

Dec. 20, 2003



FTM-8012C-S/FTM-8012C-L

1.25G 850nm SFP Transceiver

Members Of Flexon™ Family

Features

- ◆ 850nm VCSEL transmitter
- ◆ 550m with 50/125 μ m MMF
- ◆ 275m with 62.5/125 μ m MMF
- ◆ Multi-source package with LC receptacle
- ◆ Optional spring latch for high density application
 - FTM-8012C-S standard structure
 - FTM-8012C-L with spring latch
- ◆ Up to 1.25Gbps bi-directional data links
- ◆ Single +3.3V power supply
- ◆ Hot-pluggable capability
- ◆ Low power dissipation
- ◆ Low EMI and excellent ESD protection
- ◆ Class 1 laser product
- ◆ Detailed product information in EEPROM
- ◆ Operating temperature range: 0°C to +70°C



Applications

FTM-8012C-S/FTM-8012C-L is well suited for Local Area Network (LAN) and Storage Area Network (SAN), typically used in:

- ◆ Switch to Switch interface
- ◆ Switched backplane application
- ◆ Router/Server interface
- ◆ Other optical transmission systems

Standards

- ◆ Compliant with SFP MSA
- ◆ Compliant with IEEE 802.3z
- ◆ Compliant with ANSI specifications for Fibre Channel
- ◆ Compliant with FCC 47 CFR Part 15, Class B
- ◆ Compliant with FDA 21 CFR 1040.10 and 1040.11, Class I

Product Description

FTM-8012C-S/FTM-8012C-L is fully compliant with SFP Multi-Source Agreement (MSA). It can offer maximum flexibility to designers, manufacturers, and operators of Gigabit Ethernet and Fibre Channel networking equipments.

FTM-8012C-S/FTM-8012C-L can be installed into MSA standard SFP ports at any time even with the host equipment operating online. This facilitates the rapid configuration of equipment to meet the user's needs precisely: reducing inventory costs and network downtime. Compared with traditional transceivers, the size of the Small Form Factor package enables higher port densities.

FTM-8012C-S/FTM-8012C-L meets the requirements of IEEE 802.3 Gigabit Ethernet standard and ANSI specifications for Fibre Channel. It is developed with highly reliable 850nm VCSEL.

This transceiver enables cost-effective data transmission over optical fibers at a distance of 275 meters with 62.5/125 μ m and 550 meters with 50/125 μ m multimode fiber respectively.

Low Power Dissipation

By utilizing the latest chipset technology, FTM-8012C-S/FTM-8012C-L realizes low power dissipation. Typical current is 190mA, at +3.3V operation, only 63.3% of the maximum current allowed by the SFP specification (300mA).

Optional Spring latch for high-density application

FTM-8012C-L features a spring latch that allows user to easily remove the SFP transceiver by hand even in high-density application.

Excellent EMC/EMI Performance

FTM-8012C-S/FTM-8012C-L patent mechanical design can guarantee excellent EMC/EMI performance.

Detailed Product Information In EEPROM

FTM-8012C-S/FTM-8012C-L features an EEPROM that contains the detailed product information stored for retrieval by host equipment. This information is accessed via the 2-wire serial CMOS EEPROM protocol. For further information, please refer to SFP Multi-Source Agreement (MSA).

Block Diagram

This product consists of two basic parts: transmitter and receiver. They are illustrated in Figure 1.

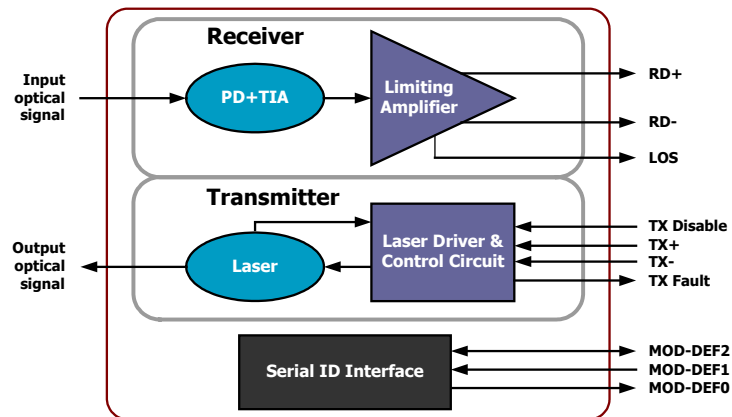


Figure 1, Product Block Diagram

Regulatory Compliance

This product has 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 documentation.

