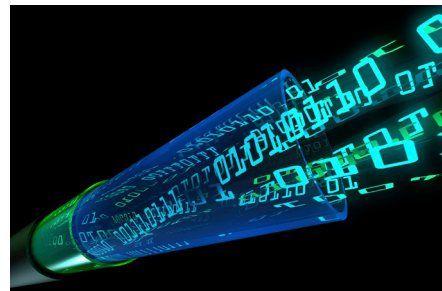




# optical



**2015** - High Performance Portfolio

## Optical & IC Selector Guide

- TIAs
- ROSAs
- Single-Lane CDRs
- Dual-Lane CDRs
- Quad-Lane CDRs
- Multi-Lane Signal Conditioners
- Laser & Modulator Drivers
- Limiting Amplifiers
- Transceiver ICs
- Optical Reference Design Kits

**High-Speed Communications** Products

  
**SEMTECH**

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# High Performance Optical and Copper Products

Shipping more than 300 million Optical ICs, Semtech is an active contributor to networking standards development. This combination of real-world experience and industry leadership enables us to deliver the most complex solutions to our customers' designs.

Semtech designs the industry's most innovative optical, analog and mixed signal semiconductor solutions to serve the rising global demand for high-speed data transmission products.

Semtech also offers one of the industry's most comprehensive portfolios of optical transceiver IC products ranging from 100 Mb/s-100 Gbps supporting such key industry standards as Fibre Channel, InfiniBand®, Ethernet, CPRI, PON, SONET and PCI Express®. Semtech is also investing in leading edge technologies to enable communication systems at 400 Gbps and beyond.

For optical component suppliers, this highly differentiated set of products provides a unique roadmap that improves performance and reliability, simplifies design, lowers costs and speeds time-to-market.

For systems designers and manufacturers working on the next generation of high-speed networks, Semtech's multi-lane and multi-rate 10 Gbps-100 Gbps backplane solutions provide cost-effective, low power, high performance products to enable next-generation networks.





## Enabling High Performance, High-Speed

- Class leading IC solutions for 100G applications in CFP, CFP2/4 and QSFP28 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 CDRs (Tx/Rx) with integrated DML or EML driver
- Low power, reference-free CDRs
- Limiting amplifiers (LA) that provide wideband, low noise post-amplification
- Transimpedance amplifiers (TIAs) that exceed the IEEE 10 GbE 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 10 Gbps CDR, enabling long reach Infiniband® QDR, 40 GbE and 100 GbE applications
- Protocol-independent repeaters/redrivers
- SFP+ reference design kits for optical modules to decrease design time

## Building the Future Together

As networking requirements continue to evolve, so will we, 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.

# Technology Leadership for the Future of Optical Communications

## TECHNOLOGIES

### CDRs

Market leader in CDRs

Reference-Free operation

Integrated solutions to address power requirements of emerging SFP+ SONET market

### ROSAs

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

### TIA's

Proven reliability, with over 150 million sold

### LASER DRIVERS & LIMITING AMPS

Industry-leading integrated solutions

## MARKETS

### 100G ETHERNET

Class leading CDRs, TIAs, Drivers and ROSAs

Solutions for CFP, CFP2/4 and QSFP28

### 16G FIBRE CHANNEL

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

### 10G

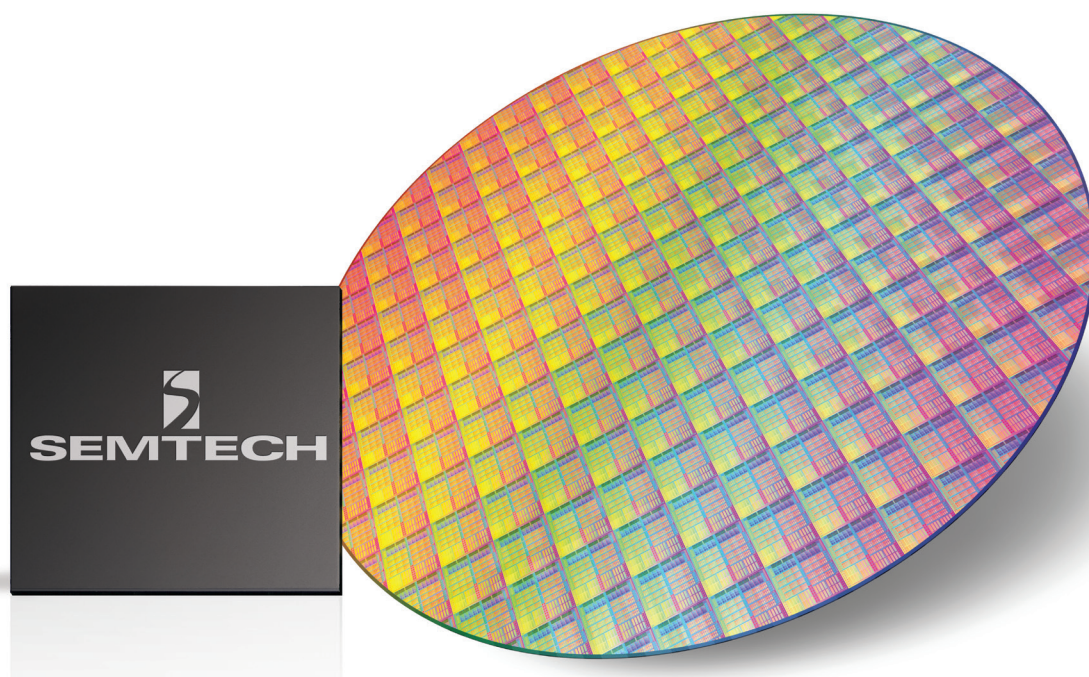
Complete portfolio of module IC and backplane solutions

Solutions for XFP, SFP+, QSFP+

### PON/FTTH

Industry's first fully integrated 10G PON solutions

Highly integrated chipset solutions for EPON & GPON ONU/OLT





# New Products

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## **GN2104 Low-Power Quad-CDR 25-28 Gbps for optical modules**

- Low power dissipation (400mW typical)
- Provides reference-free signal conditioning for CFP4 and QSFP28 modules

## **GN2106 Low-Power Quad-CDR with integrated EML drivers 25-28 Gbps**

- Fully monolithically integrated quad EML driver and CDRs
- Provides reference-free signal conditioning for CFP4 and QSFP28 modules

## **GN2504 Low-Power Quad-CDR 25-28 Gbps Reference Free Repeater**

- Low power dissipation (600mW typical)
- Provides reference-free signal conditioning on backplanes and linecards
- Highly configurable signal path with advanced adjustable equalization

## **GN1185 High Performance Quad 28 Gbps DML Laser Driver**

- Quad low power driver for active TOSA
- Max modulation/bias currents 55mA/70mA
- Advanced eye-shaping features

## **GN1084 & GN1085 Low Power 28 Gbps TIAs**

- Single (GN1084) and Quad (GN1085) versions
- 20 GHz Bandwidth
- 105mW (typ) power dissipation per channel

## **GN2108 Quad 25 Gbps Transmitter Array for SR-4**

- Integrated reference-free CDR and VCSEL array driver
- 250um channel pitch

## **GN2109 Quad 25 Gbps Receiver Array for SR-4**

- Integrated TIA array and reference-free CDR
- 250um channel pitch

## **GN3486 Fully Hermetic Quad 28 Gbps ROSA**

- Integrated 1:4 demultiplexer for CWDM
- Low power dissipation (400mW)
- Sensitivity per lane: -14dBm

