

RCA Electro Optics

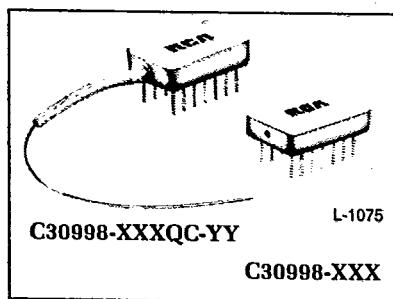
Silicon Avalanche Photodiodes

C30998 Series

DATA SHEET

T-41-67

For Detection of 400 to 1000 nm Radiation Transimpedance Preamplifier Modules With or Without Integral Fiber Optic Pigtails



The RCA C30998 Series are Silicon avalanche photodiodes with hybrid preamplifiers supplied in hermetically-sealed 14-pin dual in-line packages.

They are avail-

able with glass windows which provide optical access to the photodiode or with integral fiber optic pigtails.

The avalanche photodiode (C30902) used in these devices utilizes a silicon detector chip fabricated with a double-diffused "reach-through" structure. This structure provides high responsivity between 400 and 1000 nanometers as well as extremely fast rise and fall-times at all wavelengths.

The preamplifier is a transimpedance type employing a low noise GaAs FET front-end and a cascode feedback circuit. An emitter follower-stage is added to the output to provide improved output coupling efficiency and isolation.

Modules are available having bandwidths ranging from 10 MHz to 250 MHz; they are designated C30998-XXX. The suffix -XXX denotes module bandwidth in MHz and the performance associated with this bandwidth can be derived from Figures 2 through 5. Modules with integral fiber optic pigtails are designated C30998-XXXQC-YY. The suffix -YY denotes the fiber type (see Mechanical Characteristics). When ordering, the customer should specify the required bandwidth and preferred fiber. For example, C30998-090QC-01 is a device with a bandwidth of 90 MHz and a Corning 3008D 50 μ m graded index fiber.

To obtain wideband characteristics, the output of these devices should be AC (Capacitively) coupled to terminations equal to or greater than 500 ohms. Devices for 50 ohm termination are also available.

- **System Bandwidth (3 dB point)**
10 MHz (C30998-010) to
250 MHz (C30998-250)
- **Responsivity at $T_A = 22^\circ \text{C}$**
 $8.5 \times 10^6 \text{ V/W}$ (C30998-010) to
 $3.3 \times 10^5 \text{ V/W}$ (C30998-250)
- **Spectral Response Range**
400 to 1000 nm
- **Sensitivity at 10^{-9} B.E.R.**
-60 dBm (C30998-010) to
-46 dBm (C30998-250)
- **System Noise Equivalent Power (NEP)**
at $T_A = 22^\circ \text{C}$
 $0.012 \times 10^{-12} \text{ W/Hz}^{1/2}$ (C30998-010) to
 $0.090 \times 10^{-12} \text{ W/Hz}^{1/2}$ (C30998-250)
- **Hermetically-Sealed 14-Pin Dual In-Line Packages**

Absolute-Maximum Ratings, Limiting Values¹

Photodiode Reverse Current at 22°C :		
Average value, continuous operation.....	200	μA
Peak value (for 1 second duration, non-repetitive).....	1	mA
Preamplifier Voltage:		
Positive, + V_{CC}	+6.3	V
Negative, - V_{CC}	-6.3	V
Ambient Temperature —		
Storage, T_{stg}	-50 to + 100	$^\circ\text{C}$
Operating, T_A	-40 to +70	$^\circ\text{C}$

¹ These are limiting values of operating and environmental conditions. Exceeding these values can cause damage to the device.

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Mechanical Characteristics

Type (Series)	Diode Chip (Dia.)	Fiber Type	Fiber Optic Core Dia.
C30998-XXX	500 μ m	—	—
C30998-XXXQC-01	—	Corning 3008D ²	50 μ m
C30998-XXXQC-02 ⁴	—	Corning 0000105- 005004 ²	50 μ m
C30998-XXXQC-04 ⁴	—	Spectran 300 ³	63 μ m
C30998-XXXQC-00	—	Customer supplied	—

² A product of Corning Glass Works, Corning, NY 14831.

³ A product of Spectran Corp., Sturbridge, MA 01566.

⁴ QC-02 and QC-04 are "Hytrel" coated. QC-04 has oversize core to reduce connector losses.

