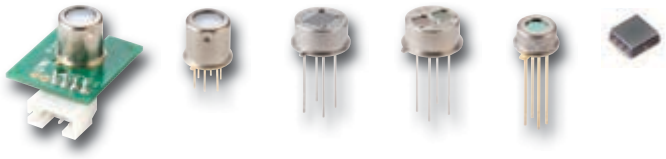
Infrared Sensing Solutions

New, Updated Edition 3



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.

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

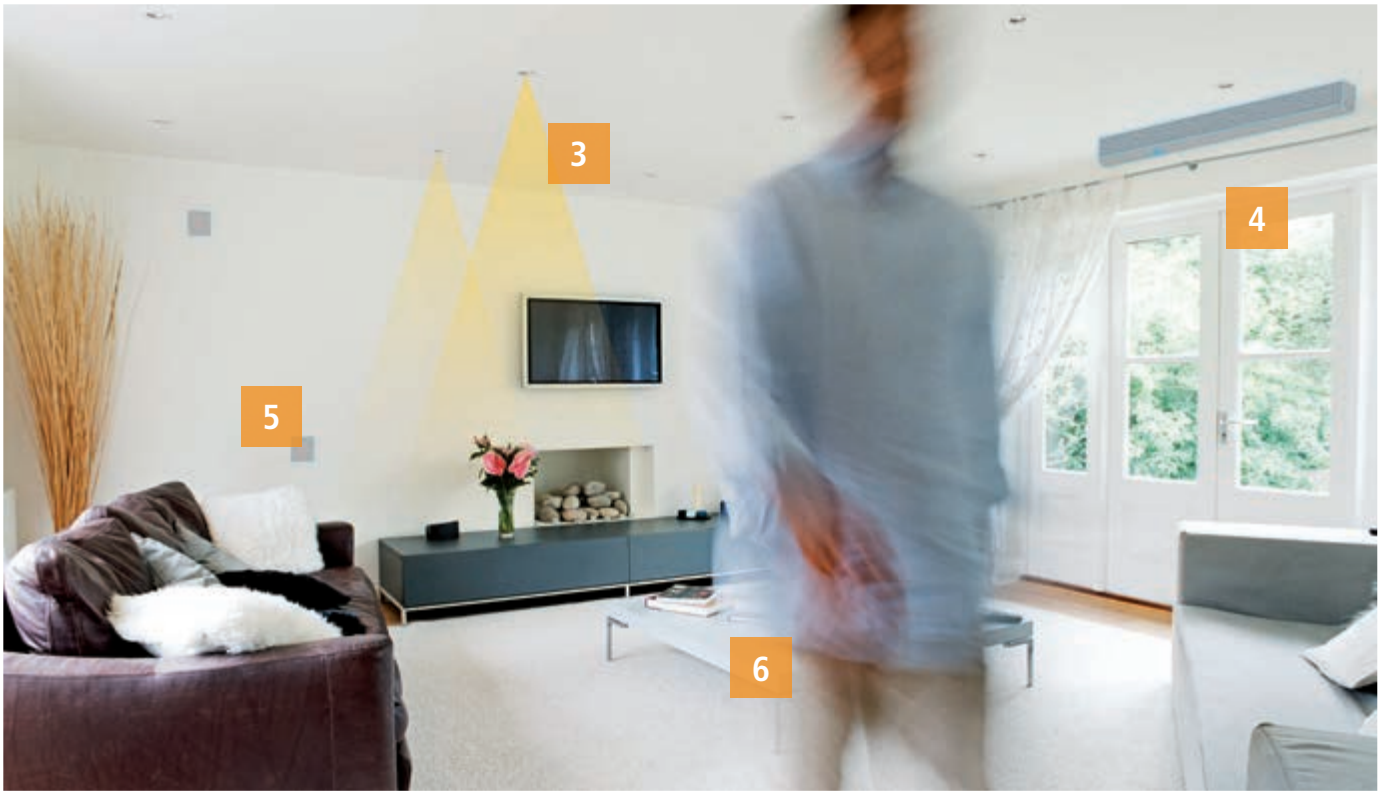
Thermometry for Healthier Families

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

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Thermometry	TPD 1T 0122		round Aperture, Thermistor	small housing	32
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Non-contact Measurement	TPiD 1S 0222	small target area	SMD Housing	isothermal	34
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Non-contact Measurement	TPiS 1T 0134	integrated Signal processing	round Aperture	fully calibrated	38
Non-contact Measurement	TPiS 1T 0136 L5.5	integrated Signal processing	integral optics	fully calibrated	38
Non-contact Measurement	TPS 1T 0136 IRA	integrated Signal processing	integral optics	fully calibrated	38
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Non-contact Measurement	TPiS 1T 1254			DigiPile	36
Non-contact Measurement	TPiS 1T 1256 L5.5			DigiPile	36
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Non-contact Measurement	TPiM 1T 0134 P(x) M(y)	integrated Signal processing	pcb w connector	fully calibrated	40
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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:

λmax =2898 / T

T = Temperature in K (Kelvin)

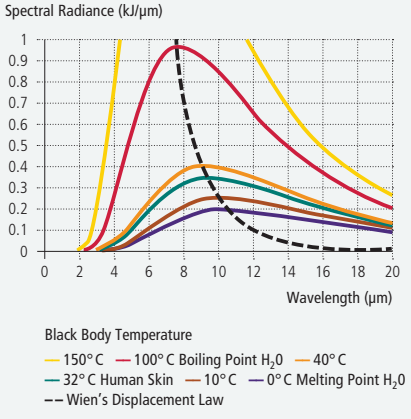
λ = Wavelength in µm

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.

Figure 1

Radiated Energy vs. Wavelength



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.

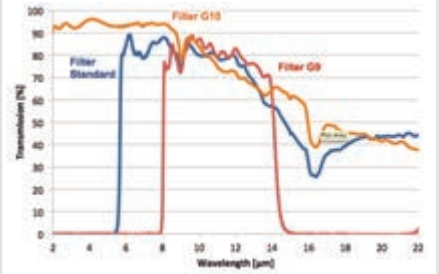
Filters for Infrared Sensors

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

Broad Band Filters



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 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.

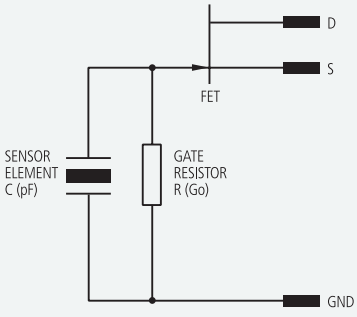
This pyroelectric effect is the basic principle for detectors that can recognize temperature variations. The characteristic value for the permanent polarization, called pyroelectric coefficient, disappears above the Curie point. The Curie temperature limits the operation temperature range for such detectors. 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

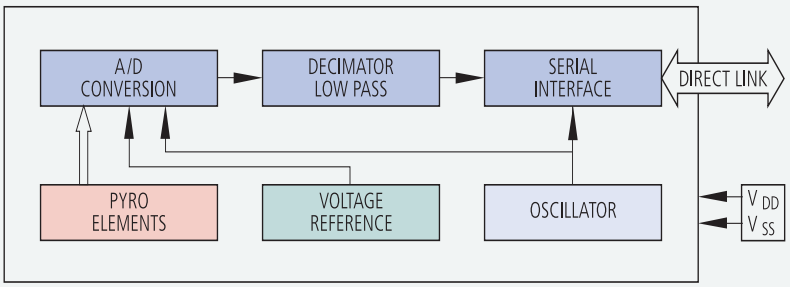
Electrical Configuration



Excelitas is the first to having introduced digital technology to Pyroelectric Detectors with it's 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

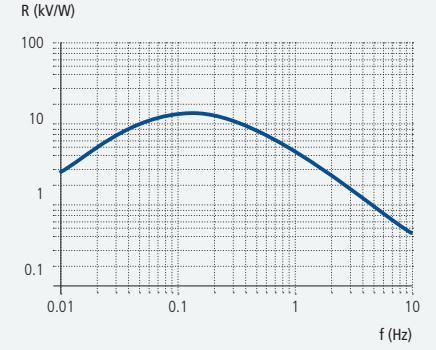
The most important electrical data of the IR-Sensor are its responsivity, balance and noise. Sometimes it is also useful to refer to NEP or D*.

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 tree 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 µV 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.

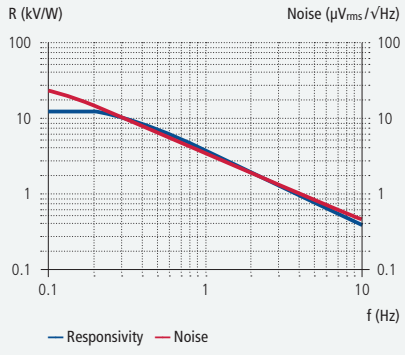
NEP, D*

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°C up to +85°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 μC 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 μV 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 ≙ 6.5 μV
- Noise: 6 Count ≙ 39 μV (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 μV to 500 μV, 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.

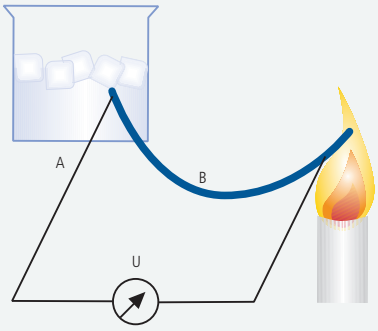
For Gas Sensing single element with narrow band filters are applied in single or dual channel configuration.

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

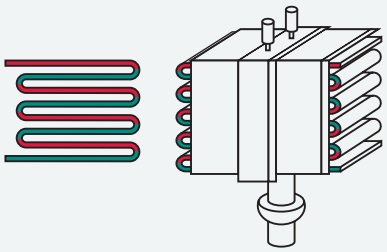
The Seebeck Effect



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 thermo-electric- 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 thermo-electric 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 SiO2/Si3N4, 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.

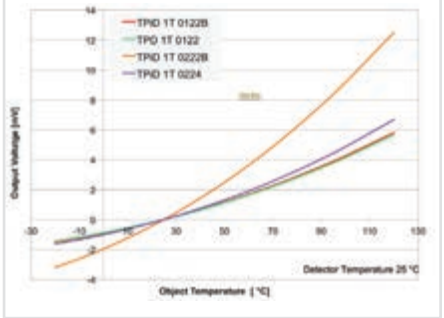
Sensitivity

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 Ω at temperature T in K
R_R	NTC resistance in Ω at rated temperature TR 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.

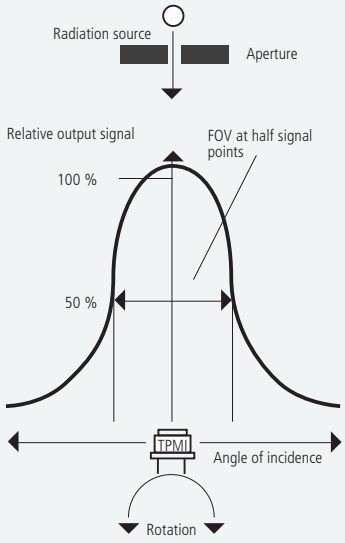
The Field of View

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
Lens Type (L5.5)						
	FOV	Field of view		7	12	°
	OA	Optical axis		0	±3.5	°
	D:S	Distance to spot size ratio		8:1		
Integral Reflector Type (IRA)						
	FOV	Field of view		15	20	°
	OA	Optical axis		0	±2	°
Standard Aperture Type						
	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 it's 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.

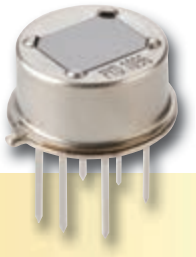
In many industrial process control units thermopile sensors are used to contactless monitor temperature or to serve as overheating protection feature.

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

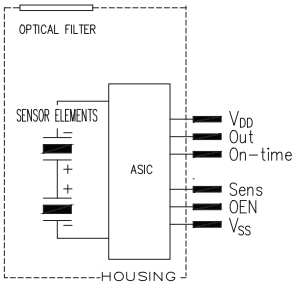
Features and Benefits

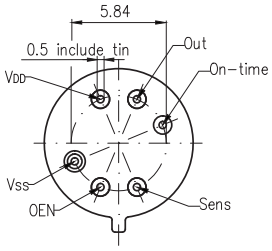
- TO-5 metal housing
- All electronics included
- Dual Element: PYD 1096
- Quad Element: PYQ 1046

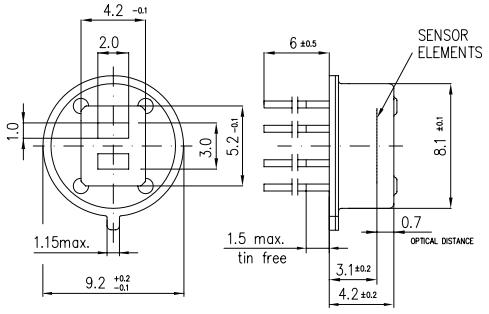
Product Description

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.

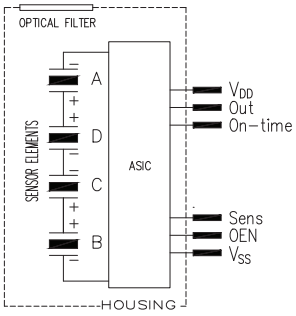
PYD 1096

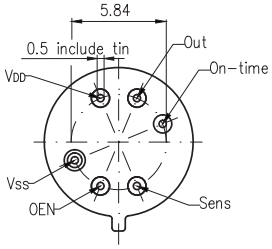


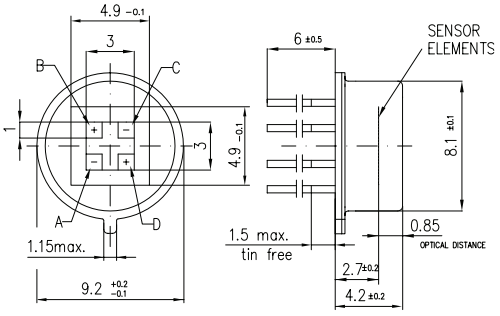




PYQ 1046





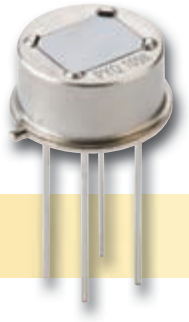


PYD 1096 and PYQ 1046

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°	119°		unobstructed
Field of View, vertical		100°	119°		unobstructed
Operating Voltage	V_{DD}	2,7...3,3	2,7...3,3	V	
Supply Current	I_{DDmax}	15	15	µA	V_{DD} < VR, Outputs unloaded
Sensitivity Threshold		120	120…530	µVp	
Noise, max.		50	100	$µV_{pp}$	0,4…10Hz/20°C
On-Time		2…4194	2…4194	s	
OEN (ambient light control)		n. a.	Low<0.2*V_{DD}; High>0.8V_{DD}	V	
Output Driving Current		1	1	µA	
Filter, Signal Processing					
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

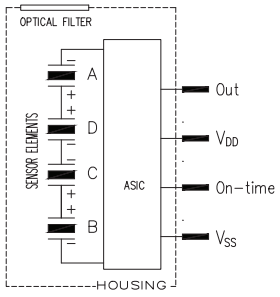
- TO-5 metal housing
- All electronics included
- Dual-Element: PYD 1098
- Quad-Element: PYQ 1048

