



## **AXSD-35C4 2.67Gbps Single-mode 1550nm, SFP Transceiver with Monitoring Interface**



### **Product Overview**

The AXSD-35C4 is specifically designed for the high performance integrated duplex data link over single-mode optical fiber. This transceiver module is compliant with the Small Form-factor Pluggable (SFP) Multisource Agreement (MSA). An enhanced Digital Diagnostic Monitoring Interface has been incorporated into the Axcen SFP Transceiver. Real time monitors of temperature, supply voltage, laser bias current, laser average output power and received output power are provided, based on the SFF-8472.

The AXSD-35C4 SFP transceivers using a long wavelength (1550nm) DFB laser diodes enable data transmission up to 25km on a single-mode (9/125 $\mu$ m) optical fiber.

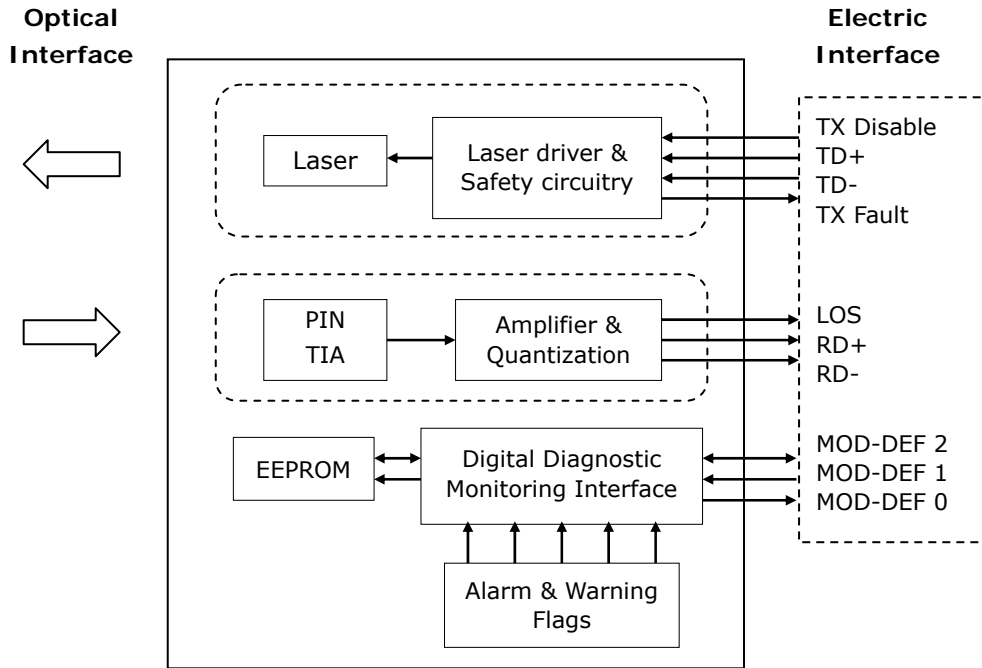
### **Features**

- **SFP Multi-Source Agreement compliant**
- **LC duplex receptacle**
- **2.67Gbps multi-rate support**
- **2.488Gbps ITU-T G.957 STM S-16.2 compliant.**
- **2.488Gbps SONET OC-48 IR-2 compliant**
- **SFF-8472 diagnostic monitoring interface for optical transceivers**
- **Alarms and warnings to indicate status of real time monitors**
- **25km reach**
- **Low power dissipation**

### **Applications**

- **SONET OC-48 IR-2 / SDH STM S-16.2**
- **SONET OC-12 / SDH STM-4**
- **SONET OC-3 / SDH STM-1**
- **Gigabit Ethernet / Fibre Channel**

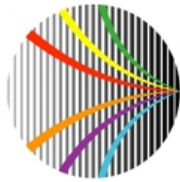
**Block diagram**



The transceiver is fundamentally consisted by two parts: transmitter and receiver. The transmitter features a TTL logic level Disable signal and a Fault indicator. The receiver features a TTL logic Loss of Signal (LOS) detection. The serial ID interface defines a 256-byte memory map in EEPROM, accessible over a 2 wire, serial interface at the 8 bit address 1010000X (A0h). The Digital Diagnostic Monitoring Interface makes use of the 8 bit address 1010001X (A2h), so the originally defined serial ID memory map remains unchanged and is therefore backward compatible. The detailed signal descriptions are listed in the following sections.

