Thermopile detectors

Description
Thermopile detectors directly sense thermal radiation, providing the perfect device for remotely measuring temperatures without the need for any mechanical chopper. PerkinElmer’s proprietary and innovative Si-based micromachining technology guarantees a new generation of components: extreme long-term stability, very low temperature coefficient in sensitivity, and excellent repeatability of electro-optical parameters.

Thermopile sensors allow remote temperature sensing at a low system cost. The sensor does not require cooling, and can reach an accuracy of ±1°C, dependent on the measurement range. For narrow temperature ranges, as in body temperature measurement, a precision of 0.1°C is possible.

Single-Element Thermopile Detectors: TPS series
The different available chip sizes and packaging types, together with the variety in window openings with and without a silicon lens, enable the adaptation of the PerkinElmer thermopiles to virtually every application where a remote temperature measurement or control is needed.

Dual- and Quad-Element Types: TPS 2, TPS 4 series
PerkinElmer offers thermopile detectors with two or four channels, each of which can be equipped with one of the many available infrared spectral bandpass filters. The main application of multiple channel thermopiles is gas detection through IR absorption. Prominent gases to be detected are CO₂, hydrocarbons and CO.

Thermopile Modules with integrated signal processing: TPMI series
For convenient use, PerkinElmer offers thermopile sensors with an integrated electronic circuit for the necessary signal condition and ambient temperature compensation – the TPMI. This very compact and miniature thermopile module is offered as a fully calibrated, ready-to-go sensor. Various temperature ranges and optics are available.

Thermopile Line and Matrix Arrays: TPL, TPA series
The latest PerkinElmer thermopile technology development features more than a single test spot. The new TPA- (matrix array) and TPL- (line array) series offer multi-element thermopile arrays combined with an optical lens, amplifier, and interface electronics (multiplexer, ambient temperature sensor) in a compact TO-39-type housing. This combines solid-state, non-choppered temperature measurement without the need for in-field calibration.

Typically, the array sensors are sold as a modular type, i.e. on a PCB with external data memory. These TPA- and TPL-Modules are recalibrated with the data stored in an EEPROM. In an application, the associated micro controller (µC) reads this calibration information and converts the sensor signals to the object temperatures.

Features
- Available in TO-39 and TO-18 housings
- Integrated signal processing
  ASIC available (TPMI)
- Single, dual or quad elements
- 8 element line arrays and 4x4 matrix arrays with various lens optics and integrated ASIC with multiplexer
- Various filters for optical broadband or narrow-band applications
- Excellent repeatability of electro-optical parameters
- Ambient temperature reference (thermistor) included
- High sensitivity of several 10 V/W; DC radiation sensitive
- Extremely low temperature coefficient of sensitivity and resistivity
- Constant response over the infrared spectrum
- The absence of microphonic noise effects
- Low susceptibility to electromagnetic pulses (EMP) due to the low internal resistance (<100 kΩ)
- Rugged construction based on CMOS silicon micromachining technology

Datasheets available upon request

Typical Applications
- Remote Temperature Sensing, Hand-Held or Industrial Pyrometers
- Ear or Body Thermometers
- Temperature-Sensor Modules in Microwave Ovens, Hair Dryers, Cookers, Toasters
- Sensor Modules for Control of Air Condition Systems (Heat Management, Home, Automotive)
- Temperature Control in Copiers and Printers
- Sensor Arrays for Spatial Temperature Measurements (Imaging Applications)
- Sensors with Infrared Bandpass Filters for Gas Detection by Infrared Absorption

www.optoelectronics.perkinelmer.com
**Dual and Quad Element Thermopile Detectors**

### General Data

- **Tc of sensitivity (absolute value):** 0.02%/K
- **Tc of resistance (absolute value):** 0.02%/K
- **Max. operating temperature:** -20 to 100°C
- **Max. storage temperature:** -40 to 100°C
- **Thermistor BETA:** 3964 K
- **Option for all types:** 8-14 um
- **Pyrometry filter:** G9

**Thermopile Arrays**

**Line and Matrix Arrays**

**TPM1 Modules**

For further details please contact us.

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### Single Element Thermopile Detectors

