Instant
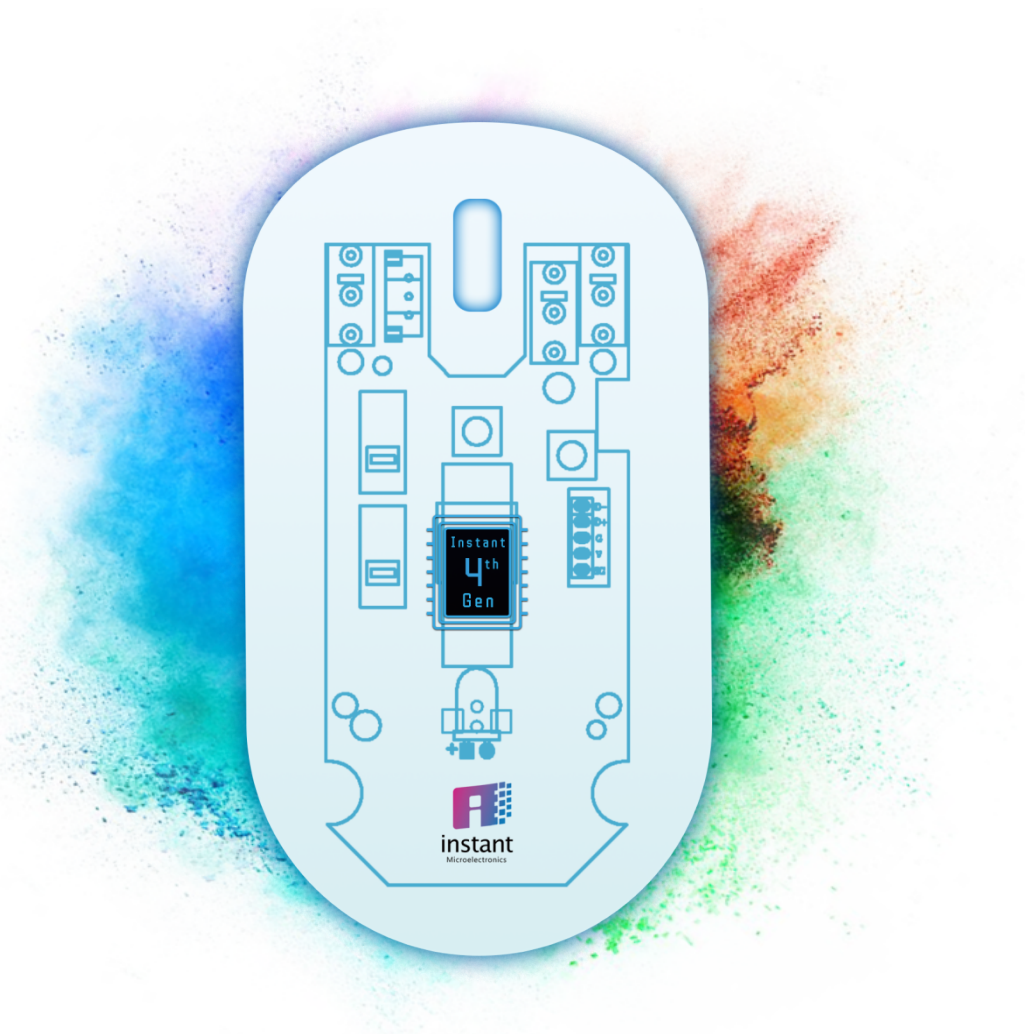
A725F Gaming Mouse SOC

DATASHEET

Instant Microelectronics Co., Ltd.

Version：V1.00

Table of Contents

1. General Description

A725F is a high performance CMOS process optical mouse SOC with low speed USB interface. It is based on Instant 4th generation Optical Navigation Technology with high-precision algorithm which measures changes of sequential surface images, and provides higher precision positioning than any previous generation. It's real resolution can reach **7200 CPI**. Max frame rate is **7000 fps**. Max speed is **60 inch/s**. Max acceleration is **20 g**. The number of resolution levels is up to 6, and each level has 17 values to be selected.

In backlight application, A725F supports up to 10 kinds of backlight effects, and a specific function key can be defined to switch the backlight effects.

A725F provides 32kb storage capacity and supports strong customization function. All mouse functions, such as buttons, X/Y movements, multimedia, MACRO, resolutions, VID/PID, backlight colors and effects etc., can be defined by users.

2. Feature

◆ Optical Navigation Technology, Max FPS 7000, Max acceleration 20g, Max moving speed 60inch/s.

