



# STK3331

**Ambient Light Sensor and Proximity Sensor with  
Built-in IR LED**

---

**Preliminary Datasheet**

Version – 0.9.1

**Sensortek Technology Corporation**

## 1. OVERVIEW

### Description

The STK3331 is an integrated ambient and infrared light to digital converter with a built-in IR LED and I<sup>2</sup>C interface. This device provides not only ambient light sensing to allow robust backlight/display brightness control but also infrared sensing to allow proximity estimation featured with interrupt function.

For ambient light sensing, the STK3331 incorporates a photodiode, timing controller and ADC in a single chip. The excellent spectral response is designed to be close-to human eye. The STK3331 is suitable for detecting a wide range of light intensity environment.

For proximity sensing, the STK3331 also incorporates a photodiode, timing controller and ADC in the same chip. The spectral response of STK3331 is optimized for wavelength 940nm infrared light. The STK3331 provides programmable current setting to drive IR LED and employs a noise cancellation scheme to highly reject unwanted ambient IR noise.

The STK3331 has excellent temperature compensation, robust on-chip refresh rate setting without external components. Software shutdown mode control is provided for power saving application. The STK3331 operating voltage range is 1.7V to 3.0V.

### Feature

- Integrated ambient light sensor, proximity sensor and infrared LED in one package.

#### Proximity Sensor

- 16 bits resolution for proximity detection
- Built-in LED driver with flexible setting
  - LED turn-on time : 7 steps IT
  - LED current : 3.125 / 6.25 / 12.5 / 25 / 50 / 100 / 150 mA
- Flexible interrupt setting
  - Several interrupt modes meet application requirements.
  - Flag modes are included.
  - Intelligent persistence to speed up the response time : 1/2/4/16 times
- Low noise design
- High ambient light suppression
- 940nm LED for STK3331.

#### Ambient Light Sensor

- Convert ambient light intensity to 16-bit digital data format
- 3rd generation ambient light sensor which closes to human-eye response and suppress IR portion.
- Flexible digital settings
  - Integration time : 7 steps IT
- Flexible interrupt setting
  - Interrupt while out-of- window
  - Persistence : 1/2/4/8 times
- Clear channel for different light source compensation.

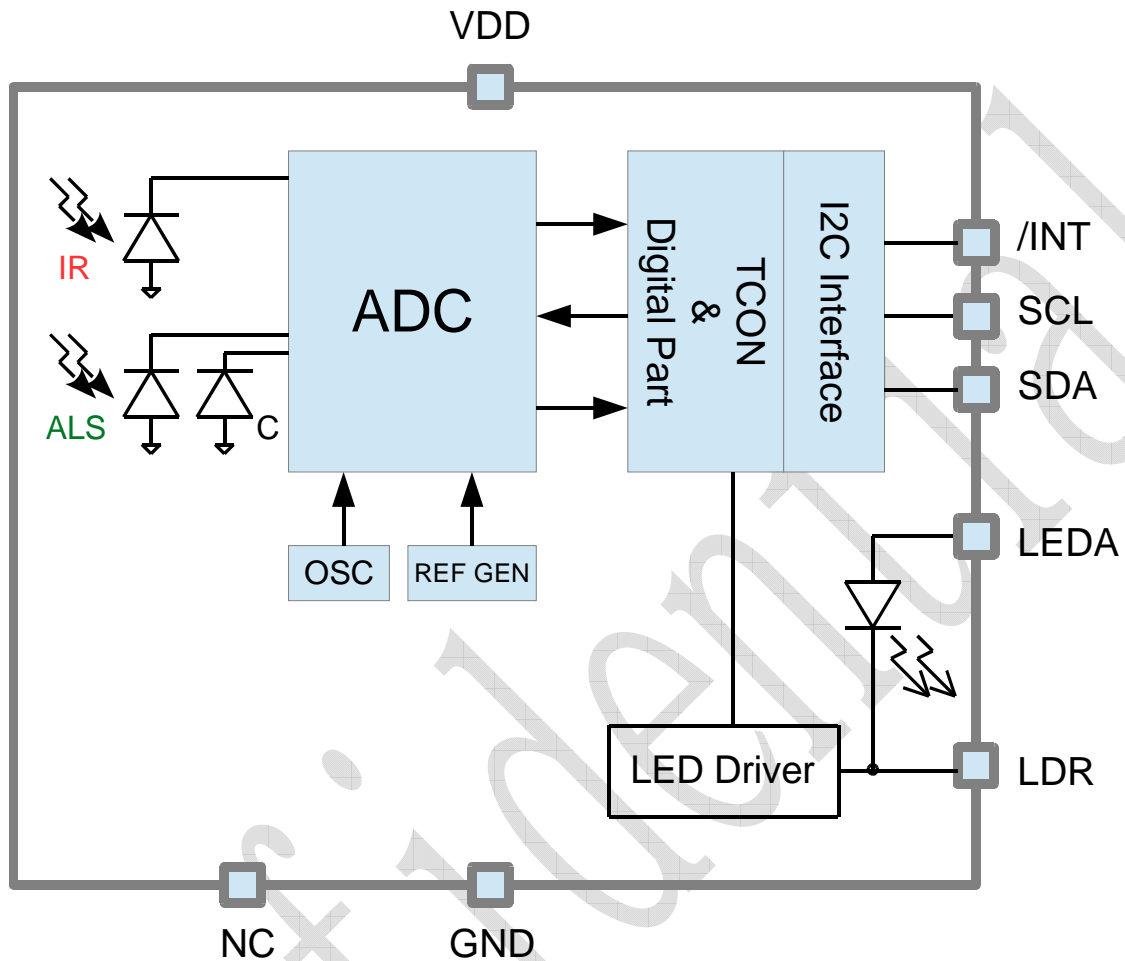
#### General

- Fully digital control with I<sup>2</sup>C interface
  - 1.7 ~ 3.6V I<sup>2</sup>C interface
- Low power design
  - Standby mode
  - Wait mode
- V<sub>DD</sub> wide operation voltage : 1.7~3.0V
- Excellent temperature compensation: -40 to 85°C
- Available package options: OLGA
  - STK3331 : 5 x 1.5 x 1 (mm)
- Lead-free package (RoHS compliant)
- Moisture Sensitivity Level 3

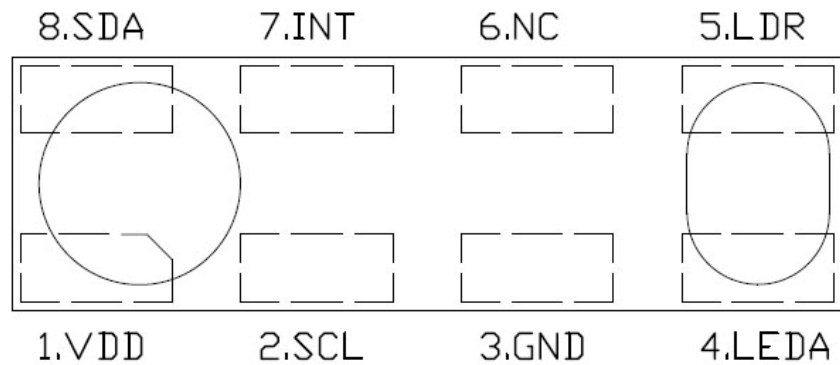
#### Applications

- Mobile Phone, Smart-phone, PDA

## 2. FUNCTION BLOCK



### 3. PINOUT DIAGRAM



Top View

### 4. PIN DESCRIPTION

| Pin No. | Pin Name | Dir. | Pin Function   |
|---------|----------|------|--|
| 1       | VDD      | PWR  | Power supply: 1.7V to 3.0V.  |
| 2       | SCL      | I    | I <sup>2</sup> C serial clock line.  |
| 3       | GND      | GND  | Ground. The thermal pad is also connected to the GND pin.  |
| 4       | LEDA     | I    | Anode of the embedded IR LED, connect to power.  |
| 5       | LDR      | I    | IR LED driver pin connecting to the cathode of the external IR LED. The sink current of the IR LED driver can be programmed through I <sup>2</sup> C or the external resistor. |
| 6       | NC       |      | No Connect.  |
| 7       | /INT     | O    | Interrupt pin, LO for interrupt alarming. (Open Drain)   |
| 8       | SDA      | B    | I <sup>2</sup> C serial data line. (Open Drain)  |

Direction denotation:

|     |        |     |              |
|-----|--------|-----|--------------|
| O   | Output | GND | Ground       |
| I   | Input  | B   | Bi-direction |
| PWR | Power  | NC  | Not Connect  |

## 5. ELECTRICAL SPECIFICATIONS

### Absolute Maximum Ratings

| Symbol            | Parameter              | Min. | Typ. | Max. | Unit |
|-------------------|------------------------|------|------|------|------|
| V <sub>DD</sub>   | Supply voltage         | -0.3 | —    | 3.6  | V    |
| V <sub>LEDA</sub> | Voltage of LED's anode | -0.3 | —    | 4.7  | V    |
| V <sub>LDR</sub>  | Voltage of LDR         |      |      | 3.6  | V    |
| T <sub>a</sub>    | Operation temperature  | -40  | —    | 85   | °C   |
| T <sub>s</sub>    | Storage temperature    | -40  | —    | 85   | °C   |

NOTE: All voltages are measured with respect to GND

### Recommended Operating Conditions

| Symbol            | Parameter                           | Min. | Typ. | Max. | Unit |
|-------------------|-------------------------------------|------|------|------|------|
| V <sub>DD</sub>   | Supply voltage                      | 1.7  | —    | 3.0  | V    |
| V <sub>LEDA</sub> | Voltage of LED's anode              | 2.8  | —    | 4.6  | V    |
| f <sub>I2C</sub>  | Clock frequency of I <sup>2</sup> C | —    | —    | 400  | KHz  |
| T <sub>a</sub>    | Operation temperature               | -40  | —    | 85   | °C   |

NOTE: All voltages are measured with respect to GND

| Symbol | Parameter                          | Max.           | Unit |
|--------|------------------------------------|----------------|------|
| ESD    | Electrostatic discharge protection | 2 (HBM)        | kV   |
|        |                                    | 200 (MM)       | V    |
|        |                                    | 100 (Latch Up) | mA   |

NOTE: All voltages are measured with respect to GND

## 5.1 Electrical and Optical Characteristics

$V_{DD} = V_{LED} = 2.8V$ , under room temperature 25°C (unless otherwise noted)

| Symbol                    | Parameter                                | Condition              | Min. | Typ.  | Max.     | Unit    |
|---------------------------|--|------------------------|------|-------|----------|---------|
| Operation Characteristics |  |                        |      |       |          |         |
| $I_{ALS}$                 | ALS only supply current                  | Note1,2                |      | TBD   |          | $\mu A$ |
| $I_{PS}$                  | PS only supply current                   | Note1,2                |      | TBD   |          | $\mu A$ |
| $I_{WAIT}$                | Supply current at wait state             | Note1,2                |      | TBD   |          | $\mu A$ |
| $I_{SD}$                  | Shutdown current                         | Note1,2                |      | TBD   |          | $\mu A$ |
| $V_{IH}$                  | Logic high, I <sup>2</sup> C             | Note6                  | 1.3  |       | $V_{DD}$ | V       |
| $V_{IL}$                  | Logic low, I <sup>2</sup> C              | Note7                  | —    |       | 0.4      | V       |
| ALS Characteristics       |  |                        |      |       |          |         |
| $\lambda_{p1}$            | Peak sensitivity wavelength for ALS      |                        |      | 550   |          | nm      |
| $ALS_{FSCNT}$             | Full scale ALS counts                    |                        |      |       | 65535    | counts  |
| $ALS_{DARK}$              | ALS dark offset                          | Note2,3,4              |      | 0     | TBD      | counts  |
| $ALS_{SENSE}$             | ALS sensing tolerance                    | Note2,3                |      |       | TBD      | %       |
| Proximity Characteristics |  |                        |      |       |          |         |
| $\lambda_{p2}$            | High sensitivity wavelength range for PS |                        | 800  |       | 1000     | nm      |
| $PS_{FSCNT}$              | Full scale PS counts                     |                        |      |       | 65535    | counts  |
| $I_{LED_{SINK}}$          | LED sink current                         | IRDR_LED[2:0]<br>Note5 |      |       |          |         |
|                           |  | 000                    |      | 3.125 |          | mA      |
|                           |  | 001                    |      | 6.25  |          | mA      |
|                           |  | 010                    |      | 12.5  |          | mA      |
|                           |  | 011                    |      | 25    |          | mA      |
|                           |  | 100                    |      | 50    |          | mA      |
|                           |  | 101                    |      | 100   |          | mA      |
|                           |  | 110                    |      | 150   |          | mA      |
| $AMB_{SUPP}$              | Ambient Light Suppression                | Note8                  |      |       | TBD      | Lux     |

Note 1 : No LED operation.

