

Quantum

SOLUTIONS[®]

QDot™ PbS Quantum Dots, oleic acid capped, absorption (abs) type

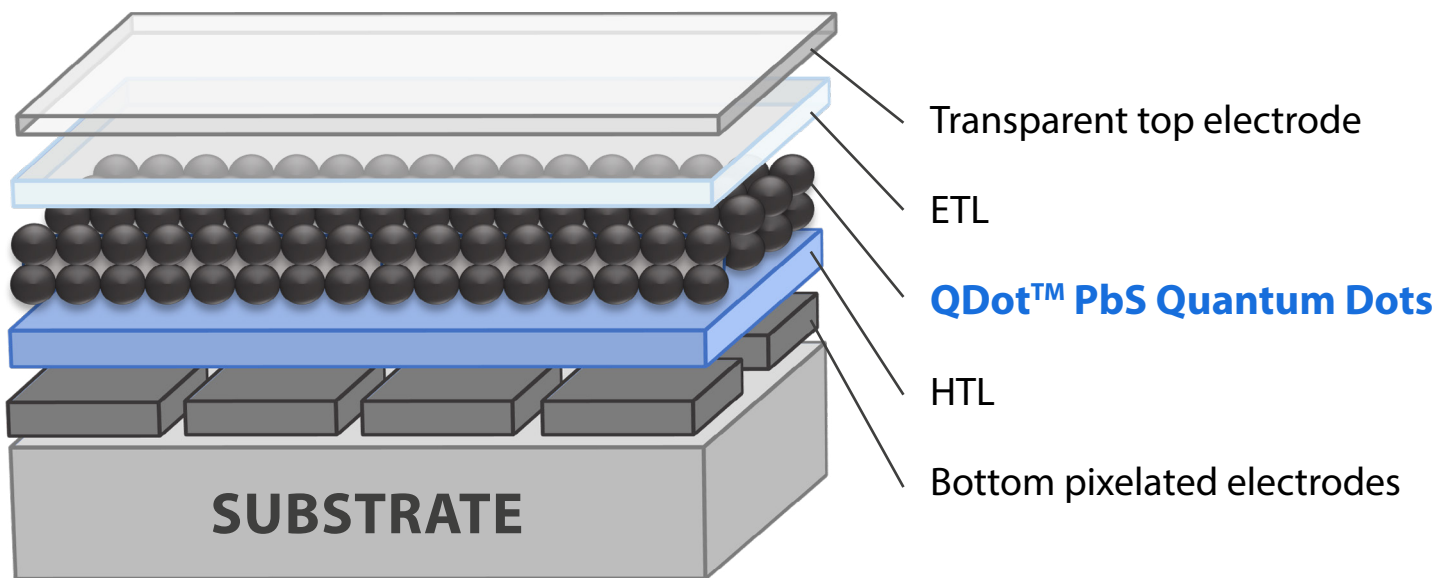
Technical Data Sheet

Introduction and product highlights

QDot™ PbS (Lead Sulfide) Quantum Dots absorb light from UV and visible up to the short-wave infrared (SWIR) spectral range. The absorption cut-off profiles can be tuned from 800 to 2500 nm simply by changing the nanoparticle sizes from 2 to 12 nm. This material has outstanding light absorption and photoelectrical properties and is considered the best quantum dot absorber in short-wave infrared (SWIR) photodetectors and image sensors. The

material can also be suitable as absorbers in X-ray sensors and solar cells.

QDot™ PbS quantum dots can be deposited within a QDot™ photodiode stack using spin-coating methods from a colloidal solution. In principle, a QDot™ photodiode stack consists of a substrate, an HTL (hole transport layer), a QDot™ PbS Quantum Dots absorber, an ETL (electron transport layer), and a transparent top electrode.



These novel solution-based methods for depositing thin films of compound semiconductor materials have made it possible to create artificial nanocrystalline InAs absorbing structures at affordable cost that offer unprecedented possibilities. Unlike epitaxially grown InAs

or InGaAs thin films, the quality of quantum dot semiconductors is less dependent on the crystallographic characteristics of substrates and their interfacial relationships ensuring the device architecture flexibility and large-scale manufacturability on 8" or 12" wafers.

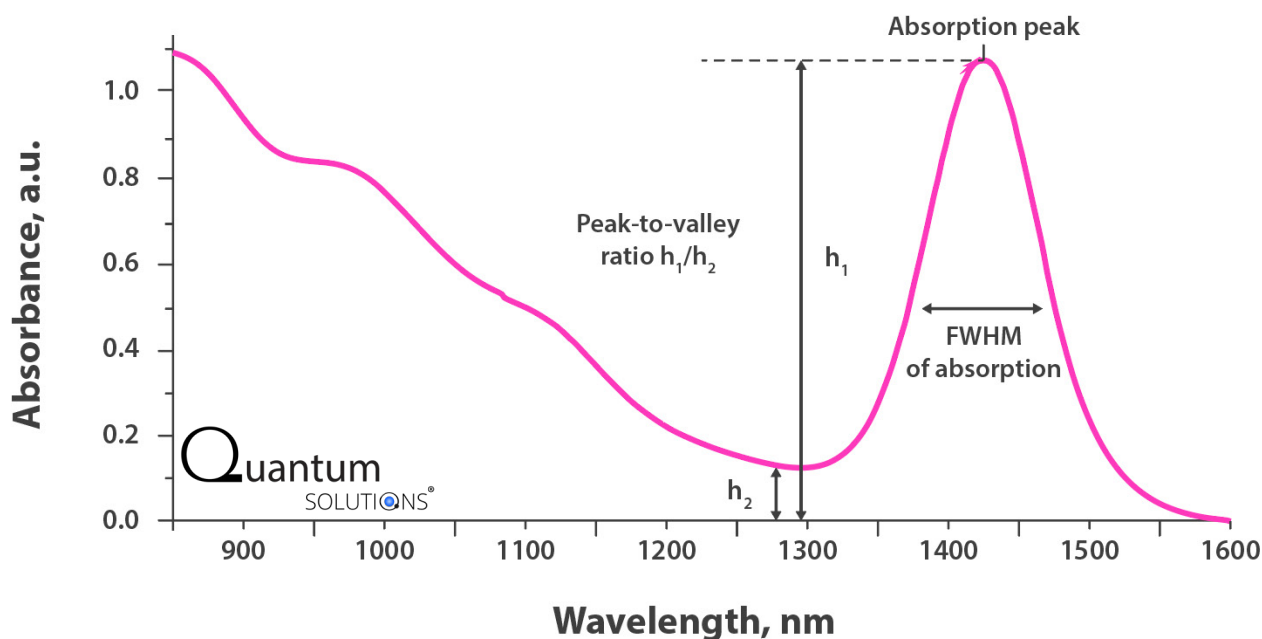
QDot™ PbS Quantum Dots offer the following advantage

- ✓ Solution-processed compound semiconductor nanomaterial to be used in short-wave infrared (SWIR)/near-infrared (NIR) photodetectors and image sensors.
- ✓ Easy integration within a QDot™ photodiode stack through spin-coating or other printing processes, guaranteeing affordability and manufacturability on large 8" or 12" wafers.
- ✓ Broad spectral range availability from 2 to 12 nm with the spectral cut-off from 800 nm to 2500 nm. Unprecedented first excitonic absorption peak accuracy and reproducibility (up to ± 5 nm).
- ✓ Narrow particle size distribution with absorbance FWHM < 100-120 nm and STDV < 5-10%.

QDot™ PbS Quantum Dots (abs type) selection guide

QDot™ PbS Quantum Dots have a broad absorption profile, from UV and visible up to SWIR spectral ranges. QDot™ PbS Quantum Dots can be categorised according to their first excitonic absorption peak position that varies from 800 nm to 2200 nm. Absorption peak is characterised with the absorption FWHM and the peak-to-valley ratio.

QDot™ PbS quantum dots can be supplied as a solid paste/powder form that is easily soluble in octane or any other non-polar solvents (hexane, toluene, chloroform, chlorobenzene, etc.) in a wide range of concentration up to 150 mg/mL. QDot™ PbS quantum dots dispersed in octane, toluene or other non-polar solvents are also available.



