SFF GEPON PX20 ONU Transceiver

FTM-9412P-F20F(D)G

(IEEE 802.3ah™-2004 1000BASE-PX20-U)

Members of Flexon™ Family

Features

- Single fiber bi-directional data links with symmetric 1.25Gbps upstream and 1.25Gbps downstream
- Integrated with micro-optics WDM filter for dual wavelength Tx/Rx operation at 1310/1490nm
- 1310nm burst-mode transmitter with FP laser
- 1490nm continuous-mode receiver with PIN-TIA and optional 1550nm optical signal rejection
- 0 to 70℃ operating temperature
- 2×5 SFF package with SC/UPC pigtail
- Single 3.3V power supply
- LVPECL/CML compatible data input/output interface
- LVTTL transmitter burst-mode control
- LVTTL receiver signal-detected indication
- Low EMI and excellent ESD protection
- Class I laser safety standard IEC-60825 compliant
- RoHS compliance

Applications

- Gigabit Ethernet Passive Optical Networks (GEPON) – ONU side
- Gigabit Ethernet Point-to-Point Bi-directional Transmission
- Media Converts for Fiber-In-The-Loop (FITL)

Standard

- Compliant with SFF MSA
- Compliant with IEEE Std 802.3ah™ -2004 1000BASE-PX20-U
- Compliant with FCC 47 CFR Part 15, Class B
- Compliant with FDA 21 CFR 1040.10 and 1040.11, Class I

Description

FTM-9412P-F20FG/F20FDG is Optical Network Unit (ONU) for IEEE802.3ah™-2004 1000BASE-PX20-U application

The transceiver is the high performance module for 1.25Gbps data link in single fiber by using 1310nm burst-mode transmitter and 1490nm continuous-mode receiver with optional 1550nm optical signal rejection.

The transmitter section uses a multiple quantum well 1310nm FP laser and is Class Ⅰ laser compliant product according to international safety standard IEC-60825.

The receiver section uses an integrated 1490nm PIN and preamplifier mounted in an optical header and limiting post-amplifier IC.

The optical burst output can be enabled by a LVTTL logic high-level input of TX_BRST. Signal Detected (SD) output is provided to indicate the detection of an input optical signal of receiver.

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 documentation.

Table 1 - Regulatory Compliance

Feature	Standard	Performance
Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883E Method 3015.7	Class Ⅰ(>500 V)
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN55022 Class B (CISPR 22B) VCCI Class B	Compliant with standards
Immunity	IEC 61000-4-3	Compliant with standards
Laser Eye Safety	FDA 21CFR 1040.10 and 1040.11 EN60950, EN (IEC) 60825-1,2	Compliant with Class I laser product
Component Recognition	UL and CSA	Compliant with standards
RoHS	2002/95/EC 4.1&4.2	Compliant with standards

Absolute Maximum Ratings

Absolute Maximum Ratings are those values, beyond which, some damages may occur to the devices. Exposure to conditions above the Absolute Maximum Ratings listed in Table 2 may negatively impact the reliability of the products.

Table 2 - Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit	Note
Storage Ambient Temperature	T_{STG}	-40	85	°C	
Operating Case Temperature	T_C	0	70	°C	
Operating Humidity	H_{OPR}	5	95	%	
Power Supply Voltage	V_{CC}	0	4	V	
Input Voltage		GND	Vcc	V	
Receiver Damaged Threshold		2		dBm	
Soldering Temperature			380/10	°C/s	1
			240/10	°C/s	2
Bending Radius		30		mm	
Pigtail Fiber Contact Temperature			85	°C	

Note 1: Only for soldering by iron

Note 2: Only for wave soldering

Recommended Operating Conditions

Table 3 - Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Power Supply Voltage	V_{CC}	3.13	3.3	3.47	V	3.3±5%
Operating Ambient Temperature	T_{OPR}	0		70	°C	1
Operating Humidity	H_{OPR}	5		95	%	
Data Rate			1.25		Gbit/s	
Data Rate Drift		-100		+100	PPM	

Note 1: When ambient temperature is above 60°C, airflow at rate higher than 1m/sec is required