Note 2 :  $GAIN\_ALS[1:0] = 2'b00$ ,  $.IT\_ALS[3:0] = 4'b0010$ ,  $GAIN\_PS[1:0] = 2'b00$ ,  $.IT\_PS[3:0] = 4'b0000$ .

Note 3 : White LED parallel light source.

Note 4 :  $E_{ambient} = 0$  Lux.

Note 5 : The voltage of LDR pin is fixed at 1V.

Note 6 : I<sup>2</sup>C logical high voltage level is specified as worst-case condition when all of the recommended operation supply voltages ( $V_{DD}$ ) are taken into consideration. The logical high level is different when different supply voltage is applied.

Note 7 : I<sup>2</sup>C logical low voltage level is specified as worst-case condition when all of the recommended operation supply voltages ( $V_{DD}$ ) are taken into consideration. The logical low level is different when different supply voltage is applied.

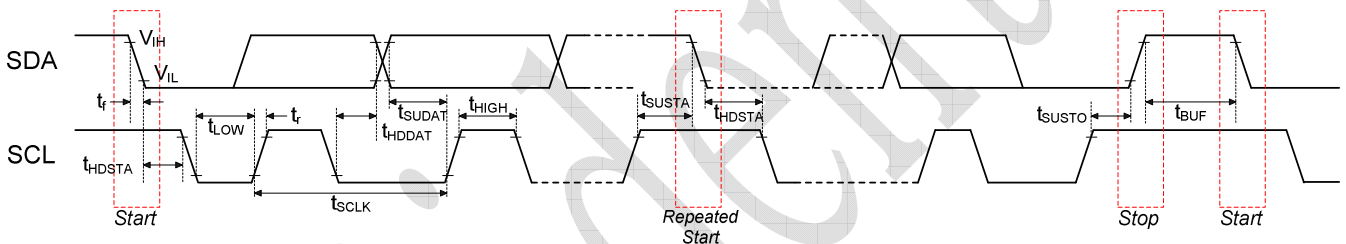
Note 8 : Sunlight environment.

## 5.2 Timing Chart

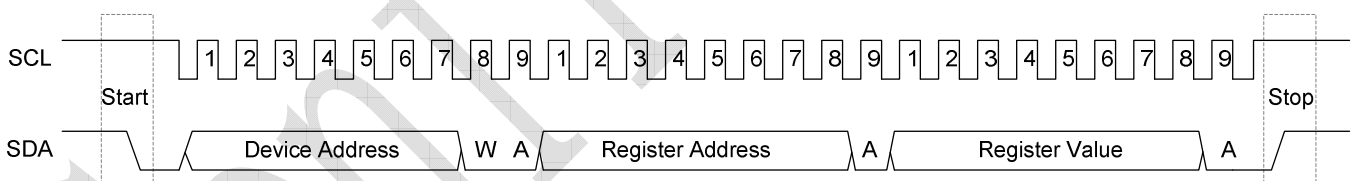
### Characteristics of the SDA and SCL I/O

| Symbol      | Parameter   | Standard Mode |      | Fast Mode |      | Unit    |
|-------------|---|---------------|------|-----------|------|---------|
|             |   | Min.          | Max. | Min.      | Max. |         |
| $f_{SCLK}$  | SCL clock frequency   | 10            | 100  | 10        | 400  | KHz     |
| $t_{HDSTA}$ | Hold time after (repeated) start condition. After this period, the first clock is generated | 4.0           | —    | 0.6       | —    | $\mu$ s |
| $t_{LOW}$   | LOW period of the SCL clock   | 4.7           | —    | 1.3       | —    | $\mu$ s |
| $t_{HIGH}$  | HIGH period of the SCL clock  | 4.0           | —    | 0.6       | —    | $\mu$ s |
| $t_{SUSTA}$ | Set-up time for a repeated START condition  | 4.7           | —    | 0.6       | —    | $\mu$ s |
| $t_{HDDAT}$ | Data hold time  | 0             | —    | 0         | —    | ns      |
| $t_{SUDAT}$ | Data set-up time  | 250           | —    | 100       | —    | ns      |
| $t_r$       | Rise time of both SDA and SCL signals   | —             | 1000 | —         | 300  | ns      |
| $t_f$       | Fall time of both SDA and SCL signals   | —             | 300  | —         | 300  | ns      |
| $t_{SUSTO}$ | Set-up time for STOP condition  | 4.0           | —    | 0.6       | —    | $\mu$ s |
| $t_{BUF}$   | Bus free time between a STOP and START condition  | 4.7           | —    | 1.3       | —    | $\mu$ s |

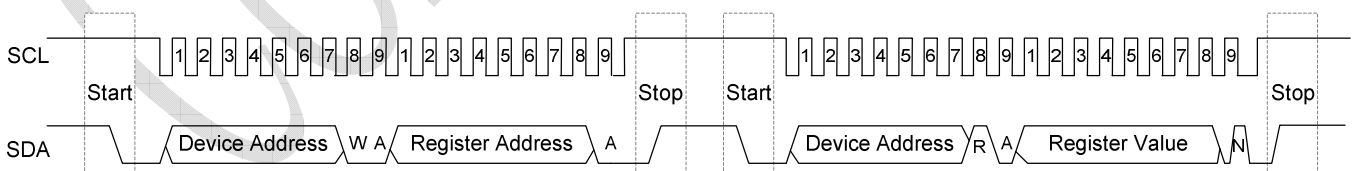
Note 1:  $f_{SCLK}$  is the  $(t_{SCLK})^{-1}$ .



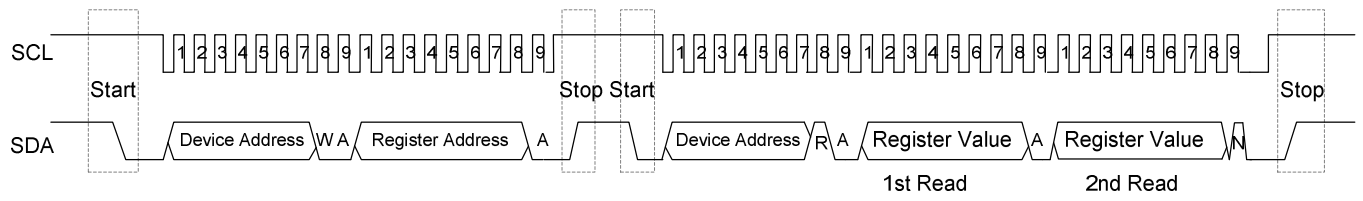
Timing Chart of the SDA and SCL



Write Command



Read Data



**Sequential Read Data**

Confidential



## 6. FUNCTION DESCRIPTION

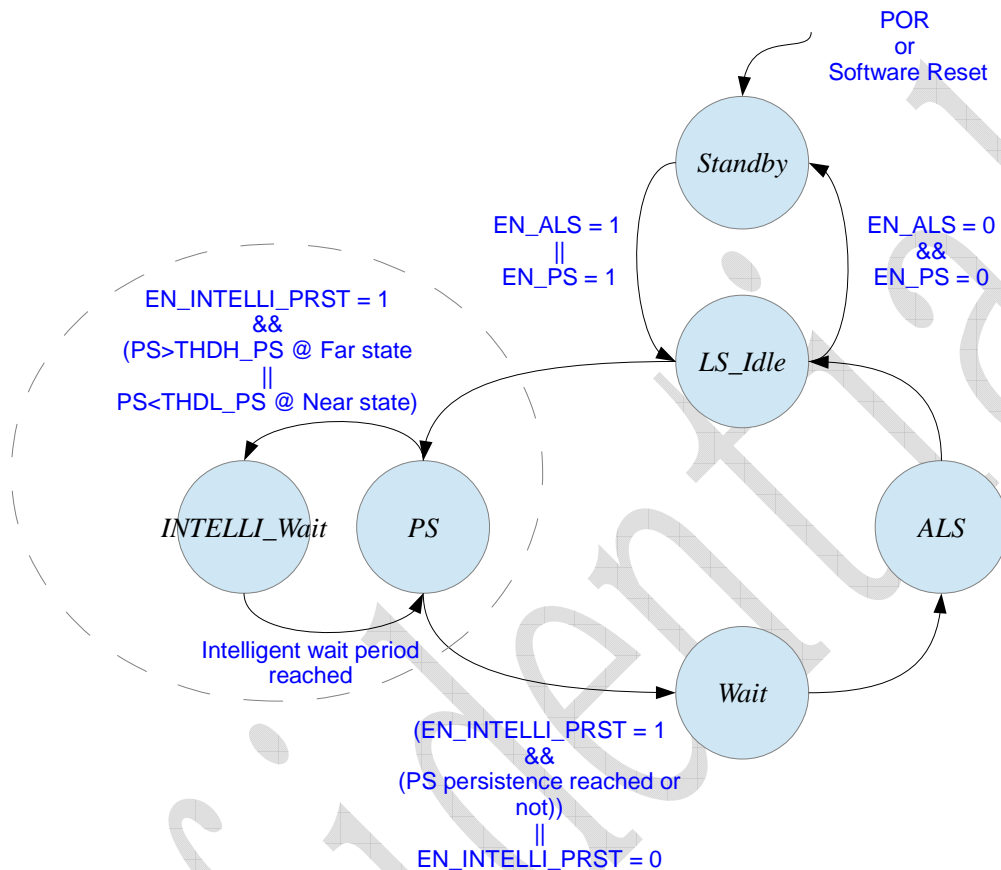
### 6.1 Digital Interface

STK3331 contains eight-bit registers accessed via the I<sup>2</sup>C bus. All operations can be controlled by the command register. The simple command structure makes user easy to program the operation setting and latch the output data from STK3331. Section 5.2 Timing chart displays the STK3331 I<sup>2</sup>C command format for reading and writing operation between host and STK3331.

STK3331 provides fixed I<sup>2</sup>C slave address of 0x47 using 7 bit addressing protocol.

| Slave Address             | R/W Command Bit | OPERATION                |
|---------------------------|-----------------|--------------------------|
| 0x47                      | 0               | Write Command to STK3331 |
| (followed by the R/W bit) | 1               | Read Data from STK3331   |

## 6.2 System Operation



## 6.3 ALS Operation

### 6.3.1 ALS General Operation

The related ALS control bits are summarized below.

**ALS Control Bits**

| <b>General Control</b>       |                                   |
|------------------------------|-----------------------------------|
| EN_ALS                       | Enable ALS sensing function       |
| IT_ALS[3:0]                  | ALS integration time              |
| GAIN_ALS[1:0]                | ALS gain control                  |
| PRST_ALS[1:0]                | ALS persistence number            |
| GAIN_C[1:0]                  | Clear channel gain control        |
| <b>ALS Interrupt Control</b> |                                   |
| EN_ALS_INT                   | Enable ALS function interrupt     |
| EN_ALS_DR_INT                | Enable ALS data ready interrupt   |
| THDH_ALS[15:0]               | ALS out-of-windows high threshold |
| THDL_ALS[15:0]               | ALS out-of-windows low threshold  |

**ALS Data/Status Bits**

| <b>Data</b>    |   |
|----------------|---|
| DATA_ALS[15:0] | 16-bits ALS channel raw data                    |
| DATA_C[15:0]   | 16-bits Clear channel raw data                  |
| <b>Status</b>  |   |
| FLG_ALS_DR     | Indicate the ALS data ready event               |
| FLG_ALS_INT    | Indicate the Green channel out-of-windows event |

STK3331 uses the coated photodiode array to measure the Lux of the incoming light and also an un-filtered clear photodiode array to improve the ALS sensing accuracy.

The ALS sensing function is enabled by the EN\_ALS bit and the gain control bit GAIN\_ALS[1:0]/GAIN\_C[1:0] and IT period IT\_ALS[3:0] shall be set before the EN\_ALS.

