

## Components for Gas Analysis

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## Contents

INTRODUCTION	3
OPR1-3439 OPTOPAIR ( <i>hydrocarbons</i> )	4
OPR2-3439 OPTOPAIR ( <i>hydrocarbons</i> )	5
OPR1-3230 OPTOPAIR ( <i>methane</i> )	6
OPR2-3230 OPTOPAIR ( <i>methane</i> )	7
OPR1-4239 OPTOPAIR ( <i>carbon dioxide</i> )	8
OPR2-4239 OPTOPAIR ( <i>carbon dioxide</i> )	9
DIMENSION OUTLINES	10
OPTIONAL OPTOPAIRS	12
HOW TO SELECT	13

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## Coordinated Opto-pairs for NDIR Gas Analyzers

RMT offers coordinated pairs (solid state light emitters and photodetectors) suitable for application in non-dispersive infra-red (NDIR) gas analyzers.

The pair consist of high-effective photodetectors and special solid state pulsed light emitters.

The spectral response of the photodetector and spectral emission of the light emitter are straightly coordinated for effective operation at absorption lines of measuring gases.

Additional built-in narrow band filters mounted onto photodetector (or/and light emitter) provide high selectivity of measuring schemes.

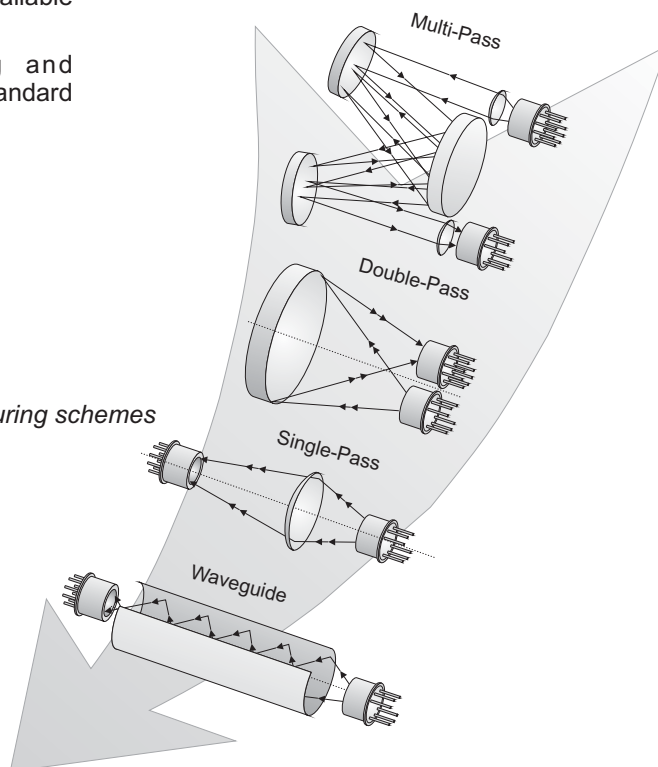
Standard options of the optopairs are suitable for analyzing of CO<sub>2</sub> (carbon dioxide), CH<sub>4</sub> (methane), hydrocarbons mixtures. Other options are available on request.

Optopairs with built-in TE cooling and thermostabilization are presented as standard options, as well as uncooled simpler types.



### Features

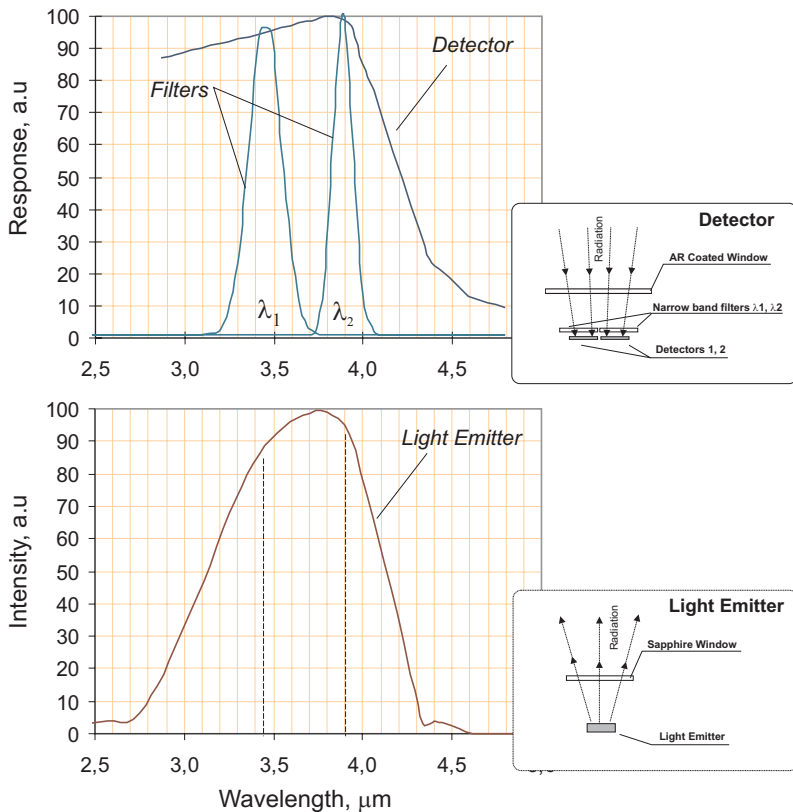
- ✓ No moving parts
- ✓ Miniature design
- ✓ Low power consumption
- ✓ Standard options for a range of measuring schemes
- ✓ Long operation lifetime
- ✓ High speed of response
- ✓ High selectivity.



