

**Multi-mode multi-key multi-function series**

# **A603P Datasheet**

---

**USB Optical Mouse**

**Version 1.00**

## Table of contents

<b>1. General Description .....</b>	<b>1</b>
<b>2. Feature .....</b>	<b>1</b>
<b>3. Pin Assignment .....</b>	<b>2</b>
<b>4. Pin Description .....</b>	<b>2</b>
<b>5. Block Diagram .....</b>	<b>3</b>
<b>6. Application Note .....</b>	<b>3</b>
<b>6.1 Buttons Matrix definition.....</b>	<b>3</b>
<b>6.2 Mode Switching .....</b>	<b>4</b>
<b>6.3 CPI Switching.....</b>	<b>4</b>
<b>6.4 CPI Indication.....</b>	<b>4</b>
<b>6.5 Backlight LED.....</b>	<b>5</b>
<b>7. Electrical Characteristics .....</b>	<b>5</b>
<b>7.1 Absolute Maximum Rating .....</b>	<b>5</b>
<b>7.2 Recommend Operating Conditions .....</b>	<b>5</b>
<b>7.3 DC Electrical Characteristic (VDD = 5.0V, Temperature = 25°C) .....</b>	<b>6</b>
<b>7.4 AC Electrical Characteristic (VDD = 5.0V, Temperature = 25 °C ) .....</b>	<b>6</b>
<b>8. Sensor Pixel Array Mapping .....</b>	<b>7</b>
<b>9. Typical Application Circuit .....</b>	<b>8</b>
<b>10. Package .....</b>	<b>9</b>
<b>11. Assembly Drawing .....</b>	<b>10</b>
<b>12. Revision History .....</b>	<b>10</b>

## 1. General Description

Multi-mode multi-key multi-function mouse Sensor A603P is a high performance single chip CMOS process optical mouse sensor. This chip solution is used to implement a non-mechanical tracking engine for USB computer mouse.

A603P is based on algorithm which measures changes of sequential surface images and then determines the movement. It has the basic mouse function (R/M/L button, Y motion and Z axis wheel) and additional support for office applications. It supports 4 level CPI resolutions (1200/1600/2400/3200). A603P provides two application modes. It can switch between normal mode and multimedia mode freely by press CPI key over 5s, which provides convenience for users.

A603P is unique in backlight which supports 7 colors in full color backlight breathing application and single backlight breathing application. All backlights support 4<sup>th</sup>(or 5<sup>th</sup>)+CPI combination key switch

A603P 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,
- Compliant with USB2.0 and USB HID Specification V1.1.
- Support 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
- Adjustable four-level resolutions 1200(def)/1600/2400/3200 by CPI key
- Support 4 levels CPI light and shade indication of LED
- Support full color backlight LED which breathes with 7 colors in cyclic change and single backlight breathing application
- All backlights support 4<sup>th</sup>(or 5<sup>th</sup>)+CPI combination key switch
- Free switching between normal mode and multimedia mode (see Section 6.3 for details) by long press CPI key over 5s
- Support L/M/R 3 buttons and X/Y/Z three axis
- Support the 4<sup>th</sup>/ 5<sup>th</sup> buttons
- IDIP-12 package and RoHS Compliant

