# ADI’s Early Fire Detection Solutions

May 2021


AHEAD OF WHAT’S POSSIBLE™

# Early Fire Detection—Saving Lives

**3 out of 5 Deaths**

Properties without working smoke alarms

**23% of Deaths**

Smoke alarms present but disabled due to false alarms

**83% Less Time**

To escape a fire than in the 1970s due to advances in synthetic building materials

**Driving increasing regulatory requirements for more reliable smoke detection**

# Smoke Detection Challenge and Solution

## The Challenge for Manufacturers

### High Occurrence of Nuisance Alarms, Which Results in:

- Turning off the detector
- Not changing batteries
- Covering the detector with plastic

### Large Size and High Power

- Cannot be integrated into fixtures to meet architectural or aesthetic designs
- High power consumption
- Less suitable to meet demand for wireless detectors

### Regulatory Compliance

- New products must pass UL 217 and EN 54/EN 14604 tests to reduce false alarms and detect fires caused by synthetic materials

## The Solution from ADI

Space-saving integrated module—photodiode, AFE, and LEDs

On-chip calibration reduces factory end-of-line calibration requirements

Reduces power dissipation

Particle size estimation using two LEDs reduces false alarms

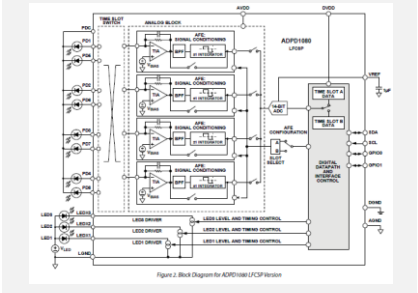
Enables compliant detectors

# Smoke Detection Regulations

- U.S. and Canadian
  - UL 268: Smoke Detectors for Fire Alarm Systems (7th Ed. June 30th 2021)
  - UL 217: Standard for Smoke Alarms (8th Ed. June 30th 2022)
    - ***Updates to flaming and smoldering polyurethane foam and cooking nuisance (hamburger) tests***
- European
  - EN 14604: Smoke Alarm Devices (2006)
  - BS EN 54: Fire Detection and Fire Alarm Systems (2015)
    - Part 29: Multi-sensor fire detectors. Point detectors using a combination of smoke and heat sensors.
- International
  - ISO 7240: Fire Detection and Alarm Systems (2018)
    - Part 7: Point-type smoke detectors using scattered light, transmitted light or ionization
    - Chinese standard for point-type smoke detectors follows 2003 edition of this standard

# Smoke Detection Solutions

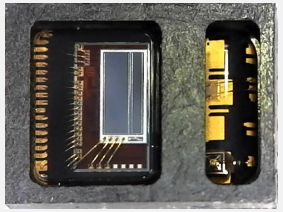
## Sensor Interface IC



Integrated High Performance Photometric Front End

ADPD1080 AFE

## Smoke Sensor Module



Fully Integrated and Calibrated Smoke-to-Bits Smoke Sensor

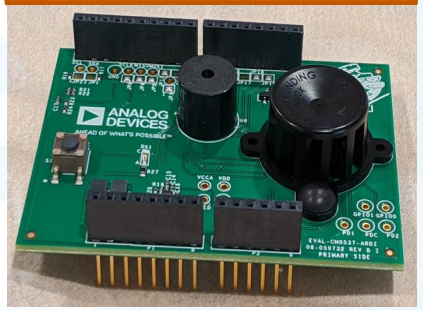
ADPD188BI Sensor

## Smoke Chamber

Precision Molded Chamber Optimized for ADPD188BI

Accumold 28800X

## Reference Design




UL 217/UL 268 Verified Algorithm with Arduino Compatible Hardware

CN-0537

## 3rd Party Solutions

OEM Modules

White Label Detectors

Chamber-less Algorithm IP

好神奇科技 HOTURNKEY Valor

# ADPD1080/ADPD1081: Integrated Photometric Front End

## Features and Specifications

- Multifunction photometric front end
- Fully integrated AFE, ADC, LED drivers, and timing core
- Enables ambient light rejection capability without the need for photodiode optical filters
- Three 370 mA LED peak current drivers
- Flexible, multiple, short LED pulses per optical sample
- 20-bit burst accumulator enabling 20 bits per sample period
- On-board sample to sample accumulator, enabling up to 27 bits per data read
- Low power operation
- SPI, I²C interface, and 1.8 V analog/digital core
- Flexible sampling frequency ranging from 0.122 Hz to 2700 Hz
- FIFO data operation

