

FOCUS-8548-02X 4.25Gbps SFP

Transceiver with Internally-calibrated

Digital Diagnostic Function

Features

- Compliant with SFP Transceiver SFF-8472 MSA specification with internal calibration
- Compliant with proposed specifications for IEEE 802.3z/Gigabit Ethernet
- Compliant with MSA SFP specification
- Compliant with Industry Standard RFT Electrical Connector and Cage
- 100Ω differential AC coupled CML Outputs
- Single + 3.3V Power Supply and TTL Logic Interface
- Up to 4.25Gb/s bi-directional data link
- 850nm Oxide VCSEL Laser Transmitter
- Up to 500m with 50/125 μm MMF , 300m on 62.5/125 μm MMF
- Hot Pluggable
- EEPROM with Serial ID Functionality
- Duplex LC Connector interface
- Metal enclosure, for lower EMI
- Class 1 Laser Product Compliant with the Requirements of IEC 60825-1 and IEC 60825-2

Applications

- ◆ Tri-Rate 1.063/2.125/4.25 Gb/s Fibre Channel
- ◆ 1.25 Gb/s 1000Base-SX Ethernet

Description

The FOCUS-8548-02X pluggable transceiver module is a high performance integrated duplex data link for bi-directional communication over multimode optical fiber. It is compliant with the MSA Small Form Factor Pluggable (SFP) specification.

The FOCUS- 8548 -02D series are designed to be compliant with SFF-8472 SFP Multi-source Agreement (MSA).

Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Storage Temperature	Ts	-40		85	°C	
Supply Voltage	VCC	-0.5		4.0	V	

Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Ambient Operating Temperature	T _A	0		70	°C	
Supply Voltage	VCC	3.15	3.3	3.45	V	
Baud Rate		1.0625		4.25	GBaud	
Total Supply Current	I _S			300	mA	
Surge Current	I _{surge}			+30	mA	

PERFORMANCE SPECIFICATIONS - ELECTRICAL

0°C < T_c < +80°C; +3.15V < V_{cc} < +3.6V

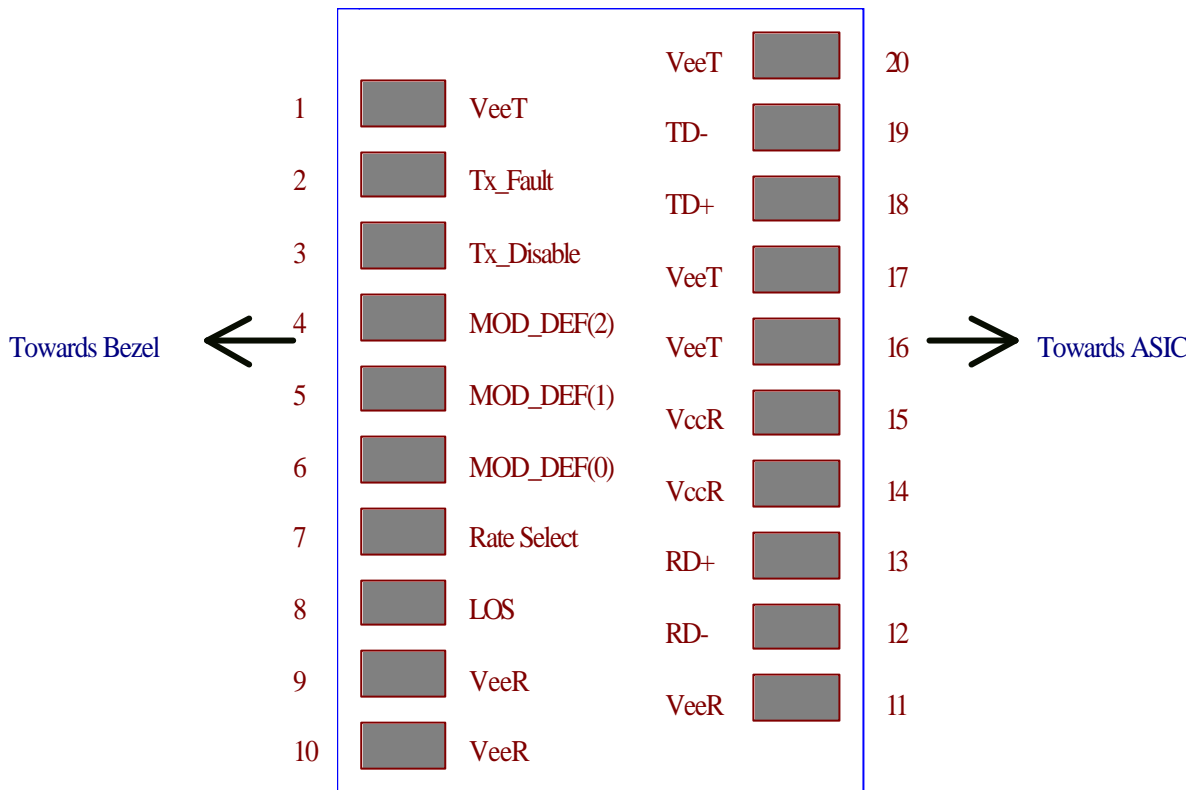
Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
TRANSMITTER						
CML/PECL Inputs (Differential)	V _{in}	400		2500	mVpp	AC coupled inputs
Input Impedance (Differential)	Z _{in}	85	100	115	ohms	R _{in} > 100 kohms @ DC
Tx_DISABLE Input Voltage - High		2		3.45	V	
Tx_DISABLE Input Voltage - Low		0		0.8	V	
Tx_FAULT Output Voltage -- High		V _{cc} -0.5		V _{cc} +0.3	V	I _o = 400μA; Host V _{cc}
Tx_FAULT Output Voltage -- Low		0		0.5	V	I _o = -4.0mA
RECEIVER						
CML Outputs (Differential)	V _{out}	400	800	1200	mVpp	AC coupled outputs
Output Impedance (Differential)	Z _{out}	85	100	115	ohms	
Rx_LOS Output Voltage - High		V _{cc} -0.5		V _{cc} +0.3	V	I _o = 400μA; Host V _{cc}
Rx_LOS Output Voltage - Low		0		0.8	V	I _o = -4.0mA
Total Jitter [Pk - Pk]	TJ			23.5	ps	Measured with 27 - 1 PRBS @ 4.25Gbps
MOD_DEF (0:2)	VoH	2.5			V	With Serial ID
	VoL	0		0.5	V	

