155Mbps SFP Transceiver

(For 15km～80km transmission)

Members of Flexon™ Family

Features

- Up to 155Mbps data-rate
- 1310nm FP laser and PIN photodetector for 15km and 40km transmission
- 1550nm uncooled DFB laser and PIN photodetector for 80km transmission
- Standard serial ID information compliant with SFP MSA
- SFP MSA package with duplex LC connector
- Very low EMI and excellent ESD protection
- +3.3V single power supply
- Operating case temperature:
  Standard : 0 to +70°C
  Industrial : -40 to +85°C

Applications

- SDH STM-1, S-1.1, L-1.1, L-1.2
- SONET OC-3 IR1, LR1, LR2
- Other optical links

Standard

- Compliant with SFP MSA
- Compliant with ITU-T G.957 and G.958
- Compliant with Telcordia GR-253-CORE
- Compliant with FCC 47 CFR Part 15, Class B
- Compliant with FDA 21 CFR 1040.10 and 1040.11, Class I

Description

Fiberxon 155Mbps SFP transceiver is high performance, cost effective module that supports data-rate of 155Mbps and transmission distance from 15km to 80km.

The transceiver consists of two sections: The transmitter section incorporates a FP or uncooled DFB laser, and the receiver section consists of a PIN photodiode integrated with a trans-impedance preamplifier (TIA). All modules satisfy class I laser safety requirements.

The optical output can be disabled by a TTL logic high-level input of Tx Disable. Tx Fault is provided to indicate that degradation of the laser. Loss of signal (LOS) output is provided to indicate the loss of an input optical signal of receiver.

The standard serial ID information compliant SFP MSA describes the transceiver's capabilities, standard interfaces, manufacturer and other information. The host equipment can access this information via the 2-wire serial CMOS EEPROM protocol. For further information, please refer to SFP Multi-Source Agreement (MSA).

Regulatory Compliance

The transceivers have been tested according to American and European product safety and electromagnetic compatibility regulations (See Table 1). For further information regarding regulatory certification, please refer to Fiberxon regulatory specification and safety guidelines, or contact Fiberxon, Inc. America sales office listed at the end of the documentation.

Table 1 - Regulatory Compliance

Feature	Standard	Performance
Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883E Method 3015.7	Class 1(>500 V)
Electrostatic Discharge (ESD) to the Duplex LC Receptacle	IEC 61000-4-2 GR-1089-CORE	Compliant with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN55022 Class B (CISPR 22B) VCCI Class B	Compliant with standards
Immunity	IEC 61000-4-3	Compliant with standards
Laser Eye Safety	FDA 21CFR 1040.10 and 1040.11 EN60950, EN (IEC) 60825-1,2	Compliant with Class 1 laser product. TUV Certificate No. 50030043
Component Recognition	UL and CSA	UL file E223705

Absolute Maximum Ratings

Stress in excess of the maximum absolute ratings can cause permanent damage to the module.

Table 2 - Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	T_S	-40	+85	°C
Supply Voltage	V_{CC}	-0.5	3.6	V
Operating Relative Humidity	-	5	95	%

Recommended Operating Conditions

Table 3 - Recommended Operating Conditions

Parameter		Symbol	Min.	Typical	Max.	Unit
Operating Case Temperature	Standard	T_C	0		+70	°C
	Industrial		-40		+85	
Power Supply Voltage		V_{CC}	3.13		3.47	V
Power Supply Current		I_{CC}			300	mA
Data Rate				155		Mbps

FTM-3001C-S15, FTM-3001C-S15i (1310nm FP and PIN, 15km)

