

SPS-7380W-CXX0

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

**FEATURES**

- Hot-Pluggable SFP Footprint LC Optical Transceiver
- Small Form-Factor Pluggable (SFP) MSA compatible
- Compliant with IEEE 802.3z Gigabit Ethernet 1000BASE-ZX
- Compliant with Fiber Channel 1x SM-LC-L FC-PI
- 18 Wavelength ( $\lambda$ ): 1270 nm to 1610 nm CWDM DFB LD Transmitter
- 24 dB Power Budget at Least
- SFF-8472 Digital Diagnostic Function
- AC/AC Coupling according to MSA
- Single +3.3 V Power Supply
- 0 to 70°C Operation
- Class 1 Laser International Safety Standard IEC-60825 Compliant

**APPLICATIONS**

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

**DESCRIPTION**

The SPS-7380W-CXX0 series single mode transceivers is small form factor pluggable module for bi-directional serial optical data communications such as Gigabit Ethernet 1000BASE-ZX and Fiber Channel 1x 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 I<sup>2</sup>C series bus specified in the SFP MSA SFF-8472. 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 24 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) | 1000 BASE | Power Budget (dB) | Wavelength (nm) | Package         | Case Temp. (°C) | TX Power (dBm) | RX Sens. (dBm) |
|----------------|-----------------|-----------|-------------------|-----------------|-----------------|-----------------|----------------|----------------|
| SPS-7380W-CXX0 | 1.25/1.063      | ZX        | > 24              | CWDM*           | LC SFP with DMI | 0 to 70         | 5 to 0         | -24            |

\*CWDM Wavelength (0 to 70°C)

| Central Wavelength | Min. (nm) | Typ. (nm) | Max. (nm) | Central Wavelength | Min. (nm) | Typ. (nm) | Max. (nm) |
|--------------------|-----------|-----------|-----------|--------------------|-----------|-----------|-----------|
| -C270              | 1264.5    | 1270      | 1277.5    | -C450              | 1444.5    | 1450      | 1457.5    |
| -C290              | 1284.5    | 1290      | 1297.5    | -C470              | 1464.5    | 1470      | 1477.5    |
| -C310              | 1304.5    | 1310      | 1317.5    | -C490              | 1484.5    | 1490      | 1497.5    |
| -C330              | 1324.5    | 1330      | 1337.5    | -C510              | 1504.5    | 1510      | 1517.5    |
| -C350              | 1344.5    | 1350      | 1357.5    | -C530              | 1524.5    | 1530      | 1537.5    |
| -C370              | 1364.5    | 1370      | 1377.5    | -C550              | 1544.5    | 1550      | 1557.5    |
| -C390              | 1384.5    | 1390      | 1397.5    | -C570              | 1564.5    | 1570      | 1577.5    |
| -C410              | 1404.5    | 1410      | 1417.5    | -C590              | 1584.5    | 1590      | 1597.5    |
| -C430              | 1424.5    | 1430      | 1437.5    | -C610              | 1604.5    | 1610      | 1617.5    |

| Absolute Maximum Ratings   |        |      |     |       |                 |
|----------------------------|--------|------|-----|-------|-----------------|
| Parameter                  | Symbol | Min  | Max | Units | Notes           |
| Storage Temperature        | Tstg   | -40  | 85  | °C    |                 |
| Operating Case Temperature | Topr   | 0    | 70  | °C    | Air flow 1m/sec |
| Power Supply Voltage       | Vcc    | -0.5 | 3.6 | V     |                 |

| Recommended Operating Conditions |                        |     |      |     |                      |
|----------------------------------|------------------------|-----|------|-----|----------------------|
| Parameter                        | Symbol                 | Min | Typ  | Max | Units / Notes        |
| Power Supply Voltage             | Vcc                    | 3.1 | 3.3  | 3.5 | V                    |
| Case Operating Temperature       | Topr                   | 0   |      | 70  | °C / air flow 1m/sec |
| Power Supply Current             | I <sub>CC(TX+RX)</sub> |     | 200  | 300 | mA                   |
| Data Rate                        |                        | 100 | 1250 |     | Mb/s                 |

