Data Sheet

AFBR-24x8xZ

DC to 50-Mbaud Miniature Link Fiber-Optic Receiver

Description

The Broadcom® AFBR-24x8xZ receivers are designed to provide cost-effective, high-performance, fiber optic communication links for information systems and industrial applications with link distances up to 2 km. The receivers are directly compatible with the popular “industry-standard” connectors ST and SMA. They are designed for use with 50/125-µm, 62.5/125-µm, and 200-µm multimode fiber.

Table 1: AFBR-24x8xZ Available Part Numbers

Part Number	Description
AFBR-2408Z	Receiver with SMA port
AFBR-2418Z	Receiver with ST port
AFBR-2418TZ	Receiver with threaded ST port
AFBR-2418MZ	Receiver with metal ST port

Table 2: Link Length[a]

Data Rate (Mbaud)	Max. Distance (m)	Fiber Size (µm)	Transmitter
50	900	50/125	HFBR-1414Z
50	2000	62.5/125	HFBR-1414Z
50	100	200	HFBR-1414Z

a. The link lengths were verified with a PRBS7 pattern using an HFBR-1414Z transmitter, respecting its worst case LOP conditions but assuming a proper fiber connection (direct connection without additional connectors). Multiple or weak connections might reduce the achievable link length.

Features

- RoHS compliant
- Designed to operate with the Broadcom HFBR-14xxZ (820-nm LED) transmitters
- Data transmission at signal rates from DC up to 50 Mbaud
- Receiver: Integrated PIN diode and digitalizing IC with CMOS/TTL output logic
- Up to a 2-km distance with a multimode glass fiber cable
- Operating temperature range of –40°C to +85°C
- 3.3V and 5V supply voltage operation
- RSSI output

Applications

- Optical transmission from DC 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

Package

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 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

Each part comes with a protective port cap or plug that covers the optics. These caps/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-24x8xZ Low-Cost 50-Mbaud Receiver

The AFBR-24x8xZ fiber optic receiver is designed to operate with the Broadcom HFBR-14xxZ fiber optic transmitters and a multimode glass fiber cable. Consistent coupling into the receiver is assured by the optical system and lens. The receiver output is a digital CMOS/TTL signal. The AFBR-24x8xZ 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 a high sensitivity over temperature are achievable. The data rate typically goes from DC 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 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	Notes
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	1.6 mm below the seating plane
Lead Soldering Cycle – Time	t_{SOLD}	—	10	seconds	

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	Notes
Optical Input Peak Power Range (50 Mbaud proprietary)	P_{IN-50}	–24	—	+1	dBm	DR = 50 Mbaud	b, c, d
Optical Spectrum Range	λ_{IN}	792	820	865	nm	Peak wavelength	
Data Rate	DR	DC	—	50	Mbaud	—	
Supply Current	I_{CC}	—	20	30	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	b, d
Output Fall Time (90–10%)	t_F	—	—	5	ns	C_L = 10 pF	b, d
Pulse Width Distortion	PWD	–4	—	+4	ns	—	d, e
Pulse Width Distortion 1st to 3rd Pulse	PWD_{INIT}	–5	—	+8	ns	—	e, f, g
Propagation Delay	t_{RD}	—	—	40	ns	—	e
RSSI Output Responsivity	I_{RSSI}/P_{IN}	—	0.72	—	A/W	—	h
Voltage at RSSI Output	V_{RSSI}	0	—	V_{CC} – 1	V	—	
PoR_disable Delay Time	t_{PoR_dis}	—	10	15	ms	—	i

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

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

c. Condition for sensitivity limit: Total jitter ≤ 0.6 UI (unit intervals). The sensitivity was characterized by using the HFBR-1414Z transmitter, an optical attenuator for the particular power setting, and a short piece of fiber (a few meters). Using long-fiber connections up to the maximum link length, as specified in Table 2, Link Length, might reduce the sensitivity.

d. Verified using a PRBS7 signal with a mark ratio = ½ running at 50 Mbaud (in this case, the optical input average power levels are 3dB less than the specified peak power levels).

