

SPS-9380W-CXX0G / SPS-9380BW-CXX0G

(RoHS Compliant)

3.3V / CWDM / 2.5 Gbps Digital Diagnostic SFP LC SINGLE-MODE TRANSCEIVER

FEATURES

- | Hot-Pluggable SFP Footprint LC Optical Transceiver
- | Small Form-Factor Pluggable (SFP) MSA compatible
- | Up to 2.67 Gb/s bi-directional data links
- | Compliant with SONET OC-48 LR / SDH STM-16
- | Compliant with Fibre Channel 1X/2X SM-LC-L FC-PI
- | Compliant with IEEE 802.3z 1000BASE
- | **SFF-8472 Digital Diagnostic Function**
- | **18 Wavelength (λ): 1270 nm to 1610 nm CWDM DFB LD Transmitter**
- | Multi-rate Operation for 2.488/2.125/1.25/1.063 Gb/s
- | APD High Sensitivity Receiver
- | 28 dB Power Budget at Least
- | AC/AC Coupling according to MSA
- | Single +3.3 V Power Supply
- | RoHS Compliant
- | 0 to 70°C Operation: SPS-9380W-CXX0G
- | -5 to 85°C Operation: SPS-9380BW-CXX0G
- | Class 1 Laser International Safety Standard IEC-60825 Compliant

APPLICATIONS

- | SONET OC-48 SR / SDH STM-16 I-16
- | SONET OC-12 / SDH STM-4
- | SONET OC-3 / SDH STM-1
- | Gigabit Ethernet / 1X/2X Fibre Channel

DESCRIPTION

The SPS-9380W-CXX0G series single mode transceivers is small form factor pluggable module for bi-directional serial optical data communications such as SONET OC-48 / SDH STM-16, Gigabit Ethernet 1000BASE and Fibre Channel 1X/2X SM-LC-L FC-PI. 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 eighteen center wavelengths available from 1270 nm to 1610 nm, with each step 20 nm. A guaranteed minimum optical link budget of 28 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 detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.

LASER SAFETY

This single mode transceiver is a Class 1 laser product. It complies with IEC-60825 and FDA 21 CFR 1040.10 and 1040.11. The transceiver must be operated within the specified temperature and voltage limits. The optical ports of the module shall be terminated with an optical connector or with a dust plug.

ORDER INFORMATION

| P/No. | Bit Rate (Gb/s) | SONET /SDH | Power Budget (dB) | Wavelength (nm) | Package | Temp. (°C) | TX Power (dBm) | RX Sens. (dBm) | RoHS Compliant |
|------------------|-----------------|-------------|-------------------|-----------------|-----------------|------------|----------------|----------------|----------------|
| SPS-9380W-CXX0G | 2.488 | LR-2/L-16.2 | > 28 | CWDM* | LC SFP with DMI | 0 to 70 | 5 to 0 | -28 | Yes |
| SPS-9380BW-CXX0G | 2.488 | LR-2/L-16.2 | > 28 | CWDM* | LC SFP with DMI | -5 to 85 | 5 to 0 | -28 | 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 |
|--------------------|-----------|-----------|-----------|------------------|--------------------|-----------|-----------|-----------|------------------|
| -C270 | 1264.5 | 1270 | 1277.5 | Light Purple | -C450 | 1444.5 | 1450 | 1457.5 | Yellow Orange |
| -C290 | 1284.5 | 1290 | 1297.5 | Sky Blue | -C470 | 1464.5 | 1470 | 1477.5 | Gray |
| -C310 | 1304.5 | 1310 | 1317.5 | Yellow Green | -C490 | 1484.5 | 1490 | 1497.5 | Violet |
| -C330 | 1324.5 | 1330 | 1337.5 | Yellow Ocher | -C510 | 1504.5 | 1510 | 1517.5 | Blue |
| -C350 | 1344.5 | 1350 | 1357.5 | Pink | -C530 | 1524.5 | 1530 | 1537.5 | Green |
| -C370 | 1364.5 | 1370 | 1377.5 | Beige | -C550 | 1544.5 | 1550 | 1557.5 | Yellow |
| -C390 | 1384.5 | 1390 | 1397.5 | White | -C570 | 1564.5 | 1570 | 1577.5 | Orange |
| -C410 | 1404.5 | 1410 | 1417.5 | Silver | -C590 | 1584.5 | 1590 | 1597.5 | Red |
| -C430 | 1424.5 | 1430 | 1437.5 | Black | -C610 | 1604.5 | 1610 | 1617.5 | Brown |

