1.25Gbps CWDM Spring-latch SFP Transceiver

(For 22dB/30dB minimum link budget with monitoring function)

Members of Flexon™ Family

Features

- Up to 1.25Gbps bi-directional data links
- Uncooled DFB laser transmitter
- Ten CWDM wavelengths available
- Multi-source package with LC optical interface
- With Spring latch for high density application
- Color coded lever for different wavelengths
- Class 1 laser product
- 22dB/30dB minimum link budget
- Single +3.3V power supply
- Hot-pluggable capability
- Monitoring interface compatible with SFF-8472
- Operating temperature 0°C to +70°C

Applications

Optical communication in Metro/Access Networks:

- Switch to switch interface
- Switched backplane applications
- Router/Server interface
- Other optical transmission systems

Standard

- Compatible with SFP MSA
- Compatible with SFF-8472 Rev 9.5
- Compatible with FCC 47 CFR Part 15, Class B
- Compatible with FDA 21 CFR 1040.10 and 1040.11, Class I
- Compatible with ITU-T G.694.2
- Compatible with ITU-T G.695
- RoHS compliant

Description

FTM-6112C-SLxxxxxG is designed for Coarse Wavelength Division Multiplexing (CWDM) applications at data rates of 1.25Gbps. There are ten centre wavelengths available at present: 1431nm, 1451nm, 1471nm, 1491nm,. 1511nm, 1531nm, 1551nm, 1571nm, 1591nm and 1611nm, compatible with ITU-T G694.2. It offers a guaranteed minimum optical link budget of 22dB or 30dB.

The transmitter section of FTM-6112C-SLxxxxxG incorporates a highly reliable uncooled DFB laser and the receiver section utilizes a PIN/APD receiver. All modules satisfy Class 1 Laser Safety requirements.

FTM-6112C-SLxxxxxG provides an enhanced monitoring interface, 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 sophisticated system of alarm and warning flags, which alerts end-users when particular operating parameters are outside of a factory set normal range.

FTM-6112C-SLxxxxxG is 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 Fiberxon regulatory specification and safety guidelines, or contact with Fiberxon, Inc. America sales office listed at the end of 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 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
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

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	%
Input Optical Power	FTM-6112C-SL80xxG	P_{max}		+3	
	FTM-6112C-SL100xxG			-3	

Recommended Operating Conditions

Table 3- Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Unit
Operating Case Temperature	T_C	0		+70	°C
Power Supply Voltage	V_{CC}	3.13		3.47	V
Power Supply Current	I_{CC}			300	mA
Data Rate			1.25		Gbps

Optical and Electrical Characteristics

All parameters are specified at overall operating case temperature and power supply range, unless otherwise stated.

FTM-6112C-SL80xxG (DFB and PIN, 22dB Min. link budget, Monitoring function)

Table 4 - Optical and Electrical Characteristics

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
Transmitter							
Centre Wavelength		λ_C	x-6.5	x	x+6.5	nm	1
Spectral Width (-20dB)		$\Delta\lambda$			1	nm	
Average Output Power		P_{0ut}	0		5	dBm	2
Side Mode Suppression Ratio		SMSR	30			dB	
Extinction Ration		EX	9			dB	
Optical Rise/Fall Time		t_r/t_f			0.26	ns	3
P_{0ut}@TX Disable Asserted					-45	dBm	
Optical Path Penalty					1.5	dB	10
Total Jitter (pk-pk)		TJ			0.431	UI	4
Output Optical Eye		IEEE 802.3 Gigabit Ethernet Compliant					5
Differential Data Input Swing		V_{IN}	500		2400	mV	6
Input Differential Impedance		Z_{IN}	85	100	115	Ω	
TX Disable	Disable		2.0		Vcc	V	7
	Enable		0		0.8	V	
TX Fault	Fault		2.0		Vcc+0.3	V	
	Normal		0		0.8	V	
TX Disable Assert Time		t_off			10	μs	
Receiver							
Centre Wavelength		λ_C	1270		1620	nm	8
Receiver Sensitivity					-22	dBm	9
Receiver Overload			0			dBm	
Return Loss			12			dB	
LOS De-Assert		LOS_D			-23	dBm	

