

# SMART BLDC FAN WITH HUMIDITY AND GAS SENSOR

- EU2019-08.911

# SMART BLDC FAN WITH HUMIDITY AND GAS SENSOR: OVERVIEW

Ventilation in buildings is important and it is recognised that lack of a good, clean air supply is detrimental to health and the quality of life. In the UK, the ventilation requirements form a part of Building Regulations. \*It was estimated that poor housing costs the National Health Service in the UK £2.5bn in treatment costs. Poor indoor air quality has been linked to allergy, asthma and other chronic diseases. High levels of CO<sub>2</sub> can lead to drowsiness, lack of concentration and headaches.

This solution using the Renesas MCU RX13T, HS3001 humidity and temperature sensor and ZMOD4410 TVOC gas sensor detect and significantly improve indoor air quality by using:

- Precise, factory calibrated sensors.
- Energy efficient BLDC control for fan.
- Activating the fan only when VOC, moisture or CO<sub>2</sub> are detected.

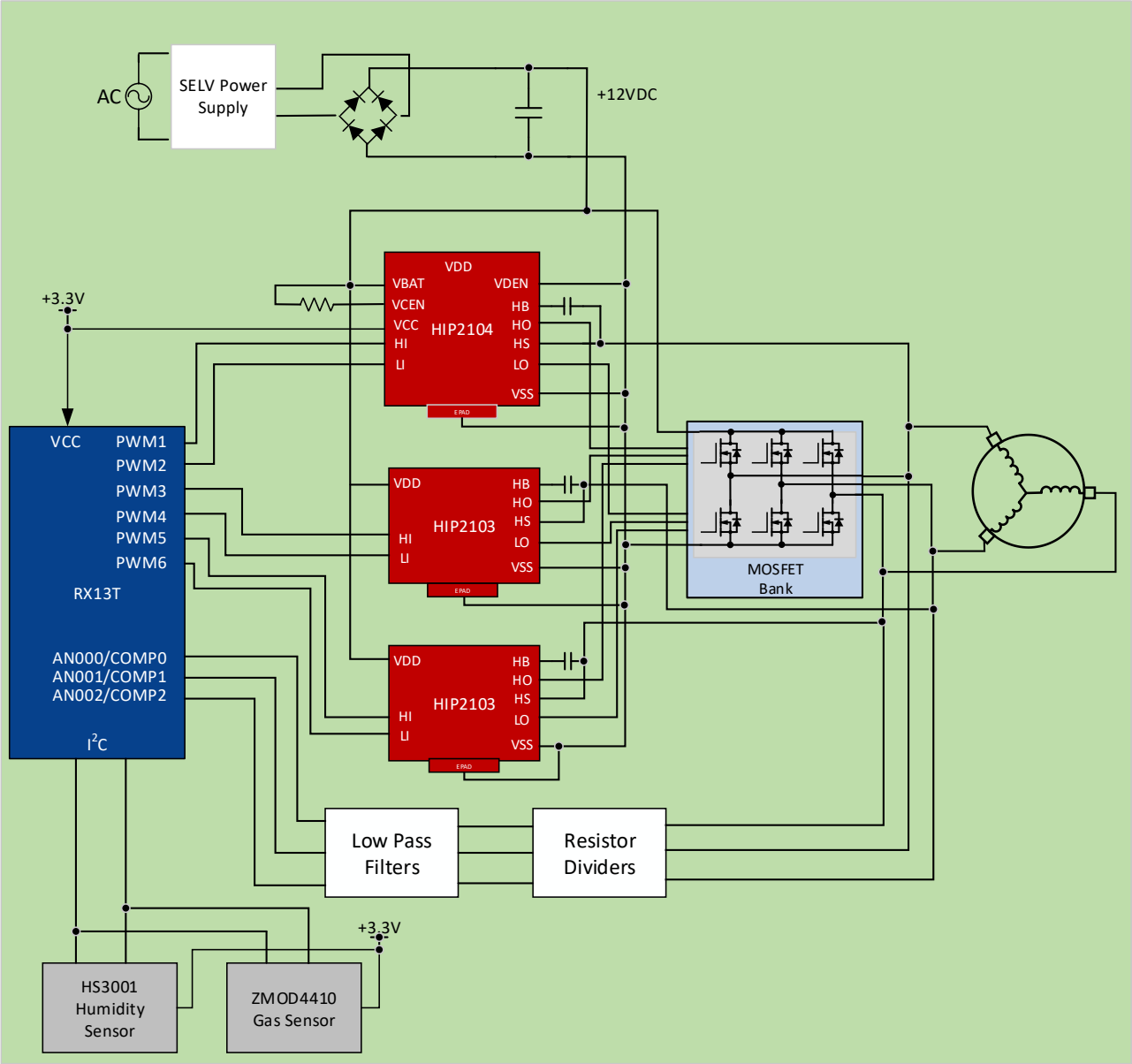
Thus keeping residents healthy and improving their quality of life with low development effort.

