SENSOR SOLUTIONS

Product Specification

Thermopile Sensor
TPS 1T 0236 L5.5 OAA300

Revision16 - Date: 2013/11/21

Features and Benefits

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

Target Applications

- General purpose temperature monitoring

Reference Document:	
Product Name: TPS 1T 0236 L5.5 OAA300	**Part Number:** 6260
Sensing Range: -20…300 °C	
Accuracy: ± 2.5 K @ Tobj = 100 - 300°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 02						
S	Sensitive (absorber) area		0.7 x 0.7		mm^2	
N	Noise voltage		38		nV/√Hz	
τ	Time constant		25		ms	

Table 5: V_{Tobj} Characteristics

Temperature [°C]	Min	Typ	Max	Unit	Gradient [V*K^{-1}]
-20	1.106	1.110	1.115	V	0.0019
0	1.147	1.153	1.160	V	0.0024
25	1.217	1.225	1.233	V	0.0033
40	1.269	1.279	1.289	V	0.0039
60	1.353	1.365	1.377	V	0.0048
80	1.456	1.471	1.485	V	0.0058
100	1.580	1.598	1.615	V	0.0069
120	1.728	1.749	1.769	V	0.0082
140	1.902	1.926	1.950	V	0.0096
150	2.000	2.026	2.052	V	0.0104
160	2.106	2.133	2.161	V	0.0111
170	2.219	2.249	2.279	V	0.0120
180	2.341	2.373	2.405	V	0.0128
200	2.612	2.648	2.685	V	0.0147
220	2.920	2.962	3.004	V	0.0167
240	3.271	3.318	3.365	V	0.0189
260	3.666	3.719	3.772	V	0.0212
280	4.108	4.168	4.227	V	0.0237
300	4.602	4.668	4.734	V	0.0264

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

Note 4: A temperature gradient over the sensor can result in a reduction of the accuracy.

Polynomial to calculate Tobj from VTobj (optimized between -20°C and 300°C) :

$$Tobj\,[°C] = -2.815556\,x^6 + 51.71967\,x^5 - 386.82412\,x^4 + 1510.2414\,x^3 - 3267.076\,x^2 + 3820.25\,x - 1792.64$$

$x = V_{TObj}$ in Volt

Polynomial to calculate Tobj from VTobj (optimized between 60°C and 300°C) :

$$Tobj\,[°C] = -0.746255\,x^6 + 14.59148\,x^5 - 117.64609\,x^4 + 503.5084\,x^3 - 1223.685\,x^2 + 1691.02\,x - 904.62$$

