



**NEC's $\phi 50 \mu\text{m}$
InGaAs APD IN COAXIAL PACKAGE
FOR 155 Mb/s AND 622 Mb/s APPLICATIONS**

NR8500 Series

FEATURES

- **SMALL DARK CURRENT:**
 $I_D = 7 \text{ nA}$
- **HIGH SENSITIVITY:**
 $S = 0.94 \text{ A/W}$ at $\lambda = 1310 \text{ nm}$, $M = 1$
 $S = 0.96 \text{ A/W}$ at $\lambda = 1550 \text{ nm}$, $M = 1$
- **HIGH SPEED RESPONSE:**
 $f_c = 1.5 \text{ GHz}$ at $M = 10$
- **COAXIAL MODULE WITH SMF or GI-50 FIBER**
- **WITH SC CONNECTOR: Standard**
FC CONNECTOR: Option

DESCRIPTION

NEC's NR8500 series is an InGaAs avalanche photo diode (APD) coaxial module with optical fiber pigtail. This module is designed for long wavelength optical communication systems and is ideal as a receiver for Synchronous Digital Hierarchy (SDH) system, STM-4 and STM-1, ITU-T recommendations.

ELECTRO-OPTICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$, Unless otherwise specified)

PART NUMBER			NR8500 Series		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
V_{BR}	Reverse Breakdown Voltage, $I_D = 100 \mu\text{A}$	V	50	70	90
δ^1	Temperature Coefficient of Reverse Breakdown Voltage	%/°C		0.2	
I_D	Dark Current, $V_R = V_{BR} \times 0.9$	nA		7	30
I_{DM}	Multiplied Dark Current, $M = 2$ to 10	nA		1	5
C_t	Terminal Capacitance, $V_R = V_{(BR)} \times 0.9$, $f = 1 \text{ MHz}$	pF		0.5	0.75
f_c	Cut-off Frequency, $M = 10$ $M = 20$	GHz	1.0	1.5 1.2	
S	Sensitivity, $\lambda = 1310 \text{ nm}$ $\lambda = 1550 \text{ nm}$	A/W	0.8 0.81	0.94 0.96	
M	Multiplication Factor, $\lambda = 1310 \text{ nm}$, $I_{PO} = 1.0 \mu\text{A}$ $V_R = V$ (@ $I_D = 1 \mu\text{A}$)		30	40	
x	Excess Noise Factor ² , $\lambda = 1310 \text{ nm}$, 1550 nm , $I_{PO} = 1.0 \mu\text{A}$, $M = 10$, $f = 35 \text{ MHz}$, $B = 1 \text{ MHz}$			0.7	
F	Excess Noise Factor ² , $\lambda = 1310 \text{ nm}$, 1550 nm , $I_{PO} = 1.0 \mu\text{A}$, $M = 10$, $f = 35 \text{ MHz}$, $B = 1 \text{ MHz}$			5	
ORL	Optical Return Loss SMF GI-50 Fiber	dB	30 28		

Note:

1. $\delta = \frac{V_{BR}(25^\circ\text{C} + \Delta T^\circ\text{C}) - V_{BR}(25^\circ\text{C})}{\Delta T^\circ\text{C} \cdot V_{BR}(25^\circ\text{C})}$

2. $F = M^x$

ABSOLUTE MAXIMUM RATINGS¹

(T_C = 25°C, unless otherwise specified)

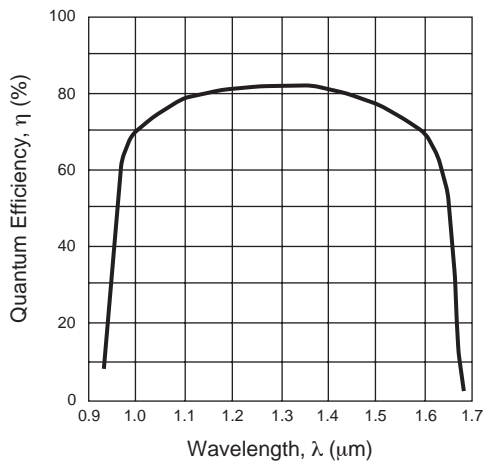
SYMBOLS	PARAMETERS	UNITS	RATINGS
I _F	Forward Current	mA	10
I _R	Reverse Current	mA	1.0
T _C	Operating Case Temp.	°C	-40 to +85
T _{STG}	Storage Temperature	°C	-40 to +85
T _{SLD}	Lead Soldering Temperature	°C	260 (10 sec.)
RH	Relative Humidity (noncondensing)	%	85

