AIR QUALITY MONITOR (PM2.5) WITH SECURE CLOUD CONNECTION: OVERVIEW

Detecting poor air quality is vital for protecting against harmful exposure. Air quality can be compromised due to Volatile Organic Compounds (VOCs) as well as tiny particulates in the air. This reference design utilizes sensors to detect air quality contaminants and send an alert to the cloud via WiFi.

The HS3001 humidity sensor, ZMOD4410 gas sensor, Synergy S5D9 microcontroller, and high performance power devices enable users to sense and monitor the environment through a mobile cloud connection.

Utilizing the Renesas AE-Cloud2 kit enables new customers and new applications at IoT market. A product level solution helps customers quickly prototype, evaluate and implement their designs. This kit helps break down the barriers to success thanks to the system level reference design which includes kit hardware, secure cloud connectivity and control through a dashboard.

Key Features:

- Temperature, humidity and gas sensing via the HS3001 and ZMOD4410 sensors

- Color LCD control via the Synergy S5D9

- System-level solution with source code

- Secure cloud connection through MQTT+TLS

Back to Directory

BIG IDEAS FOR EVERY SPACE

RENESAS

AIR QUALITY MONITOR (PM2.5) WITH SECURE CLOUD CONNECTION: BLOCK DIAGRAM
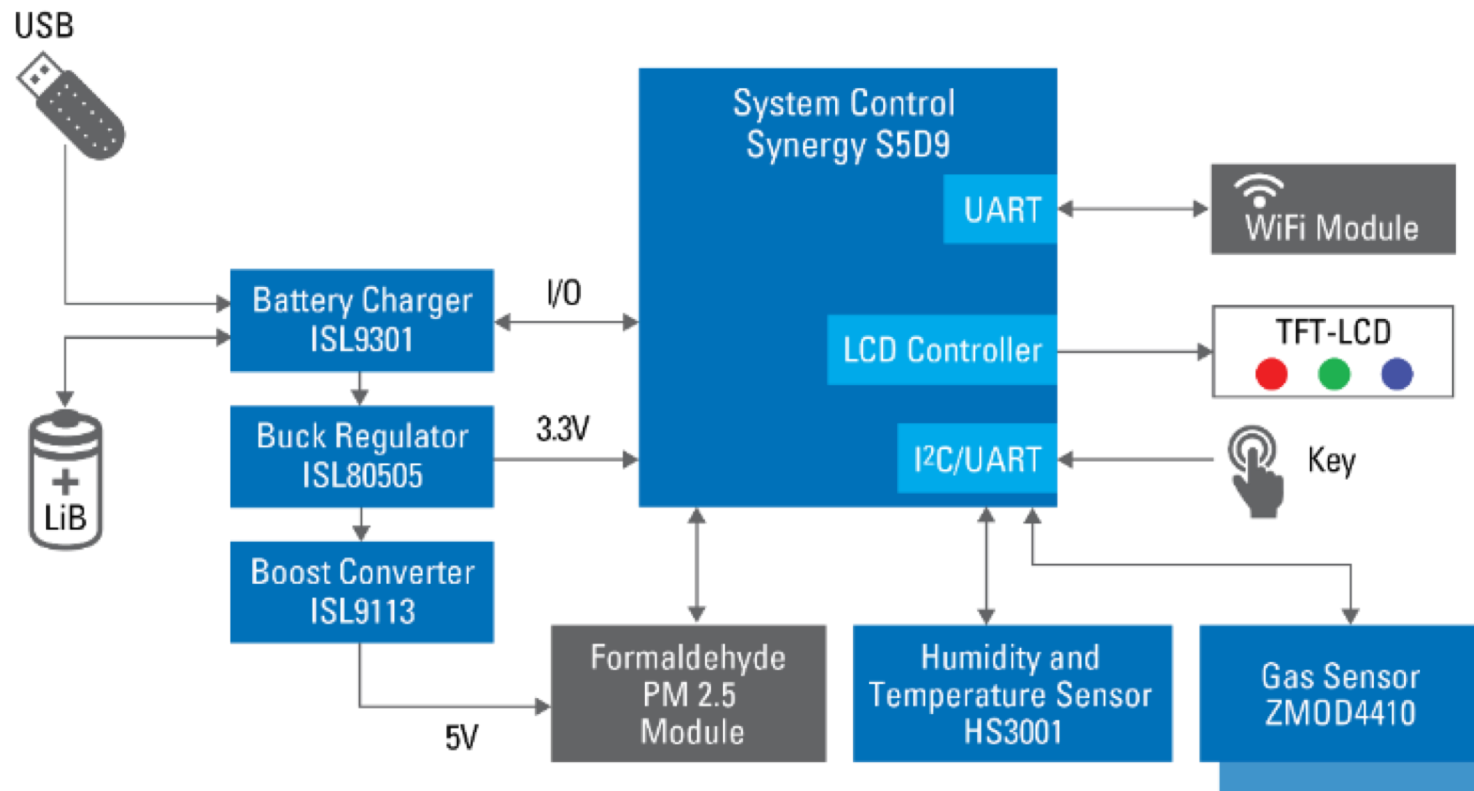
New elements can be added by the customer through the Pmod option

