ENVIRONMENTAL SENSOR AND SENSOR IC SOLUTIONS

Sensing solutions for a connected world
Sensing Technologies and Sensor Solutions

With more than 20 years of industry experience, Renesas is an expert in providing sensor technologies that enable our customers to design and build best-in-class sensor solutions. As we expand the breadth of our sensor technologies, Renesas will create unique and differentiated sensor solutions.
Breadth of Experience

- Bringing decades of knowledge, know-how and data from our technologies today into our solutions of the future

Trusted, Reliable Partner

- A proven supplier who has shipped millions of parts into major consumer and automotive manufacturers

Best-in-Class Performance

- Featuring low-power, high-accuracy solutions meeting ISO 26262, Automotive EMC, and reliability requirements
GAS SENSOR OVERVIEW

ZMOD4410 METAL OXIDE GAS SENSOR FOR INDOOR AIR QUALITY

FEATURES

■ Environmentally compensated heater driver control
■ Dual output - detects wide range of TVOC from ppb to ppm concentrations and provides eCO₂ reading
■ I²C interface: up to 400kHz
■ Firmware configurable architecture
■ Configurable alarm/interrupt output

BENEFITS

■ Proven MOx material with 15+ years of reliability data
■ Each sensor module is electrically and chemically tested and calibrated
■ Renesas offers downloadable source files and compiled code, enabling a product road map of indoor air measurement innovation
■ Only sensor provider to utilize third-party validation of IAQ rating to help assess levels of clean air and recommend actions

Renesas’ ZMOD4410 gas sensor platform provides best-in-class stability and sensitivity and is designed to identify trace gases in various locations within indoor environments. These air quality sensors feature a miniature package, integrated ASIC, and MEMS sensing element that is comprised of a controlled heater and proven metal oxide (MOx) material. Constant temperature operation or a very precisely regulated variation of the heater temperature allows the detection of a wide range of indoor air contaminants by accurately measuring the sensor conductivity and resistance.

This flexibility makes the sensors in the ZMOD4410 platform capable of providing a variety of measurement options by varying the method of operation or changing the firmware used to interpret the resistance measurements. Downloadable libraries and source code provided by Renesas make upgrades straightforward to implement. All sensors are electrically and chemically (gas) tested with calibration data stored in the built-in nonvolatile memory (NVM).

The ZMOD4410 platform focuses on detection, control and rating of Indoor Air Quality (IAQ). The indoor air quality rating is based on TVOC concentrations defined by the German Environment Agency (UBA) as the main source for unpleasant air in an indoor environment. By detecting TVOC and rating the IAQ, the ZMOD4410 helps systems address clean air in the ambient environment. Additional downloadable algorithms are available to estimate levels of CO₂ and control ventilation systems.
**ZMOD4410 GAS SENSOR PRODUCT DETAILS**

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**RECOMMENDED APPLICATIONS**

- Monitor home, office and personal environment for healthy conditions and comfort
- Smart appliances that control or monitor indoor air quality
- Automation based on indoor ambient air quality

**PRODUCT SUPPORT**

- Evaluation kits
- Manuals, videos, application notes and programming examples
- Third-party certification for compliance with standard defined by the German Environment Agency (UBA)
- Engineering support for sensor implementation

**PHYSICAL CHARACTERISTICS**

- Normal Operation mode Power consumption <14 mW in continuous operation, <1mW in low power mode
- −40°C to +65°C operating temperature range
- 1.7 to 3.6 V supply voltage
- 3.0 x 3.0 x 0.7 mm 12-LGA package

The ZMOD4410 uses the German Environment Agency (UBA) study as a basis to define clean air. Sensors are calibrated to this definition to ensure customer satisfaction.

