TGS 2611 - for the detection of Methane

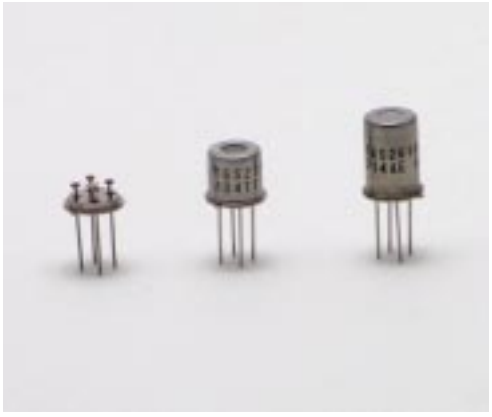
Features:

* **Low power consumption**
* **High sensitivity to methane**
* **Long life and low cost**
* **Uses simple electrical circuit**

Applications:

* **Domestic gas alarms**
* **Portable gas detectors**
* **Gas leak detector for gas appliances**

TGS2611 is a semiconductor type gas sensor which combines very high sensitivity to methane gas with low power consumption and long life. Due to miniaturization of its sensing chip, TGS2611 requires a heater current of only 56mA and the device is housed in a standard TO-5 package.



The TGS2611 is available in two different models which have different external housings but identical sensitivity to methane gas. Both models are able to satisfy the requirements of performance standards such as UL1484 and EN50194.

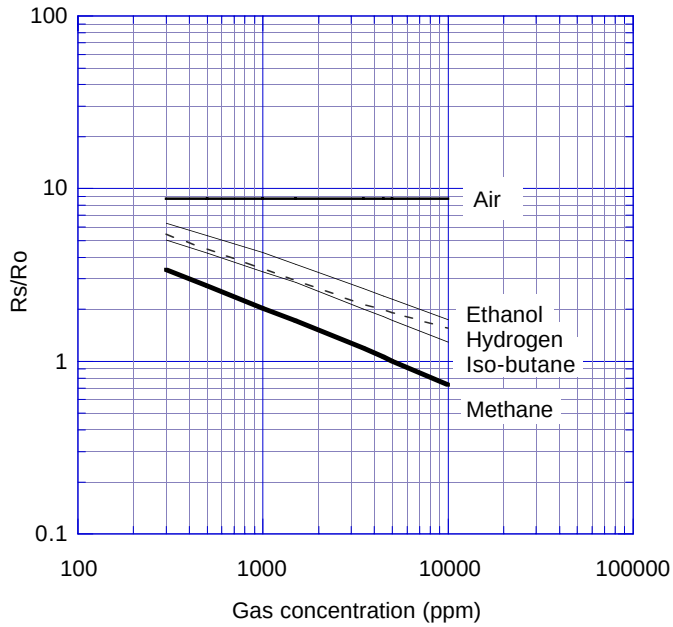
TGS2611-C00 possesses small size and quick gas response, making it suitable for gas leakage checkers.

TGS2611-E00 uses filter material in its housing which eliminates the influence of interference gases such as alcohol, resulting in highly selective response to methane gas. This feature makes the sensor ideal for residential gas leakage detectors which require durability and resistance against interference gas.

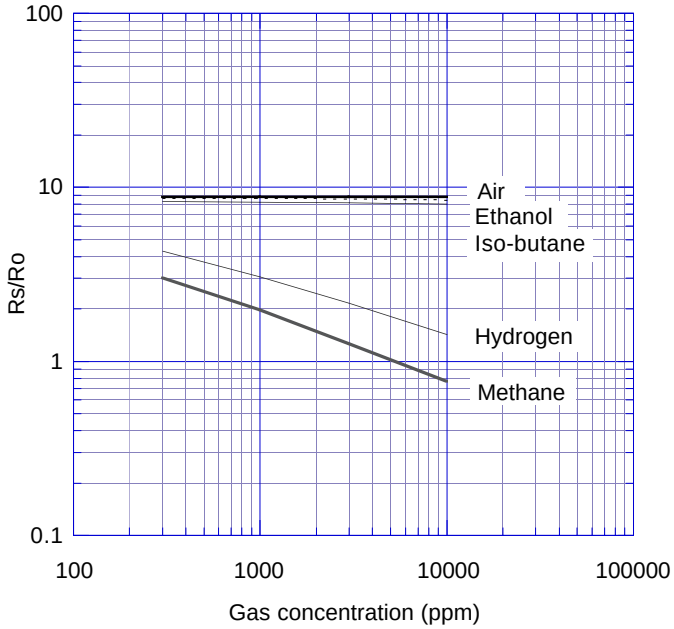
The figure below represents typical sensitivity characteristics, all data having been gathered at standard test conditions (see reverse side of this sheet). The Y-axis is indicated as *sensor resistance ratio* (Rs/Ro) which is defined as follows:

Rs = Sensor resistance in displayed gases at various concentrations
Ro = Sensor resistance in 5000ppm of methane

TGS2611-C00 Sensitivity Characteristics:



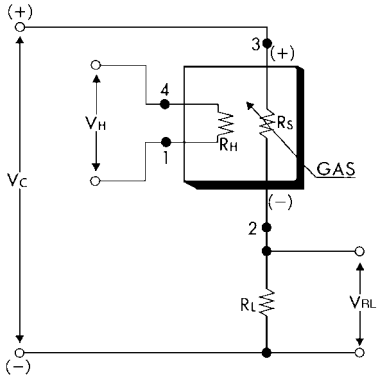
TGS2611-E00 Sensitivity Characteristics:



Basic Measuring Circuit:

The sensor requires two voltage inputs: heater voltage (V_H) and circuit voltage (V_C). The heater voltage (V_H) is applied to the integrated heater in order to maintain the sensing element at a specific temperature which is optimal for sensing. Circuit voltage (V_C) is applied to allow measurement of voltage (V_{RL}) across a load resistor (R_L) which is connected in series with the sensor.

