

SPS-4385W-DXXXG**(RoHS Compliant)****8.5 Gbps/ 50 GHz DWDM / 80 km Digital Diagnostic LC SFP+ SINGLE-MODE TRANSCEIVER****FEATURES**

- | Up to 8.5 Gbps Bi-directional Data Links
- | Complaint to SFP+ MSA
- | Compliance with Fibre Channel FC-PI-4 800-SM-LC-L
- | Compliant with 4G and, 2G Fibre Channel
- | **Temperature-stabilized DWDM EML Transmitter**
- | **50 GHz ITU Grid, C Band**
- | **Distance up to 80 km**
- | SFF-8472 Digital Diagnostic Function
- | AC/AC Coupling according to MSA
- | Single +3.3 V Power Supply
- | RoHS 6/6 Compliant
- | 0 to 70°C Operating
- | Class 1 Laser International Safety Standard IEC-60825 Compliant

APPLICATIONS

- | Multi-rate 8x / 4x / 2x Fibre Channel

DESCRIPTION

The SPS-4385W-DXXXG series single mode transceiver is small form factor pluggable module for bi-directional serial optical data communications such as 8x/4x/2x Fibre Channel.

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 50GHz ITU Grid, C Band DWDM wavelength. A guaranteed minimum optical link budget of 23 dB is offered. The transmitter section consists of a temperature-stabilized DWDM electrical-modulated laser (EML), driver and signal conditioner. 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) | FC-PI | Power Budget (dB) | Spacing (GHz) | Wavelength (nm) | Package | Temp. (°C) | RoHS Compliant |
|-----------------|-----------------|---------|-------------------|---------------|-----------------|---------------|------------|----------------|
| SPS-4385W-DXXXG | 8 / 4 / 2 | FC-PI-4 | > 23 | 50 | DWDM* | SFP+ with DMI | 0 to 70 | Yes |

*: XXX: 50GHz ITU Grid wavelength (Please see below)

| Channel # | Product code | Frequency (THz) | Center Wavelength (nm) | Label |
|-----------|-----------------|-----------------|------------------------|-------|
| 200 | SPS-4385W-D200G | 192.00 | 1561.42 | 200 |
| 205 | SPS-4385W-D205G | 192.05 | 1561.01 | 205 |
| 210 | SPS-4385W-D210G | 192.10 | 1560.61 | 210 |
| 215 | SPS-4385W-D215G | 192.15 | 1560.20 | 215 |
| 220 | SPS-4385W-D220G | 192.20 | 1559.79 | 220 |
| 225 | SPS-4385W-D225G | 192.25 | 1559.39 | 225 |
| 230 | SPS-4385W-D230G | 192.30 | 1558.98 | 230 |
| 235 | SPS-4385W-D235G | 192.35 | 1558.58 | 235 |
| 240 | SPS-4385W-D240G | 192.40 | 1558.17 | 240 |
| 245 | SPS-4385W-D245G | 192.45 | 1557.77 | 245 |
| 250 | SPS-4385W-D250G | 192.50 | 1557.36 | 250 |
| 255 | SPS-4385W-D255G | 192.55 | 1556.96 | 255 |
| 260 | SPS-4385W-D260G | 192.60 | 1556.55 | 260 |
| 265 | SPS-4385W-D265G | 192.65 | 1556.15 | 265 |
| 270 | SPS-4385W-D270G | 192.70 | 1555.75 | 270 |
| 275 | SPS-4385W-D275G | 192.75 | 1555.34 | 275 |
| 280 | SPS-4385W-D280G | 192.80 | 1554.94 | 280 |
| 285 | SPS-4385W-D285G | 192.85 | 1554.54 | 285 |
| 290 | SPS-4385W-D290G | 192.90 | 1554.13 | 290 |
| 295 | SPS-4385W-D295G | 192.95 | 1553.73 | 295 |
| 300 | SPS-4385W-D300G | 193.00 | 1553.33 | 300 |
| 305 | SPS-4385W-D305G | 193.05 | 1552.93 | 305 |
| 310 | SPS-4385W-D310G | 193.10 | 1552.52 | 310 |
| 315 | SPS-4385W-D315G | 193.15 | 1552.12 | 315 |
| 320 | SPS-4385W-D320G | 193.20 | 1551.72 | 320 |
| 325 | SPS-4385W-D325G | 193.25 | 1551.32 | 325 |
| 330 | SPS-4385W-D330G | 193.30 | 1550.92 | 330 |
| 335 | SPS-4385W-D335G | 193.35 | 1550.52 | 335 |
| 340 | SPS-4385W-D340G | 193.40 | 1550.12 | 340 |
| 345 | SPS-4385W-D345G | 193.45 | 1549.72 | 345 |
| 350 | SPS-4385W-D350G | 193.50 | 1549.32 | 350 |
| 355 | SPS-4385W-D355G | 193.55 | 1548.91 | 355 |
| 360 | SPS-4385W-D360G | 193.60 | 1548.51 | 360 |
| 365 | SPS-4385W-D365G | 193.65 | 1548.11 | 365 |
| 370 | SPS-4385W-D370G | 193.70 | 1547.72 | 370 |
| 375 | SPS-4385W-D375G | 193.75 | 1547.32 | 375 |
| 380 | SPS-4385W-D380G | 193.80 | 1546.92 | 380 |
| 385 | SPS-4385W-D385G | 193.85 | 1546.52 | 385 |
| 390 | SPS-4385W-D390G | 193.90 | 1546.12 | 390 |
| 395 | SPS-4385W-D395G | 193.95 | 1545.72 | 395 |
| 400 | SPS-4385W-D400G | 194.00 | 1545.32 | 400 |
| 405 | SPS-4385W-D405G | 194.05 | 1544.92 | 405 |
| 410 | SPS-4385W-D410G | 194.10 | 1544.53 | 410 |
| 415 | SPS-4385W-D415G | 194.15 | 1544.13 | 415 |
| 420 | SPS-4385W-D420G | 194.20 | 1543.73 | 420 |
| 425 | SPS-4385W-D425G | 194.25 | 1543.33 | 425 |
| 430 | SPS-4385W-D430G | 194.30 | 1542.94 | 430 |
| 435 | SPS-4385W-D435G | 194.35 | 1542.54 | 435 |
| 440 | SPS-4385W-D440G | 194.40 | 1542.14 | 440 |
| 445 | SPS-4385W-D445G | 194.45 | 1541.75 | 445 |

