SPCM-AQRH-XX-TR

Timing Resolution Optimized Single Photon Counting Module

Key Features

- Timing resolution <250ps
- Peak photon detection efficiency (PDE) @ 650 nm: 75% typical
- Active area: 180 µm
- Gated output
- Single +5 V supply
- RoHS-compliant
- Linearity over high count rate

Applications

- Time correlated single photon counting
- Fluorescence lifetime imaging microscopy
- Ultra-sensitive fluorescence lifetime measurements
- Quantum Cryptography
- Photon correlation spectroscopy
- Optical range finding
- Particle sizing
- Adaptive Optics

Excelitas Technologies' SPCM-AQRH-XX-TR is a Single Photon Counting Module of the most recent product generation, specifically selected and performance-optimized for timing resolution.

The SPCM-AQRH-XX-TR uses a specially selected SLiK silicon avalanche photodiode giving module timing resolution better than 250 ps while maintaining peak photon detection efficiency (PDE) of more than 75% at 650 nm over a 180 µm diameter active area. While some performance parameters, in particular afterpulse probability, are traded off against the optimized timing performance, other performance parameters of the standard SPCM-AQRH, such as outstanding uniformity, overload protection, temperature stability and linearity, are still maintained by this new timing-optimized module.

This family of –TR modules is designed to support applications in time correlated single photon counting (TCSPC), fluorescence lifetime measurements and fluorescence lifetime imaging microscopy (FLIM).

Excelitas' series of photon counting modules are designed and built to be fully compliant with the European Union Directive 2015/863/EU – Restriction of the use of certain Hazardous Substances in Electrical and Electronic equipment (RoHS).

Table 1. Specifications of SPCM-AQRH-XX-TR, @ 22 ºC, all models; unless otherwise indicated (1)

Parameter	Min	Typ	Max	Unit
Active area (diameter) at minimum PDE	170	180		µm
Photon detection efficiency (PDE) (2) at:				
650 nm		75		%
830 nm		50		%
Dark Count SPCM-AQRH-W0			1500	Counts / second
SPCM-AQRH-W1			1000	
SPCM-AQRH-W2			500	
SPCM-AQRH-W3			250	
SPCM-AQRH-W4			100	
Single photon timing resolution (at 825 nm)(2,3) Contact factory for optimized timing below 200 ps and at other wavelengths		225	250	ps
Output pulse width (9)				
SPCM-AQRH-1X, SPCM-AQRH-4X		10		ns
SPCM-AQRH-2X, SPCM-AQRH-5X		18		ns
SPCM-AQRH-3X, SPCM-AQRH-6X		28		ns
See table 3.				
Dead time (count rate below 5M/c)				
SPCM-AQRH-1X, SPCM-AQRH-4X		22		ns
SPCM-AQRH-2X, SPCM-AQRH-5X		28		ns
SPCM-AQRH-3X, SPCM-AQRH-6X		35		ns
See table 3.				
Output pulse amplitude: SPCM-AQRH-1X, SPCM-AQRH-2X, SPCM-AQRH-3X				
TTL HIGH	1.5	2.2		V
TTL LOW	-0.1		0.8	V
See table 3.				
SPCM-AQRH-4X, SPCM-AQRH-5X, SPCM-AQRH-6X				
TTL HIGH	3.0	4.4		V
TTL LOW	-0.1		0.8	V
See table 3.				
Linearity correction factor at 200 Kc/s		1		
1 Mc/s		1.02		
5 Mc/s		1.16		
10 Mc/s		1.40		
Afterpulsing probability		1.0	3.0	%

(1) For other performance characteristics, refer to Operating Instructions, product notes and specifications listed on the standard SPCM-AQRH data sheet.

(2) See Figure 1 for timing resolution vs. photon detection efficiency curve.

(3) Timing resolution is measured using a 10 µm diameter light spot, at 825 nm, case temperature at 22°C. For timing resolution requirements measured with a larger spot size, or at different wavelength, please contact Excelitas.

