

# NEC $\phi 50 \mu\text{m}$ InGaAs APD COAXIAL MODULE FOR 622 Mb/s, 156 Mb/s FIBER OPTIC COMMUNICATIONS

## 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 SINGLE MODE FIBER (SMF) or GI-50 Fiber**
- **WITH SC CONNECTOR: Standard, FC Connector: Option**  
(Refer to Ordering Information)

### DESCRIPTION

The NR8500 Series are InGaAs avalanche photo diode (APD) coaxial modules with single mode fiber. They are designed for long wavelength optical communication systems and are 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	100
$\delta^1$	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	1.5 1.2	
$S$	Responsivity, $\lambda = 1300 \text{ nm}$ $\lambda = 1550 \text{ nm}$	A/W	0.8 0.81	0.94 0.96	
$M$	Multiplication Factor, $\lambda = 1300 \text{ nm}$ , $I_{PO} = 1.0 \mu\text{A}$ $V_R = V$ (@ $I_D = 1 \mu\text{A}$ )		30	40	
$x$	Excess Noise Exponent, $\lambda = 1300 \text{ nm}$ , $1550 \text{ nm}$ , $I_{PO} = 1.0 \mu\text{A}$ , $M = 10$ , $f = 35 \text{ MHz}$ , $B = 1 \text{ MHz}$			0.7	
$F$	Excess Noise Factor <sup>2</sup> , $\lambda = 1300 \text{ nm}$ , $1550 \text{ nm}$ , $I_{PO} = 1.0 \mu\text{A}$ , $M = 10$ , $f = 35 \text{ MHz}$ , $B = 1 \text{ MHz}$			5	
ORL	Optical Return Loss				
	SMF	dB	30		
	GI-50 Fiber		28		

Note:

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

$$2. F = M^x$$

# NR8500 SERIES

## ABSOLUTE MAXIMUM RATINGS<sup>1</sup>

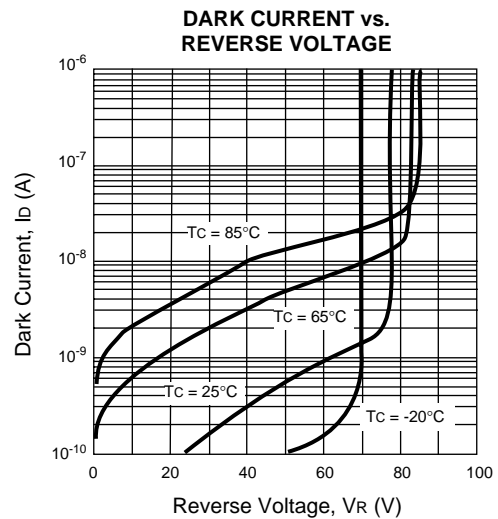
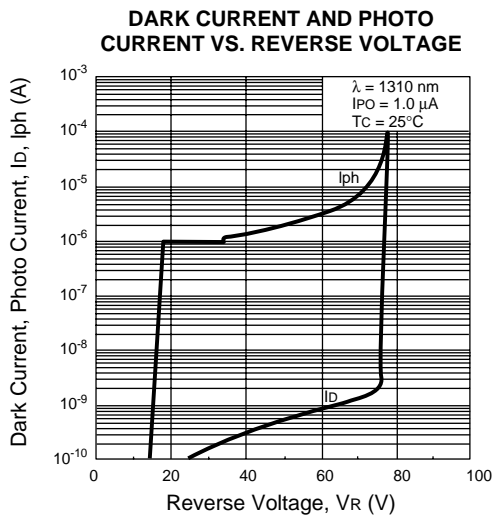
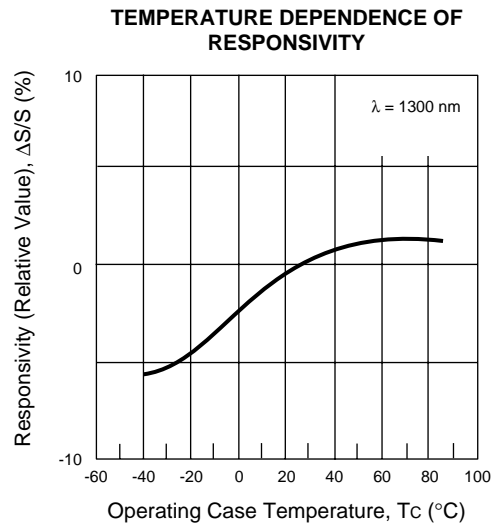
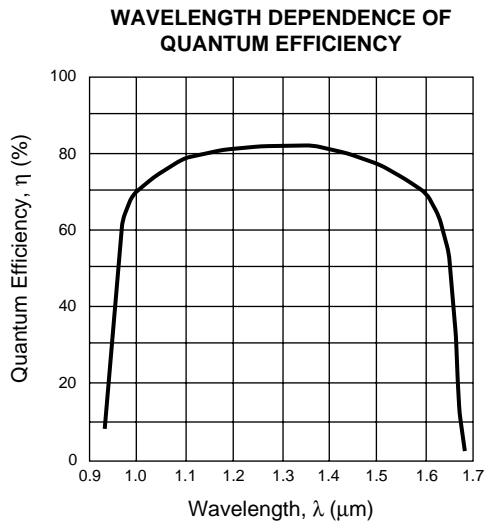
(T<sub>C</sub> = 25°C, unless otherwise specified)

