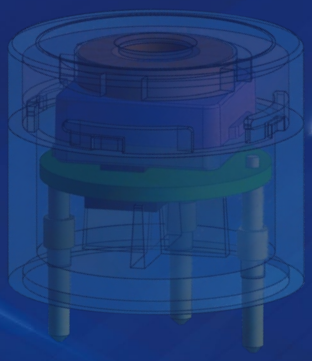
EC Sense
Easy Gas Sensors

DS4
Smart Digital Gas Sensor

Datasheet



Printed Solid Electrochemical Sensing Technology

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DS4 Digital Gas Sensor

Overview

The DS4 Digital Gas Sensor is a smart gas sensor, using the innovative printed solid polymer electrochemical sensing technology. With the powerful microprocessor, high-precision ADC and intelligent algorithm incorporated in the compact design, it can be easily integrated into the IoT and other sensing systems.

Available with a single Digital Gas Sensor Evaluation Kit for sensor testing. Sensor data is acquired through the test software with UART to USB data transmission.

Available with a bulk evaluation kit for over 25 gas sensors for sensor testing, calibration and quality control. Sensor data acquisition or batch calibration can be performed through the test software with RS485 to USB data transmission. Large-scale testing can be achieved by the serial communication of multiple evaluation kits.

Available with a 4S Flow Cap for compatibility testing or calibration of a single gas sensor and for gas testing equipment for diffusion testing and calibration of multiple gas sensors.

Features

- Low power consumption, wide range power supply from 3.3 to 5V DC (5V recommended).
- Wide operating temperature range from -40 ℃ to +55 ℃, without temperature compensation.
- Long-term zero point stability.
- Fast response time and timely detection of gas concentration changes.
- Excellent linearity.
- Anti-poisoning and long lifetime.
- Solidification design of the electrolyte, avoiding the risk of liquid leakage caused by high humidity environments or material aging.

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Features

Standard Industrial Dimensions

Standard industrial 4-series dimensions, with a 20 * 16.6 mm cylindrical shell, allowing easy iteration of new product designs. Suitable for stationary and portable gas detectors, saving costs from shell design for new products. Standard three-electrode pin dimensions (VCC_power positive, GND_power negative, IO_data transmission/reception.)

Use Without Preheating

The intelligent hardware design enables gas sensors to remain operational even without power supply, ensuring immediate gas detection upon power-up-anytime and anywhere. In IoT or battery application fields, energy-saving and low-power designs allow users to avoid lengthy preheating and slow data acquisition.

Certification

- Intrinsic safety certified EX ia IIC T6 Ga -40 ℃ to +55 ℃
- Power UI: DC 6V, Ii: 100 mA, Ci: 0.1 µF, Li: 0 mH, Pi: 0.6 W
- Communication UI: DC 6V, Ii: 100 mA, Ci: 0 µF, Li: 0 mH, Pi: 0.6 W
- RoHs compliant

Easy-to-Use UART Digital Output

The DS4 sensor utilizes UART 3.3V half-duplex single bus mode for output signals. The gas concentration values can be output without complex communication protocols, making secondary development application design simple, flexible and fast.

Low-Power Sleep Mode Function

The sensor has a sleep function that allows users to customize the sleep and wake-up modes, making it suitable for low-power battery and IoT applications.

Self-Recognition Function

The DS4 sensor provides identity information such as gas type and detection range, which enables the development of self-identification functions. and offers more flexibility in use.

User-Configurable Encryption Code Function

Users can customize their own user code to individually identify the sensor. When other types of sensors are inserted, the instrument can automatically verify whether the user code is correct. If an incorrect user code is detected, the instrument can display an error prompt, reminding the user to insert the correct sensor.

Easy Maintenance

Plug-and-play and hot-swappable design. Open calibration protocols allow for secondary offline calibration for customer service as well as factory reset calibration at the touch of a button. The plug-and-play function enables offline calibration, eliminating the need to introduce hazardous gases into the testing environment for instrument calibration. As a result, safety risks and on-site pollution can be avoided, providing a safer, easier and more convenient maintenance.

High Accuracy Pre-Calibration

Each DS4 Smart Digital Gas Sensor undergoes a professional gas calibration at the factory, with the calibration information stored in the sensor's microprocessor, allowing the user to operate the sensors directly without additional calibration. The factory calibration employs a diffusion gas calibration which simulates ambient conditions to closely resemble real application environments, thereby enhancing data accuracy. (For gas detection instruments utilizing pump-suction measurement methods, secondary calibration is needed based on the design parameters of the instrument.)

