

# TP297A

## THERMOPILE INFRARED SENSOR

### ■ Features

The thermopile sensor consists of a series of 44 thermoelements, forming a sensitive area of 0.5 x 0.5 mm<sup>2</sup>. The sensor is hermetically sealed into a TO-5 metal housing, with optical filter. This filter allows measurements to be made in the spectral range above 8 µm wavelength. The thermosensor exhibits an almost white noise, comparable to an ohmic resistance. It has a constant signal versus frequency up to its frequency limit, and is directly proportional to incident radiation. The thermopile sensors are featured with an additional thermistor on the same package. The standard version of thermistor is housing connected to ground.

### ■ Applications

- \* Ear thermometers; clinic thermometers
- \* Infrared thermometers
- \* Consumer applications: hair dryer, micro-wave oven, air conditioner, refrigerator
- \* Continuous temperature control of manufacturing
- \* Security system
- \* Radiation monitor switch system
- \* Absorbing measurement for gas analysis
- \* Thermoelectric converter
- \* Heat flux flowmeter

### ■ Electrical Characteristics

## ROITHNER LASERTECHNIK

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Parameter	Condition	Min.	Typ.	Max.	Unit
<b>Thermopile</b>					
Number of thermojunctions		---	44	---	
Chip size		---	1920x1725	---	$\mu\text{m}^2$
Active area	Interference layer	---	500x500	---	$\mu\text{m}^2$
Thickness of substrate	Silicon-substrate	600	625	650	$\mu\text{m}$
Resistance of thermopile	25 °C	60	70	60	KOhm
Chip Sensitivity	With 5-14 $\mu\text{m}$ filter	40	55	70	V/W
Detectivity		$4 \cdot 10^7$	$7 \cdot 10^7$	$9 \cdot 10^7$	$\text{cm} \cdot \text{Hz}^{1/2} / \text{W}$
Time Constant		---	30	---	ms
Noise voltage		---	34	---	$\text{nV}/\text{Hz}^{1/2}$
NEP		---	0.8	---	$\text{nW}/\text{Hz}^{1/2}$
Temperature range	Operation	-20	---	100	°C
<b>Temperature reference resistor</b>					
Resistance (1)	25 °C	29.1	30.0	30.9	KOhm
Resistance (2)	25 °C	97	100	103	KOhm
$\beta$ value (1)	0°C/50 °C	3773	3811	3849	K
$\beta$ value (2)	0°C/50 °C	3950	3970	3990	K

Measured at 1 Hz chopper frequency, within spectral range 5-14  $\mu\text{m}$ , using a blackbody radiator of 500 K temperature.

Note : Thermistor should be operated under 1 mA.

