User guide

TSL2572 EVM

TSL2572 Light-to-Digital Ambient Light Sensor
Version 1. 2

Content

TSL2572

The TSL2572 devices are packaged to support various operational uses. Software is provided to control the devices. Throughout this document, the device will be referred to as TSL2572.

Initial hardware setup

The software should be installed prior to connecting any hardware to the computer. Follow the instructions found in the Quick Start Guide (QSG). This will load the required driver for the USB interface and also the control software and graphical user interface (GUI). The hardware consists of the EVM v2.1a Controllerboard, the TSL2572 Daughterboard and a USB interface cable and a USB Memory Stick. When the USB cable is connected the green LED should light up indicating that power is being received via the USB interface, and the controllerboard processor is running. If the green LED does not light up, check the USB cable connections; unplug the USB cable and try again. If the green LED still does not light, check the PC for USB error messages. See the Resources section at the end of this document for additional assistance.

1   Establishing basic functionality

The software should be started using the desktop icon or by double clicking the DigitalLightSensor.exe file from the installation directory. The default installation directory, depending on the device and the operating system you are using, is:

C:\Program Files\ams\TSL2572EVM Windows 32 bit operating systems

C:\Program Files (x86)\ams\TSL2572EVM Windows 64 bit operating systems

A different install path may be selected by the user. When started, two windows will open on the PC. The top window, or Parent Window (PW), is not typically needed and may be placed out of the way. The bottom window, or Child Window (CW), is the main user interface and should be positioned on the screen for easy access. Clicking on the red "X" on the PW will close both windows and terminate the application. Clicking on the red "X" on the CW will close only the CW.

The "Functional" tabs on both the left and right side of the main display (bottom window) will be selected by default. On the right side, numbers should be changing, showing that the ALS functions are operational. By changing the ambient light source or waving your hand over the sensor at <4 inch (100mm) separation you should see the ALS readings change correspondingly.
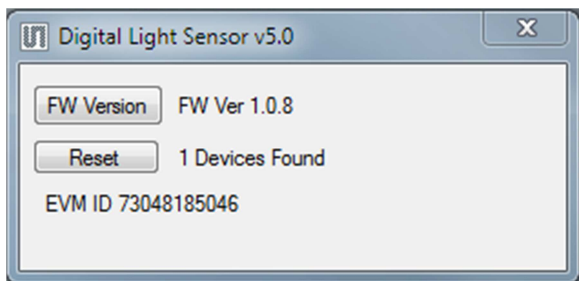
The balance of this document identifies and describes the controls available on the different tabs of the GUI. In combination with the TSL2572 datasheet, the QSG and application notes available on the ams website, www.ams.com, there should be enough information to allow evaluation of the TSL2572 device.
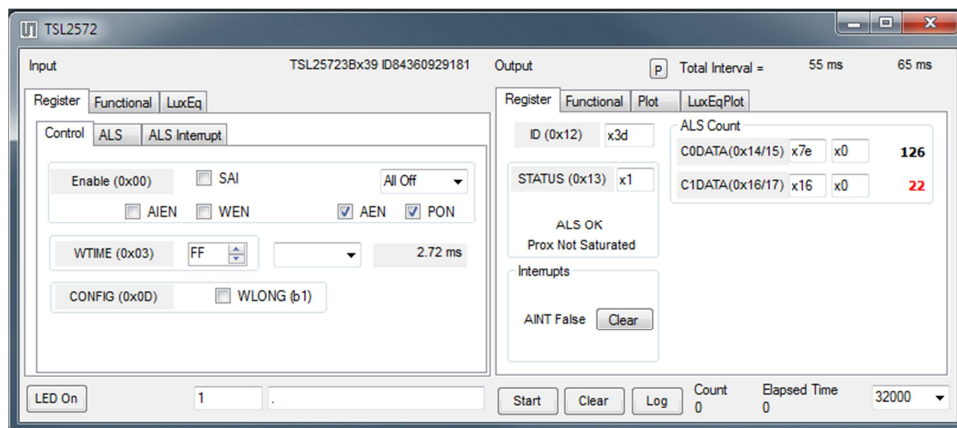
2   TSL2572 EVM graphical user interface (GUI)

2.1   Software overview

On initialization the software displays two windows – a smaller "Digital Light Sensor" window and a larger window containing controls pertinent to the device connected.

