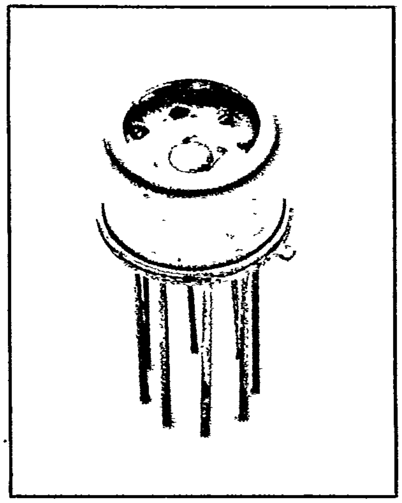
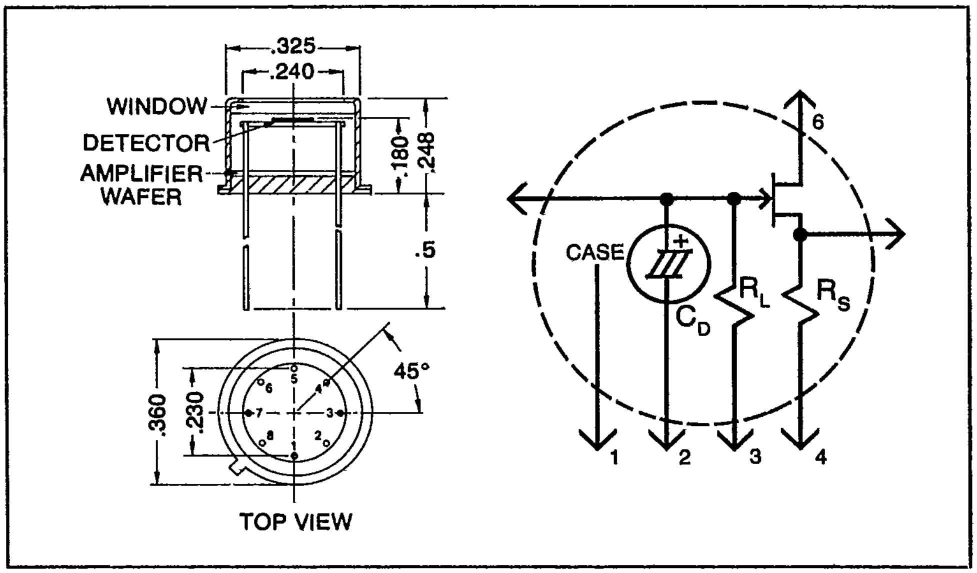
F-08-19

P1-70 Ultra-Low Noise Pyroelectric Detector/FET Preamp

Molectron DETECTOR, INCORPORATED

T-65-13





Features

- Rugged $LiTaO_3$ material
- 610°C Curie temperature
- 0.2%/°C temperature stability
- Non-hygroscopic
- Broad spectral range .001 to 1000 microns
- Low noise
- 0°C to 70°C operation
- Optional windows
- Low leakage current hybrid FET preamplifiers
- Low NEP 0.3×10^{-9} $W/Hz^{1/2}$

Applications

- Laser power and energy measurement
- Non-contact temperature measurement
- Security and surveillance systems
- Process control
- X-ray calorimetry
- Gas analyzer instrumentation
- Solar instrumentation
- IR Spectrometry

The P1-70 series features a 1, 2, 3, or 5 mm standard detector element and incorporates a specially selected low leakage current hybrid FET circuit. Because it uses a 3×10^{11}-ohm load/feedback resistor, this series offers superlative narrow-band low NEP performance. An external parallel load resistor can be used to extend the uniform frequency response bandwidth to an upper −3dB frequency of 100 kHz.

Convenient pin connections are available for using the P1-70 in either a source follower or gain configuration as a first stage for either a voltage or current mode amplifier. External Operation is from +9VDC with −20dB supply rejection.

