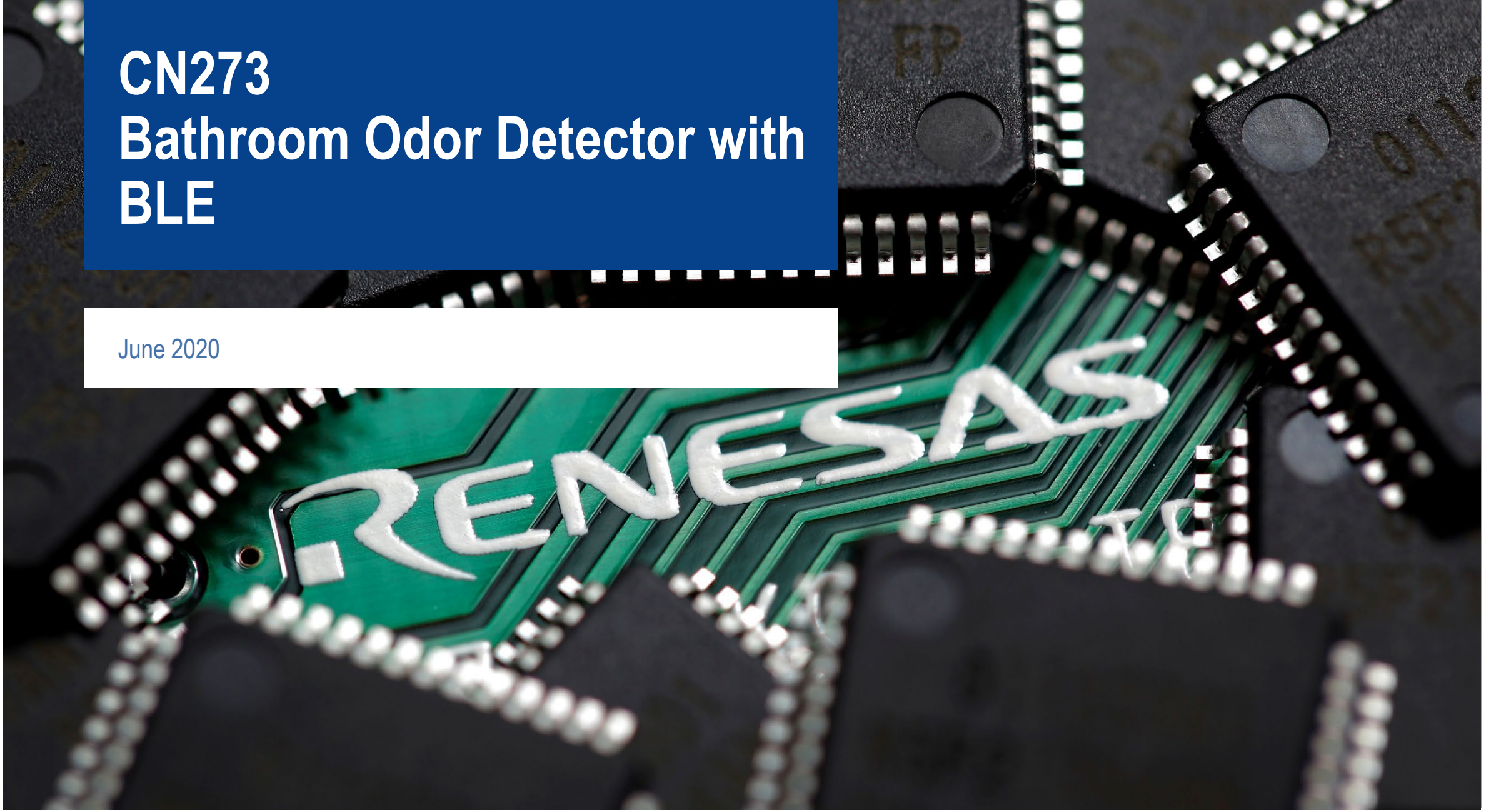
CN273
Bathroom Odor Detector with BLE



June 2020

Bathroom Odor Detector with BLE

Overview

The combination of Renesas' ZMOD4410 indoor air quality sensor, HS3003 temperature and humidity sensor, and RA4W1 microcontroller (MCU) enables users to detect gases in the bathroom. Odor levels, temperature, and humidity values can be monitored through a handy device with Bluetooth® 5.0 Low Energy (BLE) communication. The RX23W or RA4W1 is a 32-bit MCU with Bluetooth® 5.0 Low Energy and is very suitable for IoT endpoint devices. All the power on the sensor board is provided by the ISL9001A high performance LDO and Li-ion battery. The ISL9301 is a high input voltage charger with a power path management charger for single-cell Li-ion/Polymer batteries.

