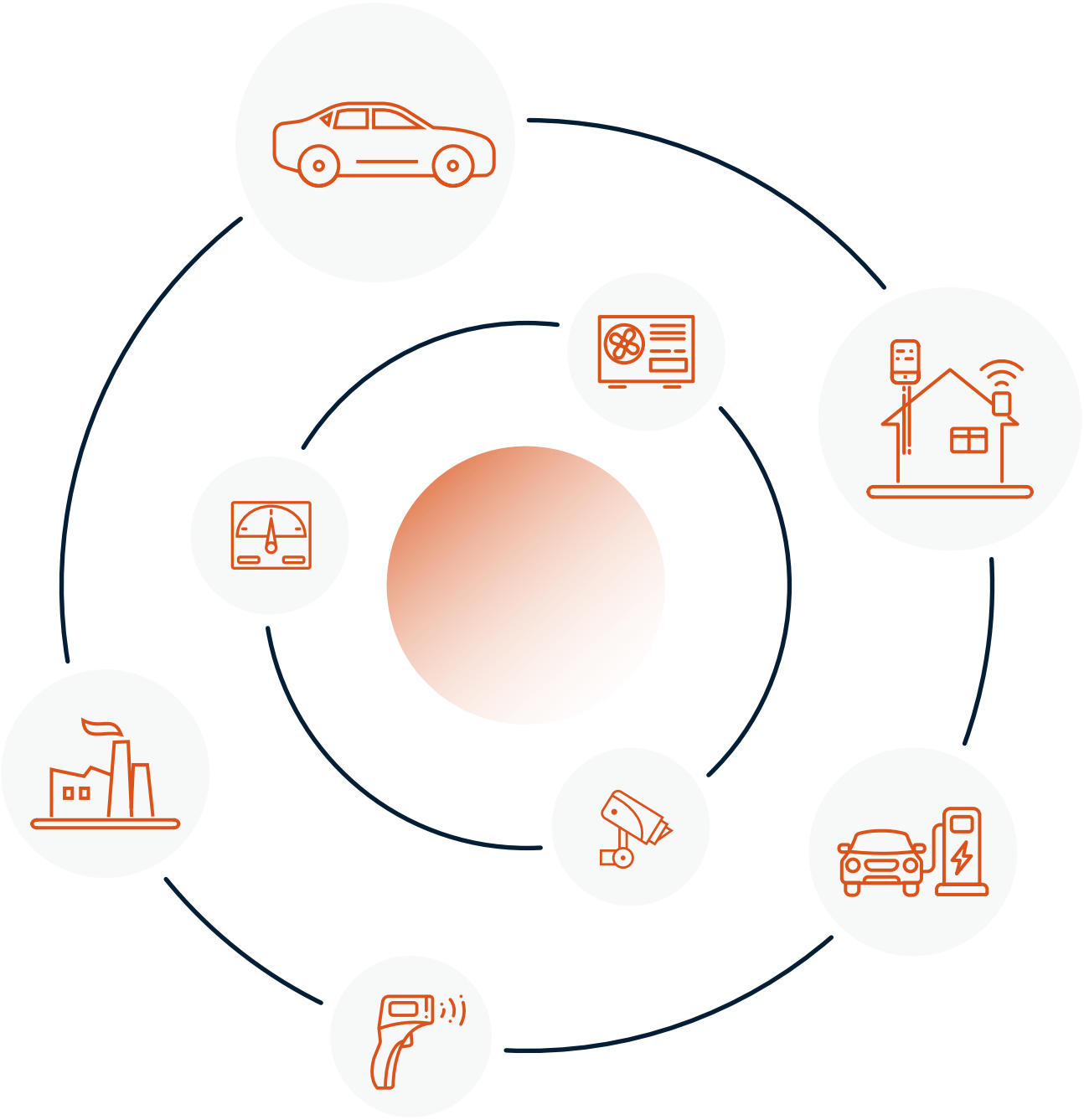
MFrontier
美 思 先 端



Shenzhen MemsFrontier Electronics Co.,Ltd

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1.1 About MFrontier

2015 Year
Company Establishment

6 types
Product Series

7000 m²
Clean Factory

Founded in 2015, Shenzhen MemsFrontier Electronics Co., Ltd. (MFrontier) is a national high-tech "little giant" enterprise specialized in MEMS sensor and precision optical design and manufacturing. MemsFrontier is committed to providing high-quality intelligent sensors, optical elements and industry application solutions for global users.

MFrontier is located in Guangming, Shenzhen, owning a factory with clean room area of 7,000 square meters and more than 200 sets of advanced equipment. MFrontier integrates the industrial links such as chip design, manufacturing, packaging, testing, marketing and terminal applications to shorten the product launch cycle and quickly respond to user requirements.

MFrontier is a professional R&D MEMS sensor enterprise since 2015. Relying on its strong capabilities in MEMS sensor chip design, wafer manufacturing, packaging and testing to build temperature, gas, pressure, dust, flow, optical components product systems. It has developed more than 50 MEMS sensors modules and more than 100 precision optical components. They can be widely used in smart home appliances, HVAC, medical equipment, consumer electronics, automotive electronics, industry monitoring, security monitoring, smart energy, smart agriculture, aerospace, public safety, semiconductors and other fields.

Adhering to the business philosophy of "quality first, customer first, sincerity and perfection", MFrontier focuses on using advanced technology and solutions to help customers continue to create value, and can provide optical components, sensors, modules, and terminal systems to many customers. Customized solutions and services to meet the different needs of customers in the industry chain.

1.2 Memorabilia

2023

Obtained certification from “China, Guangdong Province MEMS based Infrared Intelligent Sensor Engineering Technology Research Center”.

The testing center has obtained “CNAS” qualification.

Obtained the certification of "T Ü V Rheinland Witness Laboratory Qualification".

2022

Trial production of MEMS infrared thermopile array sensor

Building a MEMS sensor laboratory

2021

Selected as a "National Key Integrated Circuit Design Enterprise"

Selected as a national level specialized and innovative "little giant" enterprise

Obtained IATF16949 qualification

2020

Participated in the joint effort to tackle infrared sensor technology during the 2020 epidemic period in China

Becoming the only enterprise in the sensor industry to receive a thank-you letter from the State Council

2018

MTP10-B6F55/MTP10-B7F55

The two most well-known infrared thermopile sensors in the industry are born

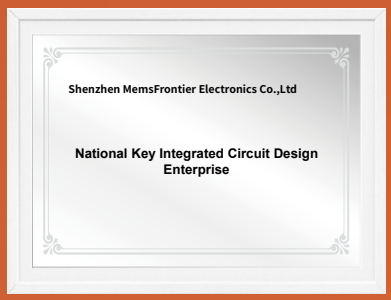
Opening a new chapter in domestic MEMS sensor chips

Obtained certification from "National High tech Enterprise"

2015

Established in Shenzhen ,Guangming

1.3 Qualification and Honor

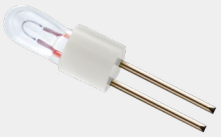


02

Optical components

MFrontier has a complete and mature core preparation process and quality control system for optical components, and has infrared filter coating production that integrates design, production, and testing. The production line and mature research and development technology can customize various specifications of filters for customers, which can be widely used in medical devices, security monitoring, gas detection, chemical analysis, Biological analysis, aerospace and other fields.

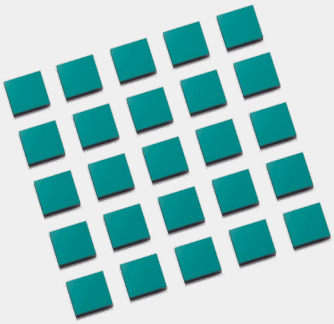
2.1 Infrared light source

Part/No	MIR-715	MIR-718
images		
Voltage	5.0V	5.0V
electric current	115±10%mA	115±10%mA
brightness	0.15±25%	0.15±25%
service life	40000h	40000h
Tungsten wire shape	C-2R	C-2R

2.2 Infrared narrowband filter

Narrowband filter is a subdivision of bandpass filter, which is used in specific applications. The band allows light signals to pass through, while light signals on both sides outside of this band are blocked, Reducing interference information lays the foundation for subsequent image processing and recognition. The passband is relatively narrow, generally less than 5% of the central wavelength value.

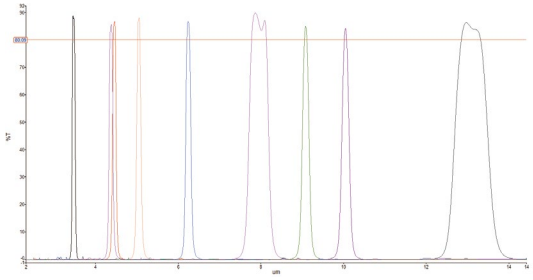
The narrowband filter developed by MFrontier uses single crystal silicon, sapphire, germanium, and fluoride Calcium, zinc selenide and other base materials, covering Φ 150 * 0.5mm, Φ 100 * 0.5mm, Sizes such as Φ 76 * 0.5mm, Φ 25 * 0.6mm, etc. can be customized according to needs. Its main parameters include: center wavelength λ 0, full width at half maximum (FWHM), peak transmittance Tp，Cut off range and depth (OD value).