### Indoor Air Quality Ratings

<table>
<thead>
<tr>
<th>Renesas IAQ Rating</th>
<th>Reference Level*</th>
<th>Air Information</th>
<th>TVOC (mg/m³)</th>
<th>Air Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 1.99</td>
<td>Level 1</td>
<td>Clean Hygienic Air (Target Value)</td>
<td>&lt; 0.3</td>
<td>Very Good</td>
</tr>
<tr>
<td>2.00 - 2.99</td>
<td>Level 2</td>
<td>Good Air Quality (if no threshold is exceeded)</td>
<td>0.3 - 1.0</td>
<td>Good</td>
</tr>
<tr>
<td>3.00 - 3.99</td>
<td>Level 3</td>
<td>Noticeable Comfort Concerns (Not recommended for exposure &gt; 12 months)</td>
<td>1.0 - 3.0</td>
<td>Medium</td>
</tr>
<tr>
<td>4.00 - 4.99</td>
<td>Level 4</td>
<td>Significant Comfort Issues (Not recommended for exposure &gt; 1 months)</td>
<td>3.0 - 10.0</td>
<td>Poor</td>
</tr>
<tr>
<td>≥ 5.00</td>
<td>Level 5</td>
<td>Unacceptable conditions (Not recommended)</td>
<td>&gt; 10.0</td>
<td>Bad</td>
</tr>
</tbody>
</table>

* Based on a study by the German Environment Agency (UBA).

### IAQ Firmware Application

<table>
<thead>
<tr>
<th>IAQ Firmware</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZMOD4410-1st Generation</td>
<td>UBA &amp; CO2 (Not Recommended for New Designs)</td>
</tr>
<tr>
<td>ZMOD4410-LP</td>
<td>Low power battery</td>
</tr>
<tr>
<td>ZMOD4410-0Odors</td>
<td>Fan control</td>
</tr>
<tr>
<td>ZMOD4410-Sulfur Discrimination</td>
<td>Bathroom odors</td>
</tr>
<tr>
<td>ZMOD4410-2nd generation</td>
<td>UBA &amp; CO2</td>
</tr>
</tbody>
</table>

To request samples, download documentation or learn more, visit: [renesas.com/ZMOD4410](renesas.com/ZMOD4410)
**GAS SENSOR OVERVIEW**

**ZMOD4510 GAS SENSOR FOR OUTDOOR AIR QUALITY**

**FEATURES**
- Reliable detection of outdoor air quality
- Correlates with the Air Quality Index (AQI) by the US Environmental Protection Agency (EPA)
- Software upgradeable
- Proven MOx material with more than 15 years of reliability data
- Electrical and gas calibrated
- Miniature footprint (3 x 3 x 0.7 mm)
- Digital (I²C) output
- Siloxane resistant

**BENEFITS**
- First digital gas sensor module for outdoor air quality to detect ppb levels of nitrogen oxides and ozone
- High sensitivity and long term stability allows <20 ppb detection limits
- Smallest sensor in the market enables reduced end product size
- Allows improved energy efficiency without compromising air quality
- Enables rapid customer integration with easy to use precompiled software
- Pre-calibrated sensors save in production costs

Renesas’ ZMOD4510 gas sensor platform is a software-upgradeable digital Outdoor Air Quality (OAQ) sensor module that provides high sensitivity and reliability for detecting total nitrogen oxides (NOx) and ozone (O₃) gases, two significant causes of unhealthy outdoor air quality. Because of its outstanding combination of flexibility and small size, it is ideal for a wide variety of industrial and consumer applications.

The ZMOD4510 is based on proven metal oxide (MOx) material and each sensor is calibrated electrically with gas to ensure consistency from lot to lot, an important advantage for manufacturers with long production runs. ZMOD4510 devices are also highly resistant to siloxanes for superior reliability use in harsh applications.

Implementation of the ZMOD4510 will enable an accurate and local measurement of outdoor air quality, which can be used to provide end users with health-protection information as well as automate smart buildings for improved air quality and energy efficiency. The ZMOD4510 outdoor air quality sensor can also be combined with the ZMOD4410 Indoor Air Quality (IAQ) sensor to provide a complete understanding of air quality.

