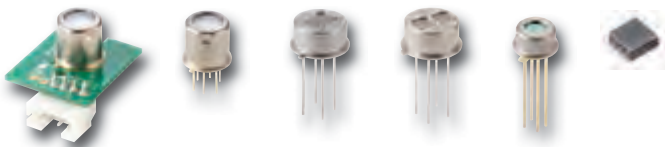


## Infrared Sensing Solutions

New, Updated Edition 3.2



For Motion and Presence Detection,  
Temperature Sensing, Gas Detection  
and Energy Conservation.

**EXCELITAS**  
TECHNOLOGIES®

# Infrared Sensing Technologies

## For Your Cutting-edge Applications.

Excelitas' infrared sensing technologies are playing a vital role in creating a healthier, cleaner and safer tomorrow. Excelitas has gained worldwide recognition for the design and production of high-performance pyroelectric detectors, thermopile detectors and sensor modules which – every day – contribute to safeguarding homes, saving energy, and providing comfort. From motion and presence detection to gas detection, thermometry and indoor climate control applications, Excelitas' IR sensing technologies and growing IR product range are meeting your challenges. We are sensing what you need for your cutting-edge applications.

**Sensing what you need – from motion sensors for secure homes to gas detection systems, indoor climate control systems and ear thermometers.**

### **Our Infrared Sensing Solutions provide:**

- Excellent performance
- Strong reliability
- Innovative features

### **We support our products with:**

- Applications – expertise
- Suitable features and functions
- Special optical filters for gas sensing

### ■ **WORLDWIDE COMMITMENT TO YOUR CHALLENGES**

You can depend on Excelitas' world-class global network of production, R&D, and distribution centers including Montreal, Canada; Wiesbaden, Germany; Singapore; Batam, Indonesia; and Shenzhen, China. We have customer service hubs on each continent to ensure just-in-time delivery. We believe in forging a collaborative partnership in which we are communicating proactively with you and refining our forecasts of your requirements to better serve you.

We have the detection technologies and capabilities needed to enhance and accelerate your OEM designs. Our R&D groups are focusing on new products and capabilities for your new and emerging applications. We pride ourselves on deep applications expertise to respond to and anticipate your detection requirements. Feel confident that you can discuss your requirements with our engineers. We thrive on addressing your challenges and will always try to provide you with sincere assistance based on our know-how and experience.

### ■ **UNPARALLELED QUALITY**

The consistent quality of our products is the foundation for which we build our relationship with you. The global adoption of our detectors in a host of consumer products as well as medical, industrial and commercial applications is testimony to our quality commitment and to your confidence in us.

We implement cutting-edge quality assurance system and measures; SPC and reliability testing are standard procedures at Excelitas. Of course, everything begins with the quality of our raw materials. Inspection procedures transcend all processes and conclude with 100% final inspection for all major parameters. We maintain our certification to major quality and environmental standards, which are subject to regular audits. All of our factories have received certifications for ISO 9001, OHSAS 18001, NLF/ILO-OSH 2001.

|   |    |
|---|----|
| Selection Guide                                 | 6  |
| Infrared Basics                                 | 7  |
| Pyroelectric Detector Basics                    | 8  |
| Thermopile Detector Basics                      | 10 |
| “Smart” DigiPyro®                               | 12 |
| Pyroelectric Detectors                          | 14 |
| DigiPyro® TO and SMD                            | 19 |
| Pyroelectric Detectors for Gas Detection        | 26 |
| Thermopile Detectors for Gas Detection          | 30 |
| Thermopile Detectors TO and SMD for Thermometry | 32 |
| Thermopile Sensors and DigiPile™                | 37 |
| Thermopile Sensors                              | 42 |
| Thermopile Modules                              | 44 |
| Handling and Precautions                        | 46 |



# Sensing for your daily life

1 2

## Home Appliances Applications

Our infrared components enable healthy and safely food processing in microwave ovens, electric cooking hobs, toasters, refrigerators and exhaust huts.



3 4 5 6

**Indoor Home Comfort and Security**

Our Infrared Detectors monitor presence, switch lights, control Room Air Condition Systems and trigger Intrusion Alarms, contributing to both more secure homes and energy savings.

7

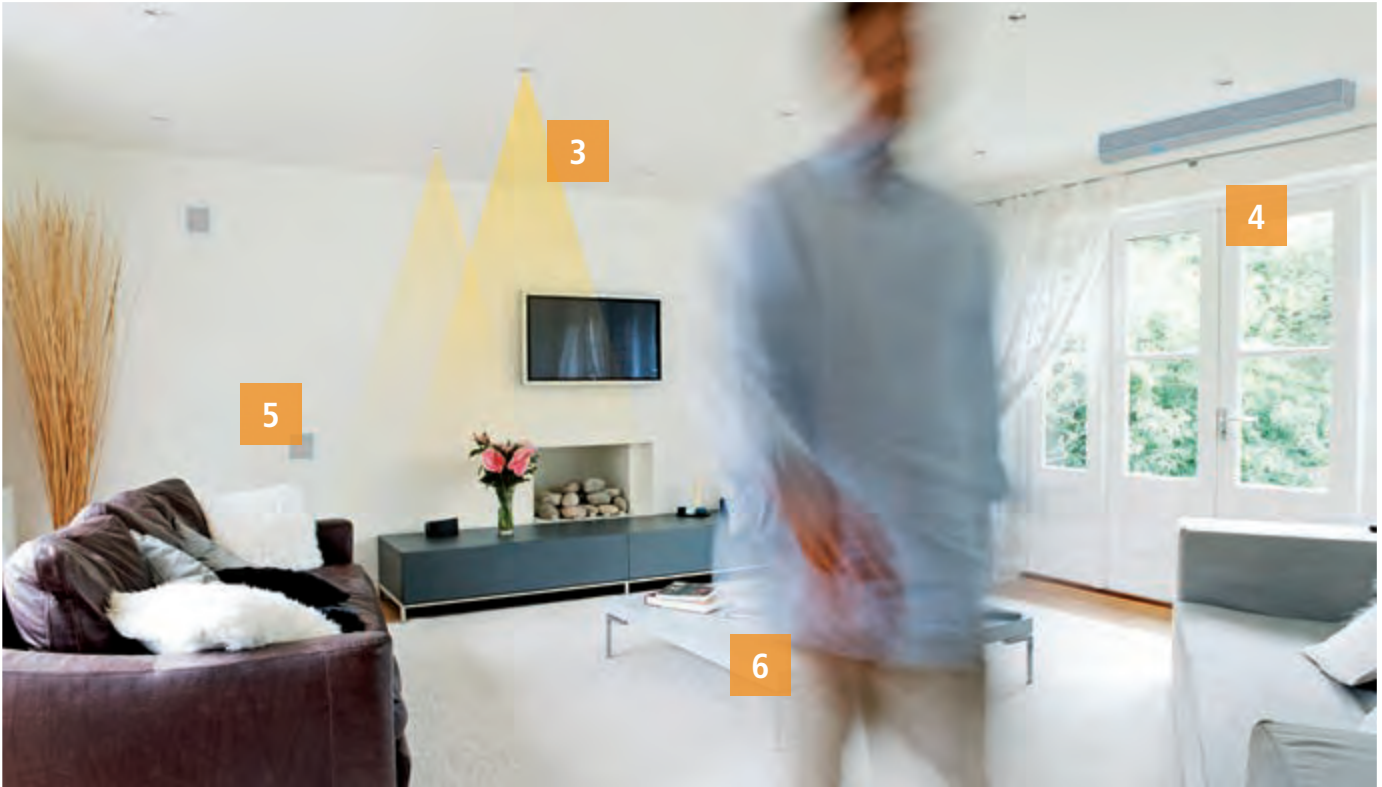
**Thermometry for Healthier Families**

Excelitas infrared detectors are used in popular Ear Thermometers and Forehead Thermometry. Our products are also applied in Pyrometry and non-contact measurement systems to instantly determine temperatures at a distance.

8

**Energy Conservation and Safety**

Public places, parking lots and public buildings consume a lot of energy. Our detectors for presence detection are making environments safer, more secure and contribute to reduce energy waste and reduce carbon dioxide emissions to the environment.



## Selection Guide – Infrared Sensors

| Application             | Model                 | Requirements                  | Feature                            | Comments         | Page |
|-------------------------|-----------------------|-------------------------------|------------------------------------|------------------|------|
| Simple Motion Detection | PYD 1096              | All in 1 electronics          | Dual Element                       | smart DigiPyro®  | 12   |
| Simple Motion Detection | PYD 1098              | All in 1 electronics          | Dual Element                       | smart DigiPyro®  | 13   |
| Simple Motion Detection | PYQ 1048              | All in 1 electronics          | Four Element                       | smart DigiPyro®  | 13   |
| Simple Motion Detection | PYQ 1046              | All in 1 electronics          | Four Element, add time & light set | smart DigiPyro®  | 12   |
| Intrusion alarm         | LHI 968               | RF Immunity                   | Dual Element                       | analog standard  | 14   |
| Intrusion alarm         | PYD 1398              | White Light Immune            | Dual Element                       | analog           | 14   |
| Intrusion alarm         | LHI 1148              | Dual channel                  | Four Element                       | analog           | 15   |
| Intrusion alarm         | PYD 1798              | EMI protected                 | High End Dual                      | DigiPyro®        | 21   |
| Intrusion alarm         | PYQ 2898              | Four Element "Quad"           | (2+1) Channel incl.Tref            | DigiPyro®        | 23   |
| Motion Detection        | LHI 778               | low cost                      | Dual Element                       | analog           | 16   |
| Motion Detection        | PYQ 1748              | Ceiling Mount                 | Dual Element                       | DigiPyro®        | 23   |
| Motion Detection        | PYD 1688              | Low Power                     | Dual Element                       | DigiPyro®        | 24   |
| Motion Detection        | PYD 1698              | Low Power                     | Dual Element                       | DigiPyro®        | 24   |
| Motion Detection        | PYQ 1648              | Ceiling Mount, Low Power      | Dual Element                       | DigiPyro®        | 25   |
| Motion Detection        | LHI 878               | Standard                      | Dual Element                       | analog           | 16   |
| Motion Detection        | LHI 874               | Standar, low profile          | Dual Element                       | analog           | 17   |
| Motion Detection        | PYD 1388              | RF Immunity                   | Dual Element                       | analog           | 16   |
| Motion Detection        | LHI 944               | large Field of View           | Dual Element, low profile          | analog           | 17   |
| Motion Detection        | PYD 1394              | RF Immunity, Field of View    | Dual Element, low profile          | analog           | 17   |
| All Motion Detection    | PYD 1788              | RF Immunity                   | Dual Element                       | DigiPyro®        | 21   |
| Presence Detection      | LHI 1128              | Wide field of View            | Four Element, single channel       | analog standard  | 18   |
| Presence Detection      | PYQ 1348              | RF Immunity                   | Four Element, single channel       | analog standard  | 18   |
| PresenceDetection       | PYQ 1398              |                               | Four Element, single channel       | analog standard  | 18   |
| Presence Detection      | PYQ 5848              | RF Immunity, Digital          | Four Element,                      | DigiPyro®        | 23   |
| PresenceDetection       | PYD 5190              | SMD housing                   | Dual Element                       | analog           | 20   |
| Presence Detection      | PYD 5790              | SMD housing                   | Dual Element                       | DigiPyro®        | 20   |
| Gas Detection           | PYS 3798              | Narrow band filter            | (1+1) Channel                      | DigiPyro®        | 28   |
| Gas Detection           | PYS 3828              | 2 Narrow band filters         | (2+1) Channel with Tref            | DigiPyro®        | 29   |
| Gas Detection           | LHI 807 TC            | Narrow band filter            | Single Channel                     | analog           | 26   |
| Gas Detection           | PYS 3428 TC           | 2 Narrow band filters         | RF protection                      | analog           | 27   |
| Gas Detection           | TPD 1T 0625           | Narrow band filter            | Single Channel                     | Thermopile       | 30   |
| Gas Detection           | TPD 2T 0625           | 2 Narrow band filters         | Dual Channel                       | Thermopile       | 31   |
| Gas Detection           | TPD 1T 0223           | Narrow band filters           | Single Channel                     | small housing    | 34   |
| Gas Detection           | TPD 1T 0623           | Narrow band filters           | Single Channel                     | small housing    | 34   |
| Non-contact Measurement | TPID 1S 0222          | SMD Housing                   | SMD Housing                        | isothermal       | 36   |
| Thermometry             | TPID 1T 0224          | high S/N ratio                | round Aperture, Thermistor         | isothermal       | 32   |
| Thermometry             | TPID 1T 0624          | high S/N ratio                | round Aperture, Thermistor         | isothermal       | 32   |
| Thermometry             | TPD 1T 0122           |                               | round Aperture, Thermistor         | small housing    | 32   |
| Thermometry             | TPID 1T 0122B         | excellent Thermal shock perf. | round Aperture, Thermistor         | isothermal       | 35   |
| Thermometry             | TPID 1T 0222B         | excellent Thermal shock perf. | round Aperture, Thermistor         | isothermal       | 35   |
| Non-contact Measurement | TPD 1T 0226 IRA       | small target area             | integral optics                    | isothermal       | 33   |
| Non-contact Measurement | TPID 1T 0226 L5.5     | small target area             | integral optics                    | isothermal       | 33   |
| Non-contact Measurement | TPIS 1S 0133          | integrated Signal processing  | SMD Housing                        | fully calibrated | 37   |
| Non-contact Measurement | TPIS 1T 0134          | integrated Signal processing  | round Aperture                     | fully calibrated | 42   |
| Non-contact Measurement | TPIS 1T 0136 L5.5     | integrated Signal processing  | integral optics                    | fully calibrated | 42   |
| Non-contact Measurement | TPS 1T 0136 IRA       | integrated Signal processing  | integral optics                    | fully calibrated | 42   |
| Non-contact Measurement | TPiM 1T 0134 L5.5     | integrated Signal processing  | pcb w connector                    | fully calibrated | 44   |
| Non-contact Measurement | TPIS 1T 1252B         |                               |                                    | DigiPile         | 38   |
| Non-contact Measurement | TPIS 1T 1254          |                               |                                    | DigiPile         | 38   |
| Non-contact Measurement | TPIS 1T 1256 L5.5     |                               |                                    | DigiPile         | 38   |
| Non-contact Measurement | TPIS 1S 1252          |                               |                                    | DigiPile         | 40   |
| Non-contact Measurement | TPIS 1S 1051          |                               |                                    | DigiPile         | 40   |
| Non-contact Measurement | TPM 1T 0134 P(x) M(y) | integrated Signal processing  | pcb w connector                    | fully calibrated | 44   |



# Infrared Basics

## Infrared Basics

All solid bodies when having temperatures above the absolute zero (-273 C) emit electromagnetic waves. The range of longer wave lengths beyond the visual spectrum is referenced as infrared radiation. The scientist Wilhelm Wien (1864–1928) has described the relation between a solid body's temperature and its emitting peak wave length by following equation:

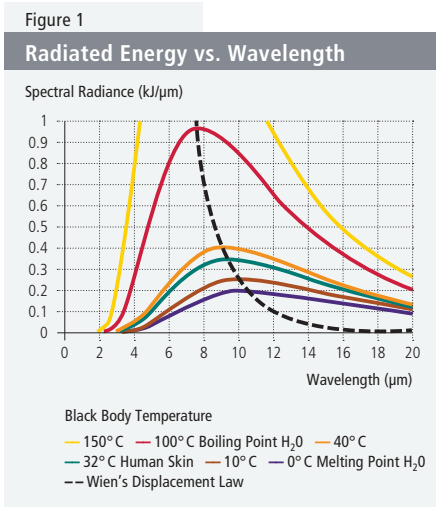
$$\lambda_{\max} = 2898 / T$$

T = Temperature in K (Kelvin)

λ = Wavelength in μm

Using this law we can calculate the specific peak emission wave length of any material or body: A human body, of a surface temperature of approx. 35°C or 308 K calculates into a peak wavelength of 9,4 μm; a cat of 38°C temperature into 9,3 μm. According to Max Planck (1858 – 1947) the intensity curve of all emitted wave lengths for a solid body is rather broad. For our example above this means we cannot distinguish human from the cat by their infrared spectrum.

For various temperatures of an ideal black body radiator the intensity curves of radiated energy versus wave length are shown below.



A hot body of 2000 K emits a lot of energy, some in the visible light range, some in the infrared (it glows red or white-hot). A body of 500 K emits radiation in the invisible part of the spectrum, the infrared range, which we can feel, but not see.

## Infrared Detectors

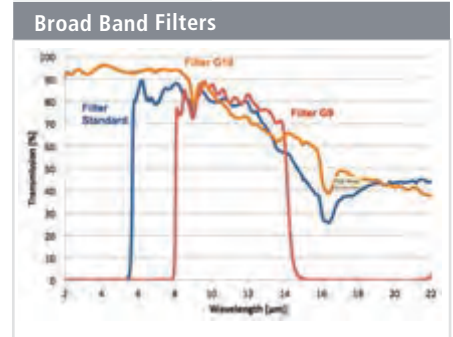
With detectors for the infrared spectrum there are two major classes by their physical principles: Photon Detectors and Thermal Detectors. Photon detectors convert radiation directly into electrons, Thermal Detectors receive radiation, transfer it to raising temperature of the sensing material which changes it's electrical property in response to the temperature rise. Photon detectors such as Photodiodes and Phototransistors range from visible to near infrared, Thermal Detectors have a broad response from below visible light up to over 100 μm. Fitted with special infrared windows as spectral filters they work in the mid to far infrared range without ambient visible light interference.

## Filters for Infrared Sensors

The spectral sensitive range of the detectors is defined by a filter window. Common applications in infrared reference wavelengths from 2 to 20 μm. Infrared windows for pyrometric applications are defined for the atmospheric window 5-14μm, which is our standard filter window. Long range pyrometers apply a sharp cut-on/cut-off window of 9-14μm (G9) as per fig.2.

For the special application of Gas sensing by infrared absorption we offer narrow band filters to detect specific gas absorption lines. The appropriate narrow band optical filters enable detection of Carbon Monoxide, Carbon Dioxide, Natural Gas and other environmental gases, as well as some technical gases.

Figure 2



In Fig.2 we show the graph for standard infrared window and the pyrometric window "G9". As to narrow band Infrared filters, the range of available filters and specifications is given in Table 1 below:

## Optical Properties

With respect to optical parameters of Detectors and Sensors, there are some interesting items to be mentioned: the optical bandwidth, transmission and blocking characteristics of the optical filter and, as major selection criteria, the sensor field of view, and performance of the detector within the field of view. The corresponding charts are given for the various sensors and types.

Table 1

| Narrow Band Filters |             |                  |        |
|---------------------|-------------|------------------|--------|
| Filter Type         | Application | CWL              | HPB    |
| G1                  | CO          | 4.64 μm          | 180 nm |
| G2                  | CO2         | 4.26 μm          | 180 nm |
| G2.2                | CO2         | 4.43 μm          | 60 nm  |
| G2.5                | CO2         | 4.33 μm          | 160 nm |
| G2.6                | N2O         | 4.53 μm          | 85 nm  |
| G3                  | CO+CO2      | 4.48 μm          | 620 nm |
| G4                  | NO          | 5.3 μm           | 180 nm |
| G5                  | HC          | 3.35 μm-3.4 μm   | 190 nm |
| G5.1                | HC          | 3.46 μm          | 163 nm |
| G5.2                | HC          | 3.28-3.31 μm     | 160 nm |
| G5.3                | HC          | 3.09 μm          | 160 nm |
| G5.5                | HC          | 3.32-3.34 μm     | 160 nm |
| G5.6                | HC          | 3.42 μm-3.451 μm | 160 nm |
| G5.7                | HC          | 3.30-3.32 μm     | 160 nm |
| G5.9                | HC          | 3.375 μm-3.4 μm  | 190 nm |
| G7.1                | R12         | 11.3 μm          | 200 nm |
| G7.2                | R134a       | 10.27 μm         | 210 nm |
| G7.3                |             | 12.4 μm          | 180 nm |
| G20                 | Reference   | 3.95 μm          | 90 nm  |

# Pyroelectric Infrared Detectors

## Pyroelectric Effect

Since ancient times the pyroelectric effect has been known as a property of ferroelectric materials. It is based on a specific behavior of dielectric materials, the phenomenon of a permanent electrical polarization. When changing temperature of such materials, this polarization will increase, or decrease, we observe a charge displacement.

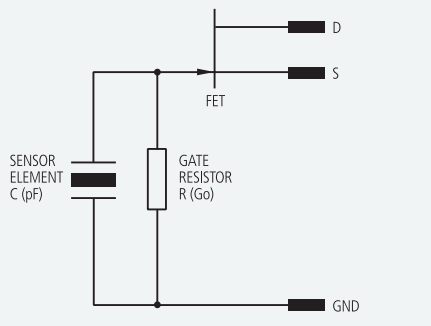
This pyroelectric effect is the basic principle for detectors that can recognize temperature variations. The characteristic value for the permanent polarization, called pyroelectric coefficient, disappears above the Curie point. The Curie temperature limits the operation temperature range for such detectors. Pyroelectric detectors do not require cooling.

## Detector Design

Within our detectors, a thin slice of pyroelectric material is fitted with electrodes to form a capacitor. Incoming radiation will generate extremely low levels of thermal energy, so the pyroelectric current flow is rather small. It needs a circuit to convert this small current into a convenient signal. The traditional analog detectors apply a high ohmic resistor and a special low-leakage current FET to transform the high impedance of the detector material to a common output resistance. The pyroelectric element's capacitance and the high gate resistance of the FET form a RC circuit with a time constant of approx. 1 s., which makes the detector suitable for very low frequencies.

Figure 3

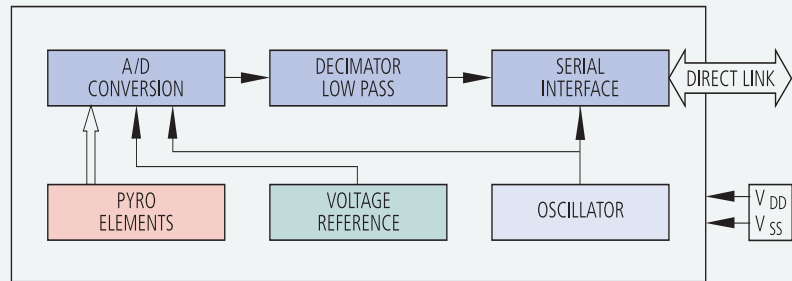
### Electrical Configuration



Excelitas is the first to having introduced digital technology to Pyroelectric Detectors with its DigiPyro® family. Here, a special ADC circuit provides amplification, A/D conversion and interfacing to the outside electronics.

Figure 4

### DigiPyro®



## Detector Construction

The pyroelectric material is placed on a special pc-board which provides thermal and mechanical isolation for the delicate pyroelectric material and provides space for the gate resistor and the FET. The connections are made either by wire bonding or conductive bonding. The whole pc-board is placed on to a TO header and closed with a TO cap, which has the relevant optical filter window. The window possesses a special infrared transmission characteristic, selected for the detector application.

## Pyro Characteristics

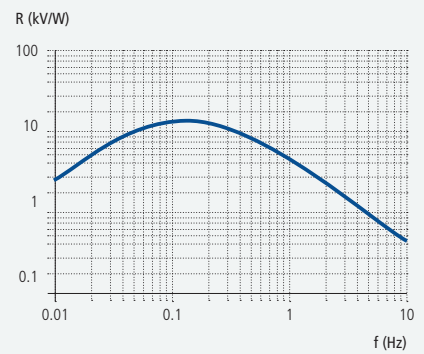
The most important electrical data of the IR-Sensor are its responsivity, balance and noise. Sometimes it is also useful to refer to NEP or  $D^*$ .

## Responsivity

The responsivity shows bandpass characteristics with a maximum at approx. 0.1 Hz radiation modulation. A typical curve „responsivity versus frequency“ is indicated below as figure 5. Responsivity is measured in V/W by means of a defined black body radiator. Responsivity refers to the active sensor area and is usually tested at 1 Hz modulation frequency unless specified differently.

Figure 5

### Transfer Function



## Balance

The balance of a dual element detector indicates the common mode rejection also called matching between the two elements. It is an important value for the performance of dual element detectors, applied in motion applications, as it is a measure for distinction between moving and fixed objects. It can be specified either in V/W or in % of Responsivity.

## Noise

The noise of the sensor consists of three parts: The basic thermal noise of the sensing material, the (Johnson) noise of the high ohmic resistor and the input noise of the FET. The total output of these three parts is rather stable for temperatures below 40°C. Above this temperature, noise increases exponentially with temperature as can be observed with typical active electronic components. Noise is given in  $\mu$ V peak-to-peak or zero-peak. Similar to the dependence of responsivity on frequency, the noise values decrease with frequency from approx. 0.15 Hz to 50 Hz.

