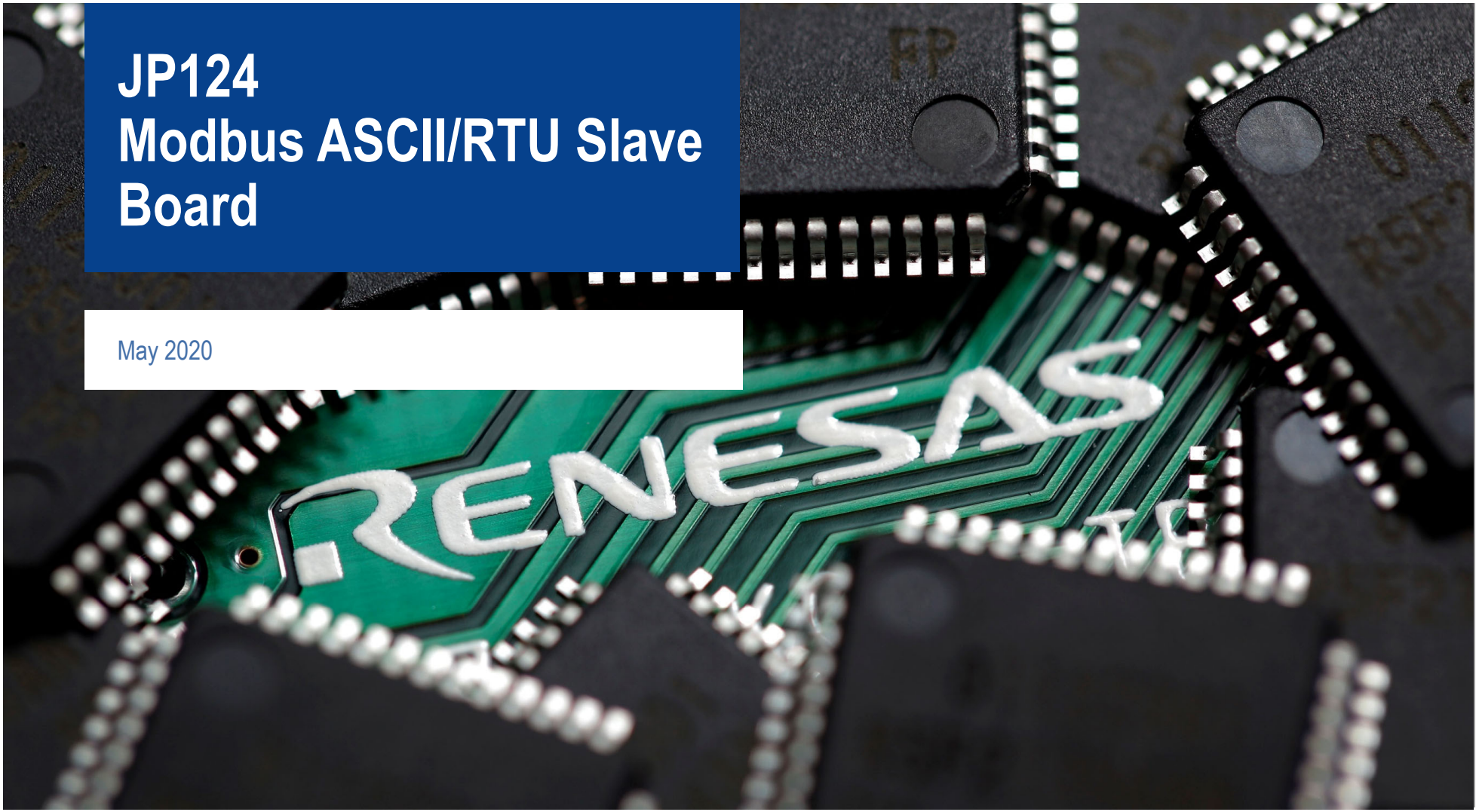
JP124
Modbus ASCII/RTU Slave Board



May 2020

Modbus ASCII/RTU Slave Board

- **Overview**

  Modbus is widely used in the field of factory automation and plant automation because its specifications are open to the public, free to use, and relatively easy to implement. Therefore, Modbus is the most common serial communication protocol for connecting industrial equipment.