The ZMOD4510 platform focuses on detection, control, and rating of the OAQ. The OAQ rating is based on the US Environmental Protection Agency (EPA) standards. By detecting ozone and NOx, the ZMOD4510 helps systems address unhealthy air in outdoor environments.
ZMOD4510 GAS SENSOR PRODUCT DETAILS

RECOMMENDED APPLICATIONS

■ Home & building automation systems, including HVAC systems
■ Smart fans and damper applications
■ City air monitoring stations
■ Personal monitors

PRODUCT SUPPORT

■ Evaluation kits
■ Manuals, videos and application notes
■ Firmware and programming examples
■ Application engineering support for easy sensor implementation

PHYSICAL CHARACTERISTICS

■ Power consumption <21 mW in continuous operation
■ −40°C to +65°C operating temperature range
■ 1.7 to 3.6V supply voltage
■ 3.0 x 3.0 x 0.7 mm 12-LGA package

OUTDOOR GASES VARY WITH LOCATION

Unhealthy outdoor air comes from automobiles and factories, which can also make its way inside buildings.

The ZMOD4510 OAQ sensors detect parts per billion (ppb) levels of nitrogen oxides and ozone gases and are calibrated to report the EPA’s AQI (for combined O3 and NOx). By measuring both of these gases together and reporting concentrations relative to this EPA standard, these sensors provide vital information that helps users take control of their health and environment.

OUTDOOR AIR QUALITY RATINGS

<table>
<thead>
<tr>
<th>ZMOD4510 Output of AQI Index</th>
<th>Air Quality Index (AQI)</th>
<th>Level of Concern and Air Quality Condition</th>
<th>NOx Concentration [ppb]</th>
<th>O3 Concentration [ppb]</th>
<th>Color Code</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 to 50</td>
<td>Good</td>
<td>0 to 53</td>
<td>0 to 62</td>
<td>Green</td>
</tr>
<tr>
<td></td>
<td>51 to 100</td>
<td>Moderate</td>
<td>54 to 100</td>
<td>63 to 124</td>
<td>Yellow</td>
</tr>
<tr>
<td></td>
<td>101 to 150</td>
<td>Unhealthy for Sensitive Groups</td>
<td>101 to 360</td>
<td>125 to 164</td>
<td>Orange</td>
</tr>
<tr>
<td></td>
<td>151 to 200</td>
<td>Unhealthy</td>
<td>361 to 649</td>
<td>165 to 204</td>
<td>Red</td>
</tr>
<tr>
<td></td>
<td>201 to 300</td>
<td>Very unhealthy</td>
<td>650 to 1249</td>
<td>205 to 404</td>
<td>Purple</td>
</tr>
<tr>
<td></td>
<td>301 to 500</td>
<td>Hazardous</td>
<td>1250 to 2050</td>
<td>405 to 604</td>
<td>Maroon</td>
</tr>
</tbody>
</table>

*Based on Environmental Protection Agency’s (EPA) Air Quality Index (AQI)

To request samples, download documentation or learn more, visit: renesas.com/ZMOD4510
HIGH-PERFORMANCE GAS SENSOR FAMILY

Leveraging more than 10 years of development and use, Renesas’ gas sensors are reliable and proven.

Renesas offers innovative, high-performance gas sensors ideal for industrial leak detection and air quality applications. Our industry-leading sensors are based upon a highly reliable ceramic substrate, coupled with advanced nanostructured materials tailored for individual applications.

The SGAS family of gas sensors are capable of accurately detecting a range of gases, including hydrogen, flammable gases (methane, propane, natural gas) and volatile organic compounds (includes TVOC, alcohols, aldehydes, ketones and more).

FEATUES AND BENEFITS

- Reliable gas detection
- High sensitivity to a wide range of gases
- Long lifetime:
  - SGAS707: 3 to 5 years
  - SGAS701/SGAS711: 5+ years
- Minimal response to relative humidity (RH)
- Over a decade of gas sensing experience
- Reduced frequency of calibrations
- Reduced maintenance and overall system
- TVOC < 1 to 1000 ppm (SGAS707)

TYPICAL APPLICATIONS

<table>
<thead>
<tr>
<th>Building/Industrial Air Quality</th>
<th>Leak Detection</th>
<th>Process Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Measure VOC in offices, light industrial settings, schools and hospitals</td>
<td>PPM range leak measurement of hydrogen, methane, propane, LPG, natural gas and other flammable gases</td>
<td>Measure hydrogen leaks to test seals and product integrity</td>
</tr>
<tr>
<td>• Measure efficacy of filtration/purification systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Control ventilation systems based on real-time air quality</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

