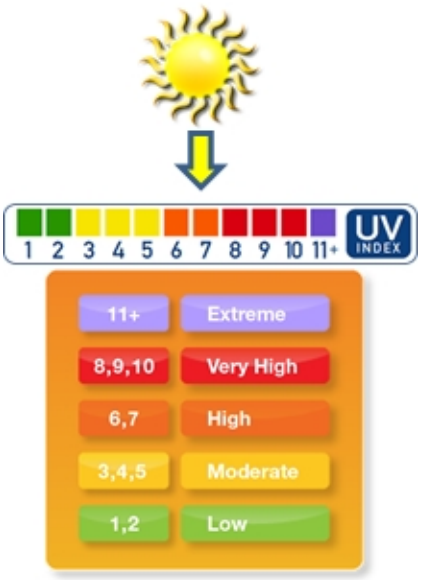
Si1132 UV Index and ALS Sensor
Si1145/46/47 UV Index, ALS, and Proximity Sensors
February 2014

Product Description

The latest additions to Silicon Labs' growing sensor family are the Si1132 and the Si1145/46/47, the industry's first single-chip digital Ultraviolet (UV) Index sensors. This optical sensor family enables fitness wrist/arm bands, smart watches, and smartphones to differentiate by measuring UV sun exposure. Customers can benefit by receiving a warning of when their current UV exposure is unhealthy or to determine their cumulative UV exposure during exercise. This measurement is critical for people with an elevated risk of sunburn or anyone who is concerned about their sun exposure. This highly integrated sensor family also enables sleep tracking, proximity/gesture control, pulse rate measurement, and pulse oximetry measurement. An innovative low-power integrated processing unit and sensor extends battery life with as little as 1.2 µA average current for UV measurements. The sensor family features an all-digital I^2C control interface and up to three infrared LED drivers in an impressively small 2 mm x 2 mm clear QFN package. Developers have the freedom to implement one-dimensional systems with a range of up to 50 cm or multi-dimensional systems capable of advanced motion/gesture sensing with a range of up to 15 cm. The robust infrared sensing architecture works in direct sunlight and includes an ambient light sensor capable of sensing light levels up to 128 kLux.



Key Feature	Customer Benefits
UV Index sensor	• Determine UV sun exposure risk and cumulative UV sun exposure • Recommend sun screen apply/re-apply
Ambient light sensor	• Enables sleep tracking when combined with accelerometer • Improved user visual experience and reduced backlight energy • Enables accurate light level monitoring under mixed-light sources
Up to 3 LED drivers	• Enables heart rate and pulse oximetry measurements • Improve user interface with 1, 2 and 3-D gestures
Low power sensor architecture	• Long battery life with as little as 1.2 µA average current • Dynamic adjustment of LED currents minimizes power consumption • Long battery life with Ir-LED on-time of only 25.6 µs

Target Customers

Consumer fitness and health applications like smart watches, activity tracking wrist bands/arm bands, and smartphone handsets.

Cross-selling Opportunities

Competitors in the optical products space are unable to offer a companion low-power MCU solution such as Silicon Labs' industry leading EFM32 32-bit MCUs or 8051 8-bit MCUs. The Si114x's various sensing modes provide valuable information to a controller in order to algorithmically provide UV index, heart rate, pulse oximetry, sleep tracking, and advanced user control with gestures or proximity detection.

Why We Win!

The Si1132 and Si1145/46/47 are the industry's first single-chip digital UV Index sensors. The Si114x devices offer greater sensitivity and sensing range at significantly lower power levels than our competitors. See additional information on page 4.

Overview

The Si1132 is a low-power UV Index and ambient light sensor with an I²C digital interface and programmable-event interrupt output. This sensor IC includes an analog-to-digital converter, integrated high-sensitivity photodiodes, and a digital signal processor. The Si1145/46/47 adds reflectance-based, infrared proximity and gesture detection with an additional infrared photodiode and one, two or three integrated infrared LED drivers with fifteen selectable drive levels. The Si114x enables implementation of reflective heart rate and pulse oximetry measurements as well as touchless interfaces to control equipment and applications, allowing user control from a distance. The Si1132 and Si114x offer excellent performance under a wide dynamic range of light sources including direct sunlight. The photodiode response and associated digital conversion circuitry provide excellent immunity to artificial light flicker noise and natural light flutter noise. The two and three infrared-LED-driver devices are capable of supporting proximity motion detection. The Si114x devices are provided in a 10-pin 2 mm x 2 mm QFN package and are capable of operation from 1.8 to 3.6 V over the –40 to +85 °C temperature range.

