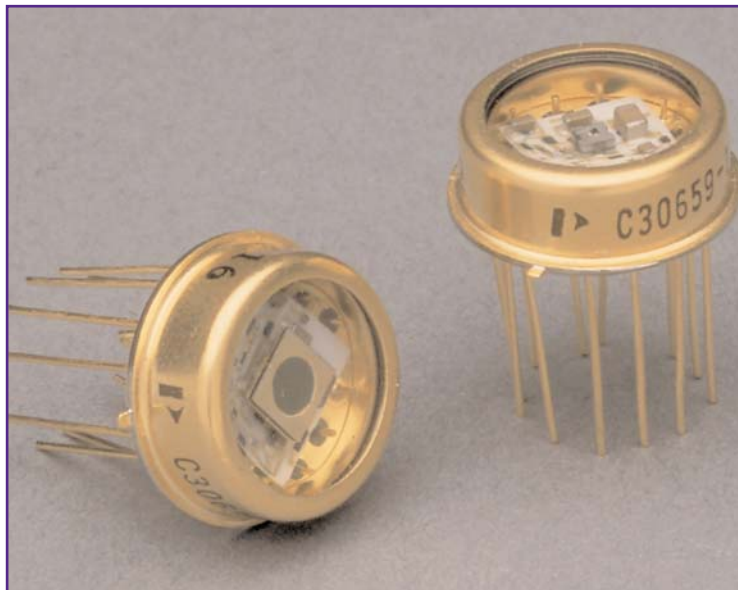


C30659E-900-1060-1550 nm Series

Silicon and InGaAs APD Preamplifier Modules



Description

PerkinElmer C30659 Series includes a Silicon or InGaAs Avalanche Photodiode with a hybrid preamplifier. It is supplied in a single modified 12-lead TO-8 package.

The avalanche photodiodes used in these devices are the C30817E, C30902E, C30954E, C30956E, C30645E and C30662E that provide very good response between 830 and 1550 nanometers and very fast rise and fall times at all wavelengths. The preamplifier section uses a very low noise GaAs FET front end designed to operate at higher transimpedance than the regular C30950 series.

The C30659 is pin to pin compatible with the C30950 series. The output of the C30659 is negative. An emitter follower is used as an output buffer stage. To obtain the wideband characteristics, the output of these devices should be AC (capacitively) coupled to a 50 Ohm termination. The module must not be DC coupled to loads of less than 2,000 Ohms.

For field use, it is recommended that a temperature compensated HV supply such as the HVTC series be employed to maintain responsivity constant over temperature.

Applications

- Range Finding
- Confocal Microscope
- LIDAR

Features

- System bandwidth (3 dB Point): DC to 50 MHz, 200 MHz
- Ultra low-noise equivalent power (NEP)
- Spectral response range (10% Points):
Silicon APD for 400 to 1000nm
InGaAs APD for 1100 to 1650 nm
- Power consumption (20 mW typ.)
- +/-5 Volts amplifier operating voltages
- 50 Ω AC Load capability
- Hermetically sealed TO-8 packages
- High reliability
- Fast overload recovery
- PIN compatible with the C30950 series
- Light entry angle $\alpha \sim 130^\circ$



C30659E-900 nm Series

Electrical Characteristics at $T_A=22^\circ\text{C}$

Conditions: Ambient Temperature, $V_{\text{amp}} = \pm 5$ Volts, $HV = +VR$ (see Note 1), $R_1 = 50\Omega$ AC Coupled

