DESCHUTES BSI™
Submounted APD Die

Reduced-noise Avalanche Photodiode (R-APD) w/Submount

Model VFC1-xBZA Series Submounted Die

Backside-illuminated operation of the Deschutes BSI^{TM} reduced-excess-noise avalanche photodiode (R-APD) provides both higher responsivity and lower capacitance than competing frontside-illuminated APDs. The R-APD is custom-engineered for reduced excess noise, which allows this APD to achieve higher sensitivity, better signal-to-noise (SNR) performance, and lower bit error rates (BERs) than conventional telecom APDs.

In comparison to conventional telecom InGaAs/InP APDs, which have an excess noise characterized by keff = 0.4, Voxtel's Deschutes BSI^{TM} InGaAs/InAlAs R-APDs, characterized by keff = 0.2, have 40% less excess noise, which allows for lower shot noise over the operating gain of the R-APD. The increased sensitivity of the R-APD improves system cost, size, weight, and power (CSWAP) by reducing computational burden and laser power, while increasing standoff range as used in a laser range-finding system.

For ease of integration, these APD die are provided on a ceramic submount with a co-mounted temperature sensor. Smaller footprint submounts without the temperature sensor are available upon request.

Features

- Low-capacitance high sensitivity back-side illuminated (BSI) design
- 950–1700nm response
- Reduced excess noise design, (R-APD) from conventional APDs
- Operation up to a multiplication gain of M=20
- Custom devices available upon request

Applications

- Free-space optical communications
- Laser range finding
- Optical time domain reflectometry
- Optical coherence tomography
- Fluorescence measurements, spectroscopy, chromatography and electrophoresis
- Telecommunications
- LADAR/LIDAR

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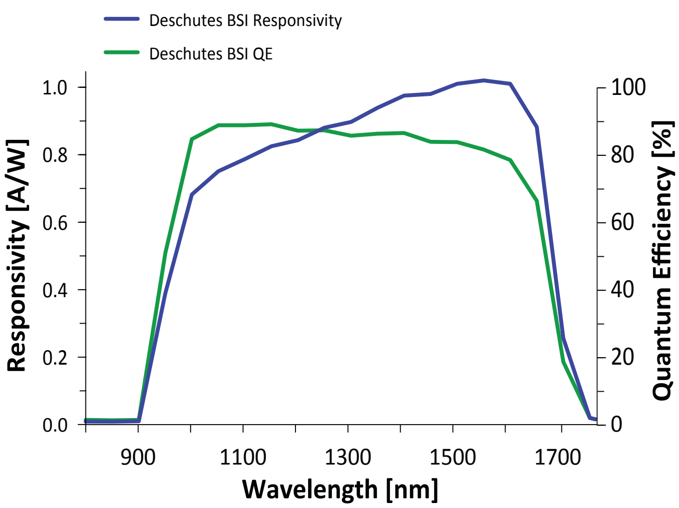
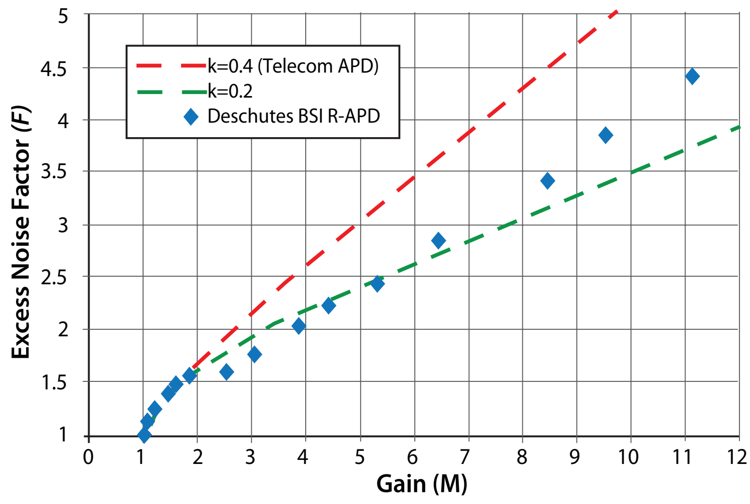
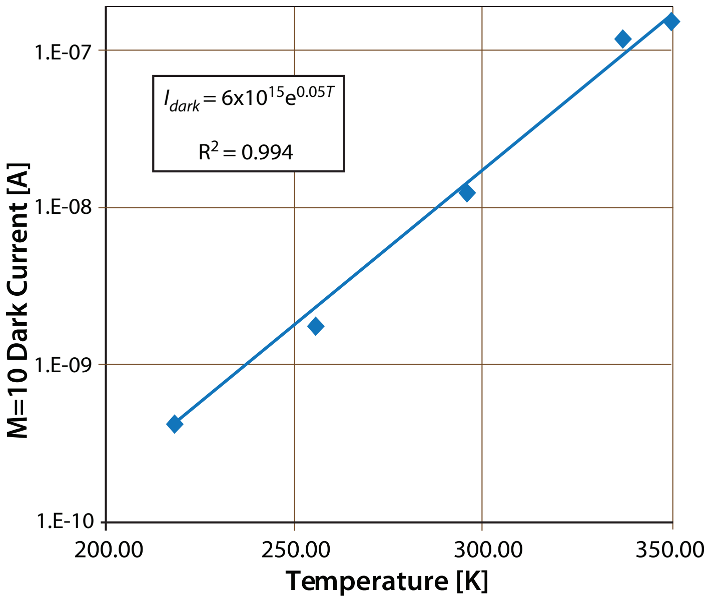
Deschutes BSI™ Series Near-Infrared APDs

