Technical Article

Four Tech Trends That Improve the Driver Experience

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According to a survey by the AAA Foundation for Traffic Safety, adult drivers spend up to 58 minutes a day in their cars. So it's no surprise that with all that time spent commuting to work or stuck in traffic, drivers want the most enjoyable in-car experience possible. Car manufacturers are continually packing in more features to improve the driver experience.

In this post, I'll discuss ways to integrate some the most innovative features into cars, including haptic-feedback touch screens, knob replacement, smart glass and driver-notification applications.

Integrated Haptic Touch Screens

Some infotainment touch screens lack tactile feedback to confirm that users pressed the correct buttons. Screens that incorporate haptic feedback have the potential to improve road safety by decreasing the amount of time that the driver spends glancing at the center console screen. Typical haptic feedback found in tablets and phones is not sufficient, because the feedback strength needs to overcome the road and engine vibrations of everyday driving.

Many engineers are finding that a good way to achieve strong feedback is through the use of one or multiple solenoids paired with a solenoid driver such as TI's DRV251x-Q1 family of solenoid drivers. Providing feedback with solenoids is different than using typical actuators like linear resonant actuators (LRAs), eccentric rotating masses (ERMs) or piezo. In order to drive solenoids that push a large mass, such as an 8-inch infotainment screen, you need a high-current-capable device. The DRV2511-Q1 integrated driver provides up to 8A of peak current to charge solenoids.

Figure 1 shows the current needed to drive a typical solenoid at 15V; the peak current is 2A. Depending on the weight of the mass being moved, solenoids could require a peak charging current up to 6A or more.