e. The AFBR-24x8xZ is an inverting receiver; hence a logic high at the input (light on) causes a logic low at the electrical data output. Respectively, a rising input edge causes a falling output edge and vice versa.

f. If the data rate were below 1 Mbaud, the pulse width distortion would be equal to the pulse width distortion of the 1st to 3rd pulses for higher data rates.

g. The threshold of the 1st pulse of a data sequence is difficult to adjust, and therefore the pulse width distortion up to the 3rd pulse is higher than for all other pulses (worst case for the 1st pulse). This strongly depends on the quality of the rising and falling edges of the optical input. The faster the edges, the smaller the pulse width variation. Furthermore, lower data rates result in the same issue because all pulses become 1st pulses.

h. Verified with an external resistor R_{RSSI} = 2 kΩ.

i. A power-on reset (PoR) is implemented to ensure stable output levels when switching the supply voltage (V_{CC}), as illustrated in Figure 3. When the PoR is enabled/active, both receiver outputs (/DO, RSSI) are forced to Low. Once the supply voltage level reaches approximately 2.8V during the V_{CC} ramp-up phase, it takes up to 15 ms (t_{PoR_dis}) to deactivate/disable the PoR. In the V_{CC} ramp-down phase, the outputs are forced to Low without a delay once the supply voltage falls below approximately 2.6V.

