SILETZ BSI™ APD Photoreceivers

Features

- InGaAs/InAlAs single-carrier multiplication APD (SCM-APD)
- Integrated low-noise transimpedance amplifier
- 950–1700nm spectral response
- High responsivity
- Low excess noise
- High bandwidth
- High gain
- −5 to +75°C operating case temperature

Applications

- Range finding
- LADAR/LIDAR
- Fluorescence measurements
- Free-space optical communication systems
- Spectroscopy, electrophoresis, chromatography
- Ultra-fast pulse and transient measurements

MHz- and GHz-Class Receivers with High-Gain, Low Excess Noise NIR Single-Carrier Multiplication APDs (SCM-APDs)

Model RDP1-NJAF: 200µm APD, 350MHz
Model RIP1-NJAF: 200µm APD, 1GHz
Model RIP1-JJAF: 75µm APD, 2.2GHz
Model R2P1-JCAA: 75µm APD, 1.5GHz TO-46

Voxtel offers high-sensitivity photoreceivers based on its Siletz™ single-carrier multiplication APDs (SCM-APDs) in the RXP-1000 product series. High bandwidth as well as 75-µm and 200-µm optical areas make these ideal for laser rangefinders, laser designators, free space optical communication, optical instrumentation, and LADAR/LIDAR.

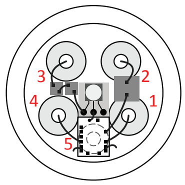
Voxtel's VFP-1000 Series of Siletz™ SCM-APDs integrates low-noise with transimpedance amplifiers (TIAs). Voxtel's SCM-APDs offer extremely low excess-noise NIR–SWIR APDs, allowing the receiver to operate at high avalanche gain, boosting the optical signal over the amplifier noise level without the degrading effects of avalanche-induced excess noise. These photoreceivers are the most sensitive receivers available on the market today. A single-stage thermoelectric cooler (TEC) is included to eliminate temperature-induced gain variations and allow optimal performance over the range of application environments.

Standard fiber pigtail options for the 75µm receivers include 62.5/125 (0.37NA) graded-index and 105/125 (0.37NA) step-index multi-mode fibers; other fiber options can be custom ordered. Optionally available with the photoreceivers are Support Electronics Modules, which provide power conditioning and TEC control.