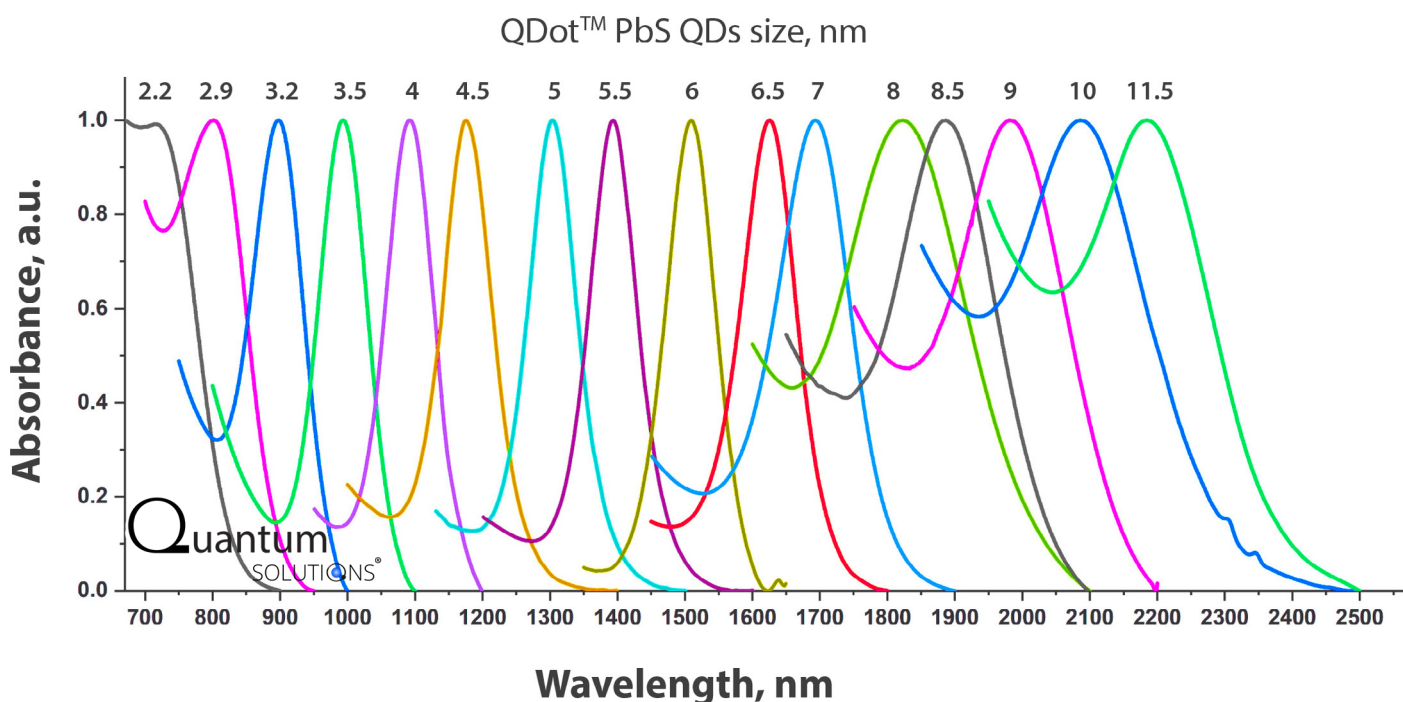
Specification of QDot™ PbS Quantum Dots (abs type)

