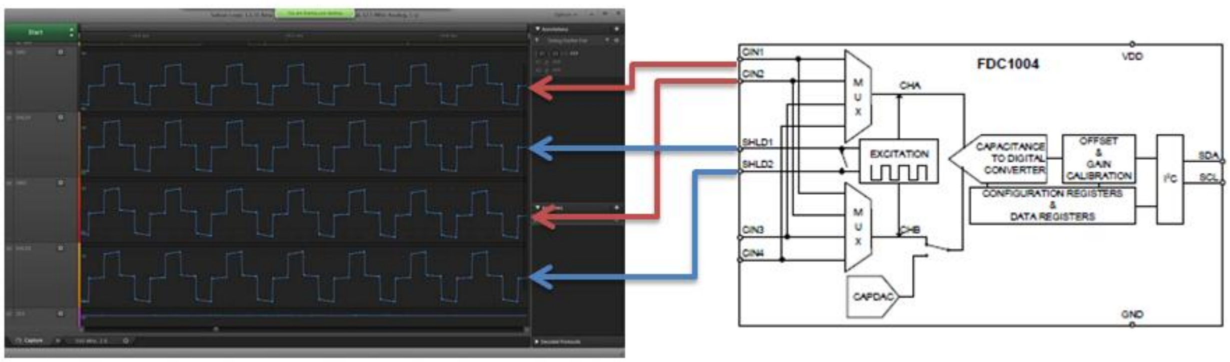
Design Considerations for TIDA-00506

Cabling:

In a kick to open application the FDC1004 will likely be located far from the capacitive sensors on the bumper, requiring shielded transmission lines to reduce the effects of stray capacitances on the resulting measurements.

The active shield drivers will create an equipotential signal on the shielding conductor to negate the impacts of local capacitive changes on the transmission line, but the drive strength of the driver is limited to 400pF loads and should be taken into consideration when trying to determine the maximum length of the transmission line and size of the shield behind a sensor. Below is a screen capture of a typically performing shield driver.



If the capacitance of the shield is too large, it can have negative impacts on the measured capacitive values. For comparison, below is a demonstration of a shield driver that is saturated due to a larger than acceptable shield capacitance.

Sensors:

The capacitive proximity sensors can be constructed from any conductive material, and for this design copper tape was utilized for its flexibility and low resistance. To provide directionality to the capacitive measurements, an additional conductor with a larger surface area was mounted behind each measurement sensor and connected to the corresponding driven shield of the FDC1004EVM.

For more information on designing sensors with active shields, refer to "The Ins and Outs of Active Shielding" on the FDC1004 product folder on Ti.com.

Ins and Outs of Active Shielding - SNOA926A

Sensor Placement:

Sensor placement will ultimately depend on the desired application, detection motion, and installation environment of the intended design. Larger sensors tend to give a larger detection region but may not be necessary for measurements less than 15cm, and the active area in which a kick is detected can be widened by increasing the length of the sensors. With the FDC1004's ability to have four channels, additional sensor configurations can be utilized to reliably detect various interactions such as a high step by comparing measurements with multiple parallel bars behind and below the vehicle, or a leg sweep by comparing measurements between multiple adjacent sensor pads. The active shielding will help to reduce the effect of the sensors from coupling directly to the ground plane/chassis of a vehicle.

Additional considerations:

To reduce noise injection into the system through the supply and ground lines, ensure the utilization of a low noise PSRR LDO and necessary filtering to limit high/low frequency disturbances.

The FDC1004 is a wideband system operating at 25kHz. With the current architecture, external filtering on the inputs will help reduce the noise but will also degrade the drive signal to the sensor. The LDC1614 can be utilized as a capacitive to digital converter that is more robust in noisy environment since it operates as a narrowband system.

IMPORTANT NOTICE FOR TI REFERENCE DESIGNS

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