Electro Optical Components, Inc.
5464 Skylane Boulevard, Suite D, Santa Rosa, CA 95403
Toll Free: 855-EOC-6300
www.eoc-inc.com | info@eoc-inc.com

Click to go to Product Selector

CAMBRIDGE CMOS SENSORS

CCS801 Datasheet

CC-000015-DS

Ultra-low power multi-gas sensor for monitoring indoor air quality

Cambridge CMOS Sensors Technology Advantage

Our patented CMOS MEMS Micro-hotplate technology provides a unique silicon platform for our Metal Oxide (MOX) gas sensors and enables sensor miniaturisation, significantly lower power consumption and fast heating times.

Our resistive Micro-hotplates are fabricated using a high reliability silicon dioxide membrane and act as a heating element for the MOX based sensing material. The micro-hotplate can be used to heat the MOX material to up to 400°C and its electrical resistance can be monitored to detect the target gas. Through enabling fast heater cycling times, temperature modulation techniques can be used to reduce the device power consumption and implement advanced gas sensing methods.

Advanced algorithms support the MOX gas sensors family, for maximum sensitivity, selectivity, drift compensation, and for self-calibration; enabling easy and timely integration into a wide range of products and applications.

Product Overview

CCS801 is an ultra-low power MOX multi-gas sensor for monitoring indoor air quality including Carbon Monoxide (CO) and a wide range of Volatile Organic Compounds (VOCs).

The sensitivity of CCS801 to a target gas is optimised by adapting the supply voltage (V_H) of the integrated micro-heater, and the gas concentration can be correlated to the change in resistance of the MOX sensing layer (R_s).

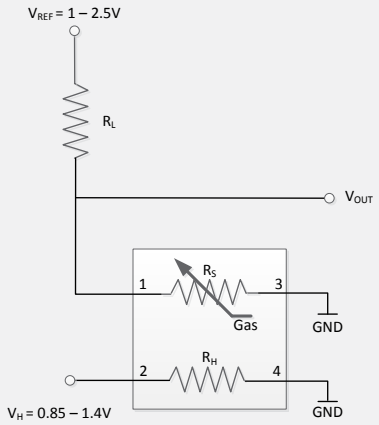
V_H can be set using a low-dropout (LDO) regulator or operated in pulsed PWM mode to reduce power consumption. The sensor resistance (R_s) is determined using a series load resistor (R_L), a reference voltage (V_{REF}), and an output voltage (V_{OUT}) read by an Analogue-to-Digital Converter (ADC).

Miniaturisation

The CCS801 multi-gas sensor is supported in a compact 2 mm x 3 mm Surface Mount Device (SMD) package as standard. Other package options including TO are available on request. The inherent design of this sensor enables ultra-low power consumption for battery operated portable handheld devices.

Key Benefits

- Ultra-low power consumption for battery operated devices
- High sensitivity and fast heating times
- Compact 2 mm x 3 mm SMD package for small form factor designs