**Absolute Maximum Ratings**

| Parameter                 | Symbol                               | Min. | Max. | Unit | Note |
|---------------------------|--------------------------------------|------|------|------|------|
| Storage Temperature       | T <sub>s</sub>                       | -40  | +85  | °C   |      |
| Supply Voltage            | V <sub>ccT</sub><br>V <sub>ccR</sub> | -0.5 | 4.0  | V    |      |
| Storage Relative Humidity | RH                                   | 5    | 95   | %    |      |



## Recommended Operating Conditions

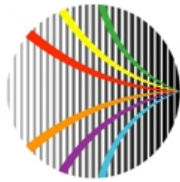
| Parameter                  | Symbol            | Min. | Typ. | Max. | Unit               | Note |
|----------------------------|-------------------|------|------|------|--------------------|------|
| Case Operating Temperature | $T_C$             | 0    |      | 70   | $^{\circ}\text{C}$ |      |
| Supply Voltage             | $V_{CC}$          | 3.1  | 3.3  | 3.5  | V                  |      |
| Supply Current             | $I_{TX} + I_{RX}$ |      | 180  | 300  | mA                 |      |
| Data Rate                  | BR                | 155  |      | 2667 | Mb/sec             |      |

## Transmitter Electro-Optical Interface

| Parameter                              | Symbol           | Min.     | Typ. | Max.         | Unit | Note |
|--|------------------|----------|------|--------------|------|------|
| Transmitter Differential Input Voltage | TD +/-           | 400      |      | 2400         | mV   |      |
| Tx_Fault - High                        | $V_{Fault\_H}$   | 2        |      | $V_{CC}$     | V    |      |
| Tx_Fault - Low                         | $V_{Fault\_L}$   | $V_{EE}$ |      | $V_{EE}+0.8$ | V    |      |
| Tx_Disable - High                      | $V_{Disable\_H}$ | 2        |      | $V_{CC}$     | V    |      |
| Tx_Disable - Low                       | $V_{Disable\_L}$ | $V_{EE}$ |      | $V_{EE}+0.8$ | V    |      |
| Optical Output Power                   | $P_o$            | -5       |      | 0            | dBm  | 1    |
| Optical Extinction Ratio               | $E_R$            | 8.2      |      |              | dB   |      |
| Center Wavelength                      | $\lambda_C$      | 1520     | 1550 | 1580         | nm   |      |
| Spectral Width (-20dB)                 | $\Delta\lambda$  |          |      | 1            | nm   |      |
| Side Mode Suppression Ratio            | SMSR             |          |      | 30           | dB   |      |
| Optical Rise / Fall Time               | $t_r / t_f$      |          |      | 0.16         | ns   | 2    |

