

## Overview

Multilayer piezoelectric actuators convert electrical energy into mechanical energy. The length of a piezo actuator is effected by an applied voltage. The displacement or force by utilizing the piezoelectric longitudinal effect. The product line ACTuatorBare offers highly reliable actuators for direct integration in customer mechanism.

The unique design has full stack-through electrodes electrodes fields with external insulation of layers with different polarity on the sides. The internal electrical field is quite homogenous and produce uniform deformation of the stack. The key performances are high actuator performance and long life. A wide variety of shapes are available.

## Benefits

- High forces up to tons load capability and force density 400 N per cm<sup>2</sup>.
- Ultra fast response: up to several ten kHz, tens of microseconds rise time, and ultra high acceleration up to 100.000 m/s<sup>2</sup>.
- High stiffness. Piezo is a structural actuator.
- Solid-state – no friction, no lag, and no wear.
- High stroke resolution up to the sub nm range.
- Retain position with very low power consumption.
- No magnetic fields.
- Conform with vacuum and cryogenic environment.



## Applications

Typical applications include positioning, force generation, mass-flow valves, vibration source, vibration controls, sensors, manipulators, motors and printers, and tuning of laser and rf cavities

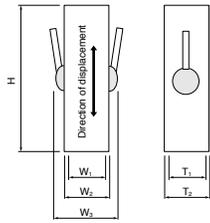
## Ordering Information

| PB                    | 5                                    | 18   |
|-----------------------|--------------------------------------|--|
| Series                | Ceramic Cross Section (mm)           | Length (mm)                                      |
| PB = Piezo bare stack | 5 = 5 mm x 5 mm<br>2.3 = 2 mm x 3 mm | specify the length of the actuator<br>18 = 18 mm |

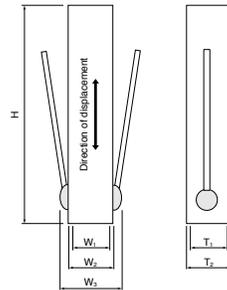
Example PB5.18 (5mm x 5 mm x 18 mm); PB2.3.9 (2 mm x 3 mm x 9 mm)

## Outer Dimensions in mm

Overall length 10,20mm Products



Overall length 5,9,18 and 40mm Products



**Note:**

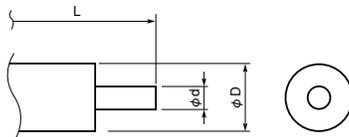
Factory-shipped polarization : Red lead wire = (+) ,  
White lead wire = (-)

Above drawings do not include dimension of wire connection area and diameter of the wire. Please contact us for details.

| Part Number | H      | T <sub>1</sub> | W <sub>1</sub> | T <sub>2</sub>  | W <sub>2</sub>  | W <sub>3</sub>  | L   |
|-------------|--------|----------------|----------------|-----------------|-----------------|-----------------|-----|
| PB2.3.5     | 5±0.1  | 2±0.1          | 3±0.1          | 2.4<br>Maximum  | 3.4<br>Maximum  | 5.5<br>Maximum  | 100 |
| PB2.3.9     | 9±0.1  |                |                |                 |                 |                 |     |
| PB2.3.18    | 18±0.1 |                |                |                 |                 |                 |     |
| PB2.3.40    | 40±0.1 |                |                |                 |                 |                 |     |
| PB5.9       | 9±0.1  | 5±0.1          | 5±0.1          | 5.4<br>Maximum  | 5.4<br>Maximum  | 7.5<br>Maximum  |     |
| PB5.18      | 18±0.1 |                |                |                 |                 |                 |     |
| PB5.40      | 40±0.1 |                |                |                 |                 |                 |     |
| PB10.18     | 18±0.1 | 10±0.1         | 10±0.1         | 10.4<br>Maximum | 10.4<br>Maximum | 12.5<br>Maximum |     |
| PB10.40     | 40±0.1 |                |                |                 |                 |                 |     |

