

A close-up photograph of a green printed circuit board (PCB) populated with several black integrated circuits (chips). The word "RENESAS" is printed in white, stylized capital letters across the center of the PCB. The chips have gold wire bonds and some have markings like "FP" and "011".

US076 Furnace Control

June 2020

Furnace Control

- **Overview**

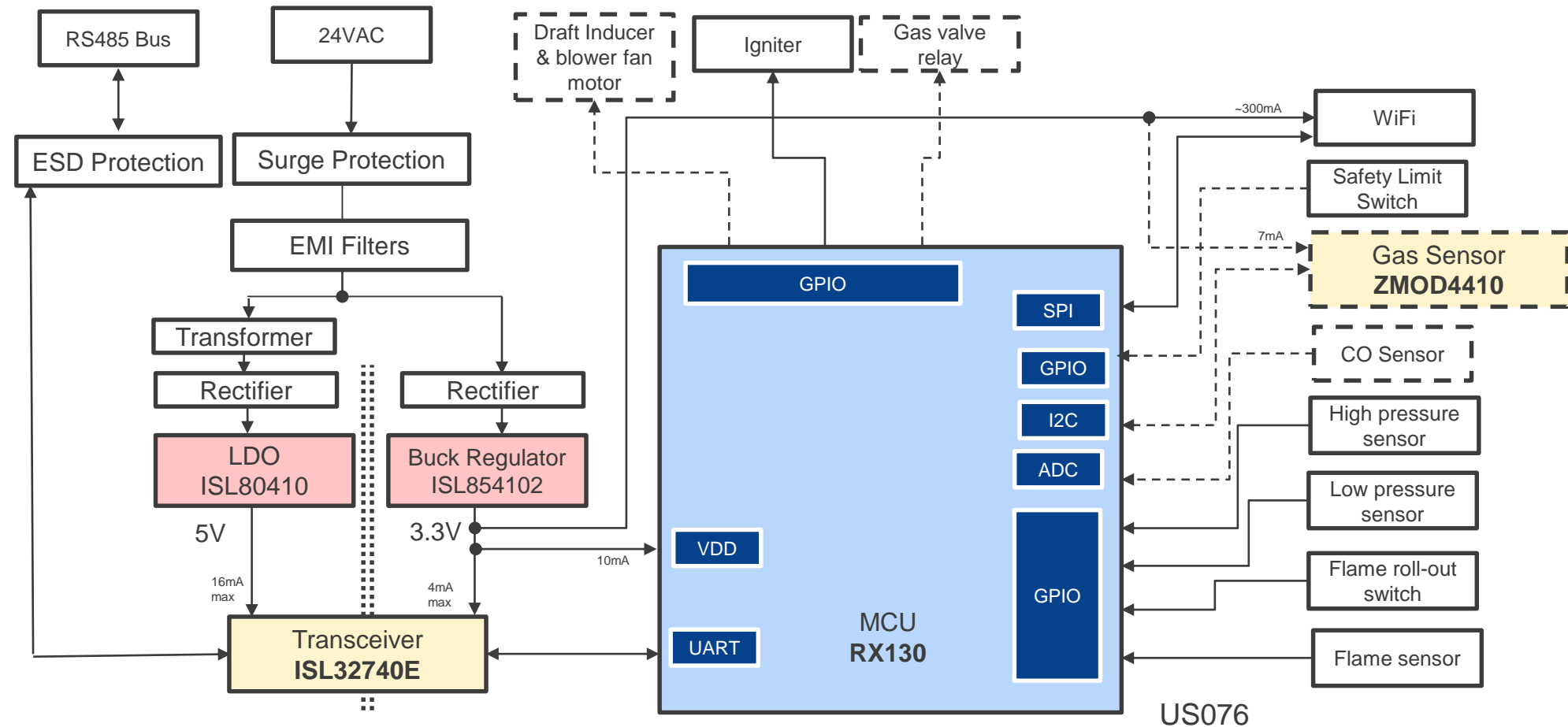
A furnace is a device used to control high temperature heating. A residential furnace is a device that heats air and passes it (via ductwork) to the space where the air is being heated. In this reference design, Renesas provides solutions for residential furnaces that are equipped with a moving blower to move air via the duct system. The reference design also includes an air quality sensor that can monitor conditions in rooms or ducts.

