

Design Guide



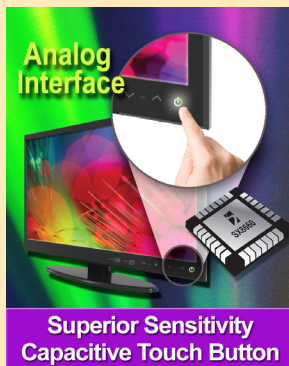
SEMTECH ADVANCED COMMUNICATIONS & SENSING



Touch-Interface Design Guide

Semtech adds proximity to its 4D-Touch family of Capacitive and Resistive Touch Platforms

LCD TVs



Control Panels



Mobile



Portable Navigation



Feature Keys:



Multi-touch



Low Power



Robust ESD Protection



Small Footprint



Proximity



Haptic Driver



LED Driver



Analog Output



Extreme Sensitivity



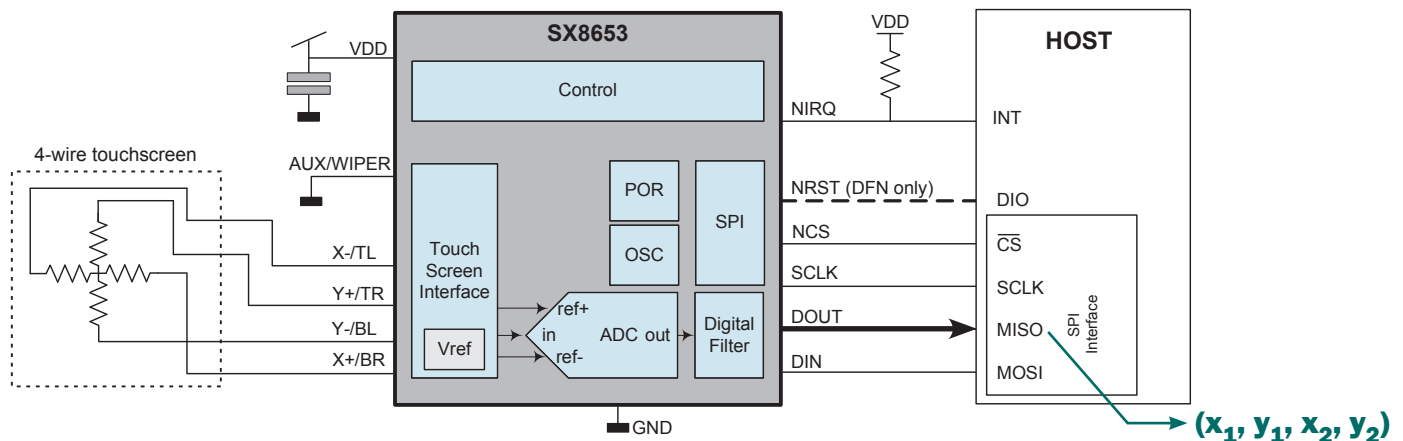
Smart Auto Calibration



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World's Lowest Power Resistive Touchscreen Controller with +/-15kV ESD Protection and Multi-touch

Semtech's ultra low power, resistive touchscreen controller family, provides the best-in-class on-chip ESD protection as well as multi-touch capability on a resistive panel. An extremely small footprint makes these controllers ideal for portable applications where power consumption and board-space are at a premium. The SX8651/53 also enables various multi-touch gestures such as pinch, stretch and rotation on a regular 4-wire analog resistive touchscreen.



