

## MP7227-R Datasheet

### Miniature MEMS Catalytic Combustible Gas Sensor

The MP7227-R pellistor is a low power, hazardous area safe, extremely robust and poison-resistant device in a certified flameproof enclosure. The MP7227-R type sensor is designed for low power operation in continuous mode providing additionally ultra-low power consumption when used in pulse mode operation, which makes this sensor a preferred choice for battery operated devices.

The MP7227-R has been designed to provide the basic sensor performance that will enable a suitable instrument to meet the various (Group 1) mining and industrial (Group 2) performance standards.

Whilst being optimised for its methane response (up to 5% volume in air), will also detect some other flammable gases and vapours. For further information, contact SGX Sensortech. Small size and ultra-low power consumption in pulsed operation mode make the proposed sensor a preferred choice for applications where size and long battery operation are essential.

### FEATURES

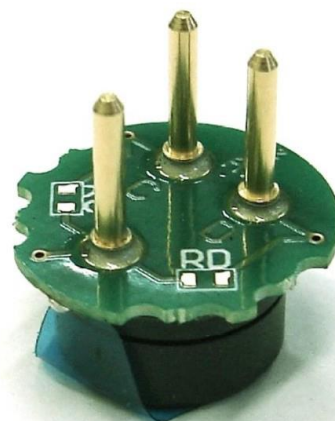
- Low power – designed for battery operation
- Small size (14.4 x 6.7 mm)
- High resistance to mechanical shocks
- Low orientation effect
- ATEX Certified (II 1G Ex da IIC Ga, I M1 Ex da I Ma)
- IECEx certified (Ex da IIC Ga, Ex da I Ma)



### OPERATING PRINCIPLE

The silicon pellistor structure consists of a pair of accurately micro machined diaphragms with two embedded planar heater meanders coated with a layer incorporating a noble metal catalyst for the detector device and with inert layer for the compensator device.

The meander acts both as an electrical heater and as a resistance thermometer. The device is mounted on a PCB with wire bonding and is surrounded by a plastic can with the end open to the atmosphere. If a flammable gas is present when the device is heated to about 400 – 500 °C, the gas will oxidise and the resultant release of energy will heat the device still further. This increase in temperature is detected as an increase in resistance of the meander. The temperature of the meander is also affected by ambient temperature and by variations in thermal conductivity of the air caused by the possible presence of inert gases such as carbon dioxide. To compensate for temperature changes not caused by the oxidation of the flammable gas a second, inert device is used.



The compensator is made in the same way as a detector device except that instead of incorporating a catalyst in the coating layer, the device is treated so that oxidation cannot take place.

The two devices are then used in a circuit that detects the difference in their resistances. Since the two devices are generally a different colour, they have different emissivity and hence different slope resistances. Therefore, to obtain the best temperature performance, it is necessary on occasion to connect a fixed resistor in parallel with the compensator to correct for its higher slope resistance.

### TECHNICAL SPECIFICATION

#### Mechanical

Dimensions	see outline, page 4
Body material	PEI
Weight	1g

#### Environmental

Ambient temperature range for operation / storage: certified:	-40 to +60 °C -40 to +60 °C
Operational pressure range	70 to 130 kPa
Humidity range for operation and storage	0 to 95% (non-condensing)
Gases Detected	Most flammable gases and vapours

#### Electrical

DC supply to detectors	+2.9 to +3.1V;
Typical power	37.0 to 41.0 mA (<96mA at power on)
Mode of Operation	Continuous or pulsed <sup>(1)</sup>

<sup>(1)</sup> Suggested minimum ON pulse time is 300ms.

## PERFORMANCE

<b>Minimum sensitivity</b> (measured with 1% methane at $3.0 \pm 0.1V$ )	8 mV/% methane
<b>Zero offset range in clean air</b>	$-30mV \pm 20 mV$
<b>Response Time (<math>T_{90}</math>)</b> (See Note 2)	< 12 sec
<b>Maximum gas concentration</b> (see note 3)	5% methane in air
<b>Long Term Zero drift</b> (see note 4)	< 1.0 mV / month
<b>Long Term Sensitivity drift</b> (see note 5)	< 0.6 mV / month

## MAXIMUM RATINGS (Absolute values)

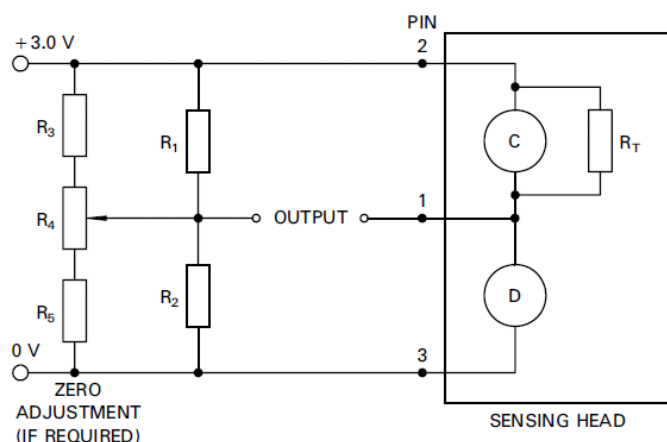
Input voltages between pins:	
<b>Pins 2 and 3</b>	3.2 V
<b>Pins 1 and 2</b>	1.6 V
<b>Pins 1 and 3</b>	1.6 V

## OPERATION

It is recommended that the detector and compensator be run in a Wheatstone bridge circuit.

