Multi-model Backlight Game Series

A715 Datasheet

USB OPTICAL MOUSE

Version 1.00

Table of Contents

1. General Description

A715 Multi-mode Backlight Gaming Mouse Sensor 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 mice.

A715 is based on algorithm which measures changes of sequential surface images and then determines the movement. The maximum frame rate is 6000fps, the maximum speed is 60inch/s, and the maximum acceleration is 15g.

In the driving mode, the mouse function supports all-round customization: the CPI gear number can be customized (up to 6 files); the resolution corresponding to the CPI gear can be customized (range 200-4800, a total of 12 levels of optional); keys and rollers can be defined as mouse, keyboard, multimedia, shortcut functions according to user needs, and also can customize macros.（Mouse buttons and mobile, keyboard, multimedia combination functions. Multimodal Backlight Game Series）

In the application of backlight, A715 has its own characteristics. It uses single-line serial LED lights or LED Driver + RGB lights to support streamer overflow backlight mode. In the driving mode, it supports backlight color customization and provides users with rich application choices. In the control of backlight, users can define specific function keys to switch backlight effect

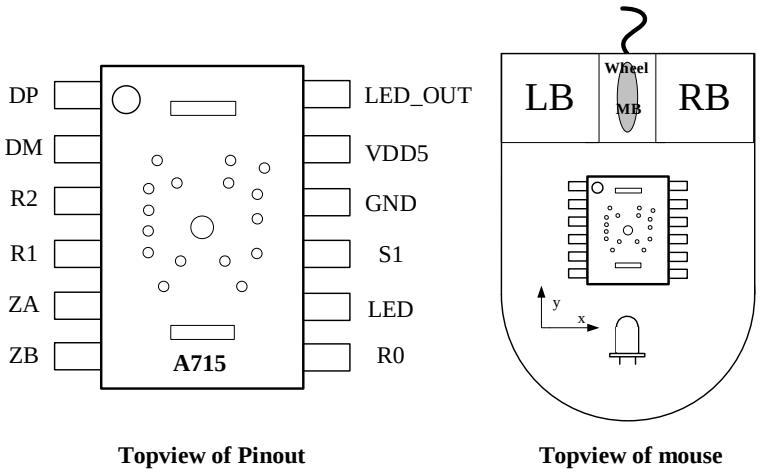
A715 package type is optical DIP12 package, and it has a built-in LED driver and internal oscillator to minimize the external components.

2. Feature

- Optical Navigation Technology, Max FPS 6000, Max acceleration 15g, Max moving speed 60inch/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 six-level resolutions 600/800(def)/1200/1600/2000/2400/3200 by CPI 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 4^{th}/ 5^{th} buttons

- Supports single-line serial cascade LED lights or LED drivers + RGB lights (one LED Driver drives two symmetrical RGB lights)
- Small form factor 12-pin PDIP package available, ROHS standard

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	Key array scan in
4	R1	IN	Key array scan in
5	ZA	IN	Z axis input
6	ZB	IN	Z axis input
7	R0	IN	Key array scan in
8	LED	OUT	LED open drain output
9	S1	OUT	Key array scan out
10	GND	GND	Ground
11	VDD5	PWR	Power 5v input
12	LED_OUT	OUT	Horse Race Lamp output. LED driver

