

Full-color Backlight multi-function series

A714 Datasheet

USB Optical Mouse

Version 1.00

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1. General Description

Full-color Backlight multi-function mouse Sensor A714 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.

A714 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 multimedia, games, Internet and office applications. The maximum frame rate is 6000fps, the maximum speed is 60inch/s, and the maximum acceleration is 15g. It supports 600/800/1200/1600/2400/3200 six-level CPI resolution (the maximum CPI that can be set when the driver software is turned on is 4800).

In the application of LED breathing mode, A714 has its own characteristics. On the basis of the commonly used functions of "circular discolored breathing" and "silent breathing", it introduces the function of "color-taking breathing" to provide users with more abundant application choices. From the point of view of user practicability, A714 uses function keys to realize the switching of three breathing modes

A714 is in a 14-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 six-level resolutions 600/800(def)/1200/1600/2000/2400/3200 by CPI key
- Supporting single and double CPI mode
- Supports 7-color breathing of three-color LED lamp, and can change breathing color with CPI switching
- With breathing mute function, LED breathing lamp can be switched on and off by 4th (or 5th) plus CPI combination key
- Supporting 7-color circulatory discolored respiratory function
- Support breathing and mute function , switching on and off by 4th(or 5th)+CPI combination key

- Support three additional multi-function keys: Boss key, Double key and Fire key (see Section 6.2 for details)
- Support L/M/R 3 buttons , X/Y/Z three axis and the 4th/ 5th buttons
- IDIP-14 package and RoHS Compliant

2. Pin Assignment

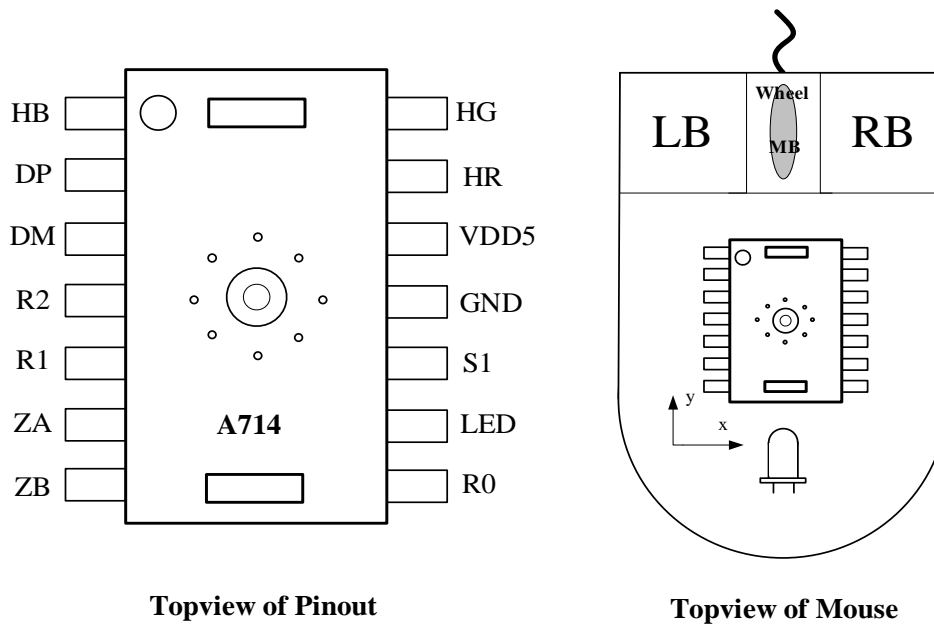


Figure 1. Pinout

4. Pin Description

	Pin Name	Type	Function Description
1	HB	OUT	Backlight LED output. Blue LED driver
2	DP	IN/OUT	USB D+
3	DM	IN/OUT	USB D-
4	R2	IN	Button array scan in, Single or double CPI select
5	R1	IN	Button array scan out
6	ZA	IN	Z axis in
7	ZB	IN	Z axis in
8	R0	IN	Button array scan in
9	LED	OUT	LED open drain output
10	S1	OUT	Button array scan out
11	GND	GND	GROUND
12	VDD5	POWER	Power 5v input
13	HR	OUT	Backlight LED output. Red LED driver
14	HG	OUT	Backlight LED output. Green LED driver

5. Block Diagram

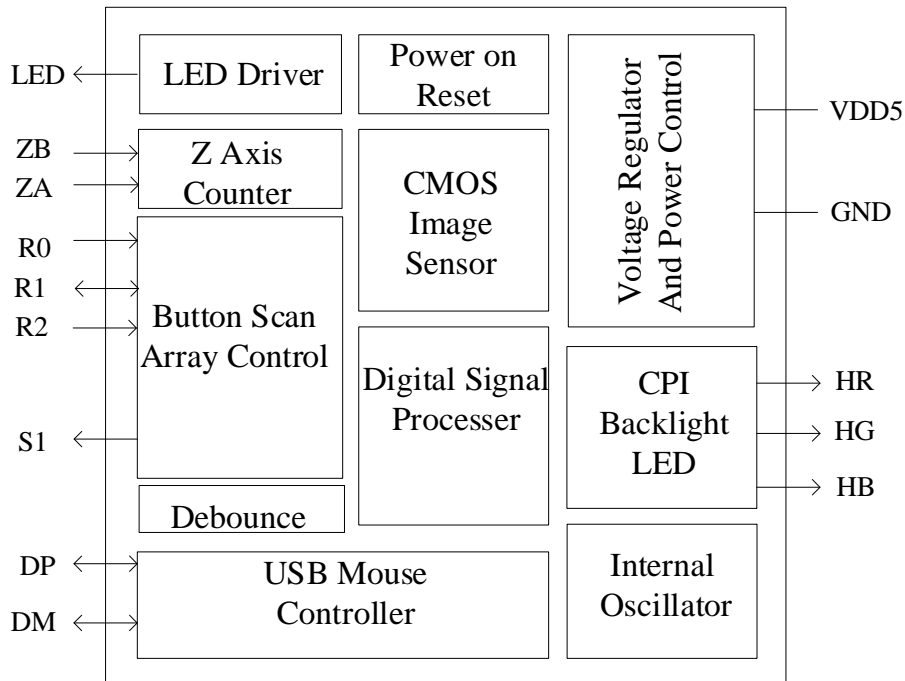


Figure 2. Block Diagram

6. Application Note

6.1 Buttons Matrix definition

Distribution of 9 physical keys in key array:

PIN	GND	S1	VDD
R0	K1	K4	K7
R1	K2	K5	K8
R2	K3	K6	K9

	Single CPI Mode	Double CPI Mode	Driver Mode
K1	L	L	User define
K2	M	M	User define
K3	R	R	User define
K4	4 th (Backward)	4 th (Backward)	User define
K5	5 th (Forward)	5 th (Forward)	User define
K6	CPI	CPI-	User define
K7	BOSS	BOSS	User define
K8	DB	CPI+	User define
K9	FIRE	FIRE	User define
Z1	Scroll up	Scroll up	User define
Z2	Scroll Down	Scroll Down	User define

Note: 1. When R2 has no pull-up resistance to power supply, the mouse is in single CPI mode. .
 2. When R2 has pull-up resistance to power supply, the mouse is in dual CPI mode.

6.2 Multifunctional Key Instructions

Key Name	Function Description
BOSS	Used to switch the current application screen and desktop
DOUBLE	Pressing this button is equivalent to complete the double click operation.
FIRE	Pressing this button is equivalent to continuing to click the left button

6.3 Driver Mode

A714 supports the functional expansion of the driver mode. Through the driver provided, it can provide more rich functions and customized applications. See the driver Application Manual for details.

6.4 CPI Setting

6.4.1 Gear and Number Settings

Out of the drive mode, A714 supports 6-speed resolution, defaulting to 800. In drive mode, A714 provides six CPIs, each of which can be selected from 12 resolution values: 200/400/600 /800/1000/1200/1600/2000/2400/3200/4000/4800. A714 supports two CPI switching modes:

- In Single CPI mode: It can be switched by single CPI button in the following order:
800(def)->1200->1600->2400->3200->600->800
- In Double CPI mode: CPI + keys make the resolution level increase to the maximum; clicking CPI - keys makes the resolution level decrease to the minimum.

6.4.2 CPI Indication

CPI	Three-color backlight breathing LED				
	HR	HB	HG	Color	Shift flicker
600	On		On	Yellow	One
800		On		Blue	Two
1200	On	On		Pink	Three
1600			On	Green	Four
2400	On			Red	Five
3200		On	On	Cyan	Six

There are two forms of CPI indication of A714, namely Backlight Color Indicator and Backlight Flash Indicator.

In auto-circulatory breathing mode, different backlight colors indicate different CPI gears when CPI is switched.

In color-picking breathing mode, different backlight flicker times indicate different CPI gears during CPI switching.

Note: See 6.5.1 Backlight LED function overview for details

6.5 Backlight LED

6.5.1 Functional overview

There are three working modes for three-color backlight breathing LED:

- 7-color automatic circulation breathing: The default working mode of the backlight LED is that the backlight LED breathes at a specific frequency. Its initial color corresponds to the color indicated by the CPI. After 6 seconds, it follows the sequence of yellow, blue, pink, green, red, green and yellow automatic circulation and discoloration breathing, providing a gorgeous visual effect.
- Color-taking breathing: A714 puts forward the concept of "color-taking breathing", that is, when the backlight breathes to the user's preferred color in the 7-color automatic circulation breathing mode, press the mode switching combination key, and switch the breathing mode to this mode. The current color is successfully extracted as a fixed backlight color, and breathe at a fixed frequency under this color
- Silence: turn off the backlight.

