VEML6031X00 Automotive Ambient Light Sensor

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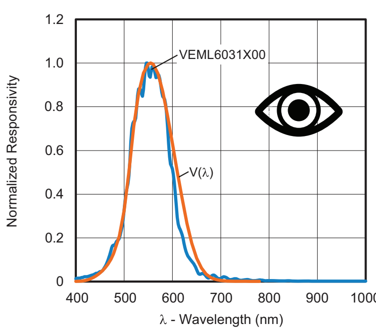
VEML6031X00 - AN AUTOMOTIVE-QUALIFIED AMBIENT LIGHT SENSOR (ALS) IN A PERFORMANCE-ENHANCING PACKAGE

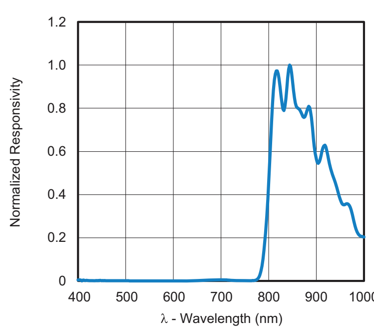
Ambient light sensors in the automotive market are used to detect variable lighting conditions inside and outside the vehicle. They are commonly located behind the rearview mirror, on the dash, or in the center console. They determine when to turn on and off headlights, adjust display backlighting and indicator lights, and they are used with other discrete components to determine rain intensity and tunnel ingress and egress. Each application requires different sensitivity, dynamic range, measurement speed, temperature compensation, and robustness of the ambient light sensor. And they need to be dynamically adjustable since a car's environment varies widely. Above all, the sensor needs to "see" light in the same way the human eye sees it.

SPECTRAL RESPONSE

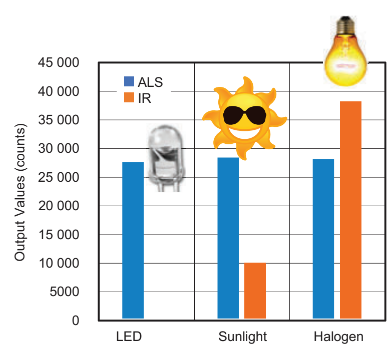
The human eye cannot see infrared light and the VEML6031X00 closely matches the λ curve of the human eye's sensitivity, with an emphasis on the suppression of infrared light. Most analog-output ambient light sensors do not fully suppress infrared wavelengths, as the filtering employed allows some near infrared light to corrupt the signal. The digital-output VEML6031X00 addresses this common issue by using two output channels: one which senses only visible light like our eyes, and a second to measure infrared light. Both channels are measured in parallel. This has two benefits. First, the sensor determines the lux level of the environment and can determine the type of light source. For example, sunlight has a high infrared content while white LED lighting has a very low infrared content. Readings from each channel can determine if the sensor is exposed to sunlight or LED lighting. Second, the two channels eliminate errors that are induced when cover glass material suppresses visible light and allows more infrared light to pass through.



Normalized ALS Channel Spectral Response



IR Channel Response



ALS and IR Channel - Absolute

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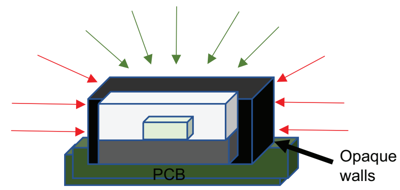
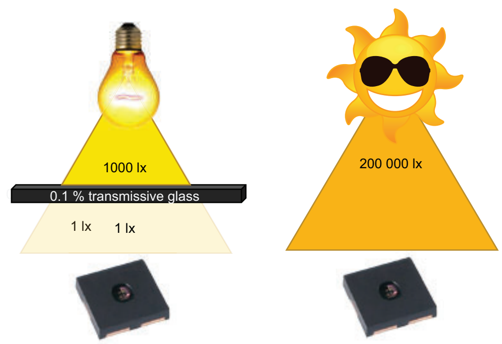
PERFORMANCE-ENHANCING PACKAGE

Unlike competitor packages, the VEML6031X00 package has opaque sides. Light from LEDs located on the PCB next to the sensor will be blocked by the opaque walls. This ensures light irradiating the sensor will only be from the source that needs to be measured, resulting in a lower signal to noise ratio and a purer lux reading. The opaque sides also eliminate the need for a rubber boot or special housing. This foil-assisted molding (FAM) package can also withstand higher temperatures up to 110 °C, versus 85 °C for a typical epoxy package.



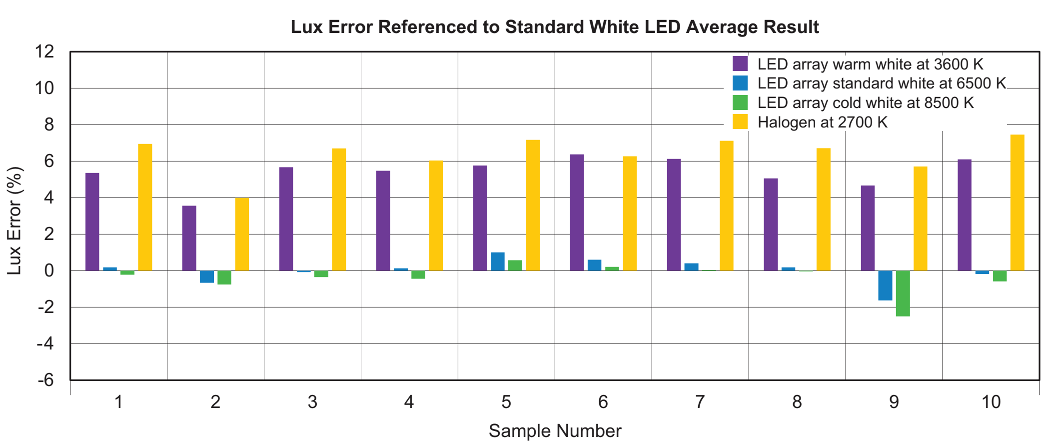
HIGH DYNAMIC MEASUREMENT RANGE

The VEML6031X00 allows for the adjustment of sensor parameters via an I^2C interface. It can be optimized for a given environment and purpose. Integration times can be set to allow for a fast measurement rate. The part features a wide range of integration times from 3.125 ms to 400 ms. Gain levels can be set to adjust sensitivity. It has four different gain levels adjusted both by internal ASIC amplification as well as the accumulative size of photodiodes used in the measurement. Cover glass can greatly reduce the light irradiating the sensor, passing as little as 1 % of the ambient light. For example, a sensor measuring a brightly lit room of 1000 lux may only have 10 lux reaching the sensor. The sensor can adjust to this by increasing the integration time and gain, so resolution is not lost. When the sensor is exposed to full sunlight, for example when it is integrated into a rain light tunnel sensor, the sensitivity can be decreased to allow for full sunlight detection. In other applications measurement speed may be of key importance; for example, when sensing light in the side mirror when driving at high speed. With a minimum integration time of 3.125 ms, the sensor can effectively measure close to 300 measurements per second.



LOW OUTPUT TOLERANCES ACROSS DIFFERENT LIGHT SOURCES

Because the sensitivity is trimmed during manufacturing, the part to part tolerances are very low. When measured under lab conditions, the lux tolerances across different light sources were below 8 %, even when a light source with a high IR content was used (halogen). This is a key characteristic for sensors near the car's window, where the sensor will be exposed to a variety of different light sources. Keeping tolerances low allows for a reliable result regardless of the conditions, allowing the sensor to react as intended.



Tolerances for Different Light Sources