Technical Information

Electrochemical Hydrogen Sulfide Gas Sensor

NAP-523

For Residential or Commercial Application

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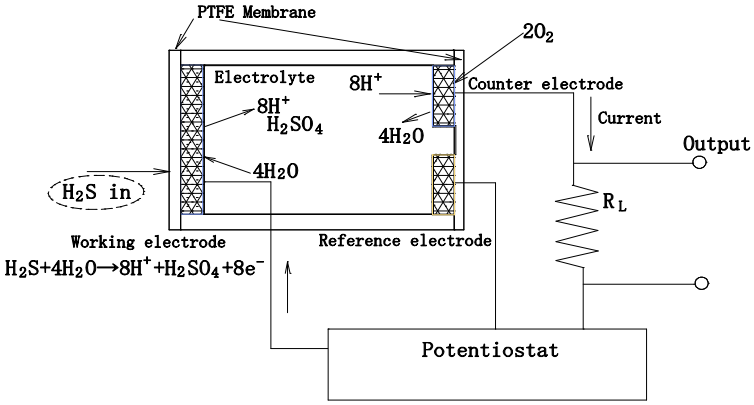
1. General

NAP-523 sensor was newly developed for residential or commercial applications, and is flat/planner type electrochemical hydrogen sulfide gas sensor. Shape and pin positions are completely the same as other 5 series sensor, but the stability, repeatability, durability and reliability are excellent and also similar to industrial sensor NE4-H2S, however the price is competitive with others. Features and applications are as follows.

2. Detection principle

Electrochemical sensor consists of working electrode on which oxidization takes place, counter electrode on which reduction takes place, and reference electrode which can monitor and keep the voltage at constant. Structure of electrochemical sensor NAP-523 is shown in the following figure, hydrogen sulfide gas diffuses through membrane into working electrode, and is oxidized at working electrode. Consequently generated proton at this reaction proceeds to counter electrode, and reacts with dissolved oxygen in electrolyte to water. Total reaction is in the below described. Hydrogen sulfide gas concentration is proportional to the current that is generated by this serial reaction.



3. Features

・Quick response
・Excellent selectivity and repeatability
・Good linearity and stability
・High reliability and long lifetime
・Excellent durability against high temperature and humidity

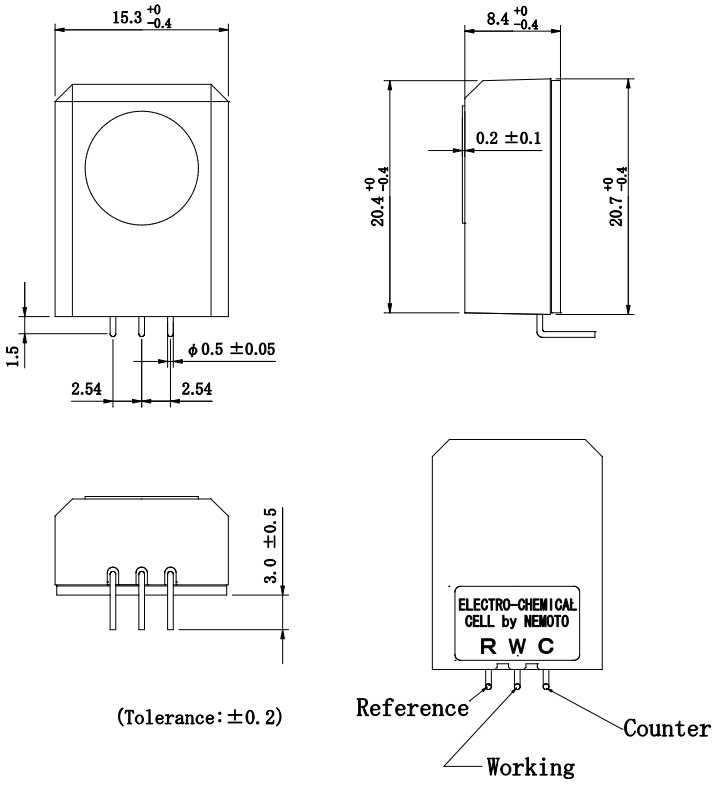
4. Detected gas

Hydrogen sulfide

5. Application

・Breath checker

6. Dimensions and appearance



Since there are 4 types of pin shape, S, SS, R and RS, please select the suitable one among them according to the applications.

Case Material	PPO
Cap Color	Yellow
Weight	2 g (approx.)

