

## GEPON ONU Triplexer

### FTM-9812T-C10(G)

(IEEE 802.3ah™-2004 1000BASE-PX10-U)



#### Members of Flexon™ Family

#### Features

- ◆ Single fiber bi-directional triple links with symmetric 1.25Gbps upstream/1.25Gbps downstream and 47M~870M CATV analog signal.
- ◆ Burst mode operation transmitter with 1310nm FP laser.
- ◆ Continuous mode operation digital receiver with 1490nm high sensitivity PIN-TIA.
- ◆ 47~870M CATV receiver with 1550nm analog PD.
- ◆ Suitable for Voice/Data/Video FTTx applications.
- ◆ 0~70°C operating temperature.
- ◆ Compact package with SC/APC pigtail.
- ◆ Single 3.3V power supply for digital transceiver.
- ◆ Dual 5V/12V power supply for CATV receiver.
- ◆ LVPECL compatible data input and data output interface.
- ◆ LVTTTL transmitter burst-mode control
- ◆ LVTTTL transmitter disable control
- ◆ LVTTTL digital receiver signal-detected indication
- ◆ CATV receiver input optical power monitor output
- ◆ Low EMI and excellent ESD protection
- ◆ Class I laser safety standard IEC-60825 compliant
- ◆ RoHS compliance (FTM-9812T-C10G)

#### Applications

- ◆ Gigabit Ethernet Passive Optical Networks (GEPON) – ONU side

#### Standard

- ◆ Compliant with IEEE Std 802.3ah™ -2004 1000BASE-PX10-U and ITU-T G.983.3
- ◆ Compliant with FCC 47 CFR Part 15, Class B
- ◆ Compliant with FDA 21 CFR 1040.10 and 1040.11, Class I

#### Description

FTM-9812T-C10(G) triplexer is Optical Network Unit (ONU) for IEEE802.3ah™-2004 1000BASE-PX10 application.

The triplexer is the high performance module for 1.25Gbps data link in single fiber by using 1310nm burst mode transmitter and 1490nm continuous mode digital receiver with 1550nm CATV analog receiver.

The transmitter section uses a multiple quantum well 1310nm FP laser, which is Class I laser compliant product according to international safety standard IEC-60825. The digital receiver section uses an integrated 1490nm PIN and preamplifier mounted in an optical header and limiting post-amplifier IC. The CATV receiver section uses high performance analog PD and low noise RF amplifier at 47~870MHz.

The optical burst output can be enabled by a LVTTTL logic high-level input of TX\_BRST. Optical output can be disabled by a LVTTTL logic high-level input of TX\_DIS. Signal Detected (SD) output is provided to indicate the detection of an input optical signal of digital receiver. CATV receiver input optical power level can be monitored by analog signal ANALOG\_SD.

## Regulatory Compliance

The triplexer 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	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

## 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 <sub>STG</sub>	-40	85	°C	
Operating Case Temperature	T <sub>OPR</sub>	0	70	°C	
Operating Humidity	H <sub>OPR</sub>	5	95	%	
Power Supply Voltage	V <sub>CC</sub>	0	4	V	Digital Transceiver
	V <sub>DD_5V</sub>	0	6		CATV Receiver
	V <sub>DD_12V</sub>	0	15		
Input Voltage		GND	V <sub>CC</sub>	V	Digital Transceiver
Digital Receiver Damaged Threshold		+7		dBm	
CATV Receiver Damaged Threshold		+3		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	Note
Power Supply Voltage	V <sub>CC</sub>	3.13		3.47	V	3.3V±5%
	V <sub>DD_5V</sub>	4.75		5.25	V	5V±5%
	V <sub>DD_12V</sub>	11.4		12.6	V	12V±5%
Operating Case Temperature	T <sub>OPR</sub>	0		70	°C	
Operating Humidity	H <sub>OPR</sub>	5		95	%	
Data Rate (Upstream/Downstream)			1250		Mbit/s	
Data Rate Drift		-100		+100	ppm	
CATV Receiver Bandwidth		47		860	MHz	

## Optical and Electrical Characteristics

**Table 4 - Transmitter Optical and Electrical Characteristics (0°C < T<sub>OPR</sub> < 70°C and 3.13V < V<sub>CC</sub> < 3.47V)**

