Digital Proximity and Ambient Light Sensor

Description

The GT432-ALS.PS01-Z3 is a light to digital converter which combines an advanced ambient light sensor, an advanced proximity sensor and a high efficiency infra LED light.

Ambient light sensor (ALS) built-in an optical filter for IR rejection, and providing a spectrum which is close to the human eye ' s response. ALS can work from dark to direct sunlight, the selectable detect range is about 40dB. Dual-channel output (human eye and clear), so ALS has excellent light ratio under different light conditions.

Proximity sensor (PS) built-in an 940nm optical filter for ambient light immunity, so PS can detect reflected IR light with high precision and excellent rejection.

GT432-ALS.PS01-Z3 has programmable interrupt function for ALS and PS with threshold based hysteresis.

Features

- I2C Interface (Fast Speed Mode at 400KHz/s)

- Supply Voltage Range from 2.4V to 3.6V

- Operating temperature from -25℃ to +85℃

- Proximity Sensor

- Recommended operating distance <100cm.
- Selectable gain and resolution (up to 12-bit).
- Programmable PWM and LED current.
- Intelligent crosstalk calibration.
- Speed mode for response time Improvement.

- Ambient Light Sensor

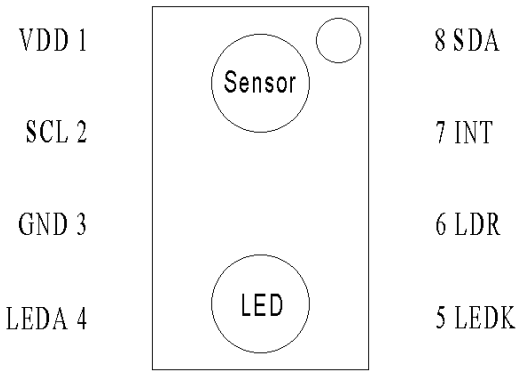
- Spectral close to human eye response.
- Fluorescent light flicker immunity.
- Selectable gain and resolution (up to 16-bit).
- High sensitivity and wide detect range.
- High accuracy of illuminance & light ratio.

Applications

- Handset device: Mobile phone, tablet, PDA, mobile POS
- Consumer device: LCD TV, digital camera, toy
- Computing device: Laptop, LCD monitor
- Smart home: Smart lighting, smart curtain, night ligh
- Outdoor: Surveillance system, street light
- Industrial Application

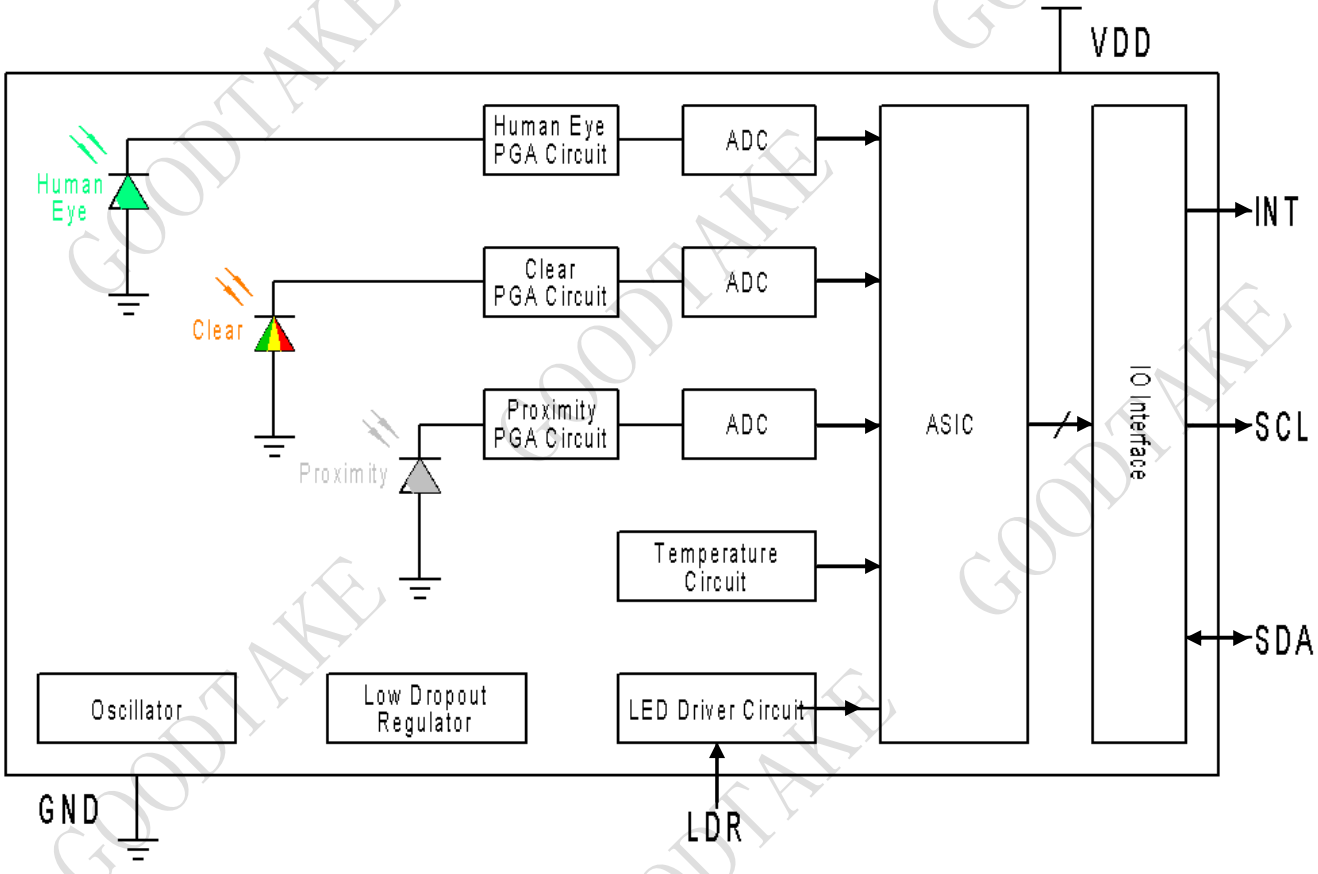
GOODTAKE

Pin Description



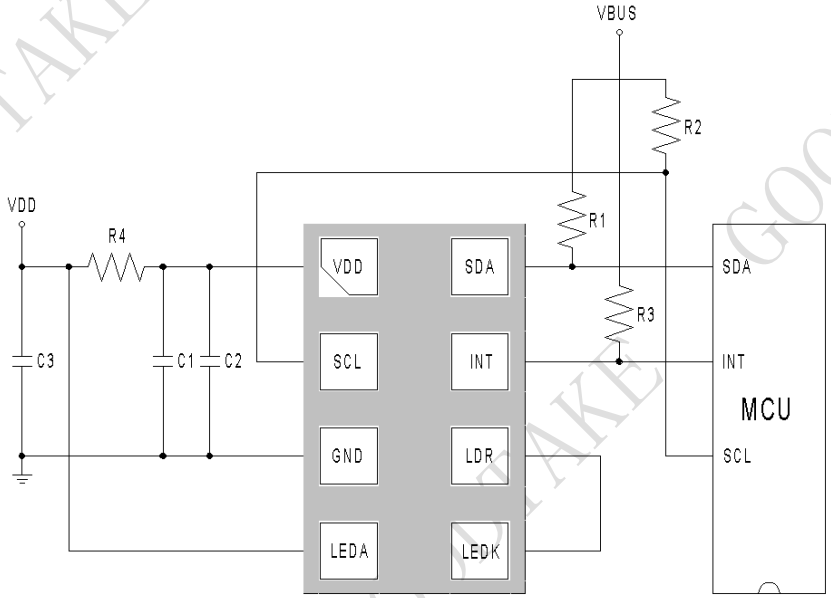
Pin	I/O Type	Pin Name	Description
1		VDD	Power supply
2	I	SCL	I²C serial clock line
3		GND	Ground
4		LEDA	LED anode
5		LEDK	LED cathode
6	O	LDR	LED driver
7	O	INT	Interrupt pin
8	I/O	SDA	I²C serial data line