Optical and Electrical Characteristics

Table 4 - Transmitter Optical and Electrical Characteristics (0°C <T_{OPR}<70°C and 3.13V<V_{CC}<3.47V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Optical Center Wavelength	λ_C	1276		1356	nm	
Optical Spectrum Width (RMS)	$\Delta\lambda$			2.8	nm	
Average Launch Power	P_{OUT}	0		4	dBm	1
Average Launch Power-OFF Transmitter	P_{OFF}			-45	dBm	
Extinction Ratio	ER	9			dB	2
Rise/Fall Time (20%-80%)	T_R/T_F			260	ps	2,3
Burst Turn On Time	T_{BURST_ON}			30	ns	4
Burst Turn Off Time	T_{BURST_OFF}			30	ns	
Burst Enable Duration	T_{EN_DUR}	600			ns	
Burst Disable Duration	T_{DIS_DUR}	100			ns	
$RIN_{15}OMA$				-115	dB/Hz	
Optical Return Loss Tolerance				15	dB	
Transmitter Reflectance				-10	dB	
Transmitter and Dispersion Penalty	TDP			2	dB	5
Optical Eye Diagram	Compliant With IEEE Std 802.3ah™-2004					2,6
Data Input Differential Swing	V_{IN}	200		1600	mV	7
Input Differential Impedance	Z_{IN}	90	100	110	Ω	
Common-Mode Input Voltage	V_{CM}	V_{CC}-1.49	V_{CC}-1.32	V_{CC}- V_{IN}/4	V	8
Power Supply Current	I_{CC_TX}			200	mA	
Transmitter Burst Control Voltage - Low	$V_{BURST,\ L}$	0		0.8	V	9
Transmitter Burst Control Voltage - High	$V_{BURST,\ H}$	2.0		V_{CC}	V	

Note 1: Launched into 9/125um Single Mode Fiber.

Note 2: Measured with PRBS 2^7-1 test pattern @1.25 Gbit/s.

Note 3: Measured with the Bessel-Thompson filter OFF.

Note 4: Refer to Timing Parameter Definition in Burst Mode Sequence.

Note 5: Maximum sensitivity penalty due to transmitter and dispersion effect through 20km of SMF optical fiber.

Note 6: Transmitter eye mask definition is {0.22UI, 0.375UI, 0.20UI, 0.20UI, 0.30UI}.

Note 7: Compatible with LVPECL/CML input
(See Recommended Interface Circuit and Table 6 - Electrical Input/Output Coupling Mode)
Note 8: Only for FTM-9412P-F20FD
Note 9: TX_BRST (See Pin Function Definitions)

Table 5 - Receiver Optical and Electrical Characteristics (0°C <T_{OPR}<70°C and 3.13V<V_{CC}<3.47V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Operating Wavelength		1480	1490	1500	nm	
Sensitivity	P_{SEN}			-27.5	dBm	1
Saturation	P_{SAT}	-3			dBm	
Signal-Detected Assert Level	P_{SDA}			-28	dBm	2
Signal-Detected Deassert Level	P_{SDD}	-39			dBm	3
Signal-Detected Hysteresis	P_{SDA}- P_{SDD}	0.5		6	dBm	
Receiver Reflectance				-12	dB	
WDM Filter Isolation	ISO (1550)	38			dB	
	ISO (1650)	35			dB	
Power Supply Current	I_{CC_RX}			140	mA	
Data Output Differential Swing	V_{OUT}	400		1600	mV	4
Signal-Detected Voltage - Low	$V_{SD,\ L}$	0		0.8	V	5
Signal-Detected Voltage - High	$V_{SD,\ H}$	2.0		V_{CC}	V	
Signal-Detected Assert Time	T_{ASS}			100	μs	
Signal-Detected Deassert Time	T_{DAS}			100	μs	

Note 1: Measured with a PRBS 2^7-1 test pattern @1.25Gbit/s and ER=9dB, BER =10^{-12}.
Note 2: An increase in optical power above the specified level will cause the Signal Detect output to switch from a low state to a high state.
Note 3: A decrease in optical power below the specified level will cause the Signal Detect output to switch from a high state to a low state.
Note 4: LVPECL output, AC coupled internally, guaranteed in the full range of input optical power (-3dBm to -28dBm)(See Recommended Interface Circuit)
Note 5: SD (See Pin Function Definitions)

