

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.

NDL5590P Series

φ50 μm InGaAs AVALANCHE PHOTO DIODE WITH MULTIMODE FIBER INTERNAL PRE-AMPLIFIER

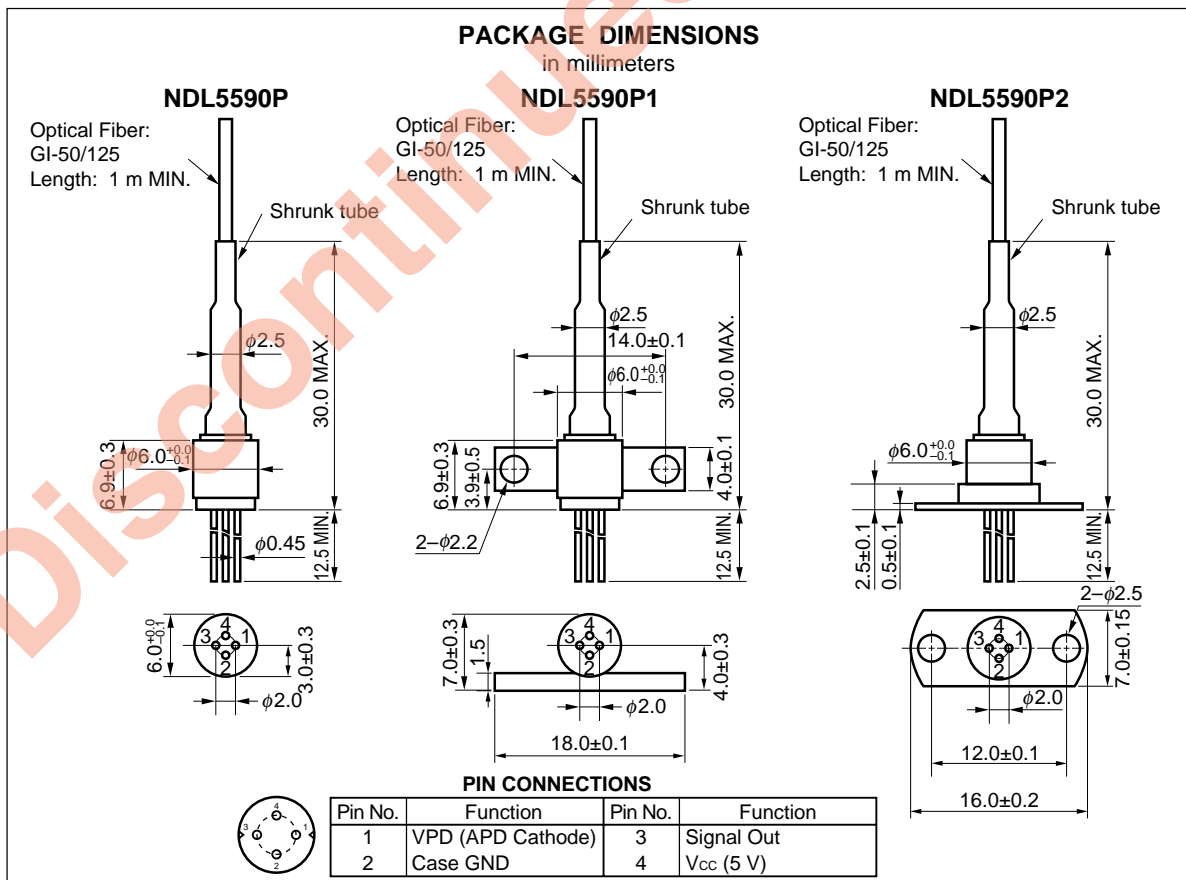
DESCRIPTION

NDL5590P Series is an InGaAs avalanche photo diode module with multimode fiber incorporating silicon pre-amplifier IC. It is designed as an optical receiver for fiber optic communications systems such as SDH, SONET, digital video transmission.

