

INFRARED COMPONENTS AND SYSTEMS

Micro-Hybrid | Product Catalog 2016 / 2017

Micro-Hybrid Electronic GmbH is a high-technology company for micro systems technology and infrared components. We develop customer specific mechanical microelectronics and infrared systems and are internationally leading in the field of infrared sensors. Micro-Hybrid designs leading-edge hybrid applications and LTCC technology for the global core markets of medical and environmental technology as well as aviation. Micro-Hybrid is part of the Micro-Epsilon Group.

Dear readers,

It is my great pleasure to present our second catalog for infrared components and systems.

As always, our metrological products and components present themselves as nothing short of high-quality products with excellent technological properties.



As well as providing our standard products in our catalog, we consider our company a „provider of solutions“. Therefore, we would be happy to assist you in creating your own specific version.

We have utilized our outstanding innovative capacities to expand our range of products: Our highlights in this respect are the new products in the field of IR sources. A worldwide innovation presented by Micro-Hybrid is Hermeseal. The product benefits of Hermeseal include increased precision of your measuring equipment and maximum stability and longevity of the component.

For the first time, Micro-Hybrid is also offering complete gas sensors for the integration with your equipment. We have been developing high-quality gas sensors for CO₂ and methane, based on the extensive depth of added value due to the design and the production of core sensor components for more than 10 years. Our sensors' special properties, such as the ability to withstand high temperatures of up to 190 °C, facilitate the use in new fields of application as well as competitive advantages for you.

Temperature, gas, flame or spectroscopy: You have a measurement problem to solve. Simply follow our application-specific table of contents on the following page: You will immediately find your field of application and an extensive variety of suitable IR components and sensors. Order your samples via our website: <http://finder.micro-hybrid.de>

I am absolutely certain that our products have the ability to improve your system! We invite you to join us in developing technologically innovative solutions in order to generate significant competitive advantages for you as our customer. Let us venture into new territory together:

Enter New Space.

A handwritten signature in blue ink, appearing to read 'K. B. Engel', written in a cursive style.

Content

TEMPERATURE MEASUREMENT



4

Application note	6
Thermopile detectors	8
High temperature thermopile detectors	9
Numerical code for thermopile detectors	10
Product overview	11

NDIR GAS MEASUREMENT



12

Application note	14
IR sources	16
MEMS JSIR 350	17
Hermeseal technology	18
JSIR 450 spiral wound	19
Pyroelectric detectors	20
Pyropile®	22
Thermopile detectors	23
Gas sensors for NDIR gas measurement in harsh environments	24
Numerical code for thin film radiation sources/ Product overview	26
Numerical code for pyroelectric detectors/ Product overview	28
Numerical code for thermopile detectors/ Product overview	30

FLAME DETECTION



32

Application note	34
Pyroelectric detectors	36
Numerical code for pyroelectric detectors/ Product overview	38

IR SPECTROSCOPY



40

Application note	42
Thermopile line array TPL 640	44

CUSTOMER SPECIFIC IR



46

Modifications of IR sources	48
Cap / Reflector	
Hermetic sealing	
Modifications of thermopile detectors	50
Sensor chip	
Infrared filter	
Modifications of pyroelectric detectors	51
Sensor chip	
Field of View	

RESEARCH AND DEVELOPMENT



52

Customized development of high-level infrared sensors and sensor systems	54
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↑ TEMPERATURE MEASUREMENT

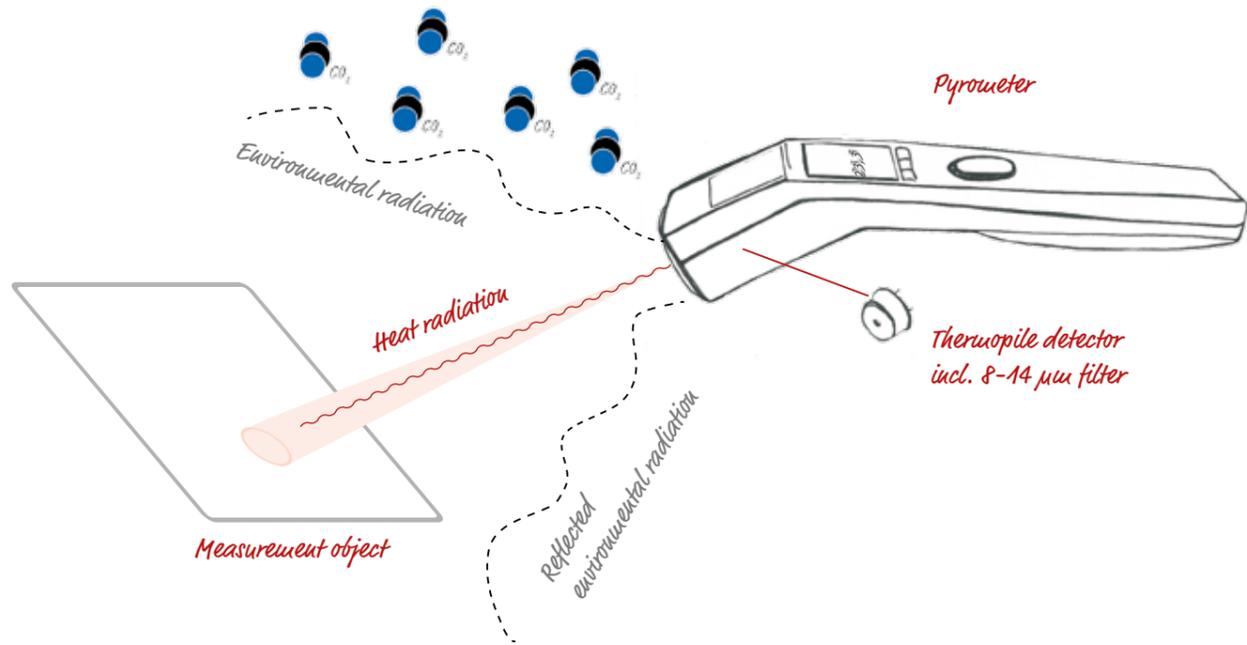
Temperature monitoring for
process optimization

The process and product temperature is an important physical indicator for manufacturing processes. Monitoring the temperature ensures a high quality level of the production line. Remote temperature measurement is ideal for large distances, moving parts or due to high temperatures applicable in various industrial fields.

+ Advantages

- Short response time
- Reactionless measuring, no influence on measuring object
- No destructions
- Continuous real-time monitoring of temperature critical time

Scheme pyrometry



„The application is defined by our customers design of equipment. Our portfolio offers products for punctual and integral measurements.“

Dipl.-Ing. Steffen Biermann, Head of R&D Department, Micro-Hybrid Electronic GmbH

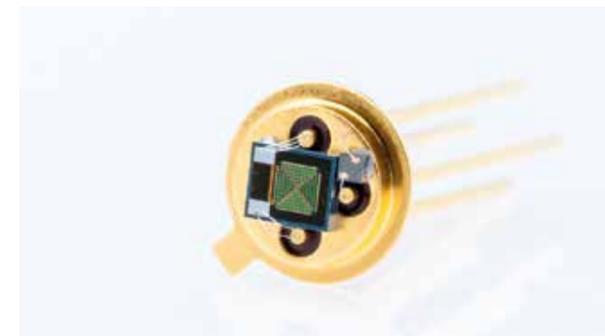
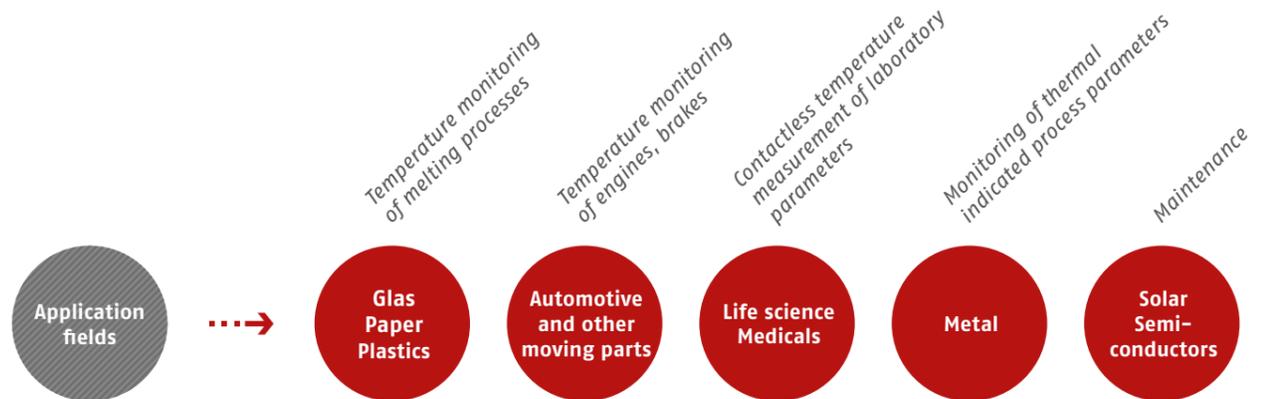
Product recommendation

We offer sensor types for different measurement demands within a housing temperature range of -20 °C up to 190 °C. Our detectors are suitable for most application fields of pyrometry.

Order individual product samples: <http://finder.micro-hybrid.de>

Application	Product
Punctual temperature measurement	TS1 × 80B-A-D0.48-1-Kr-B1
Integral temperature measurement	TS1 × 200B-A-D3.55-1-Kr-A1
Temperature measurement in high ambient temperatures	TS1 × 80B-A-D0.48-1-Kr-B1-190

For more information contact our sales team by **Email** to infrared@micro-hybrid.de or call **+49 36601 592-0**



Thermopile detector TS1x200B header assembly



Thermopile detector TS1x200B with glued window

Thermopile detectors



The base of each thermopile detector is formed by the so-called thermocouple. Due to thermal diffusion currents of two different metals (Seebeck effect), it generates an electrical voltage.

General Arrangement

These thermocouples, called thermopiles, achieve higher output voltage in series connection. One common combination of materials for industrial thermocouples are Silicon-Aluminum alloys. To achieve a higher sensitivity we use Bismuth-Antimony alloys. However the sensitive component of Micro-Hybrid thermopile detectors is a MEMS-based thin-layer system on a silicon substrate. The thermocouples themselves consist of a Bismuth-Antimony / Antimony alloy. By means of extensive layering and structural systems, we offer sensor chips with either 80 (TS 80) or 200 (TS 200) thermocouples. Depending on the application, both basic types are provided with various spectral absorber layers. They are specially matched to their specific use.

The base module consists of a sensitive component and a thermistor which directly reflects the case temperature. It is hermetically welded with a cap assembly that consists of a broadband infrared filter and a TO cap with aperture in defined atmosphere.

Micro-Hybrid's component portfolio offers a big variety of combinations and allows to configure the perfect detector solution. In addition to multiple thermistors and various inert gases, there is also the opportunity to implement an individual customer filter element.

Find out more about customer specific modifications at page 50.

Features

Excellent performance by using best materials like BiSb/Sb for thermo electrical effect:

World's best detectivity up to $7.2 \times 10^8 \text{ cm} \times \text{Hz}^{1/2} / \text{W}$

High sensitivity up to 295 V/W

Exclusively available with Micro-Hybrid products

High temperature thermopile detector

Temperature monitoring of machinery and processes within high environmental temperatures is a real challenge. Our **high temperature thermopile detectors** perfectly fit special requirements like high temperatures in various industrial applications.



Thermopile detector TS1x200B with glued window

Features

Environmental temperatures up to 190 °C

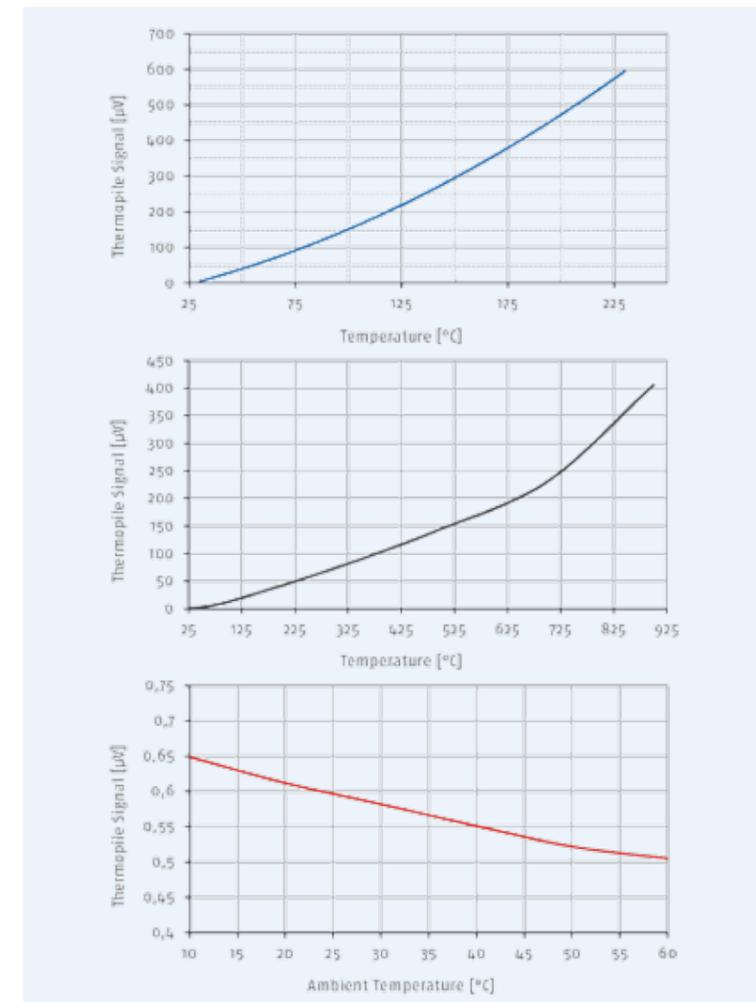
Soldered filter (optional)

High sensitivity

Humidity resistant

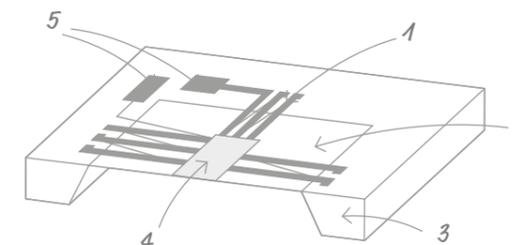
Suitable for chemical processes

Resistant against aggressive gases like methane, sulfurdioxide, etc.