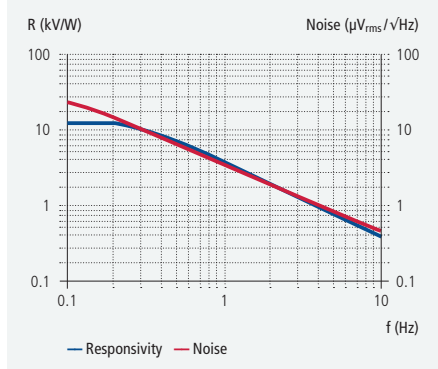


**NEP, D\***

The NEP value is a form of signal to noise ratio. The NEP value specifies the minimum radiation power that can be detected by the sensor, resulting in an output that just exceeds the noise. NEP refers to RMS values of signal and noise and in addition to the electrical bandwidth. The lower the NEP, the better the sensor is.

Sometimes also used for comparison of sensors, the Specific Detectivity ( $D^*$ ) allows the characterization of sensing materials. It is defined as reciprocal of NEP referring to the sensor area. Details of these parameters as function of the electrical frequency are given in Figure 6.

Figure 6

**Responsivity, Noise vs. Frequency****Operating conditions**

The storage and operating temperature range of the detectors is specified from  $-40^{\circ}\text{C}$  up to  $+85^{\circ}\text{C}$ . It needs to be noted that technical data usually reference room temperature and may vary within the specified temperature range.

**Digital Pyrodetectors – a New Family**

Pyroelectric detectors are AC type devices and give signals upon change of received Infrared radiation. Until today, all available detectors are analogue, i.e. they provide an analogue signal output. Excelitas is the first to introduce a family of detectors which differ from previous generations by offering a digital signal output.

With the DigiPyro® family Excelitas is offering digital Detectors for all these applications and configurations.

**1.1 Integrated Electronics**

The DigiPyro® series integrates the first stages of circuitry into the detector housing: Amplification of the signal, then the A/D conversion, which needs a voltage reference. Following an internal 10 Hz electrical low pass filter the serial interface provides for the “direct link” communication which is a one wire bidirectional communication feature. The whole concept is running by its own internal oscillator, which determines the speed of the internal process. The direct link feature enables the user to have the host  $\mu\text{C}$  request the information and its resolution, so the host controls the communication speed.

**1.2 From Analog to Digital**

The DigiPyro series is the first pyroelectric detector family to display information in Bit form as opposed to  $\mu\text{V}$  signals of analogue detectors.

To give a measure for comparisons of traditional detectors to digital versions, the rule of thumb for signal levels versus bit information can be used:

- Resolution: 1 LSB  $\triangleq$  6.5  $\mu\text{V}$
- Noise: 6 Count  $\triangleq$  39  $\mu\text{V}$  (with band-pass)
- DC Offset 8192 Counts
- Digital Range: 0 to 16383 Counts

In a typical motion electronic application the expected signal voltages range from 100  $\mu\text{V}$  to 500  $\mu\text{V}$ , so the digital signal may range about 100 bit-count on to the offset. The dynamic range of the digital detector comprises the range from 511 counts to 15873 counts and with this it is wider than the most application based signal levels. Outside of this range the detectors offers an Out-of-Range Reset function.

**1.3 Digital Zero Signal Line**

As the pyroelectric effect generates positive and negative signal amplitudes, the detector circuitry needs an electrical offset to be able to process such signals. In all analog circuitry this value is the offset voltage, which is usually subtracted after the first amplifier stage.

With DigiPyros, the amplification is included already, and the internal voltage reference provides for the required offset. As to the user this offset appears as a digital zero line at about 8000 bit-count, it may vary in series from one part to the next. To recognize the zero line of

the individual detector, the user may either use a digital band-pass or subtract the measured offset from the signal.

**1.4 The Host Needs to Filter The Signal**

The DigiPyro does not include any processing intelligence inside, unlike most analog Pyrodetectors the DigiPyro uses a direct communication with the hosting microcontroller without any analog hardware filtering (only the previously mentioned low-pass filter). Thus it becomes necessary to implement all necessary filtering by software filters within the hosting microprocessor of the unit.

**Applications for Pyroelectric Detectors**

Pyroelectric detectors had originally been designed as single element types for non-contact temperature measurement. During further research, dual element types were developed with multi-facet mirrors or Fresnel lenses entering the field of motion detection, starting as passive intrusion alarm (Burglar Alarm, PIR), followed by automatic light switches and security lights and lamps. The same concept is also applied with some automatic door openers.

Today the Environment and its protection is one of our most serious concerns. Features and instrumentation are required to measure and monitor all kinds of gas in our environment. One of the methods applied is the NDIR technique, a principle of measuring gas concentration by its absorption properties in the infrared range. Our detectors and sensors are a vital part of making our environment more safe, secure and healthy.

Most of PIR Motion detecting devices have been designed around Dual Element types, more advanced units apply Four Element “Quad” type configurations.

For Gas Sensing single element with narrow band filters are applied in single or dual channel configuration.

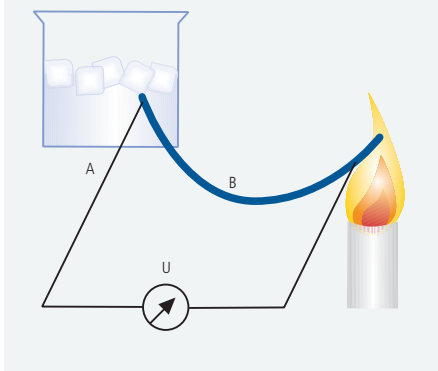
# Thermopile Detectors and Sensors

## The Thermoelectric Effect

The thermoelectric effect today is known as reverse to the Peltier- (or Seebeck-) effect. By applying a temperature difference to two junctions of two dissimilar materials A and B, a voltage U which is proportional to the temperature difference is observed.

Figure 7

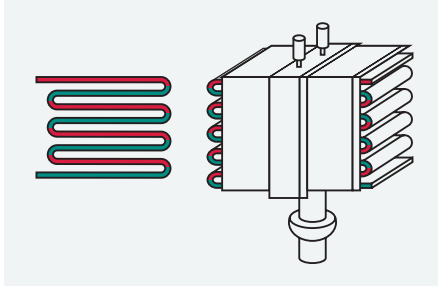
### The Seebeck Effect



Leopoldo Nobili (1784 - 1835) first used the thermoelectric effect for IR radiation measurement using a "pile" of Bismuth and Antimony contacts.

Figure 8

### Nobili's Thermopile



The measure of this effect is called the thermoelectric- or Seebeck- coefficient. For most conducting materials this coefficient is rather low, only few semiconductors possess rather high coefficients. Since the voltage of a single thermoelectric cell is very low, lots of such cells arranged in a series connection achieve a larger signal, making a "pile" of thermo-elements.

## Excelitas Thermopile Design

Our thermopile sensors are based on the technology of Silicon Micromachining. The central part of a silicon chip is removed by an etching process, leaving on top only a 1 µm thin sandwich layer (membrane) of SiO<sub>2</sub>/Si<sub>3</sub>N<sub>4</sub>, which has low thermal conductivity. Onto this membrane thin conductors of two different thermoelectric materials (to form thermocouples) are deposited. Both conductors have alternatively junctions in the centre of the membrane (hot junctions) and on the bulky part of the silicon substrate (cold junctions). A special IR-absorption layer covers the hot junctions creating the sensors sensitive area.

When exposed to infrared radiation, the absorbed energy leads to a temperature difference between "hot" and "cold" contacts. According to the thermoelectric coefficient of the thermocouples a signal voltage is generated.

## The Thermopile Construction

The sensor chip is mounted in good thermal contact on to a TO header. A transistor cap with infrared filter is sealing the sensor chip from the environment.

Excelitas's product portfolio includes detectors of various sizes, housings and infrared windows, and integrated sensors which include electronics that provide temperature compensation and calibration to a certain measurement range.

Excelitas offers unique constructions to deal with the thermal shock, referenced as ISO-thermal types.

## Advantages

Thermopile Detectors do not require any mechanical chopper to sense infrared, thus they offer simple design possibility to infrared measurements.

## Thermopile Characteristics

The most important properties of the Thermopile Sensor are it's responsivity, noise, field of view response time, and for calibrated Sensors the temperature range.

## Responsivity

The responsivity shows low pass characteristics with a cut off at approx. 30 Hz.

Responsivity is measured in Volt per Watt by means of a defined black body radiator. Responsivity data usually quote with respect to the active detector area, and are given without the infrared filter. The data show a responsivity value, tested at 1 Hz electrical frequency.

## Noise

The noise of the detector is dominated by the Johnson noise due to the resistance of the thermopile. Noise is given as RMS value in nV/√Hz.

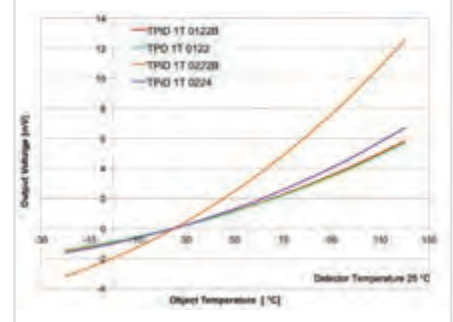
## Sensitivity

The Data tables do also mention Sensitivity, as a characteristic output voltage versus target temperature at 25°C environment temperature.

The data are given with standard IR filter as per fig.2. Two are given: S(25/40) is 25°C environment, 40°C Black Body target and S(25/100), which is 25°C environment, 100°C Black Body target. Sensitivity is depending on the field of view of the detector construction. An example can be seen below for selected TPS series:

Figure 9

### Sensitivity vs. Target Temperature



## Thermistor Is Included

As temperature reference the thermopile detectors include a thermistor which senses the internal temperature.

For exact measurements the temperature of the detector housing (cold thermopile contacts) must be known. As a standard version 100kOhm thermistor inside the detector housing serves as the ambient temperature reference, optional 30 kOhm is available.

The dependence of the resistance on temperature can be approximated by the following equation:

$$R_T = R_R \cdot e^{B \cdot \left( \frac{1}{T} - \frac{1}{T_R} \right)}$$

|       |  |
|-------|--|
| $R_T$ | NTC resistance in $\Omega$ at temperature T in K           |
| $R_R$ | NTC resistance in $\Omega$ at rated temperature $T_R$ in K |
| T     | Temperature in K   |
| $T_R$ | Rated temperature in K                                     |
| B     | B value, material-specific constant of NTC thermistor      |
| e     | Euler number (e = 2.71828)                                 |

The actual characteristic of an NTC thermistor can be roughly described by the exponential relation. This approach, however, is only suitable for describing a restricted range around the rated temperature or resistance with sufficient accuracy.

For practical applications a more precise description of the real R/T curve is required. Either more complicated approaches (e.g. the Steinhart-Hart equation) are used or the resistance/temperature relation is given in tabulated form.

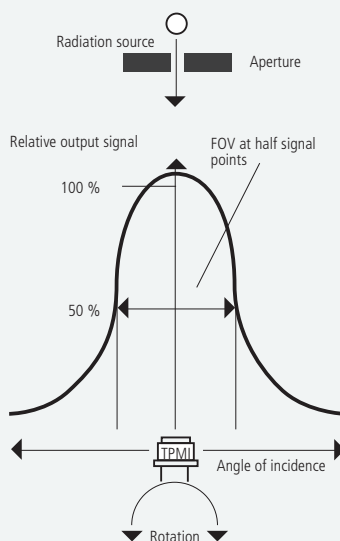
## The Field of View

The most common use of thermopile detectors is non-contact temperature sensing. All target points within the field of view will contribute to the measurement signal. To meet requirements of different applications, Excelitas offers a broad range of sensors with different windows and optics.

The field of view data describe the dependence of signal from incident angles.

Figure 10

## Field of View



The TPMI® family is available with different options on optical cap assemblies. We provide housing with aperture opening and filter window only, or with an infrared lens or also with integral mirror.

Such optical features define the viewing angle or as per definition the Field of View (FOV) of the sensor.

The FOV is defined as the difference of the incidence angles that allow the sensor to receive 50 % relative output signal, see also figure shown here, which is a sketch of a testing principle.

|                                      | Symbol | Parameter                   | Min | Typ | Max  | Unit |
|--------------------------------------|--------|-----------------------------|-----|-----|------|------|
| <b>Lens Type (L5.5)</b>              |        |                             |     |     |      |      |
|                                      | FOV    | Field of view               |     | 7   | 12   | °    |
|                                      | OA     | Optical axis                |     | 0   | ±3.5 | °    |
|                                      | D:S    | Distance to spot size ratio |     | 8:1 |      |      |
| <b>Integral Reflector Type (IRA)</b> |        |                             |     |     |      |      |
|                                      | FOV    | Field of view               |     | 15  | 20   | °    |
|                                      | OA     | Optical axis                |     | 0   | ±2   | °    |
| <b>Standard Aperture Type</b>        |        |                             |     |     |      |      |
|                                      | FOV    | Field of view               |     | 70  | 80   | °    |
|                                      | OA     | Optical axis                |     | 0   | ±10  | °    |

## Temperature Range

Excelitas offers sensors which include pre-amplification, ambient temperature compensation and calibration within a specific temperature range.

## Thermopile Arrays

Further to its range of Detectors and Sensors, Excelitas offers Line Arrays and spatial arrays based on Thermopile technology.

## Applications for Thermopile Sensors

Thermopile Sensors have been designed for non-contact temperature measurement. The signal of the sensor follows the radiation energy receipt by the sensor. This enables the application of measuring surface temperatures without contact.

In many industrial process control units thermopile sensors are used to contactless monitor temperature or to serve as overheating protection feature.

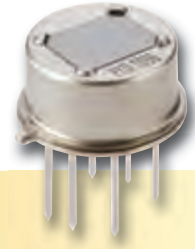
The thermopile technology is also suited for domestic appliances such as food monitoring during automated defrosting, warming-up or cooking.

Same as our Pyrodetectors, the Thermopile Detectors with specific filter windows are used as sensing components making our environment more safe, secure and healthy.



# Smart Detectors

## All Electronics for Motion Detection Included



**PYD 1096 – Dual-Element, Smart DigiPyro®**  
**PYQ 1046 – Quad-Element, Smart DigiPyro®**

### Target Applications

- Simple motion Switches
- Auto Light Switch
- Wall Switch

### Features and Benefits

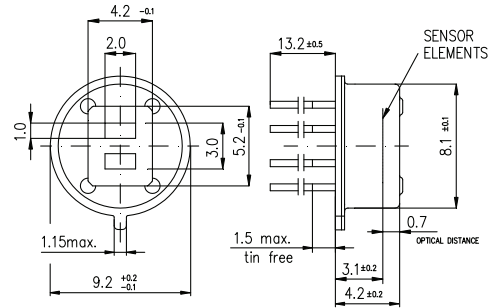
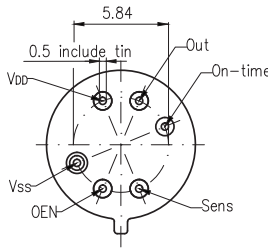
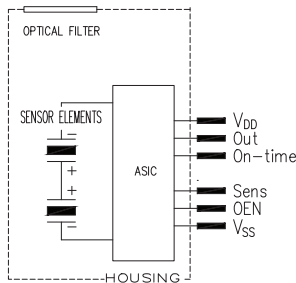
- TO-5 metal housing
- All electronics included
- Dual Element: PYD 1096
- Quad Element: PYQ 1046

### Product Description

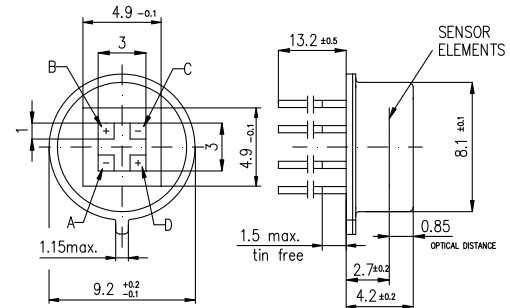
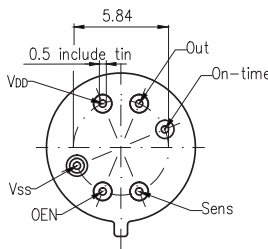
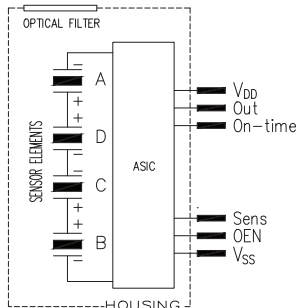
The Smart DigiPyro® family provides for a complete motion detector solution, with all electronic circuitry built-into the Detector housing. Only power supply and power-switching components need to be added to make the entire motion switch, a timer is included. The series has versions which can include ambient light level and sensitivity adjustments.

Both PYD 1096 and PYQ 1046 offer the complete setting feature of Time, Sensitivity and Light level. For the light level input, a Photocell is to be connected externally, please refer to the application notes on this product.

PYD 1096

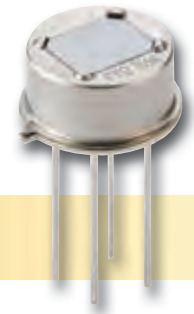


PYQ 1046



### PYD 1096 and PYQ 1046

| Parameter                        | Symbol      | PYD 1096                              | PYQ 1046                              | Unit             | Remarks                           |
|----------------------------------|-------------|---------------------------------------|---------------------------------------|------------------|-----------------------------------|
| Responsivity, min.               | $R_{min}$   | 3,3                                   | 5,4                                   | kV/W             | f = 1Hz                           |
| Responsivity, typ.               | R           | 4,0                                   | 6,5                                   | kV/W             | f = 1Hz                           |
| Match, max.                      | $M_{max}$   | 10                                    | 10                                    | %                |                                   |
| Field of View, horizontal        | FoV         | 100°                                  | 95°                                   |                  | unobstructed                      |
| Field of View, vertical          |             | 100°                                  | 95°                                   |                  | unobstructed                      |
| Operating Voltage                | $V_{DD}$    | 2,7...3,3                             | 2,7...3,3                             | V                |                                   |
| Supply Current                   | $I_{DDmax}$ | 15                                    | 15                                    | μA               | $V_{DD} < V_R$ , Outputs unloaded |
| Sensitivity Threshold            |             | 120...530                             | 120...530                             | μV <sub>pp</sub> |                                   |
| Noise, max.                      |             | 50                                    | 100                                   | μV <sub>pp</sub> | 0,4...10Hz/20°C                   |
| On-Time                          |             | 2...4194                              | 2...4194                              | s                |                                   |
| OEN (ambient light control)      |             | Low<0.2* $V_{DD}$ ; High>0.8 $V_{DD}$ | Low<0.2* $V_{DD}$ ; High>0.8 $V_{DD}$ | V                |                                   |
| Output Driving Current           |             | 1                                     | 1                                     | μA               |                                   |
| <b>Filter, Signal Processing</b> |             |                                       |                                       |                  |                                   |
| Digital Filter, cut on           |             | 0,4                                   | 0,4                                   | Hz               |                                   |
| Digital Filter, cut off          |             | 7                                     | 7                                     | Hz               |                                   |



# Smart Detectors

## Complete Motion Detection... To Make it Simple

**PYD 1098 – Dual-Element, Smart DigiPyro®**  
**PYQ 1048 – Four-Element, Smart DigiPyro®**

### Applications

- Simple Motion Switches
- Auto Light Switch
- Wall Switch

### Features and Benefits

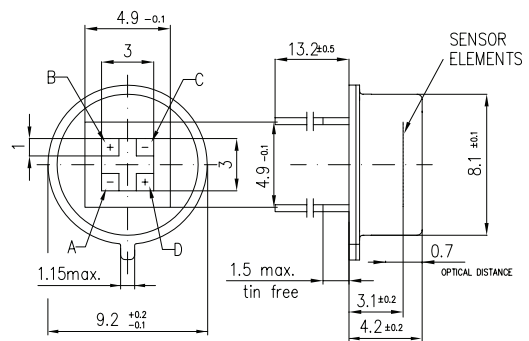
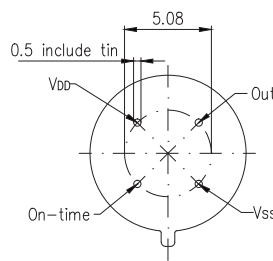
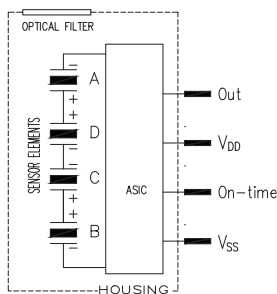
- TO-5 metal housing
- All electronics included
- Dual-Element: PYD 1098
- Quad-Element: PYQ 1048

### Product Description

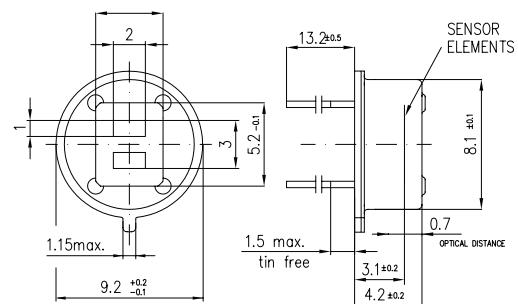
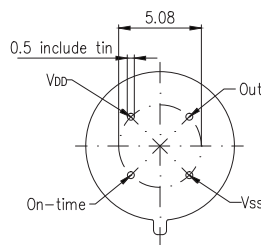
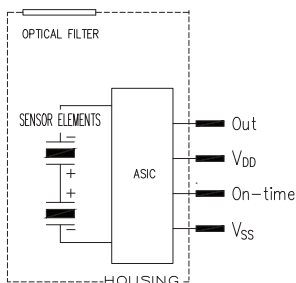
The Smart DigiPyro® family provides for a complete motion detector solution, with all electronic circuitry built-into the Detector housing. Only power supply and power-switching components need to be added to make the entire motion switch, a timer is included. The series has versions which can include ambient light level and sensitivity adjustments.

Two versions are offered: PYD 1098 Dual Element configuration and for higher spatial resolution the Quad Element with 4 square elements. Parameters as sensitivity and Light level are internally set to default values and disabled.

PYQ 1048



PYD 1098



### PYQ 1048 and PYD 1098

| Parameter                        | Symbol             | PYQ 1048  | PYD 1098  | Unit             | Remarks   |
|----------------------------------|--------------------|-----------|-----------|------------------|---|
| Responsivity, min.               | R <sub>min</sub>   | 5,4       | 3,3       | kV/W             | f = 1Hz   |
| Responsivity, typ.               | R                  | 6,5       | 4,0       | kV/W             | f = 1Hz   |
| Match, max.                      | M <sub>max</sub>   | 10        | 10        | %                |   |
| Field of View, horizontal        | FoV                | 105°      | 100°      |                  | unobstructed  |
| Field of View, vertical          |                    | 105°      | 100°      |                  | unobstructed  |
| Operating Voltage                | V <sub>DD</sub>    | 2,7...3,3 | 2,7...3,3 | V                |   |
| Supply Current                   | I <sub>DDmax</sub> | 15        | 15        | µA               | V <sub>DD</sub> < V <sub>R</sub> , Outputs unloaded |
| Sensitivity Threshold            |                    | 120       | 120       | µVp              |   |
| Noise, max.                      |                    | 100       | 50        | µV <sub>pp</sub> | 0,4...10Hz/20°C                                     |
| On-Time                          |                    | 2...4194  | 2...4194  | s                |   |
| OEN (ambient light control)      |                    | n. a.     | n. a.     | V                |   |
| Output Driving Current           |                    | 1         | 1         | µA               |   |
| <b>Filter, Signal Processing</b> |                    |           |           |                  |   |
| Digital Filter, cut on           |                    | 0,4       | 0,4       | Hz               |   |
| Digital Filter, cut off          |                    | 7         | 7         | Hz               |   |

# Pyroelectric, Dual-Element Detectors For Intrusion Alarms



## LHi 968, PYD 1398 – High-End Pyro

### Applications

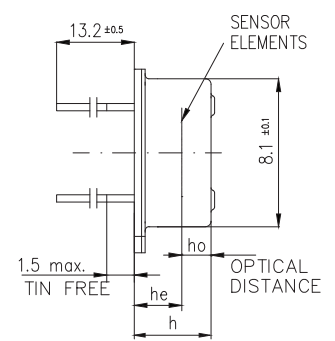
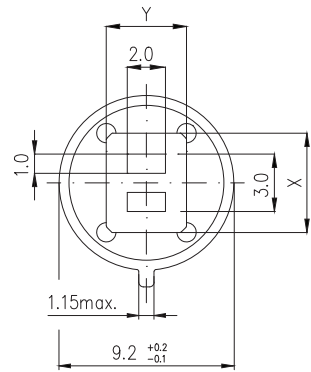
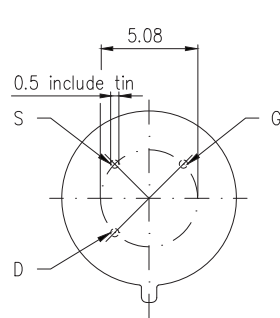
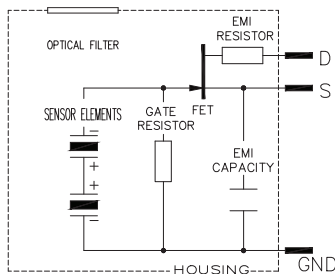
- Intrusion Alarms
- High-end Motion Sensors

### Features and Benefits

- TO-5 metal housing
- Improved EMI protection
- Reduced (WLI)

### Product Description

The analog LHi 968 series with Dual Element configuration is performance-proven top of the line product in high-end applications. The LHi 968 design provides for a reduced sensitivity to EMI and excellent White Light Immunity (WLI). PYD 1398 offers a higher level of RF immunity and is optionally available with grading for lower white light sensitivity.

