Ambient Light Sensor ICs
for automatic light control processing

- LCD TV / Displays
- LCD-equipped Portable Devices
ROHM ambient light sensor (ALS) ICs are designed to control the brightness of LED-backlighted LCD displays based on ambient light availability and brightness for optimum display visibility and energy efficiency.

The compact ROHM ALS ICs are the ideal choice for LCD-equipped portable devices as well as LCD monitors and high-definition (HDTV) backlighting control.

- Mobile Phones
- Digital Cameras
- Video Players
- PDAs
- Notebook PCs
- Car Navigation systems
- LCD TVs
- LCD Monitors /Displays

Adjusting the backlight intensity to compensate for variations in ambient light level can save 50% or more of the total power required to operate some portable electronic devices. This translates into dramatic improvement in operating time between charges ("talk time") and/or the ability to extend the device’s feature set.

To provide superior performance, backlight brightness control must be done in a uniform way over a wide range of ambient light conditions and light sources. ROHM ALS ICs feature industry-leading performance that combines stable operation regardless of the light source (from incandescent to sunlight) with superior light sensing accuracy.

ROHM’s advanced ambient light sensor ICs are offered in ultra-small WSOF5 and WSOF6 packages.

Improved Visibility with Lower Power Consumption

- Stable operation regardless of light source
- Superior light sensing accuracy

ROHM ambient light sensor ICs deliver stable output under a variety of light sources (e.g. incandescent, fluorescent, sunlight).

Unique laser trimming technology ensures high sensitivity accuracy — ±15% — more than twice as precise as conventional ICs, which can range from ±30% to ±55%.
ROHM ambient light sensor ICs are available in both analog and digital configurations. The key features of each type are highlighted in the next two pages of this selection guide.

ROHM analog ALS ICs have an output current proportional to light (current sourcing) with a measurement range of 0 to 100,000+ lux. As shown below, in a typical application, an external resistor converts the output current to a voltage for input to an MCU which in turn controls the LED driver. Direct connection to an LED driver is also possible (see page 6 for details).

ROHM Digital ALS ICs output a 16-bit (0 to ~65,535 lx) digital signal over a direct I2C bus interface to the MCU.

ROHM Semiconductor ambient light sensors all operate over a temperature range of -40 to 85°C to ensure stable operation under extreme conditions. Analog and digital ALS ICs are each offered in compact, surface-mount packages. Package choices include the ultra-small WSOF5 (1.6x1.6x0.55 mm) or WSOF6 (3.0x1.6x0.7 mm).
Ambient Light Sensor ICs from ROHM Semiconductor

Analog Output Type

The BH16xx Series of analog ambient light sensors combine a number of innovations to provide exceptional performance over a wide range of applications. ROHM’s proprietary trimming process and use of multiple photodiodes with different junction depths provides a stable output with little variation between various light sources. Three levels of gain enable the designer to make the appropriate trade-off between backlight intensity and power consumption. A logic-enabled shutdown function is also provided to further enhance power efficiency. In addition, the current source output supports full rail-to-rail voltage operation, further improving control sensitivity to variations in light intensity.

Uniform Sensitivity

Three-Step Output Gain

Built-in Shutdown Function

<table>
<thead>
<tr>
<th>GC2</th>
<th>GC1</th>
<th>Mode</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Shutdown</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>H-Gain</td>
<td>68UA @ 10 Hz</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>M-Gain</td>
<td>19UA @ 100 Hz</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>L-Gain</td>
<td>1UA @ 100 kHz</td>
</tr>
</tbody>
</table>

1: Connect to VCC  0: Connect to GND
Digital (16-bit Serial) Output Type

The BH17xx series of digital ambient light sensors ICs employ the same proprietary trimming and multiple photodiodes to assure uniform light sensitivity. The device’s 16-bit analog-to-digital converter produces 1 lux resolution over a range of 0 to 65,000 lx. The I²C output is designed for direct connection to the system’s microcontroller or baseband processor.

Two measurement resolution levels are provided, allowing design trade-offs between sampling time and performance. For example, with high-resolution sampling, optical noise like fluorescent lamp flicker can be filtered. Low resolution reduces the sampling time for applications like GPS systems where the light level changes are dynamic.

