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Digital Sensors Enhance Brand Image

Three years ago, Whirlpool Corporation began working on new electric freestanding range models with glass touch control panels. Glass is easy to clean, and panels can be produced to match the “visual brand language” established by the company. Switches mounted under glass panels typically use capacitive technology, which allows for customized sensing through the glass surface.

▶ “We began exploring our options with vendors in October 2002, and quickly started to evaluate their samples,” says Wallace J. Elston, Whirlpool’s (Benton Harbor, MI, U.S.) lead electrical engineer for the project. “We wanted a proven touch technology that could easily interface with our main control electronics. By the following February, we chose TouchSensor Technologies for the touchpads and began working with them to develop and integrate their board with the rest of the control system.”

In fact, unlike the other vendors Whirlpool evaluated, TouchSensor Technologies LLC (Wheaton, IL, U.S.) does not use a capacitive system. It makes what it describes as the world’s only field-effect switch. “From a consumer standpoint, there is no visual difference between how our switch and a capacitive switch operates,” says Gregg Schreiber, vice president of Business Development at TouchSensor. “However, from a touch response and consistency standpoint, field-effect is superior. Moreover, for the designer, the field-effect switches are easier to implement, since they operate without added software. In addition, they exhibit exceptional robustness and performance in an electrical noise environment.”

Each solid-state digital

switch uses a TouchCell, which consists of a TS100 IC, an electrode structure, and two resistors. Switch sensitivity is altered by changing resistor values, thus requiring no software alterations. Capacitive switches, in contrast, use software to alter sensitivity and past experiences with this technology showed degradation in performance over time.

In operation, when a 5-V pulsed d.c. signal is applied to the TS100, an electric field is created. The field emanates through any dielectric substrate such as glass or plastic. When a conductive mass enters the field, the sensor detects the change and indicates an event has occurred. With Whirlpool’s control, designers worked with specifications that took



Glass touch control panels are featured in a line of Whirlpool freestanding electric ranges, built in Tulsa, OK, U.S. The panels use field-effect switches that sense a conductive mass, such as a finger, through the glass.

into account a wide range of finger sizes that would be within the consumer population. Testers used metal discs with specific cross sections to measure sensitivity. Once the proper sensitivity was found, TouchSensor incorporated the right value resistors in all the TouchCells.

The ease of design is seen in the interaction of the switches with the controllers. Three different controllers are used. The top of the line controller was designed by Whirlpool; the other two come from outside vendors. Since the switches required no additional programming, it was relatively easy to integrate them with the controllers, and any requested changes could be made quickly. If Whirlpool's industrial design team required a change in the location of a TouchCell in relation to graphics, the TouchSensor engineer could re-layout the PCB in a few hours.

One particular benefit of working with TouchSensor was its partnership with Gemtron Corporation (Sweetwater, TN, U.S.), which was chosen as the decorative glass panel supplier. Gemtron is an investor in TouchSensor, and the two companies often cooperate. "We had worked well with Gemtron before," remarks Rick Morrow, Whirlpool product designer. "We saw it as an advantage to work with both companies as a team and to

receive the glass and circuit board and a metal backer plate as a unit. Procuring this assembled unit was a better choice for us than assembling it ourselves at our divisions."

The backer plates come in five different configurations that are mounted to the glass. Plates support a series of white LEDs used as night lights. Whirlpool models use 28 LEDs while private brand models are positioned differently and use 14 LEDs. The nightlight is reportedly the first of its kind to be used in a freestanding range for the U.S. or Canadian markets.


"Because of the sensitivity of the switches, the metal backer plates had to be shaped so they are at least 10 mm away from the TouchCells," says Mr. Morrow. "In addition, one of the controls was housed with metal, but needed to be housed with a non-conductive plastic housing."

Printed circuit boards are provided in four different designs ranging from 12 to 25 keys. TouchSensor adheres boards to the glass with a double-sided adhesive. The glass is provided with cutouts for cooktop knobs and a location for the mounting of the digital display. Some 53 Whirlpool-designed decorative facades on 4-mm thick glass are provided to meet Whirlpool and private brand image needs. The first units were shipped from

Whirlpool's Tulsa, OK, U.S. factory in April 2004 to the Canadian market. The U.S. versions began shipping in October 2004.

"Early in the project we were talking with both TouchSensor and Gemtron, but toward the end, all our communication went through the program launch group at TouchSensor," reveals Mr. Elston. "They quickly provided us with parts for testing and first parts approval. The approval process verified the component specification matched the graphic requirements, and that the TouchCells properly integrated with the controls."

One benefit of working with TouchSensor was that it is a turnkey operation, according to Mr. Elston. "Some other companies license their technology and aren't as responsive. We sent the company our requirements, and they came right back with the component," he explains.

"TouchSensor has their own internal engineering group and technical consultants, and worked in cooperation with sheet metal and molding houses," Mr. Elston continues. "They have met our cost, schedule, and logistics targets. Their dedication and high-speed manufacturing plant meets the high-volume, fast-changing demands of the Whirlpool Tulsa plant." 

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