

10Gbps 300m Range 850nm SFP+ Optical Transceiver

Optical Transceivers

Overview

ARIA's 10Gbps 300m Range 850nm SFP+ Optical Transceiver is designed to transmit and receive optical data over 50/125 μm or 62.5/125 μm multi mode optical fiber (see table below).

The transceiver module is comprised of a transmitter with an 850nm VCSEL and receiver with a PIN photo detector.

The transmitter converts 10Gb/s serial PECL or CML electrical data into serial optical data compliant with the 10GBASE-SR standard.

The receiver converts 10Gb/s serial optical data into serial PECL/CML electrical data.

The module provides differential termination and reduces differential to common mode conversion for quality signal termination and low EMI.



SFP+ SR Operating Range for each Optical Fiber Type

Fiber Type	Minimum Modal Bandwidth @ 850 nm (MHz*km)	Operating Range (Meters)
62.5 μm MMF	160	2 to 26
	200	2 to 33
50 μm MMF	400	2 to 66
	500	2 to 82
	2000	2 to 300

Description

The SFP+ SR module electrical interface is compliant to SFI electrical specifications.

The transmitter input and receiver output impedance is 100 Ω differential.

Data lines are internally AC coupled.

SFI typically operates over 200mm of improved FR4 material or up to about 150mm of standard FR4 with one connector.

An open collector compatible Transmit Disable (Tx_Dis) is provided. A logic "1," or no connection on this pin will disable the laser from transmitting. A logic "0" on this pin provides normal operation.

The transmitter has an internal automatic power control loop (APC) to ensure constant optical power output across supply voltage and temperature variations.

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An open collector compatible Transmit Fault (TFault) is provided. TX_Fault is a module output contact that when high, indicates that the module transmitter has detected a fault condition related to laser operation or safety. The TX_Fault output contact is an open drain/collector and shall be pulled up to the Vcc_Host in the host with a resistor in the range 4.7-10 k Ω .

TX_Disable is a module input contact. When TX_Disable is asserted high or left open, the SFP+ module transmitter output shall be turned off. This contact shall be pulled up to VccT with a 4.7-10k Ω resistor.

An open collector compatible Loss of Signal is provided. Rx_LOS when high indicates an optical signal level below that specified in the relevant standard. The Rx_LOS contact is an open drain/collector output and shall be pulled up to Vcc_Host in the host with a resistor in the range 4.7-10 k Ω , or with an active termination.

Power supply filtering is recommended for both the transmitter and receiver.

The Rx_LOS signal is intended as a preliminary indication to the system in which the SFP+ is installed that the received signal strength is below the specified range. Such an indication typically points to non-installed cables, broken cables, or a disabled, failing or a powered off transmitter at the far end of the cable.

Features

- Applications are: 10GBASE-SR at 10.3125Gbps, 10GBASE-SW at 9.953Gbps and other optical links
- Optical interface compliant to IEEE 802.3ae
- Electrical interface compliant to SFF-8431
- Hot Pluggable
- Operating case temperature: 0 to 70 °C
- Low power consumption
- Maximum link length of 300m on 2000MHz/km MMF
- All-metal housing for superior EMI performance
- Advanced firmware allows customer system encryption information to be stored in the transceiver
- Cost effective SFP+ solution, enables higher port densities and greater bandwidth
- RoHS6 compliant (lead free)



Absolute Maximum Rating

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.

Parameter	Symbol	Min.	Max.	Units
Power Supply Voltage	Vcc	0	+3.6	V
Storage Temperature	Tc	-40	+85	°C
Operating Case Temperature	Tc	0	+70	°C
Relative Humidity	RH	5	95	%
RX Input Average Power	Pmax	-	0	dBm

Recommended Operating Environment

Recommended operating environment specifies parameters for which the electrical and optical characteristics hold unless otherwise noted.

Parameter	Symbol	Min.	Typical	Max.	Units
Power Supply Voltage	Vcc	3.135	3.300	3.465	V
Operating Case Temperature	Tc	0	25	70	°C

Low Speed Characteristics

Parameter	Symbol	Min.	Max.	Units
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

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Optical Characteristics

The following optical characteristics are defined over the recommended operating environment unless otherwise specified.

