

## Industrial Fiber Optic Components, Cabling and Accessories



### Selection Guide

# Fiber Optic Components for Industrial, Automation, Power Generation/Distribution, Transportation, Gaming and Medical Applications

Avago Technologies is the world's leading provider of fiber optic transmitters, receivers, and transceivers. Avago offers unmatched quality with high-volume, cost effective manufacturing techniques. Industry leaders and small firms alike turn to Avago for their fiber optic needs.

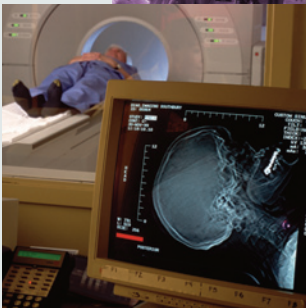
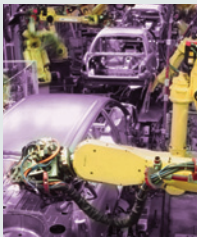
Avago fiber optic components for Industrial, Automation, Power Generation/Distribution, Transportation, Gaming and Medical applications are available in 650nm, 820nm and 1310nm wavelengths, and in discrete forms.

Avago's fiber optic components come in a selection of packages. The SFH-series (Connectorless) has 650nm fiber-optic components with the capability to work with unconnectorized POF (plastic optical fiber) for ease of installation. The Versatile Link Package (HFBR-0500 series) contains 650 nm discrete components that feature snap-in connector parts. The SMA/ST Package (HFBR-0505 series) is an extremely robust industrial-grade family with SMA or ST ports designed specifically for Fieldbus applications. The Miniature Link Package (HFBR-0300/0400 series) which provides greater link-lengths, is available with 820nm and 1300nm technology. These are discrete components that can use SMA/ST/SC/FC connectors.

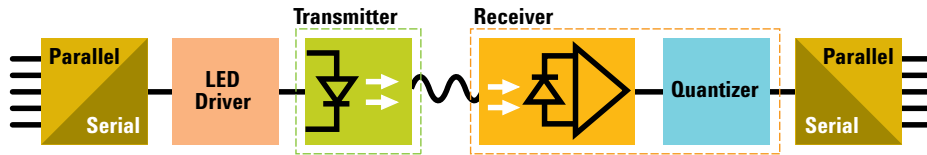
## Fundamentals of Digital Fiber Optic Links

The following reference designs concentrate on links built with Avago's 650 nm, 820 nm and 1310nm fiber optic components.

All the optical transmitters from these families include an LED without driver circuitry. Cost effective driver ICs are available from many suppliers, and these application notes will demonstrate easy integration of these ICs into a transmitter circuit.



Typical link block diagram from DC to 10 MBd



The optical receivers from DC up to 10 MBd include a photodiode, preamp, and quantizer circuit (shown in the block diagram below). These receivers have TTL outputs (dc coupled) and can be used with arbitrary timing (no duty factor restriction). Typical applications are RS232, RS485, SERCOS, INTERBUS-S and PROFIBUS protocols.

The receivers for data rates from 1 MBd to 175 MBd include a photodiode, pre-amp and analog outputs. They have to be ac coupled to a comparator or quantizer circuitry to provide digital logic levels (I.e. ECL, TTL). The ac coupling requires encoding of the serial data (I.e. Manchester, 4B/5B, scrambled coding), but provide better sensitivity than DC coupled receivers.

The application notes describe cost-effective solutions for digital fiber optic data communication links that are compatible with TTL logic for different data rate up to 160 MBd.

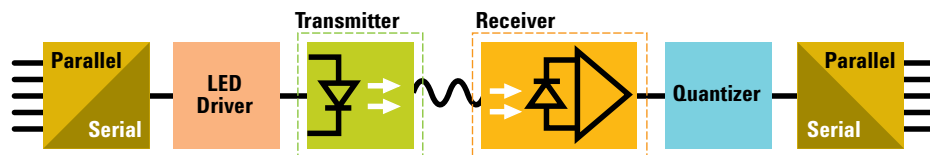
## Plastic Optical Fiber (POF) Components

Avago Technologies is committed to the advancement of fiber optics technologies and recognizes the importance of optical data transmission for today's growing data networking needs. Plastic Optical Fiber (POF) enables low cost applications with the advantages of optical data transmission; perfect for automotive, industrial and consumer markets.

