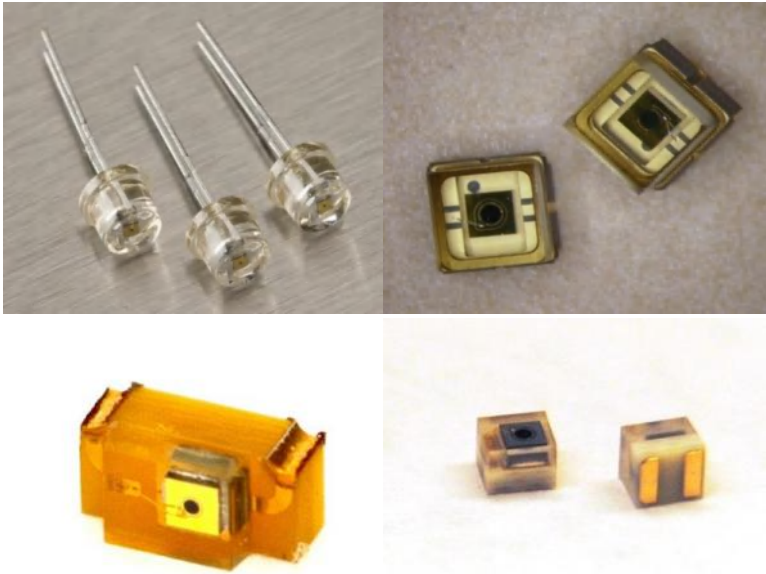


C30737PH, CH, LH, MH and EH Series

Silicon Avalanche Photodiodes (APDs) for LIDAR, range finding and laser meters – plastic, leadless ceramic and FR4 packages



Excelitas' C30737 Series APDs are ideally suited to automotive LIDAR, laser meter, laser range finding and area scanning applications, providing high responsivity in the 500 – 1000 nm range.

The Excelitas C30737 series silicon avalanche photodiodes (APDs) provide high responsivity between 500nm and 1000nm, as well as extremely fast rise times at all wavelengths with a cut-off frequency >1 GHz for some versions.

Standard versions of these APDs are available in two active area sizes: 230µm and 500µm diameter. They are offered in a metal TO-18 and plastic T1-¾ through-hole packages (C30737EH and PH), in leadless ceramic-carrier (LCC) surface-mount “side-looking” and “top-looking” packages (C30737CH and LH), and in a surface-mount “top-looking” leadless FR4 package (C30737MH). The EH and LH packages comes with clear glass or built-in 635nm, 650nm, or 905nm filter window versions. The MH package is only 1.75 x 2.0mm. These package varieties are ideally suited for high volume, cost-effective applications where a high gain APD is required.

The leadless, ceramic-carrier (LCC) SMD package parts (C30737CH, LH and MH series) are available in tape-and-reel pack for SMT-compatible, RoHS-compliant reflow soldering.

Customizations of these APDs are offered to meet your design challenges. Options for these APDs include breakdown voltage selection (binning).

Key Features

- High gain at low bias voltage
- Low breakdown voltage
- Fast response, $t_r \sim 200$ ps for high-speed applications
- Low noise ~ 0.1 pA/√Hz
- Optimized versions for high responsivity and high bandwidth
- Two standard diameters: 230µm and 500µm
- Built-in band-pass filter windows
- NEW ultra-compact and low-cost “MH” SMT package
- “Tape-and-Reel” packaging format for automated SMD pick-and-place

Applications

- Automotive LIDAR
- 905nm range-finding devices
- 635nm and 650nm laser meters
- Speed measurement
- Area scanners for safety, surveillance, automatic door opening
- Optical communication
- 3D laser scanning
- Gesture recognition

Epitaxial Silicon Avalanche Photodiodes – Through-hole and Leadless SMT packages

Table 1. Electrical Characteristics at $T_A = 22^\circ\text{C}$; at operating voltage- V_{op} – unfiltered devices

Parameter	C30737PH-230-80 C30737CH-230-80 C30737LH-230-80 C30737MH-230-80 C30737EH-230-80			C30737PH-500-80 C30737CH-500-80 C30737LH-500-80 C30737MH-500-80 C30737EH-500-80			Unit
	Min	Typical	Max	Min	Typical	Max	
Active Area Diameter	230			500			μm
Peak Sensitivity Wavelength	800			800			nm
Breakdown Voltage, V_{BR}	120		210	120		210	V
Temperature Coefficient of V_R , for Constant M	-	0.5	-	-	0.5	-	$V/^\circ\text{C}$
Gain (M) @ 800nm	-	100	-	-	100	-	
Responsivity @ 800 nm	-	50	-	-	50	-	A/W
Total Dark Current, I_d	-	0.05	0.5	-	0.1	1	nA
Noise Current, I_n , $f=10\text{kHz}$, $\Delta f=1.0\text{Hz}$	-	0.1	-	-	0.1	-	pA/ $\sqrt{\text{Hz}}$
Capacitance, C_d	-	1	-	-	2	-	pF
Rise + Fall Time, $R_L=50\ \Omega$, 10%-90%-10% points	-	0.2	-	-	0.3	-	ns
Cut-off frequency (-3 dB)	-	1.5	-	-	1.3	-	GHz
Storage Temperature	-50		+100	-50		+100	$^\circ\text{C}$
Operating Temperature	-40		+85	-40		+85	$^\circ\text{C}$

Parameter	C30737PH-230-90 C30737CH-230-90 C30737LH-230-90 C30737MH-230-90 C30737EH-230-90			C30737PH-500-90 C30737CH-500-90 C30737LH-500-90 C30737MH-500-90 C30737EH-500-90			Unit
	Min	Typical	Max	Min	Typical	Max	
Active Area Diameter	230			500			μm
Peak Sensitivity Wavelength	900			900			nm
Breakdown Voltage, V_{BR}	180		260	180		260	V
Temperature Coefficient of V_R , for Constant M		1.3			1.3		$V/^\circ\text{C}$
Gain (M) @ 900 nm	-	100	-		100		
Responsivity @ 900 nm	55	60	-	55	60		A/W
Total Dark Current, I_d	-	0.05	0.5		0.1	1	nA
Noise Current, i_n , $f=10\text{kHz}$, $\Delta f=1.0\text{Hz}$	-	0.1	-	-	0.1	-	pA/ $\sqrt{\text{Hz}}$
Capacitance, C_d	-	0.6	-	-	1	-	pF
Rise & Fall Time, $R_L=50\ \Omega$, 10%-90%-10% points	-	0.9	-		0.9	-	ns
Cut-off frequency (-3 dB)	-	380	-	-	380	-	MHz
Storage Temperature	-50		+100	-50		+100	$^\circ\text{C}$
Operating Temperature	-40		+85	-40		+85	$^\circ\text{C}$

Epitaxial Silicon Avalanche Photodiodes – Through-hole and Leadless SMT packages

Table 2. Electrical Characteristics at $T_A = 22\text{ }^{\circ}\text{C}$; at operating voltage- V_{op} – devices with optical bandpass filters

