Data sheet

XFP Optical Transceivers for 40km 10G Serial Applications

IGF series

IGF-32511

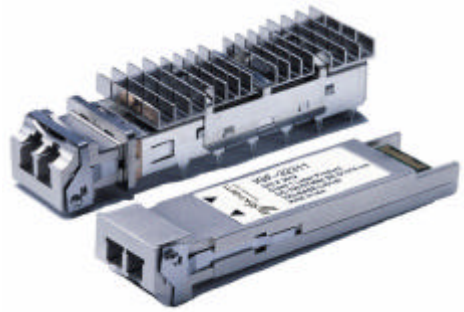
The Bookham Technology IGF-3000 Series optical transceiver modules are high-performance, cost-effective modules for serial optical data communication applications at 10Gb/s. The IGF 32511 is designed to provide SONET/SDH (with or without FEC) and 10Gb/s Ethernet for 40km compliant links.

The modules are designed for single mode fibre and operate at a nominal wavelength of 1550nm. They incorporate Bookham's exclusive IO-PKG optical packaging platform that scales with networking equipment platform upgrades.

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

The IGF-32511 uses an Externally Modulated Laser (EML) packaged in conjunction with an optical isolator for excellent back reflection performance. The transmitter has full IEC 825 and CDRH Class 1 eye safety.

The Bookham IGF-3000 series of modules have been extensively tested utilizing industry standard single mode fibres in order to ensure compatibility with enterprise, access and metro systems.



Features

- Multi-Protocol Compliant SONET/SDH OC-192 standard S-64.2b (IR-2) IEEE802.3 10G Ethernet (10GBASE-ER/EW)
- Compliant with the XFP MSA
- Ultra small form factor
- 10Gb/s serial operation
- Hot Pluggable
- Supports 40km link distances
- Integrated PIN receiver technology
- Data rates up to 10.75Gb/s
- XFI electrical interface
- On board Enhanced Digital Diagnostics providing I^2C remote monitoring capability
- Less than 3.5W power dissipation
- Integral Signal Conditioning ICs enabling FR4 host board PCB traces up to 8 inches
- Duplex LC connector
- Low EMI
- Transmit disable and loss-of-signal functions

Applications

- SONET / SDH OC-192 IR-2
- 10Gb/s Gigabit Ethernet 10GBASE-ER/EW
- Telecom and Datacom
- Client side interconnection
- Inter-office connections

Absolute maximum ratings

Parameter	Symbol	Min	Max	Units
Storage Temp	T_{stg}	-40	85	^{O}C
Supply voltage$_1$	VCC5	0	6	V
Supply voltage$_2$	VCC3	0	4.0	V
Supply voltage$_3$	VCC2	0	2.2	V
Supply voltage$_4$	VEE5	0	-6	V
Data AC volt. differential	Tx+, Tx-	-0.5	2	Vpp
Data DC volt.	Tx+, Tx-	0	VCC2	Vpp

Recommended operating conditions – IGF-32511

Parameter	Symbol	Min	Typical	Max	Units	Notes
Baud Rate		9.95		10.75	GBd	STM-64/OC-192; G.709; 10 GbE;
Supply Voltage$_5$	VCC5	4.75	5.0	5.25	V	+/- 5%
Supply Current$_5$	ICC5		TBD		mA	
Supply voltage$_3$ **Supply Current$_3$**	VCC3 ICC3	3.13	3.3 TBD	3.47	V mA	+/- 5%
Supply voltage$_2$	VCC2	1.71	1.8	1.89	V	+/- 5%
Supply Current$_2$	ICC2		TBD		mA	
Supply voltage$_{E5}$	VEE5		-5.2		V	**Not required**
Power Dissipation	Pw			3.5	W	
Temperature Case(std temp)	Ts_1	0		70	°C	

