



Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!



## Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



# HFBR-1506AFZ/HFBR-2506AFZ

## Full Metal Fiber Optic SMA Transmitters and Receivers for 16 MBd SERCOS Applications



## Data Sheet



### Description

SERCOS, an acronym for **S**ERial **R**ealtime **C**ommunications **S**ystems, is a standard digital interface for communication in industrial CNC applications. SERCOS is a European (EN 61491) and international standard (IEC 61491). The optical interface allows data rates of 2,4,8 and 16 MBd and data transfer between numerical controls and drives via fiber-optic rings, with voltage isolation and noise immunity. The HFBR-1506AFZ and HFBR-2506AFZ products have a guaranteed performance up to 16 MBd.

### Features

- RoHS-Compliant
- Meets Industrial SERCOS 16MBd standard
- SMA ports
- 650 nm wavelength
- Metal housing and port
- Specified for use with 1 mm POF and 200  $\mu$ m HCS
- DC - 16 MBd data rate

### Applications

- Industrial Control Data Links
- Factory Automation Data Links
- Voltage Isolation Applications

## Package Information

The RoHS-compliant transmitters and receivers are housed in a metal package that is high strength. Both the transmitter and receiver are built with metal housings and optical ports for excellence air discharge (ESD) performance. The package is designed for auto insertion and wave soldering so it is ideal for high volume production applications.

## Handling and Design Information

When soldering, it is advisable to leave the protective cap on the unit to keep the optics clean. Good system performance requires clean port optics and cable ferrules to avoid obstructing the optical path. Clean compressed air often is sufficient to remove particles of dirt; methanol on a cotton swab also works well.

## Recommended Chemicals for Cleaning/Degreasing

*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-methylpyrrolidone. Also, Avago Technologies does not recommend the use of cleaners that use halogenated hydrocarbons because of their potential environmental harm.

**CAUTION:** The small junction size inherent in the design of these components increases the components' susceptibility to damage from electrostatic discharge (ESD). It is advised that normal static precautions be taken in handling and assembly of these components to prevent damage and/or degradation which may be induced by ESD.

## Table 1. Link Performance Specification

-40 °C to +85 °C unless otherwise noted.

| Parameter                               | Symbol | Min | Max | Unit | Condition | Reference       |
|---|--------|-----|-----|------|-----------|-----------------|
| Link distance with HFBR-1506AFZ/2506AFZ | l      | 0.1 | 45  | mm   | POF       | Note 1, 2, 4, 6 |
|   |        | 0.1 | 100 |      | HCS       | Note 1, 3, 5, 6 |

### Notes:

1. 60 mA nominal drive current.
2. POF HFBR-ExxyyyZ 0.23 dB/m worst case attenuation.
3. HCS Worst Case Attenuation is 10dB/km (0°C to 70°C) and 12dB/km (-40°C to 85°C).
4. Including a 3 dB optical safety margin accounting for link service lifetime.
5. Including a 2 dB optical safety margin accounting for link service lifetime.
6. Signaling rate dc to 16 MBd.

## HFBR-1506AFZ Transmitter

The HFBR-1506AFZ transmitter incorporates a 650nm LED in a metal housing. The high light output power enables the use of both plastic optical fiber (POF) and Hard Clad Silica (HCS). This transmitter can operate up to 16MBd using a simple driver circuit. The HFBR-1506AFZ is compatible with SMA connectors.

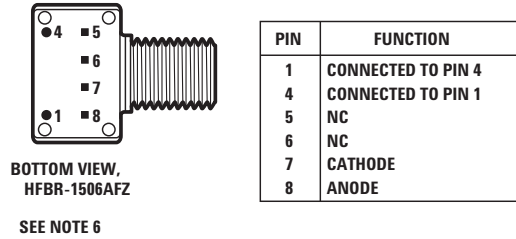


Figure 1.

