

SPECIFICATION

MX8831

USB/PS2 Single Chip Optical Mouse Sensor

VERSION 1.0

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1. General Description

The MX8831 chip is a low cost single chip optical mouse solution used to implement a non-mechanical tracking engine for computer mice. It is based on optical navigation technology with USB/PS2 combo MCU bundled. Which measures changes in position by optically acquiring sequential surface images(frames) and mathematically determining the direction and magnitude of movement. The single chip optical mouse sensor provides a complete and compact mouse solution, There are no moving parts, and precision optical alignment is not required, few outside components use and facilitate high volume assembly. It is a true crystal-less and ultra low cost solution.

2. Features

- Optical Navigation Technology
- Low-cost and powerful solution for PS/2 and low-speed USB combo mouse
- Microsoft 3D Intellimouse and IBM PS/2 mouse compatible
- Internal switch for USB DP/DM and PS2 CLK/Data I/O
- Universal Serial Bus Specification, version 2.0
- USB HID Specification, version 1.1
- USB-IF and WHQL compliable
- 5V Power Supply
- Power Saving During No Motion
- On Chip LED Drive with Regulated Current
- Crystal-less
- Resolution 1000(Default)/1600/2000 CPI
- In-use sensitivity switching to low(1000), middle(1600) and high (2000) CPI through **DPI** key
- Low EMI radiation
- Supports 3D (X, Y, Z) input
- Supports 5 buttons and mechanical wheel encoding

3. Pin Assignment

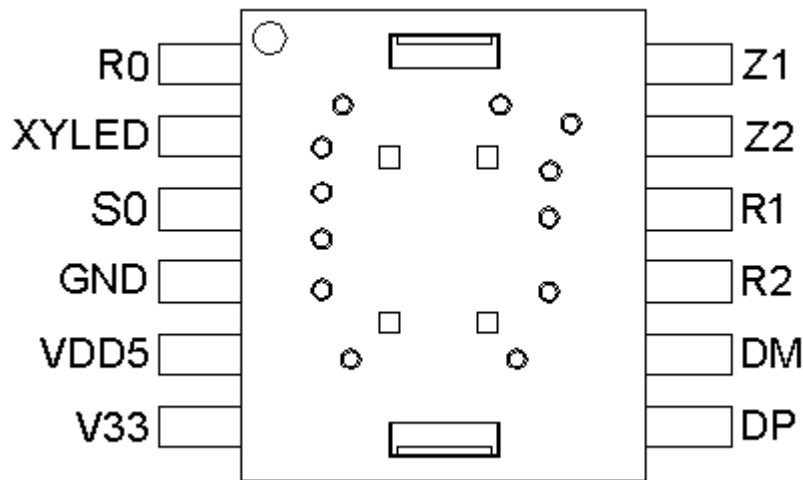
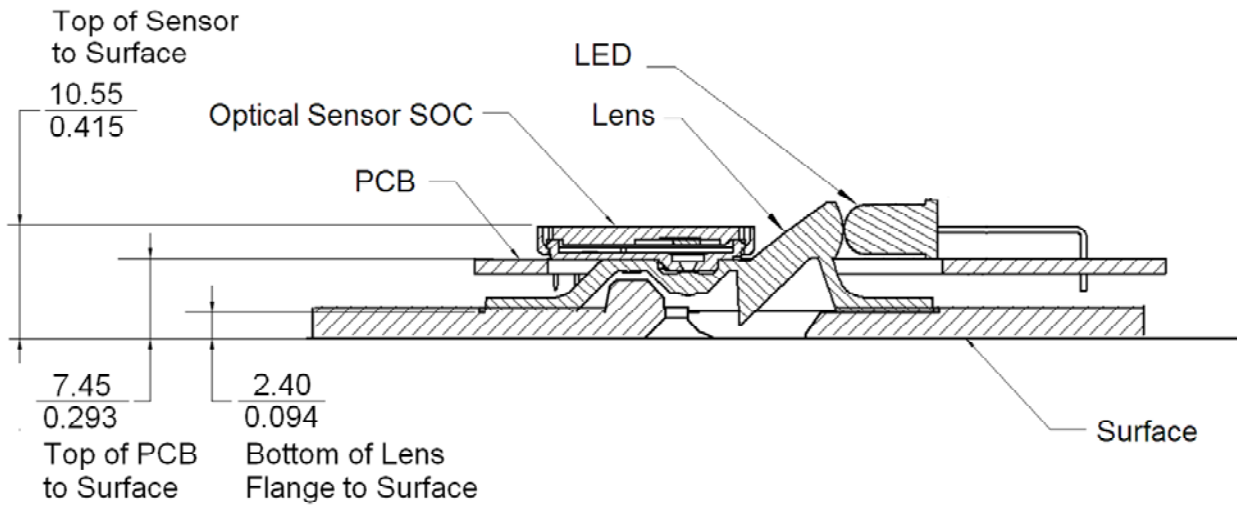


