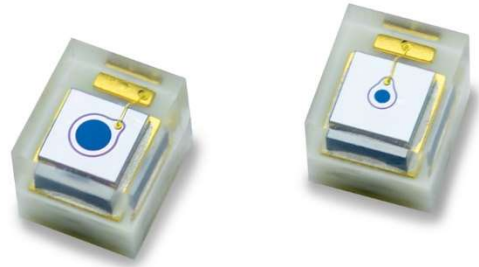


## C30737MH Series – Silicon Avalanche Photodiodes (APD) in LLC SMD package APD for High Volume LiDAR, Range Finding and Laser Meters



*Excelitas' C30737MH-230 and C30737MH-500 series Avalanche Photodiodes are high speed, low breakdown voltage APDs that provide low noise and high responsivity, optimized for wavelengths of 800 nm or 900 nm. These Photodiodes are mounted inside an ultra-compact 1.75mm x 2 mm SMD package.*

### Key Features

- Spectral response 500 nm – 1100 nm
- High Responsivity at 800 nm and 900 nm
- Low Noise 0.1 pA/VHz
- Large active area diameter of 230  $\mu\text{m}$  and 500  $\mu\text{m}$
- Ultra Compact SMD Package (1.75 mm x 2 mm)
- Tape and Reel packaging
- RoHS compliant

### Applications

- LiDAR / ToF measurements
- Laser range finding
- Speed measurements
- Optical communication systems
- 3D Laser scanning
- Gesture Recognition

All specifications are referring to an ambient temperature of  $T_A = 22\text{ }^\circ\text{C}$  and a voltage  $V_{OP}$  that operates the APD at a Gain of  $M = 100$ , unless otherwise specified.

**Table 1: Key parameters**

Parameter	Symbol	Minimum	Typical	Maximum	Unit
Breakdown Voltage <sup>1</sup>	$V_{BD}$	120		260	V
Spectral Range	$\Delta\lambda$	500		1100	nm
Recommended Operating Gain <sup>2</sup>	M		100		

**Note 1:** Breakdown Voltage binning available. Refer to Table 2.

**Note 2:** For further information on the usage at different gains, please contact our experts at Excelitas Technologies.

## C30737MH Series – Silicon Avalanche Photodiodes (APD) in LLC SMD package

### APD for High Volume LiDAR, Range Finding and Laser Meters

**Table 2: Ordering Information**

Parameter	C30737MH	-	###	-	##	X
EPI APD	X					
Ultra Compact LLC SMD package	X					
Circular Active Area	X					
230 μm useful diameter			230			
500 μm useful diameter			500			
Optimized for 800 nm					80	
Optimized for 900 nm					90	
$V_{BD} = 120 - 160 V^{1,3,4}$						A
$V_{BD} = 160 - 200 V^1$						B
$V_{BD} = 180 - 220 V^{2,3,5}$						C
$V_{BD} = 220 - 260 V^2$						D
No $V_{BD}$ binning						N

**Note 1:** Binning A and B are available for 800 nm optimized APDs (C30737MH-230-80X, C30737MH-500-80X).

**Note 2:** Binning C and D are available for 900 nm optimized APDs (C30737MH-230-90X, C30737MH-500-90X).

**Note 3:** Bandwidth tends to be lower for lower breakdown voltage bins. Please contact our experts at Excelitas Technologies for further information.

**Note 4:** Bins A and B may overlap by 2 V.

**Note 5:** Bins C and D may overlap by 5 V.

**Table 3: Absolute Maximum Ratings**

Parameter	Symbol	Condition	Value	Units
Forward Current	$I_F$	RMS	5	mA
		Single Peak, 1 s	50	
Total Power dissipation	$P_{tot}$		2	mW
Reverse Current	$I_R$	RMS	5	μA
		Single Peak, 10 ns	400	
Reverse Current Density	$J_R$	RMS	0.1	mA/mm <sup>2</sup>
		Single Peak, 10 ns	10	
Storage Temperature	$T_S$		-50 ... 100	°C
Operating Temperature	$T_{Op}$		-40 ... 85	

**Note 1:** Stresses above those listed under “Absolute Maximum Ratings” may cause permanent damage to the device.

**Note 2:** Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## C30737MH Series – Silicon Avalanche Photodiodes (APD) in LLC SMD package

