Shenzhen LIZE Electronic Technology Co., Ltd

SPECIFICATION

MX8650

Wireless Optical Mouse Sensor

VERSION 1.0

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1. General Description

　　The MX8650 is a high performance, low power and low cost CMOS process optical mouse sensor with DSP integration chip that serves as a non-mechanical motion estimation engine for implementing a computer wireless mouse.

2. Features

- ●Optical Navigation Technology

- ●Single power supply

- ●Complete 2-D motion sensor

- ●Precise optical motion estimation technology

- ●Accurate motion estimation over a wide range of surfaces

- ●High resolution up to 1600 CPI

- ●Power saving mode during times of no movement

- ●Serial interface for programming and data transfer

- ●Built-in Low Power Timer(LPT) for sleep1/sleep2 mode

- ●MOTSWK pin to wake up mouse controller when sensor wakes up from sleep mode

- ●Wide operation range from 2.0V to 3.5V

3. Pin Assignment
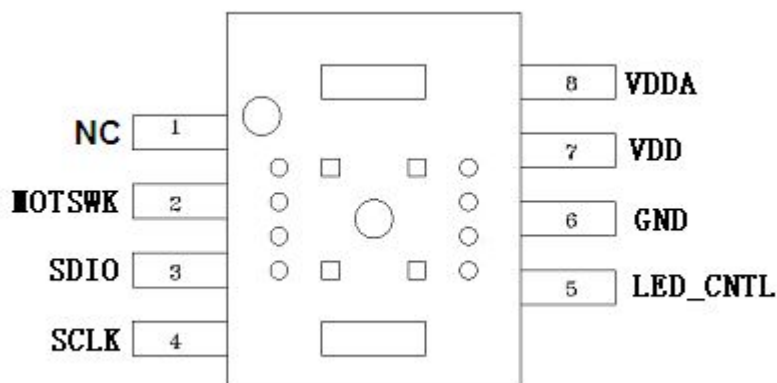
Chart 1 **Pin Assignment**

Pin No.	Symbol	I/O	Function
1	NC	-	No function
2	MOTSWK	O	Motion detect
3	SDIO	I/O	Serial interface data
4	SCLK	I	Serial interface clock
5	LED_CNTL	O	LED control
6	GND	P	GND
7	VDD	P	Power supply (2.0V~3.5V) for internal power regulator, VDDA (1.8V) is the power regulator output.
8	VDDA	P	Analog/Digital supply voltage(1.8V) Power supply (1.73V~1.87V) for low power operation voltage

4. Block Diagram and Operation
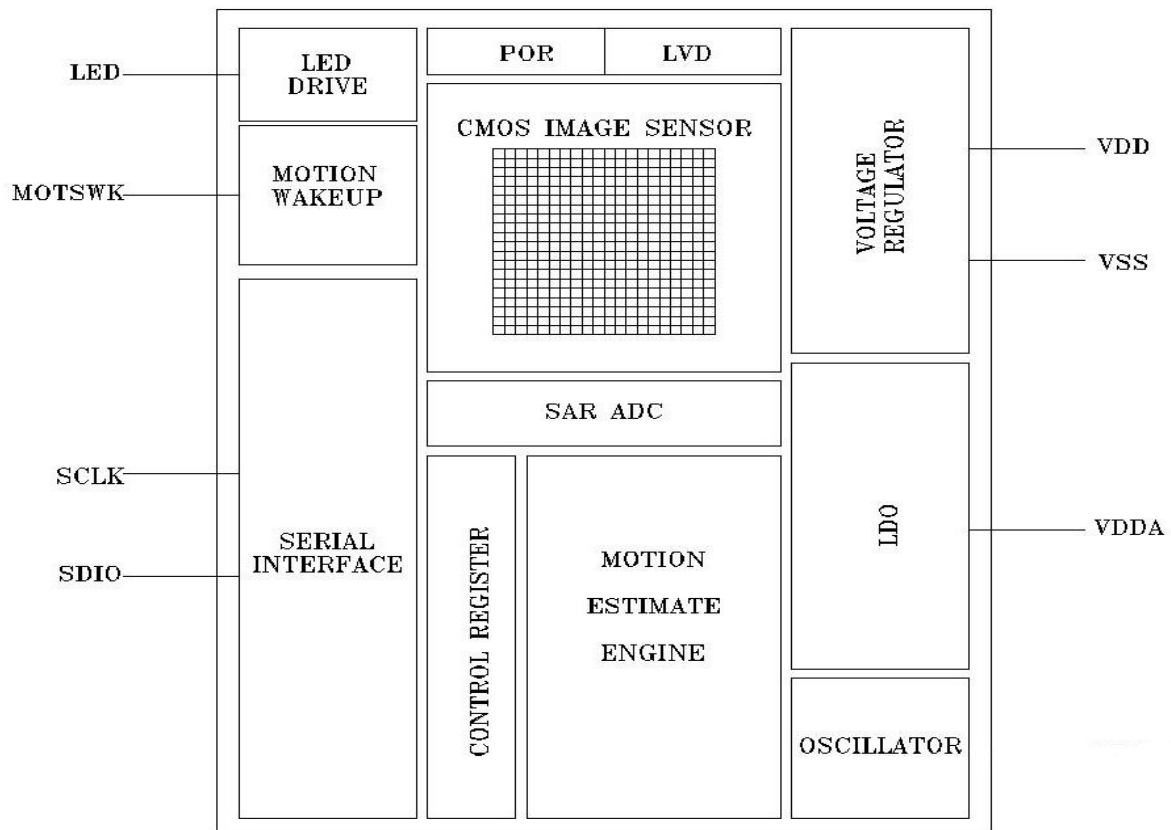
Chart 2 **Block Diagram**

The MX8650 is a high performance, low power and low cost CMOS-process optical mouse sensor with DSP integration chip that serves as a non-mechanical motion estimation engine for implementing a wireless computer mouse.

The mouse sensor is in an 8-pin optical package. The current X and Y information are available in registers accessed via a serial port.

