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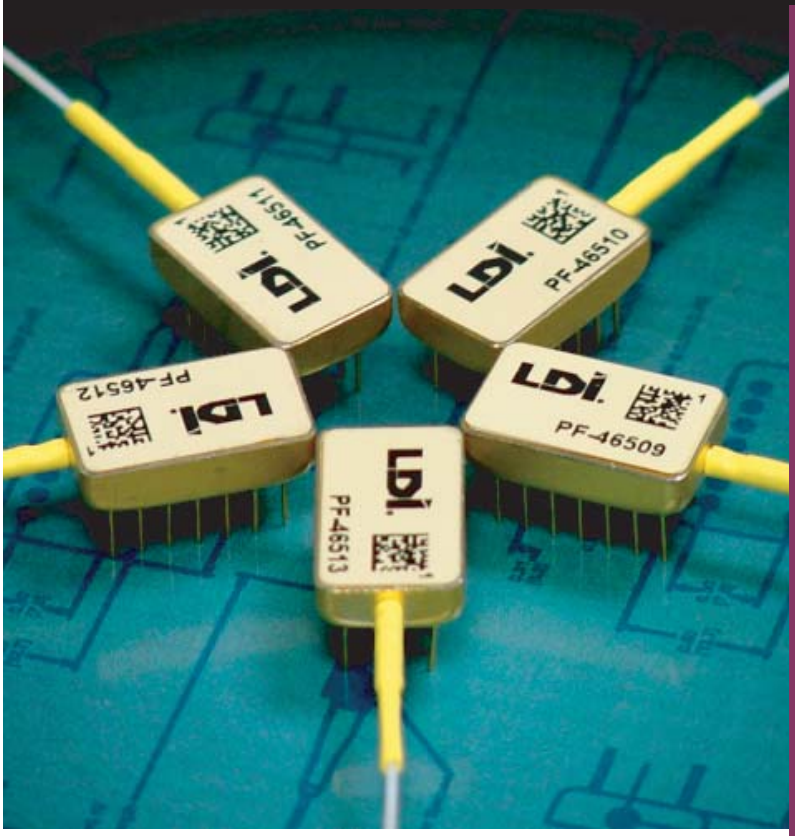
tyco / Electronics
Fiber Optic Business Unit

LDI.
Laser Diode Incorporated

PINFET
optical receiver modules



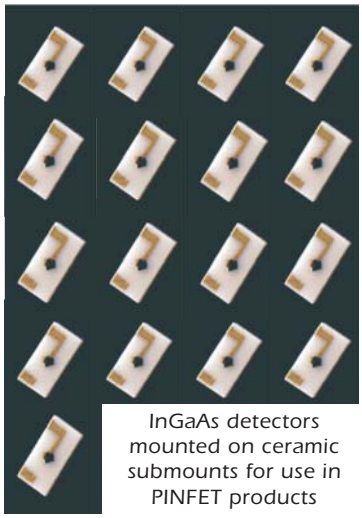
- **High sensitivity**
- **High overload power**
- **Wide dynamic range**
- **850, 1310, 1550nm operation**
- **Hermetic package**
- **Custom bandwidths available**

The Laser Diode Incorporated PINFET provides an excellent solution for optical receiver systems that require both high sensitivity and wide dynamic range. Applications include telecommunications line-terminating equipment or repeaters and optical sensor systems. The receiver package offers high reliability satisfying Telcordia specifications.

The term "PINFET" (p-intrinsic-n, field-effect transistor) indicates the integration of a PIN photodiode and a discrete, high-performance transimpedance amplifier stage. Light is coupled into the detector stage through a multimode optical fiber pigtail, which allows excellent coupling with either singlemode or multimode fiber systems.