FEATURES

- Internal Si pre-amplifier IC
- High sensitivity
- Wide dynamic range
- Transimpedance
- Output impedance
- Detecting area size
- GI-50/125 multimode fiber pigtail

$\bar{P} = -36$ dBm TYP. @ 622 Mb/s. NRZ
 $D_r = 28$ dB TYP. @ 622 Mb/s. NRZ
 300 Ω
 50 Ω
 φ50 μm



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

★ **ORDERING INFORMATION**

Part Number	Available Connector	Description
NDL5590P	Without Connector	No Flange
NDL5590PC	With FC-PC Connector	
NDL5590PD	With SC-PC Connector	
NDL5590P1	Without Connector	Flat Mount Flange
NDL5590P1C	With FC-PC Connector	
NDL5590P1D	With SC-PC Connector	
NDL5590P2	Without Connector	Vertical Flange
NDL5590P2C	With FC-PC Connector	
NDL5590P2D	With SC-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}	6.0	V
Operating Case Temperature	T _C	-40 to +85	°C
Storage Temperature	T _{stg}	-40 to +85	°C
Lead Soldering Temperature (10 s)	T _{slid}	260	°C

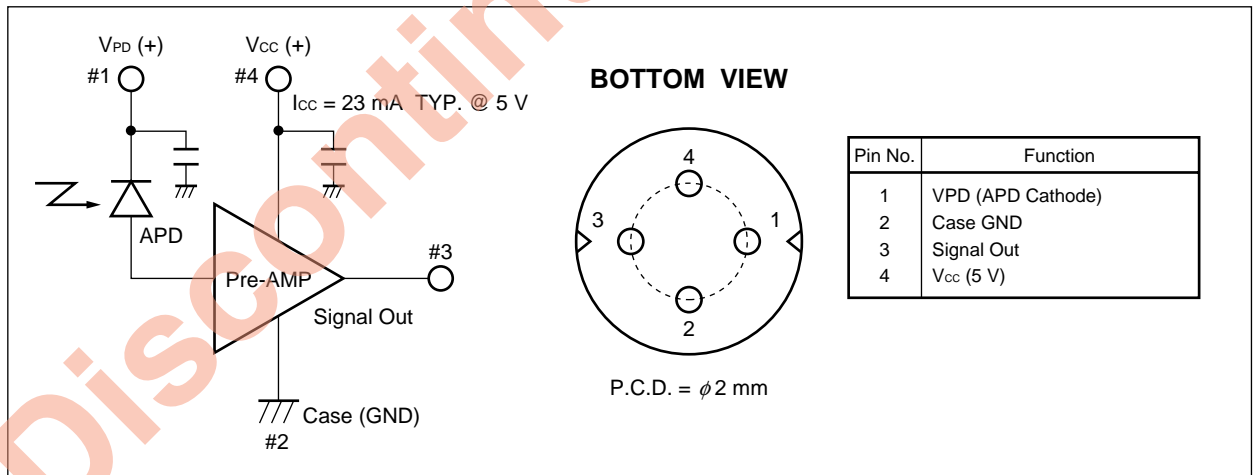
Discontinued Product

ELECTRO-OPTICAL CHARACTERISTICS (T_c = 25 °C)

