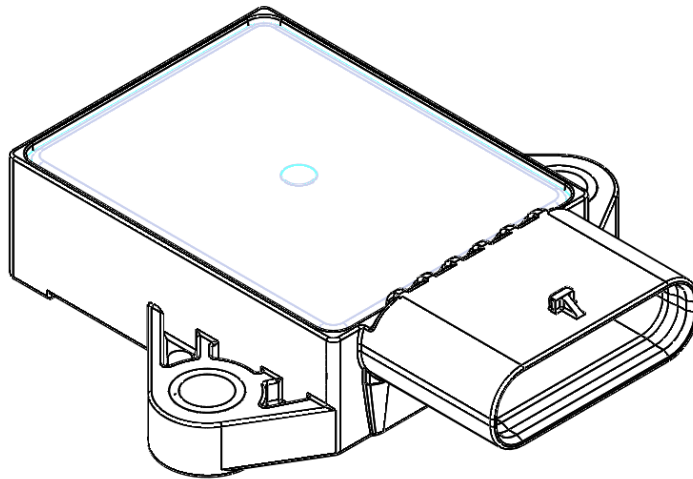


PRODUCT SPECIFICATION

SMART BPS TEM000001

BATTERY PACK PRESSURE SENSOR FOR THERMAL RUNAWAY DETECTION



DRAWN		ENGINEER XT John	APPROVAL	ECN #	DATE 4-Oct-2021
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REVISION LOG

Revision	Description	Date	Changes
1	Initial release	10/4/2021	Tem version Initial Release

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1 GENERAL DATA

1.1 DESCRIPTION

In this specification a sensor is described that has the objective to measure absolute pressure in the battery pack of electric vehicle. The sensor will provide a CAN output to battery management system (BMS), the pressure signal will be proportional to the measured pressure.

The power consumption working mode of this sensor is either controlled by BMS through request pin (the one that takes precedence) or switched by sensor itself using monitored pressure as trigger condition. When voltage on request pin is high level, sensor works at high consumption working mode and CAN communication with BMS is enabled. When voltage on request pin is low level, sensor works at low power consumption working mode to monitor internal pressure of battery pack discontinuously, and there is no CAN communication. Once sensor monitored pressure triggers the set threshold, sensor will switch from low power consumption working mode to high power consumption working mode and send out a wake-up signal to BMS.

1.2 CODING

Sensor coding conform to the envelope drawing : TEM000001-ENV

1.3 CONFIGURATION

The shape, material and the dimensions of the sensor are in accordance with the envelope drawing : TEM000001-ENV

1.4 GENERAL REQUIREMENTS

The performance of the sensor is in accordance with the requirements as defined in chapter 2 of this specification and can only be guaranteed if the sensor is used in environmental conditions as specified in this document. Any deviation from usage as defined in this document will void this specification. Test climate unless mentioned otherwise is according to : Normal, 23/50-2 DIN 50 014

1.5 LEGAL DISCLAIMER PRODUCT USE (AUTOMOTIVE SENSORS)

Churod Electronics products are developed for automotive applications. They may only be used within

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the parameters of these Product Specifications. Churod Electronics products are provided with the express understanding that there is no warranty of fitness for a particular purpose. They are not fit for use other than specified, tested and validated within the release process during product launch. Fit for use warranty claims will be compared with the provided PPAP release package. Warranty claims that goes beyond of what is agreed in that PPAP package will not be awarded.

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2 CHARACTERISTICS

2.1 GENERAL PROPERTIES

2.1.1 Operating measurement pressure range

The operating range of absolute pressure is : 50 to 165 kPa abs
in the herein defined operating temperature range,
operating voltage range and life time.

2.1.2 Operating temperature range

The operating temperature range is : -40 to 105 °C

2.1.3 Proof pressure

Proof pressure of the sensor is : 400 kPa abs
without irreversible loss of functionality in the herein
defined operating temperature range, operating voltage
range and life time.

2.1.4 Burst pressure

Burst pressure of the sensor is : 500 kPa abs
with a maximum time of : 1 minute
Afterwards, the sensor is not expected to return to
normal operation but will not cause any leakage.

