

# Pyroelectric Infrared Detectors for Measurement Applications



## Single-element and multi-channel detectors

- Detector elements made from Lithium Tantalate
- Highest detectivity ( $10^9$  cm $\sqrt{\text{Hz/W}}$ )
- Extremely low noise
- Low microphony
- Low temperature dependence
- Very good long-term stability
- Voltage or current mode
- Custom-designed IR filters
- Optional with absorber or silver black
- Optional with thermal compensation
- Up to 4 spectral channels per detector
- Individual element geometries
- Different package types
- Excellent price-performance payoff

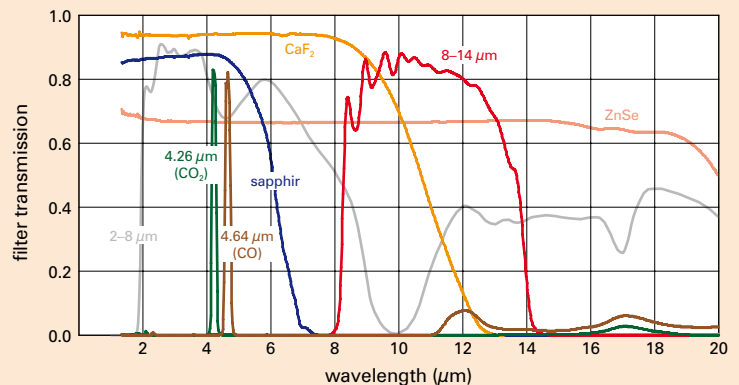
## Applications

The pyroelectric single-element and multi-channel infrared detectors from DIAS Infrared GmbH are designed for use in gas analysis, spectroscopy, pyrometry and security engineering applications.

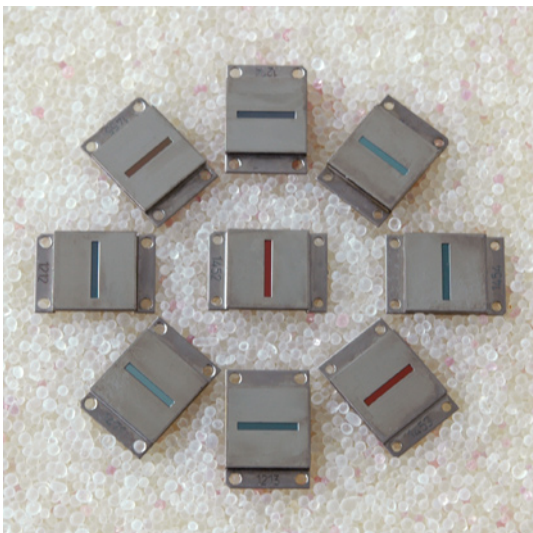
Very high values of specific detectivity  $D^*$  are achieved by using modern ion beam etching technology for extremely thin elements.

The great variety of infrared sensor constructions makes it possible to realize custom-made solutions for both small and large quantities with an excellent price-performance payoff.

## IR filter



- Coated silicon or germanium as infrared window
- Broad band windows ( $>1.4$   $\mu\text{m}$ ) or special filters
- Customised filters and integrated optics



## Linear arrays with 128 or 256 elements

- 128 or 256 elements arranged in one line
- NEP (128 Hz) down to 1.1 nW
- Dynamic range  $> 75$  dB
- Modulation frequency up to 512 Hz
- Integrated CMOS multiplexer
- High long-term stability
- Simple mode of operation
- Operation at ambient temperature
- Customised arrays with up to 256 elements with special sizes
- Modules with linear arrays

