

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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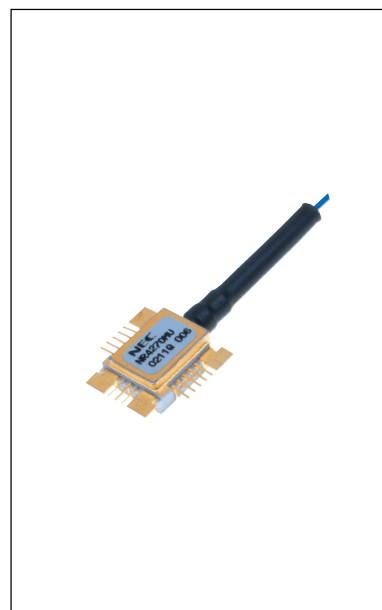
**SUPERLATTICE APD RECEIVER WITH SINGLE MODE FIBER
INTERNAL PREAMPLIFIER FOR 10 Gb/s APPLICATIONS**

DESCRIPTION

The NR4270MU-CC is a 10 Gb/s superlattice avalanche photo diode (APD) receiver in a 17-pin mini-butterfly package with an internal preamplifier. This module is ideal as a receiver for SONET OC-192 and Synchronous Digital Hierarchy (SDH) system, STM-64, ITU-T recommendations.