Product Features

- High transmittance
- Cut off depth deep
- Good consistency of central wavelength

Example spectrogram



Application


Biochemical analysis


Optical instrument


Spectral measurement


Instrumentation


Gas detection

Product specifications

Part/No	Material	Central wavelength	Half wavewidth	Peak Transmittance	Cut-off area	Average transmittance
NBP 2700 80nm Filter	single-crystal silicon	2700±30nm	80±20nm	75%	400~11000nm	⩽ 1%
NBP 3300 120nm Filter	sapphire	3300±30nm	120±20nm	85%	400~25000nm	⩽ 1%
NBP 3350 200nm Filter	single-crystal silicon	3350±30nm	200±20nm	80%	400~11000nm	⩽ 1%
NBP 3400 120nm Filter	single-crystal silicon	3400±20nm	120±20nm	80%	400~15000nm	⩽ 1%
NBP 3440 180nm Filter	single-crystal silicon	3440±30nm	180±20nm	80%	400~11200nm	⩽ 1%
NBP 3950 90nm Filter	single-crystal silicon	3950±20nm	90±20nm	80%	400~11000nm	⩽ 1%
NBP 4260 180nm Filter	single-crystal silicon	4260±20nm	180±20nm	80%	400~11000nm	⩽ 1%
NBP 4300 600nm Filter	single-crystal silicon	4300±30nm	600±30nm	85%	400~11000nm	⩽ 1%
NBP 4330 135nm Filter	single-crystal silicon	4330±30nm	120-150nm	75%	400~15000nm	⩽ 1%
NBP 4400 120nm Filter	sapphire	4400±30nm	120±20nm	80%	400~25000nm	⩽ 1%
NBP 4680 160nm Filter	sapphire	4680±30nm	160±20nm	85%	400~25000nm	⩽ 1%
NBP 5060 120nm Filter	sapphire	5060±20nm	120±20nm	80%	400~25000nm	⩽ 1%
NBP 5300 600nm Filter	single-crystal silicon	5300±50nm	600±40nm	80%	400~11000nm	⩽ 1%
NBP 7300 300nm Filter	single-crystal silicon	7300±30nm	300±30nm	80%	400~11000nm	⩽ 1%
NBP 7950 600nm Filter	single-crystal silicon	7960±40nm	600±40nm	80%	400~16000nm	⩽ 1%
NBP 8000 200nm Filter	single-crystal silicon	8000±30nm	200±30nm	80%	400~16000nm	⩽ 1%
NBP 8300 250nm Filter	single-crystal silicon	8300±30nm	250±30nm	80%	400~11000nm	⩽ 1%
NBP 9080 180nm Filter	single-crystal silicon	9080±30nm	180±20nm	75%	400~15000nm	⩽ 1%
NBP 10000 300nm Filter	single-crystal silicon	10000±50nm	300±30nm	75%	400~16000nm	⩽ 1%
NBP 10270 300nm Filter	single-crystal silicon	10270±50nm	300±30nm	75%	400~16000nm	⩽ 1%
NBP 10350 725nm Filter	single-crystal silicon	10350±50nm	725±25nm	80%	400~15000nm	⩽ 1%
NBP 10560 300nm Filter	single-crystal silicon	10560±50nm	300±30nm	75%	400~16000nm	⩽ 1%
NBP 13400 1000nm Filter	zinc selenide	13400±50nm	1000±60nm	80%	400~15000nm	⩽ 1%

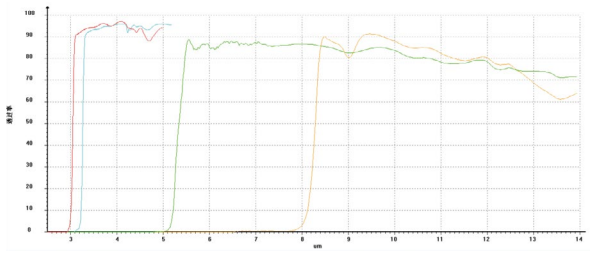
2.3 Infrared long wave pass filter

One side of the long wave pass filter is coated with a hard dielectric long wave pass filter film, and the other side is coated with an anti reflection film. The long-wave direction is transparent, and the short-wave direction is cut off, which can play the role of isolating short waves in a specific wavelength range. The infrared long-wave pass filter produced by MFrontier has the characteristics of high transmittance, low cut-off filter, measurement accuracy, stability and strong anti-interference ability.

Product Features

- Good consistency
- High transmittance
- Cut off depth deep
- Strong stability and anti-interference ability

Example spectrogram



Application

Temperature detection

Human body sensing

Security system

Thermal radiation system

Product specifications

Part/No	Material	Transmission area	Average transmittance	Cut-off area	Cut-off rate
LWP 5500-14000nm Filter	single-crystal silicon	5500-14000nm	⩾ 80%	400~5000nm	⩽ 1%
LWP 7700-9000nm Filter	single-crystal silicon	7700-9000nm	⩾ 80%	400~7600nm	⩽ 1%
LWP 3000-5000nm Filter	sapphire	3000-5000nm	⩾ 85%	400~2900nm	⩽ 1%
LWP 7000-14000nm Filter	single-crystal silicon	7000-14000nm	⩾ 80%	400~6500nm	⩽ 1%
LWP 8000-12000nm Filter	Germanium single crystal	8000-12000nm	⩾ 85%	400~7500nm	⩽ 1%

2.4 Infrared bandpass filter

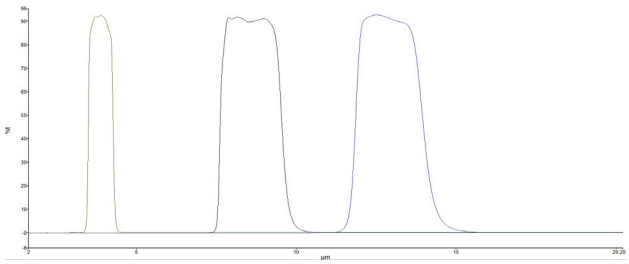
The filter with cut-off regions on both sides of the transmission band of the spectral characteristic curve is called a bandpass filter, Commonly used to transmit a portion of the spectrum while cutting off all other wavelengths. The bandpass filter is an important type of optical thin film component that can be widely used in chemistry, spectroscopy, lasers, and Fields such as physics, fiber optic communication, biology, etc.

The infrared bandpass filter developed by MFrontier uses single crystal silicon, germanium, sapphire, and zinc selenide, The base material covers a diameter of 150 * 0.5 mm, Φ 100*0.5 mm, Φ76*0.5mm, Sizes such as Φ 25 * 0.6mm can be customized as needed.

Product Features

- Good consistency
- High transmittance
- Cut off depth deep

Example spectrogram



Application

Temperature detection

Medical equipment

Security system

Thermal radiation system

Product specifications

Part/No	Material	Transmission area	Average transmittance	Cut-off area	Cut-off rate
WBP 8000-14000nm Filter	single-crystal silicon	8000~14000nm	＞ 75%	0.4~7.5μm；15~21.5μm	⩽ 1%
WBP 3100-3800nm Filter	sapphire	3100~3800nm	⩾ 85%	400~25000nm	⩽ 1%
WBP 4750-5400nm Filter	sapphire	4750~5400nm	⩾ 80%	400~25000nm	⩽ 1%
WBP 3550-4150nm Filter	Germanium single crystal	3550~4150nm	⩾ 90%	400~6000nm	⩽ 1%
WBP 8000-9450nm Filter	Germanium single crystal	8000~9450nm	⩾ 92%	400~12000nm	⩽ 1%
WBP 3250-3500nm Filter	Germanium single crystal	3250~3500nm	⩾ 88%	400~6000nm	⩽ 1%
WBP 3670-4970nm Filter	Germanium single crystal	3670~4970nm	⩾ 90%	400~6000nm	⩽ 1%
WBP 4500-5000nm Filter	Germanium single crystal	4500~5000nm	⩾ 90%	400~6000nm	⩽ 1%

2.5 Infrared anti reflection filter

Infrared anti reflection film, also known as anti reflection film, is deposited on the surface of optical components to reduce surface reflection,Optical thin films that increase the transmittance of optical systems. It can reduce scattered light in the system to improve contrast.