### Available Options

Opto-Pair Type	Measuring Gas	Formula	$\lambda_1, \mu\text{m}$	$\lambda_2, \mu\text{m}$	$\Delta\lambda, \mu\text{m}$
OPRx-4239	Carbon Dioxide	CO <sub>2</sub>	4.28	3.9	0.12
OPRx-3439	Hydrocarbons	C <sub>n</sub> H <sub>m</sub>	3.42	3.9	0.25
OPRx-3230	Methane	CH <sub>4</sub>	3.23	3.8	0.08

## OPR1-3439 Optopair (hydrocarbons)



The pair consists of a special solid state light emitter (light source) and a dual-channel photodetector.

The dual-element detector comprises two photosensitive elements, two built-in narrow band interference filters:

- one filter is near the absorption band of tested material (base channel)
- the other one is far from the absorption band (reference channel)

The device is installed into the sealed metal-glass package.

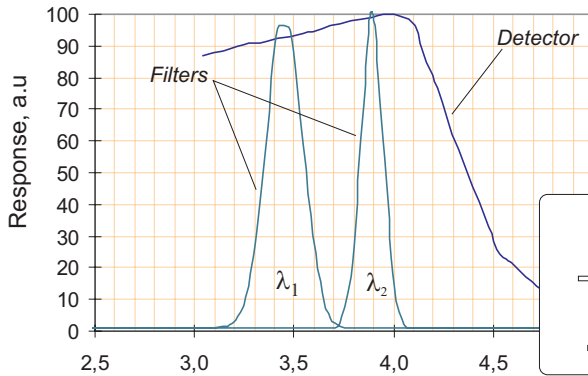
The semiconductor Light Emitter is optimized for the operation of the dual-element Photodetector. It is mounted into miniature metal package.

**Spectral Responses of Photodetector with narrow-band filters and Light Emitter**

## Optical and Electrical Characteristics

Detector			Ligh Emitter		
Sensitive Element size	mm	2x2	Emitting area size	mm	2x2
Distance between elements	mm	1,0	Angle of view	deg	70
Wavelength $\lambda_1$	$\mu\text{m}$	3,45	Wavelength $\lambda$	$\mu\text{m}$	3,75
Wavelength $\lambda_2$	$\mu\text{m}$	3,90			
Band Width $\Delta\lambda_{0,5}$	$\mu\text{m}$	0,25	Band Width $\Delta\lambda_{0,5}$	$\mu\text{m}$	0,95
Time Constant, $\tau$	$\mu\text{sec}$	<30	Time Constant, $\tau$	$\mu\text{sec}$	<2
Detectivity, $D^*$			Output Power <sup>(1)</sup> (CW)	$\mu\text{W}$	50
Measuring Channel, $\lambda_1$	$\text{smxHz}^{1/2}\times\text{W}^{-1}$	$1.0\times 10^8$	Output Power <sup>(2)</sup> (PW )	$\mu\text{W}$	500
Reference Channel, $\lambda_2$	$\text{smxHz}^{1/2}\times\text{W}^{-1}$	$1.0\times 10^8$			
Sensitivity, $S_U$			1. $I_{op}=100\text{ mA}$ , $U=2\text{ V}$ 2. $I_{op}=2\text{ A}$ , $U=2\text{ V}$ , $Q=200$ , $\tau_p=100\text{ }\mu\text{s}$ 3. All parameters are referred to 300 K		
Measuring Channel, $\lambda_1$	V/W	60			
Reference Channel, $\lambda_2$	V/W	60			
Element Dark Resistance	kOhm	20...100			

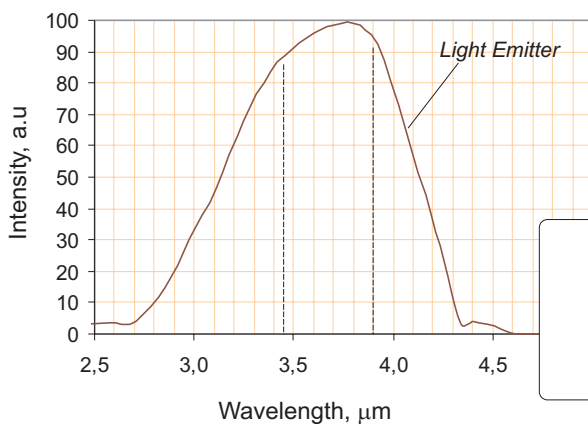
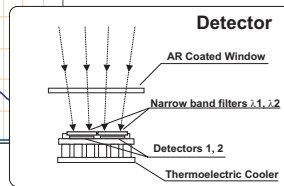
## OPR2-3439 TE cooled Optopair (hydrocarbons)



The pair consists of a special solid state light emitter (light source) and a dual-channel photodetector.

