



## Ambient Light Sensor Development Kit

### Description

The ambient light sensor development kit allows developers to quickly and easily evaluate any of Vishay's ambient light sensors. The development kit is built-to-order that includes the sensor board, adapter board and Windows® based software. The sensor board includes the customer's selected ambient light sensor, a programmable preamplifier (PGA), a 16-bit analog-to-digital converter and an I<sup>2</sup>C bus interface. The adapter board serves as the bridge from the I<sup>2</sup>C interface to the PC port. It also provides power to the sensor board.

### Features of Kit

- Convenient RS-232, I<sup>2</sup>C-port interface
- Sensor board allows direct connection to customer's host I<sup>2</sup>C bus
- Up and running in 5 minutes
- No additional power cables required
- 9-pin serial cable included
- Windows-based software with:
  - Programmable sampling rate and gain
  - Displays illumination in Lux, mA, voltage, decimal and hexadecimal
- DOS version also available



### Features of Ambient Light Sensors

- Designed to react to light just like the human eye
- Simple 2-pin connection
- Phototransistor output requires no amplifier
- Lead (Pb)-free component
- RoHS compliant

### Ambient Light Sensors

- TEMENT6000 - SMD 1206 package,  $\pm 60^\circ \phi$
- TEPT5600 - 5 mm leaded,  $\pm 20^\circ \phi$
- TEPT5700 - 5 mm leaded,  $\pm 60^\circ \phi$
- TEPT4400 - 3 mm leaded,  $\pm 30^\circ \phi$
- TEMENT6200F - SMD 0805 package,  $\pm 60^\circ \phi$

### Order Instruction

|                  |                   |                |
|------------------|-------------------|----------------|
| TEMENT6000DevKit | TEMENT6200FDevKit | TEPT4400DevKit |
| TEPT5700DevKit   | TEPT5600DevKit    |                |

### Hardware

#### Sensor Board

The sensor board consists of the customer's selected ambient light sensor, a programmable preamplifier (PGA), a 16-bit analog-to-digital converter and an I<sup>2</sup>C bus interface. With only a few additional external components, it can connect directly to the customer's host I<sup>2</sup>C bus. The schematic of the sensor board is shown in Figure 1 while the top- and bottom-side is shown in Figure 2.

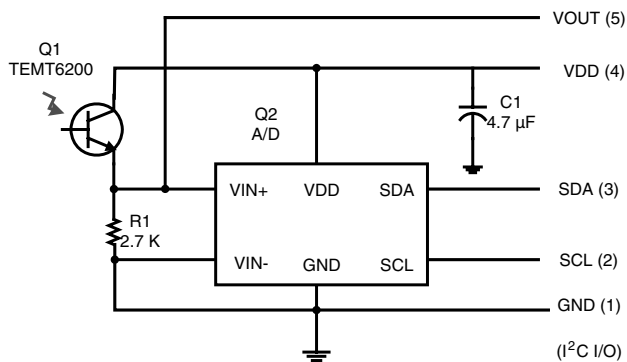


Figure 1.

# Ambient Light Sensor Development Kit

Vishay Semiconductors

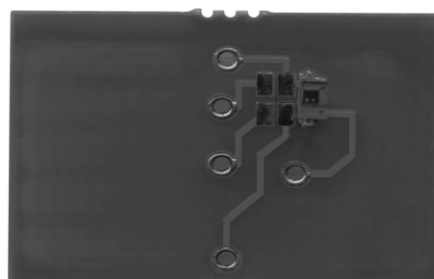
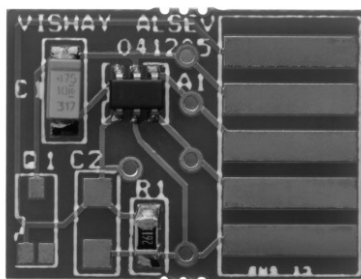


Figure 2.

## I<sup>2</sup>C - RS2323 Adapter Board

The I<sup>2</sup>C-RS232 adapter board derives its power from the RS-232 port to which it is connected. The RS-232 port interfaces to the sensor board's I<sup>2</sup>C connection. The function of each of the RS-232 signal pins is shown in Table 1.

Table 1. RS-232 Signal Functions

| Pin | Signal Name | Sensor Board I/O | Function     |
|-----|-------------|------------------|--------------|
| 1   | DCD         | Output           | Not Used     |
| 2   | RD          | Output           | Not Used     |
| 3   | TD          | Input            | SCL Control  |
| 4   | DTR         | Input            | Power Supply |
| 5   | SG          | Ground           | Ground       |
| 6   | DSR         | Output           | SDA Output   |
| 7   | RTS         | Input            | SDA Control  |
| 8   | CTS         | Output           | Not Used     |
| 9   | RI          | Output           | Not Used     |

Three inputs from the computer are used. With DTR set to high, power is supplied to the boards. To control the serial clock (SCL), TD is used. To control the serial data (SDA), RTS is used. This same line serves as a kind of "read-enable" or "release SDA" for host reading SDA from the slave through DSR.

To install the Ambient Light Sensor Development Kit, simply plug the small sensor board into the blue 10-edge connector of the I<sup>2</sup>C-RS232 adapter. Then plug the adapter into a PC RS-232 port.

## Software

To install the Windows software, unzip the [AmbientLightSensorDevKit.zip](#) in a directory. To load the DLL files, unzip the [AmbientLightSensorDevKitDLL.zip](#) in the same directory. To run the program, double click the executable file [SensorDevKit.exe](#).

