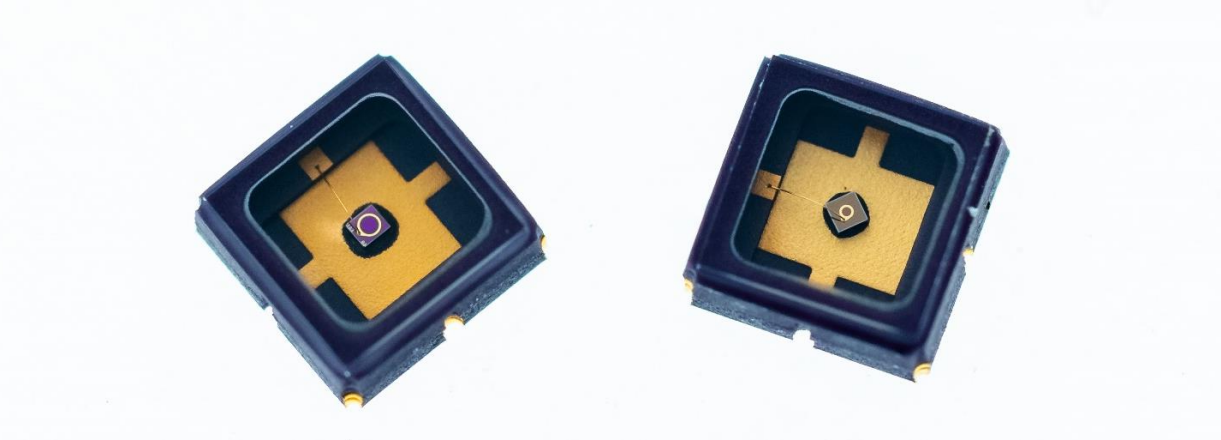
C30645L-080 and C30662L-200 – 1550 nm APDs in SMD package

Large Area and Low Noise InGaAs Avalanche Photodiode



Excelitas' C30645L-080 and C30662L-200 series Avalanche Photodiodes are high speed, large area InGaAs APDs that provide high quantum efficiency and high responsivity at low noise.

Key Features

- Spectral response 1000 nm – 1700 nm
- High responsivity
- Low dark current and noise
- Large active area of 80 µm and 200 µm
- Compact, robust ceramic SMT package
- Customizations (e.g. filters) possible
- RoHS compliant

Applications

- LiDAR / ToF measurements
- Eye-safe Laser range finding
- High volume consumer applications
- Optical time-domain reflectometer (OTDR)
- Optical communication systems
- Laser scanning

All specifications are referring to an ambient temperature of T_A = 22 °C, λ = 1550 nm and M = 10, unless otherwise specified.

Table 1: Key parameters

Parameter	Symbol	Min	Typ	Max	Unit
Breakdown Voltage	V_{BD}	45	50	70	V
Spectral Range	Δλ	1000		1700	nm
Peak Responsivity	λ_{peak}		1550		nm
Responsivity	R		9.4		A/W
Recommended Operating Gain[1]	M	10	20		

Note 1: For further information on the usage at different gains, please contact our experts at Excelitas Technologies.

Table 2: Ordering Information

Parameter	C30645L-080	C30662L-200	Units
Active Area Shape	Circular	Circular	
Useful Area	5027	31420	μm^2
Useful Diameter	80	200	µm

Table 3: Absolute Maximum Ratings

Parameter	Symbol	Value	Units
Forward Current	I_F	5	mA
Reverse Current	I_R	0.4	mA
Total Power Dissipation	P_{tot}	20	mW
Storage Temperature	T_S	-60 … 125	°C
Operating Temperature	T_{Op}	-20 … 70	°C
Soldering Temperature[3]	T_P	250	°C

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.

Note 3: For detailed reflow information, refer to Table 8.

Table 4: Optical Specifications C30645L-080

Parameter	Symbol	Minimum	Typical	Maximum	Units
Rise Time / Fall Time[1]	t_r / t_f		0.3		ns
Bandwidth	f_{3dB}	1000			MHz
Quantum Efficiency[2]	QE	75			%

Table 5: Optical Specifications C30662L-200

Parameter	Symbol	Minimum	Typical	Maximum	Units
Rise Time / Fall Time[1]	t_r / t_f		0.4		ns
Bandwidth	f_{3dB}	600	850		MHz
Quantum Efficiency[2]	QE	75			%

Note 1: As estimated by $t_{r/f} = \frac{0.35}{f_{3dB}}$

Note 2: Quantum Efficiency is a not directly measurable quantity. The above specified typical parameter is linked to the typical responsivity by $QE = \frac{1240\,R}{\lambda M}$. Please also refer to Figure 4.

