155Mbps Spring-latch SFP Transceiver

(With monitoring function, for 130km transmission)

Members of Flexon™ Family

Features

- 155Mbps data-rate
- 1510nm uncooled DFB laser and APD photodetector for 130km transmission
- Digital diagnostic monitor interface compatible with SFF-8472
- Extend RX power monitoring range to -45~-8dBm with +/-3dB monitoring precision which exceeds SFF-8472's -40dBm(min); Measured RX optical power and RX power alarm & warning thresholds in dBm .
- SFP MSA package with duplex LC connector
- With spring latch for easily removing
- +3.3V single power supply
- Operating case temperature: 0 to +70°C

Applications

- OSC for CWDM or DWDM systems
- Other optical links

Standard

- Compatible with SFP MSA
- Compatible with SFF-8472 Rev 9.5
- Refer to ITU-T G.957 and G.958
- Refer to 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
- Compliant with RoHS

Description

FTM-6101C-SL13051G 155Mbps spring-latch SFP transceiver is high performance, cost effective module that supports data-rate of 155Mbps and transmission distance up to 130km. It is specially designed for OSC (Optical Supervisory Channel) in CWDM or DWDM systems.

The transceiver consists of two sections: The transmitter section incorporates uncooled DFB laser, and the receiver section consists of APD 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 degradation of the laser. Loss of signal (LOS) output is provided to indicate the loss of an input optical signal of receiver.

An enhanced Digital Diagnostic Monitoring Interface compatible with SFF-8472 has been incorporated into the transceivers. For further information, please refer to SFF-8472 Rev 9.5.

FTM-6101C-SL13051G 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 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

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	T_C	0		+70	°C

Power Supply Voltage	V_{CC}	3.13		3.47	V
Power Supply Current	I_{CC}			300	mA
Data Rate			155		Mbps

FTM-6101C-SL13051G (1510nm DFB and APD, 130km, Monitoring function)

Table 4 - Optical and Electrical Characteristics

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
Transmitter							
Centre Wavelength		λ_C	1500	1510	1520	nm	
Average Output Power		P_{0ut}	+0.5		+5	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		Compatible with Telcordia GR-253-CORE and ITU-T G.957					2
Data Input Swing Differential		V_{IN}	500		2400	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					-42	dBm	4
Receiver Overload			-8			dBm	
LOS De-Assert		LOS_D			-43	dBm	
LOS Assert		LOS_A	-55			dBm	
LOS Hysteresis			1		4	dB	
Data Output Swing Differential		V_{OUT}	370		2000	mV	5
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. Internally AC coupled and terminated.
4. Measured with a PRBS 2^{23}-1 test pattern @155Mbps, BER $\leqslant 1\times10^{-10}$.
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). The memory contents refer to Table 5.

Table 5 - 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 08 04 00 00 00 00 00	OC 3, Single mode long reach
11	1	Encoding	03	NRZ
12	1	BR, nominal	02	155Mbps
13	1	Reserved	00	
14	1	Length (9um)-km	82	130km
15	1	Length (9um)	FF	130km
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 30 31 43 2D 53 4C 31 33 30 35 31 47 20 20	"FTM-6101C-SL13051G " (ASCⅡ)
56—59	4	Vendor rev	31 30 20 20	ASCⅡ("31 30 20 20" means 1.0 revision)
60-61	2	Wavelength	05 E6	1510nm
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	58	Diagnostics(Ext.Cal)
93	1	Enhanced option	F0	Optional Alarm/warning flag, Optional Soft RX_LOS mornitoring and Optional Soft TX_FAULT mornitoring, Optional soft TX_DISABLE control and monitoring implemented
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.

Table 6- Alarm and Warning Thresholds (2-Wire Address A2h)

Name	Low Threshold	High Threshold	Unit
Temperature Alarm	-5	90	°C
Temperature Warning	0	80	°C
Voltage Alarm	2.97	3.63	V
Voltage Waring	3.1	3.5	V
Bias Alarm	3	80	mA
Bias Warning	4	70	mA
TX Power Alarm	-0.5	6	dBm
TX Power Warning	0.5	5	dBm
RX Power Alarm	-46	-6	dBm
RX Power Warning	-45	-7	dBm

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.

