Silicon Detectors

Passivated Implanted Planar Silicon (PIPS®) Detectors for Industrial Applications and Physics Research

Radiation Safety. Amplified. www.mirion.com
Passivated Implanted Planar Silicon (PIPS®) Detectors for Industrial Applications and Physics Research

Mirion Passivated, Implanted, Planar Silicon (PIPS) detectors have proven themselves in thousands of applications worldwide. Innovations driven by the myriad of applications we serve have resulted in continuous improvements to the performance of the PIPS technology – a difference you’ll see in the performance of our alpha spectroscopy, beta detection and Continuous Air Monitors as well as in wide-ranging nuclear physics and space experiments using this technology.

For over 30 years, our specialized team has designed, developed, manufactured, tested and shipped the highest quality PIPS detectors to our customers around the world. These detectors are backed by the full integrity and resources of Mirion.

Can you accept less from your detector supplier?

Visit our web site for up-to-date information & specifications. www.canberra.com
Charged Particle Detection
(ΔE-Detectors)

Excellent Resolution for Alphas, Betas, Protons, Electrons, Heavy Ions...
- Entrance window < 50nm on all models
- Low Energy Beta’s and Electrons

Radiochemistry and Physics Research – PD, RF and A-Series

Features:
- Single junction in metal housing or on epoxy board
- Size: 25 to 5000 mm²
- Active thickness: 100 to 1000 µm thickness

Advantages:
- Stability and Reliability
- Detectors available from stock
- Excellent resolution
- Low background
- High efficiency
- Complete spectroscopy chain available

Square and Rectangular Detectors – RF Series

Dimensions Active Area:
- 10 x 10 mm - 14 x 14 mm - 30 x 30 mm - 50 x 50 mm – or other on request

Features:
- Thin junction window: ≤ 50 nm
- Ohmic window ≤ 1500 nm (for fully depleted series)
- Standard mounting on epoxy board (suffix EB)

Optional:
- Ultra thin junction window ≤ 25 nm (prefix TW)
- Timing resolution: <200 psec (FWHM)
- Thin ohmic window ≤ 150 nm (prefix TB)
- Space qualified (suffix SQ)
- Mounted in a metal housing.

Energy resolution of Silicon detectors: approaching the physical limit. NIM B85 (1994) 642-649
Charged Particle Detection

Continuous Air Monitoring - CAM-Series

Features:
- Ruggedized detector in metal housing
- Size: 300 to 5000 mm²
- Active Thickness: 100 to 500 µm

Advantages:
- Excellent reliability
- Perfect Alpha, Beta separation
- Can replace gas detectors in Alpha Beta counters
- Gamma guard versions available. Operation in combination with a plastic guard detector as in iSolo®

Spectrum in air for 450 mm² detector

CAM PIPS BV 450-AM
Betas 137 Cs
Alphas 241 Am

CL = 123.8 KEV from -71.7 KEV to 1303.9 KEV
PSET (L) 10000
ELAP (L) 341

CAM PIPS Detector – Series CAM
- Alpha, Beta Counting in Harsh Environments
- Wide Operating Temperature Range
- Cleanable Detector Surface

Entrance Window
- <1.5 µm eq. Si
- Light Tight
- Varnish Protected

Silicon Chip
- Partially Depleted at 15/24 Volts
  Active Thickness >120 µm
- Fully Depleted at 70 Volts
  Active Thickness 300 µm

Visit our web site for up-to-date information & specifications. www.canberra.com
1D Position Sensitive Detectors

**PF-CT-Series**

*Features:*
- Pad detector mounted on epoxy boards
- Sizes available: see www.canberra.com or others on request
- Active thickness: 200 to 1000 µm

*Advantages:*
- Excellent resolution
- Can be assembled on customer board
- Models available from stock

**PF-CT-CD Series**

*Features:*
- Strip detectors mounted on epoxy boards
- Size: from 40 x 60 mm² and larger or others on request
- Active thickness: 200 to 1000 µm

*Advantages:*
- Good timing performances
- Can be assembled on customer board
- Models available from stock

2D Position Sensitive Detectors

**Pad Detectors – PF-RT series**

*Features:*
- Pad detectors mounted on epoxy boards
- Size: from 40 x 40 mm² on or others on request
- Active thickness: 300 and 500 µm

*Optional:*
- Ultra thin junction window ≤ 25 nm (prefix TW)
- Resistive Pads: PF-RT-Series
- Thin ohmic window ≤ 150 nm (prefix TB)

*Advantages:*
- 2D Position information (for energies >2 MeV)
- Modest requirement for read-out electronics
- Single sided process
- Can be assembled on customer board
- Models available from stock

**Double-Sided Strip Detectors – PF-CT-CD Series**

*Features:*
- Strip detectors mounted on epoxy boards
- Size: from 40 x 60 mm² and larger or others on request
- Active thickness: 200 to 1000 µm

*Advantages:*
- Good timing performances
- Can be assembled on customer board
- Models available from stock

**Segmented Pixel Detectors – CD Series**

*Features:*
- Pixel detectors mounted on epoxy boards
- Size: custom design
- Active thickness: 200 to 1000 µm

*Advantages:*
- Good resolution (low capacitance)
- Can be assembled on customer board

Examples of 4-segmented detectors
Passivated Implanted Planar Silicon (PIPS®) Detectors
for Industrial Applications and Physics Research

Particle Identification
(ΔE-Detectors)

Nuclear Physics • Astrophysics
High Energy Physics

Fully Depleted Detectors

FD-Series

Features:
- Single junction in metal housing
- Size: 25 to 900 mm²
- Thickness: 200 to 1000 µm

