PAW3602DH-NF CMOS LASER MOUSE SENSOR

General Description

PAW3602DH-NF is a CMOS laser mouse sensor with DSP integration chip that serves as a non-mechanical motion estimation engine for implementing a computer mouse.

Features

- Single power supply
- Precise laser motion estimation technology
- Complete 2-D motion sensor
- No mechanical parts
- Accurate motion estimation over most of surfaces
- High speed motion detection up to 28 inches/sec and acceleration can be up to 20g
- High resolution up to 1600cpi
- Power down pin and register setting for low power dissipation
- Power saving mode during times of no movement
- Serial Interface for programming and data transfer
- Low power for wireless application
- Eye safety protection circuit

Key Specification

Power Supply	4.25V ~ 5.5V (VDD) 3.0V~3.6V (VDDD, VDDA)
System Clock	27 MHz
Speed	28+ inches/sec
Acceleration	20g
Resolution	800/1600cpi
Frame Rate	6600 frames/sec
Operating Current (Sensor + LD)	17 mA @Mouse moving (Normal) 5 mA @Mouse not moving (Sleep) 200 uA @Shutdown mode
Package	Shrunk DIP20

Ordering Information

Order number	I/O	Resolution
PAW3602DH-NF	CMOS output	800/1600 cpi

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1. Pin Description

| Pin No.	Name	Type	Definition
1	LD_P	PWR	LD control
2	LD_N	PWR	LD control
3	OSCOUT	OUT	Resonator output
4	OSCIN	IN	Resonator input
5	VDDD	PWR	Chip digital power, 3.3V
6	VSSD	GND	Chip digital ground
7	VSSA	GND	Chip analog ground
8	VDD	PWR	Chip power, 5V power supply
9	VDDA	PWR	Chip analog power, 3.3V
10	LDRES	IN	Connect to resistor input
11	YA	I/O	LD BIST mode input / YA quadrature output
12	YB	I/O	LD BIST mode input / YB quadrature output
13	XA	I/O	LD BIST mode input / XA quadrature output
14	XB	OUT	LD BIST mode fail output / XB quadrature output
15	CPI	IN	CPI select pin ➢ Pull-high to VDD: 800 cpi (Default) ➢ Pull-down to GND: 1600 cpi
16	LDTEST	IN	LD test pin ➢ Floating (Chip internal pull-down): Disable LD test mode ➢ Pull-high (3.3V ONLY) : Enable LD test mode
17	NC	-	No connection
18	SCLK	IN	Serial interface clock
19	SDIO	I/O	Serial interface bi-direction data
20	PD	IN	Power down pin, active high
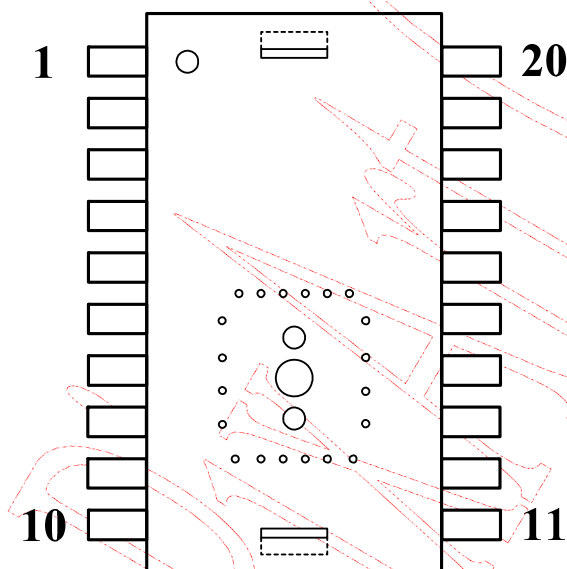
Figure 1. Top View Pinout
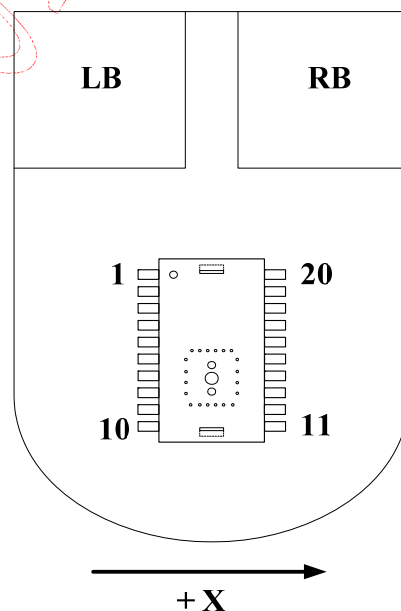
Figure 2. Top View of Mouse
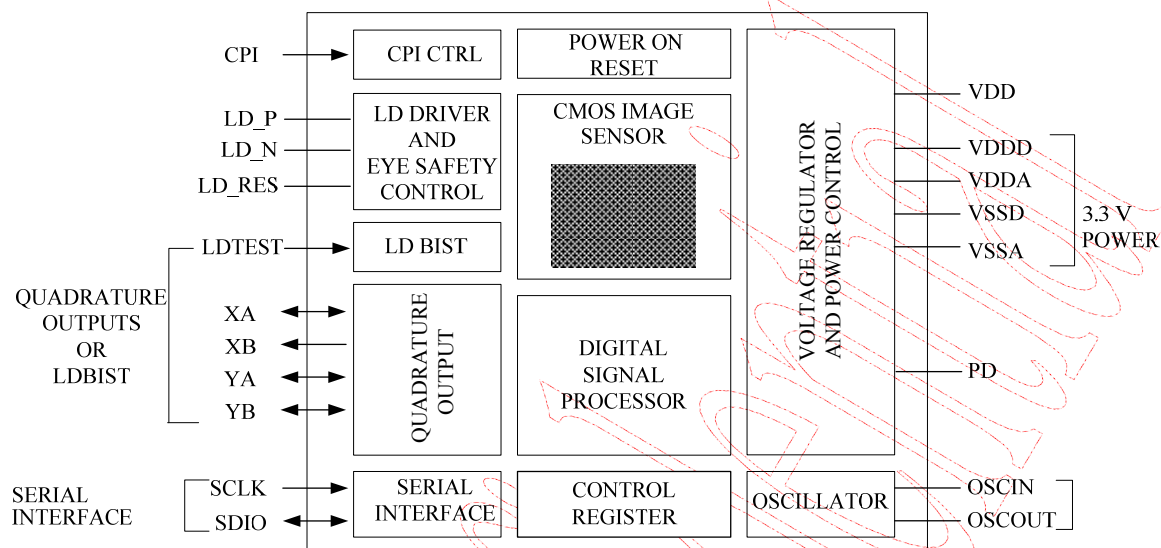
2. Block Diagram and Operation

Figure 3. Block Diagram

The PAW3602DH-NF is a high performance CMOS laser mouse sensor with DSP integration chip that serves as a non-mechanical motion estimation engine for implementing a computer mouse. It is based on new laser speckle navigation technology. In the laser mouse, it uses laser diode (LD), specially uses VCSEL (Vertical Cavity Surface Emitting Laser) as light source, where laser is one kind of coherent light. When this light illuminates on the working surface, the surface will reflect and diffuse the incident light and generates speckle pattern. The imaging sensor in the laser mouse chip detects the speckle pattern that generated from the working surface and determines the movement and direction. Since the speckle pattern can be generated on the most of the surface if this surface is not perfect smooth or transparent, the laser mouse can adapt on more surfaces as compared with traditional LED-based optical mouse.

The PAW3602DH-NF has an extra function, eye safety protection circuit. The embedded eye safety protection circuit will detect if LD_P pin is short to power, if LD_N pin is short to ground, or if LD_RES pin is short to ground to be a large LD power. And this will protect users from eye injured for large LD power. This mouse sensor is in a 20-pin optical package. The output format is two-channel quadrature (X and Y direction), which emulates encoder phototransistors. The current X and Y information are also available in registers accessed via a serial port. The word "mouse sensor," instead of PAW3602DH-NF, is used in the document.

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3. 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 firmware.

3.1 Registers

Address	Name	R/W	Default	Data Type
0x00	Product_ID	R	0x30	Eight bits [11:4] number with the product identifier
0x01	Product_ID	R	0x3N	Four bits [3:0] number with the product identifier Reserved [3:0] number is reserved for further
0x02	Motion_Status	R	-	Bit field
0x03	Delta_X	R	-	Eight bits 2's complement number
0x04	Delta_Y	R	-	Eight bits 2's complement number
0x05	Operation_Mode	R/W	-	Bit field
0x06	Configuration	R/W	-	Bit field
0x07	Image_Quality	R	-	Bit field

3.2 Register Descriptions

0x00	Product_ID						
Bit	7	6	5	4	3	2	1	0
Field	PID[11:4]							
Usage	The value in this register can't change. It can be used to verify that the serial communications link is OK.							

0x01	Product_ID						
Bit	7	6	5	4	3	2	1	0
Field	PID[3:0]				Reserved [3:0]			
Usage	The value in this register can't change. PID[3:0] can be used to verify that the serial communications link is OK. Reserved[3:0] is a value between 0x0 and 0xF, it can't be used to verify that the serial communication.							