Table 6 - Electrical Input/Output Coupling Mode

P/N	Input (TD+/TD-)	Output (RD+/RD-)
FTM-9412P-F20FG	Internal AC Coupling	Internal AC Coupling
FTM-9412P-F20FDG	Internal DC Coupling	Internal AC Coupling

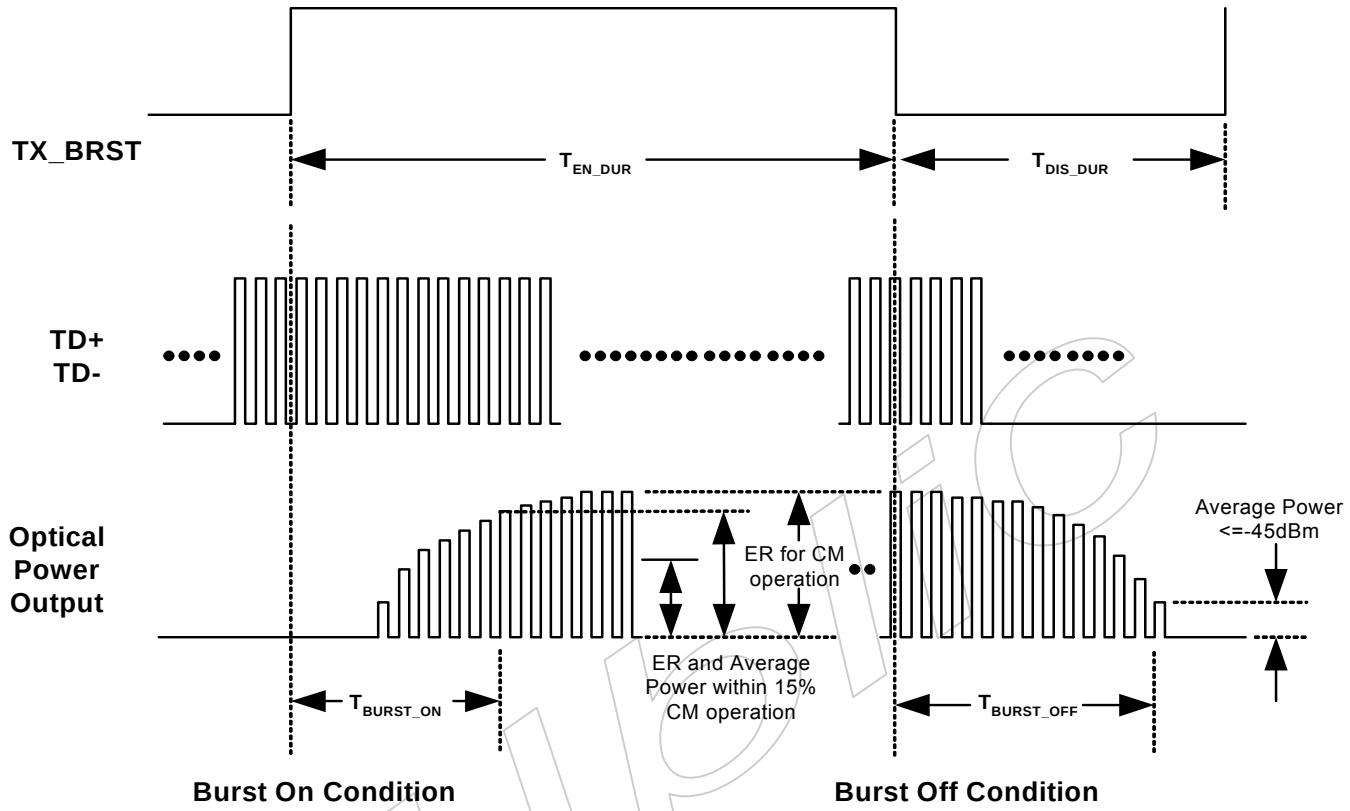

Figure 1 Timing Parameter Definition in Burst Mode Sequence

Recommended Interface Circuit

Figure 2 shows the recommended interface scheme for FTM-9412P-F20FG.

