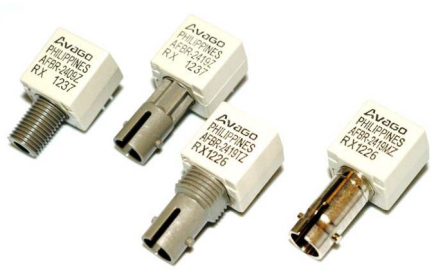
BROADCOM®

Data Sheet

AFBR-24x9xZ

50-Mbaud Miniature Link Fiber-Optic Receiver



Description

The Broadcom® AFBR-24x9xZ series components provide cost-effective, high-performance, fiber-optic communication links for information systems and industrial applications with link distances up to 3 km. The receivers are directly compatible with the popular ST and SMA industry-standard connectors. They are designed for use with 62.5/125-µm multimode fiber.

Table 1: AFBR-24x9xZ Available Part Numbers

Part Number	Description
AFBR-2409Z	Receiver with SMA port
AFBR-2419Z	Receiver with ST port
AFBR-2419TZ	Receiver with threaded ST port
AFBR-2419MZ	Receiver with metal ST port

Table 2: Link Length[a]

Data Rate (Mbaud)	Max. Distance (m)	Fiber Size (µm)	Transmitter
20	3000	62.5/125	HFBR-1414Z
32	2200	62.5/125	HFBR-1414Z
40	1500	62.5/125	HFBR-1414Z
50	1000	62.5/125	HFBR-1414Z

a. Verified with a PRBS7 pattern at the minimal Tx optical power of –19 dBm avg. (–16 dBm pk. as specified in the HFBR-1414Z data sheet).

Features

- RoHS compliant
- Works with the Broadcom HFBR-14xxZ (820-nm LED) transmitter
- Data transmission at signal rates from 100 kbaud to 50 Mbaud
- Receiver: Integrated PIN diode and digitalizing IC with CMOS/TTL output logic
- Up to a 3-km distance with a multimode glass fiber cable
- Operating temperature range of –40°C to +85°C
- Compatible with the 10BASE-FL standard
- 3.3V and 5V supply voltage operation
- RSSI output

Applications

- Optical transmission from 100 kbaud up to 50 Mbaud
- Industrial control and factory automation
- High-voltage isolation
- Elimination of ground loops
- Reduction of voltage transient susceptibility
- Power substation automation

Package and Handling Information

Package Information

The receiver is housed in a low-cost, dual-inline package that is made of high-strength, heat-resistant, chemically resistant, and UL 94V-O flame-retardant ULTEM plastic (UL File #E121562). The receivers (suffix Z and TZ) are easily identified by the dark-grey connector port. A metal port option is also available (suffix MZ). The components of the metal port option have an internal electrical connection between the metal port and the four grounding pins. Signal ground is separate from the four grounding pins to give flexibility in connecting the port to signal or chassis ground. The package is designed for auto-insertion and wave soldering, so it is ideal for high-volume production applications.

Handling and Design Information

Each part is delivered with a protective port cap or plug covering the optics. These caps and plugs vary by port style. When soldering, it is advisable to leave the protective cap on the unit to keep the optics clean. Good system performance requires clean port optics and cable ferrules to avoid obstructing the optical path. Clean compressed air is often sufficient to remove particles of dirt; methanol on a cotton swab also works well.

AFBR-24x9xZ Low-Cost 50-Mbaud Receiver

The AFBR-24x9xZ fiber-optic receiver is designed to operate with the Broadcom HFBR-14xxZ fiber-optic transmitters and multimode glass fiber cables. Consistent coupling into the receiver is ensured by the optical system and lens. The receiver output is a digital CMOS/TTL signal. The AFBR-24x9xZ receiver contains an IC with an integrated photodiode that directly converts the incoming optical signal to a digital output signal without requiring additional external circuitry. Because of its integrated design, the receiver has very high EMC resistance. A wide receiver dynamic range and high sensitivity over temperature are achievable. The data rate typically goes from 100 kbaud to 50 Mbaud. A monitor (RSSI) output, which delivers an output current proportional to the average incoming light power, is available.

