

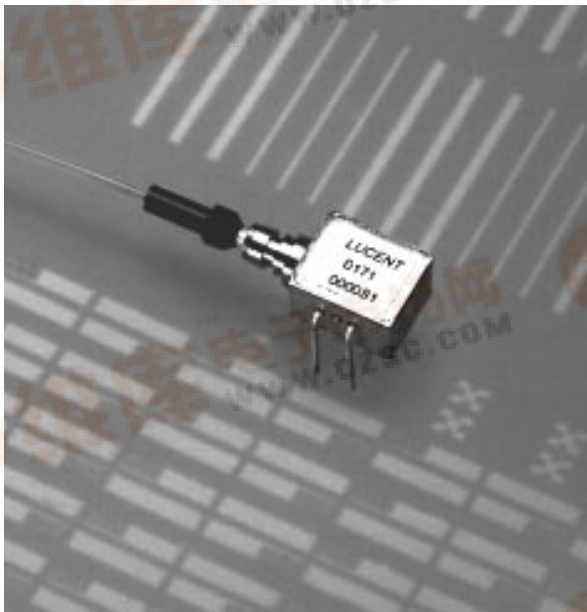
Advance Data Sheet  
March 1999

microelectronics group

Lucent Technologies  
Bell Labs Innovations



## D171-Type *FastLight*™ PIN Photodetectors



The D171-Type PIN Photodetectors feature a rear-illuminated planar diode structure with a low-capacitance 4-mil active area for maximum responsivity and speed.

### Features

- Low-profile, 4-lead mini-DIL package
  - Suitable for SONET applications
- High performance
  - High speed (<0.5 ns typical rise and fall time)
  - High responsivity (0.85 A/W typical)
  - Low dark current
- Planar structure for high reliability
- Wavelength : 1.1 $\mu$ m—1.6  $\mu$ m
- 50  $\mu$ m core multimode fiber
- Wide operating temperature range :  
—40 °C to +85 °C
- Wide bandwidth
- Qualification program : Bellcore TA-NWT-983

### Applications

- Long-reach SONET OC-3/OC-12 systems and SDH STM-1/STM-4 systems
- Secure digital data systems

### Benefits

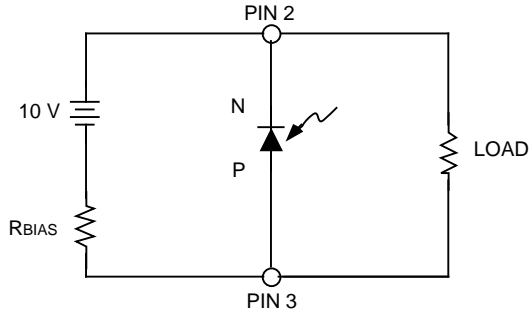
- Compact size
- Easily board mounted

**Description**

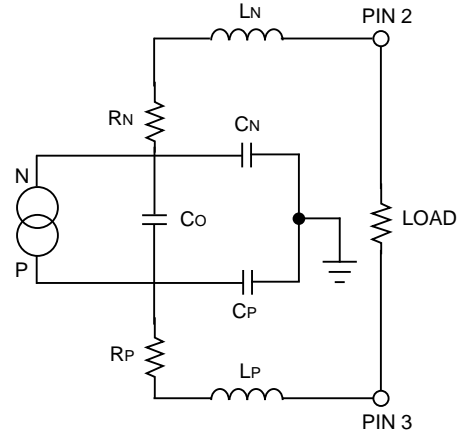
The D171-Type Photodetector consists of a PIN coupled to a multimode fiber pigtail. The device is available in a 4-pin mini-DIL configuration (see Figure 3 and/or Table 1) and is ideal for long-reach (SONET) and other high-speed digital applications.

The D171-Type PIN Photodetector is a rear-illuminated planar diode structure with a low-capacitance active area for maximum responsivity and speed.