LOS Assert		LOS_A	-35			dBm	
LOS Hysteresis			0.5		4.5	dB	
Differential Data Output Swing		V_{OUT}	400		1200	mV	11
LOS	High		2.0		Vcc+0.3	V	
	Low		0		0.8	V	
LOS Assert Time					100	μs	
LOS De-Assert Time					100	μs	

Notes:

1. "x" can be specified by the customer. The current available wavelength are: 1431, 1451, 1471, 1491, 1511, 1531, 1551, 1571, 1591, 1611nm.
2. The optical power is launched into 9/125 SMF.
3. 20%-80%, unfiltered, measured with a PRBS 2^7-1 test pattern @1.25Gbps
4. Measured with a PRBS 2^7-1 test pattern @1.25Gbps, and TJ-free data input signal, the TJ should be the sum of input total jitter in actual application.
5. Measured with a PRBS 2^7-1 test pattern @1.25Gbps
6. CML logic, internally AC coupled.
7. If Pin 3 (TX Disable) is left open, TX is disabled.
8. The 1611nm signal can also be received while the sensitivity is degraded.
9. Worst-case condition, measured with a PRBS 2^7-1 test pattern @1.25Gbps, BER better than or equal to 1×10^{-12}.
10. It is for 80km transmission over G.652 SMF, measured with a PRBS 2^7-1 test pattern @1.25Gbps, BER better than or equal to 1×10^{-12}.
11. CML logic, internally AC coupled.

FTM-6112C-SL100xxG (DFB and APD, 30dB Min. link budget, Monitoring function)

Table 5 - Optical and Electrical Characteristics

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
Transmitter							
Centre Wavelength		λ_C	x-6.5	x	x+6.5	nm	1
Spectral Width (-20dB)		$\Delta\lambda$			1	nm	
Average Output Power		P_{0ut}	0		5	dBm	2
Side Mode Suppression Ratio		SMSR	30			dB	
Extinction Ration		EX	9			dB	
Optical Rise/Fall Time		t_r/t_f			0.26	ns	3
P_{0ut}@TX Disable Asserted					-45	dBm	
Optical Path Penalty					2	dB	10
Total Jitter (pk-pk)		TJ			0.431	UI	4
Output Optical Eye		IEEE 802.3 Gigabit Ethernet Compliant					5
Differential Data Input Swing		V_{IN}	500		2400	mV	6
Input Differential Impedance		Z_{IN}	85	100	115	Ω	
TX Disable	Disable		2.0		Vcc	V	7
	Enable		0		0.8	V	

TX Fault	Fault		2.0		Vcc+0.3	V	
	Normal		0		0.8	V	
TX Disable Assert Time		t_off			10	μs	
Receiver							
Centre Wavelength		λ_C	1270		1620	nm	8
Receiver Sensitivity					-30	dBm	9
Receiver Overload			-9			dBm	
LOS De-Assert		LOS_D			-31	dBm	
LOS Assert		LOS_A	-45			dBm	
LOS Hysteresis			0.5		4.5	dB	
Differential Data Output Swing		V_{OUT}	400		1200	mV	11
LOS	High		2.0		Vcc+0.3	V	
	Low		0		0.8	V	
LOS Assert Time					100	μs	
LOS De-Assert Time					100	μs	

Notes:

1. "x" can be specified by the customer. The current available wavelength are: 1431nm, 1451nm, 1471nm, 1491nm, 1511nm, 1531nm, 1551nm, 1571nm, 1591nm, 1611nm.
2. The optical power is launched into 9/125 SMF.
3. 20%-80%, unfiltered, measured with a PRBS 2^7-1 test pattern @1.25Gbps.
4. Measured with a PRBS 2^7-1 test pattern @1.25Gbps, and TJ-free data input signal, the TJ should be the sum of input total jitter in actual application.
5. Measured with a PRBS 2^7-1 test pattern @1.25Gbps.
6. CML logic, internally AC coupled.
7. If Pin 3 (TX Disable) is left open, TX is disabled.
8. The 1611nm signal can also be received while the sensitivity is degraded.
9. Worst-case condition, measured with a PRBS 2^7-1 test pattern @1.25Gbps, BER better than or equal to 1×10^{-12}.
10. It is for 100km transmission over G.652 SMF, measured with a PRBS 2^7-1 test pattern @1.25Gbps, BER better than or equal to 1×10^{-12}.
11. CML logic, 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). The memory contents 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	07	LC
3—10	8	Transceiver	00 00 00 02 00 00 00 00	1000BASE-LX
11	1	Encoding	03	NRZ
12	1	BR, nominal	0C	1.25Gbps
13	1	Reserved	00	
14	1	Length (9um)-km	xx	80km/100km(50/64)
15	1	Length (9um)	xx	80km/100km(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	36 31 31 32 43 2D 53 4C xx xx xx xx xx 47 20 20	“6112C-SLxxxxxxG ” (ASCⅡ)
56—59	4	Vendor rev	xx xx 20 20	ASCⅡ（“31 30 20 20” means 1.0 revision)
60—61	2	Wavelength	xx xx	From 1431nm~1611nm
62	1	Reserved		
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, used for Fiberxon SFPs
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	xx	Diagnostics
93	1	Enhanced option	B0	Diagnostics (Optional Alarm/warning flags, Soft TX_FAULT , Soft TX_LOS monitoring)
94	1	SFF-8472	02	Diagnostics (SFF-8472 Rev 9.4)
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 *SFP Multi-Source Agreement (MSA)*.

