

**$\phi 50 \mu\text{m}$  InGaAs APD COAXIAL MODULE  
FOR 2.5 Gb/s FIBEROPTIC COMMUNICATIONS****DESCRIPTION**

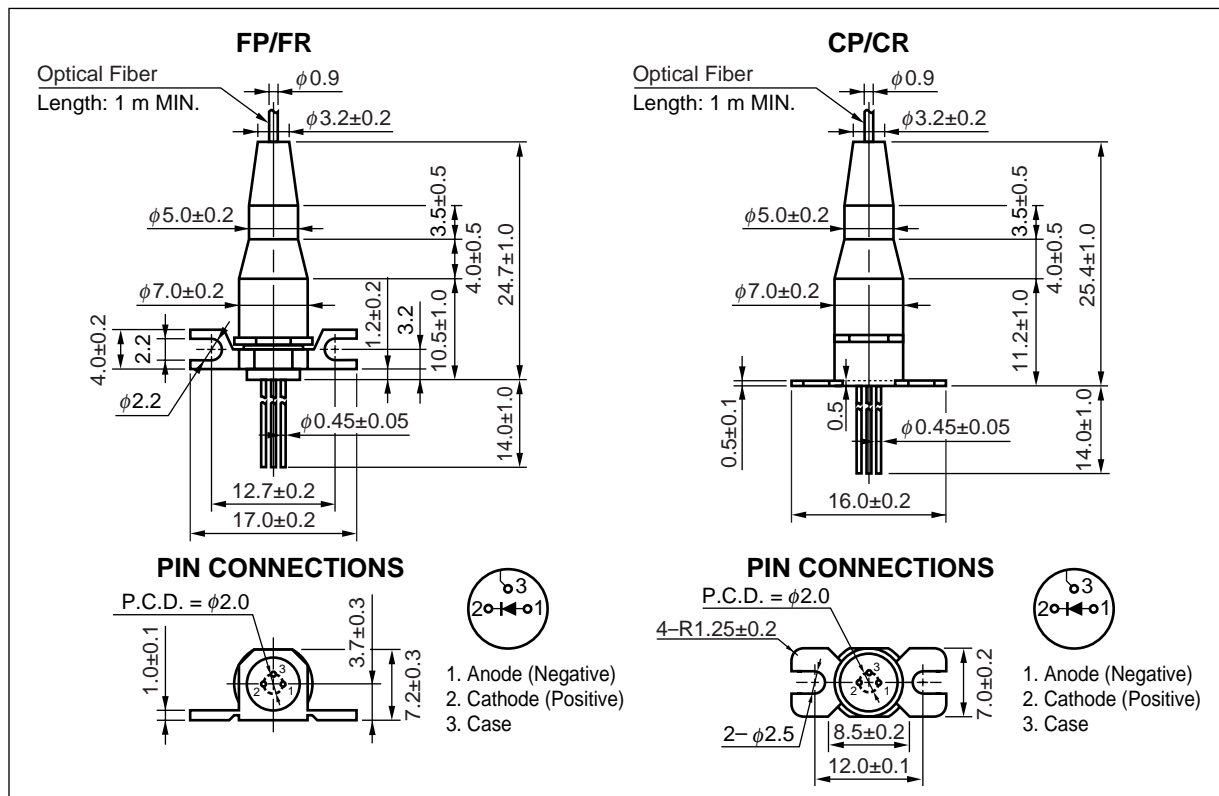
The NR8501 Series is an InGaAs avalanche photo diode (APD) coaxial module optical fiber pigtail. This module is designed for long wavelength 2.5 Gb/s optical communication systems and ideal as a receiver for Synchronous Digital Hierarchy (SDH) system, STM-16, ITU-T recommendations.

**FEATURES**

- Small dark current  $I_D = 7 \text{ nA}$
- High speed response  $f_c = 2.5 \text{ GHz MIN. @ } M = 5$
- High sensitivity  $S = 0.94 \text{ A/W @ } \lambda = 1310 \text{ nm, } M = 1$   
 $S = 0.96 \text{ A/W @ } \lambda = 1550 \text{ nm, } M = 1$
- Coaxial module with SMF or GI-50 fiber
- With SC connector : standard, FC connector : option  
(Refer to **ORDERING INFORMATION**)

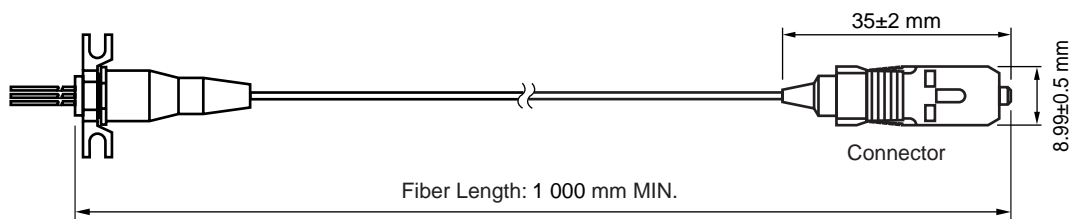
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★ PACKAGE DIMENSIONS (UNIT: mm)