| Channel # | Product code | Frequency (THz) | Center Wavelength (nm) | Label |
|-----------|-----------------|-----------------|------------------------|-------|
| 450 | SPS-4385W-D450G | 194.50 | 1541.35 | 450 |
| 455 | SPS-4385W-D455G | 194.55 | 1540.95 | 455 |
| 460 | SPS-4385W-D460G | 194.60 | 1540.56 | 460 |
| 465 | SPS-4385W-D465G | 194.65 | 1540.56 | 465 |
| 470 | SPS-4385W-D470G | 194.70 | 1539.77 | 470 |
| 475 | SPS-4385W-D475G | 194.75 | 1539.37 | 475 |
| 480 | SPS-4385W-D480G | 194.80 | 1538.98 | 480 |
| 485 | SPS-4385W-D485G | 194.85 | 1538.58 | 485 |
| 490 | SPS-4385W-D490G | 194.90 | 1538.19 | 490 |
| 495 | SPS-4385W-D495G | 194.95 | 1537.79 | 495 |
| 500 | SPS-4385W-D500G | 195.00 | 1537.40 | 500 |
| 505 | SPS-4385W-D505G | 195.05 | 1537.00 | 505 |
| 510 | SPS-4385W-D510G | 195.10 | 1536.61 | 510 |
| 515 | SPS-4385W-D515G | 195.15 | 1536.22 | 515 |
| 520 | SPS-4385W-D520G | 195.20 | 1535.82 | 520 |
| 525 | SPS-4385W-D525G | 195.25 | 1535.43 | 525 |
| 530 | SPS-4385W-D530G | 195.30 | 1535.04 | 530 |
| 535 | SPS-4385W-D535G | 195.35 | 1534.64 | 535 |
| 540 | SPS-4385W-D540G | 195.40 | 1534.25 | 540 |
| 545 | SPS-4385W-D545G | 195.45 | 1533.86 | 545 |
| 550 | SPS-4385W-D550G | 195.50 | 1533.47 | 550 |
| 555 | SPS-4385W-D555G | 195.55 | 1533.07 | 555 |
| 560 | SPS-4385W-D560G | 195.60 | 1532.68 | 560 |
| 565 | SPS-4385W-D565G | 195.65 | 1532.29 | 565 |
| 570 | SPS-4385W-D570G | 195.70 | 1531.90 | 570 |
| 575 | SPS-4385W-D575G | 195.75 | 1531.51 | 575 |
| 580 | SPS-4385W-D580G | 195.80 | 1531.12 | 580 |
| 585 | SPS-4385W-D585G | 195.85 | 1530.72 | 585 |
| 590 | SPS-4385W-D590G | 195.90 | 1530.33 | 590 |
| 595 | SPS-4385W-D595G | 195.95 | 1529.94 | 595 |
| 600 | SPS-4385W-D600G | 196.00 | 1529.55 | 600 |

