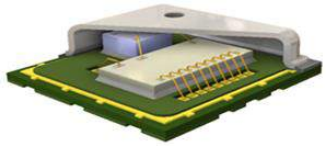
SENSORS SYSTEMS FOR BETTER LIVING

RENESAS ELECTRONICS CORPORATION

RELEASED ENVIRONMENTAL & BIO SENSING SOLUTIONS

Application	Sensor	Description
Air Quality	ZMOD4410	Application Specific Firmware • TVOC & eCO2 (estimated) • Odor Sensing • Sulfur Odor Sensing • Ultra Low Power
	ZMOD4510	Application Specific Firmware • EPA • Ultra Low Power: Selective Ozone
	ZMOD4450	Firmware Refrigerator Air Quality
	HS300X	Humidity RH accuracy: +/- 1.5%, …+/- 3.5% RH
	HS400X HS410X	Humidity & Temperature Analog / Digital, Lowest power. +/- 1.5%, …+/- 3.5% RH
Flow	FS1012/FS2012/ FS102x	Solid state MEMS Flow sensor Analog / Digital
Bio	OB1203	Heart rate, SPO2 & RR
TOF	ISL29501	Time of Flight (ToF) IC Processor

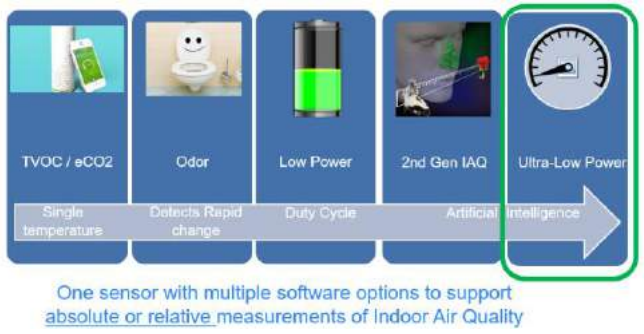
ZMOD4410 – AIR QUALITY SENSORS



MOX Based Gas Sensor for AIR Quality Measurements - TVOC & eCO2

Features	Benefits	Applications
Application Specific Firmware • TVOC & eCO2 UBA Calibrated • Odor Sensing • Sulfur Odor Sensing • Ultra Low Power • Proven 16+ year history in Mox • Siloxane resistant • Miniature size: LGA & IP67 waterproof • JEDEC qualification – JESD47 • Electrical and Gas calibrated	• One device & many sensors • Reliable and accurate sensors • Accepted definition of clean air • Part to part consistency • Integration into small foot prints • Battery operation mode • Low cost indication of CO2 • Waterproof packages • Known 3rd party quality qualification • No additional Calibration required	• HVAC systems • Air purifiers • Wireless Access Points • Smoke Detectors • Smart Thermostats • Appliances • IoT & IAQ monitors • Industrial building controls • Smart toilets

FW (AI based) Configurable Gas Sensor



One sensor with multiple software options to support absolute or relative measurements of Indoor Air Quality

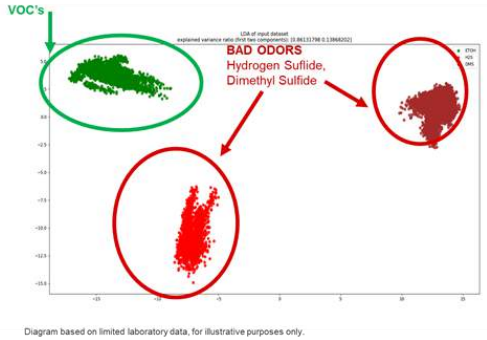
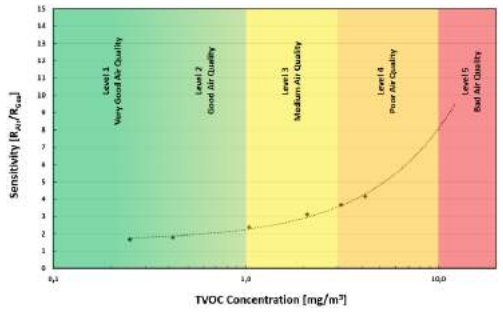
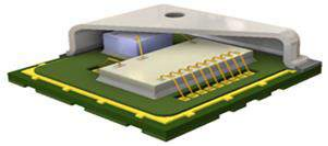


Diagram based on limited laboratory data, for illustrative purposes only.



