

Overview

KEMET's QGSM thin film digital pyroelectric IR sensor modules for gas detection and concentration measurement combine high sensitivity with fast response times and high dynamic range to ensure rapid and accurate detection of target gases.

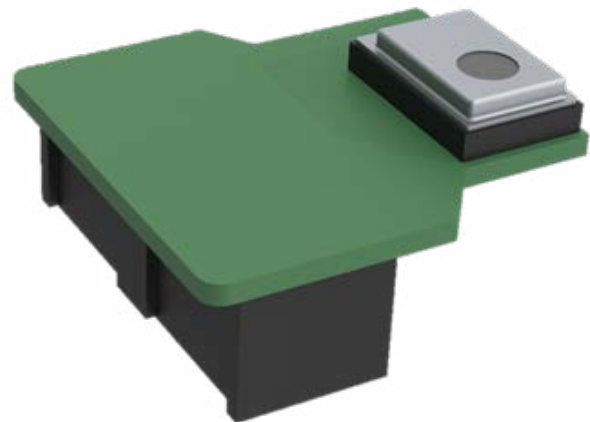
The gas sensor modules consist of a breakout board, on which a SMD motion sensor is mounted, ideal for easy evaluation and quick prototype development. These sensors integrate a digital, current mode read-out that permits lower IR-emitter duty cycles, thereby saving significantly on system level power consumption, while maintaining high SNR. Industry standard I²C communication enables plug-and-play connectivity to microcontrollers and allows easy tuning and calibration. Programmable gain and filtering offer maximum flexibility in system design, and various optical filter options are also available. These sensors can be connected together in linear series to allow synchronized sampling across devices. For further in-depth testing of these gas sensing solutions, KEMET is proposing also an evaluation kit.

Benefits

- High sensitivity with fast response time and high dynamic range
- Digital output and I²C communication
- Programmable gain and filtering
- Various optical filter options
- Integrated configurable amplifier, filter and ADC
- Low power consumption
- Sensor modules for easy evaluation and quick prototype development
- Evaluation kit for CO₂ gas sensing
- Easy to install and user-friendly software

Applications

- Gas and gas flues
- HVAC (refrigerant or CO₂-driven ventilation system)
- Industrial process and safety
- Medical capnography and anesthesia
- Handheld breath analysis and breath rate measurement
- Breath actuated dispenser
- Automotive cabin air quality
- Exhaust (CO₂ content)
- Home and building technology
- Environmental monitoring (ambient CO₂ level)
- Pollution air quality in home, office and car (excessive CO₂ level)



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Ordering Information

| USE | QGS | E | A | C821 | 8 | 0 |
|----------------|--------------------------|---|---|---|-----------|---------|
| Product Family | Series | Sensor Type | Mounting Type | Specification | Packaging | Version |
| Sensors | QGS = SMD IR Gas Sensors | M = Serial module K = Evaluation kit | 1 = Module type 1, low profile H = Module type 2, high profile 3 = Kit type 3 | 0000 = Fixed C821 = CO ₂ CH41 = CH ₄ N8L1 = NO 9501 = 9.50 μm | 0 = Bulk | 0 |

Environmental Compliance

All KEMET Gas Sensors are RoHS and REACH Compliant.



Article 33(1) of the REACH Regulation states that manufacturers and importers of articles (products) are required to notify their customers of the presence of any Substances of Very High Concern (SVHC) in their products exceeding 0.1% by weight and provide instructions on safe use of the product.

KEMET Corporation reports regarding the Article 33(1) of REACH Regulation as follows:

1. *Applicable Product: Gas Sensors (QGC, QGS & QGSM series)*

2. *Report for the content of REACH SVHC list:*

The product(s) above contains a substance by more than 0.1wt% per product weight that was published in the 8th update of the REACH SVHC substances (December 19, 2012).

