Application guide
Fire alarms and smoke detectors
Typical fire alarm and smoke detector

- The latest worldwide regulations require smoke detectors to be installed in homes and public buildings.
- Advanced smoke detectors are generally wireless with RF communication protocol.
- Smoke detectors are often equipped with a photoelectric detector to detect smoke and a heat sensor that triggers the smoke alarm when the temperature increases rapidly.

![Diagram of a wireless smoke and heat detector unit](attachment:image.png)
## Technical data example: Wireless multisensor detector

Specifications are typical and given at 23 °C and 50% relative humidity unless otherwise stated.

### Detector type
- **Point type smoke detector for fire detection and fire alarm systems for buildings**

### Detector principle
- **Smoke**: photoelectric detection of light scattered by smoke particles
- **Heat**: temperature-sensitive resistance

### Supply voltage
- Regulated 3 V

### Communication protocol
- **RF** each 10 s
- **Duration**: 75 ms

### Quiescent current
- 500 μA average, 750 μA peak

### Power-up surge current
- 1 mA

### Maximum power-up time
- 10 s

### Alarm LED current
- 3.5 mA

### Remote LED current
- 4 mA, 5 V (measured across remote load)

### Electromagnetic compatibility
- EMC generic standard EN 61000-6-3/6-4

### Temperature range
- **Max. continuous operating**: +60 °C
- **Min. continuous operating**: 0 °C
- **Min. operating (no condensation/icing)**: -20 °C
- **Storage**: -30 to +80 °C

### Humidity:
- (No condensation)
- 0 to 95% relative humidity

### Effect of temperature on optical detector
- Less than 15% change in sensitivity over rated range
- Slow changes in ambient conditions are automatically compensated for and do not affect sensitivity

### Effect of atmospheric pressure on optical sensor: None

### Chamber configuration
- Horizontal optical bench housing infra-red emitter and sensor, arranged radially to detect forward scattered light

### Sensor
- Silicon PIN photo-diode

### Emitter
- GaAs infra-red light-emitting diode

### Sampling frequency
- **Once each 10 s**
- **Duration**: 400 ms with RF communication

### Life time on battery
- 3 years

### Microcontroller characteristics
- **Core**: 8 bit
- **Flash**: less than 8 Kbytes
- **RAM**: less than 1 Kbytes
- **EEPROM**: 256 bytes (optional)
- **Pin-count**: from 8 to 20 pins
- **Package**: TSSOP, UQFN, DIP
- **Timers**: 2x 16 bits
- **Real-time clock**: yes
- **ADC**: 10-bit 3-channel minimum
- **Other**: secure reset signal, USART/SPI
ST’s answer with the ultra-low-power platform

- Commitment to low power
  - Platform for 8-bit STM8L and 32-bit STM32L MCUs
  - ST’s 130 nm ultra-low-leakage process technology
  - Significant improvement in all power consumptions – static and dynamic

- Pure efficiency
  - High performance/power-consumption ratio thanks to new architecture
  - Ultra-low-power modes: down to 350 nA with SRAM retention
  - Fast wake-up from low-power modes in 4 µs
  - Advanced analog functions down to 1.8 V
  - Reprogramming capability down to 1.65 V

- Inside the STM8L
  - ST ultra-low-power 8-bit MCU supply voltage: from 1.8 to 3.6 V
  - Power-up peak consumption: 700 µA
  - In active-halt mode (-40 to 25 °C) consumption: 0.5 µA (typ.)
  - Maximum power-up time of the 8-bit MCU: 3 ms
  - Output driving current ($V_{DD} = 3$ V): $+10$ mA

Matching smoke detector

- Supply voltage
- Power-up surge current
- Quiescent current
- Maximum power-up time
- Alarm LED current
- Remote LED current
Inside the STM8L

- Flash from 4 to 64 Kbytes + true embedded EEPROM up to 2 Kbytes
- SRAM: 1 up to 2 Kbytes
- 12-bit embedded ADC: up to 1 MSPS/25 channels
- Small package and pin count: TSSOP and UQFN, 20 pins
- 8-bit MCU EMC: IEC 61967-2 level compliant
- Embedded ultra-low-power real-time clock
  - Sub 1 μA hardware RTC and AWU or regular wake-up application
  - Sub-second hardware RTC for precise synchronization in RF networks
  - Fine-grain calibration accuracy down to +/- 2 ppm
- 5 ultra-low-power modes down to 0.35 μA
- 2 ultra-low-power comparators
- Temperature range: -40 to +125 °C
- Humidity: package supports up to 85% relative humidity
- Other features:
  - 2x16-bit timers
  - USART, SPI and I²C
  - Secure reset signal with PVD, BOR, LVD

Matching smoke detector
- Microcontroller characteristics
- Electromagnetic compatibility
- Sampling frequency
- Quiescent current
- Temperature range
- Humidity
STM8L smoke detector – power versus time

STM8L15x, 32 Kbytes, $F_{\text{CPU}} = 8 \text{ MHz}$, $V_{\text{DD}} = 3 \text{ V}$

- Using 2x AA batteries (3 V, 2700 mAh), the STM8L guarantees at least 3.5 years functionality
- Average consumption = 87 µA

- DMIPS values: measured by MCD Application Lab (using Dhrystone code V2.1)
- Consumption: MCUs execute Dhrystone code V2.1 @ 3 V, 25 °C
- Based on a standard smoke detector scenario

The STM8L helps achieve 3 years life capability
STM8L – the ideal MCU

- STMicroelectronics supports the ultra-low consumption application market with its proprietary 130 nm ultra-low-leakage process technology.

- The 5 ultra-low-power modes, combined with the ultra-low-power RTC, makes the STM8L an ideal MCU to design advanced fire alarm and smoke detector systems.

- With a 16 MHz core, a large Flash memory (4 up to 64 Kbytes) and a true embedded EEPROM, the STM8L can be used in many other applications requiring complex programming code.
Thank you for your attention

For more information, visit

www.st.com/stm32l
www.st.com/stm8l