Konstruktionsrichtlinie
Design guideline

VR-00103

MX Ultra Low Profile

MX6C – xxxx

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CHERRY MX Ultra Low Profile

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1 General

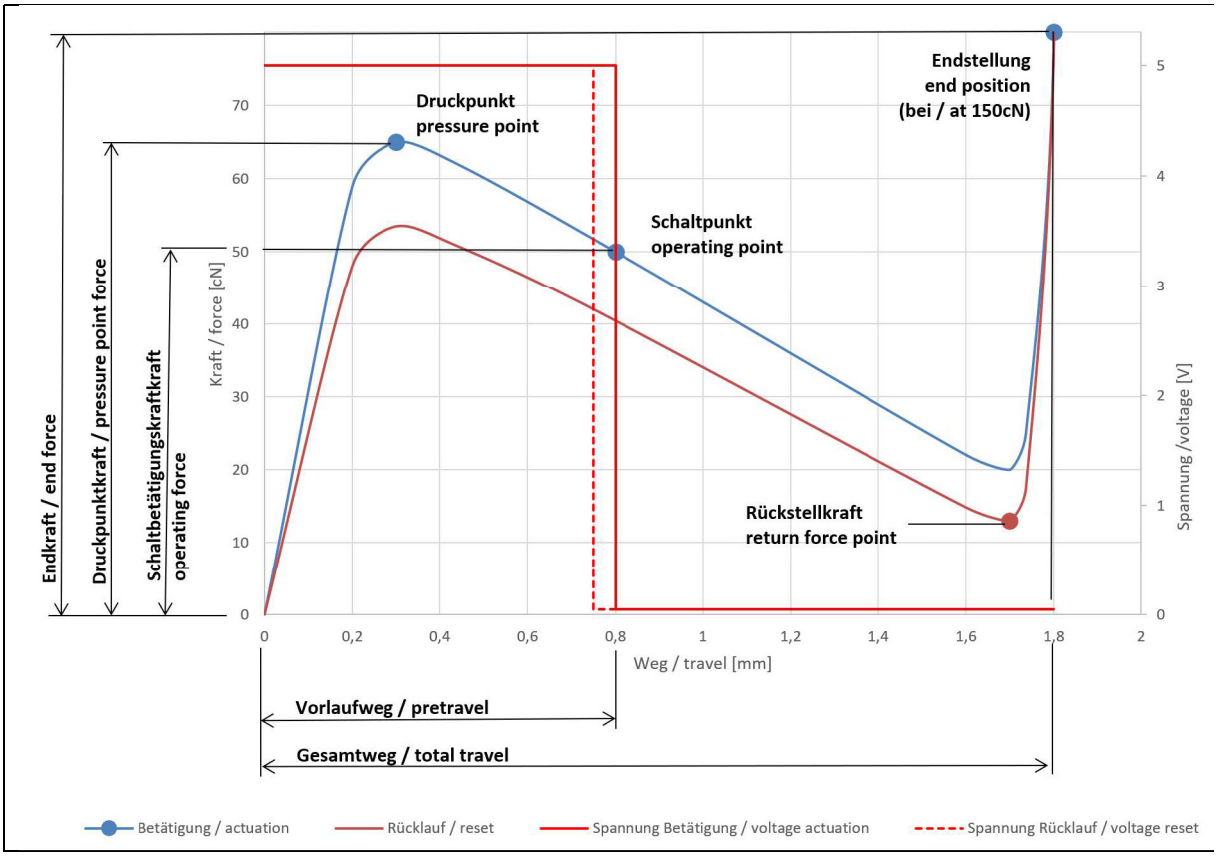
This key switch design guideline is valid for the standard version of the switch MX6C-XXXX.

ATTENTION:
This design guideline is only valid in connection with the respective switch drawing, which always takes precedence over the design guideline, for more information see technical specification TSM0058.

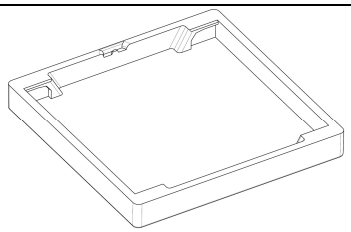
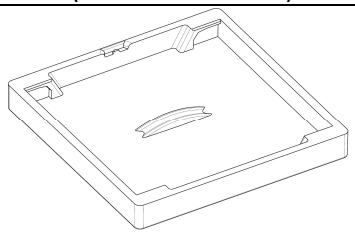
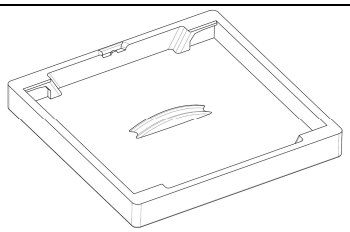
The following description is a recommendation for installing the MX6C-xxxx keycaps in the keyboard and shows various solutions that influence both the force-displacement curve and the sound of the switch.