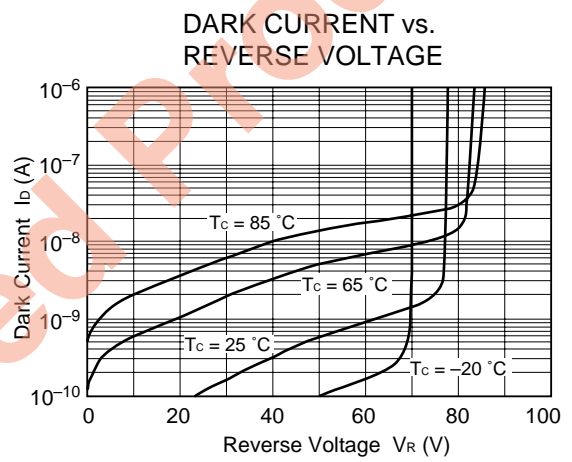
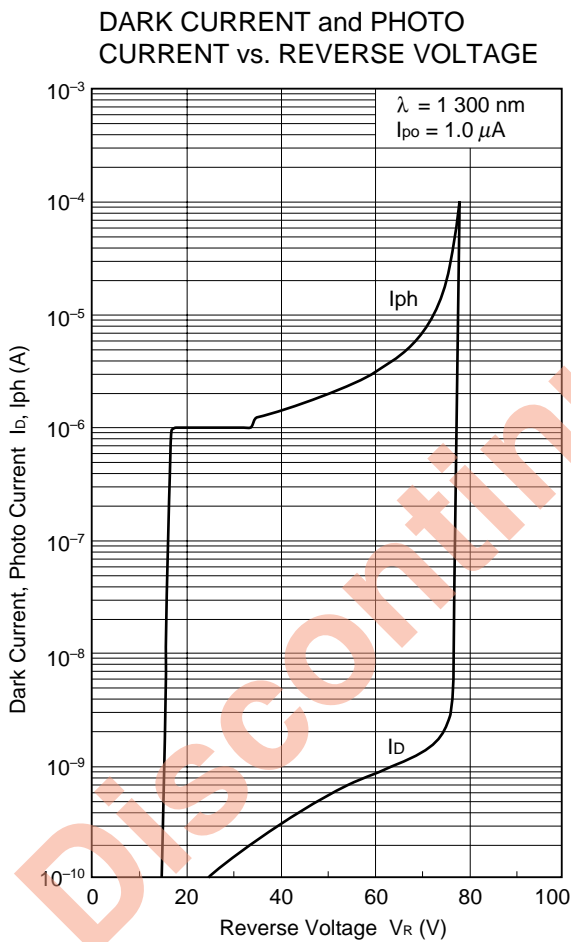
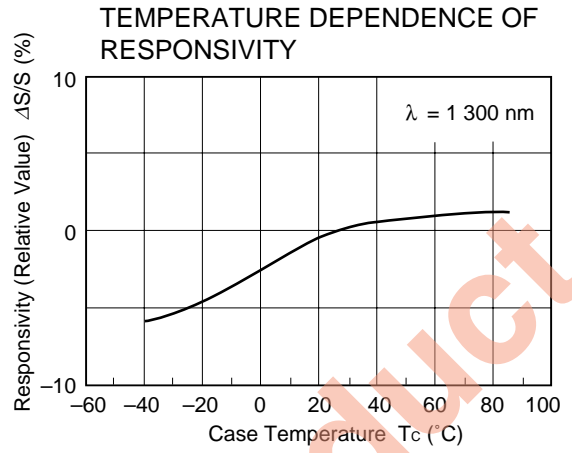
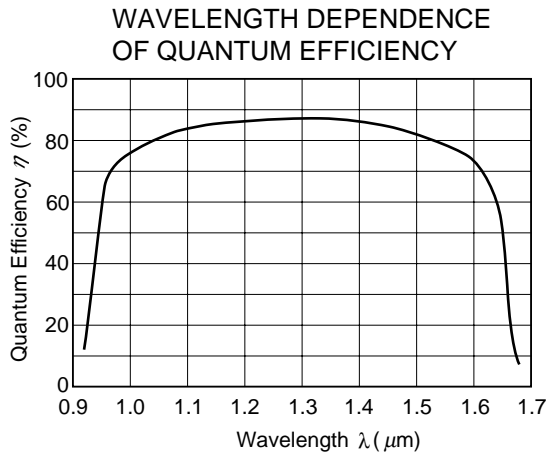
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Reverse Breakdown Voltage	V _{(BR)R}	I _D = 100 μA	50	70	100	V
Temperature Coefficient of Reverse Breakdown Voltage	δ ⁻¹			0.2		%/°C
Dark Current	I _D	V _R = V _{(BR)R} × 0.9		5.0	30	nA
Receiver Sensitivity	P̄	622 Mb/s, NRZ, PN 2 ¹⁵ - 1		-36		dBm
Dynamic range	D _r	BER = 10 ⁻¹¹ , Mark: 1/2, λ = 1 310 nm		28		dB
Quantum Efficiency	η	λ = 1 310 nm, M = 1	76	90		%
		λ = 1 550 nm, M = 1	65	77		
Responsivity	S	λ = 1 310 nm, M = 1	0.80	0.94		A/W
		λ = 1 550 nm, M = 1	0.81	0.96		
Cut-off Frequency	f _c	M = 3 to 15	1.0			GHz
Equivalent Input Noise Current	I _n	f = 100 MHz		9.0		pA/√Hz
Power Supply Voltage	V _{CC}			5.0		V
Power Supply Current	I _{CC}	V _{CC} = 5 V		23	30	mA
Transimpedance	Z _t			300		Ω

