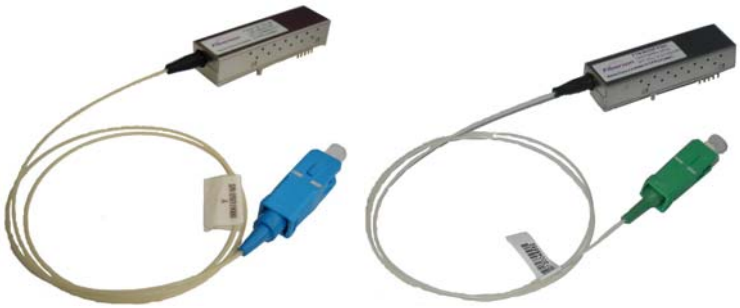
Mar. 20, 2007

Preliminary

2×5/2×10 SFF GEPON OLT Transceiver

FTM-9712P(T)-F(K)20(G)

(IEEE 802.3ah™-2004 1000Base-PX20-D)



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 1490/1310nm
- 1490nm continuous-mode transmitter with DFB laser
- 1310nm burst-mode receiver with APD-TIA
- Optical isolator built in for extreme Return Loss tolerance
- Resetless burst-mode receiver design
- Support more than 24dB dynamic range
- 0 to 70°C operating temperature
- Optional 2×5/2×10 SFF package with SC/UPC and SC/APC pigtail
- Single 3.3V power supply
- LVPECL compatible data input/output interface
- LVTTL transmitter disable control
- LVTTL transmitter laser failure alarm (P-K20(G),T-K20(G))
- LVTTL receiver signal-detected indication
- Low EMI and excellent ESD protection
- Class Ⅰ laser safety standard IEC-60825 compliant
- RoHS compliance (FTM-9712P(T)-F(K)20G)

Applications

- Gigabit Ethernet Passive Optical Networks (GEPON) – OLT side

Standard

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

Description

FTM-9712P(T)-F(K)20(G) is Optical Line Terminal (OLT) compliant with 1000BASE-PX20 application.

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

The transmitter section uses a multiple quantum well 1490nm DFB laser and is Class Ⅰ laser compliant product according to international safety standard IEC-60825.

The receiver section uses an integrated 1310nm PIN diode and preamplifier mounted in an optical header and limiting post-amplifier IC. Unlike the conventional burst-mode receiver, the receiver does not require reset pulse to receive optical data packets with different optical power.

The optical output can be disabled by a LVTTL logic high-level input of TX_DIS. LAS_nFAIL is provided to indicate that degradation of the laser (2×10 SFF). 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 damage 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	1
Operating Ambient Temperature	T_{OPR}	0	70	°C	
Operating Humidity	H_{OPR}	5	95	%	
Power Supply Voltage	V_{CC}	0	4	V	
Input Voltage		GND	V_{CC}	V	
Receiver Damaged Threshold		+4		dBm	
Soldering Temperature			400	°C	2
			260/10	°C/s	3
Bending Radius		30		mm	
Pigtail Fiber Contact Temperature			85	°C	

Note 1: When ambient temperature is above 60°C, airflow at rate higher than 1m/sec is required
Note 2: Only for soldering by iron and 10 seconds on leads only (for FTM-9712P(T)-F(K)20).
Note 3: Soldering on lead only (for FTM-9712P(T)-F(K)20G).

Recommended Operating Conditions

Table 3 - Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage	V_{CC}	3.13	3.3	3.47	V	3.3V±5%
Operating Ambient Temperature	T_{OPR}	0		70	°C	1
Operating Humidity Range	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	1480		1500	nm	
Optical Spectrum Width (-20dB)	$\Delta\lambda$			1	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Average Launch Power	P_{OUT}	+2		+7	dBm	1
Average Launch Power-OFF Transmitter	P_{OFF}			-39	dBm	
Extinction Ratio	ER	9			dB	2
Total Jitter	TJ			0.43	UI	
Rise/Fall Time (20%-80%)	T_R/T_F			260	ps	2.3
$RIN_{15}OMA$				-115	dB/Hz	
Optical Return Loss Tolerance				12	dB	
Transmitter Reflectance				-10	dB	
Transmitter and Dispersion Penalty	TDP			2.3	dB	4
Optical Eye Diagram	Compliant With IEEE Std 802.3ah™-2004					2,5
Data Input Differential Swing	V_{IN}	200		1600	mV	6
Input Differential Impedance	Z_{IN}	90	100	110	Ω	
Power Supply Current	I_{CC_TX}			200	mA	
Transmitter Disable Voltage - Low	$V_{TDIS, L}$	0		0.8	V	7
Transmitter Disable Voltage - High	$V_{TDIS, H}$	2.0		V_{CC}	V	
Laser Failure Alarm Voltage - Low	$V_{LFA, L}$	0		0.4	V	8
Laser Failure Alarm Voltage - High	$V_{LFA, H}$	2.4		V_{CC}	V	

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

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

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

Note 4: Maximum sensitivity penalty due to transmitter and dispersion effect through 20km of SMF optical fiber.