Applications:

- Portable Navigation Device
- Automotive Center Console*
- Digital Photo Frame
- DSC
- Digital Video Camera
- Handheld Games
- Mobile
- POS Terminals

* AEC-Q100 Certified



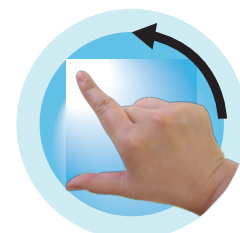
Zoom Out



Zoom In



Rotate Right



Rotate Left

Touch-Interface Products

Product Highlights:

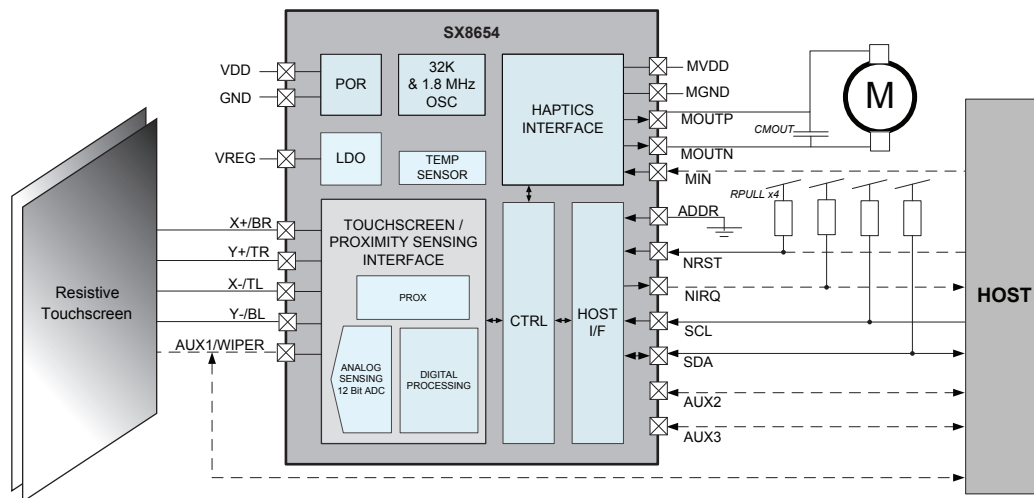


- Extremely low power consumption optimized for battery-powered devices
 - 0.4µA @ 1.8V (Standby)
 - 23µA @ 1.8V (8ksps)
- Best-in-Class on-chip ESD protection: Eliminates the needs for external components
 - ±25kV Air Gap Discharge
 - ±15kV Contact Discharge
 - ±15kV HBM
 - ±2kV CDM
 - ±300V MM
- Equivalent throughput up to 50ksps
- Enable multi-touch gestures with low cost 4-wire analog resistive touch panel
- Built-in programmable settling time and digital filter reduces host processing overhead and bus loading
- Ultra small footprint
 - 1.46 x 1.96mm 12-WLCSP
 - 3.0 x 3.0mm 12-DFN
 - 4.0 x 3.0mm 14-DFN

	Touch Panel	Resolution	Interface	Power Consumption	On-chip ESD Protection	Digital Filter	Programmable Settling Time	Multi-touch	Package
SX8650	4-wire	12-bit	I ² C	0.4µA	±25kV Air	✓	✓		1.46x1.96mm WLCSP
					±15kV Contact				3.0x3.0mm DFN
SX8651	4-wire	12-bit	I ² C	0.4µA	±25kV Air	✓	✓	✓	1.46x1.96mm WLCSP
					±15kV Contact				3.0x3.0mm DFN
SX8652	4/5-wire	12-bit	SPI	0.4µA	±25kV Air	✓	✓		1.46x1.96mm WLCSP
					±15kV Contact				4.0x3.0mm DFN
SX8653	4/5-wire	12-bit	SPI	0.4µA	±25kV Air	✓	✓	✓	1.46x1.96mm WLCSP
					±15kV Contact				4.0x3.0mm DFN

World's First Haptics Enabled ±15kV ESD Resistive Touchscreen Controller with Proximity Sensing and Multi-touch

