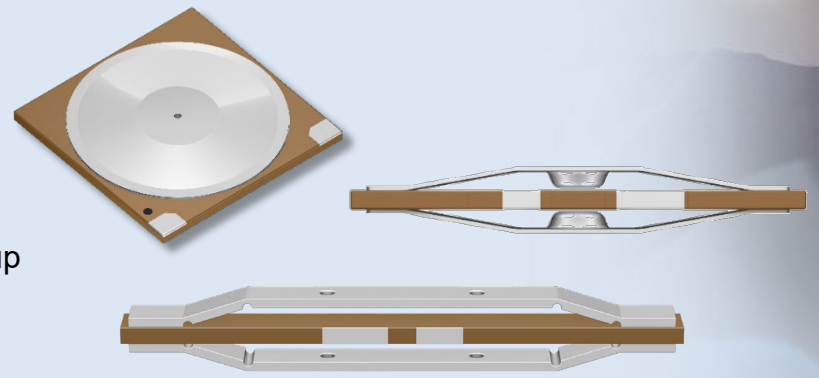
Attracting Tomorrow

PowerHap™ actuators

for active haptic solutions



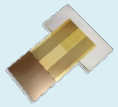
TDK Electronics AG
Piezo & Protection Devices Business Group
Munich, Germany
November 2023

Piezo Haptics solutions

A comprehensive piezo haptics portfolio

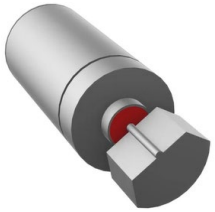
Comprehensive piezo-based actuators Overview

Attracting Tomorrow TDK

Best suitable technology for each application		Automotive		ICT		Virtual reality		General industry	Texture feeling	
										
Vibrotactile (<1000 Hz)	PowerHap™	●	●	●	●	◑	●	●	◑	**PowerHap™** **Best technology for a high-definition haptic experience** • Large displacement, force fast acceleration • High bandwidth • Small, thin, and the most powerful for heavy loads 
	PiezoHapt™ S/L	○	◑	●	◔	◑	◔	◑	◑	**PiezoHapt™ S/L** **Ultra-thin cost-effective solution** • Very low insertion height • Ideal to move low weights  
Surface friction (>20 kHz)	Booster	●	○	◑	◔	○	○	○	●	**Customized actuators (booster)** • Suitable for Hap2U display application 

Why piezo as actuator?