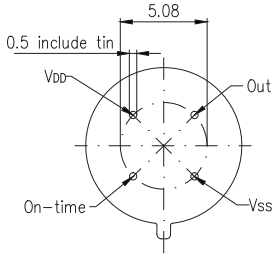
Product Description

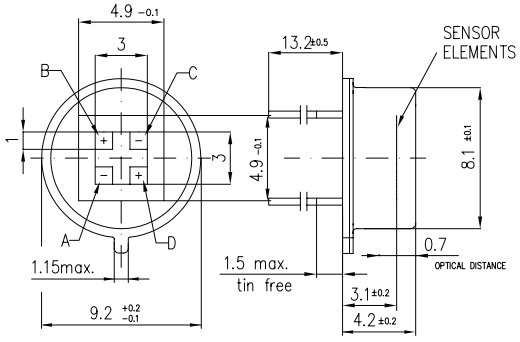
The Smart DigiPyro® family provides for a complete motion detector solution, with all electronic circuitry built-into the Detector housing. Only power supply and power-switching components need to be added to make the entire motion switch, a timer is included. The series has versions which can include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

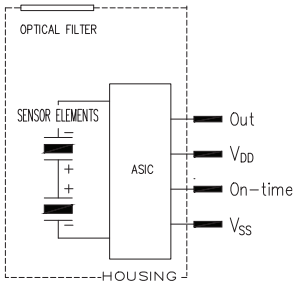
PYQ 1048

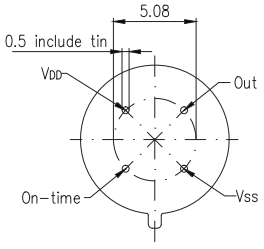


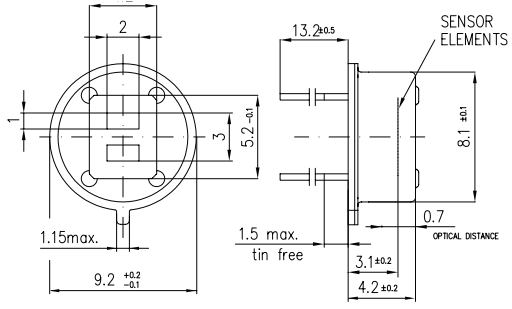




PYD 1098



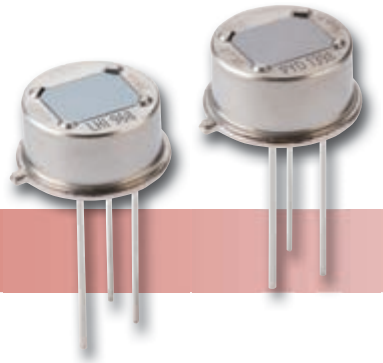




PYQ 1048 and PYD 1098					
Parameter	**Symbol**	**PYQ 1048**	**PYD 1098**	**Unit**	**Remarks**
Responsivity, min.	R_{min}	5,4	3,3	kV/W	f = 1Hz
Responsivity, typ.	R	6,5	4,0	kV/W	f = 1Hz
Match, max.	M_{max}	10	10	%	
Field of View, horizontal	FoV	119°	100°		unobstructed
Field of View, vertical		119°	100°		unobstructed
Operating Voltage	V_{DD}	2,7...3,3	2,7...3,3	V	
Supply Current	I_{DDmax}	15	15	µA	V_{DD} < VR, Outputs unloaded
Sensitivity Threshold		120	120	µVp	
Noise, max.		100	50	$µV_{pp}$	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	
Filter, Signal Processing					
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

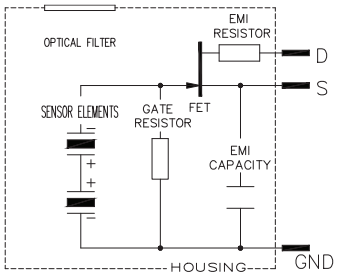
- Intrusion Alarms
- High-end Motion Sensors

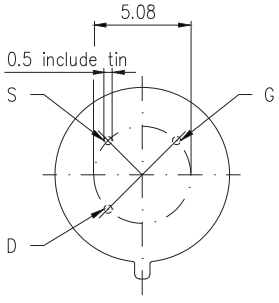
Features and Benefits

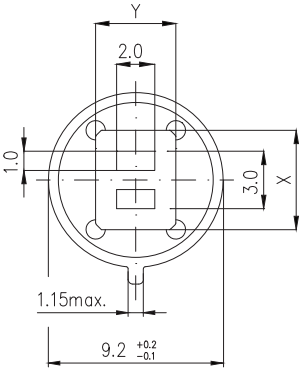
- TO-5 metal housing
- Improved EMI protection
- Reduced (WLI)

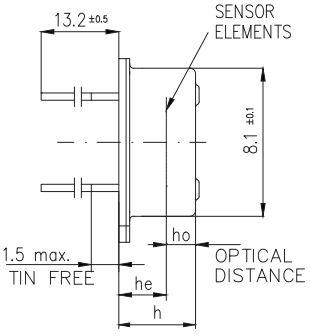
Product Description

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.





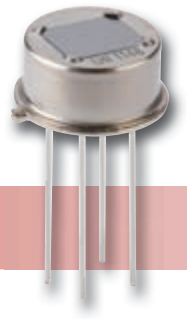




LHi 968 and PYD 1398					
Parameter	Symbol	LHi 968	PYD 1398	Unit	Remarks
Responsivity, min.	R_{min}	3,3	3,3	kV/W	f = 1 Hz
Responsivity, typ.	R	4	4	kV/W	f = 1 Hz
Match, max.	M_{max}	10	10	%	
Noise, max.	N_{max}	50	50	μV_{pp}	0,4…10Hz/20°C
Noise, typ.	N	20	20	μV_{pp}	0,4…10Hz/20°C
spec. Detectivity	D*	19	19	10^7cm*√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 x Y	5,2 x 4,2	5,2 x 4,2	mm	

Pyroelectric, Four-Element Detectors

For Intrusion Alarms



LHi 1148 – High-End, Dual-Channel Pyrodetectors

Applications

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

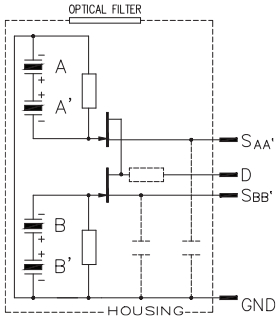
Features and Benefits

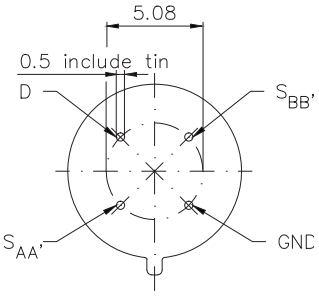
- TO-5 metal housing
- Dual Channel
- Optional Reverse/Equal Polarity
- Optional Element Configurations
- RF Protection Option

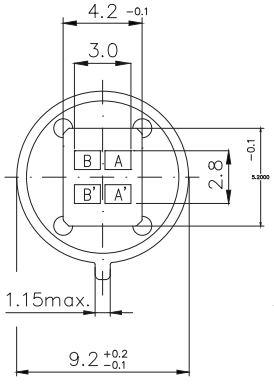
Product Description

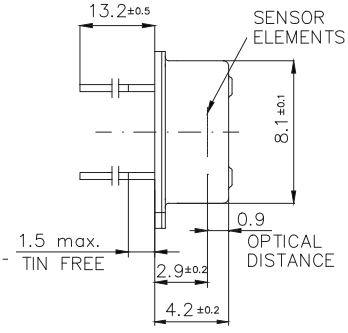
The LHi 1148 series with four element "Quad" configuration offers two independent dual element signals with opposite polarity. This enables separate signal processing option for the two channels to reduce common-mode RF influence and thermal effects.

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.



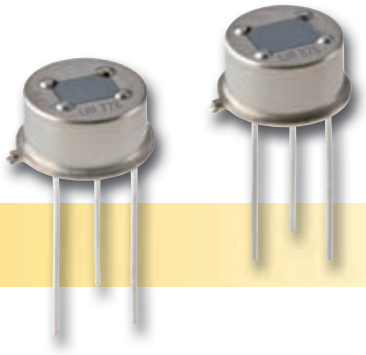






LHi 1148					
Parameter	Symbol	LHi 1148	PYQ 1488	Unit	Remarks
Responsivity, min.	R_{min}	4,3		kV/W	f = 1 Hz
Responsivity, typ.	R	5,9		kV/W	f = 1 Hz
Match, max.	M_{max}	15		%	
Noise, max.	N_{max}	75		μV_{pp}	0,4…10Hz/20°C
Noise, typ.	N	30		μV_{pp}	0,4…10Hz/20°C
spec. Detectivity	D*	16		10^7cm*√Hz/W	1Hz/ 1Hz BW/20°C
Field of View, horizontal	FoV	110°			unobstructed
Field of View, vertical		70°			unobstructed
Source Voltage		0,2…1,5	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					

Pyroelectric, Dual-Element Detectors
For Motion Sensing



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

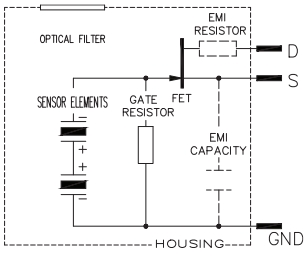
Applications
- Auto Light Switch
- Wall Switch
- Auto Lamps

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

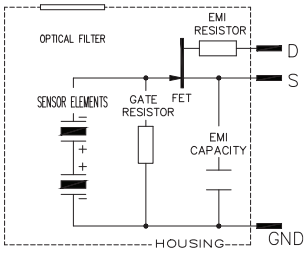
Product Description

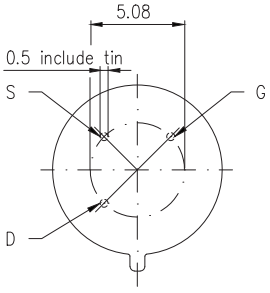
This Dual Element detector family offers standard TO-5 housings with different window sizes. Whereas LHI 778 is designed to meet low cost and having small optical window, LHi 878 offers standard window size. PYD1388 has same dimensions and provides for additional EMI protection as option.

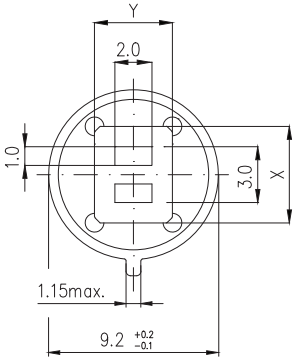
LHi 778, 878

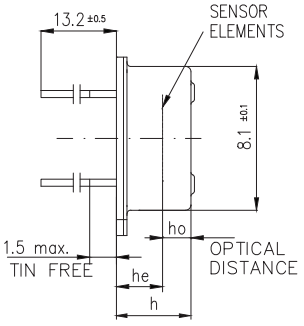


PYD 1388







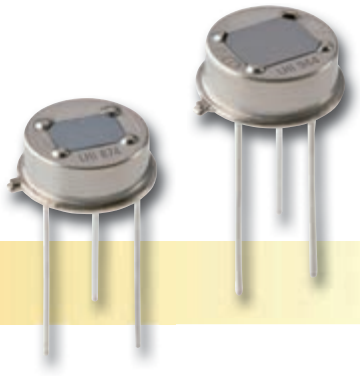


LHi 778, LHi 878 and PYD 1388

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	μV_{pp}	0,4…10Hz/20°C
Noise, typ.	N	35	25	20	μV_{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	

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

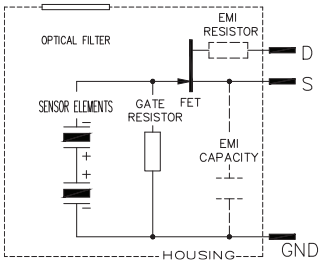
Features and Benefits

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

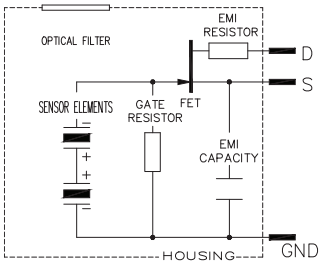
Product Description

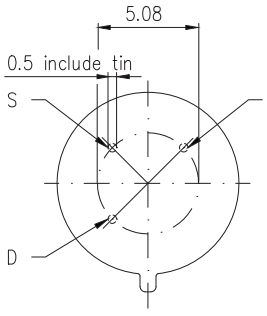
These Low-Profile TO-39 detectors are very well suited for use as two detectors arranged at an angle so as to enable a 180 degree view. The LHi 874 offers a standard window size, whereas the LHi 944 model offers a large window with greater Field Of View. The PYD 1394 has same dimensions and provides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

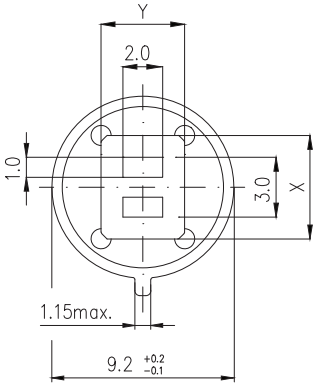
LHi 874, 944

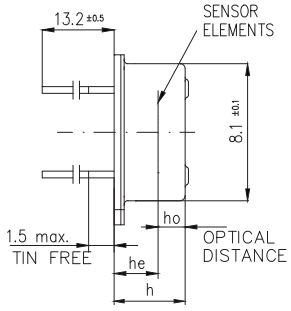


PYD 1394









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	μV_{pp}	0,4…10Hz/20°C
Noise, typ.	N	25	20	20	μV_{pp}	0,4…10Hz/20°C
spec. Detectivity	D*				10^7cm*√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	

Pyroelectric Four-Element Detectors

For Ceiling-Mount

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

Target Applications

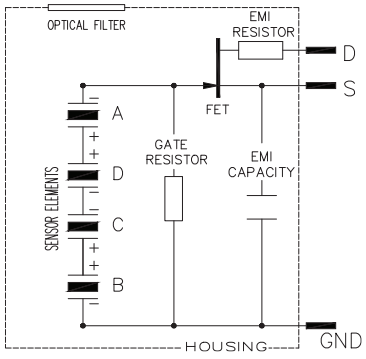
- Ceiling-Mount Alarms
- Ceiling-Mount Light Switch

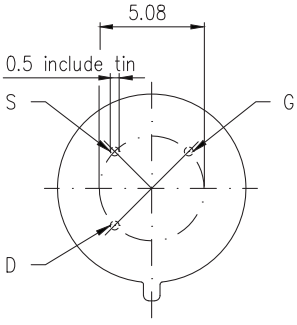
Features and Benefits

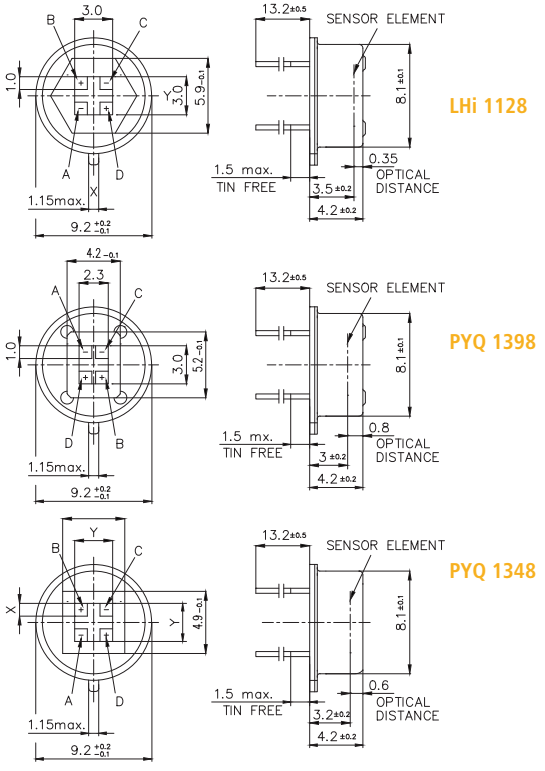
- TO-5 metal housing
- Different window sizes
- Single Channel output

