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LITEON®
OPTOELECTRONICS

Optical Sensor

Product Data Sheet

LTR-507ALS-01

Spec No.: DS86-2013-0014

Effective Date: 07/09/2014

Revision: A

LITE-ON DCC

RELEASE

BNS-OD-FC001/A4

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Optical Sensor
LTR-507ALS-01

Description

The LTR-507ALS-01 is an integrated I2C digital light sensor [ALS] and proximity sensor [PS] with built-in LED driver, in a miniature chipled lead-free surface mount package. This device converts light intensity to a digital output signal capable of direct I2C interface. It provides a linear response over a wide dynamic range and is well suited to applications under high ambient brightness. With built-in proximity sensor, LTR-507ALS-01 offers the feature to detect object at a user configurable distance of typical 50cm Gray Card.

The device supports an interrupt feature that removes the need to poll the sensor for a reading which improves system efficiency. The device also supports several features that help to minimize the occurrence of false triggering. This CMOS design and factory-set one time trimming capability ensure minimal device-to-device variations for ease of manufacturability to the end customers.

Application

To control display backlight and/or object detection in

- Mobile Devices: Mobile phone, PDA
- Computing Devices: Notebook PC, Desktop Monitor
- Consumer Devices: LCD/PDP TV backlight systems, Cameras, Personal Navigation Device, Digital Photo Frame
- Dashboard

Features

- I2C interface (Standard mode@100kbit/s, Fast Mode@400kbit/s and High Speed Mode@3.4Mbit/s)
- Built-in temperature compensation circuit
- Programmable independent thresholds and interrupts
- Low active power consumption with shutdown mode
- Supply voltage range from 2.4V to 3.6V capable of 1.7 V logic voltage
- Operating temperature range from -40°C to +85°C
- RoHS and Halogen free compliant

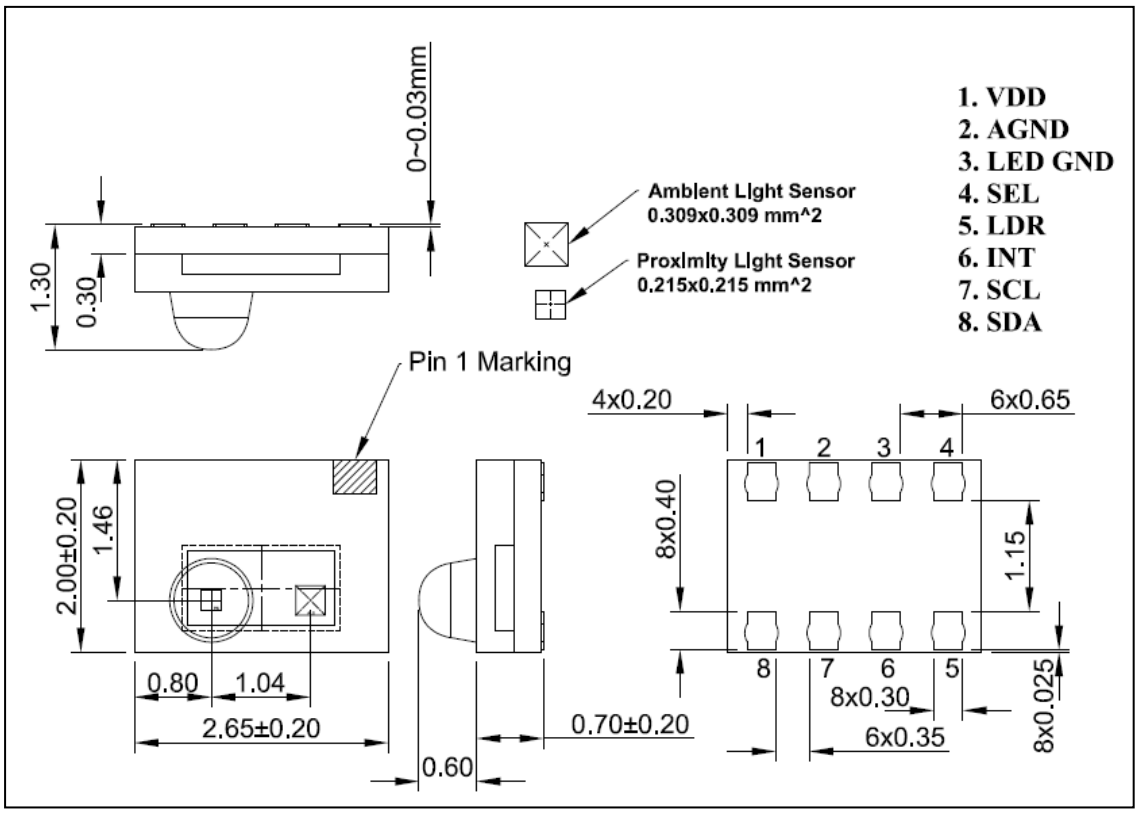
- **Light Sensor Features**
  - Close to human eye spectral response
  - 4 Gain Range Selections
  - Works under different light source conditions
  - Automatically rejects 50/60Hz lightings flicker

- **Proximity Sensor Features**
  - Built-in LED driver and detector
  - Programmable LED drive settings
  - 11-bit effective resolution
  - High ambient light suppression

Ordering Information

Part Number	Packaging Type	Package	Quantity
LTR-507ALS-01	Tape and Reel	8-pin chipled package	2000

