HEWLETT PACKARD

125 MHz Low Cost Fiber Optic Receiver

Technical Data

HFBR-24X6 Series

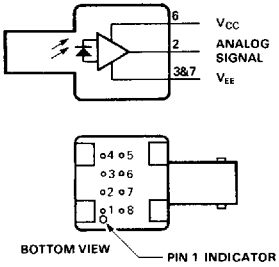
Description

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 155 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



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

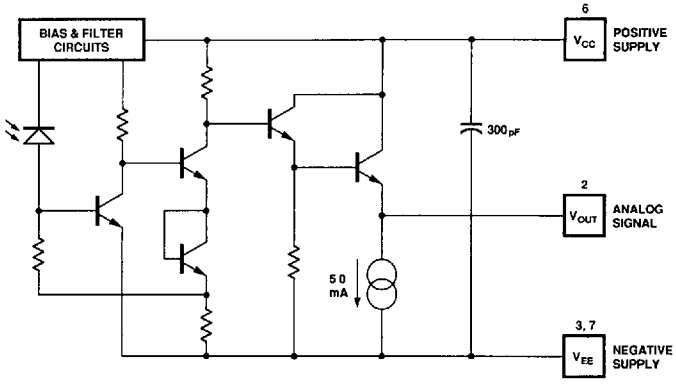
PIN	FUNCTION
1	SIGNAL
2*	V_{EE}
3	V_{CC}
4*	V_{EE}

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 155 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	

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.[1]	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 Figure 21
		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 Note 6
				175	µW		
				-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

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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.[3]	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_g 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.

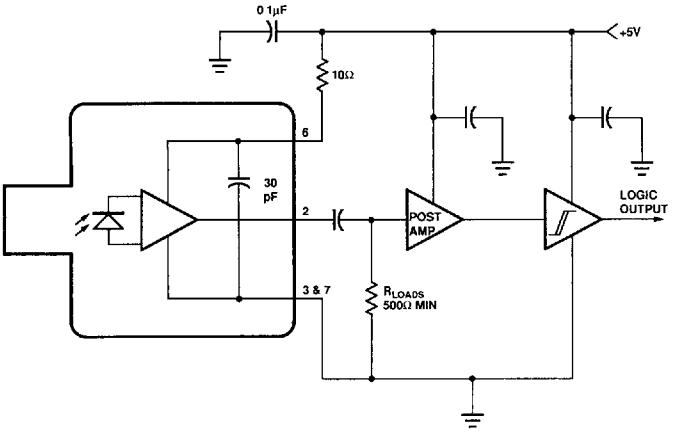


Figure 17. Recommended ac Coupled Receiver Circuit (See AB 78 and AN 1038 for More Information)