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

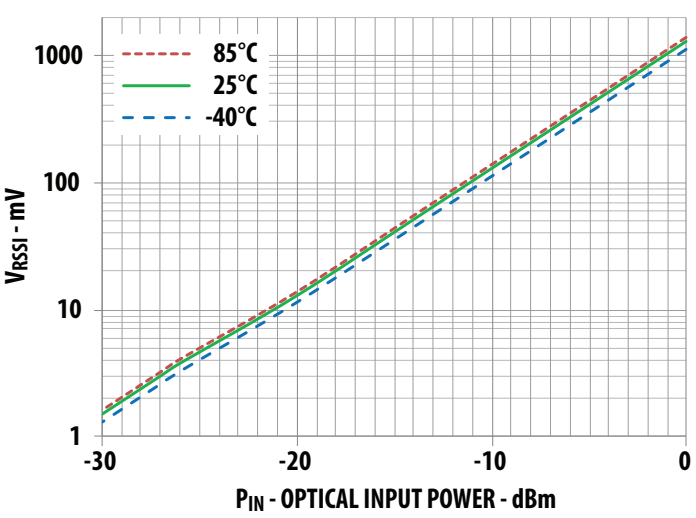
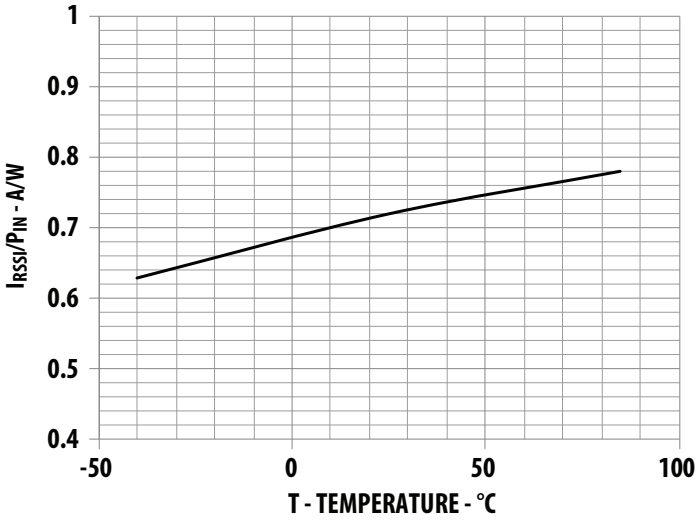
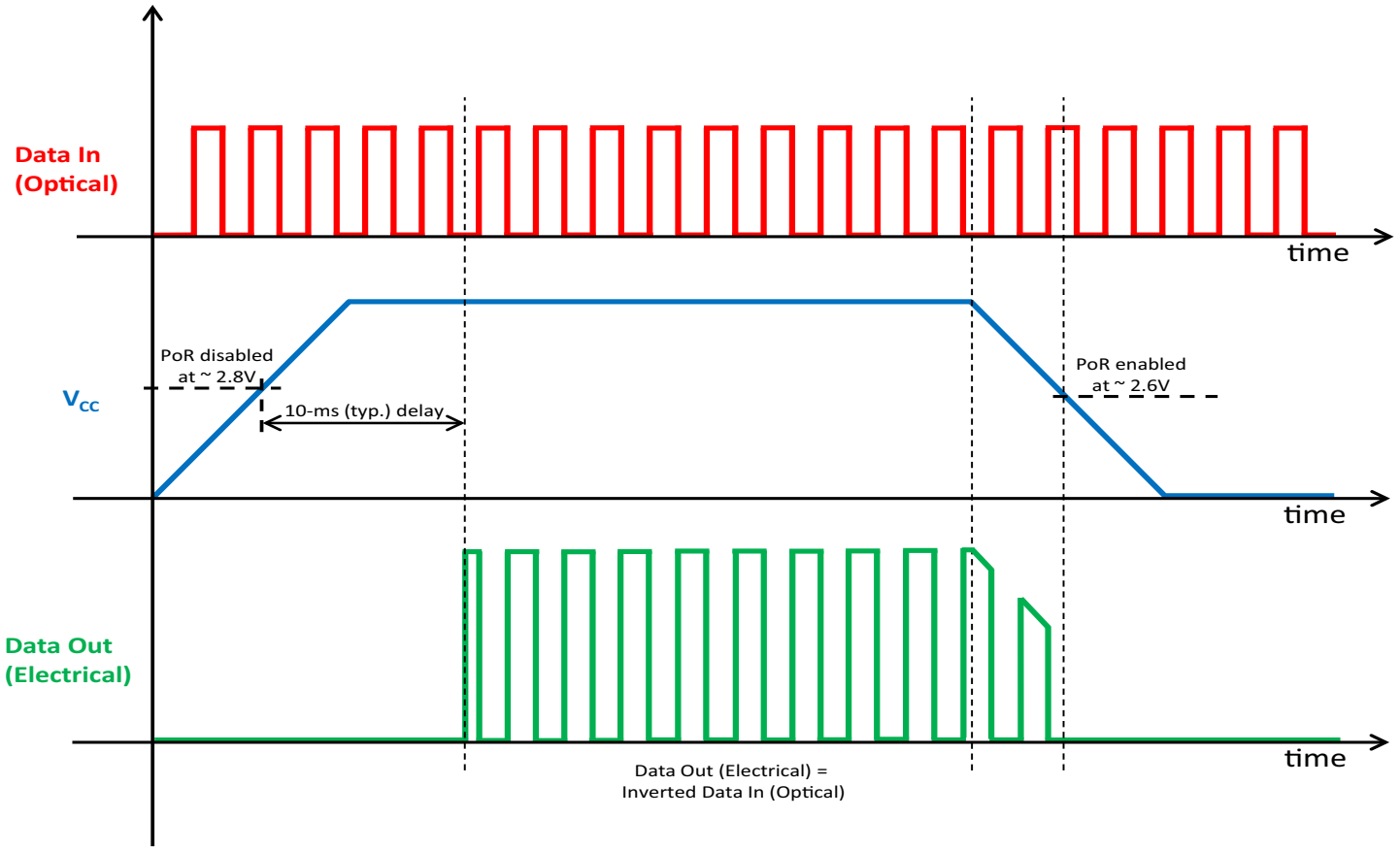


Figure 2: Typical Responsivity vs. Temperature



NOTE: To provide a suitable monitoring voltage, choose the value of R_{RSSI} 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 limit of V_{RSSI}.

