Overview
Mechanical buttons and switches for touch user interfaces are becoming a thing of the past. Proximity capacitive touch sensors in simple linear or rotational sliders offer significant advantages for numerous applications. They are more convenient to use with no moving parts to wear out, more energy efficient and are more easily integrated to create an intelligent system. Freescale’s MPR031 and MPR032 proximity capacitive touch sensor controllers are CMOS-based state machines that simplify designing numerous touch applications for Bluetooth® headsets, mobile phones, multimedia players, remote controls and other low-power, handheld, electronic products.

The MPR031 and MPR032 devices have several implementations to use in your design including touch pads and switch replacements. The MPR03x devices control up to three touch pads. The MPR03x can communicate via the inter-integrated circuit (I²C) protocol and is optimized to manage two electrodes with interrupt functionality, or three electrodes with the interrupt disabled. It can accommodate a wide range of implementations due to increased sensitivity and a specialized feature set.

Freescale offers a broad portfolio of proximity sensors for products ranging from appliance control panels to portable electronics. Target markets include consumer, appliance, industrial, medical and computer peripherals.

MPR031/2 Implementations
• Switch replacements
• Touch pads

Applications
• PC peripherals
• MP3 players
• Remote controls
• Mobile phones
• Lighting controls
**Features.**

- 1.71V to 2.75V operation
- 8 μA supply current with two electrodes being monitored with 64 ms response time and IRQ enabled
- 4 μA maximum shutdown current
- Two electrodes plus IRQ
- Three electrodes and no IRQ
- Continuous independent auto-calibration for each electrode input
- Separate touch and release trip thresholds for each electrode, providing hysteresis and electrode independence
- I2C interface, with optional IRQ output to advise electrode status changes
- 2 x 2 x 0.65 mm 8-lead uDFN package
- -40°C to +85°C operating temperature range

**Benefits**

- Elimination of mechanical buttons
- Enhances reliability by eliminating mechanical wear and tear
- Electrode multiplexing
- User interface controllers that manage multiple configurations
- Gives greater flexibility to product designers
- Reduces overall system cost

Freescale is a leading provider of pressure, inertial and proximity sensors and has offered MEMS-based sensors for more than 25 years. The sensor ICs complement Freescale's broad portfolio of ZigBee® technology, microcontrollers, microprocessors, digital signal processors, analog ICs and development tools to offer system solutions to customers.

**Electrode/Pad Connections in Run Mode**

- **Run1 Mode with Three Electrodes**
  - ELE0
  - ELE1
  - ELE2

- **Run1 Mode with Two Electrodes**
  - ELE0
  - ELE1
  - INT

- **Run1 Mode with One Electrode**
  - ELE0
  - INT

**Electrode/Pad Connections in Detection Mode Area**

- **Run2 Mode to Three Pads**
  - ELE0
  - ELE1
  - ELE2

- **Run2 Mode to Two Pads**
  - ELE0
  - ELE1

**Selector Guide**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Bus</th>
<th>Sounder</th>
<th>Touch Pad Array</th>
<th>Main Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPR031</td>
<td>I2C with IRQ</td>
<td>Yes</td>
<td>Three pads if IRQ is not being used</td>
<td>Controls two electrodes with IRQ Extremely small package</td>
</tr>
<tr>
<td>MPR032</td>
<td>I2C with IRQ</td>
<td>Yes</td>
<td>Three pads if IRQ is not being used</td>
<td>Ability to be the second address on the I2C bus Extremely small package</td>
</tr>
</tbody>
</table>

**Development Tools**

- KITMPR031EVM: Evaluation board to demonstrate key proximity sensor features
- DEMOMPR031EVM: Small, self-contained board to demonstrate key proximity sensor features

**Documentation**

<table>
<thead>
<tr>
<th>Document Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPR031/2</td>
<td>MPR031/2 Data Sheet</td>
<td>This data sheet presents the specifications for these products</td>
</tr>
</tbody>
</table>

**Application Notes**

<table>
<thead>
<tr>
<th>Document Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AN3747</td>
<td>Pad Layout Application Note</td>
<td>Explains design for conductive pads</td>
</tr>
<tr>
<td>AN3583</td>
<td>Using Low Power Mode on the MPR083 and MPR084</td>
<td>Describes how to dynamically run with low power modes</td>
</tr>
<tr>
<td>AN3579</td>
<td>Enabling an MCU for Touch Sensing Application Note</td>
<td>Describes how to enable an MCU for touch sensing with a properly designed layout and a simple software module</td>
</tr>
<tr>
<td>AN3516</td>
<td>E-Field Keyboard Designs Application Note</td>
<td>This application note provides the fundamentals for designing keyboards with electric field (E-Field) devices</td>
</tr>
</tbody>
</table>

Learn More: For more information about Freescale products, please visit www.freescale.com/proximity.