25 MHz Low Cost Fiber Optic Receiver

Technical Data

HFBR-24X4 Series

Description

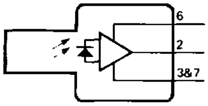
The HFBR-24X4 fiber optic receiver is designed to operate with the Hewlett-Packard HFBR-14XX fiber optic transmitters and 50/125 µm, 62.5/125 µm, and 100/140 µm fiber optic cable. Consistent coupling into the receiver is assured by the lensed optical system (Figure 1). Response does not vary with fiber size.

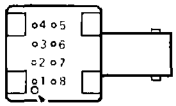
The receiver output is an analog signal that can be optimized for a variety of distance/data rate requirements. Low-cost external components can be used to convert the analog output to logic compatible signal levels for various data formats and data rates up to 35 MBaud. This distance/data rate tradeoff results in increased optical power budget at lower data rates which can be used for additional distance or splices.

The HFBR-24X4 receiver contains a PIN photodiode and low noise transimpedance pre-amplifier integrated circuit with an inverting output (see note 3). The HFBR-24X4 receives an optical signal and converts it to an analog voltage. The output is a buffered emitter-follower. Because the signal amplitude from the HFBR-24X4 receiver is much larger than from a simple PIN photodiode, it is less susceptible to EMI, especially at high signal rates. A receiver dynamic range of 15 dB over temperature is achievable (assuming 10^{-9} BER). For very noisy environments, the conductive port option is recommended.

The frequency response is typically dc to 25 MHz. Although the HFBR-24X4 is an analog receiver, it is easily made compatible with digital systems. Please refer to Application Bulletin 73 for simple and inexpensive circuits that operate up to 35 MBd.

Housed Product





BOTTOM VIEW

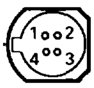
PIN 1 INDICATOR

PIN	FUNCTION
1†	N.C.
2	SIGNAL
3*	COMMON
4†	N.C.
5†	N.C.
6	V_{CC} (5 V)
7*	COMMON
8†	N.C.

*PINS 3 AND 7 ARE ELECTRICALLY CONNECTED TO HEADER

†PINS 1, 4, 5, AND 8 ARE ELECTRICALLY CONNECTED

Unhoused Product

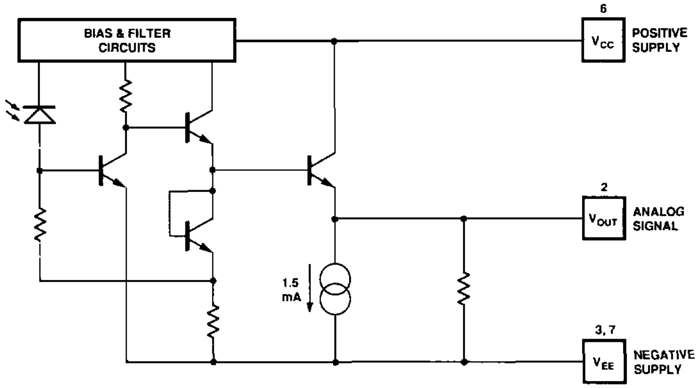


BOTTOM VIEW

PIN	FUNCTION
1	SIGNAL
2	COMMON
3	V_{CC} (5 V)
4	COMMON

***CAUTION:** The small junction sizes inherent to the design of this component increases the component's susceptibility to damage from electrostatic discharge (ESD). It is advised that normal static precautions be taken in handling and assembly of this component to prevent damage and/or degradation which may be induced by ESD.*

Simplified Schematic Diagram



Absolute Maximum Ratings

Parameter		Symbol	Min.	Max.	Units	Reference
Storage Temperature		T_S	–55	+85	°C	
Operating Temperature		T_A	–40	+85	°C	
Lead Soldering Cycle	Temp.			+260	°C	Note 1
	Time			10	sec	
Signal Pin Voltage		V_{SIGNAL}	–0.5	1	V	
Supply Voltage		V_{CC}	–0.5	7.0	V	

Electrical / Optical Characteristics –40°C to +85°C; 4.75 V ≤ V_{CC} ≤ 5.25 V; R_{LOAD} = 511 Ω; Fiber sizes with core diameter ≤ 100 µm, and N.A. ≤ 0.35 unless otherwise specified.