For an almost noise-free RSSI-signal, smoothing components are recommended. A capacitor in parallel to the resistor on the RSSI output reduces potential high-frequency signal portions. The use of a single 100-nF capacitor for signal smoothing is sufficient in most common applications, as shown in Recommended Receiver Circuitry. If this RSSI function is not required, the output pin can be left floating. The RSSI-signal is derived from internal controlling loops; therefore, the typical time constant of pure RSSI output current without an external filter can be up to 1 ms. This time constant also depends on the actual average incoming light power.

Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit	Reference
Storage Temperature	T_S	–40	+85	°C	
Operating Temperature	T_A	–40	+85	°C	
Supply Voltage	V_{CC}	–0.3	5.5	V	
Maximum DC Output Current	I_O	—	10	mA	
Voltage at RSSI Output	V_{RSSI}	–0.3	V_{CC} + 0.3	V	
Lead Soldering Cycle – Temperature	T_{SOLD}	—	260	°C	Note [a]
Lead Soldering Cycle – Time	t_{SOLD}	—	10	seconds	Note [a]
Electrostatic Discharge Voltage Capability	ESD_{HBM}	—	2000	V	Note [b]
Electrostatic Discharge Voltage Capability	ESD_{MM}	—	400	V	Note [c]

a. 1.6 mm below the seating plane.

b. ESD capability for all pins HBM (Human Body Model) according to JEDEC JESD22-A114.

c. ESD capability for all pins MM (Machine Model) according to JEDEC JESD22-A115.

Electrical/Optical Characteristics

T_A = –40°C to +85°C, V_{CC} = 3.3V ± 5% or 5V ± 5%.

Parameter	Symbol	Min.	Typ.[a]	Max.	Unit	Condition	Reference
Optical Input Avg. Power Range (40 Mbaud Proprietary)	P_{IN-40}	–30	—	0	dBm	DR = 40 Mbaud	Notes [b, c, d]
Optical Input Avg. Power Range (50 Mbaud Proprietary)	P_{IN-50}	–27	—	0	dBm	DR = 50 Mbaud	Notes [b, c, e]
Optical Input Average Power Range (10BASE-FL)	P_{IN-10B}	–32.5	—	0	dBm	DR = 10 Mb/s (biphase-coded)	Notes [b, c, f]
Optical Spectrum Range	λ_{IN}	792	820	865	nm	Peak wavelength	
Data Rate	DR	0.1	—	50	Mbaud	—	Note [g]
Propagation Delay	t_{RD}	—	27	—	ns	P_{IN} = –20 dBm avg.	
Supply Voltage	V_{CC}	3.135	—	5.25	V	—	
Supply Current	I_{CC}	—	11	20	mA	R_L = 2 kΩ	
High Level Output Voltage	V_{OH}	2.4	V_{CC} – 0.3	V_{CC}	V	R_L = 2 kΩ	
Low Level Output Voltage	V_{OL}	—	0.2	0.4	V	R_L = 2 kΩ	
Output Rise Time (10–90%)	t_R	—	—	5	ns	C_L = 10 pF	Notes [b, d]
Output Fall Time (90–10%)	t_F	—	—	5	ns	C_L = 10 pF	Notes [b, d]
Pulse Width Distortion	PWD	–5	—	5	ns	P_{IN} = –30 dBm avg.	Note [d, h]
Total Jitter	TJ	—	—	15	ns	P_{IN} = –32.5 dBm avg.	Note [f]
RSSI Output Responsivity	I_{RSSI}/P_{IN}	0.3	0.65	0.9	A/W	—	Note [i]
Voltage at RSSI Output	V_{RSSI}	0	—	V_{CC} – 1	V	—	Note [i]

a. Typical data are at 25°C, V_{CC} = 5.0V.

