

Professional high-speed optical transceiver

OPN-SG159-D37LC2 / OPN-SG159-D37LC2I

3.3V / CWDM / 1.25 Gbps Digital Diagnostic SFP LC SINGLE-MODE TRANSCEIVER

PRODUCT FEATURES

- Hot-Pluggable SFP Footprint LC Optical Transceiver
- Small Form-Factor Pluggable (SFP) MSA compatible
 - Compliant with IEEE 802.3z Gigabit Ethernet
 - Compliant with Fiber Channel 1X SM-LC-L FC-PI
 - SFF-8472 Digital Diagnostic Function
- 18 Wavelength (λ): 1270 nm to 1610 nm CWDM DFBLD Transmitter
 - APD High Sensitivity Receiver
 - 37 dB Power Budget at Least
 - AC/AC Coupling according to MSA
 - Single +3.3 V Power Supply
 - RoHS Compliant
 - 0 to 70°C Operation: OPN-SG159-D37LC2
 - -50 to 85°C Operation: OPN-SG159-D37LC2I
- Class 1 Laser International Safety Standard IEC-60825Compliant

APPLICATIONS

- Gigabit Ethernet Switches and Routers
- Fiber Channel Switch Infrastructure
 - XDSL Applications
 - Metro Edge Switching

PRODUCT DESCRIPTION

The OPN-SG159-D37LC2 series single mode transceivers are small form factor pluggable module for bi-directional serial optical data communications such as Gigabit Ethernet and Fiber Channel 1x SM-LC-L FC-PI. It is with the SFP20-pin connector to allow hot plug capability. Digitaldiagnostic functions are available via an I²C. This module is designed for single mode fiber and operates at a nominal wavelength of CWDM wavelength. There are eighteen center wavelengths available from 1270 nm to 1610 nm, with each step 20 nm. A guaranteed minimum optical linkbudget of 37 dB is offered

The transmitter section uses a multiple quantum well CWDM DFB laser and is a class 1 laser compliant according to International Safety Standard IEC-60825. The receiver section uses an integrated InGaAs Avalanche photodetector preamplifier mounted in an optical header and a limiting post-amplifier IC.

ORDER INFORMATION

| P/No. | Bit Rate (Gb/s) | 1000 BASE | Power Budget (dB) | Wavelength (nm) | Package | Temp. (°C) | TX Power (dBm) | RX Sens. (dBm) | RoHS Compliant |
|-------------------|-----------------|-----------|-------------------|-----------------|-----------------|------------|----------------|----------------|----------------|
| OPN-SG159-D37LC2 | 1.25 | | > 37 | CWDM* | LC SFP with DMI | 0 to 70 | 5 to 1 | -36 | Yes |
| OPN-SG159-D37LC2I | 1.25 | | > 37 | CWDM* | LC SFP with DMI | -50 to 85 | 5 to 1 | -36 | Yes |

CWDM* Wavelength (0 to 70°C)

| Central Wavelength | Min. (nm) | Typ. (nm) | Max. (nm) | Clasp Color Code | Central Wavelength | Min. (nm) | Typ. (nm) | Max. (nm) | Clasp Color Code |
|--------------------|-----------|-----------|-----------|------------------|--------------------|-----------|-----------|-----------|------------------|
| 127 | 1264.5 | 1270 | 1277.5 | Light Purple | 145 | 1444.5 | 1450 | 1457.5 | Yellow Orange |
| 129 | 1284.5 | 1290 | 1297.5 | Sky Blue | 147 | 1464.5 | 1470 | 1477.5 | Gray |
| 131 | 1304.5 | 1310 | 1317.5 | Yellow Green | 149 | 1484.5 | 1490 | 1497.5 | Violet |
| 133 | 1324.5 | 1330 | 1337.5 | Yellow Ocher | 151 | 1504.5 | 1510 | 1517.5 | Blue |
| 135 | 1344.5 | 1350 | 1357.5 | Pink | 153 | 1524.5 | 1530 | 1537.5 | Green |
| 137 | 1364.5 | 1370 | 1377.5 | Beige | 155 | 1544.5 | 1550 | 1557.5 | Yellow |
| 139 | 1384.5 | 1390 | 1397.5 | White | 157 | 1564.5 | 1570 | 1577.5 | Orange |
| 141 | 1404.5 | 1410 | 1417.5 | Silver | 159 | 1584.5 | 1590 | 1597.5 | Red |
| 143 | 1424.5 | 1430 | 1437.5 | Black | 161 | 1604.5 | 1610 | 1617.5 | Brown |

CWDM*: 18 Wavelengths from 1270 nm to 1610 nm, each step 20 nm.

