



**NEC's  $\phi 30 \mu\text{m}$   
InGaAs APD IN COAXIAL PACKAGE  
FOR FIBER OPTIC COMMUNICATION  
AND OTDR APPLICATIONS**

**NR8300FP-CC**

**FEATURES**

- **SMALL DARK CURRENT:**  
 $I_D = 5 \text{ nA}$
- **SMALL TERMINAL CAPACITANCE:**  
 $C_T = 0.35 \text{ pF}$  at  $0.9 V_{BR}$
- **HIGH QUANTUM EFFICIENCY:**  
 $\eta = 90\%$  at  $\lambda = 1310 \text{ nm}$ ,  $M = 1$   
 $\eta = 77\%$  at  $\lambda = 1550 \text{ nm}$ ,  $M = 1$
- **HIGH SPEED RESPONSE:**  
 $f_c = 2.5 \text{ GHz}$  at  $M = 10$
- **DETECTING AREA SIZE:**  
 $\phi 30 \mu\text{m}$
- **COAXIAL MODULE WITH SINGLE MODE FIBER (SM-9/125)**

**DESCRIPTION**

NEC'S NR8300FP-CC is an InGaAs avalanche photo diode module with single mode fiber. It is designed for optical test instruments, especially OTDR systems.

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

PART NUMBER			NR8300FP-CC		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
$V_{BR}$	Reverse Breakdown Voltage, $I_D = 100 \mu\text{A}$	V	50	70	100
$\delta$	Temperature Coefficient of Reverse Breakdown Voltage <sup>1</sup>	%/ $^\circ\text{C}$		0.2	
$I_D$	Dark Current, $V_R = V_{BR} \times 0.9$	nA		5	25
$I_{DM}$	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		0.35	0.60
$f_c$	Cut-off Frequency, $M = 10$	GHz	2.5		
$\eta$	Quantum Efficiency, $\lambda = 1310 \text{ nm}$ , $M = 1$ $\lambda = 1550 \text{ nm}$ , $M = 1$	%	76 65	90 77	
S	Responsivity, $\lambda = 1310 \text{ nm}$ , $M = 1$ $\lambda = 1550 \text{ nm}$ , $M = 1$	A/W	0.80 0.81	0.94 0.96	
M	Multiplication Factor, $\lambda = 1310 \text{ nm}$ , $I_{PO} = 1.0 \mu\text{A}$ , $V_R = V$ (at $I_D = 1 \mu\text{A}$ )	M	30	40	
X	Excess Noise Factor <sup>2</sup> , $\lambda = 1310 \text{ nm}$ , $1550 \text{ nm}$ , $I_{PO} = 1.0 \mu\text{A}$ , $M = 10$ , $f = 35 \text{ MHz}$ , $B = 1 \text{ MHz}$			0.7	
F				5	
ORL	Optical Return Loss, SMF	dB	30		

$$V_{BR} < 25^\circ\text{C} + \Delta T^\circ\text{C} > - V_{BR} < 25^\circ\text{C} >$$

Note: 1.  $\delta = \frac{V_{BR} < 25^\circ\text{C} + \Delta T^\circ\text{C} > - V_{BR} < 25^\circ\text{C} >}{\Delta T^\circ\text{C} > - V_{BR} < 25^\circ\text{C} >}$

2.  $F = M^X$

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

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

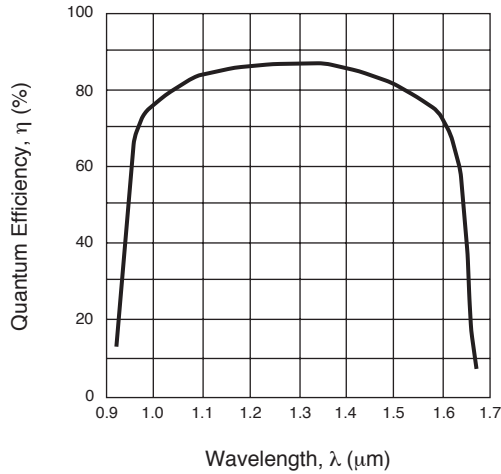
SYMBOLS	PARAMETERS	UNITS	RATINGS
I <sub>F</sub>	Forward Current	mA	10
I <sub>R</sub>	Reverse Current	mA	0.5
T <sub>C</sub>	Operating Case Temp.	°C	-40 to +85
T <sub>STG</sub>	Storage Temperature	°C	-40 to +85
T <sub>SOL</sub>	Lead Soldering Temp.	°C	260 (10 sec.)
RH	Relative Humidity (noncondensing)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

