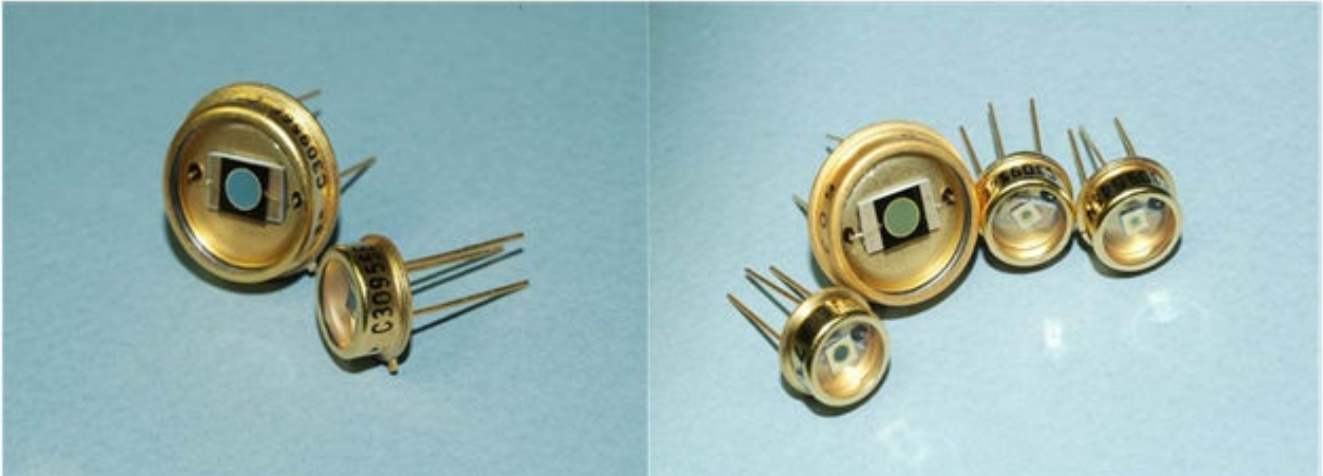


# Long Wavelength Enhanced Silicon APD

## C30954EH, C30955EH and C30956EH Series



### Overview

The Excelitas C30954EH, C30955EH, and C30956EH are general purpose silicon avalanche photodiodes made using a double-diffused "reach through" structure. The design of these photodiodes such that their long wave response (i.e. > 900 nm) has been enhanced without introducing any undesirable properties.

These APDs have quantum efficiency of up to 40% at 1060 nm. At the same time, the diodes retain the low noise, low capacitance, and fast rise and fall times characteristics.

Standard versions of these APDs are available in hermetically sealed flat top glass TO-5 package for the smaller area C30954EH and C30955EH, and TO-8 for the larger area C30956EH.

To help simplify many design needs, these APDs are also available in Excelitas' high performance hybrid preamplifier module type C30659 series, as well as the preamplifier and TE cooler incorporated module type LLAM series.

Recognizing that different applications have different performance requirements, Excelitas offers a wide range for customizing these APDs to meet your design challenges. Thermoelectric cooler packaged versions are available on a custom basis. Operating and breakdown voltage selection, dark current and NEP screening, custom device testing and packaging are among the many application-specific solutions available.

### Features and Benefits

- High quantum efficiency at 1060 nm •
- Fast response time
- Wide operating temperature range •
- Low capacitance
- Hermetically sealed packages •
- RoHS Compliant

### Applications

- Range finding
- LIDAR
- YAG laser detection

# Table of Contents

<b>Maximum Ratings, Absolute Maximum Values</b>	<b>3</b>
<b>Table 1. Mechanical and Optical Characteristics</b>	<b>3</b>
<b>Table 2. Electrical Characteristics at <math>T_A = 22\text{ }^{\circ}\text{C}</math>; at the DC reverse operating voltage <math>V_r</math>, supplied with the device<sup>2</sup></b>	<b>4</b>
<b>ESD warning</b>	<b>9</b>
<b>RoHS Compliance</b>	<b>9</b>
<b>Warranty</b>	<b>10</b>
<b>Excelitas</b>	<b>10</b>

## Maximum Ratings, Absolute Maximum Values

Reverse Bias Current .....	200 max.	$\mu\text{A}$
Photocurrent Density, $J_p$ , at 22 °C:		
Average value,		
continuous operation .....	5	$\text{mA/mm}^2$
Peak value .....	20	$\text{mA/mm}^2$
Forward Current, $I_F$ , at 22°C:		
Average value,		
continuous operation .....	5 max.	$\text{mA}$
Peak value (For 1 second		
duration, non-repetitive) . . .	50 max.	$\text{mA}$
Maximum Total Power Dissipation at 22°C:		
(With heat sink cooling provided to case) .....	0.1 max.	$\text{W}$
Ambient Temperature:		
Storage, $T_{\text{stg}}$ .....	-60 to +100	°C
Operating, $T_A$ .....	-40 to +70	°C
Soldering:		
For 5 seconds .....	200	°C
(leads only)		