| Transmitter Specifications (0°C < Topr < 70°C, 3.1V < Vcc < 3.5V) |                                   |                      |                |                      |       |                    |
|---|-----------------------------------|----------------------|----------------|----------------------|-------|--------------------|
| Parameter   | Symbol                            | Min                  | Typ            | Max                  | Units | Notes              |
| <b>Optical</b>  |                                   |                      |                |                      |       |                    |
| Optical Transmit Power  | P <sub>o</sub>                    | 0                    | ---            | 5                    | dBm   | 1                  |
| Output Center Wavelength  | λ                                 | λ <sub>c</sub> - 5.5 | λ <sub>c</sub> | λ <sub>c</sub> + 7.5 | nm    | 2                  |
| Output Spectrum Width   | Δλ                                | ---                  | ---            | 1                    | nm    | -20 dB Width       |
| Side Mode Suppression Ratio                                       | SMSR                              | 30                   |                |                      | dB    |                    |
| Extinction Ratio  | E <sub>R</sub>                    | 9                    | ---            | ---                  | dB    |                    |
| Optical Rise Time   | t <sub>r</sub>                    |                      |                | 260                  | ps    | 20 % to 80% Values |
| Optical Fall Time   | t <sub>f</sub>                    |                      |                | 260                  | ps    | 20 % to 80% Values |
| Relative Intensity Noise  | RIN                               |                      |                | -120                 | dB/Hz |                    |
| <b>Electrical</b>   |                                   |                      |                |                      |       |                    |
| Data Input Current - Low  | I <sub>IL</sub>                   | -350                 |                |                      | μA    |                    |
| Data Input Current - High   | I <sub>IH</sub>                   |                      |                | 350                  | μA    |                    |
| Differential Input Voltage  | V <sub>IH</sub> - V <sub>IL</sub> | 0.5                  |                | 2.4                  | V     | Peak-to-Peak       |
| TX Disable Input Voltage - Low                                    | T <sub>DIS,L</sub>                | 0                    |                | 0.5                  | V     | 3                  |
| TX Disable Input Voltage - High                                   | T <sub>DIS,H</sub>                | 2.0                  |                | Vcc                  | V     | 3                  |
| TX Disable Assert Time  | T <sub>ASSERT</sub>               |                      |                | 10                   | μs    |                    |
| TX Disable Deassert Time  | T <sub>DEASSERT</sub>             |                      |                | 1                    | ms    |                    |
| TX Fault Output Voltage -- Low                                    | T <sub>FaultL</sub>               | 0                    |                | 0.5                  | V     | 4                  |
| TX Fault Output Voltage -- High                                   | T <sub>FaultH</sub>               | 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).