Table 6: Electrical Specifications C30645L-080

Parameter	Symbol	Minimum	Typical	Maximum	Units
Operating Point from Breakdown	ΔV	2.5			V
Temperature Coefficient of V_{BD}	$\Delta V_{BD}/\Delta T$	0.14	0.20		V/°C
Capacitance	C		1.45		pF
Dark Current[1]	i_D		5	50	nA
Dark Noise[2]	i_N		0.35	1.00	pA/√(Hz)
Noise Equivalent Power[3]	NEP		0.04		pW/√(Hz)

Table 7: Electrical Specifications C30662L-200

Parameter	Symbol	Minimum	Typical	Maximum	Units
Operating Point from Breakdown	ΔV	2.0			V
Temperature Coefficient of V_{BD}	ΔV/ΔT		0.14	0.20	V/°C
Capacitance	C		2.70		pF
Dark Current[1]	i_D		60	150	nA
Dark Noise[2]	i_N		0.80	1.50	pA/√(Hz)
Noise Equivalent Power[3]	NEP		0.09		pW/√(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 (f_{3dB}) and operating wavelength (λ) inside the final system the illuminated noise

$$i_{ill} = \sqrt{2qf_{3dB}[i_{DS} + (i_{DB}M^2 + R_0(\lambda)M^2P)F]}$$

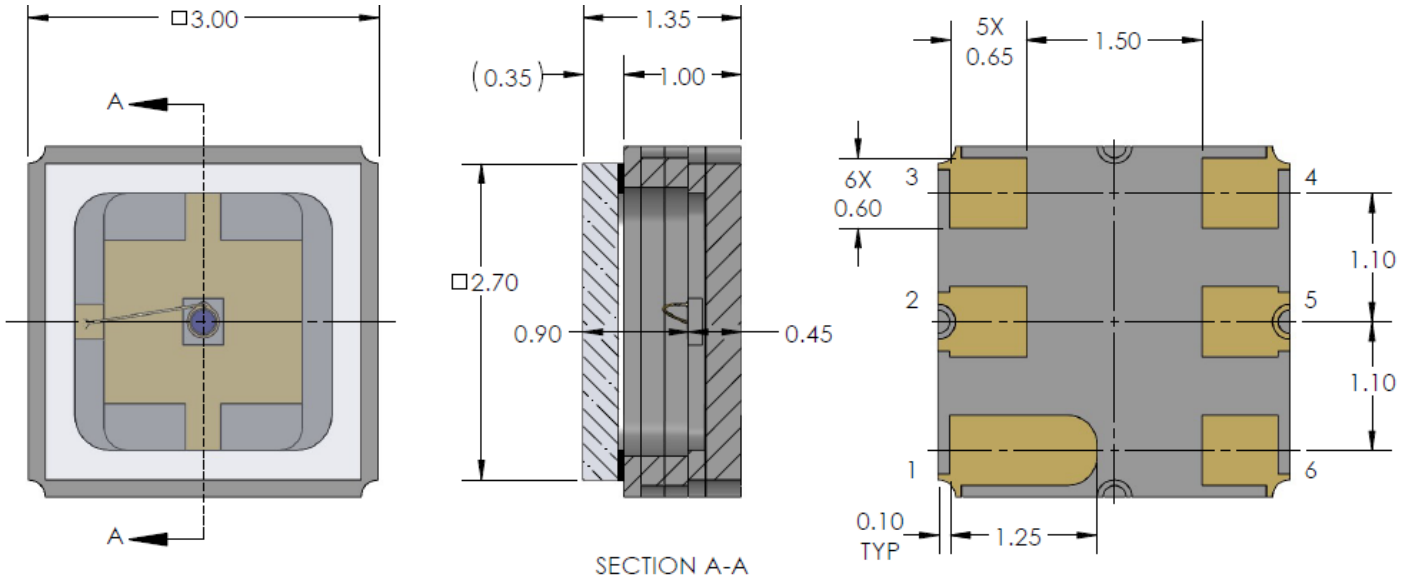
needs to be considered. Hence the SNR defines as

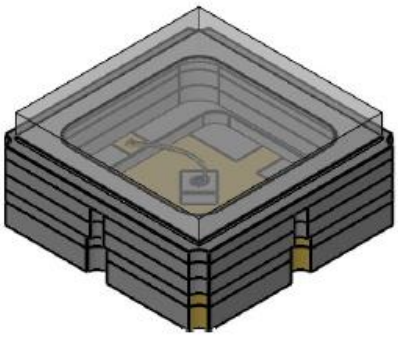
$$SNR = \frac{i_P^2}{i_{ill}^2} = \frac{(PR_o(\lambda)M)^2}{i_{ill}^2}$$

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 5.5 for InGaAs materials.