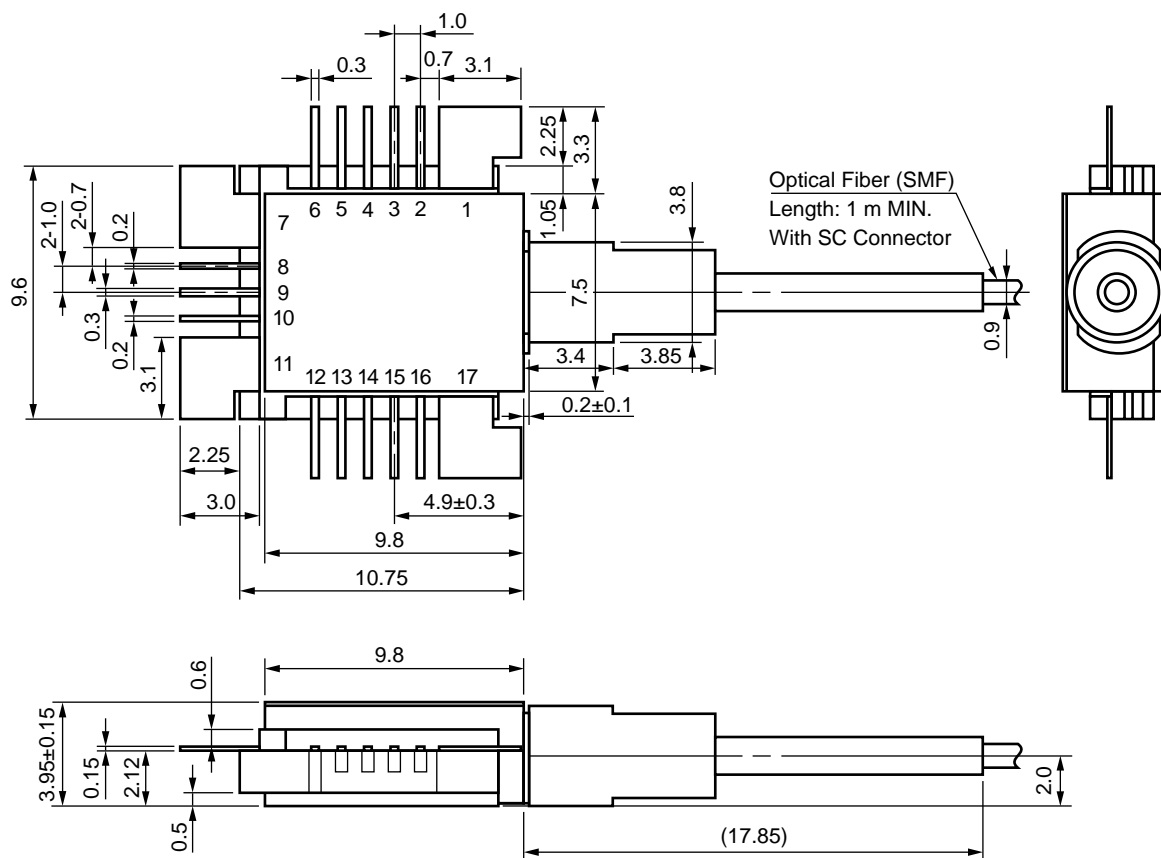
FEATURES

- Superlattice avalanche photo diode
- Internal GaAs transimpedance preamplifier
- Receiver for 10 Gb/s transmission (STM-64, OC-192)
- Minimum receiver sensitivity $P_r = -24$ dBm MAX.
- ★ • Transimpedance $Z_t = 60$ dB Ω MIN.
- 17-pin mini-butterfly package with single mode fiber
- AC coupled-differential output
- With SC-UPC connector



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PACKAGE DIMENSIONS (UNIT: mm, unless otherwise specified: ± 0.2 mm)

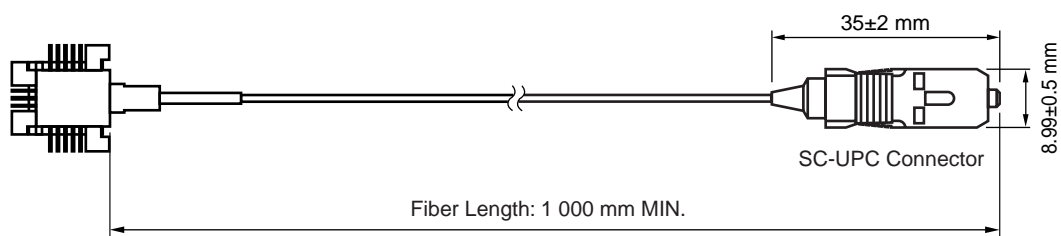


PIN CONNECTIONS

| Pin No. | Symbol | Function | Pin No. | Symbol | Function | Pin No. | Symbol | Function |
|---------|------------------|-----------------------|---------|--------|---------------------|---------|-----------------|----------------|
| 1 | GND | Ground (0.0 V) | 7 | GND | Ground (0.0 V) | 13 | NC | NC |
| 2 | V _{apd} | APD Cathode | 8 | OUT | Output (Invert) | 14 | NC | NC |
| 3 | NC | NC | 9 | GND | Ground (0.0 V) | 15 | T _{hm} | Thermistor |
| 4 | V _{ss} | Power Supply (-5.2 V) | 10 | OUT | Output (Non Invert) | 16 | T _{hm} | Thermistor |
| 5 | NC | NC | 11 | GND | Ground (0.0 V) | 17 | GND | Ground (0.0 V) |
| 6 | GND | Ground (0.0 V) | 12 | GND | Ground (0.0 V) | | | |

OPTICAL FIBER CHARACTERISTICS

| Parameter | Specification | Unit |
|-------------------------------------|----------------|------|
| Mode Field Diameter | 9.5±1 | μm |
| Cladding Diameter | 125±2 | μm |
| Maximum Cladding Noncircularity | 2 | % |
| Maximum Core/Cladding Concentricity | 1.6 | % |
| Outer Diameter | 0.9±0.1 | mm |
| Cut-off Wavelength | 1 100 to 1 270 | nm |
| Minimum Fiber Bending Radius | 30 | mm |
| Fiber Length | 1 000 MIN. | mm |
| Flammability | UL1581 VW-1 | |



ORDERING INFORMATION

| Part Number | Available Connector |
|-------------|-----------------------|
| NR4270MU-CC | With SC-UPC Connector |

ABSOLUTE MAXIMUM RATINGS

| Parameter | Symbol | Ratings | Unit |
|------------------------------|-------------------|-----------------|------|
| APD Forward Current | I _F | 5 | mA |
| APD Reverse Voltage | V _R | V _{BR} | V |
| APD Reverse Current | I _R | 1.0 | mA |
| IC Supply Voltage | V _{SS} | −6 to 0 | V |
| Operating Case Temperature | T _C | 0 to +70 | °C |
| Storage Temperature | T _{stg} | −40 to +85 | °C |
| ★ Lead Soldering Temperature | T _{slid} | 350 (3 sec.) | °C |

