



solutions



# Semtech Products

## Short Form Catalog

[www.semtech.com](http://www.semtech.com)



# Product Highlights

A promotional graphic for LinkCharge CT. It features a laptop keyboard, a calculator, and a smartphone with a green battery icon and concentric green circles around it, symbolizing wireless charging. The text "LinkCharge™ CT" is in large bold letters, followed by "Wireless Charging Anywhere" and "(page 18)" in smaller text.

## LinkCharge™ CT

Wireless Charging  
Anywhere

(page 18)

A promotional graphic for Automotive ESD Protection. It features a wireframe car and a black rectangular component labeled "SEMITECH". The text "Automotive ESD Protection 2-Line Surge" is in large bold letters, followed by "RClamp® 0512TQ" and "(page 4)" in smaller text.

## Automotive ESD Protection 2-Line Surge

RClamp® 0512TQ

(page 4)

A promotional graphic for Signal Integrity Products. It features a blue background with a fiber optic cable emitting light. The text "Signal Integrity Products" is in large bold letters, followed by "High Performance ICs for Optical Transceivers" and a list of applications: "Cloud Computing • Social Networking Video Streaming • Mobile Usage Datacenter • Access (PON/FTTx) Wireless Infrastructure". The page number "(page 26)" is at the bottom.

## Signal Integrity Products

High Performance ICs  
for Optical Transceivers

Cloud Computing • Social Networking  
Video Streaming • Mobile Usage  
Datacenter • Access (PON/FTTx)  
Wireless Infrastructure

(page 26)

A promotional graphic for FemtoSwitch Load Switches. It features an orange background with a hand holding a tablet displaying "SC33001A SC33001AH" and another hand holding a smartphone. The text "New FemtoSwitch™ Load Switches" is in large bold letters. The page number "(page 25)" is at the bottom.

## New FemtoSwitch™ Load Switches

SC33001A  
SC33001AH

(page 25)

## Join the LoRa® Community

[semtech.com/LoRaCommunity](http://semtech.com/LoRaCommunity)

### Get Involved

Collaborate and Discuss  
Contribute Ideas  
Become Experts  
Find Solutions

### Resources

Training & Webinar  
Video Library  
LPWAN Product Catalog



connect • learn • share



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*This catalog is a quick introduction to the key Semtech product families and is available from your Semtech sales representative and distribution partner. For the complete product portfolio, visit [www.semtech.com](http://www.semtech.com)*



  
**SEMTECH**  
 A World of Solutions™



# AEC-Q100 Automotive Qualified

## OUR EXPANDING COMMITMENT

As the automotive infotainment market increases, so does our commitment to power, protect and connect customers with the perfect 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 interface. Today, we continue to work on expanding our list of AEC-Q100 certified products for future applications.

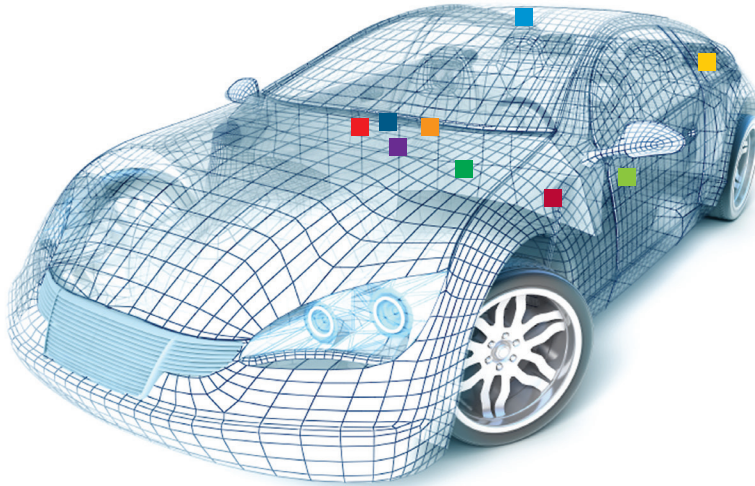
 **Two-wire Ethernet**  
ADAs, 360 Camera View, Audio

 **Antennas**  
AM/FM, DAB, GPS, Satellite, WiFi, Telematics Applications

 **USB 2.0**  
Infotainment, Phone Connectivity

 **USB 3.0/HDMI**  
Audio Video Infotainment, Back-end Display

 **CAN, LIN**  
Control Bus, Networking



 **SD Card/Memory**  
Navigation Applications

 **Analog Video, LVDS**  
ADAs, Back-up Camera Applications

 **Standard Ethernet**  
On-board Diagnostics, Networking

 **Audio**  
Infotainment, Console Display

## Transient Voltage (TVS) Protection - AEC-Q100 Qualified

| Part Number    | V <sub>RWM</sub> (V) | Lines | ESD Rating (air/contact) | Surge (8x20μs) | Cap (pF) | Package (mm)  | Interface To Protect                  |
|----------------|----------------------|-------|--------------------------|----------------|----------|---------------|---------------------------------------|
| RClamp® 2574NQ | 2.5                  | 4     | ±30kV/±30kV              | 40A            | 1.7      | 3.0x2.0x0.6   | Standard Ethernet                     |
| RClamp® 0582BQ | 5                    | 2     | ±30kV/±25kV              | 15A            | 1.2      | 1.6x1.6x0.75  | Two wire ethernet single twisted pair |
| RClamp® 0531TQ | 5                    | 1     | ±20kV/±12kV              | 4A             | 0.5      | 1.0x0.6x0.5   |                                       |
| RClamp® 2574NQ | 2.5                  | 4     | ±30kV/±30kV              | 40A            | 1.7      | 3.0x2.0x0.6   | LVDS links                            |
| RClamp® 0531TQ | 5                    | 1     | ±20kV/±12kV              | 4A             | 0.5      | 1.0x0.6x0.5   | USB 2.0                               |
| RClamp® 0582BQ | 5                    | 2     | ±30kV/±25kV              | 15A            | 1.2      | 1.6x1.6x0.75  | USB 2.0                               |
| RClamp® 0531TQ | 5                    | 1     | ±20kV/±12kV              | 4A             | 0.5      | 1.0x0.6x0.5   | Antenna interfaces                    |
| RClamp® 1521PQ | 15                   | 1     | ±15kV/±8kV               | 4A             | 0.3      | 1.0x0.6x0.5   | Antenna interfaces                    |
| RClamp® 0582BQ | 5                    | 2     | ±30kV/±25kV              | 15A            | 1.2      | 1.6x1.6x0.75  | Antenna interfaces                    |
| RClamp® 2431TQ | 24                   | 1     | ±13kV/±8kV               | 2A             | 0.35     | 1.0x0.6x0.5   | Antenna interfaces                    |
| μClamp® 0511PQ | 5                    | 1     | ±30kV/±30kV              | 12A            | 75       | 1.0x0.6x0.5   | Audio                                 |
| SLVU2.8Q       | 2.8                  | 2     | ±30kV/±25kV              | 24A            | 100      | 2.9x2.37x0.90 | Analog video                          |
| μClamp® 3311PQ | 3.3                  | 1     | ±30kV/±25kV              | 5A             | 12       | 1.0x0.6x0.5   | Multimedia touchpoint                 |
| μClamp® 0511PQ | 5                    | 2     | ±30kV/±30kV              | 12A            | 75       | 1.0x0.6x0.5   | Multimedia touchpoint                 |
| RClamp® 0512TQ | 5                    | 2     | ±30kV/±30kV              | 20A            | 2        | 1.0x0.6x0.4   | Ethernet, USB2.0, LVDS, antennas      |
| μClamp® 0301PQ | 3                    | 1     | ±30kV/±25kV              | 5A             | 25       | 1.0x0.6x0.5   | Multimedia touchpoint                 |
| RClamp® 0524PQ | 5                    | 4     | ±25kV/±15kV              | 5A             | 0.4      | 2.5x1.0x0.58  | HDMI                                  |

# AEC-Q100 Automotive Qualified

## Single-line DC Bus Protection - AEC-Q100 Qualified

| Part Number   | V <sub>RWM</sub> (V) | Lines | ESD Rating (air/contact) | Surge (8x20μs) | Cap (pF) | Package (mm)  | Application                   |
|---------------|----------------------|-------|--------------------------|----------------|----------|---------------|-------------------------------|
| μClamp® 0571P | 5                    | 1     | ±30kV/±30kV              | 80A            | 675      | 1.6x1.0x0.57  | Single-line DC Bus protection |
| μClamp® 0871P | 8                    | 1     | ±30kV/±30kV              | 65A            | 475      | 1.6x1.0x0.57  |                               |
| μClamp® 1071P | 10                   | 1     | ±30kV/±30kV              | 60A            | 350      | 1.6x1.0x0.57  |                               |
| μClamp® 1271P | 12                   | 1     | ±30kV/±30kV              | 45A            | 275      | 1.6x1.0x0.57  |                               |
| μClamp® 1571P | 15                   | 1     | ±30kV/±30kV              | 40A            | 220      | 1.6x1.0x0.57  |                               |
| μClamp® 1871P | 18                   | 1     | ±30kV/±30kV              | 35A            | 220      | 1.6x1.0x0.57  |                               |
| μClamp® 2271P | 22                   | 1     | ±30kV/±30kV              | 25A            | 165      | 1.6x1.0x0.57  |                               |
| μClamp® 2671P | 26                   | 1     | ±30kV/±30kV              | 23A            | 155      | 1.6x1.0x0.57  |                               |
| μClamp® 3671P | 36                   | 1     | ±30kV/±30kV              | 18A            | 150      | 1.6x1.0x0.577 |                               |

## Filter Devices (TVS+EMC Filter) Protection - AEC-Q100 Qualified

| Part Number    | V <sub>RWM</sub> (V) | Lines | ESD Rating (air/contact) | Filter type                      | Cap (pF) | Package (mm) | Application |
|----------------|----------------------|-------|--------------------------|----------------------------------|----------|--------------|-------------|
| EClamp® 2410PQ | 5                    | 6     | ±17kV/±12kV              | SD card termination              | 15       | 4.0x1.6x0.5  | SD card     |
| EClamp® 2357NQ | 5                    | 6     | ±20kV/±12kV              | RC filter<br>SD card termination | 20       | 3.0x3.0x0.6  | SD card     |
| EClamp® 2374KQ | 5                    | 4     | ±15kV/±8kV               | RC filter                        | 10       | 1.7x1.3x0.5  | Color LCD   |

## Power Management - Regulators and Controllers - AEC-Q100 Qualified

| Part Number | Type       | V <sub>IN</sub> |     | I <sub>OUT</sub> Max (A) | Power-Good flag | Enable | Soft Start   | PSAVE | Package (mm)   |
|-------------|------------|-----------------|-----|--------------------------|-----------------|--------|--------------|-------|----------------|
|             |            | Min             | Max |                          |                 |        |              |       |                |
| SC183CQ     | Regulator  | 2.9             | 5.5 | 2                        | No              | Yes    | Yes          | No    | MLPD-10, 3x3x1 |
| SC508A      | Controller | 4.5             | 46  | 30                       | Yes             | Yes    | Programmable | Yes   | MLPQ-20, 3x3   |
| SC4501Q     | Regulator  | 1.4             | 16  | 2                        | No              | Yes    | Programmable | No    | MLPD-10, 3x3   |
| SC284AQ     | Regulator  | 2.7<br>5        | 5.5 | 1.7<br>2                 | Yes             | Yes    | Yes          | No    | MLPQ-20, 3x3   |
| SC220Q      | Regulator  | 2.7             | 5.5 | 0.6                      | No              | Yes    | Yes          | Yes   | SOIC-8         |

## Power Management - LED Drivers - AEC-Q100 Qualified

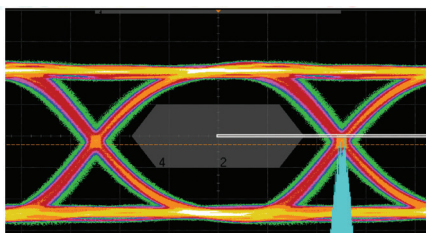
| Part Number | V <sub>IN</sub> (V) |     | V <sub>OUT</sub> (V)<br>Max | Fsw (MHz) | # LEDs per string*<br>V <sub>f</sub> =(3.5V) | # of Strings | String Current (mA) | Dimming Max Freq. | Package (mm) | Features                                                               |
|-------------|---------------------|-----|-----------------------------|-----------|----------------------------------------------|--------------|---------------------|-------------------|--------------|------------------------------------------------------------------------|
|             | Min                 | Max |                             |           |                                              |              |                     |                   |              |                                                                        |
| SC441A      | 4.5                 | 21  | 36                          | 0.7       | 10                                           | 4            | 150                 | up to 50kHz       | TSSOP-20 EDP | Open/Short LED string disable, OCP, OTP, OVP, and FFLAG                |
| SC445Q      | 4.5                 | 27  | 42                          | 0.7       | 12                                           | 4            | 150                 | up to 50kHz       | TSSOP-20 EDP | Adj SCP level, Open/Short LED string disable, OCP, OTP, OVP, and FFLAG |
| SC5012/Q    | 4.5                 | 45  | 65                          | 0.2–2.2   | 18                                           | 4            | 150                 | up to 30kHz       | MLPQ-24, 4x4 | I <sup>2</sup> C, FSYNC, 5000:1 Phase shifted PWM dimming              |

# TVS Protection - Key Advantages

Semtech Transient Voltage Suppressors (TVS) safeguard circuits against damage or latch-up caused by ESD, lightning and other destructive voltage transients. Our protection devices feature low clamping voltage, low capacitance and low leakage current.

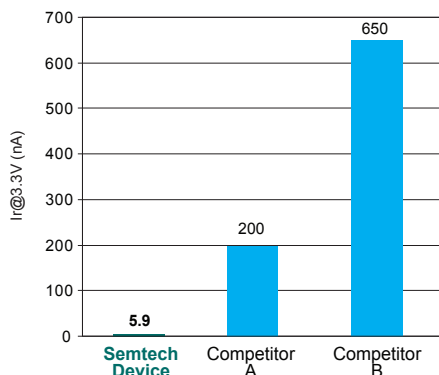
## LOW CAPACITANCE

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



## LOW LEAKAGE

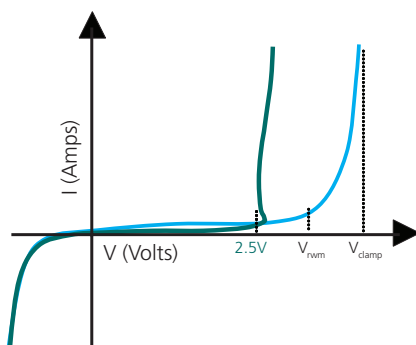
Increases battery life in handheld electronic devices



## LOWER WORKING VOLTAGE

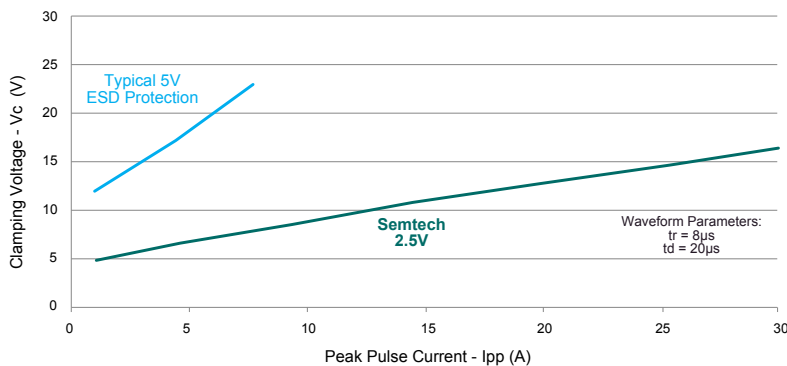
Reduces stress energy to protected IC

— Typical 5V TVS IV Curve  
— Semtech low  $V_{RWM}$  IV Curve



## LOW CLAMPING VOLTAGE

Better protection and less stress on transceiver



## PRODUCT PLATFORMS

**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

## KEY ESD PROTECTIONS

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

# TVS Key Product Applications

| Key Applications            |                |            |             |                            |                                |
|-----------------------------|----------------|------------|-------------|----------------------------|--------------------------------|
| Application (Port)          | Part Number    | # of Lines | Voltage (V) | Max Capacitance (Line-GND) | Protection level (A) (8/20μs)* |
| USB 2.0 (Data Lines)        | RClamp® 0552T  | 2          | 5           | 0.4                        | 3                              |
| USB 2.0 (Data Lines + Vbus) | RClamp® 0582N  | 3          | 5           | 0.5                        | 5                              |
| USB (OTG)                   | RClamp® 1624T  | 2+1        | 5+12        | 0.8                        | 5                              |
| USB 3.0                     | RClamp® 3346P  | 6          | 3.3         | 0.65                       | 4.5                            |
| HDMI, DisplayPort           | RClamp® 3328P  | 8          | 3.3         | 0.65                       | 5                              |
| LCD Panel                   | RClamp® 3324T  | 4          | 3.3         | 0.65                       | 5                              |
| LCD Panel (EMI filter)      | EClamp® 2388P  | 8          | 5           | 27                         | 5                              |
| Single Line                 | μClamp® 3311Z  | 1          | 3.3         | 9                          | 4                              |
|                             | μClamp® 0541Z  | 1          | 5           | 9                          | 2                              |
|                             | μClamp® 1211Z  | 1          | 12          | 25                         | 5                              |
| Single Line High Speed      | RClamp® 0531Z  | 1          | 5           | 0.4                        | 3                              |
| 10/100 Ethernet             | RClamp® 0534N  | 4          | 5           | 3**                        | 25                             |
|                             | RClamp® 3354S  | 4          | 3.3         | 5                          | 25                             |
| Gigabit Ethernet            | RClamp® 3374N  | 4          | 3.3         | 1.7**                      | 40                             |
|                             | TClamp® 3302N  | 2          | 3.3         | 25                         | 95                             |
| T1/E1                       | TClamp® 0602N  | 2          | 6           | 25                         | 95                             |
| CAN Bus                     | μClamp® 3601P  | 1          | 33          | 25                         | –                              |
|                             | μClamp® 3603T  | 3          | 36          | 50                         | 2                              |
| RS485                       | SM712          | 2          | 12/-7       | 75                         | 17                             |
|                             | TClamp® 1202P  | 2          | 12          | 12                         | 100                            |
| RS232                       | RClamp® 1224S  | 4          | 12          | 3                          | 15                             |
| Keyboard, I/O               | μClamp® 0541Z  | 1          | 5           | 9                          | 2                              |
| xDSL                        | TClamp® 1272S  | 2          | 12          | 5                          | 25                             |
|                             | TClamp® 2472S  | 2          | 24          | 3.5                        | –                              |
| 2.5G Ethernet               | RClamp® 0512TQ | 2          | 5           | 3                          | –                              |