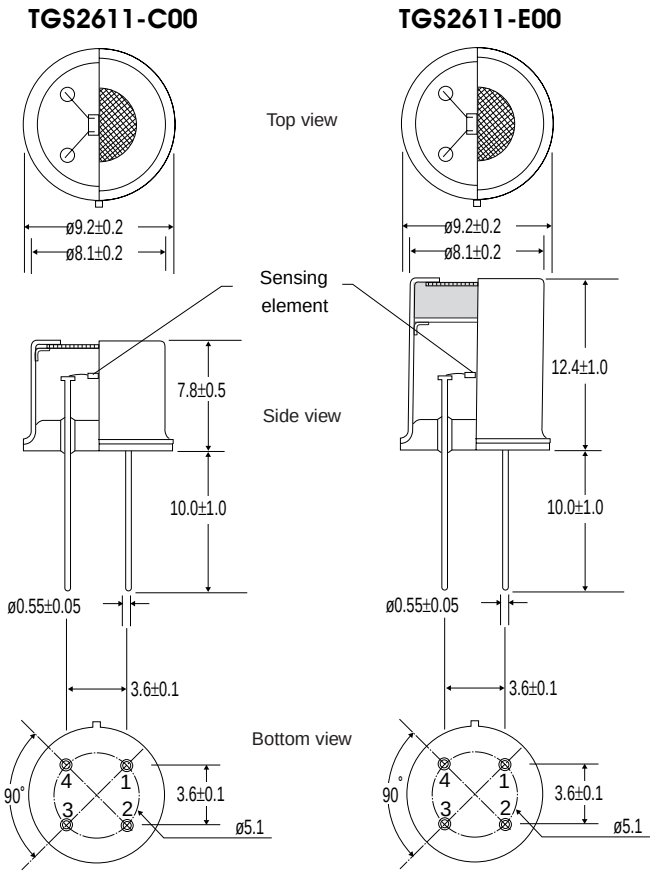
A common power supply circuit can be used for both V_C and V_H to fulfill the sensor's electrical requirements. The value of the load resistor (R_L) should be chosen to optimize the alarm threshold value, keeping power dissipation (P_S) of the semiconductor below a limit of 15mW. Power dissipation (P_S) will be highest when the value of Rs is equal to R_L on exposure to gas.



Specifications:

Model number			TGS 2611	
Sensing element type			D1	
Standard package			TO-5 metal can	
Target gases			Methane, Natural Gas	
Typical detection range			500 ~ 10,000 ppm	
Standard circuit conditions	Heater Voltage	V_H	5.0±0.2V DC/AC	
	Circuit voltage	V_C	5.0±0.2V DC	Ps ≤ 15mW
	Load resistance	R_L	Variable	0.45kΩ min.
Electrical characteristics under standard test conditions	Heater resistance	R_H	59Ω at room temp. (typical)	
	Heater current	I_H	56 ± 5mA	
	Heater power consumption	P_H	280±25mW	
	Sensor resistance	Rs	0.68~6.8 kΩ in 5000ppm methane	
	Sensitivity (change ratio of Rs)		0.60 ± 0.06	Rs (9000ppm) / Rs (3000ppm)
Standard test conditions	Test gas conditions		Methane in air at 20±2°C, 65±5%RH	
	Circuit conditions		V_C = 5.0±0.01V DC V_H = 5.0±0.05V DC	
	Conditioning period before test		7 days	

Structure and Dimensions:



Pin connection:
1: Heater
2: Sensor electrode (-)
3: Sensor electrode (+)
4: Heater

The value of power dissipation (P_S) can be calculated by utilizing the following formula:

$$P_S = \frac{(V_C - V_{RL})^2}{R_S}$$

Sensor resistance (Rs) is calculated with a measured value of V_{RL} by using the following formula:

$$R_S = \frac{V_C - V_{RL}}{V_{RL}} \times R_L$$

All sensor characteristics shown in this brochure represent typical characteristics. Actual characteristics vary from sensor to sensor. The only characteristics warranted are those in the Specification table above.

TGS 2611 - for the detection of Methane

Features:

* **Low power consumption**
* **High sensitivity to methane**
* **Long life and low cost**
* **Uses simple electrical circuit**

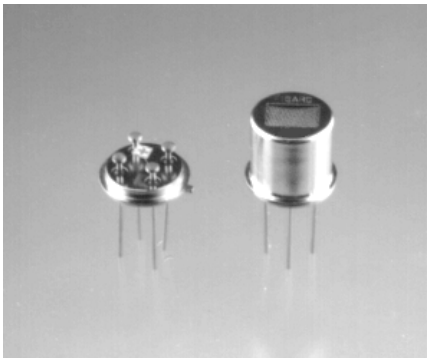
Applications:

* **Domestic gas alarms**
* **Portable gas detectors**
* **Gas leak detector for gas appliances**

The sensing element is comprised of a metal oxide semiconductor layer formed on an alumina substrate of a sensing chip together with an integrated heater. In the presence of a detectable gas, the sensor's conductivity increases depending on the gas concentration in the air. A simple electrical circuit can convert the change in conductivity to an output signal which corresponds to the gas concentration.

The **TGS 2611** has high sensitivity and selectivity to methane gas. Due to its low sensitivity to alcohol vapors (a typical interference gas in the domestic environment), the sensor is ideal for domestic gas alarms.

Due to miniaturization of the sensing chip, TGS 2611 requires a heater current of only 56mA and the device is housed in a standard TO-5 package.



The figure below represents typical sensitivity characteristics, all data having been gathered at standard test conditions (see reverse side of this sheet). The Y-axis is indicated as *sensor resistance ratio* (Rs/Ro) which is defined as follows:

Rs = Sensor resistance in displayed gases at various concentrations

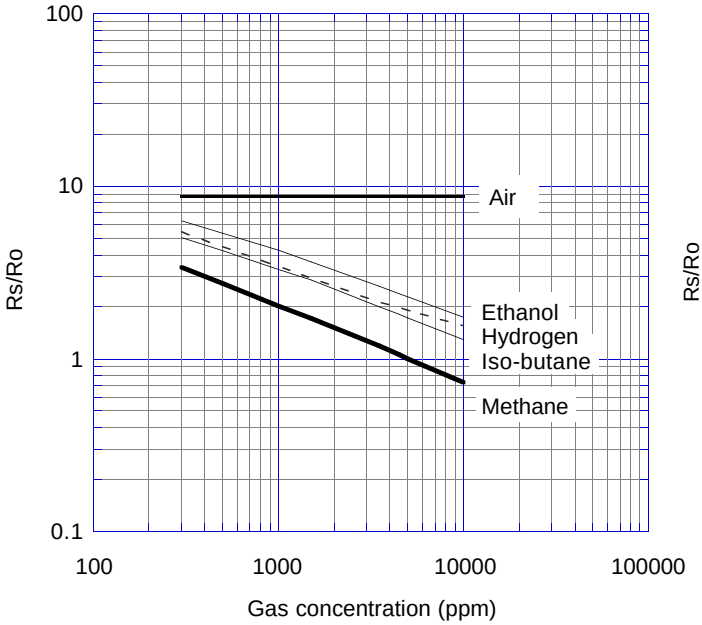
Ro = Sensor resistance in 5000ppm of methane

The figure below represents typical temperature and humidity dependency characteristics. Again, the Y-axis is indicated as *sensor resistance ratio* (Rs/Ro), defined as follows:

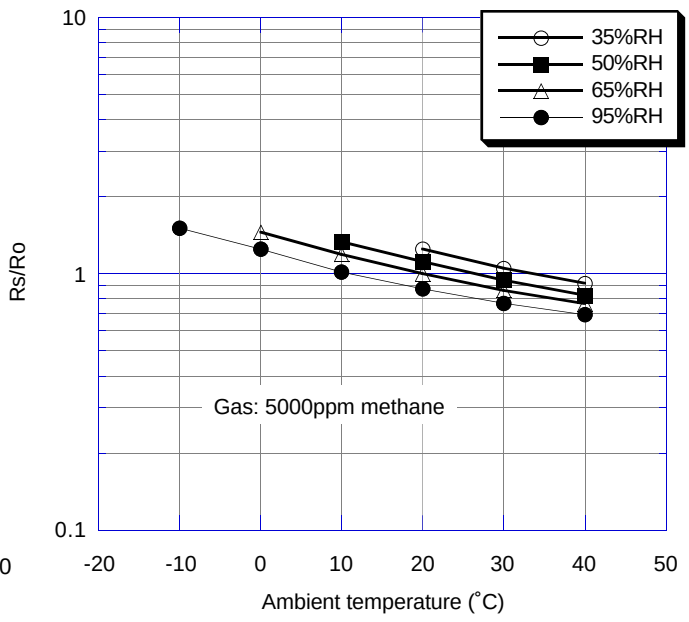
Rs = Sensor resistance in 5000ppm of methane at various temperatures/humidities

Ro = Sensor resistance in 5000ppm of methane at 20°C and 65% R.H.

Sensitivity Characteristics:



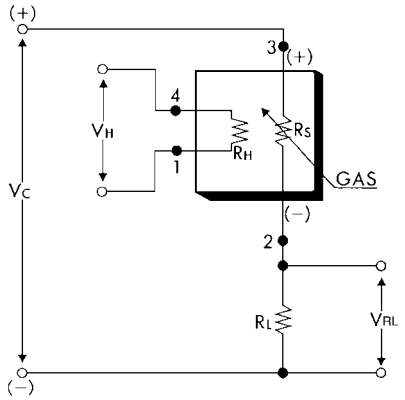
Temperature/Humidity Dependency:



Basic Measuring Circuit:

The sensor requires two voltage inputs: heater voltage (V_H) and circuit voltage (V_C). The heater voltage (V_H) is applied to the integrated heater in order to maintain the sensing element at a specific temperature which is optimal for sensing. Circuit voltage (V_C) is applied to allow measurement of voltage (V_{RL}) across a load resistor (R_L) which is connected in series with the sensor.

A common power supply circuit can be used for both V_C and V_H to fulfill the sensor's electrical requirements. The value of the load resistor (R_L) should be chosen to optimize the alarm threshold value, keeping power dissipation (P_S) of the semiconductor below a limit of 15mW. Power dissipation (P_S) will be highest when the value of Rs is equal to R_L on exposure to gas.



Specifications:

Model number			TGS 2611	
Sensing element type			D1	
Standard package			TO-5 metal can	
Target gases			Methane, Natural Gas	
Typical detection range			500 ~ 10,000 ppm	
Standard circuit conditions	Heater Voltage	V_H	5.0±0.2V DC/AC	
	Circuit voltage	V_C	5.0±0.2V DC	Ps < 15mW
	Load resistance	R_L	Variable	0.451 min.
Electrical characteristics under standard test conditions	Heater resistance	R_H	59Ω at room temp. (typical)	
	Heater current	I_H	56 ± 5mA	
	Heater power consumption	P_H	280±25mW	
	Sensor resistance	Rs	0.68~6.8 kΩ in 5000ppm methane	
	Sensitivity (change ratio of Rs)		0.60 ± 0.06	Rs (9000ppm) / Rs (3000ppm)
Standard test conditions	Test gas conditions		Methane in air at 20±2°C, 65±5%RH	
	Circuit conditions		V_C = 5.0±0.01V DC V_H = 5.0±0.05V DC	
	Conditioning period before test		7 days	

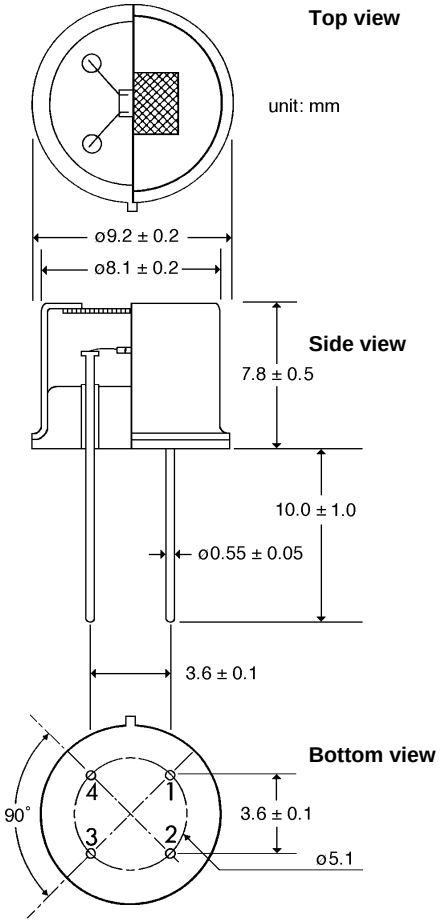
The value of power dissipation (P_S) can be calculated by utilizing the following formula:

$$P_S = \frac{(V_C - V_{RL})^2}{R_S}$$

Sensor resistance (Rs) is calculated with a measured value of V_{RL} by using the following formula:

$$R_S = \frac{V_C - V_{RL}}{V_{RL}} \times R_L$$

Structure and Dimensions:



Pin connection:

1 : Heater
2 : Sensor electrode (-)
3 : Sensor electrode (+)
4 : Heater

TGS 2611 - for the detection of Methane

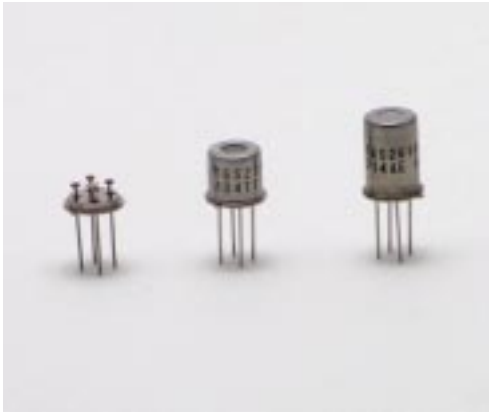
Features:

* **Low power consumption**
* **High sensitivity to methane**
* **Long life and low cost**
* **Uses simple electrical circuit**

Applications:

* **Domestic gas alarms**
* **Portable gas detectors**
* **Gas leak detector for gas appliances**

TGS2611 is a semiconductor type gas sensor which combines very high sensitivity to methane gas with low power consumption and long life. Due to miniaturization of its sensing chip, TGS2611 requires a heater current of only 56mA and the device is housed in a standard TO-5 package.



The TGS2611 is available in two different models which have different external housings but identical sensitivity to methane gas. Both models are able to satisfy the requirements of performance standards such as UL1484 and EN50194.

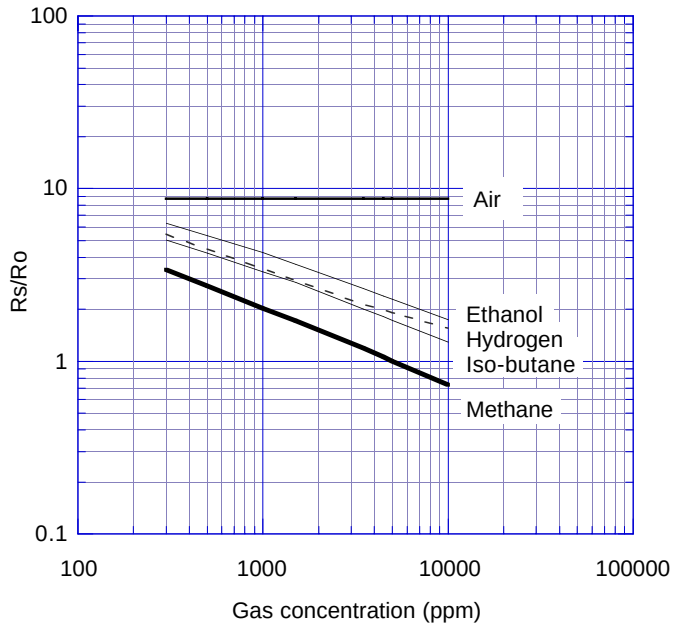
TGS2611-C00 possesses small size and quick gas response, making it suitable for gas leakage checkers.

TGS2611-E00 uses filter material in its housing which eliminates the influence of interference gases such as alcohol, resulting in highly selective response to methane gas. This feature makes the sensor ideal for residential gas leakage detectors which require durability and resistance against interference gas.

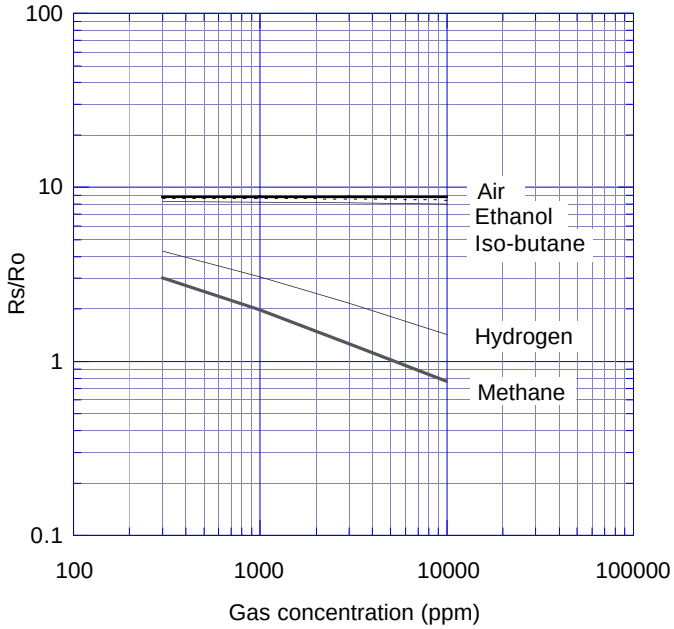
The figure below represents typical sensitivity characteristics, all data having been gathered at standard test conditions (see reverse side of this sheet). The Y-axis is indicated as *sensor resistance ratio* (Rs/Ro) which is defined as follows:

Rs = Sensor resistance in displayed gases at various concentrations
Ro = Sensor resistance in 5000ppm of methane

TGS2611-C00 Sensitivity Characteristics:



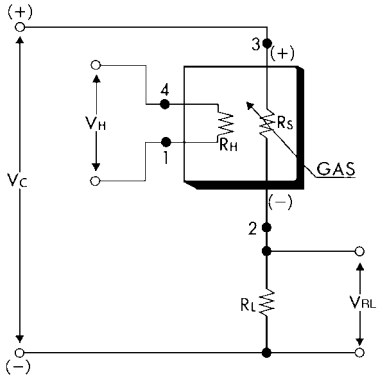
TGS2611-E00 Sensitivity Characteristics:



Basic Measuring Circuit:

The sensor requires two voltage inputs: heater voltage (V_H) and circuit voltage (V_C). The heater voltage (V_H) is applied to the integrated heater in order to maintain the sensing element at a specific temperature which is optimal for sensing. Circuit voltage (V_C) is applied to allow measurement of voltage (V_{RL}) across a load resistor (R_L) which is connected in series with the sensor.