| Absolute Maximum Ratings | | | | | |
|----------------------------|--------|------|-----|-------|---------------|
| Parameter | Symbol | Min | Max | Units | Notes |
| Storage Temperature | Tstg | -40 | 85 | °C | |
| Operating Case Temperature | Topr | 0 | 70 | °C | |
| Power Supply Voltage | Vcc | -0.5 | 3.6 | V | |
| Receiver Input for Damage | Mip | -3 | | dBm | Average Power |

| 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 |
| Power Supply Current | I _{CC(TX+RX)} | | 350 | 500 | mA |
| Data Rate | | 2.125 | 8.5 | | Gb/s |

| Transmitter Optical Specifications (0°C < Topr < 70°C, 3.13V < Vcc < 3.47V) | | | | | | |
|---|---------------------|-------|-----|-------|-------|--------------|
| Parameter | Symbol | Min | Typ | Max | Units | Notes |
| Average Launch Power | P _{O, AVG} | -1 | | 3 | dBm | 1 |
| Extinction Ratio | ER | 8.2 | | | dB | |
| Center Wavelength Spacing | | | 50 | | GHz | |
| Transmitter Center Wavelength -- over life time | λ _c | X-100 | X | X+100 | pm | 2 |
| Output Spectrum Width | Δλ | --- | | 1 | nm | -20 dB width |
| Side Mode Suppression Ratio | SMSR | 30 | | | dB | |
| Relative Intensity Noise | RIN | | | -130 | dB/Hz | |
| Transmitter Dispersion Penalty @ -500 to 1600 ps/nm | TDP | | | 3 | dB | |
| Average Launch Power of OFF Transmitter | | | | -30 | dBm | |

1. Output power is power coupled into a 9/125 μm single-mode fiber.
2. X = specified ITU Grid wavelength.

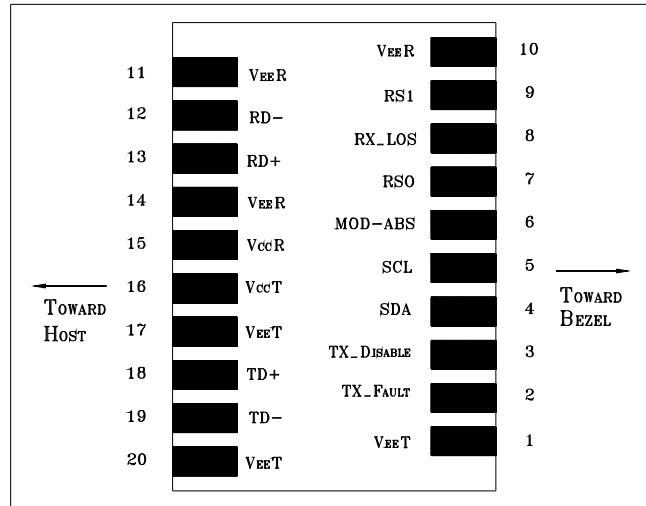
| Receiver Optical Specifications (0°C < Topr < 70°C, 3.13V < Vcc < 3.47V) | | | | | | |
|--|------------------|------|-----|------|-------|-------------------------|
| Parameter | Symbol | Min | Typ | Max | Units | Notes |
| Sensitivity | | | | -24 | dBm | 3 |
| Receiver Overload | P _{MAX} | -7 | --- | | dBm | |
| LOS -- Deasserted | LOS _D | --- | --- | -27 | dBm | Transition: low to high |
| LOS -- Asserted | LOS _A | -35 | --- | --- | dBm | Transition: high to low |
| Wavelength of Operation | λ _c | 1480 | | 1580 | nm | |

3. Measured with average power; BER < 10⁻¹² and PRBS 2⁷-1.

| Electrical Characteristics | | | | | | |
|--|------------------|-------|-----|---------|-------|-----------------------|
| Parameter | Symbol | Min | Typ | Max | Units | Notes |
| High-Speed Signal (CML) Interface Specification | | | | | | |
| Input Data Rate | | 2.125 | 8.5 | | Gb/s | |
| Differential Input Impedance | R _{in} | | 100 | | Ω | |
| Differential Data Input Amplitude | | 150 | | 1200 | mVpp | Internally AC coupled |
| Output Data Rate | | 2.125 | 8.5 | | Gb/s | |
| Differential Output Impedance | R _{out} | | 100 | | Ω | |
| Differential Data Output Amplitude | | 350 | 600 | 700 | mVpp | Internally AC coupled |
| Low-Speed Signal (LVTTTL) Interface Specification | | | | | | |
| Input High Voltage | | 2.0 | | Vcc+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 | |