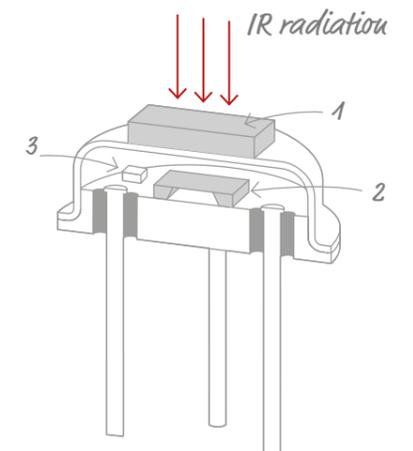


graph 1 and 2 thermopile signal depending on a change of the temperature of the measuring object; graph 3 change of the thermopile signal by variation in ambient temperature

- 1 - Thermocouple leg
- 2 - Membrane
- 3 - Si-substrate
- 4 - Absorber layer
- 5 - Bond pads



schematic illustration of the construction of a thermopile



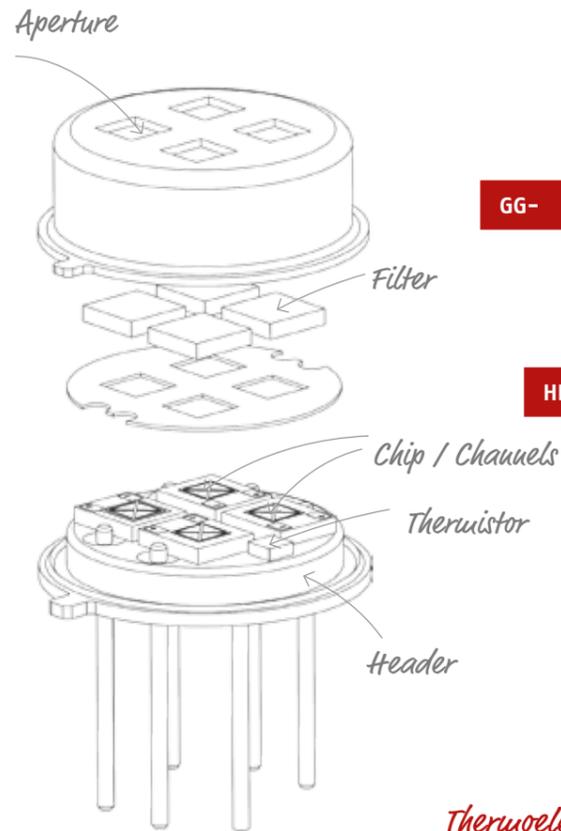
- 1 - IR-filter
- 2 - Thermopile chip
- 3 - Thermistor

Micro-Hybrid Numerical code

Thermopile detectors

With this numerical code you can easily choose the right combination of detector parts according to your applications demands.

For Example
TS4x200B-A-S1.5-1-N2-C1/F1/G1/D1



Thermoelectric sensor

- AA** TS4x200B...
Thermoelectric sensor
- Bx** TS4x200B...
Channel 1-4
- CCCC-** TS4x200B-...
Chip 80B, 200B, Q200B
- D-** TS4x200B-A...
Header A - TO 39
B - TO 46
- EEEE-** TS4x200B-A-S1.5-1-N2-C1/F1/G1/D1
Aperture
S1.5 - Square 1.5 x 1.5 mm²
D2.4 - Diameter 2.4 mm²
D3.55 - Diameter 3.55 mm²
- F-** TS4x200B-A-S1.5-1-N2-C1/F1/G1/D1
Thermistor
0 - None
1 - PTC Ni1000
2 - NTC 30k
3 - NTC 100k
4 - TRS-Si 1K 0.5%
- GG-** TS4x200B-A-S1.5-1-N2-C1/F1/G1/D1
Filling gas
Kr - Krypton
N₂ - Nitrogen
Other filling gases on customers request.
- HH/HH/HH/HH-** TS4x200B-A-S1.5-1-N2-C1/F1/G1/D1
Filter
D1 - Reference (4000 - 80 nm)
E1 - CO₂ (4265 - 120 nm)
F1 - CO (4650 - 180 nm)
B1 - Temp. measurement (8 - 14µm)
Other filter on customers request.
- III** Extended temperature range
190 - max. 190 °C; only available with two channel and sensor chip 80B
Unspecified; max. 85 °C



Thermopile detectors product range

Type	Channels	Responsivity [V/W]	D* [cmHz ^{1/2} /W]	Aperture [mm ²]	Operation temp. [°C]	Housing	Application
TS1 x 200B-A-D3.55	1	100	3.6 x 10 ⁸	3.55 dia	-20 ... +70	TO 39	NDIR gas analysis/ Temp. measurement
TS1 x 200B-B-D2.4	1	100	3.6 x 10 ⁸	2.4 dia	-20 ... +70	TO 46	NDIR gas analysis/ Temp. measurement
TS1 x 80B-A-D0.48	1	295	7.2 x 10 ⁸	0.48 dia	-20 ... +85	TO 39	Temp. measurement
TS1 x 80B-A-D0.75	1	295	7.2 x 10 ⁸	0.75 dia	-20 ... +85	TO 39	Temp. measurement
TS1 x 80B-A-D0.75- ... -190	1	295	7.2 x 10 ⁸	0.75 dia	-20 ... +190	TO 39	NDIR gas analysis/ Temp. measurement

For more information contact our sales team by Email to infrared@micro-hybrid.de or call +49 36601 592-0

➤ NDIR GAS MEASUREMENT

Sensors for NDIR gas analysis
in harsh environments



With gases being part of industrial processes, the monitoring and securing of process stability are key factors of quality. The exact and repeatable detection of gas concentration is not only of importance in medical and environmental technology. Furthermore it enables either broadband or high selective detection of hazardous materials in private or industrial areas like monitoring and detection of explosive gases and pollutants. NDIR (non dispersive infrared) gas analysis is an optical analyzing tool to detect the concentration of such gases. Referring to the optical interaction with infrared active gases NDIR is a fast and efficient method.

+ Advantages

Fast, repeatable, long-term stable determination of the concentration of various IR active gases

High accuracy and high resolution limits

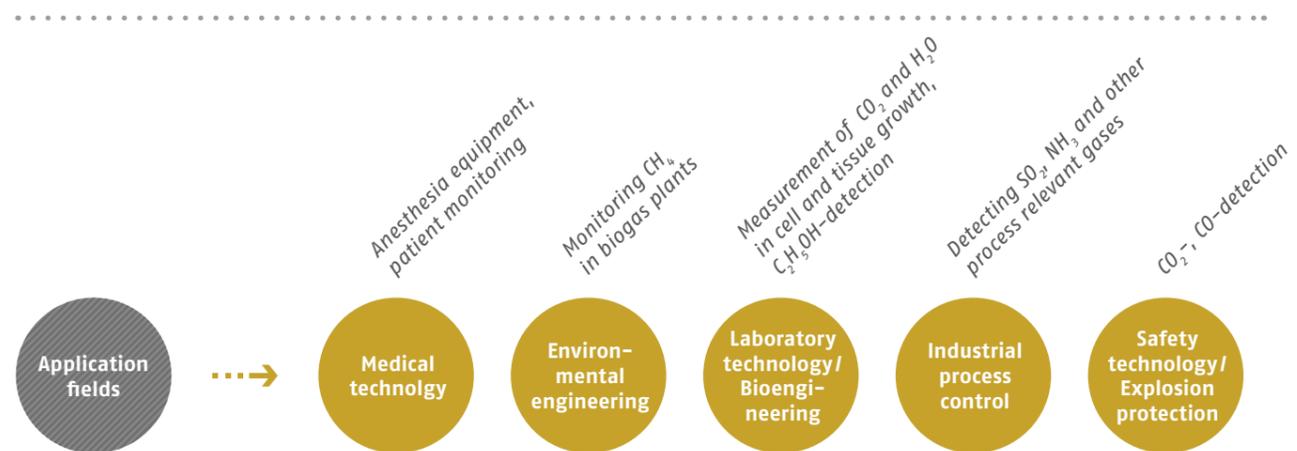
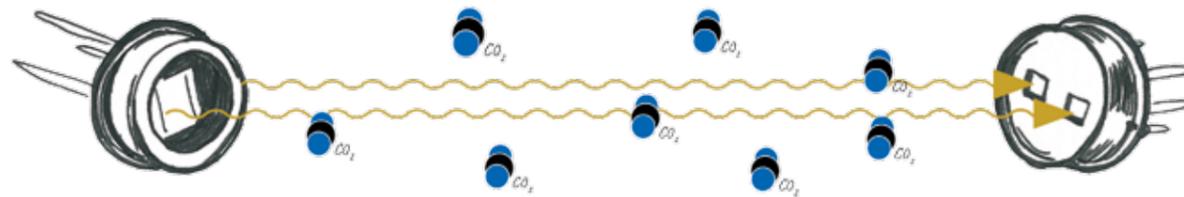
Long lifetime at lowest drift referring to no chemical reactions

High temperature capability (190 °C)

High measurement stability even in harsh environments

Infrared spectroscopy has emerged as very precise and long-term stable method for the detection of IR-active substances in NDIR gas and fluid analysis. The measurement systems long-term stability is based on infrared components.

Scheme NDIR gas analysis



Micro-Hybrid offers the complete product range for NDIR gas analysis. Even harsh environments will not discourage our customers application to Enter New Space.

Product recommendation

Based on different functional modes we combine the ideal product solution for your measurement task.

➤ Order individual product samples: <http://finder.micro-hybrid.de>

IR sources			Thermopile detectors		Pyroelectric detectors		Gas sensors	
JSIR 350-4	JSIR 350-5	JSIR 450	TS 80	TS 200	Current mode	Voltage mode	Micro-Hybrid gas sensor	OEM sensors
High frequencies	Very high frequencies	Very high radiation intensity	High temperature application	High sensitivity	Very high sensitivity	High sensitivity	High temperature resistant up to 190 °C	
High radiation intensity	Hand-held devices			Hand-held devices	Very high frequencies	Voltage mode		

For more information contact our sales team by Email to infrared@micro-hybrid.de or call +49 36601 592-0

IR sources



Whether MEMS based or spiral wound – Micro-Hybrid’s IR sources are distinguished by design and high performance in functionality.

Our well-established emitter series JSIR 350 achieves best performance characteristics by using IR chips made in Tuscon (Arizona) by our majority owned MEMS fab Nova IR.

NOVA IR

Combined with excellent German engineering and packaging technologies we created powerful IR sources for challenging demands.

We developed a special process to hermetically seal our components. IR sources made with Micro-Hybrid’s **Hermeseal** method resist harsh environments like high temperatures, aggressive gases and high humidity. Therefore they are the appropriate choice for NDIR gas analyses.

+ Advantages

- Hermetic sealing of IR sources
 - > Use in harsh environments
 - > Backfilling with different gases
- High membrane temperature
 - > High radiation output
- Good spectral emissivity
- Standard industrial housings
 - > Easy implementation into application
- Long lifetime

General arrangement

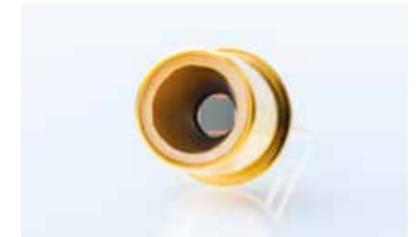


- 1 – NAC multilayer membrane
- 2 – Bond pads
- 3 – Si frame and membrane

The MEMS chip used in our infrared emitters consists of nano amorphous carbon (NAC). The substrate is made of a Si-chip with a back etched membrane. The thin film processing is conducted by Magnetron Sputtering. The last layer of the IR-chip is a protective layer consisting of silicon nitride and protecting the active element against environmental influences.

MEMS JSIR 350

JSIR 350 sources are MEMS based infrared emitters, branded with high radiation output. These emitters made of nano amorphous carbon (NAC), are a new class of nano-structured materials. By combining standard silicon materials technology with NAC coatings, Micro-Hybrid now offers a new generation of MEMS products with exceptional performance.

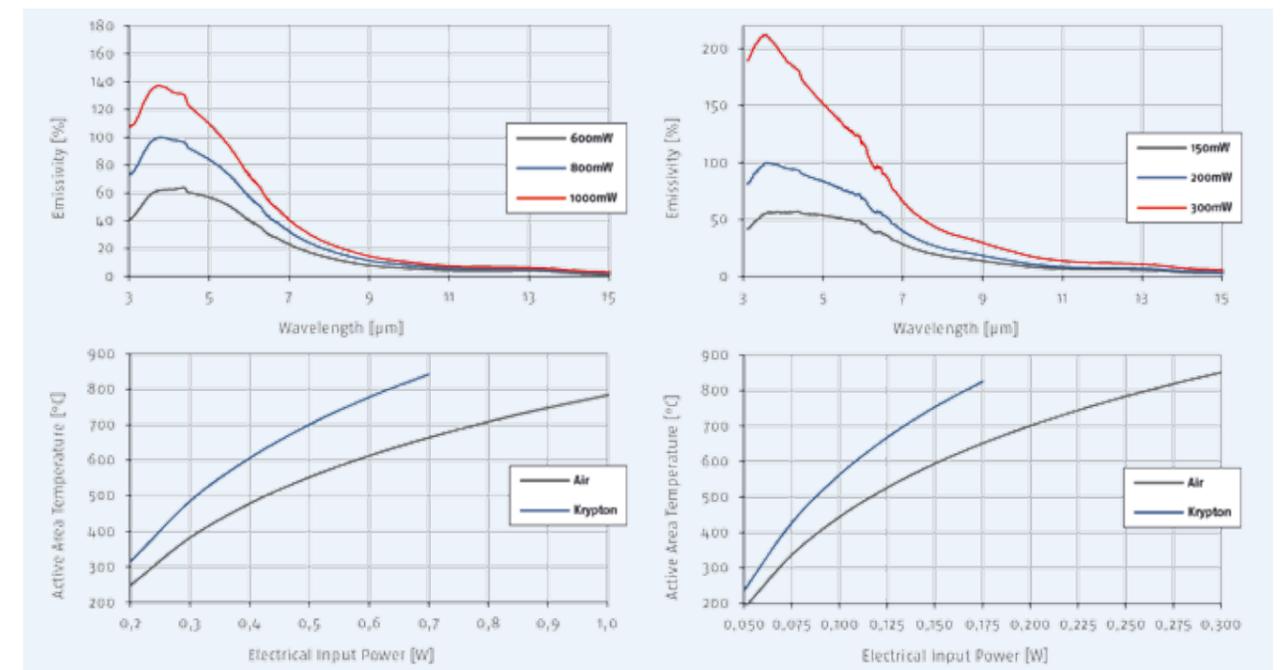


MEMS based IR source with reflector

✓ Features

- High membrane temperature up to 850 °C
- High modulation frequency up to 100 Hz > no mechanical chopper needed
- Long lifetime
- Broadband emissivity
- Hermetically sealed set up > **Hermeseal**

above spectrum of the JSIR 350-4 (left) and JSIR 350-5 (right) at different power levels
below temperature distribution of the JSIR 350-4 (left) and JSIR 350-5 (right) with different backfill gases