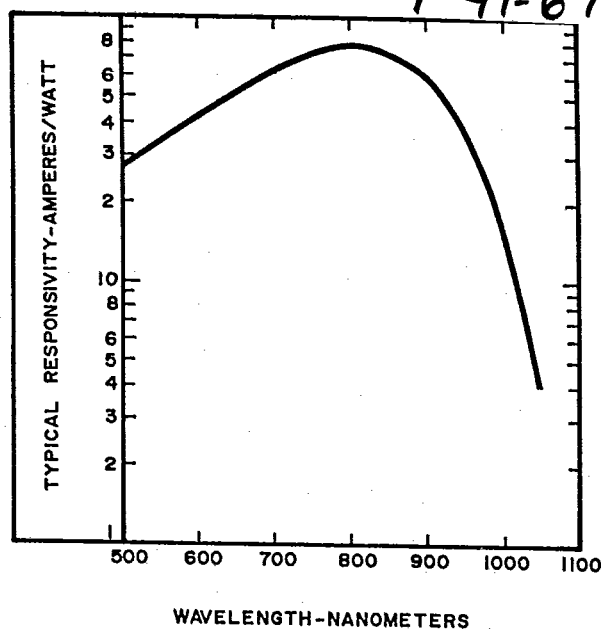


Fig. 1 Typical Spectral Responsivity at 22°C

VC-124

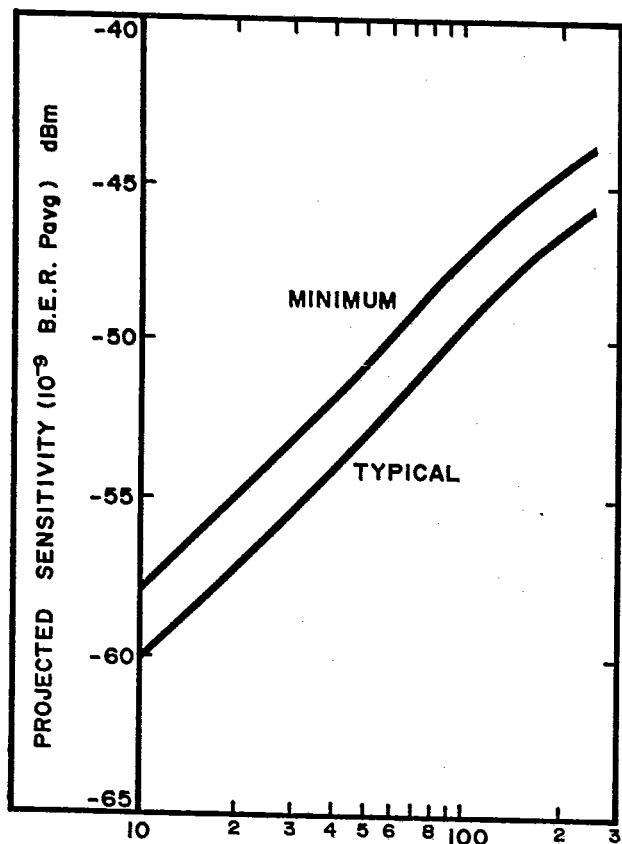
Electrical Characteristics

At an ambient temperature (T_A) of 22°C, negative photodiode bias V_R (a specific value of operating voltage is supplied with each device), preamplifier operating voltage of +5.2 VDC and -5.2 VDC, and the signal output AC (capacitively) coupled into a 500 ohm termination.

Performance of 10, 50, 90, and 250 MHz devices are tabulated. These devices are also available at other bandwidths on request; refer to Figure 2 through 5 for performance of specific types at 22°C, and 820 nm.

