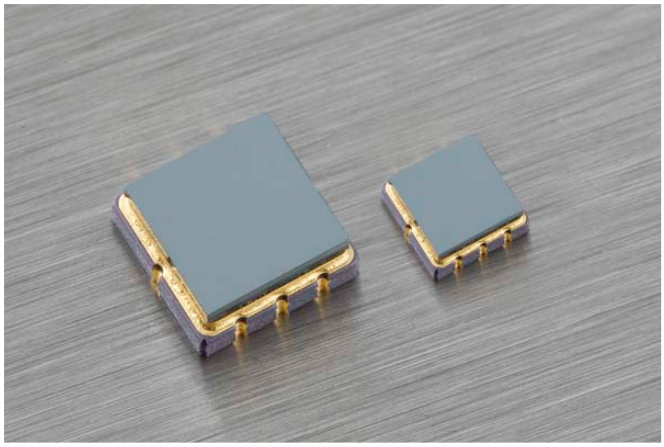
TPS 23S

Thermopile Sensor in SMD Housing

SENSOR SOLUTIONS

DATASHEET



Introduction

PerkinElmer Optoelectronics Thermopile sensors are used for remote temperature sensing by the measurement of infrared (IR) radiation. They consist of a silicon (Si) based thermopile chip in a metal or ceramic based housing with IR transmissive filter. The Si-chip carries a series of thermoelements, forming a sensitive area covered by an IR absorbing material.

The thermopile sensing principle allows for broadband IR measurements. PerkinElmer Optoelectronics thermopile sensors are equipped with a MEMS / MOEMS state-of-the art sensing element and an optical filter that defines the sensitive spectral range of the sensor and at the same time serves as device window.

Properties of TPS 23S

The TPS 23S sensor is sealed into a small ceramic SMD package with IR transmissive window. The window is equipped with an IR longpass filter with 5.5 µm cut-on wavelength.

The TPS 23S is the first SMD thermopile sensor available in industrial quantities.

Besides its advantages in assembly and its smaller size, the package has superior thermal properties, allowing the sensor to operate reliably in challenging environments with thermal gradients and ambient temperature changes.
A 100 kΩ thermistor inside the TO-housing serves as the ambient temperature reference.

Features and Benefits

- Extremely small package
- Thermopile sensor with large absorber area
- High output voltage
- Low thermopile resistance
- High signal to noise ratio
- 5.5 µm IR longpass filter
- Stable signal in the case of ambient thermal shock due to the small housing

Applications

- High precision temperature sensing
- Ear thermometer
- Infrared pyrometry

PerkinElmer® precisely.

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1 General Characteristics

1.1 Absolute Maximum Ratings

Table 1: Absolute Maximum Ratings

Symbol	Parameter	Min	Typ	Max	Unit	Conditions
T_A	Ambient temperature range	-20		100	°C	Operation
T_A	Ambient temperature range	-40		100	°C	Storage

1.2 Handling Requirements

Stresses above the absolute maximum ratings may cause damages to the device. Do not expose the sensor to aggressive detergents such as Freon, Trichloroethylene, etc. Windows may be cleaned with alcohol and cotton swab.

2 Type Characteristics

2.1 Design Characteristics

The Sensor TPS 23S is a lead-free component and fully complies with the RoHS regulations.

Table 2: Design Characteristics

Parameter	Description
Header	Ceramic SMD package
Solder pads	(7 isolated + 1 ground) gold plated solder pads
Filter type	Si-based interference IR longpass filter
Temperature reference	Thermistor 100 kΩ
Insulation gas sealing	The sensor is sealed in a dry Nitrogen environment and gross leak proof

2.2 Electrical Characteristics

Table 3: Thermopile sensor characteristics

Symbol	Parameter	Min	Typ	Max	Unit	Conditions
	Sensitive area		0.2		mm^2	Absorber Ø 0.5 mm (round)
R_{TP}	Resistance	85		135	kΩ	
S_V	Responsivity		42		V/W	Tobj = 500 K (=227°C), Tamb = 298 k (=25°) 1 Hz,
τ	Time constant		15		ms	
V_{RMS}	Noise voltage		40		nV/√Hz	
	TC of resistance		0.03		%/K	
	TC of sensitivity		-0.05		%/K	