b. In the recommended receiver circuit, with an optical signal from the recommended transmitter circuit, transmitted via 62.5/125-µm MM fiber.

c. Condition for sensitivity limit: Total Jitter ≤ 0.6 UI (unit intervals).

d. Verified with a PRBS7 signal with the mark ratio = ½ running at 40 Mbaud.

e. Verified with a PRBS7 signal with the mark ratio = ½ running at 50 Mbaud.

f. Verified with a jitter-free Manchester-coded pseudo random sequence running at 20 Mbaud (~10 Mb/s) as the optical input signal.

g. The device does not support DC operation. So any static low or high at the input will cause an undefined output signal.

h. The PWD is valid for the receiver only, assuming an ideal 50% duty cycle optical input signal. PWD = $PW_{OUT-AVG} – PW_{IN-AVG}$. Operation with an unbalanced pattern (mark ratio ≠ 1/2 or DC ≠ 50%) will cause a higher PWD than what is specified in this table.

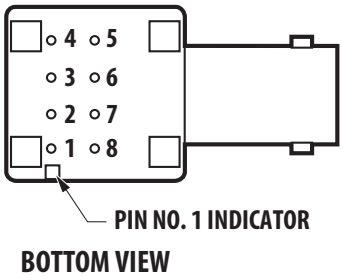
i. The RSSI current output has been verified with an external resistor R_{RSSI} = 2 kΩ.

Pin Description

Pin	Name	Function	Ref.
1	NC	NC	a
2	/DO	Data Out Inverted (CMOS/TTL logic)	b
3	VCC	5V/3.3V Supply Voltage	
4	NC	NC	a
5	NC	NC	a
6	RSSI	Received Signal Strength Indicator Output	
7	GND	Ground	
8	NC	NC	a

a. Pins 1, 4, 5 and 8 are connected together internally. The metal port option components (suffix MZ) have an internal electrical connection between the metal port and the four grounding pins.

b. The data output provides an inverted signal, thus an electrical low in case of light on and vice versa.



