# driving

**FEATURING** AEC-Q100 Qualified Portfolio

# **Automotive** Selector Guide

Semtech Automotive Solutions, helping you drive the future of automotive design with our Touch Controllers, Cable Drivers, Instrument Clusters, Key Fobs, Seatback Infotainment, Switching Regulators in EMI-Sensitive Console Applications, LED Lighting, and Drive Train Power Supplies.

Fall 2015

**SEMTECH**

## contents

# about Semtech

Semtech Corporation is a leading supplier of analog and mixed-signal semiconductor platforms for high-end consumer, enterprise computing, communications and industrial applications. Our vision is to be the global leader in analog and mixed-signal platforms enabling architectural and performance differentiation. Semtech, publicly traded since 1967, is listed on the NASDAQ Global Select Market under the symbol SMTC and has more than 32 sales and application support offices in 14 countries as well as representatives and distribution support locations in more than 30 countries.

Semtech is dedicated to providing proprietary platforms differentiated by innovation, size, efficiency, performance and reach. Our solutions are used in some of the most innovative systems and products in the fastest growing markets today. These markets include smartphones, LCD TVs, notebooks, tablets, smart grid, automotive, automatic meter reading, medical, wireless infrastructure, PON, Internet of Things, optical transport and datacenters.

More than 5,000 customers worldwide rely on our diverse product portfolio and world class technology roadmap for solutions in low-power wireless communications, optical data transport, video broadcasting, power management, circuit protection, touch sensing, and more making Semtech one of the most balanced semiconductor companies in the industry.

find us, like us, follow us

A World of Solutions™

# driving the future

Automotive manufacturers are facing increasing demand for technology that improves the safety, comfort and performance of passenger and commercial automobiles - especially when targeting a tech-savvy market permeated by digital devices.

While virtually unheard of a few years ago, features such as automotive infotainment components, brake assist, lane-departure warning and parking-assist cameras have become commonplace in today's vehicles. Drivers routinely expect their cars to be equipped with digital devices that enable them to control the cabin environment while staying focused on the road. These devices include touchscreen or voice activated controls for navigation, heating and cooling, phone or internet access, and radio and music players.

In order to meet the needs of an increasingly complex automotive market, design engineers rely on Semtech's feature-rich, highly integrated products. Our products offer design flexibility with low power, small package, high efficiency, improved reliability and a lower overall system cost.
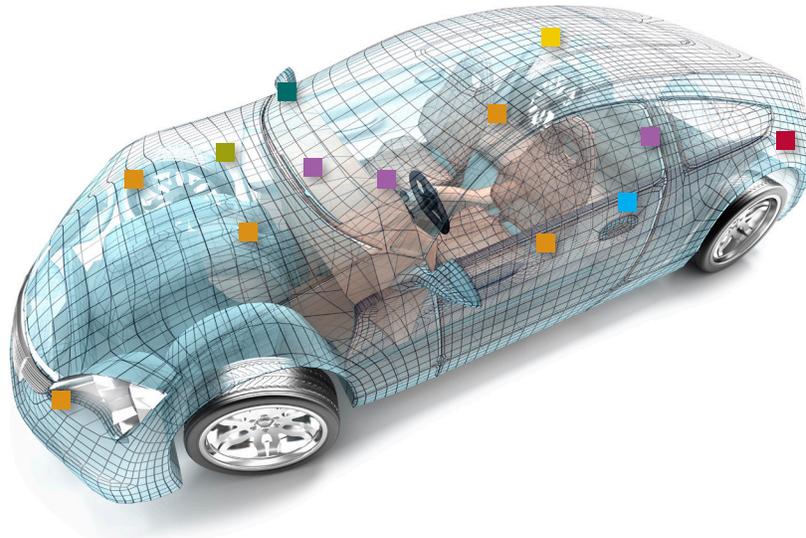
Semtech's automotive product line was created with the needs of automotive design engineers in mind. By partnering with Semtech, you will receive high-quality products, knowledgeable support, and our commitment to meet and exceed your next design challenge. Our knowledge of today's markets and dedication to your success will give you the confidence and freedom to create the solutions your customers.

# AEC-Q100 Qualified Parts

## OUR EXPANDING COMMITMENT

As the automotive market demand increases so does our commitment to power, protect and connect you with the ideal IC solutions. Semtech has provided ICs for the automotive industry for many years and, our devices are used in applications ranging from protecting sensitive electronics to in-cabin lighting and touch screen human interface. We are continuously working to expand our list of certified products to better serve our automotive customers, and we can prioritize part qualification based on demand in order to meet customer needs.

| Power Management | |
| --- | --- |
| Part Number | Features |
| SC183CQ | 2.5MHz, 2A Synchronous Step-Down Switching Regulator |
| SC4501Q | 2 Amp, 2 MHz Boost Switching Regulator with Soft-Start |
| SC220Q | 20MHz, 650mA, X-EMI™ Enabled Synchronous Step-Down Regulator |
| SC441A | High-Efficiency Integrated Boost Driver For 4-Strings Of 150mA LEDs |
| SC508A | Wide Input Range (4.5V to 46V) EcoSpeed® Buck Controller With Integrated LDO |
| SC5012Q | High-Brightness LED Driver for 150mA x 4 -strings 5,000:1 PWM Dimming I²C Control |

| RF/ISM | |
| --- | --- |
| SX1239 | Low-Power Integrated UHF Receiver |
| SX1231 | Low-Power Integrated UHF Transceiver |
| SX1233 | High Bit Rate Transceiver Low-Power Integrated UHF Transceiver |
| SX1243 | Low Cost Low Current Integrated Transmitter 310 To 928MHz Frequency Agile |

| Circuit Protection | |
| --- | --- |
| Part Number | Features |
| SLVU2.8Q | Analog Video |
| RClamp® 0512TQ | USB, LVDS, Ethernet |
| RClamp® 0524PQ | HDMI, MHL |
| RClamp® 0582BQ | Single Pair Ethernet, USB 2.0 |
| µClamp® 0571P | Vbus/DC lines |
| µClamp® 3311PQ | Multimedia Touchpoint |
| µClamp® 0511PQ | Keypads, ESD Sensitive Touch point |
| RClamp® 2574NQ | Ethernet, LVDS |
| RClamp® 1521PQ | Antenna |
| RClamp® 2431TQ | Antenna, CAN Bus |
| RClamp® 0531TQ | Antenna, CAN Bus |
| RClamp® 0531TQ | Single Pair Ethernet, USB |
| EClamp® 2357NQ | SD Card |