Parameter	Symbol	Min.	Typical	Max.	Units
Transmitter					
Center Wavelength	λ_t	840	850	860	nm
RMS Spectral Width¹	P_m	-	-	-	nm
Average Optical Power²	P_{avg}	-6.5	-	-1	dBm
Extinction Ratio³	ER	3.5	-	-	dB
Transmitter Dispersion Penalty	TDP	-	-	3.9	dB
Relative Intensity Noise⁵	R_{in}	-	-	-128	dB/Hz
Optical Return Loss Tolerance	-	-	-	12	dB
Receiver					
Center Wavelength	λ_r	840	850	860	nm
Receiver Sensitivity⁴	P_{sens}	-	-	-11.1	dBm
Stressed Sensitivity in OMA⁴	-	-	-	-7.5	dBm
Los Function	Los	-30	-	-12	dBm
Overload⁴	P_{in}	-	-	-1.0	dBm
Receiver Reflectance	-	-	-	-12	dB

Notes:

1. Trade-offs are available between spectral width, center wavelength and minimum OMA, as presented in the "Electrical Characteristics" table.
2. The optical power is launched into MMF.
3. Measured with a PRBS 2³¹-1 test pattern @10.3125Gbps.
4. Measured with a PRBS 2³¹-1 test pattern @10.3125Gbps, BER≤10⁻¹².
5. 12dB reflection.

Minimum 10GBASE-SR OMA as a Function of Wavelength and Spectral Width

Center Wavelength (nm)	RMS Spectral Width (nm)								
	Up to 0.05	0.05 to 0.1	0.1 to 0.15	0.15 to 0.2	0.2 to 0.25	0.25 to 0.3	0.3 to 0.35	0.35 to 0.4	0.4 to 0.45
840 to 842	-4.2	-4.2	-4.1	-4.1	-3.9	-3.8	-3.5	-3.2	-2.8
842 to 844	-4.2	-4.2	-4.2	-4.1	-3.9	-3.8	-3.6	-3.3	-2.9
844 to 846	-4.2	-4.2	-4.2	-4.1	-4.0	-3.8	-3.6	-3.3	-2.9
846 to 848	-4.3	-4.2	-4.2	-4.1	-4.0	-3.8	-3.6	-3.3	-2.9
848 to 850	-4.3	-4.2	-4.2	-4.1	-4.0	-3.8	-3.6	-3.3	-3.0
850 to 852	-4.3	-4.2	-4.2	-4.1	-4.0	-3.8	-3.6	-3.4	-3.0
852 to 854	-4.3	-4.2	-4.2	-4.1	-4.0	-3.9	-3.7	-3.4	-3.1
854 to 856	-4.3	-4.3	-4.2	-4.1	-4.0	-3.9	-3.7	-3.4	-3.1
856 to 858	-4.3	-4.3	-4.2	-4.1	-4.0	-3.9	-3.7	-3.5	-3.1
858 to 860	-4.3	-4.3	-4.2	-4.2	-4.1	-3.9	-3.7	-3.5	-3.2

Electrical Characteristics

The following electrical characteristics are defined over the recommended operating environment unless otherwise specified.

Parameter	Symbol	Min.	Typical	Max.	Units
Data Rate	-	-	10.3125	-	Gbps
Power Consumption	-	-	1200	1500	mW
Transmitter					
Single Ended Output Voltage Tolerance	-	-0.3	-	4.0	V
C Common Mode Voltage Tolerance	-	15	-	-	mV
Tx Input Diff Voltage	VI	400	-	1600	mV
Tx Fault¹	VoL	-0.3	-	0.4	V
Data Dependent Input Jitter	DDJ	-	-	0.10	UI
Data Input Total Jitter	TJ	-	-	0.28	UI
Receiver					
Single Ended Output Voltage Tolerance	-	-0.3	-	4.0	V
Rx Output Diff Voltage	Vo	300	-	850	mV
Rx Output Rise and Fall Time²	Tr/Tf	30	-	-	ps
Total Jitter	TJ	-	-	0.70	UI
Deterministic Jitter	DJ	-	-	0.42	UI

Notes:

1. At 0.7 mA.
2. 20% to 80%.

Figure 1: Interface to Host PBC

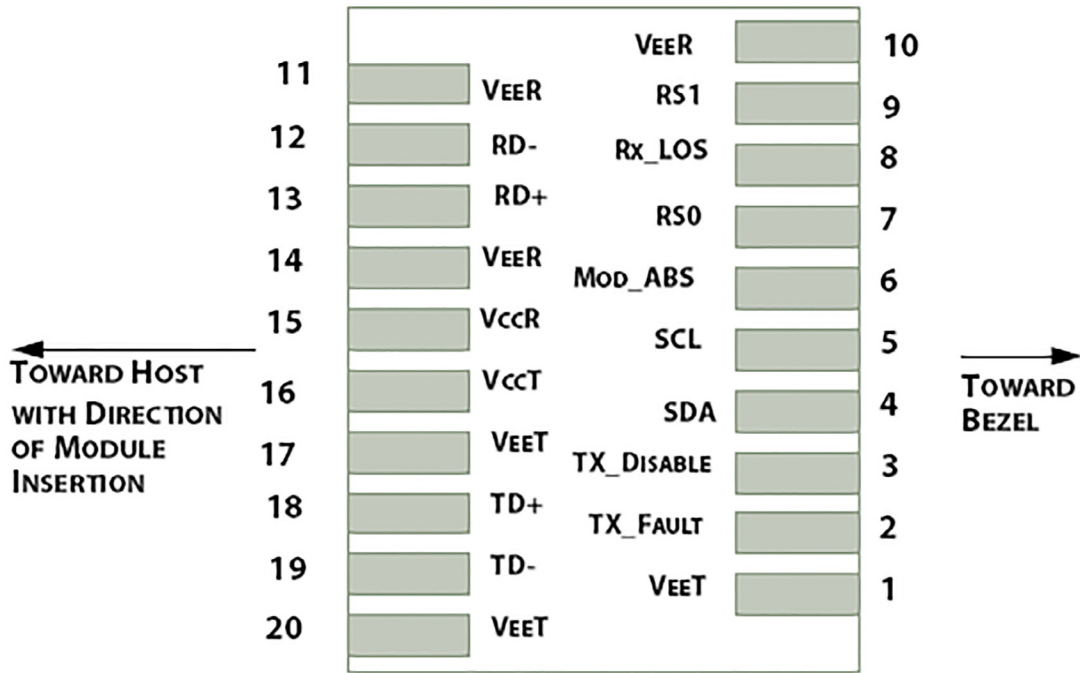
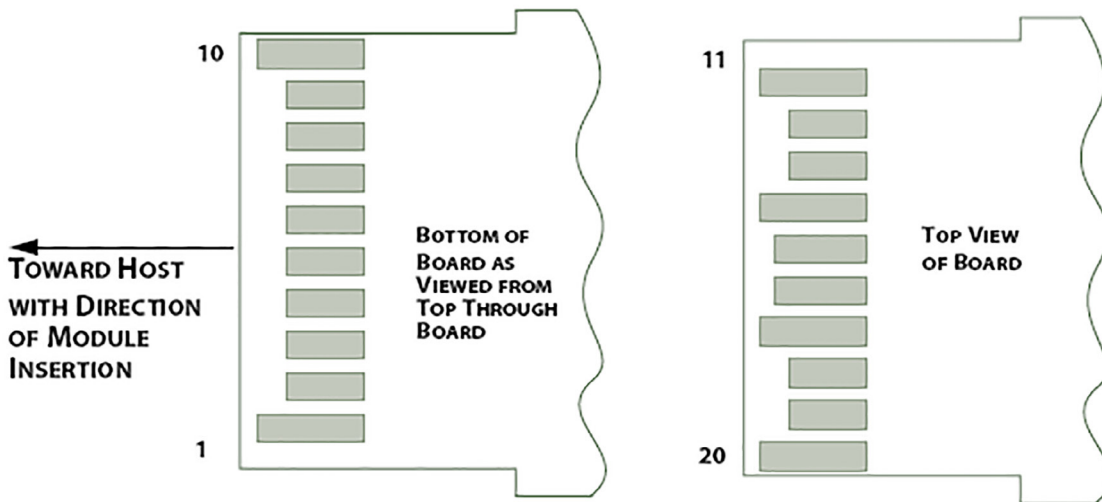


Figure 2: Module Contact Assignment



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 4.7kΩ-10kΩ on host board to a voltage between 3.15V and 3.6V.
3. Tx_Disable is an input contact with a 4.7kΩ-10kΩ 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 4.7kΩ-10kΩ. 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.