The element detector comprises two photosensitive elements, two built-in narrow band interference filters:

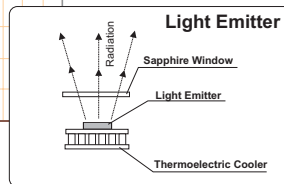
- one filter is near absorption band of tested material (base channel)
- the other one - is far from the absorption band (reference channel).



Sensitive elements with filters are placed onto the cooling surface of a single-stage thermoelectric module.

Thermosensor is used for thermostabilization.

The semiconductor Light Emitter is optimized for operation of the dual-element Photodetector.



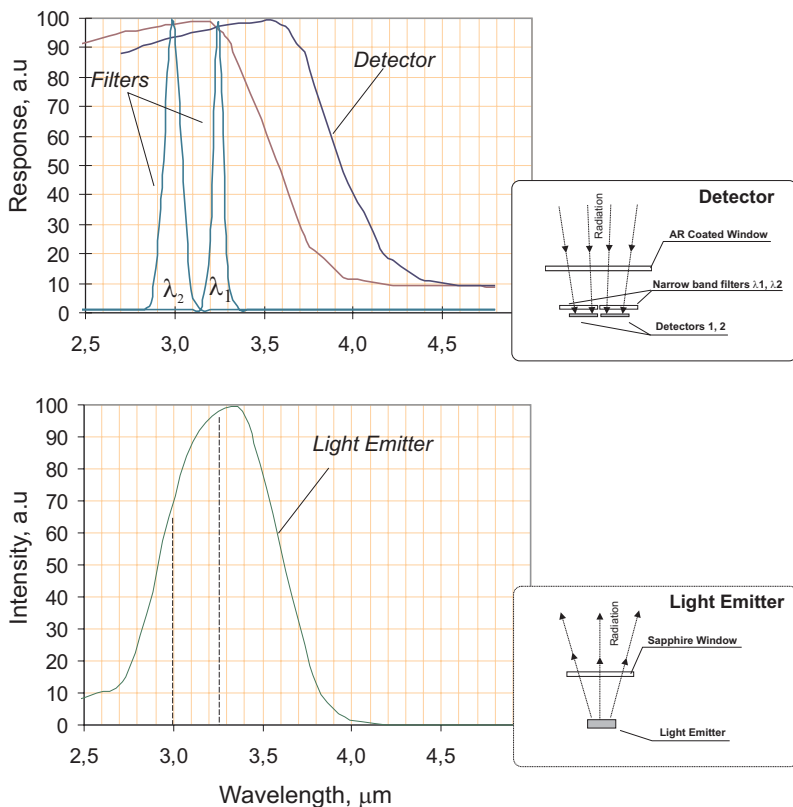
Light Emitter also is placed onto the cooling surface of a single-stage thermoelectric module with thermosensor.

Spectral Responses of Photodetector with narrow-band filters and Light Emitter

## Optical and Electrical Characteristics

Detector			Ligh Emitter		
Sensitive Element size	mm	2x2	Emitting area size	mm	2x2
Distance between elements	mm	1,0	Angle of view	deg	70
Wavelength $\lambda_1$	$\mu\text{m}$	3,45	Wavelength $\lambda$	$\mu\text{m}$	3,75
Wavelength $\lambda_2$	$\mu\text{m}$	3,90			
Band Width $\Delta\lambda_{0,5}$	$\mu\text{m}$	0,25	Band Width $\Delta\lambda_{0,5}$	$\mu\text{m}$	0,95
Time Constant, $\tau$	$\mu\text{sec}$	<100	Time Constant, $\tau$	$\mu\text{sec}$	<2
Detectivity, $D^*$			Output Power <sup>(1)</sup> (CW)		
Measuring Channel, $\lambda_1$	$\text{smxHz}^{-1/2}\text{xW}^{-1}$	$3.5 \times 10^8$	Output Power <sup>(2)</sup> (PW)	$\mu\text{W}$	500
Reference Channel, $\lambda_2$	$\text{smxHz}^{-1/2}\text{xW}^{-1}$	$3.5 \times 10^8$	1. $I_{op}=100 \text{ mA}$ , $U=2 \text{ V}$ 2. $I_{op}= 2 \text{ A}$ , $U=2 \text{ V}$ , $Q=200$ , $\tau_p= 100 \mu\text{s}$ 3. All parameters are referred to 263 K		
Sensitivity, $S_U$					
Measuring Channel, $\lambda_1$	V/W	300			
Reference Channel, $\lambda_2$	V/W	300			
Element Dark Resistance	kOhm	20...100			

## OPR1-3230 Optopair (methane)



The pair consists of a special solid state light emitter (light source) and a dual-channel photodetector.