Table 4 - Optical and Electrical Characteristics

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
Transmitter							
Centre Wavelength		λ_C	1261		1360	nm	
Average Output Power		P_{0ut}	-15		-8	dBm	1
Spectral Width (RMS)		σ			4	nm	
Extinction Ratio		EX	8.2			dB	
Jitter Generation (RMS)					0.01	UI	
Jitter Generation (pk-pk)					0.1	UI	
Output Optical Eye		Compliant with Telcordia GR-253-CORE and ITU-T G.957					2
Data Input Swing Differential		V_{IN}	300		1860	mV	3
Input Differential Impedance		Z_{IN}	90	100	110	Ω	
TX Disable	Disable		2.0		Vcc	V	
	Enable		0		0.8	V	
TX Fault	Fault		2.0		Vcc+0.3	V	
	Normal		0		0.8	V	
Receiver							
Centre Wavelength		λ_C	1260		1580	nm	
Receiver Sensitivity					-34	dBm	4
Receiver Overload			-3			dBm	4
Optical Path Penalty					1	dB	5
LOS De-Assert		LOS_D			-37	dBm	
LOS Assert		LOS_A	-45			dBm	
LOS Hysteresis			1		4	dB	
Data Output Swing Differential		V_{OUT}	370		1800	mV	6
LOS	High		2.0		Vcc+0.3	V	
	Low		0		0.8	V	

Notes:

1. The optical power is launched into SMF.
2. Measured with a PRBS 2^{23}-1 test pattern @155Mbps.
3. PECL input, internally AC coupled and terminated.
4. Measured with a PRBS 2^{23}-1 test pattern @155Mbps, worst-case extinction ratio, BER $\leqslant 1\times10^{-10}$.
5. Measured with a PRBS 2^{23}-1 test pattern @155Mbps, over 15km G.652 SMF, BER $\leqslant 1\times10^{-10}$.
6. PECL output, internally AC coupled.

FTM-3001C-S40, FTM-3001C-S40i (1310nm FP and PIN, 40km)

Table 5 - Optical and Electrical Characteristics

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
Transmitter							
Centre Wavelength		λ_C	1263		1360	nm	
Average Output Power		P_{0ut}	-5		0	dBm	1
Spectral Width (RMS)		σ			3	nm	
Extinction Ratio		EX	10			dB	
Jitter Generation (RMS)					0.01	UI	
Jitter Generation (pk-pk)					0.1	UI	
Output Optical Eye		Compliant with Telcordia GR-253-CORE and ITU-T G.957					2
Data Input Swing Differential		V_{IN}	300		1860	mV	3
Input Differential Impedance		Z_{IN}	90	100	110	Ω	
TX Disable	Disable		2.0		Vcc	V	
	Enable		0		0.8	V	
TX Fault	Fault		2.0		Vcc+0.3	V	
	Normal		0		0.8	V	
Receiver							
Centre Wavelength		λ_C	1260		1580	nm	
Receiver Sensitivity					-34	dBm	4
Receiver Overload			-3			dBm	4
Optical Path Penalty					1	dB	5
LOS De-Assert		LOS_D			-37	dBm	
LOS Assert		LOS_A	-45			dBm	
LOS Hysteresis			1		4	dB	
Data Output Swing Differential		V_{OUT}	370		1800	mV	6
LOS	High		2.0		Vcc+0.3	V	
	Low		0		0.8	V	

Notes:

1. The optical power is launched into SMF.
2. Measured with a PRBS 2^{23}-1 test pattern @155Mbps.
3. PECL input, internally AC coupled and terminated.
4. Measured with a PRBS 2^{23}-1 test pattern @155Mbps, worst-case extinction ratio, BER $\leqslant 1\times10^{-10}$.
5. Measured with a PRBS 2^{23}-1 test pattern @155Mbps, over 40km G.652 SMF, BER $\leqslant 1\times10^{-10}$.
6. PECL output, internally AC coupled.

FTM-5001C-S80 (1550nm DFB and PIN, 80km)