This device incorporates the new Laser 2000 manufacturing process from the Optoelectronics Products unit of Lucent Technologies Microelectronics Group. Laser 2000 is a low-cost platform that targets high-volume manufacturing and tight product distributions on all optical subassemblies. This platform incorporates an advanced optical design that is produced on Opto's highly automated production lines. The Laser 2000 platform is qualified for central office and uncontrolled environments, and can be used for applications requiring high performance and low cost.



**Figure 1. Typical Bias Connection**



1-697

**Notes:**

This equivalent circuit is intended for modeling the package capacitance. Minimum capacitance is achieved by connecting the N-side to ground, applying a negative voltage to the P-side, and allowing the package to float (i.e., not connected to ground).

Typical values are as follows:

$C_O = 0.3 \text{ pF}$  to  $0.5 \text{ pF}$ .

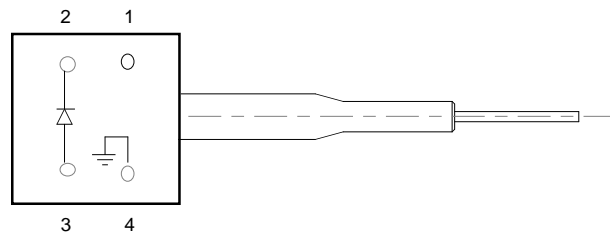
$L_N, L_P = 3.0 \text{ nH}$ .

$R_N, R_P = 5 \text{ } \Omega$ .

$C_N = 0.4 \text{ pF}$ .

$C_P = 0.1 \text{ pF}$ .

**Figure 2. Equivalent ac Circuit for Digital Applications**



1-902.a

**Figure 3. D171-Type PIN Photodetector Schematic (Top View)**

**Table 1. Pin Descriptions**

| Pin Number | Description        |
|------------|--------------------|
| 1          | NC                 |
| 2          | Photodiode Cathode |
| 3          | Photodiode Anode   |
| 4          | Case Ground        |

## Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

| Parameter                   | Symbol           | Min | Max | Unit |
|-----------------------------|------------------|-----|-----|------|
| Operating Temperature Range | T <sub>A</sub>   | -40 | 85  | °C   |
| Storage Temperature Range   | T <sub>stg</sub> | -40 | 90  | °C   |
| Forward Voltage             | V <sub>F</sub>   | —   | 0   | V    |
| Reverse Voltage*            | V <sub>R</sub>   | —   | 30  | V    |
| Photocurrent                | —                | —   | 4   | mA   |
| Humidity                    | —                | —   | 95  | %    |

\* The recommended reverse bias voltage is 5 V to 15 V.

## Handling Precautions

### Electrostatic Discharge

**CAUTION: This device is susceptible to damage as a result of electrostatic discharge. Take proper precautions during both handling and testing. Follow guidelines such as JEDEC Publication No. 108-A (Dec. 1988).**

Although protection circuitry is designed into the device, take proper precautions to avoid exposure to ESD.

## Electrical Characteristics

T<sub>C</sub> = 25 °C. Determined with a 50 Ω load.

| Parameter                  | Symbol                         | Min | Typ  | Max  | Unit |
|----------------------------|--------------------------------|-----|------|------|------|
| Capacitance (f < 900 MHz)* | —                              | —   | 0.65 | 0.70 | pF   |
| Rise/Fall Time             | t <sub>R</sub> /t <sub>F</sub> | —   | <0.5 | —    | ns   |
| Dark Current               | I <sub>D</sub>                 | —   | 1    | 5    | nA   |
| Reverse Voltage            | V <sub>R</sub>                 | 2   | 5    | 30   | V    |

\* The minimum capacitance configuration occurs when the N-side of the PIN is grounded and a negative voltage is applied to the P-side, with the package floating, not grounded (value reference only; not tested in manufacture).