CN069 - ABY

Back to Directory

BIG IDEAS FOR EVERY SPACE

RENESAS

AIR QUALITY MONITOR (PM2.5) WITH SECURE CLOUD CONNECTION: SUMMARY

System benefits

- System level reference design
- Promotion kit to enable new application and faster prototype design
- Good for lead generation

Device Category	P/N	Key Features
MCU	S124: R7FS124xxxx	• Ultra low power 32-MHz Arm® Cortex®-M0+ core
MCU	S5D9 R7FS5D9xxxx	• Leading performance 120-MHz Arm® Cortex®-M4 core, up to 2-MB code flash memory, 640-KB SRAM, Graphics LCD controller, 2D Drawing Engine, capacitive touch SensingUnit, Ethernet MAC controller with IEEE 1588 PTP, USB 2.0 High-Speed, USB 2.0 Full-Speed, SDHI, Quad SPI, security and safety features, and advanced analog.
Power	ISL80505	• 500mA output current and output voltage can be programmed from 0.8V to 5.5V. (TJ= -40˚ C to +125˚ C)
Power	ISL9301	• The ISL9301 is a fully integrated high input voltage single-cell Li-ion battery charger with power path management function
Power	ISL9113	• Low input voltage and high efficiency synchronous boost converter with 1.3A switch
Analog	HS3001	• Silicon-carbide capacitive sensing element • Excellent stability against aging, temperature sensor accuracy of ±0.2˚ C. • RH accuracy: ±1.5%RH, typical (HS3001, 10 to 90%RH, 25˚ C)
Sensor	ZMOD4410	• Indoor air quality sensor -- high sensitivity and long term stability

Back to Directory
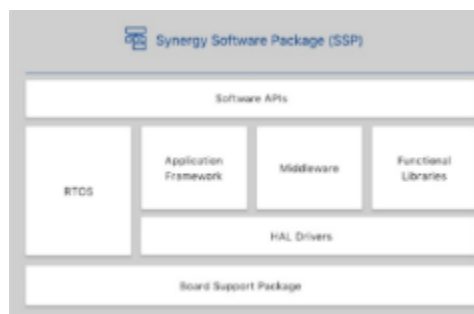
BIG IDEAS FOR EVERY SPACE

RENESAS

S124: S124 MCU GROUP

Ultra-low power 32-MHz Arm® Cortex®-M0+ microcontroller

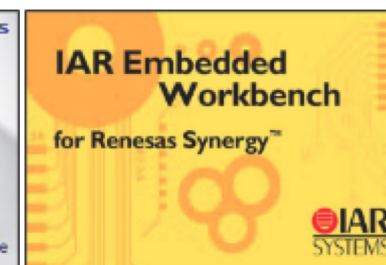| Features	Benefits	Applications
• 128-KB code flash memory • 16-KB SRAM • Capacitive Touch Sensing Unit (CTSU) • 14-bit A/D Converter (ADC14) • 12-bit D/A Converter (DAC12) • Security features	• Full access to the Synergy Software Package (SSP), which includes a commercial grade RTOS, middleware, frameworks, HAL drivers and the accompanying board support packages • Fully integrated and tested software with no licensing, royalties or maintenance fees • Unlimited usage for any Synergy device • Hardware and software scalability: Pin compatibility across packages and feature compatibility • All tech support for hardware and software done through Renesas	• Uniquely suited for battery-operated sensing and control applications • Simple system control MCU • Debugger MCU • Connection MCU • IoT sensor and node MCU

