Product Specification

10Gb/s DWDM 40km Multi-Rate Gen2 Tunable SFP+ Finisar Transceiver

FTLX6682MxC

(x = C for C-temp, N for E-temp, T for I-temp)

PRODUCT FEATURES

- Hot-pluggable SFP+ footprint
- Supports 10GE-LAN 10.3125 Gb/s
- Up to 40km link length
- 50GHz ITU-based channel spacing (C-Band) with wavelength locker
- Versions for: C, E and I-temp ranges
- Single 3.3V power supply
- Monolithic MZM Tunable TOSA
- Limiting electrical interface PIN receiver
- Duplex LC connector
- Built-in digital diagnostic functions
- RoHS compliant
- Internal CDRs for improved link performance

APPLICATIONS

- DWDM 40km point to point links:
  - Remote PHY (R-PHY)
  - Wireless Backhaul
  - 10Gb/s SONET/SDH
  - 10G Ethernet
  - 8G/10G Fibre Channel
- ITU-T G.698.1
- ITU-T G.709

Finisar® FTLX6682MxC transceivers are Enhanced Small Form Factor Pluggable Tunable SFP+ transceivers designed for use in 10-Gigabit multi-rate links up to 40km of G.652 single mode fiber. They are compliant with SFF-8418[1], SFF-8419[2] (with Power Class 4 >2W), SFF-8432[3] and SFF-8690[9], and support G.698.1, SONET OC-192, SDH STM-64, 10G Ethernet ZR and 10G Fibre Channel over 40km fiber. Digital diagnostics functions are available via a 2-wire serial interface, as specified in SFF-8472[4]. The optical transceiver is RoHS compliant as described in Application Note AN-2038[5,6].

PRODUCT SELECTION

Product Part Number	Case Temperature Range
FTLX6682MCC	-5 to +70C
FTLX6682MNC	-5 to +85C
FTLX6682MTC	-40C to +85C

I. Pin Descriptions

Pin	Symbol	Name/Description	Ref.
1	V_{EET}	Transmitter Ground	1
2	T_{FAULT}	Transmitter Fault	2
3	T_{DIS}	Transmitter Disable. Laser output disabled on high or open.	3
4	SDA	2-wire Serial Interface Data Line	2
5	SCL	2-wire Serial Interface Clock Line	2
6	MOD_ABS	Module Absent. Grounded within the module	2
7	NA	Not Used	
8	RX_LOS	Loss of Signal indication. Logic 0 indicates normal operation.	4
9	NA	No Used	
10	V_{EER}	Receiver Ground	1
11	V_{EER}	Receiver Ground	1
12	RD-	Receiver Inverted DATA out. AC Coupled.	
13	RD+	Receiver Non-inverted DATA out. AC Coupled.	
14	V_{EER}	Receiver Ground	1
15	V_{CCR}	Receiver Power Supply	5
16	V_{CCT}	Transmitter Power Supply	5
17	V_{EET}	Transmitter Ground	1
18	TD+	Transmitter Non-Inverted DATA in. AC Coupled.	
19	TD-	Transmitter Inverted DATA in. AC Coupled.	
20	V_{EET}	Transmitter Ground	1

Notes
1. Circuit ground is internally isolated from chassis ground.
2. T_{FAULT} is an open collector/drain output, which should be pulled up with a 4.7k – 10k Ohms resistor on the host board if intended for use. Pull up voltage should be between 2.0V to Vcc + 0.3V. A high output indicates a transmitter fault caused by either the TX bias current or the TX output power exceeding the preset alarm thresholds. A low output indicates normal operation. In the low state, the output is pulled to <0.8V.
3. Laser output disabled on T_{DIS} >2.0V or open, enabled on T_{DIS} <0.8V.
4. LOS is open collector output. Should be pulled up with 4.7k – 10kΩ on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.
5. Internally connected