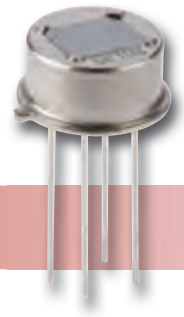


## LHi 968 and PYD 1398

| Parameter                 | Symbol       | LHi 968    | PYD 1398   | Unit                                   | Remarks               |
|---------------------------|--------------|------------|------------|--|-----------------------|
| Responsivity, min.        | $R_{min}$    | 3,3        | 3,3        | kV/W                                   | $f = 1 \text{ Hz}$    |
| Responsivity, typ.        | $R$          | 4          | 4          | kV/W                                   | $f = 1 \text{ Hz}$    |
| Match, max.               | $M_{max}$    | 10         | 10         | %                                      |                       |
| Noise, max.               | $N_{max}$    | 50         | 50         | $\mu\text{V}_{pp}$                     | 0,4...10Hz/20°C       |
| Noise, typ.               | $N$          | 20         | 20         | $\mu\text{V}_{pp}$                     | 0,4...10Hz/20°C       |
| spec. Detectivity         | $D^*$        | 19         | 19         | $10^7 \text{ cm}^* \sqrt{\text{Hz/W}}$ | 1Hz / 1Hz BW/20°C     |
| Field of View, horizontal | FoV          | 100°       | 100°       |  | unobstructed          |
| Field of View, vertical   |              | 100°       | 100°       |  | unobstructed          |
| Source Voltage            |              | 0,2...1,5  | 0,2...1,5  | V                                      | 47 kΩ, 20°C, VDD=10V  |
| Operating Voltage         |              | 2,0...10   | 2,0...10   | V                                      | 47 kΩ, 20°C           |
| EMI performance           |              | **         | **         |  |                       |
| White Light performance   |              | **         | ***        |  | Excelitas test set up |
| Height                    | $h$          | 4,2        | 4,2        | mm                                     |                       |
| Optical Element Location  | $he / ho$    | 2,6 / 0,95 | 2,6 / 0,95 | mm                                     |                       |
| Filter Size               | $X \times Y$ | 5,2 x 4,2  | 5,2 x 4,2  | mm <sup>2</sup>                        |                       |



# Pyroelectric, Four-Element Detectors For Intrusion Alarms



## LHi 1148 – High-End, Dual-Channel Pyrodetectors

### Applications

- Intrusion Alarms
- Dual-Channel Systems
- High-end Motion Sensors

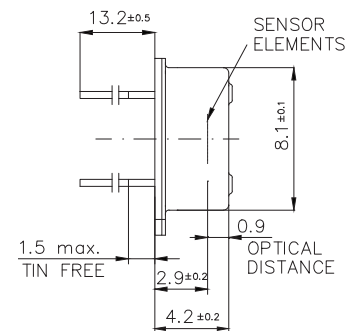
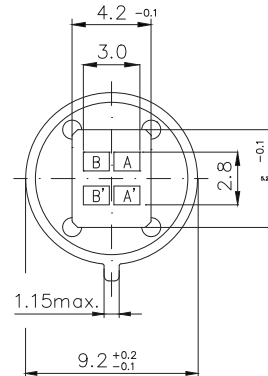
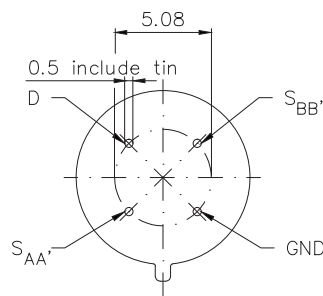
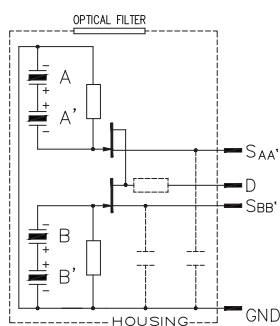
### Features and Benefits

- TO-5 metal housing
- Dual Channel
- Optional Reverse/Equal Polarity
- Optional Element Configurations
- RF Protection Option

### Product Description

The LHi 1148 series with four element “Quad” configuration offers two independent dual element signals with opposite polarity. This enables separate signal processing option for the two channels to reduce common-mode RF influence and thermal effects.

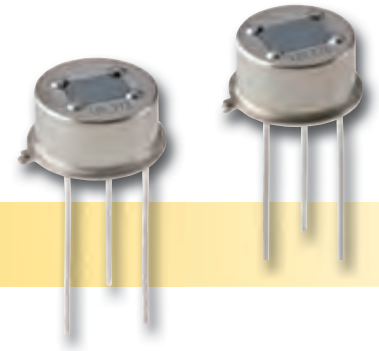
For Ceiling-mount applications, we offer – as an option – a similar version, with dual-element pairs arranged in a diagonal geometrical arrangement and with a square-type window. This enables presence detection without any preference to direction. The series further includes various options as for element spacing and polarity arrangement. Details available on request.



### LHi 1148

| Parameter                 | Symbol    | LHi 1148  | Unit   | Remarks              |
|---------------------------|-----------|-----------|--|----------------------|
| Responsivity, min.        | $R_{min}$ | 3,5       | kV/W   | $f = 1 \text{ Hz}$   |
| Responsivity, typ.        | R         | 4,5       | kV/W   | $f = 1 \text{ Hz}$   |
| Match, max.               | $M_{max}$ | 15        | %  |                      |
| Noise, max.               | $N_{max}$ | 75        | $\mu\text{V}_{pp}$                           | 0,4...10Hz/20°C      |
| Noise, typ.               | N         | 30        | $\mu\text{V}_{pp}$                           | 0,4...10Hz/20°C      |
| spec. Detectivity         | $D^*$     | 16        | $10^7 \text{ cm}^2 \cdot \sqrt{\text{Hz/W}}$ | 1Hz/ 1Hz BW/20°C     |
| Field of View, horizontal | FoV       | 110°      |  | unobstructed         |
| Field of View, vertical   |           | 70°       |  | unobstructed         |
| Source Voltage            |           | 0,2...1,5 | V  | 47 kΩ, 20°C, VDD=10V |
| Operating Voltage         |           | 2,0...10  | V  | 47 kΩ, 20°C          |

# Pyroelectric, Dual-Element Detectors For Motion Sensing



**LHi 778 – Low-Cost Pyro**  
**LHi 878, PYD 1388 – Standard Pyro**

### Applications

- Auto Light Switch
- Wall Switch
- Auto Lamps

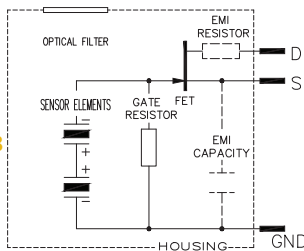
### Features and Benefits

- TO-5 metal housing
- Different window sizes
- Additional EMI protection with PYD 1388

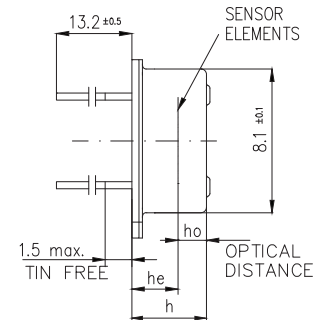
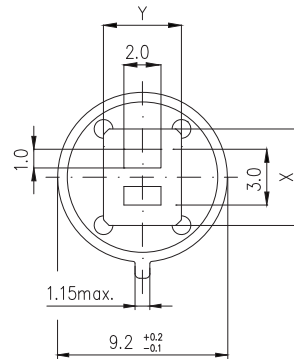
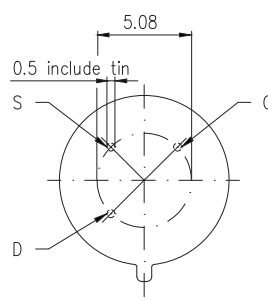
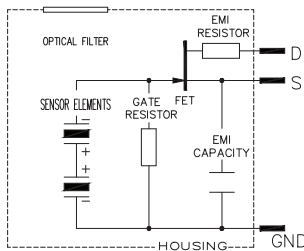
### Product Description

This Dual Element detector family offers standard TO-5 housings with different window sizes. Whereas LHi 778 is designed to meet low cost and having small optical window, LHi 878 offers standard window size. PYD1388 has same dimensions and provides for additional EMI protection as option.

LHi 778, 878



PYD 1388



### LHi 778, LHi 878 and PYD 1388

| Parameter                 | Symbol    | LHi 778    | LHi 878    | PYD 1388   | Unit            | Remarks              |
|---------------------------|-----------|------------|------------|------------|-----------------|----------------------|
| Responsivity, min.        | $R_{min}$ | 3,3        | 3,3        | 3,3        | kV/W            | f = 1 Hz             |
| Responsivity, typ.        | R         | 4,2        | 4,2        | 4,2        | kV/W            | f = 1 Hz             |
| Match, max.               | $M_{max}$ | 10         | 10         | 10         | %               |                      |
| Noise, max.               | $N_{max}$ | 50         | 50         | 50         | $\mu V_{pp}$    | 0,4...10Hz/20°C      |
| Noise, typ.               | N         | 35         | 25         | 20         | $\mu V_{pp}$    | 0,4...10Hz/20°C      |
| Field of View, horizontal | FoV       | 71°        | 95°        | 95°        |                 | unobstructed         |
| Field of View, vertical   |           | 71°        | 87°        | 87°        |                 | unobstructed         |
| Source Voltage            |           | 0,2...1,55 | 0,2...1,55 | 0,2...1,55 | V               | 47 kΩ, 20°C, VDD=10V |
| Operating Voltage         |           | 2,0...10   | 2,0...10   | 2,0...10   | V               | 47 kΩ, 20°C          |
| EMI performance           |           |            | *          | *          |                 |                      |
| Height                    | h         | 4,2        | 4,2        | 4,2        | mm              |                      |
| Optical Element Location  | he / ho   | 3,2 / 0,75 | 3,2 / 0,75 | 3,2 / 0,75 | mm              |                      |
| Filter Size               | X/Y       | 4 x 3      | 4,6 x 3,4  | 4,6 x 3,4  | mm <sup>2</sup> |                      |

# Pyroelectric, Dual-Element Detectors For Motion Sensing



## LHi 874, LHi 944, PYD 1394 – Low-Profile Pyro

### Target Applications

- Auto Light Switch
- Wall Switch
- Auto Lamps with 180°FOV w. 2 Detectors

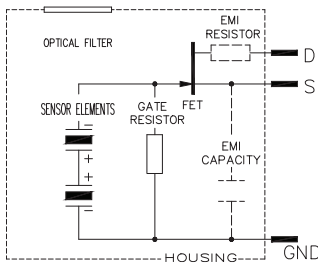
### Features and Benefits

- TO-39 metal housing
- Different window sizes
- EMI protection option

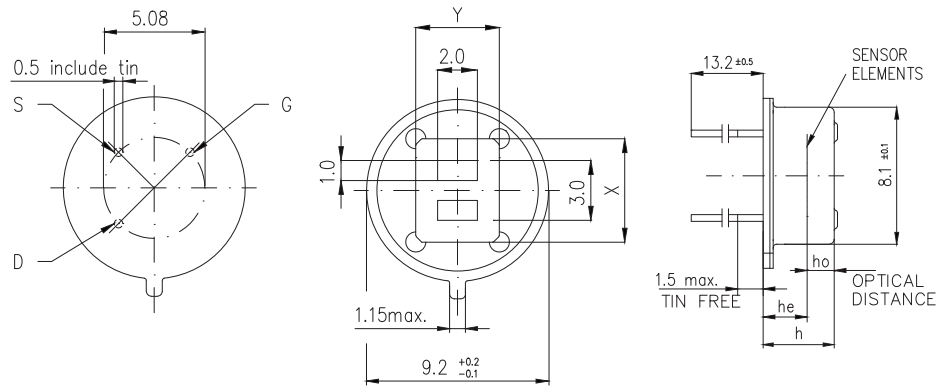
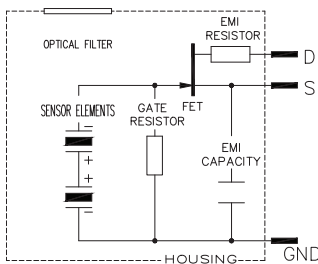
### Product Description

These Low-Profile TO-39 detectors are very well suited for use as two detectors arranged at an angle so as to enable a 180 degree view. The LHi 874 offers a standard window size, whereas the LHi 944 model offers a large window with greater Field Of View. The PYD 1394 has same dimensions and provides for additional EMI protection.

LHi 874, 944



PYD 1394

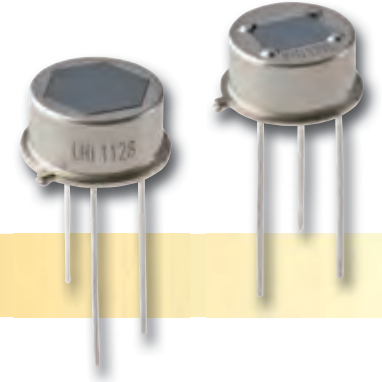


### LHi 874, LHi 944 and PYD 1394

| Parameter                 | Symbol    | LHi 874    | LHi 944    | PYD 1394   | Unit                    | Remarks              |
|---------------------------|-----------|------------|------------|------------|-------------------------|----------------------|
| Responsivity, min.        | $R_{min}$ | 3,3        | 3,3        | 3,3        | kV/W                    | f = 1 Hz             |
| Responsivity, typ.        | R         | 4,2        | 4,2        | 4,2        | kV/W                    | f = 1 Hz             |
| Match, max.               | $M_{max}$ | 10         | 10         | 10         | %                       |                      |
| Noise, max.               | $N_{max}$ | 50         | 50         | 50         | $\mu V_{pp}$            | 0,4...10Hz/20°C      |
| Noise, typ.               | N         | 25         | 20         | 20         | $\mu V_{pp}$            | 0,4...10Hz/20°C      |
| spec. Detectivity         | $D^*$     | 19         | 21         | 21         | $10^7 cm^* \sqrt{Hz/W}$ | 1Hz/ 1Hz BW          |
| Field of View, horizontal | FoV       | 95°        | 110°       | 110°       |                         | unobstructed         |
| Field of View, vertical   |           | 87°        | 110°       | 110°       |                         | unobstructed         |
| Source Voltage            |           | 0,2...1,55 | 0,2...1,55 | 0,2...1,55 | V                       | 47 kΩ, 20°C, VDD=10V |
| Operating Voltage         |           | 2,0...10   | 2,0...10   | 2,0...10   | V                       | 47 kΩ, 20°C          |
| EMI performance           |           | *          | *          | **         |                         |                      |
| Height                    | h         | 3,2        | 3,2        | 3,2        | mm                      |                      |
| Optical Element Location  | he /ho    | 2,2 / 0,75 | 2,2 / 0,75 | 2,2 / 0,75 | mm                      |                      |
| Filter Size               | X x Y     | 4,6 x 3,4  | 5,2 x 4,2  | 5,2 x 4,2  | mm <sup>2</sup>         |                      |



# Pyroelectric Four-Element Detectors For Ceiling-Mount



LHi 1128, PYQ 1398, PYQ 1348 – Single-Output Quad Pyro

### Target Applications

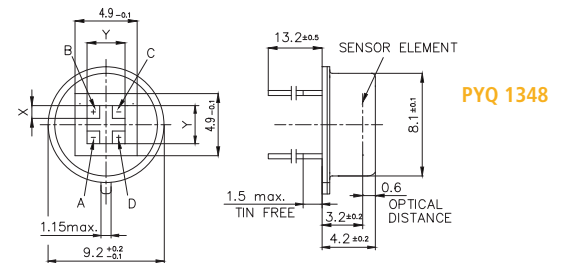
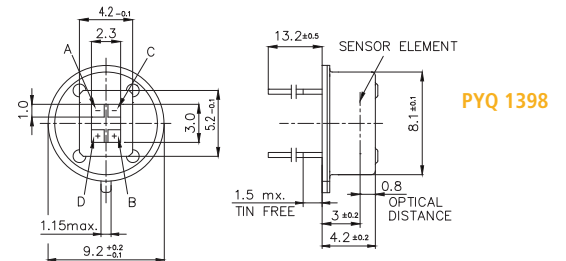
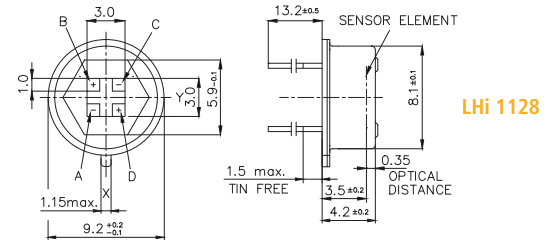
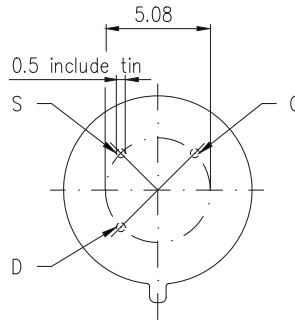
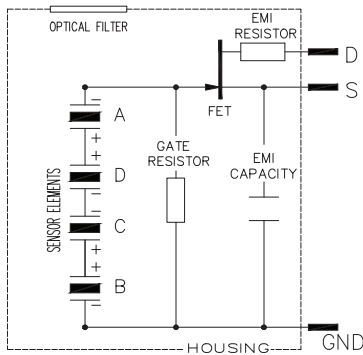
- Ceiling-Mount Alarms
- Ceiling-Mount Light Switch

### Features and Benefits

- TO-5 metal housing
- Different window sizes
- Single Channel output

### Product Description

This series of four element "Quad" Detectors provides all four elements connected to one common output. This configuration enables specific applications in ceiling-mount location when applied with suitable lens or mirror optics designs. Different window options are provided: Large window or standard rectangular window size. Various element polarities available upon request. For better EMI protection, the built-in capacitor option is available. For small fresnellens applications a smaller element configuration is provided.



### LHi 1128, PYQ 1398 and PYQ 1348

| Parameter                 | Symbol    | LHi 1128   | PYQ 1398   | PYQ 1348   | Small Element Option | Unit                    | Remarks              |
|---------------------------|-----------|------------|------------|------------|----------------------|-------------------------|----------------------|
| Responsivity, min.        | $R_{min}$ | 5,4        | 5,4        | 5,4        | 8,4                  | kV/W                    | f = 1 Hz             |
| Responsivity, typ.        | R         | 6,5        | 6,5        | 6,5        | 10,1                 | kV/W                    | f = 1 Hz             |
| Match, max.               | $M_{max}$ | 10         | 15         | 15         | 15                   | %                       |                      |
| Noise, max.               | $N_{max}$ | 100        | 100        | 100        | 125                  | $\mu V_{pp}$            | 0,4...10Hz/20°C      |
| Noise, typ.               | N         | 30         | 40         | 40         | 50                   | $\mu V_{pp}$            | 0,4...10Hz/20°C      |
| spec. Detectivity         | $D^*$     | 8          | 14         | 14         | 17                   | $10^7 cm^* \sqrt{Hz/W}$ | 1Hz/ 1Hz BW          |
| Field of View, horizontal | FoV       | 156°       | 103°       | 124°       | 129°                 |                         | unobstructed         |
| Field of View, vertical   |           | 125°       | 97°        | 124°       | 129°                 |                         | unobstructed         |
| Source Voltage            |           | 0,2...1,55 | 0,2...1,55 | 0,2...1,55 | 0,2...1,55           | V                       | 47 kΩ, 20°C, VDD=10V |
| Operating Voltage         |           | 2,0...10   | 2,0...10   | 2,0...10   | 2,0...10             | V                       | 47 kΩ, 20°C          |
| EMI performance           | **        | **         | **         | **         | **                   |                         |                      |
| Element size/spacing      |           | 1 x 1/1    | 1 x 1/1    | 1 x 1/1    | 0,8 x 0,8/0,8        | mm/mm <sup>2</sup>      |                      |

# Miniaturized, Dual-Element Pyrodetectors For Motion Sensing



## PYD 5731 – DigiPyro® in TO-46 Housing

### Applications

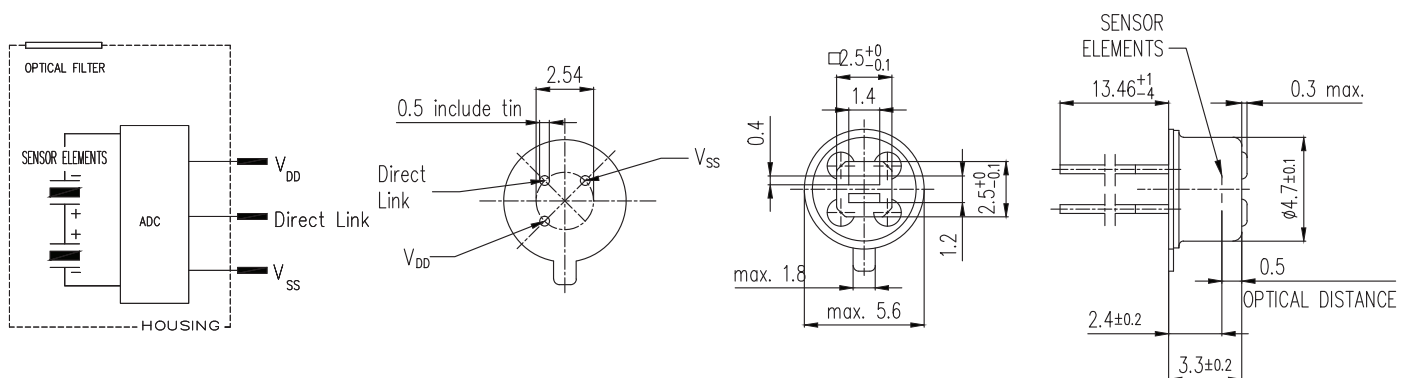
- Automatic Light Switch
- Wall Switches

### Features and Benefits

- TO-46 metal housing
- Temperature reference output included
- DigiPyro® with Direct Link Interface

### Product Description

This Pyrodetector features a miniaturized Dual Element Pyro in TO-46 housing. Furthermore, with the PYD 5731 Excelitas extends the emerging DigiPyro® family to miniaturized detector designs. The PYD 5731 offers the same Direct Link interface as the regular PYD 1798 DigiPyro, for output of Dual Element Pyro and additional temperature reference output. The small housing in connection with a reduced element size and spacing will enable customers to reduce the size of their optics and design smaller motion detection units.

