Thermopile Sensor
TPiS 1T 0136 L5.5 OAA250

Revision1 - Date: 2018/08/29

Features and Benefits

- Internal signal processing
- Factory calibrated
- Optics available
- Ambient temperature compensation
- ISOthermal housing

Target Applications

- General purpose temperature monitoring

Reference Document:	
Product Name: TPiS 1T 0136 L5.5 OAA250	**Part Number:** 6339
Sensing Range: -20…250 °C	
Accuracy:	± 1.5 K @ calibration point (Tobj = 180°C , Tamb = 25°C) ± 2.5 K @ (100°C ≤ Tobj ≤ 250°C , Tamb = 10 … 80°C)

1 Maximum Ratings

Table 1: Absolute Maximum Ratings

Parameter	Min	Max
Supply voltage V_{DD}	-0.3 V	+6.5 V
Storage temperature range Note 1)	-40° C	100° C
Operating temperature range	-25° C	100° C
Voltage at all inputs and outputs Note 2)	-0.3 V	V_{DD} +0.3 V
Current at input pins Note 2)		+/- 5 mA
Lead temperature (Soldering, 10 sec)		+300° C
ESD tolerance Note 3)		2.5 kV

Note 1: Extension to 120° C for limited periods of several minutes possible.
Note 2: Limiting input pin current is only necessary for input voltages that exceed absolute maximum input voltage ratings.
Note 3: Human body model, 1.5 kΩ in series with 100 pF. All pins rated per method 3015.7 of MIL-STD-883.

Static-sensitive device. Unused devices must be stored in conductive material. Protect devices from static discharge and static fields. Stresses above those listed under “Absolute maximum ratings” may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.
Precautions should be taken to avoid reverse polarity of power supply. Reversed polarity of power supply results in a destroyed unit.
Do not expose the sensors to aggressive detergents such as freon, trichlorethylen, etc. Optical windows (e.g. filter, lens) may be cleaned with alcohol and a cotton swab.

2 Sensor Characteristics

Table 2: Electrical Characteristics

Symbol	Parameter	Min	Typ	Max	Unit	Conditions
Power Supply						
V_{DD}	Supply Voltage	4.5	5	5.5	V	
I_{DD}	Supply Current		1.5	2	mA	R_L > 1 MΩ
Outputs V_{Tobj} / V_{Tamb}						
V_O	Output Voltage Swing	0.25		V_{DD} – 0.25	V	I_{out}: -100 µA … +100 µA
R_O	Output Resistance			100	Ω	
R_L	Resistive Output Load	50			kΩ	
C_L	Capacitive Output Load		100	500	pF	
ISC	Output short circuit current		6		mA	Sourcing
			13		mA	Sinking
V_{oL}	Low level output voltage			0.5	V	output current ≤ 2mA
V_{oH}	High level output voltage	V_{DD} – 0.6			V	output current ≥ 2mA
Reference Voltage						
V_{Ref}	Reference voltage	1.223	1.225	1.227	V	R_L > 1MΩ, T_{amb} = 25°C
TC_{VRef}	Temperature coefficient of reference voltage		±30	±100	ppm K^{-1}	

Unless otherwise indicated, all limits specified for T_{amb} = 25°C, V_{DD} = +5 V

Table 3: AC Characteristics

Symbol	Parameter	Min	Typ	Max	Unit	Conditions
In_N	V1 Input referred voltage noise			120	nV/√Hz	rms value
t_{Strt}	Response time after power on			1	s	
t_{lat}	Latency time for V_{Tobj}			75	ms	
t_{resp}	Response time		100	150	ms	

Unless otherwise indicated, all limits specified for T_{amb} = 25°C, V_{DD} = +5 V

Table 4: Thermopile Characteristics

Symbol	Parameter	Min	Typ	Max	Unit	Conditions
TPS 1T 01						
S	Sensitive (absorber) area		0.2		mm^2	
N	Noise voltage		42		nV/√Hz	
τ	Time constant		16		ms	

Table 5: V_{Tobj} Characteristics

Temperature [°C]	Min	Typ	Max	Unit	Gradient [V*K^{-1}]
-20	1.057	1.063	1.070	V	0.0026
-5	1.099	1.107	1.115	V	0.0032
10	1.151	1.161	1.171	V	0.0039
25	1.213	1.225	1.237	V	0.0047
40	1.287	1.301	1.315	V	0.0055
55	1.374	1.390	1.406	V	0.0064
70	1.476	1.494	1.513	V	0.0074
85	1.593	1.614	1.635	V	0.0085
100	1.727	1.751	1.776	V	0.0098
115	1.879	1.907	1.935	V	0.0111
130	2.053	2.084	2.115	V	0.0125
145	2.248	2.283	2.318	V	0.0141
160	2.467	2.506	2.545	V	0.0157
180	2.817	2.844	2.871	V	0.0181
190	2.984	3.032	3.081	V	0.0194
205	3.285	3.338	3.392	V	0.0214
220	3.616	3.675	3.734	V	0.0236
235	3.981	4.045	4.110	V	0.0258
250	4.381	4.451	4.522	V	0.0282