  Modbus is based on serial communication and has two transmission modes, Modbus ASCII and Modbus RTU. The physical layer of Modbus often uses the RS-485 standard. By combining the RL78 microcontroller (MCU) with sample programs and RS-485 transceiver products, you can easily implement slave devices that communicate using Modbus ASCII or Modbus RTU. The RL78 microcontroller has industry-leading low power operation, making it ideal for simple functions such as low power operation, I/O control, temperature and humidity measurement.

- **System Benefits**
  - Modbus ASCII/RTU enables 1: N connection and communication with a maximum transmission distance of 500 m by using RS-485 for the physical layer
  - Modbus can manage the environment in the factory by acquiring the illuminance, air quality, temperature and humidity information to control the equipment and air vents

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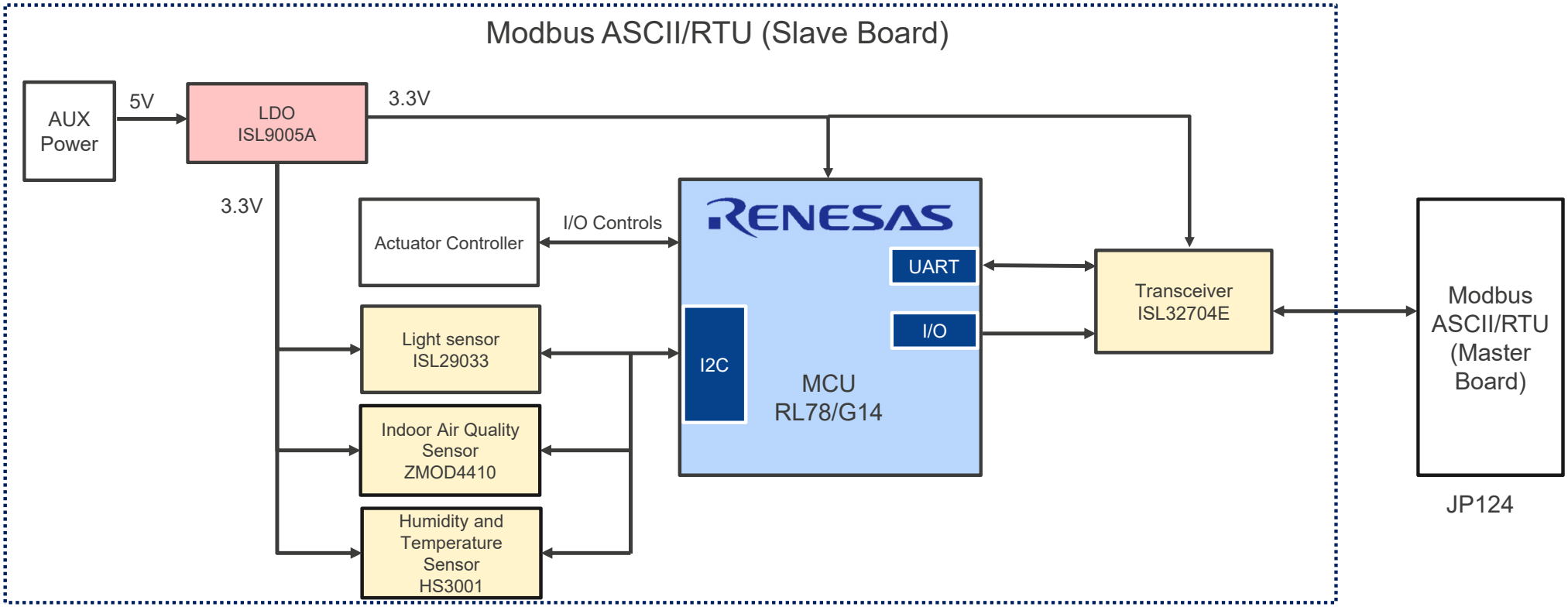

MCU / MPU Analog Power

Modbus ASCII/RTU Slave Board

Device Category	P/N	Key Features
MCU	RL78/G14	Advanced Functions MCU Suitable for motor control as well as industrial and metering applications
Power	ISL9005A	LDO with Low ISUPPLY, High PSRR. Wide Input Voltage: 2.3V to 6.5V with 300mA Current Output
Analog	ISL32704E	Smallest Package Isolated RS-485 Transceiver Ultra-Low EMI, High Drive Capability, Robust ESD
	ISL29033	Integrated Digital Ambient Light Sensor. Ultra-Low Lux, Low Power, Integrated Ambient and Infrared Light-to-Digital Converter
	ZMOD4410	Indoor Air Quality Sensor Platform. TVOC Sensor for Indoor Air Quality Applications.
	HS3001	Relative Humidity and Temperature Sensor. High Accuracy Humidity and Temperature Measurement for Environmental Monitoring