### APD for High Volume LiDAR, Range Finding and Laser Meters

Table 4: Optical Specifications C30737MH-230-80 / C30737MH-500-80

Parameter	Symbol	Minimum	Typical	Maximum	Unit
Peak Responsivity	$\lambda_{\text{peak}}$		800		nm
Responsivity @ $\lambda = 800$ nm	R		50		A/W
Quantum Efficiency @ $\lambda = 800$ nm <sup>1</sup>	QE		78		%
Rise Time / Fall Time <sup>2</sup>	$t_r / t_f$		0.3		ns
Bandwidth	$f_{3\text{dB}}$		1.3		GHz

Table 5: Optical Specifications C30737MH-230-90 / C30737MH-500-90

Parameter	Symbol	Minimum	Typical	Maximum	Unit
Peak Responsivity	$\lambda_{\text{peak}}$		900		nm
Responsivity @ $\lambda = 900$ nm	R		60		A/W
Quantum Efficiency @ $\lambda = 900$ nm <sup>1</sup>	QE		83		%
Rise Time / Fall Time <sup>2</sup>	$t_r / t_f$		0.9		ns
Bandwidth	$f_{3\text{dB}}$		400		MHz

**Note 1:** Quantum Efficiency is not a directly measurable quantity. The above specified typical parameter is linked to the typical responsivity by  $QE = \frac{1240 R}{\lambda M}$ .

**Note 2:** As estimated by  $t_{r/f} = \frac{0.35}{f_{3\text{dB}}}$ .

## C30737MH Series – Silicon Avalanche Photodiodes (APD) in LLC SMD package

### APD for High Volume LiDAR, Range Finding and Laser Meters

**Table 6: Electrical Specifications C30737MH-230-80 / C30737MH-500-80**

Parameter	Symbol	Minimum	Typical	Maximum	Units
Breakdown Voltage	$V_{BD}$	120		210	V
Temperature Coefficient of $V_{BD}$	$\Delta V/\Delta T$		0.5		V/°C
Capacitance	$C_{230}$		1		pF
	$C_{500}$		2		
Dark Current <sup>1</sup>	$i_{D,230}$		0.05	0.5	nA
	$i_{D,500}$		0.1	1	
Dark Noise <sup>2</sup>	$i_N$		0.1		pA/√Hz
Noise Equivalent Power <sup>3</sup>	NEP		2.0		fW/√Hz

**Table 7: Electrical Specifications C30737MH-230-90 / C30737MH-500-90**

Parameter	Symbol	Minimum	Typical	Maximum	Units
Breakdown Voltage	$V_{BD}$	180		260	V
Temperature Coefficient of $V_{BD}$	$\Delta V/\Delta T$		1.3		V/°C
Capacitance	$C_{230}$		0.6		pF
	$C_{500}$		1		
Dark Current <sup>1</sup>	$i_{D,230}$		0.05	0.5	nA
	$i_{D,500}$		0.1	1	
Dark Noise <sup>2</sup>	$i_N$		0.1		pA/√Hz
Noise Equivalent Power <sup>3</sup>	NEP		1.7		fW/√Hz

**Note 1:** Surface ( $i_{DS}$ ) and bulk ( $i_{DB}$ ) dark current are contributing to the total dark current by  $i_D = i_{DS} + i_{DB}M$ .

**Note 2:** Due to the natural fluctuations of amplified charge carriers the APD will also generate noise when not illuminated. Since the noise characteristics and hence the signal-to-noise ratio (SNR) are dependant on the bandwidth (B) and operating wavelength ( $\lambda$ ) inside the final system the illuminated noise

$$i_{ill} = \sqrt{2qB[i_{DS} + (i_{DB}M^2 + R_0(\lambda)M^2P)F]}$$

needs to be considered. Hence the SNR is defined as:

$$SNR = \frac{i_P^2}{i_{ill}^2} = \frac{(PR_0(\lambda)M)^2}{i_{ill}^2}$$

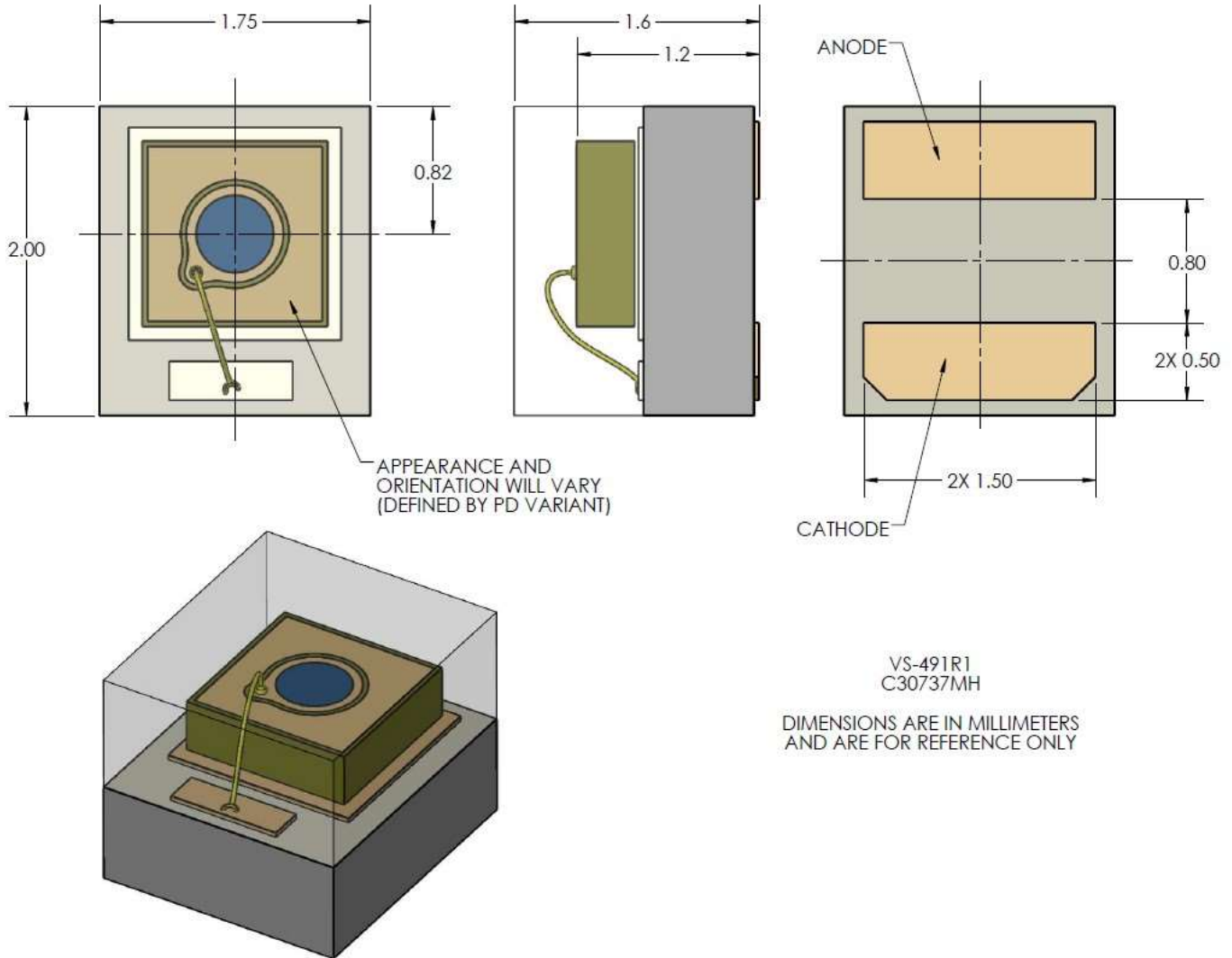
with P the incident optical power in W,  $R_0(\lambda)$  the intrinsic ( $M = 1$ ) responsivity in A/W, q the charge carrier and an excess noise factor of typical 6.9 for silicon materials.