Note:

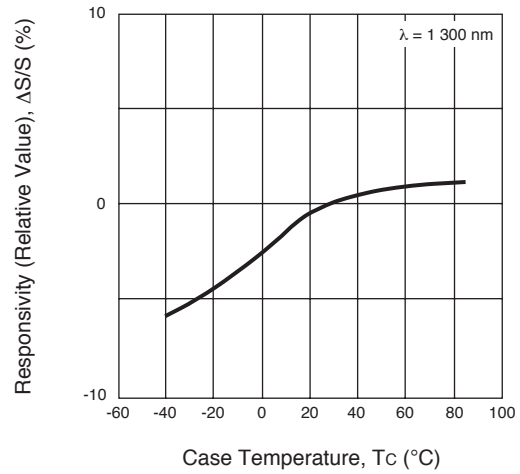
1. Operation in excess of any one of these parameters may result in permanent damage.

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

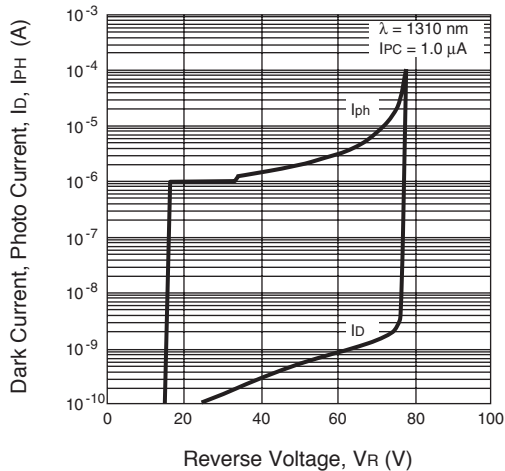
**WAVELENGTH DEPENDENCE OF QUANTUM EFFICIENCY**



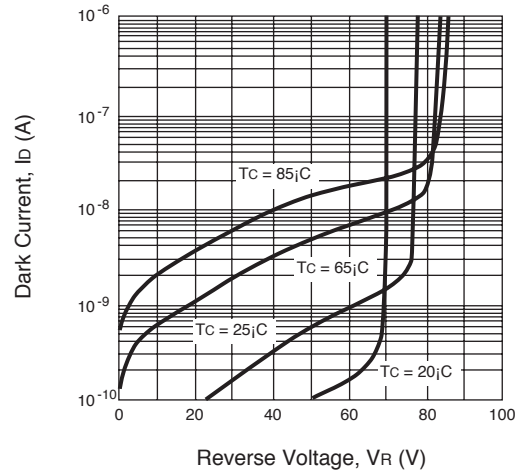
**TEMPERATURE DEPENDENCE OF RESPONSIVITY**



