



JP103 Refrigerator Odor Detector

December 2019

Refrigerator Odor Detector

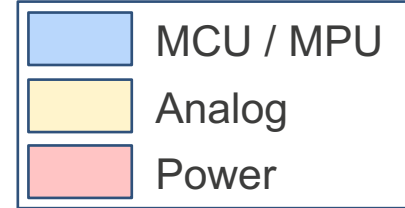
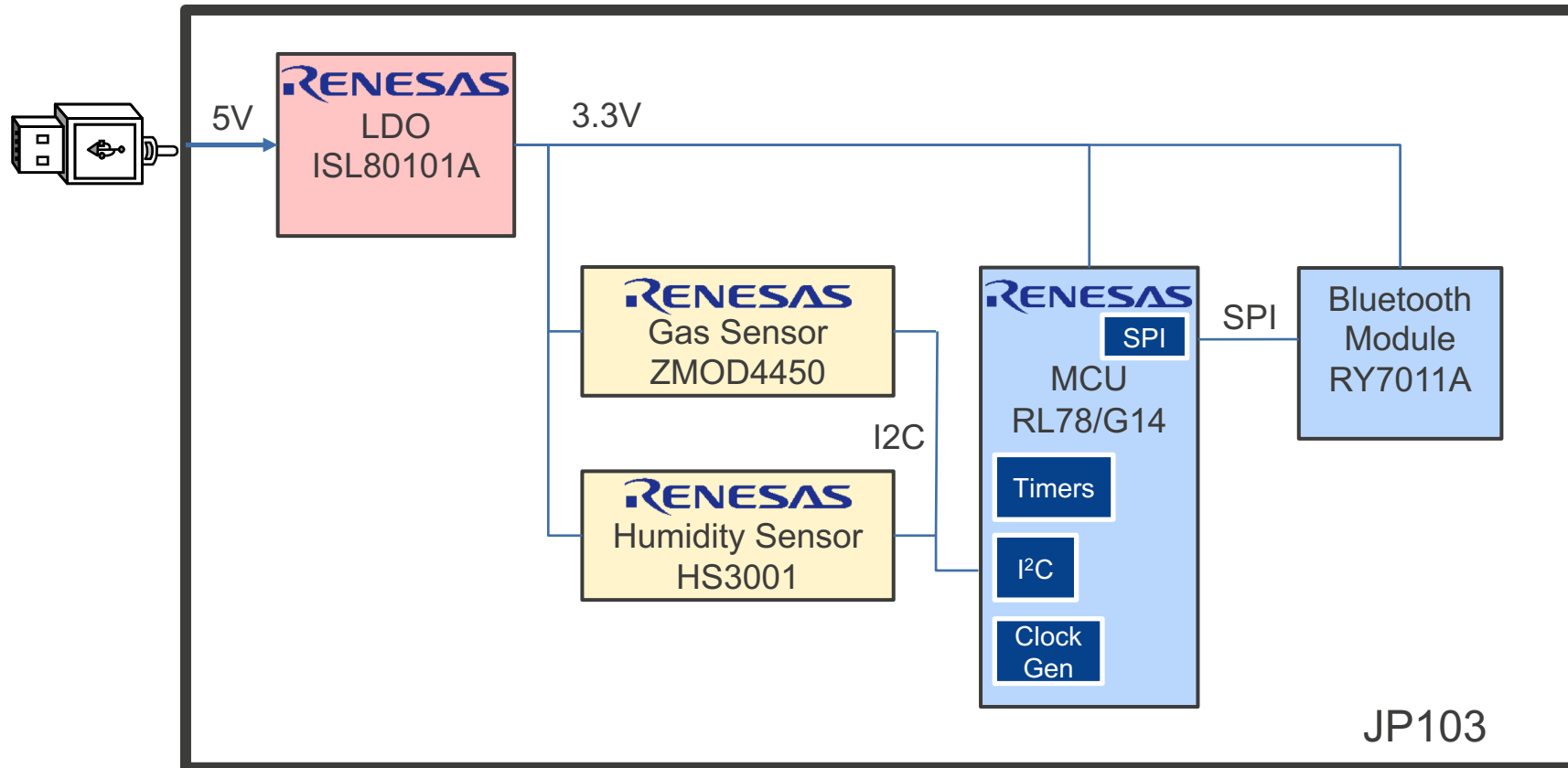
■ Overview

The combination of Renesas' gas sensor, humidity sensor, and RL78/G14 MCU enables users to detect gases in the refrigerator. Odor levels, temperature and humidity values can be monitored through a handy device by using a Bluetooth® module. The RL78/G14 microcontroller is suitable for industrial applications with high performance peripheral functions. All the power on the sensor board is provided by the ISL80101A high performance LDO.