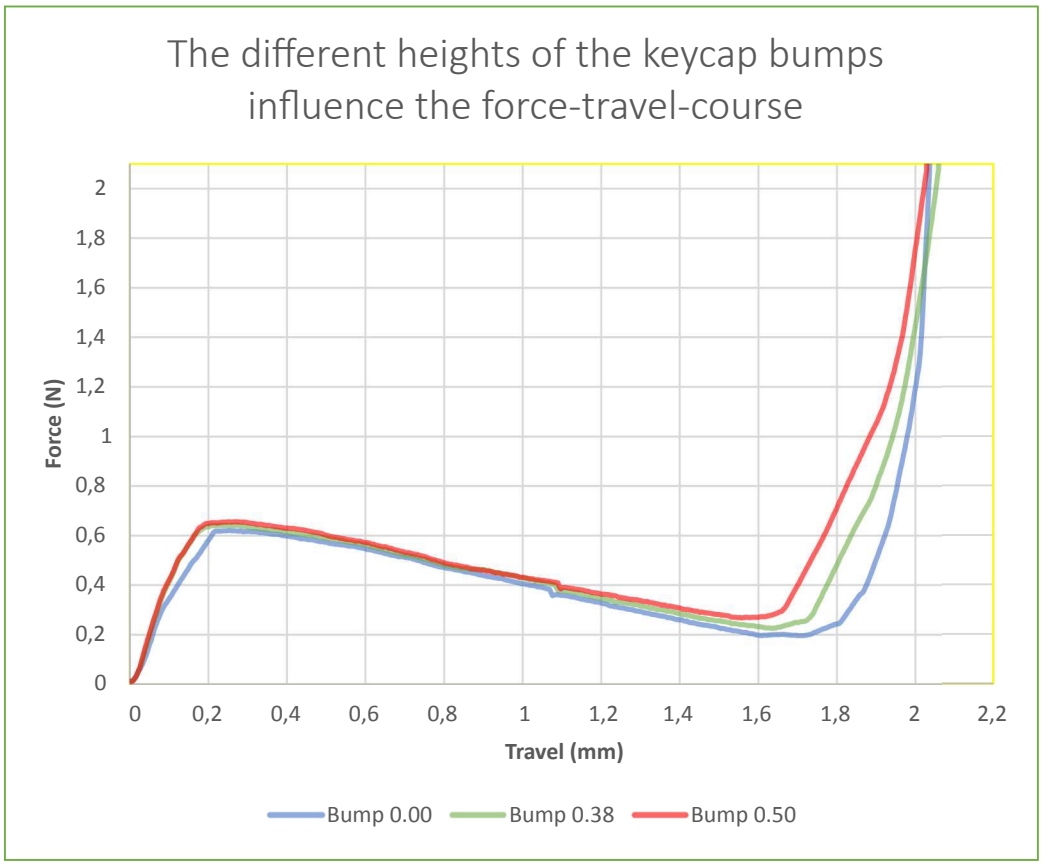
2 Force-Displacement

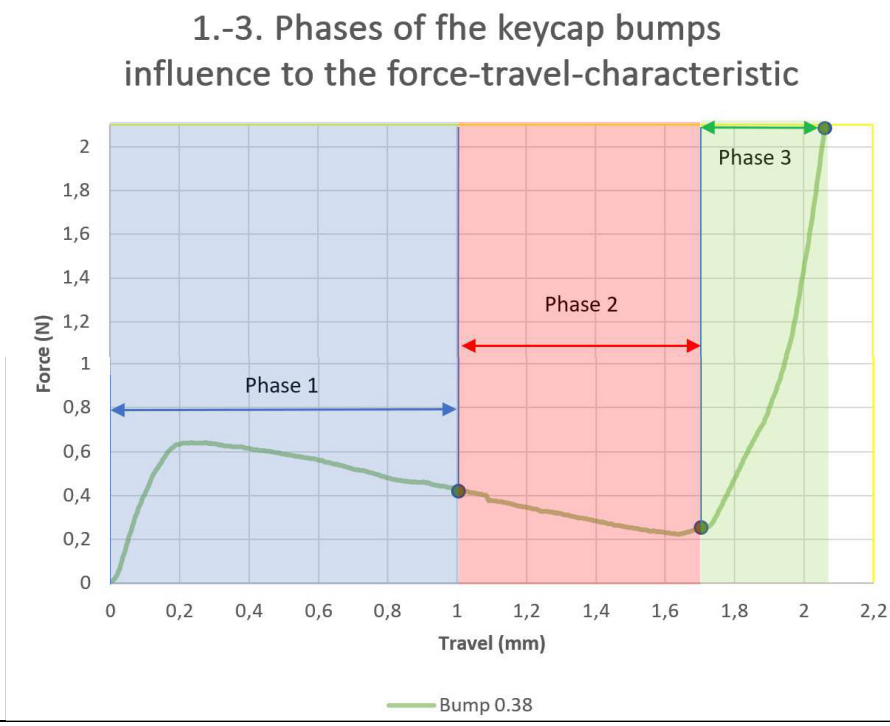
2.1 Typical force-travel-voltage chart



2.2 Effect of keycap design on the force-displacement characteristic

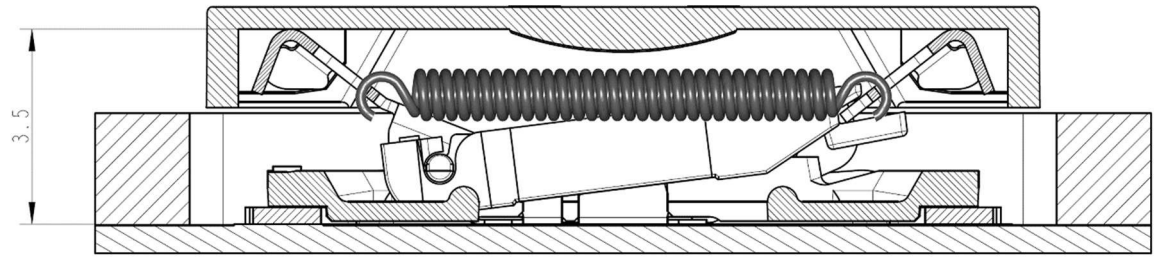
Bump 0.00 mm	Bump 0.38 mm (recommendation)	Bump 0.50 mm
		



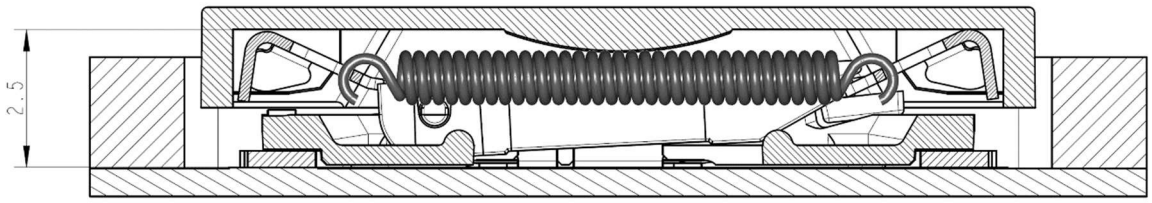


Note: In general a standard 0.38 bump of the keycap is recommended.

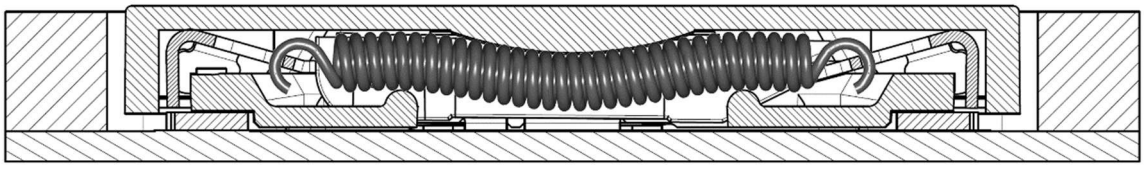
Phase 1. No contact between spring and bump in the keycap. No influence on force travel ratio.