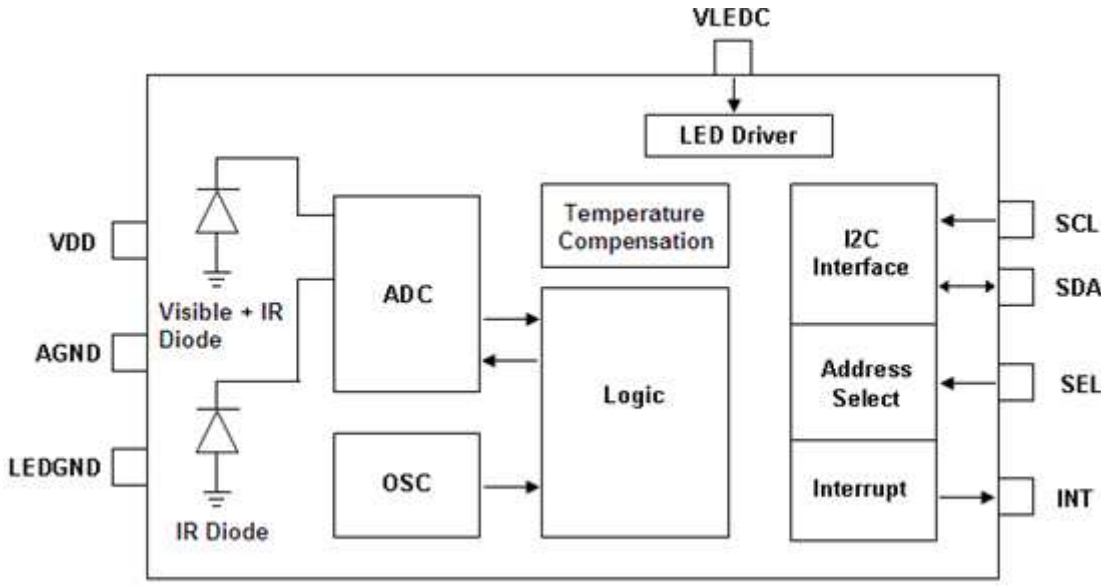
1. Outline Dimensions



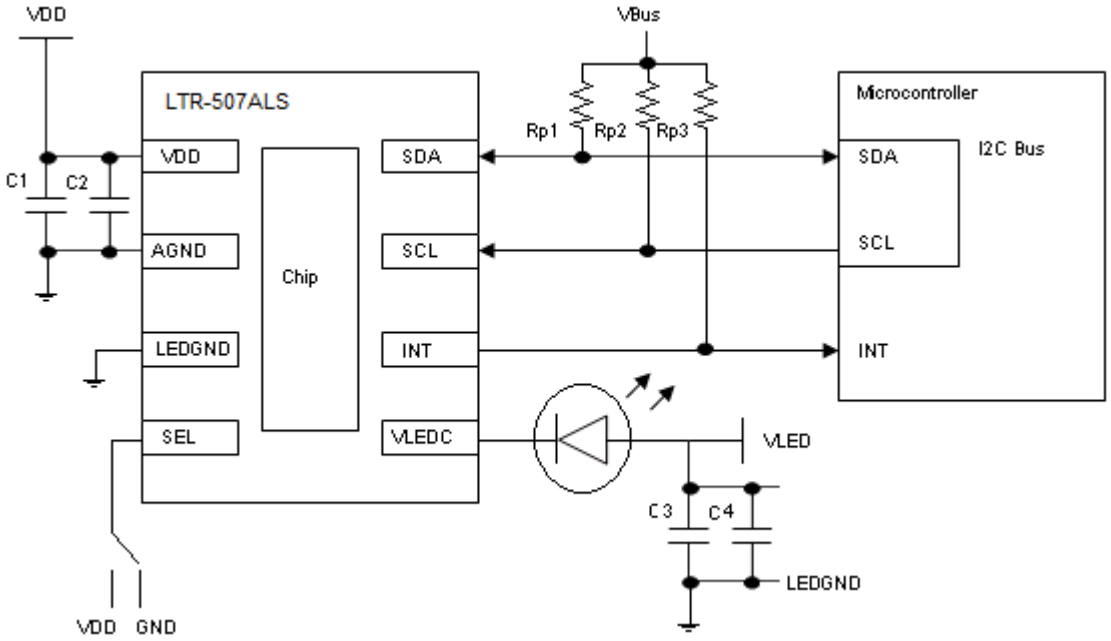
Note:

1. All dimensions are in millimeters

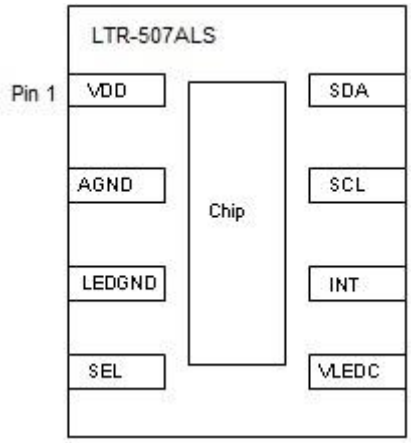
2. Functional Block Diagram



3. Application Circuit



I/O Pins Configuration Table

Pin	I/O Type	Symbol	Description
1		VDD	Supply Voltage
2		AGND	Analog Ground
3		LEDGND	LED GND
4	I	SEL	I2C address selection
5	I	VLEDC	To connect to LED Cathode.
6	O	INT	Level Interrupt pin. Active LOW for interrupt. This pin is an open drain.
7	I	SCL	I2C serial clock
			
8	I/O	SDA	I2C serial data

Recommended Application Circuit Components

Component	Recommended Value
Rp1, Rp2, Rp3 [1]	1 kΩ to 10 kΩ
C1, C3	0.1uF
C2, C4	4.7uF

Notes:

[1] Selection of pull-up resistors value is dependent on bus capacitance values. For more details, please refer to I2C Specifications: http://www.nxp.com/documents/user_manual/UM10204.pdf

[2] IR LED = LTE-C249

4. Rating and Specification

4.1. Absolute Maximum Rating at Ta=25°C

Parameter	Symbol	Rating	Unit
Supply Voltage	VDD	4.5	V
I2C Address Pin Voltage	SEL	-0.2 to 4.5	V
I2C Bus Pin Voltage	SCL, SDA	-0.2 to 4.5	V
I2C Bus Pin Current	SCL, SDA	10	mA
Storage Temperature	T_{stg}	-40 to 100	°C

Note: Exceeding these ratings could cause damage to the sensor. All voltages are with respect to ground. Currents are positive into, negative out of the specified terminal.

