

Model 407

Thermally Compensated Pyroelectric IR Detector



Manufactured under one or more of the following U.S. patents: 3,839,640 - 4,218,620 - 4,326,663 - 4,384,207 - 4,437,003 - 4,441,023 - 4,523,095

Model 407 consists of two lithium tantalate sensing elements, a load resistor and a JFET sealed into a TO-5 transistor package with an optical filter.

One centrally located sensing element is exposed to infrared radiation entering through the optical filter while the second element is shielded from outside radiation.

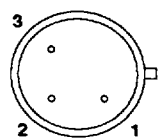
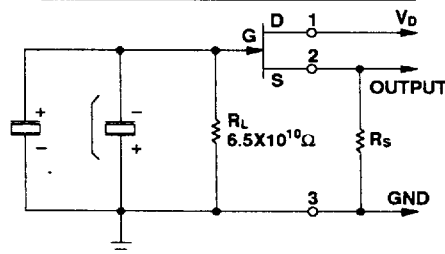
The sensing elements are connected electrically in a parallel opposed configuration for cancellation of signals generated by both crystals due to thermal changes in the housing environment.

A source resistor is required to set the drain current and the operating parameters of the JFET. A 47K Ohm to 1 Megohm resistor is recommended.

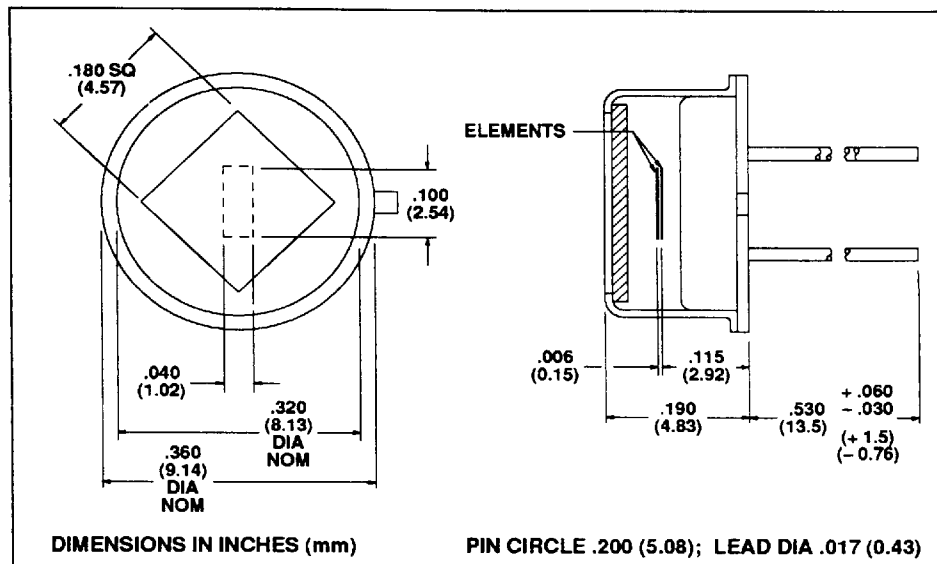
Applications

- Industrial Control
- Object Counting
- Infrared Telescopes
- Robotics
- Motion Sensing
- Intruder Detection
- Conveyor Monitoring

Detector Connected As A Source Follower



BOTTOM VIEW
(No Scale)



Characteristics	407	Unit	Test Conditions	ELTECdata Reference
Detector Type	POD	--		
Element Size ¹	.040 X .100	inches	Nominal	
Optical Bandwidth	1.5 to 1000	μm	Various filters	101
Responsivity	typ 2000	V/W	8 to 14 μm@1Hz	
Noise	typ 2.0	μV/√Hz, RMS	1.0 Hz	
NEP	typ 1.0 X 10 ⁻⁹	W/√Hz	8 to 14 μm 1 Hz, BW 1 Hz	100
D*	typ 1.5 X 10 ⁸	μm√Hz/W	8 to 14 μm 1 Hz, BW 1 Hz	100
Operating Voltage	min 3 max 15	VDC	V _D to Gnd	104 (4.1.c)
Operating Current Limits ²	min 0.1 max 40	μA	R _S Dependent	104 (4.1.c)
Offset Voltage	min 0.3 max 1.2	VDC	R _S =100KΩ	104 Fig 4
Output Impedance	<R _S	Ohms		
Thermal Breakpoint f _T	typ 0.2	Hz		102
Electrical Breakpoint f _e	typ 0.8	Hz	R _L =6.5 X 10 ¹⁰ Ω	102
Recommended Operating Temperature	-10 +50	°C		
Incident Power Limit	max 0.2	W		
Package Sealing	max 10 ⁻⁸	cm ³ /sec	Helium	
Storage Temperature	max -55 +125	°C	ΔT<50C°/minute	

