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Tel: +86-755-8981 8866 Fax: +86-755-8427 6832
Email & Skype: info@chipsmall.com Web: www.chipsmall.com
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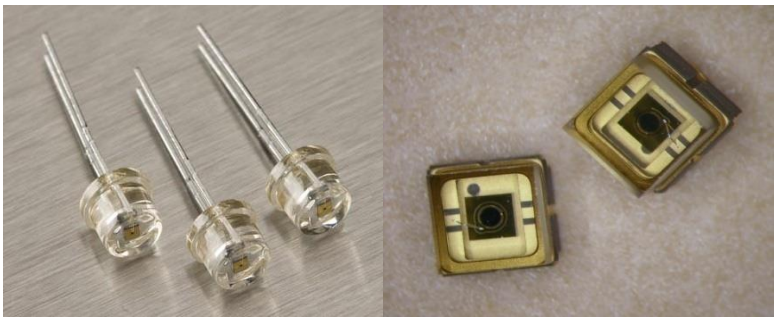
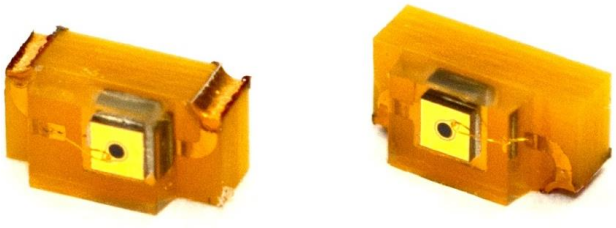
C30737PH, CH and LH Series

Silicon Avalanche Photodiodes (APDs) for LIDAR, range finding and laser meters – plastic and leadless ceramic carrier 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: 0.23 mm and 0.5 mm diameter. They are offered in a plastic through-hole T1-¾ package (C30737PH) and in leadless ceramic-carrier (LCC) surface-mount "side-looking" and "top-looking" packages (C30737CH and LH). The LH package comes with clear glass or built-in 635nm, 650nm, or 905nm filter window versions. 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 and LH 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 ~ 200 ps for high-speed applications
- Low noise ~ 0.1pA/√ Hz
- Optimized versions for high responsivity and high bandwidth
- Two standard diameters: 230µm and 500µm
- Built-in band-pass filter windows
- "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

Table 1. Electrical Characteristics at T_A = 22 °C; at operating voltage-V_{op} – unfiltered devices

Parameter	C30737PH-230-80 C30737CH-230-80 C30737LH-230-80			C30737PH-500-80 C30737CH-500-80 C30737LH-500-80			
	Min	Typical	Max	Min	Typical	Max	Unit
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/°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, $I_{n,\ f=10kHz,\ \Delta f=1.0Hz}$	-	0.1	-	-	0.1	-	pA/√Hz
Capacitance, C_d	-	1	-	-	2	-	pF
Rise + Fall Time, R_L=50 Ω, 10%-90%-10% points	-	0.2	-	-	0.3	-	ns
Cut-off frequency (-3 dB)	-	1.5	-	-	1.3	-	GHz
Storage Temperature	-40		+100	-40		+100	°C
Operating Temperature	-20		+60	-20		+60	°C

Parameter	C30737PH-230-90 C30737CH-230-90 C30737LH-230-90			C30737PH-500-90 C30737CH-500-90 C30737LH-500-90			
	Min	Typical	Max	Min	Typical	Max	Unit
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/°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, $i_{n,\ f=10kHz,\ \Delta f=1.0Hz}$	-	0.1	-	-	0.1	-	pA/√Hz
Capacitance, C_d	-	0.6	-	-	1	-	pF
Rise & Fall Time, R_L=50 Ω, 10%-90%-10% points	-	0.9	-		0.9	-	ns
Cut-off frequency (-3 dB)	-	380	-	-	380	-	MHz
Storage Temperature	-40		+100	-40		+100	°C
Operating Temperature	-20		+60	-20		+60	°C

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

Parameter	C30737LH-230-81 (635nm filter #1)			C30737LH-500-81 (635nm filter #1)			
	Min	Typical	Max	Min	Typical	Max	Unit
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	-	V/°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, $i_{n,\ f=10kHz,\ \Delta f=1.0Hz}$	-	0.1	-	-	0.1	-	pA/√Hz
Capacitance, C_d	-	1	-	-	2	-	pF
Rise & Fall Time, R_L=50 Ω, 10%-90%-10% points	-	0.2	-	-	0.3	-	ns
Cut-off frequency (-3 dB)	-	1.5	-	-	1.3	-	GHz
Storage Temperature	-40		+100	-40		+100	°C
Operating Temperature	-20		+60	-20		+60	°C