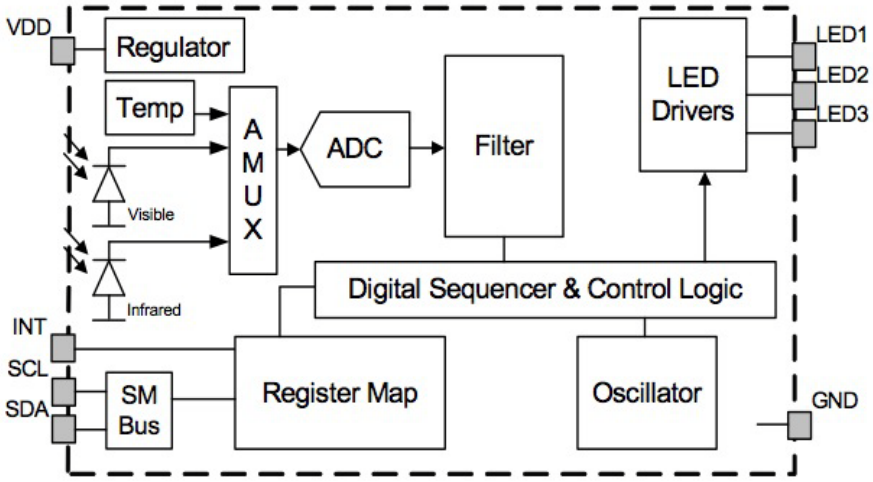


Figure 1. Si1147-A10-GM System and Block Diagram

Technical Highlights

- Integrated UV index sensor
  - Digital UV Index register that can be read through I²C interface
  - Factory calibration to address part-to-part variation
- Integrated ambient light sensor
  - 100 mlx (mill lux) resolution possible, allowing operation under dark glass
  - 1 to 128 klx (kilo lux) dynamic range possible across two ADC range settings
  - Accurate lux measurements with IR correction algorithm
- Industry's lowest power consumption
  - 1.71 to 3.6 V supply voltage
  - < 500 nA standby current

  - Internal and external wake support
  - Built-in voltage supply monitor and power-on reset controller
- Integrated infrared proximity detector
  - Proximity detection adjustable from under 1 cm to over 50 cm
  - 1, 2 and 3-axis sensing capability
  - Three independent LED drivers
  - 15 current settings from 5.6 to 360 mA for each LED driver
  - 25.6 µs LED driver pulse width
  - 50 cm proximity range with single pulse (<3 klx)
  - 15 cm proximity range with single pulse (>3 klx)
  - Operates at up to 128 klx (direct sunlight)
  - High reflectance sensitivity < 1 µW/cm
  - High EMI immunity without shielded packaging
- All-digital I^2C control interface
- Integrated temperature sensor
- Small-outline 10-lead 2 mm x 2 mm QFN
- Operating temperature range: –40 to +85 °C

Product Features and Customer Benefits

Customer Benefit

- Determine UV sun exposure risk
- Determine cumulative UV sun exposure

Industry's first single-chip digital UV Index sensors

This optical sensor family enables fitness wrist/arm bands, smart watches, and smartphones to differentiate by measuring UV sun exposure. Customers can benefit by receiving a warning of when their current UV exposure is unhealthy or to determine their cumulative UV exposure during exercise. The digital UV Index provided is linearly related to the intensity of sunlight reaching the earth and is weighted according to the CIE Erythemal Action Spectrum. This weighting is a standardized measure of human skin's response to different wavelengths of sunlight from UVB to UVA. The UV Index has been standardized by the World Health Organization.

Customer Benefit

- Enables heart rate and pulse oximetry sensing
- Enables advanced motion and gesture sensing

Three independent infrared LED drivers

The Si114x enables heart rate and pulse oximetry measurements using integrated LED driver(s). The Si1146 and Si1147 devices, with two and three infrared LED drivers respectively, enable advanced motion and gesture sensing. With its two LED drivers, the Si1146 enables motion sensing in the z- and x-axis. When coupled with the intelligent control of a Silicon Labs MCU, the Si1146 enables the Silicon Labs touchless slider. The Si1147, with its three LED drivers, enables 3-dimensional motion sensing. Both sensor devices provide reflectance measurements that can be post-processed to determine gestures. Additionally, the LED drivers are dynamically and independently controllable to minimize the necessary LED current based upon host processed reflectance levels. Fifteen levels of current drive are provided to maximize the developer's implementation freedom.