★ ELECTRO-OPTICAL CHARACTERISTICS

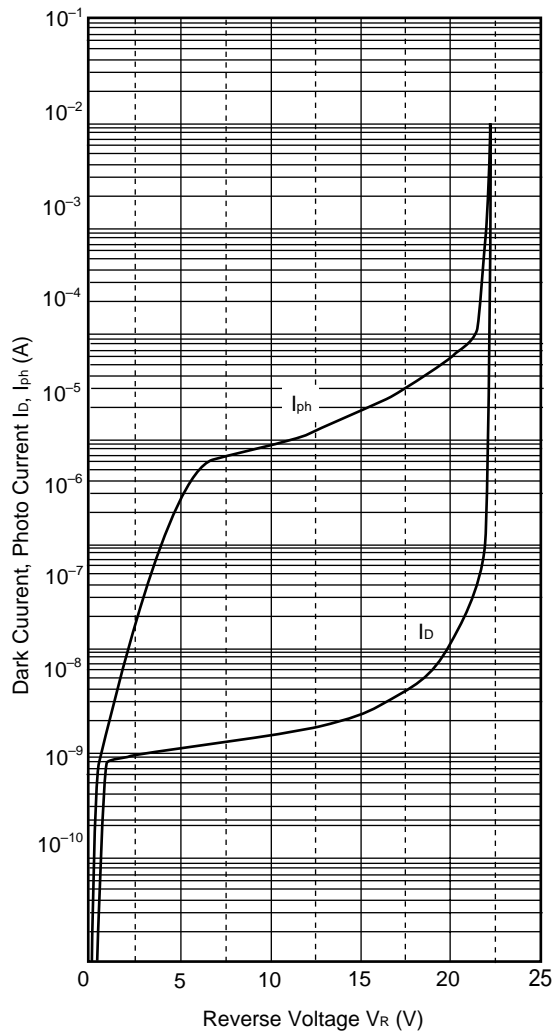
(Unless otherwise specified, T_C = 25°C, V_{SS} = −5.2 V, λ = 1 550 nm)

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|--|-----------------|--|------|------|------|-------|
| Reverse Breakdown Voltage | V _{BR} | I _D = 10 μA | 16 | | 32 | V |
| Temperature Coefficient of Reverse Breakdown Voltage | δ ^{*1} | T _C = 0 to +70°C | 5 | | 40 | mV/°C |
| Dark Current | I _D | V _R = V _{BR} × 0.9 | | | 1.2 | μA |
| Sensitivity | S | M = 1 | 0.63 | | | A/W |
| Minimum Receiver Sensitivity | P _r | PRBS = 2 ³¹ −1, 10 Gb/s, NRZ, BER = 10 ^{−12} | | −25 | −24 | dBm |
| Overload | P _O | M = 3 | −8 | −7 | | dBm |
| Cut-off Frequency | f _C | R _L = 50 Ω, M = 9, P _{in} = −20 dBm | 7.0 | 8.0 | | GHz |
| RF Output Return Loss | S ₂₂ | to 6 GHz | | | 10 | dB |
| | | 6 to 8 GHz | | | 8 | |
| Transimpedance | Z _i | R _L = 50 Ω | 60 | | | dBΩ |
| IC Power Dissipation | P _D | | | 500 | 600 | mW |
| Optical Return Loss | ORL | | | | 27 | dB |
| Thermistor Resistance | R | | 9.5 | 10 | 10.5 | KΩ |

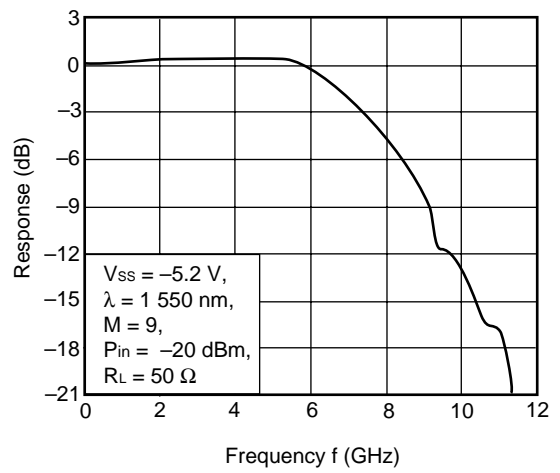
$$*1 \delta = \frac{\Delta V_{BR}}{\Delta T_C}$$