Parameter	C30737LH-230-92 (905nm filter #2)			C30737LH-500-92 (905nm filter #2)			
	Min	Typical	Max	Min	Typical	Max	Unit
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		V/°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, $i_{n,\ f=10kHz,\ \Delta f=1.0Hz}$	-	0.1	-	-	0.1	-	pA/√Hz
Capacitance, C_d	-	0.6	-	-	1	-	pF
Rise & Fall Time, R_L=50 Ω, 10%-90%-10% points	-	0.9	-	-	0.9	-	ns
Cut-off frequency (-3 dB)	-	700	-	-	580	-	MHz
Storage Temperature	-40		+100	-40		+100	°C
Operating Temperature	-20		+60	-20		+60	°C

Parameter	C30737LH-230-83 (650nm filter #3)			C30737LH-500-83 (650nm filter #3)			
	Min	Typical	Max	Min	Typical	Max	Unit
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, $i_{n,\ f=10kHz,\ \Delta f=1.0Hz}$	-	0.1	-	-	0.1	-	pA/√Hz
Capacitance, C_d	-	1	-	-	2	-	pF
Rise & Fall Time, R_L=50 Ω, 10%-90%-10% points	-	0.2	-	-	0.3	-	ns
Cut-off frequency (-3 dB)	-	1.5	-	-	1.3	-	GHz
Storage Temperature	-40		+100	-40		+100	°C
Operating Temperature	-20		+60	-20		+60	°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 950nm 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.

Figure 1–Typical Responsivity vs. wavelength.