The FLG\_ALS\_DR bit shall be asserted every ADC conversion cycle complete and shall be cleared automatically after one of the DATA\_ALS[15:0]/DATA\_C[15:0] is be read out through I<sup>2</sup>C.

The ALS/C data are 16-bit output and are stored in two bytes register. Higher byte register must be read first than lower byte. Data reading word protection is implemented to make sure the conversion data within the same conversion cycle could be read correctly. When the higher byte register is read, the lower 8-bit data will be stored into a shadow register which is read by the following sequential read or another single read to the lower byte register.

### 6.3.2 ALS Interrupt Description

#### **ALS Out-of-Windows Interrupt**

STK3331 provides the ALS data out-of-windows interrupt. Once the EN\_ALS\_INT is set to 1, then the STK3331 shall issue an ALS interrupt and assert the FLG\_ALS\_INT bit if the ALS data DATA\_ALS[15:0] are outside the user's programmed window defined by THDH\_ALS[15:0] and THDL\_ALS[15:0]. The FLG\_ALS\_INT shall be cleared by write the bit 0 and shall be reset to 0 if POR/SWRst or EN\_ALS = 0. Clear the EN\_ALS\_INT will also clear the FLG\_ALS\_INT bit to 0.

ALS persistence numbers PRST\_ALS[1:0] is used to avoid the false alarm of ALS out-of-windows event due to environment noise. If ALS persistence is set larger than 1, then the ALS out-of-windows interrupt will not be issued until continuous persistence numbers of ADC conversion results outside the defined windows.

#### **ALS Data Ready Interrupt**

STK3331 also provides the ALS data ready interrupt. Once the EN\_ALS\_DR\_INT is set to 1, then the STK3331 shall issue an ALS data ready interrupt every ADC conversion cycle and assert the FLG\_ALS\_DR bit. The FLG\_ALS\_DR shall be cleared automatically after any one of the DATA\_R/G/B/C[15:0] is be read out through I<sup>2</sup>C and shall be reset to 0 if POR/SWRst or EN\_ALS = 0. Clear the EN\_ALS\_DR\_INT will not influence the FLG\_ALS\_DR status.

## 6.4 PS Operation

### 6.4.1 PS General Operation

The related PS control bits are summarized below.

#### PS Control Bits

| <b>General Control</b>      |  |
|-----------------------------|--|
| EN_PS                       | Enable PS function                     |
| EN_INTELLI_PRST             | Enable PS intelligent persistence      |
| IT_PS[3:0]                  | PS integration time                    |
| GAIN_PS[1:0]                | PS gain control                        |
| PRST_PS[1:0]                | PS persistence number                  |
| DATA_PS_OFFSET[15:0]        | PS digital offset cancel               |
| INTELLI_WAIT_PS[6:0]        | PS intelligent persistence wait period |
| <b>LED Control</b>          |  |
| IRDR_LED[2:0]               | Choose LED driving current             |
| <b>PS Interrupt Control</b> |  |
| PS_INT_MODE[2:0]            | Choose PS interrupt mode.              |
| EN_PS_INT                   | Enable PS function interrupt           |
| EN_PS_DR_INT                | Enable PS data ready interrupt         |
| THDH_PS[15:0]               | PS near-far detect high threshold      |
| THDL_PS[15:0]               | PS near-far detect low threshold       |

#### PS Data/Status Bits

| <b>Data</b>   |  |
|---------------|--|
| DATA_PS[15:0] | 16-bits PS raw data                              |
| <b>Status</b> |  |
| FLG_NF        | Indicate the current object near/far state       |
| FLG_PS_INT    | Indicate the object near/far state changed event |
| FLG_PS_DR     | Indicate the PS data ready event                 |

The proximity function is used for object detection by IR-sensitivity photodiode detection of reflected IR energy emitted by the built-in IR LED.

The DATA\_PS[15:0] will be the ADC output subtract offset data defined in DATA\_PS\_OFFSET[15:0]. The PS data are 16-bit output and are stored in two bytes register. Higher byte register must be read first than lower byte. Data reading word protection is implemented to make sure the conversion data within the same conversion cycle could be read correctly. When the higher byte register is read, the lower 8-bit data will be stored into a shadow register which is read by the following sequential read or another single read to the lower byte register.

The FLG\_NF is used to indicate the current object is in near or far state and persistence is also applied to this flag if PRST\_PS > 1.

The FLG\_PS\_DR bit shall be asserted every ADC conversion cycle complete and shall be cleared automatically after the DATA\_PS[15:0] is be read out through I<sup>2</sup>C.

IRDR\_LED[2:0] is used to choose different LED constant driving current. STK3331 has 7 different LED current

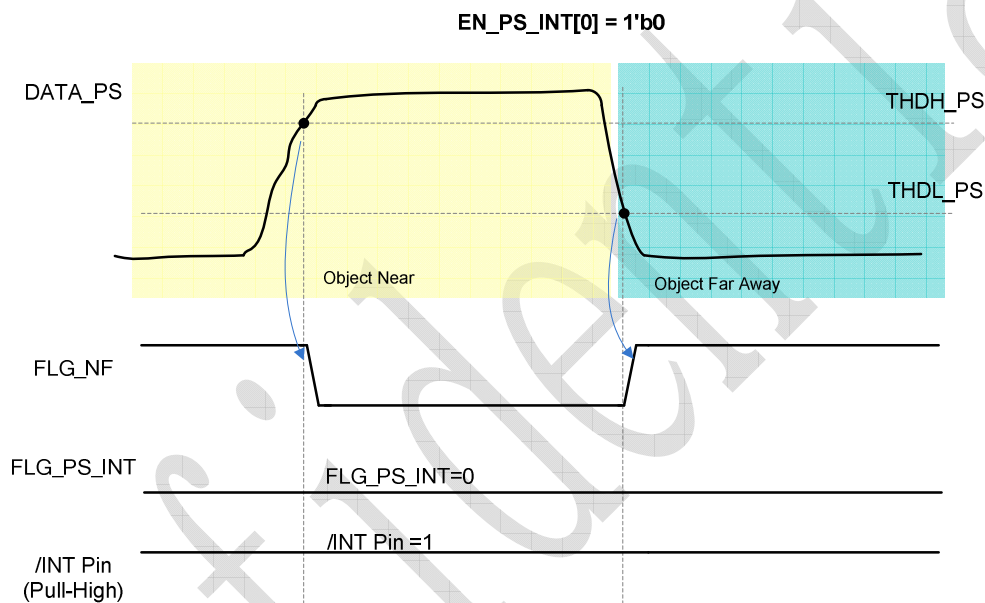
levels 3.125/6.25/12.5/25/50/100/150 mA.

## 6.4.2 PS Interrupt Description

The EN\_PS\_INT[0] register is used to control PS interrupt function for enable or disable  
 The PS\_NF\_MODE[1] register is used to select how STK3630 reports the object near/far state to application.  
 The PS\_INT\_MODE[2] register is PS interrupt modes for near/far state change are described as below.

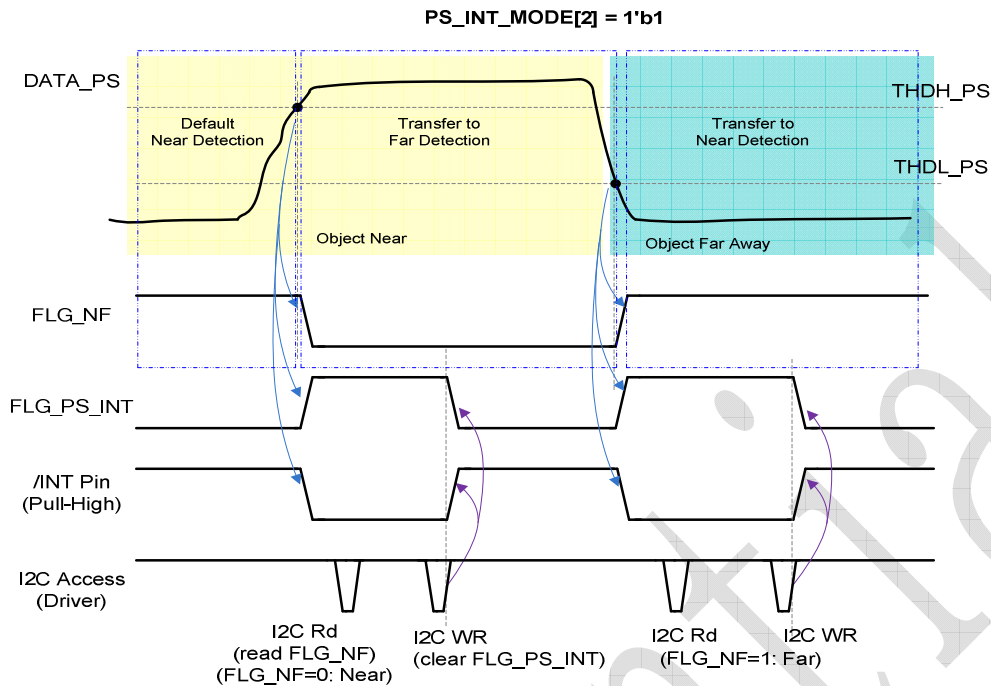
### **PS INT Function (EN\_PS\_INT[0] = 1'b0) & PS Near/Far Flag Mode (PS\_NF\_Mode[1] = 1'b0)**

If EN\_PS\_INT[0] is set to 1'b0, then the polling mode is used and the INT pin is non-active when near/far event detected. In this mode, the INT output level is fixed to pull-high and the FLG\_PS\_INT will never be asserted. The application simply polls the FLG\_NF to check the object in near or far state.



### **PS INT Function (EN\_PS\_INT[0] = 1'b1) & PS Near/Far Flag Mode (PS\_NF\_Mode[1] = 1'b0)**

The INT pin is treated as interrupt signal. The FLG\_NF is used to indicate whether the object is in near or far state. The STK3331 is default in object far state and the FLG\_NF = 1. Once the object moving close to the STK3331 and PS code exceed the high threshold THDH\_PS, STK3331 will switch to object near state and the FLG\_NF is cleared to 0. STK3331 will issue a PS interrupt to inform the object near/far state changed and also set the FLG\_PS\_INT to 1. If the object move far away from the STK3331 and PS code lower than the low threshold THDL\_PS, STK3331 will switch to object far state and the FLG\_NF is set to 1. STK3331 will also issue a PS interrupt to inform and set FLG\_PS\_INT. The FLG\_PS\_INT shall be cleared by write the bit 0 and shall be reset to 0 if POR/SWRst or EN\_PS = 0. The FLG\_NF shall be reset to 1 if POR/SWRst or EN\_PS = 0. Change the PS\_MODE will also clear the FLG\_PS\_INT to 0, but keep the current PS code and FLG\_NF state.



PS persistence numbers  $PRST\_PS[1:0]$  is used to avoid the false alarm of PS interrupt event due to environment noise. If PS persistence is set larger than 1, then the PS interrupt will not be issued until continuous persistence numbers of ADC conversion results meet the interrupt condition describe above.

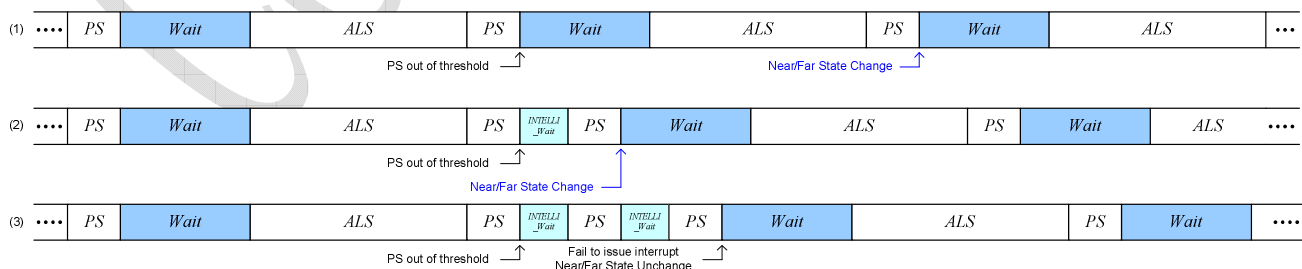
STK3331 also provides intelligent persistence to speed up the response time and can be enabled by set  $EN\_INTELLI\_PRST$  to 1. Once the PS signal is exceed the high threshold when object in far state or lower than low threshold when in near state,  $EN\_INTELLI\_PRST = 1$  and the PS persistence number  $PRST\_PS[1:0]$  large than 1, the STK3331 will enter the  $PS\_INTELLI\_WAIT$  PS function sub-state and use a shorter  $INTELLI\_WAIT\_PS$  period to perform the PS persistence check. This is used to shorten the PS response time and also avoid the flicker noise influence when choosing the right wait period. The STK3331 shall return to the normal operation state loop no matter what PS persistence success or fail.

