Haptics

Touch Feedback that Really Moves You

Overview

Imagine feeling the rumble of the road in the palm 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. TI brings touch screens to life with haptics.

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 to electronic devices through the use of vibrations.

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 products you interact with every day, such as smartphones, tablets, and portable gaming consoles as well as medical and industrial products.

Texas Instruments offers a total touch solution, providing 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
- Creates differentiated products
- It's cool and fun!

Haptics Ecosystem

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.


MCU/Apps Processor

Analog/Digital

Driver

Touch Event

Actuator

Actuator Vibration

Touch Screen & Capacitive Buttons
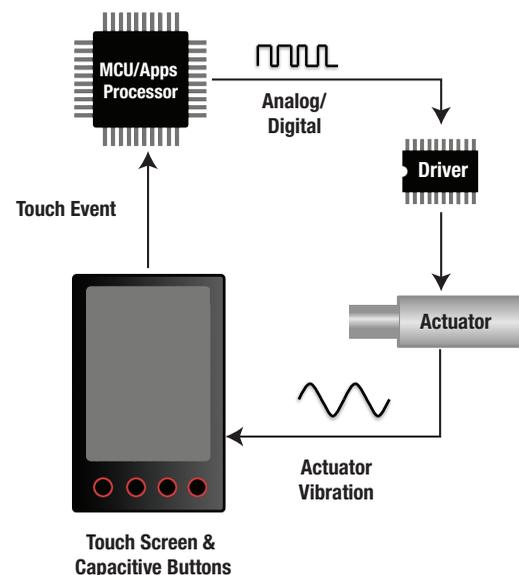
Actuator Technologies & Comparison

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 drivers:** DRV2604, DRV2605

Eccentric Rotating Mass
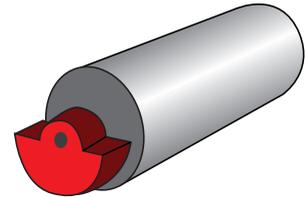
Linear Resonant Actuator (LRA)

- 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 drivers:** DRV2604, DRV2605

Linear Resonant Actuator
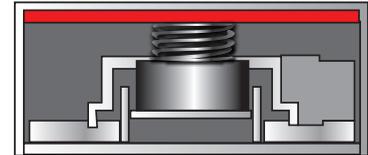
Piezo

- 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 drivers:** DRV2665, **DRV2667**

Piezo Beam

Relaxed State

Transformed State
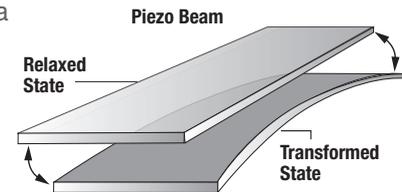
Attributes	ERM	LRA	Piezo
Actuator Type	Inertial	Inertial	Piezo
Cost	$	$$	$$$
High Definition Haptics	No	No	Yes
Localized Haptics	No	No	Yes
Whole-Device Haptics	Yes	Yes	Yes
Drive Voltage	2.5 to 5.5 V (peak)	2 V (RMS)	30 to 50 V (pk-to-pk)
Control	DC	Amp Mod.	Large BW
Response Time	40 - 80 ms	20 - 30 ms	<<1 ms
Power Consumption	Poor	Best	Good
TI Products	**DRV8601, DRV2603, DRV2604, DRV2605**	**DRV8601, DRV2603, DRV2604, DRV2605**	**DRV8662, DRV2665, DRV2667**

*Preview products are listed in **bold blue.***

See TI's complete portfolio of solutions for touch technology at ti.com/touch

- 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

TI E2E™ Community

E2E Touch Forum
ti.com/touchforum

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