\*All devices will protect at a minimum to IEC61000-4-2 (ESD) ±15kV (air), ±8kV (contact) and IEC 61000-4-4 (EFT) 40A (5/50ns) \*\* I/O to I/O Capacitance

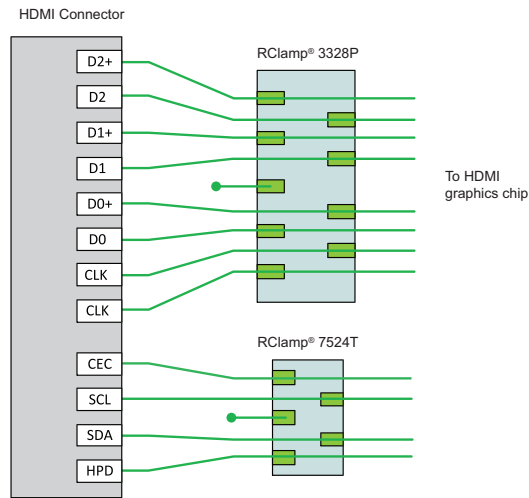
| Gigabit and 10/100 Ethernet |                                                  |                                 |
|-----------------------------|--------------------------------------------------|---------------------------------|
| Existing Devices            | Next-Generation Improved Performance & Packaging | Pin-to-Pin Improved Performance |
| RClamp® 2504N               | RClamp® 2574N                                    | –                               |
| RClamp® 3304N(A)            | RClamp® 3374N                                    | –                               |
| SLVU2.8-4                   | RClamp® 3374N                                    | μClamp® 2804L                   |
| SRV05-4(A)                  | RClamp® 0534N                                    | RClamp® 0554S<br>RClamp® 3354S  |
| LC03-3.3                    | –                                                | RClamp® 2502L                   |



# HDMI, Ethernet & USB 3.0 Protection

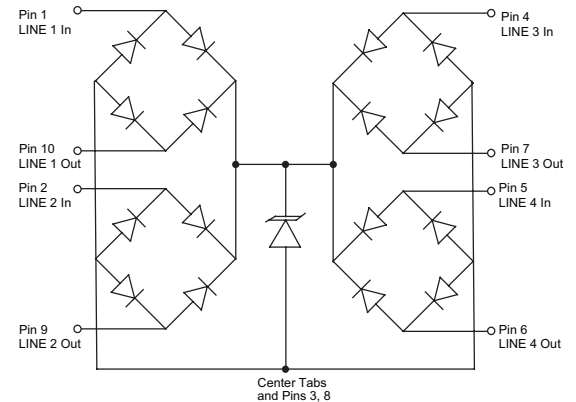
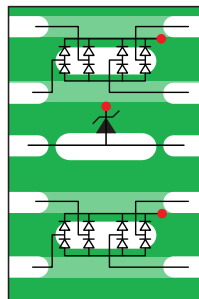
## HDMI PROTECTION

- RClamp® 3328P (3.8x1.0mm)
- RClamp® 7524T (1.3x0.7mm)
- Flow-through layout
- More than 50% PCB savings
- Low capacitance (0.25 typ) to minimize signal degradation



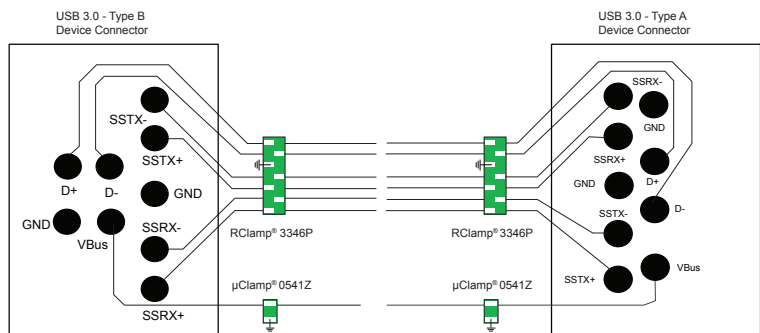
## GIGABIT ETHERNET PROTECTION

- RClamp® 3374N (3x2x0.60mm)
- 3.3V working voltage
- Low capacitance: 1.7pF I/O to I/O
- Flow-through layout
- Low clamping voltage performance
- High surge rating: 40A Ipp (8x20μs)



## USB 3.0 PROTECTION

- RClamp® 3346P (2.7x0.8x0.50mm)
- μClamp® 0541Z (0.6x0.3x0.25mm)
- Extremely low clamp across entire ESD event
- Low capacitance to minimize signal attenuation
- Low dynamic resistance



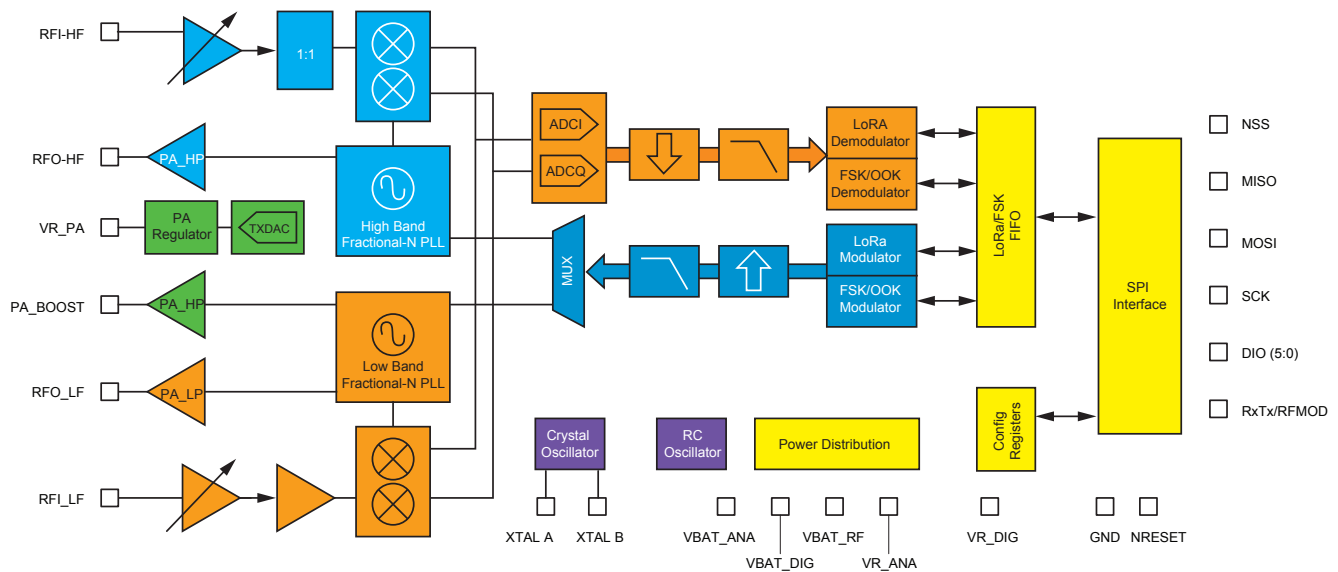
# LoRa® — The Ultimate Long-Range Solutions

Ideal for eliminating repeaters, reducing infrastructure cost, extending battery lifetime, and improving network capacity

## LoRa® PRODUCTS

- Long range of up to 30 miles outdoor line of sight
- Deep indoor coverage for hard to reach areas
- Bi-directional communication link with adaptive data rates
- Low power sensors with extended battery lifetime of up to 20 years
  - 100nA sleep mode
  - 9.7mA active receive mode
- LoRa, LoRaWAN™ and FSK compliant
- GFSK modes supported by a single radio
- Scalable, multi-channel, high-capacity gateways powered by SX1301/SX1308
- Available for any environment
- LoRa modulation offers 30dB improvement over FSK for co-channel interference rejection
- Programmable registers for maximum flexibility
- Footprint-compatible ICs for global coverage
- Supported by over 400 members of LoRa Alliance™ that defines the open LoRaWAN™ protocol
- Large and growing online developer community for LoRa-based products
- Public, semi-private and private networks available worldwide

## SX1276 BLOCK DIAGRAM

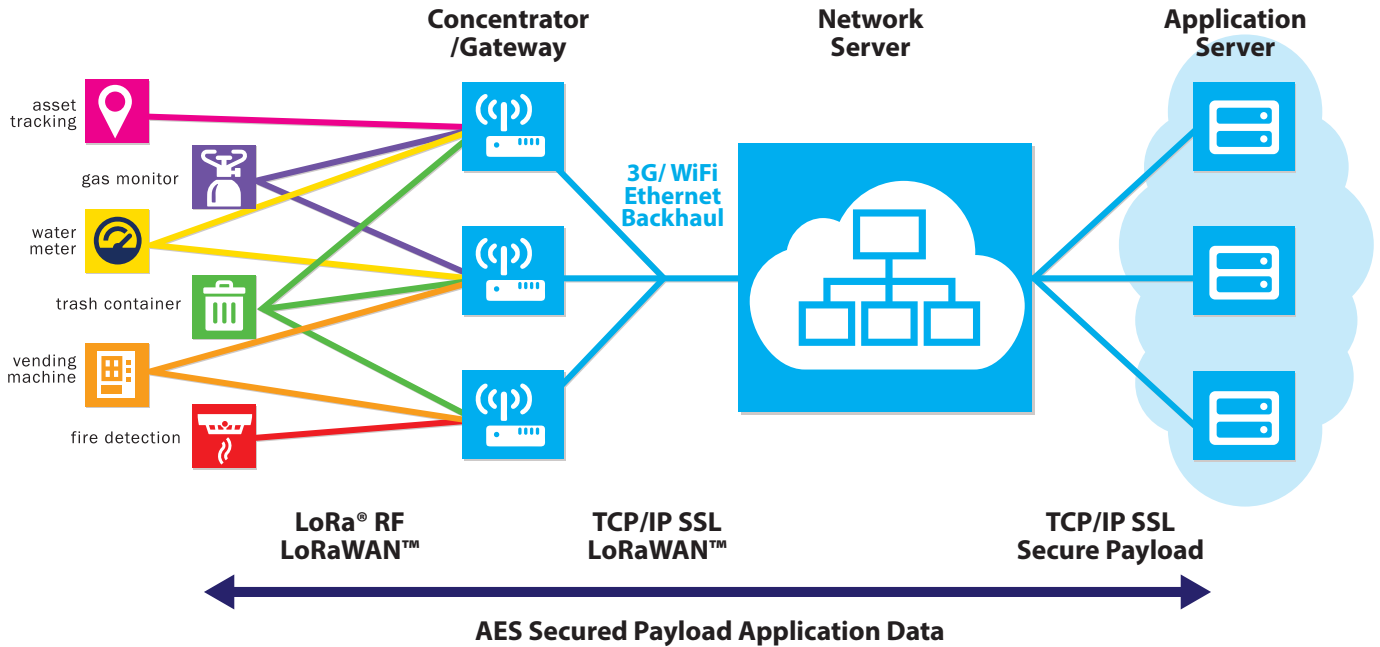


## LoRa® Products

| Part Number | Frequency Range (MHz) | Link Budget (dB) | RXCurrent (mA) | FSK Max DR (kbps) | LoRa DR (kbps) | Max Sensitivity (dBm) | TX Power (dBm) |
|-------------|-----------------------|------------------|----------------|-------------------|----------------|-----------------------|----------------|
| SX1272      | 862–1020              | 158              | 10             | 300               | 0.3–40         | -138                  | + 20           |
| SX1273      | 862–1020              | 150              | 10             | 300               | 1.7–40         | -130                  | + 20           |
| SX1276      | 137–1020              | 168              | 11             | 300               | 0.018–40       | -148                  | + 20           |
| SX1277      | 137–1020              | 158              | 11             | 300               | 1.7–40         | -138                  | + 20           |
| SX1278      | 137–525               | 168              | 11             | 300               | 0.018–40       | -148                  | + 20           |
| SX1279      | 137–960               | 168              | 11             | 300               | 0.018–40       | -148                  | +20            |

# LoRa® Gateway/Concentrator Solutions

The ultimate long-range, high-capacity solution for IoT and M2M networks



## KEY FEATURES OF SEMTECH'S LoRa WIRELESS RF TECHNOLOGY

- Long Range** Penetrates in dense urban and deep indoor environments, connecting to sensors up to 30 miles away in rural areas
- Low Power** Designed specifically for low power consumption extending battery lifetime up to 20 years
- High Capacity** Supports millions of messages per base station
- Geolocation** Enables GPS free, low power tracking applications
- Standardized** LoRaWAN specification ensures global interoperability among applications, IoT solution providers and telecom operators
- Secure** Embedded end-to-end AES-128 encryption of data for optimal privacy and protection
- Low Cost** Reduces costs three ways: infrastructure investment, operating expenses and end-node sensors

## PICOCELL SOLUTIONS

- LoRa Picocell platforms are designed for a variety of indoor applications such as home, small business and buildings.
- SX1308 picocell IC is coupled with a SX1255 or SX1257 LoRa RF transceiver, and is expected to help bring low cost LoRaWAN networks to market for consumers and private enterprises.

## GATEWAY SOLUTIONS

- Multi-channel, multi-modem receiver including LoRa and FSK modems
- Inherent two-way communication
- Receives simultaneously different data rates on same channel

### RF ICs for Gateways and Picocells

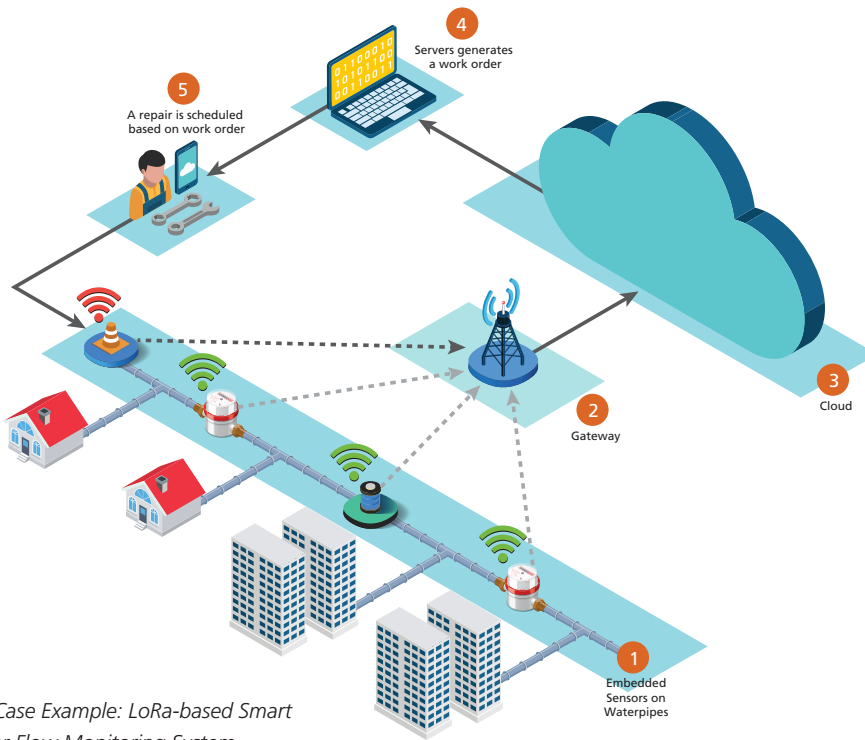
| Part Number | Tx/Rx | Operating Temp. Range | LoRa Modem | FSK Modem | Capacity              |
|-------------|-------|-----------------------|------------|-----------|-----------------------|
| SX1301      | Tx/Rx | -40–85°C              | 9          | 1         | Varies by application |
| SX1308      | Tx/Rx | 0–70°C                | 9          | 1         | Varies by application |

### RF Transceivers

| Part Number | Tx/Rx | Band (MHz) | Tx Power | NF |
|-------------|-------|------------|----------|----|
| SX1257      | Tx/Rx | 860–1000   | -20–8    | 7  |
| SX1255      | Tx/Rx | 400–510    | -20–8    | 7  |

# LoRa-based Smart Sensors

With over 20 years of experience providing RF communications and sensing ICs for battery-operated sensors. Semtech offers the widest range of RF ICs for ultra long range, narrow-band, and wide-band M2M communications.



