



INFRARED COMPONENTS AND NDIR GAS SENSORS

Micro-Hybrid | Product Catalog

Micro-Hybrid Electronic GmbH is a high tech company focused on micro systems and infrared components.

We develop customer specific mechanical microelectronics and infrared systems and are an internationally leader 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.

We are the inventor of **HermeSEAL®**.



Dear readers,

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

We are the leading manufacturer for infrared components and systems. Our focus is on our customers' needs. We want to thrill our customers with outstanding, innovative products. Our future will only be as successful if our products meet our customers' strict demands.

The outstanding **HermeseAL**® technology for harsh environments has already been established on the market with great success. In addition to this we created a wide range of innovative IR emitters providing the very highest levels of performance.

Micro-Hybrid JSIR sources are either NAC, C-MOSI® or black silicon MEMS based infrared emitters featuring true black body radiation characteristics. Moreover, the opportunity of backfilling with different gases increases their efficiency. Advanced IR emitter chips by our affiliate companies Nova IR and CMOS IR have made a decisive contribution to the breakthrough of these new technologies.

We offer **Economy, Premium and High-end IR emitters**. Customers in particular benefit from the available multitude of technology. As well as providing Micro-Hybrid standard products in our catalog, cost effective products can be developed for large volume OEM applications that are tailored to specific customers' requirements.

The very high accuracy of the measurement results is the decisive advantage of Micro-Hybrid IR detectors. With more than 20 years of experience in the development and production of IR components, Micro-Hybrid is one of the world's leading manufacturers of high-quality IR measurement systems.

We also moved our Incubator IR CO₂ sensor to a new level of outstanding performance in all respects. In summary, we develop and produce sensors and components with customer benefits for analyzing the concentration of a wide range of gases and fluids in various technical applications: **environmental & technical gases, refrigerants, anesthetic gases and fluids**.

I am absolutely certain that our products will improve your system. We invite you to join us in developing innovative solutions to generate significant competitive advantages for you, our valuable customer.

Supporting our customer's mission.

Stefan Dietl,
Director of Sales and Marketing



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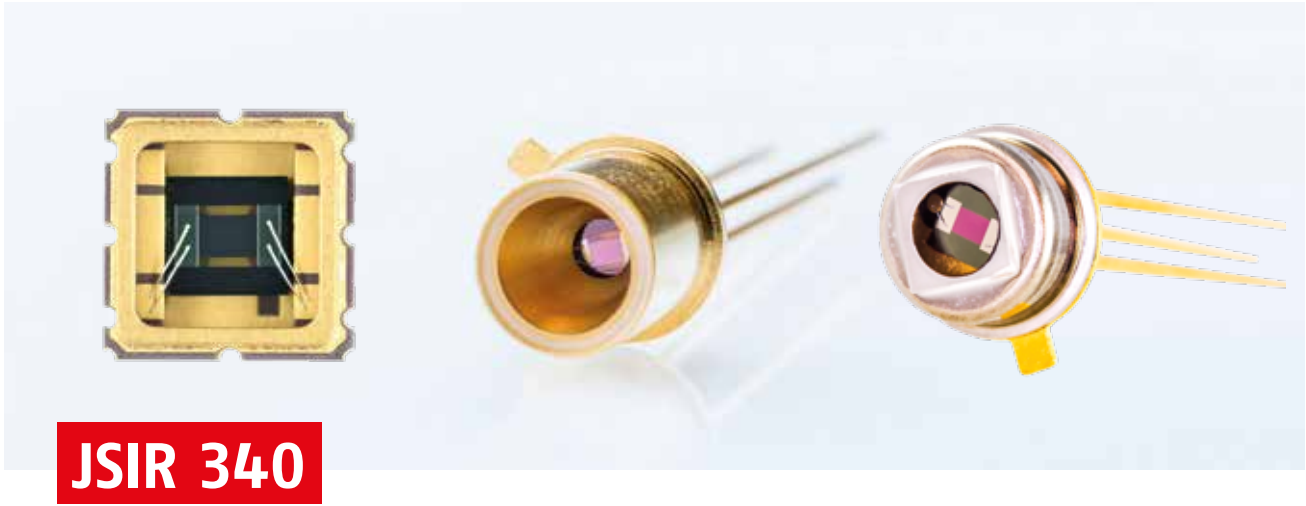


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➤ IR COMPONENTS AND GAS SENSORS Made by Micro-Hybrid

Our customers are facing challenges in IR measurement applications. We are supporting their mission.



JSIR 340

Economy MEMS C-MOSI[®] based infrared emitter for cost-effective high volume NDIR gas sensing applications like home & building automation.

The combination of MEMS technologies with CMOS compatible hot-plate resistance layer enables the production of high quality emitters in standard MEMS Fab production lines. This is the opener for high volume and cost sensitive applications. The emitter's MEMS chips with focus of cost efficiency and low thermal time constant are developed by our supplier CMOS IR. Despite the focus on mass production and mass production applications, the emitter impresses with its high radiant power at hot plate temperatures of up to 800° C and short time constants. JSIR 340 sources are available in different T0 packaging versions with cap or reflector. Different backfill gases in hermetically sealed housings create high energy efficient versions for hand-held applications. The focus on SMD packages enables an effective automatic assembly process for our customers.

GENERAL ARRANGEMENT

The MEMS chip used in our infrared emitters consists of a multi-layer hot plate membrane containing a high temperature stable metal CMOSI layer. The emitter chip is based on a silicon substrate with a back etched membrane. All thin film processes are conducted using standard MEMS processes and CMOS compatible materials. The active C-MOSI resistance layer is protected against aging effects and environment.



1 – Multi layer hot plate membrane containing CMOSI layer
2 – Bond pads
3 – Si frame and membrane

FEATURES

- Cost-efficiency components: standard MEMS technologies and CMOS compatible
- Effective automatic assembly process with SMD packages
- Hot-plate temperatures up to 800° C appropriate radiation output
- High modulation depth due to low thermal mass
- HermeSEAL[®] technology empowering application in harsh environments

APPLICATIONS

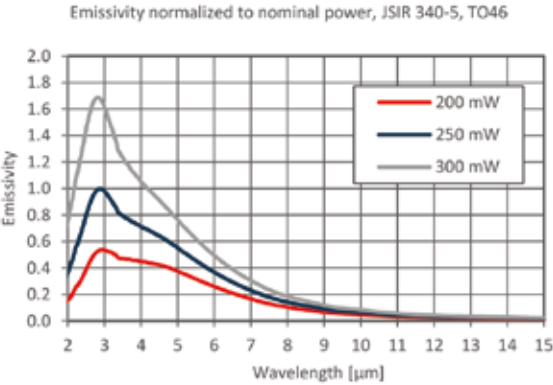
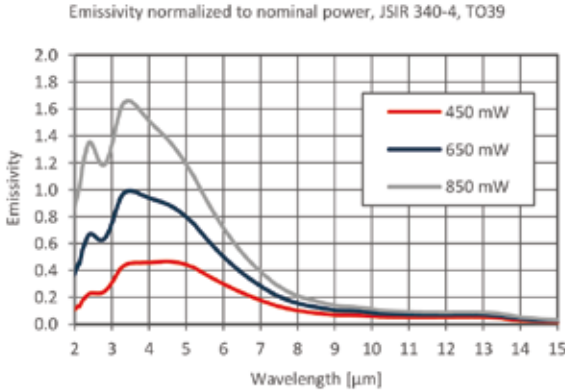
- NDIR gas detection
- Photoacoustic gas spectroscopy
- DIR & ATR spectroscopy

TARGET GASES

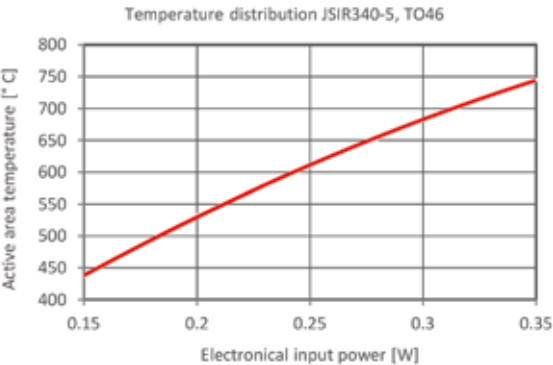
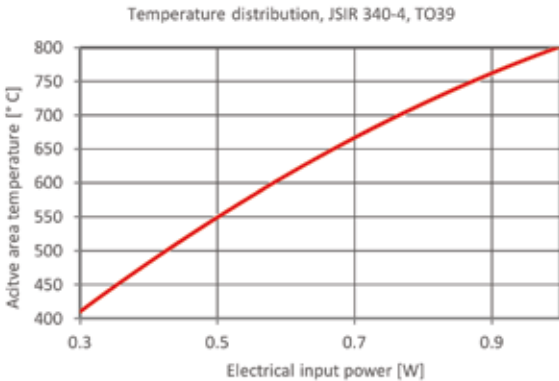
- CO₂, CH₄, C₃H₈, C₂H₅OH
- Other infrared active gases

OPERATING CHARACTERISTICS

Emissivity



Temperature distribution



Type comparison

Type	JSIR 340-4	JSIR 340-5
Time constant (modulation)	typ. 17 ms	typ. 8 ms
Lifetime	> 5.000 h at 740° C > 100.000 h at 610° C	> 100.000 h at 610° C
Membrane temperature	610° C ^{3,4}	610° C ^{1,2}
Active area	2.2 x 2.2 mm ²	1.0 x 1.0 mm ²

¹ at nominal power (0.25 W)
² at T_{amb} = 25° C
³ at nominal power (0.6 W)
⁴ at T_{amb} = 25° C



JSIR 350

Premium MEMS based infrared radiation sources with NAC emitter chip for NDIR gas analysis in applications like medical and biotechnology, industry and agriculture

By combining standard silicon material technology with NAC coatings, Micro-Hybrid offers MEMS products with exceptional performance. The powerful IR emitters made by our MEMS fab NOVA IR consist of nanoamorphous carbon (NAC). They reach membrane temperatures up to 850° C for a high and long-term stable radiation performance. JSIR 350 sources are available in different packaging options with cap and reflector. The spectral performance can be individually optimized by various filters and filling gases.

Only at Micro-Hybrid: **HermeSEAL® technology** – a unique process that creates hermetically sealed emitters for use in harsh environments.

GENERAL ARRANGEMENT

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.



1 – Multi layer hot plate membrane containing NAC layer
2 – Bond pads
3 – Si frame and membrane

FEATURES

- High radiation output (active area temperature up to 850° C)
- High modulation frequency
- Long lifetime (reliability due to high stability of the membrane)
- HermeSEAL® technology empowering application in harsh environments

APPLICATIONS

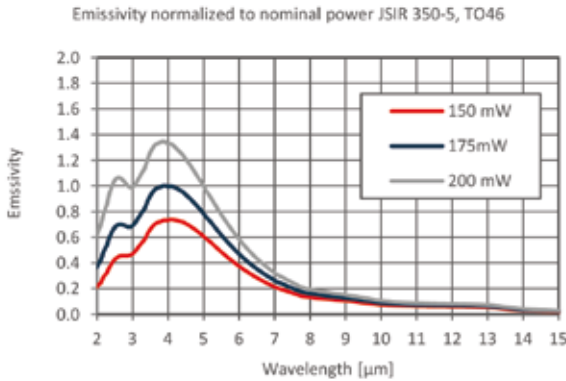
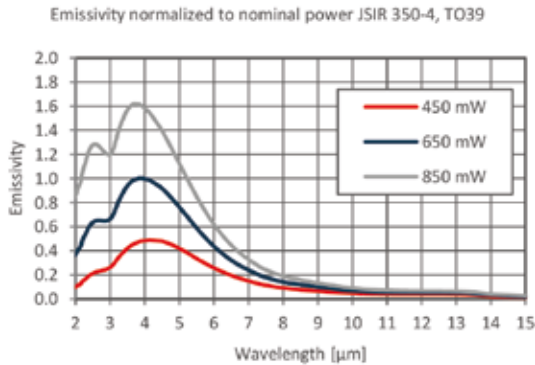
- NDIR gas analysis
- DIR & ATR spectroscopy
- Photoacoustic gas spectroscopy

TARGET GASES

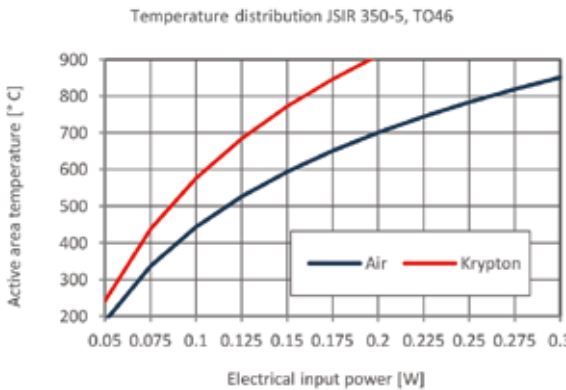
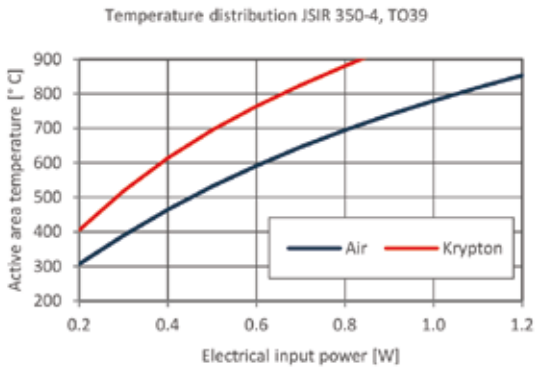
- CO₂, CO, NO₂, NH, SO_x SF₆ and ripening gases such as C₂H (ethylene) and C₂H₂ (acetylene)
- Anesthetic gases, CH₄, C₃H₈, C₂H₅OH
- All infrared active gases

