

To our customers,

Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: <http://www.renesas.com>

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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RECEIVER
NDL5522P

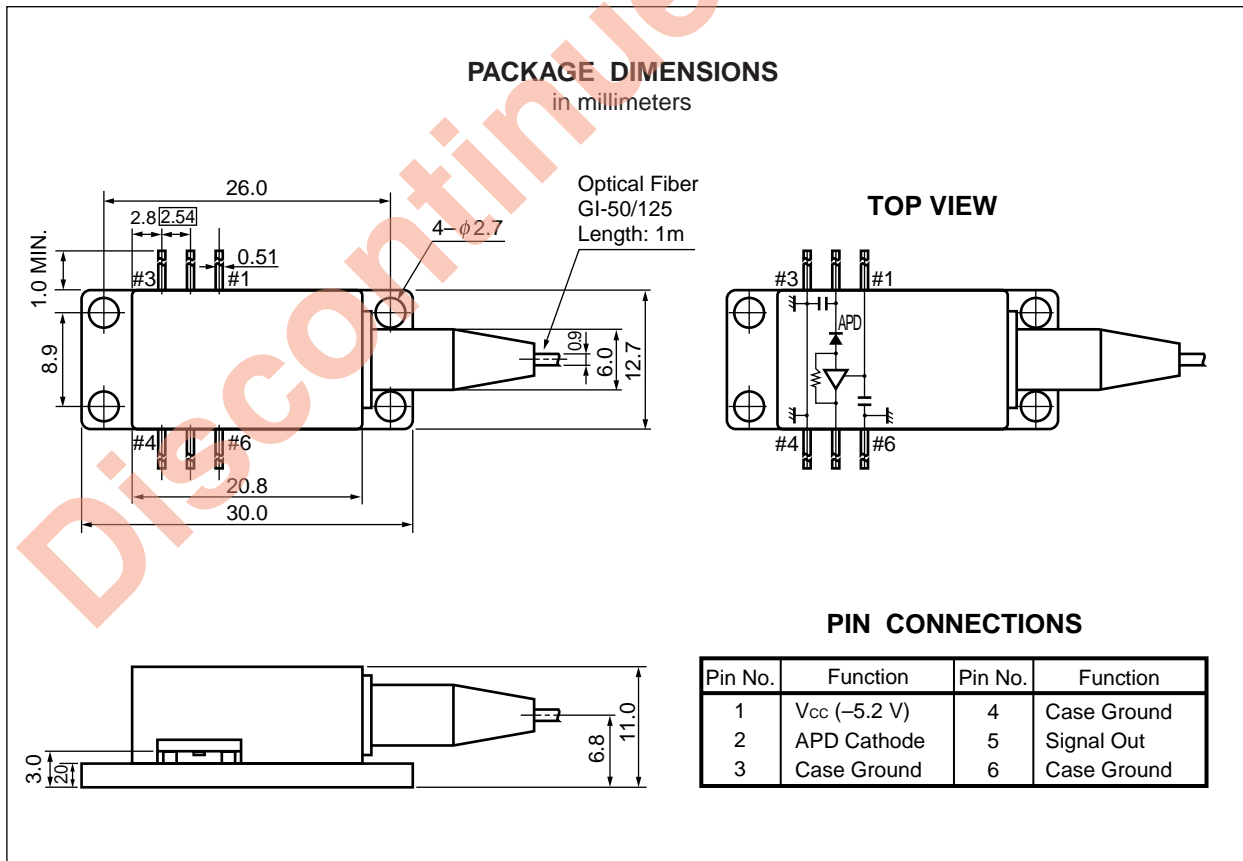
$\phi 50 \mu\text{m}$ InGaAs AVALANCHE PHOTO DIODE FOR 2.5 Gb/s BUTTERFLY MODULE WITH INTERNAL PRE-AMPLIFIER

DESCRIPTION

The NDL5522P is an InGaAs avalanche photo diode module with multimode fiber incorporating a silicon pre-amplifier IC. It is designed as an optical receiver for fiber optic communications systems such as SDH, SONET, digital video transmission. It is designed for STM-16 applications.