GAS SENSOR OVERVIEW
SGAS SENSORS PRODUCT DETAILS

To request samples, download documentation or learn more, visit: renesas.com/gas

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Sensor Function</th>
<th>Package Code</th>
<th>Package Type</th>
<th>Temperature Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>SGAS701</td>
<td>Hydrogen</td>
<td></td>
<td>T04</td>
<td>–20 to +50°C</td>
</tr>
<tr>
<td>SGAS707</td>
<td>Industrial Organic Chemical</td>
<td></td>
<td>T0-39</td>
<td>0 to +40°C</td>
</tr>
<tr>
<td>SGAS711</td>
<td>Flammable Gas</td>
<td></td>
<td></td>
<td>–20 to +50°C</td>
</tr>
</tbody>
</table>

SGAS701 Gases Detected
Hydrogen

SGAS707 Gases Detected
VOC (Volatile Organic Compounds)
TvOC (Total Volatile Organic Compounds)
Alcohols – ethanol, isopropanol
Ketones – methyl ethyl ketone (MEK)
Aldehydes – formaldehyde
Aromatics – toluene, xylene
1 to 1000 ppm

SGAS711 Gases Detected
Hydrogen
Methane
Propane
LPG
Natural Gas
Freons
10 to 1000 ppm

SGAS711 Response

To request samples, download documentation or learn more, visit: renesas.com/gas
FLOW SENSORS OVERVIEW

HIGH-PERFORMANCE MEMS FLOW SENSOR MODULE FAMILY

Our mass flow sensors are ideal for use in the industrial process, healthcare and medical, and automotive markets.

FEATURES AND BENEFITS

- Gas or liquid flow
- MEMS thermopile sensing
- Silicon-carbide coating over MEMS flow sensor
- Robust solid isolation technology
- No cavity in MEMS element to cause clogging
- Resistant to vibration and pressure shock
- High accuracy
- High sensitivity
- Food-grade compatible version
- Easy cleaning and sterilization
- 3 to 5 V DC supply, (5V for FS2012)

Renesas mass flow sensor modules measure gas or liquid flow across a sensing surface using the thermo-transfer (calorimetric) principle. The flow sensor utilizes a series of MEMS thermocouples which provides excellent signal-to-noise ratio. The solid thermal isolation of the active MEMS sensing element along with the silicon-carbide film coating offers excellent abrasive wear resistance and long-term reliability.

Renesas offers an uncalibrated millivolt output version (FS1012), uncalibrated with amplification circuit (FS102x) and fully-calibrated and linearized (FS2012) modules for either gas or liquid with typical accuracy down to 2% of reading.

Typical Applications

<table>
<thead>
<tr>
<th>Industrial Process</th>
<th>Healthcare and Medical</th>
<th>Automotive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process controls and monitoring</td>
<td>Medical infusion pumps</td>
<td>Mass air flow module</td>
</tr>
<tr>
<td>Oil and gas leak detection</td>
<td>CPAP and respiratory devices</td>
<td>Diesel fuel flow</td>
</tr>
<tr>
<td>HVAC and air-control systems</td>
<td>Breathalyzer</td>
<td>Brake fluid flow</td>
</tr>
<tr>
<td>Liquid dispensing and metering systems</td>
<td>Oxygen concentrators</td>
<td>Cabin air quality control</td>
</tr>
</tbody>
</table>
FLOW SENSORS PRODUCT DETAILS

