

# XFP Optical Transceivers for 10km 10G Datacom and Storage Applications IGF Series IGF-17311J

The Bookham IGF Series optical transceiver modules are high-performance, cost-effective modules for serial optical data communication applications at 10Gb/s. They are designed to provide 10Gb/s Ethernet and 10Gb/s Fiber Channel 10 km compliant links.

The modules are designed for single mode fiber and operate at a nominal wavelength of 1310nm. They incorporate Bookham's exclusive optical packaging platform.

The modules aid system hardware engineers in implementing low-cost single mode Physical Media Dependency (PMD) solutions that are protocol transparent. The "hot pluggable" feature built into every module reduces manufacturing cost, inventory costs and allows optical port upgrades at the customer premises. Built-in remote monitoring via digital diagnostics allows user access to static and dynamic data as well as module condition.

The IGF-17311J uses a DFB laser packaged in conjunction with an optical isolator. This design provides for maximum eye opening, minimized jitter generation, and excellent back reflection performance. The transmitter is fully EN/IEC60825-1 Class 1/Class I laser eye safety compliant.



## Features:

- Multi-Protocol support:  
IEEE 802.3ae 10G Ethernet 10GBASE-LR/LW  
10G Fibre Channel 1200-SM-LL-L
- Compliant with the XFP
- 9.95 to 10.52 Gb/s data rates
- Supports 10km link distances
- Hot Pluggable
- Low EMI for high port density
- 2.2W Typical Power Dissipation
- On board Enhanced Digital Diagnostics providing I2C remote monitoring capability
- XFI Loop-Back Diagnostic
- Integral Signal Conditioning ICs enabling FR4 host board PCB traces up to 8 inches
- Duplex LC connector
- Transmit disable and loss-of-signal functions
- RoHS compliant 

## Applications:

- High Port Density Solutions
- 10GBASE-L applications
- 10Gb/s Gigabit Ethernet Networking
- Datacom and Storage-area networking
- Rack-to-rack connectivity
- Client side interconnection
- Fiber to the X aggregation

## Absolute maximum ratings

Parameter	Symbol	Min	Max	Units
Storage Temp	T <sub>stg</sub>	-40	85	°C
Supply voltage <sub>5</sub>	VCC5	0	6	V
Supply voltage <sub>3</sub>	VCC3	0	4.0	V
Supply voltage <sub>2</sub>	VCC2	1.8V Not required		V
Supply voltage <sub>E5</sub>	VEE5	-5.2V Not required		V
Data AC volt. differential	Tx+, Tx-	-0.5	2	V <sub>pp</sub>
Data DC volt	Tx+, Tx-	0	VCC2	V <sub>pp</sub>
Receiver Input Damage Threshold	P <sub>Damage</sub>		5	dBm

## Recommended operating conditions

Parameter	Symbol	Min	Typ	Max	Units	Notes
Baud rate		9.95		10.52	GBd	10 GbE; 10G FC
Supply voltage <sub>5</sub>	VCC5	4.75	5.0	5.25	V	+/- 5%
Supply current <sub>5</sub>	ICC5		275	400	mA	
Supply voltage <sub>3</sub>	VCC3	3.13	3.3	3.47	V	+/- 5%
Supply current <sub>3</sub>	ICC3		255	300	mA	
Supply voltage <sub>2</sub>	VCC2		1.8		V	Not required
Supply voltage <sub>E5</sub>	VEE5		-5.2		V	Not required
Power dissipation	P <sub>w</sub>		2.2	2.7	W	
Temperature case	T <sub>s1</sub>	0		70	°C	

Please contact sales for special requirements

## Operating Specifications – electrical

Parameter	Symbol	Value			Units	Notes
		Min	Typical	Max		
CML input (differential)	V <sub>TxDiff</sub>	125		940	mVpp	100 ohm differential
CML output (differential)	V <sub>RxDiff</sub>	360		770	mVpp	100 ohm differential
Rise/Fall time	T <sub>r</sub> /T <sub>f</sub>	24			Ps	20% - 80%
Low Speed Electrical Signals						
Output voltage high	V <sub>OH</sub>	VCC3-0.5		VCC3+0.3	V	RX_LOS, MOD_NR, Interrupt
Output voltage low	V <sub>OL</sub>	0		0.4		
Input voltage high	V <sub>IH</sub>	2		VCC3+0.3	V	TX_DIS, P_Down/RST
Input voltage low	V <sub>IL</sub>	0		0.8		
Loss of signal timing						
Assert (off to on)	TA			100	µs	
Deassert (on to off)	TD			100	µs	