OPTICAL FIBER CHARACTERISTICS

Parameter	Specification		Unit
	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	1 100 to 1 270	—	nm
Minimum Fiber Bending Radius	30	30	mm
Fiber Length	1 000 MIN.	1 000 MIN.	mm
Flammability	UL1581 VW-1		



## ORDERING INFORMATION

	Part Number	Flange Type	Fiber Type	Available Connector <sup>*1</sup>
★	NR8501FP-BC	Flat Mount Flange	SMF	With FC-UPC Connector
★	NR8501FP-CC			With SC-UPC Connector
★	NR8501FR-BB		GI-50 Fiber	With FC-SPC Connector
★	NR8501FR-CB			With SC-SPC Connector
	NR8501CP-BC	Vertical Mount Flange	SMF	With FC-UPC Connector
	NR8501CP-CC			With SC-UPC Connector
	NR8501CR-BB		GI-50 Fiber	With FC-SPC Connector
	NR8501CR-CB			With SC-SPC Connector

\*1 SC Connector : standard  
FC Connector : option

## ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Ratings	Unit
Forward Current	I <sub>F</sub>	10	mA
Reverse Current	I <sub>R</sub>	1.0	mA
Operating Case Temperature	T <sub>C</sub>	−40 to +85	°C
Storage Temperature	T <sub>stg</sub>	−40 to +85	°C
Lead Soldering Temperature	T <sub>sld</sub>	260 (10 sec.)	°C
Relative Humidity (noncondensing)	RH	85	%

**ELECTRO-OPTICAL CHARACTERISTICS (T<sub>c</sub> = 25°C, unless otherwise specified)**

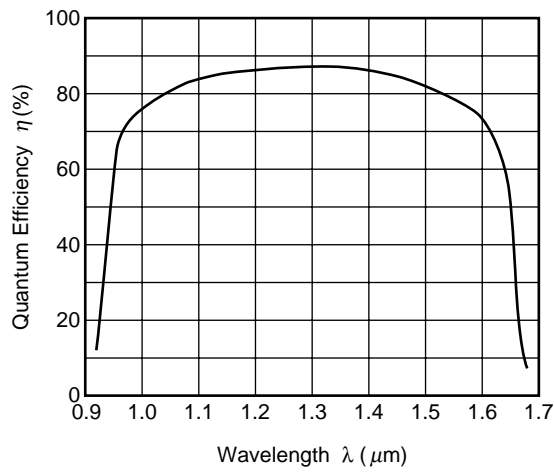
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Reverse Breakdown Voltage	V <sub>BR</sub>	I <sub>D</sub> = 100 μA	40	60	80	V
Temperature Coefficient of Reverse Breakdown Voltage	δ <sup>*1</sup>			0.2		%/°C
Dark Current	I <sub>D</sub>	V <sub>R</sub> = V <sub>BR</sub> × 0.9		7	30	nA
Multiplied Dark Current	I <sub>DM</sub>	M = 2 to 10		1	5	nA
Terminal Capacitance	C <sub>t</sub>	V <sub>R</sub> = V <sub>BR</sub> × 0.9, f = 1 MHz		0.5	0.75	pF
Cut-off Frequency	f <sub>c</sub>	M = 5	2.5	3.0		GHz
		M = 10	2.5	3.0		
		M = 30	1.0	1.2		
Sensitivity	S	λ = 1 310 nm, M = 1	0.8	0.94		A/W
		λ = 1 550 nm, M = 1	0.81	0.96		
Multiplication Factor	M	λ = 1 310 nm, I <sub>po</sub> = 1.0 μA, V <sub>R</sub> = V (@ I <sub>D</sub> = 1 μA)	30	40		
Excess Noise Factor <sup>*2</sup>	x	λ = 1 310 nm, 1 550 nm, I <sub>po</sub> = 1.0 μA,		0.7		
	F	M = 10, f = 35 MHz, B = 1 MHz		5		
Optical Return Loss	ORL	SMF	30			dB
		GI-50 Fiber	28			

