

Knock Sensor Module

1. SCOPE

This specification covers the performance, test and quality requirements for the shunt current sensor. This sensor is used to measure the knock action.

2. APPLICABLE DOCUMENTS

The following documents are the part of this specification. In case of conflict between the requirements of this specification and the product drawing or other reserved documents, this specification will take precedence.

TE Connectivity Specifications

114-106435	Application Specification
501-106435	Qualification Test Report Requirements

3. REQUIREMENTS

3.1 General Requirements

3.1.1 Function Description

The sensor is used for monitoring the knock action in a surface.

3.1.2 Connector System

3P Connector: 2321916-3 (Assembled by 2321918-3, 2321920-3, 2321922-3 and 2321921-1)

3.1.2.1 Low-side Connector Definition

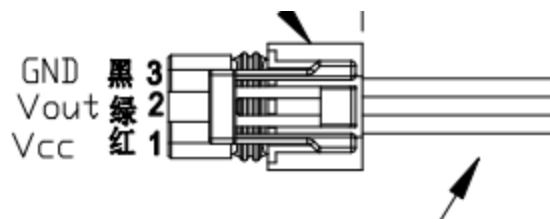


Fig. 3.1 Connector definition

3.1.2.2 Pin Out

Table 3-1 Pin descriptions

Pin No. (see drawing connector)	TE (internal)	Remarks
1	Vcc	Voltage Supply (Red)
2	Vout	Output Signal (Green)
3	GND	Ground (Black)

3.1.3 Designation of Product

Date code:	on housing
TE logo:	on housing
TE part number:	on housing
Material of housing:	on molded housing
Current direction:	on housing

3.1.4 Mechanical characteristics

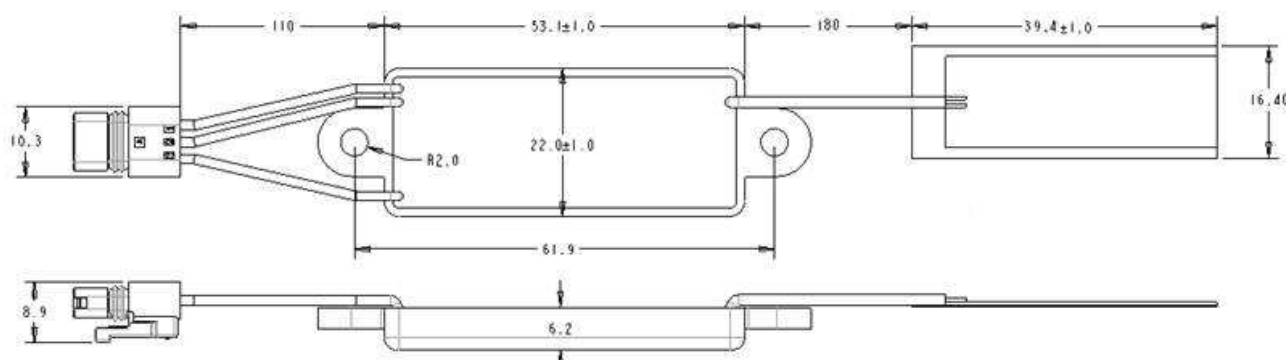


Fig. 3.2 Mechanical Outline

Table 3-2 Mechanical symbol characteristics

Symbol	Characteristics	Notes
Wiring Cable	Length 110mm, AWG24, UL1569	
Connector	TE Connectivity 2321916-3	

3.2 Electrical Characteristics

3.2.1 Schematic

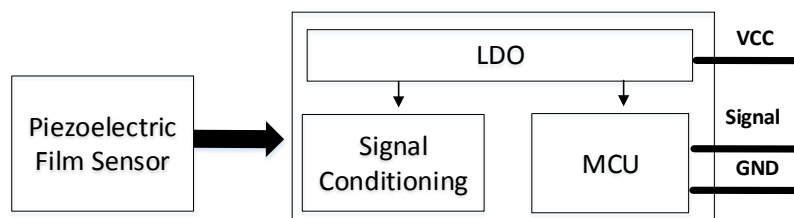


Fig. 3.3 Schematic

3.2.2 Absolute Maximum Ratings

Table 3-2 Absolute Maximum ratings

Characteristics	Symbol	Min	Type	Max	Unit
Voltage Supply	V _{CC}	8	12	16	V _{dc}
Nominal Output High Voltage	V _{OH}	-	V _{CC}	-	V
Nominal Output Low Voltage	V _{OL}	0	-	0.7	V
Current Consumption	I _{CC}	-	20	30	mA dc
Output Impedance	Imp _{out}		5.4K		Ω

Note: Exceeding the absolute maximum ratings may cause permanent damage. Exposure to absolute maximum-rated conditions for extended periods may affect device reliability.