Figure 3: Typical PoR Characteristics

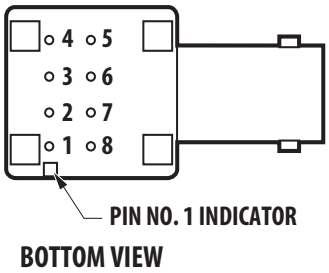


Pin Description

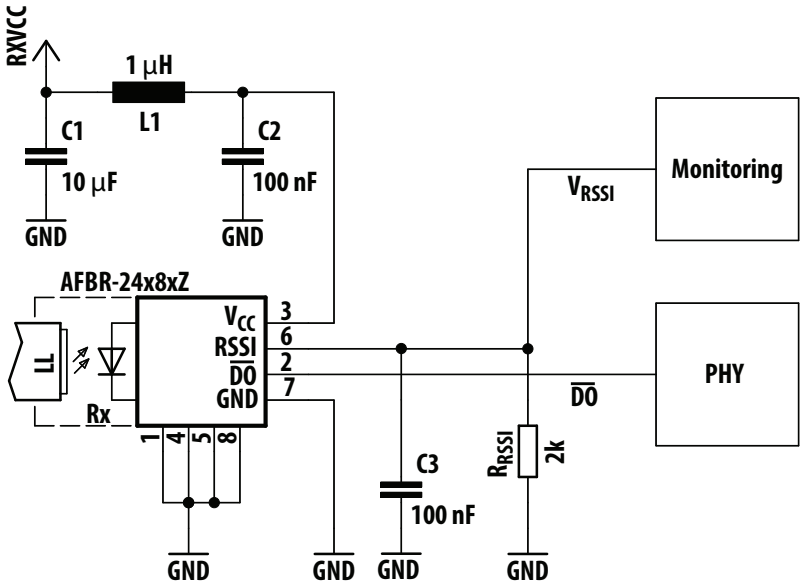
Pin	Name	Function	Notes
1	NC	Not Connected	a
2	/DO	Data Out inverted (CMOS/TTL logic)	b
3	VCC	5V/3.3V Supply Voltage	
4	NC	Not Connected	a
5	NC	Not Connected	a
6	RSSI	Received Signal Strength Indicator Output	
7	GND	Ground	
8	NC	Not Connected	a

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.

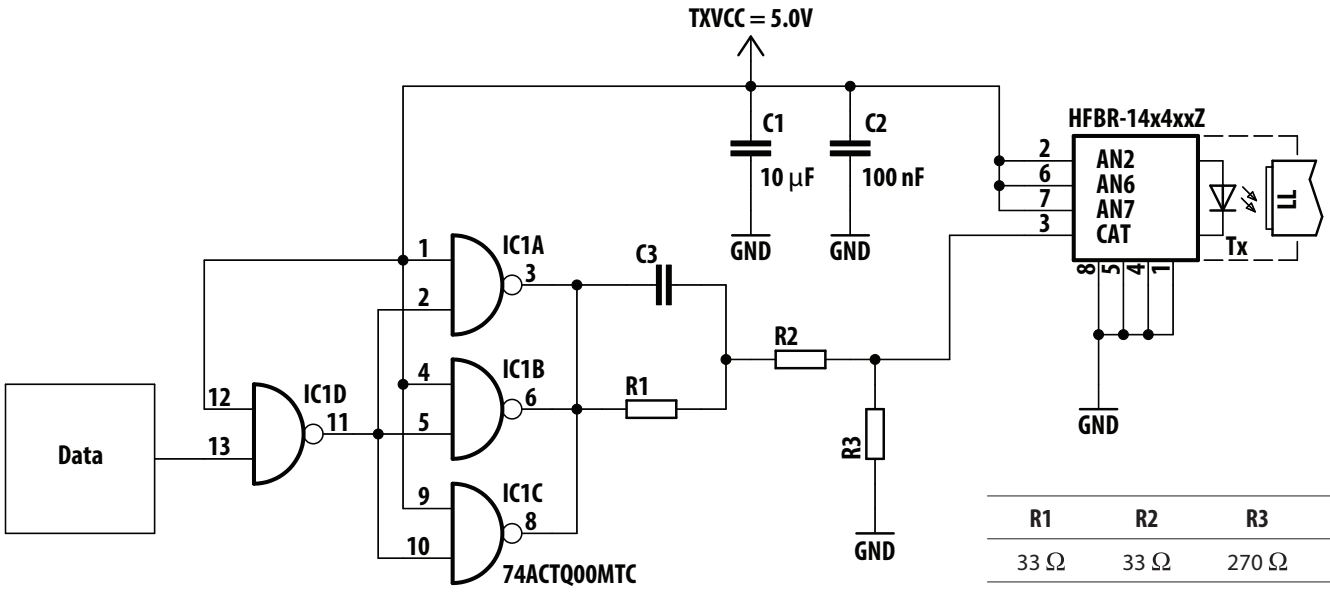
b. The data output provides an inverted signal, thus an electrical low in the case of light on and vice versa.