Uniform Sensitivity

50Hz/60Hz Optical Noise Elimination

Optical Window Sensitivity Control

Wide I²C Input Voltage

ROHM’s I²C bus is compatible with operating voltages between 1.65V and Vcc (3.6V, max) enabling operation in systems with multiple power supplies.
Ambient Light Sensor ICs
Design Tools

Ambient Light Sensor Evaluation Kits

Evaluation kits for ROHM analog and digital ALS ICs are coming soon. Each kit consists of a USB-connected PC board and a CD-ROM with software provided to simulate and measure ambient light response.

For more information, go to:
www.rohmsemiconductor.com/als.html

Optical Window Design Support

Applying an ALS requires both optical and semiconductor expertise to assure mounting of the IC with a suitable optical window for light reception. ROHM’s “Optical Window Design Manual” provides design guidance to facilitate the design process.

For more information, go to:
www.rohmsemiconductor.com/als.html

Simplified Ambient light Control

The ROHM BD16xx Series ALS ICs are designed to interface directly to ROHM LED drivers (BD60xxGU) to automatically control white LED backlights in portable devices without any requirement for light control software. An MCU is not necessary but may still be used to provide control input to the ALS gain and shutdown functions, as shown.

For more information, go to:
www.rohmsemiconductor.com/als.html
### Analog Current Output Type Ambient Light Sensor ICs

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Output Type</th>
<th>Supply Voltage (V)</th>
<th>Sensitivity Variation (%)</th>
<th>Number of Switching Levels</th>
<th>Illuminance Measurement Range (lx)</th>
<th>Operating Temperature Range (°C)</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>BH1603FVC</td>
<td>Current (Source)</td>
<td>2.4 to 5.5</td>
<td>±15</td>
<td>3 steps</td>
<td>0 to 100,000</td>
<td>-40 to +85</td>
<td>WSOF6</td>
</tr>
<tr>
<td>BH1620FVC</td>
<td>Current (Source)</td>
<td>2.4 to 5.5</td>
<td>±15</td>
<td>3 steps</td>
<td>0 to 100,000</td>
<td>-40 to +85</td>
<td>WSOF5</td>
</tr>
</tbody>
</table>

### Digital 16-bit Serial Output Type Ambient Light Sensor ICs

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Output Type</th>
<th>Supply Voltage (V)</th>
<th>Sensitivity Variation (%)</th>
<th>I/O Voltage</th>
<th>Illuminance Measurement Range (lx)</th>
<th>Operating Temperature Range (°C)</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>BH1715FVC</td>
<td>I2C I/F</td>
<td>2.6 to 3.6</td>
<td>±15</td>
<td>1.65 to Vcc</td>
<td>0 to 65,000</td>
<td>-40 to +85</td>
<td>WSOF6</td>
</tr>
<tr>
<td>BH1721FVC</td>
<td>I2C I/F</td>
<td>2.4 to 3.6</td>
<td>±15</td>
<td>1.65 to Vcc</td>
<td>0 to 65,000</td>
<td>-40 to +85</td>
<td>WSOF5</td>
</tr>
<tr>
<td>BH1750FVI</td>
<td>I2C I/F</td>
<td>2.4 to 3.6</td>
<td>±20</td>
<td>1.65 to Vcc</td>
<td>0 to 65,000</td>
<td>-40 to +85</td>
<td>WSOF6I</td>
</tr>
</tbody>
</table>

### Key

- **Analog output**
- **Serial output**
- **Output current source type**
- **Transparent package type**
- **Compact surface-mount package**
- **Gain switching**
- **High-accuracy detection**
- **Supply voltage 2.4V–3.6V/5.5V**
- **Compatible with 1.8V systems**
- **OpA standby current**
- **Supports I2C bus I/F**
- **Built-in 16-bit AD converter**
- **Spectral sensitivity close to the human eye**
- **Wide operating temperature range: -40°C to +85°C**
- **Wide dynamic range**
NOTE: For the most current product information, contact a ROHM sales representative in your area.

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The products listed in this catalog are designed to be used with ordinary electronic equipment or devices (such as audio visual equipment, office-automation equipment, communications devices, electrical appliances and electronic toys). Should you intend to use these products with equipment or devices which require an extremely high level of reliability and the malfunction of which would directly endanger human life (such as medical instruments, transportation equipment, aerospace machinery, nuclear-reactor controllers, fuel controllers and other safety devices), please be sure to consult with our sales representative in advance.

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