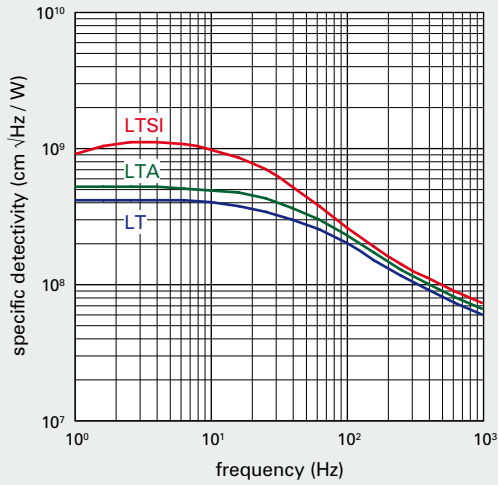
## Single-Element and Multi-Channel Detectors

| Types  |                 |                     |                      |                            |   |   |  |
|--|-----------------|---------------------|----------------------|----------------------------|---|---|--|
| Type   | Size of Element | Additional Absorber | Thermal Compensation | $S_V$ (V/W) <sup>1,2</sup> | $u_{Rn}$ (nV/ $\sqrt{\text{Hz}}$ ) <sup>1</sup> | $D^*$ (cm $\sqrt{\text{Hz/W}}$ ) <sup>1,2</sup> |  |
| <b>Single-Element Detectors<sup>4</sup></b>  |                 |                     |                      |                            |   |   |  |
| <b>LT – Standard Types</b>                   |                 |                     |                      |                            |   |   |  |
| LT Q2  | 2 mm × 2 mm     |                     |                      | 300                        | 150   | 4 · 10 <sup>8</sup>                             |  |
| LT Q1.2                                      | 1.2 mm × 1.2 mm |                     |                      | 800                        | 370   | 2.5 · 10 <sup>8</sup>                           |  |
| LT Q1  | 1 mm × 1 mm     |                     |                      | 1100                       | 500   | 2 · 10 <sup>8</sup>                             |  |
| LT Q0.5                                      | 0.5 mm × 0.5 mm |                     |                      | 3200                       | 1500  | 1 · 10 <sup>8</sup>                             |  |
| LT G2  | 2 mm × 2 mm     |                     |                      | 300                        | 170   | 3.5 · 10 <sup>8</sup>                           |  |
| LT G2PC                                      | 2 mm × 2 mm     |                     | ×                    | 150                        | 100   | 3 · 10 <sup>8</sup>                             |  |
| LT D2.5                                      | ∅ 2.5 mm        |                     |                      | 220                        | 140   | 4 · 10 <sup>8</sup>                             |  |
| LT D2  | ∅ 2 mm          |                     |                      | 360                        | 190   | 3.5 · 10 <sup>8</sup>                           |  |
| LT D1  | ∅ 1 mm          |                     |                      | 1200                       | 700   | 2 · 10 <sup>8</sup>                             |  |
| LTI Q2 <sup>3</sup>                          | 2 mm × 2 mm     |                     |                      | 250                        | 80  | 8 · 10 <sup>8</sup>                             |  |
| LTI Q1.2 <sup>3</sup>                        | 1.2 mm × 1.2 mm |                     |                      | 700                        | 120   | 6.5 · 10 <sup>8</sup>                           |  |
| LTI Q1 <sup>3</sup>                          | 1 mm × 1 mm     |                     |                      | 900                        | 160   | 6 · 10 <sup>8</sup>                             |  |
| LTI Q0.5 <sup>3</sup>                        | 0.5 mm × 0.5 mm |                     |                      | 3500                       | 500   | 3 · 10 <sup>8</sup>                             |  |
| LTI D2 <sup>3</sup>                          | ∅ 2 mm          |                     |                      | 300                        | 80  | 8 · 10 <sup>8</sup>                             |  |
| LTI D1 <sup>3</sup>                          | ∅ 1 mm          |                     |                      | 1200                       | 200   | 5 · 10 <sup>8</sup>                             |  |
| LTI Q2I100 <sup>3,5</sup>                    | 2 mm × 2 mm     |                     |                      | 300000                     | 100000  | 8 · 10 <sup>8</sup>                             |  |
| <b>LTA – Types with Increased Absorption</b> |                 |                     |                      |                            |   |   |  |
| LTA G2                                       | 2 mm × 2 mm     | ×                   |                      | 400                        | 170   | 4.5 · 10 <sup>8</sup>                           |  |
| LTA G2PC                                     | 2 mm × 2 mm     | ×                   | ×                    | 200                        | 100   | 3.7 · 10 <sup>8</sup>                           |  |
| LTAI G2 <sup>3</sup>                         | 2 mm × 2 mm     | ×                   |                      | 300                        | 100   | 6 · 10 <sup>8</sup>                             |  |