Recommended Receiver Circuitry

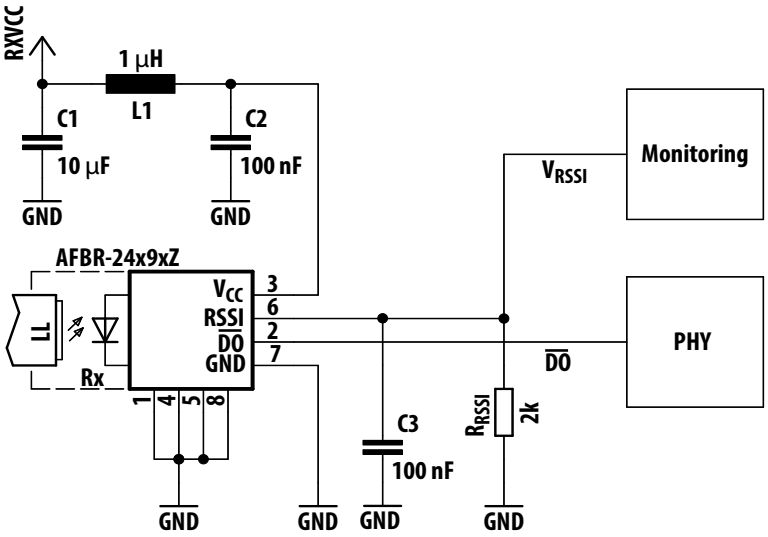


Figure 1: Typical RSSI Output Voltage across R_{RSSI} = 2 kΩ

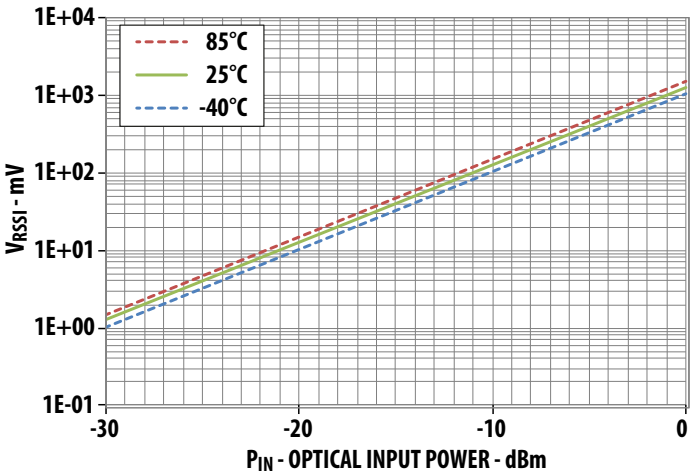
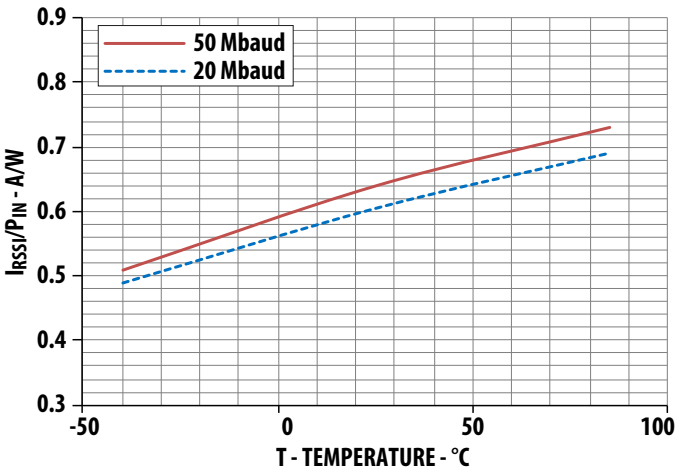


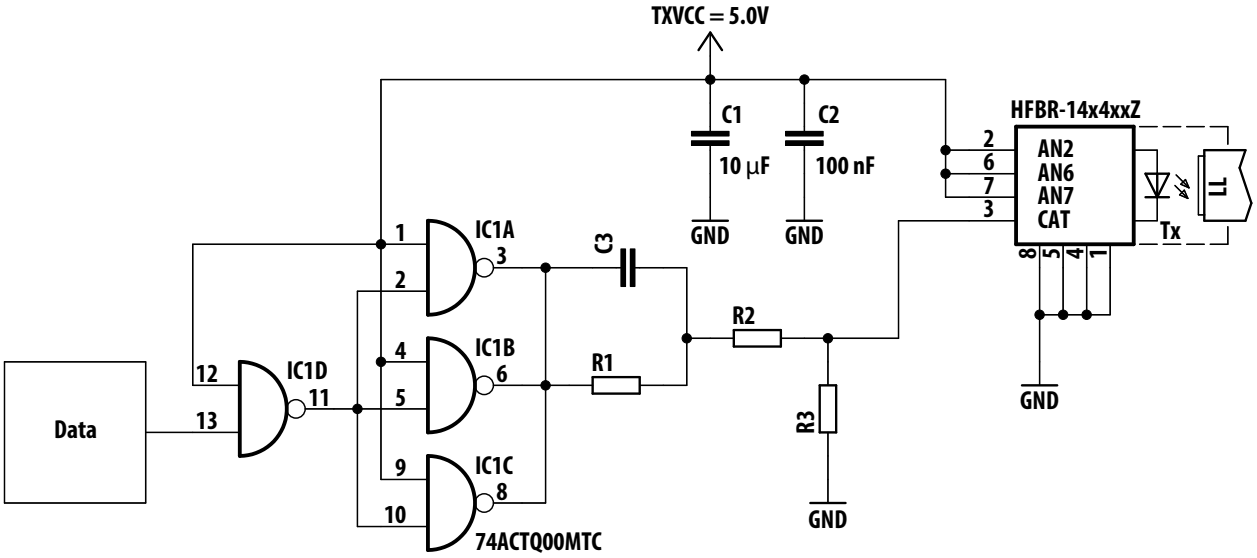
Figure 2: Typical Responsivity vs. Temperature