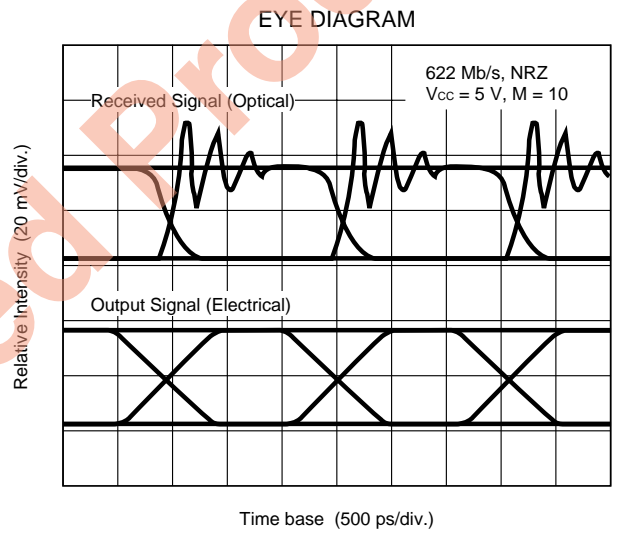
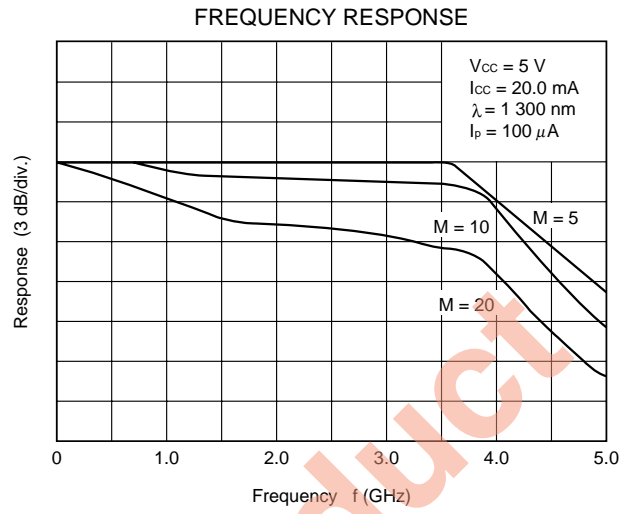
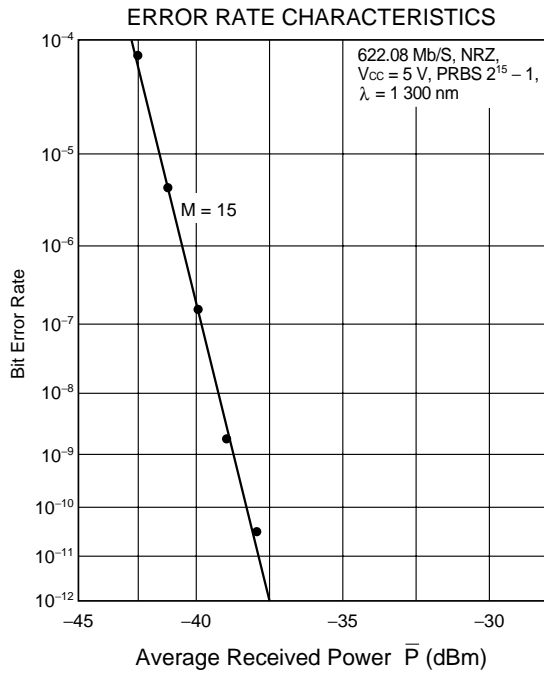
*1
$$\delta = \frac{V_{(BR)R}(25\text{ °C} + \Delta T\text{ °C}) - V_{(BR)R}(25\text{ °C})}{\Delta T\text{ °C} \cdot V_{(BR)R}(25\text{ °C})}$$