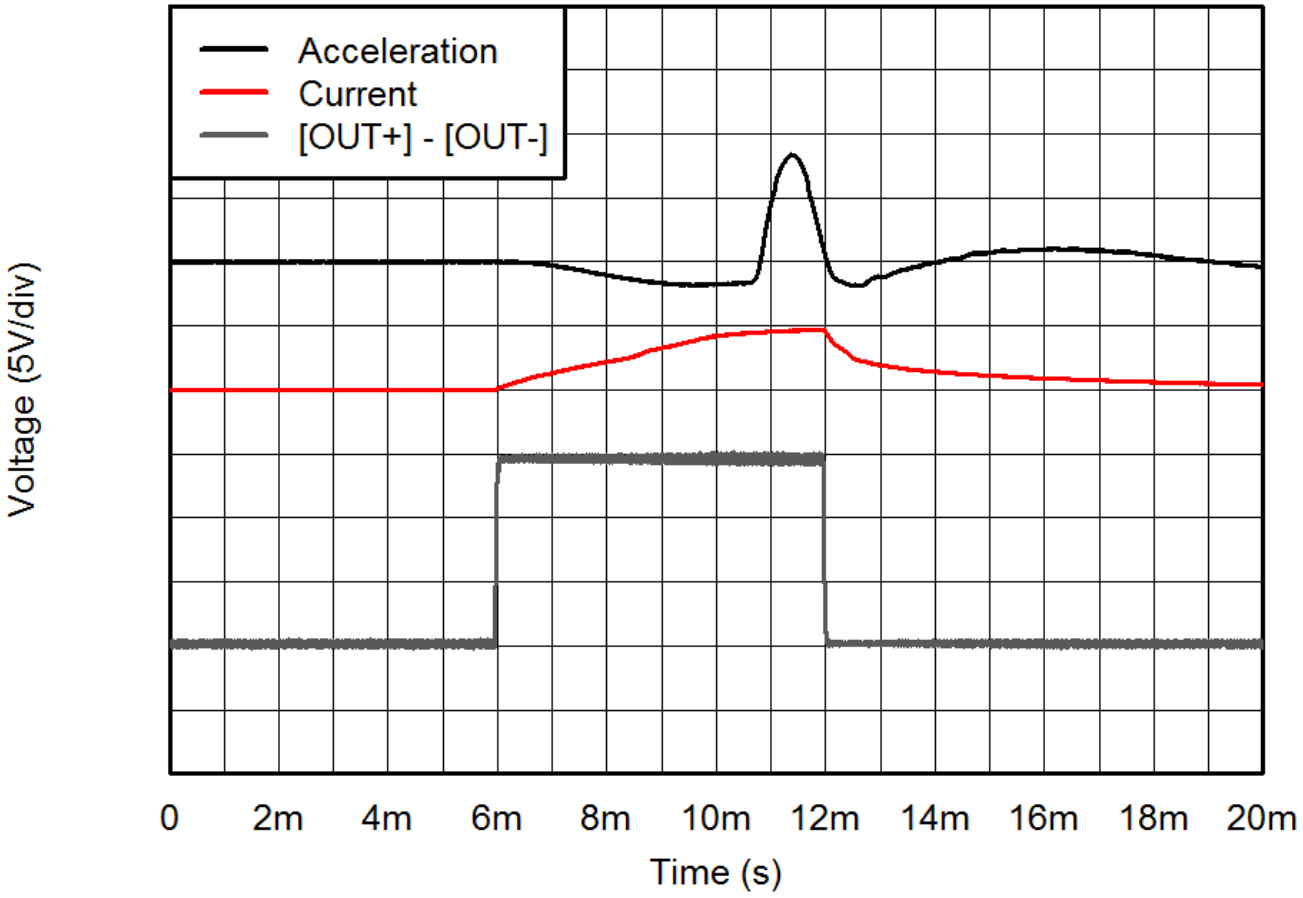