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. Two 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 Elemement 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	μV_{pp}	0,4…10Hz/20°C
Noise, typ.	N	30	40	40	50	μV_{pp}	0,4…10Hz/20°C
spec. Detectivity	D*	8	14	14	17	10^7cm*√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		

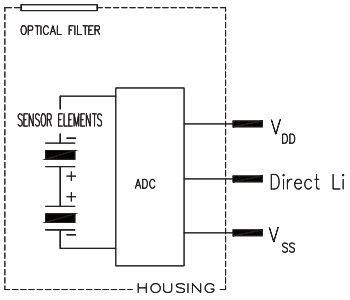
Miniaturized, Dual-Element Pyrodetectors
For Motion Sensing

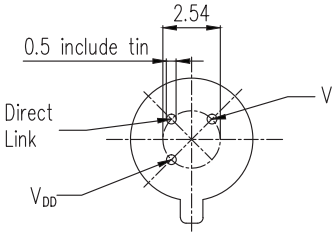
PYD 5731 – DigiPyro® in TO-46 Housing

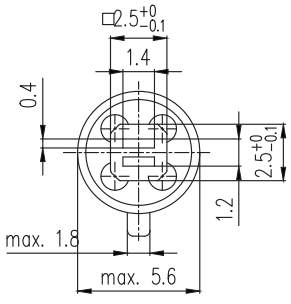
Applications
- Automatic Light Switch
- Wall Switches

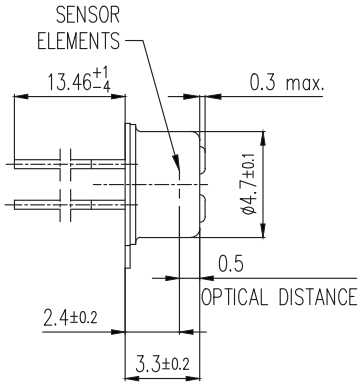
Features and Benefits
- TO-46 metal housing
- Temperature reference output included
- DigiPyro® with Direct Link Interface

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 DigPyro, 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.





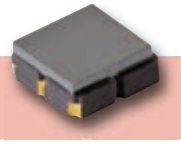




PYD 5731				
Main Parameter	**Symbol**	**PYD 5731**	**Unit**	**Remarks**
Responsivity, min.	R_{min}	8,5	kV/W	f = 1 Hz
Responsivity, typ.	R_{typ}	11	kV/W	f = 1 Hz
Match, max.	M_{max}	10	%	
Noise, max.	n_{max}	180	μV_{pp}	0,4…10Hz/ 20°C
Noise, typ.	n_{typ}	70	μV_{pp}	0,4…10Hz/ 20°C
Field of View, horizontal	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	µA	V_{DD} = 3,3V
Digital Data				
Sample Time	t_{SMPL}	2	ms	min.
ADC Resolution		14	Bits	max. Count = 214-1
Output Data Format		2 x 14	Bits	
ADC Sensitivity		6…7	µV/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
Linearity		-5…+5	%	-20°C to +80°C
Filter				
Digital Filter Cut off		10	Hz	refer to ApplicationNote

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

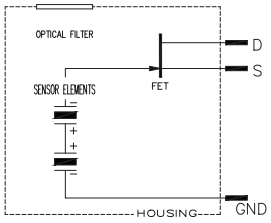
- MSL 1
- SMD housing
- Analog FET output
- DigiPyro with Direct Link Interface
- Especial designed Fresnel lens available

Product Description

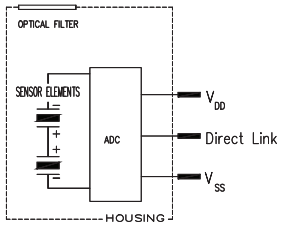
The PYD 5190 features a tiny Dual Element Pyro in SMD form. Furthermore, with the PYD 5790 Excelitas extends the emerging DigiPyro® family to the SMD form factor. Both types are fit with a small pyroelectric elements of 0,7x1,5 mm size. As to the different dimensions of elements and housing, the SMD 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 DigPyro.

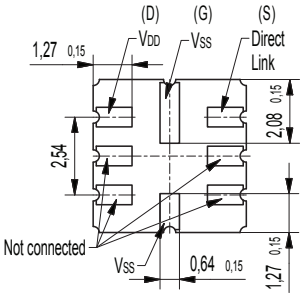
The small dimensions of the smd housing in connection with a reduced element size and spacing will enable customers to reduce the optical design and smaller motion detection for new applications.

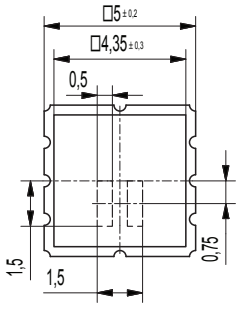
PYD 5190

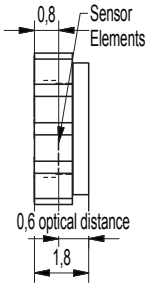


PYD 5790



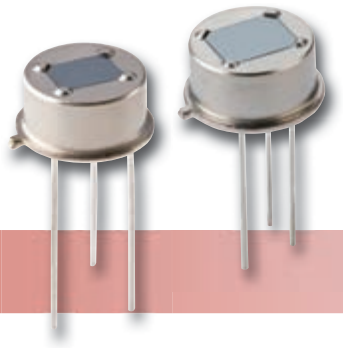






PYD 5190 and PYD 5790					
Main Parameter	**Symbol**	**PYD 5790**	**PYD 5190**	**Unit**	**Remarks**
Responsivity, min.	R_{min}	5,5	5,5	kV/W	f = 1 Hz
Responsivity, typ.	R	10	8,5	kV/W	f = 1 Hz
Match, max.	M_{max}	10	10	%	
Noise	N_{max}	200	200	μV_{pp}	0,4…10Hz/20°C
	N_{typ}	80	80		
Field of View, horizontal	FoV	133°	133°		unobstr.
Field of View, vertical		(76+33)°	(76+33)°		non symmetric, unobstr.
Source voltage		-	0,2 … 1,55		47 KΩ, 20°C, VDD=10V
Operating Voltage	V_{DD}	2,7…3,6	2,0…10	V	20°C
Supply Current	I_{DD}	10		µA	VDD = 3,3V
	I_{DDmax}	15		µA	VDD = 3,3V
Digital Data					
Sample Time	t_{SMPL}	2	-	ms	min.
ADC Resolution		14	-	Bits	max. Count = 214-1
Output Data Format		2 x 14	-	Bits	
ADC Sensitivity		6-7	-	µV/count	
ADC Output Offset		6500 - 9800	-	counts	
ADC Output Offset, typ.		8192	-	counts	
Temperature Reference					
Gain (Temperature)		80	-	Counts/K	-20°C to +80°C
Linearity		-5…+5	-	%	-20°C to +80°C
Filter, Signal Processing			-		
Digital Filter, cut off		10	-	Hz	

Digital, Dual-Element Pyros
For Motion Sensing

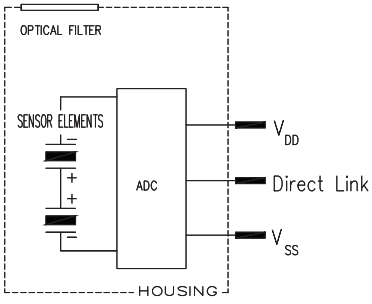


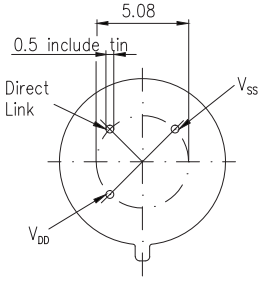
PYD 1788, PYD 1798 – DigiPyro®

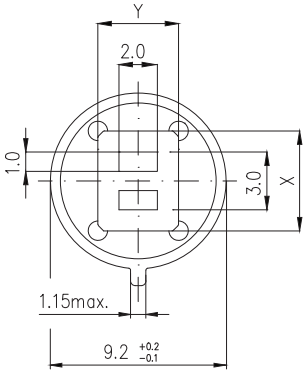
Target Applications
- Passive Intrusion Alarms
- Auto Light Switch
- Auto Lamps

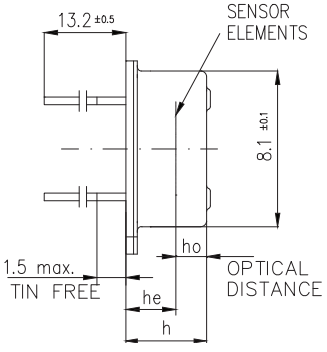
Features and Benefits
- TO-5 metal housing
- Digital Direct Link
- Different window sizes
- Excellent EMI protection

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 modelss 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 TO49 housing.

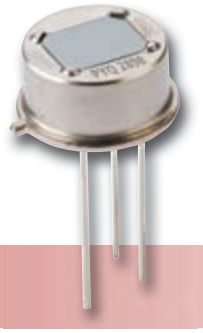








PYD 1798 and PYD 1788					
Parameter	Symbol	PYD 1798	PYD 1788	Unit	Remarks
Responsivity, min.	R_{min}	3,3	3,3	kV/W	f = 1 Hz
Responsivity, typ.	R	4	4	kV/W	f = 1 Hz
Match, max.	M_{max}	10	10	%	
Noise	N, N_{max}	78/20	78/20	μ_{Vpp}	
Field of View, vertical	FoV	110°	95°		unobstructed
Field of View, horizontal	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	
Digital Data					
Operating Voltage	V_{DD}	2,7…3,6	2,7…3,6	V	
Supply Current	I_{DD}	10	10	µA	V_{DD}=3,3V
	I_{DDmax}	15	15	µA	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	6…7	µV/count	
ADC Output Offset		7000…9200	7000…9200	counts	
ADC Output Offset, typ.		8192	8192	counts	



Digital, Pyroelectric Four-Element Detectors

For Motion Sensing

PYQ 2898 – DigiPyro® (2+1) Channel

Target Applications

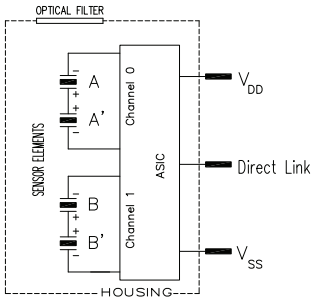
- Passive Intrusion Alarm
- High-End Motion Sensing
- Ceiling Mount Sensors

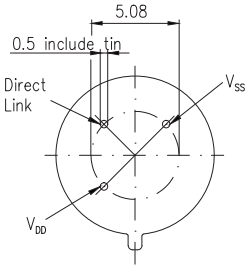
Features and Benefits

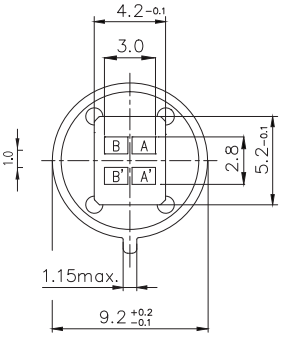
- Digital Direct Link
- Different window sizes
- Different Element configurations
- Excellent EMI protection

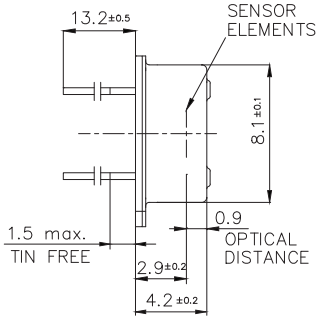
Product Description

This design of DigiPyro® detectors in TO-5 housing includes the serial 2+1 signal output, which provide two Signal outputs of the 2 element pairs and additionally the output of the temperature reference. All 3 channels are part of one 42-bit digital bit stream output via a single wire "Direct Link" connection to a suitable host microprocessor.









PYQ 2898			
Main Parameter	**PYQ 2898**	**Unit**	**Remarks**
Responsivity, min.	3,5	kV/W	f = 1 Hz
Responsivity, typ.	4,5	kV/W	f = 1 Hz
Match, max.	10	%	
Field of View, horizontal	96°		unobstr.
Field of View, vertical	56°		unobstr.
Operating Voltage	2,7…3,6	V	
Supply Current IDD	10	µA	VDD = 3,3V
Noise, max. / typ.	80 / 30	µVpp	0,4…10Hz/20°C
Digital Data			
Sample Time	2	ms	min.
ADC Resolution	14	Bits	max. Count = 214-1
Output Data Format	3 x 14	Bits	
ADC Sensitivity	6,1…7	µV/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
Linearity	-5…+5	%	-20°C to +80°C
Filter, Signal Processing			
Digital Filter, cut off	8	Hz	

Digital, Pyroelectric Four-Element Detectors

For Motion Sensing

PYQ 5868, PYQ 5848 – DigiPyro® (2+1) Channel

Target Applications

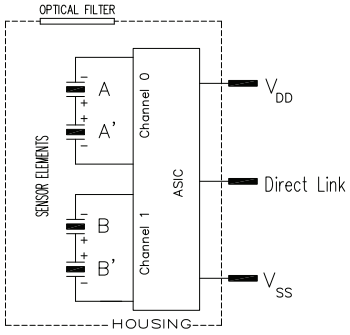
- Passive Intrusion Alarms
- High-End Motion Sensing
- Ceiling-Mount Sensors

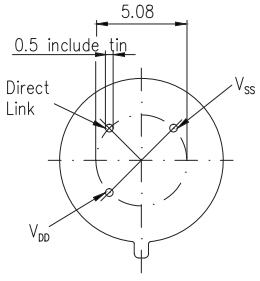
Features and Benefits

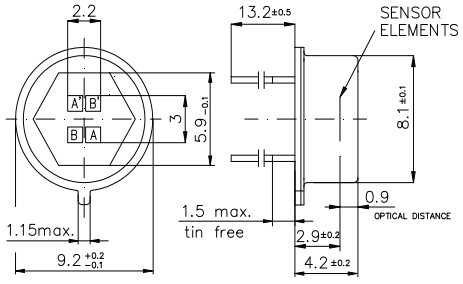
- Digital Direct Link
- Different window sizes
- Different Element configurations
- Excellent EMI protection

Product Description

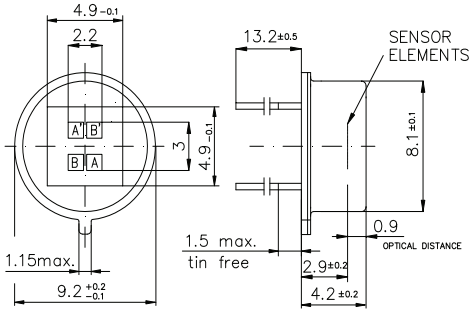
The PYQ 5868 series with "Quad" configuration offers two independent dual element signals in a diagonal geometric arrangement. For Ceiling-mount applications with suitable ceiling mount design optics, this enables separate signal processing for the two channels to provide signal levels independent of movement direction. PYQ 5868 offers a wide Field of View due to its larger window.







