



SINGLE PHOTON DETECTOR

QDC-V SERIES



The QDC-V Series, developed by QUBITRIUM, consists of high-precision, compact, and fully integrated single-photon detection modules that operate in the visible and telecommunications wavelength ranges.

FEATURES

- High Photon Detection Efficiency
- Low Dark Count Rate
- Precise Timing Resolution
- Compact and Lightweight
- Robust Mechanical Design
- Low Power Consumption
- Space-Ready Architecture
- Customizable Dead Time & Output

APPLICATIONS

- LIDAR
- Satellite Applications
- Optical Range Finding
- Adaptive Optics
- Quantum Cryptography
- Quantum Communication
- Time-correlated Single Photon Counting
- Microscopy
- Ultra-Sensitive Fluorescence

The QDC-V Series by Qubitrium represents a new generation of high-performance, single-photon counting modules designed for the most demanding optical applications. Engineered with a focus on efficiency and versatility, the series is divided into two specialized categories: the C-Grades (Commercial) for high-precision laboratory and industrial use, and the S-Grades (CubeSat) specifically optimized for spaceborne missions.

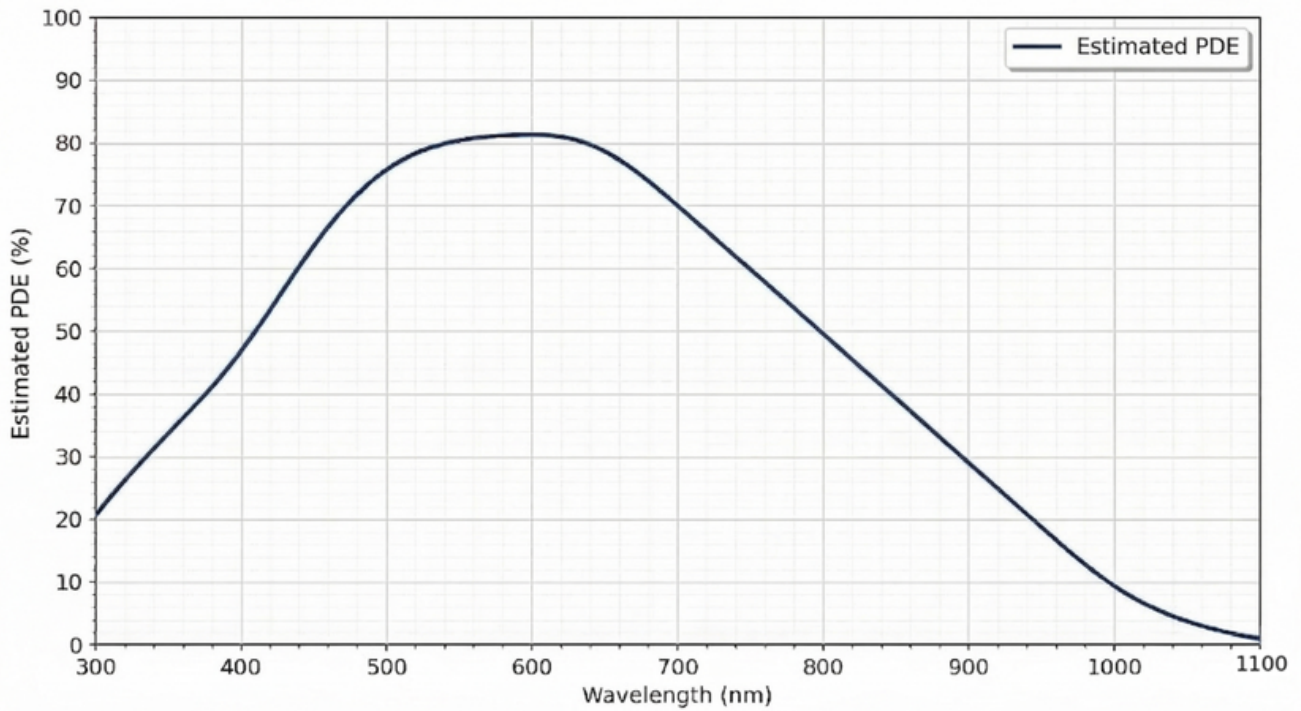
Each module is housed in a robust, aluminum enclosure, providing structural integrity and thermal stability while maintaining a compact and lightweight profile (113 ± 5 g). With a peak photon detection efficiency of up to 80% and an optimized low-power consumption architecture, the QDC-V Series delivers reliable performance in a small form factor ($62.50 \times 44 \times 30$). Whether integrated into a ground-based quantum network or a satellite-based quantum key distribution (QKD) system, the QDC-V Series offers a balance of sensitivity, durability, and energy efficiency.

KEY ADVANTAGES

- Compact & Lightweight Design:** The device features a small form factor and a lightweight build, making it ideal for integration into portable systems.
- High Detection Efficiency:** Offers high performance with up to 80% Photon Detection Efficiency (PDE) around 600 nm and 55% typical at 780 nm.
- Low Noise Performance:** Features a low dark count rate, reducing background noise for sensitive quantum measurements.
- Customizable Output Parameters:** Output pulse width, amplitude, and dead time are customizable to meet specific user requirements and system interfaces.
- Durable Aluminum Housing:** Constructed with an Aluminum 7075 T6 shell, the detector offers high structural integrity and effective thermal management.



PHOTON DETECTION EFFICIENCY (PDE) VS WAVELENGTH



The graph above illustrates the spectral response of the QDC-V Series detector across a broad wavelength range from 300 nm to 1100 nm. The device exhibits a peak detection efficiency of approximately 80% at 600 nm, maintaining high sensitivity even in the near-infrared region with a typical efficiency of 55% at 780 nm.

QDC-V2-01 (SINGLE PHOTON DETECTOR) TECHNICAL SPECIFICATIONS

Description	Condition	Min	Typical	Max
Supply Voltage			6 V	
Supply Current*			250 mA	1000 mA
Power Consumption	Standard Operation		1.5 W	
Active Area	Diameter		500 μ m	
Afterpulsing Probability			<0.1%	
Wavelength Range		300 nm		1000 nm
Dark Count			100 counts/s	1000 counts/s
Output Pulse Width (TTL)	Customizable		32 ns	
Output Pulse Amplitude	Customizable	4 V	4.2 V	5 V
Timing Resolution (jitter)**	@ 300k counts/s		0.3 ns	1 ns
Saturation Value	Customizable		15 Mcounts/s	
Photon Detection Efficiency	@ 780 nm		55%	
Dead Time	Customizable		60 ns	
Output Connector	Customizable		50 Ω SMA	

The performance parameters listed in the table above represent the high-precision capabilities of the QDC-V2-01 module under standard operating conditions. Parameters such as dead time, pulse width, and saturation value are marked as customizable, allowing the module to be tailored to specific experimental setups, such as LiDAR or QKD.

Supply Current (*): During the initial power-up phase, the module draws an in-rush current of up to 1000 mA. Once the internal components and the APD temperature have stabilized, the supply current typically settles at 250 mA. Under these standard operating conditions at a typical 6V supply, the device maintains an average power consumption of approximately 1.5W.

Timing Resolution ():** The jitter performance is optimized for high-speed applications, providing a sharp 0.3 ns typical resolution even at high count rates (300k counts/s).

OPERATING STRUCTURE

- Incorrect connection or reverse voltage may permanently damage the module. Ensure a stable DC supply is 6 V.
- While protected against light overload, avoid exposing the detector to intense ambient light or high-intensity pulses to prevent temporary dark count increases or potential damage.
- The TTL output from the SMA connector must be terminated into a 50 Ω load to maintain pulse integrity and avoid signal distortion.
- This module contains sensitive electronic components and should only be handled at an ESD-safe workstation.

