Honeywell

## Fiber Optic Components

# HFD3020-500 Series

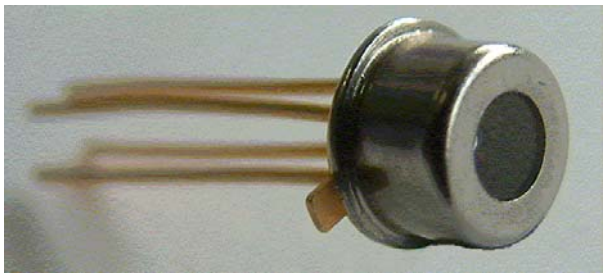
25 Mb Direct Coupled Receiver

### Features.

- Operates at 520 nm, 660 nm and 850 nm
- Suitable for POF, HCS and glass fibre
- Data rates up to 25 Mb/s NRZ
- Great optical dynamic range
- Peak-to-peak detection
- Automatic gain control
- DC-coupling throughout the device
- CMOS-level output signal
- Suggested replacement for our HFD3020-002

### Typical Applications.

- Data communications
- CCTV systems
- Machine tools
- Controls/drives
- Packaging, converting and food processing machines
- Assembly handling and robots
- Simulators and test equipment



The HFD3020-500 provides a noise-immune monolithic optical receiver for fibre-optical applications in the visible range at 520 nm, 660 nm and 850 nm.

Its fibre-optical receiver (integrated device with small mechanical dimensions) has been designed for optical data transfer via polymer fibres (POF, fibre type A4a under IEC 60793-2:1998), HCS fibres (fibre type A3c under IEC 60793-2:1998) and gradient-index glass fibres. Precisely, it serves to convert light into logic levels (CMOS) for data rates up to 25 Mb/s NRZ.

The HFD3020-500 consists of these functional groups: Photodiode, Amplifier (trans-impedance) and Main Amplifier. All functional groups are DC-coupled to allow for steady light applications of the IC.

An essential advantage over other comparable solutions is the optical dynamic range from 0dBm to –30dBm in connection with high speed.

RoHS

**NOTICE**

**PRELIMINARY DOCUMENTATION**

The information contained in this document is preliminary and for reference only. Preliminary means that the product described has not been or is currently being formally tested. Specifications are subject to change without notice. Reliance on the information contained herein is at the reader's own risk.

**WARNING**

**PERSONAL INJURY**

DO NOT USE these products as safety or emergency stop devices, or in any other application where failure of the product could result in personal injury.

**Failure to comply with these instructions could result in death or serious injury.**

**WARNING**

**MISUSE OF DOCUMENTATION**

- The information presented in this product sheet (or catalogue) is for reference only. DO NOT USE this document as product installation information.
- Complete installation, operation and maintenance information is provided in the instructions supplied with each product.

**Failure to comply with these instructions could result in death or serious injury.**

# 25 Mb Direct Coupled Receiver

**OPTICAL / ELECTRICAL DATA**

## Optical Receiver Sensitivity

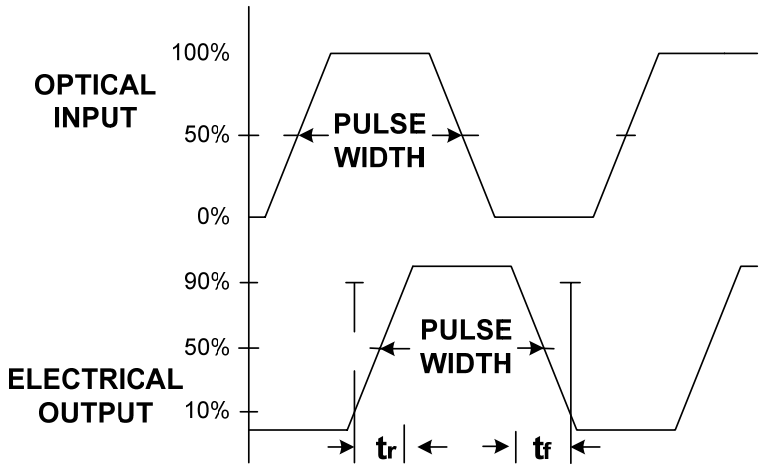
| | |
|---|---|
| at 520 nm: | $P_{MIN}$ < -28,2 dBm (polymer fibre) |
| at 660 nm: | $P_{MIN}$ < -30,0 dBm (polymer fibre) |
| | $P_{MIN}$ < -30,0 dBm (HCS fibre) |
| at 850 nm: | $P_{MIN}$ < -30,0 dBm (50µ glass fibre) |
| | $P_{MIN}$ < -30,0 dBm (62.5µ glass fibre) |
| Requirements: | Data rate: DC to max. 25 MBit/s NRZ, |
| | Random sequence, bit error rate: $10^{-9}$ |
| | Ambient temperature: -25...+85°C |
| | Bit distortion: < 20% |

