

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

# **A603EP Datasheet**

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**USB Optical Mouse**

**Version 1.00**

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## 1. General Description

Multi-mode multi-key multi-function mouse Sensor A603EP 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.

A603EP is based on algorithm which measures changes of sequential surface images and then determines the movement. It is a 3D6K mouse chip, which has extra three buttons (K4/K5/CPI) and the basic mouse function (R/M/L button, Y motion and Z axis wheel) in order to provide convenience for office application. It supports 4 level CPI resolutions (1200/1800/2400/3600). A603EP supports 7 colors in full color backlight application and Monochromatic Constantly Bright Backlight application. It supports long press CPI key over 3s or 4<sup>th</sup>(or 5<sup>th</sup>)+CPI combination key switch

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 8g, Max moving speed 30inch/s.
- 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)/1800/2400/3600 by CPI key
- Support full color backlight LED which breathes with 7 colors in cyclic change and Monochromatic Backlight application
- Support 4 levels CPI light and shade indication of LED
- All backlights support long press CPI key over 3s or 4<sup>th</sup>(or 5<sup>th</sup>)+CPI combination key switch
- 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

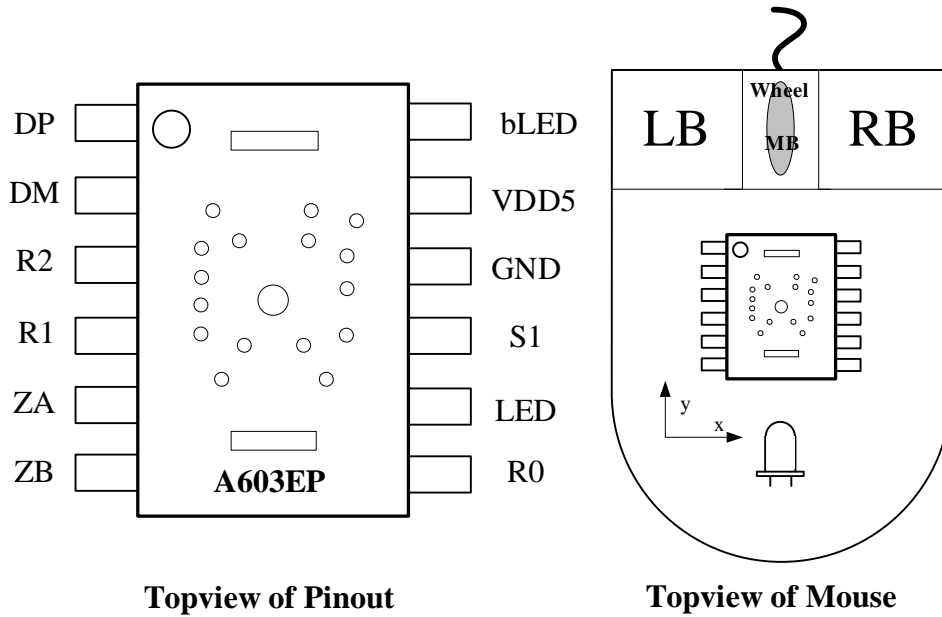


Figure 1. Pinout

### 4. Pin Description

	Pin Name	Type	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	OUT	Button array scan out
10	GND	GND	Ground
11	VDD5	POWER	Power 5v input
12	bLED	OUT	Backlight LED output.