## Absolute Maximum Ratings

| Parameter                         | Symbol       | Min | Max | Unit | Notes |
|-----------------------------------|--------------|-----|-----|------|-------|
| Storage and Operating Temperature | $T_{S, O}$   | -40 | +85 | °C   |       |
| Peak Forward Input Current        | $I_{F, PK}$  |     | 90  | mA   | 1     |
| Average Forward Input Current     | $I_{F, AVG}$ |     | 60  | mA   |       |
| Reverse Input Voltage             | $V_R$        |     | 3   | V    |       |
| Lead Soldering Cycle              |              |     |     |      |       |
| Temp                              | $T_{SOL}$    |     | 260 | °C   | 2, 3  |
| Time                              | $T_{SOL}$    |     | 10  | s    |       |

### Notes:

- For  $I_{F, PK} > 60$  mA, the duty factor must maintain  $I_{F, AVG} \leq 60$  mA and pulse width  $\leq 1$   $\mu$ s.
- 1.6 mm below seating plane.
- Moisture sensitivity level (MSL) is 3

## Electrical Characteristics Table

-40 °C to +85 °C unless otherwise noted.

| Parameter                               | Symbol                  | Min | Typ   | Max  | Unit  | Condition                   | Notes        |
|---|-------------------------|-----|-------|------|-------|-----------------------------|--------------|
| Optical Power Temperature Coefficient   | $\Delta P_T / \Delta T$ |     | -0.02 |      | dB/°C |                             | Note 3       |
| Forward Voltage                         | $V_F$                   | 1.8 | 2.1   | 2.65 | V     | $I_{F, dc} = 60$ mA         | See Figure 2 |
| Forward Voltage Temperature Coefficient | $\Delta V_F / \Delta T$ |     | -1.8  |      | mV/°C |                             | See Figure 2 |
| Breakdown Voltage                       | $V_{BR}$                | 3.0 | 13    |      | V     | $I_{F, dc} = -10$ $\mu$ A   |              |
| Peak Emission Wavelength                | $\lambda_{PK}$          | 635 | 650   | 662  | nm    |                             | See Figure 4 |
| Full Width Half Max                     | FWHM                    |     | 21    | 30   | nm    |                             | See Figure 4 |
| Diode Capacitance                       | $C_O$                   |     | 60    |      | pF    | $V_F = 0$ V, $f = 1$ MHz    |              |
| Thermal Resistance                      | $\theta_{JC}$           |     | 140   |      | °C/W  |                             | Notes 4, 5   |
| Rise Time (10% to 90%)                  | $t_r$                   |     |       | 15   | ns    | 10% to 90%<br>$I_F = 60$ mA | See Figure 6 |
| Fall Time (90% to 10%)                  | $t_f$                   |     |       | 15   | ns    |                             | See Figure 6 |

### Notes:

- Typical data are at +25 °C
- Thermal resistance is measured with the transmitter coupled to a connector assembly and fiber, and mounted on a printed circuit board.
- To further reduce the thermal resistance, the cathode trace should be made as large as is consistent with good RF circuit design.
- Pins 1 and 4 are for mounting and retaining purposes, but are electrically connected, pins 5 and 6 are electrically isolated. It is recommended that pins 1, 4, 5 and 6 all be connected to ground to reduce coupling of electrical noise.

## Peak Output Power

-40 °C to +85 °C unless otherwise noted.

| Model Number | Symbol | Min   | Max   | Unit | Condition                | Reference |
|--------------|--------|-------|-------|------|--------------------------|-----------|
| HFBR-1506AFZ | Pr     | -6.0  | -2.0  | dBm  | POF, $I_{F,dc} = 60$ mA  | Note 7    |
|              |        | -18.0 | -10.0 |      | HCS*, $I_{F,dc} = 60$ mA | Figure 3  |

### Notes:

- Optical power measured at the end of 1 meters of 1 mm diameter plastic or 200  $\mu$ m hard/plastic clad silica optical fiber with a large area detector.

