Light 3 Click

PID: MIKROE-5994

Light 3 Click is a compact add-on board for precise ambient light measurement in automotive applications. This board features the OPT4003-Q1, an automotive-grade digital ambient light sensor from Texas Instruments. This digital ambient light sensor excels in detecting both visible and near-infrared light with high accuracy, thanks to its dual-channel functionality and filters that mimic the human eye's response while efficiently segregating NIR light. The board features semi-logarithmic output for extensive light intensity range coverage, automatic gain adjustment for optimal resolution without manual intervention, and flexible configuration options to suit various application needs. With its advanced optical filters, the Light 3 Click is an ideal upgrade from traditional light sensing solutions, offering precision, dynamic range, and efficient NIR filtration. It applies to various automotive systems, including interior and exterior lighting, entertainment units, adaptive mirrors, and head-up displays.

Light 3 Click is fully compatible with the mikroBUS™ socket and can be used on any host system supporting the mikroBUS™ standard. It comes with the mikroSDK open-source libraries, offering unparalleled flexibility for evaluation and customization. What sets this Click board™ apart is the groundbreaking ClickID feature, enabling your host system to seamlessly and automatically detect and identify this add-on board.

How does it work?

Light 3 Click is based on the OPT4003-Q1, an automotive-grade digital ambient light sensor from Texas Instruments. This component is specifically designed for use in various automotive applications, including but not limited to interior and exterior lighting systems, entertainment and dashboard clusters, adaptive mirrors, rain-sensing wiper systems, head-up displays, and automotive camera setups. Central to its design, the OPT4003-Q1 sensor incorporates a dual-

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channel functionality that accurately captures and converts light from visible and near-infrared (NIR) spectrums into digital signals. The sensor's visible light detection is fine-tuned with a unique filter miming the human eye's response, ensuring precise visible light measurement by eliminating NIR interference. Conversely, its NIR channel is optimized to filter out visible light, focusing on capturing NIR light with a high degree of accuracy, marked by a clear cutoff at 800nm.
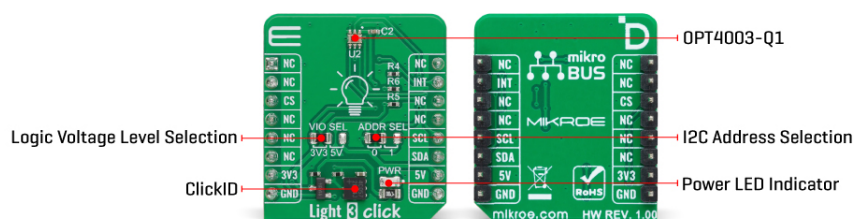
This sensor outputs measurements in a semi-logarithmic scale featuring binary logarithmic scales for full light intensity range coverage. The visible light detection channel offers nine binary light ranges, ranging from 535µlux to 143klux, with an effective dynamic range of 28 bits. On the other hand, the NIR channel spans seven light ranges, from 565pW/cm2 to 38mW/cm2, and delivers a 26-bit dynamic range. Its automatic range selection capability dynamically adjusts gain based on ambient light levels, ensuring optimal resolution without requiring manual adjustments.

The OPT4003-Q1 also includes sophisticated optical filters that provide exceptional out-of-band light rejection, which is crucial for maintaining accurate light measurements under various conditions, including under tinted glass. It is an ideal replacement for traditional light sensing solutions like photodiodes and photoresistors, which generally need more precision, dynamic range, and NIR filtration. The device offers flexible configuration options, with light conversion times adjustable between 600µs and 800ms across 12 steps to accommodate different application requirements.

The OPT4003-Q1 supports both continuous and single-shot measurement modes. It incorporates threshold detection, enabling energy-efficient operation by allowing the processor to remain in low-power states until a significant light change occurs. Communication with the sensor is achieved via an I2C-compatible interface, with a built-in FIFO buffer ensuring data integrity during slower readout periods. Besides I2C pins, the device allows the adjustment of its I2C slave address's least significant bit via an SMD jumper marked as ADDR SEL. This board also has an interrupt reporting system (INT pin) that allows the host MCU connected to the I2C bus to sleep or otherwise ignore the device results until a user-defined event occurs that requires possible action.