Customer Benefit

- Enables sleep tracking
- Improved user experience

Enhanced ambient light sensing (ALS)

The Silicon Labs Si1132/114x ambient light sensor allows developers to implement sleep tracking when combined with an accelerometer. In addition, both infrared and visible light levels can be measured to better control LCD backlighting in mixed-light source environments. The end result is an inexpensive yet effective means with which to effectively adjust backlighting to ease eyestrain and reduce power without distracting the user.
.

Customer Benefit

- Long battery life
- Smaller and thinner products due to small battery

Low-power sensor architecture

The integrated sensor, ADC, and low-power MCU architecture enables long battery life with as little as 1.2 µA average current at once per second UV sample rate. The high IR sensor sensitivity provides significantly longer battery life in motion sensing/gesture applications through the use of a single 25.6 µs Ir-LED on-time while still enabling up to 50 cm sensing range. Dynamic adjustment of LED currents further minimizes power consumption.

Competition

Silicon Labs provides the industry's first single-chip digital UV Index sensor. Typical UV sensors are made using UV sensitive photodiodes with an external MCU/ADC and signal processing firmware. All Si1132/Si1145/46/47 functions have been implemented in a single 2 mm x 2 mm package with I^2C interface.

In addition to the strong desire for a complete solution, customers care about the following:

- System power consumption
- UV index measurements following WHO compliant CIE Erythema Action Curve
- High integration
- Ease of development

Silicon Labs provides **significantly lower system power**. The **digital UV Index** is linearly related to the intensity of sunlight reaching the earth and is weighted according to the CIE Erythemal Action Spectrum as standardized by the World Health Organization. Only Silicon Labs has integrated all of this functionality in an impressively small **2 mm x 2 mm package.** Silicon Labs makes it **easy to develop** by providing a digital UV index value through the industry standard I^2C interface. In addition, Silicon Labs provides example software source code for ALS, proximity, and gesture detection algorithms.