## 5. Block Diagram

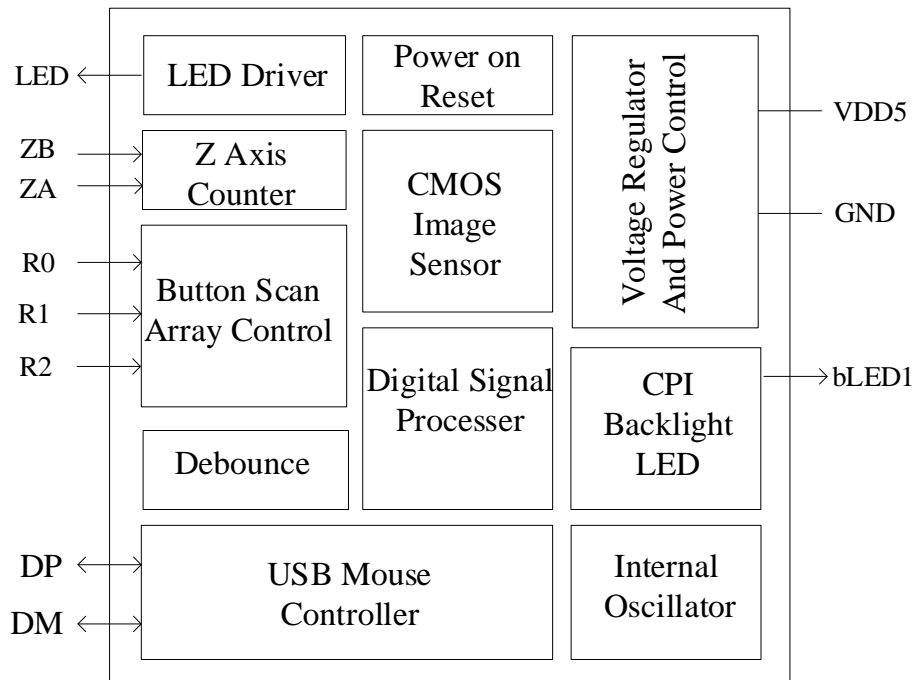


Figure 2. Block Diagram

## 6. Application Note

### 6.1 Buttons Matrix definition

Distribution of 9 physical keys in key array:

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

Button No	Button Function
K1	Left
K2	Middle
K3	Right
K4	4 <sup>th</sup> (Backward)
K5	5 <sup>th</sup> (Forward)
K6	CPI
Z1	SCROLL UP
Z2	SCROLL DOWN

## 6.2 CPI Function

### 6.2.1 CPI switching

When switching CPI, corresponding to 1200 (def)/1800/2400/3600 4 different CPI, backlight will flicker 1 to 4 times.

### 6.2.2 LED for CPI switching

CPI	Brightness
1200	Off
1800	Weak
2400	Middle
3600	Strong

Monochrome LED indicates different CPI Levels according to different brightness.

## 6.3 Backlight LED

A603EP support two backlight modes:

- Seven-color backlight has the effect of seven-color conversion and resets the backlight every 38S.
- Monochromatic synchronous backlight can be used for Constantly Bright effect.
- All backlights support long press CPI key or 4<sup>th</sup>(or 5<sup>th</sup>)+CPI combination key switch.

## 7. Electrical Characteristics

### 7.1 Absolute Maximum Rating

Parameters	Symbol	Min	Max	Unit	Notes
Supply Voltage	VDD	-0.5	5.5	V	
Operating Temperature	T <sub>o</sub>	-15	55	°C	
Storage Temperature	T <sub>s</sub>	-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
Supply Current	In motion	I <sub>DD</sub>	-	16.5	-	mA	
Supply Current	Static	I <sub>DD1</sub>	-	7.8	-	mA	
Input Voltage High	Input port	V <sub>IH1</sub>	2.0	-	-	V	
Input Voltage Low	Input port	V <sub>IL1</sub>	-	-	0.8	V	
Input Voltage High	I/O port	V <sub>IH2</sub>	2.0	-	-	V	
Input Voltage Low	I/O port	V <sub>IL2</sub>	-	-	0.8	V	
Output Voltage High	I/O port	V <sub>OH1</sub>	2.8	-	3.6	V	
Output Voltage Low	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