**Table 1. Mechanical and Optical Characteristics**

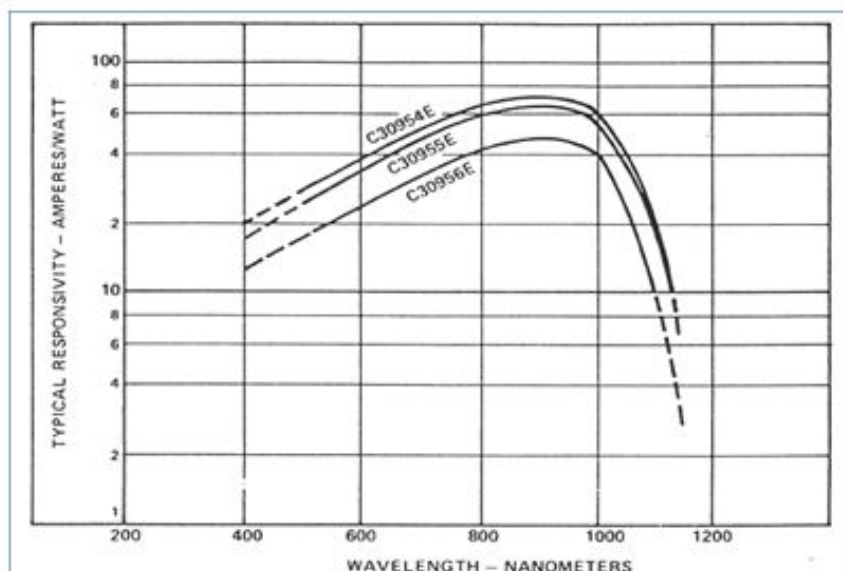
Photosensitive surface	C30954EH	C30955EH	C30956EH	Unit
Shape	Circular	Circular	Circular	
Useful Area	0.5	1.77	7	$\text{mm}^2$
Useful Diameter	0.8	1.5	3	Mm
Package	TO-5	TO-5	TO-8	
Field of View $\alpha$ (see Figure 10 ) <sup>1</sup>	110	104	132	Degrees
Field of View $\alpha'$ (see Figure 10 ) <sup>1</sup>	125	130	150	Degrees

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

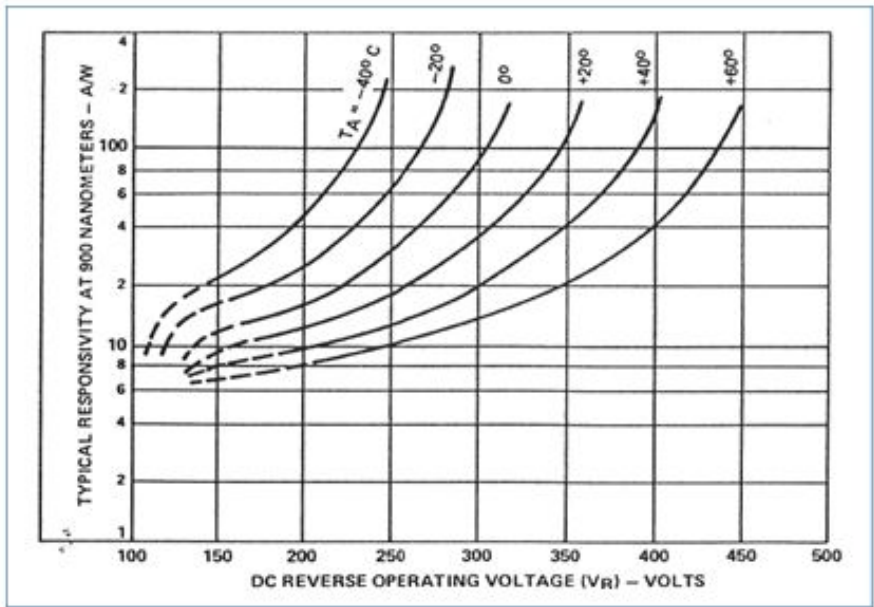
**Table 2. Electrical Characteristics at  $T_A = 22\text{ }^\circ\text{C}$ ; at the DC reverse operating voltage  $V_R$ , supplied with the device<sup>2</sup>**