Parameter	C30737LH-230-81 (635nm filter #1)			C30737LH-500-81 (635nm filter #1)			Unit
	Min	Typical	Max	Min	Typical	Max	
Active Area Diameter	230			500			μm
Peak Sensitivity Wavelength	635			635			nm
Breakdown Voltage, V_{BR}	120		210	120		210	V
Temperature Coefficient of V_R , for Constant M	-	0.5	-	-	0.5	-	$\text{V}/^{\circ}\text{C}$
Gain (M) @ 635 nm	-	100	-	-	100	-	
Responsivity @ 635 nm	-	35	-	-	35	-	A/W
Total Dark Current, I_d	-	0.05	0.5	-	0.1	1	nA
Noise Current, i_n , $f=10\text{kHz}$, $\Delta f=1.0\text{Hz}$	-	0.1	-	-	0.1	-	pA/ $\sqrt{\text{Hz}}$
Capacitance, C_d	-	1	-	-	2	-	pF
Rise & Fall Time, $R_L=50\text{ }\Omega$, 10%-90%-10% points	-	0.2	-	-	0.3	-	ns
Cut-off frequency (-3 dB)	-	1.5	-	-	1.3	-	GHz
Storage Temperature	-50		+100	-50		+100	$^{\circ}\text{C}$
Operating Temperature	-40		+85	-40		+85	$^{\circ}\text{C}$

Parameter	C30737LH-230-92 C30737EH-230-92 (905nm filter #2)			C30737LH-500-92 C30737EH-500-92 (905nm filter #2)			Unit
	Min	Typical	Max	Min	Typical	Max	
Active Area Diameter	230			500			μm
Peak Sensitivity Wavelength	905			905			nm
Breakdown Voltage, V_{BR}	180		260	180		260	V
Temperature Coefficient of V_R , for Constant M		1.3			1.3		$\text{V}/^{\circ}\text{C}$
Gain (M) @ 900nm	-	100	-		100		
Responsivity @ 900 nm	55	60	-	55	60		A/W
Total Dark Current, I_d	-	0.05	0.5		0.1	1	nA
Noise Current, i_n , $f=10\text{kHz}$, $\Delta f=1.0\text{Hz}$	-	0.1	-	-	0.1	-	pA/ $\sqrt{\text{Hz}}$
Capacitance, C_d	-	0.6	-	-	1	-	pF
Rise & Fall Time, $R_L=50\text{ }\Omega$, 10%-90%-10% points	-	0.9	-	-	0.9	-	ns
Cut-off frequency (-3 dB)	-	380	-	-	380	-	MHz
Storage Temperature	-50		+100	-50		+100	$^{\circ}\text{C}$
Operating Temperature	-40		+85	-40		+85	$^{\circ}\text{C}$

Epitaxial Silicon Avalanche Photodiodes – Through-hole and Leadless SMT packages

Parameter	C30737LH-230-83 (650nm filter #3)			C30737LH-500-83 (650nm filter #3)			Unit
	Min	Typical	Max	Min	Typical	Max	
Active Area Diameter	230			500			μm
Peak Sensitivity Wavelength	650			650			nm
Breakdown Voltage, V_{BR}	120		210	120		210	V
Temperature Coefficient of V_R , for Constant M	-	0.5	-	-	0.5	-	V/°C
Gain (M) @ 650 nm	-	100	-	-	100	-	
Responsivity @ 650 nm	-	35	-	-	35	-	A/W
Total Dark Current, I_d	-	0.05	0.5	-	0.1	1	nA
Noise Current, i_n , $f=10\text{kHz}$, $\Delta f=1.0\text{Hz}$	-	0.1	-	-	0.1	-	pA/√Hz
Capacitance, C_d	-	1	-	-	2	-	pF
Rise & Fall Time, $R_L=50\ \Omega$, 10%-90%-10% points	-	0.2	-	-	0.3	-	ns
Cut-off frequency (-3 dB)	-	1.5	-	-	1.3	-	GHz
Storage Temperature	-50		+100	-50		+100	°C
Operating Temperature	-40		+85	-40		+85	°C

Table 3. Filter Transmission Characteristics

Filter #	1	2	3	
Nominal center wavelength	635nm ^{note 1}	905nm ^{note 2}	650nm ^{note 3}	Transmission ≥ 85%
Transmission window	623...652nm		638...669nm	Transmission ≥ 85%
50% cut-on wavelength	606...617nm	870...890nm	622...634nm	
50% cut-off wavelength	657...669nm	929...949nm	673...685nm	
Average transmission from 300 nm to bandpass region	<1% @ <593nm	<1% @ <850nm	<1% @ <608nm	
Average transmission from bandpass region to 1100 nm	<1% @ >682nm	<1% @ >979nm	<1% @ >699nm	
Wavelength drift	<+0.5nm/°C	<+0.5nm/°C	<+0.5nm/°C	for range -10°C...+50°C
Typical filter thickness	0.3mm	0.3mm	0.3mm	Material: Borosilicate glass

Notes:

1. The 635nm filter is designed to work optimally with the 635nm red laser commonly used in laser meters or laser pointers.
2. The 905nm filter is designed to work optimally with the Excelitas 905nm Pulse Laser Diodes PGEW and PGA series.
3. The 650nm filter is designed to work optimally with the 650nm red laser commonly used in laser meters or laser pointers.

Epitaxial Silicon Avalanche Photodiodes – Through-hole and Leadless SMT packages

Figure 1–Typical Responsivity vs. wavelength.

800nm PSW = APD with 800nm peak sensitivity wavelength; 900nm PSW = APD with 900nm peak sensitivity wavelength