OPTICAL SPECIFICATIONS

0°C<Tc<+80°C; +3.15V<Vcc<+3.6V

Parameter		Symbol	Min.	Typ.	Max	Unit	Notes
50μ m Core Diameter MMF	1.063G				550	m	BER<1.0E-12
	2.125G				300		
	4.25G				150		
62.5μ m Core Diameter MMF	1.063G				300		
	2.125G				150		
	4.25G				70		
TRANSMITTER							
Optical Center Wavelength	λ	830			855	nm	
Spectral Width	$\Delta\lambda$				0.85	nm	RMS
Optical Transmit Power	Po	-9			-2.5	dBm	Average @850nm
Extinction Ratio @1.25Gbps	ER	9				dB	P1/P0
Total Jitter	TJ				28.2	ps	Measured with 2 ⁷ - 1 PRBS@4.25Gbps
Output Rise/Fall Time	tR, tF				150	ps	20-80%; measured @ 4.25GBaud
RECEIVER							
Optical Input Wavelength	λ	770			860	nm	
Receiver Sensitivity @ 1.0625 Gb/s					-20	dBm	
Receiver Sensitivity @ 1.25Gb/s					-20	dBm	
Receiver Sensitivity @ 2.125Gb/s					-18	dBm	
Receiver Sensitivity @ 4.25Gb/s					-15	dBm	
Optical Return Loss	ORL	12				dB	
RX_LOS - Asserted	Pa	-29				dBm	Measured on transition - Low to High
RX_LOS - Deasserted	Pd				-17	dBm	Measured on transition - High to Low

SFP Transceiver Electrical Pad Layout



Pin Function Definitions

Pin Num.	Name	FUNCTION	Plug Seq.	Notes
1	VeeT	Transmitter Ground	1	
2	TX Fault	Transmitter Fault Indication	3	Note 1
3	TX Disable	Transmitter Disable	3	Note 2, Module disables on high or open
4	MOD-DEF2	Module Definition 2	3	Note 3, 2 wire serial ID interface
5	MOD-DEF1	Module Definition 1	3	Note 3, 2 wire serial ID interface
6	MOD-DEF0	Module Definition 0	3	Note 3, 2 wire serial ID interface
7	Rate Select	Not Connect	3	Function not available
8	LOS	Loss of Signal	3	Note 4
9	VeeR	Receiver Ground	1	Note 5
10	VeeR	Receiver Ground	1	Note 5