OPERATING CHARACTERISTICS

Emissivity



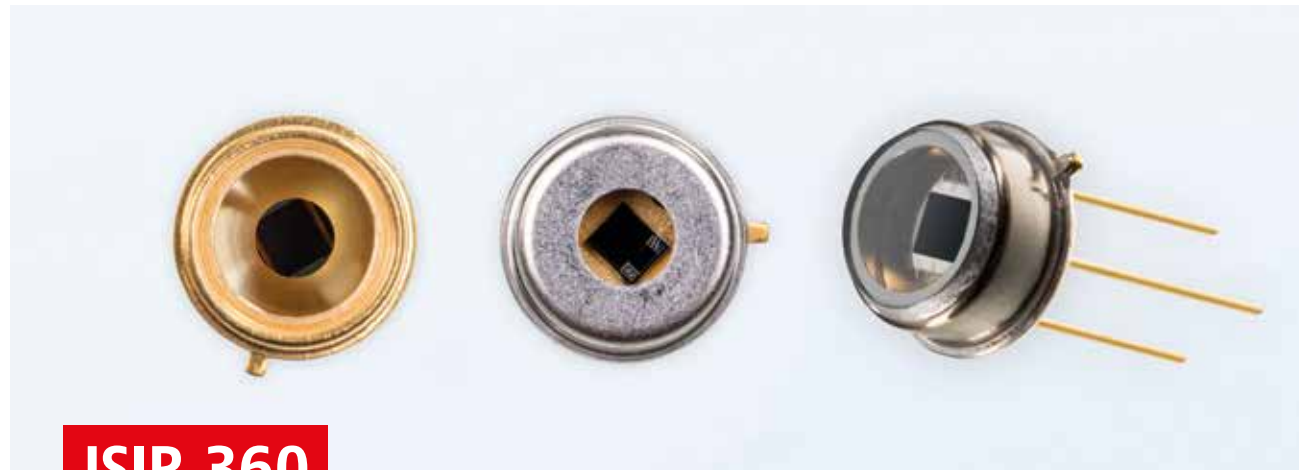
Temperature distribution



Type comparison

Type	JSIR 350-4	JSIR 350-5
Time constant (modulation)	17 ms	7 ms
Lifetime	100.000 h	100.000 h
Membrane temperature	610° C ^{3,4} 850° C at 1.2 W max. power	610° C ^{1,2} 850° C at 0.3 W max. power
Active area	2.2 x 2.2 mm²	0.65 x 0.65 mm²

¹ at nominal power (0.175 W)
² at T_{amb} = 25° C
³ at nominal power (0.6 W)
⁴ at T_{amb} = 25° C

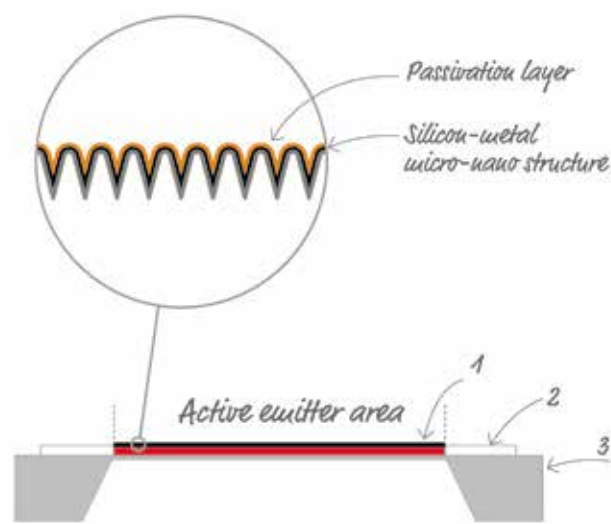


JSIR 360

High-end MEMS based infrared emitter with black-silicon emission layer for NDIR gas analysis in the long wave length range for ambitious medical and industrial applications.

By implementation of a sophisticated micro-nano structured silicon-metal emissions layer at a MEMS hot-plate emitter chip, Micro-Hybrid offers infrared sources with true black body radiation characteristic. The extraordinary performance IR emitter MEMS chips are defined by hot-plate temperatures up to 850° C in combination with a spectral broadband emission coefficient ϵ nearly 1. This enables highest radiation intensities over a wide infrared wavelength range. Besides the high infrared output intensity our successful development focused on the long term stability. JSIR 360 sources are available in different T0 packaging versions with cap or reflector as well as in SMD housings. Various backfill gases in hermetically sealed T0 packages produce highly efficient versions and less power dissipation for e.g. battery-powered applications.

Only at Micro-Hybrid: **HermeSEAL® technology** – a unique process that creates hermetically sealed emitters for use in harsh environments.



- 1 – Multilayer hot plate membrane:
black Si + metal & passivation layers
2 – Bond pads
3 – Si frame and membrane

FEATURES

- True black body radiation behavior
- Highest radiation intensities by hot-plate temperatures up to 850° C in combination with emission coefficient $\epsilon \sim 1$
- Long lifetime by thermal-mechanical adjusted membrane
- Spectral drift free behavior also in hermetically sealed packages
- HermeSEAL® technology empowering application in harsh environments

APPLICATIONS

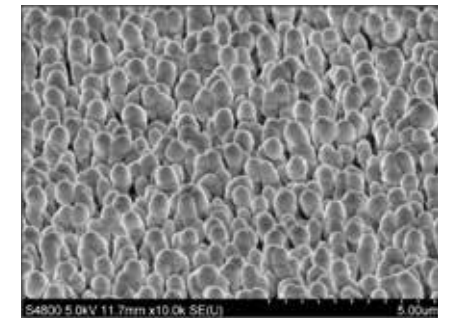
- NDIR gas analysis, DIR & ATR spectroscopy, Photoacoustic gas spectroscopy

TARGET GASES

- CO₂, CO, NO₂, NH, SO_x SF₆ and ripening gases such as C₂H (ethylene) and C₂H₂ (acetylene)
- Anesthetic gases, CH₄, C₃H₈, C₂H₅OH

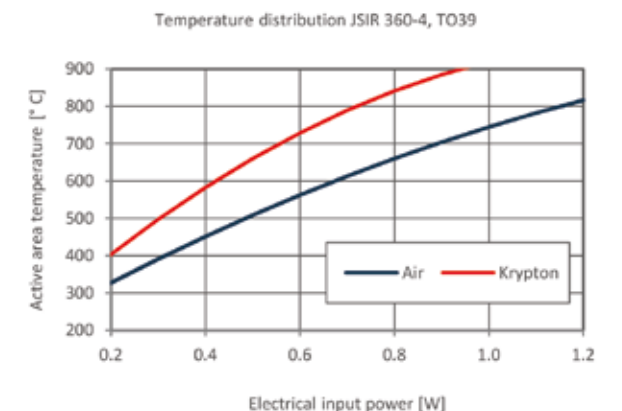
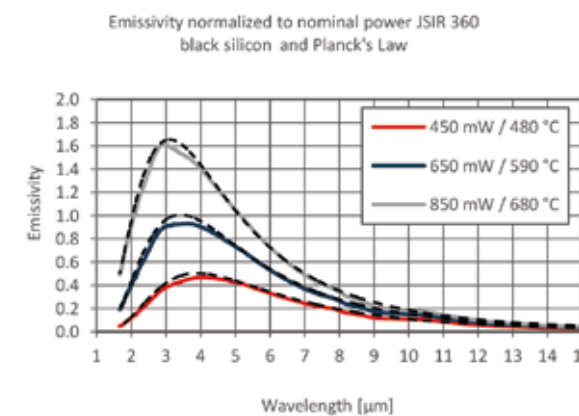
GENERAL ARRANGEMENT

The MEMS chip used in our infrared emitters consists of a multi-layer hot plate membrane containing a high temperature stable metal heater layer as well as advanced silicon-metal micro-nano structured surfaces on top. A final passivation layer guarantees long term stability of the emission behavior at hot-plate temperatures up to 850° C. The emitter chip is based on a silicon substrate with a back etched membrane. All thin film processes are conducted by CMOS compatible materials.

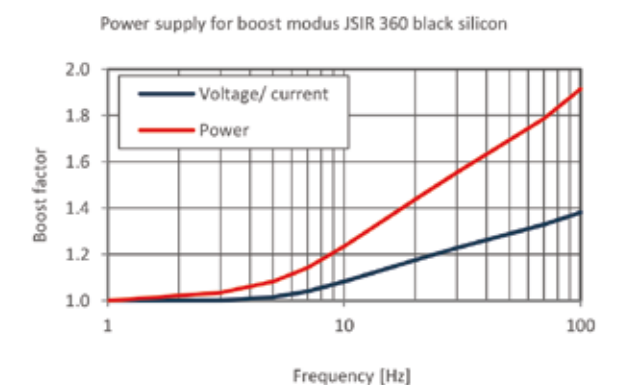
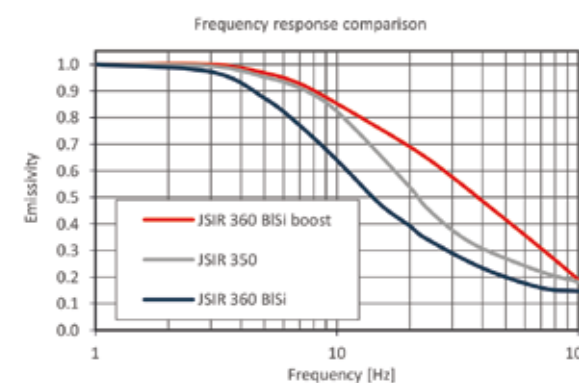


OPERATING CHARACTERISTICS

Emissivity and temperature distribution



Typical frequency response in different operating modes



Type comparison

Type	JSIR 350-4	JSIR 360-4
Time constant (modulation)	17 ms	30 ms
Lifetime	100.000 h at 610° C	100.000 h at 590° C
Membrane temperature	610° C at 650 mW nominal power	590° C at 650 mW nominal power



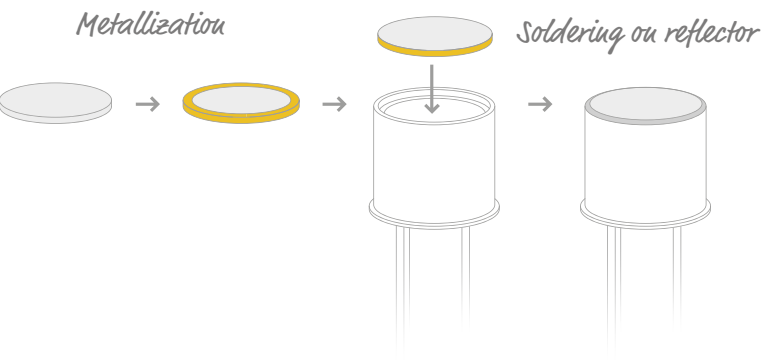
HermeSEAL® technology

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 highly efficiently* with long term stability. This new technology protects 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.



- FEATURES**
- Increased lifetime by reduction of oxidation processes
 - Backfilling with different gases for variation of radiation output corresponding to electrical input and time
 - High safety level for explosion proof applications
 - Ideal for battery or stand alone applications with low power supplies*
 - Long-term stable

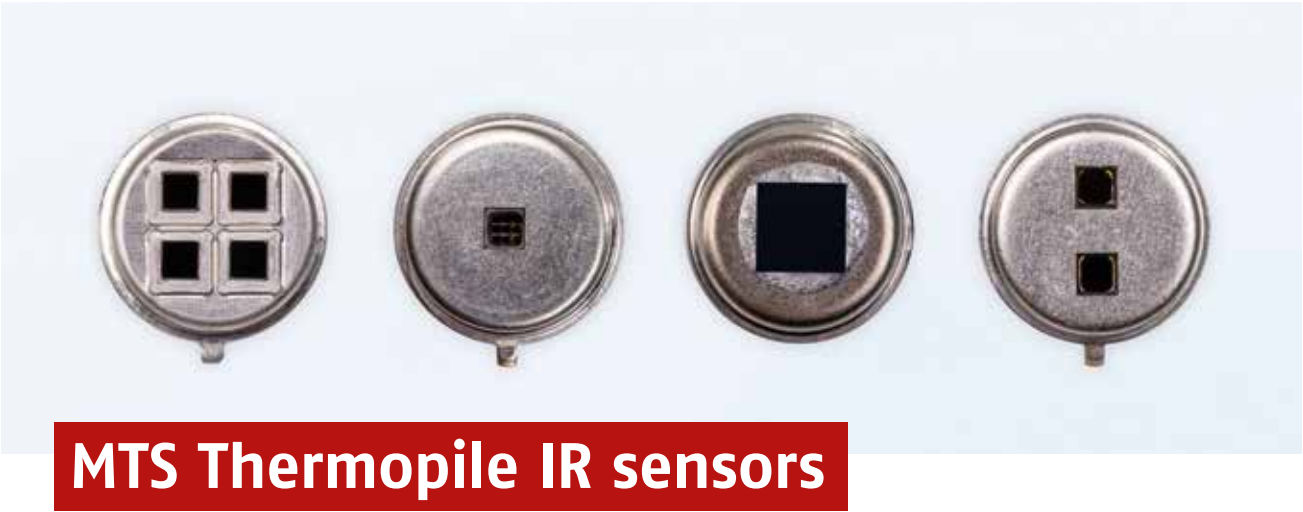
*by using thermal insulating backfill gases or variation of modulation frequency