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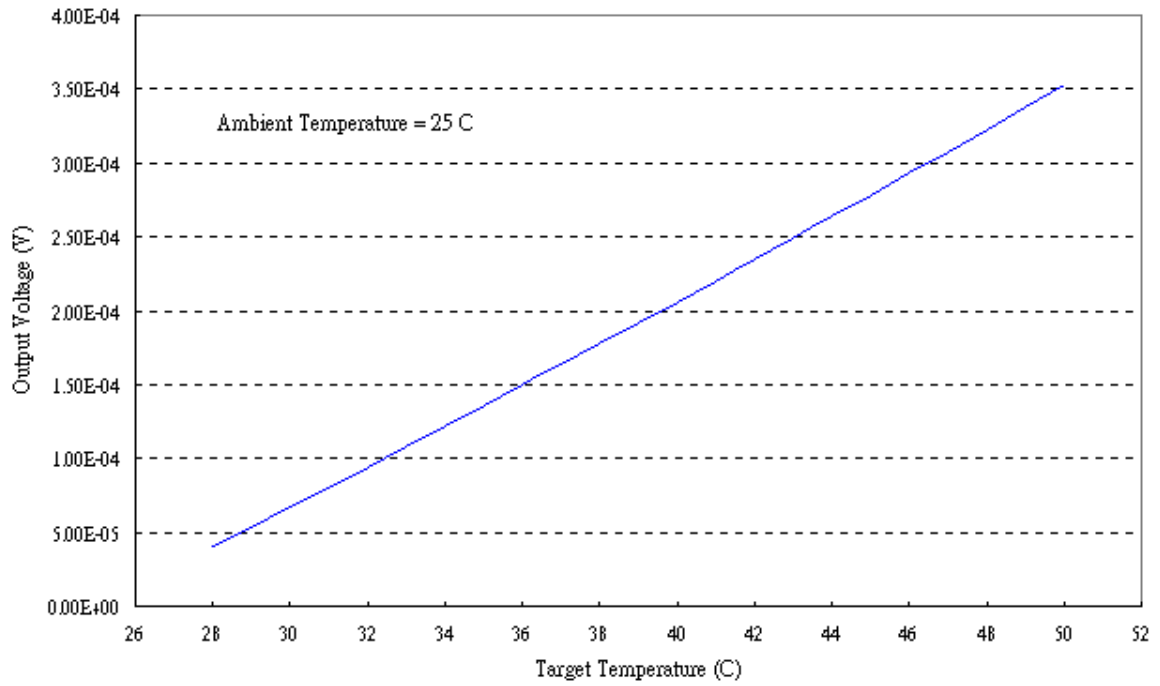
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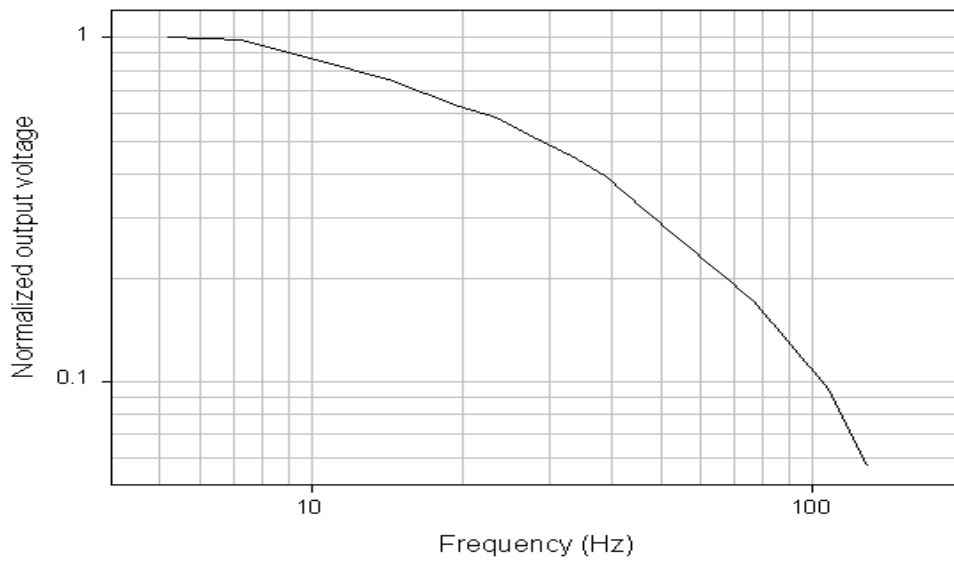
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## Thermopile voltage vs. blackbody temperature