	900nm Silicon APD						
Detector Type	C30659-900-R8A (Si APD C30817E)			C30659-900-R5B (Si APD C30902E)			
Active Diameter	0.8			0.5			m m
Active Area	0.5			0.2			m m ²
Bandwidth Range	50 Mhz			200 Mhz			
	Min	Typ	Max	Min	Typ	Max	
Temperature Coefficient of VR for constant Gain	-	2.2	-	-	0.7	-	V/°C
V_R for specified responsivity	275	Note 1	435	180	Note 1	260	V
Responsivity							
At 830 nm	-	2700	-	-	460	-	kV/W
At 900 nm	-	3000	-	-	400	-	kV/W
R_F (Internal Feedback Resistor)	-	82	-	-	12	-	k Ω
Noise Equivalent Power (NEP) (note 2) $f = 100$ kHz, $\Delta f = 1.0$ Hz							
At 830 nm	-	14	17	-	35	55	fW/ $\sqrt{\text{Hz}}$
At 900 nm	-	12	15	-	40	65	fW/ $\sqrt{\text{Hz}}$
Output Spectral Noise Voltage Density (OSNVD) :							
$f = 100$ kHz - $f_{-3\text{dB}}$	-	35	45	-	15	25	nV/ $\sqrt{\text{Hz}}$
Output Impedance	33	40	50	33	40	50	Ω
System Bandwidth, $f_{-3\text{dB}}$	40	50	-	175	200	-	MHz
Rise Time, t_r ($\lambda = 830$ and 900 nm) 10% to 90% points	-	7	-	-	2	-	ns
Fall Time, t_f ($\lambda = 830$ and 900 nm) 90% to 10% points	-	7	-	-	2	-	ns
Recovery time after overload (note 4)	-	-	150	-	-	150	ns
Output Voltage Swing (1k Ω load) (note 3)	2	3	-	2	3	-	V
Output Voltage Swing (50 Ω load) (note 3)	0.7	0.9	-	0.7	0.9	-	V
Output Offset Voltage	-1	0.25	0.5	-1	0.25	0.5	V
Supply Current	-	20	35	-	20	35	mA
Supply Current	-	10	20	-	10	20	mA

Notes: 1. A specific value of VR is supplied with each device. The VR value will be within the specified ranges.

2. NEPmax is the COSNVDmax divided by the typical Responsivity.

3. Pulsed operation.

4. 0dBm, 250ns pulse.

C30659E-1060 nm Series

Electrical Characteristics at $T_A=22^\circ\text{C}$

Conditions: Ambient Temperature, $V_{amp} = \pm 5$ Volts, $HV = +VR$ (see Note 1), $R_1 = 50\Omega$ AC Coupled

	1060nm Silicon APD						
Detector Type	C30659-1060-3A (Si APD C30956E)			C30659-1060-R8B (Si APD C30954E)			
Active Diameter	3.0			0.8			m m
Active Area	7.1			0.5			m m ²
Bandwidth Range	50 Mhz			200 Mhz			
	Min	Typ	Max	Min	Typ	Max	
Temperature Coefficient of VR for constant Gain	-	2.2	-	-	0.7	-	V/°C
V_R for specified responsivity	275	Note 1	425	275	Note 1	425	V
Responsivity (= $R_D[A/W]*R_F*A_V$)							
At 900 nm	-	450	-	-	370	-	kV/W
At 1060 nm	-	280	-	-	200	-	kV/W
R_F (Internal Feedback Resistor)	-	22	-	-	12	-	k Ω
Noise Equivalent Power (NEP) (note 2) f - 100 kHz, $\Delta f = 1.0$ Hz							
At 900 nm	-	55	80	-	55	80	fW/ $\sqrt{\text{Hz}}$
At 1060 nm	-	90	125	-	100	150	fW/ $\sqrt{\text{Hz}}$
Output Spectral Noise Voltage Density (OSNVD) :							
f = 100 kHz - f_{3dB}	-	25	35	-	20	30	nV/ $\sqrt{\text{Hz}}$
Output Impedance	33	40	50	33	40	50	Ω
System Bandwidth, f_{3dB}	40	50	-	175	200	-	MHz
Rise Time, t_r ($\lambda = 900$ and 1060 nm) 10% to 90% points	-	7	-	-	2	-	ns
Fall Time, t_f ($\lambda = 830$ and 900 nm) 90% to 10% points	-	7	-	-	2	-	ns
Recovery time after overload (note 4)	-	-	150	-	-	150	ns
Output Voltage Swing (1k Ω load) (note 3)	2	3	-	2	3	-	V
Output Voltage Swing (50 Ω load) (note 3)	0.7	0.9	-	0.7	0.9	-	V
Output Offset Voltage	-1	0.25	0.5	-1	0.25	0.5	V
Supply Current	-	20	35	-	20	35	mA
Supply Current	-	10	20	-	10	20	mA

Notes: 1. A specific value of VR is supplied with each device. The VR value will be within the specified ranges.

2. NEPmax is the COSNVDmax divided by the typical Responsivity.

3. Pulsed operation.

4. 0dBm, 250ns pulse.