## Key Features:

- High Performance  $\mu$ C + FPU designed for motor control. The MCU has all the functions required for an efficient BLDC motor control solution.
- Complementary PWM outputs with automatic dead time setting and adjustable PWM duty cycle from 0 to 100%
- 8 channels of 12 bit ADC with 3 channels have separate sample and hold
- Relative Humidity sensor with  $\pm 1.5\%$ RH(typ) and fast response time (6 seconds typ.).
- Measurement of total Organic Volatile Compounds and indoor air quality.
- Module algorithm can also estimate concentration of CO<sub>2</sub>.
- Configurable alarm/Interrupt output with static and adaptive levels.

\* BRE. Briefing Paper: The Cost of Poor Housing to the NHS. 2011.

# SMART BLDC FAN WITH HUMIDITY AND GAS SENSOR



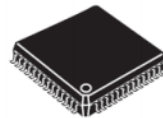
# RX13T: 32 BIT, WIDE VIN MCU WITH BUILT-IN FPU

## Motor Control MCU series within the RX Family

Features	Benefits	Applications
<ul style="list-style-type: none"> <li>• 32-bit MCU @ 32MHz</li> <li>• RX13T microcontrollers operate in a broad voltage range from 2.7 V to 5.5 V</li> <li>• Great set of timers to support Inverter Control</li> <li>• Incorporating a floating point unit (FPU), able to control up to 3 inverters</li> <li>• 8 channels of 12bit ADC</li> <li>• 3 Comparators + 3 PGAs</li> <li>• Operating Temp:: -40~85°C, -40~105°C</li> <li>• Up to 128kB Flash and 12kB RAM</li> <li>• 4kB Data Flash</li> <li>• 32pin and 48pin LQFP packages</li> </ul>	<ul style="list-style-type: none"> <li>• The RX13T is a 32-bit microcontroller with built-in FPU (floating-point processing unit) that enables it to easily program complex inverter control algorithms.</li> </ul>	<ul style="list-style-type: none"> <li>• Industrial automation</li> <li>• Industrial process control</li> <li>• Office Automation</li> <li>• Home Appliance</li> <li>• Inverter Control</li> <li>• Motor Control</li> </ul>

### Typical application and key performances

32-MHz 32-bit RX MCUs, built-in FPU, 12-bit ADC (equipped with three S/H circuits, double data registers, and comparator), Simultaneous sampling up to 3 channels ADC, 32MHz PWM 3-phase complementary output



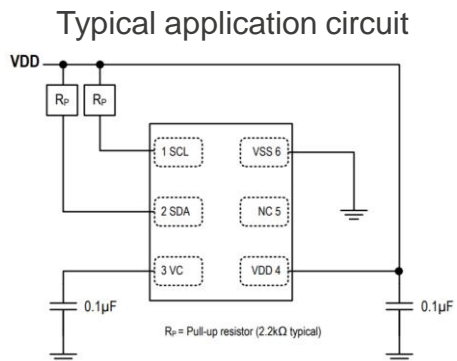
PLQP0048KB-B 7 x 7, 0.5mm pitch  
PLQP0032GB-A 7 x 7, 0.8mm pitch