### Notes:

1. Coupling into a 9/125 $\mu\text{m}$  single-mode fiber.
2. 20% to 80% value



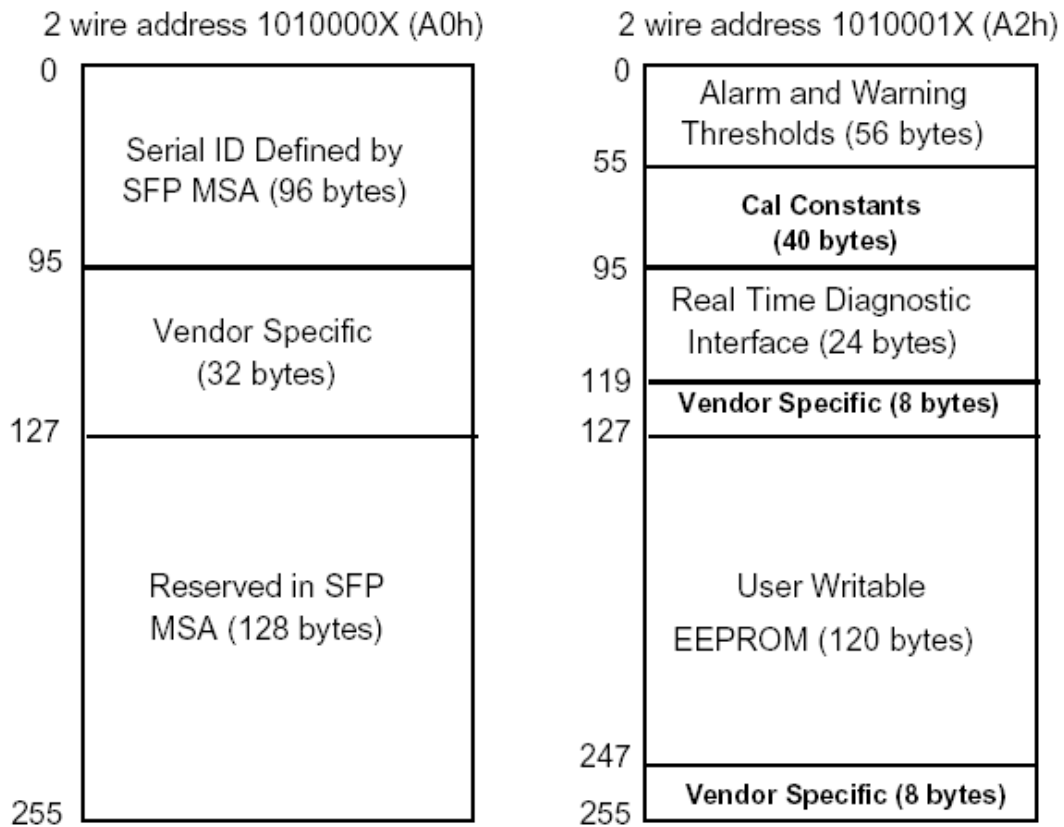
## Receiver Electro-Optical Interface

| Parameter                            | Symbol               | Min. | Typ. | Max. | Unit | Note |
|--------------------------------------|----------------------|------|------|------|------|------|
| Receiver Differential Output Voltage | RD +/-               | 400  |      | 2000 | mV   |      |
| Receiver Overload                    | P <sub>IN</sub> MAX  | 0    |      |      | dBm  | 1    |
| Receiver Sensitivity @2.67Gbps       | P <sub>IN</sub> MIN  |      |      | -18  | dBm  | 1    |
| Receiver Sensitivity @2.488Gbps      | P <sub>IN</sub> MIN  |      |      | -18  | dBm  | 1    |
| Receiver Sensitivity @2.125Gbps      | P <sub>IN</sub> MIN  |      |      | -18  | dBm  | 2    |
| Receiver Sensitivity @1.25Gbps       | P <sub>IN</sub> MIN  |      |      | -18  | dBm  | 2    |
| Receiver Sensitivity @1.063Gbps      | P <sub>IN</sub> MIN  |      |      | -18  | dBm  | 2    |
| Receiver Sensitivity @622Mbps        | P <sub>IN</sub> MIN  |      |      | -18  | dBm  | 1    |
| Receiver Sensitivity @622Mbps        | P <sub>IN</sub> MIN  |      |      | -18  | dBm  | 1    |
| Receiver Sensitivity @155Mbps        | P <sub>IN</sub> MIN  |      |      | -18  | dBm  | 1    |
| Operating Center Wavelength          | $\lambda_c$          | 1270 |      | 1580 | nm   |      |
| Return Loss                          | RL                   | 27   |      |      | dB   |      |
| Receiver Loss of Signal - TTL Low    | P <sub>RX_LOSD</sub> |      |      | -18  | dBm  |      |
| Receiver Loss of Signal - TTL High   | P <sub>RX_LOSA</sub> | -45  |      |      | dBm  |      |
| Receiver Loss of Signal - Hysteresis | P <sub>RX_LOSH</sub> | 0.5  |      |      | dB   |      |

### Notes:

1. With BER better than or equal to  $1 \times 10^{-10}$ , measured in the center of the eye opening with  $2^{23} - 1$  PRBS
2. With BER better than or equal to  $1 \times 10^{-12}$ , measured in the center of the eye opening with  $2^7 - 1$  PRBS

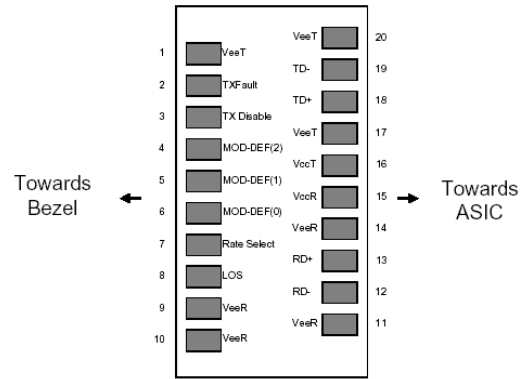
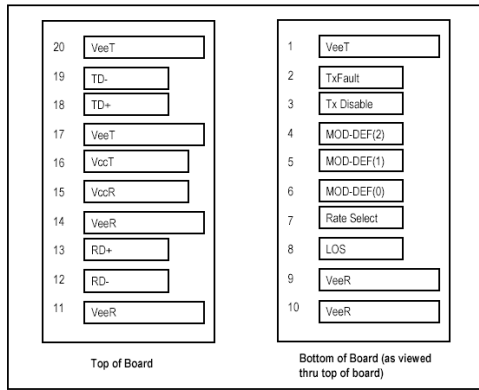
### Digital Diagnostic Memory Map