5. Registers and Operation

The mouse sensor can be programmed through registers, via the serial port, and DSP configuration and motion data can be read from these registers. **All registers not listed are reserved, and should never be written by firmare.**

5.1 Registers

| Address	Register Name	R/W	Default	Description
0x00	Product_ID1	R	0x30	Product identifier
0x01	Product_ID2	R	0x5X	Four bits[7:4] number with the product identifier Reserved[3:0] number is reserved for future use
0x02	Motion_Status	R	-	Motion status
0x03	Delta_X	R	-	X Movement
0x04	Delta_Y	R	-	Y Movement
0x05	Operation_Mode	R/W	0xB8	Chip operation mode control register
0x06	Configuration	R/W	0x04	Chip configuration register
0x07	Image_Quality	R	-	Image quality register
0x08	Operation_State	R	-	Operation state register
0x09	Write_Protect	R/W	0x00	Write protect for the register 0x0A~0x7F
0x0A	Sleep1_Setting	R/W	0x72	Sleep mode1 control register
0x0B	Enter_Time	R/W	0x12	Enter sleep mode time setting
0x0C	Sleep2_Setting	R/W	0x92	Sleep mode2 control register
0x0D	Image_ Threshold	R/W	0x10	Image threshold setting
0x0E	Image_ Recognition	R/W	0xA9	Image recognition rate setting

5.2 Register Descriptions

5.2.1 Product_ID1 (0x00, Read Only)

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
PID11	PID10	PID9	PID8	PID7	PID6	PID5	PID4
0	0	1	1	0	0	0	0

【BIT7~ BIT0】 PID11~PID4 Product ID, The value in this register can't change. It can be used to verify the serial communications link is OK.

5.2.2 Product_ID2 (0x01, Read Only)

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
PID3	PID2	PID1	PID0	Reserved	Reserved	Reserved	Reserved
0	1	0	1	x	x	x	x

【BIT7~ BIT4】 PID3~PID0 Product ID，The value in this register can't change. It can be used to verify the serial communications link is OK.

【BIT3~ BIT0】 Reserved[3:0] is a value between 0x0 and 0xF, it can't be used to verify that the serial communications.

5.2.3 Motion_Status (0x02, Read Only)

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
MOTION	Reserved	Reserved	DYOVF	DXOVF	1	RES1	RES0
0	x	x	0	0	1	0	0

Motion_Status register allows the user to determine if motion has occurred since the last time it was read. If so, then the user should read **Delta_X** and **Delta_Y** registers to get the accumulated motion. It also tells if the motion buffers have overflowed since the last reading. The current resolution is also shown.

Reading this register freezes the **Delta_X** and **Delta_Y** register values. Read this register before reading the **Delta_X** and **Delta_Y** registers. If **Delta_X** and **Delta_Y** are not read before the motion register is read a second time, the data in **Delta_X** and **Delta_Y** will be lost.

【BIT7】Motion since last report

0：No motion（**Default**）

1：Motion occurred, data ready for reading in **Delta_X** and **Delta_Y** registers

【BIT6~BIT5】Reserved for future use

【BIT4】Motion Delta_Y overflow, ΔY buffer has overflowed since last report

0：No Overflow (Default)

1：Overflow has occurred

【BIT3】Motion Delta_X overflow, ΔX buffer has overflowed since last report

0：No Overflow (Default)

1：Overflow has occurred

【BIT2】 MUST always be 1

【BIT1~BIT0】 RES1~RES0 Resolution in counts inch

00：CPI 800 （Default）

01：CPI 1000

10：CPI 1200

11：CPI 1600

5.2.4 Delta_X (0x03, Read Only)

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
X7	X6	X5	X4	X3	X2	X1	X0
0	0	0	0	0	0	0	0

X movement is counted since last report. Absolute value is determined by resolution. Reading clears the register. Report range –128 ~ +127.

5.2.5 Delta_Y (0x04, Read Only)

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Y7	Y6	Y5	Y4	Y3	Y2	Y1	Y0
0	0	0	0	0	0	0	0

Y movement is counted since last report. Absolute value is determined by resolution. Reading clears the register. Report range –128 ~ +127.

5.2.6 Operation_Mode (0x05, Read/Write)

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
LED_CTR	0	1	SLP_EN	SLP2_EN	SLP2MU	SLP1MU	WAKEUP
1	0	1	1	1	0	0	0

Operation_Mode register allows the user to change the operation of the mouse sensor. Shown below are the bits, their default values, and optional values.

【BIT4~BIT0】Operation_Mode

"0xxxx" = Disable sleep mode

"10xxx" = Enable sleep mode[1]

"11xxx" = Enable sleep mode[2]

"11100" = Force enter sleep2[3]

"1x010" = Force enter sleep1[3] (If Slp2_en is set, the mouse sensor still enter the sleep2 automatically.)

"1x001" = Force wakeup from sleep mode[3]

Notes:

1. Enable sleep mode, but disable automatic entering sleep2 mode, that is, only 2 modes will be used, normal mode and sleep1 mode. After 256 ms (±20%) not moving during normal mode, the mouse sensor will enter sleep1 mode, and keep on sleep1 mode until moving is detected or   wakeup is asserted. Note that the entering time depends on the setting of **Enter_Time** register.

2. Enable sleep mode full function, which is 3 modes will be used, normal mode, sleep1 mode and sleep2 mode. After 256 ms (±20%) not moving during normal mode, the mouse sensor will enter sleep1 mode, and keep on sleep1 mode until moving is detected or wakeup is asserted.

   And after 61 sec (±20%) not moving during sleep1 mode, the mouse sensor will enter sleep2 mode, and keep on sleep2 mode until detect moving or force wakeup to normal mode.

   Note that the entering time depends on the setting of **Enter_Time** register.

3. Only one of these three bits slp2mu, slp1mu, and wakeup can be set to 1 at the same time, others have to be set to 0. After a period of time, the bit, which was set to 1, will be reset to 0 by internal signal.

4. The user can clear **Slp_en/Slp2_en** bit to make the mouse sensor enter normal mode. If the user clears **Slp_en/Slp2_en** bit during normal mode, the mouse sensor will keep its status. If the user clears **Slp_en/Slp2_en** bit during sleep mode, the mouse sensor will enter normal mode after it detect any movement or the user sets **Wakeup** bit.

【BIT7】 LED shutter enable/disable

　　　0 = Disable

1 = Enable (Default)

【BIT6~BIT5】 MUST always be 01

【BIT4】 Sleep mode enable/disable

0 = Disable

1 = Enable (Default)

【BIT3】 Automatic enter sleep2 mode enable/disable

0 = Disable

1 = Enable (Default)

【BIT2】 Manual enter sleep2 mode, set "1" will enter sleep2 and this bit will be reset to "0"

【BIT1】 Manual enter sleep1 mode, set "1" will enter sleep1 and this bit will be reset to "0"

【BIT0】 Manual wake up from sleep mode, set "1" will enter wakeup and this bit will be reset to "0"

5.2.7 Configuration (0x06, Read/Write)

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
RESET	**MOTSWK**	0	0	PD_EN	1	CPI1	CPI0
0	0	0	0	0	1	0	0

The **Configuration** register allows the user to change the configuration of the sensor. Shown below are the bits, their default values, and optional values.