## Optical Overload Limit

| | |
|---|---|
| at 660 nm: | $P_{MAX}$ = 2 dBm |
| at 520 nm: | $P_{MAX}$ = 2 dBm |
| at 850 nm: | $P_{MAX}$ = 0 dBm (50µ glass fibre) |
| | $P_{MAX}$ = 0 dBm (62,5µ glass fibre) |
| Requirements: | Data rate: DC to 25 MBit/s NRZ, |
| | Random sequence, bit error rate: $10^{-9}$ |
| | Ambient temperature: -25...+85°C |
| | Bit distortion: < 20% |
| | Supply voltage: +4.75 ... +5.25 VDC |

## Digital Output (CMOS)

| | |
|---|---|
| Output voltage: | High level (light on): $V_{dig} \geq 0.7*VDD$ |
| | Low level (light off): $V_{dig} \leq 0.3*VDD$ |




10% - 90% (VDD), rise time measured with output capacitance $C_{load}$ = 5 pF
90% - 10% (VDD), fall time measured with output capacitance $C_{load}$ = 5 pF

25 Mb Direct Coupled Receiver

## OPERATING REQUIREMENTS / MAXIMUM RATINGS

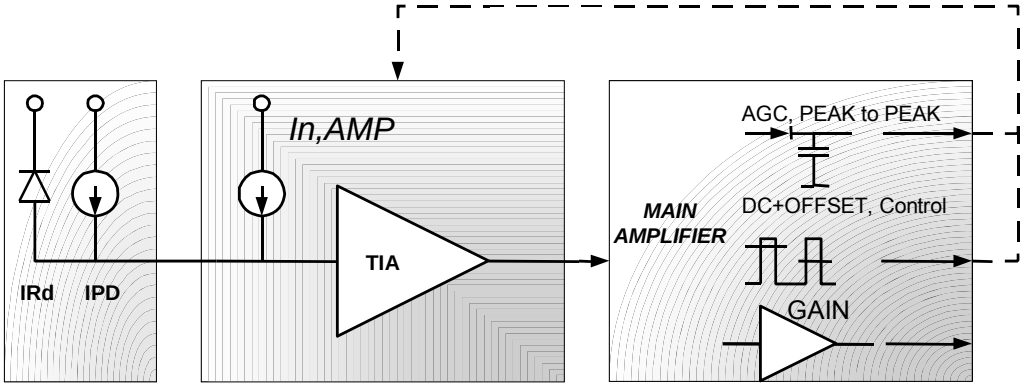
Stress greater than the listed ratings may cause permanent damage to this device. $V_{DD}$ = 5 V, $T_A$ = 25°C, GI glass fiber 50/125, unless otherwise noted

| Parameter | Test conditions | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Supply voltage | | $V_{DD}$ | 4.75 | 5.0 | 5.25 | V |
| Supply voltage to ground | | | -0.3 | | 5.5 | V |
| Supply current | | $I_{DD}$ | | 35 | | mA |
| Sensitivity | PWD < 20% [1]<br>16 MBit/s, 850 nm | $P_{in}$ | | -30 | | dBm |
| Overload limit [2] | 16 MBit/s, 850 nm | | | | | dBm |
| Maximum optical input power | 850 nm | | | | 2 | dBm |
| Data rate | | | 0 | 16 | 25 | MBit/s |
| Output level H | $I_{OH}$ = 5 mA | $V_{OH}$ | 0.7 $V_{DD}$ | | | V |
| Output level L | $I_{OL}$ = -5 mA | $V_{OL}$ | | | 0.3 $V_{DD}$ | V |
| Output current | | $I_O$ | | | 10 | mA |
| Photo-current rise time | 10% – 90%, $C_L$ = 5pF | $t_r$ | | 2 | 5 | ns |
| Photo-current fall time | 90% – 10%, $C_L$ = 5pF | $t_f$ | | 2 | 5 | ns |
| Operating temperature | | $T_A$ | -25 | | +85 | °C |
| Storage temperature | | $T_S$ | -40 | | +100 | °C |
| Soldering temperature | Max. 10 seconds | T | | | +260 | °C |

