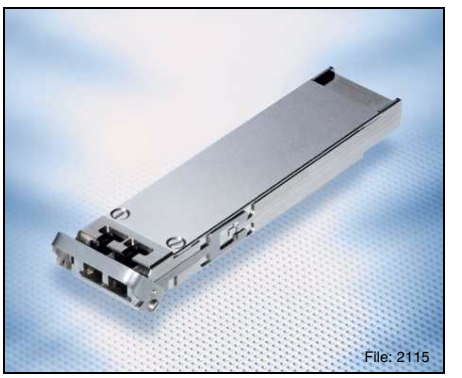
XFP
850 nm Small Form Factor Module
10 Gigabit Pluggable Transceiver
Compatible with XFP MSA Rev. 3.1

V23833-F0005-B101
V23833-F0005-B102

Preliminary Data Sheet

Features



Standards

- Compatible with IEEE 802.3ae™-2002
- Compatible with Fibre Channel 10GFC Draft 3.5
- Compatible with XFP MSA Rev. 3.1

Optical

- IEEE Ethernet: Serial 850 nm 10GBASE-SR
- T11 Fibre Channel: Serial 850 nm
  1200-M5-SN-I; 1200-M5E-SN-I; 1200-M6-SN-I
- Transmission distance
  - up to 82 m[1)] (50 µm MMF)
  - up to 300 m[1)] (on special MMF)
- Vertical Cavity Surface Emitting Laser at 850 nm (VCSEL)
- LC connector, multimode fiber
- Full duplex transmission mode

[1)] Maximum reach as defined by IEEE. Longer reach possible depending upon link implementation.

Ordering Information

Part Number	Chassis/Signal Grounding Concept	Standard
V23833-F0005-B101	Separated	Multi-Protocol
V23833-F0005-B102	Common	Multi-Protocol

Monitoring and Control

- Laser safety shut off
- Supply voltage 5 V / 3.3 V
- Transmit power
- Received power RSSI
- Laser bias current
- Tx_DIS
- Mod_NR
- Mod_DeSel
- Interrupt
- Mod_ABS
- P_Down/RST
- Rx_Los

Mechanical

- Color coded beige for 850 nm
- Belly-to-belly applications
- Latching mechanism with low insertion force

Electrical

- Hot pluggable
- Power supply 5 V / 3.3 V only
- Total power consumption < 1.5 W max.
- XFI electrical interface
- Reference clock not required
- Management and control via 2-wire interface
- 30 pin connector, 0.8 mm pitch

Applications

- 10GBE, 10GFC and G.709 transmission systems for short range
- Integration on PCI card, with eventually mid-board mounting
- Belly-to-belly for high density applications
- Enterprise and campus network applications
- Storage applications
- Backplane and switch applications
- Aggregation point for lower date rate
- XFP evaluation kit V23833-F9909-Z001 available upon request

Pin Configuration

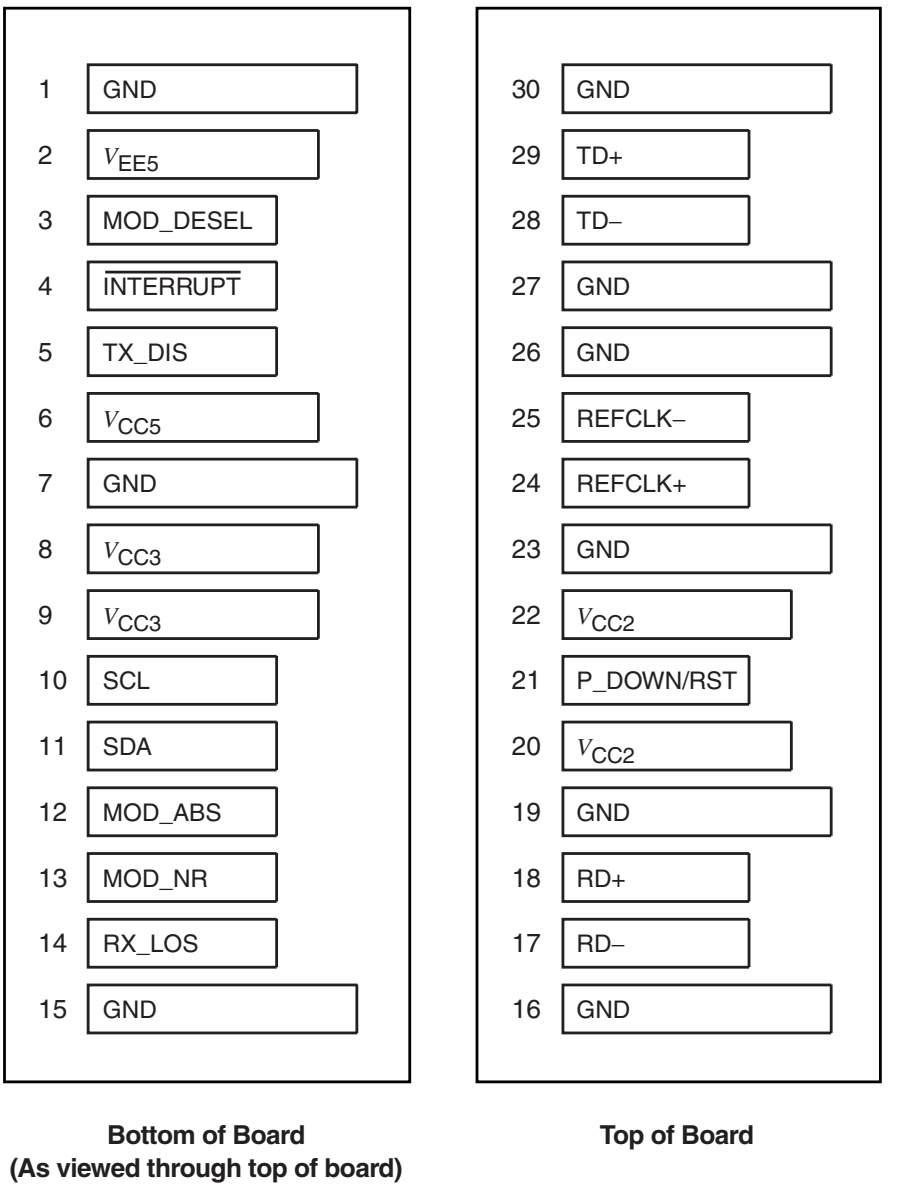


Figure 1 XFP Transceiver Electrical Pad Layout

Connector Pin Assignments

Pin No.	Signal Name
1	GND
2	V_{EE5}
3	MOD_DESEL
4	$\overline{\text{INTERRUPT}}$
5	TX_DIS
6	V_{CC5}
7	GND
8	V_{CC3}
9	V_{CC3}
10	SCL
11	SDA
12	MOD_ABS
13	MOD_NR
14	RX_LOS
15	GND

Pin No.	Signal Name
30	GND
29	TD+
28	TD–
27	GND
26	GND
25	REFCLK–
24	REFCLK+
23	GND
22	V_{CC2}
21	P_DOWN
20	V_{CC2}
19	GND
18	RD+
17	RD–
16	GND