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0x05	Operation_Mode							
Bit	7	6	5	4	3	2	1	0
Field	LDsht_enh	XY_enh	Reserved	Slp_enh	Slp2au	Slp2mu	Slp1mu	Wakeup
Usage	Register 0x05 allows the user to change the operation of the sensor. Shown below are the bits, their default values, and optional values. Operation_Mode[4:0] "0xxxx"=Disable sleep mode "10xxx"=Enable sleep mode[1] "11xxx"=Enable sleep mode[2] "1x100"=Force enter sleep2[3] "1x010"=Force enter sleep1[3] "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 0.45 sec not moving during normal mode, the chip will enter sleep1 mode, and keep on sleep1 mode until moving is detected or wakeup is asserted. 2. Enable sleep mode full function, that is 3 modes will be used, normal mode, sleep1 mode and sleep2 mode. After 0.45 sec not moving during normal mode, chip will enter sleep1 mode, and keep on sleep1 mode until moving is detected or wakeup is asserted. And after 27.3 sec not moving during sleep1 mode, the chip will enter sleep2 mode, and keep on sleep2 mode until detect moving or force wakeup to normal mode. 3. Only one of these three bits slp2mu_enh, slp1mu_enh, and wakeup can be set to 1 at the same time, others have to be set to 0. After a period of time, the bits, which was set to 1, will be reset to 0 by internal signal.								

Notes	**Field Name**	**Description**
	LDsht_enh	LD shutter enable / disable 0 = Disable **1 = Enable (Default)**
	XY_enh	XY quadrature output enable/disable 0 = Disable **1 = Enable (Default)**
	Reserved	Reserved for future. Must be written to zero
	Slp_enh	Sleep mode enable/disable 0 = Disable **1 = Enable (Default)**
	Slp2au	Automatic enter sleep2 mode enable/disable **0 = Disable (Default)** 1 = Enable
	Slp2mu	Manual enter sleep2 mode, set "1" will enter sleep2 and this bit will be reset to "0"
	Slp1mu	Manual enter sleep1 mode, set "1" will enter sleep2 and this bit will be reset to "0"
	Wakeup	Manual wake up from sleep mode, set "1" will enter wakeup and this bit will be reset to "0"

0x06	Configuration							
Bit	7	6	5	4	3	2	1	0
Field	Reset		Reserved[3:2]		PD		Reserved[1:0]	RES
Usage	The Configuration register allows the user to change the configuration of the sensor. Shown below are the bits, their default values, and optional values.							
Notes	**Field Name**		**Description**					
	Reset		Reset full chip **0 = Normal operation (Default)** 1 = Reset the fully chip					
	Reserved[3:2]		Reserved for future. Must be written to "00"					
	PD		Power down mode **0 = Normal operation (Default)** 1 = Power down mode					
	Reserved[1:0]		Reserved for future. Must be written to "00"					
	RES		Output resolution setting. In the power-on initial state, the resolution is depend on the CPI IO trap select pin. If MCU write the register, it is depend on the register value. 0 = 1600 1 = 800					

0x07	Image_Quality							
Bit	7	6	5	4	3	2	1	0
Field	Imgqa[7:0]							
Usage	Image Quality is a quality level of the sensor in the current frame. Report range 0~255. The minimum level for normally working is 45.							
Notes	**Field Name**		**Description**					
	Imgqa[7:0]		Image quality report range: 0(worst) ~ 255(best).					

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4. LD BIST (Built in Self Test) Mode

The mouse sensor can be performed the LD driver error detection function by manufactures to fit the LD power in eye safety rule. LD BIST mode is enabled by pull-high (3.3V ONLY) the LDTEST pin. Once LDTEST pin is pulled high, the XA, YB, YA pin are changed to be input pin and become the LD test mode input [XA ,YB ,YA] , XA is MSB and YA is LSB. At this moment, XB is also changed to LD test fail output.

Pin Name	Description
LDTEST	LD Test Mode disable/enable **0 = Disable (Default)** 1 = Enable
[XA , YB , YA]	" 000 " = Mode 0, Measure LD power, BIST if eye safety error detection function is fail in normal mode " 001 " = Mode 1, BIST if LD_P error detection function is fail " 010 " = Mode 2, BIST if LD_N error detection function is fail " 011 " = Mode 3, BIST if LDRES pin is short to GND
XB	0 = PASS 1 = FAIL

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5. Specifications

5.1 Absolute Maximum Ratings

Stresses above those listed under "Absolute Maximum Rating" may cause permanent damage to the device. These are stress ratings only. Functional operation of this device at these or any other conditions above those indicated in the operational sections of this specification is not implied and exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Symbol	Parameter	Min	Max	Unit	Notes
T_{STG}	Storage Temperature	-40	85	°C	
TA	Operating Temperature	-15	55	°C	
V_{DC}	DC Supply Voltage	-0.5	$V_{dd1} + 0.3$	V	
		-0.5	$V_{dd2} + 0.5$	V	
V_{IN}	DC Input Voltage	-0.5	V_{DC}	V	All I/O pin except LDTEST pin (LDTEST high is 3.3V only)
	Lead Solder Temp		260	°C	For 10 seconds, 1.6mm below seating plane.
ESD			2	kV	All pins, human body model MIL 883 Method 3015

5.2 Recommend Operating Condition

Symbol	Parameter	Min.	Typ.	Max.	Unit	Notes
T_A	Operating Temperature	0		40	°C	
V_{dd1}	Power Supply Voltage	3.0	3.3	3.6	V	VDDD, VDDA short
V_{dd2}		4.25	5	5.5		VDD
V_N	Supply Noise			80	mV	Peak to peak within 0 - 80 MHz
Z	Distance from Lens Reference Plane to Surface	2.3	2.4	2.5	mm	
R	Resolution		800	1600	CPI	
SCLK	Serial Port Clock Frequency			10	MHz	
F_{CLK}	Clock Frequency		27		MHz	
FR	Frame Rate		6600		frames/s	
S	Speed		28		inches/s	

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5.3 AC Operating Condition

Electrical Characteristics over recommended operating conditions. Typical values at 25 °C, V_{dd1} = 3.3 V, F_{CLK} = 27 MHz.

Symbol	Parameter	Min.	Typ.	Max.	Unit	Notes
t_{PDR}	PD Pulse Register			152	us	One frame time maximum after setting *PD_enh* bit in the *Configuration* register @6600frame/sec (refer to Figure 14).
t_{PD}	Power Down		500		us	From PD↑ (refer to Figure 10)
t_{PDW}	PD Pulse Width	700			us	Pulse width to reset the serial interface (refer to Figure 10).
t_{PUPD}	Power Up from PD↓	8		14.5	ms	From PD↓ to valid quad signals. After t_{PUPD}, all registers contain valid data from first image after PD↓. Note that an additional 90 frames for Auto-Exposure (AE) stabilization may be required if mouse movement occurred while PD was high (refer to Figure 10).
t_{PU}	Power Up from V_{DD}↑	8		14.5	ms	From V_{DD}↑ to valid quad signals. 500usec + 90 frames.
t_{HOLD}	SDIO Read Hold Time		3		us	Minimum hold time for valid data (refer to Figure 9).
t_{RESYNC}	Serial Interface RESYNC.	1			us	@6600 frame/sec (refer to Figure 11)
t_{SIWTT}	Serial Interface Watchdog Timer Timeout	1.7			ms	@6600 frame/sec (refer to Figure 11)
t_r , t_f	Rise and Fall Times: SDIO		35, 25		ns	C_L = 30 pF
t_r , t_f	Rise and Fall Times: XA, XB, YA, YB		30, 25		ns	C_L = 30 pF
t_r , t_f	Rise and Fall Times: I_{LD}		80, 30		ns	LD bin grade: P64; R1 = 13.2 Kohm

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5.4 DC Operating Condition

Electrical Characteristics over recommended operating conditions. Typical values at 25 °C, V_{dd1} = 3.3 V, F_{CLK} = 27 MHz.

Symbol	Parameter	Min.	Typ.	Max.	Unit	Notes
Type: PWR						
I_{DD}	Supply Current Mouse moving (Normal)		17		mA	Sensor + LD
I_{DD}	Supply Current Mouse not moving (sleep1)		5		mA	Sensor + LD
I_{DDPD}	Supply Current (Power Down)		200		uA	PD, SCLK, SDIO = high Sensor + LD
Type: SCLK, SDIO, PD						
V_{IH}	Input voltage HIGH	2.0				
V_{IL}	Input voltage LOW			0.7	V	
V_{OH}	Output voltage HIGH	2.4			V	@I_{OH} = 2mA (SDIO only)
V_{OL}	Output voltage LOW			0.6	V	@I_{OL} = 2mA (SDIO only)
Type: LDTEST						
V_{IH}	Input voltage HIGH	2.0			V	
V_{IL}	Input voltage LOW			0.7	V	
Type: XA, XB, YA, YB						
V_{OH}	Output voltage HIGH	2.4			V	@I_{OH} = 2mA
V_{OL}	Output voltage LOW			0.6	V	@I_{OL} = 2mA