Parameter	C30954EH			C30955EH			C30956EH			Unit
	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Breakdown Voltage, $V_{BR}^2$	300	375	475	315	390	490	325	400	500	V
Temperature Coefficient of $V_{BR}$ , for Constant M	-	2.4	-	-	2.4	-	-	2.4	-	V/ $^\circ\text{C}$
Gain (M)	-	120	-	-	100	-	-	75	-	
Responsivity @ 900 nm @ 1060 nm @ 1150 nm	65 30 4	75 36 5	- - -	55 26 4	70 34 5	- - -	36 20 2.8	45 25 3.5	- - -	A/W A/W A/W
Quantum Efficiency @ 900 nm @ 1060 nm @ 1150 nm	- - -	85 36 5	- - -	- - -	85 40 5	- - -	- - -	85 40 5	- - -	% % %
Total Dark Current, $I_d$	-	50	100	-	100	200	-	100	200	nA
Noise Current, $i_n$ $f=10\text{kHz}, \Delta f=1.0\text{Hz}$	-	1	2	-	1	2	-	1.1	2.2	pA/ $\sqrt{\text{Hz}}$
Capacitance, $C_d$	-	2	4	-	3	5	-	10	12	pF
Series resistance	-	-	15	-	-	15	-	-	15	$\Omega$
Rise & Fall Time, $R_L=50\text{ }\Omega$ , 10%-90%- 10% points	-	2	3	-	2	3.5	-	2	3.5	ns

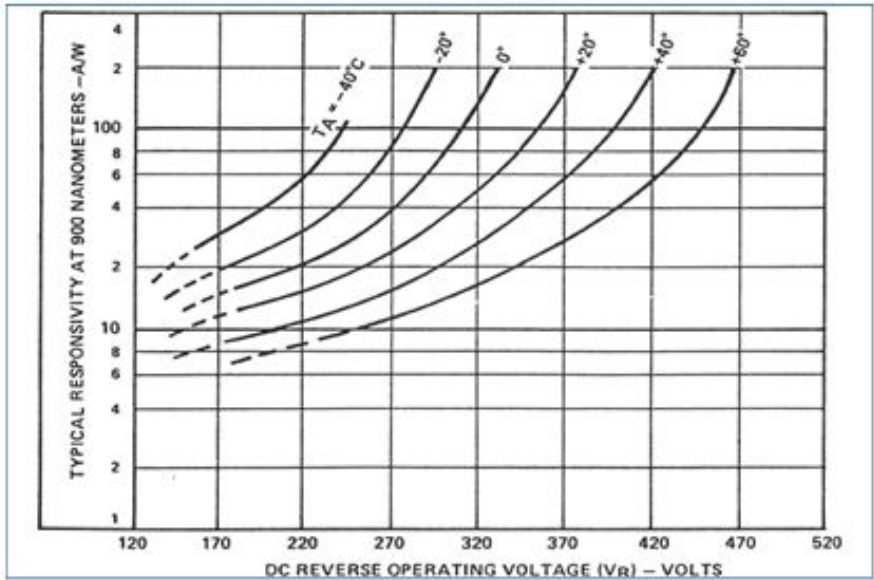
2. A specific value of  $V_R$  is supplied with each device. When the photodiode is operated at this voltage, the device will meet the electrical characteristic limits shown above. The voltage value will be within the range of 275 to 450 volts.



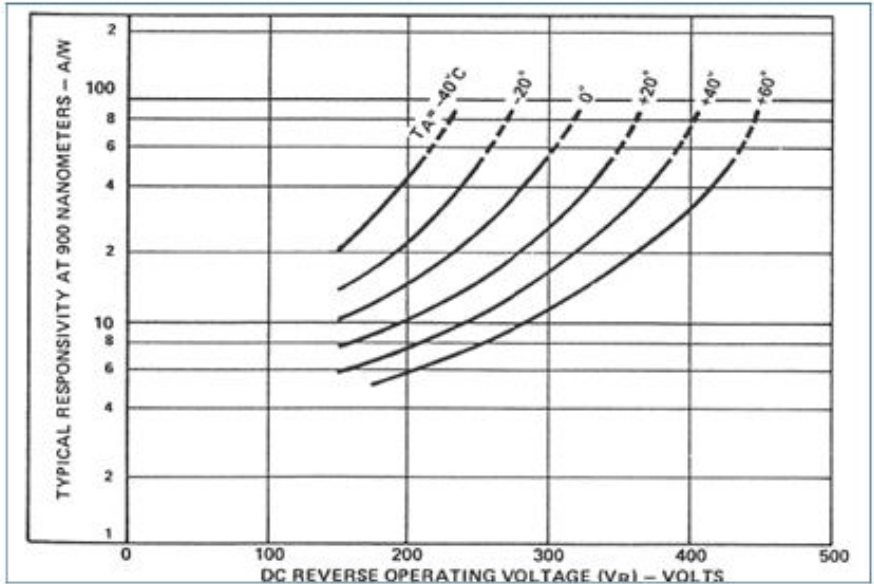
**Figure 1**  
Typical Spectral Responsivity  
Characteristics



