



# Shear Actuators

## Shear Plate Actuators

### Features

- Displacement of 1.5  $\mu\text{m}$
- Symmetrical operating voltage
- Very high stiffness for short response times (<1ms)
- Low capacitance

### Applications

- Micro- and nanopositioning
- Optical systems
- Atomic Force Microscopy

### Description

CTS piezoelectric shear actuators are ideal for a wide range of electronic designs requiring precise and fast movement. CTS shear plate actuators feature very high displacement at low operating voltages. The standard plates are produced with a thickness of 0.5mm, providing a maximum stroke of 1.5  $\mu\text{m}$ .

### Standard Product, Add-ons or Custom Solution

This document contains information about the CTS standard shear plate actuators and available add-ons. All the CTS standard products can be custom designed to match specific requirements – find more information on [www.ctscorp.com](http://www.ctscorp.com) or contact your local sales representative.



## Specifications

Product	CSAP01	CSAP02	CSAP03	CSAP04	Unit
Length (L)	2 +/- 0.10	5 +/- 0.10	10 +/- 0.20	15 +/- 0.30	mm
Width (W)	2 +/- 0.10	5 +/- 0.10	10 +/- 0.20	15 +/- 0.30	mm
Chamfer size (c)	0.2	0.5	1	1.5	mm
Height (H)	0.5 +/- 0.05				mm
Operating Voltage, $V_{max}$	320				V
Free Stroke, $-V_{max}$ to $+V_{max}$ *	1.5 +/- 15%				$\mu\text{m}$
Estimated small signal shear stiffness** (Typ.)	180	1'100	4'500	10'000	N/ $\mu\text{m}$
Capacitance @1V <sub>RMS</sub> , 1kHz (+/15%)	0.13	0.83	3.32	7.47	nF
Maximum Operating Temperature	200***				°C
PZT material	NCE51				-
External electrodes	Plated Gold on Nickel				-

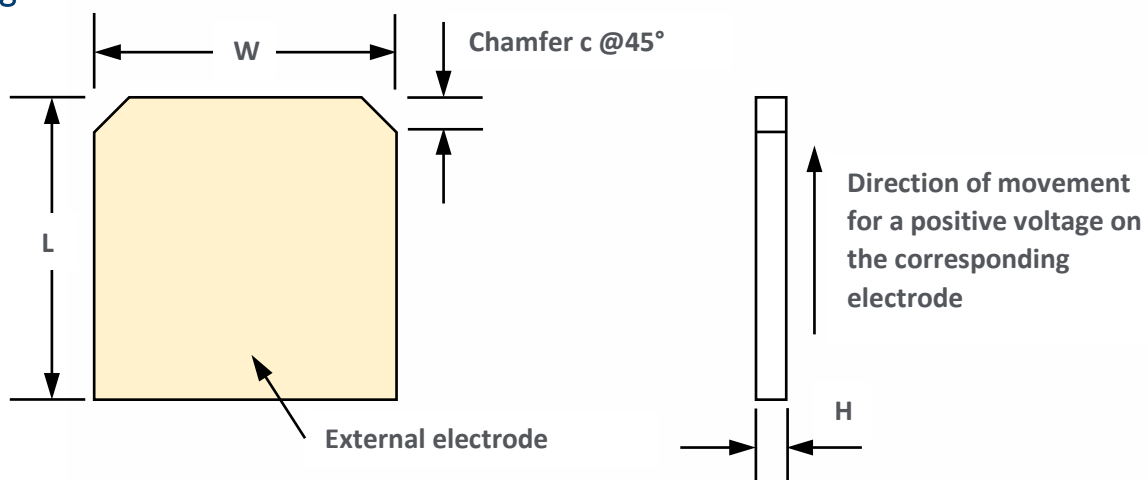
\* At room temperature. Operating voltage must be reduced at elevated temperature

\*\* Shear stiffness is very high and it is likely that other components in the system will introduce more compliance

\*\*\* Standard wire option A01 has a rating of 150°C

This product contains materials that present health hazards by inhalation or ingestion. Do not attempt to disassemble, grind or melt the product and dispose of according to local regulations.