Phase 2. The spring in touch with the bump in the keycap

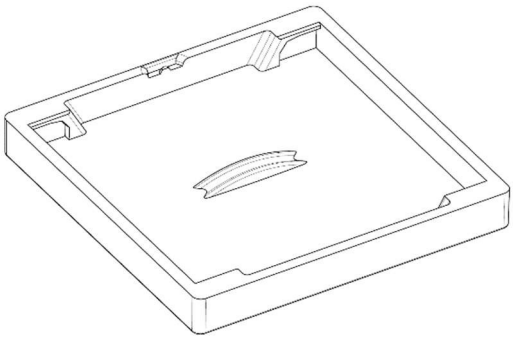


Phase 3. The spring in touch with the housing. Increased return point force can lead to different haptics due to different bump heights and the return force of the spring

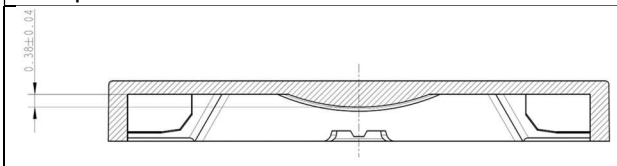
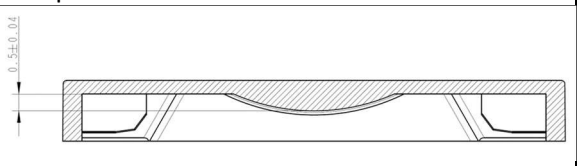


Due to friction and weight caused by stabilizers and/or larger keycaps (e.g. space bar), low return forces can cause the keycap not to return to the origin rest position. Therefore, a larger bump, for example 0.50mm, should be used in those keycaps.