Use Case Example: LoRa-based Smart Water Flow Monitoring System

## High-Link Budget

- 30dB higher than competing devices when using a low-cost BOM

## High Rx Sensitivity Solutions

- Up to -148dBm of sensitivity

## 7x Lower Power Consumption

- 100nA sleep
- 2.5mA Rx
- 27mA @ +13dBm Tx

## Support for Major Wireless Communications Protocols

- LoRaWAN™
- IEEE 802.15.4g
- Wireless M-Bus
- 6LoWPAN

| RF ICs for Smart Sensors |                                                     |                  |                 |                                                                                        |
|--------------------------|-----------------------------------------------------|------------------|-----------------|----------------------------------------------------------------------------------------|
| Part Number              | Description                                         | Link Budget (dB) | Rx Current (mA) | Evaluation Kit                                                                         |
| SX1232                   | 860–11020MHz Low Power G/FSK/OOK/ASK RF Transceiver | 143              | 9.3             | SX1232-32SKA868/915                                                                    |
| SX1272                   | 860–11020MHz Long Range LoRa G/FSK Transceiver      | 158              | 10              | SX1272DVK1BAS (868MHz)<br>SX1272DVK1CAS (915MHz)                                       |
| SX1273                   | 860–11020MHz Long Range LoRa G/FSK Transceiver      | 150              | 10              | SX1272DVK                                                                              |
| SX1276                   | 138–11020MHz Long Range LoRa G/FSK Transceiver      | 168              | 9.9             | SX1276DVK1IAS (169/868MHz)<br>SX1276DVK1IAS (433/868MHz)<br>SX1276DVK1IAS (490/915MHz) |
| SX1277                   | 138–11020MHz Long Range LoRa G/FSK Transceiver      | 158              | 9.9             | SX1276DVK                                                                              |
| SX1278                   | 138–1510MHz Long Range LoRa G/FSK Transceiver       | 168              | 9.9             | SX1276DVK                                                                              |
| SX1279                   | 138–1960MHz Long Range LoRa G/FSK Transceiver       | 168              | 9.9             | SX1276DVK                                                                              |
| SX1231                   | 290–11000MHz G/FSK/OOK/ASK RF Transceiver           | 140              | 16              | SX1231SKB433/868/915                                                                   |
| SX1233                   | 290–11000MHz G/FSK/OOK/ASK RF Transceiver           | 140              | 16              | SX1233-33SKA868/915                                                                    |
| SX1211                   | 862–1960MHz Low Power FSK/OOK/ASK RF Transceiver    | 125              | 3               | SX1211SKA868/915                                                                       |
| SX1212                   | 310–510MHz Low Power FSK/OOK/ASK RF Transceiver     | 122.5            | 3               | SX1212SKA868/915                                                                       |

# Touch & Proximity Controllers

The superior sensitivity of the Semtech touch sensor platform enables sensing through a thick overlay material. Semtech's proximity detection has an extended range (>10cm). These devices all come in a tiny footprint with zero components per input.

## Key Features

- Extreme low power
- Support button, slider and wheel design
- Proximity detection (>10cm)
- Built-in LED drivers (up to 15mA)
- 256-step intensity control (Lin/Log)



- Auto lightening
- Field programmable
- Fast scan time (15ms)
- Overlay (>5mm)
- Smart auto-offset compensation
- Ultra-small footprint
  - QFN-28 (4x4mm)
  - QFN-32 (5x5mm)
  - QFN-32 (4x4mm)
  - TSSOP-24 (4.4x7.8mm)

## Applications

- Tablet eBook
- Flat panel TV
- LCD monitors
- White goods & appliances
- Printers
- Automotive audio consoles
- Personal media players
- Set Top Boxes (STBs)
- Game consoles
- Industrial systems

| Touch & Proximity Controller Products |               |            |                          |           |        |        |       |           |        |              |           |                      |             |                 |                    |                              |
|---------------------------------------|---------------|------------|--------------------------|-----------|--------|--------|-------|-----------|--------|--------------|-----------|----------------------|-------------|-----------------|--------------------|------------------------------|
| Part Number                           | Sensor Inputs | LED Driver | Interface                | Proximity | Button | Slider | Wheel | IR Detect | Buzzer | Overlay (mm) | Auto Comp | Intensity (256-step) | Fade-in/out | Auto Lightening | Field Prog. Memory | Package (mm)                 |
| SX9510                                | 8             | 8          | I <sup>2</sup> C/ Analog | ✓         | ✓      | –      | –     | ✓         | ✓      | >5           | ✓         | Lin./Log.            | ✓           | ✓               | ✓                  | QFN (4x4)<br>TSSOP (4.4x7.8) |
| SX9511                                | 8             | 8          | I <sup>2</sup> C/ Analog | ✓         | ✓      | –      | –     | ✓         | ✓      | >5           | ✓         | Lin./Log.            | ✓           | ✓               | ✓                  | QFN (4x4)<br>TSSOP (4.4x7.8) |
| SX9512                                | 8             | 8          | I <sup>2</sup> C/ Analog | –         | ✓      | –      | –     | –         | ✓      | >5           | ✓         | Lin./Log.            | ✓           | ✓               | ✓                  | QFN (4x4)<br>TSSOP (4.4x7.8) |
| SX9513                                | 8             | 8          | I <sup>2</sup> C/ Analog | –         | ✓      | –      | –     | –         | ✓      | >5           | ✓         | Lin./Log.            | ✓           | ✓               | ✓                  | QFN (4x4)<br>TSSOP (4.4x7.8) |
| SX8633                                | 12            | 8          | I <sup>2</sup> C         | ✓         | ✓      | –      | –     | –         | –      | >5           | ✓         | Lin./Log.            | ✓           | ✓               | ✓                  | QFN (5x5)                    |
| SX8634                                | 12            | 8          | I <sup>2</sup> C         | ✓         | ✓      | ✓      | –     | –         | –      | >5           | ✓         | Lin./Log.            | ✓           | ✓               | ✓                  | QFN (5x5)                    |
| SX8635                                | 12            | 8          | I <sup>2</sup> C         | ✓         | ✓      | –      | ✓     | –         | –      | >5           | ✓         | Lin./Log.            | ✓           | ✓               | ✓                  | QFN (5x5)                    |
| SX8636                                | 8             | 8          | I <sup>2</sup> C         | ✓         | ✓      | –      | –     | –         | –      | >5           | ✓         | Lin./Log.            | ✓           | ✓               | ✓                  | QFN (4x4)                    |
| SX8638                                | 8             | 8          | I <sup>2</sup> C         | ✓         | ✓      | ✓      | –     | –         | –      | >5           | ✓         | Lin./Log.            | ✓           | ✓               | ✓                  | QFN (4x4)                    |
| SX8639                                | 8             | 8          | I <sup>2</sup> C         | ✓         | ✓      | –      | ✓     | –         | –      | >5           | ✓         | Lin./Log.            | ✓           | ✓               | ✓                  | QFN (4x4)                    |

# Smart Proximity Sensors

Semtech advanced capacitive sensing solutions provides best-in-class sensitivity (down to sub fF) with unique human discrimination feature to enhance near range proximity detection. These products are commonly used in wireless-enabled consumer devices (i.e. smartphones, tablets, notebook) for smarter RF control.

## Key Features

- Highest performance sensor on the market that enables longest distance/smallest area
- Strongest immunity to common RF noise (minimize interference)

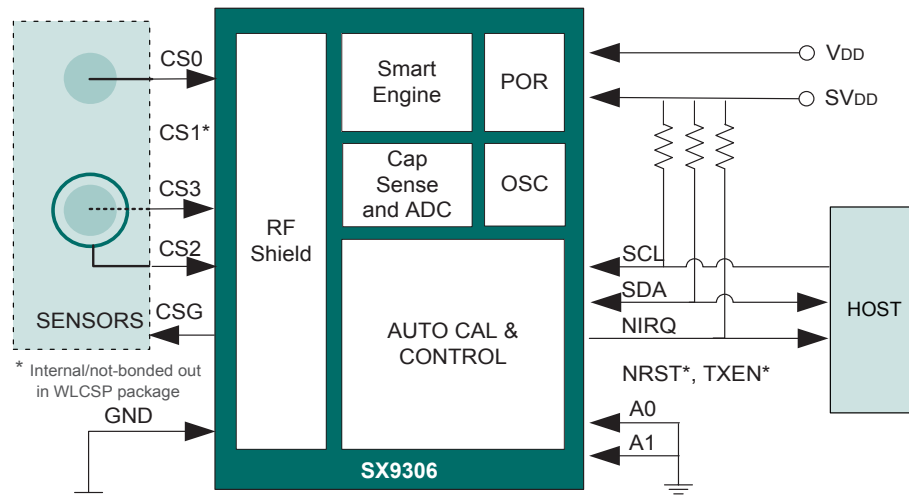


- Lowest power for extended battery life (2.5uA at Sleep, <10uA at Doze)
- Capacitive resolution down to 0.04fF
- Patented on-chip smart engine for human detection
- Built-in automatic calibration
- Advanced temperature comp.
- Active sensor guard
- Programmable I<sup>2</sup>C or standalone mode
- Extremely small footprint

## Applications

- Smartphone
- Tablet
- Wearables
- Notebooks (Ultrabook, Detachable, 2-in-1)
- Hotspot
- Portable gaming devices
- Wireless-enabled devices

| Smart Proximity Sensor Products |              |                  |       |              |                      |           |                             |                  |                              |
|---------------------------------|--------------|------------------|-------|--------------|----------------------|-----------|-----------------------------|------------------|------------------------------|
| Part Number                     | # of Sensors | Interface        | Prox. | Active Guard | Human Sensing        | RF Shield | Configurable Proximity Mode | Auto Calibration | Package (mm)                 |
| SX9300                          | 2            | I <sup>2</sup> C | ✓     | ✓            | On-chip Smart Engine | –         | –                           | ✓                | QFN (3x3)                    |
| SX9306                          | 3 or 4       | I <sup>2</sup> C | –     | ✓            | On-chip Smart Engine | ✓         | ✓                           | ✓                | WLCSP (1.2x1.6)<br>QFN (3x3) |
| SX9500                          | 4            | I <sup>2</sup> C | ✓     | ✓            | –                    | –         | –                           | ✓                | QFN (3x3)                    |
| SX9501                          | 4            | Analog           | ✓     | ✓            | –                    | –         | –                           | ✓                | QFN (3x3)                    |



SX9306 Block Diagram

# High Performance Touchscreen Solutions

Semtech offers fully integrated touch controllers in both capacitive and resistive technologies with ultra low power consumption (as low as 0.4uA) and robust on-chip ESD protection (up to  $\pm 15\text{kV}$  ESD) to support different human interface design in portable handheld applications (i.e. smartphones, wearable devices). Many of these products have the capability to sense in the X, Y and Z dimensions allowing for multi-touch and gesture control as well as providing tactile feedback to enhance the user experience.

## Key Features

- Low power (0.4 $\mu\text{A}$ )
- Compatible with a wide range of resistive panels
- Enables multi-touch gestures with 4-wire touch panel
- Built-in proximity detection with any panel (>5cm)
- Integrated haptic motor control (LRA & ERM)
- 12-bit resolution

## Applications

- Portable navigation devices
- Automotive center consoles
- Digital photo frames
- DSC, video cameras
- Handheld games & mobiles
- POS terminals
- Control panels



## Smart Sensing IC Solutions Products

| Part Number | Interface        | Multi-touch | Proximity Sensing | Haptics   | Package (mm)               |
|-------------|------------------|-------------|-------------------|-----------|----------------------------|
| SX8650      | I <sup>2</sup> C | –           | –                 | –         | WLCSP (1.5x2.0), QFN (3x3) |
| SX8651      | I <sup>2</sup> C | ✓           | –                 | –         | WLCSP (1.5x2.0), QFN (3x3) |
| SX8652      | SPI              | –           | –                 | –         | WLCSP (1.5x2.0), DFN (4x3) |
| SX8653      | SPI              | ✓           | –                 | –         | WLCSP (1.5x2.0), DFN (4x3) |
| SX8674      | I <sup>2</sup> C | ✓           | ✓                 | Generic   | WLCSP (2x2), QFN (4x4)     |
| SX8675      | I <sup>2</sup> C | ✓           | –                 | Generic   | WLCSP (2x2), QFN (4x4)     |
| SX8676      | I <sup>2</sup> C | ✓           | ✓                 | –         | WLCSP (2x2), QFN (4x4)     |
| SX8677      | I <sup>2</sup> C | ✓           | ✓                 | Immersion | WLCSP (2x2), QFN (4x4)     |
| SX8678      | I <sup>2</sup> C | ✓           | –                 | Immersion | WLCSP (2x2), QFN (4x4)     |

# General Purpose Parallel Input/Output (GPIO)

General Purpose Parallel Input/Output (GPIO) expanders are ideal for low power handheld battery powered equipment. Our IO expanders come in 4-, 8-, and 16-channels of I/Os operating with a VDD range of 1.2V to 5.5V connecting easily to today's low core voltage chipsets in battery powered handheld applications without the need for level translating circuits.

## Key Features

- 4/8/16 channel of I/Os
- True bi-directional style I/O
- Programmable Pull-up/Pull-down Push/Pull outputs
- 1.2V to 5.5V independent operating voltage for all supply rails (VDDM, VCC1, VCC2)
- 5.5V compatible I/Os, up to 24mA output sink (no total sink current limit)
- Fully programmable logic functions (PLD)
- 400kHz two wire I<sup>2</sup>C compatible slave interface

## Applications

- Smartphones, PDAs, MP3 players
- Digital cameras
- Portable multimedia players
- Notebooks
- GPS devices



## GPIO IC Products

| Part Number | I/O Chan. | I/O Volt. Range (V) | Interface        | Max Current (mA) | Dual I/O Supplies | PLD Function | Lin./Log. Intensity | Blink | Breath | Keypad Scan. Engine | Polarity Inversion | Current (μA) | I <sup>2</sup> C Add. | Package (mm) |
|-------------|-----------|---------------------|------------------|------------------|-------------------|--------------|---------------------|-------|--------|---------------------|--------------------|--------------|-----------------------|--------------|
| SX1501      | 4         | 1.2–5.5             | I <sup>2</sup> C | 12/24            | –                 | ✓            | –                   | –     | –      | –                   | –                  | 1            | 2                     | 3x3          |
| SX1502      | 8         | 1.2–5.5             | I <sup>2</sup> C | 12/24            | ✓                 | ✓            | –                   | –     | –      | –                   | –                  | 1            | 2                     | 3x3          |
| SX1503      | 16        | 1.2–5.5             | I <sup>2</sup> C | 12/24            | ✓                 | ✓            | –                   | –     | –      | –                   | –                  | 1            | 1                     | 4x4          |
| SX1508B     | 8         | 1.2–3.6             | I <sup>2</sup> C | 15               | ✓                 | –            | ✓                   | ✓     | ✓      | ✓                   | ✓                  | 1            | 4                     | 3x3          |
| SX1509B     | 16        | 1.2–3.6             | I <sup>2</sup> C | 15               | ✓                 | –            | ✓                   | ✓     | ✓      | ✓                   | ✓                  | 1            | 4                     | 4x4          |
| SX1511B     | 8         | 1.2–3.6             | SPI              | 15               | ✓                 | –            | ✓                   | ✓     | ✓      | ✓                   | ✓                  | 1            | –                     | 3x3          |
| SX1512B     | 16        | 1.2–3.6             | SPI              | 15               | ✓                 | –            | ✓                   | ✓     | ✓      | ✓                   | ✓                  | 1            | –                     | 4x4          |

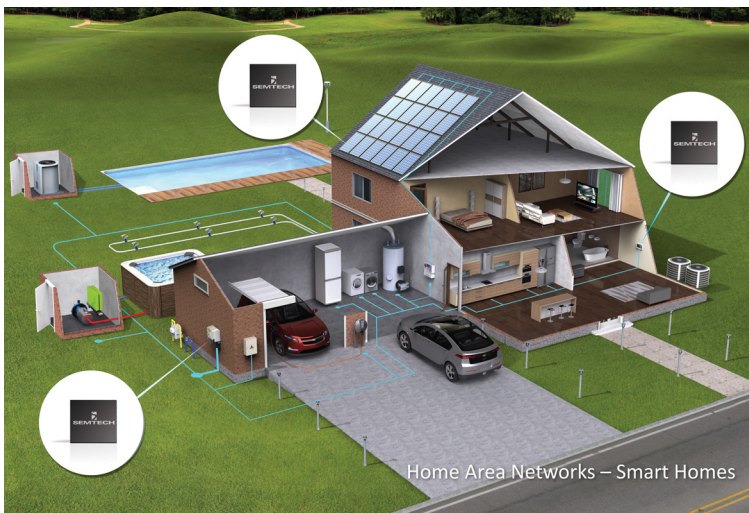
# Power Line Communications

Semtech Power Line Communications (PLC) and Hybrid (PLC+RF) series of products enable communication via low-voltage, medium-voltage power lines and through the air. PLC has long been a favorite application for utility companies because it allows them to reliably move data over infrastructure that they own and control. One of the main benefits of PLC to utilities is that it efficiently addresses their communications needs across a vast array of applications (metering, substation monitoring, load control and load shedding, home energy management, etc.) all focused on collectively addressing energy management tasks. Our PLC and Hybrid products platforms work on medium voltage (MV), low voltage (LV) and over the air networks, and our SoC offers both end-device and DCU/Service Node functionalities throughout the PHY, MAC and Convergence layers with IPV6 addressing.