The dual-element detector comprises two photosensitive elements, two built-in narrow band interference filters:

- one filter is near the absorption band of tested material (base channel)
- the other one is far from the absorption band (reference channel)

The device is installed into the sealed metal-glass package.

The semiconductor Light Emitter is optimized for the operation of the dual-element Photodetector. It is mounted into miniature metal package.

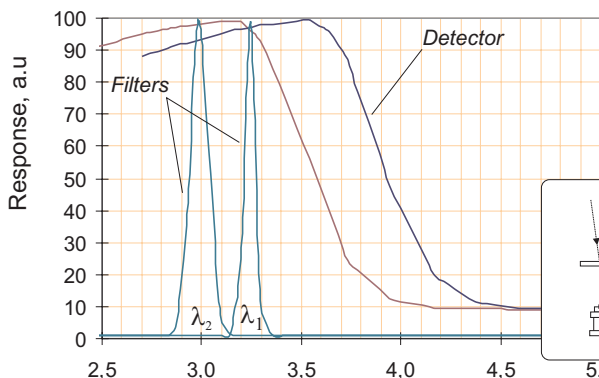
**Spectral Responses of Photodetector with narrow-band Filters and Light Emitter**

## Optical and Electrical Characteristics

Detector			Ligh Emitter		
Sensitive Element size	mm	2x2	Emitting area size	mm	2x2
Distance between elements	mm	1,0	Angle of view	deg	70
Wavelength $\lambda_1$	μm	3,23	Wavelength $\lambda$	μm	3,40
Wavelength $\lambda_2$	μm	3,00			
Band Width $\Delta\lambda_{0,5}$	μm	0,08	Band Width $\Delta\lambda_{0,5}$	μm	0,70
Time Constant, $\tau$	μsec	<30	Time Constant, $\tau$	μsec	<2
Detectivity, $D^*$			Output Power <sup>(1)</sup> (CW)		
Measuring Channel, $\lambda_1$	$\text{sm}\times\text{Hz}^{1/2}\times\text{W}^{-1}$	$0.4\times 10^8$	Output Power <sup>(2)</sup> (PW )		
Reference Channel, $\lambda_2$	$\text{sm}\times\text{Hz}^{1/2}\times\text{W}^{-1}$	$0.4\times 10^8$	μW	50	500
Sensitivity, $S_U$					
Measuring Channel, $\lambda_1$	V/W	30			
Reference Channel, $\lambda_2$	V/W	30			
Element Dark Resistance	kOhm	20...100			

1.  $I_{op}=100 \text{ mA}$ ,  $U=2 \text{ V}$
2.  $I_{op}=2 \text{ A}$ ,  $U=2 \text{ V}$ ,  $Q=200$ ,  $\tau_p=100 \text{ μs}$
3. All parameters are referred to 300 K

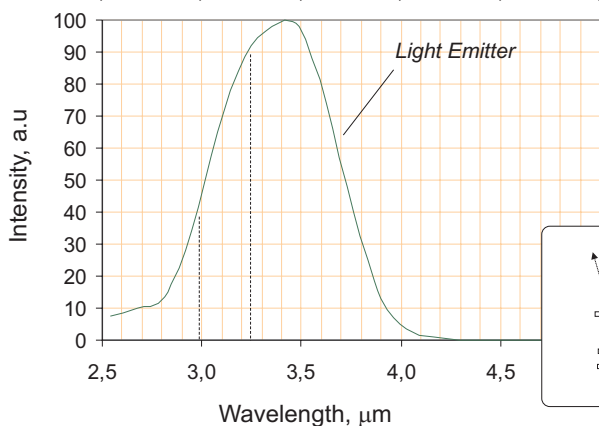
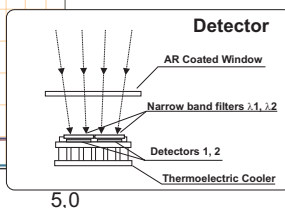
## OPR2-3230 TE cooled Optopair (methane)



The pair consists of a special solid state light emitter (light source) and a dual-channel photodetector.

The element detector comprises two photosensitive elements, two built-in narrow band interference filters:

- one filter is near absorption band of tested material (base channel)
- the other one - is far from the absorption band (reference channel).

