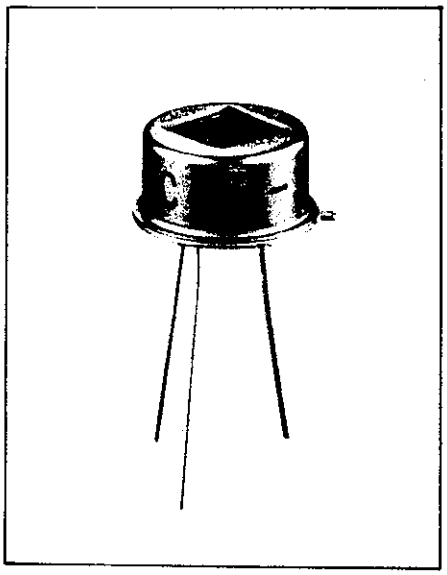
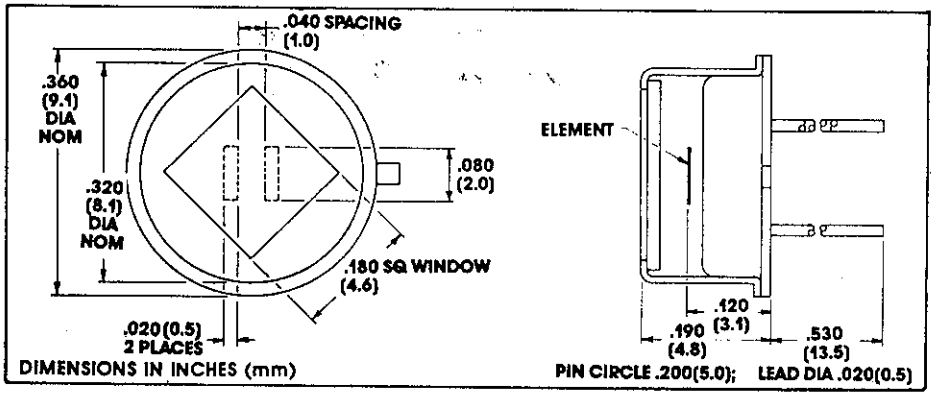
414
Series Opposed Dual Pyroelectric IR Detector with Source Follower

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





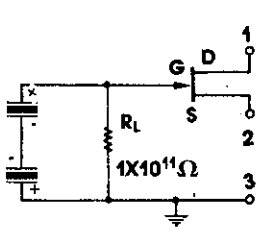
Model 414 consists of two separate sensing elements on a single lithium tantalate crystal and a JFET source follower sealed into a TO-5 transistor housing with optical filter.

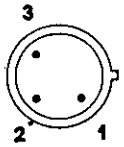
The sensing elements are connected electrically in a series opposed dual (SOD) configuration. This design affords cancellation of unwanted common mode signals due to changes in the thermal background. The signal output is comparable in magnitude to single element sensors with source followers. The small element size is adapted to short focal lengths of long range optical systems.

A source resistor, 47 KΩ or greater is needed to set the JFET drain current.

Applications

- **Intrusion Detection**
- **Lighting Control**
- **Robotics**
- **Motion Sensing**
- **Automatic Door Control**
- **Safety Warning**