**Note 3:** The NEP is specified in dark conditions and gain of  $M = 100$  as  $NEP = \frac{i_N}{R(\lambda)}$

# C30737MH Series – Silicon Avalanche Photodiodes (APD) in LLC SMD package

## APD for High Volume LiDAR, Range Finding and Laser Meters

Figure 1: APD Package Dimensions C30737MH Series



# C30737MH Series – Silicon Avalanche Photodiodes (APD) in LLC SMD package

## APD for High Volume LiDAR, Range Finding and Laser Meters

Figure 2: Typical Responsivity

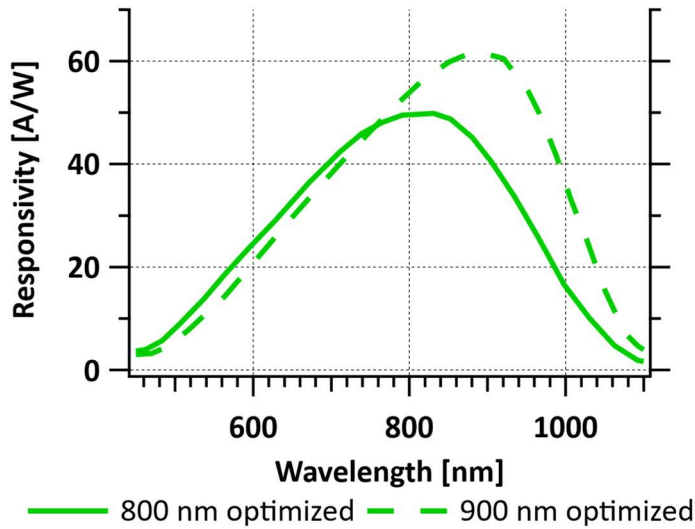


Figure 3: Typical Gain vs. Operating Voltage

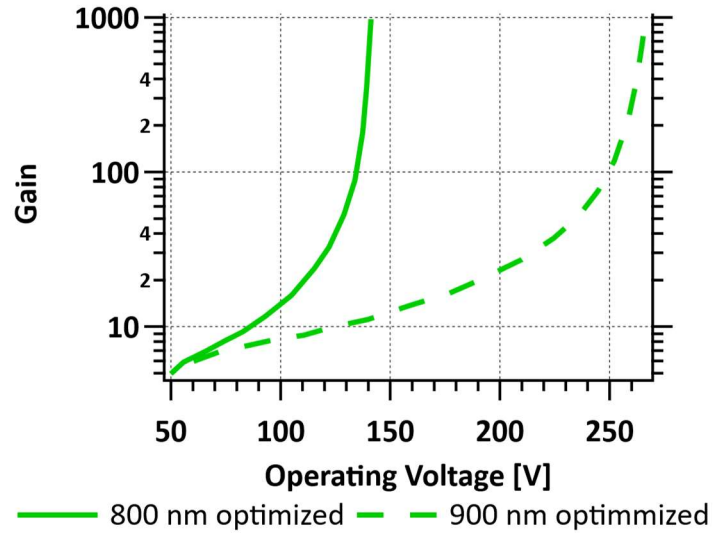


Figure 4: Typical Capacitance vs. Operating Voltage

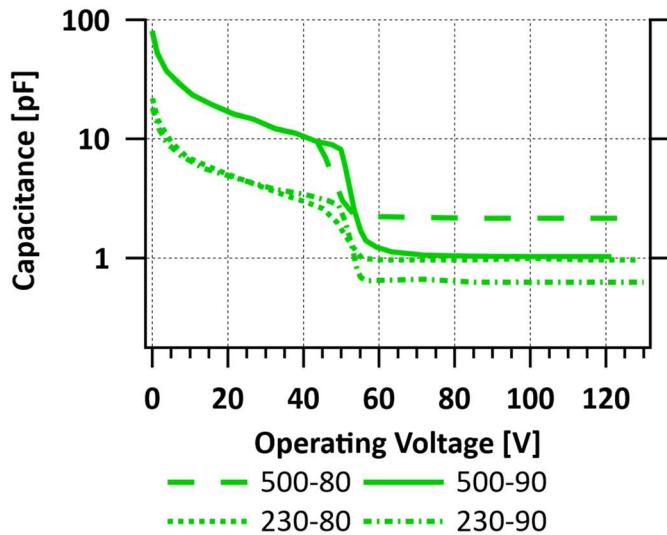
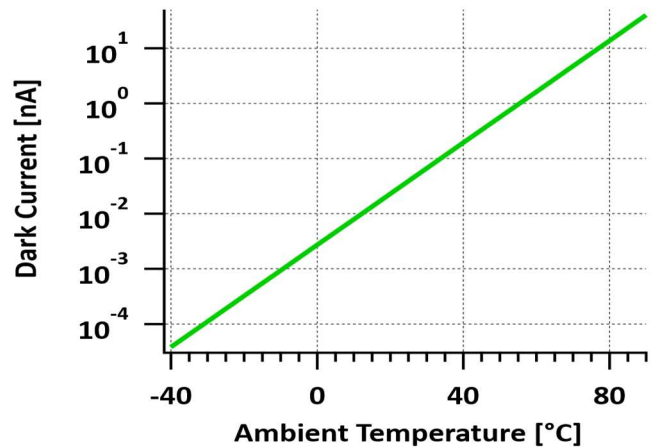


