DATASHEET
SMTIR9901/02 INFRARED SENSORS

Typical applications

- contactless measurement of surface temperatures or Infrared radiation
- temperature measurement on moving objects
- continuous temperature control of manufacturing
- thermal alarm systems
- climate control
- medical instruments
- home appliances

Features

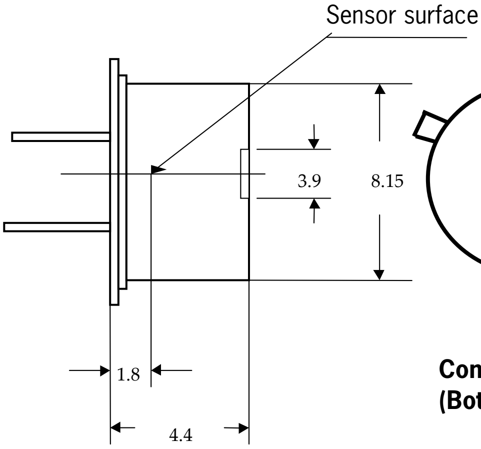
High accuracy
High sensitivity (110 V/W)
Low resistance (50 KΩ) and therefore
Very good signal-to-noise-ratio
Good response time (40 ms)
Low cost thin film technology

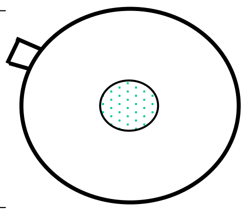
Introduction

The Smartec infrared sensor SMTIR9901 and SMTIR9902 are sophisticated full silicon infrared sensors. The sensors can be used in measuring the radiation temperature without any contact. For the different radiation temperature ranges various filters are available. The sensor type SMTIR9902 contains a temperature sensor for measuring the temperature of the sensor itself. The temperature range of the sensor-element is between - 40 to 100 °C. The sensor is available in a standard TO-05 encapsulation and with a 5.5. µm. high pass filter.

Easy and accurate measuring of the sensors temperature by means of a built-in temperature sensor (only for type SMTIR9902).

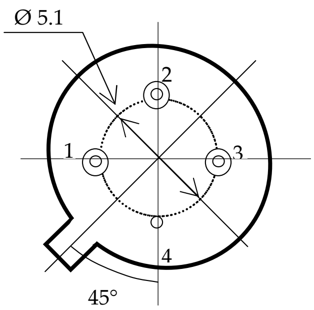
Pin-out and housing (TO 5)





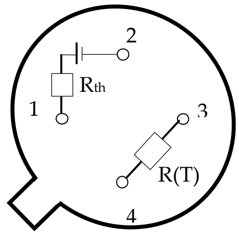
Connection diagram (Bottom view)

All sizes in mm



SMTIR9901

1 = det -
2 = det +
3 = N.C.
4 = GND



SMTIR9902

1 = det -
2 = det +
3 = NI1000
4 = NI1000/GND

SMTIR9901/02 INFRARED SENSORS

Product description.

Thermopiles are based on the Seebeck effect, which can be considered ever since a long time as standard for conventional thermocouples. The application of thin film technology allows the production of miniaturized and low cost sensor elements.

A series connection of thermo junctions deposited on a silicon substrate forms the thermopile. The hot junctions are thermally isolated from the cold junctions on the substrate by etching an extremely thin membrane. A black absorbing layer on the hot junctions transforms the incoming radiation into heat. A voltage proportional to the radiation is generated by the thermoelectric effect.

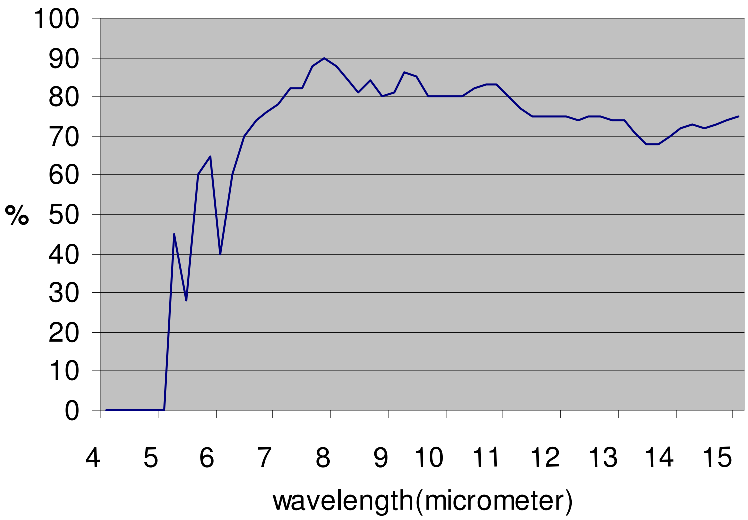
The used thermopiles are processed on 400 µm silicon substrates using BiSb and NiCr for the thermo junctions.

For different radiation spectra various filters are available to find the optimal solution.

Specifications

Parameter	typical	units
Number of thermojunctions	100	
Active area	0,5	mm^2
Die size	2,2 x 2,2	mm^2
Resistance of thermopile (Rth)	50±15	KΩ
Sensitivity	110±20	V/W [1])
Temp. Coeff. Of sensitivity	-0,52±0,08	%/K
Specific Detectivity	2,1 *10E8	cm.Hz½/W [1])
noise equivalent power	0,35	nW [1])
Noise voltage	37	nV/Hz½
Time constant	40±10	ms (63%)
Temperature range (sensor)	-20 - + 100	°C
Storage temperature	-40 - +100	°C
Filter (high pass)	5,5	µm
[1]) at 500 K dc **Reference Thermistor (SMTIR9902 only)**		
Resistance	1,000 ±0,004	KΩ (@ 0 °C

FILTER (characteristic)



Understanding the specifications

Sensitive area.

The sensitive area is a square of 0.5 mm². By using the distance between the sensor element and the glass filter and its diameter the field of view can be determined. The field of view can be changed by using special lenses. In case lenses are used the emissivity and the spectrum has to be considered.

Filter.

The sensors are standard wise equipped with a high pass filter. From the theory it is well known that each body has a radiation at a certain temperature. This radiation temperature has a frequency related to that temperature. For general use the filter used is a high pass filter with a cut-off wavelength of 5.5 µm.

Sensor resistance.

It must be clear that this type of thermopile has a reasonable output resistance. This resistance has to be considered when designing the input amplifier to prevent off-setts, etc.

Time constant.

The time constant is the time needed to reach an output voltage of 63 % of the final signal level. This time constant only depends on the physical construction.

SMTIR9901/02 INFRARED SENSORS

Temperature reference resistor (SMTIR9902).

It is well known that for application on an infrared sensor the temperature of the sensor must be considered in the calculation of the radiation temperature. The used resistor is a standard Ni resistor with a value of 1000 Ω @ 0 °C.

The relation between the resistance value of the temperature sensor and the temperature is given below:

$$R(T)=R0*(1+A*T+B*T^2+C*T^4+D*T^6)$$ tolerance class B

R0= resistance @ 0°C = 1000 Ω
T = Temperature in °C
$A = 5.485 * 10^{-3}$
$B = 6.650 * 10^{-6}$
$C = 2.805 * 10^{-11}$
$D = -2.000 * 10^{-17}$

Ordering information

SMTIR9901 Infrared sensor without Ni temperature sensor

SMTIR9902 Infrared sensor with Ni temperature sensor

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