If **MOTSWK** bit is clear, the MOTSWK pin is level-sensitive. The pin level remains low when motion has occurred; in other words, **Delta_X** and **Delta_Y** registers has data. The mouse controller can read **Motion_Status** register, **Delta_X** register, then **Delta_Y** register sequentially. After the mousecontroller reads all data, **Delta_X** and **Delta_Y** are both zero, the pin level will be high. If **MOTSWK** bit is set, the MOTSWK pin is edge-sensitive. The pin will send a pulse and trigger the mouse controller when motion has occurred during the sleep mode. The mouse controller can read **Motion_Status** register, **Delta_X** register, then **Delta_Y** register sequentially.

【BIT7】 Full chip reset

0 = Normal operation mode (Default)

1 = Full chip reset

【BIT6】 MOTSWK pin output selection

0 = Motion function output (Default)

1 = SWKINT function output

【BIT5~BIT4】 MUST always be 00

【BIT3】 Power down mode

0 = Normal operation (Default)

1 = Power down mode

【BIT2】 MUST always be 1

【BIT1~BIT0】 Output resolution setting, setting with CPI mode select bit

00：CPI 800 (Default)

01：CPI 1000

10：CPI 1200

11：CPI 1600

5.2.8 Image_Quality (0x07, Read Only)

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
IMAGEQ7	IMAGEQ6	IMAGEQ5	IMAGEQ4	IMAGEQ3	IMAGEQ2	IMAGEQ1	IMAGEQ0
0	0	0	0	0	0	0	0

Image Quality is a quality level of the sensor in the current frame. Report range 0 ~ 255

5.2.9 Operation_State (0x08, Read Only)

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Reserved	Reserved	Reserved	Reserved	SLP_STATE	OPSTATE2	OPSTATE1	OPSTATE0
X	X	X	X	0	0	0	0

【BIT7~BIT4】Reserved for future use

【BIT3】 Sleep state

0 = Sleep mode1

1 = Sleep mode2

【BIT2~BIT0】

000 = Normal state

001 = Entry sleep1 processing

010 = Entry sleep2 processing

011 = Reserved for future use

100 = Sleep mode (see SLP_STATE bit to get sleep state)

5.2.10 Write_Protect (0x09, Read/Write)

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
WP7	WP6	WP5	WP4	WP3	WP2	WP1	WP0
0	0	0	0	0	0	0	0

Write protect for the register 0x0A ~ 0x7F

【BIT7~BIT0】 Write protect enable/disable for the address 0x0A ~ 0x7F

0x00 = Enable (Default), register 0x0A ~ 0x7F are read only

0x5A = Disable, register 0x0A ~ 0x7F can be read/written

5.2.11 Sleep1_Setting (0x0A, Read/Write)

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
S1FREQ3	S1FREQ2	S1FREQ1	S1FREQ0	0	0	1	0
0	1	1	1	0	0	1	0

Sleep1_Setting register allows the user to set frequency time for the sleep1 mode.

【BIT7~BIT4】 Setting frequency time for the sleep1 mode. A scale is 4ms. Relative to its value 0 ~ 15, the frequency time is 4ms ~ 64ms. Default is 32ms. (S1FREQ [3:0] = 0111)

【BIT3~BIT0】 MUST always be 0010

5.2.12 Enter_Time (0x0B, Read/Write)

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
S1ETM3	S1ETM2	S1ETM1	S1ETM0	S2ETM3	S2ETM2	S2ETM1	S2ETM0
0	0	0	1	0	0	1	0

Enter_Time register allows the user to set enter time for the sleep1 and sleep2 mode.

【BIT7~BIT4】 S1ETM3~S1ETM0 Setting sleep1 enter time

A scale is 128ms. Relative to its value 0 ~ 15, the frequency time is 128ms ~ 2048ms

Default is 256ms. (S1ETM [3:0] = 0001)

【BIT3~BIT0】 S2ETM3~S2ETM0 Setting sleep2 enter time

A scale is 20480ms. Relative to its value 0 ~ 15, the frequency time is 20480ms ~ 327680ms, Default is 61440ms. (S2ETM [3:0] = 0010)

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5.2.13 Sleep2_Setting (0x0C, Read/Write)

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
S2FREQ3	S2FREQ2	S2FREQ1	S2FREQ0	0	0	1	0
1	0	0	1	0	0	1	0

Sleep2_Setting register allows the user to set frequency time for the sleep2 mode.

【BIT7~BIT4】 Setting frequency time for the sleep2 mode. A scale is 32ms. Relative to its value 0 ~ 15, the frequency time is 32ms ~ 512ms. Default is 320ms. (S2FREQ [3:0] = 1001)

【BIT3~BIT0】 MUST always be 0010

5.2.14 Image_Threshold (0x0D, Read/Write)

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
IMGTH7	IMGTH6	IMGTH5	IMGTH4	IMGTH3	IMGTH2	IMGTH1	IMGTH0
0	0	0	1	0	0	0	0

Image_ Threshold register allows the user to set image threshold. The mouse sensor calculates

data to **Delta_X** and **Delta_Y** registers when image quality (please see **Image_Quality** register) is

larger than image threshold.

5.2.15 Image_Recognition (0x0E, Read/Write)

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
PK_WT2	PK_WT1	PK_WT0	0	IMGQADF3	IMGQADF2	IMGQADF1	IMGQADF0
1	0	1	0	1	0	0	1

Image_Recognition register allows the user to set recognition rate.

【BIT7~BIT5】 Peak threshold weighting: 0 (Low recognition rate) ~ 7 (High recognition rate).

【BIT4】 MUST Always be 0.

【BIT3~BIT0】 Image qualification threshold difference: 0(High recognition rate) ~ 15(Low recognition

rate).