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

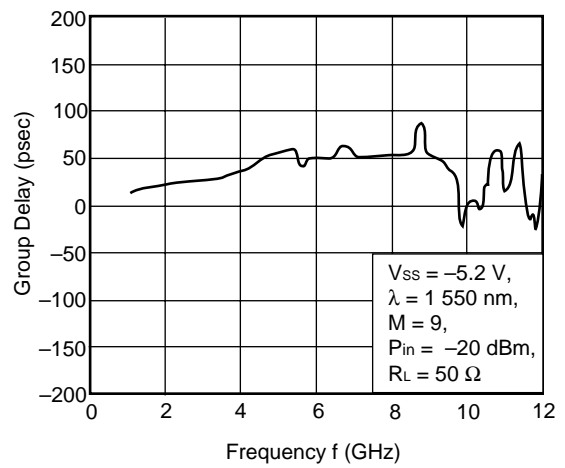
DARK CURRENT AND PHOTO CURRENT vs. REVERSE VOLTAGE



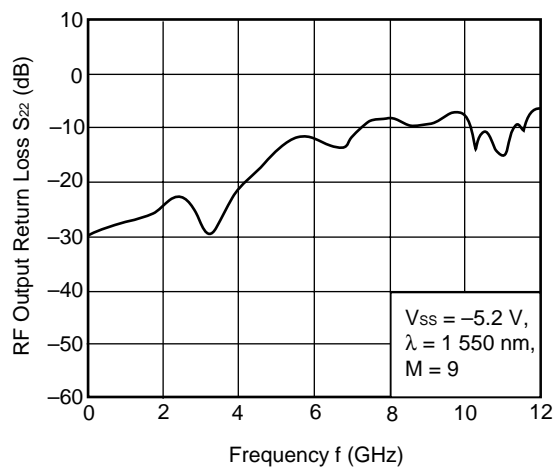
FREQUENCY RESPONSE



GROUP DELAY vs. FREQUENCY

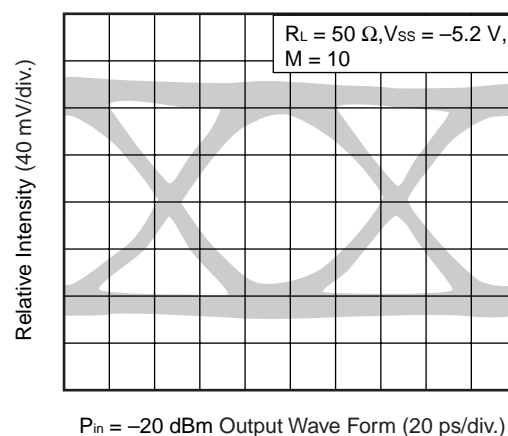
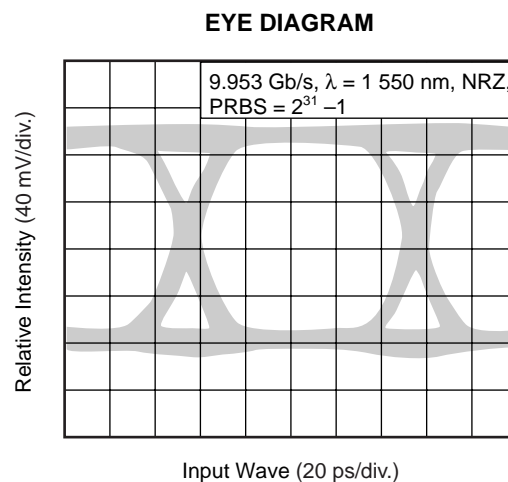
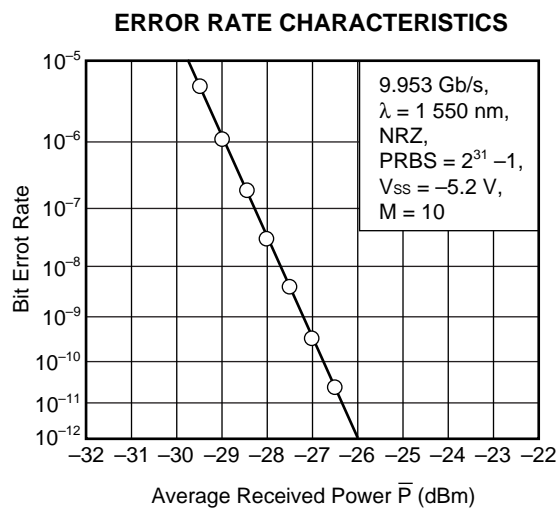