Note 5: Transmitter eye mask definition {0.22UI, 0.375UI, 0.20UI, 0.20UI, 0.30UI}.

Note 6: Compatible with LVPECL input, AC coupled internally. (See Recommended Interface Circuit)

Note 7: TX_DIS (See Pin Function Definitions)

Note 8: LAS_nFAIL, for FTM-9712P(T)-K20(G) (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.	Typical	Max.	Unit	Notes
Operating Wavelength		1260		1360	nm	
Sensitivity	P_{SEN}			-30	dBm	1
Saturation	P_{SAT}	-6			dBm	
Receiver Threshold Settling Time	$T_{SETTLING}$			250	ns	1,2
Dynamic Range		-30		-6	dBm	1,3
Signal-Detected Assert Level	P_{SDA}			-31	dBm	4
Signal-Detected Deassert Level	P_{SDD}	-45			dBm	5
Signal-Detected Hysteresis	P_{SDA}- P_{SDD}	0.5		6	dBm	
Receiver Reflectance				-12	dB	
Power Supply Current	I_{CC_RX}			120	mA	
Data Output Voltage - Low	V_{OL}-V_{CC}	-1.81		-1.62	V	
Data Output Voltage - High	V_{OH}-V_{CC}	-1.02		-0.88	V	
Data Output Differential Swing	V_{OUT}	400		1600	mV	6
Signal-Detected Voltage - Low	$V_{SD,\ L}$	0		0.4	V	7
Signal-Detected Voltage - High	$V_{SD,\ H}$	2.4		V_{CC}	V	
Signal-Detected Assert Time	T_{ASS}		1.2		μs	
Signal-Detected Deassert Time	T_{DAS}		0.5		μs	

Note 1: Measured with a PRBS 2^7-1 test pattern @1.25Gbit/s and ER=10dB, BER =10^{-12}.

Note 2: See Figure 1,2. For multiple ONUs application, It isn't easy to test $T_{SETTLING}$ directly, but there is a relationship $T_{SETTLING}$ = T_{GAP}-T_{GUARD} when T_{ON}=T_{OFF}, then $T_{SETTLING}$ can be calculated by T_{GAP} and a certain guard time at ONU side.

Note 3: See Figure 3. T_{GAP} be less than 250ns is guaranteed.

Note 4: An increase in optical power above the specified level will cause Signal-Detected (SD) output to switch from a low state to a high state.

Note 5: A decrease in optical power below the specified level will cause Signal-Detected (SD) output to switch from a high state to a low state.

Note 6: LVPECL output, DC coupled internally, guaranteed in the full range of input optical power (-6dBm to -31dBm) (See Recommended Interface Circuit)

Note 7: SD (See Pin Function Definitions)

