Novel Device laboratory Detector Innovation

SiPM 11-3030C Series

Features

For a conventional SiPM, the quenching resistors are usually fabricated on the surface, and used to connect all APD cells to trace metal lines. In contrast, NDL SiPM employs intrinsic epitaxial layer to form the quenching resistors, using a continuous silicon caping layer as an anode to connect all the APD cells. As a result, the device has more compact structure and simpler fabrication technology, allows larger micro cell density (larger dynamic range) while retaining adequate photon detection efficiency (PDE). The main advantages of NDL C Series SiPM are as follows:

- **Small Cell and Small Pitch**
- * **High Cell Density and High Fill Factor**
- Large Dynamic Range While High PDE
- **Fast Rise Time and Short Pulse Width**
- * **Short Recovery Time and High Time Resolution**
- **Cost Effective**

Applications

- * **High Energy Physics**
- **Scintillation Measurement**
- **Nuclear Medical Imaging (PET, SPECT, CT)**
- **Radiation Detection and Imaging**
- **Optical Spectroscope**
- **Other Low Level Light Detection**

Specifications

Compared with B series, the C series devices have higher gain, higher PDE, lower dark count rate, better time resolution, and can operate at low temperature down to 77 K.

Parameter	Value	Parameter	Value
Effective Active Area	$3 \times 3 \mathrm{mm}^2$	Peak PDE@420nm*	>31%
Effective Pitch	10 μm	Dark Count Rate*	~6 MHz
Micro-cell Number	~90000	1 p.e. Pulse Width	8.7ns
Operating Temperature Down to LN2 (77 K)	Yes	Temperature Coefficient For V _b	25 m∇/℃
Breakdown Voltage (V _b)	27.5±0.4 V	Gain	≥2×10 ⁵
Max. Overvoltage (ΔV_{max})	8 V	Single Photon Time Resolution	≤ 200 ps

^{*}Measured at overvoltage close to 5 V.



Characteristic Curves 1E-5 8000 1E-6 Dark Count Rate (KHz) 6000 1E-7 Current (A) 4000 1E-8 2000 1E-9 1E-10 22 24 26 28 30 32 34 36 38 40 Overvoltage (V) Voltage (V) 1000 30 Photon Detection Efficiency (%) 800 600 Count 400 Overvoltage (V) 200 Overvoltage@5V 10 L 350 5.0E-10 2.5E-9 0.0 1.0E-9 1.5E-9 2.0E-9 400 450 500 550 650 700 Pulse Area (Vs) Wavelength (nm) 600 3.5x10⁵ 550 3.0x10⁵ 500 450 2.5x10⁵ SPTR, FWHM (ps) 400 350 2.0x10⁶ 300 1.5x10⁵ 250 200 1.0x10⁶ 150 100 5.0x10⁴ 50 0 Overvoltage (V) Overvoltage (V) 80 100000 Theoretical curve Experimental value 10000 60 = 2.3ns Amplitude (mV) 1000 N 100 20 10

PDE, Pulse Area spectrum, Dynamic range and the Pulse waveform are measured at overvoltage close to 5 V. The temperature of the experiment is 20 $^{\circ}\mathrm{C}$

100

10

1000

 N_{photon} ×PDE

10000

100000 1000000

15

0 <u>⊾</u> -5

5 Time (ns)

0

10

Dimensional outlines (unit: mm)

