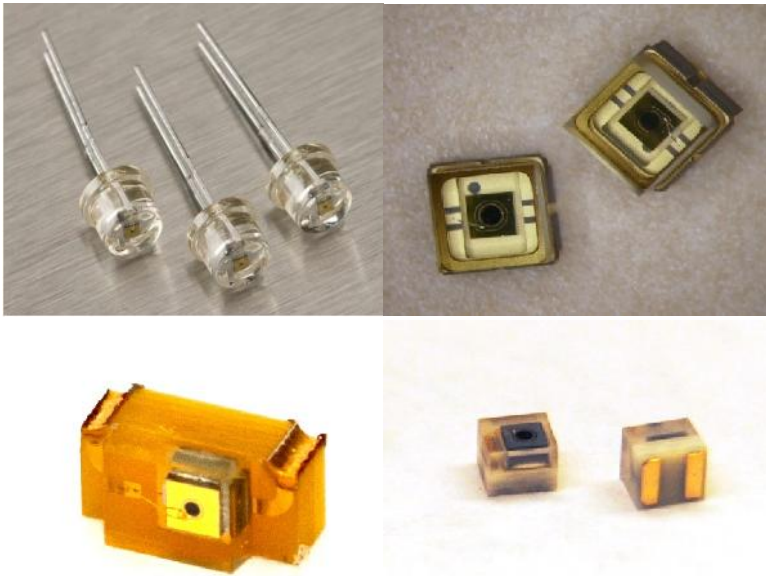


C30737PH, CH, LH, MH and EH Series

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 surface-mount “side-looking” and “top-looking” packages (C30737CH and LH), and in a compact surface-mount “top-looking” leadless package (C30737MH). The EH and LH packages come 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, 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/V 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 °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 _{BR} , 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, Δf=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 | -50 | | +100 | -50 | | +100 | °C |
| Operating Temperature | -40 | | +85 | -40 | | +85 | °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 _{BR} , 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, Δf=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 | -50 | | +100 | -50 | | +100 | °C |
| Operating Temperature | -40 | | +85 | -40 | | +85 | °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_{BR} , 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 | - | $\text{pA}/\sqrt{\text{Hz}}$ |
| 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 | 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_{BR} , 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 | - | $\text{pA}/\sqrt{\text{Hz}}$ |
| 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

| 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_{BR} , 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, $R_L=50 \Omega$, 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 = high-speed APD with 800nm peak sensitivity wavelength; 900nm PSW = high-responsivity APD with 900nm peak sensitivity wavelength

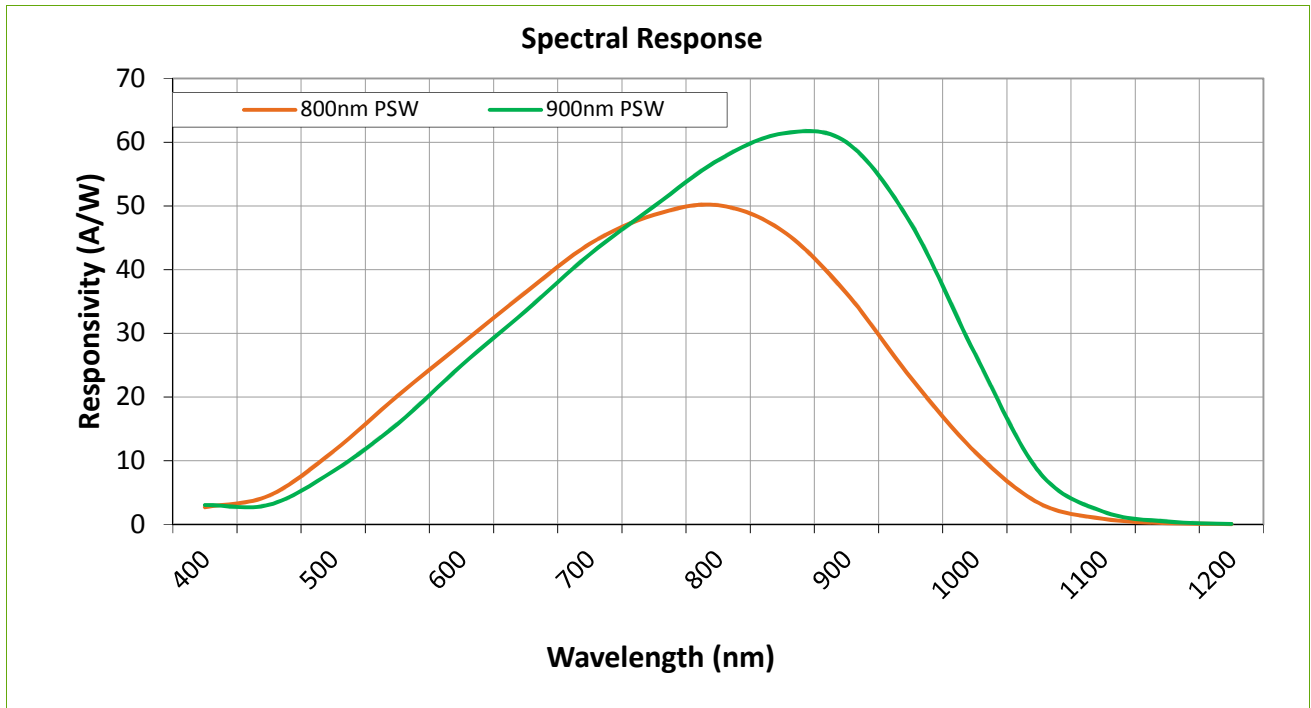
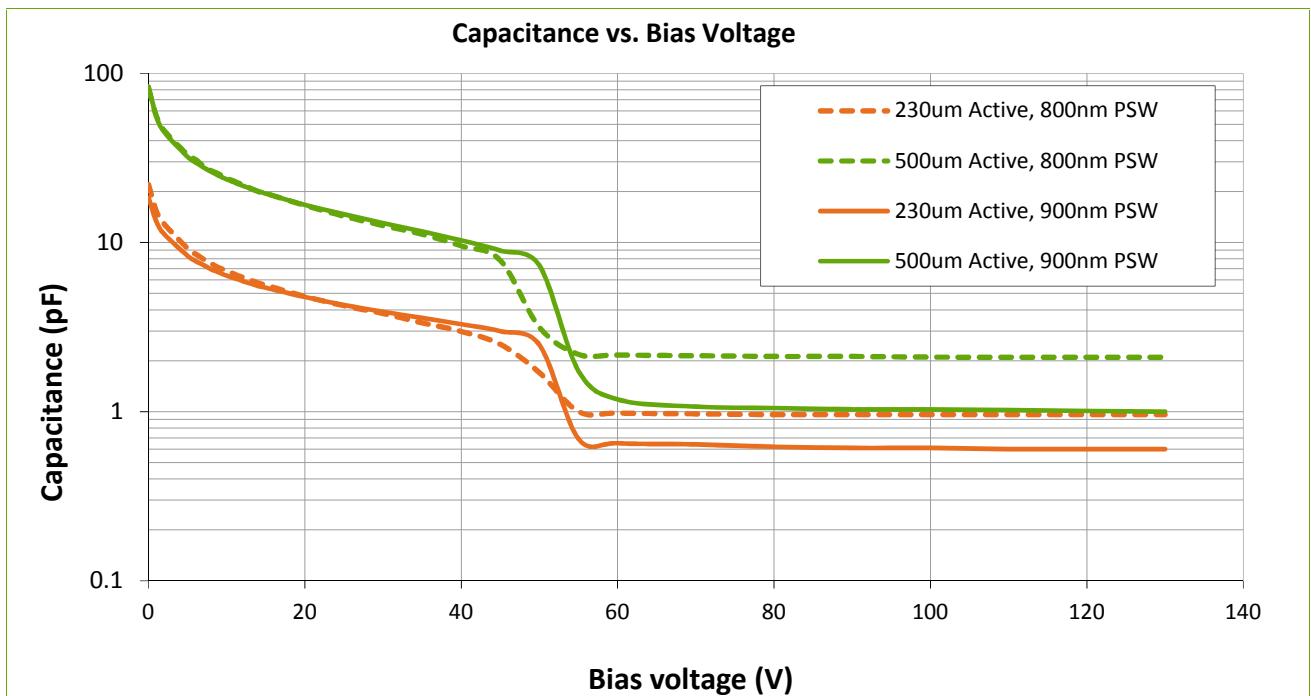