ERM = Eccentric Rotating Mass



Basic haptics

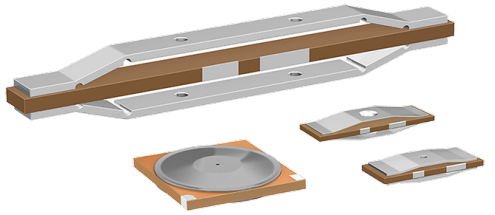
- Just notifying through vibration

LRA = Linear Resonant Actuator

Standard haptics

- More flexible than ERM
- Basic click type feedback possible
- Small bandwidth

Piezoelectric actuators PowerHap™

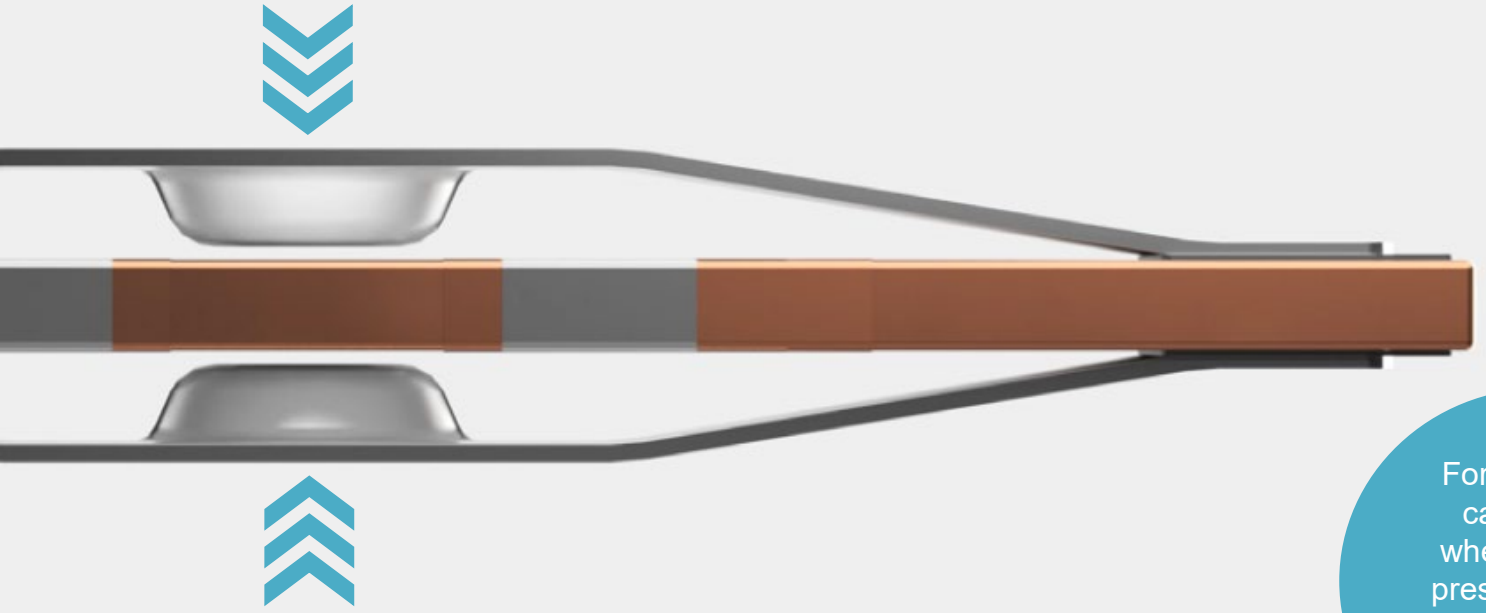


High-definition haptics

- Very fast response
- High bandwidth

PowerHap™, how does it work?

Stainless steel bows (or cymbals) on both sides of the actuator work as a displacement amplifier



Its high band-width enables endless effects by adjusting the frequency, the signal and the amplitude

The multilayer piezo-ceramic element delivers outstanding fast and precise displacements

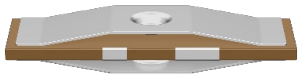
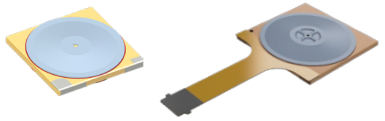
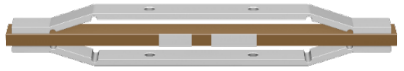
When voltage is applied (0 to 120 V), the piezo-ceramic will shrink/ contract accordingly

Force sensing capability – when applying pressure on the bows an electric charge is generated

PowerHap Portfolio and Haptic Applications

Different designs for each application

PowerHap™ in a nutshell

		Stylus	Wearables, mobile, VR	Buttons / modules / Small to medium displays	Large / heavy displays
Applications					
Max. driving specs.	Capacitance [µF, 1 V, 1 kHz]	0.26	0.50	0.9 / 2.5	3.2
	Voltage range [V]	0 to +60, +95*	0 to +60, +95*	0 to +120	0 to +120
	Displacement [µm]	15 / 23*	27 / 43*	65 / 125	120
	Acceleration** [*g*]	2.3 / 3.0*	3.3 / 4.8*	7 / 18	14
PoweHap		**The true writing feeling for stylus**	**Compact and powerful**	**Button-like feedback for switches and touchpads**	**A single actuator can move displays up to 2 kg!**
					
	Dimensions [mm] Series/type	7 x 3.75 x 1.22 **0704**H013V060	12 x 4 x 1.74 **1204**H018V060	12.7 x 12.7 x 1.8 / 19.4 x 19.4 x 2.2 **1313**H018V120 / **1919**H022V120	60 x 5 x 8 **6005**H080V120

*Overdrive mode @ +95 V – Up to two consecutive cycles with a minimum time interval of 100 ms. **Acceleration load mass 100 *g* @ single pulse, sine wave 200 Hz (g peak)

PowerHap™ for wide area of Haptic applications

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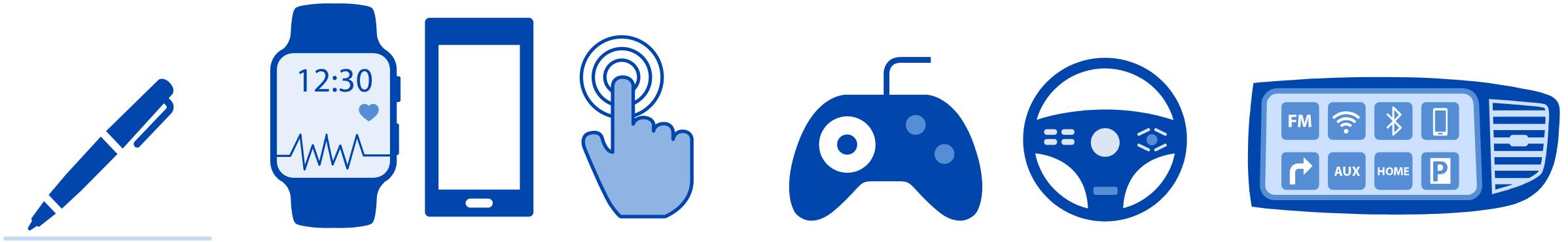
Stylus	Wearables, Mobile, VR	Buttons / Modules / Small to Medium Displays	Large / Heavy Displays



