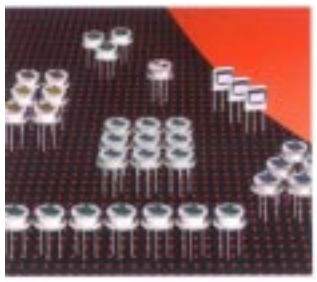
- PRODUCT GUIDE LINE -

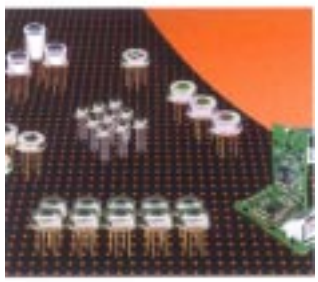
CLOSE UP

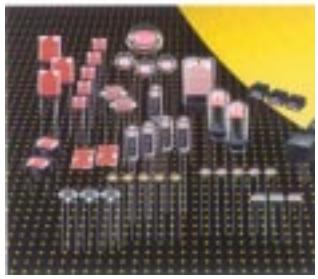
2/03

Imaging Sensor Components Lighting

About Pyros'







PerkinElmer® optoelectronics.

About Pyros'

all you want to know

Since ancient times the pyroelectric effect has been known, as being similar to the ferromagnetic effect. It is based on a speciffic property of some di-electric materials, the phenomenom of a permanent polarization.When heating up such materials, this polarization will increase, or decrease, the observer can monitor a charge flow.

Producing Infrared Detectors

As a manufacturer of special optoelectronic components for more than 50 years, the german based facility, known as Heimann gained world-wide recognition as leader in design and produce of infrared technology components. Today this is part of the Sensor product line of PerkinElmer Optoelectronics.
The quality and performance of our products is the main focus in our company, placing PerkinElmer in the position to maintain consistent product quality standards. A fact proven by the excellent performance of our detectors through which we achieved the leading position in the world market of today.

Your Partner, offering Solutions

Our todays' efforts focus on providing you with solutions to your application problem. We have established a global organization with Centers of Excellence to offer you best support. From our Asian production sites we ship goods through our various logistic centers to any place in the world on a short term notice. Throughout the world a broad network of representatives provides contact and support. Delivery 'just in time' is our expertise. We continuously work improving our services to be your partner.

Infrared Basics

All solid bodies when having temperatures above the absolute zero (-273° C) emit electromagnetic waves. This thermal radiation is called infrared radiation. Professor Wien has descibed the relation between a solid body s temperature and its emitting peak wave length by following equation:

$\lambda max = 2899 / T$

T = Temperature in K (Kelvin)
λ = Wavelength in μm

Using this law we can calculate the specific peak wave length of a human body, which has a surface temperature of approx. 35° C or 308 K as 9,4 μm; for a cat of 38° C temperature as 9,3 μm. According to Max Planck the intensity curve of all emitted wave lengths for a solid body is rather broad. For our example this means we cannot seperate human and 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.

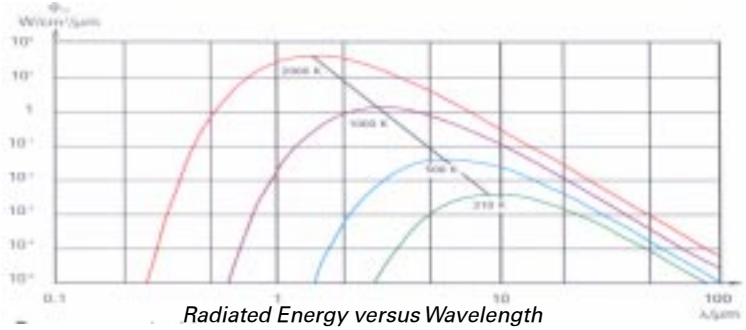
The Pyroelectric Effect

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 temperature. The Curie temperature Tc limits the range of the operation temperature for such detectors. Pyroelectric detectors may be either cooled or solid state devices, depending on the Tc of the used sensing material. Our detectors are all uncooled devices

The Detector Design

The pyroelectric material is fitted with electrodes forming a capacitor. Since these parts have been developed for extremely low levels of thermal radiation energy, the pyroelectric current is rather small. It needs a high ohmic resistor to convert this small current into a convenient voltage level. A low leakage current FET is added to transform the high impedance to a common output resistance, typically 10 kohm. The pyroelectric element's capacitance and the 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.

A hot body of 2000 K emits a lot of energy, some in the visible light range, some in the infrared. A body of 500 K only emits radiation in the infrared range, which we can feel, but not see. radiation from man we cannot see and hardly feel from a distance



Radiated Energy versus Wavelength

Definitions and Parameters

The most important electrical data of the IR-Sensor are its Responsivity, Balance (Match) and Noise. Sometimes it is also useful to refer to NEP or D*.

Responsivity
This is the main parameter for comparing detectors.It is defined as output voltage per incident radiant energy.