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

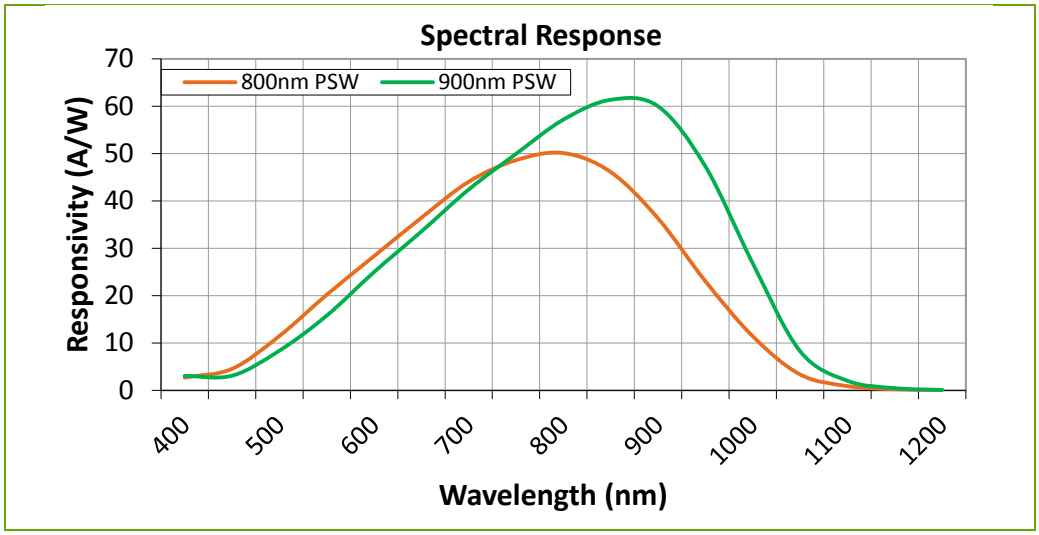


Figure 2– Typical capacitance vs. bias voltage

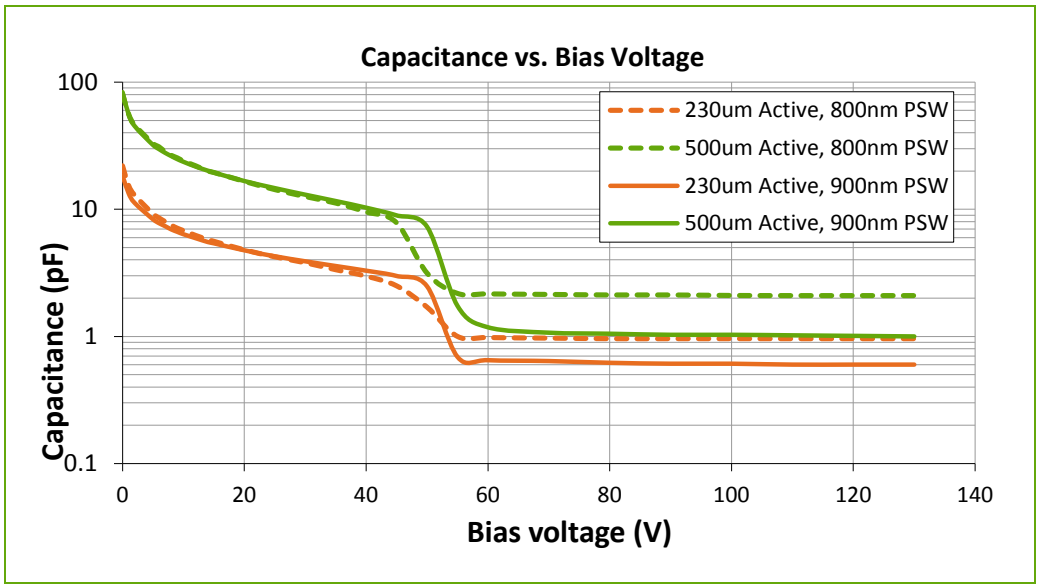


Figure 3–Typical response vs. wavelength for a 635nm filtered APD

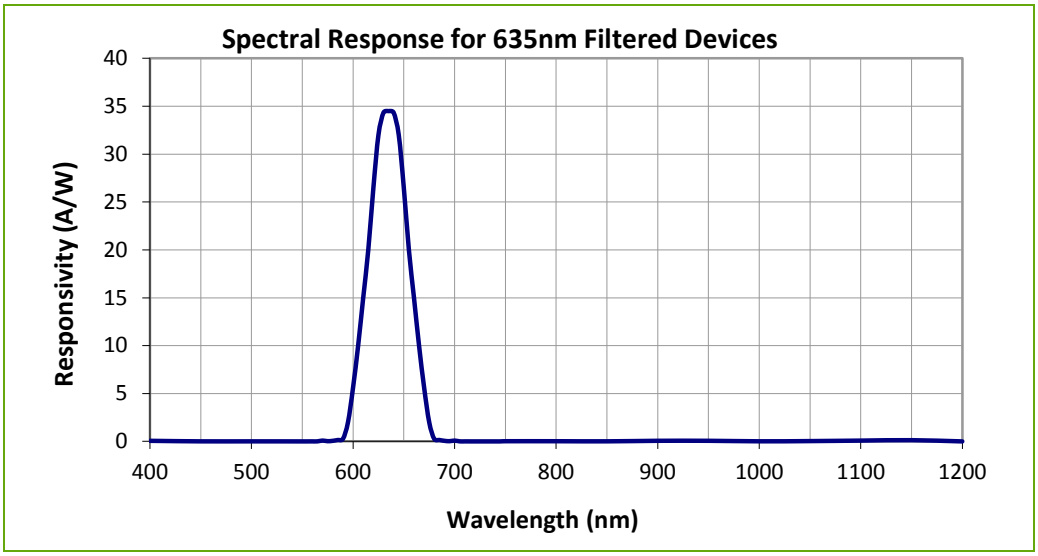


Figure 4 Typical response vs. wavelength for a 905nm filtered APD