For example:

(1)  $PRST\_PS[1:0] = 2'b01$  (x2),  $EN\_ALS = 1$ ,  $EN\_PS = 1$ ,  $EN\_WAIT = 1$ ,  $EN\_INTELLIGENT\_PRST = 0$

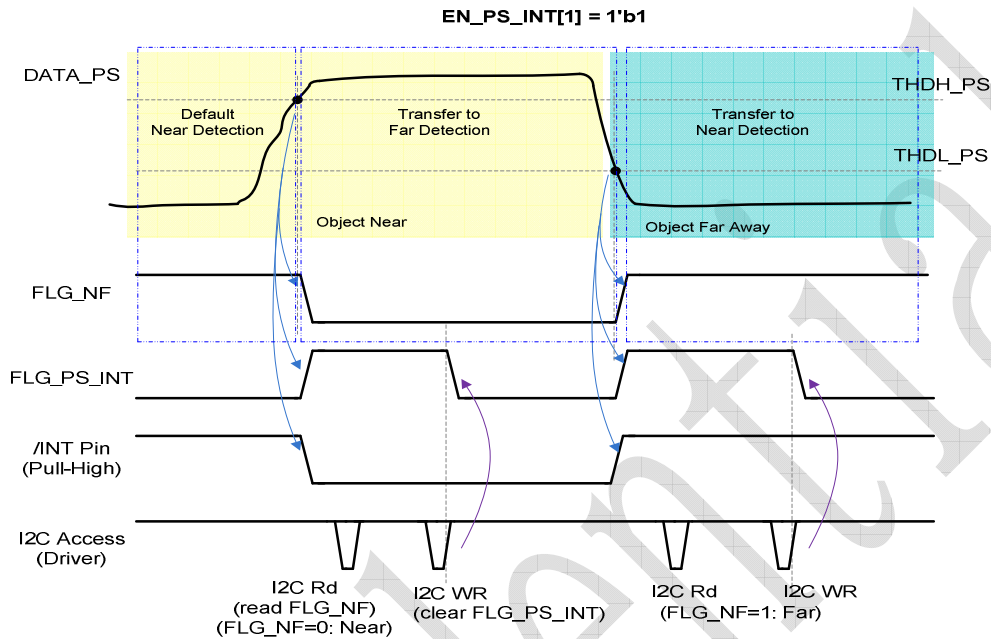
(2)  $PRST\_PS[1:0] = 2'b01$  (x2),  $EN\_ALS = 1$ ,  $EN\_PS = 1$ ,  $EN\_WAIT = 1$ ,  $EN\_INTELLIGENT\_PRST = 1$

(3)  $PRST\_PS[1:0] = 2'b10$  (x4),  $EN\_ALS = 1$ ,  $EN\_PS = 1$ ,  $EN\_WAIT = 1$ ,  $EN\_INTELLIGENT\_PRST = 1$  and fail to issue interrupt (no continue persistence numbers of PS ADC conversion results is out of threshold),



**PS INT Function (EN\_PS\_INT[0] = 1'b1) & PS Near/Far Flag Mode (PS\_NF\_Mode[1] = 1'b1)**

If PS\_NF\_MODE[1] = 1'b1, then the polling mode is used and the INT pin is treated as a near/far flag signal, not an interrupt signal. In this mode, the INT output level is same with the FLG\_NF signal level and the FLG\_PS\_INT will never be asserted. The application simply polls the INT level (high or low) to check the object in near or far state. INT Pin is only from PS FLG\_NF, and the ALS interrupt, Invalid PS interrupt is ignored.


**PS Data Ready Interrupt**

STK3331 provides the PS data ready interrupt. Once the EN\_PS\_DR\_INT is set to 1, then the STK3331 shall issue a PS data ready interrupt every ADC conversion cycle and assert the FLG\_PS\_DR bit. The FLG\_PS\_DR shall be cleared automatically after the DATA\_PS[15:0] is be read out through I2C and shall be reset to 0 if POR/SWRst or EN\_PS = 0. Clear the EN\_PS\_DR\_INT will not influence the FLG\_PS\_DR status.

## 6.5 Wait State Operation

### 6.5.1 Wait State General Operation

The related Wait control bits are summarized below.

| <b>Wait Control Bits</b> |                   |
|--------------------------|-------------------|
| <b>General Control</b>   |                   |
| EN_WAIT                  | Enable Wait state |
| WAIT[7:0]                | Wait period       |

Wait state is used for power saving



## 7. CONTROL REGISTER MAP

| ADDR | REG NAME                        | BIT                     |               |                         |                |                    |                 |                          |                  | Default |
|------|---------------------------------|-------------------------|---------------|-------------------------|----------------|--------------------|-----------------|--------------------------|------------------|---------|
|      |                                 | 7                       | 6             | 5                       | 4              | 3                  | 2               | 1                        | 0                |         |
| 0x00 | <a href="#">STATE</a>           |                         |               |                         | EN_CTAU<br>TOK | EN_INTELLI<br>PRST | EN_WAIT         | EN_ALS                   | EN_PS            | 0x00    |
| 0x01 | <a href="#">PSCTRL</a>          | PRST_PS[1:0]            |               | GAIN_PS[1:0]            |                | IT_PS[3:0]         |                 |                          |                  | 0x00    |
| 0x02 | <a href="#">ALSCTRL1</a>        | PRST_ALS[1:0]           |               | GAIN_ALS[1:0]           |                | IT_ALS[3:0]        |                 |                          |                  | 0x02    |
| 0x03 | <a href="#">LEDCTRL</a>         | IRDR_LED[2:0]           |               |                         |                |                    |                 | EN_CTIRFC                | EN_CTIR          | 0x60    |
| 0x04 | <a href="#">INTCTRL1</a>        | INT_CTRL                |               | EN_INVALIDI<br>D_PS_INT |                | EN_ALS_I<br>NT     | PS_INT_M<br>ODE | PS_NF_MO<br>DE           | EN_PS_I<br>NT    | 0x00    |
| 0x05 | <a href="#">WAIT</a>            | WAIT[7:0]               |               |                         |                |                    |                 |                          |                  | 0x00    |
| 0x06 | <a href="#">THDH1_PS</a>        | THDH_PS[15:8]           |               |                         |                |                    |                 |                          |                  | 0xFF    |
| 0x07 | <a href="#">THDH2_PS</a>        | THDH_PS[7:0]            |               |                         |                |                    |                 |                          |                  | 0xFF    |
| 0x08 | <a href="#">THDL1_PS</a>        | THDL_PS[15:8]           |               |                         |                |                    |                 |                          |                  | 0x00    |
| 0x09 | <a href="#">THDL2_PS</a>        | THDL_PS[7:0]            |               |                         |                |                    |                 |                          |                  | 0x00    |
| 0x0A | <a href="#">THDH1_ALS</a>       | THDH_ALS[15:8]          |               |                         |                |                    |                 |                          |                  | 0xFF    |
| 0x0B | <a href="#">THDH2_ALS</a>       | THDH_ALS[7:0]           |               |                         |                |                    |                 |                          |                  | 0xFF    |
| 0x0C | <a href="#">THDL1_ALS</a>       | THDL_ALS[15:8]          |               |                         |                |                    |                 |                          |                  | 0x00    |
| 0x0D | <a href="#">THDL2_ALS</a>       | THDL_ALS[7:0]           |               |                         |                |                    |                 |                          |                  | 0x00    |
| 0x10 | <a href="#">FLAG</a>            | FLG_ALS_<br>DR          | FLG_PS_D<br>R | FLG_ALS_I<br>NT         | FLG_PS_I<br>NT |                    | FLG_ALS_S<br>AT | FLG_INVALIDI<br>D_PS_INT | FLG_NF           | 0x01    |
| 0x11 | <a href="#">DATA1_PS</a>        | DATA_PS[15:8]           |               |                         |                |                    |                 |                          |                  | 0x00    |
| 0x12 | <a href="#">DATA2_PS</a>        | DATA_PS[7:0]            |               |                         |                |                    |                 |                          |                  | 0x00    |
| 0x13 | <a href="#">DATA1_ALS</a>       | DATA_ALS[15:8]          |               |                         |                |                    |                 |                          |                  | 0x00    |
| 0x14 | <a href="#">DATA2_ALS</a>       | DATA_ALS[7:0]           |               |                         |                |                    |                 |                          |                  | 0x00    |
| 0x1B | <a href="#">DATA1_C</a>         | DATA_C[15:8]            |               |                         |                |                    |                 |                          |                  | 0x00    |
| 0x1C | <a href="#">DATA2_C</a>         | DATA_C[7:0]             |               |                         |                |                    |                 |                          |                  | 0x00    |
| 0x1D | <a href="#">DATA1_PS_OFFSET</a> | DATA_PS_OFFSET[15:8]    |               |                         |                |                    |                 |                          |                  | 0x00    |
| 0x1E | <a href="#">DATA2_PS_OFFSET</a> | DATA_PS_OFFSET[7:0]     |               |                         |                |                    |                 |                          |                  | 0x00    |
| 0x20 | <a href="#">DATA_CTIR1</a>      | DATA_CTIR1[7:0]         |               |                         |                |                    |                 |                          |                  | 0x00    |
| 0x21 | <a href="#">DATA_CTIR2</a>      | DATA_CTIR2[7:0]         |               |                         |                |                    |                 |                          |                  | 0x00    |
| 0x22 | <a href="#">DATA_CTIR3</a>      | DATA_CTIR3[7:0]         |               |                         |                |                    |                 |                          |                  | 0x00    |
| 0x23 | <a href="#">DATA_CTIR4</a>      | DATA_CTIR4[7:0]         |               |                         |                |                    |                 |                          |                  | 0x00    |
| 0x3E | <a href="#">PDT_ID</a>          | PDT_ID[7:0]             |               |                         |                |                    |                 |                          |                  | 0x53    |
| 0x3F | <a href="#">Reserved</a>        | Reserved                |               |                         |                |                    |                 |                          |                  |         |
| 0x4E | <a href="#">ALSCTRL2</a>        |                         |               | GAIN_C[1:0]             |                |                    |                 |                          |                  | 0x00    |
| 0x4F | <a href="#">INTELLI_WAIT_PS</a> | INTELLI_WAIT_PS[6:0]    |               |                         |                |                    |                 |                          |                  | 0x00    |
| 0x80 | <a href="#">SOFT_RESET</a>      | Write any to soft reset |               |                         |                |                    |                 |                          |                  |         |
| 0xA1 | <a href="#">PSPDCTRL</a>        | PS_SEL                  |               |                         |                |                    |                 |                          |                  |         |
| 0xA5 | <a href="#">INTCTRL2</a>        |                         |               |                         |                |                    |                 | EN_ALS_DR<br>_INT        | EN_PS_<br>DR_INT | 0x00    |

**STATE Register (0x00)**

| Bit     | 7 | 6 | 5 | 4              | 3                   | 2       | 1      | 0     |
|---------|---|---|---|----------------|---------------------|---------|--------|-------|
| ITEM    |   |   |   | EN_CTAU<br>TOK | EN_INTEL<br>LI_WAIT | EN_WAIT | EN_ALS | EN_PS |
| Access  |   |   |   | R/W            | R/W                 | R/W     | R/W    | R/W   |
| Default |   |   |   | 0              | 0                   | 0       | 0      | 0     |

| Bit | ITEM            | Description   |
|-----|-----------------|---|
| 0   | EN_PS           | Enable the PS function.<br>0 : Disable<br>1 : Enable                      |
| 1   | EN_ALS          | Enable the ALS/C function.<br>0 : Disable<br>1 : Enable                   |
| 2   | EN_WAIT         | Enable the Wait state.<br>0 : Disable<br>1 : Enable                       |
| 3   | EN_INTELLI_PRST | Enable the intelligent persistence function.<br>0 : Disable<br>1 : Enable |
| 4   | EN_CTAUTOK      | Enable the CTAUTOK function.<br>0 : Disable<br>1 : Enable                 |