The tables on page 4 and 5 of this selection guide will help you select a part number for the data rate of your application. Please search our website by the Avago part number for additional design information at: [www.avagotech.com/fiber](http://www.avagotech.com/fiber) or [www.avagotech.com/pof](http://www.avagotech.com/pof).



Typical link block diagram from 1 MBd to 175 MBd



## 650 nm industrial fiber optic components

Components listed here are compatible with both Plastic (1 mm core diameter) and HCS (for higher data rate/link length) optical fibers. Plastic fiber often specified in cost-effective solutions will see implementations in frequency conversion, power electronics control and industrial fieldbuses. Connectorization schemes include Connectorless, ST, SMA and Versatile Link.

### Applications

- Factory automation
- Industrial Networking and Field Buses
- Audio-Visual Links and Datalinks up to 160 MBd
- High voltage conversion
- IGBT, GTO, IGCT power electronics
- High voltage isolation
- Gaming
- Human machine interfaces



### 650nm Industrial Fiber Optic Components

Voltage	Package	Data Rate	Reach		Application Note	Connector/Package	Standard RoHS Part Number*		Legacy Part Number	
			POF	HCS			Transmitter	Receiver	Transmitter	Receiver
5V	Simplex	DC-15kBd	50m		AN 5341 AN5342	2 or 3-pin insert	SFH757	SFH350		
						Connectorless	SFH757V	SFH350V		
		DC-40 kBd	110m		AN 1035	Versatile Link	HFBR-1523Z HFBR-1533Z	HFBR-2523Z HFBR-2533Z	HFBR-1523 HFBR-1533	HFBR-2523 HFBR-2533 HFBR-1524Z
							DC-1 MBd	10m		AN 1035
		DC-2 MBd	50m	400m		SMA	HFBR-1505CZ	HFBR-2505CZ	HFBR-1505C	HFBR-2505C
		DC-2 MBd	20m			SMA	HFBR-1604Z HFBR-1602Z	HFBR-2602Z HFBR-2602Z	HFBR-1604 HFBR-1602	HFBR-2602 HFBR-2602
		DC-5 MBd	20m		AN 1035	Versatile Link	HFBR-1521Z HFBR-1531Z	HFBR-2521Z HFBR-2531Z	HFBR-1521Z HFBR-1531Z	HFBR-2521Z HFBR-2531Z
							45m		AN 5341 AN5342	2 or 3-pin insert
		DC-10 MBd	40m	200m	AN 1080	SMA ST	HFBR-1505AZ HFBR-1515BZ	HFBR-2505AZ HFBR-2515BZ	HFBR-1505A HFBR-1515B	HFBR-2505A HFBR-2515B
							40m	300m	AN 1080	Versatile Link
		DC-16 MBd	45m	200m	AN 5006	SMA	HFBR-1506AMZ	HFBR-2506AMZ	HFBR-1506AM	HFBR-2506AM
		DC-32 MBd	40m	1000m	AN 1121	Versatile Link	HFBR-1527Z HFBR-1537Z	HFBR-2526Z HFBR-2536Z	HFBR-1527 HFBR-1537	HFBR-2526 HFBR-2536
		32 MBd	75m	400m	AN 1066					
		55 MBd	60m	240m	AN 1066					
		100 MBd	50m		AN 5341 AN5342	2 or 3-pin insert	SFH757	SFH250		
Connectorless	SFH757V						SFH250V			
125 MBd	30m	100m	AN 1066	Versatile Link	HFBR-1527Z HFBR-1537Z	HFBR-2526Z HFBR-2536Z	HFBR-1527 HFBR-1537	HFBR-2526 HFBR-2536		
160 MBd (N.A. = 0.375)	50m	50m	AN 1123							