#### Technical Specification

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Housing</th>
<th>Field of View</th>
<th>DC Sensitivity V/W</th>
<th>Time Constant ms</th>
<th>Active Area mm²</th>
<th>TP Chip Resistance kΩ</th>
<th>Noise nW/√Hz</th>
<th>NEP nW/√Hz</th>
<th>D* cm²/√Hz/W</th>
<th>Thermistor (25°C) kΩ</th>
</tr>
</thead>
<tbody>
<tr>
<td>TPS333</td>
<td>TO-18</td>
<td>100˚</td>
<td>35</td>
<td>25</td>
<td>0.7x0.7</td>
<td>75</td>
<td>35</td>
<td>1</td>
<td>0.7x10⁶</td>
<td>100</td>
</tr>
<tr>
<td>TPS334</td>
<td>TO-39</td>
<td>60˚</td>
<td>35</td>
<td>25</td>
<td>0.7x0.7</td>
<td>75</td>
<td>35</td>
<td>1</td>
<td>0.7x10⁶</td>
<td>30</td>
</tr>
<tr>
<td>TPS334L5.5</td>
<td>TO-39</td>
<td>60˚</td>
<td>35</td>
<td>25</td>
<td>0.7x0.7</td>
<td>75</td>
<td>35</td>
<td>1</td>
<td>0.7x10⁶</td>
<td>30</td>
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<tr>
<td>TPS434</td>
<td>TO-39</td>
<td>55˚</td>
<td>35</td>
<td>20</td>
<td>0.5x0.5</td>
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<td>24</td>
<td>0.7</td>
<td>0.7x10⁶</td>
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<td>TPS434IRA</td>
<td>TO-39</td>
<td>15˚</td>
<td>55</td>
<td>20</td>
<td>0.5x0.5</td>
<td>35</td>
<td>24</td>
<td>0.4</td>
<td>1.1x10⁶</td>
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<tr>
<td>TPS534</td>
<td>TO-39</td>
<td>80˚</td>
<td>20</td>
<td>35</td>
<td>1.2x1.2</td>
<td>50</td>
<td>29</td>
<td>1</td>
<td>0.8x10⁶</td>
<td>30</td>
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<td>TPS555</td>
<td>TO-39</td>
<td>80˚</td>
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<td>35</td>
<td>1.2x1.2</td>
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<td>29</td>
<td>1</td>
<td>0.8x10⁶</td>
<td>30</td>
</tr>
</tbody>
</table>

Test conditions: T = 25°C
- **500 K black body**
- Field of view: at 50% intensity points
- Noise: r.m.s., 300 K
- **with 5.5 mm lens**
- **with int. reflector**
- **with 2 channels**
- **with 4 channels**
- **individual bp filters for each channel**

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### Dual and Quad Thermopile Detectors

#### Technical Specification

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Housing</th>
<th>Field of View</th>
<th>DC Sensitivity V/W</th>
<th>Time Constant ms</th>
<th>Active Area mm²</th>
<th>TP Chip Resistance kΩ</th>
<th>Noise nW/√Hz</th>
<th>NEP nW/√Hz</th>
<th>D* cm²/√Hz/W</th>
<th>Thermistor (25°C) kΩ</th>
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<tbody>
<tr>
<td>TPS2534</td>
<td>TO-39</td>
<td>2x90˚</td>
<td>42</td>
<td>35</td>
<td>1.2x1.2</td>
<td>50</td>
<td>29</td>
<td>0.7</td>
<td>1.8x10⁶</td>
<td>30</td>
</tr>
<tr>
<td>TPS4339</td>
<td>TO-39</td>
<td>4x60˚</td>
<td>75</td>
<td>25</td>
<td>0.7x0.7</td>
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<td>35</td>
<td>0.5</td>
<td>1.5x10⁶</td>
<td>100</td>
</tr>
</tbody>
</table>

Test conditions: T = 25°C
- **500 K black body**
- Field of view: at 50% intensity points
- Noise: r.m.s., 300 K
- **with 2 channels**
- **with 4 channels**
- **individual bp filters for each channel**

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### Line and Matrix Arrays

#### Technical Specification

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Housing</th>
<th>Number of Pixels</th>
<th>Field of View</th>
<th>Optics</th>
<th>Output Voltage V (80°C object, 20°C ambient)</th>
<th>Object temperature</th>
<th>Noise nV/√Hz (5-20MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TPLM086L5.5</td>
<td>TO-39 on PCB 8 element line</td>
<td>41’x6’ f/1 optics, f=5.5 mm</td>
<td>0.95</td>
<td>-20-100°C</td>
<td>0.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TPLM085L9.9</td>
<td>TO-39 on PCB 8 element line</td>
<td>56’x8’ f/1 optics, f=3.9 mm</td>
<td>0.95</td>
<td>-20-100°C</td>
<td>0.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TPM166L3.9</td>
<td>TO-39 on PCB 4x4 matrix</td>
<td>41’x32’ f/1 optics, f=3.9 mm</td>
<td>0.95</td>
<td>-20-100°C</td>
<td>0.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Test conditions: T = 25°C
- Operating voltage: 5 V
- Sample frequency: 3 kHz
- Operating current: 1 mA
- Max. operating temperature: -20-100°C
- Zero signal offset: ΨDVC/2
- Max. storage temperature: -40-100°C
- Output resistance: 200 Ω
- Temperature reference slope: 10 mV/K
- Power up time: 0.3 s
- Temperature reference offset: 0 mV

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### TPM1 Modules

#### Technical Specification

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Housing</th>
<th>Optics</th>
<th>Field of View</th>
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</thead>
<tbody>
<tr>
<td>a2TPMI 334</td>
<td>TO-39</td>
<td>window opening 2.5 mm</td>
<td>60˚</td>
</tr>
<tr>
<td>a2TPMI 334</td>
<td>TO-39</td>
<td>integrated Si lens, 5.5 mm focal length</td>
<td>7˚ (D:S = 8:1)</td>
</tr>
<tr>
<td>a2TPMI 334</td>
<td>TO-39</td>
<td>integrated Si lens, 10.6 mm focal length</td>
<td>5˚ (D:S = 11:1)</td>
</tr>
<tr>
<td>a2TPMI 334</td>
<td>TO-39</td>
<td>internal mirror</td>
<td>15˚ (D:S = 4:1)</td>
</tr>
</tbody>
</table>

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