Preliminary

155M～2.67Gbps Spring-latch SFP Transceiver

(With monitoring function, industrial or extended case temperature for 2~80km transmission, RoHS compliant)

Members of Flexon™ Family

Features

- Support 155M～2.67Gbps multi-rate data links
- 1310nm FP laser and PIN photodiode for 2km transmission
- 1310nm uncooled DFB laser and PIN photodiode for 15km transmission
- 1310nm uncooled DFB laser and APD photodiode for 40km transmission
- 1550nm uncooled DFB laser and APD photodiode for 80km transmission
- Digital diagnostic monitor interface compliant with SFF-8472
- SFP MSA package with duplex LC connector
- With Spring latch for high density application
- Class I laser product
- Hot-pluggable capability
- Operating case temperature:
  Extended: -5 to +85℃ or -20 to +85℃
  Industrial : -40 to +85℃

Applications

- 1×/2× Fiber Channel
- Gigabit Ethernet
- SDH/SONET/ATM
- Other optical links

Standard

- Compatible with SFP MSA
- Compatible with SFF-8472 Rev 9.5
- Compatible with ITU-T G.957 and G.958
- Compatible with Telcordia GR-253-CORE
- Compatible with FCC 47 CFR Part 15, Class B
- Compatible with FDA 21 CFR 1040.10 and 1040.11, Class I
- RoHS compliant

Description

Fiberxon 155M～2.67Gbps Spring-latch i-temp or E-temp SFP transceiver is high performance, cost effective module that supports data-rate up to 2.67Gbps and transmission distance from 2km 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 or APD 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 degradation of the laser. Loss of signal (LOS) output is provided to indicate the loss of an input optical signal of receiver.

The transceiver provides an enhanced monitoring interface, which allows real time access to the transceiver operating parameters such as transceiver temperature, laser bias current, transmitted optical power, received optical power and transceiver supply voltage by reading a built-in memory with I2C interface. For further information, please refer to SFF-8472 Rev 9.5.

Fiberxon 155M～2.67Gbps i-temp or E-temp SFP transceiver 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 Flexon™ 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 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

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

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 Humidity		-	5	95	%
Input Optical Power	FTM-3128C-SL2E(i)G	P_{max}		+3	dBm
	FTM-3128C-SL15E(i)G			+3	
	FTM-3128C-SL40iG			-3	
	FTM-5128C-SL80EG			-3	

Recommended Operating Conditions

Table 3 - Recommended Operating Conditions

Parameter		Symbol	Min.	Typical	Max.	Unit
Operating Case Temperature	Extended	Tc	-5/-20		+85	°C
	Industrial		-40		+85	
Power Supply Voltage		V_{CC}	3.13		3.47	V
Power Supply Current		I_{CC}			300	mA
Data Rate			155	2488	2670	Mbps

Optical and Electrical Characteristics

All parameters are specified at overall operating case temperature and power supply range, and with a PRBS 2^{23}-1 test pattern @2.488Gbps unless otherwise stated.

FTM-3128C-SL2E(i)G (1310nm FP and PIN, I-16/OC48 SR, Monitoring function)

Table 4 –Optical and Electrical Characteristics

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
Transmitter							
Centre Wavelength		λ_C	1266		1360	nm	
Spectral Width (RMS)		σ		2	4	nm	
Average Output Power		P_{0ut}	-10		-3	dBm	1
Extinction Ration		EX	8.2			dB	
P_{0ut}@TX Disable Asserted					-45	dBm	
Jitter Generation (RMS)					0.01	UI	
Jitter Generation (pk-pk)					0.1	UI	
Output Optical Eye		ITU-T G.957 compatible					2
Data Input Differential Swing		V_{IN}	500		2400	mV	3
Input Differential Impedance		Z_{IN}		100		Ω	
TX Disable	Disable		2.0		Vcc+0.3	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					-18	dBm	4
Receiver Overload			-3			dBm	
Reflection					-27	dB	
LOS De-Assert		LOS_D			-20	dBm	
LOS Assert		LOS_A	-35			dBm	
LOS Hysteresis			0.5		4.5	dB	
Data Output Differential Swing		V_{OUT}	400		1200	mV	5

LOS	High		2.0		Vcc+0.3	V	
	Low		0		0.8	V	

Notes:

1. The optical power is launched into 9/125 SMF.
2. Measured with a PRBS 2^{23}-1 test pattern @2.488Gbps.
3. Internally AC-coupled and terminated to 100Ω differential load.
4. Measured with a PRBS 2^{23}-1 test pattern, BER better than or equal to 1×10^{-10}
5. AC-coupled CML logic family

FTM-3128C-SL15E(i)G (1310nm DFB and PIN, S-16.1/OC48 IR-1, Monitoring function)

Table 5 –Optical and Electrical Characteristics

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
Transmitter							
Centre Wavelength		λ_C	1260		1360	nm	
Spectral Width (-20dB)		Δλ			1	nm	
Average Output Power		P_{0ut}	-5		0	dBm	1
Side Mode Suppression Ratio		SMSR	30			dB	
Extinction Ration		EX	8.2			dB	
P_{0ut}@TX Disable Asserted					-45	dBm	
Jitter Generation (RMS)					0.01	UI	
Jitter Generation (pk-pk)					0.1	UI	
Output Optical Eye		ITU-T G.957 compatible					2
Data Input Differential Swing		V_{IN}	500		2400	mV	3
Input Differential Impedance		Z_{IN}		100		Ω	
TX Disable	Disable		2.0		Vcc+0.3	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					-18	dBm	4
Receiver Overload			0			dBm	
Reflection					-27	dB	
LOS De-Assert		LOS_D			-20	dBm	
LOS Assert		LOS_A	-35			dBm	
LOS Hysteresis			0.5		4.5	dB	
Data Output Differential Swing		V_{OUT}	400		1200	mV	5
LOS	High		2.0		Vcc+0.3	V	
	Low		0		0.8	V	

Notes:

1. The optical power is launched into 9/125 SMF.
2. Measured with a PRBS 2^{23}-1 test pattern @2.488Gbps.

3. Internally AC-coupled and terminated to 100Ω differential load.
4. Measured with a PRBS 2^{23}-1 test pattern, BER better than or equal to 1×10^{-10}
5. AC-coupled CML logic family

FTM-3128C-SL40iG (1310nm DFB and APD, L-16.1/OC48 LR-1, Monitoring function)

Table 6 –Optical and Electrical Characteristics

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
Transmitter							
Centre Wavelength		λ_C	1280		1335	nm	
Spectral Width (-20dB)		$\Delta\lambda$			1	nm	
Average Output Power		P_{0ut}	-2		+3	dBm	1
Side Mode Suppression Ratio		SMSR	30			dB	
Extinction Ration		EX	8.2			dB	
P_{0ut}@TX Disable Asserted					-45	dBm	
Jitter Generation (RMS)					0.01	UI	
Jitter Generation (pk-pk)					0.1	UI	
Output Optical Eye		ITU-T G.957 compatible					2
Data Input Differential Swing		V_{IN}	500		2400	mV	3
Input Differential Impedance		Z_{IN}		100		Ω	
TX Disable	Disable		2.0		Vcc+0.3	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					-27	dBm	4
Receiver Overload			-9			dBm	
Reflection					-27	dB	
LOS De-Assert		LOS_D			-29	dBm	
LOS Assert		LOS_A	-45			dBm	
LOS Hysteresis			0.5		4.5	dB	
Data Output Differential Swing		V_{OUT}	400		1200	mV	5
LOS	High		2.0		Vcc+0.3	V	
	Low		0		0.8	V	

Notes:

1. The optical power is launched into 9/125 SMF.
2. Measured with a PRBS 2^{23}-1 test pattern @2.488Gbps.
3. Internally AC-coupled and terminated to 100Ω differential load.
4. Measured with a PRBS 2^{23}-1 test pattern, BER better than or equal to 1×10^{-10}
5. AC-coupled CML logic family

FTM-5128C-SL80EG (1550nm DFB and APD, L-16.2/OC48 LR-2, Monitoring function)