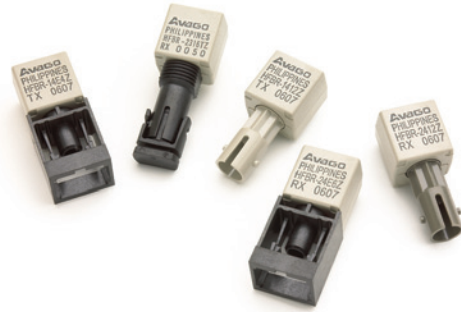
\* FOR NEW DESIGNS, AVAGO TECHNOLOGIES RECOMMENDS USING THE RoHS PARTS. LEGACY PARTS WILL UNDERGO OBSOLESCENCE

## 820 nm/1300 nm industrial fiber optic components

These cost effective components with long link-length capabilities can be used to build high-performance ethernet transceivers. Typical applications include FDDI, Token Ring, FOIRL, 10Base-FL and 100Base-SX. Glass fiber specified in the following selection guide are multimode fiber both 62.5/125  $\mu\text{m}$  and 50/125  $\mu\text{m}$  multi-mode glass fiber can be used.

### Applications

- LAN applications such as 10Base-FL
- FDDI, Token Ring, 100Base-SX
- Audio Video Links and Industrial Datalinks
- Wind Turbine Tower and Farms networking
- Hydro and Solar power generation plants
- Media/fiber converters
- Railway control systems
- Locomotive in-car and car-to-car communications
- Motorway infrastructures



### 820nm/1300nm Industrial Fiber Optic Components

Voltage	Package	Data Rate	Reach	Application Note	Connector	Standard RoHS Part Number*	
						Transmitter	Receiver
5V	Simplex	DC-5 MBd	2000m		ST, SMA, FC	HFBR-14X4Z	HFBR-24X2Z
		20 MBd	2700m	AN 1038	ST, SC, SMA	HFBR-14X4Z	HFBR-24X6Z
		32 MBd	2200m	AN 1065			
		55 MBd	1400m	AB 78			
		125 MBd	700m	AB 78/AN 5003			
		155 MBd	600m	AB 78/AN 5003			
		160 MBd	500m	AN 1123/AN 5003			
		20 MBd	5000m	AN 1038	ST	HFBR-1312TZ	HFBR-2316TZ
		32 MBd	3200m	AN 1065			
		55 MBd	3200m	AB 78			
		125 MBd	2800m	AB 78			
		155 MBd	2700m	AB 78			
		160 MBd	2000m	AN 1123			

\* For new designs, AVAGO TECHNOLOGIES RECOMMENDS USING THE RoHS PARTS. LEGACY PARTS WILL UNDERGO OBSOLESCENCE

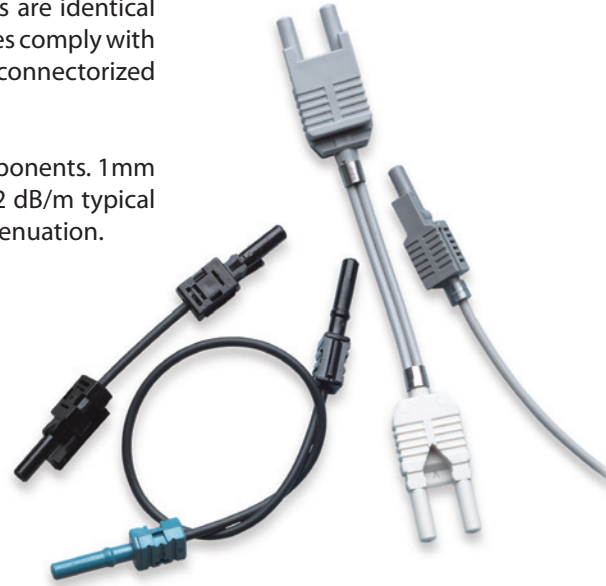
## Plastic Optical Fiber Cables

The HFBR-R/EXXYYYYZ series of plastic fiber optic cables are constructed of a single step-index fiber sheathed in a black polyethylene jacket. The duplex fiber consists of two simplex fibers joined with a zipcord web. Standard attenuation and extra low loss POF cables are identical except for attenuation specifications. Polyethylene jackets on all plastic fiber cables comply with UL VW-1 flame retardant specification (UL file #E89328) Cables are available in unconnectorized or connectorized options.

