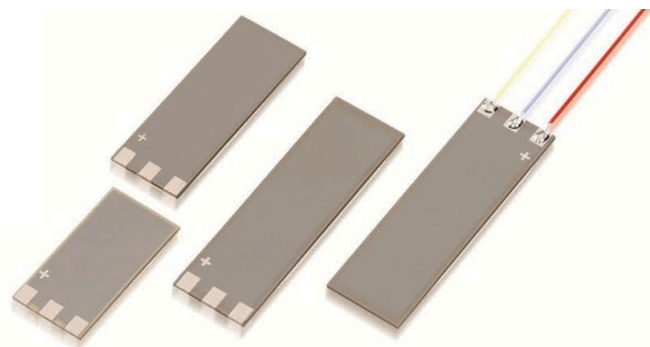


## PL112 – PL140 PICMA® Bender

All-Ceramic Bending Actuators with High Displacement



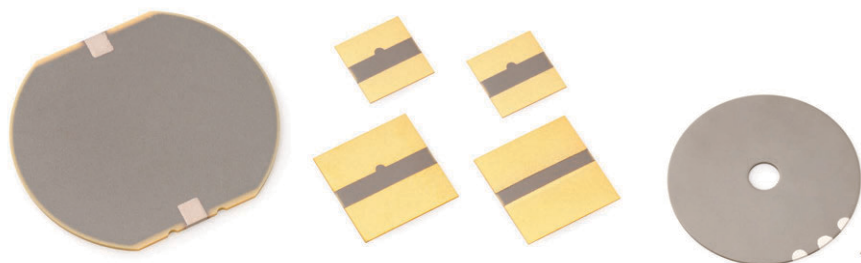
- Displacement to 2 mm
- Fast response in the ms range
- Nanometer resolution
- Low operating voltage
- Operating temperature up to 150 °C

### PICMA® multilayer bender elements with high reliability

Operating voltage 0 to 60 V. Bidirectional displacement, bimorph design. Ceramic insulation, polymer free. UHV compatible to  $10^{-9}$  hPa, no outgassing, high bakeout temperature. Reliable even under extreme conditions.

### Fields of application

Industry and research, vacuum. For medical technology, laser technology, sensor technology, automation tasks, pneumatic valves.



*Multilayer contracting plates can be manufactured in a variety of shapes, e.g., rectangular or disc-shaped, and are available on request. These plates can be applied, for example, to metal or silicon substrates, in order to realize bender or pump elements with low control voltages.*

## Specifications

	PL112.10	PL122.10	PL127.10	PL128.10	PL140.10	Unit	Tolerance
Operating voltage range	0 to 60 (±30)	0 to 60 (±30)	0 to 60 (±30)	0 to 60 (±30)	0 to 60 (±30)	V	
Displacement	±100	±310	±450	±450	±1000	µm	±20 %
Remaining length $L_F$	12	22	27	28	40	mm	
Length L	18	25	31	36	45	mm	±0.5 mm
Width W	9.60 ±0.2	9.60 ±0.2	9.60 ±0.2	6.15 ±0.1	11.00 ±0.2	mm	
Height TH	0.67	0.67	0.67	0.67	0.55	mm	±0.1 mm
Blocking force	±2.1	±1.25	±1.1	±0.55	±0.5	N	±20 %
Electrical capacitance	2 × 1.1	2 × 2.5	2 × 3.4	2 × 1.2	2 × 4.1	µF	±20 %
Resonant frequency	1800	600	420	360	160	Hz	±20 %
Operating temperature range	-20 to 150	-20 to 85	-20 to 85	-20 to 150	-20 to 85	°C	
Piezo ceramic	PIC252	PIC251	PIC251	PIC252	PIC251		

Electrical capacitance: Measured at 1 V<sub>pp</sub>, 1 kHz, RT, clamped on one side with remaining length  $L_F$ , unloaded.

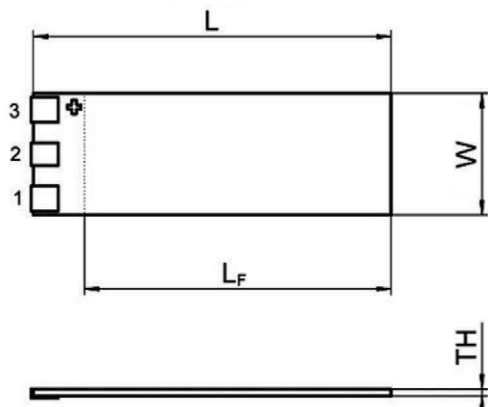
Resonant frequency: Measured at 1 V<sub>pp</sub>, clamped on one side with remaining length  $L_F$ , unloaded.