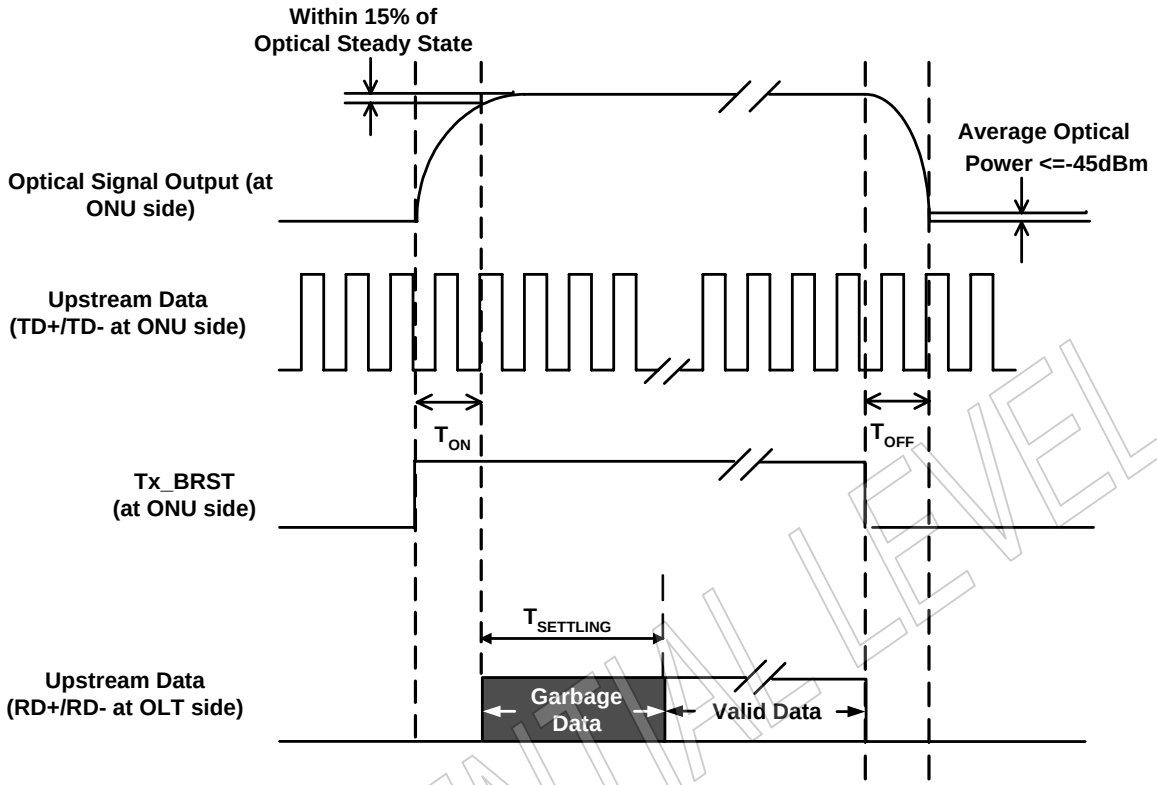


Figure 1 Timing Parameter Definition in Burst Mode Sequence (Sole ONU Application)

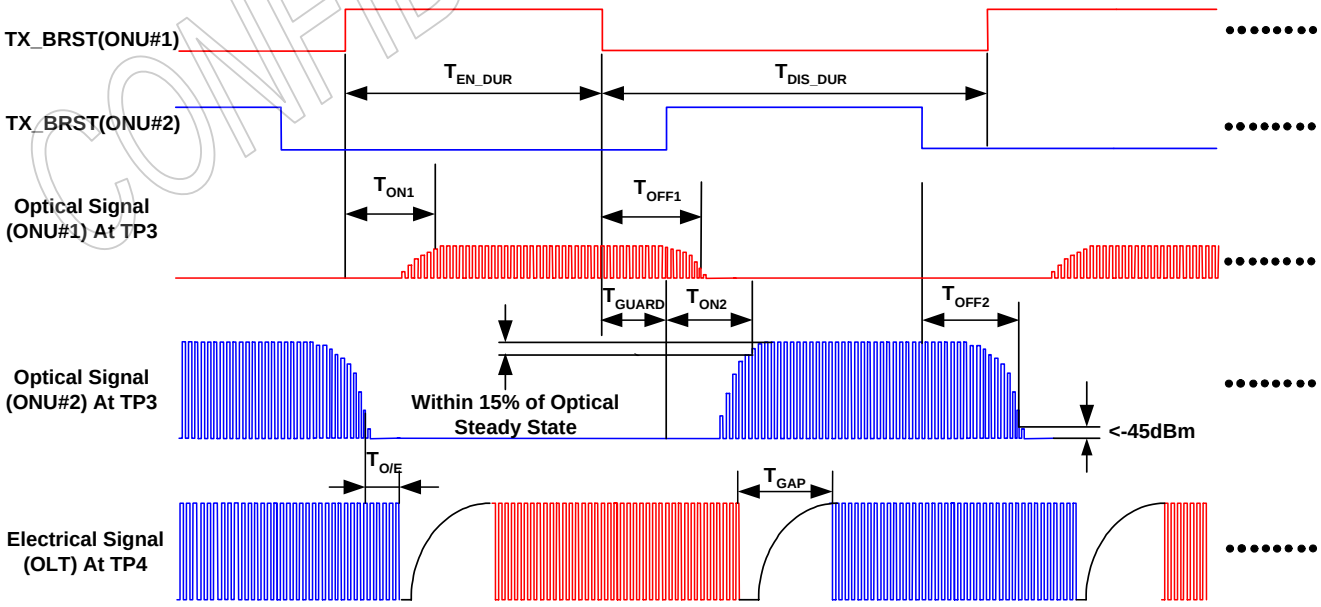


Figure 2 Timing Parameter Definitions in Burst Mode Sequence (Dual ONUs Application)

