



ENABLING THE FUTURE THROUGH LIGHT

Oct 18, 2022

# VTH21 Series of Photodiodes Alpha Particle Detection for Radon Gas Detection Applications

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# Your innovation partner for **end-to-end** photonic solutions

ILLUMINATION

TRANSMISSION

DETECTION

**From source to sensor... and everything in between**

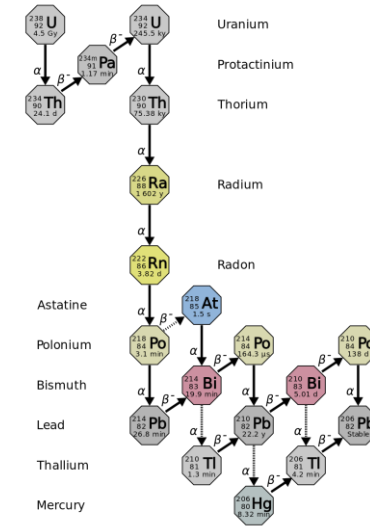
- Illumination & Lasers
- Optics & Optomechanics
- Sensors & Detectors
- Electronics & Power
- Sophisticated Custom Integration

## Expanding Global Footprint

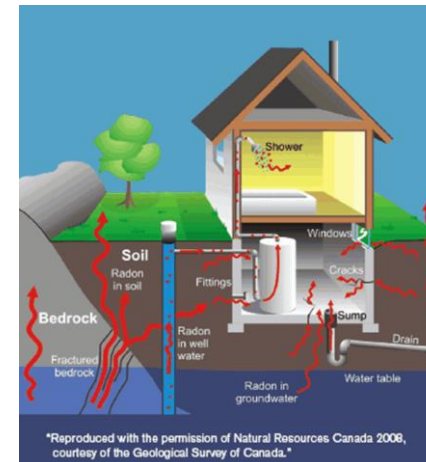
- Headquartered in Waltham, MA USA
- 18 Photonic manufacturing centers
- 10 Administrative/Sales Offices

## What is Radon? & Why Monitor Radon?

- Radon (Rn) is a radioactive inert gas
- colorless, odorless, tasteless
- EPA recognizes radon as leading cause of cancer among non-smokers
- Radon in an enclosed space, can accumulate to high concentrations and become a health concern
- Early radon detection is key to improve long-term health
- Connected Smart Home radon detector can provide continuous and early warning



Source: <https://en.wikipedia.org/wiki/Radon>



"Reproduced with the permission of Natural Resources Canada 2008, courtesy of the Geological Survey of Canada."

## Types of Radon Detectors

### Short-term Tests

- Activated Carbon Adsorption (AC)
- Charcoal Liquid Scintillation (LS)

- + Low cost
- + Practical for short period of time
- Few days test time, send to lab for analysis
- Measurements can be sensitive to temperature and humidity

### Long-term Tests

- Alpha-Track Detection (AT)

- + Relatively low cost
- + Likely to give long term average radon level
- Relatively long (min 3 months) measurement period

### Continuous Tests

- Scintillation
- Ionization Chamber
- Solid-State Detection
- **Semiconductor detector**

- + Follows variations in radon level
- + provides radon data on location
- + higher accuracy and precision over short measurement period
- + Semiconductor detector → smaller footprint
- Relatively higher cost



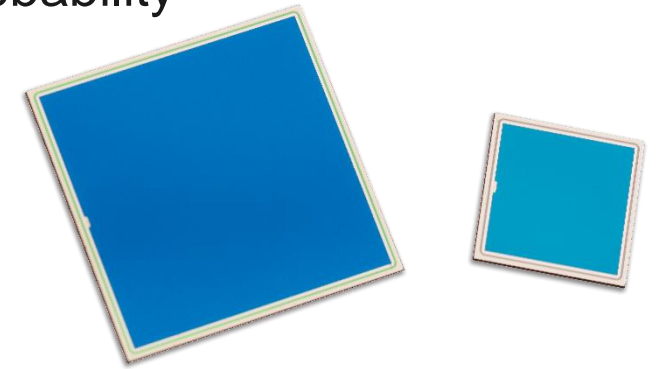
## Measurement requirements and Advantage of Si Detector