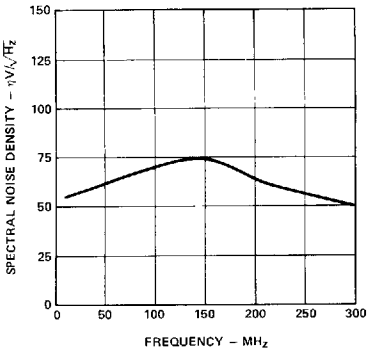


Figure 18. Typical Spectral Noise Density vs. Frequency

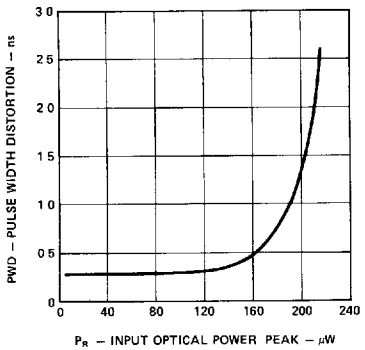


Figure 19. Typical Pulse Width Distortion vs. Peak Input Power

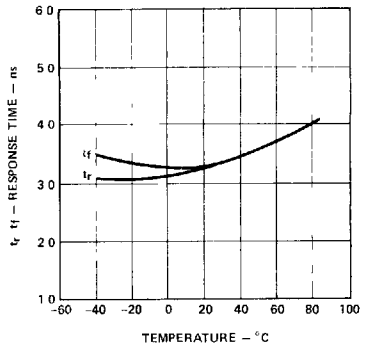


Figure 20. Typical Rise and Fall Times vs. Temperature

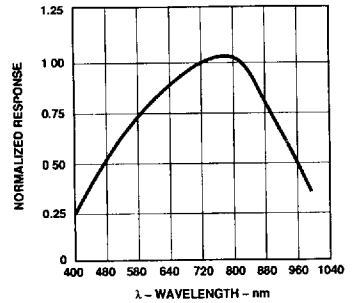
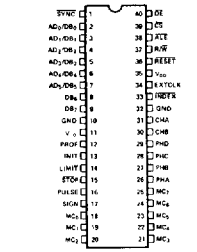
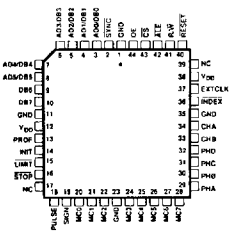
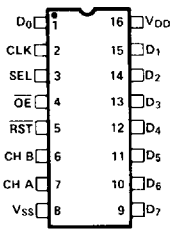
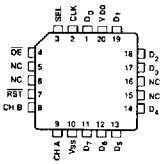
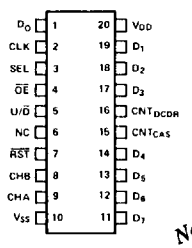
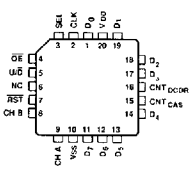


Figure 21. Receiver Spectral Response Normalized to 820 nm.

Motion Control ICS – HCTL-XXXX Series

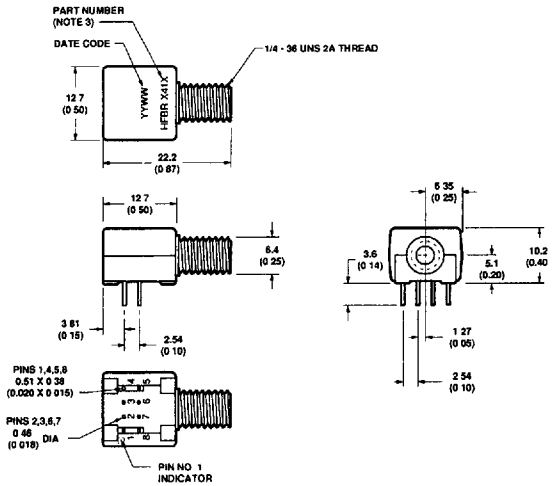
Package Outline Drawing	Part No.	Package	Description	Page No.
	HCTL-1100	PDIP	CMOS General Purpose Motion Control IC	1-104
	HCTL-1100 OPT PLC	PLCC	CMOS General Purpose Motion Control IC	
	HCTL-2000	PDIP	CMOS Quadrature Decoder/Counter IC, 12-bit Counter	1-86
	HCTL-2016	PDIP	CMOS Quadrature Decoder/Counter IC, 16-bit Counter	
	New HCTL-2016 OPT PLC	PLCC	CMOS Quadrature Decoder/Counter IC, 16-bit Counter	1-102
	HCTL-2020	PDIP	CMOS Quadrature Decoder/Counter IC, 16-bit Counter, Quadrature Decoder Output Signals, Cascade Output Signals	1-86
	New HCTL-2020 OPT PLC	PLCC	CMOS Quadrature Decoder/Counter IC, 16-bit Counter, Quadrature Decoder Output Signals, Cascade Output Signals	1-102