**PSCTRL Register (0x01)**

| Bit     | 7            | 6 | 5            | 4 | 3          | 2 | 1 | 0 |
|---------|--------------|---|--------------|---|------------|---|---|---|
| ITEM    | PRST_PS[1:0] |   | GAIN_PS[1:0] |   | IT_PS[3:0] |   |   |   |
| Access  | R/W          |   | R/W          |   | R/W        |   |   |   |
| Default | 2'b00        |   | 2'b00        |   | 4'b0000    |   |   |   |

| Bit     | ITEM         | Description   |         |           |         |           |         |           |         |           |         |         |         |         |         |         |        |          |
|---------|--------------|---|---------|-----------|---------|-----------|---------|-----------|---------|-----------|---------|---------|---------|---------|---------|---------|--------|----------|
| 3:0     | IT_PS[3:0]   | PS integration time. <table border="1"> <tr> <td>4'b0000</td> <td>96 us</td> </tr> <tr> <td>4'b0001</td> <td>192 us</td> </tr> <tr> <td>4'b0010</td> <td>384 us</td> </tr> <tr> <td>4'b0011</td> <td>768 us</td> </tr> <tr> <td>4'b0100</td> <td>1.54 ms</td> </tr> <tr> <td>4'b0101</td> <td>3.07 ms</td> </tr> <tr> <td>4'b0110</td> <td>6.14 ms</td> </tr> <tr> <td>others</td> <td>Reserved</td> </tr> </table> | 4'b0000 | 96 us     | 4'b0001 | 192 us    | 4'b0010 | 384 us    | 4'b0011 | 768 us    | 4'b0100 | 1.54 ms | 4'b0101 | 3.07 ms | 4'b0110 | 6.14 ms | others | Reserved |
| 4'b0000 | 96 us        |   |         |           |         |           |         |           |         |           |         |         |         |         |         |         |        |          |
| 4'b0001 | 192 us       |   |         |           |         |           |         |           |         |           |         |         |         |         |         |         |        |          |
| 4'b0010 | 384 us       |   |         |           |         |           |         |           |         |           |         |         |         |         |         |         |        |          |
| 4'b0011 | 768 us       |   |         |           |         |           |         |           |         |           |         |         |         |         |         |         |        |          |
| 4'b0100 | 1.54 ms      |   |         |           |         |           |         |           |         |           |         |         |         |         |         |         |        |          |
| 4'b0101 | 3.07 ms      |   |         |           |         |           |         |           |         |           |         |         |         |         |         |         |        |          |
| 4'b0110 | 6.14 ms      |   |         |           |         |           |         |           |         |           |         |         |         |         |         |         |        |          |
| others  | Reserved     |   |         |           |         |           |         |           |         |           |         |         |         |         |         |         |        |          |
| 5:4     | GAIN_PS[1:0] | PS gain setting. <table border="1"> <tr> <td>2'b00</td> <td>x 1 times</td> </tr> <tr> <td>2'b01</td> <td>x 2 times</td> </tr> <tr> <td>2'b10</td> <td>x 4 times</td> </tr> <tr> <td>2'b11</td> <td>x 8 times</td> </tr> </table>  | 2'b00   | x 1 times | 2'b01   | x 2 times | 2'b10   | x 4 times | 2'b11   | x 8 times |         |         |         |         |         |         |        |          |
| 2'b00   | x 1 times    |   |         |           |         |           |         |           |         |           |         |         |         |         |         |         |        |          |
| 2'b01   | x 2 times    |   |         |           |         |           |         |           |         |           |         |         |         |         |         |         |        |          |
| 2'b10   | x 4 times    |   |         |           |         |           |         |           |         |           |         |         |         |         |         |         |        |          |
| 2'b11   | x 8 times    |   |         |           |         |           |         |           |         |           |         |         |         |         |         |         |        |          |

|     |              |   |            |
|-----|--------------|---|------------|
| 7:6 | PRST_PS[1:0] | PS persistence setting. The PS has an interrupt persistence filter. The persistence filter allows user to specify the number of consecutive out-of-threshold PS occurrences before an interrupt is triggered. |            |
|     |              | 2'b00   | x 1 times  |
|     |              | 2'b01   | x 2 times  |
|     |              | 2'b10   | x 4 times  |
|     |              | 2'b11   | x 16 times |

### ALSCTRL1 Register (0x02)

| Bit     | 7             | 6 | 5             | 4 | 3           | 2 | 1 | 0 |
|---------|---------------|---|---------------|---|-------------|---|---|---|
| ITEM    | PRST_ALS[1:0] |   | GAIN_ALS[1:0] |   | IT_ALS[3:0] |   |   |   |
| Access  | R/W           |   | R/W           |   | R/W         |   |   |   |
| Default | 2'b00         |   | 2'b00         |   | 4'b0010     |   |   |   |

| Bit | ITEM          | Description  |            |
|-----|---------------|--|------------|
| 3:0 | IT_ALS[3:0]   | ALS integration time.  |            |
|     |               | 4'b0000  | 25 ms      |
|     |               | 4'b0001  | 50 ms      |
|     |               | 4'b0010  | 100 ms     |
|     |               | 4'b0011  | 200 ms     |
|     |               | 4'b0100  | 400 ms     |
|     |               | 4'b0101  | 800 ms     |
|     |               | 4'b0110  | 1600 ms    |
|     |               | others   | Reserved   |
| 5:4 | GAIN_ALS[1:0] | ALS gain setting. GAIN_ALS[1:0] is used to control of the ALS channels signal gain. The Clear channel is controlled by GAIN_C[1:0].  |            |
|     |               | 2'b00  | x 1 times  |
|     |               | 2'b01  | x 4 times  |
|     |               | 2'b10  | x 16 times |
|     |               | 2'b11  | x 64 times |
| 7:6 | PRST_ALS[1:0] | ALS persistence setting. The ALS has an interrupt persistence filter. The persistence filter allows user to specify the number of consecutive out-of-windows ALS occurrences before an interrupt is triggered. |            |
|     |               | 2'b00  | x 1 times  |
|     |               | 2'b01  | x 2 times  |
|     |               | 2'b10  | x 4 times  |
|     |               | 2'b11  | x 8 times  |

### LEDCTRL Register (0x03)

| Bit     | 7             | 6 | 5 | 4 | 3 | 2 | 1         | 0       |
|---------|---------------|---|---|---|---|---|-----------|---------|
| ITEM    | IRDR_LED[2:0] |   |   |   |   |   | EN_CTIRFC | EN_CTIR |
| Access  | R/W           |   |   |   |   |   | R/W       | R/W     |
| Default | 3'b101        |   |   |   |   |   | 0         | 0       |

| Bit    | ITEM                  | Description  |         |              |           |                       |        |                      |        |                      |        |                    |        |                    |        |                     |        |                     |
|--------|-----------------------|--|---------|--------------|-----------|-----------------------|--------|----------------------|--------|----------------------|--------|--------------------|--------|--------------------|--------|---------------------|--------|---------------------|
| 7:5    | IRDR_LED[2:0]         | LED constant current setting. The STK3331 provides different sinking ability for IRLED through setting IRDR. <table border="1" data-bbox="507 658 1070 891"> <thead> <tr> <th>Value</th> <th>Current Sink</th> </tr> </thead> <tbody> <tr> <td>3'b000</td> <td>3.125 mA current sink</td> </tr> <tr> <td>3'b001</td> <td>6.25 mA current sink</td> </tr> <tr> <td>3'b010</td> <td>12.5 mA current sink</td> </tr> <tr> <td>3'b011</td> <td>25 mA current sink</td> </tr> <tr> <td>3'b100</td> <td>50 mA current sink</td> </tr> <tr style="background-color: #c8e6c9;"> <td>3'b101</td> <td>100 mA current sink</td> </tr> <tr> <td>3'b110</td> <td>150 mA current sink</td> </tr> </tbody> </table> | Value   | Current Sink | 3'b000    | 3.125 mA current sink | 3'b001 | 6.25 mA current sink | 3'b010 | 12.5 mA current sink | 3'b011 | 25 mA current sink | 3'b100 | 50 mA current sink | 3'b101 | 100 mA current sink | 3'b110 | 150 mA current sink |
| Value  | Current Sink          |  |         |              |           |                       |        |                      |        |                      |        |                    |        |                    |        |                     |        |                     |
| 3'b000 | 3.125 mA current sink |  |         |              |           |                       |        |                      |        |                      |        |                    |        |                    |        |                     |        |                     |
| 3'b001 | 6.25 mA current sink  |  |         |              |           |                       |        |                      |        |                      |        |                    |        |                    |        |                     |        |                     |
| 3'b010 | 12.5 mA current sink  |  |         |              |           |                       |        |                      |        |                      |        |                    |        |                    |        |                     |        |                     |
| 3'b011 | 25 mA current sink    |  |         |              |           |                       |        |                      |        |                      |        |                    |        |                    |        |                     |        |                     |
| 3'b100 | 50 mA current sink    |  |         |              |           |                       |        |                      |        |                      |        |                    |        |                    |        |                     |        |                     |
| 3'b101 | 100 mA current sink   |  |         |              |           |                       |        |                      |        |                      |        |                    |        |                    |        |                     |        |                     |
| 3'b110 | 150 mA current sink   |  |         |              |           |                       |        |                      |        |                      |        |                    |        |                    |        |                     |        |                     |
| 1      | EN_CTIRFC             | If EN_CTIR and EN_CTAUTOK always set to 1.<br>0 : CTIR is auto mode.<br>1 : CTIR is manual mode. (To set DATA_CTIRn data can reduce sunlight effect.) <table border="1" data-bbox="507 1032 1091 1167"> <thead> <tr> <th>mode</th> <th>EN_CTAUTOK</th> <th>EN_CTIRFC</th> <th>EN_CTIR</th> </tr> </thead> <tbody> <tr> <td>Auto</td> <td>1</td> <td>0</td> <td>1</td> </tr> <tr> <td>Manual</td> <td>0</td> <td>1</td> <td>1</td> </tr> </tbody> </table>  | mode    | EN_CTAUTOK   | EN_CTIRFC | EN_CTIR               | Auto   | 1                    | 0      | 1                    | Manual | 0                  | 1      | 1                  |        |                     |        |                     |
| mode   | EN_CTAUTOK            | EN_CTIRFC  | EN_CTIR |              |           |                       |        |                      |        |                      |        |                    |        |                    |        |                     |        |                     |
| Auto   | 1                     | 0  | 1       |              |           |                       |        |                      |        |                      |        |                    |        |                    |        |                     |        |                     |
| Manual | 0                     | 1  | 1       |              |           |                       |        |                      |        |                      |        |                    |        |                    |        |                     |        |                     |
| 0      | EN_CTIR               | Enable the CTIR function.<br>0 : Disable<br>1 : Enable   |         |              |           |                       |        |                      |        |                      |        |                    |        |                    |        |                     |        |                     |

### INTCTRL1 Register (0x04)

| Bit     | 7        | 6 | 5                 | 4 | 3          | 2                | 1 | 0 |
|---------|----------|---|-------------------|---|------------|------------------|---|---|
| ITEM    | INT_CTRL |   | EN_INVALID_PS_INT |   | EN_ALS_INT | PS_INT_MODE[2:0] |   |   |
| Access  | R/W      |   | R/W               |   | R/W        | R/W              |   |   |
| Default | 0        |   | 0                 |   | 0          | 3'b000           |   |   |

| Bit | ITEM              | Description   |
|-----|-------------------|---|
| 2:0 | PS_INT_MODE[2:0]  | Select PS interrupt mode. Refer to the PS interrupt description.  |
| 3   | EN_ALS_INT        | Enable the ALS out-of-windows interrupt.<br>0 : Disable<br>1 : Enable   |
| 5   | EN_INVALID_PS_INT | Enable the Invalid PS interrupt.<br>0 : Disable<br>1 : Enable   |
| 7   | INT_CTRL          | 0 : Set /INT pin low if FLG_ALS_INT or FLG_ALS_DR or FLG_PS_INT or FLG_PS_DR high (logical OR)<br>1 : Set /INT pin low if FLG_ALS_INT and FLG_ALS_DR and FLG_PS_INT and |

|  |  |                              |
|--|--|------------------------------|
|  |  | FLG_PS_DR high (logical AND) |
|--|--|------------------------------|

