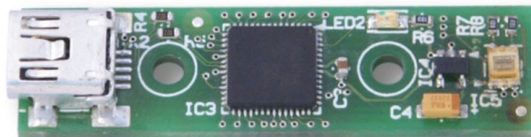


# Oak Lux

## Illuminance Sensor

# Datasheet



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## 1. Introduction

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Oak Lux is a USB attached sensor featuring a light-to-digital converter that transform light intensity to a digital signal. The device combines two different photodiode on a single CMOS integrated circuit capable of providing a near-photopic response over an effective 20-bit dynamic range (16-bit resolution). The irradiance measured is transformed into an illuminance (ambient light level) in lux using an empirical formula to approximate the human eye response.

The Oak Lux can be integrated in a custom application very easily. The operating power as well as real time sensor data and uncritical sensor configuration data are all transferred through a simple USB cable. The very low power consumption, including automatic entering into sleep mode, allows to use the device not only in fixed installations, but also in mobile applications.

### 1.1 Reference Documents

Sensor Datasheet:

[http://files.toradex.com/Oak/Datasheets/Components/Oak\\_Lux/tsl2560-e58.pdf](http://files.toradex.com/Oak/Datasheets/Components/Oak_Lux/tsl2560-e58.pdf)

Programming Guide to the Oak Sensor Family



## 2. Hardware Specifications

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### 2.1 Sensor: TAOS TSL2561

The TSL2561 is a light-to-digital converter that transforms light intensity to a digital signal. The device combines one broadband photodiode (visible plus infrared) and one infrared-responding photodiode on a single CMOS integrated circuit capable of providing a near-photopic response over an effective 20-bit dynamic range (16-bit resolution).

### 2.2 Measurement Range

Illuminance: 0 – 28303 Lux  
Resolution: 1 Lux

For more details, please refer to the sensor datasheet (link in chapter 1.1)

### 2.3 Supported Sensor Features

Read illuminance  
Sensitivity (configurable)  
Integration time (configurable)  
Sample rate adjustable

### 2.4 USB Interface

Interface: USB 2.0 Full Speed (12Mbit/s)  
Connector: Standard USB Mini-B  
Device Class: HID  
Vendor ID: 0x1B67  
Product ID: 0x0003  
Sampling Rate: 4ms to 65s, user adjustable (minimum depending on integration time)  
Report Rate: 1 ms to 65s, user adjustable

### 2.5 Operating Temperature Range

Minimum Operating Temperature: -10°C  
Maximum Operating Temperature: +70°C



## 3. Software Specifications

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All Oak Sensors are implemented as HID devices. Thus driver support is built into all major operating systems.

Captured sensor Data is transmitted through an INTERRUPT IN reports. Therefore real time processing can be guaranteed. This data can be received by the host using regular file read operations. Chapter 0 describes the contents of this report.

On an independent communication channel, sensor configuration is done using FEATURE reports that are 32 Bytes in length. Special operating system calls exist to transmit / receive feature reports. Chapter 3.2 shows the structure of a feature report for each supported command.

Please refer also to the document “Programming Guide to the Oak Sensor Family” for more details.

### 3.1 INTERRUPT IN Report Contents (Real time data)

16 Bit	Frame Number	10 <sup>-3</sup>	s
16 Bit	Illuminance	1	Lux

### 3.2 FEATURE Report Commands

#### 3.2.1 Report Mode

Byte#	0	1	2	3	4	5
Content	GnS	Tgt	0x01	0x00	0x00	RPTMODE

GnS:           0 = Set  
               1 = Get

Tgt            0 = RAM  
               1 = Flash

RPTMODE:     0 = After Sampling (Factory Default)  
               1 = After Change  
               2 = Fixed Rate

#### 3.2.2 LED Mode

Byte#	0	1	2	3	4	5
Content	GnS	Tgt	0x01	0x01	0x00	LEDMODE

GnS:           0 = Set  
               1 = Get

Tgt            0 = RAM  
               1 = Flash



## Oak Lux Datasheet

LEDMODE:      0 = Off (Factory Default)  
                   1 = On  
                   2 = Blink Slowly  
                   3 = Blink Fast  
                   4 = Blink 4 pulses

### 3.2.3 Report Rate

Number of milliseconds between two IN reports. This parameter will only be regarded if Report Mode = 2 (fixed rate)

Byte#	0	1	2	3	4	5	6
Content	GnS	Tgt	0x02	0x00	0x00	RptRate LSB	RptRate MSB

GnS:            0 = Set  
                   1 = Get

Tgt             0 = RAM  
                   1 = Flash

RptRate:       Report Rate [ms]

### 3.2.4 Sample Rate

This is the actual sample rate the sensor is working on. If Report Mode = 0 (After Sampling) this is also the rate at which the device reports values to the host PC.

