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Product Brief 2019

PowerHap – Piezo Actuators for Active Haptic Feedback

PowerHap™ is a family of powerful actuators for active haptic feedback in a very compact design. They are available in different sizes and designs and are therefore suitable for many applications from lightweight mobile devices to heavy industrial or automotive displays. The PowerHap piezo actuators are based on PZT piezo ceramics. Additional mechanical elements are used to amplify the feedback. In addition PowerHap can be also used as a sensor that provides an output voltage on its terminals when external force is applied.

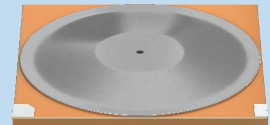
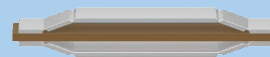
Sample applications

- Multifunctional automotive HMIs
- Displays
- Medical appliances
- Household appliances

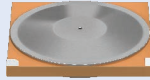

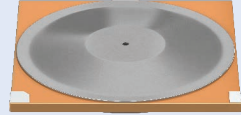
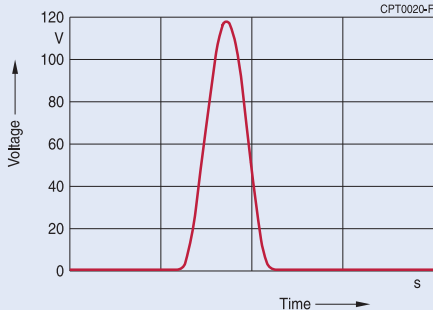
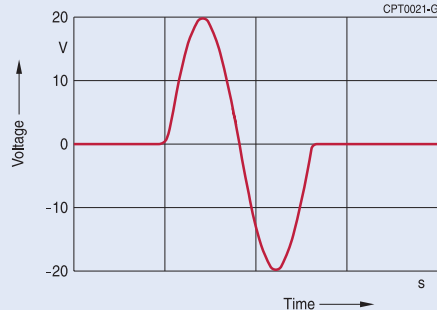
- Smartphones
- ATM's and vending machines
- Industrial equipment
- Game controllers

Key benefits and features

- Compact design
- Low insertion height down to 1.1 mm
- Multilayer structure enables high acceleration $\geq 50\text{ g}$ and high force $\geq 50\text{ N}$
- Large displacement $\geq 280\text{ }\mu\text{m}$
- Fast response time $< 1\text{ ms}$
- Low power consumption
- Flexible and programmable waveforms
- Integrated sensor functionality
- Qualified based on AEC-Q200
- Bipolar driving mode allows low operating voltage (e.g. $\pm 10\text{ V}$)

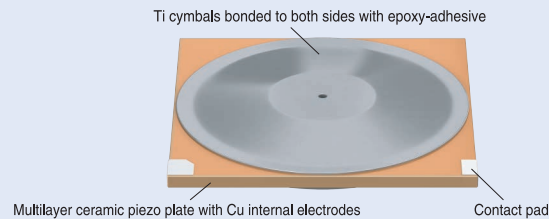


PowerHap – Piezo Actuators for Active Haptic Feedback

Specifications				
				
Type	0909H011V060	1313H018V120	2626H023V120	
Size l × w × h	9 × 9 × 1.1	12.7 × 12.7 × 1.8	26 × 26 × 2.3	mm
Ordering code	B54103H2020A001	B54102H1020A001	B54101H1020A001	
Operating temperature (powered)	−40 ... +85			°C
Custom waveforms	Yes			
Force sensing	Yes			
Unipolar driving mode				
Voltage	0 ... 60	0 ... 120	0 ... 120	V
Acceleration (20 g mass @ single pulse, sine wave 200 Hz)	2.5 (pk) 5 (pk-pk)	7 (pk) 17 (pk-pk)		g
Acceleration (100 g mass @ single pulse, sine wave 200 Hz)	2.5 (pk) 5.2 (pk-pk)	7 (pk) 13 (pk-pk)	35 (pk) 87 (pk-pk)	g
Acceleration (500 g mass @ single pulse, sine wave 200 Hz)			6 (pk) 18 (pk-pk)	g
Displacement	35	65	230	μm
Loading charge	0.09	0.19	0.8	mC
Bipolar driving mode				
Voltage	−10 ... 10	−20 ... 20	−20 ... 20	V
Acceleration (20 g mass @ single pulse, sine wave 200 Hz)	2 (pk) 4.5 (pk-pk)	5.5 (pk) 11 (pk-pk)	14 (pk) 28 (pk-pk)	g
Acceleration (100 g mass @ single pulse, sine wave 200 Hz)	0.8 (pk) 1.5 (pk-pk)	0.8 (pk) 1.5 (pk-pk)	16 (pk) 32 (pk-pk)	g
Unipolar driving mode (example)		Bipolar driving mode (example)		
				

