

**Multi Function Gaming Mouse Series**

# **A704 DATASHEET**

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**USB OPTICAL MOUSE**

**Version 1.01**

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## 1. General Description

A704 is a high performance and Multi-Function CMOS process optical mouse sensor single chip with USB interface that servers as a non-mechanical tracking engine for implementing a computer mouse.

A704 is based on optical navigation technology which measures changes of sequential surface images and then determines the movement. It supports 1200/1600/2000/3200 CPI resolution. A704 provides two application modes, Normal and Multi-Media, which can be switched freely by a function button. And it supports up to NINE buttons for 3 dimension(X, Y, and Z) in Normal mode, some buttons are reused in Multi-Media mode.

A704 provides 3 types of methods in LED lighting, in the 1<sup>st</sup> one LED breathing in different colors, in the 2<sup>nd</sup> LED breathing in fixed color, in the 3<sup>rd</sup> LED closed, and customers can switch one to another method by LED\_MODE\_SW button.

A704 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 USB2.0 and USB HID ver1.1 Specification
- Support winxp/win2003/win2008/vista/win7/win8 system, and MAC OS, and Android system
- 5V Power Supply
- Internal crystal-less oscillator and On chip LED Driver
- Resolution 1200/1600/2000/3200 adjust by CPI button
- Support CPI cycling mode and CPI+/CPI- two buttons mode.
- Support one color LED for CPI inducting
- Support 2 color backlight LED for different four CPI selection
- ‘Breathe muting’ function: Turn on /off backlight LED by press 4<sup>th</sup> + CPI (or 5<sup>th</sup> +CPI)
- Provides 4 colors for LED lighting
- Support LED lighting in 3 methods, which can be switched by a button
- Support L/M/R 3 buttons and X/Y/Z 3 axis
- Support 4<sup>th</sup>/ 5<sup>th</sup> buttons
- Support 3 additional function buttons (see section6.2): BOSS/LED\_MODE\_SW/FIRE
- Normal mode and Media mode selection by press CPI down over 5 seconds (see section6.3).