Compatible with Avago Versatile Link family of connectors and Fiber Optic components. 1mm diameter Plastic Optical Fiber (POF) offered in 2 grades: Standard POF with 0.22 dB/m typical attenuation, or High Performance Extra Low Loss POF with 0.19 dB/m typical attenuation.

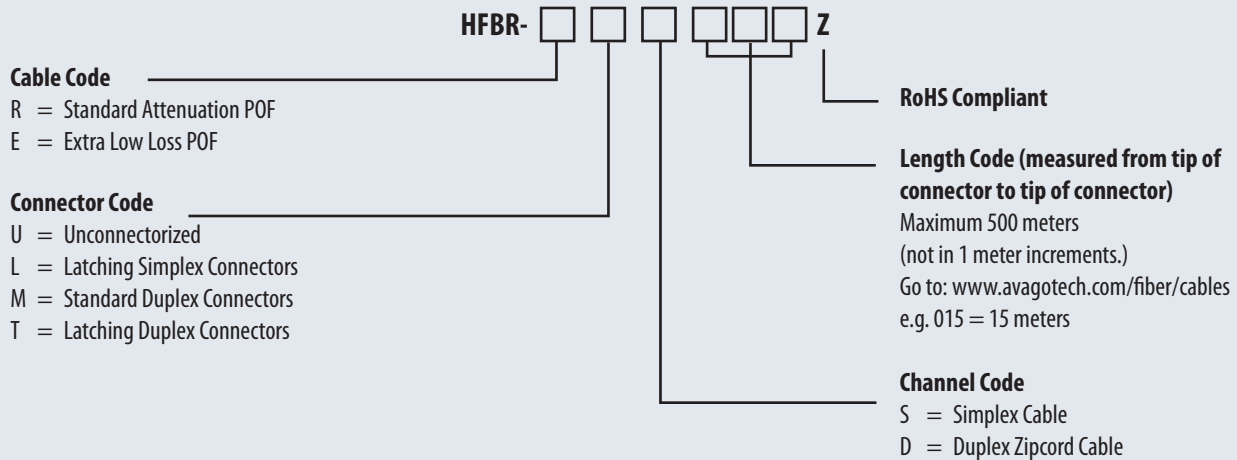
### Applications

- Industrial Data Links for Factory Automation and Plant Control
- Intra-System Links; Board-to-Board, Rack-to-Rack
- Telecommunications Switching Systems
- Computer-to-Peripheral Data Links, PC Bus Extension
- Proprietary LANs
- Digitized Video
- Medical Instruments
- Reduction of Lightning and Voltage Transient Susceptibility
- High Voltage Isolation
- Power Electronics
- Gaming Equipment
- Data communications

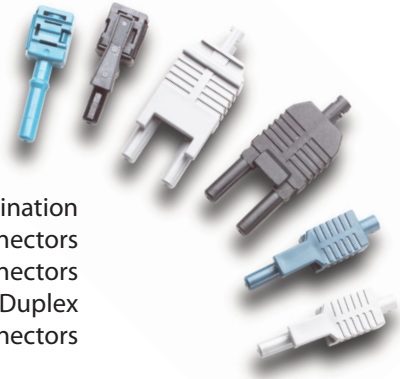


### Plastic Optical Fiber Specifications: HFBR-R/EXXYYYYZ

Parameter		Symbol	Min.	Typ.	Max	Unit	Condition
Cable Attenuation	Standard Cable Type "R"	ao	0.15	0.22	0.27	dB/m	Source is HFBR-15XX (660nm LED, 0.5NA) L=50meters
	Extra Low Loss Type "E"		0.15	0.19	0.23		
Reference Attenuation	Standard Cable Type "R"	aR	0.12	0.19	0.24	dB/m	Source is 650nm, 0.5NA monochrometer, L=50meters
	Extra Low Loss Type "E"		0.12	0.16	0.19		
Numerical Aperture		NA	0.46	0.47	0.5		>2meters
Diameter, Core and Cladding		Dc	0.94	1	1.06	mm	