The EV8600 Series comprises a hybrid sub-GHz RF + narrowband PLC single-chip transceiver SoC with both modems capable of simultaneous or independent operation. The EV8600 Series is a fully programmable single-chip soft PLC solution that not only comprises flexible analog front-end and digital (PHY + MAC) sections, but also supports upper networks layers up to and including IPV6. It also comprises integrated RAM/Flash memory and is designed specifically for the harsh power line and RF environments.

## KEY FEATURES

- EV8000 Series – PLC modem SoC: Multi-standard (G3, IEEE P1901.2, PRIME), Multiband (CA, ARIB, FCC)
  - EV8000, EV8010 – Multi-standard
  - EV8100 – Multi- Multi-standard plus application processor and LCD driver
  - EV8020 – PRIME
- EV8600 Series – PLC + RF modem SoC: Multi-standard (G3, IEEE P1901.2, PRIME, LoRa®, 802.15.4g (WiSUN), Wireless MBUS), Multiband (CA, ARIB, FCC, 137MHz-1020MHz)
  - EV8600
  - EV8610



Home Area Network (HAN)



Substation Communications

# Power Line Communications

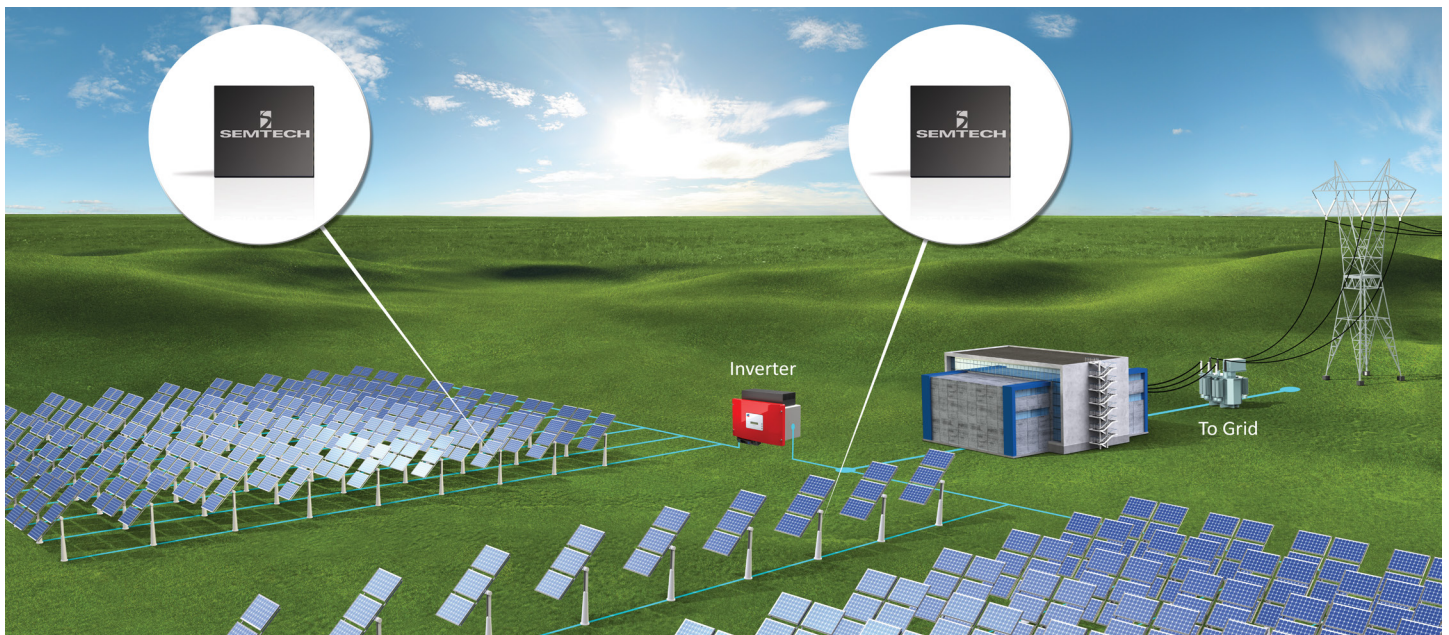
On a broad level, most, if not all, of our PLC SoC applications are tied to Active Energy Management. One of the applications for PLC technology is Advanced Metering Infrastructure (AMI), which allows utility companies to send and retrieve information from residential and industrial meters using power lines that connect directly to their servers. AMI also includes In Home Displays (IHD) and Gateways with which consumers and utility companies can use to control and manage residential energy usage. PLC usage also extends to other applications that use electricity as a source of power and require some (or substantial) intelligence for control and monitoring.

## APPLICATIONS

- Advanced Metering Infrastructure (AMI)
- Airport runway lighting
- Internet of Things (IoT)
- Home Area Networks (HAN)
- Smart appliances
- Solar plant control & monitoring
- Street lighting networks
- Substation communications
- Traffic signal control & monitoring



*Street Lighting Networks*



*Solar Plant Control & Monitoring*

# Wireless Charging Solutions

Semtech offers scalable wireless power transmitter and receiver platforms for both battery charging and power delivery in standard compliant and non-compliant systems. Semtech is a member of the Wireless Power Consortium (WPC) and AirFuel Alliance, and is active in helping shape the future standards for wireless power.

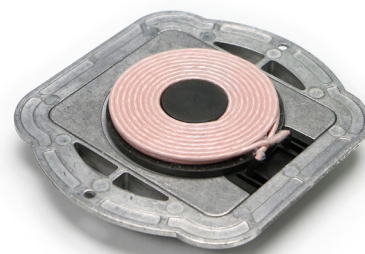
## FEATURES

- Firmware-based and programmable
  - Customizable to meet specific application requirements
  - Firmware is upgradable to support evolving standards
- Supports multiple system configurations
  - Multiple supply voltages and coil configurations with the same architecture
  - Supports custom receiver and transmitter coil sizes and inductance values
- Support for medium and high power Tx and Rx solutions
  - Up to 15W for smart phones and tablets
  - >15W for next-generation consumer products and industrial applications
  - 40W and beyond for high power applications such as notebook computers, power tools, and other industrial applications
- Support for low power (0.1W–2W) Tx and Rx solutions
  - Both standard and proprietary solutions
  - Support for very small coils and form-factors
  - Direct charging of batteries at <50mAh

- Multi-standard solutions based on single Tx hardware
  - WPC Qi® + AirFuel Inductive in a single hardware solution
  - WPC Qi® + AirFuel Inductive + Resonant in a single hardware solution

## EVALUATION MODULE SERIES

- Low Power Wearables <5W
  - LinkCharge™ LP Series
- Medium Power 5W-15W
  - **LinkCharge™ CT Series**
  - LinkCharge™ 10 Series
  - LinkCharge™ 15 Series
- High Power >15W
  - LinkCharge™ 20 Series



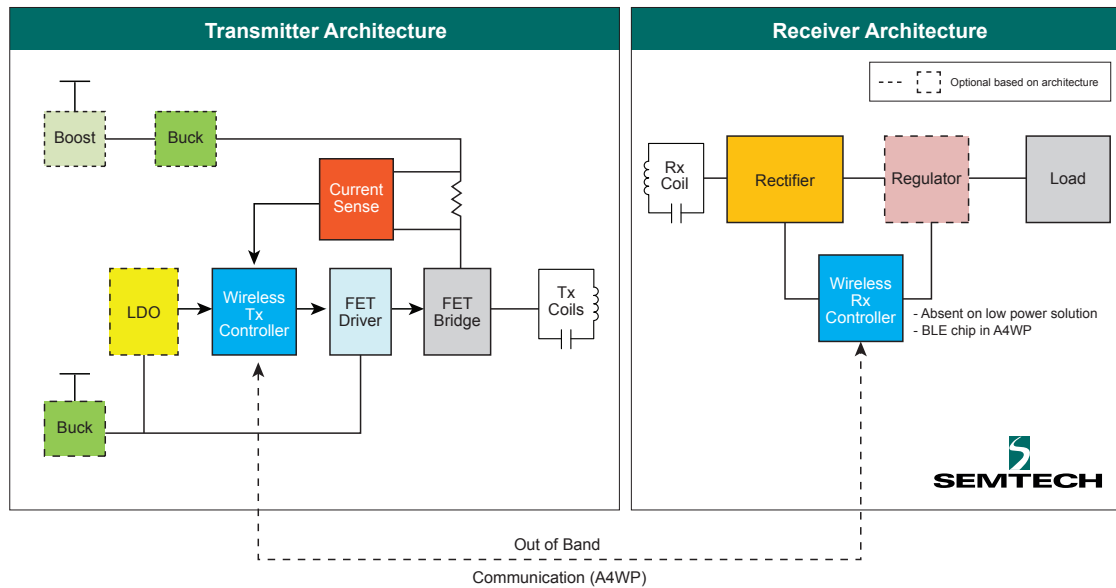
LinkCharge™ CT product photo

| Wireless Charging Standard |                                  |                                       |                                      |
|----------------------------|----------------------------------|---------------------------------------|--------------------------------------|
| Standard                   | Qi®<br>Wireless Power Consortium | AirFuel Inductive<br>AirFuel Alliance | AirFuel Resonant<br>AirFuel Alliance |
| Technology                 | Magnetic induction               | Magnetic induction                    | Magnetic resonance                   |
| Coupling Range             | 10mm (today)                     | 10mm (today)                          | 20-50mm (Today)                      |
| Frequency                  | 110-205kHz (RF)                  | 110-300kHz (RF)                       | 6.78MHz (Microwave)                  |
| Cost                       | Lower                            | Lower                                 | Higher                               |
| Power Today                | 15W at Rx                        | 15W at Rx                             | 10W at Tx                            |
| Power Next-Gen             | 15W at Rx                        | 15W at Rx                             | 22-36W at Tx                         |
| Communication              | Load Modulation                  | Load Modulation                       | Via Bluetooth™                       |
| Efficiency                 | 75%-77%                          | 65%-75%                               | 20%-70%                              |
| Transmitter                | Single or multi-coil             | Single or multi-coil                  | Single, multi-element                |

# Wireless Charging Solutions

NEW  
PRODUCT

## WIRELESS CHARGING ARCHITECTURE



### Function

| Controller | Buck | Boost | LDO | Rectifier | FET Driver | Battery Charge | Vreg | Current Sense |
|------------|------|-------|-----|-----------|------------|----------------|------|---------------|
|------------|------|-------|-----|-----------|------------|----------------|------|---------------|

### Semtech Orderable Part Numbers

|                 |                    | TS80000-QFNR                              | TS80002-QFNR | TS81000-QFNR | TS81001-QFNR | TS30011-M000QFNR | TS30012-M000QFNR | TS30041-M000QFNR | TS30042-M000QFNR | TS32105-QFNR | TS31023-QFNR | TS31223-QFNR | TS51111-M22WCSR | TS51223-M000WCSR | TS51231-QFNR | TS61005-QFNR | TS61002-QFNR | TS61001-QFNR | SC810ULTRT | TS51221-M000QFNR | TS94033SKTRC |
|-----------------|--------------------|-------------------------------------------|--------------|--------------|--------------|------------------|------------------|------------------|------------------|--------------|--------------|--------------|-----------------|------------------|--------------|--------------|--------------|--------------|------------|------------------|--------------|
| EVK Part Number |                    | Description                               |              |              |              |                  |                  |                  |                  |              |              |              |                 |                  |              |              |              |              |            |                  |              |
| NEW             | TSDMRX-5V/10W-EVM  | Dual mode 5V/10W RX                       |              |              |              |                  |                  |                  |                  |              |              |              |                 |                  |              |              |              |              |            |                  |              |
|                 | TSDMRX-5W-EVM      | Dual mode 5V/5W RX                        |              |              |              |                  |                  |                  |                  |              |              |              |                 |                  |              |              |              |              |            |                  |              |
|                 | TSDMTX-19V2-EVM    | Dual mode 19V/15W TX                      |              |              |              |                  |                  |                  |                  |              |              |              |                 |                  |              |              |              |              |            |                  |              |
|                 | TSDMTX-5V2-EVM     | Dual mode 5V/5W with quick charge TX      |              |              |              |                  |                  |                  |                  |              |              |              |                 |                  |              |              |              |              |            |                  |              |
|                 | TSDMTX-5V-EVM      | Dual mode 5V/5W TX                        |              |              |              |                  |                  |                  |                  |              |              |              |                 |                  |              |              |              |              |            |                  |              |
| NEW             | TSWIRX-5V2-EVM     | Wearable 5V/<2W Inductive RX              |              |              |              |                  |                  |                  |                  |              |              |              |                 |                  |              |              |              |              |            |                  |              |
|                 | TSWIRX-5V-EVM      | Wearable 5V/<2W Inductive RX              |              |              |              |                  |                  |                  |                  |              |              |              |                 |                  |              |              |              |              |            |                  |              |
|                 | TSWIRX-LI-EVM      | Wearable 5V/<2W Inductive RX with charger |              |              |              |                  |                  |                  |                  |              |              |              |                 |                  |              |              |              |              |            |                  |              |
|                 | TSWITX-12V-EVM     | Wearable 12V/<2W Half Bridge              |              |              |              |                  |                  |                  |                  |              |              |              |                 |                  |              |              |              |              |            |                  |              |
|                 | TSWITX-EVM         | Wearable 5V/1W Inductive TX               |              |              |              |                  |                  |                  |                  |              |              |              |                 |                  |              |              |              |              |            |                  |              |
| NEW             | TSWITX-G4-EVM      | Wearable 5V/1W Inductive TX               |              |              |              |                  |                  |                  |                  |              |              |              |                 |                  |              |              |              |              |            |                  |              |
|                 | TSDMTX-19V2-EVM    | High Power 20W Transmitter                |              |              |              |                  |                  |                  |                  |              |              |              |                 |                  |              |              |              |              |            |                  |              |
|                 | TSDMRX-19V/20W-EVM | High power 20W Receiver                   |              |              |              |                  |                  |                  |                  |              |              |              |                 |                  |              |              |              |              |            |                  |              |

# Ultra-low Power Solutions

## ULTRA-LOW POWER MANAGEMENT SOLUTIONS

Semtech nanoSmart® ultra-low power technology enables energy savings in everyday products. nanoSmart® products support multiple energy harvesting technologies including indoor and outdoor solar. Off-active™ switching and ultra-low power design result in dissipation in the nano-ampere range, ensuring more energy delivered to the application or storage element. Implementing advanced system power management and scheduled system wake-up is possible with optional microcontroller and real-time clock based solutions making it ideal for remote sensing and control applications.

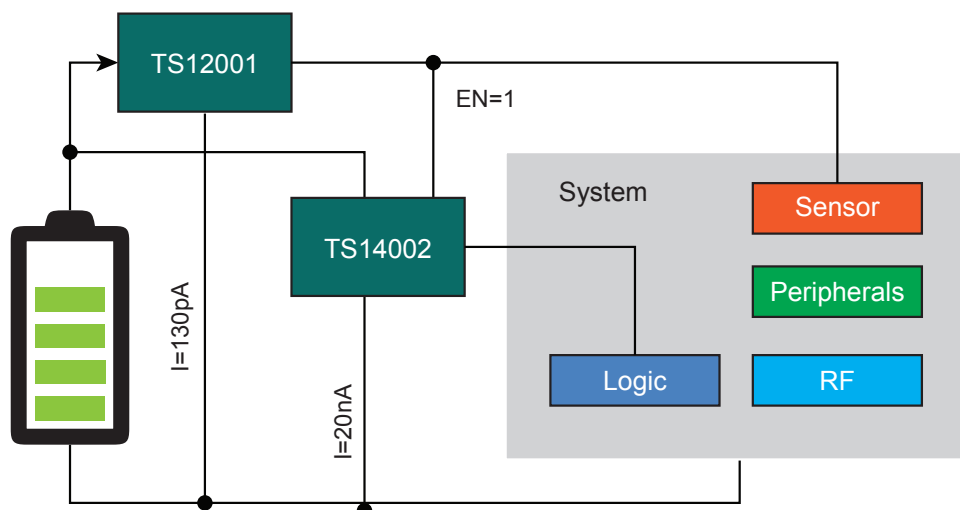
## FEATURES

- Lowest standby power in the industry
  - Eliminates standby power losses
  - Quiescent current below battery self-discharge current
- Extends battery life on portable products

## APPLICATIONS

- Enables portable standalone low-power
- Background energy scavenging
- Off-grid indoor solar energy harvesting
- Autonomous systems that run forever (i.e. wireless sensors)
- Medical and Industrial

| nanoSmart® Solutions |                                              |                                                                                                          |                                                                 |
|----------------------|----------------------------------------------|----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|
| Part Number          | Description                                  | Features                                                                                                 | Application                                                     |
| TS12001              | Battery management under voltage load switch | Trigger voltage options of 1.2V–4.2V (factory set), 70nA quiescent current                               | Protects batteries from excessive discharge in portable devices |
| TS14002              | Ultra-low power LDO                          | $V_{IN} = 2.5V$ to $5.5V$ ,<br>$V_{OUT} = 1.2V$ – $4.2V$ @250mA (factory set),<br>20nA quiescent current | Portable battery-operated electronics                           |



TS12001 and TS14002 Block Diagram

# Neo-Iso™ Isolated Power Solutions

## Neo-Iso™ ISOLATED LOAD SWITCH

Neo-Iso technology from Semtech enhances Internet of Things applications by adding higher levels of intelligence and control. Neo-Iso switches make it possible for low power microcontrollers to control high voltage loads in the system. Reporting of fault conditions from the switch to the controller enables system responses resulting in safer, more efficient operation. Low current draw allows each switch to operate on power harvested from the load eliminating the need for additional supplies. Implemented in proven, volume manufacturing processes, consistently high levels of reliability are achieved throughout the entire operating life. Semiconductor based design allows future scalability and integration options not possible with legacy technologies such as mechanical relays and opto-couplers.