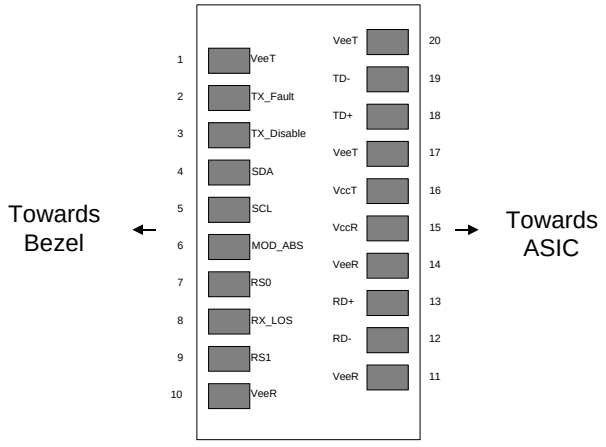


Figure 1. Diagram of Host Board Connector Block Pin Numbers and Names.

II. Absolute Maximum Ratings

Exceeding the limits below may damage the transceiver module permanently.

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Maximum Supply Voltage	Vcc	-0.5		4.0	V	
Storage Temperature	T_S	-40		85	°C	
Relative Humidity	RH	0		85	%	1
Receiver Optical Damage Threshold	RX_{Damage}	5			dBm	

Notes:

1. Non-condensing

III. Electrical Characteristics (over full T_{OP})

Parameter	Symbol	Min	Typ.	Max	Unit	Ref.
Supply Voltage	V_{cc}	3.14		3.46		
Supply Current						
FTLX6682MCC (C-temp)	Icc			670	mA	1
FTLX6682MNC (E-temp) and FTLX6682MTC (I-temp)	Icc			800	mA	1
Module total power dissipation						
FTLX6682MCC (C-temp)	P			1.8	W	2
FTLX6682MNC (E-temp) and FTLX6682MTC (I-temp)	P			2.5	W	2
Transmitter						
Input differential impedance	R_{in}	80	100	120	Ω	
Differential data input swing	Vin,pp	200		850	mV	3
Transmit Disable Voltage	V_D	V_{cc}-0.8		V_{cc}	V	
Transmit Enable Voltage	V_{EN}	V_{ee}		V_{ee}+ 0.8	V	
Receiver						
Output differential impedance	R_{out}	80	100	120	Ω	
Differential data output swing	$V_{out,pp}$	300		850	mV	4
Output rise time and fall time (per SFF-8418)	T_r, T_f	28			ps	5
LOS asserted	V_{LOS_A}	V_{cc}-0.8		V_{cc}	V	
LOS de-asserted	V_{LOS_D}	V_{ee}		V_{ee}+0.8	V	
Power Supply Noise Tolerance	V_{ccT}/V_{ccR}	Per SFF-8419			mV_{pp}	

Notes:

1. Compliant with the SFP+ Module Power Supply Requirements defined in [1], Tab. 8.
2. Maximum total power value is specified across the full temperature and voltage range. Power consumption during inrush current can go as high as 2.8W
3. Connected directly to TX data input pins.
4. Into 100Ω differential termination. If the RX side CDR is not turned on, the actual data output level will depend upon the optical input signal and may fall below the minimum value listed.
5. 20 – 80%. Measured with Module Compliance Test Board and the OMA test pattern (eight ones, eight zeros).