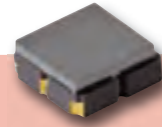


### PYD 5731

| Main Parameter               | Symbol               | PYD 5731    | Unit                       | Remarks                   |
|------------------------------|----------------------|-------------|----------------------------|---------------------------|
| Responsivity, min.           | $R_{min}$            | 8,5         | kV/W                       | $f = 1 \text{ Hz}$        |
| Responsivity, typ.           | $R_{typ}$            | 11          | kV/W                       | $f = 1 \text{ Hz}$        |
| Match, max.                  | $M_{max}$            | 10          | %                          |                           |
| Noise, max.                  | $n_{max}$            | 180         | $\mu\text{V}_{pp}$         | 0,4...10Hz/ 20°C          |
| Noise, typ.                  | $n_{typ}$            | 70          | $\mu\text{V}_{pp}$         | 0,4...10Hz/ 20°C          |
| Field of View, horizontal    | FoV                  | 99°         |                            | unobstr.                  |
| Field of View, vertical      |                      | 88°         |                            | unobstr.                  |
| Operating Voltage            | $V_{DD}$             | 2,7...3,6   | V                          |                           |
| Supply Current               | $I_{DD} / I_{DDmax}$ | 10 / 15     | $\mu\text{A}$              | $V_{DD} = 3,3\text{V}$    |
| <b>Digital Data</b>          |                      |             |                            |                           |
| Sample Time                  | $t_{SMPL}$           | 2           | ms                         | min.                      |
| ADC Resolution               |                      | 14          | Bits                       | max. Count = $2^{14}$     |
| Output Data Format           |                      | 2 x 14      | Bits                       |                           |
| ADC Sensitivity              |                      | 6...7,1     | $\mu\text{V}/\text{count}$ |                           |
| ADC Output Offset            |                      | 6500...9800 | counts                     |                           |
| ADC Output Offset            | typ.                 | 8192        | counts                     |                           |
| <b>Temperature Reference</b> |                      |             |                            |                           |
| Gain (Temperature)           | typ.                 | 80          | Counts/K                   | -20°C to +80°C            |
| Linearity                    |                      | -5...+5     | %                          | -20°C to +80°C            |
| <b>Filter</b>                |                      |             |                            |                           |
| Digital Filter Cut off       |                      | 10          | Hz                         | refer to Application Note |

# SMD Dual-Element Pyro And DigiPyro®

## For Simple Motion Sensing



**PYD 5190 – small Dual Element**  
**PYD 5790 – small Dual Element DigiPyro®**

### Target Applications

- Energy conservation in TV and Monitors
- Mobile phone power on

### Features and Benefits

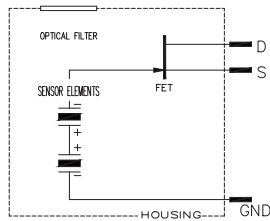
- MSL 1
- SMD housing
- Analog FET output
- DigiPyro with Direct Link Interface
- Especial designed Fresnel lens available

### Product Description

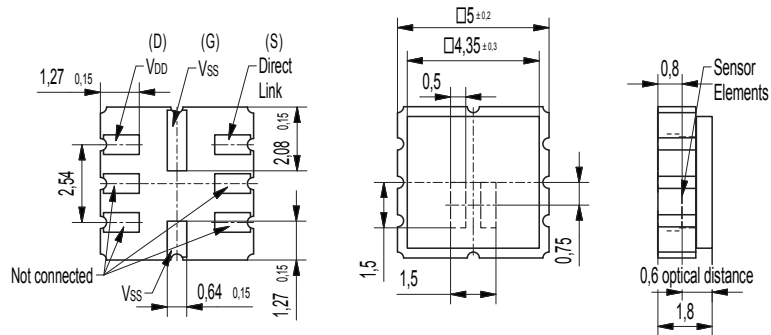
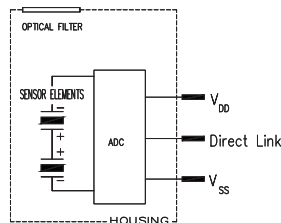
The PYD 5190 features a tiny Dual Element Pyro in SMD form. Furthermore, with the PYD 5790 Excelitas extends the emerging DigiPyro® family to the SMD form factor. Both types are fit with a small pyroelectric elements of 0,7x1,5 mm size. As to the different dimensions of elements and housing, the SMD line is not designed for 1to1 replacement of TO housing versions. Whereas PYD 5190 offers standard FET analog output, PYD 5790 offers the Direct Link interface same as the PYD 1798 DigiPyro.

The small dimensions of the smd housing in connection with a reduced element size and spacing will enable customers to reduce the optical design and smaller motion detection for new applications.

PYD 5190



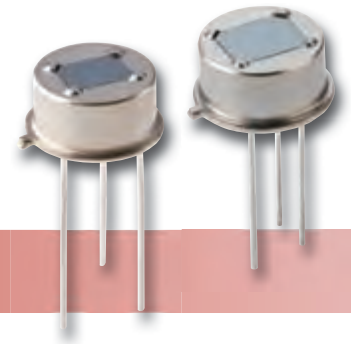
PYD 5790



### PYD 5190 and PYD 5790

| Main Parameter                   | Symbol      | PYD 5790    | PYD 5190     | Unit                       | Remarks                                   |
|----------------------------------|-------------|-------------|--------------|----------------------------|---|
| Responsivity, min.               | $R_{min}$   | 5,5         | 5,5          | kV/W                       | $f = 1 \text{ Hz}$                        |
| Responsivity, typ.               | $R$         | 10          | 8,5          | kV/W                       | $f = 1 \text{ Hz}$                        |
| Match, max.                      | $M_{max}$   | 10          | 10           | %                          |   |
| Noise                            | $N_{max}$   | 200         | 200          | $\mu\text{V}_{pp}$         | 0,4...10Hz/20°C                           |
|                                  | $N_{typ}$   | 80          | 80           | $\mu\text{V}_{pp}$         |   |
| Field of View, horizontal        | FoV         | 133°        | 133°         |                            | unobstr.                                  |
| Field of View, vertical          |             | (76+33)°    | (76+33)°     |                            | non symmetric, unobstr.                   |
| Source voltage                   |             | -           | 0,2 ... 1,55 | V                          | 47 K $\Omega$ , 20°C, $V_{DD}=10\text{V}$ |
| Operating Voltage                | $V_{DD}$    | 2,7...3,6   | 2,0...10     | V                          | 20°C                                      |
| Supply Current                   | $I_{DD}$    | 10          |              | $\mu\text{A}$              | $V_{DD} = 3,3\text{V}$                    |
|                                  | $I_{DDmax}$ | 15          |              | $\mu\text{A}$              | $V_{DD} = 3,3\text{V}$                    |
| <b>Digital Data</b>              |             |             |              |                            |   |
| Sample Time                      | $t_{SMPL}$  | 2           | -            | ms                         | min.                                      |
| ADC Resolution                   |             | 14          | -            | Bits                       | max. Count = $2^{14}-1$                   |
| Output Data Format               |             | 2 x 14      | -            | Bits                       |   |
| ADC Sensitivity                  |             | 6...7,1     | -            | $\mu\text{V}/\text{count}$ |   |
| ADC Output Offset                |             | 6500 - 9800 | -            | counts                     |   |
| ADC Output Offset, typ.          |             | 8192        | -            | counts                     |   |
| <b>Temperature Reference</b>     |             |             |              |                            |   |
| Gain (Temperature)               | typ         | 80          | -            | Counts/K                   | -20°C to +80°C                            |
| Linearity                        |             | -5...+5     | -            | %                          | -20°C to +80°C                            |
| <b>Filter, Signal Processing</b> |             |             |              |                            |   |
| Digital Filter, cut off          |             | 10          | -            | Hz                         |   |





# Digital, Dual-Element Pyros For Motion Sensing

## PYD 1788, PYD 1798 – DigiPyro®

### Target Applications

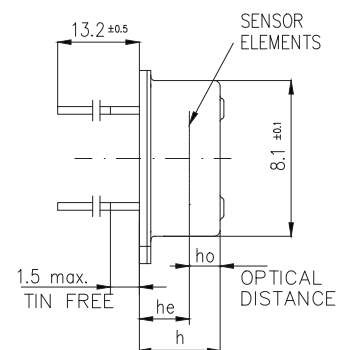
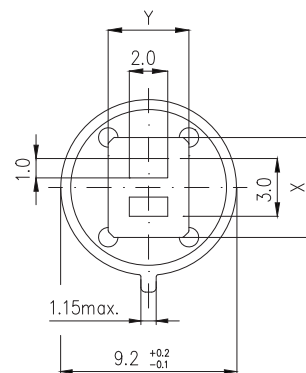
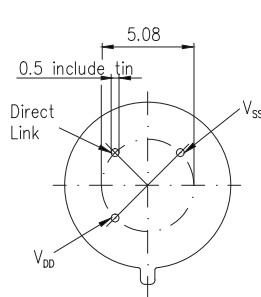
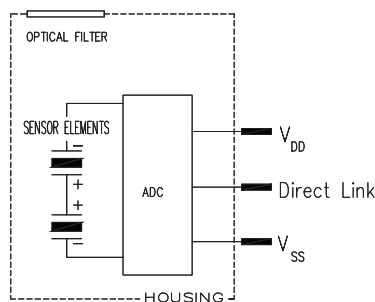
- Passive Intrusion Alarms
- Auto Light Switch
- Auto Lamps

### Features and Benefits

- TO-5 metal housing
- Digital Direct Link
- Different window sizes
- Excellent EMI protection

### Product Description

The DigiPyro® detector range in TO-5 housing includes many Dual-Element types, some with different window sizes. The element configurations are identical, along with the internal electronic circuits. The PYD 1788 is the lower-cost version with standard size window, while PYD 1798 offers better White-Light-Immunity (WLI) performance and Field of View. Both the PYD 1788 and PYD1798 models include a built-in temperature reference. The Output signals are communicated in one digital bit stream of 2x14 bit, output via a single wire "Direct Link" connection to a suitable host microprocessor. With PYD 1784 we also offer an electrically equivalent to PYD1788, but in TO39 housing.



### PYD 1798 and PYD 1788

| Parameter                 | Symbol       | PYD 1798    | PYD 1788    | Unit            | Remarks               |
|---------------------------|--------------|-------------|-------------|-----------------|-----------------------|
| Responsivity, min.        | $R_{min}$    | 3,3         | 3,3         | kV/W            | $f = 1 \text{ Hz}$    |
| Responsivity, typ.        | R            | 4           | 4           | kV/W            | $f = 1 \text{ Hz}$    |
| Match, max.               | $M_{max}$    | 10          | 10          | %               |                       |
| Noise                     | $N, N_{max}$ | 20/78       | 20/78       | $\mu V_{pp}$    |                       |
| Field of View, vertical   | FoV          | 110°        | 95°         |                 | unobstructed          |
| Field of View, horizontal | FoV          | 110°        | 90°         |                 | unobstructed          |
| WLI                       |              | ***         | **          |                 | Excelitas test set up |
| Height                    | h            | 4,2         | 4,2         | mm              |                       |
| Optical Element Location  | he/ho        | 3,1 / 0,7   | 3,1 / 0,7   | mm              |                       |
| Filter Size               | X / Y        | 5,2 / 4,2   | 4,6 / 3,4   | mm <sup>2</sup> |                       |
| <b>Digital Data</b>       |              |             |             |                 |                       |
| Operating Voltage         | $V_{DD}$     | 2,7...3,6   | 2,7...3,6   | V               |                       |
| Supply Current            | $I_{DD}$     | 10          | 10          | $\mu A$         | $V_{DD}=3,3V$         |
|                           | $I_{DDmax}$  | 15          | 15          | $\mu A$         | $V_{DD}=3,3V$         |
| Sample Time               | $t_{SMPL}$   | 2           | 2           | ms              | min.                  |
| ADC Resolution            |              | 14          | 14          | Bits            |                       |
| Output Data Format        |              | 2 x 14      | 2 x 14      | Bits            | MSB first             |
| ADC Sensitivity           |              | 6...7,1     | 6...7,1     | $\mu V/count$   |                       |
| ADC Output Offset         |              | 6500...9800 | 6500...9800 | counts          |                       |
| ADC Output Offset, typ.   |              | 8192        | 8192        | counts          |                       |

# Digital Pyrodetector

## For Ceiling Mount Applications

### PYQ 1748 - low cost (1+1) Output Quad *DigiPyro*®

#### Target Applications

- Intrusion Alarm
- Ceiling Mount Motion Detection

#### Features and Benefits

- 4 Sensing Elements
- Single Output
- Low Cost

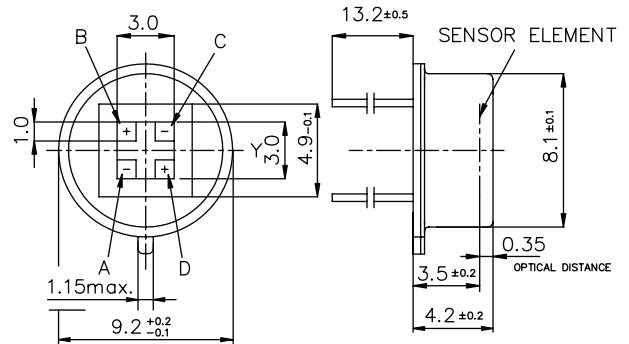
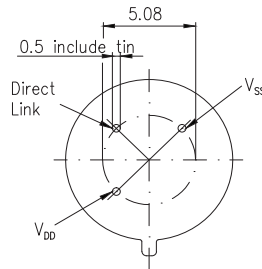
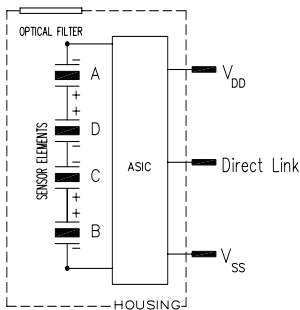
#### Product Description

The PYQ 1748 includes a Quad design pyroelectric element, A/D converter and the digital signal processor, built into a TO-5 housing.

All four sensing elements are electrically connected in series and transmitted in digital signal format to one output.

Geometrically the polarity of the elements has been arranged across and therefor represent the best configuration for ceiling mount applications.

The PYQ 1748 signal transmission provides 2x14 bit and is identical to PYD 1788 and includes the signal from the sensing elements plus internal temperature reference as second batch of bit information.

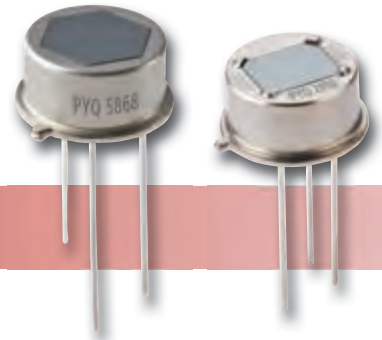


### PYQ 1748

| Main Parameter            | Symbol           | Min. | Typ. | Max. | Unit             | Remarks                         |
|---------------------------|------------------|------|------|------|------------------|---------------------------------|
| Responsivity              | R                | 5,4  | 6,5  |      | kV/W             | f = 1 Hz                        |
| Match                     | M                |      | 5    | 10   | %                |                                 |
| Noise                     | N                |      | 30   | 140  | μV <sub>pp</sub> |                                 |
| Field of View, vertical   | FoV <sub>v</sub> |      | 95°  |      |                  | unobstructed                    |
| Field of View, horizontal | FoV <sub>h</sub> |      | 95°  |      |                  | unobstructed                    |
| <b>Operation Data</b>     |                  |      |      |      |                  |                                 |
| Operating Voltage         | V <sub>DD</sub>  | 2,7  | 3,3  | 3,6  | V                |                                 |
| Supply Current            | I <sub>DD</sub>  |      | 10   | 15   | μA               | V <sub>DD</sub> = 3,3V, no load |
| <b>ADC Data</b>           |                  |      |      |      |                  |                                 |
| ADC Resolution,           | Channel 1+1      |      | 14   |      | Bits             | For each channel, MSB first     |
| PIR ADC Sensitivity       |                  | 6,0  | 6,5  | 7,1  | μV/Count         |                                 |
| ADC Output Offset         |                  | 6500 | 8192 | 9800 | Counts           |                                 |
| Sample Time               | t <sub>SMP</sub> | 2    |      |      | ms               |                                 |

# Digital Pyrodetector

## Digital Pyrodetector Quad designs



PYQ 5868, PYQ 5848, PYQ 2898 (2+1) Channel Quad Element *DigiPyro*®

### Target Applications

- Intrusion Alarms
- Ceiling-Mount Sensors

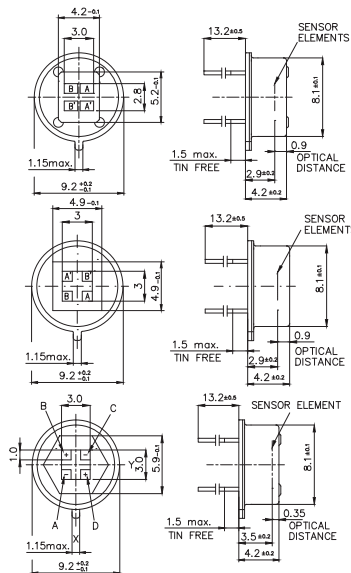
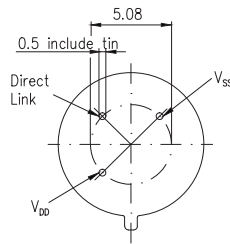
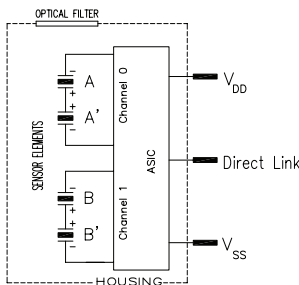
### Features and Benefits

- DigiPyro Concept
- Two independent sensing channels
- Integrated temperature reference

### Product Description

This PYQ family features 3 different „Quad“ configurations, which is the polarity, spacing and arrangement of the four sensing elements. All versions have in common the dual output channels which always combine two sensing elements in series connection to one channel output. In addition, a temperature reference output is provided, making the total output bit stream as 3x14 bit.

All types are offered only in TO-5 metal housing. Depending on element spacing and window size, the 3 versions offer different field of view. Custom variations of element designs are also possible.



PYQ 2898

PYQ 5848

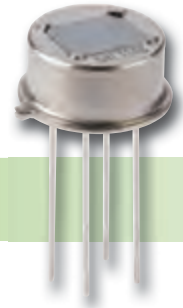
PYQ 5868

### PYQ 2898, PYQ 5848 and PYQ 5868

| Main Parameter            | Symbol             | PYQ 2898 | PYQ 5848 | PYQ 5868 | Unit     | Remarks                         |
|---------------------------|--------------------|----------|----------|----------|----------|---------------------------------|
| Responsivity              | R                  | 4,5      | 8        | 8        | kV/W     | f = 1 Hz                        |
| Responsivity, min         | R <sub>min</sub>   | 3,5      | 6        | 6        | %        |                                 |
| Match                     | M                  | 10       | 10       | 10       | %        |                                 |
| Noise                     | N                  | 30       | 40       | 40       | V        |                                 |
| Noise, max                | N <sub>max</sub>   | 100      | 100      | 100      | µA       |                                 |
| Field of View, vertical   | FoV <sub>v</sub>   | 100°     | 95°      | 115°     |          | unobstructed                    |
| Field of View, horizontal | FoV <sub>h</sub>   | 65°      | 95°      | 100°     |          | unobstructed                    |
| Operation Data for all    |                    | Min      | Typ      | Max      |          |                                 |
| Operating Voltage         | V <sub>DD</sub>    | 2,5      |          | 3,6      | V        |                                 |
| Supply Current            | I <sub>DD</sub>    |          | 10       | 18       | µA       | V <sub>DD</sub> = 3,3V, no load |
| ADC Data                  |                    |          |          |          |          |                                 |
| ADC Resolution,           | Channel 2+1        |          | 3x 14    |          | Bits     | For each channel, MSB first     |
| PIR ADC Sensitivity       |                    | 6,0      | 6,5      | 7,1      | µV/Count |                                 |
| ADC Output Offset         |                    | 7000     | 8192     | 9200     | Counts   |                                 |
| Sample Time               | t <sub>S MPL</sub> | 2        |          |          | ms       |                                 |

# Digital Pyrodetector

## For Battery Operated Applications



### PYD 1688, PYD 1698 – Low Power *DigiPyro*®

#### Target Applications

- Intrusion Alarm, wireless
- Battery operated Motion Detection

#### Features and Benefits

- Wake up/ Sleep Mode
- Low power consumption
- Band pass included
- Pulse count option

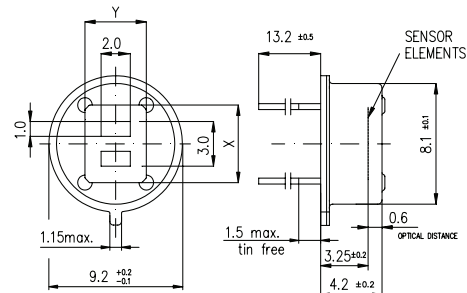
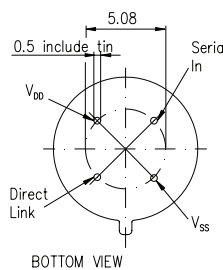
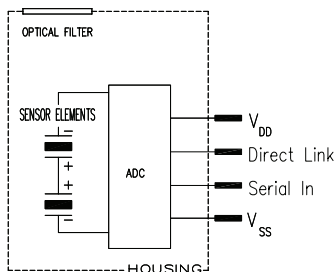
#### Product Description

The LowPower DigiPyro® is our latest introduction addressing the requirements of further reduced power consumption. With its further reduced current requirement at 3V supply the PYD 16 series offers new programmable features: The Wake-up/Sleep mode enables to save unit power, making it ideal for battery operated motion detection applications.

Continuous motion sensing, signal processing and event/motion detection is handled by the Low-Power DigiPyro while the hosting microcontroller can be set into a power saving mode. Only upon detection of a motion per its programmed settings, the LowPower DigiPyro signals the microcontroller to wake up.

Further options are selectable pulse count and electrical band pass.

The PYD 1688 /PYD 1698 include Dual Element Pyroelectric Detector design and the digital signal processor, all built into a TO-5 housing..



### PYD 1688 and PYD 1698

| Parameter                 | Symbol          | Min.          | Typ.           | Max.                  | Unit             | Remarks                         |
|---------------------------|-----------------|---------------|----------------|-----------------------|------------------|---------------------------------|
| Responsivity              |                 | 3,3           | 4,0            |                       | kV/W             | f = 1 Hz                        |
| Match                     |                 |               | 10             |                       | %                |                                 |
| Noise                     |                 |               | 20             | 78                    | µV <sub>pp</sub> |                                 |
| Field of View, vertical   |                 | PYD 1688: 95° | PYD 1698: 110° |                       |                  | unobstructed                    |
| Field of View, horizontal |                 | PYD 1688: 90° | PYD 1698: 110° |                       |                  | unobstructed                    |
| <b>Mechanical Data</b>    |                 |               |                |                       |                  |                                 |
| Window size x             |                 | PYD 1688: 4,6 | PYD 1698: 5,2  |                       | mm               |                                 |
| Window size y             |                 | PYD 1688: 3,4 | PYD 1698: 4,2  |                       | mm               |                                 |
| <b>Operation Data</b>     |                 |               |                |                       |                  |                                 |
| Operating Voltage         | V <sub>DD</sub> | 2,5           | 3,3            | 3,6                   | V                |                                 |
| Supply Current            | I <sub>DD</sub> |               | 3              |                       | µA               | V <sub>DD</sub> = 3,3V, no load |
| <b>ADC Data</b>           |                 |               |                |                       |                  |                                 |
| ADC Resolution            |                 |               | 14             |                       | Bits             | Max Count = 2 <sup>14</sup> - 1 |
| PIR ADC Sensitivity       |                 |               | 6,5            |                       |                  | µV/Count                        |
| Output Range              |                 |               |                | 2 <sup>14</sup> - 511 | Counts           |                                 |
| LPF cutoff frequency      | f <sub>1</sub>  |               | 7              |                       | Hz               |                                 |
| HPF cutoff frequency      | f <sub>2</sub>  |               | 0,44           |                       | Hz               |                                 |

# Digital 4-Element Pyrodetector

## For Battery Operated Applications

### PYQ 1648 – Low Power *DigiPyro*®, Quad Element Design

#### Target Applications

- G Intrusion Alarm
- Ceiling Mount Motion Detection

#### Features and Benefits

- 4 Sensing Elements
- Single Output
- Pulse count option
- Low current consumption

#### Product Description

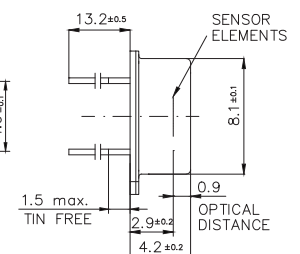
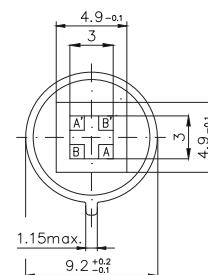
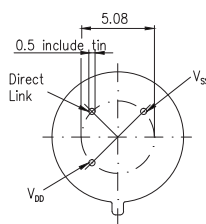
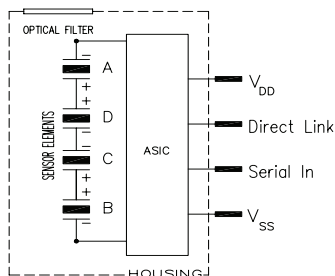
The LowPower *DigiPyro*® family has been developed for use in both residential and commercial products for applications of less power consumption.