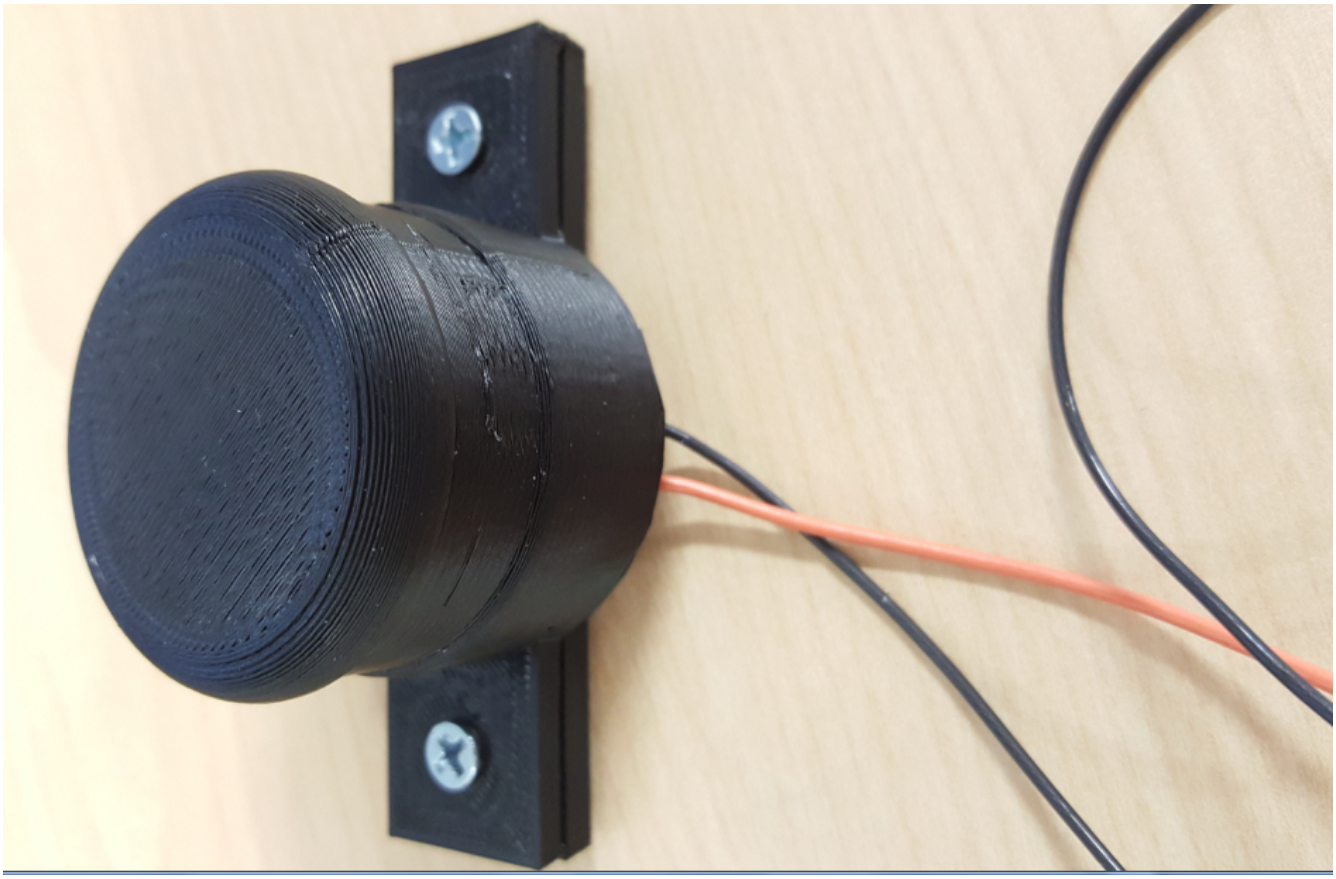