Accessories for Encoders and Encoder Modules

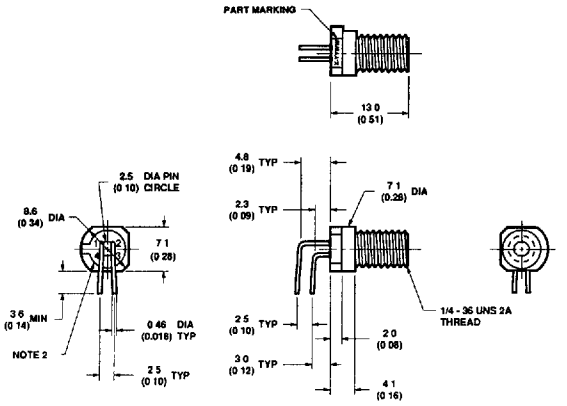
Package Outline Drawing	Part No.	Description	Page No.
	HEDS-8902	4-wire connector with 15.5 cm (6.1 in.) flying leads. Locks into HEDS-5500 and HEDS-5600 2 channel encoders. Also fits HEDS-9000, HEDS-9100, and HEDS-9200 2 channel encoder modules.	1-61 1-22 1-28
	HEDS-8903	5-wire connector with 15.5 cm (6.1 in.) flying leads. Locks into HEDS-5540 and HEDS-5640 three channel encoders. Also fits HEDS-9040 and HEDS-9140 three channel encoder modules.	1-61 1-32
	HEDS-8905	Alignment Tool for HEDS-9140	1-32
	HEDS-8906	Alignment Tool for HEDS-9040	1-32
	HEDS-8901	Gap Setting shown for film codewheels	1-51
	HEDS-8932	Gap Setting shown for glass codewheels	1-51
	HEDS-8910 OPT 0 □□	Alignment Tool for HEDS-5540/5545 and HEDS-5640/5645. Order in appropriate shaft size.	1-61

Mechanical Dimensions HFBR-0400 SMA Series

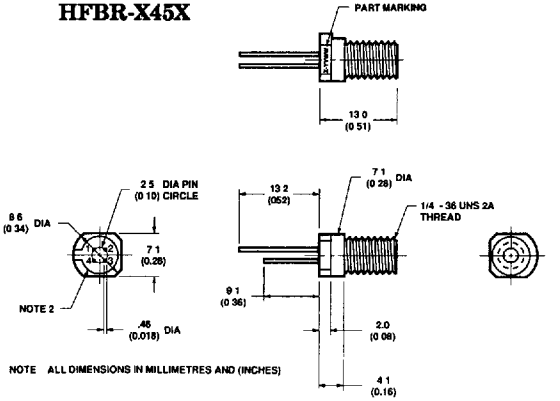
HFBR-X40X



HFBR-X43X



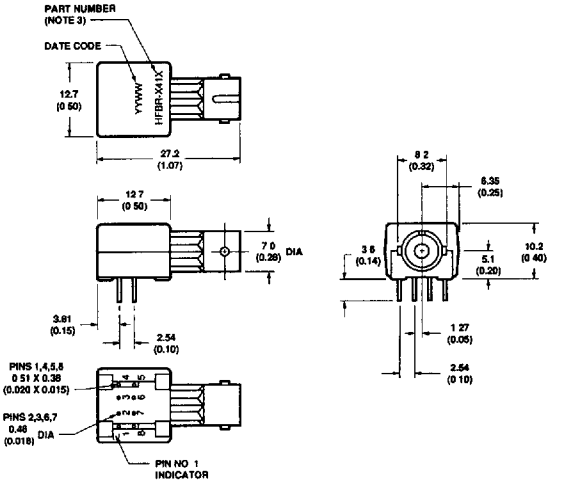
HFBR-X45X



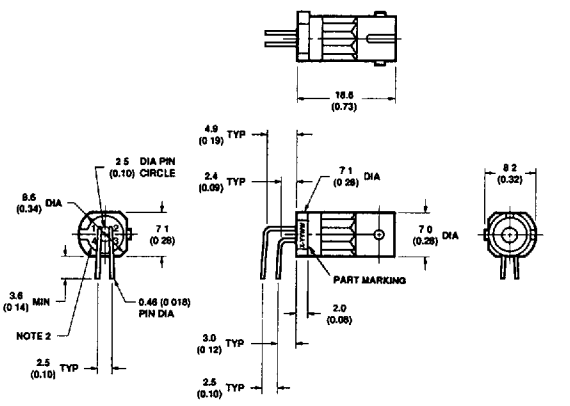
NOTE ALL DIMENSIONS IN MILLIMETRES AND (INCHES)