Parameter	Symbol	Min.	Typ.[5]	Max.	Units	Conditions	Reference
Responsivity	R_P	5.1	7	10.9	mV/µW	T_A = 25°C @ 820 nm	Figure 14
		4.6		12.3	mV/µW		
RMS Output Noise Voltage	V_{NO}		0.30	0.36	mV	T_A = 25°C, P_R = 0 µW	Figure 15
				0.43	mV	P_R = 0 µW	
Equivalent Optical Noise Input Power (RMS)	P_N		–43.7	–40.3	dBm		
			0.042	0.094	µW		
Peak Input Power	P_R			–12.6	dBm	T_A = 25°C	Note 2
				55	µW		
				–14	dBm		
				40	µW		
Output Impedance	Z_O		20		Ω	Test Frequency = 20 MHz	
DC Output Voltage	V_{odc}		0.7		V	P_R = 0 µW	Note 3
Power Supply Current	I_{CC}		3.4	6.0	mA	R_{LOAD} = ∞	
Equivalent N.A.	NA		0.35				
Equivalent Diameter	D_R		250		µm		Note 4

Dynamic Characteristics

–40°C to +85°C; 4.75 V ≤ V_{CC} ≤ 5.25 V; R_{LOAD} = 511 Ω, C_{LOAD} = 13 pF unless otherwise specified.

Parameter	Symbol	Min.	Typ.[5]	Max.	Units	Conditions	Reference
Rise/Fall Time, 10% to 90%	t_r, t_f		14	19.5	ns	T_A = 25°C P_R = 10 µW Peak	Note 6
				26	ns		
Pulse Width Distortion	$t_{phl} - t_{plh}$			2	ns	P_R = 40 µW Peak	
Overshoot			10		%	T_A = 25°C	Note 7
Bandwidth (Electrical)	BW_e		25		MHz	–3 dB Electrical	
Power Supply Rejection Ratio (Referred to Output)	PSRR		50		dB	at 1 MHz	Figure 16 Note 8
Bandwidth - Rise Time Product			0.35		Hz · s		

Notes:

1. 2.0 mm from where leads enter case.
2. If P_R > 40 µW, then pulse width distortion may increase. At P_{in} = 80 µW and T_A = 85°C, some units have exhibited as much as 100 ns pulse width distortion.
3. $V_{OUT} = V_{ODC} - (R_P \times P_R)$.
4. D_R is the effective diameter of the detector image on the plane of the fiber face. The numerical value is the product of the actual detector diameter and the lens magnification.
5. Typical specifications are for operation at T_A = 25°C and V_{CC} = 5.0 V.
6. Input optical signal is assumed to have 10% - 90% rise and fall times of less than 6 ns.
7. Percent overshoot is defined as: $\left(\frac{V_{PK} - V_{100\%}}{V_{100\%}}\right) \times 100\%$.
8. Output referred P.S.R.R. is defined as $20 \log \left(\frac{V_{POWER\ SUPPLY\ RIPPLE}}{V_{OUT\ RIPPLE}}\right)$.

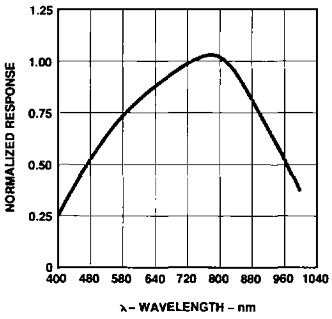


Figure 14. Receiver Spectral Response Normalized to 820 nm.

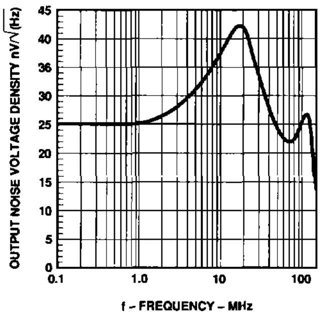


Figure 15. Receiver Noise Spectral Density.

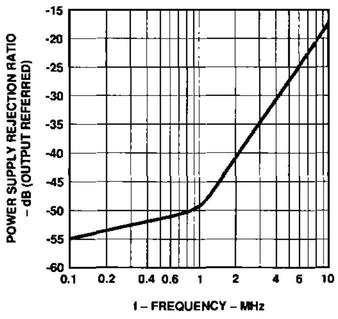


Figure 16. Receiver Power Supply Rejection vs. Frequency.