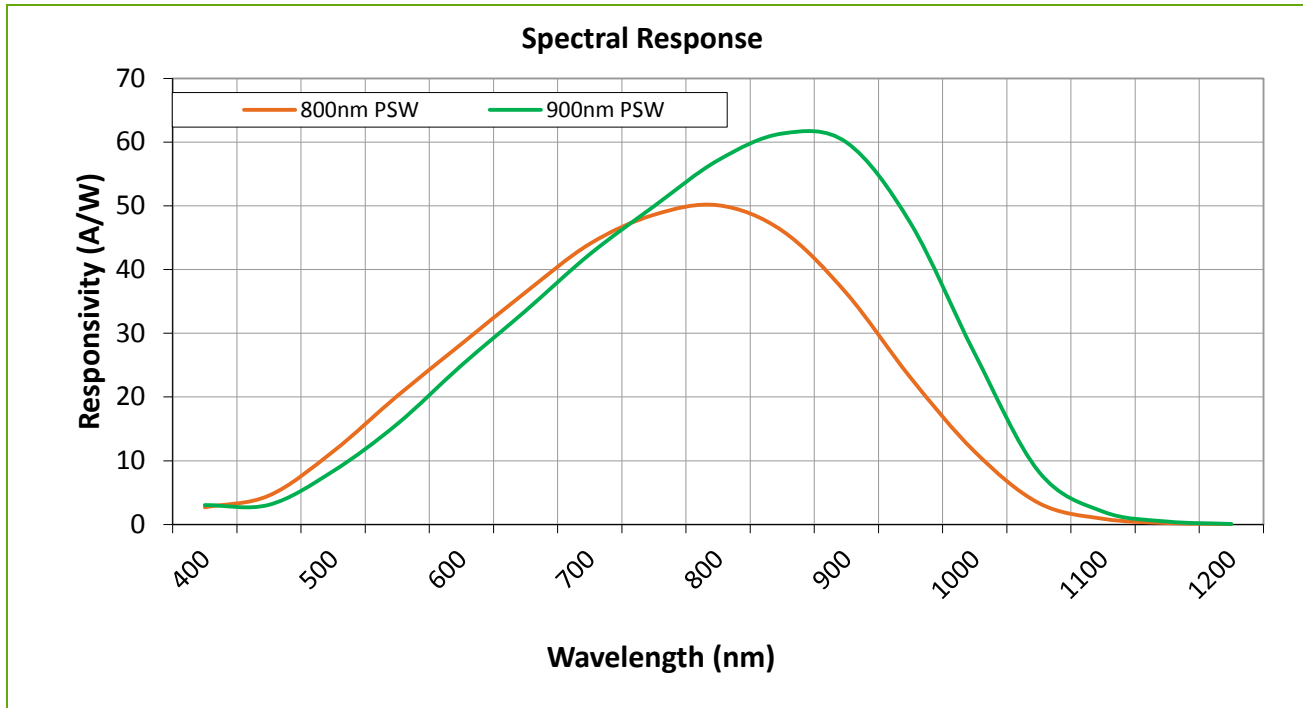
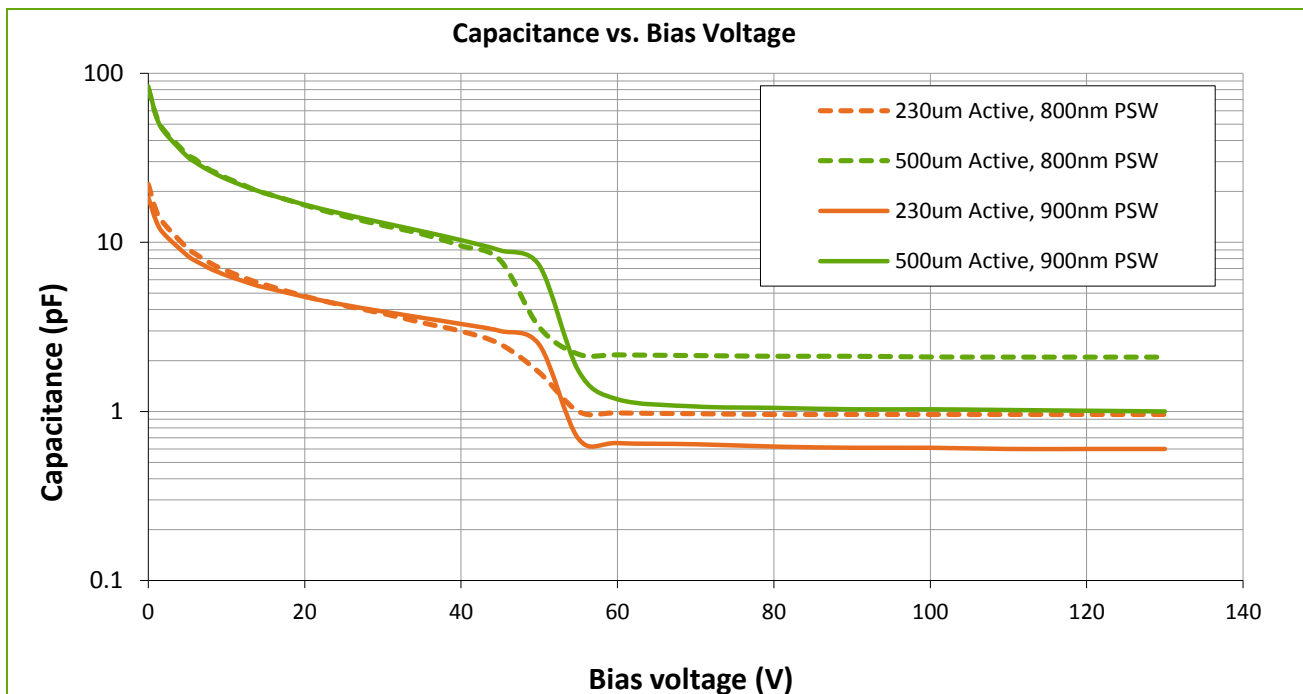