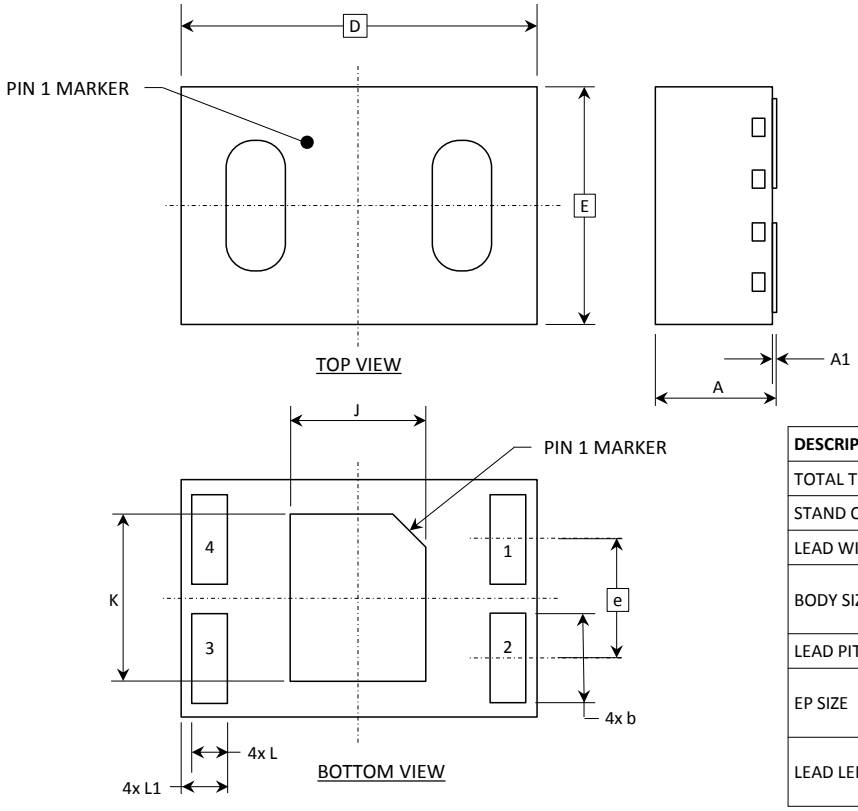


Recommended Sensor Configuration

Applications

- Indoor air quality monitoring for smartphones and tablets
- Alcohol breathalyser
- Gas leakage detection

SMD package outline and pin assignment



ALL DIMENSIONS ARE IN MM

DESCRIPTION	SYMBOL	MIN	NOM	MAX
TOTAL THICKNESS	A	0.95	1.0	1.05
STAND OFF	A1	0	0.035	0.05
LEAD WIDTH	b	0.7	0.75	0.8
BODY SIZE	D	3 BSC		
	E	2 BSC		
LEAD PITCH	e	1.0 BSC		
EP SIZE	J	1.06	1.16	1.26
	K	1.3	1.4	1.5
LEAD LENGTH	L	0.25	0.3	0.35
	L1	0.35	0.4	0.45

Pin	Description
1	Sensor+, V_{OUT}
2	Heater+, V_H
3	Sensor Ground, 0 V
4	Heater Ground, 0 V

Electrical characteristics

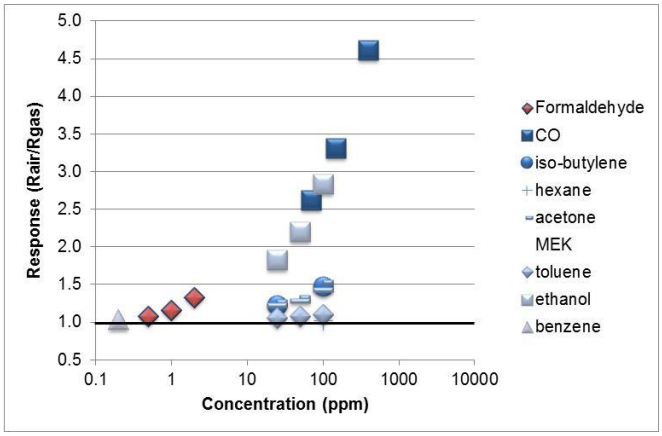
Parameters	Comments / Conditions	Min	Typical	Max	Units
Heater voltage (V_H) to set operating temperature for target gas	Carbon monoxide (~160°C)		0.87		V
	Ethanol (~240°C)		1.20		V
	Formaldehyde (~300°C)		1.40		V
Average power consumption (P_{AV}) for three target gases	Powered at V_H for target gases in pulse mode 0.5s heater on per minute[1]		130		µW
			216		µW
			275		µW
Peak power consumption (P_{DC}) for three target gases	Powered at V_H for target gases when DC powered		16		mW
			26		mW
			33		mW
Heater resistance (R_H)	Ambient temperature 25°C		40		Ω
Reference voltage (V_{REF})			+1.0	+2.5	V
Load resistance (R_L)		100K	Variable		Ω
Typical sensor resistance in air (R_S=R_0) at operating temperature		0.1	1.0	2.0	MΩ

Note:

1. Timing will vary depending on application and use case requirements

Sensor performance

Typical response curves of the CCS801 sensor to detecting Carbon Monoxide and VOCs at 45% relative humidity and 25°C is shown below.