| LTA G2I10 <sup>5</sup>                       | 2 mm × 2 mm     | ×                   |                      | 15000                      | 20000   | 1.5 · 10 <sup>8</sup>                           |  |
| LTA G2I10PC <sup>5</sup>                     | 2 mm × 2 mm     | ×                   | ×                    | 14000                      | 20000   | 1.4 · 10 <sup>8</sup>                           |  |
| LTA G2I100 <sup>5</sup>                      | 2 mm × 2 mm     | ×                   |                      | 70000                      | 20000   | 2.5 · 10 <sup>8</sup>                           |  |
| LTA G2I100PC <sup>5</sup>                    | 2 mm × 2 mm     | ×                   | ×                    | 65000                      | 20000   | 2.3 · 10 <sup>8</sup>                           |  |
| <b>LTS – Types with Silver Black</b>         |                 |                     |                      |                            |   |   |  |
| LTS Q2                                       | 2 mm × 2 mm     | ×                   |                      | 420                        | 150   | 5 · 10 <sup>8</sup>                             |  |
| LTS Q1.2                                     | 1.2 mm × 1.2 mm | ×                   |                      | 1200                       | 370   | 3.5 · 10 <sup>8</sup>                           |  |
| LTS Q1                                       | 1 mm × 1 mm     | ×                   |                      | 1600                       | 500   | 3 · 10 <sup>8</sup>                             |  |
| LTS D2.5                                     | ∅ 2.5 mm        | ×                   |                      | 340                        | 140   | 6 · 10 <sup>8</sup>                             |  |
| LTS D2                                       | ∅ 2 mm          | ×                   |                      | 520                        | 190   | 5 · 10 <sup>8</sup>                             |  |
| LTS D1                                       | ∅ 1 mm          | ×                   |                      | 1800                       | 700   | 2.5 · 10 <sup>8</sup>                           |  |
| LTSI Q2 <sup>3</sup>                         | 2 mm × 2 mm     | ×                   |                      | 350                        | 80  | 9 · 10 <sup>8</sup>                             |  |
| LTSI Q1.2 <sup>3</sup>                       | 1.2 mm × 1.2 mm | ×                   |                      | 900                        | 120   | 9 · 10 <sup>8</sup>                             |  |
| LTSI Q1 <sup>3</sup>                         | 1 mm × 1 mm     | ×                   |                      | 1300                       | 150   | 8 · 10 <sup>8</sup>                             |  |
| LTSI D2 <sup>3</sup>                         | ∅ 2 mm          | ×                   |                      | 450                        | 80  | 9 · 10 <sup>8</sup>                             |  |
| LTSI D1 <sup>3</sup>                         | ∅ 1 mm          | ×                   |                      | 1600                       | 200   | 7.5 · 10 <sup>8</sup>                           |  |
| LTSI Q2I100 <sup>5</sup>                     | 2 mm × 2 mm     | ×                   |                      | 450000                     | 100000  | 1 · 10 <sup>9</sup>                             |  |
| <b>Multi-Channel Detectors</b>               |                 |                     |                      |                            |   |   |  |
| 2LTA G2                                      | 2 × 2 mm × 2 mm | ×                   |                      | 300                        | 170   | 3.4 · 10 <sup>8</sup>                           |  |
| 2LTA G2PC                                    | 2 × 2 mm × 2 mm | ×                   | ×                    | 150                        | 100   | 3 · 10 <sup>8</sup>                             |  |
| 3LTA G2                                      | 3 × 2 mm × 2 mm | ×                   |                      | 300                        | 170   | 3.4 · 10 <sup>8</sup>                           |  |
| 3LTA G2PC                                    | 3 × 2 mm × 2 mm | ×                   | ×                    | 150                        | 100   | 3 · 10 <sup>8</sup>                             |  |
| 4LTA G2                                      | 4 × 2 mm × 2 mm | ×                   |                      | 300                        | 170   | 3.4 · 10 <sup>8</sup>                           |  |

