EU021
Smoke Detector

October 2019

Smoke Detector

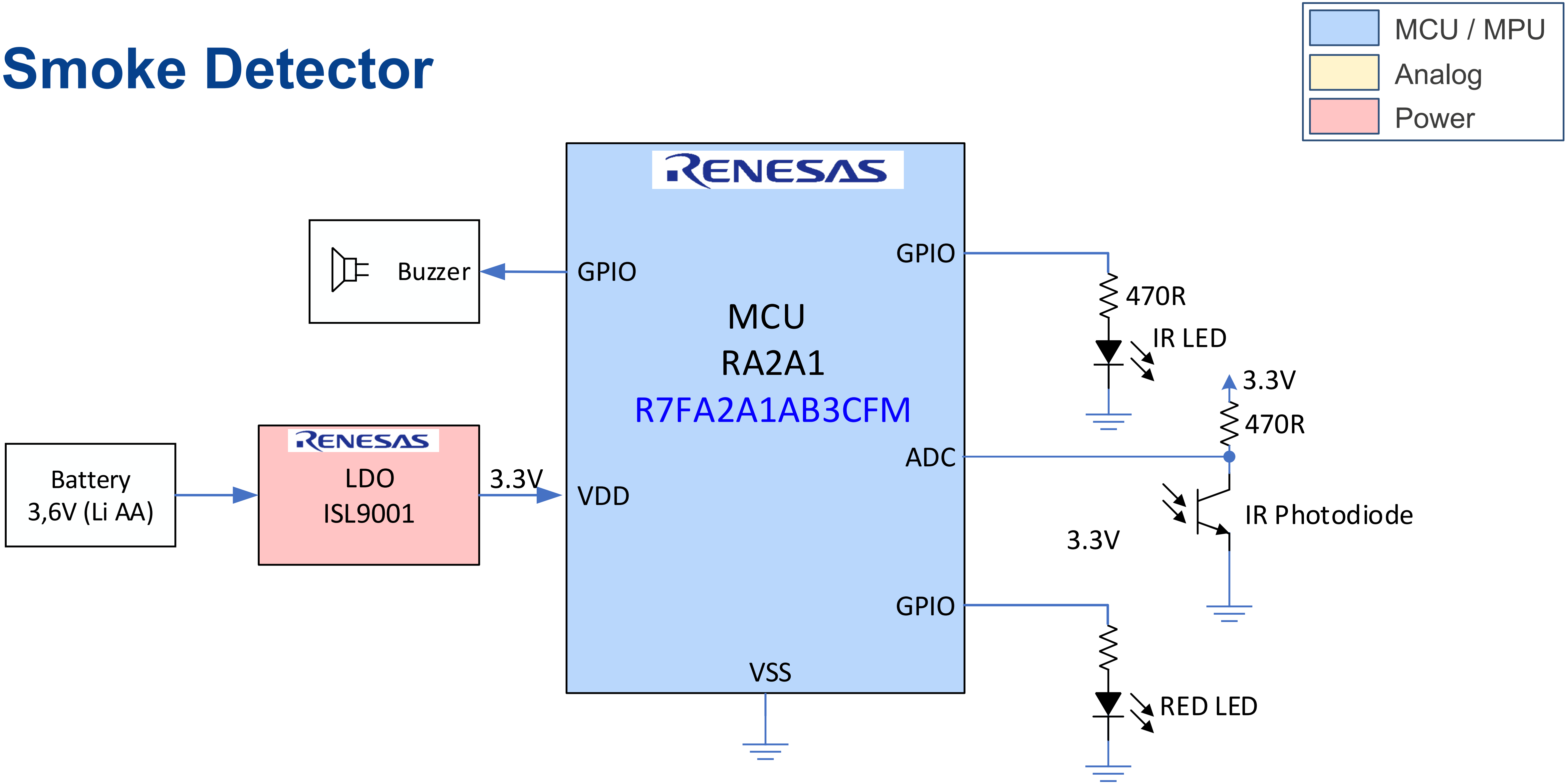
- **Overview**

Although studies by Texas A&M and the National Fire Protection Agency (NFPA) claim that photoelectric alarms react slower to rapidly growing fires than ionization alarms, laboratory and field tests have shown that photoelectric smoke alarms provide adequate warning for all types of fires, and are far less likely to be deactivated by occupants.

The functional principle of this smoke detector is having an IR photo diode and photo transistor arranged inside a chamber, where air, which may contain smoke from a nearby fire, flows. The light is not directed at the sensor because both the transmitter and receiver are positioned at an angle. If the air in the chamber contains particles (smoke or dust), the light is scattered, and some of it reaches the sensor, triggering the alarm.