Table 7 –Optical and Electrical Characteristics

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
Transmitter							
Centre Wavelength		λ_C	1500		1580	nm	
Spectral Width (-20dB)		$\Delta\lambda$			1	nm	
Average Output Power		P_{0ut}	-2		+3	dBm	1
Side Mode Suppression Ratio		SMSR	30			dB	
Extinction Ration		EX	8.2			dB	
P_{0ut}@TX Disable Asserted					-45	dBm	
Optical path penalty					2	dB	5
Jitter Generation (RMS)					0.01	UI	
Jitter Generation (pk-pk)					0.1	UI	
Output Optical Eye		ITU-T G.957 compatible					2
Data Input Differential Swing		V_{IN}	500		2400	mV	3
Input Differential Impedance		Z_{IN}		100		Ω	
TX Disable	Disable		2.0		Vcc+0.3	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					-28	dBm	4
Receiver Overload			-9			dBm	
Reflection					-27	dB	
LOS De-Assert		LOS_D			-29	dBm	
LOS Assert		LOS_A	-45			dBm	
LOS Hysteresis			0.5		4.5	dB	
Data Output Differential Swing		V_{OUT}	400		1200	mV	6
LOS	High		2.0		Vcc+0.3	V	
	Low		0		0.8	V	

Notes:

1. The optical power is launched into 9/125 SMF.
2. Measured with a PRBS 2^{23}-1 test pattern @2.488Gbps.
3. Internally AC-coupled and terminated to 100Ω differential load.
4. Measured with a PRBS 2^{23}-1 test pattern @2.488Gbps, BER better than or equal to 1×10^{-10}
5. Measured with a PRBS 2^{23}-1 test pattern @2.488Gbps, maximum dispersion 1600nm/ps , BER $\leqslant 1\times10^{-10}$.
6. AC-coupled CML logic family

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 two-wire serial interface at the 8-bit address 1010000X (A0h). The memory contents refer to Table 8

Table 8 - 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 xx 00 00 00 00 00 00	OC 48 short/intermediate/long distance
11	1	Encoding	03	NRZ
12	1	BR, nominal	xx	155~2670Mbps
13	1	Reserved	00	
14	1	Length (9um)-km	xx	2km/15km/40km/80km (02/0F/28/50)
15	1	Length (9um)	xx	2km/15km/40km/80km (14/96/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 31 32 38 43 2D 53 4C xx xx xx 47	"FTM-x128C-SLxxxG " (ASCⅡ)
56—59	4	Vendor rev	xx xx 20 20	ASCⅡ("31 30 20 20" means 1.0 revision)
60-61	2	Wavelength	05 1E/06 0E	1310nm/1550nm
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	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	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 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 9