2.3 Keycap with 0.38 mm and 0.50 mm bump



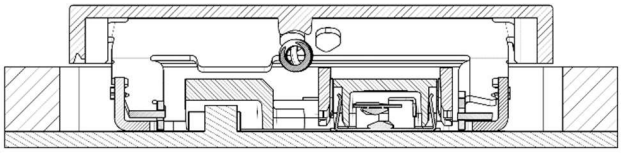
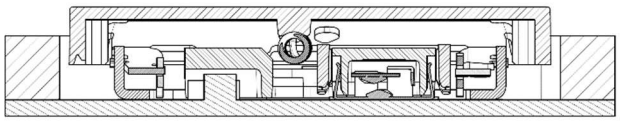
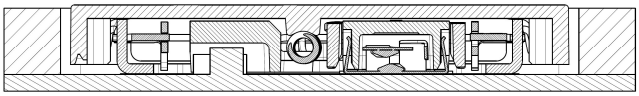
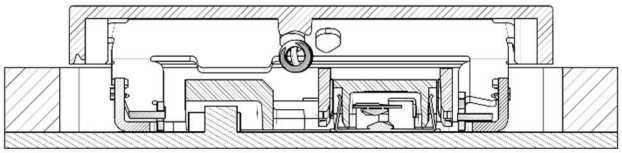
A sample 3D files can be requested from Cherry Europe GmbH for reference.

Bump 0.38 mm	Bump 0.50 mm
	

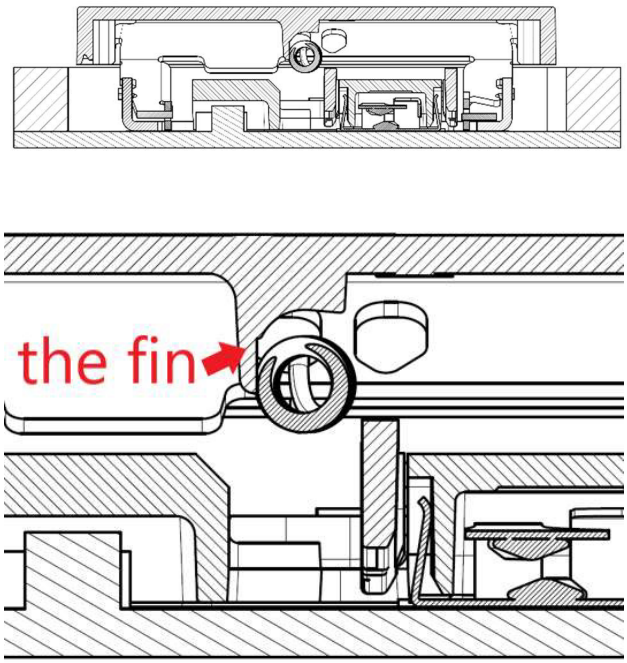
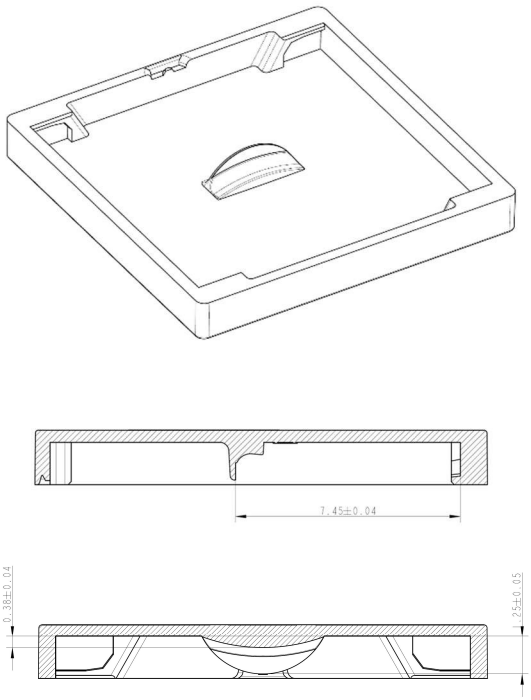
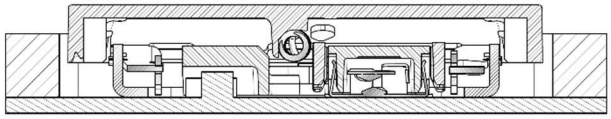
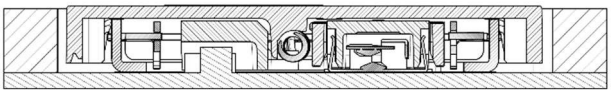
3 Sound of the switch

