Redefining Measurement

ID100 Visible Single-Photon Detector

High Timing Resolution and Low Dark Count Rate

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 7 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)

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Specifications

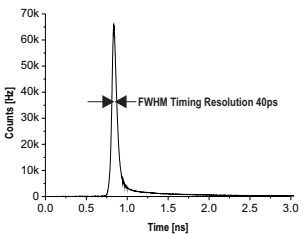
Parameter	Min	Typical	Max	Units
Wavelength range	350		900	nm
Timing resolution [FWHM] 1 2 1		40	60	ps
Single-photon detection probability (SPDE) 3				
at 400 nm	15	18		%
at 500 nm	30	35		%
at 600 nm	20	25		%
at 700 nm	15	18		%
at 800 nm	5	7		%
at 900 nm	3	4		%
Afterpulsing probability 4		0.5		%
Output pulse width 3 5	9	10	15	ns
Output pulse amplitude	1.5	2	2.5	V
Deadtime		45	50	ns
Maximum count rate (pulsed light)		20		MHz
Supply voltage 4	5.6	6	6.5	V
Supply current		100	150	mA
Storage temperature	-40		70	°C
Cooling time			5	s

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

1. Optimal timing resolution is obtained when incoming photons are focused on the photosensitive area.
2. The ID100 is free of indicating LEDs to maintain complete darkness during measurements.
3. The detector output is designed to avoid distorsion and ringing when driving a 50 Ohms load.
4. Universal network adapter provided (110/220 V).
5. See on page 4 the A-PPI-D pulse shaper for negative input equipment compatibility.
6. The ID100-SMF20 contains a single mode fibre optimized to your operating wavelength
7. The ID100-MMF50 contains a 50/125 µm multi-mode fibre optimized for the visible spectral range with a 0.22 numerical aperture. The coupling efficiency is larger than 80%.
8. 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%.

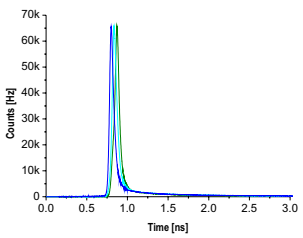
	Active Area Diameter	TE Cooled	Educational	Regular	Standard	Ultra Low Noise
ID100-20	20um	Yes	<1000Hz	<250Hz	=<25Hz	=<7Hz
ID100-SMF20	6	Yes				
ID100-50	50um	Yes	<1000Hz	<250Hz	<100Hz	<60Hz
ID100-MMF50	7	Yes				
ID100-MMF100	8	Yes				

1 Timing Resolution



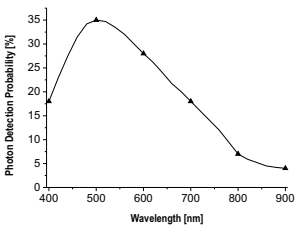
Optimal timing resolution is obtained when incoming photons are focused on the photosensitive area.

2 IRF Shift with Output Count Rate

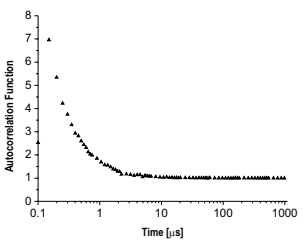


Extremely low shift of instrument response function with output count rate (less than 70 ps from 10 kHz to 8 MHz).

3 Photon Detection Probability versus λ



4 Afterpulsing



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

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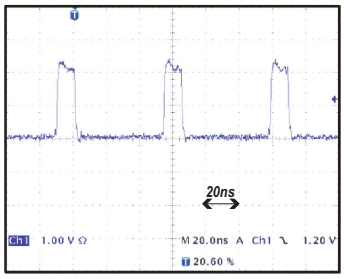
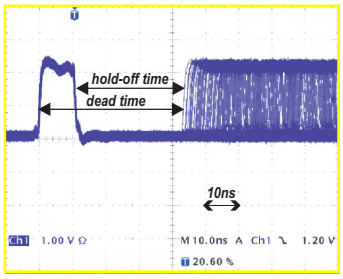
5 Maximum count rate - Pulsed light



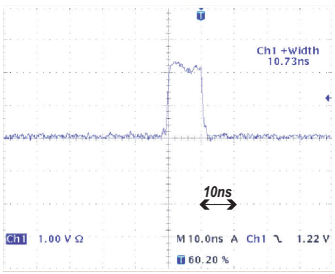
The short deadtime of the ID100 allows operation at very high repetition frequencies (up to 20 MHz).

6 Dead Time



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

7 Output Pulse

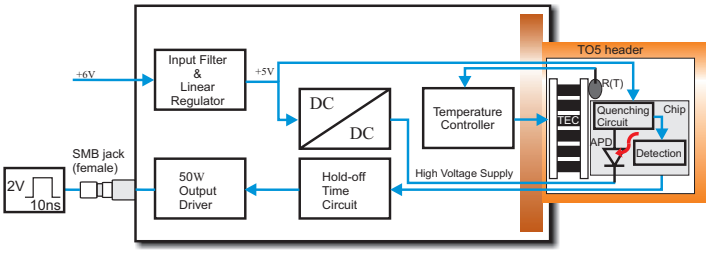


Typical pulse of 2 V amplitude and 10 ns width observed at the output of an ID100 terminated with 50 W load. Recommended trigger level: 1 V. For timing applications, triggering on rising edge is recommended to take full advantage of the detector´s timing resolution.

