PYREOS

Registered in Scotland SC 328115

Unique Thin-film Pyroelectric IR Sensor Components

Company History

2007

- Company is incorporated
- Acquires technology and patents from Siemens

2008

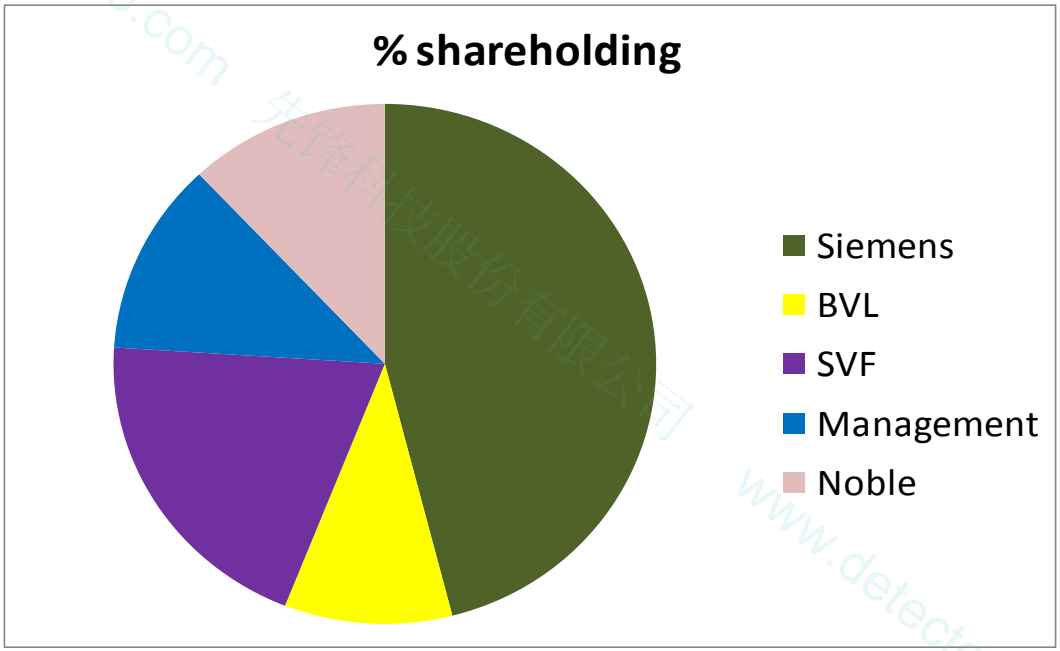
- Raises $6.5 M of investment
- Develops manufacturing supply chain
- First product(s) launched
- First revenues & product shipments

2009

- First spectroscopy sensor products launched
- First FT-IR product launched
- Customer order book >$10M
- Expanding global operation
- $2M of follow-on investment

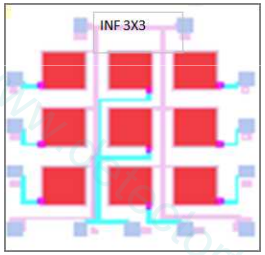
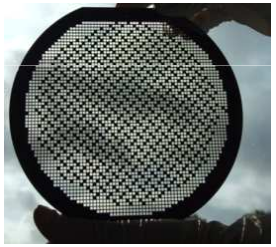
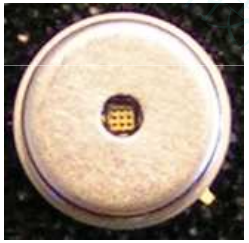
Company Introduction

- Private Company
- Backed by Siemens
- Investment from leading UK VCs
- Strong Management Team
- Aim to be leading IR component supplier
- We bring unique flexibility in IR sensor product design

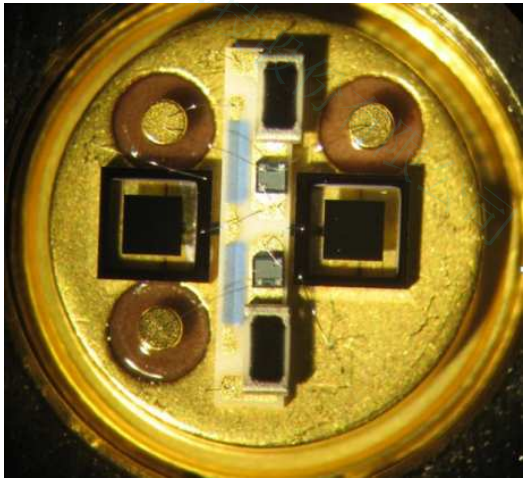


Pyreos is an IR Component Supplier

Flexible and scaleable supply chain with dual sourcing in place

	Sensor chip design	Wafers of sensor chips manufactured	Packaged to final products	Supply to customer
Pyreos Activities	Input of customer Model & design of sensor/properties	• Outsourced semiconductor processing	• Outsourced assembly & test	• Log data, ship & support customer
				
