

CN158 Kitchen Range Hood with 2D Touch Sensor

October 2019

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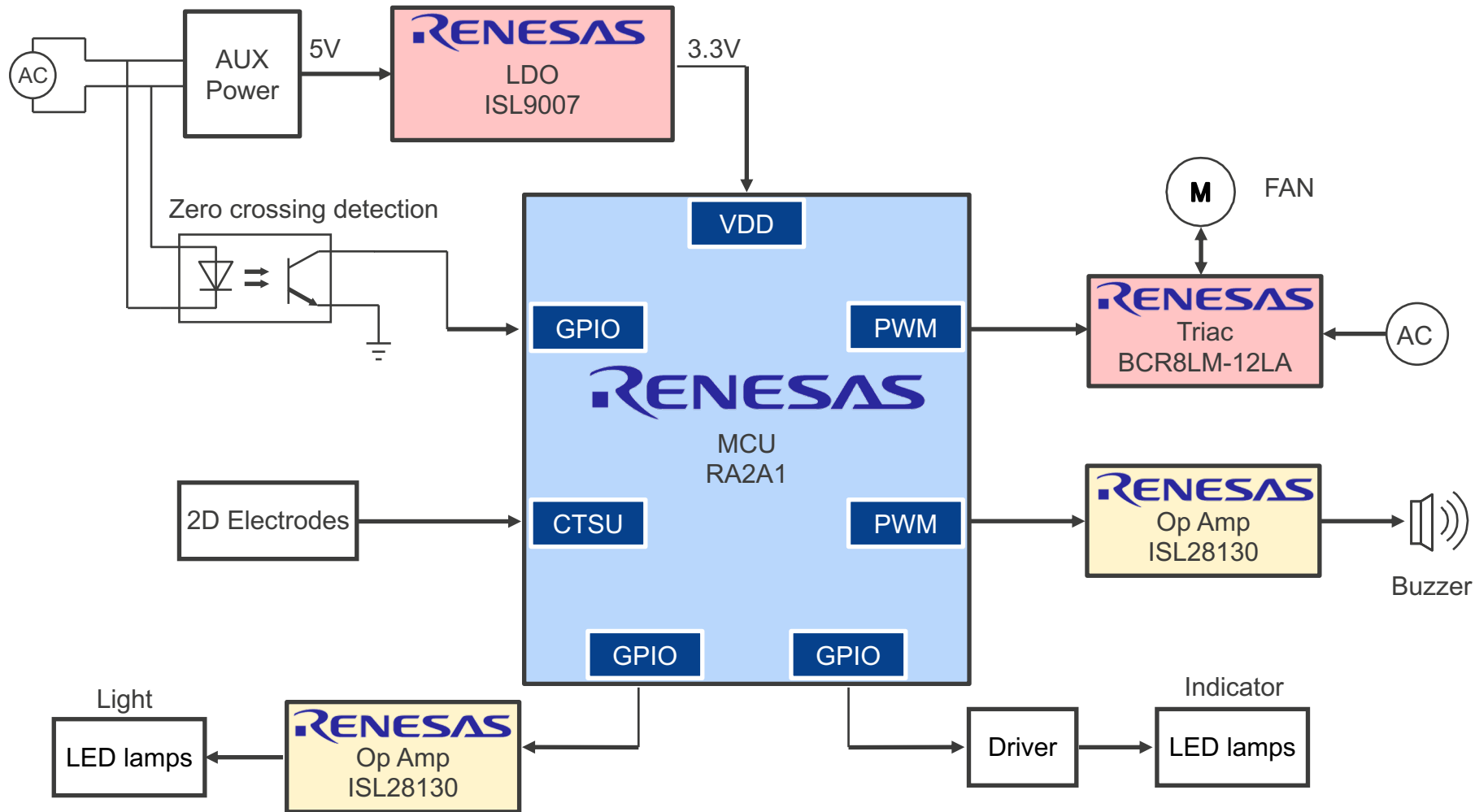
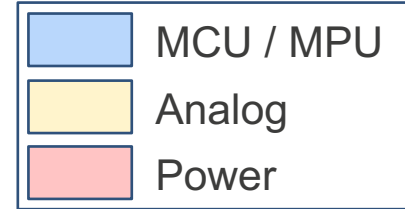
■ Overview

This design demonstrates a kitchen range hood that utilizes Renesas' capacitive touch sensing technology (CTSU) for touchless control. The RA2 MCU series provides a complete solution in a single chip thanks to the integrated 16-bit SAR ADC, 24-bit sigma-delta ADC, touch control, and lower power performance. Additionally, the combination of high performance power and analog systems from Renesas' LDOs, op amps and triacs can be utilized in other home appliances (washing machines, IH cooking heaters) that require touch panel functionality.

