Shenzhen LIZE Electronic Technology Co., Ltd

SPECIFICATION

MX8620

Optical Sensor
Version1.0

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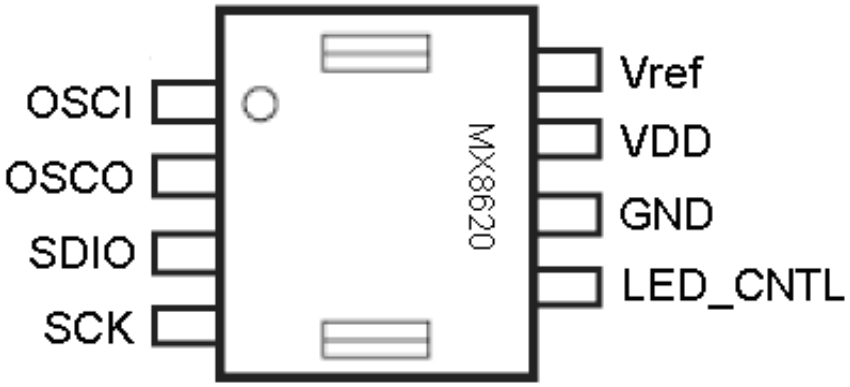
1. GENERAL DESCRIPTION

The MX8620 is a CMOS process optical mouse sensor. The ouput 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 (cpi).

2. FEATURES

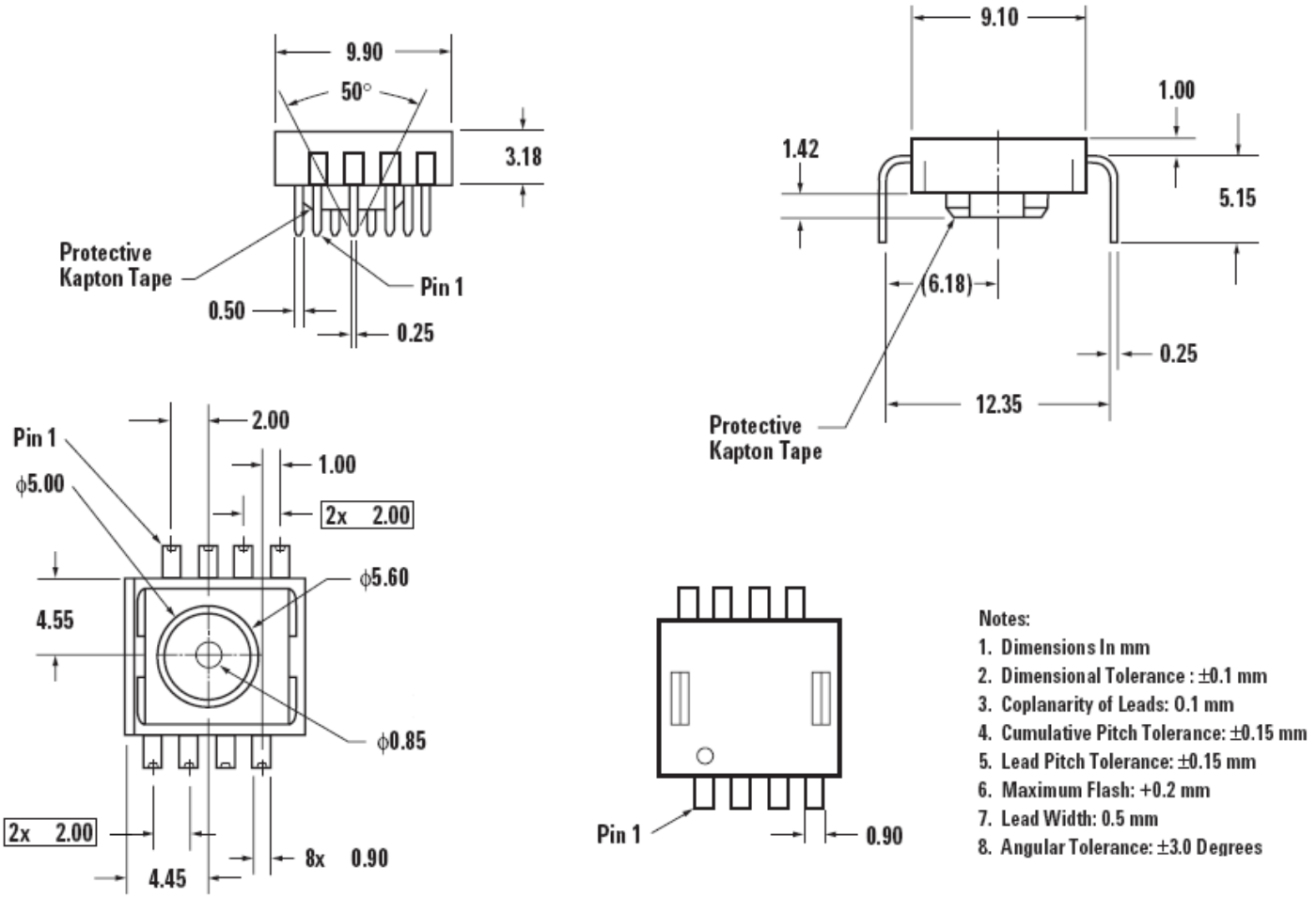
- Operating voltage 4.5V~5.5V
- Complete 2-D motion sensor
- 800 cpi resolution.
- Serial port registers
- 8-pin staggered dual inline package (DIP)

