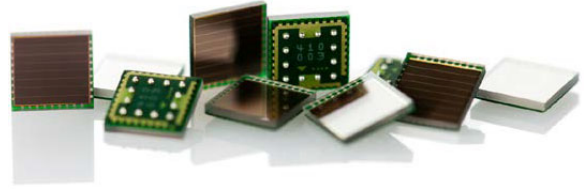


AFBR-S4K33C0115B

**3 × 3 mm² Single SiPM, WB-Type,
15-μm SPAD Pitch**



Overview

The Broadcom® AFBR-S4K33C0115B is a single silicon photomultiplier (SiPM) used for ultra-sensitive precision measurement of single photons.

The active area is 3.0 × 3.0 mm² with 15-μm single-photon avalanche diode (SPAD) pitch for providing high dynamic range and fastest recovery time to replace PMTs, APDs, and PIN diodes.

Features

- 3 × 3 mm² active area, 15-μm microcells
- High dynamic range
- Fastest recovery time
- Replacement for PMTs, APDs, and PIN diodes
- Low voltage operation (typically about 30V)
- Cost efficient and robust (MSL1 approved)

Applications

- Cytometry
- Bright scintillator readout
- Biophotonics and analytics
- X-ray photon counting
- Handheld and mobile devices
- High energy physics
- Medical imaging (PET, SPECT)
- Hazard and threat detection
- Optical sorting and XRT

NOTE: All values in this data sheet are typical values if not marked with min., max., <, or >.

Spectral Response

Figure 1: Photo Detection Efficiency at 5V Overvoltage

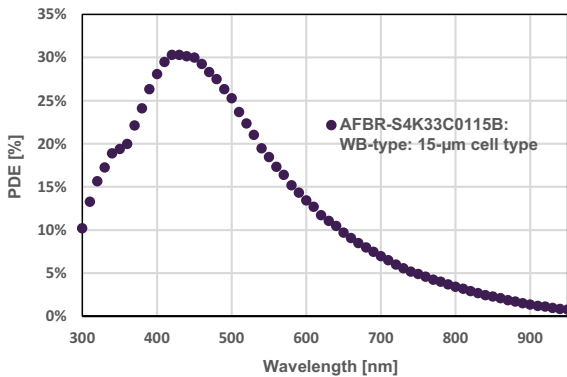
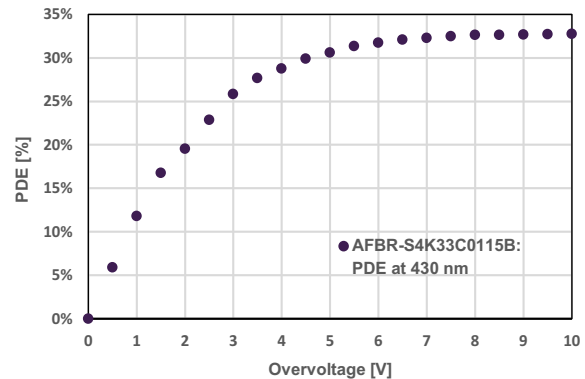


Figure 2: Photo Detection Efficiency vs. Overvoltage at 21°C



General Parameters and Ordering Information

SiPM Type	Active Area [mm ²]	Microcell Size [μ m]	No. of Microcells	Dimensions [mm ³]
AFBR-S4K33C0115B	3.0 × 3.0	15	38800	3.315 × 3.315 × 0.595

Main Characteristics

Parameter	Min.	Typ.	Max.	Unit
Breakdown Voltage (V_{BD}) at 21°C	26.0	—	28.0	V
Breakdown Voltage Variation per Reel	—	±0.125	—	V
Recommended Overvoltage (V_{OV})	—	2.0 to 5.0	6.0	V
Temperature Dependency of V_{BD}	—	22.0	—	mV/K
Temperature Dependency of Gain	—	0.3% at 5.0 V_{OV}	—	1/K
Operating Temperature Range	-40	—	+60	°C
Reliability Classification	—	MSL1	—	
Index of Refraction of Glass Entrance Window	—	1.52 at 430 nm	—	

Electrical and Optical Characteristics at 21°C

Parameter	Typ. at 2.5 V_{OV}	Typ. at 5.0 V_{OV}	Unit
Photo Detection Efficiency at 430 nm	22	31	%
Dark Count Rate	50	125	kHz/mm ²
Dark Current	0.08 (max. 0.16)	0.19 (max. 0.3)	μ A
Gain	0.35	0.70	×10 ⁶
Crosstalk Probability ^a	8	18	%
Afterpulsing Probability	1	5	%
Terminal Capacitance	0.8		nF
Recovery Time, τ	13 (at 1 Ω load), 47 (at 50 Ω load)		ns
Signal Rise Time	630		ps

a. Including delayed crosstalk with a probability < 0.1%.