C30659E-1550 nm Series

Electrical Characteristics at $T_A=22^\circ\text{C}$

Conditions: Ambient Temperature, $V_{amp} = \pm 5$ Volts, $HV = +VR$ (see Note 1), $R_1 = 50\Omega$ AC Coupled

	1550nm InGaAs APD						
Detector Type	C30659-1550-R2A (InGaAs APD C30662E)			C30659-1550-R08B (InGaAs APD C30645E)			
Active Diameter	0.2			0.08			m m
Active Area	0.03			0.005			m m ²
Bandwith Range	50 Mhz			200 Mhz			
	Min	Typ	Max	Min	Typ	Max	
Temperature Coefficient of V_R for constant Gain	-	0.2	-	-	0.2	-	V/°C
V_R for specified responsivity	40	Note 1	70	40	Note 1	70	V
Responsivity (= $R_D[A/W]*R_F*A_V$) At 1300 nm At 1550 nm R_F (Internal Feedback Resistor)	-	300	-	-	80	-	kV/W
	-	340	-	-	90	-	kV/W
	-	68	-	-	18	-	k Ω
Noise Equivalent Power (NEP) (note 2) $f = 100$ kHz, $\Delta f = 1.0$ Hz At 1300 nm At 1550 nm	-	150	180	-	250	375	fW/ $\sqrt{\text{Hz}}$
	-	130	160	-	220	330	fW/ $\sqrt{\text{Hz}}$
Output Spectral Noise Voltage Density (OSNVD) : $f = 100$ kHz - f_{3dB} Output Impedance System Bandwidth, f_{3dB}	-	45	55	-	20	30	nV/ $\sqrt{\text{Hz}}$
	33	40	50	33	40	50	Ω
	40	50	-	175	200	-	MHz
Rise Time, t_r ($\lambda = 900$ and 1060 nm) 10% to 90% points	-	7	-	-	2	-	ns
Fall Time, t_f ($\lambda = 830$ and 900 nm) 90% to 10% points	-	7	-	-	2	-	ns
Recovery time after overload (note 4)	-	-	150	-	-	150	ns
Output Voltage Swing (1k Ω load) (note 3)	2	3	-	2	3	-	V
Output Voltage Swing (50 Ω load) (note 3)	0.7	0.9	-	0.7	0.9	-	V
Output Offset Voltage	-0.5	-0.3	0.5	-0.5	-0.3	0.5	V
Supply Current	-	20	35	-	20	35	mA
Supply Current	-	10	20	-	10	20	mA

Notes: 1. A specific value of V_R is supplied with each device. The V_R value will be within the specified ranges.

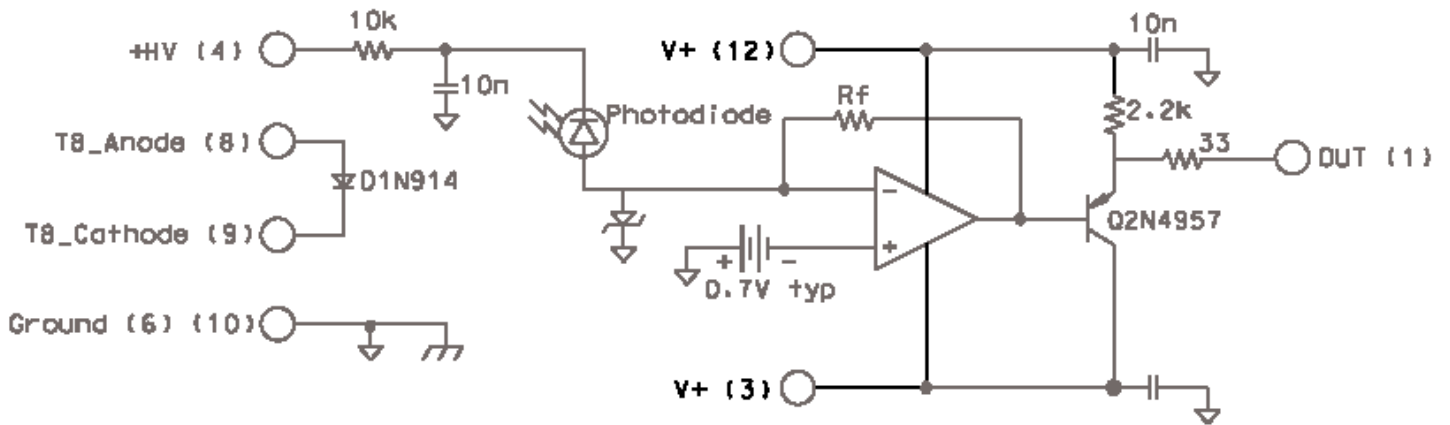
2. NEPmax is the COSNVDmax divided by the typical Responsivity.