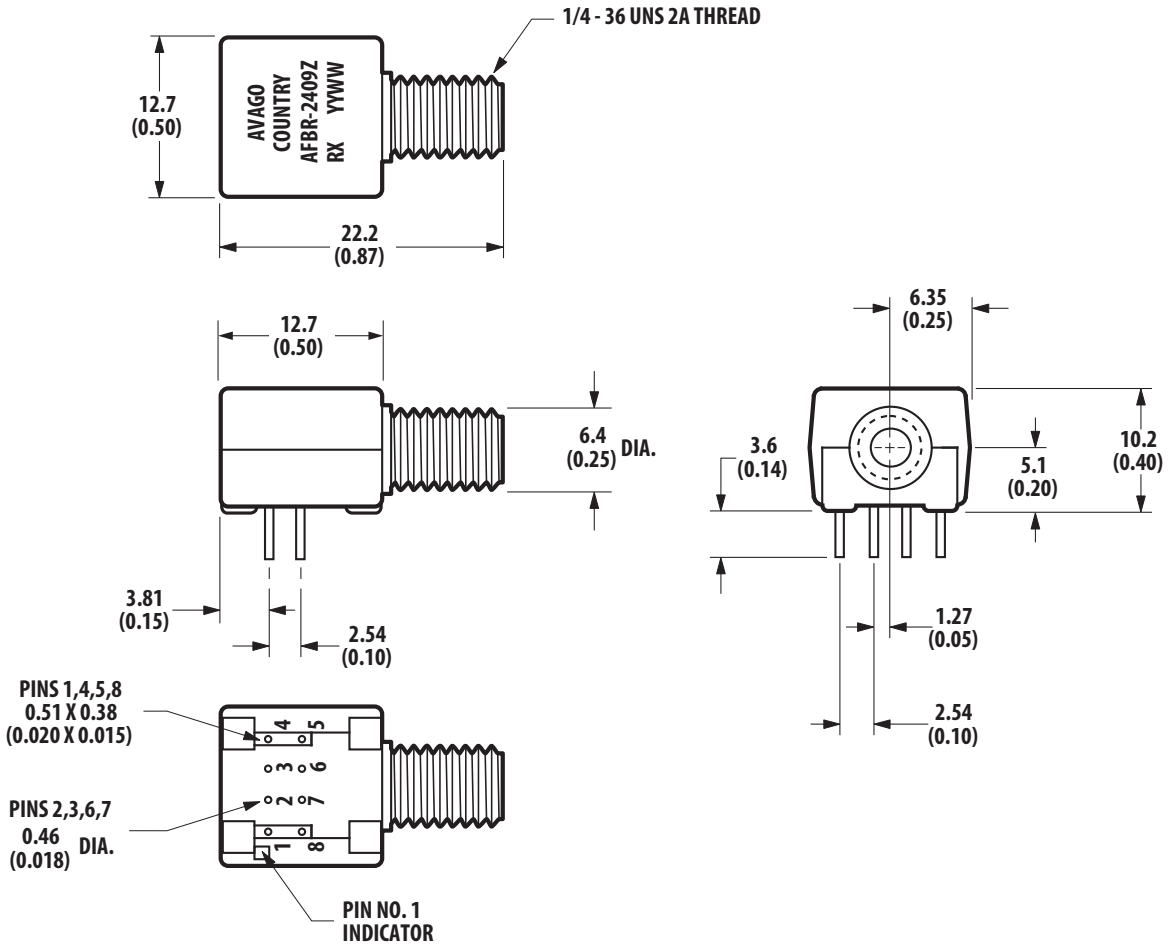
NOTE: To provide a suitable monitoring voltage, choose the R_{RSSI} value according to the particular optical power situation. For the characterization of the responsivity, 2 kΩ was used. The lower the power, the higher the resistor value should be. Do not, however, override the maximum V_{RSSI} limit.