## Frequency response



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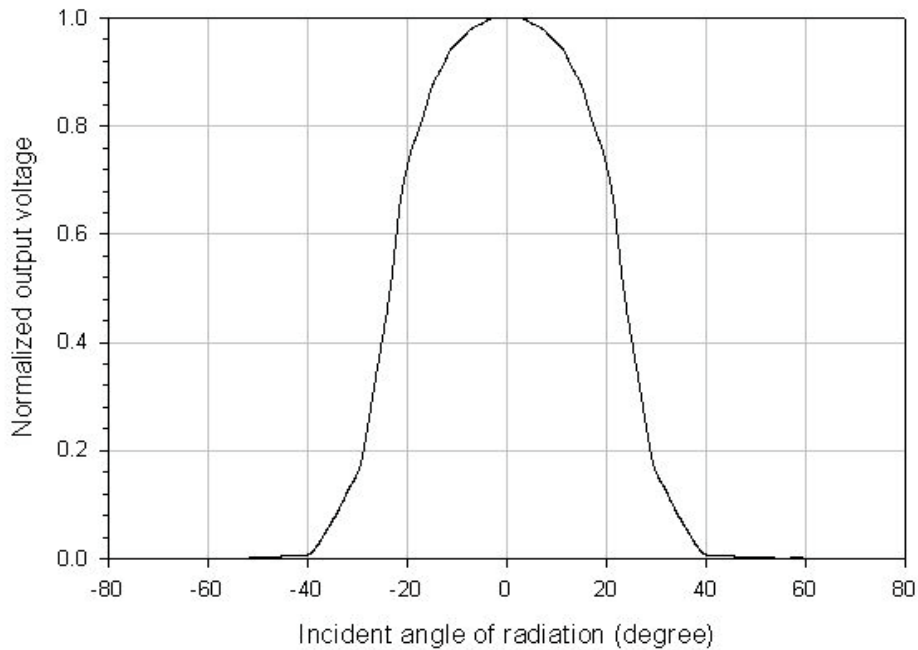
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## ■ Field of view



## ■ Thermistor vs. temperature

At temperature 25 °C,  $R(T) = R_{25} e^{\beta \left[ \frac{1}{T} - \frac{1}{T_{25}} \right]}$  describes the resistance vs. temperature, where  $R_{25}$  is the resistance at ambient temperature 25 °C and  $T$ ,  $T_{25}$  are the ambient temperatures in unit of kelvin degrees.

The resistance of the temperature reference resistor varies with temperature and the behaviour is illustrated in the following figure.

