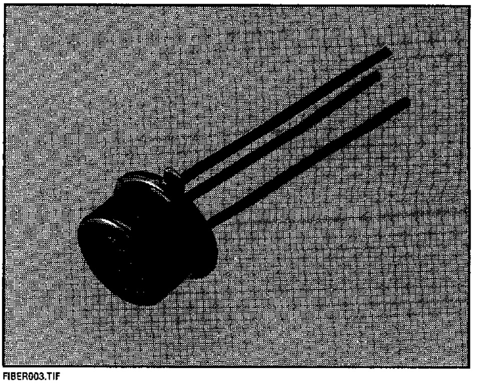
HFD3000

TTL Output Receiver

FEATURES

- Converts fiber optic input signals to TTL digital outputs
- Typical sensitivity 500 nW peak (-33 dBm)
- Single 5 V supply requirement
- Edge detection circuitry gives 20 dB minimum dynamic range, low Pulse Width Distortion
- Operates up to 10 Mbps NRZ
- Metal cap with TO-46 collar
- Designed to operate with Honeywell 850 nm LEDs and integrated transmitters
- Also available mounted in ST® connectors
- Offered in plastic package (HFD3020)



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DESCRIPTION

The HFD3000 is a sensitive differentiating optical receiver designed for use in short distance, 850 nm fiber optic systems. The receiver uses a hybrid construction consisting of a PIN photodiode, bipolar integrated receiver circuit with internal voltage regulation and internal bypass capacitor. The TTL output allows it to be directly interfaced with standard digital TTL circuits. The HFD3000 receiver is supplied in a Honeywell metal package, and can be mounted in several types of fiber optic connectors. Companion optical transmitters are available for use with the HFD3000.

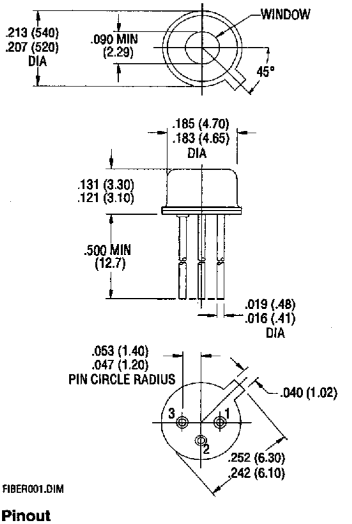
APPLICATION

The HFD3000 optical receiver converts the optical signal in a point to point data communications fiber optic link to a TTL output. The HFD3000 is designed to be mounted in a fiber optic connector that aligns the optical axis of the component to the axis of the optical fiber. Its PIN photodiode is mechanically centered within the TO-46 package. Honeywell can also mount the receiver in ST® fiber optic connectors.

Electrical isolation is important in obtaining the maximum performance of this high sensitivity receiver. Shielding can reduce coupled noise and allow maximum sensitivity to be obtained. This can include the use of ground planes in the PCB, shielding around the device, and shielding around the leads.

The maximum temperature of 100°C allows the HFD3000 to be designed into a broad variety of applications.

OUTLINE DIMENSIONS in inches (mm)



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Pinout

1. Vcc
2. Output (TTL)
3. Case (ground)

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APPLICATION (continued)

Honeywell also offers companion transmitters designed to operate in conjunction with the HFD3000.

Optical power (photons) from the fiber strikes the PIN photodiode and is converted to electrical current. This current is then converted into a voltage in the transimpedance preamplifier. The postamplifier is a voltage gain stage with excellent temperature tracking. The edge detection circuit includes an operational amplifier configured as a differentiator, whose output is proportional to the rate of change of the optical signal. A latch retains the most recent edge transition, and an inverting buffer drives the TTL output.

Bandwidth has been limited to minimize noise problems. Reduced pulse width distortion (PWD) is a byproduct of the bandwidth limitation. The output of the differentiator has a fixed setting time to insure good PWD in most applications. Another effect resulting from the fixed setting time is that PWD increases with increased optical power. The accompanying curves illustrate how PWD increases with increased optical power, increased temperature, and decreased duty cycle.