6. Specifications

6.1 Absolute Maximum Rating

Symbol	Min.	Max.	Unit
Operating Temperature	0	40	℃
Storage Temperature	−40	85	℃
DC Supply voltage(Vdc)	-0.2	Vdd1+0.3	V
	-0.3	Vdd2+0.3	V
Input voltage	−0.5	Vdc	V
Lead solder temp.		260	℃

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6.2 Recommend Operating Condition

Parameters	Sym.	Min.	Typ.	Max.	Unit
Operating voltage	Vdd1	1.73	1.8	1.87	V
	Vdd2	2.0	2.7	3.5	
Supply Noise	Vn	-	-	0.1	V
Distance from Lens Reference Plane to Surface	Z	2.3	2.4	2.5	mm
Resolution	R	800	1000	1600	CPI
Serial port Clock Frequency	SCLK	-	-	10	MHz
Frame Rate	FR	-	3000	-	Frames/sec
Speed	S	-	-	28	Inches/sec

6.3 DC Electrical Characteristic

Symbol	Parameter	Min	Type	Max	Unit
Type : Power(Test Condition: T = 25ºC, VDD=VDDA=1.8V/2.7V)					
I_{DDN}	Supply Current Mouse moving	-	2.5	-	mA
I_{DDS1}	Supply Current Mouse not moving(Slp1)	-	300	-	uA
I_{DDS2}	Supply Current Mouse not moving(Slp2)	-	65	-	uA
I_{DDPD}	Supply Current Power Down	-	7	-	uA
Type : SCLK, SDIO (Test Voltage 2.7V)					
V_{IH}	Input Voltage HIGH	2.0			V
V_{IL}	Input Voltage LOW			0.9	V
V_{OH}	Output Voltage HIGH I_{OH} = 2mA	2.3			V
V_{OL}	Output Voltage LOW I_{OL} = 2mA			0.4	V
Type : LED (Test Voltage 2.7V)					
V_{OL}	Output Voltage LOW I_{OL} = 25mA			380	mV

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6.4 AC Operating Condition (1.8V/2.7V)

Electrical Characteristics over recommended operating conditions. Typical values at 25 °C, VDD =

2.7 V for 2.7V application and VDD = VDDA = 1.8 V for 1.8V application.

Symbol	Parameter	Min.	Typ.	Max.	Unit	Notes
t_{PDR}	PD Pulse Register	-	-	666	us	Two frames time maximum after setting **PD_EN** bit in the configuration register @3000frame/sec
t_{PU}	Power Up from VDD↑	10	-	45	ms	From VDD↑to valid motion signals
t_{HOLD}	SDIO Read Hold Time	-	3	-	us	Minimum hold time for valid data
t_{RESYNC}	Serial Interface RESYNC	1	-	-	us	
t_{SIWTT}	Serial Interface Watchdog Timer Timeout	1.7 32 320	-	-	ms	@3000frame/sec 1.7ms for normal mode 32ms(+/-20%) for sleep1 mode 320ms(+/-20%) for sleep2 mode Please Note that the value depends on the setting of **Sleep1_Setting** register and **Sleep2_Setting** register.
t_{SWKINT}	Sensor Wakeup Interrupt Time	-	160	-	us	
t_r, t_f	Rise and Fall Times: SDIO	-	24,20	-	ns	CL = 30PF
t_r, t_f	Rise and Fall Times: ILED	-	30,10	-	ns	

7. Z and 2D/3D Assembly
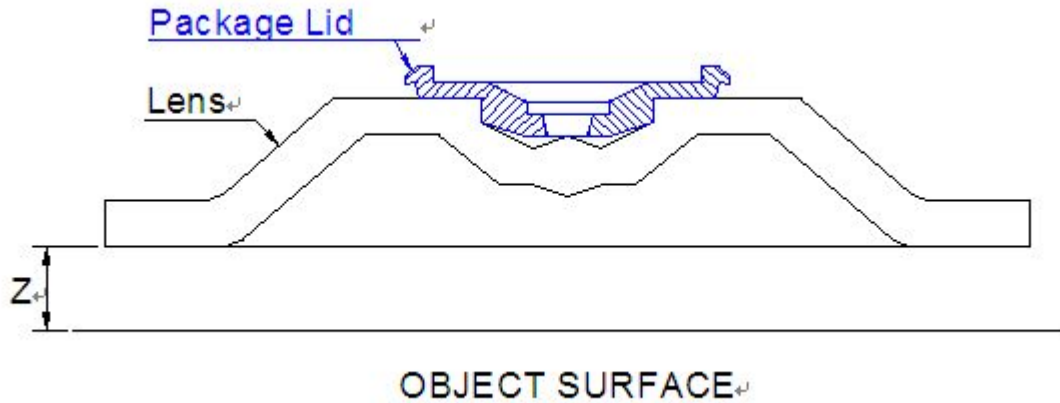
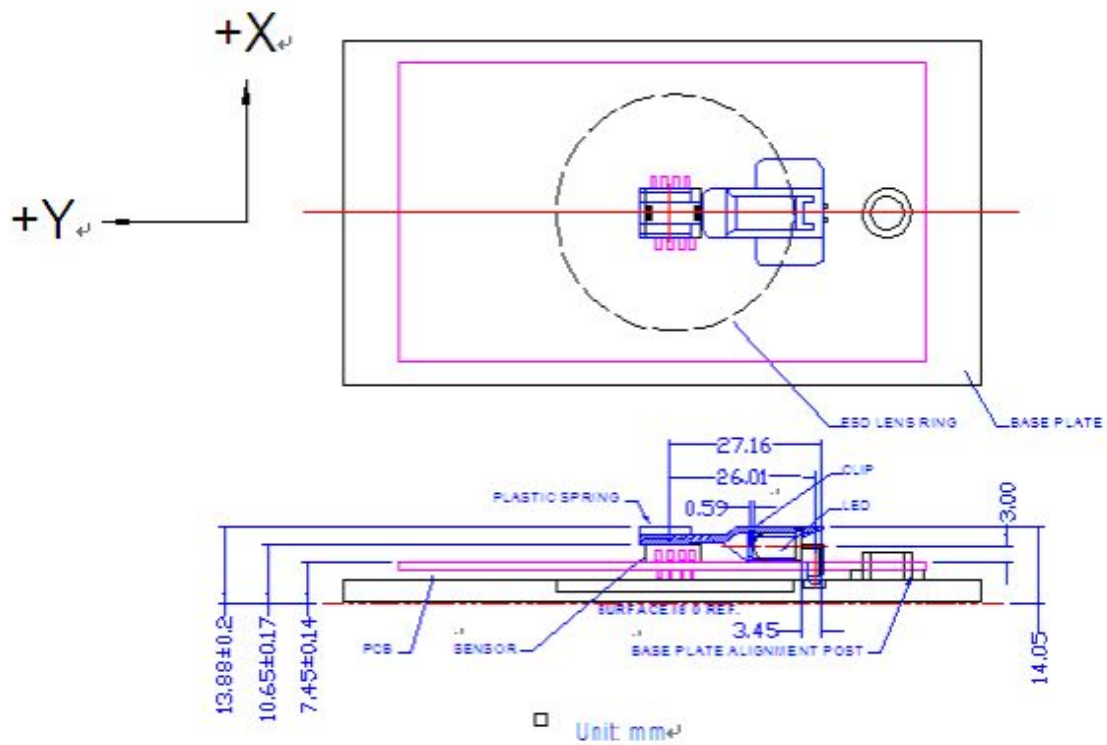**Chart 3 Distance from Lens Reference Plane to Surface**
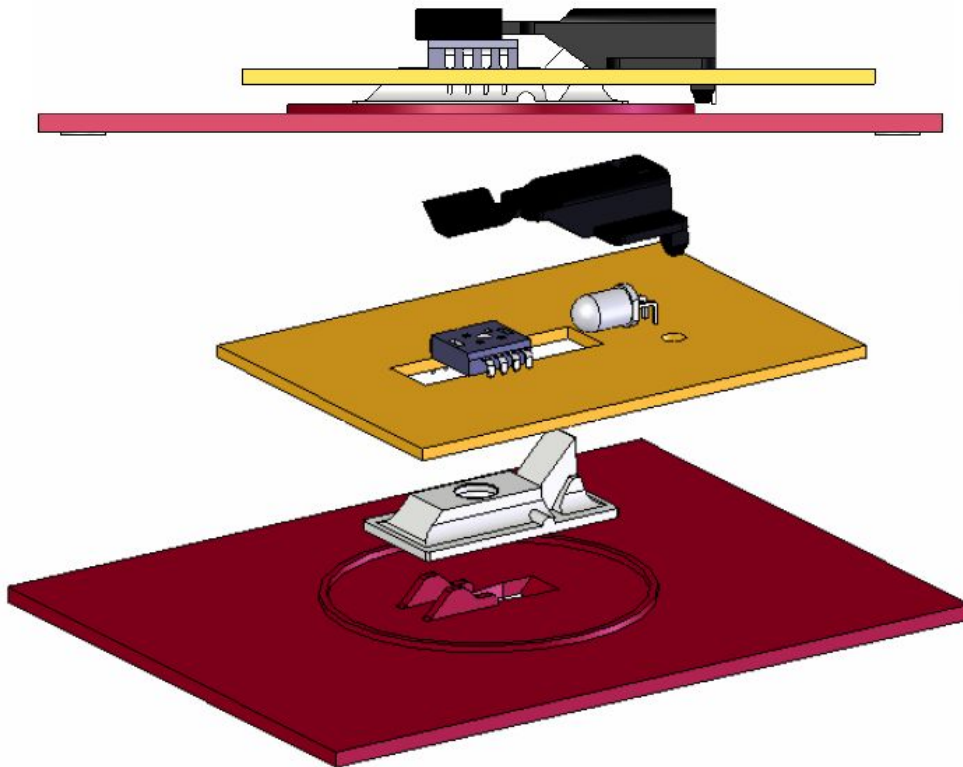