Pin Description

Signal Name	Level	I/O	Pin No.	Description
Management and Monitoring Ports				
MOD_DESEL	LVTTL	I	3	Module De-select: when “L” allows the module to respond to 2-wire serial interface command. “H” active
$\overline{\text{INTERRUPT}}$	LVTTL	O	4	Interrupt: indicates presence of an important condition which can be read on the 2-wire serial interface. “H” active
TX_DIS	LVTTL	I	5	Transmitter Disable: transmitter laser source is turned off. “H” active
SCL	LVTTL	I	10	2-wire Interface Clock
SDA	LVTTL	I	11	2-wire Interface Data
MOD_ABS	LVTTL	O	12	Module Absent: indicating the modules not present. “H” active
MOD_NR	LVTTL	O	13	Module not ready: module operational fault
RX_LOS	LVTTL	O	14	Receiver Loss Of Signal Indicator
P_DOWN	LVTTL	I	21	Power Saving Mode: places the module in the stand-by condition. Active “H”. During the falling edge set the module reset
Transmit Functions				
TD–	CML	I	28	Transmitter Inverted Data Input
TD+	CML	I	29	Transmitter Not-inverted Data Input
Receive Functions				
RD–	CML	O	17	Receiver Data Output Inverted
RD+	CML	O	18	Receiver Data Output Not-inverted
REFCLK+	PECL	I	24	Reference Clock Not-inverted Input[1)]
REFCLK–	PECL	I	25	Reference Clock Inverted Input[1)]

Pin Description (cont'd)

Signal Name	Level	I/O	Pin No.	Description
DC Power				
GND	0 V	–	1,7,15,16,19, 23,26,27,30	Ground connection for both signal and chassis on the module
V_{CC5}	+5 V	I	6	Positive power supply, nominal
V_{CC3}	+3.3 V	I	8,9	Positive power supply, nominal
V_{CC2}	+1.8 V	I	20,22	Positive power supply, nominal

[1] Reference clock not required. Input internally terminated 50 Ω to ground.

Description

System Block Diagram

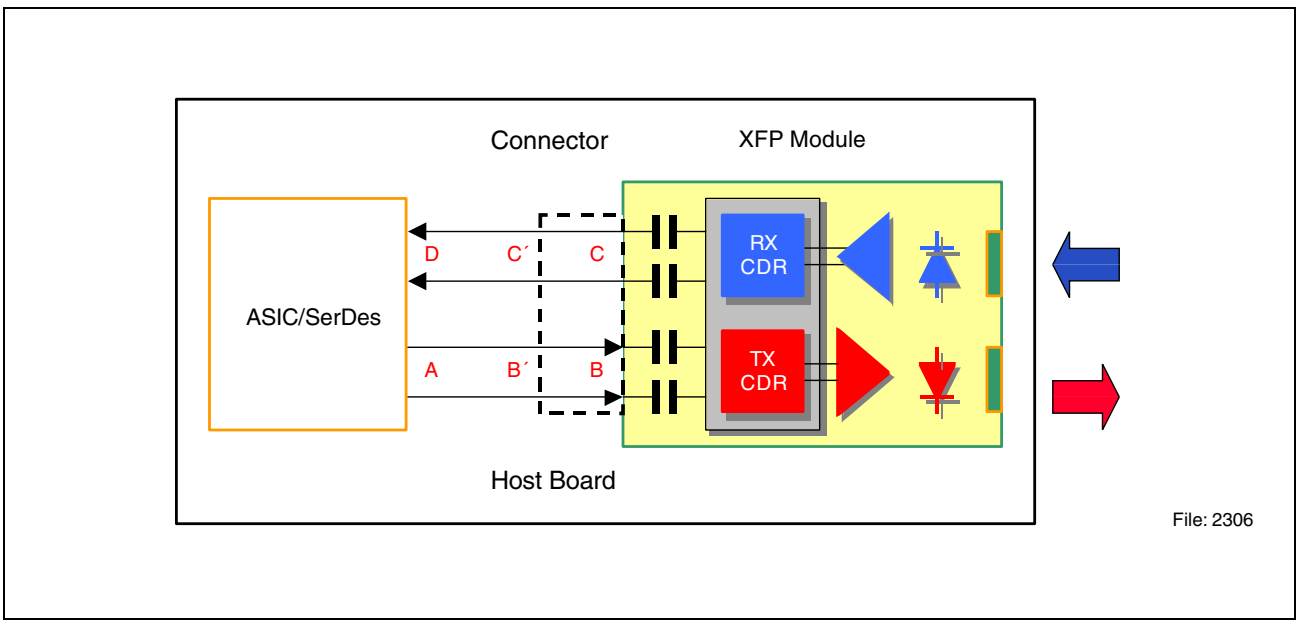


Figure 2

Optical Interface Standard Specifications

- IEEE 802.3ae™-2002 clause 52, 10GBASE-SR
- Fibre Channel 10GFC Draft 3.5, 1200-M5-SN-I
- Fibre Channel 10GFC Draft 3.5, 1200-M5E-SN-I
- Fibre Channel 10GFC Draft 3.5, 1200-M6-SN-I
- XFP MSA Rev. 3.1

Standard	Fiber Type	Minimum Modal Bandwidth at 850 nm (MHz*km)	Operating Range[1)] (meters)
IEEE	62.5 µm MMF	160	2 to 26
	50 µm MMF	400	2 to 66
Fibre Channel	62.5 µm MMF	200	0.5 to 33
	50 µm MMF	500	0.5 to 82
	50 µm MMF	2000	0.5 to 300

[1)] Longer reaches possible depending upon link implementation.

Electrical Interface Standard Specifications

- IEEE 802.3ae™-2002 clause 45 & 47
- XFP MSA Rev. 3.1

Environment: Thermal Management Recommendations

Operating air inlet temperature:	0°C - 50°C
Operating Airflow:	200 LFM (1.5 m/s)
Operating Humidity:	80% RH non-condensing

Maximum operating case temperature is 70°C as defined by UL 1950.

Module can withstand and operate within specification with case temperature of 75°C for up to 96 hrs/yr. Transceiver requires airflow parallel to cooling fins. Maximum airflow required per XFP MSA is 3 m/s.

Fibers and Connectors

The transceiver LC features a duplex receptacle and is designed for multimode LC cables, 0° polished end face (PC).

30-pin Connector

The module interface connector is a 30-pin, printed circuit board edge connection with a 0.8 mm pitch. The appropriate mating connector for the customer PCB is a 30-pin SMT, dual row, right angled, edge connector, 0.8 mm pitch (TycoAmp part number 788862C or equivalent).

Cage/Heatsink Requirement

The cage/heatsink assembly required to mount the XFP module is defined by the MSA.

Regulatory Compliance

Feature	Standard	Comments
ESD: Electrostatic Discharge to the Electrical Pins (HBM)	EIA/JESD22-A114-B (MIL-STD 883D Method 3015.7)	Class 1a (> 500 V)
Immunity: Against Electrostatic Discharge (ESD) to the Module Receptacle	EN 61000-4-2 IEC 61000-4-2	Discharges ranging from ±2 kV to ±25 kV to the front end / faceplate / receptacle cause no damage to module (under recommended conditions).
Immunity: Against Radio Frequency Electromagnetic Field	EN 61000-4-3 IEC 61000-4-3	With a field strength of 30 V/m, noise frequency ranges from 10 MHz to 2 GHz. No effect on module performance between the specification limits.
Emission: Electromagnetic Interference (EMI)	FCC 47 CFR Part 15, Class B EN 55022 Class B CISPR 22	Noise frequency range: 30 MHz to 40 GHz Radiated emission does not exceed specified limits.