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

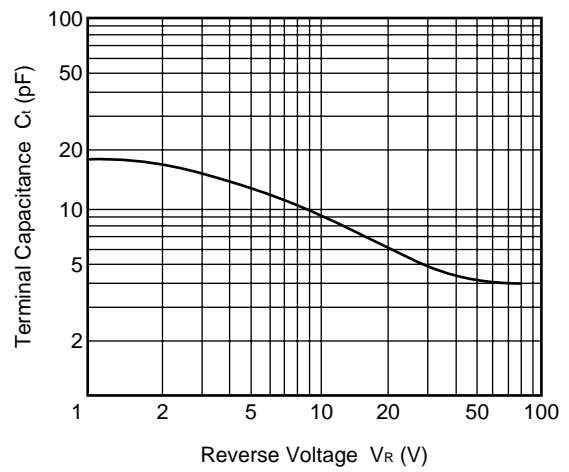
$$*2 F = M^x$$

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

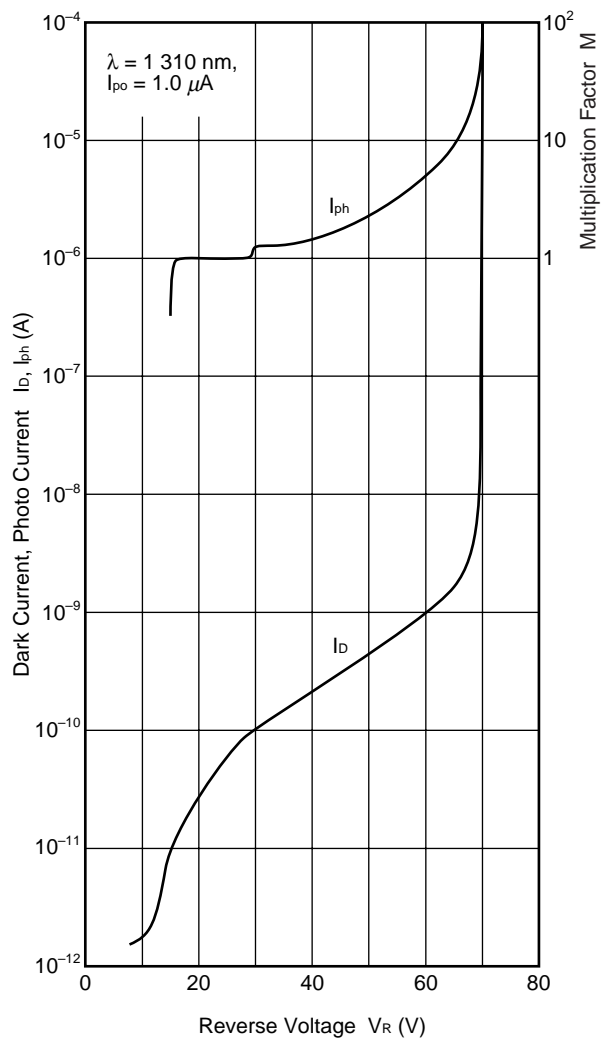
WAVELENGTH DEPENDENCE  
OF QUANTUM EFFICIENCY



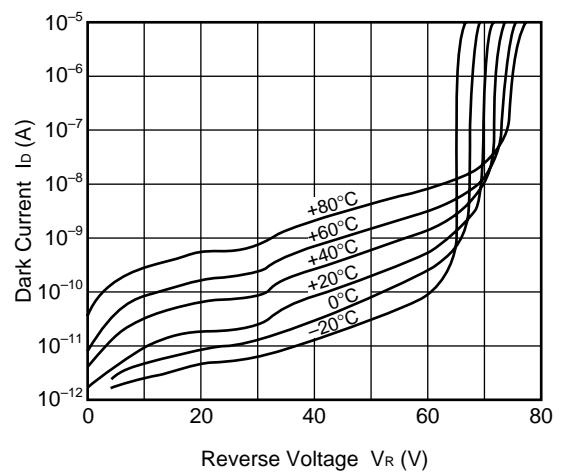
TERMINAL CAPACITANCE vs.  
REVERSE VOLTAGE



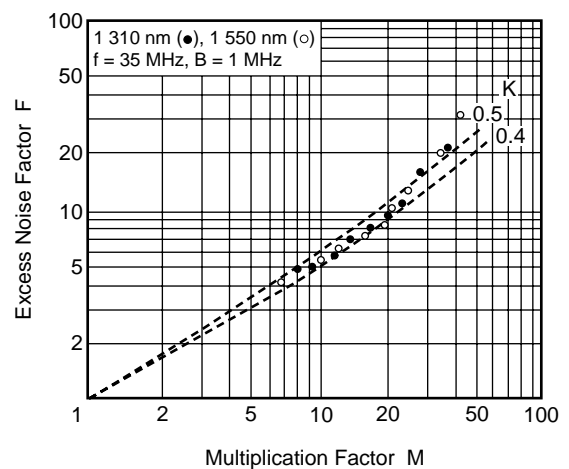
DARK CURRENT AND PHOTO CURRENT  
vs. REVERSE VOLTAGE