5. Block Diagram

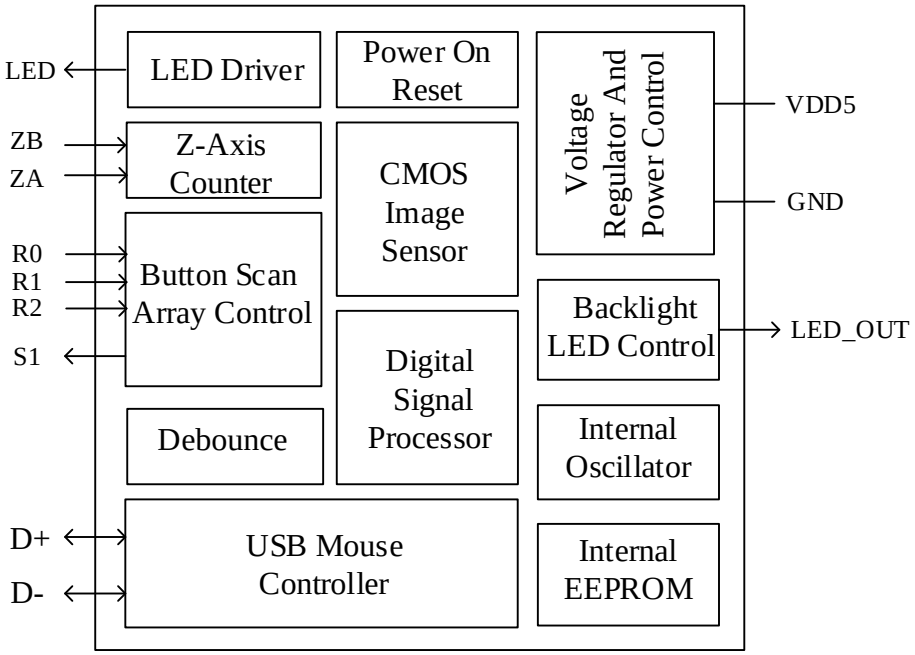


Figure 2. Block Diagram

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	4th (Backward)	4th (Backward)	User define
K5	5th (Forward)	5th (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

A715 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, A715 supports 6-speed resolution, defaulting to 800. In drive mode, A715 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.A715 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 Indicating

CPI Gear	1	2	3	4	5	6
CPI Values	600	800	1200	1600	2400	3200
CPI Indicative color	Yellow	Blue	Pink	Green	Red	Cyan

CPI indication will borrow backlight LED lamp as indication function for a short time: when CPI is switched, backlight LED indicates the gear color after CPI switching, and backlight LED will be restored to backlight function later.

In the case of Mount driver, users can customize CPI gear color, and support full-color 16.8 million colors through color palette selection in the driver

6.5 Backlight Application

6.5.1 Running-Water Backlighting Effect

A715 default backlight type is Ambilight, does not support backlight type switching, You can set any of the backlight types in the table below when mounting the drive:

Streamer type	1	2	3	4	
	M-Color	S-Color	Comet-Tail	Ambilight	
Synchronization type	5	6	7	8	9
	Circular Breathing	CPI Color Breathing	Neon	Constantly Bright	Mute

6.5.2 Backlight Control Method

Long press CPI/CPI-key to turn on backlight.

K4/K5+CPI combination key, or [K4/K5]+ [CPI-] combination switch backlight on or off.

When the keys switch CPI, the backlight will switch to the corresponding CPI indicator color (see 6.4.2 for details), and then automatically return to the original backlight effect.

Backlight applications support up to 9 single-line serial cascaded LEDs or 9 groups of LED Driver + RGB lamp.

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	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	Notes
Supply Voltage	VDD	4.5	5.0	5.5	V	
Operating Temperature	T_A	0	25	40	ºC	
System Clock	CLK	-	48	-	MHz	
Speed	S	-	-	60	Inch/Sec	
Resolution	R	200	800	4800	CPI	
Acceleration	A	-	-	15	G	
Frame Rate	Fr	-	-	6000	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 ºC)

Parameter	Condition	Symbol	Min	Typical	Max	Units	Notes
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. 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

