By LOU FRENZEL, Contributing Editor

Improved Smoke-Detection Devices Save More Lives

Sponsored by Digi-Key and Analog Devices: A new optical sensor IC consisting of two LEDs is the key to photoelectric smoke detectors that can better sense different smoke sources and trigger sooner.

One of the highest-volume products used in homes, commercial buildings, and factories is the smoke detector. Smoke detectors are mandated by government everywhere, so almost everyone has one. Literally hundreds of millions, maybe a billion, of them are installed around the world. Still, they're missing from too many older homes and buildings.

The effectiveness of a smoke detector depends on the technology used, its placement in the home or building, and its power source. Now Analog Devices offers a whole new generation of detectors. The company's ADPD188BI smoke-detector module significantly improves smoke detection and thereby can save more lives and property.

Smoke Detector Operation

There are basically two types of smoke detectors: optical and ionization. The photoelectric or optical detectors consist of an LED to emit light picked up by a phototransistor receiver inside a small chamber that's open to the surrounding environment. The LED light strikes the phototransistor with sufficient intensity to produce a signal that keeps the alarm off. When smoke drifts into the chamber, it partially blocks some of the light. The resulting lower-intensity light changes the current in the optical transistor and triggers the alarm.

The ionization type of smoke detector uses some Americium-241 sealed into a chamber. Americium-241 is a radioactive element that emits alpha particles. The chamber also contains two plates with an applied voltage.

The Americium emits alpha particles that ion-ize the oxygen and nitrogen in the chamber, producing both positive and negative ions that are attracted to the plates. The result is current flow in the external circuit. If smoke enters the chamber, it neutralizes the ions and thereby decreases the external current flow. An electrical detector senses the change and sets off the alarm.

To date, most smoke detectors fall into the ionization category. Some say that the ionization type of detector responds faster to flaming fires. On the other hand, the optical type responds more quickly to smoldering fires. Also, optical versions are less susceptible to nuisance or false alarms. However, new designs like that from Analog Devices is making the photoelectric type more effective and competitive. An additional benefit of the photoelectric approach is lower cost.

We Need a Better Smoke Sensor

Analog Devices' new ADPD188BI optical sensor IC will
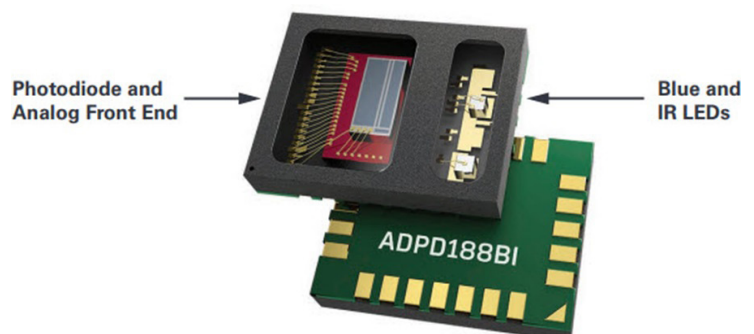
The ADPD188BI optical sensor IC, built for photoelectric smoke-detection devices, features blue and infrared LEDs plus two photodiode detectors. (Source: Analog Devices)

trigger a smoke alarm sooner. It's made up of two LEDs—one a 470-nm blue LED and other an 850-nm infrared plus two photodiode detectors *(see figure)*. By using two light wavelengths, the detector can better sense smoke from different types of sources, allowing it to better differentiate between true and false alarms. This integrated circuit also includes four amplifiers, bandpass filters, and integrators, plus a 14-bit ADC, LED drivers, and I^{2}C and SPI digital interfaces.

Furthermore, the company developed a special smoke chamber optimized for best detection results with the ADPD188BI IC. This part of the module also helps block ambient lighting that can result in a false alarm.

Paying Attention to Regulations and Certifications

Smoke detectors are highly regulated—global standards have been established to ensure stated specifications and performance goals. All smoke detectors must be tested to achieve the certification that validates their performance. The primary standards that must be met include:

U.S. and Canada:
- UL268 Smoke Detectors for Fire Alarm Systems
- UL217 Smoke Alarms

Europe:
- EN14604 Smoke alarm devices
- BS EN 54 Fire Detection and fire alarm systems

International:
- ISO 7240 Fire detection and alarm systems

Recently, the Underwriters Laboratory (UL) has put forth new versions of the UL-217 and UL-268 standards that consider the significant improvement in photoelectric smoke detectors. When using the ADPD188BI, a new smoke detector can readily pass the UL tests.

Speeding Up Development

Analog Devices offers a complete smoke-detection evaluation package called the EVAL-ADSMOKEKITZ. Its contents include the EVAL-ADPD188BIZ-S2 integrated optical, module with smoke chamber, an alternate smoke chamber designated EVAL-CHAMBER, and the EVAL-ADPDUCZ, a microcontroller board that supports the detector IC. This kit facilitates and expedites the development of any new smoke detector product.

Caption: