



- ✧ RoHS compliant and Lead Free
- ✧ Up to 2 km on 50/125μm MMF
- ✧ Single +3.3V Power Supply
- ✧ Low power dissipation <1W typically
- ✧ Operating temperature range: 0°C to 70°C

**Features:**

- ✧ Up to 1.25Gb/s Data Links
- ✧ Hot-Pluggable
- ✧ 1310nm FP laser transmitter
- ✧ Duplex LC connector

**Applications:**

- ✧ Metro/Access Networks
- ✧ 1.25 Gb/s 1000Base-SX Ethernet
- ✧ 1×Fiber Channel
- ✧ Other Optical Link

**Description:**

OP3402D Transceiver is a high performance, cost effective module which have a Duplex LC optics interface. Standard AC coupled CML for high speed signal and LVTTTL control and monitor signals. The receiver section uses a PIN receiver and the transmitter uses 1310 nm FP laser, up to 8dB link budge ensure this module 1000Base Ethernet 2Km application.

● **Absolute Maximum Ratings**

Parameter	Symbol	Min.	Typical	Max.	Unit
Storage Temperature	T <sub>s</sub>	-40		+85	°C
Supply Voltage	V <sub>CC</sub>	-0.5		4	V
Relative Humidity	RH	0		85	%

● **Recommended Operating Environment:**

Parameter	Symbol	Min.	Typical	Max.	Unit
Case operating Temperature	T <sub>c</sub>	0		+70	°C
Supply Voltage	V <sub>CCT, R</sub>	3.0		3.6	V

● **Electrical Characteristics (T<sub>OP</sub> =T<sub>c</sub>, V<sub>CC</sub> = 3.0 to 3.60 Volts)**

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
Supply Voltage	V <sub>cc</sub>	3.0	3.30	3.60	V	
Supply Current	I <sub>cc</sub>		160	250	mA	
Inrush Current	I <sub>surge</sub>			I <sub>cc</sub> +30	mA	
Maximum Power	P <sub>max</sub>			1.0	W	

**Transmitter Section:**

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Input differential impedance	$R_{in}$	90	100	110		
Single ended data input swing	$V_{in PP}$	200		1200	mVp-p	
Transmit Disable Voltage	$V_D$	$V_{cc} - 1.3$		$V_{cc}$	V	2
Transmit Enable Voltage	$V_{EN}$	Vee		$V_{ee} + 0.8$	V	
Transmit Disable Assert Time	$T_{dessert}$			10	us	
<b>Receiver Section:</b>						
Single ended data output swing	$V_{out,pp}$	300		1000	mv	3
Data output rise time	$t_r$			260	ps	4
Data output fall time	$t_f$			260	ps	4
LOS Fault	$V_{losfault}$	$V_{cc} - 0.5$		$V_{CC\_host}$	V	5
LOS Normal	$V_{los norm}$	$V_{ee}$		$V_{ee} + 0.5$	V	5
Power Supply Rejection	PSR	100			mVpp	6
Deterministic Jitter Contribution	$RX\Delta DJ$			51.7	ps	7
Total Jitter Contribution	$RX\Delta TJ$			122.4	ps	

**Note:**

1. AC coupled.
2. Or open circuit.
3. Into 100 ohm differential termination.
4. 20 – 80 %
5. LOS is LVTTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.
6. All transceiver specifications are compliant with a power supply sinusoidal modulation of 20 Hz to 1.5MHz up to specified value applied through the power supply filtering network shown on page 23 of the Small Form-factor Pluggable (SFP) Transceiver Multi-Source Agreement (MSA), September 14, 2000.
7. Measured with DJ-free data input signal. In actual application, output DJ will be the sum of input DJ and . DJ.