Table 1 - Regulatory Compliance

Feature	Test Method	Target 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	Variation of IEC 61000-4-2	Typically withstand at least 15 kV without damage when port is contacted by a Human Body Model probe.
Electromagnetic Interference (EMI)	FCC Part 15 Class B CENELEC EN55022 Class B (CISPR 22B) VCCI Class B	Compliant with standards
Immunity	Variation of IEC 61000-4-3	Typically show no measurable effect from a 10 V/m field swept from 80 MHz to 1000 MHz applied to the transceiver without a chassis enclosure
Laser Eye Safety	FDA 21CFR 1040.10 and 1040.11 EN60950, EN(IEC)60825-1,2	AEL Class I, FDA/CDRH TUV Certificate No. 50030043
Component Recognition	UL and CSA	UL file E223705

Mechanical Design Diagram

The mechanical design diagram is shown in Figure 2 and Figure 3.

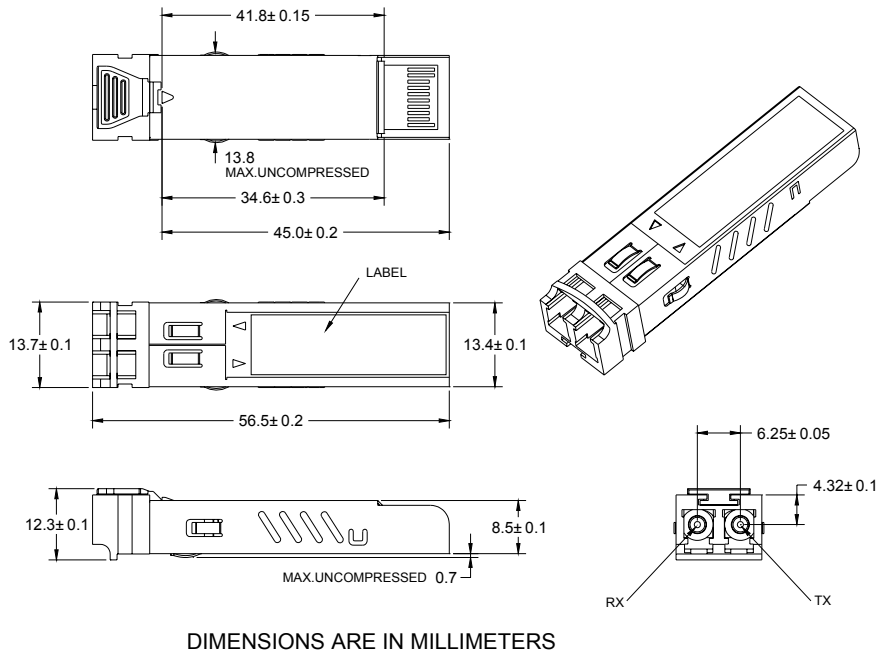


Figure 2, Mechanical Design Diagram of FTM-8012C-S

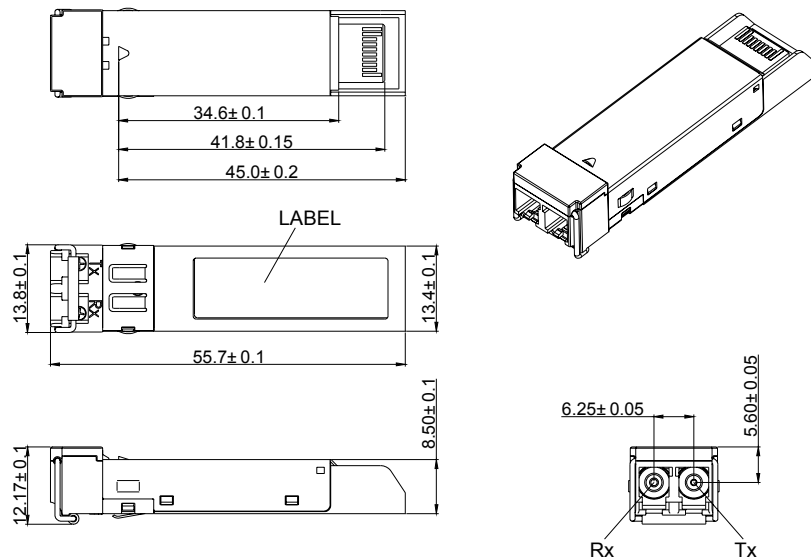


Figure 3, Mechanical Design Diagram of FTM-8012C-L

Recommended Host Board Power Supply Circuit

FTM-8012C-S/FTM-8012C-L is hot pluggable SFP transceiver. Figure 4 shows the recommended host board power supply circuit.

