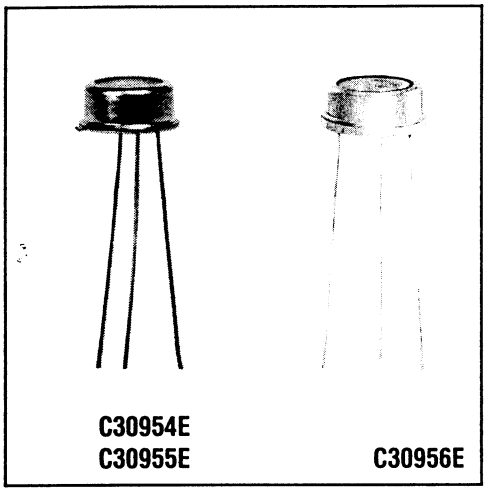
EG&G CANADA LTD.
Optoelectronics Divisio

Formerly RCA
Effective January 1, 1991

ISO-9001-87 Cert #001975

Photodiode C30954E, C30955E, C30956E

DATA SHEET



C30954E
C30955E
C30956E

Large Area Long Wavelength Enhanced Silicon Avalanche Photodiodes for General-Purpose Applications

- High Quantum Efficiency —
  85% typical at 900 nm — 36% - 40% typical at 1060 nm
  5% typical at 1150 nm
- Spectral Response Range — (10% Points) 400 to 1150 nm
- Fast Time Response —
  Rise time typically 2 ns — Fall time typically 2 ns
- Wide Operating Temperature Range — -40°C to +70°C
- Hermetically-Sealed Packages

RCA Type C30954E, C30955E, and C30956E are general purpose silicon avalanche photodiodes made using a double-diffused "reach through" structure. These photodiodes are designed such that their long wave response (i.e. λ >900 nm) has been enhanced without introducing any undesirable properties. At the same time, the desirable properties of the double diffused "reach through" structure (such as low noise, low capacitance, and fast rise and fall times) have been retained.

The C30954E, C30955E, and C30956E are improved performance versions of the RCA types C30817, C30916E, and C30872; they are hermetically sealed behind a flat glass window.

The devices are useful in a wide variety of applications including detection, ranging, optical communications, high-speed switching, and transit-time measurements.

Maximum Ratings, Absolute Maximum Values

Reverse Bias Current	200	max.	μA
Photocurrent Density, J_p, at 22° C:			
Average value, continuous operation	5		mA/mm²
Peak value	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: (With heat sink cooling provided to case)	0.1	max.	W
Ambient Temperature:			
Storage, T_{stg}	-60 to +100		°C
Operating, T_A	-40 to +70		°C
Soldering:			
For 5 seconds (leads only)	200		°C

Mechanical Characteristics

	C30954E	C309555E	C30956E
Photosensitive Surface:			
Shape	Circular	Circular	Circular
Useful area (mm²)	0.5	1.77	7
Useful diameter (mm)	0.8	1.5	3
Package	TO-5	TO-5	TO-8

Optical Characteristics

Field of View[1]:			
See Figure 18 —			
Full angle (∝) for totally illuminated photosensitive surface (deg)	110	104	132
Full angle (∝′) for partially illuminated photosensitive surface (deg)	125	130	150