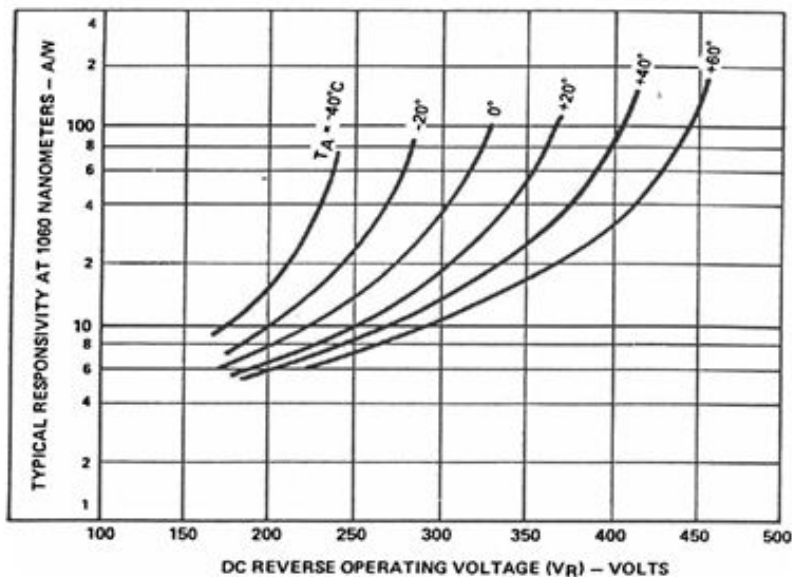
**Figure 2**  
Typical Responsivity at 900 nm  
vs Operating Voltage -  
C30954EH



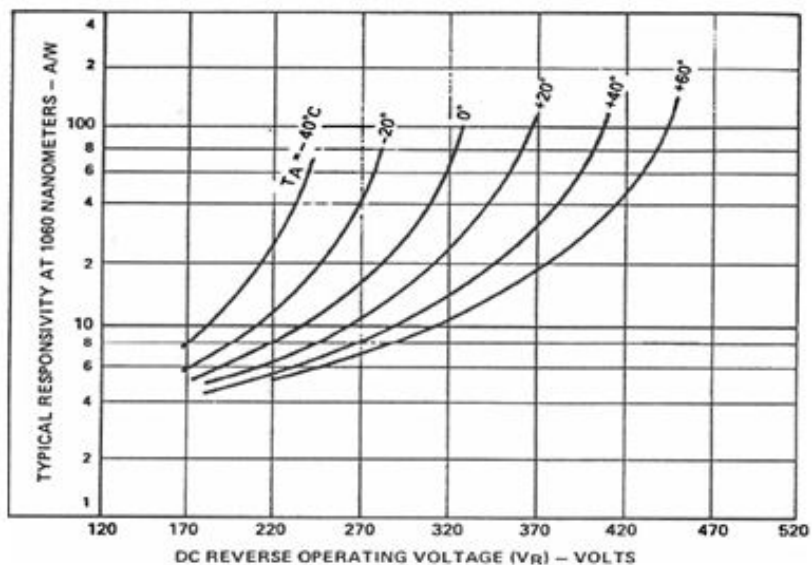
**Figure 3**  
Typical Responsivity at 900 nm vs  
Operating Voltage - C30955EH



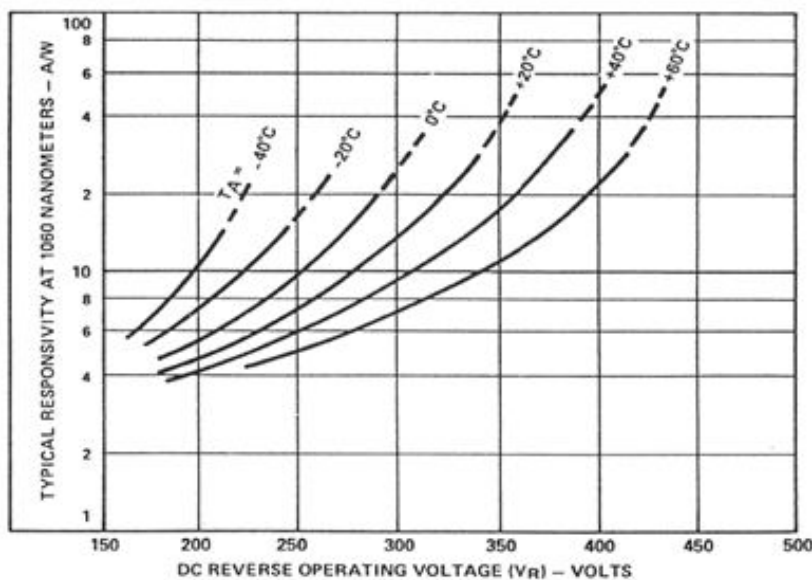
**Figure 4**  
Typical Responsivity at 900 nm vs  
Operating Voltage - C30956EH



