

## AFBR-S4KTIA33XXB Series

### SiPM TIA Module, WB-Type

### 3 x 3 mm<sup>2</sup> Active Area, 15/25 μm SPAD Pitch



#### Description

The Broadcom<sup>®</sup> AFBR-S4KTIA33XXB is a single silicon photomultiplier (SiPM) module with an integrated transimpedance amplifier (TIA) and bias source.

The SiPM module is well-suited for a wide range of fluorescence applications such as Flow Cytometry as well as those requiring single-photon counting or measurements with scintillators.

#### Features

- AFBR-S4K33C0115B or AFBR-S4K33C0125B SiPM
- Integrated Transimpedance Amplifier (TIA)
- Integrated Controllable Bias Source for SiPM
- Optionally with integrated Gain Stabilization
- Plug and Play Solution to replace PMTs
- Compatible with:-
  - Thorlabs SM05 16 mm Optical Cage Systems
  - Hamamatsu PMT mounts

#### Applications

- Biophotonics
  - Cytometry
  - Fluorescence Measurements
  - Point-of-Care Diagnostics
- Hazard and Threat Detection
  - Single Photon Counting
  - Scintillator Readout
  - Handheld Devices
- High Energy Physics
  - Low Light Level Detection
  - High Linearity Measurements
  - Energy Measurements

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

## General Parameters and Ordering Information

Type	Active Area of SiPM Pixel [mm <sup>2</sup> ]	Microcell Size of SiPM Pixel [ $\mu$ m]	No. of Microcells	Gain stabilized vs. Temperature
AFBR-S4K33TIA3315B based on AFBR-S4K33C0115B SiPM	3.0 x 3.0	15	38800	No
AFBR-S4K33TIA3325B based on AFBR-S4K33C0125B SiPM	3.0 x 3.0	25	13920	No

## Recommended Operation Parameters

Parameter	Description
Ctrl Voltage: AFBR-S4KTIA3315B AFBR-S4KTIA3325B	0.7V (resulting SiPM over voltage of about 5V)
Operating Temperature	0°C to 60°C

## Electrical and Optical Characteristics at 21°C (typ.)

Module Type <sup>a</sup>	Photo Detection Efficiency [%]	Dark Count Rate [kHz/mm <sup>2</sup> ]	Crosstalk Probability [%]	Afterpulsing Probability [%]	Recovery Time [ns]
AFBR-S4KTIA3315B @ Ctrl = 0.7V	31 (@ 430 nm)	125	18	5	15
AFBR-S4KTIA3325B @ Ctrl = 0.7V	45 (@ 430 nm)	125	26	<1	35

a. A Full SiPM specification can be found in the corresponding SiPM data sheet, visit <https://www.broadcom.com/products/optical-sensors/silicon-photomultiplier-sipm>

## Interfaces and Electrical Ratings

Parameter	Description
Outer Dimensions	40.0 x 50.0 x 19.8 mm <sup>3</sup> (L x W x H)
Mechanical Compatibility	Thorlabs SM05 Optics and 16 mm cage system Hamamatsu PMT mounts
Power Supply Input	+5V DC ( $\pm$ 0.5V, max + 12V DC), 500 mA, MCX connector Recommended ripple noise < 10 mV
Typical Power Consumption	350 mW (69 mA @ 5V power supply)
Bias Voltage / Gain Control (Ctrl)	0V to +1V (min. -0.2V, max. +1.2V), 50 mA, MCX connector
Signal Output (Signal)	Output range 0V to +1V, positive polarity MCX connector matched to 50 $\Omega$ impedance
Max. recommended Cable Length	3m

## Electrical Characteristics of Signal Output

Parameter	Description
Transimpedance Amplifier Gain	2-stage design, total gain 150 V/A
Signal Output Bandwidth	12.5 MHz
Signal Output Amplitude Noise	500 $\mu$ V ( $\sigma$ , AC coupled, 20 MHz bandwidth)
Bias Voltage/Gain Control (Ctrl)	0V to +1V, 50 mA, MCX connector
Output Offset Tuning Range	Preset to 0V, upon request -1V to 0V
Output Offset Drift with Temperature	< 0.5 mV/K