## FEATURES

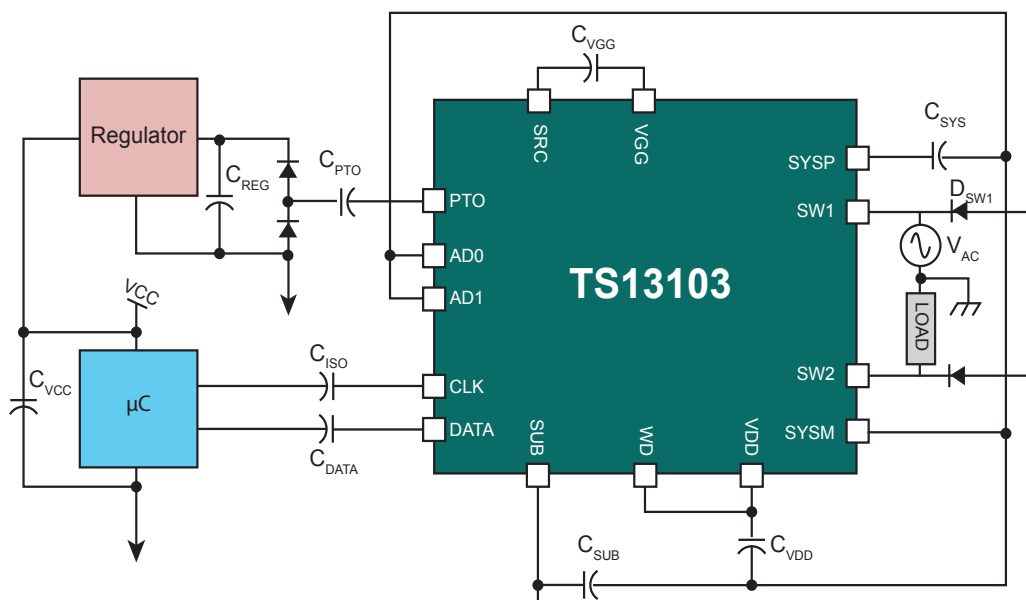
- Overcurrent protection
- Diagnostic information feedback
- Integrated protection devices
- Energy harvesting
- Energy transfer to primary side control
- Scalable galvanic from primary to secondary sides of the device
- Switch Turn-On / Turn-Off Times ~25µs
- Single control signal for on/off input (CLK) Operation Switch
- 60V switch with bi-directional blocking in OFF state
- Low profile allows thin and compact end products
- Silent operation improves user experience

## Ordering Info

| Part Number | Package (mm) | Standard Reel Quantity |
|-------------|--------------|------------------------|
| TS13101-QFN | QFN-20 (4x4) | 3,300                  |
| TS13102-QFN | QFN-16 (3x3) | 3,300                  |
| TS13103-QFN | QFN-16 (3x3) | 3,300                  |

## APPLICATIONS

- Internet of Things (IoT)
- HVAC / Thermostats
- Home Automation / Smart Home
- Security
- Smart Metering
- Industrial Control



TS13103 single channel with energy harvesting and Power Take Out (PTO)

# Power Management Solutions

Semtech supplies a wide range of power management ICs used in telecommunications and industrial equipment, portable devices, computers, and networks. Our products include feature rich, highly-integrated products for the telecom industry, and low power, small-package, high-efficiency products for smartphones, handsets, notebook PCs and other portable devices. An established leader in power management ICs across networking and industrial power, handheld power and LED lighting applications, Semtech is pushing performance to higher levels in our quest to enable a totally new class of greener, smarter and smaller end products.



## BUCK REGULATORS

With a broad selection of buck converters, Semtech offers some of the world's smallest, high-performance point-of-load (POL) regulators. These include our family of EcoSpeed® converters that set a new standard for efficiency, speed, size and simplicity in emerging green energy applications.

## BOOST REGULATORS

Semtech's expanded line of boost converters now includes the world's smallest low-voltage regulators, as well as a growing line of single- and multi-string boost LED drivers for demanding, rugged backlighting applications.

## LDOS

A wide range of ultra-low dropout regulators offers ideal solutions for systems where  $V_{OUT}$  is very close to  $V_{IN}$ .

## LED DRIVERS

Semtech manufactures an extensive line of LED driver ICs for LCD display, automotive, backlight, and LED camera flash applications. They include inductor-based boost LED drivers for series-connected LEDs and charge pump LED drivers, and low-dropout current sinks for parallel-connected LEDs. Each LED driver topology is designed for optimal high efficiency in the smallest footprint with accurate current regulation, low noise and a wide dimming range.

## CHARGE PUMPS

Semtech's high-performance, charge pump-based converters and LED backlight drivers build on a strong history of charge pump experience providing very high efficiency in the smallest footprint with accurate current regulation, low noise and a wide dimming range.

## FEMTOBUCK™ LOAD SWITCHES

Semtech's new load switch products focus on lowest RDS(ON) in class for highest system efficiency and extremely robust protection to withstand the harshest circuit conditions.

# Wide Input Voltage Regulators & Controllers



## EcoSpeed® Wide Input Synchronous Buck Regulators / Controllers

| Part Number | Input Voltage | Output Current (A) | Package (mm)  | Features                                                                 |
|-------------|---------------|--------------------|---------------|--------------------------------------------------------------------------|
| SC3303      | 5.5V–28V      | 3                  | MLPD-10 (3x3) | 0.75V–7.5V, Int. LDO, Ultrasonic PSAVE                                   |
| SC401B      | 3V–17V        | 15                 | MLPQ-32 (5x5) | 0.6V–85% $V_{IN}$ , Programmable Soft Start, Prog. LDO, Selectable PSAVE |
| SC402B      | 3V–28V        | 10                 | MLPQ-32 (5x5) | 0.6V–85% $V_{IN}$ , Programmable Soft Start, Prog. LDO, Selectable PSAVE |
| SC403B      | 3V–28V        | 6                  | MLPQ-32 (5x5) | 0.6V–85% $V_{IN}$ , Programmable Soft Start, Prog. LDO, Selectable PSAVE |
| SC414/424   | 3V–28V        | 6                  | MLPQ-28 (4x4) | 0.75V–85% $V_{IN}$ , 5V LDO, Ultrasonic/Regular PSAVE                    |
| SC417/427   | 3V–28V        | 10                 | MLPQ-32 (5x5) | 0.5V–85% $V_{IN}$ , Prog. LDO, Ultrasonic/Regular PSAVE                  |
| SC418/9     | 3V–28V        | 30                 | MLPQ-20 (3x3) | Ext. FETs, 0.5V–85% $V_{IN}$ , Prog. LDO, Ultrasonic/Regular PSAVE       |
| SC461       | 3V–28V        | 30                 | MLPQ-20 (3x3) | Ext. FETs, Hiccup, 0.6V–85% $V_{IN}$ , 5V LDO, Selectable PSAVE          |
| SC508(A)    | 4.5V–46V      | 30                 | MLPQ-20 (3x3) | Ext. FETs, Hiccup, 0.6V–85% $V_{IN}$ , 5V LDO, Ultrasonic/Regular PSAVE  |
| SC9301      | 3V–28V        | 10                 | MLPQ-32 (5x5) | Hiccup, 0.6V–5.5V, 5V LDO                                                |

EcoSpeed® is a registered trademark of Semtech Corporation.

 Automotive AEC-Q100 Qualified

## High Efficiency Wide Input Synchronous Buck Regulators

| Part Number | Input Voltage | Output Current (A) | Package (mm) | Features                                                                                                          |
|-------------|---------------|--------------------|--------------|-------------------------------------------------------------------------------------------------------------------|
| TS30011     | 4.5V–24V      | 1                  | QFN-16 (3x3) | 1 MHz Converters, Fixed $V_{OUT}$ options (1.5V, 1.8V, 2.5V, 3.3V, 5.0V) or adjustable $V_{OUT}$ (0.9V to VCC-1V) |
| TS30012     | 4.5V–24V      | 2                  | QFN-16 (3x3) |                                                                                                                   |
| TS30013     | 4.5V–18V      | 3                  | QFN-16 (3x3) |                                                                                                                   |
| TS30041     | 4.5V–40V      | 1                  | QFN-16 (3x3) |                                                                                                                   |
| TS30042     | 4.5V–40V      | 2                  | QFN-16 (3x3) |                                                                                                                   |

## Wide Input Asynchronous Buck Regulators

| Part Number | $V_{IN}$ (V) |     | $V_{OUT}$ (V) |                   | $I_{OUT}$ Max (A) | Isw Limit (A) | Shutdown Current ( $\mu$ A) | Fsw (kHz) | Package (mm) | Features                                                                    |
|-------------|--------------|-----|---------------|-------------------|-------------------|---------------|-----------------------------|-----------|--------------|-----------------------------------------------------------------------------|
|             | Min          | Max | Min           | Max (% $V_{IN}$ ) |                   |               |                             |           |              |                                                                             |
| SC4530      | 3            | 30  | 1.23          | 90                | 0.3               | 0.39          | 0.1                         | –         | MLPD-8 (3x2) | Light load idle mode                                                        |
| SC4518H     | 4.4          | 24  | 0.8           | 85                | 1.4               | 2.0           | 100                         | 600       | SO-8 EDP     | External synch                                                              |
| SC4519      | 3            | 16  | 1.2           | 85                | 2.7               | 3.0 typ.      | 5                           | 600       | SO-8 EDP     | External synch                                                              |
| SC4519H     | 4.4          | 24  | 0.8           | 85                | 3.0               | 3.5           | 100                         | 600       | SO-8 EDP     | External synch                                                              |
| SC4520      | 4.4          | 24  | 0.8           | 85                | 2.7               | 3.0           | 250                         | 100-600   | SO-8 EDP     | Programmable frequency                                                      |
| SC4521      | 4.4          | 24  | 0.8           | 85                | 3.0               | 3.5           | 250                         | 600       | SO-8 EDP     | Programmable Soft Start                                                     |
| SC4524E     | 3            | 28  | 1             | 96                | 2.0               | 2.6           | 40                          | 200-2000  | SO-8 EDP     | Programmable Soft Start, hiccup overload protection with frequency foldback |
| SC4524F     | 3            | 18  | 1             | 96                | 2.0               | 2.6           | 40                          | 200-2000  | SO-8 EDP     | Programmable Soft Start, hiccup overload protection with frequency foldback |
| SC4525E     | 3            | 28  | 1             | 96                | 3.0               | 3.9           | 40                          | 200-2000  | SO-8 EDP     | Programmable Soft Start, hiccup overload protection with frequency foldback |
| SC4525F     | 3            | 18  | 1             | 96                | 3.0               | 3.9           | 40                          | 200-2000  | SO-8 EDP     | Programmable Soft Start, hiccup overload protection with frequency foldback |

# Point of Load (POL) Solutions

## Low Dropout Regulators

| Part Number        | V <sub>IN</sub> (V) |     | V <sub>OUT</sub> (V) | I <sub>OUT</sub> (A) | V <sub>DROPOUT</sub> (V) | V <sub>DROPOUT</sub> @ Full Load (V) Typ | Package (mm) |
|--------------------|---------------------|-----|----------------------|----------------------|--------------------------|------------------------------------------|--------------|
|                    | Min                 | Max |                      |                      |                          |                                          |              |
| <b>NEW</b> TS31023 | 5                   | 16  | 1.25                 | 0.06                 | 0.55                     | 0.45                                     | MLPD-8 (2x2) |
| TS31223            | 5                   | 36  | 1.25                 | 0.06                 | 0.55                     | 0.45                                     | MLPD-8 (2x2) |
| SC4213H            | 1.4                 | 6   | 0.5                  | 0.5                  | 0.15                     | 0.075                                    | SOIC-8       |
| SC4211             | 1.4                 | 6   | 0.5                  | 1                    | 0.5                      | 0.2                                      | SOIC-8 EDP   |
| SC4212B            | 1.6                 | 6   | 0.5                  | 1                    | 0.175                    | 0.09                                     | MLPD-8 (3x3) |
| SC4215J*           | 1.4                 | 6   | 0.5                  | 2                    | 0.6                      | 0.3                                      | SOIC-8 EDP   |
| SC4216H            | 1.45                | 5.5 | 0.5                  | 3                    | 0.7                      | 0.45                                     | SOIC-8 EDP   |
| SC4217             | 1.8                 | 5.5 | 1.24                 | 3                    | 0.6                      | 0.3                                      | TO-263-5     |

\* SC4215J has 1ms internal soft start

## Low Current, Low Voltage LDO Regulators

| Part Number        | V <sub>IN</sub> (V) |     | V <sub>OUT</sub> (V) | I <sub>OUT</sub> (A) | V <sub>DROPOUT</sub> (V) | Output options                          | Package (mm)       |
|--------------------|---------------------|-----|----------------------|----------------------|--------------------------|-----------------------------------------|--------------------|
|                    | Min                 | Max |                      |                      |                          |                                         |                    |
| SC560              | 2.5                 | 5.5 | 1.2                  | 0.3                  | 0.215                    | Many dual fixed outputs available       | MLPQ-UT8 (1.5x1.5) |
| SC563              | 2.3                 | 5.5 | 1.0                  | 0.3                  | 0.540                    | Dual fixed outputs                      | MLPD-UT8 (1.6x1.2) |
| <b>NEW</b> TS14002 | 2.5                 | 5.5 | 1.2                  | 0.25                 | 0.160                    | Ultra-Low I <sub>q</sub> , Fixed output | VDFN (2x2)         |

## Buck Regulators

| Part Number              | Output Current (A)    | Package (mm)                                    | Features                                                          |
|--------------------------|-----------------------|-------------------------------------------------|-------------------------------------------------------------------|
| SC195/B                  | 0.5                   | MLPQ-8 (1.5x1.5)<br>CSP-8 (0.8x0.8)             | Low BOM 4 bit VID                                                 |
| SC197                    | 2x0.5                 | MLPQ-18 (2x3)                                   | Low BOM 4 bit VID                                                 |
| SC202A                   | 0.5                   | MLPQ-13 (2.5x3)                                 | Integrated inductor                                               |
| SC220                    | 0.65                  | SOIC 8                                          | PCB trace inductor                                                |
| SC4626                   | 1                     | SOT23-5                                         | Fixed V <sub>OUT</sub> Low BOM                                    |
| SC189                    | 1.5                   | MLPD-6 (2x2)                                    | Small size fixed V <sub>OUT</sub> Low BOM                         |
| SC283<br>SC284<br>SC284P | 2x1.8<br>2x1.8<br>2x2 | MLPQ-18 (2x3)<br>MLPQ-20 (3x3)<br>MLPQ-20 (3x3) | Low BOM 4 bit VID<br>Low BOM 4 bit VID<br>3 bit VID, PSAVE, PGOOD |
| SC183C/Q                 | 2                     | MLPQ-16 (3x3)                                   | Low BOM 4 bit VID                                                 |
| SC3102                   | 2                     | MLPQ-16 (3x3)                                   | Fixed V <sub>OUT</sub> selectable forced PSAVE                    |
| SC185                    | 4                     | MLPQ-16 (3x3)                                   | Fixed V <sub>OUT</sub> Low BOM                                    |
| SC186                    | 4                     | MLPQ-16 (3x3)                                   | Low BOM 4 bit VID                                                 |
| SC286                    | 2x4                   | MLPQ-28 (4x4)                                   | Low BOM 4 bit VID                                                 |

## DDR1 to DDR4 Memory Termination LDO Regulators

| Part Number | V <sub>CC</sub> (V) |     | V <sub>DDQ</sub> (V) | V <sub>TT</sub> (V) | I <sub>VTT</sub> (A) | DDR Type | Package                      | Features                                                              |
|-------------|---------------------|-----|----------------------|---------------------|----------------------|----------|------------------------------|-----------------------------------------------------------------------|
|             | Min                 | Max |                      |                     |                      |          |                              |                                                                       |
| SC2598      | 2.35                | 3.6 | 1–3.6                | 0.5–1.8             | ±3                   | 1,2,3,4  | SOIC-8 EDP                   | Integrated DDR VTT LDO with on-board buffered reference, remote sense |
| SC2599      | 2.35                | 3.6 | 1–3.6                | 0.5–1.8             | ±3                   | 1,2,3,4  | SOIC-8 EDP<br>MLPD-UT8 (2x2) | Integrated DDR VTT LDO with on-board buffered reference, remote sense |

