

# AFBR-24x9xZ

## 50 MBd Miniature Link Fiber Optic Receiver



## Data Sheet



### Description

The AFBR-24x9Z series components provide cost effective, high performance fiber optic communication links for information systems and industrial applications with link distances of up to 3 km. The receivers are directly compatible with popular “industry-standard” connectors: ST® and SMA. They are designed for use with 62.5/125  $\mu\text{m}$  multi mode fiber.

### 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

### Link Length

Data Rate (MBd)	Max. Distance (m)	Fiber Size ( $\mu\text{m}$ )	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

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

### Features

- RoHS-compliant
- Works with Avago HFBR-14xxZ (820 nm LED) transmitter
- Data transmission at signal rates from 100 kBd up to 50 MBd
- Receiver: Integrated PIN diode and digitalizing IC with CMOS/TTL output logic
- Up to 3 km distance with Multimode Glass Fiber Cable
- Operating temperature range of -40 °C to +85 °C
- Compatible with 10Base-FL standard
- 3.3 V and 5 V supply voltage operation
- RSSI output

### Applications

- Optical transmission from 100 kBd up to 50 MBd
- Industrial control and factory automation
- High voltage isolation
- Elimination of ground loops
- Reduces 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, TZ) are easily identified by the dark grey color connector port. A metal port option is also available (suffix MZ). The metal port option components have an internal electrical connection between the metal port and the four grounding pins, as shown in the package outline drawing. 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 a plug covering the optics. These caps/plugs will 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 often is sufficient to remove particles of dirt; methanol on a cotton swab also works well.

## AFBR-24x9xZ Low-Cost 50 MBd Receiver

### Description

The AFBR-24x9xZ fiber optic receiver is designed to operate with the Avago Technologies HFBR-14xZ fiber optic transmitters and multimode glass fiber cable. Consistent coupling into the receiver is assured by the optical system with lens. The receiver output is a digital CMOS/TTL signal. The AFBR-24x9xZ receiver contains an IC with integrated photodiode which directly converts the incoming optical signal to a digital output signal without the requisite for 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 is achievable. The data rate typically goes from 100 kBd to 50 MBd. 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 parts. The use of a single 100 nF capacitor for signal smoothing is sufficient in most common applications, as shown in the Recommended Receiver Circuitry section on page 4. 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 <sub>S</sub>	-40	+85	°C	
Operating Temperature	T <sub>A</sub>	-40	+85	°C	
Supply Voltage	V <sub>CC</sub>	-0.3	5.5	V	
Maximum DC Output Current	I <sub>O</sub>		10	mA	
Voltage at RSSI Output	V <sub>RSSI</sub>	-0.3	V <sub>CC</sub> +0.3	V	
Lead Soldering Cycle - Temp	T <sub>SOLD</sub>		260	°C	Note 1
Lead Soldering Cycle - Time	t <sub>SOLD</sub>		10	s	Note 1
Electrostatic Discharge Voltage Capability	ESD <sub>HBM</sub>		2000	V	Note 2
Electrostatic Discharge Voltage Capability	ESD <sub>MM</sub>		400	V	Note 3

Note:

1. 1.6 mm below seating plane.
2. ESD capability for all pins HBM (Human Body Model) according to JEDEC JESD22-A114.
3. ESD capability for all pins MM (Machine Model) according to JEDEC JESD22-A115.

