**KEY FEATURES**

- **Operating Voltage**  
  5Vdc ± 10%

- **Operating Temperature**  
  -40°C to +120°C

- **Response Time**  
  160 μseconds Typical

- **Current Consumption**  
  16 μamps Typical

- **UL Recognition**  
  UL File # E187820  
  (Fail Safe Device)

- **Interface**  
  DC or Matrix

- **Actuation**  
  Adjustable Sensitivity

- **Actuation Area**  
  Flexible - 14mm X 14mm Typical

- **Sense Through**  
  Glass, Plastic (Any Dielectric)

- **IC Packaging**  
  6 Pin SOT

**DESCRIPTION**

TouchSensor offers the world’s only Field-Effect switch - a digital, 5-volt switch that is software free. The switch is a low-impedance field-effect integrated circuit (IC) available in a 6 pin SOT package. The IC is used in combination with proprietary pad geometry and two resistors to form a TouchCell™. When 5 volts is applied to the TouchCell™, 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. The input stimulus to the field can take the form of a human finger, metal, or liquid.

**OUTPUT CONFIGURATIONS**

- Active high
- Active low

**APPLICATIONS**

- Human Touch - Keypads
- Fluid Level Sensing
- Position Sensing
The TouchCell™

The TS-100 Sensor is a low impedance field-effect switch that is used in combination with proprietary pad geometry to form a TouchCell™. Each TouchCell™ is comprised of three elements:

- A TS-100 sensor IC
- Two resistors for sensitivity setting
- Proprietary electrode structure

TouchSensor keypads consist of either single or multiple TouchCells™. These TouchSensor keypads are used to replace existing membrane or mechanical switches and their digital output signals offer easy integration.

Keypad Interface

Interfacing to a TouchSensor keypad is achieved via direct connect (DC Mode) or matrix/multiplexed connect (Strobe Mode). The interface mode is specified at design time. TouchSensor keypads with four or fewer TouchCells™ typically use DC mode as the preferred interface whereas higher pad count configurations use Strobe Mode. DC Mode and Strobe Mode configurations are detailed below.

DC Mode

In DC Mode, continuous power is applied to the keyboard. All TouchCells™ are connected to the incoming power. Upon a touch condition, the output changes state. Multiple keys can be actuated at the same time, if required.

DC MODE ELECTRICAL CHARACTERISTICS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>+V</td>
<td>Min.</td>
</tr>
<tr>
<td>TouchCell Current</td>
<td>16</td>
</tr>
<tr>
<td>tRESP</td>
<td>100</td>
</tr>
<tr>
<td>tOFF</td>
<td>100</td>
</tr>
<tr>
<td>VOUT <em>(RL=4.7K)</em></td>
<td>4.00</td>
</tr>
</tbody>
</table>

*Output current should be limited to no more than 10mA.
Strobe Mode

In Strobe Mode, a multiplexing scheme is used to interface to the keypad, similar to a conventional membrane matrix. TouchCells™ are arranged in row-column format. The TouchCells™ are scanned and their outputs are read using time-multiplexed scanning. A column is selected by setting the appropriate strobe line high, and the row outputs from the TouchCells™ are read at the return lines.

Power for the TouchCells™ is derived directly from the strobe signal. Considering the TouchCell’s™ ~16μA current consumption and low load current, most microcontroller ports can drive the TouchCells™ without the need of special buffers or additional power supplies. The total load that a microcontroller port will have to drive is directly proportional to the number of TouchCells™ connected to that particular strobe line.

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**Strobe Mode Timing Diagram**

- tBlank
- tSTB
- tRESP

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**Strobe Mode Electrical Characteristics**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin</td>
<td>Min.</td>
</tr>
<tr>
<td>+VSTROBE</td>
<td>4.50</td>
</tr>
<tr>
<td>Touchcell Current</td>
<td>16</td>
</tr>
<tr>
<td>tRESP</td>
<td>110</td>
</tr>
<tr>
<td>tSTB</td>
<td>300</td>
</tr>
<tr>
<td>tBLANK</td>
<td>50</td>
</tr>
<tr>
<td>VOUT (RL=4.7K)</td>
<td>4.00</td>
</tr>
</tbody>
</table>

*Recommended **Output current should be limited to no more than 10mA.*
Design Process

Designing TouchSensor keypads using TouchCells™ is a simple step-by-step process:

1) **Select Substrate**
   TouchCells™ will work behind any non-metallic dielectric. Glass or plastic is the substrate of choice. Typical thickness is 4mm or less. Designs for thicker substrates are also available. Assistance with substrate selection is available. Typical TouchCell™ size is approximately 18mm X 18mm and can be placed as close as 5mm (edge-to-edge) from another TouchCell™. A clearance of 10mm or greater is also required directly behind the TouchCell™. Following these basic requirements allows for fast project development.

2) **Select Interface Mode**
   TouchCells™ can be easily implemented in Strobe Mode (Send / Receive Matrix) or Direct DC Mode, both with positive logic signals: 0 to 5 volts.

**Constructing Keypads Using TouchSensor**

A broad variety of panel substrates are available in the construction of TouchSensor keypads; the only requirement is that the chosen substrate material is dielectric in nature. Common examples include tempered glass and many varieties of plastic, including polycarbonate and ABS. TouchSensor keypads must maintain intimate contact with the panel substrate. A pressure sensitive adhesive bonds the TouchSensor keypad to the dielectric substrate. Based upon the application, the adhesive is selected to meet the environmental requirements, including high and low temperature.