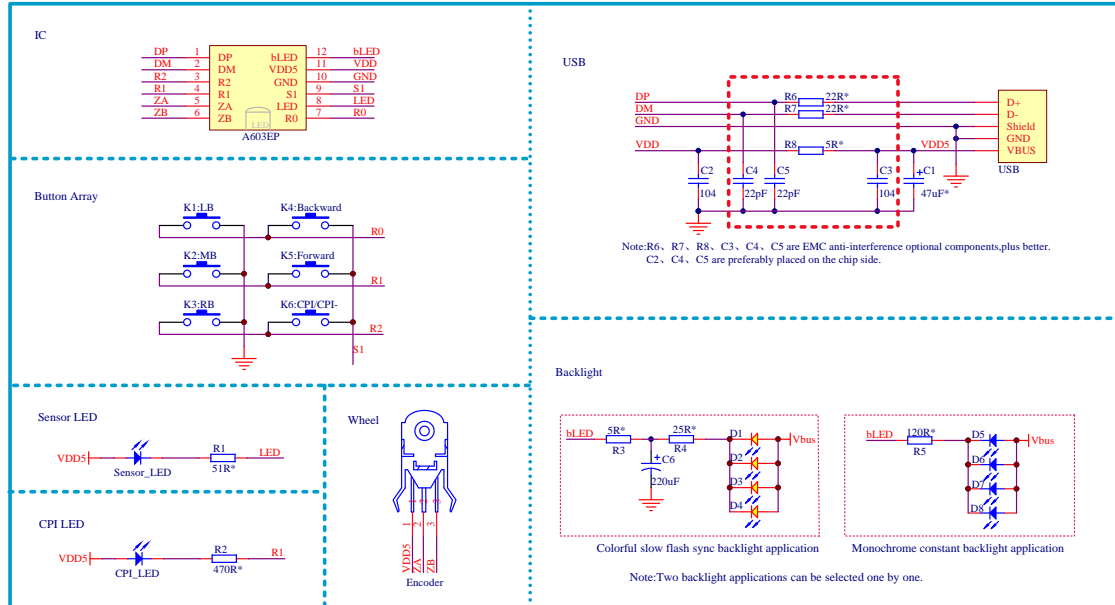


Figure 3. Application circuit

## 10. Package

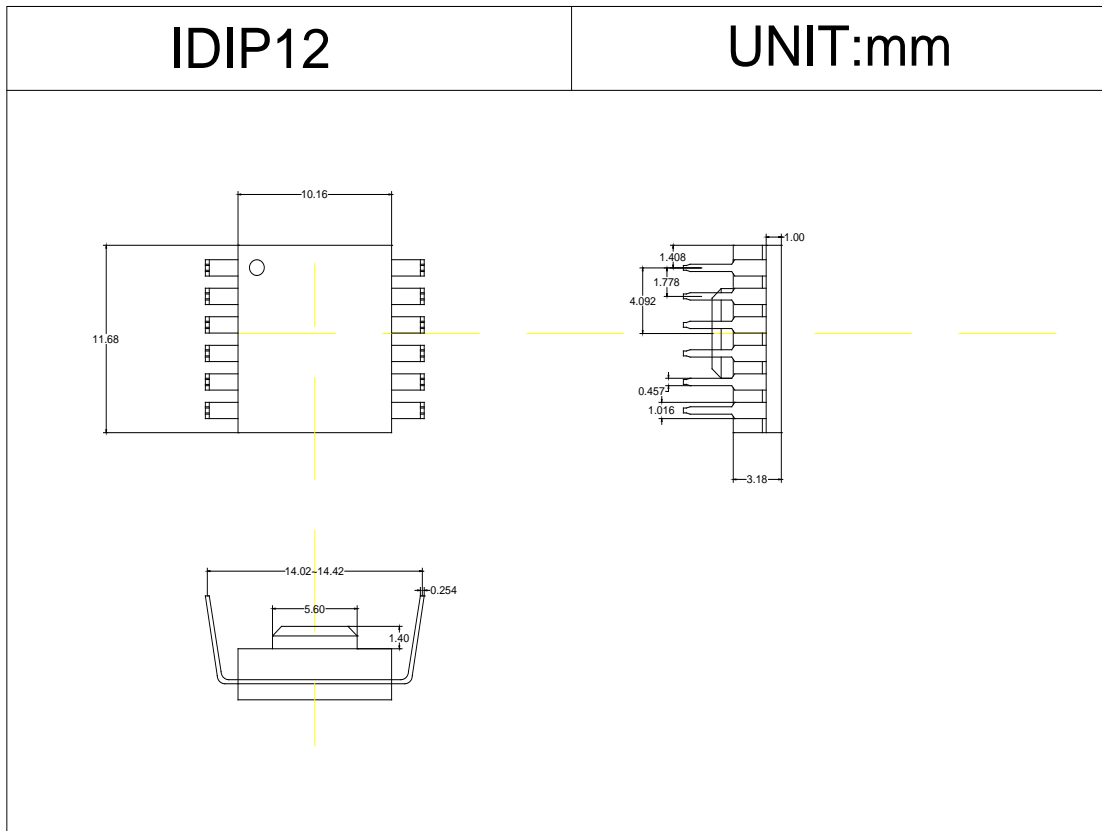


Figure 4. Package outline Drawing

## 11. Assembly Drawing