Unless otherwise indicated, all limits specified for V_{DD} = +5 V, V_{Ref} = +1.225 V

Polynomial to calculate Tobj from V_{Tobj}:

$$Tobj\ [°C] = -1.265389\ x^6 + 24.11834\ x^5 - 187.25826\ x^4 + 759.8241\ x^3 - 1714.793\ x^2 + 2127.80\ x - 1046.89$$

x = V_{TObj} in Volt

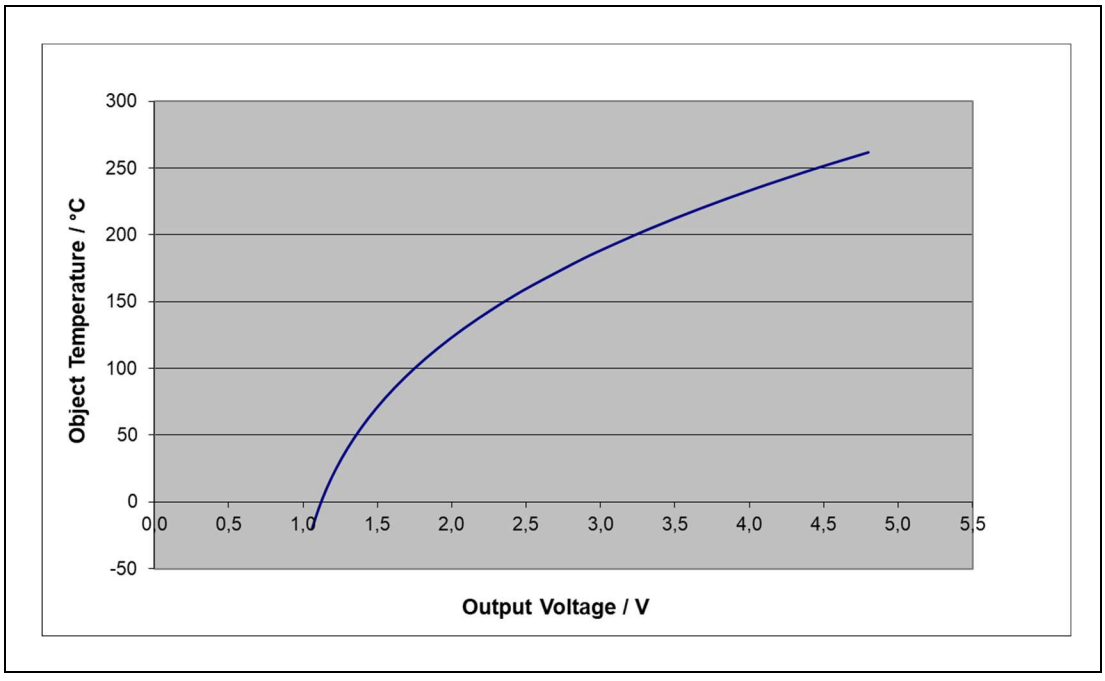


Figure 1: Output characteristic

Table 6: V_{Tamb} Characteristics

Temperature [°C]	Min	Typ	Max	Unit	Gradient [mV*K^{-1}]
-20		0.961		V	0.9
-10	0.974	0.981	0.987	V	3.1
0	1.012	1.023	1.033	V	5.3
10	1.072	1.087	1.102	V	7.5
15	1.110	1.128	1.145	V	8.6
20	1.154	1.173	1.193	V	9.7
25	1.203	1.225	1.247	V	10.9
30	1.258	1.282	1.306	V	12.0
35	1.318	1.345	1.371	V	13.1
40	1.384	1.413	1.441	V	14.2
50	1.533	1.565	1.598	V	16.4
60	1.703	1.740	1.778	V	18.6
70	1.896	1.937	1.979	V	20.8
80	2.110	2.157	2.203	V	23.0
90	2.347	2.398	2.448	V	25.2
100	2.606	2.661	2.716	V	27.4

Unless otherwise indicated, all limits specified for V_{DD} = +5 V, V_{Ref} = +1.225 V

Polynomial to calculate Tamb from V_{Tamb}:

$$Tamb\ [°C] = -35.796203\ x^6 + 413.39529\ x^5 - 1967.39585\ x^4 + 4946.6839\ x^3 - 6957.641\ x^2 + 5273.85\ x - 1676.93$$