IV. Optical Characteristics (over full T_{OP}, V_{CC} = 3.14 to 3.46 Volts)

Parameter		Symbol	Min	Typ	Max	Unit	Ref.
Transmitter (Tx)							
Average Launch Power		P_{AVE}	-1		+3	dBm	
Optical Wavelength Range (89 total wavelengths)		λ_C	As per ITU-T 694.1, 50GHz spacing, 1528.77 to 1563.86			nm	
Side-Mode Suppression Ratio		SMSR	35			dB	
Optical Extinction Ratio		ER	8.2			dB	
Average Launch power when Tx is OFF		P_{OFF}			-30	dBm	
Tx Jitter 20kHz - 80MHz		Tx_{j1}			0.3	UI	
Tx Jitter 4MHz - 80MHz		Tx_{j2}			0.1	UI	
Relative Intensity Noise		RIN			-128	dB/Hz	
Center Wavelength	Beginning of Life	λ_{c_BOL}	z-1.5	z	z+1.5	GHz	
	End of Life	λ_{c_EOL}	z-2.5	z	z+2.5	GHz	
Receiver (Rx) at 0ps/nm							
Bit rate	BER						
8.5 Gb/s – 10.7 Gb/s	<1E-12	R_{SENS1}			-16.0	dBm	1
11.1 Gb/s – 11.3Gb/s	<1E-4	R_{SENS4}			-20.0	dBm	
Overload (Average Power)		P_{AVE}	-1			dBm	
Optical Center Wavelength		λ_C	1260		1600	nm	
LOS De-Assert		LOS_D			-16	dBm	
LOS Assert		LOS_A	-26			dBm	
LOS Hysteresis		LOS_H	0.5			dB	
Receiver Reflectance		R_{rx}			-27	dB	

Notes:
1. Measured with worst ER=8.2dB; BER<10^{-12}; 2^{31} – 1 PRBS

Sensitivity through Fiber and OSNR Requirements					
Receiver Sensitivity[2]					
Data rate (Gb/s)	BER	Dispersion (ps/nm)	Sensitivity back-to-back at OSNR>30dB (dBm)	Sensitivity with Dispersion at OSNR>30dB (dBm)	Threshold Adjust Required
9.95	1e-12	-800 to +800	-16	-14	No
10.3	1e-12	-800 to +800	-16	-13.5	No
10.7 – 11.1	1e-4	-800 to +800	-20	-17	Yes
11.3	1e-4	-800 to +800	-20	-16.5	Yes
OSNR Performance[3]					
Data rate (Gb/s)	BER	Dispersion (ps/nm)	Min OSNR Back-to-back at Power: -14dBm to -2dBm (dB)	Max OSNR Penalty at Power: -14 to -2dBm (dB)	Threshold Adjust Required
9.95-10.3	1e-12	-800 to +800	24	4	Yes
10.7 – 11.1	1e-4	-800 to +800	16	4	Yes
11.3	1e-4	-800 to +800	17	4	Yes

Notes:

2. Measured between available TX wavelength range (listed in Table IV) with worst case ER and $2^{31} – 1$ PRBS31.
3. All OSNR measurements are performed with 0.1nm resolution.

V. General Specifications

Parameter	Symbol	Min	Typ	Max	Units	Ref.
Bit Rate	BR	8.5		11.3	Gb/s	1
Max. Supported Link Length	L_{MAX}			40	km	2

Notes:
1. Tested with a $2^{31} – 1$ PRBS pattern at the BER defined in Table IV.
2. Over G.652 single mode fiber.

VI. Timing Parameters

Parameter	Symbol	Min	Max	Units	Ref.
Time to initialize cooled module	t_start_up_cooled		90	s	

VII. Environmental Specifications

FTLX6682MxC transceivers have operating case temperature ranges as shown in the table below:

Environmental Specifications	Symbol	Min	Typ	Max	Units	Ref.
Case Operating Temperature						
FTLX6682MCC	T_{op}	-5		70	°C	
FTLX6682MNC	T_{op}	-5		85	°C	
FTLX6682MTC	T_{op}	-40		85	°C	
Storage Temperature	T_{sto}	-40		85	°C	

VIII. Regulatory Compliance

Finisar® transceivers are Class 1 Laser Products and comply with US FDA regulations. These products are certified by UL and/or TÜV and/or CSA to meet the Class 1 eye safety requirements of EN (IEC) 60825 and the electrical safety requirements of EN (IEC) 60950 or 62368-1. Copies of certificates are available upon request.

CAUTION: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

IX. Digital Diagnostic Functions and Specifcations

FTLX6682MxC Tunable SFP+ transceivers support the 2-wire serial communication protocol as defined in the SFP MSA. It is very closely related to the memory map defined in the GBIC standard, with the same electrical specifications.