2.1.5 Working mode

1. High power consumption working mode

Sensor works on high power consumption mode when
voltage on request pin is : high level (6~16VDC)

Sensor switches from low power consumption working
mode to high power consumption working mode when
sensor monitored internal pressure of battery pack
exceeds : set threshold

At the same time, sensor can send wake-up signal to
BMS (*Optional function*)

2. Low power consumption working mode

Sensor works on low power consumption mode when
voltage on request pin is : low level (<0.5VDC)

and sensor monitored internal pressure of battery pack
is less than : set threshold

Sensor checks pressure : every 1s
and there is no CAN communication in low power
consumption working mode.

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3. Deep sleep mode

Sensor will stop monitoring pressure after request signal is continuous low level for more than

: X hrs (disabled)

2.1.6 Wake-up function

A wake-up signal will be sent from sensor to BMS through

: Wake-up pin

Once sensor detects internal monitored pressure exceeds the set threshold during low power consumption working mode.

At the end of each wake-up high level signal, sensor checks the voltage on the request pin. Once a high-level voltage on request pin is detected, sensor will set the signal on wake-up pin to low level voltage.

2.1.7 Request signal

A request signal shall be provided by to control the working mode of sensor.

: BMS / BCU

The function of request pin is as described in section 2.1.5 and 2.1.6.

2.1.8 Threshold inside sensor

The set threshold inside sensor as described in section 2.1.5 is initially calibrated by Churod. The initial value of set threshold will be defined together with customer.

The threshold consists of pressure and pressure slope with a relation of logic or – wake up signal can be sent out with either one is triggered.

Pressure threshold consists of two parts, basic pressure value plus delta pressure.

The basic value is

: Ambient pressure

Delta pressure is

: X kPa (adjustable)

The pressure threshold will be flashed during sensor low power consumption working mode every

: 2 minutes (adjustable)

It can also be flashed during high power consumption mode if wake up signal is needed. Update frequency

: TBD (disabled)

Pressure slope

: 0.5kPa/s (adjustable)

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2.2 OPERATING ENVIRONMENT

2.2.1 Operating ambient temperature range

The operating ambient temperature range : -40 to +105 °C
The minimum and maximum operating temperature is the lowest and highest temperature respectively at which the sensor will perform according to the characteristics listed in this chapter.

2.2.2 Storage temperature range

The storage temperature range : -40 to +105 °C
The minimum respectively maximum storage temperature is the lowest respectively highest ambient temperature at which the sensor can be kept for longer periods of time without negative effects on performance.

2.2.3 Application medium

The application medium is : Air

2.2.4 Protection rating

The sensor complies to : IP67
under the condition that the electrical connector is applied.

2.2.5 Flammability rating

Flammability rating of housing plastic material : UL94 V-0

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2.3 ELECTRICAL CHARACTERISTICS

2.3.1 Supply voltage (Vcc)

The sensor requires a transient protected and regulated voltage supply. The sensor will operate properly at any supply voltage in the range

: 6 to 16 VDC, 12 VDC Typ.

2.3.2 Power consumption

The sensor average power consumption is less than
in
and less than
In
at
at

: 360 mW Typ.
: high power consumption mode
: 2.4 mW typ.
: Low power consumption mode
: room temperature
: 12VDC

2.3.3 Input / Output signal

The sensor communicates with the BMS by CAN
CAN version

: 2.0B

2.3.4 BAUD rate

Baud rate

: 500Kbps

2.3.5 Electrical parameters

The parameters as listed in Table 1 are tested at room temperature unless otherwise specified.

Table 1: Electrical parameters

Parameter	Min	Typical	Max	Unit	Remark
Operating supply voltage	6	12	16	VDC	
High power consumption ¹⁾			360	mW	
Low power consumption ²⁾			2.4	mW	
Wake-up square signal					
High level voltage	6	12	16	VDC	
Low level voltage			0.5	VDC	
Request signal from BMS	6	12	16	VDC	
Overvoltage capability			24	VDC	1 minute, RT
Reverse voltage capability	-14			VDC	1 minute, RT

1) Power consumption in high power consumption mode at room temperature, 12V.

2) Average power consumption in low power consumption mode at room temperature, 12V.

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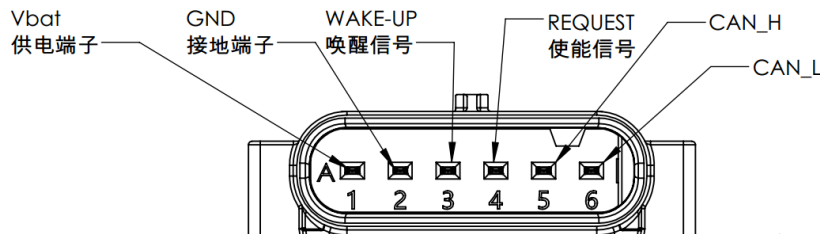
2.3.6 DBC file

Refer to the latest DBC file.