**Figure 5**  
Typical Responsivity at 1060 nm vs  
Operating Voltage - C30954EH

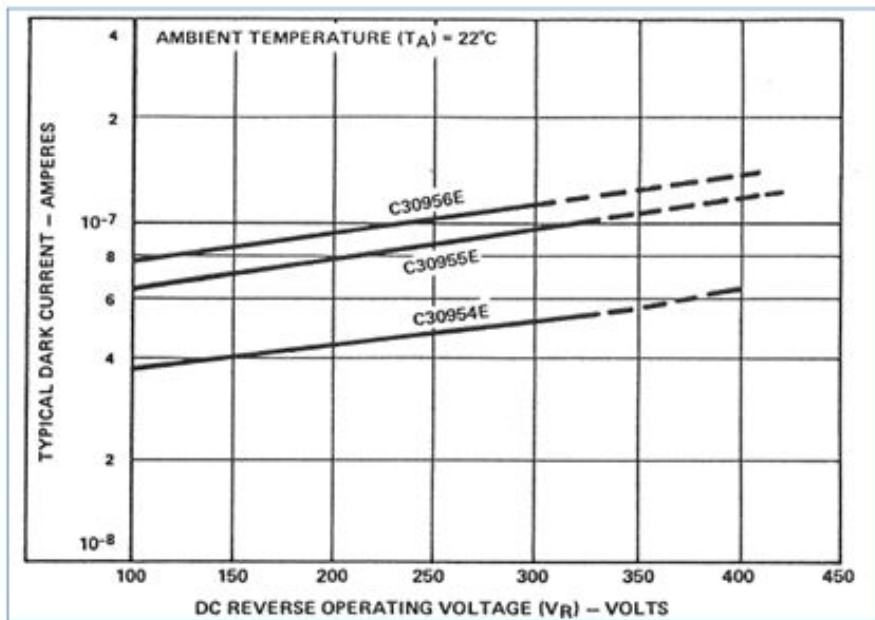


**Figure 6**  
Typical Responsivity at 1060 nm vs  
Operating Voltage - C30955EH

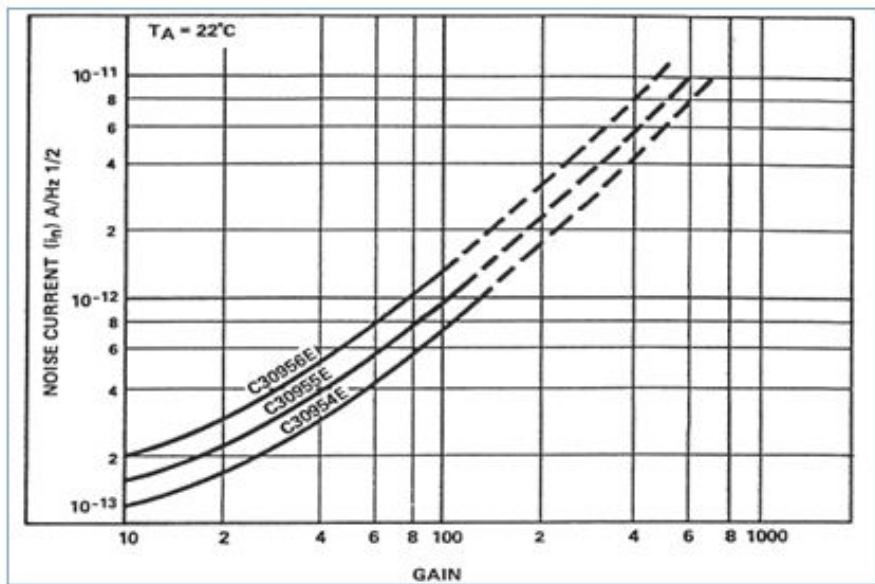


**Figure 7**  
Typical Responsivity at 1060 nm vs  
Operating Voltage - C30956EH