FEATURES

- Internal Si pre-amplifier IC
- High sensitivity $\bar{P} = -33 \text{ dBm TYP. @ 2.5 Gb/s, NRZ}$
- Wide dynamic range $D_r = 24 \text{ dB TYP. @ 2.5 Gb/s, NRZ}$
- Output impedance 50Ω
- Transimpedance 300Ω
- Detecting area size $\phi 50 \mu\text{m}$
- GI-50/125 multimode fiber pigtail
- Hermetically sealed 6-pin butterfly package



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

★ **ORDERING INFORMATION**

Part Number	Available Connector
NDL5522P	Without Connector
NDL5522PC	With FC-PC Connector

ABSOLUTE MAXIMUM RATINGS (T_c = 25 °C, unless otherwise specified)

Parameter	Symbol	Ratings	Unit
Reverse Current	I _R	0.5	mA
Supply Voltage	V _{CC}	-6	V
Operating Case Temperature	T _c	-40 to +70	°C
Storage Temperature	T _{stg}	-40 to +85	°C
Lead Soldering Temperature (10 s)	T _{sl}	260	°C

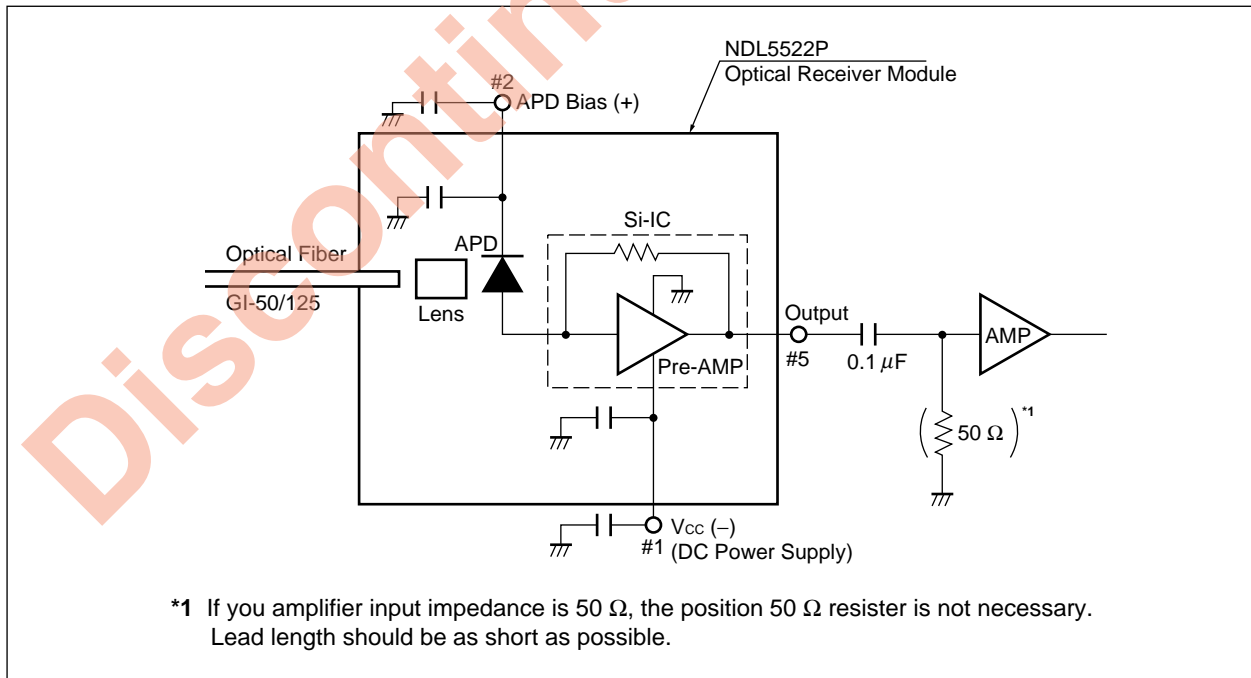
Discontinued Product

ELECTRO-OPTICAL CHARACTERISTICS (Tc = 25 °C)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Reverse Breakdown Voltage	$V_{(BR)R}$	$I_D = 100 \mu A$	40	55	80	V