PowerHap™ in buttons/modules

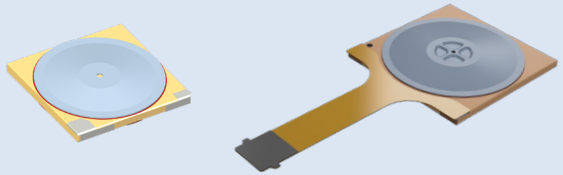
Fully configurable
Its high bandwidth enables endless tactile effects that can be reproduced from a single actuator

Compact design
Insertion heights as low as 1.8 mm are ideal for wearable and mobile devices

The quickest
Being a piezo element it provides instant responses with fast accelerations for crisp and sharp feedbacks

Force sensing
The dual function of the actuator can sense the mechanical force on the surface

PowerHap™ 1204H013V060
- Displacement: up to 47 µm
- Acceleration: 8 G, (PtP),100 g
- Stiffness:150 N/mm
- Dimensions: 12 x 4 x 1.74



PowerHap™ 1313H018V120 / 1919H022V120
- Displacement: 65 µm / 125 µm
- Acceleration: 13 G / 35 G, (PtP),100 g
- Stiffness: 130 N/mm / 160 N/mm
- Dimensions: 12.7 x 12.7 x 1.8 / 19.4 x 19.4 x 2.2

Enhance your **user experience** by delivering different **tactile sensations** according to the action or status of the device

PowerHap 1204 powerful for a crisp haptic feedback
A compact design ideal for VR/AR Gloves

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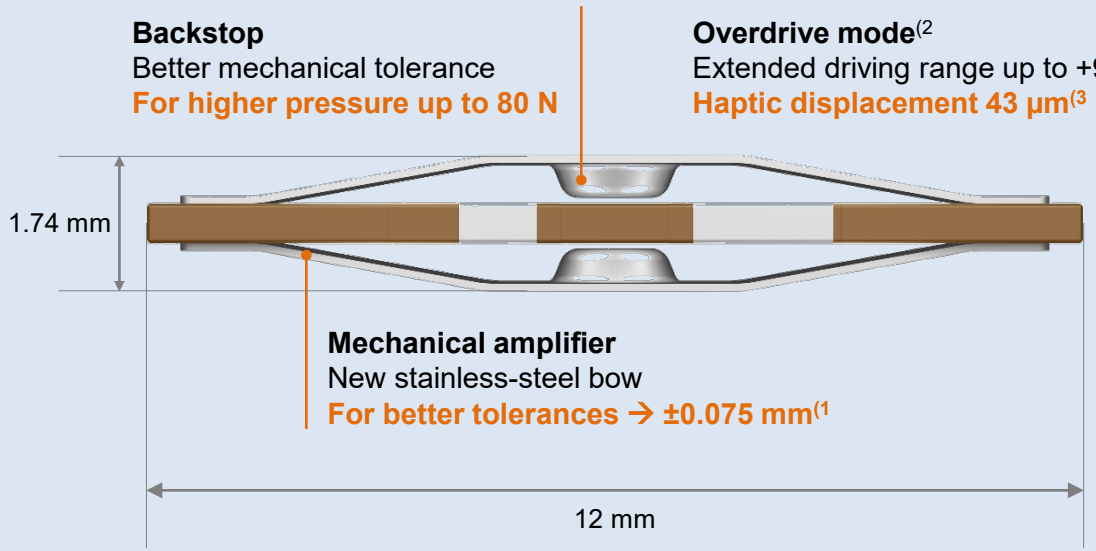
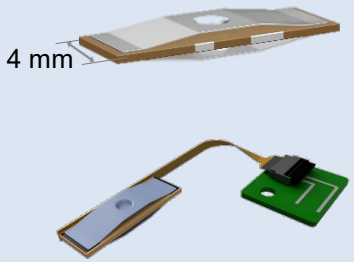
PowerHap 1204H013V060 – Adjustable haptic feedback and force sensing



Capacitance 0.45 µF @1V, 1kHz	**Voltage range** 0…+60 / +95 V(2
Displacement 27 / 43 µm(3	**Acceleration** 6.9 g, (PtP), 100 g
Stiffness 160 N/mm*	**Frenquency** 700 Hz



