

AFBR-5Fx85Z

DC to 50-Mbaud Flexible Link Fiber-Optic Components with LC Port



Description

The AFBR-5Fx85Z is an ultra-low power consumption 850-nm Flexible Link product that operates from DC to 50-Mbaud data transmission over multimode glass fiber cable. The Flexible Link family features a universal footprint, allowing designers to populate each PCB slot with a transceiver, dual-transmitter, or dual-receiver configuration as needed.

Transmitter

The transmitter consists of an 850-nm class-1-laser-compliant VCSEL with an integrated driver IC. The VCSEL driver operates at 3.3V. It receives LVTTTL electrical input and converts it into a modulated current that drives the VCSEL. The VCSEL is packaged in an optical subassembly.

The optimized lens system of the optical subassembly very efficiently couples the emitted optical power into multimode fibers.

Receiver

The receiver utilizes a fully integrated single-chip solution that provides excellent immunity to EMI and fast transient dV/dt rejection. The receiver directly converts the optical signal into a digital LVTTTL signal. The receiver operates at 3.3V.

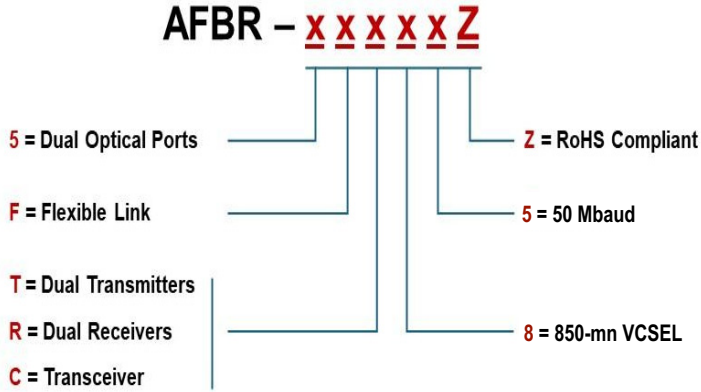
Features

- Ultra-low power consumption
- Compact size
- Single +3.3V power supply
- Data transmission at signal rates: DC up to 50 Mbaud
- Operating temperature: -40°C to 85°C
- LC duplex connector optical interface
- Integrated 850-nm VCSEL and driver IC with an LVTTTL input logic transmitter
- Integrated PIN diode and digitalizing IC with an LVTTTL output logic receiver
- Operates with a 50/125- μm , 62.5/125- μm , 105- μm , and 200- μm multimode fiber cable
- Manufactured in an ISO 9001 certified facility
- RoHS compliant