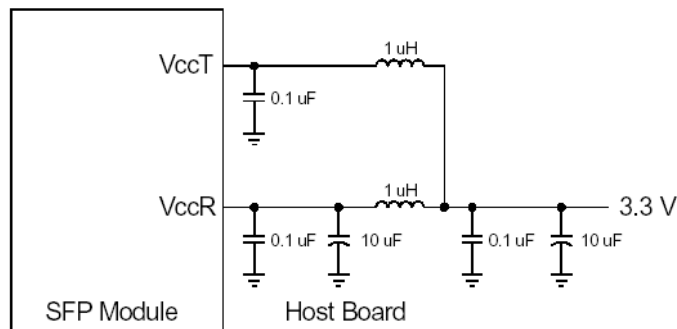
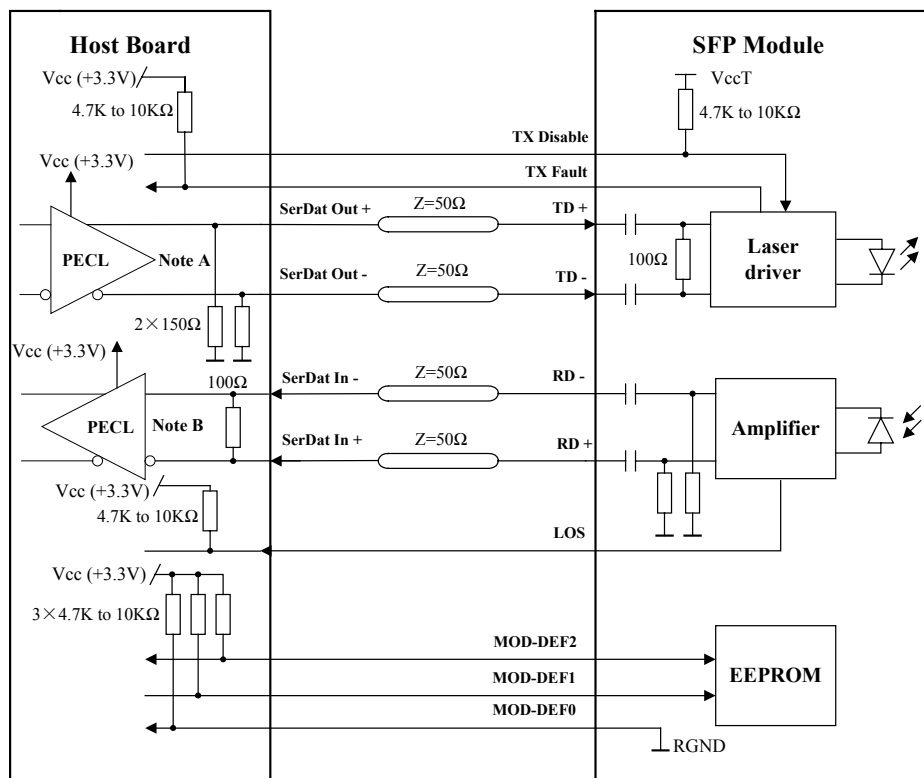


Figure 4, Recommended Host Board Power Supply Circuit

Recommended Interface Circuit

Figure 5 shows the recommended interface circuit.



Note A: Circuit assumes open emitter output

Note B: Circuit assumes high impedance internal bias @Vcc-1.3V

Figure 5, Recommended Interface Circuit

Absolute Maximum Ratings

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Exposure to conditions above the Absolute Maximum Ratings listed in Table 2 may negatively

impact the reliability of this product.

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
Voltage at any Input Pin	-	-0.5	$V_{CC}+0.3$	V
Operating Humidity	-	5	95	%

Recommended Operating Conditions

Functional operation of this device is implied at Recommended Operating Conditions (shown in Table 3).

Table 3 - Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Unit
Ambient Operating Temperature	T_A	0		+70	°C
Supply Voltage	V_{CC}	3.13		3.47	V
Data Rate	Gigabit Ethernet		1.25		Gbps
	Fibre Channel		1.0625		
Fiber Length on 50/125 μ m MMF				550	m
Fiber Length on 62.5/125 μ m MMF				275	m

Optical Characteristics

Table 4 lists the optical characteristics of FTM-8012C-S/FTM-8012C-L.