- Small form factor 14-pin PDIP package available, ROHS standard

### 3. Pin assignment

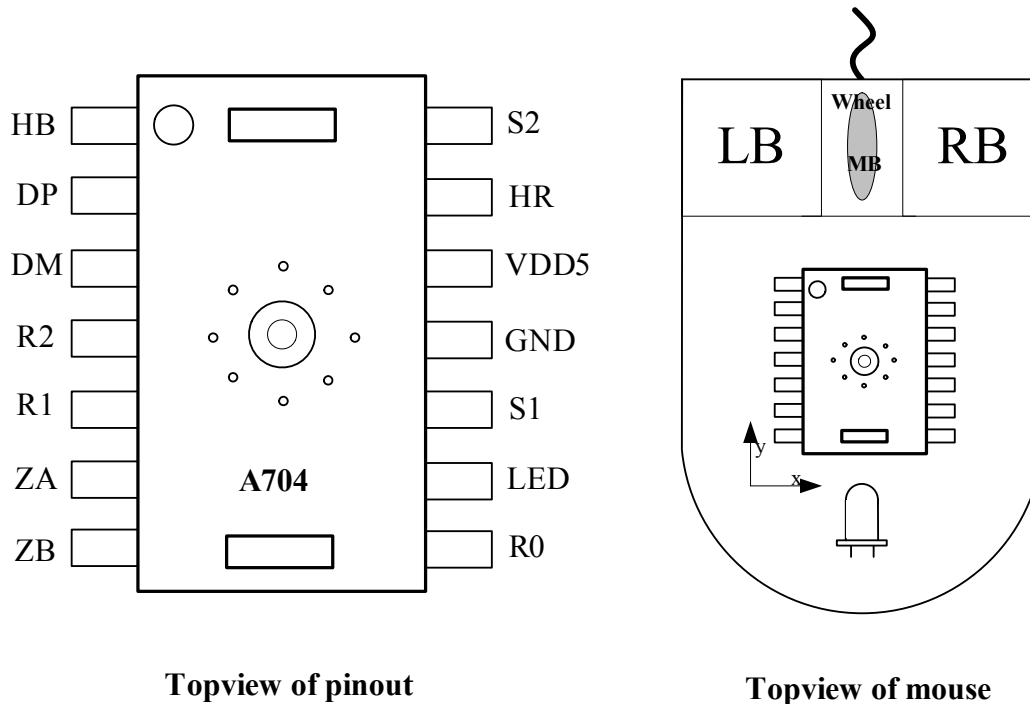


Figure 1. Pinout

### 4. Pin Description

	Pin Name	Type	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	Key array scan in
5	R1	IN	Key array scan in and CPI LED output
6	ZA	IN	Z axis input
7	ZB	IN	Z axis input
8	R0	IN	Key array scan in
9	LED	OUT	LED open drain output
10	S1	OUT	Key array scan out
11	GND	PWR	Ground
12	VDD5	PWR	Power 5v input
13	HR	OUT	Backlight LED output. Red LED driver
14	S2	OUT	Key array scan output

## 5. Block Diagram

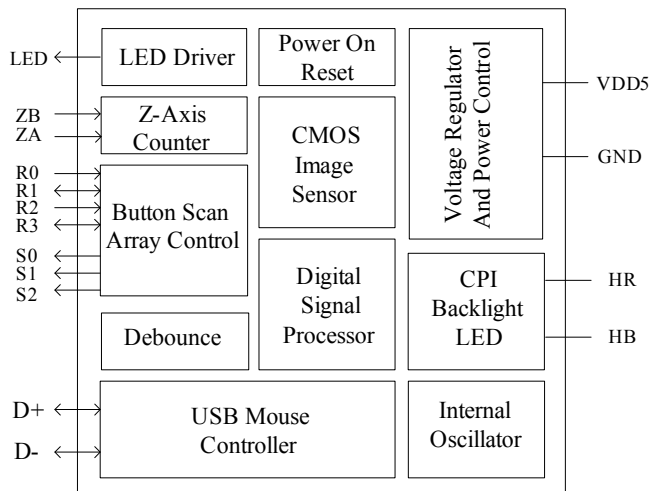


Figure 2. Block Diagram

## 6. Application Note

### 6.1 Buttons Matrix definition

PIN	GND	S1	S2
R0	K1	K4	K7
R1	K2	K5	K8
R2	K3	K6	K9

	NORMAL MODE		MULTI MEDIA MODE	
	Single CPI Button	Dual CPI Buttons	Single CPI Button	Dual CPI Buttons
K1	L	L	L	L
K2	M	M	PLAY/PAUSE	PLAY/PAUSE
K3	R	R	R	R
K4	4 <sup>th</sup> (backward)	4 <sup>th</sup> (backward)	NEXT	NEXT
K5	5 <sup>th</sup> (forward)	5 <sup>th</sup> (forward)	PREVIOUS	PREVIOUS
K6	CPI	CPI-	CPI	CPI-
K7	BOSS	BOSS	BOSS	BOSS
K8	LED_MODE_SW	CPI+	LED_MODE_SW	CPI+
K9	FIRE	FIRE	FIRE	FIRE
Z1	SCROLL UP	SCROLL UP	VOL+	VOL+
Z2	SCROLL DOWN	SCROLL DOWN	VOL-	VOL-

**Note:**

- A. Mouse will has single CPI button without pull up resistor R2.
- B. Mouse will has dual CPI buttons (CPI+/CPI-) with pull up resistor R2.

## 6.2 Multi-Function Buttons

Buttons	Functional Description
<i>BOSS</i>	Used to switch between current screen and desktop.
<i>LED_MODE_SW</i>	To switch between the 3 lighting methods
<i>FIRE</i>	Pressing this button down is equivalent to continuing clicking left button.

## 6.3 Mode switching

A704 supports two working mode. Default is Normal mode. We can change to Multi-Media mode by pressing down CPI or CPI- over 5 second. After entering the Multi-Media mode, backlight LED will stop breathing and CPI LED will begin to breath. The color of backlight LED will indicate current CPI resolution. We also can change it back to Normal mode by the same way.

