

## SNS SFP-8GD-LR

### 8Gbps SFP+ 1310 nm Single-Mode Optical Transceiver



#### Highlights

- SFP+ MSA transceiver
- Multi-Rate 2.125 to 8.5Gbps
- Protocols:
  - 2/4/8 Gbps Fibre Channel
- Single-mode fiber
- 1310nm DFB laser transmitter
- Dual Fiber (Tx/Rx)
- Up to 10km transmission with 9/125  $\mu$ m SMF
- Duplex LC connector
- Digital Diagnostics
- Hot-swap

#### Overview

Optical SNS SFP+ is a high performance transceiver compliant with Form-Factor Pluggable (SFP+) Multi-Source Agreement (MSA), supporting Multi-Rate 2.125 to 8.5 Gbps FC and transmission distance up to 10Km on 9/125  $\mu$ m SMF. The transceiver module comprises a transmitter with 1310nm DFB laser. Transmitter and receiver are separate within a wide temperature range of 0°C to +70°C and offers optimum heat dissipation and excellent electromagnetic shielding thus enabling high port densities for FC systems.

#### Specifications

|                             |                  |
|-----------------------------|------------------|
| Data Rates:                 | 2.125 to 8.5Gbps |
| Wavelength Tx               | 1310 nm          |
| Tx Power                    | -8.4 ~ 5 dBm     |
| Tx Disable                  | Yes              |
| Wavelength Range            | 1285 - 1345 nm   |
| Rx Sensitivity              | 0.042 mW         |
| Return Loss                 | 12 dBm           |
| Operating Temperature Range | 0°C to +70°C     |
| Power Consumption           | < 1.1 Watts      |

### Absolute Maximum Ratings

These values represent the damage threshold of the module. Stress in excess of any of the individual Absolute Maximum Ratings can cause immediate catastrophic damage to the module even if all other parameters are within Recommended Operating Conditions.

| Parameters                 | Symbol          | Min. | Max. | Unit |
|----------------------------|-----------------|------|------|------|
| Supply Voltage             | V <sub>CC</sub> | 0    | +3.8 | V    |
| Storage Temperature        | T <sub>c</sub>  | -40  | +85  | °C   |
| Operating Case Temperature | T <sub>c</sub>  | 0    | +70  | °C   |
| Relative Humidity          | RH              | 0    | 85   | %    |

### Operating Conditions

| Parameter                  | Symbol          | Min. | Typical | Max | Unit |
|----------------------------|-----------------|------|---------|-----|------|
| Supply Voltage             | V <sub>CC</sub> | 3.0  | 3.3     | 3.6 | V    |
| Supply current             | I <sub>CC</sub> |      | 200     | 300 | mA   |
| Operating Case Temperature | T <sub>c</sub>  | 0    | 25      | 70  | °C   |
| Module Power Dissipation   | P <sub>m</sub>  | -    | 0.7     | 1.1 | W    |

#### Notes:

1. Supply current is shared between VCCTX and VCCR<sub>X</sub>.
2. In-rush is defined as current level above steady state current requirements.

### Low Speed Characteristics

| Parameter         | Symbol | Min.         | Typical | Max          | Unit |
|-------------------|--------|--------------|---------|--------------|------|
| Power Consumption |        |              |         | 1            | W    |
| TX_Fault,RX_LOS   | VOL    | 0            |         | 0.4          | V    |
|                   | VOH    | Host_Vcc-0.5 |         | Host_Vcc+0.3 | V    |
| TX_DIS            | VIL    | -0.3         |         | 0.8          | V    |
|                   | VIH    | 2.0          |         | VCCT+0.3     | V    |
| RS0,RS1           | VIL    | -0.3         |         | 0.8          | V    |
|                   | VIH    | 2.0          |         | VCCT+0.3     | V    |