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



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

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	Bi3	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	Bi3	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	Bi3	Bit2	Bit1	Bit0
Y7	Y6	Y5	Y4	Y3	Y2	Y1	Y0

Delta_X

Access: Read

Address: 0X03

Reset Value: 0X00

Bit7	Bit6	Bit5	Bit4	Bi3	Bit2	Bit1	Bit0
X7	X6	X5	X4	X3	X2	X1	X0

SQUAL

Access: Read

Address: 0X04

Reset Value: 0X00

Bit7	Bit6	Bit5	Bit4	Bi3	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).

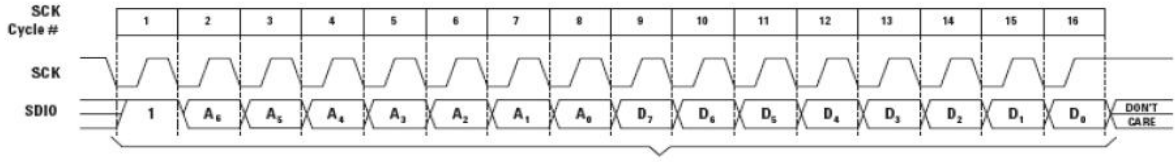


Figure A SDIO driven by microcontroller

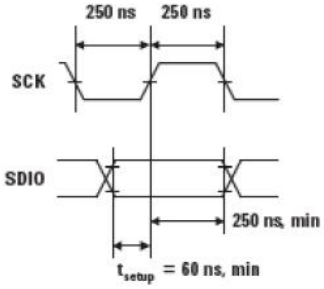
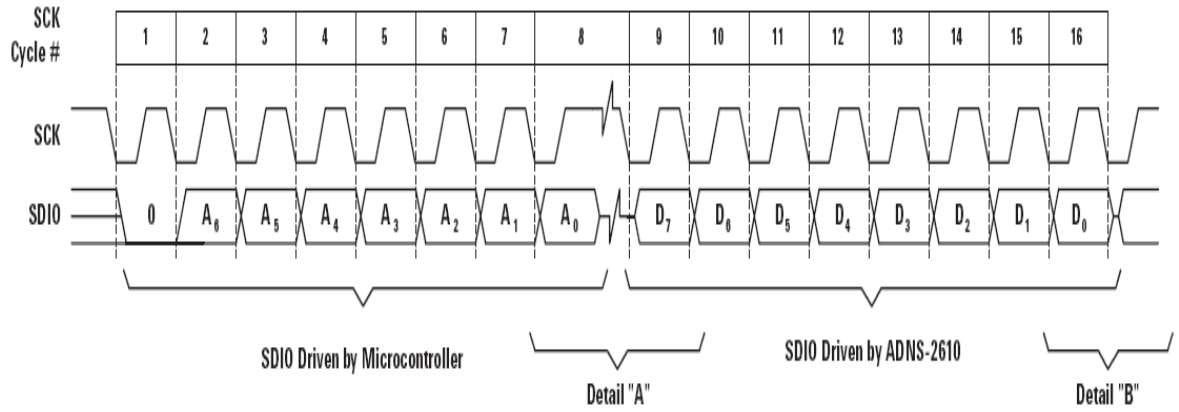