Function Block Diagram

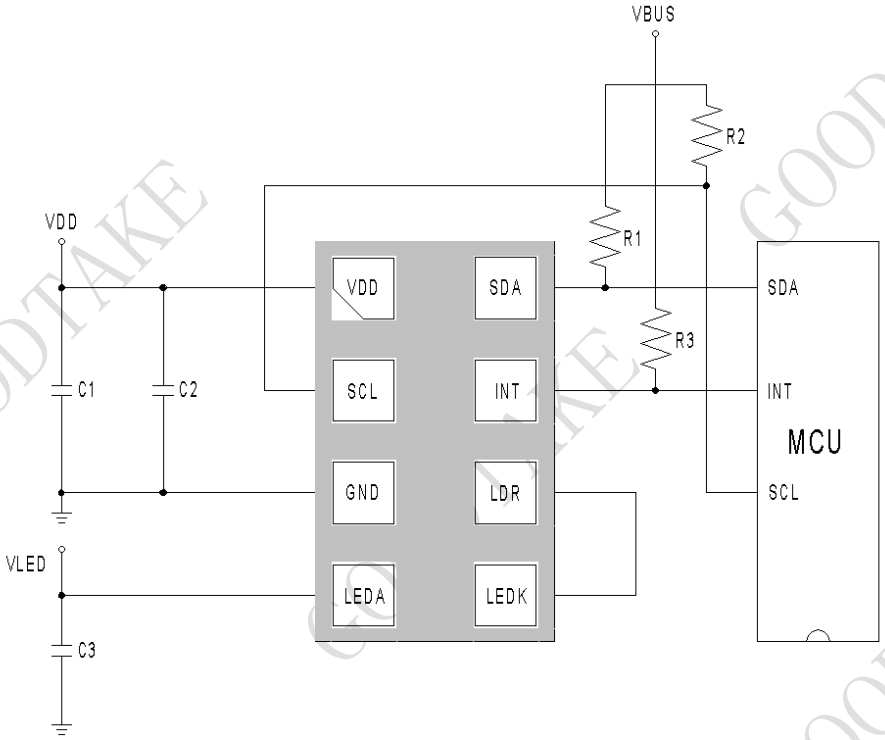


Typical Application Circuit

Single Power Supply



Separate Power Supplies



The capacitors (C1, C2) are required for sensor power supply. The capacitors should be placed as close as possible to the device. The high frequency AC noises can be shunted to the ground by the capacitors. The transient current caused by digital circuit switching also can be handled by the capacitors. A typical value0.1 / 4.7 μF can be used.

The capacitors (C3) is required for LED power supply. A typical value 2.2μF is used. The extra resistor (R4) is required when using single power supply. A typical value 22Ω is used.

The pull-up resistors (R1, R2) are required for I2C communication. At fast speed mode (400kHz/s) and VBUS = 3V, 1.5kΩ resistors can be used. The pull-up resistor (R3) is also required for the interrupt, a typical value between 10 kΩ and 100 kΩ can be used.

Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Supply Voltage	VDD	4.5	V
I2C Bus Pin Voltage	SCL, SDA, INT	-0.2 to 4.5	V
I2C Bus Pin Current	SCL, SDA, INT	10	mA
LDR Pin Voltage	VLEDC, VLEDC	-0.2V to VDD + 0.5V	V
Operating Temperature	Tope	-40 to +85	˚C
Storage Temperature	Tstg	-45 to +100	˚C
ESD Rating	Human Body Mode	2	KV

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

Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit	Condition
Supply Voltage **Note1**	V_{DD}	2.4		3.6	V	
I^2C Bus Pin Voltage	V_{Bus}	1.62	1.8	VDD	V	VBus≤VDD
Operating Temperature	Tope	-25		+85	˚C	
I^2C Bus Input High Voltage **Note2**	V_{IH_SCL}, V_{IH_SDA}	1.4			V	
I^2C Bus Input Low Voltage **Note2**	V_{IL_SCL}, V_{IL_SDA}			0.5	V	
SDA Output Low Voltage	V_{OL_SDA}	0		0.4	V	3mA sinking current
		0		0.6	V	6mA sinking current
INT Output Low Voltage	V_{OL_INT}	0		0.4	V	3mA sinking current

Notes:
1.The power supply need to make sure the VDD slew rate at least 0.5V/ms. GT432-ALS.PS01-Z3 have power on reset function. When VDD drops below 1.4V under room temp, the IC will be reset automatically. Then power back up at the requirement slew rate, and write registers to the desired values.
2.The specs are defined under VDD=3.3V, T=25℃

Electro-optical characteristics

Unless otherwise specified, the following specifications apply over the operating ambient temperature T=25˚C, VDD = 3.3V, and measure the output current by white light LED.

Electrical Characteristics	Symbol	MIN	TYP	MAX	Notes	Unit
Active Supply Current **Note1**	IDD		160		Ev=0 **Note1**	μA
	IPD		2.5		Sleep mode Ev = 0 I^2C inactive	μA
	IPD2		1.5		Sleep mode Ev=0 EN_FRST = 1	μA
Device Boot Time **Note2**	Tboot		20			ms

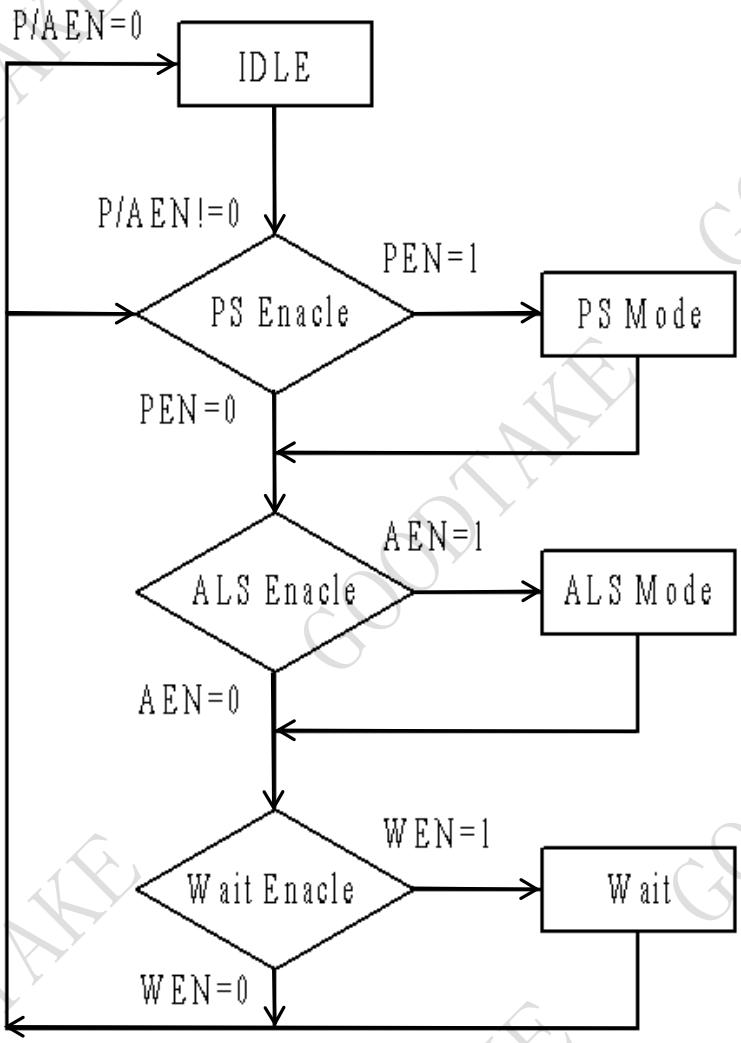
PS Characteristics	Symbol	MIN	TYP	MAX	Notes	Unit
Sensing Gain, relative to x1 setting	PGAIN		2			
			4			
			8			
Unit of ADC integration time	PStep		0.51			ms
Number of ADC integration time	PTIME	1		16		PStep
Full ADC counts per step		0		255		count
LED pulse period	T		13.8			μs
LED pulse count	PLPUC	1		256		pulse
LED Pulse width	PLPUW	1		64		T
LED Driving Current	PLDR		50		25%	mA
			100		50%	mA
			150		75%	mA
			200		100%	mA
IR Peak Wavelength			940			nm

ALS Characteristics	Symbol	MIN	TYP	M AX	Notes	Unit
Sensing Gain, relative to x1 setting	AGAIN		4			
			8			
			32			
			96			
Unit of ADC integration time	AStep		2.66			ms
Number of ADC integration time	ATIME	1		256		AStep
Full ADC counts per step		0		1023	ATIME=1 AStep	count
Dark Count (White LED, Ev=0)	ACH0		1	3	AGAIN=96 ATIME=64	count
Sensitivity (White LED, CCT=4500K)	ACH0		TBD		AGAIN=96 ATIME=64	count

Notes:
1.VDD = 3.3 V, TA = 25℃, EN_ALS=1, ATIME=63, AGAIN=96, WTIME=8
2.The Device Boot Time (Tboot) is the delay time that the host can send the first I^2C command after the VDD ready.

