BROADCOM®

Product Brief

AFBR-S4 SiPM Family
Silicon Photomultipliers

Key Features NIR

- 29% PDE at 905 nm
- High dynamic range with > 6000 SPADs per mm^2
- 16-ns cell recharge time
- Various form factors:
  - Dual-channel 1x1 mm^2 in molded leadframe package
  - Line array in automotive package
- Samples available

Key Features NUV

- 63% PDE at 420 nm
- Crosstalk probability < 23%
- Afterpulsing probability < 1%
- DCR 120 kcps/mm^2
- Overmolded PCB package
- Samples available

Overview

Silicon photomultipliers (SiPMs) are arrays of single-photon avalanche diodes (SPADs) that are operated in Geiger mode and connected in parallel with common anode and cathode contacts. Working Geiger mode enables the detection of single photons with a high gain of about 1 x 10^6. The corresponding SiPM signals have rise times in the subnanosecond range, making them perfectly suitable for timing critical applications, for example LiDAR and TOF-PET.

Broadcom® SiPM Technologies

Broadcom offers a wide range of different SPAD and SiPM technologies, all of which are tailored toward application with the goal of achieving best-in-class performance. Mainly, two different SiPM families are available and cover near infrared (NIR) and near ultraviolet (NUV) wavelength ranges.
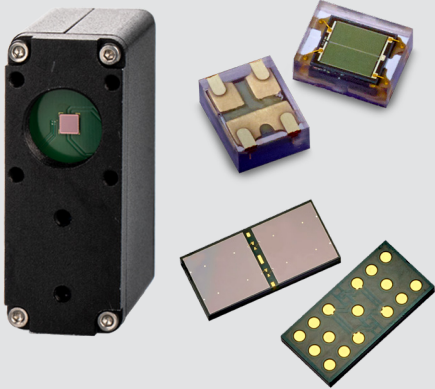
Visible to NIR-Sensitive SiPMs

Broadcom will release the first SiPM sensor products based on the advanced NIR30 process technology in 2023. The newly developed NIR30 process is optimized for automotive and industrial LiDAR, ranging, and life-sciences applications. It offers the system designer peerless performance in respect to key parameters such as PDE, crosstalk, afterpulsing, and recovery time.

NUV-Optimized SiPMs

Broadcom recently released the first products based on its newly developed NUV-MT SiPM technology. This technology brings performance to unprecedented levels (for example, PDE, crosstalk, or dark count rate) and allows customers to achieve best-in-class performance in their applications, for example, TOF-PET, flow cytometry, radiation and X-ray detection, X-ray photon counting, and line-of-sight data communication. In parallel, a new package type, an overmolded PCB package, has been developed that will serve the demands of harsh environments and industrial and mining applications.

Acquisition of KETEK's SiPM Technology

Effective end of 2021, Broadcom acquired all SiPM assets from KETEK. This allows Broadcom to grow the SiPM-related IP and know-how for both, the NIR- and the NUV-SiPM. Moreover, KETEK's plug & play SiPM-TIA modules, excellent front-end electronics and packaging technologies are completing Broadcom's expertise in silicon photomultipliers and their application.
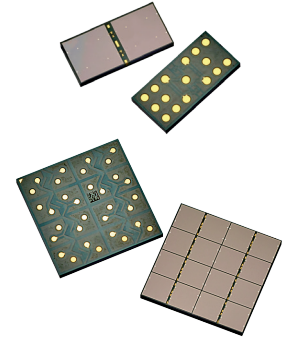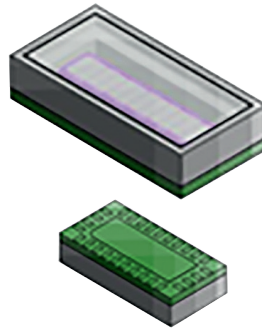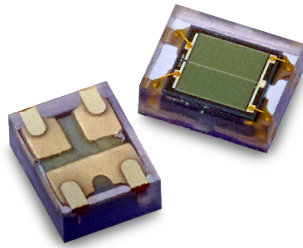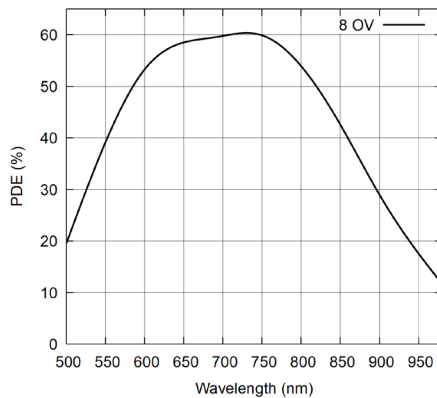
AFBR-S4 SiPM Package Variants

| Overmolded Leadframe Package | OQFN Package | Overmolded PCB Package |

AFBR-S4 SiPM Variants, Key Performance, and Package Types

Operational Conditions		
SiPM Technology	NIR30	NUV-MT
Part number	AFBR-S4Pxxxxx2Rx	AFBR-S4Nxxxxx4M
Peak sensitivity wavelength (nm)	720	420
PDE	29% at 905 nm	63% at 420 nm
SPAD pitch (µm)	12.5	40
Recharge time constant (ns)	16	55
DCR per unit area at max PDE (kcps/mm^2)	2200	120
Crosstalk probability at max PDE (%)	<3	23
Afterpulsing probability (%)	29	<1
Overmolded leadframe package	Dual-channel 1x1 mm^2 (Q2 2023)	—
OQFN package	1x24 line array (Q1 2024)	—
Overmolded PCB package	—	Single-channel 2x2 mm^2 (Q2 2023) Single-channel 4x4 mm^2 (Q1 2023) Single-channel 6x6 mm^2 (Q1 2023) 2x2 array 4x4 mm^2 4x4 array 4x4 mm^2 2x1 array 6x6 mm^2
TIA module	—	Based on NUV-MT single-channel 4x4 mm^2 (TBD)

AFBR-S4 Spectral Sensitivity (PDE)

| PDE Spectrum NIR30 | PDE Spectrum NUV-MT |

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