

Industrial Fiber Optic Components and Accessories



Selection Guide

Fiber Optic Components for Industrial, Automotive & Consumer 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, Automotive and Consumer 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.

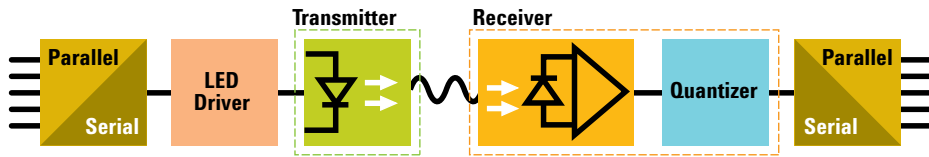
Fundamentals of Digital Fiber Optic Links

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.

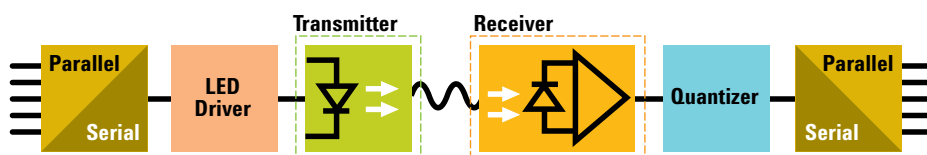
The application notes describe cost-effective solutions for digital fiber optic data communication links that are compatible with TTL logic for different data rate up to 160 MBd.

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 or 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) 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 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-1522Z HFBR-1532Z | HFBR-2522Z HFBR-2532Z | HFBR-1522 HFBR-1532 | HFBR-2522 HFBR-2532 |
| | | DC-1 MBd | 45m | | AN 1035 | Versatile Link | HFBR-1521Z HFBR-1531Z | HFBR-2521Z HFBR-2531Z | HFBR-1521Z HFBR-1531Z | HFBR-2521Z HFBR-2531Z |
| | | | | | | | 2 or 3-pin insert Connectorless | SFH757 SFH757V | SFH551/1-1 SFH551/1V-1 | |
| | | DC-2 MBd | 50m | 400m | | SMA | HFBR-1505CZ | HFBR-2505CZ | HFBR-1505C | HFBR-2505C |
| | | | | | | | HFBR-1604Z | HFBR-2602Z | HFBR-1604 | HFBR-2602 |
| | | DC-4 MBd | 40m | | | SMA | HFBR-1506AMZ | HFBR-2506AMZ | HFBR-1506AM | HFBR-2506AM |
| | | | | | | | HFBR-1527Z HFBR-1537Z | HFBR-2526Z HFBR-2536Z | HFBR-1527 HFBR-1537 | HFBR-2526 HFBR-2536 |
| | | DC-5 MBd | 20m | | AN 1035 | Versatile Link | HFBR-1527Z HFBR-1537Z | HFBR-2526Z HFBR-2536Z | HFBR-1527 HFBR-1537 | HFBR-2526 HFBR-2536 |
| | | | | | | | 2 or 3-pin insert Connectorless | SFH757 SFH757V | SFH551/1-1 SFH551/1V-1 | |
| | | 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 |
| | | | | | | | Versatile Link | HFBR-1528Z | HFBR-2528Z | HFBR-1528 |
| | | DC-16 MBd | 40m | 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 Connectorless | SFH757 | SFH250 | | | | |
| | | | | | SFH757V | SFH250V | | | | |
| | | | | | HFBR-1527Z HFBR-1537Z | HFBR-2526Z HFBR-2536Z | HFBR-1527 HFBR-1537 | HFBR-2526 HFBR-2536 | | |
| 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 | | | | | | | |

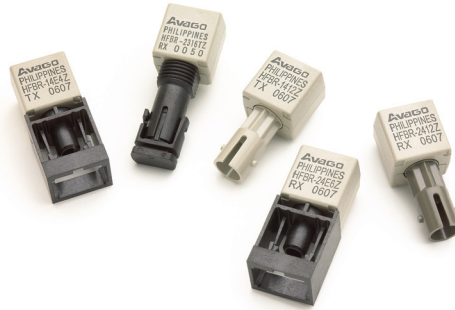
* FOR NEW DESIGNS, AVAGO TECHNOLOGIES RECOMMENDS USING THE RoHS PARTS. LEGACY PARTS WILL UNDERGO OBSOLESCE