PYQ 5868



PYQ 5848

PYQ 5848 and PYQ 5868				
Main Parameter	**PYQ 5848**	**PYQ 5868**	**Unit**	**Remarks**
Responsivity, min.	6,0	6,0	kV/W	f = 1 Hz
Responsivity, typ.	8,0	8,0	kV/W	f = 1 Hz
Match, max.	10	10	%	
Field of View, horizontal	110°	110°		unobstr.
Field of View, vertical	110°	110°		unobstr.
Operating Voltage	2,7…3,6	2,7…3,6	V	
Supply Current IDD	10	10	µA	V_{DD} = 3,3V
IDDmax	15	15	µA	V_{DD} = 3,3V
Noise, max. / typ.	100 / 40	100 / 40	µVpp	0,4…10Hz/20°C
Digital Data				
Sample Time	2	2	ms	min.
ADC Resolution	14	14	Bits	max. Count = 214-1
Output Data Format	3 x 14	3 x 14	Bits	
ADC Sensitivity	6,1…7	6,1…7	µV/count	
ADC Output Offset	7000…9200	7000…9200	counts	
ADC Output Offset, typ.	8192	8192	counts	
Temperature Reference				
Gain (Temperature)	80	80	Counts/K	-20°C to +80°C
Linearity	-5…+5	-5…+5	%	-20°C to +80°C
Filter, Signal Processing				
Digital Filter, cut off	8	8	Hz	

Single-Element Pyro Detectors
For Gas Monitoring

LHi 807 TC, PYS 4198 TC – High sensitivity Pyros

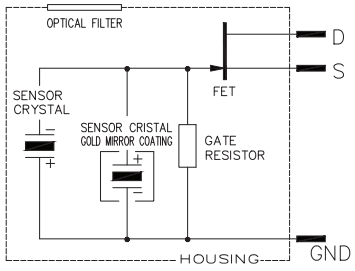
Target Applications
- Gas Sensing and Monitoring

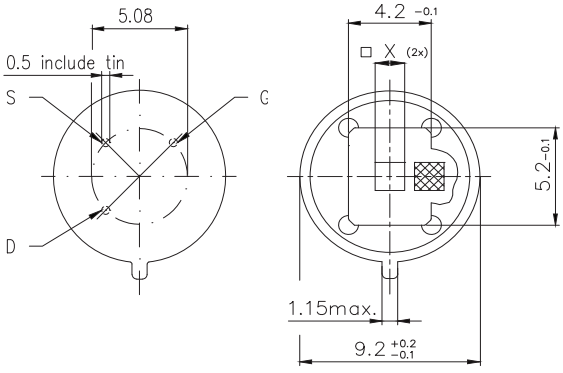
Features and Benefits
- TO-5 metal housing
- Selection of narrow band Filters
- Thermal Compensation

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 4 of this brochure for various gas species. The LHi 807 TC is usually supplied with Temperature Compensation by a separate "blind" sensing element.

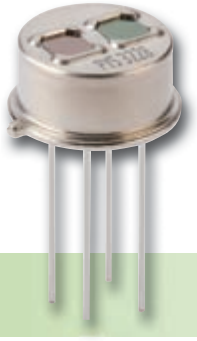
Similar features and benefits are included with the PYS 4198 TC which has large element size of 2x2 to offer more signal for non-focused optical systems. It is offered with the Thermal compensation element for compensation of thermal effects caused by temperature changes of the housing.





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 Hz
Responsivity, typ.	R	3,5	2	kV/W	f = 1 Hz
Match, max.	M_{max}	-	-	%	
Noise, max.	N_{max}	50	50	μV_{pp}	0,4…10Hz/20°C
Noise, typ.	N	15	10	μV_{pp}	0,4…10Hz/20°C
spec. Detectivity	D*	17	23	10^7cm*√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
Height	h	4,2	4,2	mm	
Optical Element Location	he /ho	3,2 / 0,75	2,9 / 1,1	mm	
Element Size	X	1,5 x 1,5	2 x 2	mm	



Pyrodetectors

For Gas Monitoring And Measuring

PYS 3228 TC, PYS 3428 TC – Dual Channel Pyros

Target Applications

- Gas Sensing and Monitoring

Features and Benefits

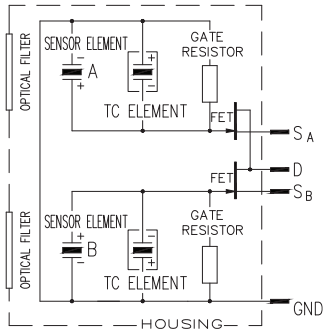
- TO-5 metal housing
- Dual Channel Output
- Thermally compensated
- Each Channel with individual Filter Window
- Selection of narrow band pass filters
- Thermal Compensation option

Product Description

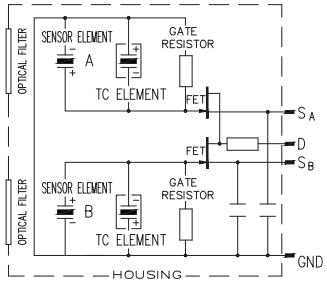
As successor of the LHi 814 series the PYS 3228 dual channel detectors have become standard for gas sensing applications, with two individual elements of size 1,5 x 1,5 and additional temperature compensation. They are available with a range of narrow band pass filters, as specified on page 7 in combination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

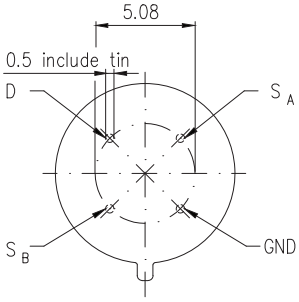
The same features are included with the PYS 3428, which offers additional EMI protection by internal capacitors.

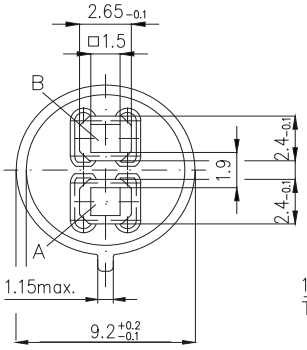
PYS 3228

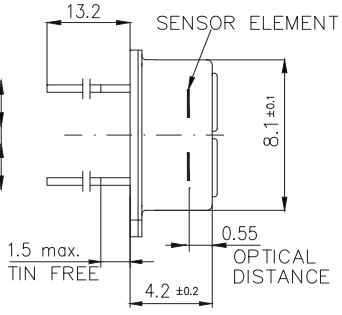


PYS 3428







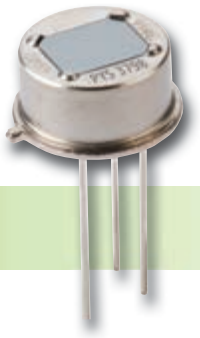


PYS 3228 and PYS 3428

Parameter	Symbol	PYS 3228 TC	PYS 3428 TC	Unit	Remarks
Operatiuon Voltage	V_{DD}	2-10	2-10	V	
Responsivity, min.	R_{min}	2,2	2,2	kV/W	f = 1 Hz
Responsivity, typ.	R	3,5	3,5	kV/W	f = 1 Hz
Match, max.	M_{max}	-	-	%	
Noise, max.	N_{max}	50	50	μV_{pp}	0,4…10Hz/20°C
Noise, typ.	N	15	15	μV_{pp}	0,4…10Hz/20°C
spec. Detectivity	D*			10^7cm*√Hz/W	1Hz/ 1Hz BW
Field of View, horizontal	FoV	77	77		unobstructed
Field of View, vertical					unobstructed
Source Voltage		0,2…1,5	0,2…1,5	V	47 kΩ, 20°C, VDD=10V
EMI Performance			***		
Height	h	4,2	4,2	mm	
Filter Size	X/Y	2,65 / 2,4	2,65 / 2,4	mm	
Element Size	X x Y	1,5 x 1,5	1,5 x 1,5	mm	

Single-Element Pyro Detectors

For Gas Monitoring And Measuring



PYS 3798 TC – (1+1) Channel DigiPyro®

Target Applications

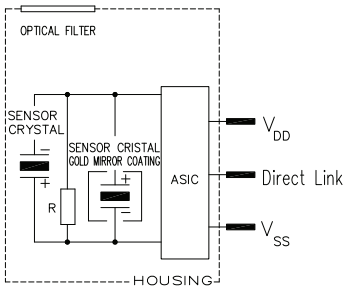
- Gas Sensing and Monitoring

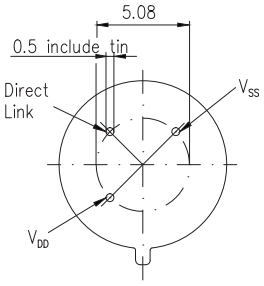
Features and Benefits

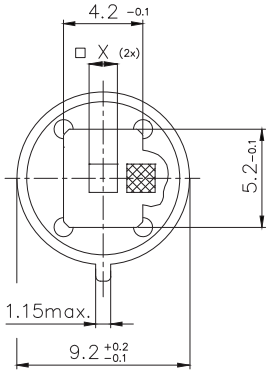
- Digital Output
- Internal Temperature reference
- Thermally compensated
- TO-5 metal housing
- Selection of narrow band pass filters

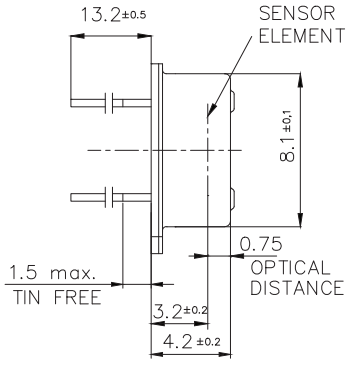
Product Description

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 additional 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.





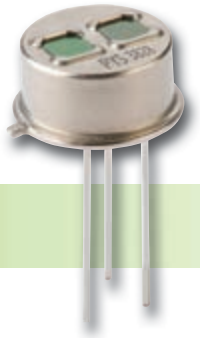




PYS 3798				
Parameter	**Symbol**	**PYS 3798**	**Unit**	**Remarks**
Responsivity, min.	R_{min}	2,2	kV/W	f = 1 Hz
Responsivity, typ.	R	3,5	kV/W	f = 1 Hz
Field of View, horizontal	FoV	135°		unobstructed
Field of View, vertical	FoV	122°		unobstructed
Operating Voltage	V_{DD}		V	
Supply Current	I_{DD}	10	µA	VDD = 3,3V
Noise, max.		80	µVpp	0,4…10Hz/20°C
Digital Data				
Sample Time	t_{SMPL}	2	ms	min.
ADC Resolution		14	Bits	max. Count = 214-1
Output Data Format		2 x 14	Bits	
ADC Sensitivity		6…7	µV/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
Linearity		-5…+5	%	-20°C to +80°C
Filter, Signal Processing				
Digital Filter, cut off		8	Hz	

Pyrodetectors

For Gas Monitoring And Measuring



PYS 3828 TC – (2+1) Channel DigiPyro®

Target Applications

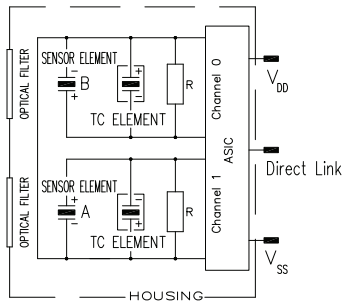
- Gas Sensing and Monitoring

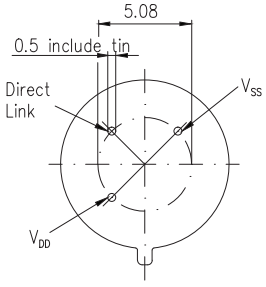
Features and Benefits

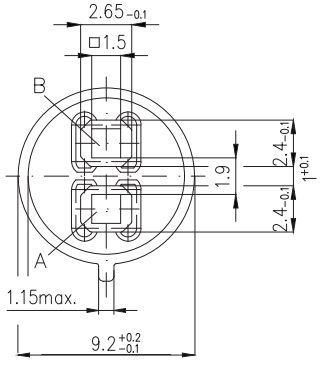
- Digital Output
- Two optical channels
- Temperature reference channel
- Temperature compensated elements
- Selection of narrow band pass filters
- TO-5 metal housing

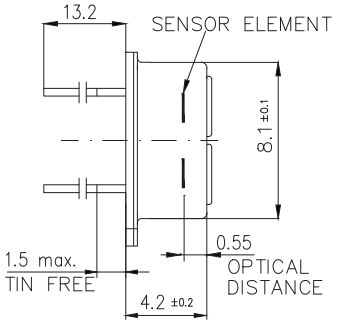
Product Description

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.





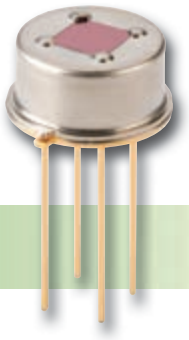




PYS 3828				
Parameter	**Symbol**	**PYS 3828**	**Unit**	**Remarks**
Responsivity, min.	R_{min}	3,3	kV/W	f = 1 Hz
Responsivity, typ.	R	4	kV/W	f = 1 Hz
Field of View, horizontal	FoV	70°		unobstructed
Field of View, vertical	FoV	85°		unobstructed
Operating Voltage	V_{DD}	2,7…3,6	V	
Supply Current	I_{DD}	12	µA	V_{DD} = 3,3V
Noise, max.		80	µVpp	0,4…10Hz/20°C
Digital Data				
Sample Time	t_{SMPL}	2	ms	min.
ADC Resolution		14	Bits	max. Count = 214-1
Output Data Format		3 x 14	Bits	
ADC Sensitivity		6,1…7	µV/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
Linearity		-5…+5	%	-20°C to +80°C
Filter, Signal Processing				
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

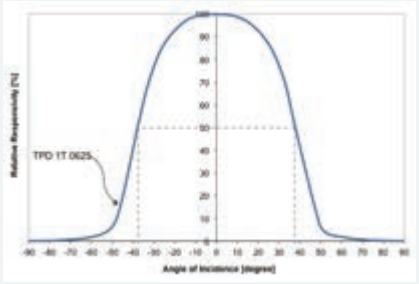
Features and Benefits

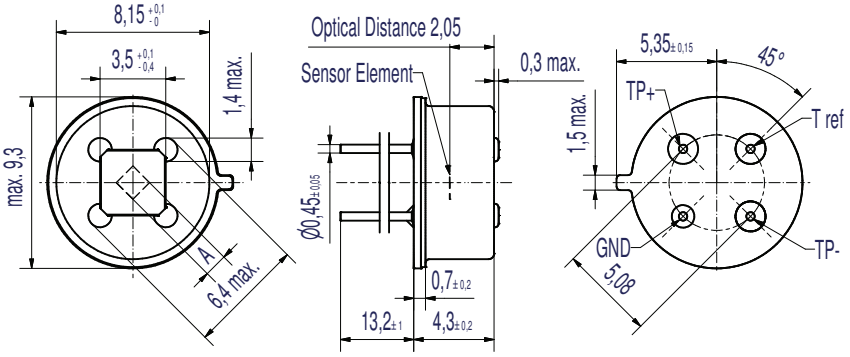
- High Sensitivity
- TO-5 metal housing
- Thermistor included Narrow band pass filter options

