

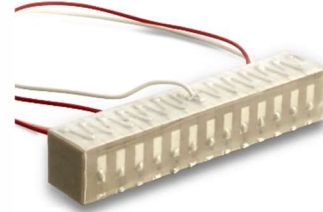


Linear Actuators

Damage Tolerant Stacks

Features

- Fuse technology ensuring high reliability
- Displacement up to 128.7 μm
- Very high force in the kN range
- High stiffness for short response times (<1ms)
- Height up to 80 mm



Applications

- Micro- and nanositioning
- Industrial equipment
- Active vibration control
- Valves
- Laser tuning
- Shaker

Description

CTS tape cast multilayer piezoelectric linear actuators are ideal for a wide range of electronic designs requiring precise and fast movement. The fuse technology is an effective way to ensure high reliability for critical applications. Thanks to the technology of damage tolerant piezo actuator stacks, the application keeps working even if a section of the actuator is damaged. The fuse technology fuses out any damaged ceramic element and the remaining ceramic elements of the stack continue to operate.

Standard Product, add-ons or Custom Solution

This document contains information about the CTS standard multilayer damage tolerant stacks and available add-ons. All the CTS multilayer products can be custom designed to match specific requirements – find more information on www.ctscorp.com or contact your local sales representative.



Product Designation

NAC5021-H20-A01

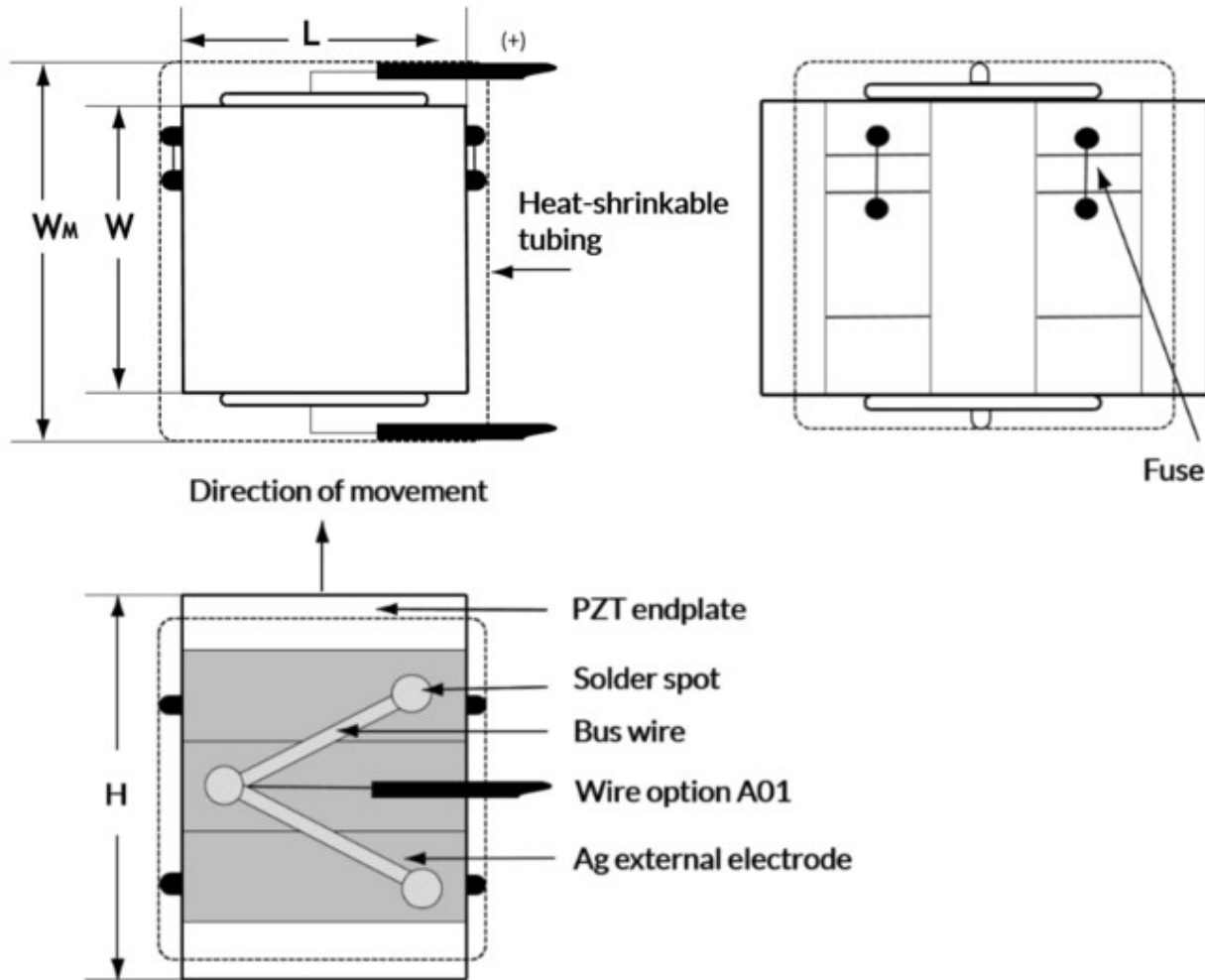


Specifications

Product series	NAC5021-HXX	NAC5022-HXX	NAC5023-HXX	Unit