3. Pulsed operation.

4. 0dBm, 250ns pulse.

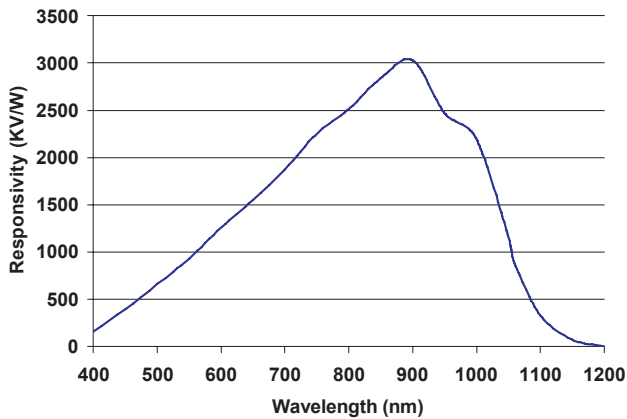
C30659E-900-1060-1550 nm Series

C30659 Series Block Diagram

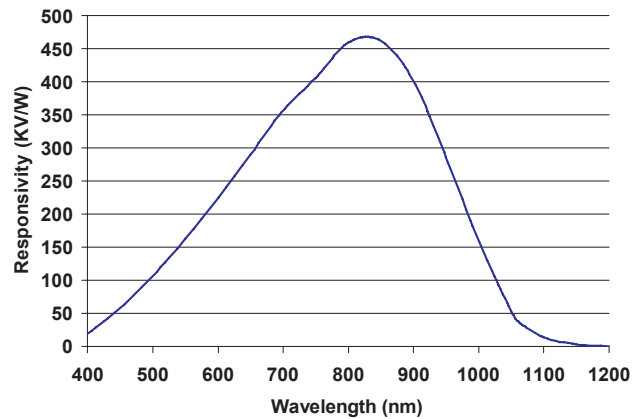


Spectral Responsivity

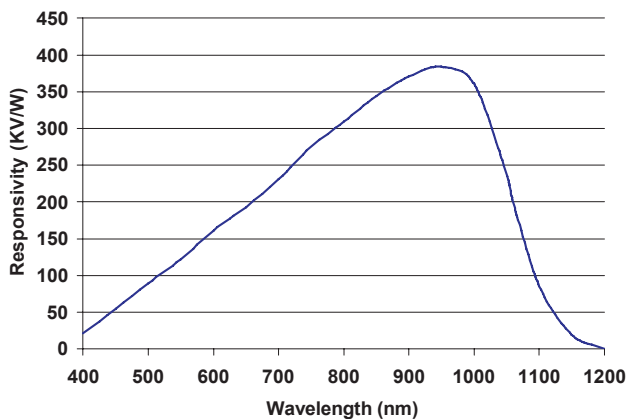
C30659-900-R8A



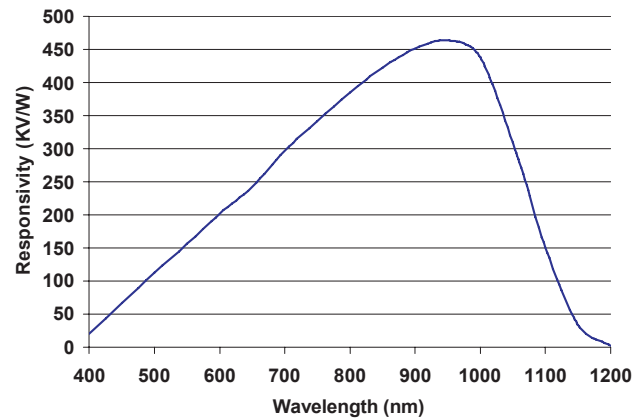
C30659-900-R5B



C30659-1060-R8B



