

# NDL5531P Series

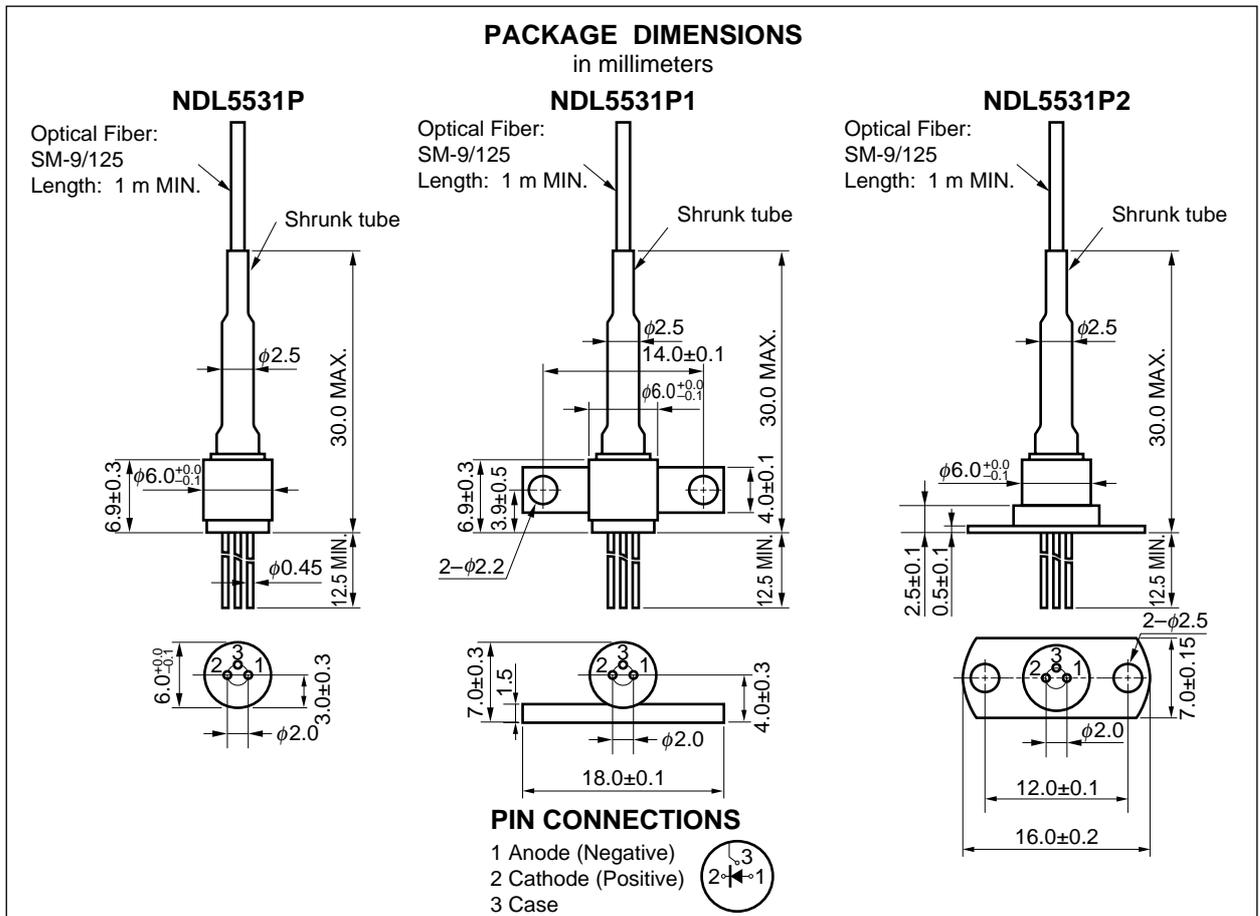
1 000 to 1 600 nm OPTICAL FIBER COMMUNICATIONS  
 $\phi 30 \mu\text{m}$  InGaAs AVALANCHE PHOTO DIODE MODULE

### DESCRIPTION

NDL5531P Series is an InGaAs avalanche photo diode module with single mode fiber. It is designed for detectors of long wavelength transmission systems. The series covers the wavelength range between 1 000 and 1 600 nm.

