

Ultra-low power gas sensor for Ethanol detection

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 robust silicon dioxide membrane and includes an embedded tungsten heater acting 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

The CCS803 is an ultra-low power MOX gas sensor for monitoring Ethanol.

The sensitivity of CCS803 to Ethanol 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).

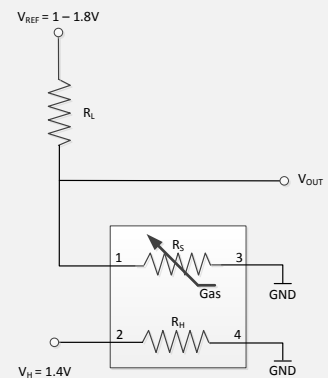
V_H can be set using a low-dropout (LDO) regulator or operated in pulsed PWM mode to reduce power consumption. The sensor resistance (R_s) is determined using a series load resistor (R_L), a reference voltage (V_{REF}), and an output voltage (V_{OUT}) read by an Analogue-to-Digital Converter (ADC).

Miniaturisation

The CCS803 is supported in a compact 2 mm x 3 mm DFN (Dual Flat No lead) package as standard. Other package options may be 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 response time
- Compact 2mm x 3mm DFN package for small form factor designs
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Recommended Sensor Configuration

Applications

- Alcohol breathalyser in consumer devices



Electrical characteristics

Parameters	Comments / Conditions	Min	Typical	Max	Units
Heater voltage (V_H) to set operating temperature	Ethanol (~300°C)		1.40		V
Average power consumption (P_{AV})	Powered at V_H in pulse mode 20% duty cycle ¹		6.8		mW
Peak power consumption (P_{DC})	Powered at V_H when DC powered		34		mW
Heater resistance (R_H)	At 300 °C		58		Ω
Reference voltage (V_{REF})			1.0	1.8	V
Load resistance (R_L)			1		k Ω
Typical sensor resistance in air R_0 at operating temperature		0.1	1.0	10	k Ω

Note:

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

Sensor performance

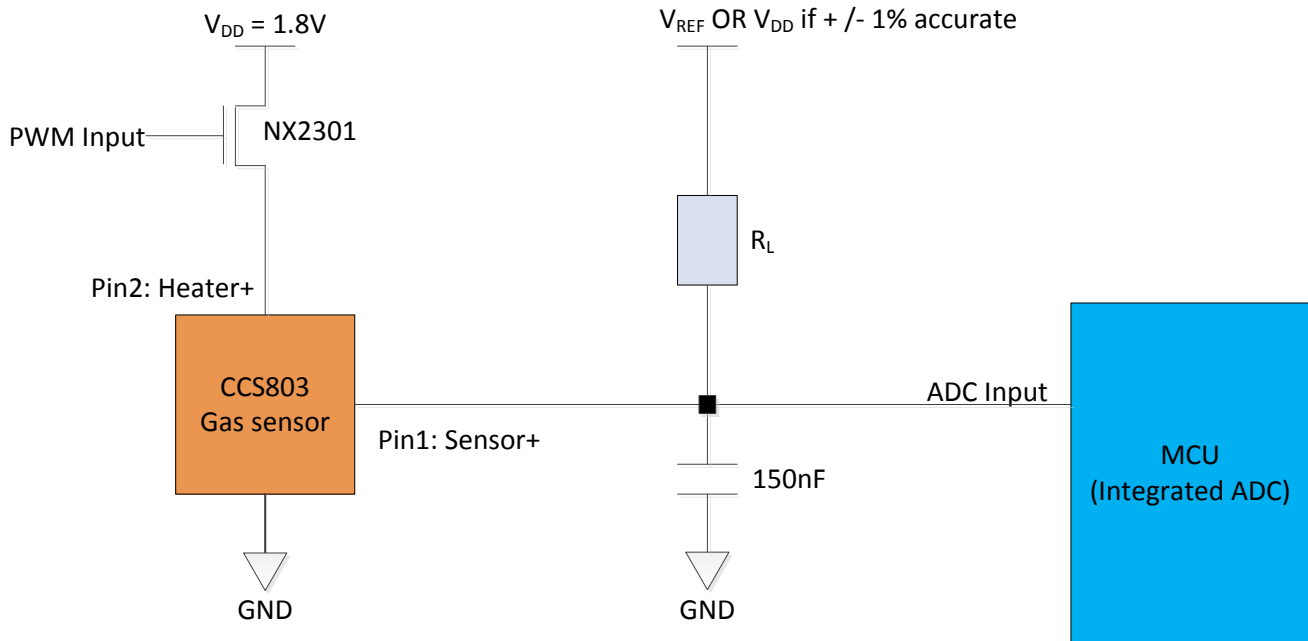
Gas type	Test condition	Sensitivity Factor ¹
Ethanol (C ₂ H ₅ OH)	R_0 / R_{100ppm}	5 - 10