Recommended Circuitry

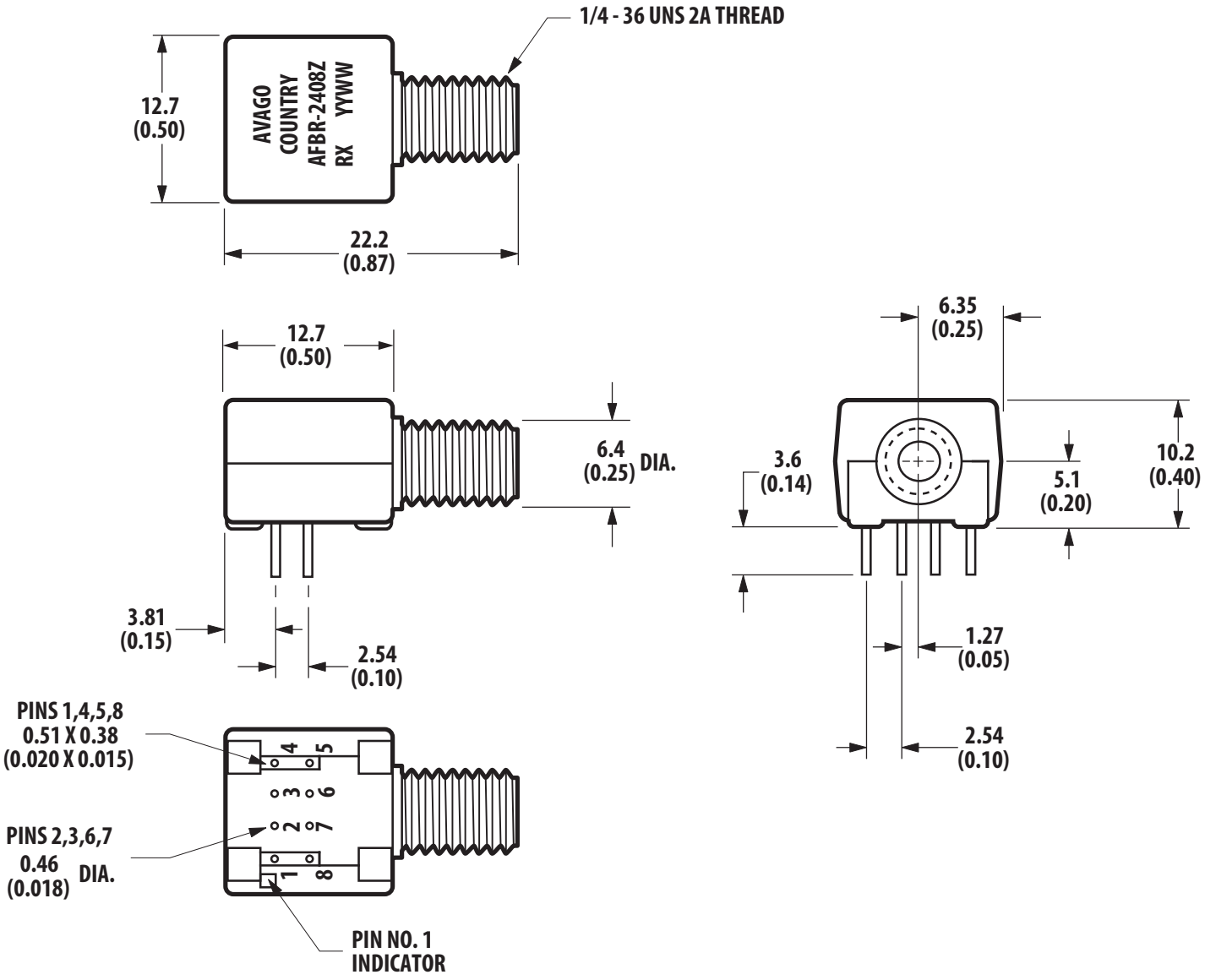


Recommended Transmitter Driver Circuitry for AFBR-24x8xZ Receivers Using the HFBR-14x4xxZ