If "No Devices" appears, verify that the daughterboard is connected to the motherboard properly. If "No_HID" appears, verify the USB cable is connected. A green LED on the motherboard indicates that the USB cable is connected and providing power to the system. The "Reset" button can be pressed, or the software can be restarted, to reinitialize the system.
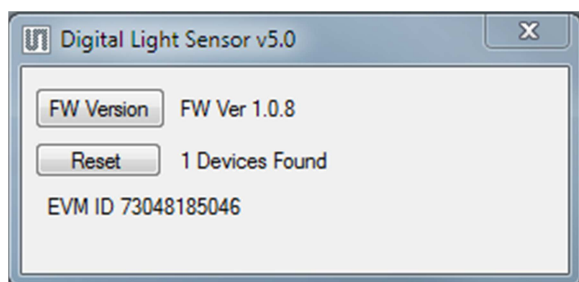
The larger window contains the user interface with control buttons, fields, selection boxes and output values for the identified device connected. Tabs are used to make control and evaluation of specific device functions easy. For the TSL2572 devices the initial display screen is shown:

This window has inputs organized on the left, and outputs organized on the right. Values for register variables may be set using multiple techniques. The Functional tab is commonly used to quickly evaluate the device with nominal settings. The Input Register tab allows the register settings to be changed, and the Output Register tab allows registers to be viewed. Other tabs provide additional demonstration and test features for evaluation.

By default the "Functional" tabs have the focus. The values shown in this document will not exactly match a user's system but the basic window and controls should be identical. This document will identify the usage and operation of these items in detail.

Always visible along the bottom are the following controls:

- LED Off – ON/OFF/ON toggle for the green motherboard LED. This LED is a good power-on indicator but can introduce errors in the optical tests. It is recommended for accurate measurements to turn the LED off.

- A section containing logging controls and sampling status information:

1. Toggles LED on the motherboard.
2. Text entered here is appended to the default file name and stored in the log file. The file name contains the Part Name and address shown in the large "Digital Light Sensor" window, an underscore "_" and the text entered. The default if nothing is entered is a period (".").
3. Secondary comment box. Text entered here is also appended to the log file name and stored in the log. The default if nothing is entered is a period (".").

Sample:

TSL25721Cx39 _ A-B-C _ 1-2-3 _ Log.csv

────── From DigitalLightSensor.exe
────── From User Input

4. The start button tells the program to start logging. The fields entered in #2 and #3 will be used as field names in the output. If you change the values in #2 or #3, the corresponding field names will change in the output beginning at the time of the change. The default log file name be based on the values in #2 and #3 at the time the log file is written.

5. Clear –The Clear button will flush the previous optical sample readings and reset the elapsed time indicator (see #7).

6. Log – Creates a comma-separated values file containing the log data. The name will be assigned as explained in #3. This will cause the system to write out any data currently in the log buffer.

7. Count of samples in the log buffer. When that number reaches the limit selected in #9, the system will show a file dialog to save the log in a named file.

8. The elapsed time since the beginning of logging data.

9. The number of log samples collected before log entry is written to the log file.

2.1.1 Input side, "Functional" tab

Simple commonly used controls exist for the ALS functionality and the wait time between samples.

ALS sensor

- Gain - The gain control allows the user access to the AGAIN settings in the Control Register (0x0F). The gain amplifies the ADC signal to increase sensitivity. The gain options include 1x, 8x, 16x and 120x and are selected from the list box when the down arrow is depressed

- Time (mS) – This list box has numerous preselected values for the integration time of both channels (Ch0 and Ch1). If a value other than what is shown in the list box is desired it must be entered manually using the Register tab (documented later). Manually entering a value will NOT work in this location. The actual integration time is shown on the line below.

NOTE: The saturation level of the device is partially dependant on the integration time. Digital saturation occurs when the ADC output registers overflow. Digital saturation is reached at 65,536, thus the full-scale output of the TSL2572 is 65,535 (16-bits). If the integration time is set less than 172ms, however, the dynamic range of the device will be limited to the following:

Integration Time > 172ms Saturation = 65,535

Integration Time < 172ms Saturation = ((Integration Time / 2.7) x 1024) – 1

Wait time

When the software initializes, a default wait period of 2.7mS is inserted between successive ALS executions. This duration can be adjusted in 2.72mS steps from 0 to 696mS. A wait multiplier (WLONG=1) may also be used to multiply the wait period by 12x. Using these controls the duration of the wait may be adjusted from none (WEN=0) to 8.3 seconds (WEN=1, WLONG=1, WTIME=0x00).

The Wait Time list box provides a quick mechanism for setting preselected wait periods from 2.72mS to 696mS. The wait period is completely disabled by setting WEN=0 (Enable Register (0x00, bit3)).

- The photodiodes receiving the optical energy are chosen in the second line. The list box shows options for Neither, Ch 0, Ch 1 or Both.
- To provide a convenient method for setting the slider values, a button and a pull down list are provided immediately to the right of the sliders.

-

Input side, "Register" tab

"Control" Sub Tab

The Register tab provides for direct control of the registers of the device.

The Control sub-tab allows enabling and disabling functionality in the part and also controls the wait time multiplier (WLONG).