Please contact sales for special requirements

Operating specifications – electrical

T_{case} = 0°C +70°C

Parameter	Symbol	Value			Units	Notes
		min	typical	max		
CML Input (differential)	V_{TxDiff}	125		940	mVpp	100 ohm differential
CML Output (differential)	V_{RxDiff}	360		770	mVpp	100 ohm differential
Rise/Fall Time	T_r/T_f	24			Ps	20% - 80%
Loss of Signal						
Output Voltage High	V_{OH}	2		VCC3+0.3	V	
Output Voltage Low	V_{OL}	0		0.8	V	
Loss of Signal Timing						
Assert (Off to On)	T_A			100	µs	
Deassert (On to Off)	T_D			100	µs	
Tx_Disable High	V_{DH}	2		VCC3+0.3	V	
Tx_Disable Low	V_{DL}	0		0.8	V	
Tx_Fault High	V_{FH}	hostVCC-0.5		hostVCC+0.3	V	
Tx_Fault Low	V_{FL}	0.0		0.5	V	

Transmitter operating specifications – optical

T_{case} = 0°C +70°C — **EML Laser - IGF-32511**

Parameter	Symbol	Value			Units	Notes
		min	typical	max		
Center Wavelength	λ_c	1530	1550	1565	nm	
Optical Transmit Power	P_o	-1.0		+2.0	dBm	EOL
Side mode suppression	SMSR	30			dB	
Extinction Ratio	ER	8.2			dB	
Jitter Generation	TJ_{rms}			0.01	UI	RMS
Jitter Generation	TJ_{p-p}			0.075	UI	Peak-to-Peak
Optical Path Penalty	OPP			2	dB	40km SMF
Output Optical Eye	Compliant with Bellcore GR-253-CORE & ITU G.691 and 802.3 clause 52					

Receiver operating specifications – optical

T_{case} = 0°C +70°C — **IGF-32511**

Parameter	Symbol	Value			Units	Notes
		min	typical	max		
Input Operating Wavelength	λ	1530		1565	nm	
Receiver Sensitivity	P_{IN-MIN}			-15.8	dBm	Ave. power at ER=8.2dB
Maximum Input Power	P_{IN-MAX}	-1			dBm	Ave. power
Reflectance				-27	dB	
Loss of Signal						
Loss of Signal Assert (Off to On)	P_A			-25	dBm	
Loss of Signal Deassert (On to Off)	P_D	-18			dBm	
Hysteresis	$P_A - P_D$	0.5		6	dB	

Electrical Pin Out: The electrical connection interface of the module and host board is shown below in Figure 1 and Figure 2, respectively.