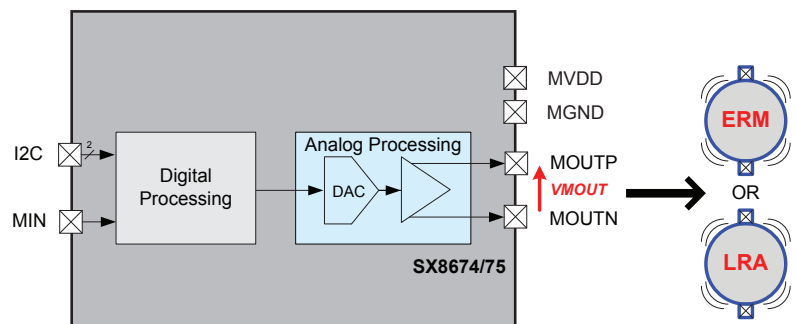
These fully integrated, haptics enabled resistive touchscreen controllers feature an unique built-in proximity sensing circuitry which enables proximity detection in applications where automatic system wake up or backlight LED dimming adjustments are required without the need for any additional components. The SX865x family can directly connect to an ERM or LRA Motor to create haptic feedback, thus eliminating the need for a dedicated μ C interface. The SX867x family also supports various multi-touch gestures such as pinch, stretch and rotation on a regular 4-wire analog resistive touchscreen.



Applications:

- Portable Navigation Device
- Automotive Center Console*
- Digital Photo Frame
- DSC
- Digital Video Camera
- Handheld Games
- Mobile
- POS Terminals

Haptic Interface:



* AEC-Q100 Certified

Touch-Interface Products

Product Highlights:

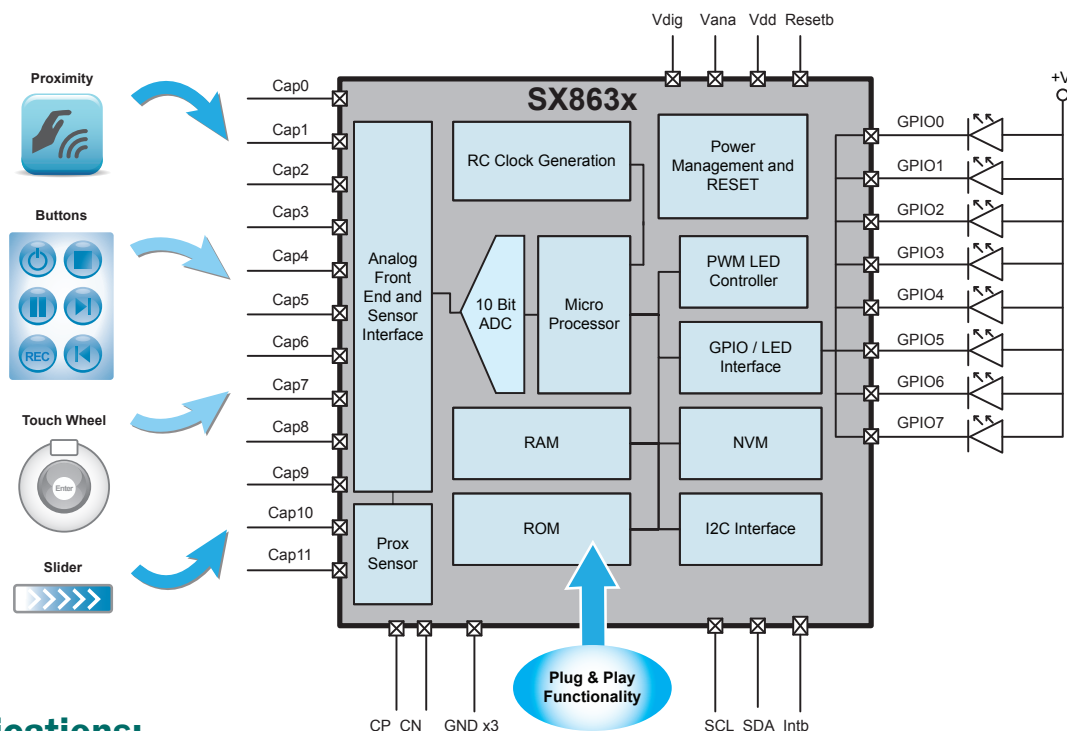


- Extremely low power consumption optimized for battery-powered devices
 - 0.4µA @ 2.3V (Standby)
 - 30µA @ 2.3V (8ksps)
- Best-in-Class on-chip ESD protection: Eliminates the needs for external components
 - ±25kV Air Gap Discharge
 - ±15kV Contact Discharge
 - ±15kV HBM
 - ±2kV CDM
 - ±300V MM
- Built-in proximity sensing with any resistive panel (>5cm)
 - Automatic system/display wake up
 - Touch panel control (IR replacement)
- Integrated haptics motor control (LRA & ERM)
- Enable multi-touch with low cost 4-wire touch panel
- Fully compatible with most 4-wire/5-wire resistive touchscreen
- Ultra small footprint
 - 2.07 x 2.07mm 19-WLCSP
 - 4.0 x 4.0mm 20-QFN

	Touch Panel	Resolution	Interface	Power Consumption	On-chip ESD Protection	Digital Filter	Programmable Settling Time	Multi-touch	Proximity Sensing	Haptics	Package
SX8654	4/5-wire	12-bit	I ² C	0.4µA	±25kV Air ±15kV Contact	✓	✓		✓	Generic	2.07x2.07mm WLCSP 4.0x4.0mm QFN
SX8655	4/5-wire	12-bit	I ² C	0.4µA	±25kV Air ±15kV Contact	✓	✓			Generic	2.07x2.07mm WLCSP 4.0x4.0mm QFN
SX8656	4/5-wire	12-bit	I ² C	0.4µA	±25kV Air ±15kV Contact	✓	✓		✓		2.07x2.07mm WLCSP 4.0x4.0mm QFN
SX8657	4/5-wire	12-bit	I ² C	0.4µA	±25kV Air ±15kV Contact	✓	✓		✓	Immersion	2.07x2.07mm WLCSP 4.0x4.0mm QFN
SX8658	4/5-wire	12-bit	I ² C	0.4µA	±25kV Air ±15kV Contact	✓	✓			Immersion	2.07x2.07mm WLCSP 4.0x4.0mm QFN
SX8674	4/5-wire	12-bit	I ² C	0.4µA	±25kV Air ±15kV Contact	✓	✓	✓	✓	Generic	2.07x2.07mm WLCSP 4.0x4.0mm QFN
SX8675	4/5-wire	12-bit	I ² C	0.4µA	±25kV Air ±15kV Contact	✓	✓	✓		Generic	2.07x2.07mm WLCSP 4.0x4.0mm QFN
SX8676	4/5-wire	12-bit	I ² C	0.4µA	±25kV Air ±15kV Contact	✓	✓	✓	✓		2.07x2.07mm WLCSP 4.0x4.0mm QFN
SX8677	4/5-wire	12-bit	I ² C	0.4µA	±25kV Air ±15kV Contact	✓	✓	✓	✓	Immersion	2.07x2.07mm WLCSP 4.0x4.0mm QFN
SX8678	4/5-wire	12-bit	I ² C	0.4µA	±25kV Air ±15kV Contact	✓	✓	✓		Immersion	2.07x2.07mm WLCSP 4.0x4.0mm QFN

World's Lowest Power, Fully Integrated Capacitive Touch Sensors with Enhanced LED Drivers and Proximity Sensing

The superior sensitivity of the SX863x/4x touch sensor platform enables sensing through a thick overlay material as well as proximity detection with an extended range (>10cm) all in a tiny footprint with zero components per input. The low power consumption and advanced, built-in LED drivers make it the ideal solution for a wide range of sensing applications in mobile phone, media players, notebooks and white goods.