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Optical Center Wavelength	λ <sub>C</sub>	1280		1350	nm	
Optical Spectrum Width (RMS)	Δλ			2.8	nm	
Average Launch Power (BOL)	P <sub>OUT</sub>	0		+4	dBm	1
Average Launch Power (EOL)		-1		+4		
Average Launch Power-OFF Transmitter	P <sub>OFF</sub>			-45	dBm	
Extinction Ratio	ER	10			dB	2
Burst Turn On Time	T <sub>BURST_ON</sub>			30	ns	3
Burst Turn Off Time	T <sub>BURST_OFF</sub>			30	ns	
Optical Return Loss Tolerance		-15			dB	
Optical Eye Diagram	Compliant With IEEE Std 802.3ah™-2004					2,4
Data Input Differential Swing	V <sub>IN</sub>	200		1600	mV	5
Common-Mode Input Voltage	V <sub>CM</sub>	V <sub>CC</sub> -1.49	V <sub>CC</sub> -1.32	V <sub>CC</sub> -V <sub>IN</sub> /4	V	
Input Differential Impedance	Z <sub>IN</sub>	90	100	110	Ω	
Power Supply Current	I <sub>CC_TX</sub>			200	mA	
Transmitter Burst Control Voltage - Low	V <sub>BURST_L</sub>	0		0.8	V	6
Transmitter Burst Control Voltage - High	V <sub>BURST_H</sub>	2.0		V <sub>CC</sub>	V	
Transmitter Disable Voltage - Low	V <sub>TDIS_L</sub>	0		0.8	V	7
Transmitter Disable Voltage - High	V <sub>TDIS_H</sub>	2.0		V <sub>CC</sub>	V	

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

Note 2: Measured with PRBS 2<sup>7</sup>-1 test pattern @1250Mbit/s, and the Bessel-Thompson filter is turned on.

Note 3: Refer to [Timing Parameter Definition in Burst Mode Sequence](#).

Note 4: Transmitter eye mask definition is {0.22UI, 0.375UI, 0.20UI, 0.20UI, 0.30UI}.

Note 5: Compatible with LVPECL input.

(See [Recommended Interface Circuit](#) and [Table 7 - Electrical Input/Output Coupling Mode](#)).

Note 6: TX\_BRST (See [Pin Function Definitions](#)).

Note 7: TX\_DIS (See [Pin Function Definitions](#)).

**Table 5 - Digital Receiver Optical and Electrical Characteristics (0°C < T<sub>OPR</sub> < 70°C and 3.13V < V<sub>CC</sub> < 3.47V)**

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Operating Wavelength		1480	1490	1500	nm	
Sensitivity	P <sub>SEN</sub>			-25	dBm	1
Overload	P <sub>OV</sub>	-3				
Signal-Detected Assert Level	P <sub>SDA</sub>			-25.5	dBm	2
Signal-Detected Deassert Level	P <sub>SDD</sub>	-39			dBm	3
Signal-Detected Hysteresis	P <sub>SDA</sub> - P <sub>SDD</sub>	0.5		6	dBm	
Power Supply Current	I <sub>CC_RX</sub>			120	mA	
Data Output Differential Swing	V <sub>OUT</sub>	200		1600	mV	4
Signal-Detected Voltage - Low	V <sub>SD, L</sub>	0		0.8	V	5
Signal-Detected Voltage - High	V <sub>SD, H</sub>	2.0		V <sub>CC</sub>	V	
Signal-Detected Assert Time	T <sub>ASS</sub>			100	μs	
Signal-Detected Deassert Time	T <sub>DAS</sub>			100	μs	

Note 1: Measured with PRBS 2<sup>7</sup>-1 test pattern @1250Mbit/s, 1310nm, ER=10dB, BER = 10<sup>-12</sup>.

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.

(See [Recommended Interface Circuit](#)).

Note 5: SD (See [Pin Function Definitions](#)).