■ System Benefits

- Easily detect gases emitted from spoiling food
- The ZMOD4450 gas sensor module is a software configurable platform designed for detecting gases associated with food ripening or rotting and is targeted for use in refrigeration air quality (RAQ) applications

Refrigerator Odor Detector



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Device Category	P/N	Key Features
MCU	RL78/G14	RL78/G14 microcontrollers balance the industry's lowest level of consumption current (CPU: 66 μ A/MHz, standby (STOP): 240 nA and a high calculation performance of 51.2 DMIPS (32 MHz).
	RY7011A	Compact Bluetooth 4.1 module (based on RL78/G1D)
Power	ISL80101A	The ISL80101A is a low dropout voltage, single output LDO with programmable current limiting. This LDO operates from input voltages of 2.2V to 6V, and is capable of providing output voltages of 0.8V to 5V.
Analog	ZMOD4450	Measurement of gases associated with food ripening and storage at trace (ppb) concentrations, including ethylene, amines, volatile sulfur compounds and others
	HS3001	Relative humidity and temperature sensor. High accuracy humidity and temperature measurement for environmental monitoring. Excellent stability. 0.1%RH per year drift.

RL78/G14 – Advanced Functions MCU

Suitable for motor control as well as industrial and metering applications

Added Instruction Functions to CPU Core

- Added multiply, divide, and multiply-accumulate instructions that enable high-speed operation by direct execution without needing to utilize library functions
- High calculation performance: 51.2 DMIPS (32 MHz)

High Performance Peripheral Functions

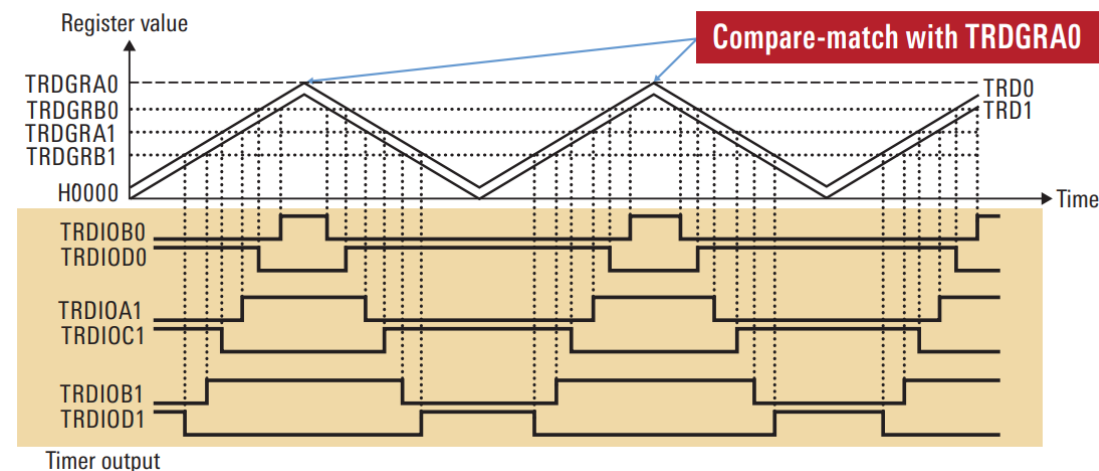
- Timer RD (Complementary PWM Mode for brushless DC motor control), Timer RG (Phase Count Mode), Timer RJ (asynchronous timer)
- Data Transfer Controller (DTC); Event Link Controller (ELC)
- Comparator, 8-bit Digital Analog Converter

Easy to Develop and Use

- Scalable lineup packages, pin-counts and Flash ROM, RAM
- Released Starter Kit and Motor Solution Evaluation Kit

Part #	Flash ROM	RAM	Package(mm)
R5F104A	16 ~ 128 KB	2.5 ~ 16 KB	30-LSSOP(7.62)
R5F104B			32-HWQFN(5 × 5), 32-LQFP(7 × 7)
R5F104C			36-WFLGA(4 × 4)
R5F104E	16 ~ 192 KB	2.5 ~ 20 KB	40-HWGFN(6 × 6)
R5F104F	16 ~ 256 KB	2.5 ~ 24 KB	44-LQFP(10 × 10)
R5F104G	16 ~ 512 KB	2.5 ~ 48 KB	48-LFQFP(7 × 7), 48-HWQFN(7 × 7)
R5F104J	32 ~ 256 KB	4 ~ 24 KB	52-LQFP(10 × 10)
R5F104L	32 ~ 512 KB	4 ~ 48 KB	64-LFQFP(10 × 10), 64-LQFP(12 × 12), 64-LQFP(14 × 14)*, 64-WFLGA(5 × 5)
R5F104M	96 ~ 512 KB	12 ~ 48 KB	80-LFQFP(12 × 12), 80-LQFP(14 × 14)
R5F104P			100-LFQFP(14 × 14), 100-LQFP(14 × 20)

*This product do not exist 384KB/512KB.



