

SPECIFICATION

MX8620

**Optical Sensor
Version1.0**

TABLE OF CONTENTS

| | |
|---|-----------|
| 1. GENERAL DESCRIPTION..... | 3 |
| 2. FEATURES..... | 3 |
| 3. PINOUT OF MX8620..... | 3 |
| 4. PRODUCT OUTLINE..... | 4 |
| 5. FUNCTION DESCRIPTION..... | 4 |
| 5.1 REGISTER..... | 4 |
| 5.2 SERIAL PORT TIMING..... | 6 |
| 5.3 POWER-DOWN MODE(PD) AND TIMING..... | 9 |
| 6. ELECTRICAL CHARACTERISTICS..... | 10 |
| 6.1 ABSOLUTE MAXIMUM RATINGS..... | 10 |
| 6.2 RECOMMENDED OPERATING CONDITIONS..... | 11 |
| 6.3 AC ELECTRICAL SPECIFICATIONS..... | 12 |
| 6.4 DC ELECTRICAL SPECIFICATIONS..... | 12 |
| 7. APPLICATION CIRCUIT..... | 13 |

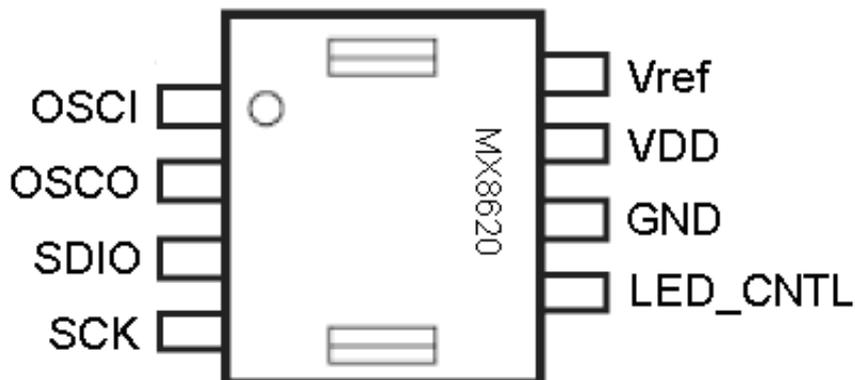
1. GENERAL DESCRIPTION

The MX8620 is a CMOS process optical mouse sensor. The output format is a two wire serial port. The current X and Y information are available in registers accessed via the serial port. Resolution is 800 counts per inch (dpi).