● **Optical Parameters( $T_{OP} = T_c$ ,  $V_{CC} = 3.00$  to  $3.60$  Volts)**

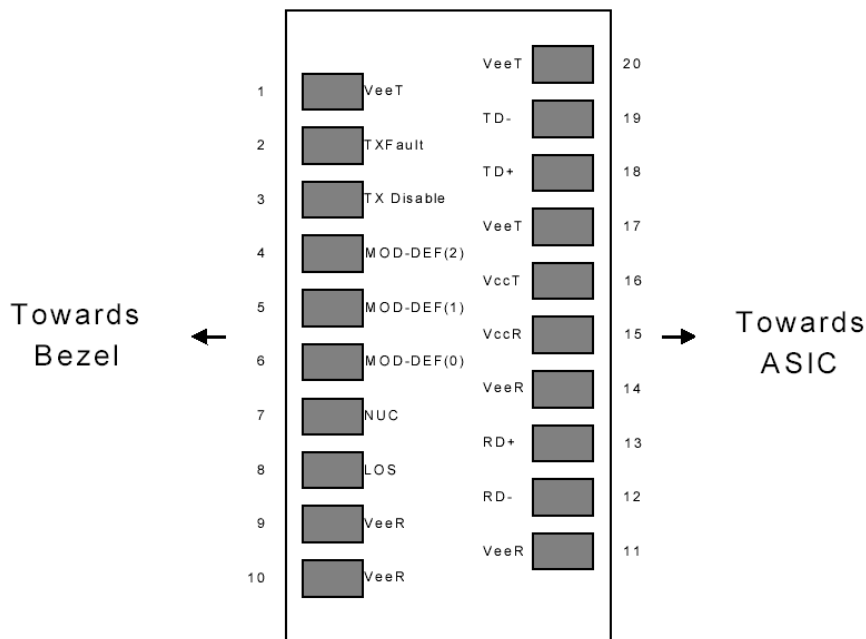
Parameter	Symbol	Min.	Typical	Max.	Unit	Note
<b>Transmitter Section:</b>						
Center Wavelength	$\lambda_c$	1270	1310	1360	nm	1
Spectral Width	$\sigma$			3	nm	
Optical Output Power	$P_{out}$	-9.0		-3.0	dBm	2
Optical Rise/Fall Time	$t_r / t_f$			260	ps	3
Extinction Ratio	ER	9			dB	
Deterministic Jitter Contribution	$TX\Delta DJ$			56.5	ps	4
Total Jitter Contribution	$TX\Delta TJ$			119	ps	
Eye Mask for Optical Output	Compliant with Eye Mask Defined in IEEE 802.3 standard					
<b>Receiver Section:</b>						
Optical Input Wavelength		1100		1670	nm	
Optical Input Power	$P_{in}$	-17		-3	dBm	5.6
Receiver Overload	$P_{ol}$			-3	dBm	5.6
RX Sensitivity	$S_{en}$			-17	dBm	5.6
RX_LOS Assert	$LOS_A$	-27			dBm	
RX_LOS Deassert	$LOS_D$			-18	dBm	
RX_LOS Hysteresis	$LOS_H$		2	2.5	dB	
<b>General Specifications</b>						

Data Rate	BR	1062		1250	Mb/s	
Bit Error Rate	BER			10 <sup>-12</sup>		
Max. Supported Link Length on 9/125µm SMF@1.25Gb/s	LMAX		2		km	7
Total System Budget	LB	8			dB	8

**Note**

1. Also specified to meet curves in FC-PI 13.0 Figures 18 and 19, which allow trade-off between wavelength spectral width.
2. Class 1 Laser Safety per FDA/CDRH and EN (IEC) 60825 regulations.
3. Unfiltered, 20-80%. Complies with IEEE 802.3 (Gig. E), FC 1x and 2x eye masks when filtered.
4. Measured with DJ-free data input signal. In actual application, output DJ will be the sum of input DJ and . DJ.
5. Measured with conformance signals defined in FC-PI 13.0 specifications.
6. Measured with PRBS 2<sup>7</sup> -1 at 10<sup>-12</sup> BER
7. Dispersion limited per FC-PI Rev. 13
8. Attenuation of 1 dB/km is used for the link length calculations. Distances are indicative only. Please refer to the Optical Specifications in Table IV to calculate a more accurate link budget based on specific conditions in your application.