State Machine

There are two operation mode ALS and PS. The state machine is shown below:



GOODTAKE

Typical Characteristics Curves

Unless otherwise specified, the following specifications apply over the operating ambient temperature T = 25°C, VDD = 3.3V.

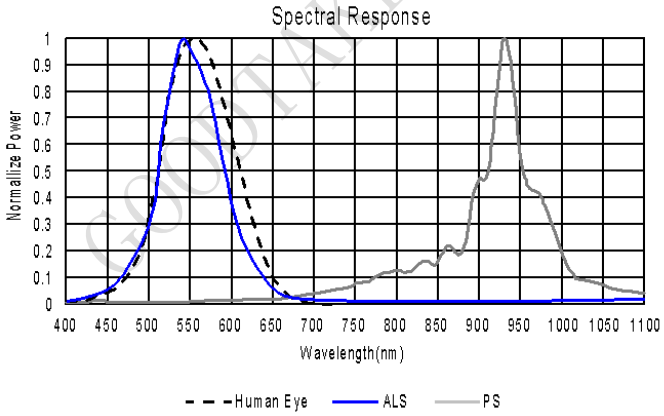


Fig.1 ALS&PS Spectral Response

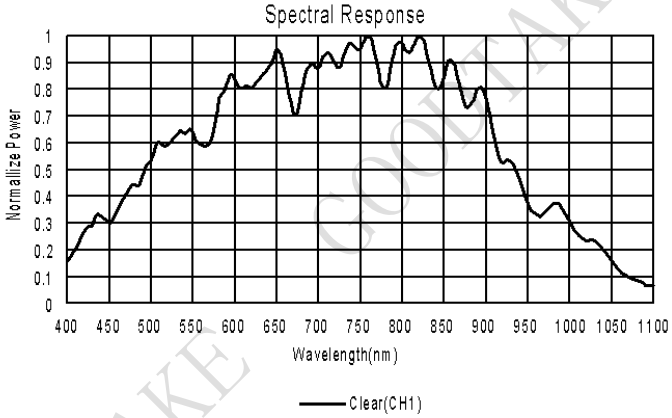


Fig.2 Clear Spectral Response

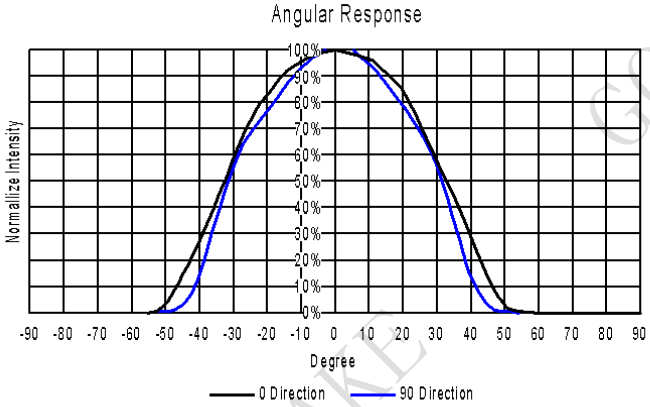


Fig.3 ALS Angular Response

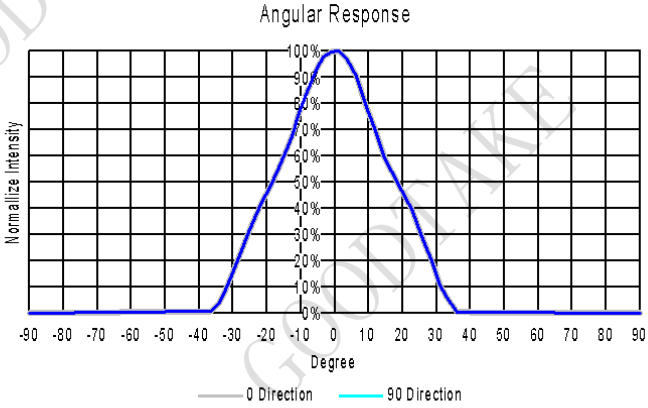


Fig.4 LED Angular Response

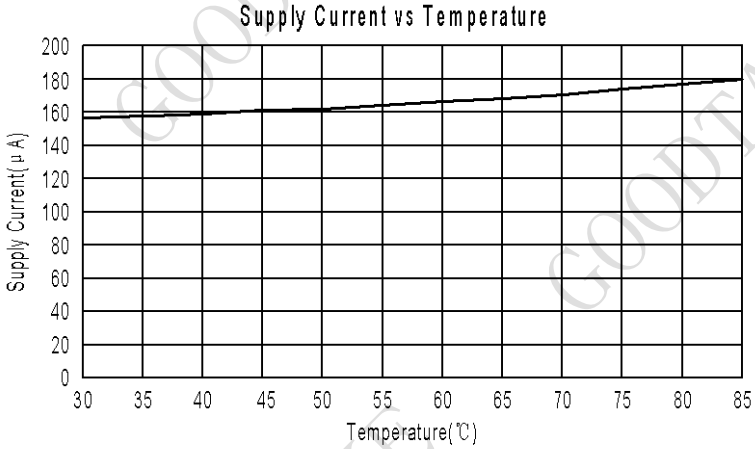
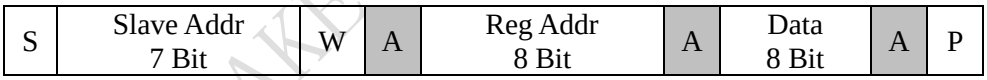


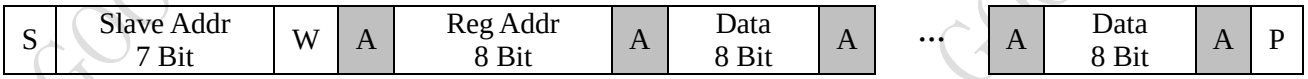
Fig.5 Supply Current vs Temperature

I²C INTERFACE

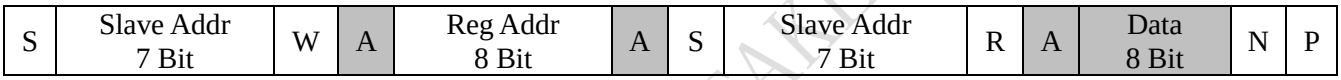
I²C Write Format



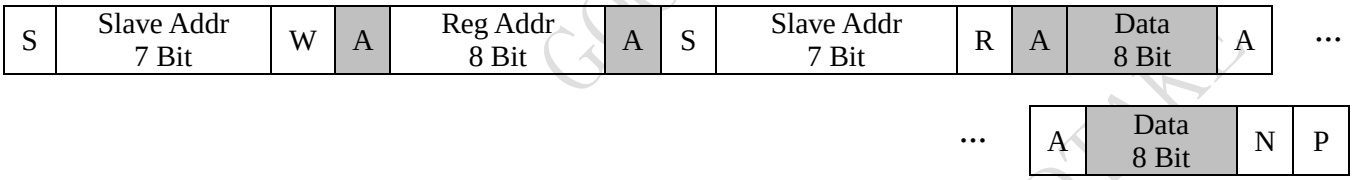
I²C Block Write Format



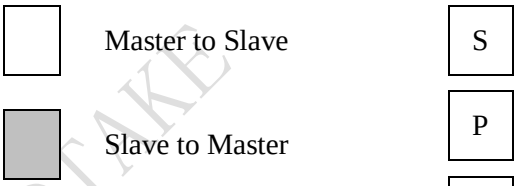
I²C Read Format

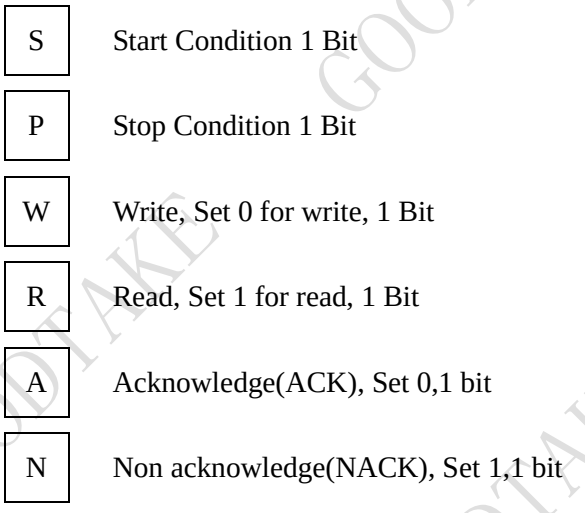


I²C Block Read Format



`





I²C Slave Address and R/W bit

This address is seven bits long followed by an eighth bit which is a data direction bit (R/W). A '0' indicates a transmission (WRITE), a '1' indicates a request for data (READ). The slave address of this device is 0x38.