VOXTELOPTO

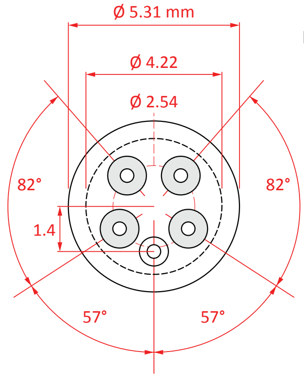
Siletz™ Series APD Photoreceivers

TO-46 Package

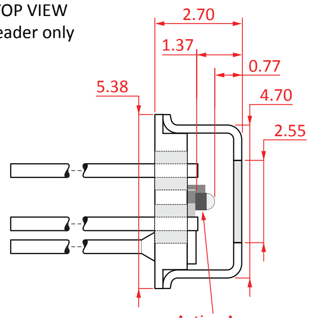


TOP VIEW
header only

Pinout
1) DOUT
2) VDD
3) V+ APD
4) DOUT B
5) GND

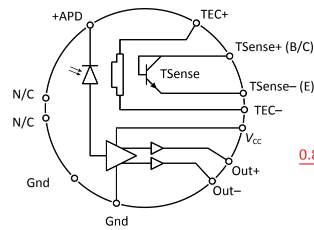


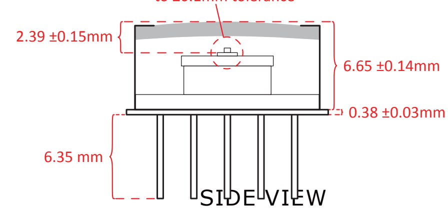
BOTTOM VIEW



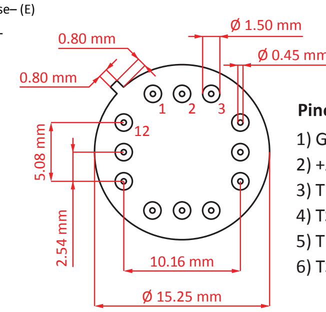
SIDE VIEW
with cap

TO-8 Package





SIDE VIEW
with cap

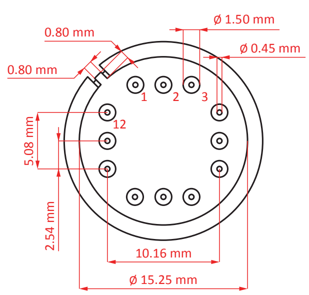


Pinout (from bottom)

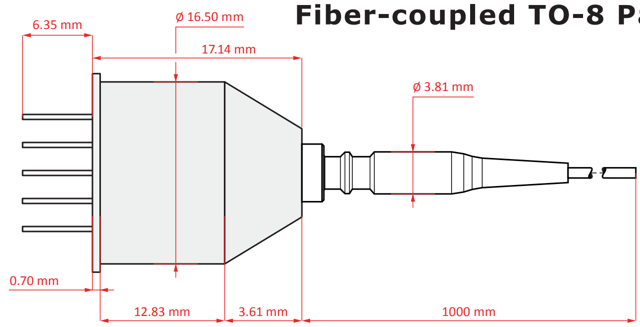
1) Gnd	7) Out–
2) +APD	8) Gnd
3) TEC+	9) Out+
4) TSense–	10) V_{CC} +3.3V
5) TEC–	11) N/C
6) TSense+	12) N/C

BOTTOM VIEW

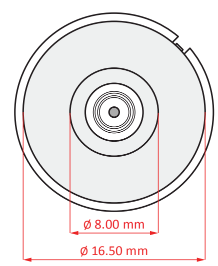
Fiber-coupled TO-8 Package



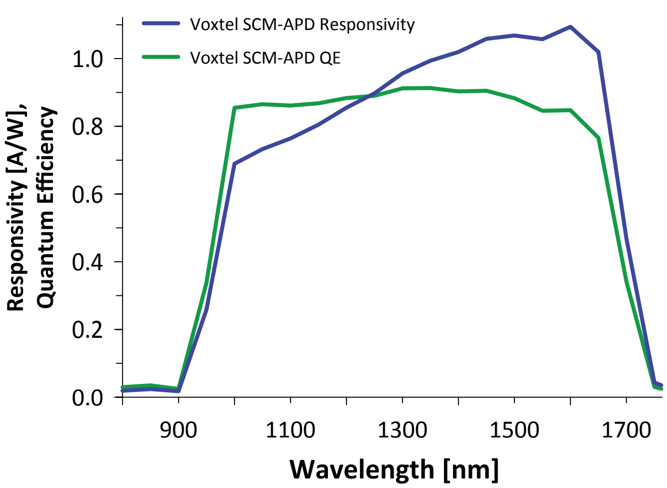
BOTTOM VIEW



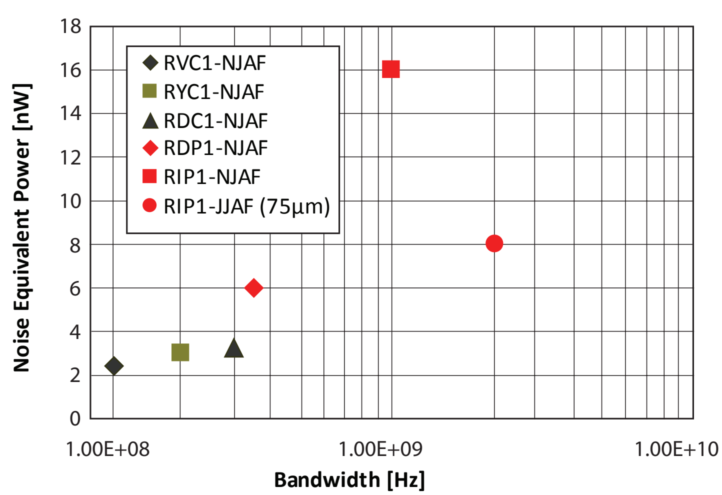
SIDE VIEW



TOP VIEW



Spectral responsivity curve and quantum efficiency at gain $M = 1$, $T = 295$ K. 200-μm SCM-APD.