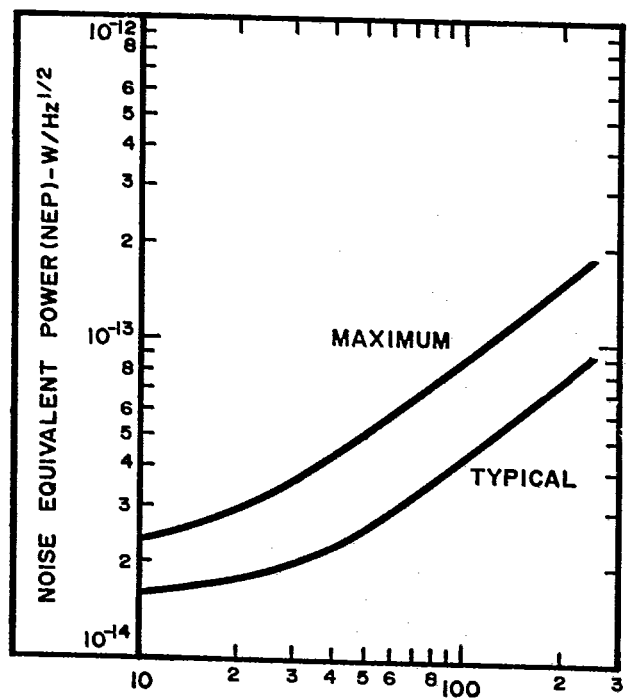
	C30998-010 C30998-010QC-YY			C30998-050 C30998-050QC-YY			C30998-090 C30998-090QC-YY			C30998-250 C30998-250QC-YY			Units
	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
Responsivity													
At 820 nm.....	6.6x10 ⁶	8.5x10 ⁶	—	1.5x10 ⁶	1.9x10 ⁶	—	7.5x10 ⁵	1x10 ⁶	—	2.7x10 ⁵	3.3x10 ⁵	—	V/W
At 900 nm.....	5.3x10 ⁶	6.8x10 ⁶	—	1.2x10 ⁶	1.5x10 ⁶	—	6x10 ⁵	8x10 ⁵	—	2.1x10 ⁵	2.6x10 ⁵	—	V/W
Noise Equivalent Power (NEP): 100 kHz <f<f ₀													
At 820 nm.....	—	0.012	0.023	—	0.025	0.050	—	0.040	0.080	—	0.090	0.170	pW/Hz ^{1/2}
At 900 nm.....	—	0.015	0.028	—	0.035	0.065	—	0.050	0.100	—	0.120	0.210	pW/Hz ^{1/2}
Output Spectral Noise Voltage Density:													
100 kHz <f<f ₀	—	100	150	—	50	75	—	40	60	—	30	45	nV/Hz ^{1/2}
Output Impedance.....	—	20	40	—	20	40	—	20	40	—	20	40	Ω
Bandwidth, f ₀ (3 dB point).....	7	10	—	40	50	—	70	90	—	200	250	—	MHz
Rise Time, t _r : $\lambda = 820$ nm & 900 nm 10% to 90% points.....	—	35	50	—	7	9	—	4	5	—	1.5	2	ns
Fall Time, t _f : $\lambda = 820$ nm & 900 nm 90% to 10% points.....	—	35	50	—	7	9	—	4	5	—	1.5	2	ns
Dynamic Range.....	21	24	—	21	24	—	21	24	—	21	24	—	dB
Output Offset Voltage.....	-0.7	-1.5	-3.0	-0.7	-1.5	-3.0	-0.7	-1.5	-3.0	-0.7	-1.5	-3.0	V
Supply Current:													
+5.2V.....	—	25	35	—	25	35	—	25	35	—	25	35	mA
-5.2V.....	—	8	15	—	8	15	—	8	15	—	8	15	mA
Projected Sensitivity @ 10 ⁻⁹ B.E.R. [NRZ, avg. power, Data Rate = 1.4x Bandwidth] at 820 nm.....	-58	-60	—	-51	-53	—	-48	-50	—	-44	-46	—	dBm

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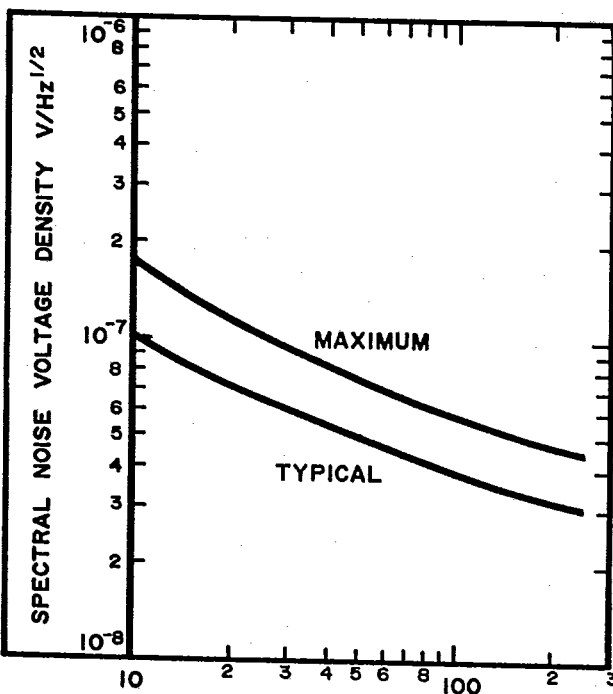
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Fig. 2 Bandwidth vs Projected Sensitivity