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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

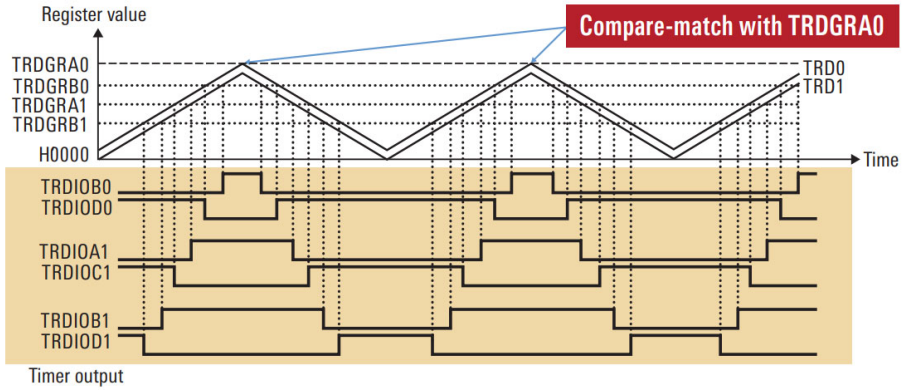
- Timer RD (Complementary PWM Mode for brushless DC motor control), Timer RG (Phase Count Mode), Timer RJ (asynchronous timer)
- Data Transfer Controller (DTC); Event Link Controller (ELC)
- Comparator, 8bit Digital Analog Converter

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

Renesas Starter Kit for RL78/G14

RL78 Family Motor Solution Evaluation Kit

24V Motor Control Evaluation System for RX23T

RL78/G14 CPU Card for Motor Control

ISL9005A – LDO with Low ISUPPLY, High PSRR

Wide Input Voltage: 2.3V to 6.5V with 300mA Current Output

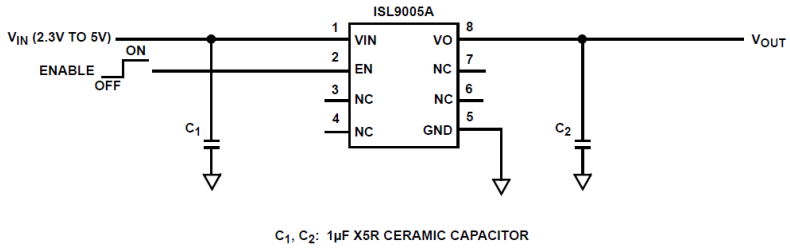
High Performance

- LDO with 300mA continuous output
- Excellent transient response to large current steps
- Excellent load regulation: <0.1% voltage change across full range of load current
- High PSRR: 75dB @ 1kHz
- Wide input voltage capability: 2.3V to 6.5V

High efficiency in a small package

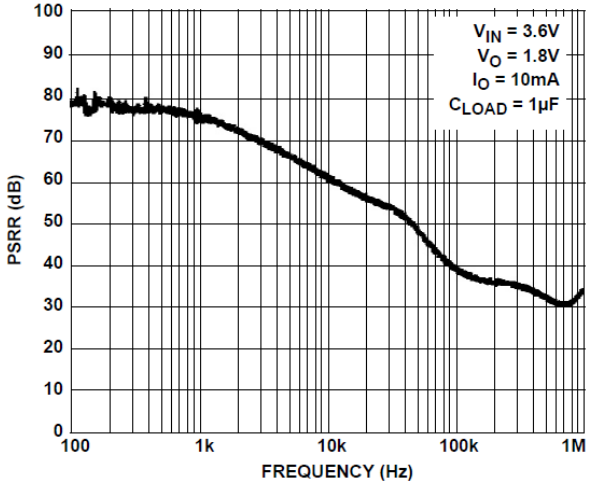
- Very low quiescent current: 50µA
- Low dropout voltage: typically 200mV at 300mA
- Low output noise: typically 45µVRMS at 100µA (1.5V)
- Tiny 2mmx3mm 8 Ld DFN package

