



NEC's $\phi 50 \mu\text{m}$ InGaAs APD IN COAXIAL PACKAGE FOR 2.5Gb/s APPLICATIONS

NR8501 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:**
 $f_c = 2.5 \text{ GHz}$ at $M = 5$
- **COAXIAL MODULE WITH SINGLE MODE FIBER (SMF) or GI-50 Fiber**
- **WITH SC CONNECTOR: Standard, FC connector: Option**
(Refer to Ordering Information)

DESCRIPTION

NEC's NR8501 Series are InGaAs avalanche photo diode (APD) coaxial modules with optical fiber pigtail. They are designed for long wavelength 2.5 Gb/s optical communication systems and are ideal as a receiver for Synchronous Digital Hierarchy (SDH) system, STM-16 ITU-T recommendations.

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

PART NUMBER			NR8501 Series		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
V_{BR}	Reverse Breakdown Voltage, $I_D = 100 \mu\text{A}$	V	40	60	80
δ^1	Temperature Coefficient of Reverse Breakdown Voltage	%/ $^\circ\text{C}$		0.20	
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, $V_R = V_{(BR)R} \times 0.9$, $f = 1 \text{ MHz}$	pF		0.5	0.75
f_c	Cut-off Frequency, $M = 5$ $M = 10$ $M = 30$	GHz	2.5 2.5 1.0	3.0 3.0 1.2	
S	Sensitivity, $\lambda = 1310 \text{ nm}$, $M = 1$ $\lambda = 1550 \text{ nm}$, $M = 1$	A/W	0.80 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	dB	30	
		GI-50 Fiber		28	

Notes:

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

$$2. F = M^x$$

NR8501 SERIES

ABSOLUTE MAXIMUM RATINGS¹

(T_C = 25°C, unless otherwise specified)

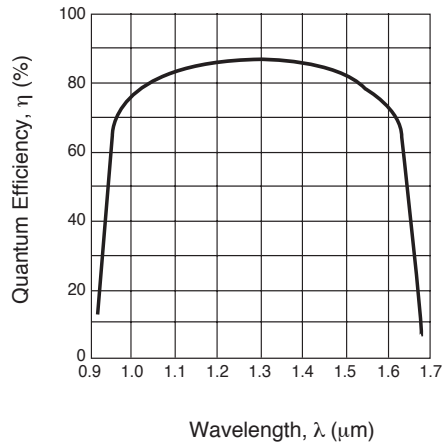
SYMBOLS	PARAMETERS	UNITS	RATINGS
I _F	Forward Current	mA	10
I _R	Reverse Current	mA	1.0
T _C	Operating Case Temp.	°C	-40 to +85
T _{STG}	Storage Temperature	°C	-40 to +85
T _{SLD}	Lead Soldering Temperature	°C	260 (10 sec.)
RH	Relative Humidity (noncondensing)	%	85

Note:

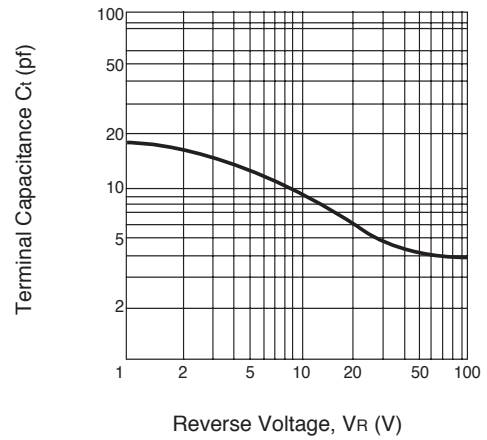
1. Operation in excess of any one of these parameters may result in permanent damage.

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

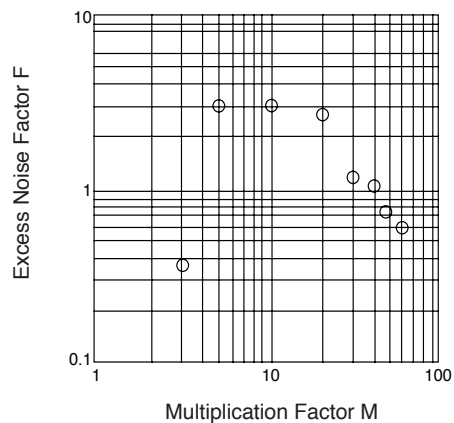
WAVELENGTH DEPENDENCE OF QUANTUM EFFICIENCY