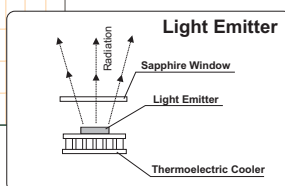


Sensitive elements with filters are placed onto the cooling surface of a single-stage thermoelectric module.

Thermosensor is used for thermostabilization.

The semiconductor Light Emitter is optimized for operation of the dual-element Photodetector.

Light Emitter also is placed onto the cooling surface of a single-stage thermoelectric module with thermosensor.



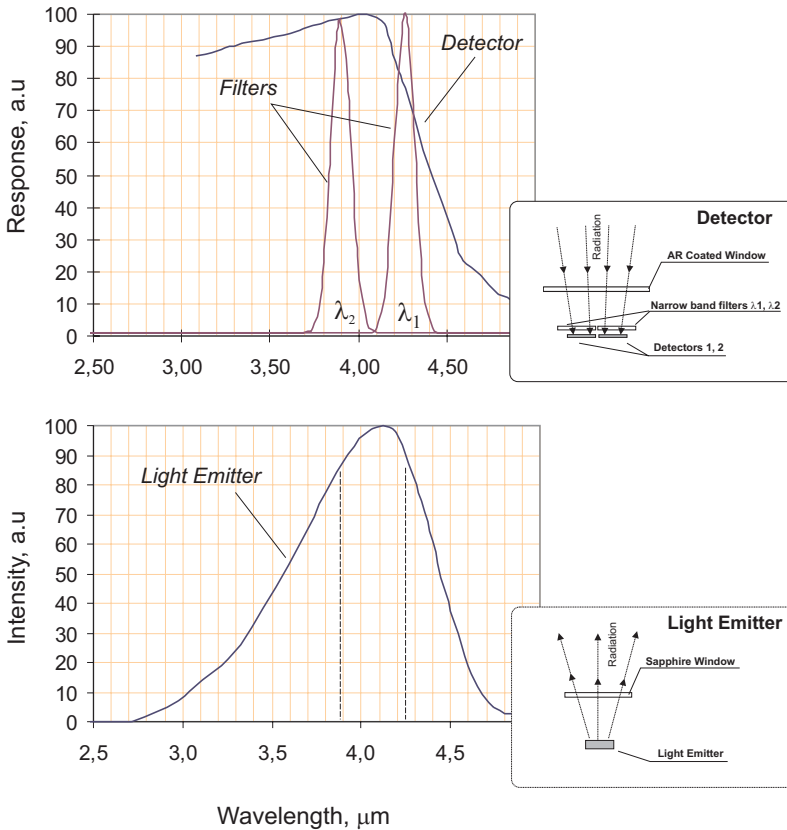
Spectral Responses of Photodetector with narrow-band Filters and Light Emitter

## Optical and Electrical Characteristics

Detector			Light Emitter		
Sensitive Element size	mm	2x2	Emitting area size	mm	2x2
Distance between elements	mm	1,0	Angle of view	deg	70
Wavelength $\lambda_1$	$\mu\text{m}$	3,23	Wavelength $\lambda$	$\mu\text{m}$	3,40
Wavelength $\lambda_2$	$\mu\text{m}$	3,00			
Band Width $\Delta\lambda_{0,5}$	$\mu\text{m}$	0,08	Band Width $\Delta\lambda_{0,5}$	$\mu\text{m}$	0,70
Time Constant, $\tau$	$\mu\text{sec}$	<100	Time Constant, $\tau$	$\mu\text{sec}$	<2
Detectivity, $D^*$			Output Power <sup>(1)</sup> (CW)	$\mu\text{W}$	50
Measuring Channel, $\lambda_1$	$\text{smxHz}^{1/2} \times \text{W}^{-1}$	$1.2 \times 10^8$	Output Power <sup>(2)</sup> (PW)	$\mu\text{W}$	500
Reference Channel, $\lambda_2$	$\text{smxHz}^{1/2} \times \text{W}^{-1}$	$1.2 \times 10^8$			
Sensitivity, $S_U$					
Measuring Channel, $\lambda_1$	V/W	200			
Reference Channel, $\lambda_2$	V/W	200			
Element Dark Resistance	kOhm	20...100			

1.  $I_{op}=100 \text{ mA}$ ,  $U=2 \text{ V}$
2.  $I_{op}= 2 \text{ A}$ ,  $U=2 \text{ V}$ ,  $Q=200$ ,  $\tau_0= 100 \mu\text{s}$
3. All parameters are referred to 263 K

## OPR1-4239 Optopair (carbon dioxide)



**Spectral Responses of Photodetector with narrow-band Filters and Light Emitter**

The pair consists of a special solid state light emitter (light source) and a dual-channel photodetector.

The dual-element detector comprises two photosensitive elements, two built-in narrow band interference filters:

- one filter is near the absorption band of tested material (base channel)
- the other one is far from the absorption band (reference channel)

The device is installed into the sealed metal-glass package.