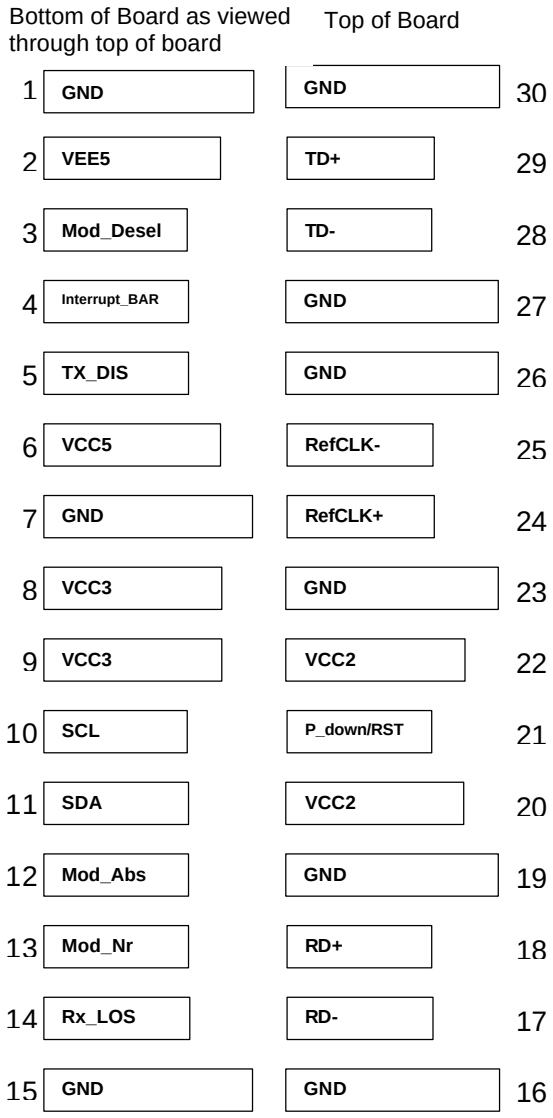


Figure 1. XFP Module Board Pinout & Names

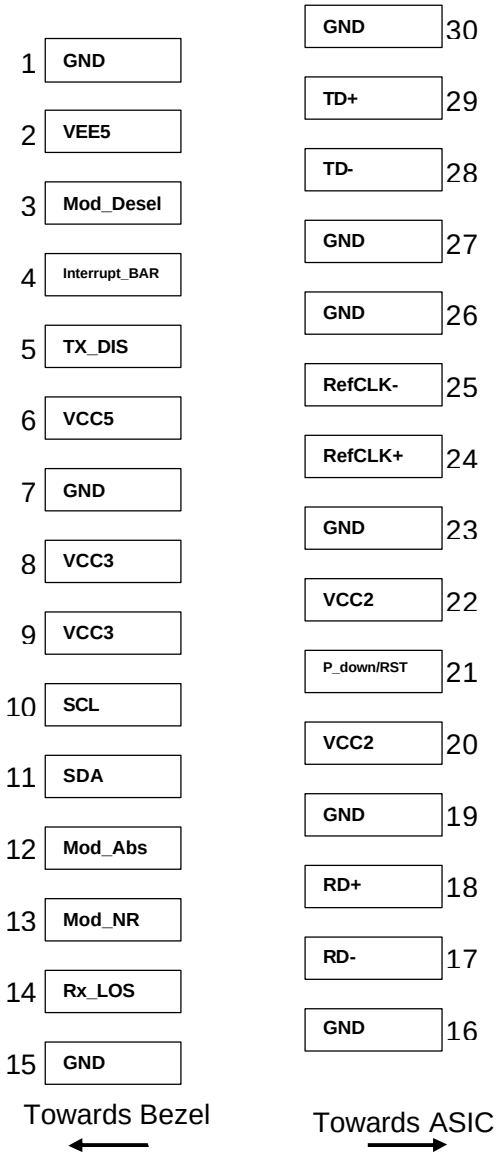


Figure 2. Host Board Connector Pinout & Names

Pin definitions

Pin Num.	Logic	Symbol	Function	Plug Seq.	Notes
1		GND	Module Ground; Signal Ground	1	1
2		VEE5	Optional -5.2V Power Supply	2	
3	LVTTL-O	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	Interrupt_BAR	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	+5V Power Supply	2	
7		GND	Module Ground; Signal Ground	1	1
8		VCC3	+3.3V Power Supply	2	
9 10	 LVTTL-I	VCC3 SCA	+3.3V Power Supply Two Wire Interface Clock	2 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	+1.8V 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 1.5W 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	+1.8V 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
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.					

