

### QDot™ PbS Quantum Dots for NIR Image Sensors

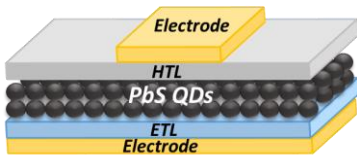
Near infrared sensing is getting very important in such applications as machine vision (for goods quality inspection and control), automotive (for 3D aerial and geographic mapping, advanced driver-assistance systems at night and adverse weather conditions (mist/fog/snow)), smartphone cameras (for biometrics and 3D photography), AR and VR headsets (for eye tracking), in night vision and surveillance. Current cameras with such NIR absorbers, such as InGaAs and Ge, have high production costs, are bulky and have limited camera resolution. QDot™ PbS QDs have high sensitivity, wider absorption range and compatibility with silicon CMOS read out integrated circuits (ROIC) making them an ideal solution for economical, high resolution and broadband cameras.

#### BENEFITS:

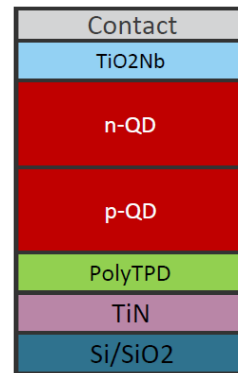
- Broad tunable absorption in NIR (SWIR) range from 700 to 2500 nm
- Superior photoelectrical properties with high devices EQE and detectivity, low dark current
- Easy integration with silicon CMOS by printing and spin-coating manufacturing processes

#### DEVICE EXAMPLE:

QDot™ PbS QDs with 1420 nm absorbance (QDot™ PbS-1420-abs) were used as an active layer on CMOS ROIC chip to make the NIR camera with a sensitivity range of 400 – 1500 nm, 768x512 px resolution with 5 μm px pitch.



Photodiode structure with QDot™ PbS QDs



The device pixel pitch structure

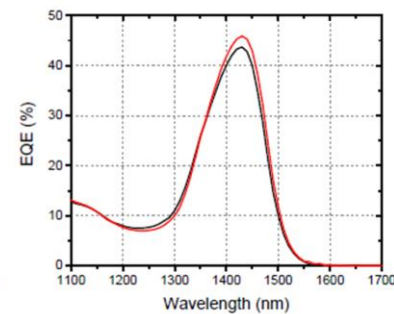
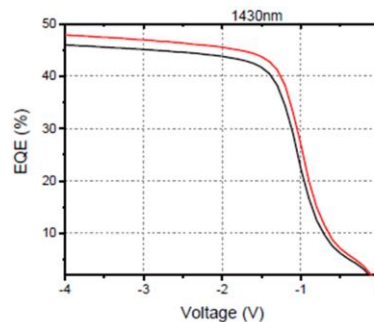
#### SENSOR PERFORMANCE:

Parameter	Typical values
Sensitivity range	300 – 2500 nm (tunable)
EQE	> 30-40 %
Specific detectivity	Up to $1 \times 10^{11}$ cm·Hz <sup>1/2</sup> /W (Jones)
Dark current	100 – 1000 nA/cm <sup>2</sup>
Response time	< 50 μs
Pixel pitch	< 2 μm
Cooling requirements	Room temperature or TEC

The typical EQE reached over 40 % at the first excitonic absorption peak 1420 nm with the specific detectivity is up to  $1 \times 10^{11}$  Jones and the dark current 100 – 1000 nA/cm<sup>2</sup>.

#### Products portfolio:

- QDot™ PbS Quantum Dots  
PbS Quantum Dots, oleic acid capped, 700-2300 nm emission/excitonic absorption peaks



The device EQE