Applications

- Factory automation
- Energy storage
- Substation automation
- HVDC systems

AFBR-xxxxxZ – Part Number Selection Guide



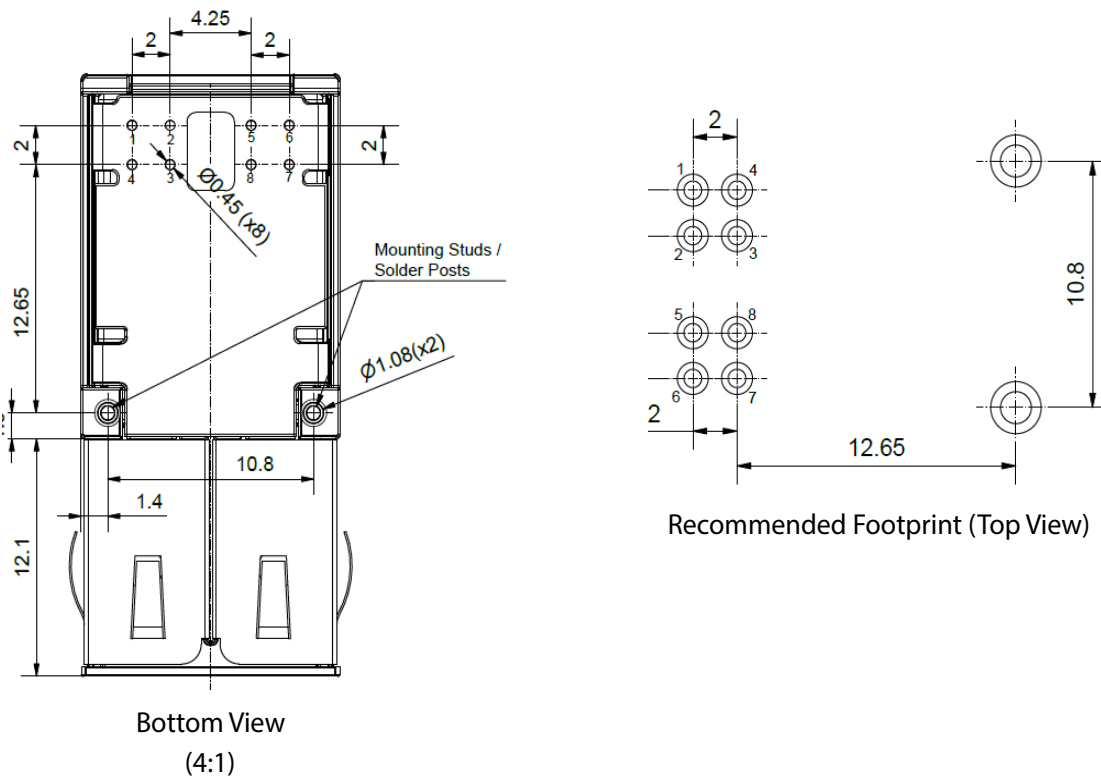
Module Package

Figure 1 shows the Broadcom Flexible Link pinout and package outline. The package allows Flexible Link products to be configured as dual transmitters or dual receivers or transceiver fiber-optic components.

The optical subassemblies use a high-volume assembly process together with hermetically sealed lens elements, which results in a rugged package with high immunity to external EMI fields.

The Flexible Link product has two solder posts that provide the primary mechanical strength to withstand the loads imposed on the product by mating with the LC connector fiber cables. The two solder posts are connected to the outer metal cover.

Figure 1: Pinout Diagram (Bottom View)



AFBR-5FC85Z Pin Descriptions

Pin	Name	Function/Description	Notes
1	RXIMON	Receiver I _{mon}	Rx signal analog current mirrored to optical signal.
2	RXV _{CC}	Receiver V _{CC}	Provides +3.3V DC via the recommended transmitter power supply filter circuit. Locate the power supply filter circuit as close as possible to the V _{CC} RX pin.
3	RXDOUT	Rx signal LVTTTL output	Receiver LVTTTL output signal.
4	RXGND	Receiver ground	Directly connect this pin to the receiver ground plane.
5	TXDIN	LVTTTL input data	LVTTTL data input. High electrical input levels to the transmitter result in optical high logic "1" output.
6	TXV _{CC}	Transmitter V _{CC}	Provides +3.3V DC via the recommended transmitter power supply filter circuit. Locate the power supply filter circuit as close as possible to the V _{CC} RX pin.
7	TXDIS	Tx disable LVTTTL input	LVTTTL input to disable the transmitter by logic high.
8	TXGND	Transmitter ground	Connect this pin to the transmitter ground plane.

AFBR-5FT85Z Pin Descriptions

Pin	Name	Function/Description	Notes
1	TX2DIN	LVTTTL input data	LVTTTL data input. High electrical input levels to the transmitter result in optical high logic "1" output.
2	TX2V _{CC}	Transmitter V _{CC}	Provides +3.3V DC via the recommended transmitter power supply filter circuit. Locate the power supply filter circuit as close as possible to the V _{CC} RX pin.
3	TX2DIS	Tx disable LVTTTL input	LVTTTL input to disable the transmitter by logic high.
4	TX2GND	Transmitter ground	Connect this pin to the transmitter ground plane.
5	TX1DIN	LVTTTL input data	LVTTTL data input. High electrical input levels to the transmitter result in optical high logic "1" output.
6	TX1V _{CC}	Transmitter V _{CC}	Provides +3.3V DC via the recommended transmitter power supply filter circuit. Locate the power supply filter circuit as close as possible to the V _{CC} RX pin.
7	TX1DIS	Tx disable LVTTTL input	LVTTTL input to disable the transmitter by logic high.
8	TX1GND	Transmitter ground	Connect this pin to the transmitter ground plane.