IR sources product overview

Article		Type	Filling gas	Temp. min	Temp. max	Aperture	Filter	Active area
JSIR340-4-AL-C-D5.8-0-0	s	T0 39 with cap		-20° C	85° C	5.88 mm	w/o	
JSIR340-5-BL-C-D2.55-0-0	s	T0 46 with cap		-20° C	85° C	2.55 mm	w/o	
JSIR350-4-AL-C-D5.8-0-0	s	T0 39 with cap		-20° C	85° C	5.8 mm	w/o	2.0 x 2.0 mm²
JSIR350-4-AL-C-D5.8-2-A2	s	T0 39 with cap	Kr	-20° C	85° C	5.8 mm	CaF2	2.0 x 2.0 mm²
JSIR350-4-AL-C-D5.8-2-A1	d	T0 39 with cap	Kr	-20° C	85° C	5.8 mm	Sapphire	2.0 x 2.0 mm²
JSIR350-4-AL-C-D5.8-2-A2	d	T0 39 with cap	Kr	-20° C	85° C	5.8 mm	CaF2	2.0 x 2.0 mm²
JSIR350-4-AL-C-D5.8-2-A4	d	T0 39 with cap	Kr	-20° C	85° C	5.8 mm	BaF2	2.0 x 2.0 mm²
JSIR350-4-AL-C-D5.8-1-A1	d	T0 39 with cap	N2	-20° C	85° C	5.8 mm	Sapphire	2.0 x 2.0 mm²
JSIR350-4-AL-C-D5.8-1-A2	d	T0 39 with cap	N2	-20° C	85° C	5.8 mm	CaF2	2.0 x 2.0 mm²
JSIR350-4-AL-C-D5.8-1-A4	d	T0 39 with cap	N2	-20° C	85° C	5.8 mm	BaF2	2.0 x 2.0 mm²
JSIR350-4-AL-C-D3.7-2-A7-I ^{HS}	s	T0 39 with cap	Kr	-20° C	125° C	5.8 mm	Silicon	2.0 x 2.0 mm²
JSIR350-4-AL-C-D5.8-2-A1-I ^{HS}	d	T0 39 with cap	Kr	-20° C	185° C	5.8 mm	Sapphire	2.0 x 2.0 mm²
JSIR350-4-AL-R-D6.0-0-0	s	T0 39 with reflector		-20° C	85° C	6.0 mm	w/o	2.0 x 2.0 mm²
JSIR350-4-AL-R-D6.0-2-A2	s	T0 39 with reflector	Kr	-20° C	85° C	6.0 mm	CaF2	2.0 x 2.0 mm²
JSIR350-4-AL-R-D6.0-2-A4	d	T0 39 with reflector	Kr	-20° C	85° C	6.0 mm	BaF2	2.0 x 2.0 mm²
JSIR350-4-AL-R-D6.0-1-A1	d	T0 39 with reflector	N2	-20° C	85° C	6.0 mm	Sapphire	2.0 x 2.0 mm²
JSIR350-4-AL-R-D6.0-1-A2	d	T0 39 with reflector	N2	-20° C	85° C	6.0 mm	CaF2	2.0 x 2.0 mm²
JSIR350-4-AL-R-D6.0-1-A4	d	T0 39 with reflector	N2	-20° C	85° C	6.0 mm	BaF2	2.0 x 2.0 mm²
JSIR350-4-AL-R-D6.0-2-A7-I ^{HS}	d	T0 39 with reflector	Kr	-20° C	125° C	6.0 mm	Silicon	2.0 x 2.0 mm²
JSIR350-4-AL-R-D6.0-2-A1-I ^{HS}	d	T0 39 with reflector	Kr	-20° C	185° C	6.0 mm	Sapphire	2.0 x 2.0 mm²
JSIR350-4-CB-0-S5.0-0-A7	s	SMD	Air	-20° C	85° C	5.0 mm	Silicon	2.0 x 2.0 mm²
JSIR350-5-BL-C-D2.55-0-0	s	T0 46 with cap		-20° C	85° C	2.55 mm	w/o	0.65 x 0.65 mm²
JSIR350-5-BL-C-D2.55-2-A1	d	T0 46 with cap	Kr	-20° C	85° C	2.55 mm	Sapphire	0.65 x 0.65 mm²
JSIR350-5-BL-C-D2.55-2-A2	d	T0 46 with cap	Kr	-20° C	85° C	2.55 mm	CaF2	0.65 x 0.65 mm²
JSIR350-5-BL-C-D2.55-2-A4	d	T0 46 with cap	Kr	-20° C	85° C	2.55 mm	BaF2	0.65 x 0.65 mm²
JSIR350-5-BL-C-D2.55-1-A1	d	T0 46 with cap	N2	-20° C	85° C	2.55 mm	Sapphire	0.65 x 0.65 mm²
JSIR350-5-BL-C-D2.55-1-A2	d	T0 46 with cap	N2	-20° C	85° C	2.55 mm	CaF2	0.65 x 0.65 mm²
JSIR350-5-BL-C-D2.55-1-A4	d	T0 46 with cap	N2	-20° C	85° C	2.55 mm	BaF2	0.65 x 0.65 mm²
JSIR350-5-BL-R-D3.6-0-0	s	T0 46 with reflector		-20° C	85° C	3.6 mm	w/o	0.65 x 0.65 mm²
JSIR350-5-BL-R-D3.6-2-A2	d	T0 46 with reflector	Kr	-20° C	85° C	3.6 mm	CaF2	0.65 x 0.65 mm²
JSIR350-5-BL-R-D3.6-2-A4	d	T0 46 with reflector	Kr	-20° C	85° C	3.6 mm	BaF2	0.65 x 0.65 mm²
JSIR350-5-BL-R-D3.6-1-A1	d	T0 46 with reflector	N2	-20° C	85° C	3.6 mm	Sapphire	0.65 x 0.65 mm²
JSIR350-5-BL-R-D3.6-1-A2	d	T0 46 with reflector	N2	-20° C	85° C	3.6 mm	CaF2	0.65 x 0.65 mm²
JSIR350-5-BL-R-D3.6-1-A4	d	T0 46 with reflector	N2	-20° C	85° C	3.6 mm	BaF2	0.65 x 0.65 mm²
JSIR350-5-CS-0-S2.8-0-A7	s	SMD	Air	-20° C	85° C	2.8 mm	Silicon	0.65 x 0.65 mm²
JSIR360-4-AL-C-D5.8-0-0	s	T0 39 with cap		-20° C	85° C	5.8 mm	w/o	

^{HS} HermeSEAL® technology s by stock d on demand

Micro-Hybrid’s offer includes IR emitter of our manufacturer **NOVA IR** and **CMOSIR** . All IR emitter are supplied in a T0 or SMD housing. We ship by stock and on demand.

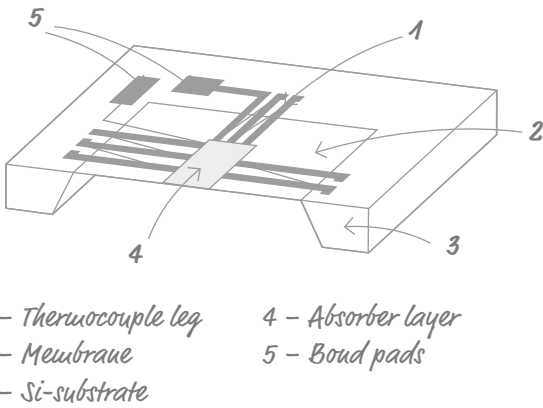
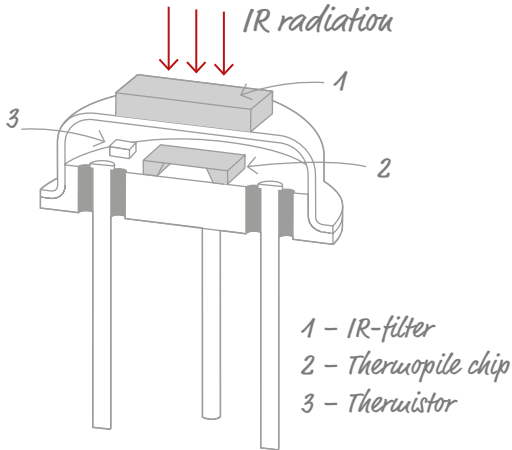


MTS Thermopile IR sensors

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 – the measurement signal.

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. 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 T0 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.



Schematic illustration of the construction of a thermopile chip

BENEFITS

- Excellent performance by best materials like BiSb / Sb for thermoelectrical 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



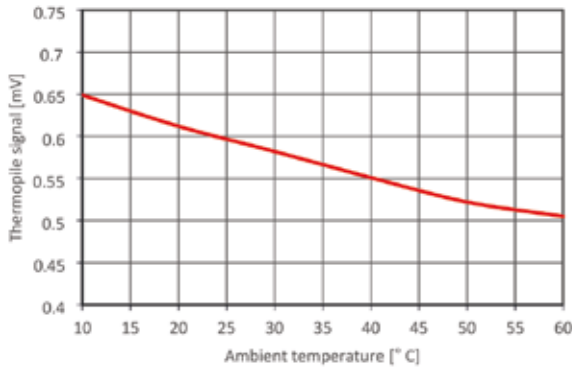
FEATURES

- Environmental temperatures up to 190° C
- Soldered filter (optional)
- High sensitivity
- Humidity resistant
- Suitable for chemical processes
- Resistent against environmental influences

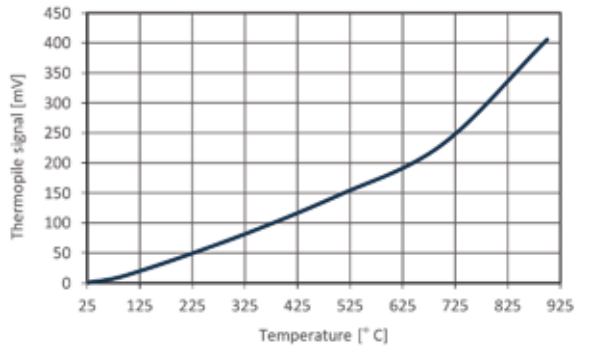


High temperature thermopile detector

OPERATING CHARACTERISTICS TS1x80B



Example chart: change of the thermopile signal by variation in ambient temperature

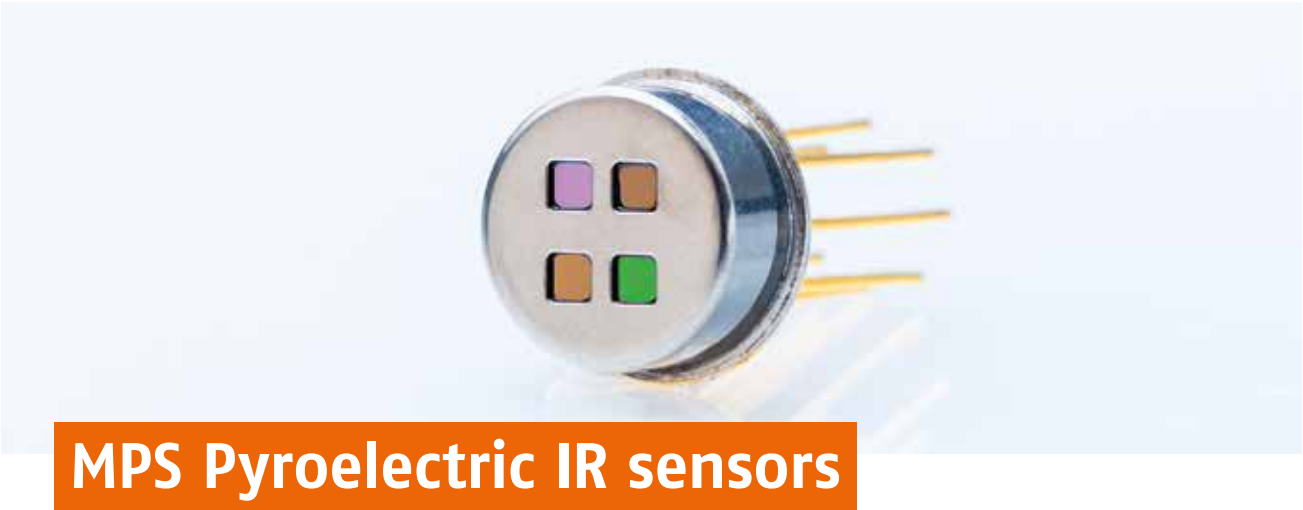


Example chart: thermopile signal depending on a change of the temperature of the measuring object

MTS Thermopile IR sensors product overview

Article		Temp. min	Temp. max	Aperture	Channel	Application
TS1x80B-A-D0.75-1-Kr-B1	s	-20° C	85° C	0.75 mm	1	IR temperature measurement
TS1x80B-A-D0.75-1-Kr-B1 extended temperature range	d	-20° C	190° C	0.75 mm	1	IR temperature measurement
TS2x200B-A-S1.5-1-Kr-E1/D2	s	-20° C	85° C	1.5 mm	2	NDIR gas analysis
TS2x200B-A-S1.5-1-Kr-G2/D2	s	-20° C	85° C	1.5 mm	2	NDIR gas analysis
TS2x200B-A-S1.5-1-Kr-F1/D2	s	-20° C	85° C	1.5 mm	2	NDIR gas analysis
TS1x200B-A-S1.5-1-Kr-E1	d	-20° C	85° C	1.5 mm	1	NDIR gas analysis
TS1x200B-A-S1.5-1-Kr-F1	d	-20° C	85° C	1.5 mm	1	NDIR gas analysis
TS1x200B-A-S1.5-1-Kr-G2	d	-20° C	85° C	1.5 mm	1	NDIR gas analysis
TS1x200B-A-S1.5-1-Kr-H1	d	-20° C	85° C	1.5 mm	1	NDIR gas analysis
TS1x200B-A-S1.5-1-Kr-J1	d	-20° C	85° C	1.5 mm	1	NDIR gas analysis
TS1x200B-A-S1.5-1-Kr-D2	d	-20° C	85° C	1.5 mm	1	NDIR gas analysis
TS2x200B-A-S1.5-1-Kr-H1/D2	d	-20° C	85° C	1.5 mm	2	NDIR gas analysis
TS2x200B-A-S1.5-1-Kr-J1/D2	d	-20° C	85° C	1.5 mm	2	NDIR gas analysis
TS2x200B-A-S1.5-1-N2-H1/D2	d	-20° C	85° C	1.5 mm	2	NDIR gas analysis
TS2x200B-A-S1.5-1-N2-J1/D2	d	-20° C	85° C	1.5 mm	2	NDIR gas analysis
TS4x200B-A-S1.5-1-Kr-XX	on request	-20° C	85° C	1.5 mm	4	NDIR gas analysis

s by stock d on demand



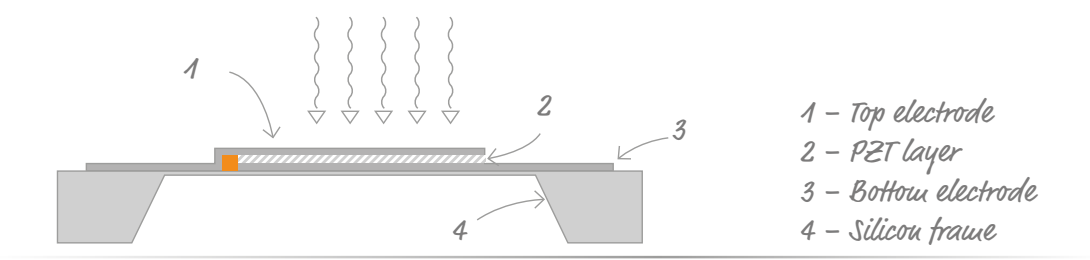
MPS Pyroelectric IR sensors

These sensors detect the typical spectral emission of burning material like wood, oil or plastics. IR Flame detection and NDIR gas analysis are the main application fields.

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

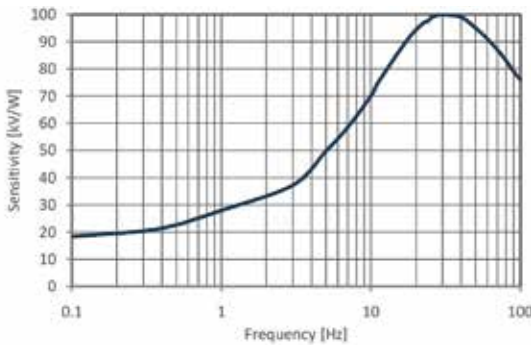
on MEMS technology. The pyroelectric element consists of a ~ 1 µm thick PZT thin film mounted on a modified Si-based membrane which is produced by a DRIE back-etch process. The front electrode is optically transparent allowing infrared radiation to be absorbed by the active area. This area has a broad absorption range from 1 – 25 µm.



