

Professional high-speed optical transceiver

OPN-SGD23-120LC2 / OPN-SGD23-120LC2I

1.25Gbps / 120km / 100GHz DWDM Digital Diagnostic LC SFP 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 Fibre Channel FC-PI 100-SM-LL-V
 - Distance up to 120km
- Temperature-stabilized DWDM DML Transmitter
 - 32 dB Power Budget at Least
 - 100 GHz ITU Grid, C Band
 - SFF-8472 Digital Diagnostic Function
 - AC/AC Coupling according to MSA
 - Single +3.3 V Power Supply
 - RoHS Compliant
 - 0 to 70°C Operation: OPN-SGD23-120LC2
 - -50 to 85°C Operation : OPN-SGD23-120LC2I
- Class 1 Laser International Safety Standard IEC-60825Compliant

APPLICATIONS

- Gigabit Ethernet Switches and Routers
- Fibre Channel Switch Infrastructure
 - XDSL Applications
 - Metro Edge Switching
- CPRI option 2: 1228.8 Mbit/s
- CPRI option 1: 614.4 Mbit/s
 - OBSAI 768 MBaud

PRODUCT DESCRIPTION

The OPN-SGD23-120LC2 series single mode transceiver is a small form factor pluggable module for bi-directional serial optical data communications such as Gigabit Ethernet 1000BASE-ZX and Fibre Channel FC-PI 100-SM-LL-V. It is with the SFP 20-pin connector to allow hot plug capability. Digital diagnostic functions are available via anI²C. This module is designed for single mode fiber and operates at a nominal wavelength of 100GHz ITU Grid, CBand DWDM wavelength. A guaranteed minimum optical link budget of 32 dB is offered. The transmitter section uses temperature-stabilized DWDM directly modulated laser (DML) and is 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) | 1000BASE | Distance (km) | Spacing (GHz) | Wavelength (nm) | Package | Temp (°C) | RoHS Compliant |
|-------------------|-----------------|----------|---------------|---------------|-----------------|-----------------|-----------|----------------|
| OPN-SGD23-120LC2 | 1.25 | | 120 | 100 | DWDM* | LC SFP with DMI | 0 to 70 | Yes |
| OPN-SGD23-120LC2I | 1.25 | | 120 | 100 | DWDM* | LC SFP with DMI | -50 to 85 | Yes |

*: XX: 100GHz ITU Grid wavelength (Please see below)

| Channel # | Product code | Frequency (THz) | Center Wavelength (nm) | Label |
|-----------|------------------|-----------------|------------------------|-------|
| 20 | OPN-SGD23-120LC2 | 192.0 | 1561.42 | D20 |
| 21 | OPN-SGD21-120LC2 | 192.1 | 1560.61 | D21 |
| 22 | OPN-SGD22-120LC2 | 192.2 | 1559.79 | D22 |
| 23 | OPN-SGD23-120LC2 | 192.3 | 1558.98 | D23 |
| 24 | OPN-SGD24-120LC2 | 192.4 | 1558.17 | D24 |
| 25 | OPN-SGD25-120LC2 | 192.5 | 1557.36 | D25 |
| 26 | OPN-SGD26-120LC2 | 192.6 | 1556.55 | D26 |
| 27 | OPN-SGD27-120LC2 | 192.7 | 1555.75 | D27 |

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| | | | | |
|----|------------------|-------|---------|-----|
| 28 | OPN-SGD28-120LC2 | 192.8 | 1554.94 | D28 |
| 29 | OPN-SGD29-120LC2 | 192.9 | 1554.13 | D29 |
| 30 | OPN-SGD30-120LC2 | 193.0 | 1553.33 | D30 |
| 31 | OPN-SGD31-120LC2 | 193.1 | 1552.52 | D31 |
| 32 | OPN-SGD32-120LC2 | 193.2 | 1551.72 | D32 |
| 33 | OPN-SGD33-120LC2 | 193.3 | 1550.92 | D33 |
| 34 | OPN-SGD34-120LC2 | 193.4 | 1550.12 | D34 |
| 35 | OPN-SGD35-120LC2 | 193.5 | 1549.32 | D35 |
| 36 | OPN-SGD36-120LC2 | 193.6 | 1548.51 | D36 |
| 37 | OPN-SGD37-120LC2 | 193.7 | 1547.72 | D37 |
| 38 | OPN-SGD38-120LC2 | 193.8 | 1546.92 | D38 |
| 39 | OPN-SGD39-120LC2 | 193.9 | 1546.12 | D39 |
| 40 | OPN-SGD40-120LC2 | 194.0 | 1545.32 | D40 |
| 41 | OPN-SGD41-120LC2 | 194.1 | 1544.53 | D41 |
| 42 | OPN-SGD42-120LC2 | 194.2 | 1543.73 | D42 |
| 43 | OPN-SGD43-120LC2 | 194.3 | 1542.94 | D43 |
| 44 | OPN-SGD44-120LC2 | 194.4 | 1542.14 | D44 |
| 45 | OPN-SGD45-120LC2 | 194.5 | 1541.35 | D45 |
| 46 | OPN-SGD46-120LC2 | 194.6 | 1540.56 | D46 |
| 47 | OPN-SGD47-120LC2 | 194.7 | 1539.77 | D47 |
| 48 | OPN-SGD48-120LC2 | 194.8 | 1538.98 | D48 |
| 49 | OPN-SGD49-120LC2 | 194.9 | 1538.19 | D49 |
| 50 | OPN-SGD50-120LC2 | 195.0 | 1537.40 | D50 |
| 51 | OPN-SGD51-120LC2 | 195.1 | 1536.61 | D51 |
| 52 | OPN-SGD52-120LC2 | 195.2 | 1535.82 | D52 |
| 53 | OPN-SGD53-120LC2 | 195.3 | 1535.04 | D53 |
| 54 | OPN-SGD54-120LC2 | 195.4 | 1534.25 | D54 |
| 55 | OPN-SGD55-120LC2 | 195.5 | 1533.47 | D55 |
| 56 | OPN-SGD56-120LC2 | 195.6 | 1532.68 | D56 |
| 57 | OPN-SGD57-120LC2 | 195.7 | 1531.90 | D57 |
| 58 | OPN-SGD58-120LC2 | 195.8 | 1531.12 | D58 |
| 59 | OPN-SGD59-120LC2 | 195.9 | 1530.33 | D59 |
| 60 | OPN-SGD60-120LC2 | 196.0 | 1529.55 | D60 |