2. FEATURES

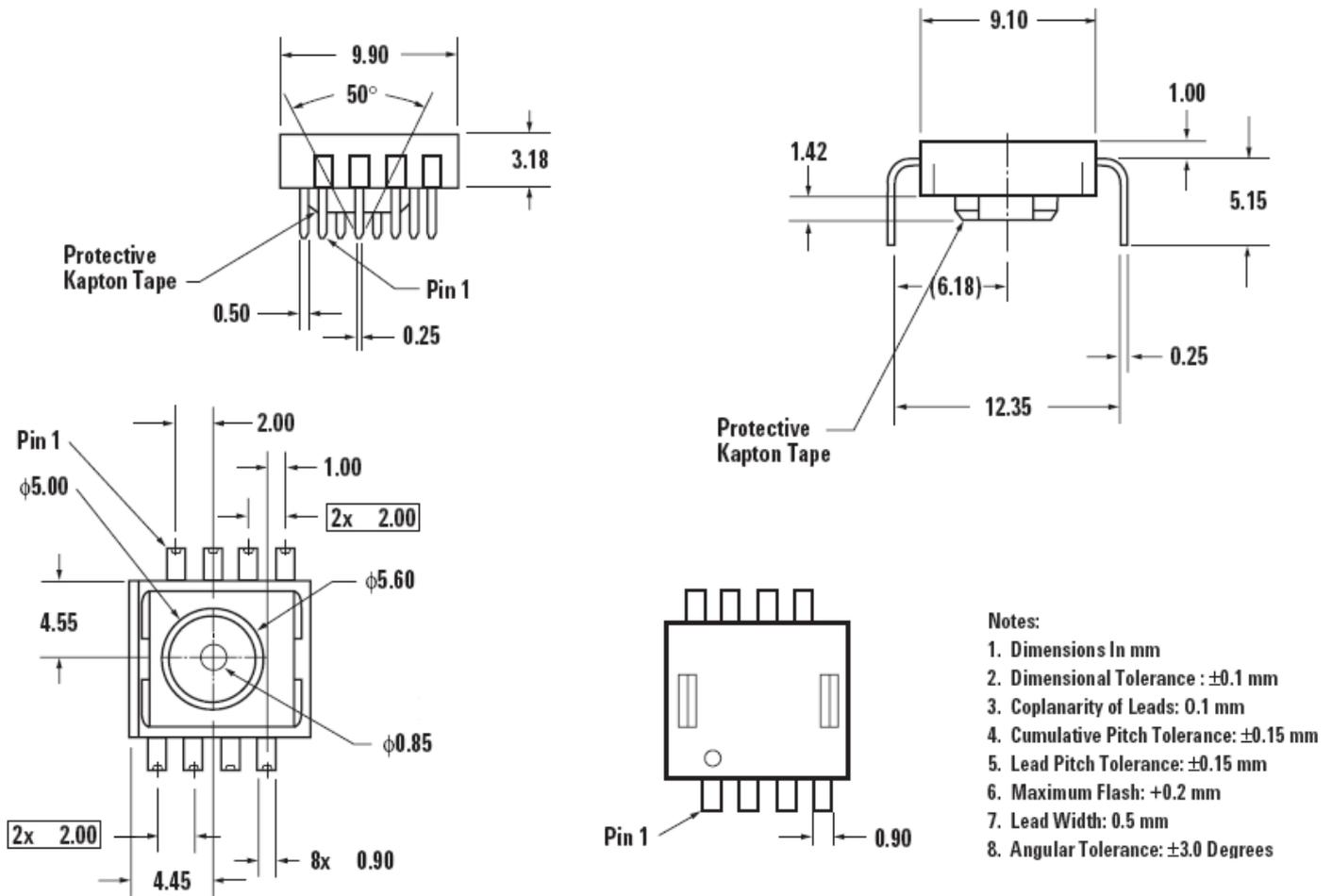
- Operating voltage 4.5V~5.5V
- Complete 2-D motion sensor
- 800 dpi resolution.
- Serial port registers
- 8-pin staggered dual inline package (DIP)

3. PINOUT OF MX8620



| Symbol | I/O | Function Description |
|----------|-----|------------------------|
| OSCI | I | Oscillator input |
| OSCO | O | Oscillator output |
| SDIO | I/O | Serial data port |
| SCK | I | Serial clock port |
| LED_CNTL | O | Digital shutter output |
| GND | | System ground |
| VDD | | 5V DC input |
| Vref | O | 3.3 V regulator output |

4. PRODUCT OUTLINE



5. FUNCTION DESCRIPTION

5.1 REGISTER

| Register | Address | Notes |
|---------------|---------|--|
| Configuration | 0x00 | bit[7]=1' b1, reset system; bit[7]=1' b0, No effect. |
| Status | 0x01 | bit[7:5] is Product ID(000 for MX8620). |
| Delta_Y | 0x02 | Y Movement |
| Delta_X | 0x03 | X Movement |
| SQUAL | 0x04 | Measure of the number of features visible by sensor |

Configuration

Access: Read/Write

Address: 0X00

Reset Value: 0X00

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|----------|----------|----------|----------|----------|-------|
| RST | PD | Reserved | Reserved | Reserved | Reserved | Reserved | FAWKM |

RST: Reset

1 - Reset system

0 - no effect

PD: Power down

1 - Power down all analog circuitry

0 - Normal operation

FAWKM: Force Awake Mode

1 - always awake

0 - Normal,fall asleep after one second of no movement

Status

Access: Read

Address: 0X01

Reset Value: 0X01

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|----------|----------|----------|----------|------|
| ID2 | ID1 | ID0 | Reserved | Reserved | Reserved | Reserved | AWK |