This new PYQ series offers the same electrical configuration as PYD 16.. series, but includes four elements in Quad design pyroelectric element, all connected in series. This series offers a number of new programmable features:

The Wake-up/Sleep Mode enables to save unit power. All motion sensing, signal processing and event/motion detection is continuously processed by the LowPower *DigiPyro* while the host microcontroller can be set into power saving (Sleep-) mode. Upon detection of a motion per programmed settings, the LowPower *DigiPyro* will sent a signal to the microcontroller to wake up and request the motion data.

Further options are selectable pulse count and electrical band pass.

The complete configuration with the sensing elements and digital signal processor is included in a TO-5 housing.



#### PYQ 1648

| Parameter                 | Symbol           | Min.               | Typ. | Max.                  | Unit             | Remarks                         |
|---------------------------|------------------|--------------------|------|-----------------------|------------------|---------------------------------|
| Responsivity              |                  | 5,4                | 6,5  |                       | kV/W             | f = 1 Hz                        |
| Match                     |                  |                    | 5    | 10                    | %                |                                 |
| Noise                     |                  |                    | 30   | 140                   | μV <sub>pp</sub> |                                 |
| Field of View, vertical   |                  |                    | 95°  |                       |                  | unobstructed                    |
| Field of View, horizontal |                  |                    | 95°  |                       |                  | unobstructed                    |
| <b>Operation Data</b>     |                  |                    |      |                       |                  |                                 |
| Operating Voltage         | V <sub>DD</sub>  | 2,5                | 3,3  | 3,6                   | V                |                                 |
| Supply Current            | I <sub>DD</sub>  |                    | 3    |                       | μA               | V <sub>DD</sub> = 3,3V, no load |
| Input Low Voltage         | V <sub>SIL</sub> |                    |      | 0,2V <sub>DD</sub>    | V                |                                 |
| Input High Voltage        | V <sub>SIH</sub> | 0,8V <sub>DD</sub> |      |                       | V                |                                 |
| <b>ADC Data</b>           |                  |                    |      |                       |                  |                                 |
| ADC Resolution            |                  |                    | 14   |                       | Bits             | Max Count = 2 <sup>14</sup> - 1 |
| PIR ADC Sensitivity       |                  |                    | 6,5  |                       | μV/Count         |                                 |
| Output Range              |                  |                    |      | 2 <sup>14</sup> - 511 | Counts           |                                 |
| LPF cutoff frequency      | f <sub>1</sub>   |                    | 7    |                       | Hz               |                                 |
| HPF cutoff frequency      | f <sub>2</sub>   |                    | 0,44 |                       | Hz               |                                 |



# Single-Element Pyro Detectors For Gas Monitoring



## LHi 807 TC, PYS 4198 TC – High sensitivity Pyros

### Target Applications

- Gas Sensing and Monitoring

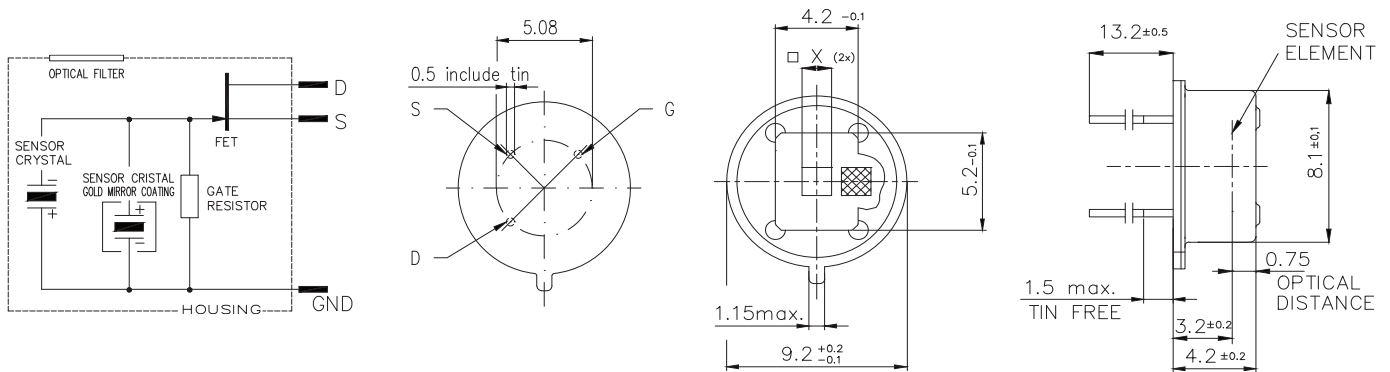
### Features and Benefits

- TO-5 metal housing
- Selection of narrow band Filters
- Thermal Compensation

### Product Description

The LHi 807 TC series has become a standard solution for gas-sensing applications. It is available with a range of narrow band filters, as specified on page 7 of this brochure for various gas species. The LHi 807 TC is usually supplied with Temperature Compensation by a separate "blind" sensing element.

Similar features and benefits are included with the PYS 4198 TC which has large element size of 2x2 to offer more signal for non-focused optical systems. It is offered with the Thermal compensation element for compensation of thermal effects caused by temperature changes of the housing.

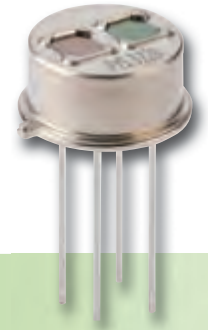


### LHI 807 TC and PYS 4198 TC

| Parameter                 | Symbol    | LHI 807 TC  | PYS 4198 TC | Unit                                   | Remarks              |
|---------------------------|-----------|-------------|-------------|--|----------------------|
| Responsivity, min.        | $R_{min}$ | 2,2         | 1,2         | kV/W                                   | $f = 1 \text{ Hz}$   |
| Responsivity, typ.        | R         | 3,5         | 2           | kV/W                                   | $f = 1 \text{ Hz}$   |
| Match, max.               | $M_{max}$ | -           | -           | %                                      |                      |
| Noise, max.               | $N_{max}$ | 50          | 50          | $\mu\text{V}_{pp}$                     | 0,4...10Hz/20°C      |
| Noise, typ.               | N         | 15          | 10          | $\mu\text{V}_{pp}$                     | 0,4...10Hz/20°C      |
| spec. Detectivity         | $D^*$     | 17          | 23          | $10^7 \text{ cm}^* \sqrt{\text{Hz/W}}$ | 1Hz/ 1Hz BW          |
| Field of View, horizontal | FoV       | 135°        | 126°        |  | unobstructed         |
| Field of View, vertical   |           | 122°        | 105°        |  | unobstructed         |
| Source Voltage            |           | 0,2 ... 1,5 | 0,2 ... 1,5 | V                                      | 47 kΩ, 20°C, VDD=10V |
| Element Size              | X         | 1,5 x 1,5   | 2 x 2       | mm <sup>2</sup>                        |                      |

# Pyrodetectors

## For Gas Monitoring And Measuring



**PYS 3228 TC, PYS 3428 TC – Dual Channel Pyros**

**Target Applications**

- Gas Sensing and Monitoring

**Features and Benefits**

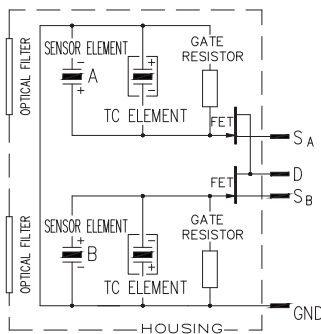
- TO-5 metal housing
- Dual Channel Output
- Thermally compensated
- Each Channel with individual Filter Window
- Selection of narrow band pass filters
- Thermal Compensation option

**Product Description**

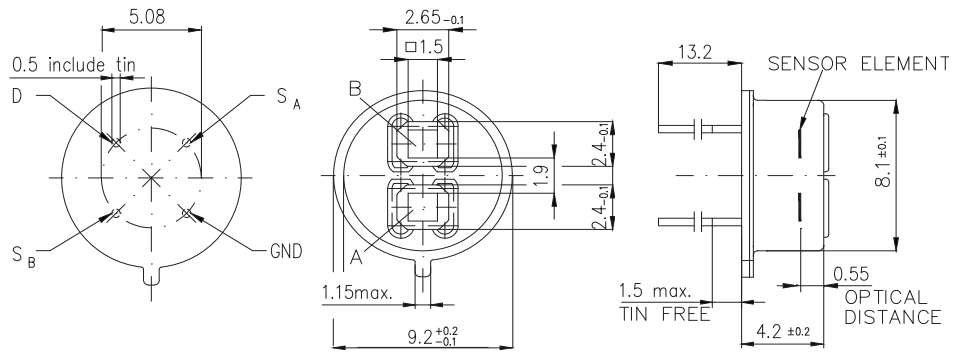
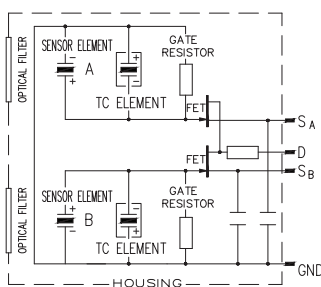
As successor of the LHi 814 series the PYS 3228 dual channel detectors have become standard for gas sensing applications, with two individual elements of size 1,5 x 1,5 and additional temperature compensation. They are available with a range of narrow band pass filters, as specified on page 7 in combination with a reference filter.

The same features are included with the PYS 3428, which offers additional EMI protection by internal capacitors.

**PYS 3228**



**PYS 3428**



| PYS 3228 and PYS 3428     |                  |             |             |                          |                                   |  |
|---------------------------|------------------|-------------|-------------|--------------------------|-----------------------------------|--|
| Parameter                 | Symbol           | PYS 3228 TC | PYS 3428 TC | Unit                     | Remarks                           |  |
| Operatiuon Voltage        | V <sub>DD</sub>  | 2-10        | 2-10        | V                        |                                   |  |
| Responsivity, min.        | R <sub>min</sub> | 2,2         | 2,2         | kV/W                     | f = 1 Hz                          |  |
| Responsivity, typ.        | R                | 3,5         | 3,5         | kV/W                     | f = 1 Hz                          |  |
| Match, max.               | M <sub>max</sub> | -           | -           | %                        |                                   |  |
| Noise, max.               | N <sub>max</sub> | 50          | 50          | µV <sub>pp</sub>         | 0,4...10Hz/20°C                   |  |
| Noise, typ.               | N                | 15          | 15          | µV <sub>pp</sub>         | 0,4...10Hz/20°C                   |  |
| spec. Detectivity         | D*               | 17          | 17          | 10 <sup>7</sup> cm*√Hz/W | 1Hz/ 1Hz BW                       |  |
| Field of View, horizontal | FoV              | 77          | 77          | degrees                  | unobstructed                      |  |
| Field of View, vertical   | FoV              | 61          | 61          | degrees                  | unobstructed                      |  |
| Source Voltage            |                  | 0,2...1,5   | 0,2...1,5   | V                        | 47 kΩ, 20°C, V <sub>DD</sub> =10V |  |
| EMI Performance           |                  | ***         |             |                          |                                   |  |
| Element Size              | X x Y            | 1,5 x 1,5   | 1,5 x 1,5   | mm <sup>2</sup>          |                                   |  |

# Single-Element Pyro Detectors For Gas Monitoring And Measuring



## PYS 3798 TC – (1+1) Channel DigiPyro®

### Target Applications

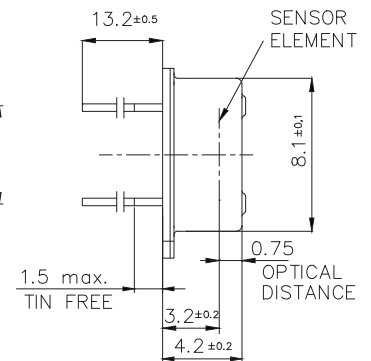
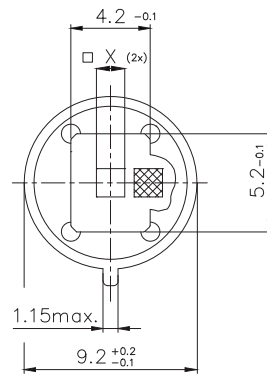
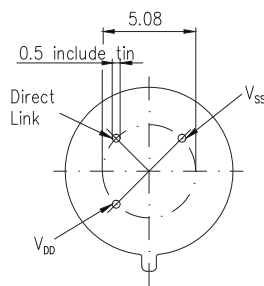
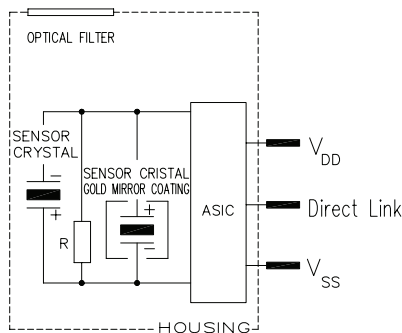
- Gas Sensing and Monitoring

### Features and Benefits

- Digital Output
- Internal Temperature reference
- Thermally compensated
- TO-5 metal housing
- Selection of narrow band pass filters

### Product Description

Excelitas extends the family of DigiPyro® detectors to applications in Gas Sensing. The PYS 3798 TC is the digital equivalent to LHi 807 TC. It includes additionally the temperature reference as a separate output. The two signals are presented in one 28-bit digital bit stream communicated via a single wire "Direct Link" interface to a suitable host microprocessor.



### PYS 3798

| Parameter                        | Symbol      | PYS 3798    | Unit          | Remarks                   |
|----------------------------------|-------------|-------------|---------------|---------------------------|
| Responsivity, min.               | $R_{min}$   | 2,2         | kV/W          | $f = 1$ Hz                |
| Responsivity, typ.               | R           | 3,5         | kV/W          | $f = 1$ Hz                |
| Field of View, horizontal        | FoV         | 135°        |               | unobstructed              |
| Field of View, vertical          | FoV         | 122°        |               | unobstructed              |
| Operating Voltage                | $V_{DD}$    |             | V             |                           |
| Supply Current                   | $I_{DD}$    | 10          | $\mu$ A       | typical, $V_{DD} = 3,3$ V |
| Noise, max.                      |             | 52          | $\mu$ Vpp     | 0,4...10Hz/20°C           |
| <b>Digital Data</b>              |             |             |               |                           |
| Sample Time                      | $t_{SAMPL}$ | 2           | ms            | min.                      |
| ADC Resolution                   |             | 14          | Bits          | max. Count = $2^{14}$     |
| Output Data Format               |             | 14          | Bits          | for both channels         |
| ADC Sensitivity                  |             | 6...7,1     | $\mu$ V/count |                           |
| ADC Output Offset                |             | 6500...9800 | counts        |                           |
| ADC Output Offset, typ.          |             | 8192        | counts        |                           |
| <b>Temperature Reference</b>     |             |             |               |                           |
| Gain (Temperature)               |             | 80          | Counts/K      | -20°C to +80°C, typ.      |
| Linearity                        |             | -5...+5     | %             | -20°C to +80°C            |
| <b>Filter, Signal Processing</b> |             |             |               |                           |
| Digital Filter, cut off          |             | 8           | Hz            |                           |

# Pyrodetectors

## For Gas Monitoring And Measuring



### PYS 3828 TC – (2+1) Channel DigiPyro®

#### Target Applications

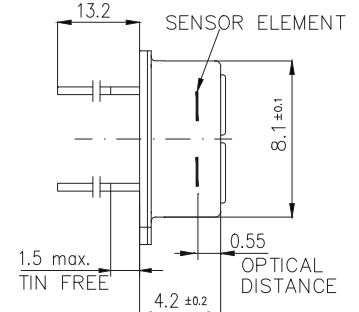
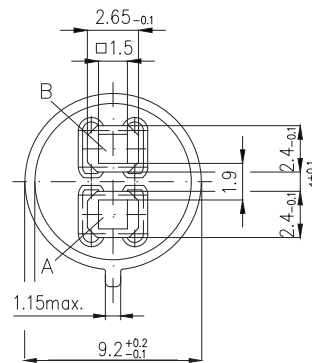
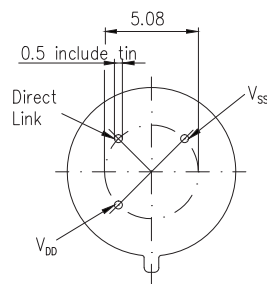
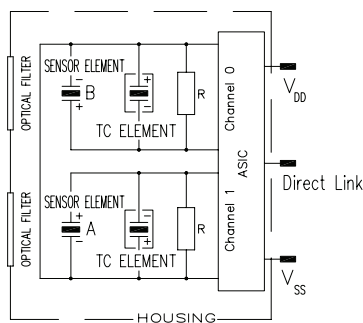
- Gas Sensing and Monitoring

#### Features and Benefits

- Digital Output
- Two optical channels
- Temperature reference channel
- Temperature compensated elements
- Selection of narrow band pass filters
- TO-5 metal housing

#### Product Description

Excelitas extends the family of DigiPyro® detectors to applications in Gas Sensing. This series includes a special triple channel version, whereas two channels having their individual optical (narrow band) windows and an additional temperature reference signal are provided. All 3 channels are output in one 42-bit digital bit stream communicated via a single wire "Direct Link" interface to a suitable host microprocessor.

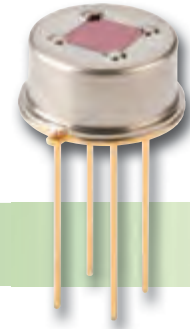


#### PYS 3828

| Parameter                        | Symbol     | PYS 3828    | Unit                | Remarks                |
|----------------------------------|------------|-------------|---------------------|------------------------|
| Responsivity, min.               | $R_{min}$  | 2,2         | kV/W                | $f = 1 \text{ Hz}$     |
| Responsivity, typ.               | R          | 3,5         | kV/W                | $f = 1 \text{ Hz}$     |
| Field of View, horizontal        | FoV        | 77°         |                     | unobstructed           |
| Field of View, vertical          | FoV        | 61°         |                     | unobstructed           |
| Operating Voltage                | $V_{DD}$   | 2,7...3,6   | V                   |                        |
| Supply Current                   | $I_{DD}$   | 18          | $\mu\text{A}$       | $V_{DD} = 3,3\text{V}$ |
| Noise, max.                      |            | 52          | $\mu\text{Vpp}$     | 0,4...10Hz/20°C        |
| <b>Digital Data</b>              |            |             |                     |                        |
| Sample Time                      | $t_{SMPL}$ | 2           | ms                  | min.                   |
| ADC Resolution                   |            | 14          | Bits                | max. Count = $2^{14}$  |
| Output Data Format               |            | 3 x 14      | Bits                |                        |
| ADC Sensitivity                  |            | 6...7,1     | $\mu\text{V/count}$ |                        |
| ADC Output Offset                |            | 7000...9200 | counts              |                        |
| ADC Output Offset, typ.          |            | 8192        | counts              |                        |
| Temperature Reference            |            |             |                     |                        |
| Gain (Temperature)               |            | 80          | Counts/K            | -20°C to +80°C, typ.   |
| Linearity                        |            | -5...+5     | %                   | -20°C to +80°C         |
| <b>Filter, Signal Processing</b> |            |             |                     |                        |
| Digital Filter, cut off          |            | 8           | Hz                  |                        |

# Thermopile Detectors

## For Measurement And Gas Sensing



### TPD 1T 0625 – High-Sensitivity Thermopiles

#### Target Applications

- Pyrometers
- Gas Sensing and Monitoring

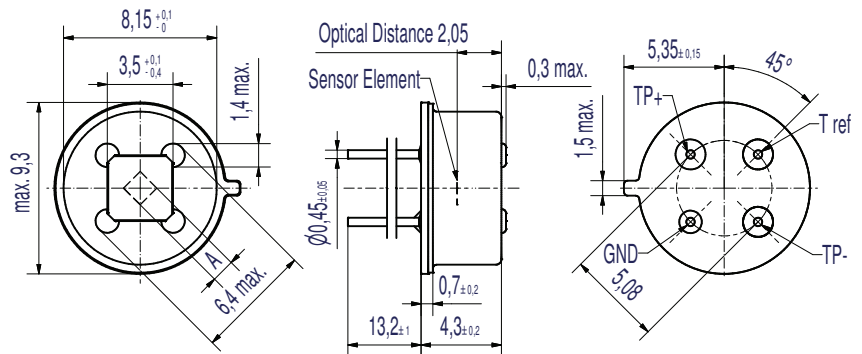
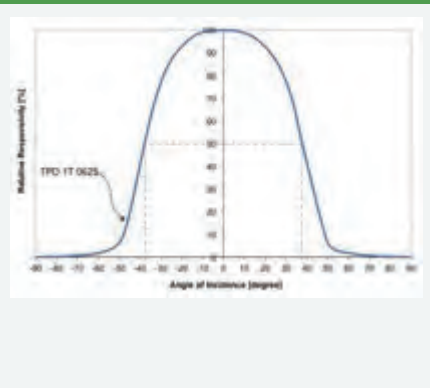
#### Features and Benefits

- High Sensitivity
- TO-5 metal housing
- Thermistor included
- Narrow band pass filter options

#### Product Description

This Thermopile Detector is specially designed for high Signal output level. It is equipped with internal Thermistor serving as temperature reference for Thermopile temperature compensation. The Detector is offered in TO-5 housing with square size window. It can be obtained with either standard IR window or optionally with narrow band pass filter window G1...G5 as per page 7 of this brochure. With the narrow band pass filters, these Detectors are an excellent choice for applications of Gas monitoring and detection.

#### Field of View



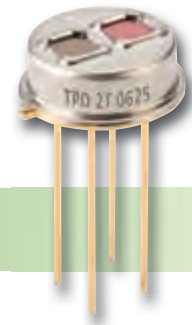
#### TPD 1T 0625

| Parameter                         | Symbol            | TPD 1T 0625 | Unit                                  | Remarks                         |
|-----------------------------------|-------------------|-------------|---------------------------------------|---------------------------------|
| Sensitive Area                    | A                 | 1,2 x 1,2   | mm <sup>2</sup>                       | Absorber Area                   |
| Thermopile Resistance             | R <sub>TP</sub>   | 50...110    | kΩ                                    | 25°C                            |
| Responsivity                      | R                 | 33          | V/W                                   | 500°K / 1Hz / Without IR-filter |
| Time Constant                     | t                 | 27          | ms                                    |                                 |
| Noise Voltage                     | V <sub>n</sub>    | 36          | nV/√Hz                                | 25°C                            |
| Specific Detectivity              | D*                | 1,1         | 10 <sup>8</sup> cm <sup>2</sup> √Hz/W | 25°C                            |
| Temp. Coefficient of Resistance   | TC <sub>RTP</sub> | 0,03        | %/K                                   |                                 |
| Temp. Coefficient of Responsivity | TC <sub>R</sub>   | -0,05       | %/K                                   |                                 |
| Field of view                     | FoV               | 76          | Degrees                               | at 50% intensity points         |
| Thermistor resistance (25°C)      | R <sub>25</sub>   | 100         | kΩ                                    | 25°C                            |
| Thermistor BETA-value             | β                 | 3964        | K                                     | defined at 25°C / 100 °C        |



# Thermopile Detectors

## For Measurement And Gas Sensing



### TPD 2T 0625 – Dual-Channel Thermopile

#### Applications

- Gas Sensing and Monitoring

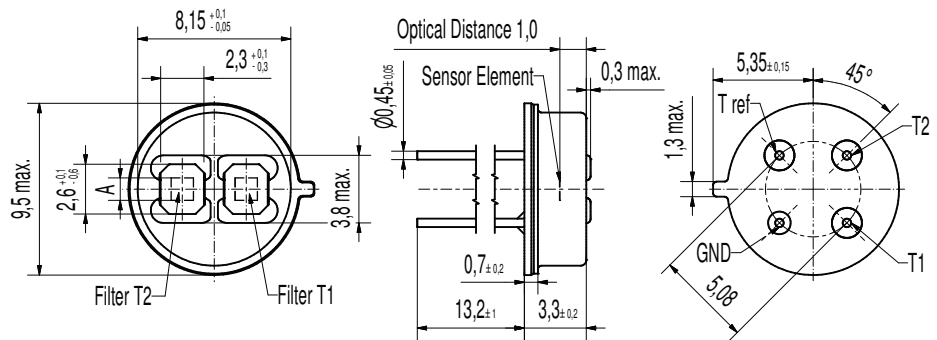
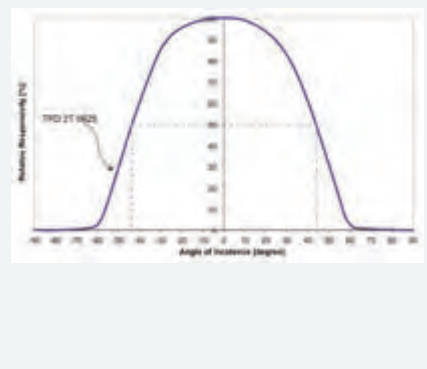
#### Features and Benefits

- High Sensitivity
- TO-39 Metal housing
- Thermistor included
- 2 Narrow band pass filters

#### Product Description

This specially designed Detector offers Dual Channel performance in a TO-39 housing with two individual optical windows. Typically one window is fitted with a reference filter G20, where as the other window is fitted with a narrow band pass filter selected for a specific gas (see page 7 of this brochure for available selection). The TPD 2T 0625 is also equipped as standard with an internal Thermistor as temperature reference for Thermopile temperature compensation.