## Electrical/Optical Characteristics

-40 °C to +85 °C, 3.135 V < V<sub>CC</sub> < 5.25 V

Parameter	Symbol	Min	Typ <sup>[1]</sup>	Max	Unit	Condition	Reference
Optical Input Avg. Power Range (40 MBd proprietary)	P <sub>IN-40</sub>	-30		0	dBm	DR = 40 MBd	Notes 2,3,4
Optical Input Avg. Power Range (50 MBd proprietary)	P <sub>IN-50</sub>	-27		0	dBm	DR = 50 MBd	Notes 2,3,5
Optical Input Average Power Range (10Base-FL)	P <sub>IN-10B</sub>	-32.5		0	dBm	DR = 10 Mbps (biphase-coded)	Notes 2,3,6
Optical Spectrum Range	λ <sub>IN</sub>	792	820	865	nm	peak wavelength	
Data Rate	DR	0.1		50	MBd		Note 7
Propagation Delay	t <sub>RD</sub>		27		ns	P <sub>IN</sub> = -20 dBm avg.	
Supply Voltage	V <sub>CC</sub>	3.135		5.25	V		
Supply Current	I <sub>CC</sub>		11	20	mA	R <sub>L</sub> = 2 kΩ	
High Level Output Voltage	V <sub>OH</sub>	2.4	V <sub>CC</sub> -0.3	V <sub>CC</sub>	V	R <sub>L</sub> = 2 kΩ	
Low Level Output Voltage	V <sub>OL</sub>		0.2	0.4	V	R <sub>L</sub> = 2 kΩ	
Output Rise Time (10-90%)	t <sub>R</sub>			5	ns	C <sub>L</sub> = 10 pF	Notes 2,4
Output Fall Time (90-10%)	t <sub>F</sub>			5	ns	C <sub>L</sub> = 10 pF	Notes 2,4
Pulse Width Distortion	PWD	-5		5	ns	P <sub>IN</sub> = -30 dBm avg.	Note 4,9
Total Jitter	TJ			15	ns	P <sub>IN</sub> = -32.5 dBm avg.	Note 6
RSSI Output Responsivity	I <sub>RSSI</sub> /P <sub>IN</sub>	0.3	0.65	0.9	A/W		Note 8
Voltage at RSSI Output	V <sub>RSSI</sub>	0		V <sub>CC</sub> -1	V		Note 8

Notes:

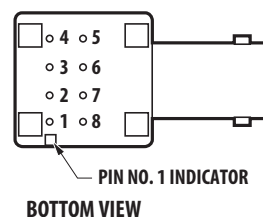
1. Typical data are at 25 °C, V<sub>CC</sub> = 5.0 V.
2. In recommended receiver circuit, with an optical signal from the recommended transmitter circuit, transmitted via 62.5/125 μm MM fiber.
3. Condition for sensitivity limit: Total Jitter ≤ 0.6 UI (unit intervals).
4. Verified with a PRBS7 signal with mark ratio = ½ running at 40 MBd.
5. Verified with a PRBS7 signal with mark ratio = ½ running at 50 MBd.
6. Verified with a jitter-free Manchester coded pseudo random sequence running at 20 MBd (~10 Mbit/s) as optical input signal.
7. The device does not support DC operation. Hence any static low or high at the input will cause an undefined output signal.
8. The RSSI current output has been verified with an external resistor R<sub>RSSI</sub>=2 kΩ
9. The PWD is valid for the receiver only, assuming an ideal 50% duty cycle optical input signal. PWD = P<sub>WOUT-AVG</sub> - P<sub>WIN-AVG</sub>  
Operation with unbalanced pattern (mark ratio ≠ 1/2 or DC ≠ 50%) will cause a higher PWD than what is specified in this table.

## Pin Description

Pin	Name	Function	Reference
1	NC	NC	1
2	/D <sub>O</sub>	Data Out inverted (CMOS/TTL logic)	2
3	V <sub>CC</sub>	5V/3.3V Supply Voltage	
4	NC	NC	1
5	NC	NC	1
6	RSSI	Received Signal Strength Indicator Output	
7	GND	Ground	
8	NC	NC	1

Notes

1. 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
2. The data output provides an inverted signal, thus an electrical low in case of light on and vice versa.



## Recommended Receiver Circuitry

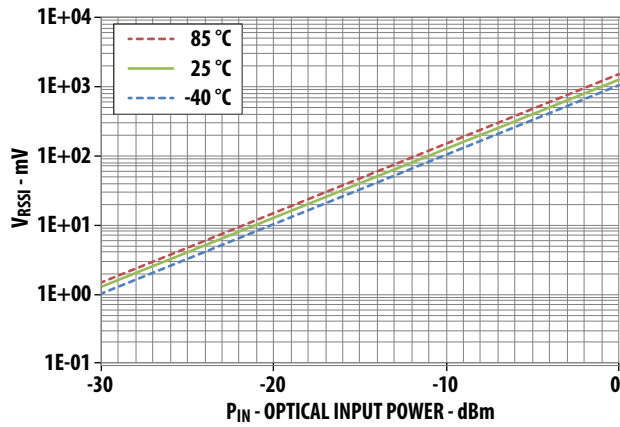
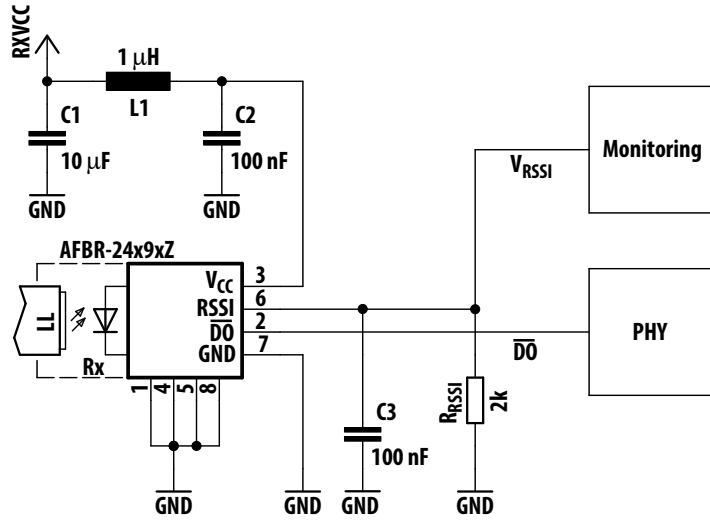