### FEATURES

- Small dark current  $I_D = 5 \text{ nA}$
- Small terminal capacitance  $C_t = 0.35 \text{ pF @ } 0.9 \text{ V}_{(BR)R}$
- High quantum efficiency  $\eta = 90 \% \text{ @ } \lambda = 1\,300 \text{ nm, } M = 1$   
 $\eta = 77 \% \text{ @ } \lambda = 1\,550 \text{ nm, } M = 1$
- High speed response  $f_c = 2.5 \text{ GHz @ } M = 10$
- Detecting area size  $\phi 30 \mu\text{m}$
- Coaxial module with single mode fiber (SM-9/125)



The information in this document is subject to change without notice.

★ ORDERING INFORMATION

Part Number	Available Connector	Description
NDL5531P	Without Connector	No Flange
NDL5531PC	With FC-PC Connector	
NDL5531PD	With SC-PC Connector	
NDL5531P1	Without Connector	Flat Mount Flange
NDL5531P1C	With FC-PC Connector	
NDL5531P1D	With SC-PC Connector	
NDL5531P2	Without Connector	Vertical Flange
NDL5531P2C	With FC-PC Connector	
NDL5531P2D	With SC-PC Connector	

**ABSOLUTE MAXIMUM RATINGS (T<sub>c</sub> = 25 °C, unless otherwise specified)**

Parameter	Symbol	Ratings	Unit
Forward Current	I <sub>F</sub>	10	mA
Reverse Current	I <sub>R</sub>	0.5	mA
Operating Case Temperature	T <sub>C</sub>	-40 to +85	°C
Storage Temperature	T <sub>stg</sub>	-40 to +85	°C

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

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Reverse Breakdown Voltage	V <sub>(BR)R</sub>	I <sub>D</sub> = 100 μA	50	70	100	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)R</sub> × 0.9		5	25	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)R</sub> × 0.9, f = 1 MHz		0.35	0.60	pF
Cut-off Frequency	f <sub>c</sub>	M = 10	2.5			GHz
Quantum Efficiency	η	λ = 1 300 nm, M = 1	76	90		%
		λ = 1 550 nm, M = 1	65	77		
Responsivity	S	λ = 1 300 nm, M = 1	0.80	0.94		A/W
		λ = 1 550 nm, M = 1	0.81	0.96		
Multiplication Factor	M	λ = 1 300 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 = 1 300 nm, 1 550 nm, I <sub>po</sub> = 1.0 μA M = 10, f = 35 MHz, B = 1 MHz		0.7		
	F			5		

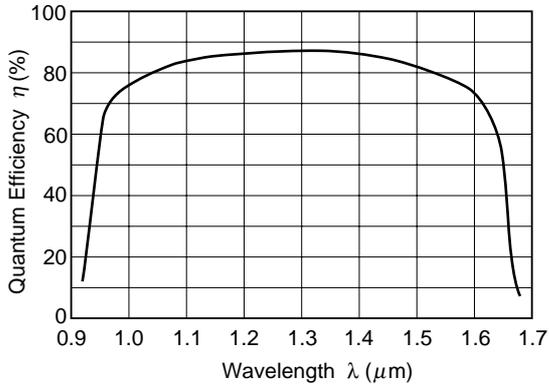
$$*1 \delta = \frac{V_{(BR)R} < 25 \text{ }^\circ\text{C} + \Delta T \text{ }^\circ\text{C} > - V_{(BR)R} < 25 \text{ }^\circ\text{C} >}{\Delta T \text{ }^\circ\text{C} \cdot V_{(BR)R} < 25 \text{ }^\circ\text{C} >}$$