## 6.4 CPI switching

A704 supports 4 different resolution. Default is 1200 DPI. It can be changed from 1200 to 3200 by pressing CPI button (in single CPI mode), and the order is 1200→1600→2000→3200→1200. With CPI- and CPI+ buttons (in double CPI mode), it can be up to 3200 by pressing CPI+ and can be down to 1200 by pressing CPI-.

## 6.5 LED for CPI Indicating

CPI	Two color LED backlight			Single color LED
	HR	HB	COLOR	brightness
1200	OFF	ON	Blue	OFF
1600	ON	ON	Pink	WEAK
2000	ON	OFF	Red	MEDIUM
3200	ON/2	ON	Purple	STRONG

**Note:** ON/2 means that LED has only half brightness of ON status.

In Multi-Media mode, the backlight LED only indicate the current resolution with certain color (according to the table above) without breathing, and the single color LED will start breathing but without DPI indicating function.

In Normal mode, the Single color LED will show different brightness in different CPI resolution, but it cannot breathe. The backlight breathing LED has three lighting methods.

- Breathing in 4 colors

Default working mode, the backlight LED breathes and cycles in 4 colors. When CPI button pressed, the certain color holds to indicate DPI resolution, after 6s LED start to breathe in 4 colors, according to

the order ‘blue>pink>red>purple>blue’.

- Breathing in Selected color

User can select favorite one from 4 colors by clicking LED\_MODE\_SW button. And the backlight LED breathes in this fixed color.

- LED Closed

The backlight LED will be closed by clicking LED\_SW\_MODE button when it is in “Breathing in Selected color” method. Beside these, the customer also can enter and quit ‘LED Closed’ by combination-button, 4<sup>th</sup>/5<sup>th</sup> and CPI/CPI-.

## 7. Electrical Characteristic

### 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	-	-	30	Inch/Sec	
Resolution	R	-	1200	-	DPI	
Acceleration	A	-	-	8	G	
Frame rate	Fr	-	-	4000	fps	
Distance from lens reference plane to surface	Z	2.2	2.3	2.4	mm	

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

Parameter	Symbol	Min	Typical	Max	Units	Notes
Supply current (in motion)	I <sub>DD</sub>	-	16.5	-	mA	
Supply current (no motion)	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 )

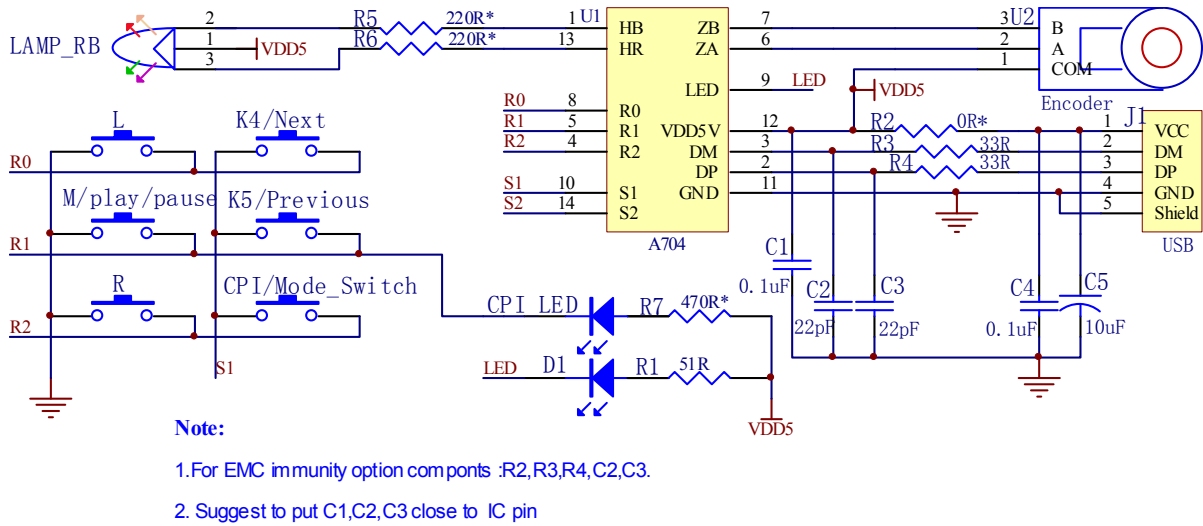
Parameter	Symbol	Min	Typical	Max	Units	Notes
Internal Ring oscillator frequency	F <sub>ROSC</sub>		10		khz	
Power up delay	T <sub>PU</sub>	-	10	-	us	POR from 0 to 3.5
Debounce time on button	T <sub>DB</sub>	9.5	11.5	13.5	ms	
Z wheel sampling period	T <sub>Z</sub>	-	125	-	us	