$x = V_{TObj}$ in Volt

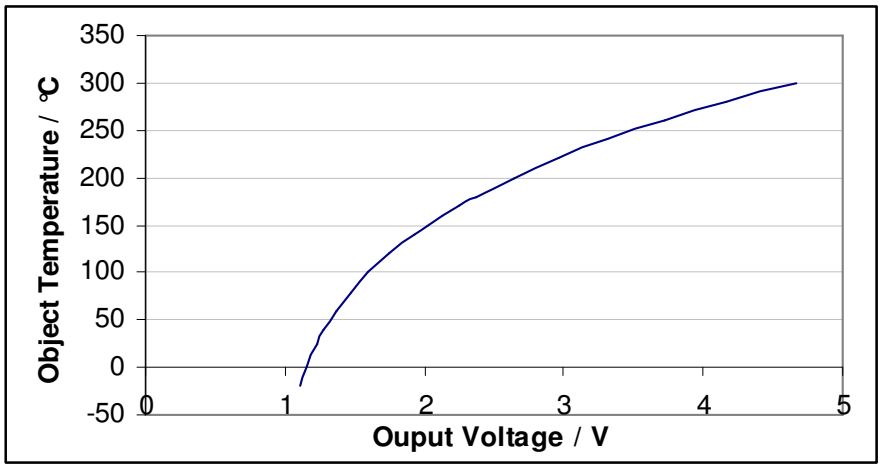


Figure 1: Output characteristic

Table 6: V_{Tamb} Characteristics

Temperature [°C]	Min	Typ	Max	Unit	Gradient [$mV*K^{-1}$]
-20		0.906		V	0.1
-10	0.916	0.923	0.929	V	3.2
0	0.958	0.970	0.983	V	6.3
10	1.039	1.049	1.058	V	9.4
15	1.089	1.100	1.111	V	11.0
20	1.146	1.158	1.171	V	12.5
25	1.211	1.225	1.239	V	14.1
30	1.284	1.299	1.315	V	15.6
35	1.364	1.381	1.398	V	17.2
40	1.452	1.471	1.490	V	18.7
50	1.652	1.674	1.696	V	21.8
60	1.858	1.908	1.958	V	25.0
70	2.117	2.173	2.229	V	28.1
80	2.407	2.469	2.532	V	31.2
90	2.728	2.796	2.865	V	34.3
100	3.080	3.155	3.229	V	37.4

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

Polynomial to calculate Tamb from VTamb:

$$Tamb\ [°C] = -29.871699\,x^6 + 375.42498\,x^5 - 1920.79470\,x^4 + 5119.0119\,x^3 - 7505.052\,x^2 + 5799.64\,x - 1835.78$$

$x = V_{Tamb}$ in Volt

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		7	12	°	50 % rel. output signal
OA	Optical axis		0	± 3.5	°	in reference to symmetrical axis of cap
D:S	Distance to Spot ratio		8:1			