## Optical characteristics

| Parameter                                     | Symbol       | Min. | Typical | Max   | Unit | Ref. |
|---|--------------|------|---------|-------|------|------|
| <b>Transmitter</b>                            |              |      |         |       |      |      |
| Output Opt. Power, 8.5 Gb/s                   | $P_o$        | -8.4 |         | +0.5  | dBm  | 1    |
| Optical Wavelength                            | $\lambda$    | 1285 |         | 1345  | nm   | 2    |
| Side Mode Suppression Ratio                   | $SMSR_{min}$ | 30   |         |       | dB   | 2    |
| Optical Modulation Amplitude                  | OMA          | 290  |         |       | uW   | 2,3  |
| Transmitter and Dispersion Penalty, 8.5 Gb/s  | TDP          |      |         | 3.2   | dB   | 4    |
| <b>Receiver</b>                               |              |      |         |       |      |      |
| Unstressed Receiver OMA Sensitivity, 8.5 Gb/s | $R_{SENSr}$  |      |         | 0.042 | mW   | 5    |
| Average Received Power                        | $R_{XMAX}$   |      |         | +0.5  | dBm  |      |
| Optical Center Wavelength                     | $\lambda_C$  | 1260 |         | 1360  | nm   |      |
| Return Loss                                   |              | 12   |         |       | dB   |      |
| LOS De-Assert                                 | $LOS_D$      |      |         | -18   | dBm  |      |
| LOS Assert                                    | $LOS_A$      | -30  |         |       | dBm  |      |
| LOS Hysteresis                                |              | 0.5  |         |       | dB   |      |

### Notes:

1. High Bandwidth Mode. Class 1 Laser Safety per FDA/CDRH and EN (IEC) 60825 regulations.
2. Also specified to meet curves in FC-PI-4 Rev 8.001 Figures 21, 22, and 23, which allow trade-off between wavelength, spectral width and OMA.
3. Equivalent extinction ratio specification for Fibre Channel. Allows smaller ER at higher average power.
4. For 8.5 Gb/s operation, Jitter values for gamma T and gamma R are controlled by TDP and stressed receiver sensitivity.
5. Measured with conformance signals defined in FC-PI-4 Rev. 8.00 specifications. Value in OMA. Measured with PRBS 27-1 at 10-12 BER.

## Electrical characteristics

| Parameter                            | Symbol                          | Min.            | Typical | Max                             | Unit | Ref. |
|--------------------------------------|---------------------------------|-----------------|---------|---------------------------------|------|------|
| Supply Voltage                       | V <sub>CC</sub>                 | 3.00            |         | 3.60                            | V    | 1    |
| Supply Voltage                       | I <sub>CC</sub>                 |                 | 200     | 300                             | mA   | 1    |
| <b>Transmitter</b>                   |                                 |                 |         |                                 |      |      |
| Input differential impedance         | R <sub>in</sub>                 |                 | 100     |                                 | Ω    | 2    |
| Single ended data input swing        | V <sub>in,pp</sub>              | 150             |         | 900                             | mV   |      |
| Transmit Disable Voltage             | V <sub>D</sub>                  | 2               |         | V <sub>CC</sub>                 | V    |      |
| Transmit Enable Voltage              | V <sub>EN</sub>                 | V <sub>ee</sub> |         | V <sub>ee</sub> +0.8            | V    | 3    |
| <b>Receiver</b>                      |                                 |                 |         |                                 |      |      |
| Single ended data output swing       | V <sub>out,pp</sub>             | 300             |         | 800                             | mV   | 4    |
| Data output rise/fall time, 8.5 Gb/s | T <sub>r</sub> , t <sub>f</sub> |                 |         | 60                              | ps   | 5    |
| LOS Fault                            | V <sub>LOS fault</sub>          | 2               |         | V <sub>CC</sub> <sub>HOST</sub> | V    | 6    |
| LOS Normal                           | V <sub>LOS norm</sub>           | V <sub>ee</sub> |         | V <sub>ee</sub> +0.8            | V    | 6    |

Notes:

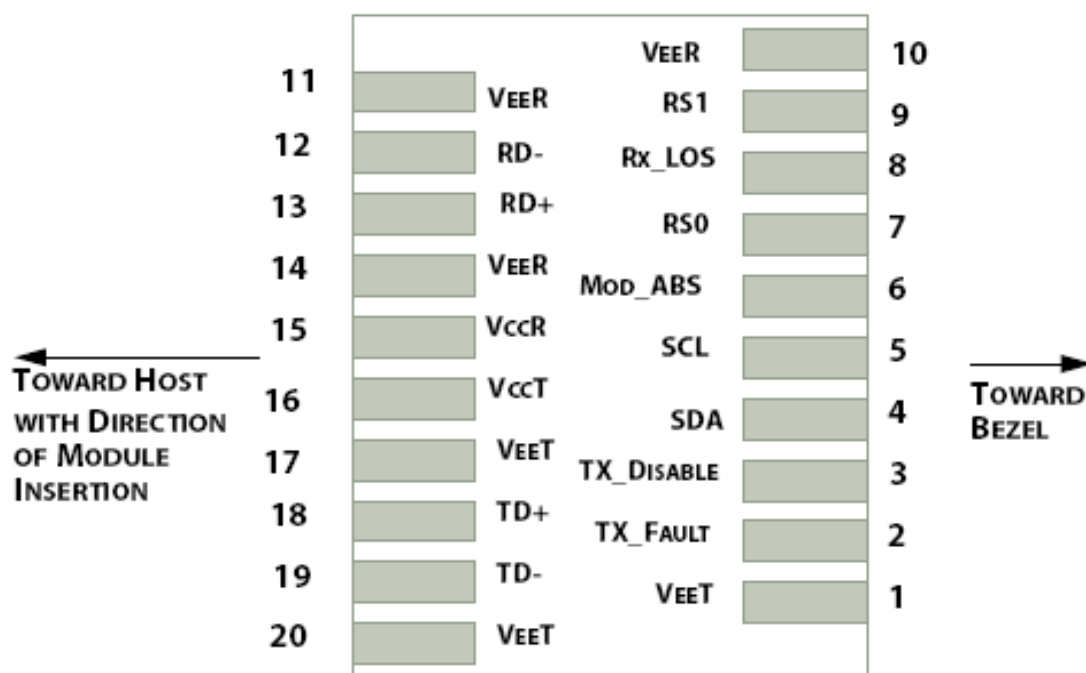
1. Module power consumption never exceeds 1W.
2. AC coupled.
3. Or open circuit.
4. Into 100 ohm differential termination.
5. 20 – 80 %.
6. LOS is LVTTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.

## General Specifications

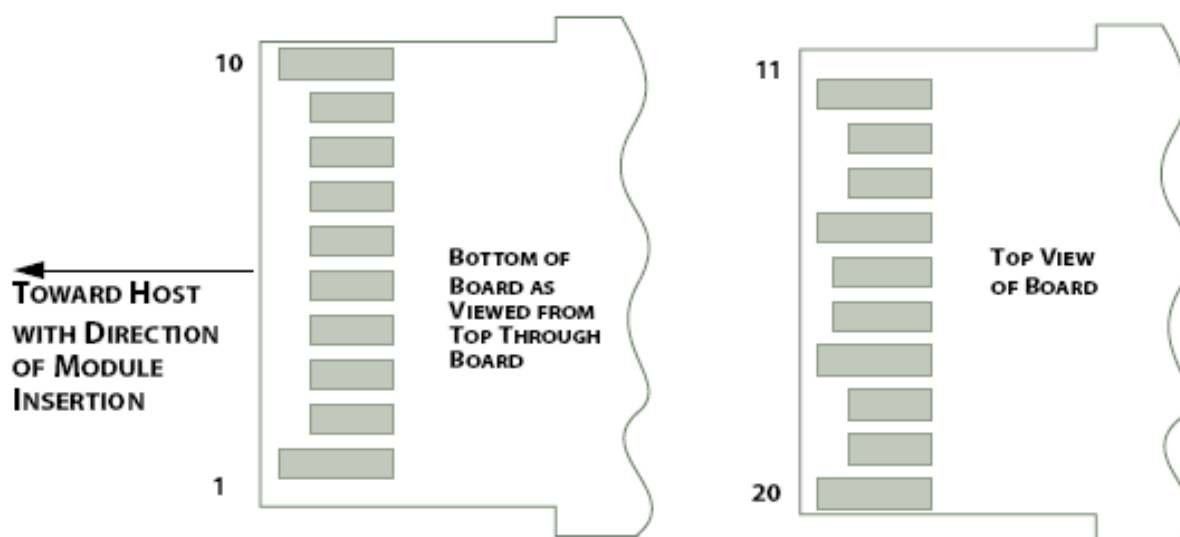
| Parameter                                  | Symbol | Min.  | Typical | Max               | Unit   | Notes |
|--|--------|-------|---------|-------------------|--------|-------|
| Data Rate                                  | DR     | 2.125 |         | 8.5               | Gb/sec | 1     |
| Bit Error Rate                             | BER    |       |         | 10 <sup>-12</sup> |        | 2     |
| Max. Supported Link Length on 9/125 μm SMF | L      |       | 10      |                   | Km     | 3     |

Notes:

1. 2x/4x/8x Fibre Channel compliant.
2. Tested with a PRBS 2<sup>-1</sup> test pattern.
3. Distances are based on FC-P1-4 Rev. 8.00<sup>1</sup> and IEEE 802.3 standards.



