<table>
<thead>
<tr>
<th>Features &amp; Attributes</th>
<th>TouchSensor Technologies Field Effect™</th>
<th>Capacitive Approaches</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software Development Required</td>
<td>No</td>
<td>Yes, some software effort required, even considerable effort for some supplier’s offerings</td>
<td>TouchSensor offers the only software free digital touch switch. No microprocessor or software is required to make the touch decision.</td>
</tr>
<tr>
<td>Adjustable Sensitivity</td>
<td>Yes, adjustable during development process, but then set once for the application. No adjustment necessary post design. Sensitivity can even be optimized to detect a human finger, yet ignore contaminants such as water from rain or a car wash.</td>
<td>Yes, but customer must do the work to determine the sensitivity level, and the expected effect of drift and sometimes contaminants, and must program the microprocessor accordingly. Changes in sensitivity made later require reprogramming and documentation tracking of software changes.</td>
<td>TouchSensor’s Field Effect™ TouchCells™ are the only touch sensitive switch technology that can be designed to detect a human touch in the presence of water running over the surface of the touch substrate.</td>
</tr>
<tr>
<td>Low Impedance</td>
<td>Yes: input impedance in the kiloohm or less range</td>
<td>Generally No. Many capacitive approaches have higher input impedance than Field Effect™ technology, some even in the megarohm range.</td>
<td>Low input impedance is critical for robust performance and to reduce the influence of noise.</td>
</tr>
<tr>
<td>High Signal to Noise Ratio</td>
<td>Yes</td>
<td>No</td>
<td>Field Effect™ technology has a 3 volt dynamic range and looks for changes in the 100 to 200 millivolt range to make touch decisions. This enables a very high signal to noise ratio for robust performance. Most capacitive approaches look for changes in the 10s of millivolts, the same amplitude as many noise signals, resulting in less robust performance.</td>
</tr>
<tr>
<td>Response Time</td>
<td>Very Fast: 160 microseconds typical</td>
<td>Slower: 10msec to 150msec typical</td>
<td>Slower response, which can be typical of capacitive approaches, could make the user dissatisfied with sluggish switch activation. With capacitive approaches, a faster response requires more current drain. With Field Effect™ technology, current drain is always low and response is always very fast so users get crisp satisfying switch response.</td>
</tr>
<tr>
<td>Immunity to Surface Contaminants</td>
<td>High</td>
<td>Lower: requires a microprocessor and signal processing software to reduce susceptibility to surface contaminants</td>
<td>TouchSensor’s proprietary electrode structure design, together with the TouchCell’s™ digital input and output with a high signal to noise ratio, ensure robust performance even in the presence of surface contaminants.</td>
</tr>
<tr>
<td>Immunity to Radio Frequency Interference</td>
<td>High</td>
<td>Medium</td>
<td>Field Effect™ TouchCells™ are inherently more immune to RFI because of their digital input and output, their low impedance signal input, and their high signal to noise ratio.</td>
</tr>
<tr>
<td>Support Services Provided</td>
<td>Maximum: (supplied by TouchSensor and Methode) TouchSensor and Methode work closely together with the customer. TouchSensor and Methode design the complete product and supply fully tested assemblies ready for use in the customer’s application.</td>
<td>Minimal: Technology supplier provides chips and application notes. Customer, or their product supplier, must have resources to understand the technology, evaluate technical feasibility, design products, and verify and validate designs for production</td>
<td>TouchSensor Technology’s Field Effect™ TouchCells™ have been in operation for more than 12 years in many demanding applications, including automotive applications. 160 million TouchCells™ are in operation today with no reported field failures. The TouchCell(tm) is the only touch switch rated as a Fail Safe Switch by Underwriters Laboratories.</td>
</tr>
<tr>
<td>Size/Pkg (profile &amp; thickness)</td>
<td>Very thin, low profile</td>
<td>Slightly thicker and higher profile due to larger chips</td>
<td>TouchSensor Technology’s Field Effect™ TouchCells™ have been in operation for more than 12 years in many demanding applications, including automotive applications. 160 million TouchCells™ are in operation today with no reported field failures. The TouchCell(tm) is the only touch switch rated as a Fail Safe Switch by Underwriters Laboratories.</td>
</tr>
<tr>
<td>Durability</td>
<td>High; solid state, no moving parts, field proven high reliability</td>
<td>Unknown, but could be high; solid state, no moving parts, field results unknown</td>
<td>TouchSensor Technology’s Field Effect™ TouchCells™ have been in operation for more than 12 years in many demanding applications, including automotive applications. 160 million TouchCells™ are in operation today with no reported field failures. The TouchCell(tm) is the only touch switch rated as a Fail Safe Switch by Underwriters Laboratories.</td>
</tr>
<tr>
<td>Stability</td>
<td>Highly Stable</td>
<td>Less stable than TouchSensor Field Effect™ technology. For example, many capacitive approaches must be programmed (software) to compensate for expected drift, or some continuously recalibrate in an effort to remain somewhat stable.</td>
<td>As indicated above, capacitive approaches require more current drain in order to increase response speed.</td>
</tr>
<tr>
<td>Current Consumption</td>
<td>Very Low: 16 microamps typical</td>
<td>Low to Medium: 50 to 600 microamps or more</td>
<td>Should be a concern to customers, or their product suppliers, that deploy a capacitive approach</td>
</tr>
<tr>
<td>Layout Dependent Design</td>
<td>No, not layout dependent because decision is made at point of touch or sense point, and all outputs are digital, not analog</td>
<td>Yes, changing or adding to design can cause additional software work, or can cause false triggering due to crosstalk between circuit board traces.</td>
<td></td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>-40ºC to +120ºC</td>
<td>0 to 70ºC, or -40 to +85ºC</td>
<td>TouchSensor’s Field Effect™ TouchCells™ operate over the widest available temperature range. This allows them to be used in some applications that are impossible for most capacitive approaches, and also makes Field Effect™ TouchCells™ even more reliable when operated in the narrower -40 to +65ºC range.</td>
</tr>
</tbody>
</table>
List of Facilities