1 PWD (pulse width deviation) with respect to input data rate, test pattern 1010… (NRZ), measured using active probe Lecroy HFP1500; PWD of ≤ 20% means <± 20% of the nominal pulse width

2 Upper limit of the dynamic range, PWD ≤ 20%, test pattern 1010… (NRZ), the overload limit is guaranteed by design, but not tested

## BLOCK DIAGRAM




## OPTICAL FIBRE TYPES

The integrated receiver HFD3020-500 is specified for operation with the following optical fibre types [3]

| | Polymer fibre (POF: polymer optical fibre) | Hard-clad silica (HCS) fibre | GI glass fibre 50/125 | GI glass fibre 62.5/125 |
|---|---|---|---|---|
| International standard | IEC 60793-2:1998, type A4a | IEC 60793-2:1998, type A3c | IEC 60793-2:1998 | IEC 60793-2:1998 |
| Core diameter | 980 µm | 200 µm | 50 µm | 62.5 µm |
| Cladding diameter | 1000 µm | 230 µm | 125 µm | 125 µm |
| Single-fibre diameter | 2.2 mm | 2.9 mm | 2.9 ± 0.1 mm | 2.9 ± 0.1 mm |
| Numerical aperture | 0.50 ± 0.03 | 0.36 ± 0.04 | 0.2 | 0.29 |
| Bandwidth-length-product | | | 400 MHz*km (850nm) | 200 MHz*km (850nm) |
| Attenuation | < 230 dB/km | < 10 dB/km | ≤ 2.5 dB/km (850nm) | ≤ 3.0 dB/km (850nm) |

3 Light power values measured with one large-area Si-photo detector, calibrated for a respective wavelength of 660nm or 850nm and operation with polymer fibres or gradient-index glass fibres

# 25 Mb Direct Coupled Receiver

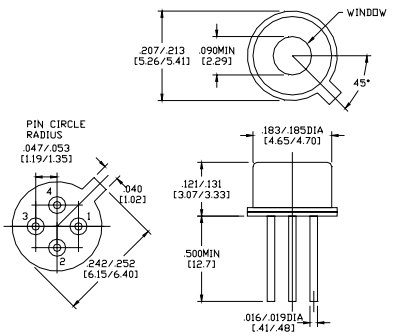
## OUTLINE DIMENSIONS and ORDER GUIDE

All dimensions are in inches [mm] (except as noted)

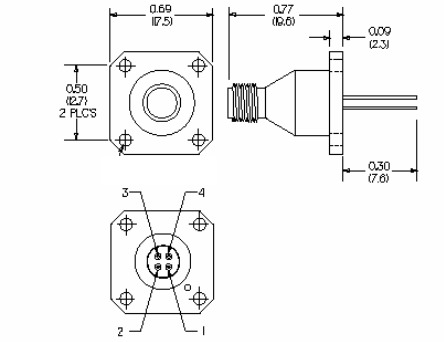
Pinout :