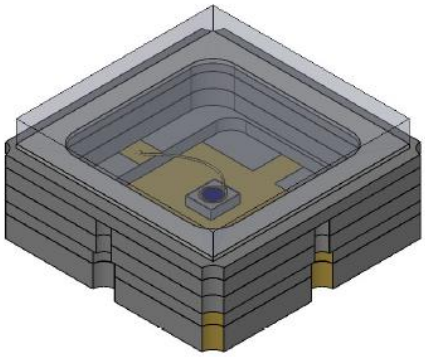
Note 3: The NEP is specified in dark conditions as $NEP = \frac{i_N}{R(\lambda)}$

Figure 1: APD Package Dimension C30645L-080 and C30662L-200





C30645L-080



C30662L-200

Figure 2: Typical Gain vs. Reverse Bias

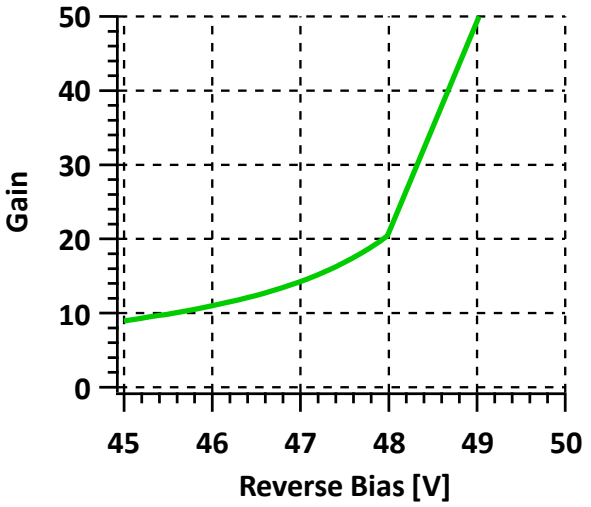


Figure 3: Typical Gain vs ΔV

