EXCELITAS TECHNOLOGIES®

Single-Element Pyro Detectors
For Gas Monitoring

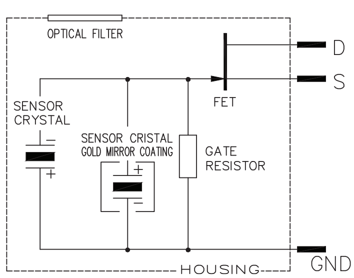
LHi 807 TC, PYS 4198 TC – High sensitivity Pyros

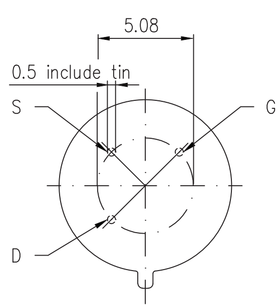
Target Applications
- Gas Sensing and Monitoring

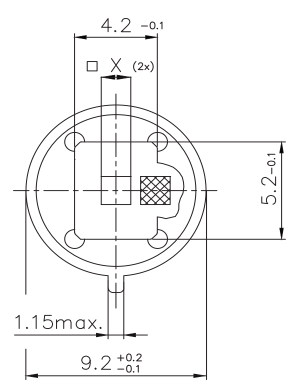
Features and Benefits
- TO-5 metal housing
- Selection of narrow band Filters
- Thermal Compensation

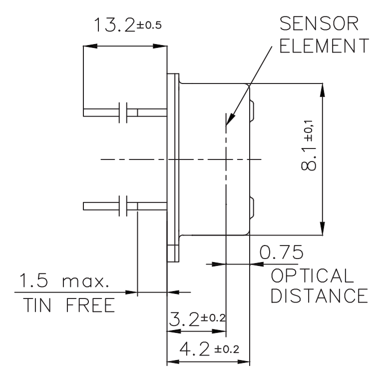
Product Description
The LHi 807 TC series has become a standard solution for gas-sensing applications. It is available with a range of narrow band filters, as specified on page 7 of this brochure for various gas species. The LHi 807 TC is usually supplied with Temperature Compensation by a separate "blind"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

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









LHI 807 TC and PYS 4198 TC					
Parameter	Symbol	LHI 807 TC	PYS 4198 TC	Unit	Remarks
Responsivity, min.	R_{min}	2,2	1,2	kV/W	f = 1 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
Element Size	X	1,5 x 1,5	2 x 2	mm^2	

Infrared Basics

Infrared Basics

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

$\lambda_{max} = 2898 / T$

T = Temperature in K (Kelvin)

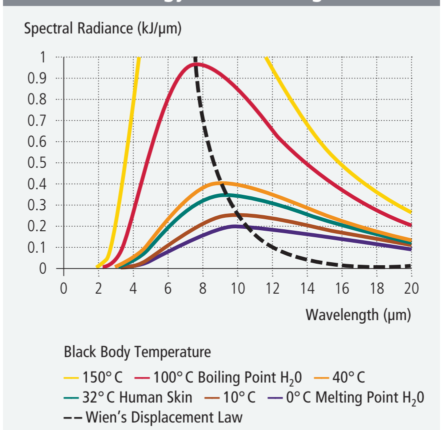
λ = Wavelength in µm

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

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

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.

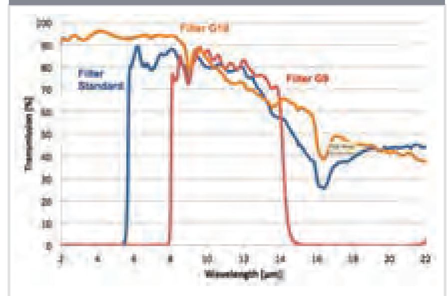
Filters for Infrared Sensors

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