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

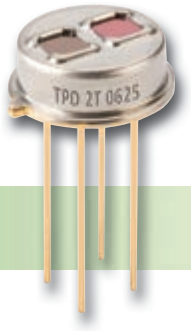




TPD 1T 0625

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

Thermopile Detectors
For Measurement And Gas Sensing



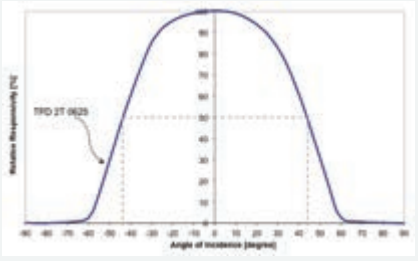
TPD 2T 0625 – Dual-Channel Thermopile

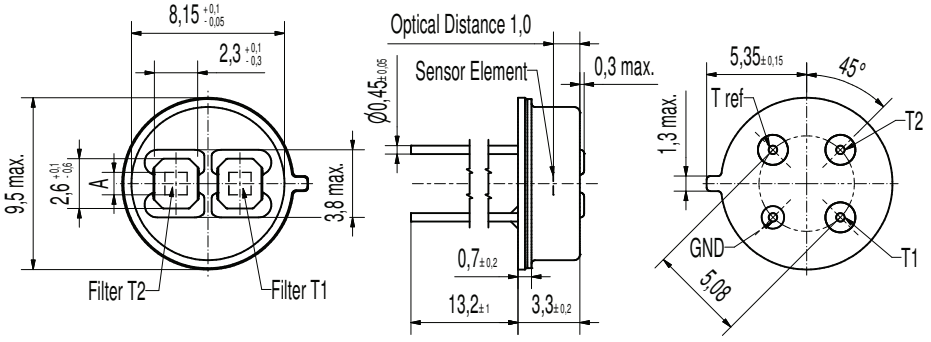
Applications
- Gas Sensing and Monitoring

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

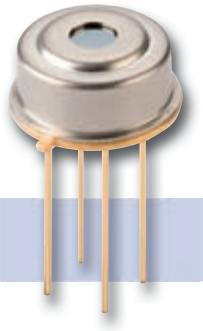




TPD 2T 0625

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

ISOthermal Detectors
For Measurement



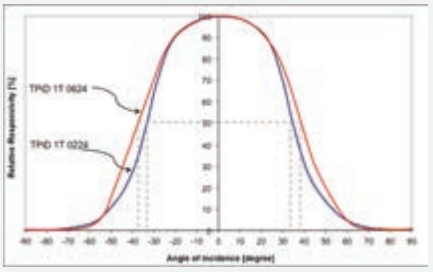
TPiD 1T 0224, TPiD 1T 0624 – Thermopile Detectors

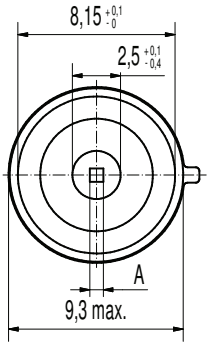
Target Applications
- Non-contact Temperature measurements
- Pyrometry

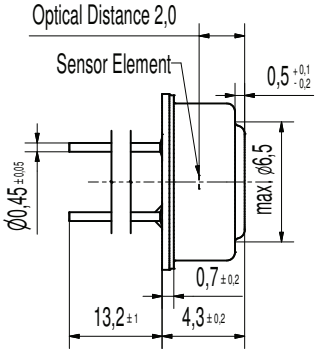
Features and Benefits
- ISOthermal performance
- TO-39 Metal housing
- Thermistor included

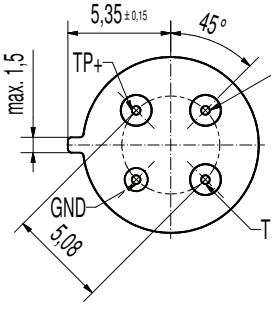
Product Description
Excelitas offers a range of ISOthermal Thermopile Detectors in TO-39 type housings. The patent protected ISOthermal feature provides improved system performance when being subjected to thermal shock conditions.
Both types are provided with round window, which also serves as aperture. 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





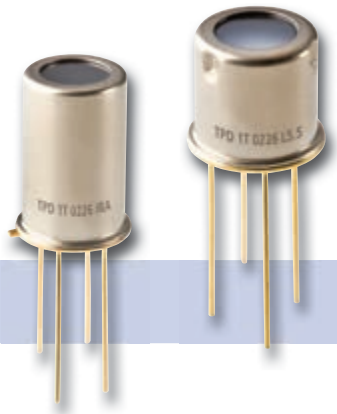




TPiD 1T 0224 and TPiD 1T 0624

Parameter	Symbol	TPiD 1T 0224	TPiD 1T 0624	Unit	Remark
Sensitive Area	A	0,7 x 0,7	1,2 x 1,2	mm^2	Absorber Area
Thermopile Resistance	R_{TP}	50…100	50…110	kΩ	25°C
Responsivity	R	45	33	V/W	500°K / 1Hz / Without IR-filter
Sensitivity (Tdet 25 °C / Tobj 40 °C)	S_{40}	50	92	µV/K	With standard filter (LWP, cut-on 5.5 µm)
Sensitivity (Tdet 25 °C / Tobj 100 °C)	S_{100}	65	120	µV/K	With standard filter (LWP, cut-on 5.5 µm)
Time Constant	t	22	27	ms	
Noise Voltage	Vn	35	36	nV/√Hz	25°C
Specific Detectivity	D^*	0,9	1,1	10^8 $cm\sqrt{Hz}/W$	25°C
Temp. Coefficient of Resistance	TC_{RTP}	0,03	0,03	%/K	
Temp. Coefficient of Responsivity	TC_R	-0,05	-0,05	%/K	
Field of view	FoV	70	76	Degrees	at 50% intensity points
Thermistor resistance (25°C)	R25	100	100	kΩ	25°C
Thermistor BETA-value	β	3964	3964	K	defined at 25°C / 100 °C

Thermopile Detectors
With Integral Optics



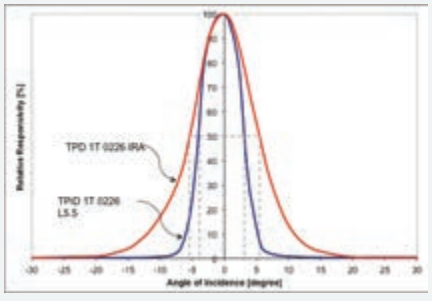
TPD 1T 0226 IRA, TPiD 1T 0226 L5.5 – High Performance Thermopiles

Target Applications
- Non-contact Temperature measurements
- Thermometry

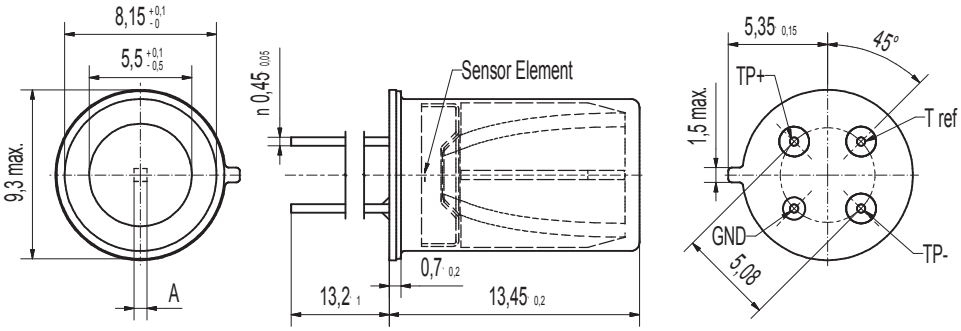
Features and Benefits
- TO type metal housing
- Optics included
- Thermistor included

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 P 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.

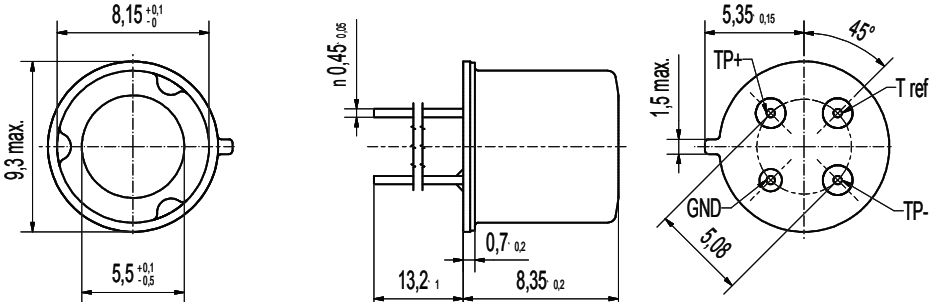
Field of View



TPD 1T 0226 IRA



TPiD 1T 0226 L5.5



TPiD 1T 0226 L5.5 and TPD 0226 IRA

Parameter	Symbol	TPiD 0226 IRA	TPD 1T 0226 L5.5	Unit	Remarks
Sensitive Area	A	0,7 x 0,7	0,7 x 0,7	mm^2	Absorber Area
Thermopile Resistance	R_{TP}	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	Vn	35	35	nV/√Hz	25°C
Specific Detectivity	D*	0,9	0,9	10^8 cm√Hz/W	25°C
Temp. Coefficient of Resistance	TC_{RTP}	0,03	0,03	%/K	
Temp. Coefficient of Responsivity	TC_R	-0,05	-0,05	%/K	
Field of view	FoV	7	15	Degrees	at 50% intensity points
Thermistor resistance (25°C)	R_{25}	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

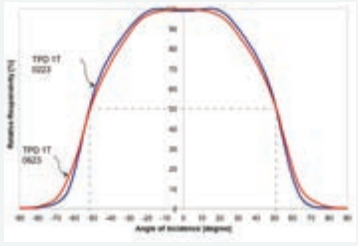
Features and Benefits

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

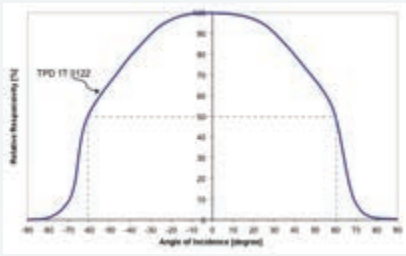
Product Description

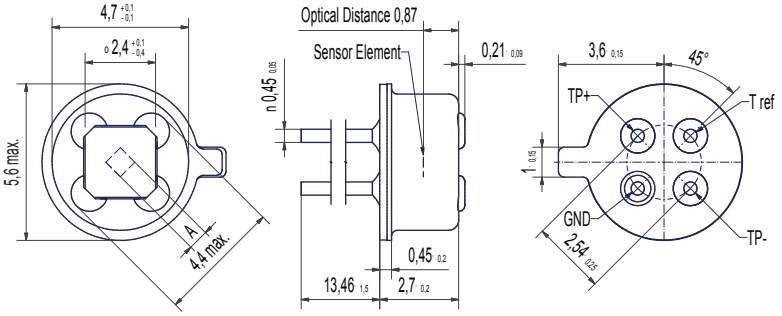
This is our range of general-purpose Detectors in 4.7 mm diameter TO-46 type housings, featuring a specially-designed element configuration, each one with different size of absorbing area. The window is available as standard infrared or optional with narrow band pass filter as per page 7 for gas sensing applications. With the narrowband filters a square window is provided.
TPD 1T 0223 and TPD 1T 0122provide 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

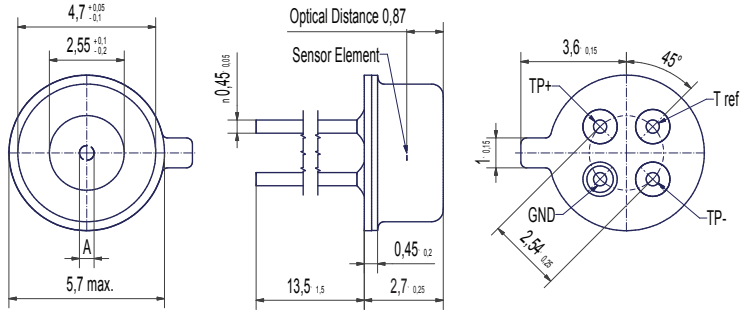


Field of View TPD 1T 0122





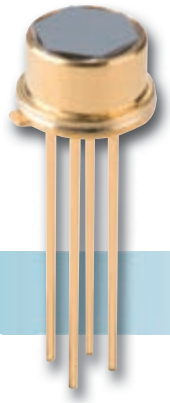
TPD 1T 0223



TPD 1T 0623

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

Parameter	Symbol	TPD 1T 0223	TPD 1T 0623	TPD 0122	Unit	Remarks
Sensitive Area	A	0,7 x 0,7	1,2 x 1,2	Ø 0,5	mm^2	Absorber Area
Thermopile Resistance	R_{TP}	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_{40}	88	133	43	µV/K	With standard filter (LWP, cut-on 5,5 µm)
Sensitivity (Tdet 25 °C / Tobj 100°C)	S_{100}	116	177	56	µV/K	With standard filter (LWP, cut-on 5,5 µm)
Time Constant	t	22	27	15	ms	
Noise Voltage	Vn	35	36	42	nV/√Hz	25°C
Specific Detectivity	D*	0,9	1,1	0,8	10^8 cm√Hz/W	25°C
Temp. Coefficient of Resistance	TC_{RTP}	0,03	0,03	0,03	%/K	
Temp. Coefficient of Responsivity	TC_R	-0,05	-0,05	-0,05	%/K	
Field of view	FoV	104	104	120	Degrees	at 50% intensity points
Thermistor resistance (25°C)	R_{25}	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

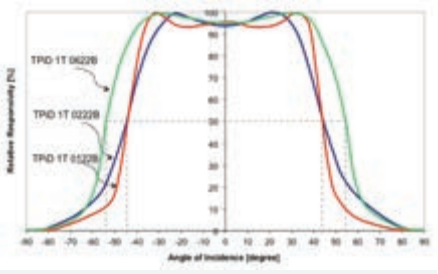
Features and Benefits

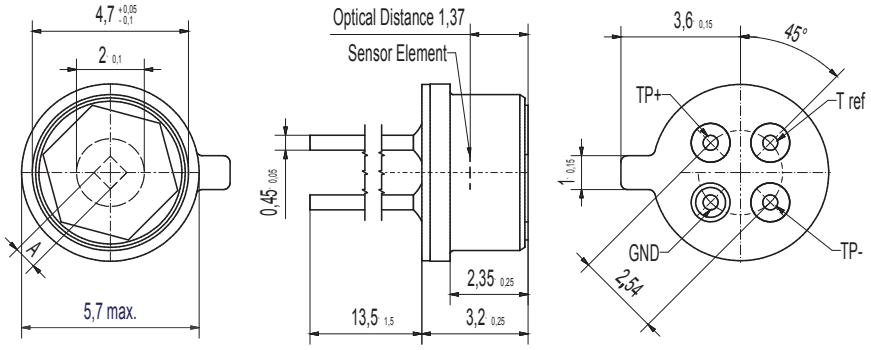
- ISOthermal performance
- Miniature, TO type metal housing
- Light collecting aperature
- Thermistor included