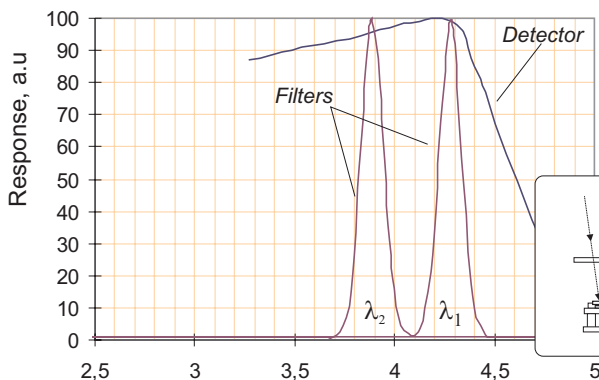
The semiconductor Light Emitter is optimized for the operation of the dual-element Photodetector. It is mounted into miniature metal package.

## Optical and Electrical Characteristics

Detector			Ligh Emitter		
Sensitive Element size	mm	2x2	Emitting area size	mm	2x2
Distance between elements	mm	1,0	Angle of view	deg.	70
Wavelength λ <sub>1</sub>	μm	4,28	Wavelength λ	μm	4,20
Wavelength λ <sub>2</sub>	μm	3,90			
Band Width Δλ <sub>0,5</sub>	μm	0,12	Band Width Δλ <sub>0,5</sub>	μm	0,80
Time Constant, τ	μsec	<10	Time Constant, t	μsec	<2
Detectivity, D*			Output Power <sup>(1)</sup> (CW)	μW	50
Measuring Channel, λ <sub>1</sub>	smxHz <sup>1/2</sup> xW <sup>-1</sup>	0.5x10 <sup>8</sup>	Output Power <sup>(2)</sup> (PW)	μW	500
Reference Channel, λ <sub>2</sub>	smxHz <sup>1/2</sup> xW <sup>-1</sup>	0.5x10 <sup>8</sup>	1. I <sub>op</sub> =100 mA, U=2 V 2. I <sub>op</sub> = 2 A, U=2 V, Q=200, τ <sub>p</sub> = 100 μs 3. All parameters are referred to 300 K		
Sensitivity, S <sub>U</sub>					
Measuring Channel, λ <sub>1</sub>	V/W	30			
Reference Channel, λ <sub>2</sub>	V/W	30			
Element Dark Resistance	kOhm	20...100			



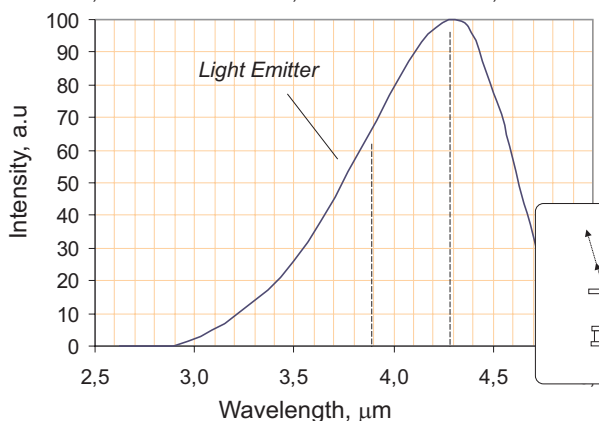
## OPR2-4239 TE cooled Optopair (carbon dioxide)



The pair consists of a special solid state light emitter (light source) and a dual-channel photodetector.

The element detector comprises two photosensitive elements, two built-in narrow band interference filters:

- one filter is near absorption band of tested material (base channel)
- the other one - is far from the absorption band (reference channel).



Sensitive elements with filters are placed onto the cooling surface of a single-stage thermoelectric module.

Thermosensor is used for thermostabilization.

The semiconductor Light Emitter is optimized for operation of the dual-element Photodetector.