Chart 1 Pin Assignment

Pin No.	Symbol	I/O	Function
1	R0	I	Key Scan input0 (Left button/B4)
2	XYLED	O	LED control (sink current)
3	S0	I/O	Key Scan Output0 (B4/B5/DPI)
4	GND	P	GND
5	VDD5	P	5V Power Input
6	V33	P	3.3V DC voltage output from internal regulator, This pin need to be tied to a 10UF/104 capacitor.
7	DP/CLK	I/O	USB D+ / PS2 CLK
8	DM/DATA	I/O	USB D- / PS2 DATA
9	R2	I	Key Scan input2 (Right button/DPI Key)
10	R1	I	Key Scan input1 (Middle button/B5)
11	Z2	I	Z axis Input 2
12	Z1	I	Z axis Input 1



Notes:

- (1) Dimensions in mm/inches
- (2) All tolerance $\pm 0.1\text{mm}$

Chart 2 Assembly drawing of MX8831

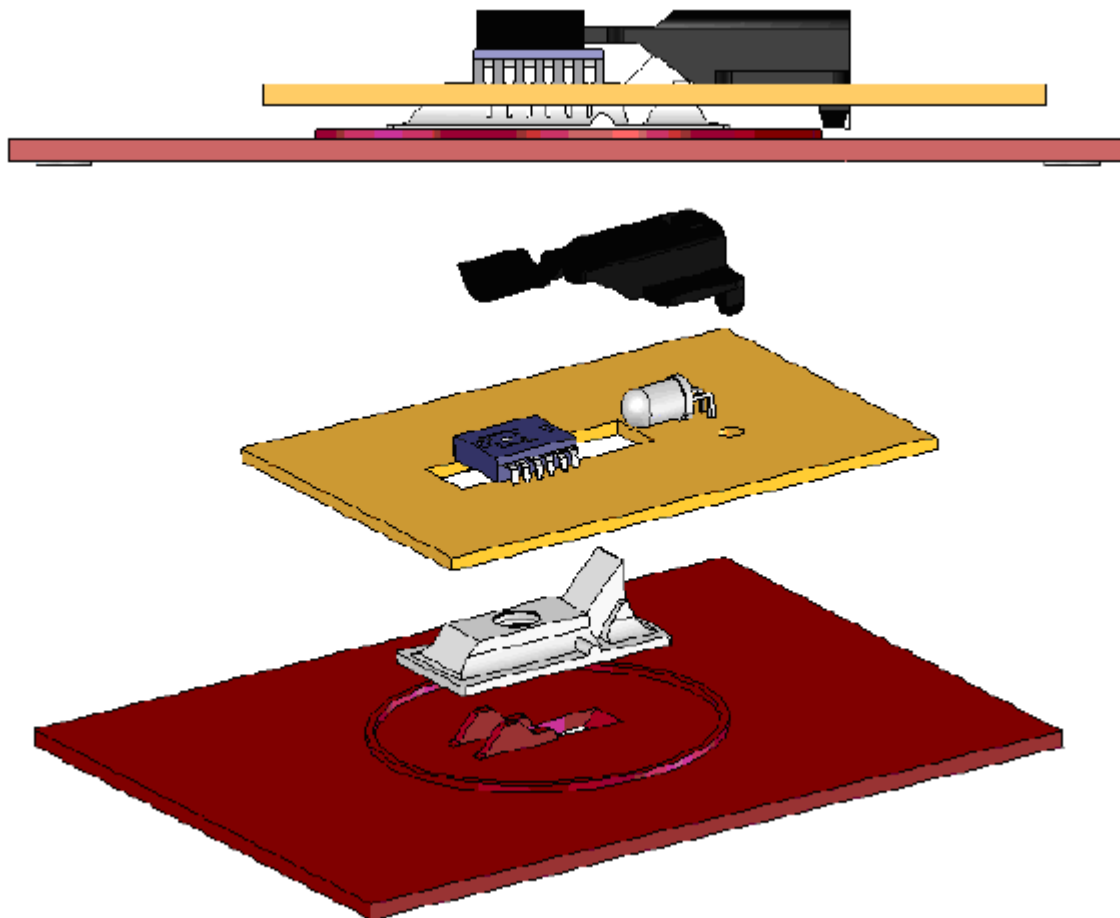


Chart 3 3D Assembly for Mounting Instructions

4. Absolute Maximum Rating

Symbol	Min.	Max.	Unit
Operating Temperature	0	70	°C
Storage Temperature	-65	150	°C
Input voltage	-0.5	6.0	V
Output voltage	-0.5	6.0	V

5. Recommend Operating Condition

Parameters	Sym.	Min.	Typ.	Max.	Unit
Operating voltage	VDD	4.5	5.0	5.5	V
Supply Noise	Vn	—	—	0.1	V
Distance from Lens Reference Plane to Surface	Z	2.3	2.4	2.5	mm
Acceleration	A	2	—	—	g
Frame Rate	FR	—	3000	—	Frames/sec
Speed	S	—	—	28	Inches/sec

6. DC Electrical Characteristic

Test Condition: T = 25°C, VDD=5.0V, VSS=0V

Symbol	Parameter	Condition	Min	Type	Max	Unit
Iop	Operating Current		—	—	15	mA
Isleep	Sleep Current		—	6.5	—	mA
