

To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

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

April 1st, 2010
Renesas Electronics Corporation

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

Send any inquiries to <http://www.renesas.com/inquiry>.

Notice

1. All information included in this document is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas Electronics products listed herein, please confirm the latest product information with a Renesas Electronics sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas Electronics such as that disclosed through our website.
2. Renesas Electronics does not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from the use of Renesas Electronics products or technical information described in this document. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
3. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part.
4. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
5. When exporting the products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. You should not use Renesas Electronics products or the technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. Renesas Electronics products and technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations.
6. Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
7. Renesas Electronics products are classified according to the following three quality grades: “Standard”, “High Quality”, and “Specific”. The recommended applications for each Renesas Electronics product depends on the product’s quality grade, as indicated below. You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application categorized as “Specific” without the prior written consent of Renesas Electronics. Further, you may not use any Renesas Electronics product for any application for which it is not intended without the prior written consent of Renesas Electronics. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for an application categorized as “Specific” or for which the product is not intended where you have failed to obtain the prior written consent of Renesas Electronics. The quality grade of each Renesas Electronics product is “Standard” unless otherwise expressly specified in a Renesas Electronics data sheets or data books, etc.
 - “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.
 - “High Quality”: 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”: Aircraft; aerospace equipment; submersible repeaters; nuclear reactor control systems; medical equipment or systems for life support (e.g. artificial life support devices or systems), surgical implantations, or healthcare intervention (e.g. excision, etc.), and any other applications or purposes that pose a direct threat to human life.
8. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.
10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.

(Note 1) “Renesas Electronics” as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.

(Note 2) “Renesas Electronics product(s)” means any product developed or manufactured by or for Renesas Electronics.

1 000 to 1 600 nm OPTICAL FIBER COMMUNICATIONS
 $\phi 50 \mu\text{m}$ InGaAs AVALANCHE PHOTO DIODE
DESCRIPTION

NDL5500C is an InGaAs Avalanche Photo diode especially designed for a detector of long wavelength optical fiber communications systems. It covers the wavelength range between 1 000 and 1 600 nm with high sensitivity.

FEATURES

- Small dark current. $I_D = 5 \text{ nA}$
- High sensitivity. $\eta = 85 \% @ 1\ 300 \text{ nm}$
 $\eta = 80 \% @ 1\ 550 \text{ nm}$
- High speed response. $f_c = 1.2 \text{ GHz @ } M = 20$
- Detecting area size. $\phi 50 \mu\text{m}$

QUALITY GRADE

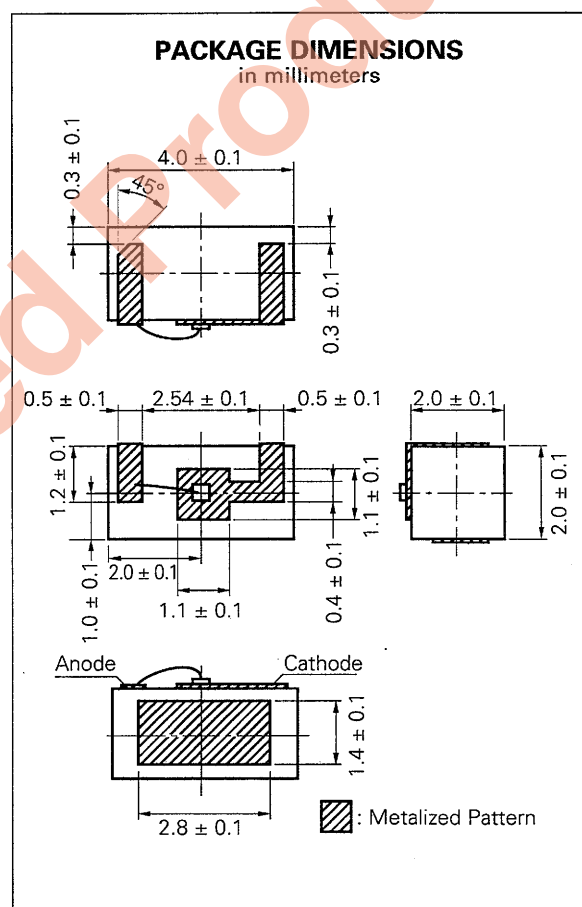
Standard

Please refer to "Quality grade on NEC Semiconductor Devices" (Document number IEI-1209) published by NEC Corporation to know the specification of quality grade on the devices and its recommended applications.