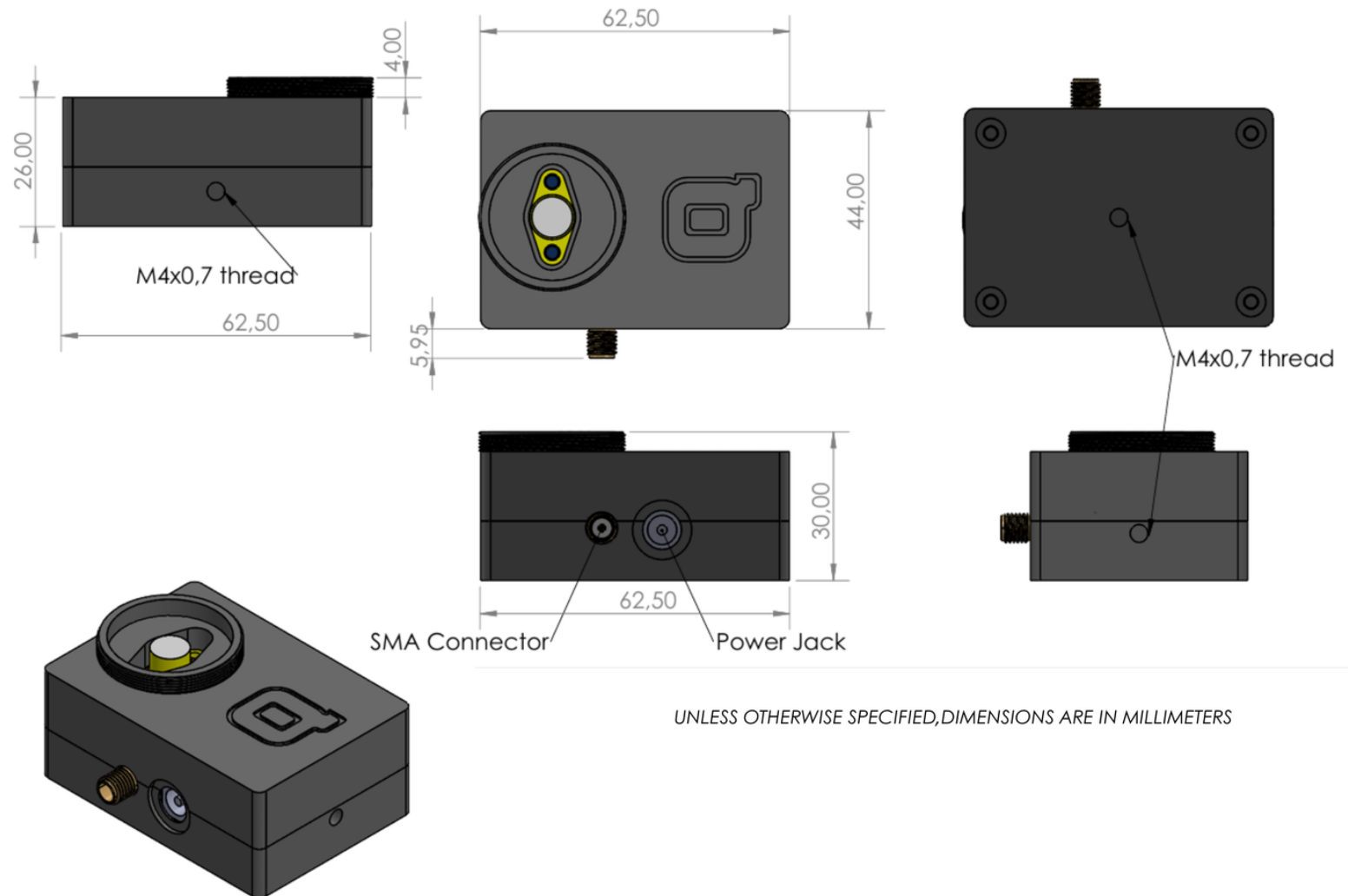
OPERATING CONDITIONS

Description	Condition	Min	Typical	Max
Operating Temperature	Standard Operation	+5°C		+35°C
Storage Temperature		-20°C		+85°C
Storage Humidity	(Non-condensing)	5 %		95 %
Operating Humidity	(Non-condensing)	15 %		95 %

CAUTION: Any attempt to open the sealed enclosure or modify the internal circuitry will void the manufacturer's warranty.