Figure 2– Typical capacitance vs. bias voltage



C30737PH, CH, LH, MH and EH Series

Epitaxial Silicon Avalanche Photodiodes – Through-hole and Leadless SMT packages

Figure 3–Typical response vs. wavelength for a 635nm filtered APD

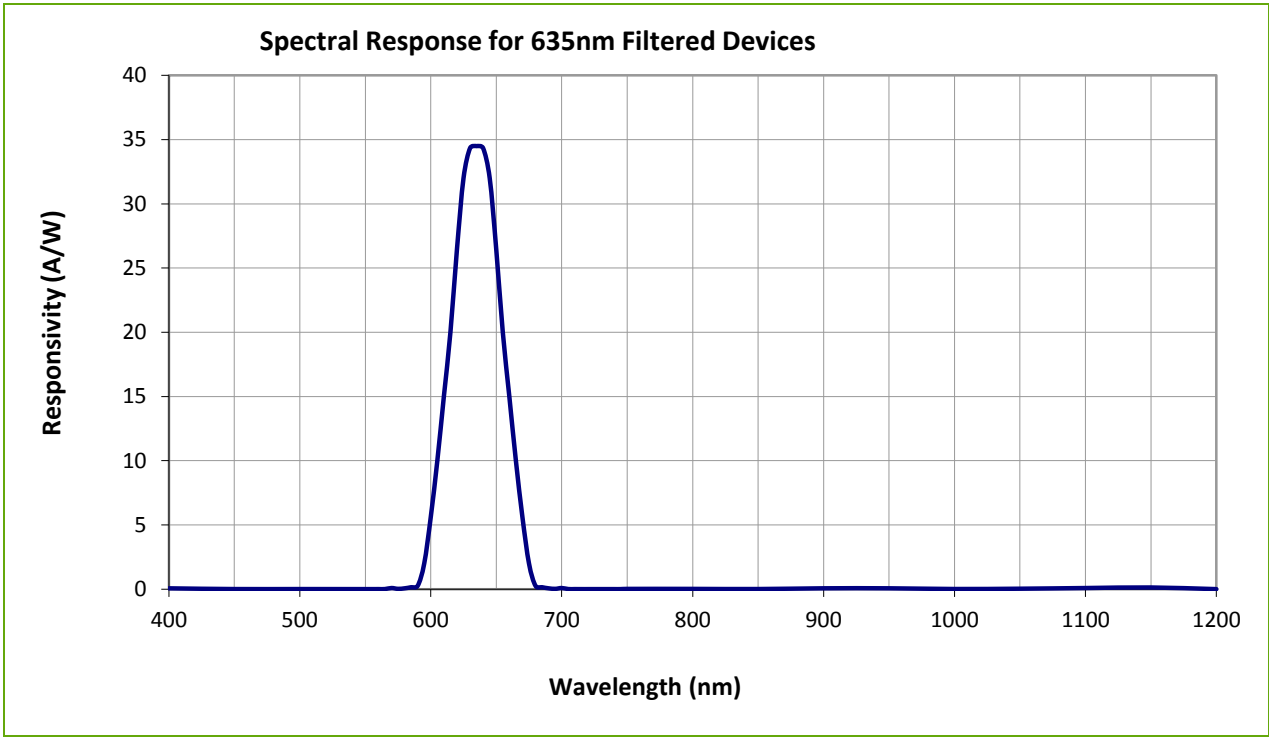


Figure 4 - Typical response vs. wavelength for a 905nm filtered APD

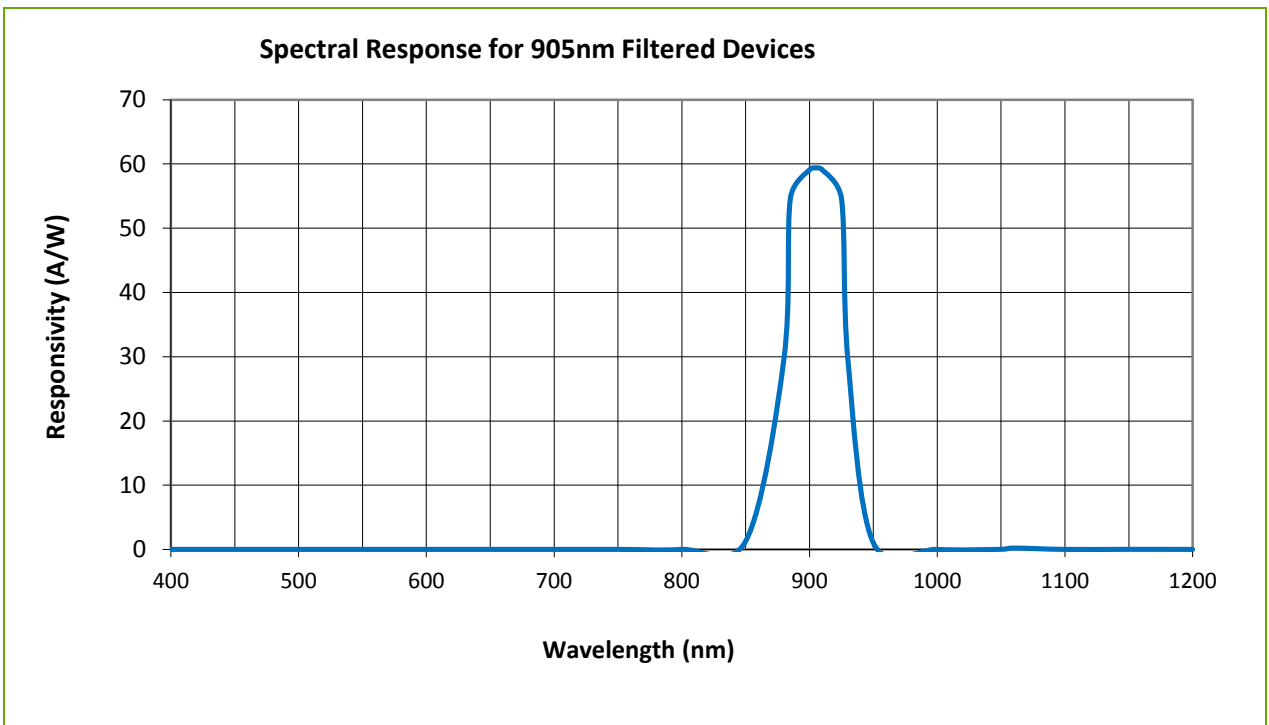


Figure 5 – Typical gain vs. bias voltage for 800nm peak sensitivity wavelength types

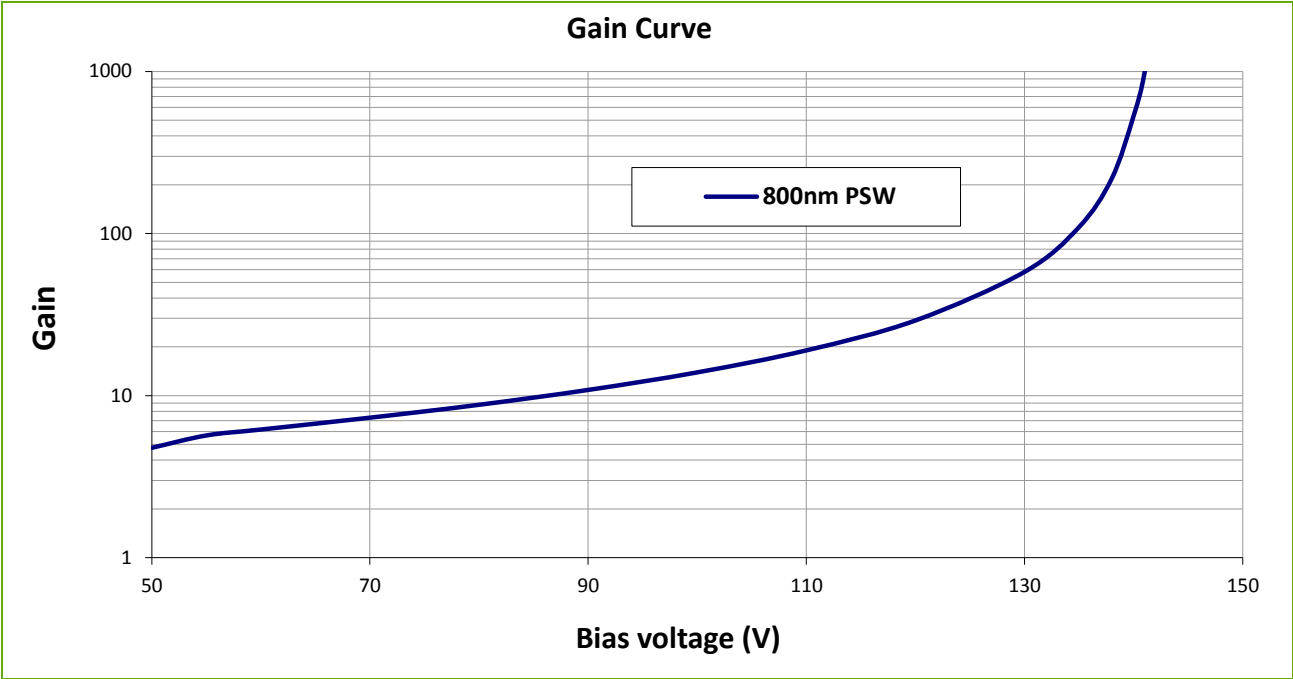
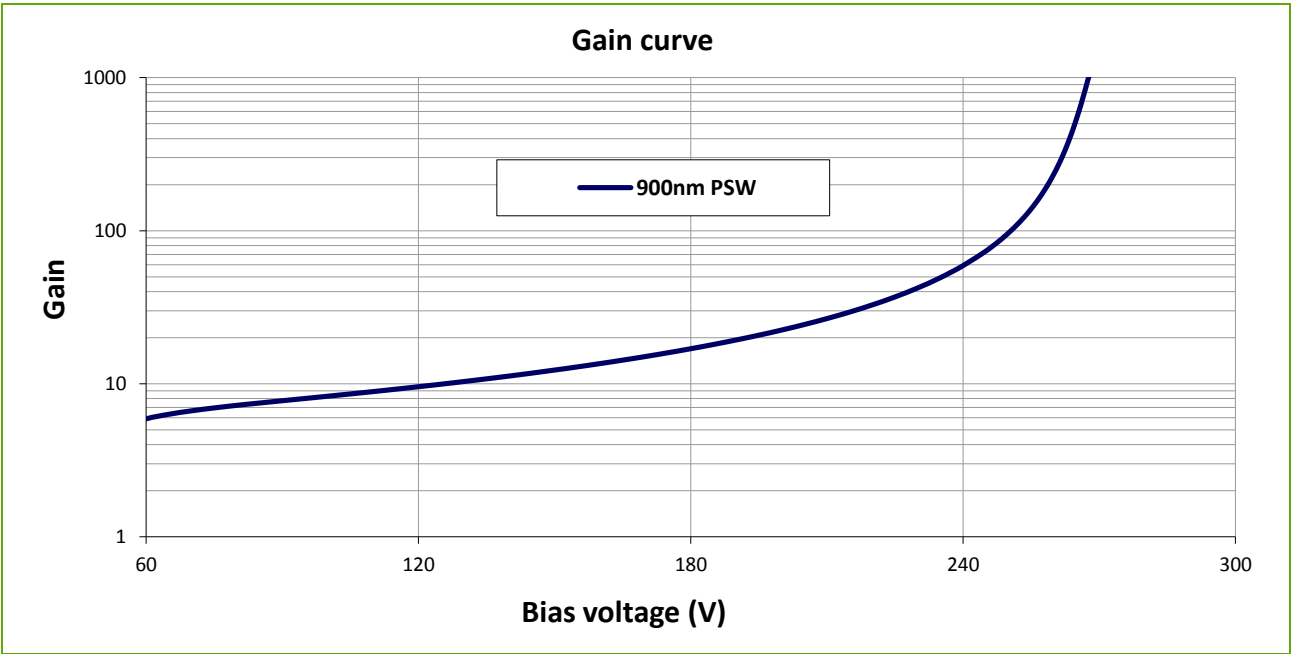


Figure 6 – Typical gain vs. bias voltage for 900nm peak sensitivity wavelength types



Epitaxial Silicon Avalanche Photodiodes – Through-hole and Leadless SMT packages

Figure 7– Plastic T 1 ¾ through-hole PH package. Dimensions in mm [inches].