**● Pin Assignment:**



**Figure2:Diagram of Host Board Connector Block Pin Numbers and Names**

**● Pin Description:**

Pin No	Name	Function	Plug Seq	Notes
1	VeeT	Transmitter Ground	1	1
2	TX Fault	Transmitter Fault Indication	3	
3	TX Disable	Transmitter Disable	3	2
4	MOD-DEF2	Module Definition	2	3
5	MOD-DEF1	Module Definition 1	3	3
6	MOD-DEF0	Module Definition 0	3	3
7	Rate Select	Not Connected	3	4
8	LOS	Loss of Signal	3	5

9	VeeR	Receiver Ground	1	1
10	VeeR	Receiver Ground	1	1
11	VeeR	Receiver Ground		1
12	RD-	Inv. Received Data Out	3	6
13	RD+	Received Data Out	3	6
14	VeeR	Receiver Ground	3	1
15	VccR	Receiver Power	2	1
16	VccT	Transmitter Power	2	
17	VeeT	Transmitter Ground	1	
18	TD+	Transmit Data In	3	6
19	TD-	Inv. Transmit In	3	6
20	VeeT	Transmitter Ground	1	

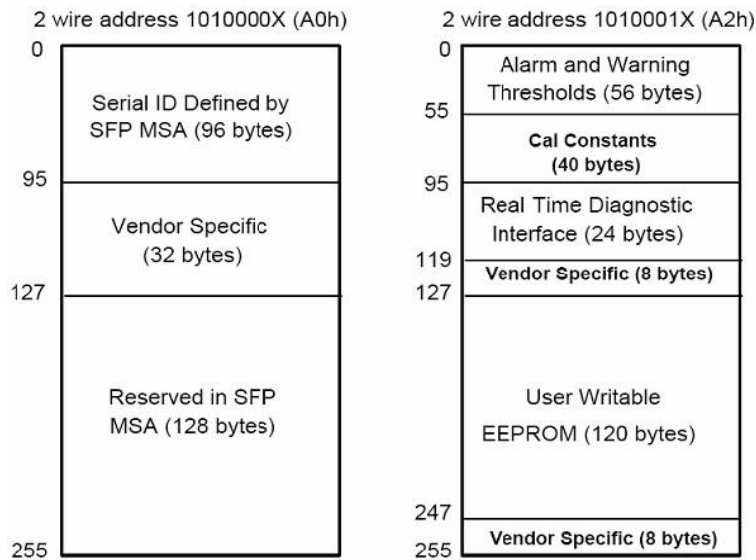
**Notes:**

1. Circuit ground is internally isolated from chassis ground.
2. Laser output disabled on TDIS >2.0V or open, enabled on TDIS <0.8V.
3. Should be pulled up with 4.7k - 10 kohms on host board to a voltage between 2.0V and 3.6V. MOD\_DEF(0) pulls line low to indicate module is plugged in.
4. Rate select is not used
5. LOS is open collector output. Should be pulled up with 4.7k – 10 kohms on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.
6. AC Coupled

● **SFP Module EEPROM Information and Management**

The SFP modules implement the 2-wire serial communication protocol as defined in the SFP -8472. The serial ID information of the SFP modules and Digital Diagnostic Monitor parameters can be accessed through the I<sup>2</sup>C interface at address A0h and A2h. The memory is mapped in Table 1. Detailed ID information (A0h) is listed in Table 2. And the DDM specification at address A2h. For more details of the memory map and byte definitions, please refer to the SFF-8472, “Digital Diagnostic Monitoring Interface for Optical Transceivers”. The DDM parameters have been internally calibrated.