**Figure 1: Interface to Host PCB**



**Figure 2: Module Contact Assignment**

## Pin definition

| Pin | Symbol       | Name/Description  |
|-----|--------------|---|
| 1   | VEET [1]     | Transmitter Ground  |
| 2   | Tx_FAULT [2] | Transmitter Fault   |
| 3   | Tx_DIS [3]   | Transmitter Disable. Laser output disabled on high or open    |
| 4   | SDA [2]      | 2-wire Serial Interface Data Line                             |
| 5   | SCL [2]      | 2-wire Serial Interface Clock Line                            |
| 6   | MOD_ABS [4]  | Module Absent. Grounded within the module                     |
| 7   | RS0 [5]      | Rate Select 0   |
| 8   | RX_LOS [2]   | Loss of Signal indication. Logic 0 indicates normal operation |
| 9   | RS1 [5]      | Rate Select 1   |
| 10  | VEER [1]     | Receiver Ground   |
| 11  | VEER [1]     | Receiver Ground   |
| 12  | RD-          | Receiver Inverted DATA out. AC Coupled                        |
| 13  | RD+          | Receiver DATA out. AC Coupled                                 |
| 14  | VEER [1]     | Receiver Ground   |
| 15  | VCCR         | Receiver Power Supply   |
| 16  | VCCT         | Transmitter Power Supply                                      |
| 17  | VEET [1]     | Transmitter Ground  |
| 18  | TD+          | Transmitter DATA in. AC Coupled                               |
| 19  | TD-          | Transmitter Inverted DATA in. AC Coupled                      |
| 20  | VEET [1]     | Transmitter Ground  |

### Notes:

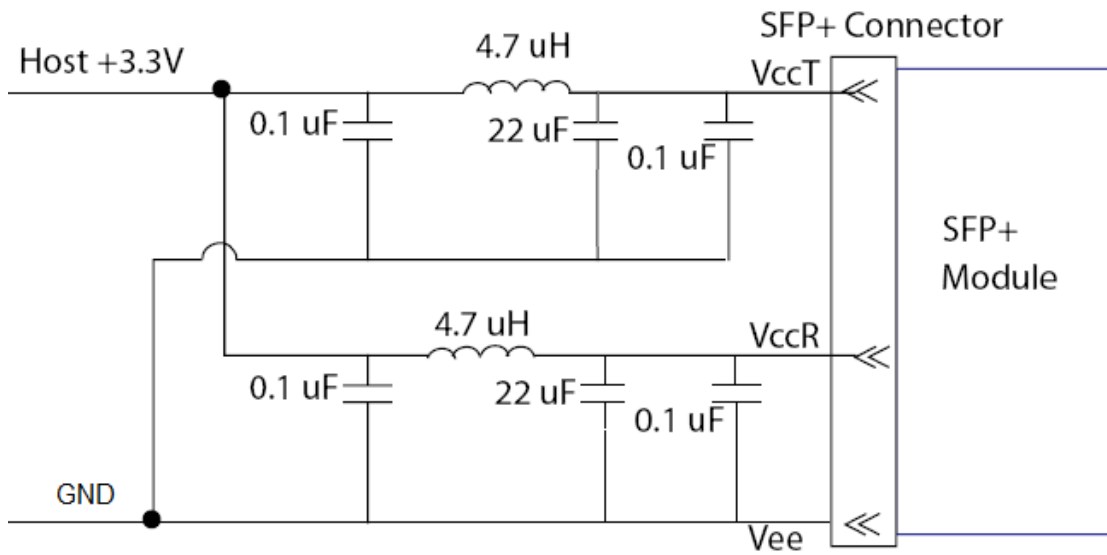
[1] Module circuit ground is isolated from module chassis ground within the module.

[2].should be pulled up with 4.7k – 10k ohms on host board to a voltage between 3.15V and 3.6V.