Length (L)	7 +0.35/-0.15	10 +0.40/-0.20	15 +0.50/-0.30	mm
Width (W)	7 +0.35/-0.15	10 +0.40/-0.20	15 +0.50/-0.30	mm
Max width/length (W _M)	9.56 Max	12.8 Max	17.9 Max	mm
Height (H)	6 to 70* +/-0.2 or 1% (whichever is largest)	6 to 80* +/-0.2 or 1% (whichever is largest)	6 to 80* +/-0.2 or 1% (whichever is largest)	mm
Operating voltage, V _{max}	200			V
Blocking force, 0 to V _{max}	2060 +/-20%	4200 +/-20%	9450 +/-20%	N
Max. operating temp.	150			°C
PZT material	NCE51F			-
External electrodes	Screen-printed silver, tinned copper bus-wire			-

* See the different height options and corresponding free displacement and capacitance data in the tables below.

Drawing



Note: product represented with wires in A01 configuration.

Mounting, Connecting and Driving

Please refer to our online tutorials for recommendations about mounting, connecting and driving damage tolerant stacks.



Stacking Options

NAC5021-Hxx		
Height	Free Stroke	Capacitance
+/-0,2 mm or 1%*	+/-15%	+/-15%
mm	µm	nF
6	6.6	400
8	9.9	590
10	13.2	790
12	16.5	990
14	19.8	1190
16	23.1	1390
18	26.4	1580
20	29.7	1780
22	33.0	1980
24	36.3	2180
26	39.6	2380
28	42.9	2570
30	46.2	2770
32	49.5	2970
34	52.8	3170
36	56.1	3370
38	59.4	3560
40	62.7	3760
42	66.0	3960
44	69.3	4160
46	72.6	4360
48	75.9	4550
50	79.2	4750
52	82.5	4950
54	85.8	5150
56	89.1	5350
58	92.4	5540
60	95.7	5740
62	99.0	5940
64	102.3	6140
66	105.6	6340
68	108.9	6530
70	112.2	6730