Technical Data

Absolute Maximum Ratings

Parameter	Symbol	Limit Values		Unit
		min.	max.	
Storage Ambient Temperature[1]	T_S	–20	85	°C
Operating Ambient Temperature[1] [2]	T_A	0	50	°C
Operating Case Temperature[1]	T_C	0	80	°C
Supply Voltage +5.0 V	V_5	0	6	V
Supply Voltage +3.3 V	V_3	0	4	V
Static Discharge Voltage, All Pins	ST_d	–500	500	V
Average Receive Optical Power	$Rx_{P\ max}$		1.5	dBm

[1] Non condensing.
[2] With specified airflow (see “**Environment: Thermal Management Recommendations**”).

Exceeding any one of these values may permanently destroy the device.

Recommended Operating Conditions

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Operating Case Temperature[1]	T_C	0		70	°C
Transceiver Total Power Consumption	P		1.25		W
Supply Voltage +5.0 V	V_{CC5}	4.75	5.0	5.25	V
Supply Current +5.0 V	I_{CC5}		50		mA
Supply Voltage +3.3 V	V_{CC3}	3.14	3.3	3.47	V
Supply Current +3.3 V	I_{CC3}		300		mA

[1] Worst case thermal location (see **Figure 15**).

Optical Characteristics

(V_{CC5} = 4.75 V to 5.25 V, V_{CC3} = 3.14 V to 3.47 V, T_C = 0°C to 70°C)

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Transmitter					
Launch Power in OMA[1]	$P_{O\text{-}OMA}$	–2.8			dBm
Average Launch Power	$P_{O\text{-}Avg}$	–3	–2	–1	dBm
Center Wavelength Range[1]	$\lambda_{C\text{-}Tx}$	840	850	860	nm
RMS Spectral Width[1]	σ_I		0.4	0.45	nm
Extinction Ratio	ER	3	5.5		dB
Relative Intensity Noise$_{12}$OMA	RIN			–128	dB/Hz
Eye Mask Definition	According to IEEE and Fibre Channel				
Transmitter and Dispersion Penalty	TDP			3.9	dB
Encircled Flux	EF	at 19 µm ≥ 86%, at 4.5 µm ≤ 30%			
Optical Return Loss Tolerance	ORL_T			12	dB
Average Launch Power of OFF Transmitter	$P_{O\text{-}OFF}$			–30	dBm
Receiver					
Stressed Receiver Sensitivity in OMA	$P_{IN\text{-}S}$			–7.5	dBm
Sensitivity in OMA[2]	P_{IN}			–11.1	dBm
Average Receive Power	$P_{IN\text{-}max}$			–1	dBm
Signal Detect Deassert Level	P_{SDL}	–30			dBm
Signal Detect Assert Level	P_{SD}		–20	–13	dBm
Signal Detect Hysteresis	P_{SD}	1	2	4	dB
Receiver Reflectance	REF_{Rx}			–12	dB
Center Wavelength Range	$\lambda_{C\text{-}Rx}$	840		860	nm

[1] Conforms to IEEE triple trade off between center wavelength, RMS spectral width and minimum OMA.

[2] Receiver sensitivity, which is defined for an ideal input signal is informative only.

Electrical DC Characteristics

(V_{CC5} = 4.75 V to 5.25 V, V_{CC3} = 3.14 V to 3.47 V, T_C = 0°C to 70°C)

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
3.3 V CMOS I/O DC Characteristics (Management, Logic and Monitoring Ports)					
External Pull-up Resistor for Open Drain	R_{pullup}	10		22	kΩ
Output High Voltage[1)]	V_{oh}	2.4		3.5	V
Output Low Voltage[1)]	V_{ol}			0.4	V
Input High Voltage	V_{ih}			2	V
Input Low Voltage	V_{il}	0		0.8	V
Input Pull-up Current[2)]	I_{pd}	–10	0	10	µA
LVPECL I/O Characteristics (REFCLK+/–)					
Differential Input Voltage (pk-pk)[3)]	V_{in_diff}	400		2000	mV p-p
XFI I/O DC Characteristics (TD+/–; RD+/–)					
Differential Input Amplitude (pk-pk)[4)]	TD+/–	240		1640	mV p-p diff
Differential Output Amplitude (pk-pk)[5)]	RD+/–	680		1700	mV p-p diff

1) $R_{pull\text{-}up}$ = 10 kΩ to 3.3 V.
2) V_{in} = 3.3 V.
3) AC coupled in transceiver.
4) AC coupled input at host board.
5) AC coupled output at host board.

Electrical AC Characteristics

(V_{CC5} = 4.75 V to 5.25 V, V_{CC3} = 3.14 V to 3.47 V, T_C = 0°C to 70°C)

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
XFI Input AC Characteristics (TD+/–)					
Baud Rate	TD+/–	9.95	10.3125	10.75	Gbit/s
Baud Rate Tolerance	TD_{tol}	–500		500	ppm
Differential Input Impedance	Z_{IN}	80	100	120	Ω
Differential Return Loss[1]	$\|S_{11}\|$	8			dB
Input Differential Skew[2]	T_{SKEWIN}		t.b.d.		ps
Total Jitter[3]	TJ_{TD}			0.61	UI pp
Deterministic Jitter[3]	TJ_{TD}			0.2	UI pp
XFI Output AC Characteristics (RD+/–)					
Baud Rate	RD+/–	9.95	10.3125	10.75	Gbit/s
Baud Rate Tolerance	RD_{tol}	–100		100	ppm
Rise and Fall Times[4]	t_r, t_f	24			ps
Output Differential Skew	$T_{SKEWOUT}$		t.b.d.		ps
Output Differential Impedance	Z_{OUT}	80	100	120	Ω
Differential Output Return Loss[1]	$\|S_{22}\|$	8			dB
Total Jitter[5]	TJ_{RD}			0.34	UI
Deterministic Jitter[5]	DJ_{RD}			0.18	UI

Electrical AC Characteristics (cont'd)

(V_{CC5} = 4.75 V to 5.25 V, V_{CC3} = 3.14 V to 3.47 V, T_C = 0°C to 70°C)

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
3.3 V CMOS I/O AC Characteristics for I²C Signals (SDA; SCL)					
SCL Clock Frequency	f_{SCL}	0		400	kHz
SCL Period Low	t_{LOW}	1.3			µs
SCL Period High	t_{HIGH}	0.6			µs
Bus Free Time[6)]	t_{BUF}	1.3			µs
Start Condition Setup Time	t_{SU_START}	0.6			µs
Stop Condition Setup Time	t_{SU_STOP}	0.6			µs
Start Condition Hold Time	t_{H_START}	0.6			µs
Data Hold Time	t_{H_DATA}	0			µs
Data Setup Time	t_{SU_DATA}	100			ns
SDA and SCL Rise and Fall Time	t_r, t_f			300	ns

1) 100 MHz - 5.5 GHz above 5.5 GHz see XFP MSA 3.1.
2) Not defined at crossing point.
3) Per XFP MSA 3.1 table 17, 1 UI = 96.97 ps.
4) 20%, 80%.
5) Per XFP MSA 3.1 table 19, 1 UI = 96.97 ps.
6) Between stop and start condition.