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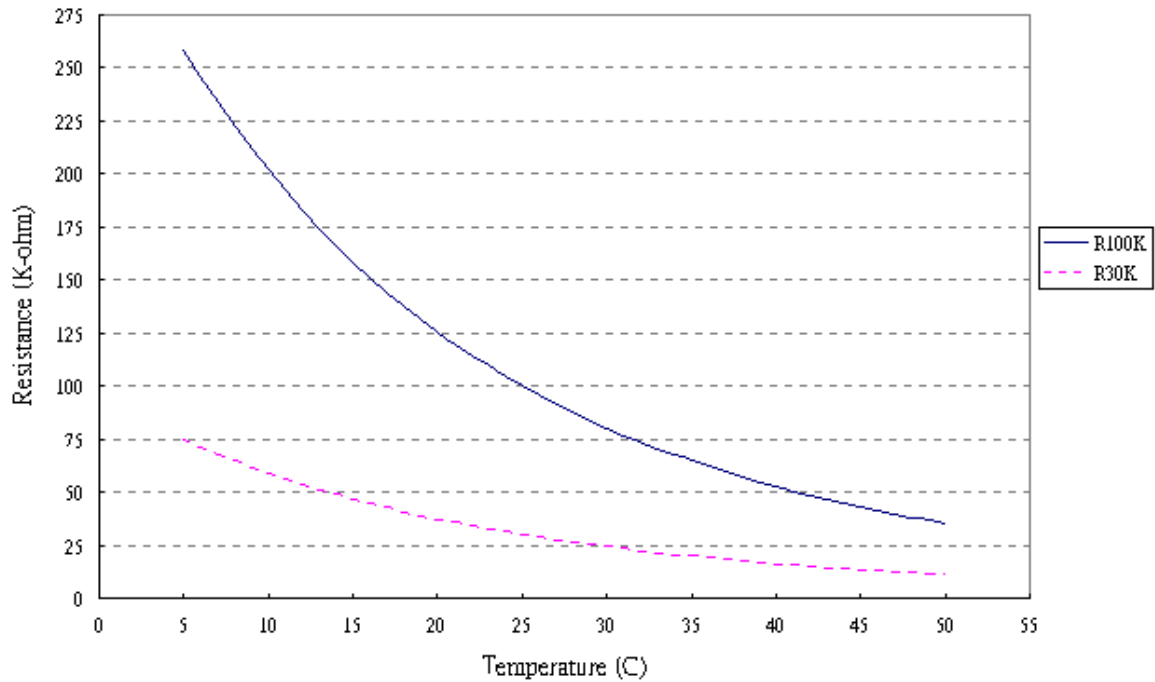
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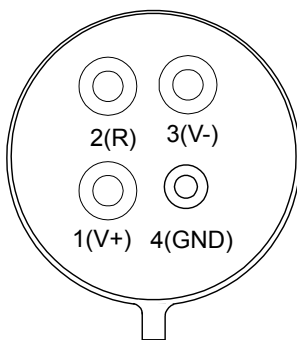
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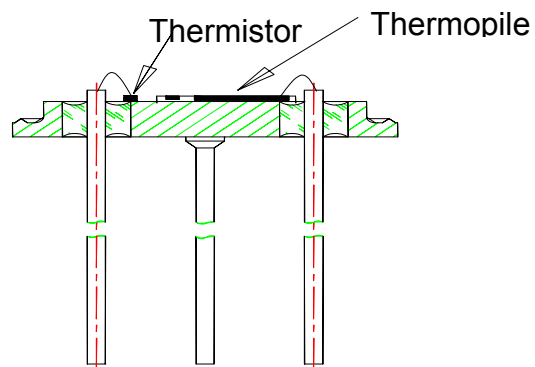


### Pin assignment & description

- 2 thermistor pin
- 4 thermistor pin (GND)
- 1 thermopile output pin (+)
- 3 thermopile output pin (-)



**BACKSIDE VIEW**



**SIDE VIEW**

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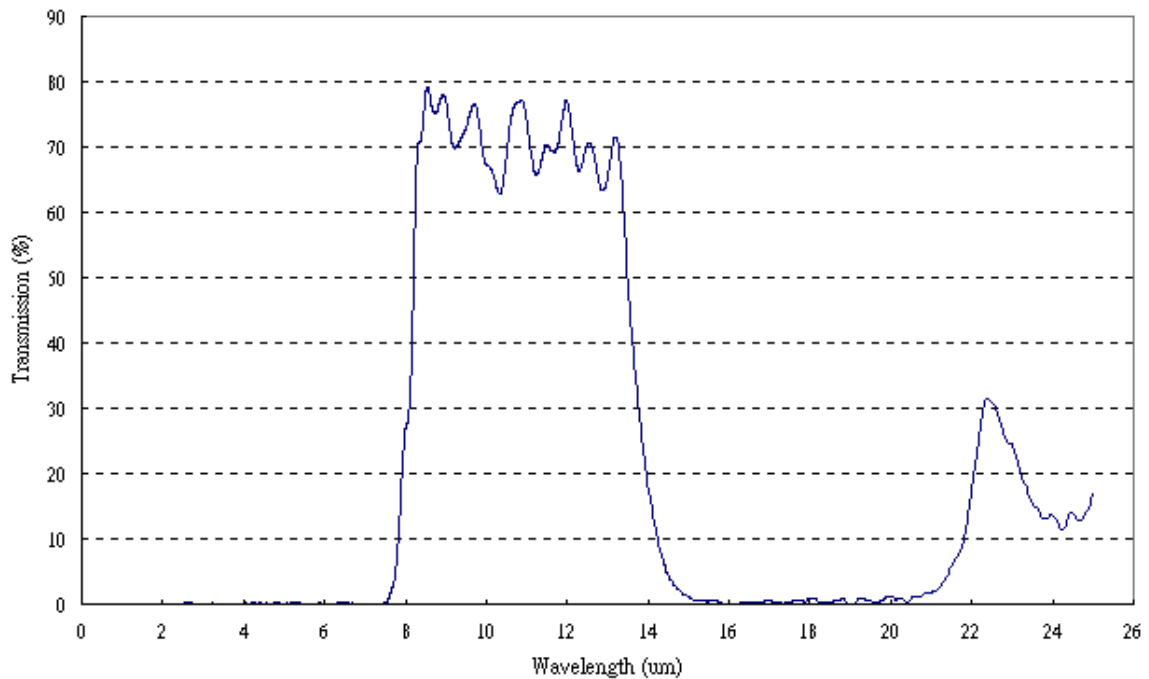
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### Transmission of filter