2.3.7 Diagnostic

Diagnosis level	Short circuit between:	Interruption of wires	BPS internal issue
CAN output CAN communication error	1-2, 1-5, 1-6 or 2-5, 2-6	1, or 2, or 5, or 6	
CAN output CAN communication normal, show error flag: BPS sense element issue			BPS Bridge resistor shortage, open, or power supply issue
Wake-Up Continuous low (0V)	2-4	1 or 2 or 4	
Wake-Up Continuous high (>98%Vbat)	1-4		

* Terminal definition refer to below figure



2.3.8 Response time

The pressure IC response time (T90, output rising from 10% to 90% of final value) less than : 2ms

in the herein defined operating temperature range, operating measurement pressure range, operating voltage range and life time.

The time for the pressure signal report to BMS will be affected by the speed of CAN communication.

2.3.9 BAUD rate

BAUD rate of CAN communication : 500K bps

2.3.10 Nominal output signal transfer curve

The nominal transfer curve is expressed by : $N_{out} = P \times 10$
where P is : Pressure (kPaA)

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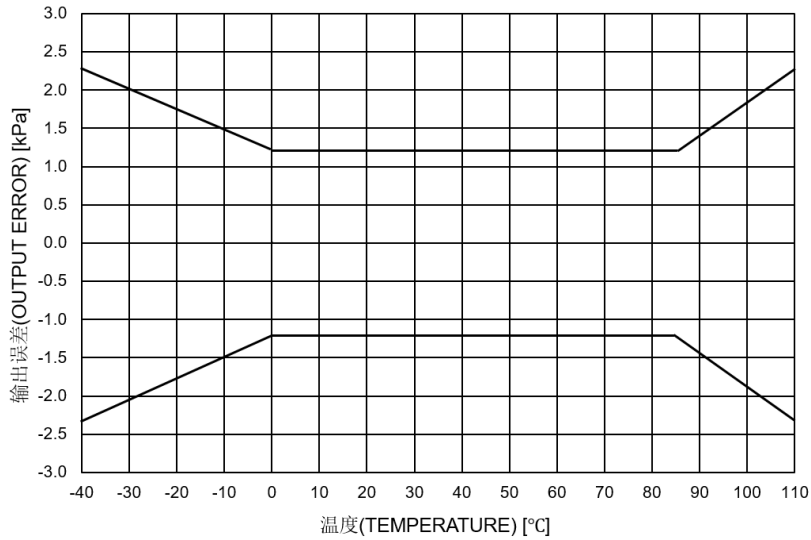


2.3.11 Pressure output accuracy

The output accuracy limits of the sensor are

: ± 1.2 kPa between 0°C ~ 85°C
 : ± 2.3 kPa at -40°C and 105°C

The absolute error includes hysteresis, repeatability, linearity and aging effects.



2.3.12 Resolution

Resolution

: 0.1 kPa

2.3.13 Recommended electrical interface

1. Request interface

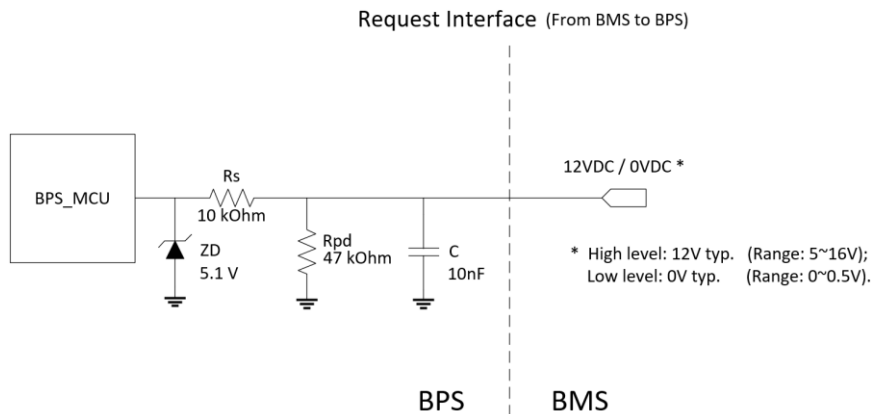
High low-level input voltage.