3. *Regarding the safety of the gas sensors (Piezoceramic products):*

The Piezoceramic that is used in this product becomes ceramic by sintering powder containing PZT as the main ingredient. It is chemically stable, with minimum risks toward the human body or environment within the intended use of the product. Please note that risks could occur in the case of inhalation or accidental oral uptake of powder ceramics.

4. *Technical product information on the gas sensors (Piezoceramic products):*

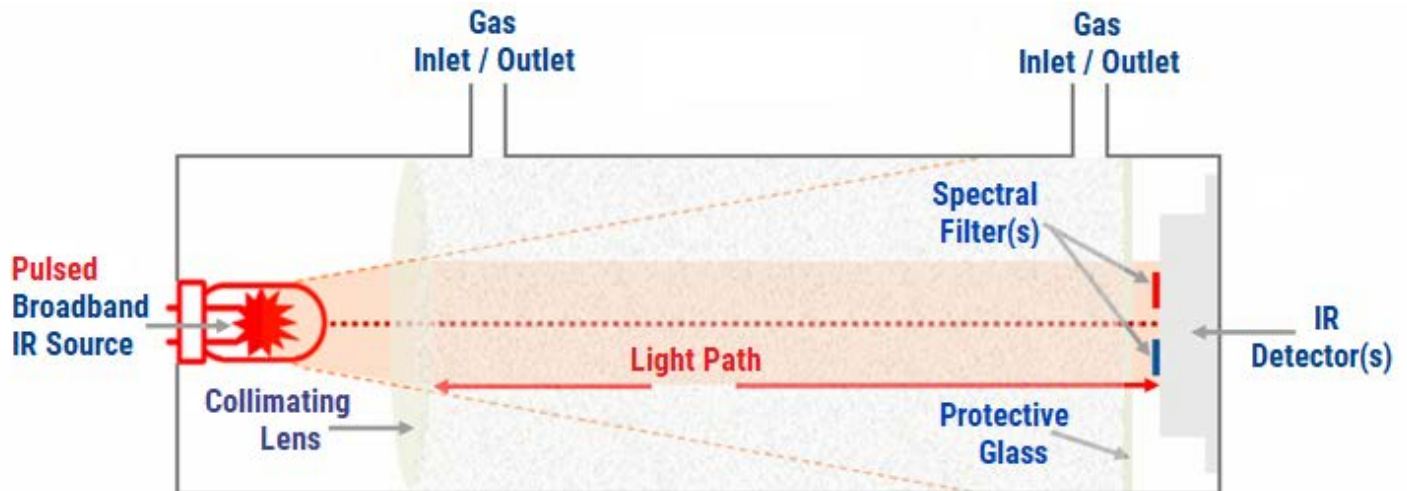
The manufacturing technique of the "piezoceramic products" whose main ingredient is Lead Titanium Zirconium Oxide (PZT) has been established, and there is no alternative material that can exhibit superior performance than PZT at this moment. Please note that the piezoceramic is listed as an exempt on RoHS (2011/65/EU) AnnexIII (7c.1).