A common power supply circuit can be used for both V_C and V_H to fulfill the sensor's electrical requirements. The value of the load resistor (R_L) should be chosen to optimize the alarm threshold value, keeping power dissipation (P_S) of the semiconductor below a limit of 15mW. Power dissipation (P_S) will be highest when the value of Rs is equal to R_L on exposure to gas.



Specifications:

Model number			TGS 2611	
Sensing element type			D1	
Standard package			TO-5 metal can	
Target gases			Methane, Natural Gas	
Typical detection range			500 ~ 10,000 ppm	
Standard circuit conditions	Heater Voltage	V_H	5.0±0.2V DC/AC	
	Circuit voltage	V_C	5.0±0.2V DC	Ps ≤ 15mW
	Load resistance	R_L	Variable	0.45kΩ min.
Electrical characteristics under standard test conditions	Heater resistance	R_H	59Ω at room temp. (typical)	
	Heater current	I_H	56 ± 5mA	
	Heater power consumption	P_H	280±25mW	
	Sensor resistance	Rs	0.68~6.8 kΩ in 5000ppm methane	
	Sensitivity (change ratio of Rs)		0.60 ± 0.06	Rs (9000ppm) / Rs (3000ppm)
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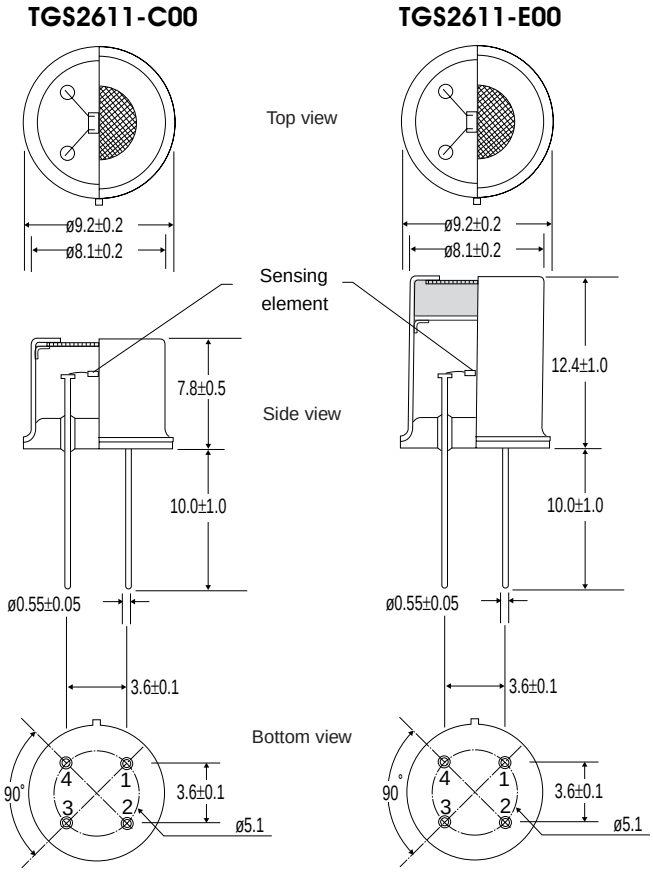
	Circuit conditions		V_C = 5.0±0.01V DC V_H = 5.0±0.05V DC	
	Conditioning period before test		7 days	

Structure and Dimensions:



Pin connection:
1: Heater
2: Sensor electrode (-)
3: Sensor electrode (+)
4: Heater

The value of power dissipation (P_S) can be calculated by utilizing the following formula:

$$P_S = \frac{(V_C - V_{RL})^2}{R_S}$$

Sensor resistance (Rs) is calculated with a measured value of V_{RL} by using the following formula:

$$R_S = \frac{V_C - V_{RL}}{V_{RL}} \times R_L$$

All sensor characteristics shown in this brochure represent typical characteristics. Actual characteristics vary from sensor to sensor. The only characteristics warranted are those in the Specification table above.

REV: 02/05

TGS 2611 - for the detection of Methane

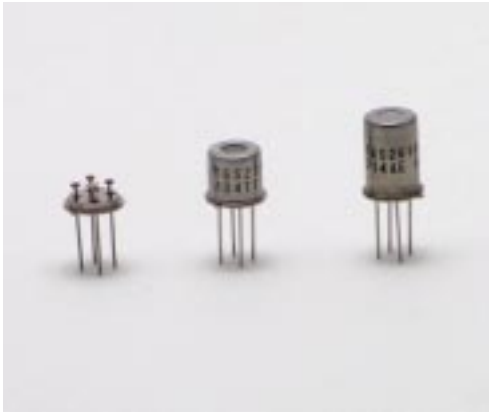
Features:

* **Low power consumption**
* **High sensitivity to methane**
* **Long life and low cost**
* **Uses simple electrical circuit**

Applications:

* **Domestic gas alarms**
* **Portable gas detectors**
* **Gas leak detector for gas appliances**

TGS2611 is a semiconductor type gas sensor which combines very high sensitivity to methane gas with low power consumption and long life. Due to miniaturization of its sensing chip, TGS2611 requires a heater current of only 56mA and the device is housed in a standard TO-5 package.