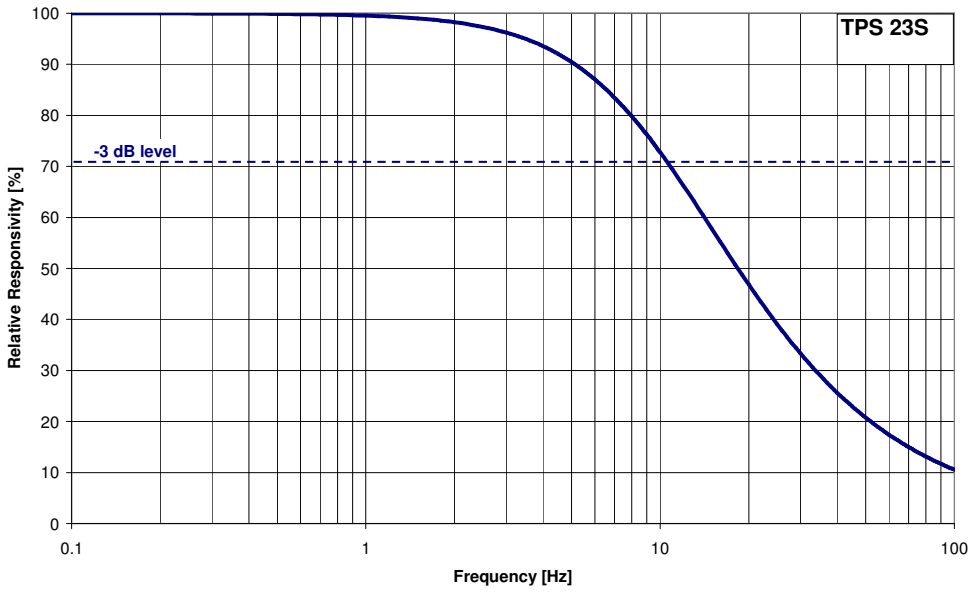

Figure 1 Relative Detector Responsivity as a Function of Frequency

Figure 1 shows the calculated relative signal output as a function of the thermal radiation signal chopping frequency. The -3 dB level at 71% relative output level defines the cut-off frequency f_{co} and thus the time constant τ via $\tau = 1/2\pi f_{co}$.

Table 4: Thermistor 100 kΩ

Symbol	Parameter	Min	Typ	Max	Unit	Conditions
R25	Base resistance	95	100	105	kΩ	Tamb = 25°C
ß	BETA -value		4097		K	Defined at 25°C/100°C
ß	BETA - tolerance			± 0.3	%	

Table 5: Tabulated Thermistor Data

Temp.	R_{min}	R_{nom}	R_{max}
°C	Ω	Ω	kΩ
-20	901230	955110	1009670
-15	681540	721680	762270
-10	519600	549750	580190
-5	399210	422040	445060
0	309003	326423	343963
5	240890	254280	267740
10	189070	199440	209840
15	149380	157460	165560
20	118770	125100	131450
25	95000	100000	105000
30	76330	80400	84480
35	61680	65010	68350
40	50110	52850	55600
45	40926	43188	45462
50	33593	35471	37361
55	27709	29275	30853
60	22964	24275	25597
65	19118	20221	21334
70	15986	16918	17858
75	13425	14214	15013
80	11321	11993	12673
85	9585	10159	10740
90	8147	8639	9137
95	6950	7374	7803
100	5952	6317	6688

R_{min} : Minimum thermistor resistance
R_{nom} : Typical thermistor resistance
R_{max} : Maximum thermistor resistance

2.3 Optical Characteristics

Table 6: Optical Characteristics

Symbol	Parameter	Min	Typ	Max	Unit	Conditions
	Field of view		114		degree	At 50% target signal
	Optical axis			+/- 10	degree	

