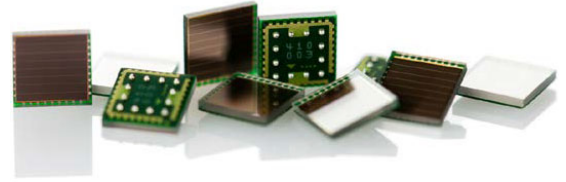


AFBR-S4K33C0125B

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



Overview

The Broadcom[®] AFBR-S4K33C0125B 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 25-μm SPAD pitch for high photo detection efficiency to replace PMTs, APDs, and PIN diodes with the AFBR-S4K33C0125B featuring excellent timing properties and low voltage operation.

Features

- 3 × 3 mm² active area, 25-μm microcells
- High photo detection efficiency
- Excellent timing properties
- Replacement for PMTs, APDs, and PIN diodes
- Low voltage operation (typically about 30V)
- Cost efficient and robust (MSL1 approved)

Applications

- Single photon counting
- Scintillator readout
- Medical imaging (PET, SPECT)
- Photon timestamping
- Handheld and mobile devices
- Hazard and threat detection
- Biophotonics
- High energy physics and research
- Analytical instrumentation

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

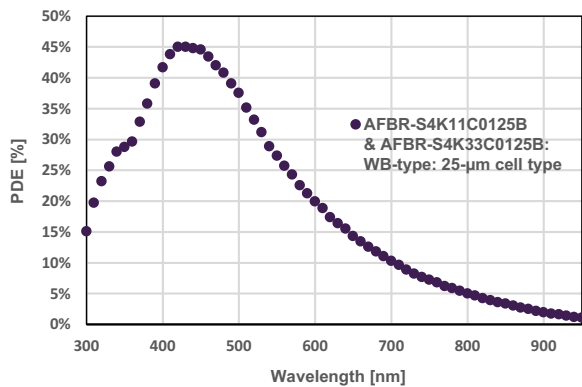
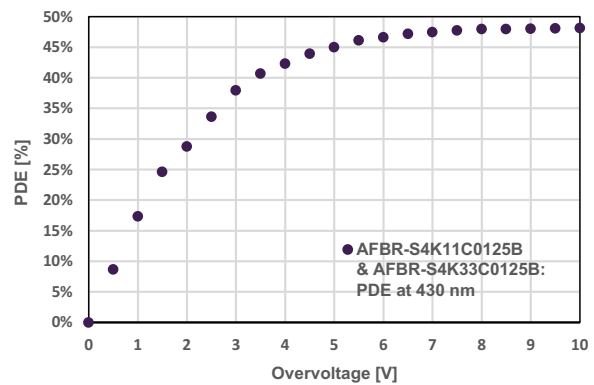


Figure 2: Photo Detection Efficiency vs. Overvoltage at 21°C



General Parameters and Ordering Information

SiPM Type	Active Area [mm ²]	Microcell Size [μ m]	No. of Microcells	Dimensions [mm ³]
AFBR-S4K33C0125B	3.0 × 3.0	25	13920	3.315 × 3.315 × 0.595

Main Characteristics

Parameter	Min.	Typ.	Max.	Unit
Breakdown Voltage (V_{BD}) at 21°C	24.0	—	25.0	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	31	45	%
Dark Count Rate	50	125	kHz/mm ²
Dark Current	0.15 (max. 0.2)	0.7 (max. 1.0)	μ A
Gain	0.87	1.74	×10 ⁶
Crosstalk Probability ^a	12	26	%
Afterpulsing Probability	1	5	%
Terminal Capacitance	1		nF
Recovery Time, τ	33 (at 1 Ω load), 80 (at 50 Ω load)		ns
Signal Rise Time	110		ps