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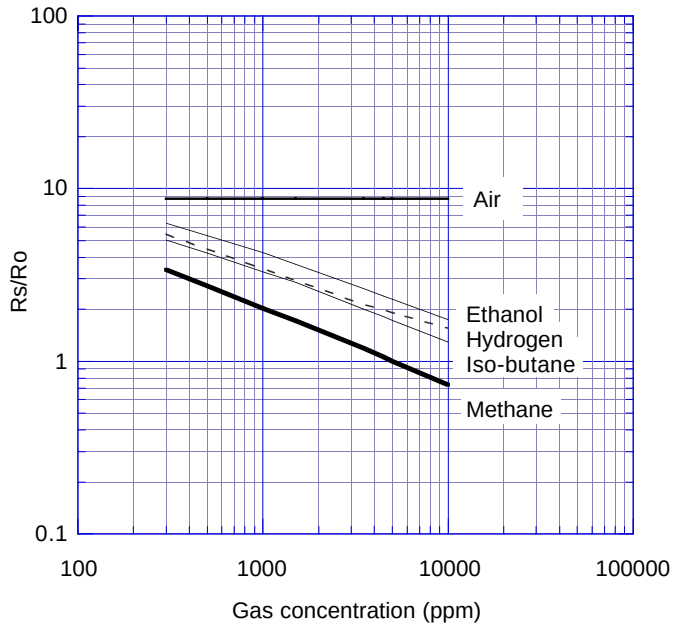
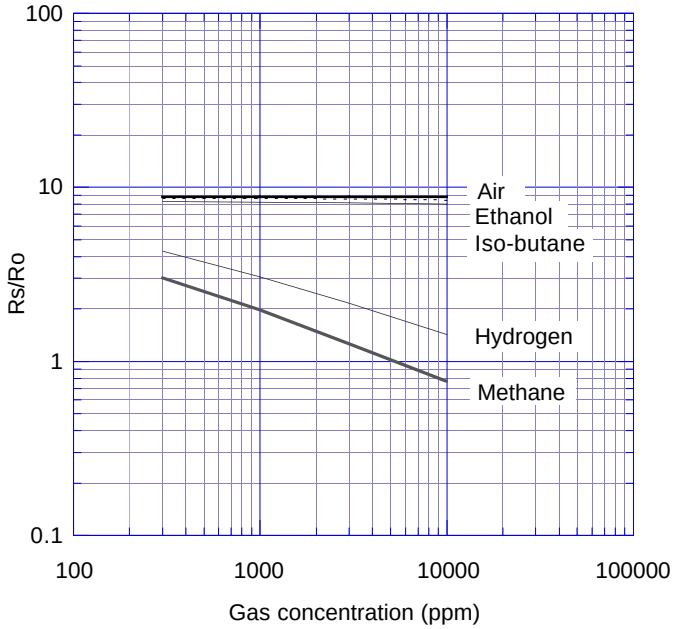
Ro = Sensor resistance in 5000ppm of methane

TGS2611-C00 Sensitivity Characteristics:



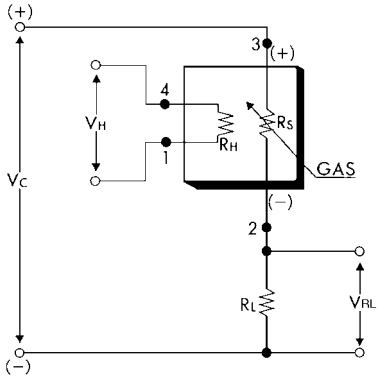
TGS2611-E00 Sensitivity Characteristics:



Basic Measuring Circuit:

The sensor requires two voltage inputs: heater voltage (V_H) and circuit voltage (V_C). The heater voltage (V_H) is applied to the integrated heater in order to maintain the sensing element at a specific temperature which is optimal for sensing. Circuit voltage (V_C) is applied to allow measurement of voltage (V_{RL}) across a load resistor (R_L) which is connected in series with the sensor.

A common power supply circuit can be used for both V_C and V_H to fulfill the sensor's electrical requirements. The value of the load resistor (R_L) should be chosen to optimize the alarm threshold value, keeping power dissipation (P_S) of the semiconductor below a limit of 15mW. Power dissipation (P_S) will be highest when the value of Rs is equal to R_L on exposure to gas.



Specifications:

Model number			TGS 2611	
Sensing element type			D1	
Standard package			TO-5 metal can	
Target gases			Methane, Natural Gas	
Typical detection range			500 ~ 10,000 ppm	
Standard circuit conditions	Heater Voltage	V_H	5.0±0.2V DC/AC	
	Circuit voltage	V_C	5.0±0.2V DC	Ps ≤ 15mW
	Load resistance	R_L	Variable	0.45kΩ min.
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	Sensor resistance	Rs	0.68~6.8 kΩ in 5000ppm methane	
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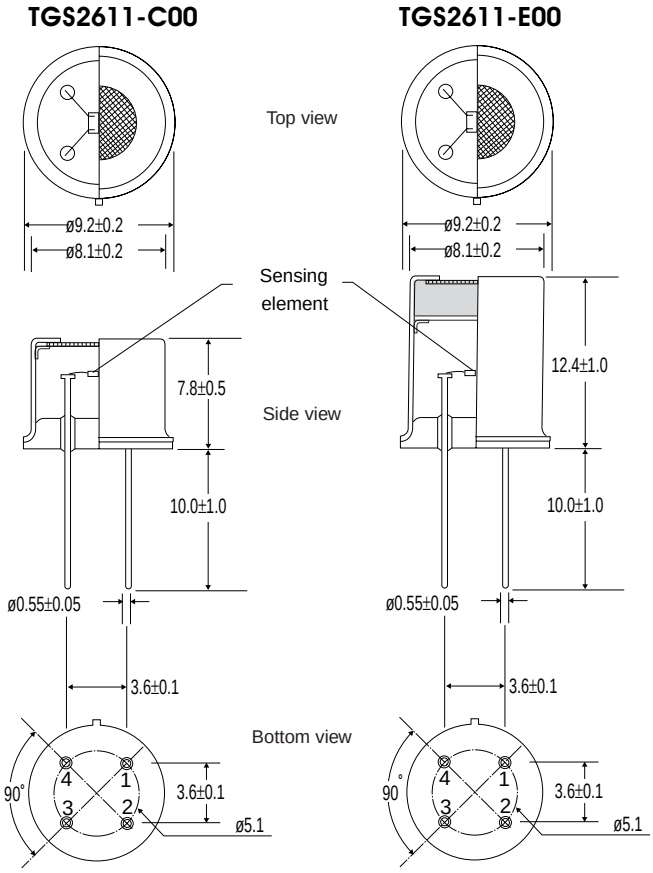
Standard test conditions	Test gas conditions		Methane in air at 20±2°C, 65±5%RH	
	Circuit conditions		V_C = 5.0±0.01V DC V_H = 5.0±0.05V DC	
	Conditioning period before test		7 days	