4.2. Recommended Operating Conditions

Description	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage	VDD	2.4		3.6	V
LED Supply Voltage	V_{LED}	2.5		4.35	V
I2C Bus Pin Voltage	V_{bus}	1.7		3.6	V
I2C Bus Input Pin High Voltage	VIH_SCL, VIH _SDA	1.3			V
I2C Bus Input Pin Low Voltage	VIL_SCL, VIL_SDA			0.3	V
Operating Temperature	T_{ope}	-40		85	°C

4.3. Electrical & Optical Specifications

All specifications are at VDD = 3.0V, Tope = 25°C, unless otherwise noted.

Parameter	Min.	Typ.	Max.	Unit	Condition
Active Supply Current			220	uA	Active Mode, Tope = 25°C
Standby Current			5	uA	Standby / Sleep Mode
Initial Startup Time	100			ms	(Note 1)
Wakeup Time from Standby			10	ms	(Note 1)

4.4. Characteristics Ambient Sensor

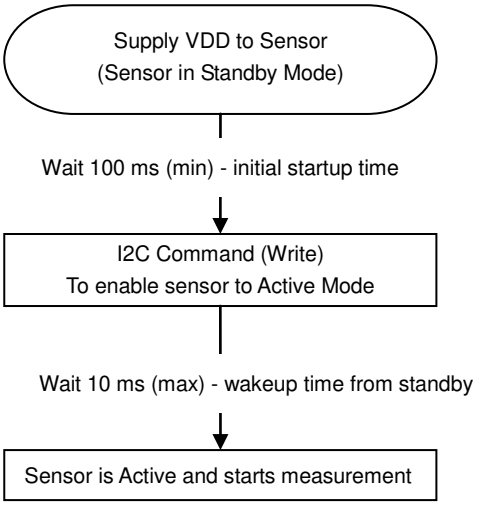
Parameter	Min.	Typ.	Max.	Unit	Condition
Full Scale ADC Count	0		65535	count	
Dark ADC Count	0		3	count	E = 0 lux, Dynamic range 1
CH1 Count	90		180	count	E=200 lux white LED (10K color temperature), Dynamic range 1, 1 to 64kux, 16 bit ADC
CH2 Count	25		55	count	E=200 lux white LED (10K color temperature), Dynamic range 1, 1 to 64kux, 16 bit ADC
Gain 2x	-5%		5%		Dynamic range 1
Gain 100x	-5%		5%		Dynamic range 1
Gain 200x	-5%		5%		Dynamic range 1

4.5. Characteristics Proximity Sensor

Parameter	Min.	Typ.	Max.	Unit	Condition
Full Scale ADC Count			2047	count	
Peak Sensitivity		850		nm	
Detection Distance		50		cm	18% Gray card IR LED=LTE-C249, 127 IR pulses
Ambient Light Suppression			50k	lux	Direct sunlight
LED Pulse Count	1		255	pulses	
LED Pulse Frequency	30k		100k	Hz	Increment of 10k Hz
LED Duty Cycle		50%		%	Fixed at 50% Duty Cycle
LED Peak Current		5		mA	LED Peak Current = 000
		10		mA	LED Peak Current = 001
		20		mA	LED Peak Current = 010
		50		mA	LED Peak Current = 011
	65		130	mA	LED Peak Current = 100/101/110/111

Notes:

1. Startup Sequence



4.6. Typical Performance Curve, VDD = 3.0V, Ta=25°C

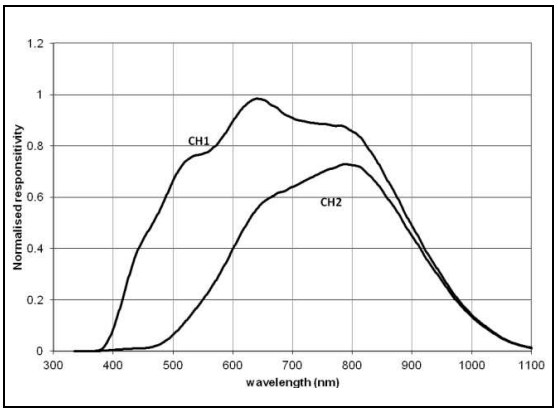


Figure 4.1 : Spectral responsivity.

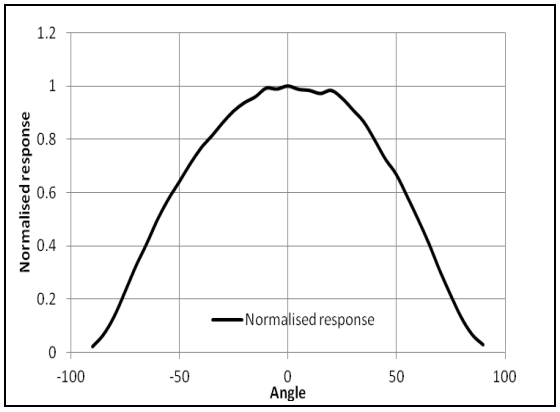


Figure 4.2 : Ambient sensor angular displacement.

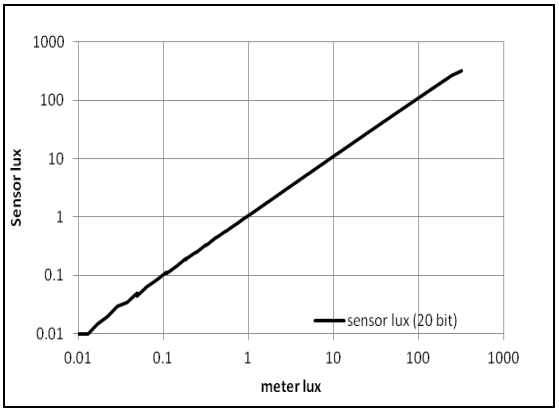


Figure 4.3: Sensor lux versus meter lux with low lux white LED source, Gain 4.