## POF and HCS Connectors and Accessories



### Crimp Style

The HFBR-4501Z, HFBR-4503Z and HFBR-4506Z connector styles are available for termination of plastic optical fiber: simplex, simplex latching, duplex and duplex latching. All connectors provide a snap-in action when mated to Versatile Link components. Simplex connectors are color coded to facilitate identification of transmitter and receiver connections. Duplex connectors are keyed so that proper orientation is ensured during insertion. The connectors are made of a flame retardant VALOX UL94 V-0 material (UL file # E121562).

### Crimpleless Style

The HFBR-453XZ series connectors are an enhanced version of the HFBR-4501Z and HFBR-4503Z connectors for plastic optical fiber, compatible with Avago's versatile link series transmitters and receivers. This design uses a simple, snap-together concept, which eliminates the need for crimping. User labor and tool cost are reduced together with the yield loss due to installation error. The HFBR-453XZ series connectors are available in two-styles: latching and non-latching. For a duplex connector, two nonlatching simplex connectors can be snapped together. The connectors are made of a rugged, flame resistant plastic which is good for industrial and other harsh environments. The HFBR-453XZ series connectors are for use with Plastic Optical Fiber only.

## POF and HCS Connectors and Accessories

### Plastic Optical Fiber Connectors

Standard RoHS Part Number*	Legacy Part Number	Description
HFBR-4501Z/4511Z	HFBR-4501/4511	Gray/Blue Simplex Connector/Crimp Ring
HFBR-4503Z/4513Z	HFBR-4503/4513	Gray/Blue Simplex Latching Connector with Crimp Ring
HFBR-4506Z/4516Z	HFBR-4506/4516	Parchment/Gray Duplex Connector with Crimp Ring
HFBR-4505Z/4515Z	HFBR-4505/4515	Gray/Blue Adapter (Bulkhead/Feedthrough)
HFBR-4531Z/4532Z	HFBR-4531/4532	Black Crimless Simplex Non-latching/Latching Connector
HFBR-4533Z/4535Z	HFBR-4533/4535	Blue/Gray Crimless Simplex Non-latching Connector

\* For new designs, Avago Technologies recommends using the RoHS parts. Legacy parts will undergo obsolescence

### Plastic Optical Fiber Accessories

Standard RoHS Part Number*	Legacy Part Number	Description
HFBR-4522Z	HFBR-4522	500 HFBR-0500 Products Port Plugs
HFBR-4525Z	HFBR-4525	1000 Simplex Crimp Rings
HFBR-4526Z	HFBR-4526	500 Duplex Crimp Rings
HFBR-4593Z	HFBR-4593	Polishing Kit (one polishing tool, two pieces 600 grit abrasive paper, and two pieces 3 µm pink lapping film)
HFBR-4597Z	HFBR-4597	Plastic Fiber Crimping Tool

\* For new designs, Avago Technologies recommends using the RoHS parts. Legacy parts will undergo obsolescence

## About Avago Technologies

Avago Technologies is a leading supplier of analog interface components for communications, industrial and consumer applications. By leveraging its core competencies in III-V compound and silicon semiconductor design and processing, the company provides an extensive range of analog, mixed signal and optoelectronics components and subsystems to more than 40,000 customers. Backed by strong customer service support, the company's products serve four diverse end markets: industrial and automotive, wired infrastructure, wireless communications, and computer peripherals. Avago has a global employee presence and heritage of technical innovation dating back 40 years to its Hewlett-Packard roots. Information about Avago is available on the Web at [www.avagotech.com](http://www.avagotech.com)

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