Isuspend	USB Suspend Current		—	—	320	uA
Tb	Button debounce time		17	—	—	ms
Tz	Z-axis debounce time		700	—	—	us
3.3V Regulator						
Vreg	Output voltage of 3.3v Regulator	Vdd=4.4V~5.25V	3.0	3.3	3.6	V
VresetL	Low Power Reset detecting low Voltage	-	-	-	3.3	V
VresetH	Low Power Reset detecting high Voltage	-	3.6	-	-	V
MCU operation						

Symbol	Parameter	Condition	Min	Type	Max	Unit
Iil	Input Leakage Current for input pins	VIN=VDD, VSS	-	-	± 1	μA
Icc	VDD operating supply current Normal frequency operation mode	Output pins floating	-	-	10	mA
USB Interface						
Voh	Static Output High	USB operation Mode	2.8	-	3.6	V
Vol	Static Output Low		-	-	0.3	V
Vdi	Differential Input Sensitivity		0.2	-	-	V
Vcm	Differential Input Command Mode Range		0.8	-	2.5	V
Vse	Single Ended Receiver Threshold		0.8	-	2.0	V
Cin	Transceiver Capacitance		-	-	20	PF
Vrg	Output Voltage of internal Regulator		3.0	-	3.6	V

7. USB Interface

7.1 USB Command Set Description

The USB host detects USB mouse device plug-in and assigns a new unique address to the USB mouse device, then asking USB mouse device for information about the device description, configuration description, and assigning a configuration value for USB mouse device during enumeration period. After enumeration, the USB mouse device is able to transfer button value and motion to the USB host.