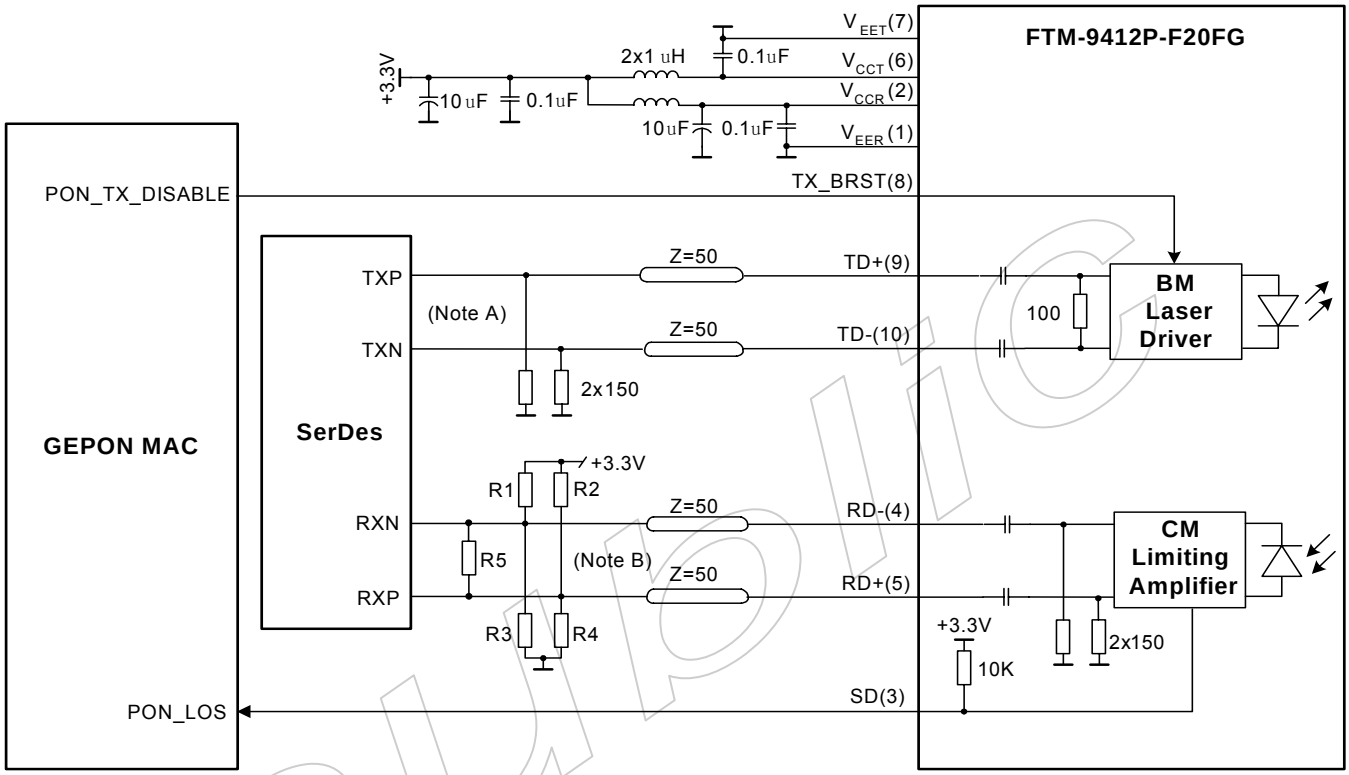

Figure 2 Recommended Interface Circuit (FTM-9412P-F20FG)

Note A: Open emitter output internally.

Note B: LVPECL output, AC coupled internally.

Input stage in SerDes IC is assumed with high impedance and internal bias to Vcc-1.3V