Temperature Coefficient of Reverse Breakdown Voltage	δ^{*1}			0.2		%/°C
Dark Current	I_D	$V_R = V_{(BR)R} \times 0.9$		5	50	nA
Receiver Sensitivity	\bar{P}	2.488 Gb/s, NRZ, PN $2^{15}-1$,		-33	-31	dBm
Dynamic Range	D_r	BER = 10^{-11} , Mark: 1/2, $\lambda = 1310$ nm	21	24		dB
Quantum Efficiency	η	$\lambda = 1310$ nm	70	85		%
		$\lambda = 1550$ nm		80		
★ Responsivity	S	$\lambda = 1310$ nm, M = 1	0.73	0.89		A/W
		$\lambda = 1550$ nm, M = 1		1.0		
Cut-off Frequency	f_c	M = 10, 3 dB down	2.5	4.0		GHz
Equivalent Input Noise Current	I_n	f = 2.5 GHz		9		pA/ \sqrt{Hz}
Supply Voltage	V_{CC}			-5.2		V
Supply Current	I_{CC}	$V_{CC} = -5.2$ V		23		mA
Transimpedance	Z_t			300		Ω
Output Impedance	Z_{out}			50		Ω

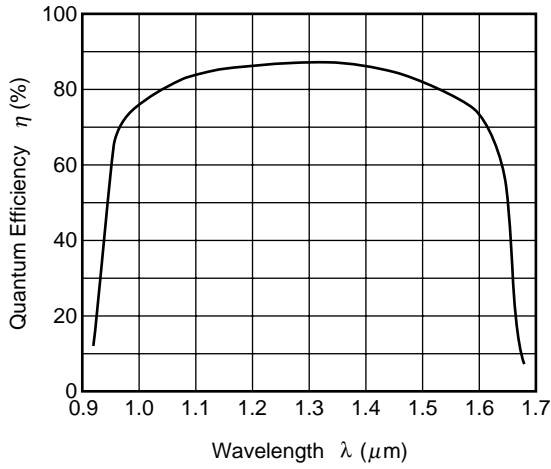
$$*1 \delta = \frac{V_{(BR)R}(25^\circ C + \Delta T^\circ C) - V_{(BR)R}(25^\circ C)}{\Delta T^\circ C \cdot V_{(BR)R}(25^\circ C)}$$

RECOMMENDED EXTERNAL CIRCUIT

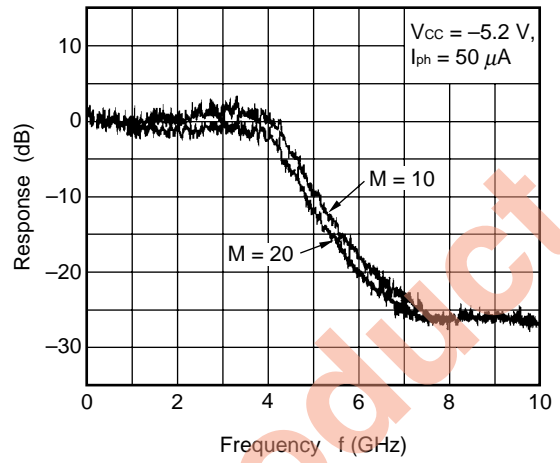


★ TYPICAL CHARACTERISTICS (T_c = 25 °C, unless otherwise specified)