◆ Compliant with USB2.0 and USB HID Specification V1.1.

◆ Supports Windows system, MAC OS, and Android system, driver software (a given application software) only used in windows systems, but the A725F configured in Windows can support applications in other systems.

◆ Up to six-level resolutions supported; each resolution is selected from 17 available values 200/400/600/800/1000/1200/1400/1600/1800/2000/2400/3200/4000/4800/5600/6400/7200.

◆ Supports 3 kinds of light modes (flowing mode, synchronous mode, and reactive mode), and 10 kinds of light effects.

◆ Supports independent button to switch light effect

◆ Supports independent button to switch between the four built-in configurations (Groups), or directly to a specified configuration.

◆ Supports storage, supports customization of VID, PID and mouse direction

◆ Supports K1~K9 and Z wheel buttons with customized function.

◆ DIP-12 package, ROHS standard

3. Pin Assignment

| Topview of Pinout | Topview of mouse |
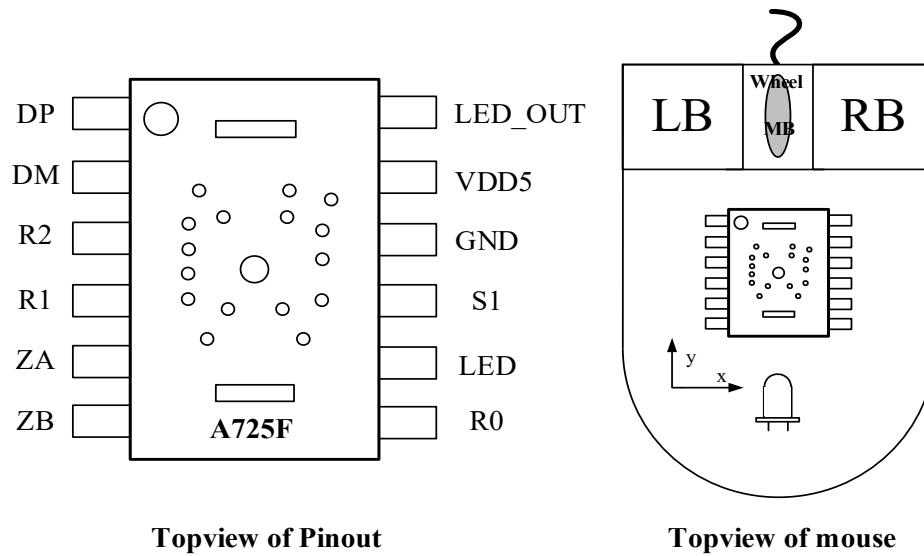
Figure 1. Pinout

4. Pin Description

Pin No.	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	Flowing Light output. LED driver

5. Block Diagram

Figure 2. Block Diagram

6. Function Description

6.1 Button Array

The location of the physical keys in the array:

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

6.2 Customized Functions

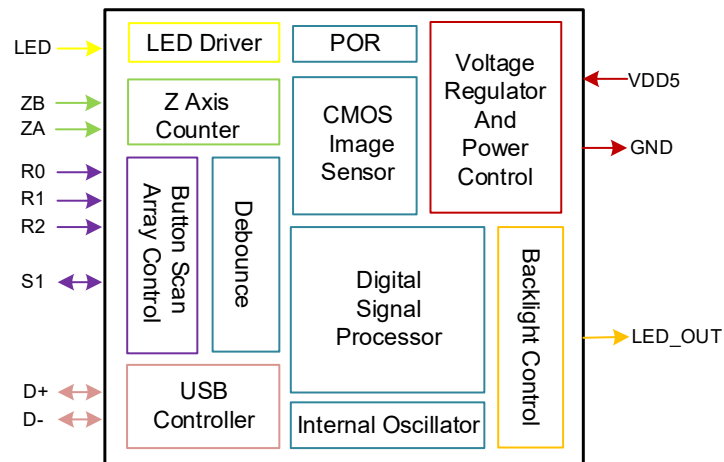| Function Type	Function Selection
Mouse	L, M, R, Forward, Backward, CPI(CPI+/CPI-), Boss, Fire, Double click
Keyboard	A-Z, F1-F12, 0-9, Shift, Ctrl, Alt, Win etc.
Multimedia	Web, Media, Mail, Vol+, Vol-, Next, Previous, Mute, Play/Pause etc.
Shortcut	Copy, Paste, Cut, All select, Undo, Find, Close window, My computer, Lock window, Calculator, Command Line etc.
MACRO	**PUBG MARCO**, LOL MARCO, CF MARCO etc.