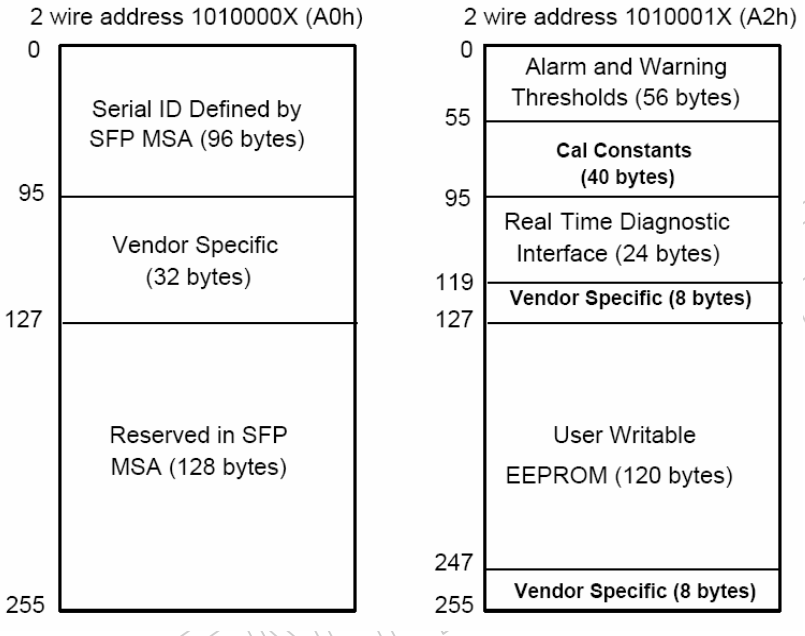


Figure 1, EEPROM Memory Map Specific Data Field Descriptions

Table 9 - Monitoring Specification

Parameter		Range	Accuracy	Calibration*
Temperature	FTM-3128C-SL2E(i)G	-20/-40 to +95°C	±3°C	Internal
	FTM-3128C-SL15E(i)G			Internal
	FTM-3128C-SL40iG	-40 to +95°C		External
	FTM-5128C-SL80EG	-30 to +95°C		External
Voltage	FTM-3128C-SL2E(i)G	3.0 to 3.6V	±3%	Internal
	FTM-3128C-SL15E(i)G			Internal
	FTM-3128C-SL40iG			External
	FTM-5128C-SL80EG			External
Bias Current	FTM-3128C-SL2E(i)G	0 to 100mA	±10%	Internal
	FTM-3128C-SL15E(i)G			Internal
	FTM-3128C-SL40iG			External
	FTM-5128C-SL80EG			External
TX Power	FTM-3128C-SL2E(i)G	-11 to -2dBm	±3dB	Internal
	FTM-3128C-SL15E(i)G	-6 to 1dBm		Internal
	FTM-3128C-SL40iG	-3 to 4dBm		External
	FTM-5128C-SL80EG	-3 to 4dBm		External
RX Power	FTM-3128C-SL2E(i)G	-20 to -2dBm	±3dB	Internal
	FTM-3128C-SL15E(i)G	-20 to 1dBm		Internal

	FTM-3128C-SL40iG	-29 to -8dBm		External
	FTM-5128C-SL80EG	-30 to -8dBm		External

Recommended Host Board Power Supply Circuit

Figure 2 shows the recommended host board power supply circuit.

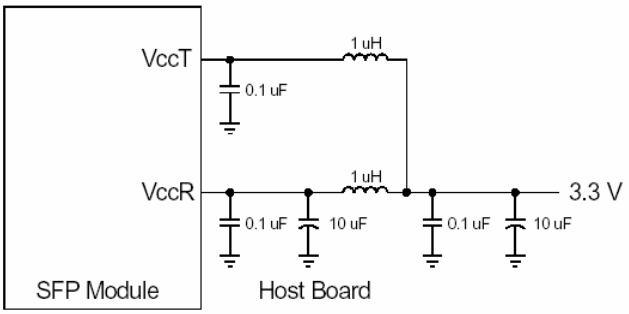


Figure 2, Recommended Host Board Power Supply Circuit

Recommended Interface Circuit

Figure 3 shows the recommended interface circuit.