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

Mechanical Specifications

Figure 3: Dimensions and Recommended Footprint

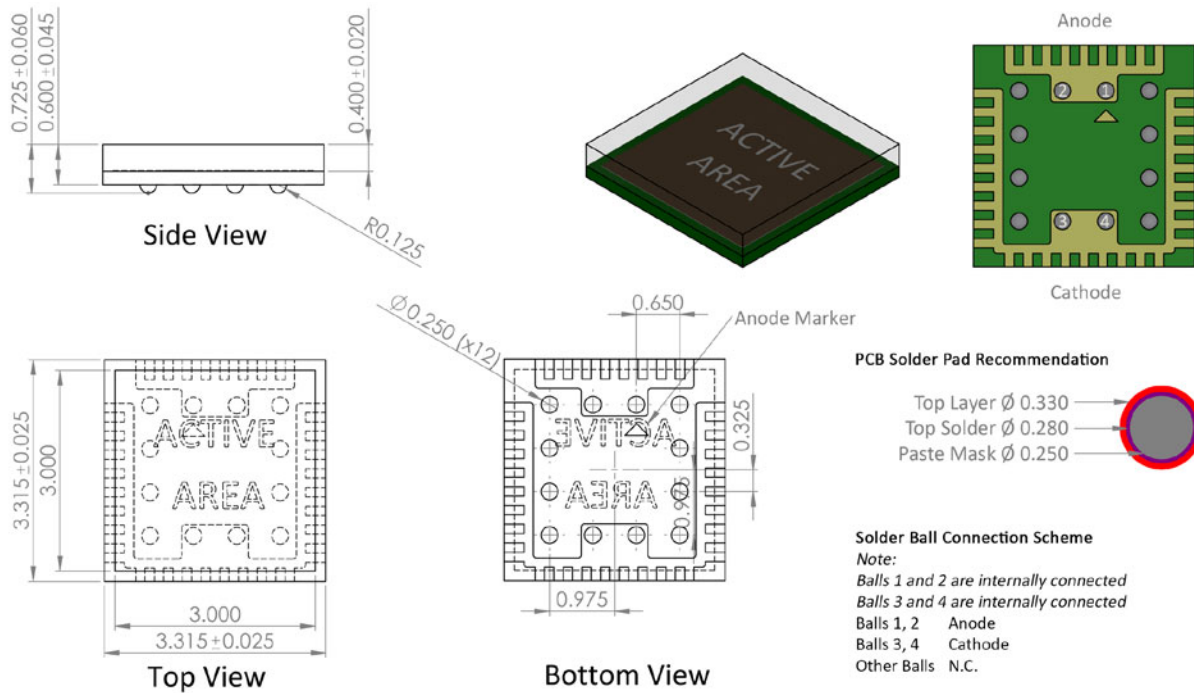
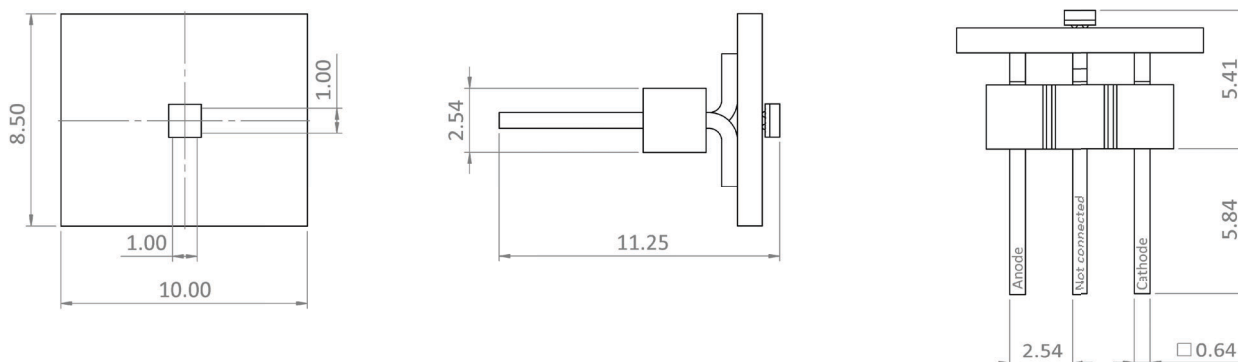


Figure 4: AFBR-S4K33C0125B Preassembled on PCB with Pins (Available for Evaluation Purposes)¹



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

Typical Performance Characteristics

Figure 5: Temperature Coefficient of the Breakdown Voltage

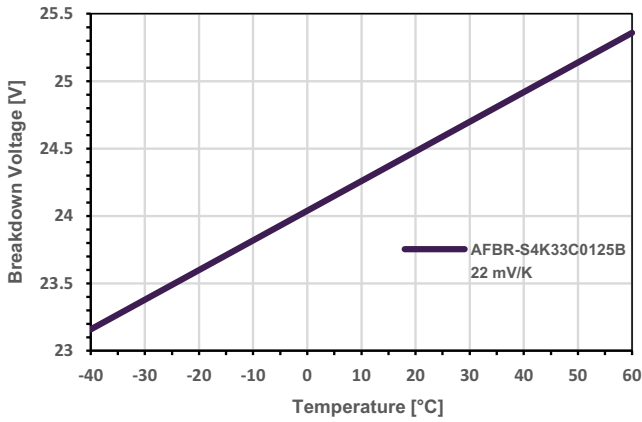


Figure 6: Temperature Coefficient of the Gain

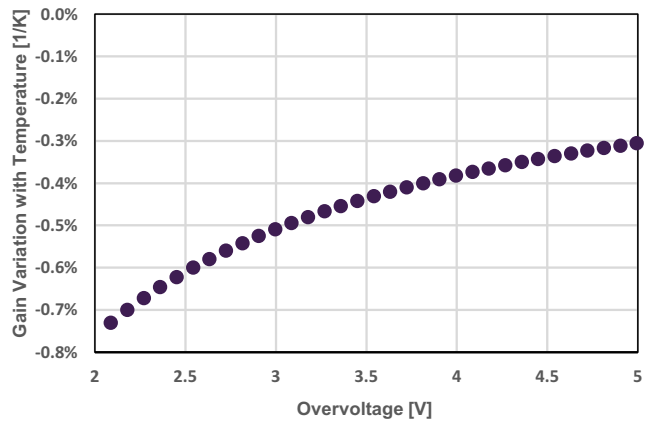


Figure 7: Linearity at 430 nm

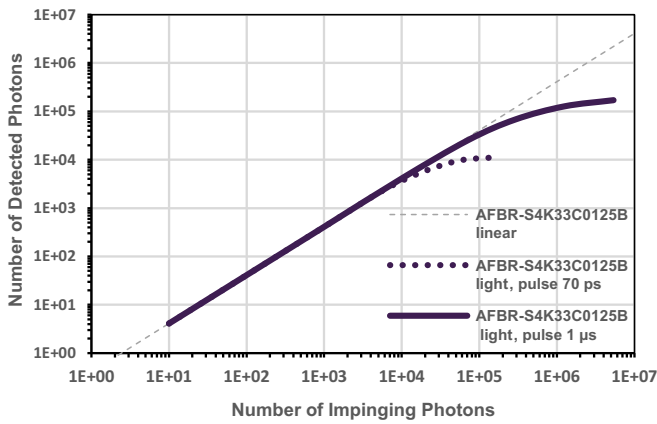


Figure 8: Gain of AFBR-S4K33C0125B