- Key requirements for detection of low radon concentration
  - Very long measurement time
  - Large detector area
  - Charge collection setup / channel volume
- Why Si PIN photodiode
  - Suitable for radiation detection, especially  $\alpha$  particles
  - Good energy resolution
  - Large absorption depth for greater absorption
  - Continuous measurement
  - Ease of use
  - Low cost

Excelitas New  
Radon  
Detection  
Photodiodes

## Excelitas VTH21 Series Photodiodes

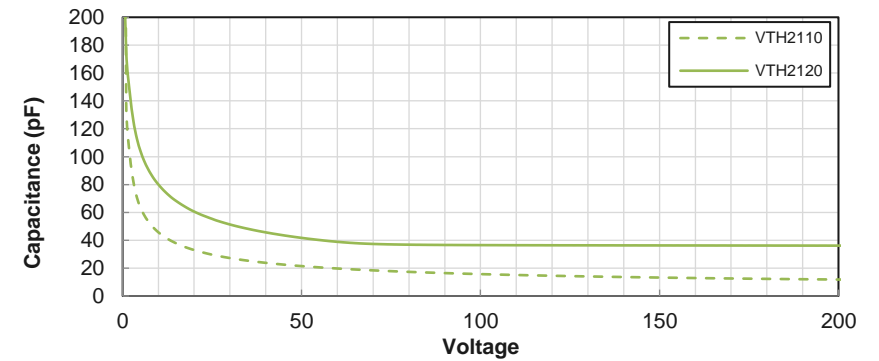
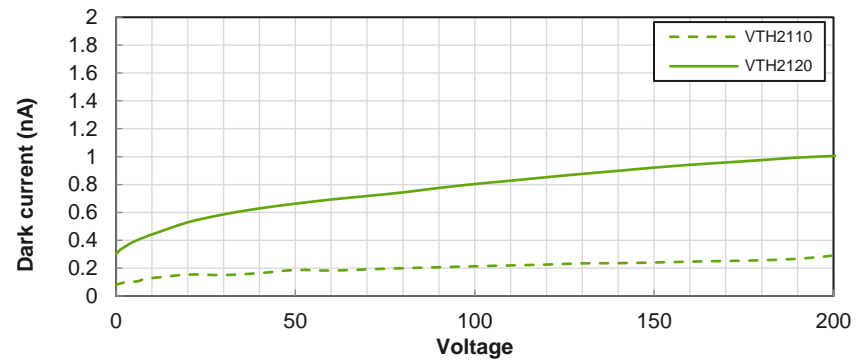
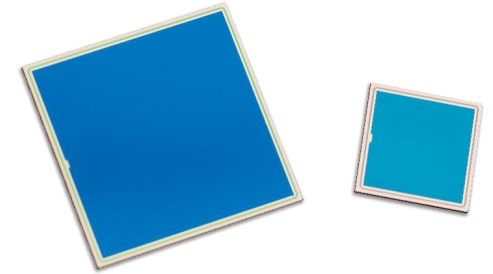
- Direct detection of alpha particles
- Large active area for higher detection probability
- Wide operating voltage range
- Low capacitance
- Low dark current
- High reliability for “open air” detection (unsealed detector)
- Two active area sizes 5 mm x 5 mm and 10 mm x 10 mm





## Key Specifications

Parameter	Symbol	Chip ID:	5 mm	10 mm	Unit
		Conditions			
Breakdown voltage	$V_{BR}$	100 $\mu$ A	> 100	> 100	V
Junction capacitance	$C_J$	20 V	< 30	< 120	pF
Dark current	$I_D$	20V	< 2	< 5	nA
		40 V	< 5	< 10	nA
Depletion layer thickness	$t$	20 V	> 0.09	> 0.09	mm
Dead layer	$t_d$	Si equivalent	< 150	< 150	nm



# Questions?





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