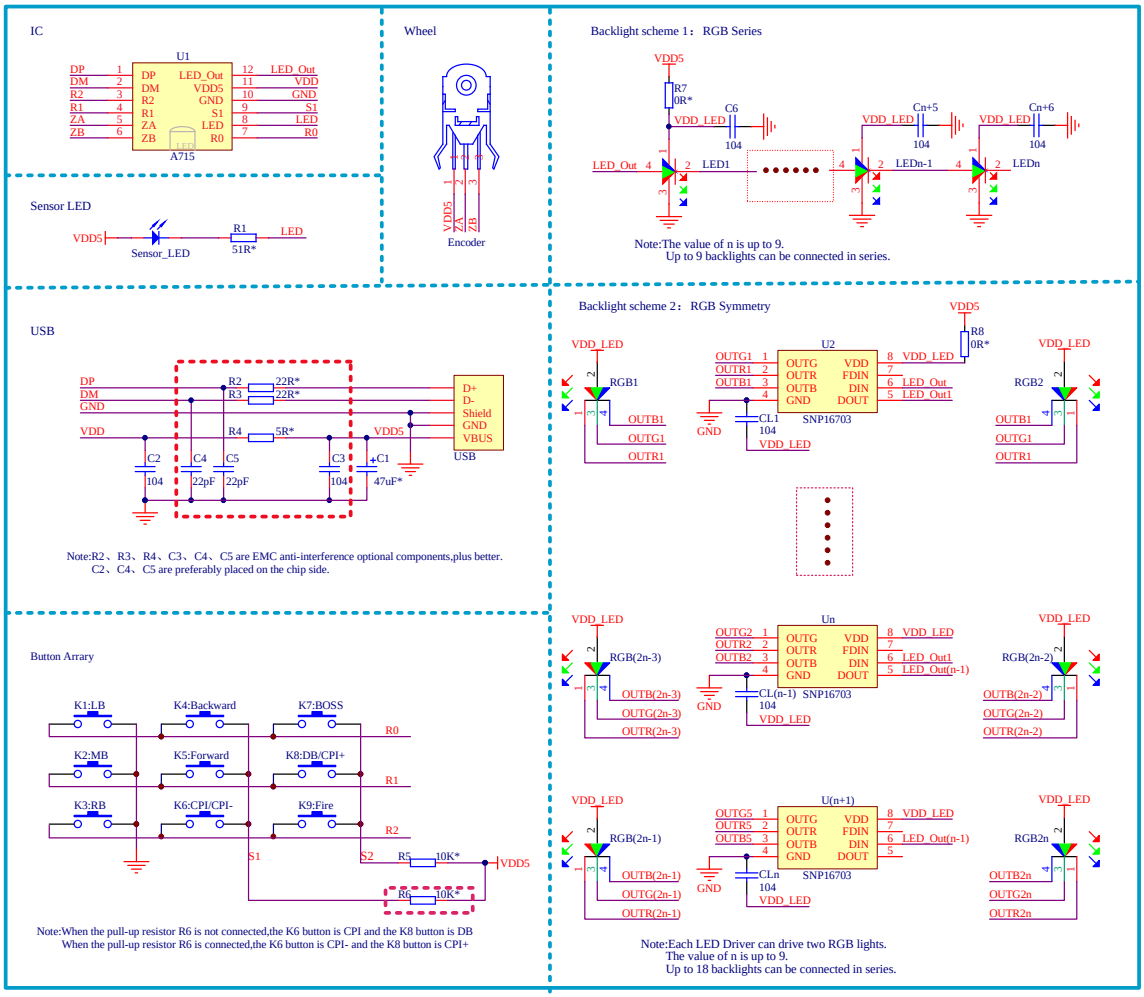


Figure 3. Application Circuit

10. Package

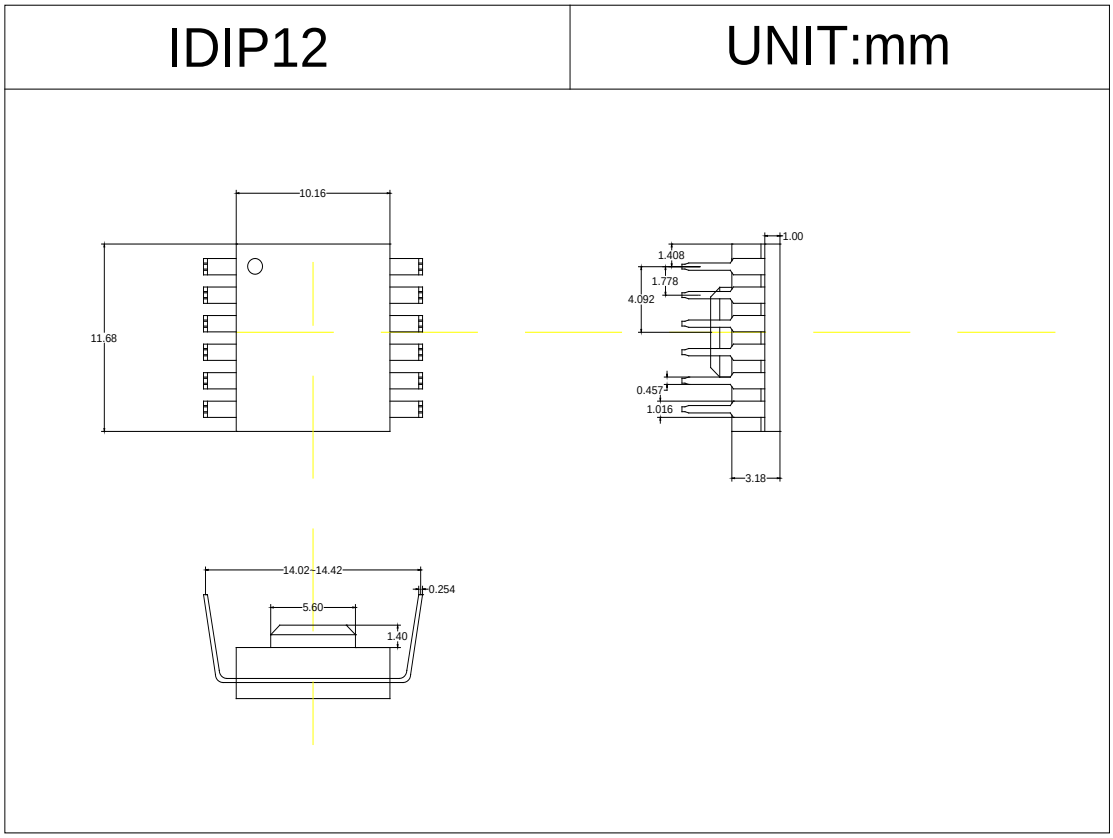


Figure 4. Package Outline Drawing

11. Assembly Drawing