## Boost Regulators

| Part Number        | V <sub>IN</sub> (V) |     | V <sub>OUT</sub> (V) |        | I <sub>OUT</sub> / I <sub>SW</sub> (A) | Shutdown Current (μA) | I <sub>q</sub> (mA) | Switching Freq (MHz) | Package (mm)                 | Features                                       |
|--------------------|---------------------|-----|----------------------|--------|----------------------------------------|-----------------------|---------------------|----------------------|------------------------------|------------------------------------------------|
|                    | Min                 | Max | Min                  | Max    |                                        |                       |                     |                      |                              |                                                |
| <b>NEW</b> TS32101 | 1.8                 | 5.5 | 1.8                  | 5.5    | /1.5                                   | 5                     | 0.05                | 2                    | MLPQ-16 (3x3)                | Synchronous, Power Save mode, bypass mode      |
| SC120              | 0.7                 | 4.5 | 1.8                  | 5      | /1.2                                   | 0.1                   | 0.05                | 1.2                  | MLPD, SOT-23 (1.5x2)         | Power Save mode for light load efficiency      |
| SC121              | 0.7                 | 4.5 | 1.8                  | 5      | /1.2                                   | 0.1                   | 3.5                 | 1.2                  | MLPD-UT-6 (1.5x2)            | No Power Save                                  |
| SC4501Q            | 1.4                 | 16  | 1.4                  | 30     | /2                                     | <18                   | <1.6                | Up to 2              | MSOP-8 EDP,<br>MLPD-10 (3x3) | Programmable Soft Start, SEPIC configurable    |
| SC4502(H)          | 1.4                 | 16  | 1.4                  | 32(40) | /1.4                                   | <18                   | <1.6                | Up to 2              | MLPD-10 (3x3)                | Programmable Soft Start, SEPIC configurable    |
| SC4503             | 2.5                 | 20  | 3                    | 27     | /1.4                                   | <1                    | <1.1                | 1.3                  | TSOT-23, MLPD-8 (2x2)        | Programmable Soft Start, SEPIC configurable    |
| SC630A             | 2.95                | 5.5 | –                    | 3.3    | 0.3/                                   | 0.1                   | 2.5                 | 1                    | MLPD-8 (2x2)                 | Buck-Boost 33mV ripple, Soft Start small caps  |
| SC632              | 2.9                 | 5.5 | –                    | 5      | 0.275/                                 | 0.1                   | 1.5                 | 0.2                  | MLPD-8 (2x2)                 | Buck-Boost <30mV ripple, Soft Start            |
| SC632A             | 2.95                | 5.5 | –                    | 5      | 0.275/                                 | 0.1                   | 2.5                 | 1                    | MLPD-8 (2x2)                 | Buck-Boost 50mV ripple, Soft Start, small caps |
| SC633              | 2.9                 | 5.5 | –                    | 5.3    | 0.4/                                   | 0.1                   | 1.5                 | 0.2                  | MLPD-8 (2x2)                 | Buck-Boost <30mV ripple, Soft Start            |

# LED Drivers and Load Switches



## LED Inductor Based

| Part Number                                                                              | V <sub>IN</sub> (V) |     | V <sub>OUT</sub> (V)<br>Max | F <sub>SW</sub> (MHz) | # LEDs per string*<br>V <sub>F</sub> =(3.5V) | # of Strings | String Current (mA)               | Dimming Max Freq. | Package (mm)         | Features                                                                  |
|------------------------------------------------------------------------------------------|---------------------|-----|-----------------------------|-----------------------|----------------------------------------------|--------------|-----------------------------------|-------------------|----------------------|---------------------------------------------------------------------------|
|                                                                                          | Min                 | Max |                             |                       |                                              |              |                                   |                   |                      |                                                                           |
|  SC441A   | 4.5                 | 21  | 36                          | 0.7                   | 10                                           | 4            | 150                               | up to 50kHz       | TSSOP-20 EDP         | Open/Short LED string disable, OCP, OTP, OVP, and FFLAG                   |
| SC442                                                                                    | 4.5                 | 21  | 42                          | 0.2–1.0               | 12                                           | 10           | 30                                | up to 50kHz       | MLPQ-UT-28 (4x4x0.6) | Adj freq, adj SCP level, Open/Short LED string disable, OCP, OTP, and OVP |
| SC443                                                                                    | 4.5                 | 27  | 42                          | 0.2–.2                | 12                                           | 3            | 30                                | up to 50kHz       | MLPQ-UT-16 (3x3x0.6) | Adj freq, Open LED string disable, OCP, OTP, and OVP                      |
|  SC445Q   | 4.5                 | 27  | 42                          | 0.7                   | 12                                           | 4            | 150                               | up to 50kHz       | TSSOP-20 EDP         | Adj SCP level, Open/Short LED string disable, OCP, OTP, OVP and FFLAG     |
| SC446                                                                                    | 4.5                 | 27  | 42                          | 0.7                   | 12                                           | 3            | 100                               | up to 50kHz       | TSSOP-16 EDP         | Open/Short LED string disable, OCP, OTP, and OVP                          |
| SC4541                                                                                   | 2.9                 | 22  | 25                          | 2                     | 7 (Boost)<br>5 (Buck)                        | 1            | 100 (max) Boost<br>200 (max) Buck | up to 1kHz        | SOT23-6, MLPD-UT-6   | High-side sensing integrated Schottky rectifier, no external compensation |
| SC5010/H                                                                                 | 4.5                 | 27  | 50                          | 0.2–2.2               | 14                                           | 8            | 30<br>50(H)                       | up to 30kHz       | MLPQ-UT-28 (4x4)     | Phase shifted, PWM/I <sup>2</sup> C dimming, extensive protection         |
|  SC5012/Q | 4.5                 | 45  | 65                          | 0.2–2.2               | 18                                           | 4            | 150                               | up to 30kHz       | MLPQ-24 (4x4)        | I <sup>2</sup> C, FSYNC, 5000:1 phase shifted PWM Dimming                 |
| SC5014                                                                                   | 4.5                 | 27  | 50                          | 0.2–2.2               | 14                                           | 4            | 120                               | up to 30kHz       | MLPQ-20 (4x4)        | Phase shifted, PWM/I <sup>2</sup> C dimming, extensive protection         |
| SC5014A                                                                                  | 4.5                 | 27  | 50                          | 0.2–2.2               | 14                                           | 2            | 240                               | up to 30kHz       | MLPQ-20 (4x4)        | Advanced high efficiency                                                  |

\*Maximum number of LEDs depends on LED forward voltage  Automotive AEC-Q100 qualified

## FemtoSwitch™ Load Switches

| Part Number                                                                                | V <sub>IN</sub> (V) |      | I <sub>OUT</sub> Max (A) | RDS ON (mΩ) | Shutdown Current (μA) | Quiescent Current (μA) | Reverse Current Blocking | Auto Discharge | ESD (kV HBM) | Package (mm)      |
|--------------------------------------------------------------------------------------------|---------------------|------|--------------------------|-------------|-----------------------|------------------------|--------------------------|----------------|--------------|-------------------|
|                                                                                            | Min                 | Max  |                          |             |                       |                        |                          |                |              |                   |
| SC704                                                                                      | 1.1                 | 3.6  | 0.5                      | 90          | 0.1                   | 2                      | –                        | –              | 5            | CSP-4 (0.76x0.76) |
| SC705                                                                                      | 1.1                 | 3.6  | 0.5                      | 90          | 0.1                   | 2                      | –                        | ✓              | 5            | CSP-4 (0.76x0.76) |
|  TS12001  | 1.2                 | 5.5  | 1.0                      | 175         | 0.0001                | 0.07                   | –                        | ✓              | 2            | DFN 8-L (2x2)     |
| SC724                                                                                      | 1.1                 | 3.6  | 2.0                      | 36          | 0.2                   | 0.81                   | –                        | –              | 3            | CSP-4 (0.76x0.76) |
| SC725                                                                                      | 1.1                 | 3.6  | 2.0                      | 36          | 0.2                   | 0.81                   | –                        | ✓              | 3            | CSP-4 (0.76x0.76) |
|  SC33020H | 1.6                 | 5.5  | 2.0                      | 32          | 0.3                   | 1                      | ✓                        | –              | 4            | CSP-4 (0.9x0.9)   |
| SC33021                                                                                    | 1.6                 | 5.5  | 2                        | 32          | 0.3                   | 0.8                    | ✓                        | ✓              | 5            | CSP-4 (0.9x0.9)   |
| SC33001A                                                                                   | 1.7                 | 5.5  | 3                        | 9           | 0.04                  | 150                    | –                        | ✓              | Class 1C     | CSP-6 (0.9x1.4)   |
| SC700                                                                                      | 0.75                | 5.25 | 4.0                      | 17          | 0.5                   | 150                    | –                        | ✓              | Class 1C     | MLPD-6 (2x2)      |
| SC700H                                                                                     | 0.75                | 5.25 | 4.0                      | 17          | 0.5                   | 150                    | –                        | –              | Class 1C     | MLPD-6 (2x2)      |
| SC701                                                                                      | 1.7                 | 5.5  | 4.0                      | 8           | 3.5                   | 125                    | –                        | ✓              | Class 1C     | CSP-6 (0.9x1.4)   |
| SC701H                                                                                     | 1.7                 | 5.5  | 4.0                      | 8           | 3.5                   | 125                    | –                        | –              | Class 1C     | CSP-6 (0.9x1.4)   |

## Current Sense Amplifier

| Part Number                                                                               | V <sub>IN</sub> (V) |     | Gain Temp Coefficient (ppm/°C) | Signal Input Voltage (V) |                       | Quiescent Current (μA) | Input Bias Current (μA) | ESD (kV HBM) | Package (mm) |
|-------------------------------------------------------------------------------------------|---------------------|-----|--------------------------------|--------------------------|-----------------------|------------------------|-------------------------|--------------|--------------|
|                                                                                           | Min                 | Max |                                | Min                      | Max                   |                        |                         |              |              |
|  TS94033 | 4.0                 | 42  | -20                            | V <sub>dd</sub> -5.5     | V <sub>dd</sub> +0.04 | 140                    | 2.1                     | 2            | SOT23-8      |

# Optical & Networking Solutions

## BUILDING THE FUTURE TOGETHER

As networking requirements continue to evolve, so will Semtech. Working with customers to provide solutions for tomorrow's networking challenges. One thing that won't change, however, is Semtech's commitment to being a reliable partner and providing innovative approaches that deliver unrivaled performance for the most sophisticated applications.

### ENABLING HIGH PERFORMANCE AND SPEED

- Class leading IC solutions for 25G and 100G applications in CFP, CFP2/4, QSFP28, and SFP28 modules
- Receive Optical Sub-Assembly (ROSA) based on Semtech's Rchip technology
- Full portfolio of integrated solutions to address all SFP+ and XFP modules
- Dual-lane Clock and Data Recovery (CDRs) (Tx/Rx) with integrated DML or EML driver
- Low power, reference-free
- Limiting amplifiers (LA) that provide wideband, low noise post-amplification
- Transimpedance amplifiers (TIAs) that exceed IEEE 10GbE and 100GbE Stressed Receiver Sensitivity (SRS) specifications
- High performance, low power laser drivers
- Full portfolio of integrated solutions for all PON applications including complete reference designs
- Industry's first single-chip 10G PON transceivers for symmetric and asymmetric applications
- Industry's first quad 10Gbps CDR, enabling long reach Infiniband® QDR, 40GbE and 100GbE applications
- Protocol-independent repeaters/redrivers
- Reference design kits for optical modules to decrease design time

### MARKETS

#### 100G ETHERNET

- Solutions for QSFP28, CFPx modules

#### 25G ETHERNET

- Market leading module IC and ROSA solutions for SFP28

#### 16G FIBRE CHANNEL

- Industry's first complete integrated IC solution for 16G Fibre Channel

#### 10G

- Complete portfolio of module IC and backplane solutions
- Solutions for XFP, SFP+, QSFP+ modules

#### PON/FTTH

- Industry's first fully integrated 10G PON solutions
- Highly integrated chipset solutions for EPON & GPON ONU/OLT

### TECHNOLOGY

#### CDRS

- Market leader
- Reference-free operation
- Integrated solutions enable best performance and lowest power

#### ROSAS

- Best-in-class sensitivity, based on our patented Rchip technology

#### TIAS

- Industry leading performance and proved reliability with over 300 million sold

#### LASER DRIVERS & TRANSCEIVER ICs

- High performance integrated solutions for single and multi-channel applications



# Optical Solutions

| Optical Module CDRs |                     |                               |              |     |                    |                   |         |                                                                         |
|---------------------|---------------------|-------------------------------|--------------|-----|--------------------|-------------------|---------|-------------------------------------------------------------------------|
| Part Number         | Data Rate (Gbps)    | Lanes                         | Laser Driver | TIA | Slice Level Adjust | Pin Compatibility | Package | Applications                                                            |
| GN2042              | 9.95–11.3           | 2 <sup>2</sup><br>(1Rx + 1Tx) | DML          | –   | Yes                | GN2044            | QFN-32  | XFP & SFP+ 10GbE & OC-192<br>Enables 1W Retimed SFP+ 10km               |
| GN2044              | 9.95–11.3           | 2 <sup>2</sup><br>(1Rx + 1Tx) | EML          | –   | Yes                | GN1444,<br>GN2042 | QFN-32  | XFP & SFP+ 10GbE,<br>OC-192 & DWDM<br>Enables 1.5W Retimed SFP+ 40/80km |
| GN2044S             | 9.95–11.3           | 2 <sup>2</sup><br>(1Rx + 1Tx) | EML          | –   | Yes                | GN1444S           | QFN-32  | Tunable SFP+, OC-192 & DWDM<br>Enables 1.5W Retimed TSFP+               |
| GN2040              | 9.95–11.3           | 2 <sup>2</sup><br>(1Rx + 1Tx) | DML          | –   | Yes                | GN204x            | QFN-32  | XFP and SFP+ 10GbE,<br>OC-192 and DWDM                                  |
| GN2017A             | 9.95–11.7<br>14.025 | 2 <sup>2</sup><br>(1Rx + 1Tx) | VCSEL        | –   | No                 | GN2010X           | QFN-32  | 16G FC, 10G FCoE                                                        |
| GN2104S             | 25–28               | 4                             | –            | –   | Yes                | –                 | FC-CSP  | 100Gbps Ethernet,<br>Infiniband EDR                                     |
| GN2106PS            | 25–28               | 4                             | EML          | –   | Yes                | –                 | BGA     | 100Gbps Ethernet/OTN,<br>Infiniband EDR                                 |
| GN2108              | 25                  | 4                             | VCSEL        | –   | Yes                | –                 | Die     | 100Gbps Ethernet SR4                                                    |
| GS2109              | 25                  | 4                             | –            | Yes | Yes                | GN2110            | Die     | 100Gbps Ethernet SR4, PSM4                                              |
| GN2110              | 25–28               | 4                             | –            | Yes | Yes                | GN2109            | Die     | 100Gbps Ethernet/OTN PSM4,<br>CWDM4, CLR4                               |
| GN2105              | 25–28               | 4                             | DML          | –   | Yes                | –                 | FC-BGA  | 100Gbps Ethernet, PSM4, CWDM4, CLR4                                     |

| Laser Drivers |                              |                  |                             |                |              |                                       |
|---------------|------------------------------|------------------|-----------------------------|----------------|--------------|---------------------------------------|
| Part Number   | Overview                     | Data Rate (Gbps) | Max Mod / Bias Current (mA) | Supply (V)     | Package      | Applications                          |
| NT20042       | 300Mbps LED Driver           | 0.3              | 100                         | 3.3/5.0        | QSOP-16      | OC-3, Fast Ethernet                   |
| NT22L33       | 1.25Gbps FP/DFB Laser Driver | 1.25             | 70/80                       | 3.3/5.0        | QFN-24 (4mm) | OC-3, OC-12, GbE                      |
| GN1160        | DFB Driver                   | to 11.3          | 90/120                      | 3.3 (Opt. 2.8) | QFN-28       | 10GE SFP+ 10GBASE-LR                  |
| GN1163        | DFB Driver                   | to 11.9          | 90/120                      | 3.3 (Opt. 2.8) | QFN-24       | QSFP+ 10GBASE-LR                      |
| GN1161        | VCSEL Driver                 | to 11.3          | 20/15                       | 3.3 (Opt. 2.8) | QFN-28       | 10GE SFP+ 10GBASE-SR                  |
| GN1190        | Quad VCSEL Driver            | to 14.3          | 12/12                       | 3.3            | Bare Die     | 40Gbps Ethernet, Infiniband, QSFP+    |
| GN1181        | DFB Driver                   | 25–28            | 55/70                       | 2.3/3.3        | Bare Die     | 25GbE and 100GbE Ethernet active TOSA |
| GN1185        | Quad DFB Driver              | 25–28            | 55/70                       | 2.3/3.3        | Bare Die     | 100GbE Ethernet active TOSA           |

| Limiting Amplifiers |                      |                  |           |       |            |                   |                     |
|---------------------|----------------------|------------------|-----------|-------|------------|-------------------|---------------------|
| Part Number         | Overview             | Data Rate (Gbps) | Gain (dB) | BW    | Supply (V) | Noise Figure (uV) | Applications        |
| NT20045             | 200Mbps Limiting Amp | 0.2              | 60        | 0.125 | 3.3/5.0    | 80                | OC-3, Fast Ethernet |