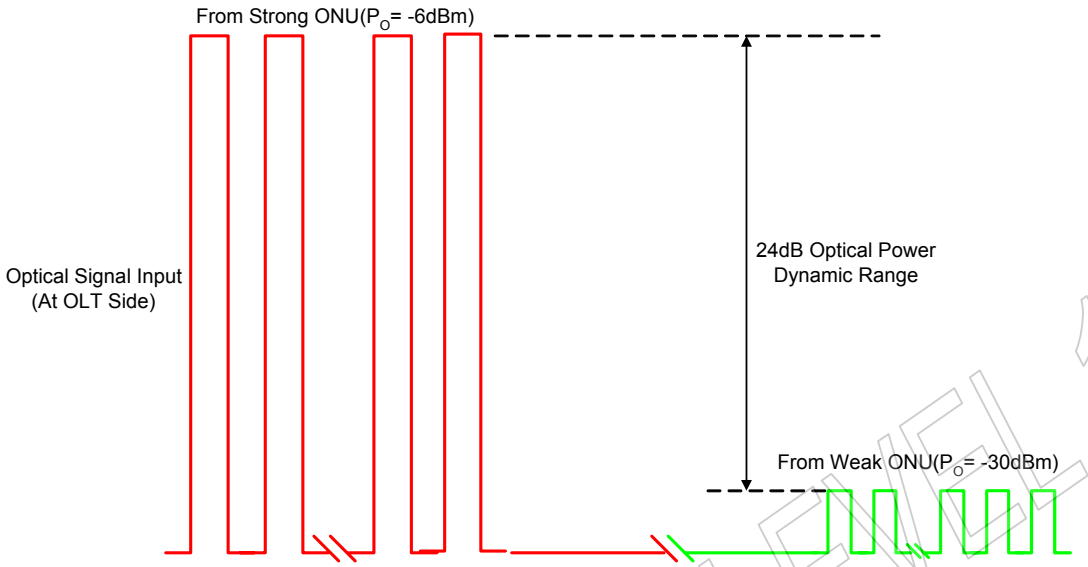


Figure 3 Burst Mode Receiver Dynamic Range in GEPON System

Recommended Interface Circuit

Figure 4 shows the recommended interface schemes for FTM-9712P(T)-F20(G).