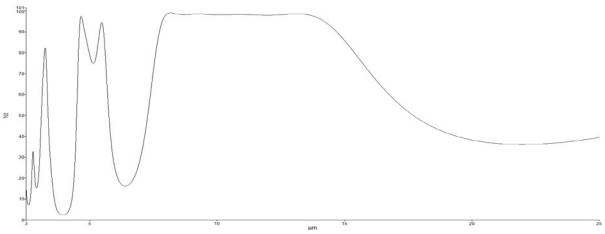
The infrared anti reflection film developed by MFrontier uses single crystal silicon, sapphire, germanium, calcium fluoride, and selenide zinc and other base materials, covering a diameter of 150 * 0.5mm, Φ100*0.5mm, Φ76*0.5mm, Sizes such as Φ 25 * 0.6mm can be customized as needed.

Its main parameters include: center wavelength λ 0, full width at half maximum (FWHM), peak transmittance Tp,Cut off range and depth (OD value).

Product Features

- High transmittance
- Wide spectral coverage range
- Good friction and corrosion resistance

Example spectrogram



Application

infrared imaging

infrared acquisition

Infrared remote sensing

Aerospace

Product specifications

Part/No	Material	Transmission area	Average transmittance
2.9-14.5μm AR	germanium	2.9~14.5μm	⩾ 73%
3-5μm AR	single-crystal silicon	3~5μm	⩾ 90%
8-14μm AR	single-crystal silicon	8~14μm	⩾ 83%
0.8-5μm AR	sapphire	0.8~5μm	⩾ 86%
7-12μm AR	single-crystal silicon	7~12μm	⩾ 88%
8-12μm AR+DLC	single-crystal silicon	8~12μm	⩾ 75%

2.6 Metallized light window

Metallized light windows are metal films (such as chromium, nickel, etc.) deposited on the edges of sapphire, germanium, or silicon substrates, Gold is used for welding to achieve airtight packaging, and the light passing area is coated with a filter film, which can be directly welded or installed on optical mechanical assemblies. Widely used in fiber optic communication, infrared detection, and production,Fields such as biomedical and infrared imaging.

Product Features

- High intensity
- High transmittance
- Good air tightness

Application

Temperature detection

Medical equipment

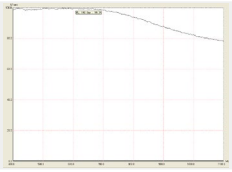
Security system

Thermal radiation system

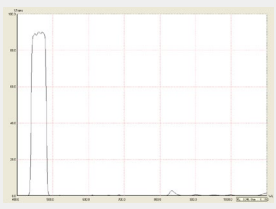
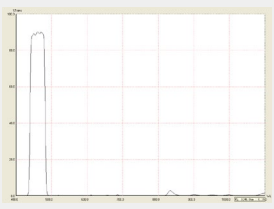
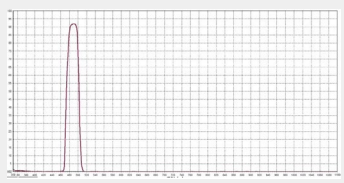
Product specifications

Part/No	Material	Dimensions (mm)	Optical effective aperture (mm)	Metallized area (mm)	Spectral index
Φ2.5*0.28mm	sapphire	Φ2.5	Φ1.6	⩾ Φ1.8	1250~1650nm, Tavg ＞ 99%
Φ18*1mm	single-crystal silicon	Φ18	Φ14	⩾ Φ14.5	3-5μm,T ⩾ 96%
Φ12*1mm	single-crystal silicon	Φ12	Φ10	⩾ Φ10.5	
Φ30*1mm	sapphire	Φ30	Φ26	⩾ Φ26.5	
16*16*0.8mm	Germanium single crystal	16*16	13.2*13.2	⩾ 13.7*13.7	
10*10*1mm	single-crystal silicon	10*10*1	8.5*8.5*0.9	⩾ 8.9*8.9	8-12μm，T ⩾ 82%

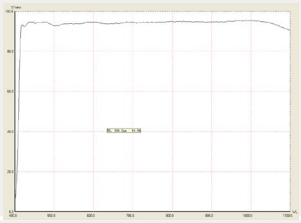
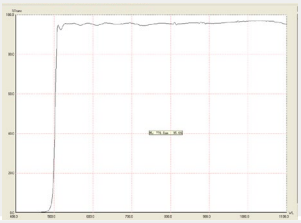
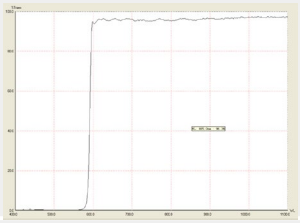
2.7 Anti reflective film

Part/No	size	Thickness	Material	Incident angle	Transmission band	Average transmittance	Example spectrogram
AR 420-680nm	80*80mm	0.2~5mm	K9,BK7,B270, Quartz, sapphire etc.	0°	420~680nm	Tavg>99.5%	

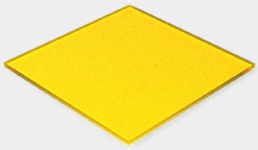
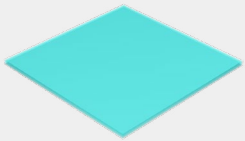
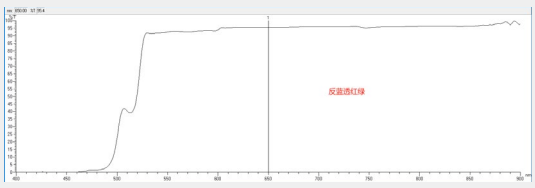
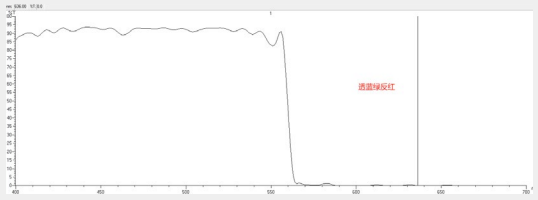
2.8 Bandpass filter

Part/No	BP450 bandpass filter	BP490 bandpass filter	BP530 bandpass filter
Images			
Feature	High transmittance, wide cutoff range, deep cutoff depth		
Application	Machine vision, intelligent robots, dry chemistry readers	Machine vision, inspection instruments,barcode scanning	Iris recognition, fluorescence analyzer, detection instrument
Material	K9, BK7, B270, Quartz, sapphire etc.	K9,BK7,B270, Quartz, sapphire etc.	K9, BK7, B270, Quartz, sapphire etc.
Incident angle	0°	0°	0°
Center wavelength	450±5nm	490±5nm	530±5nm
Half bandwidth	40±5nm	50±5nm	35±10nm
Average transmittance	Tp ⩾ 90%	Tp ⩾ 90%	Tp ⩾ 90%
Cut off band	400-430nm/470-1100nm	400-460nm/520-1100nm	400-490nm/570-1100nm
Cut off depth	⩾ OD3	⩾ OD3	⩾ OD3
Example spectrogram			
Size	80*80mm	80*80mm	80*80mm
Thickness	0.2~5mm	0.2~5mm	0.2~5mm
Shape	Can cut various sizes and shapes, such as square, circular, elliptical, hexagonal and other shaped parts		

2.9 Long pass filter

Part/No	LP420	LP520	LP590
Images			
Feature	High transmittance, wide cutoff range, deep cutoff depth		
Application	Beauty equipment, stage lighting, multi band detector		
Material	K9, BK7, B270, Quartz, sapphire etc.	K9, BK7, B270, Quartz, sapphire etc.	K9, BK7, B270, Quartz, sapphire etc.
Incident angle	0°	0°	0°
Transmission band	430~1100nm	530~1100nm	600~1100nm
Cut off band	200~410nm	200~500nm	200~540nm
Average transmittance	Tp ⩾ 90%	Tp ⩾ 90%	Tp ⩾ 90%
Cut off depth	OD3-OD5	OD3-OD5	OD3-OD5
Example spectrogram			
Size	80*80mm	80*80mm	80*80mm
Thickness	0.2~5mm	0.2~5mm	0.2~5mm
Shape	Can cut various sizes and shapes, such as square, circular, elliptical, hexagonal and other shaped parts		

2.10 Dichroic mirror

Part/No	HR400-540HT590-1100	HT400-480HR495-800
Images		
Feature	High transmittance, wide cutoff range, deep cutoff depth	High transmittance, wide cutoff range, deep cutoff depth
Application	Security monitoring, intelligent transportation, projector	Security monitoring, intelligent transportation, projector
Material	Quartz, Schott, Corning, Colored Glass	Quartz, Schott, Corning, Colored Glass
Incident angle	45°	45°
Working band reflection	Ravg>98%; 400~540nm	Ravg>98%; 400~480nm
Transmission in working band	Tavg>98%; 590~1100nm	Tavg>98%; 495-800nm
Example spectrogram		
Size	80*80mm	80*80mm
Thickness	0.2~5mm	0.2~5mm
Shape	Can cut various sizes and shapes, such as square, circular, elliptical, hexagonal and other shaped parts	

03

Sensor

Sensors can perceive and collect the information being measured, and convert it into electrical signals or other forms of information that the device can process according to certain rules, in order to meet the requirements of physical quantities,requirements for information transmission, processing, storage, display, recording, intelligent control, etc.

