LUMISSIL Microsystems

A Division of ISSI

The Return of Tactile Buttons to Passenger Vehicles

The automotive industry, in its perpetual pursuit of innovation and modernity, has for years been enamored with touch screens, integrating them into vehicle dashboards as primary interfaces. These sleek, interactive displays became synonymous with high-tech luxury, offering an array of functionalities from navigation and entertainment to controlling basic settings like air conditioning and volume. However, as more drivers spent time with these screens, the safety concerns became increasingly evident.

Touch screens, while interactive and versatile, demand a level of visual engagement that traditional buttons do not. Drivers found themselves taking their eyes off the road to navigate through multi-layered menus, causing distractions that, at high speeds, could translate to significant distances traveled without proper attention. The inherent danger of this was underscored by studies, such as one by the AAA Foundation, which concluded that infotainment touch screens could distract a driver for up to 40 seconds–a significant amount of time when driving.

Recognizing these challenges and in response to consumer feedback, there has been a discernible shift back to incorporating physical buttons in cars. Buttons offer tactile feedback, allowing drivers to adjust settings through muscle memory without diverting their gaze. This combination of tactility and familiarity makes for a safer and often more efficient driving experience.

Capacitive sensing touch keys offer an innovative middle ground between traditional physical buttons and touch screens in automotive design. Unlike traditional buttons that require a mechanical push, capacitive touch keys rely on the electrical properties of the human body to detect when and where the driver touches. When integrated into a car's dashboard or steering wheel, these touch keys can provide a tactile interface with raised areas or textured surfaces to guide the driver's fingers. This allows for intuitive operation without requiring a deep press or diverting much attention from the road. Additionally, capacitive sensing touch keys can be seamlessly incorporated into modern vehicle interiors, offering a sleek appearance while still providing the tactile feedback drivers appreciate for safety and convenience. Furthermore, a touch key can be placed at the base of a traditional physical button and will even give the added benefit of detecting a finger before it even touches the button to improve response time.

Lumissil's third-generation capacitive sensing touch key technology offers enhanced robustness and precision in touch detection. By introducing a proprietary high-resolution digital converter and an active shield system, the technology effectively combats disturbances like water droplets and electromagnetic interference, ensuring reliable performance. Moreover, with continuous self-calibration, the system adjusts to environmental and component changes, ensuring consistent touch detection through the life of the vehicle. Coupled with the industry's lowest power draw, as low as 5 uA, Lumissil's advancements promise both longevity and superior performance in touch interactivity for modern vehicles.

Figure 1 is a block diagram of a possible automotive center stack design that has booth a touchscreen display and touch keys for physical buttons. Lumissil components are shown in the colored blocks.