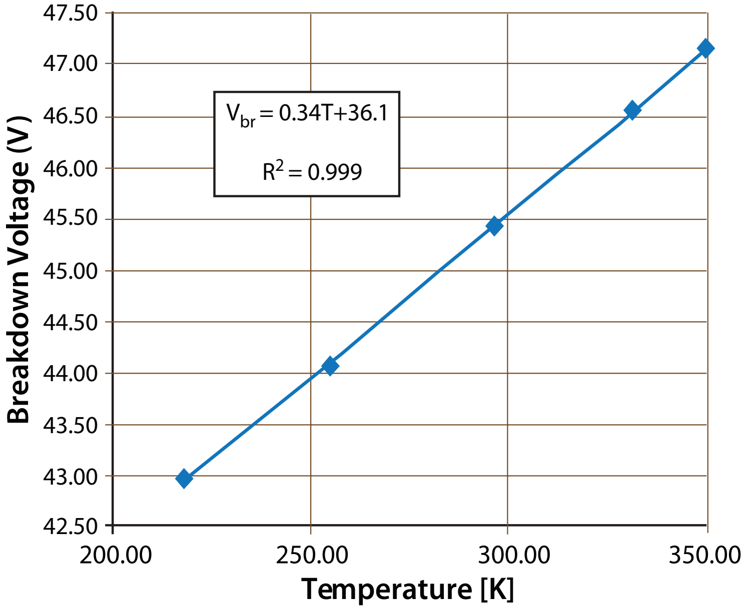


Spectral responsivity and quantum efficiency of 200μm APD @ 298K



Excess noise of the Deschutes BSI R-APD, k~0.2





Effects of temperature on dark current and breakdown voltage of a 200μm Deschutes BSI R-APD at 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. VFC1-xBZA, Version date: 06/2012 ©