Applications:

- LCD Monitors
- Appliances
- Printers
- Automotive Radio Console*
- Personal Media Players
- Set Top Box (STBs)
- Game Consoles
- Industrial Systems

Touch-Interface Products

Product Highlights:

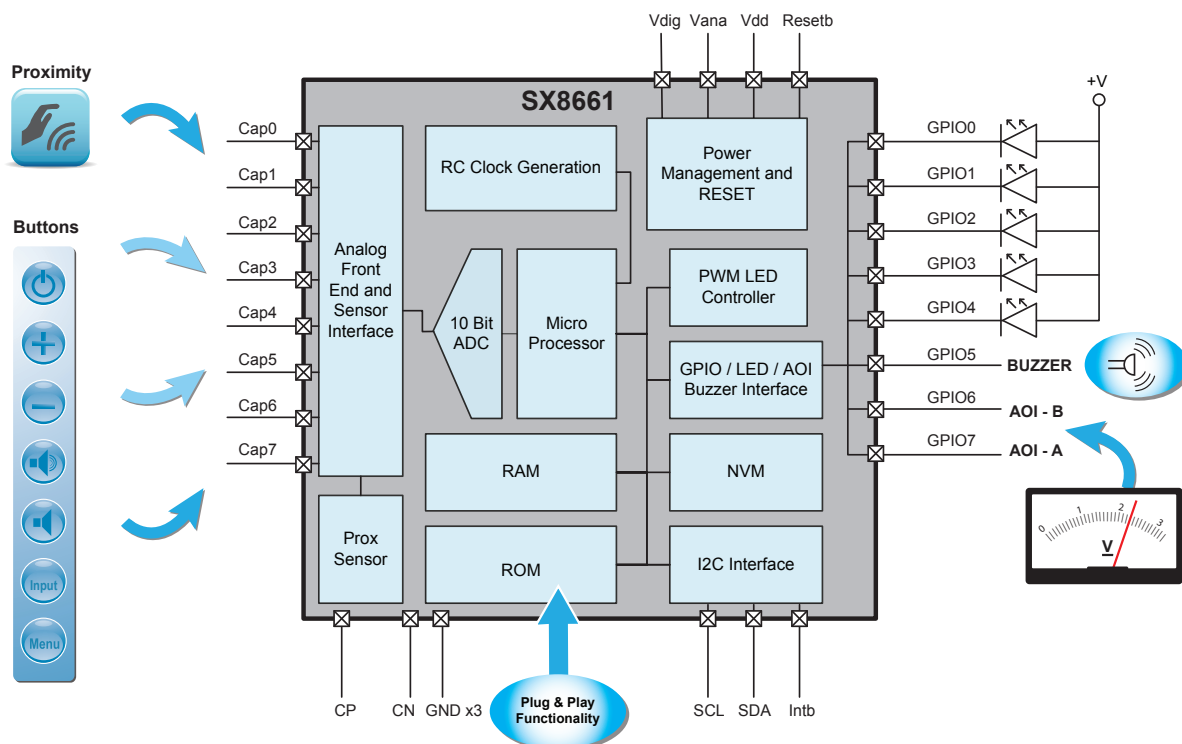


- High resolution capacitive sensing solution
 - Proximity detection up to 10cm
 - Supports button, slider and wheel design
- Extreme sensitivity:
 - Works with thick overlay materials (>5mm)
- Extremely low power with programmable scan time
 - 70µA (typ) @ 195ms
- Smart auto-offset compensation
 - Eliminates false triggers due to environmental factors
- Enhanced LED operation
 - Individual 256-step intensity/Fade-in/Fade-out control
 - Auto-lightening without host interaction
- No external components per input
- Ultra small footprint
 - 4.0 x 4.0mm 28-QFN
 - 5.0 x 5.0mm 32-QFN

