



Professional high-speed optical transceiver

OPN-S1H147-70LC2

10.3 Gbps / 70 km / CWDM Digital Diagnostic LC SFP+ SINGLE-MODE TRANSCEIVER

PRODUCT FEATURES

- Up to 10.3125 Gb/s Bi-directional Data Links
 - Complaint to SFP+ MSA
- Compliant to IEEE 802.3ae 10GBASE-ZR/ZW
 - Maximum Link Length of 70 km
- Temperature-stabilized CWDM EML Transmitter
 - SFF-8472 Digital Diagnostic Function
 - AC/AC Coupling according to MSA
 - Single +3.3 V Power Supply
 - RoHS Compliant
 - 0 to 70°C Operating: OPN-S1H147-70LC2
- Class 1 Laser International Safety Standard IEC-60825 Compliant

APPLICATIONS

- 10GBASE-ZR/ZW
- 10G SONET OC-192 / STM-64
- 70 km 10G Fibre Channel

PRODUCT DESCRIPTION

The OPN-S1H147-70LC2 series single mode transceiver is a small form factor pluggable module for bi-directional serial optical data communications such as IEEE 802.3ae 10GBASE-ZR/ZW. It is with the SFP 20-pin connector to allow hot plug capability. Digital diagnostic 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 eight center wavelengths available from 1470 nm to 1610 nm, with each step 20 nm. The transmitter section uses a temperature-stabilized CWDM electrical-modulated laser (EML) and is a class 1 laser compliant according to International Safety Standard IEC-60825. The receiver section uses an integrated InGaAs avalanche photodiode preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.

ORDER INFORMATION

| P/No. | Bit Rate (Gb/s) | 10GBASE | Power Budget (dB) | Wavelength (nm) | Package | Temp. (°C) | RoHS Compliant |
|------------------|-----------------|---------|-------------------|-----------------|---------------|------------|----------------|
| OPN-S1H147-70LC2 | 10.3 | ER / EW | >23 | CWDM* | SFP+ with DMI | 0 to 70 | Yes |

CWDM* Wavelength (0 to 70°C)

| Central Wavelength | Min. (nm) | Typ. (nm) | Max. (nm) | Label | Central Wavelength | Min. (nm) | Typ. (nm) | Max. (nm) | Label |
|--------------------|-----------|-----------|-----------|-------|--------------------|-----------|-----------|-----------|-------|
| 147 | 1464.5 | 1470 | 1477.5 | C47 | 155 | 1544.5 | 1550 | 1557.5 | C55 |
| 149 | 1484.5 | 1490 | 1497.5 | C49 | 157 | 1564.5 | 1570 | 1577.5 | C57 |
| 151 | 1504.5 | 1510 | 1517.5 | C51 | 159 | 1584.5 | 1590 | 1597.5 | C59 |
| 153 | 1524.5 | 1530 | 1537.5 | C53 | 161 | 1604.5 | 1610 | 1617.5 | C61 |

CWDM*: 8 Wavelengths from 1470 nm to 1610 nm, each step 20 nm.

| Absolute Maximum Ratings | | | | | |
|------------------------------|--------|------|-----|-------|------------------|
| Parameter | Symbol | Min | Max | Units | Notes |
| Storage Temperature | Tstg | -50 | 85 | °C | |
| Relative Humidity | RH | 5 | 85 | % | Non-condensing |
| Operating Case Temperature | Topr | 0 | 70 | °C | OPN-S1H147-70LC2 |
| Power Supply Voltage | Vcc | -0.5 | 3.6 | V | |
| Receiver Input Optical Power | Mip | | -4 | dBm | Average power |

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| Recommended Operating Conditions | | | | | |
|----------------------------------|------------------------|-------|---------|-------|-----------------------|
| Parameter | Symbol | Min | Typ | Max | Units / Notes |
| Power Supply Voltage | V _{cc} | 3.135 | 3.3 | 3.465 | V |
| Operating Case Temperature | T _{opr} | 0 | | 70 | °C / OPN-S1H147-70LC2 |
| Relative Humidity | RH | 5 | 85 | % | Non-condensing |
| Power Supply Current | I _{cc(TX+RX)} | | 330 | 500 | mA / OPN-S1H147-70LC2 |
| Data Rate | | 9.95 | 10.3125 | | Gb/s |

| Transmitter Optical Specifications (0°C < T _{opr} < 70°C, 3.13V < V _{cc} < 3.47V) | | | | | | |
|---|---------------------|---------------------|----------------|---------------------|-------|--------------|
| Parameter | Symbol | Min | Typ | Max | Units | Notes |
| Average Launch Power | P _{o, AVG} | 0 | | 4 | dBm | 1 |
| Output Center Wavelength | λ | λ _c -5.5 | λ _c | λ _c +7.5 | nm | 2 |
| Output Spectrum Width | Δλ | --- | | 1 | nm | -20 dB width |
| Extinction Ratio | ER | 8.2 | | | dB | |
| Side Mode Suppression Ratio | SMSR | 30 | | | dB | |
| Relative Intensity Noise | RIN | | | -128 | dB/Hz | |
| Average Launch Power of OFF Transmitter | | | | -30 | dBm | |

- Output power is power coupled into a 9/125 μm single-mode fiber.
- ITU-T G.694.2 CWDM wavelength from 1470 nm to 1610 nm, each step 20 nm.

