

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 <small>Note 1)</small> | -40° C | 100° C |
| Operating temperature range | -25° C | 100° C |
| Voltage at all inputs and outputs <small>Note 2)</small> | -0.3 V | V _{DD} +0.3 V |
| Current at input pins <small>Note 2)</small> | | +/- 5 mA |
| Lead temperature (Soldering, 10 sec) | | +300° C |
| ESD tolerance <small>Note 3)</small> | | 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.

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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 |
|-------------------|------------------------------------|-----|-----|-----|--------|------------|
| I _N | V1 Input referred voltage noise | | | 120 | nV/√Hz | rms value |
| t _{stt} | 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 $V_{DD} = +5\text{ V}$, $V_{Ref} = +1.225\text{ V}$

Polynomial to calculate T_{obj} from V_{Tobj} :

$$T_{obj} [^{\circ}\text{C}] = -1.265389 x^6 + 24.11834 x^5 - 187.25826 x^4 + 759.8241 x^3 - 1714.793 x^2 + 2127.80 x - 1046.89$$

$x = V_{Tobj}$ in Volt

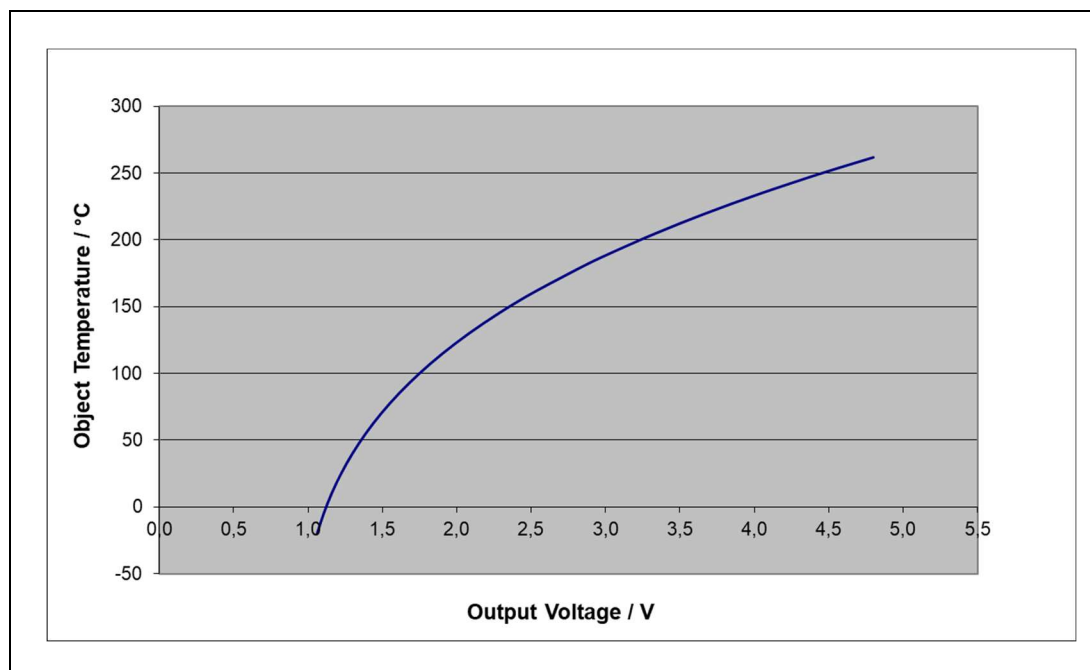


Figure 1: Output characteristic

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 $V_{DD} = +5\text{ V}$, $V_{Ref} = +1.225\text{ V}$

Polynomial to calculate T_{amb} from V_{Tamb} :

$$T_{amb} [^{\circ}\text{C}] = -35.796203 x^6 + 413.39529 x^5 - 1967.39585 x^4 + 4946.6839 x^3 - 6957.641 x^2 + 5273.85 x - 1676.93$$

$x = V_{Tamb}$ in Volt

;