Fig.1 Appearance and dimensions of NAP-523

7. Ratings

1) Ambient temperature and humidity in operation	Temperature : -20 - +50 degree C Humidity : 15 – 90%RH
2) Recommended ambient temperature and humidity in storage	Temperature : 0 – 20 degree C Humidity : 15 – 90%RH
3) Operating pressure range	0.9 – 1.1 atm
4) Detection range	0 – 0.5 ppm
5) Maximum overload	1.0 ppm
6) Recommended load resistor	10 ohm

8. Specifications

1) Output signal (at 20 degree C)	550+/- 150nA/ppm of H_2S
2) Zero offset at 20 degree C	< +/-0.1 ppm of H_2S equivalent
3) Response time (T90)	< 60sec
4) Repeatability in the same day	< +/-5% of signal
5) Annual zero offset drift at 20 degree C	+/-1 ppm of H_2S equivalent
6) Zero offset temperature dependence	< +/-0.5ppm of H_2S equivalent
7) Sensitivity reduction in long term	2% signal / months
8) Warranty	1 years
9) Recommended storage time	< 6 months

9. Electrical properties

9-1. Typical Gas Sensitivity

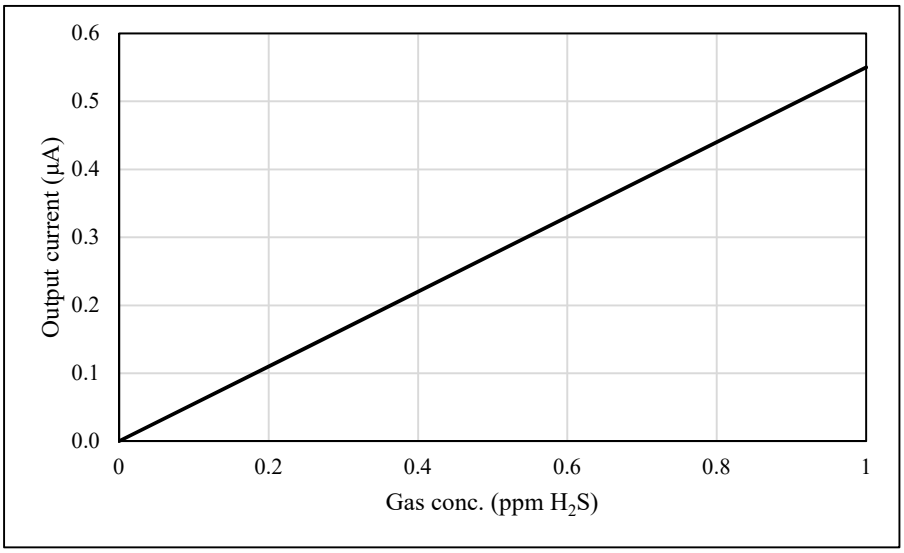


Fig. 2 : Gas Sensitivity of NAP-523

9-2. Response and recovery characteristics

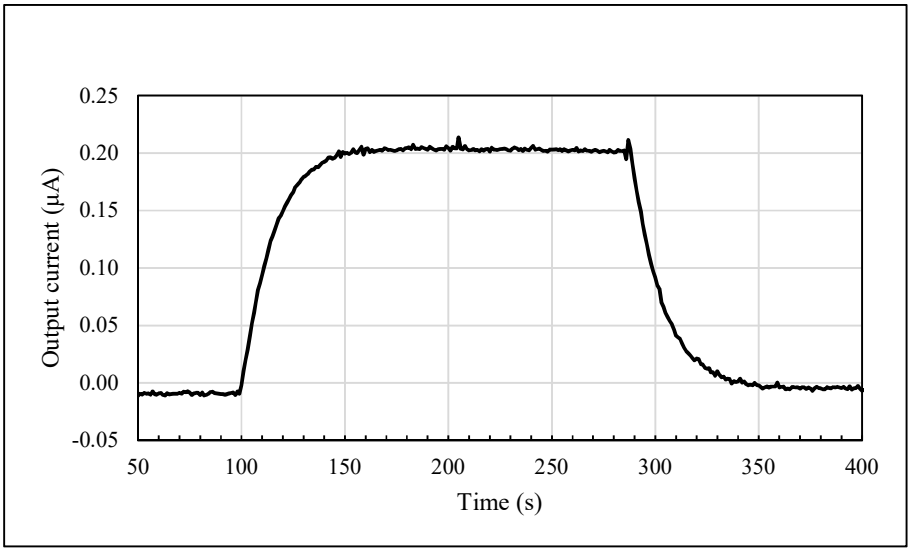


Fig. 3 Response and recovery characteristics in 0.5ppm H_2S.

