

1.25Gbps Single Fiber Bi-directional SFP Transceiver (For 15km point-to-point transmission)

Members of Flexon™ Family



Features

- ◆ 1.25Gbps bi-directional data links
- ◆ Up to 15km point-point transmission
- ◆ 1310nm FP transmitter and 1490nm PIN receiver for FTM-9612S-SL15(i)G
- ◆ 1490nm DFB transmitter and 1310nm PIN receiver for FTM-9912S-SL15(i)G
- ◆ Class I laser product
- ◆ Low EMI and excellent ESD protection
- ◆ SFP MSA package with single SC receptacle
- ◆ Single +3.3V Power Supply
- ◆ Detailed product information in EEPROM
- ◆ FTM-9612S-SL15(i)G Operating Case Temperature
Standard: 0 to +70°C
Industrial: -40 to +85°C
- ◆ FTM-9912S-SL15(i)G Operating Case Temperature
Standard: 0 to +70°C
Industrial: -40 to +85°C

Applications

- ◆ Gigabit Ethernet Application
- ◆ Point-to-Point FTTX Application

Standard

- ◆ Compatible with SFP MSA
- ◆ Refer to IEEE 802.3ah -2004 Gigabit Ethernet Specification
- ◆ Compatible with Digital Diagnostic SFF-8472
- ◆ Compatible with Bellcore GR-468
- ◆ Compatible with FDA 21 CFR 1040.10 and 1040.11, Class I
- ◆ RoHS compliance

Description

Fiberxon 1.25G single fiber bi-directional SFP transceivers are high performance, cost effective modules, which supports data rate of 1.25Gbps and transmission distance up to 15km.

FTM-9612S-SL15(i)G is normally used in the client side (ONU), which transmits 1310nm optical signal and receives 1490nm optical signal. While FTM-9912S-SL15(i)G is used in the central office side (OLT), which transmits 1490nm optical signal and receives 1310nm optical signal.

The standard serial ID information Compatible with 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 MSA.

FTM-9612S-SL15(i)G and FTM-9912S-SL15(i)G are compliant with RoHS

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 Flexon™ regulatory specification and safety guidelines, or contact with 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 2(>2000 V)
Electrostatic Discharge (ESD) to SC 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
Immunity	IEC 61000-4-3	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.
Component Recognition	UL and CSA	Compatible with standards
RoHS	2002/95/EC 4.1&4.2 2005/747/EC	Compliant with standards note

Note:

In light of item 5 in Annex of 2002/95/EC, "Pb in the glass of cathode ray tubes, electronic components and fluorescent tubes." and item 13 in Annex of 2005/747/EC, "Lead and cadmium in optical and filter glass.", the two exemptions are being concerned for Fiberxon's transceivers, because Fiberxon's transceivers use glass, which may contain Pb, for components such as lenses, windows, isolators, and other electronic components.

Absolute Maximum Ratings

Absolute Maximum Ratings are those values beyond which damage to the devices may occur.

Table 2 – Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit	Note
Storage Temperature	T_s	-40	+85	°C	
Operating Case Temperature	T_c	-40	+85	°C	1
		0	+70	°C	2
Supply Voltage	V_{CC}	0	+4	V	
Input Voltage	V_{in}	0	V_{CC}	V	

- FTM-9612S-SL15iG/ FTM-9912S-SL15iG
- FTM-9612S-SL15G/ FTM-9912S-SL15G

Recommended Operating Conditions

Table 3 - Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
Operating Case Temperature	T_c	-40		+85	°C	1
		0		+70	°C	2
Power Supply Voltage	V_{CC}	3.13	3.3	3.47	V	
Power Supply Current	I_{CC}			300	mA	
Data Rate			1.25		Gbps	

- FTM-9612S-SL15iG/ FTM-9912S-SL15iG
- FTM-9612S-SL15G/ FTM-9912S-SL15G

FTM-9612S-SL15G/FTM-9612S-SL15iG (1310nm FP Tx/1490nm PIN Rx for ONU, 15km)

Table 4 –Optical and Electrical Characteristics (Over operation temperature, $V_{CC}=3.13$ to $3.47V$)