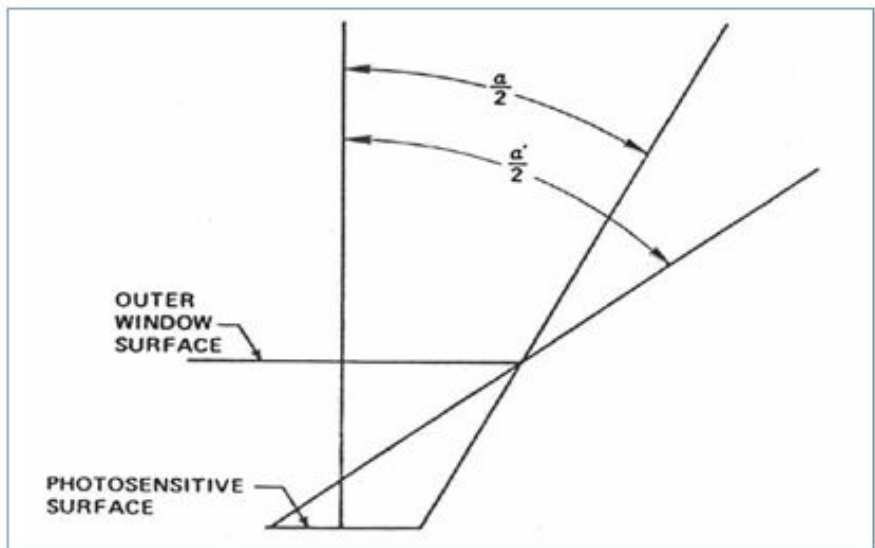




**Figure 8**  
Typical dark current vs. Operating Voltage



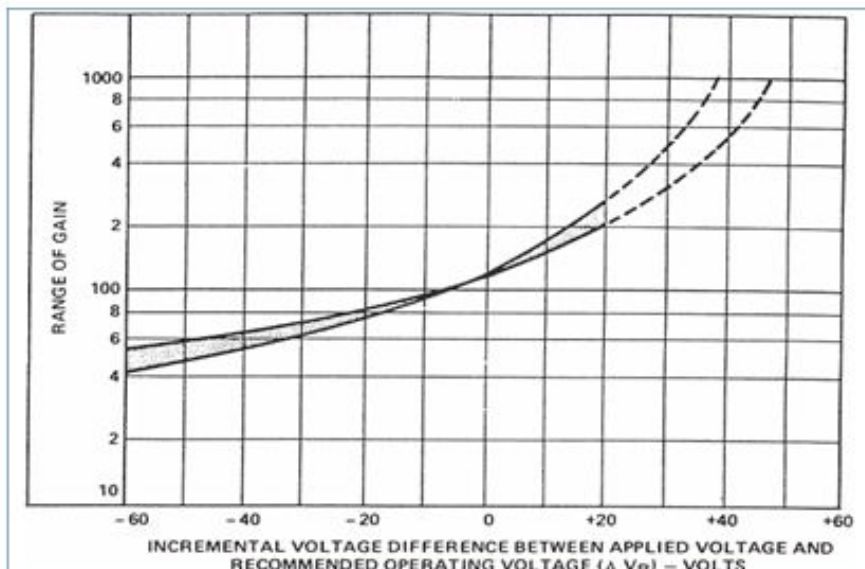
**Figure 9**  
Typical noise current vs. Gain



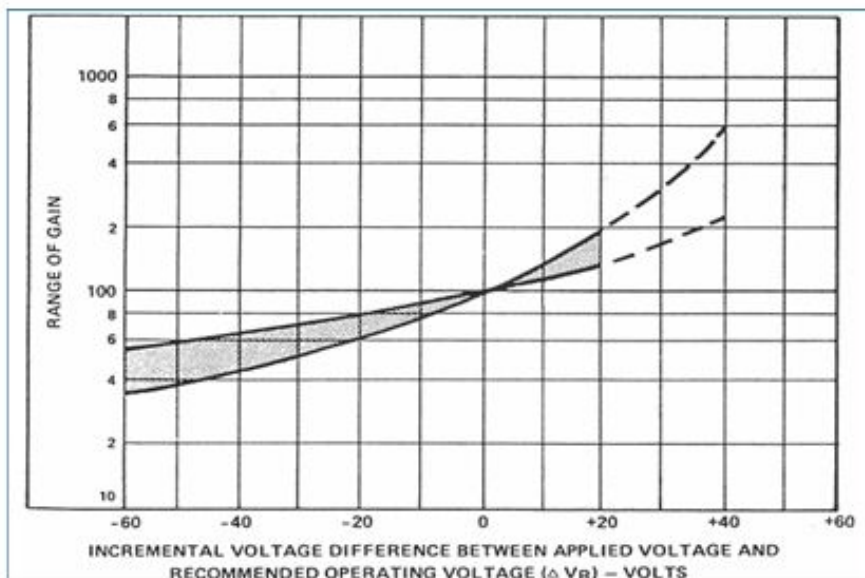
**Figure 10**  
Definition of Half-Angle approximate field of view.