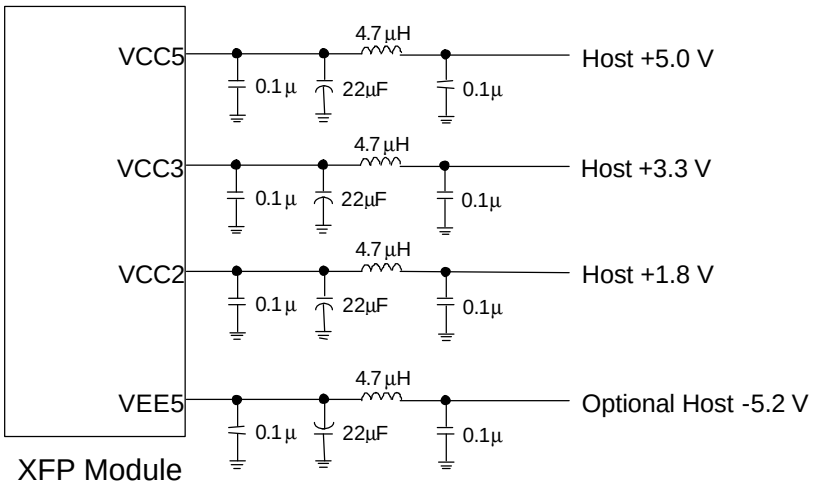


Figure 3. Host Board Supply Filtering

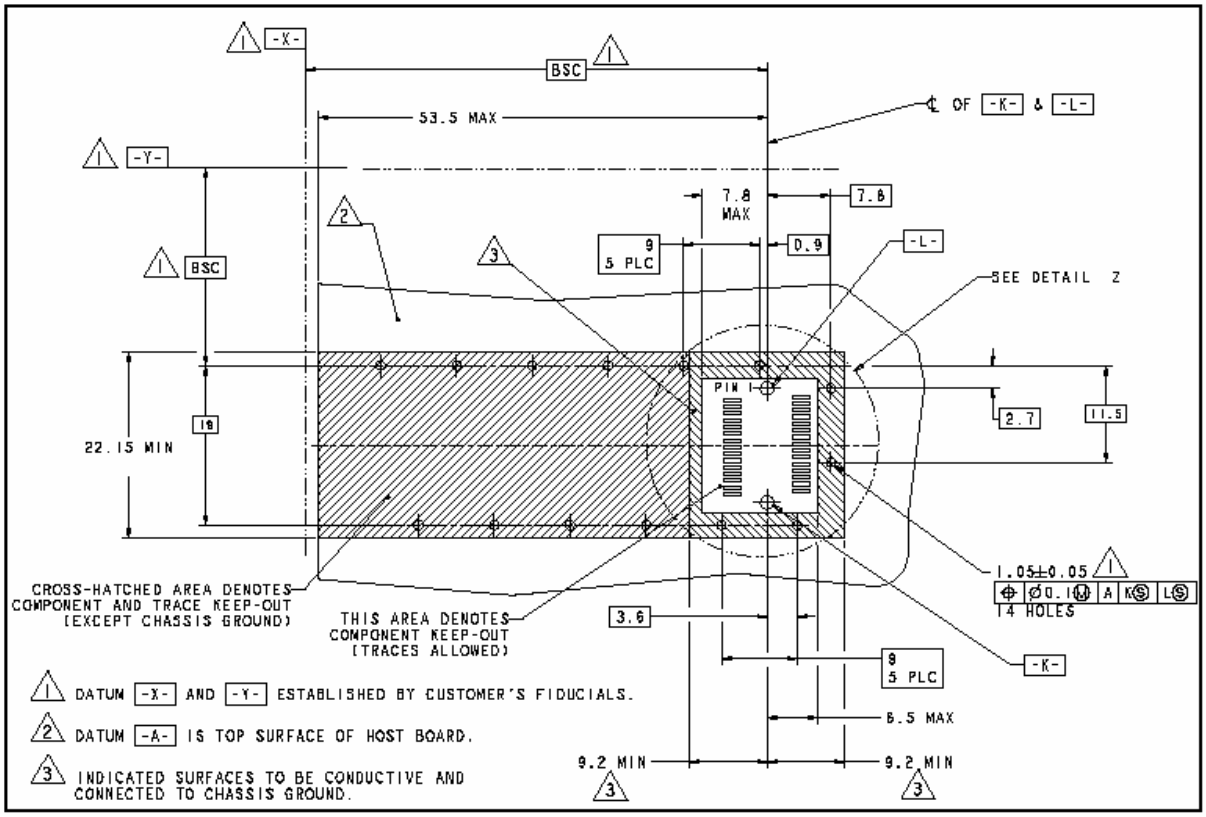


Figure 4. Host Board mechanical layout (mm)

Mechanical interface:

The XFP module is a pluggable module with its foundation 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.

