

## ASD-RGB4S-P-4x4T

### General Description

16 channels (4x4) SiPM array with 4x4 mm<sup>2</sup> active area SiPMs with independent anode and cathode connection.

The Silicon PhotoMultiplier (SiPM) is an innovative solid state silicon detector with single photon sensitivity. SiPMs are a valid solid state alternative to photomultiplier tubes (PMT detectors). The main benefits of this detector are: high gain, extremely good timing performance, low operative voltage, insensitivity to magnetic field and high integration level.

ASD RGB-SiPMs are based on the AdvanSiD "N-on-P" silicon technology for detection of Red, Green, and Blue light. RGB-SiPMs have peak efficiency at 550 nm, with detection spectrum extending from 350 nm to 900 nm.

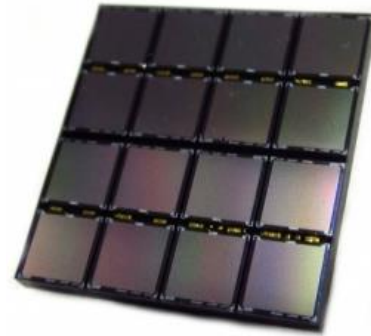
### Application

- High Energy Physics
- Medical Imaging
- Nuclear Medicine
- DNA Sequencing
- Homeland Security
- Flow Cytometry
- Biological Sensors
- Analytical Instruments
- SEM Microscopy
- Confocal Microscopy

### Ordering Information

**ASD-RGB4S-P-4x4T**

4x4 array of 4x4 mm<sup>2</sup> active area SiPM with 40x40 μm<sup>2</sup> cell size. S indicates square SiPM, P indicates plastic package, T tile.



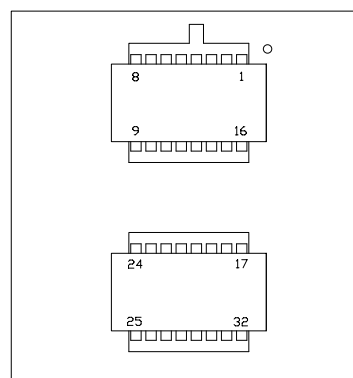
### Features

- Detection of extremely faint light
- Very high gain (10<sup>6</sup>)
- Extremely good timing performance
- Insensitive to magnetic fields
- Not damaged by ambient light
- Small and compact
- CSP Nickel free

### RGB-SiPMs Features

- Red, Green, and Blue light detection
- Superior breakdown voltage uniformity
- Excellent temperature stability

### Pins function



Array bottom view

N°	Name	Channel
1-2	A1-K1	Ch.1
3-4	K2-A2	Ch.2
5-6	K3-A3	Ch.3
7-8	A4-K4	Ch.4
9-10	A5-K5	Ch.5
11-12	K6-A6	Ch.6
13-14	K7-A7	Ch.7
15-16	A8-K8	Ch.8
17-18	A9-K9	Ch.9
19-20	K10-A10	Ch.10
21-22	K11-A11	Ch.11
23-24	A12-K12	Ch.12
25-26	A13-K13	Ch.13
27-28	K14-A14	Ch.14
29-30	K15-A15	Ch.15
31-32	A16-K16	Ch.16

K = cathode, A=anode

## ASD-RGB4S-P-4x4T

### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Min	Max	Unit
$T_A$	Operating Temperature Range	-25	+40	°C
$T_s$	Storage temperature	-40	+60	°C
$M_{VW}$	Max voltage working range	BV <sup>(1)</sup> + 4		V
ASD-SiPM4S-P-4x4T is not compatible with SMT assembly process				

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rated conditions for extended periods may affect device reliability.

### GEOMETRICAL, ELECTRICAL AND OPTICAL TYPICAL CHARACTERISTICS ( $T_A=20^{\circ}C$ )

Symbol	Parameter	ASD-RGB4S-P-4x4T (4x4 SiPMs tile with 4x4 mm <sup>2</sup> active area SiPM in plastic package)	Unit
AA	Effective Active Area	4x4x16	mm <sup>2</sup>
CS	Cell Size	40x40	μm <sup>2</sup>
FF	Cell Fill Factor	60 %	-
N	SiPM cells number	9340	-
$S_R$	Spectral response range	350 to 900	nm
$\lambda_p$	Peak sensitivity wavelength	550	nm
PDE	Photon Detection Efficiency <sup>(2)</sup>	32.5 %	%
BV	Breakdown voltage	27 ± 2 <sup>(3)</sup>	V
Wvr	Work voltage range	BV <sup>(1)</sup> + 2 to BV + 4	V
$D_c$	SiPM dark count <sup>(4)</sup>	< 600	kCps/mm <sup>2</sup>
G	Gain <sup>(5)</sup>	2.7 · 10 <sup>6</sup>	-
$\Delta BV_{MAX}$	BV uniformity <sup>(6)</sup>	0.4 (max)	V
$BV_{TS}$	BV temperature sensitivity	27	mV/°C

(1) BV = Breakdown voltage.