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| Absolute Maximum Ratings | | | | | |
|----------------------------|--------|----------|----------|-------|---------------------------------------|
| Parameter | Symbol | Min | Max | Units | Notes |
| Storage Temperature | Tstg | -50 | 85 | °C | |
| Operating Case Temperature | Topr | 0 -50 | 70 85 | °C | OPN-SG159-D37LC2 OPN-SG159-D37LC2I |
| Power Supply Voltage | Vcc | -0.5 | 3.6 | V | |

| Recommended Operating Conditions | | | | | |
|----------------------------------|------------------------|----------|------|------------|---|
| Parameter | Symbol | Min | Typ | Max | Units / Notes |
| Power Supply Voltage | Vcc | 3.13 | 3.3 | 3.47 | V |
| Operating Case Temperature | Topr | 0 -50 | | 70 85 | °C / OPN-SG159-D37LC2 °C / OPN-SG159-D37LC2I |
| Power Supply Current | I _{CC(TX+RX)} | | 200 | 300 600 | mA / OPN-SG159-D37LC2 mA / OPN-SG159-D37LC2I |
| Data Rate | | | 1250 | | Mb/s |

| Transmitter Specifications (0°C < Topr < 70°C, 3.13V < Vcc < 3.47V) | | | | | | |
|---|-----------------------------------|-------------------|-------------|-------------------|-------|--------------------|
| Parameter | Symbol | Min | Typ | Max | Units | Notes |
| Optical | | | | | | |
| Optical Transmit Power | P _o | 1 | --- | 5 | dBm | 1 |
| Output Center Wavelength | λ | $\lambda_c - 5.5$ | λ_c | $\lambda_c + 7.5$ | nm | 2 |
| Output Spectrum Width | $\Delta\lambda$ | --- | --- | 1 | nm | -20 dB Width |
| Side Mode Suppression Ratio | SMSR | 30 | | | dB | |
| Extinction Ratio | E _R | 9 | --- | --- | dB | |
| Optical Rise Time | t _r | | | 260 | ps | 20 % to 80% Values |
| Optical Fall Time | t _f | | | 260 | ps | 20 % to 80% Values |
| Relative Intensity Noise | RIN | | | -120 | dB/Hz | |
| Electrical | | | | | | |
| Data Input Current – Low | I _{IL} | -350 | | | μA | |
| Data Input Current – High | I _{IH} | | | 350 | μA | |
| Differential Input Voltage | V _{IH} - V _{IL} | 0.5 | | 2.4 | V | Peak-to-Peak |
| TX Disable Input Voltage – Low | T _{DIS, L} | 0 | | 0.5 | V | 3 |
| TX Disable Input Voltage – High | T _{DIS, H} | 2.0 | | Vcc | V | 3 |
| TX Disable Assert Time | T _{ASSERT} | | | 10 | μs | |
| TX Disable Deassert Time | T _{DEASSERT} | | | 1 | ms | |
| TX Fault Output Voltage -- Low | T _{FaultL} | 0 | | 0.5 | V | 4 |
| TX Fault Output Voltage -- High | T _{FaultH} | 2.0 | | Vcc+0.3 | V | 4 |