Parameter		Symbol	Min.	Typical	Max.	Unit	Note	
Transmitter								
Centre Wavelength		λ_C	1260	1310	1360	nm		
Average Launch Power		P_{out}	-8		-3	dBm	1	
Average Launch Power of OFF Transmitter					-45	dBm		
Spectral (RMS)	Width	$\Delta\lambda$				nm		
	1260nm				2.09			
	1270nm				2.52			
	1280nm				3.13			
	1286nm				3.50			
	1343nm				3.06			
	1350nm				2.58			
Extinction Ratio		EX	6			dB		
Launch OMA		OMA	-8.2			dBm		
Rise/Fall Time (20%~80%)		t_r / t_f			0.26	ns		
Relative Intensity Noise		RIN_{12OMA}			-113	dB/Hz		
Optical Return Loss tolerance					12	dB		
Deterministic Jitter		DJ			200	ps		
Total Jitter		TJ			385	ps		
Output Optical Eye		IEEE 802.3ah Compatible						2
Single Ended Data Input Swing		V_{IN}	250		1200	mV	3	
Input Differential Impedance		Z_{IN}	80	100	120	Ω		
TX Disable	Disable		2.0		V_{CC}	V		
	Enable		0		0.8	V		
TX Fault	Fault		2.0		$V_{CC}+0.3$	V		
	Normal		0		0.8	V		
Receiver								
Centre Wavelength		λ_C	1480	1490	1500	nm		
Receiver Sensitivity					-23	dBm	4	

Receiver Overload		-3			dBm	4
LOS De-Assert	LOS _D			-24	dBm	
LOS Assert	LOS _A	-35			dBm	
LOS Hysteresis		0.5		4	dB	
Receiver Reflectance				-12	dB	
Single ended Data Output Swing	V _{OUT}	200		800	mV	5
LOS	High		2		V _{CC} +0.3	V
	Low		0		0.8	V

1. The optical power is launched into SMF.
2. Measured with a PRBS 2⁷-1 test pattern @1.25Gbps.
3. Internally AC coupled and terminated.
4. Measured with a PRBS 2⁷-1 test pattern@1.25Gbps, BER≤1×10⁻¹².
5. Internally AC coupled.

FTM-9912S-SL15G/ FTM-9912S-SL15iG (1490nm DFB Tx/1310nm PIN Rx for OLT, 15km)

Table 5 –Optical and Electrical Characteristics (Over operation temperature, V_{CC}=3.13 to 3.47V)

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
Transmitter						
Centre Wavelength	λ _C	1480	1490	1500	nm	
Average Launch Power	P _{Out}	-8		-3	dBm	1
Average Launch Power of OFF Transmitter				-45	dBm	
Spectral Width (-20dB)	Δλ			0.88	nm	
Extinction Ratio	EX	6			dB	
Launch OMA	OMA	-8.2			dBm	
Rise/Fall Time (20%~80%)	tr /tf			0.26	ns	
Relative Intensity Noise	RIN ₁₂ OMA			-113	dB/Hz	
Optical Return Loss tolerance				12	dB	
Deterministic Jitter	DJ			200	ps	
Total Jitter	TJ			385	ps	
Output Optical Eye	IEEE 802.3ah Compatible					2
Single Ended Data Input Swing	V _{IN}	250		1200	mV	3
Input Differential Impedance	Z _{IN}	80	100	120	Ω	
TX Disable	Disable		2.0		V _{CC}	V
	Enable		0		0.8	V
TX Fault	Fault		2.0		V _{CC} +0.3	V
	Normal		0		0.8	V
Receiver						
Centre Wavelength	λ _C	1260	1310	1360	nm	
Receiver Sensitivity				-23	dBm	4
Receiver Overload		-3			dBm	4
LOS De-Assert	LOS _D			-24	dBm	

LOS Assert		LOS _A	-35				
LOS Hysteresis			0.5		4		dB
Receiver Reflectance					-12		dB
Single Ended Data Output Swing		V _{OUT}	200		800		mV
LOS	High		2.0		V _{cc} +0.3		V
	Low		0		0.8		V

Note:

1. The optical power is launched into SMF.
2. Measured with a PRBS 2⁷-1 test pattern @1.25Gbps.
3. Internally AC coupled and terminated.
4. Measured with a PRBS 2⁷-1 test pattern@1.25Gbps, BER ≤ 1 × 10⁻¹²
5. 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 the memory contents, Please refer to Table 6.