Standard connections: Solderable contacts (PL1xx.10) or PTFE-insulated stranded wires, 100 mm, AWG 32, Ø 0.49 mm (PL1xx.11).

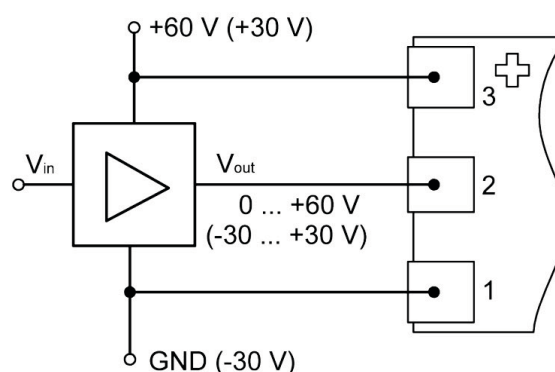
Recommended mounting: Epoxy resin adhesive.

All specifications depend on actual clamping conditions and mechanical load applied.

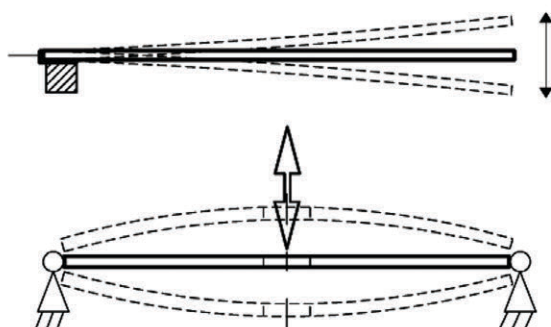
Custom designs or different specifications on request.



PL112.10 – PL140.10. L,  $L_F$ , W, TH, see data table.



PICMA® Bender bending actuators have differential control.



Displacement of the PICMA® bending actuators:  
Clamped on one side (top) and on both sides (bottom).

13.02.2017  
10:56

## Ordering Information

### **PL112.10**

PICMA® multilayer piezo bending actuator, 200 µm travel range, 18 mm × 9.60 mm × 0.67 mm

### **PL122.10**

PICMA® multilayer piezo bending actuator, 620 µm travel range, 25 mm × 9.60 mm × 0.67 mm

### **PL127.10**

PICMA® multilayer piezo bending actuator, 900 µm travel range, 31 mm × 9.60 mm × 0.67 mm

### **PL128.10**

PICMA® multilayer piezo bending actuator, 900 µm travel range, 36 mm × 6.15 mm × 0.67 mm

### **PL140.10**

PICMA® multilayer piezo bending actuator, 2000 µm travel range, 45 mm × 11.00 mm × 0.55 mm

## **With PTFE-insulated wire leads, 100 mm, AWG 32 (Ø 0.49 mm)**

### **PL112.11**

PICMA® multilayer piezo bending actuator, 200 µm travel range, 18 mm × 9.60 mm × 0.67 mm, stranded wires

### **PL122.11**

PICMA® multilayer piezo bending actuator, 620 µm travel range, 25 mm × 9.60 mm × 0.67 mm, stranded wires

### **PL127.11**

PICMA® multilayer piezo bending actuator, 900 µm travel range, 31 mm × 9.60 mm × 0.67 mm, stranded wires

### **PL128.11**

PICMA® multilayer piezo bending actuator, 900 µm travel range, 36 mm × 6.15 mm × 0.67 mm, stranded wires

### **PL140.11**

PICMA® multilayer piezo bending actuator, 2000 µm travel range, 45 mm × 11.00 mm × 0.55 mm, stranded wires

Custom designs or different specifications on request.

## Round PICMA® Multilayer Bender Actuators



### PD410

- + Displacement to 500  $\mu\text{m}$
- + Fast response in the ms range
- + Nanometer resolution
- + Low operating voltage

### PICMA® Multilayer Bender Elements with High Reliability

Operating voltage 0 to 60 V. Bidirectional displacement, bimorph design. Ceramic insulation, polymer-free. UHV-compatible to  $10^{-9}$  hPa, no outgassing, high bakeout temperature. Reliable even under extreme conditions

### Fields of Application

Research and industry, vacuum. For medical technology, laser technology, sensor systems, automation tasks, pneumatic valves

### Specifications

	Displacement	Dimensions OD x ID x TH	Blocking force	Electrical capacitance	Resonant frequency
	$\mu\text{m}$		$N$	$\mu F$	$Hz$
PD410.10	$\pm 240$	44 mm x 7 mm x 0.65 mm	$\pm 16$	$2 \times 10.5$	1000

Displacement: Tolerance  $\pm 20\%$ .