Mechanical Specifications

Figure 3: Dimensions and Recommended Footprint

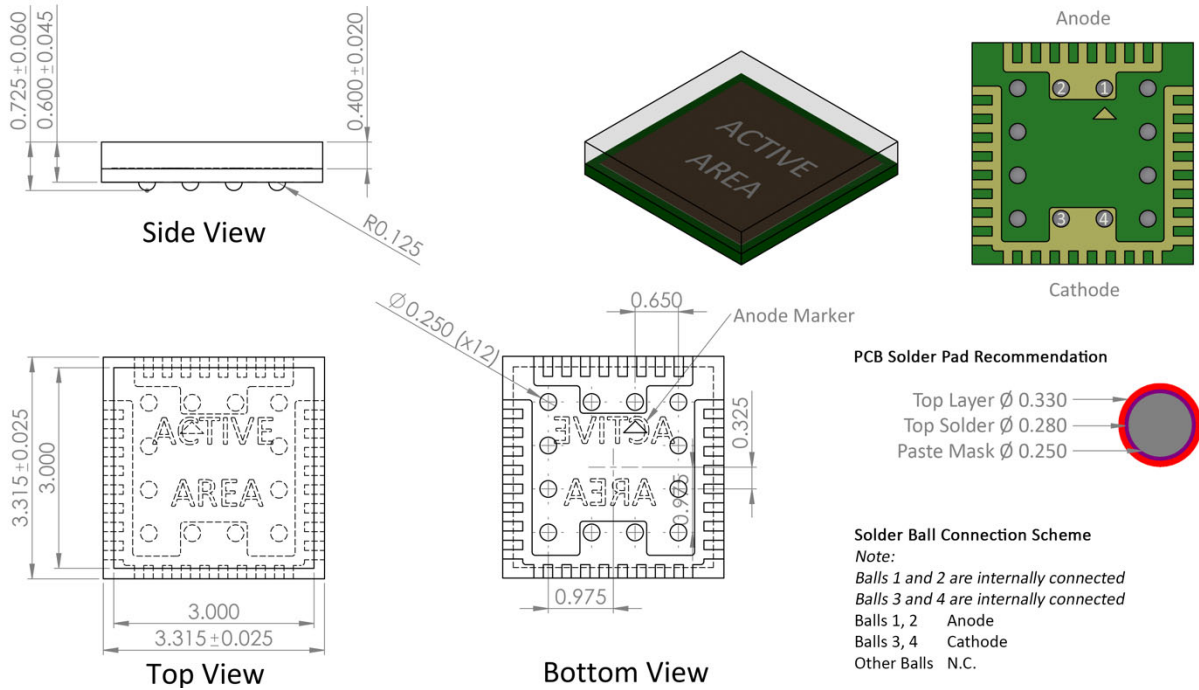
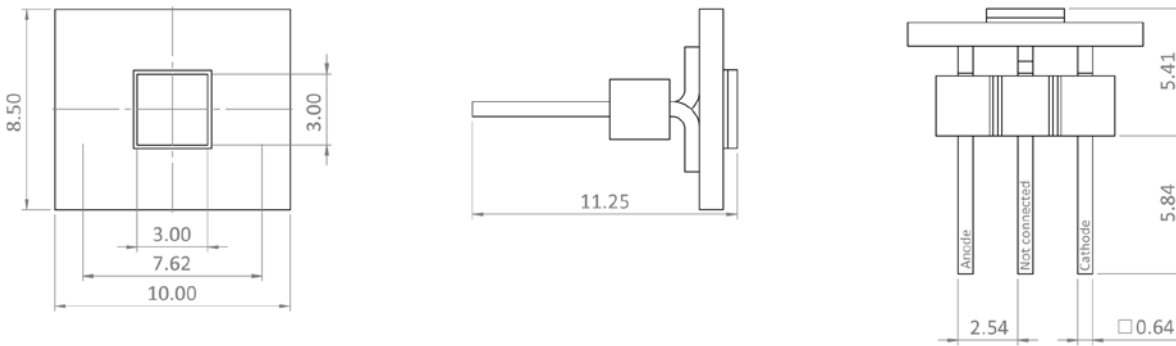