Lifespan and Performance Testing

The intelligent gas sensor has a self-test function that periodically performs a self-diagnosis of the service life and the performance indicators, whether with or without the test gas. The sensor emits warning signals to service or replace the sensor. This function provides reliable basic data for the development of intelligent instruments and makes gas detection devices safe, reliable and remotely maintainable. Users can obtain sensor error information, such as normal operation, low performance failure or detachment, through commands. This provides users with an early warning of sensor anomalies, significantly improving safety.

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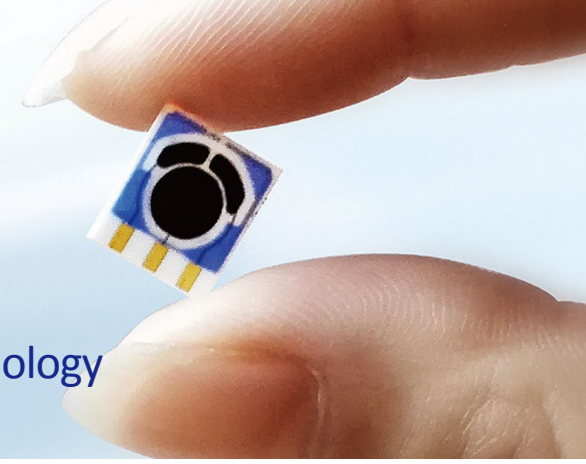


Principle

Solid Polymer Electrochemical Sensing Technology

The DS4 Digital Gas Sensor uses the Solid Polymer Electrochemical Sensing Technology. It employs a three-electrode arrangement - the working, the counter and the reference electrode - in which concentration measurements can be performed continuously and the sensor operates at a fixed potential. The gas of interest (target gas) diffuses through a diffusion barrier, such as a capillary, into the cell to the working electrode, where an electrochemical reaction takes place. Oxidation and reduction reactions are happening simultaniously. The current flowing through the cell is direct proportional to the concentration of the target gas. A reference electrode keeps, with a potentiostat, the potential constant together.

Applications

- Leakage

- Industrial Safety

- Process Monitoring

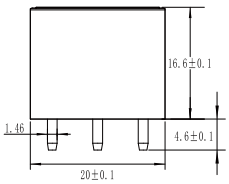
- Fire Safety

- Industrial Emission Monitoring

Mechanical Drawing Unit: mm

- Product Schematic

- Side View



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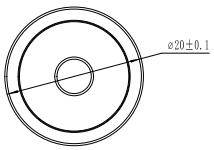

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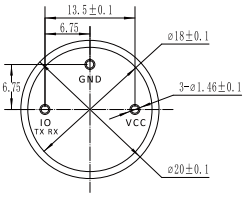

Pin Description

Pin	Description	Min Value	Typical Value	Max Value
VCC	Positive Power Supply	3.3 V	5 V	5 V
IO	Data Transceiver	-0.3 V	3.3 V	3.3 V
GND	Ground	-0.3 V	0 V	-

Technology Specifications

Gas Sensors Specifications	
Principle	Solid Polymer Electrochemical Sensing Technology
Accuracy	± 5% F.S
Repeatability	< 2%
Linearity	Linear
Warm-Up Time	< 60 s

Electrical Specifications	
Output Signal	UART 3.3V half-duplex Baud rate: 9600, Data bit: 8 bits ,Stop bit: 1 bit
Supply Voltage	3.3 to 5V DC, Recommended 5V DC
Supply Current	0.65 mA @ 5V DC
Peak Current	1 mA @ 5V DC
Sleep Mode Current	0.35 mA @ 5V DC
Power Consumption	≤ 5 mW @ 5V DC

Note: The above current reference data may have slight differences due to the varying stabilization times of different sensors upon initial power-up. Please refer to actual measurement data.

Lifetime	
Long-Term Drift	< 5 %/year
Expected Lifetime	> 3 years
Warranty	12 months from the date of shipment

Enviroment Specifications	
Operating Temperature	-40 ℃ to +55 ℃
Operating Humidity	15-95% RH. non-condensing
Operating Pressure	Atmospheric pressure ± 10 %
Storage Temperature	0 ℃ to 20 ℃

Mechanical Specifications	
Housing Material	ABS
Weight	4.56 g (including gas sensor)
Package	Individually packed in vacuum bags