## **GN3357 High Gain 11.3 Gbps Linear APD ROSA**

- High gain linear AGC TIA optimized for DWDM
- Low power dissipation, excellent sensitivity

## **GN25L96 ONU Transceiver IC**

- 3.1 Gbps combo SFP & PON BoB
- Dual Loop Tx with EYEMAX

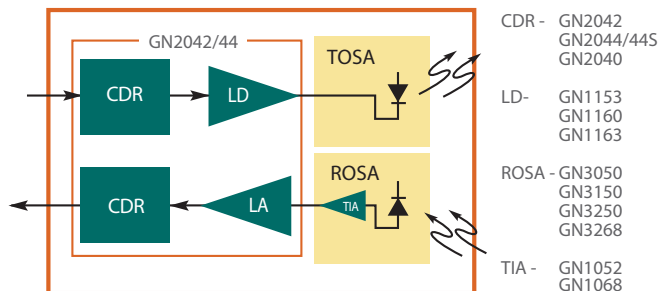
## **GN25L98 ONU Transceiver IC**

- PON Combo IC with integrated APD bias controller
- Single BOM can accommodate many different BOSA suppliers
- Programmable APD fault detection, shutdown and recovery

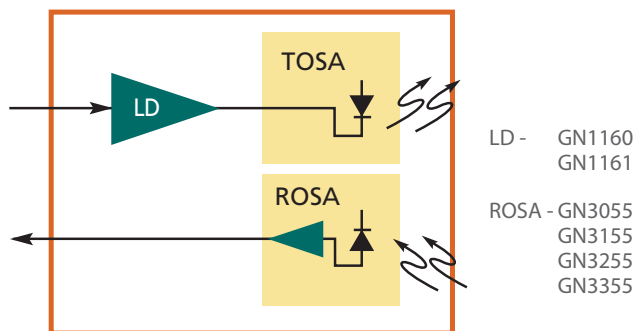
# Optical Applications

Semtech products offer a comprehensive selection of optical transceiver ICs and components for all 1-10GbE, CPRI, OC-192 and 100G module form factors, as well as copper solutions for high-speed serial line card and backplane communications.

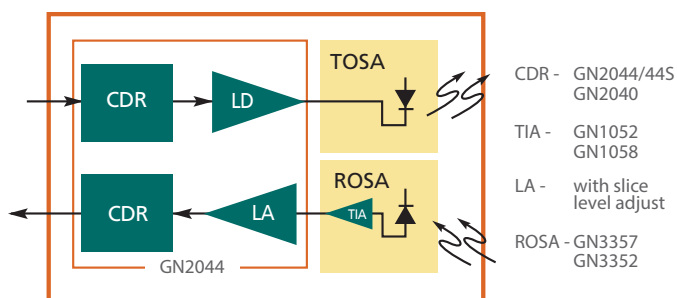
**10G XFP Retimed SFP+ Module for  $\leq 40\text{Km}$  Applications**



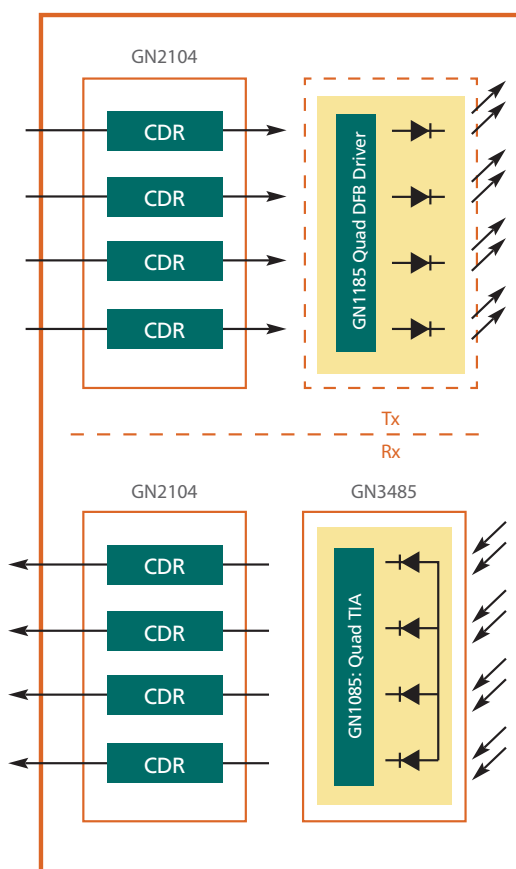
**Lowest power, LA Free SFP+ Architecture**



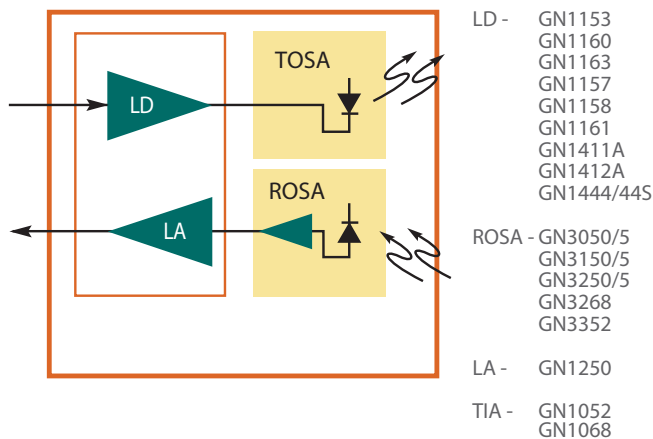
**10G XFP Module for  $\leq 80\text{Km}$  Applications**