$x = V_{Tamb}$ in Volt ; $0°C \leq T_{amb} \leq 100°C$

3 Optical Characteristics

Table 7: Optical Characteristics

Symbol	Parameter	Min	Typ	Max	Unit	Conditions
Cap Type TO39 L5.5						
FOV	Field of view in X direction		4.5	7	°	50 % rel. output signal
OA	Optical axis	-3.5	0	3.5	°	in reference to symmetrical axis of cap
D:S	Distance to Spot ratio		11:1			

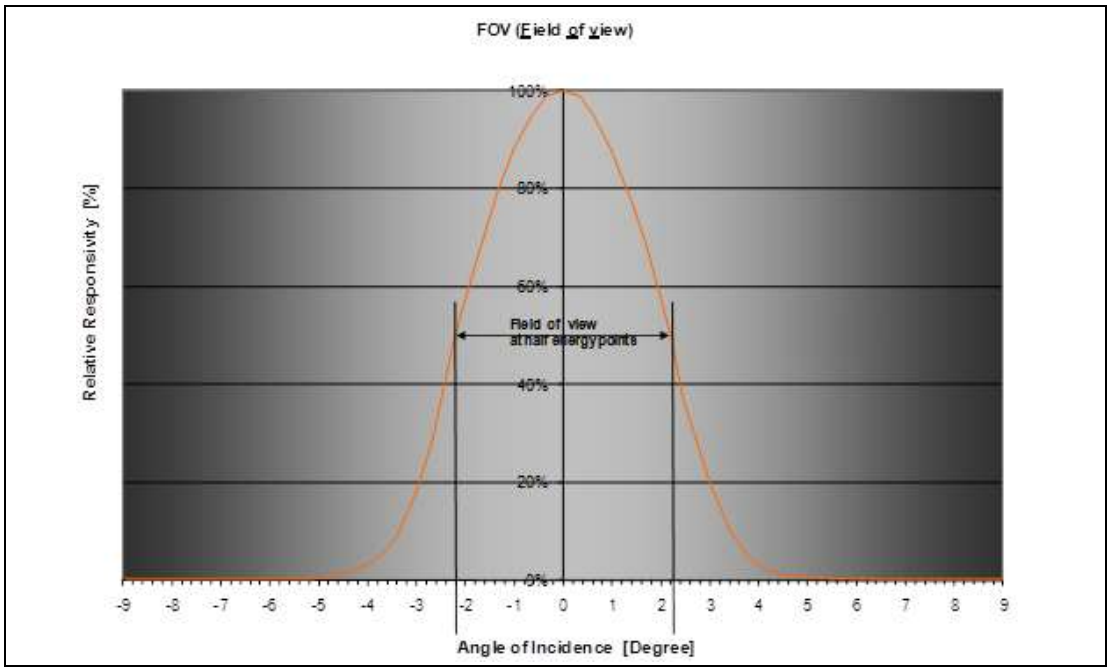


Figure 2: Typical Field of View characteristic

Table 8: Filter Parameters

Parameter	Min	Typ	Max	Unit	Conditions
Uncoated Silicon Lens (G12)					
Average Transmission	52			%	Wavelength range from 5.5 µm to 13.5 µm