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6. Quadrature Mode

The quadrature state of the mouse sensor tells mouse controller which direction the mouse is moving in. The output format is two channels quadrature (X and Y direction), which emulates encoder phototransistors. The DSP generates the Δx and Δy relative displacement values that are converted into two channel quadrature signals. The following diagrams show the timing for positive X motion, to the right or positive Y motion, up.
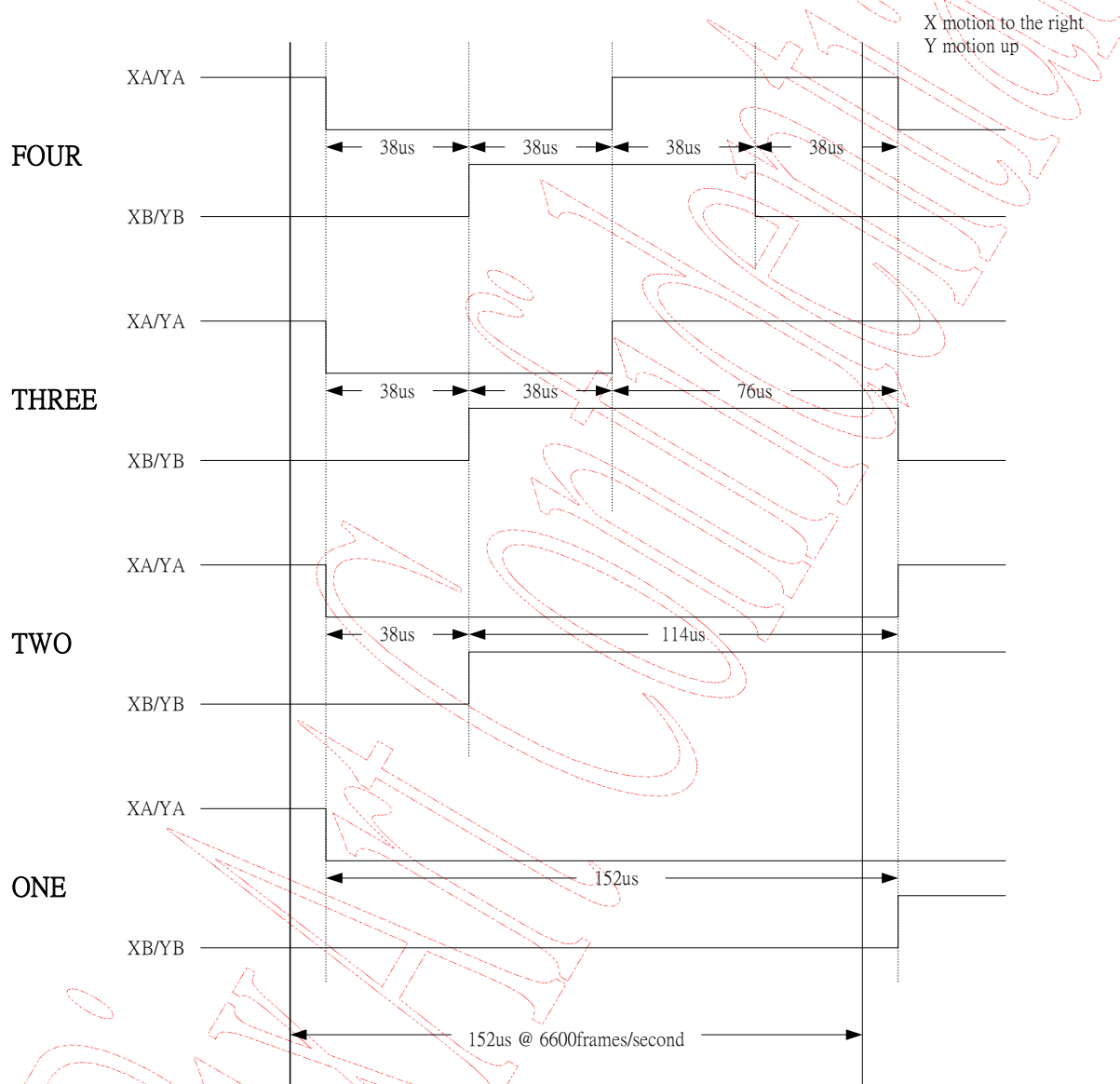
6.1 Quadrature Output Timing

Figure 4. Quadrature output timing

6.2 Quadrature Output State Machine

The following state machine shows the states of the quadrature output pins. The three things to note are that state 0 is entered after a power on reset. While the PD pin is asserted, the state machine is halted. Once PD is de-asserted, the state machine picks up from where it left off. During times of mouse no movement will entry power saving mode, until mouse was moved.

| STATE | X/Y output | |
	XA/YA	XB/YB
0	0	0
1	0	1
2	1	1
3	1	0

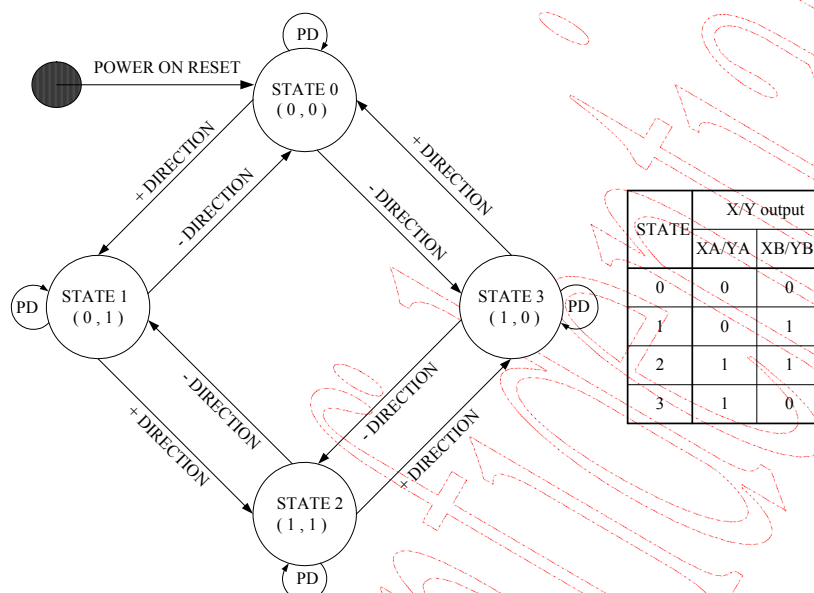**Figure 5. State machine**

6.3 Quadrature Output Waveform

The following diagrams show the waveform of the two channel quadrature outputs. If the X, Y is motionless, the (XA, XB), (YA, YB) will keep in final state. Each state change (ex. STATE2 → STATE3) is one count.
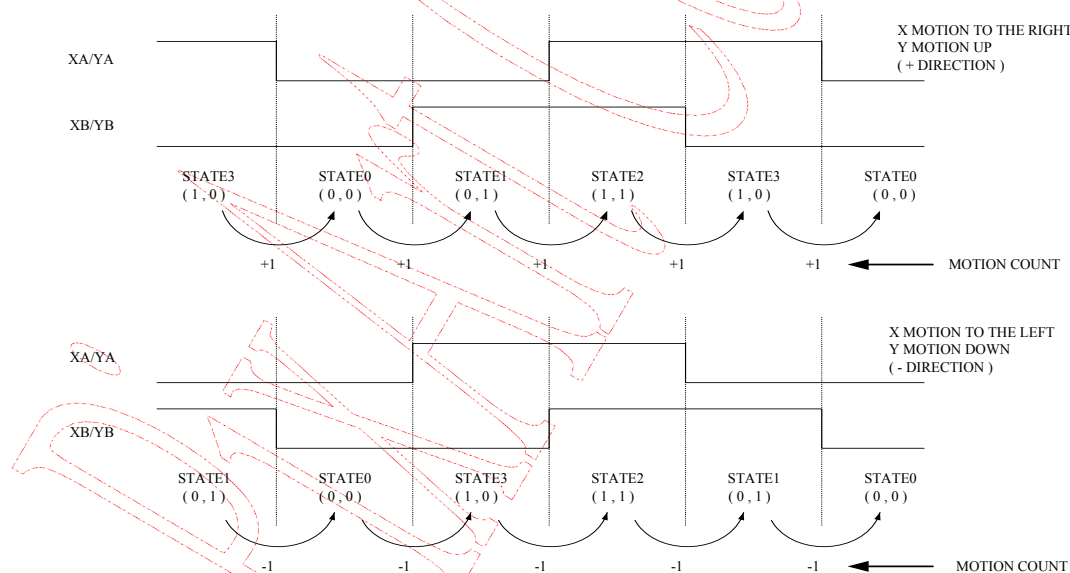

Figure 6. Quadrature output waveform

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7. Serial Interface

The synchronous serial port is used to set and read parameters in the mouse sensor, and can be used to read out the motion information instead of the quadrature data pins.

SCLK: The serial clock line. It is always generated by the host micro-controller.

SDIO: The serial data line used for write and read data.

PD: A third line is sometimes involved. PD (Power Down pin) is usually used to place the mouse sensor in a low power mode to meet USB suspend specification. PD can also be used to force re-synchronization between the micro-controller and the mouse sensor in case of an error.

7.1 Transmission Protocol

The transmission protocol is a two-wire link, half duplex protocol between the micro-controller and mouse sensor. All data changes on SDIO are initiated by the falling edge on SCLK. The host micro-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 bit7 as its MSB to indicate data direction. The second byte contains the data.
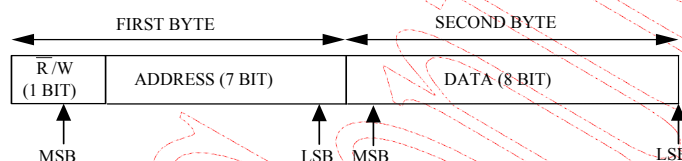
Figure 7. Transmission protocol

7.1.1 Write Operation

A write operation, which means that data is going from the micro-controller to the mouse sensor, is always initiated by the micro-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 micro-controller changes SDIO on falling edges of SCLK. The mouse sensor reads SDIO on rising edges of SCLK.