## Electrical Characteristics of Internal SiPM Bias Supply

Parameter	Description
Bias Voltage Range AFBR-S4KTIA3315B	26.81V to 34.00V (SiPM V <sub>bd</sub> at typ. 26.9V @ 21°C, no internal SiPM amplification below V <sub>bd</sub> )
Bias Voltage Range AFBR-S4KTIA3325B	24.69V to 31.55V (SiPM V <sub>bd</sub> at typ. 24.7V @ 21°C, no internal SiPM amplification below V <sub>bd</sub> )
Ripple Noise	< 2 mV min-max (1 M $\Omega$ input resistance, 22 pF capacitive load, 0.5 m RG-174-U cable)
Stability	< 5 mV min-max (f = 0.1 Hz)
Input Impedance	400 k $\Omega$
Settling Time	0.5s (time to reach stable SiPM bias after change of Ctrl voltage)
Output Current Limit	10 mA

## Typical Performance Characteristics

Figure 1: SiPM Bias Voltage vs. Ctrl Voltage

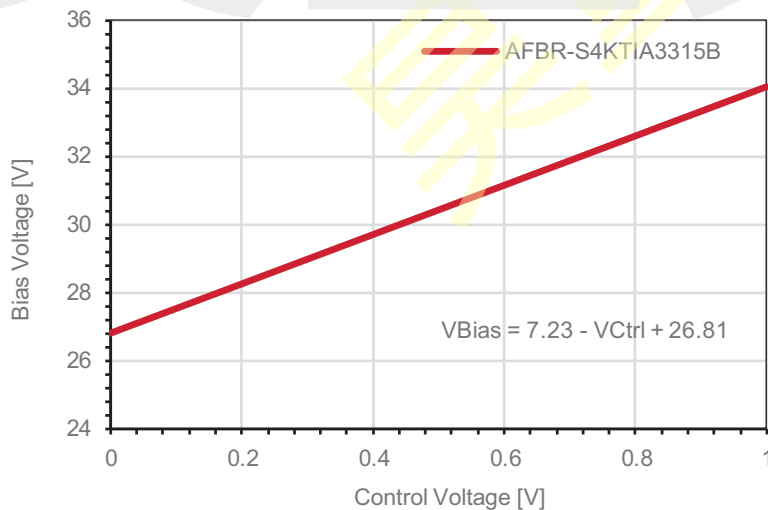


Figure 2: SiPM Bias Voltage vs. Ctrl Voltage

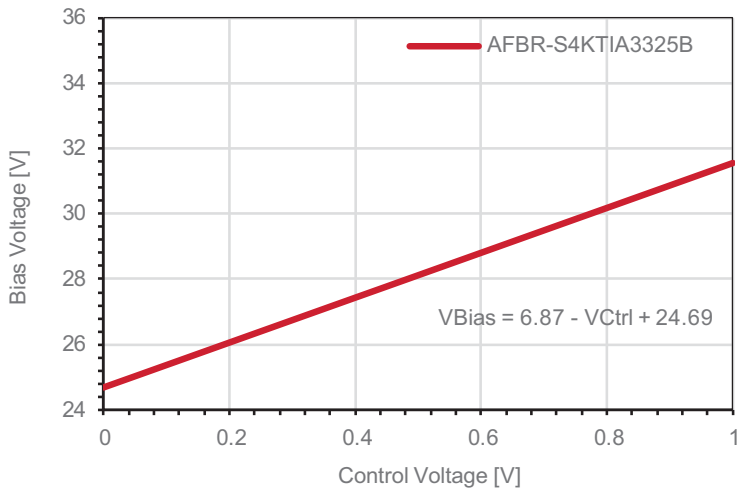
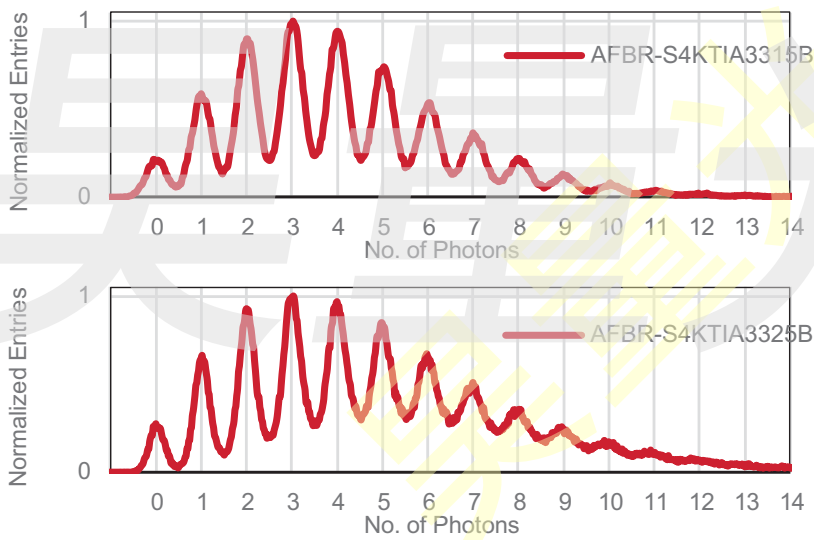
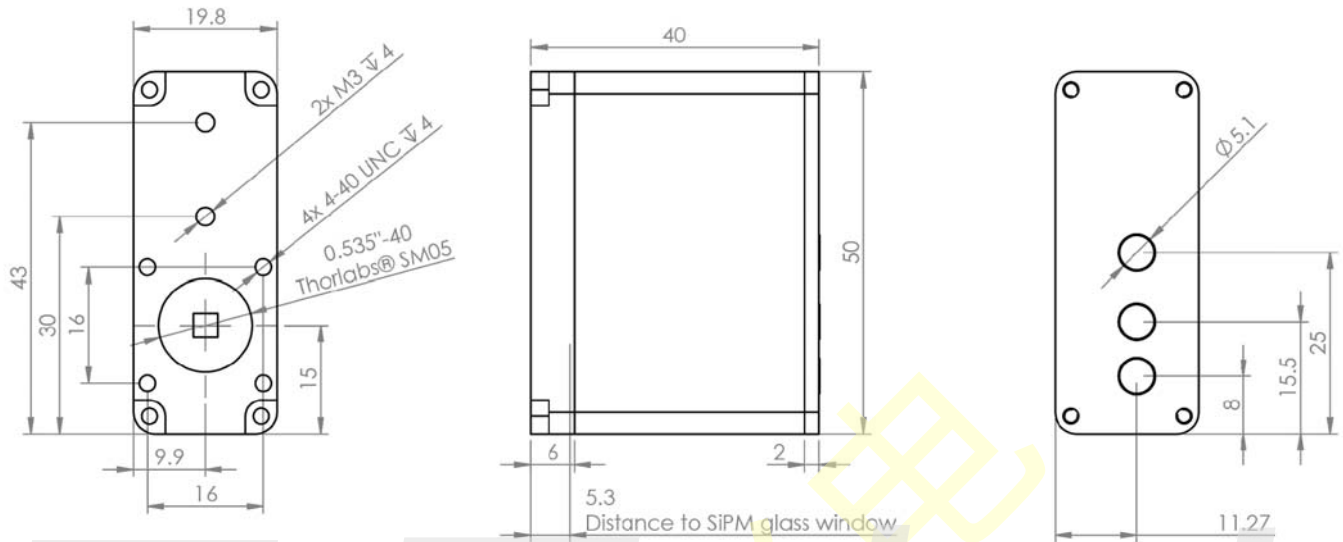


Figure 3: Single Photon Spectrum Example



# Mechanical Specifications<sup>1</sup>

Figure 4: Mechanical Specifications



1. General tolerances  $\pm$  0.1 mm unless otherwise noted