Figure 1. Solenoid Acceleration Graph: Acceleration = 5.85G/div; Current = 2A/div; Voltage = 5V/div

Knob Replacement

Replacing traditional knobs with newer haptic-enabled options can save automobile manufacturers money while extending the lifetime of car dashboards. Mechanical knobs consist of several moving parts that naturally degrade over time. At CES, TI will showcase a prototype that allows automotive designers to remove the mechanical parts and incorporate haptic feedback instead. This solution also uses solenoids and the DRV251x-Q1 family of drivers.

We are working on a reference design that will integrate capacitive touch into the knob design to complete the feedback loop for a haptic knob. The knob will remain stationary, but as the user slides their fingers around the knob, the solenoid will actuate, providing a sharp click feeling. That feedback will make it seem as if the knob is moving like a typical mechanical knob. Figure 2 shows the top and bottom view of our 3D printed prototype knob.



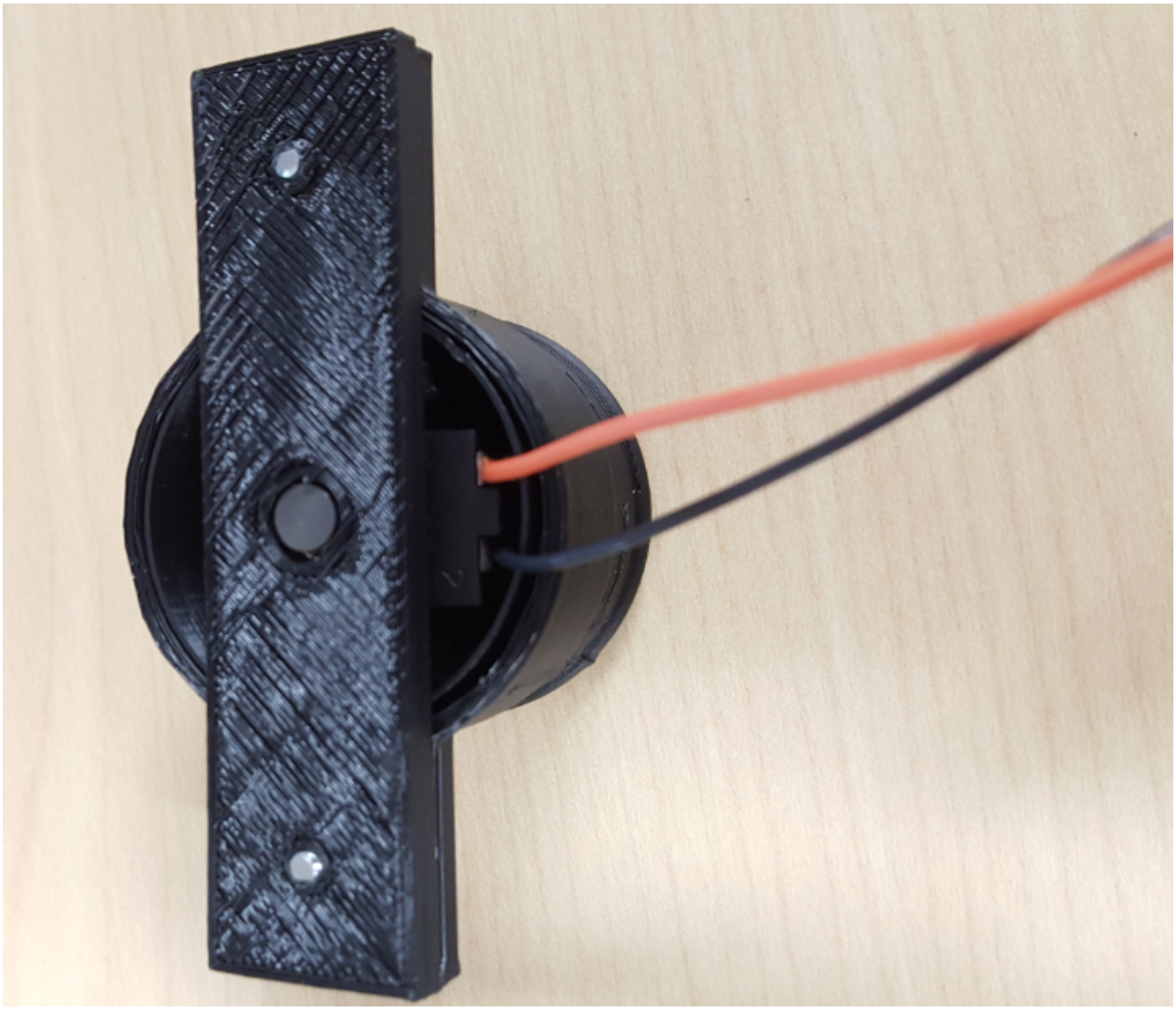


Figure 2. 3D Printed Solenoid Knob

Smart Glass

Did you know that there may be a revolution going on with your car's tinted windows? With the advancement of glass materials, electrically tinted windows are now realistic. Using high-voltage piezo drivers, automobile drivers can have the ability to control the amount of tint on their windows based on the time of day or mood. TI's DRV2700 piezo driver can provide the high voltage needed to tint smart glass while running off USB power levels. The DRV2700 has an integrated boost converter capable of $105V_P$, with a quiescent current of 24mA. Used in conjunction with a microcontroller, the DRV2700 can provide custom window tinting from clear to dark, as shown in Figure 3. This application of smart glass could even allow drivers to tint their windshields more when they leave their cars in the sun all day.