Table 6 - 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	01	SC
3—10	8	Transceiver	00 00 00 40 00 00 00 00	Transmitter Code
11	1	Encoding	01	8B10B
12	1	BR, nominal	0D	1.25Gbps
13	1	Reserved	00	
14	1	Length (9um)-km	0F	15km
15	1	Length (9um)	96	
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." (ASC II)
36	1	Reserved	00	
37—39	3	Vendor OUI	00 00 00	
40—55	16	Vendor PN	46 54 4D 2D 39 xx 31 32 53 2D 53 4C 31 35 xx 47	"FTM-9x12S-SL15xG" (ASC II)
56—59	4	Vendor rev	xx xx xx xx	ASC II ("31 30 20 20" means 1.0 revision)
60-61	2	Wavelength	05 1E/05 D2	1310/1490nm
62	1	Reserved	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	ASC II
84—91	8	Vendor date code	xx xx xx xx xx xx 20 20	Year(2 bytes), Month(2 bytes), Day (2 bytes)
92	1	Diagnostic type	58	Diagnostics(Ext.Cal)
93	1	Enhanced option	B0	Diagnostics (Optional Alarm/warning flags, Soft TX_FAULT and Soft TX_LOS monitoring)
94	1	SFF-8472	02	Diagnostics(SFF-8472 Rev 9.5)
95	1	CC EXT	xx	Check sum of bytes 64 - 94
96—255	160	Vendor specific		

Note: The “xx” byte should be filled in according to practical case. For more information, please refer to the related document of SFF-8472 Rev 9.5.

Monitoring Specification

The digital diagnostic monitoring interface also defines another 256-byte memory map in EEPROM, which makes use of the 8 bit address 1010001X (A2h). Please see Figure 1. For detail EEPROM information, please refer to the related document of SFF-8472 Rev 9.5. The monitoring specification of this product is described in Table 7 and Table 8.

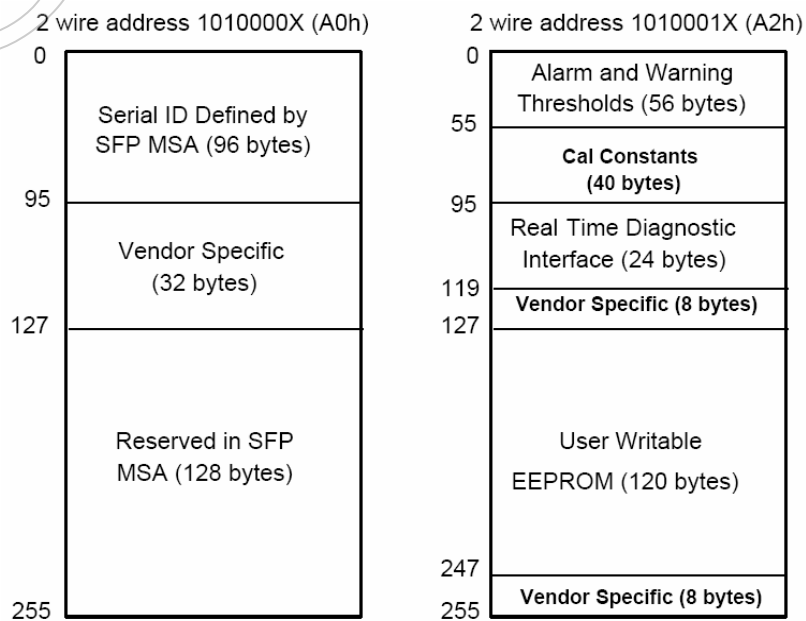


Figure 1, EEPROM Memory Map Specific Data Field Description

Table 7 - FTM-9612S-SL15iG/ FTM-9912S-SL15iG Monitoring Specification

Parameter	Range	Accuracy	Calibration
Temperature	-40 to +100°C	±3°C	External
Voltage	2.97 to 3.63V	±3%	External
Bias Current	3mA to 80mA	±10%	External
TX Power	-3 to -9dBm	±3dB	External
RX Power	-3 to -23dBm	±3dB	External

Table 8 - FTM-9612S-SL15G FTM-9912S-SL15G Monitoring Specification

Parameter	Range	Accuracy	Calibration
Temperature	-5 to + 90°C	±3°C	External
Voltage	2.97 to 3.63V	±3%	External
Bias Current	3mA to 80mA	±10%	External
TX Power	-3 to -9dBm	±3dB	External
RX Power	-3 to -23dBm	±3dB	External

Recommended Interface Circuit

Figure 2 shows the recommended interface circuit.