Typical application and key performances

Fully integrated Promotion Kits

Fully tested SSP and library for your use

Full support for either IDE, your choice

Back to Directory

BIG IDEAS FOR EVERY SPACE RENESAS

S5D9: HIGH PERFORMANCE ARM® CORTEX®-M4F MCU

High integration including Ethernet, USBHS, LCD controller, capacitive touch

| Features	Benefits	Applications
• High performance 40nm Arm® Cortex®-M4F cores • Up to 2MB flash / 640KB SRAM • High integration including Ethernet, USBHS, LCD controller, capacitive touch • Secure Crypto engine: 128-Bit Unique ID, TRNG, AES, 3DES, ECC/RSA/DSA, SHA &GHASH (Built-in hardware) • Built-in Safety: ECC in SRAM, Flash area protection, IWDT plus more • Comprehensive tools and support	• Full access to the Synergy Software Package (SSP), which includes a commercial grade RTOS, middleware, frameworks, HAL drivers and the accompanying board support packages • Fully integrated and tested software with no licensing, royalties or maintenance fees • Unlimited usage for any Synergy device • Hardware and software scalability: Pin compatibility across packages and feature compatibility • All tech support for hardware and software done through Renesas	• Graphical HMI • Connectivity hub • Medical instrumentation • Motor & position control • Security gateway/peripheral • Building automation • Industrial automation

Typical application and key performances
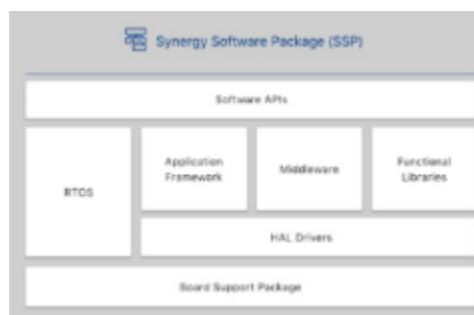
Fully integrated Promotion Kits

Fully tested SSP and library for your use

Full support for either IDE, your choice

Back to Directory

BIG IDEAS FOR EVERY SPACE RENESAS
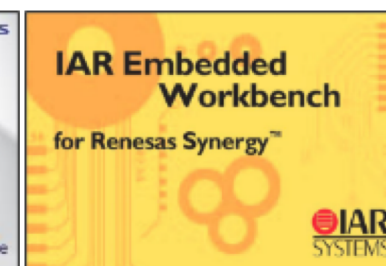
ISL80505: SINGLE OUTPUT LOW DROPOUT REGULATOR

High performance 500mA LDO

| Features	Benefits	Applications
• ±1.8% VOUT accuracy guaranteed over line, load, and TJ = -40°C to +125°C • Very low 45mV dropout voltage at VOUT = 2.5V • Stable with a 4.7µF output ceramic capacitor • Very fast transient response • Programmable output soft-start time • Excellent PSRR over wide frequency range • Current limit protection • Thermal shutdown function	• A submicron BiCMOS process is utilized for this product family to deliver the best in class analog performance and overall value • State-of-the-art internal compensation achieves a very fast load transient response and excellent PSRR	• Noise sensitive instrumentation systems • Post regulation of switched mode power supplies • Industrial systems • Medical equipment • Telecommunications and networking equipment • Servers • Hard disk drives (HD/HDD)

## Typical application and key performances

Typical application circuit

Pinout
8LD QFN

PSRR

BIG IDEAS FOR EVERY SPACE   RENESAS
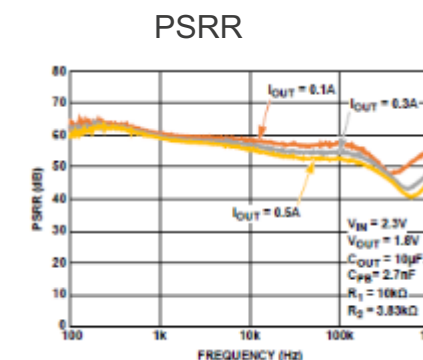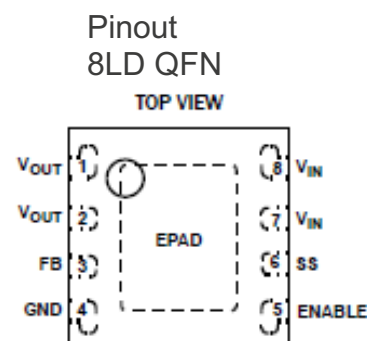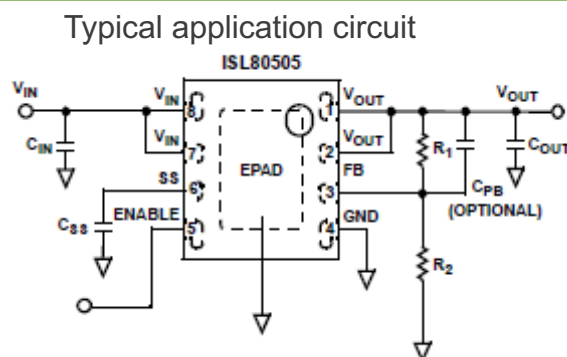
ISL9301: CHARGER FOR SINGLE-SELL LI-ION/POLYMER BATTERIES