This Click board™ can operate with either 3.3V or 5V logic voltage levels selected via the VIO SEL jumper. This way, both 3.3V and 5V capable MCUs can use the communication lines properly. Also, this Click board™ comes equipped with a library containing easy-to-use functions and an example code that can be used as a reference for further development.

Specifications

Type	Optical
Applications	Ideal for automotive interior and exterior lighting, infotainment and clusters, electrochromatic and smart mirrors, wiper modules, head-up display systems, automotive camera systems
On-board modules	OPT4003-Q1 - automotive-grade digital ambient light sensor from Texas Instruments
Key Features	Independent measurement of visible and near-infrared (NIR) light, sharp cutoff at 800nm for high NIR sensitivity, high accuracy, automatic gain adjustment, support both continuous and single-shot measurement modes, I2C interface with selectable slave address, low power consumption, and more
Interface	I2C
ClickID	Yes
Compatibility	mikroBUS™
Click board size	S (28.6 x 25.4 mm)
Input Voltage	3.3V or 5V

Pinout diagram

This table shows how the pinout on Light 3 Click corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

Notes	Pin	mikro™ BUS			Pin	Notes
	NC	1	AN	PWM	16	NC	
	NC	2	RST	INT	15	**INT**	Interrupt
ID COMM	**CS**	3	CS	RX	14	NC	
	NC	4	SCK	TX	13	NC	
	NC	5	MISO	SCL	12	**SCL**	I2C Clock
	NC	6	MOSI	SDA	11	**SDA**	I2C Data
Power Supply	**3.3V**	7	3.3V	5V	10	**5V**	Power Supply
Ground	**GND**	8	GND	GND	9	**GND**	Ground

Onboard settings and indicators

Label	Name	Default	Description
LD1	PWR	-	Power LED Indicator
JP1	VIO SEL	Left	Logic Voltage Level Selection 3V3/5V: Left position 3V3, Right position 5V
JP2	ADDR SEL	Left	I2C Address Selection 0/1: Left position 0,

Light 3 Click electrical specifications

Description	Min	Typ	Max	Unit
Supply Voltage	3.3	-	5	V
Visible Channel Measurement Range	535µ	-	143 k	lux
Wavelength (ALS/IR)	550 / 810			nm

Software Support

We provide a library for the Light 3 Click as well as a demo application (example), developed using MIKROE compilers. The demo can run on all the main MIKROE development boards.

Package can be downloaded/installed directly from NECTO Studio Package Manager(recommended), downloaded from our LibStock™ or found on Mikroe github account.

Library Description

This library contains API for Light 3 Click driver.

Key functions

- light3_sw_reset This function is used to perform software reset.

- light3_write_reg This function writes a desired data into the selected register by using I2C serial interface.

- light3_get_ch0_data This function reads ambient light data from the Channel 0 and performs the calculatios from raw data to Lux.

Example Description

This example demonstrates the use of Light 3 Click board by measuring the ambient light level in Lux.

The full application code, and ready to use projects can be installed directly from NECTO Studio Package Manager(recommended), downloaded from our LibStock™ or found on Mikroe github account.

Other Mikroe Libraries used in the example:

- MikroSDK.Board
- MikroSDK.Log
- Click.Light3

Additional notes and informations

Depending on the development board you are using, you may need USB UART click, USB UART 2 Click or RS232 Click to connect to your PC, for development systems with no UART to USB interface available on the board. UART terminal is available in all MIKROE compilers.

mikroSDK

This Click board™ is supported with mikroSDK - MIKROE Software Development Kit. To ensure proper operation of mikroSDK compliant Click board™ demo applications, mikroSDK should be downloaded from the LibStock and installed for the compiler you are using.

For more information about mikroSDK, visit the official page.

Resources

mikroBUS™

mikroSDK

Click board™ Catalog

Click boards™

Downloads

Light 3 click example on Libstock

Light 3 Click schematic v100

Light 3 Click 2D and 3D files v100

OPT4003-Q1 datasheet