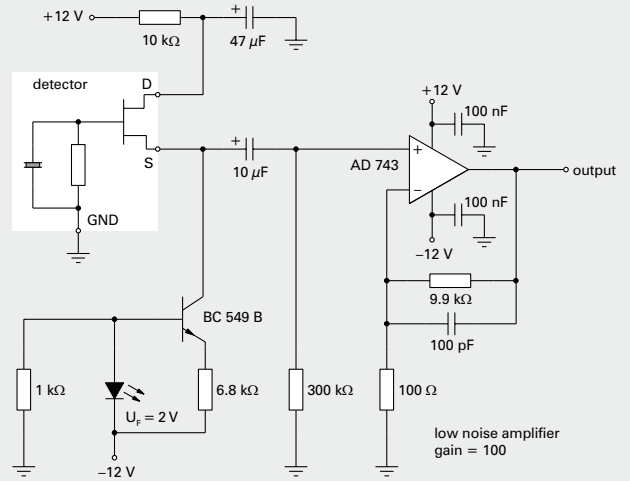
$S_V$  responsivity,  $u_{Rn}$  noise voltage,  $D^*$  specific detectivity. <sup>1</sup> frequency: 10 Hz, detector temperature: 25 °C <sup>2</sup> blackbody source temperature: 500 K, filter transmission: 100 %  
<sup>3</sup> reduced noise by ion beam etched chips <sup>4</sup> other element sizes are available optionally <sup>5</sup> current mode type  
 TO18, TO39 or TO8 housing, typical offset voltage: 0.4 V to 1.5 V, typical operating voltage: 2 V to 18 V, operating and storage temperature: -20 °C to 70 °C,  
 operating and storage temperature LTS types: -20 °C to 60 °C