11	VeeR	Receiver Ground	1	Note 5
12	RD-	Inv. Received Data Out	3	Note 6
13	RD+	Received Data Out	3	Note 7
14	VeeR	Receiver Ground	1	Note 5
15	VccR	Receiver Power	2	3.3 ± 5%, Note 7
16	VccT	Transmitter Power	2	3.3 ± 5%, Note 7
17	VeeT	Transmitter Ground	1	Note 5
18	TD+	Transmit Data In	3	Note 8
19	TD-	Inv. Transmit Data In	3	Note 8
20	VeeT	Transmitter Ground	1	Note 5

Notes:

1) TX Fault is an open collector/drain output, which should be pulled up with a 4.7K – 10KO 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 O 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 – 10KO resistor on the host board. The pull-up voltage shall be VccT or VccR (see Section IV for further details). 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) LOS (Loss of Signal) is an open collector/drain output, which should be pulled up with a 4.7K – 10KO 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.

5) VeeR and VeeT may be internally connected within the SFP module.

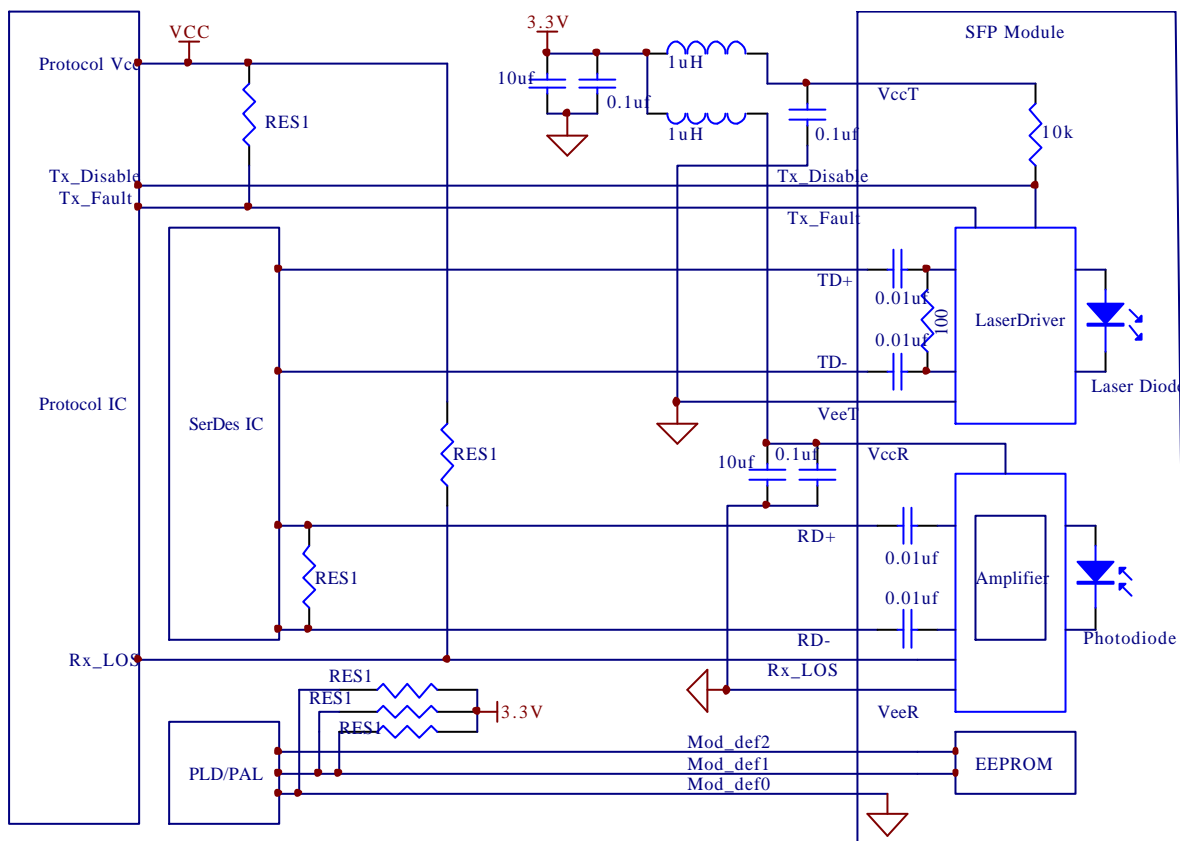
6) RD-/+ : These are the differential receiver outputs. They are AC coupled 1000 differential lines which should be terminated with 1000 (differential) at the user SERDES. The AC coupling is done inside the module and is thus not required on the host board. The voltage swing on these lines will be between 370 and 2000 mV differential (185 –1000 mV single ended) when properly terminated.