**CFP4 / QSFP28: 100 GbE LR4**



**6/8/10G SFP+ Module Applications**

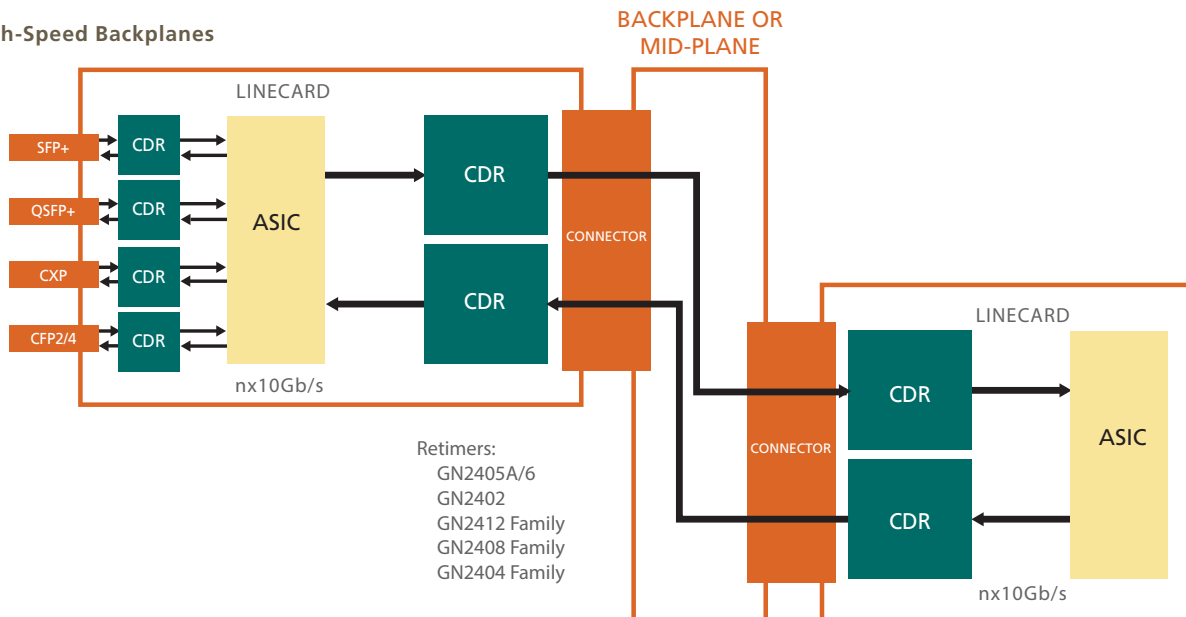




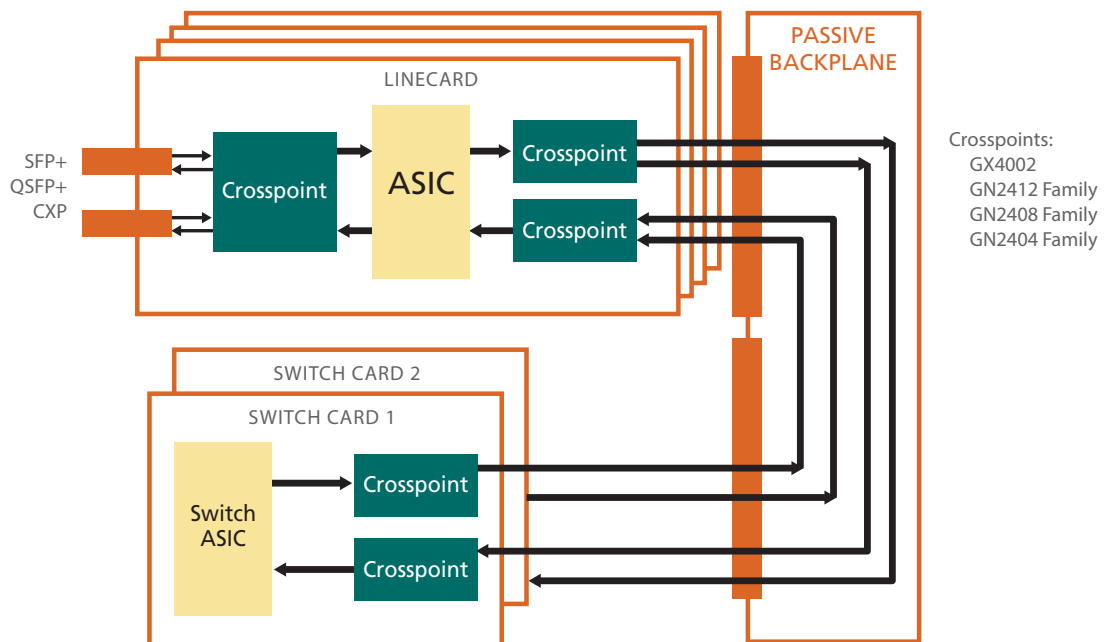
# Copper Applications

Semtech products offer a comprehensive selection of optical transceiver ICs and components for all 10 GbE and OC-192 module form factors, as well as copper solutions for high-speed serial line card and backplane communications.

## High-Speed Backplanes



## Retimed Crosspoints



# TIA

Wideband, low noise transimpedance amplifiers (TIAs) for your optical communication applications.

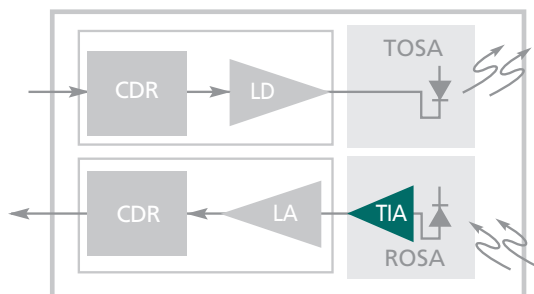
Semtech offers a portfolio of fully integrated Silicon Germanium (SiGe) BiCMOS and pure CMOS transimpedance amplifiers providing wideband, low noise pre-amplification of a current signal from a PIN photodiode or APD. Semtech's TIAs offer best-in-class performance in limiting, linear or automatic gain control versions for use in high performance optical receivers operating from 155 Mb/s to 28 Gbps.

## FEATURES

- Wideband, low noise TIAs
- Limiting, linear and AGC versions
- Fully integrated on-chip de-coupling for low cost and best performance

## APPLICATIONS

- ITU/IEEE-based transmission systems
- 10G and 100G Ethernet
- SONET/SDH based transmission systems, test equipment and optical modules from OC-3 to OC-192
- 8G and 16G Fibre Channel
- Serial data systems up to 28 Gbps
- PON/FTTH systems – BPON, EPON, GPON, 10GEPON and XG-PON
- 6G and 10G CPRI modules for wireless front haul
- 100 Gbps Client side modules



## NT20R67

Low cost 3.3V to 5.0V CMOS PIN TIA with automatic gain control and more than 43dB dynamic range for Optical Fiber applications up to 200 Mb/s.

## NT23L50

622 Mb/s high sensitivity TIA for FTTH and Telecom Fiber transceiver applications.

## NT24L50

1.25 Gbps high sensitivity TIA with automatic gain control for FTTH and datacom fiber transceiver applications.

## NT24L55

Super high sensitivity, high performance CMOS 1.25 Gbps TIA with 35dB of dynamic operating range designed for FTTH applications such as GePON transceivers and long haul telecom/datacom applications.

## NT25L51

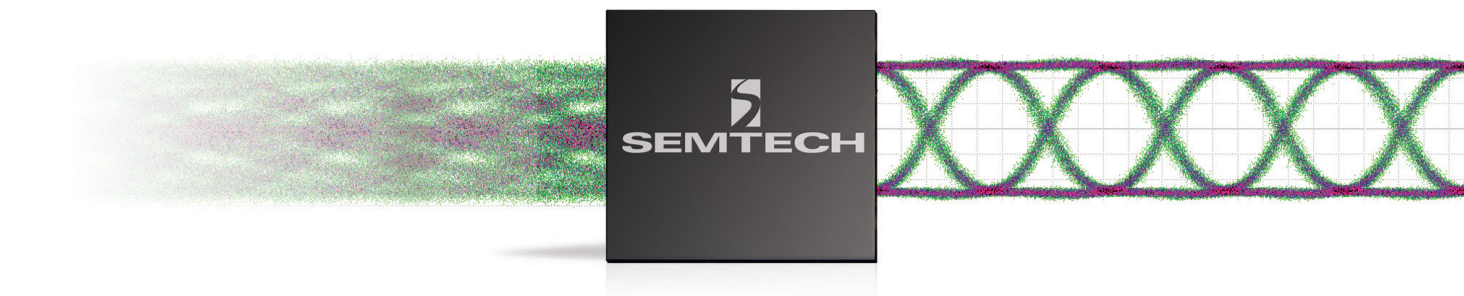
2.5 Gbps CMOS TIA for FTTH and Telecom Fiber transceiver applications with automatic gain control enabling over 27dB of dynamic operating range.