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

| Absolute Maximum Ratings | | | | | | |
|----------------------------|--------|------|-----|-------|------------------|--|
| Parameter | Symbol | Min | Max | Units | Notes | |
| Storage Temperature | Tstg | -40 | 85 | °C | | |
| Operating Case Temperature | Topr | 0 | 70 | °C | SPS-9380W-CXX0G | |
| | | -5 | 85 | | SPS-9380BW-CXX0G | |
| 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 | | 70 | °C / SPS-9380W-CXX0G | |
| | | -5 | | 85 | °C / SPS-9380BW-CXX0G | |
| Power Supply Current | I _{CC(TX+RX)} | | 230 | 300 | mA | |
| Data Rate | | 622 | 2488 | 2670 | 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 | 0 | --- | 5 | 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 |
| Side Mode Suppression Ratio | SMSR | 30 | | | dB | |
| Extinction Ratio | E _R | 8.2 | --- | --- | dB | |
| Output Eye | Compliant with Telecordia GR-253-GORE and ITU-T Recommendation G.957 | | | | | |
| Optical Rise Time | t _r | | | 150 | ps | 20 % to 80% Values |
| Optical Fall Time | t _f | | | 150 | ps | 20 % to 80% Values |
| Relative Intensity Noise | RIN | | | -120 | dB/Hz | |
| Dispersion Penalty | | | | 2 | dB | 3 |
| 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 | 4 |
| TX Disable Input Voltage – High | T _{DIS,H} | 2.0 | | Vcc | V | 4 |
| 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 | 5 |
| TX Fault Output Voltage -- High | T _{FaultH} | 2.0 | | Vcc+0.3 | V | 5 |

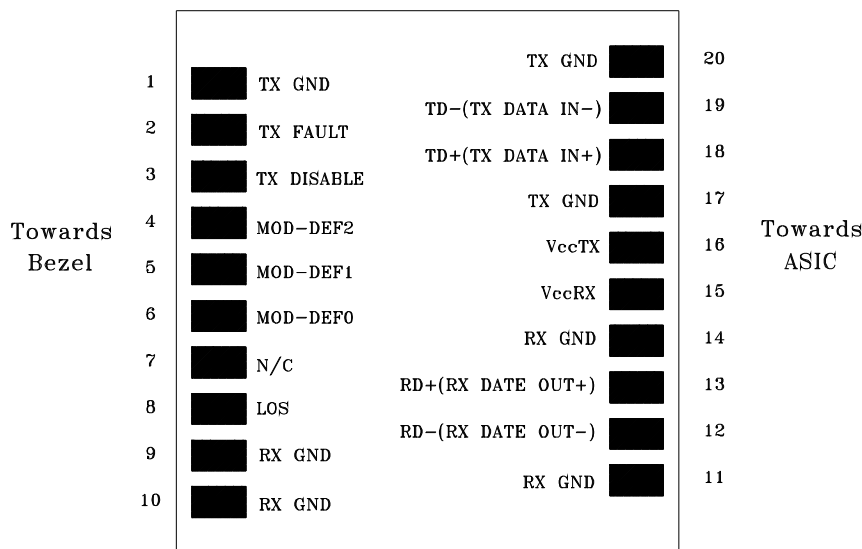
1. Output power is power coupled into a 9/125 μm single mode fiber.
2. ITU-T G.694.2 CWDM wavelength from 1270 nm to 1610 nm, each step 20 nm.
3. Specified at 1600 ps/nm dispersion over G.652/G.654 fiber with center wavelength range of 1264.5 to 1617.5 nm.
4. There is an internal 4.7K to 10K ohm pull-up 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 | | | -28 | dBm | 6,7 |
| Maximum Input Power | P _{in} | -9 | | | dBm | 6,7 |
| Signal Detect -- Asserted | P _a | --- | | -28 | dBm | Transition: low to high |
| Signal Detect -- Deasserted | P _d | -40 | --- | --- | 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 | 8 |
| Output LOS Voltage -- High | V_{OH} | 2.0 | | $V_{CC}+0.3$ | V | 8 |