Recommended Transmitter Driver Circuitry Using HFBR-14x4xxZ

Transmitter	R1	R2	R3	C3
HFBR-14x4xxZ	33Ω	33Ω	270Ω	75 pF



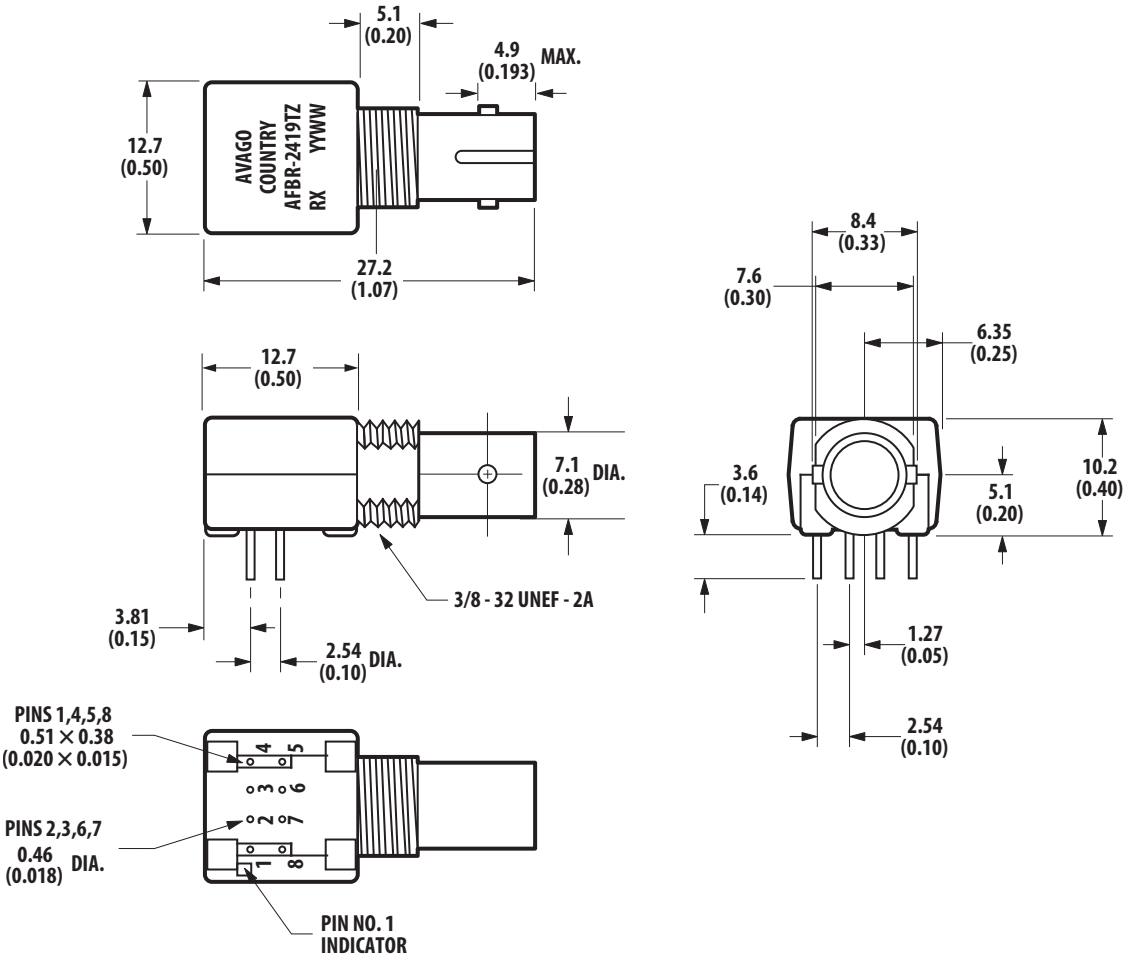
Mechanical Dimensions – SMA Port (AFBR-2409Z)



NOTE:

- Dimensions are in millimeters (inches).
- A finished hole diameter of at least 1.02 mm (0.04 in.) is recommended for all eight pins to ensure smooth mounting on the PCB.