Customer benefits	**Optimize IR sensor for their product**	**High performance, repeatable components Reduced customer manufacturing test costs**	**Range of packaging solutions available We can also supply sensor chips**	**Added value & product differentiation**

Operations



Corporate HQ in Edinburgh

- Direct sales & applications support
- Product Development
- Full product design capability
- Class 10 development cleanroom
- €30M tool-set
- Develop & improve our products
- Provide customer added value

Outsourced wafer fab in Europe

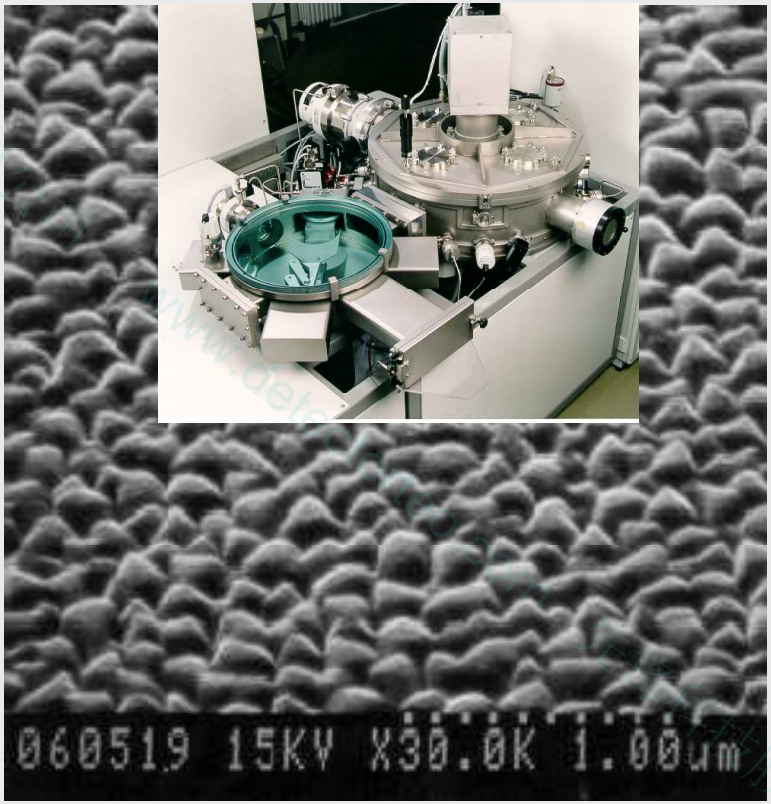
- ISO & automotive qualified foundry
- Foundry makes product for leading companies
    - Daimler, Audi, Nokia, etc
- Pyreos capacity ~ 100k sensors /mo. (depends on specific product)
- Dual sourcing in place

Outsourced assembly

- Several assembly partners
- All ISO qualified
- Europe & Asia based
- Range of packages available
- Unlimited capacity