Type	JSIR 350-4	JSIR 350-5
Time constant (modulation)	15 ms	7 ms
Lifetime	100,000 h	100,000 h
Membrane temperature	640 °C at 650 mW nominal power 850 °C at 1200 mW max. power	640 °C at 175 mW nominal power 850 °C at 300 mW max. power
Active area	2.2 x 2.2 mm ²	0.65 x 0.80 mm ²

All Micro-Hybrid emitters are available in different chip sizes as well as classical TO housing or SMD. For more information contact our sales team by **Email to infrared@micro-hybrid.de** or call **T +49 36601 592-0**

Hermeseal technology

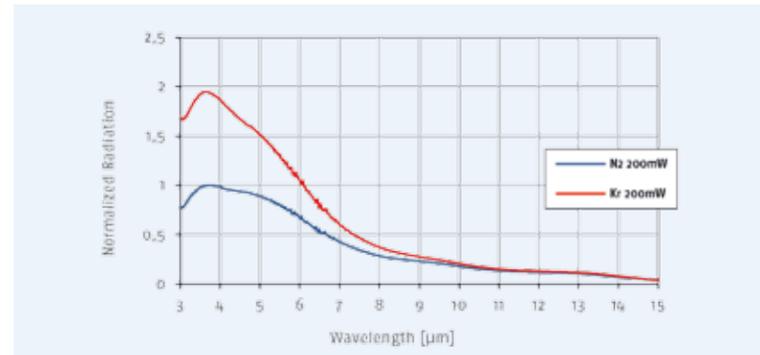


MEMS based IR source with Hermeseal reflector

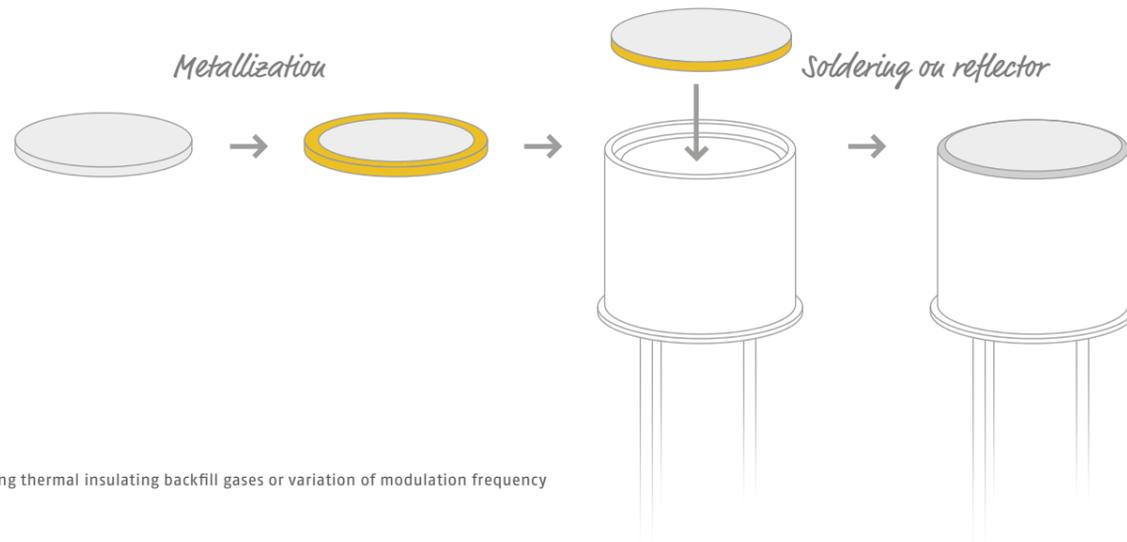
In cooperation with JENOPTIK Optical Systems GmbH our R&D engineers developed a **method to hermetically seal IR sources**.

By soldering a metalized filter on the reflector or cap Micro-Hybrid's infrared sources perform high efficient* and long term stable. This new technology effects IR components to be impenetrable to gases. The components do not show any permeation of water vapor or (environmental) gases compared to glued elements. The hermetic cap allows **new applications in harsh environments – such as high temperature, high partial gas pressure and high humidity**.

The input power of IR emitters is variable while maintaining membrane temperature. To modify the modulation frequency the emitters can be filled with different gases. These innovative filter and window elements can be customized in size and optical coating according to customer specifications. This innovation represents a huge potential of improvement in the field of NDIR gas analysis.



comparison of two IR sources with different backfill gases at the same electrical input power



*by using thermal insulating backfill gases or variation of modulation frequency

Features

Increased lifetime by reduction of oxidation processes

Backfilling with different gases for variation of radiation output and time constant

High safety level for explosion proof applications

Ideal for battery or stand alone applications with low power supplies*

Long-term stable

JSIR 450 spiral wound



Spiral wound IR source with reflector

Powerful radiation sources with circular homogeneous temperature distribution for the use with thermopile detectors in NDIR gas analysis and other applications. Our spiral wound emitter **JSIR 450** series is available with reflector and cap. (window on request)

JSIR 450 spiral element consists of a special kanthal-alloy, which emits nearly black body radiation (high emissivity). The JSIR 450 series operates in DC mode.

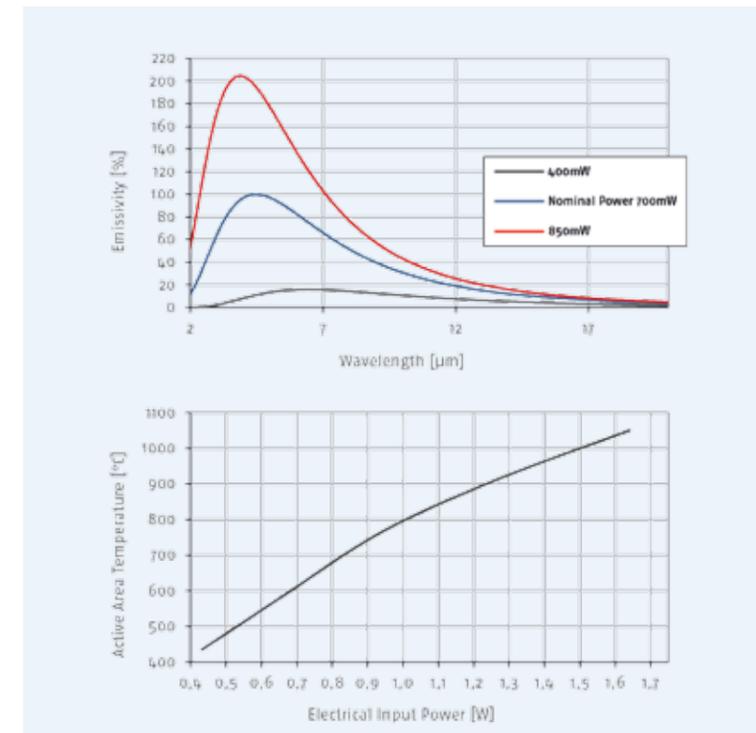
Features

Black body radiation

Long lifetime > 100,000 h

High membrane temperature:
650 °C at 700 mW nominal power
1100 °C at 1700 mW max. power

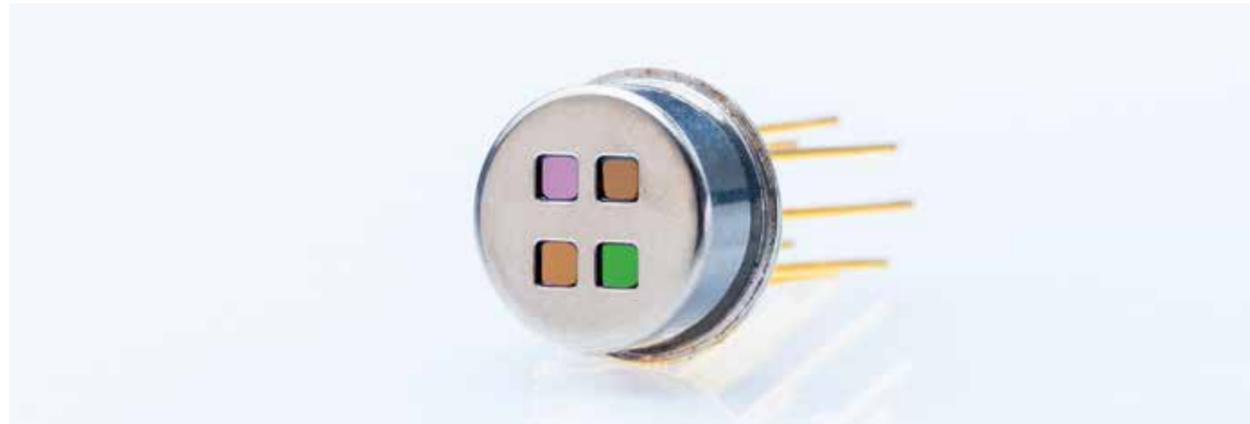
Industrial standard housing TO 39



above spectrum of the JSIR 450 at different power levels
below temperature distribution of the JSIR 450

For measurements in low frequencies this type of IR source is the appropriate choice to meet the requirements of high radiation intensity.

Pyroelectric detectors



Micro-Hybrid's pyroelectric detectors are powerful thermal infrared detectors with excellent long-term stability.

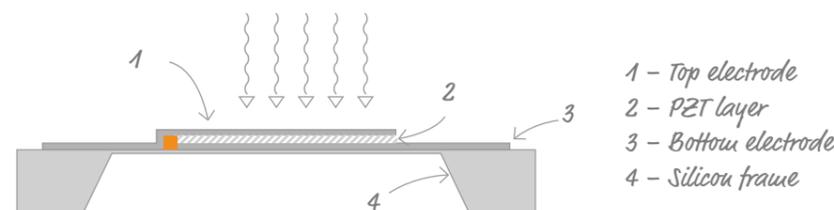
These sensors detect the typical spectral emission of burning material like wood, oil or plastics. The NDIR gas analysis represents another application field for pyroelectric sensors.

Infrared radiation impinges the sensors' active area. Due to the pyroelectric effect, the so caused effective change of temperature generates charge carriers on the electrodes.

Unlike most competitors' LiTaO₃ chip, Micro-Hybrid's pyroelectric detectors use sensitive elements based on MEMS technology. The pyroelectric element consists of a ~ 1 μm thick PZT thin film mounted on a modified Si-based membrane which is produced by a DRIE back-etch process. The front electrode is optically transparent allowing infrared radiation to be absorbed by the active area. This area has a broad absorption range from 1 – 25 μm.

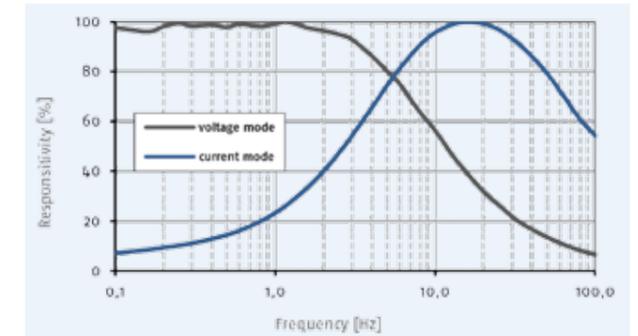
+ Advantages

- MEMS based PZT membrane
- Broad spectral sensitivity 1 – 25 μm
- High modulation frequency up to 200 Hz
- Low microphone effect referring to low membrane mass
- Very low temperature dependence
- Low thermal drift
- No cooling needed

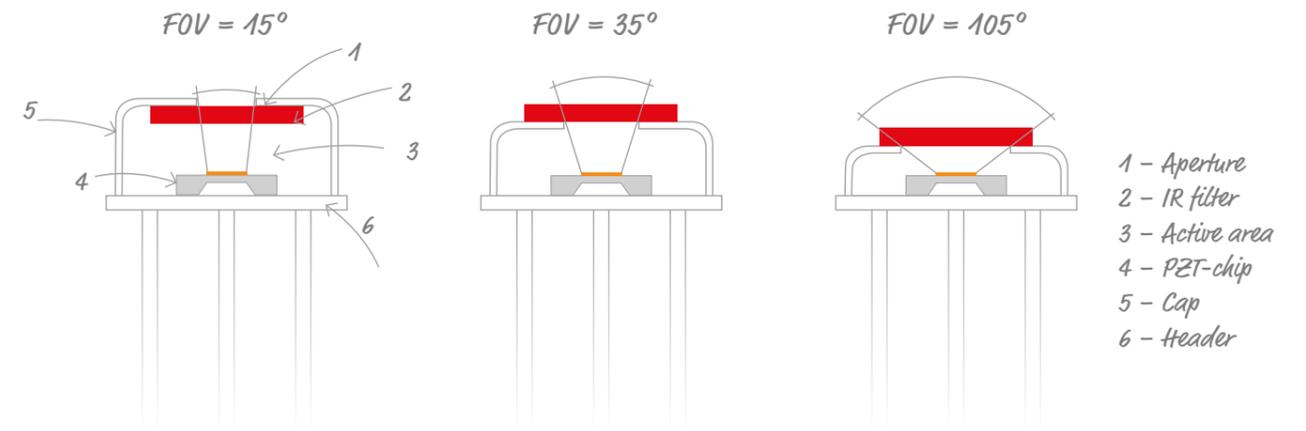


Mode

Our pyroelectric detectors are available in **current and voltage mode (Pyropile®)**. The current mode detector is available with a bipolar supply only (± 2.2 ... ± 8 VDC).



frequency response of the voltage mode (black curve) and the current mode detector (blue curve)



Cap	Aperture	FOV	Filter position
H286	3.7 mm	104.6°	outside
H217	1.5 mm	34.7°	outside
M001	3.7 mm	76.2°	inside
M001	1.5 mm	21.5°	inside

Mode	Voltage		Current	
Sensitive area [mm ²]	1.15 x 1.15		0.8 x 0.8	0.7 x 0.325
Responsivity* [V/W]	950		175,000	125,000
Detectivity [cm x Hz ^{1/2} / W]	2.09 x 10 ⁸		2.2 x 10 ⁸	1.7 x 10 ⁸
Optimal frequency [Hz]	0.2 ... 3		2 ... 55	3 ... 25
Channel	1 - 4		1 - 2	4

For more information contact our sales team by Email to infrared@micro-hybrid.de or call +49 36601 592-0

Pyropile®



2-channel Pyropile® detector



4-channel Pyropile® detector

With **Pyropile®** we created a high performant pyroelectric detector in voltage mode. The active material is divided into nine smaller pixels, connected in series. Thereby the Pyropile® detector generates a nearly 10 times higher signal output at a low noise level. Referring to the low mass of chip membrane, the detector is characterized by extremely low microphone effect, low thermal drift and thermal noise. If higher sensitivity is needed for measurement tasks with comparable measurement speed, Pyropile® represents an alternative to thermopile detectors.