#### Field of View

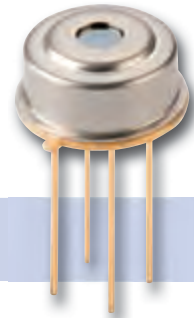


#### TPD 2T 0625

| Parameter                         | Symbol            | TPD 2T 0625 | Unit                    | Remarks                         |
|-----------------------------------|-------------------|-------------|-------------------------|---------------------------------|
| Sensitive Area                    | A                 | 1,2 x 1,2   | mm <sup>2</sup>         | Absorber Area                   |
| Thermopile Resistance             | R <sub>TP</sub>   | 50...110    | kΩ                      | 25°C                            |
| Responsivity                      | R                 | 33          | V/W                     | 500°K / 1Hz / Without IR-filter |
| Time Constant                     | t                 | 27          | ms                      |                                 |
| Noise Voltage                     | V <sub>n</sub>    | 36          | nV/√Hz                  | 25°C                            |
| Specific Detectivity              | D*                | 1,1         | 10 <sup>8</sup> cm√Hz/W | 25°C                            |
| Temp. Coefficient of Resistance   | TC <sub>RTP</sub> | 0,03        | %/K                     |                                 |
| Temp. Coefficient of Responsivity | TC <sub>R</sub>   | -0,05       | %/K                     |                                 |
| Field of view                     | FoV               | 87          | Degrees                 | at 50% intensity points         |
| Thermistor resistance (25°C)      | R <sub>25</sub>   | 100         | kΩ                      | 25 °C                           |
| Thermistor BETA-value             | β                 | 3964        | K                       | defined at 25 °C / 100 °C       |

# ISOthermal Detectors

## For Measurement



### TPiD 1T 0224, TPiD 1T 0624 – Thermopile Detectors

#### Target Applications

- Non-contact Temperature measurements
- Pyrometry

#### Features and Benefits

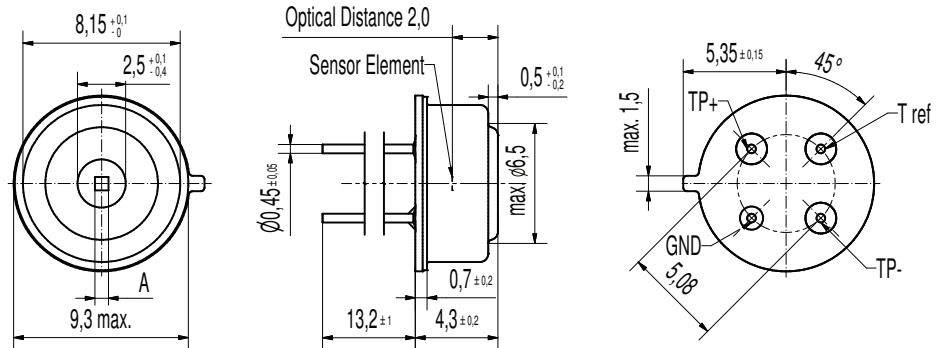
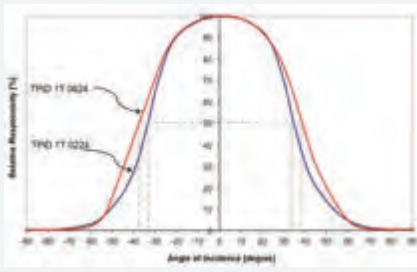
- ISOthermal performance
- TO-39 Metal housing
- Thermistor included

#### Product Description

Excelitas offers a range of ISOthermal Thermopile Detectors in TO-39 type housings. The patent protected ISOthermal feature provides improved system performance when being subjected to thermal shock conditions.

Both types are provided with round window, which also serves as aperture. All feature a specially-designed element configuration, each one with different size of absorbing area. TPiD 1T 0224 provides the smallest absorbing area, TPiD 1T 0624 offers the largest absorbing sensor area and high sensitivity. All types are equipped as standard with internal Thermistor as temperature reference for Thermopile temperature compensation.

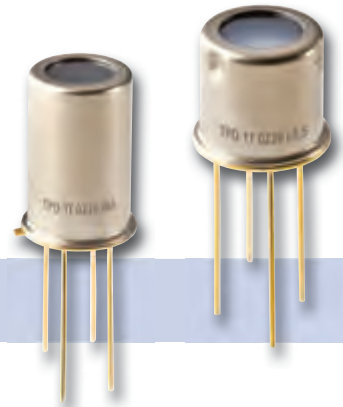
#### Field of View



#### TPiD 1T 0224 and TPiD 1T 0624

| Parameter  | Symbol            | TPiD 1T 0224 | TPiD 1T 0624 | Unit                                  | Remark                                    |
|--|-------------------|--------------|--------------|---------------------------------------|---|
| Sensitive Area   | A                 | 0,7 x 0,7    | 1,2 x 1,2    | mm <sup>2</sup>                       | Absorber Area                             |
| Thermopile Resistance  | R <sub>TP</sub>   | 50...100     | 50...110     | kΩ                                    | 25°C                                      |
| Responsivity   | R                 | 45           | 33           | V/W                                   | 500°K / 1Hz / Without IR-filter           |
| Sensitivity (T <sub>det</sub> 25 °C / T <sub>obj</sub> 40 °C)  | S <sub>40</sub>   | 50           | 92           | μV/K                                  | With standard filter (LWP, cut-on 5.5 μm) |
| Sensitivity (T <sub>det</sub> 25 °C / T <sub>obj</sub> 100 °C) | S <sub>100</sub>  | 65           | 120          | μV/K                                  | With standard filter (LWP, cut-on 5.5 μm) |
| Time Constant  | t                 | 22           | 27           | ms                                    |   |
| Noise Voltage  | V <sub>n</sub>    | 35           | 36           | nV/√Hz                                | 25°C                                      |
| Specific Detectivity   | D*                | 0,9          | 1,1          | 10 <sup>8</sup> cm <sup>2</sup> /Hz/W | 25°C                                      |
| Temp. Coefficient of Resistance                                | TC <sub>RTP</sub> | 0,03         | 0,03         | %/K                                   |   |
| Temp. Coefficient of Responsivity                              | TC <sub>R</sub>   | -0,05        | -0,05        | %/K                                   |   |
| Field of view  | FoV               | 70           | 76           | Degrees                               | at 50% intensity points                   |
| Thermistor resistance (25°C)                                   | R <sub>25</sub>   | 100          | 100          | kΩ                                    | 25°C                                      |
| Thermistor BETA-value  | β                 | 3964         | 3964         | K                                     | defined at 25°C / 100 °C                  |

# Thermopile Detectors With Integral Optics



## TPD 1T 0226 IRA, TPiD 1T 0226 L5.5 – High Performance Thermopiles

### Target Applications

- Non-contact Temperature measurements
- Thermometry

### Features and Benefits

- TO type metal housing
- Optics included
- Thermistor included

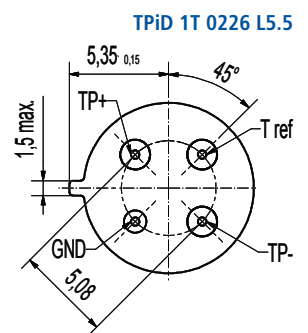
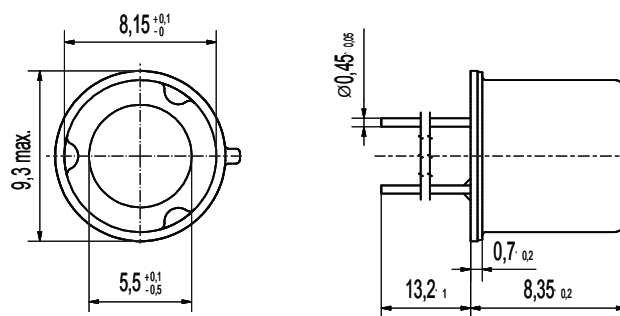
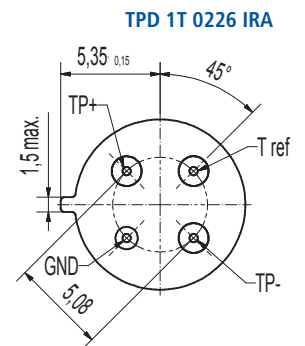
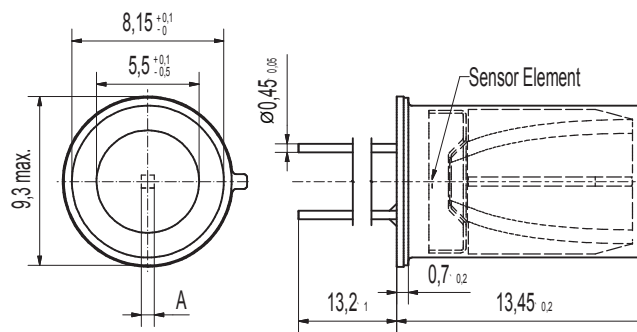
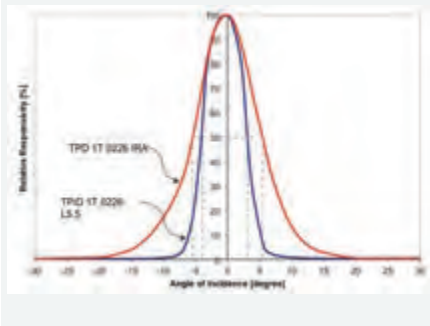
### Product Description

The -IRA type thermopile is specially suited with an internal reflector that reduces the field of view and offers a smaller measurement “target” spot than conventional detectors without optics. Due to the reflector, the housing size is taller than other types, although the housing has the same diameter as a standard TO-5 housing.

The TPiD 1T 0226 L5.5 provides the ISOthermal performance feature and integral optics. A built in internal lens provides a field of view slightly sharper than the IRA type.

All versions are equipped as standard with an internal Thermistor as temperature reference for Thermopile temperature compensation.

### Field of View

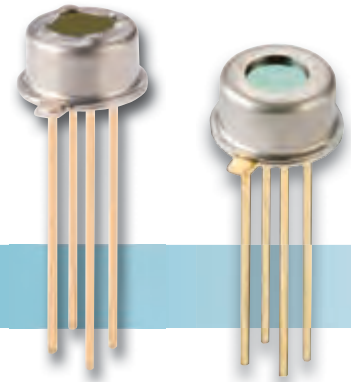


### TPD 1T 0226 IRA and TPiD 1T 0226 L5.5

| Parameter                         | Symbol            | TPD 1T 0226 IRA | TPiD 1T 0226 L5.5 | Unit                                  | Remarks                         |
|-----------------------------------|-------------------|-----------------|-------------------|---------------------------------------|---------------------------------|
| Sensitive Area                    | A                 | 0,7 x 0,7       | 0,7 x 0,7         | mm <sup>2</sup>                       | Absorber Area                   |
| Thermopile Resistance             | R <sub>TP</sub>   | 50...100        | 50...100          | kΩ                                    | 25°C                            |
| Responsivity                      | R                 | 45              | 45                | V/W                                   | 500°K / 1Hz / Without IR-filter |
| Time Constant                     | t                 | 22              | 22                | ms                                    |                                 |
| Noise Voltage                     | V <sub>n</sub>    | 35              | 35                | nV/√Hz                                | 25°C                            |
| Specific Detectivity              | D*                | 0,9             | 0,9               | 10 <sup>9</sup> cm <sup>2</sup> /Hz/W | 25°C                            |
| Temp. Coefficient of Resistance   | TC <sub>RTP</sub> | 0,03            | 0,03              | %/K                                   |                                 |
| Temp. Coefficient of Responsivity | TC <sub>R</sub>   | -0,05           | -0,05             | %/K                                   |                                 |
| Field of view                     | FoV               | 7               | 15                | Degrees                               | at 50% intensity points         |
| Thermistor resistance (25°C)      | R <sub>25</sub>   | 100             | 100               | kΩ                                    | 25°C                            |
| Thermistor BETA-value             | β                 | 3964            | 3964              | K                                     | defined at 25°C / 100 °C        |

# Miniature Thermopile Detectors

## For Gas Sensing And Measurement



### TPD 1T 0223, TPD 1T 0122, TPD 1T 0623 – Thermopile Detector

#### Target Applications

- Non-contact Temperature measurements
- IR-based Gas Sensors

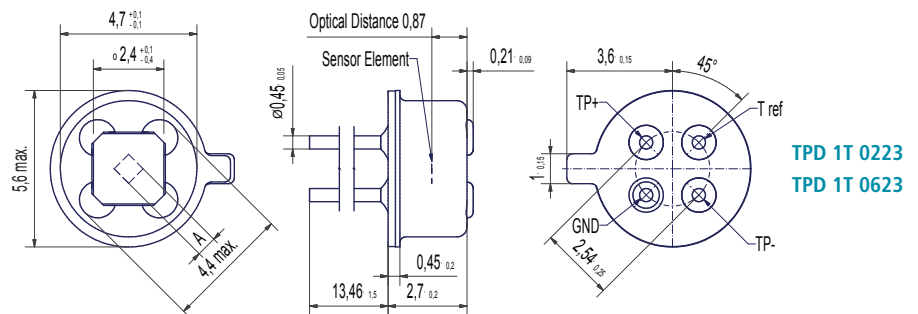
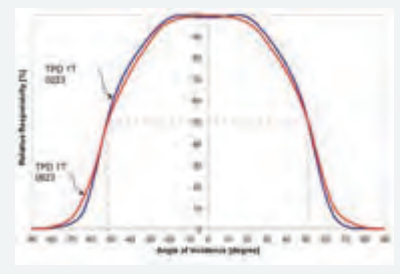
#### Features and Benefits

- TO-46 metal housing
- Square window/round window
- Optical Filter options
- Thermistor included

#### Product Description

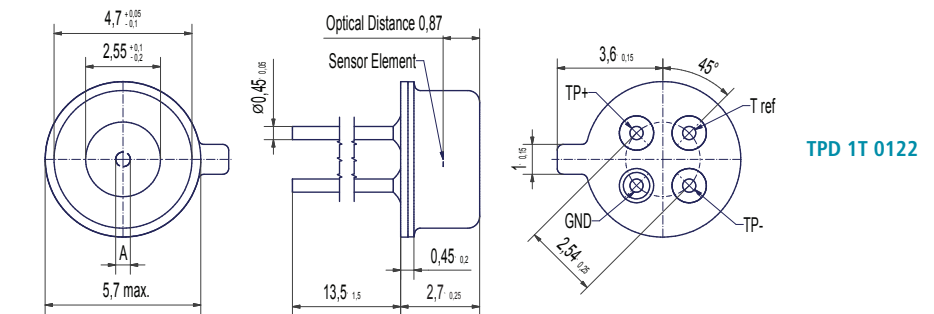
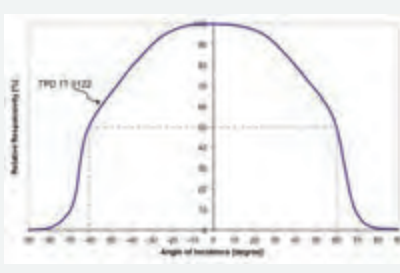
This is our range of general-purpose Detectors in 4.7 mm diameter TO-46 type housings, featuring a specially-designed element configuration, each one with different size of absorbing area. The window is available as standard infrared or optional with narrow band pass filter as per page 7 for gas sensing applications. With the narrowband filters a square window is provided. TPD 1T 0223 and TPD 1T 0122 provide the smallest absorbing area, TPD 1T 0623 is a larger design offering strong signals. All types are equipped as standard with an internal Thermistor as temperature reference for Thermopile temperature compensation.

#### Field of View TPD 1T 0223, TPD 1T 0623



TPD 1T 0223  
TPD 1T 0623

#### Field of View TPD 1T 0122

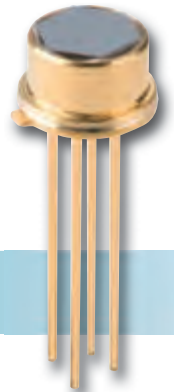


TPD 1T 0122

#### TPD 1T 0223, TPD 1T 0623 and TPD 1T 0122

| Parameter                             | Symbol            | TPD 1T 0223 | TPD 1T 0623 | TPD 1T 0122 | Unit                                  | Remarks                                   |
|---------------------------------------|-------------------|-------------|-------------|-------------|---------------------------------------|---|
| Sensitive Area                        | A                 | 0,7 x 0,7   | 1,2 x 1,2   | 0,2         | mm <sup>2</sup>                       | Absorber Area                             |
| Thermopile Resistance                 | R <sub>TP</sub>   | 50...100    | 50...110    | 85...135    | kΩ                                    | 25°C                                      |
| Responsivity                          | R                 | 45          | 33          | 77          | V/W                                   | 500°K/ 1Hz/ Without IR-filter             |
| Sensitivity (Tdet 25 °C / Tobj 40°C)  | S <sub>40</sub>   | 88          | 133         | 43          | μV/K                                  | With standard filter (LWP, cut-on 5,5 μm) |
| Sensitivity (Tdet 25 °C / Tobj 100°C) | S <sub>100</sub>  | 116         | 177         | 56          | μV/K                                  | With standard filter (LWP, cut-on 5,5 μm) |
| Time Constant                         | t                 | 22          | 27          | 15          | ms                                    |   |
| Noise Voltage                         | V <sub>n</sub>    | 35          | 36          | 42          | nV/√Hz                                | 25°C                                      |
| Specific Detectivity                  | D*                | 0,9         | 1,1         | 0,8         | 10 <sup>8</sup> cm <sup>2</sup> /Hz/W | 25°C                                      |
| Temp. Coefficient of Resistance       | TC <sub>RTP</sub> | 0,03        | 0,03        | 0,03        | %/K                                   |   |
| Temp. Coefficient of Responsivity     | TC <sub>R</sub>   | -0,05       | -0,05       | -0,05       | %/K                                   |   |
| Field of view                         | FoV               | 104         | 104         | 120         | Degrees                               | at 50% intensity points                   |
| Thermistor resistance (25°C)          | R <sub>25</sub>   | 100         | 100         | 100         | kΩ                                    | 25°C                                      |
| Thermistor BETA-value                 | β                 | 3964        | 3964        | 3964        | K                                     | defined at 25°C / 100°C                   |

# ISOthermal, Miniature Thermopile Detectors For Ear Thermometry



## TPiD 1T 0122B, TPiD 1T 0222B, TPiD 1T 0622B – Thermopile Detector

### Target Applications

- Ear Thermometry
- General purpose Thermometry

### Features and Benefits

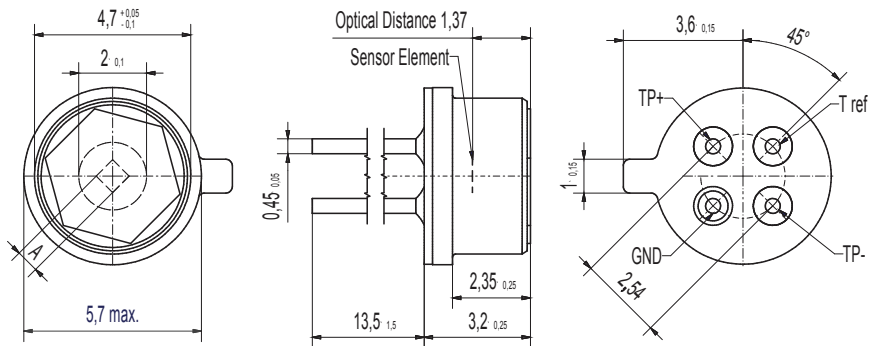
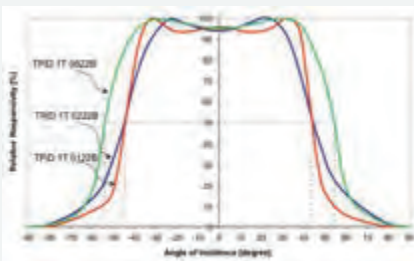
- ISOthermal performance
- Miniature, TO type metal housing
- Light collecting aperture
- Thermistor included

### Product Description

As the optimum for Ear thermometry Excelitas offers Thermopile Detectors referenced as ISOthermal detectors. The patented designs provide superior performance of thermopiles under thermal shock conditions and thereby are best suited for the tympanon ear thermometry.

The range comprises TPiD 1T0122B as the low cost version, whereas the other versions provide higher signal by either high sensitive element designs or larger element area. The physical dimensions of the ISOthermal sensors are equivalent to our TO-46 sensor housings and include a special aperture. All types are equipped with an internal Thermistor as temperature reference for Thermopile temperature compensation to further improve accuracy.

### Field of View



### TPiD 1T 0122B, TPiD 1T 0222B and TPiD 1T 0622B

| Parameter                              | Symbol            | TPiD 1T 0122B | TPiD 1T 0222B | TPiD 1T 0622B | Unit                                  | Remarks                                   |
|--|-------------------|---------------|---------------|---------------|---------------------------------------|---|
| Sensitive Area                         | A                 | 0,2           | 0,7 x 0,7     | 1,2 x 1,2     | mm <sup>2</sup>                       | Absorber Area                             |
| Thermopile Resistance                  | R <sub>TP</sub>   | 85...135      | 50...100      | 50...110      | kΩ                                    | 25°C                                      |
| Responsivity                           | R                 | 92            | 60            | 40            | V/W                                   | 500°K/ 1Hz/ Without IR-filter             |
| Sensitivity (Tdet 25 °C / Tobj 40 °C)  | S <sub>40</sub>   | 44            | 95            | 126           | μV/K                                  | With standard filter (LWP, cut-on 5,5 μm) |
| Sensitivity (Tdet 25 °C / Tobj 100 °C) | S <sub>100</sub>  | 58            | 125           | 140           | μV/K                                  | With standard filter (LWP, cut-on 5,5 μm) |
| Time Constant                          | t                 | 15            | 22            | 27            | ms                                    |   |
| Noise Voltage                          | V <sub>n</sub>    | 42            | 35            | 36            | nV/√Hz                                | 25°C                                      |
| Specific Detectivity                   | D*                | 1,0           | 1,2           | 1,3           | 10 <sup>8</sup> cm <sup>2</sup> /Hz/W | 25°C                                      |
| Temp. Coefficient of Resistance        | TC <sub>RTP</sub> | 0,03          | 0,03          | 0,03          | %/K                                   |   |
| Temp. Coefficient of Responsivity      | TC <sub>R</sub>   | -0,05         | -0,05         | -0,05         | %/K                                   |   |
| Field of view                          | FoV               | 90            | 90            | 110           | Degrees                               | at 50% intensity points                   |
| Thermistor resistance (25°C)           | R <sub>25</sub>   | 100           | 100           | 100           | kΩ                                    | 25°C                                      |
| Thermistor BETA-value                  | β                 | 3964          | 3964          | 4092          | K                                     | defined at 25°C / 100°C                   |



# SMD Miniature Thermopile Detectors

## For Various Applications

### TPiD 1S 0121, TPiD 1S 0222 – Thermopile



#### Target Applications

- Forehead Thermometry
- General, Non-contact Temperature Sensing
- Small space applications

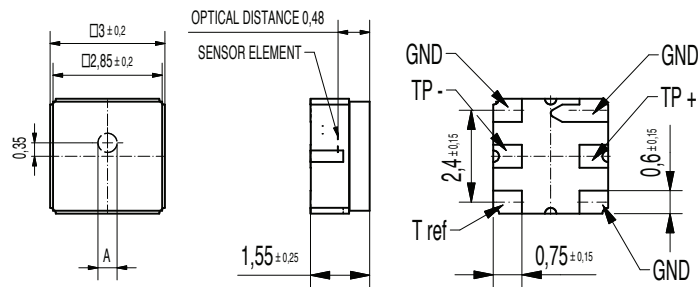
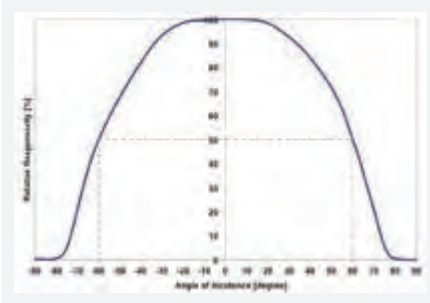
#### Features and Benefits

- Miniature SMD housing
- Flat housing
- Thermistor included
- Tape & Reel Packaging

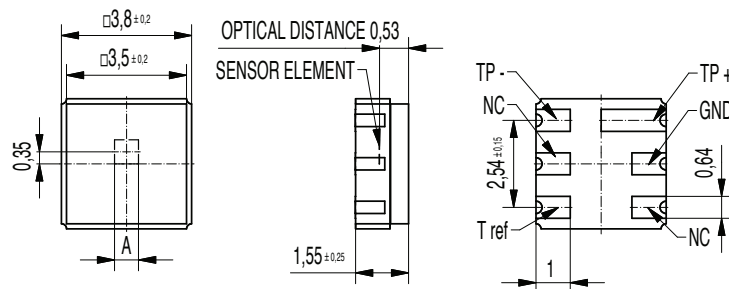
#### Product Description

Excelitas offers a series of Thermopile Detectors in small and compact SMD housings. This enables standard SMT assembly processes and provides for small dimensions. The SMD versions feature the unique ISOthermal performance when units are subjected to thermal shock conditions. The TPiD 1S 0121 is the smallest SMD version we offer, whereas the TPiD 1S 0222 provides element with higher sensitivity. Again, these detectors are equipped with an internal Thermistor as temperature reference for Thermopile temperature compensation. All SMD parts are supplied in volume in tape & reel packaging.