Table 6 - Optical and Electrical Characteristics

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
Transmitter							
Centre Wavelength		λ_C	1480		1580	nm	
Average Output Power		P_{0ut}	-5		0	dBm	1
Spectral Width (-20dB)		$\Delta\lambda$			1	nm	
Side Mode Suppression Ratio		SMSR	30			dB	
Extinction Ratio		EX	10			dB	
Jitter Generation (RMS)					0.01	UI	
Jitter Generation (pk-pk)					0.1	UI	
Output Optical Eye		Compliant with Telcordia GR-253-CORE and ITU-T G.957					2
Data Input Swing Differential		V_{IN}	300		1860	mV	3
Input Differential Impedance		Z_{IN}	90	100	110	Ω	
TX Disable	Disable		2.0		Vcc	V	
	Enable		0		0.8	V	
TX Fault	Fault		2.0		Vcc+0.3	V	
	Normal		0		0.8	V	
Receiver							
Centre Wavelength		λ_C	1260		1580	nm	
Receiver Sensitivity					-34	dBm	4
Receiver Overload			-3			dBm	4
Optical Path Penalty					1	dB	5
LOS De-Assert		LOS_D			-37	dBm	
LOS Assert		LOS_A	-45			dBm	
LOS Hysteresis			1		4	dB	
Data Output Swing Differential		V_{OUT}	370		1800	mV	6
LOS	High		2.0		Vcc+0.3	V	
	Low		0		0.8	V	

Notes:

1. The optical power is launched into SMF.
2. Measured with a PRBS 2^{23}-1 test pattern @155Mbps.
3. PECL input, internally AC coupled and terminated.
4. Measured with a PRBS 2^{23}-1 test pattern @155Mbps, worst-case extinction ratio, BER $\leqslant 1\times10^{-10}$.
5. Measured with a PRBS 2^{23}-1 test pattern @155Mbps, over 80km G.652 SMF, BER $\leqslant 1\times10^{-10}$.
6. PECL output, internally AC coupled.

EEPROM Information

The SFP MSA defines a 256-byte memory map in EEPROM describing the transceiver's capabilities, standard interfaces, manufacturer, and other information, which is accessible over a 2 wire serial interface at the 8-bit address 1010000X (A0h). For memory contents please refer to Table 7.

Table 7 - EEPROM Serial ID Memory Contents (A0h)

Addr.	Field Size (Bytes)	Name of Field	Hex	Description
0	1	Identifier	03	SFP
1	1	Ext. Identifier	04	MOD4
2	1	Connector	07	LC
3—10	8	Transceiver	00 00 xx 00 00 00 00 00	OC 3, Single mode inter. or long reach
11	1	Encoding	03	NRZ
12	1	BR, nominal	01	155Mbps
13	1	Reserved	00	
14	1	Length (9um)-km	xx	15km/40km/80km(0F/28/50)
15	1	Length (9um)	xx	15km/40km/80km(96/FF/FF)
16	1	Length (50um)	00	
17	1	Length (62.5um)	00	
18	1	Length (copper)	00	
19	1	Reserved	00	
20—35	16	Vendor name	46 49 42 45 52 58 4F 4E 20 49 4E 43 2E 20 20 20	"FIBERXON INC. "(ASCⅡ)
36	1	Reserved	00	
37—39	3	Vendor OUI	00 00 00	
40—55	16	Vendor PN	46 54 4D 2D xx 30 30 31 43 2D 53 xx xx xx 20 20	"FTM-x001C-Sxx (i)" (ASCⅡ)
56—59	4	Vendor rev	xx xx 00 00	ASCⅡ("31 30 00 00" means 1.0 revision)
60—62	3	Reserved	00 00 00	
63	1	CC BASE	xx	Check sum of bytes 0 - 62
64—65	2	Options	00 1A	LOS, TX_FAULT and TX_DISABLE
66	1	BR, max	00	
67	1	BR, min	00	
68—83	16	Vendor SN	xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx	ASCⅡ.
84—91	8	Vendor date code	xx xx xx xx xx xx 20 20	Year (2 bytes), Month (2 bytes), Day (2 bytes)
92—94	3	Reserved	00 00 00	
95	1	CC EXT	xx	Check sum of bytes 64 - 94
96—255	160	Vendor specific		All are set to 0

Note: The "xx" byte should be filled in according to practical case. For more information, please refer to the related document of *SFP Multi-Source Agreement (MSA)*.

Recommended Host Board Power Supply Circuit

Figure 1 shows the recommended host board power supply circuit.