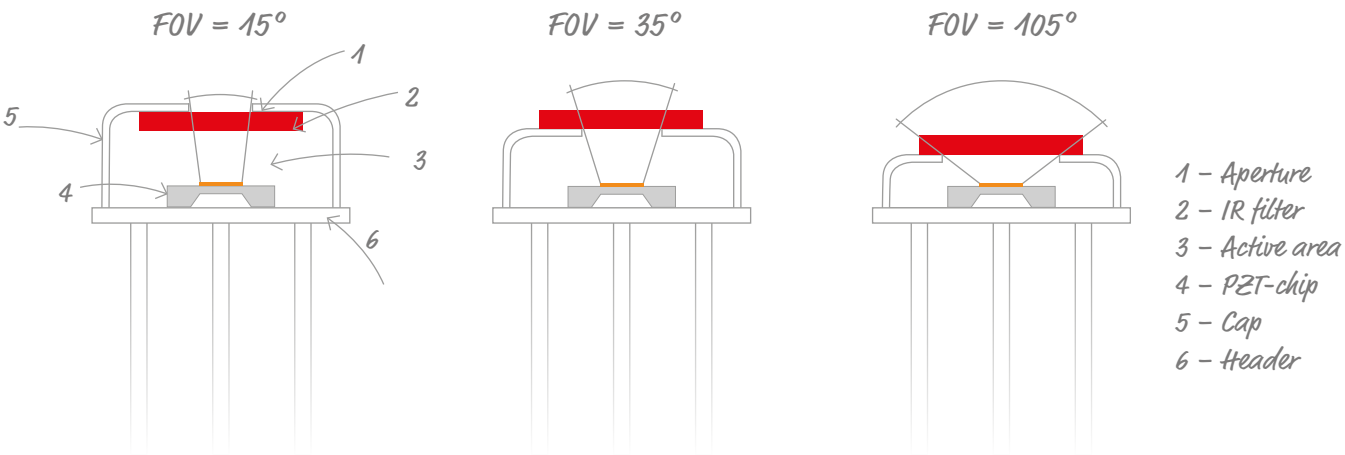
FEATURES

- 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

FREQUENCY RESPONSE



MPS pyroelectric IR detector



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

Assembling facts

Cap	Aperture	FOV	Filter position
H286	3.7 mm	105°	outside
H217	1.5 mm	35°	outside
M001	3.7 mm	76°	inside
M001	1.5 mm	22°	inside



Gas sensors

Sensors and components for NDIR gas analysis

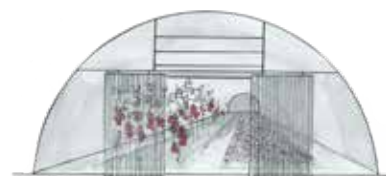
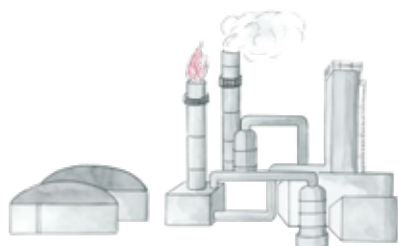
For process control, environmental measurement and laboratory analysis, over 100 different gases can be detected reliably from ppm to percent by means of NDIR analysis.

Micro-Hybrid supplies all infrared components up to the complete gas sensor for diverse measurement applications in a wide variety of industries. We develop customized systems with the latest IR technology and our own, optimally matching IR components for a wide range of measurable gases.

CUSTOMER BENEFITS OF OUR GAS SENSOR DEVELOPMENT

- High degree of innovation and flexibility in product development
- From the MEMS chip to packaging technologies to the complete gas sensor system
- Hard- and software
 - Permanent further development of all components and parts
 - Focus on long-term stability and harsh environmental conditions (environmentally stable even at high temperatures and humidity)

Our sensors are always characterized by high-precision measurement results and are suitable for almost all industrial and laboratory measurements of gas concentration.



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

We develop high quality and advanced gas sensor modules

With more than 20 years of experience in the development and production of IR components, Micro-Hybrid is one of the world's leading manufacturer of high quality measurement systems.

Micro-Hybrid NDIR gas sensors are convenient in set up and usability. We also provide after sales services and maintenance like calibration service and equipment.

ADDED VALUE

- + Suitable for use in harsh environmental conditions
- + High reliability + accuracy
- + Long lifetime
- + Multi-gas solutions

Depending on the type of gas sensing application and the corresponding measurement range we offer two different gas sensor modules:

MicroFLOW

Gas flow sensors for analysis applications



- Reflecting cuvette
- For absorption distances up to 100 mm
- Minimum gas flow through e.g. an external pump required to completely fill the cuvette

The gas to be detected flows through the absorption path of the measuring chamber. Infrared radiation delivered by a MEMS based IR-source passes through the gas and generates a signal voltage in the thermopile IR detector. The detector is assembled with narrow band pass filters. The robust housing is designed for easy implementation in gas analysers.

MicroSENS

Sensors for diffusion based measurement applications



- Open cuvette
- For absorption distances up to 50 mm
- Sample in the atmosphere to be measured

The absorption path of the measuring chamber is filled with the gas to be detected. Infrared radiation delivered by a MEMS based IR- source passes through the gas and generates a signal voltage in the thermopile IR detector. The detector is assembled with narrow band pass filters.
(Equipment for sensor calibration available)

Micro**FLOW** IR methane sensor



Inline NDIR CH₄ sensor for measuring combustible and explosive gases such as methane or propane*. Designed for various gas measurement applications like environmental monitoring, process control or leak detection, even for hand held gas detection systems.

The sensor can easily be integrated into OEM systems. IR dual beam technology and MEMS based components provide long term stability due to low signal drift.

*ATEX conformity must be guaranteed by the customer through flame arresters.

FEATURES

- High accuracy by 5 point pre calibration
- Temperature and pressure compensated, integrated temperature measurement
- RS485 interface, customized interface for controlling keys and displays
- Low signal drift by dual beam technology
- Low maintenance (maintenance service available)

APPLICATIONS

- Industry
 - Environmental monitoring and process controll
 - Detection of leaks in petro chemical facilities
- Mining
 - Underground monitoring of methane levels
- Agriculture
 - Process monitoring in bio gas plants

Technical specification

General	
Measuring principle	NDIR
Measurement range	0 – 5 Vol.-% switchable to 4.4 Vol.-% as well as to 1 Vol.-% and to 0.88 Vol.-%
Gas supply	M5 or hose screw connection 6/4 mm
Flow rate	Operation 0.5–2 l/min Rinse max. 6 l/min
Dimensions	123 mm x 30 mm x 40 mm (L x W x H)

Measurement	
Start-up time	60 s
Warm-up time	15 min (full scale)
Response time	(t ₉₀) < 10 s at 0.5 l/min
Accuracy	± 0.2 Vol.-% ± 2 % MW
Repeatability	< 0.05 Vol.-%
Long-term stability in the measuring range	± 5 % FS or ± 10 % at 60 days

Micro**SENS** Hightemp IR carbon dioxide sensor



This IR CO₂ sensor has been specially optimized for the measurement of 5 Vol.-% CO₂ in cell incubators to manage ideal cell and tissue growth.

The sensor can be placed directly in the incubation chamber to measure the exact cell experienced environment. It determines the CO₂ concentration based on its IR absorption.

FEATURES

- IR dual beam technology
- Temperature and pressure compensated
- Heat-sterilizable up to 190° C
- Long lifetime
- Humidity correction

APPLICATIONS

- Monitoring and measuring CO₂ concentration in medical, pharmaceutical and biotechnical incubators for cell and tissue growth
- To guarantee regulatory compliance
- Reliable test and process results

Technical specification

General	
Measuring gas	CO ₂
Measurement range	0 – 20 Vol.-%
Gas supply	Diffusion
Warm up time	< 1 minute (start-up) < 15 minutes (full spec)

Measurement	
Accuracy ¹	± 0.2 Vol.-% ± 2 % of reading
Response time (t ₉₀)	≤ 30 s
Digital resolution	0.001 Vol.-%
Temperature dependence ²	≤ ± 0.1 Vol.-%
Pressure dependence ³	≤ ± 0.05 Vol.-%
Long term stability ⁴	≤ ± 0.2 Vol.-% at 5 Vol.-% / year
Humidity correction	0 ... 200 hPa H ₂ O

¹ at 37° C, 1013 hPa, dry test gas, excludes calibration gas tolerance of ± 1 %

² with compensation at 1 Vol.-% ... 20 Vol.-% CO₂ and 20° C ... 60° C, 1013 hPa

³ with compensation at 600 – 1200 hPa, 37° C and 5 Vol.-% CO₂

⁴ stability at 37° C, without heat sterilization

➤ APPLICATION GUIDE

Serving measurement solutions for nearly all industries, applications and the future

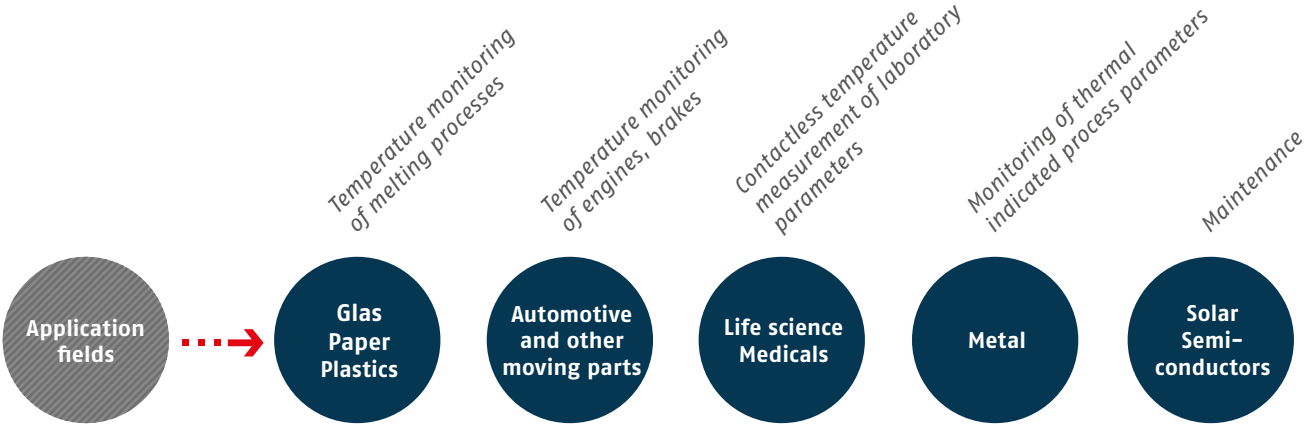
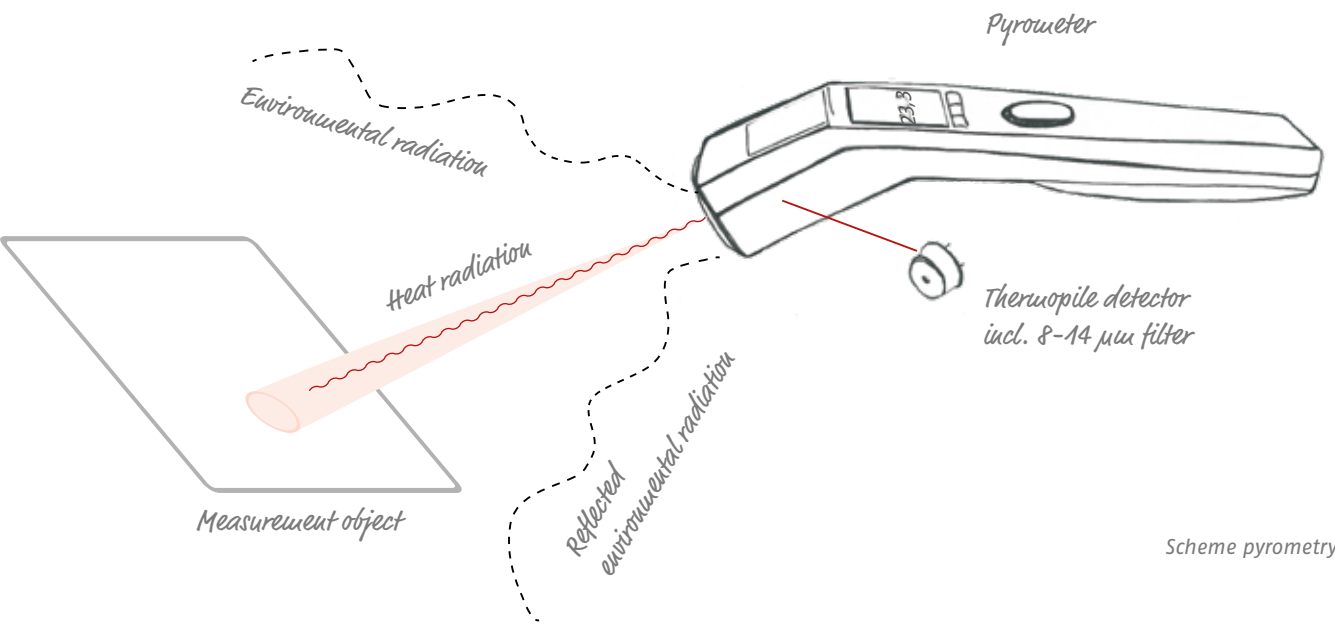




Temperature measurement

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



PRODUCT RECOMMENDATION

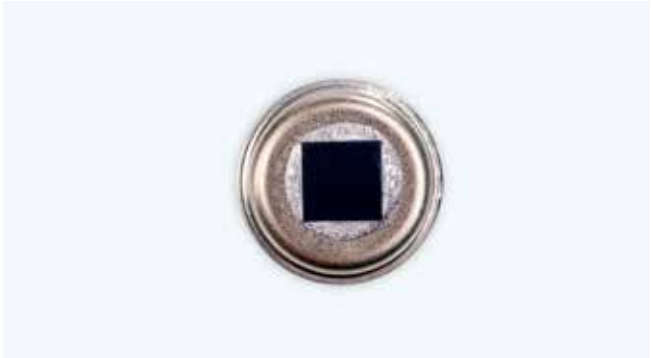
We offer sensor types for different measurement demands within a housing temperature range of -20° C up to 190° C. Our detectors are suitable for most application fields of pyrometry.