Pulse width distortion (PWD) manifests itself as an increase in the width of the TTL low portion of an output wave form, with the TTL high portion decreasing by a like amount. The amount of PWD that a given system can tolerate without an error, due to missing a bit of information is dependent upon system considerations. The output of the HFD3000 will typically connect to the input of some form of a Serial Interface Adaptor IC. The specifications for that IC govem the amount of PWD that can be tolerated in that system.

Because the HFD3000 reacts to transitions in the optical signal rather than DC levels, it shows excellent stability versus temperature and other operating conditions. Also, the device is much less sensitive to the absolute level of the optical signal than DC coupled receivers, allowing for a broad range of optical source powers and/or link distances.

The edge detection circuit monitors the output of the differentiator, and triggers when its output exceeds preset levels. These levels are established sufficiently above the worst case RMS noise level. This allows an excellent BER (bit error rate), while they are low enough to give sufficient sensitivities to permit operation over long links. This circuitry recognizes the polarity of the change of the optical signal, setting the latch to a "1" when the optical input goes from low to high, and setting the latch to a "0" when the optical input decreases.

NOTE: The final output stage inverts the polarity. When initially powered up, the output state is set to a "1". After setting of the device occurs, incoming edge transitions are recognized and logic switching occurs.

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ELECTRO-OPTICAL CHARACTERISTICS (T_C = 25°C, V_{CC} = 5 VDC unless otherwise stated)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Minimum Input Sensitivity	P_{IN} (peak)		0.5	1.0	µW	λ_P = 850 nm into 100/140 µm optical fiber, f = 2.5 MHz, Duty Cycle = 50%
High Level Logic Output Voltage	V_{OH}	2.4	3.3		V	$P_{IN} \leq 0.1$ µW, $I_O \leq 0.8$ mA
Low Level Logic Output Voltage	V_{OL}			0.4	V	$P_{IN} \geq 1$ µW, $I_O \leq 0.8$ mA
Rise Time	t_R		12		ns	P_{IN} = 1 µW, V_O = 0.4 to 2.4 V
Fall Time	t_F		3		ns	P_{IN} = 1 µW, V_O = 2.4 to 0.4 V
Supply Current	I_{CC}		15 15	20 20	mA	$P_{IN} \leq 0.1$ µW $P_{IN} \leq 1$ µW
Pulse Width Distortion	PWD		5 20	10 25	%	P_{IN} = 1 µW peak P_{IN} = 100 µW peak f = 2.5 MHz, Duty Cycle = 50%

ABSOLUTE MAXIMUM RATINGS

(25°C Free-Air Temperature unless otherwise noted)

Storage temperature	-65 to +150°C
Operating temperature	-55 to +100°C
Lead solder temperature	260°C, 10 s
Junction temperature	150°C
Supply voltage	+6 V

Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

RECOMMENDED OPERATING CONDITIONS

Operating temperature	-40 to 85°C
Supply voltage	+4.5 to +5.5 V
Optical input power	1 to 100 µW
Optical signal pulse width	> 100 ns
Optical signal edges (10 to 90%)	< 20 ns

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ORDER GUIDE

Description	Catalog Listing
Fiber optic TTL output receiver, metal package	HFD3000-002

This package is also available in special interface receptacles for interfacing to standard fiber optic cables.

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.

