

## Photodiodes

**Very Wide Bandpass Silicon Photodiode - Preamplifier Modules Available With Integral Light Pipes For Fiber Optic Applications**

- Responsivity at 830 nm, 25° C  
 $3.5 \times 10^3$  V/W (50 MHz)  
 $1.0 \times 10^3$  V/W (100 MHz)  
 $3.0 \times 10^2$  V/W (200 MHz)
- System Noise Equivalent Power (NEP) at 830 nm, 25° C  
 $4.3 \times 10^{-12}$  W/Hz<sup>1/2</sup> (50 MHz)  
 $1.5 \times 10^{-11}$  W/Hz<sup>1/2</sup> (100 MHz)  
 $5.0 \times 10^{-11}$  W/Hz<sup>1/2</sup> (200 MHz)
- Spectral Response Range (10% Points) - 400 to 1000 nm
- System Bandwidth (3 dB Point) - DC to 50 MHz, 100 MHz, 200 MHz
- Low Power Consumption
- Wide Range of Amplifier Operating Voltages
- Hermetically-Sealed Modified TO-8 Packages

### Description

RCA Developmental Types C30952E, C30952F, and C30952G are Silicon p-i-n Photodiodes with a hybrid preamplifier supplied in a single modified 12-lead To-8 package. RCA Developmental Types C30952EL, C30952FL, C30952GL are Silicon Photodiode - Preamplifier Modules with integral light pipes supplied in a single modified 12-lead TO-8 package.

The preamplifier section is designed to neutralize the input capacitance of a unity voltage gain amplifier. An emitter follower is used as an output buffer stage. To obtain the wideband characteristics, the output of these devices should be AC (capacitively) coupled to a 50-ohm termination. The module must not be DC coupled to loads of less than 10,000 ohms.

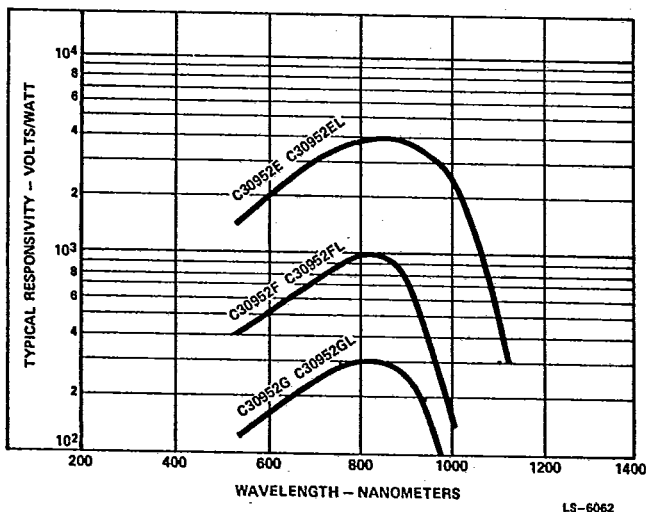


Figure 1 - Typical Spectral Responsivity Characteristics

For further information or application assistance on these devices, contact your RCA Sales Representative or Photodetector Marketing, RCA Ste Anne de Bellevue, Quebec, Canada H9X 3L3 (514) 457-9000.

### Characteristics

#### Maximum Ratings, Absolute-Maximum Values

Photodiode Bias Voltage			
(C30952E, EL):			
At T <sub>A</sub> = +70° C	100	max.	V
At T <sub>A</sub> = -40° C	100	max.	V
Photodiode Bias Voltage			
(C30952F, G, FL, GL):			
At T <sub>A</sub> = +70° C	200	max.	V
At T <sub>A</sub> = -40° C	200	max.	V
Photodiode Total Current			
(All Temp.)			
Average	100	max.	μA
Peak	100	max.	mA
Preamplifier Voltage	± 12.5 ± 5.5	max. min.	V V
Incident Radiant Flux, Φ <sub>M</sub> :			
Average value	50	max.	μW
Peak value	50	max.	mW
Ambient Temperature:			
Storage, T <sub>stg</sub>	-50 to +100		° C
Operating, T <sub>A</sub>	-40 to +70		° C