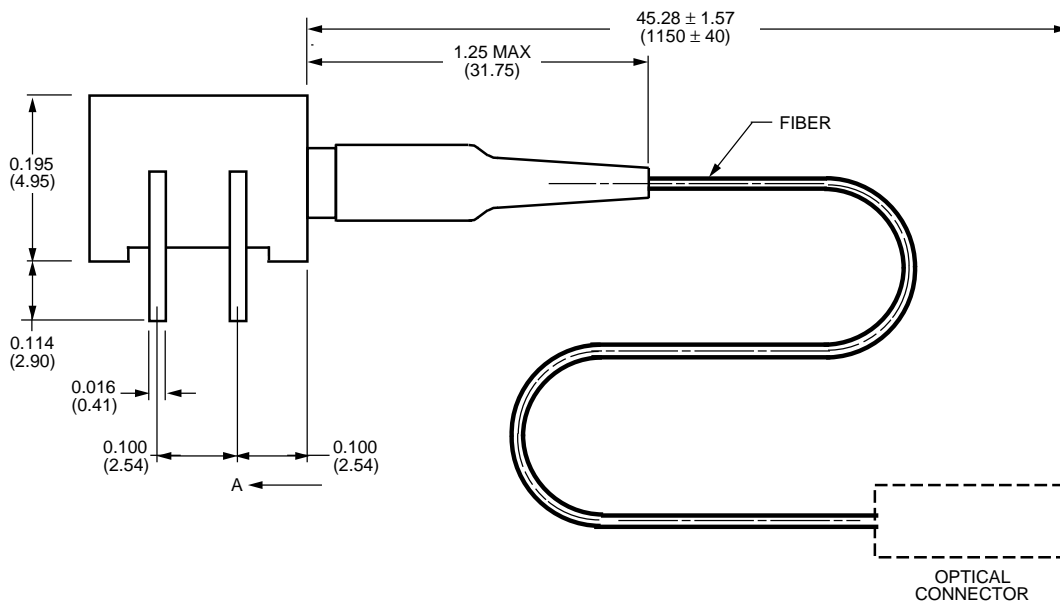
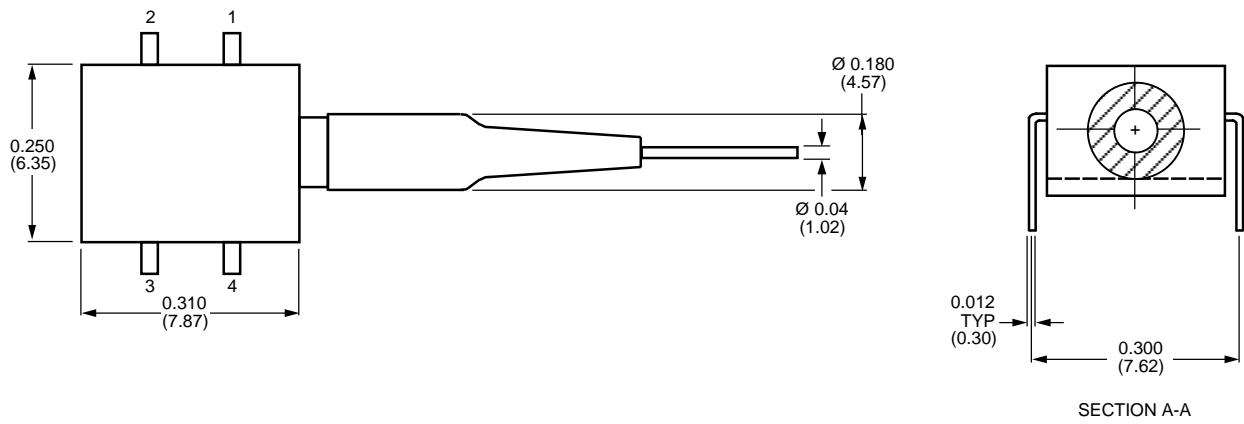
## Optical Characteristics

T<sub>C</sub> = 25 °C.

| Parameter        | Symbol | Min  | Typ  | Max | Unit |
|------------------|--------|------|------|-----|------|
| Responsivity     | R      | 0.75 | 0.85 | —   | A/W  |
| Wavelength Range | —      | 1.1  | —    | 1.6 | μm   |

Outline Diagram

Dimensions are in inches and (millimeters).