3.1 Explanation

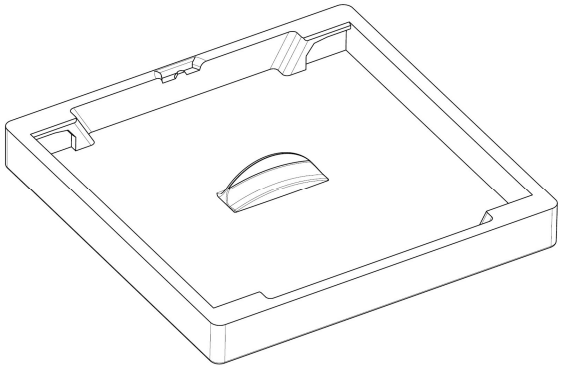
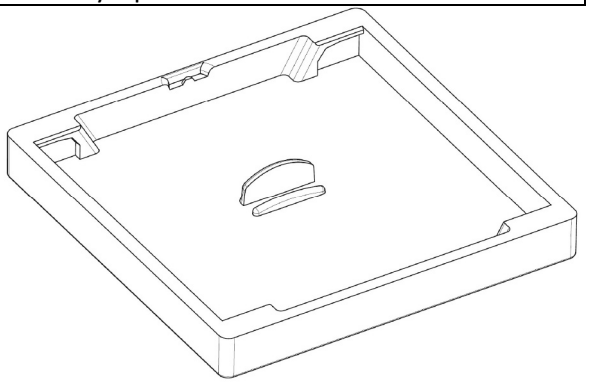
A special sound is typically produced by mechanical switches. If this sound is to be eliminated, there are various solutions to reduce the pinging sound of the spring and change the sound characteristics with a dampening mat.

	The rest position, the spring is untouched.
	Actuating point after 1.0 mm of travel. The spring is in contact with the bump on the keycap. The bump is holding the spring and prevents vibration, suppressing any sound from the spring.
	Bottom out position, switch pushed through. The switch creates a mechanical sound with the metal parts. The rest
	position after full return. The spring is released now and can vibrate, generating the typical ping sound.

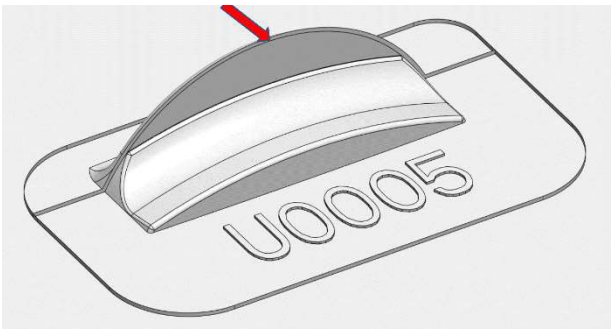
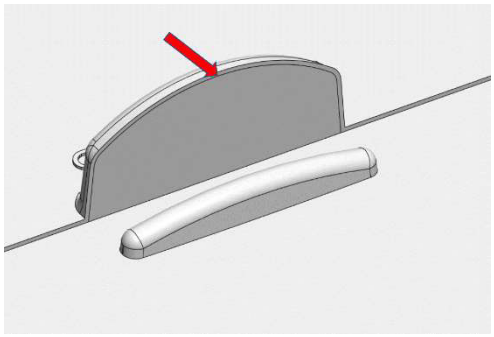
3.2 Sound canceling with the keycap to reduce the spring sound

	Switch in rest position. The spring is held by the key cap bump and cannot vibrate. 
	Actuating point after 1.0 mm of travel. The spring is held by the key cap bump and cannot vibrate.
	Final position, pushed through. The spring is held by the key cap bump and cannot vibrate. Note: In the bottom out position, the impact of the key caps can cause some noise, see point 3.3

3.2.1 Technical recommendation for risk of marks on the keycap

Version 1 Standard bump combined with sound cancelling fin	Version 2 Two ribs design to reduce the risk of sink marks on the keycap
	
Note: The fin can be combined with any bump height.	