The standard SFP serial ID provides access to identification information that describes the transceiver's capabilities, standard interfaces, manufacturer, and other information.

Additionally, Finisar® T-SFP+ transceivers provide an enhanced digital diagnostic monitoring interface, which allows real-time access to device operating parameters such as transceiver temperature, laser bias current, transmitted optical power, received optical power and transceiver supply voltage. It also defines a sophisticated system of alarm and warning flags, which alerts end-users when particular operating parameters are outside of a factory set normal range.

The SFP MSA defines a 256-byte memory map that is accessible over a 2-wire serial interface at the 8 bit address 1010000X (A0h). The digital diagnostic monitoring interface makes use of the 8 bit address 1010001X (A2h), so the originally defined serial ID memory map remains unchanged. The interface is identical to, and is thus fully backward compatible with both the GBIC Specification and the SFP Multi Source Agreement.

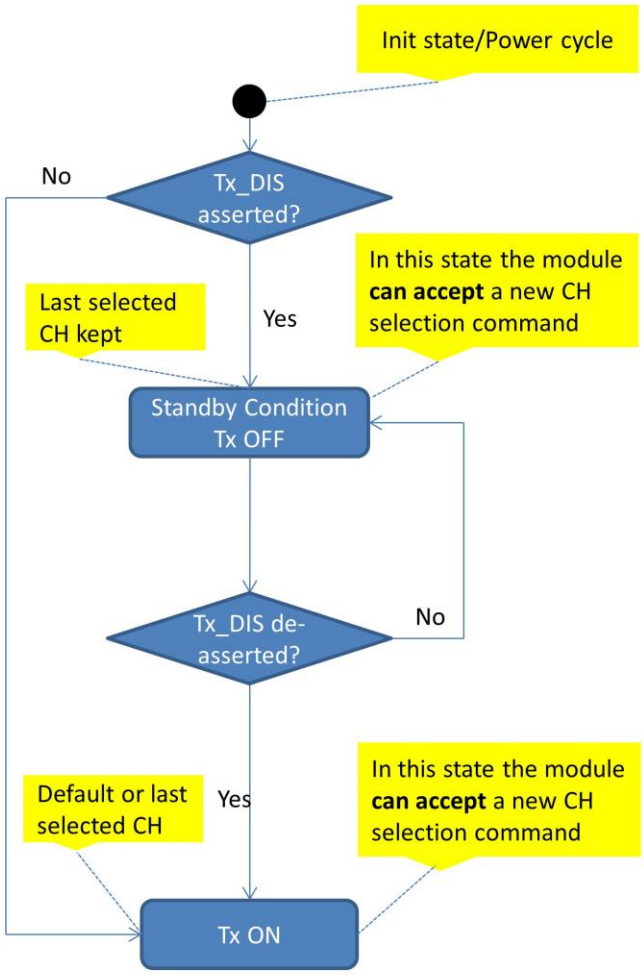
The operating and diagnostics information is monitored and reported by a Digital Diagnostics Transceiver Controller (DDTC) inside the transceiver, which is accessed through a 2-wire serial interface. When the serial protocol is activated, the serial clock signal (SCL, Mod Def 1) is generated by the host. The positive edge clocks data into the SFP transceiver into those segments of the E^2PROM that are not write-protected. The negative edge clocks data from the SFP transceiver. The serial data signal (SDA, Mod Def 2) is bi-directional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially.

Parameter	Symbol	Units	Min	Max	Accuracy	Ref.
Transceiver temperature						
FTLX6682MCC	Δ_{DDTemp}	ºC	-10	+75	±5ºC	1
FTLX6682MNC	Δ_{DDTemp}	ºC	-10	+90	±5ºC	1
FTLX6682MTC	Δ_{DDTemp}	ºC	-45	+90	±5ºC	1
Transceiver supply voltage	$\Delta_{DDVoltage}$	V	2.8	4.0	±3%	
Transmitter bias current	Δ_{DDBias}	mA	0	127	±10%	2
Transmitter output power	$\Delta_{DDTx\text{-}Power}$	dBm	-1	+5	±2dB	
Receiver average optical input power	$\Delta_{DDRx\text{-}Power}$	dBm	-20	-5	±2dB	