Descriptor Type	Byte	Byte	Byte	Byte	Byte	Byte	Byte	Byte
Device Descriptor(18bytes)	12	01	10	01	00	00	00	08
	4F	1C	32	00	10	01	01	02
	00	01						
Configuration Descriptor(9bytes)	09	02	22	00	01	01	00	A0
	31							
Interface Descriptor(9bytes)	09	04	00	00	01	03	01	02
	00							
HID Descriptor(9bytes)	09	21	10	01	00	01	22	34
	00							
Endpoint Descriptor(7bytes)	07	05	81	03	04	00	0A	
Human Interface Device Report Descriptor(52bytes)	05	01	09	02	A1	01	09	01
	A1	00	05	09	19	01	29	05
	15	00	25	01	95	05	75	01
	81	02	95	01	75	03	81	01
	05	01	09	30	09	31	09	38
	15	81	25	7F	75	08	95	03
	81	06	C0	C0				
Language String Descriptor(4bytes)	04	03	09	04				
Manufacture String Descriptor	SIGMACHIP							
Product String Descriptor	USB Mouse							

7.2 USB Data Report Format

The USB report has two data formats, depending on boot or report protocol is selected. One kind of data format is the boot protocol used in legacy environment as 7.2.1. The other kind of data format is USB report protocol format which includes Z-wheel movement data in the fourth byte as 7.2.2. The Z-wheel is moved forward the fourth byte data is 01H, the Z-wheel is moved backward the fourth byte data is FFH, and the Z-wheel is idle the fourth byte data is 00H.

7.2.1 USB Boot Protocol

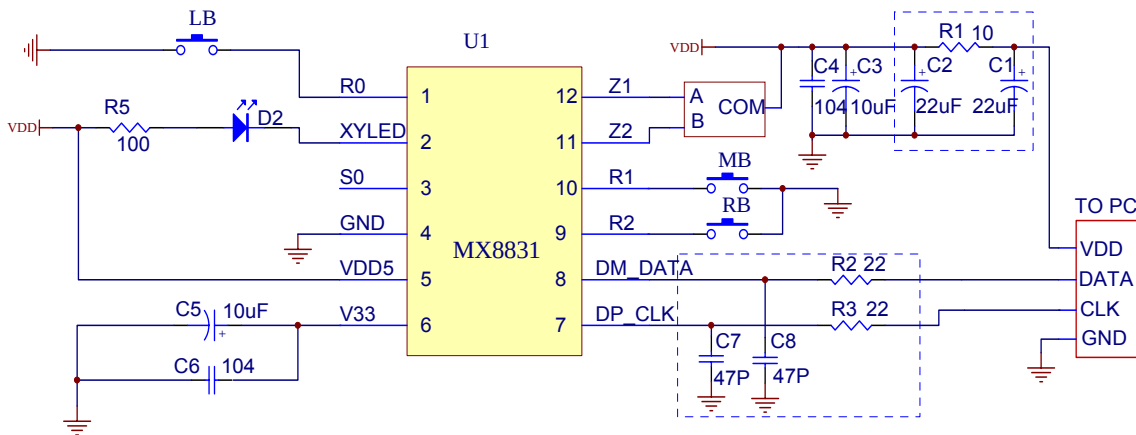
Byte	Bit	Symbol	Description
1	0	BL	1 = Left button pressed
	1	BR	1 = Right button pressed
	2	BM	1 = Middle button pressed
	3 ~ 7	NC	Reserved
2	0 - 7	X0 ~ X7	X Data. A positive value indicates motion to the right; a negative value indicates motion to the left. Bit0 = LSB.
3	0 - 7	Y0 ~ Y7	Y Data. A positive value indicates device motion downward; a negative value indicates motion upward. Bit0 = LSB.

