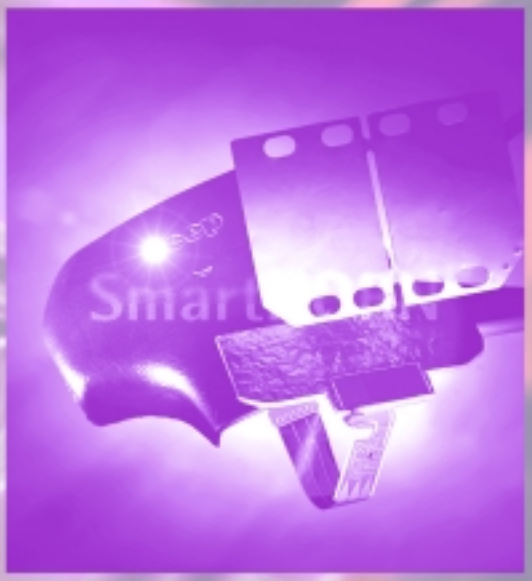
# Electrical Automotive Horn Switch

## *Improved Technology for Horn Actuation*



### Improving Horn Actuation

Traditionally, all horns are switched mechanically using a membrane switch, floating switch or mechanical buttons. *SmartHORN®* introduces a new electronic method for automotive horn actuation.

SmartHORN®

## The SmartHORN® Switch Advantage

Electronic vs. mechanical switching: Activates the horn electronically providing a significant increase in reliability and actuation force consistency through all environmental conditions.

Reliability: *SmartHORN* switches have been cycled over 1,000,000 times without a miss or loss of signal.

Center horn switching: Designed to be placed over the bag pack and will work over flat or curved surfaces. *SmartHORN* will also perform when metal emblems are incorporated into module cover designs.

Reduced Design Cycle Time: One design iteration vs. 3-10 for membrane switches (4 weeks vs. up to 1 year). The sensor is essentially a die cut copper clad pad. Actuation response is electronically tunable. Once the shape and size of the switch has been decided on, programming of the target actuation force can be completed.

Self Adjustment: Continuously adjusts itself for environmental changes in order to maintain consistent actuation force.

Increased process window for module assembly: Because the actuation force is related to a relative change in the sensor, the switch is less affected by variations in the airbag module assembly process. This allows for a robust process without issues due to bag pack variance and molded part tolerances. Mechanical switches or membrane switches cannot accommodate much variation in the assembly.

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# *SmartHORN®* meets or exceeds membrane switch requirements.

## Environmental Tests

Circuits were soaked for 200 hours at 85° C and 85% RH. Even though the pads were purple with oxidation, all samples functioned normally after exposure.

Circuits were soaked at 80° C and 95% RH for 20 hours with the power on and had no miss fires or latching.

Circuits were thermal cycled between 80° C and -30° C 200 times with a dwell of 30 minutes at each temperature. All functioned normally after exposure.

Circuits were exposed to 90° C for 240 hours and had no misfires or latching.

## Durability Tests

Current versions were cycled over 100,000 times without a miss. (Previous tests were run out to over 1,000,000 cycles) membrane switches are required to make 50,000 cycles.

Circuits were cycled over 20,000 times at -40° C and again at 80° C without a miss. Membrane switches are required to do 10,000 cycles -30° C and 80° C.

## Foreign Material

Membrane switches are extremely sensitive to the introduction of foreign material. A metal filing on the order of .005 inches will cause a membrane switch to short out and fail. We intentionally introduced metal filings that were orders of magnitude larger into the laminated pad structure. When these intentionally damaged pads were compared with control circuits there was no measurable difference in response.

## Dent, Scratch and Tear

Membrane switches are extremely sensitive to surface imperfections. Small dents will greatly reduce the actuation force. We dented the pad laminate with the claws of a hammer. We also drove a bolt into the surface with the hammer. The pads were then assembled normally. When these intentionally damaged pads were tested against control circuits there was no measurable difference in response.

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