# Dashboard Electronics, USB & Audio Ports

**dash**

## LED Drivers

**SC441A** - High-Efficiency Integrated Boost Driver For 4-Strings Of 150mA LEDs

**SC443** - High Efficiency Integrated Boost Driver for 3-Strings of 30mA LEDs

**SC445** - High Efficiency Integrated Boost Driver for 4-Strings of 150mA LEDs

**SC446** - High Efficiency Integrated Boost Driver for 3-Strings of 100mA LEDs

**SC2597** - Low Voltage DDR Termination Regulator

**SC4524/5** - Maximum 28V input, with high efficiency and tight output voltage regulation

**SC4541** - Single String LED Driver with High Side Sense

**SC5010/H** - High-Efficiency Phase Shifted 8-CH LED Driver With I²C Control

**SC5012Q** - High-Brightness LED Driver for 150mA x 4-strings 5,000:1 PWM Dimming I²C Control

**SC5014/A** - High-Efficiency 4-CH/2-CH LED Driver With I²C Control

**SC9301** - 10A EcoSpeed® Integrated FET Regulator with 5V LDO and Hiccup Restart

## Switching Regulators

**SC220Q** - 20MHz, 650mA, X-EMI™ Enabled Synchronous Step-Down Regulator

## ESD Protection

**RClamp® 0582BQ** - Single Pair Ethernet Protection

**RClamp® 0512TQ** - USB, LVDS, Ethernet

**EClamp® 0524PQ** - HDMI, MHL

**EClamp® 2357NQ** - SD Card Protection

**µClamp® 0511PQ** - Audio, AUX port

# Antenna Protection

**antenna**

## Protection

**RClamp® 0531TQ** - 5V Bidirectional ESD Protection

**RClamp® 2431TQ** - 24V Bidirectional ESD Protection

**RClamp® 1531TQ** - 15V Bidirectional ESD Protection

# Networking, Computing & Power Supply

**network**

**SC508A** - Wide Input Range (4.5V to 46V) EcoSpeed® Buck Controller With Integrated LDO

**SC414** - Wide Input Range (3V to 28V) 6A EcoSpeed® Synchronous Buck Regulator

**SC402B** - Wide Input Range (3V to 28V) 10A EcoSpeed® Synchronous Buck Regulator

**SC187** - Low Input Voltage (2.9V to 5.5V) 4A, 2.2MHz Synchronous Buck Regulator With 15 Selectable Output Voltages

**SC174** - Low Input Voltage (3V to 5.5V) 4A EcoSpeed® Synchronous Buck Regulator

**SC284** - Low Input Voltage (2.9V to 5.5V) Dual 1.8A Synchronous Buck Regulator with 15 Selectable Output Voltages Per Channel

**SC4501** - 2A, 2MHz Boost Regulator With Programmable Soft-Start

**SC2597** - Low Voltage DDR Termination Regulator

## Networking Protection

**RClamp® 2574NQ RClamp® 3374N** - ESD & Surge Protection For Ethernet Interfaces

**RClamp® 0512TQ** - ESD protection on high-speed ports

**RClamp® 0582BQ** - Low Capacitance TVS

**RClamp® 3552T - 2-Line ESD Protection**

**µClamp® 3311PQ** - Single-Pair Ethernet ESD Sensitive I/O

# Audio, Navigation, Infotainment & Power

**audio/video**

## Cable Drivers

**GS1678** - High-Speed Video Cable Driver Solution

## SDI SerDes

**GS1661A** - Multi-rate SDI Integrated Receiver For High-Speed, Low Latency, Video Transmission Solutions

**GS1662** - SDI Transmitter For High-Speed, Low Latency, Video Transmission Solutions

## Adaptive Cable Equalizer

**GS1674** - High-speed BiCMOS Integrated Circuit Design For Video Cable Equalization

## Timing

**GS4911** - Advanced Video Timing Solution

## LED Drivers

**SC441A** - High-Efficiency Integrated Boost Driver For 4-Strings Of 150mA LEDs

**SC5010/H** - High-Efficiency Phase Shifted 8-CH LED Driver With I²C Control

**SC5014/A** - High-Efficiency 4-CH/2-CH LED Driver With I²C Control

**SC5012Q** - High-Brightness LED Driver for 150mA x 4-strings 5,000:1 PWM Dimming I²C Control

## Switching Regulators

**SC508A** - Wide Input Range (4.5V to 46V) EcoSpeed® Buck Controller With Integrated LDO

**SC402B** - Wide Input Range (3V to 28V) 10A EcoSpeed® Synchronous Buck Regulator

**SC187** - Low Input Voltage (2.9V to 5.5V) 4A, 2.2MHz Synchronous Buck Regulator With 15 Selectable Output Voltages

**SC174** - Low Input Voltage (3V to 5.5V) 4A EcoSpeed® Synchronous Buck Regulator

**SC284** - Low Input Voltage (2.9V to 5.5V) Dual 1.8A Synchronous Buck Regulator with 15 Selectable Output Voltages Per Channel

**SC4501** - 2A, 2MHz Boost Regulator with Programmable Soft-Start

**SC220Q** - 20MHz, 650mA, X-EMI™ Enabled Synchronous Step-Down Regulator

**SC3303** - 3A EcoSpeed® Step-Down Regulator with LDO and Ultrasonic Power Save

## Capacitive Touch Controllers

**SX8633** - Low-Power, Capacitive Button Touch

**SX8634** - Low-Power, Capacitive Button & Slider Touch

**SX8635** - Low-Power, Capacitive Button & Wheel Touch

**SX8636** - Low-Power, Capacitive Button Touch

**SX8638** - Low-Power, Capacitive Button & Slider Touch

**SX8639** - Low-Power, Capacitive Button & Wheel Touch

**SX8643** - Ultra Low-Power, Capacitive Button Touch

**SX8644** - Ultra Low-Power, Capacitive Button & Slider Touch

**SX8645** - Ultra Low-Power, Capacitive Button & Wheel Touch

**SX8646** - Ultra Low-Power, Capacitive Button Touch

**SX8647** - Ultra Low-Power, Capacitive Wheel Touch

**SX8648** - Ultra Low-Power, Capacitive Button & Slider Touch

**SX8649** - Ultra Low-Power, Capacitive Button & Wheel Touch

## Resistive Touch Controllers

**SX8654** - Haptics Enabled 4/5-Wire Resistive Touchscreen Controller

**SX8656** - Haptics Enabled 4/5-Wire Resistive Touchscreen Controller

**SX8658** - Haptics Enabled 4/5-Wire Resistive Touchscreen Controller

**SX8675** - Haptics Enabled Multitouch 4/5-Wire Resistive Touchscreen Controller

**SX8677** - Haptics Enabled Multitouch 4/5-Wire Resistive Touchscreen Controller

**SX8678** - Haptics Enabled Multitouch 4/5-Wire Resistive Touchscreen Controller

## Protection

**µClamp® 0511PQ**, **µClamp® 3311PQ**, **µClamp® 0531TQ** - Multimedia Touchpoint Protection, Audio Protection

**RClamp® 0524PQ** HDMI, MHL

*Indicates Semtech AEC-Q100 Qualified Part*

# Backup Camera & Analog Video

**camera**

### Switching Regulators

**SC508A** - Wide Input Range (4.5V to 46V) EcoSpeed® Buck Controller With Integrated LDO

**SC187** - Low Input Voltage (2.9V to 5.5V) 4A, 2.2MHz Synchronous Buck Regulator With 15 Selectable Output Voltages

**SC174** - Low Input Voltage (3V to 5.5V) 4A EcoSpeed® Synchronous Buck Regulator

**SC284** - Low Input Voltage (2.9V to 5.5V) Dual 1.8A Synchronous Buck Regulator with 15 Selectable Output Voltages Per Channel