7.2.2 USB Report Protocol

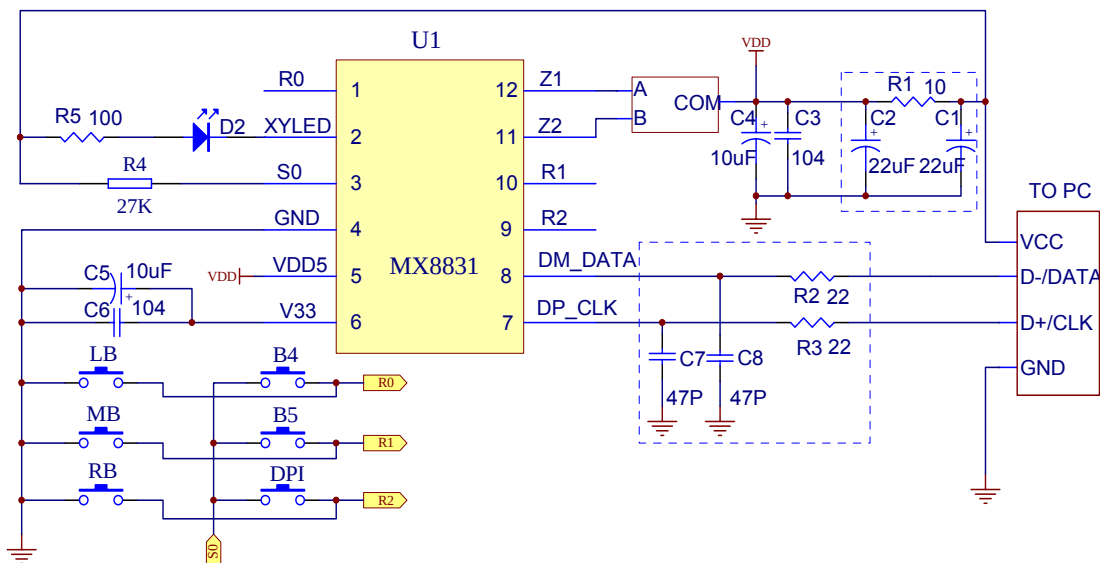
Byte	Bit	Symbol	Description
1	0	BL	1 = Left button pressed
	1	BR	1 = Right button pressed
	2	BM	1 = Middle button pressed
	3	B4	1 = 4 th button pressed
	4	B5	1 = 5 th button pressed
	5 ~ 7	NC	Reserved
2	0 ~ 7	X0 ~ X7	X Data. A positive value indicates motion to the right; a negative value indicates motion to the left. Bit0 = LSB.
3	0 ~ 7	Y0 ~ Y7	Y Data. A positive value indicates device motion downward; a negative value indicates motion upward. Bit0 = LSB.
4	0 ~ 7	Z0 ~ Z7	Z-wheel motion data. A positive value indicates device motion upward; a negative value indicates motion downward. The Z0~Z7 limit value is ± 7 ; Bit0 = LSB.