■ System Benefits

- Built-in high-touch sensitivity CTSU to support touch key and 2D gesture input. Improved noise immunity, sensitivity and water resistance is an ideal match for consumer electronics products that are used in wet environments, such as the kitchen or bathroom.
- High-performance LDO, op amps and triacs provide a full solution.

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Block Diagram #CN158
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Device Category	P/N	Key Features
MCU	RA2A1	Ultra-Low Power 48-MHz Arm® Cortex®-M23 Core with highly integrated, high-accuracy analog capabilities and offers complete analog solution for signal conditioning and measurement.
Analog	ISL28130	The ISL28130 is a single micropower, low offset drift operational amplifiers that are optimized for single and dual supply operation from 1.8V to 5.5V and $\pm 0.9V$ to $\pm 2.75V$.
Power	BCR8LM-12LA	Renesas triacs, which have a guaranteed junction temperature (Tj) of 150°C and are provided in a variety of packages, are ideal for white goods and home appliances.
	ISL9007	High performance LDO capable of sourcing 400mA current. It has a low standby current and high-PSRR and is stable with output capacitance of 1 μ F to 10 μ F with ESR of up to 200m Ω .

RA2A1 – Ultra-Low Power 48-MHz Arm® Cortex®-M23 Core

Complete Analog Solution for Signal Conditioning and Measurement

High Performance

- 48MHz Arm® Cortex®-M23 CPU

Highly Integrated, High-Accuracy Analog Capabilities

- OPAMP x3
- 24-Bit S/D ADC (10 ch.) /16-Bit SAR ADC (17 ch.)
- 12-Bit DAC (1 ch.)/8-Bit DAC (2 ch.)
- Temperature Sensor (TSN)
- High-Speed Comparator x2
- Low-Power Comparator x2

Communication Interfaces

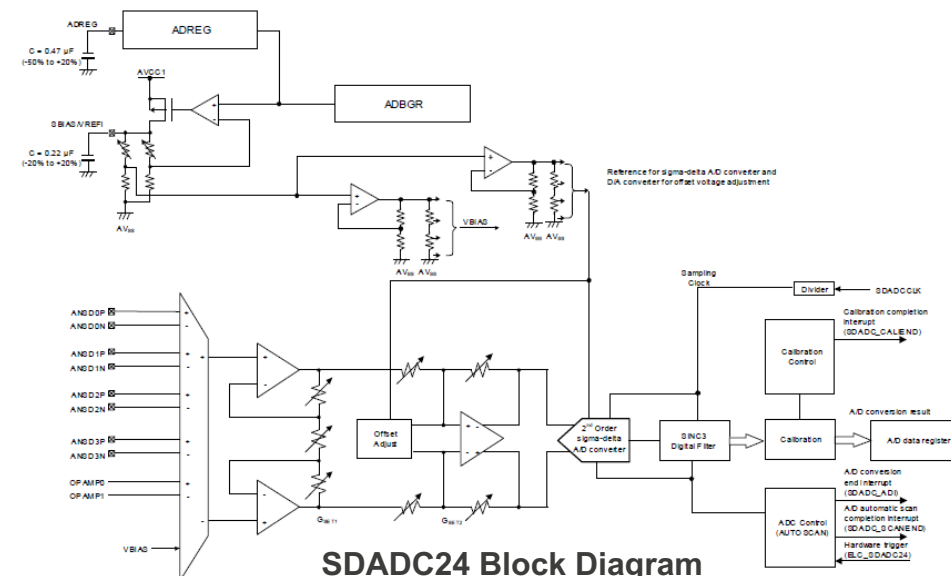
- USB 2.0 (Full Speed)
- CAN
- SCI x3/SPIx2/IICx2

HMI Interface

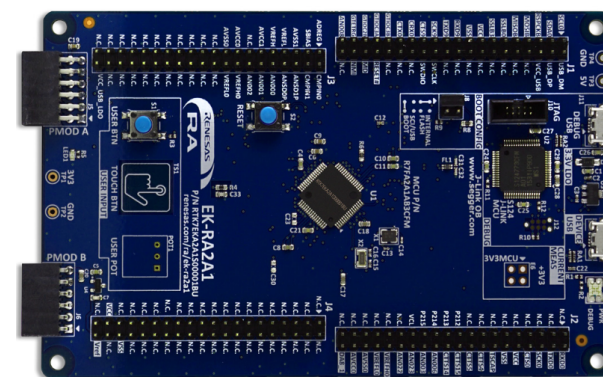
- Capacitive Touch Sensing Unit (26 ch.)