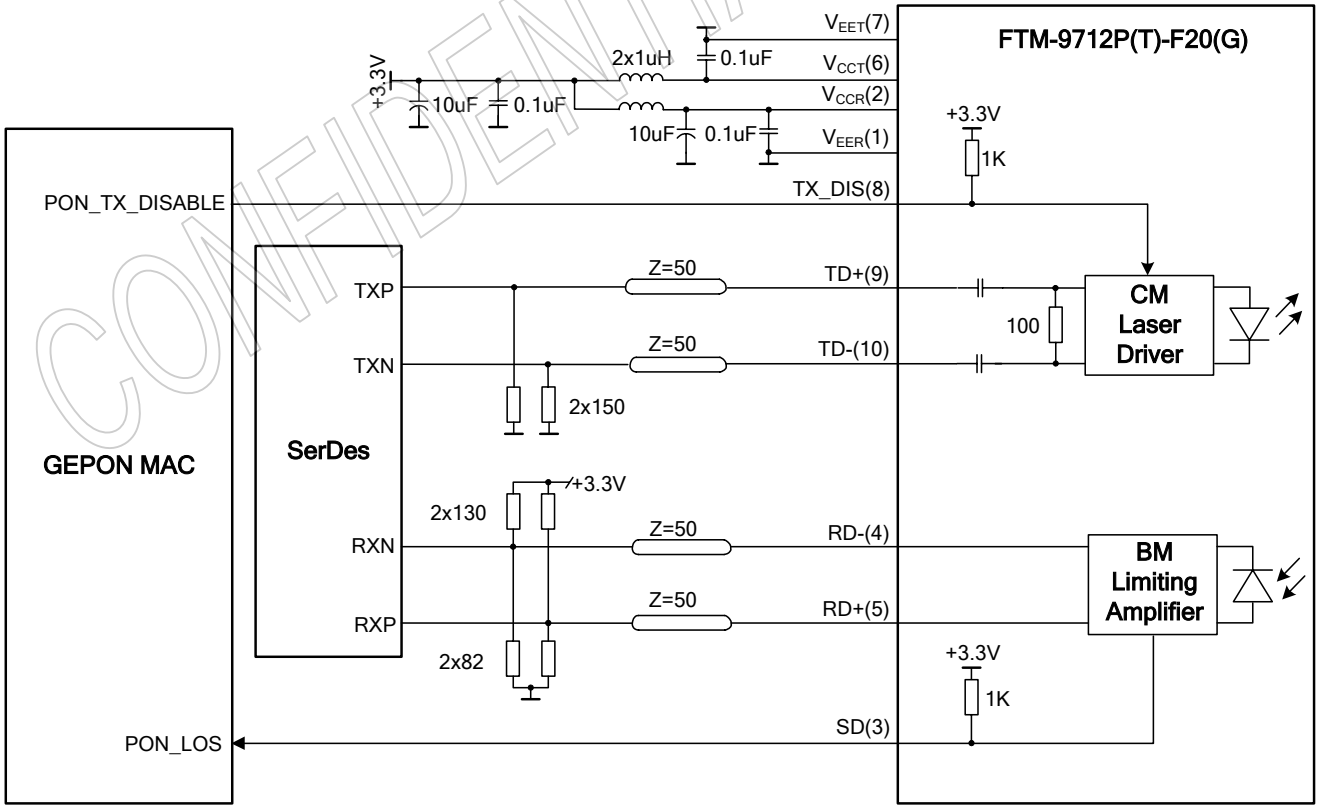


Figure 4 FTM-9712P(T)-F20(G) Recommended Interface Circuit

Figure 5 shows the recommended interface schemes for FTM-9712P(T)-K20(G).