Notes:
1. Internally measured
2. The accuracy of the Tx bias current is 10% of the actual current from the laser driver to the laser

X. Start-Up Sequence

FTLX6682MxC modules adhere to MSA SFF-8690 for wavelength / channel selection of these tunable modules. The module behavior is described in the flowchart below:



XI. Alarm and Warning Threshold Values (A2h)

ADDRESS	PARAMETER	VALUES			UNITS
		C-temp	E-temp	I-temp	
00-01	Temp High Alarm	80	90	90	C
02-03	Temp Low Alarm	-10	-10	-45	C
04-05	Temp High Warning	75	85	85	C
06-07	Temp Low Warning	-5	-5	-40	C

Address	Parameter	Threshold Values	UNITS
08-09	Voltage High Alarm	3.63	V
10-11	Voltage Low Alarm	2.97	V
12-13	Voltage High Warning	3.465	V
14-15	Voltage Low Warning	3.135	V
16-17	Bias High Alarm	130	mA
18-19	Bias Low Alarm	5	mA
20-21	Bias High Warning	120	mA
22-23	Bias Low Warning	8	mA
24-25	TX Power High Alarm	6	dBm
26-27	TX Power Low Alarm	-5	dBm
28-29	TX Power High Warning	3	dBm
30-31	TX Power Low Warning	-1	dBm
32-33	RX Power High Alarm	1	dBm
34-35	RX Power Low Alarm	-20	dBm
36-37	RX Power High Warning	0	dBm
38-39	RX Power Low Warning	-18	dBm
40-55	Reserved		

NOTE: The FTLX6682MCC modules contain Internal CDRs. The default condition is for the FTLX6682MCC modules to be shipped with both the TX and RX CDRs enabled. If you require to have either side bypassed, please contact Finisar for these details**.**

XII. Power-up Sequence

The typical power consumption of the FTLX6682MxC exceeds the limit of 1.0W specified in the SFF-8419, for which the SFF-8419 recommends a power-up sequence. Per SFF-8419, at the power-on a transceiver which normally operates above 1.0W can stay in a "low power" level mode until the host enables the transceiver to complete its power-up sequence, reaching its full operating power consumption. Please, refer to SFF-8419 and Application Note AN-2076[8] for additional details.

The FTLX6682MxC is factory set to power-up directly to its operating conditions in "full power consumption" mode. Please see **Section III. Electrical Characteristics** for specification details.

XIII. Mechanical Specifications

FTLX6682MxC transceivers are compatible with the SFF-8432 specification for improved pluggable form factor, and shown here for reference purposes only. Bail color is green.

ITEM	DIM (mm)	TOL (mm)
A	9.00	± 0.3
B	9.60	± 0.5
C	11.90	± 0.5
D	13.85	± 0.15
E	13.65	± 0.15
F	2.80	± 0.2
G	1.00	± 0.2
H	4.00	REF
J	2.00	± 0.2
K	56.50	REF
L	1.60	± 0.5
M	2.25	± 0.1
N	1.80	± 0.1
P	37.10	± 0.3
Q	9.15	± 0.15
R	1.00	± 0.1
S	8.55	± 0.15
T	47.50	± 0.2
V	2.55	± 0.1
W	43.00	± 0.2
X	14.70	± 0.5
Z	0.55	± 0.15

