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## 1 Introduction

This application note discusses methods for using IDT's ZSC31010 or ZSC31014 Sensor Signal Conditioner ICs (SSCs) to interface with typical gas sensors for the purpose of compensating the sensor signal and outputting the measurement results. Refer to the data sheets for each product for operation details and specifications for the SSCs.

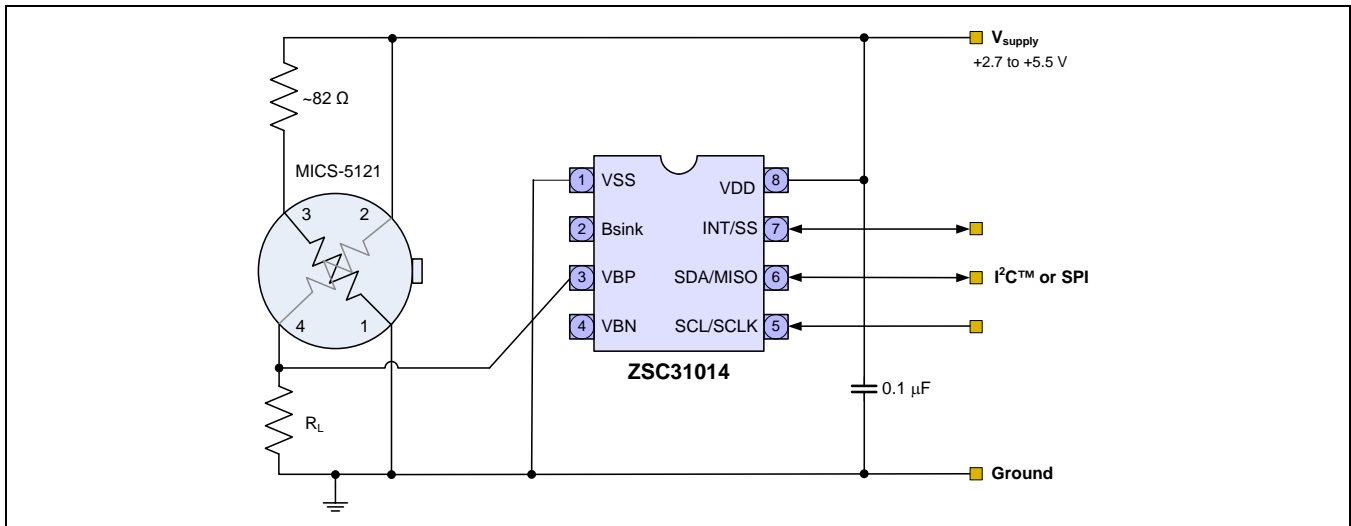
The ZSC31014 is a sensor signal conditioner for highly accurate amplification and analog-to-digital conversion of differential full-bridge and half-bridge input signals. Its operating range is  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . Measured and corrected bridge values are provided at the ZSC31014's digital output pins, which can be configured as I<sup>2</sup>C™\* or SPI. Section 2 describes an application using the ZSC31014 to compensate the sensor signal from a typical gas sensor via a digital interface.

The ZSC31010 is a sensor signal conditioner for highly accurate amplification and analog-to-digital conversion of differential input signals from a full bridge. It features a wider operating range:  $-50^{\circ}\text{C}$  to  $150^{\circ}\text{C}$ . Its output options include rail-to-rail analog output voltage, absolute analog voltage, and digital ZACwire™\* one-wire interface (OWI). Section 3 describes an application using the ZSC31010 to compensate the sensor signal from a typical gas sensor via an analog interface.

## 2 Digital Interface using the ZSC31014

In this application example, the ZSC31014 is used to interface to an SGX SensorTECH®\* gas sensor. The gas sensor consists of a heater and a gas sensor element. The heater current is set through an external  $82\Omega$  resistor, which roughly matches the resistance of the heater resistor. The gas sensor requires a load resistor to ground ( $R_L$ ).  $R_L$  is selected to set the output range of the sensor element. The sensor element changes resistance when exposed to gas and, in combination with  $R_L$ , forms a half bridge.

**Figure 2.1 Gas Sensor Connected to ZSC31014 with Digital Interface**



\* I<sup>2</sup>C™ is a trademark of NXP. SensorTECH® is a trademark of SGX Sensortech, Ltd. ZACwire™, RBic<sub>Lite</sub>™, RBic<sub>Lite</sub>™ and Sig™ are trademarks of IDT.