### 3. Pin Assignment

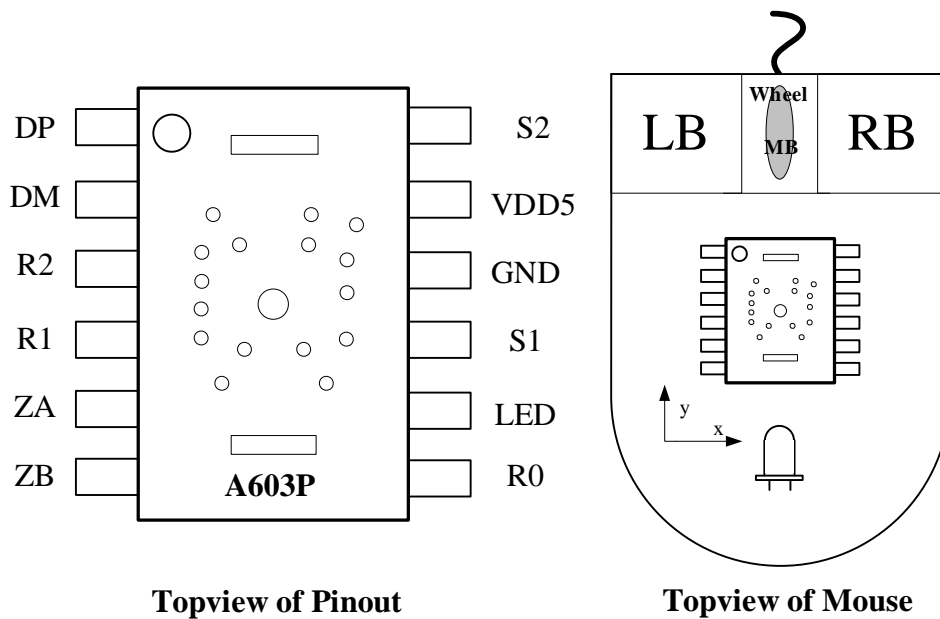


Figure 1. Pinout

### 4. Pin Description

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

## 5. Block Diagram

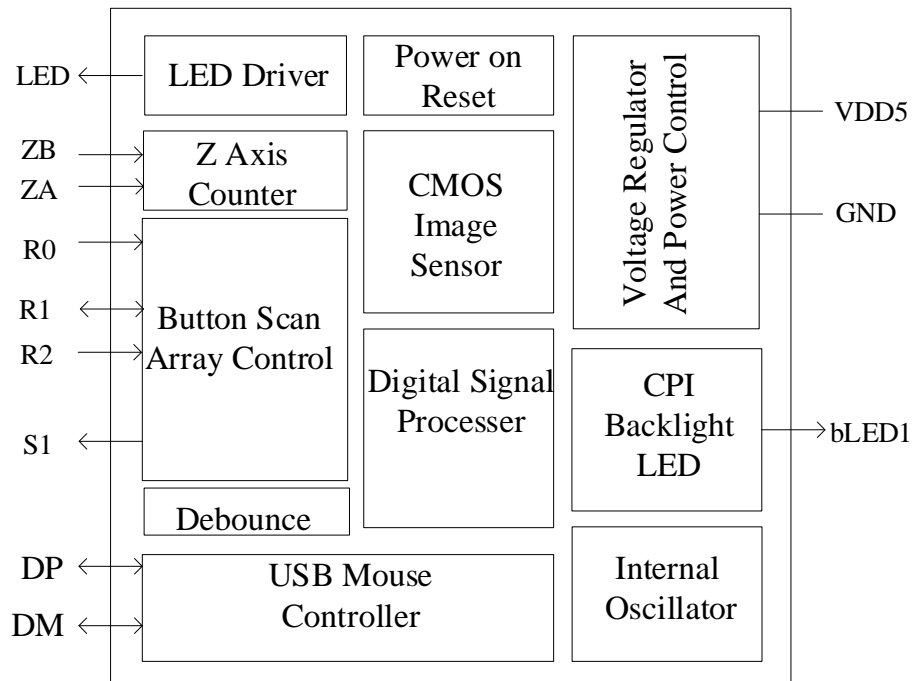


Figure 2. Block Diagram

## 6. Application Note

### 6.1 Buttons Matrix definition

Distribution of 6 physical keys in key array:

PIN	GND	S1
R0	K1	K4
R1	K2	K5
R2	K3	K6

	Mode	
	Normal	Multimedia
<b>K1</b>	L	L
<b>K2</b>	M	Play/pause
<b>K3</b>	R	R
<b>K4</b>	4 <sup>th</sup> (Backward)	Next song (set)
<b>K5</b>	5 <sup>th</sup> (Forward)	Last song (set)
<b>K6</b>	CPI	CPI
<b>Z1</b>	Scroll up	Volume+
<b>Z2</b>	Scroll Down	Volume-

## 6.2 Mode Switching

A603P supports dual working mode: the default is normal mode. Switch to multimedia mode by pressing CPI over 5s. After entering the multimedia mode, the monochrome LED begins to breathe. The same operation can be changed back to normal mode.

## 6.3 CPI Switching

A603P supports four level resolutions. By default, 1200 CPI can be switched by CPI button in the following order: 1200 (def) > 1600 > 2400 > 3200 > 1200.

## 6.4 CPI Indication

CPI	Monochrome indication LED
	Brightness
<b>1200</b>	Off
<b>1600</b>	Weak
<b>2400</b>	Middle
<b>3200</b>	Strong

In normal mode, monochrome LED indicates different CPI gears according to different brightness. After switching to multimedia mode, monochrome LED becomes breathing indicator.

Every CPI button is operated, and the LED indicator lamp changes gear once. The change of gear is reflected by the brightness of the LED. The order is: weak (default) > medium > strong > Close > weak. To improve the indicator effect, CPI indicator lamps can be connected in parallel up to 4, surrounded by the mouse

## 6.5 Backlight LED

Seven-color LED backlight or monochrome backlight breathing LED takes 5 seconds as a cycle to breathe continuously. It can switch back light through K4/K5 plus CPI button.

