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)

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PHOTO DIODE
NDL5530

1 000 to 1 600 nm OPTICAL FIBER COMMUNICATIONS
ϕ30 μm InGaAs AVALANCHE PHOTO DIODE

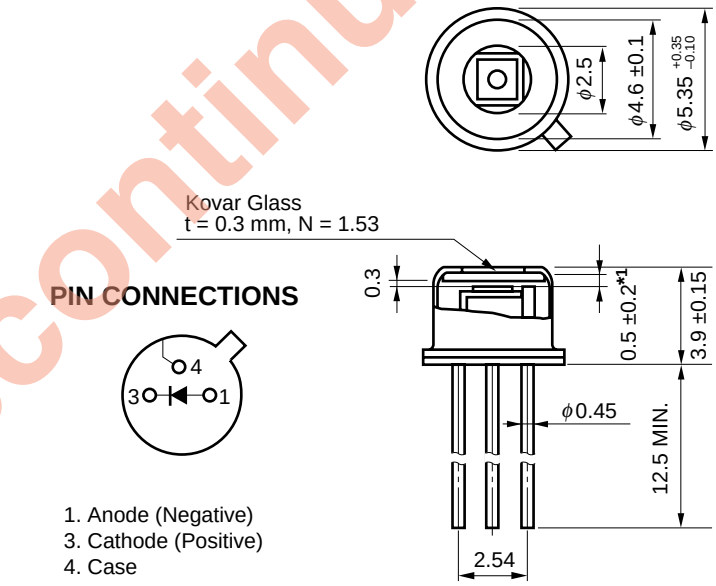
DESCRIPTION

NDL5530 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 efficiency.

FEATURES

- Small dark current — I_D = 5 nA
- High quantum efficiency — η = 90 % @ λ = 1 300 nm, M = 1
  η = 77 % @ λ = 1 550 nm, M = 1
- Cut-off frequency — f_C = 2.5 GHz MIN. @ M = 10
- Detecting area size — ϕ30 μm

PACKAGE DIMENSIONS
in millimeters



PIN CONNECTIONS

1. Anode (Negative)
3. Cathode (Positive)
4. Case

1 Optical length

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

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Printed in Japan

The mark ★ shows major revised points.

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

Parameter	Symbol	Ratings	Unit
Forward Current	I_F	10	mA
Reverse Current	I_R	0.5	mA
Operating Case Temperature	T_C	–40 to +85	°C
Storage Temperature	T_{stg}	–55 to +100	°C

ELECTRO-OPTICAL CHARACTERISTICS (T_C = 25 °C, unless otherwise specified)

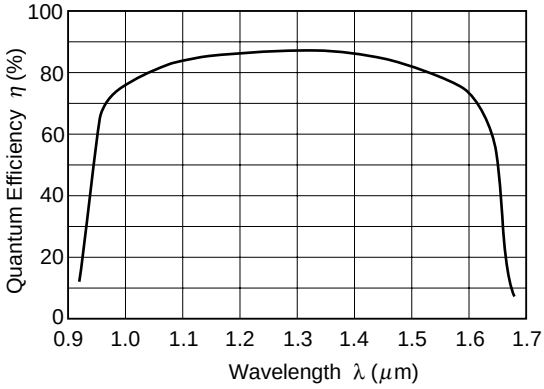
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Reverse Breakdown Voltage	$V_{(BR)R}$	I_D = 100 μA	50	70	100	V
Temperature Coefficient of Reverse Breakdown Voltage	δ *1	T_C = –40 to +85 °C		0.2		%/°C
Dark Current	I_D	$V_R = V_{(BR)R} \times 0.9$		5	25	nA
Multiplied Dark Current	I_{DM}	M = 2 to 10		1	5	nA
Terminal Capacitance	C_t	$V_R = V_{(BR)R} \times 0.9$, f = 1 MHz		0.35	0.60	pF
Cut-off Frequency	f_C	M = 5	2.5			GHz
		M = 10	2.5			
		M = 30	1.0	1.7		
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 = 1 550 nm, I_{po} = 1.0 μA, V_R = V (@ I_D = 1 μA)	30	40		
Excess Noise Factor *2	x	λ = 1 300 nm, 1 550 nm, I_{po} = 1.0 μA		0.7		
	F	M = 10, f = 35 MHz, B = 1 MHz		5		
Effective Detecting Area Size	ϕE	M = 10, 80 % of Peak	20		30	μm