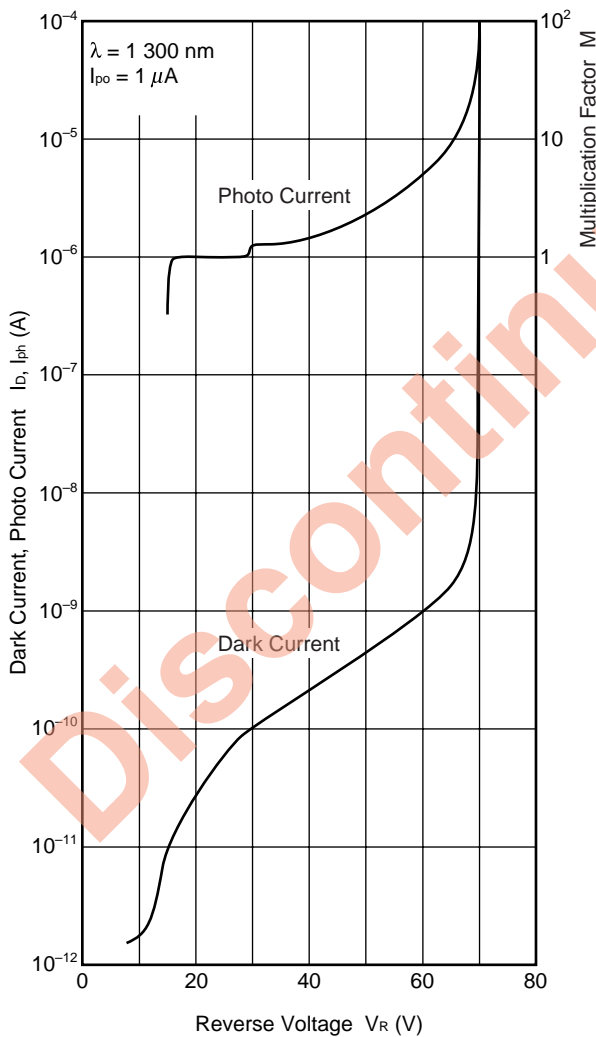
WAVELENGTH DEPENDENCE OF QUANTUM EFFICIENCY



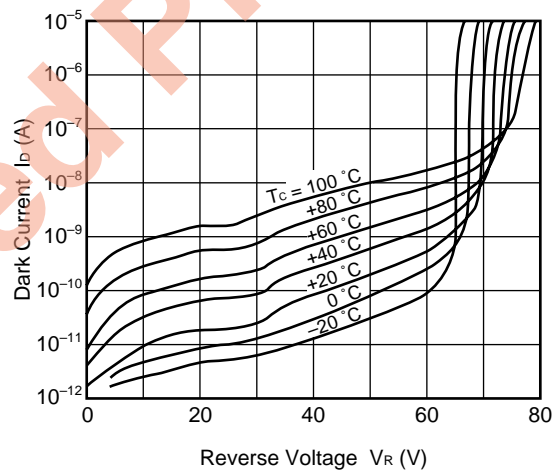
FREQUENCY RESPONSE



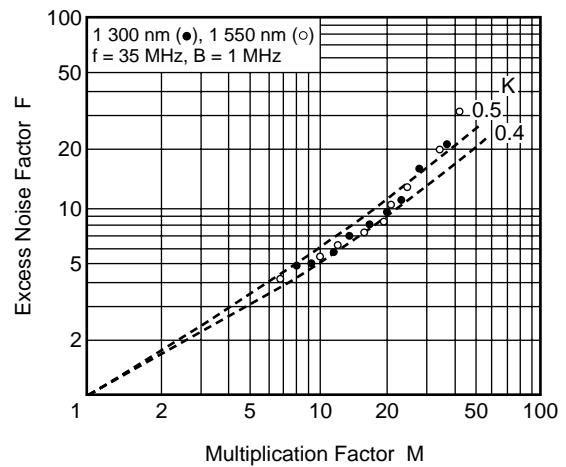
DARK CURRENT and PHOTO CURRENT vs. REVERSE VOLTAGE