Side keys 4th (or 5th) +CPI keys are backlight mode switching combination keys, that is, holding down 4th or 5th keys, and clicking CPI (CPI-) keys can achieve backlight mode switching, the switching order is "cyclic discoloration breathing, mute breathing, cyclic discoloration breathing". In addition, if the CPI is pressed for more than three seconds, the backlight can also be switched on and off.

6.5.2 Application Guideline

A714 backlight LED adopts common anode scheme. In addition to the default color matching method in the table as shown in 6.4.2, different color matching effects can be achieved by changing the connection sequence of A714 output pins (HR, HG, HB) and three primary LED pins according to customer needs.

Note: The default color matching method is adopted in application circuit of Section 9.

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 _{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	Notes
Supply Voltage	VDD	4.5	5.0	5.5	V	
Operating Temperature	T _A	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	Note
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 °C)

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. 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

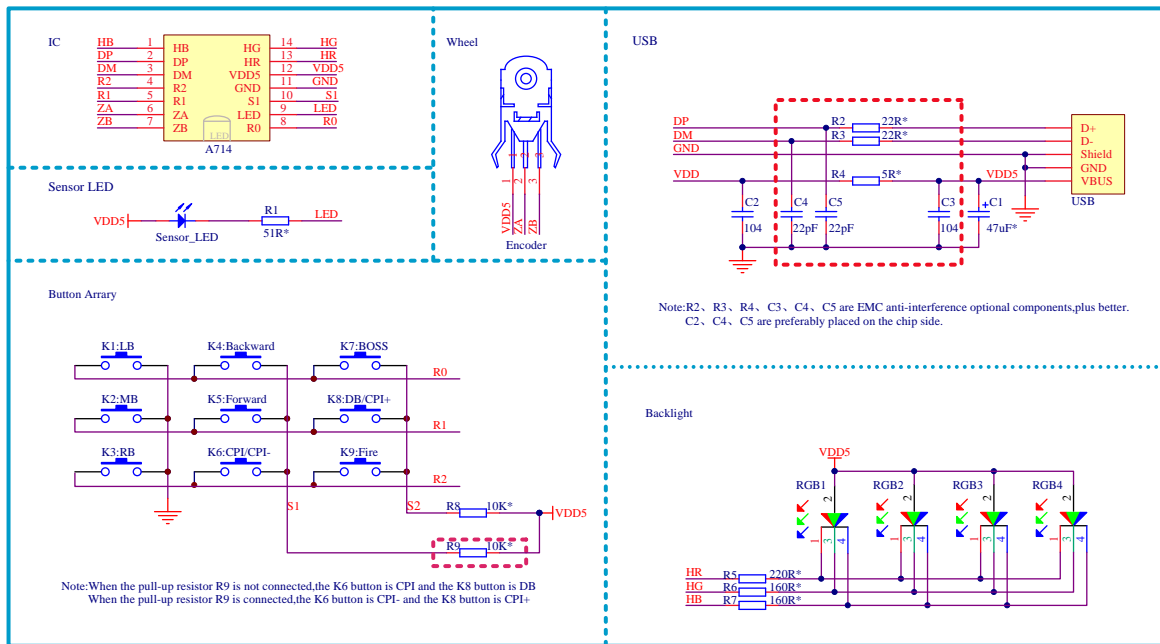


Figure 3. Application Circuit

10. Package

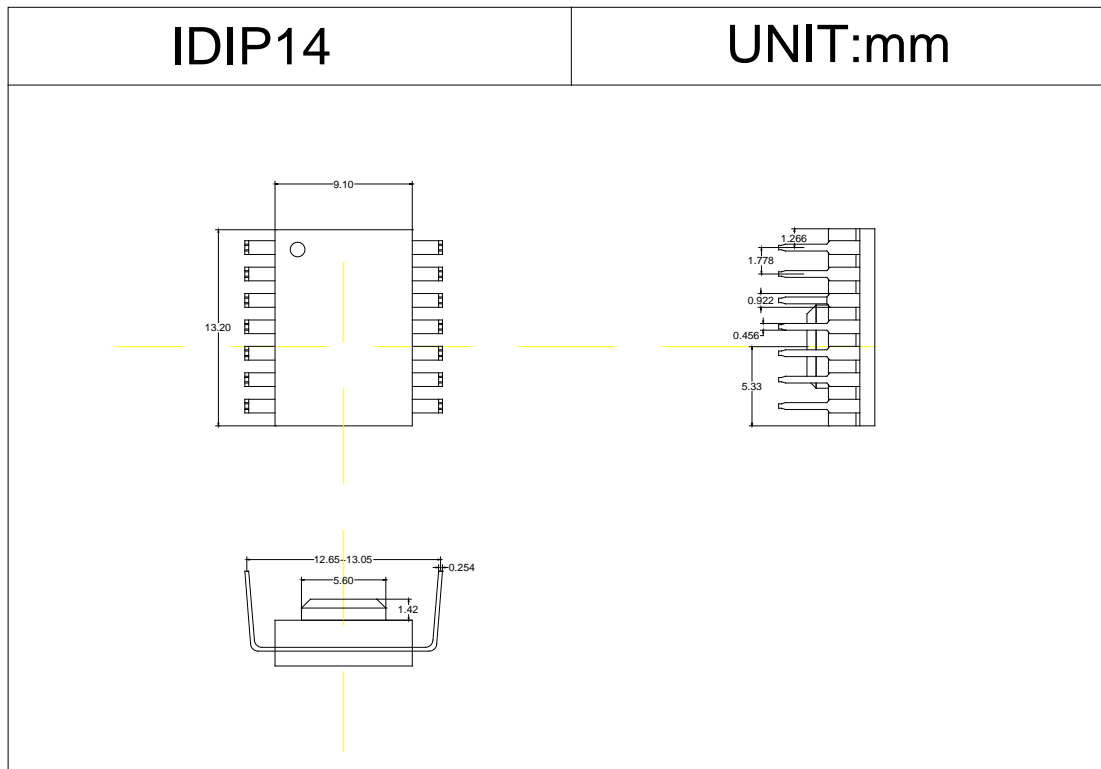


Figure 4. Package Outline Drawing

11. Assembly Drawing

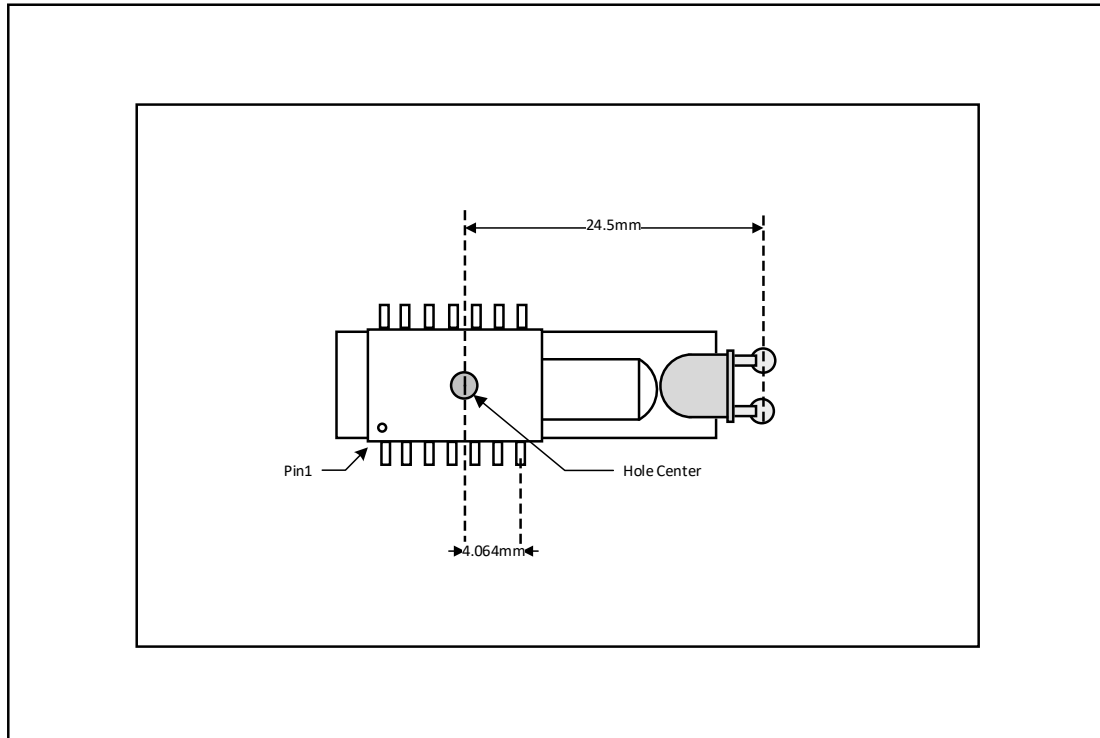


Figure 5. 2D Assembly drawing of A714 (Top and Side View)

12. Revision History

Version	Description	Date
A714_SPEC_EN.V1.00	Create Preliminary Version	2019/07/18