
SPS-4102WG / SPS-4102BWG / SPS-4102AWG

(RoHS Compliant)

3.3V / 1310 nm / 8.5 Gbps Digital Diagnostic SFP+ LC SINGLE-MODE TRANSCEIVER

FEATURES

- | Up to 8.5 Gb/s Bi-directional Data Link
- | Compliant to SFP+ MSA
- | Compliance with Fibre Channel FC-PI-4 800-SM-LC-I
- | Compliant with 4x /2x Fibre Channel
- | **SFF-8472 Digital Diagnostic Function**
- | 1310 nm FP LD Transmitter
- | Link Distance
 - 0 to 1400 m at 8.5 Gb/s
 - 0 to 5000 m at 4.25 Gb/s
 - 0 to 10,000 m at 2.125Gb/s
- | AC/AC Coupling according to MSA
- | Single +3.3 V Power Supply
- | RoHS 6/6 Compliant
- | 0 to 70°C Operating: SPS-4102WG
- | -10 to 85°C Operating: SPS-4102BWG
- | -40 to 85°C Operating: SPS-4102AWG
- | Class 1 Laser International Safety Standard IEC-60825 Compliant

DESCRIPTION

The SPS-4102WG series single mode transceiver is small form factor pluggable module for bi-directional serial optical data communications such as 8x/4x/2x/1x 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 1310 nm. The transmitter section uses a 1310 nm multiple quantum well 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.

APPLICATIONS

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

ORDER INFORMATION

| P/No. | Bit Rate (Gb/s) | FC-PI | Distance (m) | Wavelength (nm) | Package | Temp. (°C) | RoHS Compliant |
|--------------------|-----------------|---------|--------------|-----------------|---------------|------------------|----------------|
| SPS-4102WG | 8 / 4 / 2 | FC-PI-4 | 1400* | 1310 | SFP+ with DMI | 0 to 70 | Yes |
| SPS-4102BWG | 8 / 4 / 2 | FC-PI-4 | 1400* | 1310 | SFP+ with DMI | -10 to 85 | Yes |
| SPS-4102AWG | 8 / 4 / 2 | FC-PI-4 | 1400* | 1310 | SFP+ with DMI | -40 to 85 | Yes |

*: 0 to 1400 m at 8.5 Gb/s, 0 to 5000 m at 4.25 Gb/s, and 10 km at FC 1x/2x.

| Absolute Maximum Ratings | | | | | |
|----------------------------|--------|------|-----|-------|--|
| Parameter | Symbol | Min | Max | Units | Notes |
| Storage Temperature | Tstg | -40 | 85 | °C | |
| Operating Case Temperature | Topr | 0 | 70 | °C | SPS-4102WG SPS-4102BWG SPS-4102AWG |
| | | -10 | 85 | | |
| | | -40 | 85 | | |
| 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-4102WG °C / SPS-4102BWG °C / SPS-4102AWG |
| | | -10 | | 85 | |
| | | -40 | | 85 | |
| Power Supply Current | I _{CC(TX+RX)} | | 250 | 300 | mA |
| Data Rate | | 1 | 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} | -8 | | 0 | dBm | 1 |
| Optical Modulation Amplitude | P _{O, OMA} | 0.29 | | | mW | |
| Output Center Wavelength | λ _c | 1270 | 1310 | 1350 | nm | |
| Output Spectrum Width | σ _λ | | 2 | | nm | RMS (σ) |
| Optical Rise / Fall Time (8.5Gb/s) | t _r / t _f | | | 50 | ps | 20 % to 80% ,unfiltered |
| Relative Intensity Noise | RIN | | | -128 | dB/Hz | |
| Average Launch Power of OFF Transmitter | | | | -30 | dBm | |

1. Output power is power coupled into a 9/125 μm single-mode fiber.

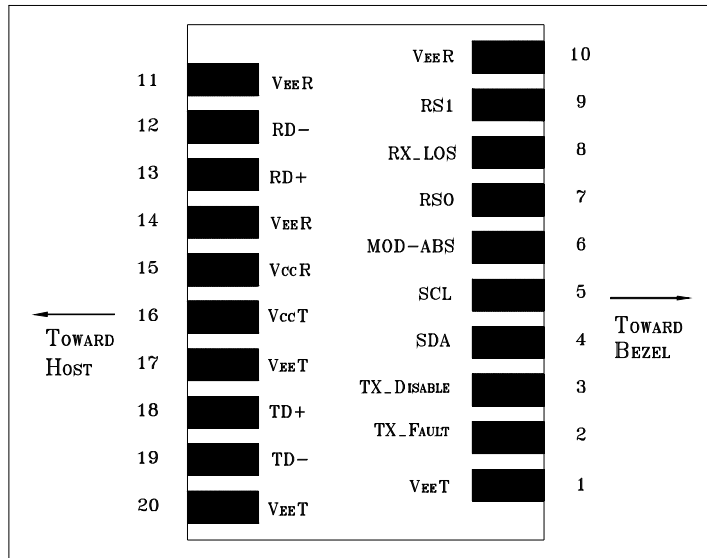
| Receiver Optical Specifications (0°C < Topr < 70°C, 3.13V < Vcc < 3.47V) | | | | | | |
|---|------------------|------|-----|-------|-------------------|-------------------------|
| Parameter | Symbol | Min | Typ | Max | Units | Notes |
| Unstressed Sensitivity at 8.5 Gb/s | Sens | | | 0.042 | mW _{p-p} | 2, OMA |
| | | | | -15 | dBm | 3, Average Power |
| Stress Sensitivity at 8.5 Gb/s | Sens | | --- | 0.066 | mW _{p-p} | 2, OMA |
| Receiver Overload | P _{MAX} | 0.5 | --- | | dBm | |
| LOS -- Deasserted | LOS _D | --- | --- | -18 | dBm | Transition: low to high |
| LOS -- Asserted | LOS _A | -30 | --- | --- | dBm | Transition: high to low |
| Wavelength of Operation | λ _c | 1260 | | 1565 | nm | |
| Optical Return Loss | ORL | | | -12 | dB | |

2. Measured with worst ER; BER < 10⁻¹² and PRBS 2⁷-1.

3. Represents sensitivity based on OMA spec, as corrected to incoming Extinction Ratio of 7 dB. For example, an OMA of 0.042 mW is approximately equal to an average power of -15 dBm, average with an Extinction ratio of 7 dB.

| Electrical Characteristics | | | | | | |
|--|------------------|-----|-----|----------------------|------------------|-----------------------|
| Parameter | Symbol | Min | Typ | Max | Units | Notes |
| High-Speed Signal (CML) Interface Specification | | | | | | |
| Input Data Rate | | 1 | 8.5 | | Gb/s | |
| Differential Input Impedance | R _{in} | | 100 | | Ω | |
| Differential Data Input Amplitude | | 150 | | 1200 | mV _{pp} | Internally AC coupled |
| Output Data Rate | | 1 | 8.5 | | Gb/s | |
| Differential Output Impedance | R _{out} | | 100 | | Ω | |
| Differential Data Output Amplitude | | 350 | 600 | 700 | mV _{pp} | 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 | |

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 pull-down 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 pull-down 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.

REVISION HISTORY

| Version | Subject | Release Date |
|---------|---------------------------------|--------------|
| 1.0 | Initial datasheet | 2007/7/1 |
| 2.0 | Add SPS-4102AWG for -40 to 85°C | 2007/12/1 |
| | | |
| | | |
| | | |