Brief Description

IDT's ZSSC416x/ZSSC417x is a family of CMOS integrated circuits for highly accurate amplification and sensor-specific correction of differential bridge sensor signals. Featuring a maximum analog pre-amplification in the range of 150 to 200, this product is adjustable to nearly all resistive bridges as well as voltage source sensor types; e.g., thermocouples.

Digital compensation of offset, sensitivity, temperature drift, and nonlinearity is accomplished with a 16-bit RISC microcontroller. Calibration coefficients and configuration data are stored in the ZSSC416x/ ZSSC417x non-volatile memory (NVM), which is reliable in automotive applications.

Measured values can be read via a digital SENT or I²C™* interface. The SENT interface enables transmission of sensor data via its fast channel as well as supplementary data via its "slow" Serial Data Message (SDM) channel using only one output pin. End-of-line calibration is supported via an I²C™ interface or via a One-Wire Interface (OWI) through the data output pin (DOUT). The ZSSC416x/ ZSSC417x and the calibration equipment communicate digitally, so the noise sensitivity is greatly reduced. Digital calibration helps keep assembly cost low as no trimming by external devices or lasers is needed.

The ZSSC416x/ZSSC417x is optimized for automotive environments by overvoltage and reverse polarity protection circuitry, excellent electromagnetic compatibility, and multiple diagnostic features.

Features

- Differential sensor bridge or voltage source inputs
- Internal or external temperature sensors, selectable for conditioning of sensor input signals or temperature output
- Digital compensation of offset, gain, and higher order nonlinearity as well as temperature coefficients of measured sensor input signals
- Operating temperature range: -40°C to 150°C
- Accuracy: ±0.25% FSO @ -40°C to 125°C
- NVM memory for configuration data, user configurable measurement and conditioning function, and user-selected data

* I²C™ is a trademark of NXP.

Benefits

- SENT output option based on SAE J2716 Rev 3.0 standard using fast and SDM data channels
- Supports output of one or more sensor signals and product identification via a single SENT interface connection
- Configurable for nearly all resistive bridge sensors
- One-pass end-of-line calibration algorithm minimizes production costs
- No external trimming or components required
- I²C™ interface option

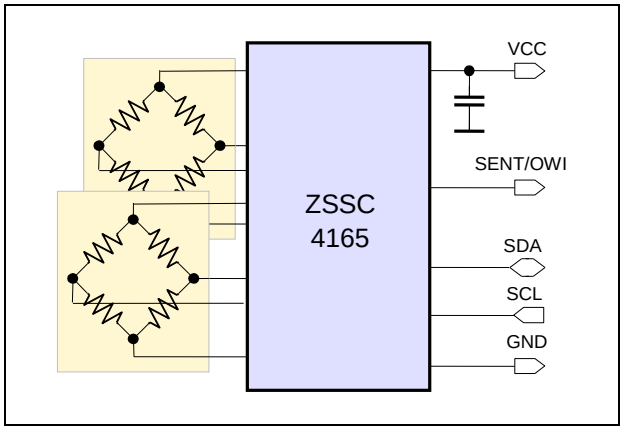
Available Support

- Evaluation Kit
- Application Notes
- Calculation Tools

Physical Characteristics

- Supply voltage: 4.75V to 5.25V
- Protection up to +/-18V
- Input span: 1 to 800 mV/V
- Analog-to-digital (ADC) resolution: configurable from 12 to 16 bit
- Large sensor offset correction using digital zooming with 14 to 18 bit resolution
- Output resolution: 12-bit via SENT interface; up to 15-bit plus a sign bit for OWI or I²C™ interface
- Package: 4x4mm QFN24 or die