R1	R2	R3	C3
33 Ω	33 Ω	270 Ω	75 pF

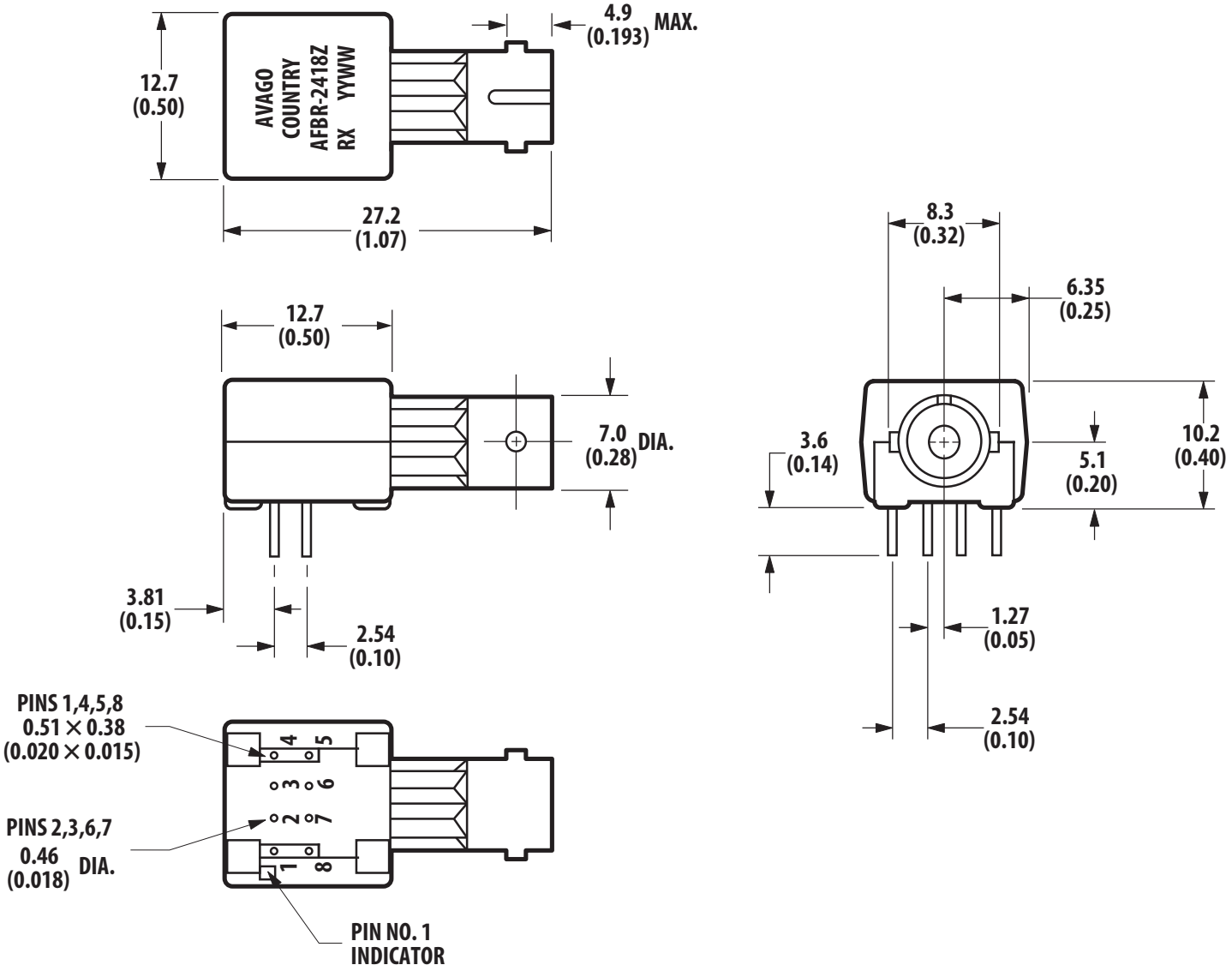
Mechanical Dimensions – SMA Port (AFBR-2408Z)



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.

