

### SPB-4940LWG / SPB-4940BLWG

**(RoHS Compliant)**

### 1330 nm TX / 1270 nm RX, 8.5 Gbps Digital Diagnostic 1-Fiber SM LC SFP+ Transceiver

#### FEATURES

- 1-Fiber Bi-Directional SFP Optical Transceiver
- Up to 8.5 Gbps Bi-directional Data Links
- Compliant with SFP+ MSA
- Compliant with Fibre Channel FC-PI-4 800-SM-LC
- Compliant with 4G and 2G Fibre Channel
- SFF-8472 Digital Diagnostic Function
- Simplex LC Connector
- 1330 nm DFB LD Transmitter
- 1270 nm Receiver
- **Distance Up to 40 km**
- AC/AC Coupling according to MSA
- Single +3.3 V Power Supply
- RoHS Compliant
- 0 to 70°C Operation: SPB-4940LWG
- -10 to 85°C Operation: SPB-4940BLWG
- Class 1 Laser International Safety Standard IEC 60825 Compliant

#### APPLICATIONS

- 8G Fibre Channel Links

#### DESCRIPTION

The SPB-4940LWG series single-mode transceiver is a small form factor pluggable module for bi-directional serial optical data communications such as 8x/4x/2x Fibre Channel by using 1330 nm transmitter and 1270 nm receiver. 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. The transmitter section uses a multiple quantum well 1330 nm DFB laser and is a class 1 laser compliant according to International Safety Standard IEC 60825. The receiver section uses an integrated 1270 nm 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   | Distance (km) | TX (nm)  | RX (nm) | Package          | Temp (°C) | RoHS Compliant |
|--------------|-----------------|---------|---------------|----------|---------|------------------|-----------|----------------|
| SPB-4940LWG  | 8 / 4 / 2       | FC-PI-4 | 40            | 1330 DFB | 1270    | LC SFP+ with DMI | 0 to 70   | Yes            |
| SPB-4940BLWG | 8 / 4 / 2       | FC-PI-4 | 40            | 1330 DFB | 1270    | LC SFP+ with DMI | -10 to 85 | Yes            |

| Absolute Maximum Ratings   |        |          |          |       |                             |
|----------------------------|--------|----------|----------|-------|-----------------------------|
| Parameter                  | Symbol | Min      | Max      | Units | Notes                       |
| Storage Temperature        | Tstg   | -40      | 85       | °C    |                             |
| Operating Case Temperature | Topr   | 0<br>-10 | 70<br>85 | °C    | SPB-4940LWG<br>SPB-4940BLWG |
| Relative Humidity          | RH     | 0        | 85       | %     | Non condensing              |
| Power Supply Voltage       | Vcc    | 0        | 3.6      | V     |                             |
| Input Voltage              | ---    | GND      | Vcc      | V     |                             |
| Output Current             | Iout   | 0        | 30       | mA    |                             |

| Recommended Operating Conditions |                        |          |     |          |                                       |
|----------------------------------|------------------------|----------|-----|----------|---------------------------------------|
| Parameter                        | Symbol                 | Min      | Typ | Max      | Units / Notes                         |
| Power Supply Voltage             | Vcc                    | 3.13     | 3.3 | 3.47     | V                                     |
| Power Supply Current             | I <sub>CC(TX+RX)</sub> |          | 270 | 320      | mA                                    |
| Operating Case Temperature       | Topr                   | 0<br>-10 |     | 70<br>85 | °C / SPB-4940LWG<br>°C / SPB-4940BLWG |
| Data Rate                        |                        | 1        | 8.5 |          | Gb/s                                  |

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| Transmitter 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    |      | 5    | dBm   | 1            |
| Output Center Wavelength  | $\lambda_c$     | 1320 | 1330 | 1340 | nm    |              |
| Output Spectrum Width   | $\Delta\lambda$ |      |      | 1    | nm    | -20 dB width |
| Side Mode Suppression Ratio   | SMSR            | 30   |      |      | dB    |              |
| Relative Intensity Noise  | RIN             |      |      | -128 | dB/Hz |              |
| Average Launch Power of OFF Transmitter                             |                 |      |      | -30  | dBm   |              |

Notes: 1. Output power is power coupled into a 9/125  $\mu$ m single mode fiber.

| Receiver Specifications (0°C < Topr < 70°C, 3.13V < Vcc < 3.47V) |             |      |     |      |       |                         |
|--|-------------|------|-----|------|-------|-------------------------|
| Parameter  | Symbol      | Min  | Typ | Max  | Units | Notes                   |
| Sensitivity  |             |      |     | -15  | dBm   | 2, Average Power        |
| 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  | $\lambda_c$ | 1260 |     | 1280 | nm    | 3                       |

