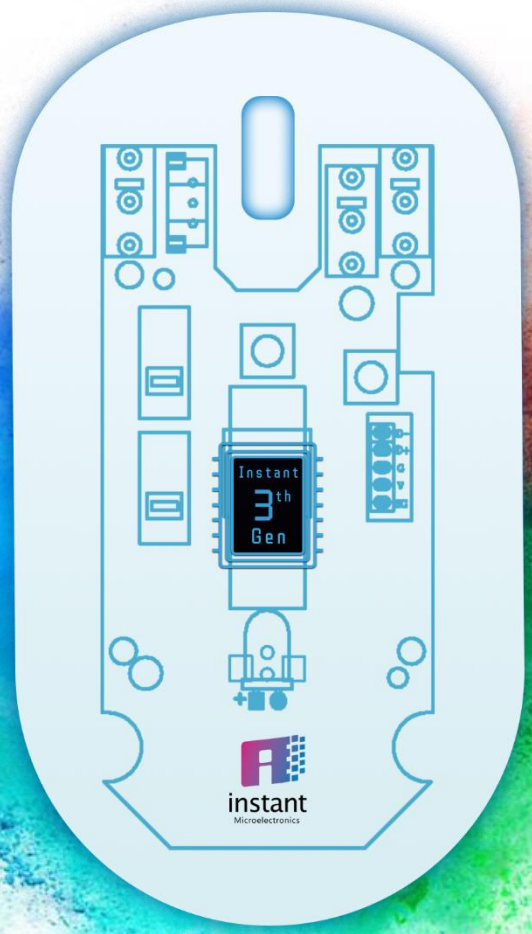
Instant

A603EP USB Optic Mouse

DATASHEET



Instant Microelectronics Co., Ltd.

Version：V1.04

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1. General Description

A603EP is a single chip CMOS process optical mouse sensor. This chip solution is used to implement a non-mechanical tracking engine for USB computer mouse.

A603EP is based on algorithm which provides X/Y movement data by measuring changes of sequential surface images. It supports standard five mouse buttons (L,M,R, 4th, 5th) and also three extra buttons for advanced functions. A603EP supports 4-level CPI resolution.

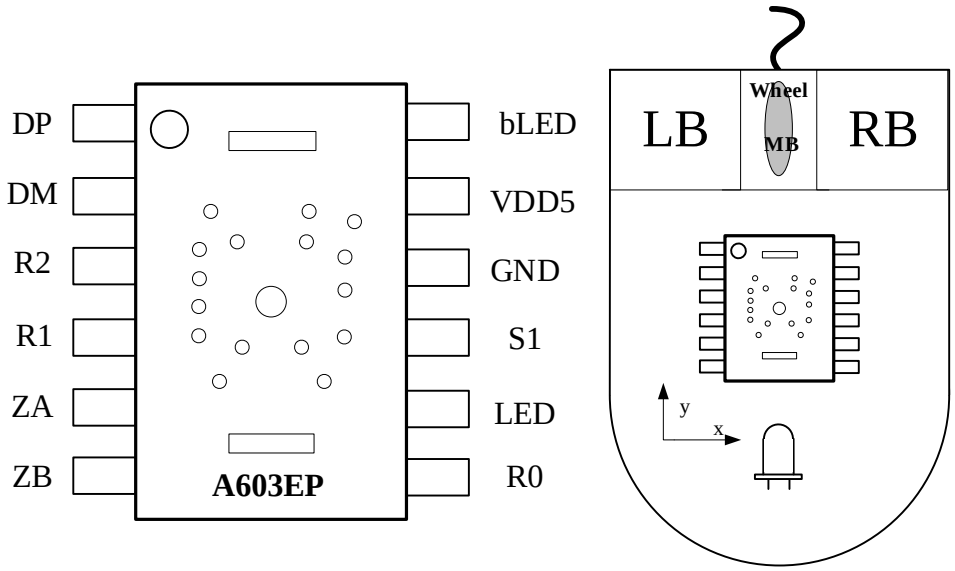
A603EP supports 7 colors in backlight application and Monochromatic Constantly Bright Backlight application. And the backlight LEDs can be turn on/off by the related buttons.

A603EP is in a 12-pin optical DIP package. It has a built-in LED driver and internal oscillator to minimize the external components.

