink. It links directly to the target controller. It integrates the code generation, the compiling, and the executable generation in one click.

For more details, please refer to the ***EcoCoder User Manual.***



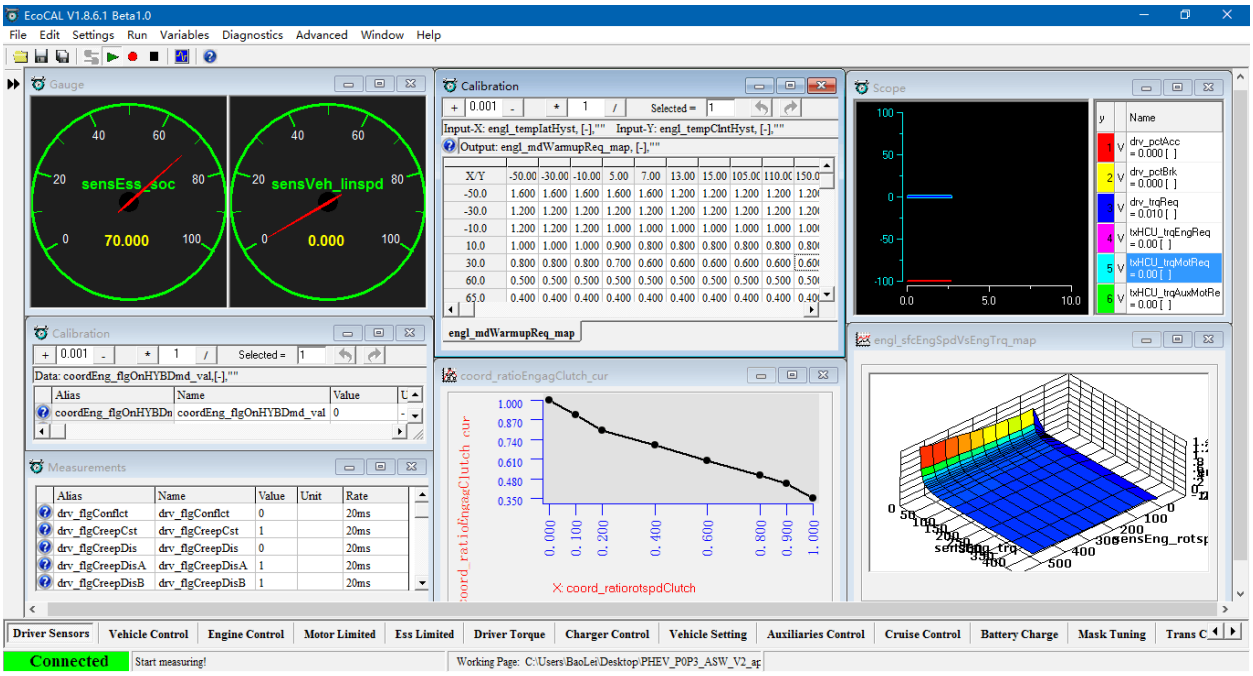
5.2 Powerful Calibration Software – EcoCAL

EcoCAL is a professional calibration tool, developed by Ecotron. It is specifically designed for Ecotron VCUs.

The software is based on the CCP protocol, and uses the CAN bus for data communication with target hardware. It has various measurement tools integrated for different kinds of signals, providing a more user-friendly interface. EcoCAL also integrates data logging function, and provides an integrated data analysis tool.

It parses the standard A2L files, and manages the calibration data in the format of S19 files, Mot files or CAL files.

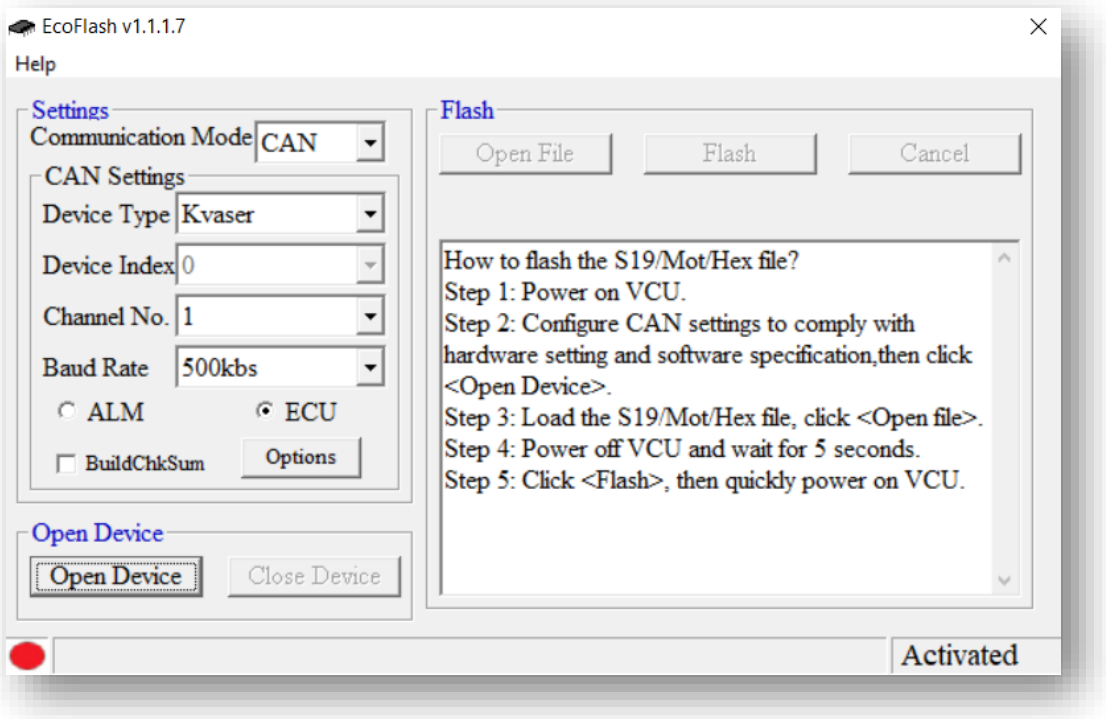
For more details, please refer to ***EcoCAL User manual***.