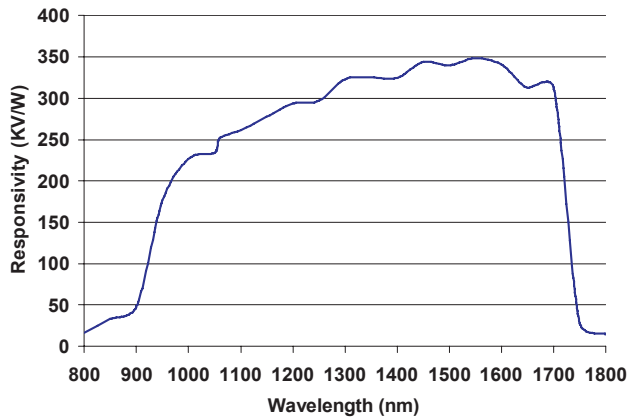
C30659-1060-3A



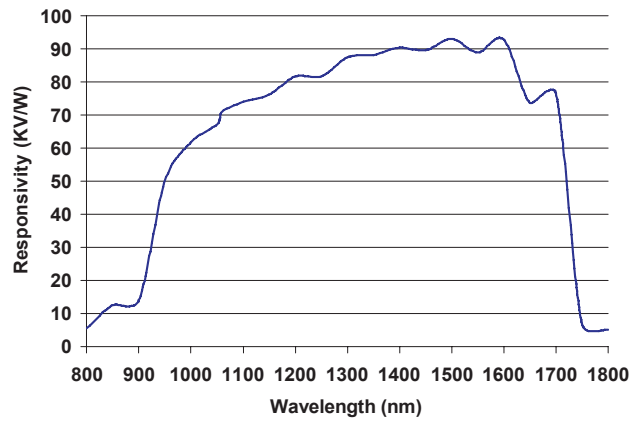
C30659E-900-1060-1550 nm Series

Spectral Responsivity continued

C30659-1550-R2A

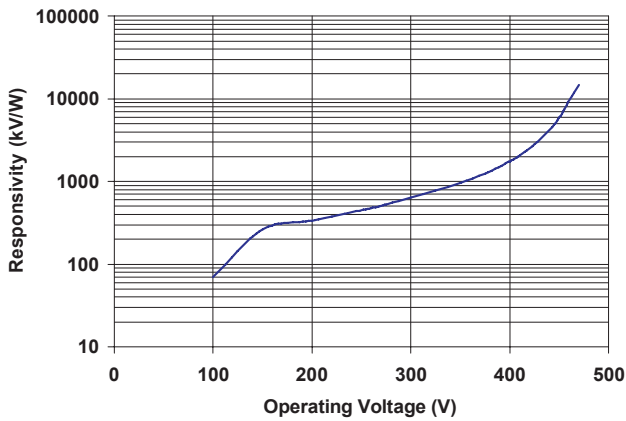


C30659-1550-R08B

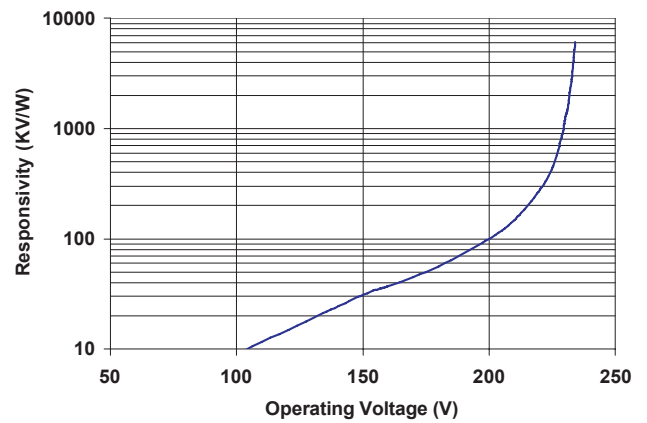


Responsivity

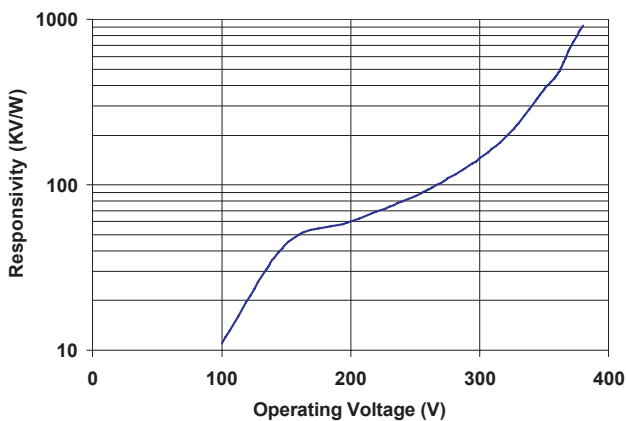
C30659-900-R8A



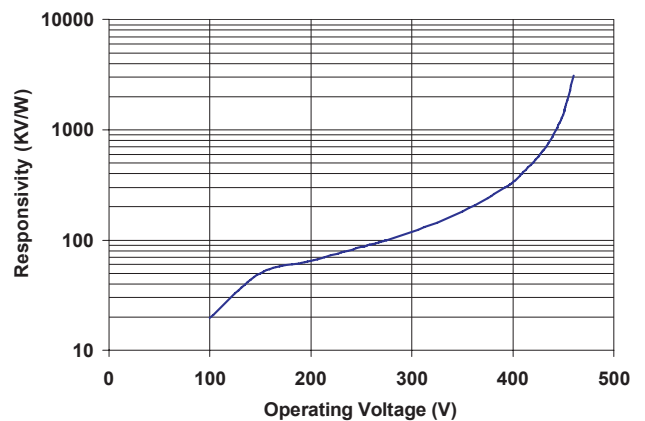