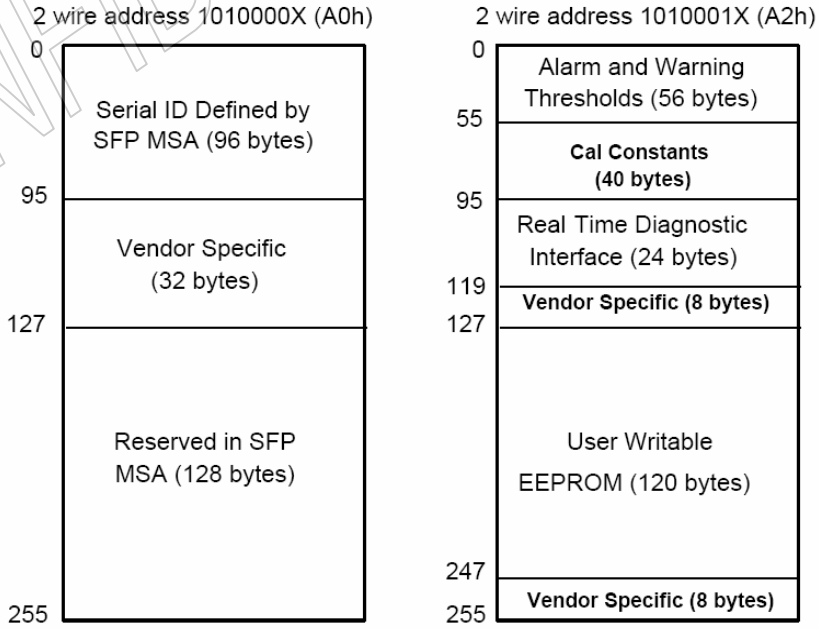


Figure 1, EEPROM Memory Map Specific Data Field Descriptions

Table 7- Monitoring Specification

Parameter	Range	Accuracy	Calibration
Temperature	-10 to 80°C	±3°C	External
Voltage	3.0 to 3.6V	±3%	External
Bias Current	0 to 100mA	±10%	External
TX Power	0 to +5 dBm	±3dB	External
RX Power	-45 to –8 dBm	±3dB	External

Measured RX optical power and RX power Alarm & warning thresholds in dBm (unit)

Represented as a 16 bit signed twos complement value in increments of 1/256 dBm.

Table 8 and Table 9 below illustrate the 16 bit signed twos complement format used for RX optical power reporting. The most significant bit (D7) represents the sign, which is zero for positive RX optical power and one for negative RX optical power.

Table 8- Bit weights (dBm) for RX optical power reporting registers

Higher Byte(A2[104])								Lower Byte(A2[105])							
D7	D6	D5	D4	D3	D2	D1	D0	D7	D6	D5	D4	D3	D2	D1	D0
SIGN	64	32	16	8	4	2	1	1/2	1/4	1/8	1/16	1/32	1/64	1/128	1/256

Table 9- RX optical power format

RX POWER		BINARY		HEXADECIMAL	
DECIMAL(dBm)	FRACTION	HIGH BYTE	LOW BYTE	HIGH BYTE	LOW BYTE
+127.996	+127 255/256	01111111	11111111	7F	FF
+125.000	+125	01111101	00000000	7D	00
+1.004	+1 1/256	00000001	00000001	01	01
+0.996	+255/256	00000000	11111111	00	FF
0.000	0	00000000	00000000	00	00
-0.004	-1/256	11111111	11111111	FF	FF
-1.000	-1	11111111	00000000	FF	00
-25.000	-25	11100111	00000000	E7	00
-40.000	-40	11011000	00000000	D8	00
-127.996	-127 255/256	10000000	00000001	80	01
-128	-128	10000000	00000000	80	00

The RX power Alarm & warning thresholds (Address32-39@A2h)are also defined as the Rx Power method above.

Recommended Host Board Power Supply Circuit

Figure 2 shows the recommended host board power supply circuit.

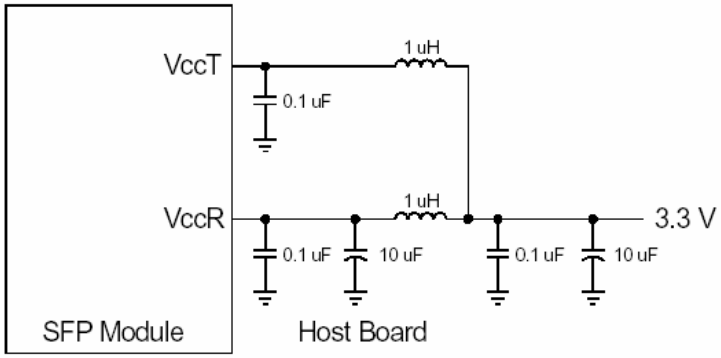


Figure 2, Recommended Host Board Power Supply Circuit

Recommended Interface Circuit

Figure 3 shows the recommended interface circuit.