Insertion height as low as 1.74 mm is ideal for **wearable and mobile devices**

PowerHap 1313 / 1919
Button-like feedback for switches and touchpads

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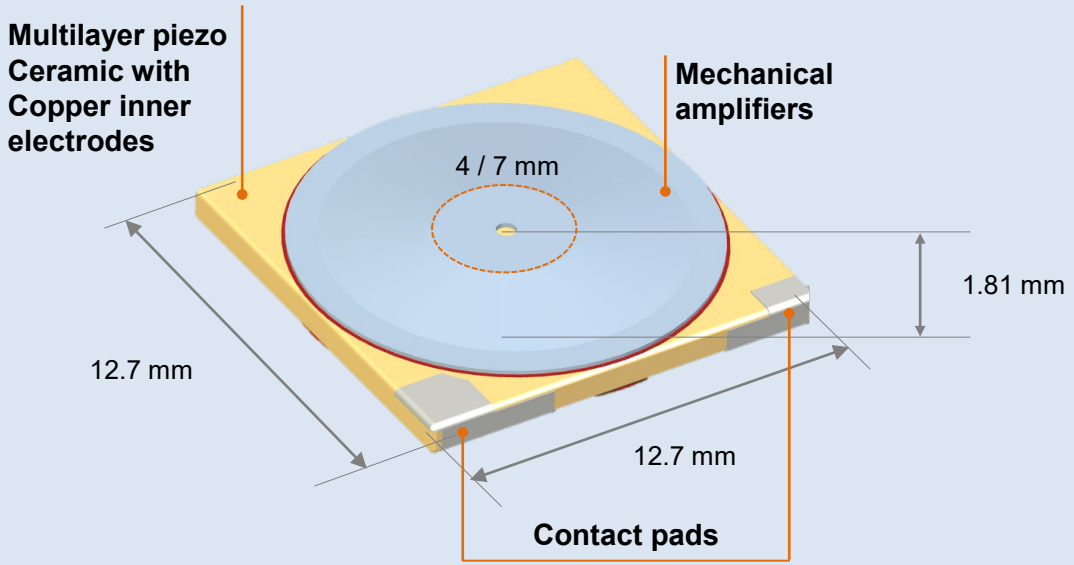
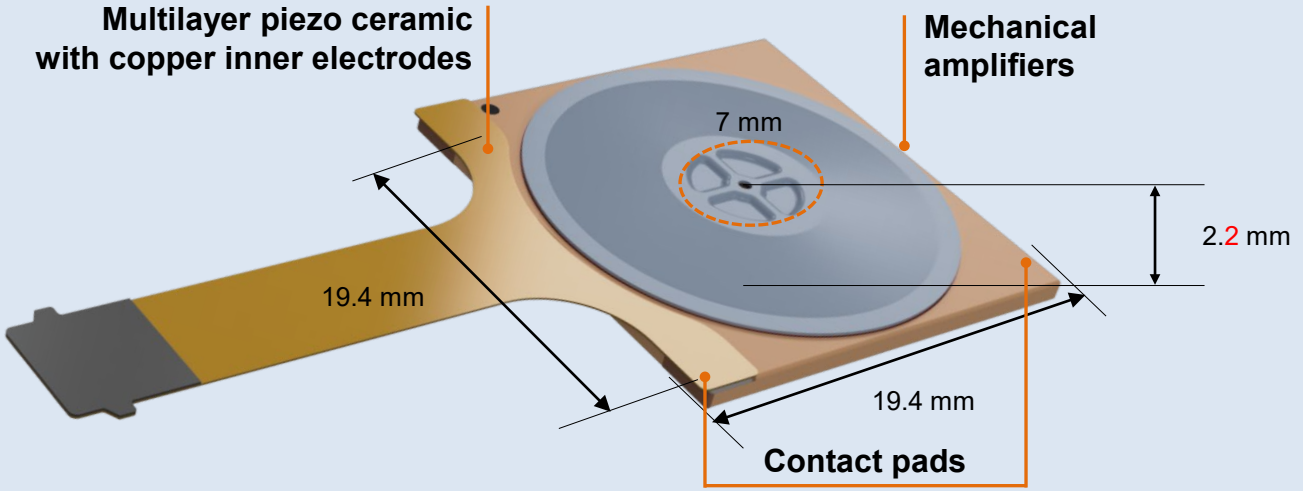
PowerHap 1313H018V120 / 1919H022V120 – Adjustable haptic feedback and force sensing





PowerHap 1313H018V120	
Capacitance	0.9 µF @ 1 V, 1 kHz
Voltage range	0 to +120 V
Displacement	65 µm
Acceleration	13 *g*, (PtP), 100 *g*
Stiffness	130 N/mm*