SYMBOLS	PARAMETERS	UNITS	RATINGS
I <sub>F</sub>	Forward Current	mA	10
I <sub>R</sub>	Reverse Current	mA	0.5
T <sub>C</sub>	Operating Case Temp.	°C	-40 to +85
T <sub>STG</sub>	Storage Temperature	°C	-40 to +85
T <sub>SLD</sub>	Lead Soldering Temperature	°C	260 (10 sec.)
RH	Relative Humidity (noncondensing)	%	85

Note:

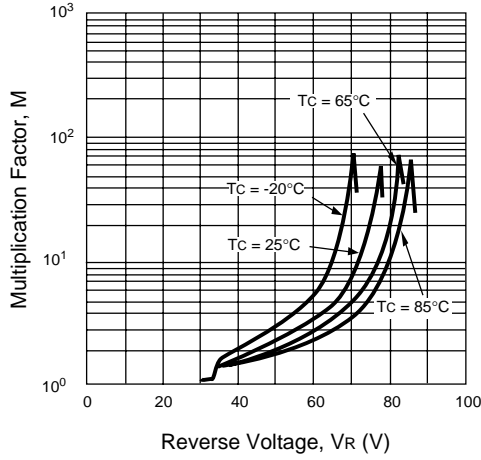
1. Operation in excess of any one of these parameters may result in permanent damage.

## TYPICAL PERFORMANCE CURVES (T<sub>C</sub> = 25°C, unless otherwise specified)

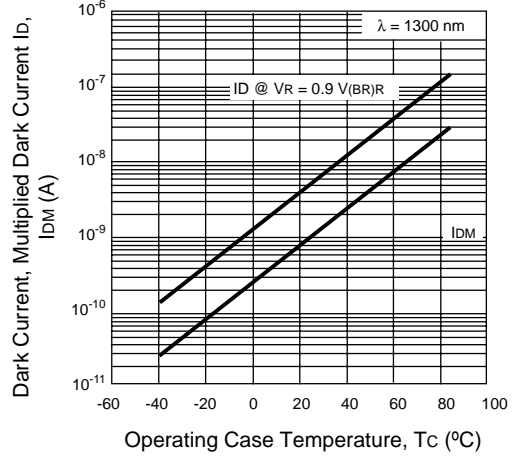


**TYPICAL PERFORMANCE CURVES** ( $T_c = 25^\circ\text{C}$ , unless otherwise specified)

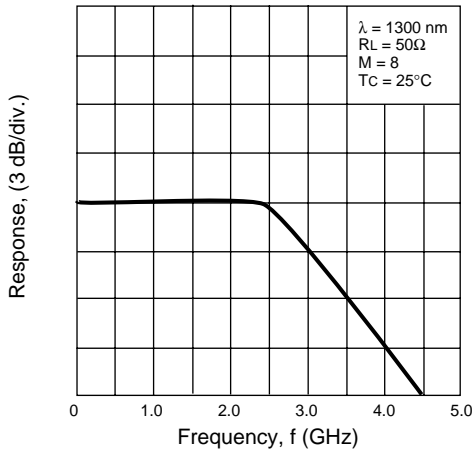
**MULTIPLICATION FACTOR vs. REVERSE VOLTAGE**



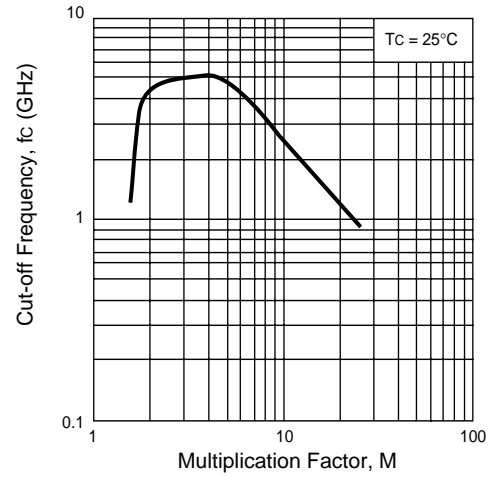
**TEMPERATURE DEPENDENCE OF DARK CURRENT and MULTIPLIED DARK CURRENT**