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 50% RH
2. A burn-in time of 24hrs is recommended to ensure sensor performance is consistent over longer period of time

Recommended basic application circuit

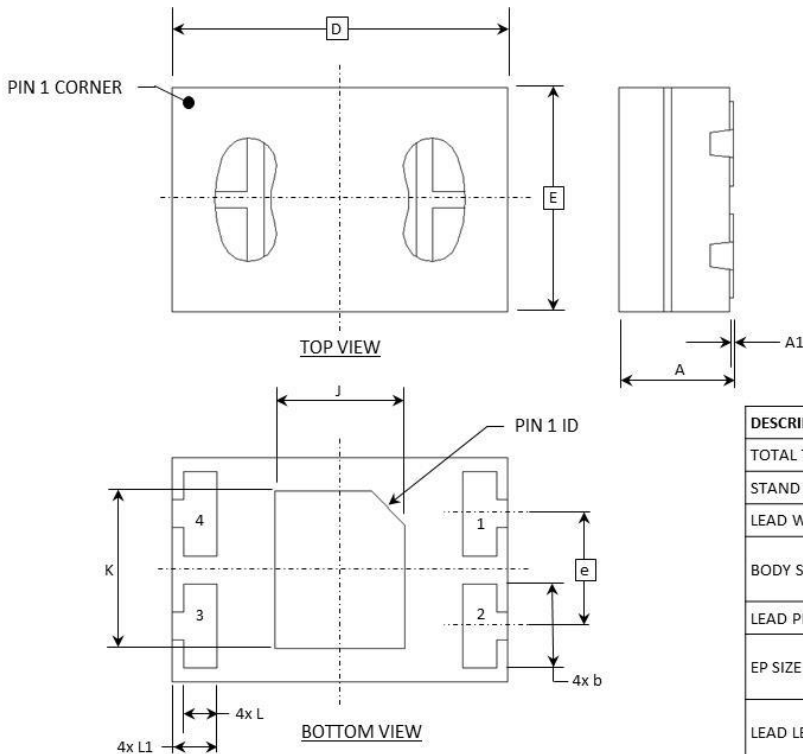
A recommended basic application circuit for CCS803 sensor is shown below:



Notes:

1. V_{DD} could be used to replace V_{REF} (+1 to +1.8 V) if $V_{DD} = +1.8 V \pm 1\%$ 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.

DFN package outline and pin assignment



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

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

Ordering Information

Part Number	Description	Package	MOQ
CCS803A-COPR	Volume production of CCS803 Ultra-low power gas sensor for ethanol detection	2x3mm DFN	5000
CCS803A-COPS	Sample of CCS803 Ultra-low power gas sensor for ethanol detection	2x3mm DFN	100

Note:

1. Refer to JEDEC J-STD020 lead-free standard for maximum soldering profile
2. Refer to application note CC-000090-AN on device assembly guidelines

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