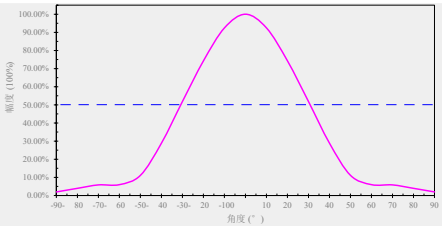
The temperature, gas, and flame sensors developed by MFrontier Technology adopt MEMS infrared thermopiles and pyroelectric chips, with excellent quality, stability, and reliability, which can serve a wide range of users ,provide bulk customization solutions.

3.1 Infrared thermopile temperature sensor

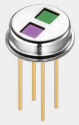
Part/No	MTP10-A6F8 H386	MTP10-A6F8-TSR	MTP10-A6F55	MTP10-A6F55-TSR	MTP10-A6LF55	MTP10-B6F8	
Images							
Package	TO-39	TO-39	TO-39	TO-39	TO-39	TO-46	
Chip area	1.8×1.8mm²						
Sensing area	1.35×1.35mm²						
Field (50% maximum signal)	62°	52°	62°	52°	18°	83°	
DS ratio	-	-	-	-	-	-	
Thermopile resistance value (25°C)	43±10%kΩ	43±10%kΩ	43±10%kΩ	43±10%kΩ	43±10%kΩ	43±10%kΩ	
Noise voltage (25°C)	27±2nV/Hz$^{1/2}$						
Equivalent power of noise （500K,1Hz）	0.62nW/Hz$^{1/2}$						
Response rate (500K, 5.5 μ m (longwave pass))	43V/W	43V/W	43V/W	43V/W	43V/W	43V/W	
Temperature coefficient of resistance （25°C /50°C）	0.1%/°C	0.1%/°C	0.1%/°C	0.1%/°C	0.1%/°C	0.1%/°C	
time constant	32ms	32ms	32ms	32ms	32ms	32ms	
Detection rate (500K,1Hz)	6.8E+07cmHz$^{1/2}$/W						
NTC resistance (25 °C)	100±3%kΩ	100±3%kΩ	100±3%kΩ	100±3%kΩ	100±3%kΩ	100±3%kΩ	
NTC β value （25°C /50°C）	3950±1%K	3950±1%K	3950±1%K	3950±1%K	3950±1%K	3950±1%K	
Filter passes through the wavelength range	8~14μm bandpass	8~14μm bandpass	5.5~14μm long wave pass	5.5~14μm long wave pass	5.5~14μm long wave pass	8~14μm bandpass	
Average transmittance of filter	⩾ 75% 8~14μm	⩾ 75% 8~14μm	⩾ 80% 5.5~14μm	⩾ 80% 5.5~14μm	⩾ 80% 5.5~14μm	⩾ 75% 8~14μm	
Average cut-off rate of filter	1%，＜ 7.5μm; 1%, 15~21μm	1%，＜ 7.5μm; 1%, 15~21μm	1%，＜ 5μm	1%，＜ 5μm	1%，＜ 5μm	1%，＜ 7.5μm; 1%, 15~21μm	
work environment	-30~100°C	-30~100°C	-30~100°C	-30~100°C	-30~100°C	-30~100°C	
Storage environment	-40~125°C	-40~125°C	-40~125°C	-40~125°C	-40~125°C	-40~125°C	

	MTP10-B6F55	MTP10-B6F55-TSR	MTP10-B6F55-L11[Si-A]	MTP10-B7F55-TSR	MTP10-B7F55	MTP10-A6L5.5	MTP10-A6LF8	MTP10-S6F55
								
	TO-46	TO-46	TO-46	TO-46	TO-46	TO-39	TO-39	SMD
	1.8×1.8mm²				1.1×1.1mm²	1.8×1.8mm²		1.1×1.1mm²
	1.35×1.35mm²			0.75×0.75mm²		1.35×1.35mm²		0.75×0.75mm²
	83°	76°	10°	76°	83°	12°	18°	120°
	-	-	8:1	-	-	8:1	-	-
	43±10%kΩ			54±10%kΩ		43±10%kΩ		54±10%kΩ
	27±2nV/Hz$^{1/2}$			30±2nV/Hz$^{1/2}$		27±2nV/Hz$^{1/2}$		30±2nV/Hz$^{1/2}$
	0.62nW/Hz$^{1/2}$			0.37nW/Hz$^{1/2}$		0.62nW/Hz$^{1/2}$	0.62nW/Hz$^{1/2}$	0.37nW/Hz$^{1/2}$
	43V/W	43V/W	43V/W	81V/W	81V/W	43V/W	43V/W	81V/W
	0.1%/°C	0.1%/°C	0.1%/°C	0.1%/°C	0.1%/°C	0.1%/°C	0.1%/°C	0.1%/°C
	32ms	32ms	32ms	20ms	20ms	32ms	32ms	20ms
	6.8E+07cmHz$^{1/2}$/W			5.9E+07cmHz$^{1/2}$/W		6.8E+07cmHz$^{1/2}$/W		5.9E+07cmHz$^{1/2}$/W
	100±3%kΩ	100±3%kΩ	100±3%kΩ	100±3%kΩ	100±3%kΩ	100±3%kΩ	100±3%kΩ	100±3%kΩ
	3950±1%K	3950±1%K	3950±1%K	3950±1%K	3950±1%K	3950±1%K	3950±1%K	3950±1%K
	5.5~14μm long wave pass					Coatings available: 5.5~14μm long wave pass; 8.0~14μm bandpass	8~14μm bandpass	5.5~14μm long wave pass
	⩾ 80% 5.5~14μm					50% 5.5~14μm	⩾ 75% 8~14μm	⩾ 80% 5.5~14μm
	1%，＜5μm					-	1%，＜7.5μm; 1%, 15~21μm	1%，＜5μm
	-30~100°C	-30~100°C	-30~100°C	-30~100°C	-30~100°C	-30~100°C	-30~100°C	-30~100°C
	-40~125°C	-40~125°C	-40~125°C	-40~125°C	-40~125°C	-40~125°C	-40~125°C	-40~125°C

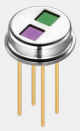
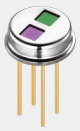
3.2 Digital temperature sensor

Part/No	MTP10-A6F55D
Images	
Tobj measurement accuracy	±2° C/±2%*Tobj
Filter type	Long wave communication
Filter passes through the wavelength range	5.5~14μm
Average transmittance of filter	⩾ 80% 5.5~14μm
Average cut-off rate of filter	1% <5μm
supply voltage	2.4V~3.6V type:3.3V
Power supply current	Continuous mode: 600 μA; Sleep mode: 5.0 μA
temperature range	-20~300°C
resolving power	0.1°C
field	62°
optical characteristics	
work environment	-20~85°C
Storage environment	-40~100°C