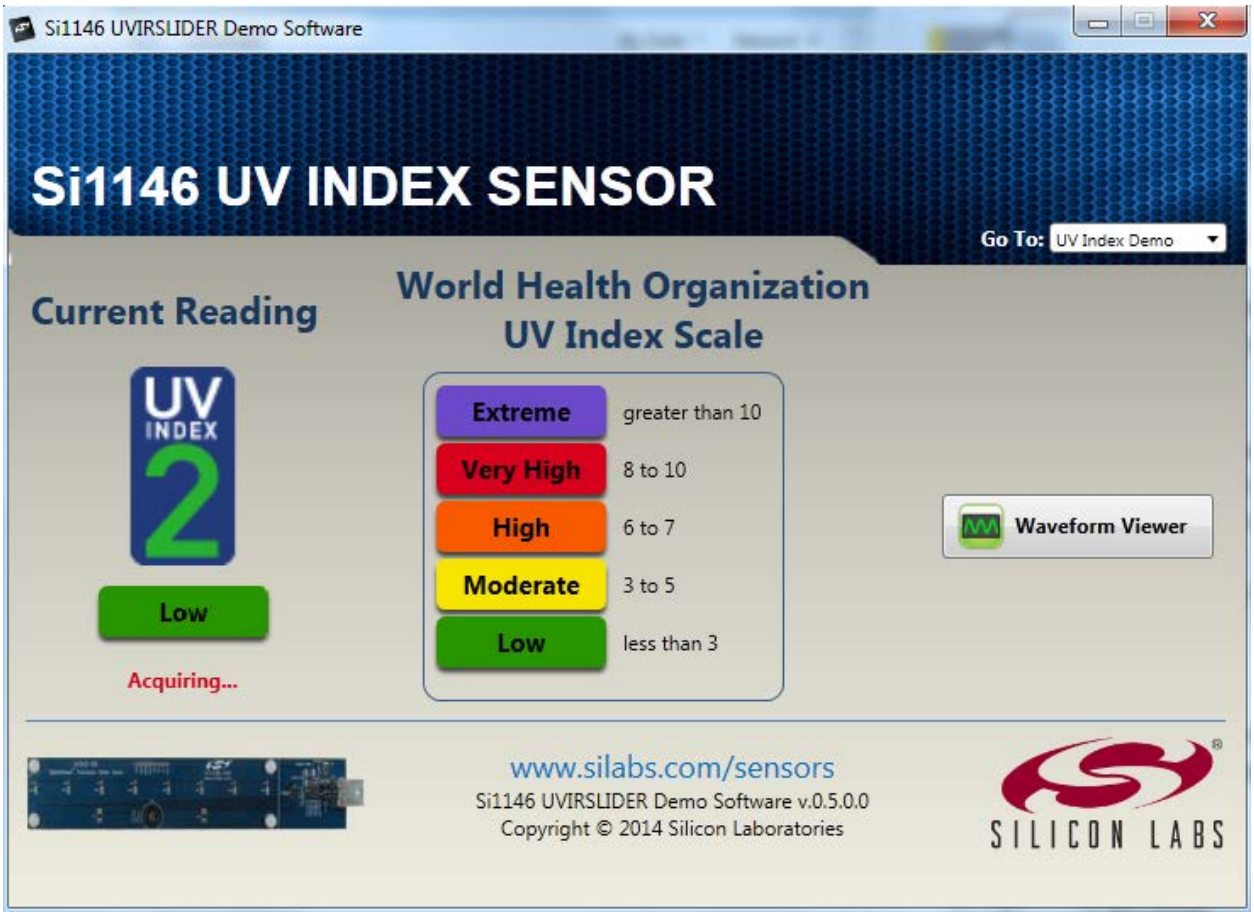
Sales Support

UVIrSlider2EK

The Ultraviolet Infrared Slider2 Evaluation Kit is an advanced development platform for the Si1132/Si1145/46/47 UV Index, IR, and ambient light sensors. Controlled by an advanced C8051F800 ultra low-power microcontroller (MCU), the UVIrSlider2EK contains a Si1146 sensor connected to two IR-LEDs. This innovative platform allows for UV index measurements, advanced 2D/2-axis touchless gesture detection as well as general-purpose object proximity detection. In addition, the Si1146 sensor on the IrSlider2EK contains an integrated ambient light sensor. The IrSlider2EK is pre-configured with firmware that displays the 5 level consumer UV strength index on 5 LEDs. The downloadable demo software provides a GUI with the full UV index and the ability to enable the IR Slider demo which demonstrates left/right gesture detection using eight visible LEDs.

Development of advanced motion and gesture sensing is assisted by the Si114x Programmer's Toolkit API, which allows for development of software to control the UVIrSlider2EK from a PC. Sample source code for the IrSlider2EK is provided with the Si114x Programmer's Toolkit to enable rapid application development. The Si114x Programmer's Toolkit also contains Silicon Labs' powerful Control Panel and Performance Analysis Tool for real-time reflectivity monitoring with the UVIrSlider2EK.

The UVIrSlider2EK Board is available for
$50 USD (MSRP)



MSRP Pricing and Availability

Suggested resale at 10Ku ranges from $1.03 to $2.00. The UVIRSLIDER2EK evaluation and demo kit is priced at $50 each. Samples and production quantities are available now.

Device	Description	Suggested Resales							
		MOQ	1K	5K	10K	25K	50K	75K	100K
Si1132-A10-GMR	I2C UV Index and Ambient Light Sensor	$1.44	$1.44	$1.16	$1.10	$1.03	$0.96	$0.93	$0.89
Si1145-A10-GMR	I2C UV Index and Proximity/Ambient Light Sensor with 1 LED Driver	$1.73	$1.73	$1.39	$1.32	$1.24	$1.15	$1.12	$1.07
Si1146-A10-GMR	I2C UV Index and Proximity/Ambient Light Sensor with 2 LED Drivers	$2.22	$2.22	$1.78	$1.68	$1.58	$1.48	$1.42	$1.36
Si1147-A10-GMR	I2C UV Index and Proximity/Ambient Light Sensor with 3 LED Drivers	$2.81	$2.81	$2.24	$2.14	$2.00	$1.88	$1.80	$1.73

Documentation

- Customer friendly presentation available on www.silabs.com/SalesGuide/
- Sales memo available on www.silabs.com/SalesGuide/
- Si1132 Data Sheet
- Si1145/46/47 Data Sheet
- UVIrSlider2EK Quickstart Guide
- UVIrSlider2EK User's Guide
- AN498: Designer's Guide for the Si114x
- AN521: Infrared LED Selection Guide

Call-to-Action

1. Order the easy to demonstrate UVIrSlider2EK.
2. Download the demo application and provide hands-on demonstrations to customers—putting simple tools in their hands will make selling simple.
3. Locate the high-volume health and fitness customers who have yet to discover the differentiation of adding UV index sensing to their products.
4. Educate the module manufacturers [LiteOn, Sharp Opto, Kodensi, Panasonic, Vishay, Citizen, SEMCO]
5. Sell the companion MCU (EFM32 or C8051).

Contact

Kevin Kilbane
Sr. Product Manager, APS
Silicon Labs
kevin.kilbanel@silabs.com
Office Phone: +1 512-532-5277