10-4400-0008 Rev. B

Specifications and Limits



InGaAs detectors mounted on ceramic submounts for use in PINFET products

Performance @ 25° C (+/- 5.0 VDC)

		Minimum[1] Bandwidth (MHz)	Suggested[2] Data Rate (Mb/s)	Sensitivity[3] (dBm) min	typ	Dynamic Range (dB) typ	Transimpedance (Kohms) typ
LDPF Series	LDPF 0004	4	6	-54	-56	25	1100
	LDPF 0012	12	17	-51	-53	25	740
	LDPF 0024	24	34	-48	-50	25	340
	LDPF 0032	32	45	-47	-49	25	210
	LDPF 0065	65	90	-43	-45	25	80
	LDPF 0120	120	168	-40	-42	25	40
	LDPF 0250	250	350	-35	-37	25	10
LDPW Series	LDPW 0003	3	4	-54	-56	53	1100
	LDPW 0012	12	17	-50	-52	49	350
	LDPW 0024	24	34	-48	-50	47	340
	LDPW 0036	36	52	-46	-48	45	210
	LDPW 0065	65	90	-41	-43	40	60
	LDPW 0110	110	155	-38	-40	37	30
LDSF Series	LDSF 0004	4	6	-51	-56	25	1100
	LDSF 0012	12	17	-48	-52	25	740
	LDSF 0024	24	34	-44	-50	25	340
	LDSF 0032	32	45	-43	-48	25	210
	LDSF 0065	65	90	-38	-43	25	80
	LDSF 0120	120	168	-34	-40	25	40
	LDSF 0250	250	350	-29	-31	25	10

Laser Diode's standard PINFETs use a low dark current, Indium Gallium Arsenide (InGaAs) PIN photodiode with high responsivity between wavelengths of 1100nm and 1600nm (higher wavelengths also available). The detector is mounted directly onto a hybrid circuit assembly for optimum signal performance. In addition, low-noise MESFETs are used in the amplifier stages to further enhance device performance. The fiber pigtail is actively aligned with the detector and soldered in place to provide a highly stable coupling mechanism.

The LDPF series PINFET receiver is LDI's highest sensitivity product. The sensitivity is maximized at a particular bandwidth that may be selected from our standard offering or can be defined by the customer for high volume applications. This product contains no automatic gain control (AGC) so the dynamic range is limited to 25 dB.

The LDPW series PINFET includes AGC and has been optimized for wide dynamic range operation (up to 0 dBm)while maintaining a very high sensitivity level.

Common Characteristics @ 25° C

	Units	LDPF Series min	typ	max	LDPW Series min	typ	max	LDSF Series min	typ	max
Dark current @ -5 V	nA		0.50	1		0.50	1		0.50	1
Maximum optical input @ -5 V	dBm		Sensitivity Level (dBm) +25dB		-3	0			Sensitivity Level (dBm) +25dB	
Sensitivity derating over operating temperature	dB		<1			<1			<1	
InGaAs detector responsivity	A/W									
1300 nm			0.9			0.9			-	
1550 nm			0.95			0.95			-	
Si detector responsivity	A/W									
850 nm			-			-			0.50	
Maximum output signal level	V_{pp}		2.5			0.8			2.5	
Output impedance	Ohms		10			10			10	
Load impedance	Ohms		1000			1000			1000	
Supply voltage	V	4.5		5.5	4.5		5.5	4.5		5.5
Power supply current +5 V	mA		25	35		25	35		25	35
Power supply current -5 V	mA		10	15		10	15		10	15

Fiber Specifications

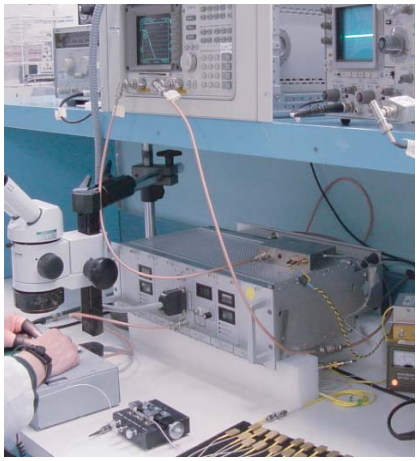
Fiber type	Index Profile	N/A	Nominal Size (um)	Cladding Tolerance	900 um Buffer Material	Fiber Yield Strength (N)	Fiber Bend Radius min. (mm)
Multimode tight buffer	Graded	0.2	50/125/245/900	125 +/-2.0 um	Hytrel	10	30

Other fiber types are available. Please contact the Laser Diode Sales Department or your local Laser Diode representative.