CAUTION: For long-term storage, ensure the protective cap is firmly attached to the optical input to prevent dust accumulation. Additionally, the module should be kept inside an anti-static (ESD-safe) bag to protect sensitive internal electronics from electrostatic discharge.



MECHANICAL DRAWINGS


The QDC-V Series is designed for easy integration into optical setups. The module features integrated M4 threaded holes on four sides (excluding the connector and optical input faces). This symmetric hole pattern, combined with an ultra-lightweight design of 113 ± 5 g, allows for direct mounting onto standard optical posts, plates, or custom breadboards in multiple orientations for flexibility in lab or system environments.

ORDERING INFORMATION

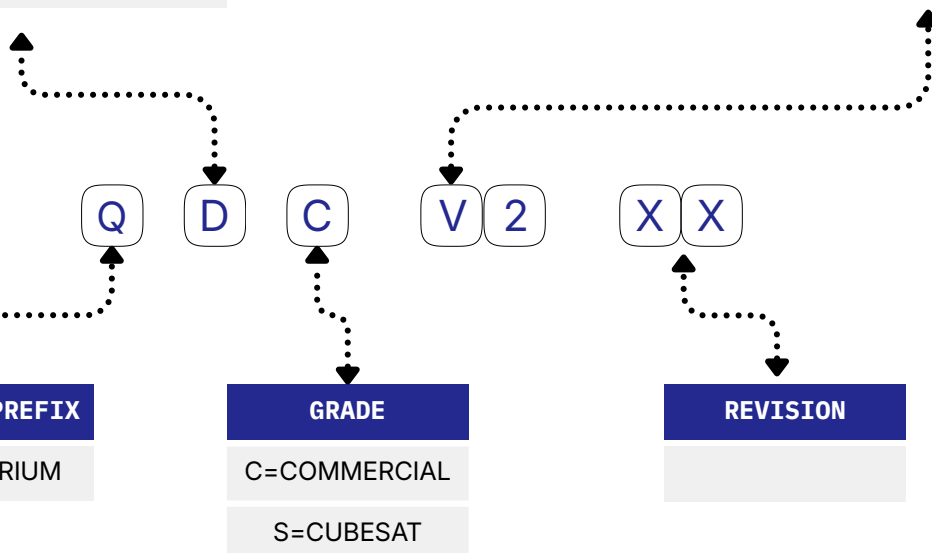
VISIBLE WAVELENGTH RANGE DETECTOR TYPE	TELECOM WAVELENGTH RANGE DETECTOR TYPE
V1 = 10kcts/s DCR (Free-space)	T1 = SMF
V2 = 1kcts/s DCR (Free-space)	T2 = MMF
V3 = 100cts/s DCR (Free-space)	
V4 = 10kcts/s DCR (MMF)	

PRODUCT
D=SINGLE PHOTON DETECTOR

COMPANY PREFIX
Q=QUBITRIUM

GRADE
C=COMMERCIAL
S=CUBESAT

REVISION



To order a QDC-V Series module tailored to your specific application, please use the nomenclature guide above. The part number defines the series, wavelength range, dark count rates (DCR), and optical interface.

- Series: Choose C for Commercial or S for CubeSat applications.
- Wavelength: V for Visible (300-1000 nm) or T for Telecom.
- Detector Type: Select from various DCR and free-space/fiber coupling configurations.

RELATED PRODUCTS

To complete your quantum optics or timing measurement setup, the following Qubitrium products are fully compatible with the QDC-V Series:

Qubitrium QTC series Time Tagger: High-performance time-to-digital converters optimized for multi-channel photon arrival time stamping with picosecond resolution

Qubitrium QLC series Laser Driver Circuits: Specialized current and temperature controllers designed for stable and low-noise photon generation.

Qubitrium QubitCore Integrated QKD Systems: Comprehensive Quantum Key Distribution solutions for secure communication research and network integration.