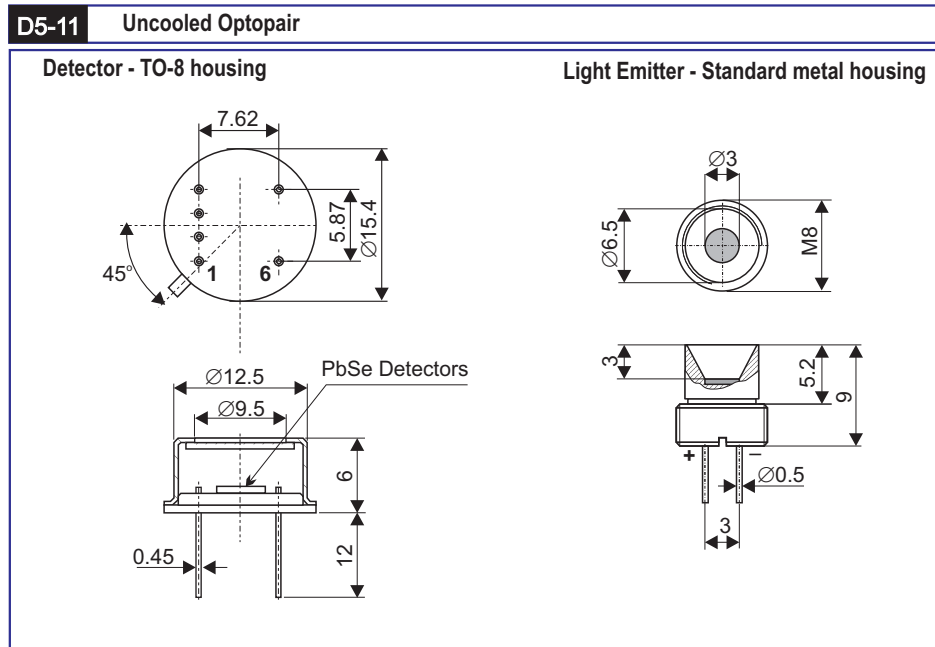
Light Emitter also is placed onto the cooling surface of a single-stage thermoelectric module with thermosensor.

**Spectral Responses of Photodetector with narrow-band Filters and Light Emitter**

## Optical and Electrical Characteristics

Detector			Light Emitter		
Sensitive Element size	mm	2x2	Emitting area size	mm	2x2
Distance between elements	mm	1,0	Angle of view	deg	70
Wavelength $\lambda_1$	$\mu\text{m}$	4,28	Wavelength $\lambda$	$\mu\text{m}$	4,30
Wavelength $\lambda_2$	$\mu\text{m}$	3,90			
Band Width $\Delta\lambda_{0,5}$	$\mu\text{m}$	0,12	Band Width $\Delta\lambda_{0,5}$	$\mu\text{m}$	0,80
Time Constant, $\tau$	$\mu\text{sec}$	<30	Time Constant, $\tau$	$\mu\text{sec}$	<2
Detectivity, $D^*$			Output Power <sup>(1)</sup> (CW)	$\mu\text{W}$	50
Measuring Channel, $\lambda_1$	$\text{smxHz}^{1/2}\times\text{W}^{-1}$	$1.5\times 10^8$	Output Power <sup>(2)</sup> (PW )	$\mu\text{W}$	500
Reference Channel, $\lambda_2$	$\text{smxHz}^{1/2}\times\text{W}^{-1}$	$1.5\times 10^8$			
Sensitivity, $S_U$			1. $I_{op}=100\text{ mA}$ , $U=2\text{ V}$ 2. $I_{op}=2\text{ A}$ , $U=2\text{ V}$ , $Q=200$ , $\tau_p=100\text{ }\mu\text{s}$ 3. All parameters are referred to 263 K		
Measuring Channel, $\lambda_1$	V/W	200			
Reference Channel, $\lambda_2$	V/W	200			
Element Dark Resistance	kOhm	20...100			

## Dimension Outlines (All dimensions are in mm)



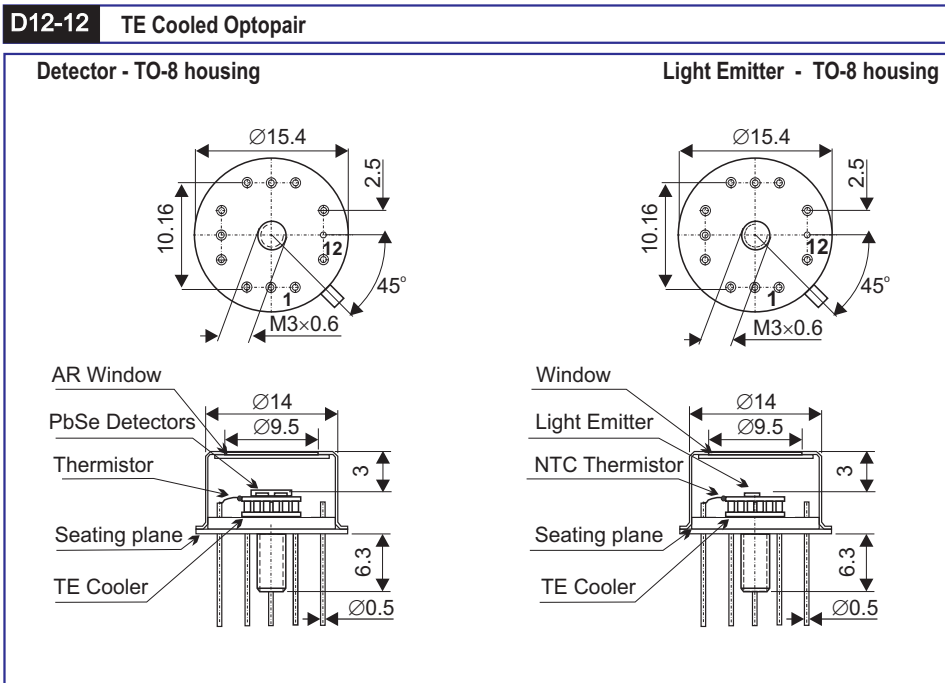
Pin	Function	Bottom View
1	Photoresistor, measuring channel	
2	Not connected	
3	Not connected	
4	Photoresistor, reference channel	
5	Photoresistor, reference channel	
6	Photoresistor, measuring channel	