Cut on wavelength :  $8.0 \pm 0.5$  ( $\mu\text{m}$ )

Cut off wavelength :  $14.0 \pm 0.5$  ( $\mu\text{m}$ )

Minimum average Transmission :  $>70\%$  (with 9~13  $\mu\text{m}$ )



### Package

The sensor is hermetically sealed into a TO-5 metal housing, with optical filter. This filter allows measurements to be made in the spectral range above 8  $\mu\text{m}$  wavelength. The dimensions of header and cap are shown below.

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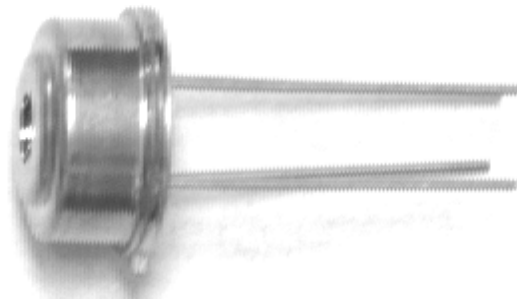
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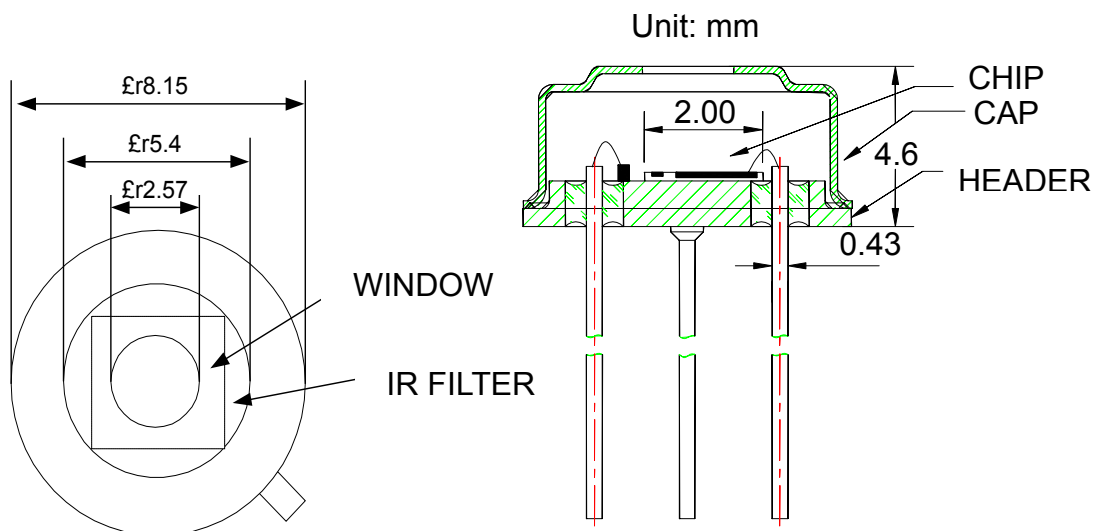
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### ■ Application circuit