Note:

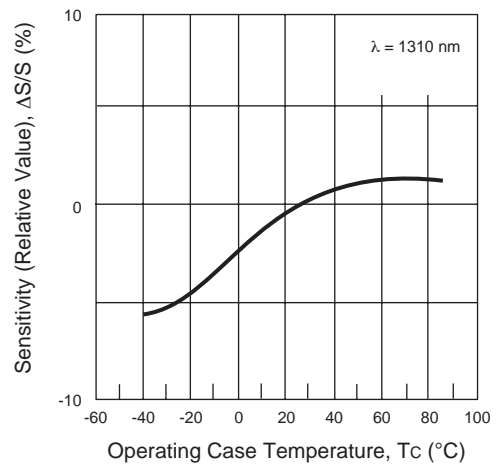
1. Operation in excess of any one of these parameters may result in permanent damage.

TYPICAL PERFORMANCE CURVES (T_C = 25°C, unless otherwise specified)

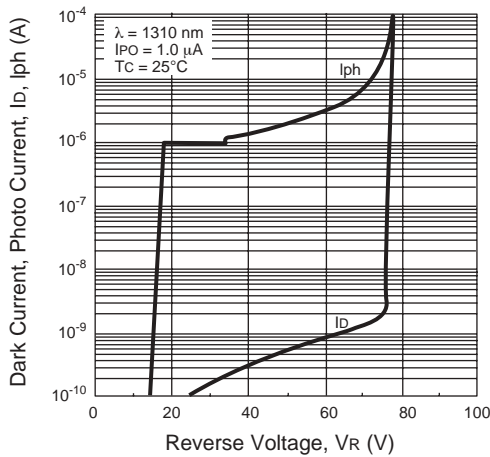
WAVELENGTH DEPENDENCE OF QUANTUM EFFICIENCY



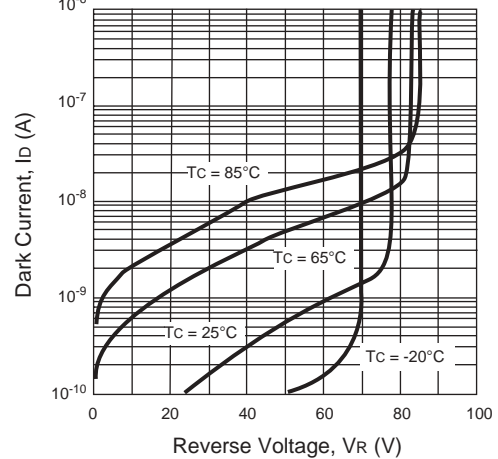
TEMPERATURE DEPENDENCE OF SENSITIVITY



DARK CURRENT AND PHOTO CURRENT VS. REVERSE VOLTAGE

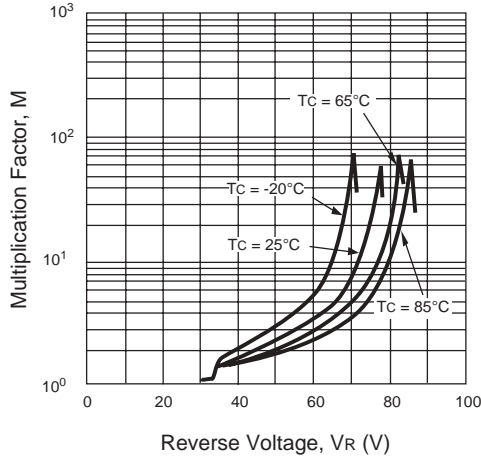


DARK CURRENT vs. REVERSE VOLTAGE

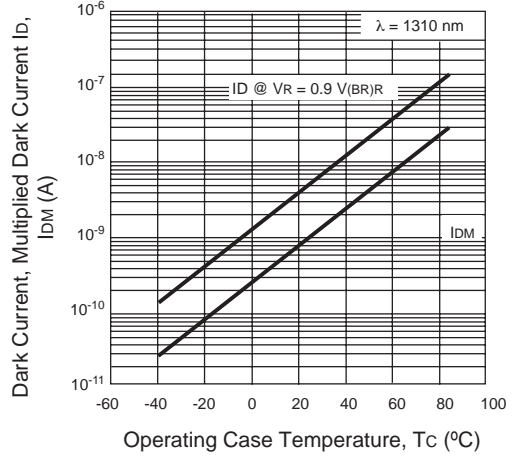


TYPICAL PERFORMANCE CURVES ($T_c = 25^\circ\text{C}$, unless otherwise specified)