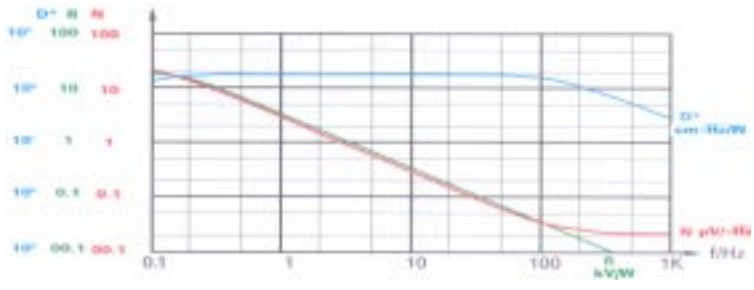
$$R(\lambda,f)=V_{RMS}/\Psi_{RMS}$$

The responsivity shows bandpass characteristics with a maximum at approx. 0.1 Hz. . Responsivity is measured in Volt per Watt by means of a defined black body radiator. Responsivity refers to the active sensor area, for Dual element detector it is measured for each element seperately. The data sheets show responsivity value, tested at 1 Hz chopping frequency for Motion detetion range, at 10Hz for Measurement range.
In the detailed parts specification, which always accopmany our samples, the curve „responsivity versus frequency" is indicated, together with many other parameters.

Balance
The balance of a dual element detector indicates the matching between the two elements. It is a very important value for the performance of the detector in the field. It can be specified either in V/W or in % of responsivity.

Noise
The noise of the sensor consists of three parts: The basic noises of the sensing material, the noise of the high ohmic resistor and the noise of the FET. The total output of these tree parts is rather stable for temperatures below 40°C., above, it increases with temperature by an e-function, as can be observed with typical active electronic components. Details can be seen by the curve below.
Noise is given in µV peak to peak or zero peak. Similar to the responsivity dependence of frequency, the noise values decrease with frequency from approx. 2 Hz to 50 Hz.

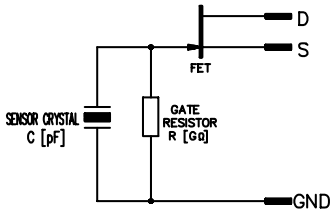
NEP, D*
The NEP value is a form of signal to noise ratio. The NEP value specifies the minimum radiation power to be detected by the sensor, resulting in output that just exceeds noise. NEP refers to RMS values of signal and noise and in addition to the electrical bandwidth. The smaller the NEP, the better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



Dependency of R, NEP and D on frequency*

The Detector Construction

The pyroelectric material is placed on a special pc board which also provides space for the gate resistance and the FET. The conections between the components are made either by bonding or conductive glue. The whole pc board is sitting on a TO baseplate and closed with a TO cap, which has a filter window. The window possesses a special infrared transmission characteristic, suited for the detectors application.



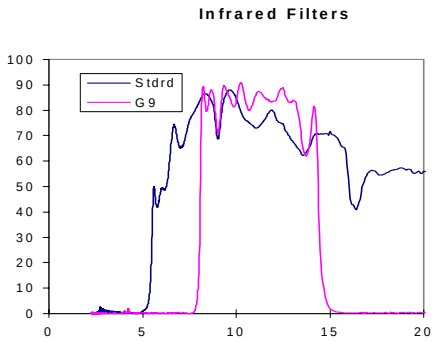
Optical Propperties

As optical sensors, the pyroedetectors are specified with some interesting optical parameters: the field of view, the optical bandwidth, i.e. transmission and blocking characteristics of the window, the optical focus point of the sensing elements and performance within the field of view. The corresponding charts are given for the various available element configurations.

The Filters built in

The pyroelectric sensing materials are sensitive to a broad range of radiation, from visible light up to over 50 µm. All of our detectors are supplieed with an infrared window that limits the spectral range of the detector. The Motion detection range is all fit with the standard window 5,5µm...14µm which is perfectly suited for the detection of human body radiation.
For the operation in analyzing systems, the Measurement range is featured with an appropriate narrow band optical filter, for non-contact temperature measurement the G9

mid IR bandpass is available. Details on filters can also be found in our technical notes.



About Quality

Statistical process control and long term reliability testing have been standard procedures at with our facilities for years. The QC activities in house begin with carefully assessing the quality of raw materials. Inspection procedures continue through all processes and conclude with 100% final test on major parameters. We implement leading-edge quality assurance systems: The factory in Singapore has been certified according to ISO 9000 Standards for more then 10 years, now followed by implementation of QS 9000 in SIngapore.

Which Type suits Your Requirement ?

The proper selection of the right type of sensor is of major importance for the design of a device and for its later performance. Selectivity of the optical filter and the type of sensor - Single, Dual element, or Quad type - these are features which have to correlate with the application of the device.
We offer various types of single element sensors, equipped with different optical windows for measuring and analyzing purposes. For Motion Detection, dual element, Quad orTwin types are recommended.

Product Safety

Precaution
Avoid touching the detector window. Finger prints on detectors are a cosmetic issue, but they may be accompanied by acid and oil, which attract dirt. The filter is the optical window, so keep it clean. Use ethyl-alcohol with a cotton swap for cleaning, when necessary. Do not use any other detergents!

Mechanical stress
Avoid stress to housing and leads. Do not bend leads less then 5mm from the base. Do not drop the detectors on to the floor. Ensure that any lead cutting process does not stress the detector.

Electrostatics
Treat the detectors as c-mos devices. Anti-static clothing shall be worn, operators, benches and table tops shall be grounded.

Operating range
The detector is specified at room temperature. Make sure the device is allowed to stabilize thermally, before testing. With varying temperature the parameters change as known for electronic parts. The detector may still operate, if outside specified limits, with modified performance.

Soldering
Soldering temperature shall not exceed 255°C , and the max. duration shall be 5 sec., wave soldering is recomended. While in the process, make sure no preheater exposes IR to the detector top. No flow soldering.

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