Advantages:
- Excellent resolution
- Thin windows
  - Entrance window < 50 nm
  - Exit window < 150 nm up to 500 µm thickness
- Detectors available from stock
- Telescope assemblies

Mounts And Dimensions

- See chart and drawings.
- Detector face is recessed 1.0mm in AM, AB, RM, ABM and SMC mounts

<table>
<thead>
<tr>
<th>Detector Size (mm²)</th>
<th>Active Diameter (mm)</th>
<th>Axial X (mm)</th>
<th>Radial X (mm)</th>
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</table>
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Special Applications

Photo-Diodes for Synchrotron Applications

Features:
- Single or multiple junction on ceramic board
- Size: 50 to 550 mm²
- Active thickness: 200 to 1500 µm

Advantages:
- Low dark current
- Fast read-out
- Used in photovoltaic or biased mode
- No optical window

Photo-Diodes for Scintillator Read-Out

EXAMPLE: Advanced Photon Detection on the next MARS ROVER

Features:
- Size: Custom Design
- Thickness: 200 to 500 µm

Advantages:
- Anti-reflective coating with QE > 80%
- Low dark current
- Direct coupling to scintillator
- Optimization for specific scintillators

Custom Design

PEPSSI (Pluto Energetic Particle Spectrometer Science Investigation)

EXAMPLE: The New Horizons spacecraft carries the PEPSSI instrument, a spectrometer designed to detect electrons and ions in the 30 keV – 1 MeV energy range. One of the aims of the PEPSSI team (located at the Johns Hopkins University Applied Physics Laboratory) is to study the interaction between the Pluto system and the solar wind by detecting neutral particles from Pluto’s atmosphere that are ionized by the Sun’s light and then picked up and accelerated by the electromagnetic field of the ~1.5 million km/hour solar wind.

A total of 54 Canberra detectors are flying on three different space missions!
Passivated Implanted Planar Silicon (PIPS®) Detectors
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Photon Detection
(From Near UV to 30 keV)

X-ray Spectroscopy • X-ray Diffraction
Synchrotron Applications

Passivated Implanted Planar Silicon (PIPS®) Detectors
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X-PIPS Series (Based on Drift Technology)
Features:
• Preamplifier included
• Temperature-controlled Peltier cooler included
• Size: 15 mm², 30 mm² and 80 mm²
• Thickness: 500 µm

Advantages:
• Excellent resolution < 135 eV
• Peak/Background > 15000
• Good stability
• Good performance with fast shaping time (< 1 µs rise time)

Single and Multi-Anode Drift Detectors
Features:
• Available as silicon chip
• Size: from 10 to 500 mm²
• Thickness: 300 and 500 µm
• Low leakage current, typically < 200pA/cm²
• Entrance window < 50 nm

7-element detector
Features:
• Array of 7 individual SDD’s of 100 or 70 mm² (collimated to 80 or 50mm²) and 500 µm thickness in a close-packed geometry.
• CMOS preamplifier (CUBE based)
• 1 mil Be window
• Detector system includes preamplifiers, HV power supply and temp. controller
• Electrical cooling – Peltier or cryo-cooled
OEM solutions

XRF-XRD-EDX Benchtop and Handheld Systems

The Canberra SDD product range is targeted to be integrated in handheld and benchtop XRF systems. CANBERRA develops designs, manufactures and assembles everything in house, which has made us the partner of choice for a good number of industrial partners.

Available as:
- TO8 module
- Including compact preamplifier
- JFET or CMOS based front stage amplification
- Custom made designs possible
Mirion Technologies provides products and services for a wide range of radiation safety, measurement and scientific purposes.

Mirion solutions are employed to protect people from radiation exposure and limit the spread of contamination. Since 1968, the company has also been committed to the development, manufacturing and service of unique specialty detectors for international scientific experiments, as well as industrial applications.

Driven by the diverse needs of our customers, a range of technologies has been developed over many years that enable Mirion to maintain its technological leadership in the nuclear measurements industry.

The Mirion Spectroscopy Division supplies detectors and instrumentation used in laboratory and in situ radiological analysis and for cutting-edge materials analysis, physics, and space studies in some of the world’s leading research institutes.

The Division’s dedicated R&D structure allows us to deliver innovative nuclear detection systems based on a comprehensive exploration of all available and emerging technologies.

Our passion for fully understanding the needs of our customers is key to our ability to provide the best solutions to contribute to their success.

Mirion Services augments your technical team, assists during peak periods, provides expert advice, trains staff and maintains your systems for optimal performance. We look forward to partnering with you.
Who we are, where to find us

Mirion Technologies is a leading provider of innovative products, systems and services related to the measurement, detection and monitoring of radiation.

With the addition of the Canberra brand in 2016, Mirion expanded its portfolio and the breadth of its expertise to bring a new standard of solutions to the market. Every member of the Mirion team is focused on enhancing the customer experience by delivering superior products, exceptional service and unsurpassed support.

As a global leader in radiation measurement, we are driven to protect people, property and the environment from the harmful effects of ionizing radiation.

Mirion sales and service locations are situated near key metro centers and innovation hubs, as well as nuclear and security installations around the world.

<table>
<thead>
<tr>
<th>Americas</th>
<th>Europe</th>
<th>Asia</th>
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Headquarters
- Mirion Worldwide HQ – San Ramon, CA
  Phone +1-925-543-0800

International Offices
- Please visit the website for a complete listing.

Sales Offices
- Mirion sales and service capability exists in virtually every country in the world.

Contact Mirion to learn more about Detectors for Challenging Applications.

www.canberra.com/detectors

Products and services for a wide range of radiation safety, measurement and scientific purposes.