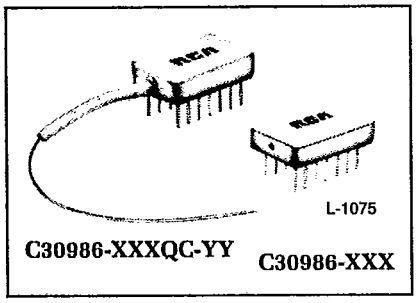
RCA Electro Optics

InGaAs Photodiodes C30986 Series

DATA SHEET

T-41-67

For Detection of 1000 to 1700 nm Radiation Transimpedance Preamplifier Modules With or Without Integral Fiber Optic Pigtails



The RCA C30986 Series are Indium Gallium Arsenide (p-i-n) photodiodes with hybrid preamplifiers supplied in hermetically-sealed 14-pin dual in-line packages. They are available with silicon windows which provide optical access to the photodiode or with integral fiber optic pigtails.

The p-i-n photodiode C30617 used in these devices is a high-speed Indium Gallium Arsenide/Indium Phosphide photodiode providing high responsivity between 1000 and 1700 nm and is optimized for detection of 1300 and 1550 nm sources. The planar structure with passivation layer results in low leakage currents even at elevated operating temperature.

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 350 MHz; they are designated C30986-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 C30986-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, C30986-090QC-01 is a device with a bandwidth of 90 MHz and a Corning 3008D 50 µm 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.

- **System Bandwidth (3 dB Point)**
  10 MHz (C30986-010) to
  350 MHz (C30986-350)
- **Responsivity at T_A = 22° C**
  4×10^5 V/W (C30986-010) to
  4×10^3 V/W (C30986-350)
- **Spectral Response Range**
  1000 to 1700 nm
- **Sensitivity at 10^{-9} B.E.R.**
  -51 dBm (C30986-010) to
  -33 dBm (C30986-350)
- **System Noise Equivalent Power (NEP) at T_A = 22° C**
  4×10^{-13} W/Hz$^{1/2}$ (C30986-010) to
  4×10^{-12} W/Hz$^{1/2}$ (C30986-350)
- **Hermetically-Sealed 14-Pin Dual In-Line Packages**

Absolute-Maximum Ratings, Limiting Values[1]

Photodiode Bias Voltage, V_R:		
At T_A = 22° C	-30	V
Preamplifier Voltage:		
Positive, + Vcc	+6.3	V
Negative, - Vcc	-6.3	V
Incident Radiant Flux, Φ_M (T_A = 22° C)		
Average value	0.6	mW
Peak value (1 sec. duration, non-repetitive)	1.2	mW
Ambient Temperature —		
Storage, T_{stg}	-50 to + 100	°C
Operating, T_A	-40 to +70	°C

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

Mechanical Characteristics

Type (Series)	Diode Chip (Dia.)	Fiber Type	Fiber Optic Core Dia.
C30986-XXX	100 µm	—	—
C30986-XXXQC-01	—	Corning 3008D[2]	50 µm
C30986-XXXQC-02[4]	—	Corning 0000105-005004[2]	50 µm
C30986-XXXQC-04[4]	—	Spectran 300[3]	63 µm
C30986-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.

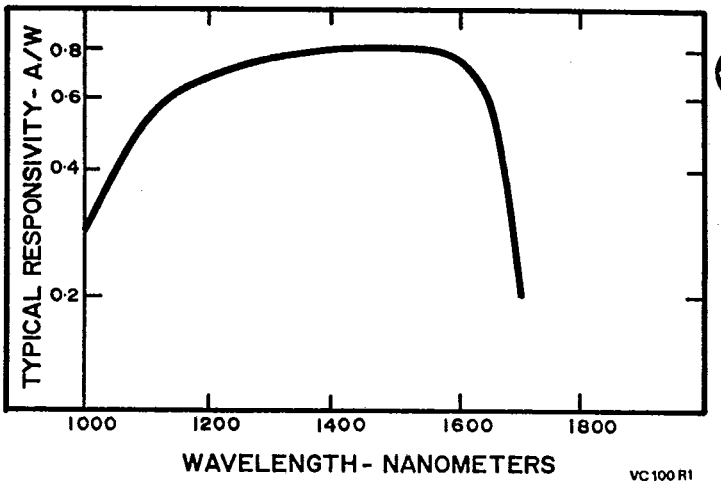


Fig. 1 Typical Spectral Responsivity Characteristic

Electrical Characteristics

At an ambient temperature (T_A) of 22°C, negative photodiode bias of -5.2 VDC, preamplifier operating voltages of +5.2 VDC and -5.2 VDC, and the signal output AC (capacitively) coupled into a 500 ohm termination.