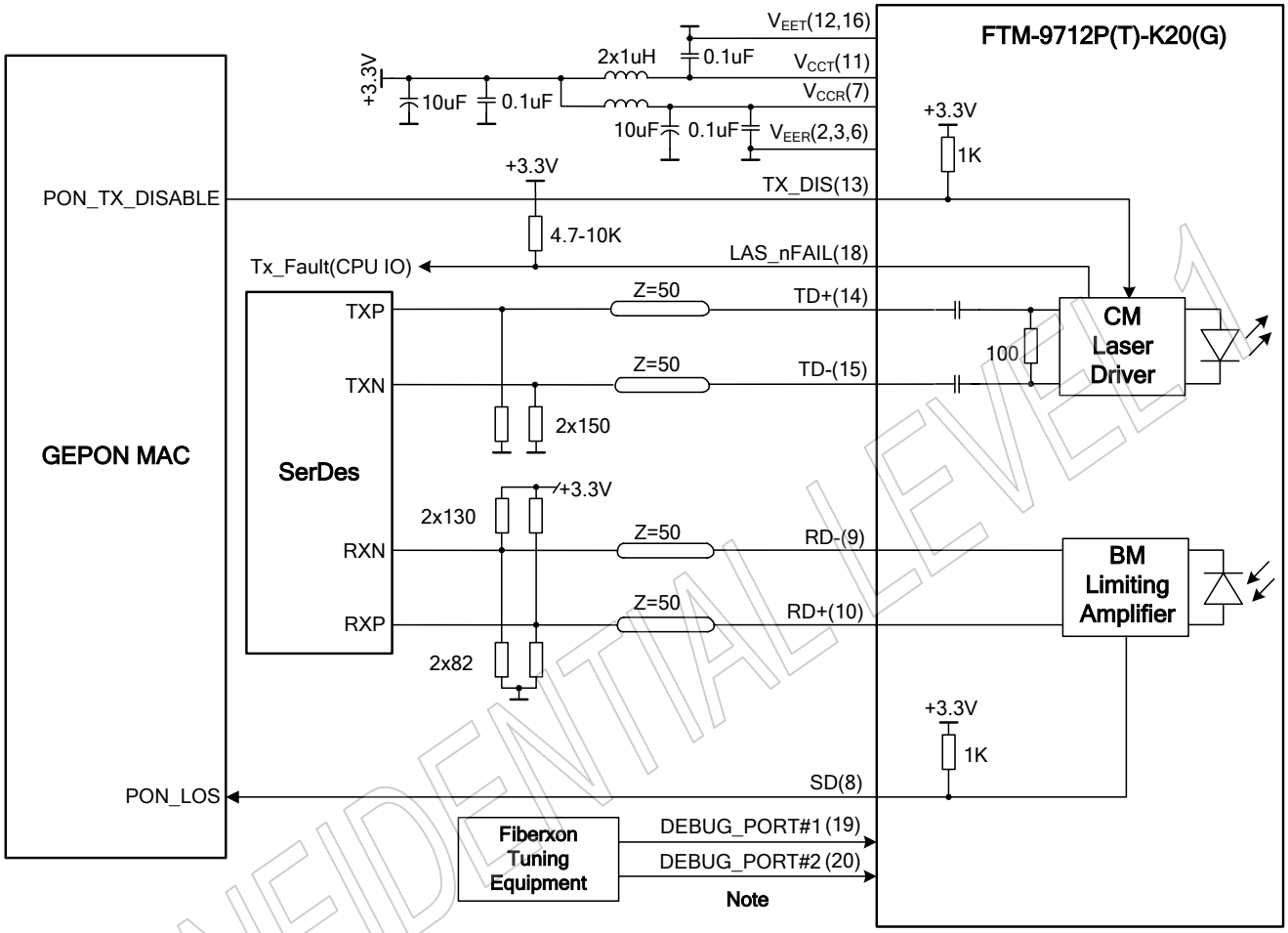


Figure 5 FTM-9712P(T)-K20(G) Recommended Interface Circuit

Note: Fiberxon reserve the two-wire debug port for module tuning.

(DO NOT connect these pins to any circuit on host board)

Pin Definitions

2×5/2×10 SFF planform in Figure 6 below shows the pin information of electrical interface and mounting studs. Functions are described in Table 6 with some accompanying notes.

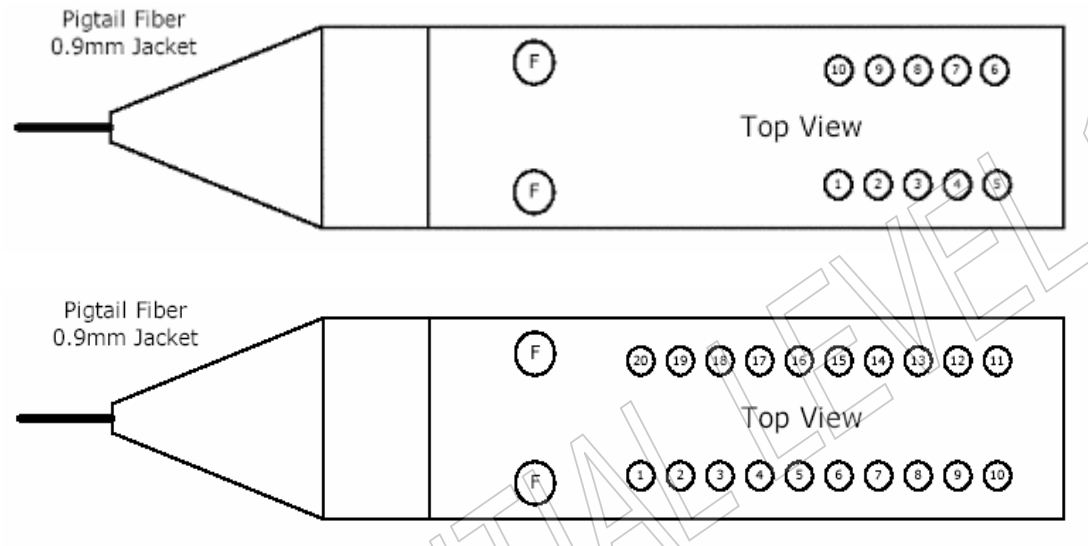


Figure 6 2×5/2×10 SFF Planform

Table 6 - Pin Function Definitions

Pin No.		Name	Description	Notes
2×5 SFF	2×10 SFF			
No Pin	1	NC	No Function Definition	Not connected
No Pin	2	V_{EER}	Receiver Signal Ground	
No Pin	3	V_{EER}	Receiver Signal Ground	
No Pin	4	NC	No Function Definition	Not connected
No Pin	5	NC	No Function Definition	Not connected
1	6	V_{EER}	Receiver Signal Ground	
2	7	V_{CCR}	Receiver Power Supply	
3	8	SD	Receiver Signal-Detected Indication	1
4	9	RD-	Inverted Receiver Data Output	2
5	10	RD+	Non-inverted Receiver Data Output	
6	11	V_{CCT}	Transmitter Power Supply	
7	12	V_{EET}	Transmitter Signal Ground	
8	13	TX_DIS	Transmitter Disable	3
9	14	TD+	Transmitter Non-inverted Data Input	4
10	15	TD-	Transmitter Inverted Data Input	
No Pin	16	V_{EET}	Transmitter Signal Ground	

No Pin	17	NC	No Function Definition	Not Connected
No Pin	18	LAS_nFAIL	Laser Failure Alarm Indication	5
No Pin	19	DEBUG PORT#1	Reserved For Module Debugging	6
No Pin	20	DEBUG PORT#2	Reserved For Module Debugging	
F		MS	Mounting Studs	7