EQUIVALENT CIRCUIT AND PIN CONNECTIONS



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



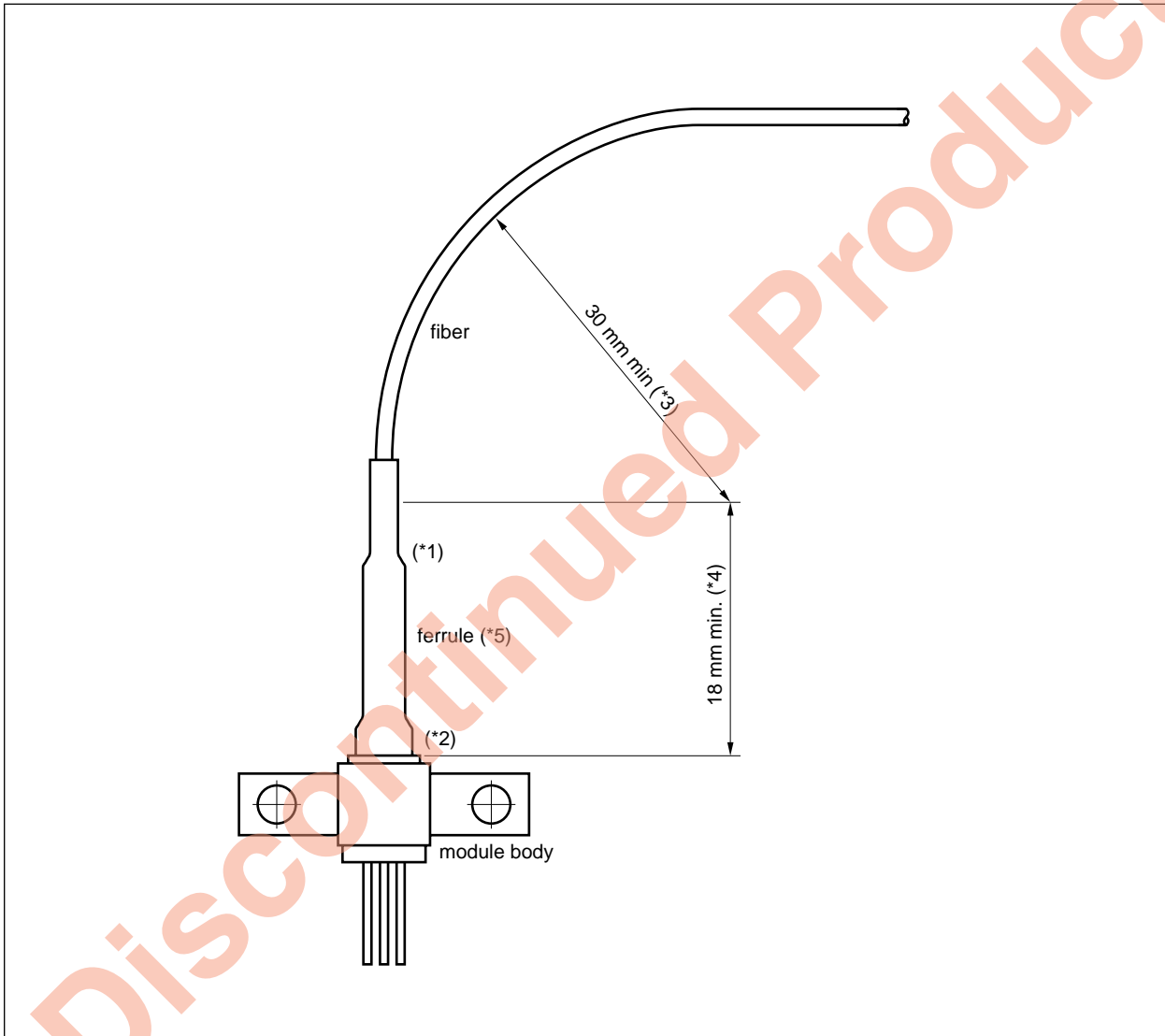


Discontinued Product

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
	$\phi 30 \mu\text{m}$ (for 2.5 Gb/s)	$\phi 50 \mu\text{m}$ (for 2.5 Gb/s)	$\phi 50 \mu\text{m}$	$\phi 80 \mu\text{m}$	$\phi 50 \mu\text{m}$ (for 2.5 Gb/s)	$\phi 80 \mu\text{m}$	
TO-18 type Can	NDL5530	_____	NDL5500	NDL5510	_____	_____	3 pins
TO-18 type Can with Micro Lens	_____	_____	_____	_____	NDL5490L ^{*3,4}	NDL5405L	3 pins
Small Can $\phi 5.6 \mu\text{m}$	NDL5531	_____	_____	_____	NDL5490 ^{*3,4}	_____	
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	_____	NDL5553PS ^{*1} NDL5553P1S ^{*1} NDL5553P2S ^{*1}	_____	_____	NDL5481P ^{*5} NDL5481P1 ^{*5} NDL5481P2 ^{*5}	
14-pin DIP Module with TEC	_____	_____	NDL5506P NDL5506PS	_____	_____	_____	$\Delta T = 45 \text{ K}$ (@ $I_c = 1.1 \text{ A}$) 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 1Gb/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

Discontinued Product

[MEMO]

Discontinued Product

[MEMO]

Discontinued Product

[MEMO]

Discontinued Product

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.

The export of this product from Japan is prohibited without governmental license. To export or re-export this product from a country other than Japan may also be prohibited without a license from that country. Please call an NEC sales representative.

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.

While NEC Corporation has been making continuous effort to enhance the reliability of its semiconductor devices, the possibility of defects cannot be eliminated entirely. To minimize risks of damage or injury to persons or property arising from a defect in an NEC semiconductor device, customers must incorporate sufficient safety measures in its design, such as redundancy, fire-containment, and anti-failure features.

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.