PowerHap 1919H022V120	
Capacitance	2.5 µF @ 1 V, 1 kHz
Voltage range	0 to +120 V
Displacement	125 µm
Acceleration	35 *g*, (PtP), 100 *g*
Stiffness	160 N/mm*

Homogeneous and crisp feedback across the display with a single actuator in lateral setup

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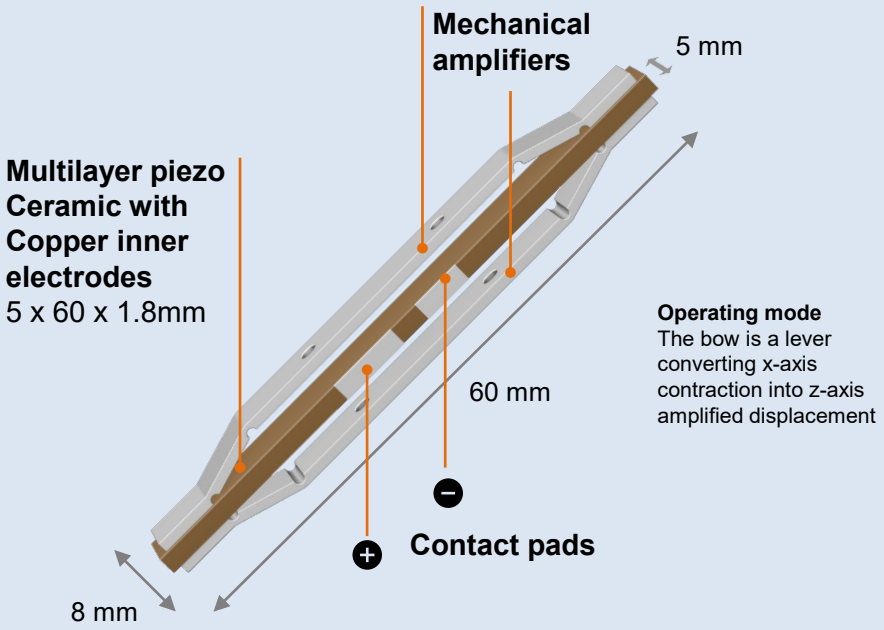
PowerHap 6005H080V120



Operating mode
The bow is a lever converting x-axis contraction into z-axis amplified displacement

Capacitance
3.2 µF @1V, 1kHz

Voltage range
0…+120 V

Displacement
120 µm*

Acceleration
8.7 G, (PtP), 1.000 g

Stiffness
340 N/mm*

Why PowerHap 6005H080V120 for displays?

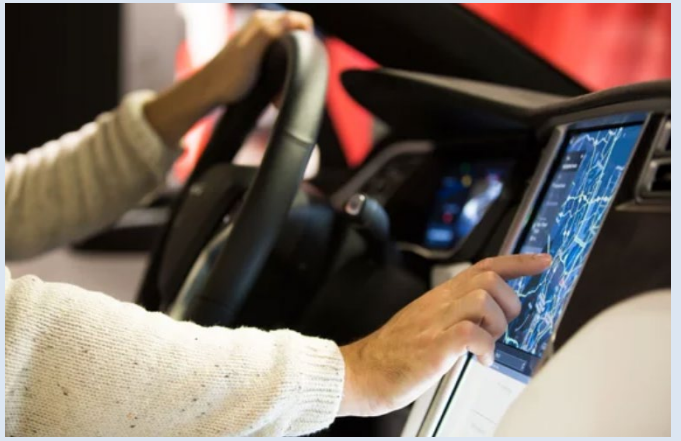
Fully configurable – A high bandwidth enables reproducing gesture, surface, and rendering effects

Powerful – A single actuator can move displays up to 2 Kg!

Silent – Having the actuator in a lateral configuration the system becomes very quiet