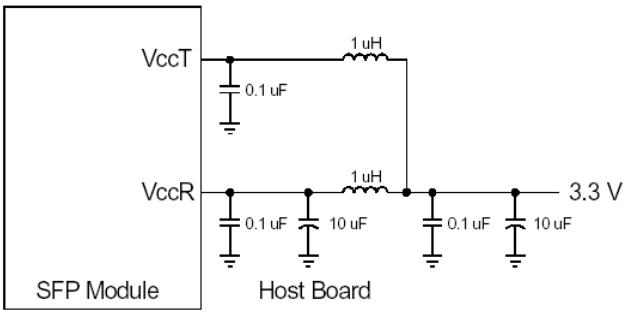
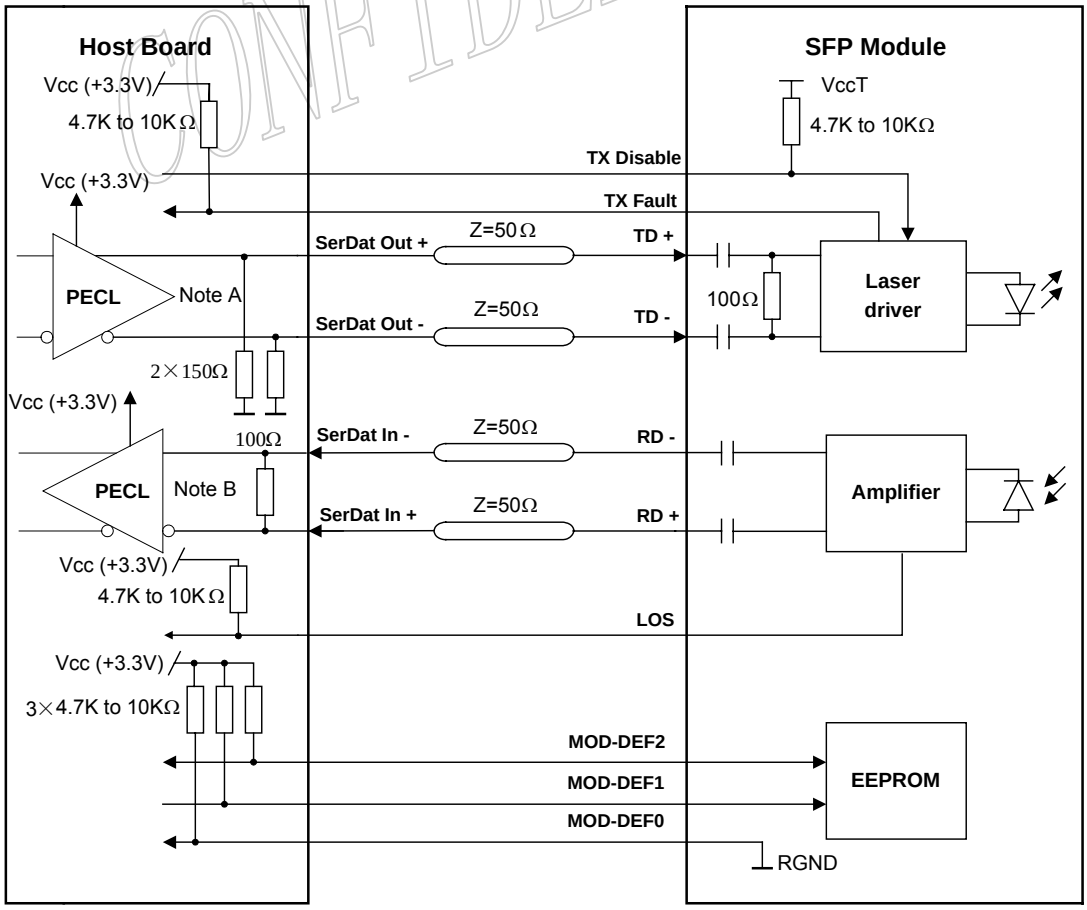


Figure 1, Recommended Host Board Power Supply Circuit

Recommended Interface Circuit

Figure 2 shows the recommended interface circuit.



Note A: Circuit assumes open emitter output
Note B: Circuit assumes high impedance internal bias @Vcc-1.3V

Figure 2, Recommended Interface Circuit

Pin Definitions

Figure 3 below shows the pin numbering of SFP electrical interface. The pin functions are described in Table 8 with some accompanying notes.