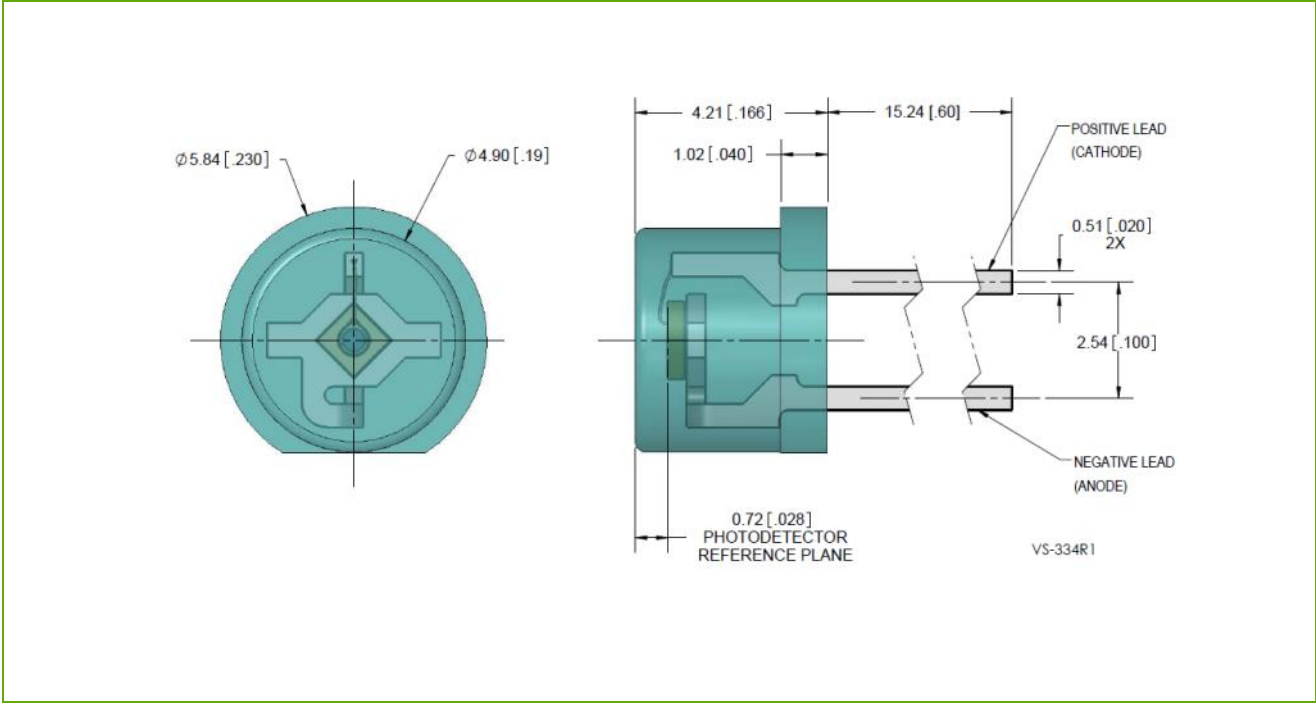
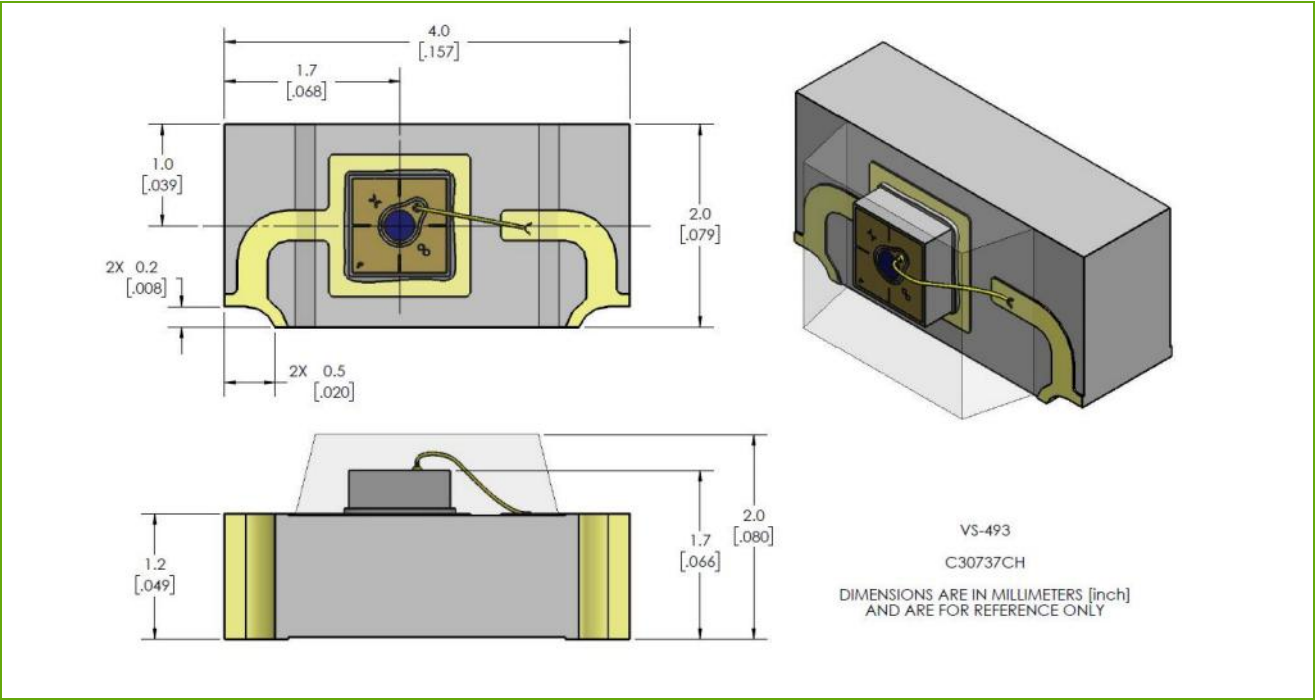


Figure 8 – Leadless ceramic carrier (LCC) side-looking CH package. Dimensions in mm [inches]



Epitaxial Silicon Avalanche Photodiodes – Through-hole and Leadless SMT packages

Figure 9 – Flat window hermetic TO-18 package dimension in mm (inches)