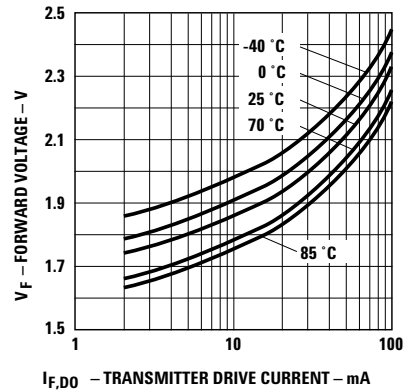


Figure 2. Typical Forward Voltage vs Drive Current

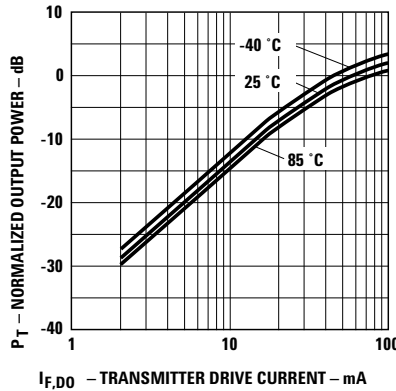


Figure 3. Typical Normalized Optical Power vs Drive Current

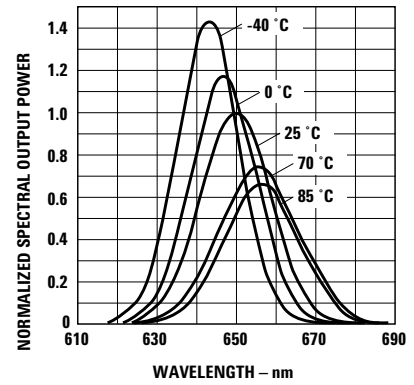


Figure 4. Typical Normalized Optical Spectra

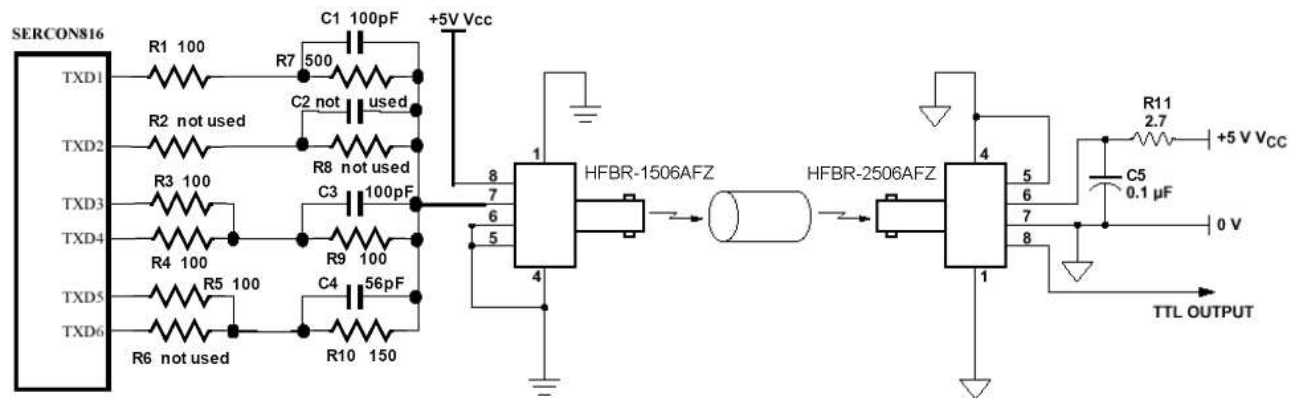
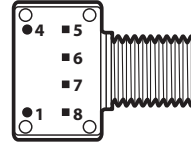


Figure 5. Recommended drive circuit according to SERCOS An17 ( $I_{fnom} \sim 35$  mA)

## HFBR-2506AFZ Receiver

The HFBR-2506AFZ receiver is housed in a metal package, consisting of a silicon PIN photodiode and digitizing IC to produce a logic compatible output. The IC includes a unique circuit to correct the pulse width distortion of the first bit after a long idle period. This enables operation from DC to 16MBd with low PWD for arbitrary data patterns.

The receiver is a “push-pull” stage compatible with TTL and CMOS logic. The HFBR-2506AFZ is compatible with SMA connectors.



BOTTOM VIEW,  
HFBR-2506AFZ

SEE NOTE 4

| PIN | FUNCTION           |
|-----|--------------------|
| 1   | CONNECTED TO PIN 4 |
| 4   | CONNECTED TO PIN 1 |
| 5   | NO CONNECT         |
| 6   | VCC                |
| 7   | GND                |
| 8   | VO                 |

Figure 6.