Our Thin-Film Pyroelectric IR Sensor Technology

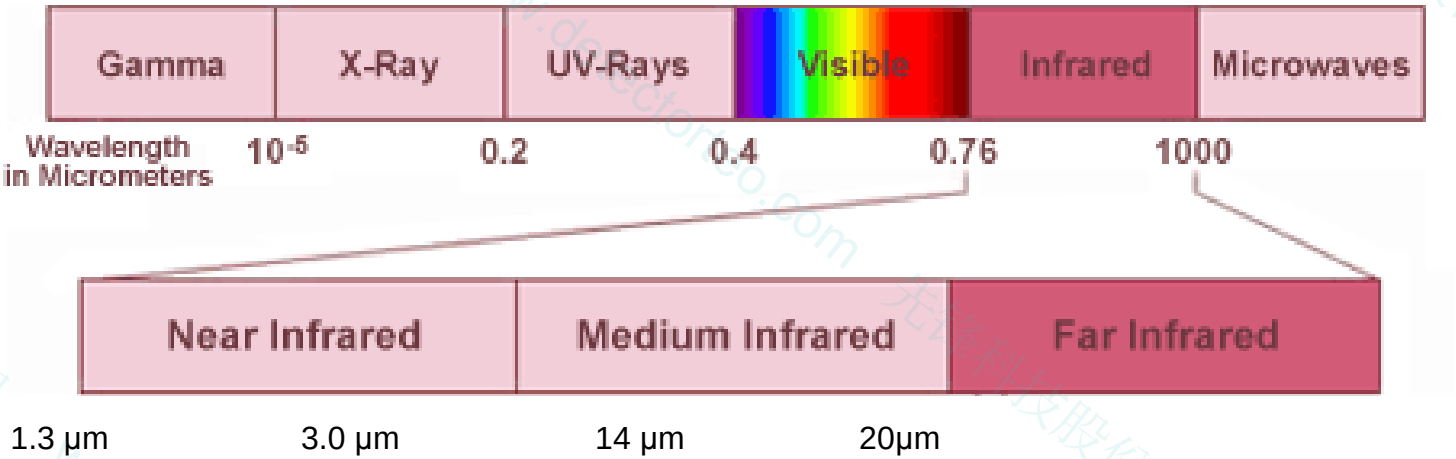
Thin film Processing



Developments

- 15 years of research into the thin film material & deposition process
- ***Unique*** PZT material & structure
- **Permanently *self-polarized*** –no performance decay ***ever***
- Extremely versatile - performance can be fully tuned
- Fully researched & understood
- **Stable** mature technology

Near-IR and Mid-IR Detectors

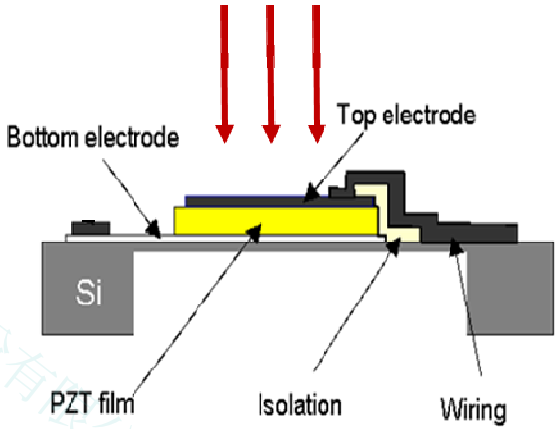


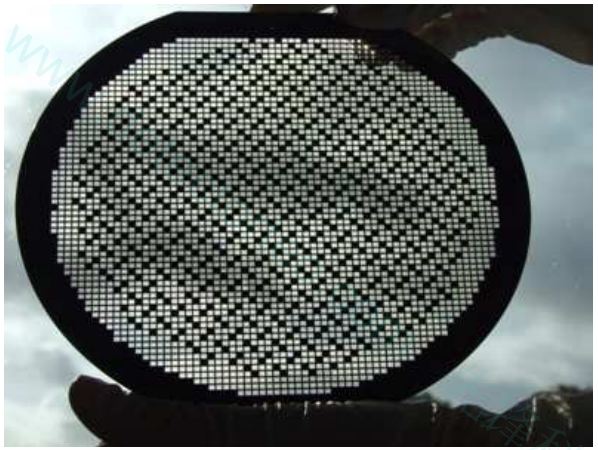
One IR technology for <u>all</u> IR regions

Unique flexibility to address all IR markets

Many environmental applications
Many security applications
Many medical applications
Consumer energy saving applications

Our Thin-film Pyroelectric IR Sensor Technology





Core Technology

- Sputtered ~1 micron PZT film
- No poling required!
- MEMs style membrane structure
- Broad absorption range from 1.3 - 25 microns
- Cost effective customization of
  - Sensor product design
  - Sensor performance

Manufacturing Process

- Standard semiconductor manufacturing
- 6 inch wafer process
- Highly controlled and repeatable performance guaranteed
- Allows new product design possibilities
- Excellent cost-to-performance ratio
- Unique technology of Pyreos