### Mechanical Characteristics

Type	Diode Chip	Dia.	Area	Light Pipe Core Dia.
C30952E	C30807	1.0 mm	0.8 mm <sup>2</sup>	-
C30952F	C30971E	0.5 mm	0.2 mm <sup>2</sup>	-
C30952G	C30971E	0.5 mm	0.2 mm <sup>2</sup>	-
C30952EL	C30807	1.0 mm	0.8 mm <sup>2</sup>	0.50 mm
C30952FL	C30971E	0.5 mm	0.2 mm <sup>2</sup>	0.25 mm
C30952GL	C30971E	0.5 mm	0.2 mm <sup>2</sup>	0.25 mm

### Optical Characteristics

Numerical Aperture of Light Pipe	0.55
Refractive Index (η) of Core	1.62

Developmental-type devices or materials are intended for engineering evaluation. The type designation and data are subject to change, unless otherwise arranged. No obligations are assumed for notice of change or future manufacture of these devices or materials.

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Electrical Characteristics <sup>1</sup>	At an ambient temperature (T <sub>A</sub> ) of 22° C, the DC reverse operating voltage (V <sub>R</sub> ) <sup>2</sup> and at V <sub>cc</sub> = ± 6 V.									Units
	C30952E, C30952EL			C30952F, C30952FL			C30952G, C30952GL			
	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
Responsivity:										
At 830 nm	3.0x10 <sup>3</sup>	3.8x10 <sup>3</sup>	-	0.8x10 <sup>3</sup>	1.3x10 <sup>3</sup>	-	2.5x10 <sup>2</sup>	3.8x10 <sup>2</sup>	-	V/W
At 900 nm	3.5x10 <sup>3</sup>	4.2x10 <sup>3</sup>	-	-	-	-	-	-	-	V/W
Noise Equivalent Power (NEP):										
f = 100 kHz, Δf = 1.0 Hz										
At 830 nm	-	3.9	12	-	15	40	-	50	150	pW/Hz <sup>1/2</sup>
At 900 nm	-	3.6	10	-	-	-	-	-	-	pW/Hz <sup>1/2</sup>
Output Spectral Noise Voltage Density:										
f = 100 kHz - 100 MHz, Δf = 1.0 Hz	-	15	30	-	15	30	-	15	30	nV/Hz <sup>1/2</sup>
Output Impedance	-	25	50	-	25	50	-	25	50	Ω
System Bandwidth, f <sub>0</sub> (3 dB point)	35	50	-	70	100	-	140	200	-	MHz
Rise Time, t <sub>r</sub> :										
λ = 900 and 1060 nm										
10% to 90% points	-	7	10	-	4	5	-	2	2.5	ns
Fall Time:										
λ = 900 and 1060 nm										
90% to 10% points	-	7	10	-	4	5	-	2	2.5	ns
Linear Output Voltage Swing	0.5	0.7	-	0.5	0.7	-	0.5	0.7	-	V
Voltage Swing	-	-	2.0	-	-	2.0	-	-	2.0	V
Output Offset Voltage	0.0	-0.8	-1.0	0.0	-0.8	-1.0	0.0	-0.8	-1.0	V
Supply Current	-	4.0	8.0	-	4.0	8.0	-	4.0	8.0	mA

<sup>1</sup> All measurements are made with the device AC (capacitively) coupled into a 50 Ω termination.  
<sup>2</sup> Recommended photodiode bias voltage (V<sub>R</sub>) - C30952E, EL: 45 V; C30952F, G, FL, GL: 100 V.

