Electronic Design

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11 Myths About Electromechanical Tactile Switches

This article debunks the misconceptions surrounding the integration and usage of tactile switches in a wide array of devices.

1. Switches are a normalized commodity.

The saying "no two snowflakes are alike" also applies to switches. Unlike connectors in which male/female coupling can be possible, even if the two components are from different origins, there's no industry standard mandating uniform design, form factor, or behavior when it comes to switches. As a result, each switch manufacturer has total freedom to define its design, select raw materials, and target different performance criteria or market needs (e.g., high-end industrial vs. low-cost toy market).

2. The same form-factor switches from various manufacturers are all the same.

The devil is in the details! Even pin-to-pin compatible, or side-by-side comparable, tactile switches can create different functionalities and perhaps different user perception on how they should work. In any case, the mechanical equivalence doesn't automatically mean correlation of actuation force, travels, haptic feeling, low current capabilities, overload resistance, corrosion resistance, reliability, and so on.

C&K's KSC family represents a system where configurations can be combined to deliver a complete switch solution. Actuators, domes, and housings are able to be mixed in order to obtain the right dimension, haptics, and resistance to meet environmental requirements.

The KMR series of tactile switches, developed by C&K, offer long-life and ultra-low-current capabilities. The switches are designed for automotive, medical, consumer, and industrial applications.

3. I can pick a switch part number (P/N) from any catalog at the last minute for my electrical device development.

It's possible, but you will probably experience a few issues. Tactile switches are small devices, manufactured by micro-mechanical companies. They're also sensitive to their surrounding elements, such as their shape, their own manufacturing tolerances, and even their assembly constraints. Consequently, it's not uncommon for some switches to be incompatible with specific devices.

The quality of the final result in the application will be led by tiny details, such as using mechanical stoppers to achieve extreme overload resistance on a button, optimized soldering reflow to get the leanest printed-circuit-board (PCB) manufacturing process, and button/switch alignment to create optimal haptic feeling and extend product lifetime.

4. The tactile switch will be the only contributor to my product's haptic feeling.

Even if the tactile switch will be the source of the haptic feeling perceived by the final user, its tactile ratio, collapsing acceleration, and sound will be affected by how its button was designed in addition to the free volume around it. Searching for a high click ratio with a soft rubber external button is kind of a (frequent) paradox! The tactile switch will never be able to produce the haptic feeling alone, because the button mechanism on top of it will always absorb, amplify, or modify its original haptic criteria. An intricate co-design work between the switch manufacturer and its integrating customer is the best way to reach the desired haptic feeling on the final application.

5. Switch travel selection doesn't matter for my electrical

device.

Considered like that, there's a big chance that the perceived haptic quality for the final user won't meet the manufacturer's expectations. The final user's perceived feeling generated by the haptic is the combination of the touch, sound, and motion of the user's finger. Usually larger equipment, or those used in vibrating environments (e.g., inside a running car), benefit from longer travels since the user feels more comfortable to interpret the haptic. For example, if the user's hand is shaking due to bumpy roads while riding in a car, the travels on the buttons should correspond with those bumps so that his brain can interpret the motion.

6. I need to select the highest tactile ratio to get the best haptic in my application.

This really depends on what you're looking for in a haptic signature for your device, and what you have designed on top of the switch. As stated above, more parameters than just the tactile ratio impact the haptic feeling, such as force, travels, acceleration, and sound. However, the highest value doesn't necessarily mean the best. A good example is a hearing-aid button—no one wants a loud and direct noise penetrating the ear when actuating the device.

7. A tactile switch is a universal device answering any final user need.

Since there's no universal perception for a switch actuation, there's no universal switch. Before making the right switch selection decision, it's important to define and understand who will be your final user. Criteria like a person's age, culture, gender, etc., can and should influence a differentiated switch selection.

8. My design or integration around the switch has no impact on its behavior.

We already talked about the haptic impact, but a switch's design and integration with devices are also determined by its reliability. Since tactile switches are small and, in some cases, fragile devices, the integration can enhance their basic performance. For example, the button on top of a switch needs to be well-aligned to receive all of the haptic transmission. Otherwise, random side movements will absorb a portion of the transmission, altering the button's intended performance in some way. Moreover, integration can be used to enhance the switch's performance (such as adding mechanical stoppers to its button) to ensure long-term reliability.

9. Low-end switches are equal to high-end switches.

Many manufacturers produce low-end switches because they simply don't have the technology and processes to create high-end versions. While low-end switches have similar form factors and design functions as their high-end counterparts, they just don't get the same job done.

This all relates to the efforts put into the details of the switch design, and into the technologies needed to build each single component of the full switch itself. For example, only high-end switches can offer a combination of high force (>4 N) and long lifetime (>1 Mcycles), be IP67 or more, withstand a harsh chemical environment, and allow the final application button's haptic feelings to be more homogeneous. Bottom line: The switches, whether low-end or high-end, need to meet the reliability and quality expectations of the user who is buying it. And you get what you pay for.

10. A side switch is the only option for my side-actuation design.

Not only is this a misconception, but a top-actuated switch is better able to cover the device functionality than any side switch. Side switches have more complex mechanisms than their vertical counterparts as the motion to the dome must be turned 90°. Side actuation on the edge of a PCB, or in a flat casing side design, can also be achieved by placing a top and narrow actuated switch on a flex PCB, or by directly seating the switch mid-mount on the PCB.

11. Dome arrays and rubber keypads are less expensive than a set of switches.

It depends. Dome arrays and keypads represent a technology that has been developed for wide keyboards with a high number of keys. It's possible to make this bold statement for a keyboard with less than 10-15 keys, but only by comparison of the direct purchasing price.

However, tactile switches are surface-mount technology (SMT) components directly assembled onto the PCB, and require less pad surface than an equivalent dome array. Moreover, if the complete application needs more electronic components on the PCB, then the switch assembly becomes transparent, and the keypad is manually assembled. In comparison, tactile switches are enclosures that are completely tested and protected against dust ingress, achieve short travels, and require less time to assemble than dome arrays or rubber keypads.

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