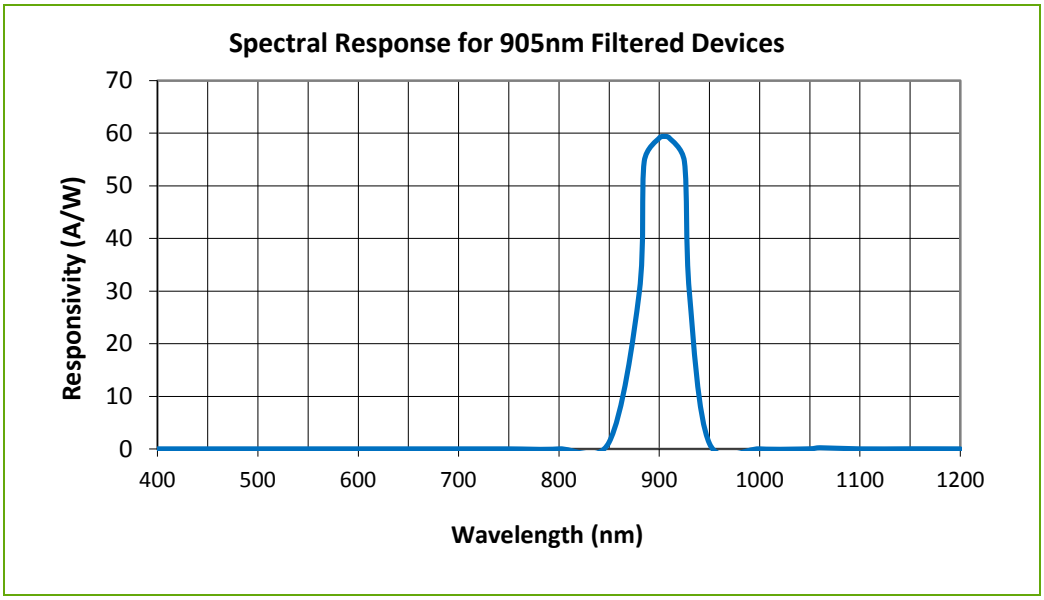


Figure 5–Typical gain vs. bias voltage for 800nm peak sensitivity wavelength types

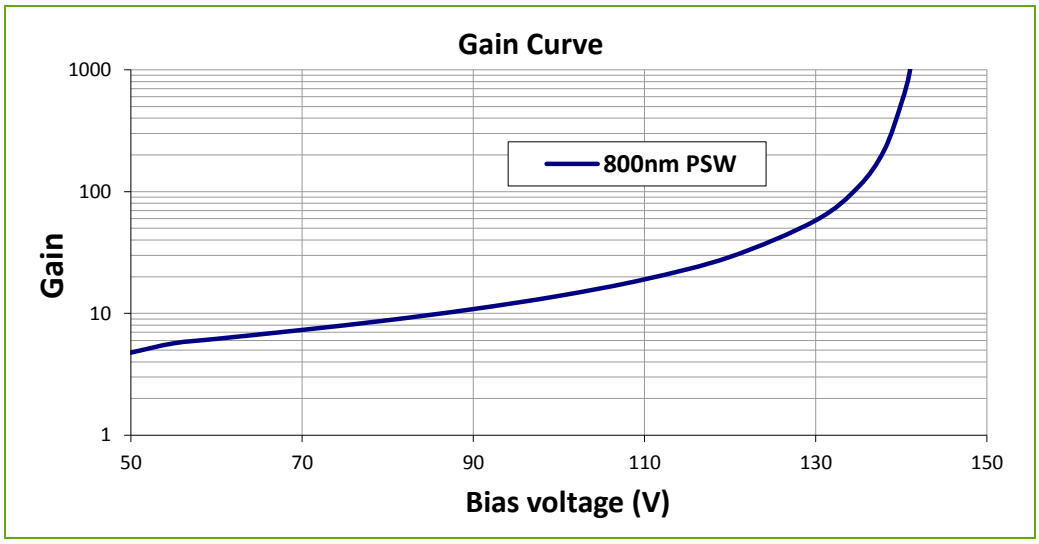


Figure 6–Typical gain vs. bias voltage for 900nm peak sensitivity wavelength types

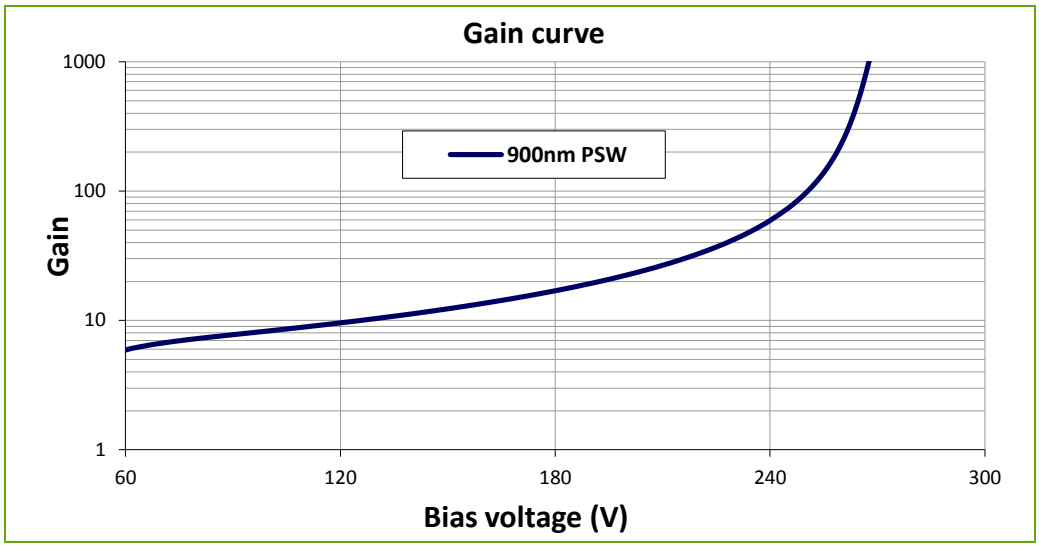


Figure 7–Plastic T 1 ¾ through-hole PH package. Dimensions in mm [inches].