QDot™ Catalogue Number	Core type	Core size	Absorption peak in SWIR range	FWHM of absorption	Peak-to-valley ratio	Ligand concentration	Max solubility in solvents: oct (octane), tol (toluene), hex (hexane)
PbS-800-abs	PbS	≈ 2.9 nm	800 ± 15 nm	-	> 1.2	40-50 wt%	> 150 mg/mL (oct, tol, hex)
PbS-900-abs	PbS	≈ 3.2 nm	900 ± 15 nm	< 120 nm	> 1.5	35-45 wt%	> 150 mg/mL (oct, tol, hex)
PbS-920-abs	PbS	≈ 3.4 nm	920 ± 15 nm	< 120 nm	> 1.5	35-45 wt%	> 150 mg/mL (oct, tol, hex)
PbS-1000-abs	PbS	≈ 3.6 nm	1000 ± 15 nm	< 120 nm	> 2	35-45 wt%	> 100 mg/mL (oct, tol, hex)
PbS-1100-abs	PbS	≈ 4 nm	1100 ± 15 nm	< 120 nm	> 3	30-40 wt%	> 100 mg/mL (oct, tol, hex)
PbS-1200-abs	PbS	≈ 4.5 nm	1200 ± 15 nm	< 120 nm	> 4	30-40 wt%	> 100 mg/mL (oct, tol, hex)
PbS-1300-abs	PbS	≈ 5.0 nm	1300 ± 15 nm	< 120 nm	> 5	30-40 wt%	> 100 mg/mL (oct, tol, hex)
PbS-1400-abs	PbS	≈ 5.5 nm	1400 ± 15 nm	< 120 nm	> 5	25-35 wt%	> 100 mg/mL (oct, tol, hex)
PbS-1420-abs	PbS	≈ 5.6 nm	1420 ± 15 nm	< 120 nm	> 5	25-35 wt%	> 100 mg/mL (oct, tol, hex)
PbS-1500-abs	PbS	≈ 6.0 nm	1500 ± 15 nm	< 120 nm	> 6	25-35 wt%	> 50 mg/mL (oct, tol, hex)
PbS-1520-abs	PbS	≈ 6.1 nm	1520 ± 15 nm	< 120 nm	> 6	25-35 wt%	> 50 mg/mL (oct, tol, hex)
PbS-1600-abs	PbS	≈ 6.4 nm	1600 ± 20 nm	< 120 nm	> 6	20-30 wt%	> 50 mg/mL (oct, tol, hex)
PbS-1700-abs	PbS	≈ 7.0 nm	1700 ± 25 nm	< 150 nm	> 3	20-30 wt%	> 50 mg/mL (oct, hex)
PbS-1800-abs	PbS	≈ 7.5 nm	1800 ± 30 nm	< 200 nm	> 2	15-25 wt%	> 50 mg/mL (oct, hex)
PbS-1900-abs	PbS	≈ 8.2 nm	1900 ± 50 nm	< 220 nm	> 1.5	15-25 wt%	< 50 mg/mL (oct, hex)
PbS-2000-abs	PbS	≈ 9.1 nm	2000 ± 50 nm	< 220 nm	> 1.5	< 20 wt%	< 50 mg/mL (oct, hex)
PbS-2100-abs	PbS	≈ 10 nm	2100 ± 50 nm	-	-	< 20 wt%	< 50 mg/mL (oct, hex)
PbS-2200-abs	PbS	≈ 12 nm	2200 ± 50 nm	-	-	< 20 wt%	< 50 mg/mL (oct, hex)