AFBR-5FR85Z Pin Descriptions

Pin	Name	Function/Description	Notes
1	RX2IMON	Receiver I _{mon}	Rx signal analog current mirrored to the optical signal.
2	RX2V _{CC}	Receiver V _{CC}	Provides +3.3V DC via the recommended transmitter power supply filter circuit. Locate the power supply filter circuit as close as possible to the V _{CC} RX pin.
3	RX2DOUT	Rx signal LVTTTL output	Receiver LVTTTL output signal.
4	RX2GND	Receiver ground	Directly connect this pin to the receiver ground plane.
5	RX1IMON	Receiver I _{mon}	Rx signal analog current mirrored to the optical signal.
6	RX1V _{CC}	Receiver V _{CC}	Provides +3.3V DC via the recommended transmitter power supply filter circuit. Locate the power supply filter circuit as close as possible to the V _{CC} RX pin.
7	RX1DOUT	Rx signal LVTTTL output	Receiver LVTTTL output signal.
8	RX1GND	Receiver ground	Directly connect this pin to the receiver ground plane.

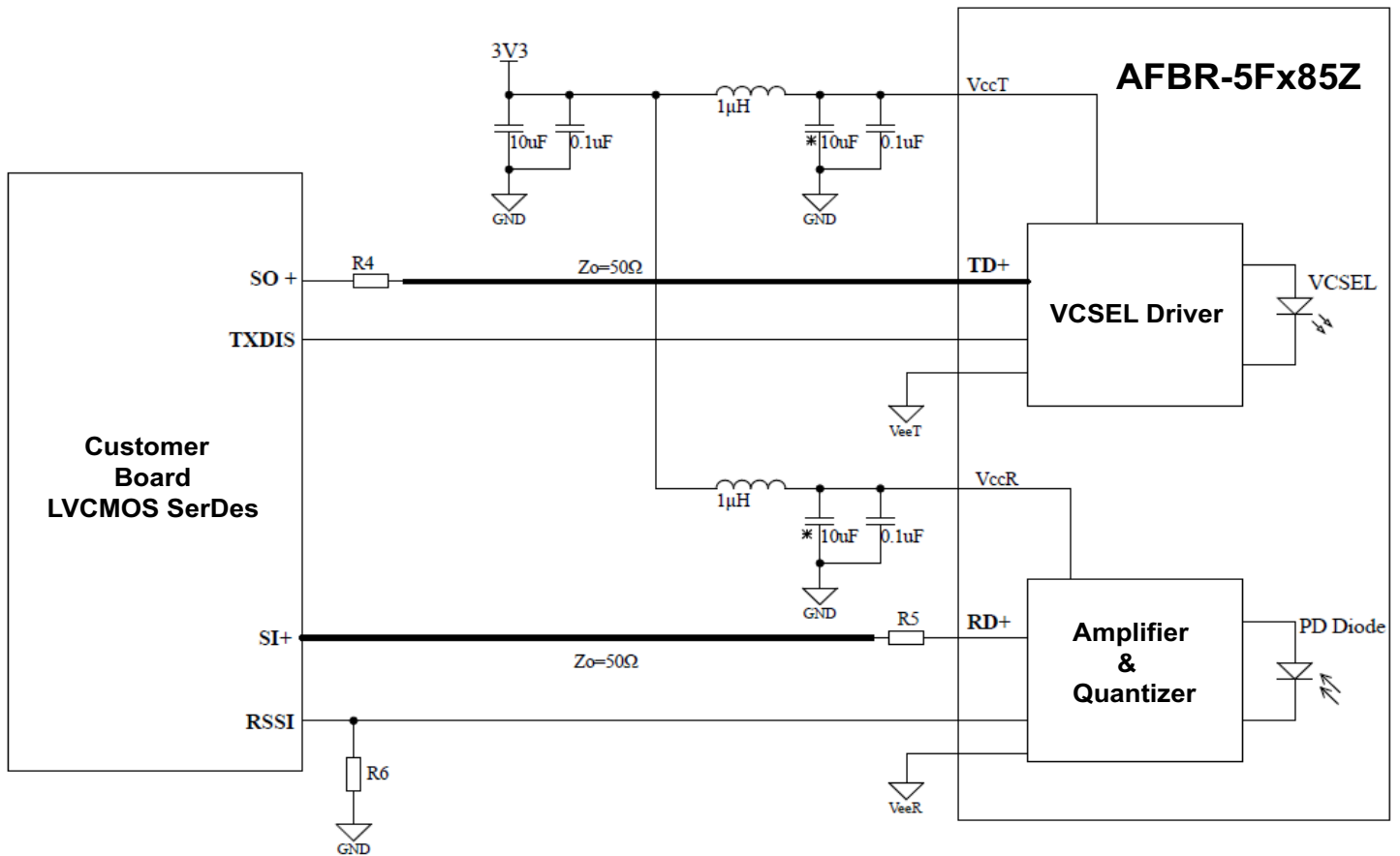
Mounting Studs/Solder Posts

The mounting studs are provided for transceiver mechanical attachment to the circuit board. It is recommended to connect to chassis ground.

Regulatory Compliance

Feature	Test Method	Performance
Electrostatic Discharge (ESD) to the Electrical Pins	JEDEC JESD22-A114	Meets Class 2 (2000V to 3999V). Withstands up to 2000V applied between electrical pins.
Electrostatic Discharge (ESD) to the Duplex LC Receptacle	Variation of IEC 61000-4-2	Typically withstands at least 8 kV without damage when the LC connector receptacle is contacted by a human-body model probe. Typically withstands a 15-kV air discharge on LC-connector receptacles.
Electromagnetic Interference (EMI)	FCC Class B, CENELEC EN55022 (CISPR 22) Class B	System margins are dependent on the customer board and the chassis design.