### Camera Protection

**SLVU2.8Q** - Analog Video/Surveillance Camera Protection

**RClamp® 0512TQ** - USB, LVDS, Ethernet

**RClamp® 3552T** - LVDS

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# Interior & Exterior LED Lighting

**lights**

*Interior - Map, Vanity Mirror, Door, Dome, Instrument, Center Stack, Foot Area and LCD Backlights*
*Exterior - Rear, Turn Signal, Center High Mount, Under Door, Mirror Down and Daytime Running Lights*

### Boost LED Drivers

**SC441A** - High-Efficiency Integrated Boost Driver For 4-Strings Of 150mA LEDs

**SC4541** - Single String LED Driver with High Side Sense

**SC446** - High Efficiency Integrated Boost Driver for 3-Strings of 100mA LEDs

**SC442** - 10-Channel High Efficiency LED Driver

**SC443** - High Efficiency Integrated Boost Driver for 3-Strings of 30mA LEDs

**SC4540** - Single String 10 LED Driver

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# Remote Keyless Entry

**key**

### RF Receivers

**SX1239** - Low-Power Integrated UHF Receiver

### RF Transceivers

**SX1231** - Low-Power Integrated UHF Transceiver

### RF Transmitters

**SX1230** - Integrated RF Transmitter IC Narrow/wideband 315, 434, 868 and 915MHz band RF Transmitter

**SX1243** - Low Cost Low Current Integrated Transmitter 310 To 928MHz Frequency Agile

### Protections

**RClamp® 0531TQ** - Antenna, Keypad

**µClamp® 0511PQ** Single-line bidirectional TVS for keypads, touch-buttons

**µClamp® 3311PQ** Single-line bidirectional TVS for keypads, touch-buttons

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# Wireless Charging

**power**

**SC4501Q** - 2 Amp, 2 MHz Boost Switching Regulator with Soft-Start

*Indicates Semtech AEC-Q100 Qualified Part*

# TVS Automotive Protection Solutions

## Automotive Transient Voltage (TVS) Protection Family

| Interface to Protect | Part Number | V$_{rwm}$ | Lines | ESD Rating (air/contact) | Surge (8x20us) | Cap (pF) | Pkg Size (mm) |
|---|---|---|---|---|---|---|---|
| Standard Ethernet | RClamp® 2574NQ | 2.5V | 4 | ±30kV / ±30kV | 40A | 1.7pF | 3.0x2.0x0.6 |
| | RClamp® 3374N | 3.3V | 4 | ±30kV/ ±30kV | 40A | 1.7pF | 3.0x2.0x0.65 |
| 2-Wire Ethernet Single Twisted Pair | RClamp® 0512TQ | 5V | 2 | ±30kV / ±30kV | 20A | 2pF | 1.0x0.6x0.58 |
| | RClamp® 0582BQ | 5V | 3 | ±30kV/ ±25kV | 15A | 1.2pF | 1.6x1.6x0.75 |
| | RClamp® 0531TQ | 5V | 1 | ±20kV/ ±12kV | 4A | 0.5pF | 1.0x0.6x0.5 |
| LVDS Links | RClamp® 2574NQ | 2.5V | 4 | ±30kV / ±30kV | 40A | 1.7pF | 3.0x2.0x0.6 |
| | RClamp® 3324P | 3.3V | 4 | ±17kV/ ±20kV | 4.5A | 0.6pF | 2.5x1.0x0.5 |
| | RClamp® 3552T | 3.5V | 2 | ±12kV/ ±17kV | 4A | 0.4pF | 1.0x0.6x0.4 |
| USB 3.0 | RClamp® 3346P | 3.3V | 6 | ±17kV/ ±20kV | 4.5A | 0.65pF | 2.7x0.8x0.5 |
| | RClamp® 3324P | 3.3V | 4 | ±17kV/ ±20kV | 4.5A | 0.6pF | 2.5x1.0x0.5 |
| | RClamp® 3552T | 3.5V | 2 | ±12kV/ ±17kV | 4A | 0.4pF | 1.0x0.6x0.4 |
| USB 2.0 | RClamp® 0582N | 5V | 3 | ±20kV/ ±12kV | 5A | 0.5pF | 1.2x1.0x0.58 |
| | RClamp® 0512TQ | 5V | 2 | ±30kV/ ±30kV | 20A | 2pF | 1.0x0.6x0.58 |
| | RClamp® 0582BQ | 5V | 2 | ±30kV/ ±25kV | 15A | 1.2pF | 1.6x1.6x0.75 |
| | EClamp® 8052P | 5V | 2 | ±25kV/ ±30kV | 6A | 1.2pF | 1.9x1.7x0.55 |
| Antenna Interfaces | RClamp® 0531TQ | 5V | 1 | ±20kV/ ±12kV | 4A | 0.5pF | 1.0x0.6x0.5 |
| | RClamp® 1521PQ | 15V | 1 | ±15kV/ ±8kV | 4A | 0.3pF | 1.0x0.6x0.5 |
| | RClamp® 2431TQ | 24V | 1 | ±13kV/ ±8kV | 2A | 0.35pF | 1.0x0.6x0.5 |
| Audio | µClamp® 0511PQ | 5V | 1 | ±30kV/ ±30kV | 12A | 75pF | 1.0x0.6x0.5 |
| CAN bus | µClamp® 3601P | 36V | 1 | ±20kV/ ±15kV | 2A | 25pF | 1.0x0.6x0.5 |
| | µClamp® 2671P | 26V | 1 | ±30kV/ ±30kV | 23A | 155pF | 1.6x1.0x0.57 |
| HDMI, MPPI, MHL | EClamp® 8052P | 5V | 2 | ±25kV/ ±30kV | 6A | 1.2pF | 1.9x1.7x0.55 |
| Analog Video | SLVU2.8Q | 2.8V | 2 | ±25kV/ ±30kV | 24A | 100pF | 2.9x2.37x0.90 |
| | RClamp® 0524PQ | 5V | 4 | ±25kV / ±20kV | 5A | 0.6pF | 2.5 x 1.0 x 0.5mm |
| Keypads, Touchbuttons, Control Lines | µClamp® 0301PQ | 3.0V | 1 | ±25kV/ ±30kV | 5A | 12pF | 1.0x0.6x0.5 |
| | µClamp® 3311PQ | 3.3V | 1 | ±25kV/ ±30kV | 5A | 12pF | 1.0x0.6x0.5 |
| | µClamp® 0511PQ | 5V | 2 | ±30kV/ ±30kV | 12A | 75pF | 1.0x0.6x0.5 |