C30659-900-R5B



C30659-1060-R8B



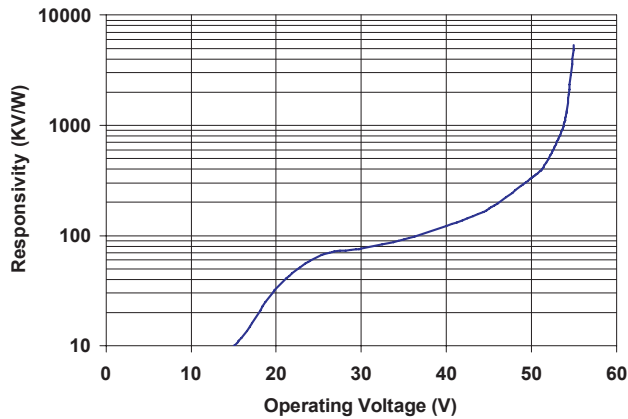
C30659-1060-3A



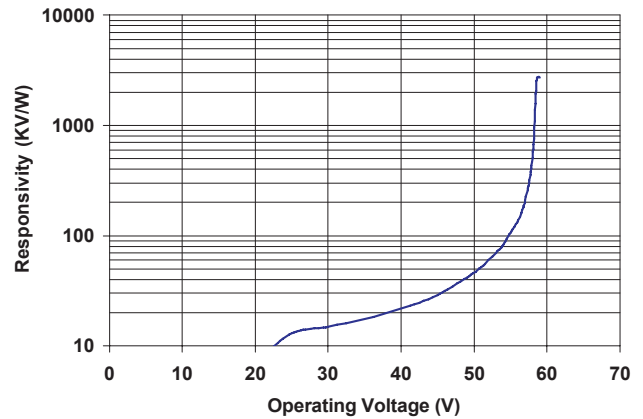
C30659E-900-1060-1550 nm Series

Responsivity continued

C30659-1550-R2A



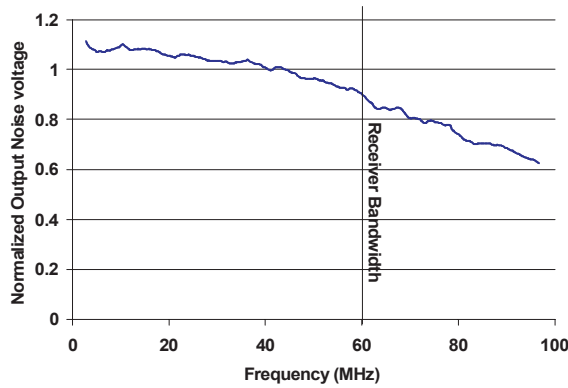
C30659-1550-R08B



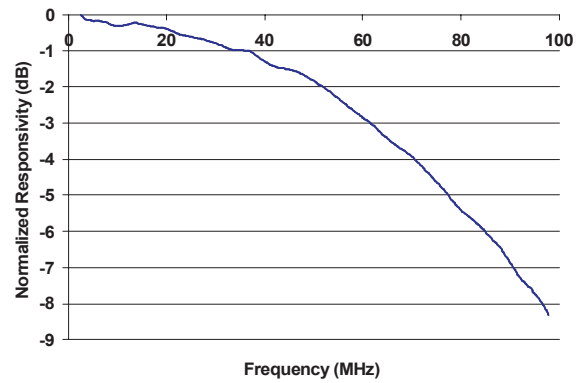
Typical Frequency Response / Noise Curves