Structure and Dimensions:



Pin connection:
1: Heater
2: Sensor electrode (-)
3: Sensor electrode (+)
4: Heater

The value of power dissipation (P_S) can be calculated by utilizing the following formula:

$$P_S = \frac{(V_C - V_{RL})^2}{R_S}$$

Sensor resistance (Rs) is calculated with a measured value of V_{RL} by using the following formula:

$$R_S = \frac{V_C - V_{RL}}{V_{RL}} \times R_L$$

All sensor characteristics shown in this brochure represent typical characteristics. Actual characteristics vary from sensor to sensor. The only characteristics warranted are those in the Specification table above.

REV: 02/05

NGM2611-C13 - pre-calibrated module for Methane

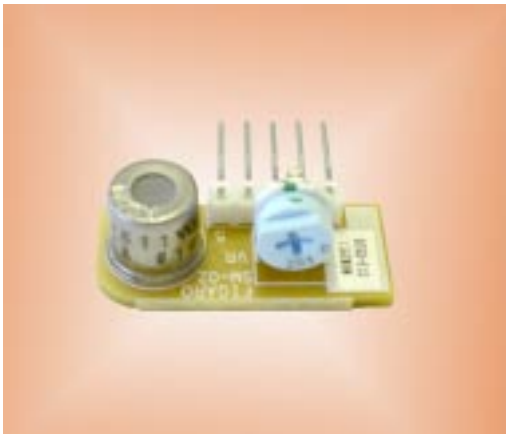
Features:

* Factory calibrated
* Temperature compensation circuit
* Low power consumption sensor TGS2611
* Compact size
* Meets RoHS regulations

Applications:

* Residential natural gas alarm

The NGM2611 is a pre-calibrated module for natural gas alarms which is precisely calibrated in Figaro's humidity and temperature controlled facility.



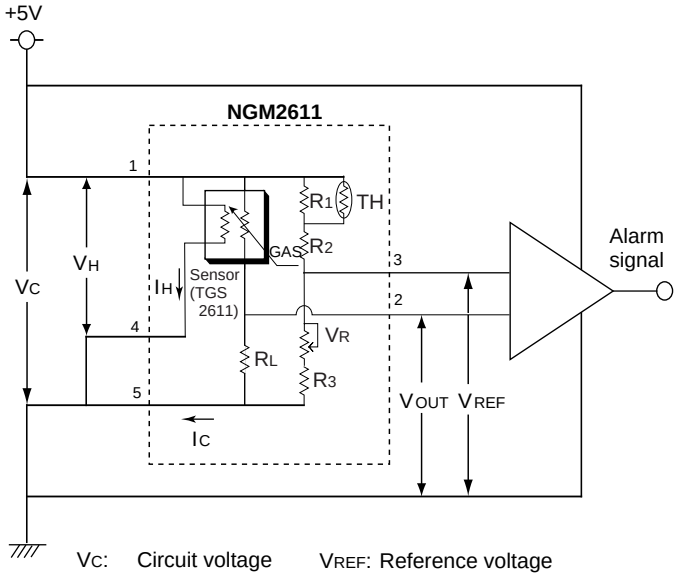
The most important process in manufacturing reliable resdential gas alarms is adjusting the alarm point. Calibration is a complicated and time consuming process which also requires a substantial investment in calibration equipment. By eliminating the costly calibration process, this module enables users to easily and simply manufacture residential natural gas alarms. Figaro has taken the complexity out of designing a gas detector circuit by providing users with a temperature compensation circuit which combines a built-in thermistor and individually adjusted load resistor together with Figaro's low power methane gas sensor.

A connector allows easy replacement of the module for the purpose of periodic sensor renewal. This input/output connector enables easy installation of the module into the gas detectors' mother board. This same mother board can be used for both methane and LPG gas detectors by simply changing the module.

This module is designed to meet the performance requirements of EN50194, and UL1484.

Please refer to *"Technical Information for TGS2611"* for sensor sensitivity characteristics. Refer to *"Application Notes for TGS2611"* for further information regarding circuit design.

Circuit Diagram



VC: Circuit voltage
VH: Heater voltage
VOUT: Output voltage
VREF: Reference voltage
IC: Circuit current
IH: Heater current

Basic Pin Connection

A regulated voltage of 5V DC should be applied to Pin #1. A voltage comparator should be connected to Pins #2 and 3. A circuit for detecting breakage of the heater may be connected to Pin #4 (in which case, Pins #4 and 5 should be connected separately to the GND).

When the gas sensor module is exposed to a concentration of target gas which exceeds the desired alarming point, the value of Vout will reach or exceed the value of VREF, causing the module to reach the alarm condition.

NOTE: As described in Sec. 2-6 of *"Technical Information for TGS2611"*, when energizing the sensor after an unpowered period, the sensor's resistance (Rs) drops sharply for the first few seconds after energizing, regardless of the presence of gases, before recovering to a stable level. This 'initial action' may cause activation of an alarm during the first few moments of energizing since VRL would exceed Vref. To prevent unnecessary alarms during sensor warmup, a circuit modification such as that shown in Sec. 1-7 of *"Application Notes for TGS2611"* should be used.