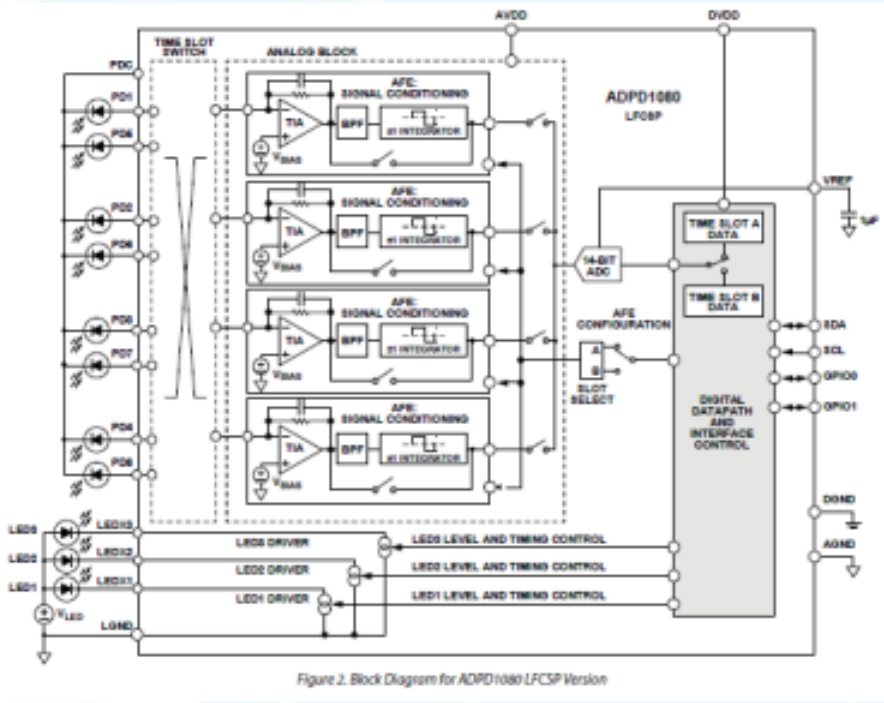


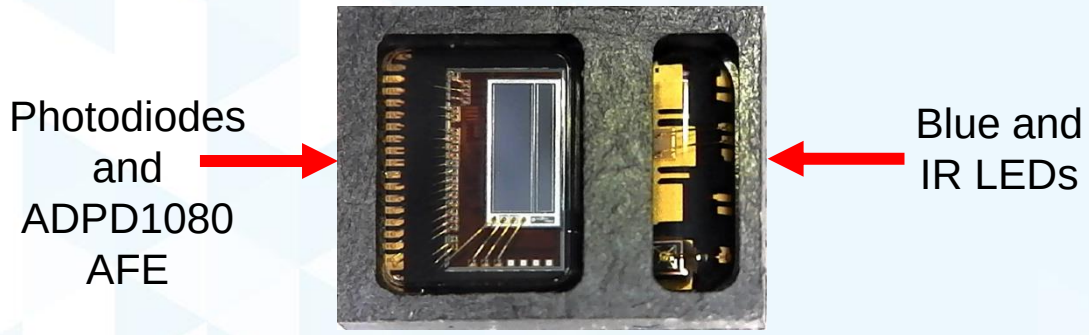
Figure 2. Block Diagram for ADPD1080 LFCSP Version