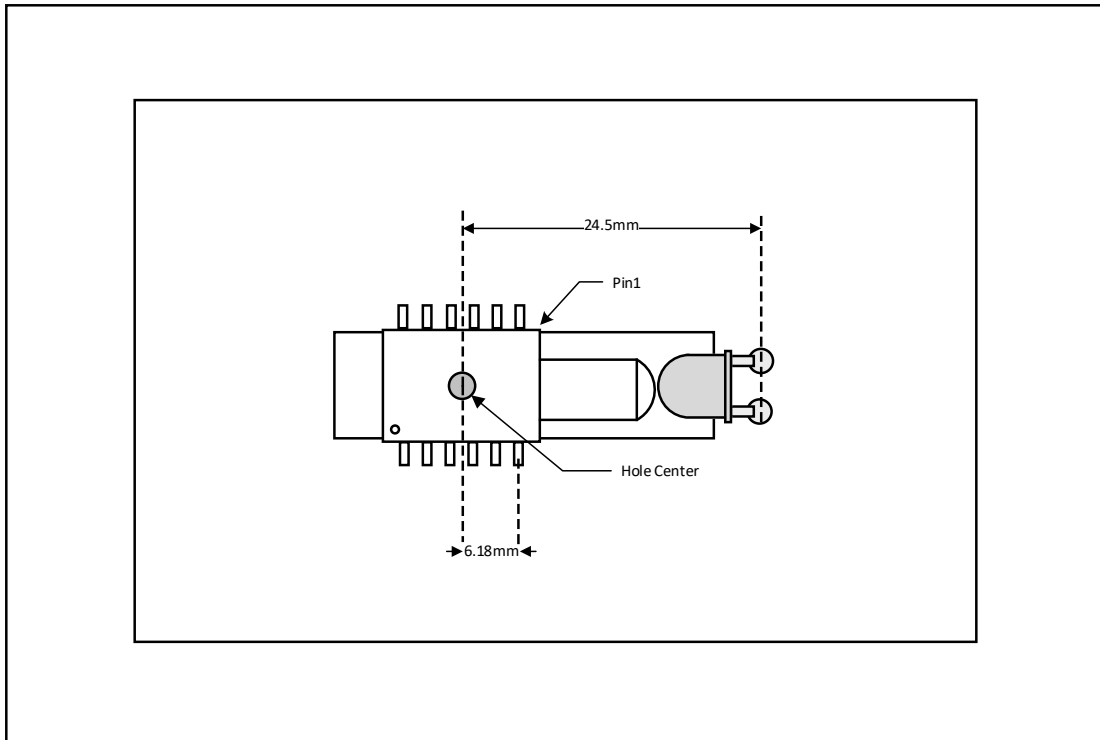


Figure 5. 2D Assembly drawing of A824E (Top and Side View)

## 12. Revision History

Version	Description	Date
A603EP_SPEC_EN.V1.00	Create Preliminary Version	2019/07/18