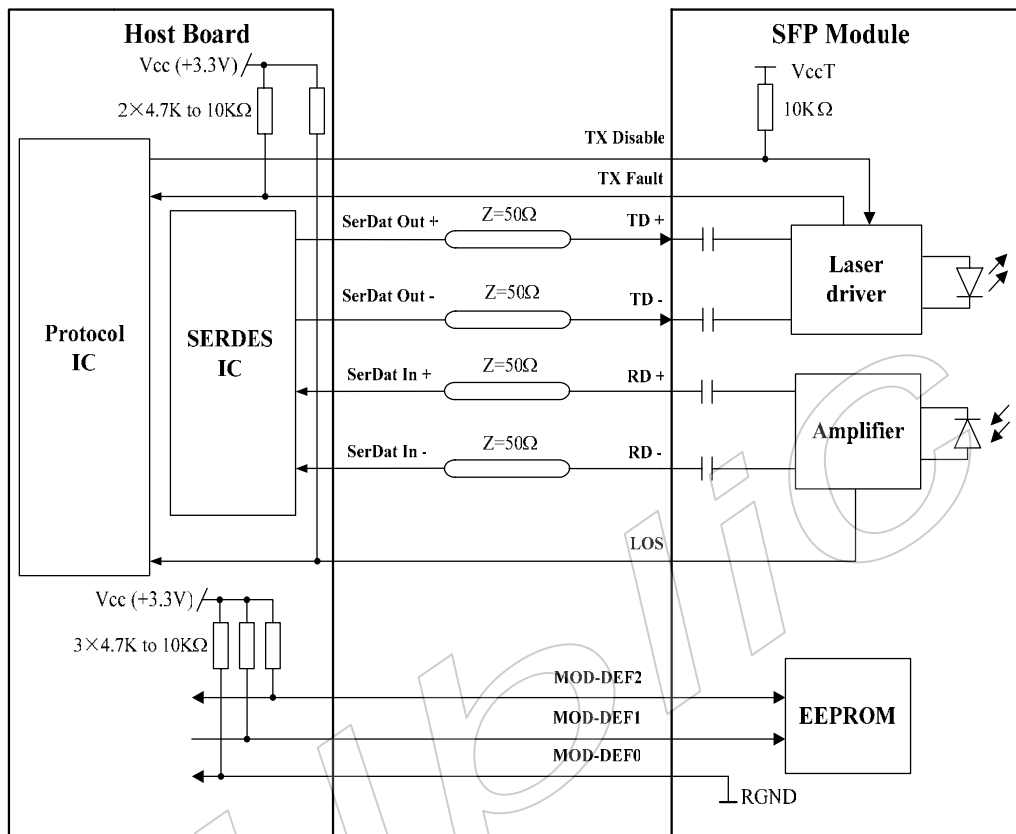


Figure 2, Recommended Interface Circuit

Pin Definitions

The pin functions are described in Table 9 with the accompanying notes.