Basic Circuit for Dual Bridge Applications



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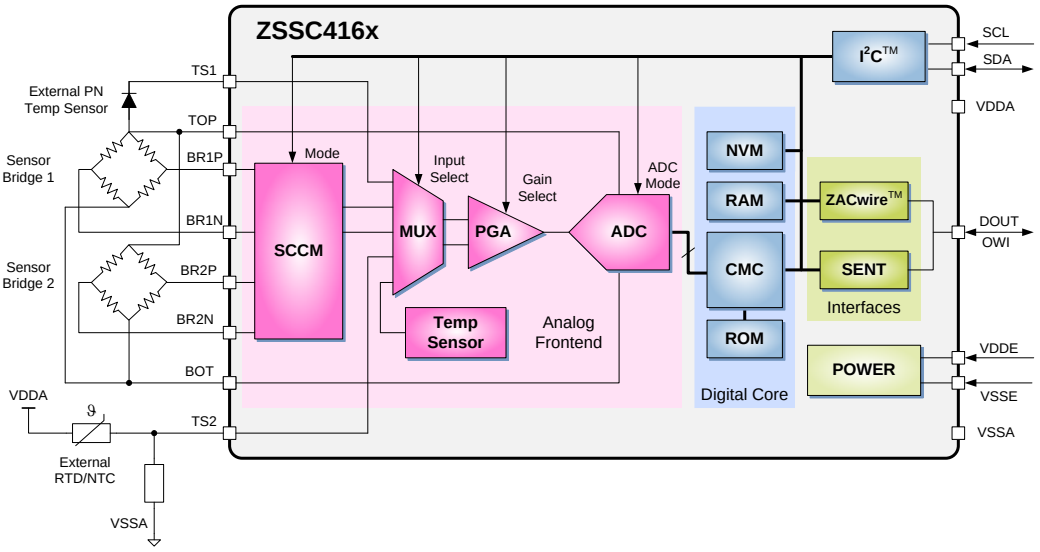
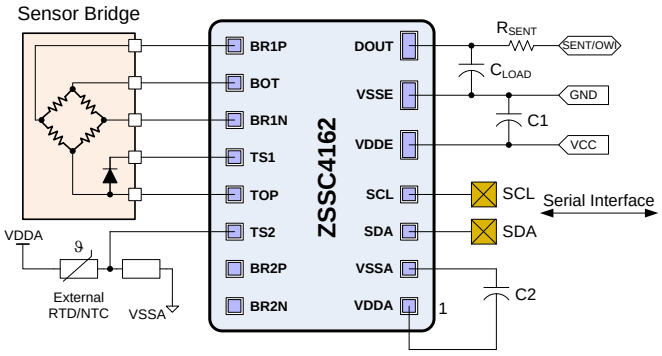
Example Block Diagram: ZSSC416x



SENT Application Example: Pressure and Temperature Sensor

- 5V module powered by the electronic control unit (ECU)
- Sensor module with 3-pin connector provides pressure and media temperature signal within SENT frame
- Media temperature signal derived from external RTD
- Temperature compensation via diode on pressure chip
- End-of-line calibration using the One Wire Interface (OWI) signal on the DOUT pin
- Additional I²C™ interface option

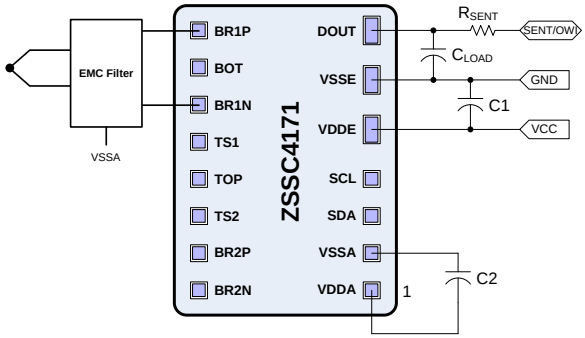
ZSSC4162 Single Full Bridge, External RTD Temp Sensor



SENT Application Example: Thermocouple Measurement

- 5V module with thermocouple interface
- Supports different thermocouple types
- Internal temperature sensor available for cold-junction temperature compensation
- Thermocouple input diagnostic tests
- Reports thermocouple measurement as a single-secure message and reports room temperature measurement through SDM channel on SENT
- End-of-line calibration using the OWI signal on the DOUT pin