Figure 8. Write operation

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7.1.2 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 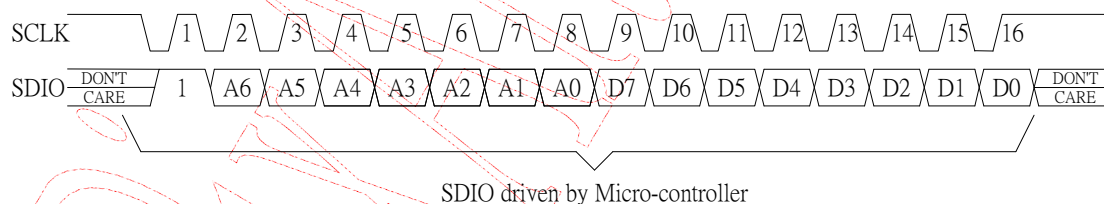to indicate data direction. The second byte contains the data and is driven by the mouse sensor. The transfer is synchronized by SCLK. SDIO is changed on falling edges of SCLK and read on every rising edge of SCLK. The mouse controller must go to a high Z state after the last address data bit. The mouse sensor will go to the high Z state after the last data bit.
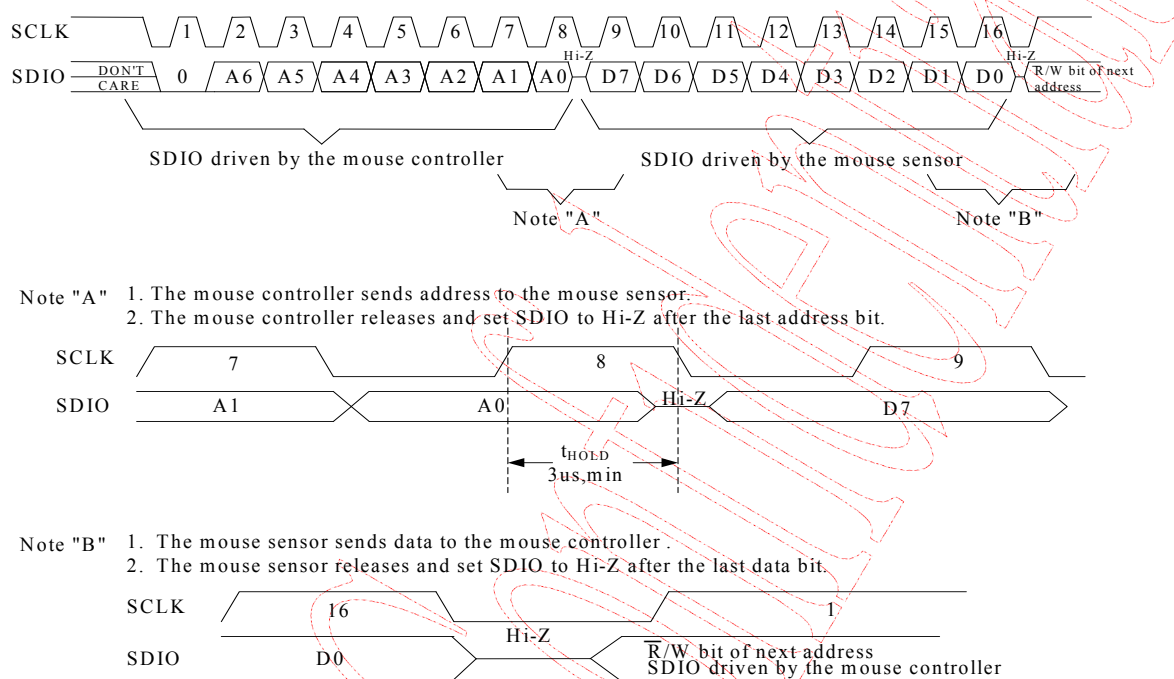

Figure 9. Read Operation

7.2 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. There are two different ways for re-synchronous serial interface.

● Re-synchronous serial interface using PD pin (see Section 7.2.1)

● Re-synchronous serial interface using watchdog timer timeout (see Section 7.2.2)

Note that "watchdog timer timeout" (see Section 7.2.2) 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.

● Power On Problem - The problem occurs if the mouse sensor powers up before the mouse controller sets the SCLK and SDIO lines to be output. The mouse sensor and the mouse controller might get out of synchronization due to power on problem. An easy way to solve this is to raise PD pin (see Section 7.2.1) or use watchdog timer timeout (see Section 7.2.2) for re-synchronous serial interface.

● ESD Events - The mouse sensor and the mouse controller might get out of synchronization due to ESD events. An easy way to solve this is to raise PD pin (see Section 7.2.1) or use watchdog timer timeout (see Section 7.2.2) for re-synchronous serial interface.

● USB suspend - Termination of a transmission by the mouse controller may be required sometimes (for example, due to a USB suspend interrupt during a read operation). An easy way to solve this is to raise PD pin (see Section 7.2.1) or use watchdog timer timeout (see Section 7.2.2) for re-synchronous serial interface.

7.2.1 Re-Synchronous Serial Interface Using PD Pin

The mouse controller raises PD line to reach re-synchronous serial interface after an incorrect read. The mouse sensor will reset the serial port but will not reset the registers and be prepared for the beginning of a new transmission. Note that using "PD pin" to reach re-synchronous is quicker than using "watchdog timer timeout".
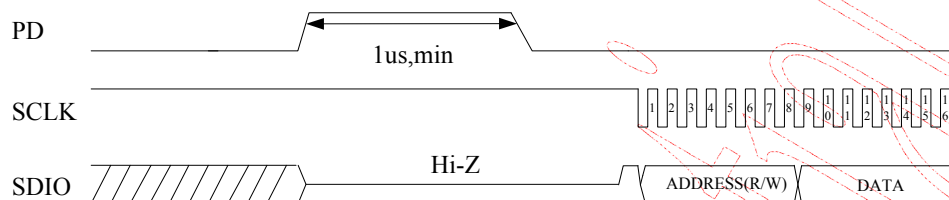
Figure 10. Re-synchronous Serial Interface Using PD Pin

7.2.2 Re-Synchronous Serial Interface Using Watchdog Timer Timeout

The mouse controller can toggle the SCLK line from high to low to high and wait at least t_{SIWTT} to reach re-synchronous serial interface after an incorrect read. The mouse sensor will reset the serial port but will not reset the registers and be prepared for the beginning of a new transmission.
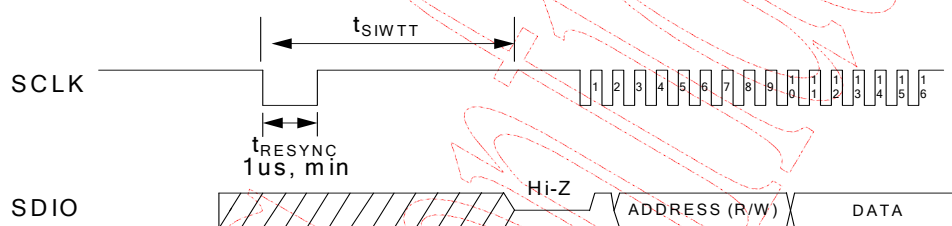
Figure 11. Re-synchronous Serial Interface Using Watchdog Timer Timeout

7.3 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 micro-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 release SDIO of the rising SCLK edge after the last data bit. The micro-controller can begin driving SDIO any time after that. In order to maintain low power consumption in normal operation or when the PD pin is pulled high, the micro-controller should not leave SDIO floating until the next transmission (although that will not cause any communication difficulties).

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7.4 Power Down Mode

There are two different ways to entry power down mode, using the PD line or register setting.

7.4.1 PD Line Power Down Mode

To place the mouse sensor in a low power mode to meet USB suspend specification, raise the PD line at least 700us. Then PD line can stay high, with the mouse sensor in the shutdown state, or the PD pin can be lowered, returning the mouse sensor to normal operation.
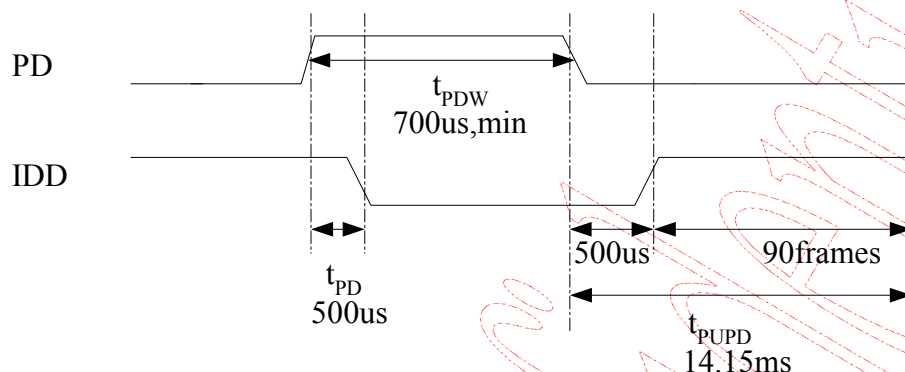
Figure 12. Power down minimum pulse width
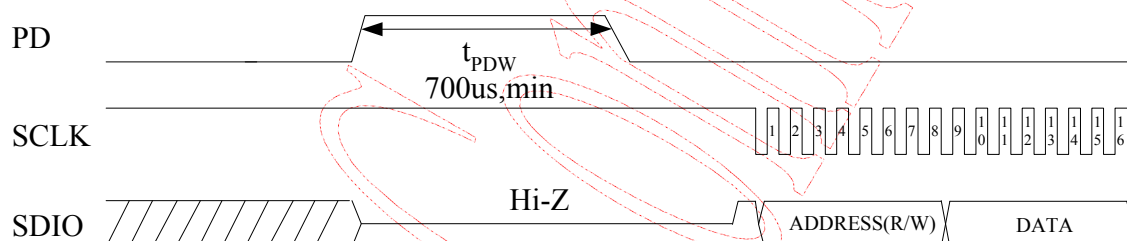
Figure 13. PD line power down mode