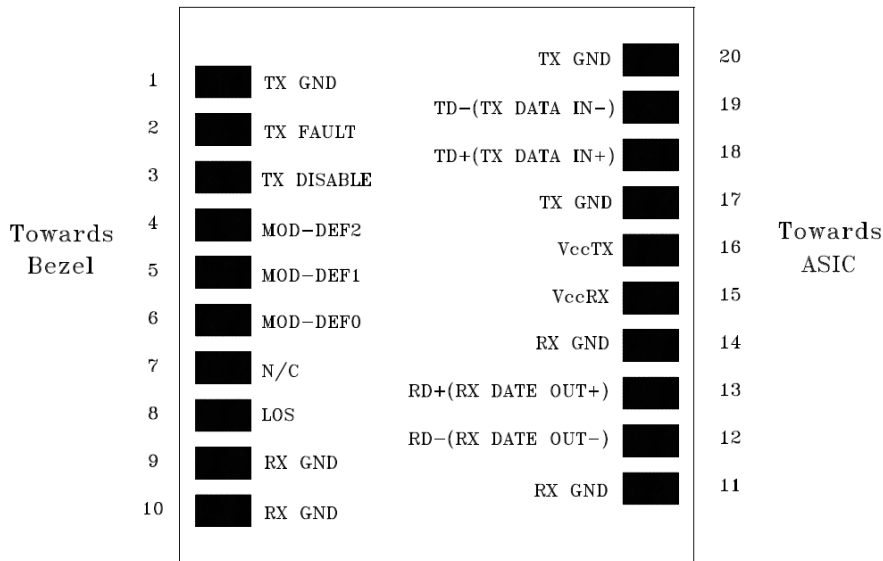
1. Output power is power coupled into a 9/125 μm single mode fiber.
2. ITU-T G.694.2 CWDM wavelength from 1270 nm to 1610 nm, each step 20 nm.
3. There is an internal 4.7K to 10K ohm pull-up resistor to VccTX.
4. Open collector compatible, 4.7K to 10K ohm pull-up to Vcc (Host Supply Voltage).

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| Receiver Specifications (0°C < Topr < 70°C, 3.13V < Vcc < 3.47V) | | | | | | |
|--|-----------------------------------|------|-----|---------|-------|-------------------------|
| Parameter | Symbol | Min | Typ | Max | Units | Notes |
| Optical | | | | | | |
| Sensitivity | Sens | | | -36 | dBm | 4 |
| Maximum Input Power | Pin | -10 | | | dBm | 4 |
| Signal Detect -- Asserted | Pa | --- | | -36 | dBm | Transition: low to high |
| Signal Detect -- Deasserted | Pd | -50 | --- | --- | dBm | Transition: high to low |
| Signal detect -- Hysteresis | | 1.0 | --- | | dB | |
| Wavelength of Operation | | 1100 | --- | 1620 | nm | |
| Electrical | | | | | | |
| Differential Output Voltage | V _{OH} – V _{OL} | 0.6 | | 2.0 | V | |
| Output LOS Voltage -- Low | V _{OL} | 0 | | 0.5 | V | 5 |
| Output LOS Voltage -- High | V _{OH} | 2.0 | | Vcc+0.3 | V | 5 |

4. Measured at 2⁷-1 PRBS at BER 1E-12. Receiver sensitivity is better than -36dBm at 1.25 Gbps. However, due to the resolution limitation of Digital Diagnostic Monitoring, the effect readout range for the RX received power at EEPROM A2 is from -10 to -34 dBm.
5. Open collector compatible, 4.7K to 10K ohm pull-up to Vcc (Host Supply Voltage).

CONNECTION DIAGRAM



| PIN | Signal Name | Description | PIN | Signal Name | Description |
|-----|-------------|---|-----|--------------|-----------------------------|
| 1 | TX GND | Transmitter Ground | 11 | RX GND | Receiver Ground |
| 2 | TX Fault | Transmitter Fault Indication | 12 | RX DATA OUT- | Inverse Receiver Data Out |
| 3 | TX Disable | Transmitter Disable (Module disables on high or open) | 13 | RX DATA OUT+ | Receiver Data Out |
| 4 | MOD-DFE2 | Modulation Definition 2 – Two wires serial ID Interface | 14 | RX GND | Receiver Ground |
| 5 | MOD-DEF1 | Modulation Definition 1 – Two wires serial ID Interface | 15 | Vcc RX | Receiver Power – 3.3V±5% |
| 6 | MOD-DEF0 | Modulation Definition 0 – Ground in Module | 16 | Vcc TX | Transmitter Power – 3.3V±5% |
| 7 | N/C | Not Connected | 17 | TX GND | Transmitter Ground |
| 8 | LOS | Loss of Signal | 18 | TX DATA IN+ | Transmitter Data In |
| 9 | RX GND | Receiver Ground | 19 | TX DATA IN- | Inverse Transmitter Data In |
| 10 | RX GND | Receiver Ground | 20 | TX GND | Transmitter Ground |