Standard receiver configurations with typical NEP valves and bandwidths

Voxtel, Inc., 15985 NW Schendel Avenue, #200, Beaverton, OR 97006, www.voxtel-inc.com, T 971.223.5646, F 503.296.2862
Voxtel Literature No. RxP1-xJAF, Version date: 06/2012 ©

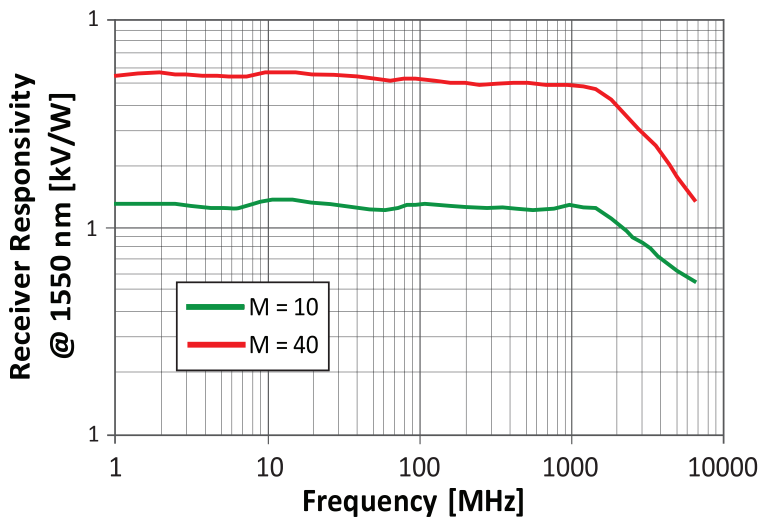
Model RDP1-NJAF

Siletz™ Series APD Photoreceiver 200μm, 350MHz

Specifications

Parameter	Min	Typical	Max	Units
Spectral Range, λ	950	1000–1600	1750	nm
Active Diameter		200		μm
Bandwidth		350		MHz
APD Operating Gain, *M*	1	10-30	40	
Receiver Responsivity at *M*=40		400/560		kV/W at 1064/1550 nm
Noise Equivalent Power at *M*=40		10/8		nW at 1064/1550 nm
Low Frequency Cutoff[i]		30		kHz
APD Breakdown Voltage, V_{BR}	70	74	80	V @ *T* = 298 K
TEC Δ*T*			40	K @ *T* = 298 K
TEC Supply			1.8/1.9	A/V
Temp Sensing Diode Voltage and ΔV/K[ii]	0.48	0.50 -2.18 mV/K	0.51	V
TIA Power		25		mA @ 3.3 V
Output Impedance[iii]	60	75	90	Ω
Overload/Saturation Power[iv]		100		μW
Maximum Instantaneous Input Power[v]			5	mW
Window Thickness	0.76	0.94	1.12	mm

[i] -3dB, 40μA input
[ii] Sourcing 10μA, T=298K
[iii] Single-ended; 150Ω differential
[iv] 1550nm signal with an APD multiplication gain of *M*=10
[v] 10ns, 1064nm signal at a 20Hz PRF with an APD multiplication gain of *M*=10



Voxtel, Inc., 15985 NW Schendel Avenue, #200, Beaverton, OR 97006, www.voxtel-inc.com, T 971.223.5646, F 503.296.2862
Voxtel Literature No. RxP1-xJAF, Version date: 06/2012 ©