ID2—ID0: Product ID, 000 for MX8620

AWK: Mouse State

1 - awake

0 - Asleep

Delta_Y

Access: Read

Address: 0X02

Reset Value: 0X00

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

Delta_X

Access: Read

Address: 0X03

Reset Value: 0X00

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

SQUAL

Access: Read

Address: 0X04

Reset Value: 0X00

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
| SQ7 | SQ6 | SQ5 | SQ4 | SQ3 | SQ2 | SQ1 | SQ0 |

5.2 SERIAL PORT TIMING

The synchronous serial port is used to set and read parameters in the MX8620, and also to read out the motion information. The port is a two wire, half duplex port. The host microcontroller always initiates communication; the MX8620 never initiates data transfers.

SCK The serial port clock. It is always generated by the master (the microcontroller).

SDIO The data line.

Write Operation

Write operations, where data is going from the microcontroller to the MX8620, is always initiated by the microcontroller 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 SCK. The microcontroller changes SDIO on falling edges of SCK. The MX8620 reads SDIO on rising

edges of SCK. (Figure A,B).

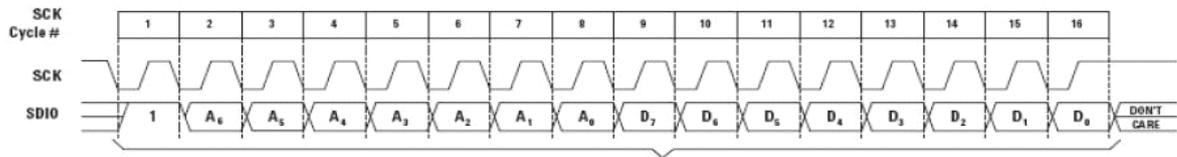


Figure A SDIO driven by microcontroller

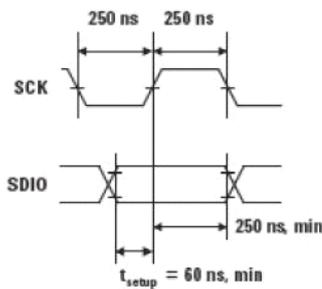
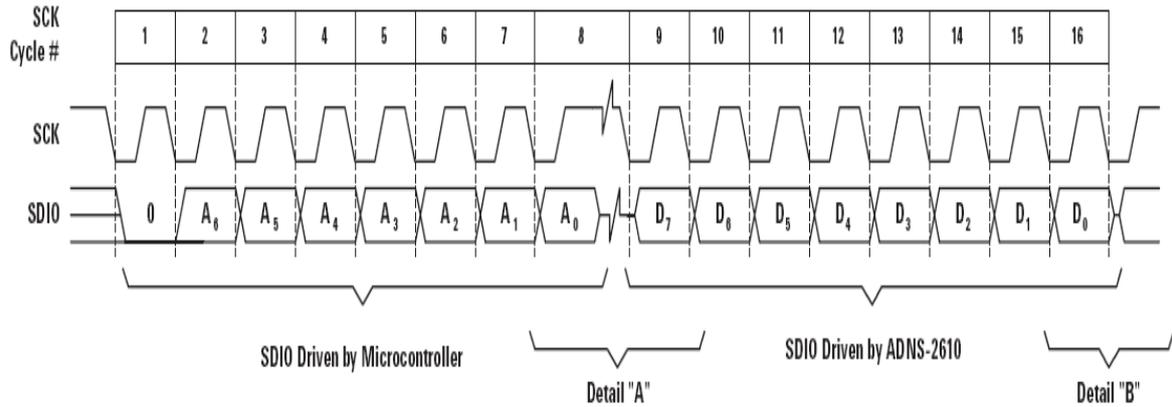