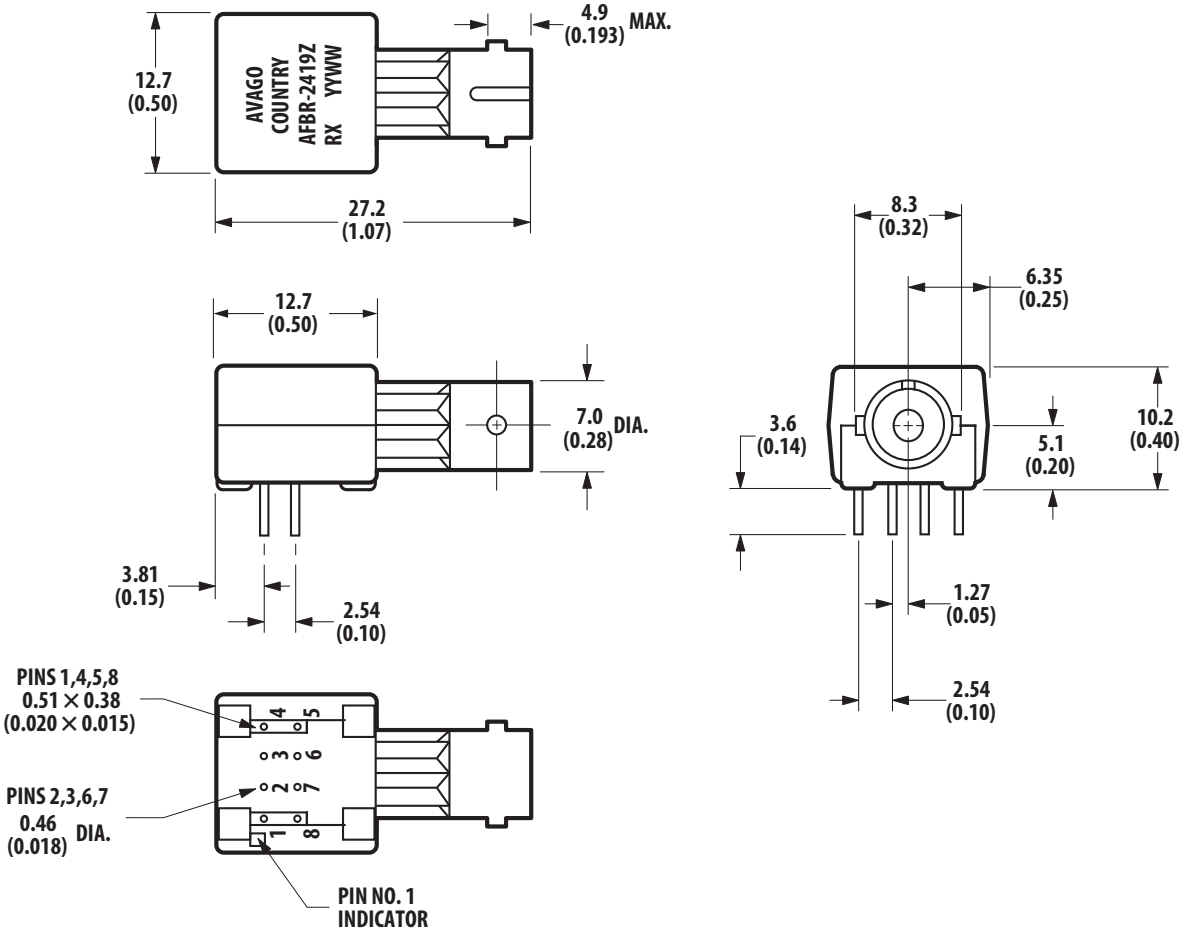
Mechanical Dimensions – Threaded ST Port (AFBR-2419TZ)



NOTE:

- Dimensions are in millimeters (inches).
- A finished hole diameter of at least 1.02 mm (0.04 in.) is recommended for all eight pins to ensure smooth mounting on the PCB.