Figure 2 – Typical capacitance vs. bias voltage



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

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

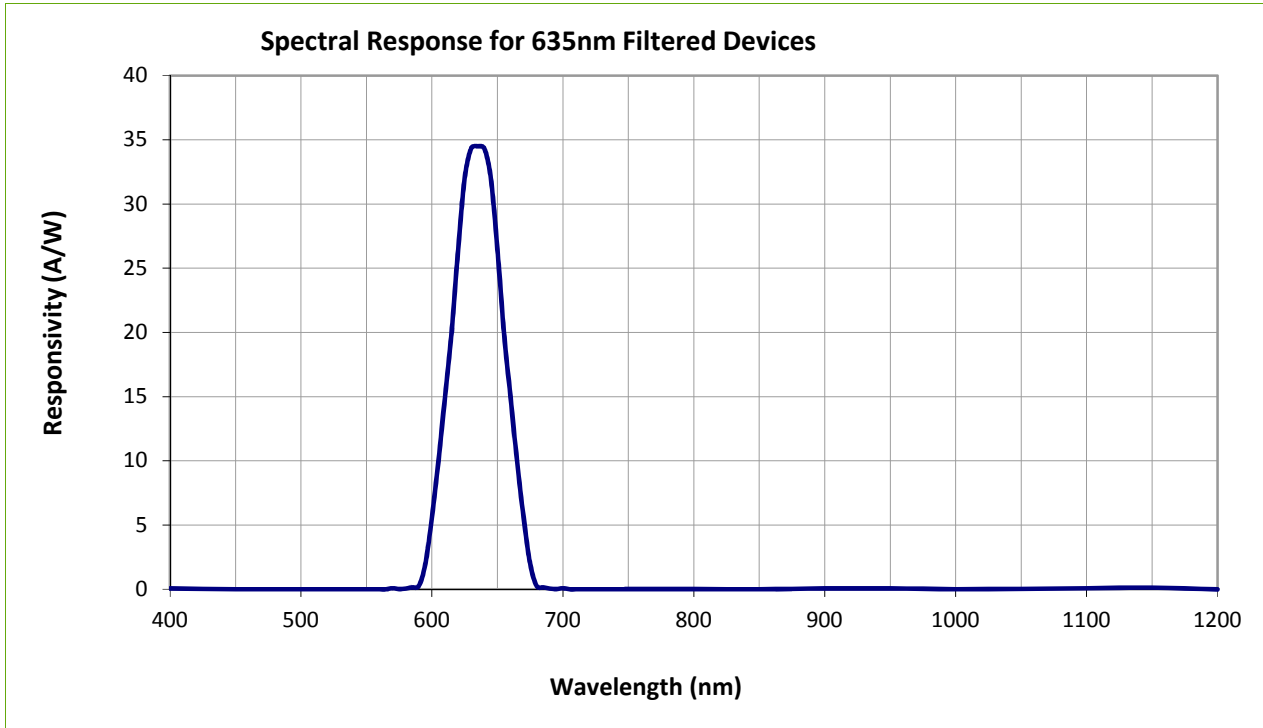
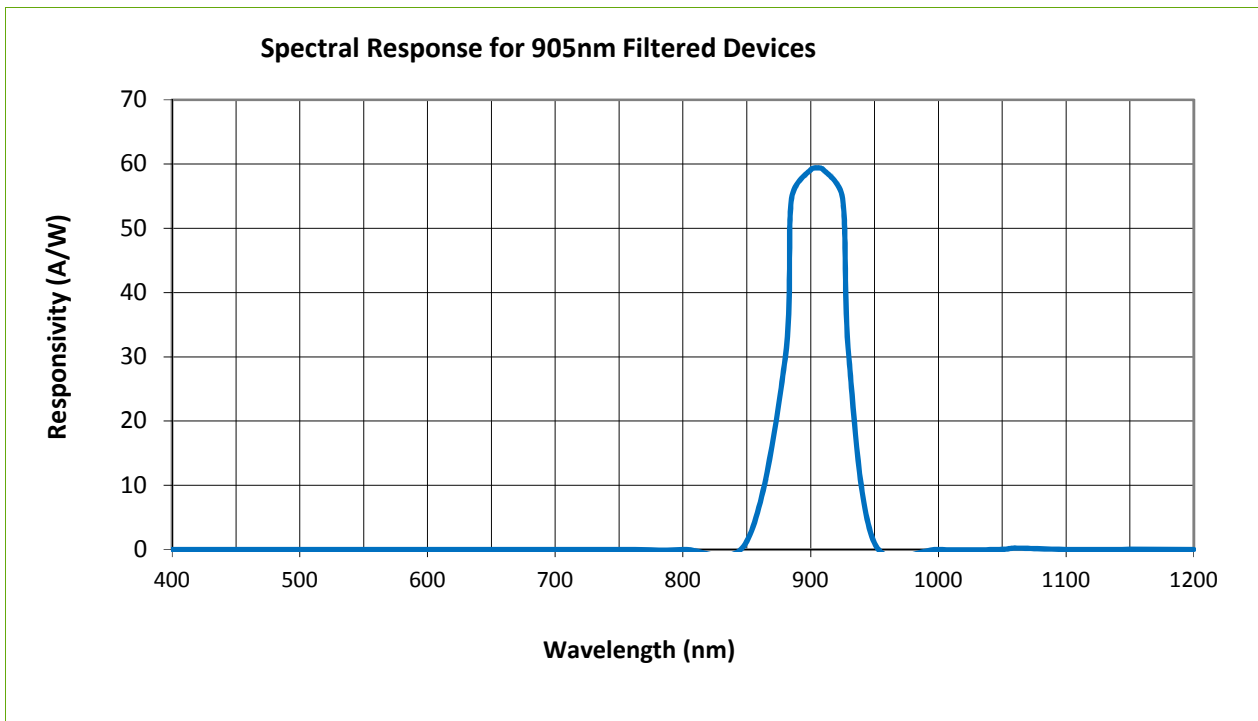