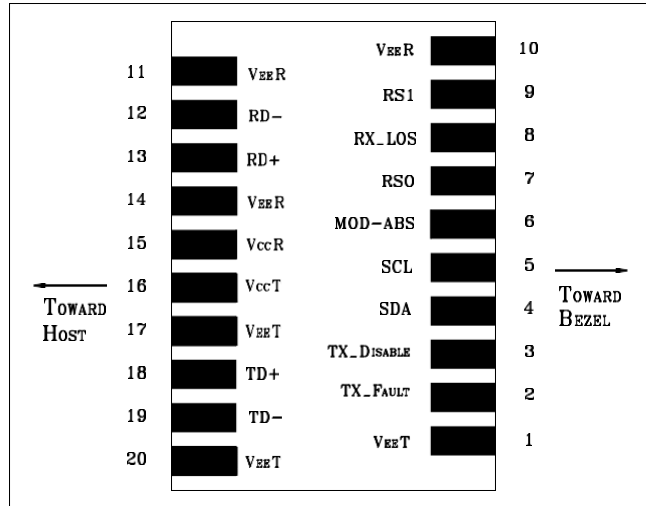
| Receiver Optical Specifications (0°C < T _{opr} < 70°C, 3.13V < V _{cc} < 3.47V) | | | | | | |
|--|------------------|------|-----|------|-------|-------------------------|
| Parameter | Symbol | Min | Typ | Max | Units | Notes |
| Sensitivity | | | | -23 | dBm | 3 |
| Receiver Overload | P _{MAX} | -7 | --- | | dBm | |
| LOS -- Deasserted | LOS _D | --- | --- | -23 | dBm | Transition: low to high |
| LOS -- Asserted | LOS _A | -35 | --- | --- | dBm | Transition: high to low |
| Wavelength of Operation | λ _c | 1260 | | 1620 | nm | |
| Optical Return Loss | ORL | | | -27 | dB | |

- Measured with average power; BER < 10⁻¹² and PRBS 2³¹-1.

| Electrical Characteristics | | | | | | |
|--|------------------|------|---------|----------------------|-------|-----------------------|
| Parameter | Symbol | Min | Typ | Max | Units | Notes |
| High-Speed Signal (CML) Interface Specification | | | | | | |
| Input Data Rate | | 9.95 | 10.3125 | | Gb/s | |
| Differential Input Impedance | R _{in} | | 100 | | Ω | |
| Differential Data Input Amplitude | | 120 | | 820 | mVpp | Internally AC coupled |
| Output Data Rate | | 9.95 | 10.3125 | | Gb/s | |
| Differential Output Impedance | R _{out} | | 100 | | Ω | |
| Differential Data Output Amplitude | | 350 | 600 | 850 | mVpp | Internally AC coupled |
| Low-Speed Signal (LVTTTL) Interface Specification | | | | | | |
| Input High Voltage | | 2.0 | | V _{cc} +0.3 | V | |
| Input Low Voltage | | GND | | 0.8 | V | |
| Output High Voltage | | 2.4 | | V _{cc} | V | |
| Output Low Voltage | | GND | | 0.5 | V | |

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CONNECTION DIAGRAM



| PIN | Signal Name | Description | PIN | Signal Name | Description |
|-----|-------------------|---|-----|-------------------|-----------------------------|
| 1 | V _{EE} T | Transmitter Signal Ground | 11 | V _{EE} R | Receiver Signal Ground |
| 2 | TX_Fault | Transmitter Fault Indication. Logic “1” Output = Laser Fault. Logic “0” Output = Normal Operation | 12 | RD- | Inverse Receiver Data Out |
| 3 | TX_Disable | Logic “1” Input (or no connection) = Laser off, Logic “0” = Laser on. | 13 | RD+ | Receiver Data Out |
| 4 | SDA | Modulation Definition 2 – Two wires serial ID Interface | 14 | V _{EE} R | Receiver Signal Ground |
| 5 | SCL | Modulation Definition 1 – Two wires serial ID Interface | 15 | V _{CC} R | Receiver Power – 3.3V±5% |
| 6 | MOD-ABS | Modulation Definition 0 – Ground in Module | 16 | V _{CC} T | Transmitter Power – 3.3V±5% |
| 7 | RS0 | RX Rate Select (LVTTL). This pin has an internal 30k pulldown to ground. A signal on this pin will not affect module performance. | 17 | V _{EE} T | Transmitter Signal Ground |
| 8 | RX_LOS | Loss of Signal Out (OC). | 18 | TD+ | Transmitter Data In |
| 9 | RS1 | TX Rate Select (LVTTL). This pin has an internal 30k pulldown to ground. A signal on this pin will not affect module performance. | 19 | TD- | Inverse Transmitter Data In |
| 10 | V _{EE} R | Receiver Signal Ground | 20 | V _{EE} T | Transmitter Signal Ground |