A suitable circuit is shown below. In use, the bridge supply voltage should be stable to within  $\pm 0.05 V$ , or the output in clean air may change in sympathy. Although it is generally recommended that pellistors should be run with a constant voltage supply to the bridge, it is possible to use a constant current supply provided that the voltage across the bridge in clean air remains within the recommended limits.

**Recommended circuit diagram**



$$R_1 = R_2 = 500\Omega \text{ to } 10 \text{ k}\Omega$$

$$R_3 = R_5 \approx 10R_1$$

$$R_4 \approx 20R_1$$

## NOTES

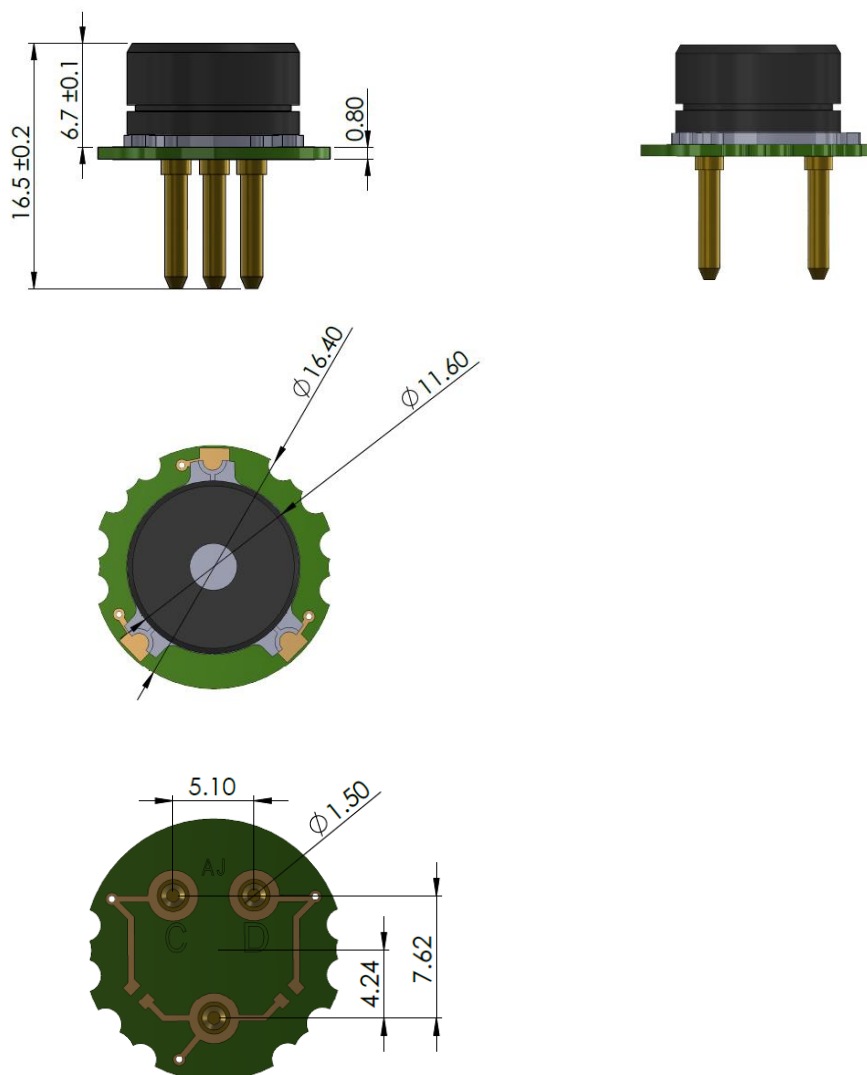
1. The polarity of the supply voltage may be reversed without harm. The only effect is to reverse the polarity of the output signal.
2. Maximum (slowest) response time measured at  $3.0 \pm 0.1 V$  using 1% methane in an SGX test manifold. Faster response times will be achieved in instruments/detectors with optimised gas delivery.
3. Exceeding these limits may degrade the stability of sensitivity or zero offset. The calibration of the sensor should be checked if it has been exposed, whilst operating, to gas concentrations greater than the Lower Explosive Limit.
4. Over 90 day period.
5. Measured at  $3.0 \pm 0.1V$  using 1% methane, over 90 days period.

## IMPORTANT PRECAUTIONS

Read the following instructions carefully before using the MP7227-R to avoid erroneous readings and to prevent the device from permanent damage.

- Heater voltages above the specified maximum rating can damage the MEMS Pellistor.
- Some compounds are known to affect the catalytic reaction of coating material used in pellistors.
  - Exposure to silicones (by far the most common & virulent poison), high levels of hydrogen sulfide (and other sulfur containing compounds), phosphates and phosphorous containing substances or lead containing compounds (e.g. tetraethyl lead) will irreversibly poison the sensor. High concentrations of flammable gas may also permanently affect the sensor response.
  - Lower concentrations of hydrogen sulfide and other compounds can cause a temporary loss in response. This is known as inhibition. Halogenated hydrocarbons such as Freons™, trichloroethylene, and methyl chloride are also possible inhibitors. Sensors generally recover most of their original response once they are returned to fresh air.
  - Specific protection may be needed in applications where poisons or inhibitors are continuously present.
- SGX recommends using ESD protection equipment when handling the sensor.
- Under no circumstances should the sensor pins be soldered directly to a PCB or wires. Excessive heat could cause irreparable damage to sensor. Information on the recommended sockets can be found on our website under the Frequently Asked Questions (FAQ) section.
- Please contact SGX Sensortech for any additional information.

## PACKAGE DIMENSIONS



All dimensions in mm  
Dimensions without limit are nominal.