**Table 6 - CATV Receiver Optical and Electrical Characteristics (0°C < T<sub>OPR</sub> < 70°C and 4.75V < V<sub>DD\_5V</sub> < 5.25V, 11.4V < V<sub>DD\_12V</sub> < 12.6V)**

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Operating Wavelength		1540		1560	nm	
Receiving Average Optical Power		-6		+2	dBm	
RF Output Level		14		17	dBmV/ch	1
RF Output Impedance			75		Ω	2
CNR	CNR	46			dB	3
C/CSO	C/CSO	55			dB	4
C/CTB	C/CTB	55			dB	
RF Return Loss		16			dB	5
		14			dB	6
Power Supply Current	I <sub>DD_5V</sub>			500	mA	
	I <sub>DD_12V</sub>			4	mA	

Note 1: Tested at 552MHz, OMI=3.5% per channel, 4dB tilt

Note 2: SMB Jack RF Connector

Note 3: Note 3: Test at -6dBm, 82 PAL\_D channels, OMI=3.5% per channel

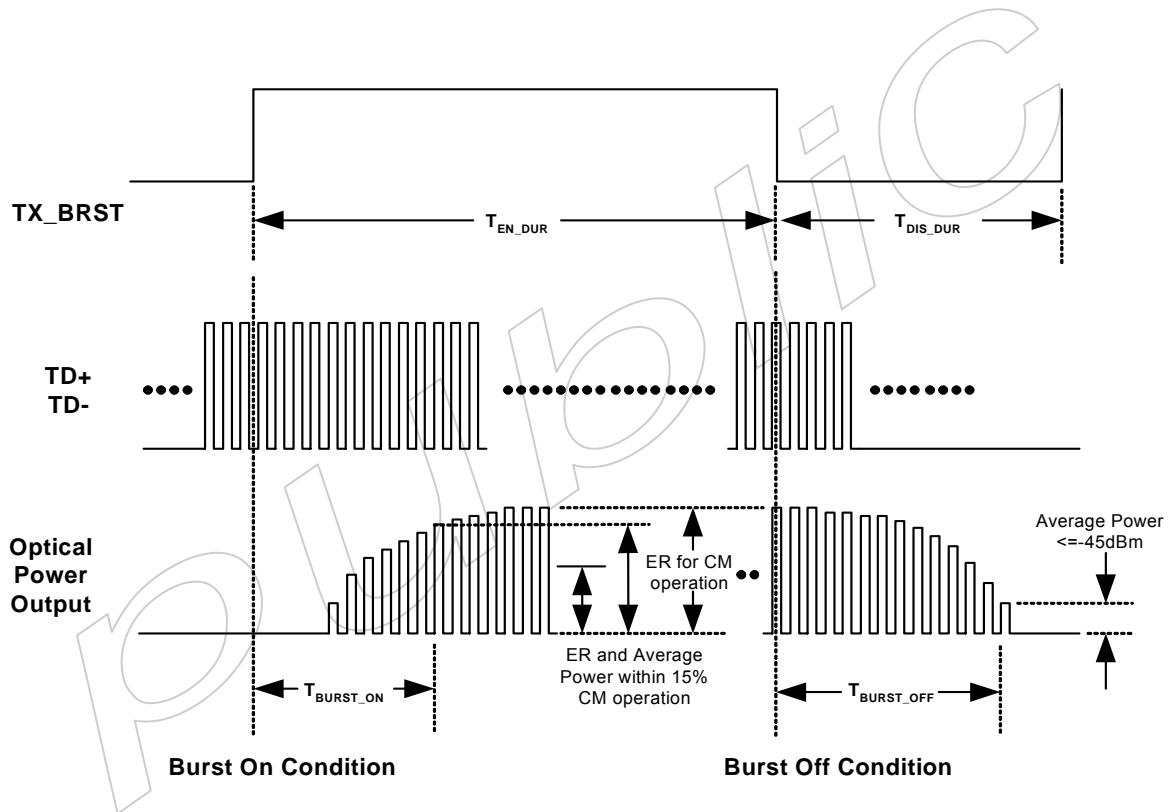
Note 4: Test at +2dBm, 82 PAL\_D channels, OMI=3.5% per channel