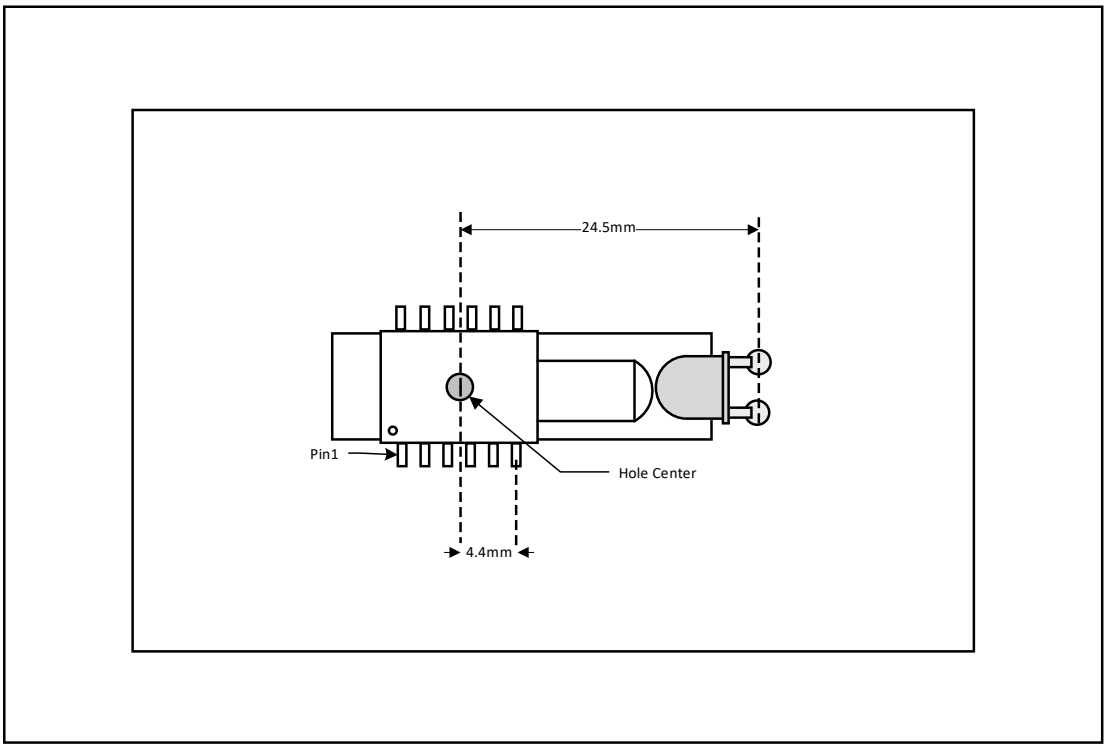


Figure 5. 2D Assembly drawing of A715 (Top and Side View)

12. Revision History

Version	Description	Date
A715_SPEC_EN.V1.00	Create Preliminary Version	2019/06/25