Damping – The same actuator damps the tail signals

Cost-effective – Reduce significantly the cost of integration and electronics



*@120 V, 10 N preload, and 25ºC

PowerHap 0704 enables the true writing feeling by moving the tip of a stylus

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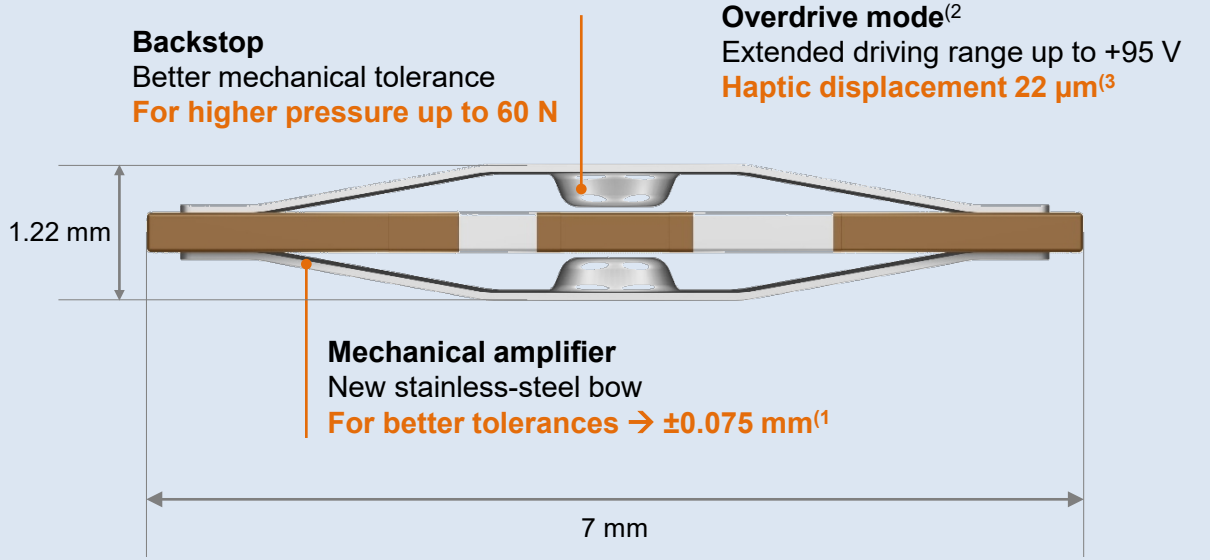
PowerHap 0704H013V060 Specs