Note 5: 47~550MHz

Note 6: 550~870MHz

**Table 7 - Electrical Input/Output Coupling Mode**

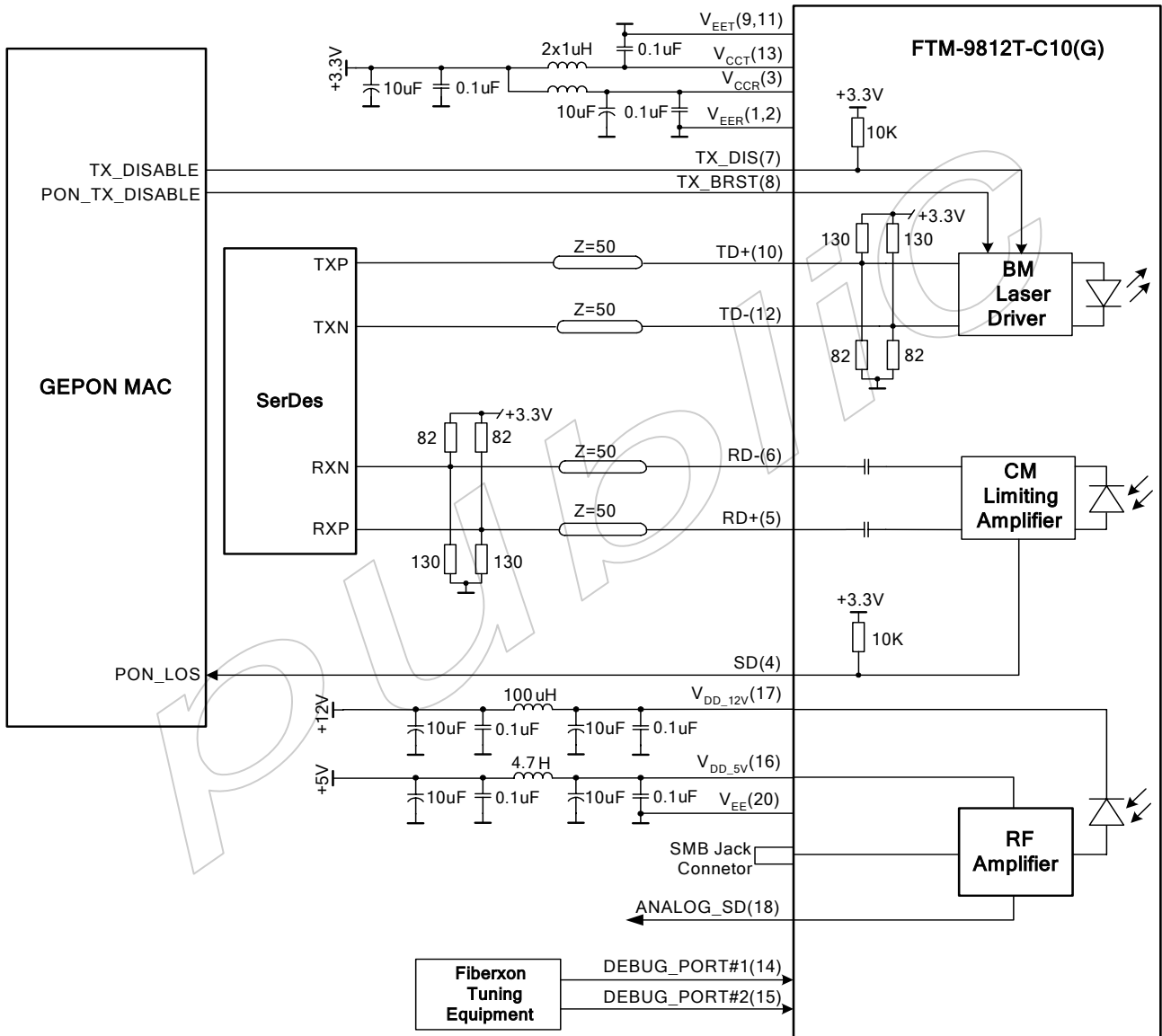
P/N	Input(TD+/TD-)	Output(RD+/RD-)	Analog Output
FTM-9812T-C10(G)	Internal DC Coupling	Internal AC Coupling	75Ω SMB Jack Connector



**Figure 1 Timing Parameter Definition in Burst Mode Sequence**

**Recommended Interface Circuit**

Figure 2 shows the recommended interface scheme.



**Figure 2 Recommended Interface Circuit**

## Pin Definitions

Compact package bottom view in Figure 3 shows the pin information of electrical interface and mounting studs. Functions are described in Table 8 with some accompanying notes.