**Table 1.** Digital Diagnostic Memory Map (Specific Data Field Descriptions)



● **Serial ID Memory Contents:**

Data Address	Length (Byte)	Name of Length	Description and Contents
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Base ID Fields			
0	1	Identifier	Type of Serial transceiver (03h=SFP)
1	1	Reserved	Extended identifier of type serial transceiver (04h)
2	1	Connector	Code of optical connector type (07=LC)
3-10	8	Transceiver	
11	1	Encoding	NRZ (03h)
12	1	BR,Nominal	Nominal baud rate, unit of 100Mbps
13	1	Reserved	(0000h)
14	1	Length(9um,km)	Link length supported for 9/125um fiber, units of km
15	1	Length(9um)	Link length supported for 9/125um fiber, units of 100m
16	1	Length(50um)	Link length supported for 50/125um fiber, units of 10m
17	1	Length(62.5um)	Link length supported for 62.5/125um fiber, units of 10m
18	1	Length(Copper)	Link length supported for copper, units of meters
19	1	Reserved	
20-35	16	Vendor Name	SFP vendor name:
36	1	Reserved	
37-39	3	Vendor OUI	SFP transceiver vendor OUI ID
40-55	16	Vendor PN	Part Number: "OPxxxx" (ASCII)
56-59	4	Vendor rev	Revision level for part number
60-61	2	Wavelength	Laser wavelength
62	1	Reserved	
63	1	CCID	Least significant byte of sum of data in address 0-62
Extended ID Fields			
64-65	2	Option	Indicates which optical SFP signals are implemented(001Ah = LOS, TX_FAULT, TX_DISABLE all supported)
66	1	BR, max	Upper bit rate margin, units of %
67	1	BR, min	Lower bit rate margin, units of %
68-83	16	Vendor SN	Serial number (ASCII)
84-91	8	Date code	Manufacturing date code
92-94	3	Reserved	
95	1	CCEX	Check code for the extended ID Fields (addresses 64 to 94)
Vendor Specific ID Fields			
96-127	32	Readable	Vendor specific date, read only

## ● Digital Diagnostic Monitor Characteristics

Data Address	Parameter	Accuracy	Unit
96-97	Transceiver Internal Temperature	±3.0	°C
98-99	VCC Internal Supply Voltage	±5.0	%
100-101	Laser Bias Current	±10	%
102-103	Tx Output Power	±3.0	dBm
104-105	Rx Input Power	±3.0	dBm

## ● Regulatory Compliance

The OP3402D complies with international Electromagnetic Compatibility (EMC) and international safety requirements and standards (see details in Table following).

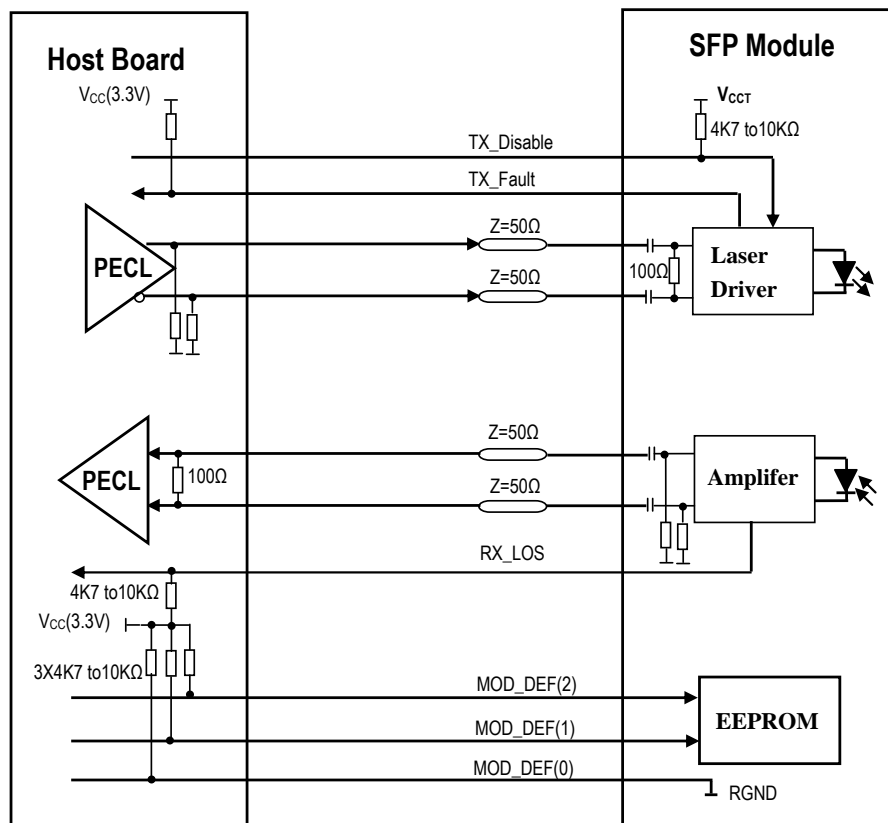
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Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883E Method 3015.7	Class 1(>1000 V)
Electrostatic Discharge (ESD) to the Duplex LC Receptacle	IEC 61000-4-2 GR-1089-CORE	Compatible with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN55022 Class B (CISPR 22B) VCCI Class B	Compatible with standards
Laser Eye Safety	FDA 21CFR 1040.10 and 1040.11 EN60950, EN (IEC) 60825-1,2	Compatible with Class 1 laser product.