Each physical button can be defined arbitrarily to the functional key that comes from mouse, keyboard, multimedia and MARCO (for example office shortcuts).

Assigning a keyboard key function to a physical button of mouse means that, the physical button has a keyboard function, and the pressing/releasing operation is exactly as same as the one of the keyboard.

MARCO key function is a combination of mouse and keyboard functions. The mouse functions maybe include a number of mouse keys and motions, and the corrected displacement is helpful for

finding exact locations in game (for example, changing ballistic parameters in a gun battle game).

6.3 CPI Setting

6.3.1 CPI Switching

The number of CPI levels can be set from 1 to 6. And each level can be assigned a resolution from 17 different values (200/400/600/800/1000/1200/1400/1600/1800/2000/2400/3200/4000/4800/5600/6400/7200).

The CPI level can be switched by pressing CPI related buttons (CPI /CPI-/CPI+).

6.3.2 CPI Indicating

Each CPI level has a specific backlight color. Once CPI level is changed, the color of backlight LED will be changed to corresponding one. The new color will be hold for a few seconds, then backlight LED returns to previous status.

A725F supports 16.8 million colors. Users can customize CPI color by using a palette in a given application program.

6.3 Light Modes And Control

A725F has 3 kinds of light modes: Flowing mode, Synchronous mode, and Reactive mode.

6.4.1 Flowing Mode

Flowing mode includes the following 4 kinds of light effects.

- M-Color

Lights flow periodically, and the lights automatically change from one color to another when cycle ends. The number of color is up to 7, but users can disable some of them, and the colors are programmable in a given application program.

- S-Color

Lights flow periodically in single color. And the color is programmable in a given application program.

- Comet-Tail

The effect of light looks like a comet trailing its tail, and the light will change from one color to another when cycle ends.

- Ambilight

The flow of light is accompanied by the flow of color, that is, the colors change according to a certain rule and flows at the same time .

These lighting effects have some features which users can configure or choose, and the features are described in the table below. Among them, Symmetry describes an effect that lights on the left and right sides of the mouse have exactly the same behavior. While Asymmetry does not.

The feature "Positive" is defined as the direction of light from first LED to last one in PCB;

"Reverse" means in the opposite direction. "Two-way" show that light starts flowing in positive direction and then flows in reverse direction. "Two-Way Changing Color" show that light flows in bidirection, and the color changes to the next one when new flowing cycle starts.

	Backlight Mode	M-Color	S-Color	Comet-Tail	Ambilight
Asymmetry	**Positive**	√	√	√	√
	Reverse	√	√	√	√
	Two-Way	√	√	√	
	Two-Way Changing Color	√			
Symmetry	**Positive**	√	√	√	√
	Reverse	√	√	√	√
	Two-Way	√	√	√	
	Two-Way Changing Color	√			
	Backlight Color Customize	√	√	√	

Note: "√" means the function is supported

6.4.2 Synchronous Mode

Synchronous mode includes 5 kinds of light effects. Among them, Multicolor Breathing, CPI Color Breathing and Static can be colored with the palette (supports up to 16.8 million colors) in a given program.

● Multicolor Breathing

Backlight LED breathes, and changes the color when cycle ends. The number of colors can be set from 1 to 7, and the speed of breathing is programmable.

● CPI Color Breathing

Backlight LED breathes in the color that is used to indicate CPI level. And The speed of breathing is programmable.

● Static

Backlight LED is on with a specific brightness, and its color is same as CPI indicating color. And the brightness is programmable.

● Neon

Backlight LED is on with colors changing. The colors cannot be programmed.

● Mute

Backlight LED is off.

6.4.3 Reactive Mode

It is designed in response to button clicks. When the button click behavior is detected, the corresponding backlight effects, which is selected from four modes (Multicolor Breathing, M-Color, S-Color, Comet-Tail), is executed for a period of time. If there is no click action, the backlight is off and no backlight is effective.

In addition, Reactive Mode can be used only when users has enabled it.

6.4.4 Backlight Control

- Users can set the desired backlight effect through a given program, and users can switch the backlight effect by pressing down CPI for more than three seconds (need to enable this function).
- In flowing mode, the flowing feature can be switched by the "K4/K5+CPI" combination key enabled by user. By pressing the combination key, user can change the feature in the sequence like this: Positive → reverse → Two-Way → Two-Way Changing Color → Mute → Positive.
- By assigning switch backlight function to a specified button, users can switch up to 10 kinds of backlight effects.
- In flowing mode, the number of LED used can be programmed, and it is limited to 16 in the Application Circuit Scheme 1 and 12 in the Application Circuit Scheme 2.

