Reverse Dimple Compensates for Tactile Metal Dome Switch Misalignment

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Tactile metal domes are low profile, momentary switch contacts used to complete electrical circuits in a variety of products and applications. Dome contacts are stamped pieces of stainless steel in the form of a dome shape. In addition to completing the electrical circuit, they provide tactile feedback when actuated. Tactile domes are widely used in applications such as keyless entry remotes, remote controls, appliance panels, aviation cockpits, medical devices, mobile phones, as well as many others. When actuated, they give the user a crisp snap, or tactile feeling. They are unique compared to other alternative standard switches on the market due to their low profile, small footprint, long life expectancy, and variety of sizes and actuation forces available.

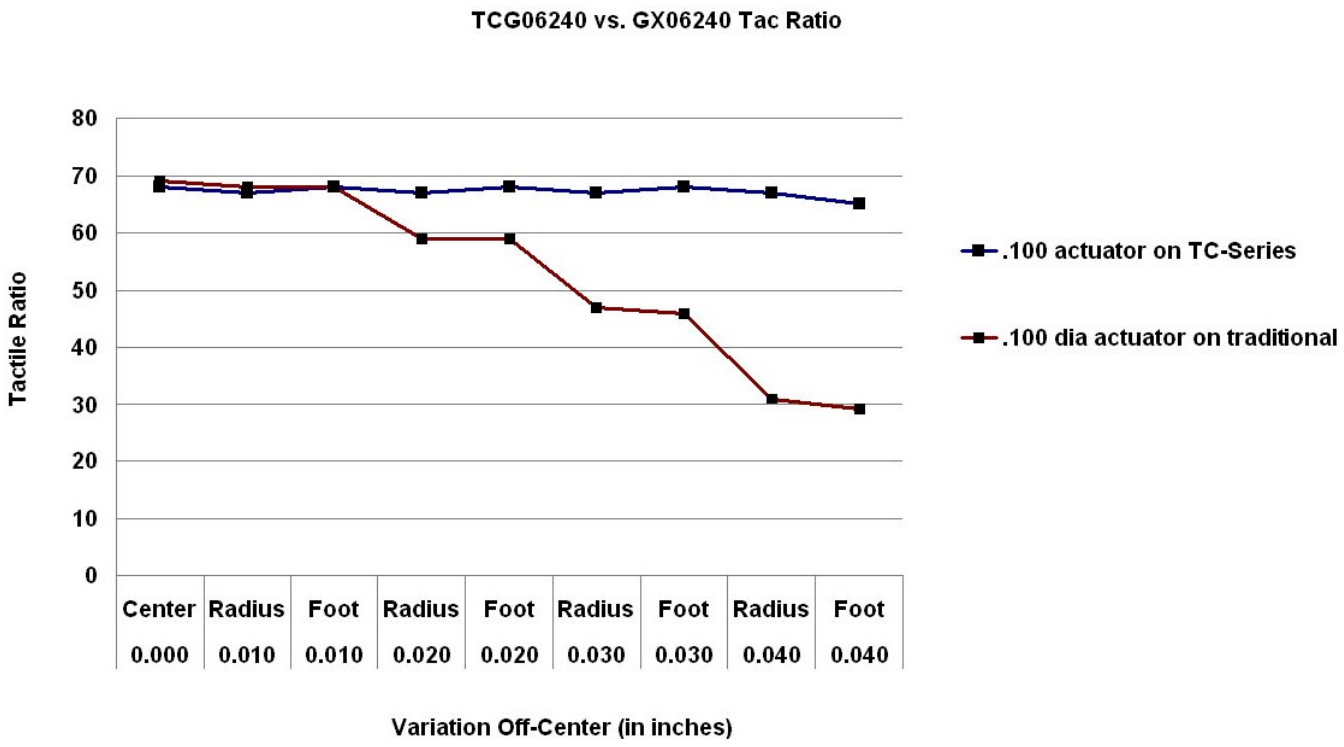
Since the original development of tactile domes, manufacturers have focused on their form, feel, shape and function. The first tactile domes were round in shape, which restricted their use to double-sided printed circuit boards and limited the amount of tactile effect achievable. Newer designs focus on forming the domes with legs, either four-legged (star shaped) or three-legged (triangle shaped). These developments have allowed manufacturers more freedom to manipulate the heights and angles of the metal domes in order to achieve more variety in terms of force, travel, tactile ratio, and force displacement. For quality purposes and battery longevity, tactile domes are often plated with nickel, gold or silver to reduce contact resistance. The printed circuit board pads, which the domes rest on, are also a critical element for proper function of tactile dome switches. For example, a hard nickel plating on the printed circuit board pads helps prevent wear, reduce contamination, and improve contact resistance over the life of the switch.

With the majority of past tactile dome design innovation focusing on the dome feel and contact function, little has been done to address the issue of dome switch alignment with respect to the keypads placed over the dome switches. Keypad overlays often have built in actuators (i.e. nubs, plungers) that are aligned to the center of the dome. As a general guideline, the diameter of these actuators should be no larger than 25% of the dome diameter. Anything larger, particularly if misaligned, can infringe on the transition ring of the dome, affecting its feel and function. The transition ring is the circular flex point around the diameter of the domes, which actually bends and snaps over when actuated. If an oversized actuator crushes the transition ring, switch function can be catastrophic, often resulting in switch failures.

Metal domes, like the electronics they are used in, are becoming increasingly smaller. The miniaturization of electronics, particularly consumer electronics, has made printed circuit board real estate a scarce commodity. Because of this, metal domes are now manufactured in sizes as small as 3mm in diameter.

Smaller tactile domes bring with them manufacturing challenges when it comes to aligning them with the keypad overlays. For instance, when actuating a 4mm tactile dome with 1mm keypad actuator, even the slightest misalignment can present problems.

One solution is to form a reverse dimple (pointing upward) into the center of the dome that serves as a tactile concentrator. By forming a tactile concentrator onto the dome, misalignment can be offset so long as the keypad actuator is positioned over the protruding tactile concentrator dimple. Another advantage is that larger actuators can be used (above the typical specification of 25% of the dome diameter). As long as the keypad actuator contacts the tactile concentrator on the metal dome, the pressure it exudes is directed back to the center of the dome via the tactile concentrator. This removes the need for precise alignment of the keypad actuator, and in some cases, the keypad actuator can be eliminated entirely.



The above graph demonstrates the effect of a misaligned keypad actuator on tactile ratio when comparing a conventional tactile dome with a new tactile concentrator dome. In this example, a .100” (2.54mm) actuator is used on a 6mm conventional dome (red line) and a 6mm tactile concentrator dome (blue line). The conventional dome shows significant tactile ratio degradation with every increment the keypad actuator is moved away from the center of the dome. The tactile concentrator domes exhibit little or no tactile ratio degradation under the same conditions.

Snaptron, Inc. offers a new series of tactile domes with such tactile concentrators. For more information, contact Snaptron at 970.686.5682.

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