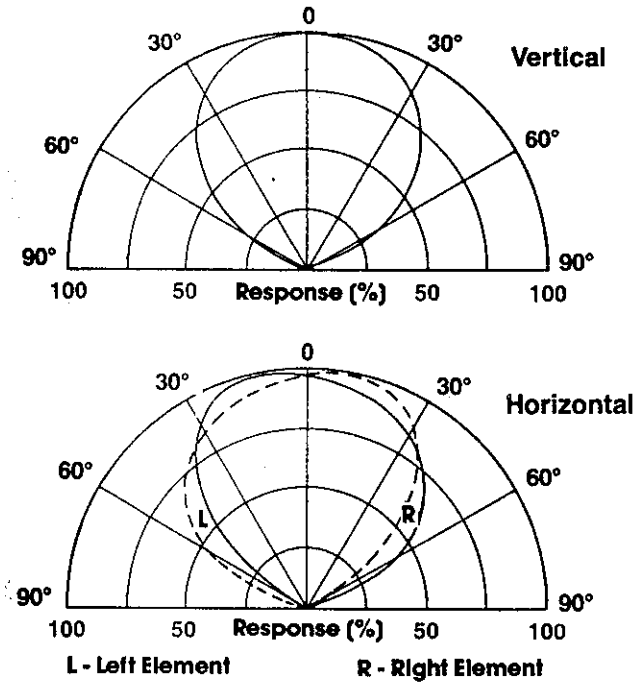
BOTTOM VIEW

1. V+
2. OUTPUT
3. GND/CASE

Characteristics		414	Unit	Test Conditions	ELTECdata Reference
Detector Type		SOD	—		
Element Size		0.5 x 2.0	mm	nominal, each	
Element Spacing		1.0	mm	nominal	
Responsivity (Each Element)	min typ max	5000 8000 11,000	V/W	8 to 14μm@1Hz	
Common Mode Rejection Ratio	min typ	5:1 10:1		8 to 14μm@1Hz	
Noise	typ max	50 100	$\mu V/\sqrt{Hz}$	1.0Hz p-p (1 minute)	
NEP	typ max	1.5×10^{-9} 5.0×10^{-9}	$W/\sqrt{Hz}$	8 to 14μm @1Hz, BW 1Hz	100
D*	min typ	2.0×10^{7} 7.0×10^{7}	$cm\sqrt{Hz}/W$	8 to 14μm @1Hz, BW 1Hz	100
Operating Voltage	min max	3 15	V	V_D to Gnd	104 (4.1.c)
Operating Current	min max	0.1 40	μA		104 (4.1.c)
Offset Voltage	min max	0.2 0.8	V	$R_S = 22K\Omega$	104 Fig. 4
Offset Voltage	min max	0.3 1.2	V	$R_S = 100K\Omega$	104 Fig. 4
Output Impedance	max	20	KΩ		
Thermal Breakpoint f_T	typ	0.25	Hz		102
Electrical Breakpoint f_e	typ	0.25	Hz	$R_L = 1 \times 10^{11}\ \Omega$	102
Recommended Operating Temp.		0 + 40	°C		
Responsivity vs. Temperature	max	+0.2	%/°C	Unity Gain Circuit	104 (3.5)
Incident Power Limit	max	0.2	W		
Pressure Sensitivity	max	200	μV/mbar	Step Response	
Microphony	max	50	μV/g	10-1000Hz	104 (3.9)
Package Sealing	max	10^{-8}	cm^3/sec	Helium	
Storage Temperature		-55 + 125	°C	ΔT<5°C/minute	

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

FIELD OF VIEW



For -3 window only. For other windows, consider refractive index and thickness.

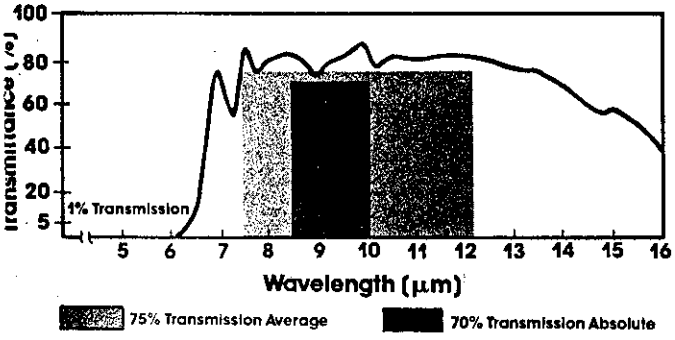
Mounting: Avoid mechanical stresses on case and leads.

Soldering: Use minimum heat and heat sink between case and leads. Leave minimum lead length of .250 inch(6.0mm). 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 (<5°C/min.) to prevent damage.

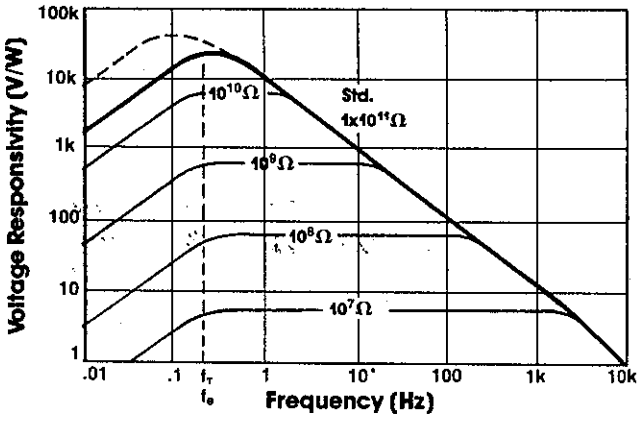
Transmission Characteristics of -3 Window (HP-7)



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

FREQUENCY RESPONSE

(Each element)



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 $1x10^{11}\Omega$ can be specified.

Noise: As a resolution or lower information limit, noise is not established 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 tantalum or electrolytic capacitors
- Mechanical contacts and weak solder joints
- Microphonics or vibration
- Outside thermal influences on the detector other than the desired infrared input, i.e. drafts.

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

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

Optical Bandwidth: The detector is sensitive in a range from 1.5 to 1000μm depending on window used. For more information, see Eltecdata #101.