## 8. Sensor Pixel Array Mapping

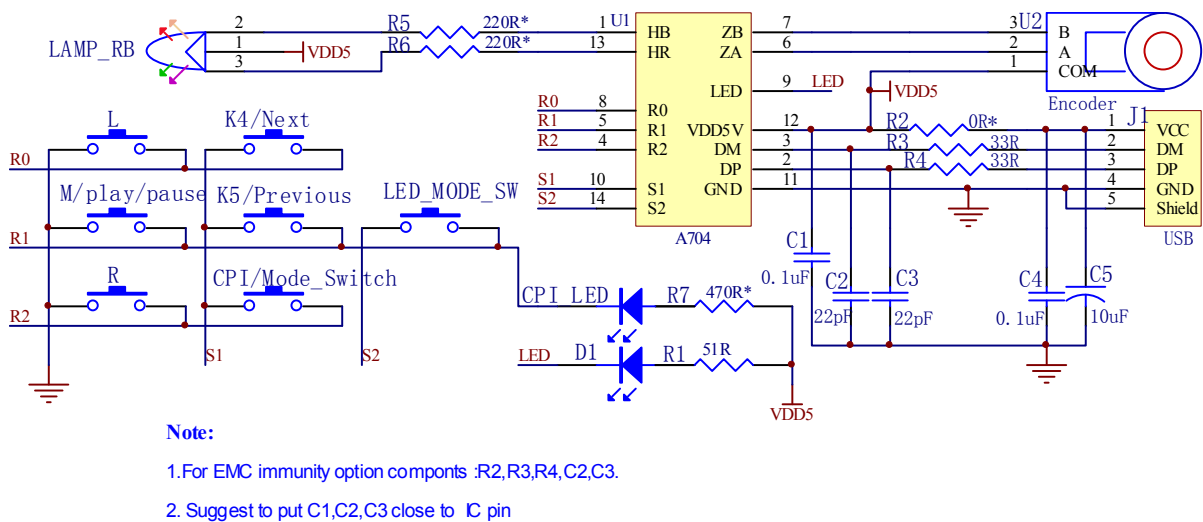
306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323
288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305
270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287
252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269
234	235	236	237	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