Chart 4 2D Assembly

Chart 5 **3D Assembly**

8. Serial interface

The synchronous serial port is used to set and read parameters in the mouse sensor.

SCLK: The serial clock line, It is always generated by the mouse controller.

SDIO: The serial data line is used to write and read data.

8.1Transmission Protocol

The transmission protocol is a two-wire link, half duplex protocol between the micro-controller and the mouse sensor.　All data changes on SDIO are initiated by the falling edge on SCLK.　The mouse controller always initiates communication; the mouse sensor never initiates data transfers.

The transmission protocol consists of the two operation modes:

- Write Operation.

- Read Operation.

Both of the two operation modes consist of two bytes. The first byte contains the address (seven bits) and has a bit 7 as its MSB to indicate data direction. The second byte contains the data.

| 15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
W/R	A6	A5	A4	A3	A2	A1	A0	D7	D6	D5	D4	D3	D2	D1	D0
First Byte								Second Byte							
W/R	ADDRESS(7BIT)							DATA(8BIT)							

8.1.1 Write Operation

A write operation, which means that data is going from the mouse controller to the mouse sensor, is always initiated by the mouse controller and consists of two bytes. The first byte contains the address (seven bits) and has a **"1"** as its MSB to indicate data direction. The second byte contains the data. The transfer is synchronized by SCLK. The mouse controller changes SDIO on falling edges of SCLK. The mouse sensor reads SDIO on rising edges of SCLK.
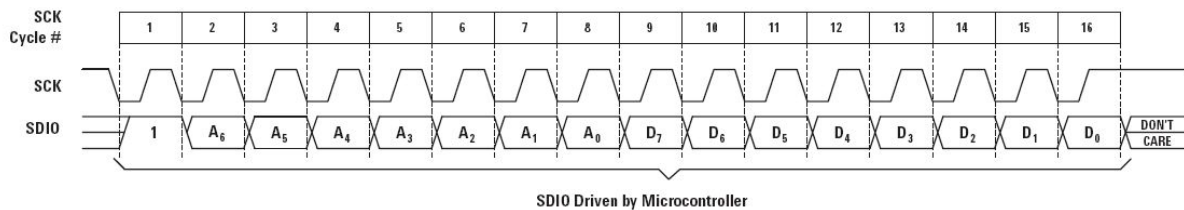