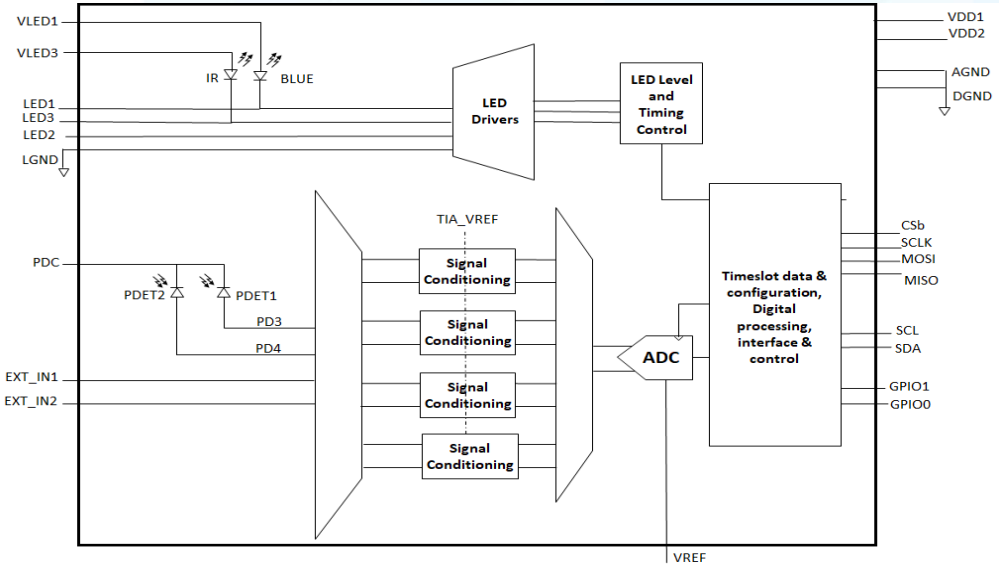
| Part Number | Interface | PD inputs | LED Drivers | Package |
|---|---|---|---|---|
| ADPD1080BCPZ | I²C | 8 | 3 | 28-lead lead frame chip scale package (LFCSP) |
| ADPD1080BCPZRL | I²C | 8 | 3 | 28-lead lead frame chip scale package (LFCSP) |
| ADPD1080WBCPZR7 | I²C | 8 | 3 | 28-lead lead frame chip scale package (LFCSP) |
| ADPD1080BCBZR7 | I²C | 2 | 3 | 16-ball, WLCSP |
| ADPD1081BCBZR7 | SPI | 2 | 3 | 17-ball, WLCSP |

# ADPD188BI Integrated Smoke Sensor Module

## Key Benefits

- Smoke-to-bits solution
  - Integrated LEDs, photodiodes, and AFE
  - LED wavelengths: 470 nm, 850 nm
  - Temp range: –40°C to +85°C
- Less nuisance alarms
  - Dual wavelength, wider dynamic range, and higher SNR
  - Meets latest UL 217/UL 268 smoke tests
- Reduced footprint
  - 3.8 mm × 5.0 mm × 0.9 mm
  - Small size enables more industrial design options
- Lower power dissipation
  - 25 µW average (four pulse configurations)
- Factory calibrated
  - Simpler and lower cost production flow
- Higher reliability
  - Fail-safe backscattering based method
  - Reduced component count
  - Eliminates LED supply chain management requirements

