ADDING PROXIMITY DETECTION TO A STANDARD ANALOG-RESISTIVE TOUCHSCREEN

Chaouki Rouaissia, Semtech Sr. Applications Engineer
SID Display Week – June 2012
Presentation Framework

1. Capacitive Sensing Basics
2. Resistive Touchscreen Basics
3. Combining Both Technologies
4. Examples of Applications
1. Capacitive Sensing Basics

2. Resistive Touchscreen Basics

3. Combining Both Technologies

4. Examples of Applications
Capacitive Sensing Basics 2

\[ C_{\text{Sensor}} = C_{\text{Env}} \]

\[ C_{\text{Sensor}} = C_{\text{Env}} + C_{\text{User}} \]
Capacitive Sensing Basics 3

$$C_{User} = \frac{\varepsilon_0 \cdot \varepsilon_r \cdot A}{d}$$

<table>
<thead>
<tr>
<th>Material</th>
<th>Typical $\varepsilon_r$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glass</td>
<td>8</td>
</tr>
<tr>
<td>FR4</td>
<td>5</td>
</tr>
<tr>
<td>Acrylic Glass</td>
<td>3</td>
</tr>
<tr>
<td>Wood</td>
<td>2</td>
</tr>
<tr>
<td>Air</td>
<td>1</td>
</tr>
</tbody>
</table>
Resistive Touchscreen Basics

1. Capacitive Sensing Basics
2. Resistive Touchscreen Basics
3. Combining Both Technologies
4. Examples of Applications
Resistive Touchscreen Basics 1

Top conductive sheet

Bottom conductive sheet

electrodes

X+

X-

Y+

Y-
Resistive Touchscreen Basics 2

Touch creates contact between resistive circuit layers, closing a switch.

Controller determines between layers to get touch coordinates.
Resistive Touchscreen Basics 3

Activate Y+ and Y- Drivers

Connect ADC Input to X+ Terminal
Combining Both Technologies

1. Capacitive Sensing Basics
2. Resistive Touchscreen Basics
3. Combining Both Technologies
4. Examples of Applications
Combining Both Technologies 1

Sensor (Top)

Shield (Bottom)

Finger, palm, face, etc

Resistive Touchscreen

Analog Front-End (AFE)

Digital Processing

PROXSTAT

SX8654/56/57/74/76/77
## Combining Both Technologies 2

<table>
<thead>
<tr>
<th>Touchscreen Status</th>
<th>ADC Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Touched</td>
<td>Resistive</td>
</tr>
<tr>
<td>Not-touched</td>
<td>Capacitive</td>
</tr>
</tbody>
</table>

- Pen Touch
- Pen Release

- TOUCHRATE tick
- PENSTAT
- CONVSTAT
- NIRQ
- I2C Read Channel

Legend:
- Green: Idle
- Red: Touch Conversion
- Blue: Pen Detection
- Yellow: Proximity Sensing
Examples of Applications

1. Capacitive Sensing Basics
2. Resistive Touchscreen Basics
3. Combining Both Technologies
4. Examples of Applications
Examples of Applications 1
Examples of Applications 2
Examples of Applications 3
Conclusion 1

- Capacitive proximity sensing using the touchscreen can significantly contribute in making touch interfaces even more intuitive, comfortable and safe.

- By enabling built-in proximity sensing using ANY resistive panel, Semtech products will enable the OEM to upgrade a generally lower cost resistive touchscreen panel with high-end features.


World’s First Resistive Touchscreen Controller Platform that Detects Proximity and Pressure with Haptics Feedback
Conclusion 2

- Proximity
- Haptic Driver
- Small Footprint
- Multi-touch
- Low Power
- Robust ESD Protection