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

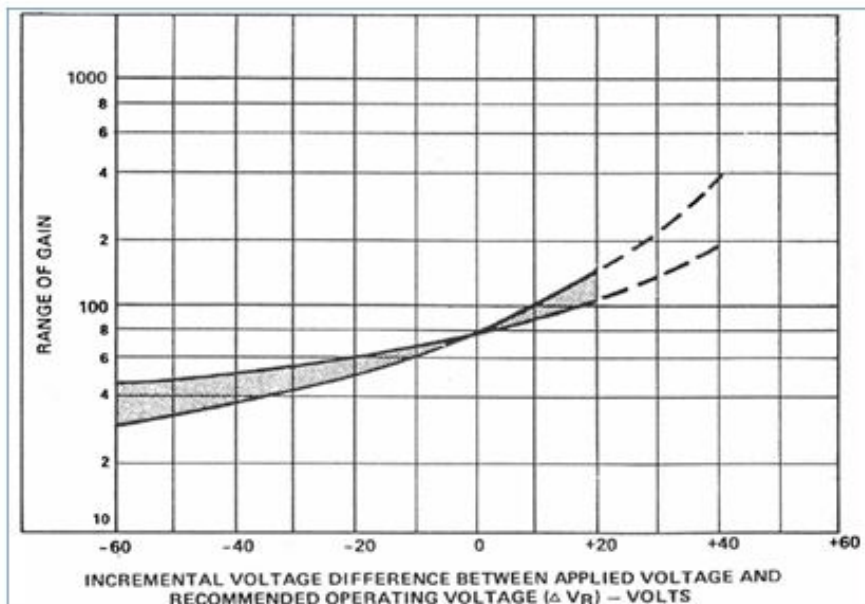
For incident radiation at angles  $> \alpha/2$ , but  $\leq \alpha'/2$ , the photosensitive surface is partially illuminated.



**Figure 11**  
Variation of Gain as a Function of  
Difference between Actual Applied  
Operating Voltage and  
Recommended Operating Voltage -  
C30954EH

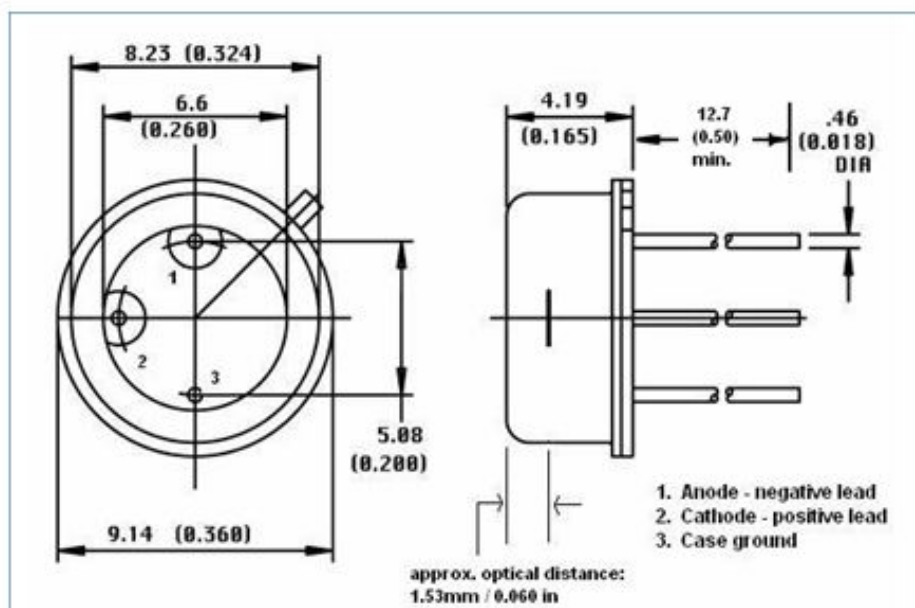


**Figure 12**  
Variation of Gain as a Function of  
Difference between Actual Applied  
Operating Voltage and  
Recommended Operating Voltage -  
C30955EH



**Figure 12**  
Variation of Gain as a Function of  
Difference between Actual Applied  
Operating Voltage and  
Recommended Operating Voltage -  
C30956EH