Parts List:

Symbol	Part	Spec.	Maker	Model #	Qty
R_1	Carbon resistor	22kΩ 1/8W	Panasonic	ERJ8GEYJ223A	1
R_2	Carbon resistor	6.8kΩ 1/8W	Panasonic	ERJ8GEYJ682A	1
R_3	Carbon resistor	6.8kΩ 1/8W	Panasonic	ERJ8GEYJ682A	1
R_L	Carbon resistor	Var. 1/8W	Panasonic	ERJ8GEYJxxxA	1
V	Potentiometer	20kΩ 1/3W	HDK	NVG6	1
	(alternate)	20kΩ 1/3W	Koa	KVSF689A	1
TH	Thermistor	10kΩ at 25˚C B const.=3400±3%	Mitsubishi Materials	SC20-3I103KT	1
	(alternate 1)	10kΩ at 25˚C B const.=3370±1%	Mitsubishi Materials	TH11-3H103FT	
	(alternate 2)	10kΩ at 25˚C B const.=3414±1%	Semitec	103K1608T-1P	
	(alternate 3)	10kΩ at 25˚C B const.=3380±1%	Murata	NCP18XH103J03RB	
Sensor	Gas Sensor	-	Figaro	TGS2611-C00	1
CN	Connector	-	Nichiatsu	MB5P-90S	1

Specifications:

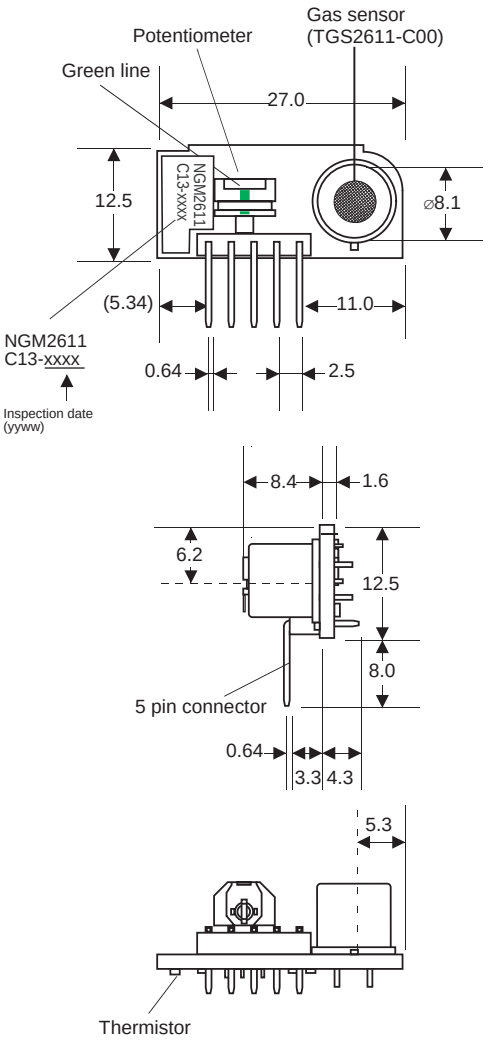
Module number			NGM 2611-C13
Standard test conditions	Test gas conditions		5000±100ppm methane in air at 20±2˚C, 65±5%RH
	Circuit conditions		V_H = 5.0±0.05V DC V_C = 5.0±0.05V DC
	Preheating period prior to test		2 days
Electrical characteristics under standard test conditions	Reference voltage	$V_{REF(STD)}$	$V_{out(STD)}$ ±0.5V DC
	Output voltage	$V_{out(STD)}$	2.5±0.5V DC

Electrical Characteristics:

Recommended operating conditions	Heater voltage	V_H	5.0±0.2V DC
	Circuit voltage	V_C	5.0±0.2V DC
	Minimum impedance between Pin#2 and GND		2.5MΩ
	Minimum impedance between Pin#3 and GND		
	Operating conditions		0~40˚C, 30~95%RH
	Temperature differential between inside and outside detector casing		≤10˚C max. (see NOTE)
Electrical characteristics under operating conditions	Heater current *(current between Pins #1 and 4)*	I_H	56±5mA
	Circuit current *(current between Pins #1 and 5)*	I_C	10mA (max.)
	Reference voltage	V_{REF}	1.0~4.0V DC
	Output voltage	V_{out}	0.05~(Vc-0.05)V DC

NOTE: Due to heat generated by circuit components, if the internal temperature of the detector exceeds the environmental temperture outside the detector casing by 10˚C or more, the calibrated alarm concentration would drift due to drifting of Vref. If users are unable to design detectors so as to keep this temperature differential below 10˚C, please consult with Figaro.

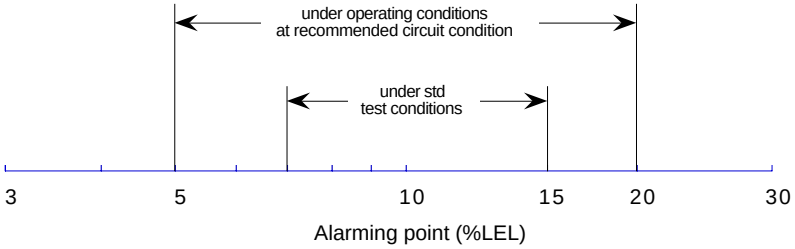
Structure and Dimensions:



u/m: mm

IMPORTANT NOTE: *The original setting of the potentiometer should be checked prior to usage of the module to verify that it is in the calibrated position. NGM2611 has a green line on the potentiometer which should be in alignment.*

Expected performance:



Expected performance of methanegas detectors
using NGM2611 and 10% LEL alarming point

NOTE: When using NGM2611, typical alarm tolerances for 10%LEL of methane gas such as those shown in the figure above can be expected. However, in actual usage, alarm thresholds may vary since the threshold is also affected by such factors as the tolerances of test conditions and heat generation inside the gas detection enclosure. As a result, Figaro neither expressly nor impliedly warrants the performance shown in this figure. If a large difference between the expected and actual performance of detectors is noticed, please consult with Figaro.

Absolute Maximum Ratings:

Absolute maximum ratings (see NOTE)	Circuit voltage	Vc	-0.3~+5.5V DC
	Heater voltage	V_H	-0.3~+5.5V DC *(max. of 2 minutes at 5.5V)*
	Operating temperature		-15~+55˚C *(max. 95%RH)*
	Storage temperature		-20~+60˚C *(avoid condensation)*
	Soldering temperature		260˚C *(max. in 10 sec.)*

NOTE: Detectors should be designed according to "Recommended Operating Conditions" as shown above. However, detector circuits should also be designed not to exceed "Absolute Maximum Ratings" under any circumstances. To exceed these ratings may cause damage or deterioration of the sensor.

For applications involving usage of NGM2611 for applications other than residential natural gas alarms, please consult with Figaro.