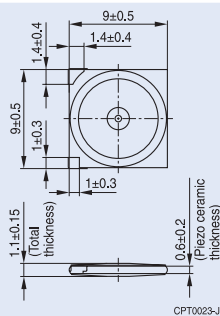
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Structure

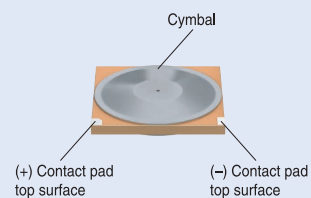


Dimensional drawings

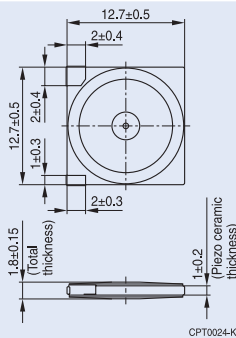
Type: 0909H011V060



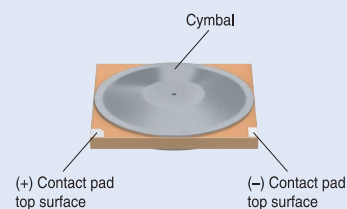
All dimensions in mm



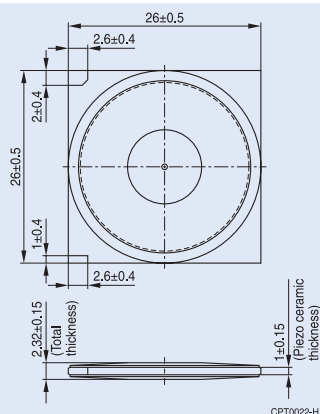
Type: 1313H018V120



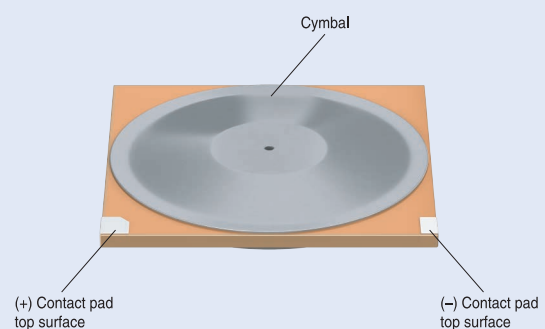
All dimensions in mm



Type: 2626H023V120



All dimensions in mm

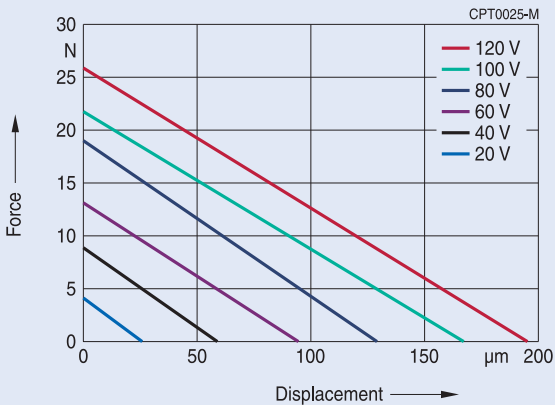


Note: Connection of PowerHap could be realised either via flexible wires or PFC.