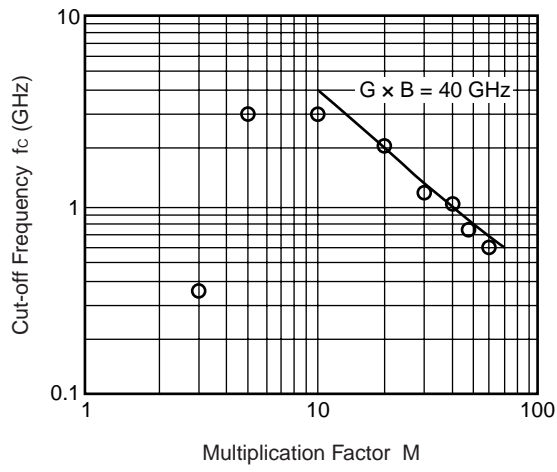
DARK CURRENT vs. REVERSE VOLTAGE



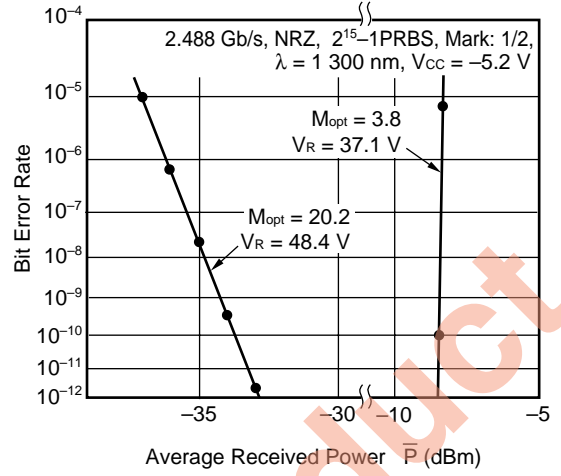
EXCESS NOISE FACTOR vs. MULTIPLICATION FACTOR