Timing Parameters for XFP Management

Parameter	Symbol	Values		Unit
		min.	max.	
TX_DIS Assert Time[1)]	t_off		10	µs
TX_DIS Negate Time[2)]	t_on		2	ms
Time to Initialize[3)]	t_init		300	ms
$\overline{\text{INTERRUPT}}$ Assert Delay[4)]	$\overline{\text{Interrupt}}$_on		200	ms
$\overline{\text{INTERRUPT}}$ Negate Delay[5)]	$\overline{\text{Interrupt}}$_off		500	µs
P_DOWN/RST Assert Delay[6)]	P_Down/RST_on		100	µs
MOD_NR Assert Delay[7)]	Mod_nr_on		1	ms
MOD_NR Negate Delay[8)]	Mod_nr_off		1	ms
P_DOWN Reset Time[9)]		10		µs
RX_LOS Assert Delay[10)]	t_loss_on		100	µs
RX_LOS Negate Delay[11)]	t_loss_off		100	µs

1) Rising edge of TX_DIS to fall of output signal below 10% of nominal.
2) Falling edge of TX_DIS to rise of output signal above 90% of nominal.
3) From power on or hot plug after supply or from falling edge of P_DOWN/RST.
4) From occurrence of the condition triggering $\overline{\text{INTERRUPT}}$.
5) From clear on read $\overline{\text{INTERRUPT}}$ flags.
6) From power down initiation.
7) From occurrence of fault to assertion of MOD_NR.
8) From clearance of signal to negation of MOD_NR.
9) Min. length of P_DOWN assert to initiate reset.
10) From occurrence of loss of signal to assertion of RX_LOS.
11) From occurrence of presence of signal to negation of RX_LOS.

Eye Safety

This laser based multimode transceiver is a Class 1M product. It complies with IEC 60825-1/A2: 2001 and FDA performance standards for laser products (21 CFR 1040.10 and 1040.11) except for deviations pursuant to Laser Notice 50, dated July 26, 2001.

INVISIBLE LASER RADIATION
CLASS 1M LASER PRODUCT
DO NOT VIEW DIRECTLY WITH OPTICAL INSTRUMENTS

To meet laser safety requirements the transceiver shall be operated within the Absolute Maximum Ratings.

Note: All adjustments have been made at the factory prior to shipment of the devices. No maintenance or alteration to the device is required.
Tampering with or modifying the performance of the device will result in voided product warranty.
Failure to adhere to the above restrictions could result in a modification that is considered an act of "manufacturing", and will require, under law, recertification of the modified product with the U.S. Food and Drug Administration (ref. 21 CFR 1040.10 (i)).

Laser Emission Data

Wavelength	850 nm
Maximum total output power (as defined by IEC: 7 mm aperture at 100 mm distance)	743 µW / –1.3 dBm
Beam divergence (full angle) / NA (half angle)	20° / 0.18 rad

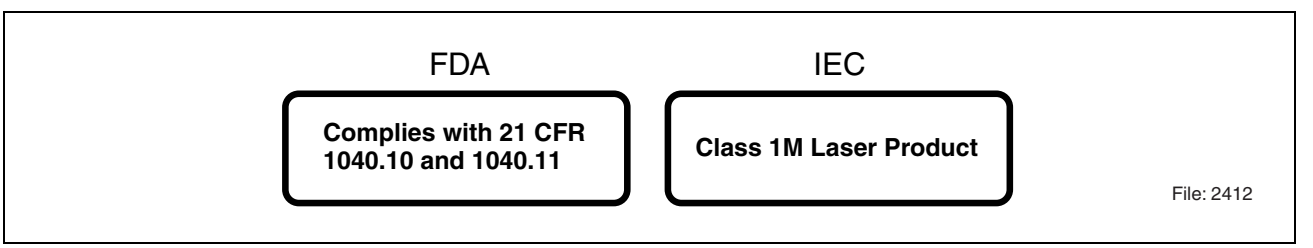


Figure 3 Required Labels

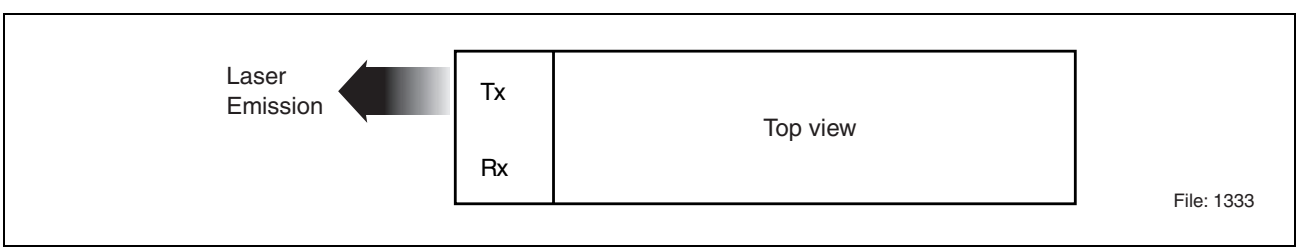


Figure 4 Laser Emission

Application Notes

Host Board Layouts

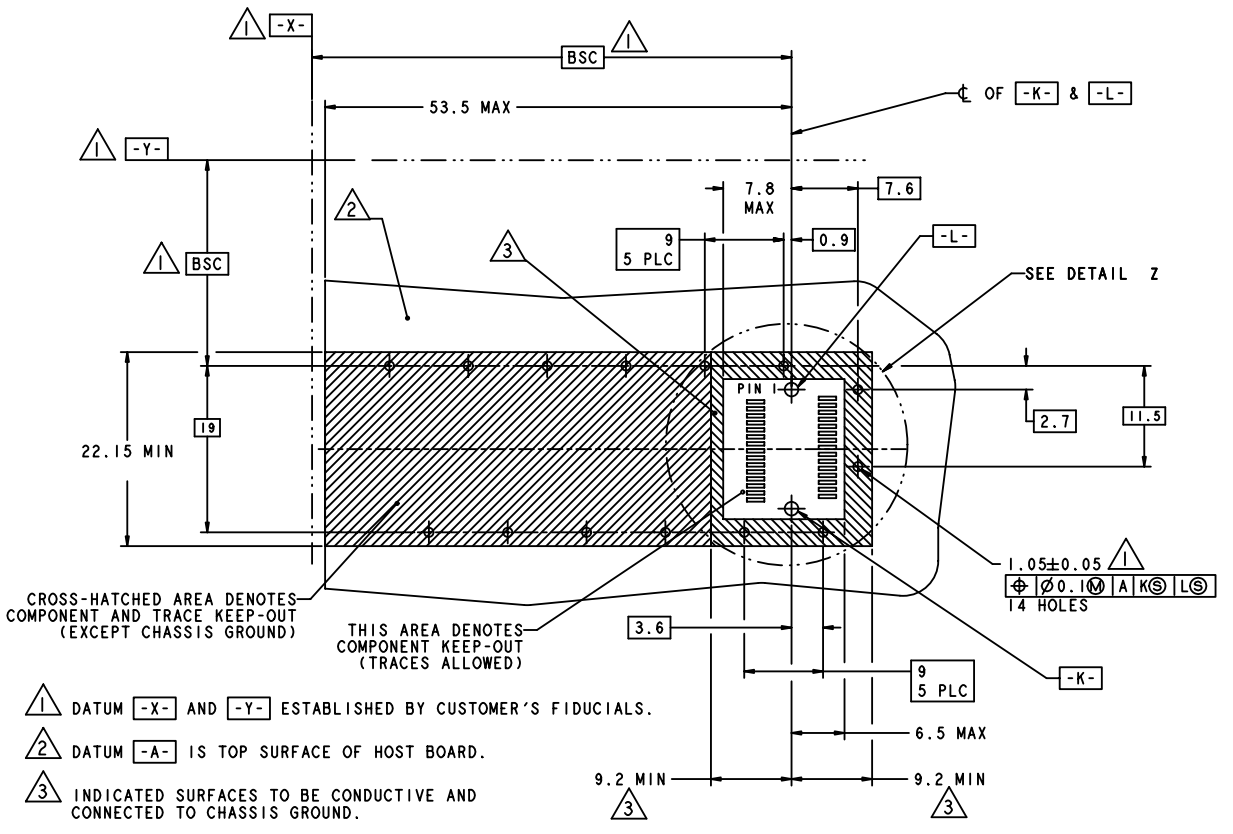


Figure 5 XFP Host Board Mechanical Layout

Detail Z see **Figure 6**.