Other sizes on request. Other forms (tubes) possible. Please contact [info@piezotechics.com](mailto:info@piezotechics.com)

## Wire Diameter



φ d =Diameter of lead wire

φ D =Outer diameter including the thickness of coating

L =Length of lead wire

| Part Number | AWG | Ød  | ØD  | L   | UL Number |
|-------------|-----|-----|-----|-----|-----------|
| PB 2,3.X    | 30  | 0.3 | 0.5 | 100 | 1993      |
| PB5.9       |     |     |     |     |           |
| PB5.18      | 26  | 0.5 | 0.8 |     |           |
| PB5.18      |     |     |     |     |           |
| PB10.18     |     |     |     |     |           |
| PB10.40     | 26  | 0.5 | 0.8 |     |           |

| Part Number | Stroke | T <sub>1</sub> | W <sub>1</sub> | T <sub>2</sub>  | W <sub>2</sub>  | W <sub>3</sub>  | L   |
|-------------|--------|----------------|----------------|-----------------|-----------------|-----------------|-----|
| PB3.9       | 9/13   | 2±0.1          | 3±0.1          | 2.4<br>Maximum  | 3.4<br>Maximum  | 5.5<br>Maximum  | 100 |
| PB3.18      | 20/28  |                |                |                 |                 |                 |     |
| PB5.9       | 9/13   |                |                |                 |                 |                 |     |
| PB5.18      | 20/28  | 5±0.1          | 5±0.1          | 5.4<br>Maximum  | 5.4<br>Maximum  | 7.5<br>Maximum  |     |
| PB5.40      | 42/58  |                |                |                 |                 |                 |     |
| PB7.18      | 20/28  |                |                |                 |                 |                 |     |
| PB7.40      | 42/58  | 10±0.1         | 10±0.1         | 10.4<br>Maximum | 10.4<br>Maximum | 12.5<br>Maximum |     |
| PB10.18     | 20/28  |                |                |                 |                 |                 |     |
| PB14.18     | 20/28  |                |                |                 |                 |                 |     |

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| Bare Stacks<br>Type | Dimensions                      |                | Displacement              |                             | Electrical       |                      |                   | Mechanical         |              |
|---------------------|---------------------------------|----------------|---------------------------|-----------------------------|------------------|----------------------|-------------------|--------------------|--------------|
|                     | Base Area<br>[mm <sup>2</sup> ] | Length<br>[mm] | Unipolar<br>[micro meter] | Semi-Bipol<br>[micro meter] | Capacity<br>[nF] | Insulation<br>[MOhm] | Resonanz<br>[kHz] | Stiffness<br>kN/mm | Force<br>[N] |
| <b>PB 3.9</b>       | 3,5 x 3,5                       | 9              | 9                         | 13                          | 350              | 50                   | 152               | 50                 | 400          |
| <b>PB 3.18</b>      | 3,5 x 3,5                       | 18             | 20                        | 28                          | 800              | 10                   | 76                | 25                 | 400          |
| <b>PB 5.9</b>       | 5 x 5                           | 9              | 9                         | 13                          | 800              | 50                   | 152               | 100                | 850          |
| <b>PB 5.18</b>      | 5 x 5                           | 18             | 20                        | 28                          | 1600             | 10                   | 76                | 50                 | 850          |
| <b>PB 5.40</b>      | 5 x 5                           | 40             | 42                        | 58                          | 3400             | 5                    | 34                | 22                 | 850          |
| <b>PB 7.18</b>      | 7 x 7                           | 18             | 20                        | 28                          | 3400             | 5                    | 76                | 100                | 1700         |
| <b>PB 7.40</b>      | 7 x 7                           | 40             | 42                        | 58                          | 6700             | 5                    | 34                | 40                 | 1700         |
| <b>PB 10.18</b>     | 10 x 10                         | 18             | 20                        | 28                          | 6600             | 5                    | 76                | 200                | 3500         |
| <b>PB 10.40</b>     | 10 x 10                         | 40             | 42                        | 58                          | 13600            | 2                    | 34                | 80                 | 3500         |
| <b>PB 14.18</b>     | 14 x 14                         | 18             | 20                        | 28                          | 11000            | 2                    | 68                | 400                | 7000         |
| <b>PB 25.15</b>     | 25 x 25                         | 15             | 16                        | 21                          | 31000            | 0,4                  | 68                | 1300               | 20000        |