● **References**

1. IEEE Std 802.3, 2002 Edition, Clause 38, PMD Type 1000BASE-LX.IEEE Standards Department, 2002.
2. “Fibre Channel Physical and Signaling Interface (FC-PH, FC-PH2, FC-PH3)”.American National Standard for Information Systems.
3. “Fibre Channel Draft Physical Interface Specification (FC-PI 13.0)”. American National Standard for Information Systems.
4. Small Form-factor Pluggable (SFP) Transceiver Multi-source Agreement (MSA) September 14, 2000.

● **Recommended Circuit:**



**Figure 5. SFP Host Recommended Circuit**

● **Mechanical Dimensions:**

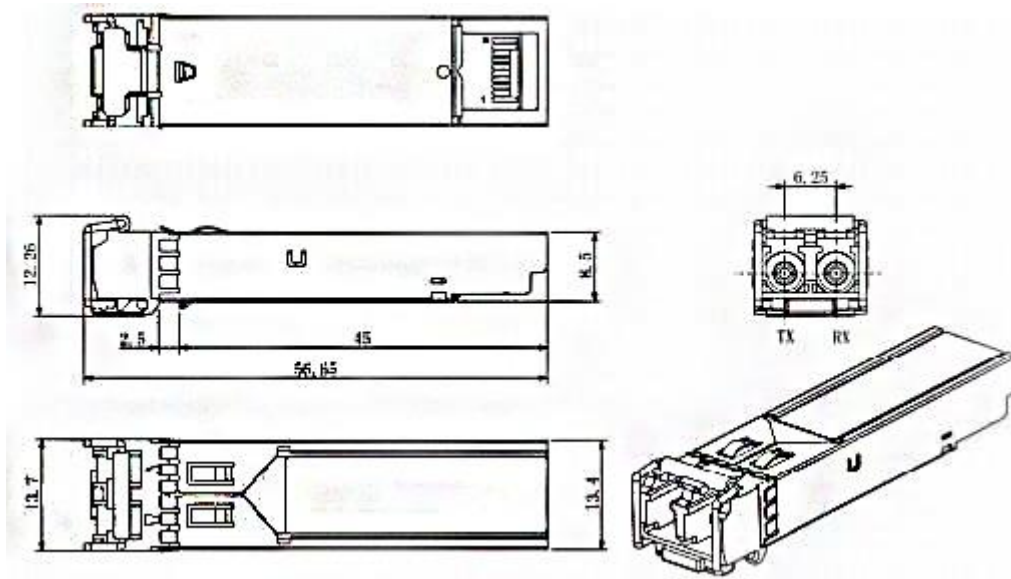


Figure 6. Mechanical Drawing

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