<table>
<thead>
<tr>
<th></th>
<th>FS1012 (Millivolt Output)</th>
<th>FS102x (Uncalibrated, Amplified Output)</th>
<th>FS2012 (Fully-Calibrated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage</td>
<td>3 to 5 V DC (Heater)</td>
<td>5V DC</td>
<td>5V DC</td>
</tr>
<tr>
<td>Gas Flow Range</td>
<td>0 to 2 Liter/Min (FS1012-1020-NG)</td>
<td>—</td>
<td>0 to 2 Liter/Min (FS2012-1020-NG)</td>
</tr>
<tr>
<td></td>
<td>0 to 10 Liter/Min (FS1012-1100-NG)</td>
<td>—</td>
<td>0 to 10 Liter/Min (FS2012-1100-NG)</td>
</tr>
<tr>
<td>Liquid Flow Range</td>
<td>0 to 0.5 Liter/Min (FS1012-1001-LQ)</td>
<td>0 to 3 Liter/Min (FS1023)</td>
<td>0 to 0.5 Liter/Min (FS2012-1001-LQ)</td>
</tr>
<tr>
<td></td>
<td>0 to 1 Liter/Min (FS1012-1002-LQ)</td>
<td>0 to 7 Liter/Min (FS1025)</td>
<td>0 to 1 Liter/Min (FS2012-1002-LQ)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 to 10 Liter/Min (FS1027)</td>
<td></td>
</tr>
<tr>
<td>Flow Accuracy</td>
<td>—</td>
<td>—</td>
<td>±2% (Typical)</td>
</tr>
<tr>
<td>Output</td>
<td>Analog (millivolts)</td>
<td>Analog (0 to 5 V DC)</td>
<td>Digital I2C and Analog (0 to 5 V DC)</td>
</tr>
<tr>
<td>Current Consumption</td>
<td>10mA at 3V DC (Heater Current)</td>
<td>11mA</td>
<td>30mA at 5V DC</td>
</tr>
<tr>
<td>Module Size</td>
<td>53.35 × 24.0 mm, 6-pin header</td>
<td>25 × 58 mm, 6-pin connector</td>
<td>53.35 × 24.0 mm, 6-pin header</td>
</tr>
</tbody>
</table>

**Figure 1:** FS1012 Single-Ended Application Circuit Diagram

**Figure 2:** FS1012 Differential Application Circuit Diagram

To request samples, download documentation or learn more, visit: renesas.com/flow
HUMIDITY SENSORS OVERVIEW

RELATIVE HUMIDITY SENSOR FAMILY

Relative humidity sensors provide industry-leading accuracy and response times to improve system performance.

FEATURES

- Silicon carbide structure
- ±1.5%RH accuracy (HS3001)
- Fast RH response time (typical 4 seconds)
- 0.1%RH per year drift
- 14-bit resolution: 0.01%RH (typical)
- Low power consumption: 1.0µA average
- Digital/Analog output
- Extended supply voltage: 1.8 to 5.5 V

Renesas’ humidity sensors offer high accuracy with the fastest measurement response time of comparable devices currently on the market.

The HS300x family of relative humidity sensors feature a ±1.5% RH accuracy and four-second response time (rated 20% to 80% RH range in still air and does not require airflow). Since humidity sensors consume the most power when they are taking a measurement, the fast response time to a stable measurement reduces the amount of sampling needed.

This is especially important for battery-powered applications where lower power consumption equates to longer battery life. In addition to high-accuracy and fast response times, the HS300x family features excellent long term stability of 0.1% RH per year as a result of a robust silicon carbide construction and an innovative design. This improves useful lifetime and lowers effective cost.

Typical Applications

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement of water vapor content in medical oxygen</td>
<td></td>
</tr>
<tr>
<td>Humidity measurement in home appliances</td>
<td></td>
</tr>
<tr>
<td>Monitor humidity in the air in industrial processes, climate control systems (HVAC), weather stations and portable personal health devices</td>
<td></td>
</tr>
</tbody>
</table>
HUMIDITY SENSORS PRODUCT DETAILS

BENEFITS

- Integrated temperature and humidity sensing solution
- Small form factor solution with lower system cost
- Low power consumption saves battery
- 14-bit high resolution provides extremely tight accuracy
- Insensitive to environmental contaminants like dirt and dust
- Small solution size saves space and BOM for compact designs
- On-board calibration reduces time to market
- Wide supply voltage range eliminates the need for LDO/DC-DC
- Fast RH response time (typical 4 seconds)