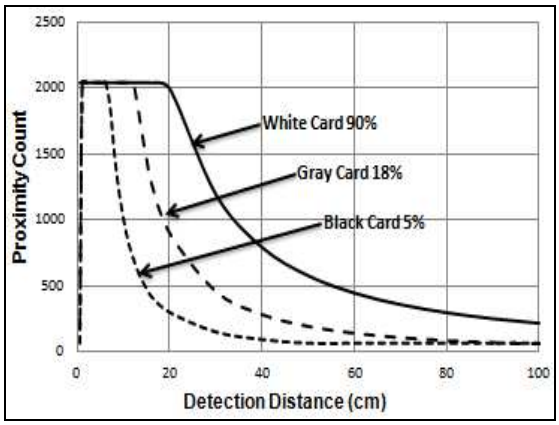


Figure 4.4 : Proximity ADC output versus detection distance (127 pulses).

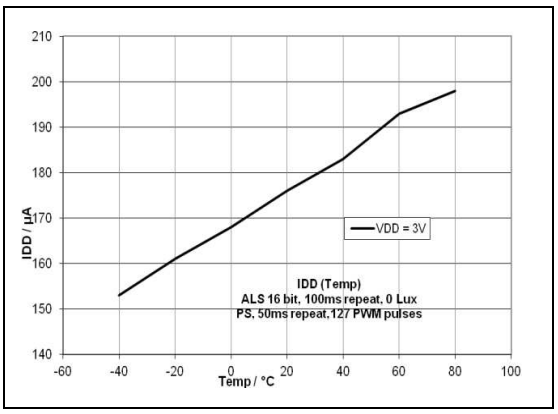


Figure 4.5 : Supply current versus temperature sensing

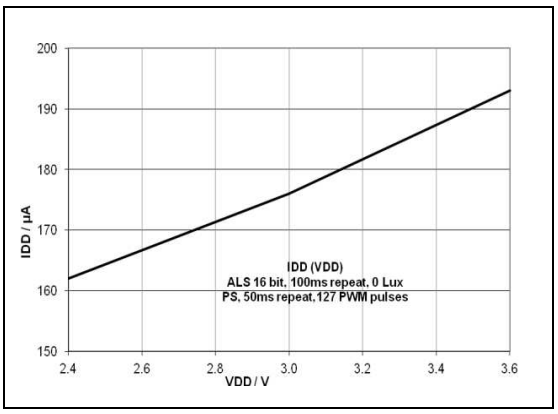
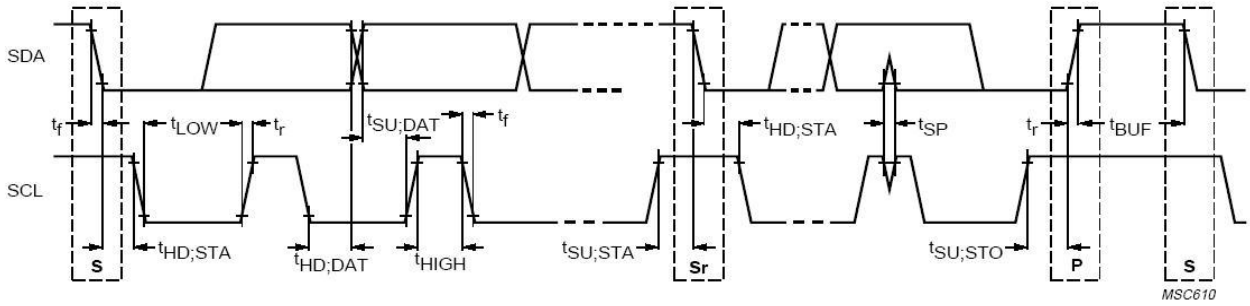


Figure4. 6: Supply current versus supply voltage

4.7. AC Electrical Characteristics

All specifications are at VBus = 1.7V, T_{ope} = 25°C, unless otherwise noted.

Parameter	Symbol	Min		Fast (Min)	Unit
SCL clock frequency	f_{SCL}	100	400	3400	KHz
Bus free time between a STOP and START condition	t_{BUF}	1.3			us
Hold time (repeated) START condition. After this period, the first clock pulse is generated	$t_{HD;STA}$	0.6			us
LOW period of the SCL clock	t_{LOW}	1.3			us
HIGH period of the SCL clock	t_{HIGH}	0.6			us
Set-up time for a repeated START condition	$t_{SU;STA}$	0.6			us
Set-up time for STOP condition	$t_{SU;STO}$	0.6			us
Rise time of both SDA and SCL signals	t_r	30		300	ns
Fall time of both SDA and SCL signals	t_f	30		300	ns
Data hold time	$t_{HD;DAT}$	0		0.9	us
Data setup time	$t_{SU;DAT}$	100			ns
Pulse width of spikes which must be suppressed by the input filter	t_{SP}	0		50	ns