Figure B SDIO setup and hold times SCK pulse width

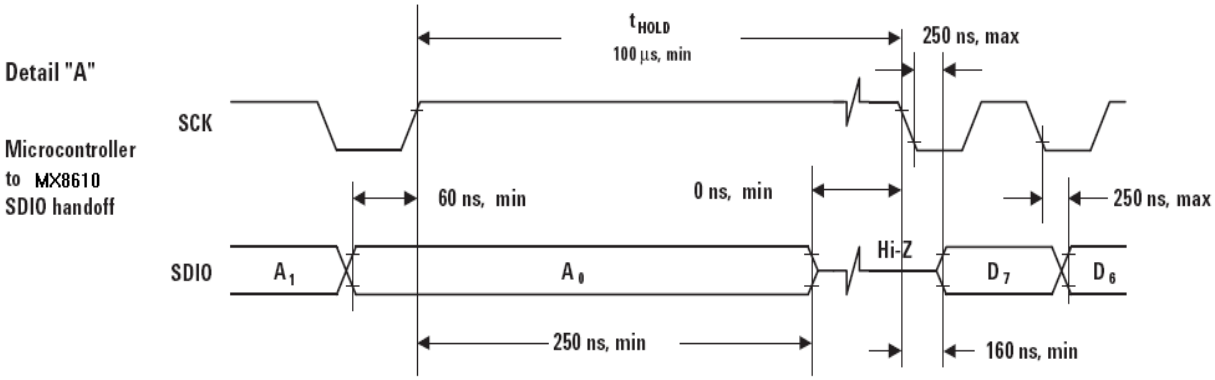
Read Operation

A read operation, meaning data that is going from theMX8620 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.

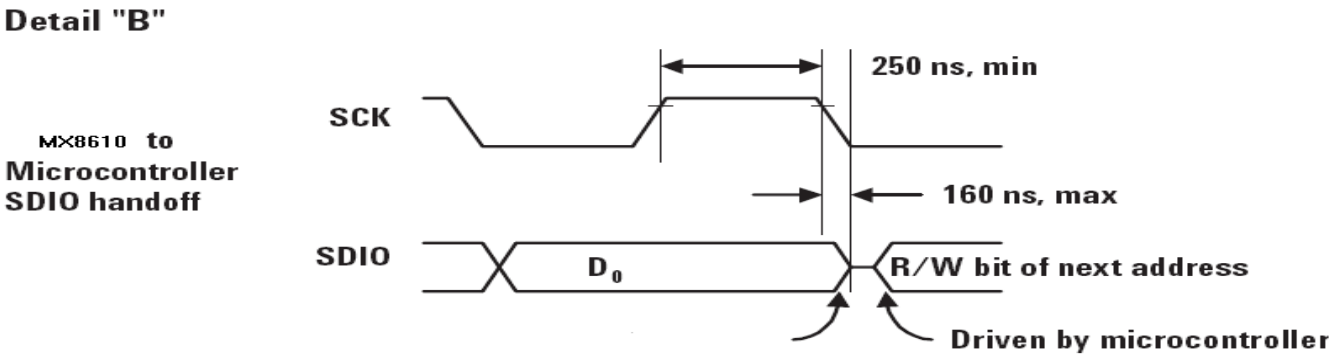
The IC will go to the High-Z state after the last data bit. Another thing to note during a read operation is that SCK needs to be delayed after the last address data bit to ensure that the IC has at least 100 us to prepare the requested data. (Figure C,D).