Application	Product
Punctual temperature measurement	TS1 × 80B-A-D0.65-1-Kr-B1

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



Thermopile detector with glued window



Thermopile detector with soldered window

Micro-Hybrid-Shop

Micro-Hybrid products available at www.microhybrid.com/shop. Filter products simply by selecting the desired properties and request your quotation.

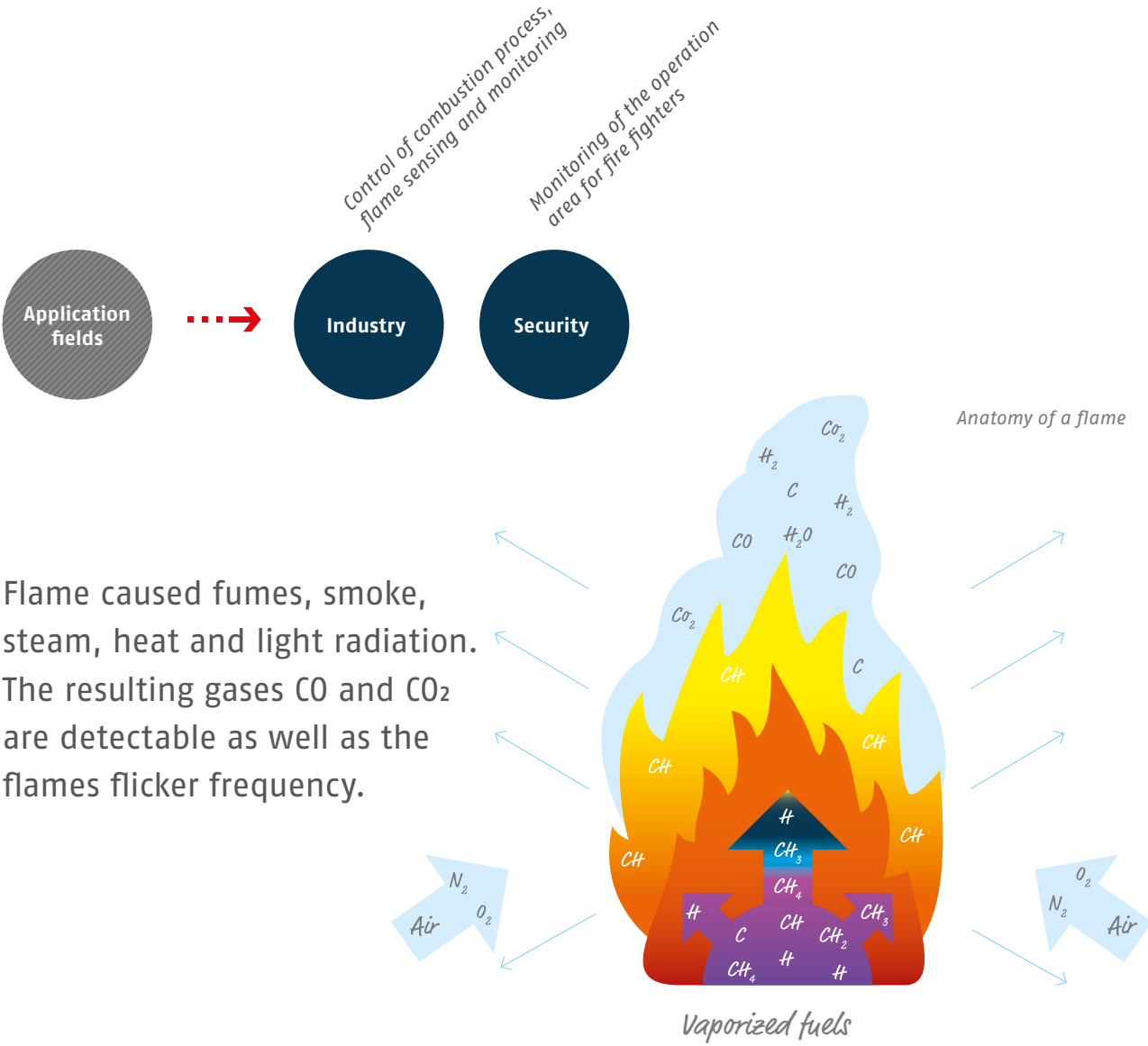
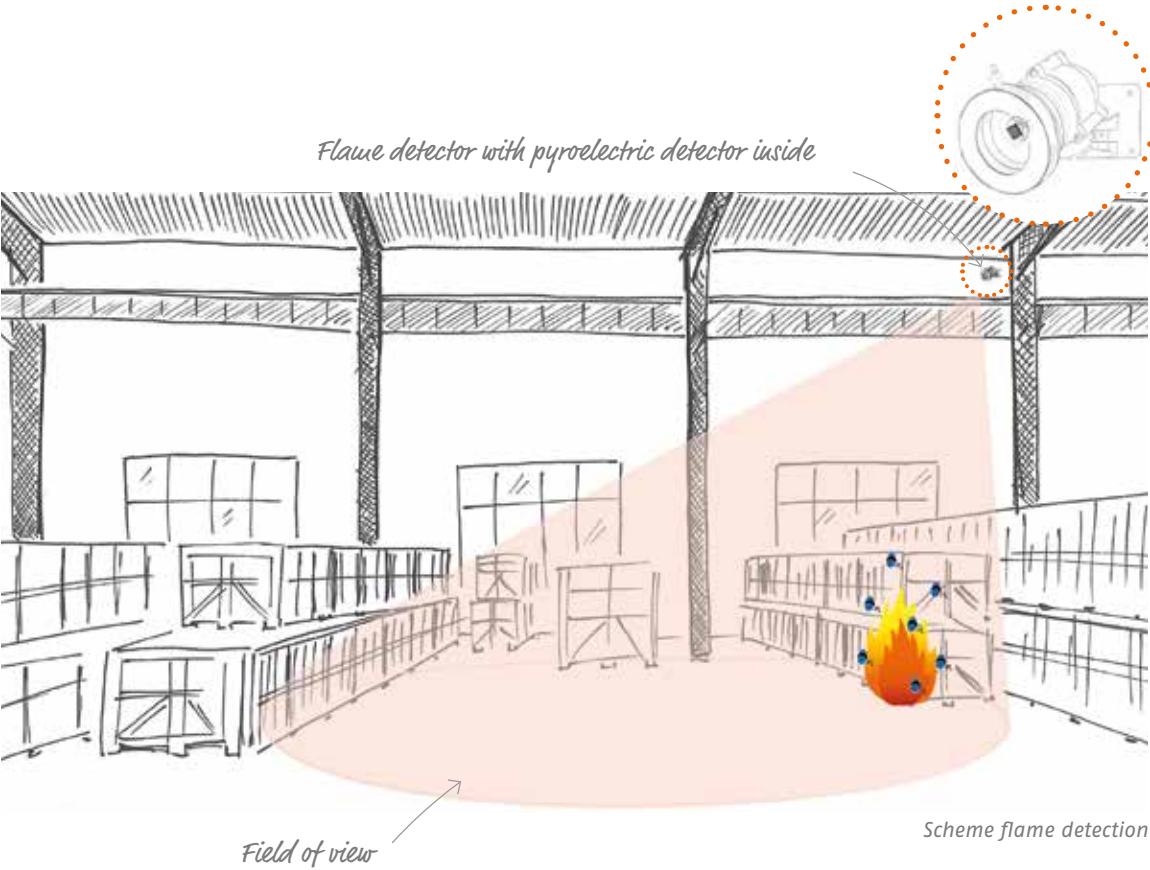


Flame detection

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 (CO_2 , CO) or flicker frequency



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.

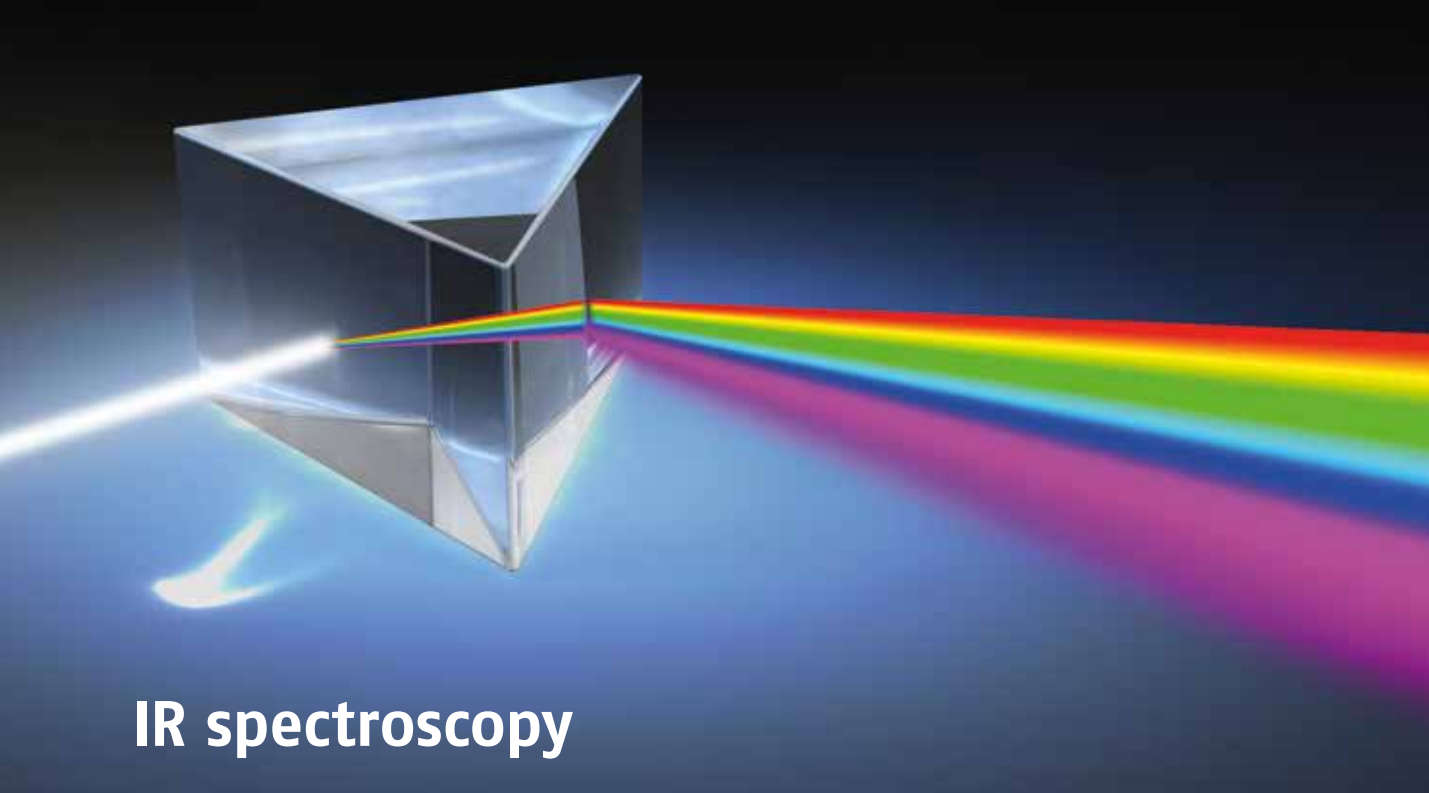
FEATURES

- High sensitivity
- Large field of view for wide angles

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

Micro-Hybrid-Shop

Micro-Hybrid products available at www.microhybrid.com/shop. Filter products simply by selecting the desired properties and request your quotation.



IR spectroscopy

IR spectrometers are among the most important instruments for the observation of vibrational spectra due to the absorption bands of molecules in a wide wavelength range. The most common spectral range is the mid-infrared, which ranges from about 2.5 to 15 μm .

This technique is used in many areas, e.g. biomedical applications, pharmaceutical industry, environmental analysis and chemistry. IR spectra provide a unique fingerprint of substances and it is possible to identify functional groups and find even small impurities in a substance. In order to evaluate and process the IR spectra, there are many databases and different methods that make this method very powerful. In addition, the IR spectra of a substance can be used for quantitative analysis.

One application of IR spectral measurement is the investigation of tissues in the vicinity of the cell plane. It is possible to determine the bio-distribution of molecules and obtain information about proteins, peptides, lipids and carbohydrates.

It is increasingly important to quickly obtain reliable results for point-of-care analysis outside a laboratory. For example, IR spectroscopy can be used to monitor metabolites at the bedside.

Studies show that IR devices can be used to monitor blood integration. Especially for It can be used to improve the treatment of seriously ill patients, but also for diabetics.

Another environmental application is the condition monitoring of liquids. Clean and standardized lubricants are the prerequisite for a flawless production process. Corrosion and wear cause a surface deterioration of the lubricated surfaces in machines and most mechanical plant downtimes.

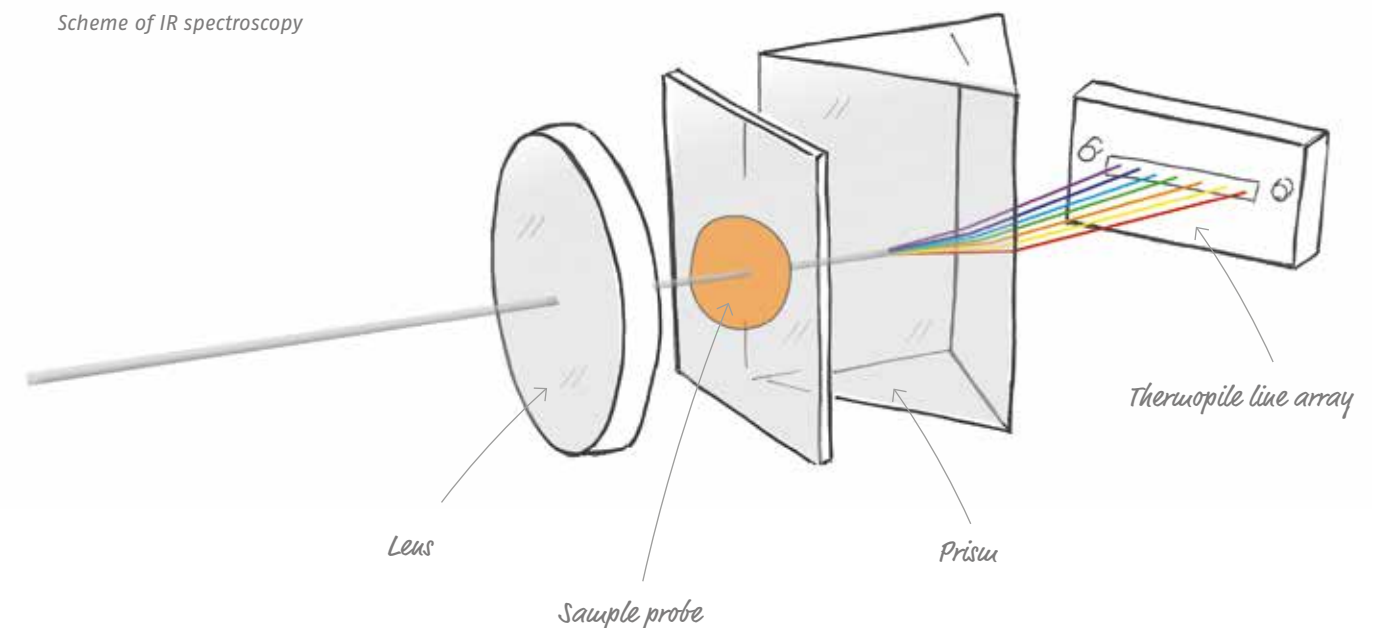
Infrared spectroscopy is one of the most efficient methods for the analysis of oils and lubricants. Machine condition monitoring provides early indications of equipment, wear mechanisms and identifies the causes of corrosion. By checking oil for impurities, changes in chemistry and the presence of abnormal situations. Wear particles and deposits; give operators the information they need to properly maintain their equipment.