Mechanical Dimensions HFBR-0400 ST Series

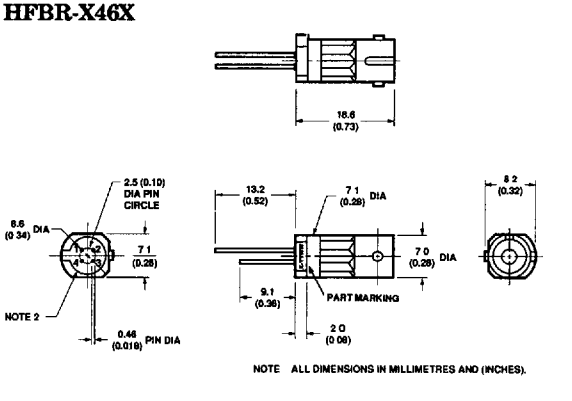
HFBR-X41X



HFBR-X44X



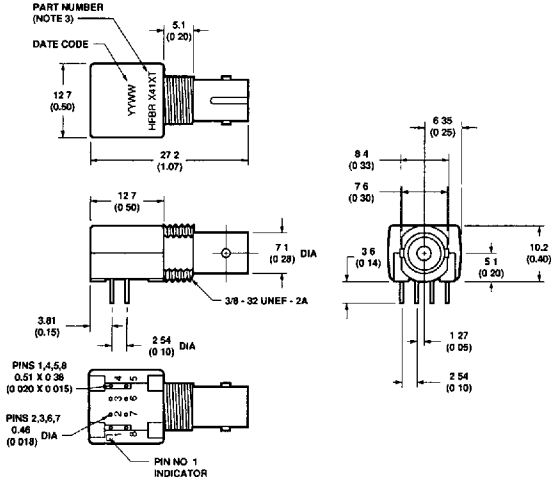
HFBR-X46X



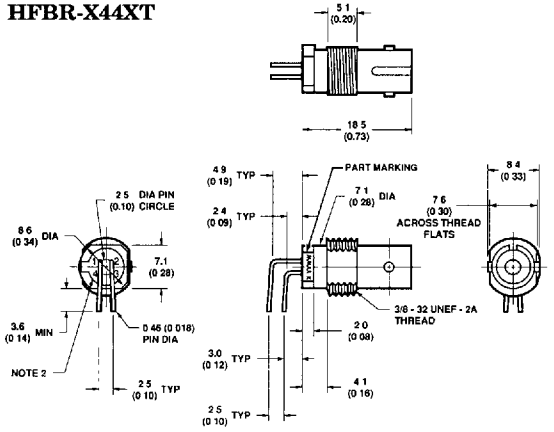
NOTE ALL DIMENSIONS IN MILLIMETRES AND (INCHES).