CUT-OFF FREQUENCY vs. MULTIPLICATION FACTOR



ERROR RATE CHARACTERISTICS



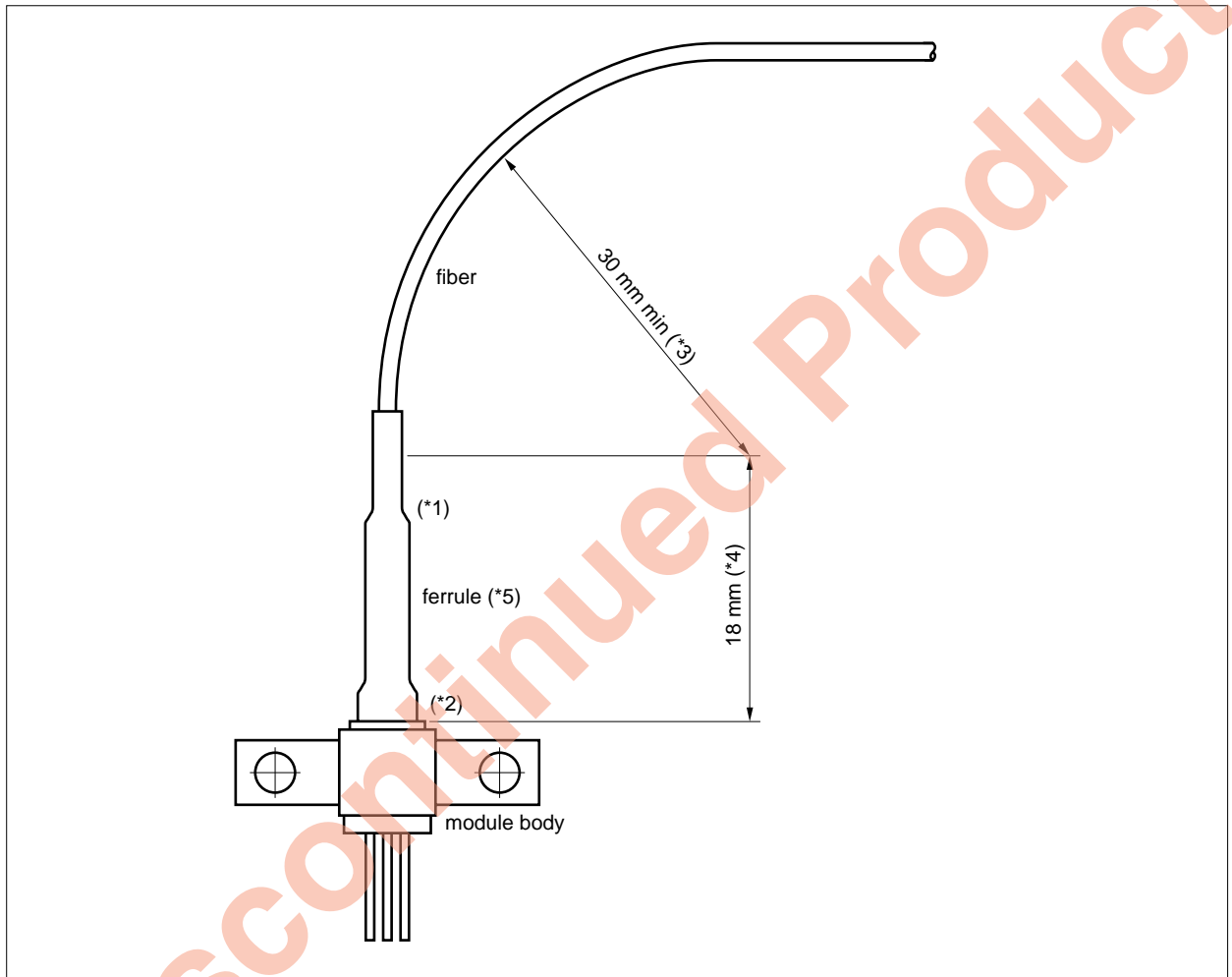
Remark The graphs indicate nominal characteristics.

Discontinued Product

★ 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	φ 120 μm	
TO-18 type CAN	NDL5530	–	NDL5500	NDL5510	–	–	–	3 pins
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 ^{*1} NDL5553P1 ^{*1} NDL5553P2 ^{*1} NDL5590P NDL5590P1 NDL5590P2	NDL5561P ^{*2} NDL5561P1 ^{*2} NDL5561P2 ^{*2}	NDL5421P NDL5421P1 NDL5421P2	NDL5461P NDL5461P1 NDL5461P2	–	P1, P2: With flange NDL5590P Series: With Pre-AMP
Coaxial Module with SMF	NDL5531P NDL5531P1 NDL5531P2 NDL5592P NDL5592P1 NDL5592P2	–	NDL5553PS ^{*1} NDL5553P1S ^{*1} NDL5553P2S ^{*1}	–	–	NDL5481P ^{*3} NDL5481P1 ^{*3} NDL5481P2 ^{*3}	–	P1, P2: With flange NDL5592P Series: With Pre-AMP
14-pin DIP Module with TEC	–	–	NDL5506P NDL5506PS	NDL5516P NDL5516PC	–	–	–	ΔT = 45 K (@ I _c = 1.1 A) PS: With SMF
6-pin BFY Module with MMF	–	NDL5522P	–	–	NDL5422P	–	–	With Pre-AMP
8-pin Mini-DIL with SMF	–	–	–	–	–	–	NDL8800P	

*1 For OTDR

*2 With GI-62.5/125

*3 For analog application (optical CATV)

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

REFERENCE

Document Name	Document No.
NEC semiconductor device reliability/quality control system	C11159E
Quality grades on NEC semiconductor devices	C11531E
Semiconductor device mounting technology manual	C10535E
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:

"Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.

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 is "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 an NEC sales representative in advance.

Anti-radioactive design is not implemented in this product.