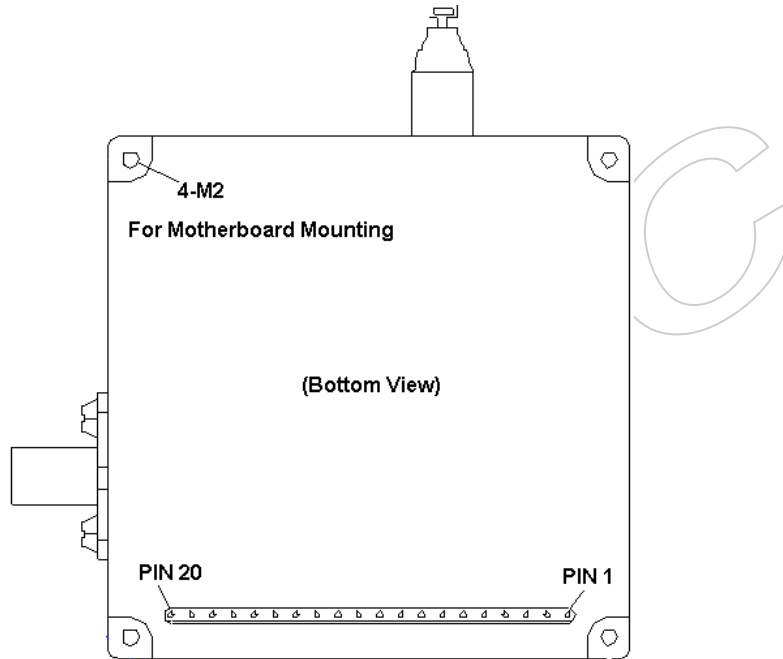


Figure 3 Compact Package Planform

Table 8 - PIN Function Definitions

PIN No.	Name	Description	Notes
1	V <sub>EE</sub>	Signal Ground	
2	V <sub>EE</sub>	Signal Ground	
3	V <sub>CCR</sub>	Digital Receiver Power Supply (+3.3V)	
4	SD	Digital Receiver Signal-Detected Indication	1
5	RD+	Non-inverted Receiver Data Output	2
6	RD-	Inverted Receiver Data Output	
7	TX_DIS	Transmitter Disable	3
8	TX_BRST	Transmitter Burst Control	4
9	V <sub>EE</sub>	Signal Ground	
10	TD+	Non-inverted Transmitter Data Input	5
11	V <sub>EE</sub>	Signal Ground	
12	TD-	Inverted Transmitter Data Input	5
13	V <sub>CCT</sub>	Transmitter Power Supply (+3.3V)	
14	DEBUG PORT#1	Reserved For Module Debugging	6
15	DEBUG PORT#2	Reserved For Module Debugging	
16	V <sub>DD_5V</sub>	CATV Receiver Power Supply (+5V)	

17	V <sub>DD_12V</sub>	CATV Receive Power Supply (+12V)	
18	ANALOG_SD	Analog Receiver Optical Power Monitor Output	7
19	NC	No Function Definition	
20	V <sub>EE</sub>	Signal Ground	
SMB	RF Output	CATV Receiver RF Analog Output (75Ω)	8

Note 1: LVTTTL 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: LVTTTL logic input, with internal 10KΩ pull-up resistor.

Transmitter Disabled: High; Transmitter Enabled: Low

Note 4: A positive level enable optical signal output under burst mode.

(See [Timing Parameter Definition in Burst Mode Sequence](#))

Note 5: Compatible with LVPECL input, DC coupled internally

(See [Recommended Interface Circuit](#) and [Table 7 - Electrical Input/Output Coupling Mode](#))

Note 6: Reserved for module tuning and compulsive for system application that any circuit doesn't be connected to them.

Note 7: Analog output, which can be used to measure CATV receiver input optical power. It should be connected with A/D converter.

Note 8: SMB Jack connector



### Mechanical Design Diagram

The form factor is 20PIN compact package with pigtail fiber. The pigtail fiber has a length of  $1000 \pm 100$ mm and 30mm minimum bending radius. The fiber connector type is SC/APC. The mechanical design diagram is shown in Figure 4. (Dimension in mm)