R1=R2=R3=R4=N.C, R5=100 Ω

Input stage in SerDes IC is assumed without internal bias to Vcc-1.3V

R1=R2=82 Ω ,R3=R4=130 Ω ,R5=N.C

Figure 3 shows the recommended interface scheme for FTM-9412P-F20FDG

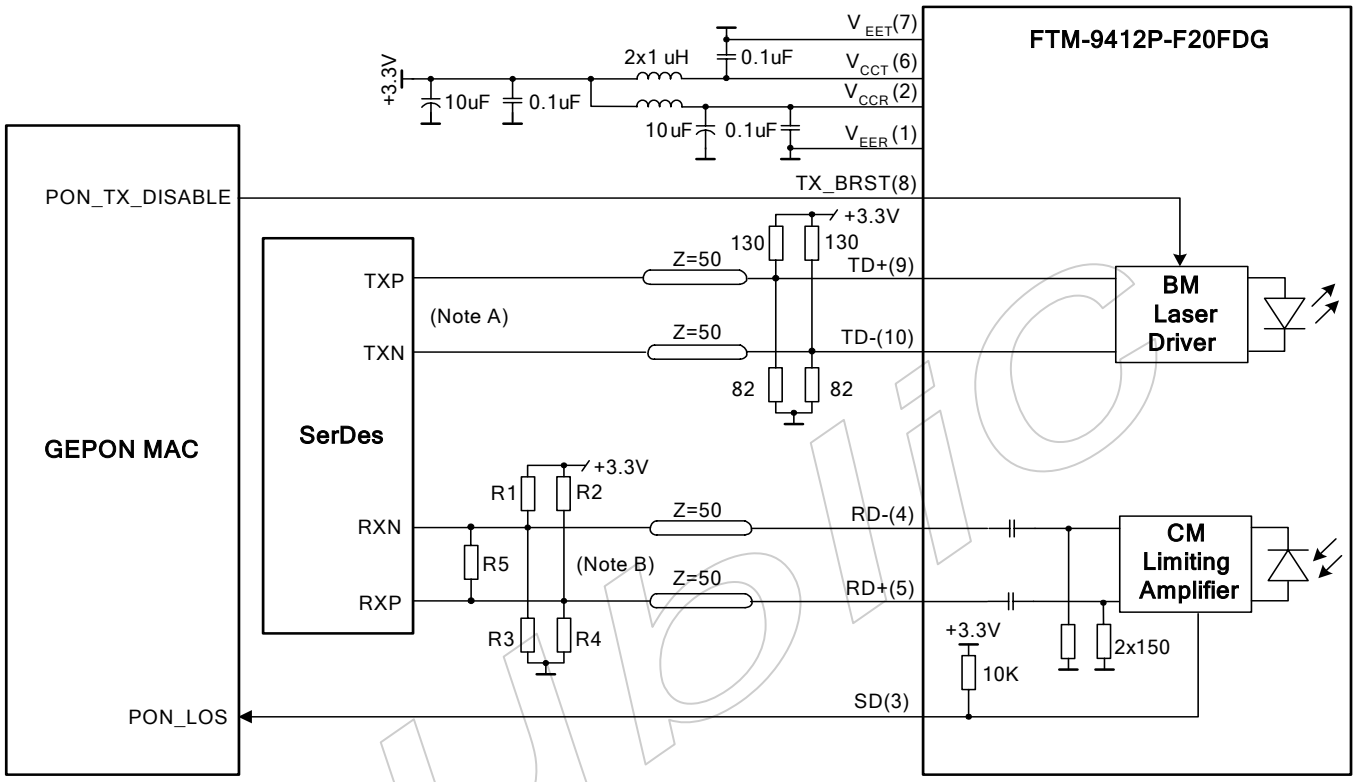

Figure 3 Recommended Interface Circuit (FTM-9412P-F20FDG)

Note A: Open emitter output internally.

Note B: LVPECL output, AC coupled internally.

Input stage in SerDes IC is assumed with high impedance and internal bias to Vcc-1.3V

R1=R2=R3=R4=N.C, R5=100Ω

Input stage in SerDes IC is assumed without internal bias to Vcc-1.3V

R1=R2=82Ω,R3=R4=130Ω,R5=N.C

Pin Definitions

2×5 SFF planform in Figure 4 below shows the pin information of electrical interface and mounting studs. Functions are described in Table 7 with some accompanying notes.