System Benefits

- Renesas MCU with Bluetooth® 5.0 Low Energy controls the system and wireless communication
- High performance and high input voltage charger with low input voltage/high PSRR LDO
- The ZMOD4410 gas sensor module is a software configurable platform used for indoor air quality applications

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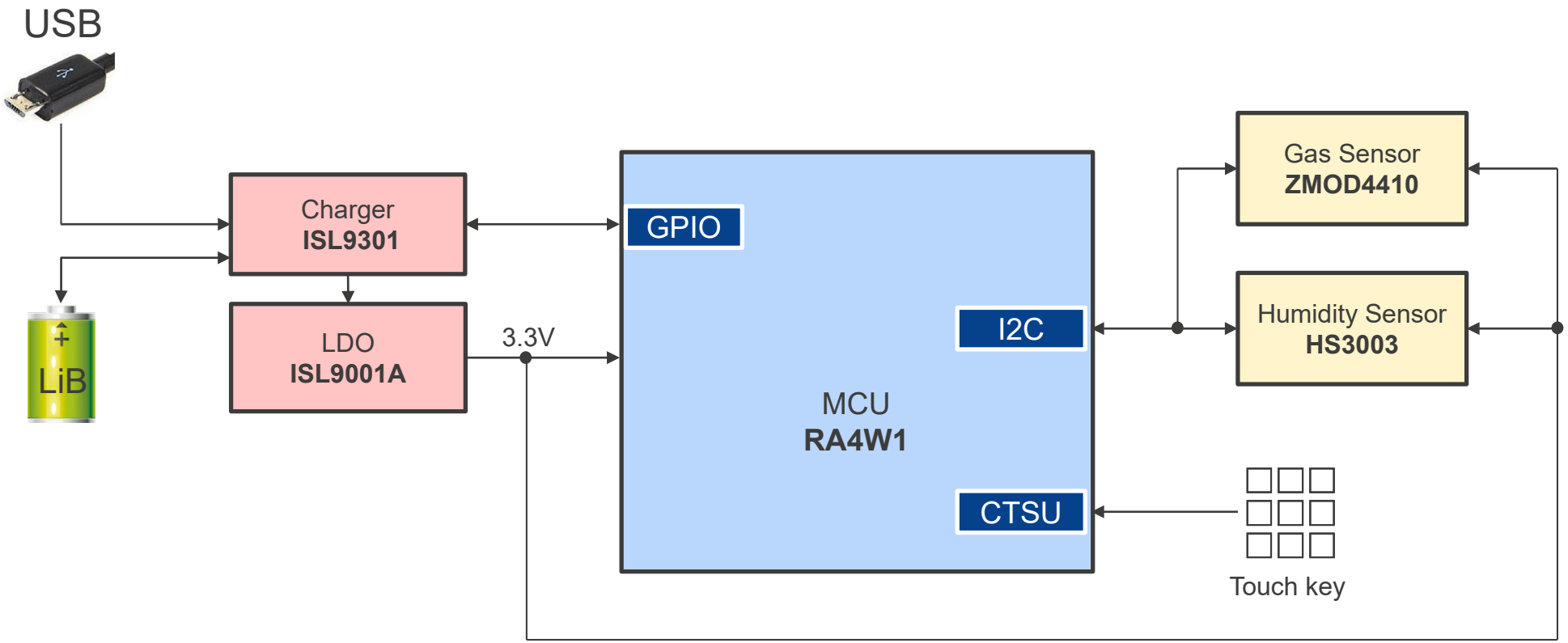

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MCU / MPU Analog Power

Bathroom Odor Detector with BLE

Device Category	P/N	Key Features
MCU	RA4W1 R7FA4W1AD2CNG	Bluetooth Low Energy 5.0 application controller with Arm® Cortex®-M4 core at 48 MHz MCUs with small 56 pin QFN packages, 512 KB flash memory and 96 KB SRAM, including segment LCD controller, capacitive touch sensing, USB Full-Speed, 14-bit A/D converter and security features.
Power	ISL9301	Fully integrated high input voltage single-cell Li-ion battery charger with power path management function
	ISL9001A	300mA output current and output voltage can be programmed from 0.8V to 5.5V. (TJ= -40°C to +125°C).
Analog	ZMOD4410	Leading high sensitivity and long term stability, Enables customer to release product families via SW changes , International accepted definition of Indoor Air Quality (IAQ), Calculation of estimated Carbon Dioxide (eCO2)
	HS3003	Highly-accurate, fully-calibrated relative humidity and temperature sensor