8.1.2 Read Operation

A read operation, which means that data is going from the mouse sensor to the mouse controller, is always initiated by the mouse controller and consists of two bytes. The first byte contains the address, is written by the mouse controller, and has a **"0"** as its MSB to indicate data direction. The second byte contains the data and is driven by the mouse sensor. The transfer is synchronized by SCLK. SDIO is changed on falling edges of SCLK and read on every rising edge of SCLK. The mouse controller must go to a high-Z state after the last address data bit. The mouse sensor will go to the high-Z state after the last data bit.
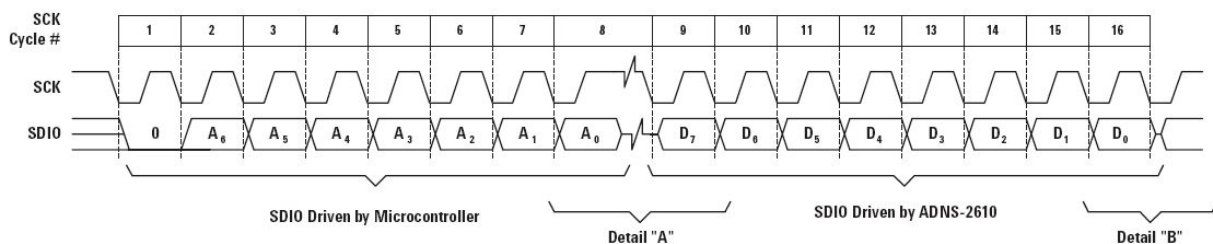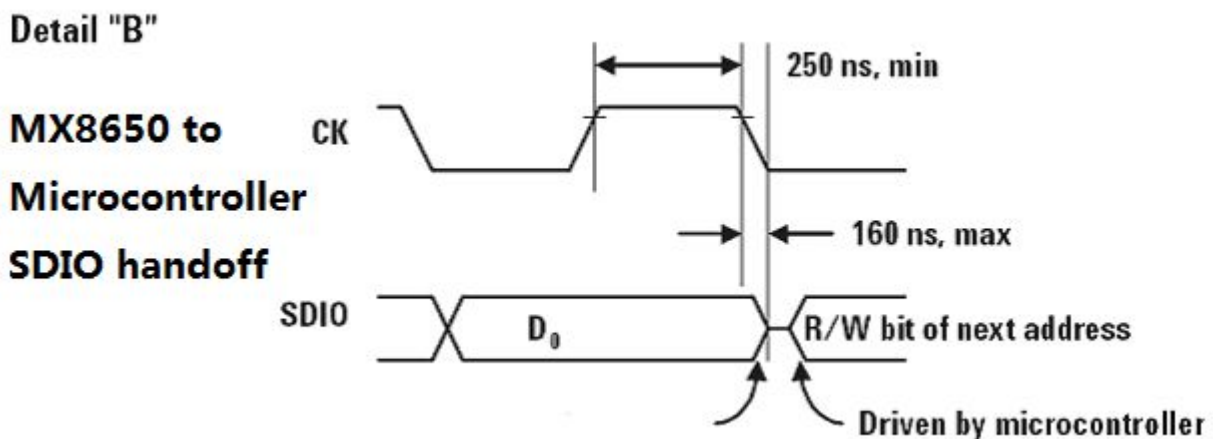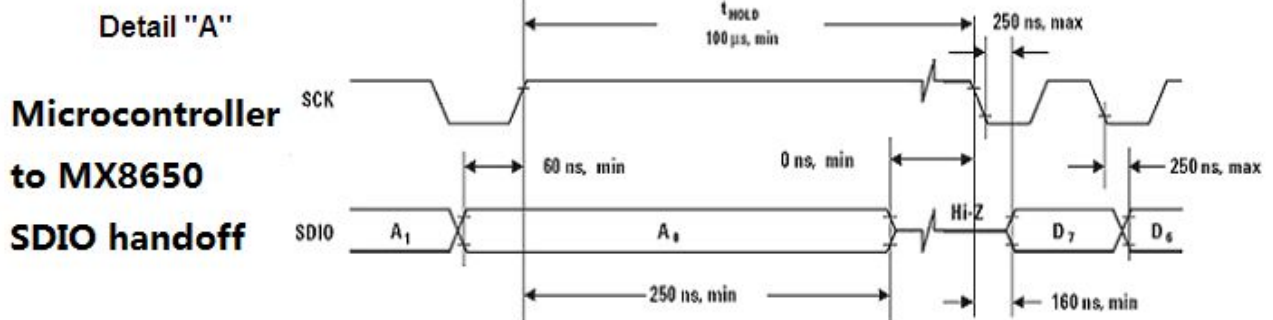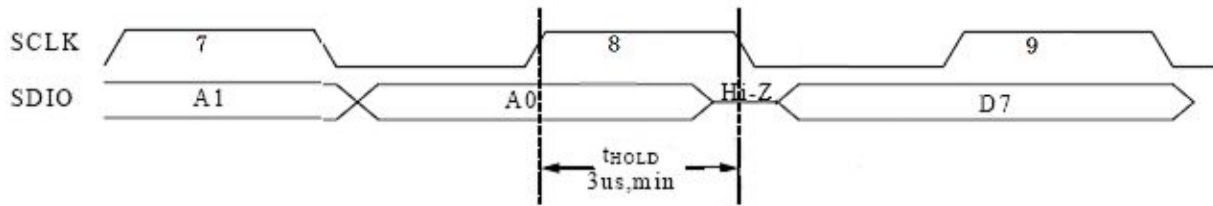
8.2 Re-Synchronous Serial Interface

If the mouse controller and the mouse sensor get out of synchronization, then the data either written or read from the registers will be incorrect. In such a case, an easy way to solve this condition is to toggle the SCLK line from high to low for least t_{RESYNC}, and then MUST toggle it from low to high to wait at least t_{SIWTT} to reach re- synchronous the serial port. This method is called by "watchdog timer timeout". The mouse sensor will reset the serial port without resetting the registers and be prepared for the beginning of a new transmission.
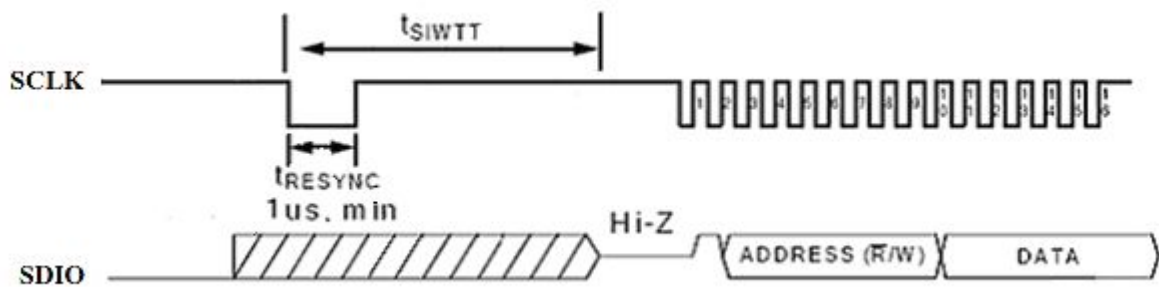
Note that this function is disabled when the mouse sensor is in the power down mode. If the user uses this function during the power down mode, it will get out of synchronization. The mouse sensor and the mouse controller also might get out of synchronization due to following conditions.

8.3 Collision Detection on SDIO

The only time that the mouse sensor drives the SDIO line is during a READ operation. To avoid data collisions, the mouse controller should release SDIO before the falling edge of SCLK after the last address bit. The mouse sensor begins to drive SDIO after the next falling edge of SCLK. The mouse sensor releases SDIO of the rising SCLK edge after the last data bit. The mouse controller can begin driving SDIO any time after that. In order to maintain low power consumption in normal operation or when the PD_EN bit is set high, the mouse controller should not leave SDIO floating until the next transmission (although that will not cause any communication difficulties).