- **System Benefits**

- High integration 32-bit microcontroller (MCU) with 12-bit A/D for better precision and compact control
- Features a galvanically isolated high-speed differential bus transceiver, which is designed for bidirectional data communication on balanced transmission lines
- Indoor air quality sensor platform for total volatile organic compounds (TVOC) and monitoring indoor air quality (IAQ)

US076

Furnace Control



Furnace Control

Device Category	P/N	Key Features
MCU	RX130	Cost optimized high performance RX microcontroller with enhanced touch key function and 5V operation support
Power	ISL80410	40V, Low Quiescent Current, 150mA Linear Regulator
	ISL854102	Wide VIN 1.2A Synchronous Buck Regulator
Analog	ISL32740E	Isolated 40Mbps RS-485 PROFIBUS Transceiver
	ZMOD4410	Sensor for detecting total volatile organic compounds (TVOC) and monitoring indoor air quality (IAQ)

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RX130 – 32-bit MCU with Up to 36 Touch Key Channels

Cost Optimized and High Performance RX MCU 5V Operation Support

Cost Optimized and High Performance

- Max. operating frequency: 32MHz
- Accumulator support DSP instructions
- Up to 512 Kbytes code flash and 48 Kbytes SRAM, no wait states
- Incorporating external components into MCU like POR/LVD, RTC, E2 data flash, temperature sensor and port with 5V support

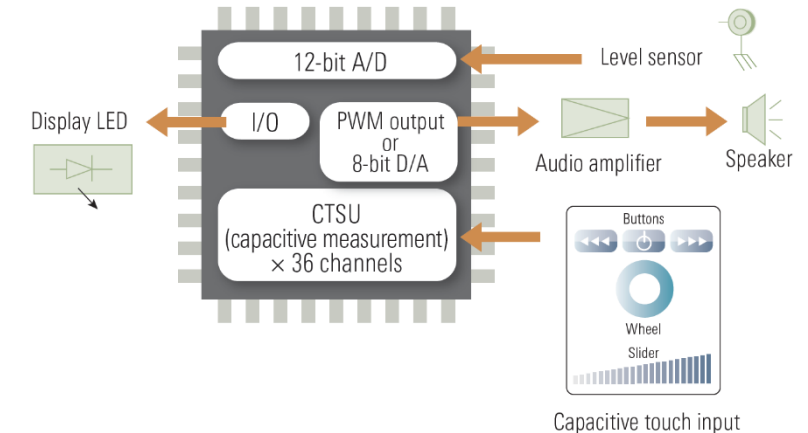
Capacitive Touch Sensors with Sensitivity and Noise Tolerance

- Up to 36 capacitive touch sensors (CTSUs) channels
- Improved noise immunity, sensitivity and water resistance
- Support wet environment, support a variety of materials like wood, acrylic, glass or stone
- Operation possible when wearing gloves

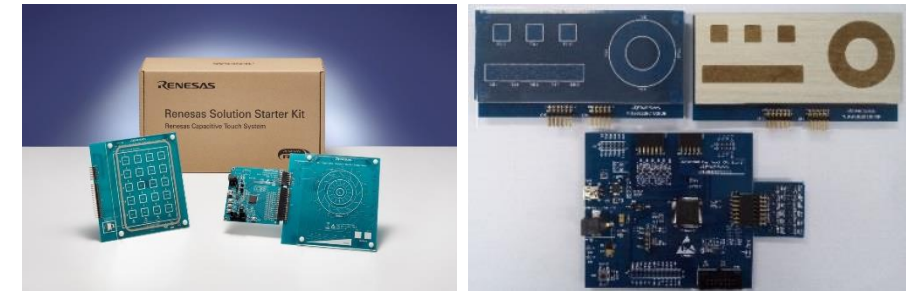
Rich Peripheral Functions and Low Power Design

- 3 low power consumption modes
- Low power timer (LPT) that operates during the software standby states
- Supply current: high-speed operating mode: 96 μ A/MHz software standby mode: 0.37 μ A
- Up to 6 communication functions, up to 12 extended-function timers, 12-bit ADC, 8-bit DAC, comparator, remote control signal reception