## Transmitter operating specifications – optical

Parameter	Symbol	Value			Units	Notes
		Min	Typical	Max		
Center wavelength	λ <sub>c</sub>	1260	1310	1355	nm	
Optical transmit power	P <sub>o</sub>	-6.0		0.5	dBm	EOL
Transmitter Optical Modulation Amplitude	OMA	-5.2			dBm	
Transmitter power (in OMA) - TDP		-6.2			dBm	
Side mode suppression	SMSR	30			dB	
Extinction ratio	ER	3.5			dB	
Transmitter and dispersion penalty	TDP			3.2	dB	10km SMF
TX disabled output power	P <sub>oFF</sub>			-30	dBm	
Output optical eye	Compliant with IEEE 802.3æ clause 52					

## Receiver operating specifications – optical

Parameter	Symbol	Value			Units	Notes
		Min	Typical	Max		
Input operating wavelength	$\lambda$	1260		1360	nm	
Receiver sensitivity	PIN-MIN		-17		dBm	Ave. power at ER=6dB
Receiver sensitivity in OMA	PIN-OMA			-12.6	dBm	
Stressed receiver sensitivity in OMA	SRS			-10.3	dBm	
Receiver overload	PIN-MAX	0.5			dBm	Ave. power
Reflectance				-12	dB	
Loss of Signal						
Loss of Signal Assert (Off to On)	PA	-32		-20	dBm	
Loss of Signal Deassert (On to Off)	PD			-15	dBm	
Hysteresis	PA - PD	0.5		6	dB	