$0^{\circ}\text{C} \leq T_{amb} \leq 100^{\circ}\text{C}$

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 | | | |

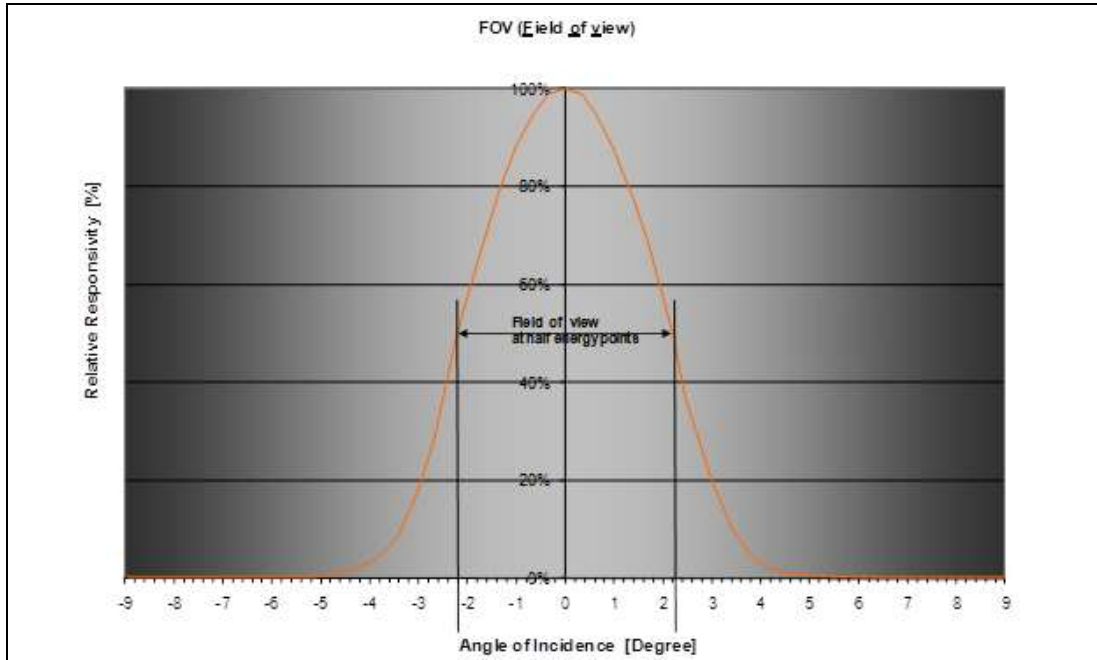


Figure 2: Typical Field of View characteristic

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 |

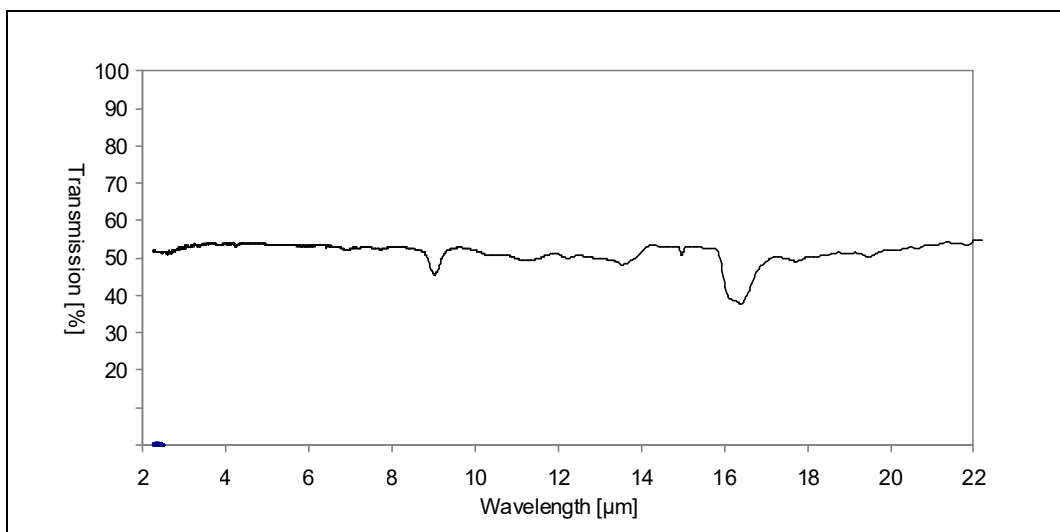


Figure 3: IR-Filter characteristic

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:

| Tobj | Tamb | V_{Tobj} | | | V_{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

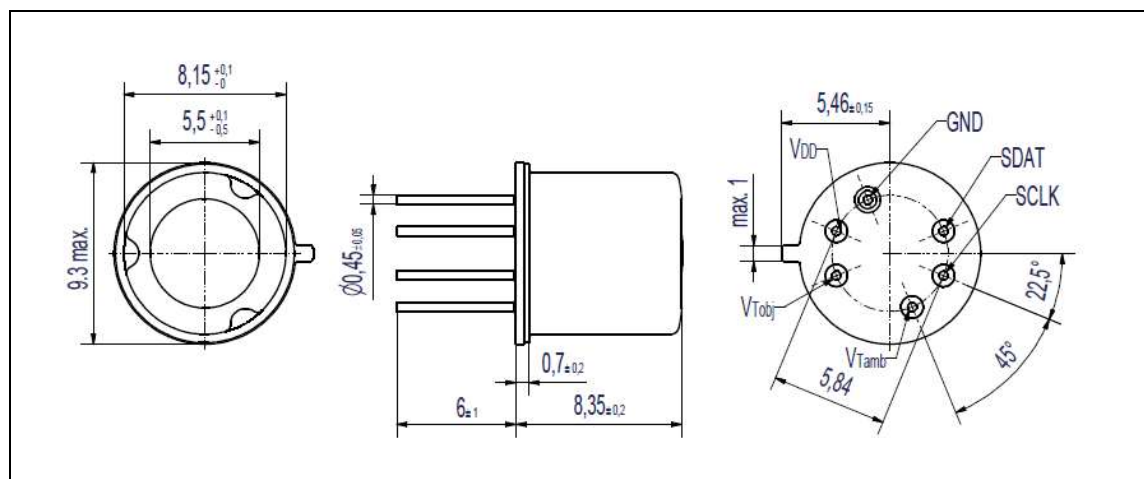


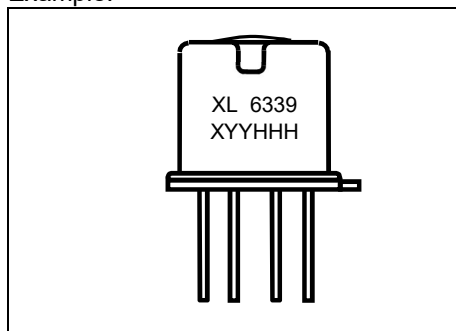
Figure 4: Mechanical dimensions of TPiS 1T 0136 L5.5 sensor

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 to 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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