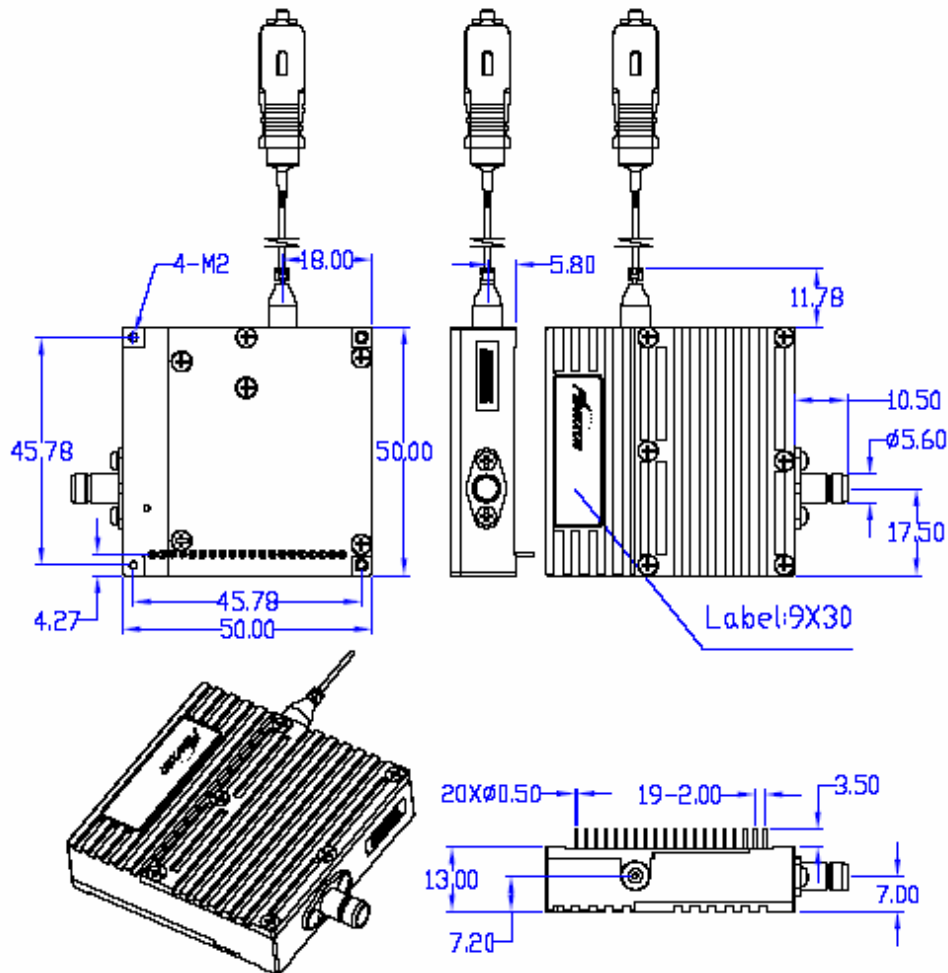


Figure 4 Mechanical Design Diagram

Table 9 - 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	900	1000	1100	mm
Optical Return Loss (APC type) -1310nm	55			dB

## Ordering Information

Part No.	Product Description
FTM-9812T-C10	1310nm(TX)/1490nm(Digital RX)/1550nm(Analog RX), SC/APC Pigtailed Compact Package for GE-PON ONU 10km application, 0°C ~+70°C, Tx DC Coupling, Rx AC Coupling
FTM-9812T-C10G	1310nm(TX)/1490nm(Digital RX)/1550nm(Analog RX), SC/APC Pigtailed Compact Package for GE-PON ONU 10km application, 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 (Doc No. DS3523000-1a)	2005-6-10
Pre 1b	Zachary Lu	Johnny Yang	Peter Tang	1, Change the PN form FTM-9812P-C10 to FTM-9812T-C10 2, Change the TD+/TD- termination with internal termination. 3, Update Recommended Interface Circuit. 4, Update the Mechanical Design Diagram, add SMB connector dimension.	2005-11-15
1c	Jacob Cai	Johnny Yang	Peter Tang	Revised datasheet 1. add FTM-9812T-C10G (Doc No. DS3523000-1c)	2007-8-10

**© Copyright Fiberxon Inc. 2007**

All Rights Reserved.

All information contained in this document is subject to change without notice. The products described in this document are NOT intended for use in implantation or other life support applications where malfunction may result in injury or death to persons.

The information contained in this document does not affect or change Fiberxon's product specifications or warranties. Nothing in this document shall operate as an express or implied license or indemnity under the intellectual property rights of Fiberxon or third parties. All information contained in this document was obtained in specific environments, and is presented as an illustration. The results obtained in other operating environment may vary.

THE INFORMATION CONTAINED IN THIS DOCUMENT IS PROVIDED ON AN "AS IS" BASIS. In no event will Fiberxon be liable for damages arising directly from any use of the information contained in this document.

**Contact**

U.S.A. Headquarters:

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/>