

# Industry's Lowest-Power Ambient Light Sensor with ADC

## General Description

The MAX44009 ambient light sensor features an I<sup>2</sup>C digital output that is ideal for a number of portable applications such as smartphones, notebooks, and industrial sensors. At less than 1 $\mu$ A operating current, it is the lowest power ambient light sensor in the industry and features an ultra-wide 22-bit dynamic range from 0.045 lux to 188,000 lux.

Low-light operation allows easy operation in dark-glass applications.

The on-chip photodiode's spectral response is optimized to mimic the human eye's perception of ambient light and incorporates IR and UV blocking capability. The adaptive gain block automatically selects the correct lux range to optimize the counts/lux.

The IC is designed to operate from a 1.7V to 3.6V supply voltage range and consumes only 0.65 $\mu$ A in full operation. It is available in a small, 2mm x 2mm x 0.6mm UTDFN-Opto package.

## Applications

Tablet PCs/Notebook Computers  
TVs/Projectors/Displays  
Digital Lighting Management  
Portable Devices  
Cellular Phones/Smartphones  
Security Systems

## Features

- ◆ Wide 0.045 Lux to 188,000 Lux Range
- ◆ Small, 2mm x 2mm x 0.6mm UTDFN-Opto
- ◆ VCC = 1.7V to 3.6V
- ◆ I<sub>CC</sub> = 0.65 $\mu$ A Operating Current
- ◆ -40°C to +85°C Temperature Range
- ◆ Device Address Options  
1001 010x and 1001 011x

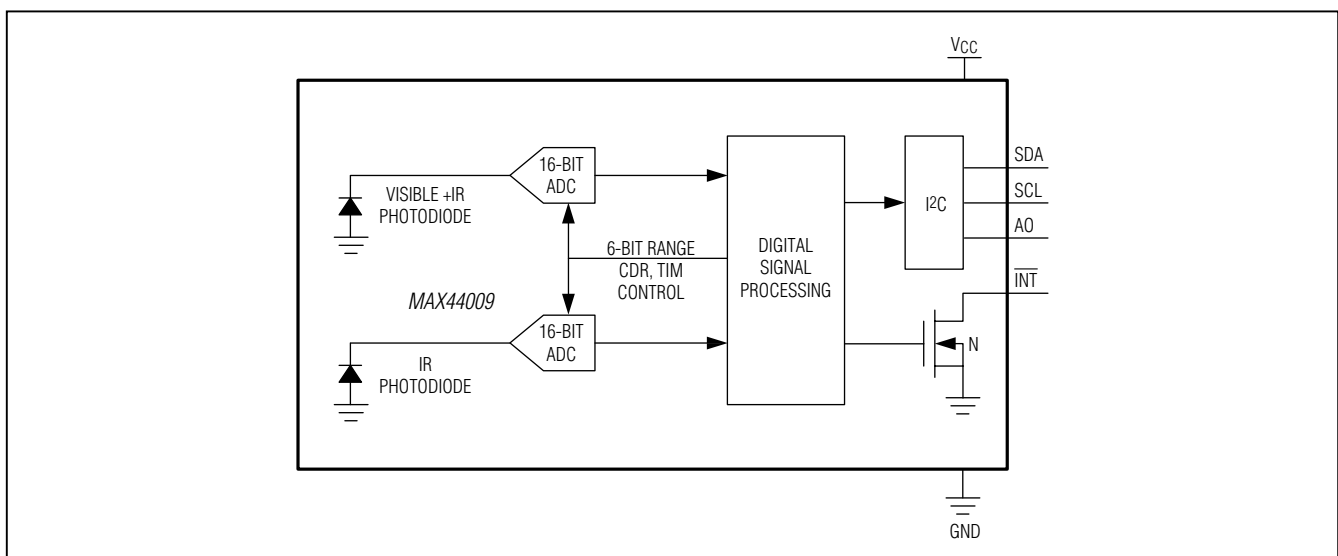
## Ordering Information

| PART         | PIN-PACKAGE      | TEMP RANGE     |
|--------------|------------------|----------------|
| MAX44009EDT+ | 6 UTDFN-Opto-EP* | -40°C to +85°C |

+Denotes a lead(Pb)-free/RoHS-compliant package.

\*EP = Exposed pad.