Figure 4: AFBR-S4K33C0115B Preassembled on PCB with Pins (Available for Evaluation Purposes)¹



1. Mates, for example, with Preci-Dip 801-87-003-10-001101.

Typical Performance Characteristics

Figure 5: Temperature Coefficient of the Breakdown Voltage

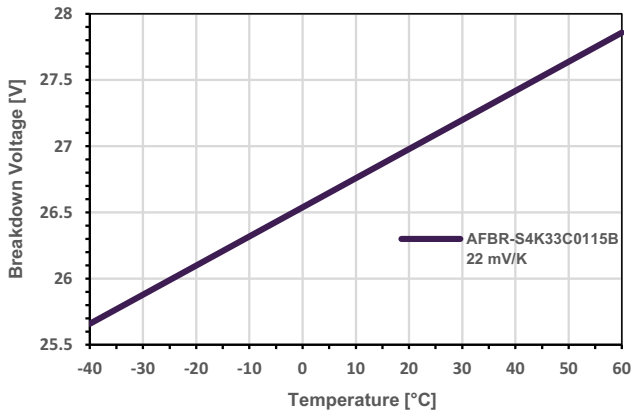


Figure 6: Temperature Coefficient of the Gain

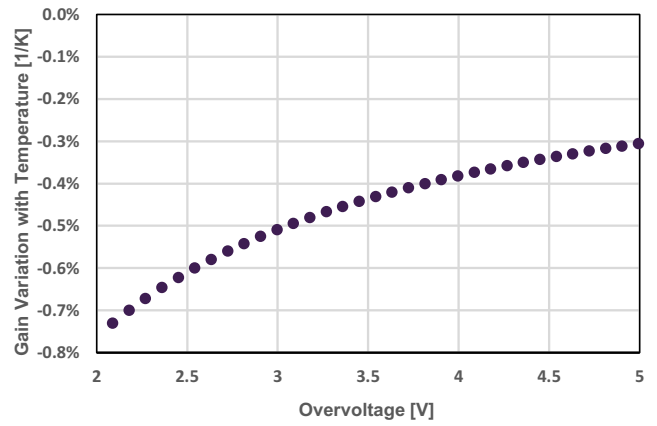


Figure 7: Linearity at 430 nm

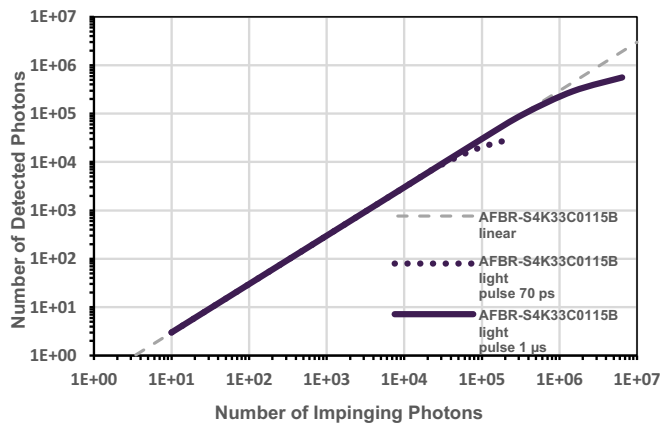


Figure 8: Gain of AFBR-S4K33C0115B

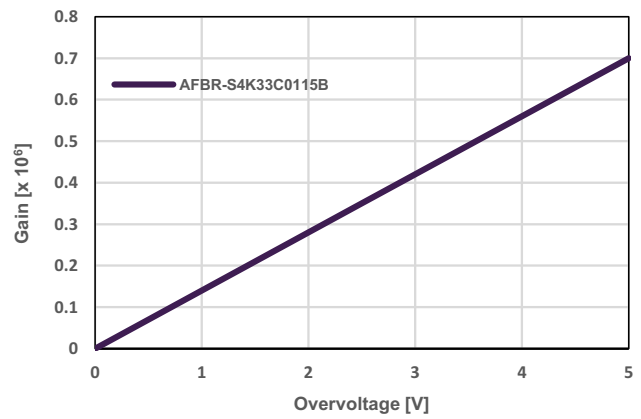


Figure 9: Dark Count Rate at 21°C

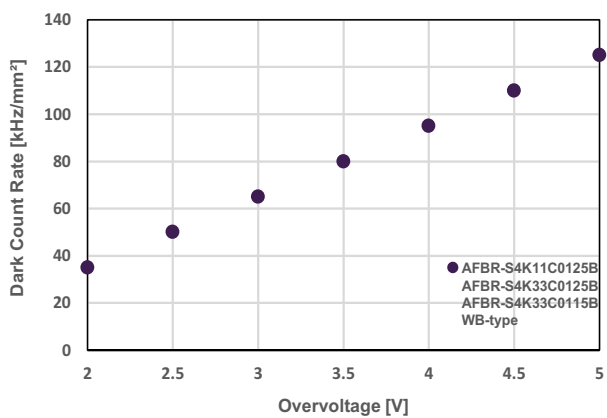


Figure 10: Dark Count Rate vs. Temperature

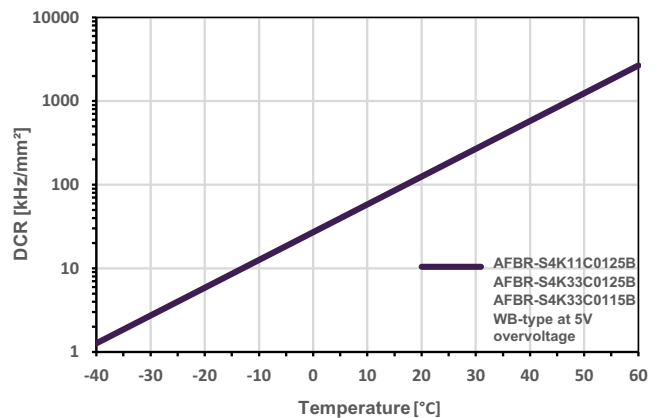


Figure 11: Direct Optical Crosstalk

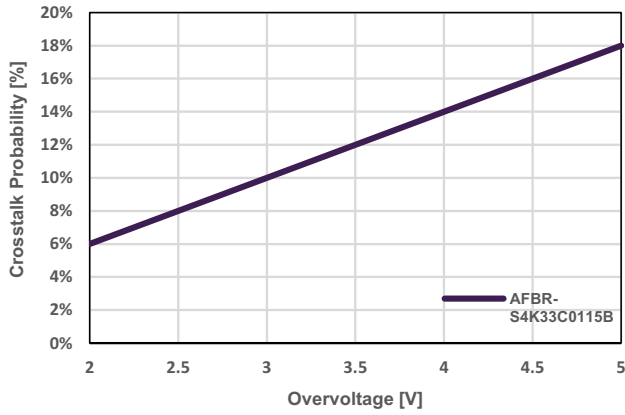


Figure 12: Delayed Optical Crosstalk

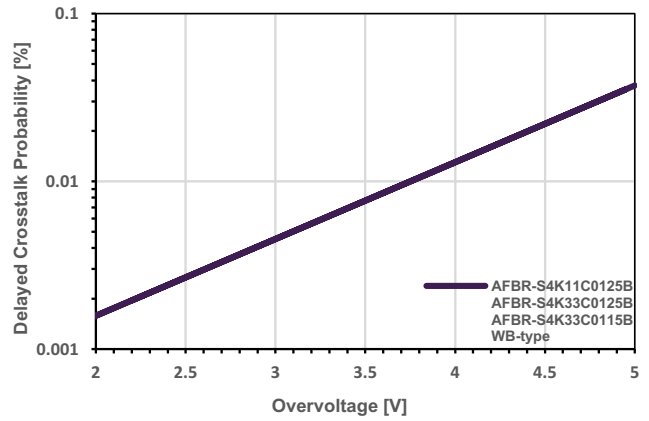


Figure 13: Afterpulsing Probability

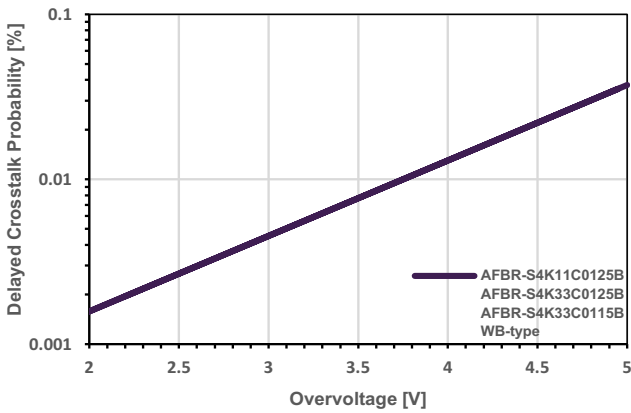