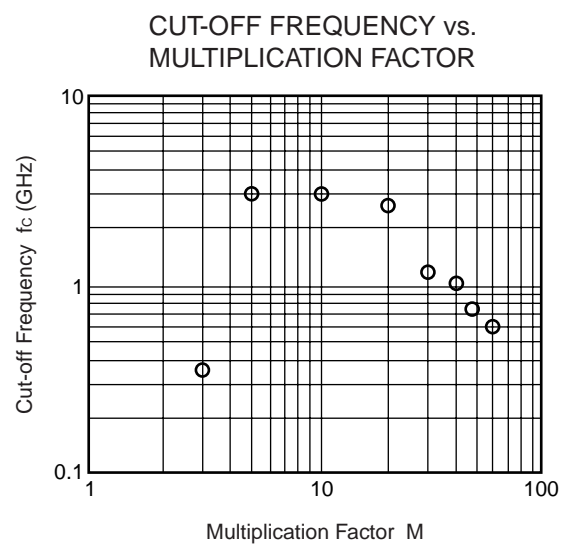


DARK CURRENT vs. REVERSE VOLTAGE



EXCESS NOISE FACTOR vs.  
MULTIPLICATION FACTOR





**Remark** The graphs indicate nominal characteristics.

InGaAs APD/PD FAMILY

Part Number	Absolute Maximum Ratings		Electro-Optical Characteristics (T <sub>c</sub> = 25°C)						Applications	Package
	T <sub>c</sub> (°C)	T <sub>stg</sub> (°C)	Detect- ing Area Size (μm)	I <sub>b</sub> (nA) TYP.	f <sub>c</sub> (GHz) MIN.	S (A/W)		V <sub>R</sub> (V)		
						TYP.	@λ (nm)			
NR4500BP-CC NR4500CP-CC	0 to +85	−40 to +85	ϕ50	−	2.5 <sup>*1</sup>	0.94	1 310	0.9V <sub>BR</sub>	2.5 Gb/s: STM-16	Coaxial APD with an Internal pre-amp
						0.96	1 550			
NR7500 Series	−40 to +85	−40 to +85	ϕ50	0.1	2.5	0.89	1 310	5	2.5 Gb/s: STM-16	Coaxial PD
						0.94	1 550			
NR7800 Series	−40 to +85	−40 to +85	ϕ80	0.1	2.5	0.89	1 310	5	≤ 622 Mb/s: STM-4, STM-1	Coaxial PD
						0.94	1 550			
NR8500 Series	−40 to +85	−40 to +85	ϕ50	7	1	0.94	1 310	0.9V <sub>BR</sub>	≤ 622 Mb/s: STM-4, STM-1	Coaxial APD
						0.96	1 550			
NR8501 Series	−40 to +85	−40 to +85	ϕ50	7	2.5	0.94	1 310	0.9V <sub>BR</sub>	2.5 Gb/s: STM-16	Coaxial APD
						0.96	1 550			

\*1  $\bar{P}_{Low}$  and  $\bar{P}_{High}$  are specified at 2.5 Gb/s

**REFERENCE**

Document Name	Document No.
Optical semiconductor devices for fiberoptic communications Selection Guide	P12480E
Opto-Electronics Devices Pamphlet	P13623E
Opto-Electronics Devices (CD-ROM)	P12944X
NEC semiconductor device reliability/quality control system <sup>*1</sup>	C11159E
Quality grades on NEC semiconductor devices <sup>*1</sup>	C11531E
SEMICONDUCTOR SELECTION GUIDE –Products and Packages– <sup>*1</sup>	X13769E

<sup>\*1</sup> Published by NEC Corporation



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**SAFETY INFORMATION ON THIS PRODUCT**

<div>Caution</div> GaAs Products	<p>The product contains gallium arsenide, GaAs. GaAs vapor and powder are hazardous to human health if inhaled or ingested.</p> <ul style="list-style-type: none"> <li>• Do not destroy or burn the product.</li> <li>• Do not cut or cleave off any part of the product.</li> <li>• Do not crush or chemically dissolve the product.</li> <li>• Do not put the product in the mouth.</li> </ul> <p>Follow related laws and ordinances for disposal. The product should be excluded from general industrial waste or household garbage.</p>
<div>Caution</div> Optical Fiber	<p>A glass-fiber is attached on the product. Handle with care.</p> <ul style="list-style-type: none"> <li>• When the fiber is broken or damaged, handle carefully to avoid injury from the damaged part or fragments.</li> </ul>

►Business issue

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►Technical issue

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