## Resin Coated Type Multilayer Piezoelectric Actuators

| Item                                     | Performance Characteristics  | Conditions  |
|--|--|---|
| Operating Temperature Range              | -25 to +85°C   | When applied with a DC voltage at ambient temperature.<br>When driven by an AC voltage at ambient temperature plus temperature rise due to heat generation. |
| Recommended Storage Condition            | -5 to +40°C / less than 40% R.H  | No condensation.<br>Recommended storage to be at room temperature.  |
| Maximum Driving Voltage                  | 150 VDC  |   |
| Displacement                             | See Table 1 – Ratings & Part Number Reference  | At 150 VDC  |
| Generated Force (Compression Resistance) | See Table 1 – Ratings & Part Number Reference  | The force required for restricting the displacement to zero when the maximum driving voltage is applied.  |
| Capacitance                              | See Table 1 – Ratings & Part Number Reference  | f = 1 kHz, V = 1 V <sub>rms</sub> (< 10 μF)<br>f = 120 Hz, V = 1 V <sub>rms</sub> (> 10 μF)   |
| Capacitance Tolerance                    | ±20%   |   |
| Dissipation Factor                       | 5% or less   |   |
| Insulation Resistance                    | See Table 1 – Ratings & Part Number Reference  | Value obtained in one minute at 150 VDC.  |
| Resonance Frequency                      | See Table 1 – Ratings & Part Number Reference  | Both ends of the element are in free state.<br>Typical values of the element under our test conditions.   |
| Tensile Strength                         | 1/10 of generated force  | Typical values of the element under our test conditions.  |
| Young's Modulus                          | 4.4 X 10 <sup>10</sup> N/m <sup>2</sup>  | Typical values of the element under our test conditions.  |
| Temperature Cycle Test                   | Displacement: Initial value ±20%<br>Capacitance: Initial value ±30%<br>tan δ: Less than initial rated value<br>Insulation Resistance: 1 MΩ or more | Room temperature (3 minutes)<br>At -25°C for 30 minutes<br>Room temperature (3 minutes)<br>At +85°C for 30 minutes<br>Repetition of 10 cycles of the above  |

## Environmental Compliance

All Multilayer Piezoelectric Actuators are RoHS and REACH Compliant.

Article 33(1) of the REACH Regulation states that manufacturers and importers of articles (products) are required to notify their customers of the presence of any Substances of Very High Concern (SVHC) in their products exceeding 0.1% by weight and provide instructions on safe use of the product.

1. Applicable Product: Multilayer piezoelectric actuators (AE series and ASB Series)
2. The product(s) above contain a substance by more than 0.1wt% per product weight that was published in the 8th update of the REACH SVHC substances (December 19, 2012).
3. Regarding safety of the multilayer piezoelectric actuators (Piezoceramic products): The Piezoceramic that is used in this product becomes ceramic by sintering powder containing PZT as a main ingredient. It is chemically stable, with minimum risks toward the human body or environment within the intended use of the product. Please note that risks could occur in the case of inhalation or accidental oral uptake of powder ceramics.
4. Technical product information on the multilayer piezoelectric actuators (Piezoceramic products): The manufacturing technique of the "piezoceramic products" whose main ingredient is Lead Titanium Zirconium Oxide (PZT) has been established, and there is no alternative material that can exhibit superior performance than PZT at this moment. Please note that the piezoceramic is listed as an exempt on RoHS (2011/65/EU) AnnexIII (7c.1).
5. Responsibility of piezoceramic manufacturers: Piezoceramic manufacturers report information regarding PZT containment in their products to the customers to obey the article 33 of the REACH regulation