Immunity	Variation of IEC 61000-4-3 Std C37.90.2-2004	Typically shows no measurable effect from a 20 V/m field swept from 80 MHz to 1 GHz applied to the transceiver without a chassis enclosure.
Eye Safety	IEC 62368-1 IEC 60825-1 IEC 60825-2	Compliant per Broadcom testing under single fault conditions.
RoHS Compliance	—	Reference to RoHS Directive 2011/65EU.

Figure 2: Recommended Application Circuit



*A tantalum capacitor is recommended.

NOTE:

- Tx disable has an internal pull-down resistor. TxDIS pin high logic disables the transmitter.
- For an Imon signal, a 10-k Ω (R6) pull-down resistor is recommended.
- The starting value of the empirical derivation of R4 and R5 is 33 Ω .

Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause catastrophic damage to the device. Limits apply to each parameter in isolation, all other parameters having values within the recommended operating conditions. It should not be assumed that limiting values of more than one parameter can be applied to the product at the same time. Exposure to the absolute maximum ratings for extended periods can adversely affect device reliability.

Parameter	Symbol	Min.	Max.	Unit	Notes
Storage Temperature	T_S	-40	+100	°C	—
Supply Voltage	V_{CC}	-0.5	3.63	V	—
Operating Relative Humidity	ϕ	—	95	%	a
Data Input Voltage	V_i	-0.5	V_{CC}	V	—
Data Output Current	I_O	—	10	mA	—

a. The normal operating humidity range is up to 85%. 95% humidity conditions at 70°C must not exceed 16 hours.

Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Ambient Operating Temperature	T_C	-40	—	+85	°C	a
Supply Voltage	V_{CC}	3.0	3.3	3.6	V	—
Signaling Rate	B	DC	—	50	Mbaud	b

a. Electrical and optical specifications of the product are guaranteed across the recommended ambient operating temperature only.

b. Characterized with a 50-Mbaud, PRBS 2⁷-1 pattern.