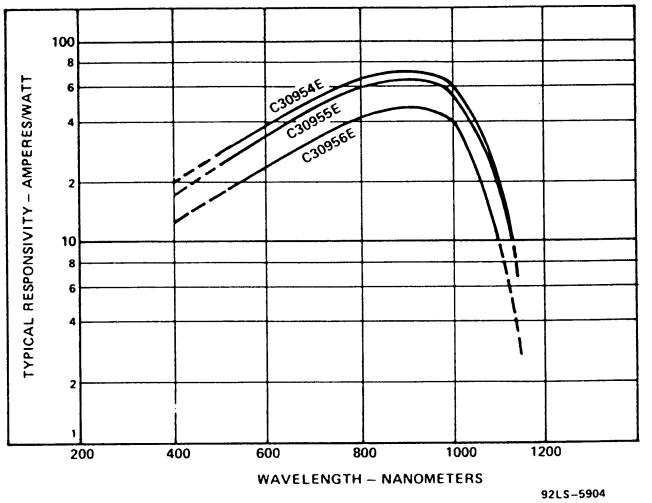


Figure 1 — Typical Spectral Responsivity Characteristics

Electrical Characteristics at T_A = 22°C **At the DC reverse operating voltage V_R supplied with the device [2]**	**C30954E** **Light spot diameter 0.25 mm (0.01")**			**C30955E** **Light spot diameter 1.0 mm (0.04")**			**C30956E** **Light spot diameter 2.5 mm (0.10")**			
	Min.	**Typ.**	**Max.**	**Min.**	**Typ.**	**Max.**	**Min.**	**Typ.**	**Max.**	**Units**
Breakdown Voltage, V_{BR} .... For V_{BR} at other temperat., see Figures 2 thru 7	300	375	475	315	390	490	325	400	500	V
Temperature Coefficient of V_R for Constant Gain	—	2.2	—	—	2.2	—	—	2.2	—	V/°C
Gain	—	120	—	—	100	—	—	75	—	
Responsivity:										
At 900 nm	65	75	—	55	70	—	36	45	—	A/W
At 1060 nm	30	36	—	26	34	—	20	25	—	A/W
At 1150 nm	4	5	—	4	5	—	2.8	3.5	—	A/W
Quantum Efficiency:										
At 900 nm	—	85	—	—	85	—	—	85	—	%
At 1060 nm	—	36	—	—	40	—	—	40	—	%
At 1150 nm	—	5	—	—	5	—	—	5	—	%
Total Dark Current, I_d	—	5×10^{-8}	1×10^{-7}	—	1×10^{-7}	2×10^{-7}	—	1×10^{-7}	2×10^{-7}	A
Noise Current, i_n: f = 10 kHz, Δf = 1.0 Hz ..... See Figure 9	—	1×10^{-12}	2×10^{-12}	—	1×10^{-12}	2×10^{-12}	—	1.1×10^{-12}	2.2×10^{-12}	$A/Hz^{1/2}$
Capacitance, C_d	—	2	4	—	3	5	—	10	12	pF
Series Resistance	—	—	15	—	—	15	—	—	15	Ω
Rise Time, t_r: R_L = 50Ω, λ = 900 nm, 10% to 90% points.....	—	2	3	—	2	3.5	—	2	3.5	ns
Fall Time: R_L = 50Ω, λ = 900 nm, 90% to 10% points.....	—	2	3	—	2	3.5	—	2	3.5	ns

[1] The values specified for field of view are approximate and are critically dependent on the dimensional tolerances of the packages component parts.

[2] 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 value will be within the range of 275 to 425 volts.