TERMINAL CAPACITANCE vs. REVERSE VOLTAGE

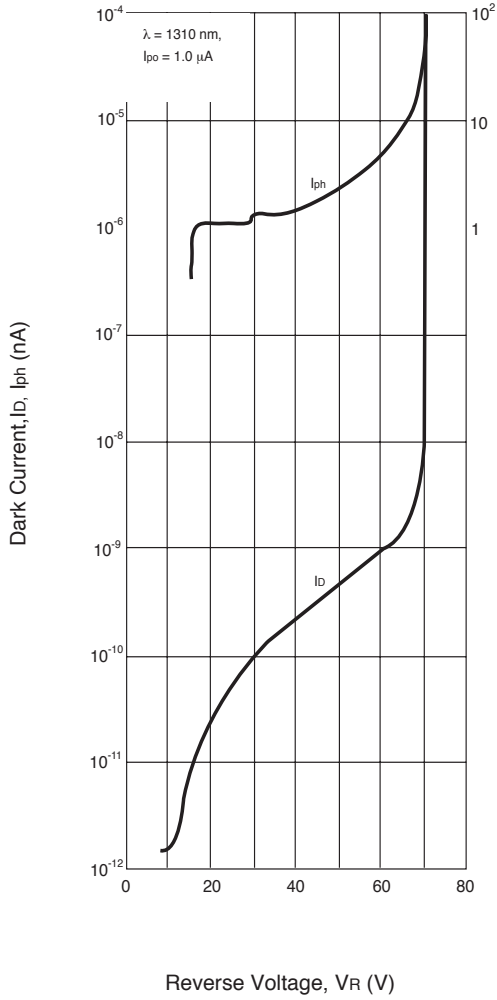


EXCESS NOISE FACTOR vs. MULTIPLICATION FACTOR

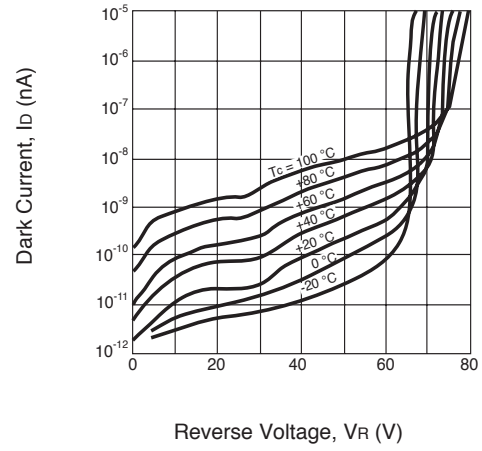


TYPICAL PERFORMANCE CURVES ($T_C = 25^\circ\text{C}$, unless otherwise specified)

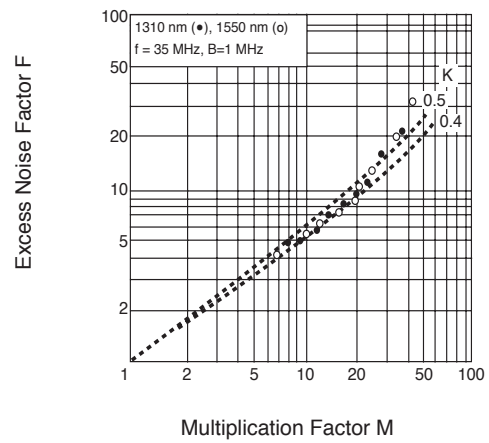
DARK CURRENT AND PHOTO CURRENT vs. REVERSE VOLTAGE