Complementary PWM mode operation example

RL78 Family Motor Solution Evaluation Kit



Renesas Starter Kit for RL78/G14



24V Motor Control Evaluation System for RX23T



RL78/G14 CPU Card for Motor Control

RX7011 – Bluetooth® Low Energy Module

Compact Module with Built-in 32 MHz Crystal Resonator for RF and Antenna



High Integration

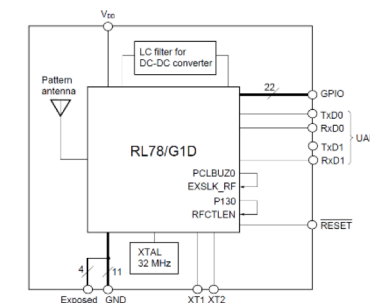
- The RL78/G1D module (RX7011) contains the RL78/G1D, a 32 MHz crystal resonator for RF chip, and an antenna, all in a compact (8.95 x 13.35 x 1.7 mm) module.
- GPIO 24 pins mounted, these can use the UART, I²C, SPI, Timer, ADC.
- RF transceiver is certified with Bluetooth v4.2 Specification (Low Energy Single mode)

Easy to Develop and Use

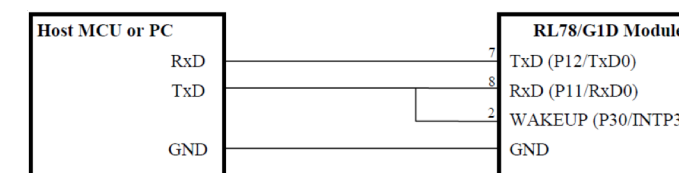
- The module has been tested and found to comply with global regulatory certification for Japan, FCC, IC, and CE as well as Bluetooth SIG certification
- The module inherits the functional pins of the RL78/G1D, so not only can you use it for modem configuration, but you can also leverage the strengths of the microcontroller for embedded configuration

Low Power Consumption

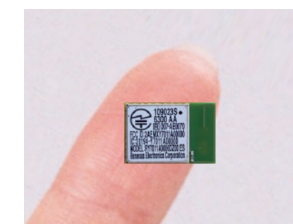
- RL78/G1D module support Bluetooth® Low Energy and achieved the lowest level of current consumption in the industry.
 - RF transmitter active normal mode: 4.3 mA, Low power mode: 2.6 mA
 - RF receiver active normal mode: 3.5 mA
 - Average current: 9.1 µA (1-second intervals, connection maintained, CC-RL compiler)



RL78/G1D module (RX7011) Block Figure



Connections to the host microcontroller



RL78/G1D module (RX7011)
(RX7011A000DZ00)
Size: 8.95 × 13.35 × 1.7 mm

Part #	Flash ROM	RAM	Package
RX7011A000DZ00	256KB	20KB	42-pin LGA (8.95 × 13.35mm)

ISL80101A – High Performance 1A LDO

Programmable Current-Limited LDO for Telecommunications

Stable Output Voltage

- $\pm 2\%$ Adjustable V_{OUT} accuracy guaranteed over line, load and $T_J = -40-125\text{ }^{\circ}\text{C}$
- High Accuracy current limit programmable up to 1.75A

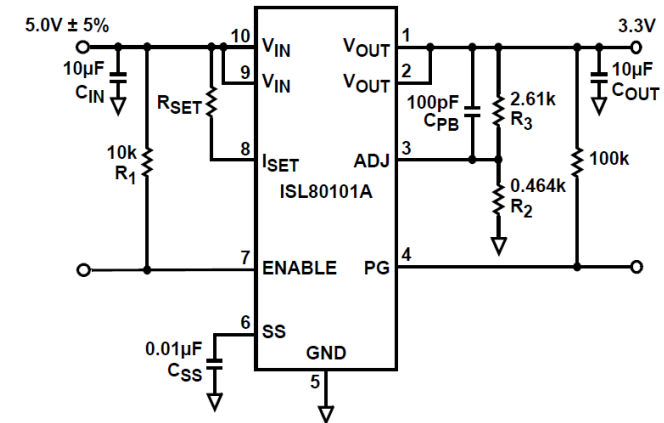
High Performance

- Very low 212mV dropout voltage at $V_{IN}=4.5\text{V}$
- Very fast transient response
- $100\mu\text{V}_{\text{RMS}}$ output noise