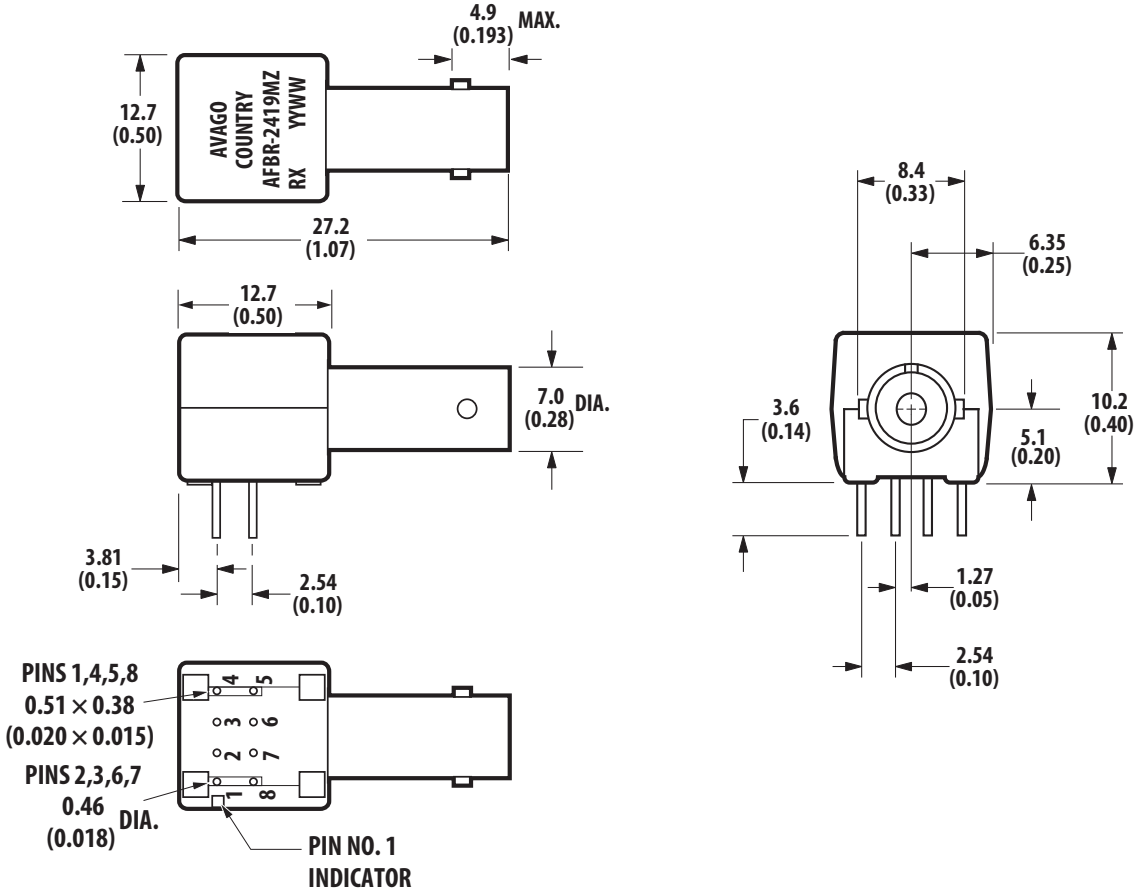
Mechanical Dimensions – ST Port (AFBR-2419Z)



NOTE:

- Dimensions are in millimeters (inches).
- A finished hole diameter of at least 1.02 mm (0.04 in.) is recommended for all eight pins to ensure smooth mounting on the PCB.

Mechanical Dimensions – Metal ST Port (AFBR-2419MZ)



NOTE:

- Dimensions are in millimeters (inches).
- A finished hole diameter of at least 1.02 mm (0.04 in.) is recommended for all eight pins to ensure smooth mounting on the PCB.

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