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Relative Humidity Accuracy Typ (±%RH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS3001</td>
<td>1.5</td>
</tr>
<tr>
<td>HS3002</td>
<td>1.8</td>
</tr>
<tr>
<td>HS3003</td>
<td>2.5</td>
</tr>
<tr>
<td>HS3004</td>
<td>3.5</td>
</tr>
</tbody>
</table>

High Relative Humidity Accuracy and Long Term Stability You Can Depend On

To request samples, download documentation or learn more, visit: renesas.com/humidity
IPS2200 INDUCTIVE POSITION SENSORS

FEATURES

- Industrial qualified, with stable operation in harsh environments and -40° to 125° C ambient temperatures
- Interface: Sin/cos single ended or differential
- Voltage Supply: 3.3V ±10% or 5.0V ±10%
- Rotational Speed: Up to 250,000 rpm (electrical)
- Propagation delay: Programmable, <10μs
- Sin/cos gain mismatch and offset compensation on chip
- Overvoltage, reverse polarity, short-circuit protected
- Digital programming interface: I2C or SPI

BENEFITS

- Flexible design around the motor, on-axis and off-axis capabilities
- Supports higher speed
- Better accuracy
- Cost effective
- Stray field immunity
- No tight mechanical tolerances needed
- Lower weight, smaller size

APPLICATIONS

The IPS2200 is ideal for motor commutation applications, such as:
- Robots
- Industrial Equipment
- Medical Devices
- Small E-vehicles
- Power Tools
- Automatic Machines

Renesas’ magnet-free IPS2200 inductive position sensor features high accuracy and speed, total stray field immunity, and efficient motor integration in a thin and lightweight form factor. The IPS2200 is ideal for use as an absolute position sensor in a wide range of industrial, medical, and robot applications. The sensor allows engineers to cost effectively tailor sensor design for their applications and maximize the performance of the sensor’s mechanical accuracy.

The IPS2200 is designed around the motor, allowing customers to match the number of sectors to pole pairs of the motor to maximize accuracy, accommodating both off-axis (through shaft and side shaft) and on-axis positioning. The magnet-free IPS2200 is up to 10x thinner and up to 100x lighter compared with traditional resolvers. The sensor’s thin and light form factor and total stray field immunity enables easier motor integration and provides the standard materials required for customers to manufacture their own resolvers – reducing bill of materials costs. Four-wire operation provides up to 250krpm electrical rotational speeds and very low latency compared with resolver- or magnetic based solutions.
RENESAS INDUCTIVE POSITION SENSORS

The flexibility of the IPS2200 inductive position sensor technology allows engineers to design the sensor around the motor. It is capable of supporting both off-shaft and any number of pole pairs.

**IPS2200 Products**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPS2200BI1R</td>
<td>High-Speed Inductive Position Sensor with Sine/Cosine Output for Motor Commutation</td>
</tr>
<tr>
<td>IPS2200BI1W</td>
<td>High-Speed Inductive Position Sensor with Sine/Cosine Output for Motor Commutation</td>
</tr>
<tr>
<td>IPS2200STKIT</td>
<td>Evaluation Kit for IPS2200 Position Sensor</td>
</tr>
</tbody>
</table>

For more details, please visit [renesas.com/position](renesas.com/position)
Designing sensor interfaces can be quite challenging and time consuming, and producing them in volume is often expensive due to long test cycles on costly production test equipment. Renesas Sensor Signal Conditioner (SSC) ICs facilitate both design and production of sensor interfaces by providing programmable, highly accurate, wide gain and quantization functions combined with powerful, high-order digital correction and linearization algorithms.

Renesas is a trusted partner in the sensing market with more than twenty years of experience developing leading-edge core technologies for sensor signal conditioning devices.

Renesas’ SSC ICs are all-in-one, energy efficient products that are easy-to-use and are supported by advanced software and expert technical support staff.

Our portfolio offers a broad range of resistive and capacitive SSC ICs. Renesas’ highly accurate single-pass calibration operation enables the design of cost-effective, accurate sensing systems.

