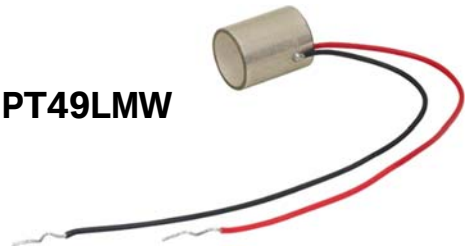
Piezoelectric Tube, 500 V, 2.8 µm / 1.8 µm Travel

PT49LMW



Description

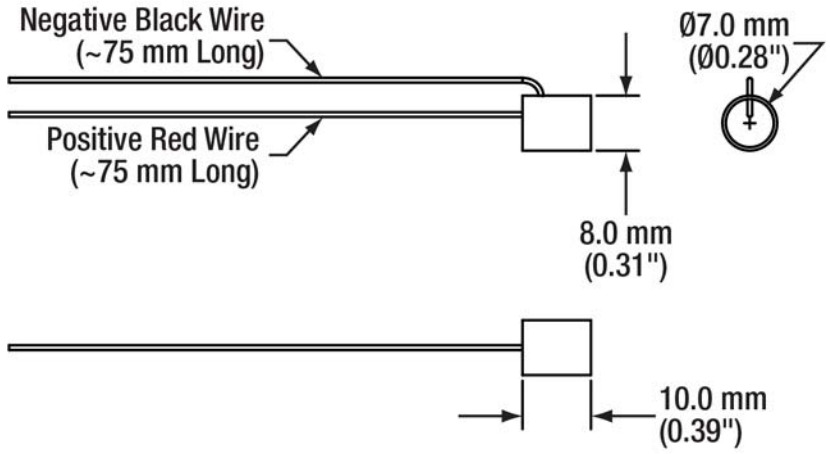
The PT49LMW piezoelectric actuator is a tube with an 8 mm outer diameter, 7 mm inner diameter, and 10 mm length. It offers a maximum displacement of 2.8 µm ± 15% in the axial direction and 1.8 µm ± 15% in the radial direction. The tube contracts in both the axial and radial directions when a positive voltage is applied. The internal and external walls have fired silver electrodes with pre-attached wires. The inner surface (red wire) is the positive electrode and the outer surface (black wire) is the negative electrode. The piezo element can be driven by voltages between 0 V and 500 V.

Specifications

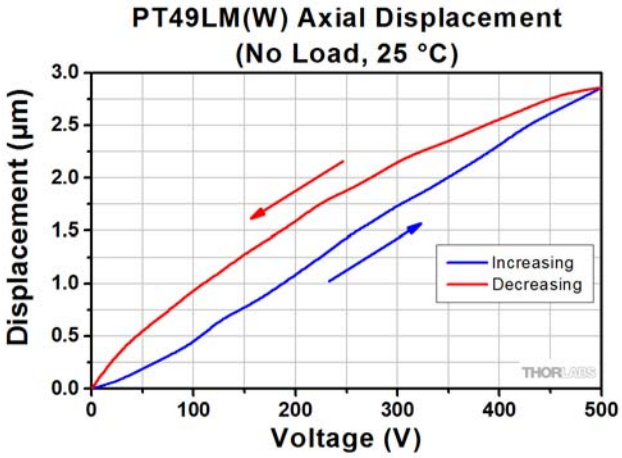
PT49LMW[a]	
Drive Voltage Range	0 - 500 V
Axial Displacement (Free Stroke[b])	0.8 µm ± 15% (@ 150 V) 2.8 µm ± 15% (@ 500 V)
Radial Displacement (Free Stroke[b])	0.5 µm ± 15% (@ 150 V) 1.8 µm ± 15% (@ 500 V)
Hysteresis	<15% (See Graph on Next Page)
Resonant Frequency	165 kHz (No Load)
Impedance at Resonant Frequency	4 Ω
Anti-Resonant Frequency	200 kHz
Dissipation Factor[c]	<2.0%
Capacitance[c]	13 nF ± 15%
Operating Temperature	-25 to 130 °C
Curie Temperature	230 °C
External Electrodes	Fired Silver
Dimensions	Outer Diameter: 8.0 mm ± 0.05 mm Inner Diameter: 7.0 mm ± 0.1 mm Length: 10.0 mm ± 0.05 mm