#### Field of View TPiD 1S 0122, TPiD 1S 0122



TPiD 1S 0121



TPiD 1S 0222

#### TPiD 1S 0121, TPiD 1S 0222

| Parameter                             | Symbol            | TPiD 1S 0121 | TPiD 1S 0222 | Unit                                  | Remark                                    |
|---------------------------------------|-------------------|--------------|--------------|---------------------------------------|---|
| Sensitive Area                        | A                 | 0,2          | 0,7 x 0,7    | mm <sup>2</sup>                       | Absorber Area                             |
| Thermopile Resistance                 | R <sub>TP</sub>   | 85...135     | 50...100     | kΩ                                    | 25°C                                      |
| Responsivity                          | R                 | 77           | 45           | V/W                                   | 500°/ 1Hz/ Without IR-filter              |
| Sensitivity (Tdet 25 °C / Tobj 40°C)  | S <sub>40</sub>   | 60           | 130          | μV/K                                  | With standard filter (LWP, cut-on 5,5 μm) |
| Sensitivity (Tdet 25 °C / Tobj 100°C) | S <sub>100</sub>  | 80           | 170          | μV/K                                  | With standard filter (LWP, cut-on 5,5 μm) |
| Time Constant                         | t                 | 15           | 22           | ms                                    |   |
| Noise Voltage                         | V <sub>n</sub>    | 42           | 35           | nV/√Hz                                | 25°C                                      |
| Specific Detectivity                  | D*                | 0,8          | 1,2          | 10 <sup>8</sup> cm <sup>2</sup> /Hz/W | 25°C                                      |
| Temp. Coefficient of Resistance       | TC <sub>RTP</sub> | 0,03         | 0,03         | %/K                                   |   |
| Temp. Coefficient of Responsivity     | TC <sub>R</sub>   | -0,05        | -0,05        | %/K                                   |   |
| Field of view                         | FoV               | 120          | 120          | Degrees                               | at 50% intensity points                   |
| Thermistor resistance (25°C)          | R <sub>25</sub>   | 100          | 100          | kΩ                                    | 25°C                                      |
| Thermistor BETA-value                 | β                 | 4092         | 4092         | K                                     | defined at 25°C / 100°C                   |

# SMD Sensor With Integrated Processing

## For Non-Contact Temperature Measurement



### TPiS 1S 0133 – Thermopile Sensor

#### Target Applications

- General purpose Temperature Monitoring

#### Features and Benefits

- SMD Housing
- ISOthermal Performance
- Internal Signal Processing
- Factory calibrated
- Available in "Tape and Reel"

#### Product Description

Excelitas offers the proven concept of TPMI® in SMD housing. It senses the thermal radiation emitted by objects and converts this to an analog voltage. The product is fully factory-calibrated for an accurate signal output over a specified temperature range and includes optional temperature compensation. The internal signal processing, with 8 bit resolution of the control registers and the EEPROM technology, allows for calibration as per customer requirements.

A temperature reference output is included. Upon request, other object temperature ranges can be provided. The sensors can also be supplied as "OBA" version without internal temperature compensation. By integrating the thermopile and electronic circuit into an industry-standard SMD housing, the TPiS 1S 0133 enables fully-automated "pick and place" and soldering processes associated with the SMD technology.

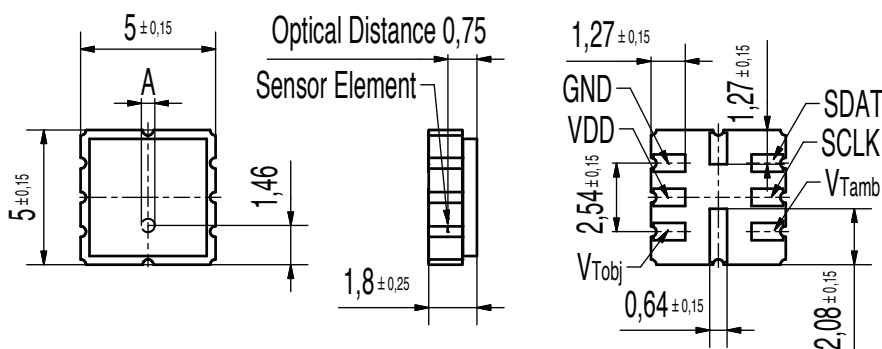
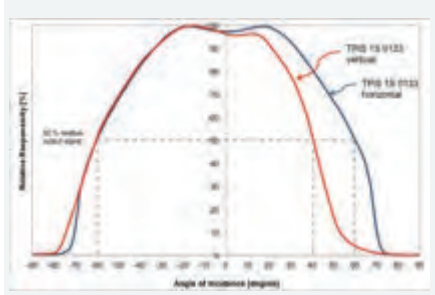
To address object temperature ranges, Excelitas offers the following standard pre-calibrated Sensors:

-20...60°C: TPiS 1S 0133 OAA060

-20...120°C: TPiS 1S 0133 OAA120

Customized calibrations on request.

#### Field of View



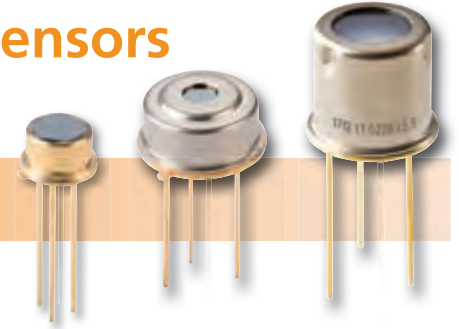
#### TPiS 1S 0133

| Parameter             | Symbol     | TPiS 1S 0133                                 | Unit            | Remark                 |
|-----------------------|------------|--|-----------------|------------------------|
| Output Voltage Swing  | $V_O$      | 0,25...(VDD-0,25)                            | V               |                        |
| Resistive Output Load | $R_L$      | 50   | k $\Omega$      | min.                   |
| Object Temp Accuracy  |            | 1,5  | K               | + / -                  |
| Response Time         | $t_{resp}$ | 100  | ms              | typ.                   |
| Sensitive area        | A          | 0,2  | mm <sup>2</sup> |                        |
| Field of View         | FoV        | 120  | Degrees         |                        |
| Supply Voltage        | $V_{DD}$   | 4,5...5,5                                    | V               |                        |
| Supply Current        | $I_{DD}$   | 1,5  | mA              | typ.; $R_L > 1M\Omega$ |
| Operating Temp range  |            | -25...+100                                   | °C              |                        |
| Storage Temp range    |            | -40...+100                                   | °C              |                        |
| ESD tolerance         |            | 2,5  | kV              | human body model       |
| Soldering Temp        |            | Refer to Page 46 (handling and precautions). |                 |                        |

# DigiPile™ – ISOthermal Thermopile Sensors

## For Non-Contact Temperature Measurement

TPiS 1T 1252B, TPiS 1T 1254, TPiS 1T 1256 L5.5 – Thermopile Sensor with digital Output



### Target Applications

- Ear Thermometry
- Non-contact Thermometry

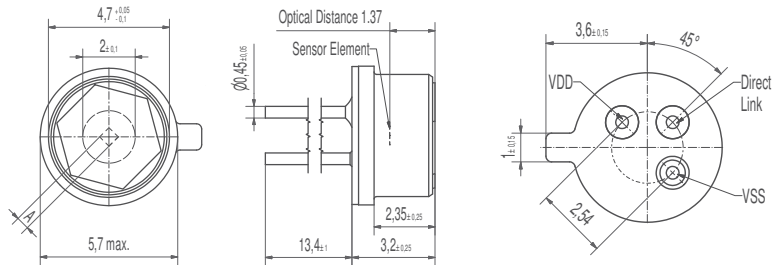
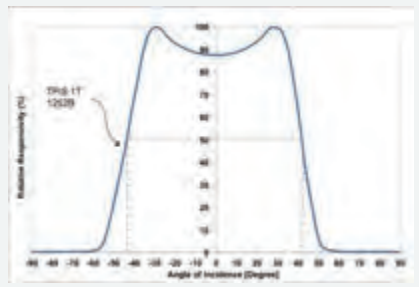
### Features and Benefits

- Digital output
- ISOthermal performance
- Miniature, TO type metal housing
- Temperature reference output included

### Product Description

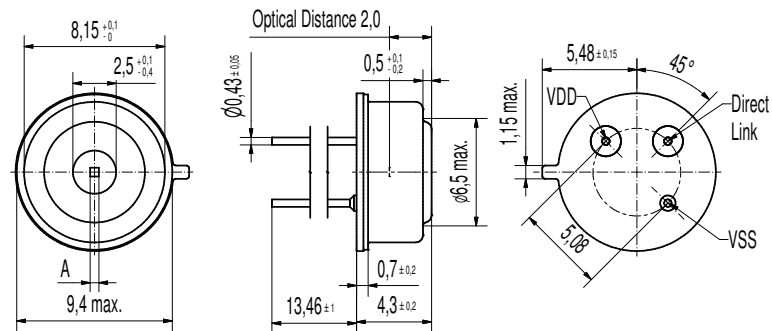
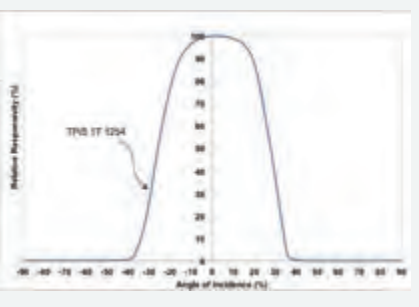
As continuation of Excelitas' focus on innovation and digitization the DigiPile™ provides for a Thermopile with digital 17bit output. The complete range of Detectors is offered with the patent protected ISOthermal performance. Within the bit stream the thermopile signal is followed by another signal given by an internal temperature reference diode. With the digital output low interference of electric disturbance is achieved. These features included enable optimum designs for ear thermometry and forehead thermometry.

### Field of View TPiS 1T 1252B



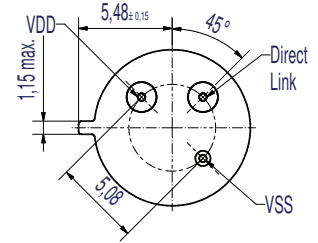
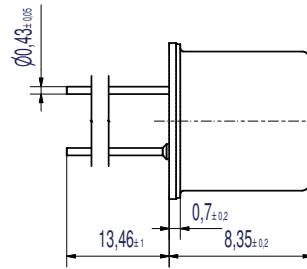
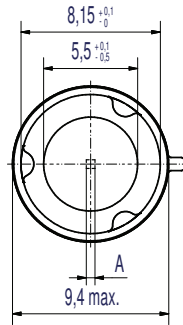
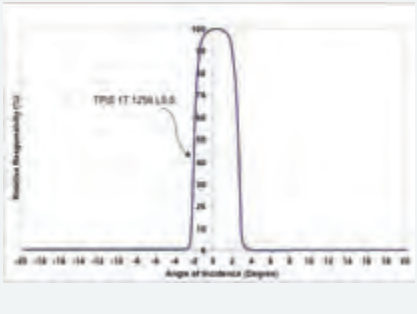
TPiS 1T 1252B

### Field of View TPiS 1T 1254



TPiS 1T 1254

Field of View TPiS 1T 1256 L5.5



TPiS 1T 1256 L5.5

DigiPile™ - All Types

| Parameter                         | Symbol               | TPiS 1T 1252B | TPiS 1T 1254  | TPiS 1T 1256 L5.5 | Unit          | Remarks / Conditions   |
|-----------------------------------|----------------------|---------------|---------------|-------------------|---------------|--|
| Operating Conditions              |                      |               |               |                   |               |  |
| Operating Voltage                 | $V_{DD}$             | 2,4...3,6     | 2,4...3,6     | 2,4...3,6         | V             |  |
| Supply Current                    | $I_{DD}$             | 11...15       | 11...15       | 11...15           | $\mu A$       | $V_{DD} = 3,3 V$   |
| Operating Temperature             | $T_o$                | -20...70      | -20...70      | -20...70          | $^{\circ}C$   | "parameters may vary from specified values with temperature dependence." |
| Storage Temperature               | $T_s$                | -40...100     | -40...100     | -40...100         | $^{\circ}C$   | Avoid storage in humid environment.                                      |
| Thermopile Characteristics        |                      |               |               |                   |               |  |
| Sensitive Area                    | A                    | 0,51 x 0,51   | 0,51 x 0,51   | 0,51 x 0,51       | $mm^2$        | Absorber area  |
| Sensitivity of TP                 | Dcounts / $\Delta T$ | 290           | 150           | 67                | counts/K      | $T_{obj} = 40^{\circ}C, T_{amb} = 25^{\circ}C$                           |
|                                   |                      | 400           | 200           | 85                | counts/K      | $T_{obj} = 100^{\circ}C, T_{amb} = 25^{\circ}C$                          |
| Noise of TP                       |                      | 8             | 8             | 8                 | counts        | $T_{obj} = 40^{\circ}C, T_{amb} = 25^{\circ}C$                           |
| Time Constant                     | t                    | 45            | 45            | 45                | ms            |  |
| <b>Ambient Temperature sensor</b> |                      |               |               |                   |               |  |
| Sensitivity of $T_{amb}$          |                      | 90            | 90            | 90                | counts/K      | Linear for $T_{amb}$ from $0^{\circ}C$ to $90^{\circ}C$                  |
| Count @ $T_{amb} = 25^{\circ}C$   |                      | 7000...9400   | 7000...9400   | 7000...9400       | counts        | Range  |
| <b>Optical Characteristics</b>    |                      |               |               |                   |               |  |
| Field of View                     |                      | 84            | 56            | 5                 | Degree        |  |
| Optical Axis                      |                      | +/- 10        | +/- 10        | +/- 2             | Degree        | At 50% intensity points  |
| <b>Electrical Characteristics</b> |                      |               |               |                   |               |  |
| ADC Resolution $T_{obj}$          |                      | 17            | 17            | 17                | Bits          | Max Count = $2^{17}$   |
| ADC Resolution $T_{amb}$          |                      | 14            | 14            | 14                | Bits          | Max Count = $2^{14}$   |
| ADC Sensitivity of $T_{obj}$      |                      | 0,7...0,9     | 0,7...0,9     | 0,7...0,9         | $\mu V/count$ |  |
| ADC Offset $T_{obj}$              |                      | 64000...65000 | 64000...65000 | 64000...65000     | counts        | Range  |
| Input Low Voltage                 | $V_{IL}$             | 0,2 $V_{DD}$  | 0,2 $V_{DD}$  | 0,2 $V_{DD}$      | V             |  |
| Input High Voltage                | $V_{IH}$             | 0,8 $V_{DD}$  | 0,8 $V_{DD}$  | 0,8 $V_{DD}$      | V             |  |
| Pull Down Current                 |                      | 200           | 200           | 200               | $\mu A$       | Direct link pin to $V_{DD}$  |
| Pull Up / Down Current            |                      | 130           | 130           | 130               | $\mu A$       | Direct link pin to $V_{SS}$  |
| LPF Cut-Off Frequency             |                      | 8             | 8             | 8                 | Hz            |  |

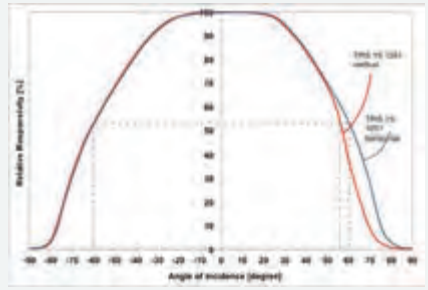
# SMD Thermopile Sensor DigiPile™

## For Non-Contact Temperature Measurement

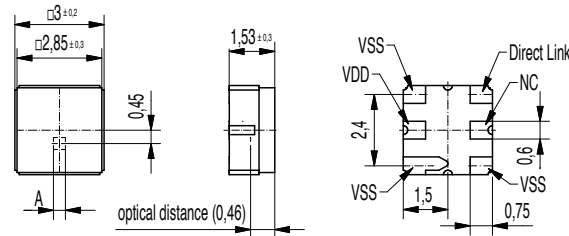
TPiS 1S 1051, TPiS 1S 1252 – Thermopile Sensor with Digital Output



### Field of View TPiS 1S 1051

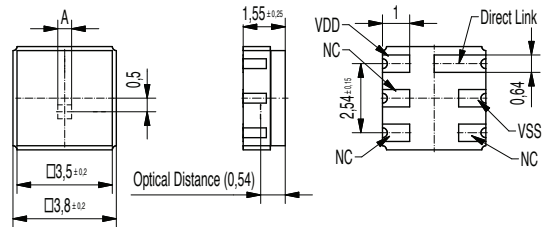
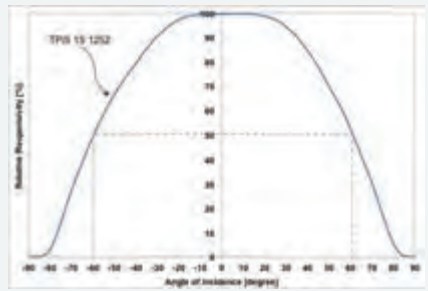


The new family of DigiPile is extended to SMD housings with the two types TPiS 1S 1252, and TPiS 1S 1051. With TPiS 1S 1051 we provide the smallest housing of Thermopile and the smallest thermopile chip. With TPiS 1S 1252 the housing is slightly larger due to a high sensitivity thermopile chip built in. The signal preparation of both types is equivalent to those versions in TO type housings.



TPiS 1S 1051

### Field of View TPiS 1S 1252



TPiS 1S 1252

### DigiPile™

| Parameter                           | Symbol          | TPiS 1S 1252        | TPiS 1S 1051        | Unit            | Remarks / Conditions   |
|-------------------------------------|-----------------|---------------------|---------------------|-----------------|--|
| Operating Conditions                |                 |                     |                     |                 |  |
| Operating Voltage                   | V <sub>DD</sub> | 2,4...3,6           | 2,4...3,6           | V               |  |
| Supply Current                      | I <sub>DD</sub> | 11...15             | 11...15             | µA              | V <sub>DD</sub> = 3.3 V  |
| Operating Temperature               | T <sub>o</sub>  | -20...70            | -20...70            | °C              | "parameters may vary from specified values with temperature dependence." |
| Storage Temperature                 | T <sub>s</sub>  | -40...100           | -40...100           | °C              | Avoid storage in humid environment.                                      |
| Sensitive Area                      | A               | 0,51 x 0,51         | 0,4 x 0,4           | mm <sup>2</sup> | Absorber area  |
| Sensitivity of TP                   | Dcounts / ΔT    | 400                 | 210                 | counts/K        | T <sub>obj</sub> = 40°C, T <sub>amb</sub> = 25°C                         |
|                                     |                 | 530                 | 280                 | counts/K        | T <sub>obj</sub> = 100°C, T <sub>amb</sub> = 25°C                        |
| Noise of TP                         |                 | 8                   | 8                   | counts          | T <sub>obj</sub> = 40°C, T <sub>amb</sub> = 25°C                         |
| Time Constant                       | t               | 45                  | 15                  | ms              |  |
| <b>Ambient Temperature sensor</b>   |                 |                     |                     |                 |  |
| Sensitivity of T <sub>amb</sub>     |                 | 90                  | 90                  | counts/K        | Linear for T <sub>amb</sub> from 0°C to 90°C                             |
| Count @ T <sub>amb</sub> = 25°C     |                 | 7000...9400         | 7000...9400         | counts          | Range  |
| <b>Optical Characteristics</b>      |                 |                     |                     |                 |  |
| Field of View                       |                 | 120                 | 120 / 116           | Degree          |  |
| Optical Axis                        |                 | +/- 10              | +/- 10              | Degree          | At 50% intensity points  |
| <b>Electrical Characteristics</b>   |                 |                     |                     |                 |  |
| ADC Resolution T <sub>obj</sub>     |                 | 17                  | 17                  | Bits            | Max Count = 2 <sup>17</sup>  |
| ADC Resolution T <sub>amb</sub>     |                 | 14                  | 14                  | Bits            | Max Count = 2 <sup>14</sup>  |
| ADC Sensitivity of T <sub>obj</sub> |                 | 0,7...0,9           | 0,7...0,9           | µV/count        |  |
| ADC Offset T <sub>obj</sub>         |                 | 64000...65000       | 64000...65000       | counts          | Range  |
| Input Low Voltage                   | V <sub>IL</sub> | 0,2 V <sub>DD</sub> | 0,2 V <sub>DD</sub> | V               |  |
| Input High Voltage                  | V <sub>IH</sub> | 0,8 V <sub>DD</sub> | 0,8 V <sub>DD</sub> | V               |  |
| Pull Down Current                   |                 | 200                 | 200                 | µA              | Direct link pin to V <sub>DD</sub>                                       |
| Pull Up / Down Current              |                 | 130                 | 130                 | µA              | Direct link pin to V <sub>SS</sub>                                       |
| LPF Cut-Off Frequency               |                 | 8                   | 8                   | Hz              |  |



# DigiPile™ Module

## For Non-Contact Temperature Sensing

### TPiM 1T 1256 L5.5 Calibrated Temperature Sensing Module

#### Target Applications

- GNon-Contact Temperature Measurement
- Thermometry

#### Features and Benefits

- Fully Digital
- Temperature Signal Output
- Industry Bus I<sup>2</sup>C
- Factory calibrated

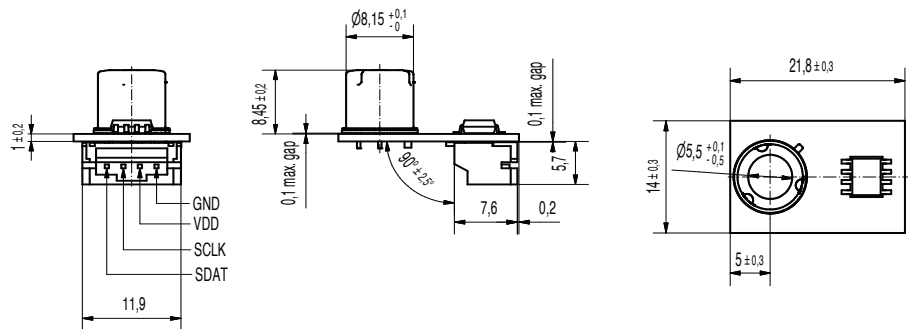
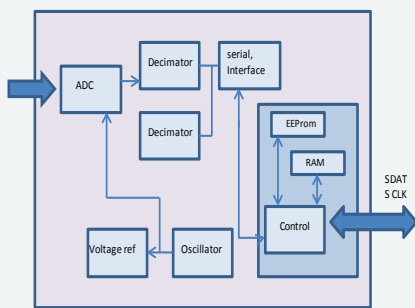
#### Product Description

The DigiPile-Module is our new IR Sensor Module with calibrated temperature signal output. It consists of *Digipile*™-Sensor and Microcontroller with integrated E<sup>2</sup>PROM for signal processing and interfacing.

The microcontroller calculates the object (T<sub>obj</sub>) and ambient temperature (T<sub>amb</sub>) and post-processes the temperatures to deliver the linear signal via a digital serial interface (I<sup>2</sup>C-Bus).

The module is delivered factory calibrated. Based on the calibration settings stored in the microcontroller's E<sup>2</sup>PROM and on the above described calculation results, a linearised and ambient temperature compensated object temperature signal is available via the serial I<sup>2</sup>C interface.