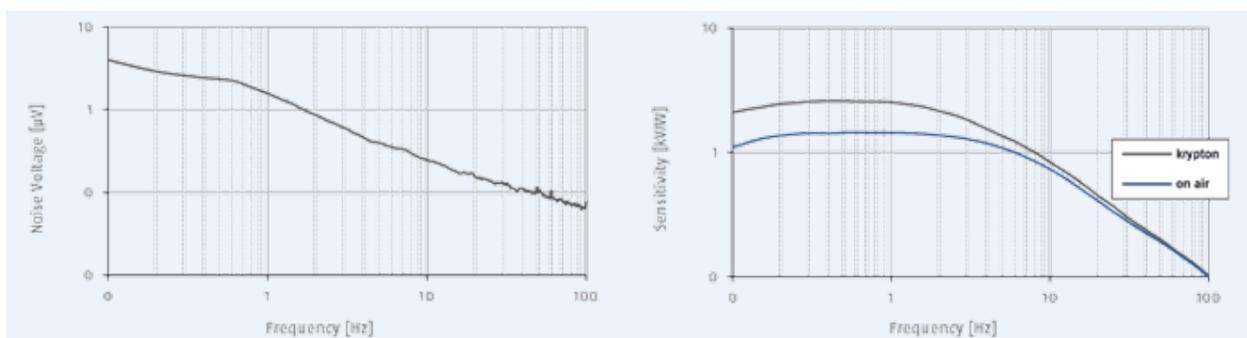
Features

High signal to noise ratio > detectivity up to $2.1 \times 10^8 \text{ cm} \times \text{Hz}^{1/2} / \text{W}$

High sensitivity up to 950 V/W

Output: voltage signal

This high performance pyroelectric detector is available with up to 4 channels.



noise voltage as a function of frequency

sensitivity behavior over the frequency range of the Pyropile®

Thermopile detectors



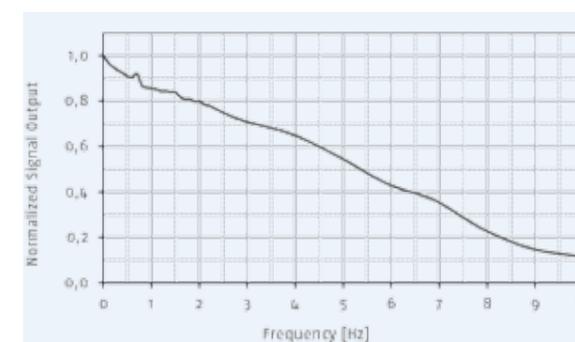
The base of each thermopile detector is formed by the so-called thermocouple. Due to thermal diffusion currents of two different metals (Seebeck effect), it generates an electrical voltage.

These thermocouples, called thermopiles, achieve higher output voltage in series connection. One common combination of materials for industrial thermocouples are Silicon-Aluminum alloys. To achieve a higher sensitivity we use Bismuth-Antimony alloys. However the sensitive component of Micro-Hybrid thermopile detectors is a MEMS-based thin-layer system on a silicon substrate. The thermocouples themselves consist of a Bismuth-Antimony/Antimony alloy. By means of extensive layering and structural systems, we offer sensor chips with either 80 (TS 80) or 200 (TS 200) thermocouples. Depending on the application, both basic types are provided with various spectral absorber layers. They are specially matched to their specific use.

The base module consists of a sensitive component and a thermistor which directly reflects the case temperature. It is hermetically welded with a cap assembly which consists of a narrow bandpass infrared filter and a TO cap with aperture in defined atmosphere.

Micro-Hybrid's component portfolio offers a big variety of combinations and allows to configure the perfect detector solution. In addition to multiple thermistors and various inert gases, there is also the opportunity to implement an individual customer filter element.

Find out more about customer specific modifications at page 50.



frequency response of the thermopile detector

Features

Excellent performance by using best materials like BiSb/Sb for thermo electrical effect:

Worlds best detectivity up to $7.2 \times 10^8 \text{ cm} \times \text{Hz}^{1/2} / \text{W}$

High sensitivity up to 295 V/W

Exclusively available with Micro-Hybrid products

Gas sensors for NDIR gas measurement in harsh environments



✓ **Features**

Extended temperature range up to 190 °C

Vapour partial pressure up to 800 mbar

Solvent atmosphere resistant

Signal processing is mounted in lower temperature range up to 70 °C, outside of the measurement environment

NDIR gas sensors are used successfully in a wide range of detecting, measuring and controlling infrared active gases. The maximum storage and operating temperature of common NDIR gas sensors is limited at around +60 °C.

Breaking this limit was our motivation to develop NDIR gas sensors for harsh environments.

Within the last years we created a groundwork of NDIR gas sensors for the fast realizing of customers demands in NDIR gas measurement technology. Based on our hermetically packaged IR components and temperature stable electronics even very demanding measurement tasks can now be solved. An optimal system design of the gas sensor is guaranteed by the specific parameter adaption of all core components: IR emitters and detectors. Mechanic, electronic and optical elements of the gas sensor can be combined by modular principle. MEMS based IR chips, calibration, environmental and long-term tests of the complete gas sensor top off the successful processing of our customers' optical gas sensor projects.

Modular principles

Depending on the type of gas and the corresponding measurement range we offer two different module systems:

Diffusion based gas sensor module

Open cuvette

For absorption distances up to 50 mm

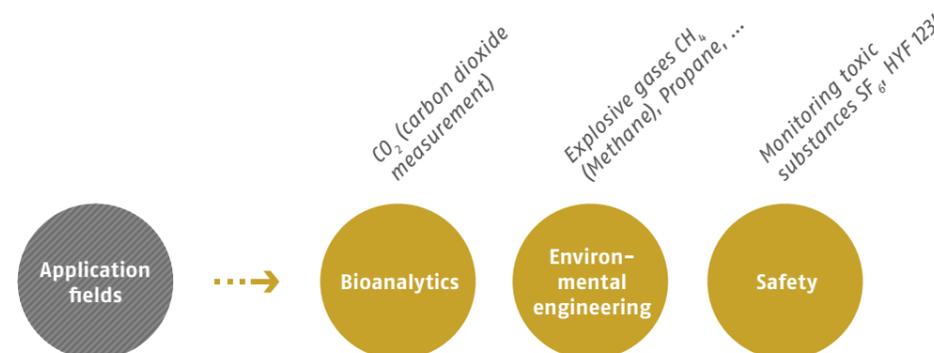
Directly placed as sample in the atmosphere to be measured

Reflective cuvette based gas sensor module

Reflecting cuvette

For absorption distances up to 100 mm

Minimum gas flow through e.g. an external pump required to completely fill the cuvette

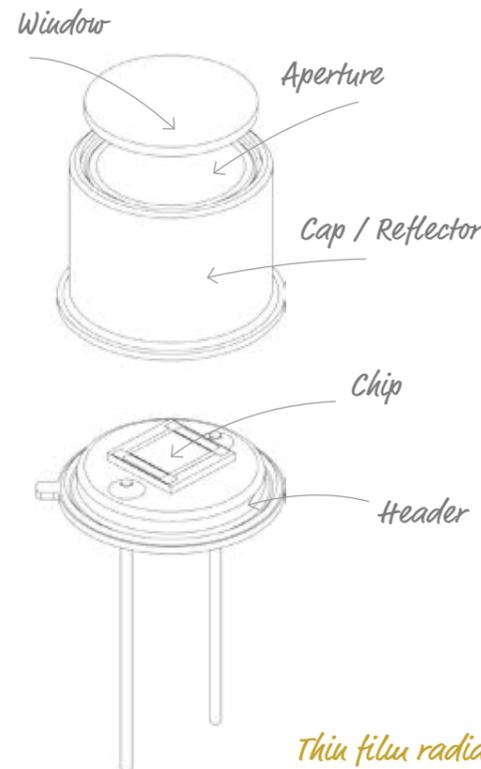


Micro-Hybrid Numerical code

Thin film radiation sources

With this numerical code you can easily choose the right combination of source parts according to your applications demands.

➤ For Example
JSIR350-4-AL-C-D5.8-0-0



Thin film radiation source

JSIRAAA-

JSIR350-4-...
Thin film radiation source

B-

JSIR350-4-...
Chip
 4 – Supreme chip active area square 2.2 x 2.2 mm²
 5 – Supreme chip active area square 0.8 x 0.65 mm²
 JSIR450-... no chip

CC-

JSIR350-4-AL-C-D5.8-0-0
Header
 AL – T039
 BL – T046
 CB – SMD housing (for chip 4)
 CS – SMD housing (for chip 5)

D-

JSIR350-4-AL-C-D5.8-0-0
Cap
 0 – None
 C – Cap
 R – Reflector

EEE-

JSIR350-4-AL-C-D5.8-0-0
Aperture
 S5.0 – Square 5 x 5 mm² (only with body CB)
 S2.8 – Square 2.8 x 2.8 mm² (only with body CS)
 D2.4 – Diameter 2.4 mm (in combination with body BL)
 D3.7 – Diameter 3.7 mm (only body AL)
 D5.8 – Diameter 5.8 mm (only body AL)
 D6.0 – Diameter 6 mm (only with reflector)

F-

JSIR350-4-AL-C-D5.8-0-0
Filling gas
 Kr – Krypton
 N₂ – Nitrogen
 Other filling gases on customers request.

GG

JSIR350-4-AL-C-D5.8-0-0
Window
 0 – None
 A1 – Sapphire
 A2 – Calcium fluoride
 A3 – Germanium
 A4 – Barium fluoride
 A5 – Silicone ARC 2 – 12 μm
 A6 – Silicium 3 – 7 μm
 More information and filters see filter application note.

III

Hermetic Seal
 I – Hermetically sealed by soldered window (Only with cap and filter A1, A3, A5, A6) Unspecified; Window glued to cap



IR sources product range

Type	Function principle	Active area [mm ²]	Cut off freq. [Hz]	Housing	Design	Window/Filter	Filling gas
JSIR350-4-AL-C-D5.8	Thin film	2.2 x 2.2	8	T0 39	cap	available	available
JSIR350-4-AL-R-D6.0	Thin film	2.2 x 2.2	8	T0 39	reflector	available	available
JSIR350-4-CB-0-S5.0	Thin film	2.2 x 2.2	8	SMD	open	on request	none
JSIR350-5-BL-C-D2.55	Thin film	0.65 x 0.8	9	T0 46	cap	available	available
JSIR350-5-BL-R-D3.6	Thin film	0.65 x 0.8	9	T0 46	reflector	available	available
JSIR350-5-CS-0-S2.8	Thin film	0.65 x 0.8	9	SMD	open	on request	none
JSIR450-AL-C-D3.7	Spiral wound	2.2 dia	0.3	T0 39	cap	available	available
JSIR450-AL-R-D6.0	Spiral wound	2.2 dia	0.3	T0 39	reflector	available	available

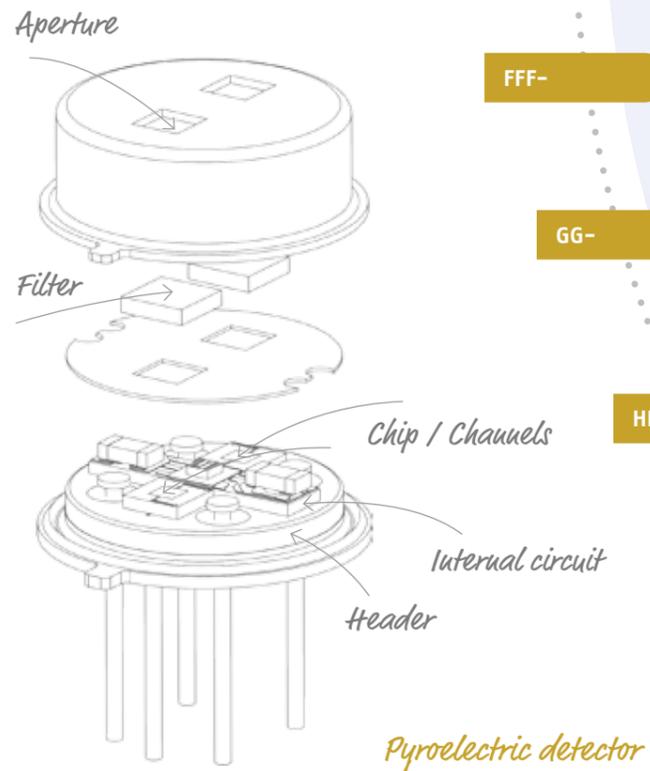
For more information contact our sales team by Email to infrared@micro-hybrid.de or call +49 36601 592-0

Micro-Hybrid Numerical code

Pyroelectric detectors

With this numerical code you can easily choose the right combination of detector parts according to your applications demands.

➤ For Example
PS2x1C8-A-S1.5-Kr-E1/D1



- AA-** PS2x1C8-...
Pyroelectric sensor
- Bx** PS2x1C8-...
Channel 1-4
- C** PS2x1C8-...
Chip
 - 1 - PZT pyro chip; absorber size square 0.8 x 0.8 mm²
 - 2 - PZT pyro chip; absorber size square 0.7 x 0.325 mm²
 - 3 - PZT pyro chip; absorber size square 1.65 x 1.65 mm²
 - 4 - PZT pyro chip; absorber size square 1.15 x 1.15 mm²
- DD-** PS2x1C8-A-S1.5-Kr-E1/D1
Internal circuitry
 - V1 - voltage mode with JFET
 - C2 - current mode with low noise op amp and 10 GOhm feedback resistor
 - C8 - current mode with low noise op amp and 100 GOhm feedback resistor
- E-** PS2x1C8-A-S1.5-Kr-E1/D1
Header
A - T039
- FFF-** PS2x1C8-A-S1.5-Kr-E1/D1
Aperture
 - S1.5 - Square 1.5 x 1.5 mm²
 - D3.7 - Diameter 3.7 mm
- GG-** PS2x1C8-A-S1.5-Kr-E1/D1
Filling gas
 - Kr - Krypton
 - N₂ - Nitrogen
 - Other filling gases on customers request.
- HH/HH/HH/HH** PS2x1C8-A-S1.5-Kr-E1/D1
Filter
 - D1 - Reference (4000 - 80 nm)
 - E1 - CO₂ (4265 - 120 nm)
 - F1 - CO (4650 - 180 nm) ...
 - Other filter on customers request.