### WAIT Register (0x05)

| Bit     | 7           | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|-------------|---|---|---|---|---|---|---|
| ITEM    | WAIT[7:0]   |   |   |   |   |   |   |   |
| Access  | R/W         |   |   |   |   |   |   |   |
| Default | 8'b00000000 |   |   |   |   |   |   |   |

| Bit | ITEM      | Description   |
|-----|-----------|---|
| 7:0 | WAIT[7:0] | PS/GS wait state period.<br>wait period = (WAIT[7:0] + 1) * 1.54 ms |

### THDH1 PS Register (0x06)

| Bit     | 7             | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|---------------|---|---|---|---|---|---|---|
| ITEM    | THDH_PS[15:8] |   |   |   |   |   |   |   |
| Access  | R/W           |   |   |   |   |   |   |   |
| Default | 8'b11111111   |   |   |   |   |   |   |   |

### THDH2 PS Register (0x07)

| Bit     | 7            | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|--------------|---|---|---|---|---|---|---|
| ITEM    | THDH_PS[7:0] |   |   |   |   |   |   |   |
| Access  | R/W          |   |   |   |   |   |   |   |
| Default | 8'b11111111  |   |   |   |   |   |   |   |

### THDL1 PS Register (0x08)

| Bit     | 7             | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|---------------|---|---|---|---|---|---|---|
| ITEM    | THDL_PS[15:8] |   |   |   |   |   |   |   |
| Access  | R/W           |   |   |   |   |   |   |   |
| Default | 8'b00000000   |   |   |   |   |   |   |   |

### THDL2 PS Register (0x09)

| Bit     | 7            | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|--------------|---|---|---|---|---|---|---|
| ITEM    | THDL_PS[7:0] |   |   |   |   |   |   |   |
| Access  | R/W          |   |   |   |   |   |   |   |
| Default | 8'b00000000  |   |   |   |   |   |   |   |

| Bit  | ITEM          | Description        |
|------|---------------|--------------------|
| 15:0 | THDH_PS[15:0] | PS high threshold. |
| 15:0 | THDL_PS[15:0] | PS low threshold.  |

### THDH1 ALS Register (0x0A)

| Bit     | 7              | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|----------------|---|---|---|---|---|---|---|
| ITEM    | THDH_ALS[15:8] |   |   |   |   |   |   |   |
| Access  | R/W            |   |   |   |   |   |   |   |
| Default | 8'b11111111    |   |   |   |   |   |   |   |

### THDH2 ALS Register (0x0B)

| Bit     | 7             | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|---------------|---|---|---|---|---|---|---|
| ITEM    | THDH_ALS[7:0] |   |   |   |   |   |   |   |
| Access  | R/W           |   |   |   |   |   |   |   |
| Default | 8'b11111111   |   |   |   |   |   |   |   |

### THDL1 ALS Register (0x0C)

| Bit     | 7              | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|----------------|---|---|---|---|---|---|---|
| ITEM    | THDL_ALS[15:8] |   |   |   |   |   |   |   |
| Access  | R/W            |   |   |   |   |   |   |   |
| Default | 8'b00000000    |   |   |   |   |   |   |   |

### THDL2 ALS Register (0x0D)

| Bit     | 7             | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|---------------|---|---|---|---|---|---|---|
| ITEM    | THDL_ALS[7:0] |   |   |   |   |   |   |   |
| Access  | R/W           |   |   |   |   |   |   |   |
| Default | 8'b00000000   |   |   |   |   |   |   |   |

| Bit  | ITEM           | Description         |
|------|----------------|---------------------|
| 15:0 | THDH_ALS[15:0] | ALS high threshold. |
| 15:0 | THDL_ALS[15:0] | ALS low threshold.  |

### FLAG Register (0x10)

| Bit     | 7          | 6         | 5           | 4          | 3 | 2           | 1                  | 0      |
|---------|------------|-----------|-------------|------------|---|-------------|--------------------|--------|
| ITEM    | FLG_ALS_DR | FLG_PS_DR | FLG_ALS_INT | FLG_PS_INT |   | FLG_ALS_SAT | FLG_INVALID_PS_INT | FLG_NF |
| Access  | R/W        | R/W       | R/W         | R/W        |   | RO          | R/W                | RO     |
| Default | 0          | 0         | 0           | 0          |   | 0           | 0                  | 1      |

| Bit | ITEM               | Description   |
|-----|--------------------|---|
| 0   | FLG_NF             | Object near/far flag. Default FLG_NF = 1, object in far state.<br>0 : Object in near state<br>1 : Object in far state |
| 1   | FLG_INVALID_PS_INT | Indicate if interrupt event is related to INVALID_PS_INT. Write bit 0 to clear.<br>0 : No INVALID_PS_INT event        |

|   |             |   |
|---|-------------|---|
|   |             | 1 : INVALID_PS_INT event  |
| 2 | FLG_ALS_SAT | Indicate the ALS channel circuit saturation.<br>0 : No ALS channel circuit saturation, the data is valid.<br>1 : ALS channel circuit saturation, the data is not valid. |
| 4 | FLG_PS_INT  | Indicate if interrupt event is related to PS_INT. Write bit 0 to clear.<br>0 : No PS_INT event<br>1 : PS_INT event  |
| 5 | FLG_ALS_INT | Indicate if interrupt event is related to ALS_INT. Write bit 0 to clear.<br>0 : No ALS_INT event<br>1 : ALS_INT event   |
| 6 | FLG_PS_DR   | Indicate PS data conversion complete. Automatically cleared after DATA_PS[15:0] is read.<br>0 : PS data is not ready<br>1 : PS data is ready                            |
| 7 | FLG_ALS_DR  | Indicate ALS data conversion complete. Automatically cleared after DATA_ALS[15:0] is read.<br>0 : ALS data is not ready<br>1 : ALS data is ready                        |

### DATA1 PS Register (0x11)

|         |               |   |   |   |   |   |   |   |
|---------|---------------|---|---|---|---|---|---|---|
| Bit     | 7             | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| ITEM    | DATA_PS[15:8] |   |   |   |   |   |   |   |
| Access  | RO            |   |   |   |   |   |   |   |
| Default | 8'b00000000   |   |   |   |   |   |   |   |

### DATA2 PS Register (0x12)

|         |              |   |   |   |   |   |   |   |
|---------|--------------|---|---|---|---|---|---|---|
| Bit     | 7            | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| ITEM    | DATA_PS[7:0] |   |   |   |   |   |   |   |
| Access  | RO           |   |   |   |   |   |   |   |
| Default | 8'b00000000  |   |   |   |   |   |   |   |

The STK3331 has two 8-bit read-only registers to hold the data from ADC of PS. The most significant bit (MSB) is accessed at register 0x11, and the least significant bit (LSB) is accessed at register 0x12. The registers are updated for every PS integration time (conversion cycle).

### DATA1 ALS Register (0x13)

|         |                |   |   |   |   |   |   |   |
|---------|----------------|---|---|---|---|---|---|---|
| Bit     | 7              | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| ITEM    | DATA_ALS[15:8] |   |   |   |   |   |   |   |
| Access  | RO             |   |   |   |   |   |   |   |
| Default | 8'b00000000    |   |   |   |   |   |   |   |

### DATA2 ALS Register (0x14)

|     |   |   |   |   |   |   |   |   |
|-----|---|---|---|---|---|---|---|---|
| Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|-----|---|---|---|---|---|---|---|---|

|         |               |
|---------|---------------|
| ITEM    | DATA_ALS[7:0] |
| Access  | RO            |
| Default | 8'b00000000   |

### DATA1 C Register (0x1B)

|         |              |   |   |   |   |   |   |   |
|---------|--------------|---|---|---|---|---|---|---|
| Bit     | 7            | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| ITEM    | DATA_C[15:8] |   |   |   |   |   |   |   |
| Access  | RO           |   |   |   |   |   |   |   |
| Default | 8'b00000000  |   |   |   |   |   |   |   |

### DATA2 C Register (0x1C)

|         |             |   |   |   |   |   |   |   |
|---------|-------------|---|---|---|---|---|---|---|
| Bit     | 7           | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| ITEM    | DATA_C[7:0] |   |   |   |   |   |   |   |
| Access  | RO          |   |   |   |   |   |   |   |
| Default | 8'b00000000 |   |   |   |   |   |   |   |

The STK3331 has two 8-bit read-only registers to hold each data from ADC of ALS/C. The registers are updated for every ALS/C integration time (conversion cycle).

### DATA1 PS OFFSET Register (0x1D)

|         |                      |   |   |   |   |   |   |   |
|---------|----------------------|---|---|---|---|---|---|---|
| Bit     | 7                    | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| ITEM    | DATA_PS_OFFSET[15:8] |   |   |   |   |   |   |   |
| Access  | RW                   |   |   |   |   |   |   |   |
| Default | 8'b00000000          |   |   |   |   |   |   |   |

### DATA2 PS OFFSET Register (0x1E)

|         |                     |   |   |   |   |   |   |   |
|---------|---------------------|---|---|---|---|---|---|---|
| Bit     | 7                   | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| ITEM    | DATA_PS_OFFSET[7:0] |   |   |   |   |   |   |   |
| Access  | RW                  |   |   |   |   |   |   |   |
| Default | 8'b00000000         |   |   |   |   |   |   |   |

### DATA CTIR1 Register (0x20)

|         |                 |   |   |   |   |   |   |   |
|---------|-----------------|---|---|---|---|---|---|---|
| Bit     | 7               | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| ITEM    | DATA_CTIR1[7:0] |   |   |   |   |   |   |   |
| Access  | RW              |   |   |   |   |   |   |   |
| Default | 8'b00000000     |   |   |   |   |   |   |   |

### DATA CTIR2 Register (0x21)

|     |   |   |   |   |   |   |   |   |
|-----|---|---|---|---|---|---|---|---|
| Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|-----|---|---|---|---|---|---|---|---|



|         |                 |
|---------|-----------------|
| ITEM    | DATA_CTIR2[7:0] |
| Access  | RW              |
| Default | 8'b00000000     |

### DATA CTIR3 Register (0x22)

|         |                 |   |   |   |   |   |   |   |
|---------|-----------------|---|---|---|---|---|---|---|
| Bit     | 7               | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| ITEM    | DATA_CTIR3[7:0] |   |   |   |   |   |   |   |
| Access  | RW              |   |   |   |   |   |   |   |
| Default | 8'b00000000     |   |   |   |   |   |   |   |

### DATA CTIR4 Register (0x23)

|         |                 |   |   |   |   |   |   |   |
|---------|-----------------|---|---|---|---|---|---|---|
| Bit     | 7               | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| ITEM    | DATA_CTIR4[7:0] |   |   |   |   |   |   |   |
| Access  | RW              |   |   |   |   |   |   |   |
| Default | 8'b00000000     |   |   |   |   |   |   |   |

### Product ID (0x3E)

Read Only; PDT\_ID = Product ID(0x53) to indicate the product information.

### Reserved (0x3F)

Read Only; RSRVD = Reserved for engineering mode.

### ALSCTRL2 Register (0x4E)

|         |             |   |   |   |   |   |   |   |
|---------|-------------|---|---|---|---|---|---|---|
| Bit     | 7           | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| ITEM    | GAIN_C[1:0] |   |   |   |   |   |   |   |
| Access  | R/W         |   |   |   |   |   |   |   |
| Default | 2'b00       |   |   |   |   |   |   |   |

| Bit   | ITEM        | Description   |       |           |       |           |       |            |       |            |
|-------|-------------|---|-------|-----------|-------|-----------|-------|------------|-------|------------|
| 5:4   | GAIN_C[1:0] | Clear channel gain setting. GAIN_C[1:0] is used to control of the Clear channel signal gain. The ALS are controlled by GAIN_ALS[1:0].   |       |           |       |           |       |            |       |            |
|       |             | <table border="1"> <tr> <td>2'b00</td> <td>x 1 times</td> </tr> <tr> <td>2'b01</td> <td>x 4 times</td> </tr> <tr> <td>2'b10</td> <td>x 16 times</td> </tr> <tr> <td>2'b11</td> <td>x 64 times</td> </tr> </table> | 2'b00 | x 1 times | 2'b01 | x 4 times | 2'b10 | x 16 times | 2'b11 | x 64 times |
| 2'b00 | x 1 times   |   |       |           |       |           |       |            |       |            |
| 2'b01 | x 4 times   |   |       |           |       |           |       |            |       |            |
| 2'b10 | x 16 times  |   |       |           |       |           |       |            |       |            |
| 2'b11 | x 64 times  |   |       |           |       |           |       |            |       |            |

### INTELLI\_WAIT\_PS Register (0x4F)

|        |                      |   |   |   |   |   |   |   |
|--------|----------------------|---|---|---|---|---|---|---|
| Bit    | 7                    | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| ITEM   | INTELLI_WAIT_PS[6:0] |   |   |   |   |   |   |   |
| Access | R/W                  |   |   |   |   |   |   |   |

|         |  |            |
|---------|--|------------|
| Default |  | 7'b0000000 |
|---------|--|------------|

| Bit | ITEM                 | Description   |
|-----|----------------------|---|
| 6:0 | INTELLI_WAIT_PS[6:0] | PS wait state period for intelligent persistence.<br>wait period = (INTELLI_WAIT_PS[6:0] + 1) * 390us |

### Soft reset (0x80)

Write any data to this register will reset the chip.