**DARK CURRENT AND PHOTO CURRENT vs. REVERSE VOLTAGE**

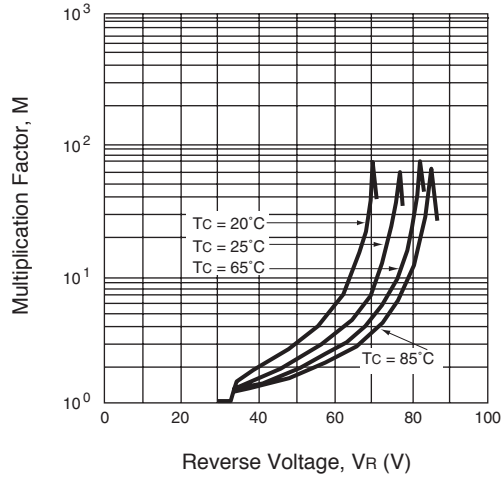


**DARK CURRENT vs. REVERSE VOLTAGE**

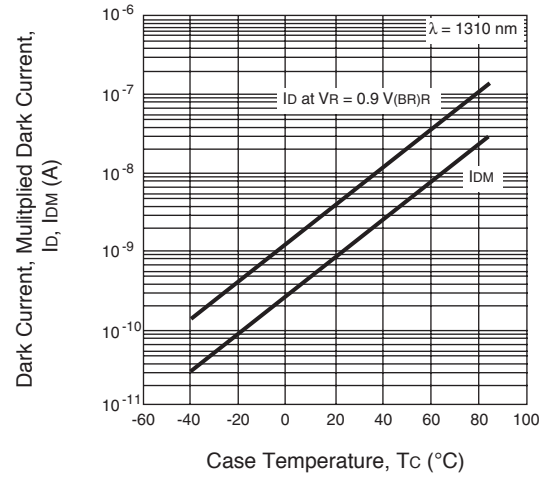


TYPICAL PERFORMANCE CURVES (T<sub>C</sub> = 25°C)

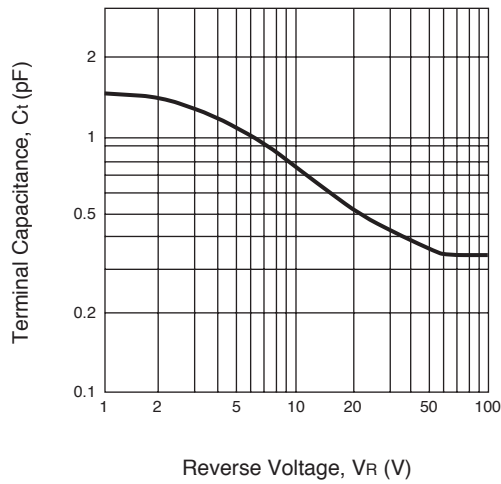
MULTIPLICATION FACTOR vs. REVERSE VOLTAGE



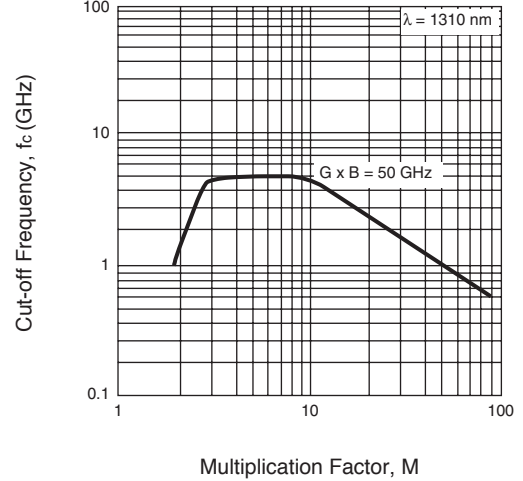
TEMPERATURE DEPENDENCE OF DARK CURRENT vs. MULTIPLIED DARK CURRENT



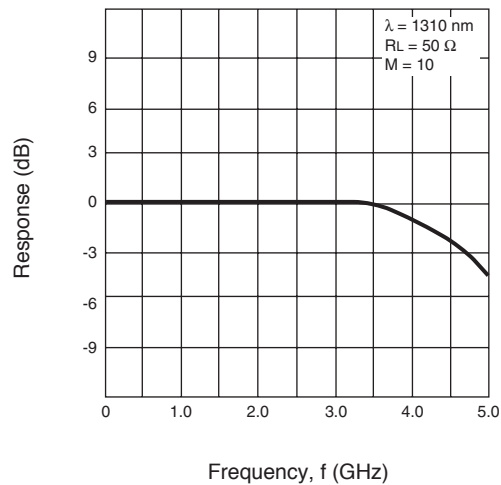
TERMINAL CAPACITANCE vs. REVERSE VOLTAGE