Part #	ROM (Kbytes)	RAM (Kbytes)	E2 DataFlash (Kbytes)	Package
R5F51308AGFP	512	48	8	LFQFP100/0.50
R5F51307AGFN	384	48	8	LFQFP80/0.50
R5F51306BGFM	256	32	8	LFQFP64/0.50
R5F51305AGFL	128	16	8	LFQFP48/0.50
R5F51303AGNE	64	10	8	HWQFN48/0.50



System Block



Evaluation Kits

ISL80410 – High Voltage Adjustable V_{OUT} LDO

Low Quiescent Current and 40V/150mA Output

High Performance and Wide Input Range

- Wide V_{IN} range of 6V to 40V
- Adjustable output voltage from 2.5V to 12V
- Ensured 150mA output current
- $\pm 1\%$ accurate voltage reference (over temperature, load)

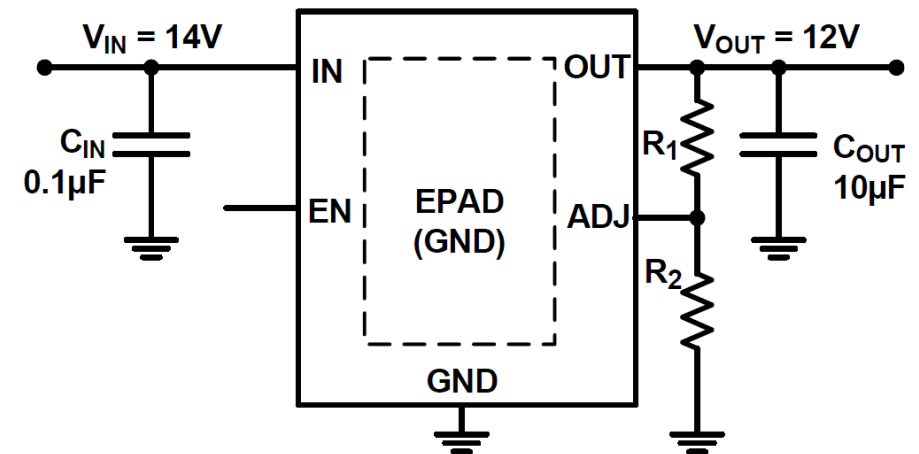
High Efficiency

- Ultra low 18 μ A typical quiescent current
- Low 2 μ A of typical shutdown current
- Low dropout voltage of 295mV at 150mA
- Low 26 μ V_{RMS} noise

Excellent Safety

- 40V tolerant logic level (TTL/CMOS) enable input
- 5kV ESD HBM rated
- Thermal shutdown and current limit protection

Part #	V_{IN} Range(V)	V_{OUT} Range(V)	Enable Pin	Package
ISL80410IBEZ	6 to 40	ADJ	Yes	8 Ld EPSOIC
ISL80410IBEZ-T	6 to 40	ADJ	Yes	8 Ld EPSOIC
ISL80410IBEZ-T7A	6 to 40	ADJ	Yes	8 Ld EPSOIC



Typical Application Circuit



ISL80410EVAL1Z Evaluation Board

ISL854102 – Wide VIN 1.2A Synchronous Buck Regulator

Support 3V-40V Input Voltage Range

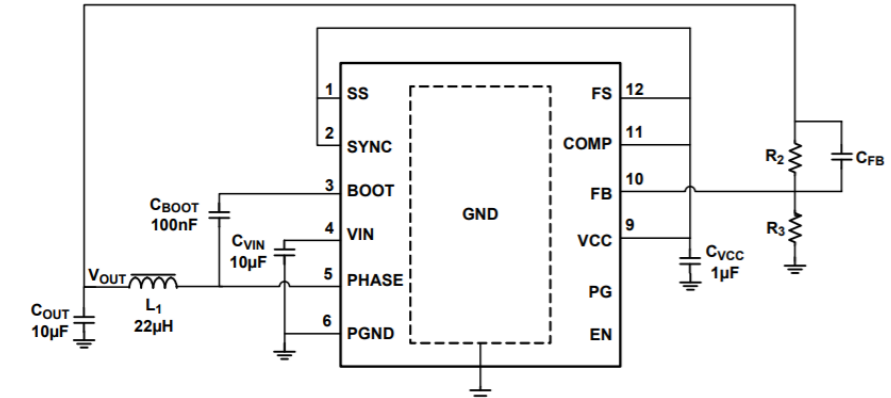
Wide Working Range and Space-Limited Applications