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

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

Note 3: LVTTL logic input, with internal 1KΩ pull-up resistor.
Transmitter Disabled: High; Transmitter Enabled: Low

Note 4: LVPECL logic input, AC coupled with internal termination (See Recommended Interface Circuit)

Note 5: TTL logic output, pulled up by a 4.7-10KΩ resistor on the host board.
Laser Normal State: High; Laser Failure State: Low

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

Note 7: 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 Outline

The form factor is 2×5/2×10 SFF with pigtail fiber. The pigtail fiber has a length of 520 - 550mm and 30mm minimum bending radius. The fiber connector type is SC/UPC. The mechanical design diagram is shown in Figure 7 and 8. (Dimension in mm)

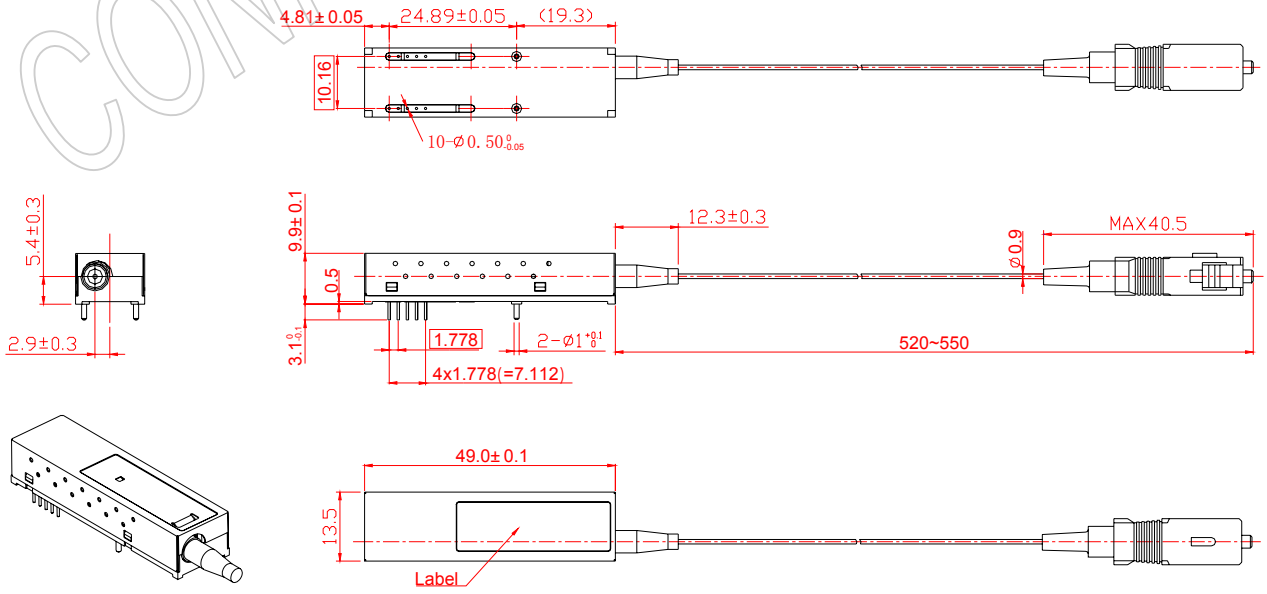


Figure 7 FTM-9712P(T)-F20(G) Mechanical Design Outline

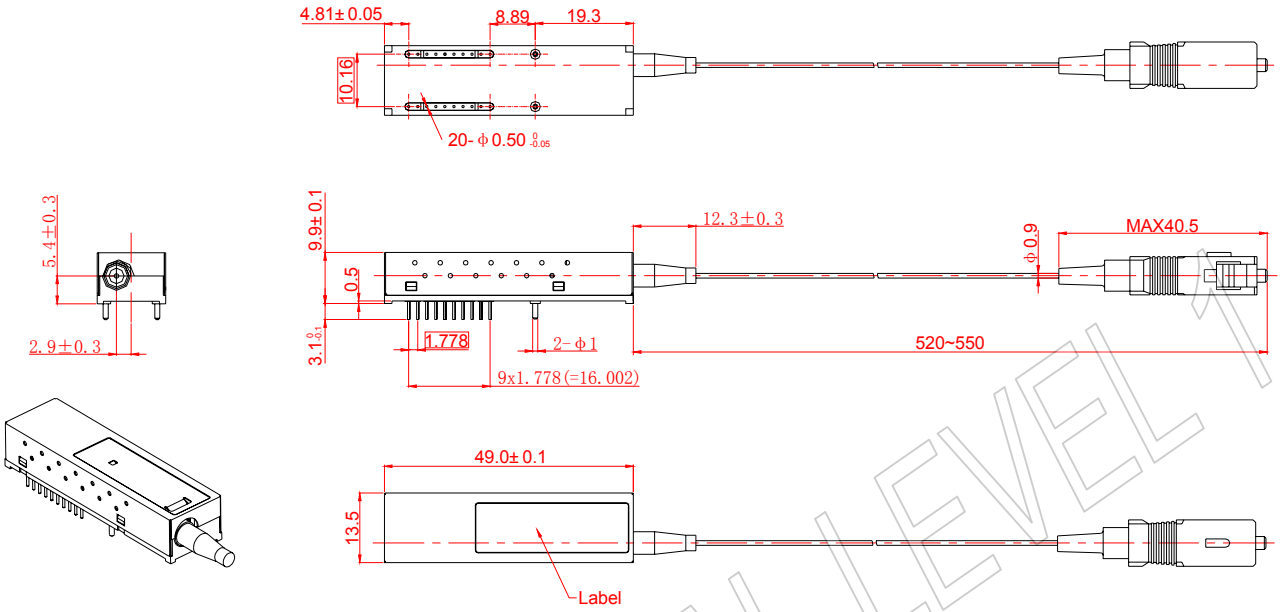


Figure 8 FTM-9712P(T)-K20(G) Mechanical Design Outline

Table 7- Pigtail Fiber 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	520		550	mm
Optical Return Loss (UPC type) -1490nm	50			dB
Optical Return Loss (APC type) -1490nm	60			dB

Ordering Information

Part No.	Product Description
FTM-9712P-F20	1490nm(TX)/1310nm(RX), SC/UPC Pigtailed 2×5 SFF for GEPON OLT, 20km application, 0°C ~70°C
FTM-9712T-F20	1490nm(TX)/1310nm(RX), SC/APC Pigtailed 2×5 SFF for GEPON OLT,20km application, 0°C ~70°C
FTM-9712P-K20	1490nm(TX)/1310nm(RX), SC/UPC Pigtailed 2×10 SFF for GEPON OLT, 20km application, 0°C ~70°C
