EU022
Carbon Monoxide (CO) Detector

October 2019

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Carbon Monoxide (CO) Detector

▪ Overview

A carbon monoxide (CO) detector is a device that detects the presence of CO gases in order to prevent carbon monoxide poisoning. CO is a colorless, tasteless, and odorless compound produced by an incomplete combustion of carbon-containing materials. It is often referred to as the "silent killer" because it is virtually undetectable by humans without using detection technology. Elevated levels of CO can be dangerous to humans, depending on the amount of gas that is present and the length of exposure. Smaller concentrations can be harmful over longer periods of time, while increasing concentrations require diminishing exposure times to be harmful.
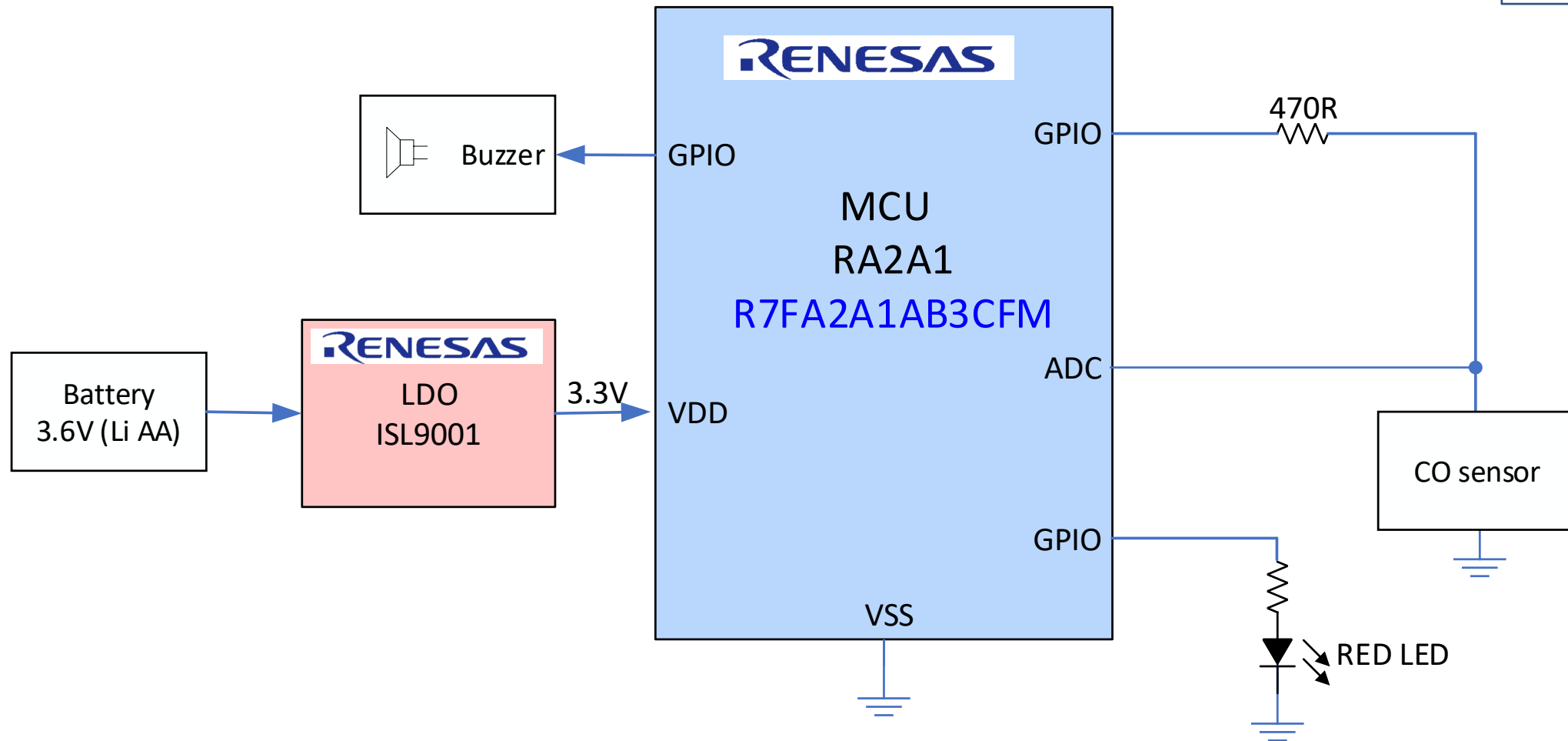
The sensor used for this design is based on an electrochemical function, as this is a type of fuel cell that is designed to produce a signal current that is precisely related to the amount of the target gas (in this case, CO) in the atmosphere.