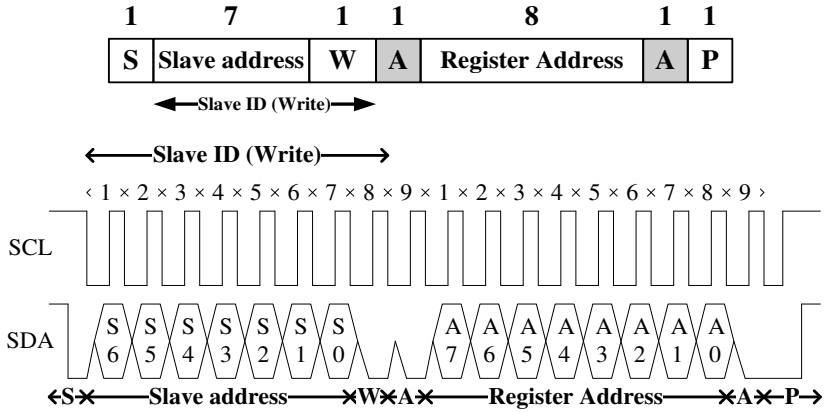


Definition of timing for I²C bus

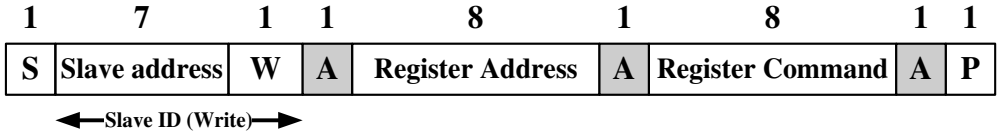
5. Principle of Operation

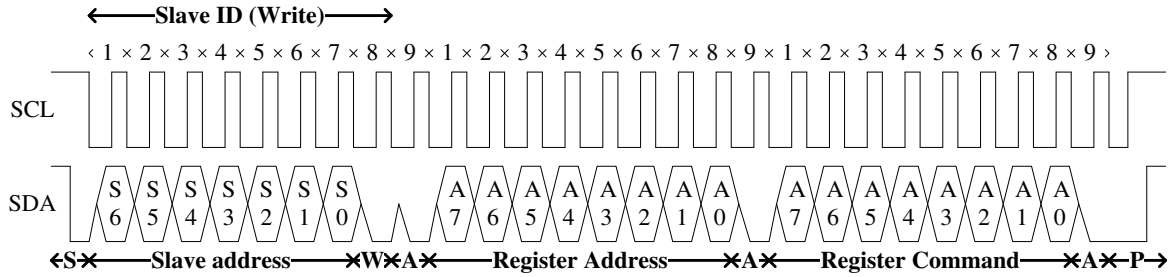
5.1. I2C Protocol

5.1.1. I2C Write Protocol (type 1)

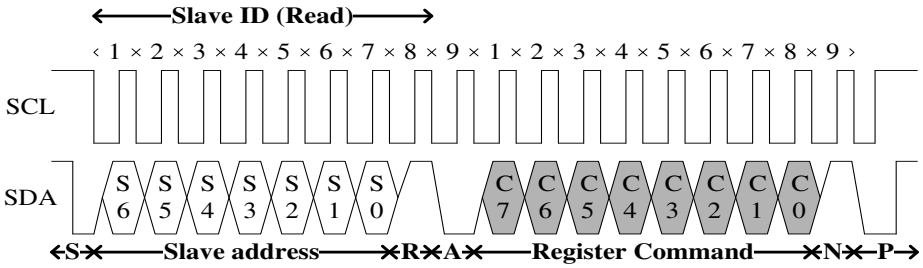


5.1.2. I2C Write Protocol (type 2)

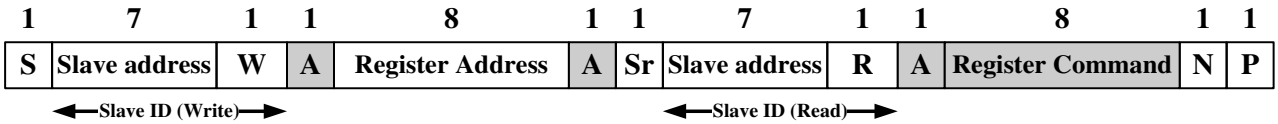


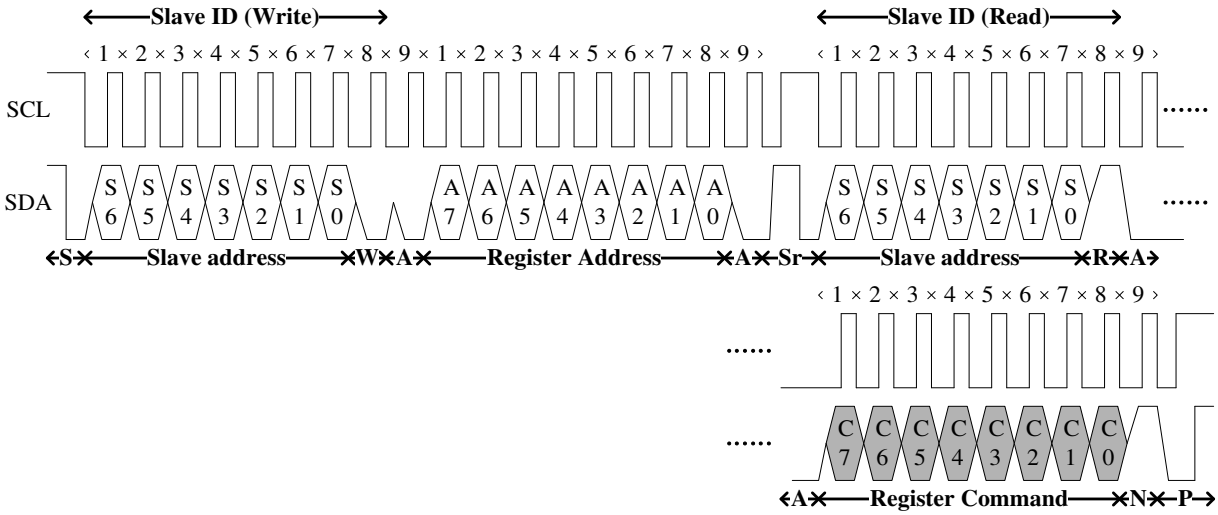


5.1.3. I2C Read Protocol



5.1.4. I2C Read (Combined format) Protocol





A	Acknowledge (0 for an ACK)	**N**	Non-Acknowledge(1 for an NACK)
S	Start condition	**Sr**	Repeated Start condition
P	Stop condition		
W	Write (0 for writing)	**R**	Read (1 for read)
■	Slave-to-master	□	Master-to-Slave

5.2. I2C Slave Address

The device offers three slave addresses that are selectable via pin 4 (SEL). The slave addresses are 7 bits. A read/write bit should be appended to the slave address by the master device to properly communicate with the device.