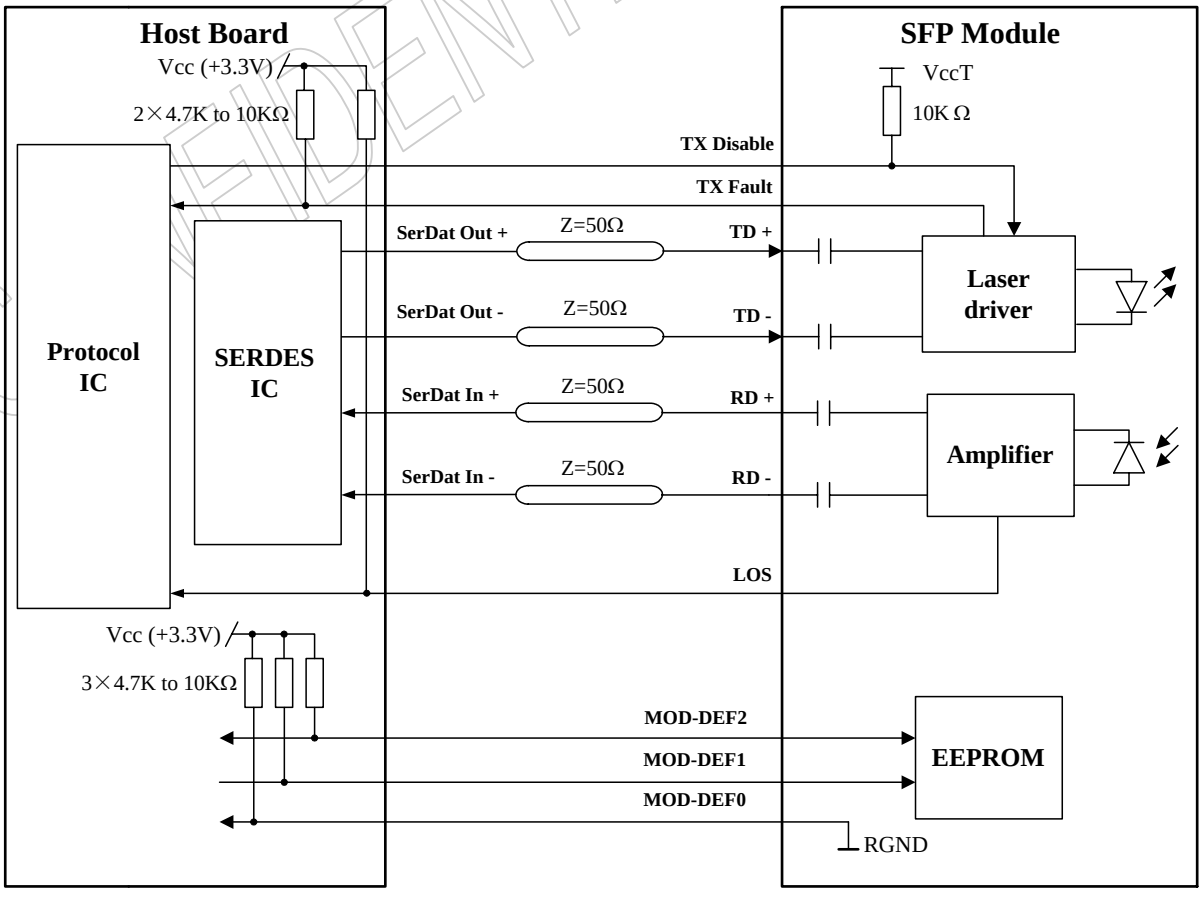


Figure 3, Recommended Interface Circuit

Pin Definitions

Figure 4 below shows the pin numbering of SFP electrical interface. The pin functions are described in Table 10 and the accompanying notes.

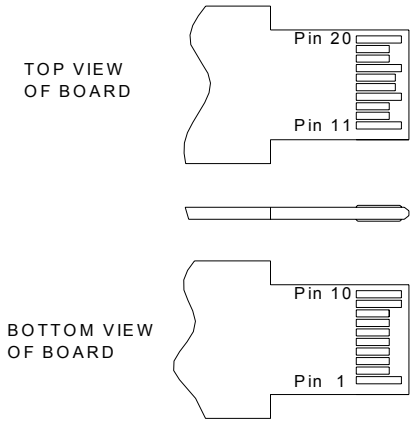


Figure 4, Pin View

Table 10 – 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-wireserial 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 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.