9-3. Cross Sensitivity

Table 1 : Cross Sensitivity of NAP-523

Detected gases	Concentration used (ppm)	Typical hydrogen sulfide reading (ppm) equivalent	Cross sensitivity %
Hydrogen sulfide	0.5	0.5	100
Methyl mercaptan	0.5	<0.5	<100
Tertiary-butylmercaptan	0.5	<0.4	<80
Tetrahydrothiophene	0.5	0.5	100
2-nonenal	100	0	0
Carbon monoxide	100	-0.1 to 0	Approx. 0
Carbon dioxide	5000	0	0
Hydrogen	100	-0.1 to 0	Approx. 0
Chlorine	1	-0.4	-8
Sulfur-dioxide	1	< 0.25	<5
Nitrogen monoxide	5	-0.25 to 0	-5~0
Methane	100	0	0
Ammonia	10	0	0
Nitrogen dioxide	5	-0.5 to 0	-10~0
Ethanol	10000	< 0.5*	0
Acetone	10000	-0.5 to 0.1*	0
Acetaldehyde	100	0	0

* Exposure time : 5min.

9-4. Temperature dependence

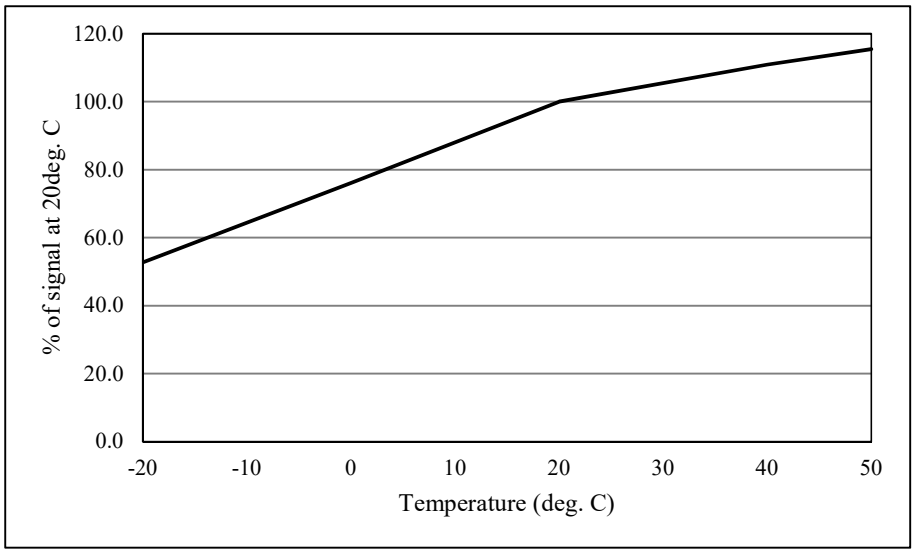


Fig. 4 Typical temperature coefficient of NAP-523
(100 at 20 degree C)

Table 2 Temperature coefficient of NAP-523 (100 at 20 degree C)

	-20℃	**0℃**	**20℃**	**40℃**	**50℃**
% of signal at 20 deg. C	**52.7**	**76.1**	**100**	**111**	**116**

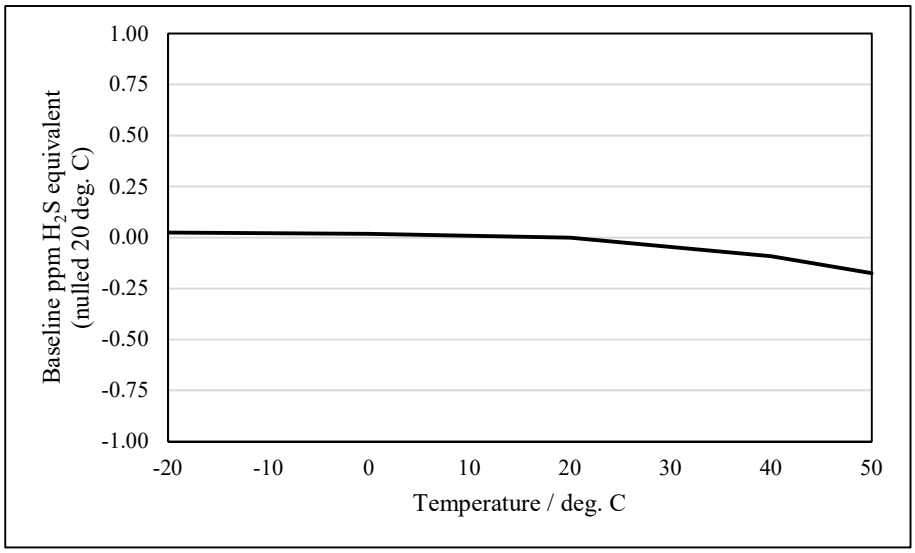


Fig. 5 Typical baseline vs. temperature characteristics of NAP-523

9-5. Long term stability

It is stable in normal circumstance for over 1 years.