- Power input voltage range from 3V to 40V
- Continuous Output current Up to 1.2A
- Industrial Temperature range: -40to125C
- Minimal external components required

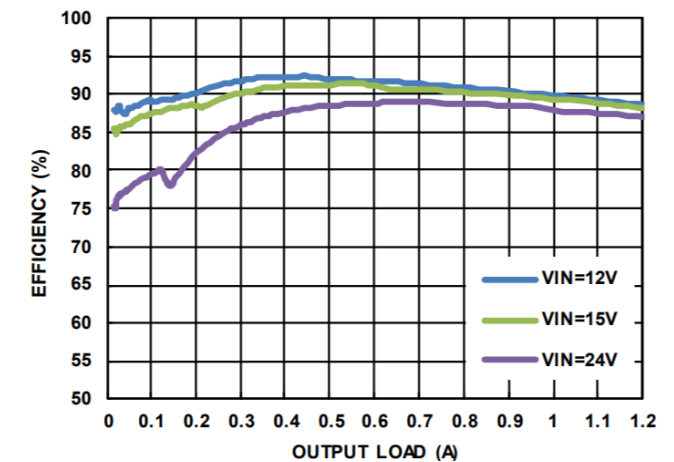
High Efficiency and Performance

- Synchronous operation for high efficiency
- No compensation required
- Integrated High-side and Low-side NMOS devices
- Selectable PFM or forced PWM mode at light loads
- Internal fixed (500kHz) or adjustable switching frequency 300kHz to 2MHz

Part #	Count	Temp.(°C)	Package
ISL854102FRZ	750 (Tray)	-40 to 125	12 Ld DFN 4x3
ISL854102FRZ-T	6K (T&R)	-40 to 125	12 Ld DFN 4x3
ISL854102FRZ-T7A	250 (T&R)	-40 to 125	12 Ld DFN 4x3