Height	NAC5022-Hxx		NAC5023-Hxx	
	Free Stroke	Capacitance	Free Stroke	Capacitance
+/-0,2 mm or 1%*	+/-15%	+/-15%	+/-15%	+/-15%
mm	µm	nF	µm	nF
6	6.6	790	6.6	1750
8	9.9	1190	9.9	2620
10	13.2	1580	13.2	3490
12	16.5	1980	16.5	4370
14	19.8	2380	19.8	5240
16	23.1	2770	23.1	6110
18	26.4	3170	26.4	6980
20	29.7	3560	29.7	7860
22	33.0	3960	33.0	8730
24	36.3	4360	36.3	9600
26	39.6	4750	39.6	10480
28	42.9	5150	42.9	11350
30	46.2	5540	46.2	12220
32	49.5	5940	49.5	13100
34	52.8	6340	52.8	13970
36	56.1	6730	56.1	14840
38	59.4	7130	59.4	15710
40	62.7	7520	62.7	16590
42	66.0	7920	66.0	17460
44	69.3	8320	69.3	18330
46	72.6	8710	72.6	19210
48	75.9	9110	75.9	20080
50	79.2	9500	79.2	20950
52	82.5	9900	82.5	21830
54	85.8	10300	85.8	22700
56	89.1	10690	89.1	23570
58	92.4	11090	92.4	24440
60	95.7	11480	95.7	25320
62	99.0	11880	99.0	26190
64	102.3	12280	102.3	27060
66	105.6	12670	105.6	27940
68	108.9	13070	108.9	28810
70	112.2	13460	112.2	29680
72	115.5	13860	115.5	30560
74	118.8	14260	118.8	31430
76	122.1	14650	122.1	32300
78	125.4	15050	125.4	33170



Damage Tolerant Stacks

80	128.7	15440	128.7	34050
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* whichever is largest

Stack heights exceeding listed values on request.

Add-ons

Wire Options

When you order damage tolerant actuator stacks from CTS, they are delivered with wires. Therefore, when you order, you have to select one of our wire options. However, you should consider these parameters, when you select a wire for connection:

- Operation voltage
- Intensity of current
- Operating temperature
- Environment for example vacuum

We recommend wires with PTFE insulation

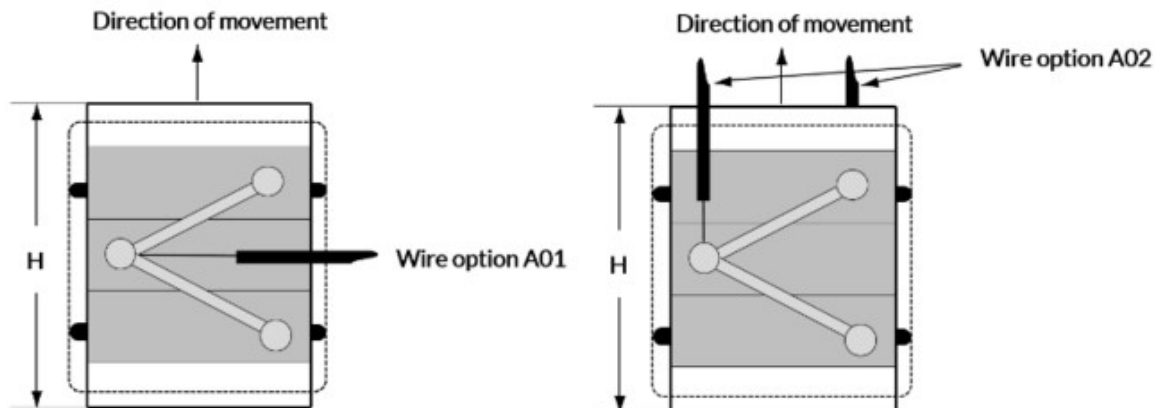
PTFE wires can stand temperatures above 200 °C, whereas PVC wires only resist temperatures up to 80 °C. We recommend PTFE for the thermal and chemical resistance of the insulation.

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

Standard wire options for Damage Tolerant Stacks

Two standard wire options are available:

	Option A01	Option A02
Wire type	MIL-W-16878/4, 28 AWG, 7 strands	
Length	200mm +/-10mm	
Position	Middle of the actuator	
Direction	Perpendicular to the height	Toward the top



Wire gauge (AWG)

The wire gauge (AWG) and insulation type should be determined according to the voltage, current and operating environment. Should the standard –A01 or –A02 configuration not suit your application, we offer 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 311-KAPM-035 (Kapton insulation, UHV)	1000*	0.5	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.

Reduced tolerances

For demanding applications, piezoelectric actuators can be re-worked after stacking in order to achieve better geometrical and dimensional properties. CTS offer this customization possibility for damage tolerant stacks with cross sections of 7x7 mm and 10x10 mm.