## Qualified Single-line DC Bus Protection

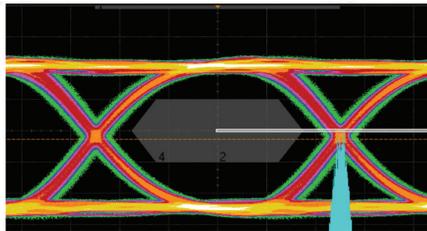| Typ Application | Part Number | V$_{rwm}$ | Lines | ESD Rating (air/contact) | Surge (8x20us) | Cap (pF) | Pkg Size (mm) |
|---|---|---|---|---|---|---|---|
| Single-line DC Bus Protection | µClamp® 0571P | 5V | 1 | ±30kV/ ±30kV | 80A | 675pF | 1.6x1.0x0.57 |
| | µClamp® 0871P | 8V | 1 | ±30kV/ ±30kV | 65A | 475pF | 1.6x1.0x0.57 |
| | µClamp® 1071P | 10V | 1 | ±30kV/ ±30kV | 60A | 350pF | 1.6x1.0x0.57 |
| | µClamp® 1271P | 12V | 1 | ±30kV/ ±30kV | 45A | 275pF | 1.6x1.0x0.57 |
| | µClamp® 1571P | 15V | 1 | ±30kV/ ±30kV | 40A | 220pF | 1.6x1.0x0.57 |
| | µClamp® 1871P | 18V | 1 | ±30kV/ ±30kV | 35A | 220pF | 1.6x1.0x0.57 |
| | µClamp® 2271P | 22V | 1 | ±30kV/ ±30kV | 25A | 165pF | 1.6x1.0x0.57 |
| | µClamp® 2671P | 26V | 1 | ±30kV/ ±30kV | 23A | 155pF | 1.6x1.0x0.57 |
| | µClamp® 3671P | 36V | 1 | ±30kV/ ±30kV | 18A | 150pF | 1.6x1.0x0.57 |

## Filter Devices - TVS + EMC Filter

| Typ Application | Part Number | V$_{rwm}$ | Lines | ESD Rating (air/contact) | Filter Type | Cap (pF) | Pkg Size (mm) |
|---|---|---|---|---|---|---|---|
| SD Card | EClamp® 2410PQ | 5V | 6 | ±17kV/ ±12kV | SD Card Termination | 15pF | 4.0x1.6x0.5 |
| | EClamp® 2357NQ | 5V | 6 | ±20kV/ ±12kV | RC filter SD Card Termination | 20pF | 3.0x3.0x0.6 |

# TVS Protection - Features & Benefits

Semtech provides TVS (Transient Voltage Suppression) diodes that safeguard low voltage circuits against damage or latch-up caused by electrostatic discharge (ESD), lightning, and other destructive voltage transients. Our circuit protection devices feature low clamping voltage, low capacitance, and low leakage current. Furthermore, we meet the industry's toughest transient immunity standards.
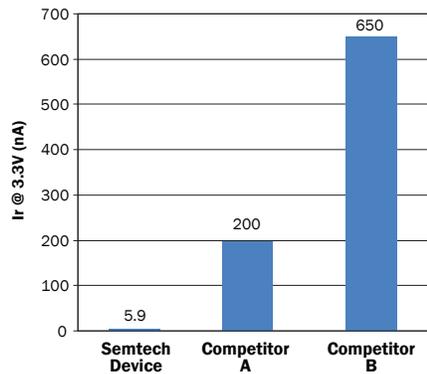
## LOW CAPACITANCE

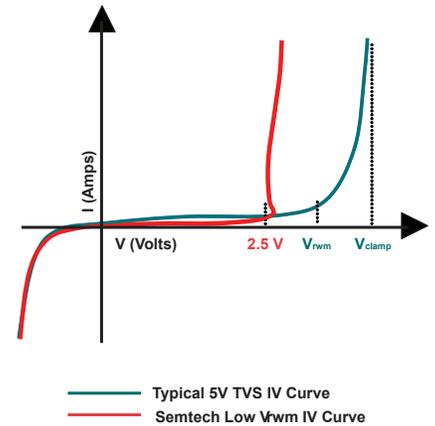Provides robust protection while preserving signal integrity in high-speed video and data interfaces

## LOW LEAKAGE

Increases battery life in handheld electronic devices

## LOWER WORKING VOLTAGE

Reduces stress energy to protected IC

Typical 5V TVS IV Curve
Semtech Low Vrwm IV Curve

## KEY FEATURES

- ESD protection
- ESD-EMI filter protection
- High-current lightning protection
- Low capacitance ESD protection
- Low voltage ESD protection