# HS300X: RELATIVE HUMIDITY AND TEMPERATURE SENSOR

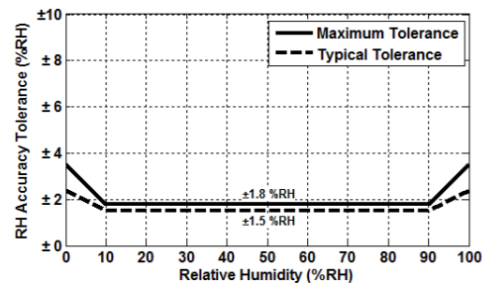
*Humidity Sensor with Industry Leading Accuracy, Response Time, and Excellent Stability*

Features	Benefits	Applications
<ul style="list-style-type: none"> <li>• <math>\pm 1.5\%</math> Relative Humidity Accuracy (HS3001)</li> <li>• Fast RH response time (Typical 6 seconds)</li> <li>• 14-bit resolution, 0.01%RH (Typical)</li> <li>• Low power consumption, 1.0<math>\mu</math>A average (one RH + T measurement per second)</li> <li>• Temperature sensor accuracy of <math>\pm 0.2^\circ</math> C (HS3001, HS3002)</li> <li>• Extended supply voltage, 1.8V to 5.5V</li> </ul>	<ul style="list-style-type: none"> <li>• Silicon-carbide capacitive sensing element</li> <li>• Excellent stability against aging</li> <li>• Highly robust protection from harsh environmental conditions and mechanical shock</li> <li>• Very low power consumption</li> <li>• Digital I2C Output</li> </ul>	<ul style="list-style-type: none"> <li>• Climate control systems</li> <li>• Home appliance</li> <li>• Weather stations</li> <li>• Industrial automation</li> <li>• Process controls and monitoring</li> <li>• Automotive climate control</li> <li>• Medical equipment</li> </ul>

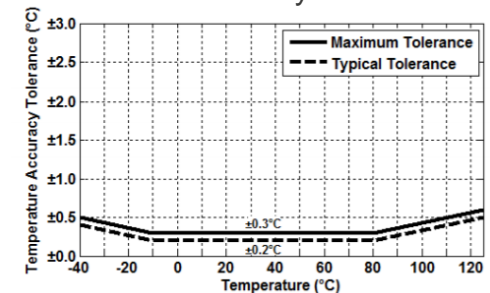
## Typical application and key performances



HS3001 RH Accuracy Tolerance at 25°C



HS3001 Temperature Sensor Accuracy Tolerance

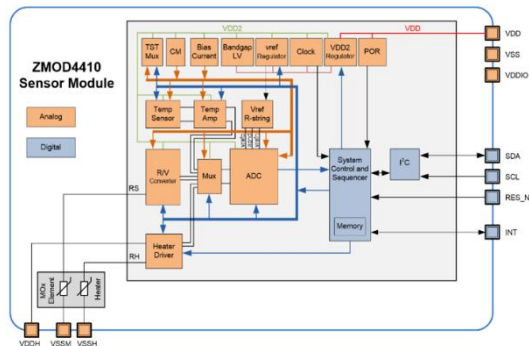


# ZMOD4410: GAS SENSOR MODULE TVOC

## Indoor Air Quality Sensor Platform

Features	Benefits	Applications
<ul style="list-style-type: none"> <li>• Proven MOx Material</li> <li>• Electrical and Gas calibrated</li> <li>• Flexible architecture with available GUI and firmware for different operation modes</li> <li>• Correlates German Committee on Indoor Guidelines (UBA study)</li> <li>• Miniature 3 x 3 x 0.7mm</li> <li>• Power consumption of &lt;1 mW in Low Power operation</li> <li>• Digital (I<sup>2</sup>C) output</li> <li>• Siloxane resistant</li> </ul>	<ul style="list-style-type: none"> <li>• Leading high sensitivity and long term stability</li> <li>• Calibrated sensor allows easy and fast system integration</li> <li>• Enables Customer to release product families via SW changes</li> <li>• International accepted definition of Indoor Air Quality (IAQ)</li> <li>• Calculation of estimated Carbon Dioxide (eCO<sub>2</sub>)</li> <li>• Reduced end product size</li> </ul>	<ul style="list-style-type: none"> <li>• HVAC Systems</li> <li>• Air Purifiers</li> <li>• Smart Thermostats</li> <li>• Smart Speakers</li> <li>• Bathroom fans</li> <li>• Kitchen exhaust hoods</li> <li>• Smart outlets &amp; receptacles</li> </ul>

