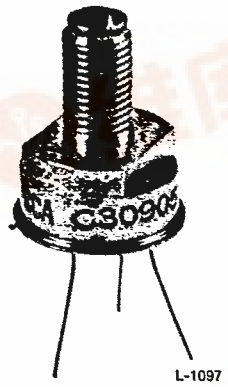
C30904E, C30905E, C30908E
Silicon Avalanche Photodiodes

Developmental Types



L-1097

Silicon Avalanche Photodiodes With Integral Light Pipes —

Desigred Especially for Optical Communication Systems

- Simplified Coupling to Fiber Optics Up to 1.25 mm Dia.
- Light Pipe Diameters of 0.25 mm, 0.5 mm, and 1.25 mm
- Spectral Response Range (10% Points) — 400 to 1100 nm
- Fast Time Response — Rise and fall times to 0.5 ns
- Wide Operating Temperature Range — −40° C to +70° C
- Hermetically-Sealed TO-8 Package

RCA Developmental Types C30904E, C30905E, and C30908E are Silicon Avalanche Photodiodes containing a light pipe which is an integral part of the package. These avalanche photodiodes are made using a double-diffused "reach through" structure. This structure provides high responsivity between 600 and 1100 nanometers as well as fast rise and fall times at all wavelengths.

The C30904E is a general purpose device, the C30905E is a large area general purpose device, and the C30908E is a very fast device with responsivity independent of modulation frequency up to 800 MHz. These devices are hermetically sealed in a modified 3 lead TO-8 package.

Maximum Rating, Absolute-Maximum Values

Reverse Bias Dark Current	100 max.	μA
Photocurrent Density, Jp, at 22° C:		
Average value, continuous operation	5	mA/mm²
Peak value (For 1 second duration, non-repetitive)	20	mA/mm²
Forward Current, I_F, at 22° C:		
Average value, continuous operation	5 max.	mA
Peak value (For 1 second duration, non-repetitive)	50 max.	mA
Maximum Total Power Dissipation at 22° C	0.1 max.	W
Ambient Temperature:		
Storage, T_{stg}	−60 to +100	°C
Operating, T_A	−40 to +70	°C
Soldering:		
For 5 seconds	200	°C

Mechanical Characteristics

Type	Diode Chip (Dia.)	Light Pipe Core Dia.
C30904E	C30817 (0.8 mm)	0.50 mm
C30905E	C30916E (1.5 mm)	1.25 mm
C30908E	C30902E (0.5 mm)	0.25 mm

Optical Characteristics

Numerical Aperture of Light Pipe	0.60
Refractive Index (η) of Core	1.61

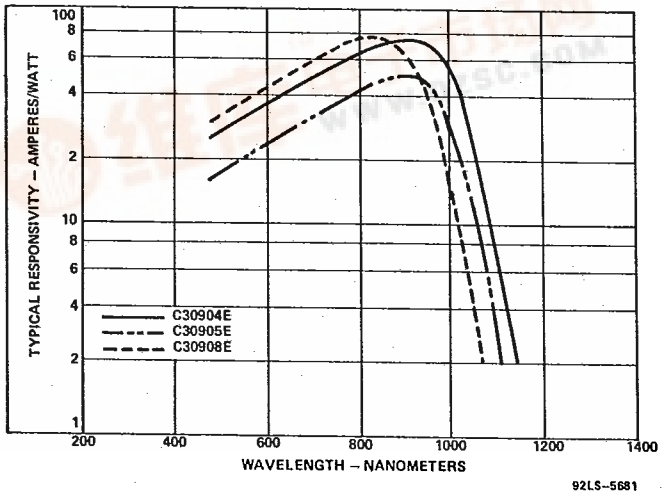


Figure 1 — Typical Spectral Responsivity Characteristics

Electrical Characteristics[a]	At an ambient temperature (T_A) of 22°C and the DC reverse operating voltage (V_R) value supplied with each device.[b]									Units
	C30904E			C30905E			C30908E			
	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
Breakdown Voltage, V_{BR}	300	375	475	315	390	490	185	225	265	V
Temperature Coefficient of V_R for Constant Gain	—	2.2	—	—	2.2	—	—	0.6	—	V/°C
Gain	—	120	—	—	80	—	—	150	—	
Responsivity:										
At 830 nm	60	69	—	40	46	—	70	77	—	A/W
At 900 nm	65	75	—	43	50	—	55	65	—	A/W
At 1060 nm	15	18	—	10	12	—	—	—	—	A/W
Quantum Efficiency:										
At 830 nm	—	85	—	—	85	—	—	77	—	%
At 900 nm	—	85	—	—	85	—	—	60	—	%
At 1060 nm	—	18	—	—	18	—	—	—	—	%
Total Dark Current, I_d	—	50	200	—	100	400	—	15	30	nA
Noise Current, i_n:										
f = 10 kHz, Δf = 1.0 Hz	—	1	2	—	1	2	—	0.23	0.50	$pA/Hz^{1/2}$
Capacitance, C_d	—	2	4	—	3.5	5.0	—	1.6	2.0	pF
Series Resistance	—	—	15	—	—	15	—	—	15	Ω
Rise Time, t_r:										
R_L = 50 Ω, λ = 900 nm, 10% to 90% points	—	2	3	—	3	4	—	0.50	0.75	ns
Fall Time:										
R_L = 50 Ω, λ = 900 nm, 90% to 10% points	—	2	3	—	3	4	—	0.50	0.75	ns

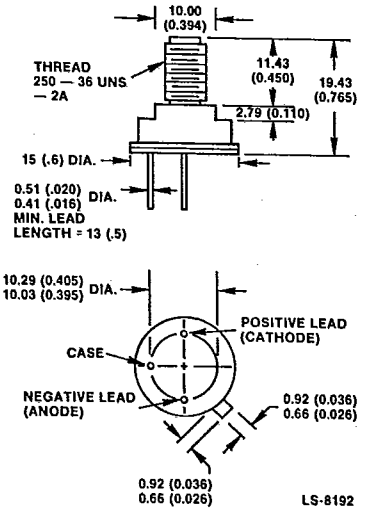
[a] Performance characteristics are referred to the input surface of the light pipe.

[b] A specific value of V_R is supplied with each device. When the photodiode is operated at this voltage, the device will meet the electrical characteristic limits shown above. The voltage values will be within the ranges specified below:

Type	Range of V_R (Recommended operating voltage)
C30904E	275 — 425 V
C30905E	275 — 425 V
C30908E	180 — 250 V

Warning – Personal Safety Hazards

Electrical Shock – Operating voltages applied to these devices present a shock hazard.



Dimensions in millimeters. Dimensions in parentheses are in inches.

Figure 2 — Dimensional Outline

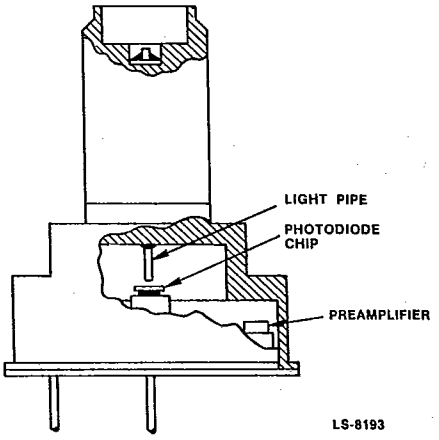


Figure 3 — Cutaway of Package

For further information or application assistance on these devices, contact your RCA Sales Representative or Photodetector Marketing, P.O. Box 1200, RCA, Ste. Anne de Bellevue, Quebec, Canada H9X 3L3 (514) 457-9000.