Blocking force: Tolerance  $\pm 20\%$ .

Electrical capacitance: Tolerance  $\pm 20\%$ , measured at  $1 V_{pp}$ , 1 kHz, RT.

Resonant frequency at  $1 V_{pp}$ , restraint with rotatable mounting on the outer circumference, tolerance  $\pm 20\%$ .

Piezoceramic type: PIC252.

Standard connections: Solderable contacts (PD410.10) or PTFE-insulated wire leads, 100 mm, AWG 32,  $\varnothing 0.49$  mm (PD410.11).

Operating voltage: 0 to 60 ( $\pm 30$ ) V.

Operating temperature range: -20 to 150 °C.

Recommended mounting: Epoxy resin adhesive.

All parameters depend on actual clamping conditions and applied load.

Custom designs or different specifications on request.

### Order Information

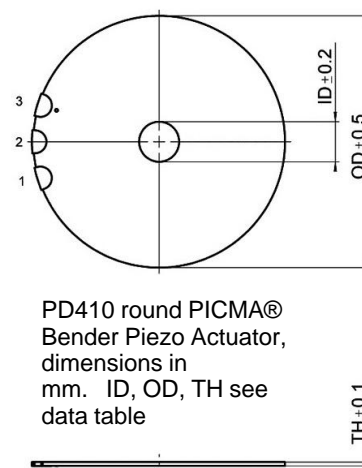
#### PD410.10

Circular PICMA® Multilayer Piezo Bender Actuator,  $\pm 240 \mu\text{m}$  Travel Range

#### PD410.11

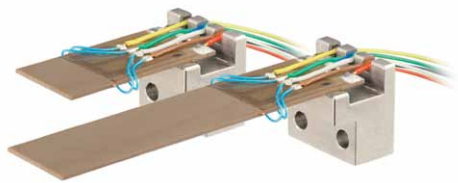
Circular PICMA® Multilayer Piezo Bender Actuator,  $\pm 240 \mu\text{m}$  Travel Range, Wire Leads

Custom designs or different specifications on request.

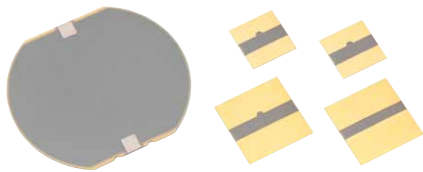


PD410 round PICMA® Bender Piezo Actuator, dimensions in mm. ID, OD, TH see data table

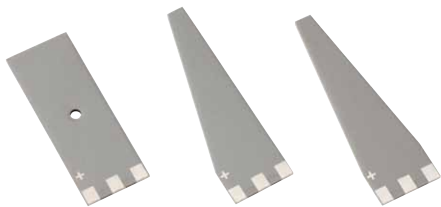
# Custom Designs



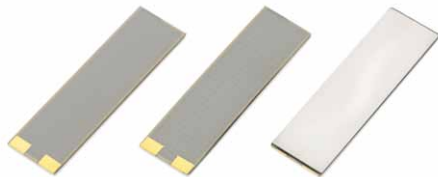
P-871 bender actuators with attached SGS position sensors offer closed-loop, position-controlled displacements of up to 1.6 mm with response times in the millisecond range. The integrated sensors allow a considerably better linearity and repeatability in closed-loop operation. For easy installation, the actuators are supplied with cables, connectors and a mounting adapter.



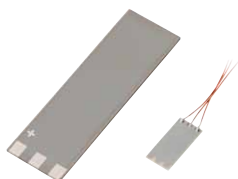
Multilayer contracting plates can be manufactured in a variety of shapes, e. g. rectangular or disk-shaped, and are available on request. These plates can be applied e. g. to metal or silicon substrates, in order to realize bender or pump elements with low control voltages.



Multilayer bender actuators can be manufactured in almost any shape. The manufacturing process allows, among other things, inner holes with an all-ceramic insulation. The height of the active layers can be varied from a minimum height of 15  $\mu\text{m}$  so that control voltages of only 10 V can be used.



Benders with unidirectional displacement consist of a single active piezoceramic layer that is glued together with a substrate of  $\text{Al}_2\text{O}_3$  ceramics or stainless steel. In comparison with the bimorph structure, these actuators achieve a higher stiffness and a greater displacement, which only takes place in one direction, however.



PICMA® Bender Piezo Actuators can be manufactured in the smallest dimensions of only a few millimeters. Here, a version with connection wire leads and a side length of 4 x 10 mm is shown compared to a PL127.10.