Pyroelectric detectors product range

Type	Channels	Mode	Supply	Optimal freq. [Hz]	Responsivity [V/W]	D* [cmHz ^{1/2} /W]	Aperture [mm ²]	Application
PS2x1C2-A-S1.5	2	Current	Bipolar	2 ... 55	175,000	2.8 x 10 ⁸	1.5 x 1.5	NDIR gas analysis
PS1x1C2-A-S1.5	1	Current	Bipolar	2 ... 55	175,000	2.8 x 10 ⁸	1.5 x 1.5	NDIR gas analysis
PS4x2C1-A-S1.4	4	Current	Bipolar	3 ... 25	125,000	1.7 x 10 ⁸	1.4 x 1.4	NDIR gas analysis
PS2x1C8-A-S1.5	2	Current	Bipolar	1 ... 12	1,100,000	5.5 x 10 ⁸	1.5 x 1.5	NDIR gas analysis
PS1x1C8-A-S1.5	1	Current	Bipolar	1 ... 12	1,100,000	5.5 x 10 ⁸	1.5 x 1.5	NDIR gas analysis
PS2x4V1-A-S1.5	2	Voltage	Unipolar	0.2 ... 3	950	2.09 x 10 ⁸	1.5 x 1.5	NDIR gas analysis
PS1x4V1-A-S1.5	1	Voltage	Unipolar	0.2 ... 3	950	2.09 x 10 ⁸	1.5 x 1.5	NDIR gas analysis

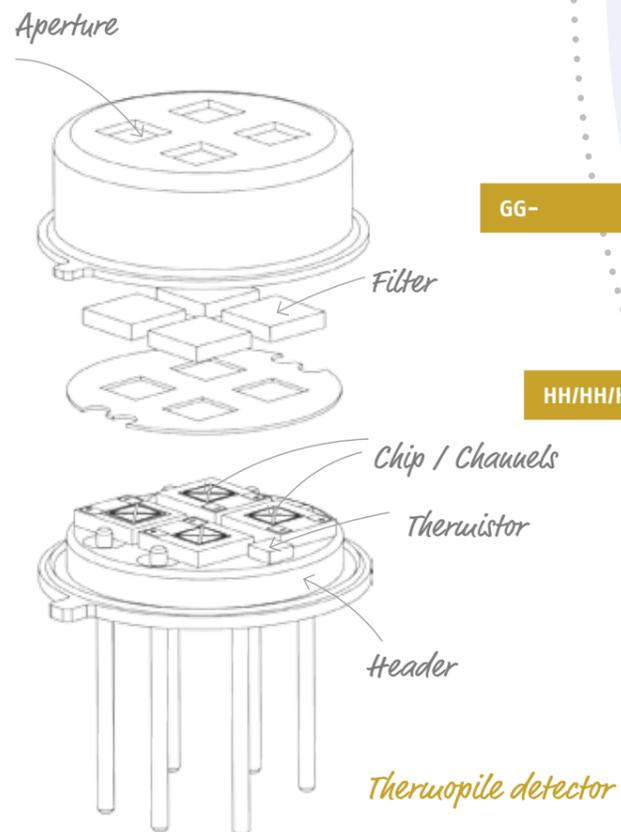
For more information contact our sales team by Email to infrared@micro-hybrid.de or call +49 36601 592-0

Micro-Hybrid Numerical code

Thermopile detectors

With this numerical code you can easily choose the right combination of detector parts according to your applications demands.

➤ For Example
TS4x200B-A-S1.5-1-N2-C1/F1/G1/D1



- AA** TS4x200B...
Thermoelectric sensor
- Bx** TS4x200B...
Channel 1-4
- CCCC-** TS4x200B-...
Chip 80B, 200B, Q200B
- D-** TS4x200B-A...
Header A - T0 39
 B - T0 46
- EEEE-** TS4x200B-A-S1.5-1-N2-C1/F1/G1/D1
Aperture
 S1.5 - Square 1.5 x 1.5 mm²
 D2. - Diameter 2.4 mm²
 D3.55 - Diameter 3.55 mm²
- F-** TS4x200B-A-S1.5-1-N2-C1/F1/G1/D1
Thermistor
 0 - None
 1 - PTC Ni1000
 2 - NTC 30k
 3 - NTC 100k
 4 - TRS-Si 1K 0.5%
- GG-** TS4x200B-A-S1.5-1-N2-C1/F1/G1/D1
Filling gas
 Kr - Krypton
 N₂ - Nitrogen
 Other filling gases on customers request.
- HH/HH/HH/HH-** TS4x200B-A-S1.5-1-N2-C1/F1/G1/D1
Filter
 D1 - Reference (4000 - 80 nm)
 E1 - CO₂ (4265 - 120 nm)
 F1 - CO (4650 - 180 nm) ...
 Other filter on customers request.
- III** **Extended temperature range**
 190 - max. 190 °C; only available with two channel and sensor chip 80B
 Unspecified; max. 85 °C



Thermopile detectors product range

Type	Channels	Responsivity [V/W]	D* [cmHz ^{1/2} /W]	Aperture [mm ²]	Operation temp. [°C]	Housing	Application
TS1 x 200B-A-D3.55	1	100	3.6 x 10 ⁸	3.55 dia	-20 ... +70	T039	NDIR gas analysis
TS1 x 200B-B-D2.4	1	100	3.6 x 10 ⁸	2.4 dia	-20 ... +70	T046	NDIR gas analysis
TS1 x 80B-A-D0.75- ... -190	1	295	7.2 x 10 ⁸	0.75 dia	-20 ... +190	T039	NDIR gas analysis/ Temp. measurement
TS2 x 200B-A-S1.5	2	100	3.6 x 10 ⁸	1.5 x 1.5	-20 ... +70	T039	NDIR gas analysis
TS4 x 200B-A-S1.5	4	100	3.6 x 10 ⁸	1.5 x 1.5	-20 ... +70	T039	NDIR gas analysis
TS4 x Q200B-A-S1.5	4	80	2.95 x 10 ⁸	1.5 x 1.5	-20 ... +70	T039	NDIR gas analysis

For more information contact our sales team by Email to infrared@micro-hybrid.de or call +49 36601 592-0



FLAME DETECTION

Instant fire and flame detection

safety for life and health

Safety for health and life as well as for all other values is the first demand in all industrial process meanings. Fire detection in all industrial buildings, storages etc. by IR flame detectors is an indispensable safety requirement. For secure building fire protection IR flame detectors guarantee immediate reaction in hazardous situations to prevent fire caused damages.

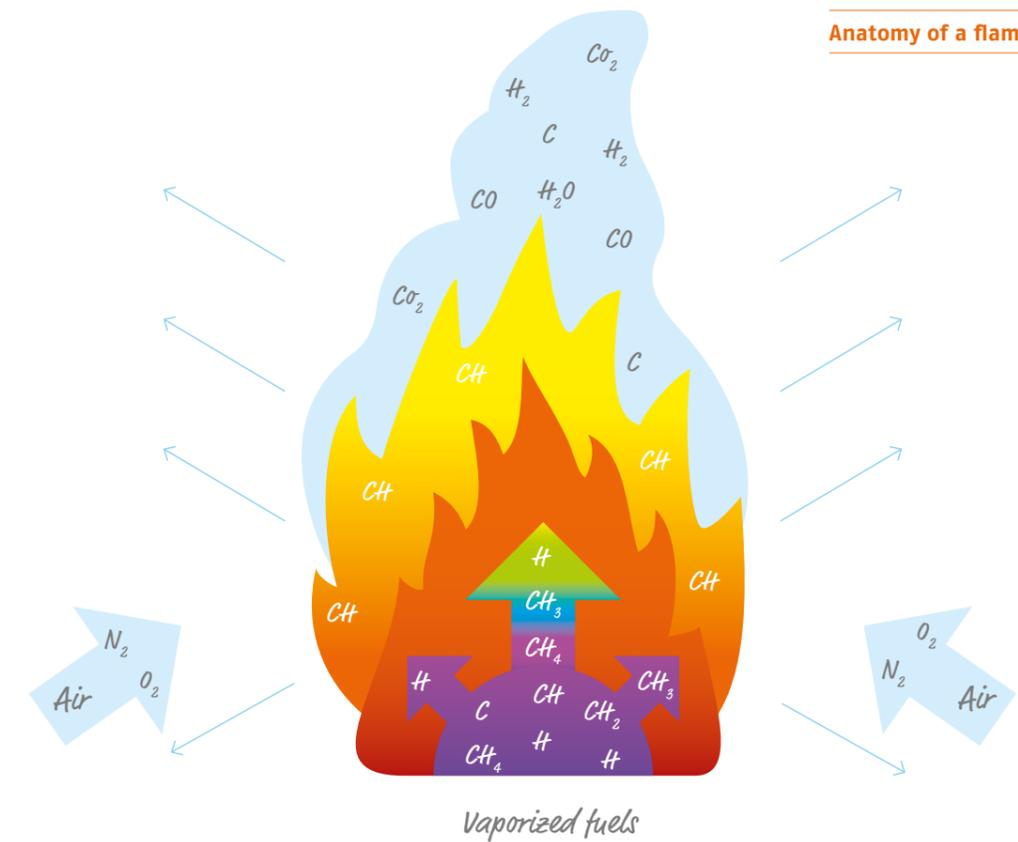
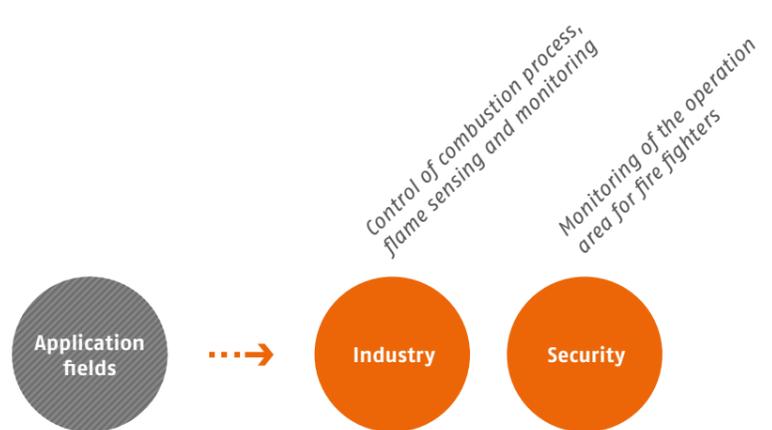
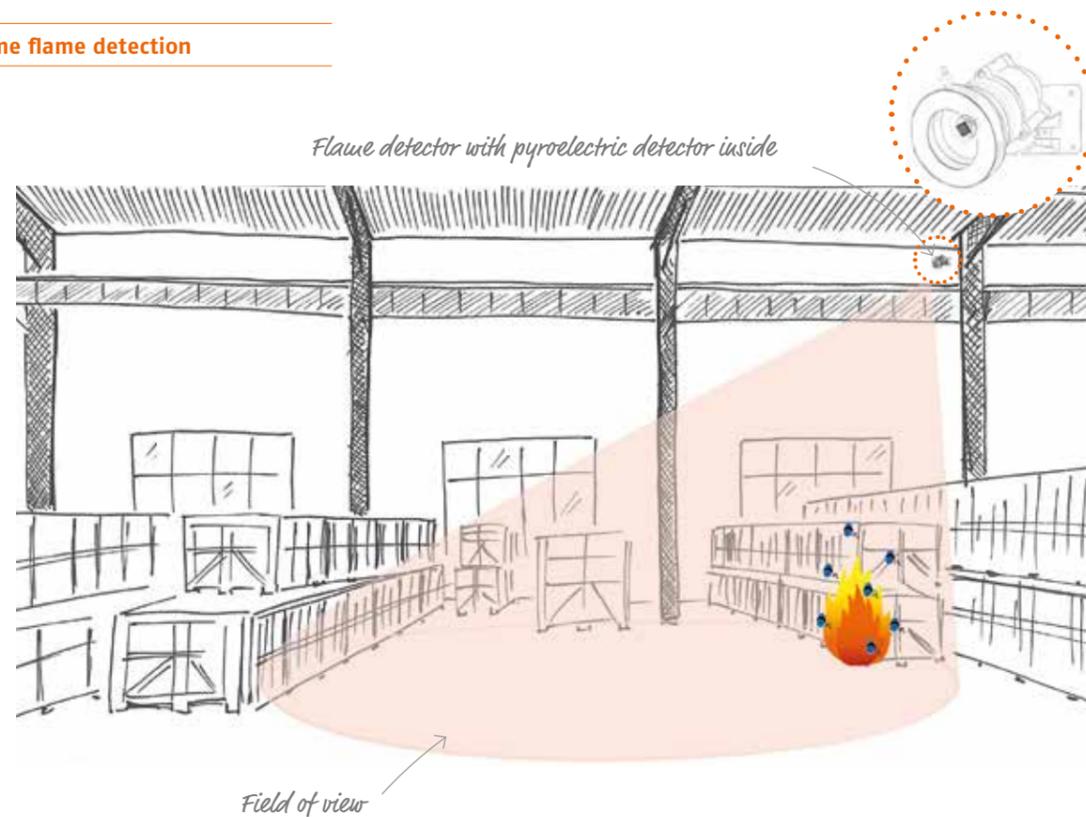
+ Advantages

In house fire detection

Fast and reliable measurement even in smoky rooms and over large distances

Detecting different flame features like heat, gases (CO₂, CO) or flicker frequency

Scheme flame detection



Flame caused fumes, smoke, steam, heat and light radiation. The resulting gases CO and CO₂ are detectable as well as the flames flicker frequency.