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 thympanon 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 0122B	TPiD 0222B	TPiD 0622B	Unit	Remarks
Sensitive Area	A	Ø 0,5	0,7 x 0,7	1,2 x 1,2	mm^2	Absorber Area
Thermopile Resistance	R_{TP}	85…135	50…100	50…110	kΩ	25°C
Responsivity	R	92	60	33	V/W	500°K/ 1Hz/ Without IR-filter
Sensitivity (Tdet 25 °C / Tobj 40 °C)	S_{40}	44	95	126	µV/K	With standard filter (LWP, cut-on 5,5 µm)
Sensitivity (Tdet 25 °C / Tobj 100 °C)	S_{100}	58	125	140	µV/K	With standard filter (LWP, cut-on 5,5 µm)
Time Constant	t	15	22	27	ms	
Noise Voltage	V_n	42	35	36	nV/√Hz	25°C
Specific Detectivity	D_*	1,0	1,2	1,1	10^8 cm√Hz/W	25°C
Temp. Coefficient of Resistance	TC_{RTP}	0,03	0,03	0,03	%/K	
Temp. Coefficient of Responsivity	TC_R	-0,05	-0,05	-0,05	%/K	
Field of view	FoV	90	90	110	Degrees	at 50% intensity points
Thermistor resistance (25°C)	R_{25}	100	100	100	kΩ	25°C
Thermistor BETA-value	β	3964	3964	4097	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

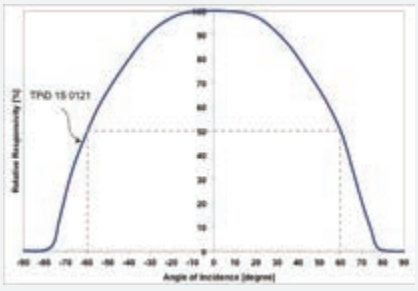
Features and Benefits

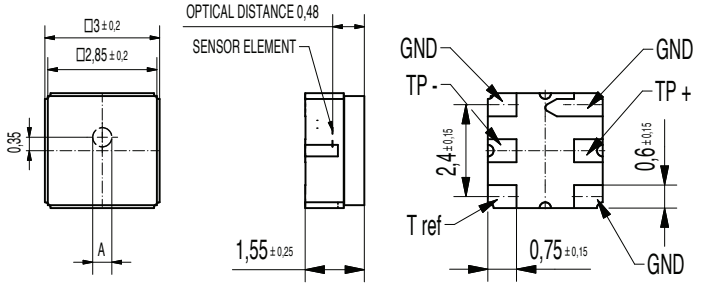
- Miniature SMD housing
- Flat housing
- Thermistor included
- Tape & Reel Packaging

Product Description

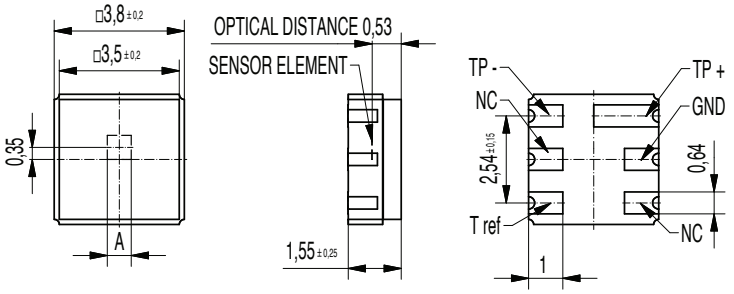
Excelitas offers a series of Thermopile Detectors in small and compact SMD housings. This enables standard SMT assembly processes and provides for small dimensions. The SMD versions feature the unique ISOthermal performance when units are subjected to thermal shock conditions.
The TPiD 1S 0121 is the smallest SMD version we offer, whereas the TPiD 1S 0222 provides element with higher sensitivy. 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 0121, TPiD 1S 0222





TPiD 1S 0121



TPiD 1S 0222

TPiD 1S 0121, TPiD 1S 0222 FM					
Parameter	Symbol	TPiD 1S 0121	TPiD 1S 0222	Unit	Remark
Sensitive Area	A	Ø 0,5	0,7 x 0,7	mm^2	Absorber Area
Thermopile Resistance	R_{TP}	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_{40}	60	130	µV/K	With standard filter (LWP, cut-on 5,5 µm)
Sensitivity (Tdet 25 °C / Tobj 100°C)	S_{100}	80	170	µV/K	With standard filter (LWP, cut-on 5,5 µm)
Time Constant	t	15	22	ms	
Noise Voltage	V_n	42	35	nV/√Hz	25°C
Specific Detectivity	D*	0,8	1,2	10^8 cm√Hz/W	25°C
Temp. Coefficient of Resistance	TC_{RTP}	0,03	0,03	%/K	
Temp. Coefficient of Responsivity	TC_R	-0,05	-0,05	%/K	
Field of view	FoV	120	120	Degrees	at 50% intensity points
Thermistor resistance (25°C)	R_{25}	100	100	kΩ	25°C
Thermistor BETA-value	β	4097	4097	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

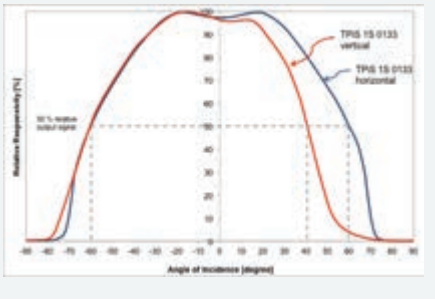
- SMD Housing
- ISOthermal Performance
- Internal Signal Processing
- Factory calibrated
- Available in "Tape and Reel"

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 E2PROM 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.

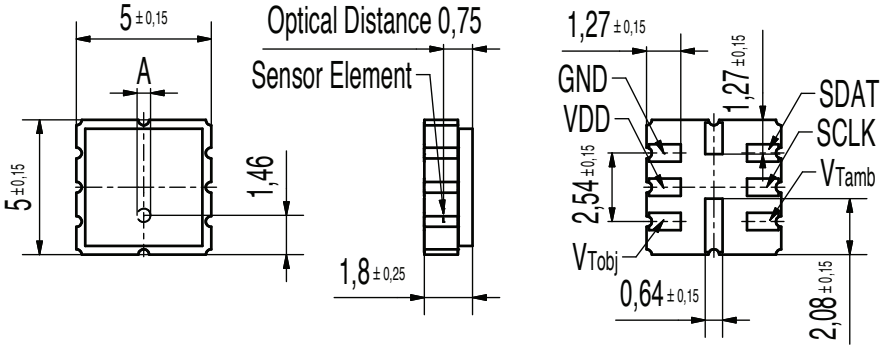
To address object temperature ranges, Excelitas offers the following standard pre-calibrated Sensors:

Field of View



-20...60°C: TPiS 1S 0133 OAA060
-20...120°C: TPiS 1S 0133 OAA120

Customized calibrations on request.

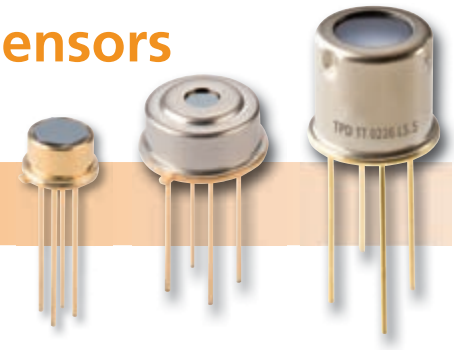


TPiS 1S 0133 and TPiS 1S 0133 FM

Parameter	Symbol	TPiS 1S 0133	Unit	Remark
Output Voltage Swing	V_O	0,25...(VDD- 0,25)	V	
Resistive Output Load	R_L	50	kW	min.
Object Temp Accuracy		1,5	K	+ / -
Response Time	t_{resp}	100	ms	typ.
Sensitive area	A	Ø 0.5	mm^2	
Field of View	FoV	120	°	
Supply Voltage	V_{DD}	4,5....5,5	V	
Supply Current	I_{DD}	1,5	mA	typ.; RL > 1MW
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 1256 L5.5, TPiS 1T 1254 – Thermopile Sensor with digital Output

Target Applications

- Ear Thermometry
- Non-contact Thermometry

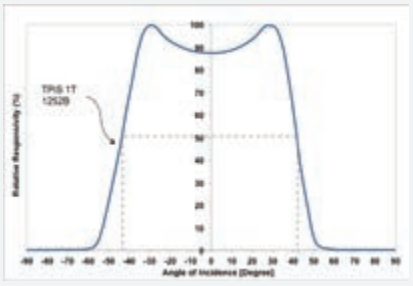
Features and Benefits

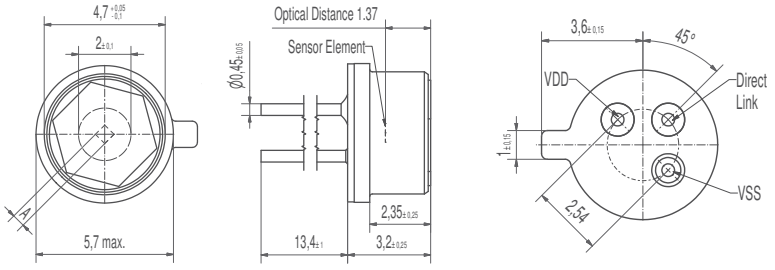
- Digital output
- ISOthermal performance
- Miniature, TO type metal housing
- Temperature reference output included

Product Description

As continuation of Excelitas' focus on innovation and digitization the new 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.

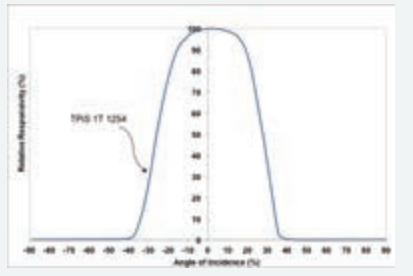
Field of View TPiS 1T 1252B

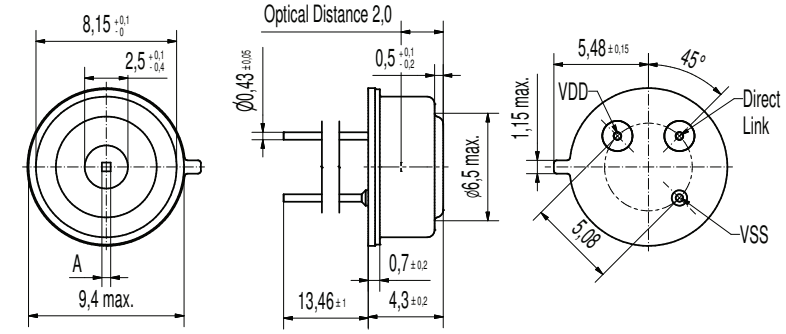




TPiS 1T 1252B

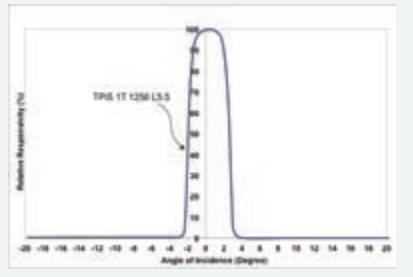
Field of View TPiS 1T 1254

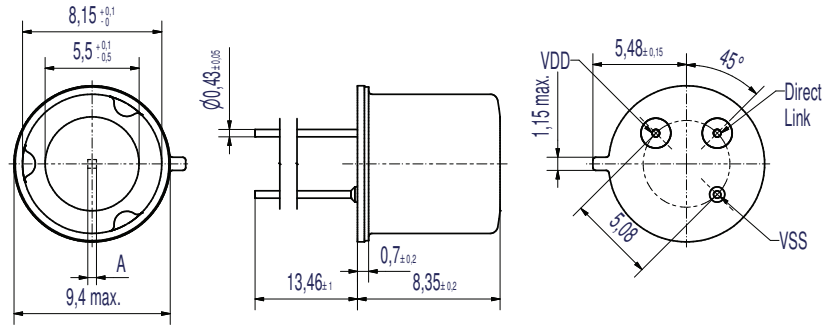




TPiS 1T 1254

Field of View TPS 1T 1256

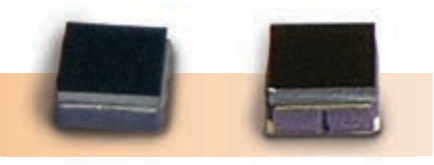




TPS 1T 1256

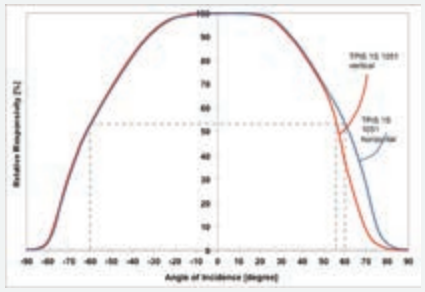
SMD Thermopile Sensor DigiPile™

For Non-Contact Temperature Measurement

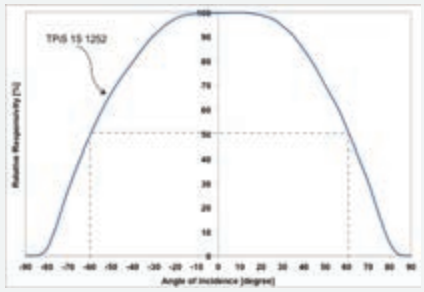


TPiS 1S 1051, TPiS 1S 1252 – Thermopile Sensor with digital Output

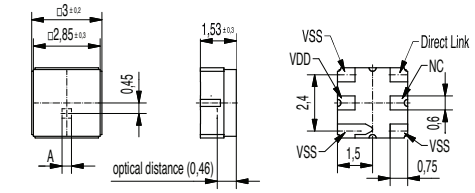
Field of View TPiS 1S 1051



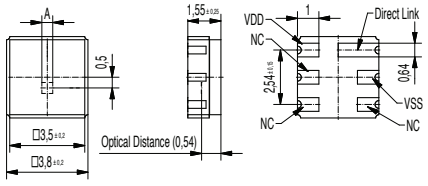
Field of View TPiS 1S 1252



TPiS 1S 1051



TPiS 1S 1252



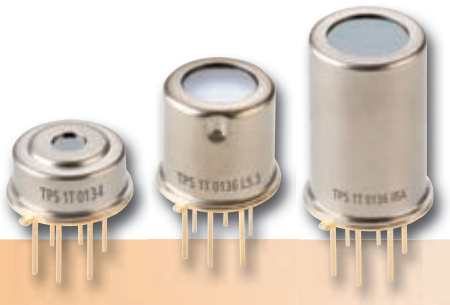
The new family of DigiPile is extended to SDM housings with the two types TPiS 1S 1252,and TPiS 1S 1051. With TPiS 1S 1051 we provide the smallest housing of Thermopile and the smallest thermopile chip. With TPiS 1S 1252 the housing is lightly larger due to a high sensitivity thermopile chip built in.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