Performance Specifications P1-70

CHARACTERISTICS (25°C unless otherwise noted)

		P1-71			P1-72			P1-73			P1-75				
ELEMENT ONLY		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	UNIT	CONDITIONS
Dia	Active Diameter		1			2			3			5		mm	
R_I	Current Responsivity	.5	1		.25	.5		.25	.5		.13	.25		μA/Watt	λ = 632.8 nm, f ≥ 15 Hz
C_d	Element Capacitance		15			24			54			75		pF	f = 1 KHz
f_T	Thermal 3db Frequency		3.5	6		1.6	3		.8	2		.5	1	Hz	$P_{avg} \leq 10$ mW
ELEMENT AND FET															
R_V	Voltage Responsivity (See Figures 1-4)	400	900		100	200		45	90		12	25		Volts/Watt	λ = 632.8 nm, f = 15 Hz, Source Follower
NEP	Noise Equivalent Power (See Figures 1 and 2)		0.3	0.7		0.6	1.8		1.0	2.5		2.0	4.5	10^{-9} $W/Hz^{1/2}$	λ = 632.8 nm, f = 15 Hz, BW = 1 Hz
D*	Detectivity	1.3	3		1.0	3		1.0	2.7		1.0	2.2		10^{8} cm-$Hz^{1/2}$/Watt	λ = 632.8 nm, f = 15 Hz, BW = 1 Hz
f_H	Flat Frequency Response	100K			100K			100K			100K			Hz	External Load Resistor
R_L	Internal Load Resistor		3			3			1			1		10^{11} Ohms	
R_o	Output Impedance: Source Follower / Gain Configuration		5K / 50K			5K / 50K			5K / 50K			5K / 50K		Ohms	
$P_{max\ avg}$	Maximum Average Power			50			50			50			50	m Watts	
V_{DD}	Supply Voltage		+9	+15		+9	+15		+9	+15		+9	+15	Volts	15 Volts only with gain configuration. V_D max is 9 volts.

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Note: 1. R_I, R_V, NEP and D* are specified at 632.8nm with windowless detector. These parameters improve 30% at 10.6μm.
2. If CC Black Absorbing Coating is specified R_I, R_V, NEP and D* can improve by 20 to 40% at all wavelengths. However, this coating limits their use to frequencies <100 Hz.

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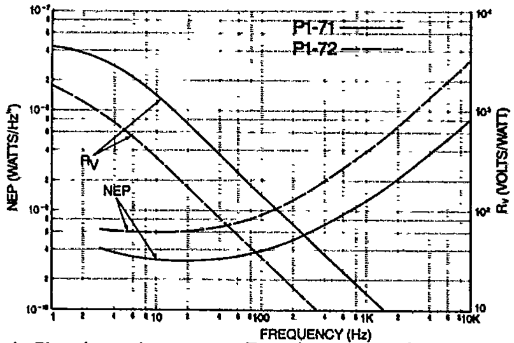

Fig. 1. Plot of typical responsivity R_V and noise equivalent power NEP versus frequency for P1-71 and P1-72 pyroelectric detectors.

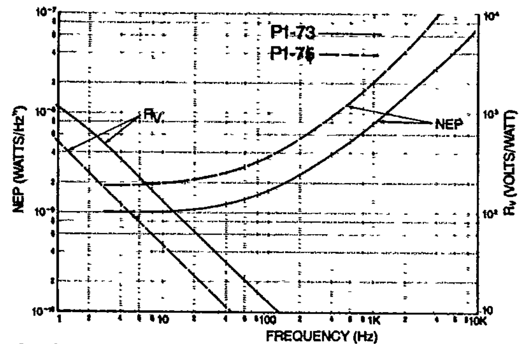

Fig. 2. Plot of typical responsivity R_V and noise equivalent power NEP versus frequency for P1-73 and P1-75 pyroelectric detectors.

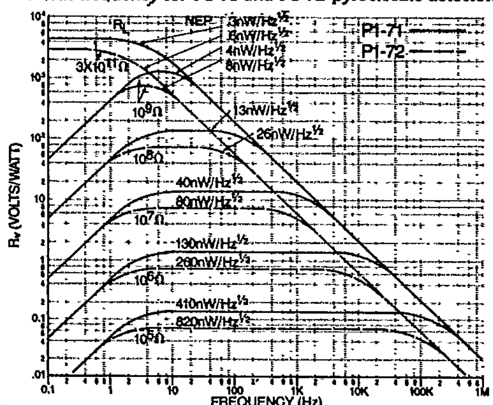

Fig. 3. Plot of typical responsivity R_V versus frequency for P1-71 and P1-72 pyroelectric detectors with various external load resistors.