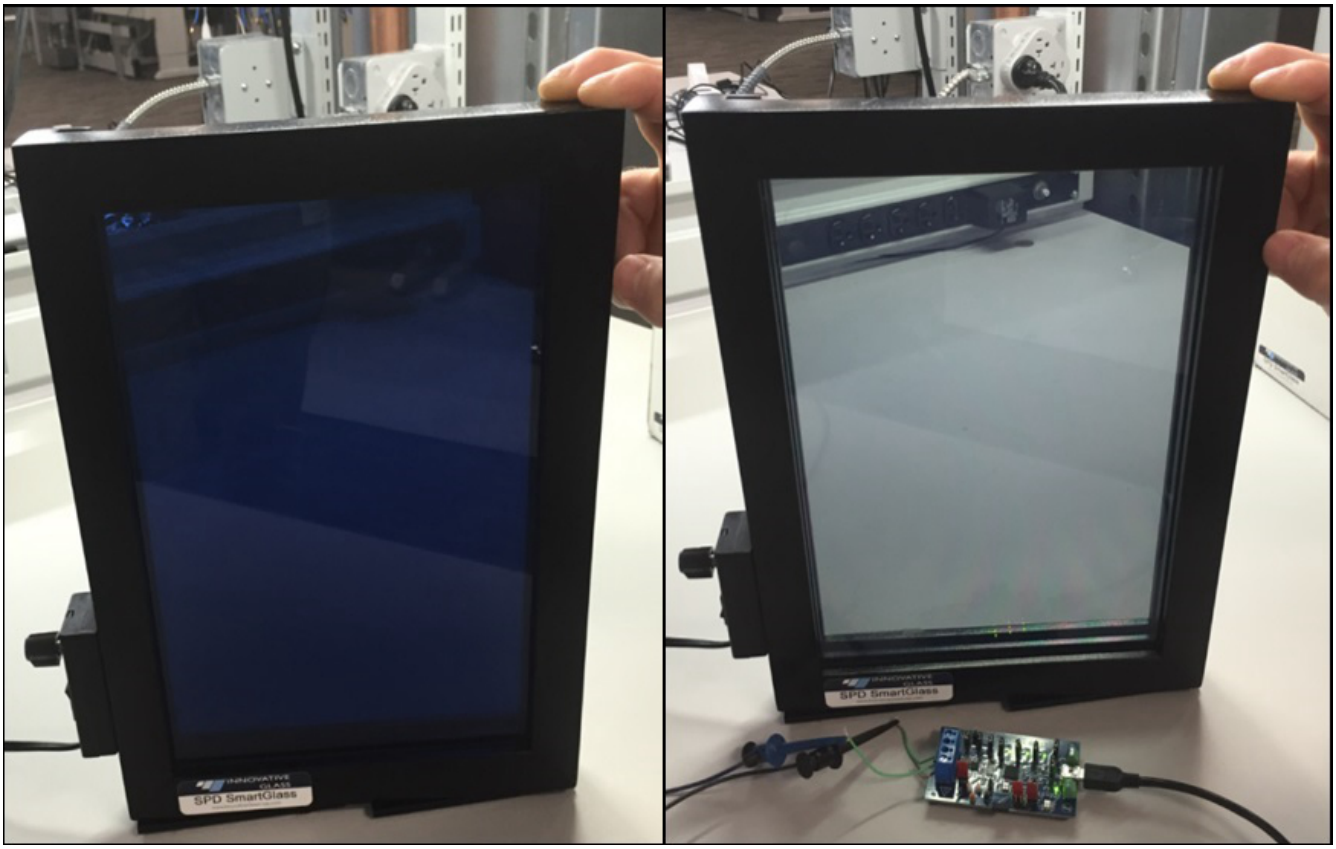


Figure 3. Side-by-side Image of Glass Changing Colors

Driver Notification

Driver notifications have also been widely integrated into automobiles. These notifications can be found in steering wheels or seats and alert drivers when other automobiles are in their blind spots, or when they cross over lanes unintentionally. Typically, powerful ERMs create a strong, rumbling haptic feedback. The DRV2605L-Q1 was created to drive ERMs and includes an integrated waveform library for different types of effects. This gives designers the flexibility to notify drivers with effects such as ramping buzzes, pulsing alerts and buzzes of different lengths. TI's EvoCar, shown in Figure 4, demonstrated these different effects in the seats and steering wheel.

Figure 4. TI's EvoCar Demo from CES 2016

While I've covered four different features, many more are in development to help drivers get the most out of their experience. Whether you are looking to update knobs to lower replacement costs and extend life spans or incorporate luxurious smart glass to increase driver privacy, TI has solutions to help bring your designs to life. Be sure to explore the TI Designs library for more automotive reference designs.

Additional Resources

- Learn more about designing with haptic feedback.
- Watch this training series to learn why an electrical system should be matched to an actuator.
- Review important factors to consider when choosing haptic feedback in this blog series: Eight things to consider when choosing haptic feedback – part 1 and Eight things to consider when choosing haptic feedback – part 2.
- Interested in learning how a linear resonant actuator works? Click to read a post from one of our customers.
- Learn more about TI haptic drivers.

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