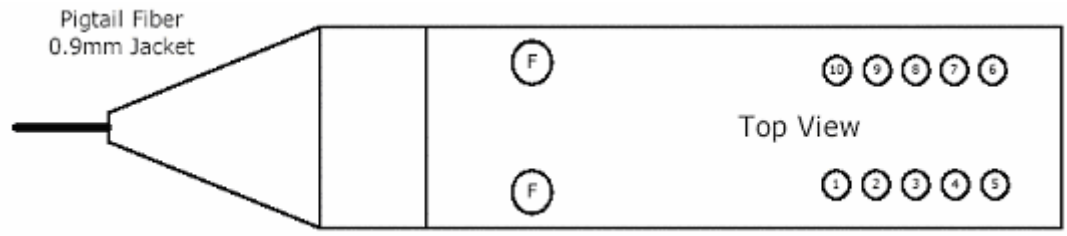

Figure 4 2×5SFF Planform

Table 7 - Pin Function Definitions (2×5 SFF)

Pin No.	Name	Description	Notes
1	V_{EER}	Receiver Signal Ground	
2	V_{CCR}	Receiver Power Supply	
3	SD	Receiver Signal-Detected Indication	1
4	RD-	Inverted Receiver Data Output	2
5	RD+	Non-inverted Receiver Data Output	
6	V_{CCT}	Transmitter Power Supply	
7	V_{EET}	Transmitter Signal Ground	
8	TX_BRST	Transmitter Burst Control	3
9	TD+	Transmitter Non-inverted Data Input	4
10	TD-	Transmitter Inverted Data Input	
F	MS	Mounting Studs	5

Note 1: TTL logic output, with internal 10KΩ pull-up resistor.
Optical Signal-Detected: High; Optical Signal Loss: Low

Note 2: LVPECL logic output, AC coupled internally. (See Recommended Interface Circuit)

Note 3: A positive level enable optical signal output under burst mode.
(See Timing Parameter Definition in Burst Mode Sequence)

Note 4: Compatible with LVPECL/CML input
(See Recommended Interface Circuit and Table 6 - Electrical Input/Output Coupling Mode)

Note 5: The mounting studs are provided for transceiver mechanical attachment to circuit board. They may also provide an optional connection of the transceiver to the equipment chassis ground. The holes in the circuit board must be tied to chassis ground. It is not recommended that the mounting studs be connected to signal ground.

Mechanical Design Diagram

The form factor is 2×5 SFF with pigtail fiber. The pigtail fiber has a length 1000 - 1600mm and 30mm minimum bending radius. The fiber connector type is SC/UPC. The mechanical design diagram is shown in Figure 5. (Dimension in mm)

