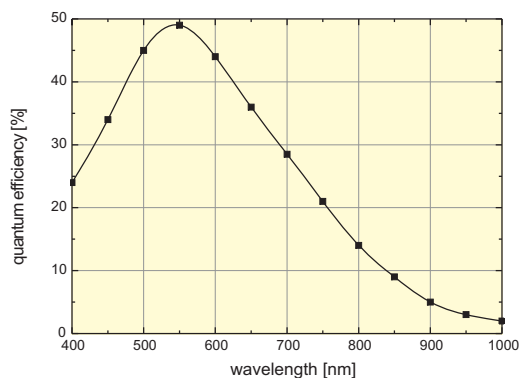


# PDM Series



PICOQUANT GmbH  
Unternehmen für optoelektronische  
Forschung und Entwicklung

## Single Photon Avalanche Diodes



- Timing resolution down to 50 ps (FWHM)
- Quantum efficiency 49% at 550 nm
- Different detector diameters: 20, 50 and 100  $\mu\text{m}$
- Ultrastable at high count rates
- Low power consumption



## Applications

- Time-resolved fluorescence spectroscopy
- Single Molecule Spectroscopy (SMS)
- Fluorescence Lifetime Imaging (FLIM)
- Fluorescence Correlation Spectroscopy (FCS)
- Fast laser measurement and calibration
- LIDAR, Ranging, ...
- Dynamic light scattering, Particle sizing
- Quantum optics

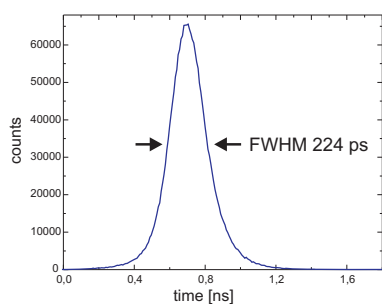
# Single Photon Avalanche Diodes

The photon counting detector modules of the PDM series are all solid-state instruments designed and manufactured by Micro-Photon-Devices (MPD) of Bolzano, Italy. They have photon detection efficiency of 49% at 550 nm and generate a TTL output pulse per detected photon. With fast-timing option (additional circuit board installed inside) they provide better than 50 ps FWHM photon timing resolution for a wide range of wavelengths. The excellent photon detection efficiency and superior timing resolution is obtained through the use of epitaxial silicon Single Photon Avalanche Diodes (SPAD) and patented integrated Active Quenching Circuits (iAQC), specifically designed and optimized for time-resolved photon counting applications.

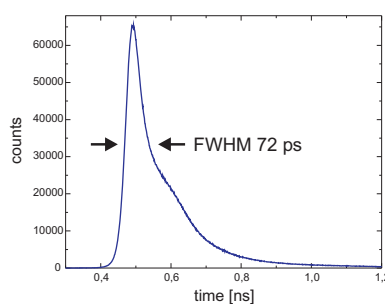
The SPADs are available with a diameter of the active area of 20, 50 or 100  $\mu\text{m}$ . They cover a spectral range from about 400 nm to 900 nm with the highest quantum efficiency in the VIS range around 550 nm. They are extremely robust and can withstand continuous exposition to daylight. Their superior timing makes them a real alternative to photomultiplier tubes for many applications. Especially above 470 nm, the temporal response is even comparable to MCP-PMTs. Moreover, the high quantum efficiency makes them an ideal detector for single molecule applications, like Fluorescence Correlation Spectroscopy (FCS) or Fluorescence Lifetime Imaging (FLIM), especially as the SPAD has a stable timing even at count rates exceeding 1 Million counts/sec.

## Measurement Examples

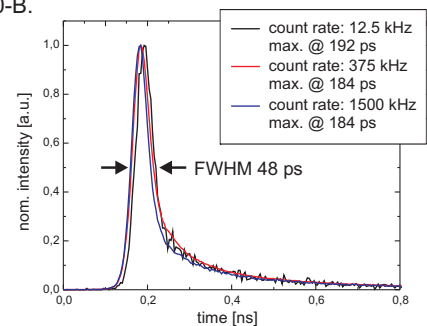
Instrument Response Function (IRF) of a PDM module with an active area of 50  $\mu\text{m}$ . The measurements were taken with the TCSPC module PicoHarp 300 and different laser heads of the LDH series driven by the PDL 800-B.



Excitation with LDH-P-C-405, laser pulse width: 60 ps



Excitation with LDH-P-C-470, laser pulse width: 56 ps



Excitation with LDH-P-670, showing the independence of the IRF from the count rates, laser pulse width: 32 ps

## Specifications (@ 25 °C and 5 V overvoltage)

|                                    |                             |                             |                              |
|------------------------------------|-----------------------------|-----------------------------|------------------------------|
| <b>Dark Counts (typical)</b> ..... | 20 $\mu\text{m}$ SPAD ..... | 50 $\mu\text{m}$ SPAD ..... | 100 $\mu\text{m}$ SPAD ..... |
| Non-cooled version .....           | <250 cps .....              | <5.000 cps .....            | <20.000 cps .....            |
| Cooled version .....               | <25 cps .....               | <100 cps .....              | <250 cps .....               |

### Single Photon Timing Resolution

|                                  |  |
|----------------------------------|--|
| TTL counting output (FWHM) ..... | 250 ps   |
| NIM timing output (FWHM) * ..... | down to 50 ps, increases in blue/UV spectral range |

**After-Pulsing Probability** .....

2.5% (typical)

### Input / Output

|  |  |
|--|--|
| Dead time .....                        | 77 ns (typical)                                  |
| Output signal .....                    | TTL for counting output, NIM for timing output * |
| Output pulse rise and fall times ..... | <2 ns on 10 pF load                              |
| Output pulse duration .....            | 20 ns (typical)                                  |
| Gating input .....                     | TTL control (low level gates detector off)       |
| Supply input connector .....           | Standard 3.5 mm supply socket                    |

**Supply Voltage** .....

unregulated DC, any value 5 V - 12 V

\* Available as an option

Further available are Fluorescence Lifetime Spectrometers; Time-resolved Fluorescence Microscopes; Upgrade kit for Laser Scanning Microscopes; Picosecond / Nanosecond Pulsed, Modulated and Fast Switched Diode Lasers; PC Modules for TCSPC. Please call for detailed information and data sheets. **Please check our webpage for latest changes of specs.**

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