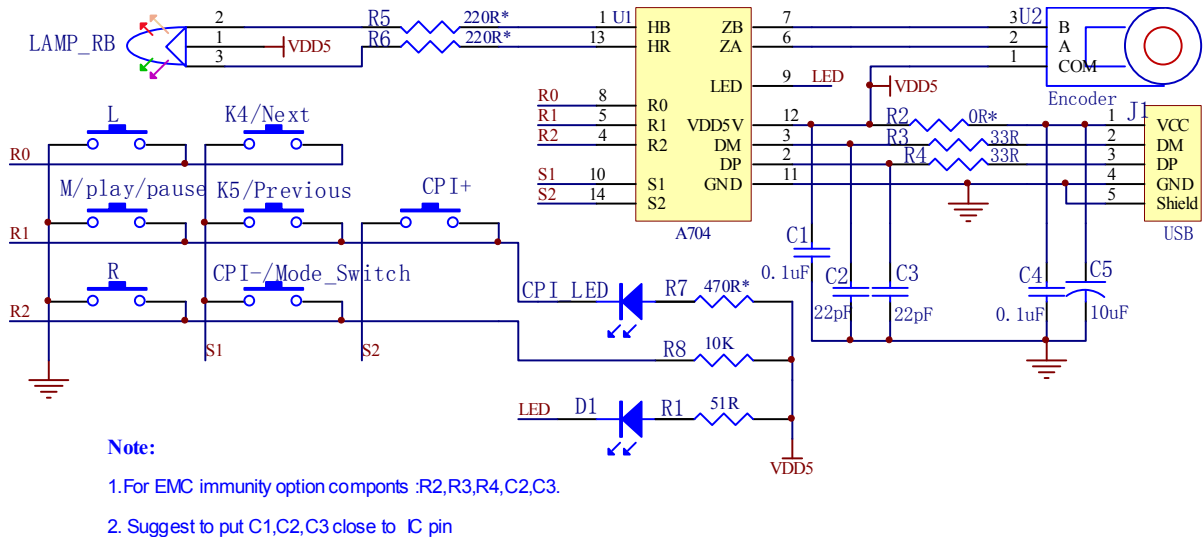
## 9. Typical Application Circuit



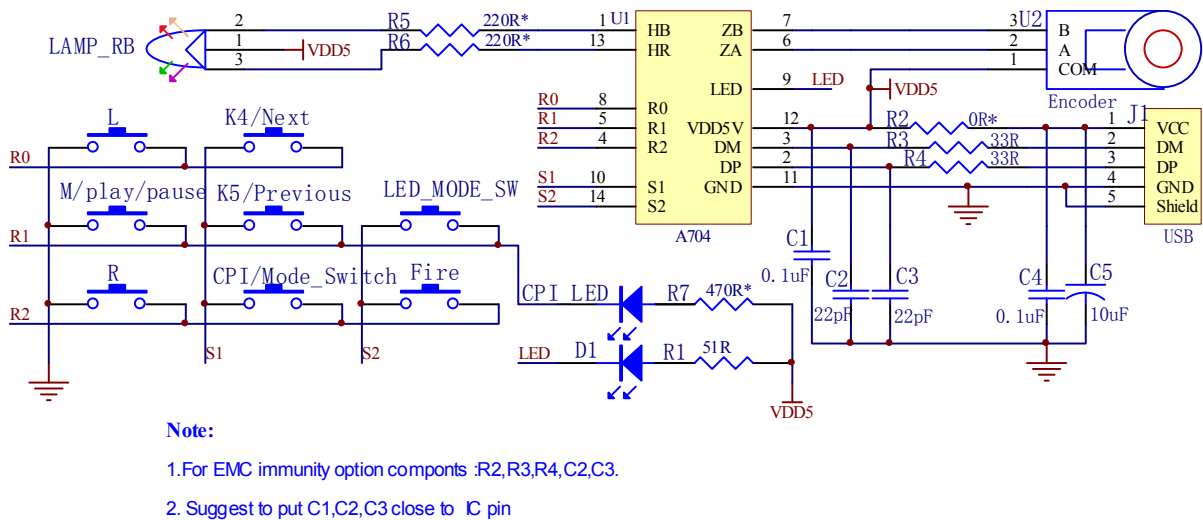
**Figure 3. Basic Application , 3D6K with single CPI button**