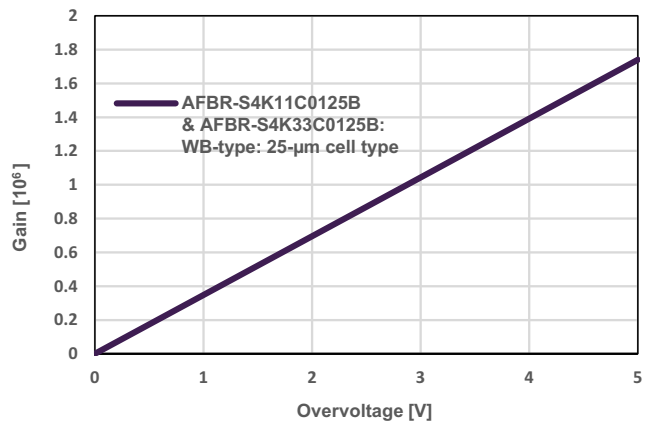


Figure 9: Dark Count Rate at 21°C

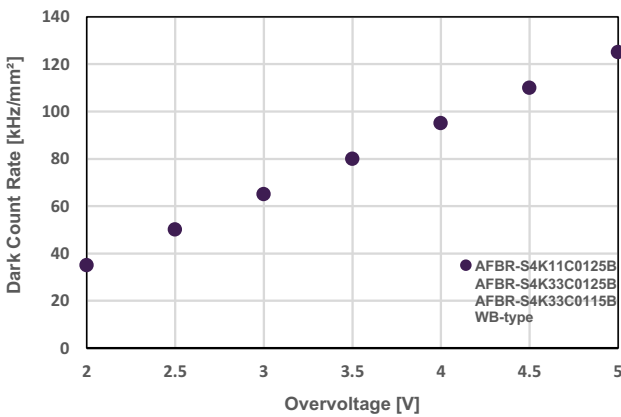


Figure 10: Dark Count Rate vs. Temperature

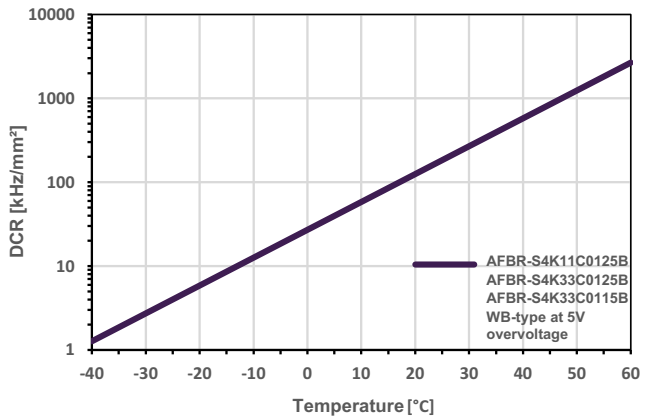


Figure 11: Direct Optical Crosstalk

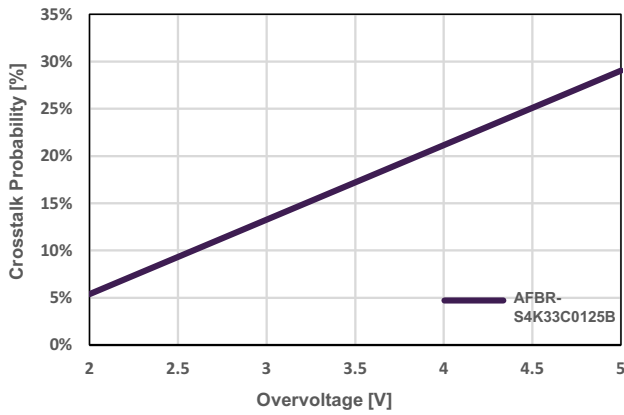


Figure 12: Delayed Optical Crosstalk

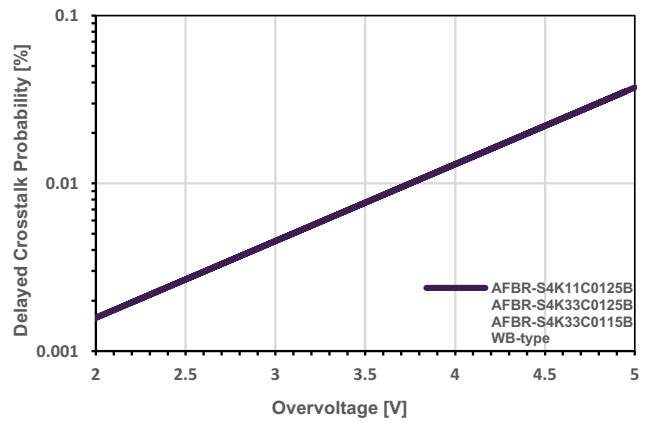


Figure 13: Afterpulsing Probability

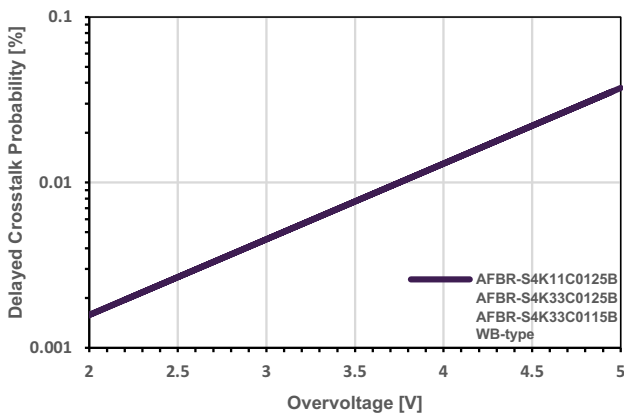