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RA4W1 – 48-MHz Arm® Cortex®-M4 Core for BLE 5.0

Bluetooth® 5.0 Low Energy Single Chip MCU for IoT Applications

High Performance

- 48MHz 32-bit Arm® Cortex®-M4 core with FPU
- 512KB Flash,96KB SRAM and 8KB Data Flash

Full Functionality of Bluetooth 5.0 Low Energy

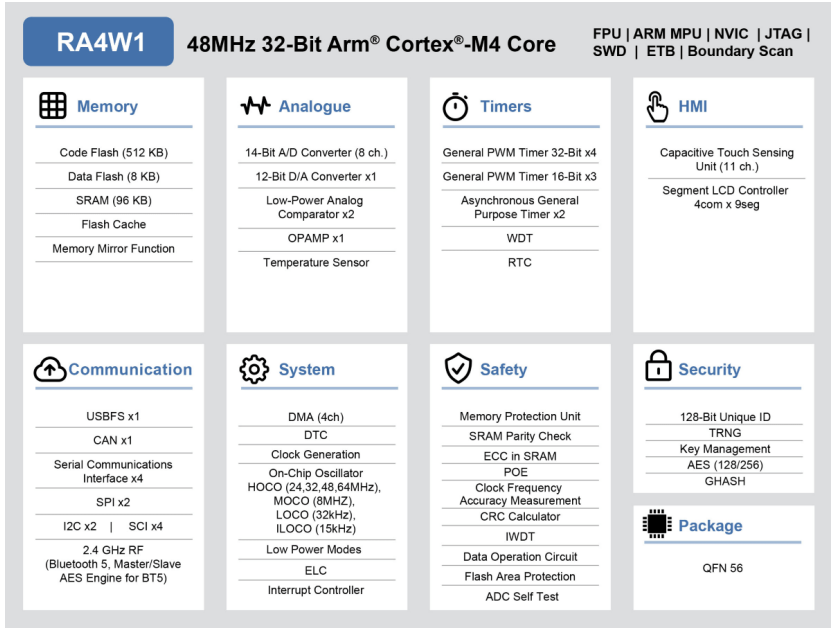
- 2.4 GHz radio with Bluetooth 5.0 Low Energy
- LE 1M, 2M, Coded PHY, and LE advertising extension
- Secure Crypto Engine (AES128 / 256, GHASH, TRNG)

Highly Integrated Capabilities

- 14-Bit ADC (8 ch.)
- 12-Bit DAC (1 ch.) and temperature sensor
- Low power analog comparator(2 ch), OPAMP x 1
- USB 2.0(Full Speed)/CAN/SCI x 4/SPI x 2 /IIC x 2
- GPT 32-bit(4 ch)/GPT 16-bit(3 ch)/AGT 16-bit(2 ch)/WDT/RTC

HMI Interface and Small Package

- Capacitive Touch Sensing Unit (11 ch.)
- Segment LCD Controller - up to 9 segments x 4 commons
- 7x7mm QFN 56 pin package



RA4M2 Block Diagram

Part #	Flash Memory	RAM	Temp	Package
R7FA4W1AD2CNG	512KB	96KB	40～85℃	56 QFN

EK-RA4W1

ISL9301- Charger for Single-cell Li-ion/Polymer Batteries

High Input Voltage Charger With Power Path Management

Fully Integrated with Power Path Management

- Complete Charger for Single-Cell Li-ion/Polymer Batteries
- Integrated Disconnect Switch to Disconnect the Battery
- Power Path Management Optimize Charge and System Currents