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.

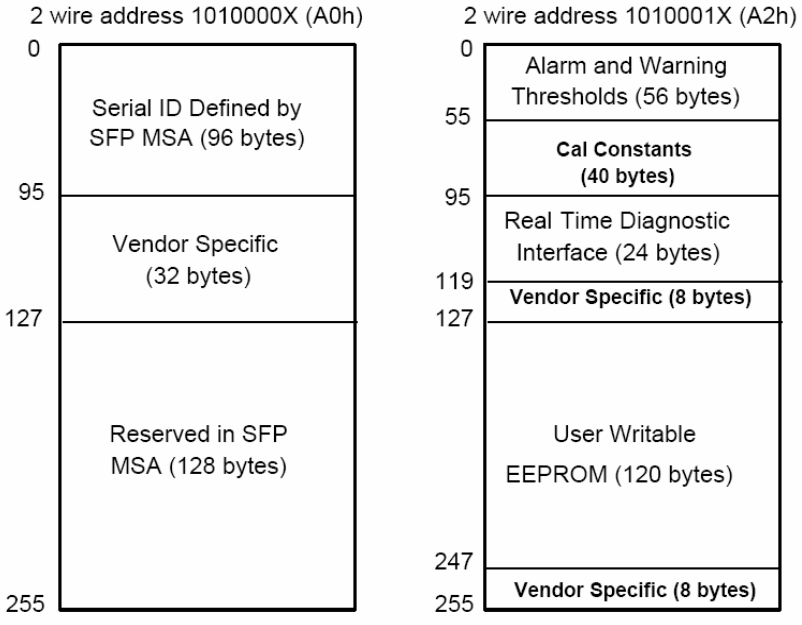


Figure 1, EEPROM Memory Map Specific Data Field Descriptions

Table 7- Monitoring Specification

Parameter		Range	Accuracy	Calibration
Temperature	FTM-6112C-SL80xxG	-10 to 80°C	±3°C	Internal
	FTM-6112C-SL100xxG			External
Voltage	FTM-6112C-SL80xxG	3.0 to 3.6V	±3%	Internal
	FTM-6112C-SL100xxG			External
Bias Current	FTM-6112C-SL80xxG	0 to 100mA	±10%	Internal
	FTM-6112C-SL100xxG			External
TX Power	FTM-6112C-SL80xxG	-1 to 6dBm	±3dB	Internal
	FTM-6112C-SL100xxG			External
Rx Power	FTM-6112C-SL80xxG	-24 to 1dBm	±3dB	Internal
	FTM-6112C-SL100xxG	-32 to -8dBm		External

Recommended Host Board Power Supply Circuit

Figure 2 shows the recommended host board power supply circuit.

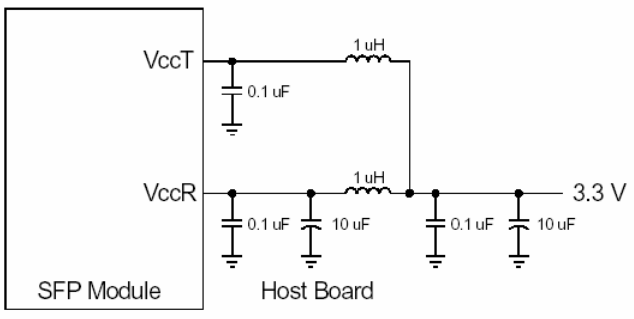


Figure 2, Recommended Host Board Power Supply Circuit

Recommended Interface Circuit

Figure 3 shows the recommended interface circuit.