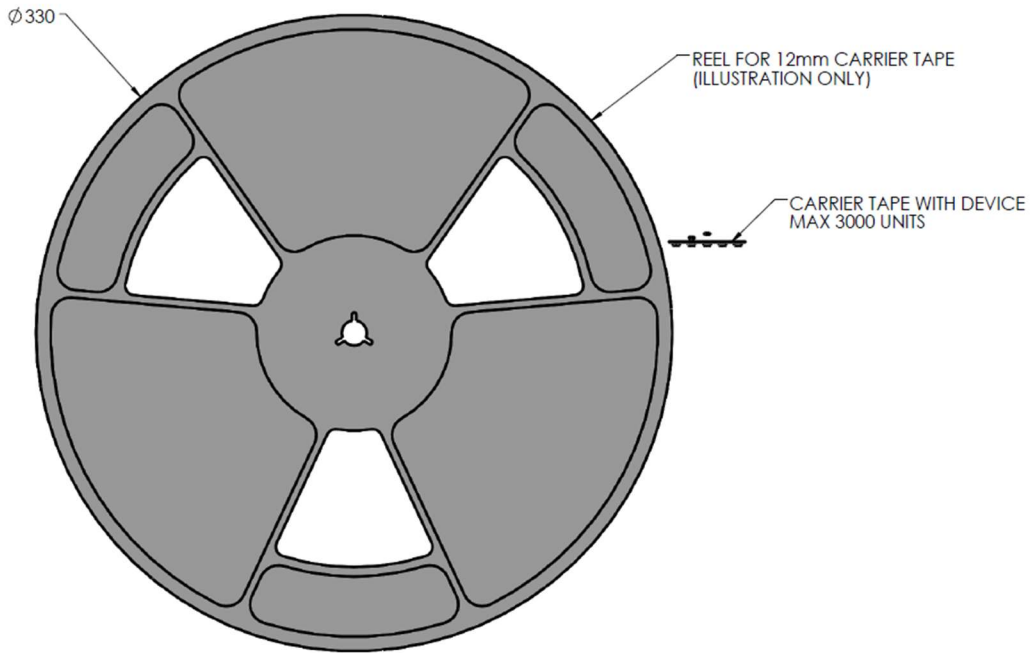
Figure 5: Typical Dark current vs. Ambient Temperature



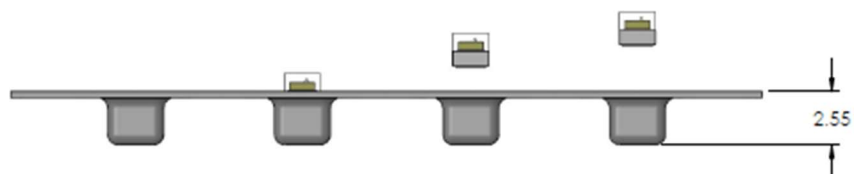
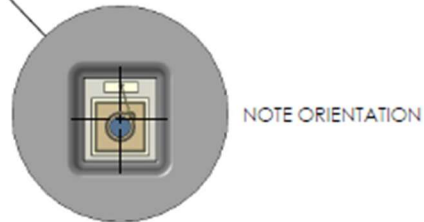
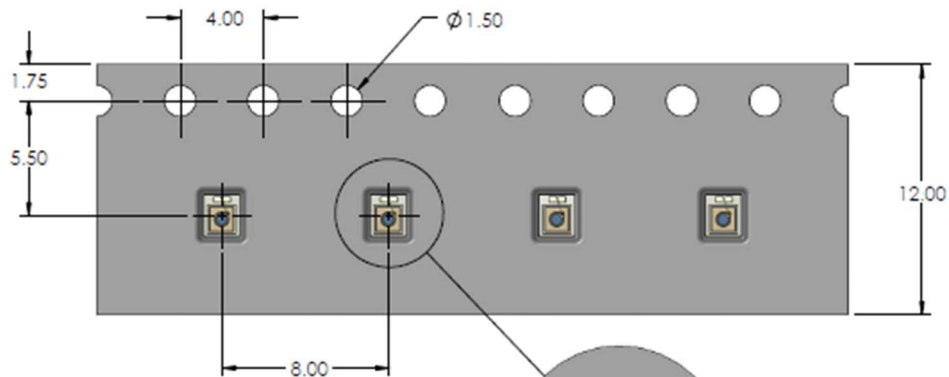
# C30737MH Series – Silicon Avalanche Photodiodes (APD) in LLC SMD package