High Performance

- 1% Charger Output Voltage Accuracy
- 28V Maximum Voltage at VIN pin

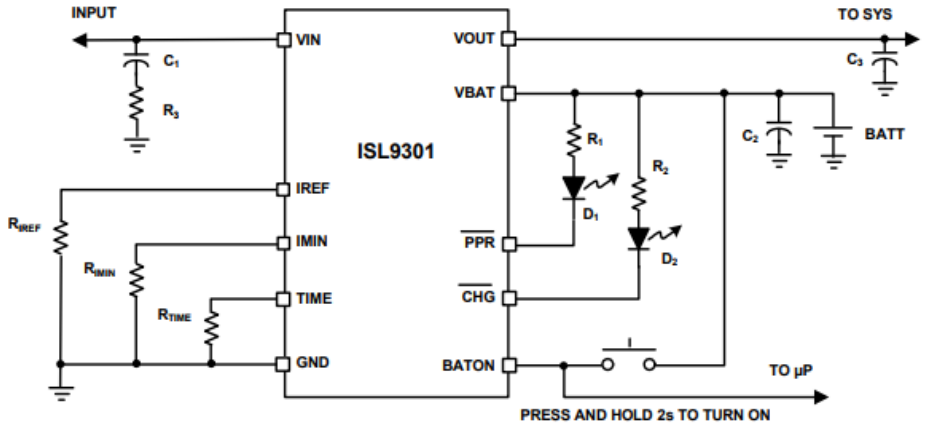
Programmable /Easy Control

- Programmable Charge Current & End-of-Charge Current
- Power Presence and Charge Indications

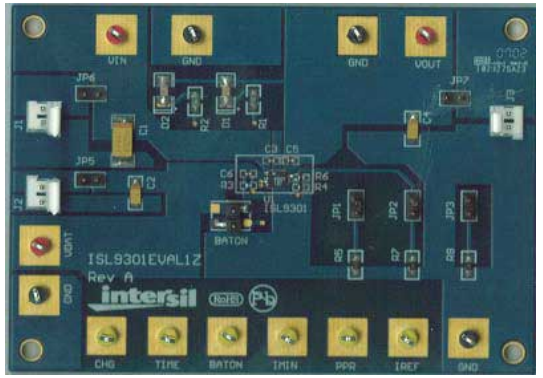
Safety & Battery Protection

- Charge Current Thermal Foldback for Thermal Protection
- Trickle Charge for Fully Discharged Batteries
- Intelligent Timeout Interval Based on Actual Charge Current

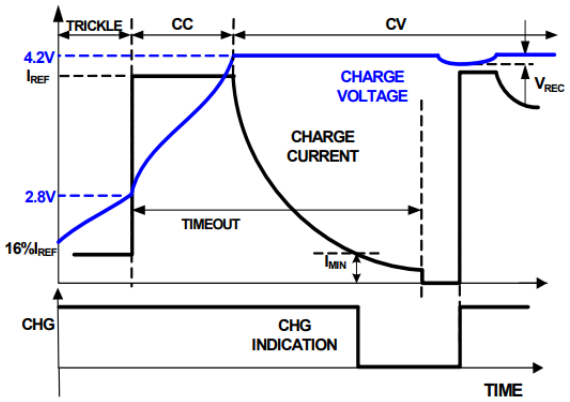
Part #	Temp Range (°C)	Package
ISL9301IRZ	-40 to +85	10 Ld 3x3 DFN
ISL9301IRZ-T	-40 to +85	10 Ld 3x3 DFN



Typical Application Circuit



ISL9301EVAL1Z: evaluation tool for single-cell Li-ion battery



Typical Charger Cycle

ISL9001A – V_{OUT} 1.5V to 3.3V/300mA LDO

LDO with Low I_{SUPPLY} and High PSSR

High Performance

- Excellent load regulation: <0.1% voltage change across full range of load current
- High PSRR: 90dB @ 1kHz

Stable Output Voltage

- ±1.8% V_{OUT} accuracy over all operating conditions
- Stable with 1µF to 10µF ceramic capacitor

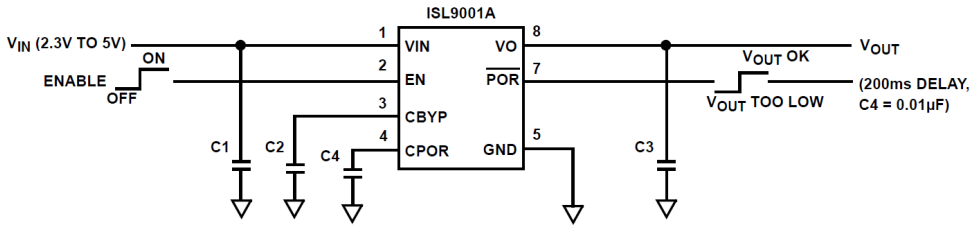
High Efficiency

- Extremely low quiescent current: 25µA
- Low dropout voltage: typically 200mV @ 300mA