Additionally, a list box provides options for turning ON all parts (All On) of the device or turning OFF all parts (All Off) of the device simultaneously.

- Enable Register (0x00) – Provides the ON/OFF control of the device.
- Check boxes are provided to allow selection of specific functions on the device:
    1. PON – Power on. Activates internal oscillator. When =0 device is in standby.

2. AEN – ALS Enable. Writing a one (1) enables the ALS
3. WEN – Wait Enable. Writing a one (1) activates the wait timer.
4. AIEN – ALS Interrupt Enable. Writing a one (1) enables the ALS interrupt.
5. SAI – Stop After Interrupt. Writing a one (1) causes the device to power down at the end of the ALS cycle when an interrupt has been generated.

- WTIME (0x03) – Wait time in 2.72ms increments, unless the WLONG bit is set, in which case the wait time is multiplied by 12. The number to the right is the computed WTIME. See the ATIME note in the ALS Sub Tab description.
- Config Register (0x0D) – Controls the wait time multiplication factor of x12.
   1. WLONG – Wait Long. When checked (=1) enables the wait multiplier.

"ALS" Sub Tab

The ALS tab shows the registers associated with ambient light sensing control. Register values in hex are shown on the left, preselected values are available in list boxes in the middle, and actual values are shown on the right.

- ATIME Register (0x01) controls the ALS integration time. The actual time is:
(256-ATIME) * 2.72 ms

Note: The column on the right is the computed value for ATIME and is always correct. Sometimes the value shown in the list box will be one of the preselected values but it has not been selected. If this happens the number will not be the same as the computed number for WTIME on the Control Sub-Tab. The computed value is the one that is correct. This can be fixed by selecting a preselected value from the list box or by cycling the register value UP/DOWN or DOWN/UP. This will set the list box value or clear the value from the list box so the screen is correct.

- Control Register (0x0F) – Controls the ALS gain settings.
   1. AGAIN – Adjusts the ALS input gain. Valid values are 1x, 8x, 16x, and 120x.

2. AGL – Setting this bit to one (1) causes the actual gain value to be 1/6 of the selected AGAIN value.

3.

"ALS Interrupt" Sub Tab

This tab contains the settings for controlling the generation of ALS interrupts to a control processor.

The AILT and AIHT values are 16 bit thresholds for the upper and lower trigger points. Each is set using two 8-bit registers. Another control (APERS) establishes the required persistence of the interrupt signal.

Also on this screen is a button that will automatically generate the register values to provide threshold settings 25% higher and lower than the currently measured amount of ambient light.

- ALS Interrupt Low Threshold (0x04, 0x05) – Low light threshold for ALS interrupt.
    1. AILTL (0x04) – The lower 8 bits of the 16 bit low threshold value.
    2. AILTH (0x05) – The upper 8 bits of the 16 bit low threshold value.
- ALS Interrupt High Threshold (0x06, 0x07) – High light threshold for ALS interrupt.
    1. AIHTL (0x06) – The lower 8 bits of the 16 bit high threshold value.
    2. AIHTH (0x07) – The upper 8 bits of the 16 bit high threshold value.
- APERS (0x0C) – The APERS field (bits 3:0) controls the number of times the ALS interrupt threshold (AILT, AIHT) is exceeded before the interrupt is generated. Setting a zero means an interrupt is generated on every ALS reading. The meaning of the other settings is shown in this table.

APERS Value	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Consecutive Out of Range ADC Values	Every	1	2	3	5	10	15	20	25	30	35	40	45	50	55	60

- The +/-25% button takes the current ambient light reading and automatically computes new values for the AILT and AIHT registers, each with a 25% wider latitude.

2.1.2 Output side, "Register" tab

The value of internal registers is displayed on this tab. Register values cannot be set here. To set registers use the Register tab on the input side of the screen. Buttons are provided for clearing the ALS interrupt (AINT). The current interrupt status is also shown. The C0DATA, C1DATA and are the ADC values for the Ch 0 and Ch 1 photodiode value. Each is read via two 8-bit registers.

- ID (0x12) – The ID register provides the value for the part number.
- Status (0x13) – Internal status. Interrupts active (2 bits) and ALS valid bits are here. The contents of the register is decoded as follows:
    1. "ALS OK" or "ALS Not OK" will be displayed based on the AVALID bit.
    2. Interrupts
        a. "AINT True" or "AINT False" is displayed to indicate whether the ALS interrupt bit is set. Clicking on this Clear button will clear the ALS interrupt. Note that if the proper conditions exist, the interrupt will be raised again immediately.
        b. Clicking on the Clear Both button will clear the ALS interrupts. Note that if the proper conditions exist, either (or both) of the interrupt(s) will be raised again immediately.
- C0DATA (0x14, 0x15):
    1. C0DATA (0x14) – The lower 8 ADC bits of the Ch 0 photodiode.
    2. C0DATAH (0x15) – The upper 8 ADC bits of the Ch 0 photodiode.
    3. The full 16-bit value is displayed, in black, next to the C0DATA fields.
- C1DATA (0x16, 0x17):
    1. C1DATA (0x16) – The lower 8 ADC bits of the Ch 1 photodiode.
    2. C1DATAH (0x17) – The upper 8 ADC bits of the Ch 1 photodiode.
    3. The full 16-bit value is displayed, in red, next to the C1DATA fields.