8.4 Power Down Mode

The mouse sensor can be placed in a power-down mode by setting **PD_EN** bit in the **Configuration** register via a serial port write operation. After setting the **Configuration** register, wait at most 2 frames times. To get the chip out of the power down mode, clear **PD_EN** bit in the **Configuration** register via a serial port write operation. In the power down mode, the serial interface watchdog timer is not available. But, the serial interface still can read/write normally. For an accurate report after leave the power down mode, wait about 3ms before the mouse controller is able to issue any write/read operation to the mouse sensor.
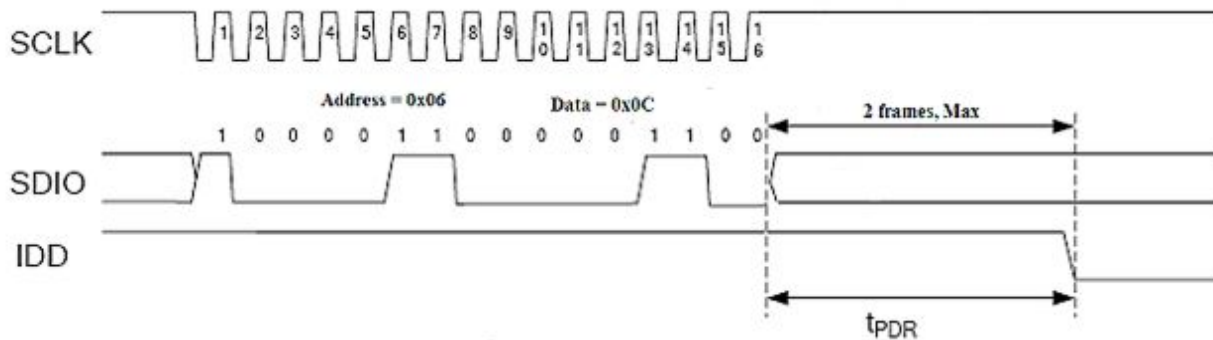
8.5 Error Detection

1. The mouse controller can verify success of write operations by issuing a read command to the same address and comparing written data to read data.

2. The mouse controller can verify the synchronization of the serial port by periodically reading the product ID register

8.6 MOTSWK function

8.6.1 Motion function

To use Motion function, the **MOTSWK** bit in the **Configuration** register must be set to zero. Motion is used to monitor if the mouse sensor has finished sending X-Y movement data to the mouse controller. If all movement data are not read, MOTSWK pin level will remain low. After the mouse controller reads all movement data from the mouse sensor, the mouse sensor will set MOTSWK pin level to high
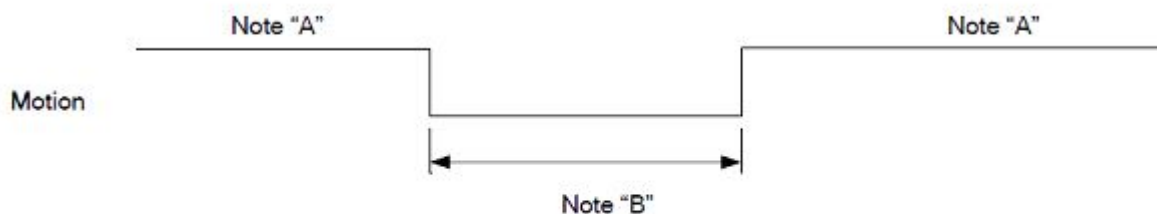
Note "A": *Delta_X*/ *Delta_Y* are equal to 0.
Note "B": *Delta_X*/ *Delta_Y* are not equal to 0.

8.6.2 SWKINT function

To use SWKINT function, the **MOTSWK** bit in the **Configuration** register must be set to one. SWKINT works when the mouse sensor is in the sleep mode and the mouse controller is also in the sleep mode. If the mouse sensor detects any motion occurrence at this moment, the mouse sensor will wake the mouse controller up promptly via MOTSWK pin. The mouse sensor will trigger the mouse controller at the rising/falling edge of MOTSWK pin.
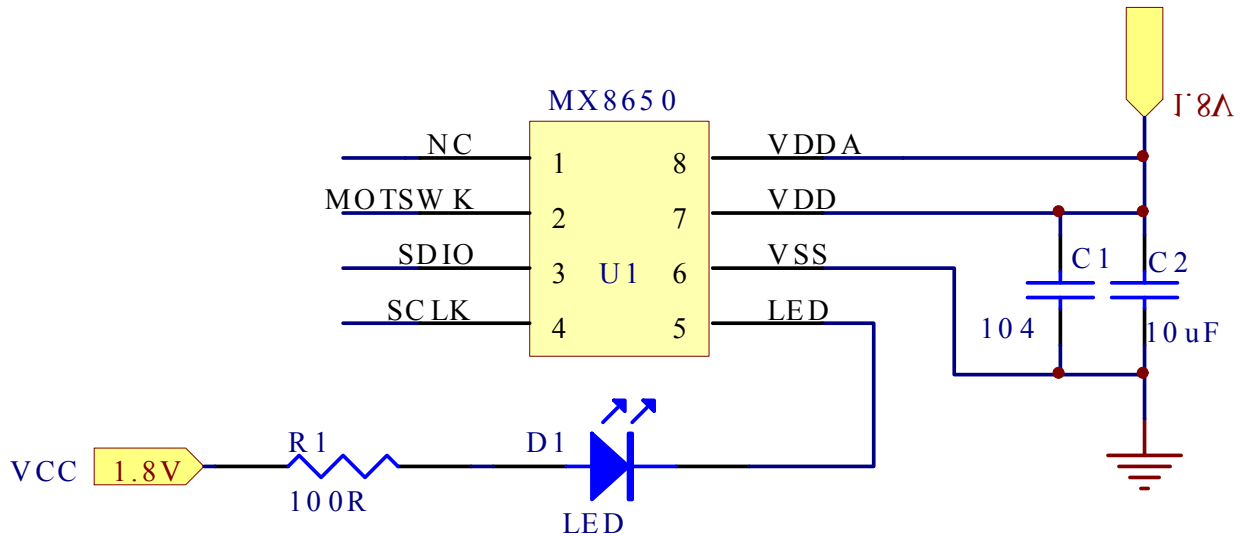