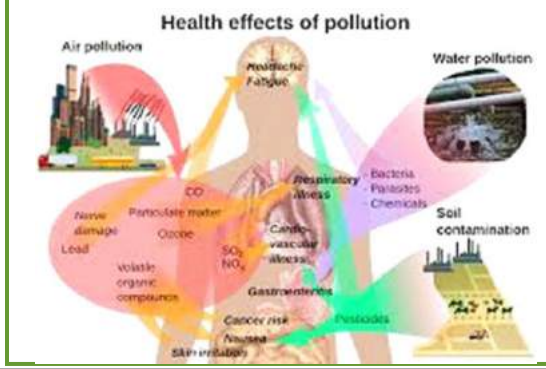
ZMOD4510 – OZONE & NITROGEN DIOXIDE AIR QUALITY SENSORS



MOX Based Gas Sensor – Outdoor Air Quality

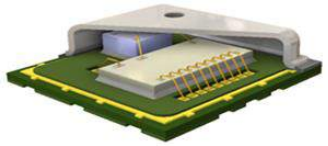
Features	Benefits	Applications
• Waterproof package • Reliable Detection of Outdoor Air Quality: O3 & NOx / Selective O3 • Correlates with US Environmental Protection Agency (EPA) Air Quality Index (AQI) • Proven MOx Material, JEDEC JESD47 qualified • Electrical and Gas calibrated • Miniature 3 x 3 x 0.9mm • Digital (I^2C) output • Siloxane resistant	• IP67 rated package • Leading high sensitivity and long term stability allows 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	• Wearables • Home & Building automation systems, including HVAC systems • Smart fans and damper applications • City air monitoring stations • Personal monitors • Indoor appliances • Weather stations

Reporting Calibrated EPA Definition



Air Quality Index (AQI) Values	Levels of Health Concern	Colors
When the AQI is in this range:	*..air quality conditions are:*	*...as symbolized by this color:*
0 to 50	Good	Green
51 to 100	Moderate	Yellow
101 to 150	Unhealthy for Sensitive Groups	Orange
151 to 200	Unhealthy	Red
201 to 300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon

ZMOD4450 – REFRIGERATOR AIR QUALITY SENSORS

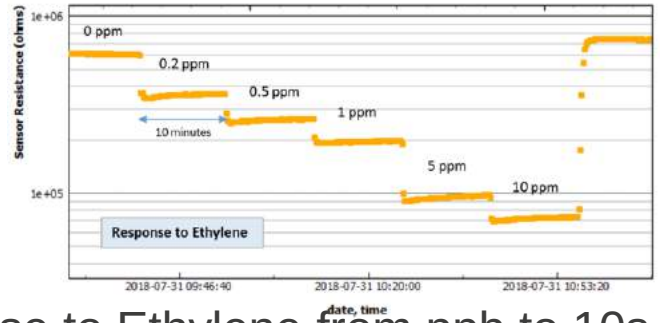


MOX Based Gas Sensor – Supports smart refrigeration systems

Features	Benefits	Applications

• Targeted refrigerator gasses:
  • VSC: Volatile Sulfur gasses
  • Ethylene
• Proven 16+ year history in MOx production
• Siloxane resistant
• Miniature size: LGA & IP67 waterproof
• JEDEC qualification – JESD47
• Electrical and Gas calibrated
	• Detects Fruit ripening
	• Part to part consistency
	• Integration into small foot prints
	• Waterproof packages
	• Trusted qualification ensuring 10 year life
	• No additional Calibration required
		• Smart refrigerators
		• Shipping containers
		• Freezer systems
		• Food storage trucking systems
		• Commercial refrigeration

Targeting Food Spoilage and Odors



Response to Ethylene from ppb to 10s of ppm

HS3XXX RELATIVE HUMIDITY & TEMPERATURE SENSOR

High Accuracy Relative Humidity & Temperature Sensor

Features

- ±1.5% relative humidity accuracy (HS3001)
- Fast RH response time (Typical 3-6 seconds)
- 14-bit resolution, 0.01% RH (Typical)
- Low power consumption, 1.0µA average (one RH + T measurement per second)
- Temperature sensor accuracy of ±0.2ºC (HS3001, HS3002)
- Extended supply voltage, 1.8 to 5.5 V