The CO detector will measure CO levels over time and sound an alarm before dangerous levels of CO accumulate in an environment.

▪ System Benefits

- Utilizes the new family of RA Arm®-based microcontrollers
- Microcontroller contains the required amplifiers needed to level the input signals
- Very few external components needed

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Carbon Monoxide (CO) Detector

Legend:
- MCU / MPU
- Analog
- Power

Buzzer — GPIO

Battery 3.6V (Li AA) → LDO ISL9001 → 3.3V → VDD

MCU RA2A1
R7FA2A1AB3CFM

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GPIO — 470R — CO sensor

ADC — CO sensor

GPIO — RED LED

VSS

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Carbon Monoxide (CO) Detector

Device Category	P/N	Key Features
MCU	RA2A1 R7FA2A1AB3CFM	RA2 Family of Arm®-based Microcontrollers, Including Analog Amplifiers
Power	ISL9001A	300mA LDO Regulator 90dB PSSR 0.1-25µA Iq

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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
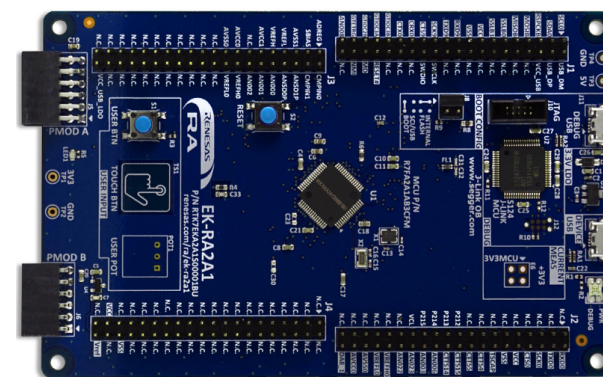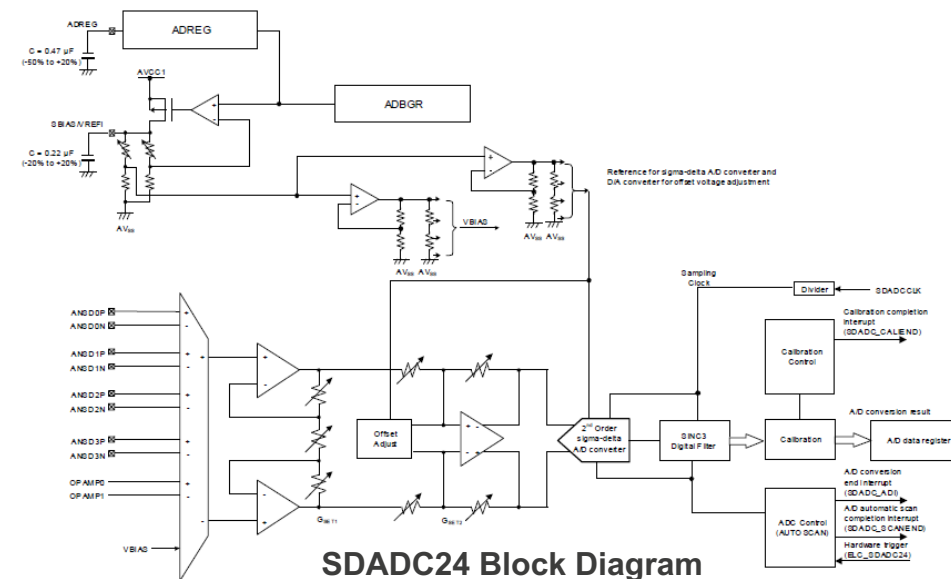- Low-Power Comparator x2