Deschutes BSI™ Submounted APD Die

VFC-1000 Series

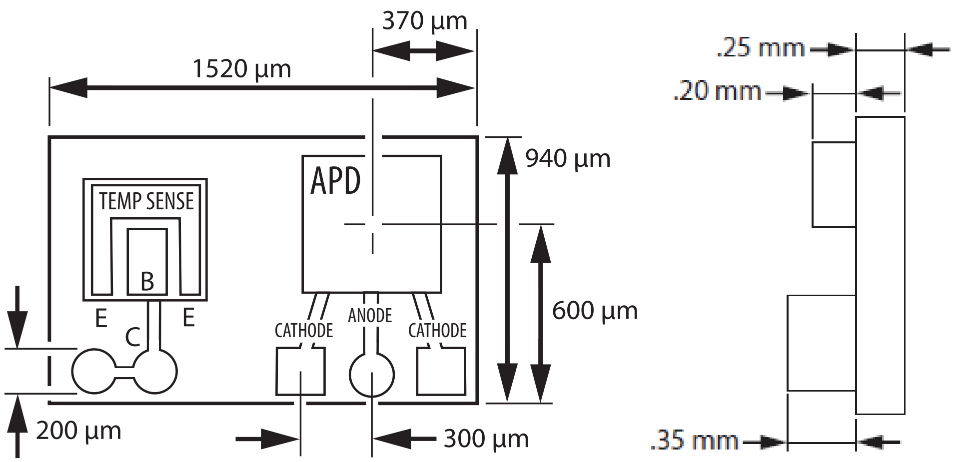
MODEL VFC1-EBZA

VFC-1000 Series Near-Infrared R-APD
30-micron , 5.0GHz R-APD

Specifications

Parameter	Min	Typical	Max	Units
Spectral Range, λ	950	1000–1600	1750	nm
Active Diameter		30		µm
Bandwidth		6.0		GHz
APD Operating Gain, *M*	1	10	20	
Receiver Responsivity at *M*=1	.66 .91	.73 1.01	.78 1.04	A/W λ=1064nm λ=1550nm
Excess Noise Factor, F(*M,k*)		3.4 / 4.3		M=10, M=15
Noise Spectral Density @ *M*=10		.37		$pA/Hz^{1/2}$
Dark Current @ *M*=1[i]	0.80	1.08	1.25	nA
Total Capacitance[ii]		35		fF
Bandwidth		5.0		GHz
Breakdown Voltage, V_{BR}[iii]	44	49	55	V
$\Delta V_{BR}/\Delta T$	30	34	39	mV/K
Temperature Sensing Diode Voltage and ΔV/K[iv]	0.48	0.50 -2.18 mV/K	0.51	V
Maximum Instantaneous Input Power[v]			125	µW

[i] Gain normalized from *M*=10, T=298K
[ii] *M*>3
[iii] *T*=298K; I_{dark}>0.1 mA
[iv] Sourcing 10µA, T=298K
[v] 10ns, 1064nm signal at a 20Hz PRF with an APD multiplication gain of *M*=10



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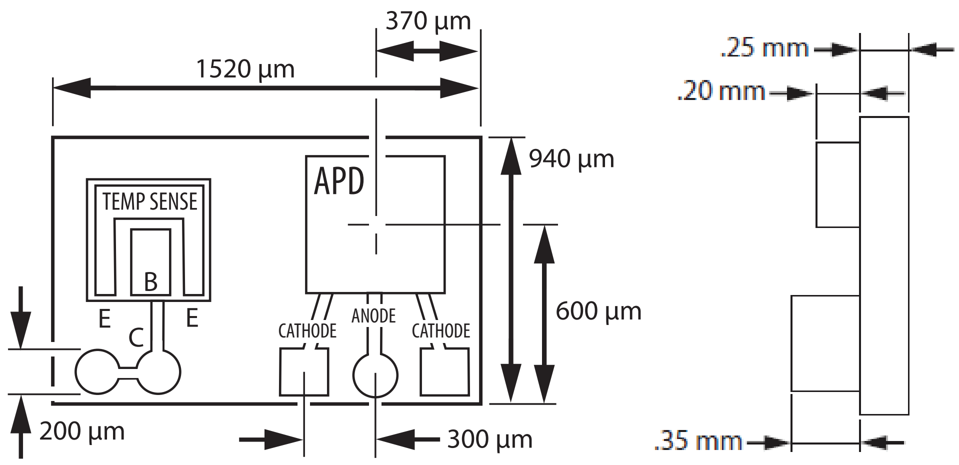
MODEL VFC1-JBZA