Absolute Maximum Ratings

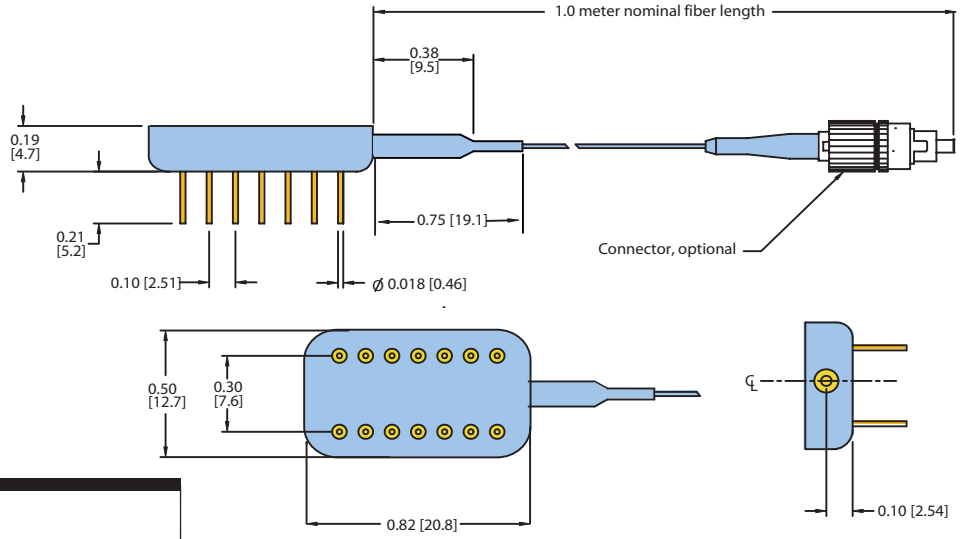
	Units	LDPF Series	LDPW Series	LDSF Series
Operating temperature	°C	-40 to 70	-40 to 70	-40 to 70
Storage temperature	°C	-40 to 85	-40 to 85	-40 to 85
Positive supply voltage	V	7	7	7
Negative supply voltage	V	-7	-7	-7
Detector bias	V	-20	-20	-20
Soldering time at 260°C	secs	10	10	10

Notes:
1. Bandwidth is measured at the -3 dB point.
2. A given bandwidth will typically support an NRZ data rate of 1.4 times the 3 dB bandwidth.
3. Sensitivity is calculated using the noise voltage measured at 25°C at the output of a 3-pole Butterworth filter whose bandwidth equals that of the PINFET's minimum specified bandwidth. Sensitivity is specified as the average optical power in dBm measured at 1300nm and T_a = 25°C for a BER of 10^{-9}.



Characteristic testing of PINFET receivers.

Outline Drawing



Pin Assignments	
Pin	Function
1	-5 V detector bias
2,6,9,11	no connection
12,13,14	no connection
3,5,8	ground
4	-5 volts
7	output
10	+5 volts

Application Notes:

1. Laser Diode's standard or custom bandwidth tuned products offer optimized sensitivity at the specified bandwidth. A PINFET essentially operates as an analog receiver. However, in the great majority of applications, they are used to receive digital information. A given bandwidth will typically support an NRZ data rate of 1.4 times the specified 3 dB bandwidth.
2. Sensitivity is the minimum optical input power required to achieve a targeted bit error rate (BER). Sensitivity is determined by measuring the noise voltage at the output of a 3-pole Butterworth filter with a bandwidth equal to the minimum required bandwidth. Sensitivity is calculated by using the noise voltage value in the following equation:

$$\text{Sensitivity (dBm)} = 10 \log \frac{K\, V_n}{T_g}$$

where:

K is a constant determined by the target BER,

i.e.

BER	K
10^{-9}	6.0
10^{-10}	6.4

V_n is the noise voltage in millivolts.

T_g is the transfer gain in V/W. It is defined as the voltage out per unit of optical power into the PINFET. This can be calculated using: T_g = Responsivity (A/W multiplied by Transimpedance (ohms).