## APD for High Volume LiDAR, Range Finding and Laser Meters

Figure 6: Tape and Reel Packing Specification



VS-542 (C30737LHTR)  
DIMENSIONS ARE IN MILLIMETERS  
AND ARE FOR REFERENCE ONLY



DIMENSIONS ARE IN MILLIMETERS  
AND ARE FOR REFERENCE ONLY

## C30737MH Series – Silicon Avalanche Photodiodes (APD) in LLC SMD package

### APD for High Volume LiDAR, Range Finding and Laser Meters

#### Information

Excelitas Technologies' C30737MH series silicon avalanche photodiodes (APD) provide high responsivity between 500 nm and 1100 nm, as well as extremely fast rise times at all wavelengths with a cut-off frequency > 1 GHz for some versions.

The APDs are available in standard sizes of 230 µm and 500 µm diameter. The diodes are mounted on a FR4 substrate leadless laminate carrier (LLC) for surface mount assembly. The encapsulation material is an epoxy resin for cost efficient and high-volume manufacturing.

The package design and assembly processing techniques are such that the die positioning is well controlled to the reference surfaces. This aids in the alignment of optical elements to the package and is superior to many of the commercially available plastic lead frame TO packages.

#### Testing methods

Excelitas verifies the electro optical specifications on every device. Visual inspection during fabrication is performed as per our quality standards.

Excelitas Technologies is certified to meet ISO-9001.

#### Packaging and shipping

All C30737MH APDs are supplied in tape and reel for quantities of 3000 units per reel; as shown in Figure 6.

For sampling quantities the APDs are shipped in Gel Pack packages.

#### Storage and handling

Excelitas highly recommends to follow the below guidelines:

- Keep devices in an ESD controlled environment until final assembly.
- Keep Tape & Reel package closed until final assembly.
- Remove Devices from Tape & Reel by using a vacuum pick-up tool.
- If a manual picking method is necessary, use a vacuum pick or non-metallic tweezer.



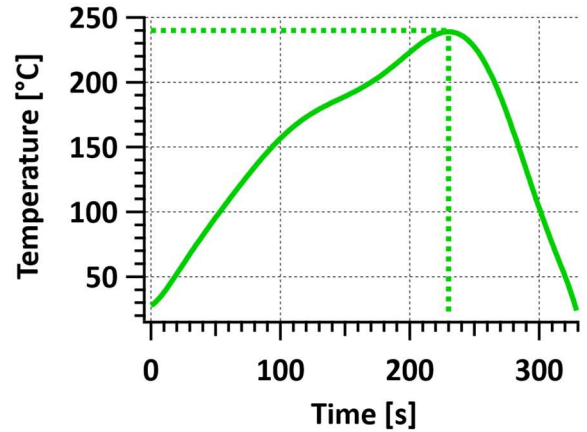
## C30737MH Series – Silicon Avalanche Photodiodes (APD) in LLC SMD package

### APD for High Volume LiDAR, Range Finding and Laser Meters

**Table 8: Reflow Solder Profile**

The following reflow solder profile is a typical used profile for SAC305 solder alloys. Specific solder parameters depend on the solder alloy used.

Profile Feature	Symbol	Typical	Units
Minimum Sparkling Temperature	$T_{Smin}$	150	°C
Maximum Sparkling Temperature	$T_{Smax}$	200	°C
Sparkling Time	$t_S$	75	s
Minimum Reflow Temperature	$T_L$	217	°C
Peak Temperature	$T_P$	244	°C
Reflow Time	$t_L$	65	s
Time within $T_P - 5^\circ\text{C}$	$t_P$	25	s
Ramp Down Rate	$\Delta T_c$	2	°C/s



#### MSL rating

The series of PIN diodes comply with a moisture sensitivity level (MSL) rating of 2A as defined in IPC/JEDEC-J-STD-033C. This allows for up to 4 weeks floor life at  $\leq 30^\circ\text{C} / 60\% \text{RH}$  once removed from the sealed reel packaging. For complete details refer to the IPC/JEDEC-J-STD-033C specification.

## C30737MH Series – Silicon Avalanche Photodiodes (APD) in LLC SMD package

### APD for High Volume LiDAR, Range Finding and Laser Meters

#### RoHS Compliance

This series of APD diodes are designed and built to be fully compliant with the European Union Directive on restrictions 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.

#### 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 7,000 employees in North America, Europe and Asia, serving customers across the world.

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