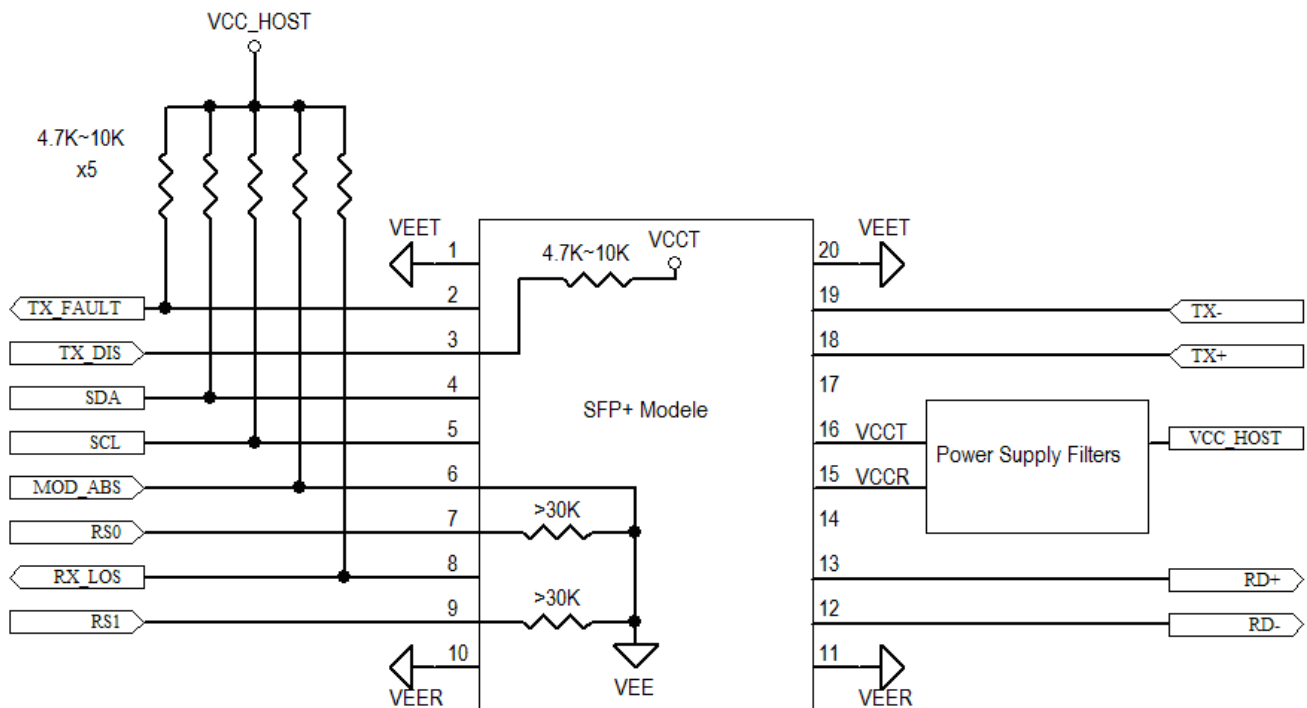
[3]Tx\_Disable is an input contact with a 4.7 kΩ to 10 kΩ pullup to VccT inside the module.

[4]Mod\_ABS is connected to VeeT or VeeR in the SFP+ module. The host may pull this contact up to Vcc\_Host with a resistor in the range 4.7 kΩ to 10 kΩ. Mod\_ABS is asserted "High" when the SFP+ module is physically absent from a host slot.