IP Protection

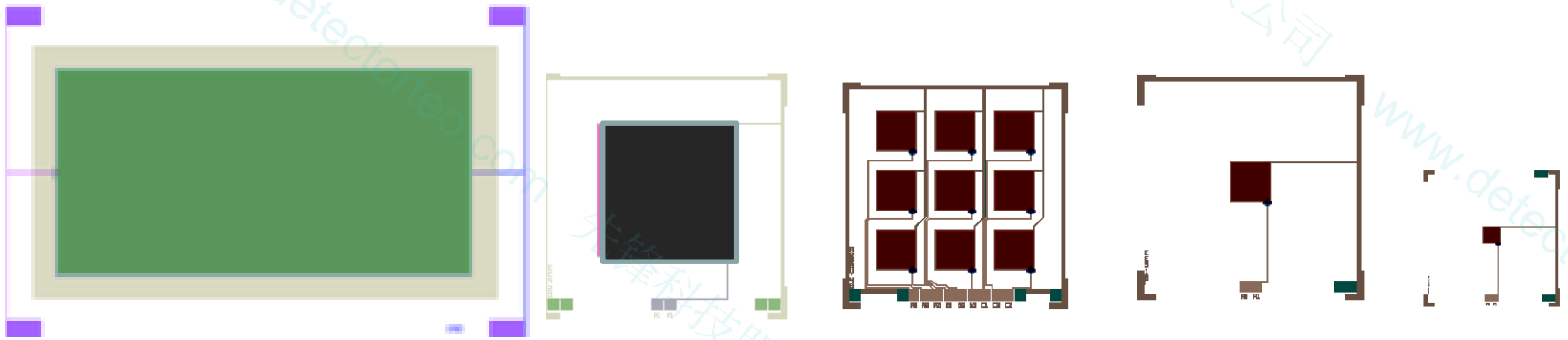
- 14 granted patents
- ~10 patent applications proceeding
- Process , equipment & design know-how
- Continuing to build IP portfolio

Completely Tunable Sensor Performance

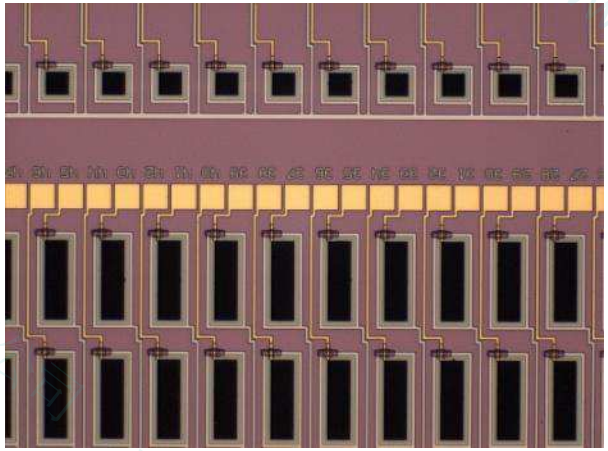
All parameters of device are controlled for the first time!

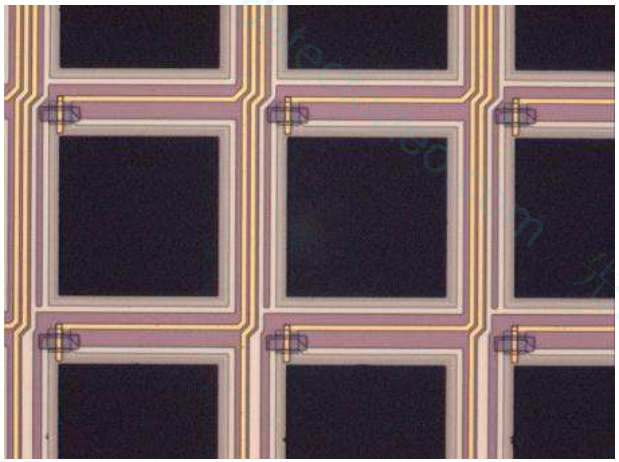
Control of
•Pyroelectric capacitance (layer thickness)
•Pyroelectric device area (small or large)
•Extent of thermal isolation (membrane size)