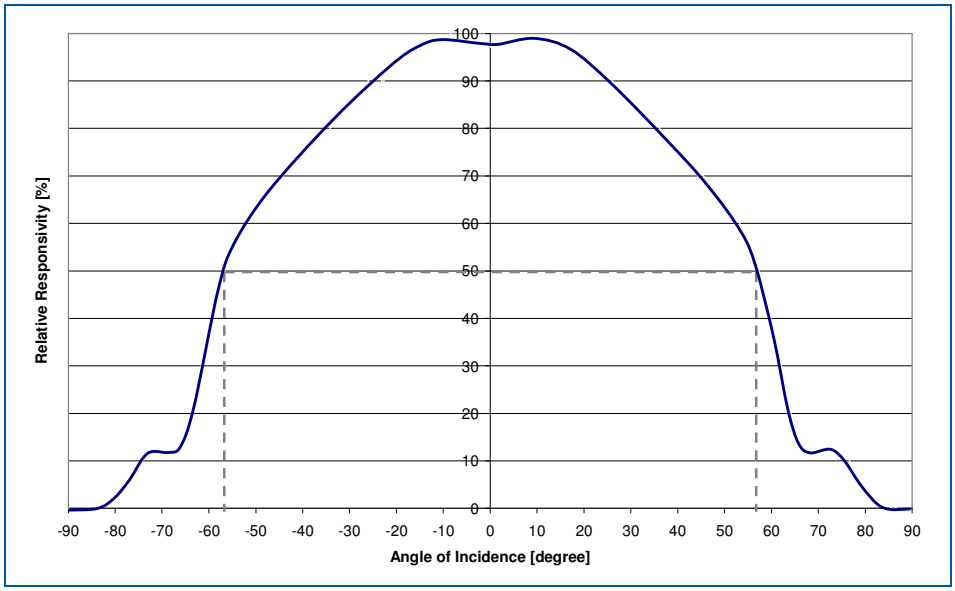

Figure 2 Field of View Curve

Table 7: Filter Parameters

Symbol	Parameter	Min	Typ	Max	Unit	Conditions
T_A	Average transmittance	75	> 77		%	Wavelength range from 7.5 µm to 13.5 µm
T_A	Average transmittance			< 0.5	%	Wavelength range < 5 µm
λ (5 %)	Cut on wavelength	5.2	5.5	5.8	µm	At 25°C