3.2.2 Technical recommendation for the molding tool

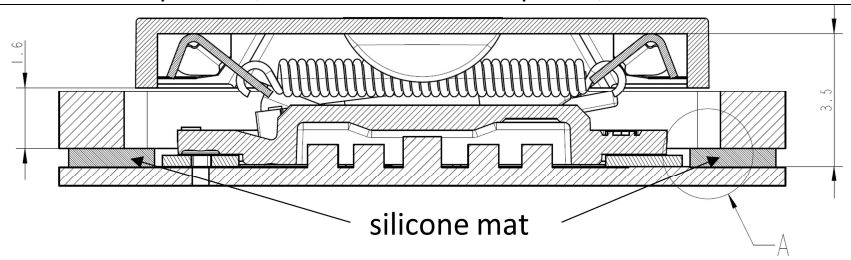
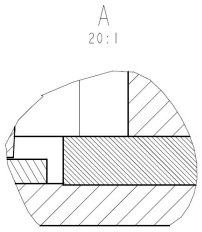
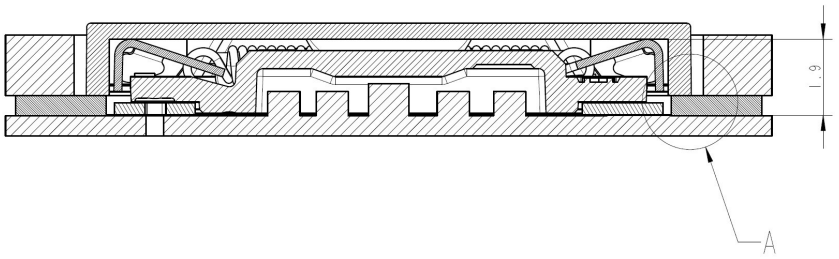
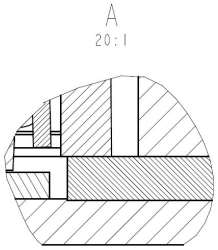
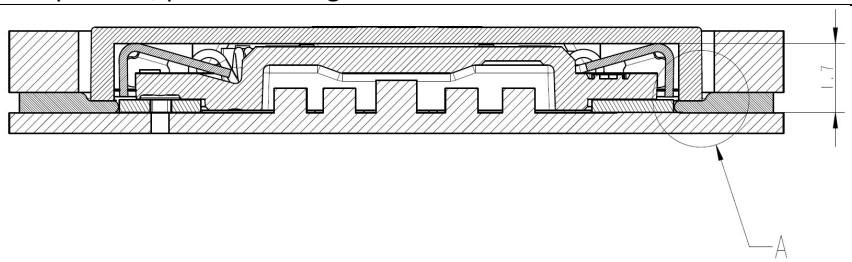
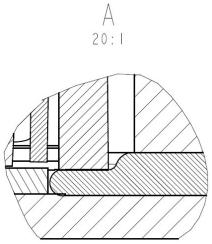
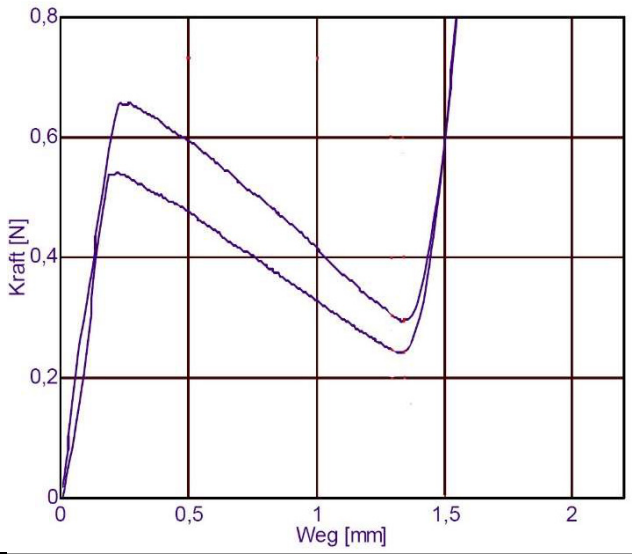
Ventilation at the cam peak position
 