(1) SEL Pin is “GND” :

I^2C Slave Address (SEL = GND)									
Command Type	(0x3AH)							W/R	value
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
Write	0	1	1	1	0	1	0	0	0x74H
Read	0	1	1	1	0	1	0	1	0x75H

(2) SEL Pin is “VDD” :

I^2C Slave Address (SEL = VDD)									
Command Type	(0x3BH)							W/R	value
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
Write	0	1	1	1	0	1	1	0	0x76H
Read	0	1	1	1	0	1	1	1	0x77H

(3) SEL Pin is “Float” :

I^2C Slave Address (SEL = Float)									
Command Type	(0x23H)							W/R	value
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
Write	0	1	0	0	0	1	1	0	0x46H
Read	0	1	0	0	0	1	1	1	0x47H

6. Register Set

Address	R / W	Register Name	Description	Reset Value
0x80	R / W	ALS_CONTR	ALS operation mode control SW reset	0x00
0x81	R / W	PS_CONTR	PS operation mode control	0x0C
0x82	R / W	PS_LED	PS LED setting	0x6B
0x83	R / W	PS_N_PULSES	PS number of pulses	0x7F
0x84	R / W	PS_MEAS_RATE	PS measurement rate in active mode	0x03
0x85	R / W	ALS_MEAS_RATE	ALS measurement rate in active mode	0x82
0x86	R	PART_ID	Part Number ID and Revision ID	0x91
0x87	R	MANUFAC_ID	Manufacturer ID	0x05
0x88	R	ALS_DATA_0	Direct ALS measurement, lower byte	0x00
0x89	R	ALS_DATA_1	Direct ALS measurement, upper byte	0x00
0x8A	R	ALS_PS_STATUS	ALS and PS new data status	0x00
0x8B	R	PS_DATA_0	PS measurement data, lower byte	0x00
0x8C	R	PS_DATA_1	PS measurement data, upper byte	0x00
0x8D	R	ALS_DATA_CH1_0	ALS measurement CH1 data, lower byte	0x00
0x8E	R	ALS_DATA_CH1_1	ALS measurement CH1 data, mid byte	0x00
0x8F	R	ALS_DATA_CH1_2	ALS measurement CH1 data, upper byte	0x00
0x90	R	ALS_DATA_CH2_0	ALS measurement CH2 data, lower byte	0x00
0x91	R	ALS_DATA_CH2_1	ALS measurement CH2 data, mid byte	0x00
0x92	R	ALS_DATA_CH2_2	ALS measurement CH2 data, upper byte	0x00
0x93	R / W	ALS_COEFF1_DATA_0	Coefficient for Clear diode, lower byte	0x80
0x94	R / W	ALS_COEFF1_DATA_1	Coefficient for Clear diode, upper byte	0x03
0x95	R / W	ALS_COEFF2_DATA_0	Coefficient for IR diode, lower byte	0xC8
0x96	R / W	ALS_COEFF2_DATA_1	Coefficient for IR diode, upper byte	0xFB
0x97	R / W	ALS_IRF_CUT_OFF	ALS cut-off limit of IR factor	0xD0
0x98	R / W	INTERRUPT	Interrupt settings	0x08
0x99	R / W	PS_THRES_UP_0	PS interrupt upper threshold, lower byte	0xFF
0x9A	R / W	PS_THRES_UP_1	PS interrupt upper threshold, upper byte	0x07
0x9B	R / W	PS_THRES_LOW_0	PS interrupt lower threshold, lower byte	0x00

0x9C	R / W	PS_THRES_LOW_1	PS interrupt lower threshold, upper byte	0x00
0x9E	R / W	ALS_THRES_UP_0	ALS interrupt upper threshold, lower byte	0xFF
0x9F	R / W	ALS_THRES_UP_1	ALS interrupt upper threshold, upper byte	0xFF
0xA0	R / W	ALS_THRES_LOW_0	ALS interrupt lower threshold, lower byte	0x00
0xA1	R / W	ALS_THRES_LOW_1	ALS interrupt lower threshold, upper byte	0x00
0xA4	R / W	INTERRUPT PERSIST	ALS / PS Interrupt persist setting	0x00

6.1. ALS_CONTR Register (Address: 0x80)

The ALS_CONTR register controls the ALS operation modes and software (SW) reset for the sensor. The ALS sensor can be set to either standby mode or active mode. At either of these modes, the I2C circuitry is always active. The default mode after power up is standby mode. During standby mode, there is no ALS measurement performed but I2C communication is allowed to enable read/write to all the registers

0x80	ALS_CONTR (default = 0x00)							
	Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
	Reserved			***ALS Gain***		***SW Reset***	***ALS Mode***	***Reserved***

Field	BITS	Description
Reserved	7:5	Must write as 0
ALS Gain	4:3	00: Dynamic Range 1 (1 lux to 64k lux) (1 lux / count) (default) 01: Dynamic Range 2 (0.5 lux to 32k lux) (0.5 lux / count) 10: Dynamic Range 3 (0.02 lux to 640 lux) (0.01 lux / count) 11: Dynamic Range 4 (0.01 lux to 320 lux) (0.005 lux / count)
SW Reset	2	0: Software reset is NOT started (default) 1: Software reset is started, default value after reset is 0
ALS Mode	1	0: Standby Mode (default) 1: Active Mode
Reserved	0	Must write as 0

6.2. PS_CONTR Register (0x81)

The PS_CONTR register controls the PS operation modes. The PS sensor can be set to either standby mode or active mode. At either of these modes, the I2C circuitry is always active. The default mode after power up is standby mode. During standby mode, there is no ALS measurement performed but I2C communication is allowed to enable read/write to all the registers.