High input voltage charger with power path management

| Features	Benefits	Applications
• Complete charger for single-cell Li-ion/polymer batteries • Power path management optimizes charge and system currents • Intelligent timeout interval based on actual charge current • Integrated disconnect switch to disconnect the battery	• The ISL9301 uses separate power paths to supply the system load and charge the battery. This feature allows the system to immediately operate with a completely discharged battery. This feature also allows the charge to terminate when the battery is full while continuing to supply the system with the input source, thus minimizing unnecessary charge/discharge cycles and improving the battery life. • Two indication pins (PPRand CHG) allow simple interface to a microprocessor or LEDs.	• Mobile phones • Bluetooth® devices • Stand-alone chargers • Other handheld devices

Typical application and key performances
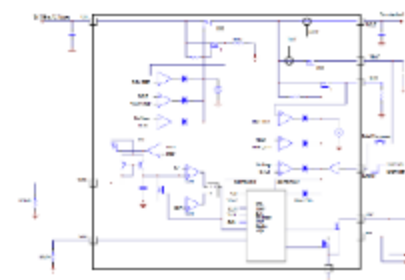
Typical application circuit

Pinout

Block Diagram

Back to Directory

BIG IDEAS FOR EVERY SPACE

RENESAS
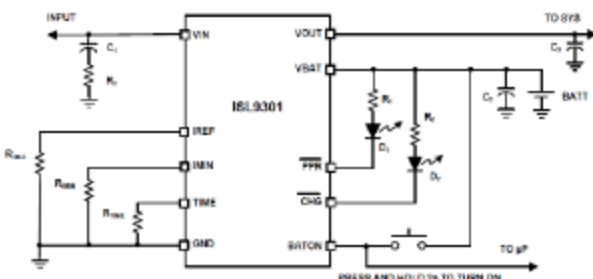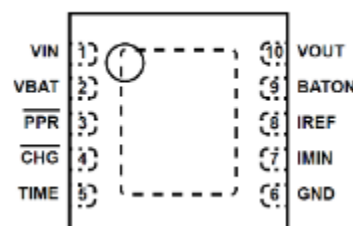
ISL9113: SYNCHRONOUS BOOST CONVERTER

Low input voltage and high efficiency synchronous boost converter with 1.3A switch

| Features	Benefits	Applications
• Up to 95% efficiency at typical operating conditions • Input voltage range: 0.8V to 4.7V • Output current: Up to 500mA (VBAT = 3.0V, VOUT = 5.0V) • Low quiescent current: 20µA (typical) • Logic control shutdown (IQ < 1µA) • Fixed 5V, 5.1V or adjustable output	• The ISL9113 provides a power supply solution for devices powered by three-cell alkaline, NiCd, NiMH or one-cell Li-Ion/Li-Polymer batteries. It offers either a fixed 5V or an adjustable output option for USB-OTG or portable HDMI applications. The device is guaranteed to supply 500mA from a 3V input and 5V output and has a typical 1.3A peak current limit. High 1.8MHz switching frequency allows for the use of tiny, low-profile inductors and ceramic capacitors to minimize the size of the overall solution.	• Products including portable HDMI and USB-OTG • Smartphones • Tablet and mobile internet devices

Typical application and key performances

Typical application circuit

Pinout

Block Diagram

Back to Directory

BIG IDEAS FOR EVERY SPACE
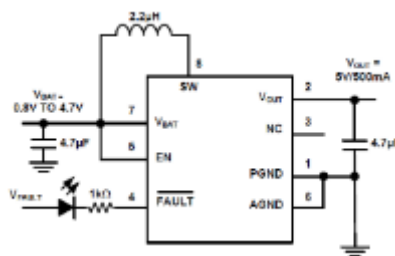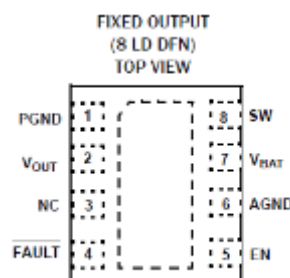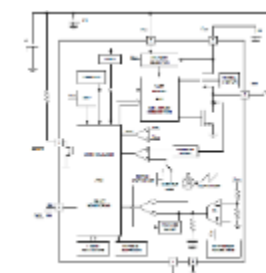
HS300X: RELATIVE HUMIDITY AND TEMPERATURE SENSOR