## Absolute Maximum Ratings

Detector	Light Emitter	
Bias Voltage	Direct Current, max	Pulsed Current, max
V	mA	A
5	300	4

*Information furnished by RMT Ltd is believed to be reliable. However, no responsibility is assumed for possible inaccuracies or omission. Specifications are a subject to change without notice.*

## Dimension Outlines *(All dimensions are in mm)*



Pin	Function	Bottom View	Pin	Function	Bottom View
1	TE cooler, cathode		1	TE cooler, cathode	
2	Not connected		2	Not connected	
3	TE cooler, anode		3	TE cooler, anode	
4	Photoresistor, measuring channel		4	LED, cathode	
5	Not connected		5	Not connected	
6	Photoresistor, reference channel		6	LED, anode	
7	Thermistor		7	Not connected	
8	Not connected		8	Not connected	
9	Thermistor		9	Not connected	
10	Photoresistor, reference channel		10	Thermistor	
11	Not connected		11	Not connected	
12	Photoresistor, measuring channel		12	Thermistor	

## Absolute Maximum Ratings

Detector	Light Emitter		Both		
Bias Voltage	Direct Current, max	Pulsed Current, max	Typical TE Cooler Power near maximal cooling		Thermosensor
	V	mA	A	Current, A    Voltage, V	
5	300	4	1,3 0,4*	2,2 4*	2.2 kOhm & -3.4%/deg

*Information furnished by RMT Ltd is believed to be reliable. However, no responsibility is assumed for possible inaccuracies or omission. Specifications are a subject to change without notice.*

## Optional Opto-Pairs

### D4-11 Single-element Detector (2 pcs), Standard Light Emitter

**Detector - TO-5 housing**

**Light Emitter - metal housing**

### D15-11 Double-side, dual-element Detector, Standard Light Emitter (2 pcs)

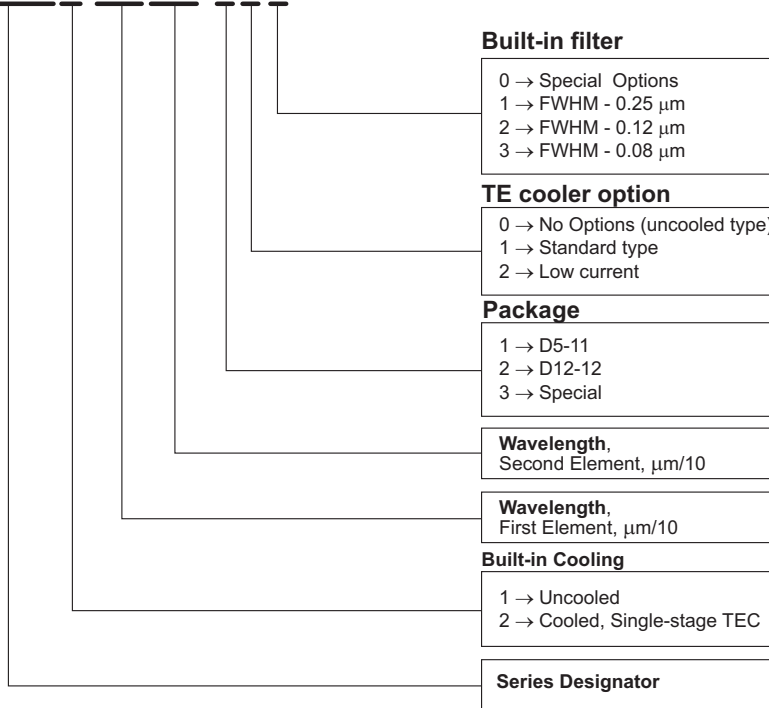
**Detector - metal glass housing**

**Light Emitter - metal housing**

**Double-beam, double-channel Scheme**

## How to Select an Opto-pair

### OPR1-3439-121



This example details:

#### OPR1-3439-121

- *Uncooled Optopair*
- *First wavelength - 3.4 μm (hydrocarbons)*
- *Second wavelength - 3.9 μm (reference)*
- *Housing D5-11*  
  - Detector - D5 housing (TO-8 package)*
  - Light Emitter - D11 housing (metal pack)*
- *TE coolers with low current*
- *Built-in narrow band filters with FWHM 0.25 μm*



