

# Industrial Fiber Optic Components and Accessories



# Selection Guide

# Fiber Optic Components for Industrial, Medical & Ethernet 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, Medical and Ethernet applications are available in 650nm and 820nm wavelengths, and in discrete forms.

Avago's fiber optic components come in a selection of packages. 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 a cost-effective family with transmitter and receiver housed separately in a small footprint 1x4 simplex SMA or ST port package. The Miniature Link Package (HFBR-0300/0400/0600 series) is available with 650nm, 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 and 820 nm 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.

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.

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) 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. Connectors include SMA and Versatile Link.

#### **Applications**

- Industrial Control Data Link
- Industrial Field Buses
- Audio-Visual Links and Datalinks up to 160Mbd



#### 650nm Industrial Fiber Optic Components

Voltage	Package	Data Rate	Reach		Application	Company	Dia Out	Standard RoHS Part Number*		Legacy Part Number	
			POF	HCS	Note	Connector	PIN-OUT	Transmitter	Receiver	Transmitter	Receiver
5V	Simplex	DC-40 kBd	110m		AN 1035	Versatile Link	1x4	HFBR-1523Z HFBR-1533Z	HFBR-2523Z HFBR-2533Z	HFBR-1523 HFBR-1533	HFBR-2523 HFBR-2533
		DC-1 MBd	45m		AN 1035	Versatile Link	1x4	HFBR-1522Z HFBR-1532Z	HFBR-2522Z HFBR-2532Z	HFBR-1522 HFBR-1532	HFBR-2522 HFBR-2532
		DC-2 MBd	50m	400m		SMA	1x4	HFBR-1505CZ	HFBR-2505CZ	HFBR-1505C	HFBR-2505C
		DC-4 MBd	40m			SMA	2x4	HFBR-1604Z	HFBR-2602Z	HFBR-1604	HFBR-2602
		DC-5 MBd	20m		AN 1035	Versatile Link	1x4	HFBR-1521Z HFBR-1531Z	HFBR-2521Z HFBR-2531Z	HFBR-1521 HFBR-1531	HFBR-2521 HFBR-2531
		DC-10 MBd	40m	200m	AN 1080	SMA ST	1x4	HFBR-1505AZ HFBR-1515BZ	HFBR-2505AZ HFBR-2515BZ	HFBR-1505A HFBR-1515B	HFBR-2505A HFBR-2515B
			40m	300m	AN 1080	Versatile Link	1x4	HFBR-1528Z	HFBR-2528Z	HFBR-1528	HFBR-2528
		DC-16 MBd	40m	200m	AN 5006	SMA	1x4	HFBR-1506AMZ	HFBR-2506AMZ	HFBR-1506AM	HFBR-2506AM
		DC-32 MBd	40m	1000m	AN 1121	Versatile Link	1x4	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						
		125 MBd	30m	100m	AN 1066						
		160 MBd (N.A.=0.375)	50m	50m	AN 1123						

Typical operating temperature range: 0 to +70°C

\* 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 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 (62.5/125  $\mu$ m), though 50/125  $\mu$ 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



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

Valtana	Deskens	Data Rate	Reach	Application Note	Connector	Pin-Out	Standard RoHS Part Number*		Legacy Part Number	
voitage	Раскаде						Transmitter	Receiver	Transmitter	Receiver
	Simplex	DC-5 MBd	2000m		ST, SMA, FC	2x4	HFBR-14X4Z	HFBR-24X2Z	HFBR-14X4	HFBR-24X2
		20 MBd	2700m	AN 1038	- - ST, SC, SMA -	2x4	HFBR-14X4Z	HFBR-24X6Z	HFBR-14X4	HFBR-24X6
		32 MBd	2200m	AN 1065						
		55 MBd	1400m	AB 78						
		125 MBd	700m	AB 78/AN 5003						
5V		155 MBd	600m	AB 78/AN 5003						
		160 MBd	500m	AN 1123/AN 5003						
		20 MBd	5000m	AN 1038	- ST	2x4	HFBR-1312TZ	HFBR-2316TZ	HFBR-1312T	HFBR-2316T
		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						

Typical operating temperature range: -40 to +85°C

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

# **Plastic Optical Fiber Cables**

The HFBR-R/EXXYYYZ 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 ULVW-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
- Gaming Equipment
- Data communications

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

Parameter	Symbol	Min.	Тур.	Мах	Unit	Condition		
Cable Attenuation	Standard Cable Type "R"	20	0.15	0.22	0.27	dB/m	Source is HFBR-15XX (660nm LED, 0.5NA) L=50meters	
	Extra Low Loss Type "E"	dU	0.15	0.19	0.23			
Deference Attenuation	Standard Cable Type "R"	ъD	0.12	0.19	0.24	dB/m	Source is 650nm, 0.5NA monochrometer, L=50meters	
	Extra Low Loss Type "E"	dh	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).

#### **Crimpless 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 Crimpless Simplex Non-latching/Latching Connector
HFBR-4533Z/4535Z	HFBR-4533/4535	Blue/Gray Crimpless 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

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#### **About Avago Technologies**

Avago Technologies is a leading global supplier of analog, mixed-signal and optoelectronic components and subsystems. The company serves three primary product categories comprising optoelectronics, RF/microwave components and enterprise ASICs.

Avago Technologies' product solutions include fiber optic transceivers and ICs for storage, computing and networking. For mobile handsets, Avago offers RF components, infrared transceivers, light and proximity sensors, CMOS image sensors, and LEDs for camera flash as well as keypad and display backlighting. Avago's optoelectronics solutions include a broad range of LEDs, the world's most comprehensive line of isolation devices, an illumination and color management system for backlighting LCD flat-panel TVs, motion control components for office automation and industrial systems, optical navigation sensors for computer mice, and fiber optics transmitters and receivers for industrial and automotive applications.

Avago Technologies combines the capabilities and track record of an established global leader with the vigor and responsiveness of a startup. Avago's heritage of technical innovation dates back 40 years to its Agilent/Hewlett-Packard roots. During those years, the company amassed more than 2,000 patents and applications, and a reputation for innovation, quality and superior customer service.

For product information and a complete list of distributors, please go to our web site:

#### www.avagotech.com www.avagotech.com/industrial

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