7.4.2 Register Power Down Mode

The mouse sensor can be placed in a power down mode by setting *PD_enh* bit in the *configuration* register via a serial port write operation. After setting the *configuration* register, wait at least 1frame times. To get the chip out of the power down mode, clear *PD_enh* bit in the *configuration* register via a serial port write operation. In the power down mode, the serial interface watchdog timer is not available (see Section 7.2.2). 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.
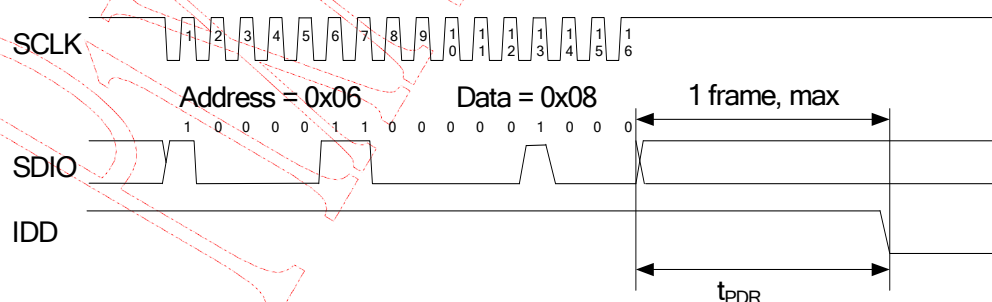
Figure 14. Power-down Configuration Register Writing Operation

7.4.3 Register Power Down Mode

The mouse sensor can be placed in a power-down mode by setting bit 3 in the configuration register via a serial port write operation. After setting the configuration register, wait at least 1frame times. To get the chip out of the power-down mode, clear bit 3 in the configuration register via a serial port write operation. In 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 power down mode, wait about 3ms before the micro-controller is able to issue any write/read operation to the mouse sensor.
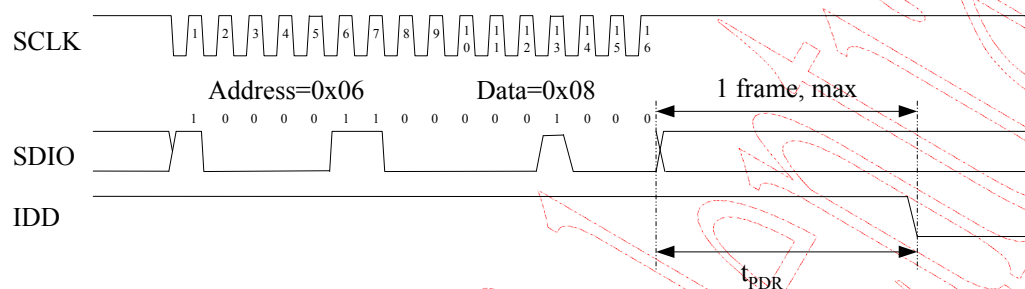
Figure 15. Power-down configuration register writing operation

7.5 Error Detection

1. The micro-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 micro-controller can verify the synchronization of the serial port by periodically reading the product ID register.

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8. Referencing Application Circuit

8.1 Typical Application using Serial Interface for Full Speed USB Wire Mouse

MA6721 DIR SETTING

DIR1	SENSOR DIRECTION
OPEN	0 DEGREE
ON	90 DEGREE

MA6721 KEY SETTING

KEY1	KEY SETTING
ON	3 Key
OPEN	5 Key

MA6721 PCB LAYOUT NOTE
Please placement the C1, C2 near the PIN17(VDD).

PAW3602 CPI SETTING

CPI2	CPI1	Resolution
OPEN	0R	800 CPI
0R	OPEN	1600 CPI

PAN3602 RESERVED FUNCTION
*TP1, *TP2, *TP3, *TP4, *TP5
=> Please reserved for PAW3602 eye safety test
*C12, *C13
=> Please reserved for future use

Note:The suggested resistor tolerance
is 1% precise resistor for R1

Figure 16. Application Circuit Using Serial Interface with MosArt MA6721 (Full Speed USB)

8.2 Typical Application using Serial Interface for Low Speed USB Wire Mouse
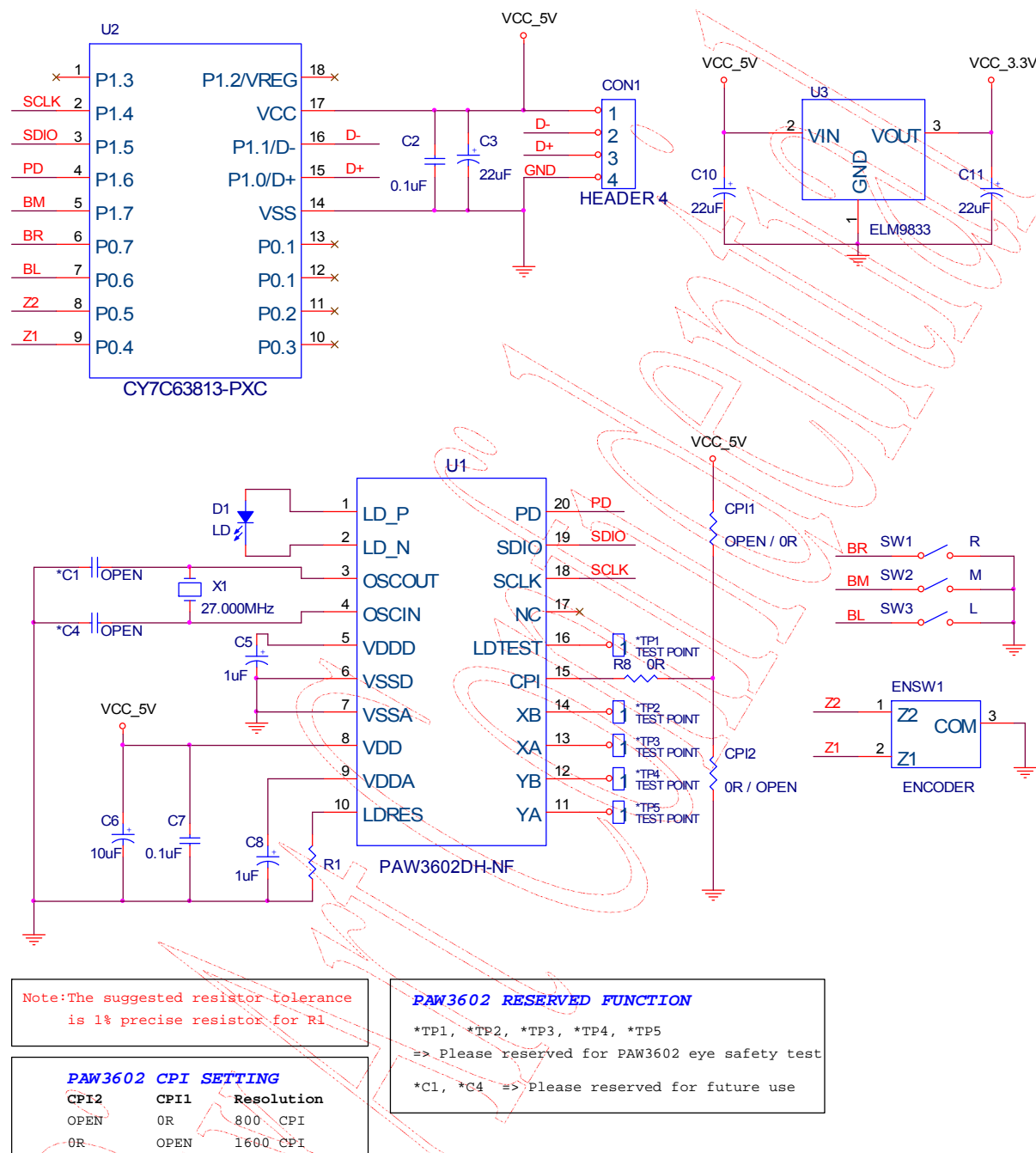
Figure 17. Application circuit using serial interface with Cypress CY7C63813 (Low Speed USB)