Absolute Maximum Ratings

| Parameter | Symbol | Min | Max | Units | Notes |
|----------------------------|------------------|------|-----|-------|-------------------|
| Storage Temperature | T _{stg} | -50 | 85 | °C | |
| Relative Humidity | RH | 5 | 85 | % | Non-condensing |
| Operating Case Temperature | T _{opr} | 0 | 70 | °C | OPN-SGD23-120LC2 |
| | | -50 | 85 | | OPN-SGD23-120LC2I |
| Power Supply Voltage | V _{cc} | -0.5 | 3.6 | V | |

Recommended Operating Conditions

| Parameter | Symbol | Min | Typ | Max | Units / Notes |
|----------------------------|------------------------|------|------|------|------------------------|
| Power Supply Voltage | V _{cc} | 3.13 | 3.3 | 3.47 | V |
| Operating Case Temperature | T _{opr} | 0 | | 70 | °C / OPN-SGD23-120LC2 |
| | | -50 | | 85 | °C / OPN-SGD23-120LC2I |
| Relative Humidity | RH | 5 | | 85 | % / Non-condensing |
| Power Supply Current | I _{CC(TX+RX)} | | | 430 | mA / OPN-SGD23-120LC2 |
| | | | | 600 | mA / OPN-SGD23-120LC2I |
| Data Rate | | 100 | 1250 | | Mb/s |

Transmitter Specifications (0°C < T_{opr} < 70°C, 3.13V < V_{cc} < 3.47V)

| Parameter | Symbol | Min | Typ | Max | Units | Notes |
|-------------------------------|---------------------|-------|-----|-------|-------|-------|
| Optical | | | | | | |
| Average Launch Power | P _{o, AVG} | 0 | --- | +5 | dBm | 1 |
| Center Wavelength Spacing | | | 100 | | GHz | 2 |
| Transmitter Center Wavelength | λ _c | X-100 | X | X+100 | pm | 3 |
| -- over life time | | | | | | |

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| | | | | | | |
|----------------------------------|-------------------|------|-----|---------|---------|-------------------|
| 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 | | | μ A | |
| Data Input Current -- High | I_{IH} | | | 350 | μ A | |
| 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 | 4 |
| TX Disable Input Voltage -- High | $T_{DIS, H}$ | 2.0 | | Vcc | V | 4 |
| TX Disable Assert Time | T_{ASSERT} | | | 10 | μ s | |
| TX Disable Deassert Time | $T_{DEASSERT}$ | | | 1 | ms | |
| TX Fault Output Voltage -- Low | T_{FaultL} | 0 | | 0.5 | V | 5 |
| TX Fault Output Voltage -- High | T_{FaultH} | 2.0 | | Vcc+0.3 | V | 5 |