Product recommendation

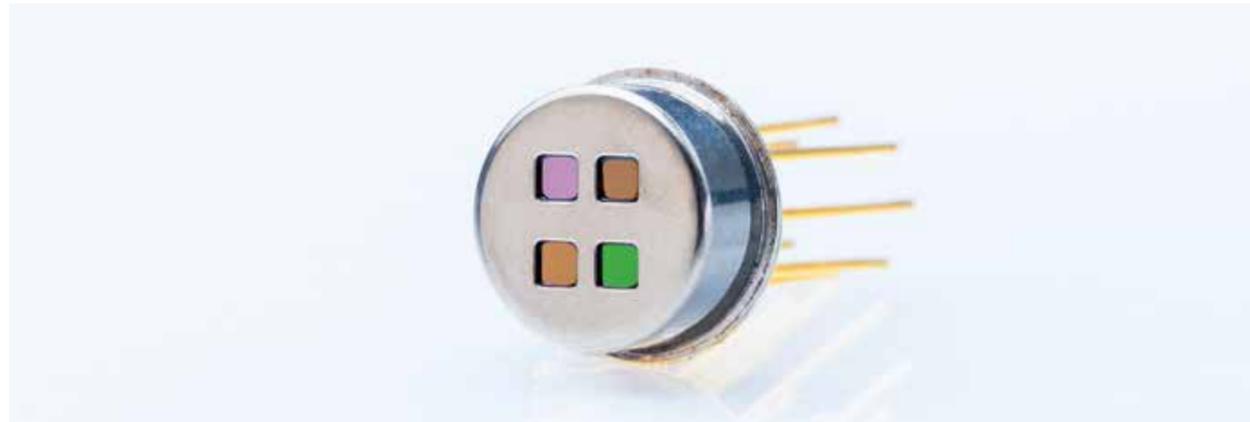
Micro-Hybrid pyroelectric detectors are especially long-term stable and available in four chip sizes and two operating modes.

➤ Order individual product samples: <http://finder.micro-hybrid.de>

Type	Features
PS1 x 3C2	High sensitivity
PS1 x 1C2	Large field of view for wide angles
PS1 x 1C8	Large field of view for wide angles
PS1 x 4V1	Voltage mode

For more information contact our sales team by **Email** to infrared@micro-hybrid.de or call **+49 36601 592-0**

Pyroelectric detectors



Micro-Hybrid's pyroelectric detectors are powerful thermal infrared detectors with excellent long term stability.

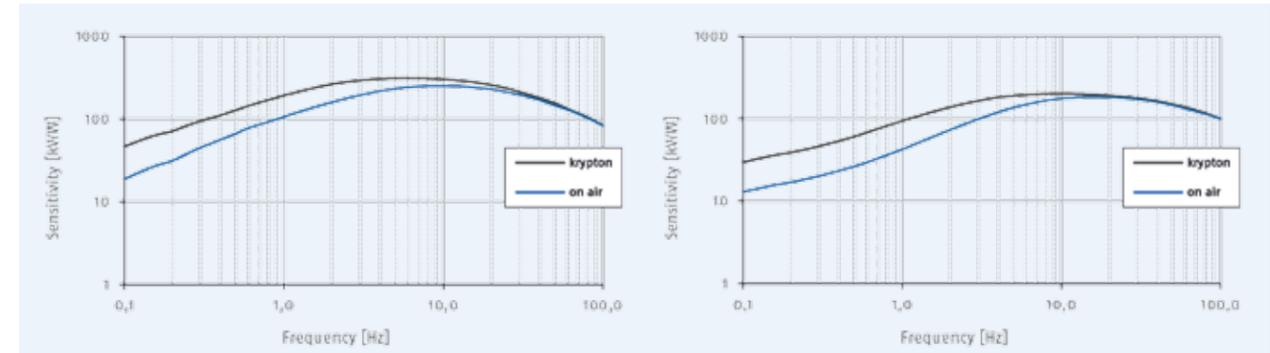
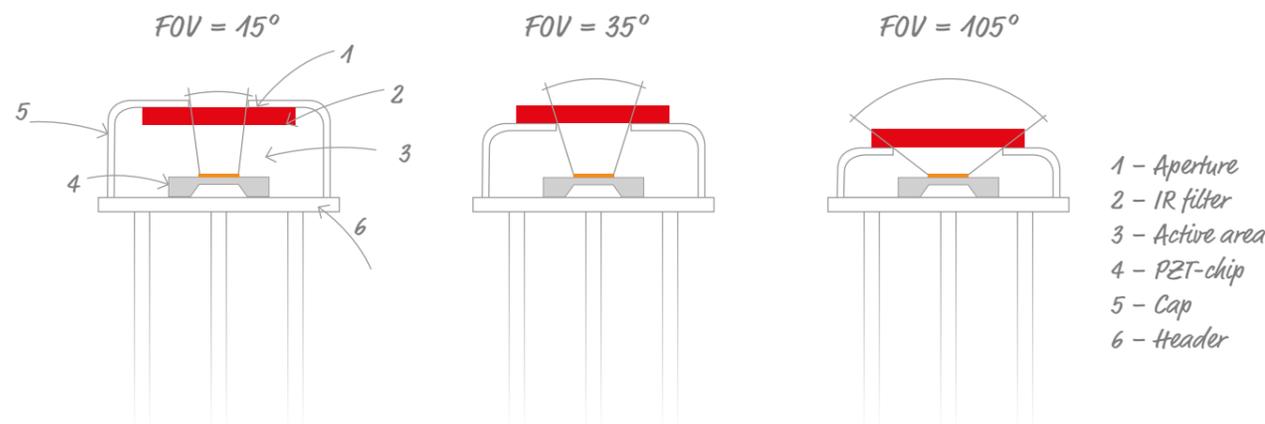
These sensors detect the typical spectral emission of burning material like wood, oil or plastics. The NDIR gas analysis represents another application field of pyroelectric sensors.

Infrared radiation impinges the sensors' active area. Due to the pyroelectric effect, the so caused effective change of temperature generates charge carriers on the electrodes.

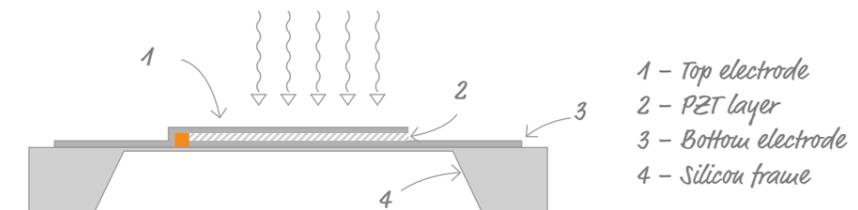
Unlike most competitors' LiTaO₃ chip, Micro-Hybrid's pyroelectric detectors use sensitive elements based on MEMS technology. The pyroelectric element consists of a ~ 1 µm thick PZT thin film mounted on a modified Si-based membrane which is produced by a DRIE back-etch process. The front electrode is optically transparent allowing infrared radiation to be absorbed by the active area. This area has a broad absorption range from 1 – 25 µm.

+ Advantages

- MEMS based PZT membrane
- Broad spectral sensitivity 1 – 25 µm
- High modulation frequency 200 Hz
- Low microphone effect referring to low membrane mass
- Very low temperature dependence
- Low thermal drift
- No cooling needed



sensitivity behavior over the frequency range of PS1x3C2 (left); PS1xC2 (right) with different backfill gases



Cap	Aperture	FOV	Filter position
H217	3.7 mm	104.6°	outside
H217	1.5 mm	34.7°	outside
M001	3.7 mm	76.2°	inside
M001	1.5 mm	21.5°	inside

Mode	Voltage	Current		
Sensitive area [mm ²]	1.15 x 1.15	0.8 x 0.8	0.7 x 0.325	1.65 x 1.65
Responsivity* [V/W]	950	175,000	125,000	275,000
Detectivity [cm x Hz ^{1/2} / W]	2.09 x 10 ⁸	2.2 x 10 ⁸	1.7 x 10 ⁸	4.32 x 10 ⁸
Optimal frequency [Hz]	0.2 ... 3	2 ... 55	3 ... 25	1 ... 25
Channel	1	1	1	1

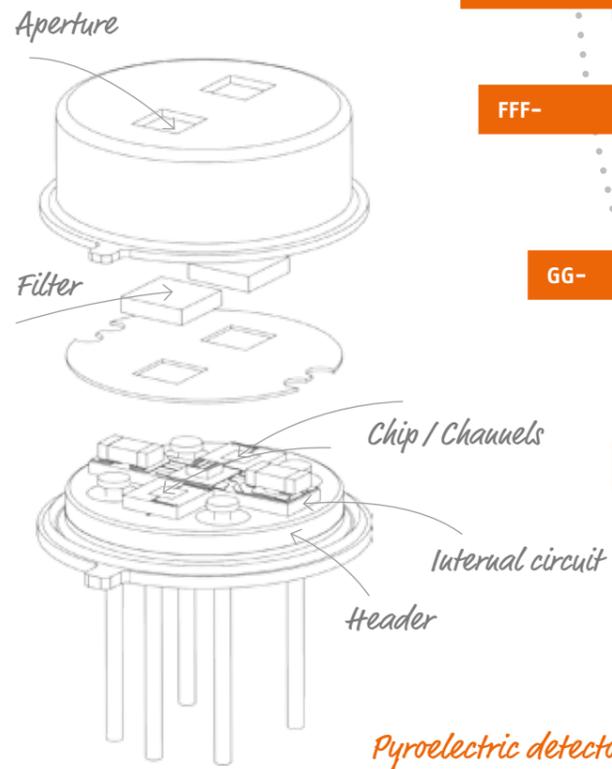
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Micro-Hybrid Numerical code

Pyroelectric detectors

With this numerical code you can easily choose the right combination of detector parts according to your applications demands.

➤ For Example
PS2x1C8-A-S1.5-Kr-E1/D1



AA- PS2x1C8-...
Pyroelectric sensor

Bx PS2x1C8-...
Channel 1-4

C PS2x1C8-...
Chip
1 - PZT pyro chip; absorber size square 0.8 x 0.8 mm²
2 - PZT pyro chip; absorber size square 0.7 x 0.325 mm²
3 - PZT pyro chip; absorber size square 1.65 x 1.65 mm²
4 - PZT pyro chip; absorber size square 1.15 x 1.15 mm²

DD- PS2x1C8-A-S1.5-Kr-E1/D1
Internal circuitry
V1 - voltage mode with JFET
C2 - current mode with low noise op amp and 10 GOhm feedback resistor
C8 - current mode with low noise op amp and 100 GOhm feedback resistor

E- PS2x1C8-A-S1.5-Kr-E1/D1
Body
A - T039

FFF- PS2x1C8-A-S1.5-Kr-E1/D1
Aperture
S1.5 - Square 1.5 x 1.5 mm²
D3.7 - Diameter 3.7 mm

GG- PS2x1C8-A-S1.5-Kr-E1/D1
Filling gas
Kr - Krypton
N₂ - Nitrogen
Other filling gases on customers request.

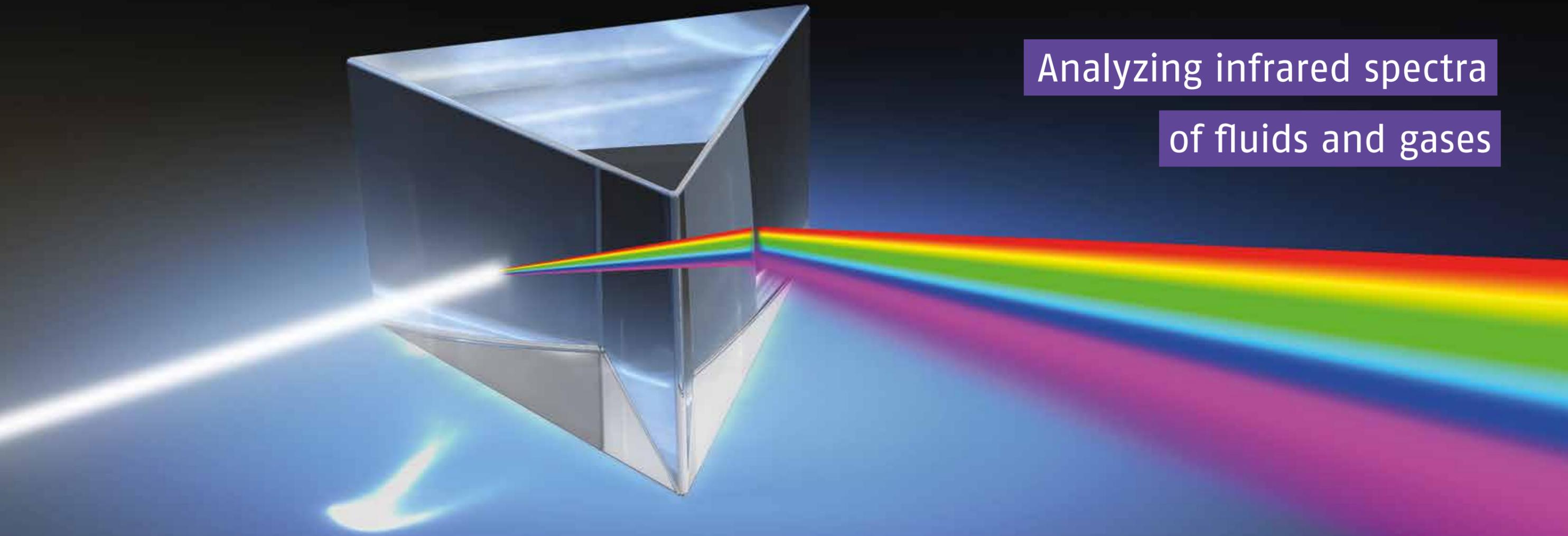
HH/HH/HH/HH Filter
A1 - Sapphire
A2 - Calcium fluoride
A3 - Germanium (ARC 2 - 16 μm)
C1 - Flame detection (4300 nm)
For all filters and more information see filter application note. Other filters on customers request.



Pyroelectric detectors product range

Type	Channels	Mode	Supply	Optimal freq. [Hz]	Responsivity [V/W]	D* [cmHz ^{1/2} /W]	Aperture [mm ²]	Application
PS1x3C2-A-D3.7	1	Current	Bipolar	1 ... 25	275,000	4.32 x 10 ⁸	3.7 dia	Flame detection
PS1x1C2-A-D3.7	1	Current	Bipolar	2 ... 55	175,000	2.8 x 10 ⁸	3.7 dia	Flame detection
PS1x1C8-A-D3.7	1	Current	Bipolar	1 ... 12	1,100,000	5.5 x 10 ⁸	3.7 dia	Flame detection
PS1x4V1-A-D3.7	1	Voltage	Unipolar	0.2 ... 3	950	2.09 x 10 ⁸	3.7 dia	Flame detection

For more information contact our sales team by Email to infrared@micro-hybrid.de or call +49 36601 592-0



Analyzing infrared spectra
of fluids and gases

IR spectrometers are one of the most important instruments for observing vibrational spectra due to the absorption bands of molecules in a wide wavelength range. The most widely used spectral region is the mid-infrared that extends from about 2.5 to 15 μm .