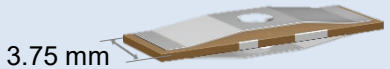
Capacitance
0.21 µF @1V, 1kHz

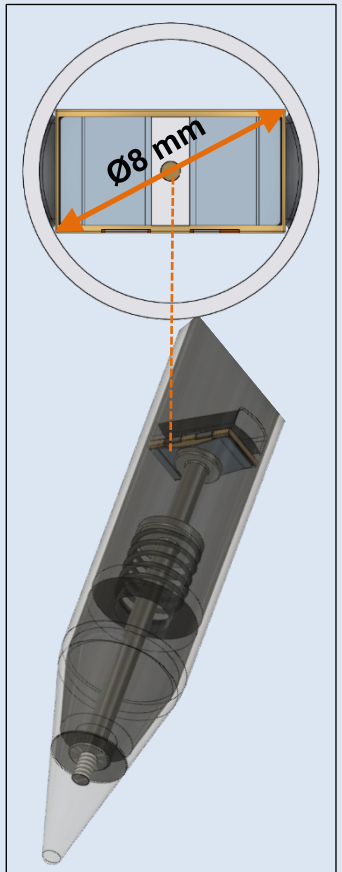
Voltage range
0…+60 / +95 V(2

Displacement
14 / 22 µm(3

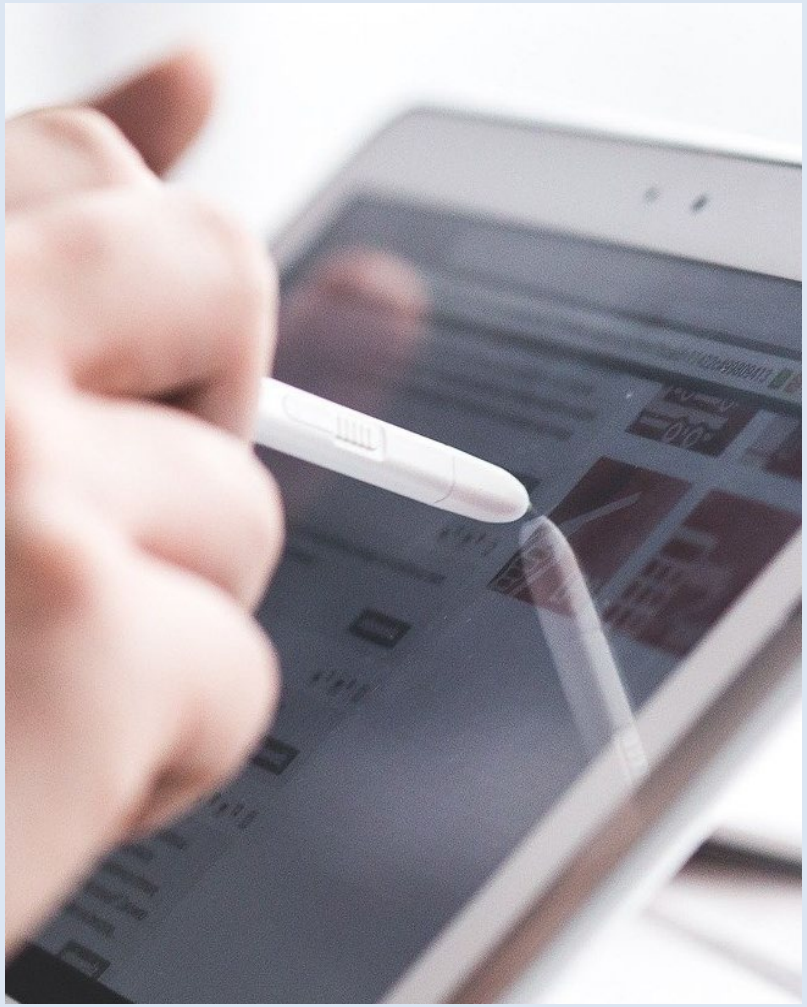
Acceleration
3.8 G, (PtP), 100 g

Stiffness
160 N/mm*





PowerHap 0704 insertion in Stylus

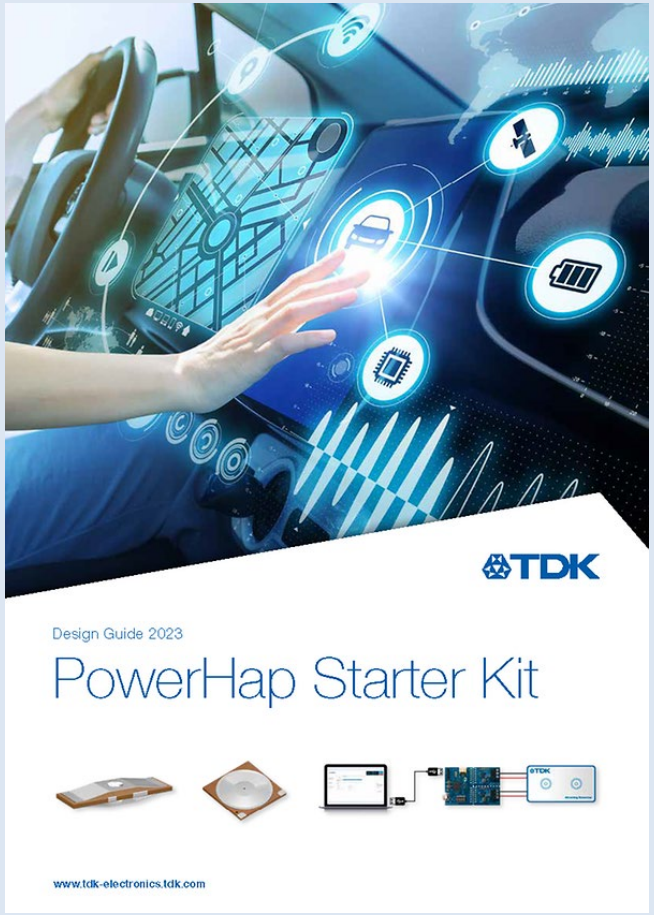


1) All PowerHaps are measured at the end of the line. The tolerance target is ±0.05 mm.
2) Extended voltage range for up to two consecutive cycles with a minimum time interval of 100ms. Getting approx. ~50% in displacement → a much better experience.
3) Driven at Overdrive mode +95 V

PowerHap Tools and Material Support

Speeding-up your haptic application

The PowerHap starter kit



PowerHap Starter Kit

PowerHap Starter Kit offers haptics and sensing experience with PowerHap actuators out-of-the-box. It is a standalone plug-and-play product development tool to experience and understand the capabilities of the TDK PowerHap actuators. In addition, this reference design shows how to integrate the actuator mechanically and how to adapt it to various applications.

Content

- Seamless button assembly (incl. PowerHap 1204H018V060 and PowerHap 1313H018V120)
- Round button assembly (incl. PowerHap 1204H018V060)
- Boréas Technologies BOS1901-Kit driver board
- Additional PowerHaps
- Accessories

Features

- Fully modular buttons: a seamless button and a round button
- Customizable high-definition haptic experience with very fast response and unlimited bandwidth
- Fully adjustable sensing and waveform parameters
- Design Guide and further reference design

Starter Kit Resources

Design Guide | Data Sheet | Download Design Files | Order Starter Kit

https://www.tdk-electronics.tdk.com/en/2124786/products/product-catalog/switching-heating-piezo-components-buzzers-microphones/powerhap

The PowerHap starter kit
What is it and what can I do with it?