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Product Selection Table

Smart Digital Gas Sensor Product List

Product	Formula	Partnumber	Range	Resolution	Response Time
DS4 Smart Digital Arsine Gas Sensor	AsH_3	04-DS4-AsH_3-1-01	0-1 ppm	0.001 ppm	< 3 s (T90 < 80 s)
DS4 Smart Digital Diborane Gas Sensor	B_2H_6	04-DS4-B_2H_6-1-01	0-1 ppm	0.001 ppm	< 3 s (T90 < 80 s)
DS4 Smart Digital Methyl Mercaptan Gas Sensor	CH_4S	04-DS4-CH_4S-10-01	0-10 ppm	0.001 ppm	< 3 s (T90 < 80 s)
		04-DS4-CH_4S-100-01	0-100 ppm	0.01 ppm	< 3 s (T90 < 80 s)
		04-DS4-CH_4S-5000-01	0-5000 ppm	0.1 ppm	< 3 s (T90 < 80 s)
DS4 Smart Digital Chlorine Gas Sensor	Cl_2	04-DS4-Cl_2-100-01	0-100 ppm	0.01 ppm	< 3 s (T90 < 30 s)
DS4 Smart Digital Carbon Monoxide Gas Sensor	CO	04-DS4-CO-10-01	0-10 ppm	0.001 ppm	< 3 s (T90 < 80 s)
		04-DS4-CO-100-01	0-100 ppm	0.01 ppm	< 3 s (T90 < 30 s)
		04-DS4-CO-1000-01	0-1000 ppm	0.1 ppm	< 3 s (T90 < 30 s)
		04-DS4-CO-2%-01	0-2% vol.	0.001% vol.	< 3 s (T90 < 30 s)
DS4 Smart Digital Ethylene Oxide Gas Sensor	ETO (C_2H_4O)	04-DS4-ETO-10-01	0-10 ppm	0.001 ppm	< 3 s (T90 < 30 s)
		04-DS4-ETO-200-01	0-200 ppm	0.1 ppm	< 3 s (T90 < 30 s)
		04-DS4-ETO-1000-01	0-1000 ppm	0.1 ppm	< 3 s (T90 < 30 s)
DS4 Smart Digital Germane Gas Sensor	GeH_4	04-DS4-GeH_4-5-01	0-5 ppm	0.001 ppm	< 3 s (T90 < 80 s)
DS4 Smart Digital Hydrogen Gas Sensor	H_2	04-DS4-H_2-1000-01	0-1000 ppm	0.1 ppm	< 3 s (T90 < 30 s)
		04-DS4-H_2-5000-01	0-5000 ppm	0.1 ppm	< 3 s (T90 < 30 s)
		04-DS4-H_2-5%-01	0-5% vol.	0.001% vol.	< 35 s (T90 < 90 s)
DS4 Smart Digital Hydrogen Sulfide Gas Sensor	H_2S	04-DS4-H_2S-10-01	0-10 ppm	0.001 ppm	< 3 s (T90 < 30 s)
		04-DS4-H_2S-100-01	0-100 ppm	0.01 ppm	< 3 s (T90 < 30 s)
		04-DS4-H_2S-1000-01	0-1000 ppm	0.1 ppm	< 3 s (T90 < 30 s)
		04-DS4-H_2S-5000-01	0-5000 ppm	0.1 ppm	< 3 s (T90 < 30 s)
DS4 Smart Digital Formaldehyde Gas Sensor	HCHO	04-DS4-HCHO-5-01	0-5 ppm	0.001 ppm	< 3 s (T90 < 80 s)
		04-DS4-HCHO-100-01	0-100 ppm	0.01 ppm	< 3 s (T90 < 60 s)
DS4 Smart Digital Hydrogen Cyanide Gas Sensor	HCN	04-DS4-HCN-50-01	0-50 ppm	0.01 ppm	< 3 s (T90 < 30 s)
DS4 Smart Digital Ammonia Gas Sensor	NH_3	04-DS4-NH_3-10-01	0-10 ppm	0.001 ppm	< 3 s
		04-DS4-NH_3-100-01	0-100 ppm	0.01 ppm	< 3 s
DS4 Smart Digital Nitrogen Dioxide Gas Sensor	NO_2	04-DS4-NO_2-50-01	0-50 ppm	0.01 ppm	< 3 s (T90 < 30 s)
		04-DS4-NO_2-100-01	0-100 ppm	0.01 ppm	< 3 s (T90 < 30 s)
		04-DS4-NO_2-1000-01	0-1000 ppm	0.01 ppm	< 3 s (T90 < 30 s)
		04-DS4-NO_2-2000-01	0-2000 ppm	0.01 ppm	< 3 s (T90 < 30 s)
DS4 Smart Digital Oxygen Gas Sensor	O_2	04-DS4-O_2-25%-01	0-25% vol.	0.01% vol.	< 3 s (T90 < 30 s)