## Absolute Maximum Ratings

| Parameter                         | Symbol      | Min  | Max | Unit | Notes |
|-----------------------------------|-------------|------|-----|------|-------|
| Storage and Operating Temperature | $T_{S,O}$   | -40  | +85 | °C   |       |
| Supply Voltage                    | $V_{CC}$    | -0.5 | 5.5 | V    |       |
| Average Output Current            | $I_{O,AVG}$ |      | 16  | mA   |       |
| Output Power Dissipation          | $P_{OD}$    |      | 80  | mW   |       |
| Lead Soldering Cycle              |             |      |     |      |       |
| Temp                              | $T_{SOL}$   |      | 260 | °C   | 1, 5  |
| Time                              | $T_{SOL}$   |      | 10  | s    |       |

## Electrical Characteristics Table

-40 °C to +85 °C, 4.75 V <  $V_{CC}$  < 5.25 V,  $V_{P,P}$  Noise < = 100 mV unless otherwise noted.

| Parameter                         | Symbol                | Min        | Typ  | Max        | Unit | Condition                                    | Notes |
|-----------------------------------|-----------------------|------------|------|------------|------|--|-------|
| Peak Input Power Level Logic HIGH | $P_{RH}$              |            |      | -42<br>-44 | dBm  | 1 mm POF<br>200 $\mu$ m HCS                  | 2     |
| Peak Input Power Level Logic LOW  | $P_{RL}$              | -20<br>-22 |      | -2<br>-10  | dBm  | 1 mm POF<br>200 $\mu$ m HCS<br> PWD  < 19 ns | 3     |
| Supply Current                    | $I_{CC}$              |            | 19   | 45         | mA   | $V_O$ = Open                                 |       |
| High Level Output Voltage         | $V_{OH}$              | 4.2        | 4.7  |            | V    | $I_O$ = 40 $\mu$ A                           |       |
| Low Level Output Voltage          | $V_{OH}$              |            | 0.22 | 0.4        | V    | $I_O$ = 1.6 mA                               |       |
| Pulse Width Distortion            | PWD                   | -19        |      | 19         | ns   |  |       |
| Propagation Delay Time            | $T_{P,HL}$ or $_{LH}$ |            |      | 150        | ns   |  |       |

### Notes:

- 1.6 mm below seating plane.
- Typical data are at +25 °C,  $V_{CC}$  = 5.0 V
- BER < =  $10E^{-9}$ , includes a 10.8 dB margin below the receiver switching threshold level (signal to noise ratio =12)
- Pins 1 and 4 are electrically connected to the metal housing and are also used for mounting and retaining purposes. It is recommended that pins 1 and 4 to be connected to ground to maintain housing shield effectiveness.
- Moisture sensitivity level (MSL) is 3