3.3 Infrared thermopile gas sensor

Part/No	MTP20-B6-CO2	MTP20-A6-CO2 (3.95μm-4.26μm)	MTP20-A6-CO2 (3.95μm-4.33μm)	MTP20-B6-CO (4.75μm)	MTP20-A6-CO (3.95μm-4.75μm)
Images					
Detect gas type	carbon dioxide	carbon dioxide	carbon dioxide	carbon monoxide	carbon monoxide
Package	TO-46(single channel)	TO-39(dual channel)	TO-39(dual channel)	TO-46(single channel)	TO-39(dual channel)
Chip area	1.8×1.8mm²	1.8×1.8mm²	1.8×1.8mm²	1.8×1.8mm²	1.8×1.8mm²
Sensing area	1.35×1.35mm²	1.35×1.35mm²	1.35×1.35mm²	1.35×1.35mm²	1.35×1.35mm²
Thermopile resistance value (25 °C)	43±10% kΩ	43±10% kΩ	43±10% kΩ	43±10% kΩ	43±10% kΩ
Noise voltage (25 °C)	27±2nV/Hz$^{1/2}$	27±2nV/Hz$^{1/2}$	27±2nV/Hz$^{1/2}$	27±2nV/Hz$^{1/2}$	27±2nV/Hz$^{1/2}$
Equivalent power of noise (500K,1Hz)	0.62nW/Hz$^{1/2}$	0.62nW/Hz$^{1/2}$	0.62nW/Hz$^{1/2}$	0.62nW/Hz$^{1/2}$	0.62nW/Hz$^{1/2}$
Response rate (500K, 5.5μm (longwave pass))	43V/W	43V/W	43V/W	43V/W	43V/W
Temperature coefficient of resistance (25°C/50°C)	0.1%/°C	0.1%/°C	0.1%/°C	0.1%/°C	0.1%/°C
time constant	32ms	32ms	32ms	32ms	32ms
Detection rate (500K,1Hz)	6.8E+07cmHz$^{1/2}$/W	6.8E+07cmHz$^{1/2}$/W	6.8E+07cmHz$^{1/2}$/W	6.8E+07cmHz$^{1/2}$/W	6.8E+07cmHz$^{1/2}$/W
NTC resistance (25 °C)	100±3%kΩ	100±3%kΩ	100±3%kΩ	100±3%kΩ	100±3%kΩ
NTC β value (25°C /50°C)	3950±1%K	3950±1%K	3950±1%K	3950±1%K	3950±1%K
Filter type	Narrowband filter	Narrowband filter	Narrowband filter	Narrowband filter	Narrowband filter
Center wavelength of filter	4.26μm	Working channel:4.26μm Reference channel:3.95μm	Working channel:4.33μm Reference channel:3.95μm	4.75μm	Working channel:4.75μm Reference channel:3.95μm
Half wave width of filter	180nm	Working channel:180nm Reference channel:90nm	Working channel:20nm Reference channel:90nm	180nm	Working channel:180nm Reference channel:90nm
Peak transmittance of filter	＞80%	Working channel: ＞80%; Reference channel: ＞80%	Working channel: ＞80%; Reference channel: ＞80%	＞80%	Working channel: ＞80%; Reference channel: ＞80%
work environment	-30~100°C	-30~100°C	-30~100°C	-30~100°C	-30~100°C
Storage environment	-40~125°C	-40~125°C	-40~125°C	-40~125°C	-40~125°C

Part/No	MTP20-B6-CH4 (3.4μm)	MTP20-B6-CH4 (7.65μm)	MTP20-A6-CH4 (3.95μm-3.4μm)	MTP20-A6-CH4 (3.95μm-7.65μm)	MTP20-A6-SF6 (3.95μm-10.60μm)	MTP20-A6-SF6 (3.95μm-10.56μm)
Images						
Detect gas type	methane				Sulfur hexafluoride	
Package	TO-46 (single channel)		TO-39 (dual channel)			
Chip area	1.8×1.8mm²	1.8×1.8mm²	1.8×1.8mm²	1.8×1.8mm²	1.8×1.8mm²	1.8×1.8mm²
Sensing area	1.35×1.35mm²	1.35×1.35mm²	1.35×1.35mm²	1.35×1.35mm²	1.35×1.35mm²	1.35×1.35mm²
Thermopile resistance value (25 °C)	43±10% kΩ	43±10% kΩ	43±10% kΩ	43±10% kΩ	43±10% kΩ	43±10% kΩ
Noise voltage (25 °C)	27±2nV/Hz$^{1/2}$	27±2nV/Hz$^{1/2}$	27±2nV/Hz$^{1/2}$	27±2nV/Hz$^{1/2}$	27±2nV/Hz$^{1/2}$	27±2nV/Hz$^{1/2}$
Equivalent power of noise (500K,1Hz)	0.62nW/Hz$^{1/2}$	0.62nW/Hz$^{1/2}$	0.62nW/Hz$^{1/2}$	0.62nW/Hz$^{1/2}$	0.62nW/Hz$^{1/2}$	0.62nW/Hz$^{1/2}$
Response rate (500K, 5.5μm (longwave pass))	43V/W	43V/W	43V/W	43V/W	43V/W	43V/W
Temperature coefficient of resistance (25°C /50°C)	0.1%/°C	0.1%/°C	0.1%/°C	0.1%/°C	0.1%/°C	0.1%/°C
time constant	32ms	32ms	32ms	32ms	32ms	32ms
Detection rate (500K,1Hz))	6.8E+07cmHz$^{1/2}$/W	6.8E+07cmHz$^{1/2}$/W	6.8E+07cmHz$^{1/2}$/W	6.8E+07cmHz$^{1/2}$/W	6.8E+07cmHz$^{1/2}$/W	6.8E+07cmHz$^{1/2}$/W
NTC resistance (25 °C)	100±3%kΩ	100±3%kΩ	100±3%kΩ	100±3%kΩ	100±3%kΩ	100±3%kΩ
NTC β value (25°C /50°C)	3950±1%K	3950±1%K	3950±1%K	3950±1%K	3950±1%K	3950±1%K
Filter type	Narrowband filter	Narrowband filter	Narrowband filter	Narrowband filter	Narrowband filter	Narrowband filter
Center wavelength of filter	3.4μm	3.4μm	Working channel:3.4μm Reference channel:3.95μm	Working channel:7.65μm Reference channel:3.95μm	Working channel:10.6μm Reference channel:3.95μm	Working channel:10.56μm Reference channel:3.95μm
Half wave width of filter	180nm	180nm	Working channel:180nm Reference channel:90nm	Working channel:180nm Reference channel:90nm	Working channel:240nm Reference channel:90nm	Working channel:370nm Reference channel:90nm
Peak transmittance of filter	＞80%	＞80%	Working channel: ＞80% Reference channel: ＞80%	Working channel: ＞70% Reference channel: ＞70%	Working channel:80% Reference channel:80%	Working channel:80% Reference channel:80%
work environment	-30~100°C	-30~100°C	-30~100°C	-30~100°C	-30~100°C	-30~100°C
Storage environment	-40~125°C	-40~125°C	-40~125°C	-40~125°C	-40~125°C	-40~125°C

	MTP20-A6-SF6 (10.0μm-10.56μm)	MTP20-A6-G1 (3.95μm-8.34μm)	MTP20-B6-C2H4 (10.5μm)	MTP20-A6-C2H6 (3.95μm-3.375μm)	MTP20-B6-C2H6 (3.375μm)	MTP20-A6-SO2 (3.95μm-7.3μm)
						
	Sulfur hexafluoride	Ether based anesthetic gases	ethylene	ethane	ethane	sulfur dioxide
	TO-39 (dual channel)		TO-46 (single channel)	TO-39 (dual channel)	TO-46 (single channel)	TO-39 (dual channel)
	1.8×1.8mm²	1.8×1.8mm²	1.8×1.8mm²	1.8×1.8mm²	1.8×1.8mm²	1.8×1.8mm²
	1.35×1.35mm²	1.35×1.35mm²	1.35×1.35mm²	1.35×1.35mm²	1.35×1.35mm²	1.35×1.35mm²
	43±10% kΩ	43±10% kΩ	43±10% kΩ	43±10% kΩ	43±10% kΩ	43±10% kΩ
	27±2nV/Hz$^{1/2}$	27±2nV/Hz$^{1/2}$	27±2nV/Hz$^{1/2}$	27±2nV/Hz$^{1/2}$	27±2nV/Hz$^{1/2}$	27±2nV/Hz$^{1/2}$
	0.62nW/Hz$^{1/2}$	0.62nW/Hz$^{1/2}$	0.62nW/Hz$^{1/2}$	0.62nW/Hz$^{1/2}$	0.62nW/Hz$^{1/2}$	0.62nW/Hz$^{1/2}$
	43V/W	43V/W	43V/W	43V/W	43V/W	43V/W
	0.1%/°C	0.1%/°C	0.1%/°C	0.1%/°C	0.1%/°C	0.1%/°C
	32ms	32ms	32ms	32ms	32ms	32ms
	6.8E+07cmHz$^{1/2}$/W	6.8E+07cmHz$^{1/2}$/W	6.8E+07cmHz$^{1/2}$/W	6.8E+07cmHz$^{1/2}$/W	6.8E+07cmHz$^{1/2}$/W	6.8E+07cmHz$^{1/2}$/W
	100±3%kΩ	100±3%kΩ	100±3%kΩ	100±3%kΩ	100±3%kΩ	100±3%kΩ
	3950±1%K	3950±1%K	3950±1%K	3950±1%K	3950±1%K	3950±1%K
	Narrowband filter	Narrowband filter	Narrowband filter	Narrowband filter	Narrowband filter	Narrowband filter
	Working channel:10.56μm Reference channel:10.0μm	Working channel:8.34μm Reference channel:3.95μm	10.5μm	Working channel:3.375μm Reference channel:3.95μm	3.375μm	Working channel:7.30μm Reference channel:3.95μm
	Working channel:370nm Reference channel:90nm	Working channel:200nm Reference channel:90nm	600nm	Working channel:180nm Reference channel:90nm	180nm	Working channel:300nm Reference channel:90nm
	Working channel:80% Reference channel:80%	Working channel:80% Reference channel:80%	＞80%	Working channel:80% Reference channel:80%	＞80%	Working channel:70% Reference channel:70%
	-30~100°C	-30~100°C	-30~100°C	-30~100°C	-30~100°C	-30~100°C
	-40~125°C	-40~125°C	-40~125°C	-40~125°C	-40~125°C	-40~125°C