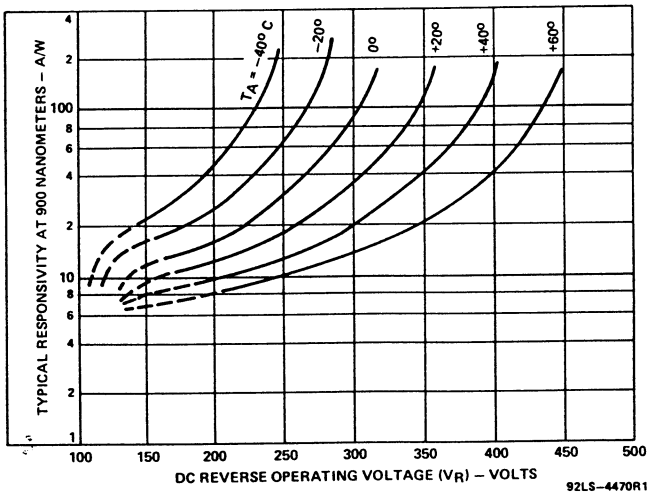


Figure 2 - Typical Responsivity at 900 nm vs Operating Voltage - C30954E

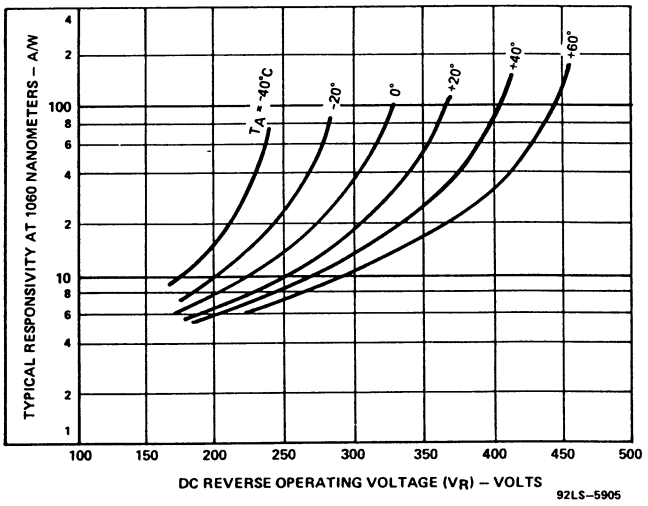


Figure 3 - Typical Responsivity at 1060 nm vs Operating Voltage - C30954E

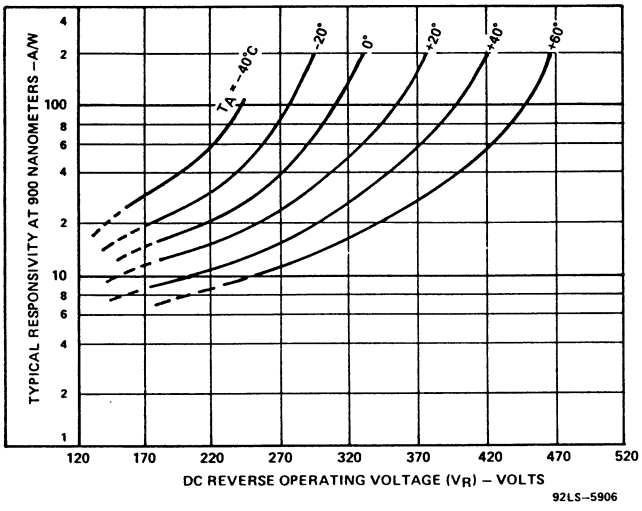


Figure 4 - Typical Responsivity at 900 nm vs Operating Voltage - C30955E

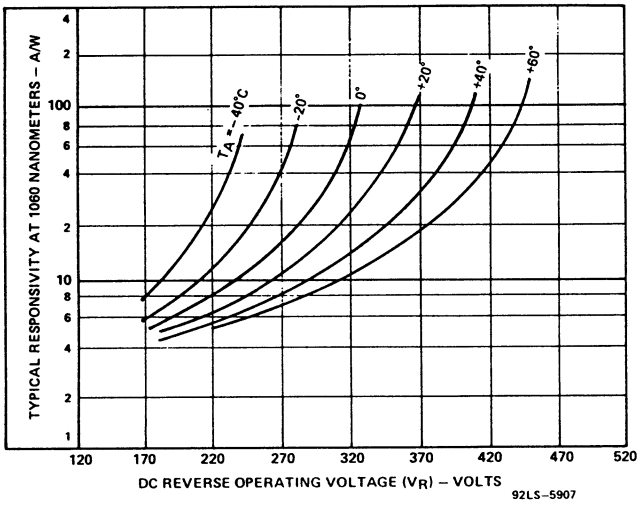