. Read operation.



.Microcontroller toMX8620 SDIO handoff.



.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).

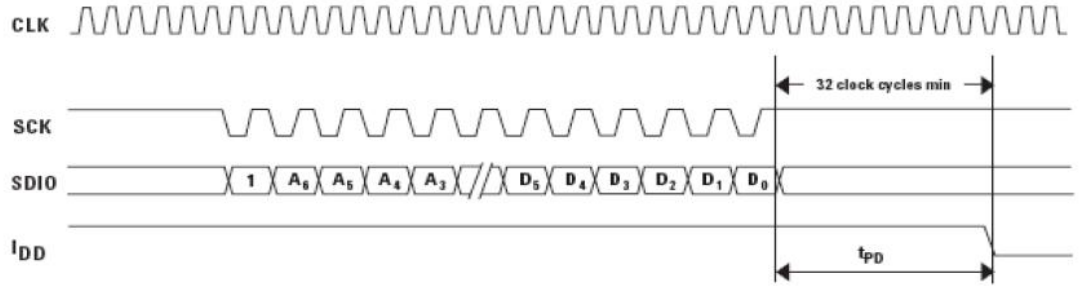


Figure E Power timing

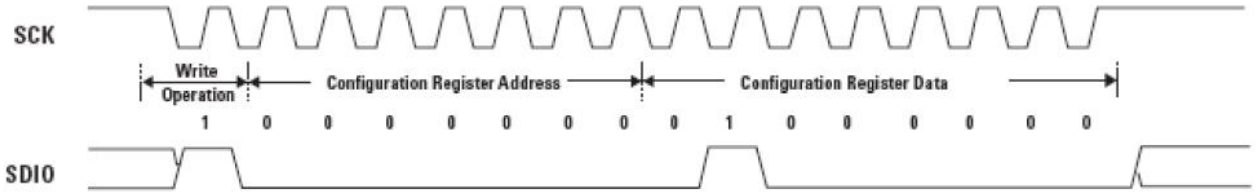


Figure F Power down configuration register writing operation

6. ELECTRICAL CHARACTERISTICS

6.1 ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min.	Max.	Units	Notes
Storage Temperature	T_S	-40	85	°C	
OperatingTemperature	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
Acdeleration	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 opteration
SDIO Serial Read-write Time	t_{SRW}	250			ns	Time between read and write opteration
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 Dowm.
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℃,VDD＝5V，24MHz,1500fps.

Parameter	Symbol	Min.	Typ.	Max.	Units	Notes
Power Down(PD)	tPD	1.33			uS	32 clock cycle minimum after setting bit 6 in the Configuration register.
Power Up after PD mode reports deactivated	tPUPD			50	ms	From PD mode deactivation to accurate 610uS + 75 frames
Power Up from V_{DD} ↑	tPU			40	ms	From VDD to valid accurate reports 610uS + 50 frames
Rise and Fall TimesSDIO	tr		30		ns	C_L=30 pF(the rise time is between 10% to 90%)
	tf		16		ns	C_L=30 pF(the fall time is between 10% to 90%)
Serial Port TransactionTimer	tSPTT		90		ms	Serial port will reset if current transaction is not complete within T_{SPTT}
Transient Supply Current	IDDT		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℃,VDD＝5V， 24MHz,1500fps.

Parameter	Symbol	Min.	Typ.	Max.	Units	Notes
Supply Current	$I_{DD\ AVG}$	-	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
LED_CNTL pin Drive Current	I_{OL}	-	25	-	mA	VDD=5V,R2=82Ω

7. APPLICATION CIRCUIT