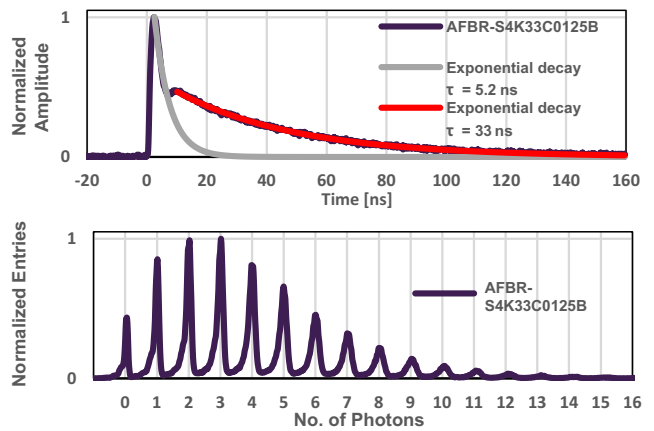


Figure 14: Pulse Shape at 1Ω Load, Single Photon Spectrum



Assembly Specifications

Figure 15: Tape and Reel

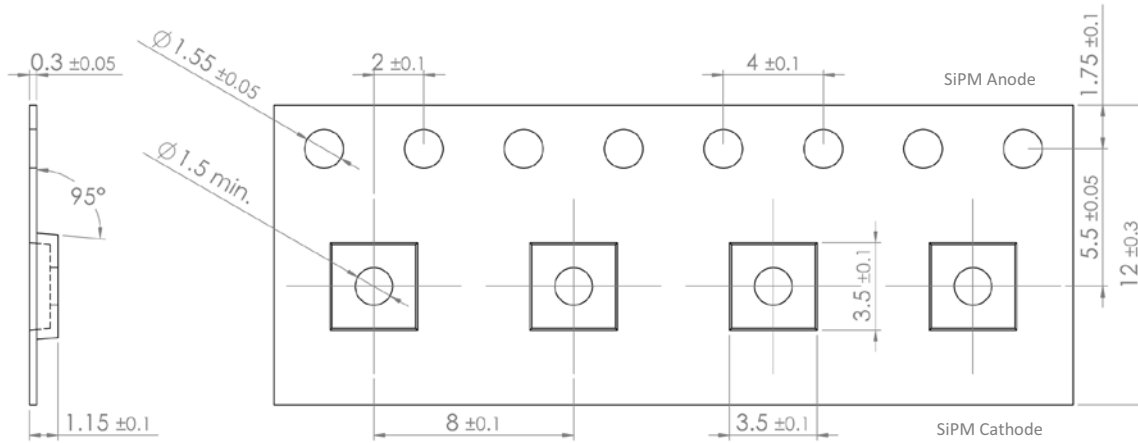
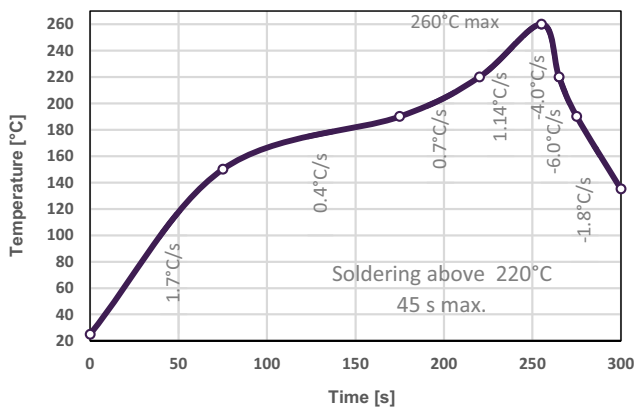


Figure 16: Recommended Reflow Solder Profile



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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