0x81	PS_CONTR (default = 0x0C)							
	Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
	Reserved				***PS Gain***		***PS Mode***	***Reserved***

Field	BITS	Description
Reserved	7:4	Must write as 0
PS Gain	3:2	Must write as 11
PS Mode	1	0: Standby Mode (default) 1: Active Mode
Reserved	0	Must write as 0

6.3. PS_LED Register (0x82)

The PS_LED register controls the LED pulse modulation frequency, LED current duty cycle and LED peak current.

0x82	PS_LED (default = 0x6B)							
	Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
	LED Pulse Frequency			***LED Duty Cycle***		***LED Peak Current***		

Field	BITS	Description
LED Pulse Frequency	7:5	000: 30k Hz 001: 40k Hz 010: 50k Hz 011: 60k Hz (default) 100: 70k Hz 101: 80k Hz 110: 90k Hz 111: 100k Hz
LED Duty Cycle	4:3	Must write as 01
LED Peak Current	2:0	000: 5mA 001: 10mA 010: 20mA 011: 50mA (default) Others: 100mA

6.4. PS_N_Pulses Register (0x83)

The PS_N_Pulses register controls the number of LED pulses to be emitted.

0x83	PS_N_Pulses (default = 0x7F)							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	LED Pulse Count							

Field	BITS	Description
LED Pulse Count	7:0	0000 0000: Number of pulses = 0 0000 0001: Number of pulses = 1 0000 0010: Number of pulses = 2 … 0111 1111: Number of pulses = 127 (default) … 1111 1110: Number of pulses = 254 1111 1111: Number of pulses = 255

6.5. PS_MEAS_RATE Register (0x84)

The PS_MEAS_RATE register controls the timing of the periodic measurements of the PS in active mode. PS Measurement Repeat Rate is the interval between PS_DATA registers update.

0x84	PS_MEAS_RATE (default = 0x03)							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Reserved					***PS Measurement Repeat Rate***		

Field	BITS	Description
Reserved	7:3	Must write as 0
PS Measurement Repeat Rate	2:0	000: 12.5ms (ALS will be disabled automatically) 001: 50ms 010: 70ms 011: 100ms (default) 100: 200ms 101: 500ms 110: 1000ms 111: 2000ms

6.6. ALS_MEAS_RATE Register (0x85)

The ALS_MEAS_RATE register controls the ALS ADC resolution (bit width) and ALS Measurement Repeat Rate. The integration time is depends on selected ADC bit width. ALS Measurement Repeat Rate is the interval between ALS_DATA registers update.

ALS Measurement Repeat Rate must be larger than the ALS Integration Time. If ALS Measurement Repeat Rate is set to be smaller than ALS Integration Time, it will automatically be reset to be larger than ALS Integration Time by the IC internally.

0x85	ALS_MEAS_RATE (default = 0x82)							
	Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
	ADC Resolution / Bit Width			***Reserved***		***ALS Measurement Repeat Rate***		

Field	BITS	Description
ADC Resolution / Bit Width	7:5	000: 20 bit (Integration Time = 1200ms) 001: 19 bit (Integration Time = 600ms) 010: 18 bit (Integration Time = 300ms) 011: 17 bit (Integration Time = 150ms) 100: 16 bit (Integration Time = 75ms) (default) 101: 12 bit (Integration Time = 4.685ms) 110: 8 bit (Integration Time = 292us) 111: 4 bit (Integration Time = 18us)
Reserved	4:3	Must write as 0
ALS Measurement Repeat Rate	2:0	000: 100ms 001: 200ms 010: 500ms (default) 011: 1000ms Others: 2000ms

6.7. PART_ID Register (0x86) (Read Only)

The PART_ID register defines the part number and revision identification of the sensor.

0x86	PART_ID (default = 0x91)							
	Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
	Part Number ID				***Revision ID***			

Field	BITS	Description
Part Number ID	7:4	0x09H
Revision ID	3:0	0x01H

6.8. MANUFAC_ID Register (0x87) (Read Only)

The MANUFAC_ID register defines the manufacturer identification of the sensor.

0x87	MANUFAC_ID (default = 0x05)							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Manufacturer ID							

Field	BITS	Description
Manufacturer ID	7:0	0x05H

6.9. ALS_DATA Register (0x88 / 0x89) (Read Only)

The final ALS converted lux data are expressed as a 16-bit data spread over two registers. The ALS_DATA_0 and ALS_DATA_1 registers provide the lower and upper byte respectively. This 16-bit data equals to illuminance in lux. When the I2C read operation starts, both the registers are locked until the I2C read operation is completed. This will ensure that the data in the registers is from the same measurement even if an additional integration cycle ends during the read operation. New measurement data is stored into temporary registers and the ALS_DATA registers are updated as soon as there is no on-going I2C read operation.

0x88	ALS_DATA_0 (default = 0x00)							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	LS Data Low							

0x89	ALS_DATA_1 (default = 0x00)							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	LS Data High							

Field	Addr	BITS	Description
ALS Data Low	0x88	7:0	ALS ADC lower byte data
ALS Data High	0x89	7:0	ALS ADC upper byte data

6.10. ALS_PS_STATUS Register (0x8A) (Read Only)

The ALS_PS_STATUS register stores the information about interrupt status and ALS and PS data status. New data means data has not been read yet. When the measurement is completed and data is written to the data register, the data status bit will be set to logic 1. When the ALS_PS_STATUS register is read, the data status bit will be set to logic 0. Interrupt status determines if the ALS and PS interrupt criteria are met. It will check if the ALS or PS measurement data is outside of the range defined by the upper and lower threshold limits.