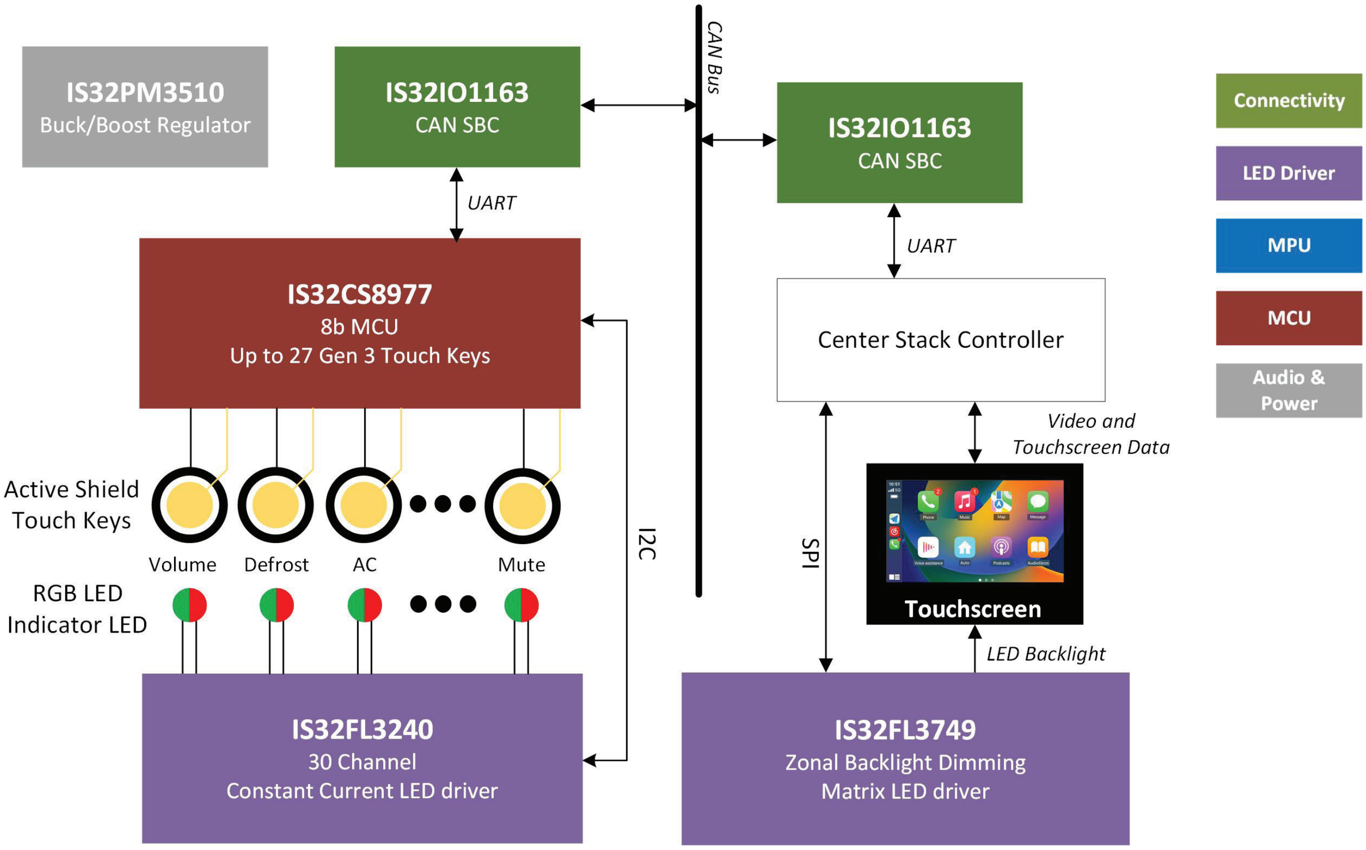

Figure 1: Automotive Center Stack Potential Design

In this system the left side of the CAN bus is monitoring the capacitive touch keys through the IS32CS8977 MCU. When the MCU detects a pressed key, it will put that information on the CAN bus through the system basis chip. Each touch key has a green or red LED associated with it to determine that function's state. Green can be for on and red for off. The LED driver IS32FL3240 will switch the state of the LED based on information over the I2C bus. On the right side of the CAN bus the center stack controller (i.e. domain controller) is able to get messages off the CAN bus through our IS32IO1163 CAN system basis chip and then take the appropriate action like activating the defrost or muting the music and many other functions. Also, on the right side of the CAN bus there is the IS32FL3749 which will drive the backlight of the touchscreen and communicate with the center stack controller through the SPI bus.

Here is a deeper look at each of the components in the block diagram.

IS32PM3510: buck/boost regulator. It is an asynchronous multi-topology PWM controller that employs a single inductor to provide excellent voltage regulation. In a Buck-Boost topology regulated output voltage is maintained when the input voltage is either less or greater than the desired output voltage, making it especially suitable for automotive applications, where this wide input voltage variation is expected.

IS32IO1163: CAN FD system basis chip with a built in LDO. It has been verified to be compliant to ISO 11898-2/5/6 standards. The IC will handle all communications necessary on the CAN bus and talk through a UART to its associated MCU.

IS32CS8977: 8-bit MCU with 64KB eFlash, 2K SRAM and a math accelerator. It is feature rich with Timers, ADC, DAC, GPIOs, I2C, SPI and melody generator. Up to 27 gen 3 touch keys can be connected to this MCU. It is well known for a robust and reliable touch key and yet cost effective compared to competitor's products.

IS32FL3240: 30 channel, 60 mA LED driver that allows for fine tuning of RGB LEDs. Up to 38 mA per channel and 16b PWM control. Features EMI and Noise reduction. The IS32FL3240 is communicating with the IS32CS8977 via I2C to determine the LED state of each touch key.

IS32FL3749: 24 channel matrix LED driver, 16b PWM for smooth control. Features DOT correction and current scaling.

All the components listed are in mass production and full automotive grade, AECQ100 grade 2.

Lumissil is a fast-growing innovator and an ideal partner for your HMI needs. To learn more please visit us at www.lumissil.com