Transmitter Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Supply Current	I_{CC}	—	7	12	mA	a
Power Dissipation	P_{diss}	—	23	40	mW	—
Input Voltage Low	V_{IL}	0.0	—	0.8	V	—
Input Voltage High	V_{IH}	2.0	—	V_{CC}	V	—
Data Input Capacitance	C_{in}	—	5	—	pF	—
Data Input Resistance	R_{in}	—	80	—	kΩ	—
Propagation Delay	T_{PD}	—	6	15	ns	—
Tx Disable Input Voltage	V_{IH}	—	2.0	V_{CC}	V	—

a. Typical values are for room temperature at 3.3V.

Receiver Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Supply Current	I_{CC}	—	20	30	mA	a
Power Dissipation	P_{diss}	—	66	108	mW	—
Data Output Rise Time (10% – 90%)	t_r	—	2.4	5.0	ns	b
Data Output Fall Time (90% – 10%)	t_f	—	1.7	4.0	ns	b
Data Output High	V_{OH}	2.0	—	V_{CC}	V	c
Data Output Low	V_{OL}	0.0	—	0.8	V	c
Pulse Width Distortion Subsequent Pulses	R_{PWDS}	–4	—	+4	ns	d, e, f
Pulse Width Distortion 1 st to 3 rd Pulse	R_{PWD1}	–8	—	+8	ns	f, g
Propagation Delay	R_{PD}	—	8	30.0	ns	—
Received Signal Strength	RSSI	—	1	—	$\mu A/\mu W$	—

- Typical values are for room temperature at 3.3V.
- Maximum capacitive load of 5 pF and minimum resistive load of 1 k Ω .
- RD+ data is LVTTTL output logic.
- Optical input of a 50-Mbaud PRBS 2⁷-1 pattern and 50% duty cycle.
- The pulse width is measured at 50% threshold using a rising edge trigger and PRBS 2⁷-1 pattern.
- If the data rate is below 1 Mbaud, the pulse width distortion is equal to the pulse width distortion of the first to third pulses for higher data rates.
- The threshold of the first pulse of a data sequence is difficult to adjust, and therefore the pulse width distortion up to the third pulse is higher than for all other pulses (worst case for the first pulse). This strongly depends on the quality of the rising and falling edge of the optical input. The faster the edges, the smaller the pulse width variation. Furthermore, lower data rates result in the same issue as all the pulses become first pulses.

Transmitter Optical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Output Optical Power (Peak) 50/125- μm NA = 0.22 MMF 62.5/125- μm NA = 0.275 MMF 105/125- μm NA = 0.3 MMF 200/230- μm NA = 0.37 MMF	P_O	–14.0 –14.0 –14.0 –7	–11.0 –9.0 –5.0 –1.0	–2.0 –2.0 1 1	dBm	a
Extinction Ratio	ER	10	13.5	—	dB	—
Central Wavelength	λ_C	830	850	860	nm	—
Spectral Width – FWHM	$\Delta\lambda$	—	0.5	5	nm	—
Optical Rise Time (20% – 80%)	t_r	—	0.8	4	ns	b, c
Optical Fall Time (80% – 20%)	t_f	—	0.7	3	ns	b, c
Pulse Width Distortion 1st Pulse	T_{PWD1}	–7	—	2	ns	b, d
Pulse Width Distortion Subsequent Pulses	T_{PWDS}	–5	—	2	ns	b, e