## PRODUCTS

**TClamp**® = TransClamp
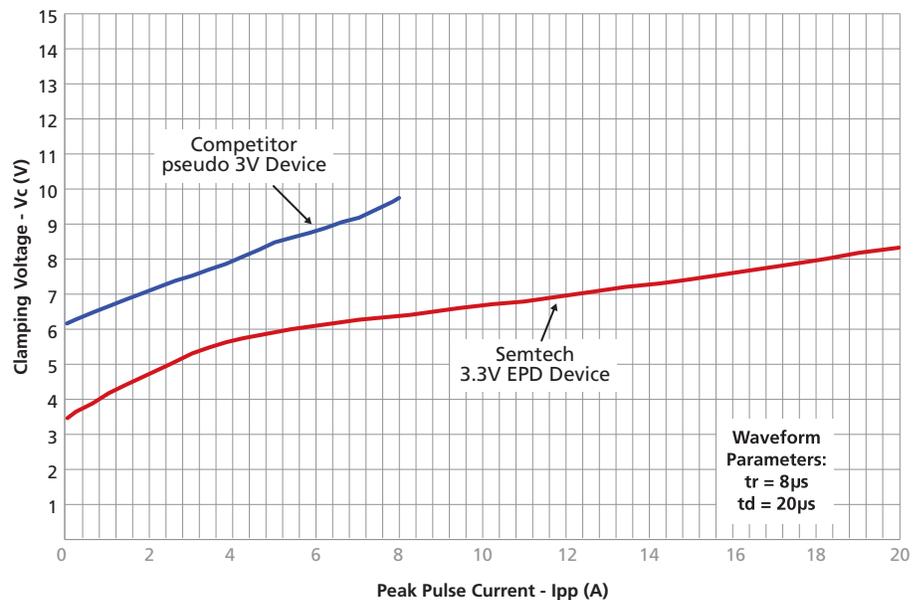High Surge lightning current handling capability

**RClamp**® = RailClamp
Low capacitance for high speed applications

**µClamp**® = MicroClamp
Single TVS or TVS arrays for general purpose Standard TVS Process

**EClamp**® = EMIClamp
ESD and EMI protection with integrated inductor or resistor

## LOW CLAMPING VOLTAGE

Better protection and less stress on transceiver

Competitor pseudo 3V Device

Semtech 3.3V EPD Device

Waveform Parameters:
tr = 8µs
td = 20µs

# RF / Wireless & Long Range RFIC Solutions

## LOW-POWER INTEGRATED UHF TRANSCEIVERS, TRANSMITTERS AND RECEIVERS

Semtech wireless RF transceivers, transmitters and receivers are designed with a highly integrated architecture allowing for a minimum external component count while maintaining RF design flexibility.

Operating in the license-free ISM (Industry Scientific and Medical) bands, our devices comply with relevant European and North American standards. What makes our ISM band RF devices unique is their extremely low current consumption of only 3mA in full active mode. Our RF devices are used in wireless security systems, sensor networks, industrial monitoring, meter reading, home automation and remote wireless control applications.

The SX1239 is a highly integrated RF receiver capable of operation over a wide frequency range, including the 433,868 and 915MHz license-free ISM frequency bands. Its highly integrated architecture allows for a minimum of external components while maintaining maximum design flexibility.

### FEATURES & BENEFITS

- High sensitivity: down to -120dBm at 1.2kbps
- High selectivity: 16-tap FIR channel filter
- Bullet-proof front end: IIP3 = -18dBm, IIP2 = +35dBm, 80dB blocking immunity, no image frequency response
- Low current: Rx = 16mA, 100nA register retention
- Constant RF performance over voltage range of chip
- FSK bit rates up to 300kb/s
- Fully integrated synthesizer with a resolution of 61Hz
- FSK, GFSK, MSK, GMSK and OOK demodulation
- Built-in bit synchronizer performing clock recovery
- Incoming sync word recognition
- 115dB+ dynamic range RSSI
- Automatic RF sense with ultra-fast AFC
- Packet engine with CRC, AES-128 encryption and 66-byte FIFO
- Built-in temperature sensor and low battery indicator

### PARTNER SOLUTIONS

Complete solutions with RF, MCU and software protocol stacks.

**Freescale**

- TRX SoC – SX1231 + MCU (MC12311)
- Multiple SW protocols including WMBus

**Microchip**

- TX SoC –SX1243 + PIC (PIC12LF1840T & PIC12F529T)
- SX1211* module w/ mesh networking solution
- Sell rebranded SX1211 (MRF89XAM9A)

### APPLICATIONS

- Wireless sensor networks
- Wireless alarm and security systems
- Monitoring and control
- TPMS (tire pressure monitoring)
- RKE (remote keyless entry)

### Long Range RFIC

| Part Number | TX / RX | Band (MHz) | TX Power (dBm) | Modulation | Max Bit Rate (kbps) | RX Sensitivity (dBm) | Link Budget (dB) | TX Current (mA) | RX Current (mA) |
|---|---|---|---|---|---|---|---|---|---|
| SX1230 | TX | 290-1020 | -18 ~ 17 | G/F/MSK & OOK | 300 (FSK) 32.7 (OOK) | – | – | 33mA@10dBm | – |
| SX1243 | TX | 310-928 | 0 & 10 | FSK/OOK/ASK | 100 | – | – | 15mA@10dBm | – |
| SX1239 | RX | 290-1020 | – | G/F/MSK & OOK | 300 (FSK) 32.7 (OOK) | -120 | – | – | 16 |
| SX1231 | TX / RX | 290-1020 | -18 ~ 17 | G/F/MSK & OOK | 300 (FSK) 32.7 (OOK) | -120 | 137 | 33mA@10dBm | 16 |
| SX1276 | TX / RX | 137-1020 | +20 | LoRa®, GFSK, OOK | 300kbps (FSK) 32.7kbps (OOK) | -156 | -176 | 29mA@13dBm | 10.8 |

*Indicates Semtech AEC-Q100 Qualified Part*

# Wireless Charging Solutions for Automotive

## WIRELESS POWER TRANSMITTERS AND RECEIVERS

Semtech offers wireless power transmitter and receiver platforms for both direct and indirect charge applications in both standards compliant and non-compliant systems. Semtech is a member of the Wireless Power Consortium (WPC), Power Matters Alliance (PMA) and the Alliance for Wireless Power (A4WP), and is active in helping shape the future standards for wireless power.

## FEATURES & BENEFITS

**Optimized Dual-mode (PMA + WPC Qi®):**

- Transmitter solution on a single hardware platform

**Support for Tri-mode**

- WPC Qi®, PMA and A4WP-Rezence applications

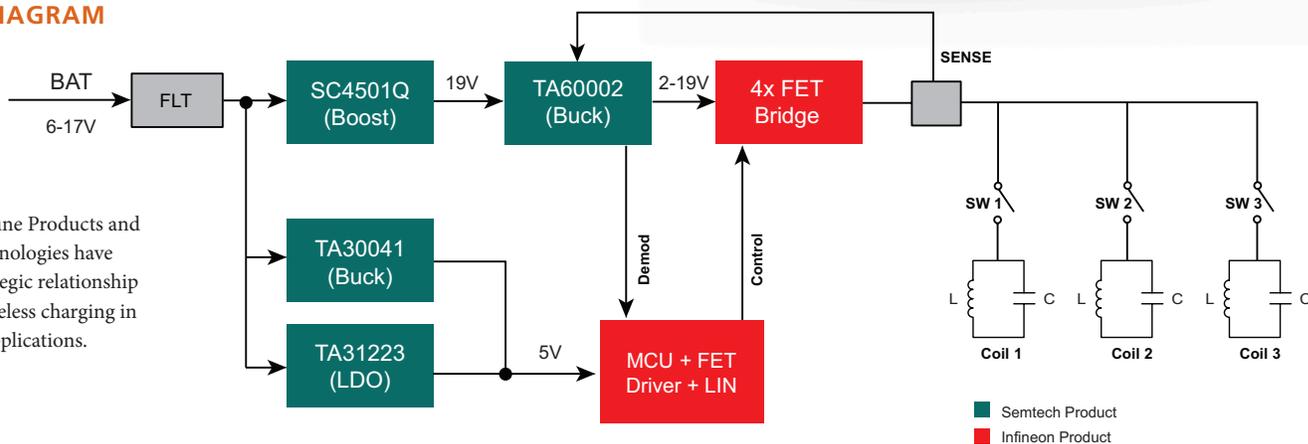**Firmware-based solution for ultimate flexibility:**

- Easy updates to support standard revisions
- Integrate custom firmware for proprietary applications
- Multi-coil support allows freedom of positioning

**Fully compatible with automotive environment:**

- Fixed-frequency operation reduces EMI to minimize interference with other systems
- Operates on 6 - 16V input supply; option to work up to 24V
- Can be protected from load dump, double battery and reverse battery
- Can be integrated into the automotive communications infrastructure
- AEC-Q100 certified

## BLOCK DIAGRAM

Semtech's Triune Products and Infineon Technologies have formed a strategic relationship to expand wireless charging in automotive applications.