Figure 4 – Typical response vs. wavelength for a 905nm filtered APD



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

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

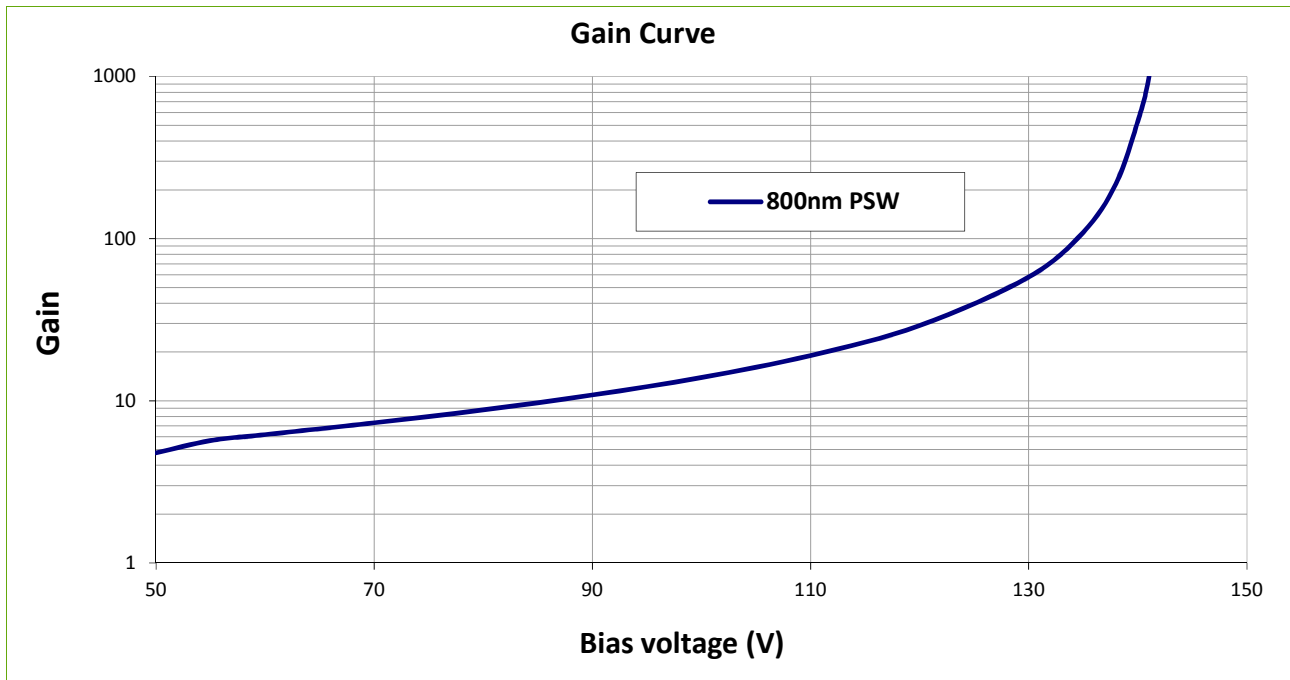
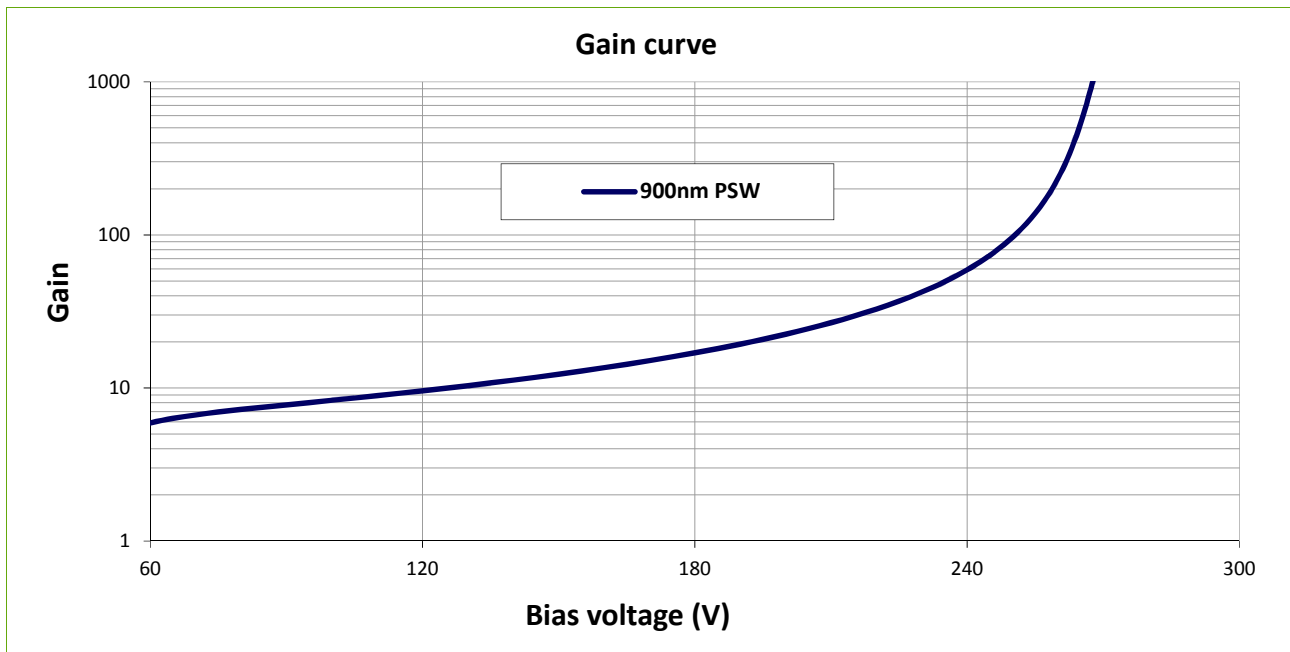