FTM-9712T-K20	1490nm(TX)/1310nm(RX), SC/APC Pigtailed 2×10 SFF for GEPON OLT, 20km application, 0°C ~70°C
FTM-9712P-F20G	1490nm(TX)/1310nm(RX), SC/UPC Pigtailed 2×5 SFF for GEPON OLT, 20km application, 0°C ~70°C, RoHS compliance
FTM-9712T-F20G	1490nm(TX)/1310nm(RX), SC/APC Pigtailed 2×5 SFF for GEPON OLT, 20km application, 0°C ~70°C, RoHS compliance
FTM-9712P-K20G	1490nm(TX)/1310nm(RX), SC/UPC Pigtailed 2×10 SFF for GEPON OLT, 20km application, 0°C ~70°C, RoHS compliance
FTM-9712T-K20G	1490nm(TX)/1310nm(RX), SC/APC Pigtailed 2×10 SFF for GEPON OLT, 20km application, 0°C ~70°C, 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	Frank Zeng	Peter Tang	Initial datasheet (Doc No. DS3513000-1a) 1. Replace that interim version dated on Oct.23,2004 2. Defined with "*Premium Version*" to distinguish with "*Functional Version*" 3. Combine P-F20 with P-K20	Jul.6,2005
Pre 1b	Zachary Lu	Frank Zeng	Peter Tang	Revised datasheet 1. Add new parts (APC connector) 2. Add RoHS parts 3. Update appearance picture in page 1 4. Modify "Laser Failure Alarm Voltage" in Table 4 5. Modify "Signal-Detected Voltage" in Table 5 6. Delete "*Premium Version*" (Doc No. DS3513000-1b)	Mar.23,2006
Pre 1c	Zachary Lu	Frank Zeng	Peter Tang	Revised datasheet Modify "Receiver Threshold Settling Time" in Table 5 to MAX. 250ns (Doc No. DS3513000-1c)	Apr.28,2006
Pre 1d	Jacob Cai	Frank Zeng	Peter Tang	Revised datasheet 1. Correct the clerical error of product description in Order Information section. 2. Update Soldering Temperature and its notes in Table 2. (Doc No. DS3513000-1d)	Mar. 20, 2007

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