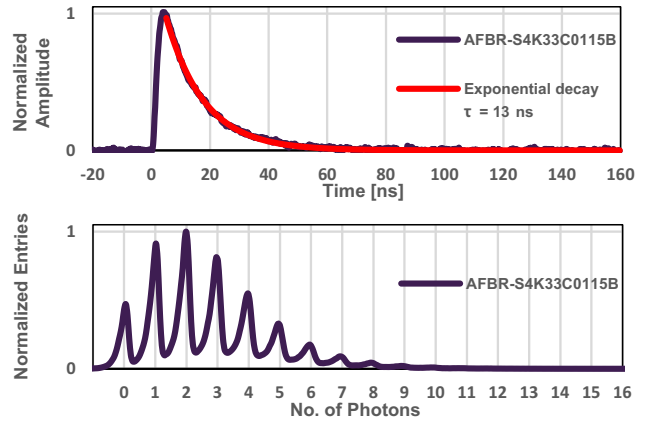


Figure 14: Pulse Shape at 1 Ω Load, Single Photon Spectrum



Assembly Specifications

Figure 15: Tape and Reel

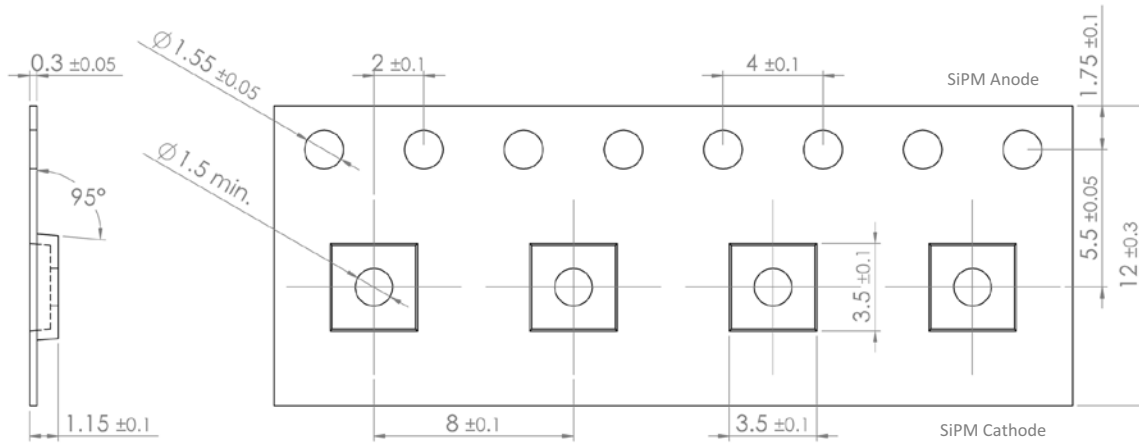
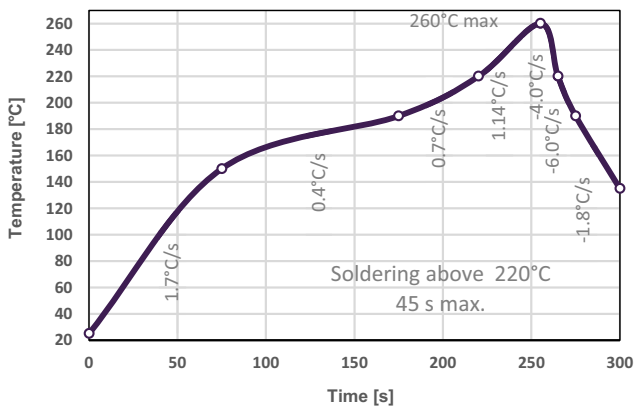


Figure 16: Recommended Reflow Solder Profile



NOTE: Lead-free no-clean solder paste type 4 is recommended; for example, SAC305 ROL0 Nihon Handa PF305-118. SMD stencil thickness of 80 μm is recommended.

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