MINIATURIZED 2 CHANNEL THERMAL RADIATION SENSOR

FEATURES

- High Responsivity
- Rugged Construction
- Low Cost
- Broad Spectral Response in the IR
- Self-Generating Voltage
  - No Bias Required
  - No 1/f Noise
- Ambient Temperature Operation
- High Reliability
- Hermetically Sealed
- Excellent Long-Term Stability

TECHNICAL DESCRIPTION

The sensor model TS2x176 is a miniaturized multijunction thermopile made by thin-film and other microsystem technologies on Si wafers. It consists of 176 rectangularly arranged junction pairs per channel formed from evaporated antimony and bismuth thin films. The centrally located active (hot) junctions comprise an area of 2.25 mm² per channel. The whole membrane (1.5 x 1.5 mm² per channel) supporting the active layer is coated with an interference absorption multilayer system.

The sensor is hermetically sealed in a small modified TO-39 package under an inert gas atmosphere. By means of special interference absorption layers the spectral range is restricted to 3.0 ... 5.0 µm or 5.5 ... 13.0 µm, respectively.

The output e.m.f. of the sensor is proportional to the temperature difference between the active and the reference junctions. The thermopile requires no cooling and no bias voltage or current for operation. It generates no 1/f noise but only the thermal resistance (Johnson-Nyquist) noise. The sensor can be used for DC and low frequency AC measurements.
### Parameters

<table>
<thead>
<tr>
<th>Parameters</th>
<th>units</th>
<th>values</th>
<th>conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Area per Channel</td>
<td>mm² (mm x mm)</td>
<td>2.25 (1.5 x 1.5)</td>
<td>membrane area</td>
</tr>
<tr>
<td>Number of Junctions per Channel</td>
<td></td>
<td>176</td>
<td>thermocouples</td>
</tr>
<tr>
<td>Resistance</td>
<td>kΩ</td>
<td>30 … 60</td>
<td></td>
</tr>
<tr>
<td>Resistance TC</td>
<td>% /K</td>
<td>- 0.02 … - 0.04</td>
<td></td>
</tr>
<tr>
<td>Noise Voltage</td>
<td>nV/Hz¹⁄²</td>
<td>≤ 30</td>
<td>room temperature (300 K)</td>
</tr>
<tr>
<td>Max. Irradiance</td>
<td>mW/mm²</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>DC Responsivity</td>
<td>V/W</td>
<td>45 … 50</td>
<td>black body, 500 K, without window, ¹ absorbing layer 3.0…5.0 µm</td>
</tr>
<tr>
<td>DC Responsivity</td>
<td>V/W</td>
<td>50 … 55</td>
<td>black body, 500K, without window, ² absorbing layer 5.5…13 µm</td>
</tr>
<tr>
<td>Responsivity TC</td>
<td>% /K</td>
<td>-0.35…-0.55 N₂</td>
<td></td>
</tr>
<tr>
<td>DC Output @ 38μW/mm²</td>
<td>mV</td>
<td>4.0</td>
<td>black body, 500 K, without window, ³ absorbing layer 3.0…5.0 µm</td>
</tr>
<tr>
<td>DC Output @ 38μW/mm²</td>
<td>mV</td>
<td>4.4</td>
<td>black body, 500 K, without window, ⁴ absorbing layer 3.0…5.0 µm</td>
</tr>
<tr>
<td>Time Constant</td>
<td>ms</td>
<td>≤ 37</td>
<td>r_{631}, N₂</td>
</tr>
<tr>
<td>D* (500K, DC)</td>
<td>cmHz¹⁄²/W</td>
<td>2.6 x 10⁸</td>
<td>black body, 500 K, without window, ⁵ absorbing layer 3.0…5.0 µm</td>
</tr>
<tr>
<td>D* (500K, DC)</td>
<td>cmHz¹⁄²/W</td>
<td>2.8 x 10⁸</td>
<td>black body, 500 K, without window, ⁶ absorbing layer 3.0…5.0 µm</td>
</tr>
</tbody>
</table>

### Filling Gases
- Ne, Kr, Xe, Ar, N₂

### Spectral Response
(see technical description)
- Flat from 3.0 ... 5.0 µm or 5.5 ... 13 µm, respectively

### Window Materials
- Standard: 8 ... 14 µm Filter (other materials on request)

### Case
- TO-39 Package (modified)

### Operating Temperature
- - 20 ... + 85 °C

### Weight
- < 1 g

**Spectral absorptance of the multilayer system with an interference absorbing layer in the spectral range 3.0 ... 5.0 µm**

**Spectral absorptance of the multilayer system with an interference absorbing layer in the spectral range 5.5 ... 13 µm**

### APPLICATIONS
- Non-Contact Temperature Measurements
- Radiometry
- Imaging System Requiring Small Spot Size
- Precise NDIR spectroscopic gas detection and control in medical applications