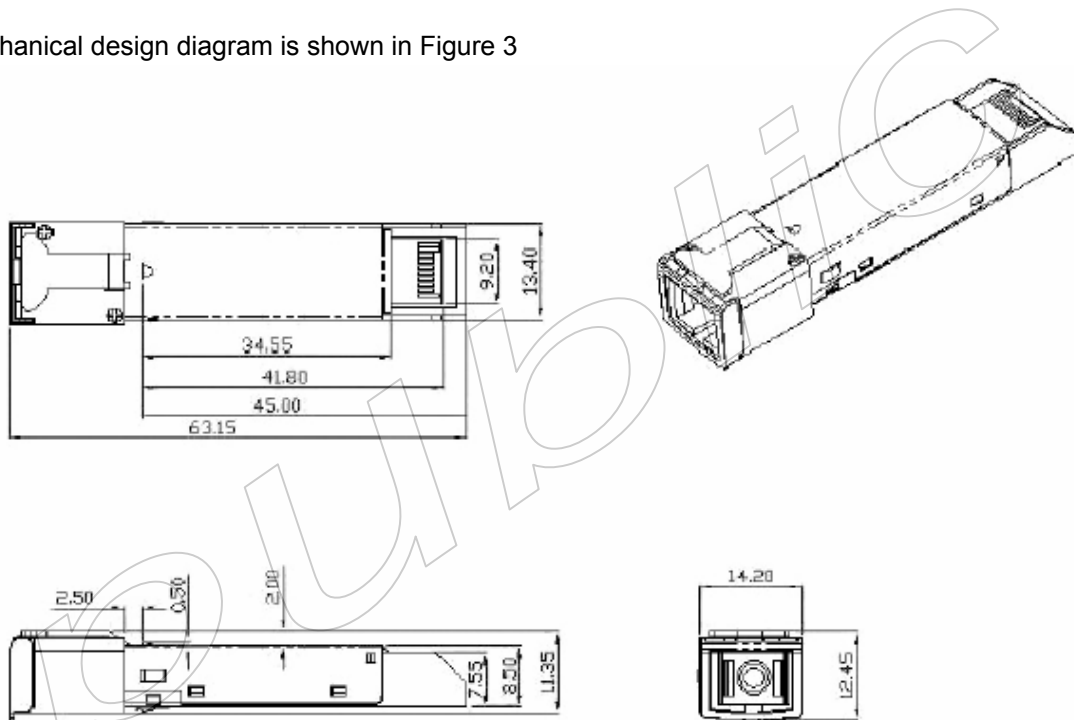
Table 9 – Pin Function Definitions

Pin	Function	Notes
1	VeeT	TX GND
2	TX-FAULT	Open Collector
3	TX-DISABLE	Internally Pulled High
4	MOD-DEF2	Serial Data Input
5	MOD-DEF1	Serial Clock Input
6	MOD-DEF0	Internally Grounded
7	NC	Not Connected
8	LOS	Open Collector
9	VeeR	RX Ground
10	VeeR	RX Ground
11	VeeR	RX Ground
12	RXD-	RX Data Negative
13	RXD+	RX Data Positive
14	VeeR	RX GND

15	VccR	RX Power
16	VccT	TX Power
17	VeeT	TX GND
18	TXD+	TX Data Positive
19	TXD-	TX Data Negative
20	VeeT	TX GND

Mechanical Design Diagram

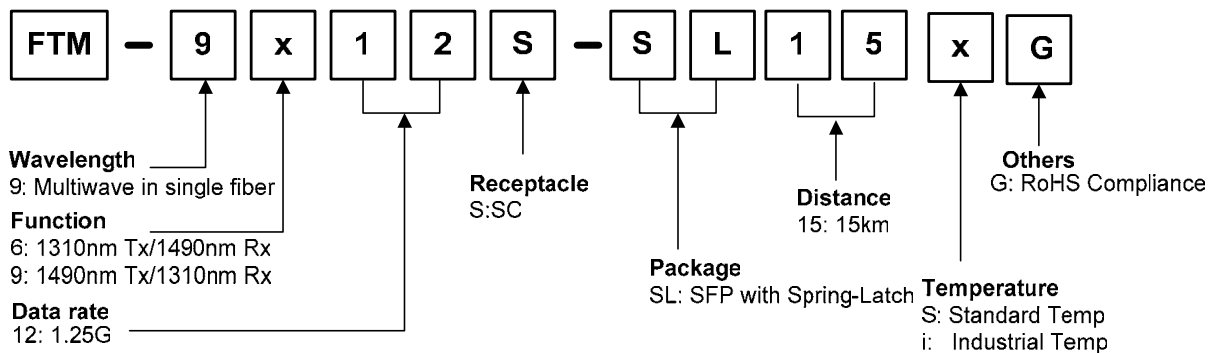
The mechanical design diagram is shown in Figure 3



Dimensions are in millimeters

Figure 3, Mechanical Design Diagram of SFP with Spring Latch

Ordering information



Note:
The "Temperature" bit may be omitted when it is "Standard Temp"

Part No.	Product Description
FTM-9612S-SL15G	1310nm Tx/1490nm RX for ONU, 1.25Gbps, 15km, SFP with Spring-Latch ,SC receptacle, 0°C~+70°C
FTM-9612S-SL15iG	1310nm Tx/1490nm RX for ONU, 1.25Gbps, 15km, SFP with Spring-Latch ,SC receptacle, -40°C~+85°C
FTM-9912S-SL15G	1490nm Tx/1310nm RX for OLT, 1.25Gbps, 15km, SFP with Spring-latch, SC receptacle, 0°C~+70°C
FTM-9912S-SL15iG	1490nm Tx/1310nm RX for OLT, 1.25Gbps, 15km, SFP with Spring-latch, SC receptacle, -40°C~+85°C

Related Documents

For further information, please refer to the following documents: *Flexon™ SFP Installation Guide*

- ◆ *Flexon™ SFP Installation Guide*
- ◆ *Flexon™ SFP Application Notes*
- ◆ *SFP Multi-Source Agreement (MSA)*

Obtaining Document

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Revision History

Revision	Initiate	Review	Approve	Subject	Release Date
Rev. 1a	Solaris.Zhu	Gary.Chen	Walker.Weii	Initial datasheet	Jan. 18, 2006
Rev. 1b	Solaris.Zhu	Monica.Weii	Walker.Weii	Modified the recommended interface circuit; Adjusted RMS spectral width	Mar. 30, 2006
Rev. 1c	Solaris.Zhu	Monica Wei	Walker.Weii	ADD P/N: FTM-9612S-SL15G	Oct. 18, 2006
Rev. 1d	Solaris.Zhu	Monica Wei	Walker.Weii	Updated datasheet from preliminary version to formal version	Jun. 12, 2007

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