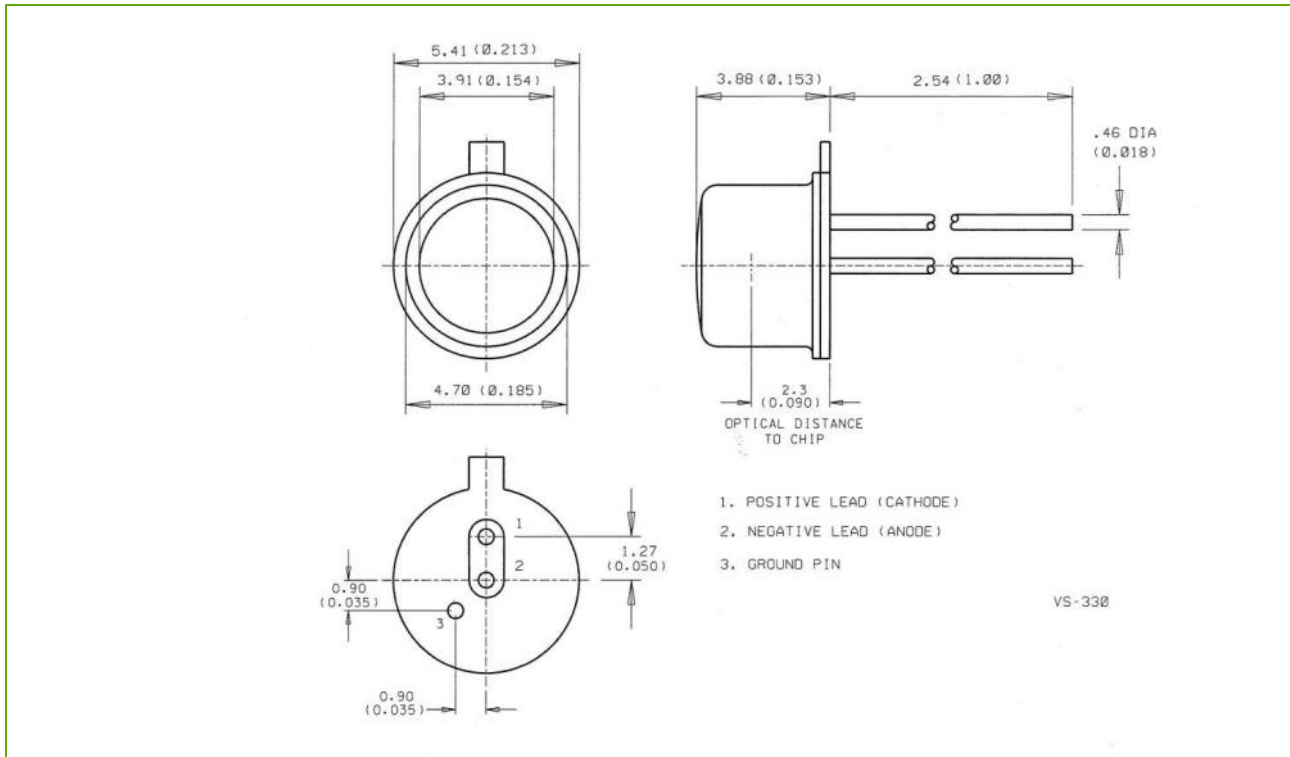
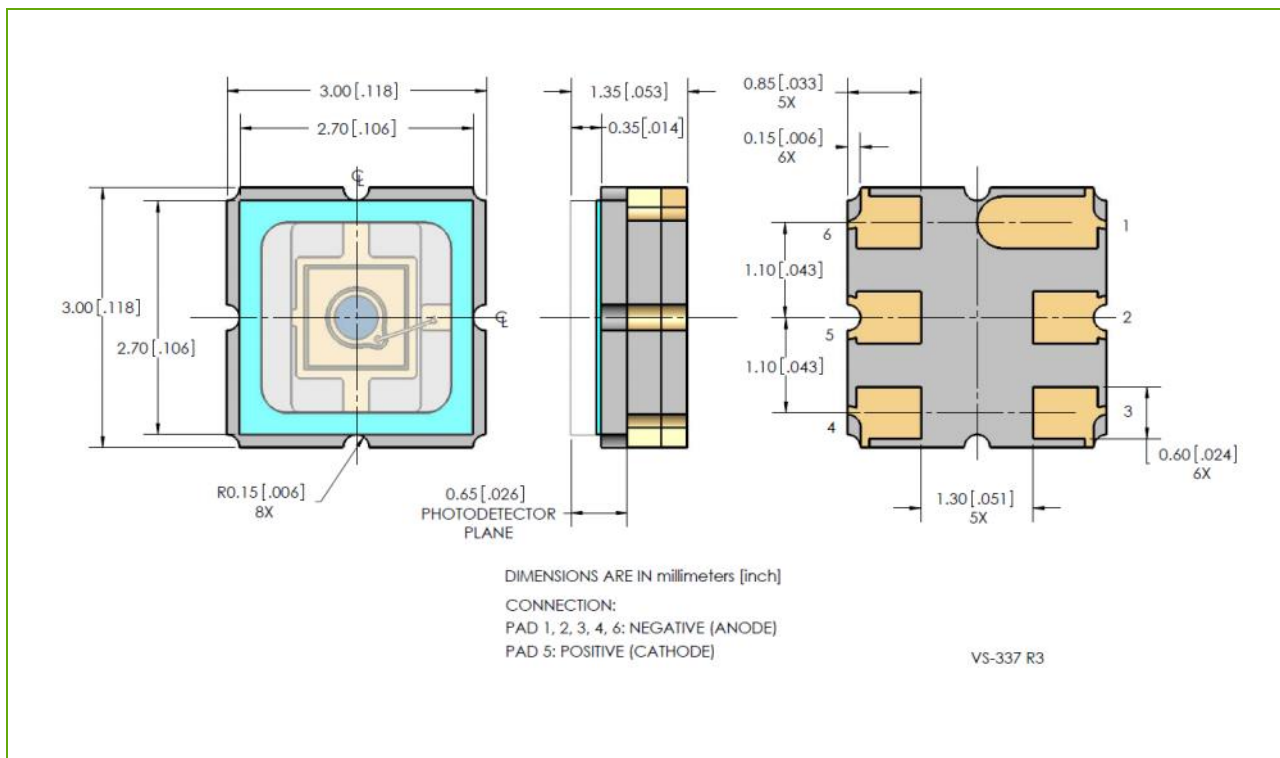
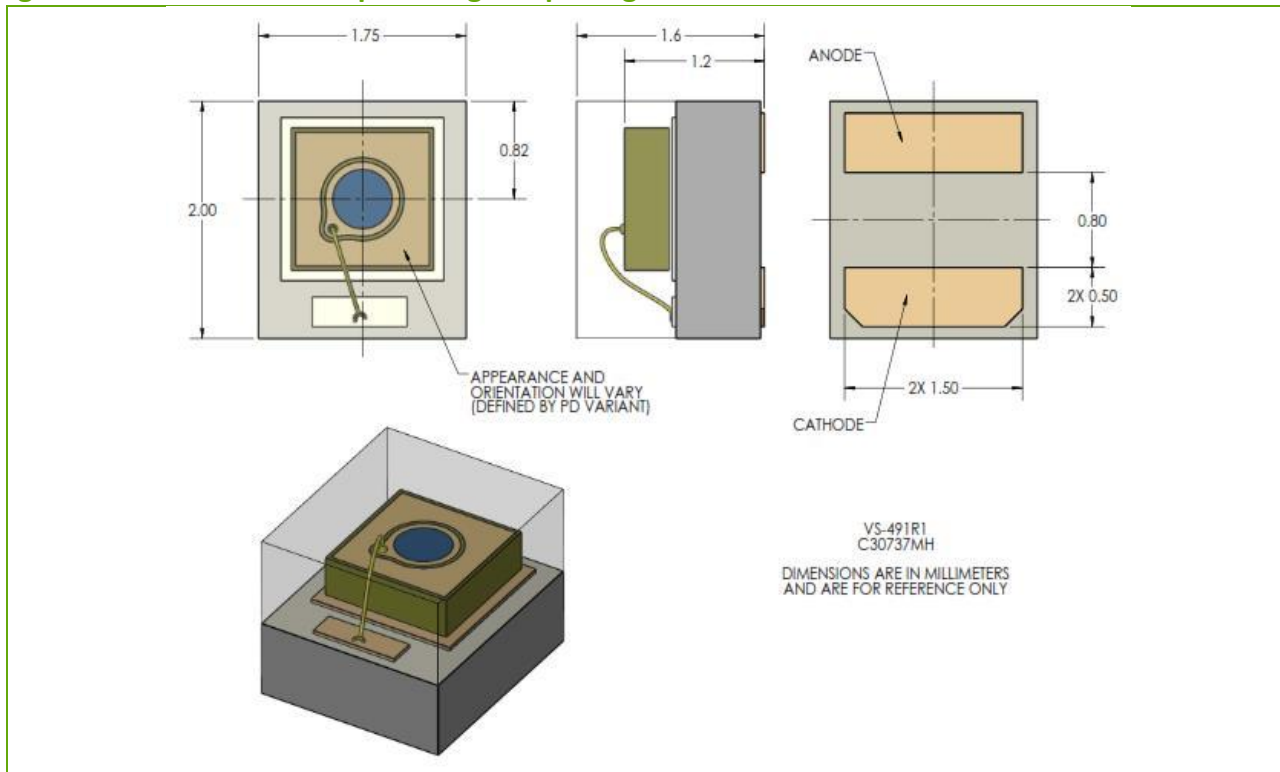