## AEC-Q100 Qualified

| Part Number | Type | V<sub>in</sub> | | Iout Max (A) | PowerGood flag | Enable | Soft Start | PSAVE | Package (mm) |
|---|---|---|---|---|---|---|---|---|---|
| | | Min | Max | | | | | | |
| SC4501Q | Regulator | 1.4 | 16 | 2 | No | Yes | Programmable | No | 10 Pin - MLPD, 3x3 |

For further inquires, please contact Semtech Sales Rep directly.

# Power Management Solutions - EcoSpeed®

## 46V ECOSPEED® DC-DC BUCK CONTROLLER WITH INTEGRATED LDO - AEC-Q100 QUALIFIED

The SC508/SC508A is a synchronous EcoSpeed® buck controller, which incorporates Semtech's advanced, patented adaptive on-time control architecture to provide excellent light-load efficiency and fast transient response.

### FEATURES & BENEFITS

- Power system
  - Input voltage 4.5V to 46V
  - Integrated bootstrap switch
  - Fixed 5V LDO output 200mA
  - 1% reference tolerance -40 to +85 °C
  - Selectable internal/external bias power supply
  - EcoSpeed® architecture with pseudo-fixed frequency adaptive on-time control

- Logic input and output control
  - Independent EN control for LDO and switcher
  - Programmable Soft-Start time
  - Programmable VIN UVLO threshold
  - Power-Good output
  - Selectable power-save mode
  - Programmable ultrasonic power-save mode

- Protection
  - Automatic restart on fault shutdown
  - Over-voltage and under-voltage
  - TC compensated RDS (ON) sensed current limit
  - Thermal shutdown
  - Smart power-save
  - Pre-bias start-up

- Capacitor types: SP, POSCAP, OSCON and ceramic

- Package: MLPQ-20, 3.0mm x 3.0mm

- Lead-free and halogen-free

- RoHS and WEEE compliant

### APPLICATIONS

- Office automation and computing

- Networking and telecommunication equipment

- Point-of-load power supplies and module replacement

- Automotive applications

### DDR1 to DDR4 Memory Termination LDO Regulator

| Part Number | $V_{DD}$ (V) Min | $V_{DD}$ (V) Max | $V_{DDQ}$ (V) | $V_{TT}$ (V) | $I_{VTT}$ (A) Max | DDR Type | Package | Features |
|---|---|---|---|---|---|---|---|---|
| SC2597 | 2.35 | 3.6 | 1-3.6 | 0.5 - 1.8 | ±1% | 1,2,3,4 | SOIC-8 EDP | Integrated DDR VTT LDO with on-board buffered reference, remote sense. Also provides an accuracy of +/-1% over temperature |

### Power management

| Part Number | Type | $V_{in}$ Min | $V_{in}$ Max | Iout Max (A) | Power-Good flag | Enable | Soft Start | PSAVE | Package (mm) |
|---|---|---|---|---|---|---|---|---|---|
| SC220Q | Regulator | 2.7 | 5.5 | 0.65 | No | Yes | Yes | Regular | SOIC-8 EDP |
| SC195 | Regulator | 2.9 | 5.5 | 0.5 | No | No | Yes | Automatic | MLPQ UT8,1.5x1.5x0.6 |
| SC183CQ | Regulator | 2.9 | 5.5 | 2 | No | Yes | Yes | No | MLPD-10, 3.0x3.0x1.0 |
| SC187 | Regulator | 2.9 | 5.5 | 4 | Yes | Yes | Programmable | No | MLPQ UT16, 3.0x3.0x0.6 |
| SC284 | Regulator | 2.9 | 5.5 | 1.8/1.8 | No | Yes | Yes | No | MLPQ-UT20, 3.0x3.0x0.6 |
| SC174 | Regulator | 3 | 5.5 | 4 | Yes | Yes | Yes | Ultrasonic | MLPD 10, 3.0x3.0x1.0 |
| SC4501Q | Regulator | 1.4 | 16 | 2** | No | Yes | Programmable | No | 10 Pin - MLPD, 3.0x3.0 |
| SC4524/5 | Regulator | 3 | 28 | 2/3 | No | Yes | Yes | No | SOIC-8 EDP |
| SC3303 | Regulator | 5.5 | 28 | 3 | Yes | Yes | Yes | Ultrasonic | MLPD 10, 3.0x3.0x1.0 |
| SC414 | Regulator | 3 | 28 | 6 | Yes | Yes | Yes | Ultrasonic | MLPQ 28, 4.0x4.0x1.0 |
| SC9301 | Regulator | 3 | 28 | 10 | Yes | Yes | Yes | No | MLPQ-32, 5.0x5.0 |
| SC508A | Controller | 4.5 | 46 | 30 | Yes | Yes | Programmable | Programmable Ultrasonic or Regular | MLPQ –UT20, 4.0x4.0x1.0 |

*Indicates Semtech AEC-Q100 Qualified Part     ** Switch current limit*

# Power Management Solutions - LED Drivers

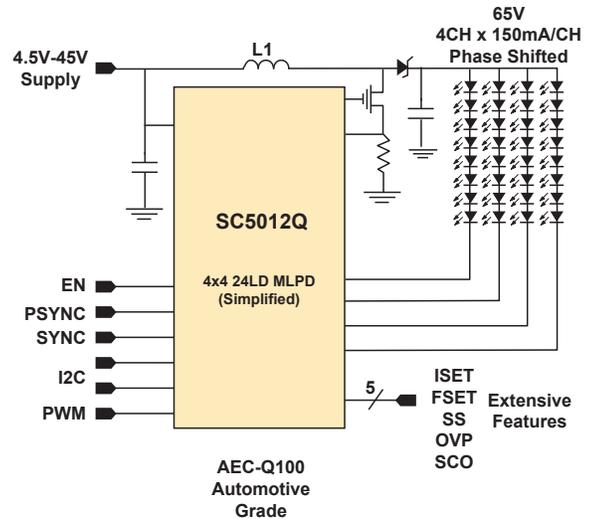## HIGH BRIGHTNESS 4-CHANNEL 150MA/CH. LED DRIVER WITH PHASE-SHIFTING - AEC-Q100 QUALIFIED

The SC5210Q is a high brightness 4-Channel LED driver that prevents false registering of short circuit fault. It enables ultra-thin display panels and eliminates audible noise, water fall effect and reduces EMI. The dimming profile is smooth with no visible steps. It also has I2C interface and low quiescent current. It is perfect for Automotive LCD Backlight and industrial displays.