### PSPDCTRL Register (0xA1)

| Bit     | 7 | 6 | 5 | 4 | 3      | 2      | 1      | 0      |
|---------|---|---|---|---|--------|--------|--------|--------|
| ITEM    |   |   |   |   | PS_PS3 | PS_PS2 | PS_PS1 | PS_PS0 |
| Access  |   |   |   |   | R/W    | R/W    | R/W    | R/W    |
| Default |   |   |   |   | 1      | 1      | 1      | 1      |

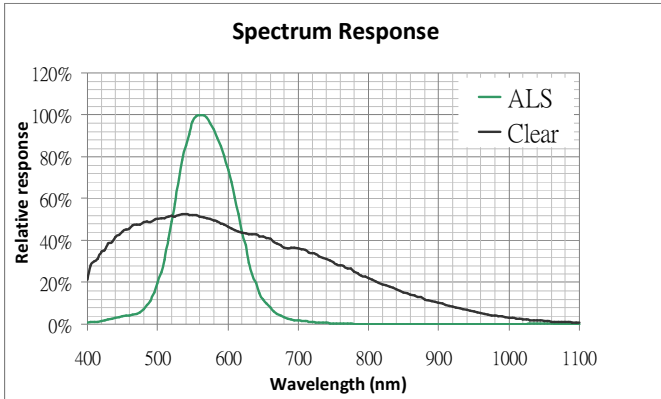
| Bit | ITEM   | Description                                      |
|-----|--------|--|
| 0   | PS_PS0 | Enable the PS0 PD .<br>0 : Disable<br>1 : Enable |
| 1   | PS_PS1 | Enable the PS1 PD .<br>0 : Disable<br>1 : Enable |
| 2   | PS_PS2 | Enable the PS2 PD .<br>0 : Disable<br>1 : Enable |
| 3   | PS_PS3 | Enable the PS3 PD .<br>0 : Disable<br>1 : Enable |

### INTCTRL2 Register (0xA5)

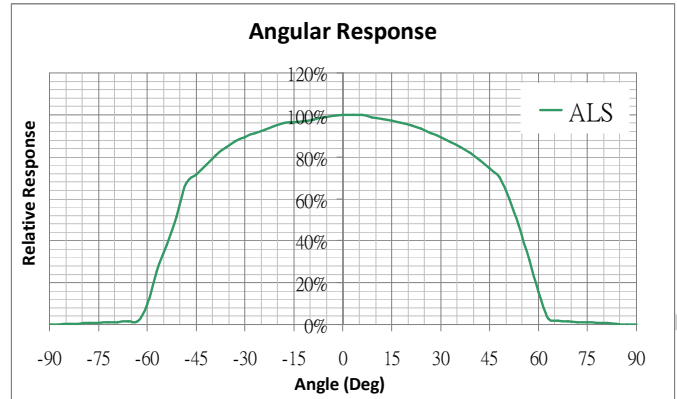
| Bit     | 7 | 6 | 5 | 4 | 3 | 2 | 1             | 0            |
|---------|---|---|---|---|---|---|---------------|--------------|
| ITEM    |   |   |   |   |   |   | EN_ALS_DR_INT | EN_PS_DR_INT |
| Access  |   |   |   |   |   |   | R/W           | R/W          |
| Default |   |   |   |   |   |   | 0             | 0            |

| Bit | ITEM          | Description   |
|-----|---------------|---|
| 0   | EN_PS_DR_INT  | Enable the PS Data Ready interrupt.<br>0 : Disable<br>1 : Enable  |
| 1   | EN_ALS_DR_INT | Enable the ALS Data Ready interrupt.<br>0 : Disable<br>1 : Enable |

**8. ALS RESPONSE CHARTS**



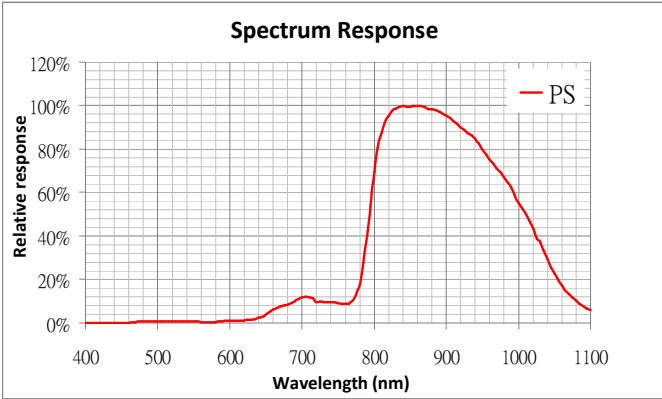
**Spectrum**



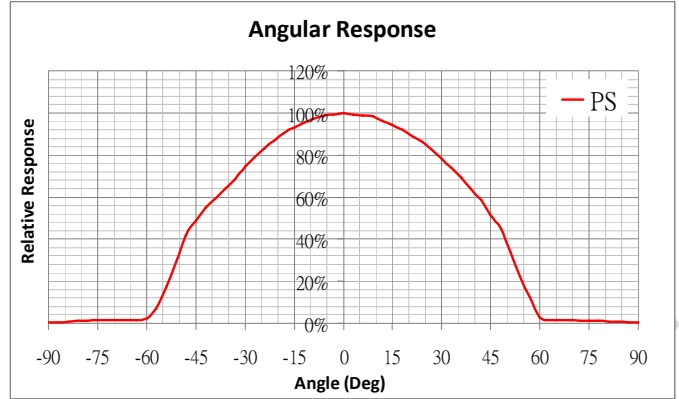
**View Angle**

Confidential

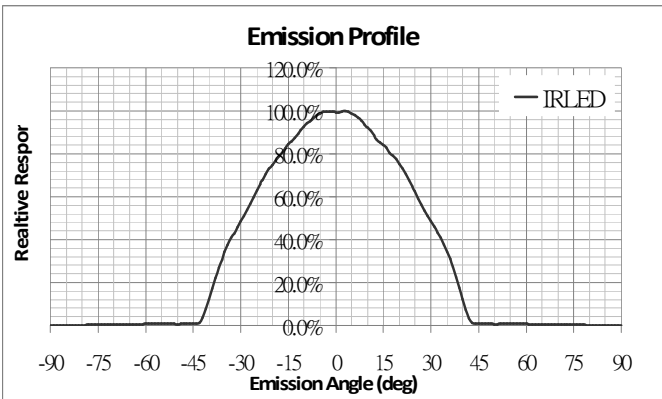
**9. PROXIMITY CHARACTERISTIC**



**Spectrum**

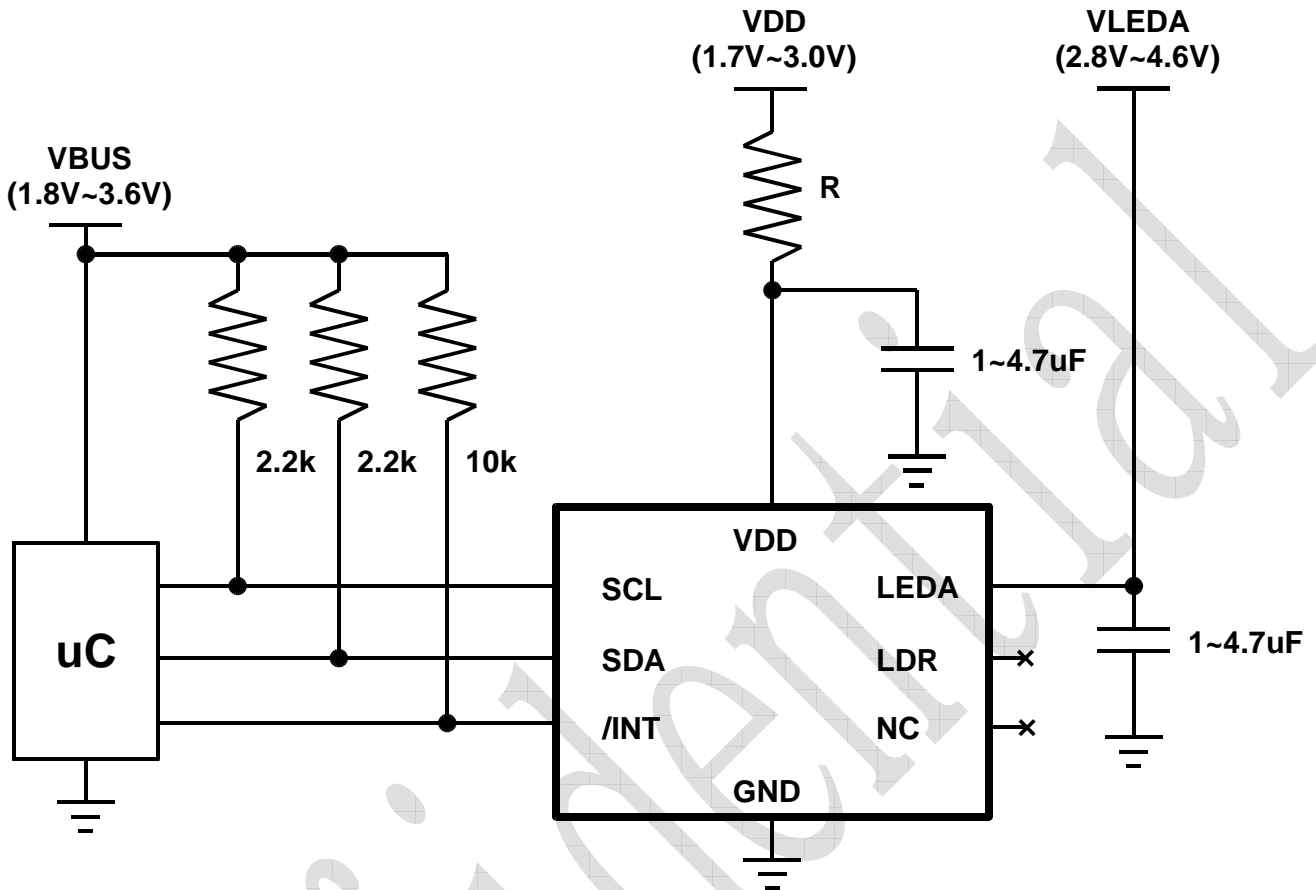


**View Angle**



**IRLED Emission Angle**

## 10. APPLICATION NOTE

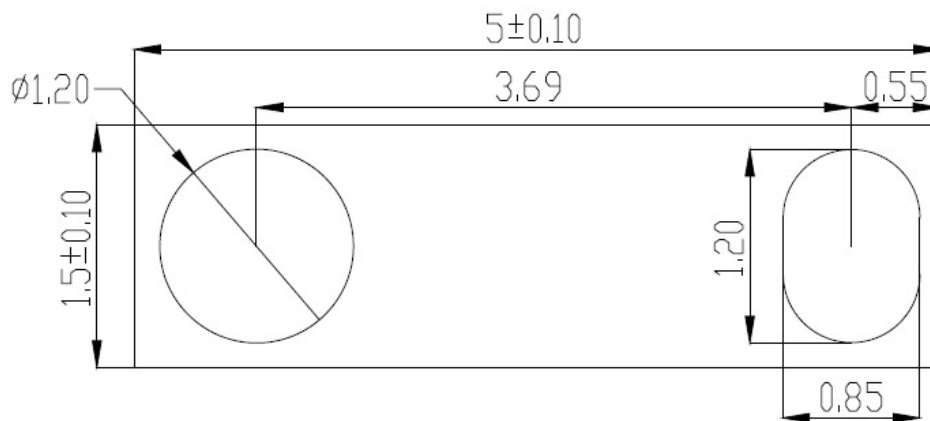


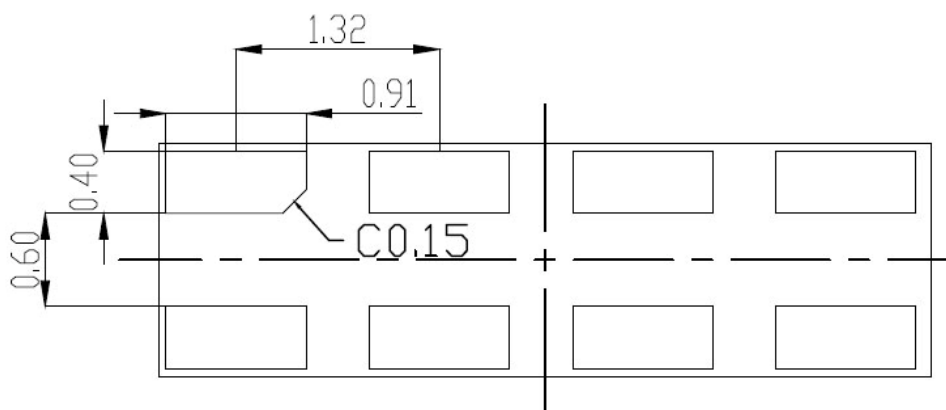
STK3331 Typical Application Circuit with Independent VDD and VLED Supply Voltage