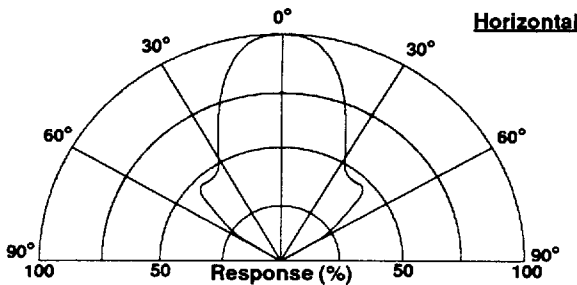
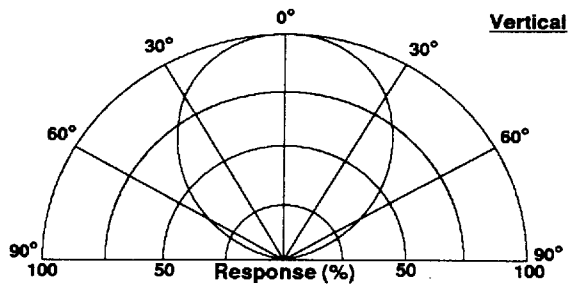
Characteristics at 25°C, with .3 filter, V_D=5 VDC, R_S=100KΩ unless otherwise stated. Data is established on a sample basis and is believed to be representative.

¹Dual elements, over under configuration with 1 element shielded from incident light.

²Actual current is given by offset voltage and source resistor, R_S.

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FIELD OF VIEW



For -3 filter only. For other filters, consider refractive index and thickness.

For best results, the following precautions and recommendations should be observed. (See ELTECdata #101):

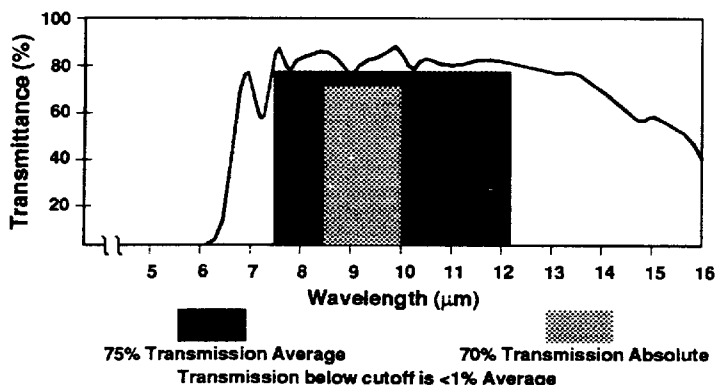
Mounting: Avoid mechanical stresses on case and leads.

Soldering: Use minimum heat and a heat sink between case and leads. Leave minimum lead length of .250 inch (6.35mm). DO NOT MACHINE SOLDER.

Static Discharge: Protect detectors from electrostatic charges.

Thermal Shock: Temperature changes and rate of change must be kept to a minimum (<50C°/min.) to prevent damage.

Transmission Characteristics of -3 Filter (HP-7)



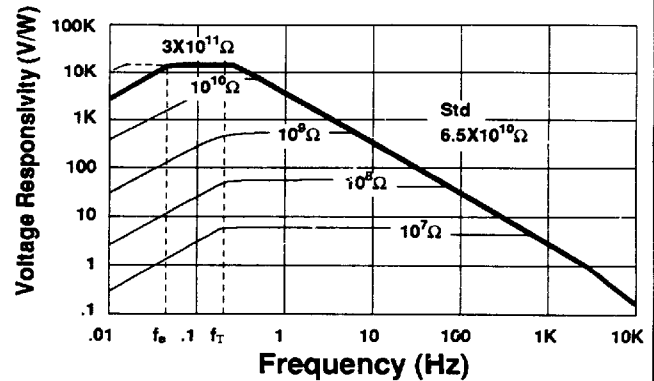
For information on other standard filters available, refer to ELTECdata # 101.



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FREQUENCY RESPONSE



The voltage response of this detector is dependent on the pulse rate or equivalent frequency of input. The frequency response of the detector can be linearized by using a lower value resistor, but at the expense of a lower responsivity and a lower D^* . Load resistor values other than the standard $6.5 \times 10^{10} \Omega$ can be specified.

Noise: As a resolution or lower information limit, noise is established not only by the detector. Other noise sources are:

- Radiated and conducted RF signals
- Subsequent amplification or signal conditioning stages
- Power supply noise
- Components, such as high value resistors and capacitors (tantalum and aluminum electrolytic)
- Mechanical contacts and weak solder joints
- Shock and vibration excited microphonics
- Outside thermal influences on the detector other than the desired infrared input, i.e. drafts. (The Model 407 is less sensitive to drafts than single element detectors)

All of these noise sources should be considered carefully when the information signal is <1mV.

Light Leakage: Slight sensitivity to visible light leaking through the glass-to-metal seal on the base may be observed.

Optical Design: Use of a detector with a filter in an optical system may require consideration of the image displacement toward the filter. This displacement (s) caused by the insertion of a planoparallel plate (filter thickness = t ; refractive index = N) is given by $s = (t/N)(N-1)$.