Haptics: Touch feedback that really moves you

Imagine feeling the rumble of the road in the palms of your hands, the stroke of a paintbrush as you complete your masterpiece, or the beat of a drum as you conclude your solo all on your digital device....Touch screens come to life with haptics from TI.

What is Haptics?
Haptics enhance the user experience in digital devices by appealing to the one sense that often goes overlooked, touch. Haptics, by definition, refers to the sense of touch and is a technology that adds tactile feedback through the use of vibrations to electronic devices. Touch screen devices with haptics can give your finger the impression you are pressing an actual button or your hand the feeling it is resting on a resonating guitar. The technology can be found in consumer electronics such as smartphones, tablets and portable gaming consoles as well as medical and industrial products you interact with everyday.

Texas Instruments, in the continued effort to offer the total solution, provides a complete line of touch products including touch screen controllers and haptic drivers.

Benefits of Haptics
- Adds tactile feedback to touch screen devices
- Creates unique effects and sensations
- Provides reassuring touch confirmations
- Increases productivity while typing
- Offers a differentiated product
- It’s cool and fun!

The haptics ecosystem consists of three parts:

1. Actuator
   The actuator vibrates the device in a specific pattern. The type of actuator will determine the resolution and quality of the haptic effects.

2. Driver
   The driver is part of the electrical design and is the bridge between the controller and the actuator. Drivers can have either simple analog or intelligent digital interfaces and output high or low voltages depending on the type of actuator.

3. Software
   The software generates the haptic waveforms and can reside on an applications processor, microcontroller or integrated driver depending on the availability in a system.

Learn more: www.ti.com/touch
Ask questions: www.ti.com/touchforum
Actuator Technologies & Comparison

Actuators create the physical vibrations used in haptics. There are three primary actuator technologies, each with their own unique characteristics and benefits.

**Eccentric Rotating Mass (ERM)**
- **Vibration method:** A motor with an off-center mass that spins
- **Effects:** Creates strong vibrations for alerts, but lacks the precision for high-definition
- **Very mature technology**
- **Recommended TI driver:** DRV8601

**Linear Resonant Actuator (LRA)**
- **Vibration method:** Spring mass system that oscillates in a linear motion
- **Effects:** Enhanced precision over ERMs; produces effects with various intensities at the actuator’s resonant frequency
- **Operating at the resonant frequency yields power savings**
- **Recommended TI driver:** DRV8601

**Piezo**
- **Vibration method:** A strip or disk shaped piezo-electric material that bends when a voltage is applied
- **Effects:** Highest level of precision with varying intensity and frequency which creates high-definition effects
- **Various form factors are available including strips, disks and modules (strip + weight)**
- **Recommended TI driver:** DRV8662

<table>
<thead>
<tr>
<th>Attributes</th>
<th>ERM</th>
<th>LRA</th>
<th>SL Piezo</th>
<th>ML Piezo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actuator Type</td>
<td>Inertial</td>
<td>Inertial</td>
<td>Piezo</td>
<td>Piezo</td>
</tr>
<tr>
<td>Cost</td>
<td>$</td>
<td>$$</td>
<td>$</td>
<td>$$</td>
</tr>
<tr>
<td>High Definition Haptics</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Localized Haptics</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Whole-Device Haptics</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Drive Voltage</td>
<td>2.5V to 5.5V (peak)</td>
<td>2V (RMS)</td>
<td>150 V - 200 V (pk-to-pk)</td>
<td>30 V - 50 V (pk-to-pk)</td>
</tr>
<tr>
<td>Control</td>
<td>DC</td>
<td>Amp Mod.</td>
<td>Large BW</td>
<td>Large BW</td>
</tr>
<tr>
<td>Response Time</td>
<td>40 - 80 ms</td>
<td>20 - 30 ms</td>
<td>&lt;&lt;1 ms</td>
<td>&lt;&lt;1 ms</td>
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<tr>
<td>Power Consumption</td>
<td>Poor</td>
<td>Best</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>TI Products</td>
<td>DRV8601 MSP430</td>
<td>DRV8601 DRV2603* MSP430</td>
<td>DRV8662 DRV2665*</td>
<td>DRV8662 DRV2665*</td>
</tr>
</tbody>
</table>

SL - Single layer, ML - Multi layer
*Under development

See TI's complete portfolio of solutions for touch technology, including:
- Innovative haptics products for touch-screen enabled devices
- Cool solutions for buttons, sliders and wheels featuring MSP430
- Touch screen controllers for a broad range of performance options

Visit [www.ti.com/touch](http://www.ti.com/touch) now to find the products and design support you need to get your touch-related application to market fast

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