2. Feature

- Optical Navigation Technology, Max FPS 4000, Max acceleration 10g, Max moving speed 40inch/s.
- Compliant with USB2.0 and USB HID Specification V1.1.
- Supports Winxp/Win2003/Win2008/Vista/Win7/Win8/Win10/Linux system, MAC OS, and Android system
- 5V Power Supply
- Internal crystal-less oscillator and on-chip LED Driver
- Supports 8 buttons : L、M、R、4th、5th、CPI(/CPI-) 、LED_On_Off(/CPI+)、Fire
- Supports 2 CPI Modes : CPI Loop mode and CPI±mode
- Supports X/Y/Z three axis
- Supports 4-level resolutions: 1200(default)/1800/2400/3600
- Supports 4-level brightness of CPI_LED to indicate 4-level resolutions
- Supports 7-color LED (with LED driver to control its color change) which breathes with 7 colors in cyclic change
- Supports ordinary monochrome LED
- Long press CPI(/CPI-) key or 4th(or 5th)+CPI(/CPI-) combination key to turn on/off backlight LEDs, Short press the LED_on_off button can also turn on/off backlight LEDs.
- IDIP-12 package and RoHS Compliant

3. Pin Assignment



Topview of Pinout **Topview of Mouse**

Figure 1. Pinout

4. Pin Description

	Pin Name	Type	Description
1	DP	IN/OUT	USB D+
2	DM	IN/OUT	USB D-
3	R2	IN	Button array scan in
4	R1	IN	Button array scan in，CPI Single LED output
5	ZA	IN	Z axis input
6	ZB	IN	Z axis input
7	R0	IN	Button array scan in
8	LED	OUT	LED open drain output
9	S1	IN/OUT	Single and double CPI mode switch/Button array scan out
10	GND	GND	Ground
11	VDD5	POWER	Power 5v input
12	bLED	OUT	Backlight LED output.

5. Block Diagram

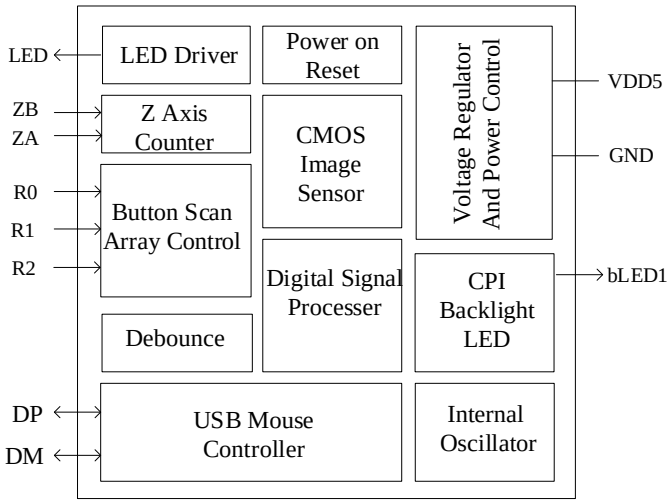


Figure 2. Block Diagram

6. Application Note

6.1 Buttons Matrix definition

The location of 8 physical keys in key array:

PIN	GND	S1	VDD5V
R0	K1	K4	K7
R1	K2	K5	-
R2	K3	K6	K8

Button No	Button Function
K1	Left
K2	Middle
K3	Right
K4	4th (Backward)
K5	5th (Forward)
K6	CPI/CPI-
K7	LED_on_off/CPI+
K8	Fire
Z1	SCROLL UP
Z2	SCROLL DOWN

Among them, Fire key means that when the K8 key is pressed, the mouse keeps clicking the left button until the K8 key is released, and the click interval is 50ms.

6.2 CPI Function

6.2.1 CPI switching

A603EP supports 4-level CPI resolutions, corresponding to 1200 (default)/1800/2400/3600. The default value is 1200. A603EP provides 2 CPI modes :CPI loop mode and CPI± mode (See section 9 for details).

In CPI± mode, there are two CPI related buttons(CPI-/CPI+). While In CPI loop mode, there is only one CPI related button (CPI).

- CPI loop: with the pull-up resistor R9, K6 is CPI (loop) button and K7 is LED_on_off button.
- CPI±: without the pull-up resistor R9, K6 is CPI- button and K7 is CPI+ button.

6.2.2 Indication for CPI switching

6.2.2.1 Backlight flashing indication

When CPI level switched, backlight LED will flash 1~4 times to represent CPI level1~level4 correspondingly. The 1200 resolution is CPI level1 and the 3600 resolution is CPI level4.

6.2.2.2 Monochrome LED indication

CPI	Brightness
1200	Off
1800	Weak
2400	Middle
3600	Strong

CPI_LED indicates different CPI Levels according to different brightness.

6.3 Backlight LED

A603EP support two backlight modes：

- 7-color backlight mode: it has the effect of seven-color conversion and resets the backlight every 38S. The LED used is packaged with 2 pins, and its color change is controlled by a LED driver inside.
- Monochrome backlight mode: it can be used for Constantly Bright effect. The LEDs used are ordinary monochrome LED (without a LED driver inside).
- Long press CPI(/CPI-) key or 4th(or 5th)+CPI(/CPI-) combination key to turn on/off backlight LEDs
- LED_on_off button can also turn on/off backlight LEDs.