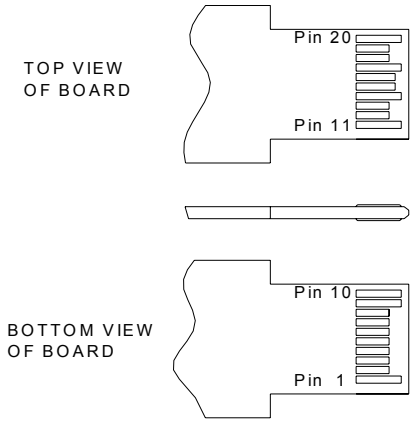


Figure 3, Pin View

Table 8 – Pin Function Definitions

Pin No.	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
4	MOD-DEF2	Module Definition 2	3	Note 3
5	MOD-DEF1	Module Definition 1	3	Note 3
6	MOD-DEF0	Module Definition 0	3	Note 3
7	Rate Select	Not Connected	3	
8	LOS	Loss of Signal	3	Note 4
9	VeeR	Receiver Ground	1	
10	VeeR	Receiver Ground	1	
11	VeeR	Receiver Ground	1	
12	RD-	Inv. Received Data Out	3	Note 5
13	RD+	Received Data Out	3	Note 5
14	VeeR	Receiver Ground	1	
15	VccR	Receiver Power	2	
16	VccT	Transmitter Power	2	
17	VeeT	Transmitter Ground	1	
18	TD+	Transmit Data In	3	Note 6
19	TD-	Inv. Transmit Data In	3	Note 6
20	VeeT	Transmitter Ground	1	

Notes:

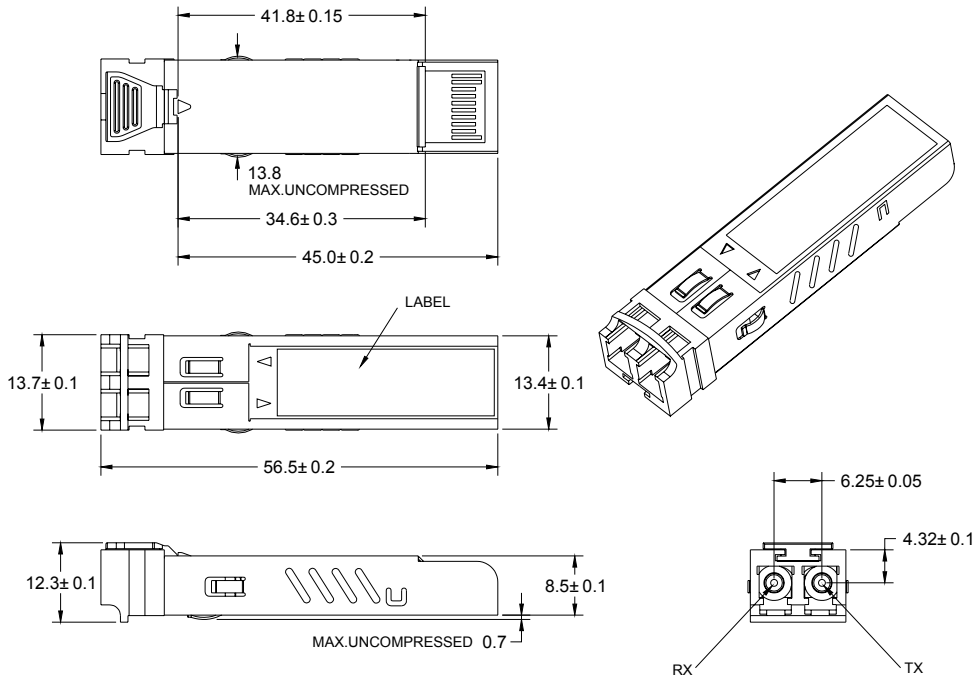
1. TX Fault is an open collector output, which should be pulled up with a 4.7k~10kΩ resistor on the host board to a voltage between 2.0V and Vcc+0.3V. Logic 0 indicates normal operation; logic 1 indicates a