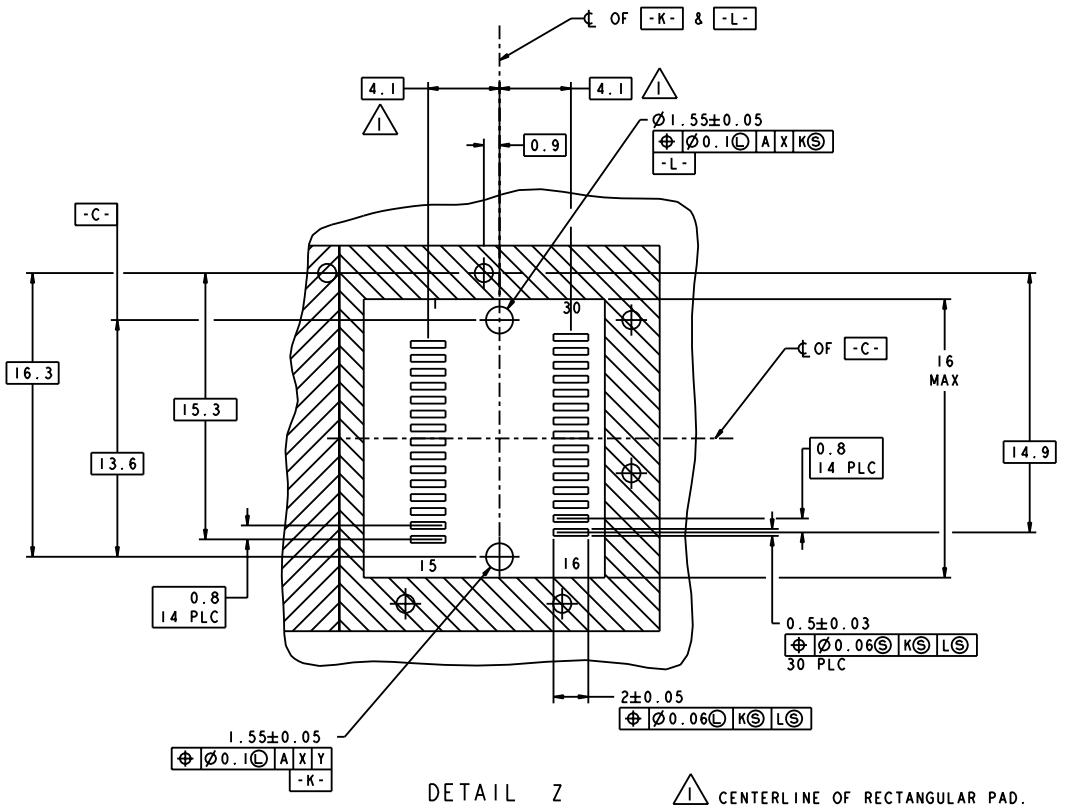
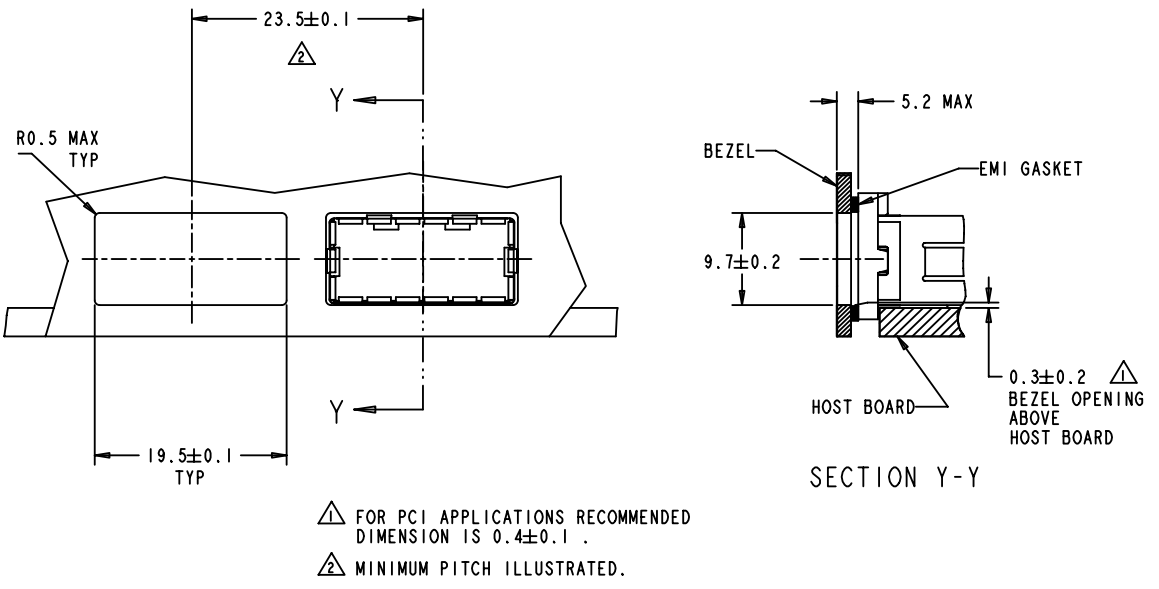


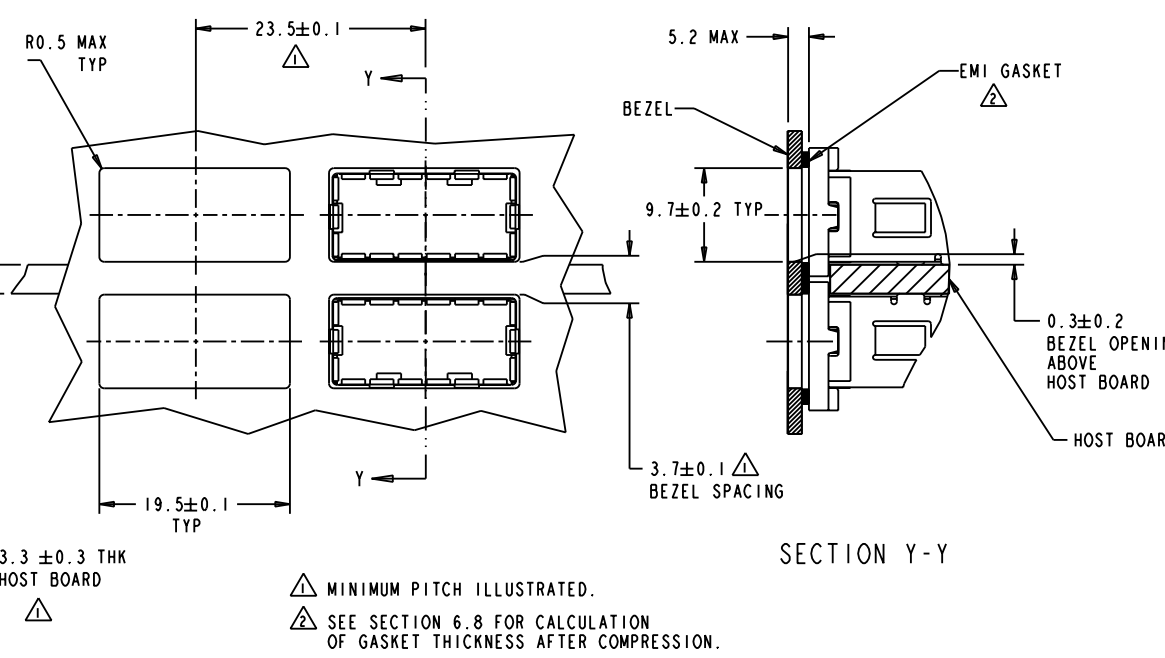
Figure 6 XFP Host Board Mechanical Layout, Detail Z