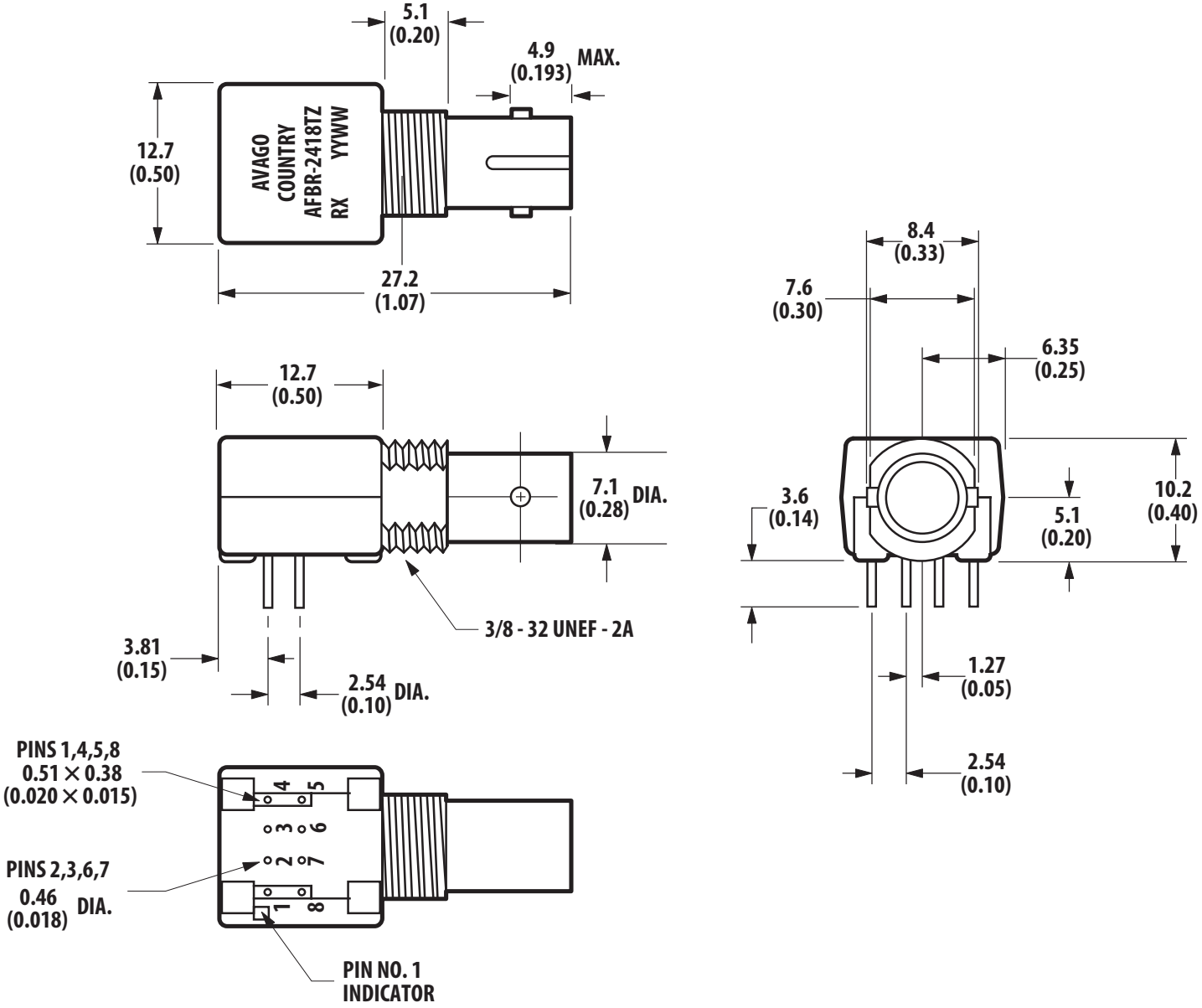
Mechanical Dimensions – ST Port (AFBR-2418Z)



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.