Pin 1: NC, Pin 2: VDD, Pin 3: D_OUT, Pin 4: GND

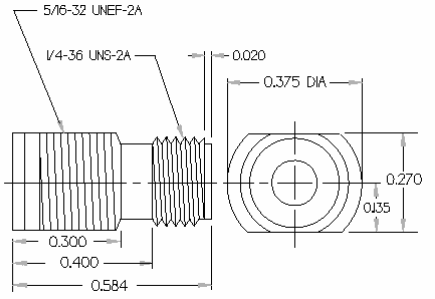
HFD3020-500



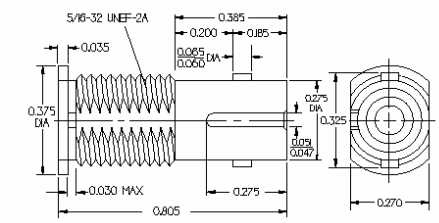

HFD3020-500-ADA SMA 4 hole



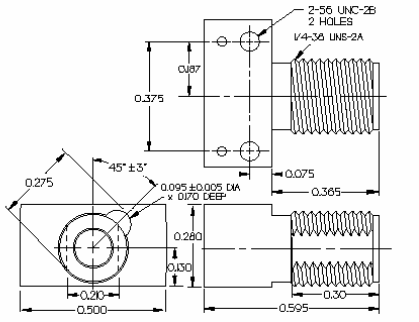

HFD3020-500-AAA SMA single hole



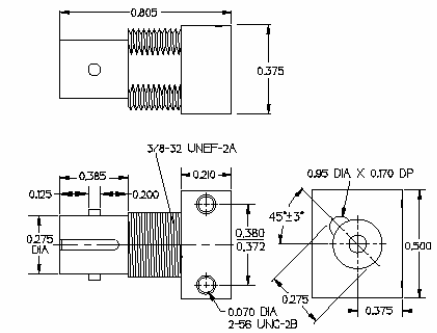

HFD3020-500-BAA ST single hole




HFD3020-500-ABA SMA PCB

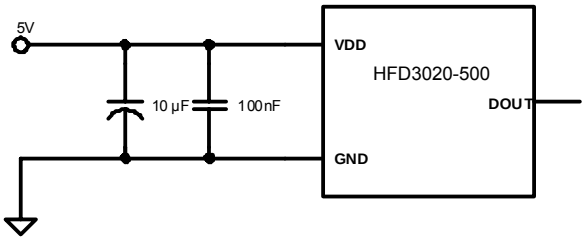



HFD3020-500-BBA ST PCB



**APPLICATION INFORMATION**

A)

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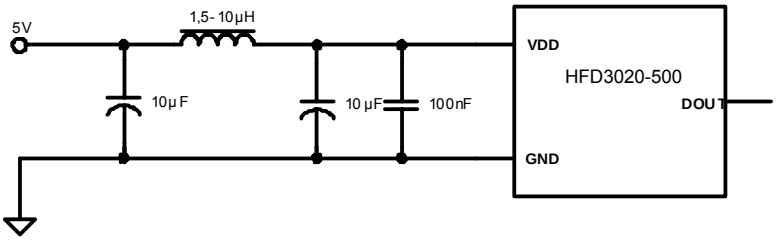
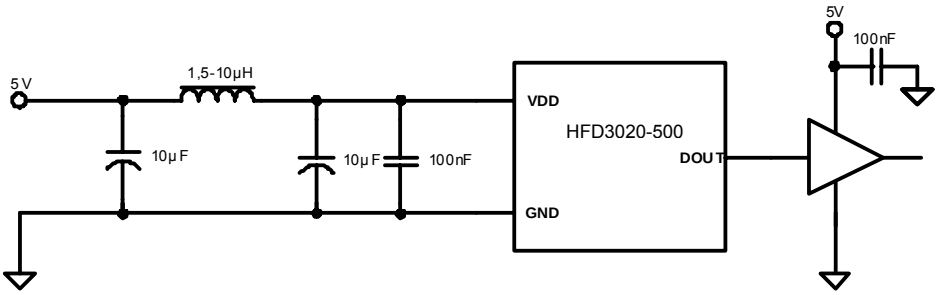
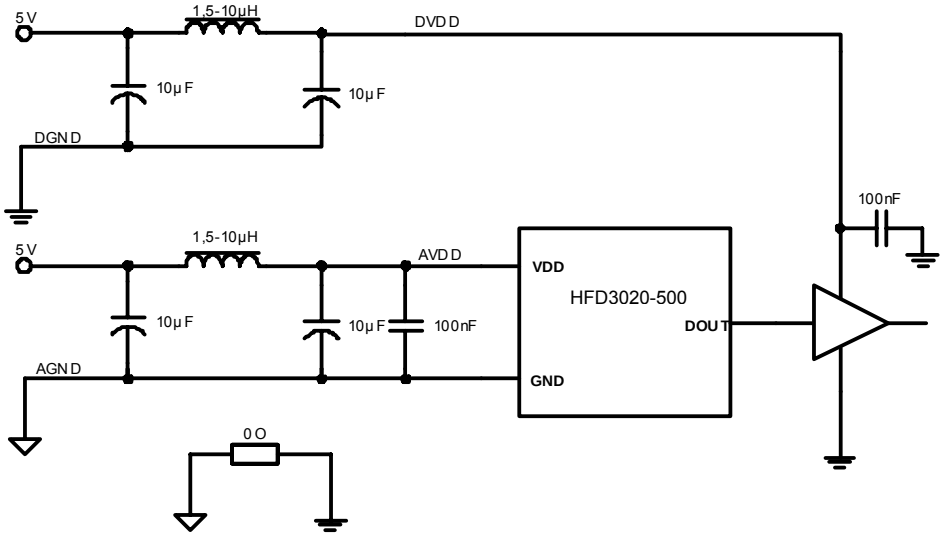