Dimensions in mm

File: 2510

Figure 7 Recommended Single Sided Bezel Design



Dimensions in mm

File: 2511

Figure 8 Recommended Double Sided Mounting Bezel Design

Mechanical

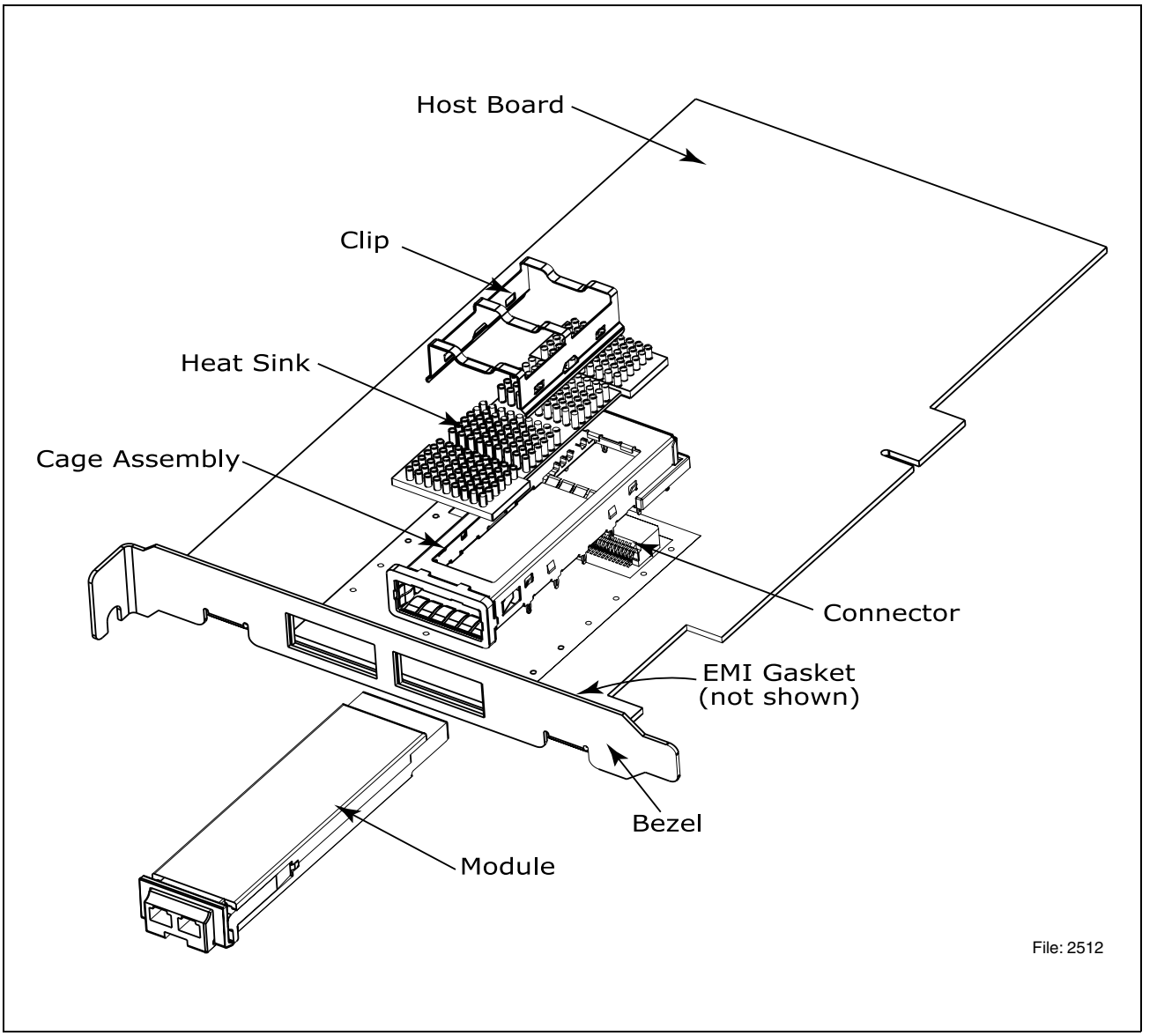


Figure 9 PCI Card Application

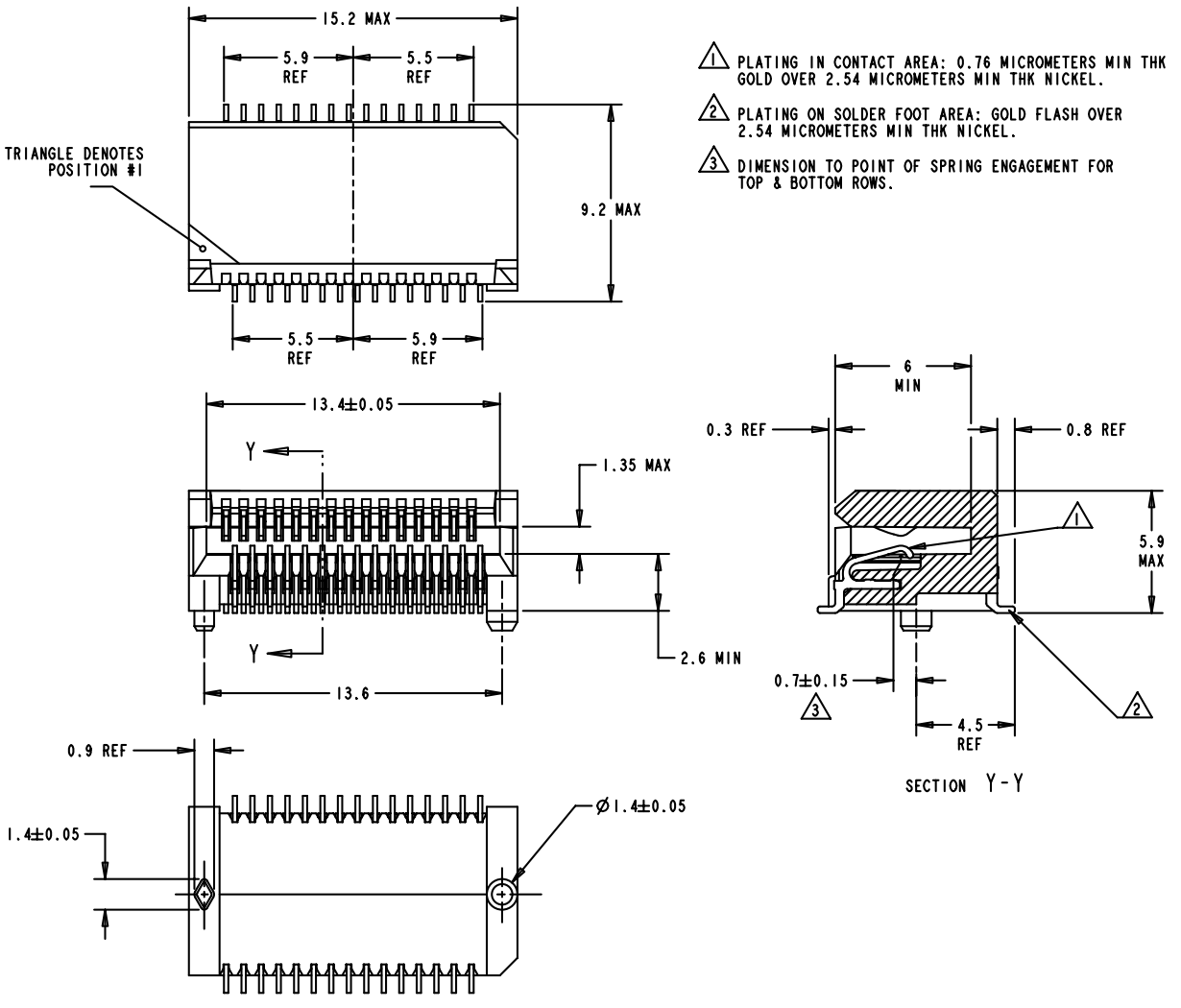


Figure 10 XFP Transceiver Connector Illustration

