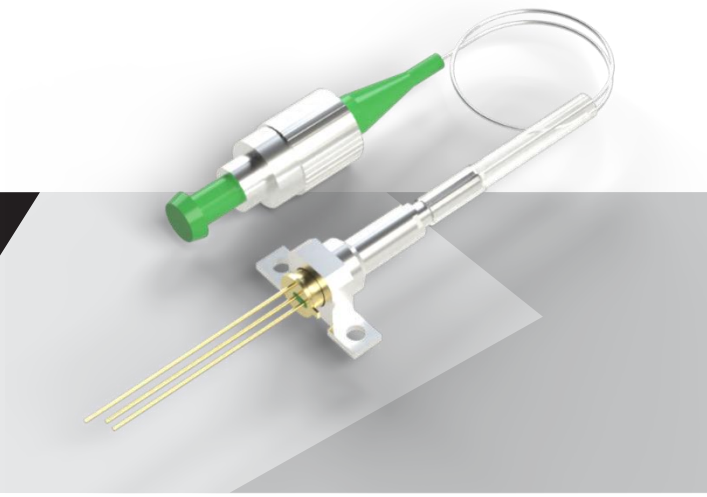
excelitas®



C30733EQC-3

Pigtailed High Gain InGaAs Avalanche Photodiode

Excelitas C30733EQC-3 Pigtailed APDs are small size, high speed InGaAs/InP avalanche photodiodes. Due to the small active area of 30 µm, these photodiodes provide highest gains at high quantum efficiency. Their low noise levels provide high signal to noise ratios and low NEP values, perfectly suited for distributed fiber sensing applications.

With its advanced, newly engineered design, the C30733EQC-3 achieves reduced dark current and faster recovery times at wavelengths exceeding 1550 nm. This enhanced recovery performance improves the device's effectiveness in detecting Raman-scattered signals in optical fibers for applications such as DTS and DAS.

YOUR BENEFITS

- Operating gain up to 100 to enhance sensitivity over long fiber lengths
- Optimized for fast transient signal detection
- Enables operation across key telecom wavelengths (O, E, S, C, L bands)
- Supports flexibility for multi-wavelength systems

SPECIFICATIONS

- High Quantum Efficiency of 75 % between 1100 nm – 1550 nm
- Typ. Bandwidth: 2 GHz
- Low NEP down to 8 fW/√(Hz) at gain M=40
- Small active area: 30 µm
- Fiber pigtail with FC/APC termination

C30733EQC-3 Pigtailed High Gain InGaAs APD

All specifications refer to an ambient temperature of TA = 22 °C, λ = 1550 nm, HV bias applied on cathode, case connected to ground, and M = 40, unless otherwise specified.

Table 1: Key Parameters

Parameter	Symbol	Min	Typ.	Max	Unit
Breakdown Voltage	V_{BD}	45	50	70	V
Spectral Range	Δλ	900		1700	nm
Peak Responsivity	λ_{peak}		1550		nm
Responsivity at M=1	R_{1550nm}		0.94		A/W
	R_{1650nm}		0.65		
Operating Gain[1]	M		40	100	

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

Table 2: 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}	-40 … 85	°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.

Table 3: Pigtail Specifications

Parameter	Typical Value
Pigtail Length[1]	1 m
Pigtail Fiber[1]	Single Mode (SM-9/125)
Pigtail Termination[1]	FC/APC

Note 1:Alternative fiber options available upon request.

Table 4: Electrical Specifications

Parameter	Symbol	Minimum	Typical	Maximum	Units
Temperature Coefficient of VBD	ΔV/ΔT		0.14		V/°C
Capacitance[1]	C		0.35	0.5	pF
Dark Current[2]	$I_{D,M=40}$		0.5	5	nA
	$I_{D,M=65}$		1	15	
Dark Noise[3]	$i_{N,M=40}$		0.3	0.5	pA/√(Hz)
	$i_{N,M=65}$		0.4	0.7	
	$i_{N,M=100}$		1.0		
Noise Equivalent Power[4]	$NEP_{M=40}$		8.0	13.3	fW/√(Hz)
	$NEP_{M=65}$		6.5	11.5	
	$NEP_{M=100}$		10		

Note 1:At gain M=10 or higher.

Note 2:Surface (I_{DS}) and bulk (I_{DB}) dark current are contributing to the total dark current with the following:

$$i_D = i_{DS} + i_{DB}M$$

Note 3: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 dependent on the bandwidth (f3dB) and operating wavelength (λ) inside the final system the illuminated noise must be considered with the following:

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

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 carrier charge, and F the excess noise factor.