Wide Voltage and Low Power Consumption

- Wide operating voltage range of 1.6V to 5.5V
- Various Low Power Modes



SDADC24 Block Diagram



RTK7EKA2A1S00001BU

Part #	Flash Memory	RAM	Temp	Package
R7FA2A1AB3CFJ	256KB	32KB	40 ~ 105°C	32 LQFP
R7FA2A1AB3CFM	256KB	32KB	40 ~ 105°C	64 LQFP

ISL28130 – Low Power/Drift RRIO Operational Amplifier

Low Power Operational Amplifier for Battery-Powered Devices

Low Offset

- Low input offset voltage: 40 μ V, Max
- Low offset drift: 150nV/°C, Max.
- Input bias current: 250 pA, Max.

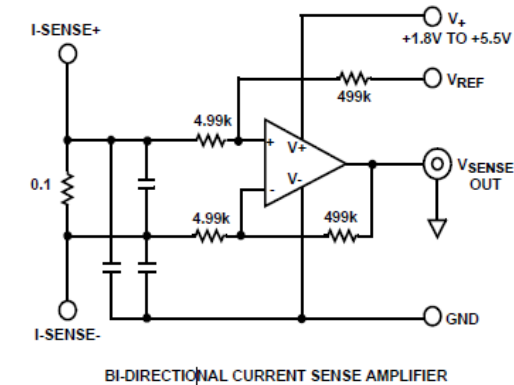
Good Dynamic Performance

- Low noise (0.01Hz to 10Hz): 1.1 μ VP-P, Typ.
- Rail-to-rail input and output

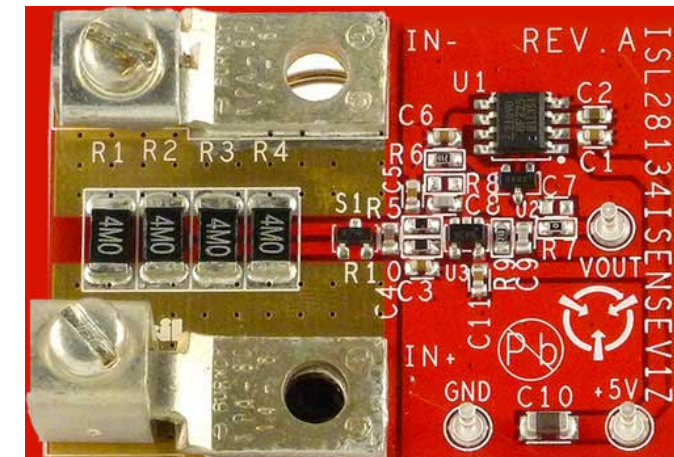
Low Power Design

- Quiescent current (per amplifier): 20 μ A, Typ.
- Single supply range: +1.8V to +5.5V
- Dual supply range: \pm 0.9V to \pm 2.75V

Part #	Temp.	Package
ISL28130FHZ	-40 - 125°C	5 Ld SOT-23
ISL28130CEZ	0 - 70°C	5 Ld SC-70
ISL28230CUZ	0 - 70°C	8 Ld MSOP
ISL28230FRZ	-40 - 125°C	8 Ld 3x3 DFN
ISL28430CBZ	0 - 70°C	14 Ld SOIC
ISL28430FVZ	-40 - 125°C	14 Ld TSSOP



Typical Operating Circuit



ISL2813xxSENSEV1Z Precision Current Sense Op Amp

ISL9007 – V_{IN} 2.3V to 6.5V/400mA LDO

High Current LDO with Low I_Q and High PSRR

High Performance

- Excellent load regulation: <0.1% voltage change across full range of load current
- Very high PSRR: 75dB @ 1kHz

Wide Input Voltage and Stable Output Voltage

- $\pm 1.8\%$ V_{OUT} accuracy over all operating conditions
- Wide input voltage capability: 2.3V to 6.5V
- Low output noise: typically 30 μ VRMS @ 100 μ A (2.5V)

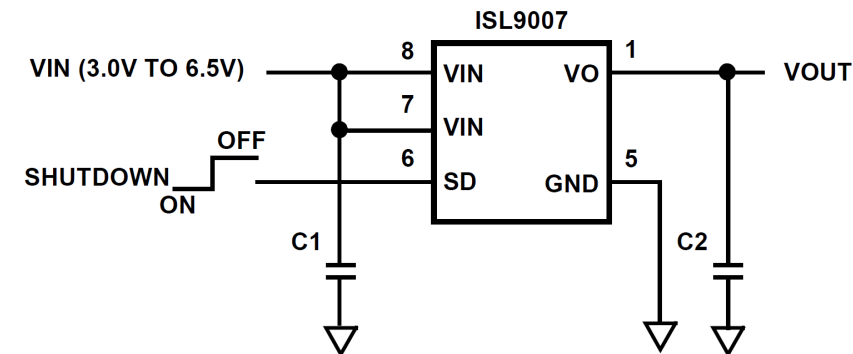
High Efficiency

- Very low quiescent current: 50 μ A
- Low dropout voltage: typically 200mV @ 300mA
- Low output noise: typically 30 μ VRMS @ 100 μ A (2.5V)
- Shutdown pin turns off LDO for 1 μ A (max) standby current