7. Electrical Characteristics

7.1 Absolute Maximum Rating

Parameters	Symbol	Min	Max	Unit	Notes
Supply Voltage	VDD	-0.5	5.5	V	
Operating Temperature	To	-15	55	ºC	
Storage Temperature	Ts	-40	85	ºC	
Lead Solder Temperature			260	ºC	
Input Voltage	V_{in}	-0.5	5.5	V	
ESD	V_{ESD}		2	KV	All pins, Human Body Model

7.2 Recommend Operating Conditions

Parameter	Symbol	Min	Typical	Max	Units
Supply Voltage	VDD	4.5	5.0	5.5	V
Operating Temperature	T_A	0	25	40	ºC
System Clock	CLK	22	24	26	MHz
Speed	S	-	-	40	Inch/Sec
Resolution	R	1200	1200	3600	Pixels/Inch
Acceleration	A	-	-	10	G
Frame Rate	Fr	-	-	4000	fps
Distance from the Bottom of Lens to the Working Surface	Z	2.1	2.2	2.3	mm

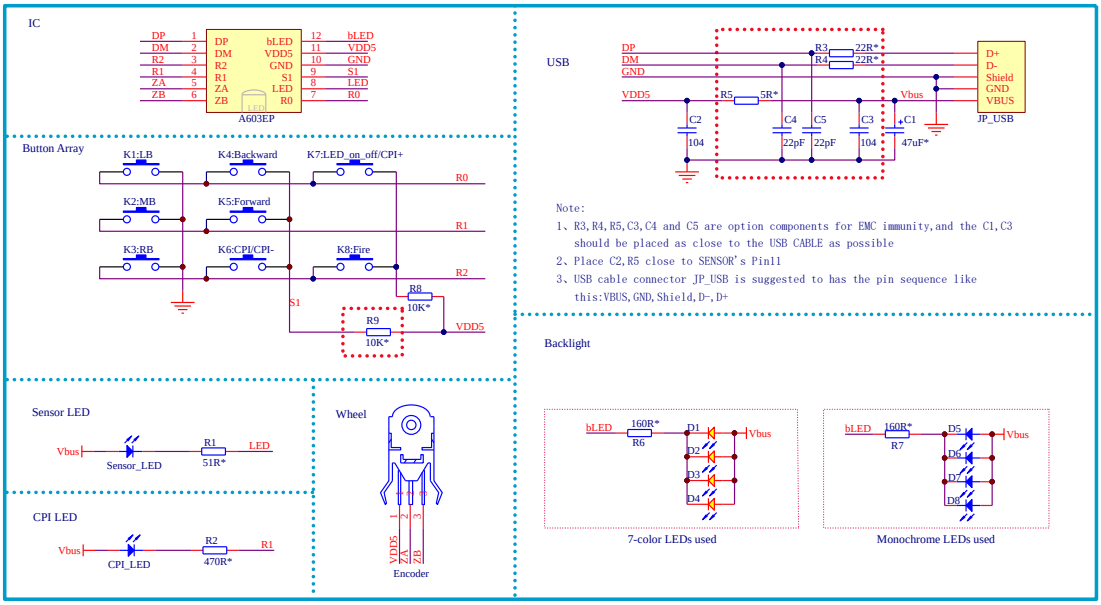
7.3 DC Electrical Characteristic (VDD = 5.0V, Temperature = 25°C)

Parameter	Condition	Symbol	Min	Typical	Max	Units
Supply Current	In motion	I_{DD}	-	16.5	-	mA
Supply Current	Static	I_{DD1}	-	7.8	-	mA
Input Voltage High	Input port	V_{IH1}	2.0	-	-	V
Input Voltage Low	Input port	V_{IL1}	-	-	0.8	V
Input Voltage High	I/O port	V_{IH2}	2.0	-	-	V
Input Voltage Low	I/O port	V_{IL2}	-	-	0.8	V
Output Voltage High	I/O port	V_{OH1}	2.8	-	3.6	V
Output Voltage Low	I/O port	V_{OL1}	0	-	0.3	V

7.4 AC Electrical Characteristic (VDD = 5.0V, Temperature = 25 ºC)

Parameter	Symbol	Min	Typical	Max	Units	Notes
Internal Ring Oscillator Frequency	F_{ROSC}		10		kHz	
Power-up Reset delay	T_{PU}	-	10	-	us	POR signal from 0 to 3.5
Debounce Time on Button	T_{DB}	9.5	11.5	13.5	ms	
Z-axis Sampling Time	T_Z	-	125	-	us	

