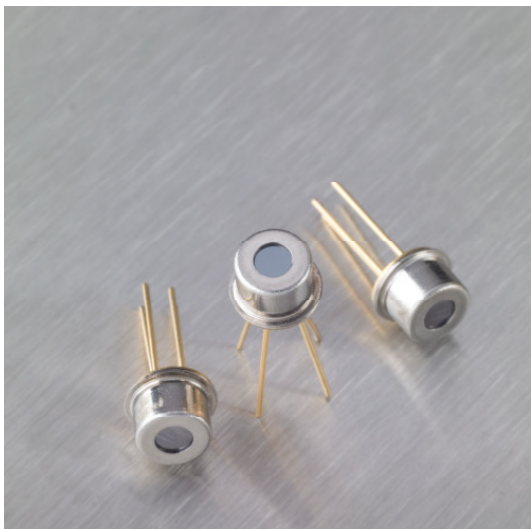


Thermopile Sensor

TPS 230 / 3365

Revision - Date: 2007/11/12



Introduction

PerkinElmer introduces the new TPS 230 as part of the TPS 23x family for low-cost remote temperature measurement applications. It consists of a silicon (Si) based thermopile chip in a metal housing with IR transmissive filter. The Si-chip carries a series of thermoelements, forming a sensitive area covered by an IR absorbing material.

With its optimized output signal, the TPS 23x family replaces the TPS 43x series by offering better performance at a lower cost.

The thermopile sensing principle allows for broadband IR measurements. PerkinElmer Opto-electronics 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 230

The TPS 230 is a miniature thermopile sensor in the extremely small TO-41 (3.5 mm cap diameter) housing. It is especially suited for compact ear thermometer solutions.

The sensor employs a very small thermopile chip with a 0.5 mm round active area allowing small spot sizes in pyrometer applications. The chip is optimized for a large output signal.

The round window is equipped with an PerkinElmer's standard IR longpass filter with 5.5 μm cut-on wavelength. The frequency behavior corresponds to a low pass characteristic.

A 100 k Ω thermistor inside the TO-housing serves as the ambient temperature reference.

Features and Benefits

- Miniature TO-41 housing (3.5 mm \varnothing)
- Small and perfectly round measurement spot
- Large output voltage
- High signal to noise ratio
- 5.5 μm IR longpass filter
- Stable signal in the case of ambient thermal shock due to the small TO-41 housing
- RoHS compliant – Si-chip made by standard CMOS processes

Applications

- Compact ear thermometer
- High precision remote temperature sensing
- Infrared pyrometry

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1 General Characteristics

1.1 Absolute Maximum Ratings

Table 1: Absolute Maximum Ratings

Symbol	Parameter	Min	Typ	Max	Unit	Conditions
TA	Ambient temperature range	-20		100	°C	Operation
TA	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. Hand soldering and wave soldering may be applied by a maximum temperature of 260 °C for a dwell time less than 10 s. Avoid heat exposure to the top and the window of the detector. Reflow soldering is not recommended.

2 Type Characteristics

2.1 Design Characteristics

The Sensor TPS 230 is a lead-free component and fully complies with the RoHS regulations.

Table 2: Design Characteristics

Parameter	Description
Cap	Metal cap with integrated IR window
Header	TO 41
Leads	(3 isolated + 1 ground) pins with solderable gold coating
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
Device marking	PerkinElmer Logo "P" + device number xxxx + 3 digits date code YWW

2.2 Electrical Characteristics

Table 3: Thermopile sensor characteristics

Symbol	Parameter	Min	Typ	Max	Unit	Conditions
	Sensitive Area		0.2		mm ²	Absorber Ø0.5 mm (round)
R _{TP}	Resistance	85		135	kΩ	
S _V	Responsivity		42		V/W	T _{obj} = 500 K (=227 °C), T _{amb} = 298 K (=25 °C) 1Hz,
ΔU / ΔT	Average sensitivity		28		μV/K	T _{obj} = 313 K (=40 °C), T _{amb} = 298 K (=25 °C)
ΔU / ΔT	Average sensitivity		36		μV/K	T _{obj} = 373 K (=100 °C), T _{amb} = 298 K (=25 °C)
τ	Time constant		15		ms	
V _{RMS}	Noise voltage		40		nV/√Hz	
	TC of resistance		0.03		%/K	
	TC of sensitivity		-0.05		%/K	