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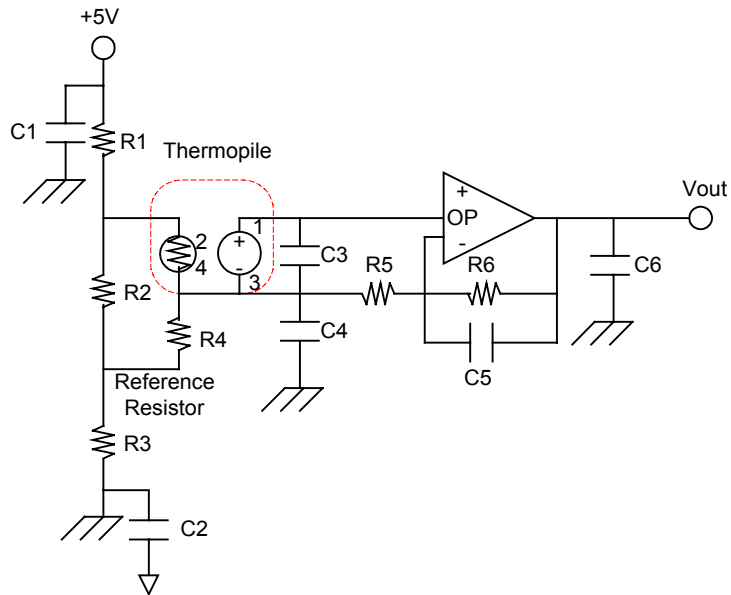
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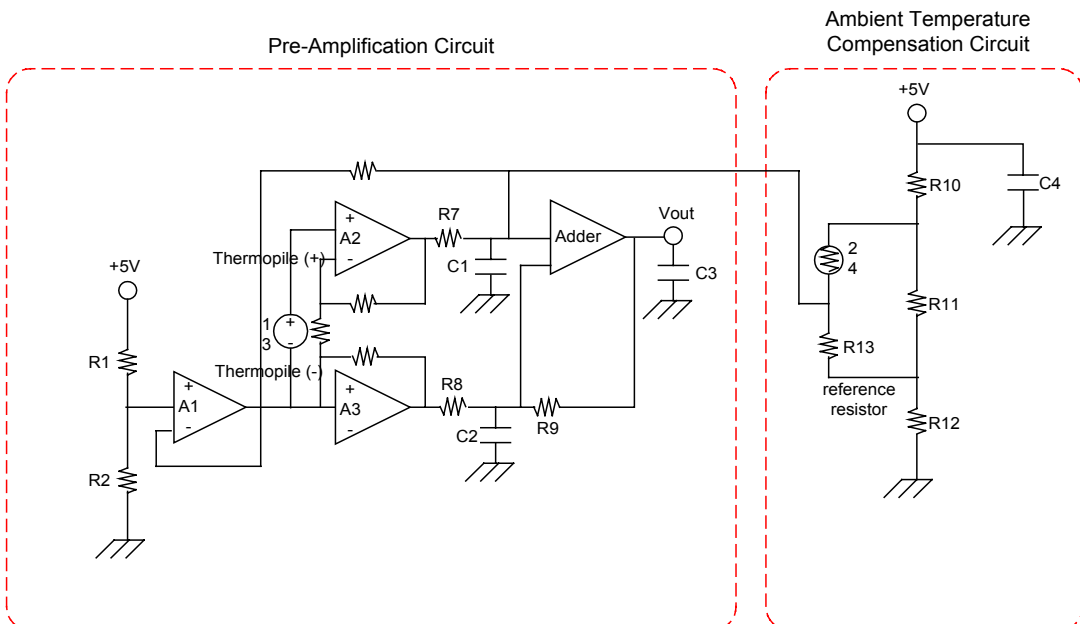
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Circuit 1 :



Circuit 2 :



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