5. *The responsibility of piezoceramic manufacturers:*

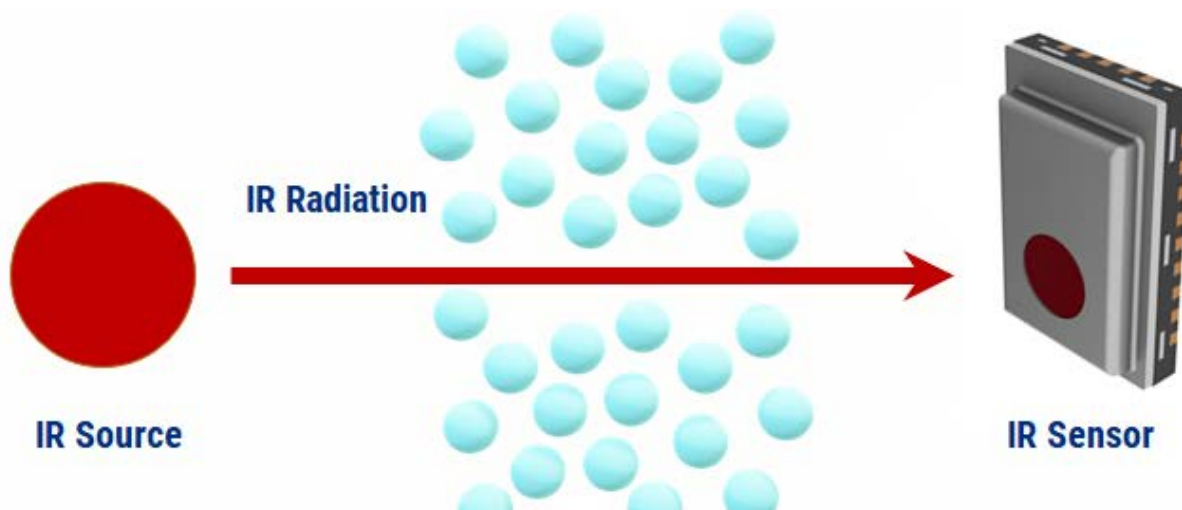
Piezoceramic manufacturers report information regarding PZT containment in their products to the customers to obey the article 33 of the REACH regulation.

Infrared Spectroscopy

KEMET Infrared Sensors work in the MID Infrared Spectrum. They are a critical component -- but not the only component -- in a gas analysis system. An IR heat source and a suitable gas path “mechanical enclosure” are also required in order to complete the gas analysis system.



IR Absorption - Active IR Sensing

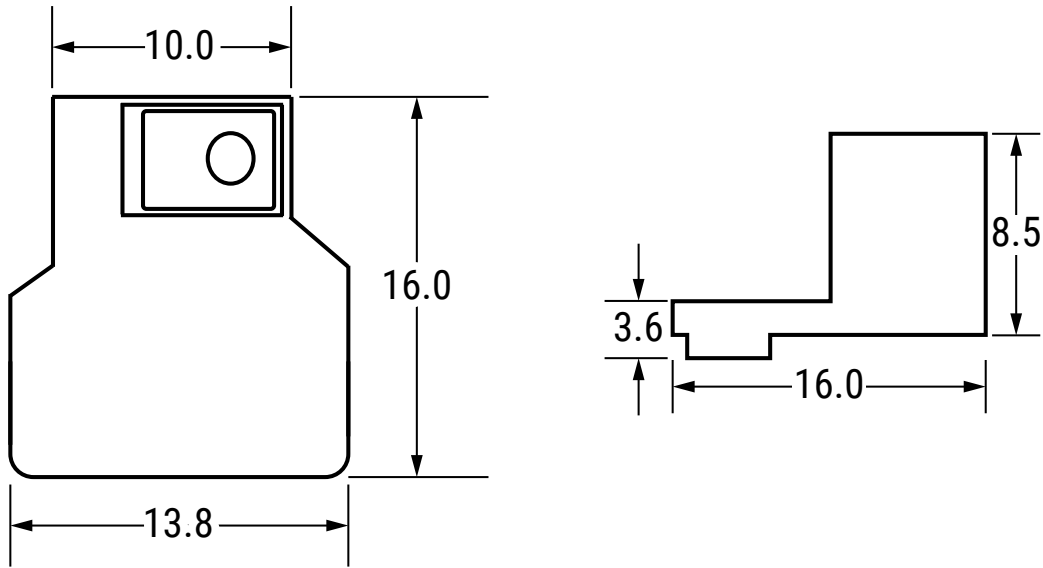


The IR source is directed as energy towards the sensor like an IR spotlight. Depending on the specific gas of interest or gas concentration levels between the IR source and the pyroelectric sensor, the IR transmitted is absorbed by the presence of the gas by a small amount. Understanding how much IR is being optically transmitted versus how much is received can indicate gas concentration levels.

