

## SFF 1.25G/2.5G EPON ONU Transceiver

### FTM-9423P-F10DC(G)



#### Members of Flexon™ Family

#### Features

- ◆ Single fiber bi-directional data links with asymmetric 1.25Gbit/s upstream and 2.5Gbit/s downstream
- ◆ Integrated with micro-optics WDM filter for dual wavelength Tx/Rx operation at 1310/1490nm
- ◆ Integrated with a 1550nm block filter to meet RF overlay application
- ◆ Burst mode operation transmitter with 1310nm FP laser
- ◆ Continuous mode operation receiver with 1490nm high sensitivity PIN-TIA with 1550nm optical signal rejection
- ◆ 0 to 70°C operating ambient temperature
- ◆ 2×5 SFF package with SC/UPC pigtail
- ◆ Single 3.3V power supply
- ◆ LVPECL data input and CML data output interface
- ◆ LVTTTL transmitter burst-mode control
- ◆ LVTTTL receiver signal-detected indication
- ◆ Low EMI and excellent ESD protection
- ◆ Class I laser safety standard IEC-60825 compliant
- ◆ RoHS Compliance (for FTM-9423P-F10DCG)

#### Applications

- ◆ 1.25G/2.5G Ethernet Passive Optical Networks (EPON) – ONU side

#### Standard

- ◆ Compliant with SFF MSA
- ◆ Compliant with FCC 47 CFR Part 15, Class B
- ◆ Compliant with FDA 21 CFR 1040.10 and 1040.11, Class I

#### Description

FTM-9423P-F10DC(G) is Optical Network Unit (ONU) transceiver for 1.25G/2.5G 10km Ethernet Passive Optical Networks (EPON) application.

The transceiver is the high performance modules for 1.25G/2.5G data link in single fiber by using 1310nm burst mode transmitter and 1490nm continuous mode receiver with 1550nm optical signal rejection.

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 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 LVTTTL 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 (for FTM-9423P-F10DCG)	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 <sub>STG</sub>	-40	85	°C	
Operating Ambient Temperature	T <sub>OPR</sub>	0	70	°C	1
Operating Humidity	H <sub>OPR</sub>	5	95	%	
Power Supply Voltage	V <sub>CC</sub>	0	4	V	
Input Voltage		GND	V <sub>CC</sub>	V	
Receiver Damaged Threshold		+4		dBm	
Soldering Temperature			400/10	°C/s	2
			260/10	°C/s	3
Bending Radius		30		mm	
Pigtail Fiber Contact Temperature			85	°C	

Note 1: With airflow 1m/sec when ambient temperature is above 60°C

Note 2: Only for soldering by iron on leads only (for FTM-9423P-F10DC).

Note 3: Soldering on lead only (for FTM-9423P-F10DCG).

## Recommended Operating Conditions

**Table 3 - Recommended Operating Conditions**

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage	$V_{CC}$	3.13		3.47	V	3.3V±5%
Operating Ambient Temperature	$T_{OPR}$	0		70	°C	1
Operating Humidity	$H_{OPR}$	5		95	%	
Data Rate(Upstream/Downstream)			1.25/2.5		Gbit/s	

Note 1: With airflow 1m/sec when ambient temperature is above 60°C

## 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	$\lambda_C$	1260		1360	nm	
Optical Spectrum Width (RMS)	$\Delta\lambda$			3	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Average Launch Power	$P_{OUT}$	-1		+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 <sub>15</sub> OMA				-115	dB/Hz	
Optical Return Loss Tolerance				15	dB	
Transmitter Reflectance				-10	dB	
Transmitter and Dispersion Penalty	TDP			1.8	dB	5
Optical Eye Diagram	Compliant With IEEE Std 802.3ah™-2004					2,6
Data Input Differential Swing	$V_{IN}$	200		1600	mV	
Input Differential Impedance	$Z_{IN}$	90	100	110	Ω	
Power Supply Current	$I_{CC\_TX}$			200	mA	
Transmitter Burst Control Voltage - Low	$V_{BURST\_L}$	0		0.8	V	7
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<sup>7</sup>-1 test pattern @1.25 Gbit/s.

Note 3: Measured with the fourth-order Bessel-Thomson 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 10km of SMF optical fiber.