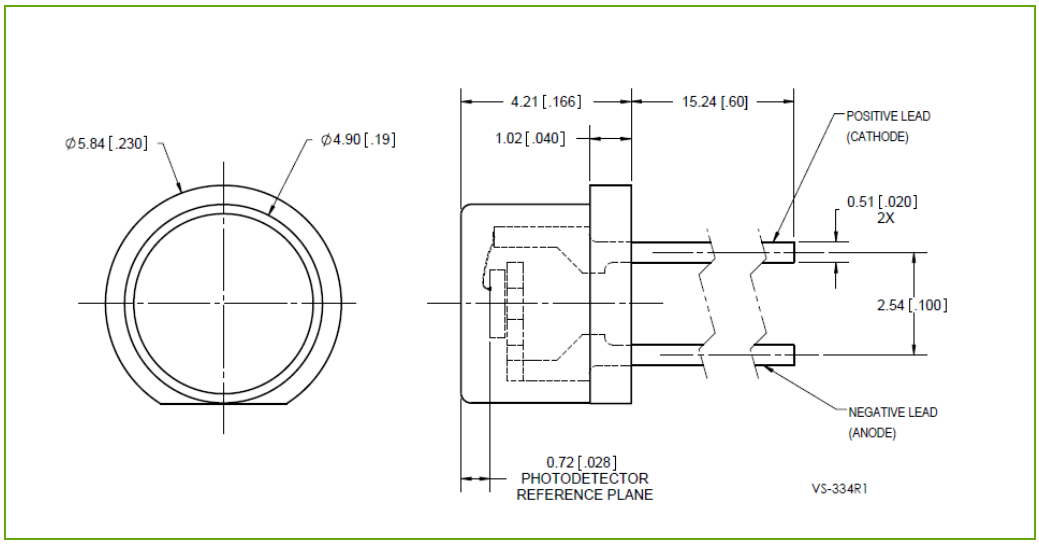


Figure 8–Leadless ceramic carrier (LCC) top-looking LH package. Dimensions in mm [inches]

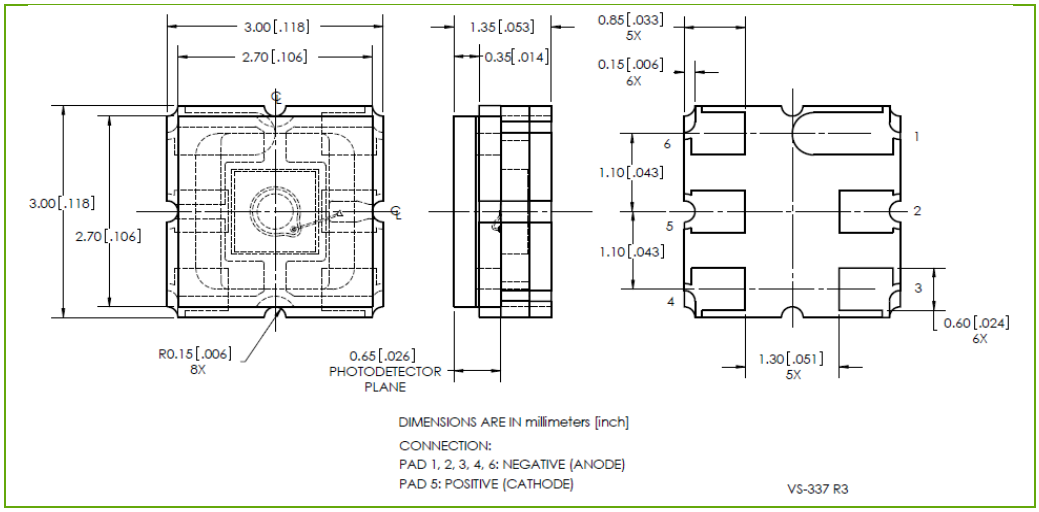


Figure 9–Leadless ceramic carrier (LCC) side-looking CH package. Dimensions in mm [inches]