9. Application Circuit

9.1 Power 3.0V application circuit
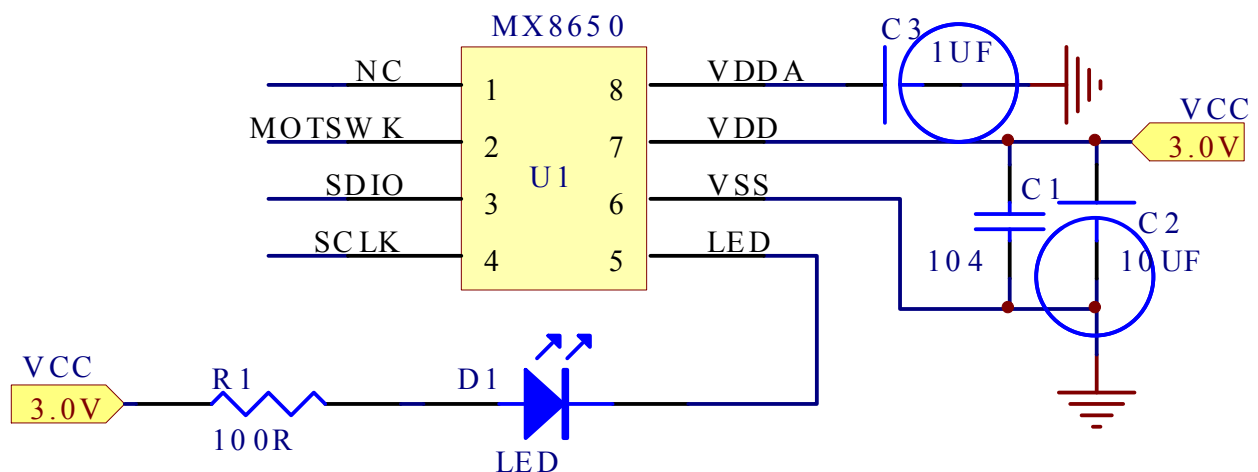
9.2 Power 1.8V application circuit

10. PCB Layout Guideline

The following guidelines apply to component placement and routing on the PCB. That will get an optimum EMC solution and tracking performance.

10.1 Key Components Placement Rules

1. Caps must have the short trace to IC pins7/8.

2. Recommend to have ground grid on the PCB periphery.

10.2 Recommended Value for R1

Radiometric intensity of red LED

Bin limits (mW/Sr at 20mA)

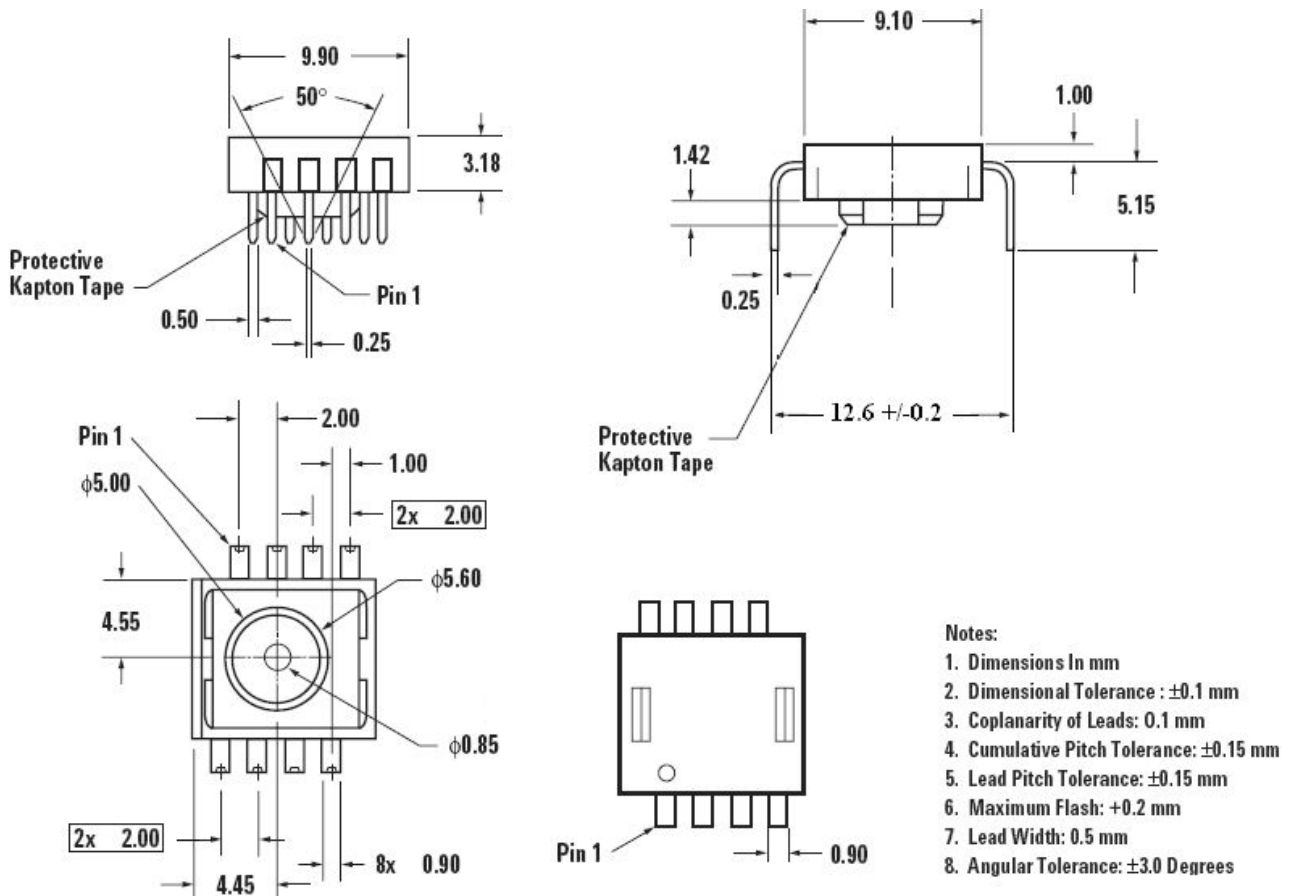| LED Bin Grade	Min	Typ	Max	Unit
Q	21.2	-	25.4	mW/Sr

Note: Tolerance for each bin will be +/- 15%

R1 Value (ohm), VDD = 2.7V

LED Bin Grade	Min	Typ	Max	Unit
Q	-	22	-	ohm

11. Package (Dimension In mm)

Notes:
1. Dimensions In mm
2. Dimensional Tolerance : ±0.1 mm
3. Coplanarity of Leads: 0.1 mm
4. Cumulative Pitch Tolerance: ±0.15 mm
5. Lead Pitch Tolerance: ±0.15 mm
6. Maximum Flash: +0.2 mm
7. Lead Width: 0.5 mm
8. Angular Tolerance: ±3.0 Degrees

12. Revision History

Version	Update date	Revised Content	Revised by	Confirmed by
V1.0	2015-1-22	Original	LiuXing	