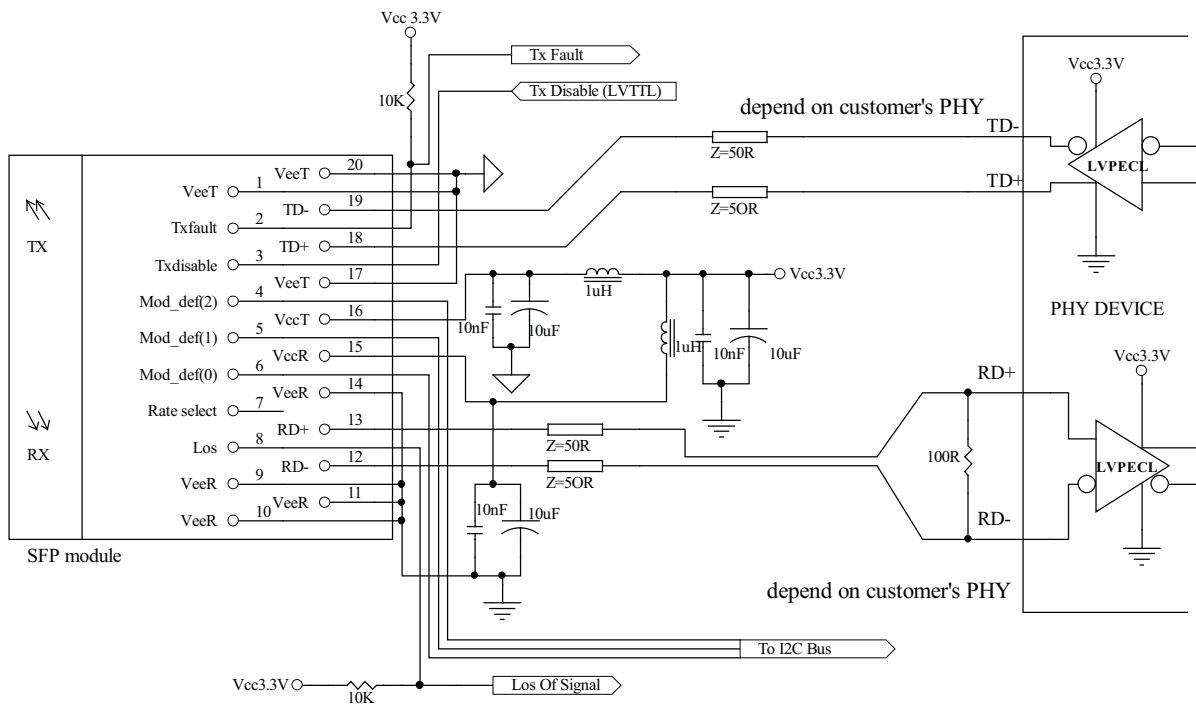
Receiver Specifications (0°C < Topr < 70°C, 3.1V < Vcc < 3.5V)

| Parameter                   | Symbol            | Min  | Typ | Max          | Units | Notes                   |
|-----------------------------|-------------------|------|-----|--------------|-------|-------------------------|
| <b>Optical</b>              |                   |      |     |              |       |                         |
| Sensitivity                 | Sens              |      |     | -24          | dBm   | 5                       |
| Maximum Input Power         | Pin               | -3   |     |              | dBm   | 5                       |
| Signal Detect -- Asserted   | Pa                | ---  |     | -24          | dBm   | Transition: low to high |
| Signal Detect -- Deasserted | Pd                | -36  | --- | ---          | dBm   | Transition: high to low |
| Signal detect -- Hysteresis |                   | 1.0  | --- |              | dB    |                         |
| Wavelength of Operation     |                   | 1100 | --- | 1620         | nm    |                         |
| <b>Electrical</b>           |                   |      |     |              |       |                         |
| Differential Output Voltage | $V_{OH} - V_{OL}$ | 0.6  |     | 2.0          | V     |                         |
| Output LOS Voltage -- Low   | $V_{OL}$          | 0    |     | 0.5          | V     | 6                       |
| Output LOS Voltage -- High  | $V_{OH}$          | 2.0  |     | $V_{cc}+0.3$ | V     | 6                       |