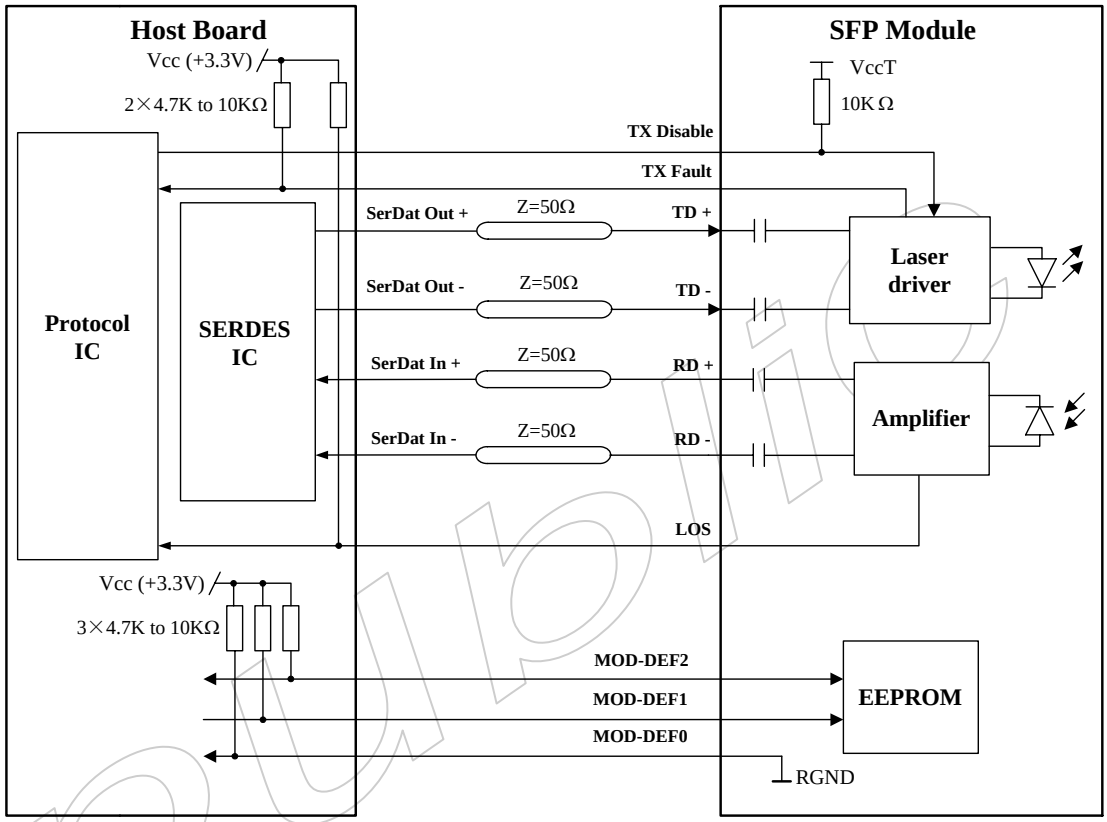


Figure 3, Recommended Interface Circuit

Pin Definitions

Figure 4 below shows the pin numbering of SFP electrical interface. The pin functions are described in Table 8 with some accompanying notes.

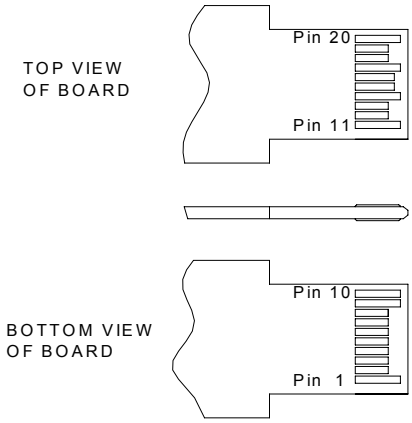


Figure 4, Pin View

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 is grounded by the module to indicate that the module is present
   MOD-DEF 1 is the clock line of two wires serial interface for serial ID
   MOD-DEF 2 is the data line of two wires 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 output. 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 5.