ABSOLUTE MAXIMUM RATINGS

($T_c = 25 \text{ }^\circ\text{C}$, in dry nitrogen atmosphere)

Forward Current	I_F	10	mA
Reverse Current	I_R	0.5	mA
Operating Case Temperature	T_c	-40 to +70	$^\circ\text{C}$
Storage Temperature	T_{stg}	-55 to +100	$^\circ\text{C}$

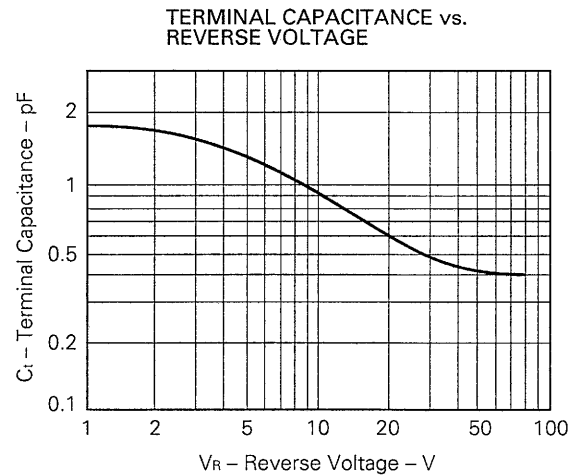
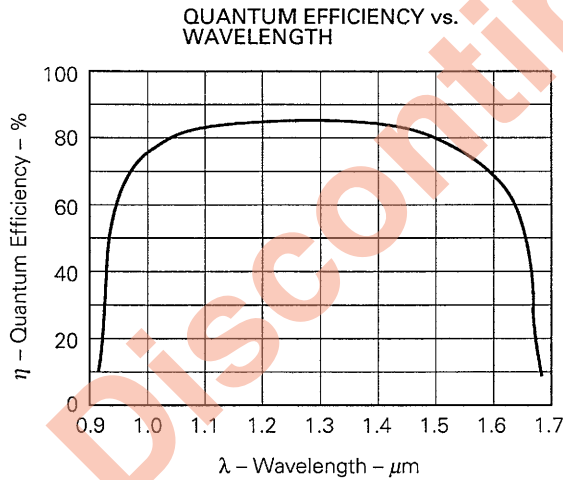


ELECTRO-OPTICAL CHARACTERISTICS (T_c = 25 °C)