Figure B SDIO setup and hold times SCK pulse width

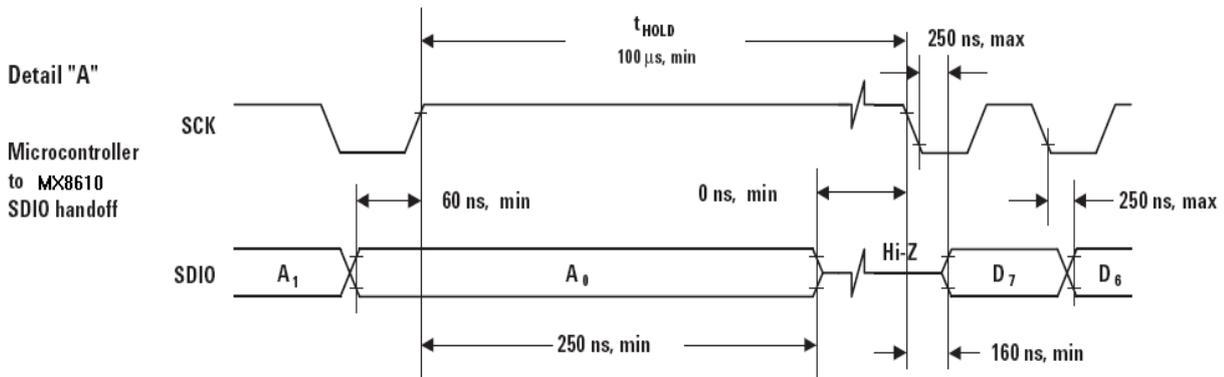
Read Operation

A read operation, meaning data that is going from the MX8620 to the microcontroller, is always initiated by the microcontroller and consists of two bytes. The first byte that contains the address is written by the microcontroller and has a "0" as its MSB to indicate data direction. The second byte contains the data and is driven by the MX8620. The transfer is synchronized by SCK. SDIO is changed on falling edges of SCK and read on every rising edge of SCK. The microcontroller must go to a High-Z state after the last address data bit.

The IC will go to the High-Z state after the last data bit. Another thing to note during a read operation is that SCK needs to be delayed after the last address data bit to ensure that the IC has at least 100 us to prepare the requested data. (Figure C,D).



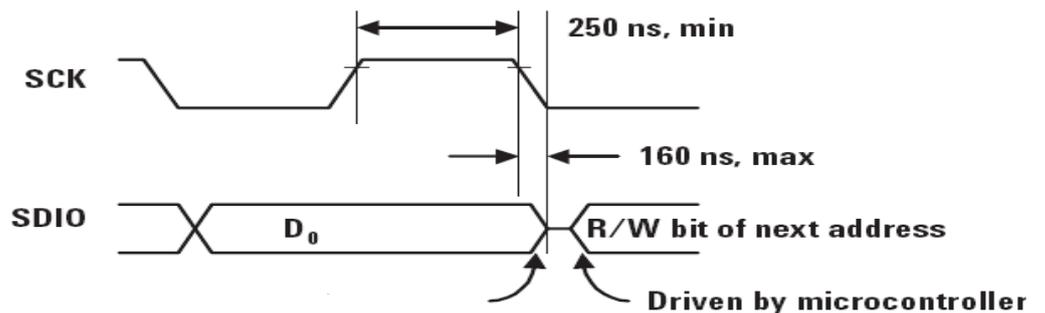
. Read operation.



.Microcontroller toMX8620 SDIO handoff.

Detail "B"

MX8620 to Microcontroller SDIO handoff



.MX8620 to microcontroller SDIO handoff.

Forcing the SDIO Line to the Hi-Z state

There are times when the SDIO line from the MX8620 should be in the Hi-Z state. For example, if the microprocessor has completed a write to the MX8620, the SDIO line will go into a Hi-Z state,

because the SDIO pin was configured as an input. However, if the last operation from the microprocessor was a read, the MX8620 will hold the D0 state on SDIO until a falling edge of SCK.