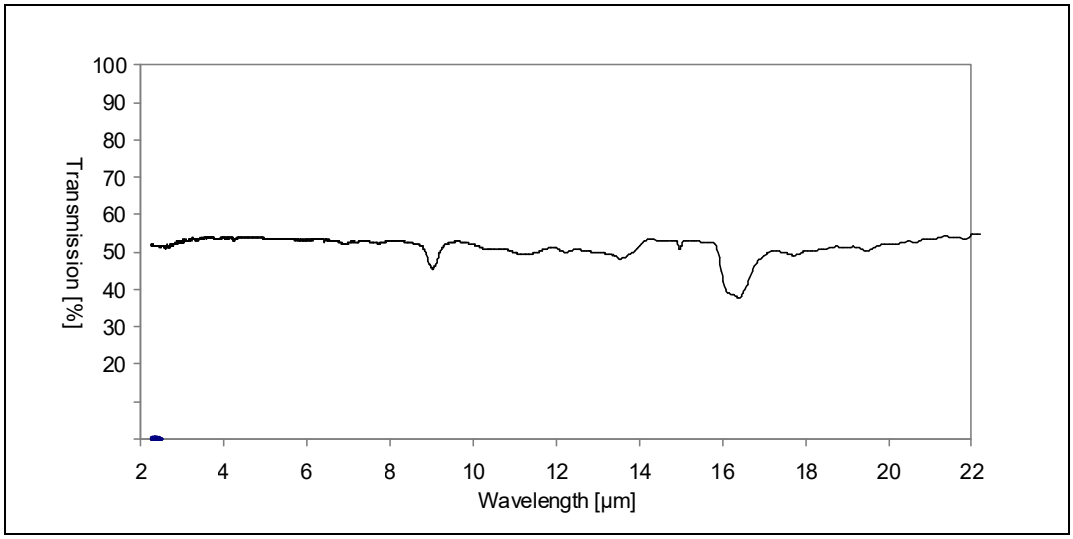


Figure 3: IR-Filter characteristic

4 Configuration

Feature	Adjustment	
Ambient Temperature Compensation	Enabled	✔
	Disabled	
V_{Tamb}/V_{Ref} Output Signal	Reference Voltage V_{Ref}	
	V_{Tamb} Signal	✔
V_{Tobj} Output Configuration	Analog Mode	✔
	Comparator Mode	
V_{Tamb} Output Configuration	Analog Mode	✔
	Comparator Mode	

5 Test Conditions

Object Size	Full FOV Coverage
Object Emissivity	> 99%
Object Temperature	180°C ± 1°C
Ambient Temperature	25°C ± 1°C
Supply Voltage	5V
Test Level	100%

Test pass criteria:

		V_{Tobj}			V_{Tamb}		
Tobj	**Tamb**	**Minimum**	**Typical**	**Maximum**	**Minimum**	**Typical**	**Maximum**
°C	°C	V	V	V	V	V	V
180	25	2.817	2.844	2.871	1.203	1.225	1.247

6 Mechanical Dimensions

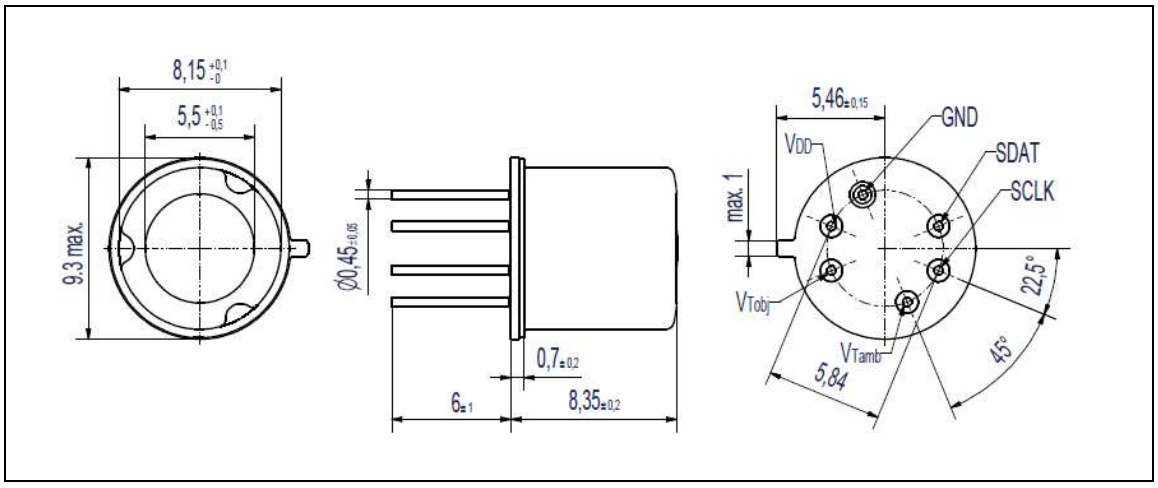


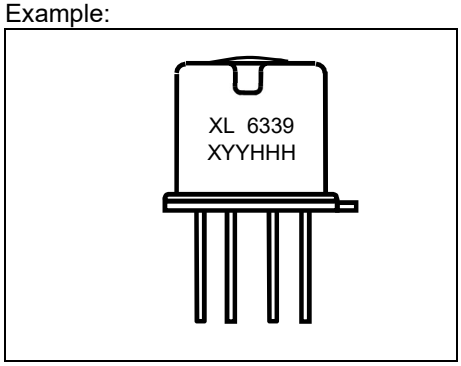
Figure 4: Mechanical dimensions of TPiS 1T 0136 L5.5 sensor

7 Labeling

Sensor:

SSSS	Last four digits of the device part number
XYY	X = Last digit of the calendar year, YY = Week of the calendar year
HHH	Serial number of the production lot

Example:



8 Quality Statement

Excelitas Technologies is an ISO 9001 certified manufacturer. All devices employing PCB assemblies are manufactured according IPC-A-610 guidelines.
The sensor fully complies with the European RoHS environmental directives against the use of hazardous materials in electrical and electronic equipment.

8.1 Liability Policy

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