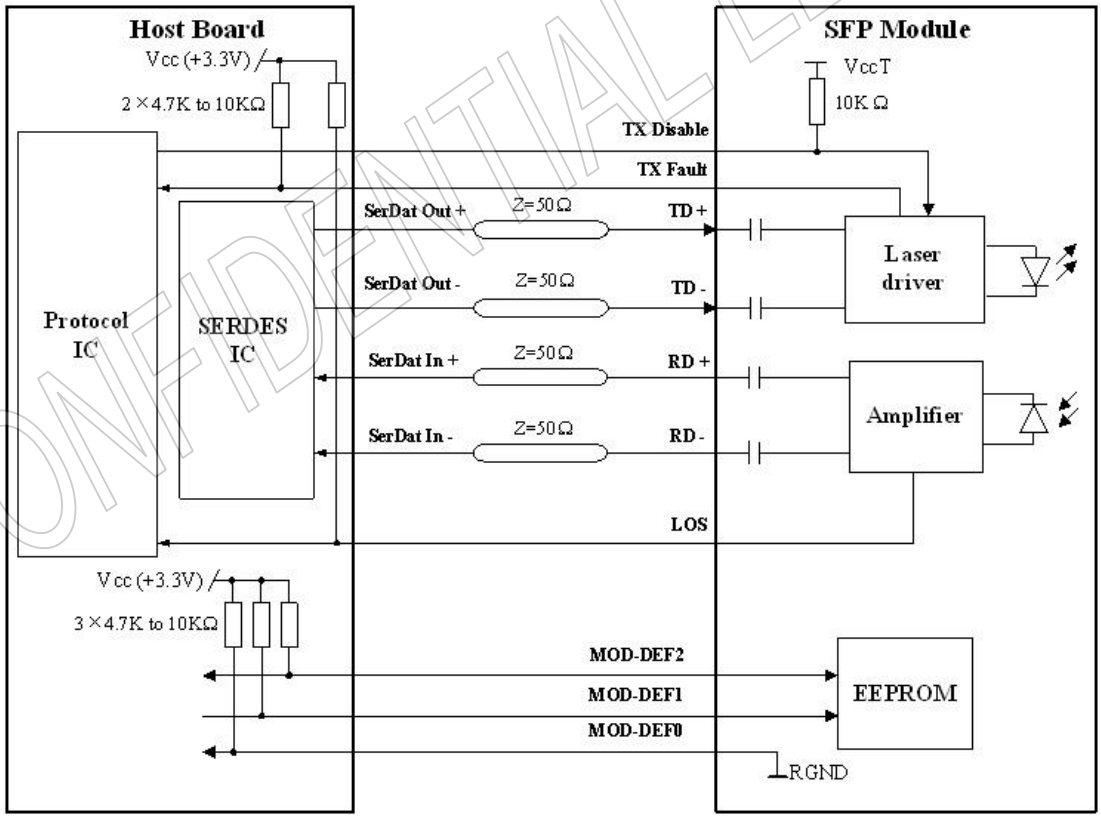


Figure 3, Recommended Interface Circuit

Pin Definitions

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

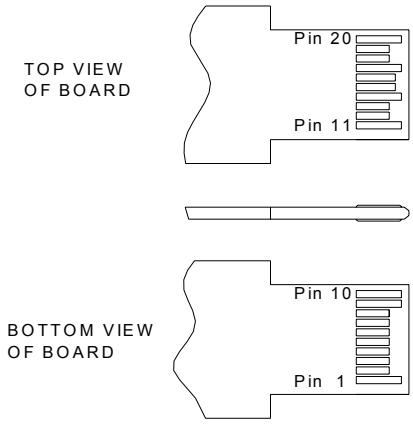


Figure 4, Pin View

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 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.