To place the SDIO pin into a Hi-Z state, activate the power-down mode by writing to the configuration register. Then, the power down mode can stay activated, with the MX8620 in the shutdown state, or the power-down mode can be deactivated, returning the MX8620 to normal operation. In both conditions, the SDIO line will go into the Hi-Z state.

Another method to put the SDIO line into the Hi-Z state, while the MX8620 at normal mode, is to write any data to an invalid address such as 0x20 to address 0x77. The SDIO line will go into the Hi-Z state after the write operations.

5.3 POWER-DOWN MODE(PD) AND TIMING

MX8620 can be placed in a power-down mode by setting bit 6 in the configuration register via a serial I/O port write operation. Note that while writing a “1” to bit 6 of the configuration register, all other bits must be written with their original value in order to keep the current configuration. After setting the configuration register, wait at least 32 system clock cycles. To get the chip out of the power-down mode, clear bit 6 in the configuration register via a serial I/O port write operation. While the sensor is in power-down mode, only the bit 6 data will be written to the configuration register. Writing the other configuration register values will not have any effect. For an accurate report after power-up, wait for a total period of 50 ms before the microcontroller is able to issue any write/read operation to the MX8620. The sensor register settings, prior to power-down mode, will remain during power-down mode. (Figure E,F).

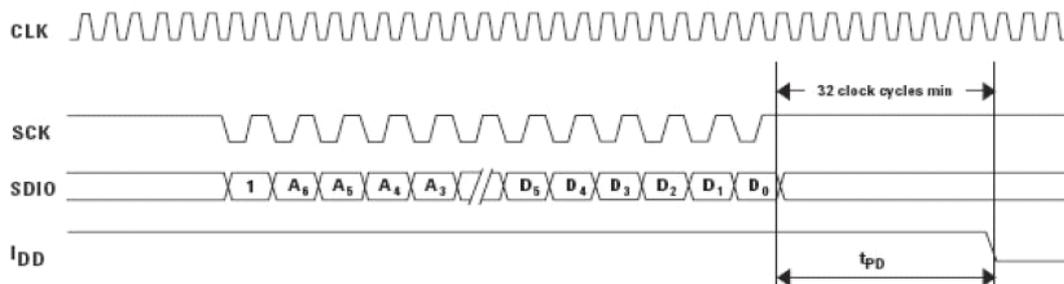


Figure E Power timing

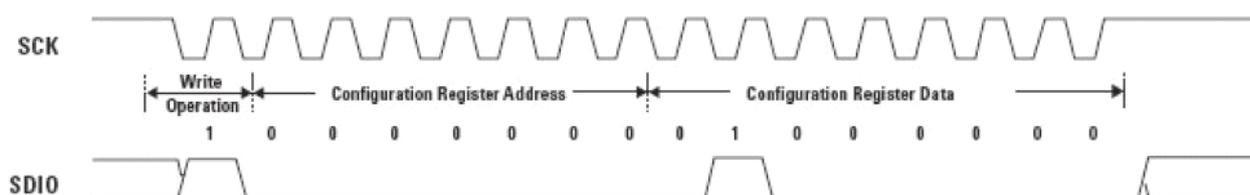


Figure F Power down configuration register writing operation

6. ELECTRICAL CHARACTERISTICS

6.1 ABSOLUTE MAXIMUM RATINGS

| Parameter | Symbol | Min. | Max. | Units | Notes |
|-----------------------|-----------------|------|-----------------------|-------|--|
| Storage Temperature | T _S | -40 | 85 | °C | |
| Operating Temperature | T _A | -15 | 55 | °C | |
| Lead Solder Temp | | | 260 | °C | For 10 seconds, 1.6 mm below seating plane |
| Supply Voltage | V _{DD} | -0.5 | 5.5 | V | |
| ESD | | | 2 | KV | |
| Input Voltage | V _{IN} | -0.5 | V _{DD} + 0.5 | V | SDIO,CLK,LED_CNTL |

| | | | | | |
|---------------|----------|------|-----|---|-----------------------|
| Input Voltage | V_{IN} | -0.5 | 3.6 | V | OSC_IN, OSC_OUT, REFA |
|---------------|----------|------|-----|---|-----------------------|