DARK CURRENT vs. REVERSE VOLTAGE

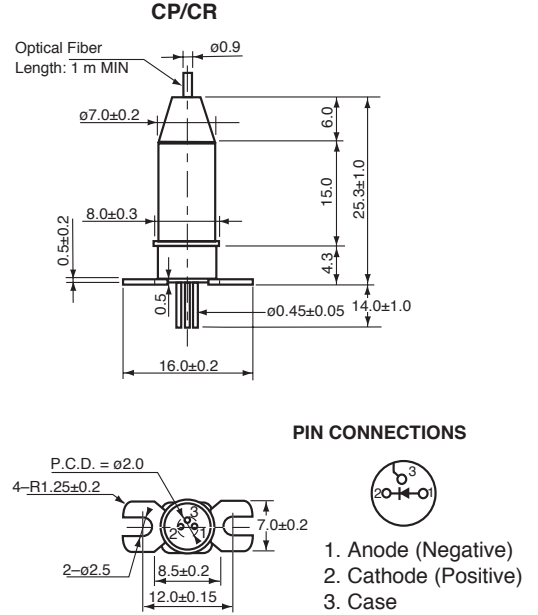
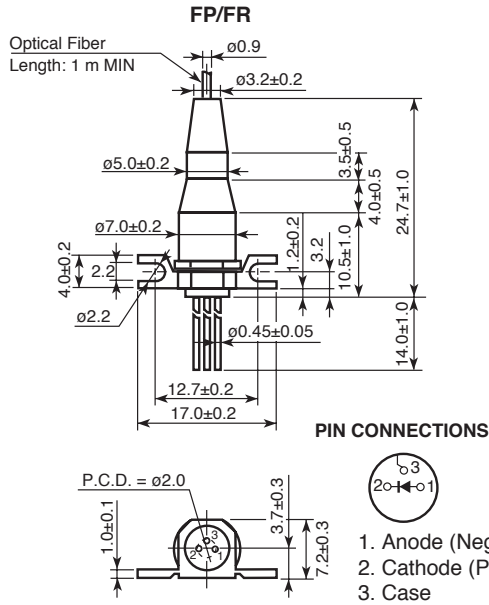


EXCESS NOISE FACTOR vs. MULTIPLICATION FACTOR



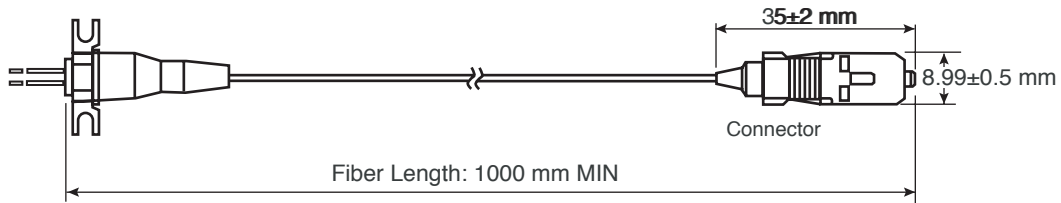
NR8501 SERIES

OUTLINE DIMENSIONS (Units in mm)



OPTICAL FIBER CHARACTERISTICS

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



ORDERING INFORMATION

PART NUMBER	FLANGE TYPE	FIBER TYPE	AVAILABLE CONNECTOR
NR8501FP-BC-AZ*	Flat Mount Flange	SMF	With FC-UPC Connector
NR8501FP-CC-AZ*			With SC-UPC Connector
NR8501FR-BB-AZ*		GI-50 Fiber	With FC-UPC Connector
NR8501FR-CB-AZ*			With SC-UPC Connector
NR8501CP-BC-AZ*	Vertical Mount Flange	SMF	With FC-UPC Connector
NR8501CP-CC-AZ*			With SC-UPC Connector
NR8501CR-BB-AZ*		GI-50 Fiber	With FC-UPC Connector
NR8501CR-CB-AZ*			With SC-UPC Connector

***NOTE:**

Please refer to the last page of this data sheet, "Compliance with EU Directives" for Pb-Free RoHS Compliance Information.

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.



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02/24/2003

NEC

A Business Partner of NEC Compound Semiconductor Devices, Ltd.

Subject: Compliance with EU Directives

CEL certifies, to its knowledge, that semiconductor and laser products detailed below are compliant with the requirements of European Union (EU) Directive 2002/95/EC Restriction on Use of Hazardous Substances in electrical and electronic equipment (RoHS) and the requirements of EU Directive 2003/11/EC Restriction on Penta and Octa BDE.

CEL Pb-free products have the same base part number with a suffix added. The suffix –A indicates that the device is Pb-free. The –AZ suffix is used to designate devices containing Pb which are exempted from the requirement of RoHS directive (*). In all cases the devices have Pb-free terminals. All devices with these suffixes meet the requirements of the RoHS directive.

This status is based on CEL’s understanding of the EU Directives and knowledge of the materials that go into its products as of the date of disclosure of this information.

Restricted Substance per RoHS	Concentration Limit per RoHS (values are not yet fixed)	Concentration contained in CEL devices	
		-A	-AZ
Lead (Pb)	< 1000 PPM	Not Detected	(*)
Mercury	< 1000 PPM	Not Detected	
Cadmium	< 100 PPM	Not Detected	
Hexavalent Chromium	< 1000 PPM	Not Detected	
PBB	< 1000 PPM	Not Detected	
PBDE	< 1000 PPM	Not Detected	

If you should have any additional questions regarding our devices and compliance to environmental standards, please do not hesitate to contact your local representative.

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