Note 4:The NEP is specified in dark conditions as $NEP = \frac{i_N}{R(\lambda)}$

Table 5: Optical Specifications

Parameter	Symbol	Minimum	Typical	Maximum	Units
Rise Time / Fall Time[1]	t_r, t_f		0.2		ns
Bandwidth	f_{3dB}		2		GHz
Quantum Efficiency[2,3]	QE	75			%
Optical Return Loss	ORL		-30		dB
Polarization Dependent Responsivity	PDR		±1.5		%

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

Note 2:Between 1300 and 1550 nm.

Note 3: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 1.

FIG. 1: TYPICAL RESPONSIVITY AND QUANTUM EFFICIENCY

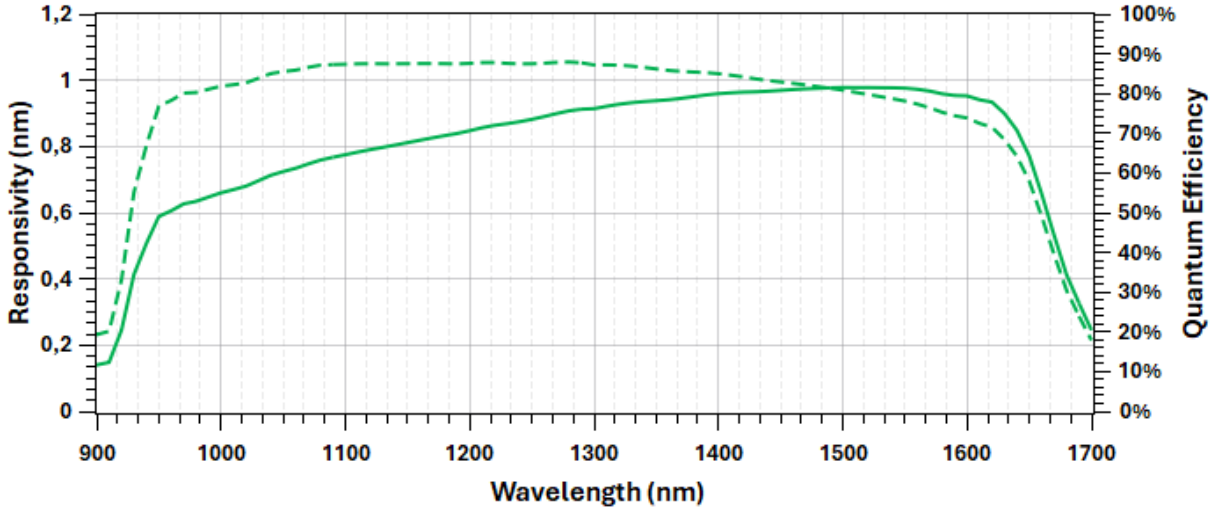


FIG. 2: TYPICAL GAIN AND RESPONSIVITY

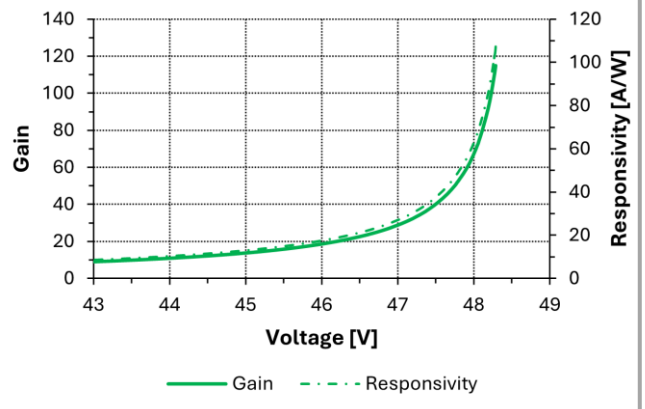


FIG. 3: TYPICAL DARK CURRENT AND NOISE

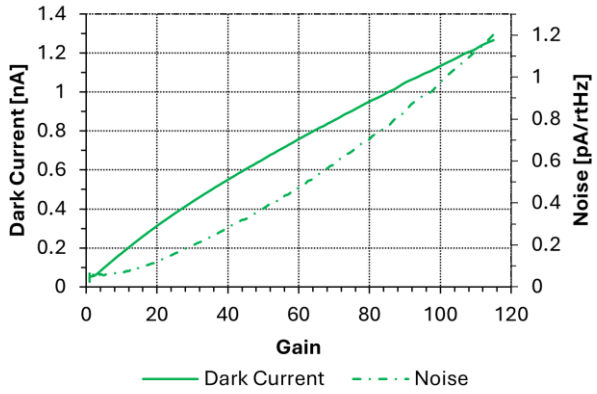


FIG. 4: TYPICAL CAPACITANCE

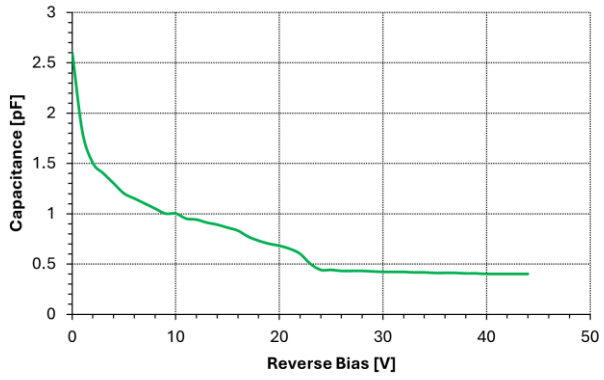


FIG. 5: TYPICAL NOISE EQUIVALENT POWER

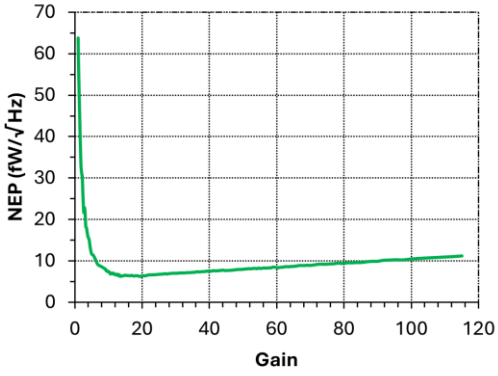
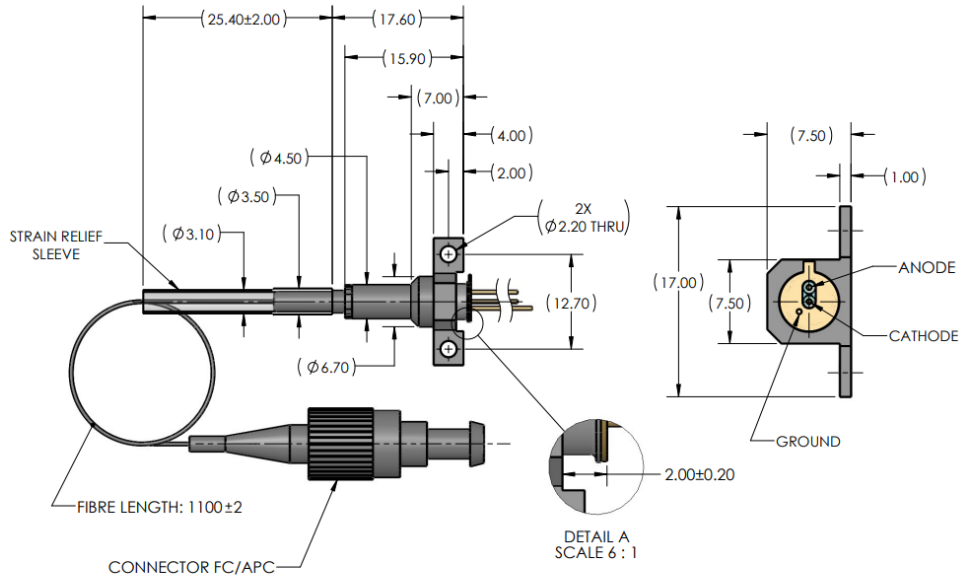


FIG. 6: MECHANICAL DIMENSIONS



Testing and operation 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 by applying voltage on the cathode (at 22 °C), it will meet the electrical specifications shown above.

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:

- Measurement at 1550 nm
- Breakdown Voltage (IR = 1 µA)
- Operating Voltage (M = 40 and 65)
- Dark Current (M = 40 and 65)
- Capacitance (sampling)

Testing at different gain is available upon request.

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

Packaging and shipping

The APDs are shipped in individual plastic trays.

Storage and handling

Excelitas highly recommends following the notes below:

- Keep devices in an ESD controlled environment until final assembly.
- Keep the fiber termination sealed until final assembly.
- Do not contact the bare fiber end.

RoHS compliance

This series of APD diodes is designed and built to be fully compliant with the European Union Directive on restrictions on the use of certain hazardous substances in electrical and electronic equipment.

Warranty

A standard 12-month warranty following shipment applies

About Excelitas

Excelitas is a leading provider of advanced, life-enriching technologies that make a difference, serving global market leaders in the life sciences, advanced industrial, next-generation semiconductor and avionics end markets. Headquartered in Pittsburgh, PA, USA, Excelitas is an essential partner in the design, development and manufacture of advanced technologies, offering leading-edge innovation in sensing, detection, imaging, optics and specialty illumination for customers worldwide. Excelitas is at the forefront of addressing many of the relevant megatrends impacting the world today, including precision medicine, industrial automation, artificial intelligence and connected devices (IoT).

Connect with Excelitas on LinkedIn, Facebook, X and Instagram, or visit our website at www.excelitas.com for more information.

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