- **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

Smoke Detector



Block Diagram #EU021
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Smoke 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

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

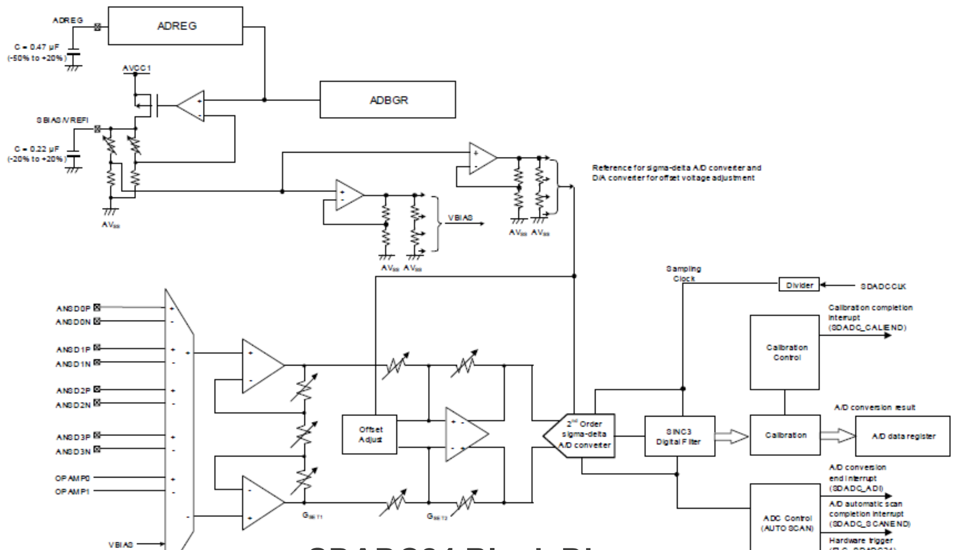
HMI Interface

- Capacitive Touch Sensing Unit (26 ch.)

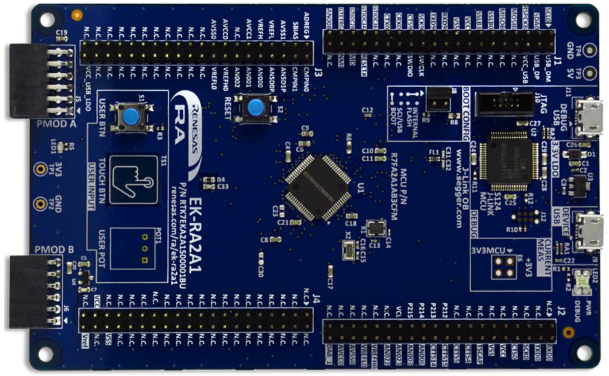
Wide Voltage and Low Power Consumption

- 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



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BIG IDEAS FOR EVERY SPACE RENESAS

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

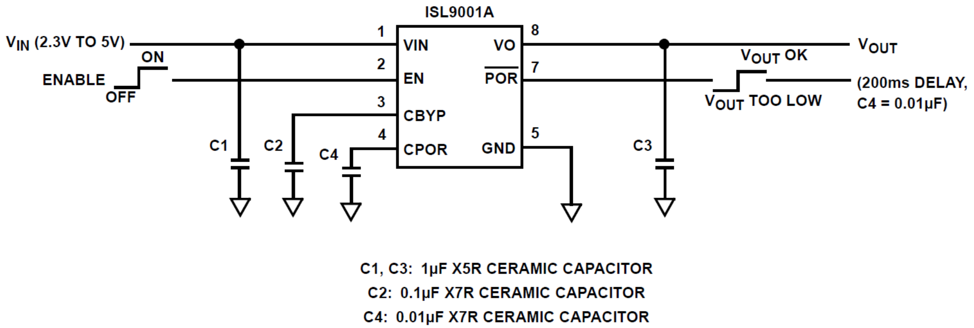
High Efficiency

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

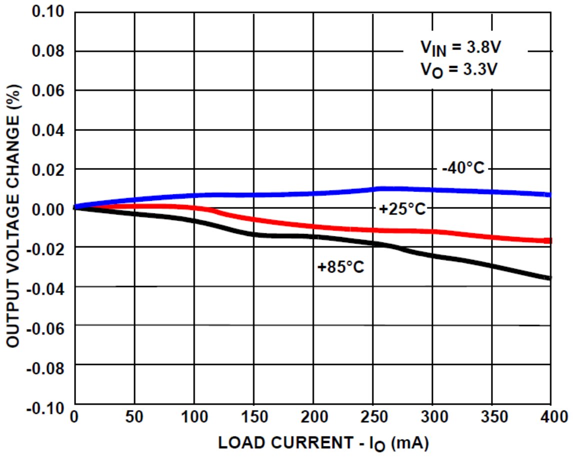
Excellent Safety

- 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



Typical Application Circuit



Output Voltage Change vs Load Current

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