# Optical Solutions

| Transceiver IC (LD&LA) |                                              |                      |                           |                                          |         |                                |
|------------------------|----------------------------------------------|----------------------|---------------------------|------------------------------------------|---------|--------------------------------|
| Part Number            | Overview                                     | Data Rate (Gbps)     | Max Mod/Bias Current (mA) | Supply (V)                               | Package | Applications                   |
| GN25L95                | Burst Mode DFB + Receive LA                  | to 2.5               | 90/100                    | 3.3                                      | QFN-28  | EPON, GPON, BOSA-on-Board      |
| GN25L96                | Programmable Burst Mode DFB + Receive LA     | to 2.5               | 90/100                    | 3.3                                      | QFN-28  | EPON, GPON, BOSA-on-Board, SFP |
| GN25L98                | Burst Mode DFB + Receive LA + APD Controller | to 2.5               | 90/100                    | 3.3                                      | QFN-28  | EPON, GPON, BOSA-on-Board      |
| GN25L95C               | SFP Burst Mode DFB + Receive LA              | 3.1G to 125M         | 90/100                    | 3.3                                      | QFN-28  | Single and multi rate SFP      |
| NT28L90                | 2.5Gbps Burst Mode DFB + 10 Gbps Receive LA  | Rx 10.3<br>Tx 2.5    | 90/100                    | 3.3                                      | QFN-28  | 10G EPON, XG-PON1 (Asymmetric) |
| GN7354                 | Burst Mode DFB + Receive LA & CDR            | Rx 10.3<br>Tx to 2.5 | 90/90                     | 3.3<br>(3.3 or 5 output stage)           | QFN-32  | 10G EPON, XG-PON (Asymmetric)  |
| GN7355                 | Burst Mode DFB + Receive LA & CDR            | 10.3                 | 90/90                     | 3.3 + 5 output stage<br>(optional 3.3 V) | QFN-32  | 10G EPON, XG-PON (Symmetric)   |
| GN1412B                | EML Laser Driver + Receive LA                | to 11.3              | 2.5Vpp/120mA              | 3.3                                      | QFN-32  | 10GbE, OC-192                  |
| GN1444S                | EML Laser Driver + Receive LA                | to 11.3              | 2.5Vpp/120mA              | 1.8 & 3.3                                | QFN-32  | 10GbE, OC-192                  |
| GN1157                 | DML Laser Driver + Receive LA                | to 11.3              | 90/120                    | 3.3<br>(Optional 2.8)                    | QFN-28  | 10GbE LR SFP+, CPRI            |
| GN1157B                | DML Laser Driver + Receive LA                | to 12.5              | 90/120                    | 2.4 & 3.3                                | QFN-28  | 10GbE LR SFP+, CPRI            |
| GN1158                 | VCSEL Laser Driver + Receive LA              | to 11.3              | 20/15                     | 3.3<br>(Optional 2.8)                    | QFN-28  | 10GbE SR SFP+                  |

| TIAs        |                                   |                  |           |          |            |        |                         |
|-------------|-----------------------------------|------------------|-----------|----------|------------|--------|-------------------------|
| Part Number | Overview                          | Data Rate (Gbps) | Gain (kΩ) | BW (GHz) | Supply (V) | Noise  | Applications            |
| NT20R67     | 155Mbps AGC TIA                   | 0.155            | 63        | 0.165    | 3.3/5.0    | 11 nA  | OC-3, Fast Ethernet     |
| NT20067     | 155Mbps AGC TIA                   | 0.155            | 23        | 0.165    | 3.3/5.0    | 11 nA  | OC-3, Fast Ethernet     |
| NT23L50     | 622Mbps AGC TIA                   | 0.622            | 50        | 0.32     | 3.3        | 60 nA  | OC-12, BPON             |
| NT24L50     | 1.25Gbps AGC TIA                  | 1.25             | 25        | 0.75     | 3.3        | 92 nA  | GbE, EPON               |
| NT24L55     | 1.25Gbps High Sensitivity AGC TIA | 1.25             | 46        | 0.75     | 3.3        | 74 nA  | EPON                    |
| NT25L51     | 2.5Gbps AGC TIA                   | 2.5              | 8         | 1.7      | 3.3        | 230 nA | OC-48, GPON (APD)       |
| GN25L53     | 3.1Gbps AGC TIA                   | 3.1              | 5.5       | 1.9      | 3.3        | 335 nA | CPRI, GPON, OC-48 (APD) |
| GN25L55     | 2.5Gbps High Sensitivity AGC TIA  | 2.5              | 21        | 1.4      | 3.3        | 87 nA  | GPON (PD)               |
| NT28L52     | 10G Limiting                      | to 10.3          | 2.35      | 7        | 3.3        | 1.2 μA | PON, 10GBASE-SR         |
| GN1056      | 10G Linear                        | to 11.3          | 500/1     | 12       | 3.3        | 1μA    | OC-192                  |
| GN1058      | 10G Linear AGC                    | to 11.3          | 4         | 12       | 3.3        | 1μA    | 10GBASE-LRM & DWDM      |

# Optical Solutions

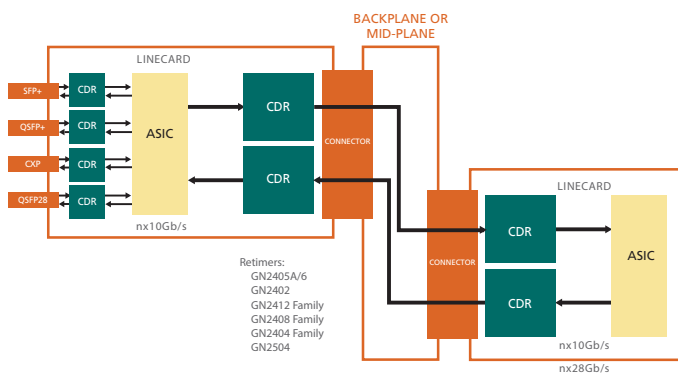
| TIAs (Conti.) |                             |                       |                    |                     |            |              |                                                 |
|---------------|-----------------------------|-----------------------|--------------------|---------------------|------------|--------------|-------------------------------------------------|
| Part Number   | Overview                    | Data Rate (Gbps)      | Gain (k $\Omega$ ) | BW (GHz)            | Supply (V) | Noise        | Applications                                    |
| GN7068        | 10G Limiting                | to 11.3               | 3                  | 12                  | 3.3        | 1 $\mu$ A    | APD ROSAs for 10G PON ONU & 10GBASE-ZR          |
| GN1068        | 14G Limiting                | to 14.3               | 6.75               | 12                  | 3.3        | 1.2 $\mu$ A  | CPRI, 10GBASE-SR/LR/ER & 16G FC                 |
| GN1090        | Quad 10G limiting           | to 14.3               | *                  | *                   | 3.3        | 0.9 $\mu$ A  | 40Gbps Ethernet; Infiniband, QSFP+              |
| GN7050        | 1.25G Burst Mode Limiting   | 1.25                  | 13                 | 1.0                 | 3.3        | *            | 1G EPON OLT                                     |
| GN7052        | Tri-rate PON TIA            | 1.25/<br>2.5/<br>10.3 | 13/<br>1.2/<br>2.3 | 1.1/<br>2.5/<br>8.7 | 3.3        | *            | 1.25G EPON/<br>2.5G XG-PON/<br>10G EPON OLT     |
| GN7053        | 1G GPON Burst Mode Limiting | 1.25                  | 1.25               | 1.5                 | 3.3        | *            | 1G GPON OLT                                     |
| GN1081        | 28G Limiting                | 28                    | 6                  | 22                  | 3.3        | 1.78 $\mu$ A | 25Gbps and 100Gbps Ethernet/OTN, Infiniband EDR |
| GN1084        | 25G Limiting                | 25                    | 6                  | 22                  | 3.3        | 2.3 $\mu$ A  | 25Gbps and 100Gbps Ethernet                     |
| GN1085        | Quad 28G Limiting           | 28                    | 6                  | 22                  | 3.3        | 1.78 $\mu$ A | 100Gbps Ethernet / OTN, Infiniband EDR          |

| ROSAs & Super High Gain ROSAs |                            |                  |                    |                 |      |                        |                               |       |
|-------------------------------|----------------------------|------------------|--------------------|-----------------|------|------------------------|-------------------------------|-------|
| Part Number                   | Overview                   | Data Rate (Gbps) | Gain (k $\Omega$ ) | Supply          | RSSI | Unstressed Sensitivity | Comments                      | ORL   |
| GN3050                        | 10km Rchip Limiting        | to 11.3          | 10                 | +3.3V $\pm$ 10% | Yes  | -21dBm                 | -16.8dBm OMA (Stressed sens.) | -14dB |
| GN3250                        | 40km Rchip Limiting        | to 11.3          | 10                 | +3.3V $\pm$ 10% | Yes  | -21dBm                 | -16.0dBm OMA (Stressed sens.) | -27dB |
| GN3052                        | LRM Rchip AGC              | to 11.3          | 9                  | +3.3V $\pm$ 10% | Yes  | -17dBm OMA             | -12dBm OMA (Stressed sens.)   | -14dB |
| GN3155                        | SR Super High Gain Rchip   | to 11.3          | 35                 | +3.3V $\pm$ 10% | Yes  | -15dBm OMA             | Eliminates LA in SFP+         | -14dB |
| GN3055                        | 10km Super High Gain Rchip | to 11.3          | 35                 | +3.3V $\pm$ 10% | Yes  | -21dBm                 | Eliminates LA in SFP+         | -14dB |
| GN3255                        | 40km Super High Gain Rchip | to 11.3          | 35                 | +3.3V $\pm$ 10% | Yes  | -21dBm                 | Eliminates LA in SFP+         | -27dB |
| GN3068                        | 10km Low Power Limiting    | to 11.3          | 7                  | +3.3V $\pm$ 10% | Yes  | -21dBm                 | 94 mW power dissipation       | -14dB |
| GN3268                        | 40km Low Power Limiting    | to 11.3          | 7                  | +3.3V $\pm$ 10% | Yes  | -21dBm                 | 94mW power dissipation        | -27dB |
| GN3257                        | PIN with AGC               | to 11.3          | 8.5                | +3.3V $\pm$ 10% | Yes  | -19dBm                 | –                             | -27dB |
| GN3352                        | APD with AGC               | to 11.3          | 4                  | +3.3V $\pm$ 10% | VAPD | -27dBm                 | –                             | -27dB |
| GN3357                        | High Gain APD with AGC     | to 11.3          | 8.5                | +3.3V $\pm$ 10% | VAPD | -27dBm                 | –                             | -27dB |
| GN3358                        | High Gain APD Rchip        | to 11.3          | 13                 | +3.3V $\pm$ 10% | VAPD | -27dBm                 | Ideal for Non-Retimed SFP+    | -27dB |
| GN3368                        | Limiting APD RChip         | to 11.3          | 4                  | +3.3V $\pm$ 10% | VAPD | -27dBm                 | –                             | -27dB |
| GN3270                        | 25G Limiting PIN ROSA      | 28               | 6                  | +3.3V $\pm$ 10% | Yes  | -14dBm                 | SFP28 LR applications         | -27dB |

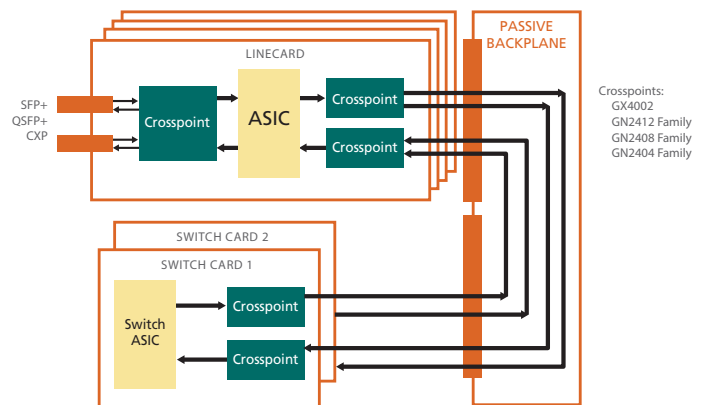
# Networking Solutions

| Multi-LANE Signal Conditioners |                           |       |     |           |                        |             |            |         |                                                                                                       |
|--------------------------------|---------------------------|-------|-----|-----------|------------------------|-------------|------------|---------|-------------------------------------------------------------------------------------------------------|
| Part Number                    | Data Rate (Gbps)          | Lanes | CDR | Ref Clock | Input Stage            | De-emphasis | Supply (V) | Pkg     | Applications                                                                                          |
| GN2504                         | 25.6–28.1                 | 4     | Yes | Not Req.  | Adaptive Equalizer     | Yes         | 1.8        | QFN-54  | 25G/50G/100G Linecards, nx28G Backplanes, 25G/50G/100G Active Copper Cables                           |
| GT1706 family                  | 1.25–14.5                 | 6     | Yes | Req.      | Adaptive Equalizer     | Yes         | 0.9<br>1.8 | BGA-144 | HD/3G/4K/8K Video Broadcast testing Fibre Channel/Infiniband/ Ethernet Link Testing BERT Developments |
| GN2412 family                  | 1.25–12.8                 | 12    | Yes | Req.      | Adaptive Equalizer DFE | Yes         | 0.9<br>1.8 | BGA-144 | > nx10G Backplanes, 10G/40G/100G Linecards, 10G-KR, 40G-KR4, 40G-CR4, Crosspoint Switching, CPRI      |
| GN2408 family                  | 1.25–12.8                 | 8     | Yes | Req.      | Adaptive Equalizer DFE | Yes         | 0.9<br>1.8 | BGA-144 | >nx10G Backplanes, 10G/40G Linecards, 10G-KR, Crosspoint Switching, CPRI                              |
| GN2404 family                  | 1.25–12.8                 | 4     | Yes | Req.      | Adaptive Equalizer DFE | Yes         | 0.9<br>1.8 | BGA-144 | >nx10G Backplanes, 10G/40G Linecards, 10G-KR, 40G-KR4, 40G-CR4, Crosspoint Switching, CPRI            |
| GN2402                         | 10.3125                   | 4     | Yes | Not Req.  | Equalizer              | Yes         | 3.3        | QFN-44  | nx10G Backplanes, 10G/40G Linecards, 10G/40G Active cables                                            |
| GX4002                         | 9.9–11.3, 14.025          | 2     | Yes | Not Req.  | Equalizer              | Yes         | 3.3        | QFN-32  | nx10G Backplanes, 10G/40G Linecards, Infiniband FDR, 16G Fibre Channel, Crosspoint Switching          |
| GN2405A/5S                     | 9.95–11.3                 | 4     | Yes | Not Req.  | Equalizer              | Yes         | 3.3        | QFN-48  | nx10G Backplanes 10G/40G Linecards 10G/40G Active cables                                              |
| GN2406/6S                      | 9.95–10.95                | 4     | Yes | Not Req.  | Limiting Amp           | Yes         | 3.3        | QFN-48  | 10G/40G Linecards                                                                                     |
| GN1407                         | 1–8                       | 4     | No  | Not Req.  | Equalizer              | No          | 1.2<br>1.8 | QFN-56  | PCIe Gen 1/2/3, SNAP-12, POP-4/LX-4/CX-4/KX-4, XAUI/RXAUI and Rapid I/O                               |
| GN1406                         | 2.5<br>3.125<br>5.0, 6.25 | 4     | Yes | Req.      | Equalizer              | Yes         | 1.2<br>1.8 | QFN-56  | PCIe Gen 1/2, SNAP-12, POP-4/LX-4/CX-4/KX-4, XAUI/RXAUI and Rapid I/O                                 |

## HIGH-SPEED BACKPLANES



## RETIMED CROSSPOINTS



# HD-VLC™ The Future of HD Surveillance

Semtech's next-generation of high-performance, all-digital HD video connectivity solutions for surveillance with integrated HD-VLC™ provide unprecedented levels of cable reach performance and enable long-distance transmission of high-quality HD digital video.

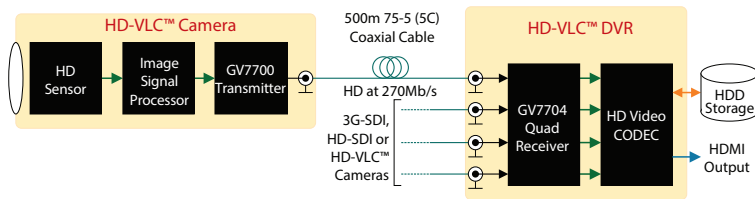
The High-Definition Visually Lossless CODEC (HD-VLC™) has been specifically developed to allow both 720p and 1080p high-definition video to be transmitted at lower data rates over conventional CCTV coaxial cables. Combined with Semtech's industry-leading cable equalizer and CDR technology, cable distances can be extended up to four times the reach of existing HD-SDI and HDcctv 1.0 products, and up to two times the reach of other VLC-based products.