Register Set

The GT432-ALS.PS01-Z3 is operated over the I^2C bus with registers that contain configuration, status, and result information. All registers are 8 bits long.

Address	Name	Type	Default value	Description
0x00	SYSM_CTRL	RW	0x00	ALS operation mode control, waiting mode control, SW reset
0x01	INT_CTRL	RW	0x03	Interrupt pin control, interrupt persist control
0x02	INT_FLAG	RW	0x00	Interrupt flag, error flag, power on reset(POR) flag
0x03	WAIT_TIME	RW	0x00	Waiting time setting
0x04	ALS_GAIN	RW	0x00	ALS analog gain setting
0x05	ALS_TIME	RW	0x00	ALS integrated time setting
0x06	LED_CTRL	RW	0x00	LED setting
0x07	PS_GAIN	RW	0x00	PS analog gain setting
0x08	PS_PULSE	RW	0x00	PS number of LED pulse
0x09	PS_TIME	RW	0x00	PS integrated time setting
0x0B	PERSISTENCE	RW	0x11	ALS/PS persistence setting
0x0C	ALS_THRES_LL	RW	0x00	ALS low interrupt threshold - LSB
0x0D	ALS_THRES_LH	RW	0x00	ALS low interrupt threshold - MSB
0x0E	ALS_THRES_HL	RW	0xFF	ALS high interrupt threshold - LSB
0x0F	ALS_THRES_HH	RW	0xFF	ALS high interrupt threshold - MSB
0X10	PS_THRES_LL	RW	0x00	PS lower interrupt threshold - LSB
0X11	PS_THRES_LH	RW	0x00	PS lower interrupt threshold - MSB
0X12	PS_THRES_HL	RW	0xFF	PS lower interrupt threshold - LSB
0X13	PS_THRES_HH	RW	0xFF	PS lower interrupt threshold - MSB
0X14	PS_OFFSET_L	RW	0x00	PS offset level - LSB
0X15	PS_OFFSET_H	RW	0x00	PS offset level - MSB
0x16	INT_SOURCE	RW	0x00	ALS interrupt source
0x17	ERROR_FLAG	RW	0x00	Error flag
0X18	PS_DATA_L	RW	0x00	PS output data - LSB
0X19	PS_DATA_H	RW	0x00	PS output data - MSB
0X1A	IR_DATA_L	R	0x00	IR output data - LSB
0X1B	IR_DATA_H	R	0x00	IR output data - MSB
0x1C	CH0_DATA_L	R	0x00	Channel 0 output data - LSB
0x1D	CH0_DATA_H	R	0x00	Channel 0 output data - MSB

SYSM_CTRL

0x00	SYSM_CTRL, System Control (Default =0x00)							
BIT	7	6	5	4	3	2	1	0
R/W	SWRST	EN_WAIT	EN_FRST	0	0	0	EN_PS	EN_ALS

SWRST： Software reset. Reset all register to default value.

0: (default)

1: Reset will be triggered.

EN_WAIT： Waiting time will be inserted between two measurements.

0: Disable waiting function.

1: Enable waiting function.

EN_FRST： Brown out detection function control

0: Disable

1: Enable

EN_PS： Enables PS function.

0: Disable PS function (default)

1: Enable PS function

EN_ALS： Enables ALS function.

0: Disable ALS function (default)

1: Enable ALS function

INT_CTRL

0x01	Interrupt Pin Control (Default = 0x03)							
BIT	7	6	5	4	3	2	1	0
R/W	PS_INT_ MODE	SINT_ MODE	PS_ SYNC	ALS_ SYNC	0	0	EN_PINT	EN_AINT

PS_INT_MODE： This bit selects the interrupt triggered mode of PS function.

0: Hysteresis Mode (default).

1: Zone Mode.

SINT_MODE： Speeding up the interrupt response of PS mode by skipping waiting time in each

conversion cycle.

0: Disable speed up (default).

1: Enable speed up.

PS_SYNC： Measurement is pended when PS interrupt is triggered. Until clear the interrupt then start the next measurement.

0: Disable pending PS function (default).

1: Enable pending PS function.

ALS_SYNC： Measurement is pended when ALS interrupt is triggered. Until clear the interrupt then start the next measurement.

0: Disable pending ALS function (default).

1: Enable pending ALS function.

EN_PINT： The PS interrupt (INT_PS)flag can trigger the INT pin to low.

0: Disable INT_PS effect INT pin.

1: Enable INT_PS effect INT pin(default)

EN_AINT： The ALS interrupt (INT_ALS)flag can trigger the INT pin to low.

0: Disable INT_ALS effect INT pin.

1: Enable INT_ALS effect INT pin(default)

INT_FLAG

0x02	NT_FLAG, System Control (Default = 0x00)							
BIT	7	6	5	4	3	2	1	0
R/W	INT_POR	DATA_ FLAG	OBJ	0	0	0	INT_PS	INT_ALS

INT_POR： Power-On-Reset Interrupt flag trigger the INT pin when the flag sets to one. Write zero to clear the flag.

0:

1: This bit will be set to one when it satisfies one of the following conditions:

Power On VDD < 1.4V SWRST

DATA_FLAG： It shows if any data is invalid after completion of each conversion cycle. This bit is read-only.

0: data valid

1: data invalid

OBJ： Object Detection Bit. It shows the position of the object. It is a read-only bit. Refer to PMODE
(register 0x02, bit 5) for detailed definition of OBJ. This bit is read only.

0: object disappear.

1: object appear.

INT_PS： PS Interrupt flag. It correlation with PS_INT_MODE, PS_DATA and PS high/low threshold. Write zero to clear the flag.

0: PS Interrupt not triggered or be cleared.

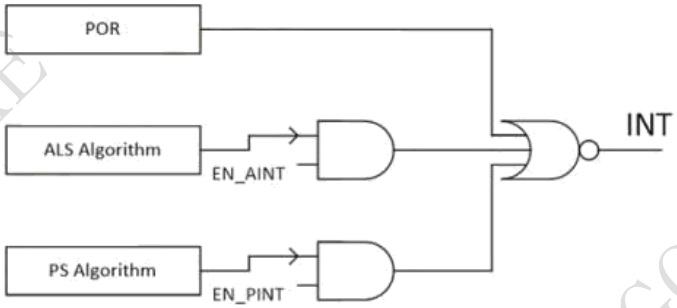
1: PS Interrupt triggered.

INT_ALS： ALS Interrupt flag. It correlation with CH0/1 data and ALS high/low threshold. Write zero to clear the flag.

0: ALS Interrupt not trigger or be cleared.

1: ALS Interrupt triggered

Interrupt Behavior :



ALS Interrupt Algorithm

Correlative register:

The ALS Interrupt (INT_ALS, register 0x02, bit0).