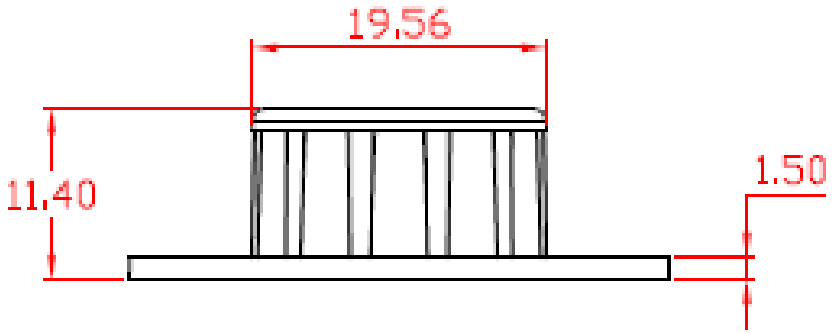


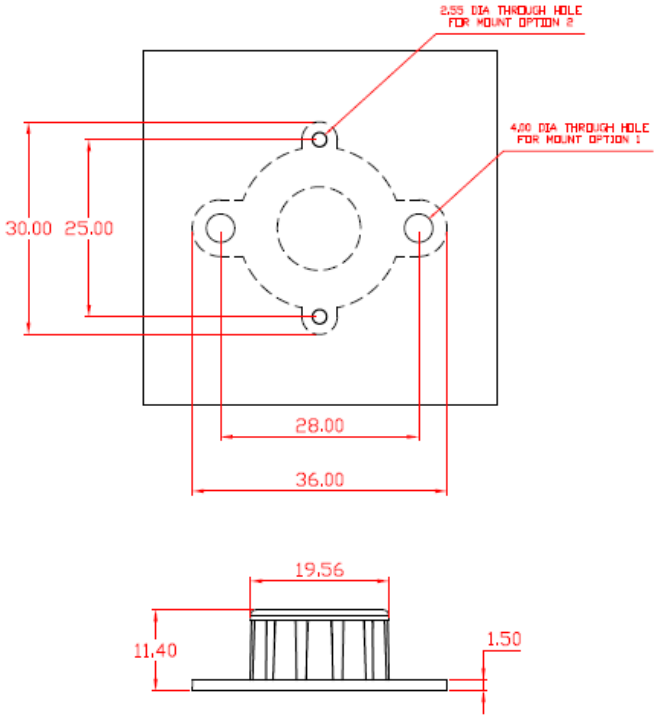
# 28800X Precision Molded Smoke Chamber

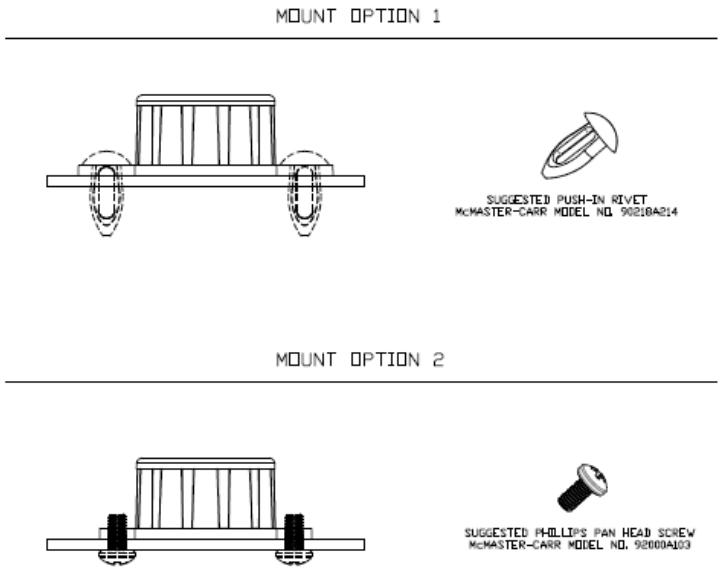
- Chamber design by ADI optimized for ADPD188BI
  - Low attenuation of smoke and low resistance to airflow
  - Low scatter for the LED light
  - Manufactured using a special compound that is designed to absorb any reflected light entering the chamber
  - Provides scaffolding for bug mesh
  - Small and easy to mount
- Evaluation chambers available
  - EVAL-CHAMBER (2 pcs)
  - EVAL-CHAMBER-10 (10 pcs)
  - Plastic rivets included
- Production quantities available
  - Accumold-28800X (via Arrow or Accumold)
  - Plastic rivets not included
- Design license option available

Accumold 28800X



# Smoke Chamber Mounting




Two mounting options:

1. M2.5 × 5 mm long screws (McMaster-Carr 92000A103 or equivalent)
2. Plastic rivet (McMaster-Carr 90218A214 or equivalent)

# 3rd Party Solutions

好神奇科技
HOTURNKEY

**Multi-Light Path Technology**

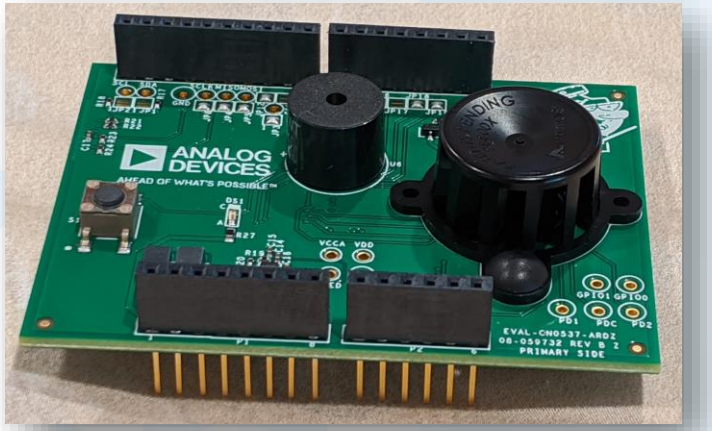
- Module power consumption <5 µA
- Module size: Φ50 mm ↕20 mm
- Patented chamber design
- Robust to steam, mist, and dust
- OEM module and detector/alarm level options
- China CCCF Approval PN: JTY-GD-ZH307 No. DZ2020100365

# Smoke Detection Resources Summary

- Evaluation Resources
  - Evaluation Boards
    - EVAL-ADPD188BIZ-S2
    - Requires processor interface board: EVAL-ADPDUCZ
  - Evaluation Smoke Chambers
    - EVAL-CHAMBER (2 pcs)
    - EVAL-CHAMBER-10 (10 pcs)
  - Smoke Detection Reference Design
    - EVAL-CN0537-ARDZ
    - Requires processor interface board: EVAL-ADICUP3029
    - Includes embedded algorithm for evaluation
- More information
  - analog.com/smokedetection
  - analog.com/ADPD188BI
  - analog.com/CN0537
  - EngineerZone®