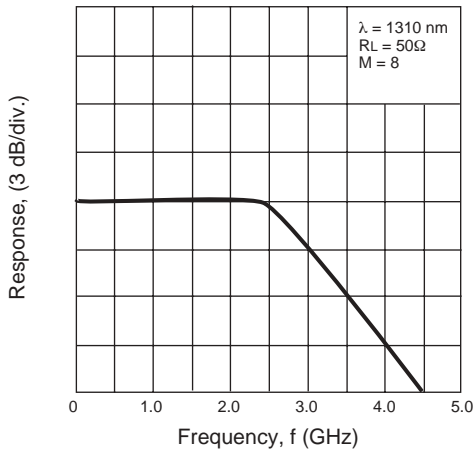
MULTIPLICATION FACTOR vs. REVERSE VOLTAGE



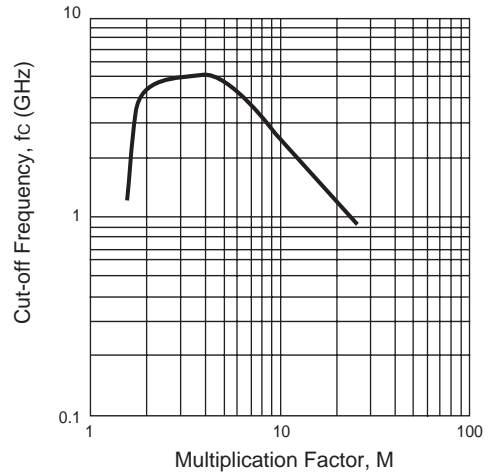
TEMPERATURE DEPENDENCE OF DARK CURRENT and MULTIPLIED DARK CURRENT



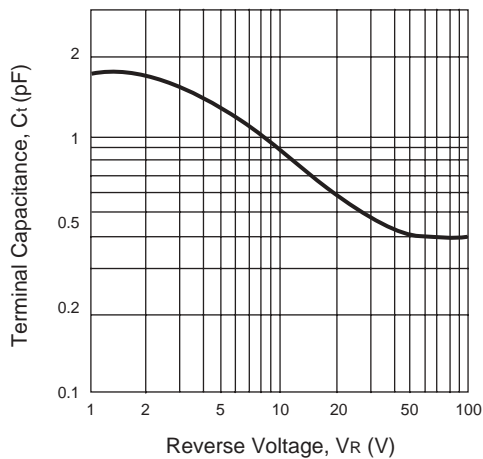
FREQUENCY RESPONSE



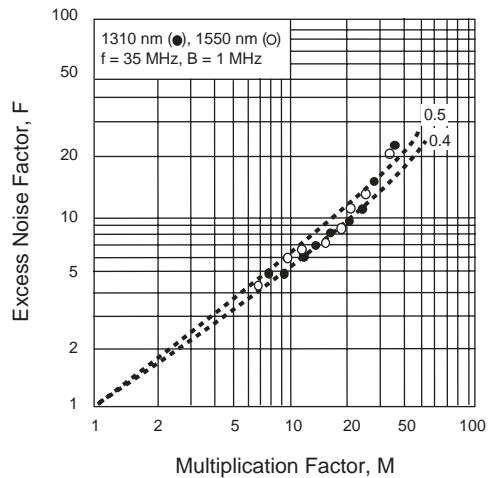
CUT-OFF FREQUENCY vs. MULTIPLICATION FACTOR