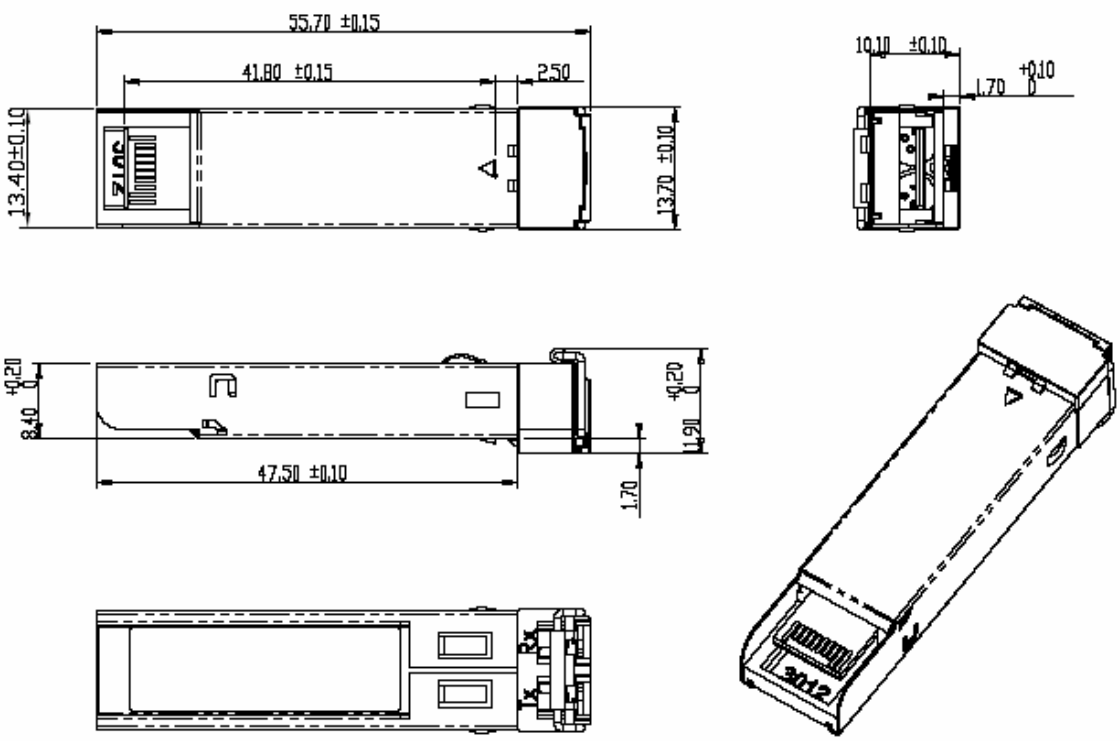
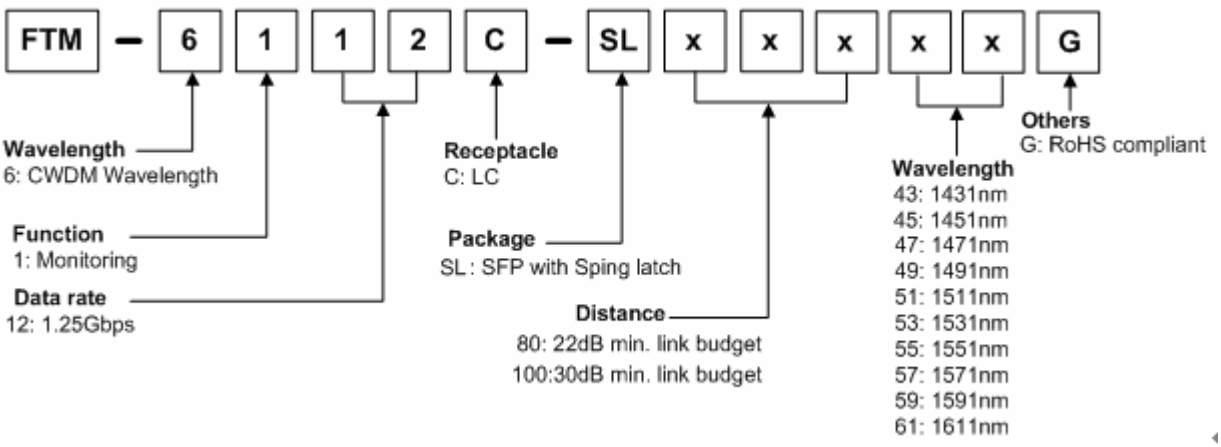