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 thermo-electric 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.

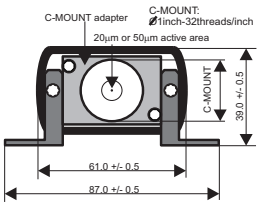
Block Diagram



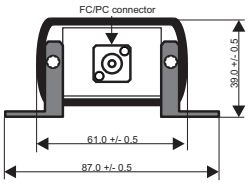
Dimentional Outline

(in mm)

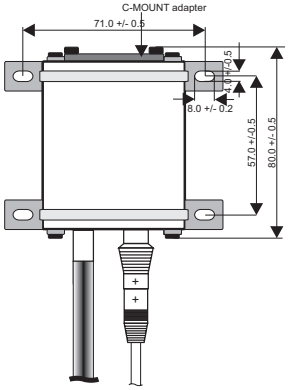
ID100-20 / ID100-50 Front View



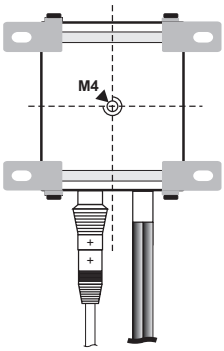
ID100-SMF20 Front View
ID100-MMF50 Front View
ID100-MMF100 Front View



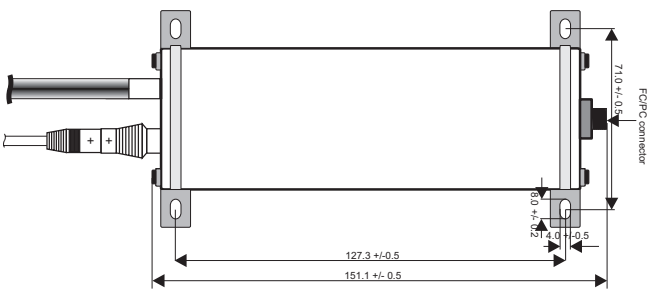
ID100-20 ID100-50 Top View



ID100-20 / ID100-50 Bottom View



ID100-SMF20 ID100-MMF50 ID100-MMF100 Top View



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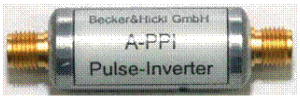
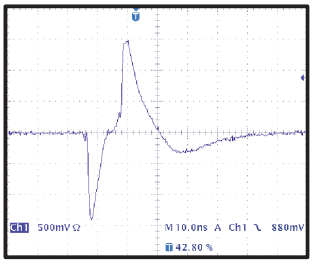
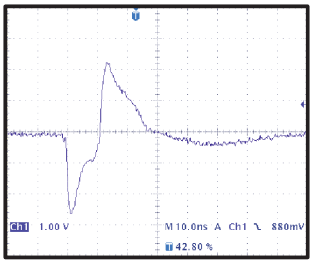
Accessory - Optional Pulse Shaper



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.

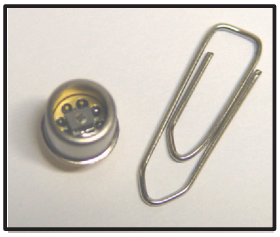


Typical output pulse of an ID100 equipped with a A-PPI-D pulse shaper in 50 Ω load.



Typical output pulse of an ID100 equipped with a A-PPI-D pulse shaper in high impedance load.

ID101 Series - The world's smallest photon counter



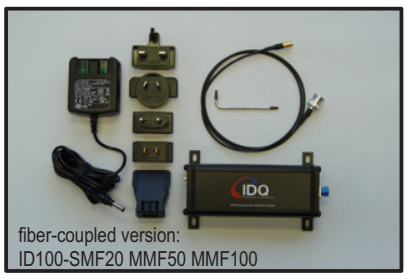
For large-volume OEM applications, IDQ offers the ID101 series, consisting of a standard TO5 - 8pins optoelectronic package with a CMOS silicon chip (single-photon avalanche diode and fast active quenching circuit) mounted on top of a thermoelectric cooler. A thermistor is available for temperature monitoring 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



fiber-coupled version:
ID100-SMF20 MMF50 MMF100

- 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 adapterAngled T10
- Torx key to remove mounting brackets

Ordering information

D100-20-XXX	Photon counter with 20 µm active area.
ID100-50-XXX	Photon counter with 50 µm active area.
ID100-SMF20-XXX	Photon counter with singlemode fibre pigtail (FC/PC connector).
ID100-MMF50-XXX	Photon counter with multimode fibre pigtail (50/125 µm, FC/PC connector).
ID100-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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