50 MHz Receivers

Noise

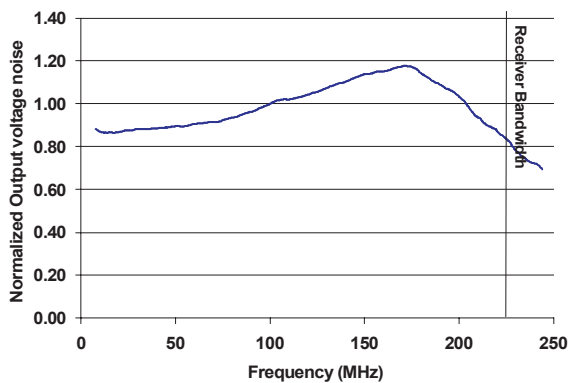


Frequency

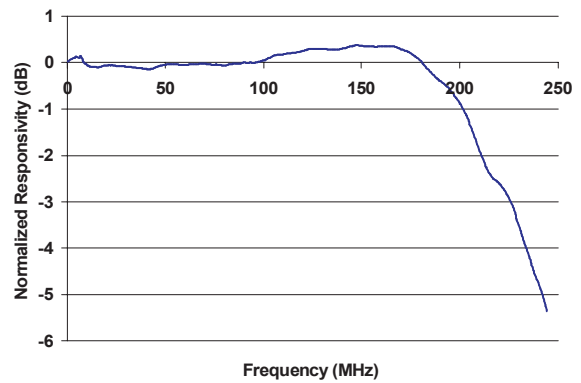


200 MHz Receivers

Noise



Frequency



Output voltage noise normalization is calculated using the following formula:

$$Vn_{normalize} = \frac{Vn}{Vn_{average}}$$

$$Vn_{average} \left(\frac{V}{\sqrt{Hz}} \right) = \sqrt{\frac{\int_{100kHz}^{f_{-3dB}} Vn^2 \cdot df}{f_{-3dB}}}$$

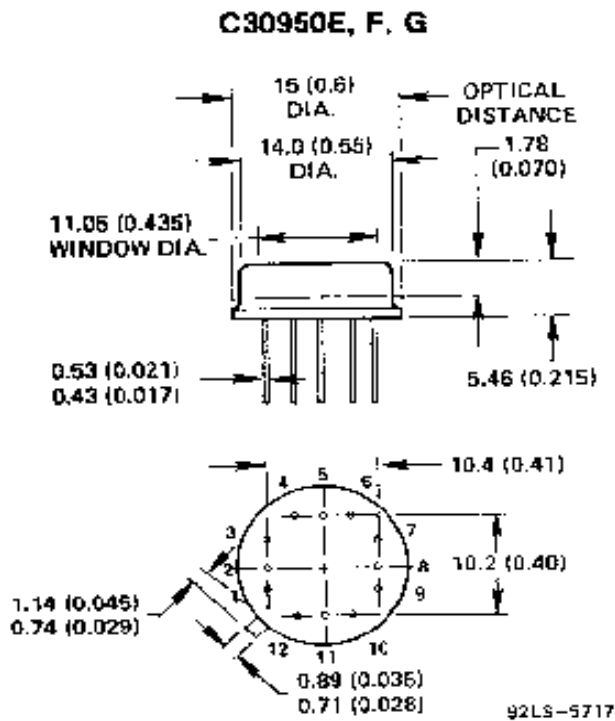
C30659E-900-1060-1550 nm Series

Absolute - Maximum Ratings, Limiting Values

	C30659-900 (Si)			C30659-1060 (Si)			C30659-1550 (InGaAs)			
	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Photodiode Bias Voltage:										
At TA = +70°C	-	600	-	-	600	-	-	100	-	V
At TA = - 40°C	-	300	-	-	300	-	-	50	-	V
Incident Radiant Flux, Φ_M	-	20	100	-	20	100	-	20	100	m W
Case Temperature:										
Storage, T _{stg}	-50	-	100	-50	-	100	-50	-	100	°C
Operating, T _A	-40	-	70	-40	-	70	-40	-	70	°C
Preamplifier Voltage:	-4.5	-	-5.5	-4.5	-	-5.5	-4.5	-	-5.5	V

Notes: 1.