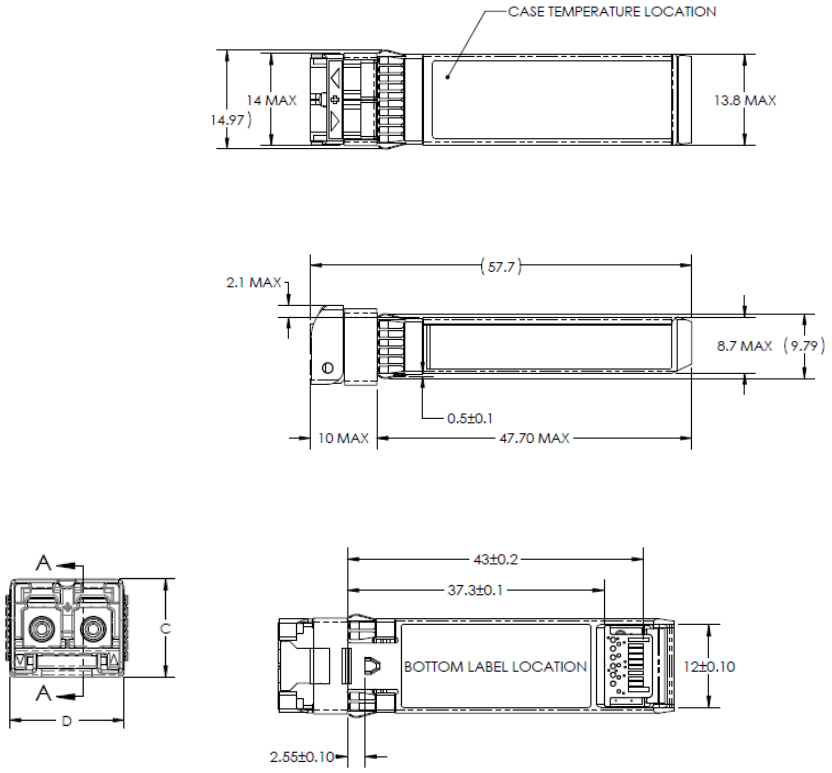


Figure 2. Mechanical Dimensions

Product Label (FTLX6882MCC sample versions shown)