3.4 Pyroelectric flame sensor

Part/No	MPY30-A211-3.8-5.3	MPY30-A211	MPY30-A211T	
Images				
channel	Single channel dual window	Single channel	Single channel dual window	
Package	TO39	TO-39	TO-39	
Mode	Voltage mode	Current mode	Voltage mode	
Thermal compensation	No thermal compensation	No thermal compensation	thermal compensation	
Window size	5.0×5.0mm²	5.0×5.0mm²	5.0×5.0mm²	
Sensitive element size	2.0×2.0mm²	2.0×2.0mm²	2.0×2.0mm²	
Feedback resistor	50GΩ	100GΩ	50GΩ	
Working voltage	2~10V	2~5V	2~10V	
Voltage response rate (windowless) Rv(500K,10Hz,25°C)	⩾ 380V/W	⩾ 100000V/W	⩾ 280V/W	
Noise density (10Hz,BW1Hz,25°C)	⩽ 150nV/Hz$^{1/2}$	⩽ 12μV/Hz$^{1/2}$	⩽ 150nV/Hz$^{1/2}$	
Specific detection rate (windowless) D*(500K,10Hz,BW1Hz,25°C)	⩾ 3.5×10E8cm·Hz$^{1/2}$/W	⩾ 4.0×10E8 cm·Hz$^{1/2}$/W	⩾ 3.8×10E8 cm·Hz$^{1/2}$/W	
Field of view angle	⩾ 60°	⩾ 110°	⩾ 110°	
Detection distance	> 30m	> 30m	> 30m	
Filter specifications (Customizable)	2.7μm/3.8μm/4.3μm/5.3μm...			
Working temperature	-40~80°C	-40~80°C	-40~80°C	

	MPY30-A221T	MPY30-A211-4.3B	MPY30-A212T-3.8-5.3	MPY30-C114T	MPY30-C124T
					
	Single channel	Single channel	Dual channel	Four channels	Four channels
	TO-39	TO-39	TO-39	TO-8	TO-8
	Current mode	Voltage mode	Voltage mode	Voltage mode	Current mode
	thermal compensation	No thermal compensation	thermal compensation	thermal compensation	thermal compensation
	5.0×5.0mm²	5.0×5.0mm²	2.5×2.5mm²	ϕ3.5mm	ϕ3.5mm
	2.0×2.0mm²	2.0×2.0mm²	1.6×1.6 mm²	1.6×1.6 mm²	1.6×1.6 mm²
	100GΩ	50GΩ	50GΩ	50GΩ	100 GΩ
	2~5V	2~10V	2~10V	2~10V	2~5V
	⩾ 85000V/W	⩾ 450V/W	⩾ 200V/W	⩾ 300V/W	⩾ 50000V/W
	⩽ 15μV/Hz$^{1/2}$	⩽ 250nV/Hz$^{1/2}$	⩽ 150nV/Hz$^{1/2}$	⩽ 180nV/Hz$^{1/2}$	⩽ 45μV/Hz$^{1/2}$
	⩾ 3.8×10E8 cm·Hz$^{1/2}$/W	⩾ 3.8×10E8 cm·Hz$^{1/2}$/W	⩾ 3.8×10E8 cm·Hz$^{1/2}$/W	⩾ 4.0×10E8 cm·Hz$^{1/2}$/W	6.0×10E8 cm·Hz$^{1/2}$/W
	⩾ 110°	⩾ 110°	⩾ 60°	⩾ 90°	⩾ 90°
	> 30m	> 30m	> 30m	> 30m	> 30m
	-40~80°C	-40~80°C	-40~80°C	-40~80°C	-40~80°C

3.5 Pyroelectric gas sensor

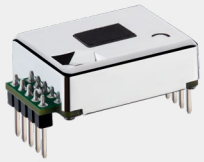
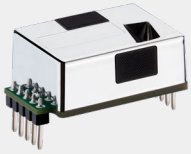
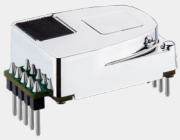
Part/No	MPY20-A112T	MPY20-A122T	MPY20-C114T	MPY20-C124T
Images				
Detect gas type	CO/CO2/CH4/NO/NO2/N2O/SO2/SF6/Anesthesia gas			
channel	Dual channel	Dual channel	Four channels	Four channels
Package	TO-39	TO-39	TO-8	TO-8
Mode	Voltage mode	Current mode	Voltage mode	Current mode
Window size	2.5×2.5 mm^2	2.5×2.5 mm^2	ϕ3.5mm	ϕ3.5mm
Sensitive element size	1.6×1.6 mm^2	1.6×1.6 mm^2	1.6×1.6 mm^2	1.6×1.6 mm^2
Thermal time constant	150 ms	150 ms	150 ms	150 ms
Feedback resistor	50 GΩ	100 GΩ	50 GΩ	100 GΩ
Recommended voltage	2~10V	2~5V	2~10V	2~5V
Voltage response rate (windowless) Rv(500K,10Hz,25℃)	⩾ 200V/W	⩾ 45000V/W	⩾ 220V/W	⩾ 50000V/W
Noise density (10Hz,BW1Hz,25℃)	⩽ 150nV/$Hz^{1/2}$	⩽ 35μV/$Hz^{1/2}$	⩽ 150nV/$Hz^{1/2}$	⩽ 45μV/$Hz^{1/2}$
Specific detection rate (windowless) D*(500K,10Hz,BW1Hz,25℃)	3.5×10E8 cm·$Hz^{1/2}$/W	4.0×10E8 cm·$Hz^{1/2}$/W	4.0×10E8 cm·$Hz^{1/2}$/W	6.0×10E8 cm·$Hz^{1/2}$/W
Optimal output load	47kΩ	470kΩ	47kΩ	470kΩ
Working/storage temperature	-40~80℃	-40~80℃	-40~80℃	-40~80℃

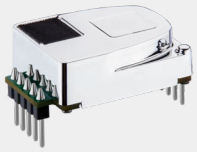
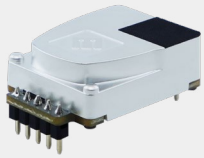
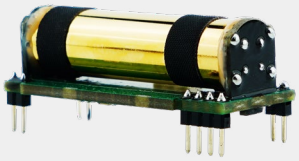
04

Module

The temperature, gas, and dust sensor module developed by MFrontier adopts a scientifically reasonable structural design, superior algorithms, high sensitivity, high stability, and low power consumption with advantages such as long service life, it can be efficiently and seamlessly integrated with a wide range of application end users, achieving a stable landing of applications. Meanwhile, MFrontier can collaborate with a wide range of users,technological breakthroughs to assist in the large-scale application of new technologies and products.

4.1 NDIR gas sensor

Part/No	MTP40-F	MTP50-A Dual Channel	MTP60-A	
Images				
Detect gas type	carbon dioxide	carbon dioxide	carbon dioxide	
Measurement concentration range	400~5000ppm	400~5000ppm	400ppm~5000ppm (The range can be customized to 10000ppm)	
Measurement Interval	2s	2s	2s	
measurement accuracy	± (50ppm + 5% reading)	± (50ppm + 5% reading)	± (50ppm + 5% reading)	
response time	T90=90s	T90=90s	T90=90s	
working voltage	4.2V~5.5V	4.2V~5.5V	4.2V~5.5V	
current consumption	300mA peak current 4mA normal operating current 13mA average working current	300mA peak current 4mA normal operating current 13mA average working current	250mA peak current 5mA Valley current 20mA average working current	
communication interface	UART /IIC/PWM	UART /IIC/PWM	UART /IIC/PWM	
PWM Output	Period：1004ms， Pulse：2ms-1002ms（0~5000ppm）	Period：1004ms， Pulse：2ms~1002ms（0~5000ppm）	Period：1004ms， Pulse：2ms-1002ms（0~5000ppm）	
Alarm Output	concentration>1000ppm, output 1, concentration<800ppm, output 0, Pin is in open drain output mode and cannot draw current	concentration>1000ppm, output 1, concentration<800ppm, output 0, Pin is in open drain output mode and cannot draw current	concentration>1000ppm, output 1, concentration<800ppm, output 0, Pin is in open drain output mode and cannot draw current	
Self calibration cycle	The first self calibration cycle after power on is 24 hours, thereafter is 7 days	The first self calibration cycle after power on is 24 hours, thereafter is 7 days	The default self calibration cycle is 7 days	
Working temperature	0~50° C	0~50° C	0~50° C	
Working humidity	0~90% RH (non condensing)	0~90% RH (non condensing)	0~90% RH (non condensing)	
Storage conditions	-20~60° C	-20~60° C	-20~60° C	
Service life	⩾ 10years	⩾ 10years	⩾ 10years	
Size	32.5×20×8.5mm	35.6×21.2×12mm	32.5×20.8×17.6mm	