6.5 Configuration And Storage

A725F provides 32kb storage capacity. Through a given program, users can customize button/wheel function, resolution (CPI), backlight effects and colors. All settings can be stored in the chip, and they are not be lost when mouse is power off.

A725F supports 4 groups of settings, and users can customize a specific key to switch one group to another (for example: Office settings(Group1) → Game settings I(Group2) → Game settings II (Group3) → Multimedia Settings(Group4) → Office settings(Group1).

6.6 MACRO Configuration

- A MACRO can contain a lot of functions of keyboard, mouse, and multimedia such as keys, motions, CPI resolutions, volume control and so on.
- A single MACRO can contain 2000 bytes of information, such as an ultra-long URL MACRO.
- Light effects can be implanted in a MACRO.

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
Supply Voltage	VDD	4.5	5.0	5.5	V
Operating Temperature	T_A	0	25	40	°C
System Clock	CLK	-	24	-	MHz
Speed	S	-	-	60	Inch/Sec
Resolution	R	200	1200	7200	CPI
Acceleration	A	-	-	20	G
Frame Rate	Fr	-	-	7000	fps
Distance from the Bottom of Lens to the Tracking Surface	Z	2.1	2.2	2.3	mm

7.3 DC Electrical Characteristic (VDD = 5.0V, Temperature = 25 ºC)

Parameter	Condition	Symbol	Min	Typical	Max
Supply Current(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. Typical Application Circuit

8.1 Application Circuit Scheme 1

This is a serial LED application scheme. By 1-wire communication protocol, it can support up to 16 specialized LEDs.
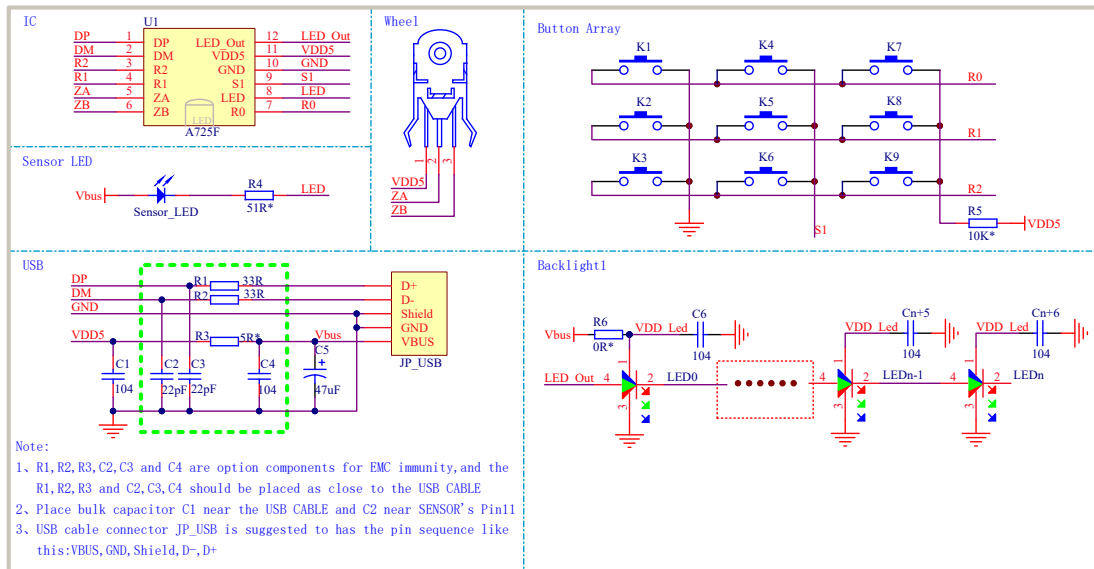
Figure 3. Application circuit with specialized LED