DigiPile™ - All Types

Parameter	Symbol	TPiS 1T 1252B	TPiS 1T 1254	TPiS 1T 1256 L5.5	TPiS 1S 1252	TPiS 1S 1051	Unit	Remarks / Conditions
Operating Conditions								
Operating Voltage	V_{DD}	2,4…3,6	2,4…3,6	2,4…3,6	2,4…3,6	2,4…3,6	V	
Supply Current	I_{DD}	11…15	11…15	11…15	11…15	11…15	µA	V_{DD} = 3.3 V
Operating Temperature	T_o	-20…70	-20…70	-20…70	-20…70	-20…70	°C	" parameters may vary from specified values
Storage Temperature	T_s	-40…100	-40…100	-40…100	-40…100	-40…100	°C	with temperature dependence."
Thermopile Characteristics								Avoid storage in humid environment.
Sensitive Area	A	0,51 x 0,51	0,51 x 0,51	0,51 x 0,51	0,51 x 0,51	0,4 x 0,4	mm^2	
Sensitivity of TP	Dcounts / ΔT	290	150	67	400	210	counts/K	Absorber area
		400	200	85	530	280	counts/K	Tobj = 313K = 40°C, Tamb = 298K = 25°C
Noise of TP		8	8	8	8	8	counts	Tobj = 313K = 100°C, Tamb = 298K = 25°C
Time Constant	t	45	45	45	45	15	ms	Tobj = 313K (=40°C), Tamb = 298K (=25°C)
Ambient Temperature sensor								
Sensitivity of Tamb		90	90	90	90	90	counts/K	
Count @ Tamb = 25°C		7000…9400	7000…9400	7000…9400	7000…9400	7000…9400	counts	Linear for Tamb from 0°C to 90°C
								Range
Optical Characteristics								
Field of View		84	56	5	120	120 / 116	Degree	
Optical Axis		+/- 10	+/- 10	+/- 2	+/- 10	+/- 10	Degree	At 50% intensity points
Electrical Characteristics								
ADC Resolution Tobj		17	17	17	17	17	Bits	
ADC Resolution Tamb		14	14	14	14	14	Bits	Max Count = 217
ADC Sensitivity of Tobj		0,7…0,9	0,7…0,9	0,7…0,9	0,7…0,9	0,7…0,9	µV/count	Max Count = 214
ADC Offset Tobj		64000…65000	64000…65000	64000…65000	64000…65000	64000…65000	counts	
Input Low Voltage	V_{IL}	0,2 V_{DD}	0,2 V_{DD}	0,2 V_{DD}	0,2 V_{DD}	0,2 V_{DD}	V	Range
Input High Voltage	V_{IH}	0,8 V_{DD}	0,8 V_{DD}	0,8 V_{DD}	0,8 V_{DD}	0,8 V_{DD}	V	
Pull Down Current		200	200	200	200	200	µA	
Pull Up / Down Current		130	130	130	130	130	µA	Direct link pin to V_{DD}
LPF Cut-Off Frequency		8	8	8	8	8	Hz	Direct link pin to V_{SS}

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)

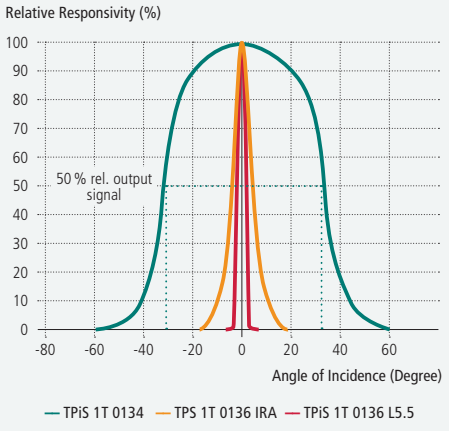
Target Applications

- General-purpose Temperature Monitoring

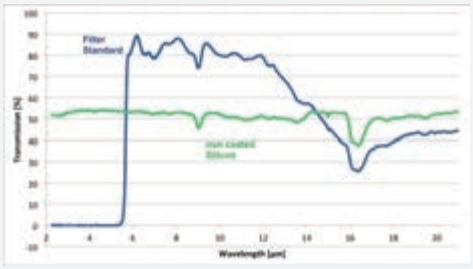
Features and Benefits

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

Field of View



Filter



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 E2PROM 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.

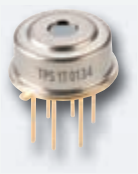
For defined spot size requirements we offer sensors with defined Field of View, obtained by apertures, internal lenses or integrated mirrors. The TPMI sensor family includes the integrated ambient temperature compensation and the calibration to a certain temperature range. When ordering, please specify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

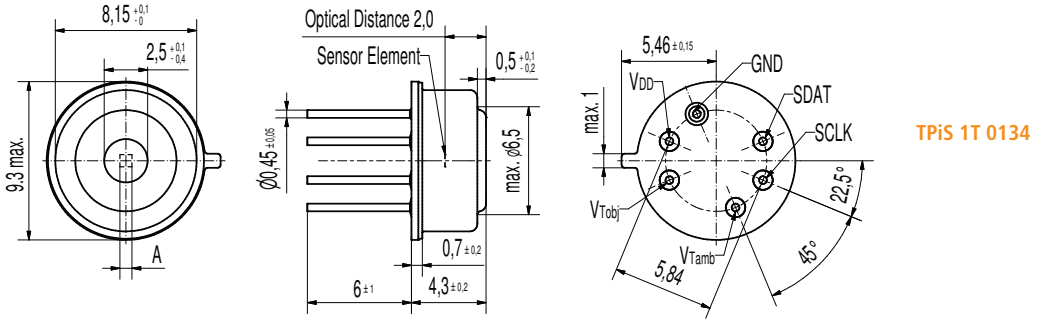
-20...60°C:	TPiS 1T 0134 OAA060	20...120°C:	TPiS 1T 0134 OAA120
-20...120°C:	TPiS 1T 0136 L5.5 OAA120	-20...250°C:	TPS 1T 0136 IRA OAA250

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

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.

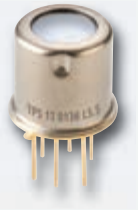
TPiS 1T 0134

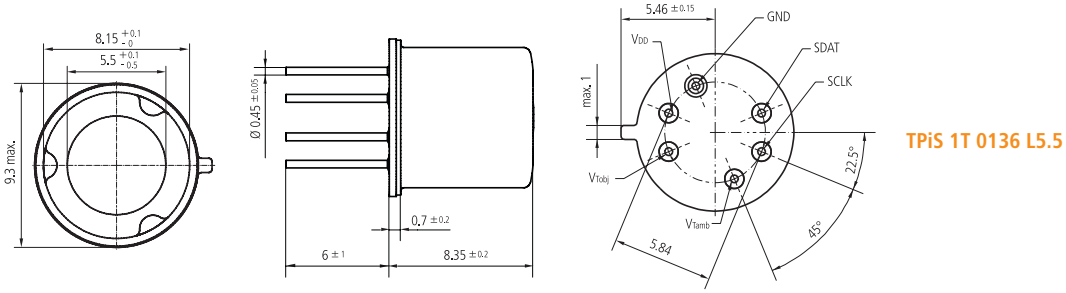




TPiS 1T 0134

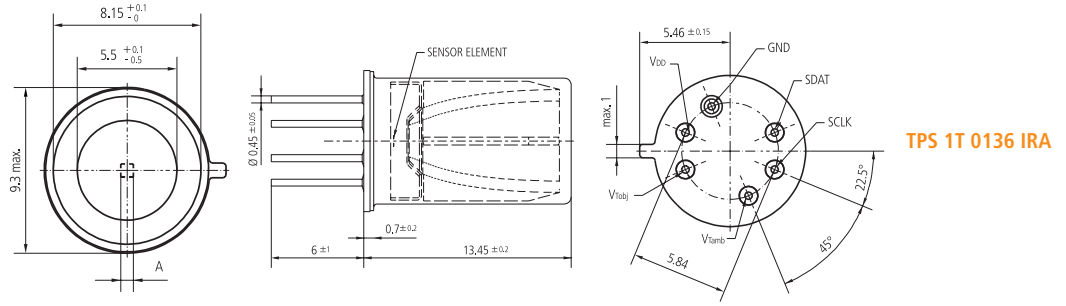
TPiS 1T 0136 L5.5





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_{DD} - 0,25)	0,25...(VDD - 0,25)	0,25...(V_{DD} - 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.; RL > 1MΩ
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
Parameter	Symbol	TPiS 1T 0134	TPiS 1T 0136 L5.5	TPS 1T 0136 IRA	Unit	Remark
Sensitive area	A	Ø 0,5	Ø 0,5	Ø 0,5	mm^2	
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^2	
Field of View , typ.	FoV	70	7	15	°	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, TPiM 1T 0134 M(y) – Thermopile Module with TPMI®

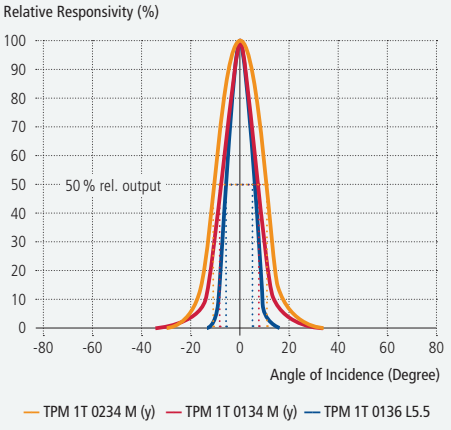
Target Applications

- Industrial Temperature monitoring
- Pyrometry

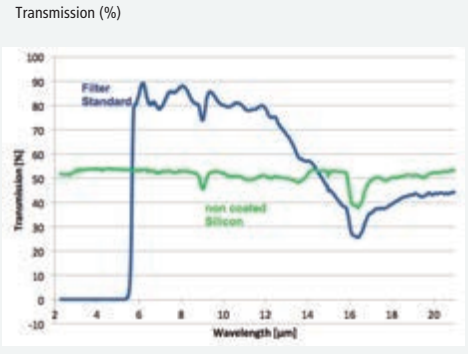
Features and Benefits

- Internal Signal Processing
- Factory-calibrated
- Lens or Mirror Optics
- Ambient temperature compensation
- ISOthermal performance

Field of View



Filter



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

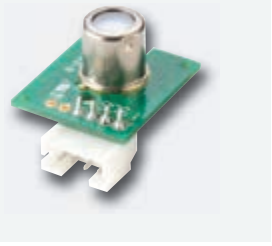
External Mirror types

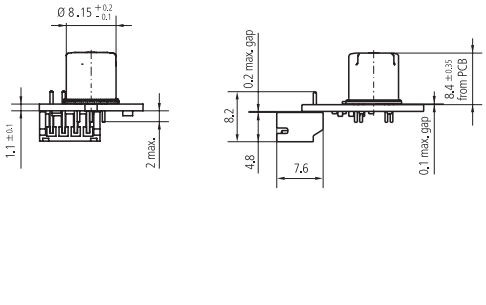
-20...60°C:	TPM 1T 0234 OAA060 P M(y)
-20...140°C:	TPM 1T 0134 OAA120 P M(y)
-20...250°C:	TPM 1T 0134 OAA250 P M(y)
-20...180°C:	TPM 1T 0134 OAA180 P M(y)

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

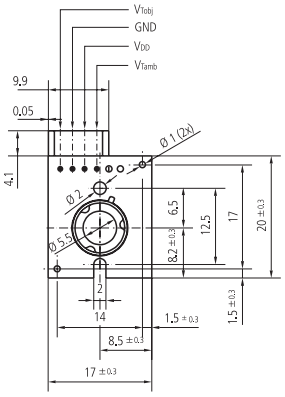
A temperature reference output is included. Upon request, the modules can be supplied as "OBA" version, which are calibrated but without internal temperature compensation. In this case the customer will do the temperature compensation externally with the use of the supplied reference output. The temperature 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.

TPiM 1T 0136 L5.5

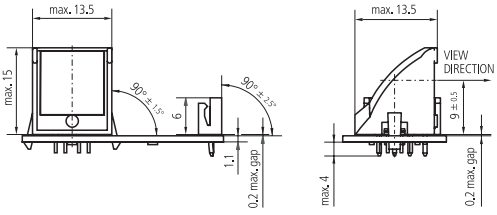




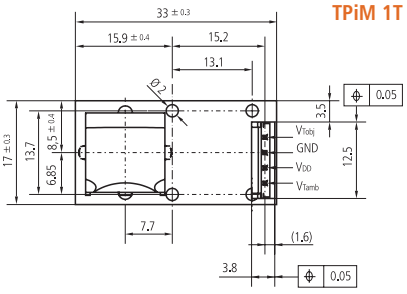
TPiM 1T 0136 L5.5



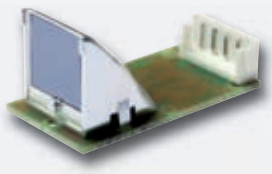
TPM 1T 0134 P6 M(y)

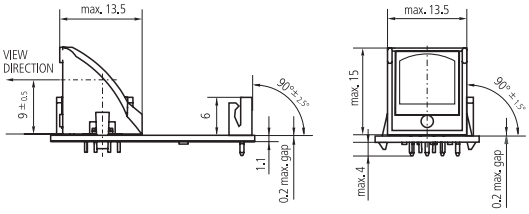


TPiM 1T 0134 P6 M(y)

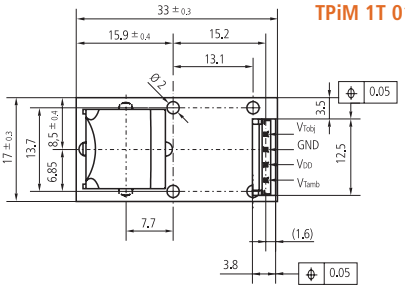


TPM 1T 0134 P9 M(y)



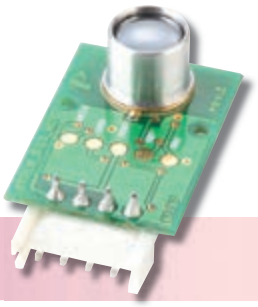


TPiM 1T 0134 P9 M(y)



TPiM 1T 0136 L5.5, TPM 1T 0134 P6 M(y) and TPM 1T 0139 P9 M(y)						
General Parameter	Symbol	TPiM 1T 0136 L5.5	TPM 1T 0134 P6 M(y)	TPM 1T 0134 P9 M(y)	Unit	Remark
Output Voltage Swing	V_O	0,25...(V_{DD} - 0,25)	0,25...(V_{DD} - 0,25)	0,25...(V_{DD} - 0,25)	V	
Resistive Output Load	R_L	50	50	50	kW	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....15*	V	*= voltage regulator
Supply Current	I_{DD}	1.5	1,5	1,7	mA	typ.; RL > 1MΩ
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
Field of View , typ.	FoV	4,5	5,5	5,5	°	at 50% point
Distance to Spot size ratio		11:1	-	-		
Field of View , typ.	FoV	7	7	7	°	at 50% point
Distance to Spot size ratio		8:1	-	-		

Digital Array Modules
With Integral Optics

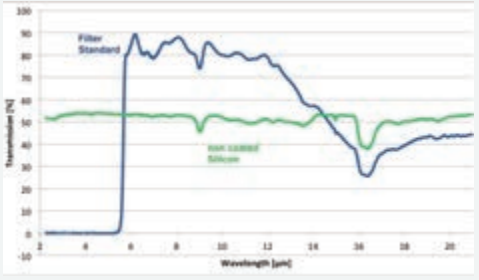


TPiL 8T 2146 L3.9T, TPiL 8T 2246 L3.9, TPiL 16T 3446 L3.9 – Thermopile Line
TPiA 16T 4146 L3.9 – Thermopile Array

Target Applications
- Presence Detection
- Non-contact Temperature Measurement
- Temperature-dependent Switch for Alarm or Thermostatic applications.
- Household Appliances such as Microwave Ovens

Features and Benefits
- Digital SMBus interface
- Factory Calibration
- Temperature Signal
- Ambient temperature output signal
- Programmable emissivity
- Noise reduction filter

Filter



Product Description

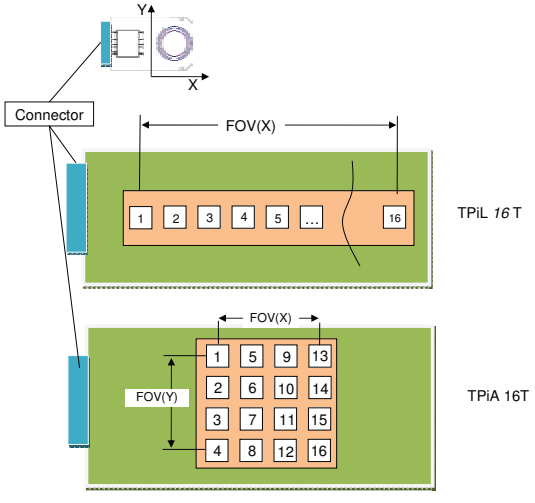
Excelitas offers a range of thermopile arrays in multiple configurations. All arrays are of module type with PCB that provides the communication interface and a 4 pin connector. For Line Arrays, we offer 8 Elements with 3.9mm focus integral lens and a high temperature range version with 16 Elements. The spatial design provides for 4by4 elements. All parts employ the patented ISOthermal concept and offer uniquely-high performance under thermal shock conditions.
The Thermopile Line or Array Modules consist of a 1 x 8, 1 x 16 or 4 x 4-element thermopile chip connected to an integrated multiplexing and signal conditioning circuit, E2PROM and microcontroller with integrated A/D converter for signal processing and interfacing. The sensor is equipped with an internal reference temperature sensor for correct target temperature determination.
The temperature accuracy by digital signal processing in combination with the numeric ambient temperature compensation algorithm outperforms any discrete solution. The ISOthermal sensor Module provides digital output signal by SM Bus which is representing real temperature data for each pixel.