	MTP80-A	MGP50-CH4	MGM24-SF6
			
	carbon dioxide	methane	Sulfur hexafluoride
	400ppm~5000ppm (The range can be customized to 10000ppm)	0~100%LEL	0~5000ppm
	2s	2s	1s
	±(40ppm + 4% reading)，25°C +2°C，50%±10%RH environment	±1500ppm（@0-40°C），±2500ppm（@40-50°C）	±50ppm（0-1000ppm），±150ppm（1000-3000ppm），±250ppm（3000-5000ppm）
	T90=90s	T90 ＜ 30s	T63 ⩽ 12s，T90 ⩽ 25s
	4.2V~5.5V	4.2V~5.5V	5±10%VDC，Power supply allows ripple: Vp-p ⩽ 40mV
	250mA peak current 5mA Valley current 20mA average working current	250mA peak current 5mA Valley current 20mA average working current	Average ⩽ 20mA@12V， Peak value ⩽ 65mA@12V
	UART /IIC/PWM	UART /IIC	UART/IIC
	Period：1004ms， Pulse：2ms~1002ms（0~5000ppm）	Period：1004ms， Pulse：2ms~1002ms（0~50000ppm）； Pin is push-pull output	/
	concentration>1000ppm, output 1, concentration<800ppm, output 0, Pin is in open drain output mode and cannot draw current	concentration>10%LEL, output 1, concentration<8%LEL, output 0, Pin is in open drain output mode and cannot draw current	OUTPUT2：Alarm High（⩾ 1000ppm）
	The default self calibration cycle is 7 days	/	The default self calibration cycle is 7 days, Default not enabled
	0~50° C	0-50° C	-20~60° C
	0~90% RH (non condensing)	0~90% RH (non condensing)	0~90% RH (non condensing)
	-20~60° C	-20~60° C	-30~70°C
	⩾ 10years	⩾ 10years	⩾ 10years
	32.5×20.8×17.6mm	32.5×20.8×17.6mm	42×16×15mm

4.2 Industrial grade infrared sensor

Part/No		MPY20-CO2	MPY20-HC methane	MPY20-HC propane
Images				
Detect gas type		carbon dioxide	methane	propane
Detection accuracy		0~0.2%:±0.03%vol 0~1%:±0.04%vol; 0~5%:±(0.05% vol+5% of true value); 0-20%: ± (0.05% vol+6% of true value)	0~1%vol:±0.06%vol 1~100% vol: True value ± 6%	0~1%VOL:±0.06%VOL; 1-2% VOL: True value ± 6%
resolution ratio		0~0.2%:20ppm; 0~1%:50ppm; 0~5%:100ppm; 0~20%:0.05%	0~10%:0.01%; 10~100%:0.1%	0~2.2%:0.01%
response time (20 °C)		T90 ⩽ 25s	T90 ⩽ 25s	T90 ⩽ 25s
Zero point repeatability (20 °C)		±2%FSD	±2%FSD	±2%FSD
Sensitivity repeatability(20 °C)		±2%FSD	±2%FSD	±2%FSD
Stable startup time		60s	60s	60s
Long-term Drift(20 °C)		± 1% FSD/month	± 1% FSD/month	± 1% FSD/month
Input Voltage		3.2~5.5V DC, typical: 3.3V DC	3.2~5.5V DC, typical: 3.3V DC	3.2~5.5V DC, typical: 3.3V DC
Input Current		70-80mA, typical: 75mA	70-80mA, typical: 75mA	70-80mA, typical: 75mA
Input current fluctuation		⩽ ± 5%, typical: ± 2%	⩽ ± 5%, typical: ± 2%	⩽ ± 5%, typical: ± 2%
imitate Output	Output voltage	0~2.5V DC	0~2.5V DC	0~2.5V DC
	output current	⩽ 5mA	⩽ 5mA	⩽ 5mA
Digital Output (TTL_3.0V)	Low level	⩽ 0.4V	⩽ 0.4V	⩽ 0.4V
	high level	⩾ 2.4V	⩾ 2.4V	⩾ 2.4V
digital input (TTL-3.0V)	Low level	-0.3~0.8V	-0.3~0.8V	-0.3~0.8V
	high level	0.7*3V~3.3V	0.7*3V~3.3V	0.7*3V~3.3V
Serial communication baud rate		19200-115200, typical: 38400	19200-115200, typical: 38400	19200-115200, typical: 38400
ambient condition	Work Temperature	-20~60 °C , typical: 20 °C	-40~70 °C , typical: 20 °C	-40~70 °C , typical: 20 °C
	Storage Temperature	-20~60 °C , typical: 20 °C	-40~85 °C , typical: 20 °C	-40~85 °C , typical: 20 °C
	ambient humidity	0~95% RH (non condensing)	0~95% RH (non condensing)	0~95% RH (non condensing)
	Pressure Range	80~120kpa	80~120kpa	80~120kpa
service life		> 5years	> 5years	> 5years

4.3 PM2.5 infrared dust sensor

Part/No	MPM20 series	MPM30 series (MPM30-C4/MPM30-C6)
Images		
Detection Principle	Infrared Light Scattering	Infrared Light Scattering
Detecting particle diameter	⩾ 0.5μm	PM0.3~PM10
Detection concentration range	0~500μg/m³	0~1000μg/m³
Resolution of particulate matter mass concentration	1μg/m³	1μg/m³
Detection accuracy (@25±2°C , 50%±10%RH)	±25%(@100~500μg/m³) ±25 μg/m³(@ 0~100μg/m³)	±15μg/m³ (@0~100μg/m³) Or ±15% reading (@100~1000μg/m³)
terminal	5pin	4pin/6pin
Power on stability time	⩽ 60s	⩽ 10s
Output	PWM / IIC	UART / PWM
Working Voltage	DC 5V±5%； Voltage ripple below 50mV	DC 5V ± 5%, ripple below 50mV
Working Current	90mA	⩽ 15mA
Working temperature	0~50°C	-20~75°C
Working humidity	0~95% RH (non condensing)	0~95% RH (non condensing)
Storage Environment	-20~60°C	-40~85°C
Size	59×45×22mm	46×34×18.15mm
Service life	⩾ 8years	⩾ 8years

4.4 PM2.5 laser dust sensor

Part/No	MPM10 series	MPM11 series	
Images			
Detection Principle	Laser Light Scattering	Laser Light Scattering	
Detecting particle diameter	0.3~10μm	0.3~10μm	
Detection concentration range	0~1000μg/m³	0~1000μg/m³	
Resolution of particulate matter mass concentration	1μg/m³	1μg/m³	
Single response time	⩽ 1s	⩽ 1s	
Comprehensive response time	⩽ 10s	⩽ 10s	
Detection accuracy（@25±2°C , 50%±10%RH）	±10%(@100~500μg/m³)； ±10μg/m³ (@ 0~100μg/m³)	±10%(@100~500μg/m³)； ±10μg/m³ (@ 0~100μg/m³)	
Output	UART / IIC / PWM	UART / IIC/ PWM	
Data interface level	Datainterface level:L<0.8@3.3V H>2.7@3.3V	-	
Working Voltage	4.5~5.5V, average voltage: 5V	4.5~5.5V, average voltage: 5V	
Working Current	⩽ 85mA	⩽ 85mA	
Standby current	⩽ 45μA	⩽ 45μA	
Working temperature	-10~60°C	-10~60°C	
Working humidity	0~95% RH (non condensing)	0~95% RH (non condensing)	
Storage Environment	-30~70°C	-30~70°C	
Size	37.8×34.8×11.8mm	47×36.8×11.8mm	
service life	⩾ 3years	⩾ 3years	

	MPM12 series	MPM13 series	MPM14 series
			
	Laser Light Scattering	Laser Light Scattering	Laser Light Scattering
	0.3~10μm	0.3~10μm	0.3~10μm
	0~1000μg/m³	0~1000μg/m³	0~1000μg/m³
	1μg/m³	1μg/m³	1μg/m³
	⩽ 1s	⩽ 1s	⩽ 1s
	⩽ 10s	⩽ 10s	⩽ 10s
	±10%(@100~500μg/m³); ±10μg/m³ (@ 0~100μg/m³)	±10%(@100~500μg/m³); ±10μg/m³ (@ 0~100μg/m³)	±10%(@100~500μg/m³); ±10μg/m³(@ 0~100μg/m³)
	UART / IIC / PWM	UART / IIC / PWM	UART / IIC / PWM
	L<0.8@3.3V H>2.7@3.3V	L<0.8@3.3V H>2.7@3.3V	L<0.8@3.3V H>2.7@3.3V
	4.5~5.5V, average voltage: 5V	4.5~5.5V，typ：5V	4.5~5.5V，typ：5V
	⩽ 85mA	⩽ 85mA	⩽ 85mA
	⩽ 45μA	⩽ 45μA	⩽ 20μA
	-10~60°C	-10~60°C	-10~60°C
	0~95% RH (non condensing)	0~95% RH (non condensing)	0~95% RH (non condensing)
	-30~70°C	-30~70°C	-30~70°C
	47.8×39.8×11.8mm	49.9×37.9×21.1mm	43×36×22mm
	⩾ 3years	⩾ 3years	⩾ 3years