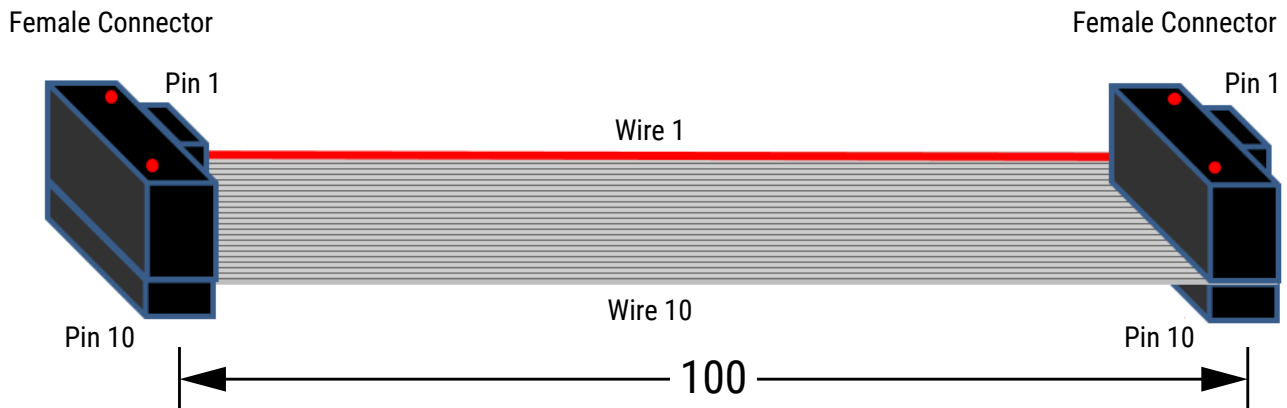
Filters are used to shorten the optical spectrum of the sensor to specifically match the gas of interest. These filters are usually included within the sensor, but for special cases KEMET can make optimised filters to suit customers specific gas requirements.

Dimensions – Millimeters

Module



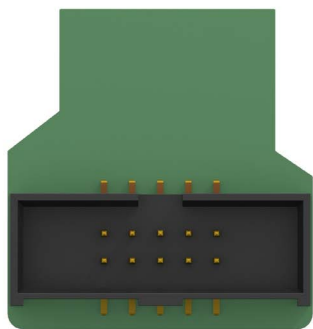
Cable



Dimensions – Millimeters cont.

Pin Configuration of the Module

Outfitted with all necessary components for the 1.8-3.6 V power supply of the device, all functionality of the sensor is routed out to a 10-pin 1.27 mm pitch IDC connector on the back side of the 16 x 13.8 mm PCB. The build height including the socket is 9 mm. They provide up to 1 MHz Fast Mode+ I²C communication to configure the sensor and read data from it.



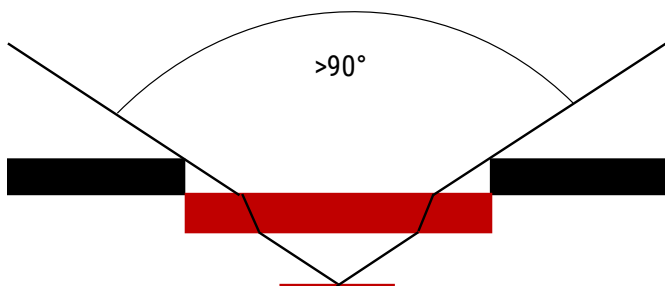
| | | | | |
|-----|----|----|----|----|
| •9 | •7 | •5 | •3 | •1 |
| •10 | •8 | •6 | •4 | •2 |

| Pin | Symbol | Type |
|-----|------------------------|----------------|
| 1 | V _{supply} | Power supply |
| 2 | Unassigned | - |
| 3 | SCL (I ² C) | Digital in/out |
| 4 | SDA (I ² C) | Digital in/out |
| 5 | CS | Digital in |
| 6 | INT | Digital out |
| 7 | SYNC | Digital in/out |
| 8 | CLK | Digital in/out |
| 9 | Unassigned | - |
| 10 | GND | Ground |