Figure 6 – Typical gain vs. bias voltage for 900nm peak sensitivity wavelength types



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

Figure 7 – Plastic T 1 ¼ through-hole PH package. Dimensions in mm [inches].

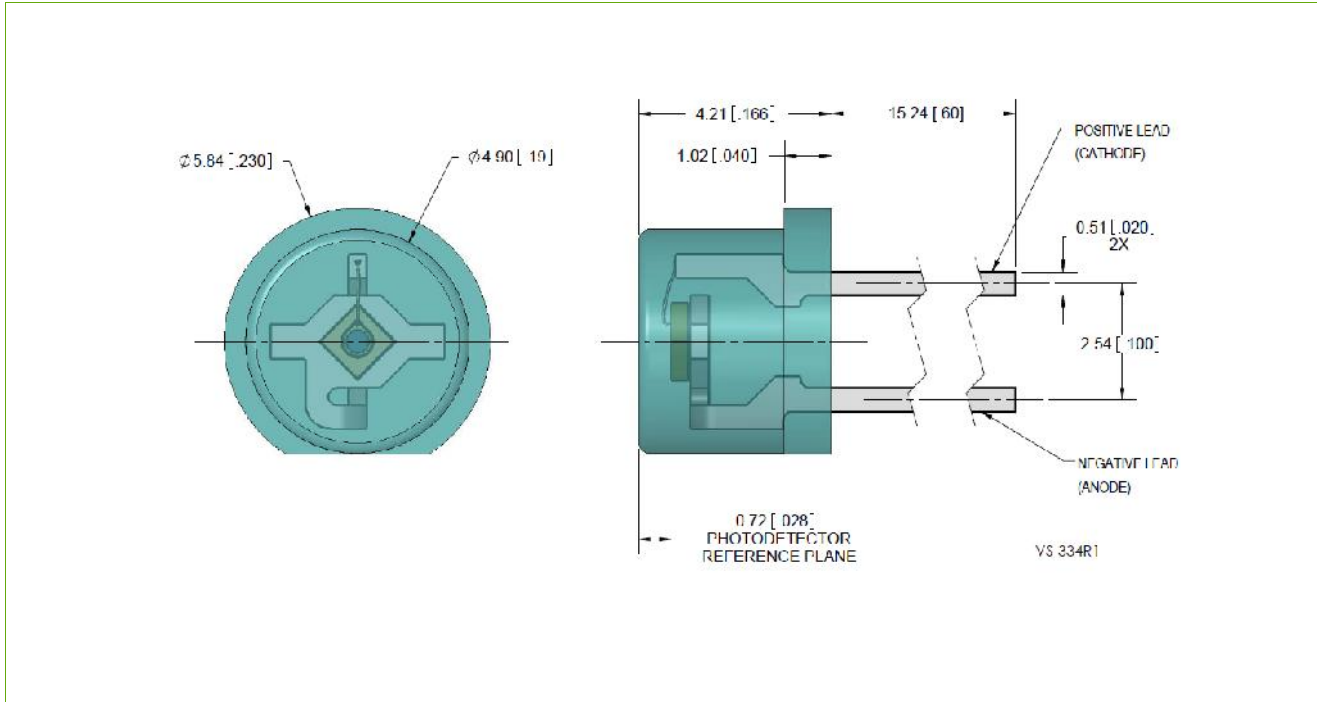
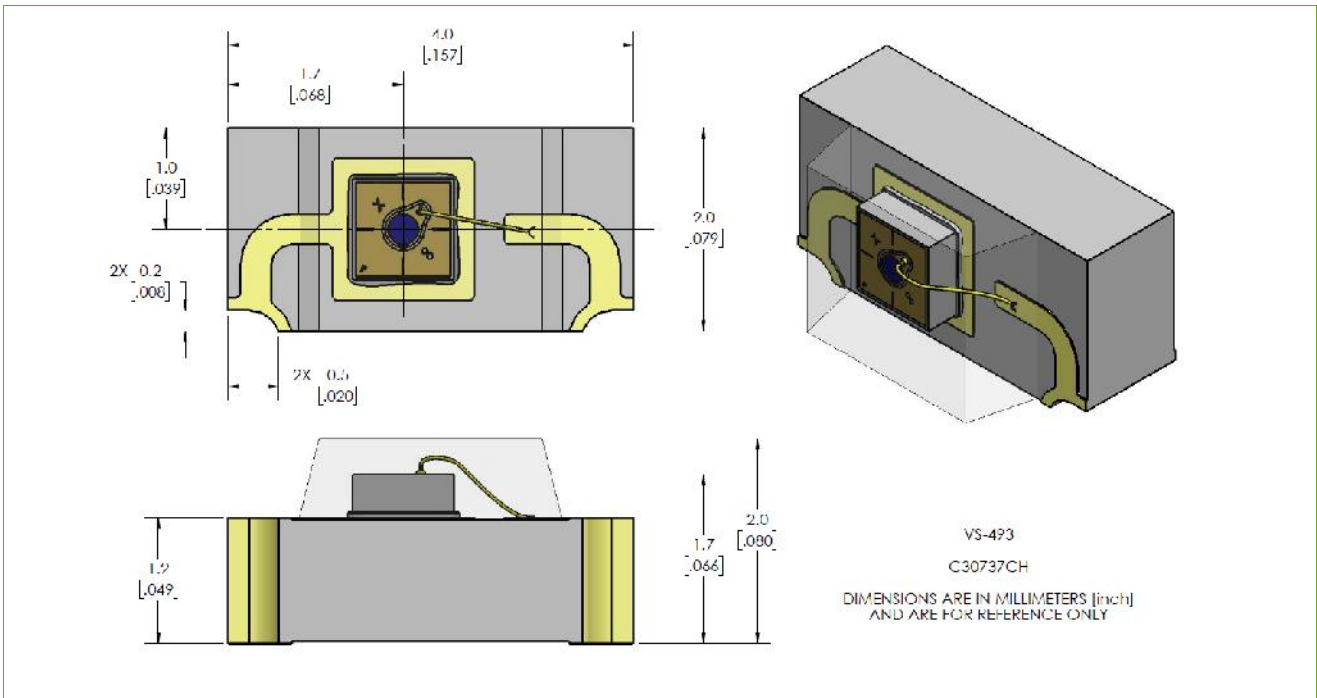


