IDQ's ID100 series consists of compact and affordable single-photon detector modules with best-in-class timing resolution and state-of-the-art dark count rate based on a reliable silicon avalanche photodiode sensitive in the visible spectral range: 350-900 nm. The ID100 series detectors come as:

- free-space modules, the ID100-20 and ID100-50 with 20 μm and 50 μm photosensitive area, respectively
- fibre-coupled modules, the ID100-SMF20, ID100-MMF50 and the ID100-MMF100 coming with a standard FC/PC optical input.

The modules are available in four dark count grades, with a dark count rate as low as 5 Hz.

With a timing resolution as low as 40 ps and a remarkably short dead time of 45 ns, these modules outperform existing commercial detectors in all applications requiring single-photon detection with high timing accuracy and stability up to a count rate of 20 MHz.

**Key Features**

- 350-900 nm
- Best-in-class timing resolution (40 ps)
- Low dead time (45 ns)
- Small IRF shift at high count rates
- Regular, standard and ultra-low noise grades
- Peak photon detection at λ = 500 nm
- Active area diameter of 20 μm or 50 μm
- Free-space or fibre coupling
- Not damaged by strong illumination
- No bistability

**Applications**

- Time correlated single-photon counting (TCSPC)
- Fluorescence and luminescence detection
- Single molecule detection, DNA sequencing
- Fluorescence correlation spectroscopy
- Flow cytometry, spectrophotometry
- Quantum cryptography, quantum optics
- Laser scanning microscopy
- Adaptive optics
- Particle physics
- Dynamic light scattering (DLS)
Optimal timing resolution is obtained when incoming photons are focused on the photosensitive area.

The ID100 is free of indicating LEDs to maintain complete darkness during measurements.

The detector output is designed to avoid distortion and ringing when driving a 50 Ohms load.

Universal network adapter provided (110/220 V).

See on page 4 the A-PPI-D pulse shaper for negative input equipment compatibility.

The ID100-SMF20 contains a single mode fibre optimized to your operating wavelength.

The coupling efficiency is larger than 80%.

The ID100-MMF100 contains a 100/140 μm multi-mode fibre optimized for the visible spectral range with a 0.22 numerical aperture.

The coupling efficiency is larger than 50%.

Dark count rate: IDQ’s modules are available in four grades: Educational, Regular, Standard and Ultra-Low Noise, depending on dark count rate specifications.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min</th>
<th>Typical</th>
<th>Max</th>
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<td>Wavelength range</td>
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<td>900 nm</td>
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<td>nm</td>
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<td>Timing resolution [FWHM]</td>
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<td>ps</td>
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<td>Single-photon detection probability (SPDE)</td>
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<td>at 400 nm</td>
<td>15 18</td>
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<td>at 500 nm</td>
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<td>%</td>
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<td>at 900 nm</td>
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<td>Afterpulsing probability</td>
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<td>Output pulse width</td>
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<td>9 10 15</td>
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<tr>
<td>Output pulse amplitude</td>
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<td>Deadtime</td>
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<td></td>
<td>ns</td>
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<td>Maximum count rate (pulsed light)</td>
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<td>Cooling time</td>
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</table>

ID100-20 | 20um | Yes | <1000Hz | <250Hz | =<25Hz | <5Hz
ID100-SMF20 | 6 | Yes | <1000Hz | <200Hz | <100Hz | <60Hz
ID100-50 | 50um | Yes | <1000Hz | <200Hz | <100Hz | <60Hz
ID100-MMF50 | 7 | Yes | <1000Hz | <200Hz | <100Hz | <60Hz
ID100-MMF100 | 8 | Yes | <1000Hz | <200Hz | <100Hz | <60Hz

Optimal timing resolution is obtained when incoming photons are focused on the photosensitive area.

Extremely low shift of instrument response function with output count rate (less than 70 ps from 10 kHz to 8 MHz).

Typical autocorrelation function of a constant laser signal, recorded at a count rate of 10 kHz.

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The short deadtime of the ID100 allows operation at very high repetition frequencies (up to 20 MHz).

Measurement obtained with an oscilloscope in infinite persistence mode: the deadtime consists of the output pulse width and the hold-off time during which the ID100 is kept insensitive.

Typical pulse of 2 V amplitude and 10 ns width observed at the output of an ID100 terminated with 50 Ω load. Recommended trigger level: 1 V. For timing applications, triggering on rising edge is recommended to take full advantage of the detector’s timing resolution.

Principle of Operation

The ID100 consists of an avalanche photodiode (APD) and an active quenching circuit integrated on the same silicon chip. The chip is mounted on a thermoelectric cooler and packaged in a standard TO5 header with a transparent window cap. A thermistor is used to measure temperature. The APD is operated in Geiger mode, i.e. biased above breakdown voltage. A high voltage supply used to bias the diode is provided by a DC/DC converter. The quenching circuit is supplied with +5 V. The module output pulse indicates the arrival of a photon with high timing resolution. The pulse is shaped using a hold-off time circuit and sent to a 50 Ω output driver. All internal settings are preset for optimal operation at room temperature. In the fibre-coupled version, a fibre pigtail with FC/PC connector is coupled to the detector.
Accessory - Optional Pulse Shaper

IDQ provides as an option a pulse shaper (A-PPI-D) which can be used with devices requiring negative input pulses. The leading edge of the ID100 output pulse is converted into a sharp negative pulse with typical amplitudes of 1.4 V for a 50 Ω load and 2.5 V for a high impedance load. The pulse shaper comes with two SMA/BNC adapters.

ID101 Series - The world’s smallest photon counter

For large-volume OEM applications, IDQ offers the ID101 series, consisting of a standard TO5-8pins optoelectronic package with a CMOS silicon chip (single-photon avalanche diode and fast active quenching circuit) mounted on top of a thermoelectric cooler. A thermistor is available for temperature monitoring and control. An evaluation board is available upon request. When properly biased, the performance is comparable with that of the ID100-50. IDQ’s engineering team offers technical support to simplify integration. A fibre coupled version, the ID101-MMF50, is also available. See the ID101 datasheet for more information.

Mounting options

The ID100 series comes with different mounting options:
- Mounting brackets (supplied) for screws of diameter up to 4mm.
- A standard optical post holder (not supplied) with the M4 threaded hole on the bottom (ID100-20 & ID100-50 only).
- The C-MOUNT adapter to add optical elements in front of the detector (ID100-20 & ID100-50 only).

Supplied Accessories

- Mounting brackets (4x)
- C-Mount adapter (except for fibre coupled devices)
- Coaxial cable (1 m, BNC-SMB)
- Power supply with universal input plugs
- Operating guide
- Angled 2.5 mm hexagonal key to remove the C-Mount adapter
- Angled T10 Torx key to remove mounting brackets

Ordering information

D100-20-XXX  Photon counter with 20 μm active area.
D100-50-XXX  Photon counter with 50 μm active area.
D100-SMF20-XXX  Photon counter with singlemode fibre pigtail (FC/PC connector).
D100-MMF50-XXX  Photon counter with multimode fibre pigtail (50/125 μm, FC/PC connector).
D100-MMF100-XXX  Photon counter with multimode fibre pigtail (100/140 μm, FC/PC connector).

Select dark count grade:
XXX = EDU for Educational; REG for Regular; STD for Standard; ULN for Ultra-Low Noise.

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