### Electrical pin out

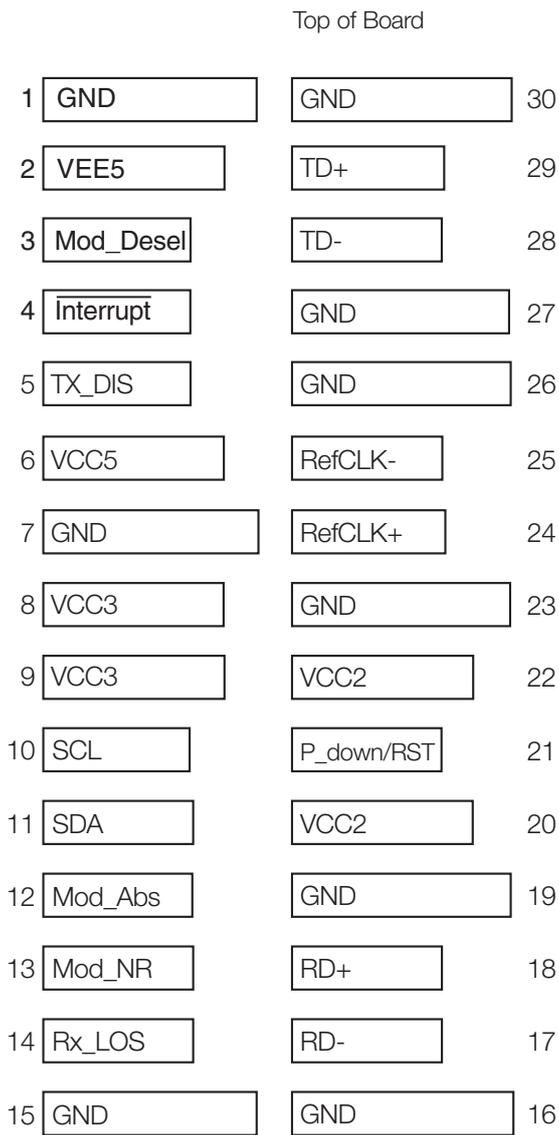


Figure 1: XFP Module Board Pinout & Names

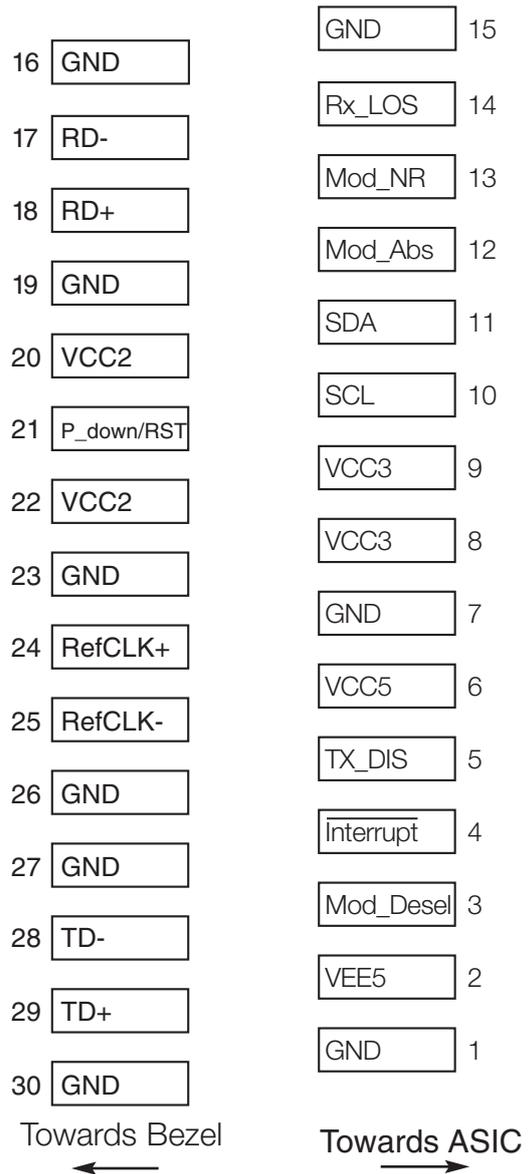


Figure 2: Host PCB XFP Pinout Top View

## Pin definitions

Pin #	Logic	Symbol	Function	Plug Seq	Notes
1		GND	Module Ground; Signal Ground	1	1
2		VEE5	Optional -5.2V Power Supply—NOT USED	2	
3	LVTTL-I	Mod_Desel	Module De-select; When held low by host allows the module to respond to 2-wire serial interface commands	3	
4	LVTTL-O	$\overline{\text{Interrupt}}$	Interrupt_BAR; Indicates the presence of an important condition that can be read over the two wire interface	3	2
5	LVTTL-I	TX_DIS	Transmitter Disable; Turns Off Transmitter Laser Source	3	
6		VCC5	+5 V Power Supply	2	
7		GND	Module Ground; Signal Ground	1	1
8		VCC3	+3.3 V Power Supply	2	
9		VCC3	+3.3 V Power Supply	2	
10	LVTTL-I	SCA	Two Wire Interface Clock	3	2
11	LVTTL-I/O	SDA	Two Wire Interface Data Line	3	2
12	LVTTL-O	Mod_Abs	Indicates Module Not Present; Grounded in Module	3	2
13	LVTTL-O	Mod_NR	Module Not ready or Indicating Module Operational Fault	3	2
14	LVTTL-O	RX_LOS	Receiver Loss of Signal Indicator	3	2
15		GND	Module Ground; Signal Ground	1	1
16		GND	Module Ground; Signal Ground	1	1
17	CML-O	RD-	Receiver Inverted Data Output	3	
18	CML-O	RD+	Receiver Non-Inverted Data Output	3	
19		GND	Module Ground; Signal Ground	1	1
20		VCC2	+1.8 V Power Supply	2	
21	LVTTL-I	P_down/RST	Power down; When high, places the module in the low power standby mode of less than 1.5 W with 2-wire interface still operational. Reset; The falling edge of P_Down/RST initiates a complete module reset including the 2-wire interface.	3	
22		VCC2	+1.8 V Power Supply	2	
23		GND	Module Ground; Signal Ground	1	1
24	PECL-I	RefCLK+	Reference Clock Non-Inverted Input, AC coupled on Host Board	3	
25	PECL-I	RefCLK-	Reference Clock Inverted Input, AC coupled on Host Board	3	
26		GND	Module Ground; Signal Ground	1	1
27		GND	Module Ground; Signal Ground	1	1
28	CML-I	TD-	Transmitter Inverted Data Input	3	
29	CML-I	TD+	Transmitter Non-Inverted Data Input	3	
30		GND	Module Ground; Signal Ground	1	1

**Notes:**

1. Module ground pins are isolated from the module case and chassis ground within the module.
2. Open Collector should be pulled up with 4.7K-10Kohms to a voltage between 3.15V and 3.6V on the host board.