8. Application Circuit

8.1 Application Circuit for 3D3B



8.2 Application Circuit for 3D5B

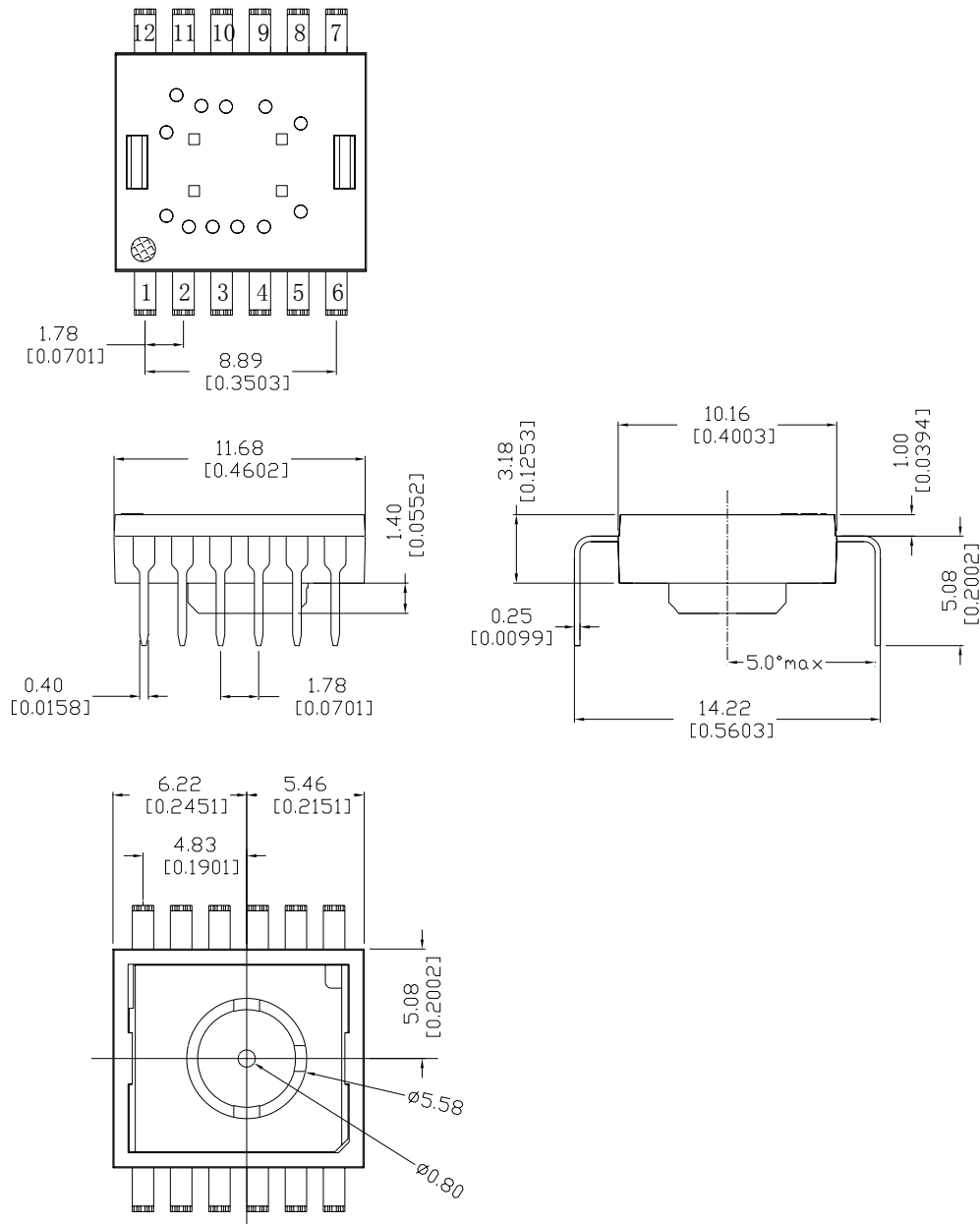


Note:

1. Pull-high resistor R4 must be placed for B4/B5/DPI key scan.
2. C1, R1 as close USB/PS2 line solder pad on PCB as possible, PCB layout should be designed in such a way as to ensure that the VDD is stable and pass through RC filter.
3. The capacitance C3, C4, C5 & C6 have to close to IC (VDD5 & V33 Pin).
4. D+/CLK and D-/DATA signal line have the short trace to IC.
5. The C7/C8 and R2/R3 should be placed as close to the USB cable.
6. Recommend to have ground grid on the PCB periphery.

7. Components in dotted line are used for EMC issue.

9. Package (Dimension In mm)



10. Revision History

Version	Update date	Revised Content	Revised by	Confirmed by
V1.0	2012-5-9	Original	LiuXing	