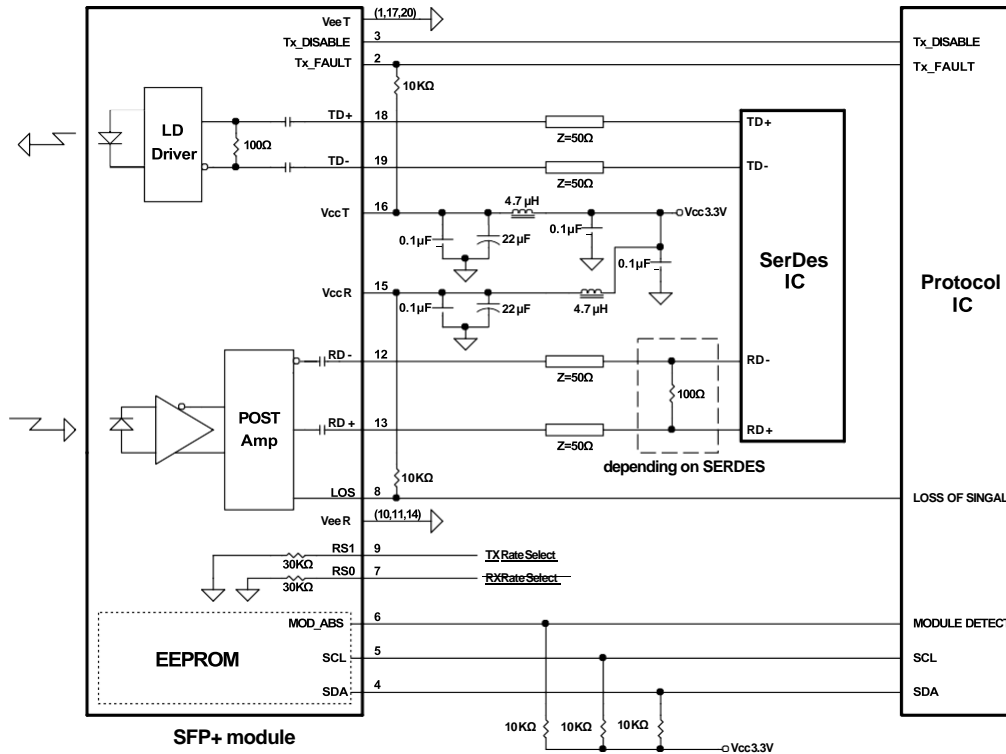
MODULE DEFINITION

| Module Definition | PIN 4 | PIN 5 | PIN 6 | Interpretation by Host |
|-------------------|-------|-------|---------|-----------------------------------|
| 4 | SDA | SCL | MOD-ABS | Serial module definition protocol |

Module Definition 4 specifies a serial definition protocol. For this definition, upon power up, SDA and SCL appear as no connection (NC) and MOD-ABS 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.

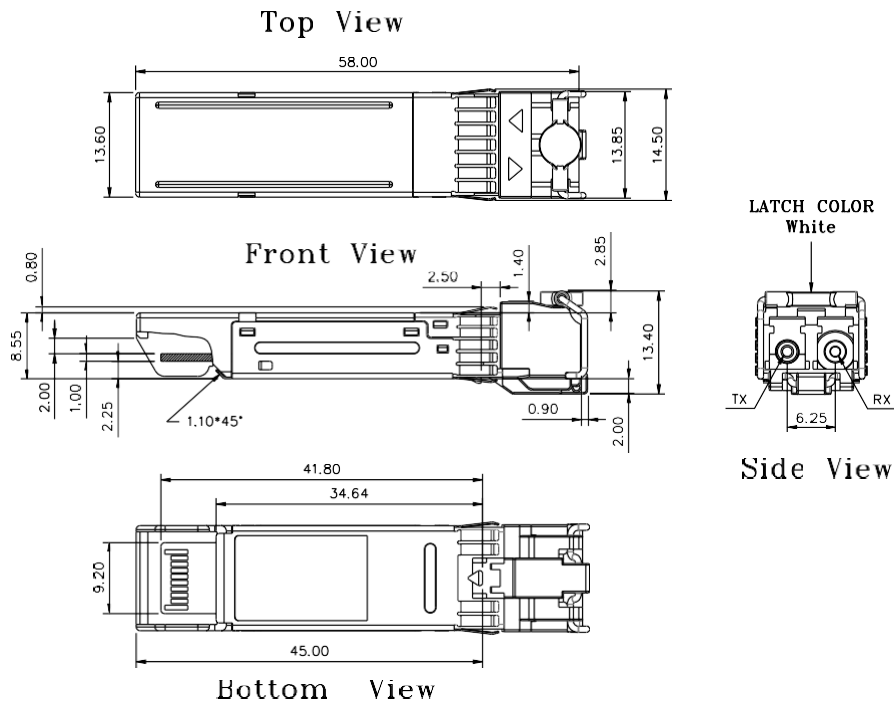
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RECOMMENDED CIRCUIT SCHEMATIC



PACKAGE DIAGRAM

Units in mm



Note: Specifications subject to change without notice.