Figure 10 – Leadless ceramic carrier (LCC) top-looking LH package. Dimensions in mm [inches]



Epitaxial Silicon Avalanche Photodiodes – Through-hole and Leadless SMT packages

Figure 11 – Leadless FR4 top-looking MH package. Dimensions in mm



Epitaxial Silicon Avalanche Photodiodes – Through-hole and Leadless SMT packages

Table 4– Ordering Guide

	C30737	AA -	BBB -	C	D ⁽¹⁾	E ⁽²⁾⁽³⁾
Epitaxial structure Si APD	C30737					
Plastic TO-18 can (P-package)		PH -				
Flat window hermetic TO-18 package		EH				
Leadless ceramic carrier side-looking package		CH -				
Leadless ceramic carrier (3 x 3 mm ² LCC) top-looking package		LH -				
Ultra-compact (1.75 x 2 mm) FR4 top-looking package		MH-				
Active area diameter = 230 µm			230 -			
Active area diameter = 500 µm			500 -			
Optimum chip response λ @ 800 nm				8		
Optimum chip response λ @ 900 nm				9		
No filter					0	
With 635 nm filter					1	
With 905 nm filter					2	
With 650 nm filter					3	
V _{bd} = 120 - 160 V						A
V _{bd} = 160 - 200 V						B
V _{bd} = 180 - 220 V						C
V _{bd} = 220 - 260 V						D
V _{bd} = whole V _{bd} range (no V _{bd} binning)						N

(1) Filter option is only available for the LCC (LH) package option.

(2) V_{bd} binning /screening is available in these options:

A and B are available for APD with optimum response λ @ 800nm

C and D are available for APD with optimum response λ @ 900nm

N is available for all types

(3) Bandwidth tends to be lower for lower voltage bins. Contact factory for further information.

(4) For binning please allow 2 V overlap between bins for the 800nm versions and 5 V for the 900nm versions.

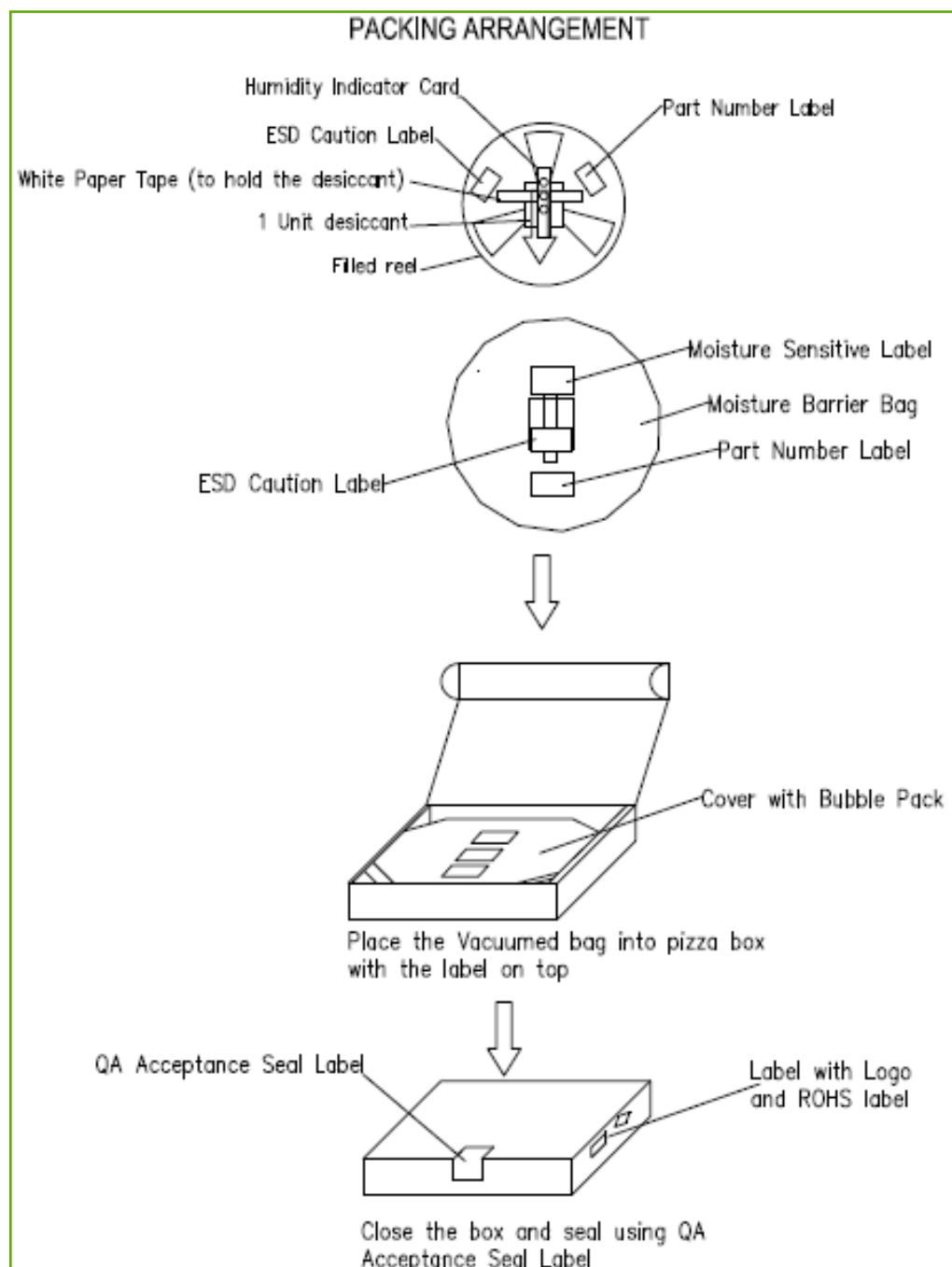
Example: C30737LH-230-92C: A C30737 in the 3 x 3mm ceramic carrier package, with optimum 900nm response wavelength, with 905nm filter and selected for V_{bd} of 180V - 220V.

Epitaxial Silicon Avalanche Photodiodes – Through-hole and Leadless SMT packages

Tape-and-Reel Shipping Pack Option

All the C30737LH (leadless ceramic carrier SMD package) series are offered in the tape-and-reel shipping pack option for quantities of 3000 units per reel; as shown in Figure 11 and 12. This packing option should be indicated at the time of order placement.