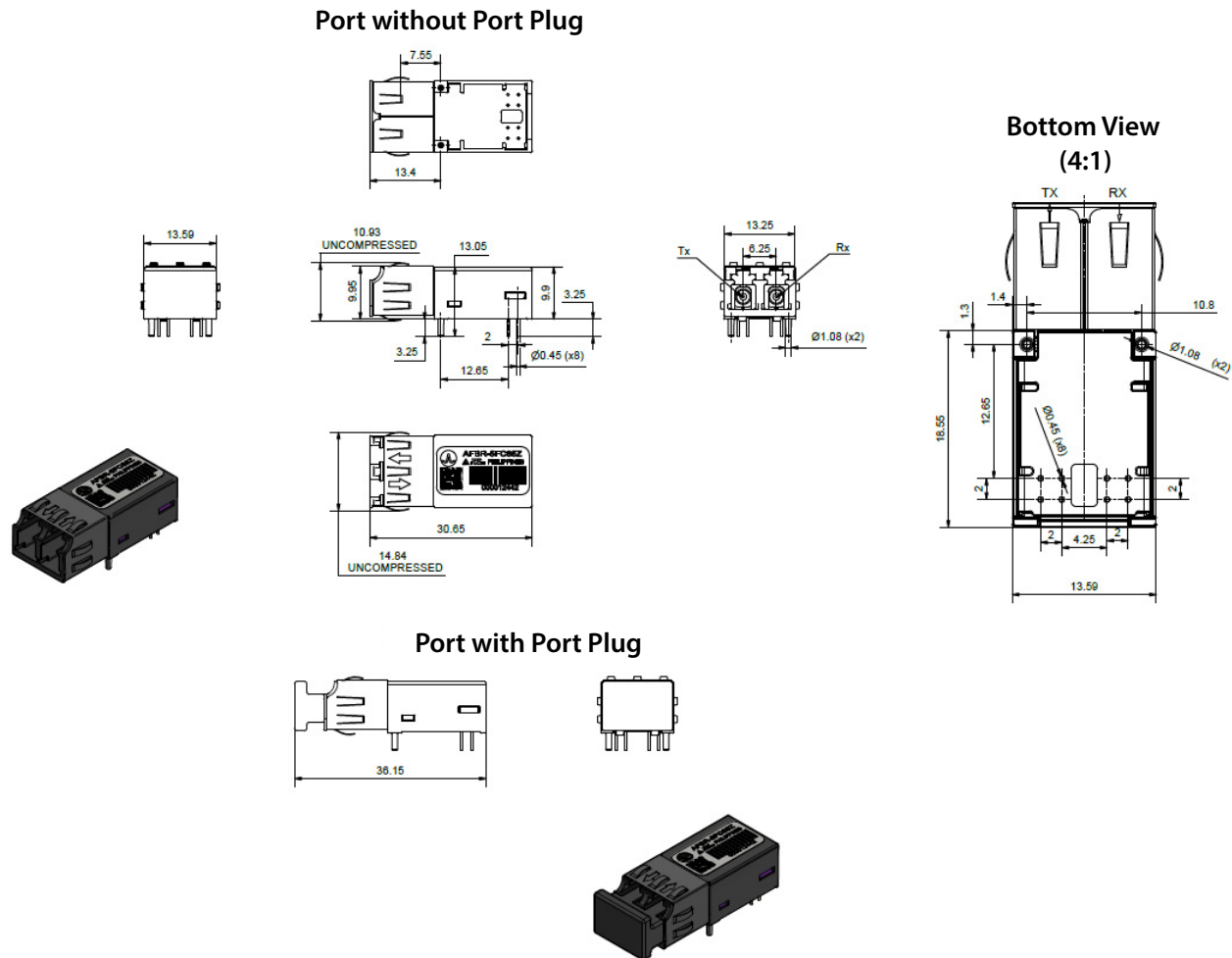
- Optical values are measured over the specified operating voltage and temperature ranges. The peak power can be converted to an average value by subtracting 3 dB.
- Measured with a 1.25-Gb/s optical-to-electrical converter. Measured with 62.5/125- μm NA = 0.275 MMF at 50 Mb/s.
- The rise and fall times are captured using 20%–80% reference markers.
- The first pulse width is measured with a long period of low pulses followed by a high pulse.
- The pulse width is measured at 50% threshold using a rising edge trigger tested with a PRBS 2⁷-1 pattern.

Receiver Optical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Input Optical Power (Peak) 50/125- μm NA = 0.22 MMF 62.5/125- μm NA = 0.275 MMF 105/125- μm NA = 0.3 MMF 200/230- μm NA = 0.37 MMF	P_{in}	-25.0 -25.0 -24.0 -22.0	—	+1 +1 +1 +1	dBm	a
Input Optical Power (Peak) Off State	P_{in_off}	—	-34.0	—	dBm	—
Operating Wavelength	λ_O	830	—	860	nm	—