Figure 8 – Leadless ceramic carrier (LCC) side-looking CH package. Dimensions in mm [inches]



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

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

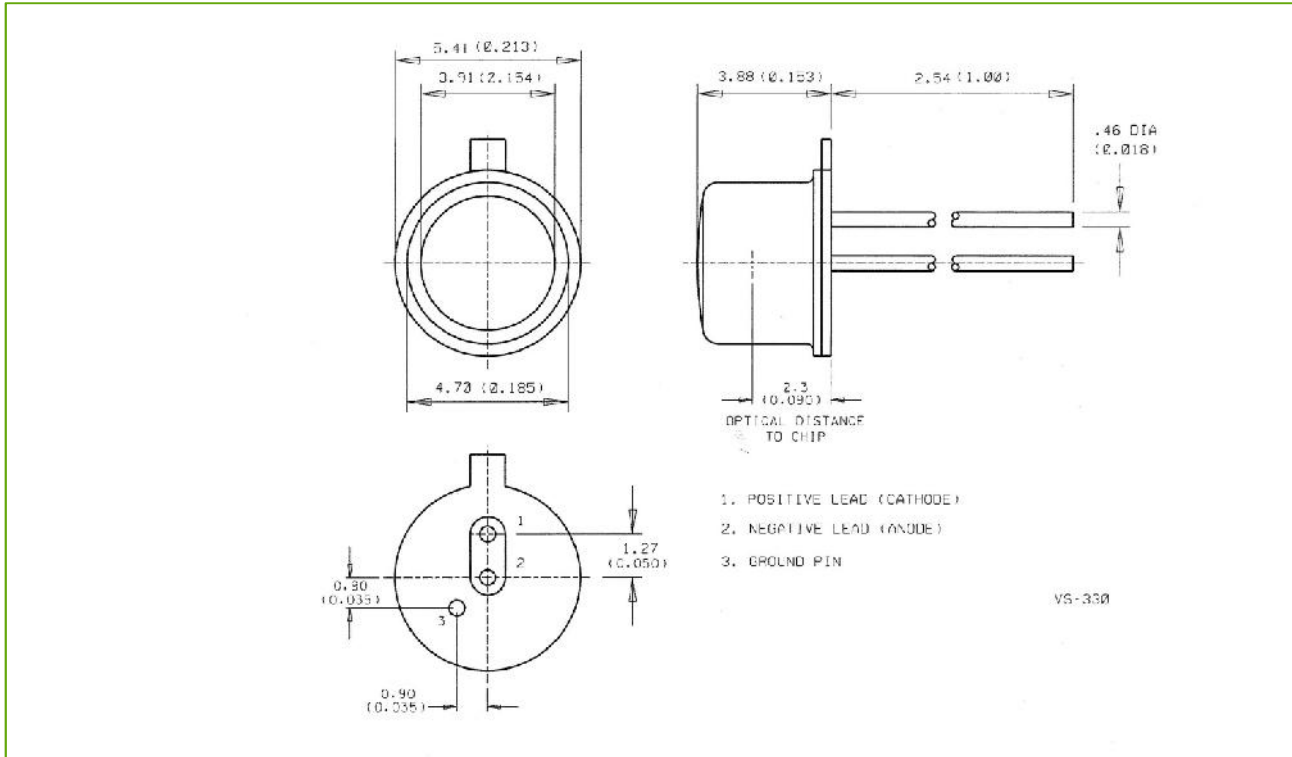