## 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	°C	
Storage Temperature	Ts	-40	85	°C	
Lead Solder Temperature			260	°C	
Input Voltage	V <sub>in</sub>	-0.5	5.5	V	
ESD	V <sub>ESD</sub>	2		KV	All pins, Human Body Model

### 7.2 Recommend Operating Conditions

Parameter	Symbol	Min	Typical	Max	Units	Notes
Supply Voltage	VDD	4.5	5.0	5.5	V	
Operating Temperature	T <sub>A</sub>	0	25	40	°C	
System Clock	CLK	22	24	26	MHz	
Speed	S	-	-	40	Inch/Sec	
Resolution	R	800	1200	2400	CPI	
Acceleration	A	-	-	10	G	
Frame Rate	Fr	-	-	4000	fps	
Distance from the Bottom of Lens to the Working Surface	Z	2.2	2.3	2.4	mm	

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

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

**7.4 AC Electrical Characteristic (VDD = 5.0V, Temperature = 25 °C )**

Parameter	Symbol	Min	Typical	Max	Units	Notes
<b>Internal Ring Oscillator Frequency</b>	F <sub>ROSC</sub>		10		kHz	
<b>Power-up Reset delay</b>	T <sub>PU</sub>	-	10	-	us	POR signal from 0 to 3.5
<b>Debounce Time on Button</b>	T <sub>DB</sub>	9.5	11.5	13.5	ms	
<b>Z-axis Sampling Time</b>	T <sub>Z</sub>	-	125	-	us	



## 8. Sensor Pixel Array Mapping

306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323
288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305
270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287
252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269
234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251
216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233
198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215
180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197
162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179
144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161
126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143
108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107
72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89
54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	51	53
18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