C)




D)



The HFD3020-500 is a sensitive mixed-signal IC operating at high frequencies. Please note that the case is connected to the GND pin. Care should be taken applying the IC to meet the specifications. Prototyping boards are not recommended. A good practice is to use a printed circuit board (PCB) with a ground plane. A 100 nF ceramic chip capacitor should be placed as close as possible to the power supply pins.

A) This figure shows a simple circuit. In addition to the ceramic capacitor a 10 µF electrolytic capacitor is used for supply buffering. Tantalum capacitors are a better choice than aluminium parts.

B) This circuit shows a LC filter for better noise suppression. Tantalum capacitors are recommended. Please note that the HFD3020-500 draws about 35 mA. The inductor resistance should be lower than 1 Ω to avoid large voltage drops. This filter configuration is useful when noisy power supplies are used.

C) Some applications require buffering or inverting of the output signal. Therefore good supply filtering of the HFD3020-500 is recommended to suppress peaks caused by the switching of the buffer. A decoupling capacitor must be applied to the supply of the buffer.

D) Most applications are digital systems (shown as a buffer) where the output data of the HFD3020-500 are processed using microcontrollers and digital signal processors. It is well known that digital circuits produce much noise which may disturb the analog parts. Therefore special care must be taken to keep digital noise away from the receiver. It is proposed to separate the analog power supply (AVDD) from the digital power supply (DVDD) and the analog ground (AGND) from the digital ground (DGND) as well. Use just one point on the PCB to connect AGND and DGND. This connection is symbolized by the 0 Ω bridge in the figure. Avoid ground loops. A ground plane for AGND is recommended.

Power supply filtering is necessary if switched-mode power supplies or switched-mode regulators such as DC-DC converters are used because of their switching noise. Excessive noise can disturb the performance of the ASIC. An additional linear regulator for AVDD may help to damp the ripple.

Buffering the HFD3020-500

Some applications require buffering, inverting or level shifting of DOUT. Long wires and cables are not recommended for interfacing the IC with other circuits. The ASIC is designed to drive a load of 5 pF. Please note that an additional circuit may reduce the rise and fall times of the IC.

The pulse width at DOUT is measured at 0.5 x VDD and can change at the output of the buffer compared to the original pulse width at DOUT. This is an additional PWD (pulse width deviation) caused by buffers operating at TTL levels (or other levels) and can slightly reduce the system performance.

Bus drivers or logic gates of the CMOS standard logic series like 74HC, 74AC, 74LCX or 4K are recommended for buffering or inverting of DOUT. Connect only one gate or buffer to DOUT. Please check if the rise and fall times are sufficient for the application.

25 Mb Direct Coupled Receiver

**CAUTION**

The inherent design of this component causes it to be sensitive to electrostatic discharge (ESD). To prevent ESD-induced damage and/or degradation to equipment, take normal ESD precautions when handling this product.


**FIBER INTERFACE**

Honeywell detectors are designed to interface with multimode fibers with sizes (core/cladding diameters) ranging from 50/125 to 200/230 microns. Honeywell performs final tests using 100/140 micron core fiber. The fiber chosen by the end user will depend upon a number of application issues (distance, link budget, cable attenuation, splice attenuation, and safety margin). The 50/125 and 62.5/125 micron fibers have the advantages of high bandwidth and low cost, making them ideal for higher bandwidth installations. The use of 100/140 and 200/230 micron core fibers results in greater power being coupled by the transmitter, making it easier to splice or connect in bulkhead areas. Optical cables can be purchased from a number of sources.

**NOTICE**

**EVALUATION PRODUCTS**

These products are prototype, pre-production items that have yet to complete all phases of product release testing and are for customer evaluation.

These items are sold **"AS IS" WITH NO WARRANTY, EXPRESS OR IMPLIED, INCLUDING THAT OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.**

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