Part #	Output Voltage (V)	Package
ISL9005AIRNZ-T	3.3	8 Ld 2mmx3mm DFN
ISL9005AIRKZ-T	2.85	8 Ld 2mmx3mm DFN
ISL9005AIRJZ-T	2.8	8 Ld 2mmx3mm DFN
ISL9005AIRFZ-T	2.5	8 Ld 2mmx3mm DFN
ISL9005AIRCZ-T	1.8	8 Ld 2mmx3mm DFN
ISL9005AIRBZ-T	1.5	8 Ld 2mmx3mm DFN



C_1, C_2: 1µF X5R CERAMIC CAPACITOR

Typical Application Circuit



PSRR vs Frequency

ISL32704E – Smallest Package Isolated RS-485 Transceiver

Ultra-Low EMI, High Drive Capability, Robust ESD

High Speed

- 4Mbps data rate

High Reliability

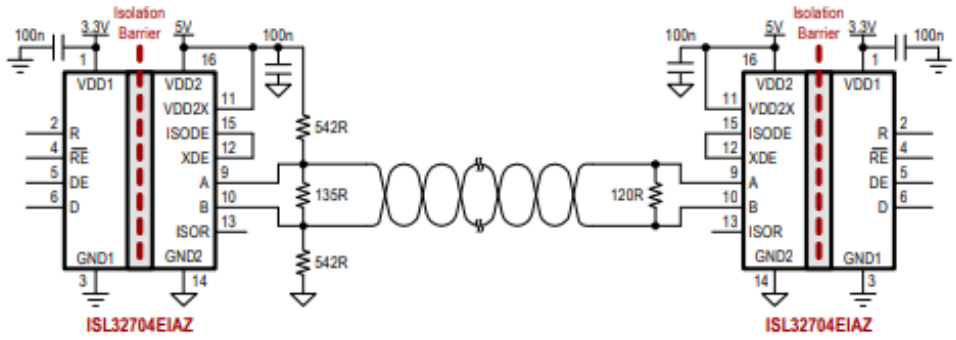
- 2.5kVRMS isolation per UL 1577
- 600VRMS working voltage per VDE 0884
- 15kV ESD bus-pin protection

Good Connectivity

- The device is compatible with 3V and 5V input supplies

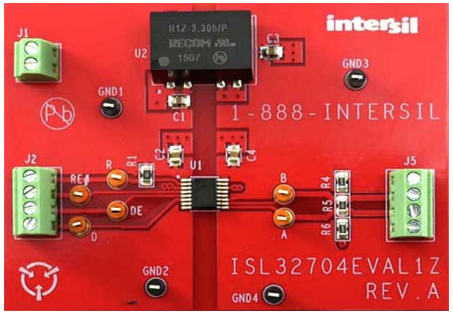
Industry Standard

- UL 1577 recognized
- VDE V0884-10 certified



Typical Operating Circuits

Part #	HALF/FULL DUPLEX	Temp. Rang	Data Rate Mbps	Isolation Rating	Package
ISL32704EIAZ	Half	-40 to +85	4	2.5kV	16 Ld QSOP
ISL32704EIBZ	Half	-40 to +85	4	2.5kV	16 Ld SOIC



ISL32704EVAL1Z Evaluation Board

ISL29033 – Integrated Digital Ambient Light Sensor

Ultra-Low Lux, Low Power, Integrated Ambient and Infrared Light-to-Digital Converter

Integrated Functions and Small Package

- 6 pin 2.0mmx2.1mm ODFN
- On-chip 16-bit ADC
- I²C(SMBus compatible) Interface

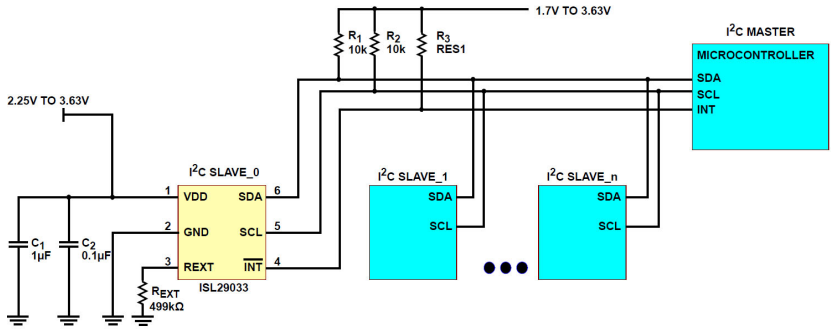
High Performance

- Adjustable sensitivity up to 520 counts per lux
- Measurement range: 0.0019 to 8,000lux with four selectable ranges
- Close to human eye response with excellent IR/UV rejection
- Operation across -40 to +85ºC