Figure 5 - Typical Responsivity at 1060 nm vs Operating Voltage - C30955E

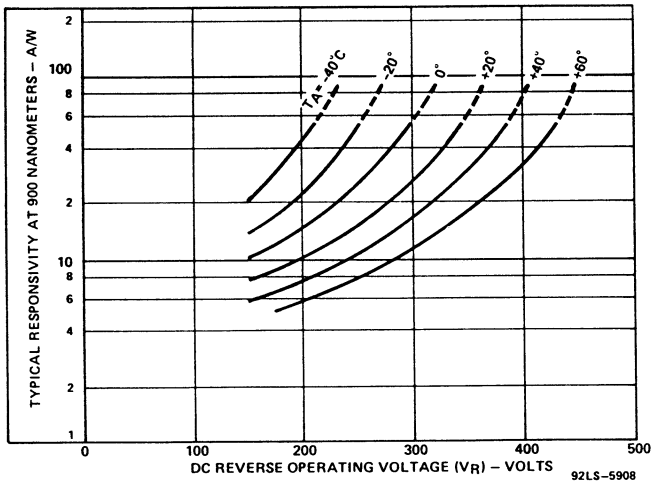


Figure 6 - Typical Responsivity at 900 nm vs Operating Voltage - C30956E

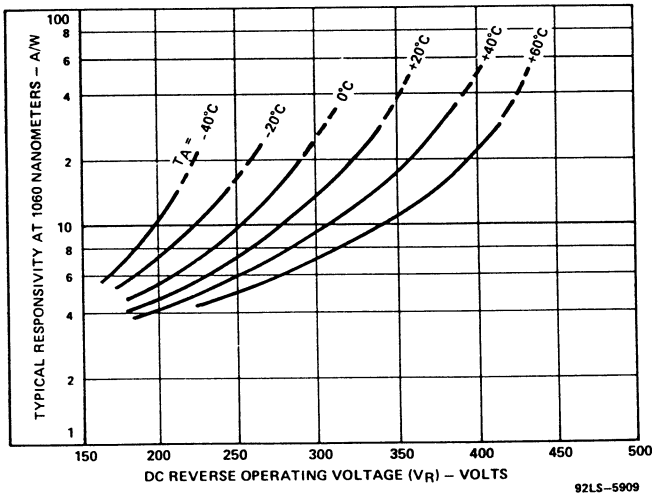


Figure 7 - Typical Responsivity at 1060 nm vs Operating Voltage - C30956E

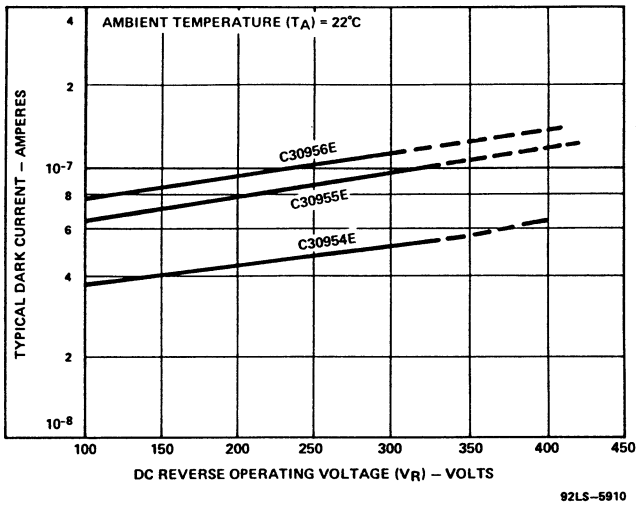


Figure 8 - Typical Dark Current vs Operating Voltage