Figure 12– Tape-and-reel packing specification



Epitaxial Silicon Avalanche Photodiodes – Through-hole and Leadless SMT packages

Figure 13– Tape-and-reel device carrier specification

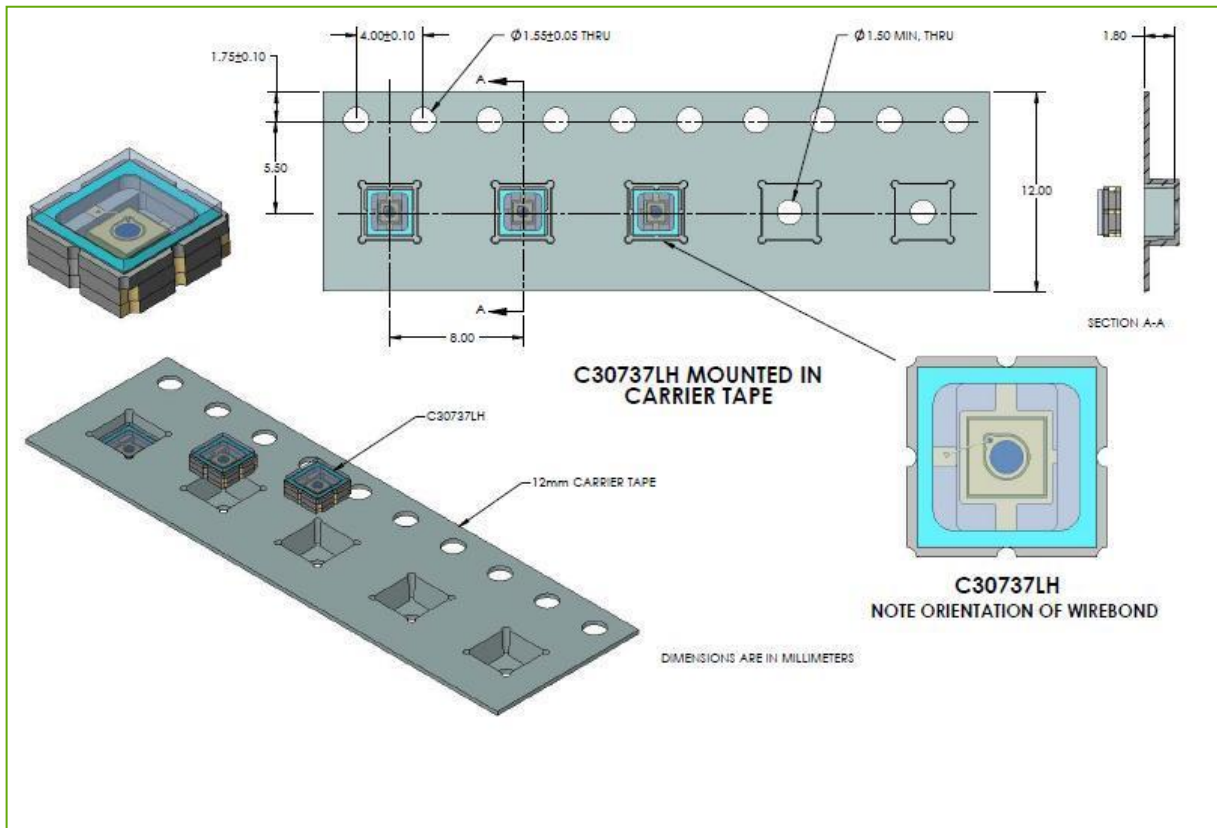
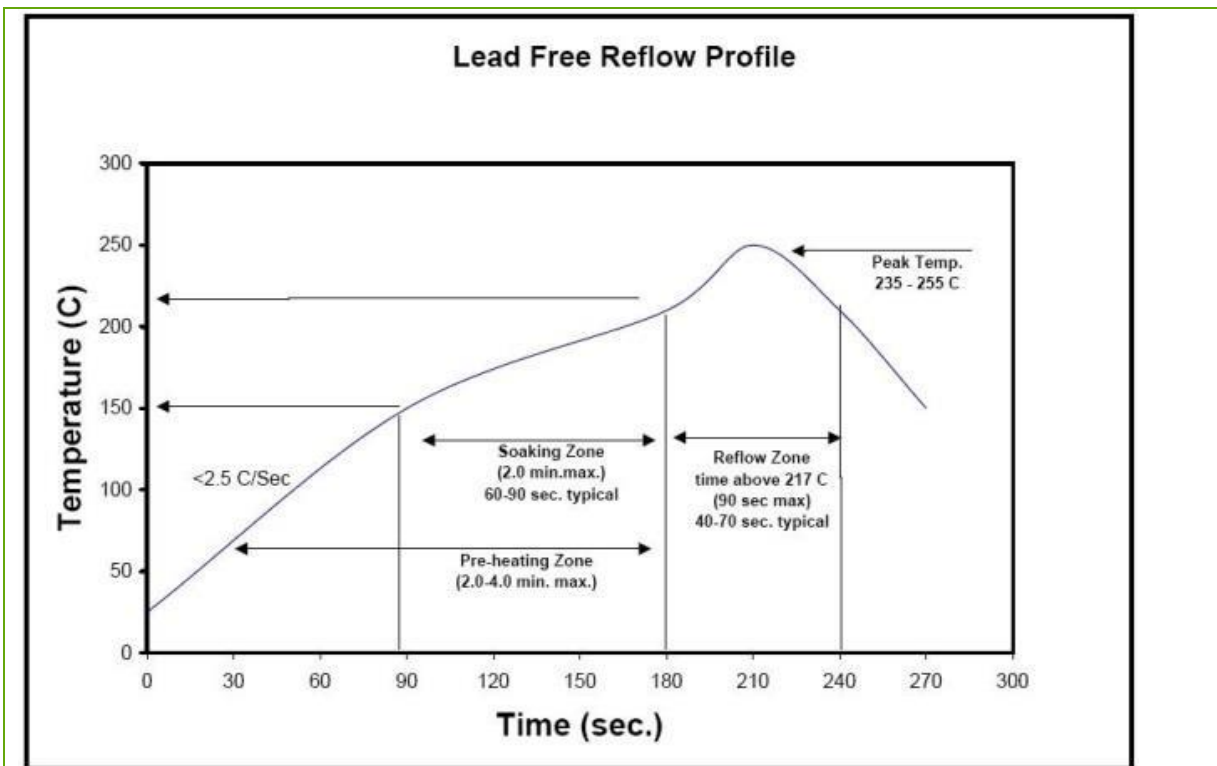


Figure 14 – Solder Reflow Diagram



Epitaxial Silicon Avalanche Photodiodes – Through-hole and Leadless SMT packages

RoHS Compliance

This series of APDs is designed and built to be fully compliant with the European Union Directive 2011/65/EU – Restriction of the use of certain Hazardous Substances (RoHS) in Electrical and Electronic equipment.



Warranty

A standard 12-month warranty following shipment applies.

About Excelitas Technologies

Excelitas Technologies is a global technology leader focused on delivering innovative, customized solutions to meet the lighting, detection and other high-performance technology needs of OEM customers.

Excelitas has a long and rich history of serving our OEM customer base with optoelectronic sensors and modules for more than 45 years beginning with PerkinElmer, EG&G, and RCA. The constant throughout has been our innovation and commitment to delivering the highest quality solutions to our customers worldwide.

From aerospace and defense to analytical instrumentation, clinical diagnostics, medical, industrial, and safety and security applications, Excelitas Technologies is committed to enabling our customers' success in their specialty end-markets. Excelitas Technologies has approximately 3,000 employees in North America, Europe and Asia, serving customers across the world.

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