Product	Formula	Partnumber	Range	Resolution	Response Time
DS4 Smart Digital Ozone Gas Sensor	O_3	04-DS4-O_3-5-01	0-5 ppm	0.001 ppm	< 3 s (T90 < 80 s)
		04-DS4-O_3-50-01	0-50 ppm	0.01 ppm	< 3 s (T90 < 30 s)
		04-DS4-O_3-100-01	0-100 ppm	0.01 ppm	< 3 s (T90 < 30 s)
DS4 Smart Digital Phosphine Gas Sensor	PH_3	04-DS4-PH_3-5-01	0-5 ppm	0.001 ppm	< 3 s (T90 < 80 s)
		04-DS4-PH_3-20-01	0-20 ppm	0.01 ppm	< 3 s (T90 < 80 s)
		04-DS4-PH_3-100-01	0-100 ppm	0.01 ppm	< 3 s (T90 < 80 s)
		04-DS4-PH_3-2000-01	0-2000 ppm	0.1 ppm	< 3 s (T90 < 80 s)
DS4 Smart Digital Silane Gas Sensor	SiH_4	04-DS4-SiH_4-10-01	0-10 ppm	0.001 ppm	< 3 s (T90 < 80 s)
DS4 Smart Digital Odor Gas Sensor	SMELL	04-DS4-SMELL-5-01	0-5 ppm	0.001 ppm	< 3 s (T90 < 30 s)
		04-DS4-SMELL-10-01	0-10 ppm	0.001 ppm	< 3 s (T90 < 30 s)
		04-DS4-SMELL-200-01	0-200 ppm	0.1 ppm	< 3 s (T90 < 30 s)
		04-DS4-SMELL-500-01	0-500 ppm	0.1 ppm	< 3 s (T90 < 30 s)
DS4 Smart Digital Sulfur Dioxide Gas Sensor	SO_2	04-DS4-SO_2-50-01	0-50 ppm	0.01 ppm	< 3 s (T90 < 30 s)
		04-DS4-SO_2-100-01	0-100 ppm	0.01 ppm	< 3 s (T90 < 30 s)
		04-DS4-SO_2-1000-01	0-1000 ppm	0.1 ppm	< 3 s (T90 < 30 s)
		04-DS4-SO_2-2000-01	0-2000 ppm	0.1 ppm	< 3 s (T90 < 30 s)
DS4 Smart Digital Volatile Organic Compounds Gas Sensor	TVOC	04-DS4-TVOC-10-01	0-10 ppm	0.001 ppm	< 3 s (T90 < 30 s)
		04-DS4-TVOC-200-01	0-200 ppm	0.1 ppm	< 3 s (T90 < 30 s)
		04-DS4-TVOC-1000-01	0-1000 ppm	0.1 ppm	< 3 s (T90 < 30 s)
		04-DS4-TVOC-2000-01	0-2000 ppm	0.1 ppm	< 3 s (T90 < 30 s)

Test Calibration Tool

Product	Partnumber
DS Series Single Test Calibration Tool	07-CAL-DS4-01
DS Series 25 Test Calibration Tool	07-CAL-DS4-25-01

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Disclaimer

The above performance data stated by EC Sense is obtained under test conditions using EC Sense gas distribution system and AQ Sense testing software. EC Sense reserves the right to modify design features and specifications for continuous product improvement without prior notice, and we do not assume any legal liability for any losses, injuries or damages from this. EC Sense also bears no responsibility for any indirect losses, injuries, or damages resulting from the use of the information contained in this document or any omissions or errors herein. This document does not constitute a sales offer, the data provided herein is for reference only and should not be considered as a guarantee. The use of the given data must be evaluated and determined by the user to comply with federal, state, and local laws and regulations. All specifications outlined are subject to change without prior notice.

⚠ Warning

EC Sense sensors are designed for various environmental conditions. However, due to the principles and characteristics of solid-state polymer electrochemical sensors, strict adherence to this document and the general application methods for PCB circuit boards is required during storage, assembly, and operation to ensure standard performance. Any damage caused by the non-compliant usage will not be covered by the warranty. While our products are highly reliable, we recommend checking the sensor's reaction to the target gas before use to ensure suitability for on-site use. At the end of the product's service life, please do not dispose of any product components in household waste, but in accordance with local electronic waste recycling regulations.

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