$$*2 F = M^X$$

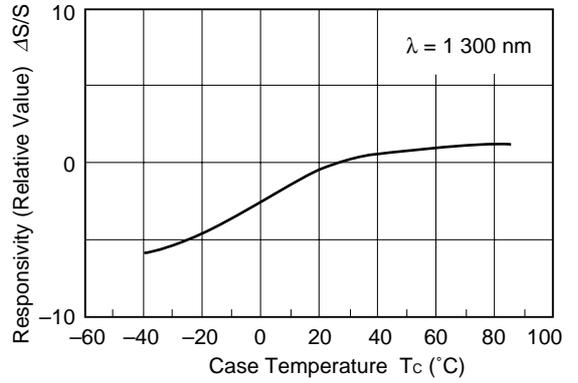
TYPICAL CHARACTERISTICS (T<sub>c</sub> = 25 °C, unless otherwise specified)



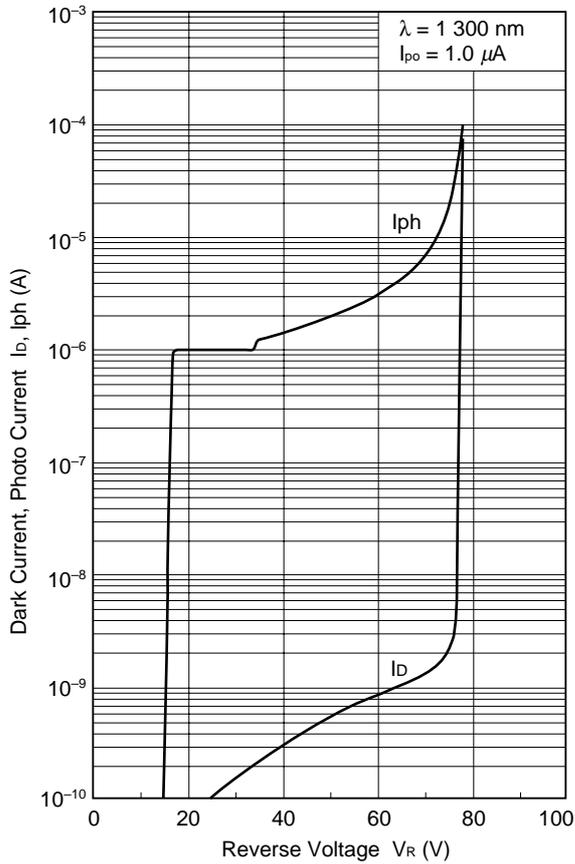
WAVELENGTH DEPENDENCE OF QUANTUM EFFICIENCY



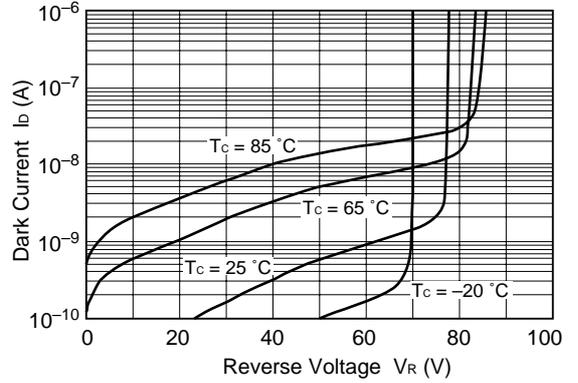
TEMPERATURE DEPENDENCE OF RESPONSIVITY



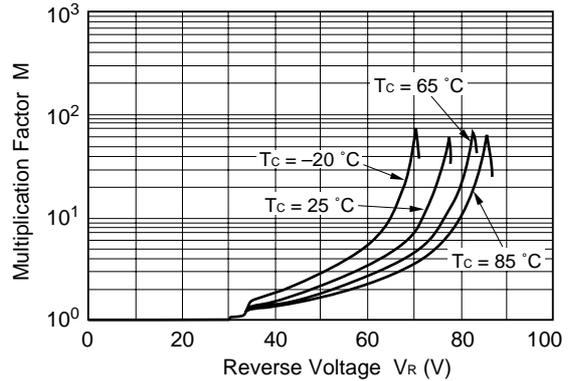
DARK CURRENT and PHOTO CURRENT vs. REVERSE VOLTAGE