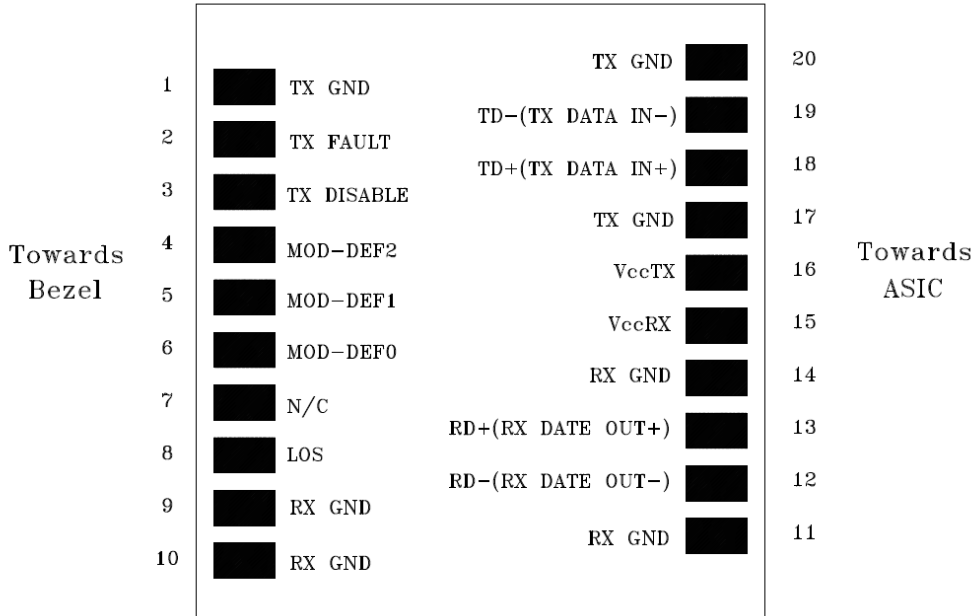
1. Output power is power coupled into a 9/125 μ m single-mode fiber.
2. Corresponds to approximately 0.8 nm.
3. X = specified ITU Grid wavelength
4. There is an internal 4.7K to 10K ohm pull-up resistor to VccTX.
5. Open collector compatible, 4.7K to 10K ohm pull-up to Vcc (Host Supply Voltage).

| Receiver Specifications (0°C < Topr < 70°C, 3.13V < Vcc < 3.47V) | | | | | | |
|--|-------------------|------|-----|---------|-------|-------------------------|
| Parameter | Symbol | Min | Typ | Max | Units | Notes |
| Optical | | | | | | |
| Sensitivity | Sens | | | -32 | dBm | 6 |
| Maximum Input Power | P_{in} | -9 | | | dBm | 6 |
| Signal Detect -- Asserted | P_A | --- | | -32 | dBm | Transition: low to high |
| Signal Detect -- Deasserted | P_D | -45 | --- | --- | 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 | 7 |
| Output LOS Voltage -- High | V_{OH} | 2.0 | | Vcc+0.3 | V | 7 |

6. Measured at PRBS 2⁷-1 at BER 1E-12.
7. Open collector compatible, 4.7K to 10K ohm pull-up to Vcc (Host Supply Voltage)

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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 |

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, 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.

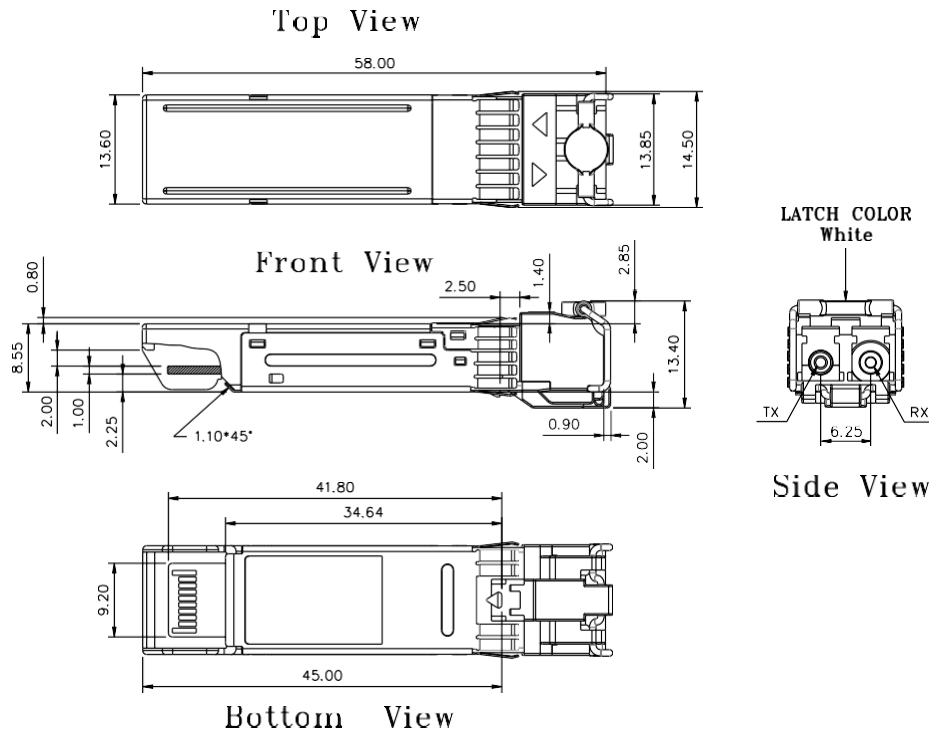
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RECOMMENDED CIRCUIT SCHEMATIC



PACKAGE DIAGRAM

Units in mm



Note: Specifications subject to change without notice.