HEWLETT PACKARD

125 MHz Low Cost Fiber Optic Receiver

Technical Data

HFBR-24X6 Series

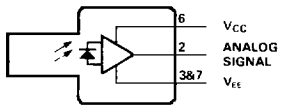
Description

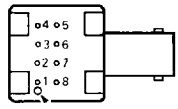
The HFBR-24X6 fiber optic receiver is designed to operate with the Hewlett-Packard HFBR-14XX fiber optic transmitters and 50/125 µm, 62.5/125 µm, and 100/140 µm fiber optic cable. Consistent coupling into the receiver is assured by the lensed optical system (Figure 1). Response does not vary with fiber size for core diameters of 100 µm or less.

The receiver output is an analog signal which allows follow-on circuitry to 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 150 MBd. 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-24X6 receiver contains a PIN photodiode and low noise transimpedance pre-amplifier integrated circuit. The HFBR-24X6 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-24X6 receiver is much larger than from a simple PIN photodiode, it is less susceptible to EMI, especially at high signal rates. For very noisy environments, the conductive port option is recommended. A receiver dynamic range of 23 dB over temperature is achievable (assuming 10^{-9} BER). Because the maximum receiver input power is 6 dB larger and the noise is 2 dB lower over temperature than HP's HFBR-24X4 25 MHz receiver, the HFBR-24X6 is well suited for more demanding link designs that require wide receiver dynamic range.

Housed Product





BOTTOM VIEW — PIN 1 INDICATOR

PIN	FUNCTION
1†	N.C.
2	SIGNAL
3*	V_{EE}
4†	N.C.
5†	N.C.
6	V_{CC}
7*	V_{EE}
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

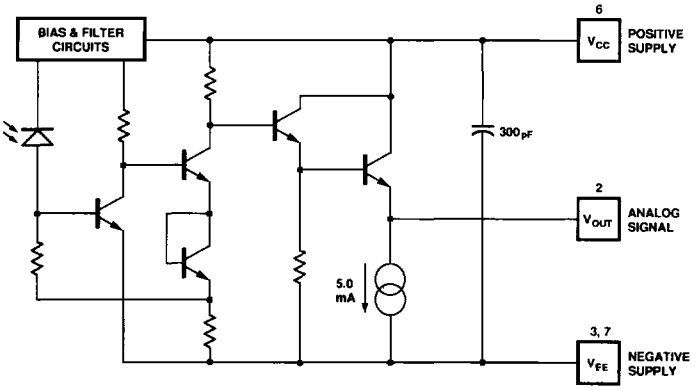
PIN	FUNCTION
1	SIGNAL
2*	V_{EE}
3	V_{CC}
4*	V_{EE}

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.*

The frequency response is typically dc to 125 MHz. Although the HFBR-24X6 is an analog receiver, it is easily made compatible with digital systems. Please refer to Application Bulletin 78 for simple and inexpensive circuits that operate up to 150 MBd.

The recommended ac coupled receiver circuit is shown in Figure 17. It is essential that a 10 ohm resistor be connected between V_{EE} and the power supply, and a 0.1 µF ceramic bypass capacitor be connected between the power supply and ground.

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	V_{CC}	V	
Supply Voltage		V_{CC}-V_{EE}	–0.5	6.0	V	
Output Current		I_O		25	mA	

FIBER OPTICS

Electrical / Optical Characteristics –40°C to +85°C; –5.45 V ≤ Supply Voltage ≤ –4.75 V, R_{LOAD} = 511 Ω, Fiber sizes with core diameter ≤ 100 µm, and N.A. ≤ 0.35 unless otherwise specified.

Parameter	Symbol	Min.	Typ.[3]	Max.	Units	Conditions	Reference
Responsivity	R_P	5.3	7	9.6	mV/µW	T_A = 25° C @ 820 nm, 50 MHz	Note 3, 4
		4.5		11.5	mV/µW	@ 820 nm, 50 MHz	
RMS Output Noise Voltage	V_{NO}		0.40	0.59	mV	Bandwidth Filtered @ 75 MHz P_R = 0 µW	Note 5
				0.70	mV	Unfiltered Bandwidth P_R = 0 µW	Figure 18
Equivalent Optical Noise Input Power (RMS)	P_N		–43.0	–41.4	dBm	Bandwidth Filtered @ 75 MHz	
			0.050	0.065	µW		
Peak Input Power	P_R			–7.6	dBm	T_A = 25°C	Figure 19
				175	µW		Note 6
				–8.2	dBm		
				150	µW		
Output Impedance	Z_O		30		Ω	Test Frequency = 50 MHz	
DC Output Voltage	V_{odc}	–4.2	–3.1	–2.4	V	P_R = 0 µW	
Power Supply Current	I_{EE}		9	15	mA	R_{LOAD} = ∞	
Equivalent N.A.	NA		0.35				
Equivalent Diameter	D_R		324		µm		Note 7

Dynamic Characteristics –40°C to +85°C; –5.45 V ≤ Supply Voltage ≤ –4.75 V; R_{LOAD} = 511 Ω, C_{LOAD} = 5 pF unless otherwise specified.