Benefits

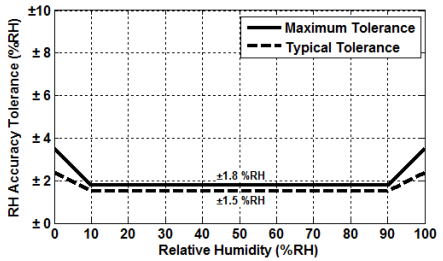
- Silicon carbide capacitive sensing element
- Excellent stability against aging
- Highly robust protection from harsh environmental conditions and mechanical shock
- Very low power consumption
- Digital I²C output

Applications

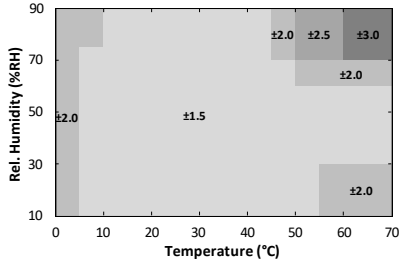
- Climate control systems
- Home appliance
- Weather stations
- Industrial automation
- Process controls and monitoring
- Automotive climate control
- Medical equipment

High RH Accuracy and Long Term Stability You Can Depend On

HS3001 Accuracy at 25 ° C



HS3001 Accuracy over Temperature



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HS4XXX RELATIVE HUMIDITY & TEMPERATURE SENSOR

Lowest Power with High Accuracy

Features

- ±1.5% Relative Humidity Accuracy (HS4001, HS4101)
- Fast RH response time (Typical 3 seconds)
- 14-bit resolution, 0.01%RH (Typical)
- Low power consumption, 0.62µA average (one RH + T measurement per second, 14-bit)
- Standby current: 25nA
- Temperature sensor accuracy of ±0.2ºC (HS4001/2, HS4101/2)
- Digital and Analog Output
- Hydrophobic membrane
- Supply voltage, 1.71V to 3.6V
- 2.5 × 2.5 ×0.9 mm, 8-LGA

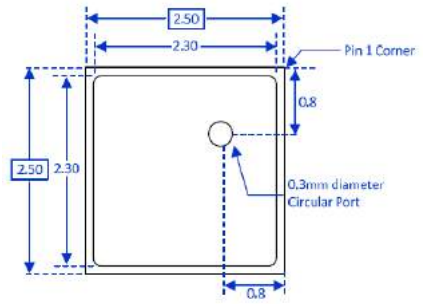
Benefits

- Silicon-carbide capacitive sensing element
- Excellent stability against aging
- Highly robust protection from harsh environmental conditions and mechanical shock
- Very low power consumption
- Digital I²C Output (HS400x)
- Analog Output (HS410x)
- Automotive Qualified, -40ºC to +125ºC

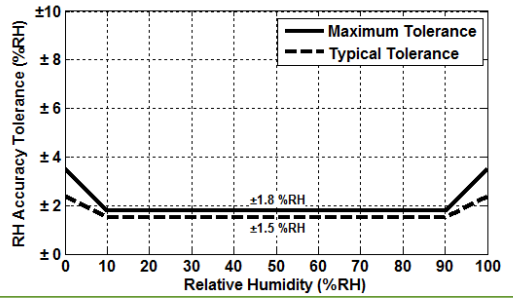
Applications

- Climate control systems
- Home appliance
- Weather stations
- Industrial automation
- Process controls and monitoring
- Automotive climate control
- Medical equipment

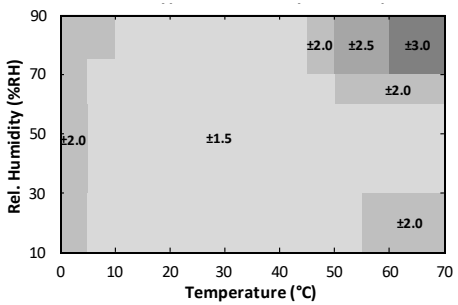
High RH Accuracy and Long-Term Stability You can Depend On



HS4001 Accuracy at 25 ° C



HS4001 Accuracy over Temperature



OB1203 BIO SENSOR

Fully customizable HR, SP02, RR algorithm included

Features

- Fully Integrated Sensor Module
- Algorithm included
- *Clinical Grade Accuracy*
    - **Bio sensing**
        - Heart Rate,
        - SP02 (Blood Oxygen)
        - **RR (Breathing Rate)**
- Smallest from factor 4.2x2x1.2mm