Condition monitoring of engineering fluids and gases is a fundamental challenge to the success of ongoing efforts to conserve valuable fossil resources such as oil and gas. It is a prerequisite for optimized use of raw materials and, in this context, indispensable for cost-effective production of goods throughout the industry.

State-of-the-art IR spectrometers calculate the IR spectra with an intermediate interferometer and a Fourier transform. This technique is called FTIR spectroscopy. Stationary instruments are available for laboratory applications. Handheld instruments are practical for the acquisition and analysis of data in the field.

As a result, there is a significant need for robust, cost-effective and portable instruments for point-of-care analysis and condition monitoring in our environment. By using the advantages of the 64-pixel line array TPL 640 it is possible to build dispersive infrared spectrometers with the desired properties.

Scheme of IR spectroscopy



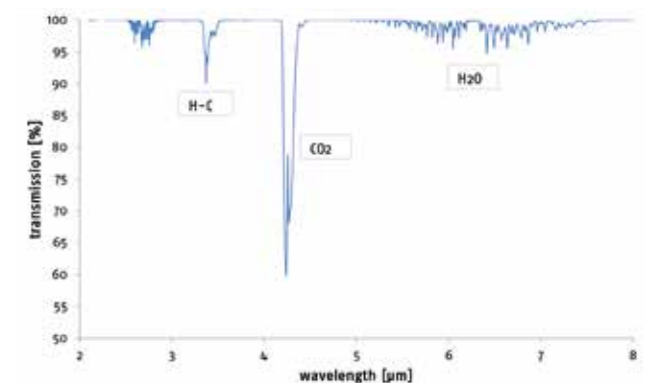
PRODUCT RECOMMENDATION

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.

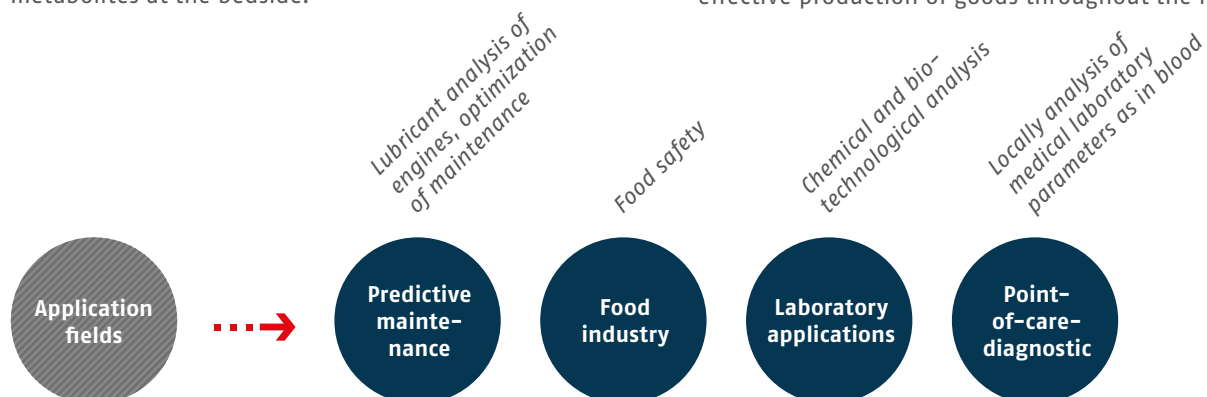
For more information contact our sales team by Email to infrared@micro-hybrid.de or call +49 36601 592-0



Thermopile Line Array TPL 640



Example chart: transmission spectrum



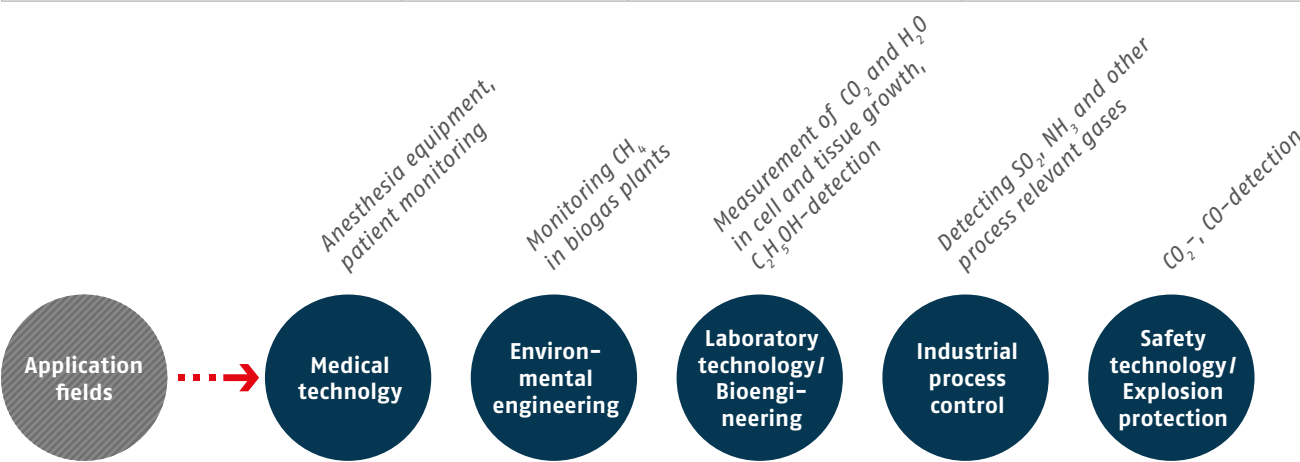


Gas measurement

Applications of NDIR gas sensors and IR components

For process control, environmental measurement and laboratory analysis, over 100 different gases can be detected reliably from ppm to percent by means of NDIR analysis. We develop and produce sensors and components for analyzing the concentration of a wide range of gases and fluids in various technical applications:

Environmental & technical gases	Refrigerants	Anesthetic gases	Fluids
CO (carbon monoxide)	R134a	N ₂ O (nitrous oxide)	Oil
CO ₂ (carbon dioxide)	R404a	C ₄ H ₃ F ₇ O (sevoflurane)	Beer
CH ₄ (methane)	R1234ze	C ₃ H ₂ ClF ₅ O (isoflurane)	Others on request
C ₃ H ₈ (propane)	R449a	C ₂ HBrClF ₃ (halothane)	
C ₄ H ₁₀ (n-butane)	R407c	C ₃ H ₂ F ₆ O (desflurane)	
SF ₆ (sulfur hexafluoride)	...	C ₃ H ₄ Cl ₂ F ₂ O (methoxyflurane)	
C ₂ H ₄ (ethylene)		CHCl ₃ (chloroform)	
C ₂ H ₂ (acetylene)			
SO ₂ (sulfur dioxide) ...			



- CO₂ Measurement:** ■ Exhaust gas ■ Process gas ■ Biogas ■ Wood carbonisation ■ Fruit storage ■ Capnography ■ Incubator ■ TOC
- CH₄ Measurement:** ■ Ex. Warning ■ Leakage detection ■ Wobbe index

The concentration of gases is reliably detected by infrared sensors and further processed as a measurement signal by stationary or portable devices. For gas measurement and gas warning systems we offer gas sensors with different functional principles:

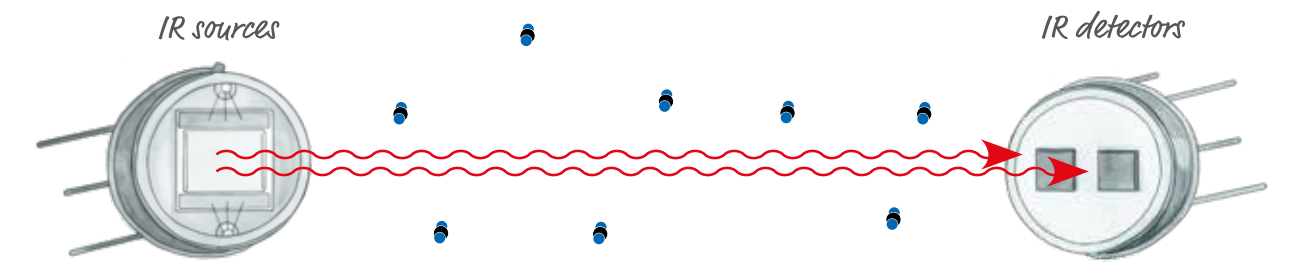
MicroFLOW
Inline flow sensors



MicroSENS
In-situ diffusion sensors



Micro-Hybrid also provides the complete range of high-quality IR components for various purposes of optical gas detection systems like NDIR gas analysis or photoacoustic spectrometry.



JSIR sources: Micro-Hybrid IR sources are MEMS based hot plate emitters for all applications of non dispersive measurement technology. We developed a worldwide unique process to hermetically seal our emitters. The HermeSEAL® emitters are gastight and suitable for use in harsh environments.

IR detectors by Micro-Hybrid: reliably measure the spectral emission of hot materials. In industrial applications the high accuracy of the measurement results is the decisive advantage.



Medical applications demand highest precision and reliability.



Quality is the result of monitoring bio- and agricultural process from the seed to the consumer.

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 precision 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-Hybrid's IR sources are perfectly suitable for the use in NDIR gas analysis.

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-Hybrid's 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.



IR source with reflector

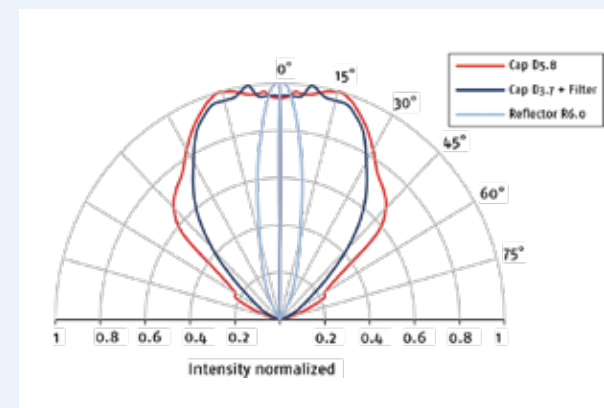
Hermetic sealing

Wavelength selective bandpass filters usually get attached to cap or reflector by gluing which may not exclude eventual permeability of diverse gases or vapor. That is why we created a unique process of filter-cap-connection: HermeSEAL® technology.

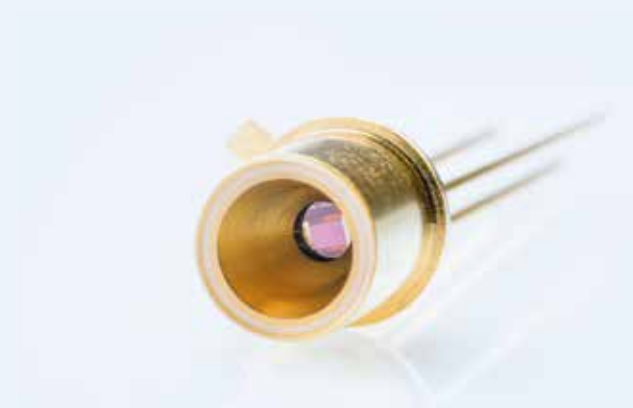
The edge area of the filter is first metallized and then soldered hermetically to the cap or the reflector. The result is an IR source made for harsh environments. The use of refill gases allows further parameters to be adjusted and the power of the radiator to be optimised.



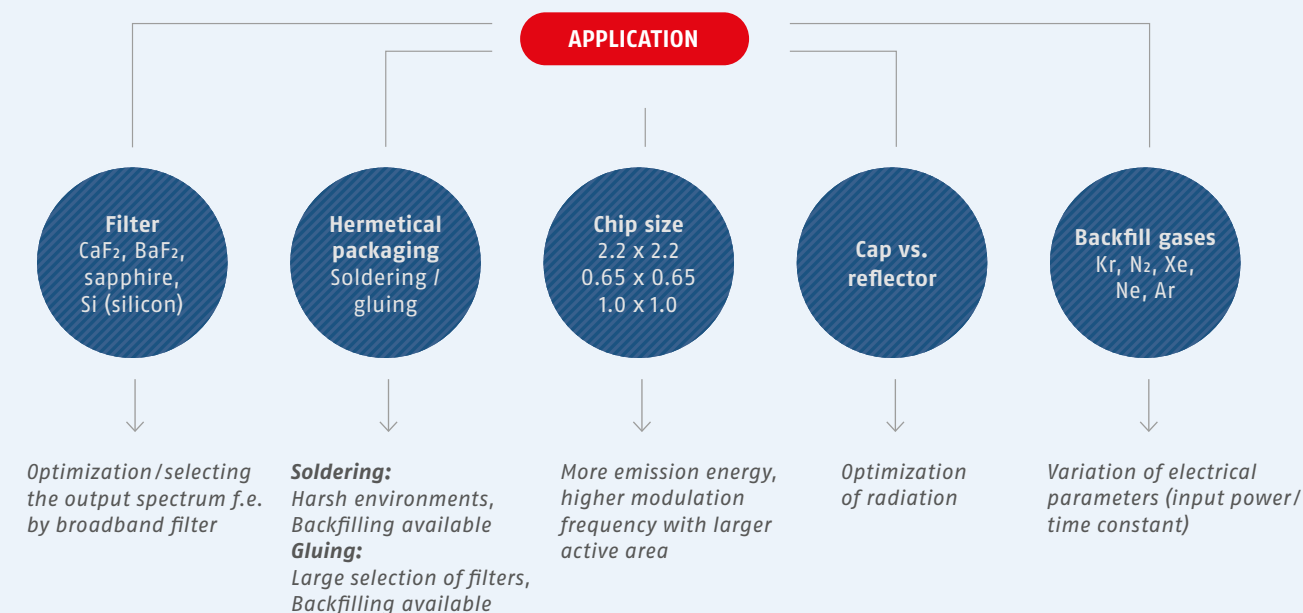
IR source with reflector and hermetically soldered filter



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



IR source with reflector and filter



Modifications of thermopile detectors

IR thermopile detectors are among the core components in infrared measurement technology. Micro-Hybrid produces multichannel detectors based on thermal sensors for simultaneous measuring of up to 7 different gases.