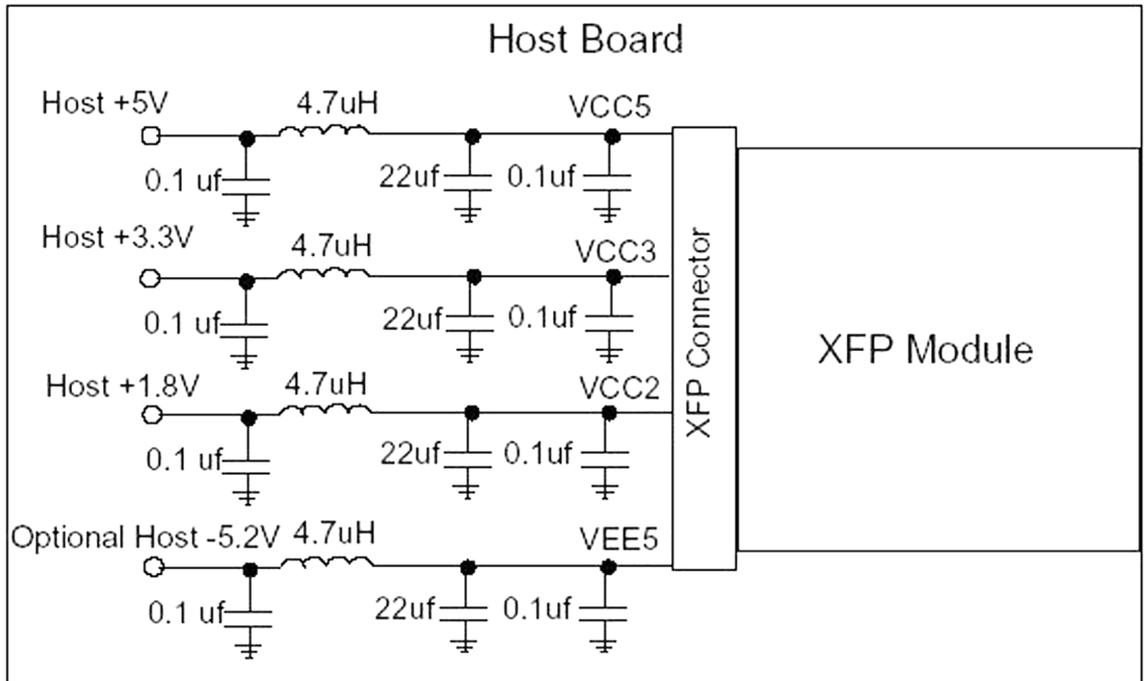


Figure 3. Host Board Supply Filtering

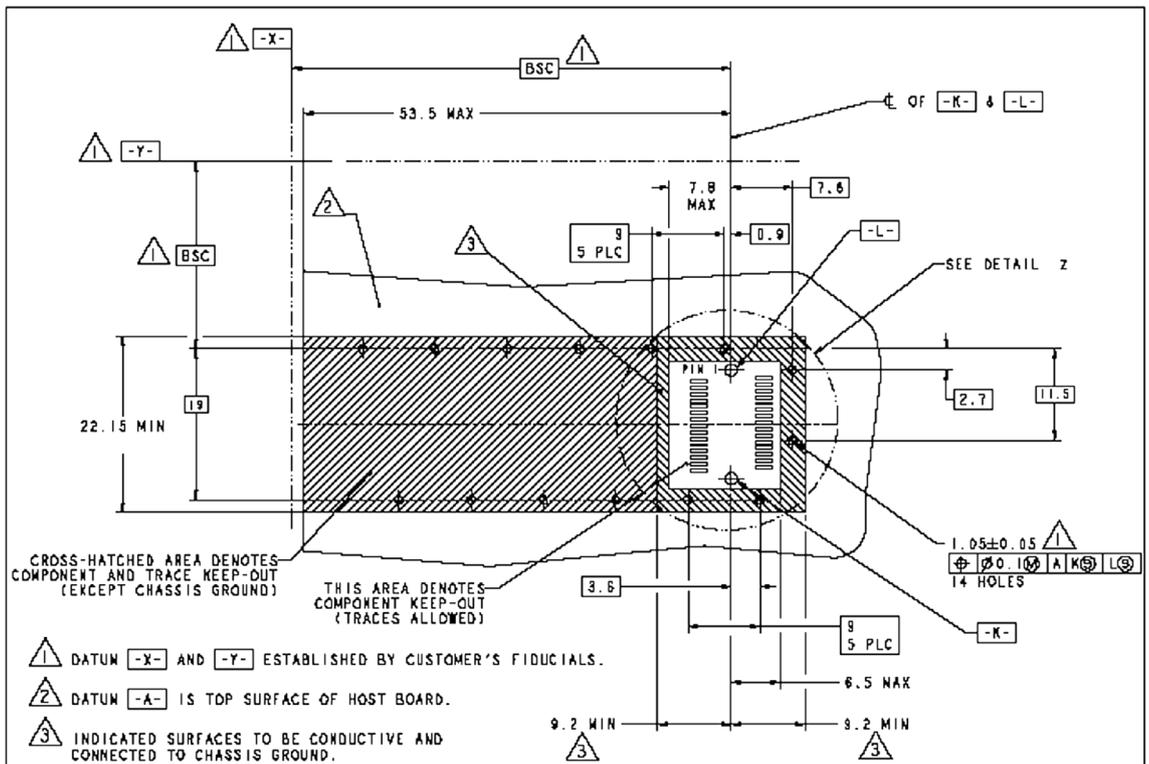


Figure 4. Host Board mechanical layout (mm)

## Mechanical interface

The XFP module is a pluggable module with its foundation based on the successful SFP package configuration. It consists of a rectangular package that is approximately 18mm wide and 78mm long. The module interface is a 30 lead connector. The module is inserted into a metal cage assembly. As an option, a heat sink can be clipped to the cage to enhance the cooling of the module.