# Single-Element and Multi-Channel Detectors

Specific Detectivity<sup>1</sup>

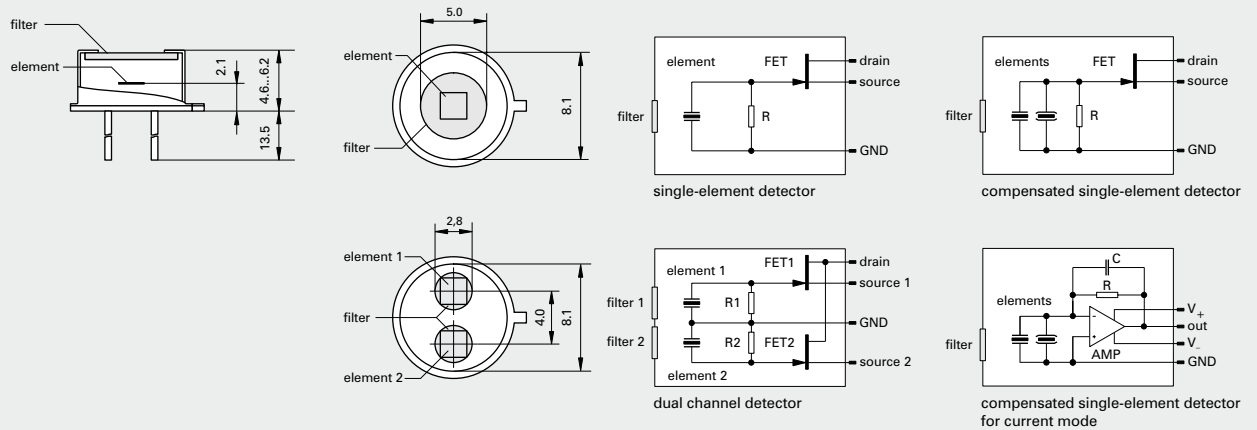


Detector in Voltage Mode with Amplifier

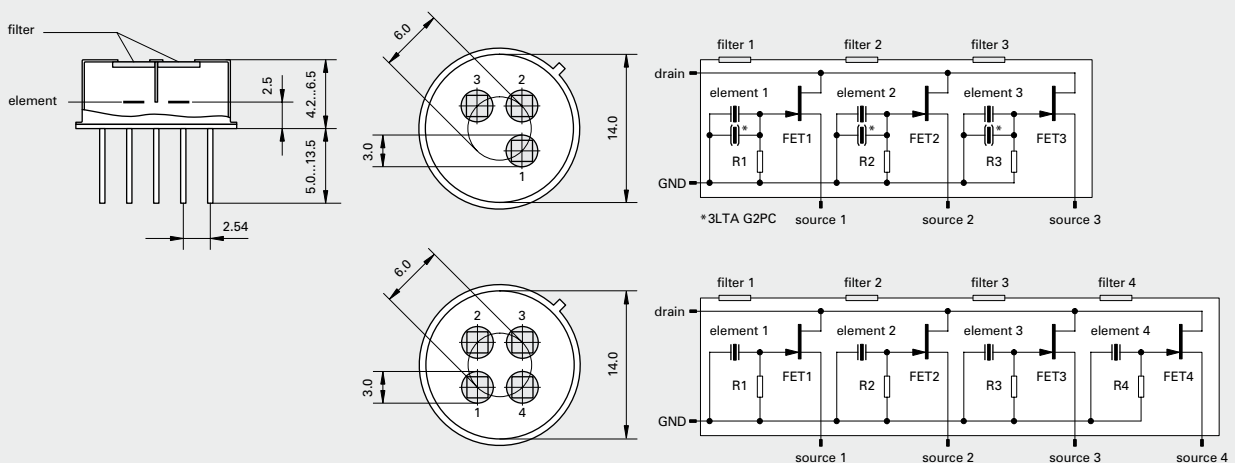


<sup>1</sup> detector temperature: 25 °C, blackbody source temperature: 500 K, filter transmission: 100 %, voltage mode

## Single-Element and Dual Channel Detectors in TO39 Housing



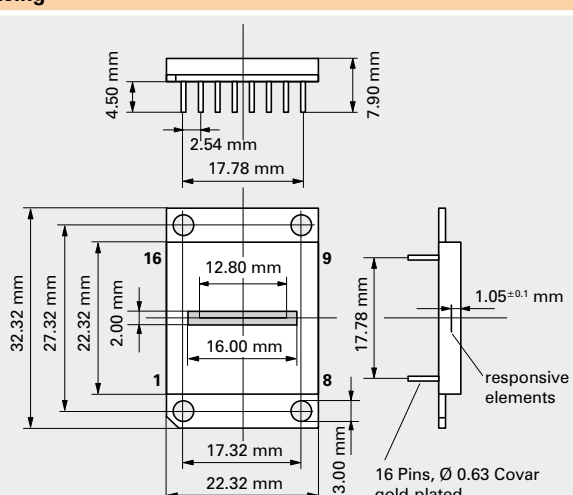
## Three and Four Channel Detectors in TO8 Housing



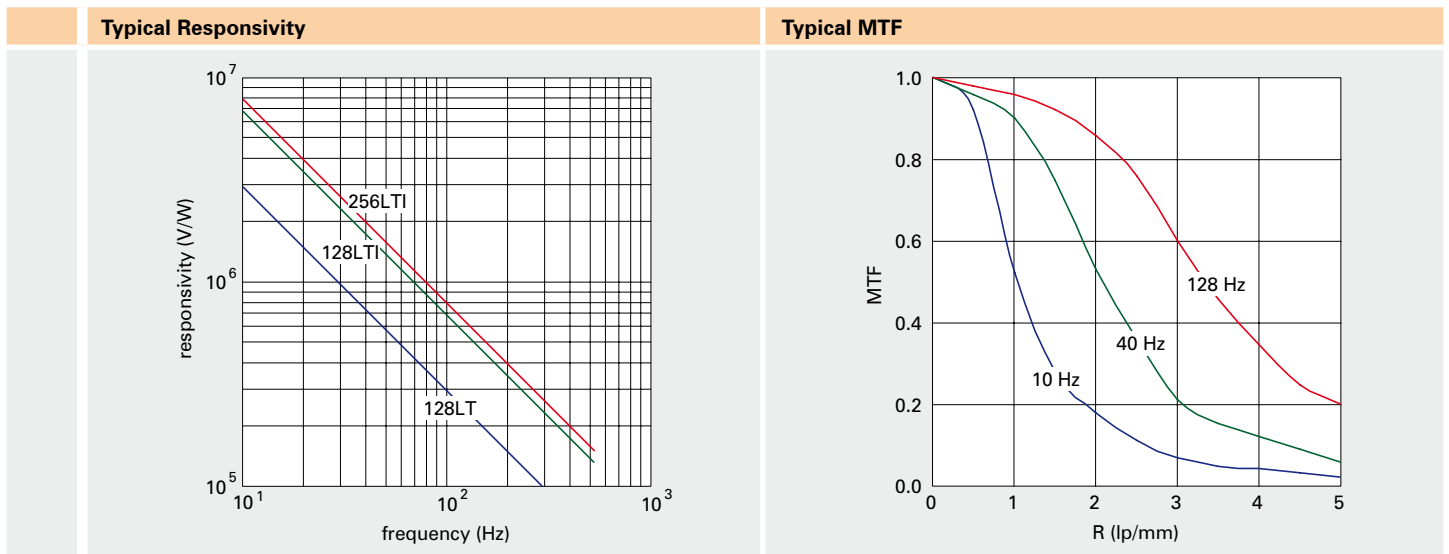
## Pyroelectric Linear Arrays 128LTx and 256LTx