Performance of 10, 30, 90, 250 and 350 MHz devices are tabulated. These devices are also available at other bandwidths on request; refer to **Figures 2** through **5** for performance of specific types at 22° C and 1.3 µm.

	C30986-010 C30986-010QC-YY			C30986-030 C30986-030QC-YY			C30986-090 C30986-090QC-YY			C30986-250 C30986-250QC-YY			C30986-350 C30986-350QC-YY			
	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Units
Responsivity:																
At 1.3 µm	3.5×10^5	4.3×10^5	–	1.8×10^5	2.0×10^5	–	4.5×10^4	5.0×10^4	–	5.5×10^3	7.0×10^3	–	3.3×10^3	4.1×10^3	–	V/W
At 1.55 µm	3.7×10^5	4.5×10^5	–	1.9×10^5	2.1×10^5	–	4.8×10^4	5.3×10^4	–	5.9×10^3	7.4×10^3	–	3.5×10^3	4.4×10^3	–	V/W
Noise Equivalent Power (NEP): 100 kHz <f<f_0																
At 1.3 µm	–	0.4	0.6	–	0.6	0.9	–	1.0	1.5	–	3.1	5.4	–	3.7	6.1	$pW/Hz^{1/2}$
At 1.55 µm	–	0.3	0.5	–	0.5	0.8	–	0.9	1.4	–	3.0	5.1	–	3.4	5.7	$pW/Hz^{1/2}$
Output Spectral Noise Voltage Density:																
100 kHz <f<f_0	–	150	200	–	120	160	–	50	70	–	22	30	–	15	20	$nV/Hz^{1/2}$
Output Impedance	–	20	40	–	20	40	–	20	40	–	20	40	–	20	40	Ω
Bandwidth, f_0 (3 dB point)	7	10	–	24	30	–	70	90	–	200	250	–	280	350	–	MHz
Rise Time, t_r: λ = 1.3 µm & 1.55 µm 10% to 90% points	–	35	50	–	12	15	–	4	5	–	1.5	2	–	1.0	1.3	ns
Fall Time, t_f: λ = 1.3 µm & 1.55 µm 90% to 10% points	–	35	50	–	12	15	–	4	5	–	1.5	2	–	1.0	1.3	ns
Dynamic Range	21	24	–	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	-0.7	-1.5	-3.0	V
Supply Current:																
+5.2V	–	25	35	–	25	35	–	25	35	–	25	35	–	25	35	mA
-5.2V	–	7	15	–	7	15	–	8	15	–	8	15	–	8	15	mA
Projected Sensitivity @ 10^{-9} B.E.R. [NRZ, avg. power, Data Rate = 1.4x Bandwidth] at 1.3 µm	-49	-51	–	-45	-47	–	-40	-42	–	-33	-35	–	-31	-33	–	dBm

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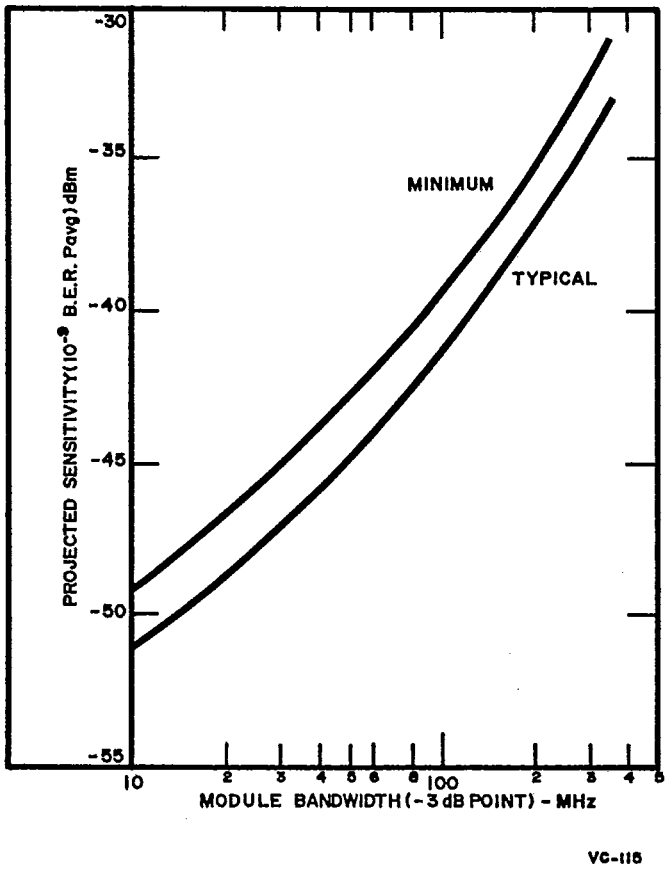