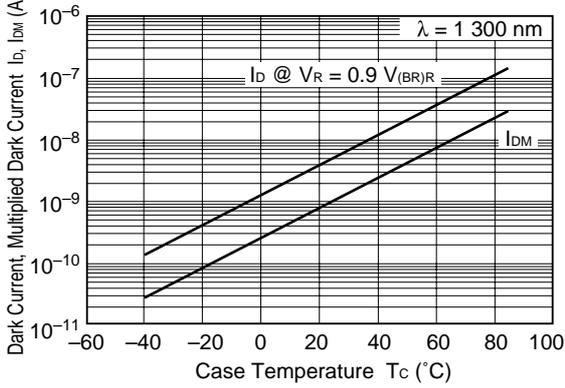
DARK CURRENT vs. REVERSE VOLTAGE



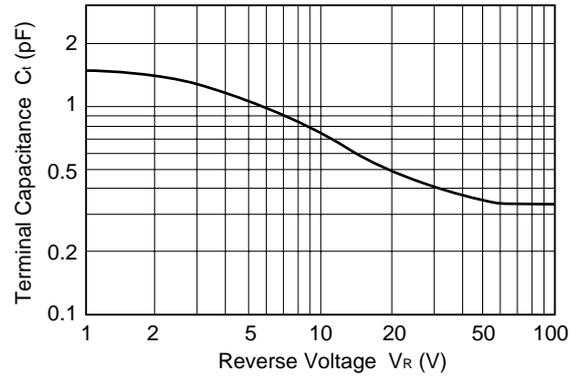
MULTIPLICATION FACTOR vs. REVERSE VOLTAGE



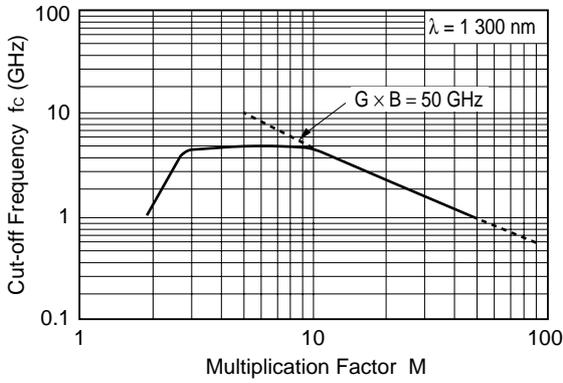
TEMPERATURE DEPENDENCE OF DARK CURRENT vs. MULTIPLIED DARK CURRENT



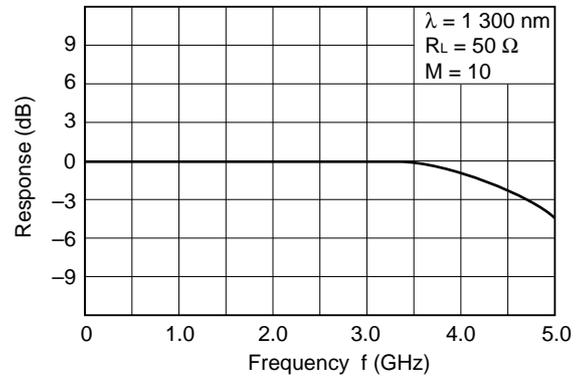
TERMINAL CAPACITANCE vs. REVERSE VOLTAGE



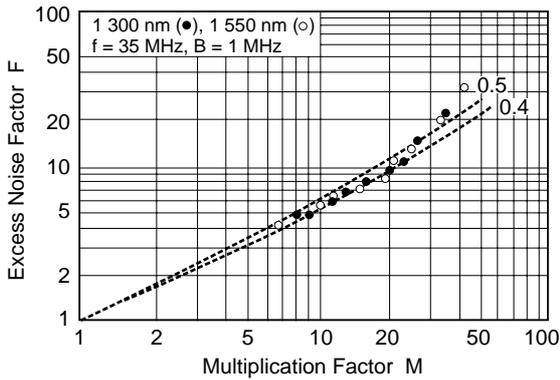
CUT-OFF FREQUENCY vs. MULTIPLICATION FACTOR