For more information about sensor signal conditioners, visit: renesas.com/ssc
### Single-Bridge Automotive Sensor Signal Conditioners

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>Supply Voltage (V)</th>
<th>Interface Options / Programming Interface</th>
<th>Adjustable Analog Gain Values</th>
<th>ADC Resolution (Bit)</th>
<th>Sample Rate (kHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZSC31150</td>
<td>Fast Automotive Sensor Signal Conditioner</td>
<td>4.5 to 5.5</td>
<td>Ratiometric Voltage / ZACwire, I2C</td>
<td>3 to 420</td>
<td>13 to 16</td>
<td>7.8</td>
</tr>
<tr>
<td>ZSSC3131</td>
<td>Sensor Signal Conditioner for Cost-Optimized Switch Applications</td>
<td>4.5 to 5.5</td>
<td>Ratiometric Voltage / ZACwire, I2C</td>
<td>3 to 105</td>
<td>13 to 14</td>
<td>0.2</td>
</tr>
<tr>
<td>ZSSC3135</td>
<td>Sensor Signal Conditioner for Piezoresistive Bridge Sensors</td>
<td>4.5 to 5.5</td>
<td>Ratiometric Voltage / ZACwire, I2C</td>
<td>3 to 105</td>
<td>13 to 14</td>
<td>0.2</td>
</tr>
<tr>
<td>ZSC3136</td>
<td>Sensor Signal Conditioner for Safety Switch Applications</td>
<td>4.5 to 5.5</td>
<td>Ratiometric Voltage / ZACwire, I2C</td>
<td>3 to 105</td>
<td>13 to 14</td>
<td>0.2</td>
</tr>
<tr>
<td>ZSSC3138</td>
<td>Sensor Signal Conditioner for Ceramic Sensor Applications</td>
<td>4.5 to 5.5</td>
<td>Ratiometric Voltage / ZACwire, I2C</td>
<td>3 to 420</td>
<td>13 to 16</td>
<td>7.8</td>
</tr>
<tr>
<td>ZSSC3154</td>
<td>Automotive Sensor Signal Conditioner with Dual Analog Output</td>
<td>4.5 to 5.5</td>
<td>Ratiometric Voltage, Dual Analog Output / ZACwire, I2C</td>
<td>3 to 420</td>
<td>14</td>
<td>1</td>
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<tr>
<td>ZSSC3170</td>
<td>Automotive Sensor Signal Conditioner with LIN and PWM Interface</td>
<td>7 to 18</td>
<td>LIN and PWM</td>
<td>3 to 420</td>
<td>13 to 14</td>
<td>0.43</td>
</tr>
<tr>
<td>ZSSC4151</td>
<td>Automotive Sensor Signal Conditioner with Analog Output</td>
<td>4.5 to 5.5</td>
<td>Ratiometric Voltage, Switch Output / ZACwire</td>
<td>2 to 200</td>
<td>14 to 18</td>
<td>2.4</td>
</tr>
<tr>
<td>ZSSC4161</td>
<td>Automotive Sensor Signal Conditioner with Single-Bridge Input, SENT Output, supporting ASIL-B</td>
<td>4.5 to 5.5</td>
<td>SENT / I2C</td>
<td>2 to 200</td>
<td>14 to 18</td>
<td>1.2</td>
</tr>
<tr>
<td>ZSSC4169</td>
<td>Automotive Sensor Signal Conditioner with SENT Output, supporting ASIL-C</td>
<td>4.5 to 5.5</td>
<td>SENT / I2C</td>
<td>2 to 200</td>
<td>14</td>
<td>1.56</td>
</tr>
<tr>
<td>ZSSC4175</td>
<td>Automotive Sensor Signal Conditioner for Dual Voltage Source Sensor Inputs (e.g. Thermocouples) with SENT Output</td>
<td>4.5 to 5.5</td>
<td>SENT / I2C</td>
<td>Fixed</td>
<td>14</td>
<td>0.5</td>
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</tbody>
</table>