laser fault of some kind. In the low state, the output will be pulled to less than 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 4.7k~10kΩ resistor. Its states are:
   Low (0~0.8V): Transmitter on
   (>0.8V, <2.0V): Undefined
   High (2.0~3.465V): Transmitter Disabled
   Open: Transmitter Disabled
3. MOD-DEF 0,1,2 are the module definition pins. They should be pulled up with a 4.7k~10kΩ resistor on the host board. The pull-up voltage shall be VccT or VccR.
   MOD-DEF 0 grounded by the module indicates 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 is an open collector output, which should be pulled up with a 4.7k~10kΩ resistor on the host board to a voltage between 2.0V and Vcc+0.3V. Logic 0 indicates normal operation; logic 1 indicates loss of signal. In the low state, the output will be pulled to less than 0.8V.
5. These are the differential receiver outputs. They are internally AC-coupled 100Ω differential lines which should be terminated with 100Ω (differential) at the user SERDES.
6. These are the differential transmitter inputs. They are AC-coupled, differential lines with 100Ω differential termination inside the module.

Mechanical Design Diagram

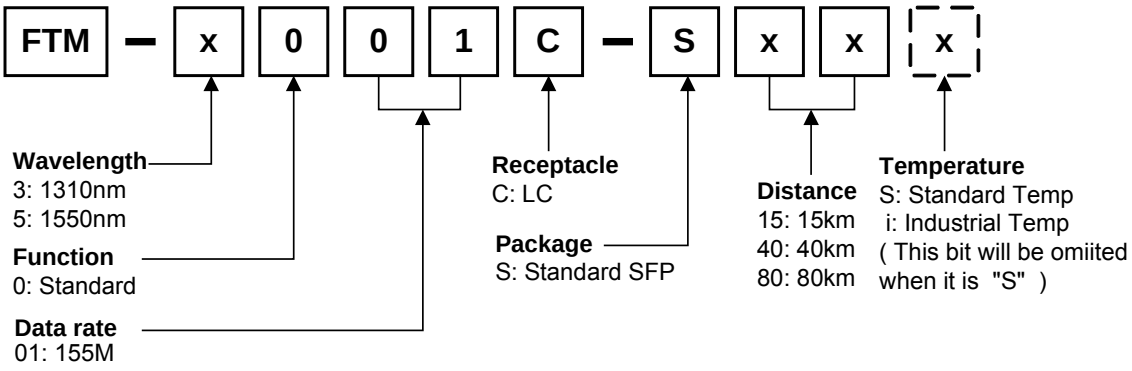
The mechanical design diagram is shown in Figure 4.



DIMENSIONS ARE IN MILLIMETERS

Figure 4, Mechanical Design Diagram of the SFP

Ordering information



Part No.	Product Description
FTM-3001C-S15	1310nm, 155Mbps, 15km, Standard SFP, 0°C~+70°C
FTM-3001C-S15i	1310nm, 155Mbps, 15km, Standard SFP, -40°C~+85°C
FTM-3001C-S40	1310nm, 155Mbps, 40km, Standard SFP, 0°C~+70°C
FTM-3001C-S40i	1310nm, 155Mbps, 40km, Standard SFP, -40°C~+85°C
FTM-5001C-S80	1550nm, 155Mbps, 80km, Standard SFP, 0°C~+70°C

Related Documents

For further information, please refer to the following documents:

- *Fiberxon SFP Installation Guide*
- *Fiberxon SFP Application Notes*
- *SFP Multi-Source Agreement (MSA)*

Obtaining Document

You can visit our website:

http://www.fiberxon.com

Or contact with Fiberxon, Inc. America Sales Office listed at the end of documentation to get the latest documents.

Revision History

Revision	Initiate	Review	Approve	Subject	Release Date
Rev. 1a	Andy.Xiao	Gary.Chen	Walker.Wei	Initial datasheet	Sep 22, 2004
Rev. 1b	Univer.Yang	Gary.Chen	Walker.Wei	Add the Revision History	Mar 15, 2005

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