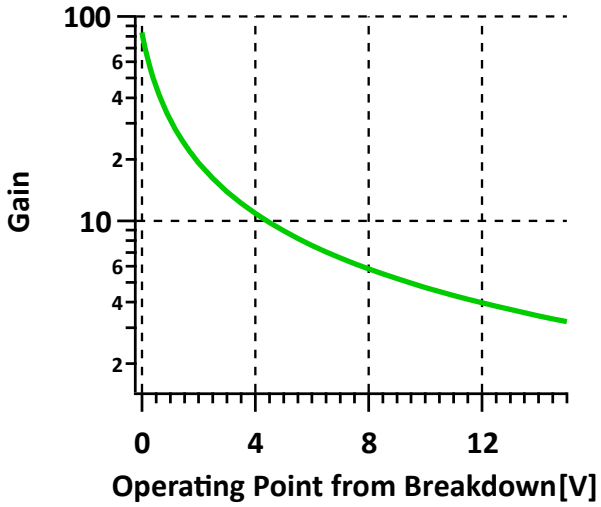


Figure 4: Typical Responsivity and Quantum Efficiency vs. Wavelength

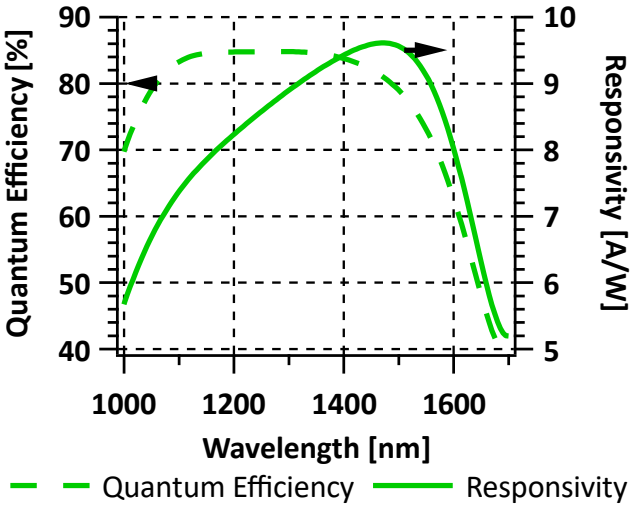


Figure 5: Typical Dark Current vs. Gain

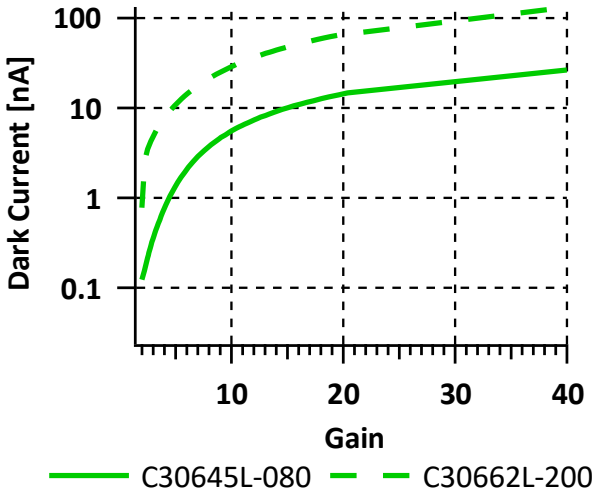
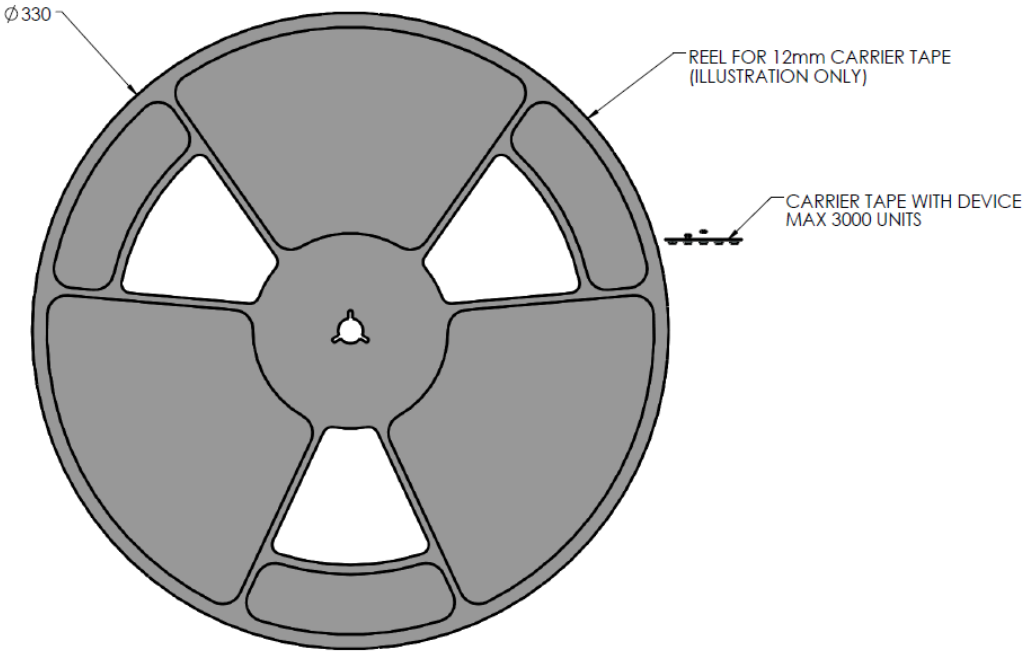
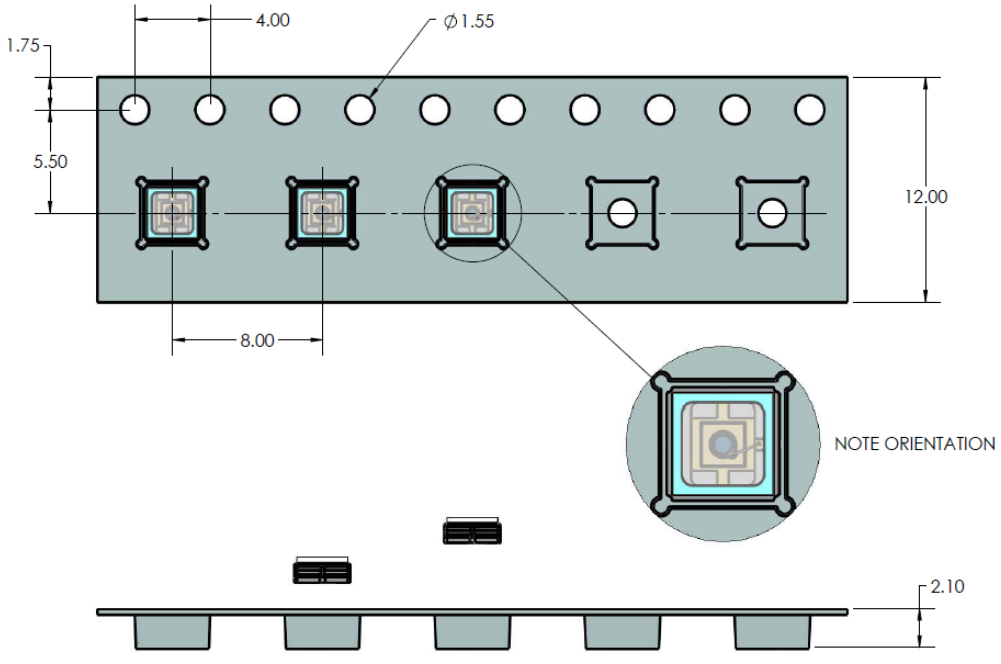