This highest degree of adaptation is achieved through our deep value chain. In order to guarantee the optimal function of the measuring system, subcomponents such as cap, socket, sensor chip and infrared filter can be individually adapted 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 different measurement environments. Optional your detector can be equipped with an additional thermistor to display the housing temperature.

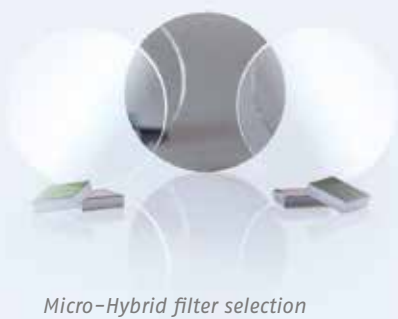


Four TS 200 chips on a TO 8 socket

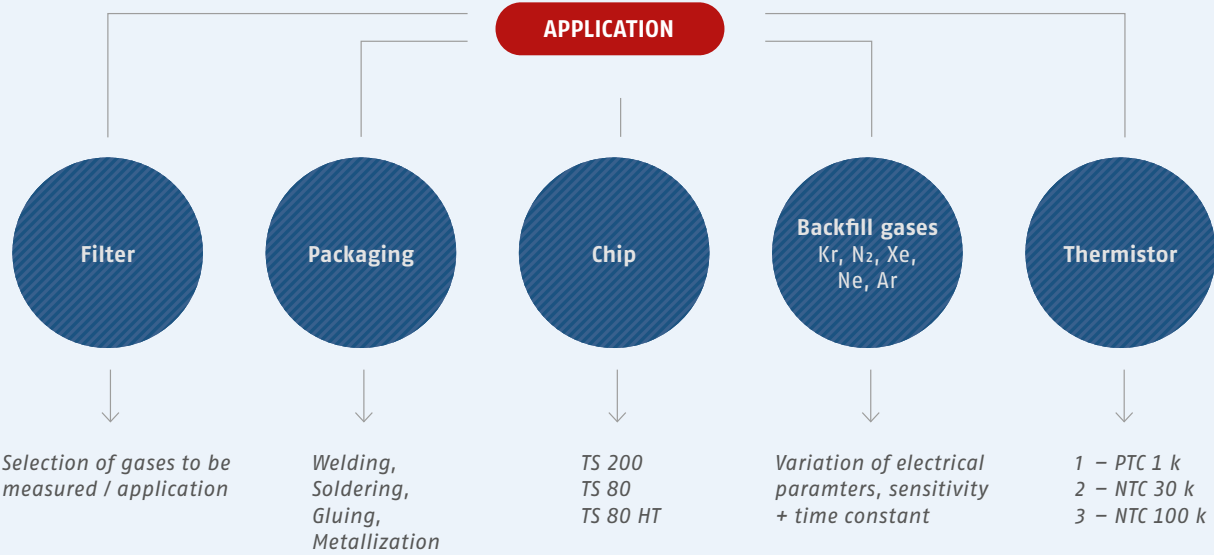
Infrared filter

Big variety and complexity mark the application fields of infrared measurement technology. To ensure a reliable function of your measurement system it is 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

MPS pyroelectric detectors operate with an external voltage supply and are suitable for diverse measurement tasks referring to their internal pre-amplification.

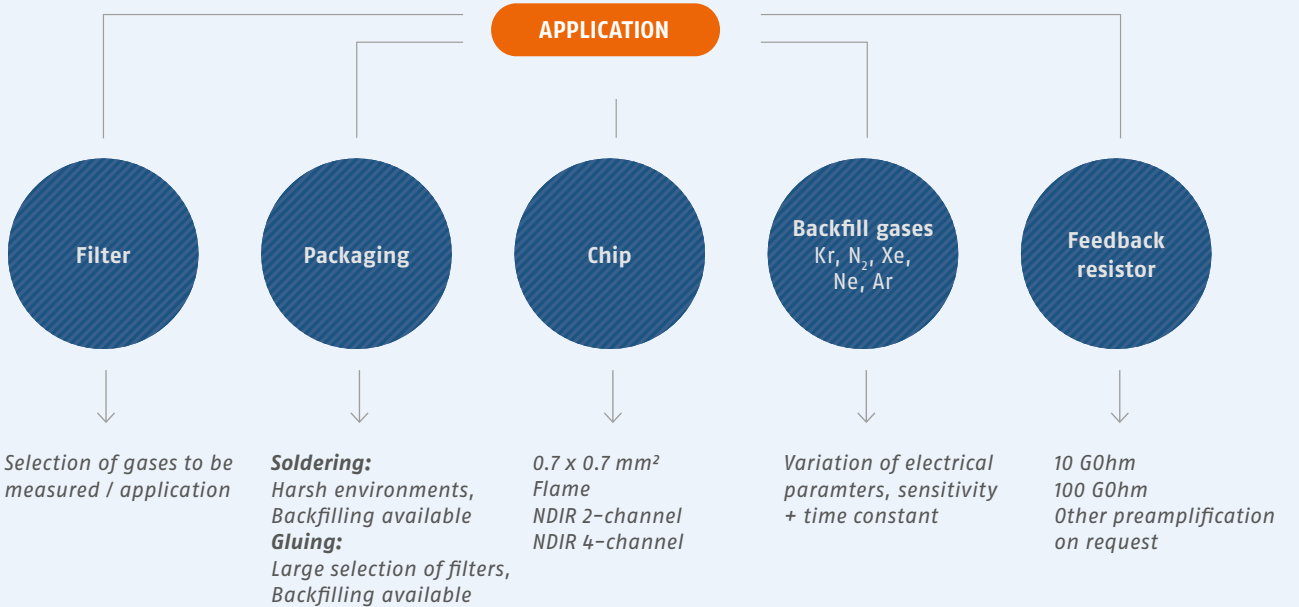
Time constant and sensitivity of the current mode detector are adaptable to special demands by diverse feedback resistors.

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 mainly 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.

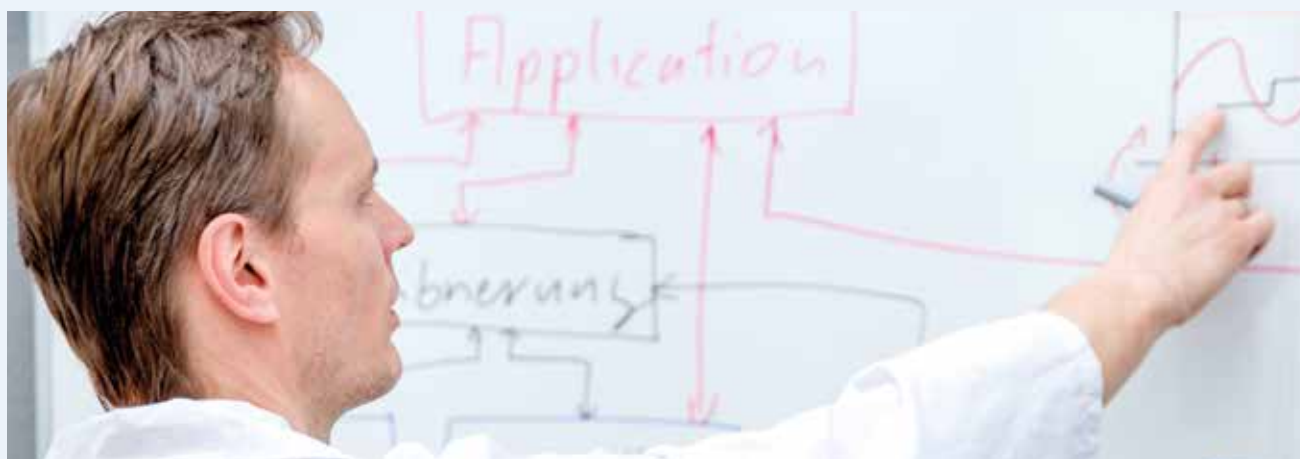


Different cap sizes with different apertures



Customized development of high-level infrared sensors and sensor systems

Focused on gas measurement applications

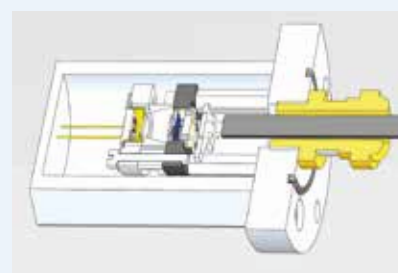
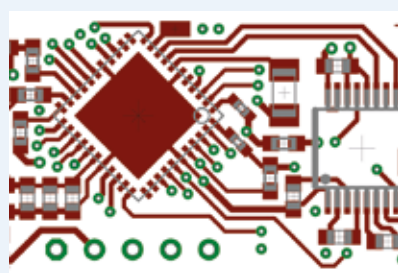
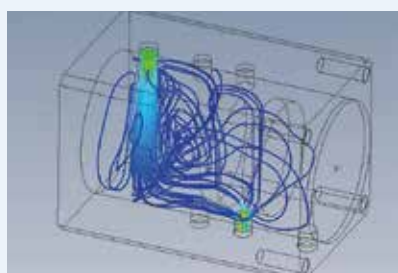


As part of our application consulting, we work closely with you to find the perfect combination of technological possibilities to realize the ideal sensor. In this way, projects are also created that cannot be realized on the basis of conventional production standards. Even harsh environments do not stop us.

Whether in the idea, concept or product development phase – you can access the project in every phase of the development process. We combine our technological competencies in the fields of electronics and mechanics, software development, optics, microelectronic packaging as well as simulation and testing in a synergetic way in order to realize the optimal customer-specific solution.

We can also adapt and enhance existing technologies and processes as part of our process development.

Joint and cooperative projects with renowned universities and institutes regularly give us new impulses to expand our portfolio. A strong team of physicists, technologists, designers, hardware and software developers are waiting for your challenge!



Inhouse R&D competences

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 analysis
- 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

5 Locations worldwide

- Germany**
 - Hermsdorf
 - Ilmenau
 - Münchenbernsdorf
- China**
 - Qingdao
- US Arizona**
 - Tucson