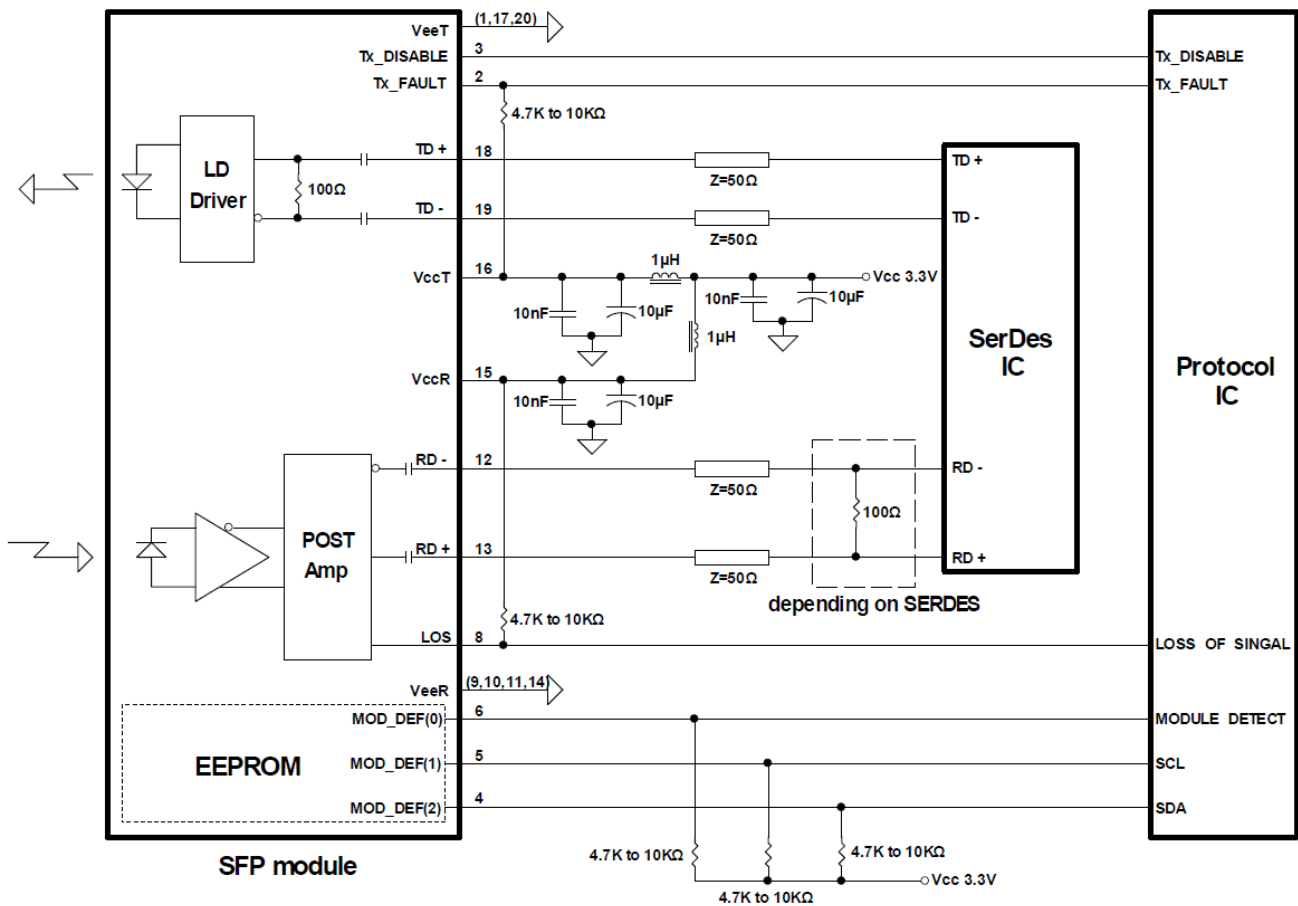
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Module Definition

| Module Definition | MOD-DEF2 PIN 4 | MOD-DEF1 PIN 5 | MOD-DEF0 PIN 6 | Interpretation by Host |
|-------------------|-------------------|-------------------|-------------------|-----------------------------------|
| 4 | SDA | SCL | LV-TTL Low | Serial module definition protocol |