5.3 VCU Programming Tool – EcoFlash

EcoFlash is a code flashing software. The function of the software is to flash the compiled executable code into the low-level device and start the device to execute the program to achieve software code flashing and online upgrade.

For more details, please refer to ***EcoFlash User Manual***.

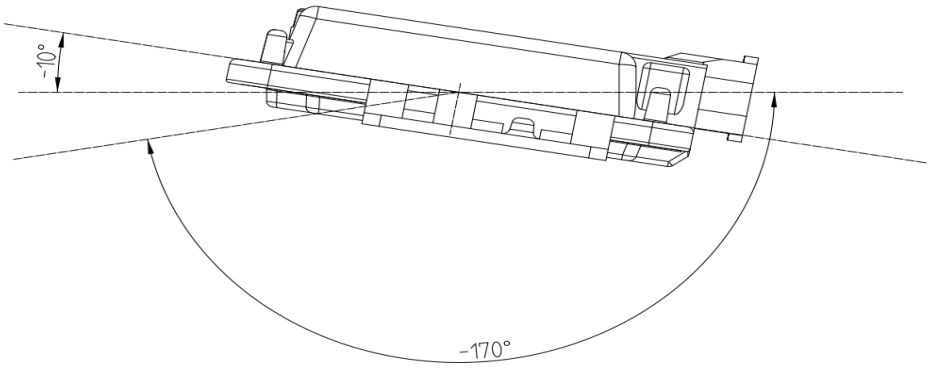


Chapter 6 Installation Requirements

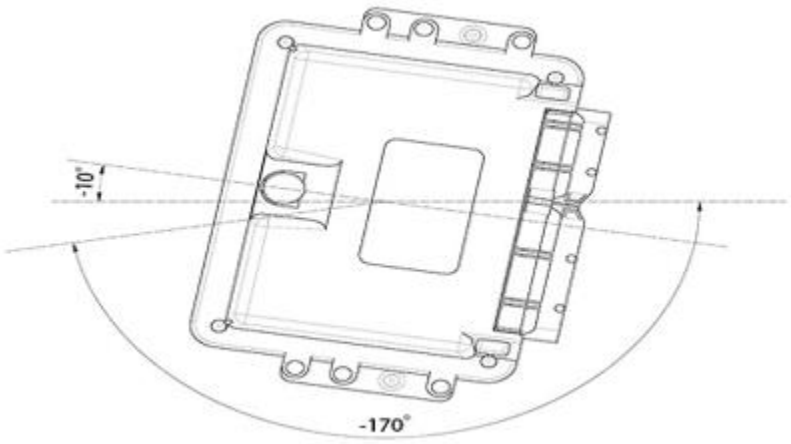
Ecotron recommends installing the HCU in the cockpit. If you want to install the HCU in another location, the corresponding installation location should be evaluated by Ecotron engineers and your engineers.

The requirements for HCU installation are as follows:

1. The installation of HCU and wiring harness should be firm and reliable. The HCU should be avoided to support the wire harness, and the arrangement of the HCU wire harness should be able to prevent and protect all wires in the wire harness from damage due to wear and overheating.
2. Try to avoid installing in places where dust is easy to gather. A large amount of dust accumulation will affect the reliability of HCU work.
3. Keep away from the location where the temperature of the housing itself may exceed 85°C, and prevent the heat released by surrounding parts from radiating to the HCU.
4. Avoid installing the HCU in a location where oil, moisture and water droplets are easy to splash.
5. Avoid the possibility of additional mechanical shock and external impact due to the installation position and fixing method of the HCU, and avoid installing the HCU at the resonance point of the vehicle body.
6. Avoid installing the HCU near the location where it is likely to come into contact with the battery or other acid-alkaline solutions that easily leak out, and where the HCU is easily corroded.
7. Avoid installing the HCU near the positive terminal of the battery and the ignition power terminal.
8. HCU installation should avoid water inflow from the connector. Therefore, in the horizontal direction, the recommended installation angle is -170° to -10°, as shown in Figure 1 below. In the vertical direction, the recommended installation angle is -170°~-10°, as shown in Figure 2 below.



Horizontal installation angle



Vertical installation angle

Ecotron recommends using the six installation points of the HCU itself for installation and fixation. It is recommended to use metal materials such as aluminum alloy for the mounting bracket, and the housing has a reliable electrical connection with the vehicle body through the bracket. If other materials are used, customers need to ensure that they can meet HCU requirements for vibration, heat dissipation, temperature, EMC, etc.