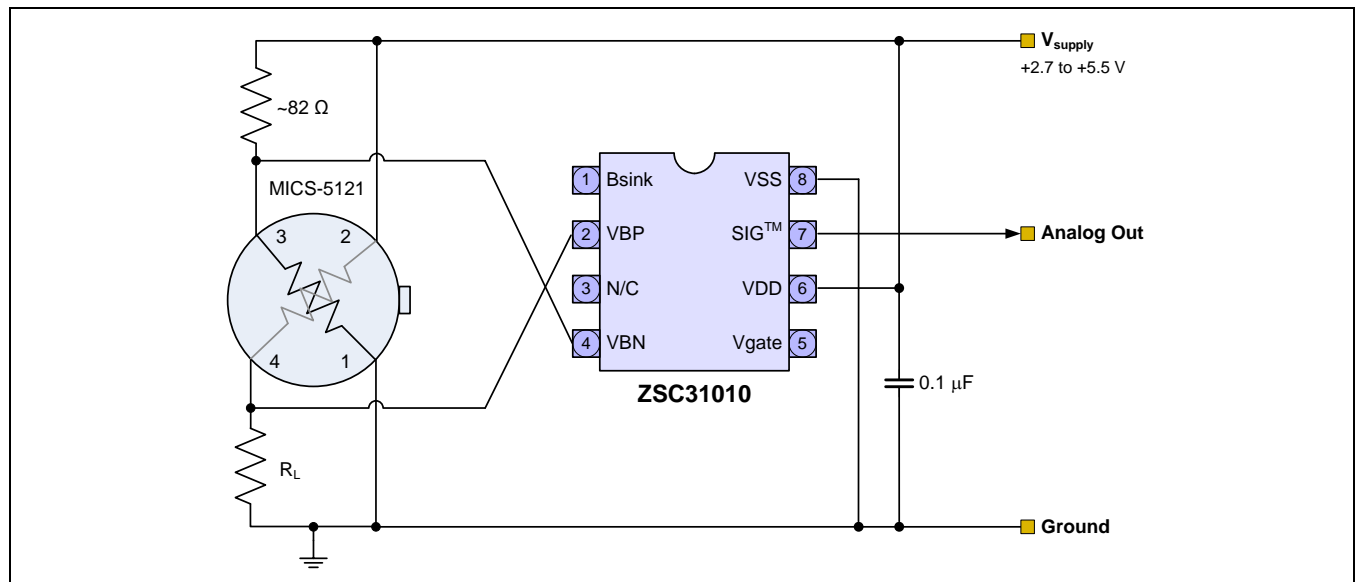
The ZSC31014 has a differential signal path to support full-bridge measurements into the VBP and VBN pins. There is an option that sets VBN to an internal VDD/2 reference and thus supports a half-bridge measurement through VBP. Figure 2.1 shows how the gas sensor interfaces to the VBP pin.

The ZSC31014 has an analog front-end that allows gain adjustment from 1.5 up to 192. A 14-bit ADC converts the signal to the digital domain, and an integrated math engine performs linearization, calibration, and offset correction operations. An onboard temperature sensor can be used to temperature compensate the sensor signal. The digital serial output format is I<sup>2</sup>C™ or SPI.

### 3 Analog Interface

An alternative is to use the ZSC31010 to provide an analog output. This device does not have the option to supply an internal VDD/2 reference; however, the gas sensor already has a ½ supply divider in the heater section. Any variation in the divider voltage over temperature can be compensated via calibration using the on-chip temperature sensor available on the ZSC31010. Figure 3.1 shows the circuit configuration.

**Figure 3.1 Gas Sensor Connected to the ZSC31010 with Analog Output**



If the gas sensor does not have ½ supply divider available, then a two-resistor divider is required. Typical resistor values would be 10KΩ.

The ZSC31010 has an analog front-end that allows gain adjustment from 6 up to 48. A 14-bit ADC converts the signal to the digital domain. An on-board temperature sensor can be used to temperature compensate the sensor signal. The on-chip DSP applies temperature compensation and then the signal is converted back to analog through a DAC converter. A buffer amplifier drives the Sig™\* pin. The Sig™ pin also supports a one-wire interface that allows for digital bidirectional communications with the part during calibration.

## 4 Related Documents

Document
ZSC31010 RBiC <sub>Lite</sub> <sup>TM</sup> Data Sheet
ZSC31014 RBiC <sub>Lite</sub> <sup>TM</sup> Data Sheet

Visit the following ZSC31010 and ZSC31014 product pages on IDT's website [www.IDT.com](http://www.IDT.com) or contact your nearest sales office for the latest version of these documents.

[www.IDT.com/ZSC31010](http://www.IDT.com/ZSC31010)

[www.IDT.com/ZSC31014](http://www.IDT.com/ZSC31014)

## 5 Glossary

Term	Description
ADC	Analog-to-Digital Converter
DAC	Digital-to-Analog Converter
DSP	Digital Signal Processor

## 6 Document Revision History

Revision	Date	Description
1.00	July 9, 2014	First release.
	April 26, 2016	Changed to IDT branding.

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