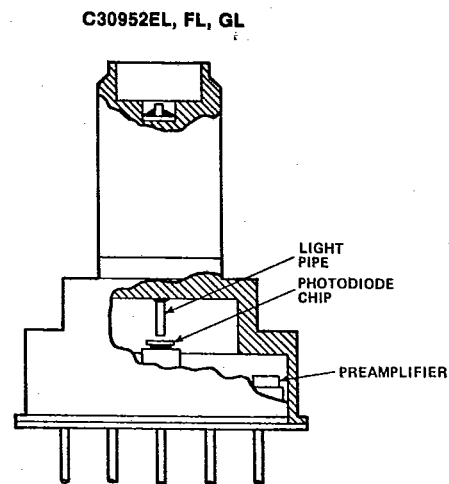
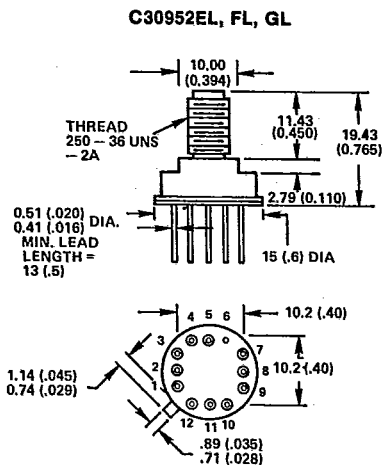
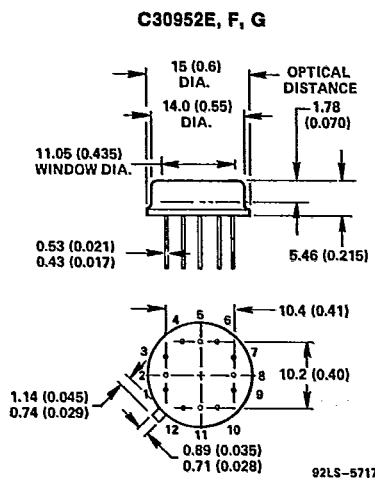


Figure 3 - Cutaway of Package

**Pin Connections**

- |   |  |
|---|--|
| 1: Signal Output                                | 7: Signal Ground                                 |
| 2: No Connection, Do Not Use                    | 8: Temp. Sensing Diode - Anode                   |
| 3: -V <sub>cc</sub> Negative Bias for Amplifier | 9: Temp. Sensing Diode - Cathode                 |
| 4: Positive Bias for Photodiode                 | 10: Ground (Power Supply)                        |
| 5: No Connection, Do Not Use                    | 11: No Connection, Do Not Use                    |
| 6: Case   | 12: +V <sub>cc</sub> Positive Bias for Amplifier |

Dimensions in millimeters. Dimensions in parentheses are in inches.

Figure 2 - Dimensional Outlines

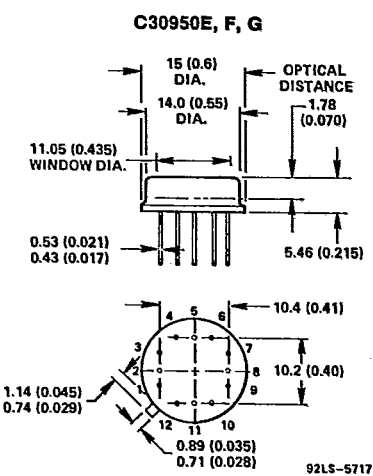
**Warning - Personal Safety Hazards**  
Electrical Shock - Operating voltages applied to this device present a shock hazard.

**Electrical Characteristics at  $T_A = 22^\circ C$**

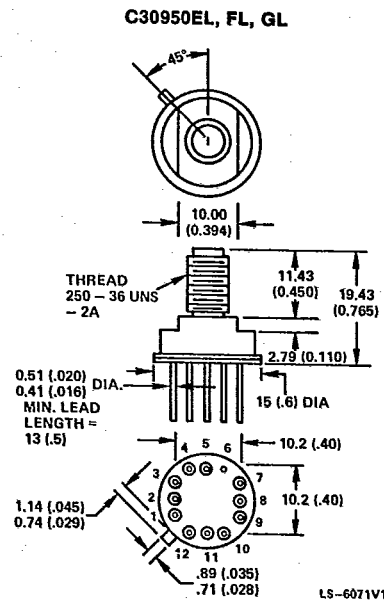
At an ambient temperature ( $T_A$ ) of  $22^\circ C$  and the DC reverse operating voltage ( $V_R$ ) value supplied with each device.<sup>2</sup>

