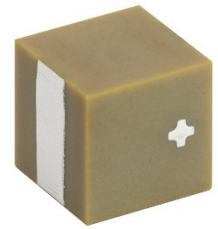


Piezoelectric Chip, Narrow-Width Exposed Electrodes, 150 V, 6.1 μm Travel

PA4FL

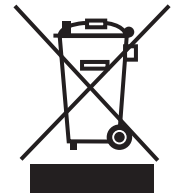


Description

The PA4FL piezoelectric chip, with narrow-width exposed electrodes, consists of stacked piezoelectric ceramic layers (which are mechanically in series) that are sandwiched between interdigitated electrodes (which are electrically in parallel). It offers a maximum displacement of $6.1 \mu\text{m} \pm 15\%$. A silver plus sign is located next to the electrode that should receive positive bias; the other electrode should be grounded. The electrodes are bare.

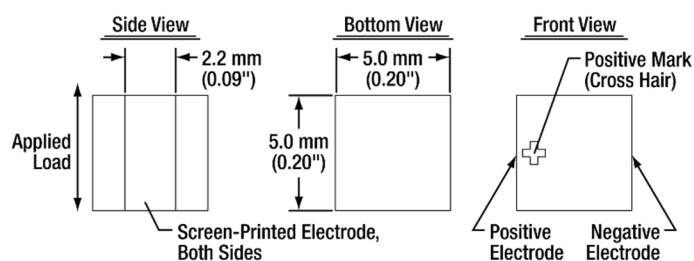
Specifications

PA4FL ^a	
Drive Voltage Range	0 - 150 V
Displacement (Free Stroke ^b) at 150 V	$6.1 \mu\text{m} \pm 15\%$
Hysteresis	<15% (See Graph on Next Page)
Load (Recommended) ^c	400 N (90 lbs)
Blocking Force at 150 V	1000 N (225 lbs)
Resonant Frequency ^d	210 kHz (No Load)
Impedance at Resonant Frequency ^d	110 m Ω
Anti-Resonant Frequency ^d	290 kHz
Dissipation Factor ^e	<2.0%
Capacitance ^e	$460 \text{ nF} \pm 15\%$
Operating Temperature	-25 to 130 °C
Curie Temperature	230 °C
Vacuum Compatibility ^d	10^{-10} Torr
External Electrodes	Screen-Printed Silver
Dimensions	Width 1: $5.0 \text{ mm} \pm 0.1 \text{ mm}$ Width 2: $5.0 \text{ mm} \pm 0.1 \text{ mm}$ Length (Electrode Height): $5.0 \text{ mm} \pm 5 \mu\text{m}$ Electrode Width: $2.2 \text{ mm} \pm 0.1 \text{ mm}$



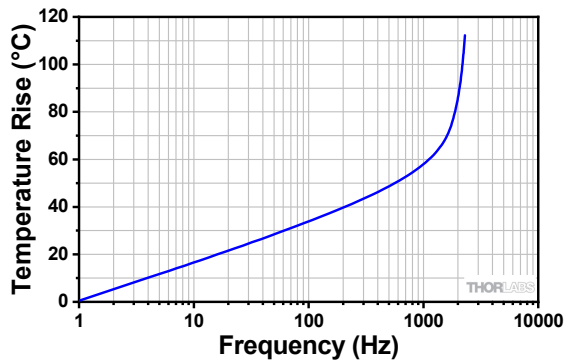
- All specifications are quoted at 25 °C, unless otherwise stated.
- The “free stroke” displacement corresponds with no load.
- Displacement varies with loading. When used with this load, these chips achieve the maximum displacement, which is larger than the free stroke displacement.
- These specifications are for the unwired chip.
- Specified at 1 kHz, 1 VRMS

Drawing

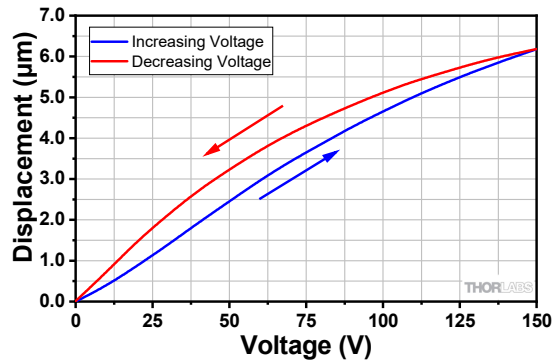


Typical Performance Plots

Temperature Rise vs. Drive Voltage Frequency



Displacement (No Load, 25 °C, 150 V Max)



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

Operation

Electrical Considerations

- The electrode closest to the silver plus sign should be positively biased, and the opposite electrode should be grounded. The maximum drive voltage is 150 V. Exceeding 150 V will decrease the device's lifespan and may cause mechanical failure. Reverse biasing the device may 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 spot. Solder to the middle of the electrode, 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 #s 353NDPK or TS10. Loctite Hysol 9340 is also usable.
- Loads should only be attached to the central area of the faces perpendicular to the narrow electrode width (2.2 mm) since the edges do not translate. Attaching a load to the other faces may lead to mechanical failure.

Storage Instructions

- Do not store the device at temperatures above 80 °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.