6.2 RECOMMENDED OPERATING CONDITIONS

| Parameter | Symbol | Min. | Typ. | Max. | Units | Notes |
|---|---------------|------|------|--------------|----------|---|
| Operating Temperature | T_A | 0 | | 40 | °C | |
| Power Supply voltage | V_{DD} | 4.1 | 5 | 5.5 | V | Register values retained for voltage transients below 4.10v but greater than 3.9v |
| Power supply Rise Time | V_{RT} | | | 100 | ms | |
| Supply Noise | V_N | | | 100 | mV | Peak to peak within 0-100 MHz bandwidth |
| Clock Frequency | f_{CLK} | 23.0 | 24.0 | 25.0 | MHz | Set by ceramic resonator |
| Serial Port Clock Frequency | SCLK | | | $f_{CLK}/12$ | MHz | |
| Resonator Impedance | X_{RES} | | | 55 | Ω | |
| Distance from Lens Reference Plane to Surface | Z | 2.3 | 2.4 | 2.5 | mm | Results in ± 0.2 mm DOF |
| Speed | S | 0 | | 12 | in/sec | @ frame rate = 1500 fps |
| Accleration | A | | | 0.25 | g | @ frame rate = 1500 fps |
| SDIO Read Hold Time | t_{HOLD} | 100 | | | nS | Hold time for valid data |
| SDIO Serial Write-write Time | t_{SWW} | 100 | | | ns | Time between two write commands |
| SDIO Serial Write-read Time | t_{SWR} | 100 | | | ns | Time between write and read operation |
| SDIO Serial Read-write Time | t_{SRW} | 250 | | | ns | Time between read and write operation |
| SDIO Serial Read-read Time | t_{SRR} | 250 | | | ns | Time between two read commands |
| Data Delay after PD deactivated | $t_{COMPUTE}$ | 3.1 | | | ms | After $t_{COMPUTE}$, all registers contain data from first image after wakeup from Power-Down mode. Note that an additional 75 frames for AGC stabilization may be required if mouse movement occurred while Power Down. |

| Parameter | Symbol | Min. | Typ. | Max. | Units | Notes |
|-----------------------|-------------------|------|------|------|----------|---|
| SDIO Write Setup Time | t _{STUP} | 60 | | | ns | Data valid time before the rising of SCLK |
| Frame Rate | FR | | 1500 | | frames/s | |

6.3 AC ELECTRICAL SPECIFICATIONS

Electrical Characteristics over recommended operating conditions. Typical values at 25 °C ,VDD = 5V, 24MHz,1500fps.

| Parameter | Symbol | Min. | Typ. | Max. | Units | Notes |
|--|-------------------|------|------|------|-------|---|
| Power Down(PD) | t _{PD} | 1.33 | | | uS | 32 clock cycle minimum after setting bit 6 in the Configuration register. |
| Power Up after PD mode reports deactivated | t _{PUPD} | | | 50 | ms | From PD mode deactivation to accurate 610uS + 75 frames |
| Power Up from V _{DD} ↑ | t _{PU} | | | 40 | ms | From VDD to valid accurate reports 610uS + 50 frames |
| Rise and Fall TimesSDIO | t _r | | 30 | | ns | C _L =30 pF(the rise time is between 10% to 90%) |
| | t _f | | 16 | | ns | C _L =30 pF(the fall time is between 10% to 90%) |
| Serial Port TransactionTimer | t _{SPTT} | | 90 | | ms | Serial port will reset if current transaction is not complete within T _{SPTT} |
| Transient Supply Current | I _{DDT} | | 20 | 37 | mA | Max supply current during a VDD ramp from 0 to 5.0V with>500uS rise time. Does not include charging current for bypass capacitors |