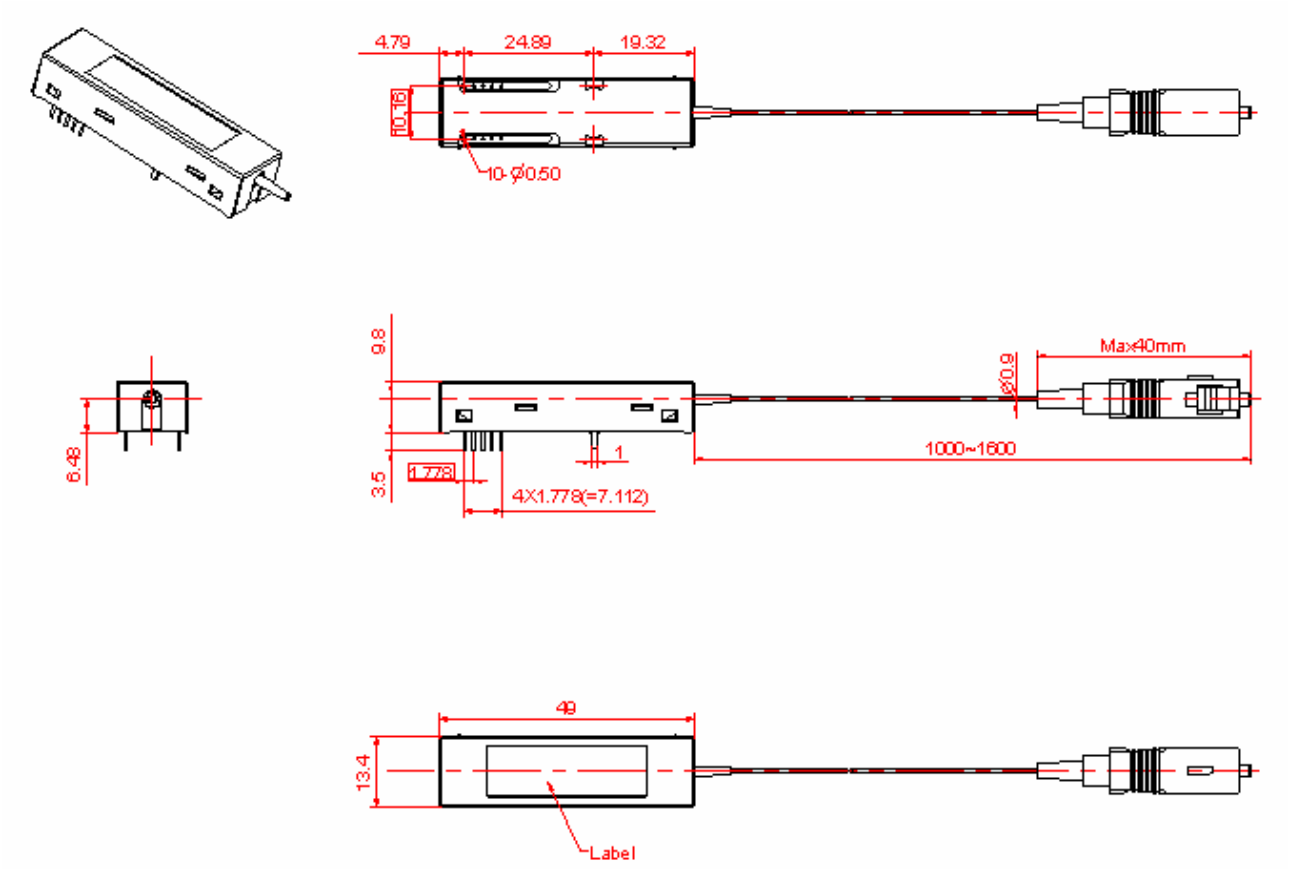

Figure 5 Mechanical Design Diagram (2×5 SFF)

Table 8 - Pigtail Fibre Characteristics

Parameter	Min.	Typical	Max.	Unit
Mode Field Diameter		9		μm
Cladding Diameter		125		μm
Jacket Diameter		0.9		mm
Bending Radius of Pigtail Fiber	30			mm
Tension Force on Pigtail Fiber			1	Kg
Pigtail Fiber Length	1000		1600	mm
Optical Return Loss (UPC type) -1310nm	50			dB

Ordering Information

Part No.	Product Description
FTM-9412P-F20FG	1310nm(TX)/1490nm(RX), SC/UPC Pigtailed 2×5 SFF for GE-PON ONU 20km application, with 1550nm optical signal blocked, 0°C ~ 70°C, Tx AC Coupling, Rx AC Coupling, RoHS compliance
FTM-9412P-F20FDG	1310nm(TX)/1490nm(RX), SC/UPC Pigtailed 2×5 SFF for GE-PON ONU 20km application, with 1550nm optical signal blocked, 0°C ~ 70°C, Tx DC Coupling, Rx AC Coupling, RoHS compliance

Related Documents

For further information, please refer to the following documents:

- IEEE Std 802.3ah™-2004

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

Reversion	Initiate	Review	Approve	Subject	Release Date
Pre 1a	Zachary Lu	Johnny Yang	Peter Tang	Initial datasheet Only including FTM-9412P-F20F (Doc No. DS3493006-1a)	2005-1-27
Pre 2a	Johnny Yang	Peter Tang	Peter Tang	Revised datasheet 1.Add new P/Ns: FTM-9412P-F20FD, 2.Improve Burst Turn On Time and Burst Turn Off Time specification from 64ns(Max.) to 30ns(Max.) in Table 4, Page 3 3.Update the transmitter part Central Wavelength from 1304~ 1320nm to 1300~1325nm. (Doc No. DS3493006-2a)	2005-11-17
1c	Jacob Cai	Gary Chen	Peter Tang	Revised datasheet 1. Update P/N FTM-9412P-F20F to FTM-9412P-F20FG; 2. Update P/N FTM-9412P-F20FD to FTM-9412P-F20FDG; 3. Update photo in cover page; 4. Update Table 1 for RoHS regulation; 5. Update soldering temperature information in Table 2; 6. Update Figure 5; 7. Update datasheet template. (Doc No. DS3493006-1c)	Aug. 20, 2007

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