Figure 1. Typical RSSI output voltage across  $R_{RSSI} = 2\text{ k}\Omega$

Note:

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

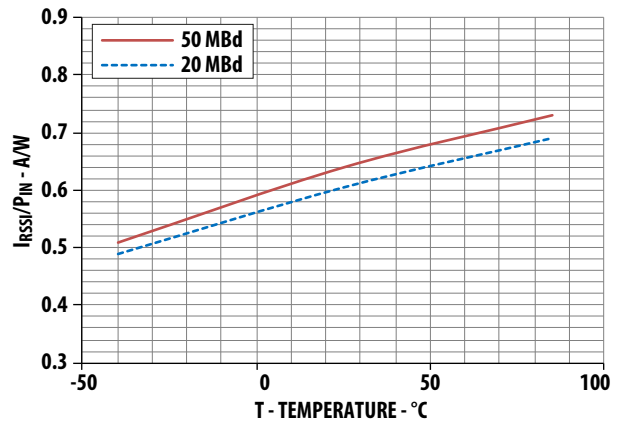
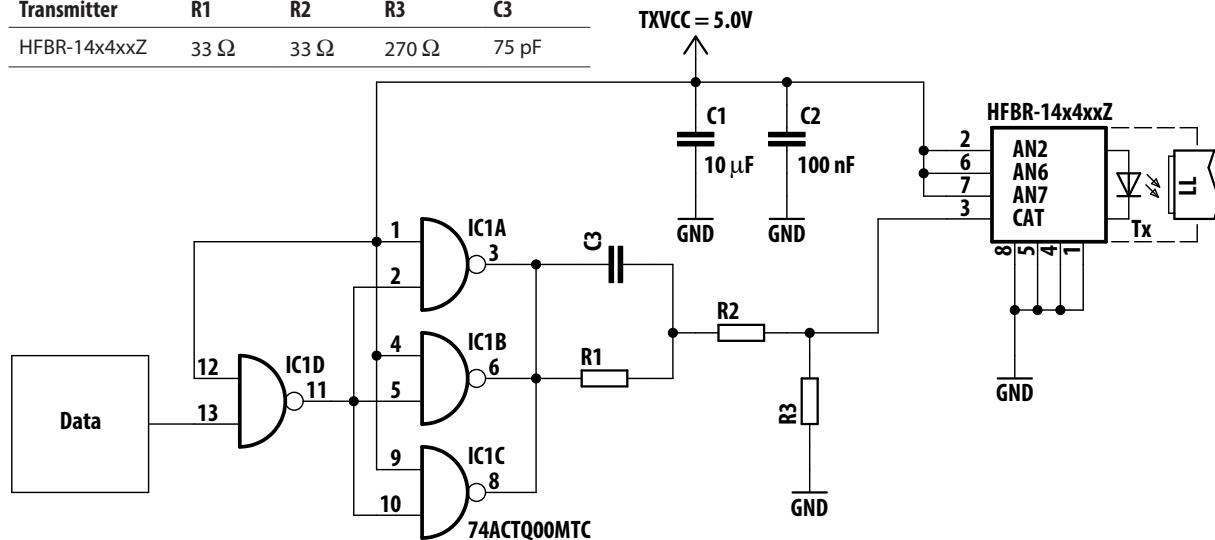