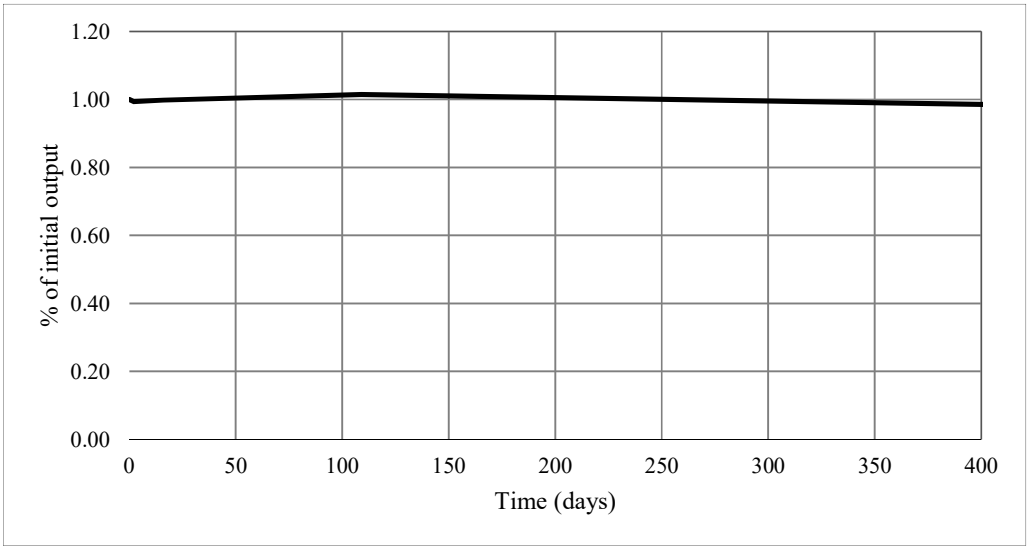
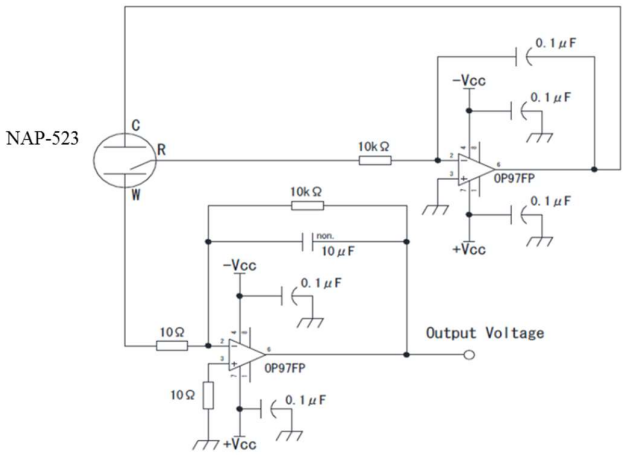


Fig. 6 Long term stability of NAP-523 in normal circumstance

10. Recommended circuit diagram

Recommended circuit diagram for evaluation of NAP-523 is shown in figure 6. In this circuit diagram, OP97 as operational amplifier is employed, however the other low price one is to be applicable for actual use. Temperature compensation is necessary at actual application, please use the microcomputer with reference to the value in Table 2.



11. Notice on handling

11-1. Seasonal variation of sensitivity

Highly hygroscopic electrolyte is normally employed for electrochemical sensor, and then the sensitivity varies according to change of temperature and humidity, i.e. sensitivity is little lower in low humidity than in high humidity. Since it is because of amount of electrolyte, this seasonal variation of sensitivity should be taken into account in case that precise measurement is necessary. However, this

variation is reversible phenomenon.

11-2. Design of gas alarm or gas densitometer

a. Calibration of gas alarm or gas densitometer is to be carried out in clean air after the output was stabilized.
b. In case that water drop or oil is on the pre-filter, accurate measurement may not be available because of low diffusion of detected gas to sensor. If such accident may be conceived, design of prevention from such one is to be considered.

11-3. Storage of sensor

It is recommended that electrochemical sensor should be stored in normal temperature and humidity, possibly 0-20 degree C, of clean air. Recommended storage time after delivery is less than 6 months. If the storage time is extended, the warranty term is to be shortened. It is because the lifetime of electrochemical sensor is not dependent on being electrified or not like semi-conductive type or catalytic type, and then this matter is to be correctly comprehensive in order to keep quality.

11-4. General notice

- Use only within specified conditions.
- Sensor characteristics must be measured in clean air.
- Electrode pins must be correctly connected. Wrong connection does not allow correct functions.
- Do not apply voltage directly to electrode pins.
- Do not bend pins.
- Do not put excess vibration or shocks.
- If sensor housing is damaged or scratched, do not use.
- Do not blow organic solvents, paints, chemical agents, oils, or high concentration gases directly onto sensors.
- Do not solder pins of sensor directly. Use exclusive sockets.
- Do not disassemble or change any parts.
- In case that sensor is stored by detachment from circuit board, it is recommended that working electrode pin should be short-circuited with reference electrode pin in order to shorten the initial stabilization time.
- If sensor is used under irregular atmosphere, contact us.

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