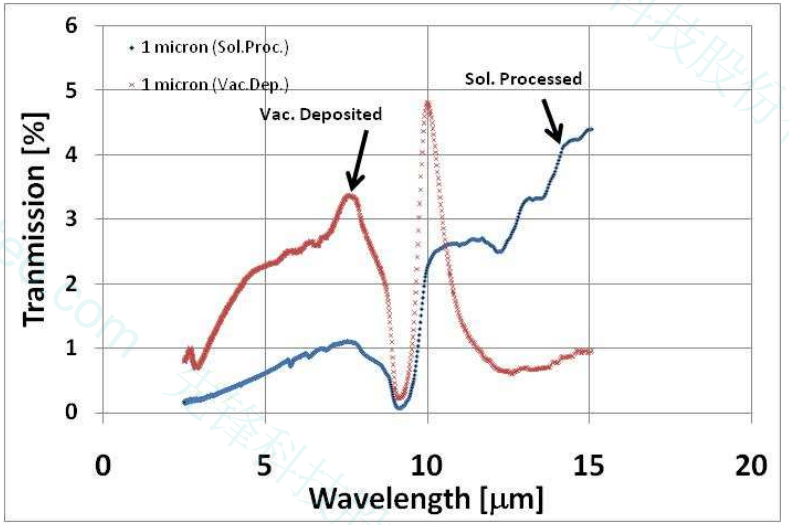
Ability to provide new products never before possible at economic cost point

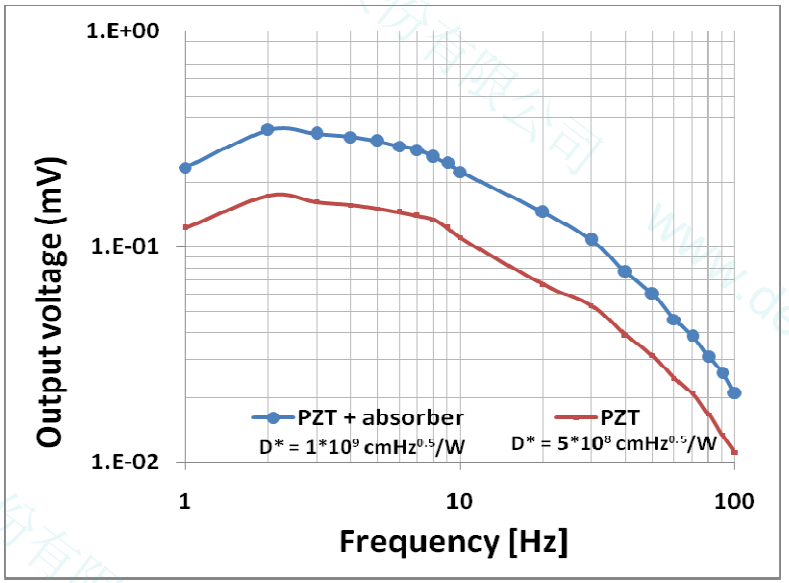


IR black absorber layer is compatible with Pyreos manufacturing process



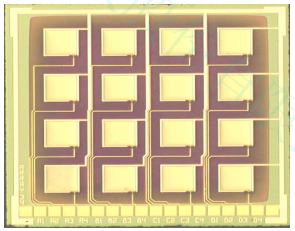




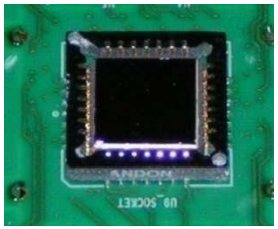


Benefit of Pyreos IR Sensors

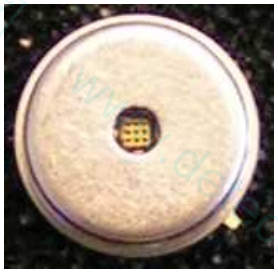
- **Highly sensitive**
  - →D* can be tuned to reach > 1 x 10^9
  - →1,000,000V/W responsivity with Op amp
- **Low noise**
  - →Noise stays low at elevated temperatures
- **Fast Response time**
  - →≤ 5ms (is part of sensor design)
- **Rugged solid state construction**
  - →SMD compatible, stable to 500ºC
- **Low microphonics**
  - →Highly stable MEMs structure
- **Small or large sensors**
  - →Design flexibility, from150um x 150um size to 3 x 2 mm