Low Power Design

- Normal operation 57uA
- 0.3uA maximum shutdown current

Part #	ALS Sensing	Interrupt Pin	Package
ISL29033IROZ-T7	Yes	Yes	6 Ld 2x2.1 ODFN



Typical Operating Circuits

ISL290xxIROZ-EVALZ evaluation board

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 (eCO_2)
- 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

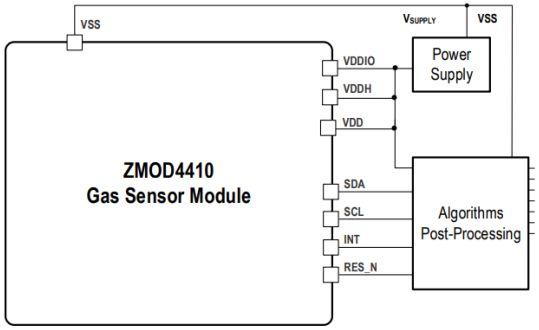
Low Power

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

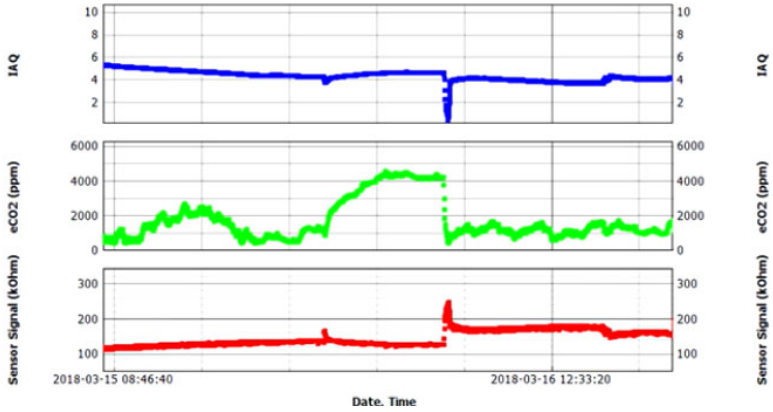
Easy to Use

- ZMOD4410 Evaluation Kit
- Manuals, application notes, blog, and white papers
- Instructional videos
- Programming libraries, example codes
- 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 CO_2 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)
- ±0.2ºC temperature accuracy (HS3001, HS3002)

Excellent Stability

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

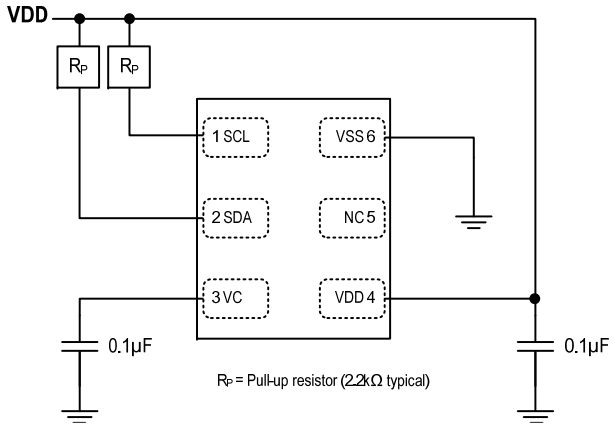
Fast Response

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

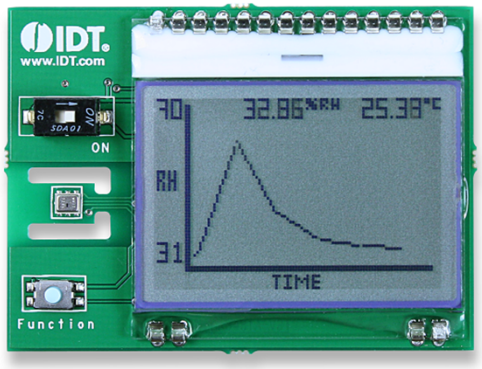
Extended Supply Voltage

- 2.3V to 5.5V, 24.4µA 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