### Single-Bridge Industrial Sensor Signal Conditioners

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Type</th>
<th>Voltage</th>
<th>Output</th>
<th>ADC</th>
<th>Package</th>
<th>Typical Application/Features</th>
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<tbody>
<tr>
<td>ZSC31010</td>
<td>Resistive</td>
<td>2.7 to 30 V</td>
<td>Analog/Digital</td>
<td>14 bit</td>
<td>SOIC, Wafer</td>
<td>Industrial/Analog Sensors</td>
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<td>ZSC31014</td>
<td>Resistive</td>
<td>2.7 to 5.5 V</td>
<td>Digital</td>
<td>14 bit</td>
<td>SOIC, Wafer</td>
<td>Industrial/I2C Sensors</td>
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<tr>
<td>ZSC31015</td>
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<td>2.7 to 30 V</td>
<td>Analog/Digital</td>
<td>14 bit</td>
<td>SOIC, Wafer</td>
<td>Industrial/Analog Sensors</td>
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<tr>
<td>ZSC31050</td>
<td>Resistive</td>
<td>2.7 to 40 V</td>
<td>Analog/Digital</td>
<td>15 bit</td>
<td>SSP, Wafer</td>
<td>Industrial/Current Loop</td>
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<tr>
<td>ZSSC3026</td>
<td>Resistive</td>
<td>1.8 to 3.6 V</td>
<td>Digital</td>
<td>16 bit</td>
<td>Wafer</td>
<td>Consumer, White Goods</td>
</tr>
<tr>
<td>ZSSC3036</td>
<td>Resistive</td>
<td>1.8 to 3.6 V</td>
<td>Digital</td>
<td>16 bit</td>
<td>Wafer</td>
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</tr>
<tr>
<td>ZSSC3027</td>
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<td>1.7 to 3.6 V</td>
<td>Digital</td>
<td>16 bit</td>
<td>Wafer</td>
<td>Stacked Die Assemblies</td>
</tr>
<tr>
<td>ZSSC3018</td>
<td>Resistive</td>
<td>1.68 to 3.6 V</td>
<td>Digital</td>
<td>18 bit</td>
<td>QFPN, Wafer</td>
<td>Industrial/White Goods</td>
</tr>
<tr>
<td>ZSSC3218</td>
<td>Resistive</td>
<td>1.68 to 3.6 V</td>
<td>Digital</td>
<td>18 bit</td>
<td>QFPN, Wafer</td>
<td>Industrial/White Goods</td>
</tr>
<tr>
<td>ZSSC3224</td>
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<td>Digital</td>
<td>24 bit</td>
<td>QFPN, Wafer</td>
<td>Industrial/Consumer</td>
</tr>
<tr>
<td>ZSSC3240</td>
<td>Resistive</td>
<td>2.7 to 48 V</td>
<td>Analog/Digital</td>
<td>24 bit</td>
<td>QFPN, Wafer</td>
<td>Industrial/Current Loop</td>
</tr>
<tr>
<td>ZSSC3123</td>
<td>Capacitive</td>
<td>2.3 to 5.5 V</td>
<td>Digital, PDM</td>
<td>14 bit</td>
<td>TSSOP, Wafer</td>
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<tr>
<td>ZSSC3230</td>
<td>Capacitive</td>
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<td>Digital, PDM</td>
<td>18 bit</td>
<td>PQFN, Wafer</td>
<td>Industrial/Consumer</td>
</tr>
</tbody>
</table>
Renesas’ ZWIR4512 connectivity module provides critical and secure 6LoWPAN wireless connectivity to link devices to the Internet of Things (IoT). These modules run application firmware on the integrated ARM Cortex M3 processor. The network API is optimized for ease of use and allows communication with a few lines of code. External components are easily integrated through digital and analog interfaces.

**APPLICATIONS**

- Smart home devices – Use network-connected products to control household devices such as lighting, automatic window blinds, bathroom exhaust fans, garagedoors, and home security systems
- Factory automation monitoring – Detect aging and failure of motors and fans, remote air quality monitoring, activate alarms and lighting in an emergency, staff presence, keep out zone and secure area detection, energy conservation
- Smart city lighting – City LED lamps, emergency alert or signaling, pedestrian danger keep out zone, reduction of light pollution
- Environmental sensing – Air quality monitoring, weather forecast, fire detection, leaks and flood detection

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