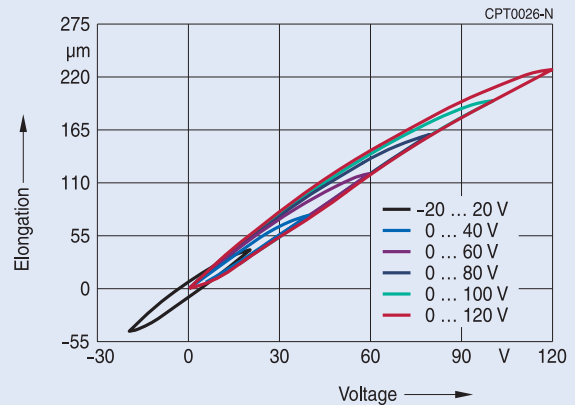
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Example of technical characteristics (type 2626H023V120)

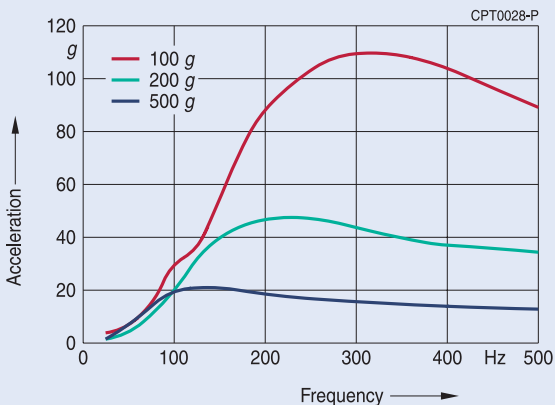
Force-stroke diagram with different loads.
Typical stiffness 130 N/mm.



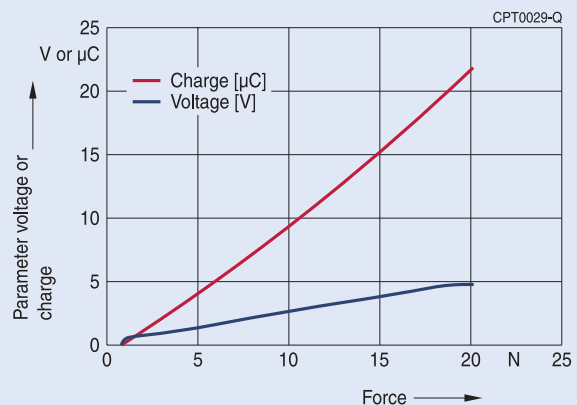
Elongation as a function of voltage measured between cymbal end-caps.



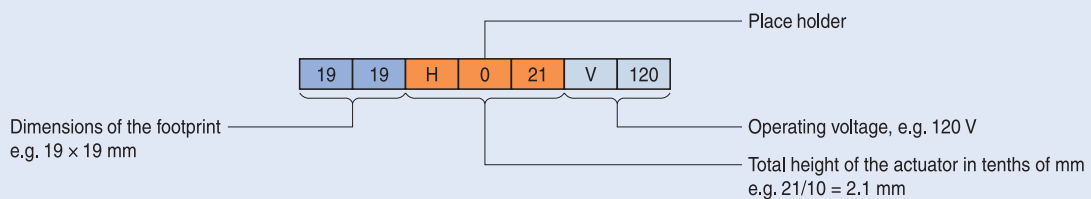
Acceleration as a function of frequency for different loads.
Input voltage has a single pulse half wave sinus signal form of amplitude 120 V and varying frequency from 50 to 500 Hz.



Sensor characteristics: open circuit voltage or short circuit charge as a function of force input.






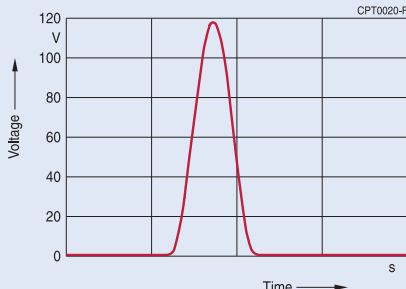



Explanation of type code based on the PowerHap actuator 1919H021V120



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Prototypes – preliminary specifications