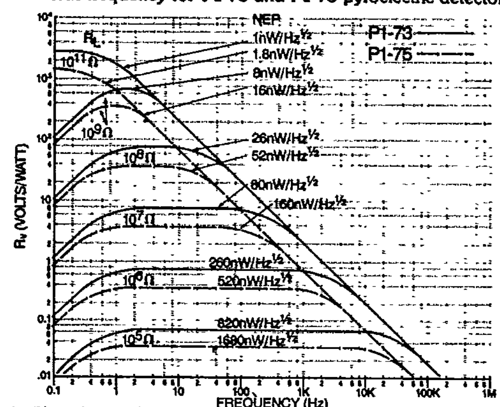

Fig. 4. Plot of typical responsivity R_V versus frequency for P1-73 and P1-75 pyroelectric detectors with various external load resistors.

Typical Circuit Diagrams

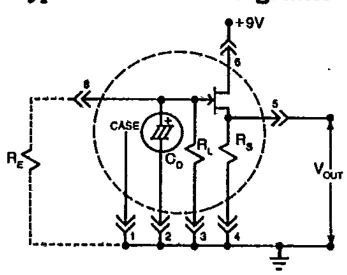

Fig. 5 Source follower circuit

Note: R_E is an optional external resistor used for wider flat bandwidth but correspondingly lower responsivity R_V.

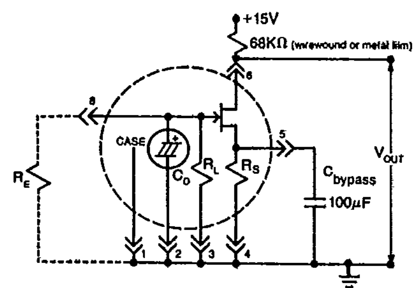

Fig. 6 Voltage gain circuit

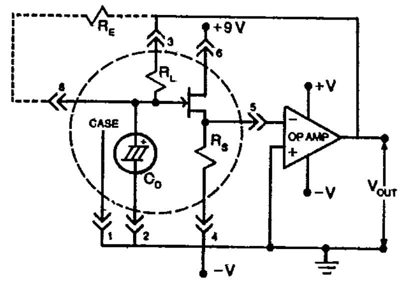

Fig. 7 Current mode circuit

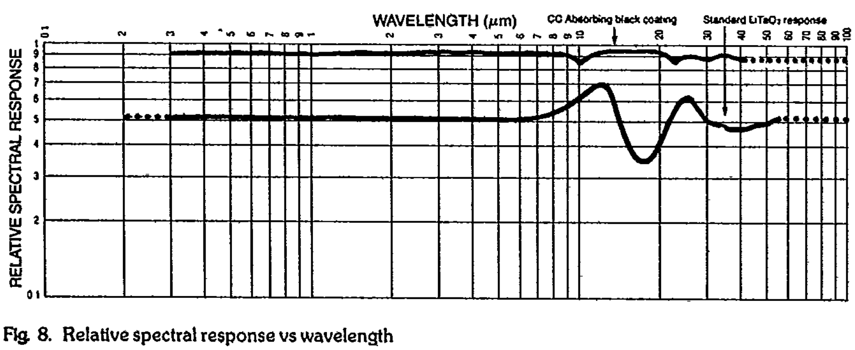

Fig. 8. Relative spectral response vs wavelength

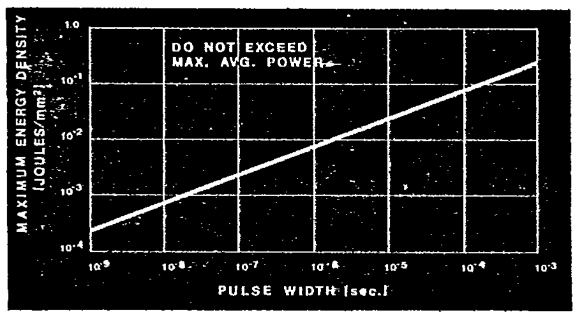

Fig. 9. Energy density damage threshold

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