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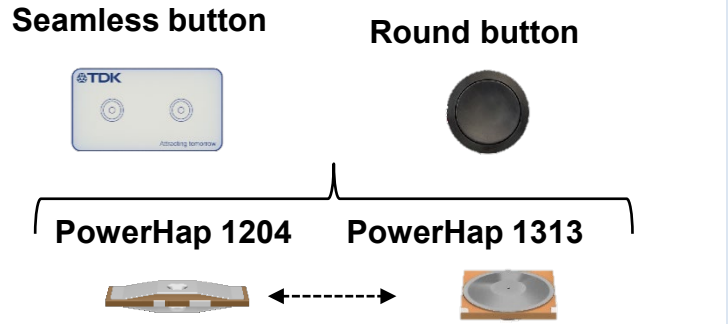
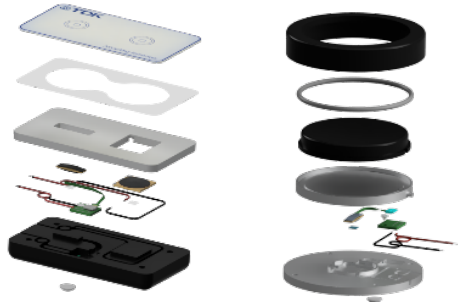
The PowerHap™ actuator starter kit provides an easy and fully configurable high-definition haptic and sensing experience. It also provides reference designs for different interfaces

- Haptics and sensing experience with PowerHap actuators out-of-the-box
- Customizable high-definition haptic experience with very fast response and unlimited bandwidth
- Fully adjustable sensing and waveform parameters.
- Design guide included with reference designs for further build interfaces.

Fully modular
Exchangeable PowerHaps between buttons



Reference designs
for further build interfaces



Fully configurable
Sensing and haptic feedback waveform

Boréas DevKit – Driver & Software

The PowerHap starter kit
What is inside?

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Content

- 1 Seamless button assembly
  (incl. PowerHap 1204H018V060 and 1313H018V120)
- 1 Round button assembly
  (incl. PowerHap 1204H018V060)
- 1 Boréas Technologies BOS1901-Kit driver board
- 1 extra PowerHap 1204H018V060 (cables included)
- 1 extra PowerHap 1313H018V120 (cables included)
- 1 USB cable
- 1 Quick guide

PN: Z63000Z2910Z1Z73

PowerHap documentation

Design guide online – kit can be ordered through Distributors

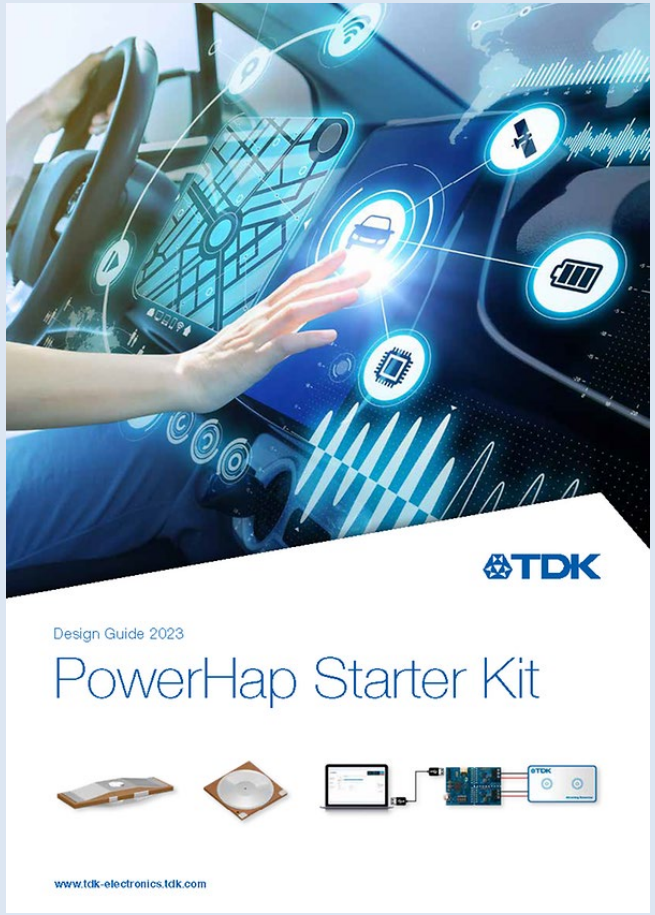
Quick guide
Plug and play manual

Design guide
PowerHap integration

Product brief &
Data sheet

Application notes
Technical customer support

(Upon request)



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