Byte#	0	1	2	3	4	5	6
Content	GnS	Tgt	0x02	0x01	0x00	SampRate LSB	SampRate MSB

GnS:            0 = Set  
                   1 = Get

Tgt             0 = RAM  
                   1 = Flash

SampRate:      Sample Rate [ms]

### 3.2.5 User Device Name

Byte#	0	1	2	3	4	5-25
Content	GnS	Tgt	0x15	0x00	0x00	UsrDevName

GnS:            0 = Set  
                   1 = Get

Tgt             0 = RAM  
                   1 = Flash

UsrDevName:   User defined name for the whole device  
                      Null-terminated string, max. 20+1 characters



## Oak Lux Datasheet

### 3.2.6 User Channel Name

Byte#	0	1	2	3	4	5-25
Content	GnS	Tgt	0x15	ChP1	0x00	UsrChName

GnS: 0 = Set  
1 = Get

Tgt 0 = RAM  
1 = Flash

ChP1 1 = Channel 0 (Frame Number)  
2 = Channel 1 (Illuminance)

UsrChName: User defined name for the channel  
Null-terminated string, max. 20+1 characters

### 3.2.7 Sensitivity / Integration Time

Byte#	0	1	2	3	4	5
Content	GnS	Tgt	0x01	0x02	0x00	SNSTVTY

GnS: 0 = Set  
1 = Get

Tgt 0 = RAM  
1 = Flash

SNSTVTY: Bit 7–5 Reserved. Must be written as 0.  
Bit 4 0 = low gain (1x)  
1 = high gain (16x)  
Bit 3 Manual timing control. (not supported by the Oak Lux)  
1 = begin an integration cycle  
0 = stop an integration cycle  
NOTE: This field only has meaning when Bits 1:0 = 11.  
Bit 2 Reserved. Must be written as 0.  
Bit 1–0 Integration time for each conversion.  
00 = 13.7ms  
01 = 101ms  
10 = 402ms (Default)  
11 = manual control (not supported by the Oak Lux)  
For more details please refer to the TSL2561 datasheet (link in section 1.1)



## 4. Technical Specifications

### 4.1 Electrical Specifications

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_q^{1)}$	Operating current				20	mA
$I_{Stby}$	Standby current	No USB activity			500	$\mu A$

<sup>1)</sup> The maximum operating current is mainly influenced by the on board LED.

### 4.2 Mechanical Dimensions

The PCB is designed to be mounted using two standard M2 screws. There are no components on the back side of the PCB.

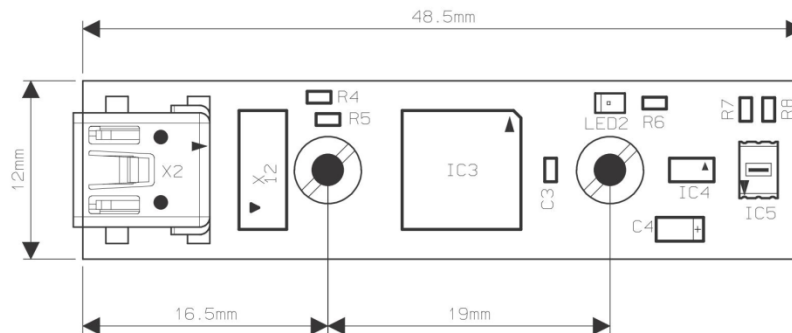


Figure 1: Mechanical dimensions of the Oak Lux sensor

### 4.3 RoHS Compliance

Unless otherwise stated, all Toradex products comply with the European Union's Directive 2002/95/EC: "Restrictions of Hazardous Substances".





#### 4.4 Pin Assignment USB Connector

An additional crimped connector (X12) is provided for the USB interface. The connector is a 5 pin through-hole of the Picoblade family by Molex ([www.molex.com](http://www.molex.com)), reference 53047-0510.

Pin	Name	Function
1	Shield	Connected to GND on pcb
2	GND	Ground reference
3	D+	Positive USB data
4	D-	Negative USB data
5	USB_VCC	5V USB Supply from host



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#### Revision history

Date	Doc. Rev.	Changes
21-Jun-2011	Rev. 1.7	Disclaimer Update
17-Jan-2011	Rev. 1.6	Modified Sample Rate Range
29-Oct-2010	Rev. 1.5	Added Operating Temperature Range
30-Sep-2010	Rev. 1.4	Added USB Vendor ID and Product ID
09-Jan-2009	Rev. 1.3	Fixed error in feature report for gain/integration time
29-Feb-2008	Rev. 1.2	Minor Edits (section 1.1)
27-Jun-2007	Rev. 1.1	Added range specification Corrected feature report to set gain/integration time
26-Mar-2007	Rev. 1.0	Initial Release

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