Benefits

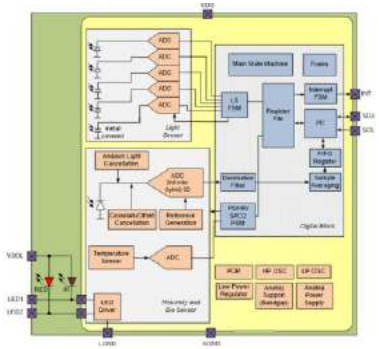
- All measurements in a single component
- No external components required
- Fully **factory calibrated**
- Direct skin contact
- Very thin form factor
- **Reflective measurement**
    - **Only one side of the finger needs to touch**
    - **Works with fingernail polish**

Applications

Fitness, Wellness, Medical

- **Digital Health / e-Doctor**
- **PuleOx Meters**
    - Mobile or tabletop Pulse Oximetry
- **Smart Rings**
- Fitness Trackers
- Personal Hygiene
- Handheld mobile gateways
- Athletic garments
- Elderly care
- NOT ideal for Wrist Applications

OB1203 Optical Bio Sensing Module



Fully calibrated
Fully integrated

- LEDs & LED Drivers
- Photo Detector
- Optimized optical perf.

Implantable
Pet & Animal Care

- Low power
- Smallest

Smart Personal Hygiene

Smart Ring

- Fully integrated solution

E-Health Gateway

- Fully integrated solution

MEMS MASS FLOW SENSOR MODULE

Solid-State MEMS Flow Sensor Module for Liquids and Gases

Features

- MEMS thermopile sensing
- Silicon-carbide coating over MEMS flow sensor
- Low power, 3 to 5 V supply
- Digital and analog output (FS2012)
- High accuracy (FS2012), 2% of reading (typical)
- Flexible product versions:
  - mV sensor voltage output, FS1012
  - Amplified voltage output, FS102x
  - Fully calibrated flow for air or liquid, FS2012, FS102x-DG

Benefits

- Gas or liquid flow
- Robust solid isolation technology
- No cavity in MEMS element to cause overpressure damage
- Resistant to vibration and pressure shock
- Food-grade compatible version
- Fast response time
- High sensitivity

Applications

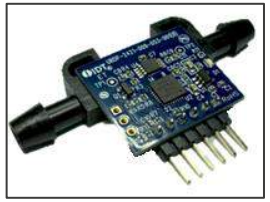
- Process controls and monitoring
- Oil and gas leak detection
- HVAC and air control systems
- CPAP and respiratory devices
- Breathalyzer
- Automotive MAF
- Air speed and wind meter
- Liquid dispensing/metering systems
- Medical infusion pumps

Flexible Flow Sensor Solutions with Easy-to-Use Evaluation Software

FS1012 (mV Output)

FS102x (Amplified Voltage Output)

FS2012 (Calibrated)



FloDemo Software (FS2012)

ISL29501 ToF SIGNAL PROCESSING IC

ToF-Based Long-Range Proximity and Distance Sensing

Features

- On-chip digital signal processor calculates the time of flight based upon phase delay between emitted and received signals (indirect ToF).
- Built-in current DAC circuit that drives LED or laser.
- On-chip active ambient light rejection
- I2C interface for configuration and control.
- Continuous and single shot modes.
- Auto gain control mechanism.
- Emitter DAC current up to 255mA.

Benefits

- Enables low cost, low power, and long-range optical distance sensing when combined with an external emitter and detector.
- Optimize performance, power and distance measurements.
- Wavelength agnostic.
- Fast response time.
- High sensitivity.
- Non-contact measurements.
- Choice of optical components based upon application requirements.

Applications

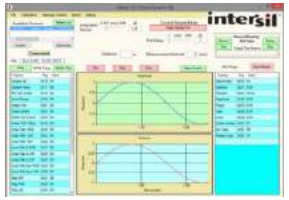
- Precise short to long range optical distance measurements - ranging devices, trailer cargo sensors, grain silo sensors.
- Obstacle detection and avoidance sensors - drones and robots.
- Human sensing - smart homes, offices, buildings, doors, gates, people counting, security, automated POS systems.
- Factory automation sensors - high speed conveyor belt object counting.

ISL29501 ToF Evaluation Kits and Software

ISL29501-CS-EVKIT1Z Cat Shark

ISL29501-ST-EV1Z Sand Tiger

ISL29501 Evaluation Software



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