The ALS Persistence (PRS_ALS, register 0x0B, bit0 to bit3),

The ALS Data (CH0_DATA and CH1_DATA, register 0x1C to 0x1F),

The ALS Low Threshold (ALS_THRES_L, register 0x0C To 0x0D),

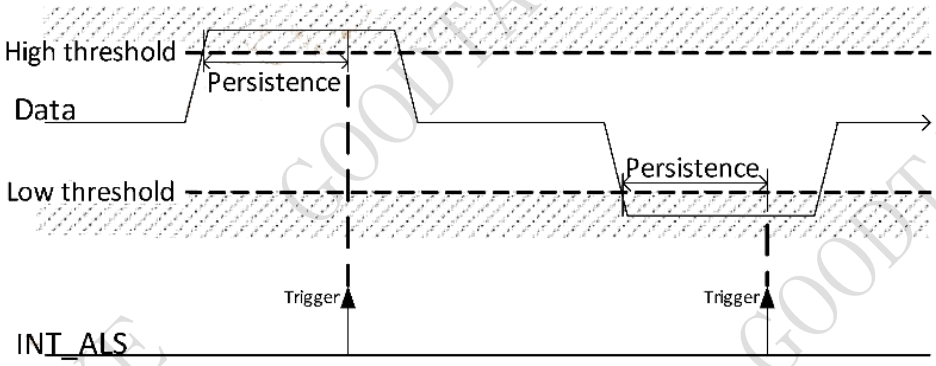
The ALS High Threshold (ALS_THRES_H, register 0x0E To 0x0F).

INT_ALS triggered condition:

1. Rule of active interrupt: DATA>ALS_THRES_H or DATA<ALS_THRES_L.
2. If the DATA meets the rule, the interrupt counter increases one.

If the DATA fails in the rule, the interrupt counter will be clear.

3. When the interrupt counter equal to PRS_ALS setting, INT_ALS will be triggered and reset the interrupt counter.
4. If PRS_ALS is set to zero, threshold will be ignored and DATA will meets the active interrupt rule forcibly.



PS Interrupt Algorithm

Correlative register:

The PS Interrupt (INT_PS, register 0x02, bit1),

The PS Persistence (PRS_PS, register 0x0B, bit4 to bit7),

The PS Data (PS_DATA, register 0x18 to 0x19),

The PS Low Threshold (PS_THRES_L, register 0x10 To 0x11),

The PS High Threshold (PS_THRES_H, register 0x12 To 0x13).

The PS Interrupt Mode (PS_INT_MODE, register 0x01, bit7).

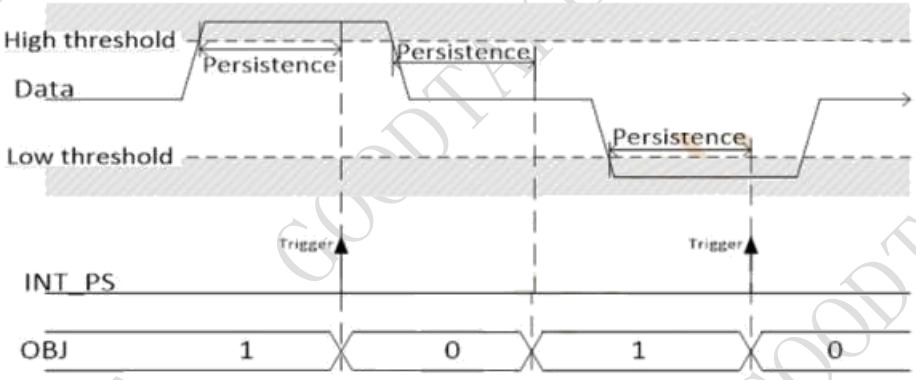
PS_INT_MODE set to one: Zone Mode

INT_PS triggered condition:

1. Rule of active interrupt: PS_DATA>PS_THRES_H or PS_DATA<PS_THRES_L.
2. If PS_DATA meets the rule, the counter (OUT_CONT) increases one AND another counter (IN_CONT) set to zero.

   If PS_DATA fails in the rule, the counter (IN_CONT) increases one and clear the value of OUT_CONT.
3. When the counter value of OUT_CONT equal to PRS_PS, The OBJ flag will set to zero, INT_PS will be triggered, and clear OUT_CONT counter.

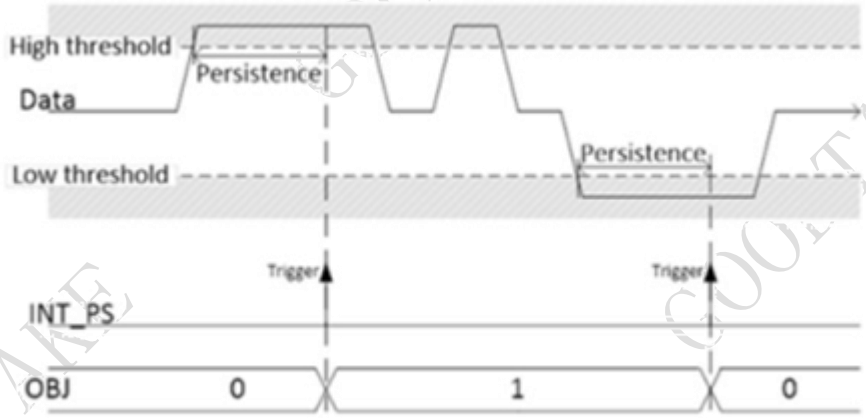
   When the INT_CONT counter value reaches PRS_PS, the counter will be clear and OBJ flag Will set to one.
4. If PRS_PS is set to zero, the threshold setting will be ignored and DATA will meets the active interrupt rule forcibly.



PS_INT_MODE set to zero: Hysteresis Interrupt mode:

INT_PS triggered condition:

1. Rule of active interrupt:
   i. When OBJ is zero,
   PS_DATA>PS_THRES_H
   ii. When OBJ is one,
   PS_DATA<PS_THRES_L.
2. If PS_DATA meets the rule, the interrupt counter increases one.
   If PS_DATA fails in the rule, the interrupt counter will be cleared .
3. When the counter value equal to PRS_PS, the OBJ flag will be inverted, INT_PS will be triggered, and clear interrupt counter.
4. If PRS_PS is set to zero, the threshold setting will be ignored and DATA will meets the active interrupt rule forcibly.



WAIT_TIME

0x03	WAIT_TIME, waiting time (Default =0x00)							
BIT	7	6	5	4	3	2	1	0
R/W	WTIME							

WTIME： This register controls the time unit of waiting state which is inserted between any two measurements. It is 5ms per time unit.

0x00 : 1 time unit

0x01 : 2 time units

……

0xFF : 256 time units

1.1 ALS_GAIN

0x04	ALS_GAIN, ALS analog gain (Default =0x00)							
BIT	7	6	5	4	3	2	1	0
R/W	0	0	0	0	0	ALS_ RANGE	PGA_ALS	

ALS_RANGE： Increase ALS sensing dynamic range (x96).

0: ALS gain is controlled by PGA_ALS(default).

1: ALS gain sets to external gain(x96).

PGA_ALS： ALS sensing gain.

0x0 :x1 (default)

0x1 :x4

0x2: x8

0x3: x32

1.2 ALS_TIME

0x05	ALS_TIME, ALS integrated time (Default =0x00)							
BIT	7	6	5	4	3	2	1	0
R/W	ALSCONV							

ALSCONV： This register controls the integrated time of AD converter at ALS mode (T_{ALS}), and the resolution of output data (CH0_DATA, CH1_DATA).

0x00: The maximum count of output data is 1023, TALS = 5.513ms (default)

0x01: The maximum count of output data is 2047, TALS = 8.138ms

……

0xff: The maximum count of output data is 65535, TALS = 674.888ms

The maximum count of output data is minimum of [1024 x (ATIME + 1) – 1.65535].

The conversion time of ALS function (T_{ALS}) is decided by ALSCONV.

T_{ALS} =2.888 + 2.625 x (ALSCONV + 1) (ms)

LED_CTRL

0x06	LED_CTRL, LED control (Default =0x00)							
BIT	7	6	5	4	3	2	1	0
R/W	IRDR_SEL		ITW_PS					

IRDR_SEL： It configures the peak current of the internal LED driver.

0x00 : 50 mA

0x01 : 100 mA

0x02 : 150 mA

0x03 : 200 mA (default)

ITW_PS： It controls the LED pulse width in PS function mode. Pulse width is 13.675 us per unit.

0x00 : 1T, 13.675 us (default).

0x01 : 2T, 27.35 us.

……

0x3F : 64T, 875.213 us.