RF OUTPUT RETURN LOSS vs. FREQUENCY



Remark The graphs indicate nominal characteristics.

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



Remark The graphs indicate nominal characteristics.

★ InGaAs APD/PD FAMILY

| Part Number | Absolute Maximum Ratings | | Electro-Optical Characteristics (T _C = 25°C) | | | | | | Applications | Package |
|----------------------------|--------------------------|--------------------------|---|------------------------|-------------------------|--------------------|----------------|-----------------------|--------------------------------|--|
| | T _C (°C) | T _{stg} (°C) | Delect- ing Area Size (μ m) | I _D (nA) | f _C (GHz) | S (A/W) | | V _R (V) | | |
| | | | | TYP. | MIN. | TYP. | @λ | | | |
| | | | | | | | (nm) | | | |
| NR3470MU-CC | 0 to +75 | −40 to +85 | φ40 | 5 | 7.5 | 1.00 | 1 550 | 5 | 10 Gb/s: STM-64 | 17-pin mini- butterfly PD with an Internal pre- amp |
| NR4270MU-CC | 0 to +70 | −40 to +85 | φ20 | 1.2 μA ^{*1} | 7.0 | 0.63 ^{*3} | 1 550 | 0.9V _{BR} | 10 Gb/s: STM-64 | 17-pin mini- butterfly APD with an Internal pre-amp |
| NR4500BP-CC NR4500CP-CC | 0 to +85 | −40 to +85 | φ50 | — | 2.5 ^{*2} | 0.94 0.96 | 1 310 1 550 | 0.9V _{BR} | 2.5 Gb/s: STM-16 | Coaxial APD with an Internal pre-amp |
| NR7500 Series | −40 to +85 | −40 to +85 | φ50 | 0.1 | 2.5 | 0.89 0.94 | 1 310 1 550 | 5 | 2.5 Gb/s: STM-16 | Coaxial PD |
| NR7800 Series | −40 to +85 | −40 to +85 | φ80 | 0.1 | 2.5 | 0.89 0.94 | 1 310 1 550 | 5 | ≤ 622 Mb/s: STM-4, STM-1 | Coaxial PD |
| NR8500 Series | −40 to +85 | −40 to +85 | φ50 | 7 | 1 | 0.94 0.96 | 1 310 1 550 | 0.9V _{BR} | ≤ 622 Mb/s: STM-4, STM-1 | Coaxial APD |
| NR8501 Series | −40 to +85 | −40 to +85 | φ50 | 7 | 2.5 | 0.94 0.96 | 1 310 1 550 | 0.9V _{BR} | 2.5 Gb/s: STM-16 | Coaxial APD |

*1 MAX.

*2 \overline{P}_{Low} and \overline{P}_{High} are specified at 2.5 Gb/s

*3 MIN.

REFERENCE

| | Document Name | Document No. |
|---|---|--------------|
| ★ | Optical semiconductor devices for fiberoptic communications Selection Guide | PX10161E |
| ★ | Opto-Electronics Devices Pamphlet | PX10160E |
| | NEC semiconductor device reliability/quality control system ^{*1} | C11159E |
| | Quality grades on NEC semiconductor devices ^{*1} | C11531E |
| | SEMICONDUCTOR SELECTION GUIDE –Products and Packages– ^{*1} | X13769E |

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M8E 00.4-0110

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| | |
|----------------------------------|---|
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| <div>Caution</div> Optical Fiber | <p>A glass-fiber is attached on the product. Handle with care.</p> <ul style="list-style-type: none"> • When the fiber is broken or damaged, handle carefully to avoid injury from the damaged part or fragments. |

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