7) VccR and VccT are the receiver and transmitter power supplies. They are defined as 3.3V

± 5% at the SFP connector pin. Maximum supply current is 300mA. Recommended host board power supply filtering is shown below. Inductors with DC resistance of less than 1 ohm 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 30mA greater than the steady state value. VccR and VccT may be internally connected within the SFP transceiver module.

8) TD-/+ : These are the differential transmitter inputs. They are AC-coupled, differential lines with 100Ω 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 – 2400 mV (250 – 1200mV single-ended), though it is recommended that values between 500 and 1200 mV differential (250 – 600mV single-ended) be used for best EMI performance.

Recommend Circuit Schematic



RES1 = 4.7k to 10k

DIGITAL DIAGNOSTIC MONITORING INTERFACE

Eoptolink SFP transceivers support the 2-wire serial communication protocol as defined in the SFP Multi-Source Agreement (MSA). The FOCUS-8548-02D SFP transceivers are provided with enhanced digital diagnostic monitoring interface (DDMI) which allows

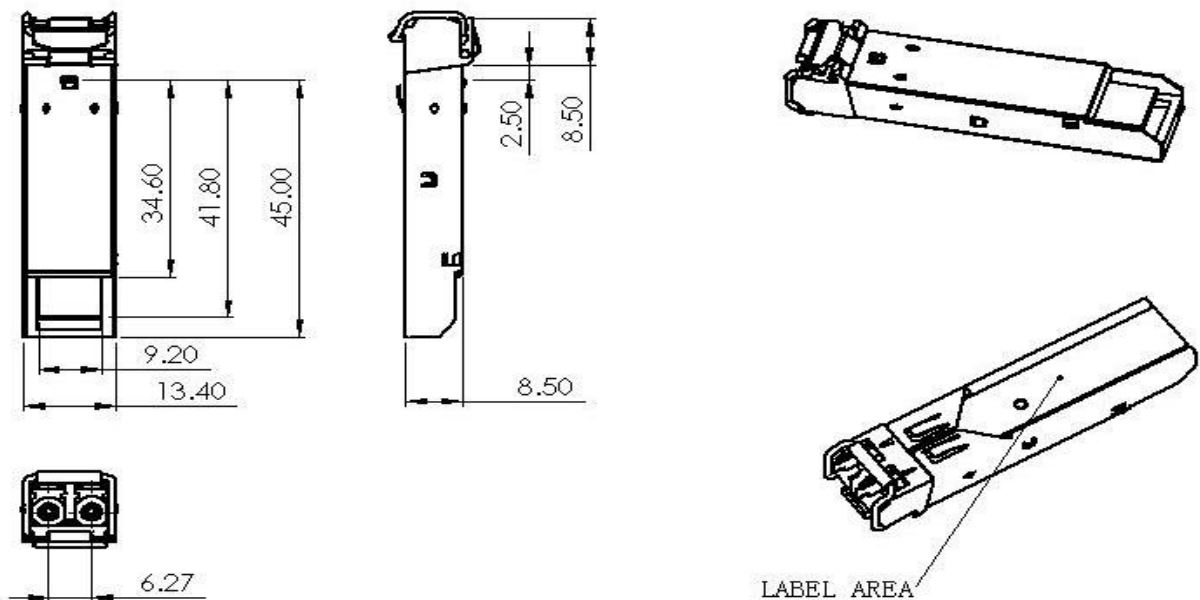
real-time access to device operating parameters such as transceiver temperature, laser bias current, transmitted optical power, received optical power and transceiver supply voltage. It also defines a system of alarm flags, which alerts end-users when particular operating parameters are outside of a factory set normal range. The SFP is fully compliant to the SFF-8472 Rev. 9.3 specification.

The SFP MSA defines a 256-byte memory map in EEPROM that is 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. The interface is identical to and is thus fully backward compatible with the SFP Multi Source Agreement.

Eoptolink SFP with DDMI are externally calibrated (bit 4 is set at address 92) which means that the measurements are raw A/D values and must be converted to real world units using calibration constants stored in the EEPROM location 56-95 at 2 wire serial bus address A2h.

For detailed interface information, please refer to SFF-8472 rev. 9.3 specification.

Mechanical Specifications



DIMENSIONS IN MILLIMETERS

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Ordering information

Part No.	Data Rate	Laser	Fiber Type	Distance	Optical interface
FOCUS-8548-02D	4.25Gbps with digital diagnostic	850nm VCSEL	MMF	500m	LC
FOCUS-8548-02	4.25Gbps	850nm VCSEL	MMF	500m	LC