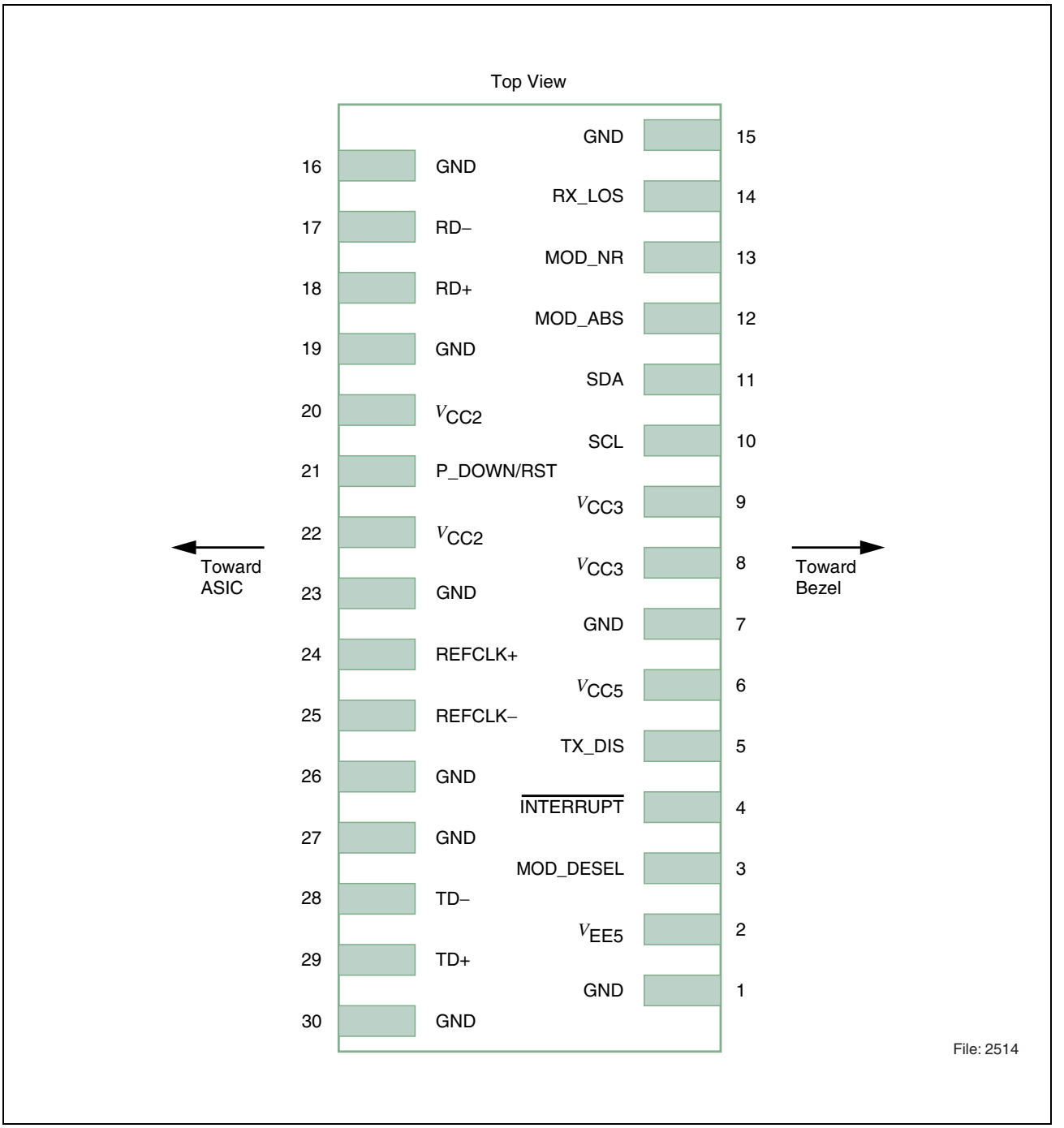
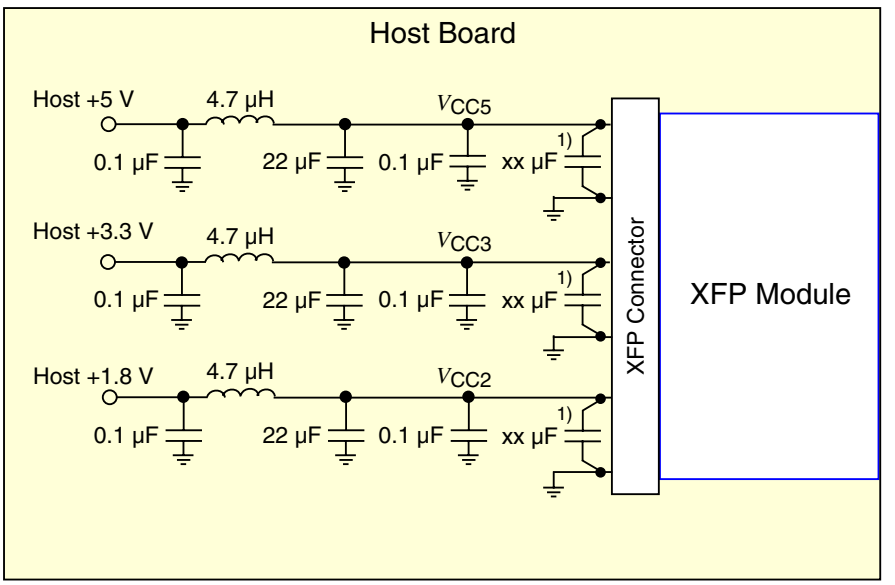


Figure 11 Host PCB XFP Pinout



1) Design criterion of the capacitor used is the resonant frequency and its value must be in the order of the nominal data rate. Use of single layer capacitors recommended. Short trace lengths are mandatory.