Customer specific modifications are possible.

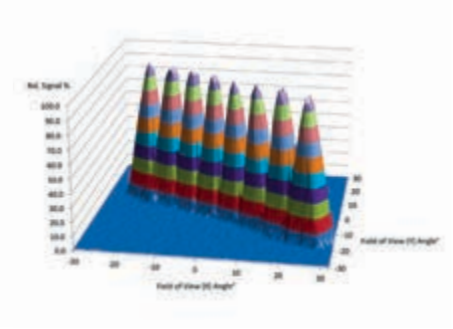
For the various object temperature ranges we offer following pre-calibrated Modules:

0...60°C:	TPiL 8T 2246 L3.9 OAA060
0...100°C:	TPiL 8T 2146 L3.9 OAA100
0...250°C:	TPiL 16T 3446 L3.9 OAA250

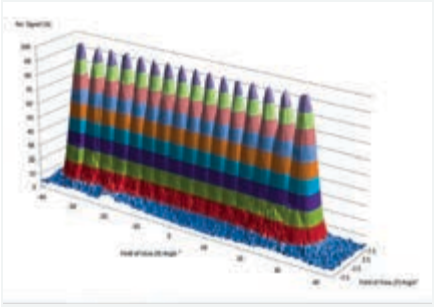
A temperature reference output is included. Upon request, the Modules can be supplied as an "OBA" version, which is calibrated but without internal temperature compensation. In this case the customer will do the temperature compensation externally with the use of the supplied reference output.



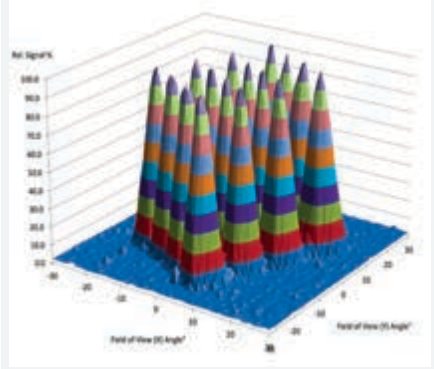
Field of View TPiL 08

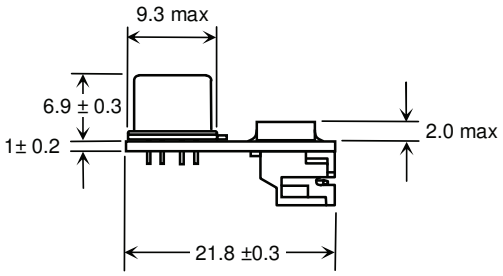


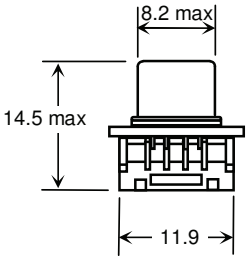
Field of View TPiL 16T



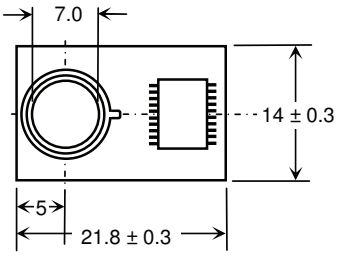
Field of View TPiA 16T

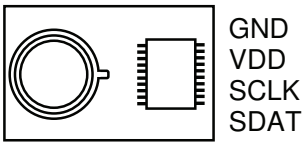






JST S 4B-PH SM4TB





TPiL 08T 2246 L3.9, TPiL 16T 3446 L3.9, TPiA 16T 4146 L3.9

Parameter	Symbol	TPiL 8 T	TPiL 16T	TPiA 16 T	Unit	Remark
Storage Temperature Range		-40 …. +100	-40 …. +100	-40 …. +100	°C	
Operating Temperature Range		-25 …. +100	-25 …. +100	-25 …. +100	°C	
Supply Voltage	V_{DD}	4,5 …. 5,5	4,5 …. 5,5	4,5 …. 5,5	V	
Supply Current	I_{DD}	5	5	5	mA	typ.
Field of View X / L3.9	FOV_X	50	71	30	°	refer to FOV definitions
Field of View Y / L3.9	FOV_Y	NA	NA	20	°	refer to FOV definitions
Digital Interface Type		SMBus	SMBus	SMBus		
Object Temperature Accuracy		±1,5			°C	for calibration conditions
Temperature Sensing Range		0….60	0….250	0….60	°C	
Signal Refresh Time	t_{PXrefr}	250	400	400	ms	all pixels and ambient temperature

CoolEye™ –
Digital Line Array Module, 32 Pixels

TPA 32T 3746 L4.7 – Thermopile Line Array

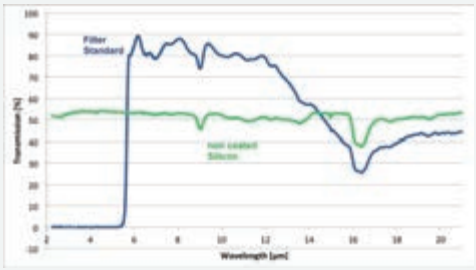
Target Applications
- Presence Detection
- Energy Conservation for Smart Home concepts
- Safety and High-end Alarm Applications

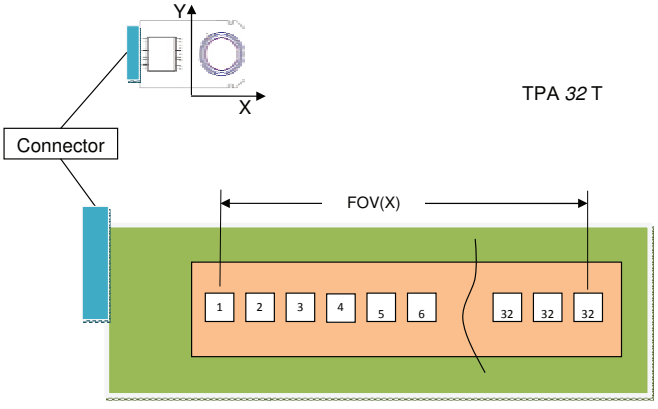
Features and Benefits
- Digital SMBus interface
- Factory Calibration
- Temperature Signal
- Ambient temperature output signal

Product Description
With this new member of the CoolEye™ family Excelitas offers a major step to low resolution image sensing. The new line array offers 32 pixels in line, built in TO-5 type similar housing and an integrated lens. The 32 pixels are connected to integrated multiplexing and signal conditioning circuits. The module pcb caters for E2PROM and microcontroller with A/D converter for signal processing and interfacing SM Bus. The Array sensor is equipped with an internal reference temperature sensor for correct target temperature determination. The temperature accuracy achieved by digital signal processing in combination with the numeric ambient temperature compensation algorithm outperforms any discrete solution. The sensor Module provides digital output signal by SM Bus which is representing real temperature data for each pixel. Customer specific modifications are possible.
The calibrated temperature range of this new model will be 0…60°C: TPA32T3746 L4.7 OAA060

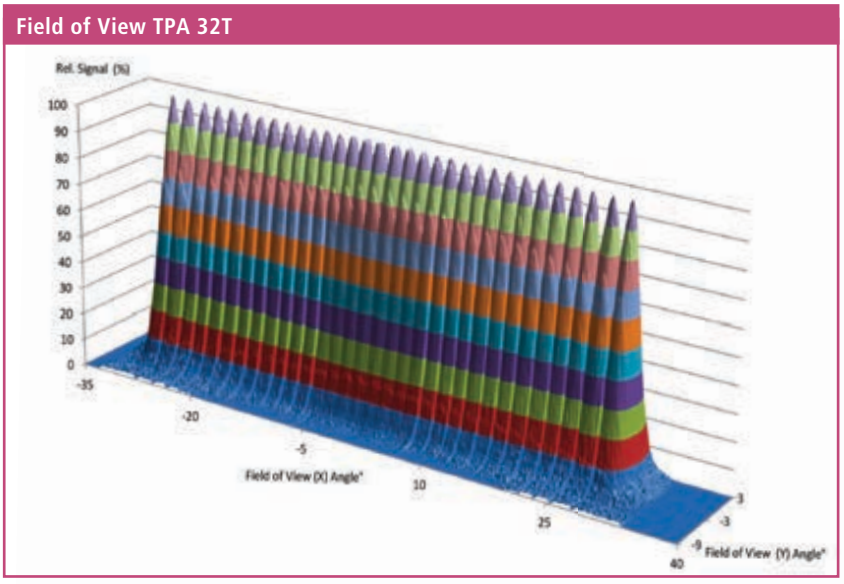
A temperature reference output is included with associated temperature compensation of the module. This CoolEye module may also be supplied as an "OBA" version, calibrated to the referenced temperature range, but allowing the customer to perform ambient temperature compensation in his circuitry by applying the temperature reference signal.

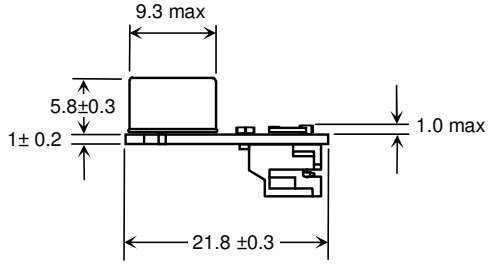
Filter

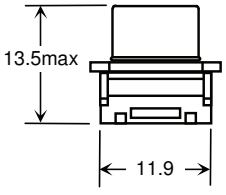




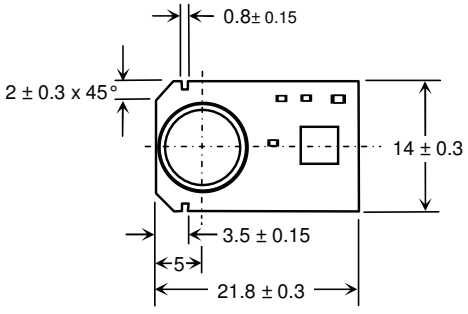
Field of View TPA 32T

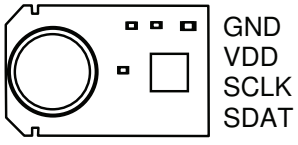






JST S4B-PH SM4TB





TPA 32T 3746 L4.7

Parameter	Symbol	TPA32 T	Unit	Remarks
Storage Temperature Range		-40 …. +100	°C	
Operating Temperature Range		-25 …. +100	°C	
Supply Voltage	V_{DD}	4,5 …. 5,5	V	
Supply Current	I_{DD}	5	mA	typ.
Field of View X / L4.7	FOV_X	59	°	refer to FOV definitions
Field of View Y / L4.7	FOV_Y	NA	°	refer to FOV definitions
Digital Interface Type		SMBus		
Object Temperature Accuracy		±1,5	°C	for calibration conditions
Temperature Sensing Range		0….60	°C	
Signal Refresh Time	t_{PXrefr}	380	ms	all pixels and ambient temperature

Handling and Precautions

Humidity
All our IR-detectors shall not increase noise or decrease responsivity when exposed to <=95 % R.H. at 30° C. Operation below dew point (i.e. with condensation) might affect performance.

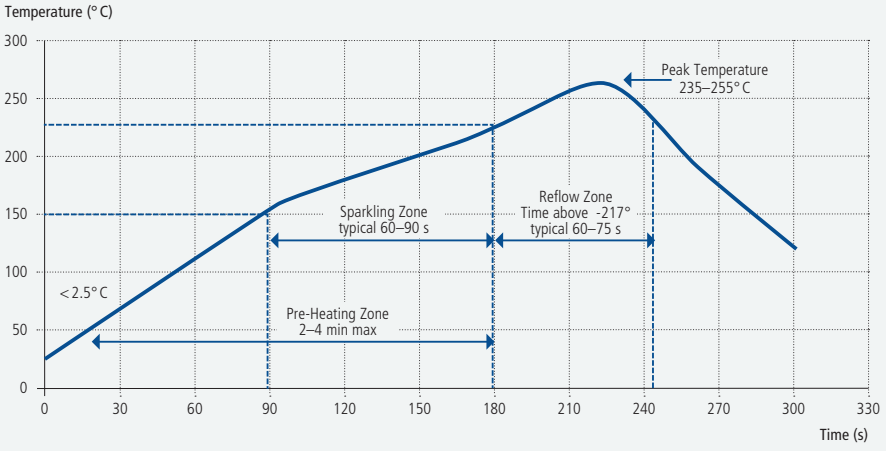
Hermetic seal
All our IR-detectors are sealed to pass a He-leakage test with maximum leak rate of 5 x 10-8 mbar.l.s-1.

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 JDEC (see table). For detailed information please contact Excelitas.

New Models and Nomenclature

Thermopiles

Comparison Table

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	TPiD 1T 0226 L5.5	TPS 336 L5.5	Now - ISOthermal	31
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	TPD 1T 0623	TPS 733	Identical	32
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	TPiL 16T 4146	dTPLM 16A	Now - ISOthermal	42
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Pyrodetectors

Recommendations

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"Smart" DigiPyro®					
	PYD 1096	Dual-Element	All-In-One Electronics	Simple Switches	12
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	PYD 1098	Dual-Element	All-In-One Electronics	Simple Alarms	13
	PYQ 1048	Quad-Element	All-In-One Electronics	Simple Alarms	13
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DigiPyro®					
	PYD 5790	Dual-Element	New - Digital, In SMD	Consumer Electronics Applications	20
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	PYD 1788	Dual-Element	Standard	Light Switches	21
	PYQ 2898	Quad-Element		Alarm Applications	22
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www.excelitas.com/Detection

Excelitas Technologies
22001 Dumberry Road
Vaudreuil-Dorion, Quebec
Canada J7V 8P7
Telephone: (+1) 450.424.3300
Toll-free: (+1) 800.775.6786
Fax: (+1) 450.424.3345

Excelitas Technologies GmbH & Co. KG
Wenzel-Jaksch-Str. 31
D-65199 Wiesbaden
Germany
Telephone: (+49) 611 492 430
Fax: (+49) 611 492 165

Excelitas Technologies
8 Tractor Road
Singapore 627969
Telephone: (+65) 6775-2022
Fax: (+65) 6778 1752

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