VFC-1000 Series Near-Infrared R-APD
75-micron, 2.5GHz R-APD

Specifications

Parameter	Min	Typical	Max	Units
Spectral Range, λ	950	1000–1600	1750	nm
Active Diameter		75		µm
APD Operating Gain, *M*	1	10	20	
Responsivity at *M*=1	.66 .91	.73 1.01	.78 1.04	A/W λ=1064nm λ=1550nm
Excess Noise Factor, *F(M,k)*		3.4 4.4		*M*=10 *M*=15
Noise Spectral Density @ *M*=10		0.48		$pA/Hz^{1/2}$
Dark Current @ *M*=1[i]	0.8	1.9	2.5	nA
Total Capacitance[ii]		0.34		pF
Bandwidth	2.0	2.5	3.0	GHz
Breakdown Voltage, V_{BR}[iii]	44	49	55	V
$\Delta V_{BR}/\Delta T$	30	34	39	mV/K
Temperature Sensing Diode Voltage and ΔV/K[iv]	0.48	0.50 -2.18mV/K	0.51	V
Maximum Instantaneous Input Power[v]			1	mW

[i] Gain normalized from *M*=10, T=298K
[ii] *M*>3
[iii] *T*=298K; I_{dark}>0.1mA
[iv] Sourcing 10µA, T=298K
[v] 10ns, 1064nm signal at a 20Hz PRF with an APD multiplication gain of *M*=10



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Deschutes BSI™ Submounted APD Die

VFC-1000 Series

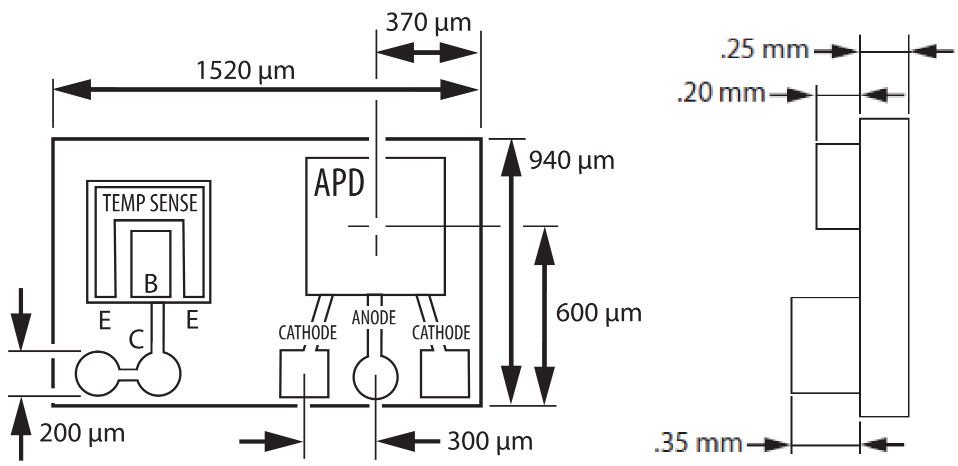
MODEL VFC1-NBZA

VFC-1000 Series Near-Infrared R-APD
200-micron, 550MHz R-APD

Specifications

Parameter	Min	Typical	Max	Units
Spectral Range, λ	950	1000–1600	1750	nm
Active Diameter		200		μm
APD Operating Gain, *M*	1	10	20	
Responsivity at *M*=1	.66 .91	.73 1.01	.78 1.04	A/W λ=1064nm λ=1550nm
Excess Noise Factor, *F(M,k)*		3.4 4.3		*M*=10 *M*=15
Noise Spectral Density @ *M*=10		0.94		$pA/Hz^{1/2}$
Dark Current @ *M*=1[i]	6	8.1	10.0	nA
Total Capacitance[ii]		1.47		pF
Bandwidth	250	550	700	MHz
Breakdown Voltage, V_{BR}[iii]	44	49	55	V
$\Delta V_{BR}/\Delta T$	30	34	39	mV/K
Temperature Sensing Diode Voltage and ΔV/K[iv]	0.48	0.50 -2.18mV/K	0.51	V
Maximum Instantaneous Input Power[v]			5	mW

[i] Gain normalized from *M*=10, T=298K
[ii] *M*>3
[iii] *T*=298K; I_{dark}>0.1mA
[iv] Sourcing 10μA, T=298K
[v] 10ns, 1064nm signal at a 20Hz PRF with an APD multiplication gain of *M*=10



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