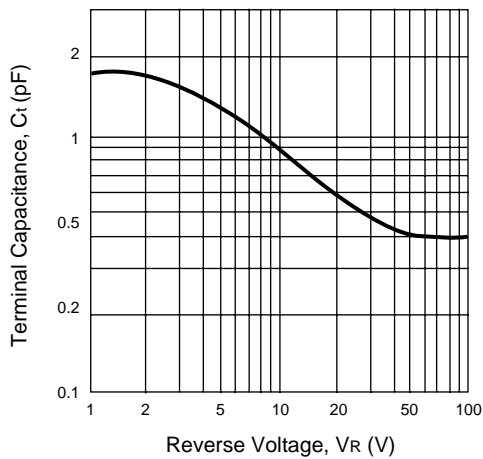
**FREQUENCY RESPONSE**



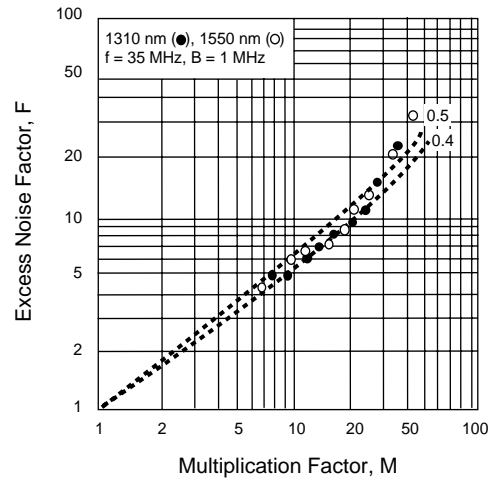
**CUT-OFF FREQUENCY vs. MULTIPLICATION FACTOR**



**TERMINAL CAPACITANCE vs. REVERSE VOLTAGE**

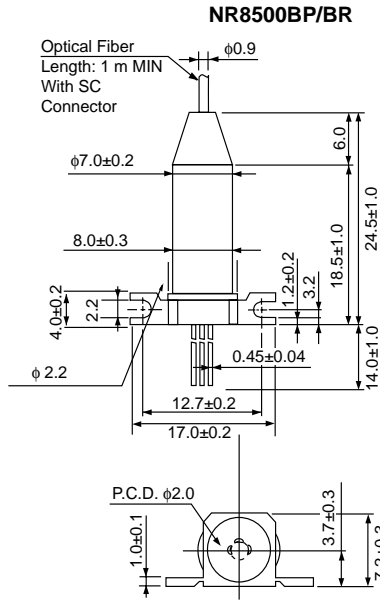


**EXCESS NOISE FACTOR vs. MULTIPLICATION FACTOR**



# NR8500 SERIES

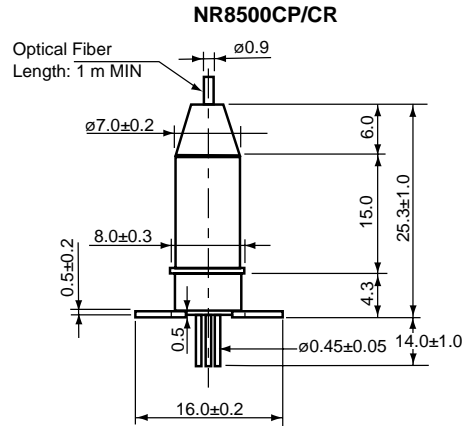
## OUTLINE DIMENSIONS (Units in mm)



### PIN CONNECTIONS



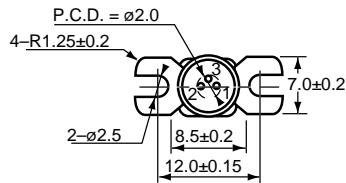
1. Anode (Negative)
2. Cathode (Positive)
3. Case



### PIN CONNECTIONS

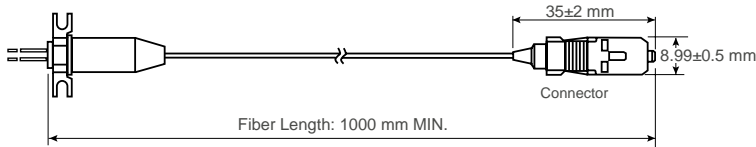


1. Anode (Negative)
2. Cathode (Positive)
3. Case



## OPTICAL FIBER CHARACTERISTICS

PARAMETER	SPECIFICATION		UNIT
	SMF	GI-50 Fiber	
Mode Field Diameter	$9.5 \pm 1$	-	$\mu\text{m}$
Core Diameter	-	$50 \pm 3$	$\mu\text{m}$
Cladding Diameter	$125 \pm 2$	$125 \pm 2$	$\mu\text{m}$
Maximum Cladding Noncircularity	2	2	%
Maximum Core/Cladding Concentricity	1.6	4.0	%
Outer Diameter	$0.9 \pm 0.1$	$0.9 \pm 0.1$	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
NR8500BP-BC	Flat Mount Flange	SMF	With FC-UPC Connector
NR8500BP-CC			With SC-UPC Connector
NR8500BR-BB		GI-50 Fiber	With FC-UPC Connector
NR8500BR-CB			With SC-UPC Connector
NR8500CP-BC	Vertical Mount Flange	SMF	With FC-UPC Connector
NR8500CP-CC			With SC-UPC Connector
NR8500CR-BB		GI-50 Fiber	With FC-UPC Connector
NR8500CR-CB			With SC-UPC Connector

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