PS_GAIN

0x07	PS_GAIN, PS analog gain (Default =0x00)							
BIT	7	6	5	4	3	2	1	0
R/W	0	0	0	0	0	0	PGA_PS	

PGA_PS： PS sensing gain.

0x0: x1 (default)

0x1: x2

0x2: x4

0x3: x8

PS_PULSE

0x08	PS_PULSE, PS pulse count control(Default =0x00)							
BIT	7	6	5	4	3	2	1	0
R/W	ITC_PS							

ITC_PS： It controls the number of LED pulse in PS function mode.

0x00： 1 pulse

0x01： 2 pulse

0x02： 3 pulse

……..

0xFF： 256 pulse

PS_TIME

0x09	PS_TIME, PS integrated time (Default =0x00)							
BIT	7	6	5	4	3	2	1	0
R/W	0	0	0	0	PSCONV			

PSCONV： This register controls the integrated time of AD converter at PS mode (T_{PS}), and the resolution of output data (PS_DATA, IR_DATA).

0x0: The maximum count of output data is 255, 1 time unit(default).

0x1: The maximum count of output data is 511, 2 time units.

……

0xf: The maximum count of output data is 4095, 16 time units.

The maximum count of output data is 256 x (time unit -1).

The conversion time of PS function (T_{PS}) is decided by ITW_PS, ITC_PS and PSCONV.

T_{PS}=[3.051 + (2 x ITC_PS + 1) x (0.01 + 0.01368 + ITW_PS) + (0.51 x PSCONV (ms)]*16

The total conversion time (T_{TOTAL}) of device is decided by T_{ALS}, T_{PS}, T_{wait} .

$T_{TOTAL}=T_{ALS} + T_{PS} + T_{wait}$ (ms)

PERSISTENCE

0x0B	PERSISTENCE, ALS, PS persistence setting (Default =0x00)							
BIT	7	6	5	4	3	2	1	0
R/W	PRS_PS				PRS_ALS			

PRS_ALS： This register sets the numbers of similar consecutive ALS interrupt events before the interrupt pin is triggered.

0x0: Every ALS conversion is done.

0x1: 1 ALS interrupt event is asserted.

……..

0xf: 15 consecutive ALS interrupt events are asserted.

PRS_PS： This register sets the numbers of similar consecutive PS interrupt events before the interrupt pin is triggered.

0x0: Every PS conversion is done.

0x1: 1 PS interrupt event is asserted.

……..

0xf: 15 consecutive PS interrupt events are asserted.

ALS_THRES_L

0x0C 0x0D	**ALS_THRES_L, ALS low interrupt threshold (Default =0x0000)**							
BIT	7	6	5	4	3	2	1	0
R/W	ALS_THRE_LL							
R/W	ALS_THRE_LH							

This register sets the low threshold value of ALS interrupt. The interrupt algorithm compares theselected ALS data and ALS threshold value.

ALS_THRE_LL：ALS low interrupt threshold value, LSB. (Reg. 0x0C)

ALS_THRE_LH：ALS low interrupt threshold value, MSB. (Reg.0x0D)

ALS_THRES_H

0x0E 0x0F	**ALS_THRES_H, ALS high interrupt threshold (Default =0xFFFF)**							
BIT	7	6	5	4	3	2	1	0
R/W	ALS_THRE_HL							
R/W	ALS_THRE_HH							

This register sets the high threshold value of ALS interrupt. The interrupt algorithm compares the selected ALS data and ALS threshold value.

ALS_THRE_HL：ALS high interrupt threshold value, LSB. (Reg. 0x0E)

ALS_THRE_HH：ALS high interrupt threshold value, MSB. (Reg.0x0F)

PS_THRES_L

0x10 0x11	**PS_THRES_L, PS low interrupt threshold (Default =0x0000)**							
BIT	7	6	5	4	3	2	1	0
R/W	PS_THRE_LL							
R/W	PS_THRE_LH							

This register sets the low threshold value of PS interrupt. The interrupt algorithm compares theselected PS data and PS threshold value.

PS_THRE_LL：PS low interrupt threshold value, LSB. (Reg. 0x10)

PS_THRE_LH：PS low interrupt threshold value, MSB. (Reg.0x11)

PS_THRES_H

0x12 0x13	**PS_THRES_H, PS high interrupt threshold (Default =0xFFFF)**							
BIT	7	6	5	4	3	2	1	0
R/W	PS_THRE_HL							
R/W	PS_THRE_HH							

This register sets the high threshold value of PS interrupt. The interrupt algorithm compares the selected PS data and PS threshold value.

PS_THRE_HL：PS high interrupt threshold value, LSB. (Reg. 0x12)

PS_THRE_HH：PS high interrupt threshold value, MSB. (Reg.0x13)

PS_OFFSET

0x14 0x15	**PS_OFFSET, PS offset level (Default =0x0000)**							
BIT	7	6	5	4	3	2	1	0
R/W	PS_OFFSET_L							
R/W	PS_OFFSET_H							

This register used to calibrate the device's cross talk. The PS_DATA should be closed to zero with no object. The PS_OFFSE is subtracted from the measured data before it output to PS_DATA.

PS_OFFSET_L：PS high interrupt threshold value, LSB. (Reg. 0x14)

PS_OFFSET_H：PS high interrupt threshold value, MSB. (Reg.0x15)

INT_SOURCE

0x16	**INT_SOURCE, ALS interrupt source (Default =0x00)**							
BIT	7	6	5	4	3	2	1	0
R/W	0	0	0	0	0	0	0	INT_SRC

INT_SRC： This register sets to select the ALS data for the ALS Interrupt algorithm.

0x0: Select CH0_DATA.

0x1: Select CH1_DATA.

ERROR_FLAG

0x17	**ERROR_FLAG, Error flag status**							
BIT	7	6	5	4	3	2	1	0
R/W	0	0	0	0	ERR_IR	0	ERR_CH1	ERR_CH0

This register indicates the ALS / IR data status. If the ALS / IR data is outside of measurable range, the corresponding error flag (ERR_CH0, ERR_CH1, ERR_IR) will set to one. That also means the data is invalid.

PS_DATA

0x18 **0x19**	**PS_DATA, PS output data.**							
BIT	7	6	5	4	3	2	1	0
R/W	PS_DATA_L							
R/W	PS_DATA_H							

The PS conversion result is written into PS DATA.

For insuring the data in the register comes the same measurement, the high byte data will be latched when the low byte data has been accessed until the high byte data has be read.

IR_DATA

0x1A **0x1B**	**IR_DATA, IR output data.**							
BIT	7	6	5	4	3	2	1	0
R/W	IR_DATA_L							
R/W	IR_DATA_H							

The IR sensor result is written into IR DATA when PS conversion is done.

For insuring the data in the register comes the same measurement, the high byte data will be latched when the low byte data has been accessed until the high byte data has be read.

CH0_DATA

0x1C **0x1D**	**CH0_DATA, Channel 0 output data.**							
BIT	7	6	5	4	3	2	1	0
R/W	CH0_DATA_L							
R/W	CH0_DATA_H							

The channel 0 result of ALS sensor is written into CH0_DATA when ALS conversion is done.
For insuring the data in the register comes the same measurement, the high byte data will be latched when the low byte data has been accessed until the high byte data has be read.

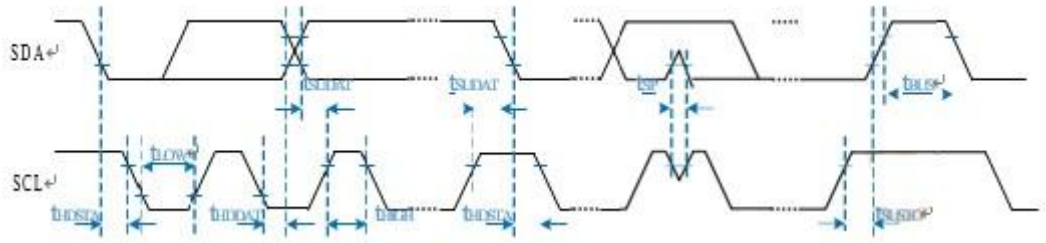
CH1_DATA

0x1E 0x1F	**CH1_DATA, Channel 1 output data.**							
BIT	7	6	5	4	3	2	1	0
R/W	CH1_DATA_L							
R/W	CH1_DATA_H							

The channel 1 result of ALS sensor is written into CH1_DATA when ALS conversion is done.
For insuring the data in the register comes the same measurement, the high byte data will be latched when the low byte data has been accessed until the high byte data has be read.