Fig. 2 Bandwidth vs Projected Sensitivity

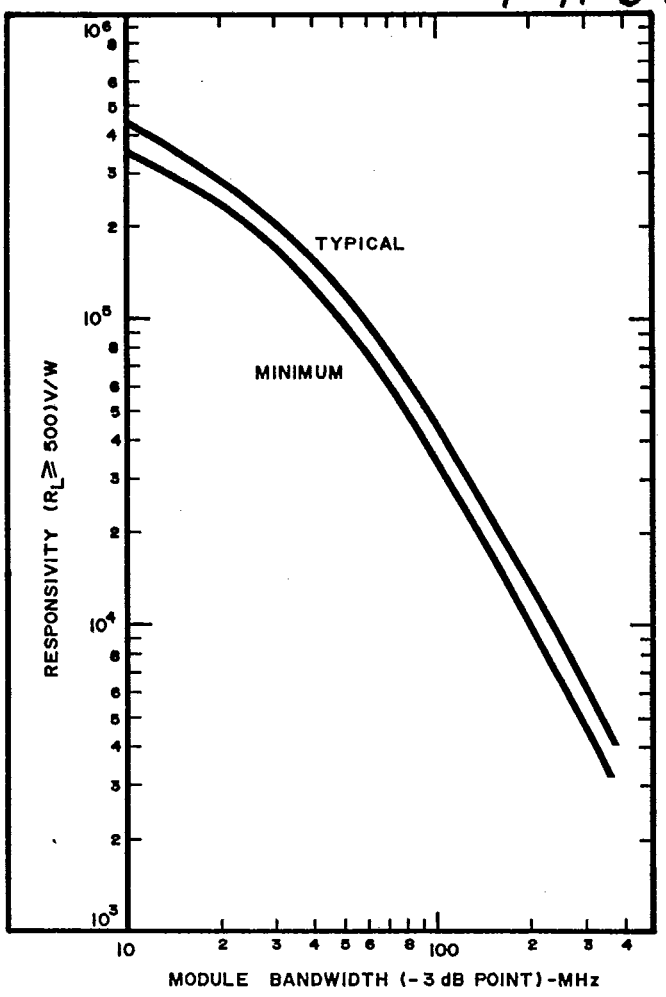

Fig. 4 Bandwidth vs Responsivity

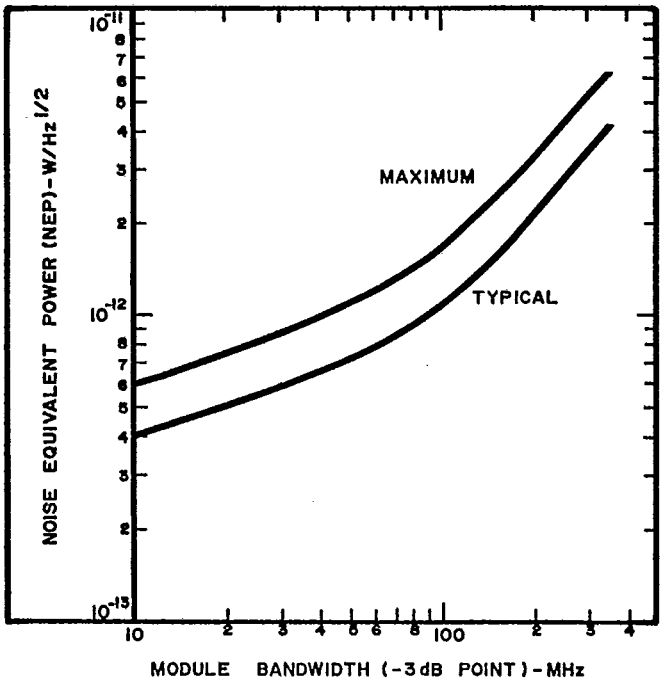

Fig. 3 Bandwidth vs NEP

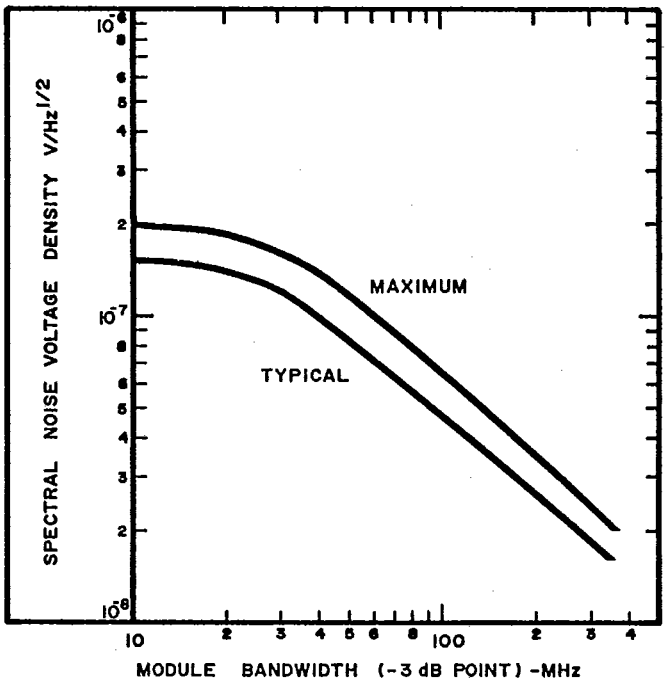

Fig. 5 Bandwidth vs Noise Density

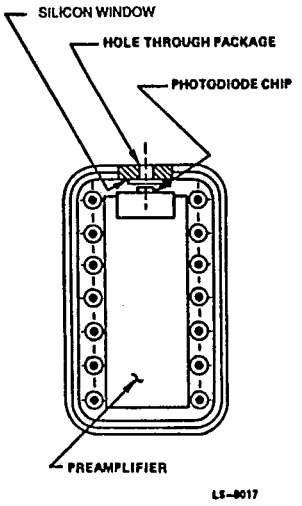

Fig. 6 Package With Cover Removed

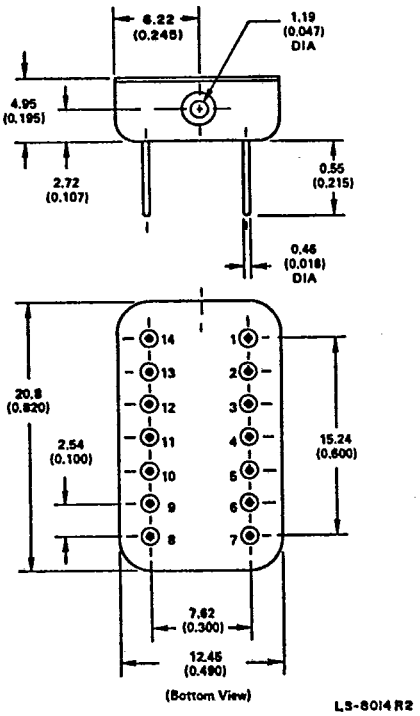

Fig. 7 Dimensional Outline C30986-XXX

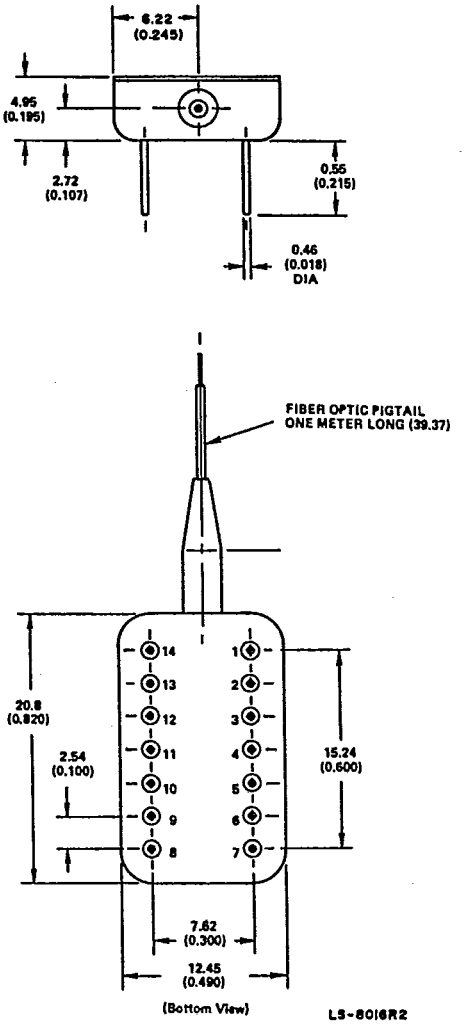

Fig. 8 Dimensional Outline - C30986-XXXQC-YY

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
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