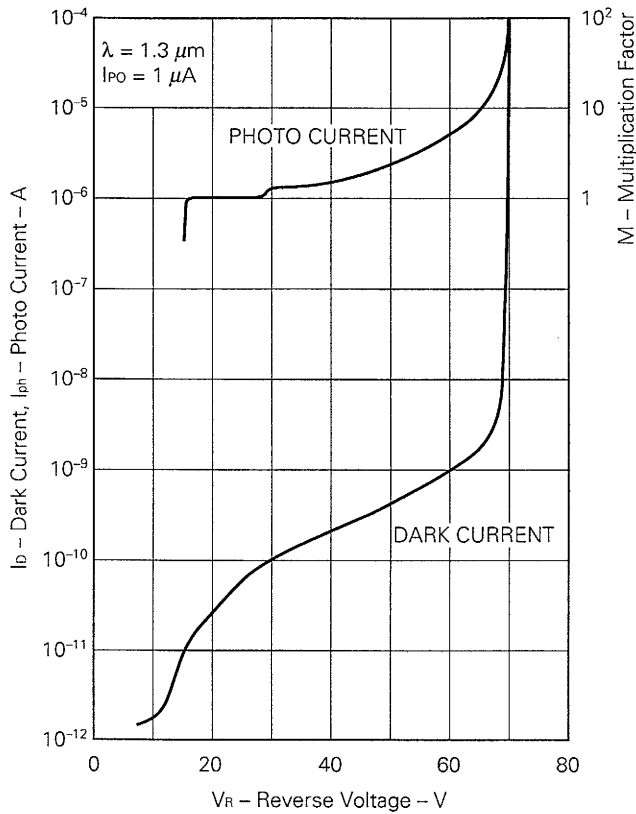
CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
Reverse Breakdown Voltage	V _{(BR)R}	50	70	100	V	I _D = 100 μA
Temperature Coefficient of Reverse Breakdown Voltage	δ *1		0.2		%/°C	
Dark Current	I _D		5	50	nA	V _R = V _{(BR)R} × 0.9
Multiplied Dark Current	I _{DM}		1	5	nA	M = 2 to 10
Terminal Capacitance	C _t		0.4	0.8	pF	V _R = V _{(BR)R} × 0.9, f = 1 MHz
Cut-off Frequency	f _c	1			GHz	M = 10
			1.2			M = 20
Quantum Efficiency	η	70	85		%	λ = 1 300 nm
			80			λ = 1 550 nm
Sensitivity	S	0.73	0.89		A/W	λ = 1 300 nm
			1.00			λ = 1 550 nm
Multiplication Factor	M	20	40			λ = 1 550 nm, I _{PO} = 1.0 μA V _R = V (@ I _D = 1 μA)
Excess Noise Factor	x		0.7			λ = 1 300 nm, 1 550 nm, I _{PO} = 1.0 μA
Excess Noise Coefficient	F		5			M = 10, f = 35 MHz, B = 1 MHz
Effective Detecting Area Size	φE	30	40		μm	M = 10, 80 % of Peak

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

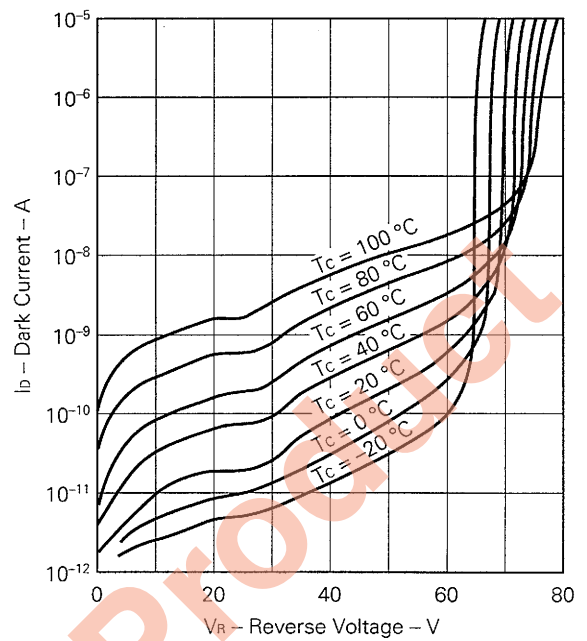
TYPICAL CHARACTERISTICS (T_c = 25 °C)



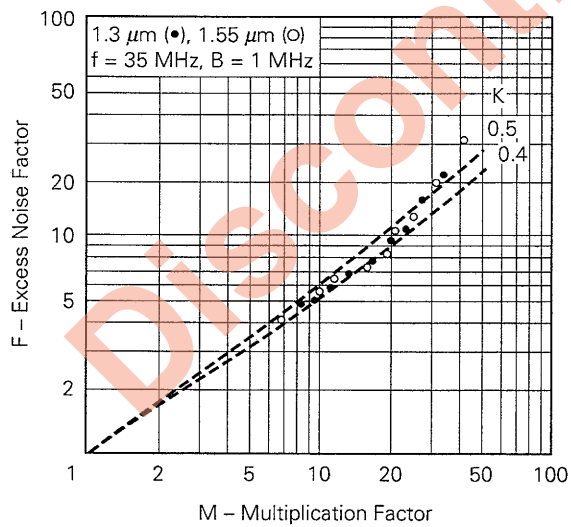
DARK CURRENT and PHOTO CURRENT vs. REVERSE VOLTAGE