### Digital Diagnostic Monitoring Characteristics

| Parameter                  | Symbol     | Accuracy | Unit        | Note |
|----------------------------|------------|----------|-------------|------|
| Transceiver Temperature    | $T_{INT}$  | $\pm 3$  | $^{\circ}C$ |      |
| Transceiver Supply Voltage | $V_{INT}$  | $\pm 3$  | %           |      |
| TX Bias Current            | $I_{BIAS}$ | $\pm 10$ | %           |      |
| TX Output Power            | $P_{TX}$   | $\pm 3$  | dB          |      |
| RX Received Optical Power  | $P_{RX}$   | $\pm 3$  | dB          |      |

### Pin Description



**SFP Transceiver Electric Pad Layout**

**Diagram of Host Board Connector Block Pin Numbers and Names**

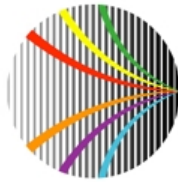
| Pin No | Pin Name    | Function  | Plug Seq. | Notes |
|--------|-------------|---|-----------|-------|
| 1      | VeeT        | Transmitter Ground                                | 1         |       |
| 2      | TX Fault    | Transmitter Fault Indication                      | 3         | 1     |
| 3      | TX Disable  | Transmitter Disable                               | 3         | 2     |
| 4      | MOD-DEF 2   | Module Definition 2                               | 3         | 3     |
| 5      | MOD-DEF 1   | Module Definition 1                               | 3         | 3     |
| 6      | MOD-DEF 0   | Module Definition 0                               | 3         | 3     |
| 7      | Rate Select | Select between full or reduced receiver bandwidth | 3         | 4     |
| 8      | LOS         | Loss of Signal                                    | 3         | 5     |
| 9      | VeeR        | Receiver Ground                                   | 1         | 6     |
| 10     | VeeR        | Receiver Ground                                   | 1         | 6     |
| 11     | VeeR        | Receiver Ground                                   | 1         | 6     |
| 12     | RD -        | Inv. Received Data Out                            | 3         | 7     |
| 13     | RD +        | Received Data Out                                 | 3         | 7     |
| 14     | VeeR        | Receiver Ground                                   | 1         | 6     |
| 15     | VccR        | Receiver Power                                    | 2         | 8     |
| 16     | VccT        | Transmitter Power                                 | 2         | 8     |
| 17     | VeeT        | Transmitter Ground                                | 1         | 6     |
| 18     | TD +        | Transmit Data In                                  | 3         | 9     |
| 19     | TD -        | Inv. Transmit Data In                             | 3         | 9     |
| 20     | VeeT        | Transmitter Ground                                | 1         | 6     |



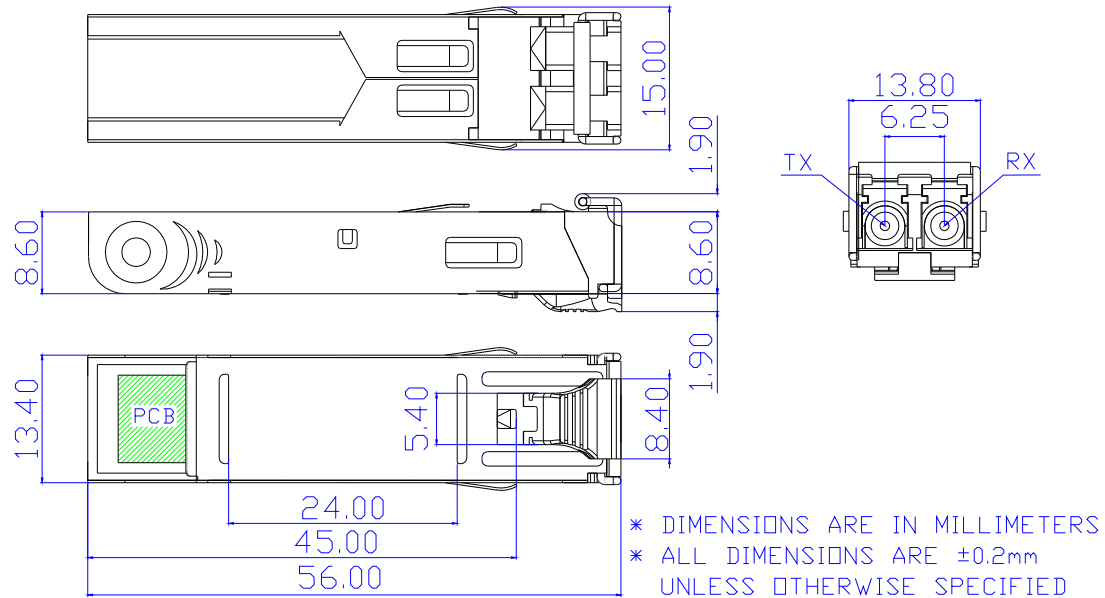
**Notes:**

Plug Seq.: Pin engagement sequence during hot plugging.