## Best Performance in Stability and Sensitivity



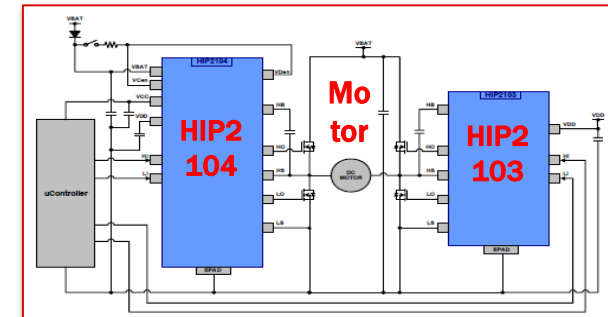
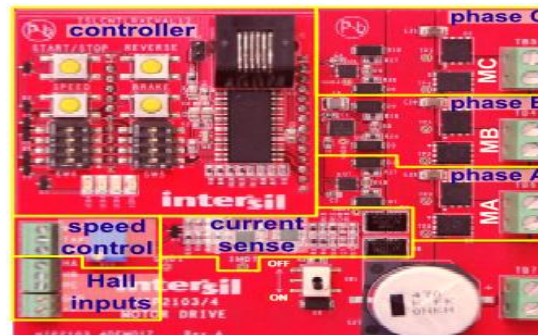
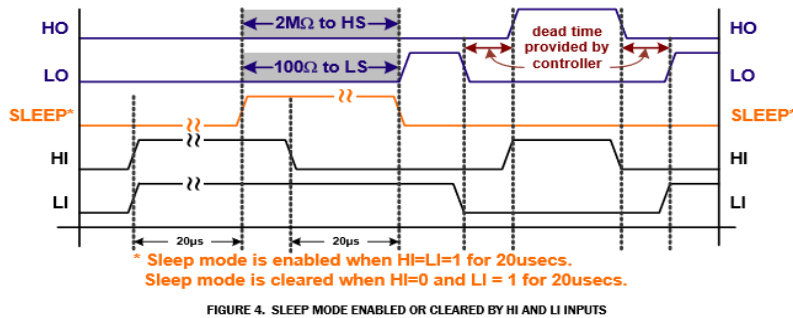
IDT IAQ Rating	Reference Level	Air Information	TVOC (mg/m <sup>3</sup> )	Air Quality
≤ 1.99	Level 1	Clean Hygienic Air (Target value)	< 0.3	Very Good
2.00 – 2.99	Level 2	Good Air Quality (if no threshold value is exceeded)	0.3 – 1.0	Good
3.00 – 3.99	Level 3	Noticeable Comfort Concerns (Not recommended for exposure > 12 months)	1.0 – 3.0	Medium
4.00 – 4.99	Level 4	Significant Comfort Issues (Not recommended for exposure > 1 month)	3.0 – 10.0	Poor
≥ 5.00	Level 5	Unacceptable Conditions (Not recommended)	> 10.0	Bad

# HIP2103/4: INTEGRATED LDO FOR MCU AND DRIVERS

## 60V half bridge Drivers

Features	Benefits	Applications
<ul style="list-style-type: none"> <li>Optimized for battery powered applications from 5V to 60V</li> <li>Small packages: 8 ld 3x3 DFN (HIP2103), 12 ld 4x4 DFN (HIP2104)</li> <li>Two integrated LDOs with enables (HIP2104 only)</li> <li>1A sourcing, 2A sinking driving current</li> <li>Very robust by offering -10V voltage transients on HB pin</li> </ul>	<ul style="list-style-type: none"> <li>Proprietary sleep mode eliminates the need for additional I/O control pins</li> <li>10uA Iq eliminates the need for a disconnect switch</li> <li>Simple power supply needs</li> <li>Integrated 3.3V LDO eliminated uC power supply needs</li> <li>Pb-free (RoHS compliant)</li> </ul>	<ul style="list-style-type: none"> <li>Power Tools</li> <li>Handheld Vacuums</li> <li>Robotics</li> <li>Drones</li> </ul>

### Typical application and key performances



---

Renesas.com