**EVAL-ADPD188BIZ-S2**

**EVAL-CHAMBER**



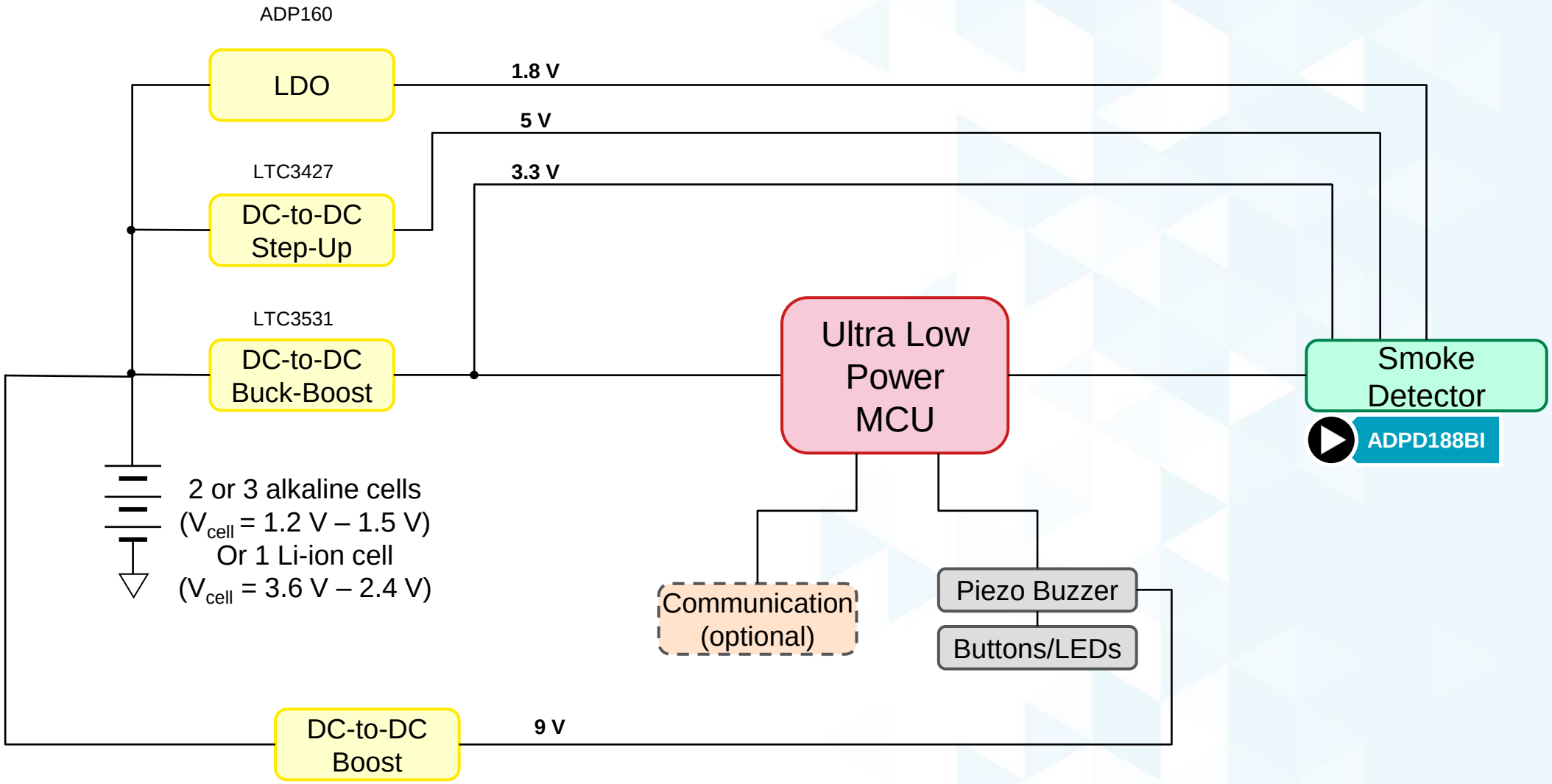

**EVAL-CN0537-ARDZ**

# Recommended Power Management Solutions

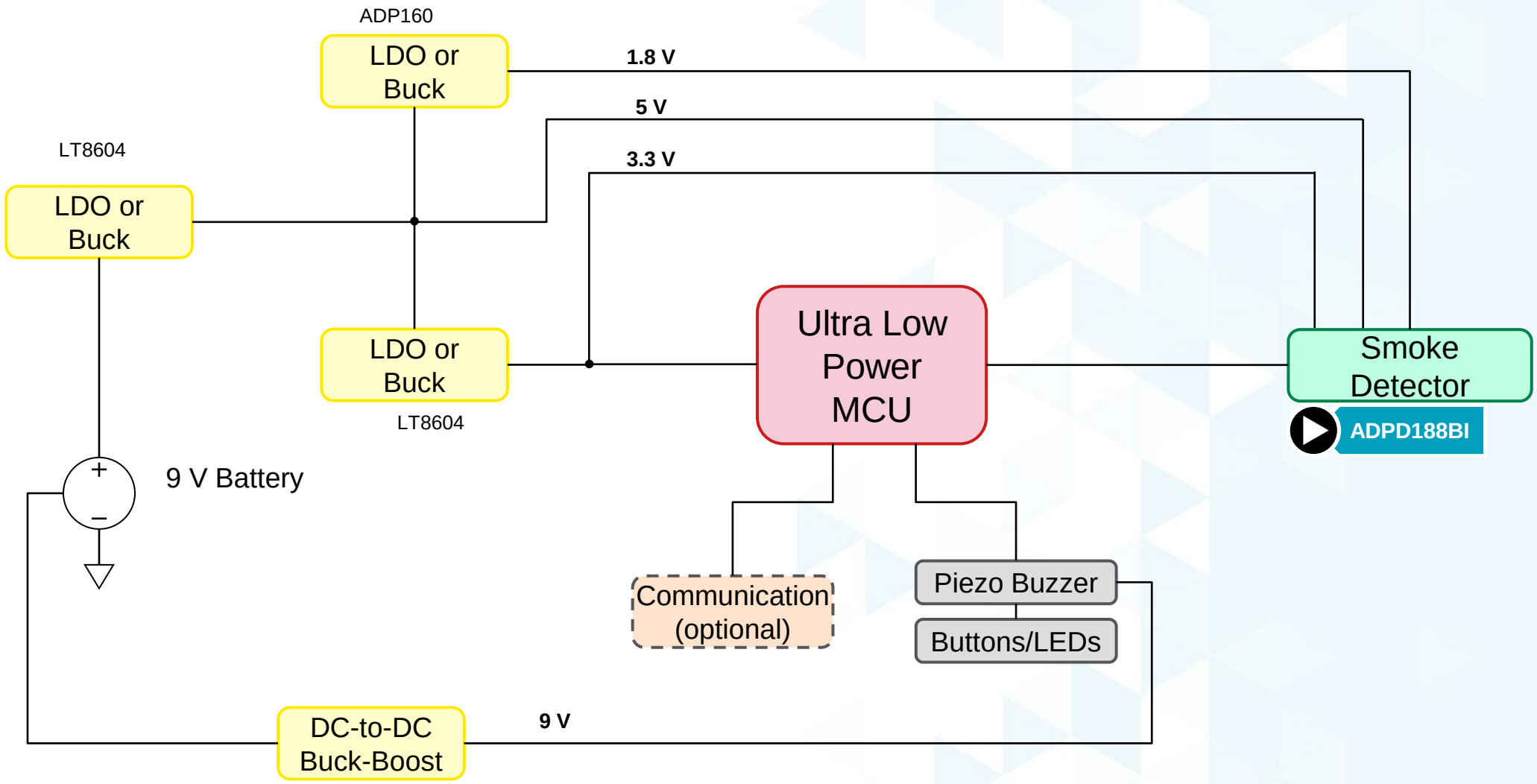
# ADPD188BI Power Requirements

- **ADPD188BI** requires the following voltage rails to operate:
  - VDD – 1.8 V typ. (1.7 V to 1.9 V)
  - VLED1 – 5 V typ. (4.5 V to 6 V)
    - If application demands >200 mA peak LED current set VLED1 ≥5.5 V
  - VLED3 – 3.3 V typ. (3 V to 4 V)
- Refer to ADPD188BI data sheet for estimating peak and average current consumption for each voltage rail.

# Low Voltage Battery—Residential Smoke Detector



# 9 V Battery—Residential Smoke Detector



# 12 V/24 V Wall Powered—Residential Smoke Detector