## Drawing



## Mounting, Connecting and Driving

Please refer to our online tutorials for recommendations about mounting, connecting and driving shear plate actuators.

## Add-ons

### Wire Options

Shear actuators are typically delivered without wires, as the preferred connection method is a mechanical contact to the gold-plated electrodes. However, CTS do have the option to apply wires.

### We recommend wires with PTFE insulation

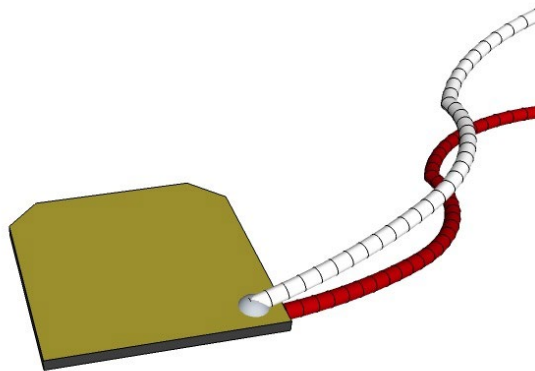
PTFE wires can stand temperatures above 200 °C, whereas PVC wires only resist temperatures up to 80 °C. We recommend PTFE for the thermal and chemical resistance of the insulation.

For vacuum and cryogenic applications, we recommend Kapton wires, which offer superior outgassing and flexibility.

### Standard wire option for shear plate actuators

One standard wire option is available:

<b>Option A01</b>	
Wire type	MIL-W-16878/4, 30 AWG, 7 strands
Length	200mm +/-10mm
Position and orientation	See sketch



Standard wire option A01 has a temperature rating of 150°C.

Customized wire option for shear plate actuators

We stock several alternative wire types:

Wire type	Voltage rating [V]	Approx. outer diameter [mm]	Rec. max. current [A]	Min. operating temperature [°C]
32AWG, MIL-W-16878/6, 7 strands	250	0.6	0.53	-60
30AWG, MIL-W-16878/4, 7 strands	600	0.8	0.86	-60
28AWG, MIL-W-16878/4, 7 strands	600	0.9	1.4	-60
28AWG, Allectra 301-KAPM-035 (Kapton insulation, UHV)	7500*	0.6	1.0	-269
22AWG, BS3G210 Type A, 19 strands	300	1.1	8	-75

\* In vacuum conditions

As part of our custom program, we can also stock specific wire.

### UHV preparation

Ultra high vacuum (UHV) is the vacuum regime characterized by pressures lower than about  $10^{-7}$  pascal or 100 nanopascals ( $\sim 10^{-9}$  torr). Extreme cleanliness and low outgassing are essential parameters in sustaining the vacuum level in such systems. Elevated temperature compatibility is often needed since water vapor and other trace gasses are removed from the system during a "bake-out".

CTS piezoceramic components are designed to support system development and integration of piezo technology in UHV applications. Among many technical capabilities, CTS is competent in producing piezoelectric actuators meeting the demands on temperature compatibility and out gassing levels set by UHV operation.

For low outgassing, Kapton-insulated wires are recommended. In addition, with the UHV preparation the products will undergo a specific cleaning process and be packaged in sealed pouches.

### Non-magnetic design

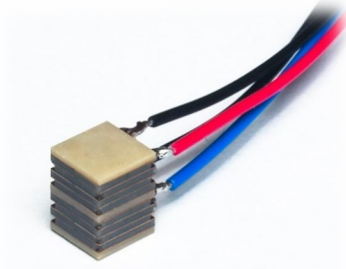
Although piezoelectric ceramic and all accessories are non-magnetic, our shear plate actuators include a thin layer of Nickel under the gold electrodes. This can be a concern when shear plates are applied in experiments where a homogeneous magnetic field or very accurate magnetic field measurements are required. If this is the case, CTS can provide special shear plates that do not include Nickel.

## Shear Actuators Product Families

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Shear Plate Actuators



Shear Stack Actuators:

- X
- XY
- XYZ

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Learn more about the different actuator product families on [www.ctscorp.com](http://www.ctscorp.com).