## 9. Typical Application Circuit

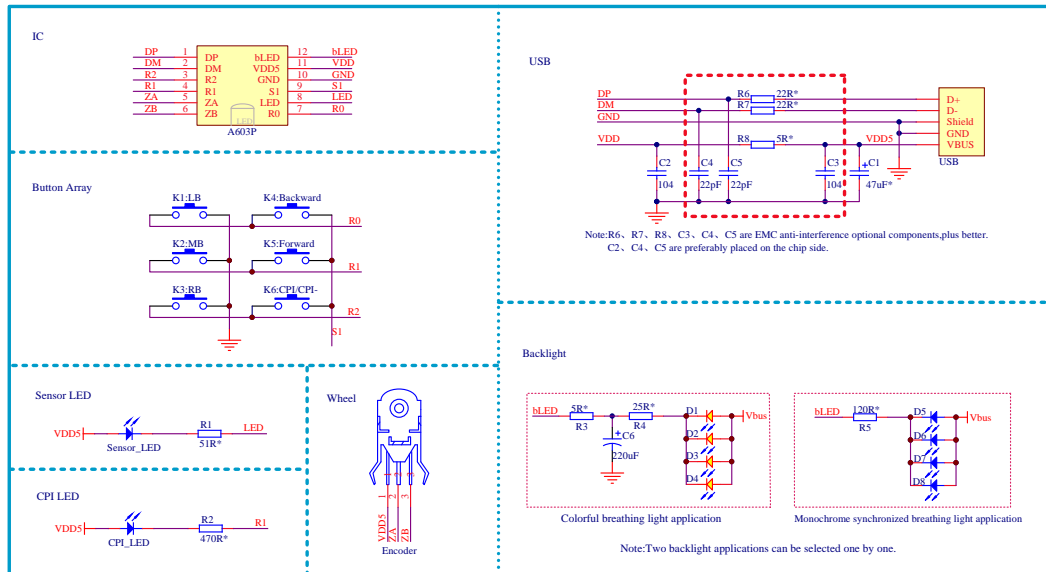


Figure 3. Application Circuit

**10. Package**

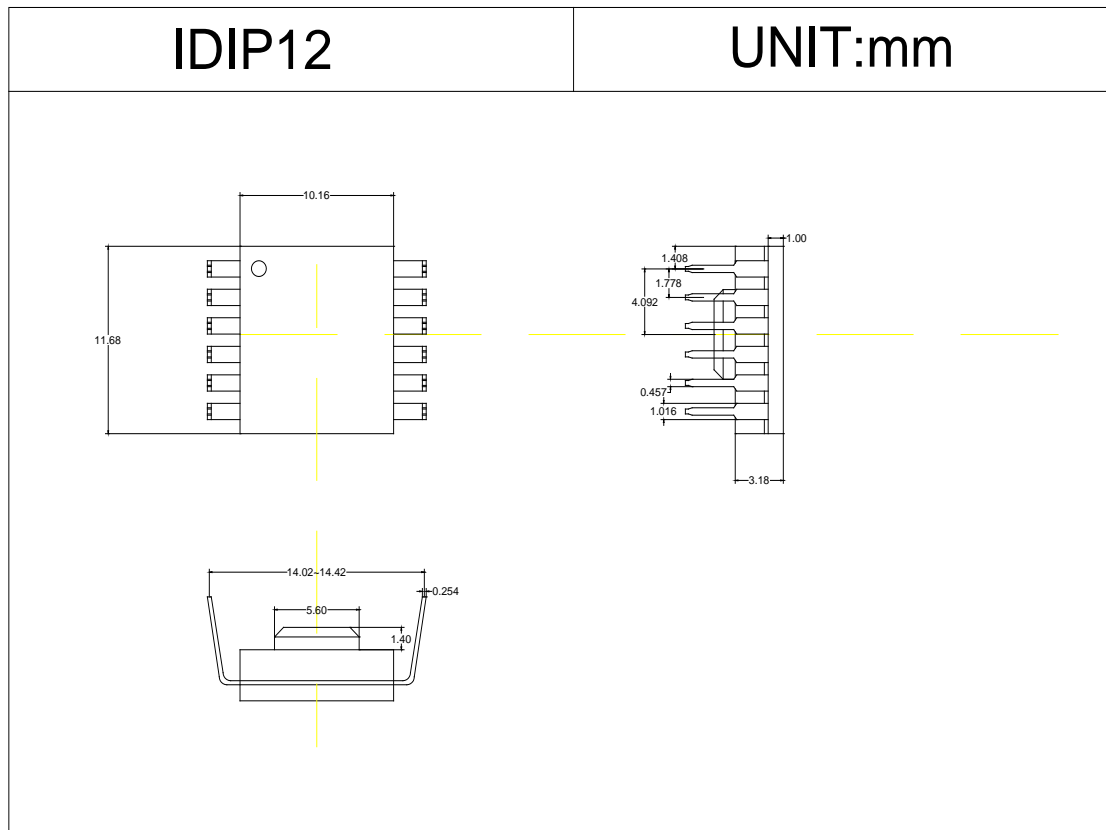


图 Figure 4. Package Outline Drawing

## 11. Assembly Drawing

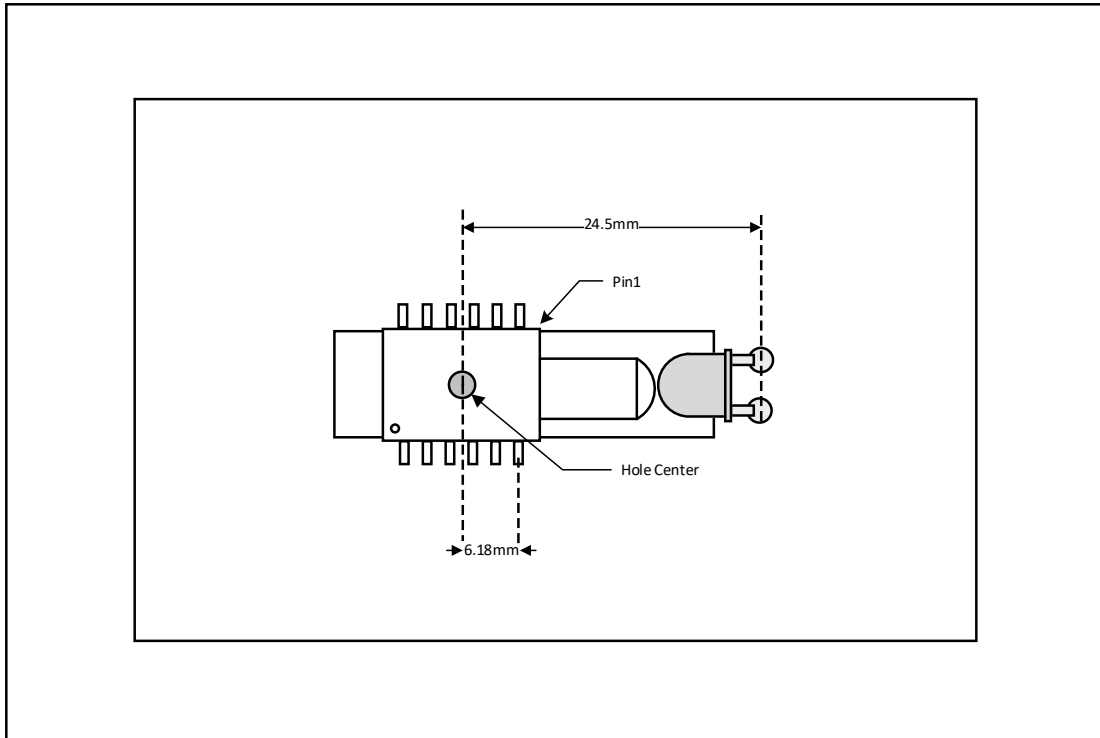


Figure 5. 2D Assembly drawing of A603P (Top and Side View)

## 12. Revision History

Version	Description	Date
A603P_SPEC_EN.V1.00	Create Preliminary Version	2019/07/18