## NT25L59

2.5 Gbps high sensitivity CMOS TIA for GPON with automatic gain control enabling over 30dB of dynamic operating range.

## GN1090

Quad 14.5Gbps array receiver for parallel & multi-channel datacom & telecom modules. Advanced receiver design for excellent optical performance and very low power consumption (240mW total for 4 channels). Use with GN1190 Quad VCSEL driver.





**GN1056**

10Gbps linear TIA for high performance APD applications such as ultra-long haul telecom and submarine applications.

**GN1058**

10Gbps high gain TIA optimized for applications requiring AGC, such as 10GBASE-LRM and DWDM receivers for low OSNR environments.

**GN7068**

10Gbps limiting TIA designed for APD applications such as ROSAs for 10G PON OLT's and 10GBASE-ZR transceivers modules.

**GN1068**

14Gbps multi-rate limiting TIA providing high gain and wideband performance for use in Ethernet and emerging 16G Fibre Channel applications.

**GN7050, GN7051, GN7052, GN7053**

Limiting TIA's designed specifically for 1G EPON, 1G GPON, 2.5G XG-PON and 10G EPON OLT applications.

**GN1085**

4x28 Gbps limiting TIA optimized for 100GBASE-LR4 applications.

| TIAs        |                                    |                  |                      |             |            |             |                                        |
|-------------|------------------------------------|------------------|----------------------|-------------|------------|-------------|----------------------------------------|
| Part Number | Overview                           | Data Rate (Gbps) | Gain                 | BW (GHz)    | Supply (V) | Noise       | Applications                           |
| NT20R67     | 155 Mb/s AGC TIA                   | 0.155            | 63k $\Omega$         | 0.165       | 3.3/5.0    | 11 nA       | OC-3, Fast Ethernet                    |
| NT20O67     | 155 Mb/s AGC TIA                   | 0.155            | 23k $\Omega$         | 0.165       | 3.3/5.0    | 11 nA       | OC-3, Fast Ethernet                    |
| NT23L50     | 622 Mb/s AGC TIA                   | 0.622            | 50k $\Omega$         | 0.32        | 3.3        | 60 nA       | OC-12, BPON                            |
| NT24L50     | 1.25 Gbps AGC TIA                  | 1.25             | 25k $\Omega$         | 0.75        | 3.3        | 92 nA       | GbE, EPON                              |
| NT24L55     | 1.25 Gbps High Sensitivity AGC TIA | 1.25             | 46k $\Omega$         | 0.75        | 3.3        | 74 nA       | EPON                                   |
| NT25L51     | 2.5 Gbps AGC TIA                   | 2.5              | 8k $\Omega$          | 1.7         | 3.3        | 230 nA      | OC-48, GPON (APD)                      |
| GN25L52     | 2.5 Gbps AGC TIA                   | 2.5              | 6.5k $\Omega$        | 1.85        | 3.3        | 455 nA      | OC-48, GPON (APD)                      |
| GN25L53     | 3.1 Gbps AGC TIA                   | 3.1              | 5.5k $\Omega$        | 1.9         | 3.3        | 335 nA      | CPRI, GPON, OC-48 (APD)                |
| NT25L59     | 2.5 Gbps High Sensitivity AGC TIA  | 2.5              | 29k $\Omega$         | 1.5         | 3.3        | 108 nA      | GPON (PD)                              |
| NT28L52     | 10G Limiting                       | to 10.3          | 2.35k $\Omega$       | 7           | 3.3        | 1.2 $\mu$ A | 10GBASE-SR                             |
| GN1056      | 10G Linear                         | to 11.3          | 500/1k $\Omega$      | 12          | 3.3        | 1 $\mu$ A   | OC-192                                 |
| GN1058      | 10G Linear AGC                     | to 11.3          | 4k $\Omega$          | 12          | 3.3        | 1 $\mu$ A   | 10GBASE-LRM & DWDM                     |
| GN7068      | 10G Limiting                       | to 11.3          | 3k $\Omega$          | 12          | 3.3        | 1 $\mu$ A   | APD ROSAs for 10G PON ONU & 10GBASE-ZR |
| GN1068      | 14G Limiting                       | to 14.3          | 6.75k $\Omega$       | 12          | 3.3        | 1.2 $\mu$ A | 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             | 13k $\Omega$         | 1.0         | 3.3        | *           | 1G EPON OLT                            |
| GN7051      | 2.5G Burst mode Limiting           | 2.5              | 1.2k $\Omega$        | 2.0         | 3.3        | *           | 2.5G XG-PON OLT                        |
| GN7052      | Tri-rate PON TIA                   | 1.25/2.5/10.3    | 13/1.2/2.3k $\Omega$ | 1.1/2.5/8.7 | 3.3        | *           | 1.25G EPON/ 2.5G XG-PON / 10G EPON OLT |
| GN7053      | 1G GPON Burst mode Limiting        | 1.25             | 1.25k $\Omega$       | 1.5         | 3.3        | *           | 1G GPON OLT                            |
| GN1085      | Quad 25G Limiting                  | 100              | 6.3k $\Omega$        | 23          | 3.3        | 2.3         | 100GBASE-LR4                           |

\* Please contact your sales representative for a detailed datasheet.

# ROSAs

Best-in-class receive optical sub-assemblies (ROSAs) based on patented Rchip technology.

Semtech's complete line of PIN and APD ROSA products spans 850 nanometer (nm) to 1550nm including limiting, linear and automatic gain control (AGC) functionality. Our PIN ROSAs operate at  $+3.3V \pm 10\%$  and from  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ , with highly accurate RSSI functionality and industry best dynamic range. The ROSA products feature patented Rchip packaged in a fully compliant SC or LC type optical subassembly and are available with optional flex circuits.

Super High Gain Rchip ROSAs deliver  $35k\Omega$  of gain that eliminates the cost and power of the limiting amplifier for SFP+ applications.

## FEATURES:

- Best-in-class stressed receiver sensitivity
- High gain to ensure exceptional crosstalk performance within the module
- Patented Rchip technology to ensure maximum module manufacturing yield
- Super High Gain delivers most integrated, lowest power SFP+ solution

## APPLICATIONS:

- |               |                |
|---------------|----------------|
| • 10GBASE-SR  | • 10G EPON     |
| • 10GBASE-LR  | • 80 km        |
| • 10GBASE-ER  | • DWDM         |
| • 10GBASE-LRM | • 8GFC & 10GFC |
| • OC-192 SR-1 | • 100GBASE-LR4 |
| • OC-192 IR-2 |                |

## GN3050

10 km limiting ROSA provides excellent performance achieving -21dBm unstressed sensitivity. Ideal for 10GBASELR and SR-1.

## GN3250

10/40 km XMD compatible limiting ROSA provides excellent -21dBm unstressed sensitivity and high ORL for 10GBASE-ER and IR-2 applications.

## GN3052

AGC ROSA for 10 GbE LRM and linear applications. Interoperability with all leading EDC solutions for LRM.

## GN3352

11.3 Gbps APD ROSA with AGC TIA is ideal for both 80km limiting and DWDM applications requiring excellent OSNR performance.