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

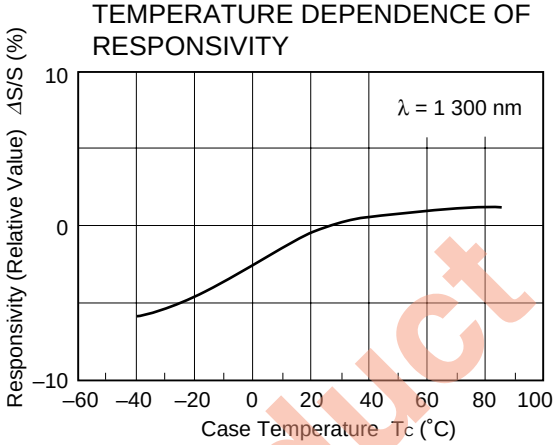
*2 $F = M^x$

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

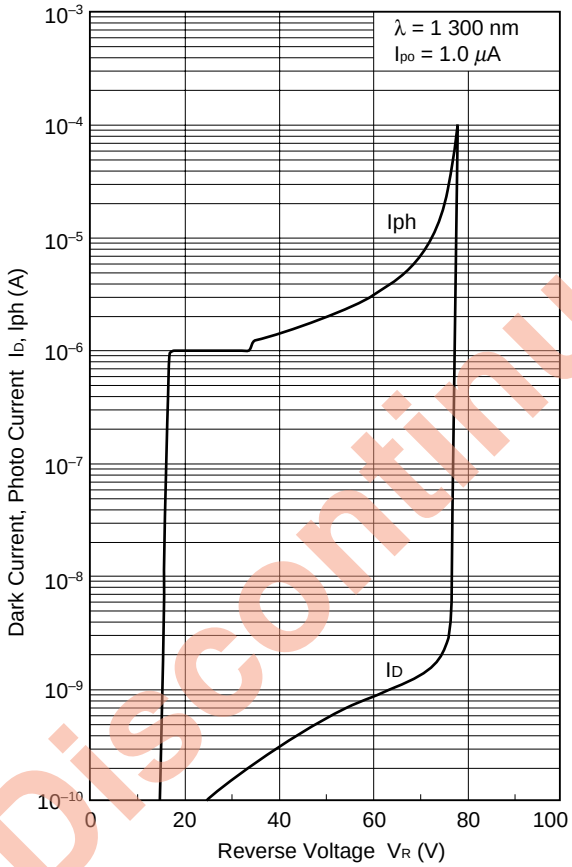
WAVELENGTH DEPENDENCE OF QUANTUM EFFICIENCY



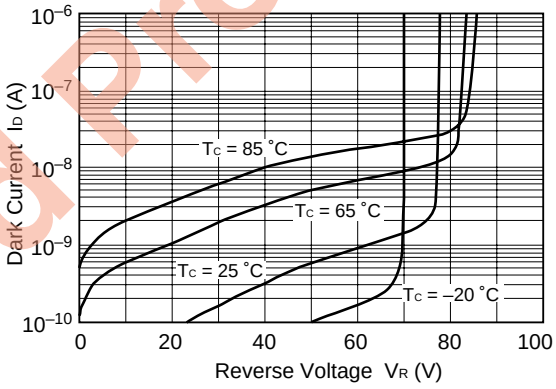
TEMPERATURE DEPENDENCE OF RESPONSIVITY



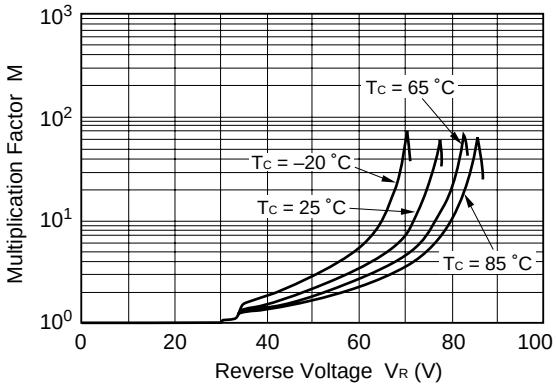
DARK CURRENT and PHOTO CURRENT vs. REVERSE VOLTAGE