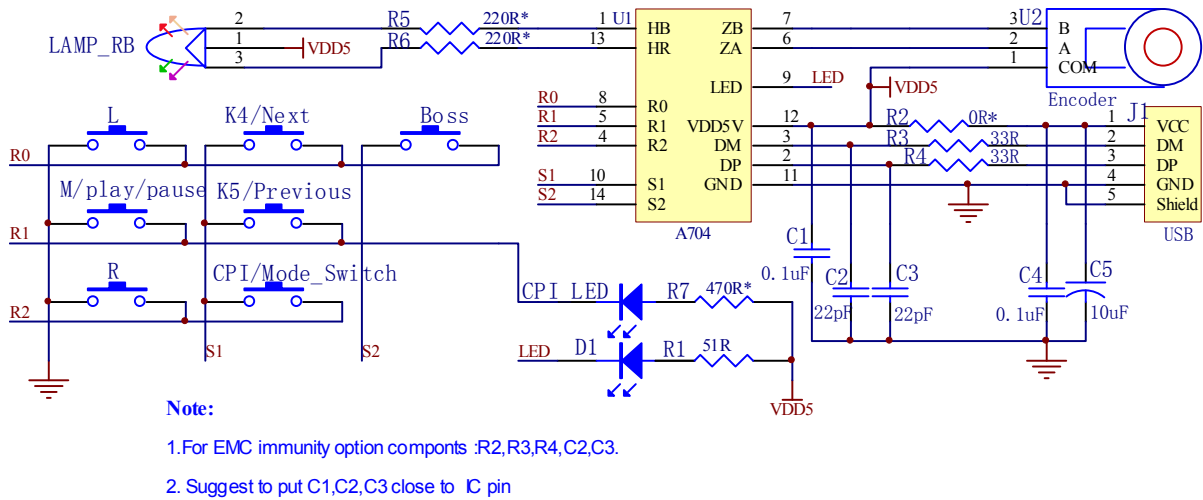
**Figure 4. Basic Application , 3D7K with single CPI button and LED\_MODE\_SW button**



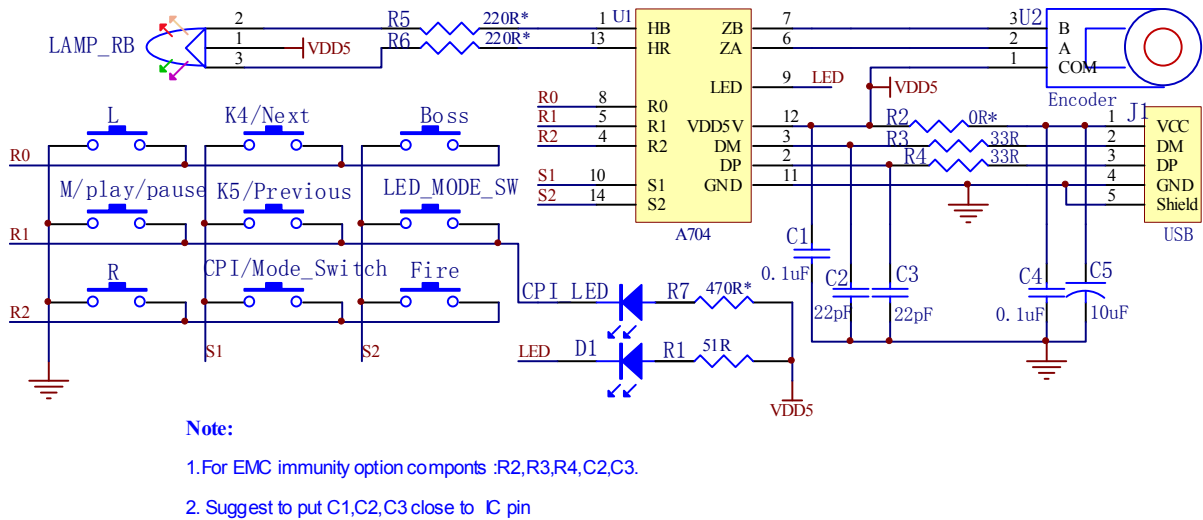
**Figure 5. Basic Application , 3D7K with dual CPI button**