Typical Application Circuit



Efficiency vs Load, PFM,
V_{OUT} = 5V

ISL32740E – Isolated High-speed RS-485 PROFIBUS Transceiver

3-5V Isolated 40Mbps RS-485 PROFIBUS Transceiver

High Speed

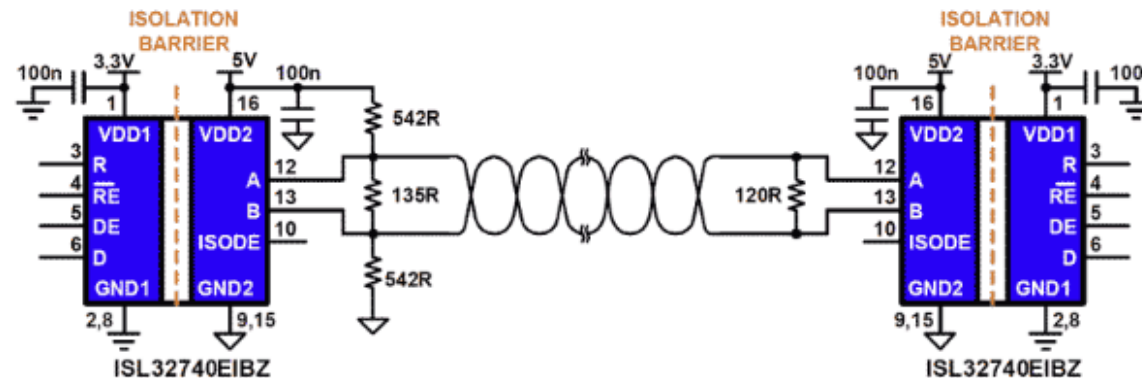
- 40Mbps data rate

High Performance and Reliability

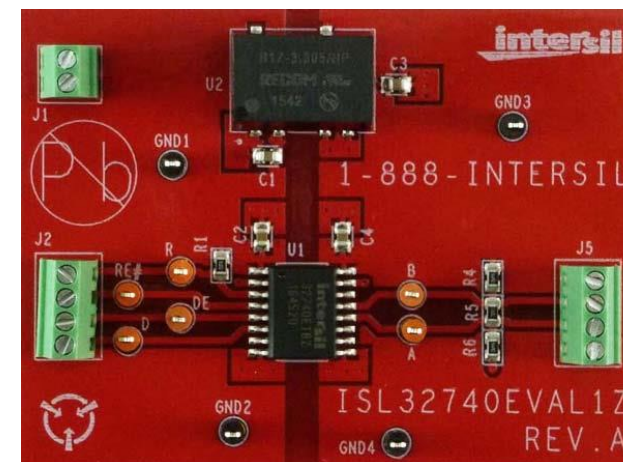
- 2.5kV_{RMS} isolation/600V_{RMS} working voltage
- 3V to 5V Power Supply
- 20ns propagation delay/5ns pulse skew
- 16.5kV ESD bus-pin protection
- 50kV/μs (typical), 30kV/μs (minimum) common-mode transient immunity
- Thermal shutdown protection

Industry Standard

- UL 1577 recognized
- VDE V0884-10 certified
- PROFIBUS Compliant
- Meets or exceeds ANSI RS-485 and
- ISO 8482:1987(E)



Typical Operating Circuits



ISL32740EVAL1Z Evaluation Board

Part #	HALF/FULL DUPLEX	Temp. Rang	Data Rate Mbps	Isolation Rating	Package
ISL32740EIAZ-T	Half	-40 to +85	40	2.5kV	16 Ld QSOP
ISL32740EIBZ-T	Half	-40 to +85	40	2.5kV	16 Ld SOICW

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

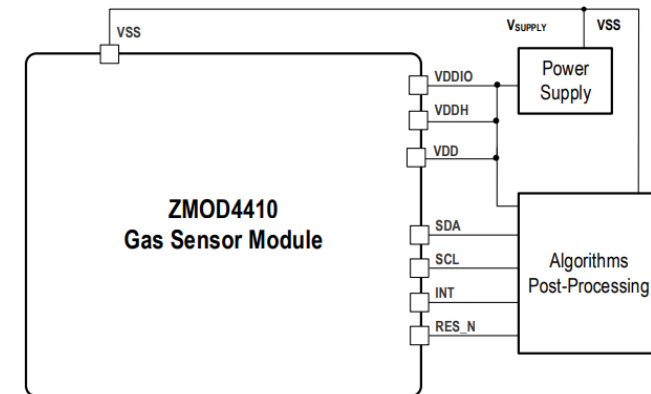
Low Power

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

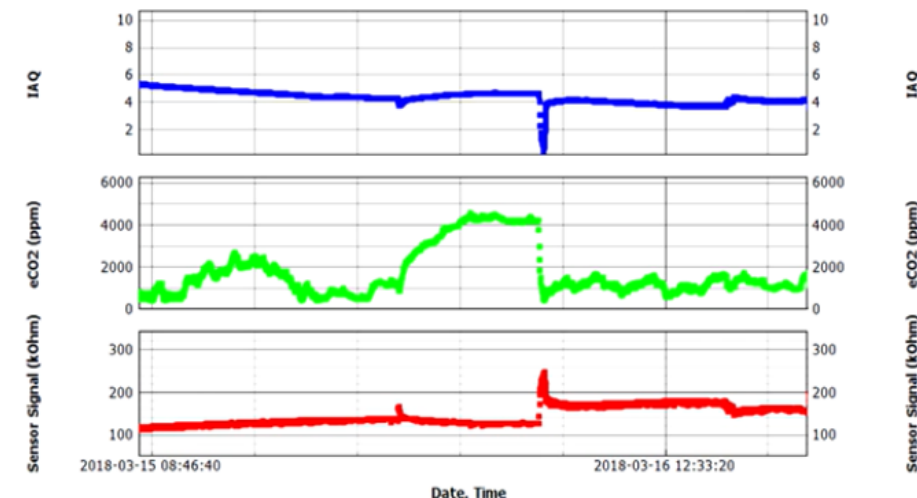
Easy to Use

- 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

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