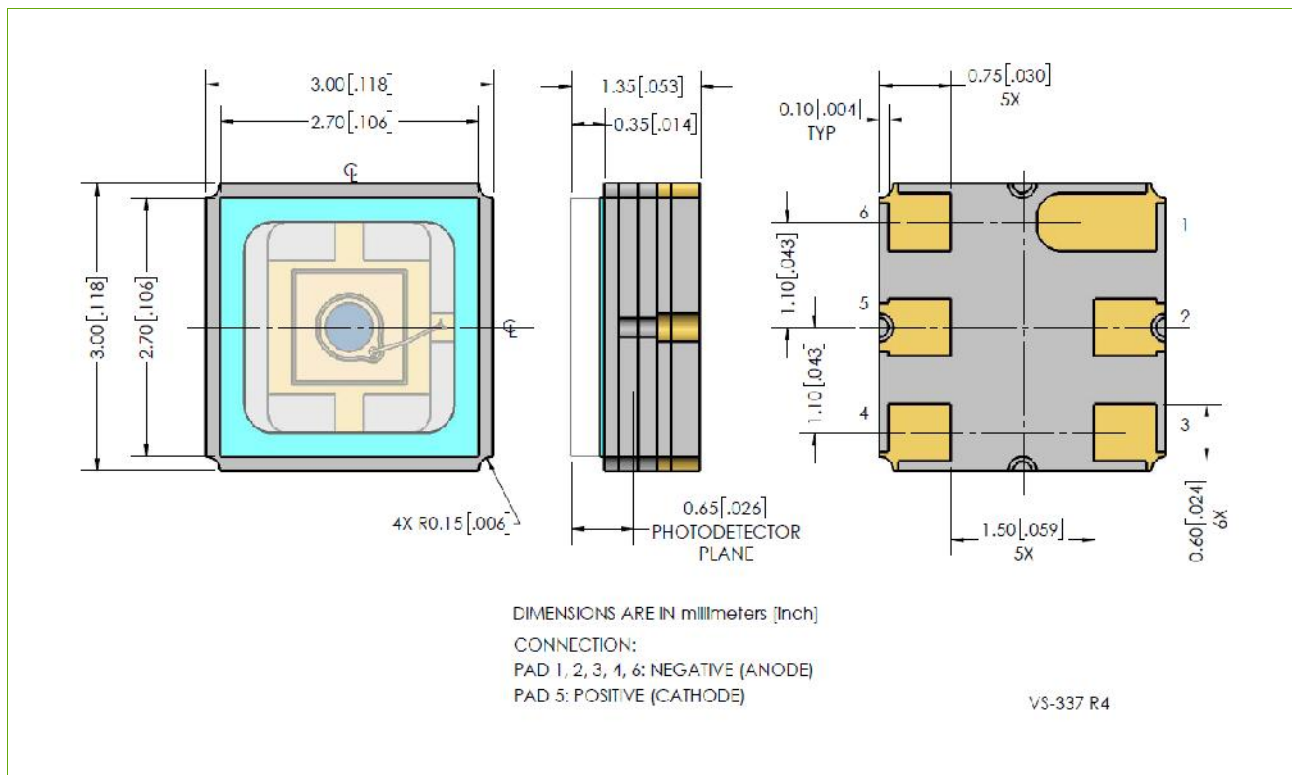
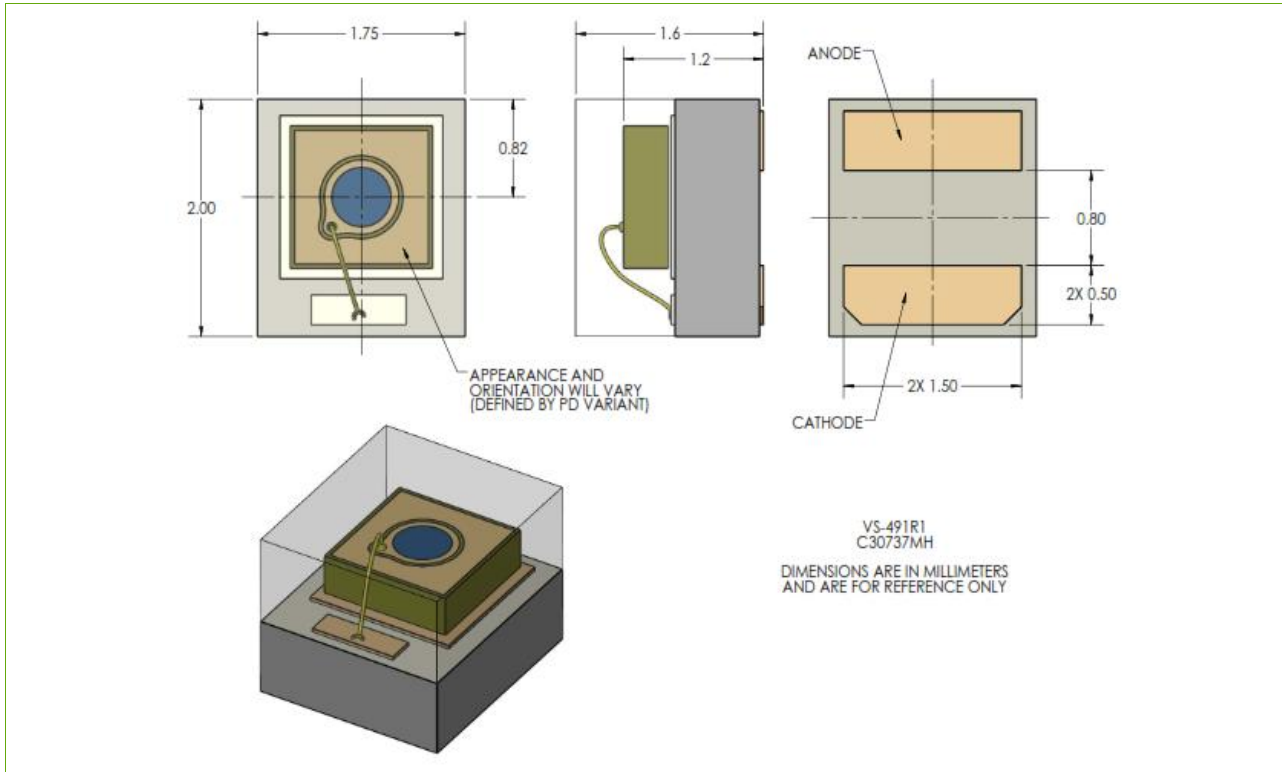


Figure 10 – Leadless ceramic carrier (LCC) top-looking LH package. Dimensions in mm [inches]



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.