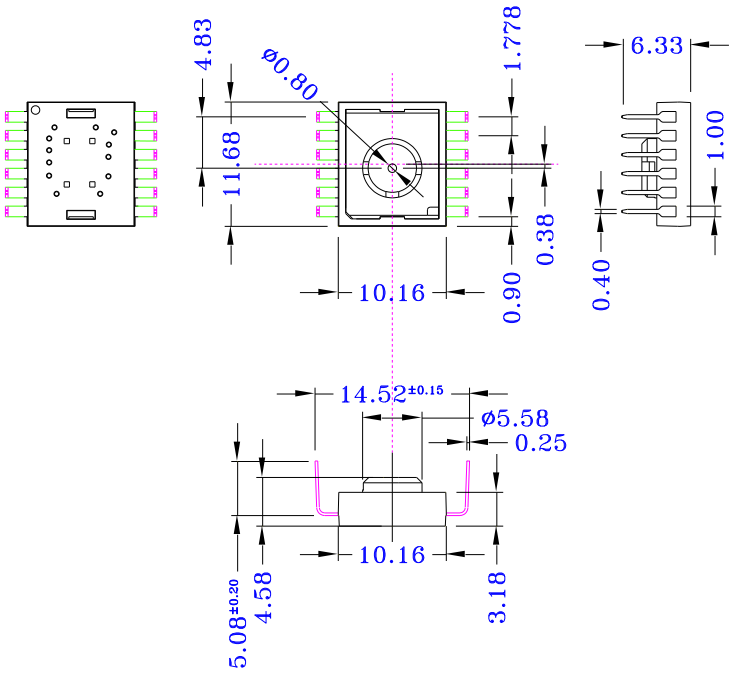
8. Typical Application Circuit



Note: with the pull-up resistor R9, K6 is CPI (loop) button and K7 is LED_on_off button; without the pull-up resistor R9, K6 is CPI- button and K7 is CPI+ button.

Figure 3. Application circuit

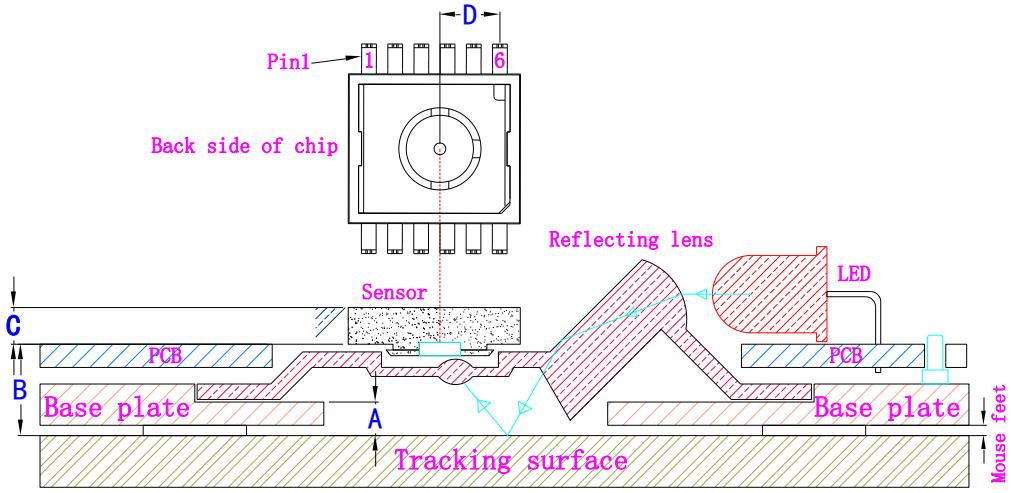
9. Package



Unit：mm

Figure 4. Package outline Drawing

10. Assembly Drawing



符号	说明	最小	典型	最大	单位
A	透镜底部到桌面距离(Z-Height)	2.1	2.2	2.3	mm
B	PCB 顶端到桌面的距离	7.3	7.5	7.7	mm
C	Sensor 封装厚度	2.98	3.18	3.38	mm
D	光孔中心到 6 脚的距离	-	4.06	-	mm

Figure 5. Assembly drawing of A603EP

11. Revision History

Version	Description	Date
A603EP_SPEC_EN.V1.00	Create Preliminary Version	2019/07/18
A603EP_SPEC_EN.V1.01	Modify the encoder 1 pin in the application circuit to VDD5	2019/12/25
A603EP_SPEC_EN.V1.02	Add K7(fire) button	2020/01/08
A603EP_SPEC_EN.V1.03	Add a button to button array	2020/11/03
A603EP_SPEC_EN.V1.04	Modify characteristic parameters	2021/07/23