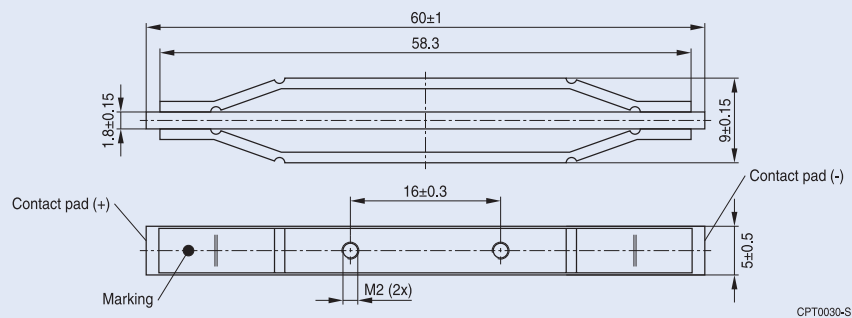
						
Type	6005H090V120	6005H070V120	0904H014V060	1204H018V060	1919H021V120	
Size l × w × h	60 × 5 × 9	60 × 5 × 7	9 × 3.75 × 1.4	12 × 4 × 1.8	19.4 × 19.4 × 2.1	mm
Ordering code ¹⁾	Z63000Z2910Z 1Z38	Z63000Z2910Z 1Z42	Z63000Z2910Z 1Z41	Z63000Z2910Z 1Z39	Z63000Z2910Z 1Z43	
Operating temperature (powered)		-40 ... +85				°C
Custom waveforms		Yes				
Force sensing		Yes				
Unipolar driving mode						
Voltage	0 ... 120	0 ... 120	0 ... 60	0 ... 60	0 ... 120	V
Acceleration (20 g mass @ sine wave 200 Hz)			2.4 (pk) 4.5 (pk-pk)	4.8 (pk) 9.2 (pk-pk)		g
Acceleration (100 g mass @ sine wave 200 Hz)	14 (pk) 36 (pk-pk)	36 (pk) 75 (pk-pk)	3.3 (pk) 6.4 (pk-pk)	5 (pk) 10 (pk-pk)	25 (pk) 52 (pk-pk)	g
Acceleration (200 g mass @ sine wave 200 Hz)			2 (pk) 4 (pk-pk)	3 (pk) 6 (pk-pk)	14 (pk) 32 (pk-pk)	g
Acceleration (500 g mass @ sine wave 200 Hz)	9 (pk) 19 (pk-pk)	6 (pk) 13 (pk-pk)			6 (pk) 16 (pk-pk)	g
Acceleration (1000 g mass @ sine wave 200 Hz)	4 (pk) 8 (pk-pk)	2 (pk) 4 (pk-pk)				g
Displacement	150	280	15	27	130	μm
Loading charge	0.5	0.5	0.03	0.05	0.44	mC
Bipolar driving mode						
Voltage (bipolar mode)	-20 ... 20	-20 ... 20	-10 ... 10	-10 ... 10	-20 ... 20	V
Acceleration (20 g mass @ single pulse, sine wave 200 Hz)	13 (pk) 28 (pk-pk)	20 (pk) 40 (pk-pk)	1.5 (pk) 3 (pk-pk)	2.5 (pk) 5.4 (pk-pk)	10 (pk) 23 (pk-pk)	g
Acceleration (100 g mass @ single pulse, sine wave 200 Hz)	10 (pk) 20 (pk-pk)	11 (pk) 23 (pk-pk)	1.2 (pk) 2.4 (pk-pk)	2 (pk) 4 (pk-pk)	11 (pk) 22 (pk-pk)	g
Unipolar driving mode (single pulse, example)			Bipolar driving mode (single pulse, example)			
						

1) These ordering codes are for prototypes only. New ordering codes will be introduced for serial parts.

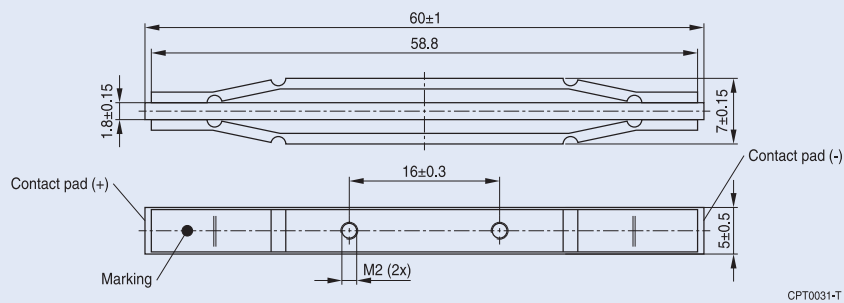
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Prototypes – dimensional drawings