*Humidity sensor with industry-leading accuracy, response time, and excellent stability*

| Features	Benefits	Applications
• ±1.5% relative humidity accuracy (HS3001) • Fast RH response time (Typical 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 ±0.2° C (HS3001, HS3002) • Extended supply voltage, 1.8V to 5.5V	• 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	• Climate control systems • Home appliances • Weather stations • Industrial automation • Process controls and monitoring • Automotive climate control • Medical equipment

Typical application and key performances

Typical application circuit
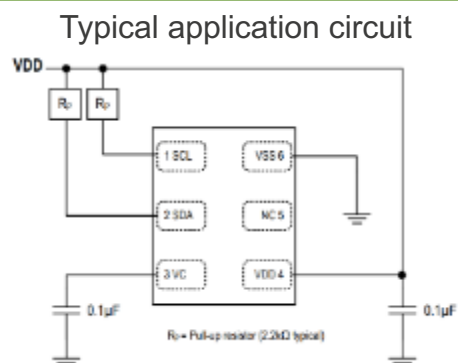
HS3001 RH Accuracy Tolerance at 25°C
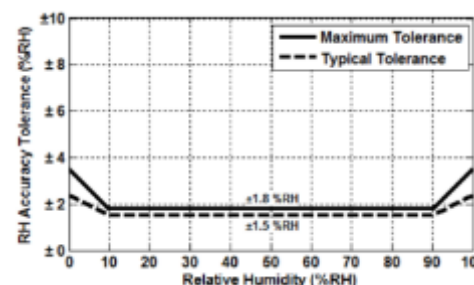
HS3001 Temperature Sensor Accuracy Tolerance

Back to Directory

BIG IDEAS FOR EVERY SPACE RENESAS
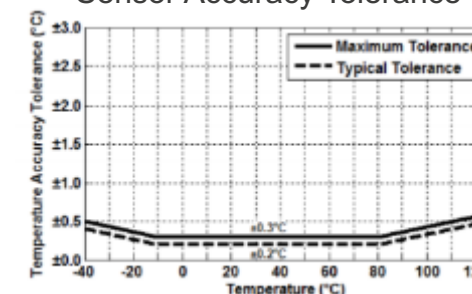
ZMOD4410: GAS SENSOR MODULE

Indoor air quality sensor platform

| Features	Benefits	Applications
• Proven MOx Material • Electrical and gas calibrated • Flexible architecture with available GUI and firmware for different operation modes • Correlates German Committee on Indoor Guidelines (UBA study) • Miniature 3 x 3 x 0.7mm • Power consumption of <1 mW in Low Power operation • Digital (I^{2}C) output • Siloxane resistant	• Leading high sensitivity and long term stability • Calibrated sensor allows easy and fast system integration • Enables Customer to release product families via SW changes • International accepted definition of Indoor Air Quality (IAQ) • Calculation of estimated Carbon Dioxide (eCO2) • Reduced end product size	• HVAC systems • Air purifiers • Smart thermostats • Smart speakers • Bathroom fans • Kitchen exhaust hoods • Smart outlets & receptacles

Best Performance in Stability and Sensitivity
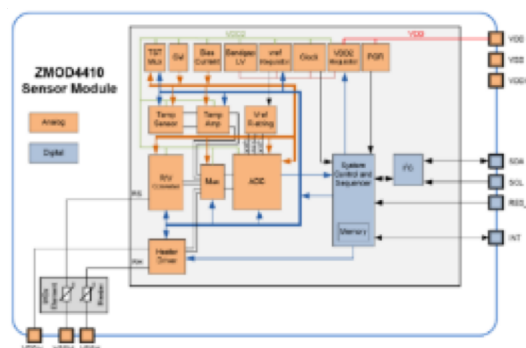
IDT IAQ Rating	Reference Level	Air Information	TVOC (mg/m³)	Air Quality
≤ 1.99	Level 1	Clean Hygienic Air (Target value)	< 0.3	Very Good
2.00 – 2.99	Level 2	Good Air Quality (if no threshold value is exceeded)	0.3 – 1.0	Good
3.00 – 3.99	Level 3	Noticeable Comfort Concerns (Not recommended for exposure > 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

Back to Directory

BIG IDEAS FOR EVERY SPACE **RENESAS**