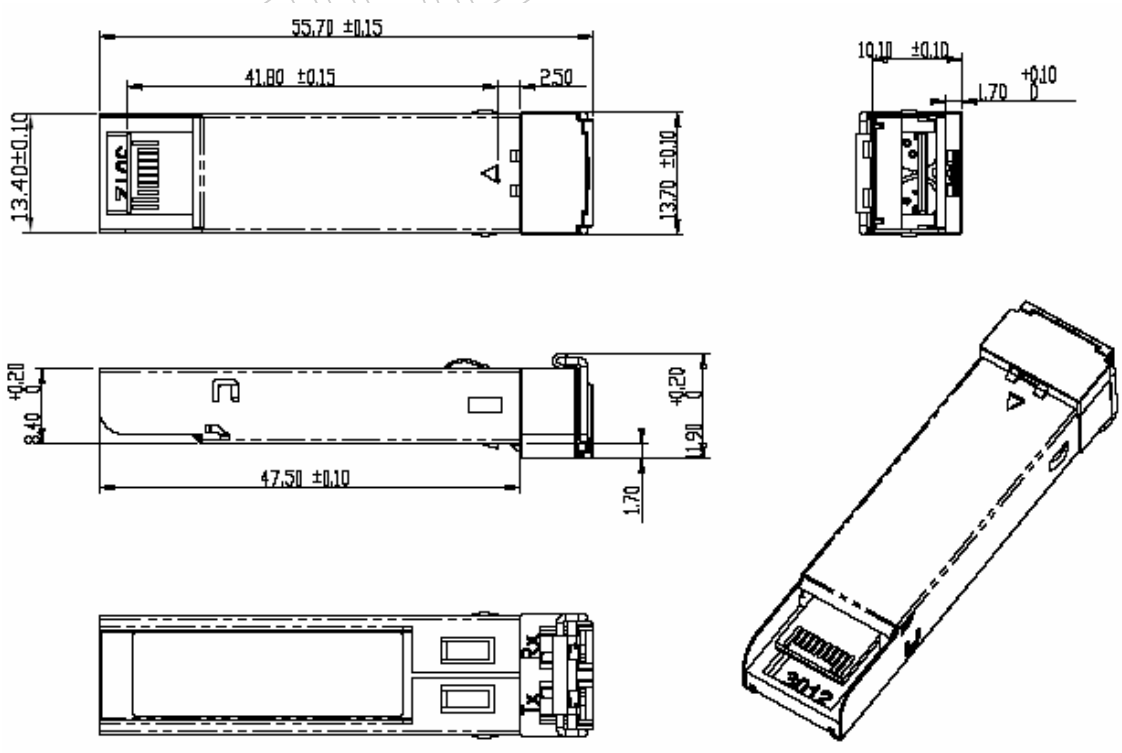
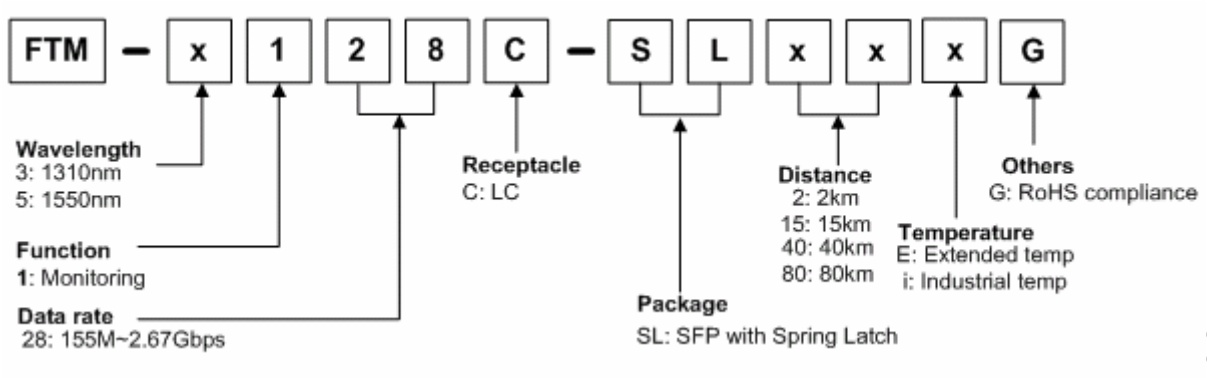


Figure 5, Mechanical Design Diagram of SFP with Spring Latch

Ordering Information



Part No.	Product Description
FTM-3128C-SL2iG	1310nm, 155M ～ 2.67Gbps, 2km, SFP with Spring latch, Monitoring function, -40°C~+85°C, RoHS compliant
FTM-3128C-SL2EG	1310nm, 155M ～ 2.67Gbps, 2km, SFP with Spring latch, Monitoring function, -5°C~+85°C, RoHS compliant
FTM-3128C-SL15iG	1310nm, 155M ～ 2.67Gbps, 15km, SFP with Spring latch, Monitoring function, -40°C~+85°C, RoHS compliant
FTM-3128C-SL15EG	1310nm, 155M ～ 2.67Gbps, 15km, SFP with Spring latch, Monitoring function, -5°C~+85°C, RoHS compliant
FTM-3128C-SL40iG	1310nm, 155M ～ 2.67Gbps, 40km, SFP with Spring latch, Monitoring function, -40°C~+85°C, RoHS compliant
FTM-5128C-SL80EG	1550nm, 155M ～ 2.67Gbps, 80km, SFP with Spring latch, Monitoring function, -20°C~+85°C, RoHS compliant

Related Documents

For further information, please refer to the following documents:

- *Flexon™ SFP Installation Guide*
- *Flexon™ SFP Application Notes*
- *SFP Multi-Source Agreement (MSA)*
- *SFF-8472 Rev 9.5*

Obtaining Document

You can visit our website:
http://www.fiberxon.com

Or contact Fiberxon, Inc. America Sales Office listed at the end of the 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	Apr. 05, 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