(2) Measured at peak sensitivity wavelength ( $\lambda = \lambda_p$ ) at +4 V Overvoltage (not including afterpulse and crosstalk).

(3) Refer to the data provided with each product.

(4) 0.5 p.e. threshold level at 20 °C and +4 V Overvoltage (primary dark count rate not including afterpulse).

(5) Measured at 20 °C at +4 V Overvoltage.

(6) Maximum variation in SiPM breakdown voltage within each tile.

### DIMENSIONAL OUTLINES

Units = mm Mechanical tolerance = ±0.15 mm unless otherwise noted.

Description	Top View	Side View	Bottom View
4x4 SiPMs tile with 4x4 mm <sup>2</sup> SiPM active area size  Material: FR4 + transparent epoxy layer			

## ASD-RGB4S-P-4x4T

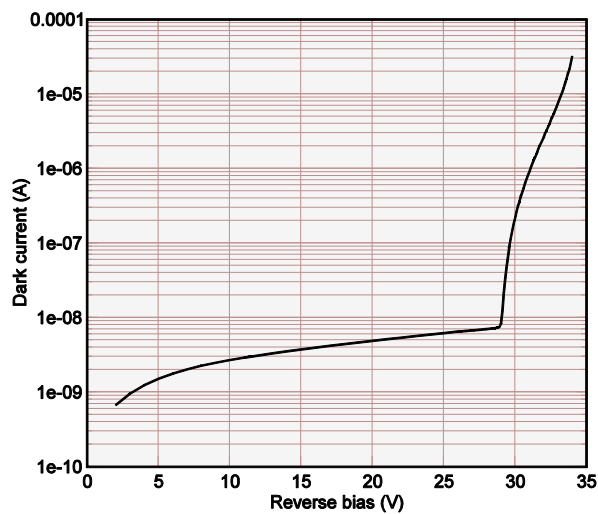
### DEVICE CHARACTERISTICS

This section reports typical SiPM reverse and forward I/V curves and the dependences on bias voltage (or overvoltage), temperature, and wavelength of most relevant device parameters. Refer to the data accompanying each shipped product for more detailed information.

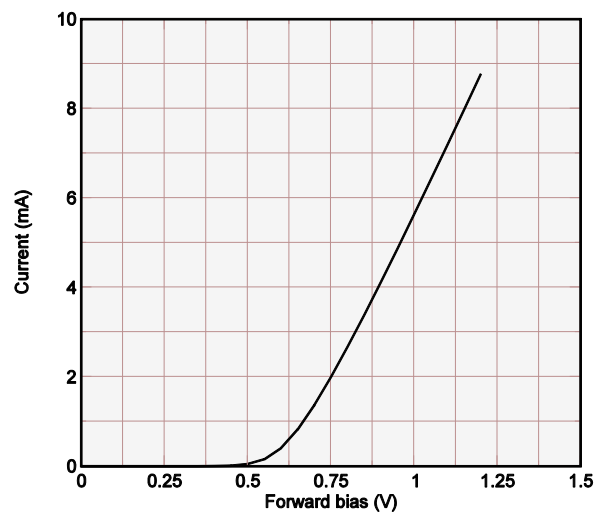
All measurements are performed in a tight-light climatic chamber at  $T=20^{\circ}\text{C}$ , unless otherwise noted.

SiPM output signals are amplified with ASD-EP-EB-N or ASD-EP-EB-PZ evaluation boards and acquired with fast oscilloscopes; the digitized data is then processed with dedicated PC programs.