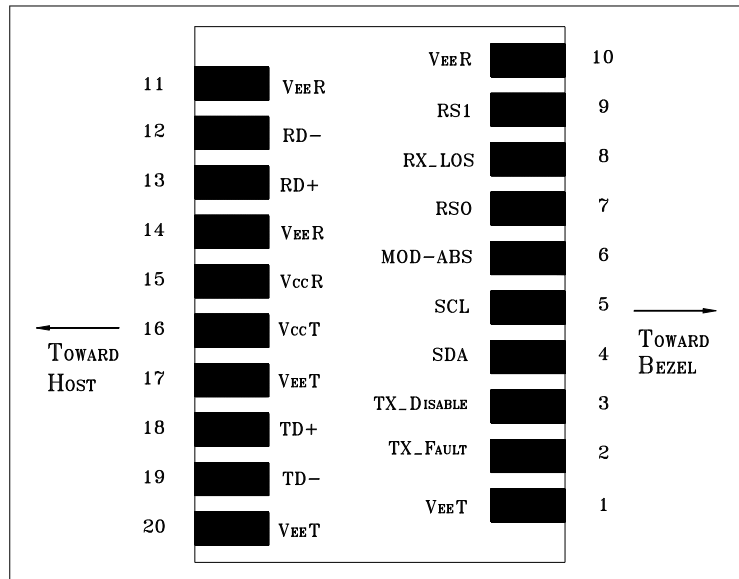
Notes: 2. Measured with average power; BER < 10<sup>-12</sup> and PRBS 2<sup>7</sup>-1.

3. At least 30 dB optical isolation for the wavelength 1320 to 1340 nm.

| Electrical Characteristics                               |           |     |     |         |          |                       |
|--|-----------|-----|-----|---------|----------|-----------------------|
| Parameter  | Symbol    | Min | Typ | Max     | Units    | Notes                 |
| <b>High-Speed Signal (CML) Interface Specification</b>   |           |     |     |         |          |                       |
| Input Data Rate  |           | 1   | 8.5 |         | Gb/s     |                       |
| Differential Input Impedance                             | $R_{in}$  |     | 100 |         | $\Omega$ |                       |
| Differential Data Input Amplitude                        |           | 150 |     | 1000    | mVpp     | Internally AC coupled |
| Output Data Rate   |           | 1   | 8.5 |         | Gb/s     |                       |
| Differential Output Impedance                            | $R_{out}$ |     | 100 |         | $\Omega$ |                       |
| Differential Data Output Amplitude                       |           | 350 | 600 | 700     | mVpp     | Internally AC coupled |
| <b>Low-Speed Signal (LVTTTL) Interface Specification</b> |           |     |     |         |          |                       |
| Input High Voltage                                       |           | 2.0 |     | Vcc+0.3 | V        |                       |
| Input Low Voltage  |           | GND |     | 0.8     | V        |                       |
| Output High Voltage                                      |           | 2.4 |     | Vcc     | V        |                       |
| Output Low Voltage                                       |           | GND |     | 0.5     | V        |                       |