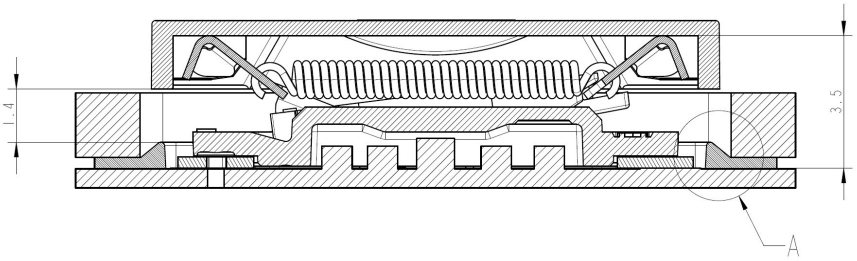
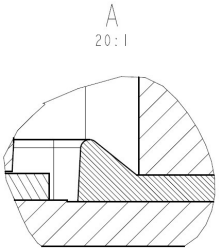
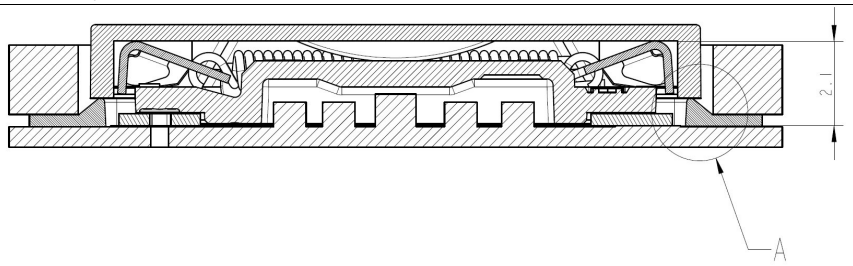
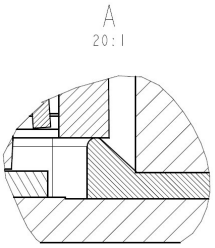
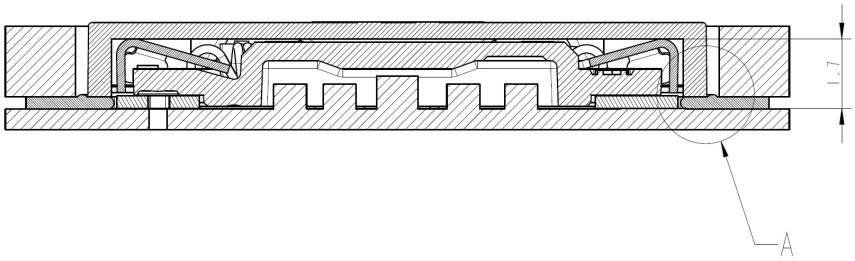
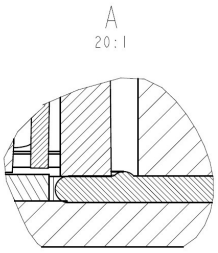
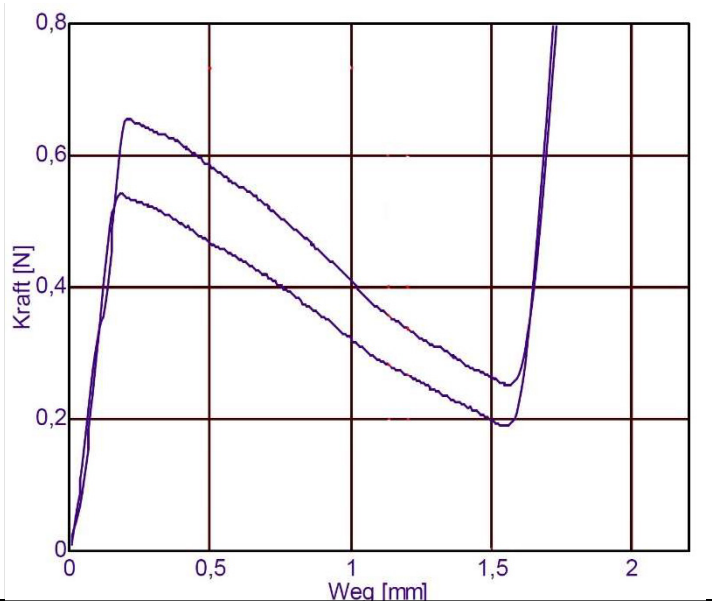
3.3 Sound canceling with a dampening mat in the final position

To reduce unwanted sounds of the ULP switches and the metal keyboard housing, a dampening mat can be added inside the product.

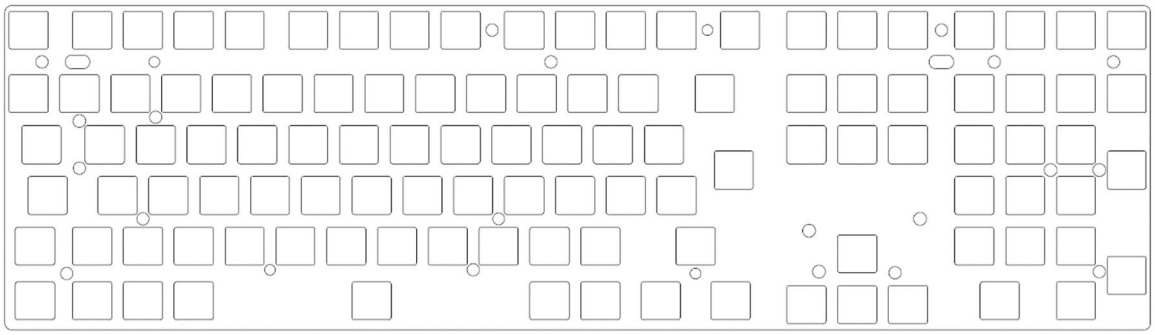
This mat is to be placed between the frame and the PCBA.

CHERRY recommends these mats to be made from silicon, shore hardness A40 – 60 +/-5, 0.5mm thick.