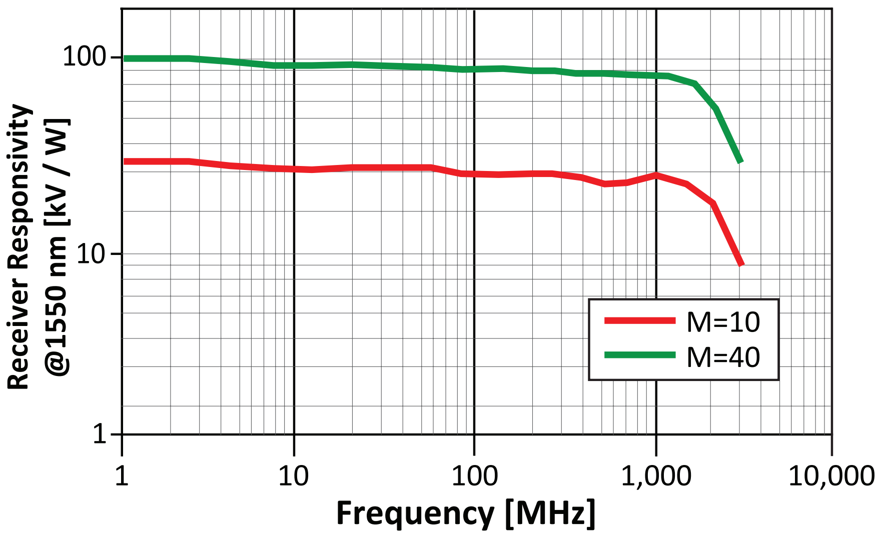
Model RIP1-NJAF

Siletz™ Series APD Photoreceiver 200µm, 1GHz

Specifications

Parameter	Min	Typical	Max	Units
Spectral Range, λ	950	1000–1600	1750	nm
Active Diameter		200		µm
Bandwidth		1		GHz
APD Operating Gain, M	1	10-30	40	
Receiver Responsivity at M=10[i]		32/40		kV/W at 1064/1550 nm
Noise Equivalent Power at M=40		20/16		nW at 1064/1550 nm
Low Frequency Cutoff[ii]		65		kHz
APD Breakdown Voltage, V_{BR}	70	74	80	V @ T = 298 K
TEC ΔT			40	K @ T = 298 K
TEC Supply			1.8/1.9	A/V
Temp Sensing Diode Voltage and ΔV/K[iii]	0.48	0.50 -2.18 mV/K	0.51	V
TIA Power		25		mA @ 3.3 V
Output Impedance[iv]	42.5	50	57.5	Ω
Overload/Saturation Power[v]		100		µW
Max Instantaneous Input Power[vi]			5	mW
Window Thickness	0.76	0.94	1.12	mm
Window Transparency		95/98%		1064/1550 nm

[i] 10MHz, -40dBm signal
[ii] 13dB, 40µA input
[iii] Sourcing 10µA, T=298K
[iv] Single-ended; 100Ω differential
[v] 1550nm signal with an APD multiplication gain of M=10
[vi] 10ns, 1064nm signal at a 20Hz PRF with an APD multiplication gain of M=10



Voxtel, Inc., 15985 NW Schendel Avenue, #200, Beaverton, OR 97006, www.voxtel-inc.com, T 971.223.5646, F 503.296.2862
Voxtel Literature No. RxP1-xJAF, Version date: 06/2012 ©