### 2.1.3 Output side, "Functional" tab
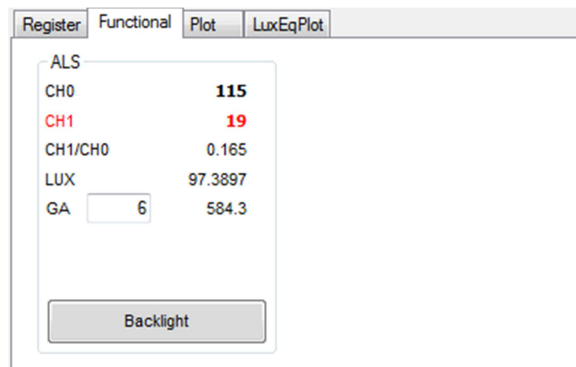
The Ch 0 and Ch 1 photodiodes output values are shown, and their ratio is shown below.

LUX is computed and displayed. When saturation approaches, "> 75% Saturated" will appear below the LUX values. A scaling factor in the box below LUX will scale the LUX value. This is useful for scaling for configurations such as dark glass.

2.1.4 Output side, "PLOT" tab

The two photodiodes, the ALS reading and the LUX can be displayed vs. time on the graph.
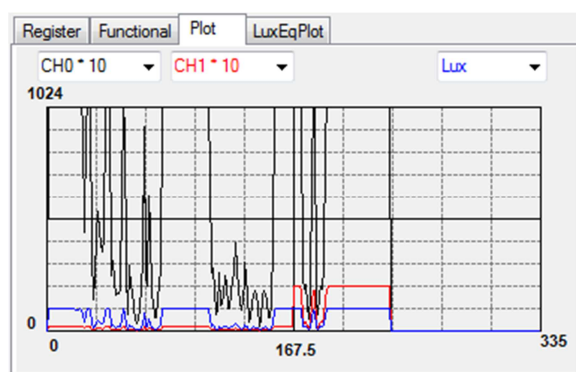
2.1.5

2.1.6 "LUXEQ" and "LUXEQPLOT" tabs

The "LuxEq" tab on the Input Side and the "LuxEqPlot" tab on the Output Side are used together when developing a custom Lux equation. Refer to Designer's Notebook number 28 (DN28), "Developing a Custom Lux Equation," for information regarding the use of these tabs.
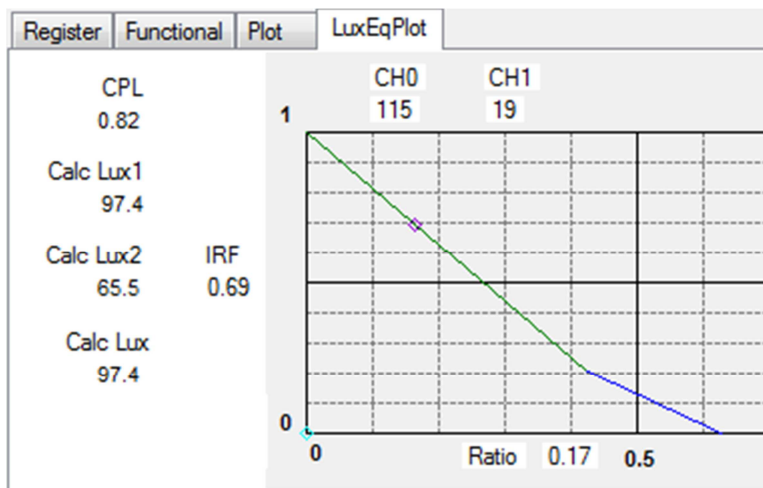
Resources

TSL2572 datasheet

TMD2572 datasheet

Quick Start Guide (QSG)

Designer's Notebooks

For additional information regarding the TSL2572 or TMD2572, please refer to the respective datasheets available at www.ams.com. For information regarding the installation of the TSL2572 or TMD2572 EVM host application please refer to the Quick Start Guide included in this EVM kit.

Designer's Notebooks dealing with various aspects of optical measurement and optical measurement applications are available. All content is available on the **ams** website at www.ams.com.