## GN3357

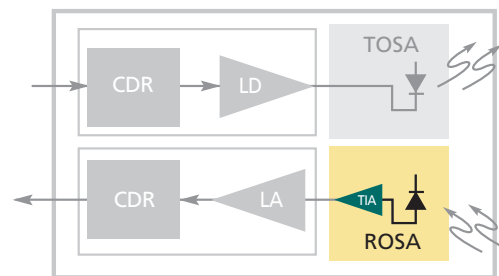
11.3 Gbps APD ROSA with high gain AGC TIA for DWDM and 80km applications

## GN3268

10/40 km XMD compatible low power (94 mW) limiting ROSA

## GN3485

Quad 25-28Gbps LR4 ROSA. Contains an integrated 1:4 WDM demultiplexer. Bandwidth 22GHz typical, gain  $6k\Omega$ . Power consumption 105mW per channel.



# Semtech's Super High Gain ROSAs

Best-in-class receive optical sub-assemblies (ROSAs) based on patented Rchip technology.

Super High Gain ROSAs deliver 300mV module output swing allowing for new SFP+ architecture. 125mW total power dissipation achieving approximately 100mW power savings over traditional architecture.

## GN3155

Super High Gain 850nm limiting ROSA is ideal for 10GBASE-SR and 8G Fibre Channel applications.

## GN3055

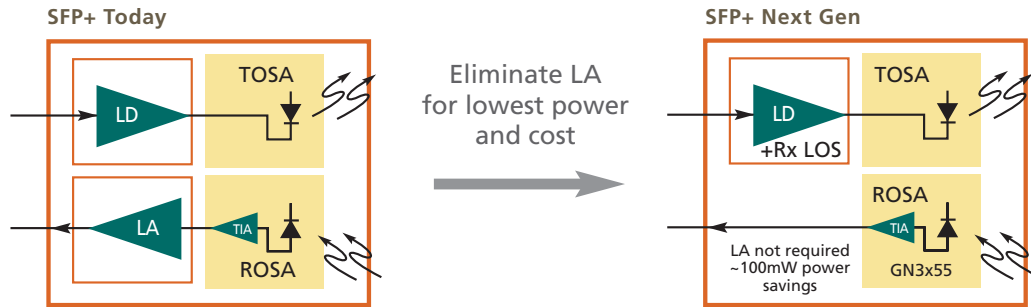
Super High Gain 10 km limiting ROSA provides excellent performance achieving -21dBm unstressed sensitivity. Ideal for 10GBASE-LR and SR-1.

## GN3255

Super High Gain 10/40 km XMD compatible limiting ROSA provides excellent -21dBm unstressed sensitivity and high ORL for 10GBASE-ER and IR-2 applications.

## GN3355

High Gain APD limiting ROSA optimized for TDM application provides best in class sensitivity and crosstalk.



## ROSAs & SUPER HIGH GAIN ROSAs

| Part Number | Overview                   | Data Rate (Gbps) | Gain  | Supply      | RSSI | Unstressed Sensitivity | Comments                        | ORL   |
|-------------|----------------------------|------------------|-------|-------------|------|------------------------|---------------------------------|-------|
| GN3150      | SR Rchip Limiting          | to 11.3          | 10kΩ  | +3.3V ± 10% | Yes  | -15dBm OMA             | -13.5dBm OMA (Stressed sens.)   | -14dB |
| GN3050      | 10km Rchip Limiting        | to 11.3          | 10kΩ  | +3.3V ± 10% | Yes  | -21dBm                 | -16.8dBm OMA (Stressed sens.)   | -14dB |
| GN3250      | 40km Rchip Limiting        | to 11.3          | 10kΩ  | +3.3V ± 10% | Yes  | -21dBm                 | -16.0dBm OMA (Stressed sens.)   | -27dB |
| GN3052      | LRM Rchip AGC              | to 11.3          | 9kΩ   | +3.3V ± 10% | Yes  | -17dBm OMA             | -12dBm OMA (Stressed sens.)     | -14dB |
| GN3155      | SR Super High Gain Rchip   | to 11.3          | 35kΩ  | +3.3V ± 10% | Yes  | -15dBm OMA             | Eliminates LA in SFP+           | -14dB |
| GN3055      | 10km Super High Gain Rchip | to 11.3          | 35kΩ  | +3.3V ± 10% | Yes  | -21dBm                 | Eliminates LA in SFP+           | -14dB |
| GN3255      | 40km Super High Gain Rchip | to 11.3          | 35kΩ  | +3.3V ± 10% | Yes  | -21dBm                 | Eliminates LA in SFP+           | -27dB |
| GN3068      | 10km Low Power Limiting    | to 11.3          | 7kΩ   | +3.3V ± 10% | Yes  | -21dBm                 | 94 mW power dissipation         | -14dB |
| GN3268      | 40km Low Power Limiting    | to 11.3          | 7kΩ   | +3.3V ± 10% | Yes  | -21dBm                 | 94mW power dissipation          | -27dB |
| GN3257      | PIN with AGC               | to 11.3          | 8.5kΩ | +3.3V ± 10% | Yes  | -19dBm                 | –                               | -27dB |
| GN3352      | APD with AGC               | to 11.3          | 4kΩ   | +3.3V ± 10% | VAPD | -27dBm                 | –                               | -27dB |
| GN3357      | High Gain APD with AGC     | to 11.3          | 8.5kΩ | +3.3V ± 10% | VAPD | -27dBm                 | –                               | -27dB |
| GN3355      | High Gain APD Rchip        | to 11.3          | 13kΩ  | +3.3V ± 10% | VAPD | -27dBm                 | Eliminate LA in SFP+            | -27dB |
| GN3368      | Limiting APD Rchip         | to 11.3          | 4kΩ   | +3.3V ± 10% | VAPD | -27dBm                 | –                               | -27dB |
| GN3485      | 100GBASE-LR4               | to 100           | 5kΩ   | +3.3V ± 10% | Yes  | -14dBm                 | 420mW typical power dissipation | -26dB |



# Optical Module CDRs

Semtech's dual-lane signal conditioners, with integrated VCSEL, DML or EML driver, offer the lowest power, smallest footprint solution for XFP, retimed SFP+ and 100G modules.

## ENABLING NEXT-GENERATION 100G ETHERNET

The GN2104 and GN2106 enable next-generation of 100G CFP4 and QSFP module form factors. The GN2106 integrates Quad 25G CDRs with an EML laser driver in a small form factor. The innovative offerings build upon Semtech's proven CDR technology and enable solutions for both Long Reach and Extended Reach applications. The high level of integration coupled with industry's lowest power and superior performance simplifies the overall module designs and saves cost.

## ENABLING SFP+ SONET

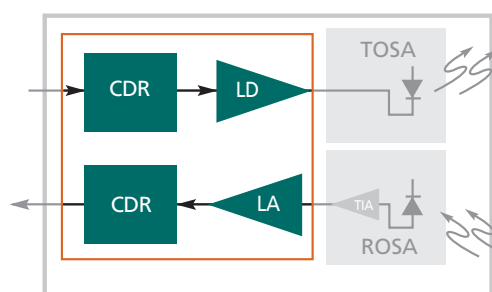
The GN2042 and GN2044 enable a SONET compliant module in an SFP+ form factor. The integration of the laser driver enables the lowest power solution for SFP+. The high level of integration also delivers a small footprint solution to fit within the form factor. The reference clock free architecture simplifies the overall module design and saves cost.