0x8A	ALS_PS_STATUS (default = 0x00)							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Reserved		*Interrupt Source*		*ALS Interrupt Status*	*ALS Data Status*	*PS Interrupt Status*	*PS Data Status*

Field	BITS	Description
Reserved	7:6	Do not care
Interrupt Source	5:4	00: No interrupt event 01: Interrupt is triggered by PS 10: Interrupt is triggered by ALS 11: Reserved
ALS Interrupt Status	3	0: ALS interrupt is clear or not yet triggered 1: ALS interrupt is triggered
ALS Data Status	2	0: ALS measurement data is old data (Data has been read) 1: ALS measurement data is new data (Data has not been read)
PS Interrupt Status	1	0: PS interrupt is clear or not yet triggered 1: PS interrupt is triggered
PS Data Status	0	0: PS measurement data is old data (Data has been read) 1: PS measurement data is new data (Data has not been read)

6.11. PS_DATA_0 Register (0x8B / 0x8C) (Read Only)

The PS ADC channel data are expressed as a 11-bit data spread over two registers. The PS_DATA_0 and PS_DATA_1 registers provide the lower and upper byte respectively. When the I2C read operation starts, both the registers are locked

until the I2C read operation is completed. This will ensure that the data in the registers is from the same measurement even if an additional integration cycle ends during the read operation. New measurement data is stored into temporary registers and the PS_DATA registers are updated as soon as there is no on-going I2C read operation.

0x8B	PS_DATA_0 (default = 0x00)							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	PS Data Low							

0x8C	PS_DATA_1 (default = 0x00)							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Reserved			*Valid*	*Reserved*	*PS Data High*		

Field	Addr	BITS	Description
PS Data Low	0x8B	7:0	PS ADC lower byte data
Reserved	0x8C	7:5	Do not care
Valid	0x8C	4	0: Valid PS data 1: Overflow PS data
Reserved	0x8C	3	Do not care
PS Data High	0x8C	2:0	PS ADC upper byte data

6.12. ALS_DATA_CH1 Register (0x8D / 0x8E / 0x8F) (Read Only)

The ALS ADC channel 1 data is the 4…20 bit ADC output data of the clear diode. The data format is MSB aligned depending on the programmed ADC resolution. When the I2C read operation starts, both the registers are locked until the I2C read operation is completed. This will ensure that the data in the registers is from the same measurement even if an additional integration cycle ends during the read operation. New measurement data is stored into temporary registers and the ALS_DATA registers are updated as soon as there is no on-going I2C read operation.

0x8D	ALS_DATA_CH1_0 (default = 0x00)							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	ALS Data Ch1_0				*Reserved*			

0x8E	ALS_DATA_CH1_1 (default = 0x00)							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	ALS Data Ch1_1							
0x8F	ALS_DATA_CH1_2 (default = 0x00)							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	ALS Data Ch1_2							

Field	Addr	BITS	Description
ALS Data Ch1_0	0x8D	7:4	ALS ADC channel 1 data least significant data byte, bit 4 is the LSB of the 20-bit data
ALS Data Ch1_0	0x8D	3:0	Do not care
ALS Data Ch1_1	0x8E	7:0	ALS ADC channel 1 data mid significant data byte
ALS Data Ch1_2	0x8F	7:0	ALS ADC channel 1 data most significant data byte, bit 7 is MSB of the 20-bit data

6.13. ALS_DATA_CH2 Register (0x90 / 0x91 / 0x92) (Read Only)

The ALS ADC channel 2 data is the 4…20 bit ADC output data of the IR diode. The data format is MSB aligned depending on the programmed ALS resolution. When the I2C read operation starts, both the registers are locked until the I2C read operation is completed. This will ensure that the data in the registers is from the same measurement even if an additional integration cycle ends during the read operation. New measurement data is stored into temporary registers and the ALS_DATA registers are updated as soon as there is no on-going I2C read operation.

0x90	ALS_DATA_CH2_0 (default = 0x00)							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	ALS Data Ch2_0				*Reserved*			

0x91	ALS_DATA_CH2_1 (default = 0x00)							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	ALS Data Ch2_1							

0x92	ALS_DATA_CH2_2 (default = 0x00)							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	ALS Data Ch2_2							

Field	Addr	BITS	Description
ALS Data Ch2_0	0x90	7:4	ALS ADC channel 2 data least significant data byte, bit 4 is the LSB of the 20-bit data
ALS Data Ch2_0	0x90	3:0	Do not care
ALS Data Ch2_1	0x91	7:0	ALS ADC channel 2 data mid significant data byte
ALS Data Ch2_2	0x92	7:0	ALS ADC channel 2 data most significant data byte, bit 7 is MSB of the 20-bit data

6.14. ALS_COEFF1 Register (0x93 / 0x94)

The ALS_COEFF1 is the 16-bit coefficient for the Ch1 diode to calculate the illuminance in lux. When the I2C read operation starts, both the registers are locked until the I2C read operation is completed. This will ensure that the data in the registers is from the same measurement even if an additional integration cycle ends during the read operation. New measurement data is stored into temporary registers and the ALS_COEFF1 registers are updated as soon as there is no on-going I2C read operation.

0x93	ALS_COEFF1_0 (default = 0x80)							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	ALS Coeff1_0							

0x94	ALS_COEFF1_1 (default = 0x03)							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	ALS Coeff1_1							

Field	Addr	BITS	Description
ALS COEFF1_0	0x93	7:0	ALS coefficient 1 data least significant data byte, bit 0 is the LSB of the 16-bit data
ALS COEFF1_1	0x94	7:0	ALS coefficient 1 data most significant data byte, bit 7 is MSB of the 16-bit data