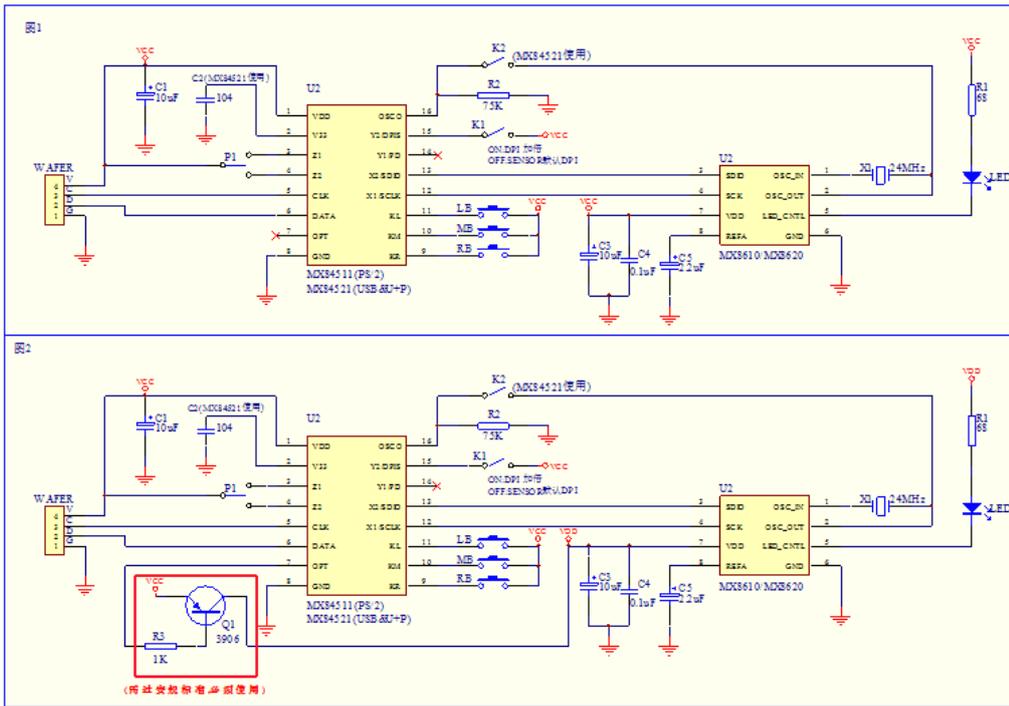
6.4 DC ELECTRICAL SPECIFICATIONS

Electrical Characteristics over recommended operating conditions. Typical values at 25 °C ,VDD = 5V, 24MHz,1500fps.

| Parameter | Symbol | Min. | Typ. | Max. | Units | Notes |
|----------------------------------|--------------------|------|------|------|-------|-------------------------|
| Supply Current | I _{DDAVG} | - | 5.0 | - | mA | VDD=5V,mouse moving |
| | I _{DD} | - | 4.7 | - | mA | VDD=5V,mouse not moving |
| Power down Mode Current | I _{DDPD} | - | 103 | 114 | uA | VDD=5V |
| SCK & SDIO pin Input Low Volage | V _{IL} | - | - | 0.8 | V | VDD=5V |
| SCK & SDIO pin Input High Volage | V _{IH} | 2.0 | - | - | V | VDD=5V |

| Parameter | Symbol | Min. | Typ. | Max. | Units | Notes |
|----------------------------|-----------------|------|------|------|-------|---------------|
| LED_CNTL pin Drive Current | I _{OL} | - | 25 | - | mA | VDD=5V,R2=82Ω |

7. APPLICATION CIRCUIT



- 备注：USB (U-P) 与 PS2 可共用同一 PCB
- USB (或者 U+P) : (MX84511+MX8610/20)
 - 使用: C2 (104); K2.
 - 电容: R2 (75K); X1 (18MHz或24MHz).
 其它元件不变
 - PS2: (MX84511+MX8610/20)
 - 使用: R2 (75K); 18MHz或24MHz
 - 电容: C2 (104); K2.
 其它元件不变