Parameter	Symbol	Min.	Typ.[8]	Max.	Units	Conditions	Reference
Rise/Fall Time 10% to 90%	t_r, t_f		3.3	6.3	ns	P_R = 100 µW	Figure 20
Pulse Width Distortion	PWD		0.4	2.5	ns	P_R = 150 µW Peak	Note 8, Figure 19
Overshoot			2		%	P_R = 5 µW Peak, $t_{r_{optical}}$ = 1.5 ns	Note 9
Bandwidth (Electrical)	BW_e		125		MHz	–3 dB Electrical	
Power Supply Rejection Ratio	PSRR		20		dB	@ 10 MHz	Note 10
Bandwidth - Rise Time Product			0.41		Hz · s		Note 11

Notes:

1. 2.0 mm from where leads enter case.
2. Typical specifications are for operation at T_A = 25°C and V_{EE} = –5.2 Vdc.
3. For 200 µm PCS fibers, typical responsivity will be 6 mV/µW. Other parameters will change as well.
4. Pin #2 should be ac coupled to a 511 ohm load. Load capacitance must be less than 5 pF.
5. Measured with a 3 pole Bessel filter with a 75 MHz, –3 dB bandwidth. Recommended receiver filters for various bandwidths are provided in Application Bulletin 78.
6. Overdrive is defined at PWD = 2.5 ns.
7. 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.
8. Measured with a 10 ns pulse width, 50% duty cycle, at the 50% amplitude point of the waveform.
9. Percent overshoot is defined as: $\left(\frac{V_{PK} - V_{100\%}}{V_{100\%}}\right)$ x 100%.
10. Output referred P.S.R.R. is defined as $20 \log \left(\frac{V_{POWER\ SUPPLY\ RIPPLE}}{V_{OUT\ RIPPLE}}\right)$.
11. The conversion factor for the rise time to bandwidth is 0.41 since the HFBR-24X6 has a second order bandwidth limiting characteristic.

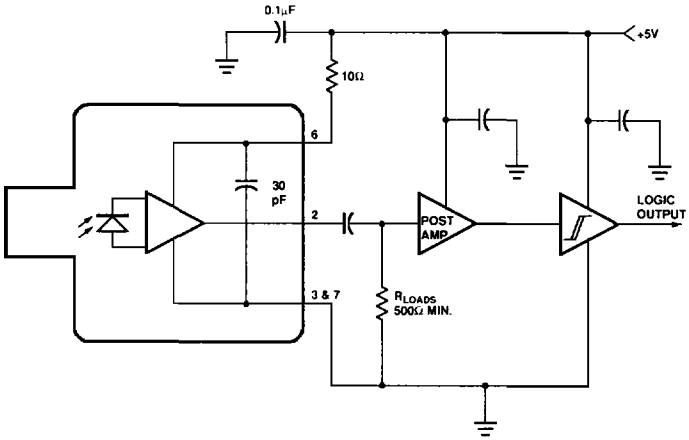


Figure 17. Recommended ac Coupled Receiver Circuit (See AB 78 and AN 1038 for More Information)

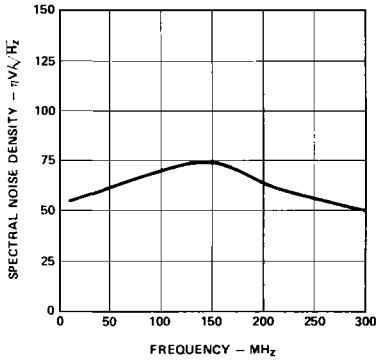


Figure 18. Typical Spectral Noise Density vs. Frequency

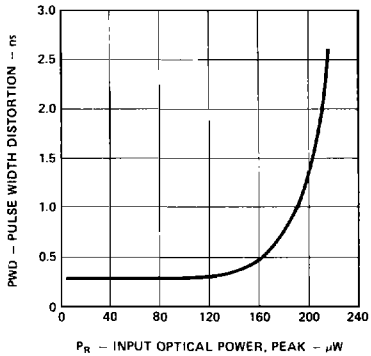


Figure 19. Typical Pulse Width Distortion vs. Peak Input Power

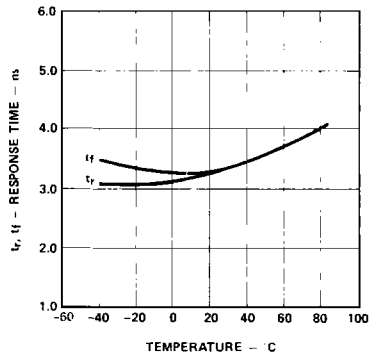


Figure 20. Typical Rise and Fall Times vs. Temperature