	C30950E, EL			C30950F, FL			C30950G, GL			
	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
Temperature Coefficient of $V_R$ for Constant Gain <sup>3</sup>	-	2.2	-	-	0.6	-	-	0.6	-	V/°C
Responsivity:										
At 830 nm	$4.5 \times 10^5$	$5.2 \times 10^5$	-	$1.7 \times 10^5$	$1.9 \times 10^5$	-	$5.3 \times 10^4$	$5.8 \times 10^4$	-	V/W
At 900 nm	$4.9 \times 10^5$	$5.6 \times 10^5$	-	$1.4 \times 10^5$	$1.6 \times 10^5$	-	$4.1 \times 10^4$	$4.9 \times 10^4$	-	V/W
At 1060 nm	$1.1 \times 10^5$	$1.4 \times 10^5$	-	-	-	-	-	-	-	V/W
Noise Equivalent Power (NEP): $f = 100 \text{ kHz}, \Delta f = 1.0 \text{ Hz}$										
At 830 nm	-	0.029	0.067	-	0.079	0.180	-	0.260	0.570	pW/Hz <sup>1/2</sup>
At 900 nm	-	0.027	0.060	-	0.094	0.210	-	0.310	0.730	pW/Hz <sup>1/2</sup>
At 1060 nm	-	0.110	0.270	-	-	-	-	-	-	pW/Hz <sup>1/2</sup>
Output Spectral Noise Voltage Density: $f = 100 \text{ kHz} - 100 \text{ MHz}, \Delta f = 1.0 \text{ Hz}$	-	15	30	-	15	30	-	15	30	nV/Hz <sup>1/2</sup>
Output Impedance	-	25	50	-	25	50	-	25	50	$\Omega$
System Bandwidth, $f_c$ (3 dB point)	35	50	-	70	100	-	140	200	-	MHz
Rise Time, $t_r$ : $\lambda = 900 \text{ and } 1060 \text{ nm}$ 10% to 90% points	-	7	10	-	4	5	-	2	2.5	ns
Fall Time: $\lambda = 900 \text{ and } 1060 \text{ nm}$ 90% to 10% points	-	7	10	-	4	5	-	2	2.5	ns
Linear Output Voltage Swing	0.5	0.7	-	0.5	0.7	-	0.5	0.7	-	V
Voltage Swing	-	-	2.0	-	-	2.0	-	-	2.0	V
Output Offset Voltage	0.0	-0.8	-1.0	0.0	-0.8	-1.0	0.0	-0.8	-1.0	V
Supply Current	-	4.0	8.0	-	4.0	8.0	-	4.0	8.0	mA

- <sup>1</sup> All measurements are made with the device AC (capacitively) coupled into a 50  $\Omega$  termination.
- <sup>2</sup> A specific value of  $V_R$  is supplied with each device. The voltage values will be within the ranges specified below:  
C30950E, EL: 275 - 425 V      C30950F, FL, C30950G, GL: 180 - 250 V.
- <sup>3</sup> At 830 and 900 nm.



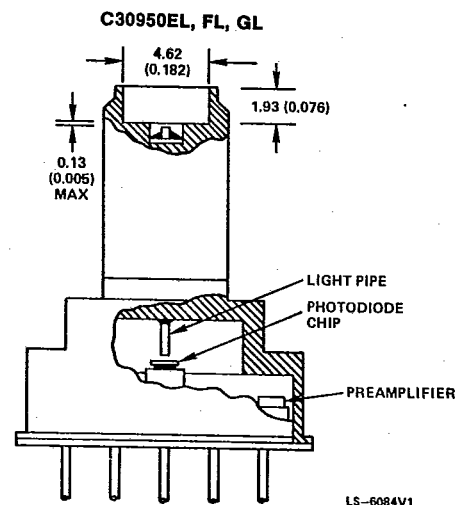
- Pin Connections**
- 1: Signal Output
  - 2: No Connection, Do Not Use
  - 3: - $V_{cc}$  Negative Bias for Amplifier
  - 4: Positive Bias for Photodiode
  - 5: No Connection, Do Not Use
  - 6: Case
  - 7: Signal Ground
  - 8: Temp. Sensing Diode - Anode



- 9: Temp. Sensing Diode - Cathode
- 10: Ground (Power Supply)
- 11: No Connection, Do Not Use
- 12: + $V_{cc}$  Positive Bias for Amplifier

Dimensions in millimeters. Dimensions in parentheses are in inches.

**Figure 2 - Dimensional Outlines**



**Figure 3 - Cutaway of Package**

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