Figure 2. Typical Responsivity vs. Temperature

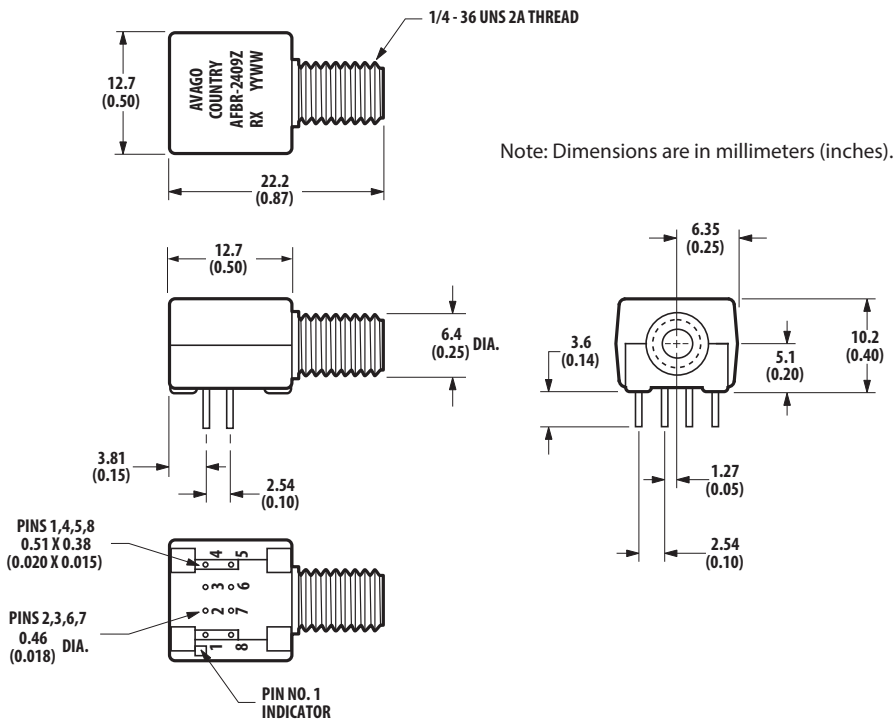
## Recommended Transmitter Driver Circuitry using HFBR-14x4xxZ