6. Measured at $2^{23}-1$ PRBS at BER 1E-10.
7. Measured at 2^7-1 PRBS at BER 1E-12 for 2.125 Gb/s, 1.25Gb/s, and 1.063 Gb/s.
8. 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 |

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 |

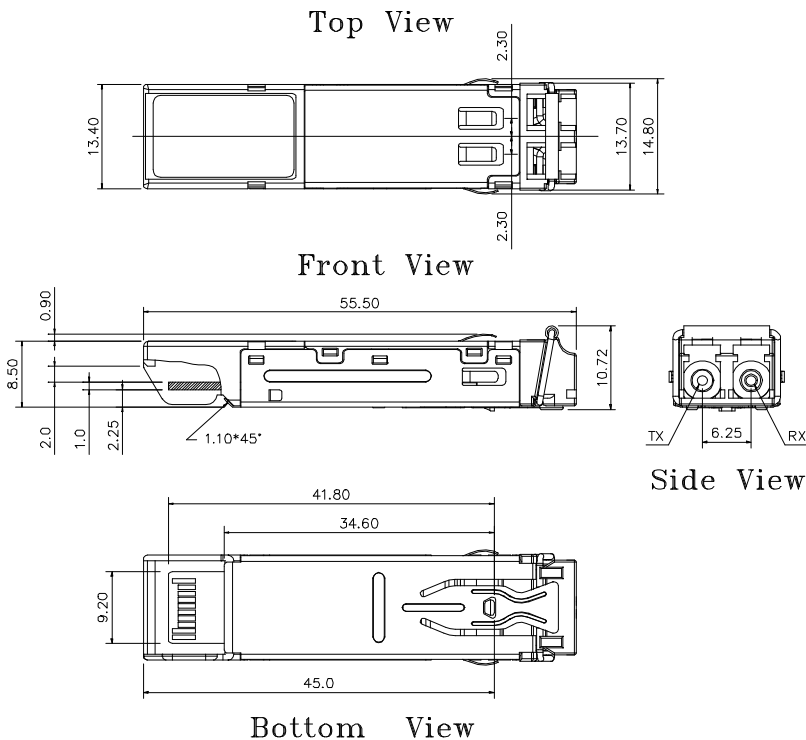
Module Definition 4 specifies a serial definition protocol. For this definition, upon power up, MOD-DEF(1:2) appear as no connector (NC) and MOD-DEF(0) is TTL LOW. When the host system detects this condition, it activates the serial protocol. The protocol uses the 2-wire serial CMOS E²PROM protocol of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

RECOMMENDED CIRCUIT SCHEMATIC



PACKAGE DIAGRAM

Units in mm



Note: Specifications subject to change without notice.

Revision History

| Version | Subject | Release Date |
|---------|--|--------------|
| 1.0 | Initial datasheet | 2004/1/1 |
| 2.0 | Add 1270 to 1450 nm CWDM. | 2005/12/1 |
| 3.0 | 1. Revise package diagram for high port density use 2. Add clasp color codes for 18 wavelengths | 2008/1/1 |
| | | |
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