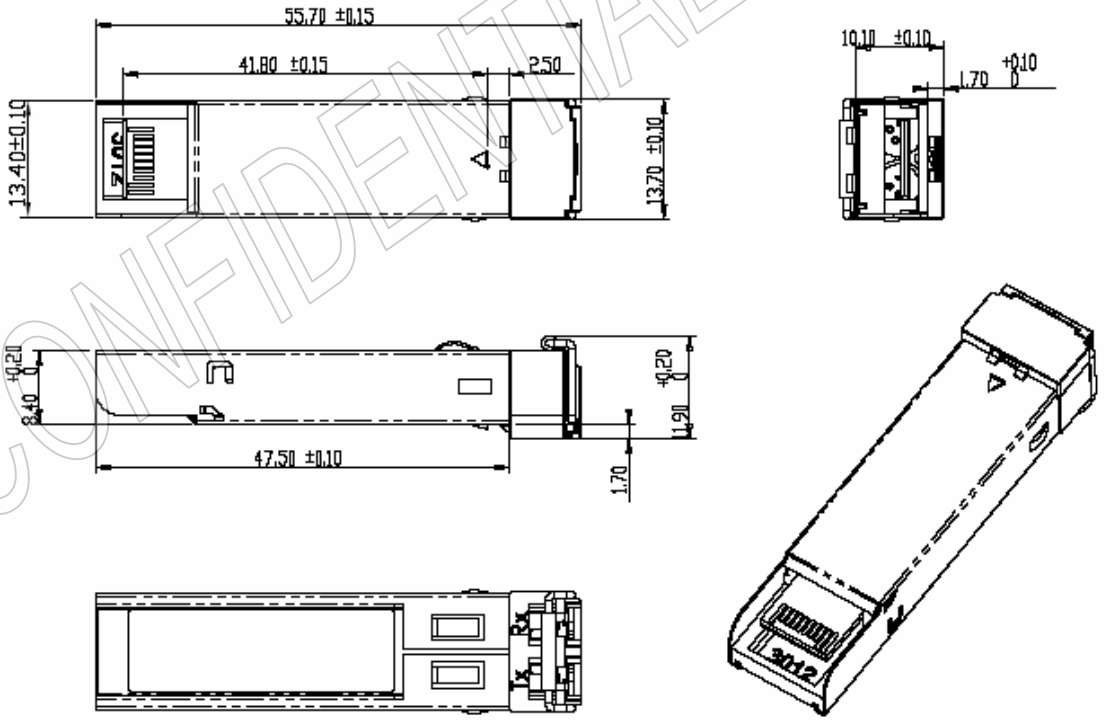
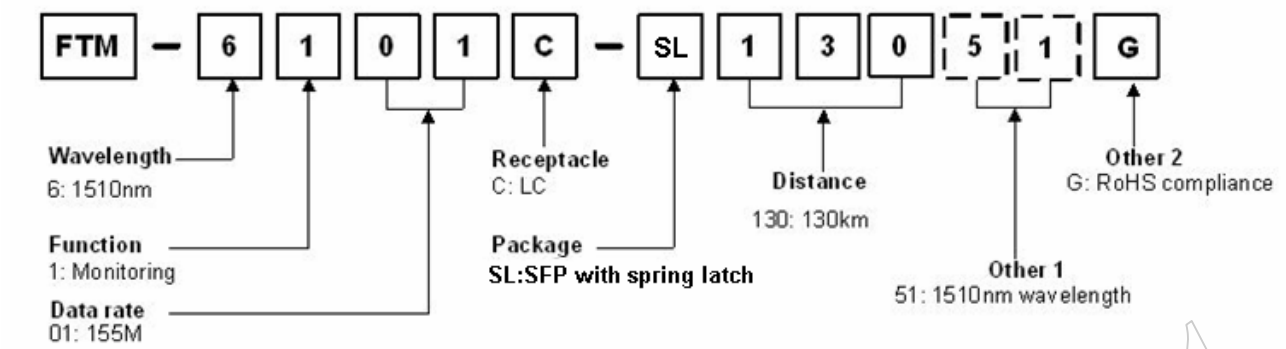


Figure 5, Mechanical Design Diagram of the SFP with spring latch

Ordering information



Part No.	Product Description
FTM-6101C-SL13051G	1510nm, 155Mbps, 130km transmission, SFP with spring latch, Monitoring function, 0°C~+70°C,RoHS compliance

Related Documents

For further information, please refer to the following documents:

- *Fiberxon 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	Solaris.Zhu	Monica.Wei	Walker.Wei	Initial datasheet	May 25, 2007

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