Note:The suggested resistor tolerance is 1% precise resistor for R1

PAW3602 CPI SETTING

CPI2	CPI1	Resolution
OPEN	0R	800 CPI
0R	OPEN	1600 CPI

PAW3602 RESERVED FUNCTION

*TP1, *TP2, *TP3, *TP4, *TP5
=> Please reserved for PAW3602 eye safety test

*C1, *C4 => Please reserved for future use

8.3 Typical Application for Wireless Laser Mouse, Power Source from Pin 5 & 9
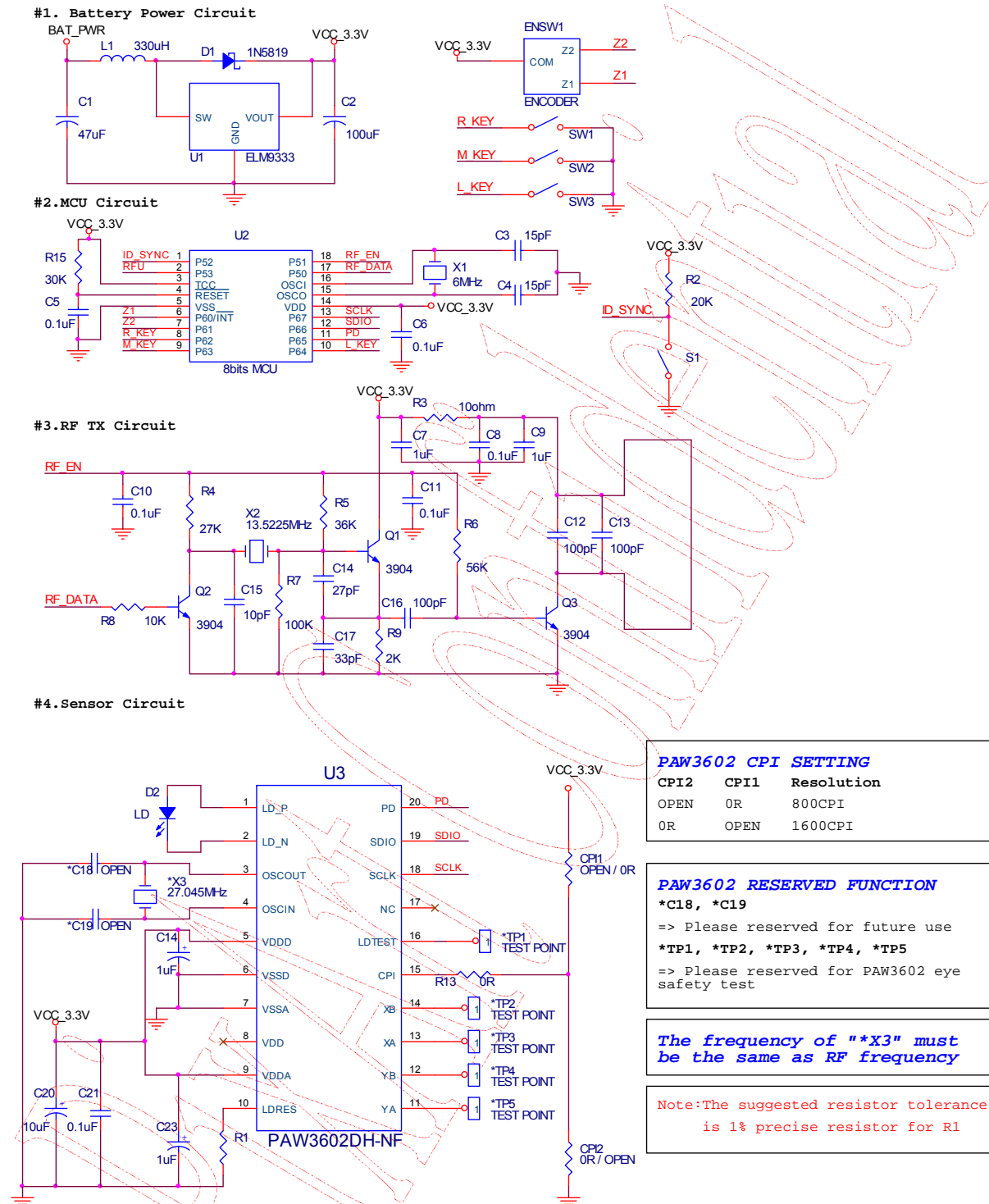
Figure 18. RF application circuit using pin 5 & 9 for power supply source

The figure contains the following labeled sub-circuits and notes:

#1. Battery Power Circuit

#2. MCU Circuit

#3. RF TX Circuit

#4. Sensor Circuit

PAW3602 CPI SETTING

CPI2	CPI1	Resolution
OPEN	0R	800CPI
0R	OPEN	1600CPI

PAW3602 RESERVED FUNCTION
*C18, *C19
=> Please reserved for future use
*TP1, *TP2, *TP3, *TP4, *TP5
=> Please reserved for PAW3602 eye safety test

*The frequency of "*X3" must be the same as RF frequency*

Note: The suggested resistor tolerance is 1% precise resistor for R1

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8.4 Typical Application for RF Receiver
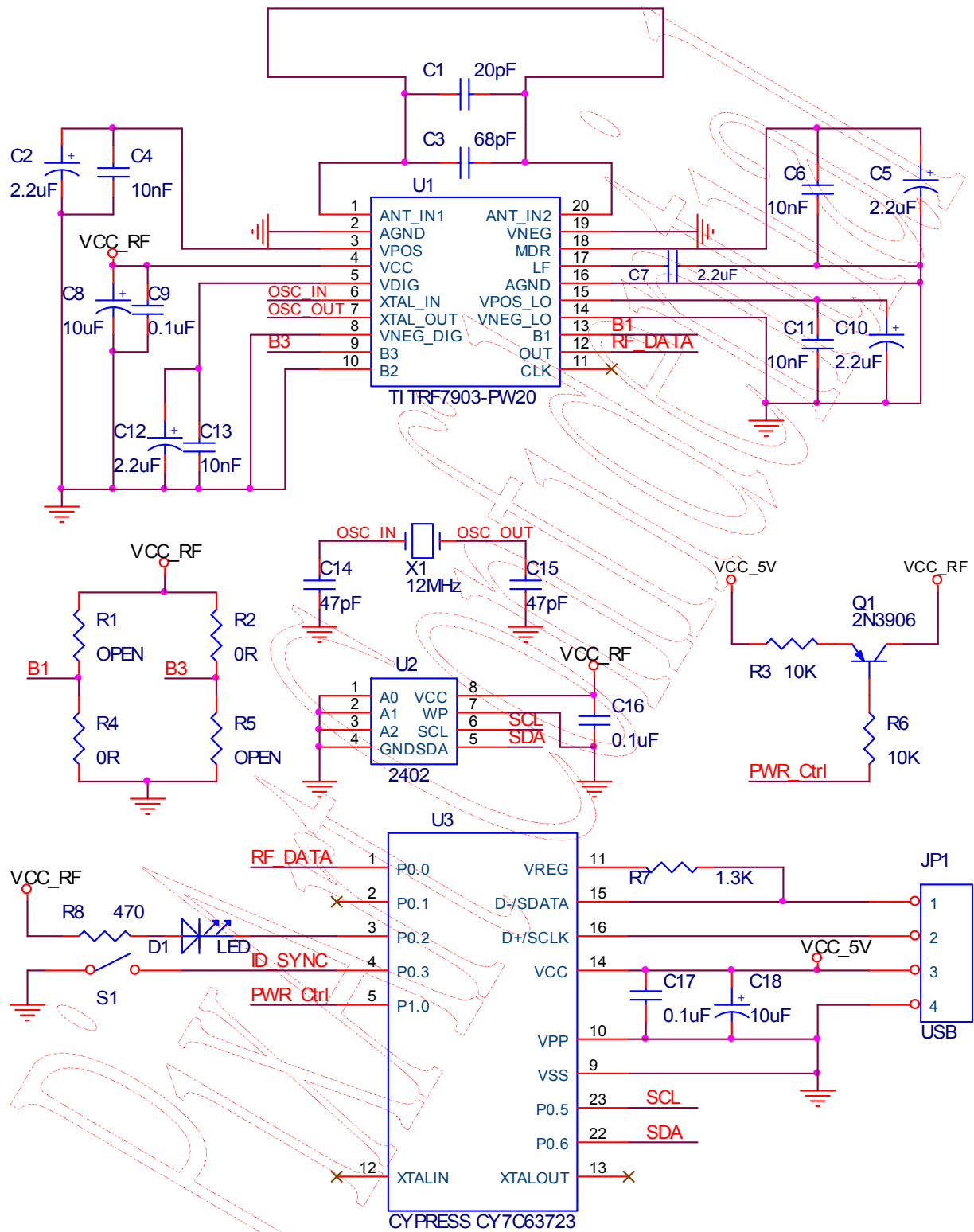
Figure 19. Application circuit with Cypress CY7C63813 (Low speed USB)

9. PCB Layout Consideration

1. Caps for pins 5, 8, 9 **MUST** have trace lengths **LESS** than **5mm**.
2. The trace lengths of OSCOUT, OSCIN must less than **6mm**.

10. Z and 2D Assembly

+X

+Y

-- Top View --

BASE PLATE

Unit: mm

LD

Lens/Package Alignment Line

Lens

10.65±0.17

7.45±0.14

SURFACE IS 0 REF.