Table 2. Absolute Maximum Ratings

Supply voltage [1]	5.5 V
Maximum count rate	Maximum count rate can be sustained if case temperature is maintained within specified limits.
Peak light intensity	10^4 photons per pulse and pulse width < 1 ns
Case temperature [3]	-20°C/+70°C storage, +5°C /+70°C operating

Table 3. SPCM Ordering Guide

Order Part#	W - Output Pulse Options			X - Dark Count Rates				
WX-YY	Output Pulse Width (ns)	Dead Time (ns)	Output Pulse Height (V)	-W0	-W1	-W2	-W3	-W4
SPCM-AQRH-1X-TR	10	22	2.2	≤1500 cps	≤1000 cps	≤500 cps	≤250 cps	≤100 cps
SPCM-AQRH-2X-TR	18	28	2.2	≤1500 cps	≤1000 cps	≤500 cps	≤250 cps	≤100 cps
SPCM-AQRH-3X-TR	28	35	2.2	≤1500 cps	≤1000 cps	≤500 cps	≤250 cps	≤100 cps
SPCM-AQRH-4X-TR	10	22	4.4	≤1500 cps	≤1000 cps	≤500 cps	≤250 cps	≤100 cps
SPCM-AQRH-5X-TR	18	28	4.4	≤1500 cps	≤1000 cps	≤500 cps	≤250 cps	≤100 cps
SPCM-AQRH-6X-TR	28	35	4.4	≤1500 cps	≤1000 cps	≤500 cps	≤250 cps	≤100 cps

Example: SPCM-AQRH-43-TR = 10ns output pulse width, 22ns dead time, 4.4V output pulse height, <250 cps dark count rate

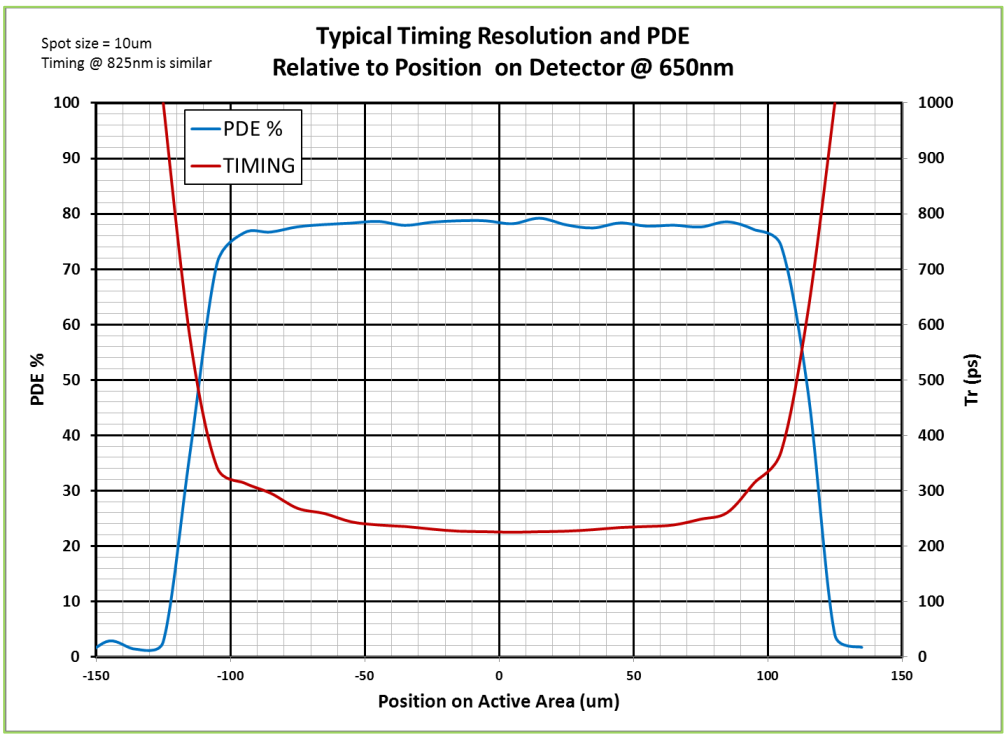

Figure 1: Typical timing resolution & PDE relative to position of detector chip @ 650 nm

Warranty

A standard 12-month warranty following shipment applies. Any warranty is null and void if the module case has been opened. Warranty is null and void if the module input exceeds 5.5V or the polarity of the +5V supply is reversed.

Individual Module Test Data

Each module is supplied with test data indicating the module's actual dark count, dead time, pulse width, photon detection efficiency @ 630 nm, timing resolution, and linearity correction factor.

About Excelitas Technologies

Excelitas Technologies is a global technology leader focused on delivering innovative, customized solutions to meet the detection, lighting, and other high-performance technology needs of OEM customers.

From analytical instrumentation to clinical diagnostics, medical, industrial, safety and security, and aerospace and defense applications, Excelitas Technologies is committed to enabling our customers' success in their end-markets. Excelitas Technologies has approximately 3,000 employees in North America, Europe and Asia, serving customers across the world.

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