Transmitter	R1	R2	R3	C3
HFBR-14x4xxZ	33 $\Omega$	33 $\Omega$	270 $\Omega$	75 pF



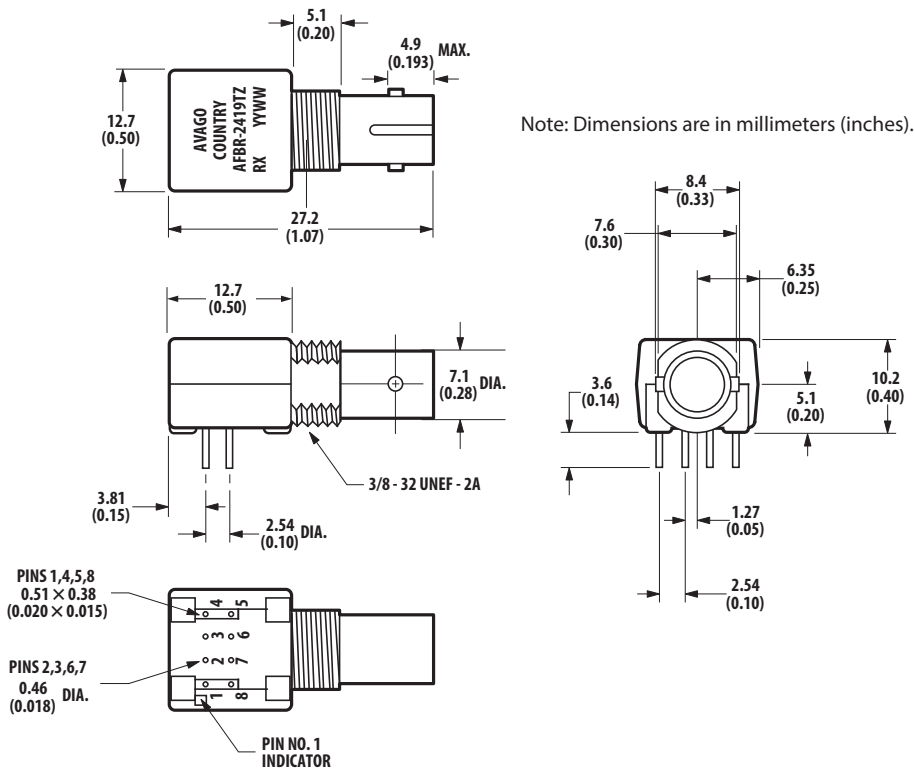
## Mechanical Dimensions – SMA Port

### AFBR-2409Z



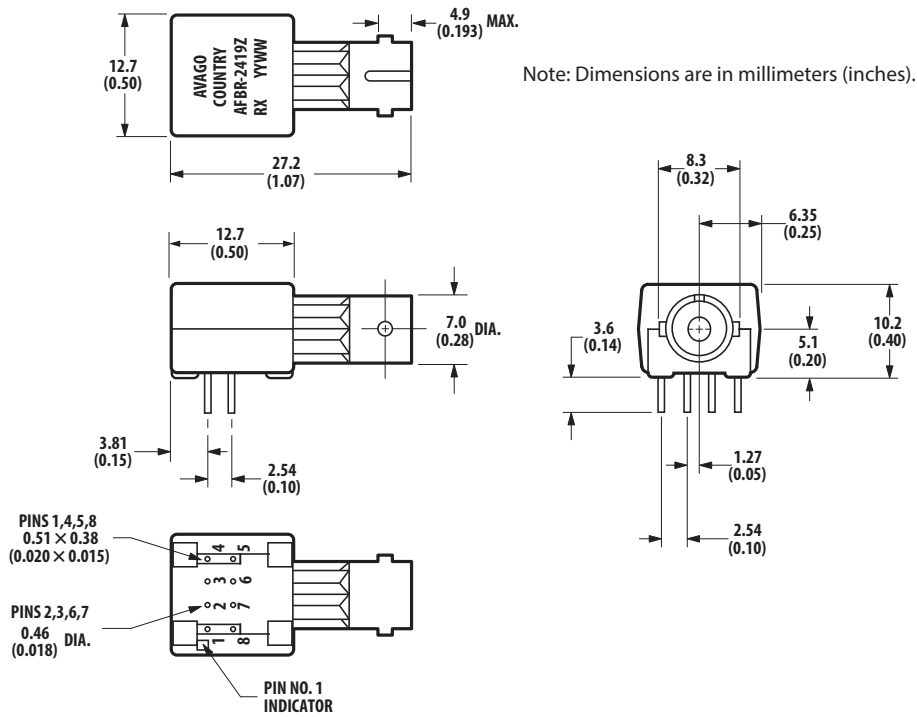
## Mechanical Dimensions – Threaded ST Port

### AFBR-2419TZ



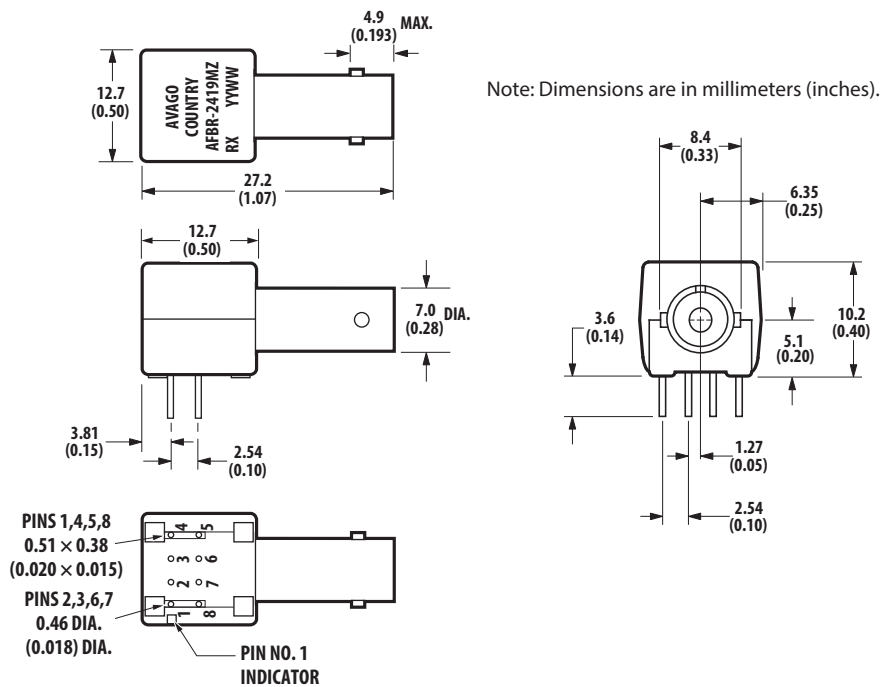
## Mechanical Dimensions – ST Port

### AFBR-2419Z



## Mechanical Dimensions – Metal ST Port

### AFBR-2419MZ



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