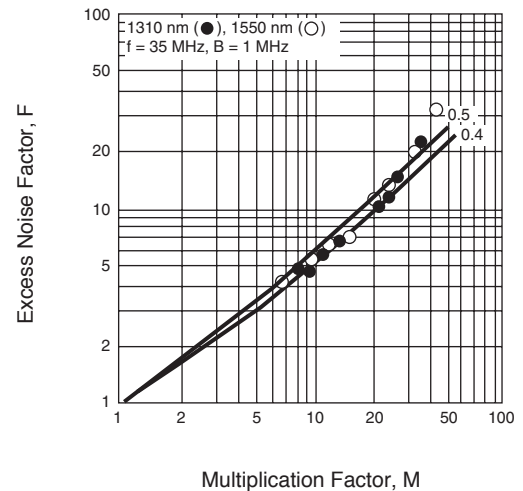
CUT-OFF FREQUENCY vs. MULTIPLICATION FACTOR



FREQUENCY RESPONSE

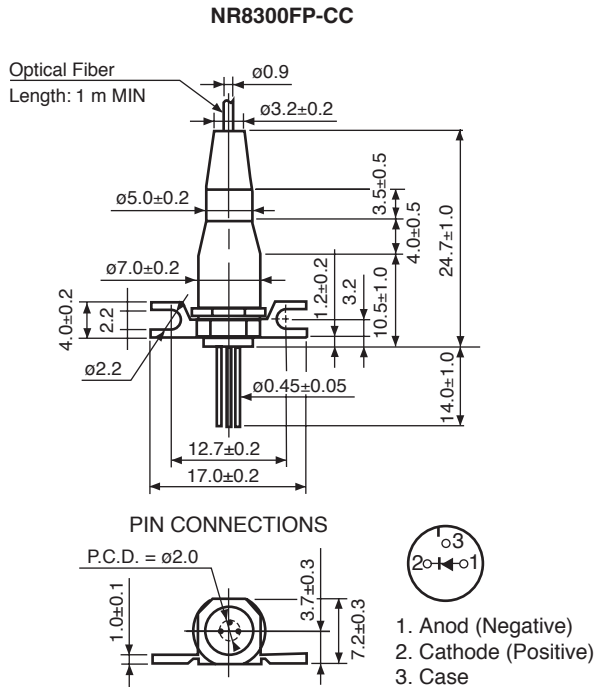


EXCESS NOISE FACTOR vs. MULTIPLICATION FACTOR



Remark: The graphs indicate nominal characteristics.

**OUTLINE DIMENSIONS** (Units in mm)



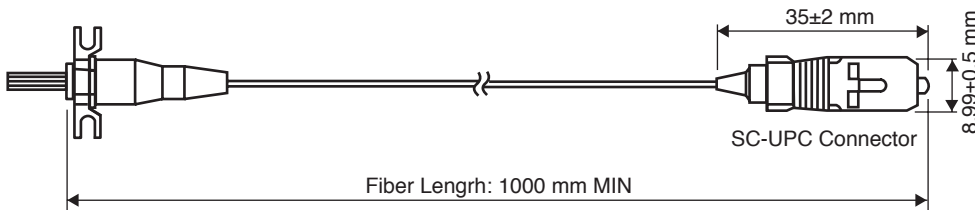
**ORDERING INFORMATION**

Part Number	Flange Type	Fiber Type	Available Connector
NR8300FP-CC-AZ*	Flat Mount Flange	SMF	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.

**OPTICAL FIBER CHARACTERISTICS**

PARAMETER	SPECIFICATION	UNIT
Mode Field Diameter	9.5±1	µm
Core Diameter	—	µm
Cladding Diameter	125±2	µm
Maximum Cladding Noncircularity	2	%
Maximum Core/Cladding Concentricity	1.6	%
Outer Diameter	0.9±0.1	mm
Cut-off Wavelength	1100 to 1270	nm
Minimum Fiber Bending Radius	30	mm
Fiber Length	1000 Min.	mm
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.

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DATA SUBJECT TO CHANGE WITHOUT NOTICE

02/24/2003

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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In no event shall CEL’s liability arising out of such information exceed the total purchase price of the CEL part(s) at issue sold by CEL to customer on an annual basis.

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