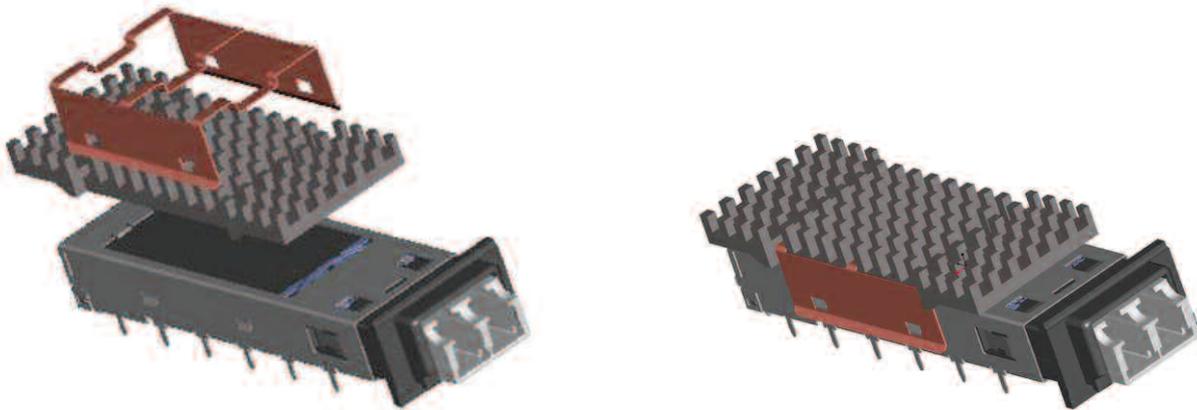


Figure 5. Example of clip-on heat sink

## Thermal interface

One of the unique features of the XFP module is that the module cage is designed with the ability to have a thermal heat sink clipped onto the cage. Thus the equipment manufacturer that designs with the XFP can select a heat sink that is optimized for the particular environmental conditions of vertical space above module, air flow, air flow direction and desired pressure drop.