Switch in rest position, silicone mat without profile, thickness: 0.5 mm	
	
Actuated, silicone mat touched	
	
Final position, pushed through	
	
	The thickness of silicon mat has influence on the return force and end position in the force-travel-characteristic

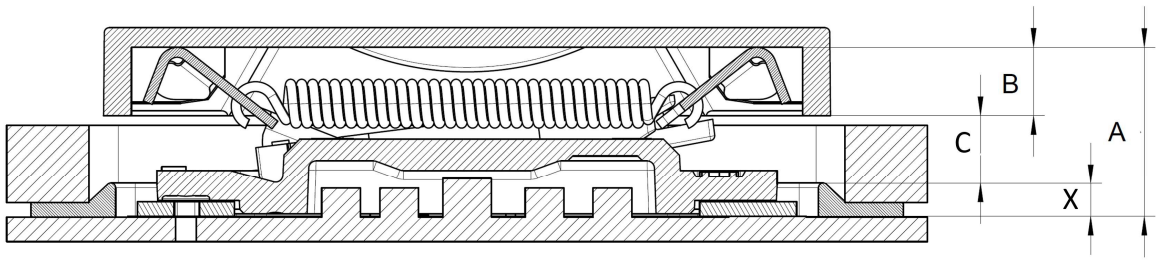
Switch in rest position, silicone mat with profile, thickness: 0.8 mm	
	
Actuated, silicone mat touched	
	
Final position, pushed through	
	
Note: If required, the profiled silicone mat can be used for better illuminatin of the keyboard.	
	The thickness of the silicon mat has influence on the return force and end position in the force-travel-characteristic

Below picture shows an example for a silicone dampening mat design. Shore hardness A 40 – 60 +/-5, 0.5mm thick.
The cutout for each switch should be 13.4 x 13.9mm (H x W) and can be changed accordingly for any other key sizes.



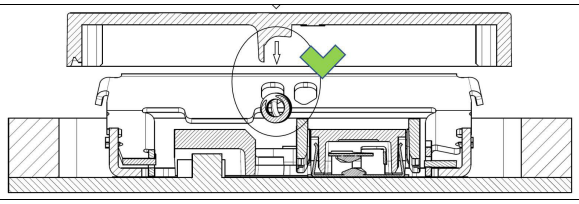
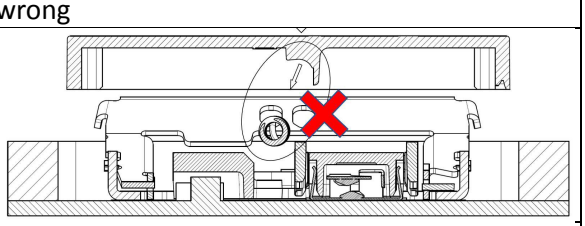
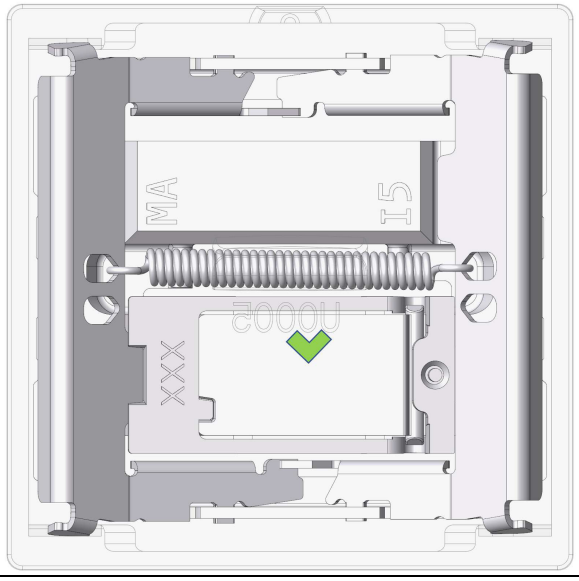
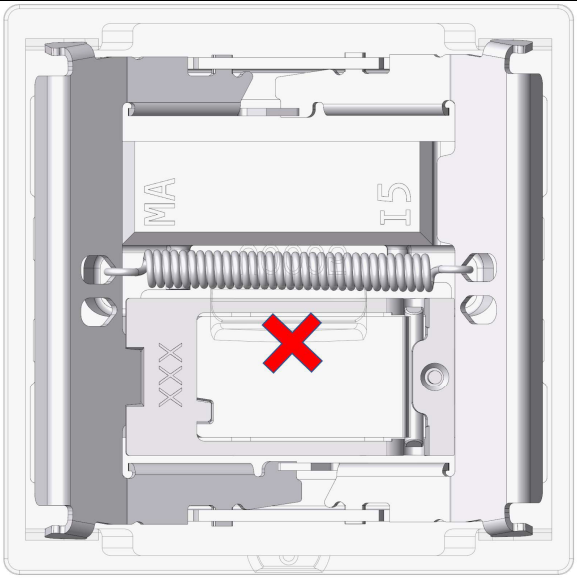
The thickness of the silicone mat can be calculated as follows:

X=A–B–C
X – Thickness of silicone mat
A – Distance between keycap and PCB, usually 3.5 mm
B – Thickness of keycap
C – Distance between the silicone mat and the bottom edge of the keycap, recommendation for profiled mat is 1.4 mm and for a flat mat 1.6 mm



4 Mounting the keycap

Assemble the keycap after the soldering process

correct	wrong
	
	If the keycap is installed in the wrong orientation, the bump can damage the base of the switch
	

Note: If after the soldering a processing functional test ist planned, it should be done before mounting the keycaps.