Excellent Safety

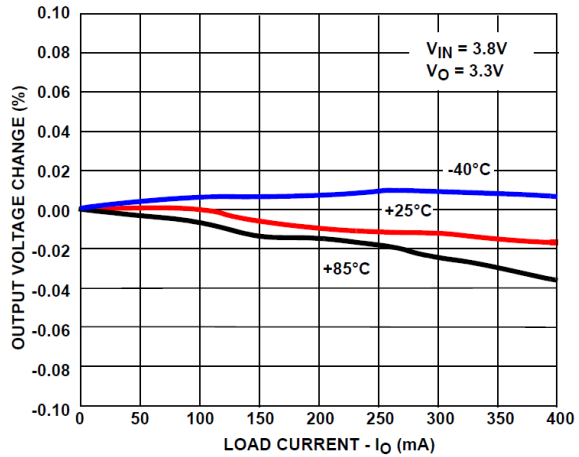
- Current limit and overheat protection

Part #	Vout (V)	Temp.(℃)	Package
ISL9001AIRBZ-T	1.5	-40 to +85	8Ld 2x3 DFN
ISL9001AIRCZ-T	1.8	-40 to +85	8Ld 2x3 DFN
ISL9001AIRFZ-T	2.5	-40 to +85	8Ld 2x3 DFN
ISL9001AIRJZ-T	2.8	-40 to +85	8Ld 2x3 DFN
ISL9001AIRKZ-T	2.85	-40 to +85	8Ld 2x3 DFN
ISL9001AIRNZ-T	3.3	-40 to +85	8Ld 2x3 DFN



C1, C3: 1µF X5R CERAMIC CAPACITOR
C2: 0.1µF X7R CERAMIC CAPACITOR
C4: 0.01µF X7R CERAMIC CAPACITOR

Typical Application Circuit



Output Voltage Change vs Load Current

ZMOD4410 – Indoor Air Quality Sensor Platform

TVOC Sensor for Indoor Air Quality Application

Flexible Measure Target

- Measurement of total organic compounds (TVOC)
- Concentrations and indoor air quality (IAQ)
- Module algorithm estimates carbon dioxide level (eCO2)
- Algorithm to set a control signal to trigger an external action based on IAQ and odor change
- Configurable alarm/interrupt output with static and adaptive Levels

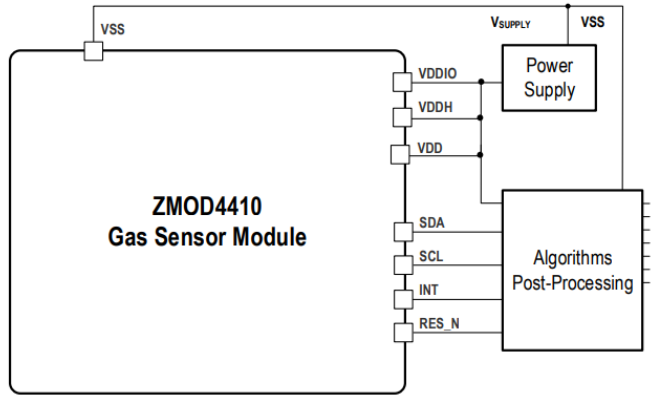
Low Power

- Very low average power consumption down to 1mW
- Excellent for low-voltage and low-power battery applications

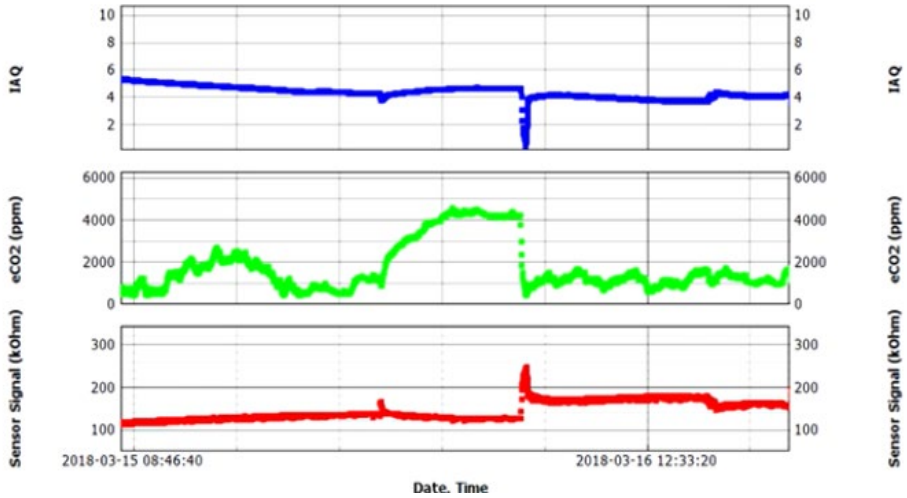
Easy to Use:

- ZMOD4410 Evaluation Kit
- Manuals, application notes, blog, and white papers
- Instructional videos
- Programming libraries, example codes, and algorithm support to optimize performance
- Third-party certification for compliance with well-accepted international IAQ standards

Part #	Operation Condition	Package
ZMOD4410AI1V ZMOD4410AI1R	1.7-3.6V -40° to +65° Est. CO2 400-5000ppm Ethanol in air 0-1000ppm	3.0 × 3.0 × 0.7mm, 12-LGA



ZMOD4410 typical application



Measuring IAQ and Est CO2 level with ZMOD4410

HS300x – Relative Humidity and Temperature Sensor

High Accuracy Humidity and Temperature Measurement for Environmental Monitoring

High Accuracy

- ±1.5%RH accuracy (HS3001)
- ±0.2°C temperature accuracy (HS3001, HS3002)

Excellent Stability

- 0.1%RH per year drift
- MEMS silicon-carbide sensor technology

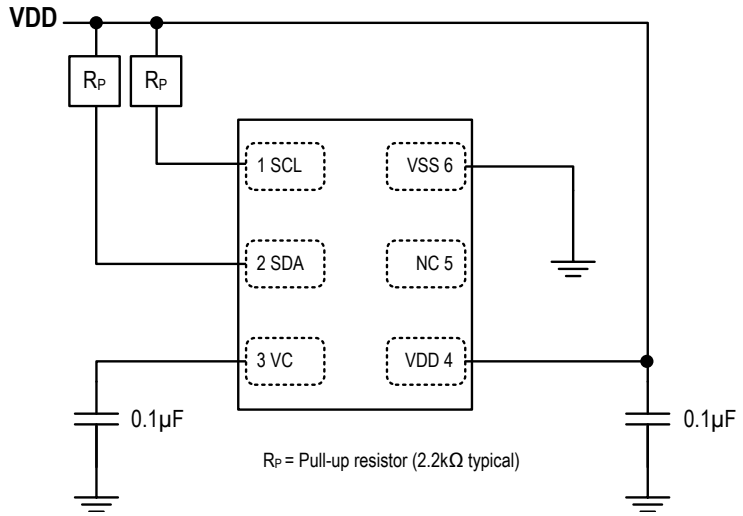
Fast Response

- Less than 4 seconds humidity response, in still air
- Less than 2 seconds temperature response

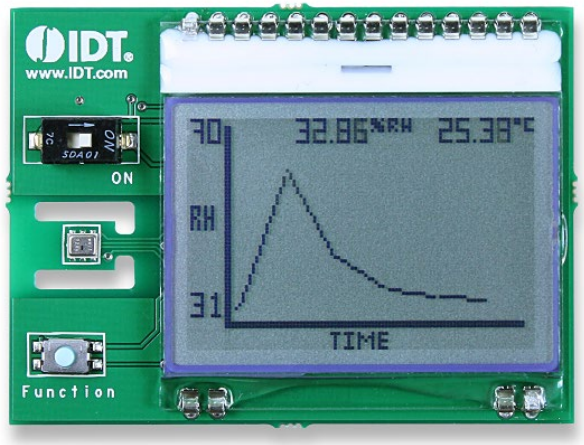
Extended Supply Voltage

- 2.3V to 5.5V, 24.4µA at 3.3V (one RH+Temp per second)
- 1.8V custom order

Part #	Feature	Package
HS3001	±1.5%RH	3×2.41×0.8 LGA
HS3002	±1.8%RH	3×2.41×0.8 LGA
HS3003	±2.8%RH	3×2.41×0.8 LGA
HS3004	±3.8%RH	3×2.41×0.8 LGA



Typical Operating Circuit



SDAH02 Evaluation Kit

Renesas.com