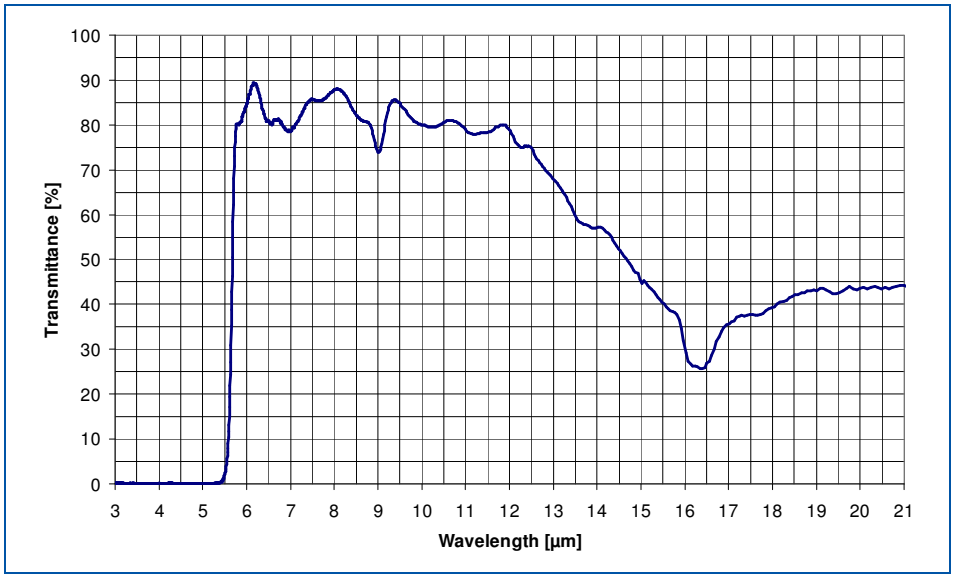

Figure 3 Transmission Curve for PerkinElmer Standard Filter

2.4 Mechanical Drawing

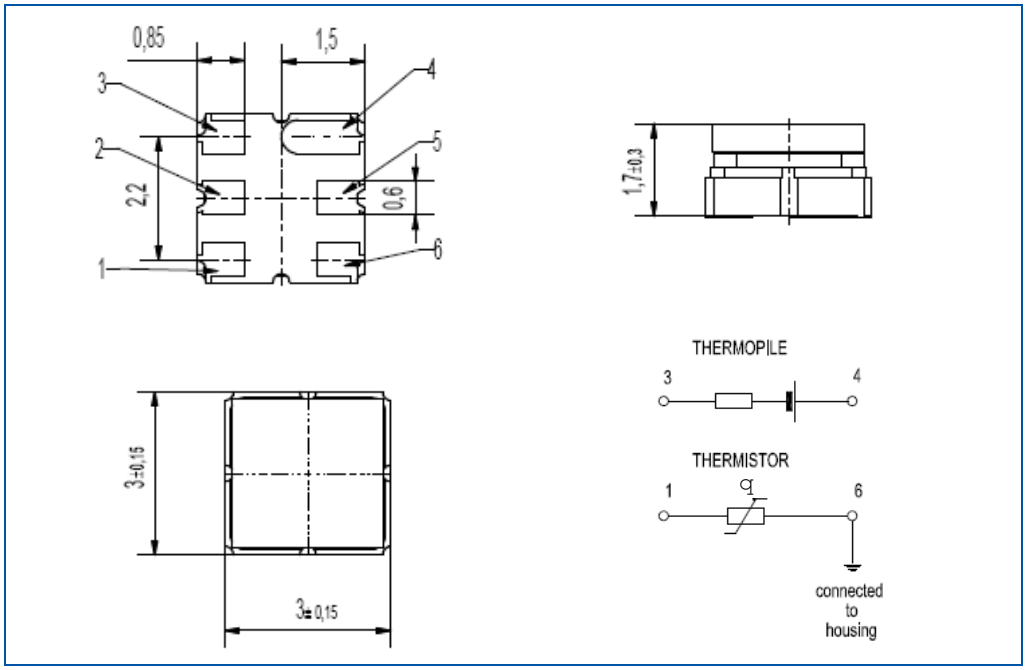

Figure 4 Mechanical Drawing of the TPS 23S (Drawing No.: 2/71788)

2.5 Soldering

The A2TPMI 23S is a lead-free component and fully complies with the RoHS regulations, especially with existing roadmaps of lead-free soldering. Reflow soldering is recommended. A typical lead free reflow profile is shown in figure 4. Specific reflow soldering parameters depend on the solder alloy used.

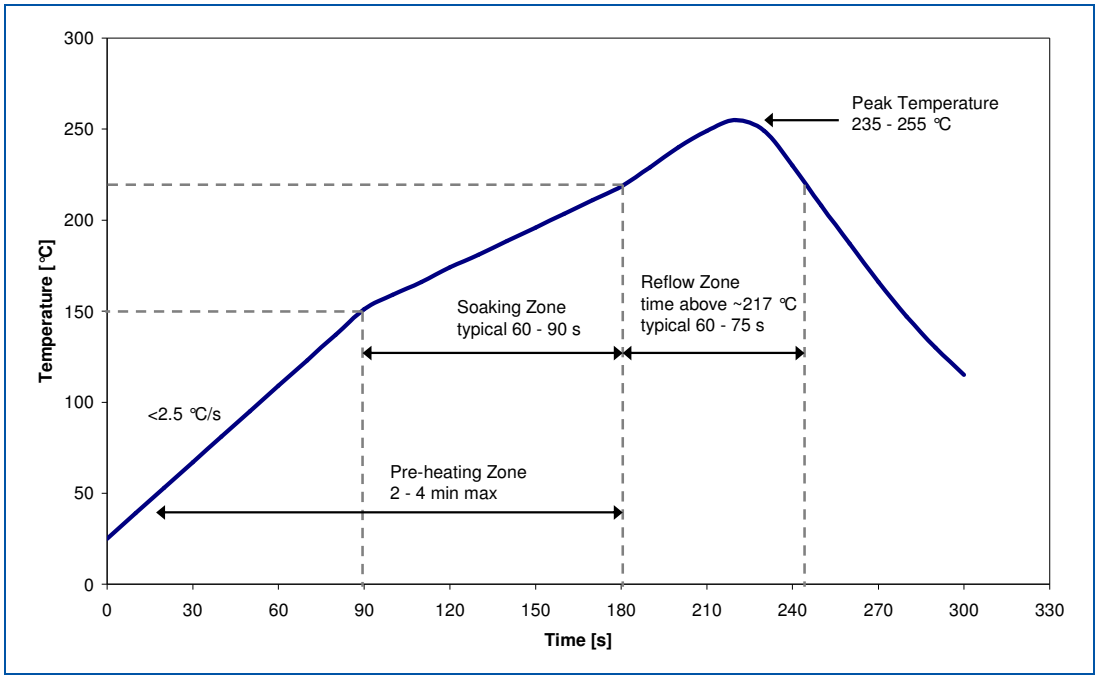

Figure 5 Typical Lead Free Reflow Profile

3 Quality Statement

PerkinElmer Optoelectronics is an ISO 9001:2002 and ISO/TS 16949:2002 certified manufacturer. All devices employing PCB assemblies are manufactured according IPC-A-610 guidelines.

3.1 Liability Policy

The contents of this document are subject to change without notice and customers should consult with PerkinElmer Optoelectronics sales representatives before ordering. Customers considering the use of PerkinElmer Optoelectronics thermopile devices in applications where failure may cause personal injury or property damage, or where extremely high levels of reliability are demanded, are requested to discuss their concerns with PerkinElmer Optoelectronics sales representatives before such use. The Company's responsibility for damages will be limited to the repair or replacement of defective product. As with any semiconductor device, thermopile sensors or modules have a certain inherent rate of failure. To protect against injury, damage or loss from such failures, customers are advised to incorporate appropriate safety design measures into their product.

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