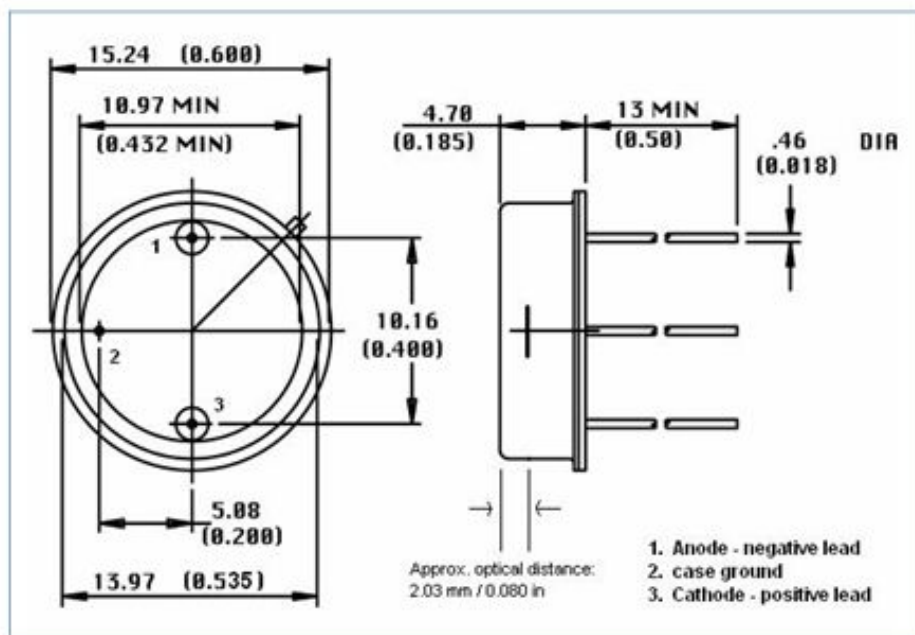


**Figure 13**

Dimensional Outline  
C30954EH, C30955EH Types

Low-Profile TO-5 Package

Dimensions in mm (inch)



**Figure 14**

Dimensional Outline  
C30956EH Type

Low-Profile TO-8 Package

Dimensions in mm (inch)

## ESD warning

APDs should only be handled at an ESD-safe work station.

## RoHS Compliance

This series of APDs are designed and built to be fully compliant with the European Union Directive 2002/95/EEC - Restriction of the use of certain Hazardous Substances in Electrical and Electronic equipment.



## Warranty

A standard 12-month warranty following shipment applies. Any warranty is null and void if the photodiode window has been opened.

## Excelitas - Your Partner of Choice

With a broad customer base in all major markets, built on ninety years of solid trust and cooperation with our customers, Excelitas is recognized as a reliable partner that delivers high quantity, customized, and superior "one-stop" solutions. Our products - from single photocells to complex x-ray inspection systems - meet the highest quality and environmental standards. Our worldwide Centres of Excellence, along with our Customer and Technical Support teams, always work with you to find the best solutions for your specific needs.

## About Excelitas

Excelitas is a global technology leader providing market-driven, integrated solutions for a wide range of applications, which leverage our lighting, sensors, and imaging expertise. Our technologies, services and support are fuelling the medical, genomic and digital revolutions by enhancing our customers' productivity, optimizing performance, and accelerating time to market. So contact us and put Excelitas's expertise to work in your demanding applications. We will show how our innovations will help you deliver the perfect product.

**North America**  
**Customer Support Hub**  
**Excelitas Technologies**  
 22001 Dumberry Road  
 Vaudreuil, QC J7V 8P7  
 Canada  
 Telephone: 1-450-424-3300  
 Fax: 1-450-424-3345  
[generalinquiries@excelitas.com](mailto:generalinquiries@excelitas.com)

**European Headquarters**  
**Excelitas Technologies**  
 Wenzel-Jaksch-Str. 31  
 65199 Wiesbaden, Germany  
 Telephone: (+49) 611-492-247  
 Fax: (+49) 611-492-170

**Asia Headquarters**  
**Excelitas Technologies**  
 47 Ayer Rajah Crescent #06-12  
 Singapore 139947  
 Telephone: (+65) 6775-2022  
 Fax: (+65) 6775-1008



For a complete listing of our global offices, visit [www.excelitas.com](http://www.excelitas.com)

©2011 Excelitas Technologies Corp. All rights reserved. The Excelitas logo and design are registered trademarks of Excelitas Technologies Corp. Excelitas reserves the right to change this document at any time without notice and disclaims liability for editorial, pictorial or typographical errors.

600251\_01 DTS0308