Excellent Safety

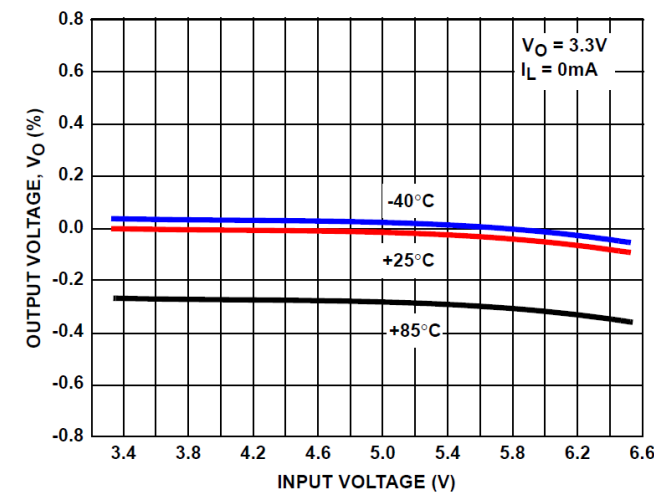
- Current limit and overheat protection
- Soft-start to limit input current surge during enable

Part #	Vout (V)	Temp.(°C)	Package
ISL9007IUNZ	3.3	-40 to +85	8Ld MSOP
ISL9007IUKZ	2.85	-40 to +85	8Ld MSOP
ISL9007IUJZ	2.8	-40 to +85	8Ld MSOP
ISL9007IUFZ	2.5	-40 to +85	8Ld MSOP
ISL9007IUCZ	1.8	-40 to +85	8Ld MSOP



C₁, C₂: 1 μ F X5R CERAMIC CAPACITOR

Typical Application Circuit



Output Voltage vs Input Voltage(3.3V Output)

BCR8LM-12LA – 600V/8A Medium Power Triacs

Guaranteed Junction Temperature(Tj) of 150°C

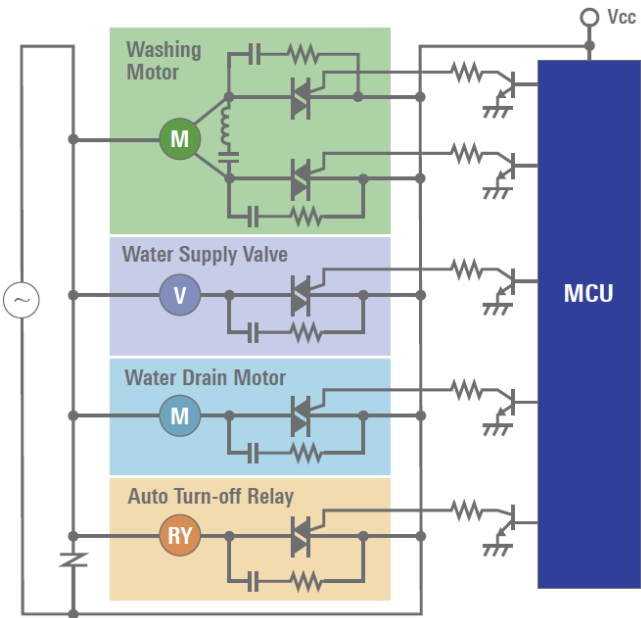
High Performance

- $I_{T(RMS)}$: 8A V_{DRM} : 600V
- $I_{FGTI}, I_{RGTI}, I_{RGT III}$: 10mA
- V_{iso} : 1800V

High Reliability

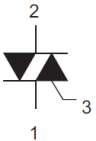
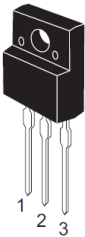
- Actual failure rate: 0.01ppm or less (long service life)
- Channel stopper provides stable voltage tolerance
- Guaranteed junction temperature(Tj) of 150°C

Part #	VDRM(V)	Peak Gate Voltage(V)	Peak Gate Current(A)	Junction Temp.(°C)	Package
BCR8LM-12LA	600	10	2	-40 to 125	TO-220FL
BCR8LM-12LA-A8	600	10	2	-40 to 125	TO-220FL



Typical Application Circuit

(Package name: TO-220FL)



- 1. T₁ Terminal
- 2. T₂ Terminal
- 3. Gate Terminal

Package and Pin Assignment

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