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

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

SDADC24 Block Diagram

RTK7EKA2A1S00001BU

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ISL9001A – V$_{OUT}$ 1.5V to 3.3V/300mA LDO
LDO with Low I$_{SUPPLY}$ and High PSSR

High Performance
- Excellent load regulation: <0.1% voltage change across full range of load current
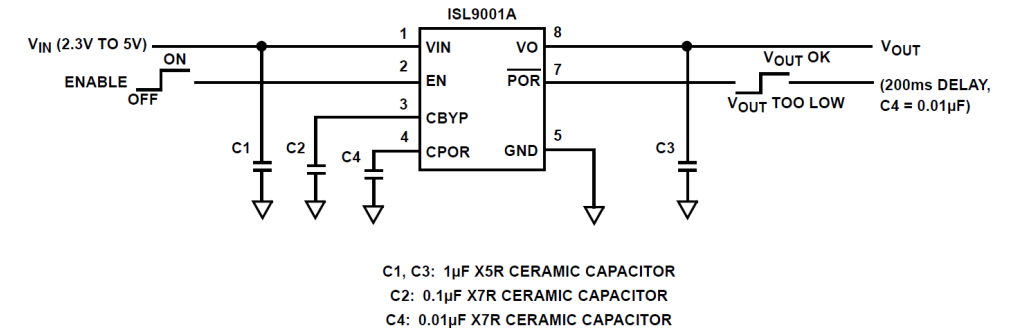- High PSRR: 90dB @ 1kHz

Stable Output Voltage
- ±1.8% V$_{OUT}$ accuracy over all operating conditions
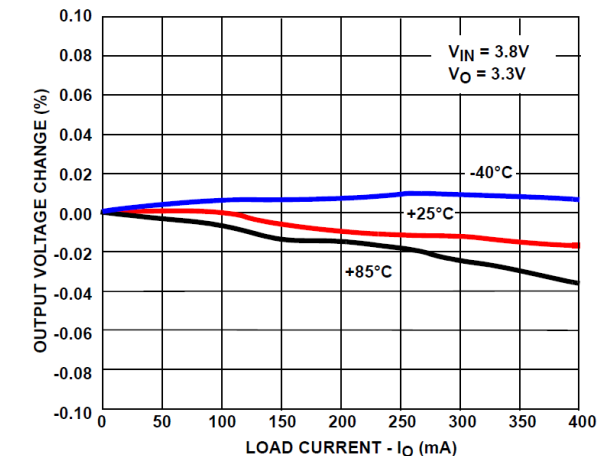- Stable with 1µF to 10µF ceramic capacitor

High Efficiency
- Extremely low quiescent current: 25µA
- Low dropout voltage: typically 200mV @ 300mA

Excellent Safety
- Current limit and overheat protection

Part #	Vout (V)	Temp.(℃)	Package
ISL9001AIRBZ-T	1.5	-40 to +85	8Ld 2x3 DFN
ISL9001AIRCZ-T	1.8	-40 to +85	8Ld 2x3 DFN
ISL9001AIRFZ-T	2.5	-40 to +85	8Ld 2x3 DFN
ISL9001AIRJZ-T	2.8	-40 to +85	8Ld 2x3 DFN
ISL9001AIRKZ-T	2.85	-40 to +85	8Ld 2x3 DFN
ISL9001AIRNZ-T	3.3	-40 to +85	8Ld 2x3 DFN

C1, C3: 1µF X5R CERAMIC CAPACITOR
C2: 0.1µF X7R CERAMIC CAPACITOR
C4: 0.01µF X7R CERAMIC CAPACITOR

Typical Application Circuit

Output Voltage Change vs Load Current

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