Engineering and Design Centers
- Southfield, Michigan
- Mriehel, Malta
- Burnley, England
- Gau-Algesheim, Germany
- Shanghai, China
- Bangalore, India

Manufacturing Facilities
- Wheaton, Illinois
- Carol Stream, Illinois
- Mriehel, Malta
- Monterrey, Mexico
- Reynosa, Mexico
- Shanghai, China

Customer Support Offices
- Mriehel, Malta
- Beaune, France
- Burnley, England
- Gau-Algesheim, Germany
- Tokyo, Japan
- Chicago, Illinois
- Southfield, Michigan
- Shanghai, China

Test Laboratories
- Palatine, Illinois
- Hunt Valley, Maryland
- Mriehel, Malta
- Burnley, England

Sales and Technical Center

TouchSensor Automotive Sales
24585 Evergreen Road • Southfield, MI 48075
Phone: 248.603.2124 • Fax: 248.354.6667
Email: autosales@methode.com • www.touchsensor.com

Sales and Support

North America
Methode Electronics, Inc.
Automotive Electronic Controls
KBA Automotive Group
24585 Evergreen Road
Southfield, MI 48075
Phone: 248.603.2124
Fax: 248.354.6667
Email: thomas.beshke@methode.com

Europe
Methode Electronics Int. GmbH
Automotive Division
Rhein Strasse 48
55435 Gau-Algesheim
Germany
Phone: +49 (0) 6725 2095 128
Fax: +49 (0) 6725 3095 160
Email: kevin.borg@methode-eur.com

Japan
Methode Electronics, Inc.
Automotive Electronics Controls - Japan Office
3-15-7 Kuramae, Taito-ku,
Tokyo 111-0051, JAPAN
Phone: +81 (0)3-3862-7903
Fax: +81 (0)3-3863-2948
Email: yutaka.harada@methode-japan.jp
Email: masuji.sugiyama@methode-japan.jp

Far East
Methode Electronics (Shanghai) Co. Ltd.
Automotive Division
211 Qin Qiao Road #T71-7 (West)
Jin Qiao, Pudong, Shanghai 201206
Mobile: +86-13671603323
Phone: +86-21-61686389
Fax: +86-21-61057272
Email: campuswu@methode.com.cn

www.methode.com