	Sensor Inputs	LED Driver (12 mA)	Interface	Proximity	Button	Slider	Wheel	Min. Scan Time	Power @ 195ms	Overlay	Auto Compensation	Intensity (256-step)	Fade-in/out	Auto Lightening	Field Programmable	Footprint
SX8633	12	8	I ² C	✓	✓			15ms	80µA	>5mm	✓	Lin./Log.	✓	✓	✓	5x5mm
SX8634	12	8	I ² C	✓	✓	✓		15ms	80µA	>5mm	✓	Lin./Log.	✓	✓	✓	5x5mm
SX8635	12	8	I ² C	✓	✓		✓	15ms	80µA	>5mm	✓	Lin./Log.	✓	✓	✓	5x5mm
SX8636	8	8	I ² C	✓	✓			15ms	70µA	>5mm	✓	Lin./Log.	✓	✓	✓	4x4mm
SX8638	8	8	I ² C	✓	✓	✓		15ms	70µA	>5mm	✓	Lin./Log.	✓	✓	✓	4x4mm
SX8639	8	8	I ² C	✓	✓		✓	15ms	70µA	>5mm	✓	Lin./Log.	✓	✓	✓	4x4mm
SX8643	12	8	I ² C		✓			15ms	80µA	>5mm	✓	Lin./Log.	✓	✓	✓	5x5mm
SX8644	12	8	I ² C		✓	✓		15ms	80µA	>5mm	✓	Lin./Log.	✓	✓	✓	5x5mm
SX8645	12	8	I ² C		✓		✓	15ms	80µA	>5mm	✓	Lin./Log.	✓	✓	✓	5x5mm
SX8646	8	8	I ² C		✓			15ms	70µA	>5mm	✓	Lin./Log.	✓	✓	✓	4x4mm
SX8647	8	8	I ² C				✓	15ms	70µA	>5mm	✓	Lin./Log.	✓	✓	✓	4x4mm
SX8648	8	8	I ² C		✓	✓		15ms	70µA	>5mm	✓	Lin./Log.	✓	✓	✓	4x4mm
SX8649	8	8	I ² C		✓		✓	15ms	70µA	>5mm	✓	Lin./Log.	✓	✓	✓	4x4mm

World's Lowest Power, Capacitive Touch Button and Proximity Solution with Advanced LED Drivers and Analog Output Interface

This ultra low power capacitive touch family features a special Analog Output Interface for legacy TV system architecture and provides superior sensitivity for different touch button control designs. With advanced LED drivers for enhanced visual feedback and long range proximity sensing, the SX8660/61 family are the ideal choice for LCD TV Capacitive button applications.



Applications:

- Flat Panel TVs
- LCD Monitors
- Mechanical Button Replacement



Touch-Interface Products

Product Highlights:



- High resolution capacitive sensing solution
 - Proximity detection up to 10cm
 - Supports button design
- Up to 2 analog output interfaces
 - Enable button reporting thru host's ADC
- Versatile button reporting configuration
 - Advanced channel filtering responds to the strongest touch
- Extreme sensitivity:
 - Works with thick >5mm overlay materials
- Extremely low power with programmable scan time
 - 70µA (typ) @ 195ms
- Smart auto-offset compensation
 - Eliminates false triggers due to environmental factors
- Advanced LED drivers
 - Individual 256-step intensity/Fade-in/Fade-out control
 - Continuous breathing mode
 - Auto-lightening without host interaction
- Support of buzzer for audible feedback
- No external components per input
- Ultra small footprint
 - 4.0 x 4.0mm 28-QFN

	Sensor Inputs	LED Driver (12 mA)	Interface	Proximity	Button	Min. Scan Time	Power @ 195ms	Overlay	Auto Compensation	Intensity (256-step)	Fade-in/out	Auto Lightening	Field Programmable	Footprint
SX8660	8	8	I ² C/Analog		✓	15ms	70µA	>5mm	✓	Lin./Log.	✓	✓	✓	4x4mm
SX8661	8	8	I ² C/Analog	✓	✓	15ms	70µA	>5mm	✓	Lin./Log.	✓	✓	✓	4x4mm

Touch-Interface Products



Semtech Debuts Touchscreen Controller Platform with Lowest Power, Smallest Footprint and $\pm 15\text{kV}$ ESD Protection

The SX8650 is the first in a new platform of touchscreen controllers and is optimized for power ($23\mu\text{A}$), size ($1.46\text{mm} \times 1.96\text{mm}$), and ESD protection. These features make it the most application-specific resistive touchscreen controller on the market for such applications as mobile phones, digital still cameras, MP3 players, PDAs, personal navigation devices, and handheld gaming devices.