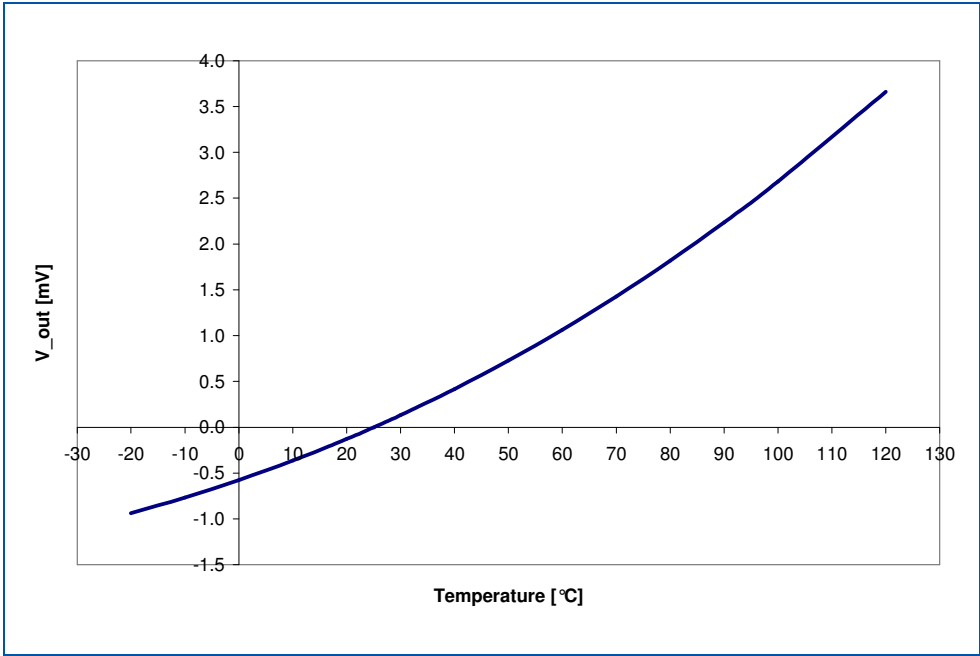


Figure 1: Typical output voltage versus object temperature with sensor at 25 °C.

Table 4: Typical numerical data of Thermopile's output voltage (sensor at 25 °C)

Temp. °C	V_out mV
-20	-0.94
-10	-0.77
0	-0.58
10	-0.36
20	-0.13
25	0.00
30	0.13
40	0.42
50	0.73
60	1.06
70	1.43
80	1.82
90	2.24
100	2.68
120	3.66

Table 5: Thermistor 100 k Ω

Symbol	Parameter	Min	Typ	Max	Unit	Conditions
R25	Base resistance	95	100	105	k Ω	Tamb = 25° C
β	BETA -value		3964		K	Defined at 25° C/100° C
β	BETA - tolerance			± 0.3	%	

Table 6: Tabulated Thermistor Data

Temp. °C	R _{min1} Ω	R _{min2} Ω	R _{nom} Ω	R _{max2} Ω	R _{max1} Ω
-20	862756	909418	915479	921581	968201
-15	655207	690548	694575	698625	733944
-10	501697	528693	531349	534018	561001
-5	387196	407985	409715	411452	432234
0	301098	317232	318336	319444	335574
5	235852	248468	249149	249832	262445
10	186038	195972	196369	196767	206701
15	147731	155608	155815	156022	163900
20	118070	124357	124439	124521	130808
25	95000	100000	100000	100000	105000
30	76707	80791	80843	80895	84978
35	62328	65649	65732	65815	69137
40	50926	53643	53743	53843	56559
45	41833	44067	44175	44283	46516
50	34541	36387	36497	36608	38453
55	28662	30195	30303	30412	31944
60	23898	25176	25280	25385	26663
65	20017	21089	21187	21286	22357
70	16842	17744	17836	17928	18830
75	14231	14994	15079	15165	15927
80	12075	12721	12800	12879	13526
85	10286	10838	10910	10983	11534
90	8796	9268	9334	9401	9872
95	7550	7956	8016	8077	8481
100	6504	6853	6908	6964	7313

- R_{min1} : Minimum Thermistor Resistance resulting from the Total Tolerance
- R_{min2} : Minimum Thermistor Resistance resulting from the BETA-Tolerance
- R_{nom} : Typical Thermistor Resistance
- R_{max1} : Maximum Thermistor Resistance resulting from the Total Tolerance
- R_{max2} : Maximum Thermistor Resistance resulting from the BETA-Tolerance

2.3 Optical Characteristics

Table 7: Optical Characteristics

Symbol	Parameter	Min	Typ	Max	Unit	Conditions
	Field of view		82		degree	At 50% target signal
	Optical axis		0	+/- 10	degree	