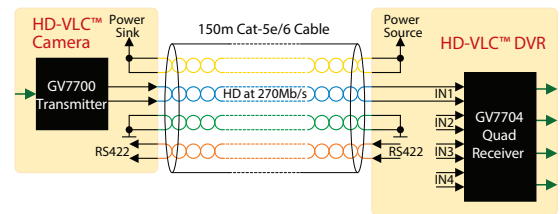
## CABLE REACH COMPARISON

| Cable Type              | HD-VLC™ 270Mbps | HD-SDI 1.485Gbps |
|-------------------------|-----------------|------------------|
| <b>Belden 1694A</b>     | 700m            | 230m             |
| <b>Belden 543945</b>    | 550m            | 150m             |
| <b>KW-Link SYV 75-5</b> | 500m            | 140m             |
| <b>Canare L-3C2V</b>    | 300m            | 100m             |
| <b>KW-Link SYV 75-3</b> | 300m            | 80m              |
| <b>Cat-5e/6 UTP</b>     | 150m            | –                |

## COAXIAL CABLE APPLICATION: 500M CABLE REACH



## UTP CABLE APPLICATION: 150M CABLE REACH



### GV7700 HD-VLC™ Transmitter

| Data Rate (Mbps)     | Downstream Data Insert | Downstream Audio Insert | Max Output Jitter (ps) | BT.1120 Bus Width | HD-VLC Encoder | I/O Voltage (V) | Temp Range (°C) | Power (mW) | Package (mm)          |
|----------------------|------------------------|-------------------------|------------------------|-------------------|----------------|-----------------|-----------------|------------|-----------------------|
| 270, 540, 1485, 2970 | Yes                    | 4 channels              | 77                     | 8/10 or 16/20 bit | Yes            | 1.8 or 3.3      | -20 to +85      | 180        | Dual Row QFN-84 (7x7) |

### GV7704 Quad HD-VLC™ Receiver

| Data Rate (Mbps)     | Integrated Equalizer | Downstream Data Extract | Downstream Audio Extract | IJT (UI)                    | Serial Loop Through | BT.1120 Bus Width | HD-VLC Decoder | Temp Range (°C) | Power (mW) | Package (mm)    |
|----------------------|----------------------|-------------------------|--------------------------|-----------------------------|---------------------|-------------------|----------------|-----------------|------------|-----------------|
| 270, 540, 1485, 2970 | Yes                  | Yes                     | 4 channels               | 0.06 (@270)<br>0.11 (@1485) | Yes                 | 8/10 bit          | Yes            | -20 to +85      | 810*       | BGA-169 (11x11) |

\* All four channels active

### GV8601 Adaptive Cable Equalizer

| Data Rate (Mbps) | Cable Reach with Belden 543945 |      |      | Output Jitter (UI) | Output Coupling | Temp Range (°C) | Power (mW) | Package |
|------------------|--------------------------------|------|------|--------------------|-----------------|-----------------|------------|---------|
|                  | 3G                             | HD   | SD   |                    |                 |                 |            |         |
| 270, 1485, 2970  | 100m                           | 150m | 330m | 0.2                | 2.5/3.3V        | -40 to +85      | 195        | QFN-16  |

### GV8500 Cable Driver

| Data Rate (Mbps) | Single Ended Outputs | Output Jitter (ps) | Adjustable Slew Rate | Output Amplitude Adjust | Temp Range (°C) | Power (mW) | Package |
|------------------|----------------------|--------------------|----------------------|-------------------------|-----------------|------------|---------|
| 270, 1485, 2970  | 2                    | <22                | Yes                  | Yes                     | 0 to +70*       | 168        | QFN-16  |

\* The GV8500 been characterized to meet typical conditions over the -40°C to +85°C extended temperature range.

# Broadcast Video

Semtech's Gennum Products Group extends its 20+ year leadership in SDI technology by being first to market with an array of advanced UHD-SDI solutions. Semtech's multi-rate device line-up enables customer roadmaps, facilitating the creation of differentiated and advanced UHD-SDI products. We offer the world's most advanced solutions designed specifically for real world broadcast challenges, including the latest innovations designed to help push the boundaries of performance, reach, power, and signal integrity while reducing time-to-market and design risks.

## UHD-SDI: THE NEXT-GENERATION BROADCAST TELEVISION PRODUCTION INTERFACE

We offer the most comprehensive end-to-end portfolio of UHD-SDI video solutions available, including our new family of long-reach, multi-rate 12G retiming equalizers and cable drivers, 6G high performance reclockers, low-power 3G equalizer and cable drivers, single-chip configurable cable driver/adaptive cable equalizer (BiDi), and innovative UHD-SDI gearbox solutions.

## UHD-SDI: THE NEXT-GENERATION BROADCAST TELEVISION PRODUCTION INTERFACE

New UHD-SDI solutions are needed to enable next-generation broadcast television and D-Cinema applications. UHD-SDI is the only interface for next-generation broadcast

television production for high definition television (HDTV), ultra-high definition television (UHDTV), high dynamic range (HDR), high frame rate (HFR), and wide color gamut (WCG) services.

## DEDICATED TO CUSTOMER SUCCESS

Our commitment to customer success is evident in everything we do. That is why we:

- Comprehensively test each component in production, assuring high yield on assembled boards
- Offer complimentary design review and feedback on Semtech-based designs to shorten design cycles, reduce risks and optimize performance
- Provide dedicated field and applications engineering support throughout the product's life-cycle

| Adaptive Equalizers |                                                  |                  |            |         |                                            |                         |
|---------------------|--------------------------------------------------|------------------|------------|---------|--------------------------------------------|-------------------------|
| Part Number         | Application                                      | Data Rate (Mbps) | Power (mW) | Outputs | Cable Length (m)                           | Cable Length Indication |
| GS12141             | 12G, 6G, 3G, HD, SD, MADI, low power, long reach | 1–11880          | 350*       | 2       | 12G(70), 6G(90), 3G(180), HD(240), SD(400) | Yes                     |
| GS3140              | 3G, HD, SD, MADI, low power, long reach          | 1–2970           | 85         | 1       | 3G(200), HD(280), SD(500)                  | Yes                     |
| GS6042              | 6G, 3G, HD, SD, MADI, long reach                 | 125–5940         | 180        | 1       | 6G(80), 3G(210), HD(300), SD(550)          | No                      |
| GS3440<br>GS3441    | 3G, HD, SD, MADI, long reach                     | 125–2970         | 169<br>212 | 1<br>2  | 3G(210), HD(250), SD(500)                  | No<br>Yes               |
| GS2994<br>GS2993    | 3G, HD, SD, long reach                           | 143–2970         | 165<br>165 | 1<br>2  | 3G(140), HD(200), SD(400)                  | No<br>Yes               |
| GS1674              | HD, SD, long reach                               | 143–1485         | 195        | 1       | HD(220), SD(400)                           | No                      |

\* Power specifications includes power consumed by integrated retimer

| Cable Drivers    |                                                     |                  |            |                |         |                       |
|------------------|-----------------------------------------------------|------------------|------------|----------------|---------|-----------------------|
| Part Number      | Application                                         | Data Rate (Mbps) | Power (mW) | Input Trace EQ | Outputs | Max Output Swing (mV) |
| GS12181          | 12G, 6G, 3G, HD, SD, MADI, dual output cable driver | 1–11880          | 340*       | Yes            | 2       | 1200                  |
| GS6080<br>GS6081 | 6G, 3G, HD, SD, single or dual output cable driver  | 143–5940         | 135<br>210 | Yes            | 2<br>4  | 1800                  |
| GS2988<br>GS2989 | 3G, HD, SD, single or dual output                   | 143–2970         | 110<br>180 | Yes            | 2<br>4  | 1800                  |

\* Power specifications includes power consumed by integrated retimer

# Broadcast Video



| Reclockers  |                                                                               |                            |           |                |                    |              |
|-------------|-------------------------------------------------------------------------------|----------------------------|-----------|----------------|--------------------|--------------|
| Part Number | Application                                                                   | Data Rate (Mbps)           | Input MUX | Input Trace EQ | Output De-emphasis | Package (mm) |
| GS6151      | 6G, 3G, HD, SD, MADI, reclocking with eye monitoring, low power, high density | 125, 270, 1485, 2970, 5940 | 2:1       | Yes            | Yes                | 4x4          |
| GS6152      | 6G, 3G, HD, SD, MADI, reclocking with eye monitoring, low power               | 125, 270, 1485, 2970, 5940 | 4:1       | Yes            | Yes                | 6x6          |
| GS2985      | 3G, HD, SD reclocking                                                         | 270, 1485, 2970            | 4:1       | Yes            | Yes                | 9x9          |
| GS2986      | 3G, HD, SD reclocking                                                         | 270, 1485, 2970            | 4:1       | Yes            | Yes                | 6x6          |
| GS2965      | 3G, HD, SD reclocking, high density                                           | 270, 1485, 2970            | 2:1       | Yes            | Yes                | 5x5          |

| Configurable SDI Input/Output - Equalizer/Cable Driver |                                                     |                  |                        |            |                                            |              |
|--------------------------------------------------------|-----------------------------------------------------|------------------|------------------------|------------|--------------------------------------------|--------------|
| Part Number                                            | Application                                         | Data Rate (Mbps) | Power (mW)             | Outputs    | Cable Reach (m, Belden 1694A)              | Package (mm) |
| NEW GS12090*                                           | 12G, 6G, 3G, HD, SD, MADI Configurable EQ/CD (BiDi) | 1–11880          | EQ: 430**<br>CD: 370** | EQ:1, CD:1 | 12G(60), 6G(70), 3G(160), HD(230), SD(450) | 6x4          |
| GS3490                                                 | 3G, HD, SD, MADI Configurable EQ/CD (BiDi)          | 125-2970         | EQ: 202<br>CD: 215     | EQ:1, CD:1 | 3G(140), HD(250), SD(550)                  | 5x5          |

\* GS12090 specifications are preliminary and subject to change \*\* Power specifications includes power consumed by integrated retimer

| Gearbox     |                               |                            |                     |                       |                                  |            |         |
|-------------|-------------------------------|----------------------------|---------------------|-----------------------|----------------------------------|------------|---------|
| Part Number | SDI Rates                     | Error and Format detection | SMPTE 352M Handling | Input SKEW adjustment | Per Lane output delay adjustment | Temp Range | Package |
| GS12070     | HD, 3G, 6G, 12G, (270 Bypass) | YES                        | YES                 | YES                   | YES                              | -40 to +85 | BGA196  |

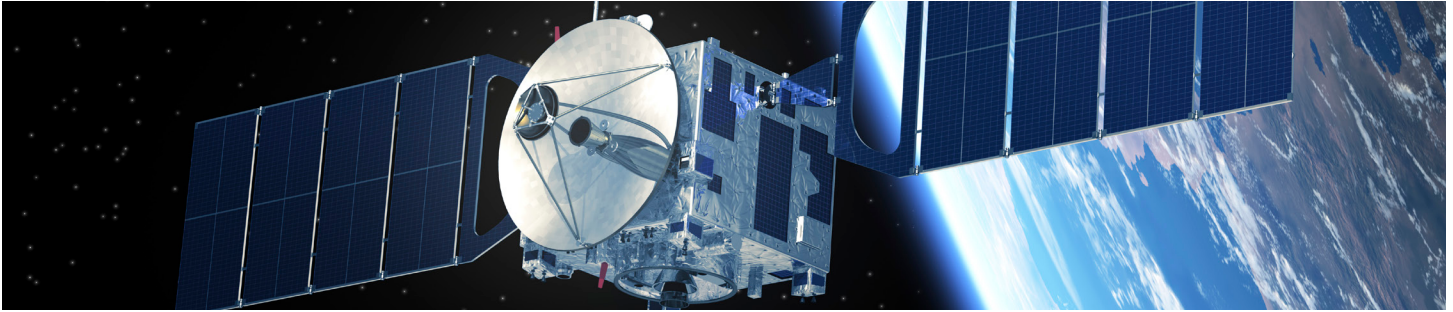
| Transmitters |                  |                |                         |                  |                    |            |
|--------------|------------------|----------------|-------------------------|------------------|--------------------|------------|
| Part Number  | Data Rate (Mb/s) | Audio Embedded | Output Jitter (ps)      | Video Processing | Parallel Bus Width | Power (mW) |
| GS2972       | 270, 1485, 2970  | Yes            | 3G(40), HD(50), SD(200) | Yes              | 10 or 20           | 400        |
| GS2962       | 270, 1485, 2970  | No             | 3G(40), HD(50), SD(200) | Yes              | 10 or 20           | 350        |
| GS1672       | 270, 1485        | Yes            | HD(50), SD(200)         | Yes              | 10 or 20           | 350        |
| GS1662       | 270, 1485        | No             | HD(50), SD(200)         | Yes              | 10 or 20           | 330        |

| Receivers   |                  |           |                |                       |                 |            |
|-------------|------------------|-----------|----------------|-----------------------|-----------------|------------|
| Part Number | Data Rate (Mbps) | Equalizer | Audio De-embed | Audio Clock Generator | Package (mm)    | Power (mW) |
| NEW GS3471* | 270, 1485, 2970  | Yes       | Yes            | Yes                   | 100 BGA (9x9)   | 300        |
| GS3470*     | 270, 1485, 2970  | No        | Yes            | Yes                   | 100 BGA (9x9)   | 220        |
| GS2971A     | 270, 1485, 2970  | Yes       | Yes            | Yes                   | 100 BGA (11x11) | 525        |
| GS2961A     | 270, 1485, 2970  | Yes       | No             | No                    | 100 BGA (11x11) | 500        |
| GS2970A     | 270, 1485, 2970  | No        | Yes            | Yes                   | 100 BGA (11x11) | 350        |
| GS2960A     | 270, 1485, 2970  | No        | No             | No                    | 100 BGA (11x11) | 320        |
| GS1661A     | 270, 1485        | Yes       | No             | No                    | 100 BGA (11x11) | 460        |
| GS1660A     | 270, 1485        | No        | No             | No                    | 100 BGA (11x11) | 250        |

\* GS3470/71 specifications are preliminary and subject to change

| Crosspoint  |                  |        |         |           |                |                    |
|-------------|------------------|--------|---------|-----------|----------------|--------------------|
| Part Number | Data Rate (Gbps) | Inputs | Outputs | Power (W) | Input Trace EQ | Output De-emphasis |
| GX3290      | 3.5              | 290    | 290     | 34        | Yes            | Yes                |
| GX3190      | 3.5              | 146    | 290     | 25        | Yes            | Yes                |
| GX3246      | 3.5              | 290    | 146     | 18        | Yes            | Yes                |
| GX3202      | 3.5              | 202    | 202     | 24        | Yes            | Yes                |
| GX3146      | 3.5              | 146    | 146     | 18        | Yes            | Yes                |

# High Reliability Discretes & Assemblies



Semtech designs and manufactures discrete power diodes that are listed in the QPL, both in axial and surface mount (US) configuration. These rectifier diodes, Zener diodes and TVS diodes are also configured into custom modules and ISOPAC™ packages.

## PRODUCTS

- Half wave discrete rectifiers (QPL)
- TVS diodes (QPL)
- Zener voltage regulators (QPL)
- Silicon carbide Schottky barrier diodes
- Diode arrays / assemblies in ISOPAC™ and module packages

## JANS – QUALIFIED DIODES

- MIL-PRF-19500/356, 5W Zener voltage regulator (axial and surface mount available)
- MIL-PRF-19500/406, 1.5W Zener voltage regulator (axial and surface mount available)
- MIL-PRF-19500/411, fast recovery rectifier diode (axial available)
- MIL-PRF-19500/420, standard recovery rectifier diode (axial and surface mount available)
- MIL-PRF-19500/427, standard recovery rectifier diode (axial available)
- MIL-PRF-19500/429, fast recovery rectifier diode (axial available)
- MIL-PRF-19500/477, ultra-fast recovery rectifier diode (axial and surface mount available)
- MIL-PRF-19500/516, bipolar transient voltage suppressor (axial and surface mount available)

## AVAILABLE IN SPACE GRADE (UPSCREEN\*)

- MIL-PRF-19500/ 551, transient voltage suppressor (axial and surface mount available)
- MIL-PRF-19500/ 552, transient voltage suppressor (axial and surface mount available)
- \* *Consult factory for other upscreen device options*
- MIL-PRF-19500/578, switching rectifier diode (axial and surface mount available) *Coming Soon*

## MODULES

- Epoxy encapsulated rectifier assemblies
- mA to 130A+ and 50V to 225kV+
- Catalog and custom products to source control drawings available

## ISOPAC™

- High power density, rugged and reliable high current rectifier assemblies
- Fully hermetic open-frame construction
- 15A to 100A+
- Zero lead length connections for optimal thermal resistance
- Catalog and custom products to source control drawings available



15A Ministud Rectifier



45A Three Phase Full Wave Bridge



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- LD – Laser Driver
- LA – Limiting Amplifier

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- RCLK – Reclocker (i.e. a CDR)
- EQ – Equalizer
- CD – Cable Driver
- SER, DES – Serializer, Deserializer

### *Integrated Variants*

- EQ+CD, CD+SER, EQ+DES



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