#### Block Diagram

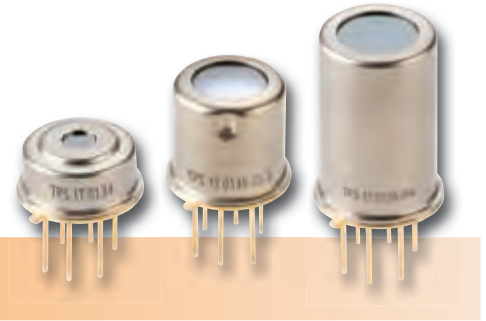


#### TPiM 1T 1256 L5.5

| Parameter   | Symbol                | Min. | Typ | Max                  | Unit  | Conditions              |
|---|-----------------------|------|-----|----------------------|-------|-------------------------|
| <b>Calibration Settings</b>                       |                       |      |     |                      |       |                         |
| Object temperature sensing range                  | T <sub>obj</sub>      | -20  |     | 320                  | °C    | Emissivity = 99.9%      |
| Ambient temperature sensing range                 | T <sub>amb</sub>      | -20  |     | 90                   | °C    |                         |
| Resolution of object temperature                  | T <sub>obj res</sub>  | 0,01 |     |                      | °C    | T <sub>obj</sub> = 25°C |
| Resolution of ambient temperature                 | T <sub>amb res</sub>  | 0,01 |     |                      | °C    |                         |
| Noise equivalent temperature                      | NETD                  |      | 0.1 |                      | °C    |                         |
| <b>Electrical Characteristics</b>                 |                       |      |     |                      |       |                         |
| <b>Power Supply</b>                               |                       |      |     |                      |       |                         |
| Supply Voltage                                    | V <sub>DD</sub>       | 2,8  | 3,0 | 3,6                  | V     |                         |
| Supply Current                                    | I <sub>DD</sub>       |      | 1,2 |                      | mA    | μC = 16MH Clock         |
| <b>Serial Interface SDAT, SCLK</b>                |                       |      |     |                      |       |                         |
| Low level input voltage                           | V <sub>IL</sub>       |      |     | 0.3 V <sub>DD</sub>  | V     | falling edge            |
| High level input voltage                          | V <sub>IH</sub>       |      |     | V <sub>DD</sub> +0.5 | V     | rising edge             |
| Low level output voltage 1)                       | V <sub>OL</sub>       |      |     | 0.4                  | V     | 2mA output              |
| Note 1: SDAT and SCLK pins have open drain output |                       |      |     |                      |       |                         |
| <b>Absolute Maximum Ratings</b>                   |                       |      |     |                      |       |                         |
| Storage temperature range                         |                       | -40  |     | +100                 | °C    |                         |
| Operating temperature range                       |                       | -20  |     | +85                  | °C    |                         |
| <b>AC Characteristics</b>                         |                       |      |     |                      |       |                         |
| T <sub>obj</sub> signal refresh time              | T <sub>obj refr</sub> |      |     | 20                   | ms    |                         |
| T <sub>amb</sub> signal refresh time              | T <sub>amb refr</sub> |      |     | 20                   | ms    |                         |
| <b>E<sup>2</sup>PROM Data</b>                     |                       |      |     |                      |       |                         |
| Data Retention                                    |                       | 20   |     |                      | years | T <sub>a</sub> = +85°C  |
| Write Cycle Time                                  | t <sub>WR</sub>       |      | 65  |                      | ms    |                         |

# ISOthermal Thermopile Sensor

## With Integrated Processing And Optics For Non-Contact Temperature Measurement



TPiS 1T 0134 ,TPiS 1T 0136 L5.5, TPS 1T 0136 IRA –  
Calibrated Thermopile Sensor (TPMI® family)

### Target Applications

- General-purpose Temperature Monitoring

### Features and Benefits

- Internal Signal Processing
- Factory-calibrated
- Optics available
- Ambient Temperature Compensation

### Product Description

This series includes the proven concept of TPMI® in TO-5 housing. It senses the thermal radiation emitted by objects and converts this to an analog voltage. The product is fully factory-calibrated for an accurate signal output over a specified temperature range and includes optional temperature compensation. The internal signal processing with 8 bit resolution of the control registers and the EEPROM technology allow for calibration as per customer requirements.

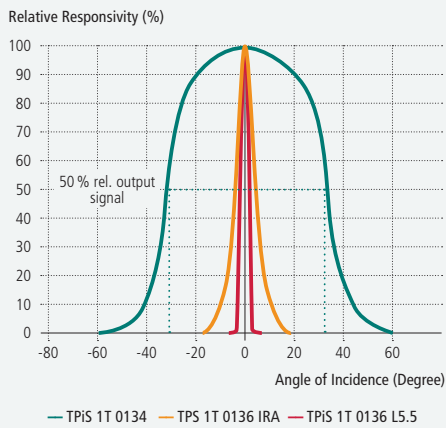
The unique and patented ISOthermal construction offers substantially better performance of the entire sensor under transient thermal conditions. The temperature accuracy of the fully adjustable integrated circuit outperforms discrete solutions. With the integration of Thermopile and electronic circuits in compact TO-5 type metal housing, the TPiS is robust and insensitive to environmental influences like leakage currents on the parent PCB, relative humidity or electromagnetic interference. For amplification of the highly sensitive thermopile signal a high resolution programmable low noise amplifier is provided. An adjustable high precision ambient temperature sensor followed by a signal processor offers accurate compensation signals with polynomial characteristics perfectly matching the thermopile output to achieve an output signal which is closely linear with object temperature. Adding these signals will result in an ambient independent object temperature signal over a large temperature range. This range can be adapted and scaled to customer requirements by means of the flexible offset and post gain adjustment.

For defined spot size requirements we offer sensors with defined Field of View, obtained by apertures, internal lenses or integrated mirrors. The TPMI sensor family includes the integrated ambient temperature compensation and the calibration to a certain temperature range. When ordering, please specify the correct temperature range needed. Excelitas offers the following pre-calibrated Sensors:

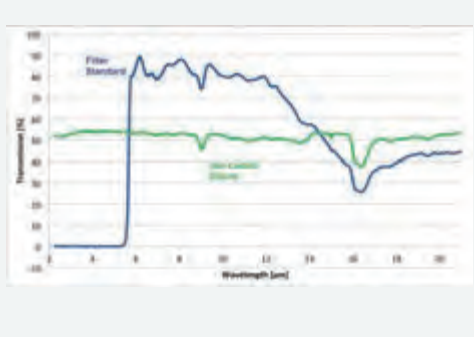
- |                                       |                                     |
|---------------------------------------|-------------------------------------|
| -20...60°C: TPiS 1T 0134 OAA060       | 20...120°C: TPiS 1T 0134 OAA120     |
| -20...120°C: TPiS 1T 0136 L5.5 OAA120 | -20...250°C: TPS 1T 0136 IRA OAA250 |

IRA = internal reflector      L5.5 = 5.5mm focal length lens.

### Field of View

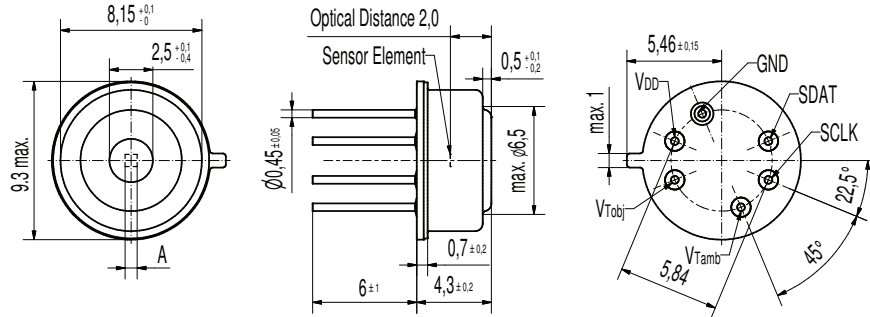
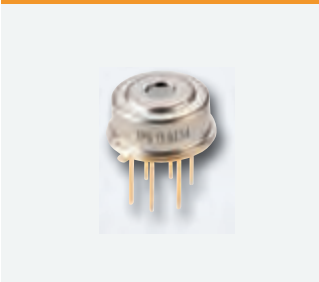


### Filter



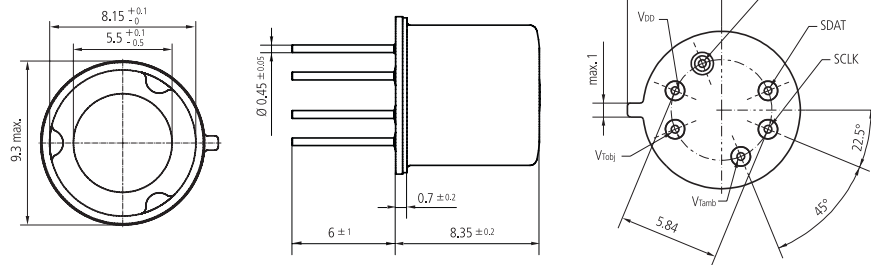
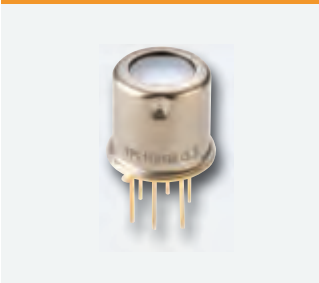
A temperature reference output is included. Upon request, other object temperature ranges can be provided. The sensors can also be supplied as "OBA" version without internal temperature compensation.

**TPiS 1T 0134**



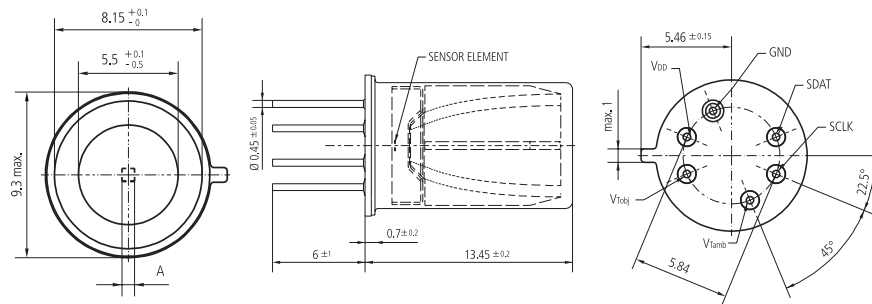
**TPiS 1T 0134**

**TPiS 1T 0136 L5.5**



**TPiS 1T 0136 L5.5**

**TPS 1T 0136 IRA**

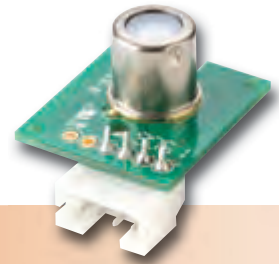


**TPS 1T 0136 IRA**

**TPiS 1T 0134, TPiS 1T 0136 L5.5 and TPS 1T 0136 IRA**

| Parameter                   | Symbol     | TPiS 1T 0134                    | TPiS 1T 0136 L5.5               | TPS 1T 0136 IRA                 | Unit            | Remark                 |
|-----------------------------|------------|---------------------------------|---------------------------------|---------------------------------|-----------------|------------------------|
| Output Voltage Swing        | $V_O$      | 0,25...(V <sub>DD</sub> - 0,25) | 0,25...(V <sub>DD</sub> - 0,25) | 0,25...(V <sub>DD</sub> - 0,25) | V               |                        |
| Resistive Output Load       | $R_L$      | 50                              | 50                              | 50                              | kΩ              | min.                   |
| Object Temp Accuracy        |            | 1,5                             | 1,5                             | 1,5                             | K               | + / -                  |
| Response Time               | $t_{resp}$ | 100                             | 100                             | 100                             | ms              | typ.                   |
| Supply Voltage              | $V_{DD}$   | 4,5...5,5                       | 4,5...5,5                       | 4,5...5,5                       | V               |                        |
| Supply Current              | $I_{DD}$   | 1,5                             | 1,5                             | 1,5                             | mA              | typ.; $R_L > 1M\Omega$ |
| Operating Temp range        |            | -25...+100                      | -25...+100                      | -25...+100                      | °C              |                        |
| Storage Temp range          |            | -40...+100                      | -40...+100                      | -40...+100                      | °C              |                        |
| ESD tolerance               |            | 2,5                             | 2,5                             | 2,5                             | kV              | human body model       |
| Soldering Temp              |            | 300                             | 300                             | 300                             | °C              | max., 10 s             |
| Sensitive area              | A          | 0,2                             | 0,2                             | 0,2                             | mm <sup>2</sup> |                        |
| Field of View , typ.        | FoV        | 67                              | 4,5                             | 11                              | Degrees         | at 50% point           |
| Distance to Spot size ratio |            | -                               | 11:1                            | -                               |                 |                        |
| Parameter                   | Symbol     | TPiS 1T 0234                    | TPiS 1T 0236 L5.5               | TPS 1T 0236 IRA                 | Unit            | Remark                 |
| Sensitive area              | A          | 0,7 x 0,7                       | 0,7 x 0,7                       | 0,7 x 0,7                       | mm <sup>2</sup> |                        |
| Field of View , typ.        | FoV        | 70                              | 7                               | 15                              | Degrees         | at 50% point           |
| Distance to Spot size ratio |            | -                               | 8:1                             | -                               |                 |                        |

# Thermopile Module With Integrated Processing And Optics For Temperature Measurement



TPiM 1T 0136 L5.5, TPM 1T 0134 M(y) – Thermopile Module with TPiM<sup>®</sup>

## Target Applications

- Industrial Temperature Monitoring
- Pyrometry

## Features and Benefits

- Internal Signal Processing
- Factory-calibrated
- Lens or Mirror Optics
- Ambient Temperature Compensation
- ISOthermal Performance

## Product Description

The Module range consists of a thermopile sensor, mounted on a PCB with connector. The PCB can also provide for optional features as voltage regulation and a noise-reduction filter. The Module is also featuring ISOthermal performance and includes the integrated temperature compensation for a defined temperature environment, and the calibration to a certain object temperature range. When ordering, please specify the correct ambient and object temperature ranges needed. For defined spot size requirements, we offer sensors with a Field of View defined by optical apertures, internal lenses or external mirror optics. The lens module is provided with a very small pcb. The mirror version has a longer size pcb and allows different orientations for the Mirror, M(y). A protective external filter may be supplied with the mirror module.

For the various object temperature ranges, Excelitas offers the following pre-calibrated Modules:

### Integral Lens types

- 20...60°C: TPiM 1T 0136 L5.5 OAA060 P7
- 20...120°C: TPiM 1T 0136 L5.5 OAA120 P7
- 20...180°C: TPiM 1T 0136 L5.5 OAA180 P7
- 20...250°C: TPiM 1T 0136 L5.5 OAA250 P7

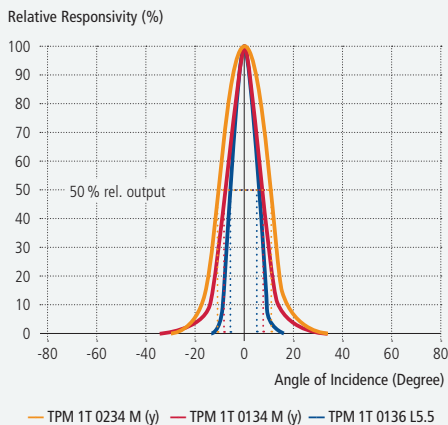
### External Mirror types

- 20...140°C: TPM 1T 0134 OAA140 P M(y)
- 20...180°C: TPM 1T 0134 OAA180 P M(y)
- 20...250°C: TPM 1T 0134 OAA250 P M(y)

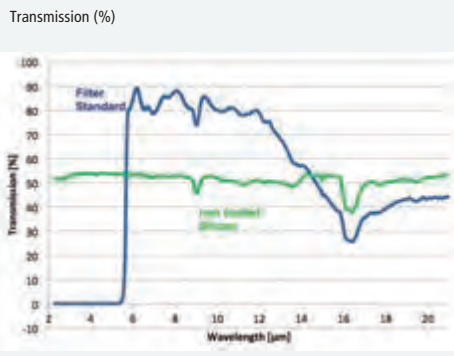
Mirrors in different viewing orientations M(y); y = L (left) / y = F (front) / y = R (right).

A temperature reference output is included. Upon request, the modules can be supplied as "OBA" version, which are calibrated but without internal temperature compensation. In this case the customer will do the temperature compensation externally with the use of the supplied reference output. The temperature accuracy of the fully-adjustable integrated circuit outperforms discrete solutions. With the integration of Thermopile and electronic circuits in compact TO-5 type metal housing, the TPiS is robust and insensitive to environmental influences like leakage currents on the parent PCB, relative humidity, or electromagnetic interference.

## Field of View



## Filter





## Handling and Precautions

### Humidity

All our IR-detectors shall not increase noise or decrease responsivity when exposed to  $\leq 95\%$  R.H. at  $30^\circ\text{C}$ . Operation below dew point (i.e. with condensation) might affect performance.

### Hermetic seal

All our IR-detectors are sealed to pass a He-leakage test with maximum leak rate of  $5 \times 10^{-8} \text{ mbar.l.s}^{-1}$ .

### Quality

Excelitas is an ISO 9001-certified manufacturer with established SPC and TQM. Detector outgoing inspections include the parameters Responsivity, Match, Offset, Noise, Gross leak (MIL Std 883 method 1014C1). Individual data are not stored, statistical details can be disclosed on request.

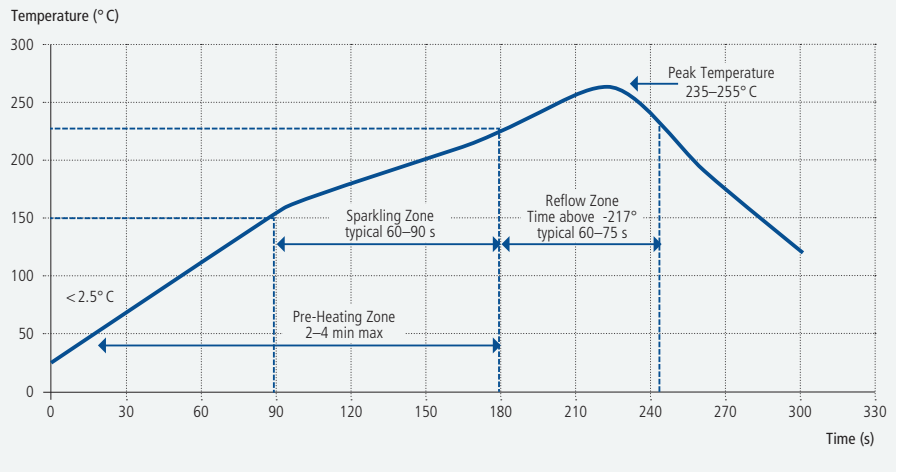
### Handling

Electrostatic charges may destroy the detector. We recommend applying pre-cautions necessary for ESD devices to avoid damages. Do not apply physical force to detector leads. Do not expose detector to aggressive detergents such as freon, trichloroethylene, etc.

### Soldering conditions

Hand soldering and standard wave soldering process may be applied. Avoid heat exposure to the top and the window of the detector. Reflow soldering is not recommended for all TO-housing types. Our new SMD types are designed for reflow-soldering in accordance with general practices for SMD.

### Typical Lead Free Reflow Profile



### Reliability Standards

#### International Electrotechnical Commission (IEC) Standards

|                |   |
|----------------|---|
| IEC 60068-2-1  | Environmental testing – Part 2: Tests. Tests A: Cold                        |
| IEC 60068-2-2  | Environmental testing – Part 2: Tests. Tests B: Dry heat                    |
| IEC 60068-2-78 | Environmental testing – Part 2-78: Tests. Test Cab: Damp heat, steady state |
| IEC 60068-2-14 | Environmental testing – Part 2: Tests. Test N: Change of temperature        |

#### Joint Electron Devices Engineering (JEDEC) Standards

|         |                     |
|---------|---------------------|
| JESD-22 | Series test methods |
|---------|---------------------|

#### US Military (MIL) Standards

|             |  |
|-------------|--|
| MIL-STD-883 | Test methods and procedures for microelectronics |
|-------------|--|

### Reliability Standards

Excelitas' continuous reliability qualification and monitoring program ensures that all outgoing products meet quality and reliability standards. Tests are performed according to approved semiconductor device standards, such as IEC, MIL, and JEDEC (see table). For detailed information please contact Excelitas.



## New Models and Nomenclature

### Thermopiles

| Comparison Table |                   |              |                   |
|------------------|-------------------|--------------|-------------------|
|                  | Model             | Prior Name   | Comments          |
| <b>Detectors</b> |                   |              |                   |
|                  | TPD 1T 0625       | TPS 735      | Identical         |
|                  | TPD 2T 0625       | TPS 2734     | Identical         |
|                  | TPiD 1T 0224      | TPS 334      | Now - ISOthermal  |
|                  | TPiD 1T 0624      | TPS 734      | Now - ISOthermal  |
|                  | TPiD 1T 0226 L5.5 | TPS 336 L5.5 | Now - ISOthermal  |
|                  | TPD 1T 0226 IRA   | TPS 336 IRA  | Identical         |
|                  | TPD 1T 0223       | TPS 333      | Identical         |
|                  | TPD 1T 0623       | TPS 733      | Identical         |
|                  | TPD 1T 0122       | TPS 232      | Identical         |
|                  | TPiD 1T 0122 B    | TPS 23 B     | Identical         |
|                  | TPiD 1T 0222 B    | TPS 33 B     | Identical         |
|                  | TPiD 1T 0622 B    | TPS 73 B     | Identical         |
| <b>Sensors</b>   |                   |              |                   |
|                  | TPiD 1S...        | New          | SMD Detector      |
|                  | TPiS 1S...        | New          | SMD Sensor        |
|                  | TPiS 1T 125...    | New          | DigiPile™         |
|                  | TPiS 1S 1252      | New          | DigiPile™ in SMD  |
|                  | TPiS 1T 013...    | a2TPMI       | Calibrated Sensor |
| <b>Modules</b>   |                   |              |                   |
|                  | TPiM 1T 013...    | a2TPMI       | Calibrated Module |
|                  | TPiM 1T 1256 L5.5 | New          | Calibrated Module |

### Pyrodetectors

| Recommendations           |          |                   |                             |                                   |
|---------------------------|----------|-------------------|-----------------------------|-----------------------------------|
|                           | Model    | Features          | Comments                    | Market/ Applications              |
| <b>"Smart" DigiPyro®</b>  |          |                   |                             |                                   |
|                           | PYD 1096 | Dual-Element      | All-In-One Electronics      | Simple Switches                   |
|                           | PYQ 1046 | Quad-Element      | All-In-One Electronics      | Simple Switches                   |
|                           | PYD 1098 | Dual-Element      | All-In-One Electronics      | Simple Alarms                     |
|                           | PYQ 1048 | Quad-Element      | All-In-One Electronics      | Simple Alarms                     |
| <b>High-end Detectors</b> |          |                   |                             |                                   |
|                           | LHi 968  | Dual-Element      | Analog, Standard            | Alarm Applications                |
|                           | PYD 1398 | Dual-Element      | Improved version            | Alarm Applications                |
|                           | LHi 1148 | Quad-Element      | Analog                      | Alarm Applications                |
|                           | PYD 5190 | Dual-Element      | New - In SMD                | Consumer Electronics Applications |
| <b>DigiPyro®</b>          |          |                   |                             |                                   |
|                           | PYD 5790 | Dual-Element      | New - Digital, In SMD       | Consumer Electronics Applications |
|                           | PYD 1798 | Dual-Element      |                             | Alarm Applications                |
|                           | PYD 1788 | Dual-Element      | Standard                    | Light Switches                    |
|                           | PYQ 2898 | Quad-Element      |                             | Alarm Applications                |
|                           | PYQ 5848 | Quad-Element      | Ceiling-mount configuration | Light Switches                    |
|                           | PYS 3798 | Single-Element    | Single-Channel              | Gas Monitoring                    |
|                           | PYS 3828 | 2x Single Element | (2+1) Channel               | Gas Monitoring                    |
| <b>Low Cost</b>           |          |                   |                             |                                   |
|                           | LHi 778  | Dual-Element      | Low Cost                    | Light Switches                    |

## About Excelitas Technologies

Excelitas Technologies is a global technology leader focused on delivering innovative, customized solutions to meet the detection, lighting, optical, imaging, photonic and advanced electronic systems needs of OEM customers.

From safety and security applications to industrial, consumer, medical, analytical instrumentation, clinical diagnostics, and aerospace and defense applications, Excelitas Technologies is committed to enabling our customers' success in their end-markets.

Excelitas Technologies has approximately 5,500 employees in North America, Europe and Asia, serving customers across the world.

[www.excelitas.com/Detection](http://www.excelitas.com/Detection)

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