

CH-8135 Langnau a/A Tel. +41 (0)43 377 60 60 www.precitek-logotron.ch





PerkinElmer Type C30902E avalanche photodiode utilizes a silicon detector chip fabricated with a double-diffused "reachthrough" structure. This structure provides high responsivity between 400 and 1000 nm as well as extremely fast rise and fall times at all wavelengths. Because the fall time characteristics have no "tail", the responsivity of the device is independent of modulation frequency up to about 800 MHz. The detector chip is hermetically-sealed behind a flat glass window in a modified TO-18 package. The useful diameter of the photosensitive surface is 0.5 mm.

PerkinElmer Type C30921E utilizes the same silicon detector chip as the C30902E, but in a package containing a lightpipe which allows efficient coupling of light to the detector from either a focussed spot or an optical fiber up to 0.25 mm in diameter. The internal end of the lightpipe is close enough to the detector surface to allow all of the illumination exiting the lightpipe to fall within the active-area of the detector. The hermetically-sealed TO-18 package allows fibers to be epoxied to the end of the lightpipe to minimize signal losses without fear of endangering detector stability.

The C30902E and C309021E are designed for a wide variety of uses including optical communications at data rates to 1 GBit/second, laser range-finding, and any other applications requiring high speed and/or high responsivity.

Silicon Avalanche Photodiodes C30902E, C30902S, C30921E, C30921S

High Speed Solid State Detectors for Fiber Optic and Very Low Light-Level Applications



IN A

NEW

LIGHT.



Features

- ·High Quantum Efficiency 77% Typical at 830 nm
- C30902S and C30921S in Geiger Mode:

Single-Photon Detection Probability to 50%

Low Dark-Count Rate at 5% Detection Probability - Typically

15,000/second at +22°C

350/second at -25°C

Count Rates to 2 x 106/second

- · Hermetically Sealed Package
- ·Low Noise at Room Temperature

C30902E, C30921E - 2.3 x 10⁻¹³ A/Hz^{1/2}

C30902S, C30921S - 1.1 x 10⁻¹³ A/Hz^{1/2}

- ·High Responsivity Internal Avalanche Gains in Excess of 150
- *Spectral Response Range (10% Points) 400 to 1000 nm
- •Time Response Typically 0.5 ns
- •Wide Operating Temperature Range -40°C to +70°C



C30902E, C30902S, C30921E, C30921S



The C30902S and C30921S are selected C30902E and C30921E photodiodes having extremely low noise and bulk dark-current. They are intended for ultra-low light level applications (optical power less than 1 pW) and can be used in either their normal linear mode ($V_R < V_{BR}$) at gains up to 250 or greater, or as photon counters in the "Geiger" mode ($V_R > V_{BR}$) where a single photoelectron may trigger an avalanche pulse of about 10⁸ carriers. In this mode, no amplifiers are necessary and single-photon detection probabilities of up to approximately 50% are possible.

Photon-counting is also advantageous where gating and coincidence techniques are employed for signal retrieval.

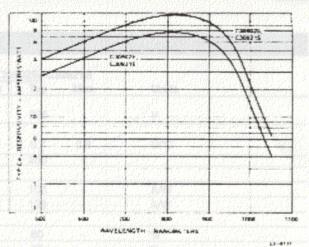


Figure 1. Typical Spectral Responsivity at 22°C

Optical Characteristics

C30902E, C30902S (Figure 13)

Photosensitive Surface:

	Shape	
	Jseful area0.2 mm	2
	Jseful diameter	
ě		

Field of View:

Approximate full angle for totally illuminated photosensitive surface100 deg

C30921E, C30921S (Figure 14)

Numerical Aperture of Light Pipe0.55	
Refractive Index (n) of Core	
Lightpipe Core Diameter	

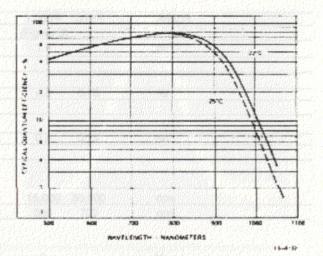


Figure 2, Typical Quantum Efficiency vs. Wavelength

Maximum Ratings, Absolute-Maximum Values (All Types)

Reverse Current at 22°C:

Average value, continuous operation	200 μΑ
Peak value	
(for 1 second duration, non-repetitive)	1 mA
Forward Current, IF at 22°C:	
Average value, continuous	
operation while a will a while the operation of the control of the	5 mA
Peak value (for 1 second	
duration, non-repetitive)	50 mA
Maximum Total Power Dissipation at 22°C	60 mW
Ambient Temperature:	
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imum Total Power Dissipation at 22°C 60 mW
bient Temperature:

Storage, T_{stg} -60 to +100°C
Operating, T_A -40 to +70°C
Soldering (for 5 seconds) 200°C