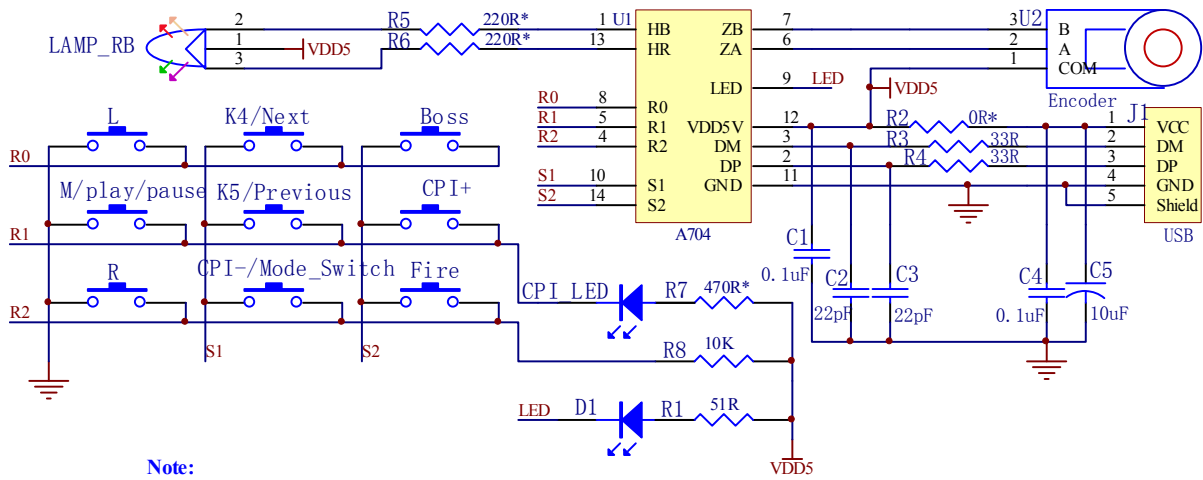
**Figure 6. Gaming Application , 3D8K with single CPI button and LED\_MODE\_SW button**