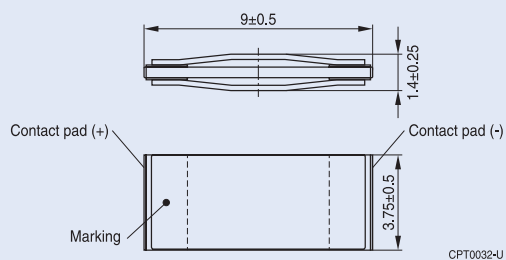
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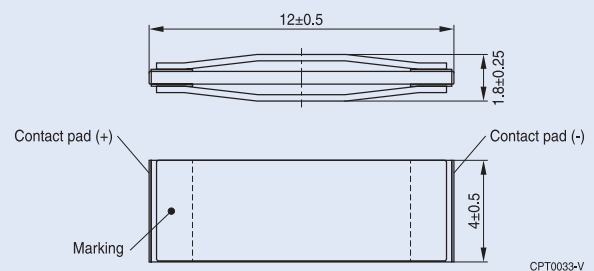
Type: 6005H070V120



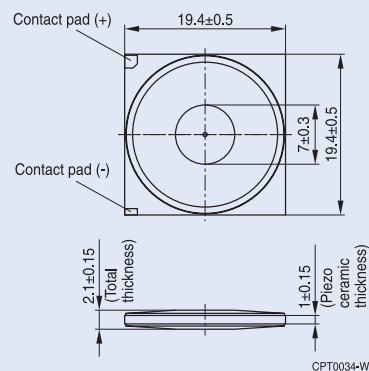
Type: 0904H014V060



Type: 1204H018V060




Type: 1919H021V120




PowerHap – Piezo Actuators for Active Haptic Feedback

Evaluation kit		
Type	1 channel evaluation kit for PowerHap	5 channel evaluation kit for PowerHap
Ordering code	Z63000Z2910Z 1Z 1	Z63000Z2910Z 1Z 7
Software of evaluation kits allows following adjustments	Wave profiles	
	Frequencies	
	Amplitude	
	Cycle count	
	Sensing function included	
Supported products	All PowerHap actuators	
Samples	One piece each included of 0909H011V060, 1313H018V120, 2626H023V120	
Example for PowerHap five channel driver board		