Effective signal, high level

Low level

: 5~16VDC, typ.12V

: 0~0.5V, typ. 0V



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2. Wake-up interface

Effective Signal, High Level

Rpull-Down

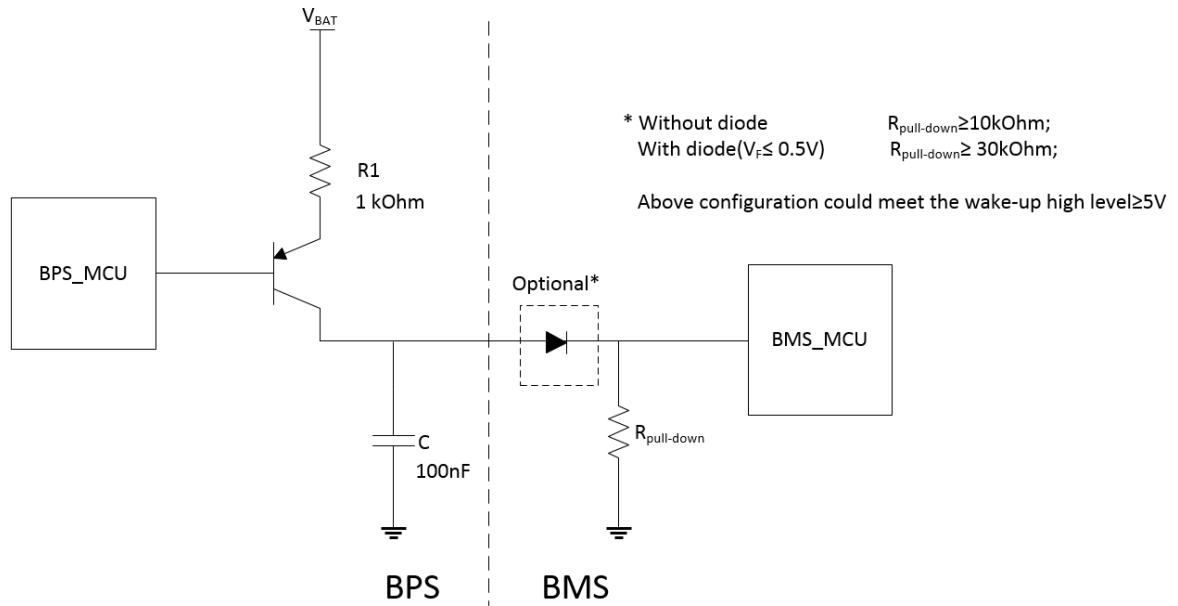
Rpull-down

: 5~16vdc, Typ 12vdc

: $\geq 10\text{k}\Omega$ without diode

: $\geq 30\text{k}\Omega$ with diode ($V_F \leq 0.5\text{V}$)

Wake-up Interface (From BPS to BMS)



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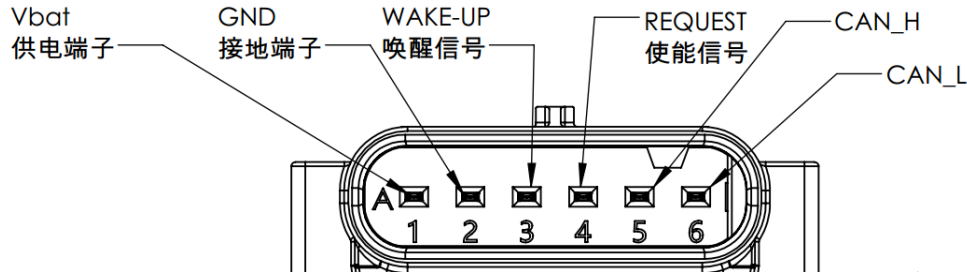
2.4 MECHANICAL CHARACTERISTICS

2.4.1 Dimensions

Sensor dimensions conform to the envelope drawing : TEM000001-ENV

2.4.2 Connector pin sequence

The connector pin sequence : see below figure.



2.4.3 Installation

The sensor will operate conform the herein described characteristics when mounted with suitable dimensioned tooling

The recommended screwing torque is : 5.3 Nm \pm 10%

for mounting with two M5 bolts

The interfacing surface below each bolt should be according to : DIN 125 M5 or GB/T 97 M5

Or use a flange bolt according to : DIN 921 M5 or GB/T 16674.1 M5

No force should be applied on the cover of the sensor

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