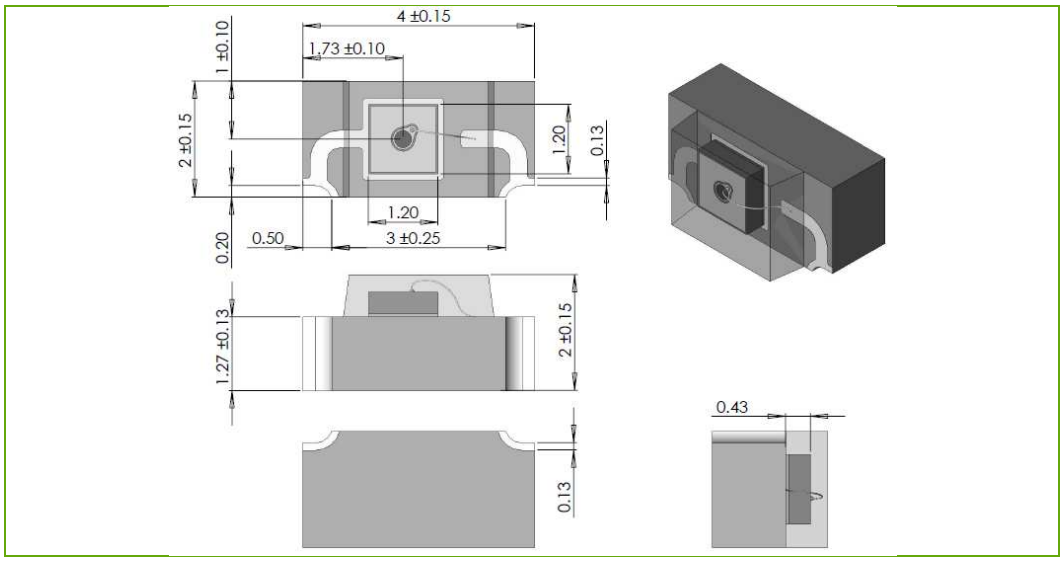


Table 4– Ordering Guide

	C30737	AA -	BBB -	C	D[(1)]	E[(2)(3)]
Epitaxial structure Si APD	C30737					
Plastic TO-18 can (P-package)		PH -				
Leadless ceramic carrier (3 x 3 mm^2 LCC) top-looking package		LH -				
Leadless ceramic carrier side-looking package		CH -				
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.

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 9 and 10. This packing option should be indicated at the time of order placement.