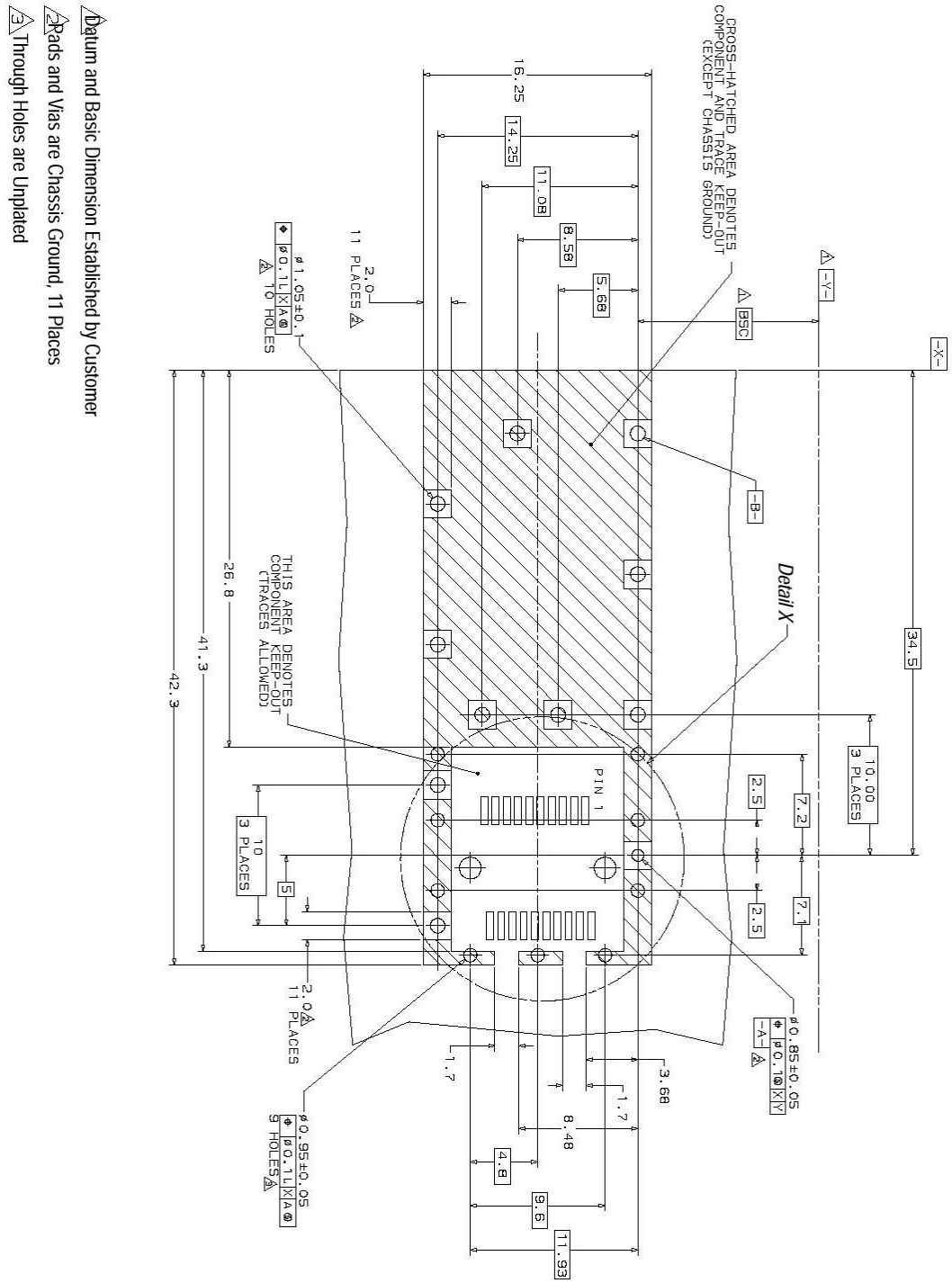


Figure 3. PCB Layout and Bezel Recommendations, as per [2]