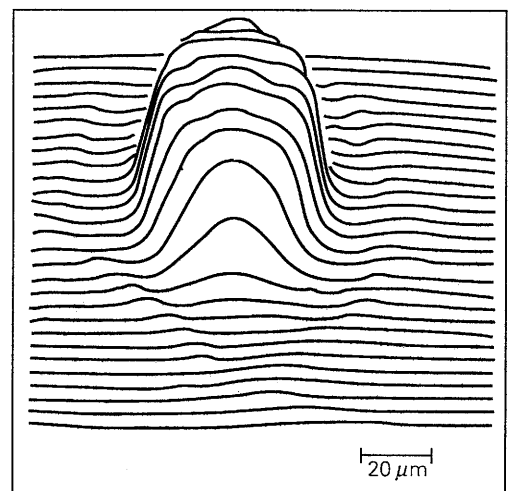
DARK CURRENT vs. REVERSE VOLTAGE

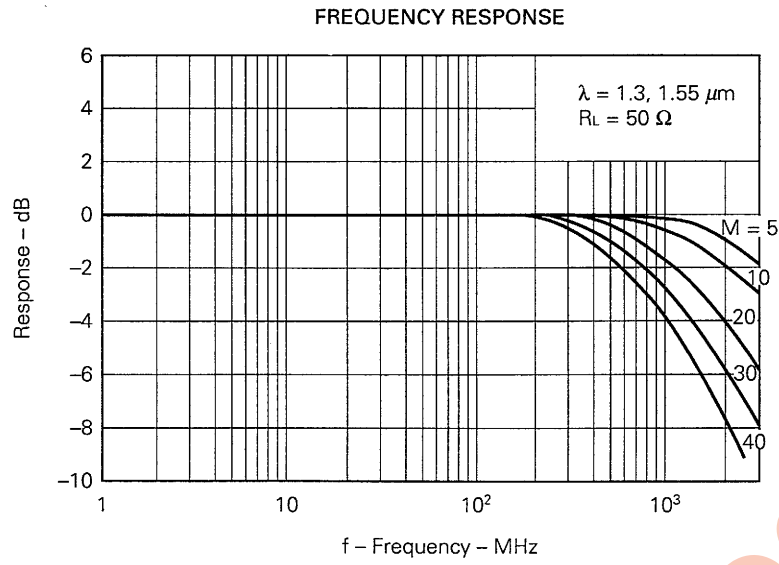


EXCESS NOISE FACTOR vs. MULTIPLICATION FACTOR



MULTIPLICATION MAP





Discontinued Product

DETECTOR CHIP ON CARRIER HANDLING PRE-CAUTION

DETECTOR CHIP ON CARRIER IS NON HERMETIC SEALED DEVICE.

THEREFORE, THERE IS A POSSIBILITY THAT RELIABILITY OF THE DEVICE IS AFFECTED BY STORAGE AND/OR ASSEMBLY CONDITION. IN ORDER TO ASSURE DEVICE RELIABILITY, NEC RECOMMENDS THE FOLLOWING CONDITIONS FOR HANDLING.

1) STORAGE CONDITIONS

WHEN THE DEVICE IS PRESERVED AFTER BREAKING CONTAINER SEAL, THE FOLLOWING CONDITION SHOULD BE MAINTAINED.

- STORAGE TEMPERATURE : +20 °C to +30 °C
- CONTAINER : CLEAN DRY BOX WITH ESD PROTECTION
- AMBIENT GAS : DRY NITROGEN ATMOSPHERE

2) HANDLING/ASSEMBLY CONDITIONS

2-1) BONDING WIRE

ANY CONTACT TO BONDING WIRE SHOULD BE AVOIDED.