CONNECTION DIAGRAM



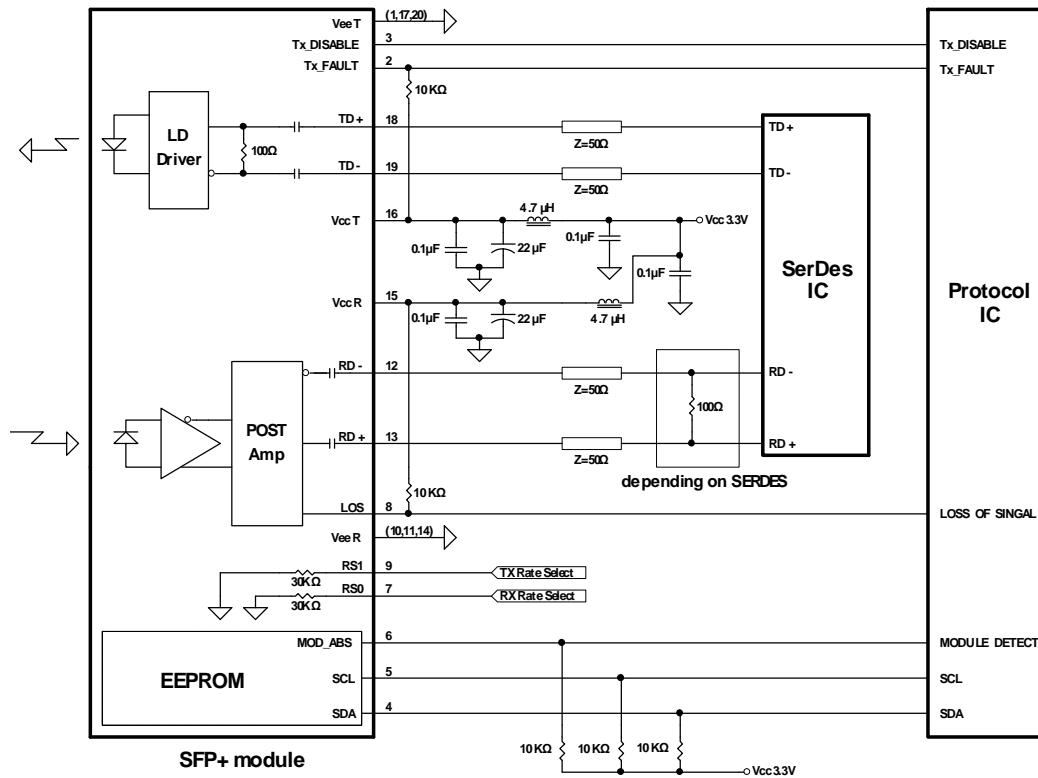
| PIN | Signal Name | Description | PIN | Signal Name | Description |
|-----|-------------------|--|-----|-------------------|-----------------------------|
| 1 | V _{EE} T | Transmitter Signal Ground | 11 | V _{EE} R | Receiver Signal Ground |
| 2 | TX_Fault | Transmitter Fault Indication. Logic "1" 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 | SDL | 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 (LVTTTL). 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 (LVTTTL). 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 SDL appear as no connector (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.

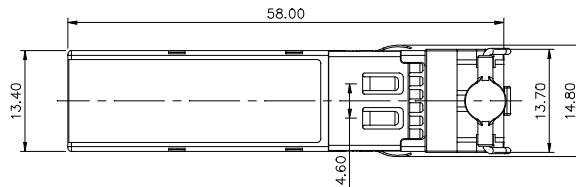
RECOMMENDED CIRCUIT SCHEMATIC



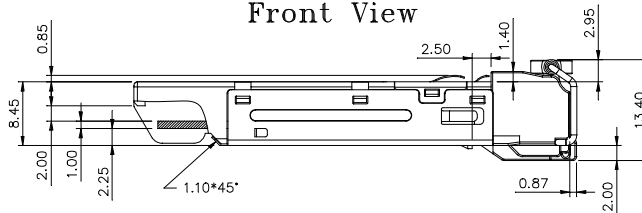
PACKAGE DIAGRAM

Units in mm

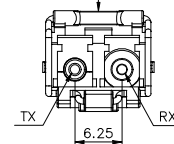
Top View



Front View

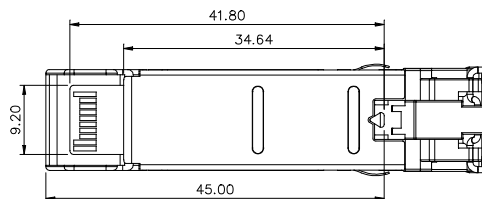


LATCH COLOR
White



Side View

Bottom View



REVISION HISTORY

| Version | Subject | Release Date |
|---------|-------------------|--------------|
| 1.0 | Initial datasheet | 2011/7/1 |
| | | |
| | | |
| | | |

Note: Specifications subject to change without notice.