Module Definition 4 specifies a serial definition protocol. For this definition, upon power up, MOD-DEF(1:2) appear as no connector (NC) and MOD-DEF(0) is TTL LOW. When the host system detects this condition, it activates the serial protocol. The protocol uses the 2-wire serial CMOS E²PROM protocol of the ATMEL AT24C01A/02/04 family of components.

RECOMMENDED CIRCUIT SCHEMATIC

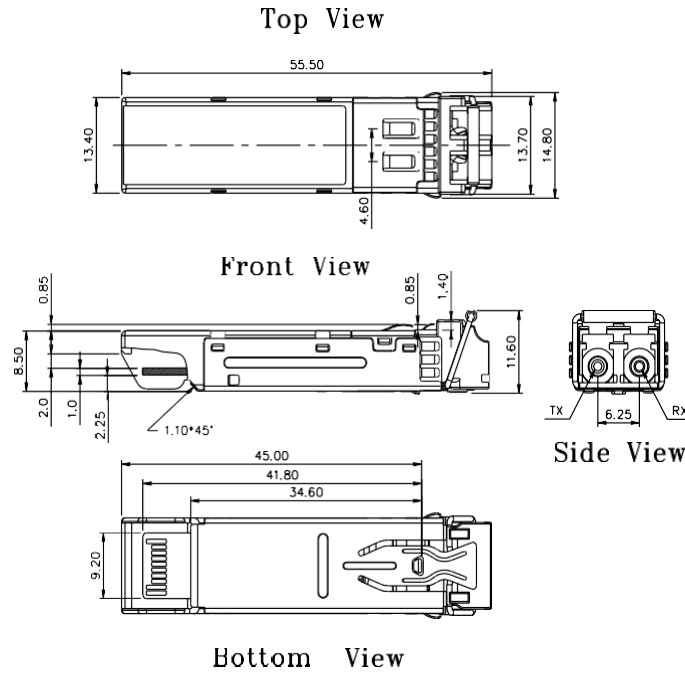


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PACKAGE DIAGRAM

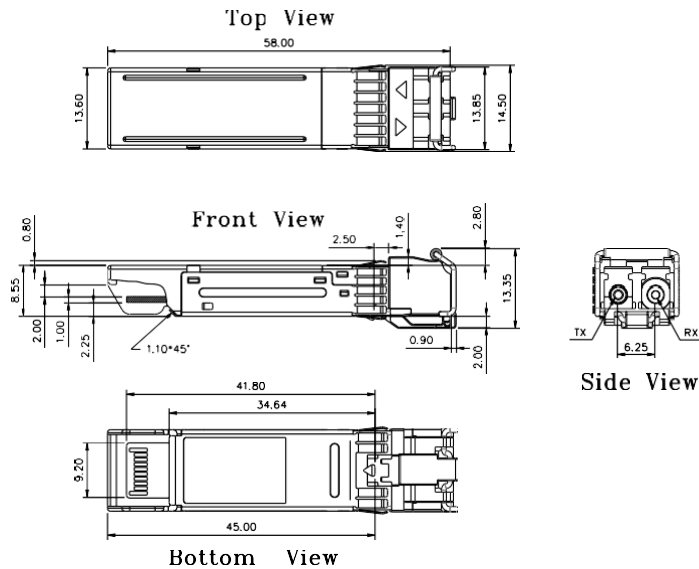
Units in mm

1)



OPN-SG159-D37LC2

2)



OPN-SG159-D37LC2I

Note: Specifications subject to change without notice.