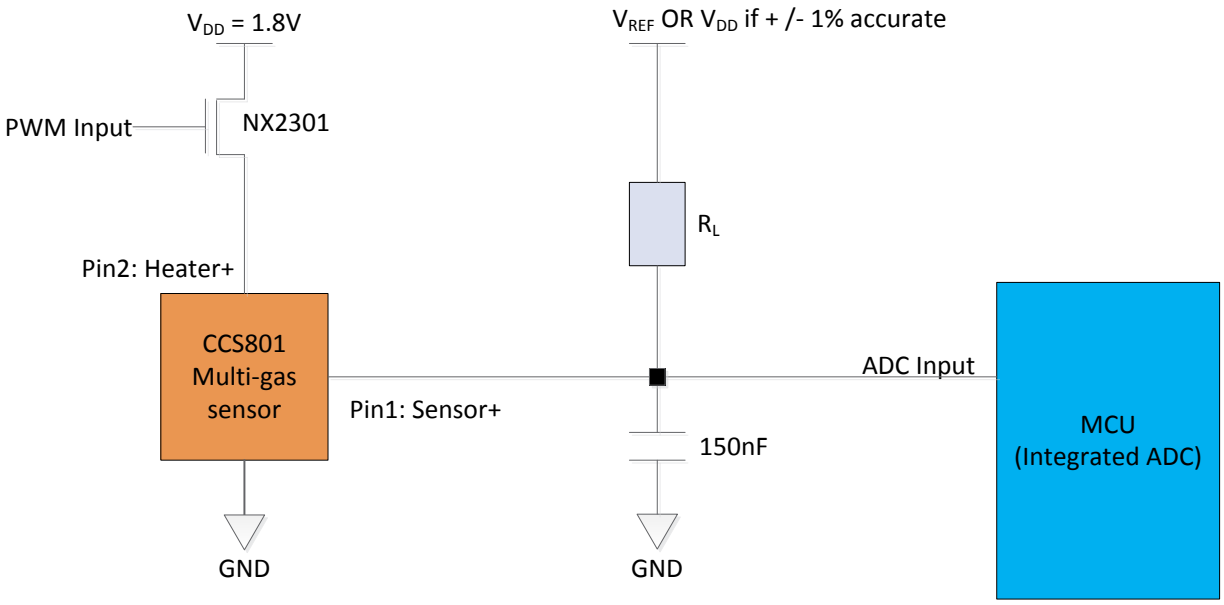
Gas type	Test condition	Sensitivity Factor[1]
Carbon Monoxide (CO)	R_0 / R_{400ppm}	4
Ethanol (C_2H_5OH)	R_0 / R_{208ppm}	15
Formaldehyde (HCHO)	R_0 / R_{2ppm}	1.6

Note:

1. Defined as the sensor's resistance in air (R_0) divided by the sensor's resistance at a specific gas concentration level at 45% RH and 25°C. Typical values given for each different gas.

Recommended basic application circuit

A recommended basic application circuit for CCS801 multi-gas sensor is shown below:



Notes:

1. V_{DD} could be used to replace V_{REF} (+1 to +2.5 V) if V_{DD} = +1.8 V +/- 1% and the ADC's input range covers V_{DD}. However we recommend using a reference voltage and the same V_{REF} used by the ADC if available externally.

2. The sensor can be operated in pulsed mode to reduce overall power consumption. This assumes a PWM output from the MCU is available to drive an external MOSFET switch (p-channel).

3. 1 x ADC input is required on the MCU to measure the sensors resistance. A buffer is optional but recommended if the ADC input impedance is <2 MΩ or the PCB connection (track length) from the sensor to the ADC input is long.