BLOCK DIAGRAM

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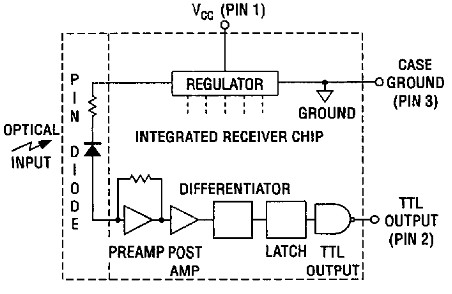

SWITCHING WAVEFORM

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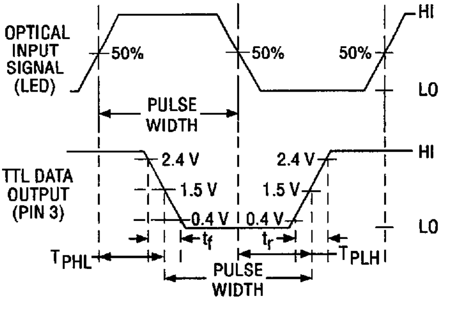

Fig. 1 Pulse Width Distortion vs Temperature

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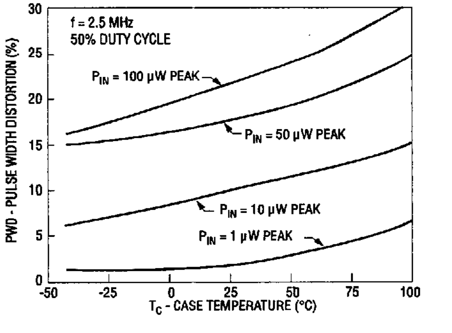

Fig. 2 Propagation Delay vs Temperature

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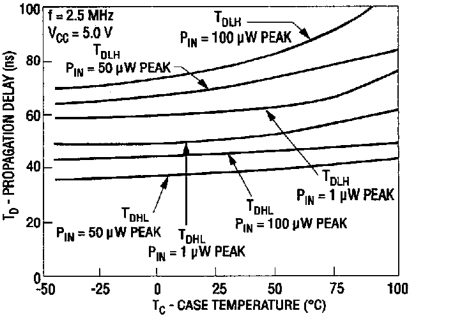

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Fig. 3 Pulse Width Distortion vs Optical Input Power

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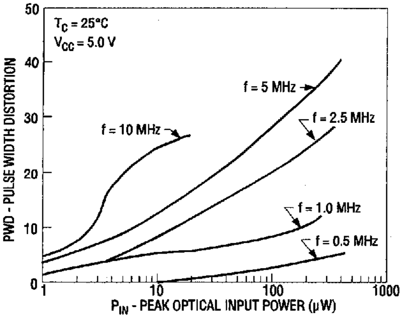

Fig. 4 Propagation Delay Time vs Optical Input Power

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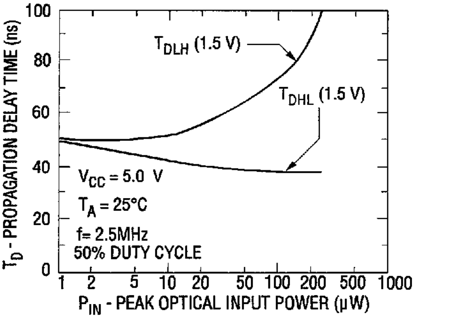

Fig. 5 Supply Current vs Temperature

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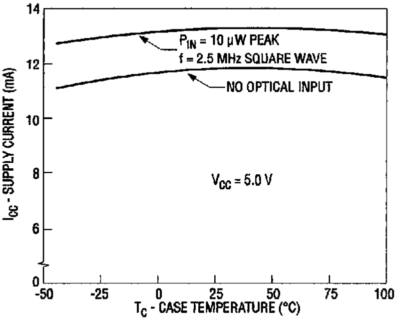

Fig. 6 Spectral Responsivity

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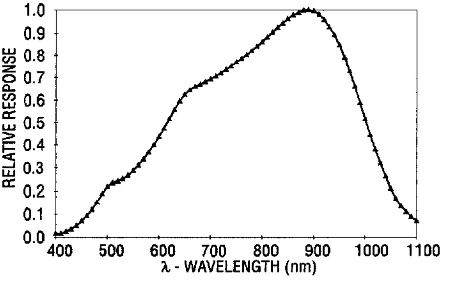

Fig. 7 Pulse Width Distortion vs Frequency

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