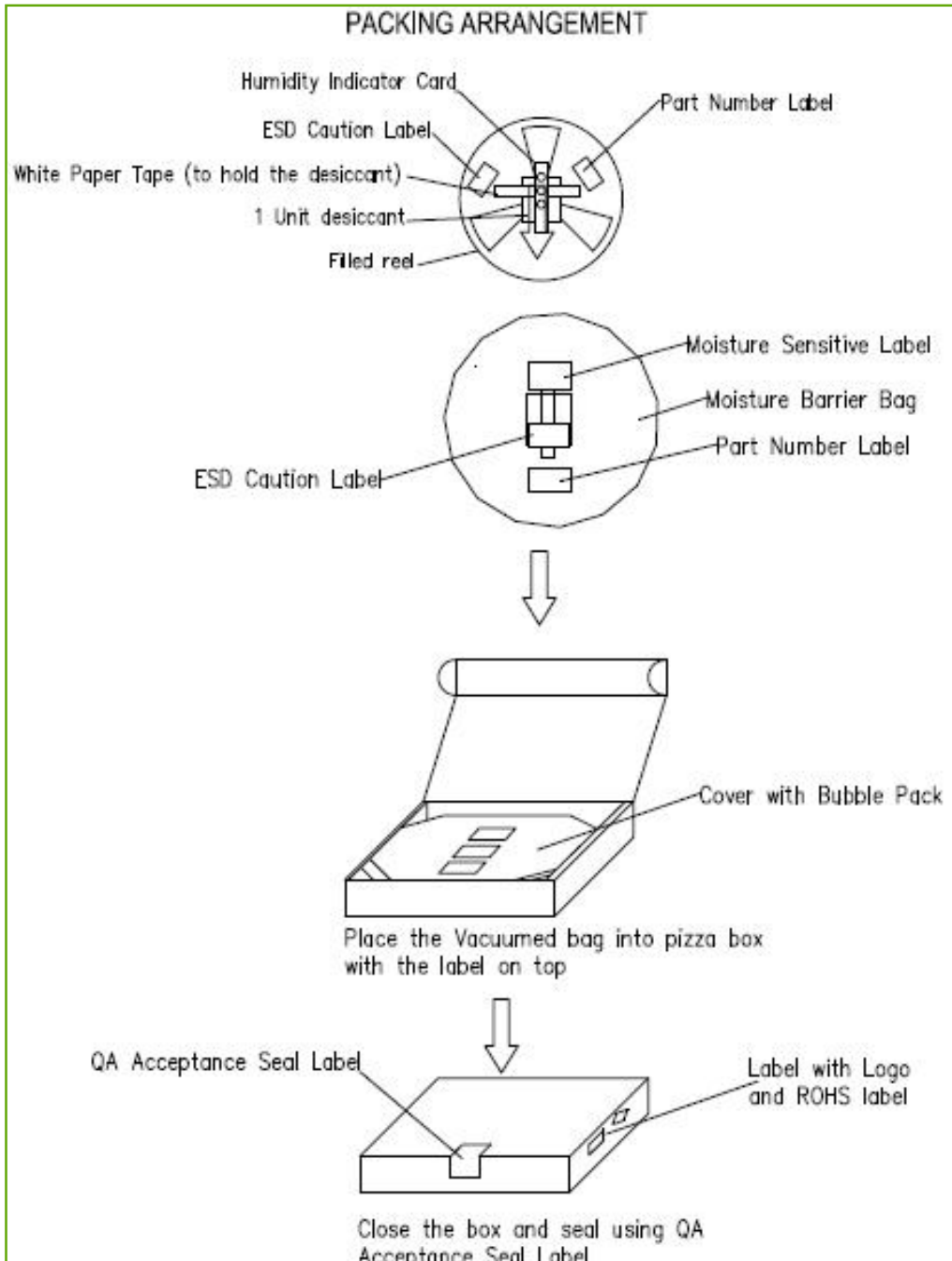
Example: C30737LH-230-92C: A C30737 in the 3 x 3mm ceramic carrier package, with optimum 900nm response wavelength, with 905nm filter and selected for V_{bd} of 180V - 220V.