PCB

SENSOR

BASE PLATE ALIGNMENT POST

-- Side View --
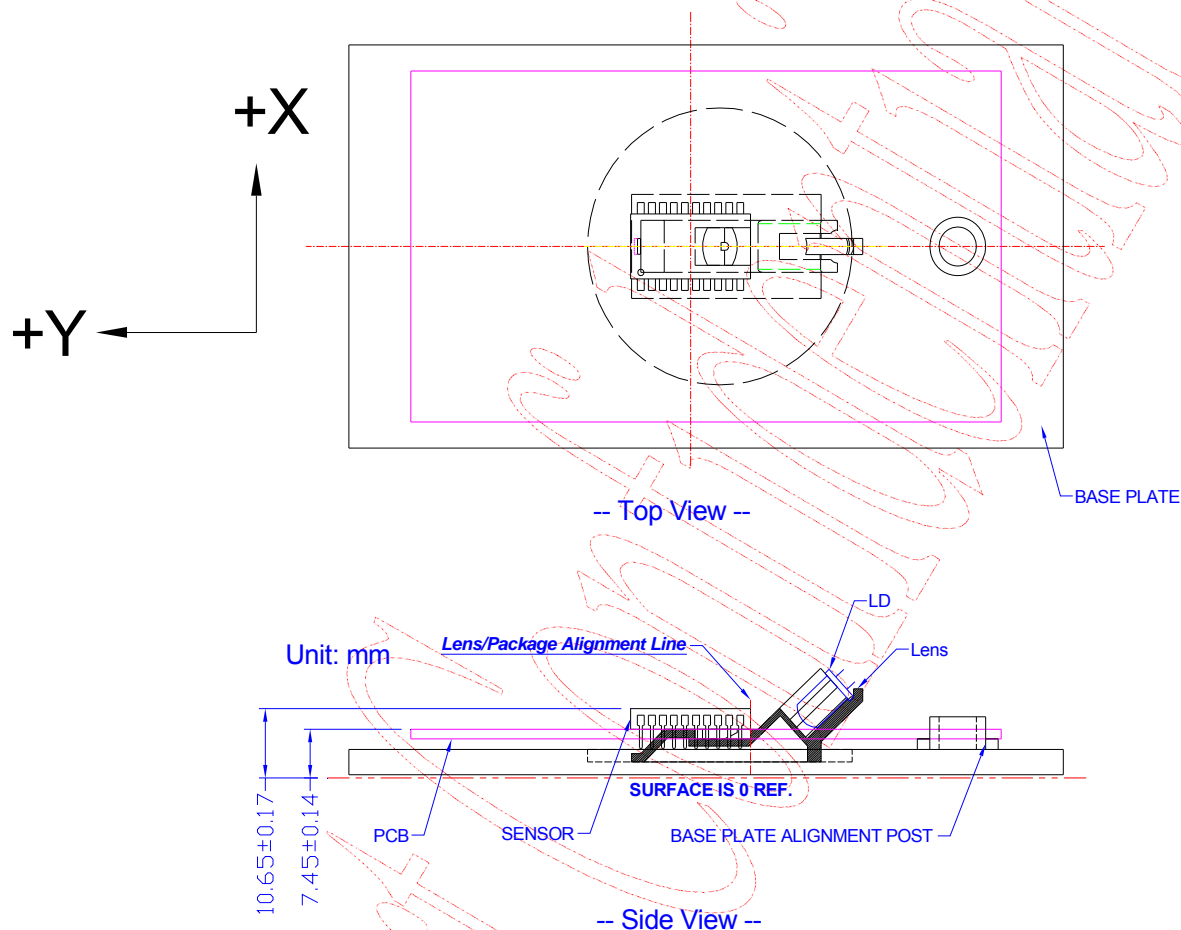
Figure 20. 2D Assembly

11. Package Information

11.1 Package Outline Drawing

SYMBOL	DIMENSION (MM)			DIMENSION (MIL)		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	4.430	4.630	4.830	174	182	190
A1	1.350	1.450	1.550	53	57	61
A2	3.080	3.180	3.280	121	125	129
A3	0.920	1.020	1.120	36	41	44
b	0.357	0.457	0.508	14	18	20
b1	0.889	1.016	1.143	35	40	45
c	0.203	0.254	0.279	8	10	11
D	19.20	19.30	19.40	756	760	764
D1	0.500	0.600	0.700	20	24	28
E	10.060	10.160	10.260	396	400	404
E1	14.020	14.220	14.420	552	560	568
E2	9.880	9.980	10.080	389	393	397
F	15.090	15.190	15.290	594	598	602
G	4.000	4.100	4.200	157	161	165
H	4.980	5.080	5.180	196	200	204
e	1.778 BASIC			70 BASIC		
L	4.980	5.080	5.180	196	200	204
Θ			12°			12°

Figure 21. Package outline drawing

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PAW3602DH-NF   **CMOS Laser Mouse Sensor**

11.2 Base Plate Modeling Dimension
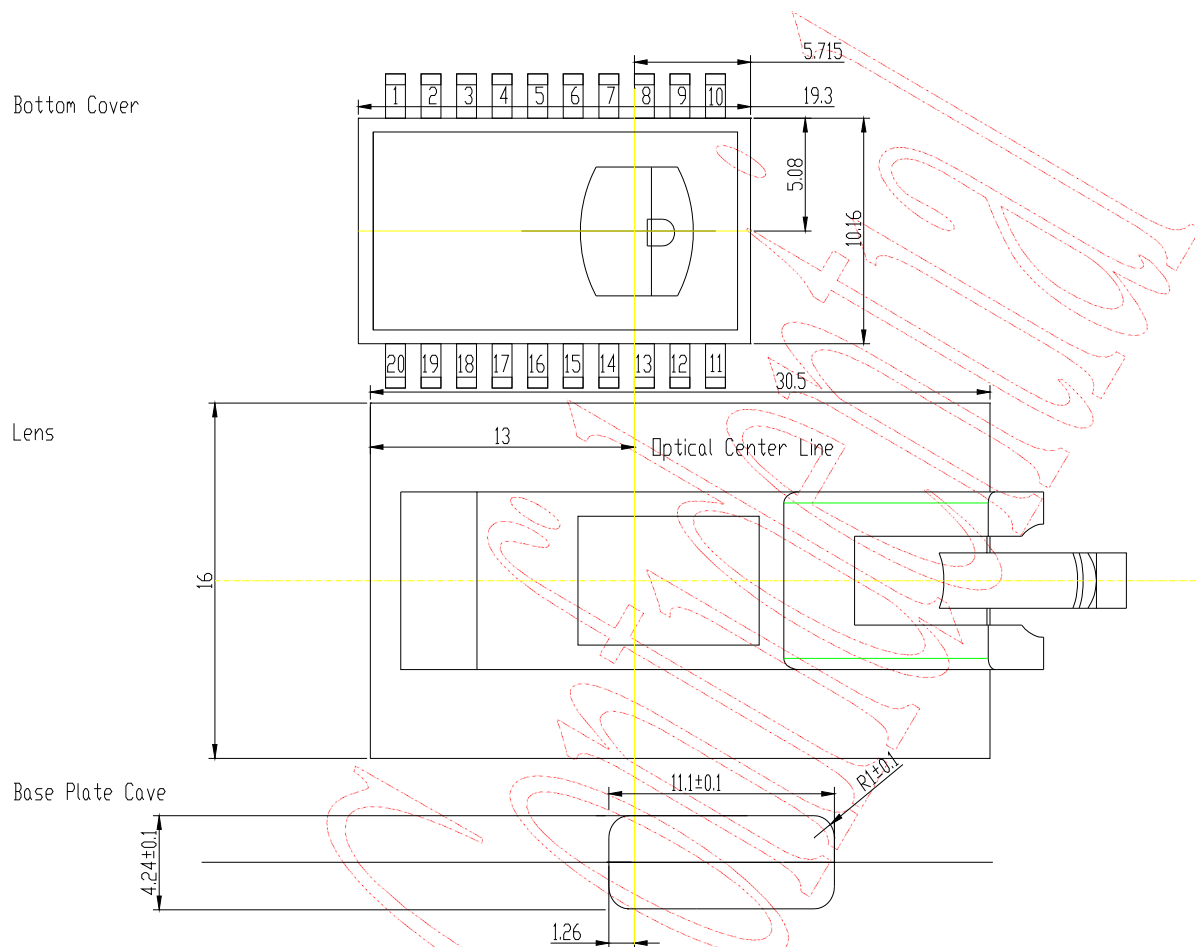
Figure 22. Base plate molding dimension

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11.3 Recommended PCB Mechanical Cutouts and Spacing

All Dimensions : mm / inch

Figure 23. Recommended PCB mechanical cutouts and spacing

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6. Update History

Version	Update	Date
V1.0	Creation, Preliminary 1st version	06/28/2007

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Vertical Cavity Surface Emitting Laser

(VCSEL)

Components Specification

Distribution

Internal Only ☐

External All ☐

External Restricted ☐ If restricted, specify restricted to whom:

_____

Document No.: **PNDR-00004**

Revision: **Rev 2.50**

Date: **2007/06/15**

Revision History

Revision	Author	Date	Description
1.0	M.H.Chien	2006/06/14	Initial version
1.5	Chadwick	2007/01/18	Add VDD=2.7V and delete VDD=5.0V constraint resistor table
2.0	Chadwick	2007/05/04	Revise resistor table for higher CW radiant power 300uW ~550uW on Mouse operation ; Delete P32/ P64/ P68/ P72/ P76/ P80 six Grades
2.5	Chadwick	2007/06/15	Note PAN/PAW 3601DH-NF for constraint resistor table and add new constraint resistor table for PAN/PAW 3602DH-NF

PNDR-00004

850nm Epoxy molded VCSEL for Laser Mouse

FEATURES

● Epoxy Molded with round emission surface.

● Small divergence angle.