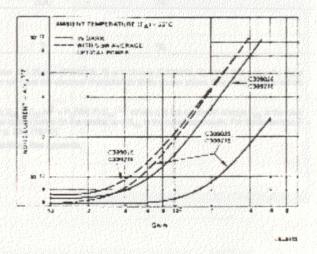


Figure 3. Typical Noise Current vs. Gain



Electrical Characteristics	at T	A = 22°C					
	C3	C30902E, C309021E			0902S, C	200245	แบบรายออกเลยเกราะเบารอยู่สุดให้และเลยเราะความเป็นเสียม
	Min	Typ	Max	Min	Typ	Max	Units
		Alie Carlos Carlos					
Breakdown voltage, V _{BR} Temperature Coefficient of		225	-		225	орижи Л есов завесто	is a giller in M in the interpretation of the section of the section M
V _R for Constant Gain	0.5	0.7	0.8	0.5	0.7	0.0	z integralization planting contraction from
Gain	0.5	150		0.5	0.7	8.0	V/°C
		150	+		250	• /	
Responsivity:		0.5				Contribution of the contribution	
At 900 nm	55	65	-	92	108	*	AW
At 830 nm	70	77	Medianian Median	117	128	acerci pivini 🖷 (27 a ili se 12 a ili se).	AM contraction and a second se
Quantum Efficiency:	(skylostorij	(a) 190 g/g - Selegi 100					
At 900 nm	-	60	agos Sasanie	-	60	6.5	% 1997e)
At 830 nm		77	-	-100	77		%
Dark Current, I _d	-	1.5x10-8	3x10-8		1x10-8	3x10 ⁻⁸	A
	200	(Figure 6)		HIV XORS IV	(Figure 6		
Noise Current, i _n : 2							
f = 10 kHz, Δf = 1,0 Hz	7-1	2.3x10-13	5x10-13		1.1x10-13	2x10-13	A/Hz1/2
		(Figure 3)			(Figure 3)	
Capacitance, C _d		1.6	2		1.6	2	pF
Rise Time, t _r :							Statistical PRO Introductives International Programme International Programme International Programme International Programme International In
$R_L = 50\Omega$, $\lambda = 830$ nm,		Constant					6 Table 1 Tabl
10% to 90% points	Hot extraction	0.5	0.75	-	0.5	0.75	ns
Fall Time:							
$R_1 = 50\Omega$, $\lambda = 830$ nm,	nylra (Zens)	icas hervielekkingarin	A Sovjetsko revint vodi	44424			
90% to 10% points	-	0.5	0.75		0.5	0.75	ns
Geiger Mode (See Appendix)				And District	-		
Dark Count Rate at 5% Photon	namii (d)					PROBLEM STATES	permitted (Announce South and Mineral Property (Announce Manager) Montage Manager (Announce South and Manager) Manager (Announce Manager) Manager (Announce Manager)
Detection Probability 3 (830 nm):							
22°C		Colonia Arabilla (planti	obstrument (maje)		15,000	30,000	
-25°C	thaightain a	ing the second second			350	700	cps cps
Voltage Above V _{BR} for 5% Photon Detection Probability 3			artini ir saidini Sarvi ir saidini		555	700	\$\frac{1}{2}\text{\$\frac{1}\text{\$\frac{1}{2}\text{\$\frac{1}{2}\text{\$\frac{1}{2}\text{\$\frac{1}{2}\text{\$\frac{1}{2}\text{\$\frac{1}{2}\text{\$\frac{1}{2}\text{\$\frac{1}{2}\text{\$\frac{1}{2}\text{\$\frac{1}\text{\$\frac{1}\text{\$\frac{1}\text{\$\frac{1}\text{\$\frac{1}\text{\$\frac{1}\te
(830 nm) (See Figure 8)	g Grish	light file is stilled.			es de Ardalidas cuma 12 de m	TROM TELESTICS STABILITY - PRISE JULY VERNOUS MAN	Protoprazolia (ak.a. 1946) pok lukupino Hrabini sum. Igrimpan M akimpandra na Progra (1921) postavnena
Dead-Time Per Event	1					Anna State (New York)	ng sakaranas (n. 26. 250), antseks telah sakasana saksana Unisten Cu 20.76
(See Appendix)					300		ri kanton salam 🚣 kultsierinnis ikhitini kkeishiyarillesi sajasumu bakeritatibiti
After-Pulse Ratio at 5% Photon	lakajanjas	organista kanana	esferiment remons		300		ns
Detection Probability (830 nm)						ar (Chillipping Locate	(1994) - Mariello II december en mariello esculperado (1994)
					2	15	%

Note 1. At the DC reverse operating voltage V_R supplied with the device and a light spot diameter of 0.25 mm (C30902E, S) or 0.10 mm (C30921E, S). Note that a specific value of V_R is supplied with each device. When the photodiode is operated at this voltage, the device will meet the electrical characteristic limits shown above. The voltage value will be within the range of 180 to 250 volts.

Note 2. The theoretical expression for shot noise current in an avalanche photodiode is $i_n = (2q (l_{dS} + (l_{dD}M^2 + P_0RM) F) B_W)^{1/2}$ where q is the electronic charge, l_{dS} is the dark surface current, l_{dD} is the dark bulk current, F is the excess noise factor, M is the gain, P_0 is the optical power on the device, and B_W , is the noise bandwidth. For these devices F = 0.98 (2-1M) + 0.02 M. (Reference: PP Webb, RJ McIntyre, JJ Conradi, "RCA Review", Vol. 35 p. 234, (1974)).

Note 3. The C30902S and C30921S can be operated at a substantially higher Detection Probabilities. See Appendix.

Note 4. After-Pulse occurring 1 microsecond to 60 seconds after main pulse.