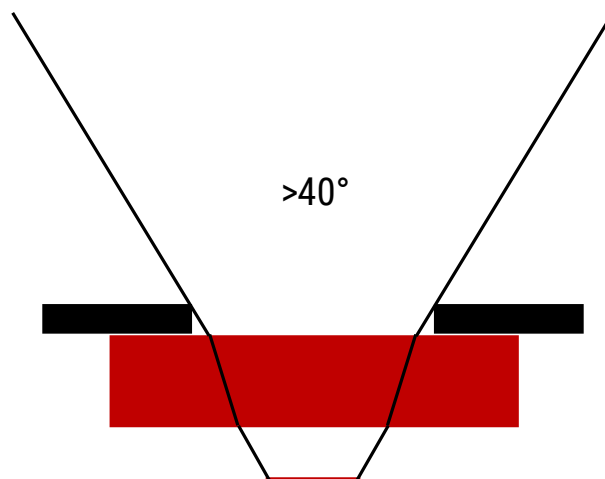
There is a chip select/enable pin and an interrupt output available. The CLK/SYNC pins can be used to feed an external clock signal in to the board or, alternatively, distribute the clock signal of one board to several other boards, thereby creating a synchronized “network” of sensors.

Field of View

USEQGSM1***** Low Profile



USEQGSMH***** High Profile



Performance Characteristics

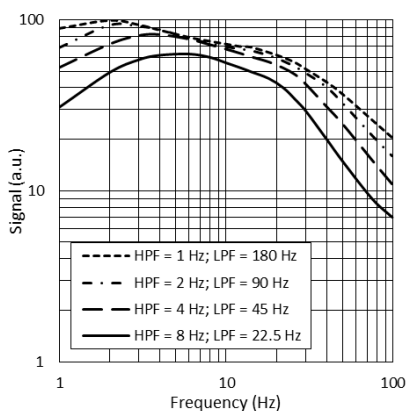
Signal Filtering & Power Modes

| Power Mode (base sample rate) | High Pass Filter – Analog (Hz) | | | | | Fixed Analog Low Pass Filter (Hz) | Fixed Digital Low Pass Filter (Hz) | Digital Low Pass Filter (Hz) | | | | Maximum ADC Sampling Rate (sps) |
|----------------------------------|-----------------------------------|------|------|------|------|---|--|---------------------------------|-------|------|------|--|
| | Off | 1.0 | 2.0 | 4.0 | 8.0 | | | 180.0 | 90.0 | 45.0 | 22.5 | |
| Normal Power Mode | Off | 1.0 | 2.0 | 4.0 | 8.0 | 600 | 250 | 180.0 | 90.0 | 45.0 | 22.5 | 1,000 |
| Low Power Mode | Off | 0.17 | 0.33 | 0.66 | 1.30 | 100 | 42 | 30.00 | 15.00 | 7.50 | 3.75 | 166 |

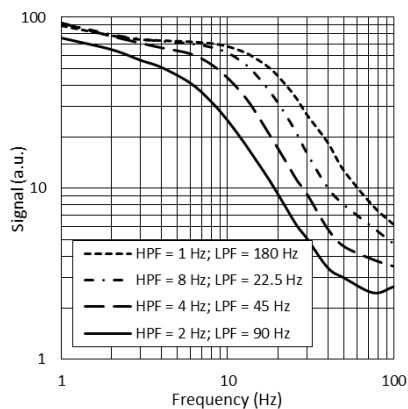
| Item | Mode | Description | Typical Current Consumption (1.8 V, room temperature) |
|-------------------|-----------------------|---|--|
| Power consumption | Normal Power Mode | Normal power consumption, 1 kHz maximum sample rate | 22 μ A |
| | Low Power Mode | Low power consumption, 166 Hz maximum sample rate | 3.5 μ A |
| Operational state | Normal Operation Mode | Sensor signal readout over I ² C | 22 μ A |
| | Sleep Mode | Hardware interrupt on infrared trigger | 21 μ A (Normal Power Mode) 3.5 μ A (Low Power Mode) |
| | Power Down Mode | Sensor is disabled | 1.1 μ A |