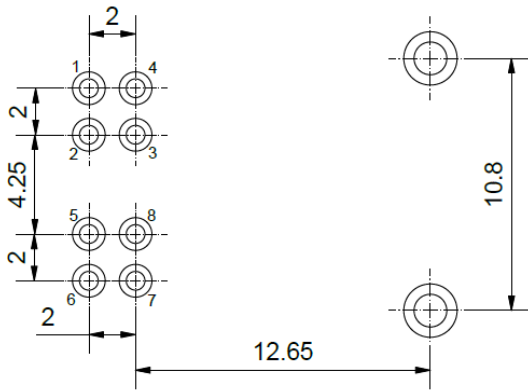
- a. This specification is intended to indicate the performance of the receiver section of the transceiver when optical input power signal characteristics are present as per the following definitions:
- The Recommended Operating Conditions table shows the specified voltage and temperate range.
 - The bit error rate (BER) is better than or equal to 1×10^{-10} .
 - The transmitter operates to simulate any crosstalk present between the transmitter and receiver sections of the transceiver.

Figure 3: Package Outline Drawing



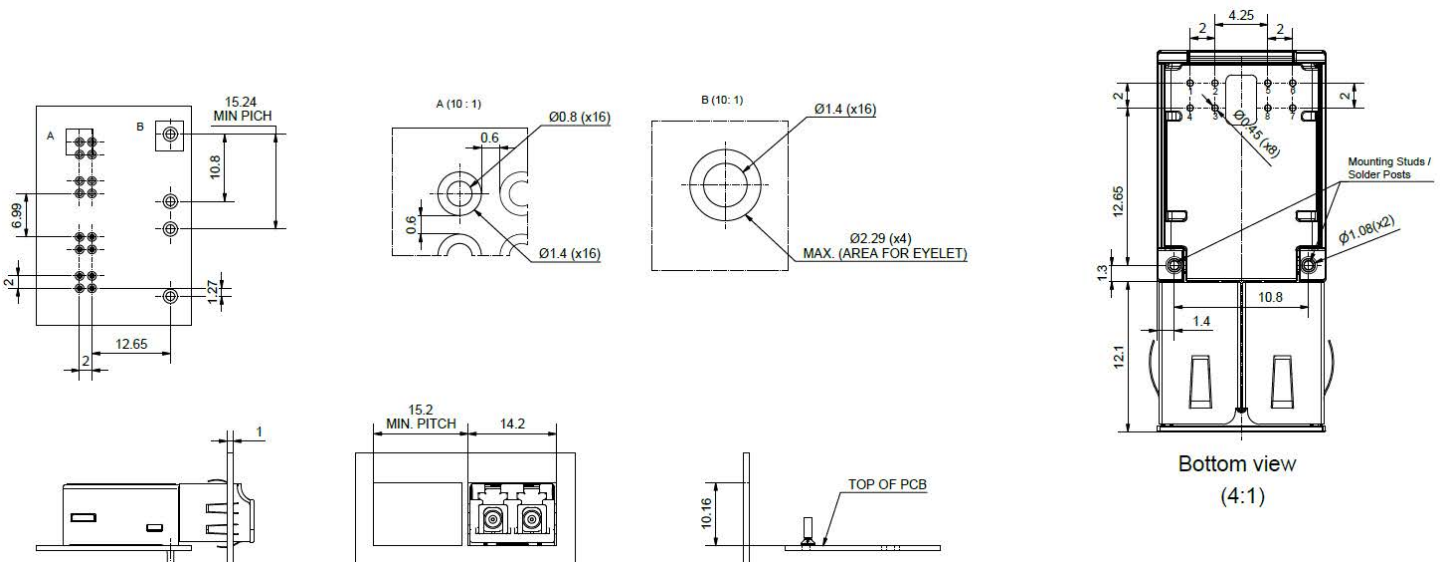
NOTE: All dimensions are in millimeters.

Figure 4: Recommended Footprint (Top View)



NOTE: All dimensions are in millimeters.

Figure 5: Recommended Board Layout Hole Pattern



NOTE: To prevent pin and port misalignment caused by excessive force during PCB insertion and soldering, please keep the dust plug inserted throughout the entire soldering process to ensure stability.

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