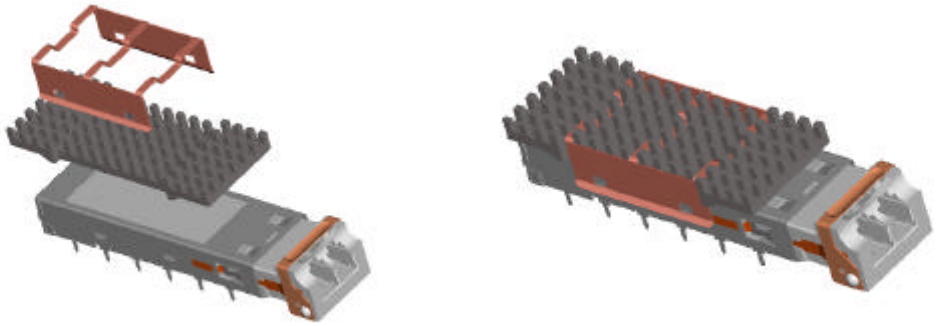


Figure 5. Example of clip-on heat sink

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.

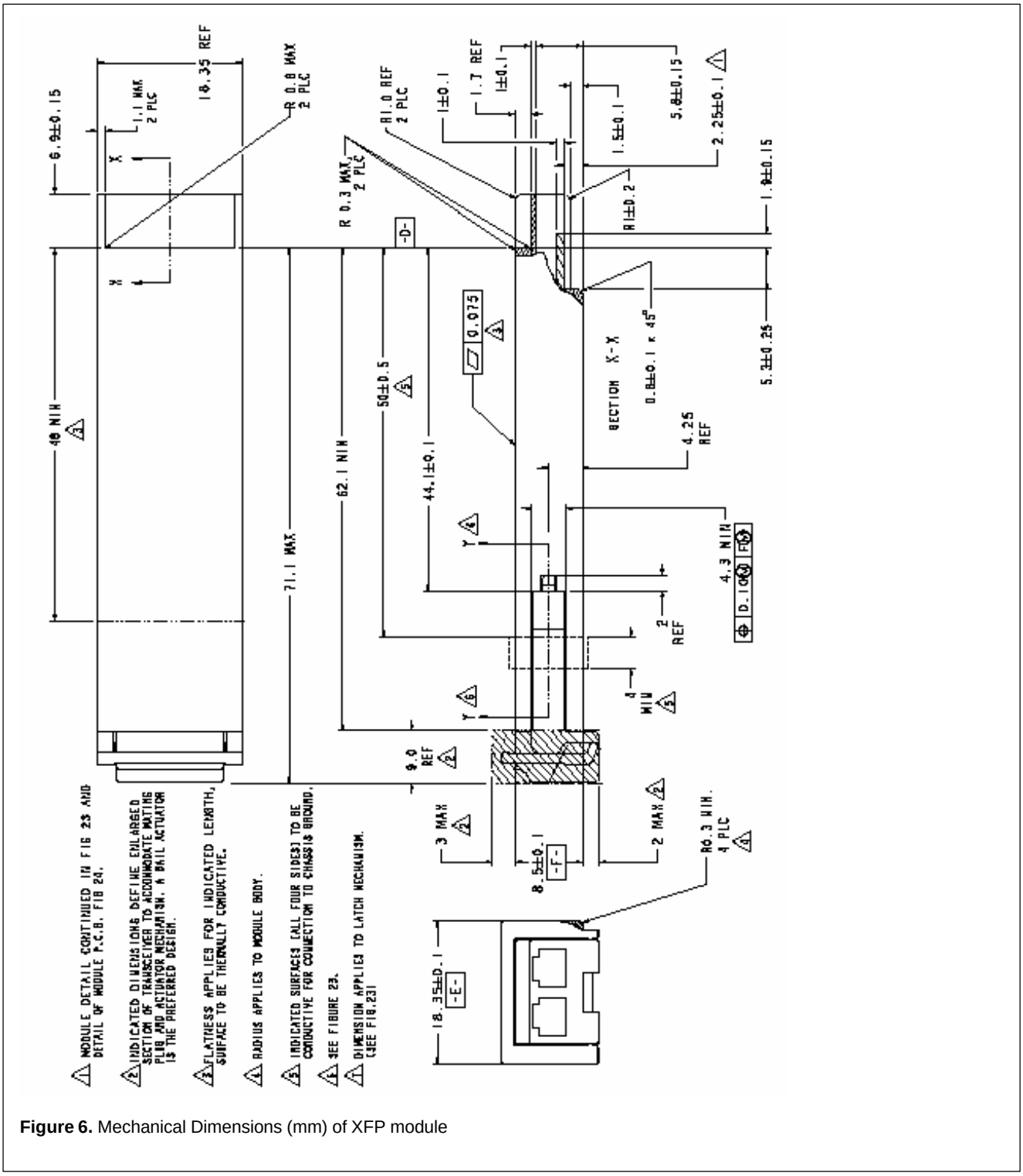


Figure 6. Mechanical Dimensions (mm) of XFP module

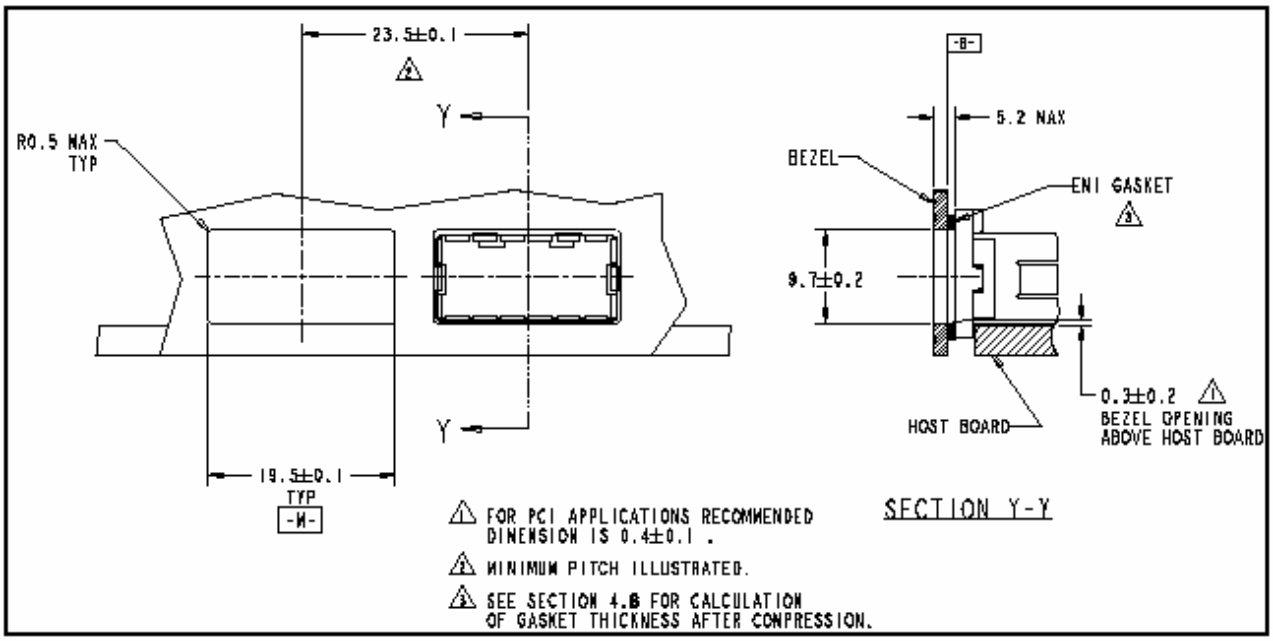


Figure 8. Interface Design with Bezel (mm)

Regulatory compliance

BookhamIGF-3000 Series 1550 nm XFP transceivers are designed to be Class 1 Laser compliant. They are certified per the following standards:

Feature	Agency	Standard	Certificate / Comments
Laser Safety	FDA/CDRH	CDRH 21(J) CFR 1040.10 Laser Safety Notice 50, July 2001	Pending
	TÜV	IEC/EN 60950 IEC/EN 60825-1	Pending
Component Safety	UL/CSA	UL 94 V-0 UL 1950 CLASS 3862	Pending
ESD	IEC	MIL-STD 883 IEC61000-4-2	Pending
EMI	FCC	Class B	Noise frequency range up to 13GHz. Greater than 9dB margin over tested range using PRBS pattern. Pending

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 = 32Kbytes 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 3.1 found at www.xfpmsa.org; April 2, 2003

Ordering information

Part Number	Description
IGF-32511	TRx 10G 40KM XFP LC STD TEMP

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