Model 420M3

5mmØ Pyroelectric Laser Detector for UV/Vis/IR

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 420M3 consists of a single lithium tantalate sensing element sealed into a TO-5 transistor housing with an optical filter. See EltecData #101 for filter selection guide.

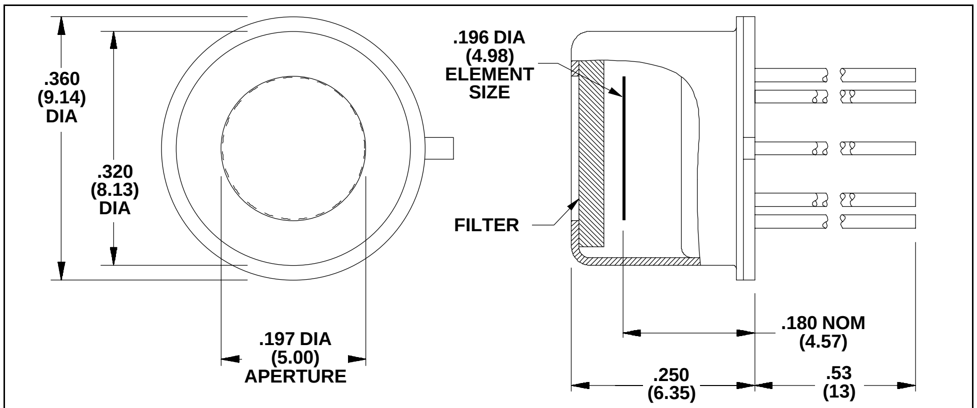
A special element mounting technique is used to heat sink the sensing element, allowing detection at higher power levels.

Because the Model 420M3 is a thermal integrator above the thermal breakpoint, the voltage output falls 20 dB per decade of increasing frequency. Short pulse resolution will be enhanced by using a low value (50Ω to 10 KΩ) load resistor, which will create a differentiator with the crystal capacitance. This will cancel the detector thermal integration, resulting in a flat frequency response up to the RC 3 dB point.

Another way to achieve a uniform frequency response is to connect the detector to a current to voltage converter (current mode operation). As the detector is connected to the virtual ground of the converter, the load resistance is zero, forming an infinite differentiator with the crystal capacitance. The upper frequency limit is determined by resistance and the shunt capacitance of the converter feedback resistor, $1/(2\pi R_F C_S)$. If pulse integration is desired, the detector may be operated in the voltage mode with a high value load resistor ($1X10^6\Omega$ to $1X10^{11}\Omega$) which will preserve the natural integration of the detector. Rise time and frequency response is dependent on electronics employed. See EltecData # 134 for more information.

Applications

- **Laser Pulse Profile Studies**
- **Pulse Energy Measurements**
- **Useful with Monochromatic, Tunable or Multi-Laser Systems**
- **Laser Power Monitoring (when used with a beamsplitter)**
- **Millimeter Wave Studies**
- **UV Laser Detector**

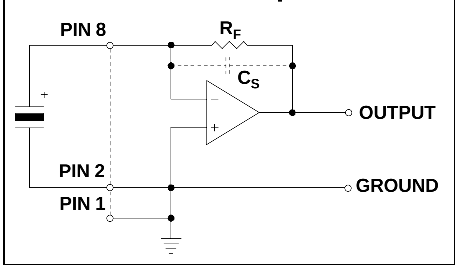


DIMENSIONS IN INCHES (mm) **PIN CIRCLE .200 (5.08) LEAD DIA. .017 (.43)**

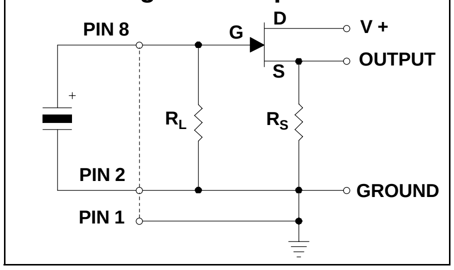
Characteristics		420M3	Unit	Test Conditions	ELTECdata Reference
Detector Type		Single			
Element Size		4.98	mmØ		
Optical Bandwidth		0.1 to 1,000	µm	Various Filters	101
Element Capacitance	(min) (max)	76 140	pF		
Current Responsivity	(min)	0.25	µA/W	8.3 - 14µm, 10Hz	
Element Impedance	(typ)	$>5 X 10^{12}$	Ω		
Thermal Breakpoint f_t	(typ)	5	Hz		102
Electrical Time Constant τ_e	(typ)	5	ns	R_L=50Ω	102
Incident Power Limit[1]		5	W/cm²		109
Recommended Operating Temperature		-55 to +125	ºC	Functional	
Storage Temperature		-55 to +125	ºC	ΔT<50Cº/min	
Curie Temperature		610	ºC		
Output Protection		Short leads together if ΔT exceeds 50Cº/min			

Characteristics at 25ºC.
Data is established on a sample basis and is believed to be representative.
[1]Dependent on pulse width, power & duty cycle.

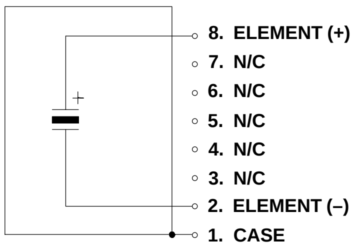
Current Mode Operation

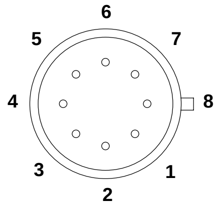


Voltage Mode Operation



PIN DESIGNATIONS





BOTTOM VIEW

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

Mounting: Avoid mechanical stresses on case and leads.

Soldering: Detectors must be hand soldered to minimize the chance of destroying the internal components. Avoid machine or hot air soldering. Leave a minimum lead length of .250 inch (6.35mm). When soldering to detector leads, use a heat sink between the case and leads. Beware that the new RoHS compliant solders require a higher soldering temperature making heat sinking the detector extremely important.

Static Discharge: Protect detectors from electro-static charges.

Optical Filter: This Model can be used with any standard ELTEC detector filter or used without a filter. For more information, please refer to ELTECdata # 101.

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

Polarity: In current mode operation a positive output for a positive change can be achieved by connecting pin 2 to input of amplifier and pin 8 to ground.

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 or 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

All of these noise sources should be considered carefully when the information signal is <1mV and <20mV for current mode operation.

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 $s = (t/N)(N-1)$.

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