## Block Diagram



# MAX44009

## Industry's Lowest-Power Ambient Light Sensor with ADC

### ABSOLUTE MAXIMUM RATINGS

|  |                              |  |                   |
|--|------------------------------|--|-------------------|
| $\overline{\text{INT}}$ to GND.....                          | -0.3V to ( $V_{CC} + 0.3V$ ) | Continuous Input Current into Any Terminal.....  | $\pm 20\text{mA}$ |
| All Other Pins to GND .....                                  | -0.3V to +4V                 | Continuous Power Dissipation                     |                   |
| $\overline{\text{INT}}$ Short-Circuit Current Duration ..... | 10s                          | 6 UTDFN-Opto (derate 11.9mW/°C above +70°C)..... | 953mW             |
| All Other Pins Short-Circuit Current Duration.....           | Continuous                   | Operating Temperature Range.....                 | -40°C to +85°C    |

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

### ELECTRICAL CHARACTERISTICS

( $V_{CC} = 1.8V$ ,  $T_{MIN}$  to  $T_{MAX} = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ , unless otherwise noted.) (Note 1)

| PARAMETER                                       | SYMBOL              | CONDITIONS   | MIN             | TYP     | MAX            | UNITS         |
|---|---------------------|--|-----------------|---------|----------------|---------------|
| <b>OPTICAL CHARACTERISTICS</b>                  |                     |  |                 |         |                |               |
| Maximum Lux Sensitivity                         |                     | Fluorescent light  |                 | 0.045   |                | Lux/LSB       |
| Saturation Ambient Lux Level                    |                     | Sunlight   |                 | 188,000 |                | Lux           |
| Total Error                                     | TE                  | Green LED 538nm response,<br>$T_A = +25^{\circ}\text{C}$ (Note 2)      |                 |         | 15             | %             |
| Light Source Matching                           |                     | Fluorescent/incandescent light   |                 | 10      |                | %             |
| Infrared Transmittance at 940nm                 | IRR                 | $T_A = +25^{\circ}\text{C}$ (Note 3)                                   |                 | 0       | 0.5            | %             |
| Ultraviolet Transmittance at 363nm              | UVR                 | $T_A = +25^{\circ}\text{C}$ (Note 3)                                   |                 | 1.2     |                | %             |
| Dark Level Count                                | 0LUX                | 0 lux, $T_A = +25^{\circ}\text{C}$ , 800ms range                       |                 | 0       | 0.045          | Lux           |
| Maximum Signal Integration Time                 |                     | Has 50/60Hz rejection  |                 | 800     |                | ms            |
| Minimum Signal Integration Time                 |                     | Automatic mode, has 50/60Hz rejection                                  |                 | 100     |                | ms            |
|   |                     | Manual mode only   |                 | 6.25    |                |               |
| ADC Conversion Time                             | ACT                 | 100ms range, $T_A = +25^{\circ}\text{C}$                               | 99.6            | 100     | 100.4          | ms            |
|   |                     | 100ms range  | 97              | 103     | 107            |               |
| <b>POWER SUPPLY</b>                             |                     |  |                 |         |                |               |
| Power-Supply Voltage                            | $V_{CC}$            | Guaranteed by TE test  | 1.7             |         | 3.6            | V             |
| Power-Supply Current                            | $I_{CC}$            | $T_A = +25^{\circ}\text{C}$ , 90 lux, I <sup>2</sup> C inputs inactive |                 | 0.65    | 1.2            | $\mu\text{A}$ |
|   |                     | $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$                   |                 |         | 1.6            |               |
| <b>DIGITAL I/O CHARACTERISTICS</b>              |                     |  |                 |         |                |               |
| Output Low Voltage SDA, $\overline{\text{INT}}$ | $V_{OL}$            | $I_{SINK} = 6\text{mA}$  |                 | 0.06    | 0.4            | V             |
| $\overline{\text{INT}}$ Leakage Current         |                     | $T_A = +25^{\circ}\text{C}$  |                 | 0.01    | 20             | nA            |
| SCL, SDA, A0 Input Current                      | $I_{IH}$ , $I_{IL}$ | $T_A = +25^{\circ}\text{C}$  |                 | 0.01    | 20             | nA            |
| I <sup>2</sup> C Input Low Voltage              | $V_{IL\_I2C}$       | SDA, SCL   |                 |         | 0.3 x $V_{CC}$ | V             |
| I <sup>2</sup> C Input High Voltage             | $V_{IH\_I2C}$       | SDA, SCL   | 0.7 x $V_{CC}$  |         |                | V             |
| Address Input Low Voltage                       | $V_{IL\_A0}$        | A0   |                 |         | 0.3            | V             |
| Address Input High Voltage                      | $V_{IH\_A0}$        | A0   | $V_{CC} - 0.3V$ |         |                | V             |
| Input Capacitance                               |                     |  |                 | 3       |                | pF            |