### FEATURES & BENEFITS

- $V_{IN}$ Range 4.5V to 45V
- $V_{OUT}$ up to 65V
- 2.2µH Inductor
- Up to 150mA/Channel
- Adj Switch frequency 200kHz-2.2MHz
- Optional True Disconnect FET
- Channel Matching: 1%
- PWM Dimming (100Hz–30KHz)
- 9 or 10 Bit Dimming Resolution
- Phase Shifted Operation
- Optional VSYNC / HSYNC / FSYNC
- I²C Control / Configuration

- 6µA Shutdown Current
- Extensive Protection (Adj OVP, OCP, UVLO, Open/Short LED)
- 4x4mm 24 lead QFN
- "Q" is AEC-Q100, Grade-2, Qualified Version

### APPLICATIONS

- Automotive
- Medium-sized LCD panel
- Notebook display
- Sub-notebook and tablet computer displays
- Portable media players



## LED Driver

| Part Number | Vin (V) Min | Vin (V) Max | Vout (V) Max | fsw (MHz) | Max # LEDs | # LED Strings | LEDs Per String Max (Vf=3.5V) | Current Per LED String Max (mA) | Total Current Max (mA) | Dimming (Max Freq) | Package | Features |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SC441A | 4.5 | 21 | 36 | 0.7 | 40 | 4 | 10 | 150 | 600 | PWM up to 50kHz | TSSOP-20 EDP | Open/short LED string disable, OCP, OTP, OVP and FFLAG |
| SC443 | 4.5 | 27 | 42 | 0.2-1.2 | 36 | 3 | 12 | 30 | 90 | PWM up to 50kHz | MLP-UT-16 | +/- 1% string to string current matching greater than 90% efficiency. |
| SC445 | 4.5 | 27 | 42 | 0.7 | 40 | 4 | 10 | 150 | 600 | PWM up to 50kHz | TSSOP-20 | Feed Forward Boost Topology => smaller Input Caps, PWM Dimming. |
| SC446 | 4.5 | 27 | 42 | 0.8 | 36 | 3 | 12 | 100 | 300 | PWM up to 50kHz | TSSOP-16 | 500:1 PWM Dimming |
| SC4541 | 2.9 | 22 | 25 | 2 | 27 | 1 | 7 | 100/200 | 100/200 | PWM up to 1kHz | SOT23 | High side sense for single wire connection |
| SC5010/H | 4.5 | 27 | 50 | Adj. to 2.2 | 112 | 2 | 8 | 30/50 | 240/400 | PWM / Analog | QFN-28 | Phase shifted, PWM/I²C dimming, extensive protection |
| SC5014 | 4.5 | 27 | 50 | Adj. to 2.2 | 56 | 4 | 14 | 120 | 480 | PWM / Analog | MLPQ-20 | Phase shifted, PWM/I²C dimming, extensive protection |
| SC5014A | 4.5 | 27 | 50 | Adj. to 2.2 | 28 | 2 | 14 | 240 | 480 | PWM / Analog | MLPQ-20 | PWM / I²C dimming, extensive protection |
| SC5012/Q | 4.5 | 45 | 65 | Adj. to 2.2 | 68 | 4 | 17 | 150 | 600 | PWM / Analog | MLPQ-24 | 5,000:1 PWM Dimming I²C control extensive protection |

*Indicates Semtech AEC-Q100 Qualified Part*

# Touch Screen Solutions

## HAPTICS ENABLED 4/5-WIRE RESISTIVE TOUCHSCREEN CONTROLLER WITH PROXIMITY SENSING

The SX8654/74 belong to a family of high performance haptics enabled 4/5-wire Multitouch screen controllers with proximity detection optimized for hand-held applications such as mobile phones, portable music players, game machines, point-of-sales terminal, and other consumer, industrial and automotive applications. They feature a wide input supply range from 2.3V to 3.6V.

### FEATURES & BENEFITS

- Low voltage operation
- Low-power consumption
- 4/5-wire touchscreen interface
- Capacitive proximity sensing (SX8654/56/74/76)
- Haptics driver for LRA and ERM (SX8654/55/74/75)
- 400kHz I²C serial interface
- Several host operating modes available
- Hardware, software, and power-on reset
- -40°C to +85°C operating temp. range
- 15kV HBM and IEC ESD protection
- Small footprint packages
- Pb and halogen free, RoHS/WEEE compliant

### APPLICATIONS

- DSC, DVR, phones
- POS/POI terminals
- Automotives
- Touch-screen monitors
- Mobile phones
- Game machines
- Portable music players



Get the system ready before you "touch" with backlight or menu control

Pressure measurement coupled with emulating tactile feedback via haptics

Proximity Detection

Pressure

Haptics Feedback

Two-dimensional measurement gives you touch position in X, Y coordinates

## Haptics Enabled 4/5-Wire

| Part Number | Touch Panel | Resolution | Interface (mm) | Power Consumption (µA) | On-chip-ESD Protection (+/− kV) | Multi-touch | Proximity Sensing | Haptics | Package (mm) |
|---|---|---|---|---|---|---|---|---|---|
| SX8650 | 4-wire | 12-bit | I²C | 0.4 | 25kV Air 15kV Contact | – | – | – | QFN 3.0x3.0 |
| SX8651 | 4-wire | 12-bit | I²C | 0.4 | 25kV Air 15kV Contact | ✓ | – | – | QFN 3.0x3.0 |
| SX8652 | 4/5-wire | 12-bit | SPI | 0.4 | 25kV Air 15kV Contact | – | – | – | DFN 4.0x3.0 |
| SX8653 | 4/5-wire | 12-bit | SPI | 0.4 | 25kV Air 15kV Contact | ✓ | – | – | DFN 4.0x3.0 |
| SX8654 | 4/5-wire | 12-bit | I²C | 0.4 | 25kV Air 15kV Contact | – | ✓ | Generic | QFN 4.0x4.0 |
| SX8655 | 4/5-wire | 12-bit | I²C | 0.4 | 25kV Air 15kV Contact | – | – | Generic | QFN 4.0x4.0 |
| SX8656 | 4/5-wire | 12-bit | I²C | 0.4 | 25kV Air 15kV Contact | – | ✓ | – | QFN 4.0x4.0 |
| SX8657 | 4/5-wire | 12-bit | I²C | 0.4 | 25kV Air 15kV Contact | – | ✓ | Immersion | QFN 4.0x4.0 |
| SX8658 | 4/5-wire | 12-bit | I²C | 0.4 | 25kV Air 15kV Contact | – | – | Immersion | QFN 4.0x4.0 |
| SX8674 | 4/5-wire | 12-bit | I²C | 0.4 | 25kV Air 15kV Contact | ✓ | ✓ | Generic | QFN 4.0x4.0 |
| SX8675 | 4/5-wire | 12-bit | I²C | 0.4 | 25kV Air 15kV Contact | ✓ | – | Generic | QFN 4.0x4.0 |
| SX8676 | 4/5-wire | 12-bit | I²C | 0.4 | 25kV Air 15kV Contact | ✓ | ✓ | – | QFN 4.0x4.0 |
| SX8677 | 4/5-wire | 12-bit | I²C | 0.4 | 25kV Air 15kV Contact | ✓ | ✓ | Immersion | QFN 4.0x4.0 |
| SX8678 | 4/5-wire | 12-bit | I²C | 0.4 | 25kV Air 15kV Contact | ✓ | – | Immersion | QFN 4.0x4.0 |

# Touch Button Solutions

## LOWEST POWER CAPACITIVE TOUCH SENSORS WITH ENHANCED LED DRIVERS AND PROXIMITY SENSING

Semtech's 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 phones, media players, notebooks, white goods and automobiles.
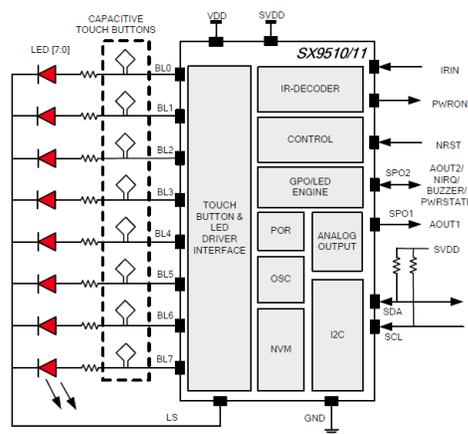
### FEATURES & BENEFITS

- High resolution capacitive sensing solution
  - Proximity detection up to 10cm
  - Supports button, slider and wheel design
- Extreme sensitivity
  - Works with thick overlay materials (>5mm)
- Smart auto-offset compensation
  - Eliminates false triggers due to environmental factors
- Enhanced LED operation
  - Individual 256-step intensity/fade-in/fade-out control
  - Auto-lighting without host interaction
- No external components per input

### APPLICATIONS

- DSC, DVR, phones
- POS/POI terminals
- Automotives
- Touch-screen monitors
- Mobile phones
- Game machines
- Portable music players

### PACKAGE

- QFN-28, 4.0mm x 4.0mm
- QFN-32, 5.0mm x 5.0mm
- QFN-32, 4.0mm
- TSSOP-24, 4.4mm x 7.8mm

## SX9510/11/12/13, SX8633/34/35/36/38/39/43/44/45/46/47/48/49

| Part Number | Sensor Inputs | LED Driver | Interface | Proximity | Button | Slider | Wheel | IR Detect | Buzzer | Overlay (mm) | Auto Comp | Intensity (256-step) | Fade-in Fade-out | Auto Lighting | Field Prog. Memory | Package (mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SX9510 | 8 | 8 | I²C/Analog | ✓ | ✓ | – | – | ✓ | ✓ | >5 | ✓ | Lin./Log. | ✓ | ✓ | ✓ | 4x4 QFN 4.4x7.8 TSSOP |
| SX9511 | 8 | 8 | I²C/Analog | ✓ | ✓ | – | – | ✓ | ✓ | >5 | ✓ | Lin./Log. | ✓ | ✓ | ✓ | 4x4 QFN 4.4x7.8 TSSOP |
| SX9512 | 8 | 8 | I²C/Analog | – | ✓ | – | – | – | ✓ | >5 | ✓ | Lin./Log. | ✓ | ✓ | ✓ | 4x4 QFN 4.4x7.8 TSSOP |
| SX9513 | 8 | 8 | I²C/Analog | – | ✓ | – | – | – | ✓ | >5 | ✓ | Lin./Log. | ✓ | ✓ | ✓ | 4x4 QFN 4.4x7.8 TSSOP |
| SX8633 | 12 | 8 | I²C | ✓ | ✓ | – | – | – | – | >5 | ✓ | Lin./Log. | ✓ | ✓ | ✓ | 5x5 QFN |
| SX8634 | 12 | 8 | I²C | ✓ | ✓ | ✓ | – | – | – | >5 | ✓ | Lin./Log. | ✓ | ✓ | ✓ | 5x5 QFN |
| SX8635 | 12 | 8 | I²C | ✓ | ✓ | – | ✓ | – | – | >5 | ✓ | Lin./Log. | ✓ | ✓ | ✓ | 5x5 QFN |
| SX8636 | 8 | 8 | I²C | ✓ | ✓ | – | – | – | – | >5 | ✓ | Lin./Log. | ✓ | ✓ | ✓ | 4x4 QFN |
| SX8638 | 8 | 8 | I²C | ✓ | ✓ | ✓ | – | – | – | >5 | ✓ | Lin./Log. | ✓ | ✓ | ✓ | 4x4 QFN |
| SX8639 | 8 | 8 | I²C | ✓ | ✓ | – | ✓ | – | – | >5 | ✓ | Lin./Log. | ✓ | ✓ | ✓ | 4x4 QFN |
| SX8643 | 12 | 8 | I²C | – | ✓ | – | – | – | – | >5 | ✓ | Lin./Log. | ✓ | ✓ | ✓ | 5x5 QFN |
| SX8644 | 12 | 8 | I²C | – | ✓ | ✓ | – | – | – | >5 | ✓ | Lin./Log. | ✓ | ✓ | ✓ | 5x5 QFN |
| SX8645 | 12 | 8 | I²C | – | ✓ | – | ✓ | – | – | >5 | ✓ | Lin./Log. | ✓ | ✓ | ✓ | 5x5 QFN |
| SX8646 | 8 | 8 | I²C | – | ✓ | – | – | – | – | >5 | ✓ | Lin./Log. | ✓ | ✓ | ✓ | 4x4 QFN |
| SX8647 | 8 | 8 | I²C | – | – | – | ✓ | – | – | >5 | ✓ | Lin./Log. | ✓ | ✓ | ✓ | 4x4 QFN |
| SX8648 | 8 | 8 | I²C | – | ✓ | ✓ | – | – | – | >5 | ✓ | Lin./Log. | ✓ | ✓ | ✓ | 4x4 QFN |
| SX8649 | 8 | 8 | I²C | – | ✓ | – | ✓ | – | – | >5 | ✓ | Lin./Log. | ✓ | ✓ | ✓ | 4x4 QFN |

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