Figure 10– Tape-and-reel packing specification

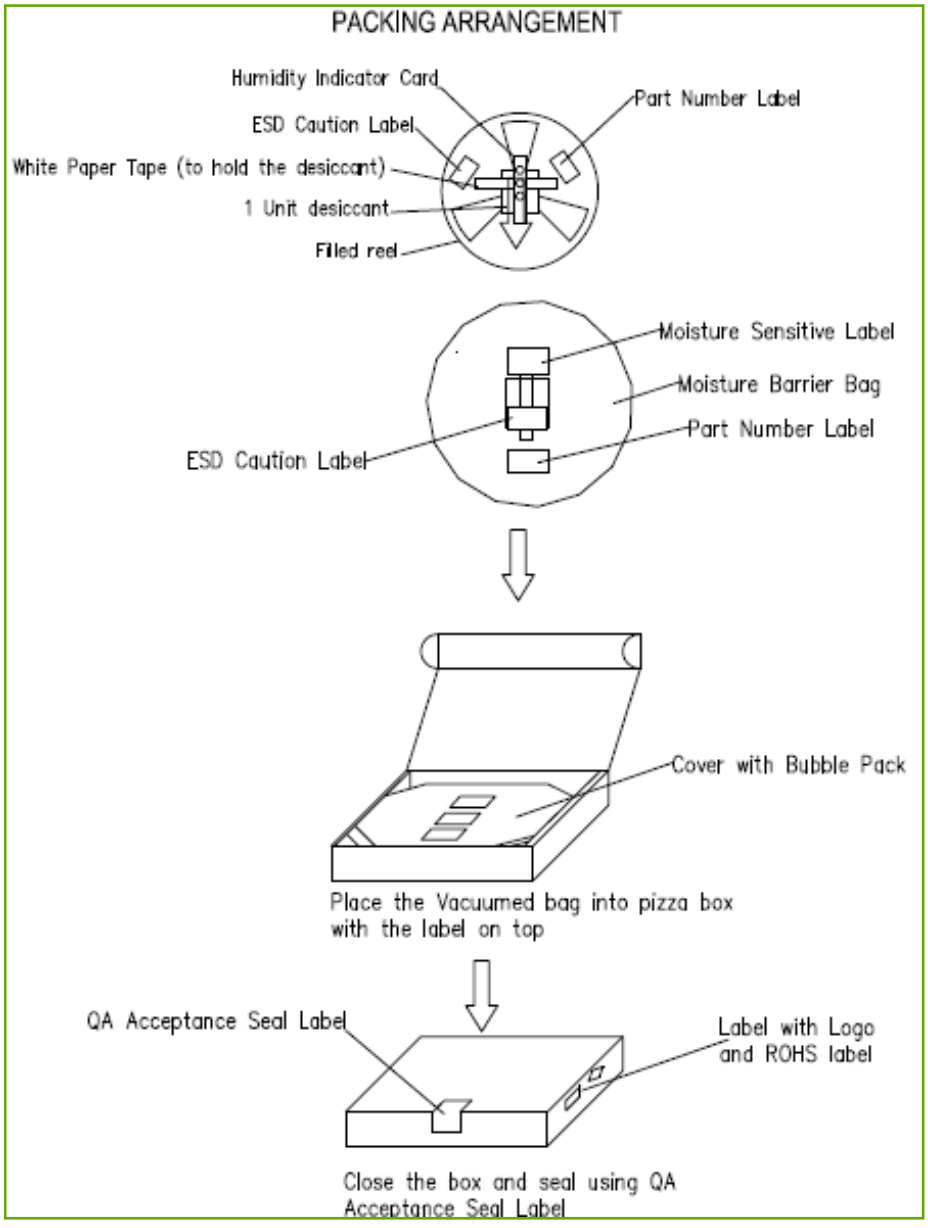


Figure 11– Tape-and-reel device carrier specification

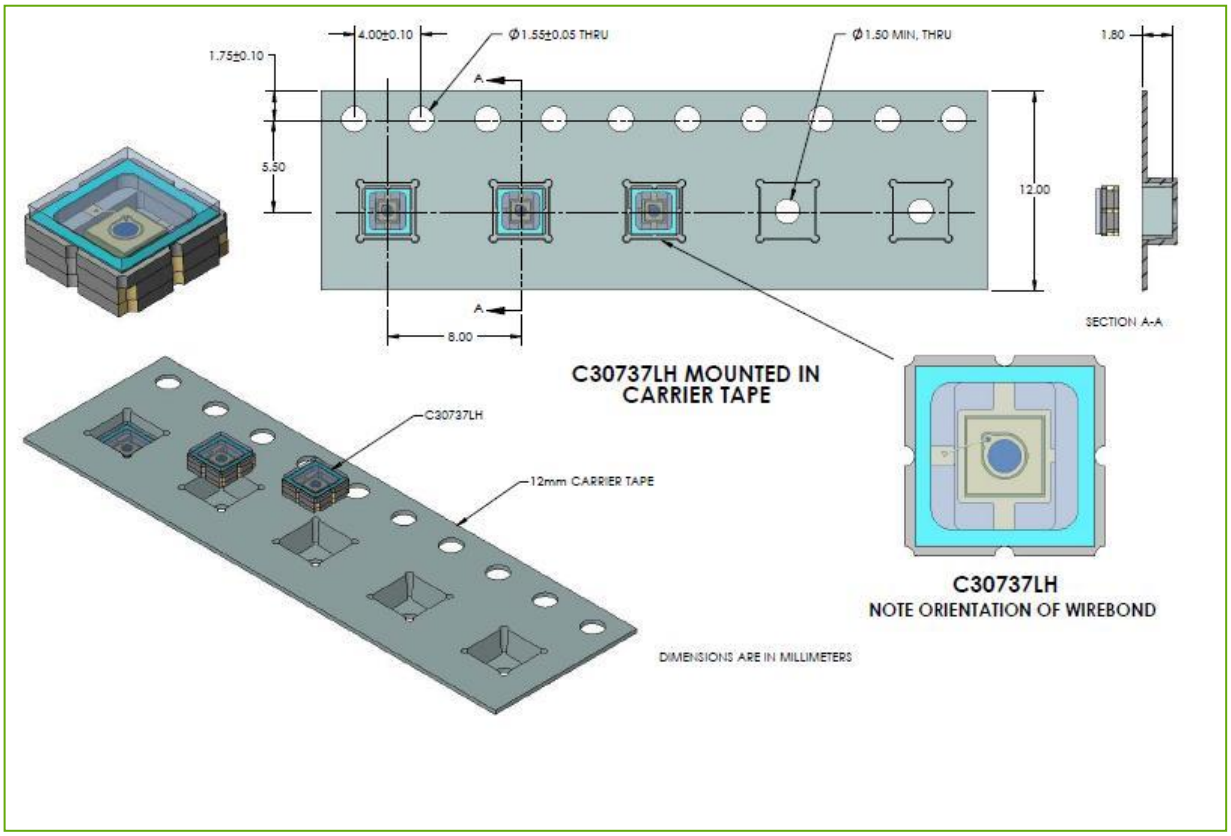
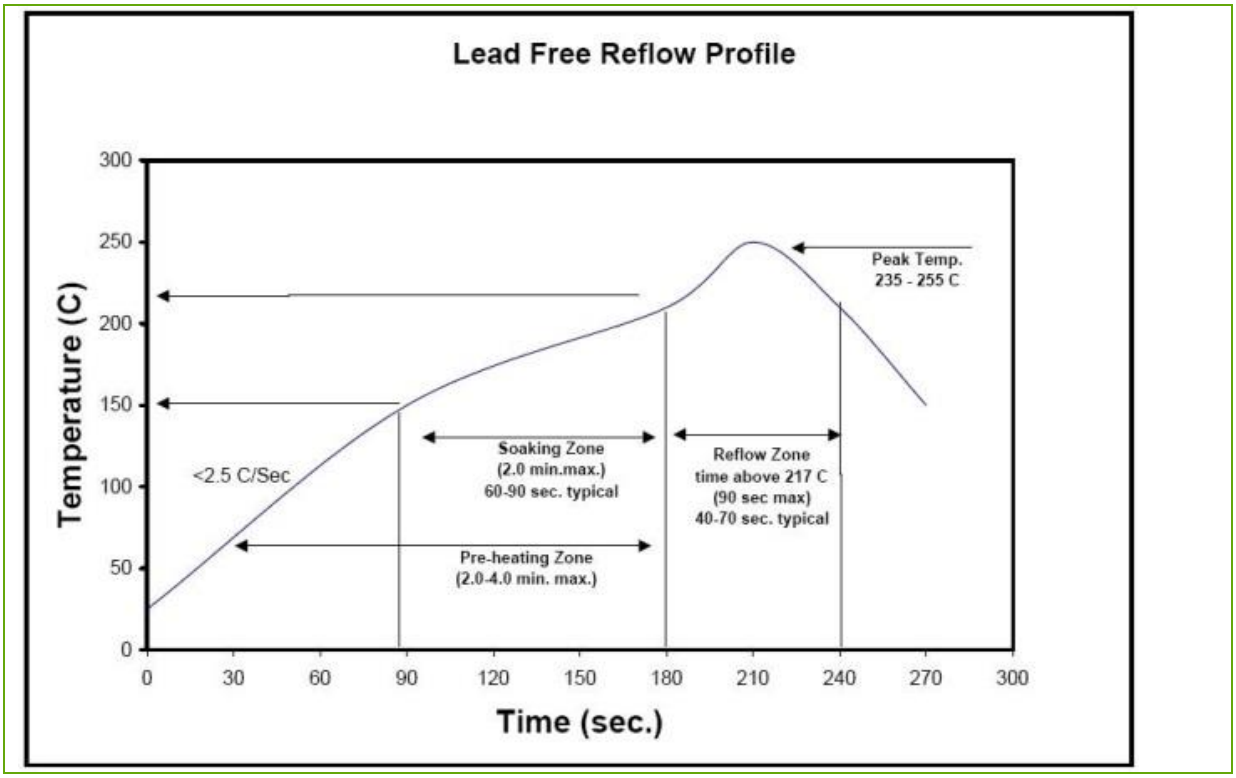


Figure 12 – Solder Reflow Diagram



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.

Excelitas Technologies
22001 Dumberry Road
Vaudreuil-Dorion, Quebec
Canada J7V 8P7
Telephone: (+1) 450.424.3300
Toll-free: (+1) 800.775.6786
Fax: (+1) 450.424.3345
detection@excelitas.com

Excelitas Technologies GmbH & Co. KG
Wenzel-Jaksch-Str. 31
D-65199 Wiesbaden
Germany
Telephone: (+49) 611 492 430
Fax: (+49) 611 492 165
detection.europe@excelitas.com

Excelitas Technologies Singapore, Pte. Ltd.
8 Tractor Road
Singapore 627969
Telephone: (+65) 6775 2022 (Main number)
Telephone: (+65) 6770 4366 (Customer Service)
Fax: (+65) 6778-1752
detection.asia@excelitas.com

For a complete listing of our global offices, visit www.excelitas.com/ContactUs