Mechanical Dimensions HFBR-0400T Threaded ST Series

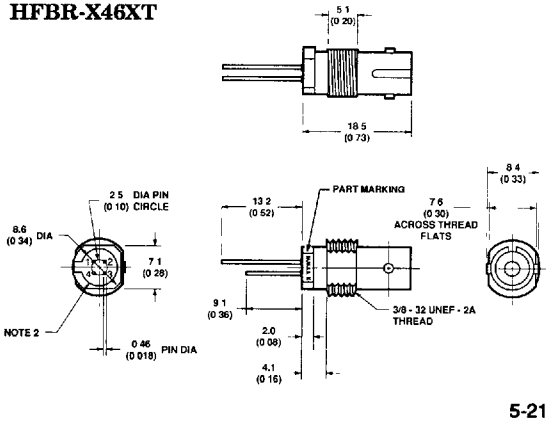
HFBR-X41XT



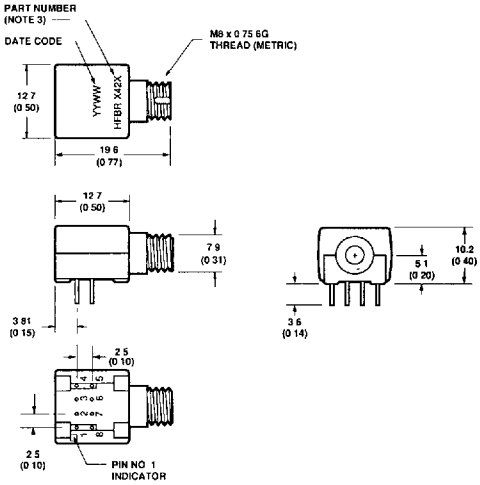
HFBR-X44XT



HFBR-X46XT



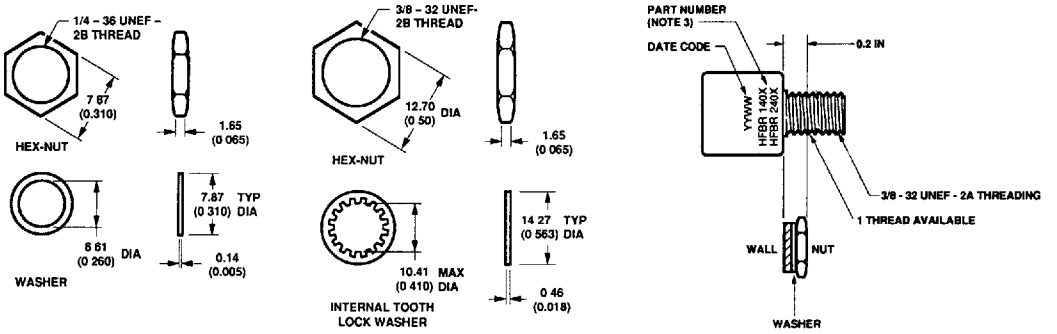
Mechanical Dimensions HFBR-0400FC Series



FIBER OPTICS

Panel Mounting Hardware

HFBR-4401: for SMA Ports **HFBR-4411: for ST Ports**



(Each HFBR-4401 and HFBR-4411 kit consists of 100 nuts and 100 washers.)

Port Cap Hardware

HFBR-4402: SMA Port Caps
HFBR-4412: ST Port Caps
(Each HFBR-4402 and HFBR-4412 consists of 500 port caps)

Recommended Chemicals for Cleaning/Degreasing HFBR-0400 Products

Alcohols (methyl, isopropyl, isobutyl)
Aliphatics (hexane, heptane)
Other (soap solution, naphtha)

(Do not use partially halogenated hydrocarbons (such as 1,1.1 trichloroethane), ketones (such as MEK), acetone, chloroform, ethyl acetate, methylene dichloride, phenol, methylene chloride, or N-methylpyrolldone. Also, HP does not recommend the use of cleaners that use halogenated hydrocarbons because of their potential environmental harm.)

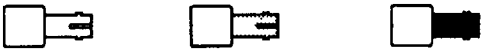
Notes:

1. All dimensions are in millimetres and (inches).
2. Unhoused products are distinguished by the combination of the first character in the part marking and the part marking color.
   YYWW represents the date code

Base Part Number	Part Marking	Part Marking Color
HFBR-14X2	2-YYWW	Red
HFBR-14X4	4-YYWW	Red
HFBR-24X2	2-YYWW	White
HFBR-24X4	4-YYWW	White
HFBR-24X6	6-YYWW	White

This marking scheme does not distinguish between different connector styles.

3. The ports are shaded as shown below.



Transmitters **Receivers** **Conductive Port Receivers**