Figure 6: Tape and Reel Packaging Specification



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Information

Excelitas Technologies' C30645L-080 and C30662L-200 APDs are high speed, large area InGaAs/InP avalanche photodiodes. These photodiodes provide high quantum efficiency, high responsivity**,** and low noise in the spectral range between 1000 nm and 1700 nm. They are optimized for a wavelength of 1550 nm, suitable to use in eye-safe laser range finding systems.

The ceramic surface mount package allows for easy integration into high volume applications.

Recognizing that different applications have different performance requirements, Excelitas offers a wide range of customization of these photodiodes to meet your design challenges. Responsivity and noise screening, custom device testing and incorporating band pass filters are among many of the application-specific solutions available.

Testing Methods

Excelitas verifies the electro optical specifications on every device. Hence, a specific voltage, V_{OP}, is supplied with each device. When the photodiode is operated at this voltage (at 22 °C), it will meet the electrical specifications shown above. The voltage will be within the range of the breakdown Voltage V_{BD}.

Visual inspection during fabrication is performed as per our quality standard and failed dies are removed.

The following parameters are part of Excelitas testing procedures:

- Breakdown Voltage
- Reach-Through Voltage
- Operating Voltage (M = 10)
- Dark Current (M = 10)

Excelitas Technologies is certified to meet ISO-9001 and are designed to meet MIL-STD-883 and/or MIL-STD-750 specifications.

Packaging and Shipping

All C30645L-080 and C30662-200 APDs are offered in tape and reel shipping pack for quantities of 3000 units per reel; as shown in Figure 6.

For sampling quantities, the diodes are shipped in Gel Pack packages.

Storage and handling

Excelitas highly recommends following the below notes:

- Keep devices in an ESD controlled environment until final assembly.
- Keep T&R closed until final assembly
- Remove devices from T&R by using a vacuum pick-up tool
- If a manual picking method is necessary, use a non-marring tweezer to pick the APD by the sides of the package.
- Do not make contact to the window surface.

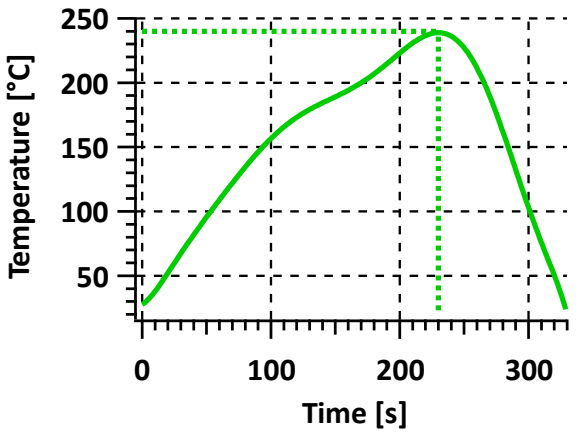
MSL Rating

The series of APD diodes comply with a moisture sensitivity level (MSL) rating of 3 as defined in IPC/JEDEC-J-STD-033C. This allows for up to 168 hours floor life at ≤ 30 °C / 60% RH once removed from the sealed reel packaging. For complete details refer to the IPC/JEDEC-J-STD-033C specification.

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 Soaking Temperature	T_{Smin}	150	°C
Maximum Soaking Temperature	T_{Smax}	200	°C
Soaking 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°C	t_P	25	s
Ramp Down Rate	ΔT_c	2	°C/s



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.

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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