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

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

**Table 5 - 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>			-21	dBm	1
Overload	P <sub>OV</sub>	-1				
Signal-Detected Assert Level	P <sub>SDA</sub>			-22	dBm	2
Signal-Detected Deassert Level	P <sub>SDD</sub>	-32			dBm	3
Signal-Detected Hysteresis	P <sub>SDA</sub> - P <sub>SDD</sub>	0.5		6	dB	
Tolerance to Reflected Optical Power				10	dB	
Receiver Reflectance				-20	dB	
Optical Crosstalk (1310nm/1490nm)				-47	dB	
Polarization Dependent Loss	PDL			0.5	dB	
Power Supply Current	I <sub>CC_RX</sub>			120	mA	
Data Output Differential Swing	V <sub>OUT</sub>	600		1000	mV	4
Signal-Detected Voltage - Low	V <sub>SD, L</sub>	0		0.4	V	5
Signal-Detected Voltage - High	V <sub>SD, H</sub>	2.4		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 a PRBS 2<sup>7</sup>-1 test pattern @2.5Gbit/s and ER=9dB, 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: CML output, AC coupled internally, guaranteed in the full range of input optical power(-1dBm to -22dBm) (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-9423P-F10DC(G)	Internal DC Coupling	Internal AC Coupling

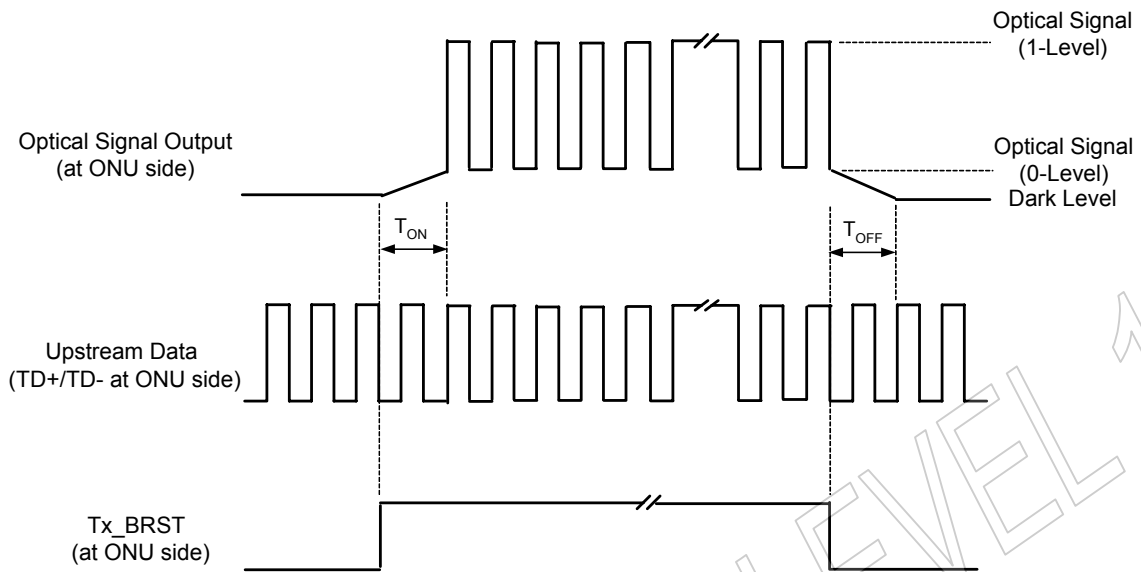


Figure 1 Timing Parameter Definition in Burst Mode Sequence

Recommended Interface Circuit

Figure 2 shows the recommended interface scheme

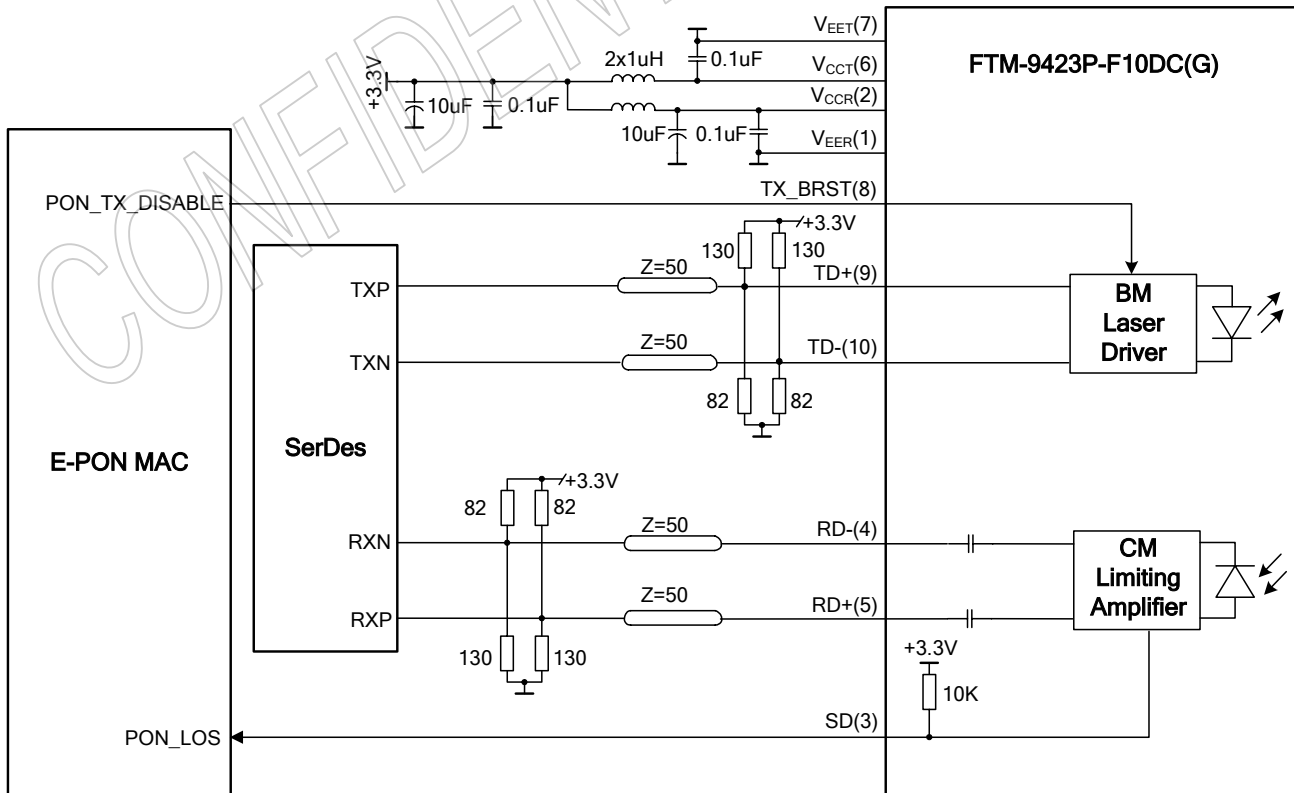


Figure 2 Recommended Interface Circuit

## Pin Definitions

2×5 SFF planform in Figure 3 below shows the pin information of electrical interface and mounting studs. Functions are described in Table 7 with some accompanying notes.

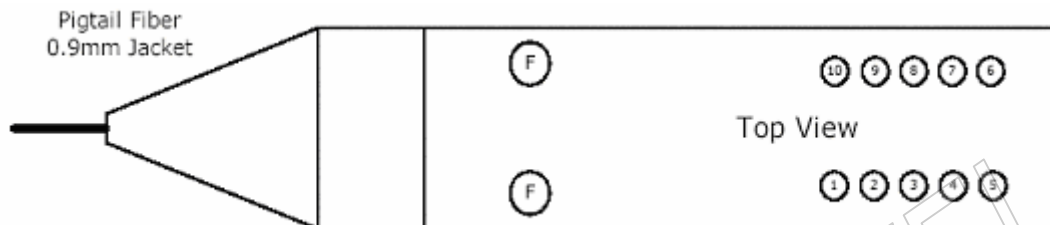


Figure 3 2×5 SFF Planform

Table 7 - Pin Function Definitions

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 (LVTTTL)	3
9	TD+	Transmitter Non-inverted Data Input	4
10	TD-	Transmitter Inverted Data Input	
F	MS	Mounting Studs	5

Note 1: LVTTTL logic output, with internal 10K $\Omega$  pull-up resistor.