**Figure 7. Office Application , 3D7K with single CPI button**



**Figure 8. Full function Application , 3D9K with single CPI button and LED\_MODE\_SW button**



**Figure 8. Full function Application , 3D9K with Dual CPI button**

## 10. Package

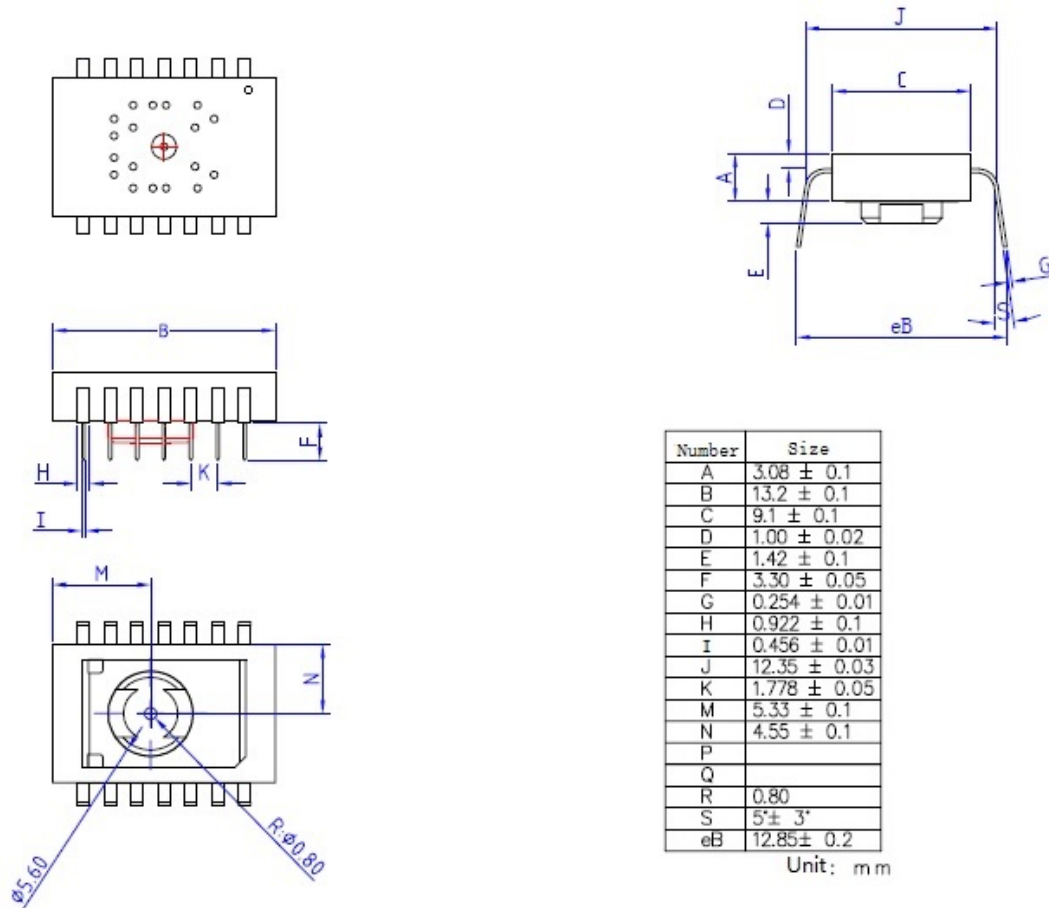


Figure 9. Package Outline Drawing

### 11. Assembly Drawing

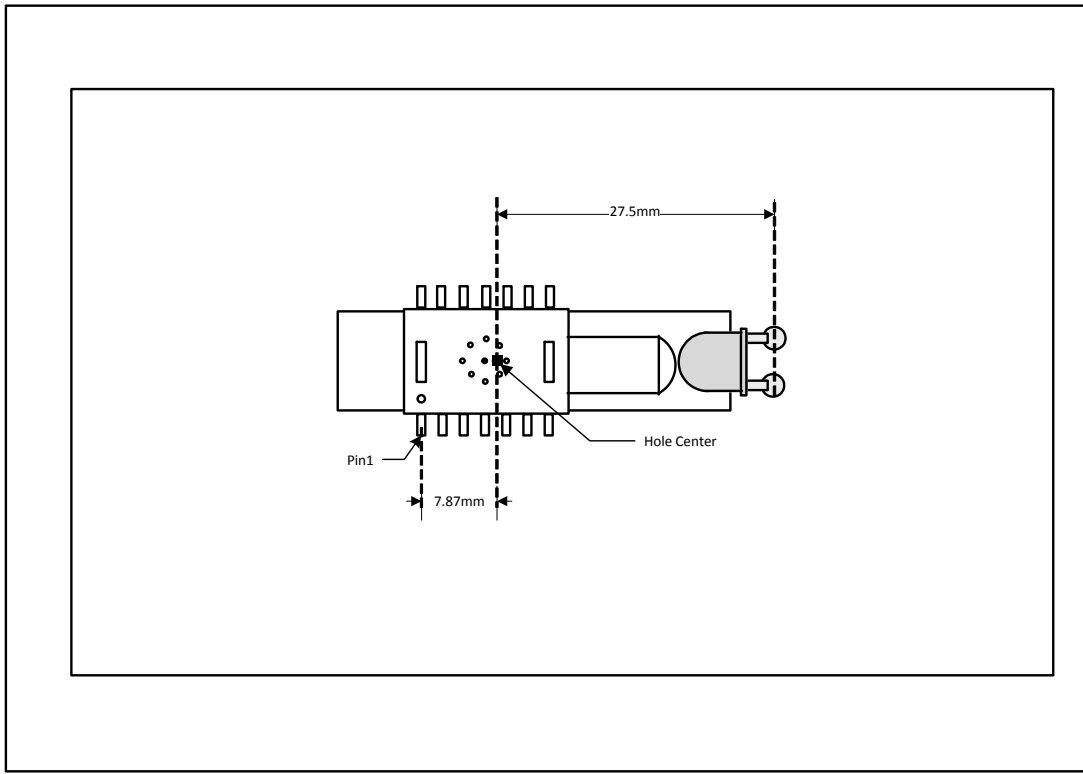


Figure 10. 2D Assembly drawing of A704 (Top and Side View)

### 12. Revision History

Version	Description	Date
A704_SPEC_EN.V1.00	Creation, Preliminary Version	2015/03/31
A704_SPEC_EN.V1.01	Update the maximum CPI:2000	2016/08/08