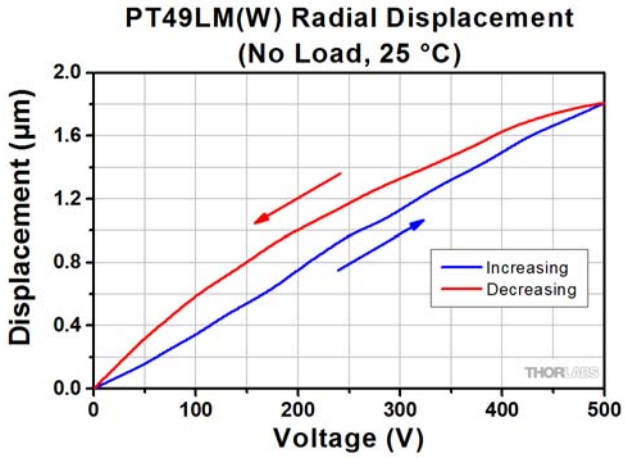
a. All specifications are quoted at 25 °C, unless otherwise stated.
b. The “free stroke” displacement corresponds to contraction under no load. Because these piezo elements contract with an applied voltage, applying a "pushing" load to the piezo enhances the stroke; however, the load negatively influences the recovery. The radial load should be less than 20 N; exceeding 20 N may cause mechanical failure.
c. Specified at 1 kHz, 1 V_{RMS}.

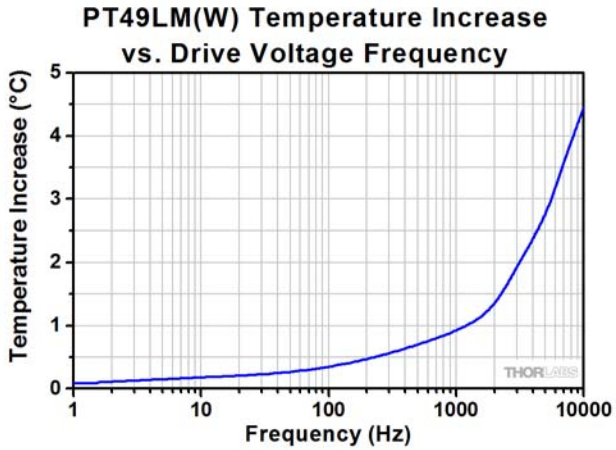
Drawing

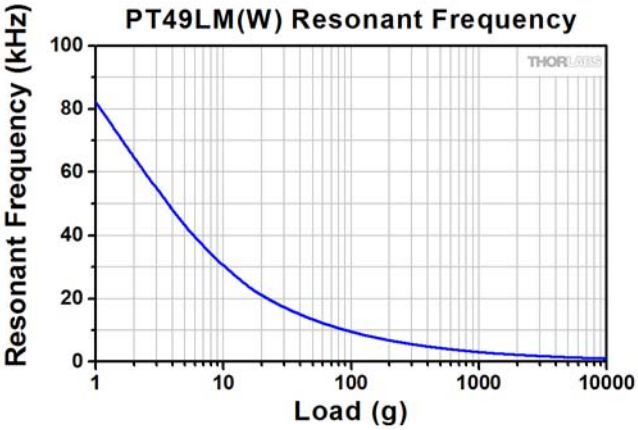


Typical Performance Plots









The temperature increase was measured after applying a sine-wave drive voltage ranging from 0 to 150 V at the specified frequency for 10 minutes.

Operation

Electrical Considerations

- The electrode with the red wire should be positively biased, and the electrode with the black wire should be grounded. The maximum drive voltage is 500 V. Exceeding 500 V will decrease the device's lifespan and may cause mechanical failure. Reverse biasing the device may also cause mechanical failure.
- When soldering wires to the electrodes, use a temperature no greater than 370 °C (700 °F) for a maximum of 2 seconds per location. Solder only to points at least 1 mm away from the edge, keeping the spot as small as possible.
- **Caution:** After driving, the piezo is fully charged. Directly connecting the red and black wires has the risk of electricity discharging, spark, and even failure. We recommend using a resistor (>1 kΩ) between the wires to release the charge.

Attaching Devices to the Piezo

- Any epoxy which cures at a temperature lower than 80 °C is safe to use. We recommend Thorlabs item # 353NDPK or TS10. Loctite Hysol 9340 is also usable.
- A radial load should be attached to the central area of the outer surface, at least 1 mm away from the edges. Attaching a radial load to the edges may lead to mechanical failure. For axial loads, try to obtain as large an area of contact as possible on the top and bottom edges of the tube without interfering with the attached wires.

Storage Instructions

- Do not store the device at temperatures above 110 °C.
- Do not store the device in humid environments. The relative humidity (RH) should be less than 40%.
- Do not immerse the device in organic solvents.
- Do not use the device around combustible gases or liquids.