VOXTELOPTO

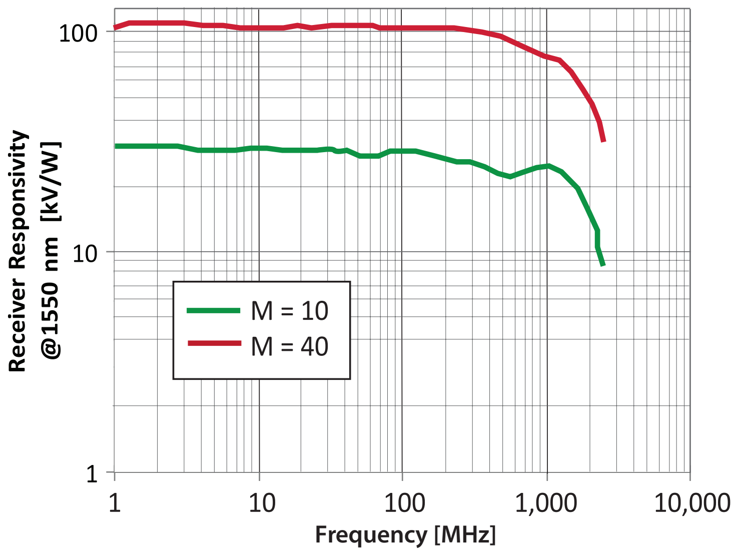
Model RIP1-JJAF

Siletz™ Series APD Photoreceiver
75µm, 2.2GHz

Specifications

Parameter	Min	Typical	Max	Units
Spectral Range, λ	950	1000–1600	1750	nm
Active Diameter		75		µm
Bandwidth		2.2		GHz
APD Operating Gain, M	1	10-30	40	
Receiver Responsivity at M=40		88/115		kV/W at 1064/1550 nm
Noise Equivalent Power at M=40		10/8		nW at 1064/1550 nm
Low Frequency Cutoff[i]		65		kHz
APD Breakdown Voltage, V_{BR}[ii]	70	74	80	V
TEC ΔT			40	K @ T = 298 K
TEC Supply			1.8/1.9	A/V
Temp Sensing Diode Voltage and ΔV/K[iii]	0.48	0.50 -2.18 mV/K	0.51	V
TIA Power		25		mA @ 3.3 V
Output Impedance[iv]	42.5	50	57.5	Ω
Overload/Saturation Power[v]		100		µW
Max Instantaneous Input Power[vi]			1	mW
Window Thickness	0.76	0.94	1.12	mm
Window Transparency		95/98%		1064/1550 nm

[i] -3dB, 40µA input
[ii] T=295K
[iii] Sourcing 10µA, T=298K
[iv] Single-ended; 100Ω differential
[v] 1550nm signal with an APD multiplication gain of M=10
[vi] 10ns, 1064nm signal at a 20Hz PRF with an APD multiplication gain of M=10



Voxtel, Inc., 15985 NW Schendel Avenue, #200, Beaverton, OR 97006, www.voxtel-inc.com, T 971.223.5646, F 503.296.2862
Voxtel Literature No. RxP1-xJAF, Version date: 06/2012 ©

VOXTELOPTO

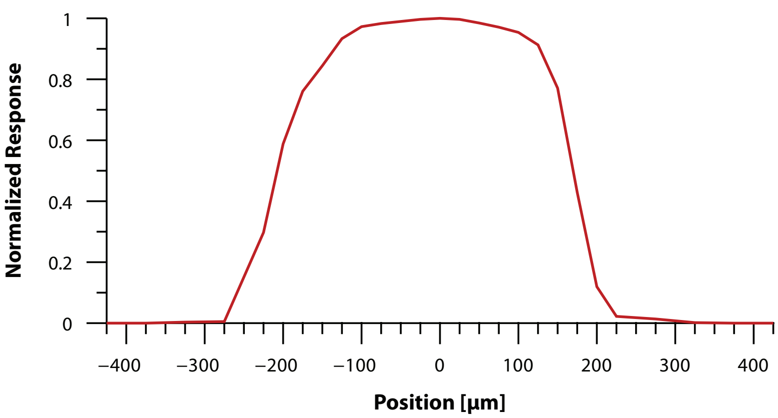
Model R2P1-JCAA

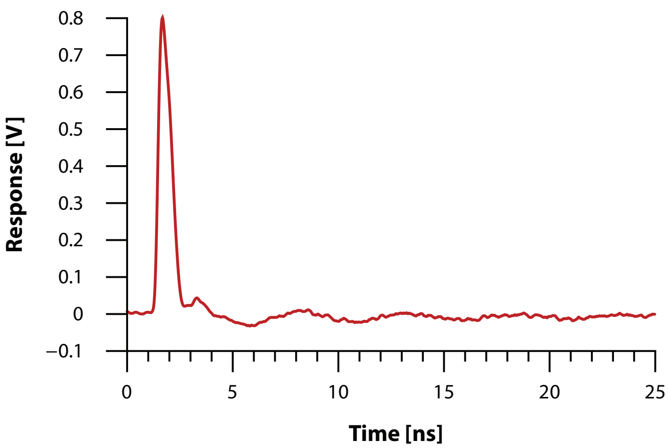
Siletz™ Series APD Photoreceiver
75µm, 1.5GHz, Ball-Lens-Coupled TO-46