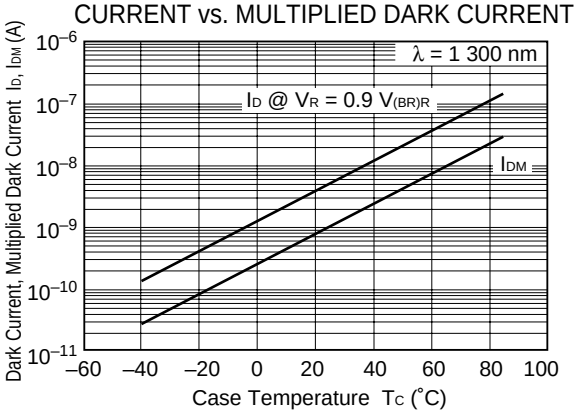
DARK CURRENT vs. REVERSE VOLTAGE



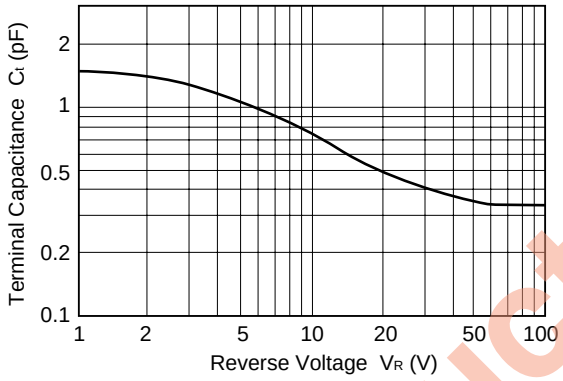
MULTIPLICATION FACTOR vs. REVERSE VOLTAGE



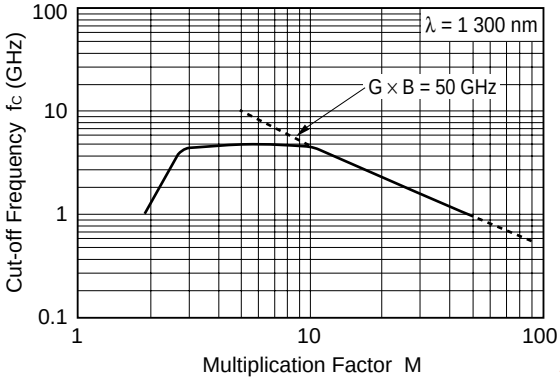
TEMPERATURE DEPENDENCE OF DARK CURRENT vs. MULTIPLIED DARK CURRENT



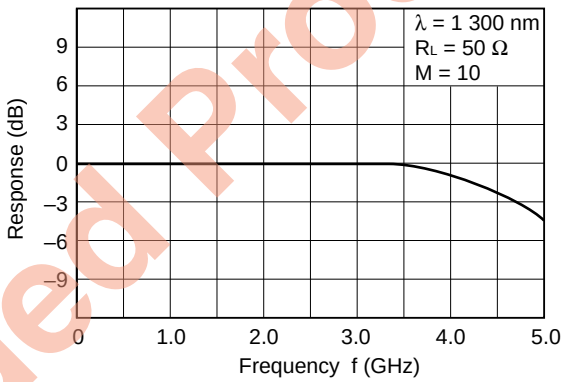
TERMINAL CAPACITANCE vs. REVERSE VOLTAGE



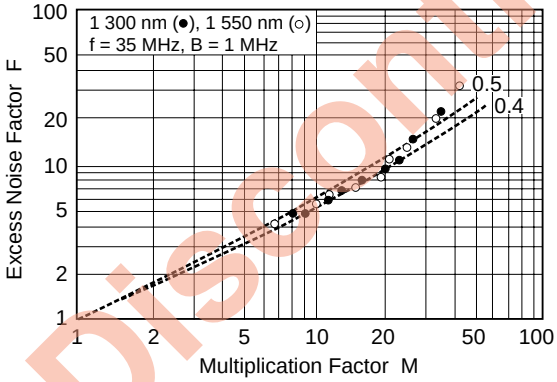
CUT-OFF FREQUENCY vs. MULTIPLICATION FACTOR



FREQUENCY RESPONSE



EXCESS NOISE FACTOR vs. MULTIPLICATION FACTOR



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*3, 4	NDL5405L	3 pins
Small Can ϕ 5.6 μm	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	—	—	—	ΔT = 45 K (@ Ic = 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

[MEMO]

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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M4 96.5