Optical Signal-Detected: High; Optical Signal Loss: Low

Note 2: CML 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 input, DC coupled internally

(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 2X5 SFF with pigtail fiber. The pigtail fiber has a length 605 - 625mm and 30mm minimum bending radius. The fiber connector type is SC/UPC. The mechanical design diagram is shown in Figure 4. (Dimension in mm)

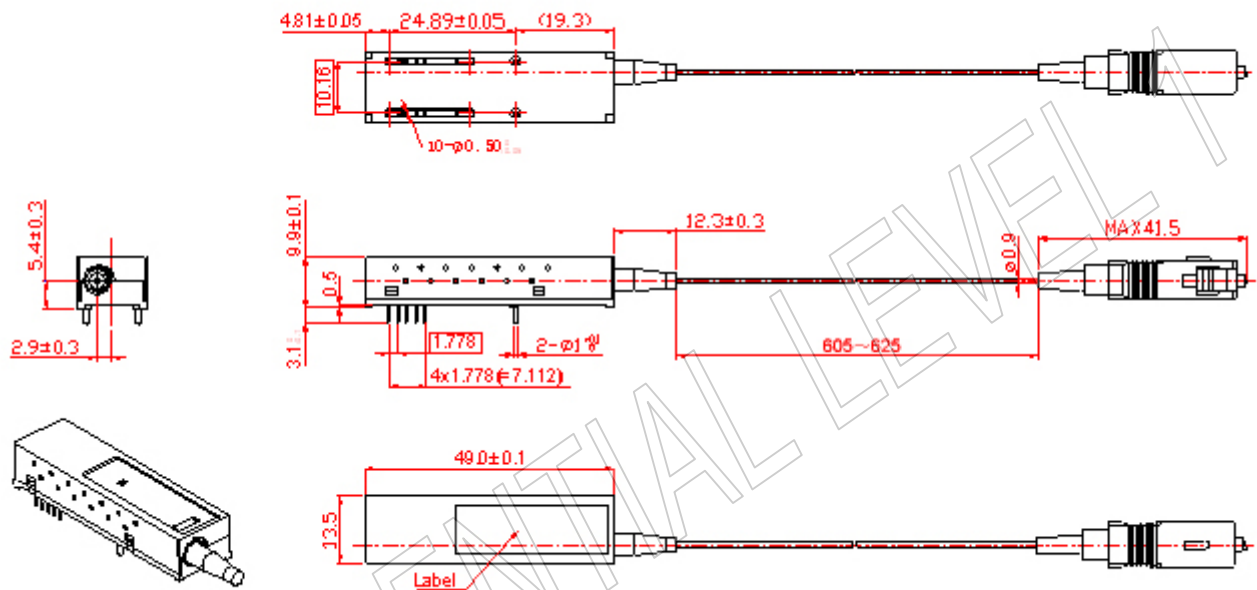


Figure 4 Mechanical Design Diagram

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	605		625	mm
Optical Return Loss (UPC type) -1310nm	50			dB

## Ordering Information

Part No.	Product Description
FTM-9423P-F10DC	1310nm(TX)/1490nm(RX), SC/UPC Pigtailed 2x5 SFF for EPON ONU 1.25G/2.5G 10km application, 0°C ~ 70°C, Tx DC Coupling, Rx AC Coupling
FTM-9423P-F10DCG	1310nm(TX)/1490nm(RX), SC/UPC Pigtailed 2x5 SFF for EPON ONU 1.25G/2.5G 10km application, 0°C ~ 70°C, Tx DC Coupling, Rx AC Coupling, RoHS compliance

## Related Documents

For further information, please refer to the following document:

- IEEE Std 802.3ah<sup>TM</sup>-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
1a	Jacob Cai	Johnny Yang	Peter Tang	Initial datasheet (Doc No. DS0000190-1a)	Mar. 30, 2007
1b	Jacob Cai	Zachary Lu	Peter Tang	Revised datasheet 1. Update document template; 2. Correct a typo in ordering information. (Doc No. DS0000190-1b)	Dec. 5, 2007

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