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### CONNECTION DIAGRAM



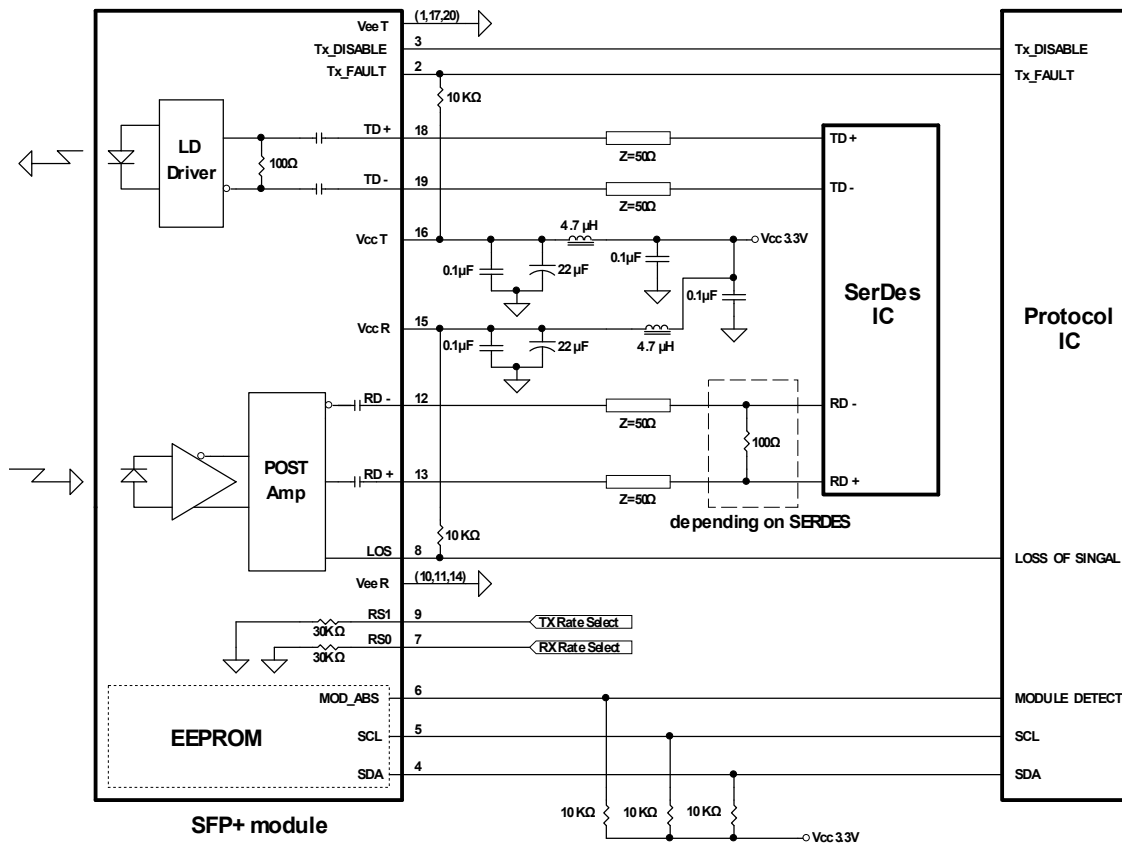
| PIN | Signal Name | Description   | PIN | Signal Name | Description                 |
|-----|-------------|---|-----|-------------|-----------------------------|
| 1   | VEET        | Transmitter Signal Ground   | 11  | VEER        | Receiver Signal Ground      |
| 2   | TX_Fault    | Transmitter Fault 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  | VEER        | Receiver Signal Ground      |
| 5   | SCL         | Modulation Definition 1 – Two wires serial ID Interface   | 15  | VccR        | Receiver Power – 3.3V±5%    |
| 6   | MOD-ABS     | Modulation Definition 0 – Ground in Module  | 16  | VccT        | Transmitter Power – 3.3V±5% |
| 7   | RS0         | RX Rate Select (LVTTL). This pin has an internal 30k pulldown to ground. A signal on this pin will not affect module performance. | 17  | VEET        | Transmitter Signal Ground   |
| 8   | RX_LOS      | Loss of Signal Out (OC).  | 18  | TD+         | Transmitter Data In         |
| 9   | RS1         | TX Rate Select (LVTTL). 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  | VEER        | Receiver Signal Ground  | 20  | VEET        | 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 |

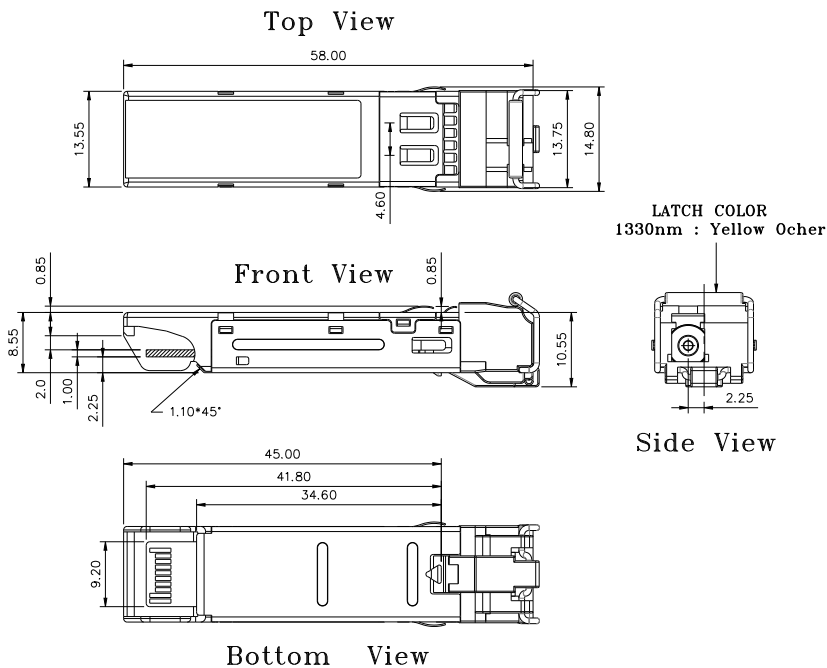
Module Definition 4 specifies a serial definition protocol. For this definition, upon power up, SDA and SCL appear as no connection (NC) and MOD-ABS is TTL LOW. When the host system detects this condition, it activates the serial protocol. The protocol uses the 2-wire serial CMOS E<sup>2</sup>PROM protocol of the ATMEL AT24C01A/02/04 family of components.

### RECOMMENDED CIRCUIT SCHEMATIC



### PACKAGE DIAGRAM

Units in mm



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

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**REVISION HISTORY**

| Version | Subject                | Release Date |
|---------|------------------------|--------------|
| 1.0     | Initial datasheet      | 2008/10/1    |
| 2.0     | Change package diagram | 2015/12/1    |
|         |                        |              |
|         |                        |              |