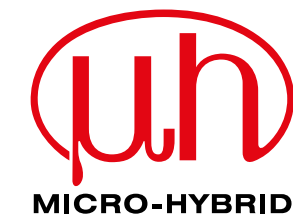
> 200 Employees worldwide

> 2 Mill. IR components sold since 2010

> 25 Years electronic micro systems
OEM experts of ceramic multilayer circuits

> 13 Mill. Investment since 2016

> 3.000 qm production area
ISO certified quality standards



Shareholdings

MICRO-SENSOR

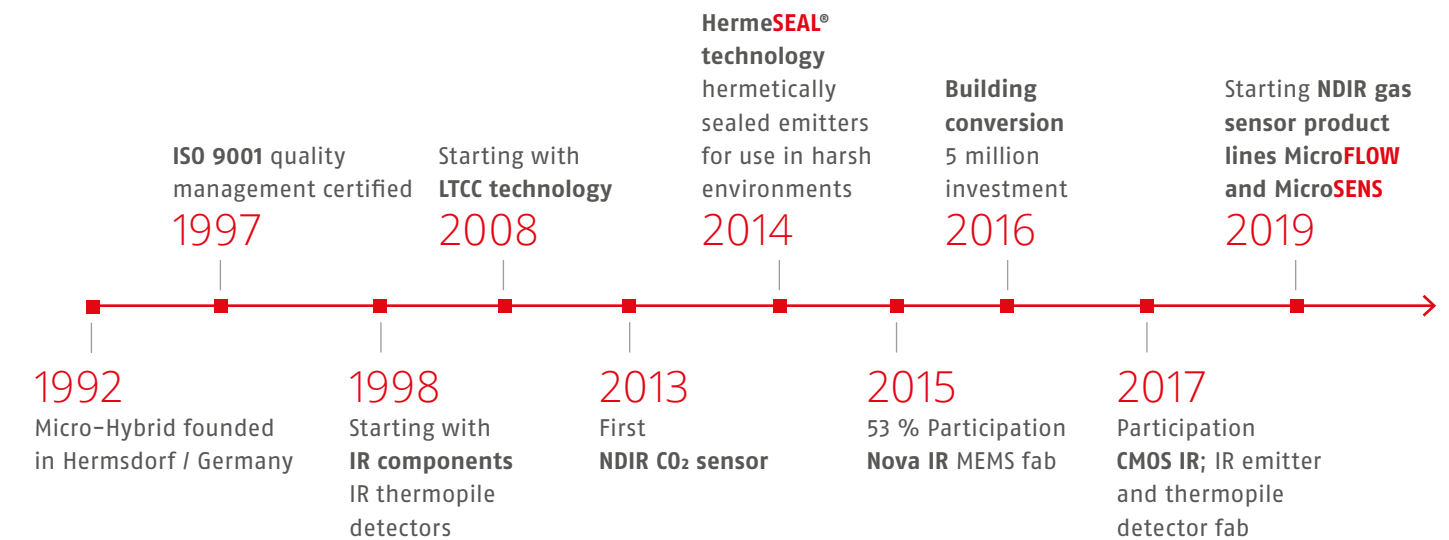
Inertial sensors for industry and rail

NOVA IR

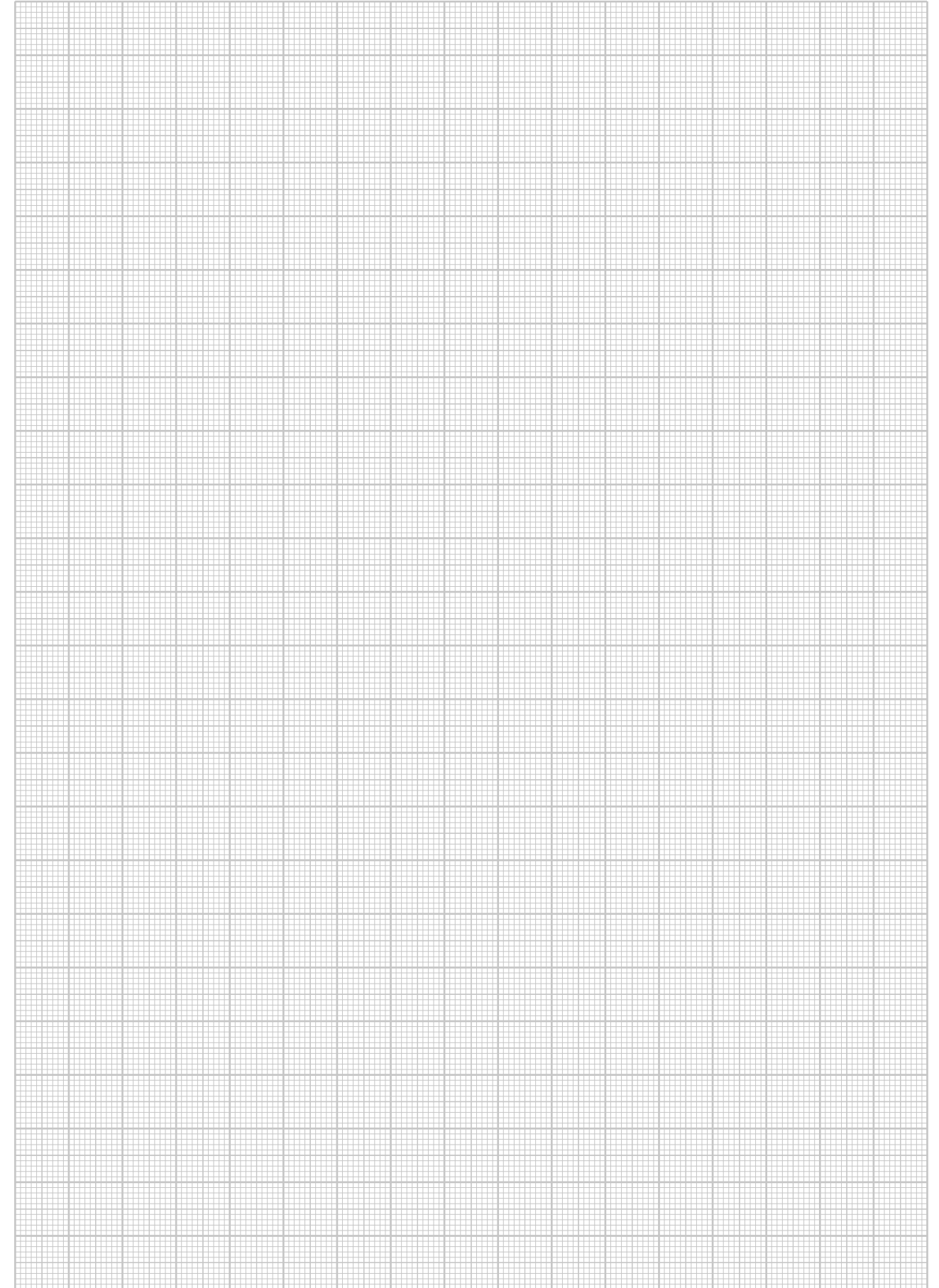
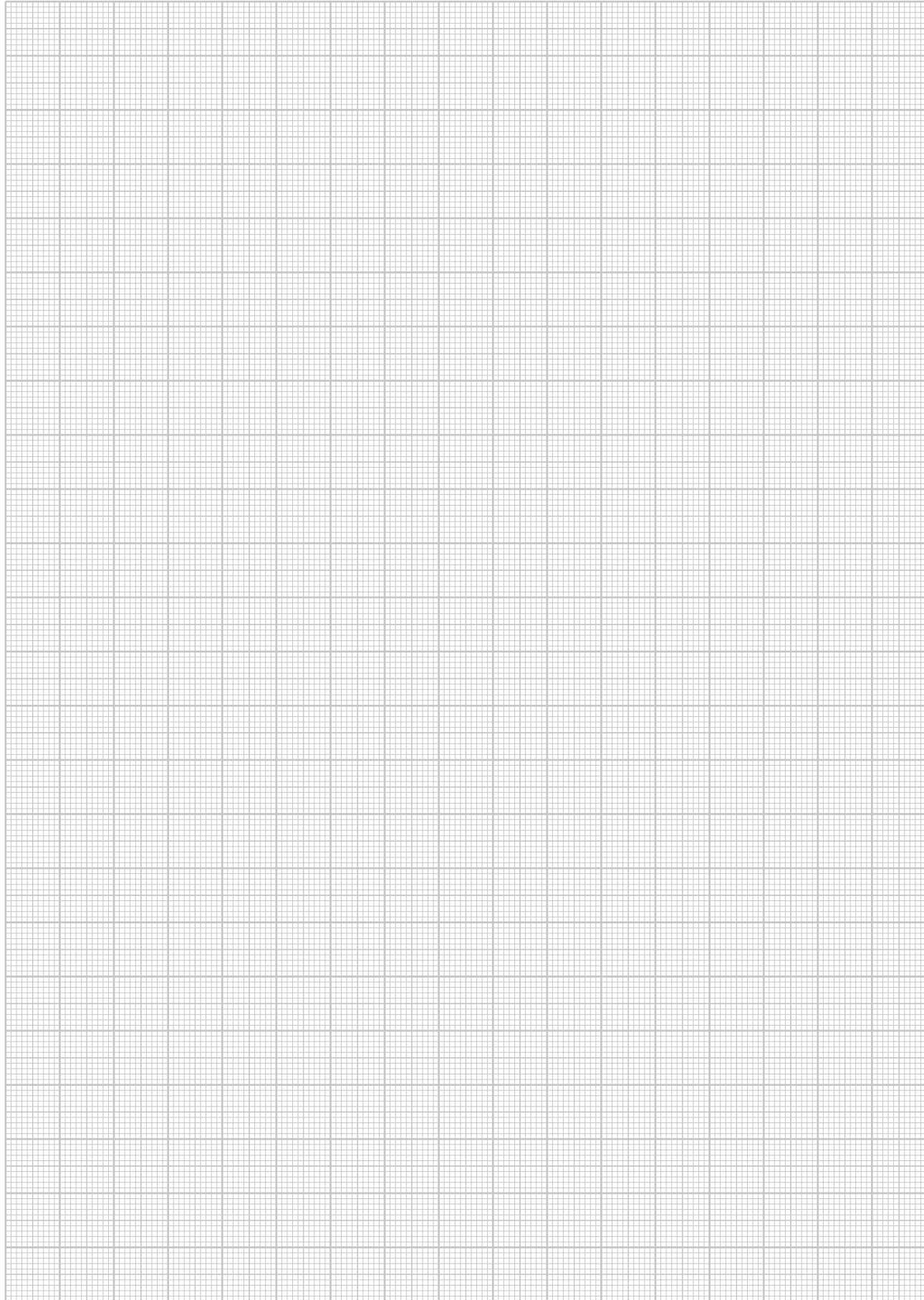
Infrared source MEMS fab

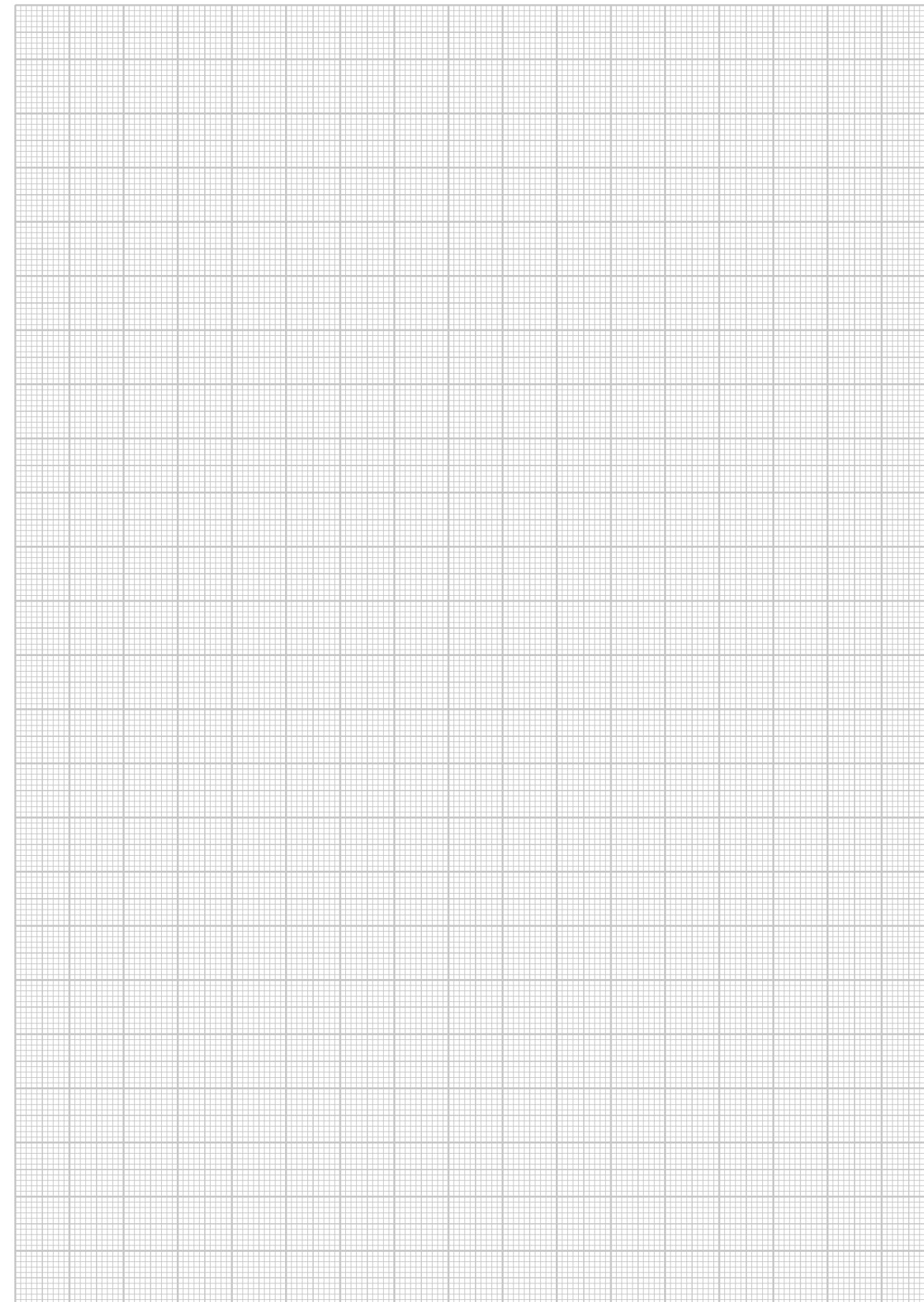
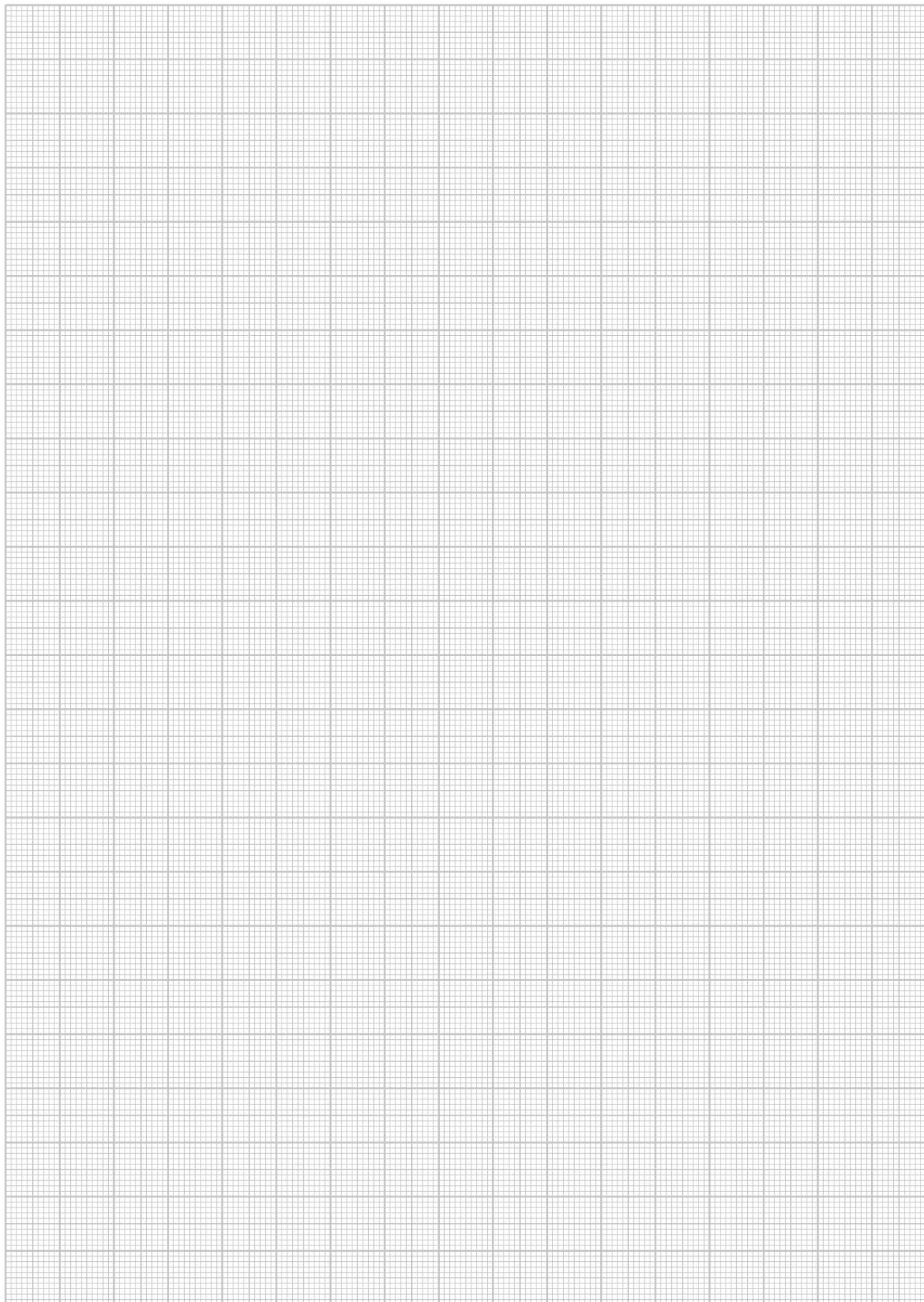
CMOS IR

IR emitter chips & thermopile detectors



Micro-Hybrid is a company of Micro-Epsilon group.
www.micro-epsilon.de







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*All technical data are based on simulations and tests
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