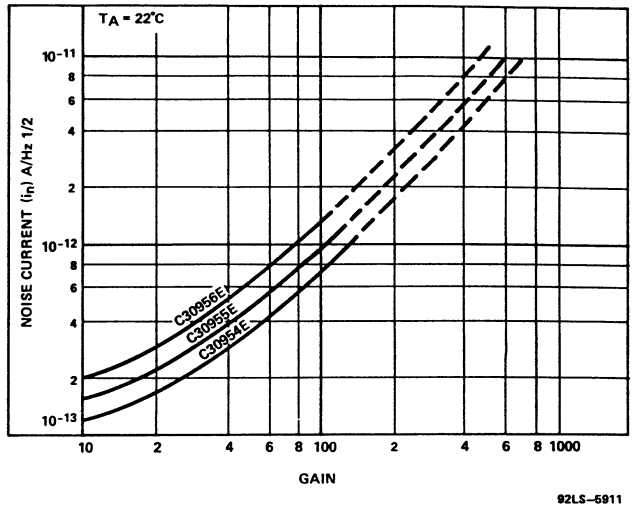


Figure 9 - Typical Noise Current vs Gain

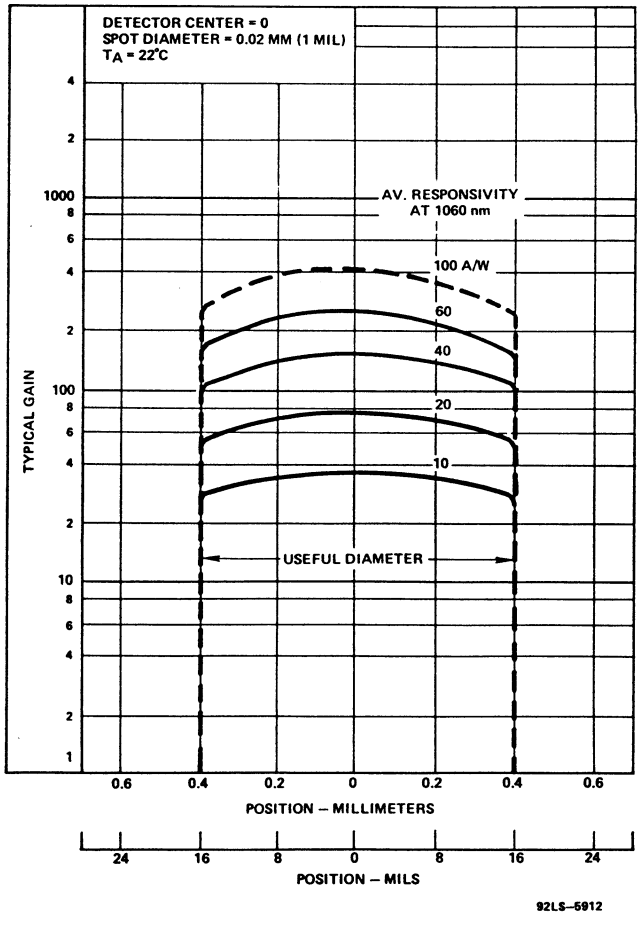


Figure 10 - Typical Gain vs Light Spot Position - C30954E

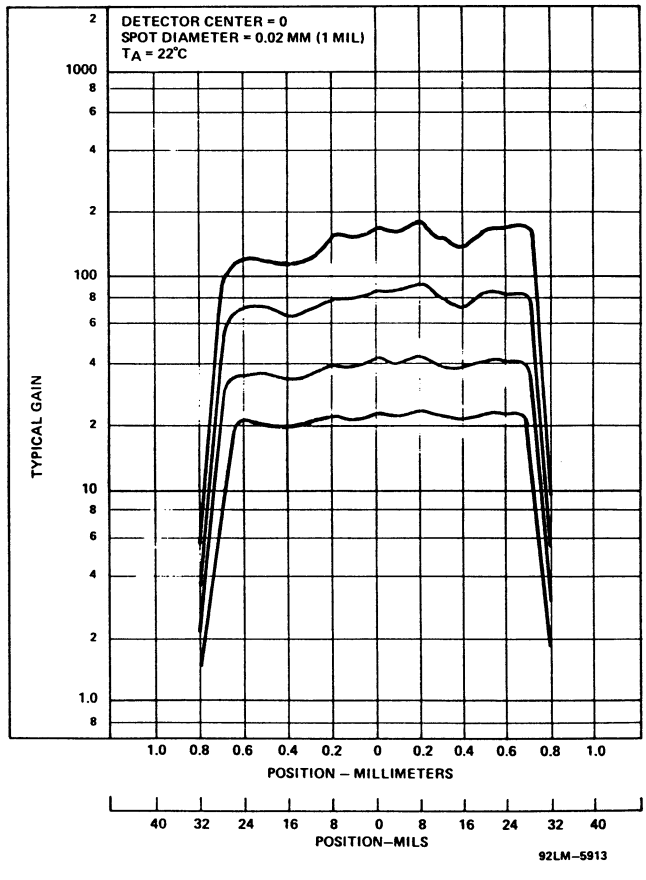


Figure 11 - Typical Gain vs Light Spot Position - C30955E

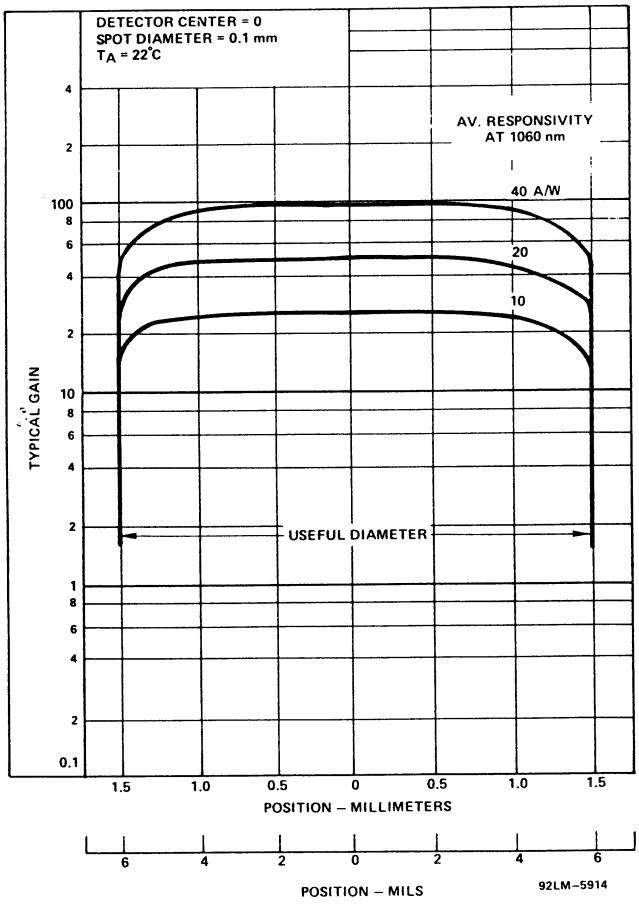


Figure 12 - Typical Gain vs Light Spot Position - C30956E