4.5 Infrared temperature measurement module

Part/No	MTP31-A	MTP31-B
Images		
Measuring range	Body temperature mode: 32-42.5 °C , Surface mode 0~300 °C	Body temperature mode: 32-42.5 °C , Surface mode 0~300 °C
Accuracy	± 0.3 °C for body temperature mode ± 1 °C or ± 1% m.v for surface mode	± 0.3 °C for body temperature mode ± 1 °C or ± 1% m.v for surface mode
Digital resolution	0.1 °C	0.1 °C
Measurement cycle (Measurement cycle can be set)	0.5 s	0.5 s
Supply Voltage	4.5~5.5 V	4.5~5.5 V
Working Current	＜ 2 mA	＜ 2 mA
Output Signal	UART / IIC	UART
Communication level	TTL 3.3 V	TTL 3.3 V
Temperature Compensation	10.0~40.0 ° C	10.0~40.0 ° C
visual angle (50% signal strength)	12.4°	5°
spectral response	5.5~14 μm	5.5~14 μm
DS ratio	6:1	10:1
Working temperature	0~50 °C	0~50 °C
Working humidity	0~95% RH (non condensing)	0~95% RH (non condensing)
Size（L×W×H）	35×26×30mm	35.4×26×30 mm

4.6 Thermopile array sensor

Manufactured using CMOS-MEMS technology, it contains 256 thermal sensors in a 16x16 mesh layout stack components, integrated with ASIC signal processing circuits, can operate without touching the object being tested.The absolute temperature of the object surface can be detected in both TO/SMD packaging forms.

Part/No	MTPA16X16
Technical type	thermopile array
Array size	16×16
Target temperature	-20~500°C
Built in clock	13MHz/26MHz
Frame rate	5~20Hz
Working Voltage	3.3V
Working temperature	-20~85°C
Storage temperature	-40~85°C

4.7 Refrigerant sensor

Miniature refrigerant sensor		
Part/No		
Part/No	MGM-11-X	MGS-11-X
Detection Principle	NDIR	NDIR
Detect gas type	R32/R410A/R454B/R1234yf (Different refrigerant requirements can be customized)	
Measuring range	0-25%LFL	0-25%LFL
Detection accuracy	±2.5%LFL	±2.5%LFL
Warm-up time	Run the operation for 1 minute, Achieve performance in 5 minutes	
Response time	⩽ 12s（7%LFL Alarm point）	＜ 20s (1)
Working Voltage	5±10%DC	12±10%DC
Working Current	Average ⩽ 45mA, Peak value ⩽ 100 mA	Average ⩽ 45mA, Peak value ⩽ 150 mA
Output	OUTPUT1: Alarm switch output ； OUTPUT2: RS485@Modbus-RTU Output	Switching output: 1 channel (leakage output) Digital output: RS485/UART/IC
Alarm threshold	Default 7.0% LFL, modifiable	Default 7.0% LFL, modifiable
Alarm return difference	Default 1.0% LFL, modifiable	Default 1.0% LFL, modifiable
Storage temperature	-40°C ~+85°C	-40°C ~+85°C
Working temperature range	-40°C ~+85°C	-40°C ~+85°C
Working humidity range	0~95% RH (non condensing)	0~95% RH (non condensing)
Working pressure range	80~120kPa	80~120kPa
Average No Fault time	⩾ 10years	⩾ 10years
Size	33×42×12.7mm	62×39×18.8mm
Electrical interface	S05B-XASK	0.3mm2 5-core RVV cable
Protection grade	IP55	IP54

Indoor refrigerant alarm	
	
Part/No	MGR-11-X
Detection Principle	NDIR
Detect gas type	R32/R410A/R454B/ R1234yf (Different refrigerant requirements can be customized)
Measuring range	0-25%LFL
Detection accuracy	±2.5%LFL
Stability	⩽ 1%FS/years
Warm-up time	Run the operation for 1 minute, Achieve performance in 5 minutes
Response time	＜ 20s
Output	Relay output, Contact capacity 220VAC@5A
Average No Fault time	⩾ 10years
Size	82×82×22.2mm
Protection grade	IP30
Working temperature range	-20°C ~+60°C
Working humidity range	0~95% RH (non condensing)
Alarm method	audible and visual alarm
Alarm Sound	⩾ 70dB(1m)

Note: (1) According to UL 60335-2-40_2022 Appendix LL.3DV test conditions

4.8 Automotive sensors

Automotive laser particle sensor	
	
Part/No	MPM60-C4
Types of particle detection	PM1.0, PM2.5, PM10
Particle size range	0.3~10μm
Particle mass concentration range (PM2.5 standard value)	0~1000μg/m³
Resolution of particulate matter mass concentration	1μg/m³
Consistency of particle mass concentration (PM2.5 standard value)	±15%(@100~999μg/m³) ±15μg/m³ (@ 0~100μg/m³)
Single response time	⩽ 1s
Comprehensive response time	⩽ 10s
DC power supply voltage	9V~16V typ：12V
Working current	⩽ 100mA
Sleep current	⩽ 50μA
Output	LIN
Working temperature	-20~70°C
Working humidity	0~95%RH (non condensing)
Storage temperature	-40~85°C
Average No Fault	⩾ 5 years
time	63.79×47.62×24.4mm

Automotive CO2 gas sensor	
	
Part/No	MGC20-CO2
Detect gas type	CO_2
Measuring range	0~10000ppm（0~1%） Can be expanded to 0-50000ppm (0-5%)
Detection accuracy	±50ppm±5% RD
Temperature influence	The larger of ± 5ppm/ °C or ± 0.02% RD/ °C , after compensation
Pressure influence	⩽ ± 0.02% RD/hPa, after compensation
Stability	⩽ 1%FS/years
Warm-up time	Run the operation for 1 minute, Achieve performance in 5 minutes
Response time	T90 ⩽ 25s
Working voltage	8~18V DC, power supply allows ripple: Vp-p ⩽ 60mV
Working current	Average ⩽ 20mA@12V Peak value ⩽ 65mA@12V
Output	LIN bus
Working temperature range	-40~90°C
Working humidity range	0~95%RH (non condensing)
Storage temperature	-40~105°C
Working pressure range	80~120kPa
Average No Fault time	⩾ 12years
Size	52.1×26.9×26mm
Mounting Hole	Install screw M3 with a hole spacing of 64.2mm
electrical interface	C-1612035 Automotive Connector
Protection grade	IP55

MCS63-AC

Integrating PM2.5, CO2, and AQS, combined with a gold-plated chamber and high-precision sampling circuit, A device that can accurately detect air pollution sources inside and outside vehicles, such as exhaust PM2.5 and CO2.It has the advantages of long service life, high measurement accuracy, good gas selectivity, and stable performance.

Detection type	PM2.5/CO2 /AQS	
PM2.5 performance parameters	Detection Principle	light scattering
	Measuring range	0~1000 μg/m³
	Measurement data resolution	1 μg/m³
	Measuring particle size range	0.3~2.5 μm
	Detection accuracy	±15% (@100~1000 μg/m³)；±15μg/m³ (@0~100μg/m³)
	Response time	T90 ⩽ 10s
CO2 performance parameters	Detection Principle	NDIR
	Measuring range	0~10000ppm（0~1%）； Can be expanded to 0-50000ppm (0-5%)
	Detection accuracy	±（50ppm+5%RD）
	Temperature influence	The larger of ± 5ppm/°C or ± 0.02% RD/°C , after compensation
	Pressure influence	⩽ ± 0.02% RD/hPa, after compensation
	Stability	⩽ 1%FS/years
	Warm-up time	Run the operation for 1 minute, Achieve performance in 5 minutes
	Response time	T90 ⩽ 25s
AQS performance parameters	Detect gas type	CO/hydrocarbons, NO2, NH3, etc
	Detection Principle	MEMS Semiconductor
	Detection accuracy	Air quality level: 1-10 levels
	Warm-up time	⩽ 30s
	Response time	T90 ⩽ 10s
working conditions	Working voltage	DC 9.0V ~ 16.0V；Rated voltage: DC 12V
	Working current	⩽ 280mA
	Sleep current	⩽ 0.1mA
	Overvoltage capability	26V
	Reverse voltage capability	-14V