The development software functions as a simple digital voltmeter to measure the light current of the ambient light sensor. When the program starts, it searches serial ports from COM1 thru COM4 for the ambient light sensor. If this search fails, a warning message is displayed, Figure 3. Possible causes include:

- COM1 thru COM4 are unavailable. A port must be enabled or released
- The sensor board is plugged-in incorrectly. The chip and capacitor are on the top-side and the sensor is on the bottom-side. See Figure 2.
- The adapter or the sensor board is not functioning and must be replaced

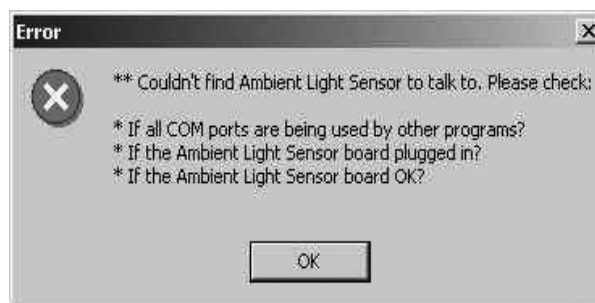


Figure 3.

Click OK. Make the necessary changes. Click Rescan located in the upper right-hand corner of the main program window to reinitiate the sensor board search.



The main program window is shown in Figure 4 and has the following features :

- Data from the sensor board is displayed on the top half of the screen. The data is displayed in hexadecimal, decimal, voltage, current in  $\mu\text{A}$ , and illuminance in lux
- Status messages are displayed at the very bottom
- Hardware configuration is shown in the lower right corner. The connected COM port is shown along with configuration data read from the configuration file. See Configuration File below for more information
- Conversion Mode selection and the interval update setting box is shown in the lower middle
- The Gain selection box is shown in the lower left corner. The buttons in the Gain box are used to change the PGA setting. Note that changing the PGA setting often will cause little change in the voltage reading because the voltage reading reflects the voltage present at the input pins. The initial gain is set in the configuration file



Figure 4.

## Conversion Mode

The development software supports both single and continuous conversion modes. In continuous conversion mode the software reads from the sensor board every  $1/8^{\text{th}}$  of a second and displays the average of the readings. The time interval for continuous readings and conversion is selected via a pull down menu in the Conversion Mode box. The longer the time selected, the more readings are taken and the more accurate the results will be. For example if the interval is 0.5 seconds, the software will calculate the average of the 4 readings taken every  $1/8^{\text{th}}$  of a second. This software feature is designed to increase the immunity

from the 50/60 Hz interference or noise. In single conversion mode, click the Trigger button to take a single reading.

## Gain

The voltage converter is a 16-bit analog-to-digital converter with differential inputs and a preamplifier. The preamplifier gain is programmable to 1, 2, 4 and 8 times. Its positive full-scale is  $0x7FFF$  (32767). If the input and the gain are too high, the converter output may be out-of-range ( $0x7FFF$ ) as shown in Figure 5. In this case, the gain must be reduced. First, try choosing a lower gain value. If the reading is still out-of-range, the value of the resistor,  $R_L$ , must be reduced.

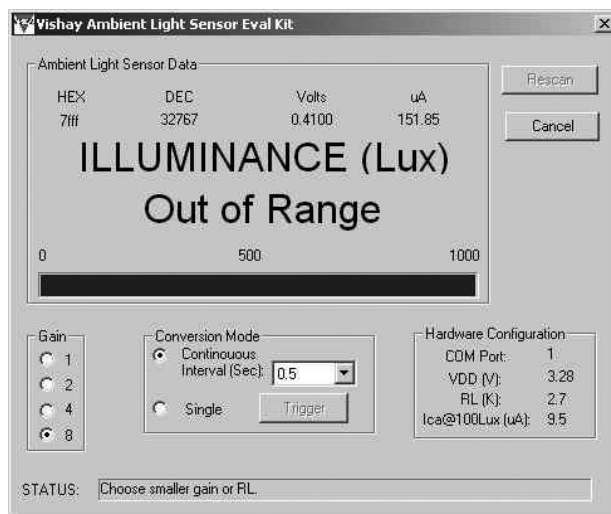


Figure 5.

## Program Calculations

The following calculations are performed by in the software program:

The input light voltage,  $V_{RL}$  (mV), calculation is a function of the code read from the ADC (newcode), the preamplifier gain (GAIN) and the power supply,  $V_{DD}$ .

$$V_{RL} = (\text{newcode} * V_{DD}) / (\text{GAIN} * 32768)$$

The sensor light current,  $I_P$  ( $\mu\text{A}$ ), calculation is a function of the input voltage,  $V_{RL}$ , and the load resistor,  $R_L$ .

$$I_P = V_{RL} / R_L * 1000$$

The light illuminance,  $E_v$  (lux), depends on the sensor responsivity,  $\text{Resp}$  ( $\mu\text{A}$  at 100 lux)

$$E_v = (100 * I_P / \text{Resp}).$$



## Configuration File

The included text file, [AmbientLightSensorDevKit.txt](#) shows a sample of the configuration that sets hardware values used in the executable program data calibration and calculations. The configuration file should be kept in the same directory as the other files. If the configuration file must be changed, modify only the number after the colon. Do not change the names.

The following is an example of a configuration file:

```
VDD(V): 3.28  
RL(KOhm): 2.7  
ICA at 100 LUX (μA): 9.7  
Gain: 2
```

**VDD** is the power reference voltage, which is the same as the power supply.

**RL** is the sensor load resistance, which converts the sensor current to voltage. It should be equal to the value of R1 on the board.

**ICA** is the calibrated sensor responsivity (light current at 100 lux).

**Gain** is an index number from 0 to 3 referring to the preamplifier gain 1, 2, 4 and 8.



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