Specifications

Parameter	Min	Typical	Max	Units
Spectral Range, λ	950	1000-1600	1750	nm
Active Diameter		75		µm
Effective Diameter		300		
Bandwidth		1.5		GHz
APD Operating Gain, *M*	1	10-30	40	
Receiver Responsivity @ M=10[i]		75/93		kV/W at 1064/1550 nm
Noise Equivalent Power @ M=40		14/12		nW at 1064/1550 nm
Low Frequency Cutoff[ii]		30		kHz
APD Breakdown Voltage, V_{BR}	70	74	80	V @ T = 298 K
ΔV_{BR}/TEC ΔT		29		K @ T = 298 K
TIA Power		20		mA@3.3V
Output Impedance[iii]	40	50	60	Ω
Overload/Saturation Power[iv]		100		µW
Max Instantaneous Input Power[v]			1	mW
Window Thickness	0.76	0.94	1.12	mm
Window Transparency		95/98%		1064/1550 nm

[i] 10MHz, -40dBm signal
[ii] -3dB, 40µA input
[iii] Single-ended; 100Ω differential
[iv] 1550nm signal with an APD multiplication gain of M=10
[v] 10ns, 1064nm signal at a 20Hz PRF with an APD multiplication gain of M=10





6

Voxtel, Inc., 15985 NW Schendel Avenue, #200, Beaverton, OR 97006, www.voxtel-inc.com, T 971.223.5646, F 503.296.2862
Voxtel Literature No. RxP1-xJAF, Version date: 06/2012 ©

Ordering Information For VFP-1000 Series APD Products

R	-	P1	-	-	-	-
Device Type	**Amplifier**	**Detector**	**Diameter**	**Package Option**	**Lens Option**	**Revision**
R=Photoreceiver	D=580MHz TIA I=2.5GHz TIA 2=1.7GHz TIA	P=Siletz SCM-APD	J=75µm N=200µm	C=TO-46 J=TO-8 with 1-Stage TEC	A=Flat Window Q=MM 62.5/125µm R=MM 105/125µm S=MM 200/125µm	

Not all combinations of product features are available. Please contact Voxtel for specific ordering information and parts availability.

Caution During APD Operation

If an APD is operated above its breakdown voltage without some form of current protection, it can draw enough current to permanently damage the device. To guard against this, the user can add either a protective resistor to the bias circuit or a current-limiting circuit in the supporting electronics.

The breakdown voltage of an APD is dependent upon its temperature: the breakdown voltage decreases when the APD is cooled. Consequently, a reverse bias operating point that is safe at room temperature may put the APD into breakdown at low temperature. The approximate temperature dependence of the breakdown voltage is published in the spec sheet for the part, but caution should be exercised when an APD is cooled.

Low-noise readout circuits usually have high impedance, and an unusually strong current pulse from the APD could generate a momentary excessive voltage that is higher than the readout's supply voltage, possibly damaging the input to the amplifier. To prevent this, a protective circuit should be connected to divert excessive voltage at the inputs to a power supply voltage line.

As noted in the specification, another consideration is that the APD gain changes depending on temperature. When an APD is used over a wide temperature range, it is necessary to use some kind of temperature compensation to obtain operation at a stable gain. This can be implemented as either regulation of the applied reverse bias according to temperature, feedback temperature control using a thermoelectric cooler (TEC) or other refrigerator, or both.

Upon request, Voxtel will gladly assist customers in implementing the proper controls to ensure safe and reliable operation of APDs in their system.