1. TX Fault is an open collector/drain output, which should be pulled up with a 4.7K – 10K $\Omega$  resistor on the host board. Pull up voltage between 2.0V and VccT, R+0.3V. When high, output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to < 0.8V.
2. TX disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a 4.7 – 10 K $\Omega$  resistor. Its states are:  
Low (0 – 0.8V): Transmitter on  
(>0.8, < 2.0V): Undefined  
High (2.0 – 3.465V): Transmitter Disabled  
Open: Transmitter Disabled
3. Mod-Def 0,1,2. These are the module definition pins. They should be pulled up with a 4.7K - 10K $\Omega$  resistor on the host board. The pull-up voltage shall be VccT or VccR  
Mod-Def 0 is grounded by the module to indicate that the module is present  
Mod-Def 1 is the clock line of two wire serial interface for serial ID  
Mod-Def 2 is the data line of two wire serial interface for serial ID
4. This is an optional input used to control the receiver bandwidth for compatibility with multiple data rates (most likely Fiber Channel 1x and 2x Rates). If implemented, the input will be internally pulled down with > 30k $\Omega$  resistor. The input states are:  
Low (0 - 0.8V): Reduced Bandwidth  
(>0.8 , < 2.0V): Undefined  
High (2.0 V -3.465V): Full Bandwidth  
Open: Reduced Bandwidth
5. LOS (Loss of Signal) is an open collector/drain output, which should be pulled up with a 4.7K -10K $\Omega$  resistor. Pull up voltage between 2.0V and VccT, R+0.3V. When high, this output indicates the received optical power is below the worst-case receiver sensitivity (as defined by the standard in use). Low indicates normal operation. In the low state, the output will be pulled to < 0.8V.
6. VeeR and VeeT may be internally connected within the SFP module.
7. RD-/+: These are the differential receiver outputs. They are AC coupled 100 $\Omega$  differential lines which should be terminated with 100 $\Omega$  (differential) at the user SERDES. The AC coupling is done inside the module and is thus not required on the host board. The voltage swing on these lines will be between 370 and 2000 mV differential (185 - 1000 mV single ended) when properly terminated.
8. VccR and VccT are the receiver and transmitter power supplies. They are defined as 3.3V  $\pm$ 5% at the SFP connector pin. Maximum supply current is 300 mA. Recommended host board power supply filtering is shown below. Inductors with DC resistance of less than 1 $\Omega$  should be used in order to maintain the required voltage at the SFP input pin with 3.3V supply voltage. When the recommended supply filtering network is used, hot plugging of the SFP transceiver module will result in an inrush current of no more than 30 mA greater than the steady state value. VccR and VccT may be internally connected within the SFP transceiver module.
9. TD-/+: These are the differential transmitter inputs. They are AC-coupled, differential lines with 100 $\Omega$  differential termination inside the module. The AC coupling is done inside the module and is thus not required on the host board. The inputs will accept differential swings of 500 mV - 2400 mV (250 mV - 1200 mV single-ended), though it is recommended that values between 500 and 1200 mV differential (250 mV- 600 mV single-ended) be used for best EMI performance.



## Mechanical Dimensions (Units in mm)



## Ordering Information

### AXSD-35C4-054<sub>x</sub>



#### Operating Temperature

- 1: 0~ 70°C
- 3: -40~ 85°C

| Model No.      | Wavelength | LD  | I/O   | LOS | Link | Temp.    |
|----------------|------------|-----|-------|-----|------|----------|
| AXSD-35C4-0541 | 1550nm     | DFB | AC/AC | TTL | 25km | 0~70°C   |
| AXSD-35C4-0543 | 1550nm     | DFB | AC/AC | TTL | 25km | -40~85°C |

#### NOTE:

Distances are indicative only. Attenuation of 0.25 dB/km is used for the link length calculations. To calculate a more precise link budget based on specific conditions in your application, please refer to the Optical Specifications in Page#3~4.