Infrared Frequency Characteristics

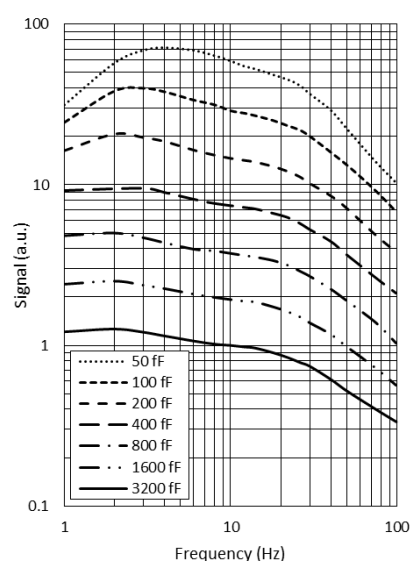
Typical Frequency Response in Normal Power Mode



Typical Frequency Response in Low Power Mode



Typical Frequency Response at Different Gain Settings



Part Number Specifications

Sensor Characteristics

| Filter Aperture (mm) | Element Size (mm ²) | SMD Package (mm) | D* ¹ (cm√Hz/W) Typical | NEP ¹ (W/√Hz) Typical | Time Constant (ms) at 10-20 Hz peak | Field of View |
|----------------------|---------------------------------|--------------------|-----------------------------------|----------------------------------|-------------------------------------|---------------|
| φ 1.65 | 0.64 x 0.64 | 5.65 x 3.70 x 1.55 | 2.5 x 10 ⁸ | 2.7 x 10 ⁻¹⁰ | ~10 | ~90° |

¹ 10 Hz, 500 K, room temperature, without window and optics.

Electrical Characteristics

| Supply Voltage (V) | Supply Current (μA) Typical | Digital I/O | ΔΣ ADC at 1 ksp | Operating Temperature Range (°C) | Storage Temperature Range (°C) | Sensor Read-out | Configurable |
|--------------------|-----------------------------|-----------------------------------|-----------------|----------------------------------|--------------------------------|-----------------|---|
| 1.75 to 3.60 | 1 to 23 | I ² C (FM+ compatible) | 15 bit | -40 to +85 | -40 to +110 | Current mode | Gain Digital filtering Sampling rate Power modes |

Part Number (Module)

| Part Number | Including Sensor | Filter (μm) | Filter BW (nm) | Use | Weight (gr) |
|-----------------|------------------|-------------|----------------|-----------------|-------------|
| USEQGS1C82100 | USEQGSEAC82180 | 4.26 | 180 | CO ₂ | 5.40 |
| USEQGS1CH4100 | USEQGSEACH4180 | 3.30 | 160 | CH ₄ | 5.40 |
| USEQGS1N8L100 | USEQGSEAN8L180 | 5.30 | 180 | NO | 5.40 |
| USEQGS1MH950100 | USEQGSEH950180 | 9.50 | 400 | Sugar, Ethanol | 5.41 |

| Part Number | Including Sensor | Filter (μm) | Filter BW (nm) | Use | Weight (gr) |
|---------------|-----------------------------|-------------|----------------|-----------|-------------|
| USEQFS1391100 | USEQFSEA391180 | 3.91 | 90 | Reference | 5.40 |
| USEQFS122L100 | USEQFSEA22L180 ¹ | 2.20 | Long pass | Broadband | 5.40 |
| USEQFS150L100 | USEQFSEA50L180 ¹ | 5.00 | Long pass | Broadband | 5.40 |
| USEQFS1464100 | USEQFSEA464180 ² | 4.64 | 180 | CO | 5.40 |