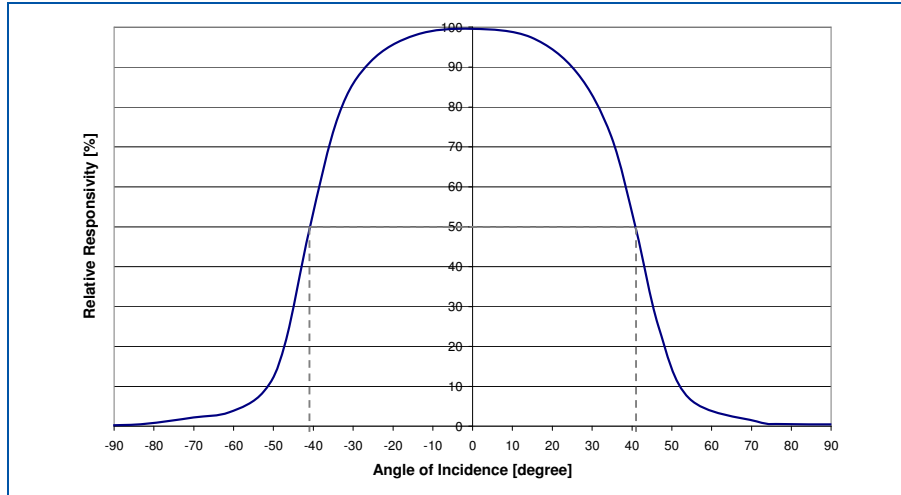


Figure 2: Field of View Curve

Table 8: Filter Parameters

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

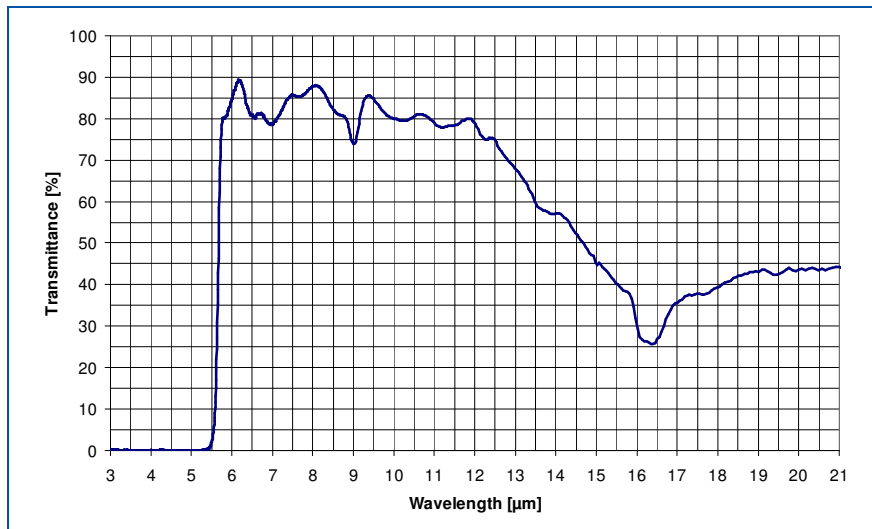


Figure 3: Transmission Curve for PerkinElmer Standard Filter

2.4 Mechanical Drawing

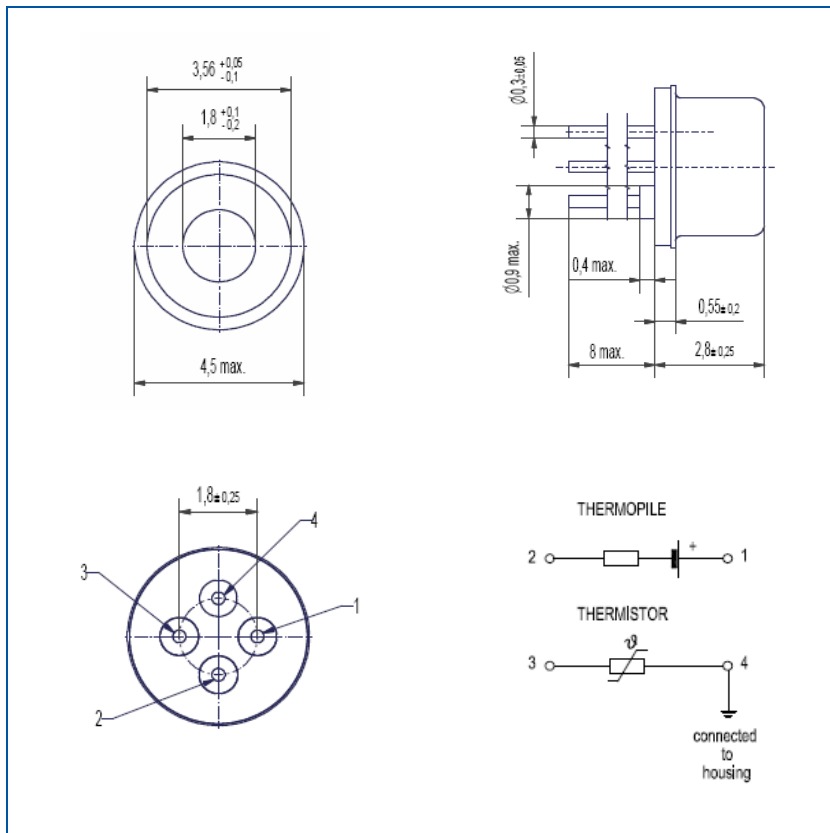


Figure 4: Mechanical Drawing of the TPS 230

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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