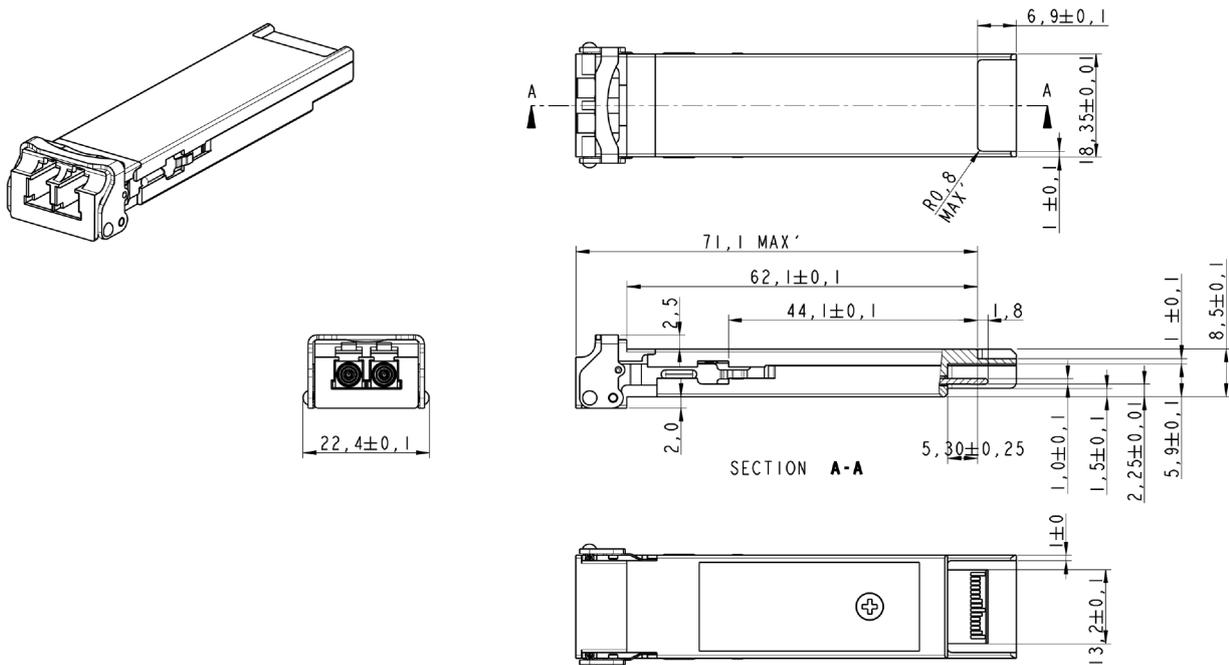


Figure 6. Mechanical Dimensions (mm) of the XFP module.

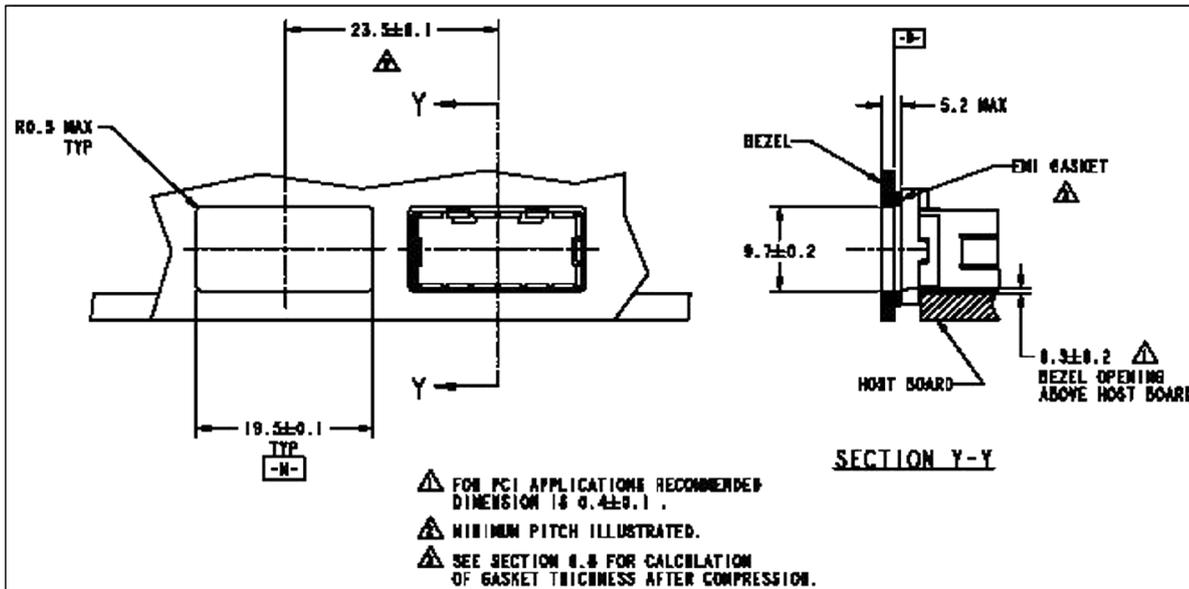


Figure 7. Interface Design with Bezel (mm)