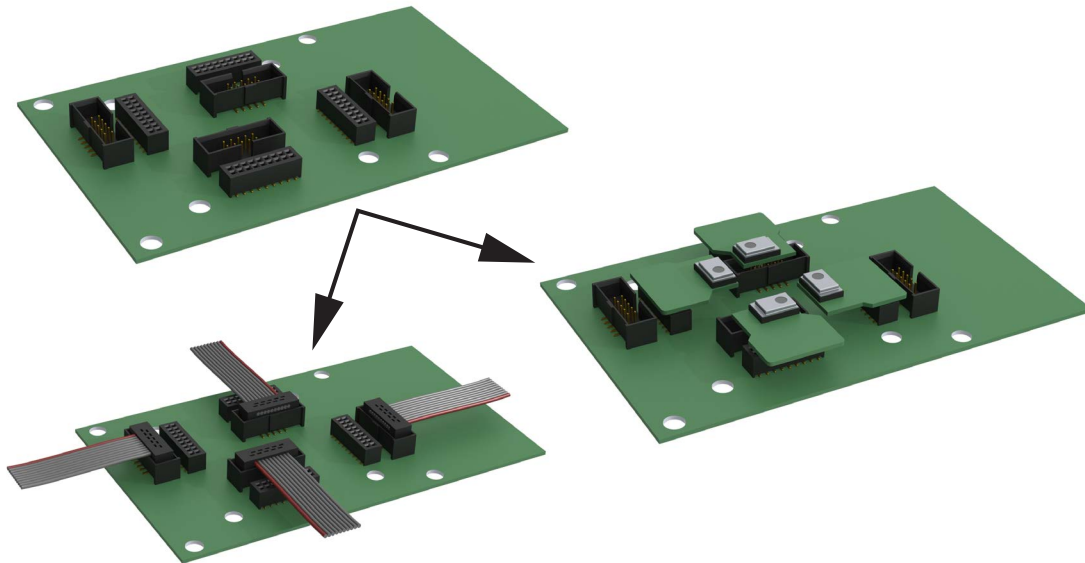
¹ Used with bespoke, customer or application-specific (narrowband) filters mounted externally.

² Used as gas or active filter.

Evaluation Kits

Control Board for Module

| Part Number | Use | Includes | Weight |
|----------------|---------------------------|--|--------|
| USEQCSK0000000 | Control Board for Modules | Preassembled backplane PCB USB communications cable Ribbon cable, optional use (up to 4) | 250 gr |



USEQCSK0000000 can flexibly host up to four modules. With no hardware design work required, a combination of this backplane board and any of the attached SMD sensors can produce infrared sensor signal measurements out of the box in the early evaluation and design stages. This control board is provided with PC software allowing the user to configure and read out each of the SMD sensors connected. The sensor data is visualised in real time on a scope plot in the user interface. A csv file capture facility records the digital signals from the sensors for further processing by the user.

Evaluation Kits

- Quick prototype development
- Easy way to evaluate
- Easy to install software
- Digital output

The digital SMD CO₂ Gas Sensing Evaluation Kit is to enable engineers and technicians to carry out a simple and effective evaluation of the QGS SMD sensors, to capture measured data and send it to a PC.

Evaluation Kits cont.

| Part Number | Use | Includes | Weight (gr) |
|----------------|--|--|-------------|
| USEQGSK3000000 | SMD CO ₂ Gas Sensing Evaluation Kit | PCB with STM32F303K8T6 microcontroller USEQFSEA391180, 1 px 3.91 μm / 90 nm USEQGSEAC82180, 1 px 4.26 μm / 180 nm Emitter drive PCB, with TO39 IR emitter 3D printed gas cell 9 V DC power supply USB communications cable | 300 |



Packaging

| Part Number | Packaging Type | Pieces Per Bag |
|--------------|--------------------|----------------|
| USEQMSM***** | ESD Protective Bag | 1 |

| Part Number | Packaging Type | Pieces Per Box |
|----------------|----------------|----------------|
| USEQCSK0000000 | Cardboard Box | 1 |
| USEQGSK3000000 | | |

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