FREQUENCY RESPONSE



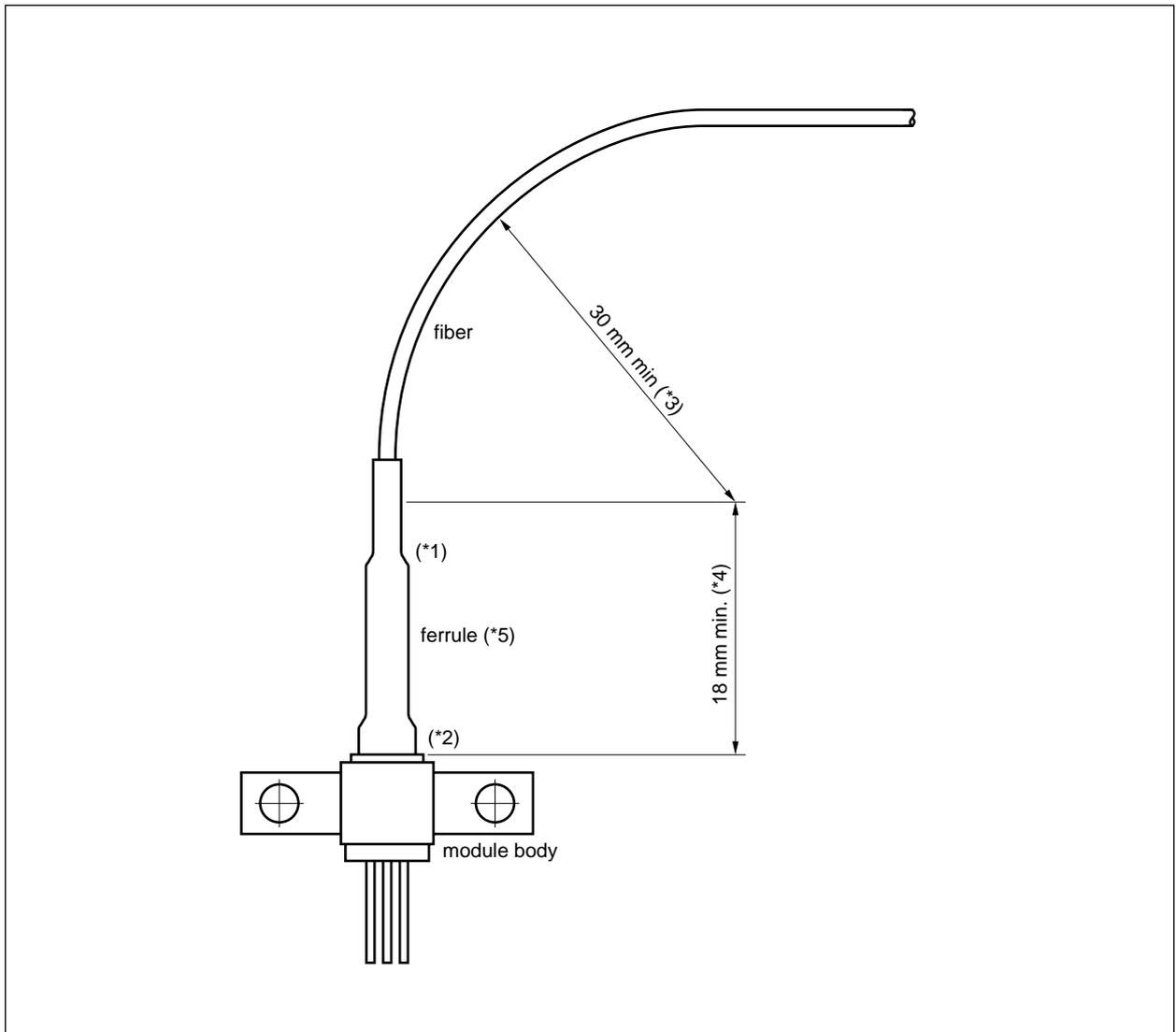
EXCESS NOISE FACTOR vs. MULTIPLICATION FACTOR



**HANDLING PRECAUTION for PD/APD MODULE**

The NEC PD/APD module has heat shrink tubing to protect the ferrule edge (\*1) and the junction between the ferrule and the module body (\*2). In order to avoid breaking the fiber and/or optical coupling degradation, NEC recommends the following handling precautions.