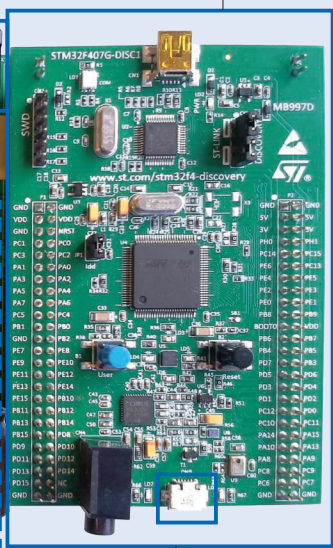
High voltage power supply module




12 V_{DC} power supply



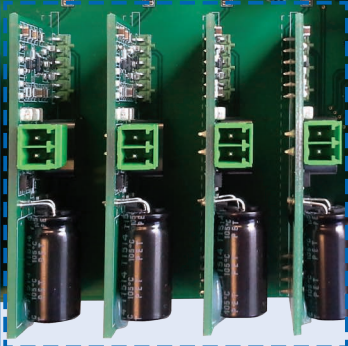
CPU unit




Output driver board



Option for four additional driver boards



Micro USB connector to PC

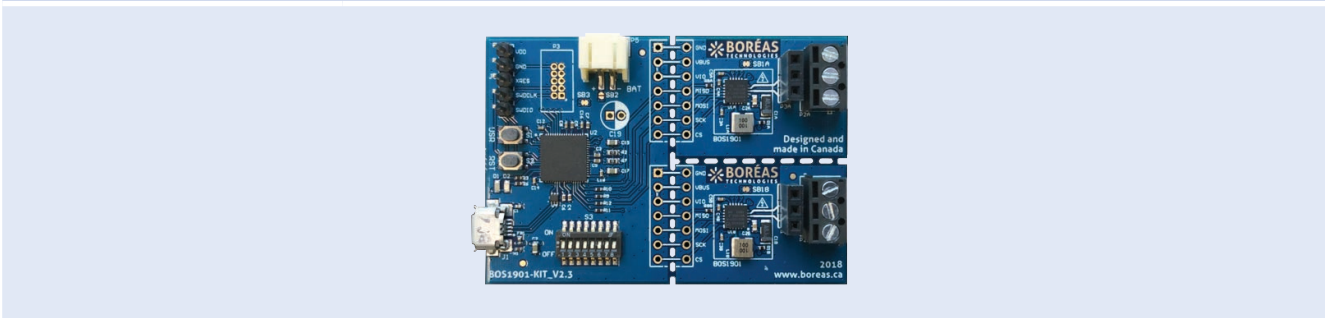


Note: These evaluation kits are NOT intended to be used as driver for our PowerHap devices in series products.

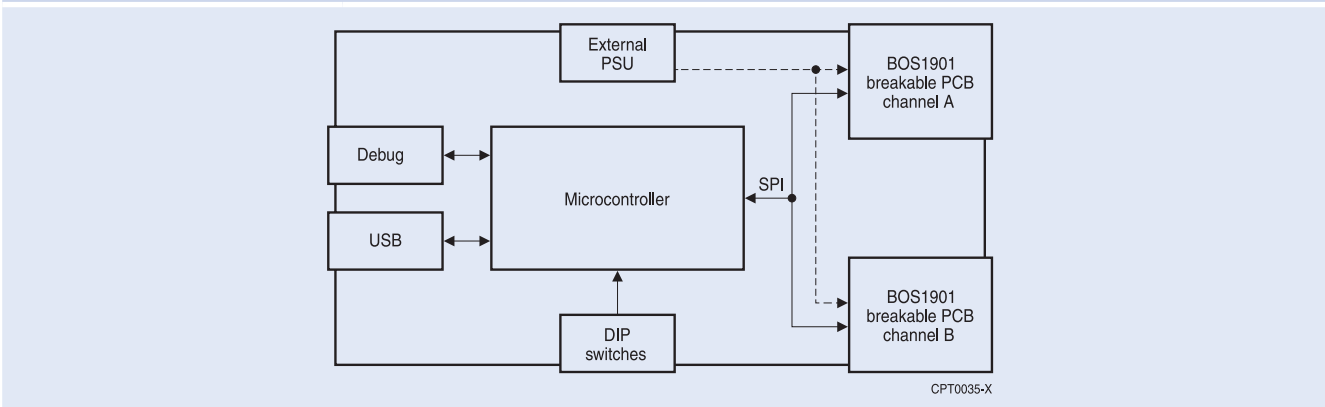
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Evaluation kit – 60 V	
Type	Evaluation kit for 60 V PowerHap actuators
Ordering code	Z63000Z2910Z 1Z44
Software of evaluation kits allows following adjustments	Wave profiles
	Frequencies up to 300 Hz
	Amplitude
	Cycle count
	Sensing function included
	USB Audio interface to prototype haptic effects in Matlab, Python, Audacity and many other software. Firmware source code provided.
Supported products	All 60 V PowerHap actuators
Samples	One piece each included of 0909H011V060, 0904H014V060, 1204H018V060
Features	Low power consumption
	Very low latency
	Very power efficient
	Small dimensions
	Two breakable miniature PCB's with BOS1901 drivers (by Boreas Technologies)

Driver board



Simplified BOS1901-KIT diagram



Note: These evaluation kits are NOT intended to be used as driver for our PowerHap devices in series products.

Structure of ordering codes: The ordering code for one and the same product can be represented differently in data sheets, data books, other publications and the website of TDK Electronics, or in order-related documents such as shipping notes, order confirmations and product labels. **The varying representations of the ordering codes are due to different processes employed and do not affect the specifications of the respective products.** Detailed information can be found on the Internet under www.tdk-electronics.tdk.com/orderingcodes.

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