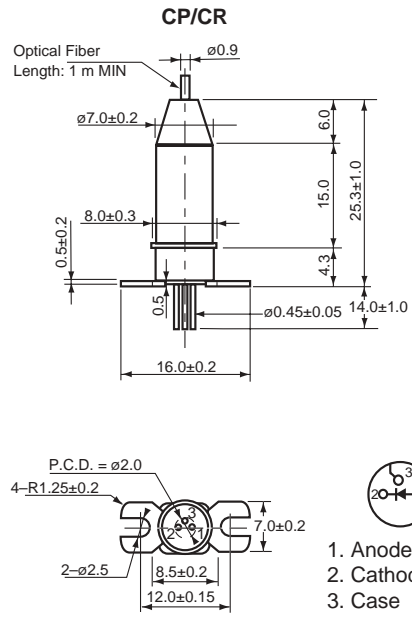
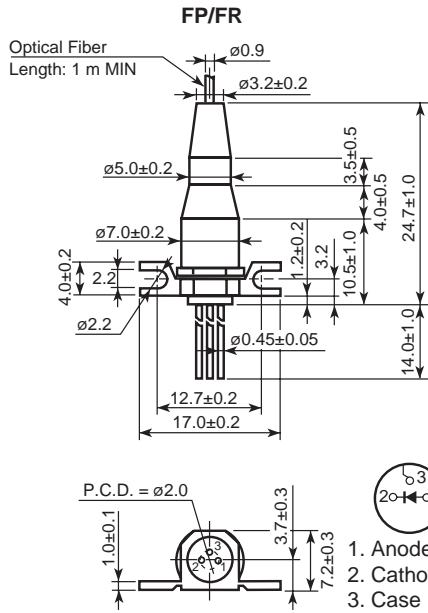
TERMINAL CAPACITANCE vs. REVERSE VOLTAGE



EXCESS NOISE FACTOR vs. MULTIPLICATION FACTOR



OUTLINE DIMENSIONS (Units in mm)

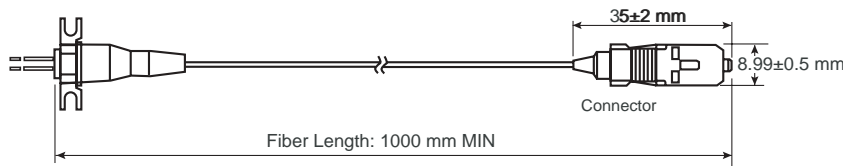


ORDERING INFORMATION

PART NUMBER	FLANGE TYPE	FIBER TYPE	AVAILABLE CONNECTOR
NR8500FP-BC	Flat mount Flange	SMF	With FC-UPC Connector
NR8500FP-CC			With SC-UPC Connector
NR8500FR-BB		GI-50 Fiber	With FC-SPC Connector
NR8500FR-CB			With SC-SPC Connector
NR8500CP-BC	Vertical Mount Flange	SMF	With FC-UPC Connector
NR8500CP-CC			With SC-UPC Connector
NR8500CR-BB		GI-50 Fiber	With FC-SPC Connector
NR8500CR-CB			With SC-SPC Connector

OPTICAL FIBER CHARACTERISTICS

PARAMETER	UNITS	SPECIFICATION	
		SMF	GI-50
Mode Field Diameter	μm	9.5 ± 1	-
Core Diameter	μm	-	50 ± 3
Cladding Diameter	μm	125 ± 2	125 ± 2
Maximum Cladding Noncircularity	%	2	2
Maximum Core/Cladding Concentricity	%	1.6	4.0
Outer Diameter	mm	0.9 ± 0.1	0.9 ± 0.1
Cut-off Wavelength	nm	1100 to 1270	-
Minimum Fiber Bending Radius	mm	30	30
Fiber Length	mm	1000 MIN	1000 MIN
Flammability		UL1581 VW-1	



Life Support Applications

These NEC products are not intended for use in life support devices, appliances, or systems where the malfunction of these products can reasonably be expected to result in personal injury. The customers of CEL using or selling these products for use in such applications do so at their own risk and agree to fully indemnify CEL for all damages resulting from such improper use or sale.

CEL California Eastern Laboratories, Your source for NEC RF, Microwave, Optoelectronic, and Fiber Optic Semiconductor Devices.
4590 Patrick Henry Drive • Santa Clara, CA 95054-1817 • (408) 988-3500 • FAX (408) 988-0279 • www.cel.com

DATA SUBJECT TO CHANGE WITHOUT NOTICE

02/27/2003