File: 2305

Figure 12 Recommended Host Board Supply Filtering Network

Package Outlines

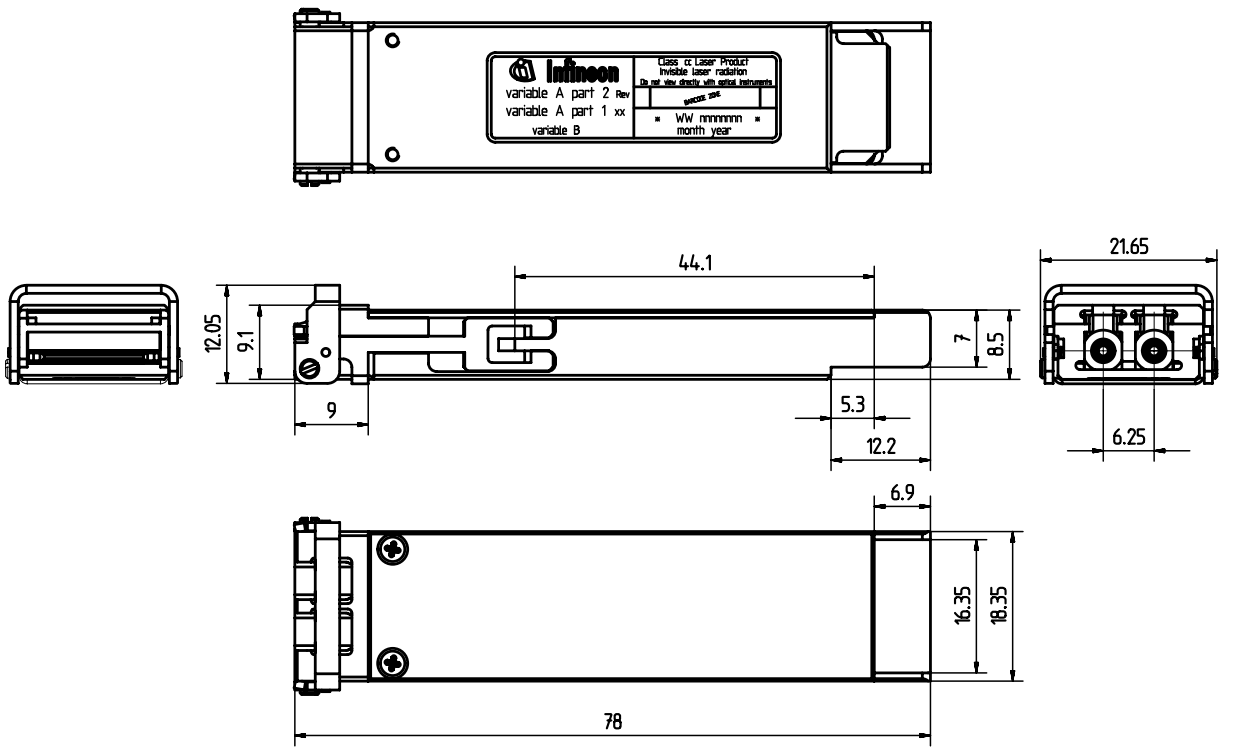


Figure 13 Mechanical Dimensions

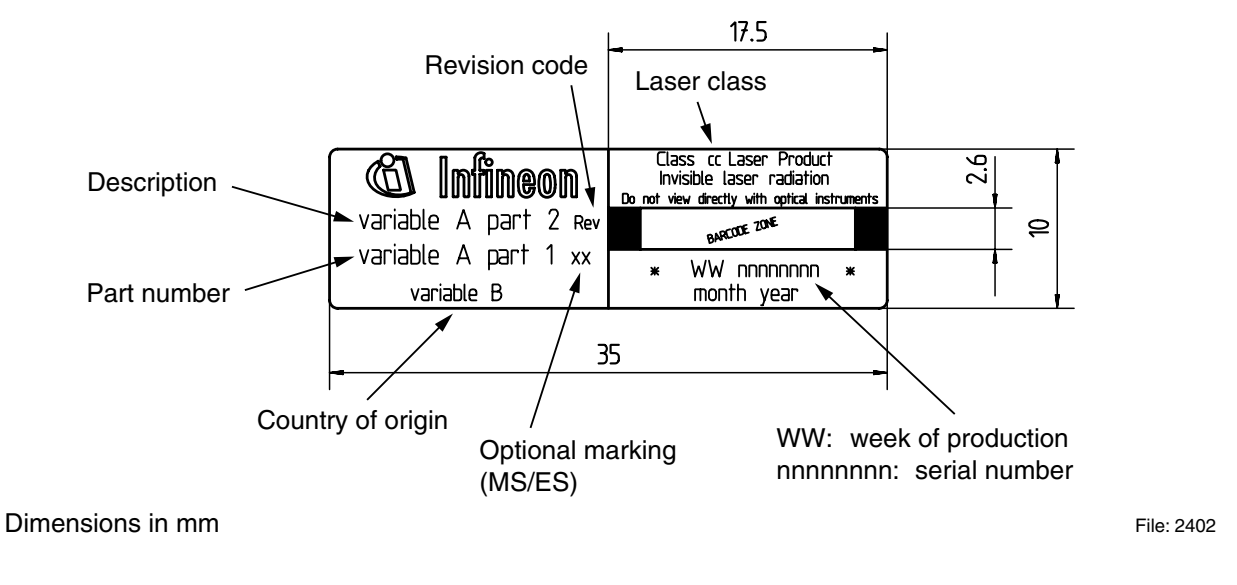
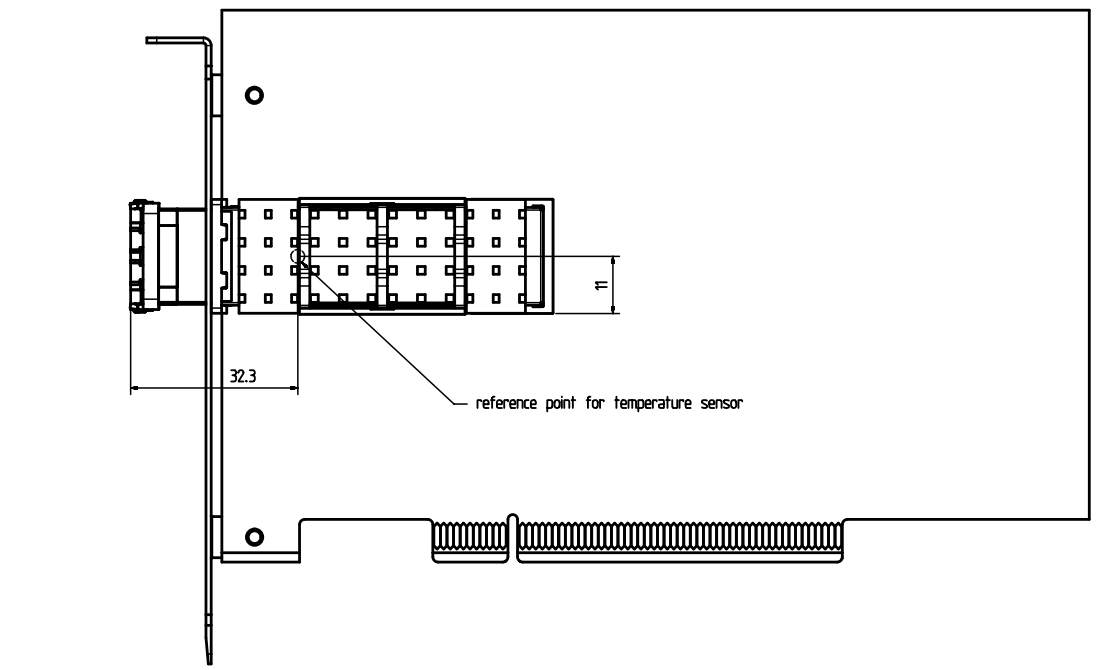


Figure 14 Label Description



Dimensions in mm

File: 2207

Figure 15 XFP Temperature Reference Point

V23833-F0005-B101
V23833-F0005-B102

Revision History:	**2004-06-16**	DS0
Previous Version:	none	

Page	**Subjects (major changes since last revision)**

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