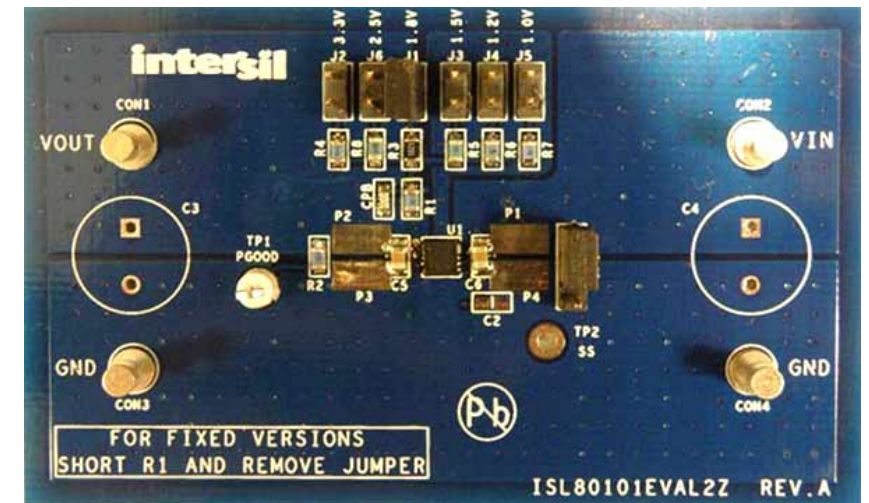
Excellent Safety

- Power good output
- Programmable soft-start
- Over temperature protection

Part #	V_{OUT}	Programmable I_{LIMIT}	Package
ISL80101	1.8V, 2.5V, 3.3V, 5V, ADJ	No	10Ld 3x3 DFN
ISL80101A	0.8-5V	Yes	10Ld 3x3 DFN



Typical Application Circuit



ISL80101EVAL2Z 1A LDO Eval Board

ZMOD4450 – Refrigeration Air Quality Sensor Platform

Gas Sensor Module for Refrigeration Air Quality (RAQ) Applications

Flexible Measure Target and Integrated Functions

- Measurement of gases associated with food ripening and storage: ethylene, amines, volatile sulfur compounds
- Heater driver and regulation loop for constant heater voltage or constant heater resistance
- Internal auto-compensated temperature sensor; not stress sensitive
- Built-in nonvolatile memory (NVM) for user data
- Adjustable ADC resolution for optimal speed versus resolution: 16-bit maximum
- Algorithm to set a control signal to trigger an external action based on RAQ
- No external trimming components required

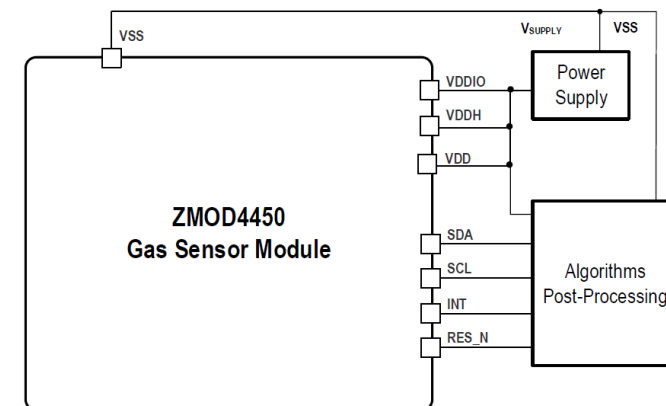
Low Power

- Low average power consumption in the mW range
- Excellent for mobile and consumer applications