## FEATURE SET FOR DWDM AND TUNABLE APPLICATIONS

The GN2040 family has a rich feature set to enable optimal performance in DWDM and Tunable applications. The features include slice level adjust, programmable peaking on the receive path input and sampling clock phase adjust.

## LOW COST, SMALL FOOTPRINT SOLUTION

By integrating the limiting amplifier, laser driver and receive and transmit CDR, the GN2042, GN2044 and GN2017A provide an optimal path for lower cost designs. The integrated APC loop and small number of external components also save cost. The high level of integration in a small, 5mmx5mm 32-QFN package enables use in very high density designs. For designs requiring even smaller packages, such as Tunable SFP+ applications, the GN2044S offers an even smaller 4mmx4mm 32-QFN package with all the same benefits.



| OPTICAL MODULE CDRs |                       |                      |              |                    |                   |        |                                                                       |
|---------------------|-----------------------|----------------------|--------------|--------------------|-------------------|--------|-----------------------------------------------------------------------|
| Part Number         | Data Rate (Gbps)      | Lanes                | Laser Driver | Slice Level Adjust | Pin Compatibility | Pkg    | Applications                                                          |
| GN2042              | 9.95 - 11.3           | $2$<br>(1 Rx + 1 Tx) | DML          | Yes                | GN2044            | 32 QFN | XFP & SFP+ 10 GbE & OC-192<br>Enables 1W Retimed SFP+ 10km            |
| GN2044              | 9.95 - 11.3           | $2$<br>(1 Rx + 1 Tx) | EML          | Yes                | GN1444, GN2042    | 32 QFN | XFP & SFP+ 10 GbE, OC-192 & DWDM<br>Enables 1.5W Retimed SFP+ 40/80km |
| GN2044S             | 9.95 - 11.3           | $2$<br>(1 Rx + 1 Tx) | EML          | Yes                | GN1444S           | 32 QFN | Tunable SFP+, OC-192 & DWDM<br>Enables 1.5W Retimed TSFP+             |
| GN2040              | 9.95 - 11.3           | $2$<br>(1 Rx + 1 Tx) | DML          | Yes                | GN204x            | 32 QFN | XFP and SFP+ 10 GbE,<br>OC-192 and DWDM                               |
| GN2017A             | 9.95 - 11.7<br>14.025 | $2$<br>(1 Rx + 1 Tx) | VCSEL        | No                 | GN2010X           | 32 QFN | 16G FC, 10G FCoE                                                      |
| GN2425A             | 25 - 28               | $2$<br>(2 Tx)        | –            | Yes                | –                 | 32 QFN | 100 Gbps Ethernet / OTN,<br>Infiniband EDR                            |
| GN2426A             | 25 - 28               | $2$<br>(2 Rx)        | –            | Yes                | –                 | 32 QFN | 100 Gbps Ethernet / OTN,<br>Infiniband EDR                            |
| GN2104              | 25 - 28               | 4                    | –            | Yes                | –                 | 54 QFN | 100 Gbps Ethernet / OTN,<br>Infiniband EDR                            |
| GN2106              | 25 - 28               | 4                    | EML          | Yes                | –                 | 58 QFN | 100 Gbps Ethernet / OTN,<br>Infiniband EDR                            |

# Backplane & Linecard Signal Conditioners

Semtech's multi-channel signal conditioners enhance the reach and robustness of high-speed serial links by compensating for transmission losses and re-setting the crosstalk and jitter budgets.

## HIGH LEVEL OF INTEGRATION AND SMALL FOOTPRINT

Semtech's backplane & linecard signal conditioners are ideal for small form factor modules or dense backplane /linecard applications.

## FULL PORTFOLIO

Semtech products offer solutions for Ethernet, Infiniband®, Fibre Channel® and PCI Express®. Solutions are available with and without CDR functionality.

## DRIVE LONG BACKPLANES OR CABLES

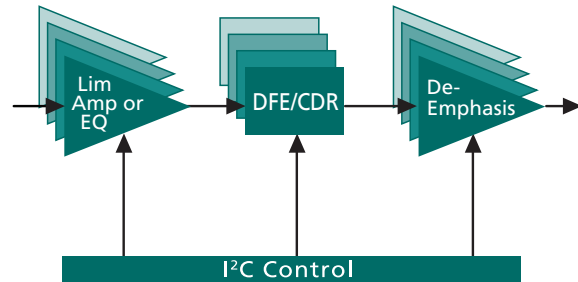
A combination of Equalizer, DFE and CDR technology allows for an optimal solution to drive long, dense backplanes or cables at high speeds.

## LOW POWER

Semtech's CDR products require the lowest power in the industry, a key factor as densities increase.

## RESET THE JITTER AND CROSSTALK BUDGETS

Using CDRs will reset the jitter budget, substantially increasing the robustness of the system and allowing for design flexibility. Using CDRs in multi-channel systems will also reset the crosstalk budget, an increasing concern at higher data rates.



## 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 Required | Adaptive Equalizer     | Yes         | 1.8        | 54 QFN  | 25G/50G/100G Linecards, nx28G Backplanes, 25G/50G/100G Active Copper Cables                           |
| GN2415        | 1.2 - 15.0          | 8     | Yes | Required     | Adaptive Equalizer DFE | Yes         | 0.9 1.8    | 144 BGA | 16G Fiber Channel, >nx12.5G Backplanes                                                                |
| GT1706 Family | 1.25 - 14.5         | 6     | Yes | Required     | Adaptive Equalizer     | Yes         | 0.9 1.8    | 144 BGA | HD/3G/4K/8K Video Broadcast testing Fibre Channel/Infiniband/ Ethernet Link Testing BERT Developments |
| GN2412 Family | 1.25 - 12.8         | 12    | Yes | Required     | Adaptive Equalizer DFE | Yes         | 0.9 1.8    | 144 BGA | > nx10G Backplanes, 10G/40G/100G Linecards, 10G-KR, 40G-KR4, 40G-CR4, Crosspoint Switching, CPRI      |
| GN2408 Family | 1.25 - 12.8         | 8     | Yes | Required     | Adaptive Equalizer DFE | Yes         | 0.9 1.8    | 144 BGA | >nx10G Backplanes, 10G/40G Linecards, 10G-KR, Crosspoint Switching, CPRI                              |
| GN2404 Family | 1.25 - 12.8         | 4     | Yes | Required     | Adaptive Equalizer DFE | Yes         | 0.9 1.8    | 144 BGA | >nx10G Backplanes, 10G/40G Linecards, 10G-KR, 40G-KR4, 40G-CR4, Crosspoint Switching, CPRI            |
| GN2402        | 10.3125             | 4     | Yes | Not Required | Equalizer              | Yes         | 3.3        | 44 QFN  | nx10G Backplanes, 10G/40G Linecards, 10G/40G Active cables                                            |
| GX4002        | 9.95 - 11.3, 14.025 | 2     | Yes | Not Required | Equalizer              | Yes         | 3.3        | 32 QFN  | nx10G Backplanes, 10G/40G Linecards, Infiniband FDR, 16G Fibre Channel, Crosspoint Switching          |
| GN2405A/5S    | 9.95 - 11.3         | 4     | Yes | Not Required | Equalizer              | Yes         | 3.3        | 48 QFN  | nx10G Backplanes 10G/40G Linecards 10G/40G Active cables                                              |
| GN2406/6S     | 9.95 - 10.95        | 4     | Yes | Not Required | Limiting Amp           | Yes         | 3.3        | 48 QFN  | 10G/40G Linecards                                                                                     |
| GN1407        | 1 - 8               | 4     | No  | Not Required | Equalizer              | No          | 1.2 1.8    | 56 QFN  | PCIe Gen 1/2/3, SNAP-12, POP-4/LX-4/CX-4/KX-4, XAUI/RXAUI and Rapid I/O                               |
| GN1406        | 2.5 3.125 5.0, 6.25 | 4     | Yes | Required     | Equalizer              | Yes         | 1.2 1.8    | 56 QFN  | PCIe Gen 1/2, SNAP-12, POP-4/LX-4/CX-4/KX-4, XAUI/RXAUI and Rapid I/O                                 |