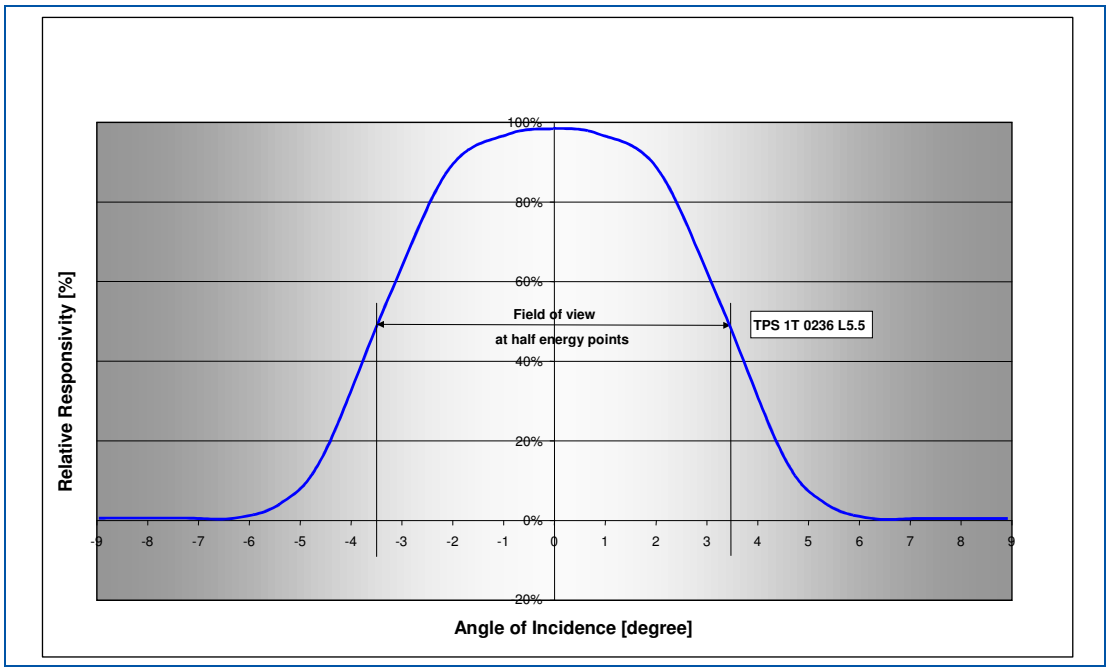


Figure 2: Typical Field of View characteristic

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

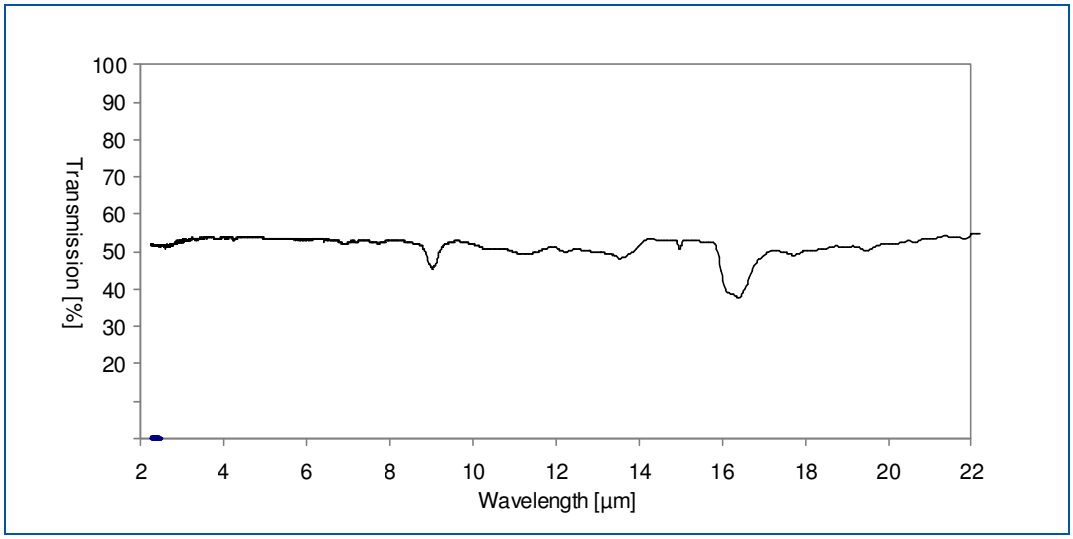


Figure 3: IR-Filter characteristic

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	160℃ ± 1℃
Ambient Temperature	25℃ ± 1℃
Supply Voltage	5V
Test Level	100%

Test pass criteria:

		V_{Tobj}			V_{Tamb}		
Tobj	**Tamb**	**Minimum**	**Typical**	**Maximum**	**Minimum**	**Typical**	**Maximum**
℃	℃	V	V	V	V	V	V
160	25	2.106	2.133	2.161	1.211	1.225	1.239

6 Mechanical Dimensions

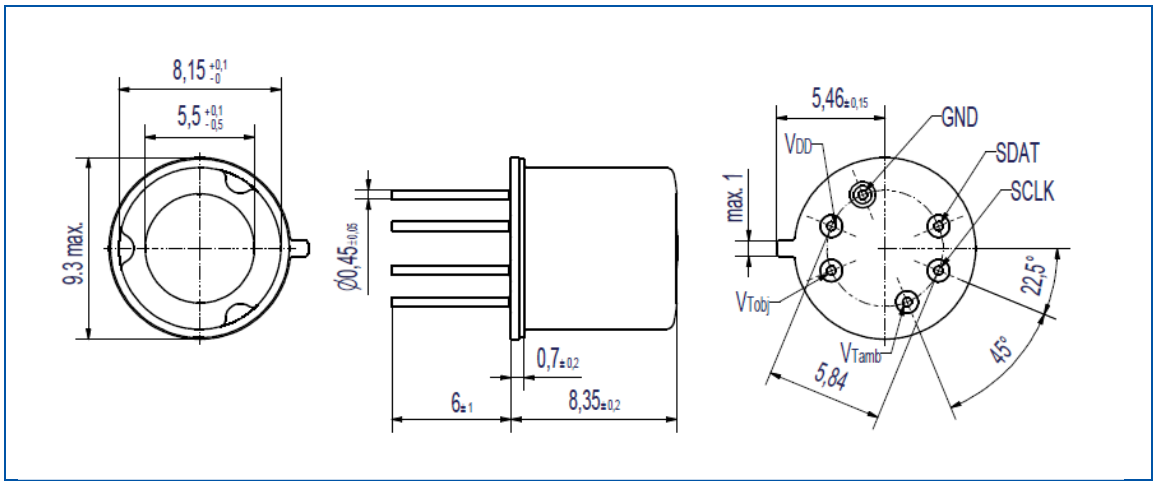


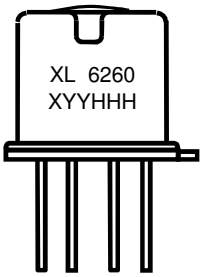
Figure 4: Mechanical dimensions of TPS 1T 0236 L5.5 sensor

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

The contents of this document are subject to change without notice and customers should consult with Excelitas Technologies sales representatives before ordering. Customers considering the use of Excelitas Technologies 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 Excelitas Technologies 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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