I^2C Interface Timing Characteristics

This section will describe the protocol of the I2C bus. For more details and timing diagrams please refer to the I2C specification.



Parameter (*)	**Symbol**	**Fast mode**		**Unit**
		Min	Max	
SCL clock frequency	f_{SCL}	100	400	kHz
Bus free time between STOP condition and START condition	t_{BUS}	1.3	--	μs
LOW period of the SCL clock	t_{LOW}	1.3	--	μs
HIGH period of the SCL clock	t_{HIGH}	0.6	--	μs
Hold time (repeated) START condition	t_{HDSTA}	0.6	--	μs
Set-up time (repeated) START condition	t_{SUSTA}	0.6	--	μs
Set-up time for STOP condition	t_{SUSTO}	0.6	--	μs
Data hold time	t_{HDDAT}	50	--	ns
Data set-up time	t_{SUDAT}	100	--	ns
Pulse width of spikes which must be suppressed by the input filter	t_{SP}	0	50	ns
Rise time of both SDA and SCL signals	t_r	20 x VDD/5.5	300	ns
Fall time of both SDA and SCL signals	t_f	20 x VDD/5.5	300	ns

(*) Specified by design and characterization; not production tested.

(**) All specifications are at VBus = 3.3V, Tope=25oC, unless otherwise noted.

Note:

I2C BUS Clear

In the unlikely event where the clock (SCL) is stuck LOW, the preferential procedure is to reset the bus using the HW reset signal if your I2C devices have HW reset inputs. If the I2C devices do not have HW reset inputs, cycle power to the devices to activate the mandatory Internal Power-On Reset (POR) circuit.

If the data line (SDA) is stuck LOW, the master should send nine clock pulses. The device that held the bus LOW should release it sometime within those nine clocks.

I2C General Call Software Reset

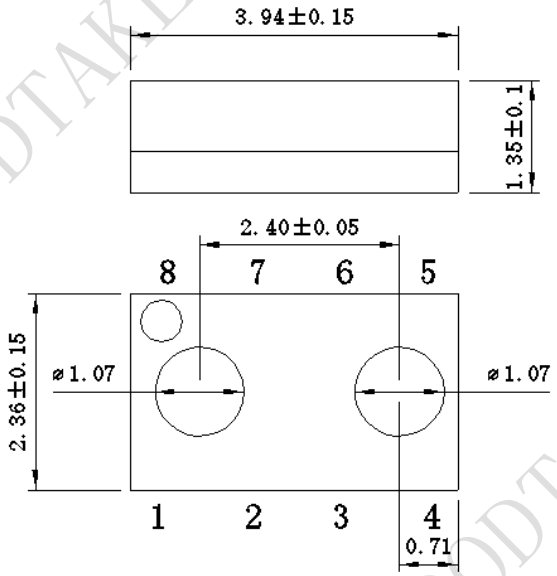
Following a General Call, (0000 0000), sending 0000 0110 (06h) as the second byte causes software reset. This feature is optional and not all devices will respond to this command. On receiving this 2-byte sequence, all devices designed to respond to the general call address will reset and take in the programmable part of their address.

Precautions have to be taken to ensure that a device is not pulling down the SDA or SCL line after applying the supply voltage, since these low levels would block the bus.