# Laser Drivers and Limiting Amplifiers

High performance laser drivers and limiting amplifiers for optical communication.

## APPLICATIONS:

- 10G EPON, XG-PON1 and XG-PON2
- 8G Fibre Channel
- 9.95 Gbps OC-192 and 10.70 Gbps OC-192 with FEC
- 10.3 Gbps Ethernet
- 10.52 Gbps Fibre Channel
- 11.1 Gbps Ethernet over SONET
- 11.3 Gbps Fibre Channel with Forward Error Correction
- 40G QSFP+ modules
- 6 Gbps and 10 Gbps CPRI modules for wireless front haul
- 100 Gbps Ethernet

## LASER DRIVERS:

### GN1185

High performance Quad 25 - 28 Gbps DML driver for active TOSAs targeting 100GE applications.

### NT20042

Low cost 3.3V / 5.0 V 300 Mb/s LED driver for SONET, ESCON and Fast Ethernet applications over optical fiber.

### NT22L33

3.3 V/ 5.0 V CMOS laser driver for data rates of 125 Mb/s to 1.25 Gbps.

### GN1160, GN1161 AND GN1163

Very low power laser drivers for DFB/VCSEL applications. RSSI feature for compatibility with our high gain ROSA's, enabling SFP+ modules without limiting amplifiers.

### GN1190

Quad VCSEL driver for parallel and multi-channel datacom & telecom modules. Low power consumption, 210mW typical for 4 channels. Use with GN1090 quad TIA.

## LIMITING AMPLIFIERS:

### NT20045

Low cost 3.0 V to 5.5 V, 200 Mb/s limiting amplifier for SONET, SDH, ESCON and Fast Ethernet applications over optical fiber.

### NT24L71

1.25 Gbps CMOS 3.0 V to 5.5 V limiting amplifier with CML data outputs and signal status output in QSOP 16.

### NT24L73

1.25 Gbps CMOS limiting amplifier with CML data outputs and signal status in an MSOP package.

### GN1250L

A limiting amplifier that provides wideband, low noise postamplification, aimed primarily at OC-192 and SDH STM-64 systems.

| LASER DRIVERS |                               |                  |                        |                  |           |                                    |
|---------------|-------------------------------|------------------|------------------------|------------------|-----------|------------------------------------|
| Part Number   | Overview                      | Data Rate (Gbps) | Max Mod / Bias Current | Supply           | Pkg.      | Applications                       |
| NT20042       | 300 Mb/s LED Driver           | 0.3              | 100mA                  | 3.3/5.0V         | QSOP 16   | OC-3, Fast Ethernet                |
| NT22L33       | 1.25 Gbps FP/DFB Laser Driver | 1.25             | 70mA/80mA              | 3.3/5.0V         | 4mm QFN24 | OC-3, OC-12, GbE                   |
| GN1160        | DFB driver                    | to 11.3          | 90mA/ 120mA            | 3.3V (Opt. 2.8V) | 28 QFN    | 10GE SFP+ 10GBASE-LR               |
| GN1163        | DFB driver                    | to 11.9          | 90mA/120mA             | 3.3V (Opt. 2.8V) | 24QFN     | QSFP+ 10GBASE-LR                   |
| GN1161        | VCSEL driver                  | to 11.3          | 20mA/15mA              | 3.3V (Opt. 2.8V) | 28 QFN    | 10GE SFP+ 10GBASE-SR               |
| GN1190        | Quad VCSEL Driver             | to 14.3          | 12mA/12mA              | 3.3V             | Bare Die  | 40Gbps Ethernet, Infiniband, QSFP+ |
| GN1185        | Quad DFB driver               | 25-28            | 55mA/70mA              | 2.3/3.3V         | Bare Die  | 100GE Ethernet active TOSA         |

| LIMITING AMPLIFIERS |                        |                  |        |         |          |              |                              |
|---------------------|------------------------|------------------|--------|---------|----------|--------------|------------------------------|
| Part Number         | Overview               | Data Rate (Gbps) | Gain   | BW      | Supply   | Noise Figure | Applications                 |
| NT20045             | 200 Mb/s Limiting Amp  | 0.2              | 60dB   | 0.125   | 3.3/5.0V | 80uV         | OC-3, Fast Ethernet          |
| NT24L71             | 1.25 Gbps Limiting Amp | 1.25             | 46dB   | 0.938   | 3.3V     | 300uV        | OC-3, OC-12, GbE             |
| NT24L73             | 1.25 Gbps Limiting Amp | 1.25             | 46dB   | 0.938   | 3.3V     | 300uV        | OC-3, OC-12, GbE             |
| GN1250L             | 10/14G Limiting Amp    | to 14.5          | 33.7dB | 14.7GHz | +3.3V    | 13dB         | 10 GbE, OC-192, 8G and 16GFC |

# Transceiver ICs (LD & LA)

High performance laser drivers and limiting amplifiers for optical communication.

## NT25L91

2.5 Gbps CMOS burst mode laser driver and limiting post amplifier with digital set-up, control, on-chip NVM and APD DAC output.

## NT28L90

Combined 10 Gbps limiting post amplifier and 2.5 Gbps burst mode laser driver for cost critical 10GEPON and XG-PON asymmetric applications. The NT28L90 features Tx & Rx sleep control, TX\_SD output and Tx Power burst monitoring.

## GN7354 & GN7355

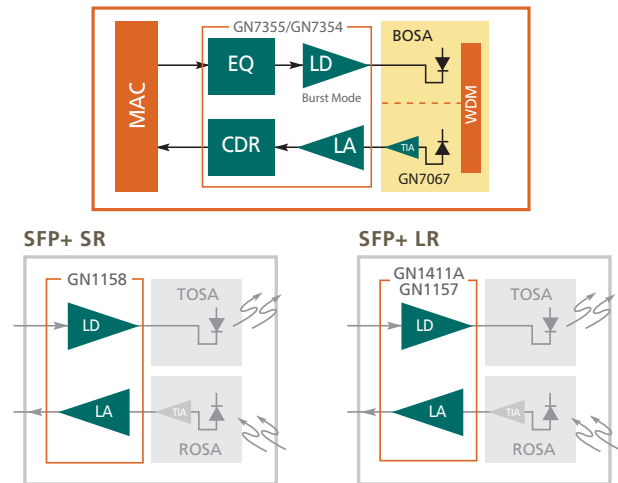
10G EPON transceiver for next generation PON systems. The GN7355 combines a 10G burst mode laser driver with a receive CDR and is targeted at 10G EPON symmetric applications. The GN7354 is a pin-for-pin compatible, de-rated version of the GN7355 intended to address the 1.25 Gbps and 2.5 Gbps transmit data rate, and cost pressures of the 10 Gbps asymmetric EPON and XG-PON applications.