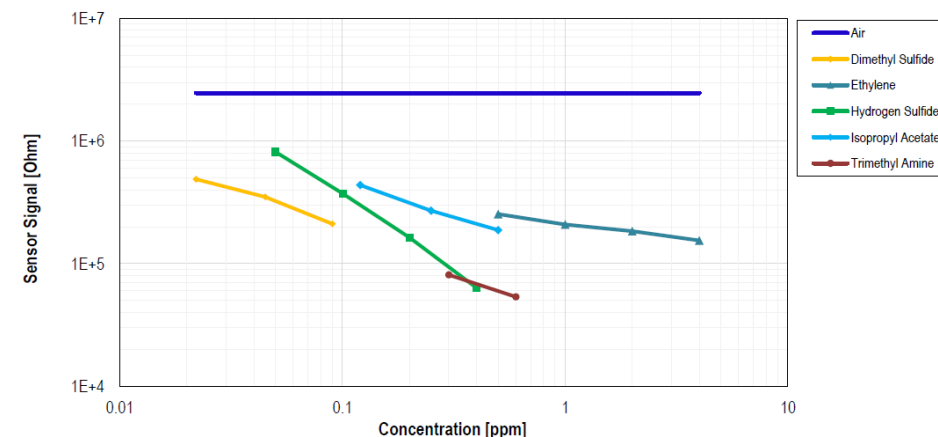
Flexible and Easy to Use

- ZMOD4450 Evaluation Kit
- Software configurable methods of operation based on application and use case
- Firmware upgradable platform for application optimizations, such as ultra-low-power battery applications
- Every sensor is calibrated with ethylene providing consistency from lot-to-lot
- Complete qualification with harsh cases such as siloxanes

Part #	Operation Condition	Package
ZMOD4450AI1V ZMOD4450AI1R	1.7-3.6V 0° to +25°	3.0 × 3.0 × 0.7mm, 12-LGA



ZMOD4450 Typical Application



Gas Response to Typical Gases and Levels of Expected Refrigeration Gases

HS300x – Relative Humidity and Temperature Sensor

High Accuracy Humidity and Temperature Measurement for Environmental Monitoring

High Accuracy

- $\pm 1.5\%$ RH accuracy (HS3001)
- $\pm 0.2^\circ\text{C}$ temperature accuracy (HS3001, HS3002)

Excellent Stability

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

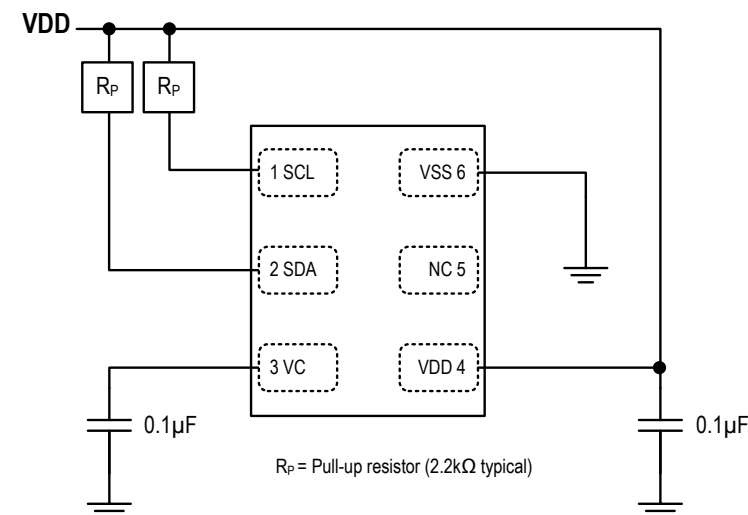
Fast Response

- Less than 6 seconds humidity response, in still air
- Less than 2 seconds temperature response

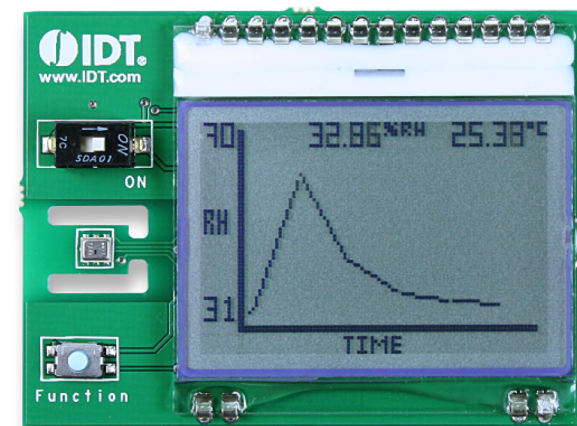
Extended Supply Voltage

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

Part #	Feature	Package
HS3001	$\pm 1.5\%$ RH	3 \times 2.41 \times 0.8 LGA
HS3002	$\pm 1.8\%$ RH	3 \times 2.41 \times 0.8 LGA
HS3003	$\pm 2.8\%$ RH	3 \times 2.41 \times 0.8 LGA
HS3004	$\pm 3.8\%$ RH	3 \times 2.41 \times 0.8 LGA



Typical Operating Circuit



SDAH02 Evaluation Kit

[Renesas.com](https://www.renesas.com)