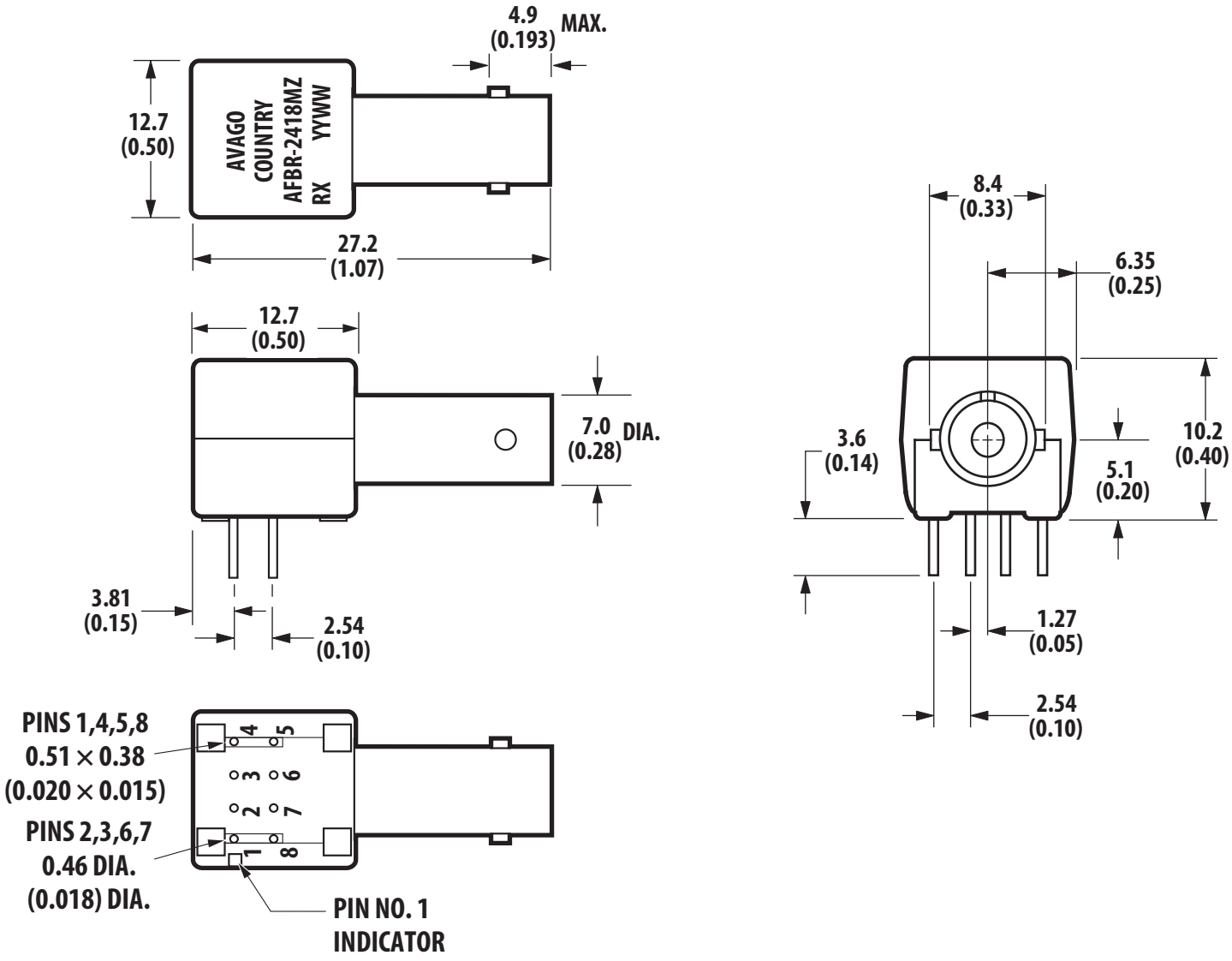
Mechanical Dimensions – Threaded ST Port (AFBR-2418TZ)



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-2418MZ)



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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