3. To calculate the output voltage (peak-to-peak) of a PINFET, use the following equation:

$$V_{out} = 2\, P_{in} \times T_g$$

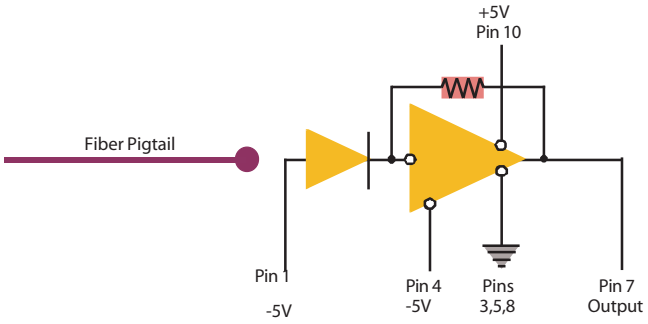
where:

P_{in} is the average optical input power in watts.

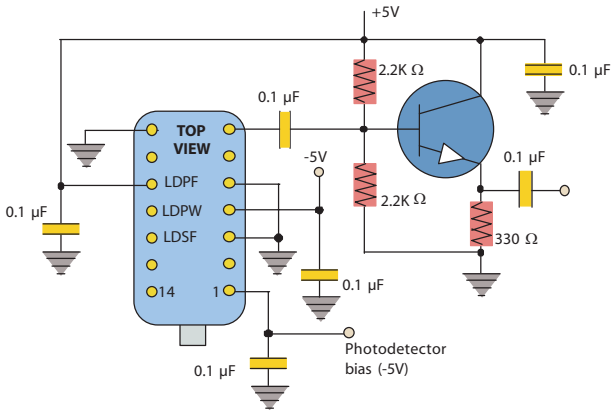
T_g is defined in 2 above.

4. When designing a receiver using LDI's transimpedance PINFETs, the following practices should be observed:
   a. Match the output impedance to 1 Kohm. A suitable schematic is shown herein.
   b. For maximum stability, use a low impedance ground return in your design.
   c. If your voltage supply lines are susceptible to noise, use a full LC filter close to the PINFET module.

Functional Diagram - LDPF Series Receiver



Typical Interface - LDPF, LDPW, and LDSF Series



PINFET
optical receiver modules

Our Sites
in
Edison, New Jersey

Product Changes

Laser Diode Incorporated reserves the right to make changes to the product(s) or information contained herein without notice. No liability is assumed as a result of their use or application.

Handling Precautions

Handle optical fiber with normal care, avoiding stretch, tension, twist, kink or bend abuse. Products are subject to the risks normally associated with sensitive electronic devices including static discharge, transients, and overload.

Ordering

Products can be ordered directly from Laser Diode Incorporated or its representatives. When ordering, refer to the model numbers below. For a complete listing of representatives, visit our website at www.laserdiode.com.

Special Orders

Some products can be supplied with performance characteristics to meet unique customer requirements and differ from those indicated herein. Contact the Laser Diode Incorporated Sales Department or your local representative to discuss your individual requirements. For a complete listing of representatives, visit our website at www.laserdiode.com.

Model Numbers

Using the performance tables in this document, select a series and a bandwidth within the series and use the following numbers to order:

LDPF Series High Sensitivity	**LDPW Series** Wide Dynamic Range	**LDSF Series** 850nm Operation
LDPF 0004XX	LDPW 0003XX	LDSF 0004XX
LDPF 0012XX	LDPW 0012XX	LDSF 0012XX
LDPF 0024XX	LDPW 0024XX	LDSF 0024XX
LDPF 0032XX	LDPW 0036XX	LDSF 0032XX
LDPF 0065XX	LDPW 0065XX	LDSF 0065XX
LDPF 0120XX	LDPW 0110XX	LDSF 0120XX
LDPF 0250XX		LDSF 0250XX

Note:
To indicate the pigtail connector termination you require, substitute one of the following designations for "XX" in the above table:

No suffix indicates no connector.
Use **FC** to indicate an FC/PC type connector.
Use **LC** to indicate an LC/PC type connector.
Use **SC** to indicate an SC/PC type connector.
Use **ST** to indicate an ST® type connector.

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