Mechanical Characteristics

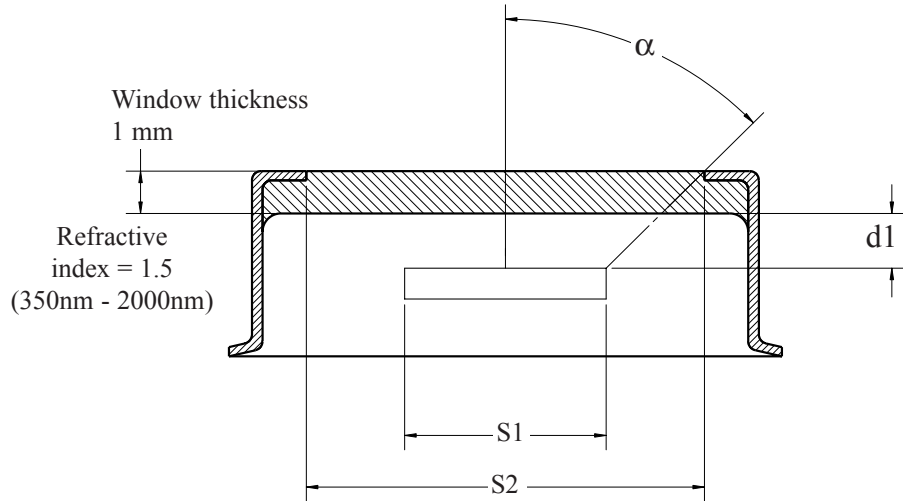


PIN CONNECTIONS

- 1: Signal Output
- 2: No Connection
- 3: -Vcc Negative Amplifier Bias
- 4: Positive high voltage
- 5: No Connection
- 6: Case Ground
- 7: No Connection
- 8: Temp. Sensing Diode - Anode
- 9: Temp. Sensing Diode - Cathode
- 10: Ground, DC returns
- 11: No Connection
- 12 +Vcc Positive Amplifier Bias.

C30659E-900-1060-1550 nm Series

Optical Geometry



Model	Detector	S1 (mm)	S2 (mm)	d1 (mm)	α (deg)
C30659-900-R8A	C30817E	0.80	<u>9.14</u>	1.4	150
C30659-900-R5B	C30902E	0.50	9.14	1.4	150
C30659-1060-3A	C30956E	3.00	9.14	1.4	140
C30659-1060-R8B	C30954E	0.80	9.14	1.3	150
C30659-1550-R2A	C30662E	0.20	9.14	1.7	150
C30659-1550-R08B	C30645E	0.08	9.14	1.7	150

Ordering Guide

Model	Description
C30659-900-R8A	50 MHz, 900nm, 0.8mm Active Region Diameter
C30659-900-R5B	200 MHz, 900nm, 0.5mm Active Region Diameter
C30659-1060-3A	50 MHz, 1060nm, 3mm Active Region Diameter
C30659-1060-R8B	200 MHz, 1060nm, 0.8mm Active Region Diameter
C30659-1550-R2A	50 MHz, 1550nm, 0.2mm Active Region Diameter
C30659-1550-R08B	200 MHz, 1550nm, 0.08mm Active Region Diameter

Ordering Information

While the information in this data sheet is intended to describe the form, fit and function for this product, PerkinElmer reserves the right to make changes without notice.

For more information e-mail us at opto@perkinelmer.com or visit our web site at www.perkinelmer.com/optoelectronics. All values are nominal; specifications subject to change without notice.

Canada:
PerkinElmer Optoelectronics
16800 Trans Canada Highway
Kirkland, Quebec, H9H 5G7
Canada
Phone: (514) 683-2200
Fax: (514) 693-2210

USA:
PerkinElmer
Optoelectronics
44370 Christy Street
Fremont, CA
94538-3180
Phone: (510) 979-6500
Fax: (510) 687-1152

Europe:
PerkinElmer
Optoelectronics GmbH
Wenzel-Jaksch-Str.31
65199 Wiesbaden
Phone: +49 611 492 534
Fax: +49 611 492 578

Asia:
PerkinElmer Optoelectronics
47 Ayer Rajah Crescent #06-12
Singapore 139947
Phone: +65 6775 2022
Fax: 65 6775 1008