ELECTRO-OPTICAL CHARACTERISTICS:

PARAMETERS	SYMBOL	MIN	TYP	MAX	UNIT	TEST CONDITIONS
Output Power	P_o		0.475	0.7	mW	$I = I_F$ [(1)]
Wavelength	λ_P	830	850	860	nm	I_F = 6 mA
Forward Voltage	V_F	1.6	1.75	1.9	V	I_F = 6 mA
Series Resistance	R_S		40	60	Ω	I_F = 6 mA
Breakdown voltage	V_{BD}	7	14		V	Ir = 10uA
Beam Divergence($1/e^2$)	θ		8		degree	I_F = 6 mA

Notes :(1) Binning

APPIY TO PAN3602DH-NF/ PAW3602DH-NF

Optical power at each of following nominal bin operating current and constrained resistor

Bin grade	LD current (mA)	Single Constrain resistor :R(Ω)	Bin grade	LD current (mA)	Single Constrain resistor :R(Ω)
P36	3.6	18K	P50	5.0	13K
P40	4.0	15K	P52	5.2	13K
P42	4.2	15K	P54	5.4	12K
P44	4.4	15K	P56	5.6	12K
P46	4.6	15K	P58	5.8	12K
P48	4.8	13K	P60	6.0	10K

Warning! For Single constrain resistor(R) , please using the recommend value, if resistor value is less than recommend value, there will be eye safety issue.

Note: The suggested resistor tolerance is 1% precise resistor for constrained resistor R.

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ABSOLUTE MAXIMUM RATINGS:

PARAMETERS	MIN	MAX	UNIT	Condition
Storage Temperature	-30	85	°C	
Operating Temperature	-10	60	°C	
Continuous Forward Current		12	mA	
Continuous Reverse Voltage		7	V	
Lead Solder Temperature		260	°C	10 seconds

Fig. 1 Typical Optical Characteristics   Fig. 2 Typical Electrical Characteristics
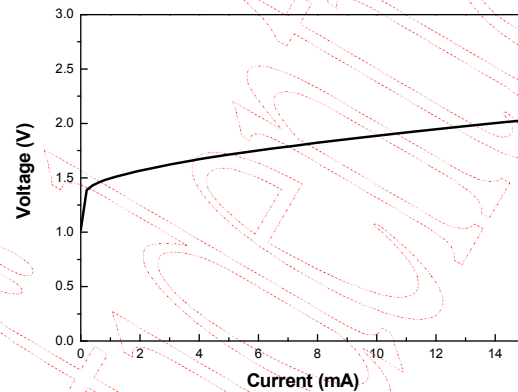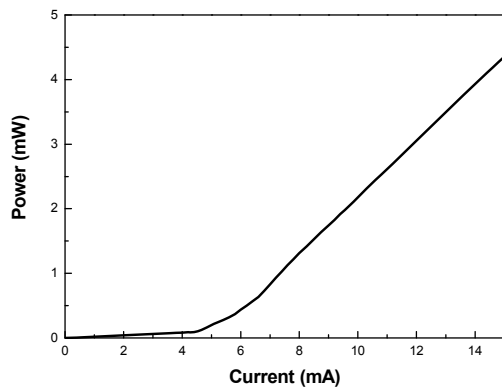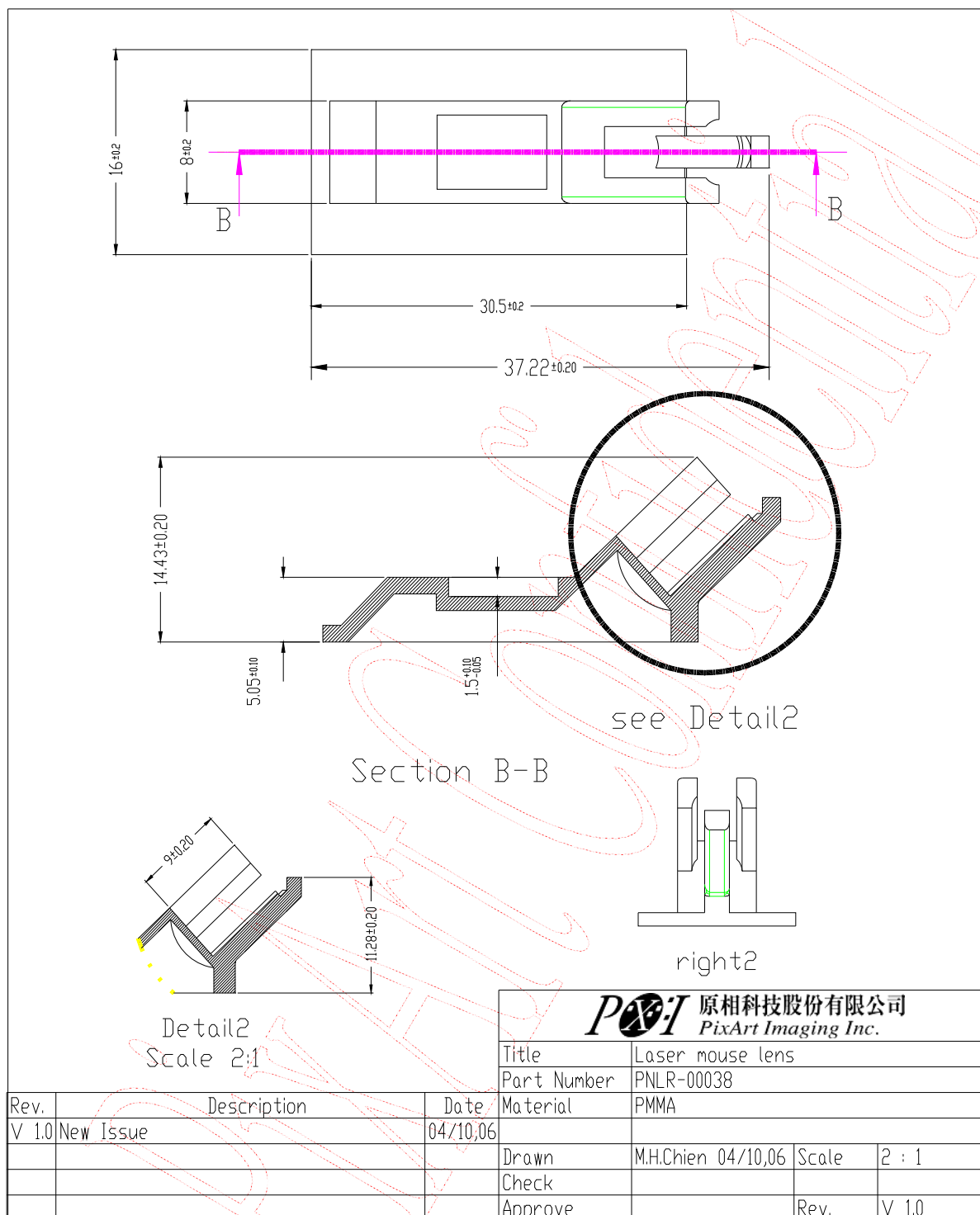

OUTLINE DIMENSIONS:
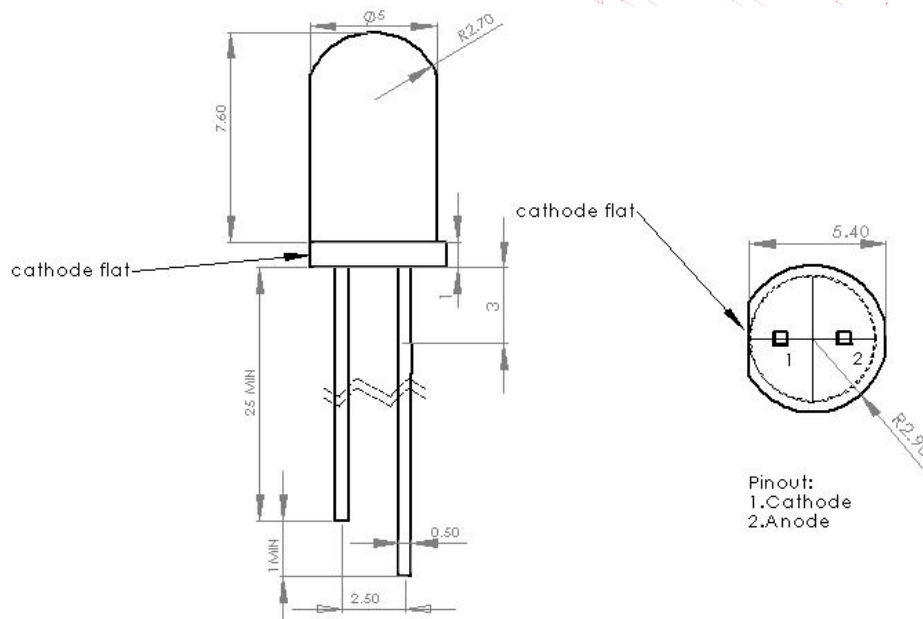
Note: Unit is millimeters and Tolerance is ± 0.2 mm unless otherwise notes

WARNING:

The VCSEL is a class IIIa laser in the safety standard ANSI Z136.1 and should be treated as a potential eye hazard.

PNLR-00038 Lens Dimensions

PixArt Imaging Inc. 原相科技股份有限公司			
Title	Laser mouse lens		
Part Number	PNLR-00038		
Material	PMMA		
Rev.	Description	Date	
V 1.0	New Issue	04/10,06	
		Drawn	M.H.Chien 04/10,06	Scale	2 : 1
		Check			
		Approve		Rev.	V 1.0

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