The technique is used in lot of fields e.g. biomedical applications, pharma industry, environmental analysis and chemistry. IR spectra deliver a unique fingerprint of substances and it's possible to identify functional groups and find slightly contaminations in a substance. To evaluate and process the IR spectra a lot of databases and multivariate methods exist and make this method very powerful. Even more the IR spectra of a substance can be used for quantitative analysis.

One application of IR-spectral measurements is to investigate tissues close to the cellular level. It is possible to determine the bio-distribution of molecules and get information about proteins, peptides, lipids and carbohydrates. The big advantage is: all that can be done without any pre-treatment, it's marker free and it opens the way for parallel analysis of various medical parameters. It became more and more important to get fast reliable results for point of care analysis outside a lab. For example IR spectroscopy can be used to monitor metabolites bedside. Studies show that IR devices can be used for blood integrant monitoring. Especially for critically ill patients but also for diabetic patients it can be used to improve their therapy.

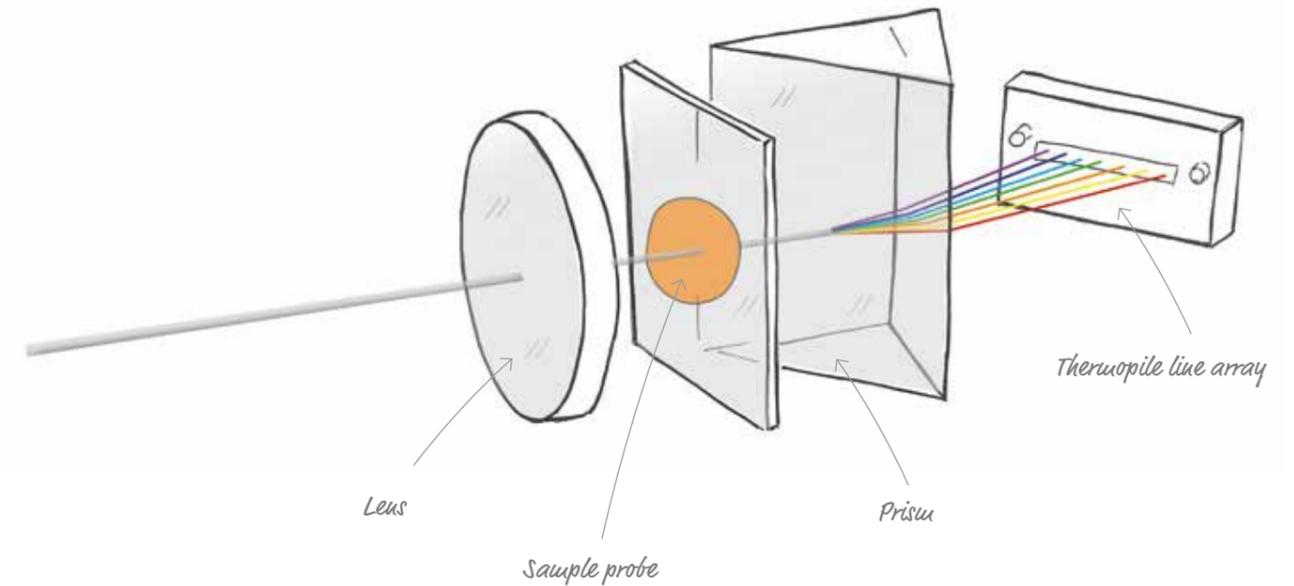
Another environmental application is the condition monitoring of fluids. Clean and standardized lubricants are essential for a faultless production process.

Corrosion and wear cause surface degradation of the lubricated surfaces in machinery and most mechanically induced equipment downtime. Infrared spectroscopy is one of the most powerful methods to analyze oil and lubricants. Machine condition monitoring provides early indications of equipment wear mechanisms and identifies the root causes of corrosion. By monitoring oil for contamination, changes in chemistry and the presence of abnormal machinery wear particles and debris; operators get the information they need to properly maintain their equipment. The condition monitoring of technical fluids and gases is a fundamental key challenge for the success of ongoing efforts to save valuable fossil resources like oil and gas and to protect our environment in the future. It is a prerequisite for an optimized utilization of raw materials and in this context essential for a cost efficient production of goods in the entire industry.

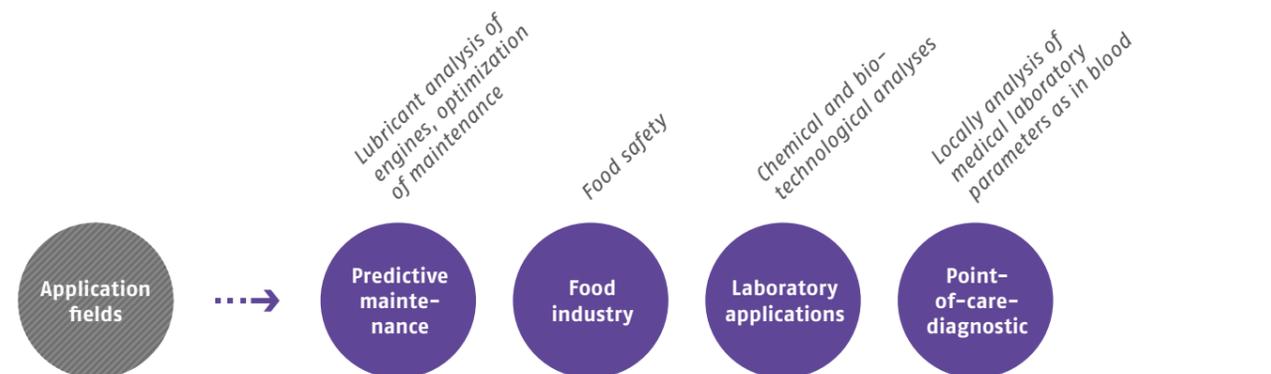
State of the art IR spectrometers working with an interferometer and via Fourier transformation the IR spectra is calculated. This technique is called FTIR spectroscopy. The most instruments are large and are used for stationary applications in the lab e.g.

To collect and analyze data in the field hand-held devices are practicable. As a result there is a substantial need for robust, cost efficient and also portable measurement devices for point of care analyses and condition monitoring in our environment. Capitalizing on the advantages of the 64-pixel line array TPL 640, it is possible to build up dispersive infrared spectrometers which have the desired properties.

Scheme IR spectroscopy



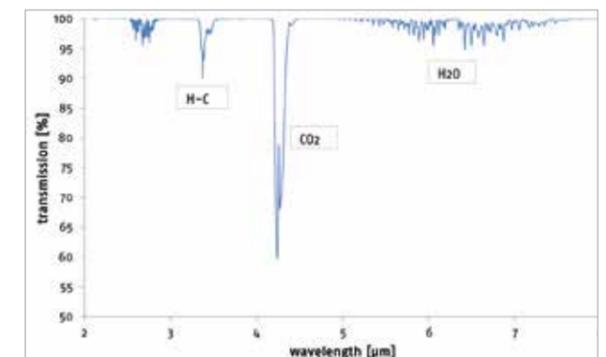
Micro-Hybrids thermopile line array TPL 640 is an outstanding device for spectroscopy applications.



Product recommendation

For condition analysis in harsh environments, point of care analysis and biomedical and biochemical applications the dispersive infrared spectroscopy with line arrays is the method of choice. Micro-Hybrid's Thermopile Line Array TPL 640 is an outstanding device for spectroscopy applications.

For more information contact our sales team by Email to infrared@micro-hybrid.de or call +49 36601 592-0



Thermopile line array TPL 640



64-pixel thermopile line array

The **64-pixel thermopile line array** detects infrared radiation and converts it to an analog voltage signal. Important parameters such as high sensitivity and specific detectivity of each pixel are top values in comparison to other similar products on the market.

The excellent spectral range of sensitivity from 2 – 16 μm allows various applications. Special absorption layers can be established according to the specific requirements of the application.

Features

64 independent thermopile chips in a single line

Wide range window 2 – 16 μm

Main application: infrared spectroscopy of fluids and gases

Sensitivity up to 155 V/W ^{*1}

High precision housing to adapt optics

Filled with inert gas

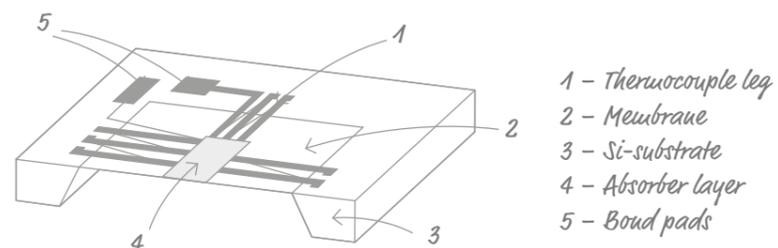
NEP only 0.08 nW/Hz ^{*1}

Low crosstalk of the line chip given by thermal separated pixels ^{*1}

Detectivity typ. $1.08 \times 10^9 \text{ cm} \times \text{Hz}^{1/2} / \text{W}^{1/2}$

^{*1} depends on inert gas / vacuum

^{*2} on air without windows, Blackbody T=500 K; E=38 W/m²; at T_{amb}=25 °C; filling gas Xenon, assumed window transmission



schematic illustration of the construction of a thermopile chip



Analysis of lubricants to detect degradation in heavy gear oil or for other spectroscopic applications

The process of hermetical sealing enables us to fill our components and modules with different inert gases.

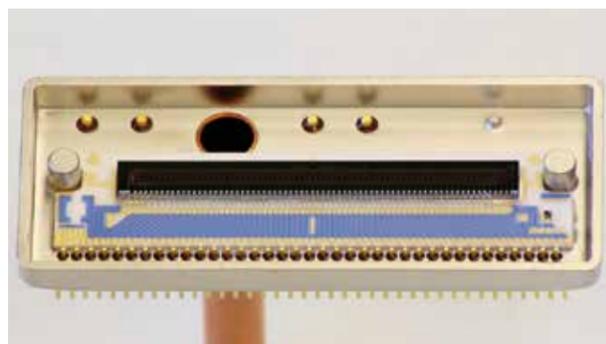
Different gases influence electrical parameters like sensitivity and time constant of thermopile detectors by changing thermal conductivity.

	Air	Xenon	Vacuum
Sensitivity [V/W]	45	155	245
Time constant [ms]	37	110	154
Crosstalk [%]	38	25	0.4

We are pleased to talk to you about the adaption of parameters needed for your application.



Micro assembly of thermopile line array TPL 640



Thermopile line array TPL 640 without cap

Order information

Thermopile array TPL640Xe-Ge 2-16 Art.-Nr. 7102.02-A.00

For more information contact our sales team by Email to infrared@micro-hybrid.de or call +49 36601 592-0

➤ CUSTOMER SPECIFIC IR

Modification range to customize
IR components and systems
just the way you need

Modifications of IR sources

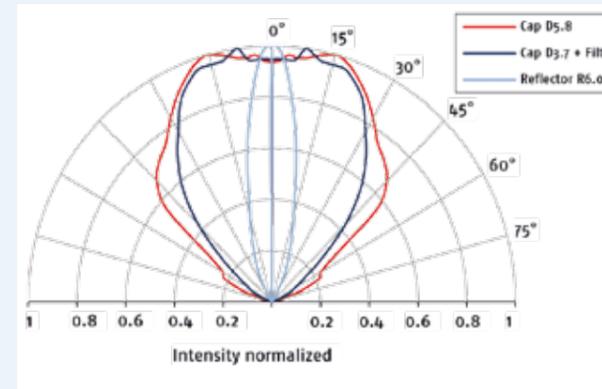
Many process relevant gases are detectable by NDIR gas measuring systems.

The performance of all participant IR components is essential for the preciseness of all measurement results. Therefore a powerful, broadband emitting radiation source is of central importance. Due to high membrane temperature and Planck similar radiation Micro-Hybrids IR sources are perfectly suitable for the use in NDIR gas analyses.

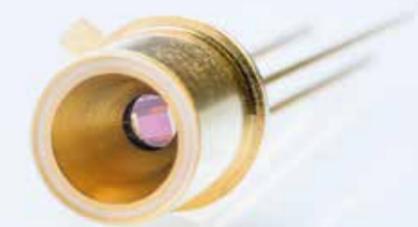
We can adapt chip size and the reflectors' geometry individually corresponding to application demands. The range of possible adaptations extends even more by the big variety of filters and protective gases.

Cap / Reflector

Micro-Hybrids IR sources are available either with cap or reflector. Compared to the cap, the reflector is characterized by a very small beam angle and collimates radiation. An up to ten times higher radiation intensity can be achieved. For perfect integration into the application we also offer to draw up customized reflectors.



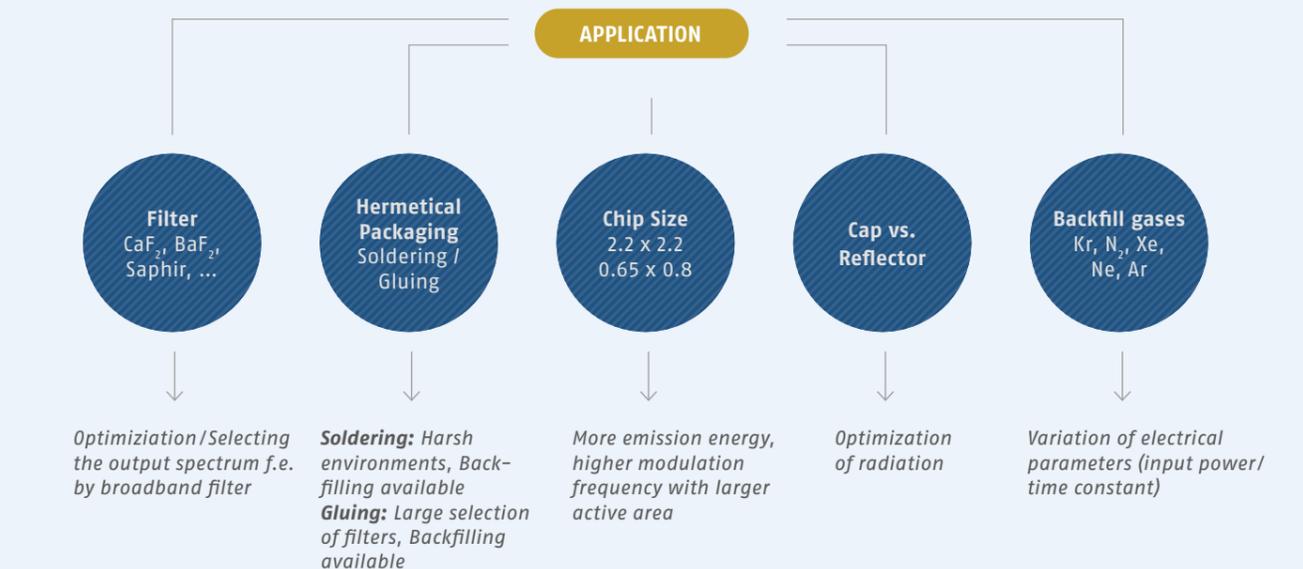
angular distribution of the JSIR 350 with large aperture cap (red) small aperture cap and window (blue) and with a reflector (light blue)



Hermetic sealing

Wavelength selective bandpass filters usually get attached to cap or reflector by gluing which may not exclude eventual permeability of diverse gases or outgassing of or for other spectroscopic applications. That's why we created a unique process of filter-cap-connection: Hermeseal.