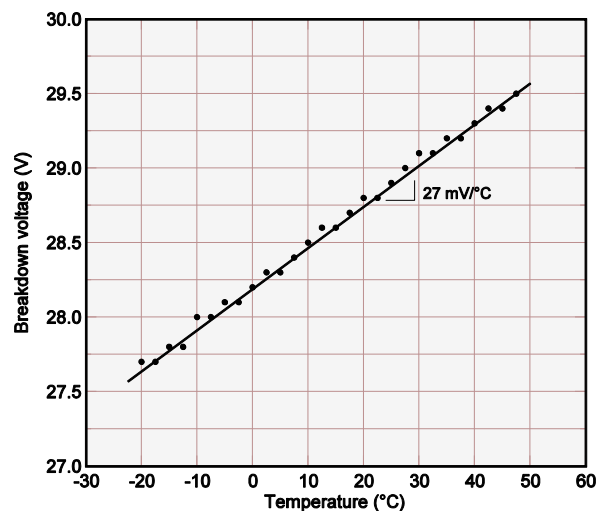
Explanation of SiPM working principle and details on SiPM properties parameters can be found on the [Introduction to SiPMs](http://advansid.com/resources/the-silicon-photmultiplier) available at <http://advansid.com/resources/the-silicon-photmultiplier>.



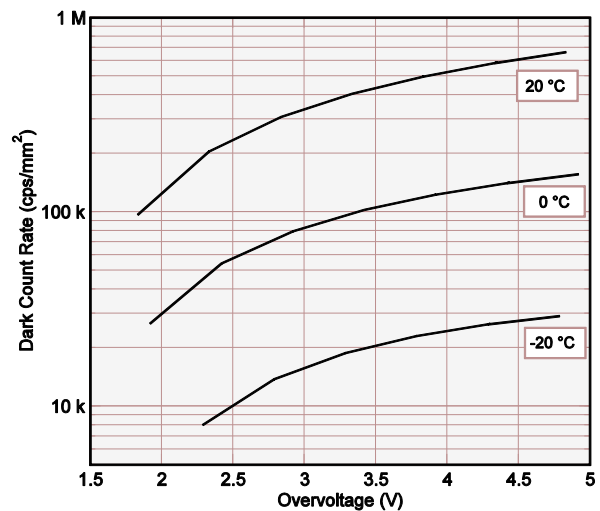
**Fig.1** ASD-RGB4S-P-4x4T typical reverse IV curve (one channel).



**Fig.2** ASD-RGB4S-P-4x4T typical forward IV curve (one channel).



**Fig.3** RGB-SiPMs breakdown voltage temperature dependence.



**Fig.4** Dark count rate per square mm in ASD-RGB4S-P-4x4T SiPMs as a function of overvoltage and temperature.

ASD-RGB4S-P-4x4T

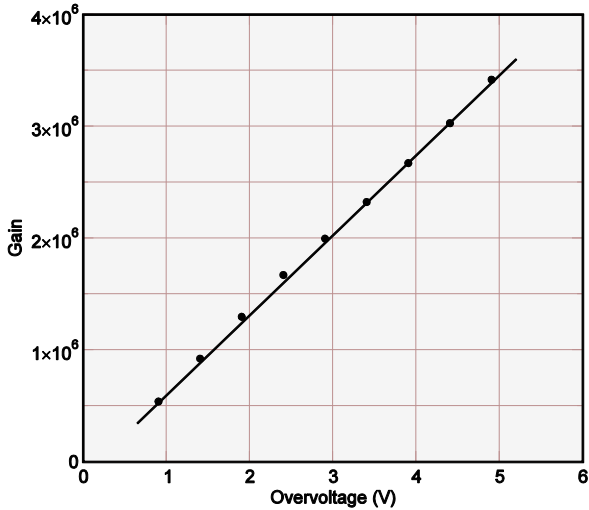


Fig.5 Gain of RGB-SiPMs as a function of overvoltage.

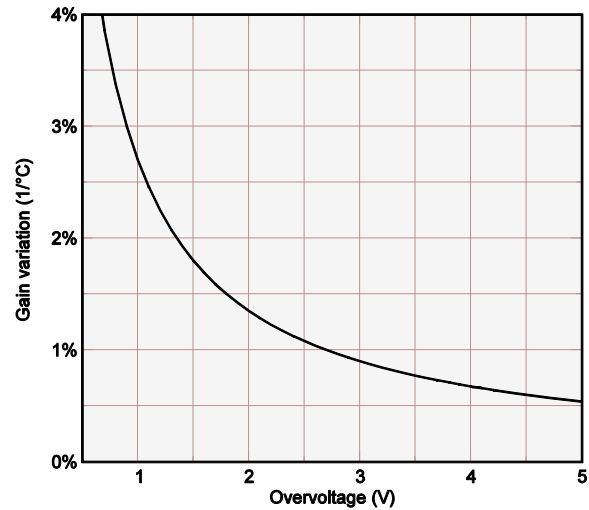


Fig.6 Relative variation of gain with temperature in RGB-SiPMs as a function of overvoltage.