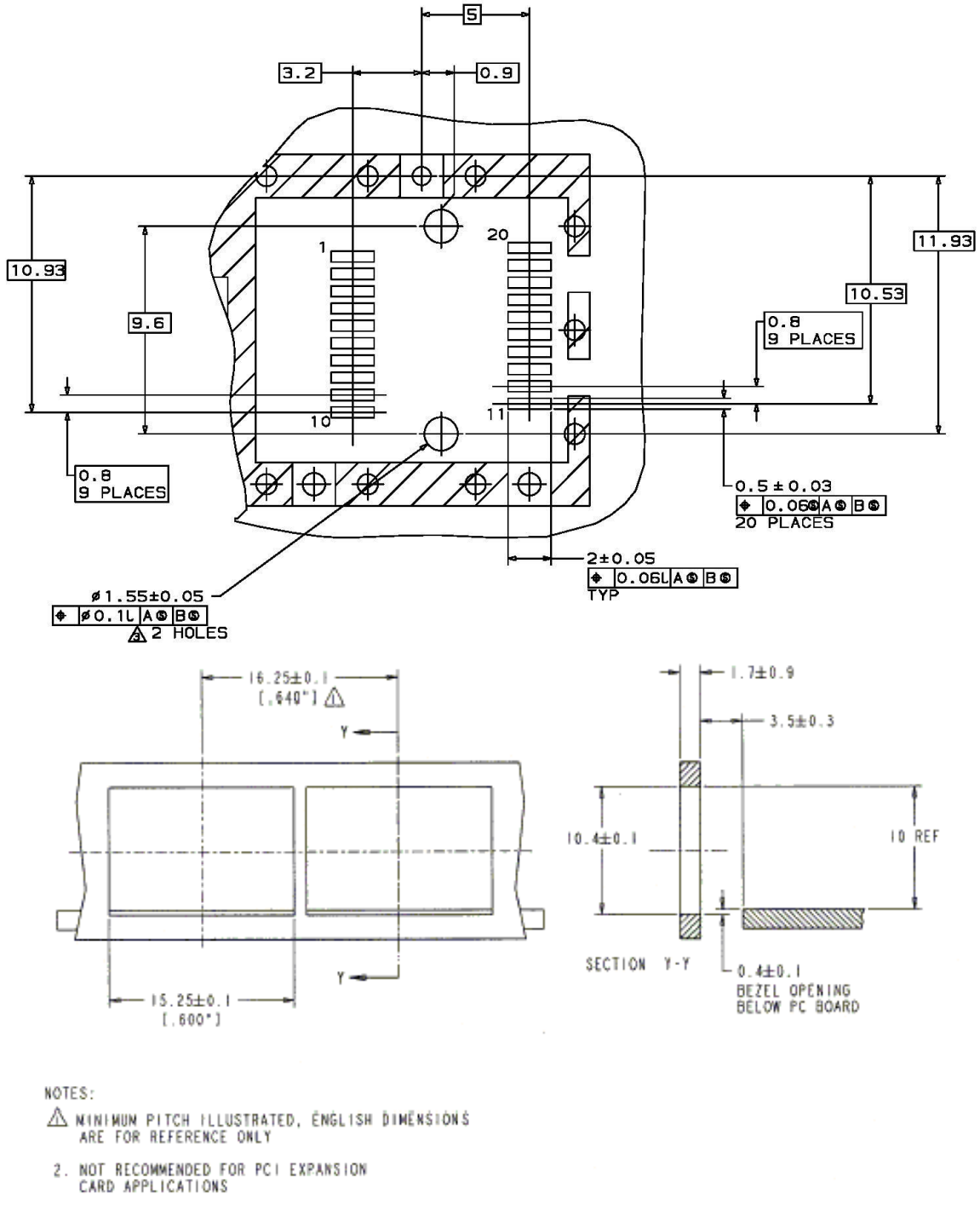

5
3.2
0.9
1
20
10
11
10.93
9.6
11.93
10.53
0.8
9 PLACES
0.8
9 PLACES
0.5 ± 0.03
0.06 M A B
20 PLACES
2±0.05
0.06 L A B
TYP
ø1.55±0.05
ø0.1 L A B
2 HOLES
16.25±0.1
[.640"]
Y
Y
15.25±0.1
[.600"]
1.7±0.9
3.5±0.3
10.4±0.1
10 REF
SECTION Y-Y
0.4±0.1
BEZEL OPENING
BELOW PC BOARD
NOTES:
1. MINIMUN PITCH ILLUSTRATED, ENGLISH DIMENSIONS ARE FOR REFERENCE ONLY
2. NOT RECOMMENDED FOR PCI EXPANSION CARD APPLICATIONS

Figure 4

XIV. References

1. "Specification for SFP+ 10Gb/s Electrical Interface", SFF Document Number SFF-8418, Revision 1.4 (or later).
2. "Specification for SFP+ Power and Low Speed Interface", SFF Document Number SFF-8419, Revision 1.3 (or later).
3. "Improved Pluggable Form factor", SFF Document Number SFF-8432, Revision 4.2, April 18, 2007 (or later).
4. "Digital Diagnostics Monitoring Interface for Optical Transceivers". SFF Document Number SFF-8472, Revision 11.3, (or later).
5. Directive 2011/65/EU of the European Council Parliament and of the Council, "on the restriction of the use of certain hazardous substances in electrical and electronic equipment" as well as Commission Delegated Directive (EU) 2015/863 amending Annex II to Directive 2011/65/EU. Certain products may use one or more exemptions as allowed by the Directive.
6. "Application Note AN-2038: Finisar Implementation of RoHS Compliant Transceivers", Finisar Corporation, January 21, 2005.
7. Small Form-factor Pluggable (SFP) Transceiver Multi-Source Agreement (MSA)
8. "Application Note AN-2076: SFP+ Level II Power Up Sequence", Rev B (or later)
9. Tunable SFP+ MSA; SFF-8690

XV. Revision History

Revision	Date	Description
A00	November 2023	Initial Release of FTLX6682MxC Data Sheet in Coherent Template which combines all 3 temperature range versions
A01	April 2024	Updated product photo on first page
B00	January 2025	Add AGILE PN and update Note 5 in Section III

XVI. For More Information

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