ZSSC4171 Thermocouple Sensor



Product Options

BRIDGE SENSOR APPLICATIONS		VOLTAGE SOURCE SENSOR APPLICATIONS (e.g., Thermocouples)	
ZSSC4161	Single full or half bridge; basic internal and/or external temperature measurements; SENT or I²C™ interface; OWI option for calibration	***ZSSC4171***	Single thermocouple interface; supports N-type thermocouples; additional thermocouple types on request; diagnostics for thermocouples; internal temperature sensor for cold-junction temperature compensation; SENT or I²C™ interface; OWI option for calibration
ZSSC4162	Single full or half bridge; extended temperature measurement options (i.e., internal sensor, external diode, and/or RTD; math support for NTC temperature sensors); SENT or I²C™ interface; OWI option for calibration	***ZSSC4175***	Dual thermocouple interface; supports N-type thermocouples; additional thermocouple types on request; diagnostics for thermocouples; internal temperature sensor for cold-junction temperature compensation; SENT or I²C™ interface; OWI option for calibration
ZSSC4165	Dual full or half bridge; extended temperature measurement options; SENT or I²C™ interface; OWI option for calibration		
Typical Applications for ZSSC416x/ZSSC417x: Pressure sensors, strain gauges, thermocouple temperature, NTC/PTC RTD temperature sensors, temperature sensing via the bridge, and more.			

Ordering Information *(Contact IDT for die options)*

Sales Code	Description	Package
ZSSC4161BE2	ZSSC4161 QFN24, single bridge input, SENT or I²C™ output interface, basic internal and/or external temperature measurement, operating temperature: -40 to 150°C	Add R for 13" reel or W for 7" reel
ZSSC4162BE2	ZSSC4162 QFN24, single bridge input, SENT or I²C™ output interface, extended temperature measurement options, operating temperature: -40 to 150°C	Add R for 13" reel or W for 7" reel
ZSSC4165BE2	ZSSC4165 QFN24, dual bridge input, SENT or I²C™ output interface, extended temperature measurement options, operating temperature: -40 to 150°C	Add R for 13" reel or W for 7" reel
ZSSC4171BE2	ZSSC4171 QFN24, single voltage source sensor input, SENT or I²C™ output interface, internal temperature measurement, support for N-type thermocouples, operating temperature: -40 to 150°C	Add R for 13" reel or W for 7" reel
ZSSC4175BE2	ZSSC4175 QFN24, dual voltage source sensor inputs, SENT or I²C™ output interface, internal temperature measurement, support for N-type thermocouples, operating temperature: -40 to 150°C	Add R for 13" reel or W for 7" reel
ZSSC416xKITV1.4	ZSSC416x SSC Evaluation Kit: Communication Board, SSC Board, Sensor Replacement Board, 5 samples. Software is available through your IDT sales representative or field applications engineer with an IDT Non-Disclosure Agreement (NDA).	
ZSSC417xKITV1.4	ZSSC417x SSC Evaluation Kit: Communication Board, SSC Board, Sensor Replacement Board, 5 samples. Software is available through your IDT sales representative or field applications engineer with an IDT Non-Disclosure Agreement (NDA).	

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Document Revision History

Revision	Date	Description
1.00.00	March 23, 2015	First release.
1.00.01	May 28, 2015	Correction for description for part ZSSC4169BE2 in order information table.
1.00.02	August 2, 2015	Revision for description of extended temperature feature and typical applications list in the “Product Options” table on page 4. Update for ZSSC416x/7x Evaluation Kit order code.
1.11.00	September 21, 2015	Update to remove ZSSC4169 and ZSSC4179. Addition of ZSSC4175. Edits to “Product Options” table and descriptions in “Order Information” table. Minor edits for clarity.
1.11.01	April 18, 2016	Update to remove reference in part code table to T package option, which is not available. Update for kit order codes.
	April 24, 2016	Changed to IDT branding.