Figure 3. Host Board Power Supply Filters Circuit

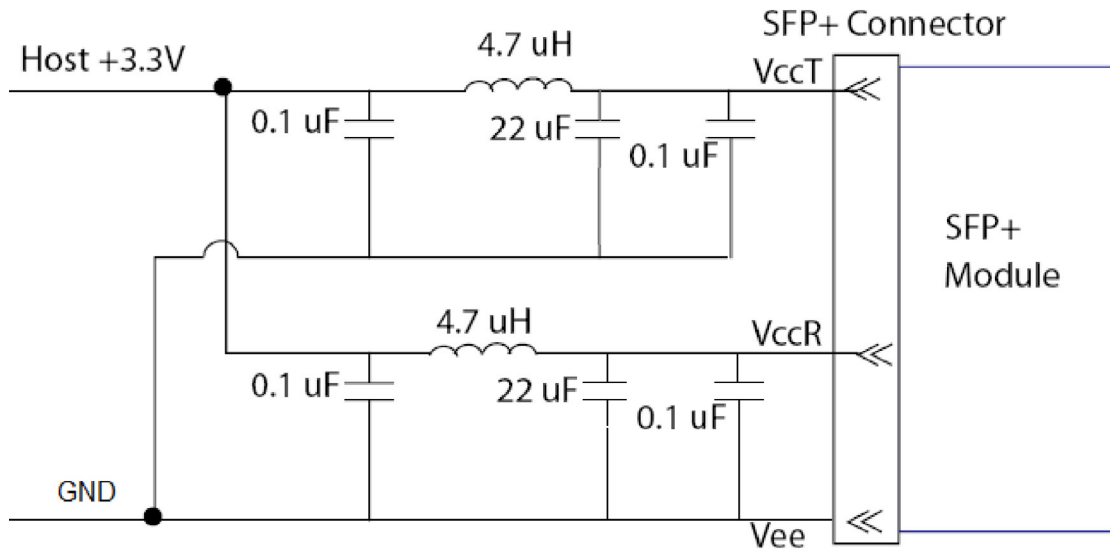


Figure 4. Host-Module Interface

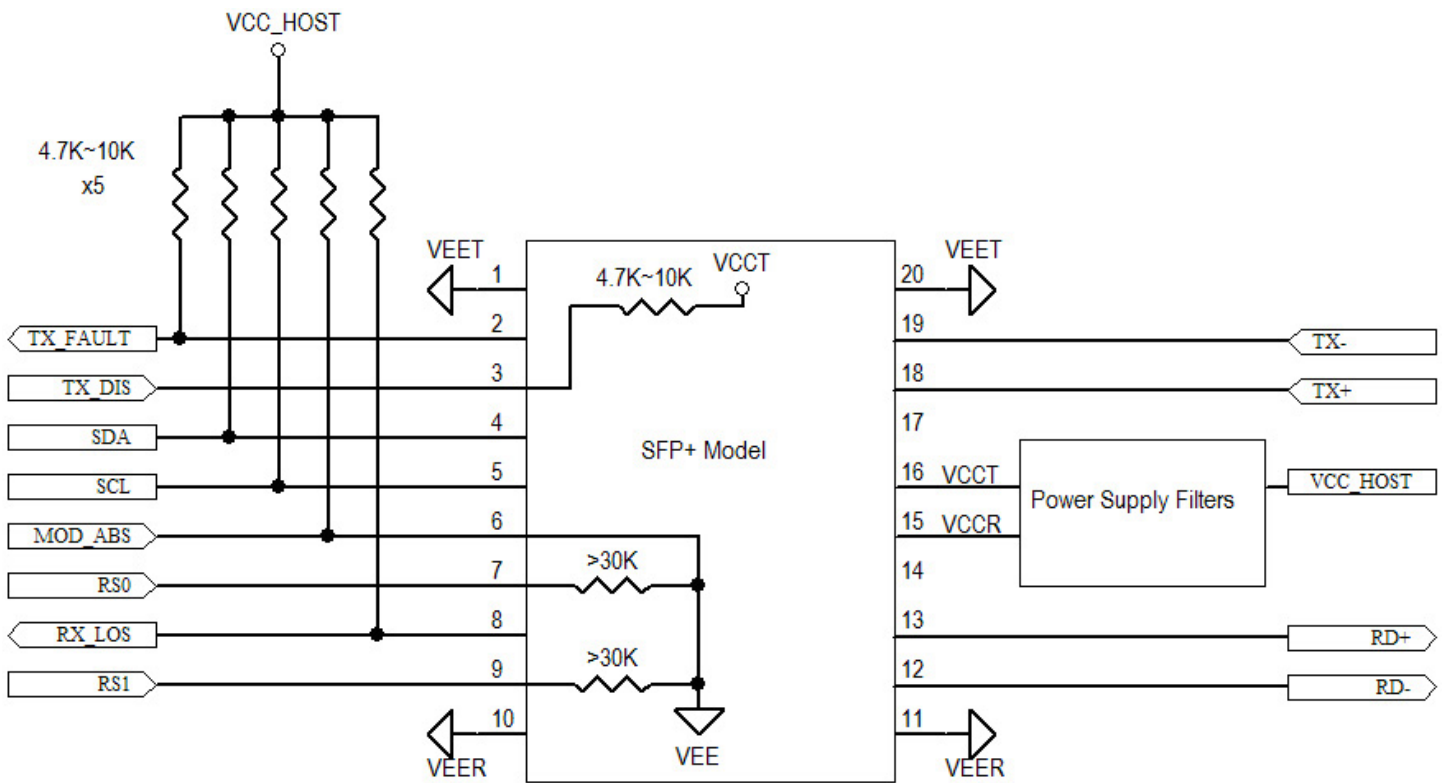
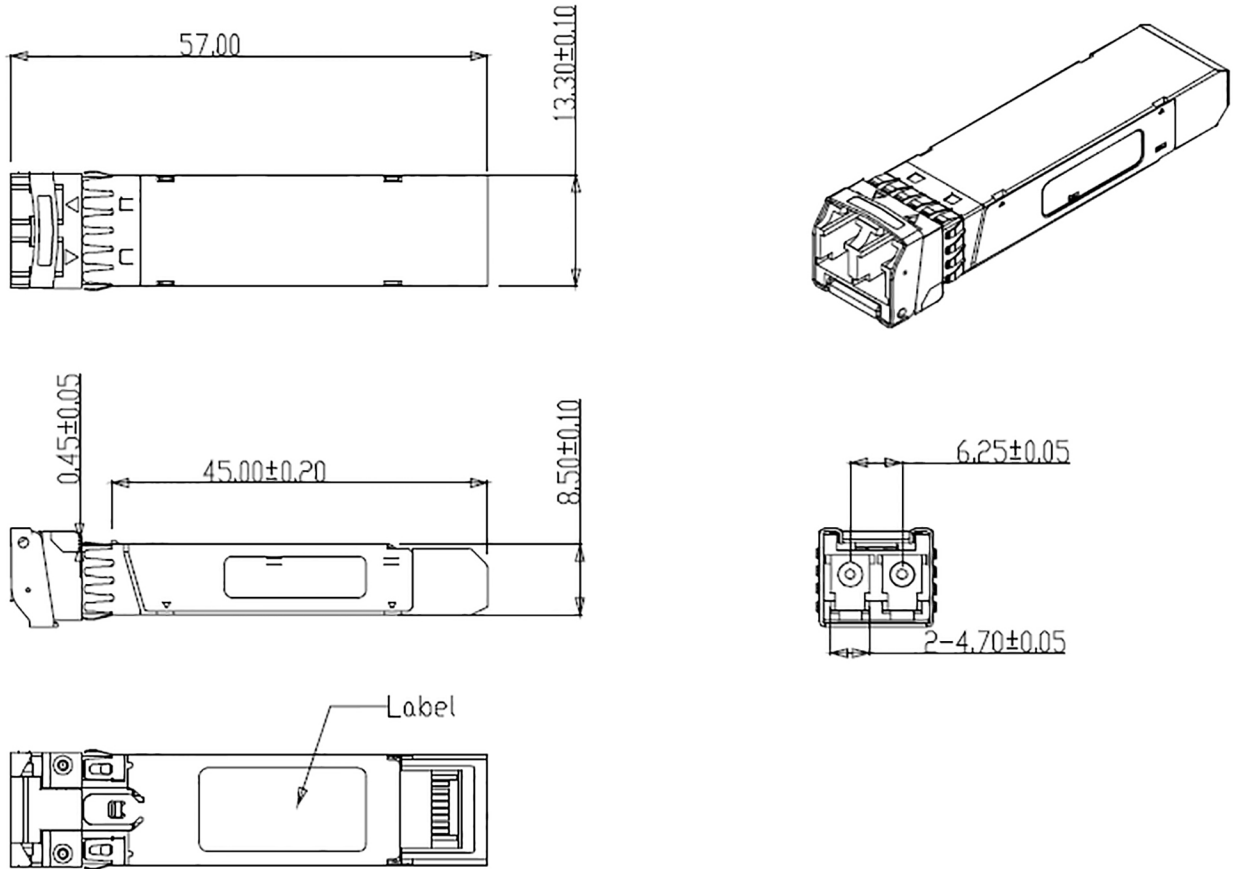


Figure 5: Mechanical Specifications



Regulatory Compliance

This 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 and 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 EN 55024:1998+A1+A2:2003	WT10093759-D-E-E

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Ordering Information

Part Number	Product Description
AT-10GBPS-300M-SRC	850nm,10Gbps,SFP + 300m, 0°C - +70°C

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