Relevant Products:

- CT512 Series Digital Switch

Relevant Resources:

- CT512 Datasheet
- CTD501 Switch Demo Board

Introduction

This application note provides guidance for replacing the reed switch with the CT512 digital switch solution. The CT512 is a solid state, magnetic switch that detects the magnetic field of a magnet’s south pole. Both the electrical and physical orientation of the devices needs to be considered to ensure accurate magnetic switch behavior.

Reed Replacement Circuit

The CT512 functionality is similar to a magnetic reed switch in a SPST (single pole, single throw) configuration. Instead of closing the circuit however, the CT512 has an active-low digital output. When biased with a 3V supply, the CT512 outputs a 3V logic High when no magnetic field is present, and 3V logic Low when it senses a magnetic field. To get passed these differences, an external FET can be used to open and close the circuit and handle the higher current and voltages. Figure 1 describes the recommend electrical circuit for reed switch replacement.

![CT512 circuit solution for reed switch replacement](figure1.png)
The CT512 is implemented to drive current flow with a FET, providing a replacement for the traditional SPST (single pole, single throw) reed switch design. The recommended MOSFET is the SSM3K329R, an n-channel, enhancement mode FET for this low-side switch configuration. The CT512 sensor drives the FET which connects the Load to ground, activating current flow.

**Mechanical Considerations**

When replacing the reed switch with the CT512 solution, the device and magnet orientation need to be understood. Figure 2 illustrates the typical reed switch-magnet configuration. In the case of the CT512 solution, the CT512 orientation will need to maintain the correct magnetic field direction as shown if Figure 3 below. The CT512 not only accommodates the reed switch configuration, but can provide more design flexibility as the device can also be positioned 360° around the magnet. The CTD501 Switch Demo board provides a means to easily and immediately characterize the field profile and behavior in your system with the CT512.

Another factor is the physical size of the CT512 solution versus the reed switch. Both the CT512 and the recommended FET are packaged in very small SOT-23 package which will take less space, provide placement flexibility, and conducive to high volume manufacturing. As the CT512 has no glass components or moving parts, higher reliability and high assembly yields provide a more streamlined, cost competitive solution. Figures 4 and 5 provide mechanical dimensions for both the CT512 and the Toshiba MOSFET.
Output Behavior versus the Magnetic Field

As mentioned earlier, once the physical orientation and distances are defined, the CT512 will provide the following output behavior to ensure a seamless reed switch replacement. When observing the reed switch and CT512 parameters, it is important to note that the ‘Pull-in’ magnetic field point is analogous to the Operating Switch Point, Bop, of the CT512. Similarly, the ‘Drop-out’ point is analogous to the Release Point, Brp, of the CT512.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Conditions</th>
<th>CT512 Output</th>
<th>FET Output</th>
<th>Reed Switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Pole</td>
<td>B &gt; Bop (Pull - in)</td>
<td>High</td>
<td>OFF</td>
<td>Open</td>
</tr>
<tr>
<td>Null or weak magnetic field</td>
<td>B &lt; Brp (Drop-out)</td>
<td>High</td>
<td>OFF</td>
<td>Open</td>
</tr>
<tr>
<td>North Pole</td>
<td>B &gt; Bop (Pull - in)</td>
<td>Low</td>
<td>ON</td>
<td>Closed</td>
</tr>
</tbody>
</table>

Table 1: Output Behavior vs. Magnetic Field
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Reed Switch Replacement with a Digital Switch

<table>
<thead>
<tr>
<th>Revision Number</th>
<th>Revision Date</th>
<th>Summary of Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>12/15/16</td>
<td>Datasheet Initiated</td>
</tr>
<tr>
<td>0.2</td>
<td>10/21/16</td>
<td>Updated device polarity.</td>
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</tbody>
</table>

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