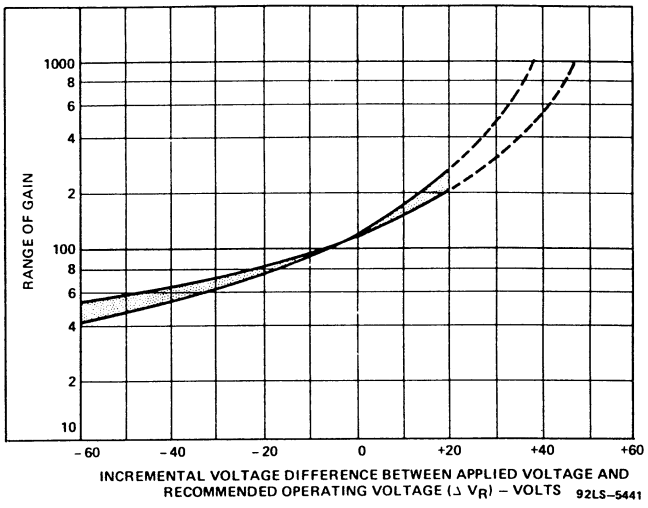


Figure 13 - Variation of Gain as a Function of Difference Between Actual Applied Operating Voltage and Recommended Operating Voltage - C30954E

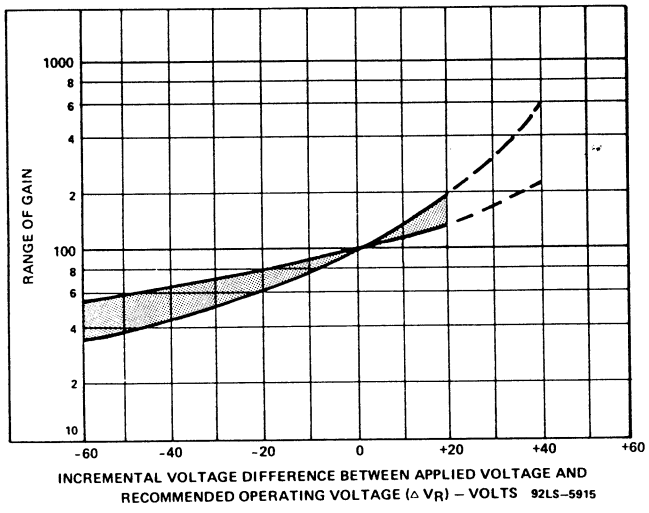


Figure 14 - Variation of Gain as a Function of Difference Between Actual Applied Operating Voltage and Recommended Operating Voltage - C30955E