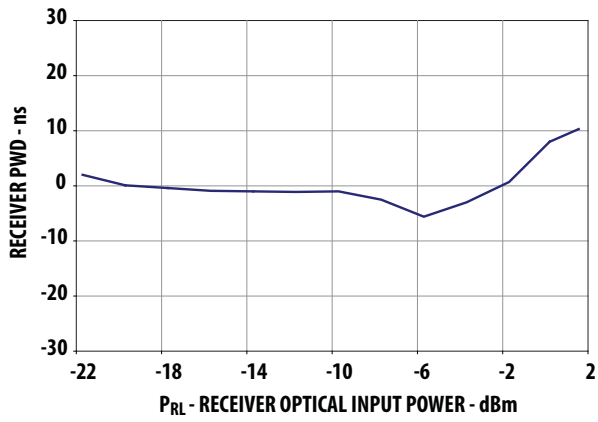


Figure 7. Typical POF receiver pulse width distortion vs optical power

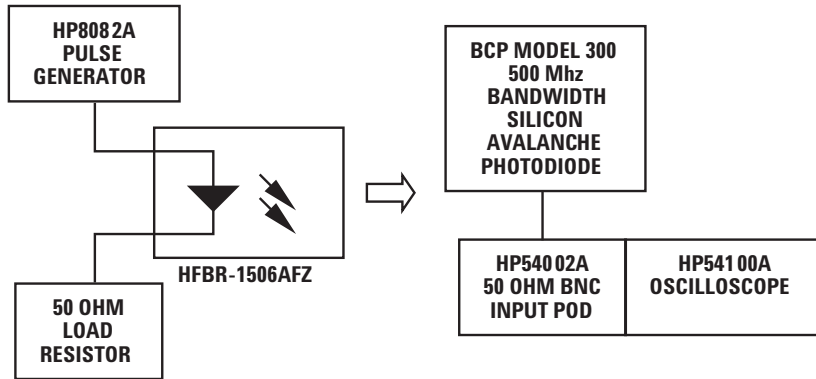
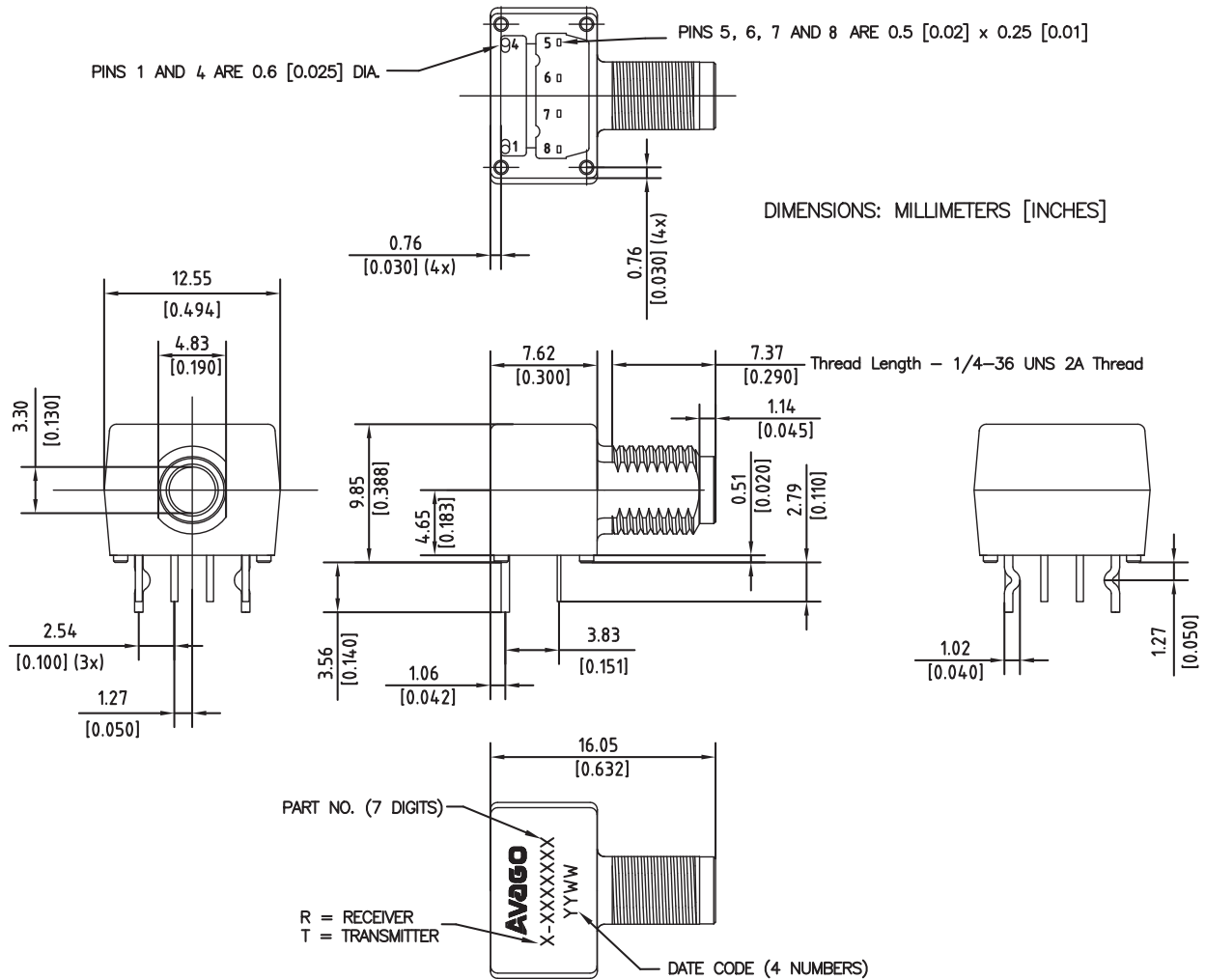


Figure 8. Test Circuit for Measuring Unpeaked Rise and Fall Times

# Mechanical Dimensions

## HFBR-X506AFZ



For product information and a complete list of distributors, please go to our web site: [www.avagotech.com](http://www.avagotech.com)

Avago, Avago Technologies, and the A logo are trademarks of Avago Technologies in the United States and other countries. Data subject to change. Copyright © 2005-2011 Avago Technologies. All rights reserved.  
AV02-1412EN - November 4, 2011



Specifications and content subject to change without prior notification.