3.2.3 Operation Conditions

Table 3-3 Operating ratings

Ratings	Symbol	Value	Unit
Storage Temperature	T _{stg}	-40 to 70	°C
Supply Voltage (Peak)	V _{CC}	16V	V _{dc}
Humidity Operating Range	RH	0 to 100	%RH

Temperature Operating Range	T_a	-20 to +70	°C
Input current on any pin		-10 to +10	mA

3.2.4 Sensor Characteristics

Table 3-4 Transfer characteristics

Electronic Characteristics	Symbol	Min	Type	Max	Unit
No knock or other knock (1 time or >2 times) action output voltage	V_{out}	-	V_{OH}	-	V
Low voltage output time after monitoring double knock action.	T_o	-	100	-	ms
Output impedance	Z	-		50	Ω
Double knock interval time	T_i	100	250	500	ms
Pulse happen time after knock action	T_h	-	$T_i + 80$	-	ms

3.2.5 Communicate Descriptions

3.2.5.1 Basic information

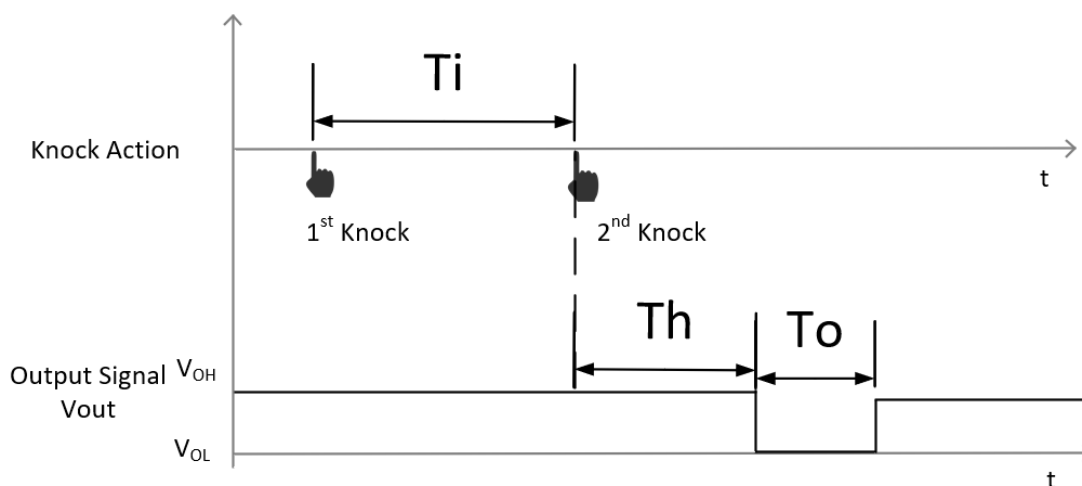


Fig. 3.4 Working Sequence

Notes:

- This sensor output is active only when the double knock action is happened. T_i is the time during 2 times knock actions. 1 time or 3 times knock actions all can't active the sensor output.
- V_{out} is the output signal of the sensor module.
- The sensor's output signal is high (voltage is V_o) when the sensor is not active.
- T_o is the low-level voltage time when sensor output is validated.
- T_h is the time between the low voltage output and the last knock action.

4. TYPICAL PRODUCT QUALIFICATION

4.1 Classes of Operation

Functional status A

All functions of the device/system as designed during and after the test.

Functional status B

All functions of the device/system perform as designed during the test. However, one or more of them may go beyond the specified tolerance. All functions return automatically to within normal limits after the test. Memory functions shall remain class A.

It shall be specified by the vehicle manufacturer which function of the DUT must perform as designed during the test and which function can be beyond the specified tolerance.

Functional status C

One or more functions of a device/system do not perform as designed during the test but return automatically to normal operation after the test.

Functional status D

One or more functions of a device/system do not perform as designed during the test and do not return to normal operation after the test until the device/system is reset by simple "operation/use" action.

Functional status E

One or more functions of a device/system do not perform as designed during and after the test and cannot be returned to proper operation without repairing or replacing the device/system.