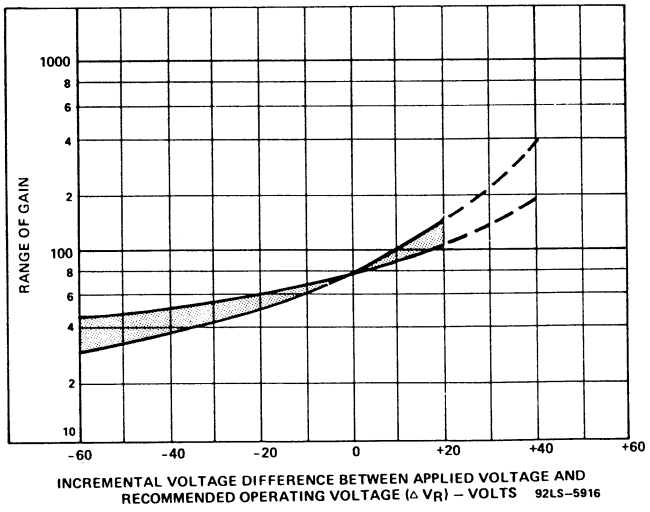
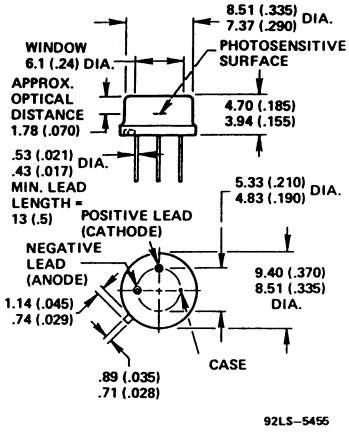


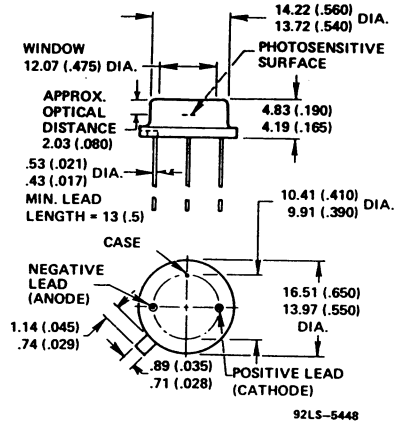
Figure 15 - Variation of Gain as a Function of Difference Between Actual Applied Operating Voltage and Recommended Operating Voltage - C30956E



Low-Profile TO-5 Package

Note: Optical distance is defined as the distance from the surface of the silicon chip to the front surface of the window.

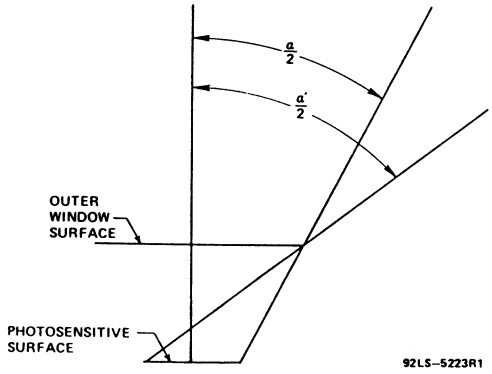
Figure 16 - Dimensional Outline - C30954E, C30955E



Low-Profile TO-8 Package

Note: Optical distance is defined as the distance from the surface of the silicon chip to the front surface of the window.

Figure 17 - Dimensional Outline - C30956E



For incident radiation at angles $\leqslant \alpha/2$, the photosensitive surface is totally illuminated.

For incident radiation at angles $> \alpha/2$ but $\leqslant \alpha'/2$, the photosensitive surface is partially illuminated.

Figure 18 - Definition of Half-Angle Approx. Field-of-View (Scale is exaggerated for clarity)

Warning — Personal Safety Hazards

Electric Shock — Operating voltages applied to this device present a shock hazard.

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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