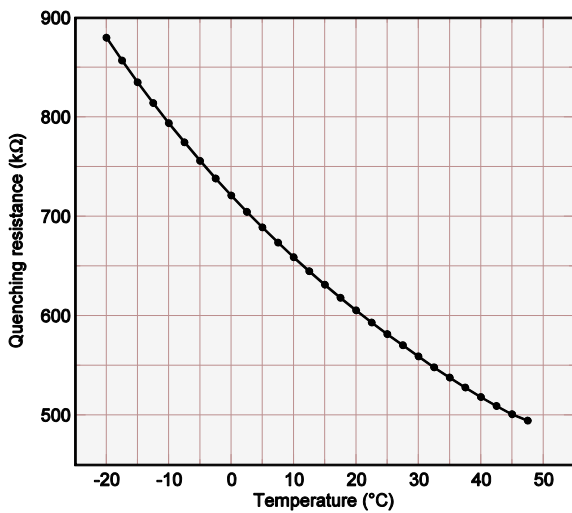


Fig.7 Temperature dependence of poly-silicon quenching resistance in RGB-SiPMs.

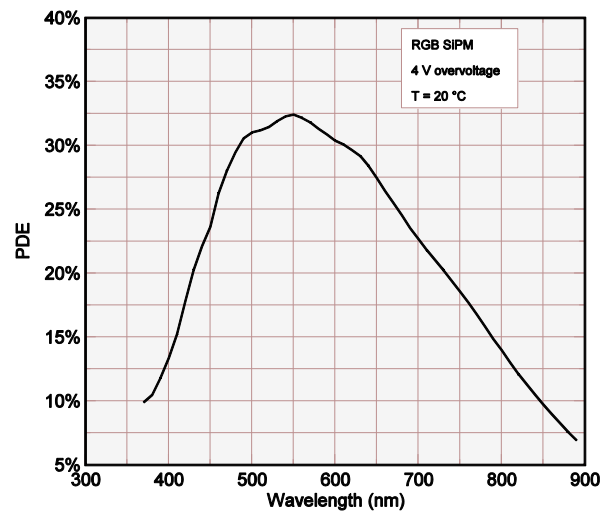


Fig.8 Photo detection efficiency (PDE) in RGB-SiPMs as a function of wavelength (crosstalk and afterpulse not included).

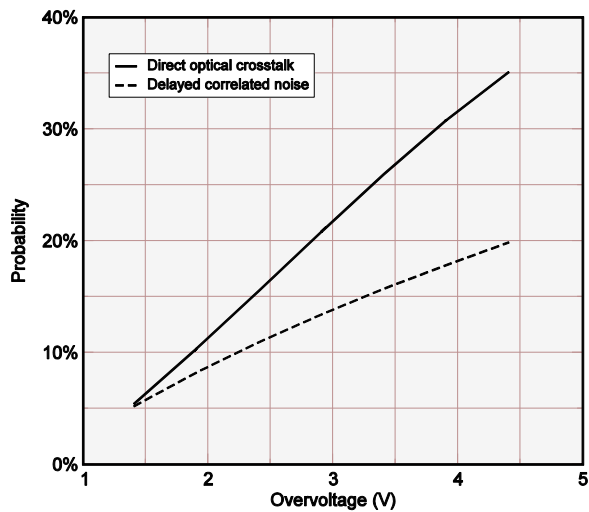


Fig.9 Correlated noise probability in RGB SiPMs as a function of overvoltage. Delayed correlated noise includes delayed crosstalk and afterpulse.

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### ASD-RGB4S-P-4X4T CONNECTOR

JAE 0.8mm pitch IL-WX series. Two pin header connectors mounted on the back of the module (part number JAE IL-WX-16P-VF-BE). Two receptacles (sockets) provided with each shipped SiPM array (part number JAE IL-WX-16S-VF-BE). SMT mounting of sockets should follow constructor's indications.

Datasheet and mechanical information available at [this link](#) (JAE website).

#### General Specifications (JAE IL-WX-16P-VF-BE)

Parameter	Value	Unit
Number of contacts	16	-
Rated current	0.5	A
Dielectric withstanding voltage	500 (1 minute)	V (AC rms)
Insulation resistance	100 (min)	MΩ
Contact resistance	20 (max)	mΩ
Operating temperature range	-40 to +85	°C

*Information in this datasheet is believed to be reliable. However, no responsibility is assumed for possible inaccuracies or omissions. Specification are subject to change without notice.*