2-2) MAXIMUM TEMPERATURE IN ASSEMBLY CONDITIONS

THE FOLLOWING CONDITION SHOULD BE KEPT.

TEMPERATURE	DURATION	AMBIENT GAS
230 °C	1 minute	DRY NITROGEN ATMOSPHERE
175 °C	3 hours	
130 °C	100 hours	

2-3) PRE-CAP BAKING CONDITION

IN ORDER TO STABILIZE DARK CURRENT, NEC RECOMMENDS ONE OF THE FOLLOWING CONDITIONS FOR PRE-CAP BAKING.

TEMPERATURE	DURATION	AMBIENT GAS
120 °C to 150 °C	24 hours	DRY NITROGEN ATMOSPHERE

2-4) HERMETIC SEALING

THE DEVICE SHOULD BE FINALLY INSTALLED IN HERMETIC SEALED PACKAGE.
 INERT GAS ATMOSPHERE SUCH AS NITROGEN IS RECOMMENDED.
 HERMETISITY SHOULD BE LESS THAN 10⁻⁸ atm.cc/sec BY He LEAKAGE TEST.

2-5) ELECTRO STATIC DISCHARGE (ESD) PROTECTION

DURING HANDLING PROCESS, ESD PROTECTION SUCH AS EARTH-BAND SHOULD BE CARRIED OUT.

InGaAs APD/PD FAMILY

FEATURES PACKAGES	APD			PIN-PD		REMARKS
	$\phi 50 \mu\text{m}$ (for 2.5 Gb/s)	$\phi 50 \mu\text{m}$	$\phi 80 \mu\text{m}$	$\phi 80 \mu\text{m}$	$270 \times 330 \mu\text{m}^2$	
TO-18 TYPE CAN	-	NDL5500	NDL5510	NDL5405	NDL5406	3 PIN
TO-18 TYPE CAN WITH MICRO LENS	-	-	-	NDL5405L	-	3 PIN
CHIP ON CARRIER	NDL5520C	NDL5500C	NDL5510C	NDL5405C	NDL5406C	
FC-RECEPTACLE MODULE	-	-	-	NDL5405RA1 NDL5405RA2 NDL5405RA3	-	3 PIN
COAXIAL MODULE WITH MMF	NDL5520P NDL5520P1	NDL5501P NDL5501P1	-	NDL5407P NDL5407P1	-	P1 : WITH FLANGE
COAXIAL MODULE WITH SMF	-	-	-	NDL5408P NDL5408P1	-	ANALOG APPLICATION (CATV)
14 PIN DIP MODULE WITH MULTI-MODE FIBER	-	NDL5506P	NDL5516P	-	-	WITH TEC NDL5506P: WITH GI-50 NDL5516P: WITH GI-62.5
6-PIN BFY MODULE WITH MMF	NDL5522P	-	-	NDL5422P*2 (for 2.5 Gb/s)	-	WITH PRE-AMP

*2 NDL5422P: $\phi 50 \mu\text{m}$, $f_c = 2.5 \text{ GHz MIN.}$

Discontinued Product

[MEMO]

Discontinued Product

[MEMO]

No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Corporation. NEC Corporation assumes no responsibility for any errors which may appear in this document.

NEC Corporation does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from use of a device described herein or any other liability arising from use of such device. No license, either express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Corporation or others.

The devices listed in this document are not suitable for use in aerospace equipment, submarine cables, nuclear reactor control systems and life support systems. If customers intend to use NEC devices for above applications or they intend to use "Standard" quality grade NEC devices for applications not intended by NEC, please contact our sales people in advance.

Application examples recommended by NEC Corporation.

Standard: Computer, Office equipment, Communication equipment, Test and Measurement equipment, Machine tools, Industrial robots, Audio and Visual equipment, Other consumer products, etc.

Special: Automotive and Transportation equipment, Traffic control systems, Antidisaster systems, Anticrime systems, etc.