Table 4 – Optical Characteristics (0°C to +70°C, 3.13V to 3.47V)

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Transmitter						
Centre Wavelength	λ_c	830	850	860	nm	
Spectral Width (RMS)	σ			0.85	nm	
Output Power	P_{OUT}	-9.5		-4	dBm	1
Rise/Fall Time (20%~80%)	t_r/t_f			0.26	ns	2
Extinction Ratio	ER	9			dB	
Total Jitter	1.25G	TJ		0.431	UI	3
	1.0625G			0.43		
Deterministic Jitter	1.25G	DJ		0.2	UI	3
	1.0625G			0.21		
P_{OUT} @TX Disable Asserted				-45	dBm	
Output Optical Eye	IEEE 802.3z and ANSI Fibre Channel compliant					4
Receiver						

Centre Wavelength	λ_c	770		860	nm	
Receiver Sensitivity				-17	dBm	5
Receiver Overload		0			dBm	
Return Loss		12			dB	
LOS Assert		-30			dBm	
LOS De-Assert				-18	dBm	
LOS Hysteresis		1		4	dB	

Notes:

1. Measured average power coupled into MMF.
2. Unfiltered, measured with a PRBS 2⁷-1 test pattern @1.25Gbps
3. Meet the specified maximum output jitter requirements if the specified maximum input jitter is present.
4. Measured with a PRBS 2⁷-1 test pattern @1.25/1.0625Gbps.
5. measured with a PRBS 2⁷-1 test pattern @1.25Gbps, BER better than or equal to 1×10^{-12}

Electrical Characteristics

All the electrical interfaces are full compliant with SFP MSA specifications. The high speed DATA interface uses PECL signal that is AC-coupled. The low speed control and sense input/output signals are level compatible with TTL. Table 5 below shows the detailed electrical characteristics of this product.

Table 5 – Electrical Characteristics (0°C to +70°C, 3.13V to 3.47V)

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Transceiver Power Supply						
Supply Voltage	V _{CC}	3.13		3.47	V	
Supply Current	I _{CC}		190	300	mA	
Transmitter						
Differential Data Input Swing	V _{IN}	500		2000	mV	1
Differential Input Impedance	Z _{IN}	90	100	110	Ω	
TX Disable	Disable		2.0	V _{CC}	V	2
	Enable		0	0.8	V	
TX Fault	Fault		2.0	V _{CC} +0.3	V	
	Normal		0	0.8	V	
TX Disable Assert Time	t _{off}			10	μs	
Receiver						
Differential Data Output Swing	V _{OUT}	370		2000	mV	3
Total Jitter	1.25G	TJ		0.749	UI	4
	1.0625G			0.61		

Deterministic Jitter	1.25G	DJ			0.462	UI	4
	1.0625G				0.36		
LOS Output Voltage	High		2.0		V _{CC} +0.3	V	
	Low		0		0.8	V	

Notes:

1. Internally AC coupled and terminated (100Ω differential).
2. If Pin 3 (TX Disable) is left open, TX is disabled.
3. Internally AC coupled, should be terminated with 100Ω (differential).
4. Meet the specified maximum output jitter requirements if the specified maximum input jitter is present.

Pin Definitions

Figure 6 below shows the pin numbering of SFP electrical interface. The pin functions are described in Table 6 and the accompanying notes.

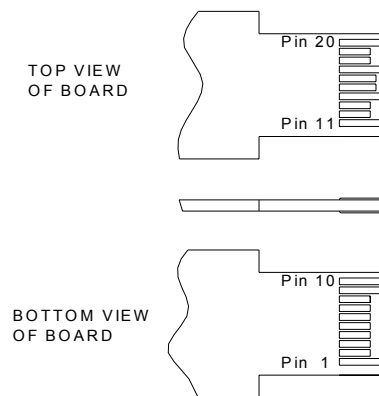


Figure 6, Pin View

FTM-8012C-S/FTM-8012C-L has three stages of contact sequencing during insertion. The ground make contact at first in sequence stage 1, then followed by power supply in sequence stage 2, finally, signal lines engage in sequence stage 3. Conversely, when the module is plugged out from the host system, signal lines disengage firstly, then power supply and ground.

It is the responsibility of the system integrator to assure that no thermal, energy, or voltage hazard exists during the hot-plug-unplug sequence. It is also the responsibility of the system integrator and end-user to minimize static electricity and the probability of ESD events by careful design.

Table 6 – 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:

- 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.
- 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
- 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 wire serial interface for serial ID
 - MOD-DEF 2 is the data line of two wire serial interface for serial ID
- 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.
- These are the differential receiver outputs. They are AC coupled 100Ω differential lines which should be terminated with 100Ω (differential) at the user SERDES.
- These are the differential transmitter inputs. They are AC-coupled, differential lines with 100Ω differential termination inside the module.

Ordering Information

Part No.	Product Description
FTM-8012C-S	850nm 1.25/1.0625Gbps MMF SFP, T _A =0 to 70°C
FTM-8012C-L	850nm 1.25/1.0625Gbps MMF SFP with Spring latch, T _A =0 to 70°C

Related Documents

For further information, please refer to the following documents:

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

Obtaining Document

You can visit our website:

<http://www.fiberxon.com>

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