### 10.1 Power Noise Consideration

It is suggested that IC power and  $V_{LED}$  comes from individual source to get the best performance of STK3331 and an R/C low pass filter is also suggested to be added in the  $V_{DD}$  path of STK3331 to reduce the switching noise from whole system. The recommended R value is 22 Ohm.

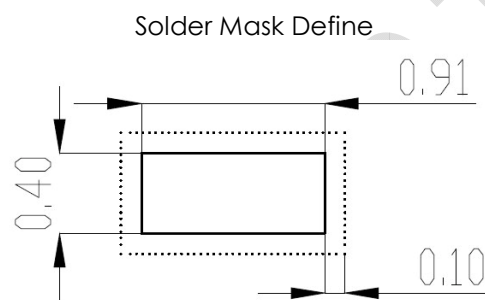
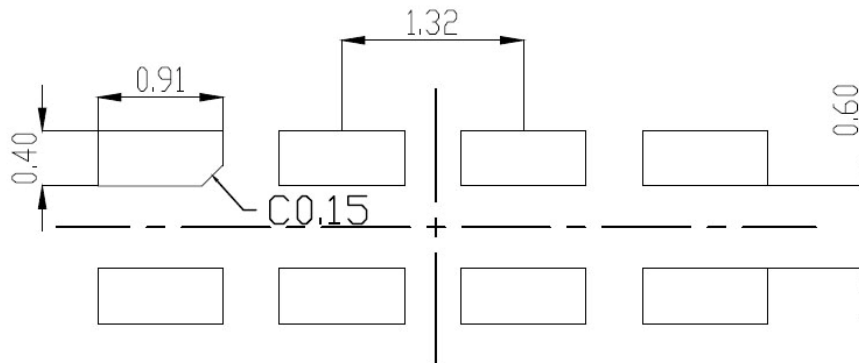
## 11. PACKAGE OUTLINE

**Top View**

**Side View**

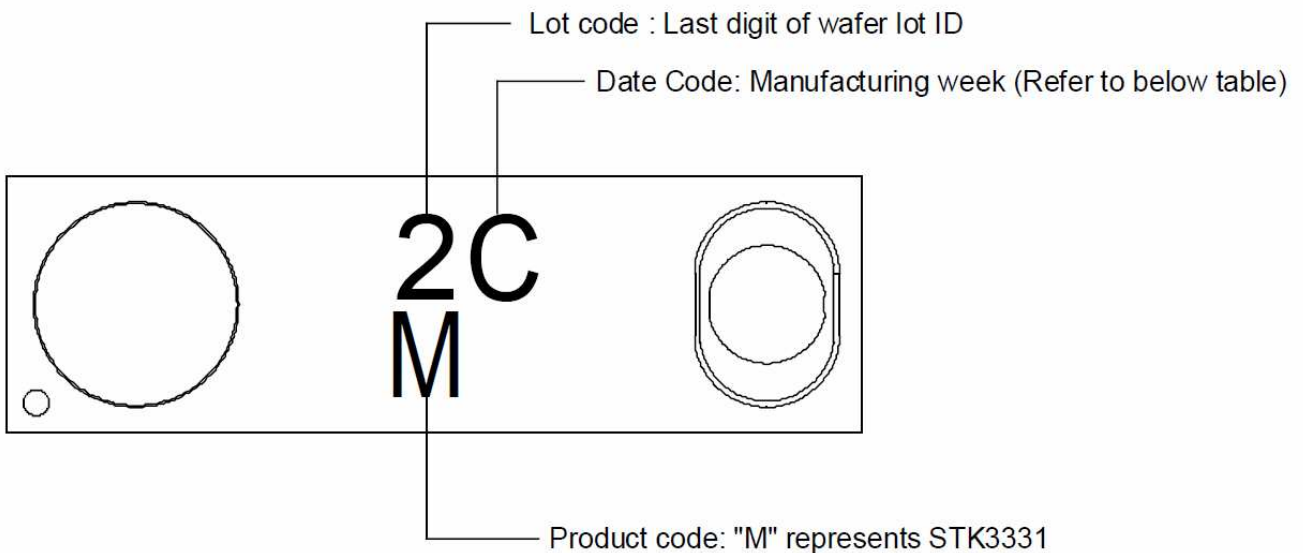
**Bottom View**


**PCB Pad Layout and Solder Mask Define Recommendation**

Suggested PCB pad layout guidelines for the Dual Flat No-Lead surface mount package are shown below.



Notes: all linear dimensions are in mm.

**Marking Rule**
**STK3331 Marking**


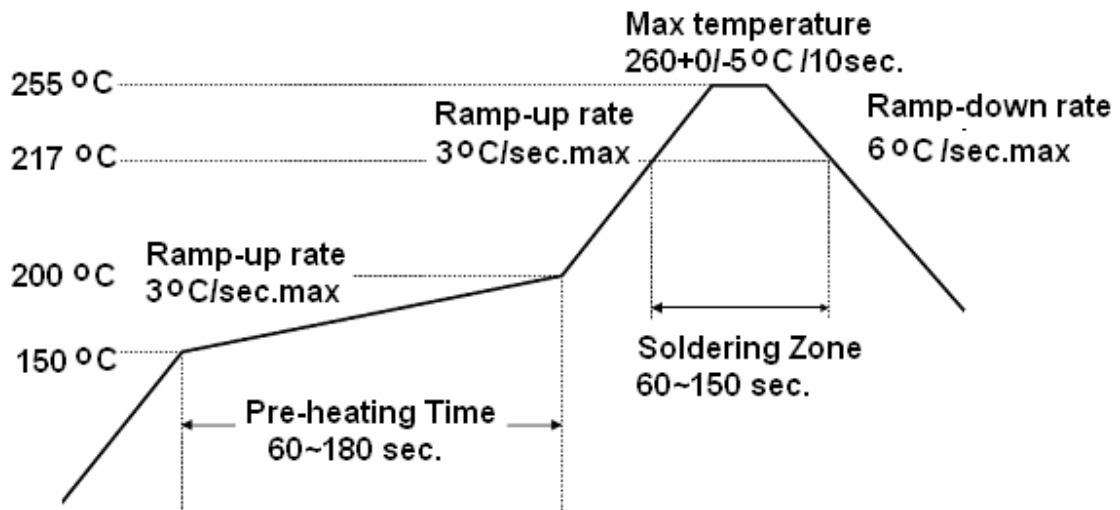
|              |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|--------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Date code    | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| Marking code | A  | B  | C  | D  | E  | F  | G  | H  | I  | J  | K  | L  | M  | N  | O  | P  | Q  | R  | S  | T  |
| Date code    | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| Marking code | U  | V  | W  | X  | Y  | Z  | a  | b  | 1  | d  | e  | f  | g  | h  | i  | j  | k  | 2  | m  | n  |
| Date code    | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 |    |    |    |    |    |    |    |
| Marking code | 3  | 4  | q  | r  | 5  | t  | u  | 6  | 7  | 8  | y  | 9  |    |    |    |    |    |    |    |    |



## 12. SOLDERING INFORMATION

### 12.1 Soldering Condition

0. Pb-free solder temperature profile



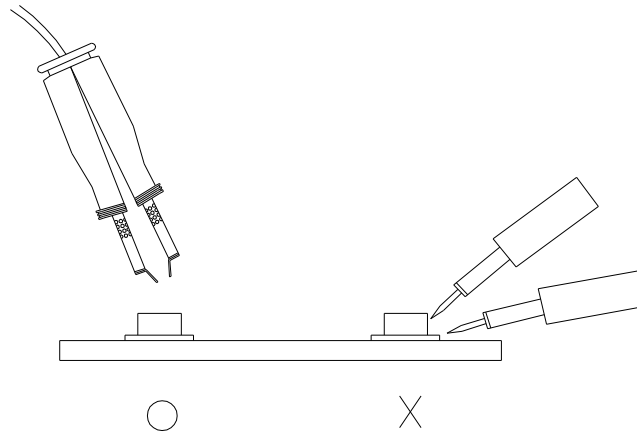
2. Reflow soldering should not be done more than three times.
3. When soldering, do not put stress on the ICs during heating.
4. After soldering, do not warp the circuit board.

### 12.2 Soldering Iron

Each terminal is to go to the tip of soldering iron temperature less than 350°C for 3 seconds within once in less than the soldering iron capacity 25W. Leave two seconds and more intervals, and do soldering of each terminal. Be careful because the damage of the product is often started at the time of the hand solder.

### 12.3 Repairing

Repair should not be done after the ICs have been soldered. When repairing is unavoidable, a double-head soldering iron should be used (as below figure). It should be confirmed beforehand whether the characteristics of the ICs will or will not be damaged by repairing.



## 13. STORAGE INFORMATION

### 13.1 Storage Condition

1. Devices are packed in moisture barrier bags (MBB) to prevent the products from moisture absorption during transportation and storage. Each bag contains a desiccant.
2. The delivery product should be stored with the conditions shown below:

|                     |             |
|---------------------|-------------|
| Storage Temperature | 10 to 30°C  |
| Relatively Humidity | below 60%RH |

### 13.2 Treatment After Unsealed

1. Floor life (time between soldering and removing from MBB) must not exceed the time shown below:

|                     |             |
|---------------------|-------------|
| Floor Life          | 168 Hours   |
| Storage Temperature | 10 to 30°C  |
| Relatively Humidity | below 60%RH |

2. When the floor life limits have been exceeded or the devices are not stored in dry conditions, they must be re-baked before reflow to prevent damage to the devices. The recommended conditions are shown below

|                |          |
|----------------|----------|
| Temperature    | 60°C     |
| Re-Baking Time | 12 Hours |

## 14. TAPE AND REEL DIMENSION

TBD

Notes: all linear dimensions are in mm.

Confidential

## Revision History

| Date       | Version | Modified Items                     |
|------------|---------|------------------------------------|
| 2018/01/23 | 0.9.0   | Initial release.                   |
| 2018/01/25 | 0.9.1   | Datasheet update (Marking rule...) |
|            |         |                                    |

### Important Notice

This document contains information that is proprietary to Sensortek Technology Corp. ("sensortek"), and is subject to change without notice. Any part of this document may not be used, reproduced, duplicated or disclosed in any form or any means without the prior written permission of sensortek.

Sensortek does not warrant or represent that any license, either express or implied, is granted under any sensortek's patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which sensortek's products or services are used. In addition, Sensortek does not assume any liability for the occurrence of infringing on any patent or other intellectual property rights of a third party.

Sensortek reserves the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete.

单击下面可查看定价，库存，交付和生命周期等信息

[>>Sensortek \(升佳电子\)](#)