1. Do not make the fiber bend radius less than 30 mm (\*3).
2. Do not bend the fiber within the 18 mm section from the module body (\*4).
3. Do not stress the ferrule with a lateral force exceeding 500 g (\*5).



★ InGaAs APD/PD FAMILY

Features Packages	APD				PIN-PD		Remarks
	φ 30 μm (for 2.5 Gb/s)	φ 50 μm (for 2.5 Gb/s)	φ 50 μm	φ 80 μm	φ 50 μm (for 2.5 Gb/s)	φ 80 μm	
TO-18 type Can	NDL5530	—	NDL5500	NDL5510	—	—	3 pins
TO-18 type Can with Micro Lens	—	—	—	—	NDL5490L <sup>*3, 4</sup>	NDL5405L	3 pins
Small Can φ 5.6 μm	NDL5531	—	—	—	NDL5490 <sup>*3, 4</sup>	—	
Chip on Carrier	NDL5530C	NDL5520C	NDL5500C	NDL5510C	—	—	
Receptacle Module	—	—	—	—	—	NDL5471RC NDL5471RD	3 pins RC: FC receptacle RD: SC receptacle
Coaxial Module with MMF	—	NDL5521P NDL5521P1 NDL5521P2	NDL5551P NDL5551P1 NDL5551P2 NDL5553P <sup>*1</sup> NDL5553P1 <sup>*1</sup> NDL5553P2 <sup>*1</sup> NDL5590P NDL5590P1 NDL5590P2	NDL5561P <sup>*2</sup> NDL5561P1 <sup>*2</sup> NDL5561P2 <sup>*2</sup>	NDL5421P NDL5421P1 NDL5421P2	NDL5461P NDL5461P1 NDL5461P2	P1, P2: With flange NDL5590P Series: With Pre-AMP
Coaxial Module with SMF	NDL5531P NDL5531P1 NDL5531P2	—	NDL5553PS <sup>*1</sup> NDL5553P1S <sup>*</sup> 1 NDL5553P2S <sup>*</sup> 1	—	—	NDL5481P <sup>*5</sup> NDL5481P1 <sup>*5</sup> NDL5481P2 <sup>*5</sup>	
14-pin DIP Module with TEC	—	—	NDL5506P NDL5506PS	—	—	—	ΔT = 45 K (@ I <sub>c</sub> = 1.1 A) PS: With SMF
6-pin BFY Module with MMF	—	NDL5522P	—	—	NDL5422P	—	With Pre-AMP

- \*1 For OTDR
- \*2 With GI-62.5/125
- \*3 Under development
- \*4 Internal pre-amplifier for 1 Gb/s
- \*5 For analog application (optical CATV)

**Remark** Modules are available with FC-PC connector or optional SC-PC connector.

**REFERENCE**

Document Name	Document No.
NEC semiconductor device reliability/quality control system	LEI-1201
Quality grades on NEC semiconductor devices	IEI-1209
Semiconductor device mounting technology manual	C10535E
Guide to quality assurance for semiconductor devices	MEI-1202
Semiconductor selection guide	X10679E

## CAUTION

**Within this device there exists GaAs (Gallium Arsenide) material which is a harmful substance if ingested. Please do not under any circumstances break the hermetic seal.**

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NEC devices are classified into the following three quality grades:

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Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

Specific: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

The quality grade of NEC devices in "Standard" unless otherwise specified in NEC's Data Sheets or Data Books. If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact NEC Sales Representative in advance.

Anti-radioactive design is not implemented in this product.