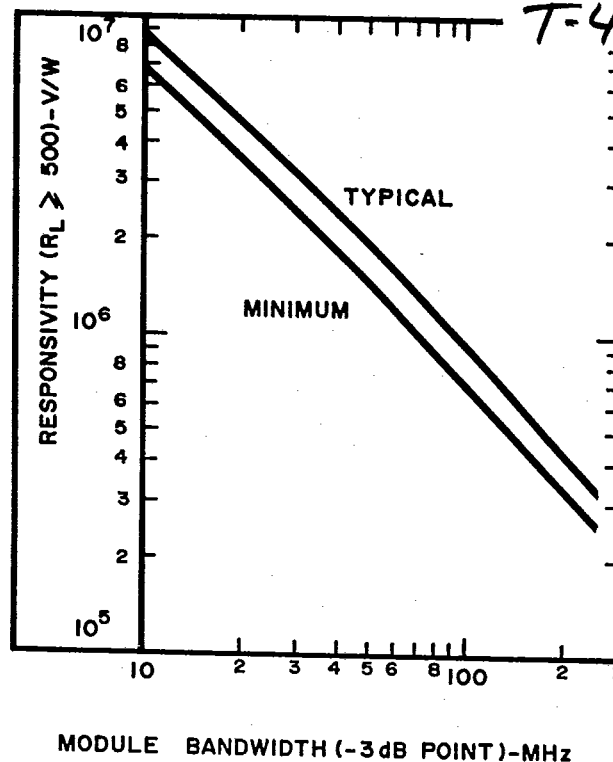
VC-125

Fig. 3 Bandwidth vs NEP



VC-128

Fig. 5 Bandwidth vs Noise Density



VC-127

Fig. 4 Bandwidth vs Responsivity

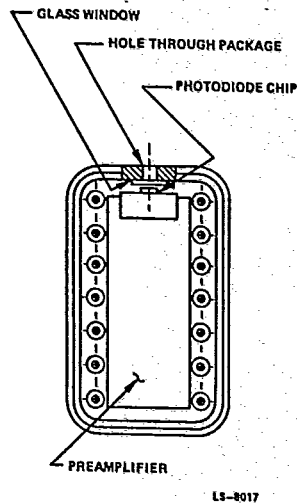


Fig. 6 Package With Cover Removed

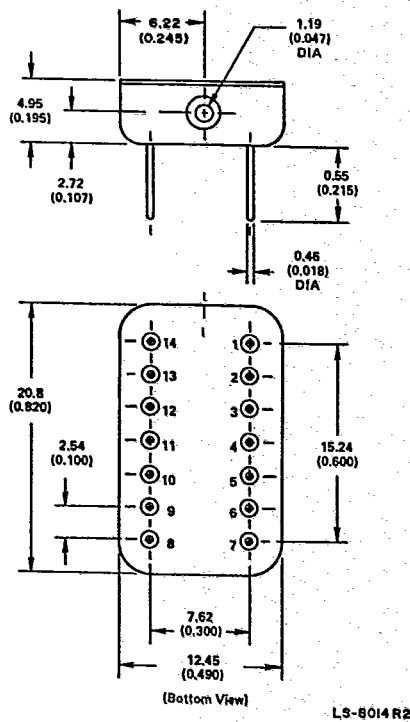


Fig. 7 Dimensional Outline C30998-XXX

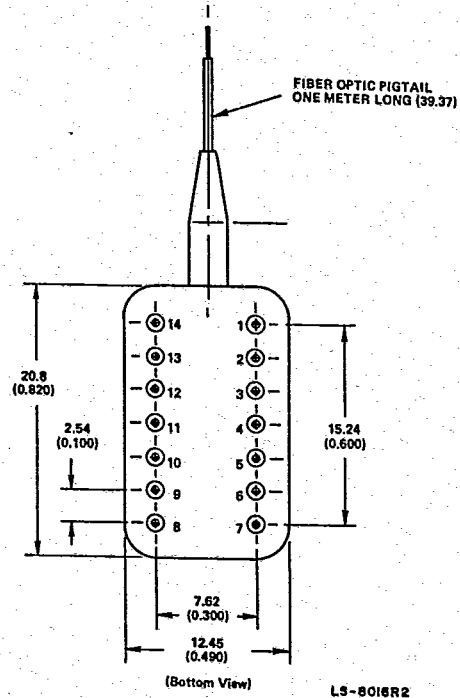
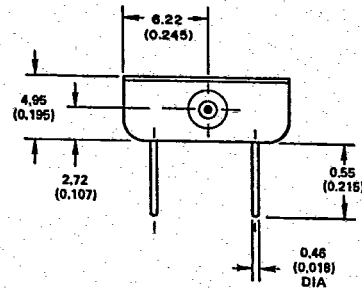


Fig. 8 Dimensional Outline - C30998-XXXQC-YY

- 1: Negative Bias for Photodiode
- 2, 6, 9, 11, 12, 13, 14: No Connection, Do Not Use
- 3, 5, 8: Ground (Case and Power Supply)
- 4: -Vcc Negative Bias for Amplifier
- 7: Signal Output
- 10: +Vcc Positive Bias for Amplifier

Fig. 9 Pin Connections - All Types

Dimensions in millimeters. Dimensions in parentheses are in inches.

For further information, please contact your local RCA Electro Optics representative or RCA Inc., Electro Optics, P.O. Box 900, Vaudreuil, Canada J7V 7X3
Tel.: (514) 455-6191

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