The edge area of the filter is first metallized and then soldered hermetically to the cap or the reflector. The result is an IR source made for harsh environments. To influence additional parameters, inert gases can be used as backfilling.



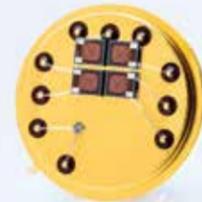
Modifications of thermopile detectors

One core component of infrared measurement technology is the thermopile detector. Micro-Hybrid produces multi-channel detectors based on thermo sensors for simultaneous measuring of up to 7 different gases.

This highest degree of adjustment is available by our deep value chain. To get to the optimal function of the measuring system, sub components like cap, socket, sensor chip and infrared filter can be adjusted specially to the application.

Sensor chip

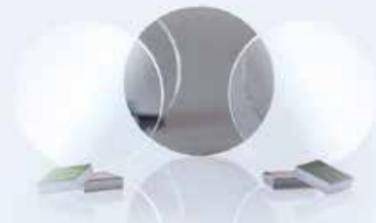
A sensor chip based on the thermocouple operation principle forms the base of each thermopile detector. Besides sensor chips for one- and multi-channel in gas analyzing applications we offer special chips for remote temperature measurement in separate measurement environment. Optional your detector can be equipped with an additional thermistor to display the housing temperature.



Four TS 200 chips on a TO 8 socket

Infrared filter

Big variety and complexity mark the application fields of infrared measurement technology. To ensure a reliable function of your measurement system it's essential to choose the right Infrared filter. We provide individual support and a very extensive portfolio for this sometimes tricky choice. This includes diverse infrared windows such as: CaF₂ or BaF₂, Cut on/off as well as bandpass filter.



Micro-Hybrid filter selection

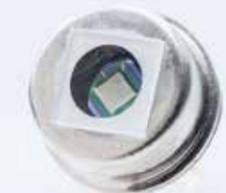
Modifications of pyroelectric detectors

Pyroelectric detectors differ in two operating modes: current mode and voltage mode. Both of them operate with external voltage supply and are suitable for diverse measurement tasks referring to their internal pre-amplification.

With its JFET base the voltage mode detector offers best performance within 0.1-10 Hz. Time constant and sensitivity of the current mode detector are adaptable to special demands by diverse feedback resistors.

Sensor chip

Similar to thermopile detectors the sensor chip is the core component of the pyro electrical detector. Our in different sizes and membrane thickness available PZT chips cover a wide area of applications: Large surface chips in voltage mode detectors are especially suitable for the use in flame detectors. Small chips in combination with operating amplifiers usually take action in multi-channel detectors for fast gas analyzing demands.



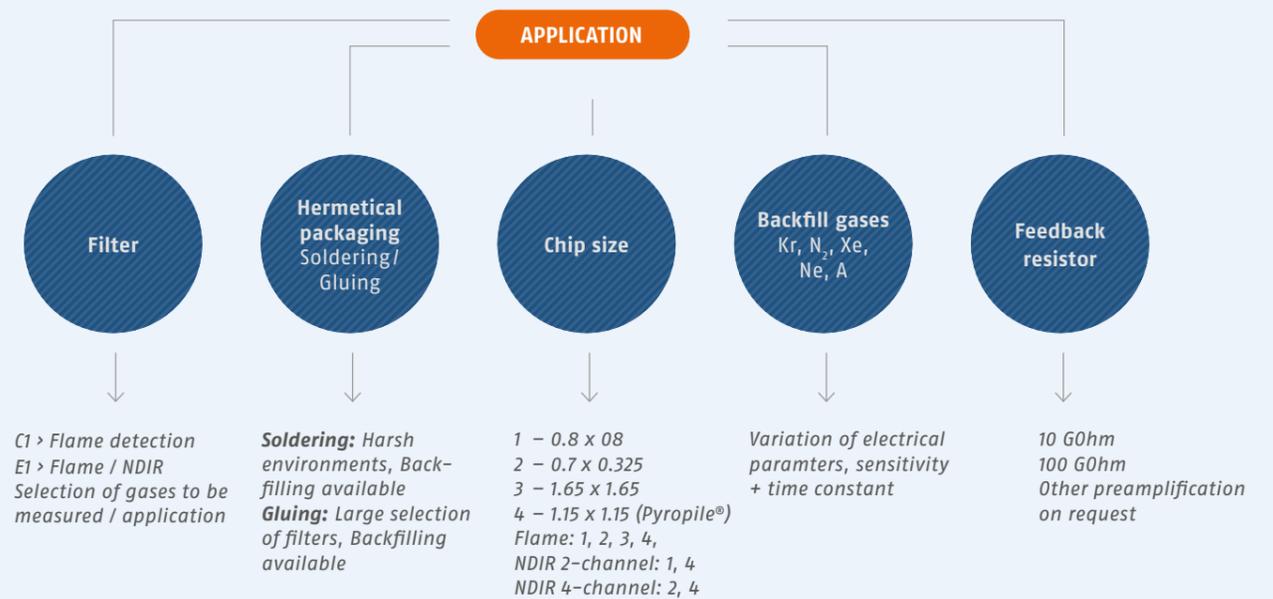
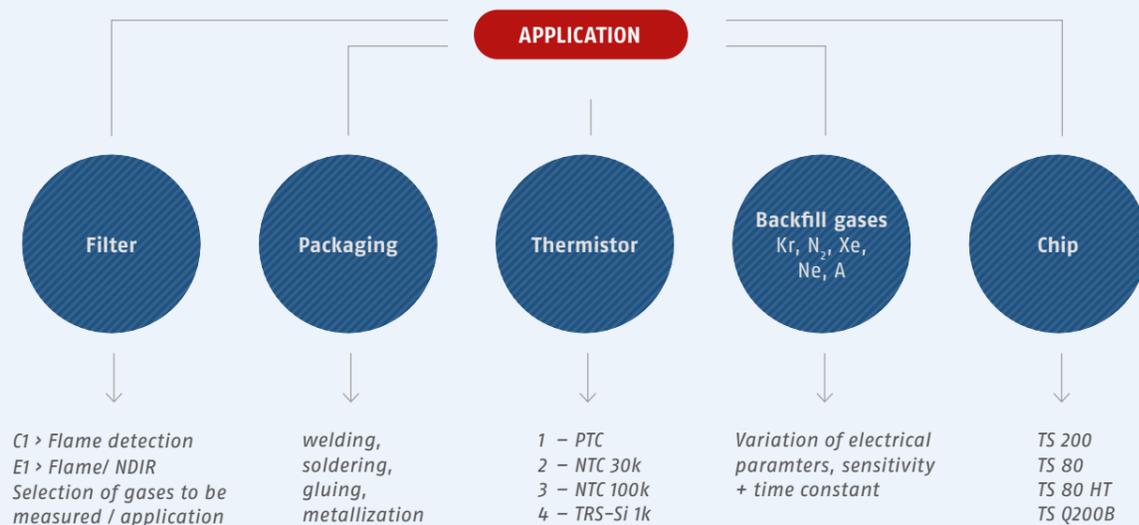
PS1x3C2 with CaF₂ window

Field of view (FOV)

Different applications may ask for very different demands to the detector such as field of view. Detectors with a large FOV are to be used for flame detection. For gas analysis a narrow FOV is needed. To achieve optimal performance we can adapt the FOV by the combination of sensor chip and TO cap with different apertures.



Different cap sizes with different apertures



Modifications for pyroelectric detectors

Focus on optimizing the
product performance for
tangible competitive advantages

Customized development of high-level infrared sensors and sensor systems

Especially for gas measurement applications

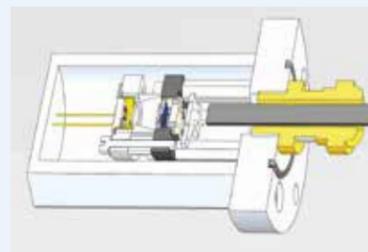
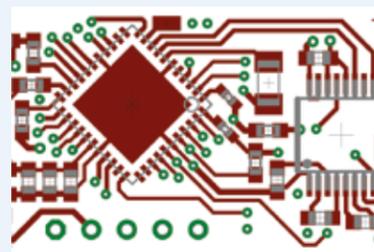
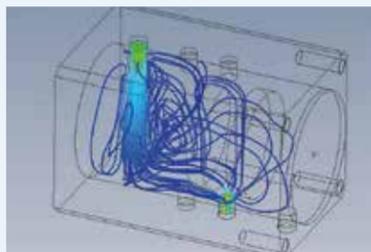


Within our application consulting we closely cooperate with you to find the perfect combination of technological options to realize the ideal sensor. In this way even such projects come true that cannot be realized on the basis of conventional production standards. Even harsh environments won't stop us.

Whether at the idea-finding, concept or product development phase – you can access the project at any stage of the development process. We synergistically combine our technological competencies in electronic and mechanical design, software engineering, optics, microelectronic packaging as well as simulation and test to perform the optimal customized solution.

For you to reach your goals, we are also able to adapt and further develop our existing technologies and processes as part of our process development.

Joint and cooperative projects with renowned universities and institutes regularly provide us with new impulses to extend our portfolio. A powerful team consisting of physicists, technologists, design engineers, hard- and software developers is awaiting your challenge!



Product development



- Mechanical 3D design and construction
- Flow and thermal simulation
- Analog and digital electronic hardware design and simulation
- Microcontroller and PC based software design and simulation
- Measurement systems for optical characterization and calibration
- Durability and reliability verification
- Statistical evaluation of all measurement results
- Customized housing and packaging

Test and measurement equipment



- Pyrometers and infrared cameras
- FTIR spectrometer with external input for IR sources
- Calibration black body up to 1200 °C
- Calibration systems for gas measurement
- Measurement equipment for electrical characterization and calibration
- Mechanical measurement/test
- AOI tests, optical measurements
- He leakage test for hermetically sealed components
- Burn-in-test for IR-sources

Laboratory



- Metallographic analyses
- Environment tests
- Fast temperature change
- High and low temperature storage (+300 °C; -70 °C)
- High humidity storage
- Mechanical vibration and acceleration
- Rapid prototyping of electronic and mechanical development samples
- Development of customized optical and electrical test equipment

FACTS & FIGURES



3 manufacturing sites in Germany
Headquarter – Hermsdorf



130 employees
A powerful team is awaiting your challenge!

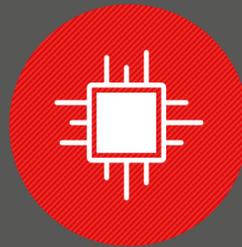


International sales:
> 500,000 IR detectors sold since 2004
> 50,000 IR sources sold since 2012
> 35,000 customized OEM modules sold since 2010

Business segments (2015)

ELECTRONIC MICRO-SYSTEMS

70 %



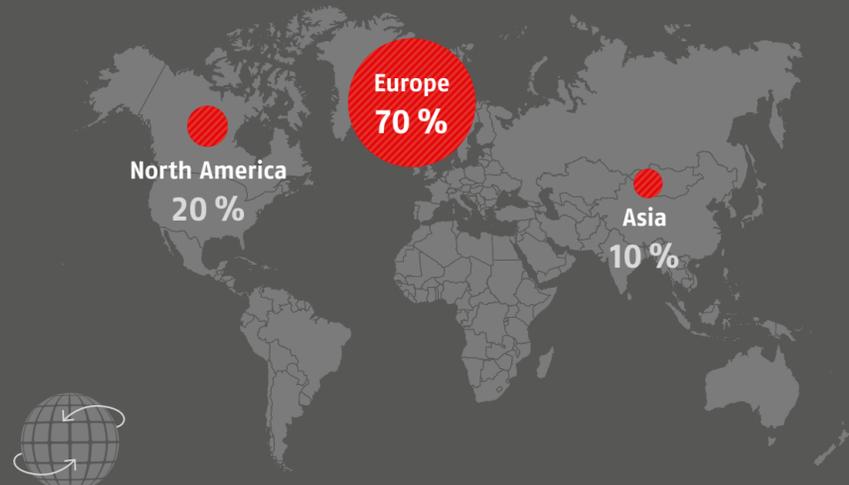
INFRARED COMPONENTS AND SYSTEMS

30 %

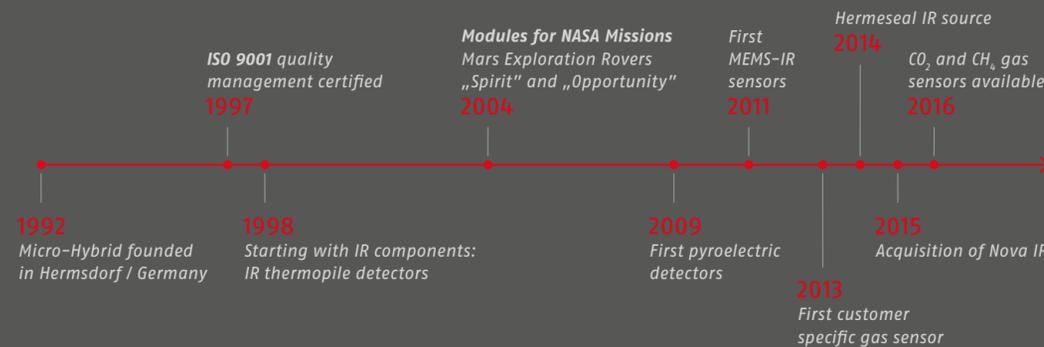


Enter New Space.

International sales 2015 – Over 15 Mill dollar worldwide



International distribution



5,000 qm production area

Majority owner of NOVA IR MEMS fab, Tuscon USA

5 mill investment in innovation and growth

Micro-Hybrid is part of Micro-Epsilon Group

www.micro-epsilon.de

*All technical data are based on simulations and tests
and subject to change without notice.*





INFRARED COMPONENTS AND SYSTEMS

International Sales

Worldwide availability of product portfolio

Order products on <http://finder.micro-hybrid.de> or contact us!

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