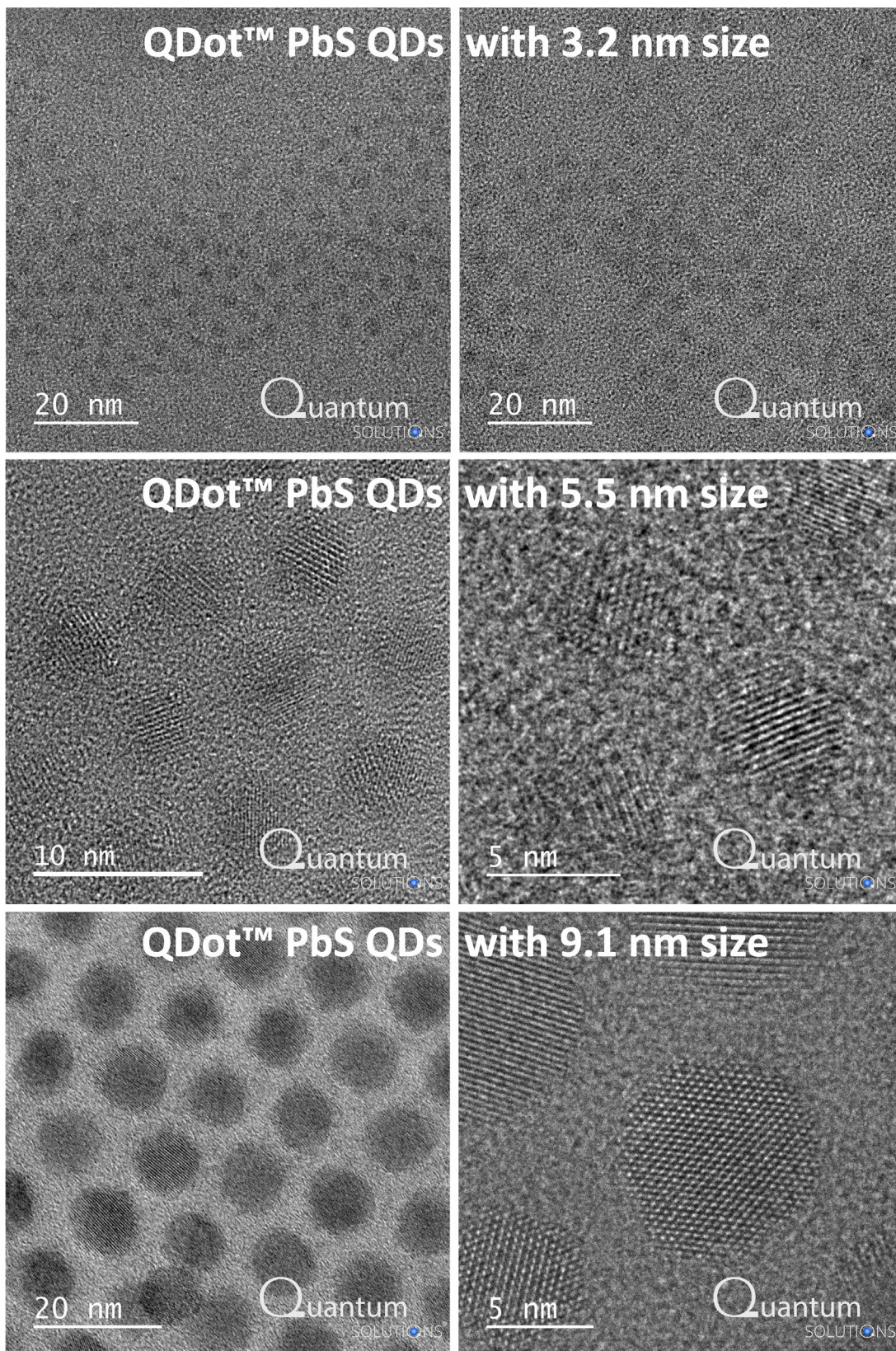
General Specification*	
Quantum dot core type	PbS
Capping ligand	Oleic acid
Appearance	Black powder - for solid forms Black liquid - for dispersion forms
Form available	Solid/powder: PbS-800-abs, ..., PbS-2200-abs 50 mg/mL in octane or toluene: PbS-800-abs, ..., PbS-1600-abs 10 mg/mL in octane: PbS-800-abs, ..., PbS-2200-abs 10 mg/mL in toluene: PbS-800-abs, ..., PbS-1600-abs
Deposition method	Spin-coating with solid ligand exchange or solution ligand exchange

* QDot™ PbS Quantum Dots with different solvents, concentrations, and absorptions peaks are available upon request.
QDot™ PbS quantum dots with conductive ligands are available: [QDot™ PbS quantum dot n-type ink](#).

First excitonic absorption peak profiles of QDot™ PbS Quantum Dots (abs type)



TEM images of QDot™ PbS Quantum Dots



QDot™ is a trademark of QUANTUM SOLUTIONS | 22 December 2023

Notes for handling

Shelf Life 12 months. Shipping and storage temperature 4-25 °C. Store in DARK conditions, in original packaging or in airtight, sealed packaging inside a glovebox. Repackage in a glovebox only. Avoid contact with air. Process inside the glovebox or another enclosed inert gas environment.