## Management Interface

Digital diagnostics is an available interface on all Bookham XFP transceivers. A 2-wire Serial ID interface provides user access to vendor/module identification, customer specific data, link type, static and dynamic monitor hooks, and a check code mechanism for verifying accuracy in the data registers. These “static” and “dynamic” diagnostics allow users to remotely and accurately identify modules and their vendors, make determinations about its compatibility with the system, verify which “Enhanced” diagnostics are supported, and monitor module parameters to determine the module and link condition.

The module’s “Enhanced Digital Diagnostics” features provide real-time monitoring of receiver input power, transmitter power, internal module temperature, laser bias current, and supply voltage parameters.

The 2-wire serial ID interface was originally defined by the GBIC (GigaBit Interface Converter) and SFF-8472 specifications. The XFP MSA (Multi-Source Agreement) document further defined the diagnostics features and introduced a new memory map of the diagnostic information. This interface is a 2-wire interface that allows read-only access to separate memory locations.

The memory location starting at A0h (data address 0 ~ 127) contains the Digital Diagnostic Functions.

The normal 256 Byte I2C address space is divided into lower and upper blocks of 128 Bytes. The lower block of 128 Bytes is always directly available and is used for the diagnostics and control functions that must be accessed repeatedly.

One exception to this is that the standard module identifier Byte defined in the GBIC and SFP is located in Byte 0 of the memory map (in the diagnostics space) to allow software developed for multiple module types to have a common branching decision point. This Byte is repeated in the Serial ID section so that it also appears in the expected relationship to other serial ID bits.

Multiple blocks of memories are available in the upper 128 Bytes of the address space. These are individually addressed through a table select Byte which the user enters into a location in the lower address space. Thus, there is a total available address space of  $128 * 256 = 32\text{Kbytes}$  in this upper memory space. The upper address space tables are used for less frequently accessed functions such as serial ID, user writable EEPROM, reserved EEPROM and diagnostics and control spaces for future standards definition, as well as ample space for vendor specific functions. These are allocated as follows:

- Table 01h: Serial ID EEPROM
- Table 02h: User writable EEPROM

The details of each memory space are found in the XFP MSA specification Chapter 5.

Reference Documents:

1. XFP MSA revision 4.0 found at [www.xfpmsa.org](http://www.xfpmsa.org); April 13, 2004

## Regulatory compliance

Bookham IGF-17311J 1310nm XFP transceivers are designed to be Class I Laser compliant. They are certified per the following standards:

Feature	Agency	Standard	Certificate/Comments
Laser Safety	FDA/CDRH	CDHR 21(J) CFR 1040.10	0212646-01
	TÜV	IEC/EN 60950-1:2001 IEC/EN 60825-1/A2:2001	DE3-54632
		CAN/CSA-60825-1-03	U8V 06 06 54880 002
Product Safety	UL/CSA	UL 60950-1:2003 UL 94 V-0 CAN/CSA-C22.2 No.60950-1-03	U8V 06 06 54880 002
ESD	IEC	MIL-STD 883 Method 3015 IEC61000-4-2	Pass
EMI	FCC/89/336/EE [EU Directive]	Part 15 Class B	Pass
		EN55022, EN55024 Class B	Pass
CE	EU Directive	73/23/EEC (Low voltage) 89/336/EEC (EMC)	Pass

## RoHS Compliance



Bookham is fully committed to environment protection and sustainable development and has set in place a comprehensive program for removing polluting and hazardous substances from all of its products. The relevant evidence of RoHS compliance is held as part of our controlled documentation for each of our compliant products. RoHS compliance parts are available to order, please refer to the ordering information section for further details.

### Ordering Information:

IGF-17311J

TRX 10G XFP 10KM SR GBE COM ROHS 5/6

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