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

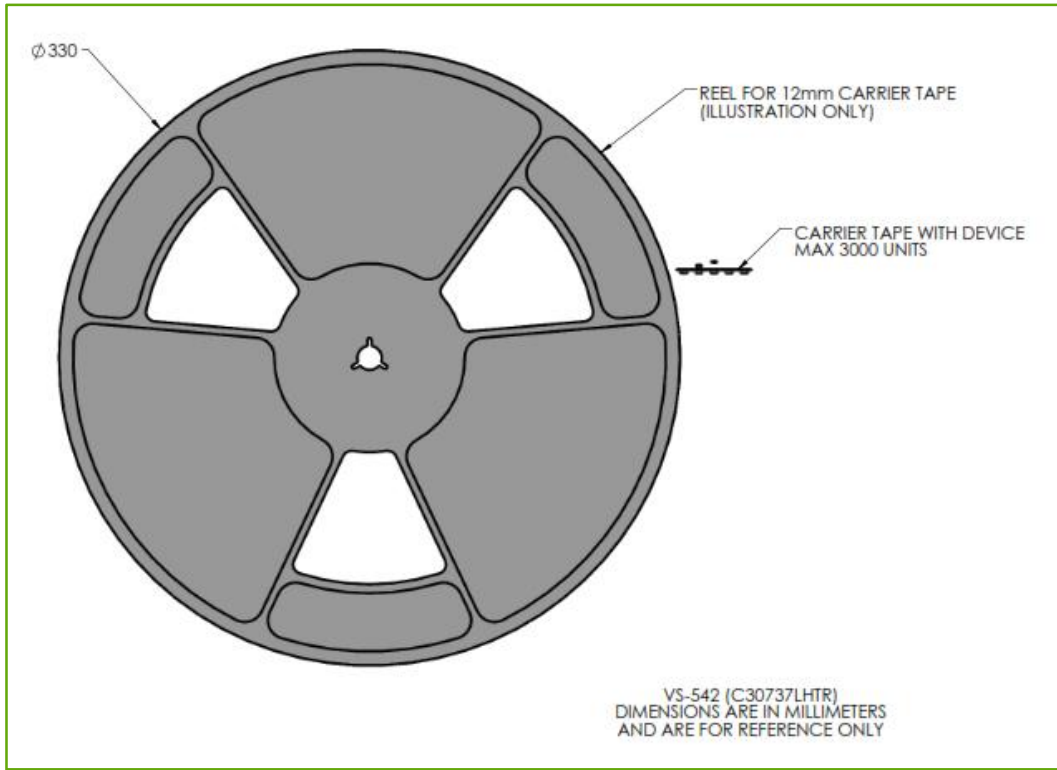
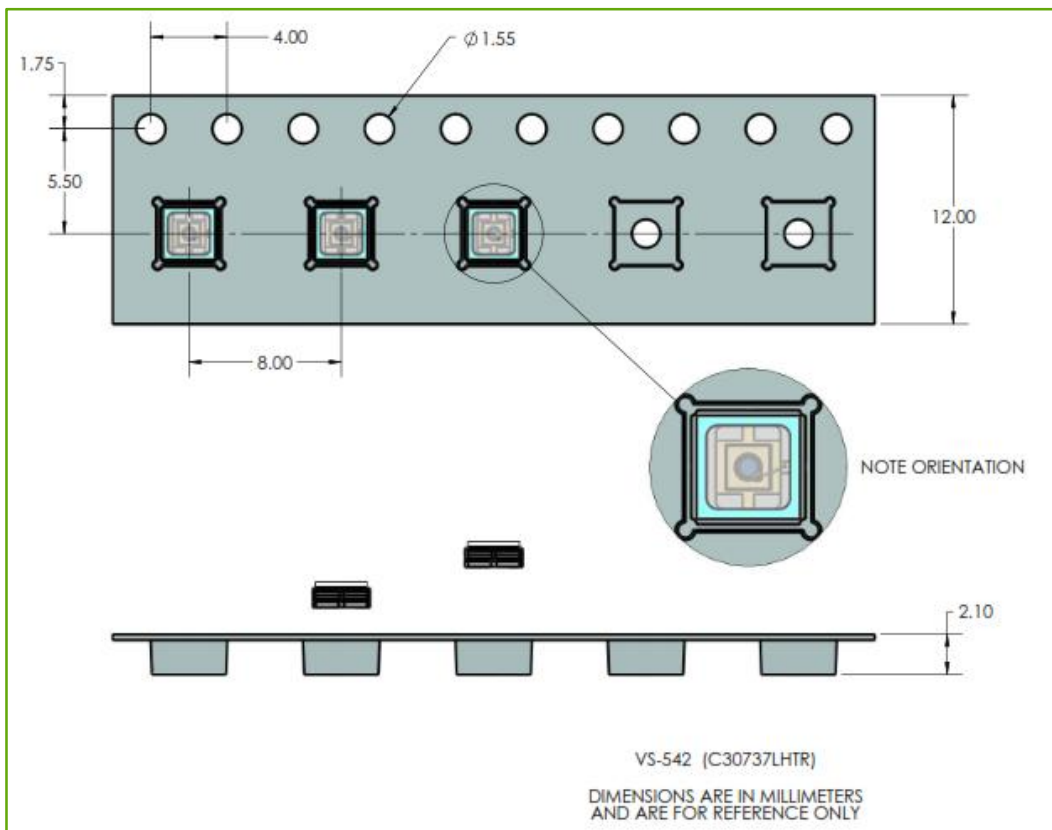
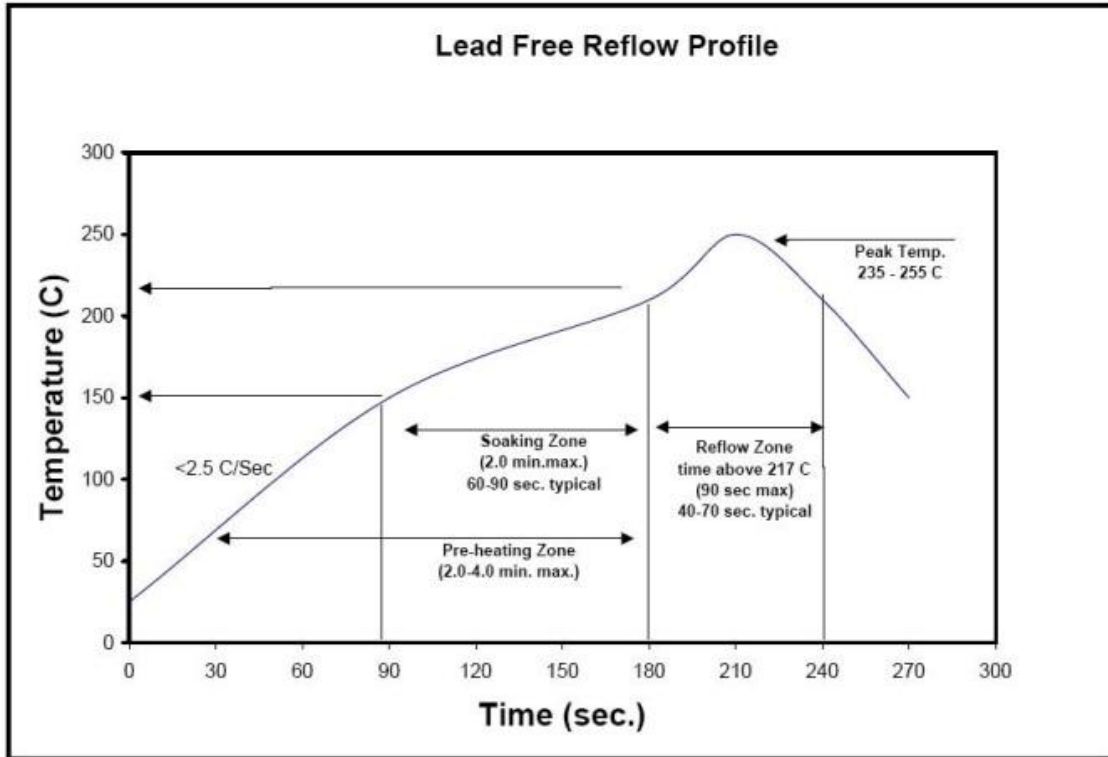


Figure 13 – Tape-and-reel device carrier specification



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

Figure 14 – 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.

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

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
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

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