Sensor array die

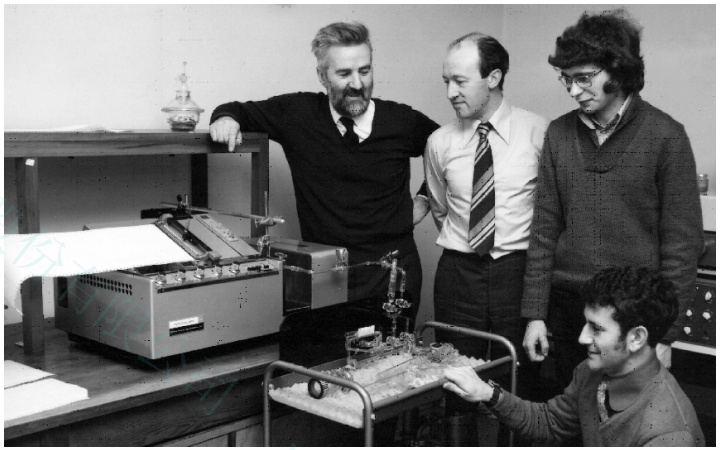


SMD compatible package



T0 packaged array

New Opportunities for IR Spectrometers



1960's onwards

1980's onwards

21st Century

Gratings Based IR
First affordable lab based IR

Bulky, slow, fragile
Expensive / Difficult to use
Major advance in analytical science

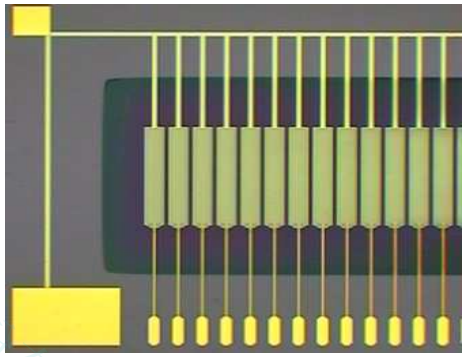
FT-IR
Easy to use in lab.

Fast , flexible but $$$
Completely replaced gratings based IR equipment

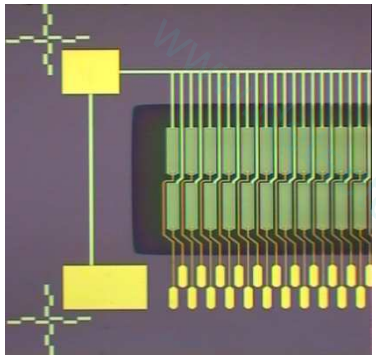
Portable
Simple to use& quick results
Untrained users

Grating and FT-IR approaches work in portable

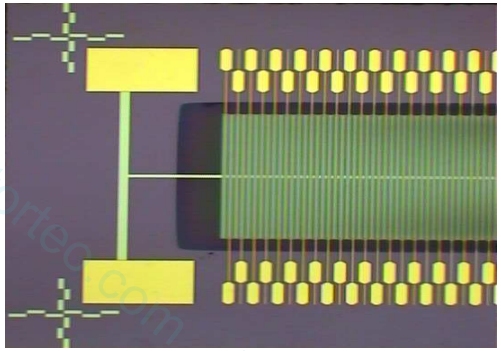
Pyreos IR Line Sensor Products



1 x 128 line sensor



2 x 128



1 x 512 line sensor

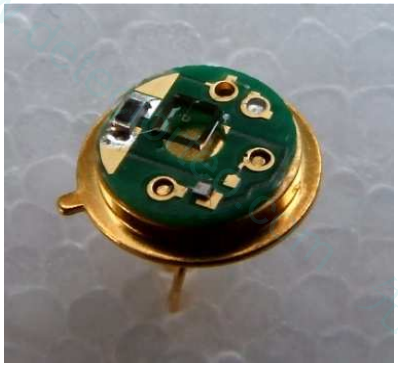
Common package type

Available with wavelength filter for;
Near IR Filter (1.3 -3.2 microns) , Mid & Far IR Filter(2-20 microns) also Linear Variable Filters

Brings new opportunities for personal & portable IR products

- Personal health monitoring devices e.g. blood, blood glucose levels, urine, saliva - healthcare “daily analysis at home”
- Lower cost miniature NIR spectrometers, New MIR miniature spectrometers
- Industrial process control at affordable price
- Security applications, - drug and explosive detection
- Laser calibration

Pyreos Large Area FT-IR Detector Product



Single Element Detector

Large area detector (3 x 2 mm) with good performance
Familiar TO can package
Solid state product (no window required)
High Curie point (600C) with low microphonics

Excellent performance from 2-20 microns, at a very affordable price

A new option for FT-IR manufacturers

Gas Detection Products (Mid-IR Detection)

Pyreos Product Range

Aimed at most common gases - replacement type products
Single & dual channel sensors e.g. CO_2 & Ref – see datasheets

Competitive Advantages:

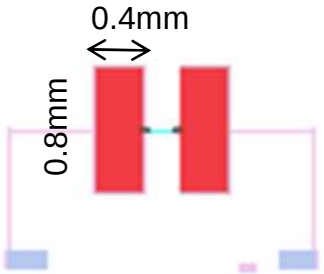
High responsivity 1,000,000 V/W with D* =3 x 10^{8}
Low noise allows standard low cost amplifiers to be used
Excellent reliability
Good cost

Product Roadmap

4 channel TO-5 miniature gas sensor

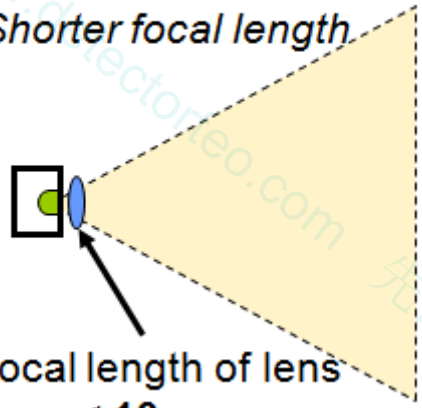
Pyreos offers Small Sensors for Motion Detection

Pyreos PIR



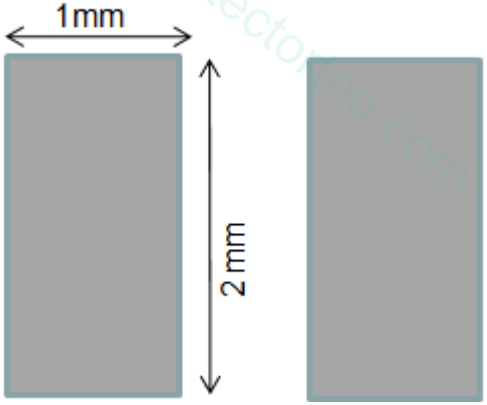
Small size leads to:

Shorter focal length

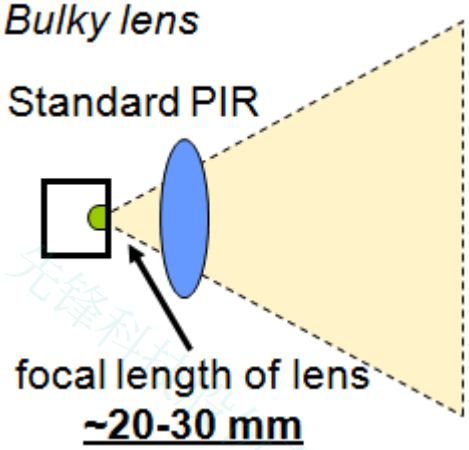


Smaller products
No performance loss
More market share

Conventional PIR

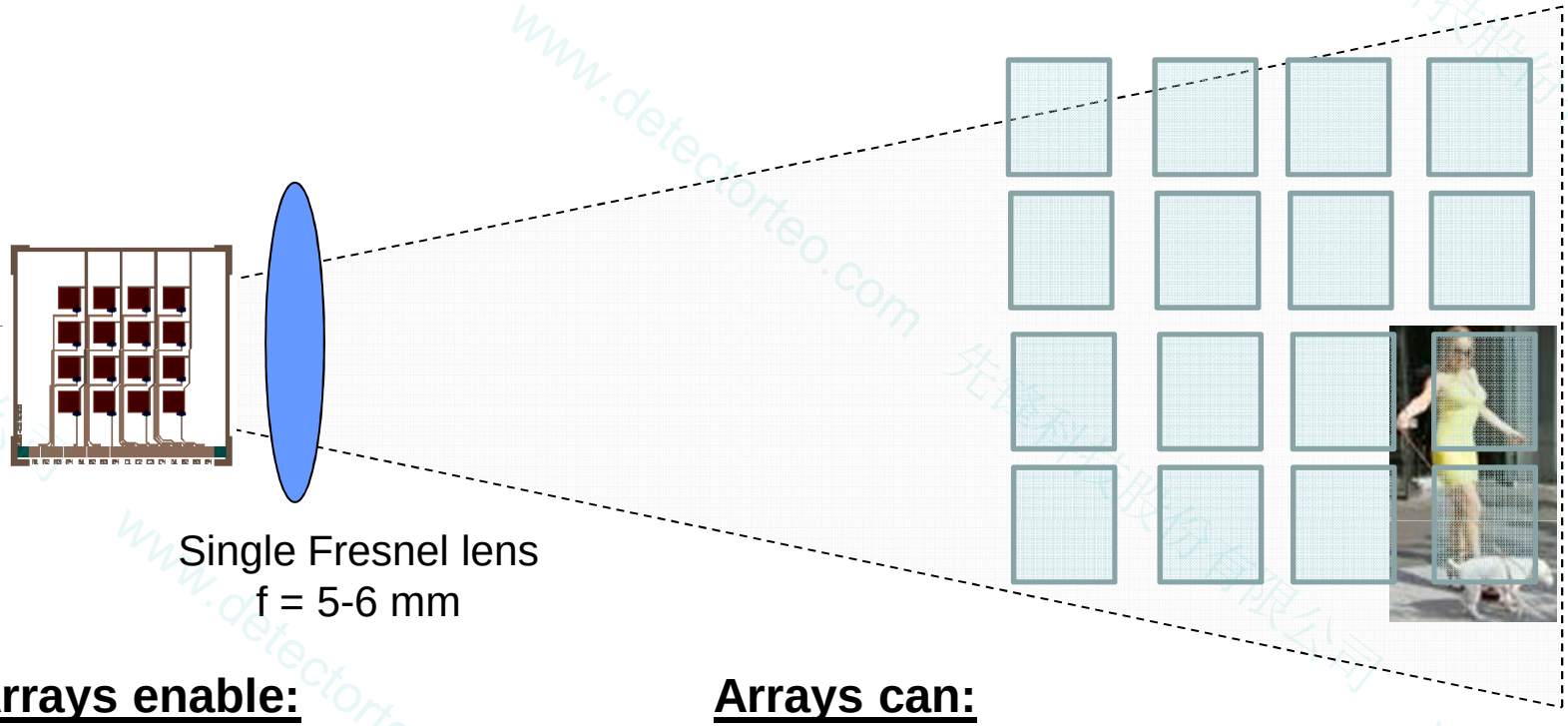


Bulky lens



Bulky, large products

Pyreos offers Sensor Arrays:
People counting, security, transport



Single Fresnel lens
f = 5-6 mm

Arrays enable:

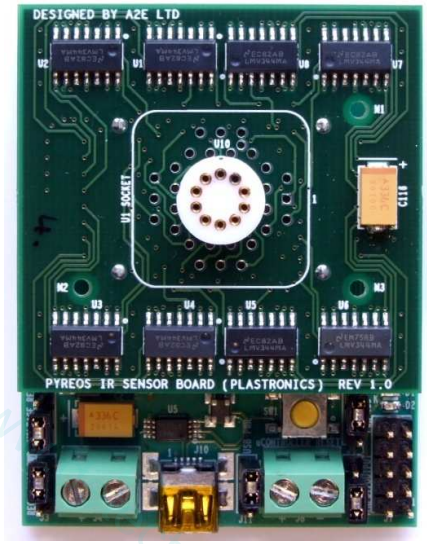
- True spatial location
- Accurate People counting
- Accurate tracking products
- Tailgating products

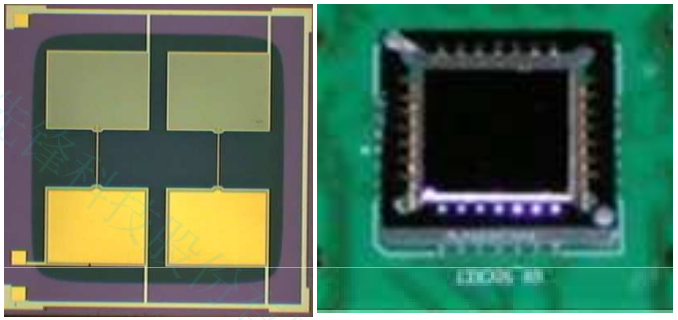
Arrays can:

- Add value & functionality
- Differentiate between objects in FOV
- Reduce incorrect alarms
- Cope with all common false alarms
- Replace multiple PIRs in a small footprint

Full Application Support Offered By Pyreos

Starter Kits to support all Products **OR** **Sample Chips or Sensors**





- Also available for ***LCC package***
- Available for line sensors
- Confirm the high performance of *IR sensors*
- Application notes & white papers
- Helps build up your own app. Software

- Range of detectors & packages
- Will supply chips
- Paired & compensated designs available
- Analogue & new digital products available on request

Infrared Sensor Market – Competitive Pricing