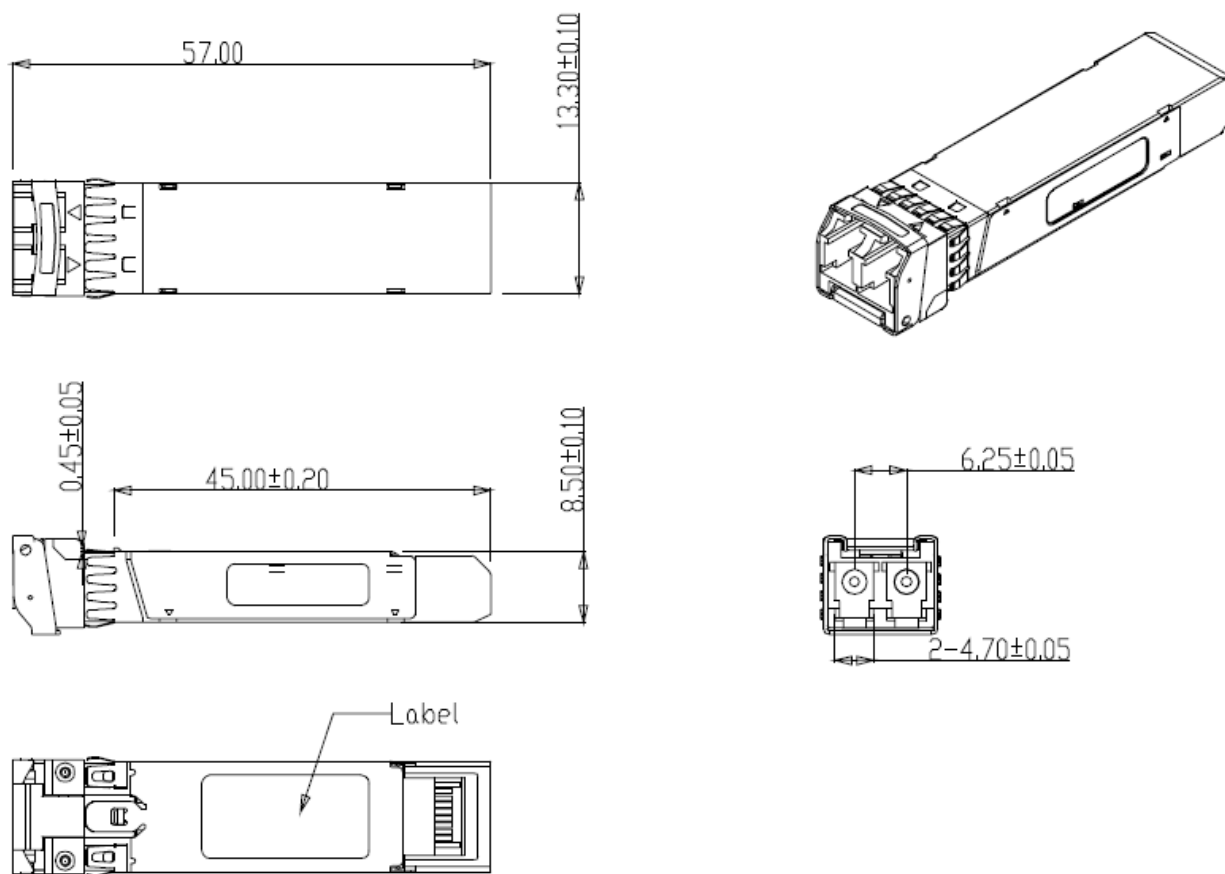
[5] RS0 and RS1 are module inputs and are pulled low to VeeT with > 30 kΩ resistors in the module.



**Figure3. Host Board Power Supply Filters Circuit**



**Figure4. Host-Module Interface**



**Figure5. Mechanical Specifications**

## Regulatory Compliance

SFP+ transceiver is designed to be Class I Laser safety compliant and is certified per the following standards:

| Feature                  | Agency | Standard  | Certificate / Comments |
|--------------------------|--------|---|------------------------|
| Laser Safety             | FDA    | CDRH 21 CFR 1040 annd Laser Notice No. 50         | 1120292-000            |
| Product Safety           | UL     | UL and CUL EN60950-2:2007                         | E347511                |
| Environmental protection | SGS    | RoHS Directive 2002/95/EC                         | GZ1001008918/CHEM      |
| EMC                      | WALTEK | EN 55022:2006+A1:2007<br>EN 55024:1998+A1+A2:2003 | WT10093759-D-E-E       |





### Ordering information

| Part Number    | Product Description                                |
|----------------|--|
| SNS SFP-8GD-LR | 8Gbps SFP+ 1310 nm Single-Mode Optical Transceiver |

### References

1. "Specifications for Enhanced Small Form Factor Pluggable Module SFP+", SFF-8431, Rev 4.1, July 6, 2009.
2. "Improved Pluggable Formfactor", SFF-8432, Rev 4.2, Apr 18, 2007
3. IEEE802.3ae – 2002
4. "Diagnostic Monitoring Interface for Optical Transceivers" SFF-8472, Rev 10.3, Dec 1, 2007

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