| Types <sup>1</sup>                    |        |        |             |              |             |              |        |              |              |  |
|---------------------------------------|--------|--------|-------------|--------------|-------------|--------------|--------|--------------|--------------|--|
| Type                                  | 128LT  | 128LT1 | 128LT SP0.5 | 128LT1 SP0.5 | 128LT SP1.0 | 128LT1 SP1.0 | 256LT1 | 256LT1 SP0.5 | 256LT1 SP1.0 |  |
| Pixel number                          | 128    | 128    | 128         | 128          | 128         | 128          | 256    | 256          | 256          |  |
| Pixel width in $\mu\text{m}$          | 90     | 90     | 90          | 90           | 90          | 90           | 42     | 42           | 42           |  |
| Pixel length in $\mu\text{m}$         | 100    | 100    | 500         | 500          | 1000        | 1000         | 100    | 500          | 1000         |  |
| Pitch in $\mu\text{m}$                | 100    | 100    | 100         | 100          | 100         | 100          | 50     | 50           | 50           |  |
| Responsivity $S_V$ in V/W             | 230000 | 540000 | 230000      | 540000       | 230000      | 540000       | 620000 | 620000       | 620000       |  |
| Noise voltage $U_N$ in mV             | 0.7    | 0.8    | 0.9         | 1.2          | 1.1         | 1.9          | 0.7    | 0.9          | 1.1          |  |
| NEP in nW                             | 3.0    | 1.5    | 3.9         | 2.2          | 4.9         | 3.5          | 1.1    | 1.4          | 1.8          |  |
| MTF ( $R = 3 \text{ lp/mm}$ )         | 0.6    | 0.6    | 0.6         | 0.6          | 0.6         | 0.6          | 0.6    | 0.6          | 0.6          |  |
| Uniformity <sup>2</sup> of $S_V$ in % | 5      | 5      | 5           | 5            | 5           | 5            | 5      | 5            | 5            |  |

<sup>1</sup> Typical values, rectangular chopping with 128 Hz, array temperature 25 °C, black body source temperature 400 °C, filter transmission 100 %. <sup>2</sup> No defective elements.

| Specification <sup>1</sup>          |                       | Housing  |
|-------------------------------------|-----------------------|--|
| Parameter                           | Value                 |  |
| Operating voltage VDD               | 5 V                   |       |
| Operating voltage VD2               | 2.5 V                 |  |
| Digital inputs, low voltage         | < 0.3 VDD             |  |
| Digital inputs, high voltage        | > 0.7 VDD             |  |
| Digital inputs, switching threshold | 0.5 VDD               |  |
| Chopping frequency $f_{ch}$         | 10 Hz to 512 Hz       |  |
| Current consumption                 | 8 mA                  |  |
| Maximum irradiance                  | 50 mW/mm <sup>2</sup> |  |
| Operating temperature               | -15 °C to 70 °C       |  |
| Storage temperature                 | -20 °C to 80 °C       |  |
| Soldering temperature               | 300 °C                | 16 Pins, $\varnothing 0.63$ Cover gold-plated<br>responsive elements<br>$1.05^{+0.1}$ mm |

<sup>1</sup> All voltages refer to ground (pin 10, 15).



Technical details are subject to change without notice. May 2008.