Product series	Standard height tolerance	Reduced height tolerance
NAC5021	+/-0.2mm or +/-1%*	+/-0.040mm
NAC5022	+/-0.2mm or +/-1%*	+/-0.050mm

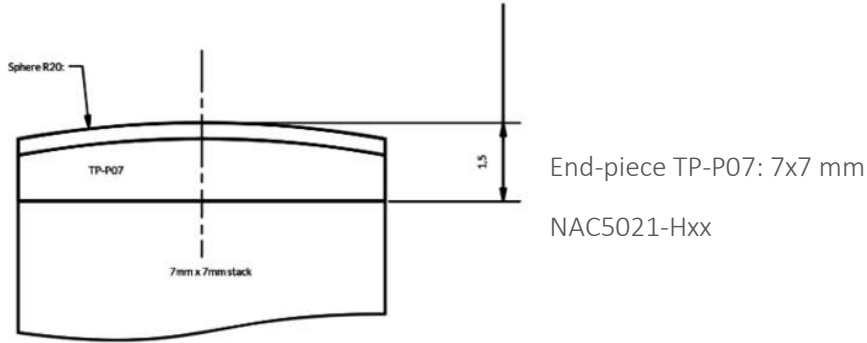
* whichever is largest

End-pieces

Metallic end-pieces can be useful in terms of:

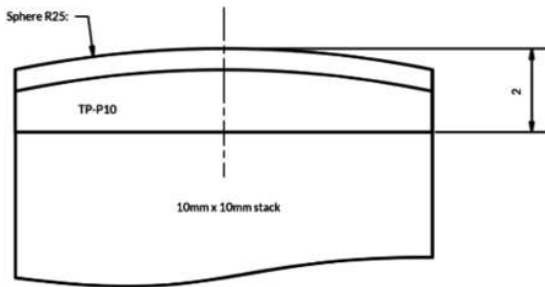
- Spreading a high mechanical load on the whole surface of an actuator
- Providing some de-coupling, i.e. allowing a stack to tilt
- Centering an actuator in an assembly

CTS stock end-pieces for our most popular cross-sections (5x5, 7x7 and 10x10 mm). The material is stainless steel (AISI 316). These products are compatible with:



End-piece TP-P07: 7x7 mm

NAC5021-Hxx



End-piece TP-P10: 10x10 mm

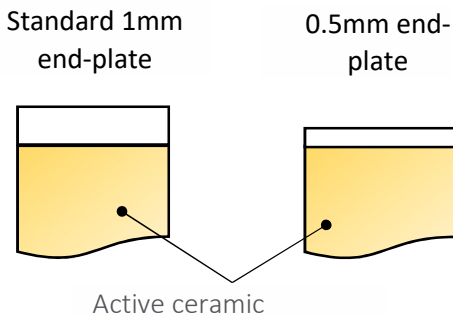
NAC5022-Hxx

The design is compact, with spherical caps providing some de-coupling, thereby releasing the requirements on alignment. The parts are low-magnetic and compatible with our other add-ons. End-pieces can be attached at one or both ends of a stack. They can be supplied with a short lead-time and are more cost-effective for small series.

End-plates

As a standard, damage tolerant stacks are supplied with 1mm thick ceramic end-plates. All our standard end-plates and end rings are produced with our piezoceramic material NCE51. Ceramic provides ideal electrical insulation properties, low thermal expansion mismatch as well as good mechanical properties to spread the load over the surface of the active piezoceramic. We recommend a thickness of 1mm for a good spread of the load.

It is nevertheless possible to use different configurations as illustrated below:

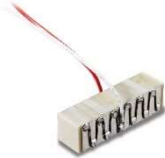




Linear Actuators Product Families



Plate and Ring Actuators



Stacked Actuators:

- Plate Stacks
- Plate stacks, compact
- Ring Stacks
- High Temperature Stacks
- Damage Tolerant Stacks



Preloaded Actuators

Learn more about the different linear actuators product families on www.ctscorp.com.