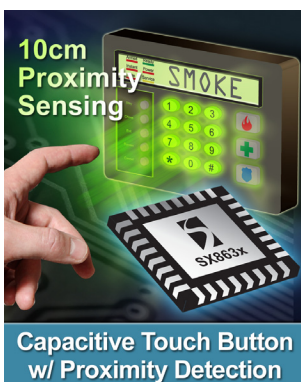
Semtech Debuts World's Lowest Power, Fully Integrated Capacitive Touch Sensor IC Platform

The capacitive analog interface on each of the seven ICs in the SX864x platform is designed with a highly accurate ADC that provides superior sensitivity to work with overlay materials more than 5mm thick, offering extremely robust and ESD-immune system design. With current consumption as little as $80\mu\text{A}$ at operation, these ICs are the ideal choice for battery-powered devices. This SX864x platform also integrates eight, 256-step LED drivers with individual intensity and linear and logarithmic fading control that is optimized for human vision.



Semtech Expands Ultra-Low Power, Resistive Touchscreen Controller Platform with 5-Wire, SPI Interface Device

The SX8652 is one of a new generation of touchscreen controllers that are optimized for low-power consumption ($23\mu\text{A}$), small size ($1.46\text{mm} \times 1.96\text{mm}$ chip-scale package), and high electrostatic discharge (ESD) protection ($\pm 15\text{kV}$). These features make the SX8652 the most application-specific resistive touchscreen controller on the market for applications including PDAs, digital still cameras, point-of-sales terminals, printers and other portable touchscreen monitor devices.



Semtech Adds World's Most Sensitive Proximity Function to Leading Capacitive Touchbutton Platform

The new SX863x capacitive touch button controllers come in 8- and 12-channel versions and feature a long range of proximity detection of 10cm (view SX863x proximity detection range video clip), allowing the sensor to control power-management and other convenience features such as system wake-up, LED wake-up and automatic backlight activation upon user detection.

Touch-Interface Products



SX8660/61 Semtech Easy-to-Use Proximity Capacitive Touch Sensor Platform is Optimized for TV Applications

The 8-channel SX8660/61 touch sensor platform features integrated LED drivers and an extended, 10cm range of proximity sensing. It is designed to easily replace legacy mechanical button controllers with an analog output interface (AOI) that supports the use of a buzzer for audible feedback making the platform fully compatible with a wide range of television designs.



SX8654/55/56/57/58 Resistive Touchscreen Controllers

The SX8654/55/56/57/58 features a highly accurate 12-bit Analog-to-Digital converter for coordinates and touch pressure measurement with current consumption as little as 30 μ A at 8ksps rate. These resistive touchscreen controllers can also support a proximity detection distance of > 5cm using ANY standard 4/5-wire resistive panel, enabling various power-saving features such as automatic backlight activation or system wake-up. These devices also incorporate a haptics motor driver for controlling Linear Resonant Actuator (LRA) and Eccentric Rotating Mass (ERM) micro motors (up to 250mA) while providing acknowledgement to touch events, thus emulating the tactile feedback similar to mechanical keys which enhance the overall user experience.



SX8674/75/76/77/78 Resistive Touchscreen Controllers

The new SX867x family is a fully integrated resistive touchscreen platform which incorporates various innovative high end features such as multi-touch gesture support for 4-wire touchscreen, proximity detection distance of >5cm with zero external component and an advanced haptics driver for controlling Linear Resonant Actuator (LRA) and Eccentric Rotating Mass (ERM) micro motors all packed in a very tiny 2.07x2.07mm footprint. With current consumption as low as 30 μ A at operation (0.4 μ A at standby) and a robust built-in ESD protection that can withstand an ESD event up to +/-15kV, these controllers are the ideal solution for a wide variety of touchscreen applications.

Touch-Interface Products

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- Sales/Support Offices



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