

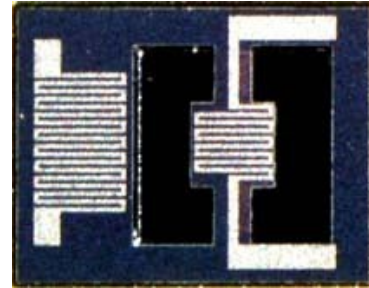
## Thermal Conductivity Gas Sensor Die

### Description

Posifa's PTCD10 Thermal Conductivity Gas Sensor Die measures thermal conductivity (ability to conduct heat) of the surrounding gas. Operating on the principle that gases differ in their thermal conductivity, it can be used to measure gas concentration in binary mixture or quasi-binary mixture (e.g. H<sub>2</sub>, CH<sub>4</sub> or CO<sub>2</sub> in air) where component gases have different thermal conductivity. It can also be used as a Pirani gauge to measure pressure in vacuum systems.

The sensor die is composed of two platinum thin-film resistors, one (measurement resistor) residing on a thin electrical and thermal insulating membrane suspended over a cavity, and the other (reference resistor) on the silicon substrate. The measurement resistor heats the membrane and measure its temperature. The reference resistor measures the temperature of the substrate. Under a constant heating current, the delta temperature of the membrane over the substrate correlates to thermal conductivity of the surrounding gas. As gas thermal conductivity varies with ambient temperature, the reference resistor is also used for ambient temperature compensation.

Posifa's innovative micro-machining process creates the optimal micro-structure for precision thermal conductivity measurement: the membrane is 960 µm long but only 2.5 µm thick (negligible heat transfer through the membrane); the membrane and the bottom of the cavity have parallel opposite sides. These critical characteristics of the micro-structure ensure that all heater thermal energy is transferred to the heat sink (i.e. the silicon substrate) by conduction through the gas gap inside the cavity.



### Applications

- Replace traditional TCD (thermal conductivity detector) in gas chromatography (GC) systems and gas analyzers
- Leak detection for Natural Gas (CH<sub>4</sub>), Hydrogen (H<sub>2</sub>), and refrigerant gases
- Natural gas quality control
- Natural gas engine combustion control
- Fuel cell applications
- Carbon Dioxide (CO<sub>2</sub>) monitoring for Indoor Air Quality (IAQ)
- Methane (CH<sub>4</sub>) detection for mining safety
- Pirani vacuum gauge

### Features

- Extremely low power consumption
- Operate in high temperature environment
- Very stable long term operation
- Minimal field maintenance required
- Small footprint: 1.8 x 1.4 mm

### Absolute Maximum Ratings

- Operating Temperature: -40 °C to 300 °C
- Humidity: 0 to 100% RH, non-condensing
- Shock: 1000g
- Overpressure: 27.5 Bar
- Heating Current (1 Atmosphere): 20 mA

## Electrical Characteristics

PARAMETER	MIN	TYP	MAX	UNIT
Measurement Resistor (@25°C)	135	150	165	Ω
Reference Resistor (@25°C)	270	300	330	Ω
Reference Resistor TCR (0°C to 200°C)		0.0025		/ °K

## PTCD10 Test Results\*

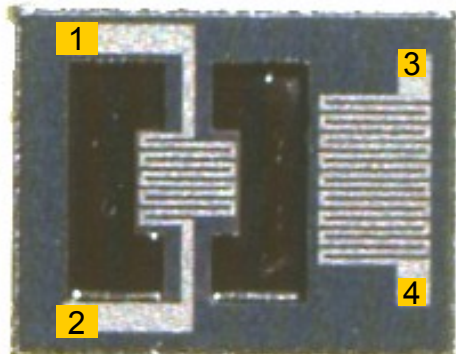
Gas being sensed in air		Range of concentration	PTCD10 Precision
Hydrogen	H <sub>2</sub>	0-3%	170 ppm
Carbon Dioxide	CO <sub>2</sub>	0-5%	1500 ppm
Methane	CH <sub>4</sub>	0-40%	1000 ppm

\* Please contact Posifa for test methodology

## Die Dimensions

PARAMETERS	MIN	TYP	MAX	UNIT
Length		1.8		mm
Width	1.35	1.4	1.46	mm
Thickness	0.5		0.55	mm
Pad Size		100 x 120		μm

## Die Connections



[1,2] Measurement Resistor  
[3,4] Reference Resistor

## Die Attachment

If the base material for die attachment is thermal conductive, e.g. a TO5 metal can, we recommend using a thermal insulating material as intermediary between the die and the base, such as thermal insulating epoxy or a ceramic plate. The purpose is to minimize the effect of ambient temperature fluctuation on the sensor performance.

## Ordering Information

Part Number	Specifications
PTCD10	Bare die, thermal conductivity of gas