Figure 5, Mechanical Design Diagram of the SFP with Spring Latch

Ordering information



Part No.	Product Description
FTM-6112C-SL10043G	1431nm (Black Lever) 1.25Gbps SFP with Spring latch, 30dB minimum link budget, with monitoring function, RoHS compliant
FTM-6112C-SL10045G	1451nm (Black Lever) 1.25Gbps SFP with Spring latch, 30dB minimum link budget, with monitoring function, RoHS compliant
FTM-6112C-SL10047G	1471nm (Gray Lever) 1.25Gbps SFP with Spring latch, 30dB minimum link budget, with monitoring function, RoHS compliant
FTM-6112C-SL10049G	1491nm (Violet Lever) 1.25Gbps SFP with Spring latch, 30dB minimum link budget, with monitoring function, RoHS compliant
FTM-6112C-SL10051G	1511nm (Blue Lever) 1.25Gbps SFP with Spring latch, 30dB minimum link budget, with monitoring function, RoHS compliant
FTM-6112C-SL10053G	1531nm (Green Lever) 1.25Gbps SFP with Spring latch, 30dB minimum link budget, with monitoring function, RoHS compliant
FTM-6112C-SL10055G	1551nm (Yellow Lever) 1.25Gbps SFP with Spring latch, 30dB minimum link budget, with monitoring function, RoHS compliant
FTM-6112C-SL10057G	1571nm (Orange Lever) 1.25Gbps SFP with Spring latch, 30dB minimum link budget, with monitoring function, RoHS compliant
FTM-6112C-SL10059G	1591nm (Red Lever) 1.25Gbps SFP with Spring latch, 30dB minimum link budget, with monitoring function, RoHS compliant
FTM-6112C-SL10061G	1611nm (Brown Lever) 1.25Gbps SFP with Spring latch, 30dB minimum link budget, with monitoring function, RoHS compliant
FTM-6112C-SL8043G	1431nm (Black Lever) 1.25Gbps SFP with Spring latch, 22dB minimum link budget, with monitoring function, RoHS compliant
FTM-6112C-SL8045G	1451nm (Black Lever) 1.25Gbps SFP with Spring latch, 22dB minimum link budget, with monitoring function, RoHS compliant
FTM-6112C-SL8047G	1471nm (Gray Lever) 1.25Gbps SFP with Spring latch, 22dB minimum link budget, with monitoring function, RoHS compliant
FTM-6112C-SL8049G	1491nm (Violet Lever) 1.25Gbps SFP with Spring latch, 22dB minimum link budget, with monitoring function, RoHS compliant
FTM-6112C-SL8051G	1511nm (Blue Lever) 1.25Gbps SFP with Spring latch, 22dB minimum link budget, with monitoring function, RoHS compliant
FTM-6112C-SL8053G	1531nm (Green Lever) 1.25Gbps SFP with Spring latch, 22dB minimum link budget, with monitoring function, RoHS compliant
FTM-6112C-SL8055G	1551nm (Yellow Lever) 1.25Gbps SFP with Spring latch, 22dB minimum link budget, with monitoring function, RoHS compliant
FTM-6112C-SL8057G	1571nm (Orange Lever) 1.25Gbps SFP with Spring latch, 22dB minimum link budget, with monitoring function, RoHS compliant
FTM-6112C-SL8059G	1591nm (Red Lever) 1.25Gbps SFP with Spring latch, 22dB minimum link budget, with monitoring function, RoHS compliant
FTM-6112C-SL8061G	1611nm (Brown Lever) 1.25Gbps SFP with Spring latch, 22dB minimum link budget, with monitoring function, RoHS compliant

Related Documents

For further information, please refer to the following documents:

- *Fiberxon Spring-latch 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	Univer.Yang	Bell.Huang	Walker.Wei	Initial datasheet	April 17, 2007
Rev. 1b	Univer.Yang	Bell.Huang	Walker.Wei	Formal edition	June 13, 2007

Contact

U.S.A. Headquarter:
5201 Great America Parkway, Suite 340
Santa Clara, CA 95054
U. S. A.
Tel: 408-562-6288
Fax: 408-562-6289
Or visit our website: http://www.fiberxon.com