4.2 Test Requirements

The products are designed to meet the mechanical, electrical and environmental performance's target specified in the table.

Table 4-1 Test requirements and procedures summary

ELECTRICAL			
NO.	Test items	Standard	Function class
4.2.1	E-01 overvoltage		Functional status A
4.2.2	E-02 under-voltage		Functional status A
EMC/ESD			
4.2.10	ESD: Powered-On Mode	IEC 61000-4-2	± 8kV air, Functional status C
4.2.11	ESD: Remote I/O	IEC 61000-4-2	± 8kV air, Functional status A
Environment Test			
4.2.21	70°C / 85%	70°C and 85% humidity environment. Power on for 230min and power down 10min. Run 21 days.	Functional status A 70°C and 85% humidity environment. Power on for 230min and power down 10min. Run 7 days.
4.2.22	High/Low Temperature Storage	2 cycles of 24 h (consisting of 12 h storage at $T_{min}=-40^{\circ}\text{C}$ and 12 h storage at $T_{max}=70^{\circ}\text{C}$)	Functional status A (TE)
4.2.23	High Temperature	Place the sample to 48 h in $70^{\circ}\text{C} \pm 2^{\circ}\text{C}$ environment and input 1.1 times voltage. and recover 4 h in the normal temperature environment. To do the function test.	Functional status A
4.2.24	Low Temperature	Place the sample to 72h in $-20^{\circ}\text{C} \pm 2^{\circ}\text{C}$ environment and recover 2h in the normal temperature. To do the function test.	Functional status A

4.2.25	Damp Heat	Put the sample in the $60^{\circ}\text{C} \pm 2^{\circ}\text{C}$ temperature and 90% ~ 95% humidity environment for 30min. And change the environment to $-10^{\circ}\text{C} \pm 2^{\circ}\text{C}$ temperature, 20% relative humidity for 30min. That 1 damp heat cyclic. Total running 120 cycles. Place 2h in the normal environment and to do the function test.	Functional status A
4.2.26	Thermal Shock	Put the sample in the $70^{\circ}\text{C} \pm 2^{\circ}\text{C}$ temperature environment for 30min. And change the environment to $-20^{\circ}\text{C} \pm 2^{\circ}\text{C}$ temperature for 30min. That's 1 cycle. Total running 10 cycles. Place 2h in the normal environment and to do the function test.	Functional status A
4.2.27	Random vibration	Controller board is fix on the vibration table, set the frequency to 10Hz ~ 75Hz, XYZ direction, 1 oct/min rate, 2 hours/direction. Make sure the appearance and to do the function test.	Functional status A
4.2.28	Free Fall	The sample with package. In 1m high, drop to the concrete ground. Check the appearance and to do the function test.	Functional status C TE Inner test 1m
4.2.29	Pull Force after be pasted	Paste the sensor to glass, pull the cable and measure the pull-out force.	Min pull force should be larger than 20N.

NOTE: Shall meet visual requirements, show no physical damage, and meet requirements of additional tests as specified in the Product Qualification and Requalification Test Sequence.

5. QUALITY

Basically the goal is 0 defects.

A theoretical consideration of the estimated defects has to be done.

5.1 Qualification Testing

The samples are prepared in accordance with product drawings. They are selected from current production. Qualification inspections are verified by testing samples as specified in section 4.2.

5.2 Requalification Testing

If changes significantly affecting form, fit, or function are made to the product or to the manufacturing process, product assurance shall coordinate requalification testing, consisting of all or part of the original testing sequence as determined by development/product, quality, and reliability engineering.

5.3 Acceptance

Acceptance is based on verification that the product meets the requirements of section 4.2. Failures attributed to equipment, test setup, or operator deficiencies shall not disqualify the product. When product failure occurs, corrective action shall be taken, and samples resubmitted for qualification. Testing to confirm corrective action is required before resubmitted.

5.4 Quality Conformance Inspection

The applicable TE quality inspection plan will specify the sampling acceptable quality level to be used. Dimensional and functional requirements shall be in accordance with the applicable product drawing and this specification.

6. ANNEX1-EMC/ESD

6.1 Electrostatic Discharger

ESD Tests shall be performed as described in ISO 10605. Discharger parameters for unpowered and powered tests are given in below table respectively.

6.1.1 Power on Mode

Discharge		
Sequence	Type	Level (kV)
1	Air	±8

6.1.2 Remote I/O

Discharge		
Sequence	Type	Level (kV)
1	Air	±8