1-933

## Qualification Information

The D171-Type PIN Photodetector has completed the following qualification tests and meets the intent of Bellcore TR-NWT-000468 for interoffice environments and TA-NWT-000983 for outside plant environments.

**Table 2. D171-Type PIN Photodetector Qualification Test Plan**

| Test                       | Conditions               | Sample Size | Reference                    |
|----------------------------|--------------------------|-------------|------------------------------|
| Mechanical Shock           | 500 G                    | 11          | MIL-STD-883<br>Method 2002   |
| Vibration                  | 20 g, 20 Hz—2000 Hz      | 11          | MIL-STD-883<br>Method 2007   |
| Solderability              | —                        | 11          | MIL-STD-883<br>Method 2007   |
| Thermal Shock              | Delta T = 100 °C         | 11          | MIL-STD-883<br>Method 2003   |
| Fiber Pull                 | 1 kg; 3 times            | 11          | Bellcore 983                 |
| Accelerated (biased) Aging | 85 °C, 5000 hrs.         | 25          | Bellcore 983<br>Section 5.18 |
| High-temperature Storage   | 85 °C, 2000 hrs.         | 11          | Bellcore 983                 |
| Temperature Cycling        | 500 cycles               | 11          | Bellcore 983<br>Section 5.20 |
| Cyclic Moisture Resistance | 10 cycles                | 11          | Bellcore 983<br>Section 5.23 |
| Damp Heat                  | 40 °C, 95% RH, 1344 hrs. | 11          | MIL-STD-202<br>Method 103    |
| Internal Moisture          | <5000 ppm water vapor    | 11          | MIL-STD-883<br>Method 1018   |
| Flammability               | —                        | —           | TR357<br>Sec. 4.4.2.5        |
| ESD Threshold              | —                        | 6           | Bellcore 983<br>Section 5.22 |

## Ordering Information

| Device Code | Description  | Comcode   |
|-------------|--|-----------|
| D171C004BAA | PIN 4-Lead Package, 50 $\mu$ m, MM Fiber, SC Connector | 108156654 |
| D171C004BAF | PIN 4-Lead Package, 50 $\mu$ m, MM Fiber, FC Connector | 108156662 |
| D171C004CAN | PIN 4-Lead Package, SM Fiber, No Connector             | 108271699 |

For additional information, contact your Microelectronics Group Account Manager or the following:

INTERNET: <http://www.lucent.com/micro>, or for Optoelectronics information, <http://www.lucent.com/micro/opto>  
E-MAIL: [docmaster@micro.lucent.com](mailto:docmaster@micro.lucent.com)

N. AMERICA: Microelectronics Group, Lucent Technologies Inc., 555 Union Boulevard, Room 30L-15P-BA, Allentown, PA 18103  
**1-800-372-2447**, FAX 610-712-4106 (In CANADA: **1-800-553-2448**, FAX 610-712-4106)

ASIA PACIFIC: Microelectronics Group, Lucent Technologies Singapore Pte. Ltd., 77 Science Park Drive, #03-18 Cintech III, Singapore 118256  
**Tel. (65) 778 8833**, FAX (65) 777 7495

CHINA: Microelectronics Group, Lucent Technologies (China) Co., Ltd., A-F2, 23/F, Zao Fong Universe Building, 1800 Zhong Shan Xi Road, Shanghai 200233 P. R. China **Tel. (86) 21 6440 0468, ext. 316**, FAX (86) 21 6440 0652

JAPAN: Microelectronics Group, Lucent Technologies Japan Ltd., 7-18, Higashi-Gotanda 2-chome, Shinagawa-ku, Tokyo 141, Japan  
**Tel. (81) 3 5421 1600**, FAX (81) 3 5421 1700

EUROPE: Data Requests: MICROELECTRONICS GROUP DATALINE: **Tel. (44) 1189 324 299**, FAX (44) 1189 328 148  
Technical Inquiries: OPTOELECTRONICS MARKETING: **(44) 1344 865 900** (Ascot UK)

Lucent Technologies Inc. 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. No rights under any patent accompany the sale of any such product(s) or information. *FastLight* is a trademark of Lucent Technologies Inc.