## GN1411A/12B/44/44S

The GN1411A/GN1412A are highly-integrated, low-power, small footprint transceivers that are ideal for SFP+ LR/ER optical modules.

## GN1157/58

Semtech's latest, lowest power transceiver IC's for SFP+ LR/ SR applications with integrated APC and advanced eye shaping features.



## TRANSCEIVER IC (LD&LA)

| Part Number | Overview                                     | Data Rate (Gbps)       | Max Mod / Bias Current | Supply                                  | Pkg.   | Applications                  |
|-------------|----------------------------------------------|------------------------|------------------------|-----------------------------------------|--------|-------------------------------|
| GN25L95     | Burst Mode DFB + Receive LA                  | to 2.5G                | 90mA / 100mA           | 3.3V                                    | 28 QFN | EPON, GPON, BOSA-on-Board     |
| NT25L90/91  | 2.5 Gbps Burst Mode LDD & LA                 | 2.5                    | 90mA / 100mA           | 3.3V                                    | 28 QFN | EPON, GPON, BOSA-on-Board     |
| NT28L90     | 2.5 Gbps Burst Mode DFB + 10 Gbps Receive LA | Rx: 10.3<br>Tx: 2.5    | 90mA / 100mA           | 3.3V                                    | 28 QFN | 10GEPON, XG-PON1 (Asymmetric) |
| GN7354      | Burst Mode DFB + Receive LA & CDR            | Rx: 10.3<br>Tx: to 2.5 | 90mA / 90mA            | 3.3V<br>(3.3 V or 5V output stage)      | 32 QFN | 10GEPON, XG-PON (Asymmetric)  |
| GN7355      | Burst Mode DFB + Receive LA & CDR            | 10.3                   | 90mA / 90mA            | 3.3V +5 V output stage (optional 3.3 V) | 32 QFN | 10GEPON, XG-PON (Symmetric)   |
| GN1411A     | DFB/FB Laser Driver + Receive LA             | to 11.3G               | 80mA / 120mA           | 3.3V                                    | 32 QFN | 10 GbE, OC-192                |
| GN1412B     | EML Laser Driver + Receive LA                | to 11.3G               | 2.5Vpp / 120mA         | 3.3V                                    | 32 QFN | 10 GbE, OC-192                |
| GN1444S     | EML Laser Driver + Receive LA                | to 11.3G               | 2.5Vpp / 120mA         | 1.8 & 3.3V                              | 32 QFN | 10 GbE, OC-192                |
| GN1157      | DML Laser Driver + Receive LA                | to 11.3G               | 90mA / 120mA           | 3.3V (Optional 2.8V)                    | 28 QFN | 10GbE LR SFP+, CPRI           |
| GN1158      | VCSEL Laser Driver + Receive LA              | to 11.3G               | 20mA / 15mA            | 3.3V (Optional 2.8V)                    | 28 QFN | 10 GbE SR SFP+                |



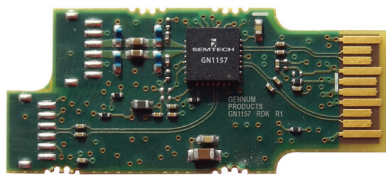
# Optical Module Reference Design Kit

Improve the performance and time to market of your SFP+ design with Semtech Optical Module Reference Design Kits.

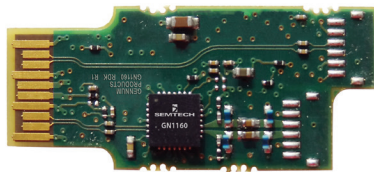
## FAST TIME TO MARKET

Semtech's reference design kits include schematics, layout files and a design guide as well as attentive support from experienced applications engineers. This reduces both design costs and decreases time to market. This is further realized in the FTTx market where it is possible to re-use the 10G symmetric SFP+ design to address the 10G asymmetric market.

### GN1157 RDK (RDK-SFP+-Optical02)



### GN1160/GN3055 RDK (RDK-SFP+-Optical04)

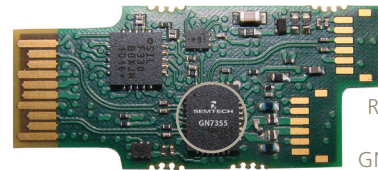


## BROAD RANGE OF REFERENCE DESIGNS AVAILABLE

Reference design kits are offered to cover a wide variety of SFP+ applications, including symmetrical and asymmetrical PON, and 10 GbE SR and LR applications.

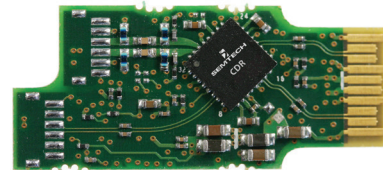
For ethernet SFP+, designs are available for both the traditional architecture (including a limiting amplifier in the receive chain), as well as a new LA-free architecture enabled by Semtech's High Gain ROSA portfolio.

### GN7354/7355 RDK RDK-SFP+-PON-S00 RDK-SFP+-PON-A00



Rx CDR+ Tx Burst Mode  
DML driver  
GN7355 - Symmetric PON  
GN7354 - Asymmetric PON

### RDK-SFP++LR



## OPTICAL REFERENCE DESIGN KITS

| Part Number        | Parts Demonstrated            | Data Rate (Gbps)  | Connector Type | Wavelength (nm)         | Applications              |
|--------------------|-------------------------------|-------------------|----------------|-------------------------|---------------------------|
| RDK-SFP++LR        | GN3068/GN3268, GN2010D/GN2042 | 9.95 - 11.3       | SFP+           | 1310                    | 10 GbE LR, OC-192         |
| RDK-SFP++ER        | GN3268, GN2010EA/GN2044       | 9.95 - 11.3       | SFP+           | 1550                    | 10Gb ER, OC-192           |
| RDK-SFP+-PON-S00   | GN7355                        | 10.3              | SFP+           | 1577/ 1270              | 10G EPON                  |
| RDK-SFP+-PON-A00   | GN7354                        | 10/1.25<br>10/2.5 | SFP+           | 1577/1310<br>1577/ 1270 | 10G EPON Asym.<br>XG-PON1 |
| RDK-SFP+-Optical02 | GN1157                        | 1 - 11.3          | SFP+           | 1310                    | 10 GbE LR                 |
| RDK-SFP+-Optical03 | GN1158                        | 1 - 11.3          | SFP+           | 850                     | 10 GbE SR                 |
| RDK-SFP+-Optical04 | GN1160 & GN3055               | 1 - 11.3          | SFP+           | 1310                    | 10 GbE LR                 |
| RDK-SFP+-Optical05 | GN1161 & GN3155               | 1 - 11.3          | SFP+           | 850                     | 10 GbE SR                 |

Design files and results available upon request.



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