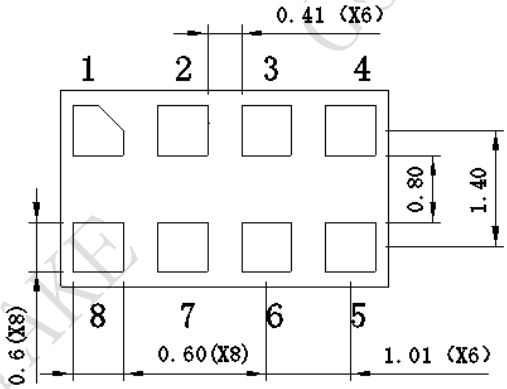
GOODTAKE

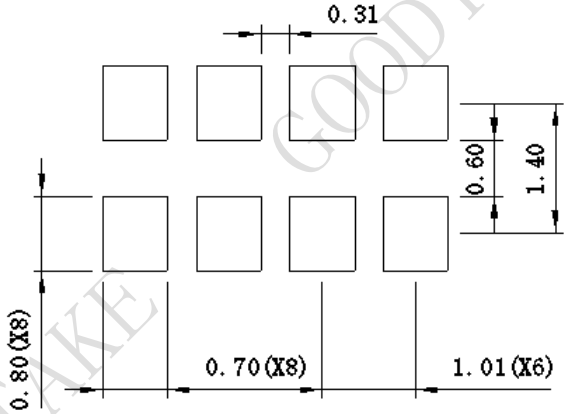
Package Outline Dimensions

1. All dimensions are in mm.
2. Tolerance is ±0.2 unless otherwise noted.



Pin-out	Name
1	VDD
2	SCL
3	GND
4	LEDA
5	LEDK
6	LDR
7	INT
8	SDA



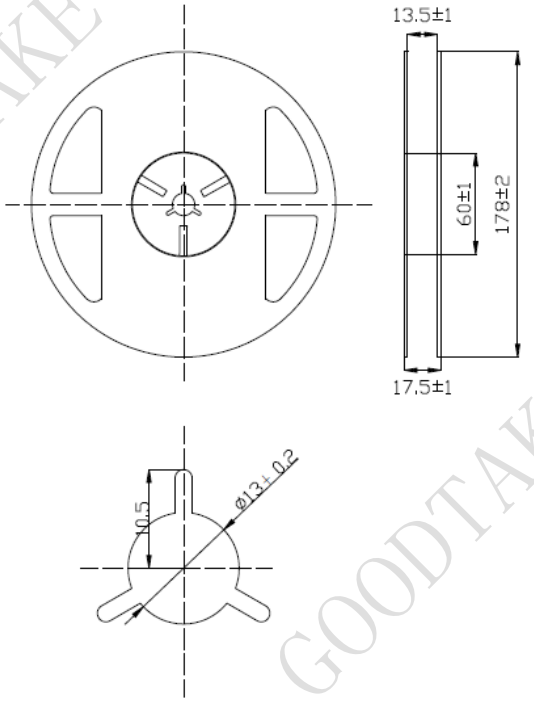


Recommend pad layout

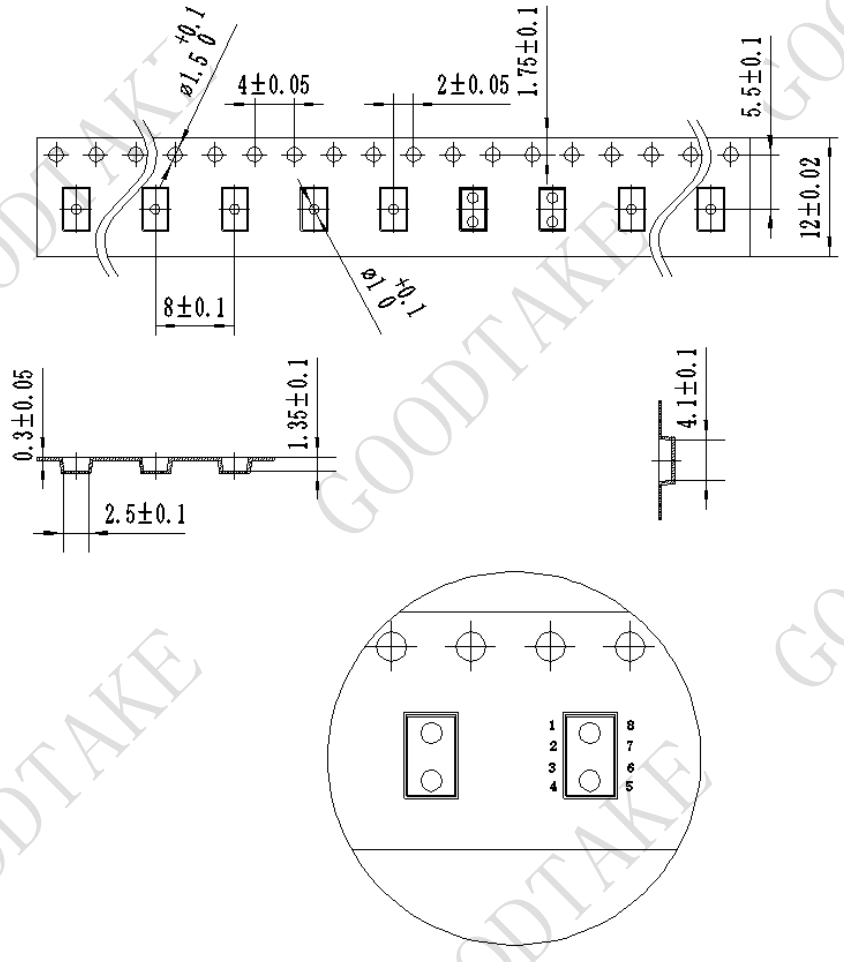
GOODTAKE

Taping Specifications

（1）Shape and dimensions of reels： unit in mm

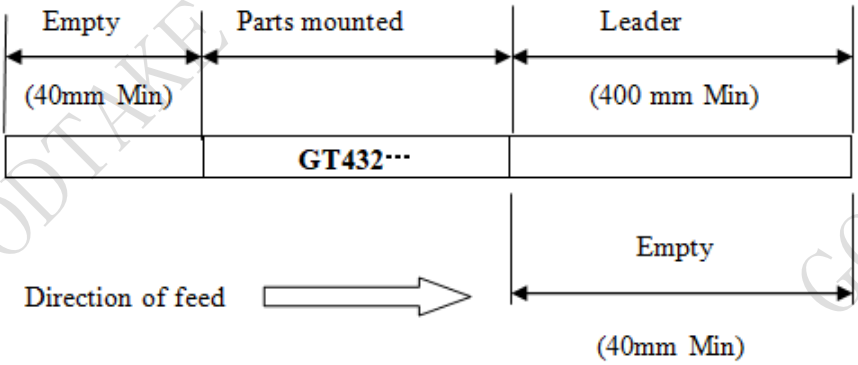


（2） Dimensions of tape



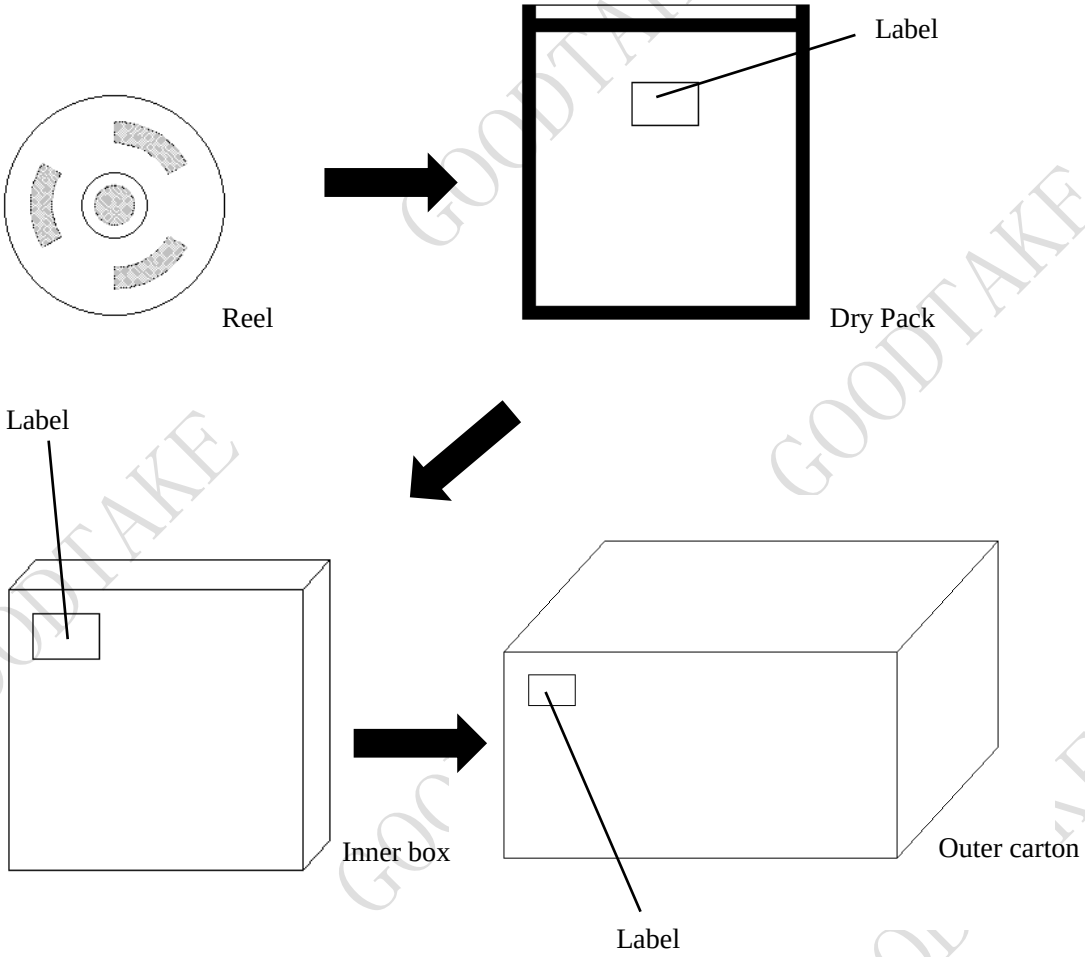
GOODTAKE

（3） **Configuration of tape**



（4） **Quantity:** 1,200pcs/ reel

（5） **Packing Information**



Dry Pack

A reel packed & sealed in a Dry Pack with silica

Quantities per reel：1,200pcs

Inner box

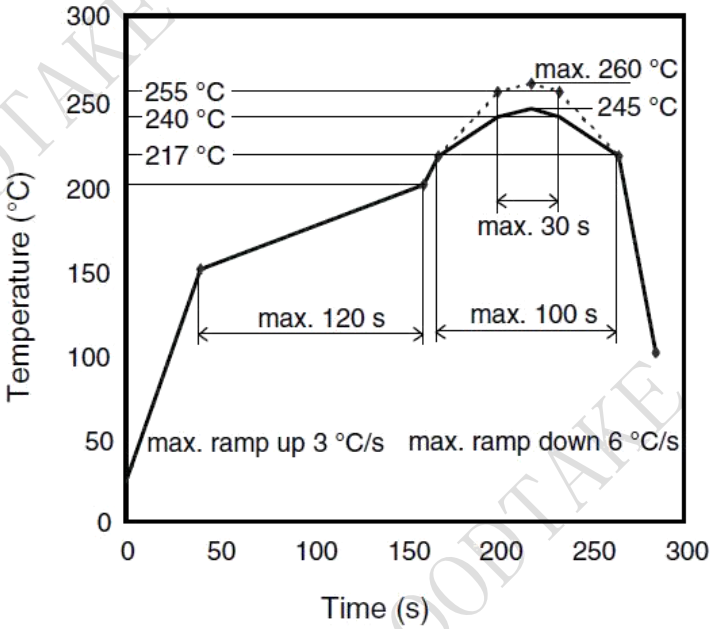
Contains 5 Dry packs

Outer carton

Contains 5 inner boxes

Total quantities：30,000pcs

Reflow Soldering Profile



Antistatic Dry Pack

Opto devices in SMD package may be sensitive to moisture. Devices are taped & reeled, sealed in antistatic bag with silica gel desiccants.

Do not open the sealed moisture-proof bag before ready to use. If sealing is void, baking treatment may be required.

Storage

Shelf life – Devices should be stored in its original packing, in a controlled environment of temperature less than 40 ℃ and relative humidity below 90%.

Suggested shelf life is12 months in its original packing.

Floor life – 72hours in controlled environment, T_{amb} <30 ℃, RH <60%. Time between soldering and removing from moisture barrier bags must not exceed the time indicated in J-STD-020.

Moisture Sensitive Level classification: LEVEL 4

Drying (Baking Process)

If original packing is voided (such as faded silica gel or exceeded storage time), baking treatment should be performed with the following conditions: T bake = 40 + 5 ℃, RH <5%, Time =192hours.