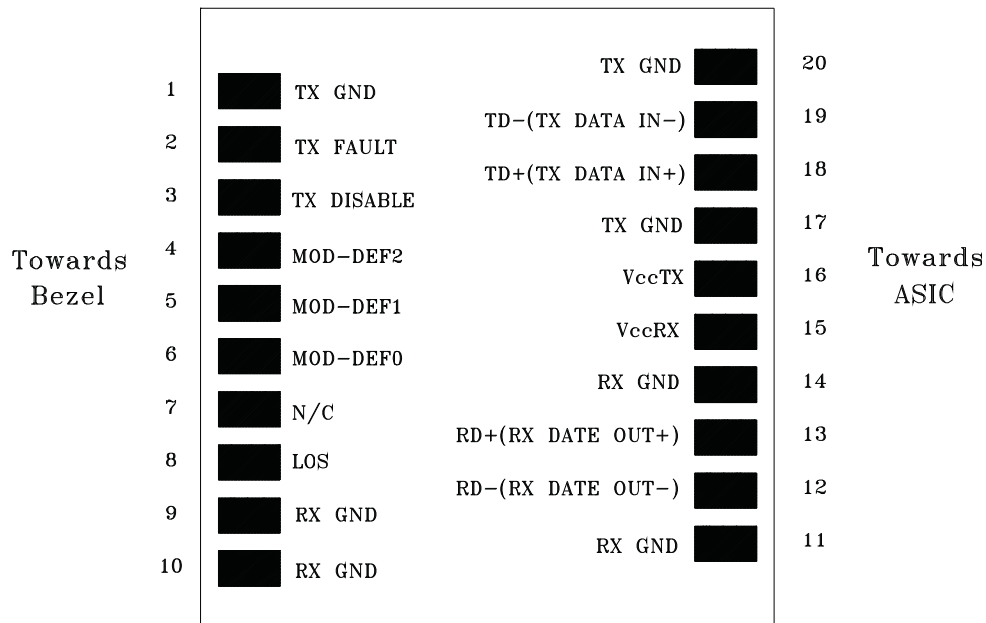
5. Measured at 2<sup>7</sup>-1 PRBS at BER 1E-12.

6. Open collector compatible, 4.7K to 10K ohm pull-up to Vcc (Host Supply Voltage).

RECOMMENDED CIRCUIT SCHEMATIC



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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          |

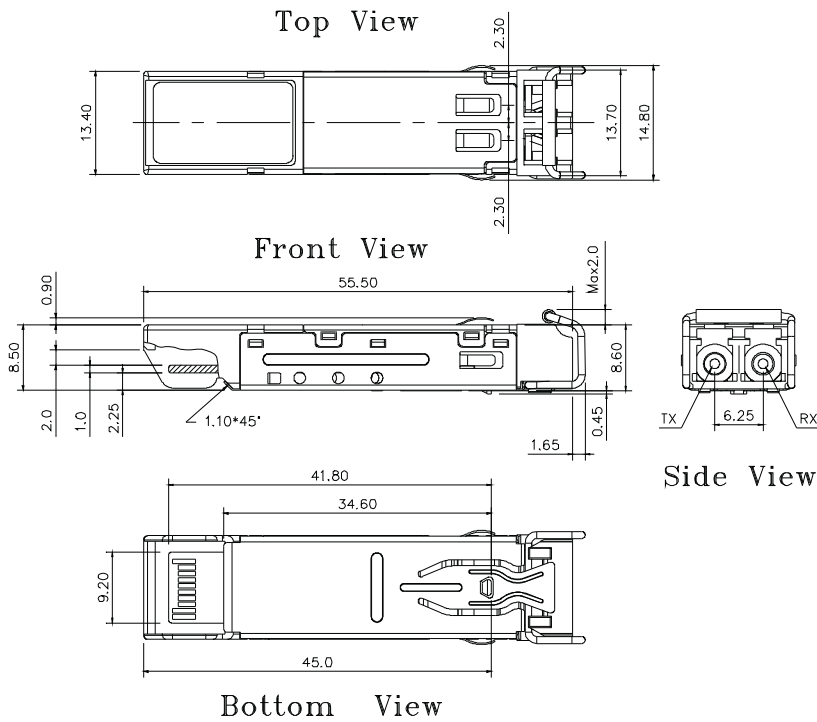
**Module Definition**

| Module Definition | MOD-DEF2<br>PIN 4 | MOD-DEF1<br>PIN 5 | MOD-DEF0<br>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 E<sup>2</sup>PROM protocol of the ATMEL AT24C01A/02/04 family of components.

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**PACKAGE DIAGRAM**

**Units in mm**



**Note:** Specifications subject to change without notice.