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 μm), though 50/125 μm 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

| Voltage | Package | Data Rate | Reach | Application Note | Connector | Standard RoHS Part Number* | | Legacy Part Number | |
|---------|---------|-----------|-------|------------------|-------------|----------------------------|-------------|--------------------|------------|
| | | | | | | Transmitter | Receiver | Transmitter | Receiver |
| 5V | Simplex | DC-5 MBd | 2000m | | ST, SMA, FC | HFBR-14X4Z | HFBR-24X2Z | HFBR-14X4 | HFBR-24X2 |
| | | 20 MBd | 2700m | AN 1038 | ST, SC, SMA | 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 | | | | | |
| | | 155 MBd | 600m | AB 78/AN 5003 | | | | | |
| | | 160 MBd | 500m | AN 1123/AN 5003 | | | | | |
| | | 20 MBd | 5000m | AN 1038 | ST | 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 | | | | | |

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

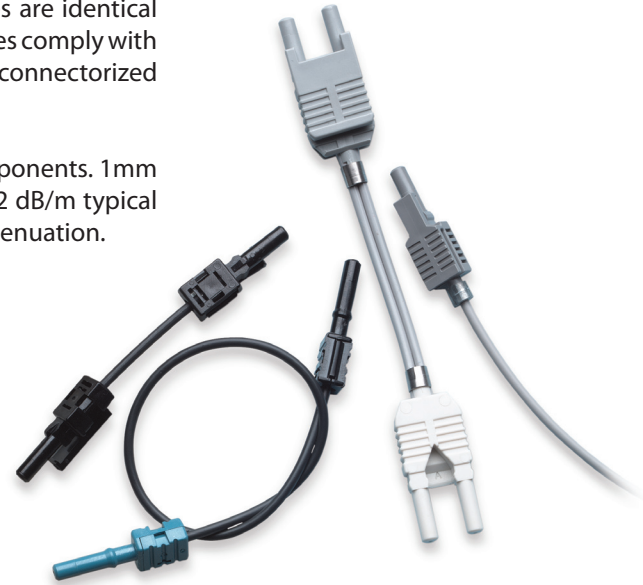
Plastic Optical Fiber Cables

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 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.

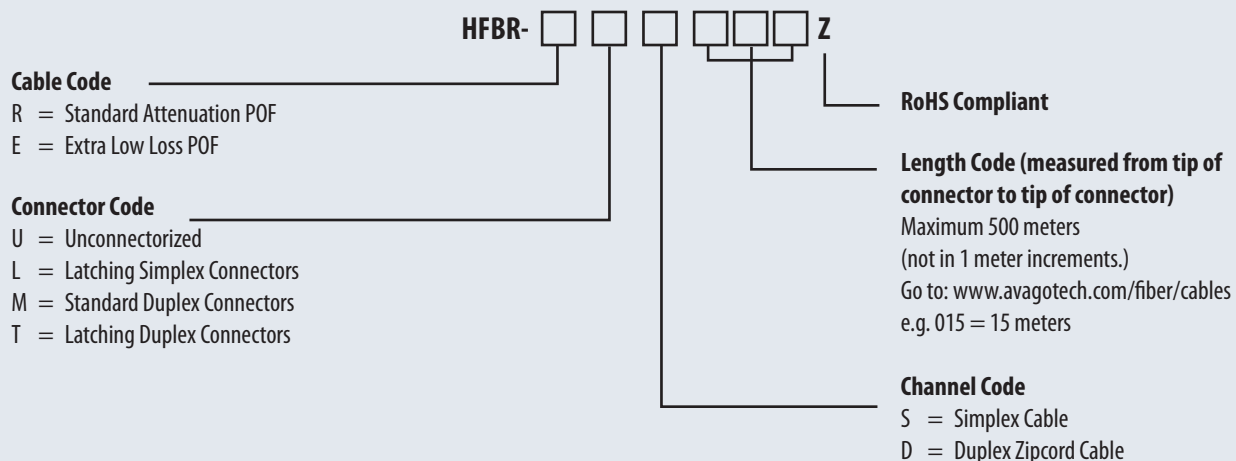
Applications

- 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
- Gaming Equipment
- Data communications

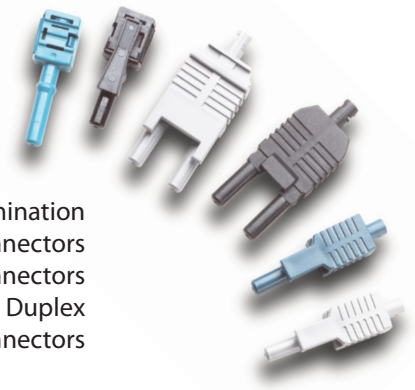


Plastic Optical Fiber Specifications: HFBR-R/EXXYYYZ

| 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).

Crimless 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

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

www.avagotech.com
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AV00-0121EN 8/31/07

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