8.2 Application Circuit Scheme 2

This application is the scheme of using D26 (Instant LED driver chip) with RGB LEDs, and the number of LEDs is limited to 12.
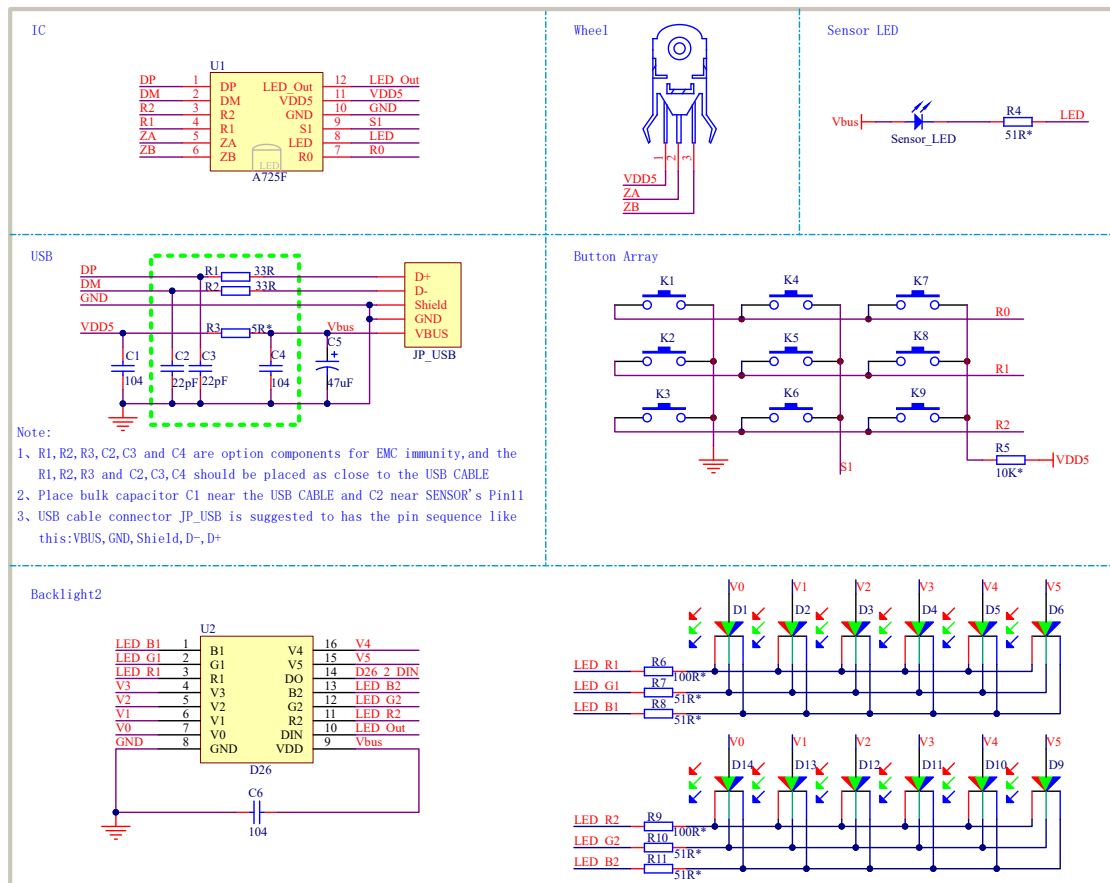

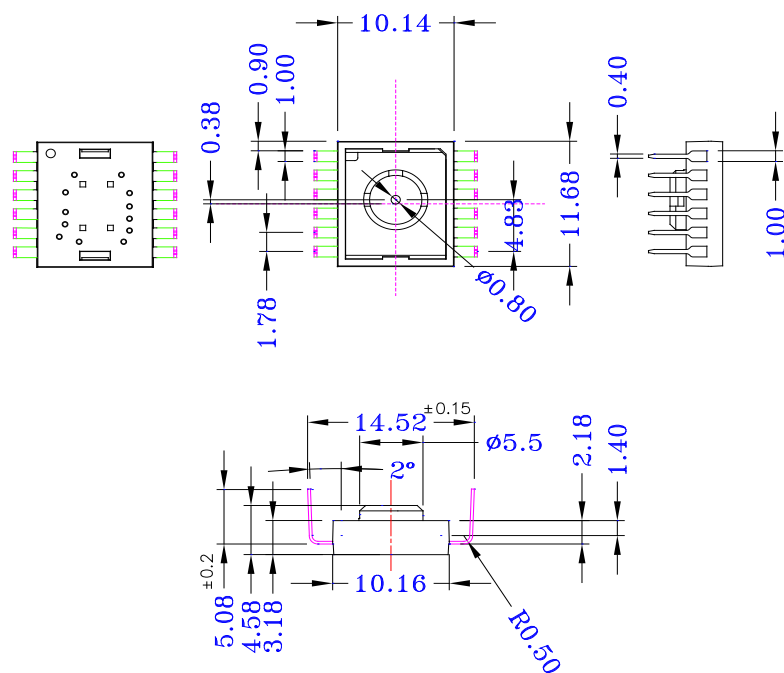Figure 4. Application circuit with D26

9. Package

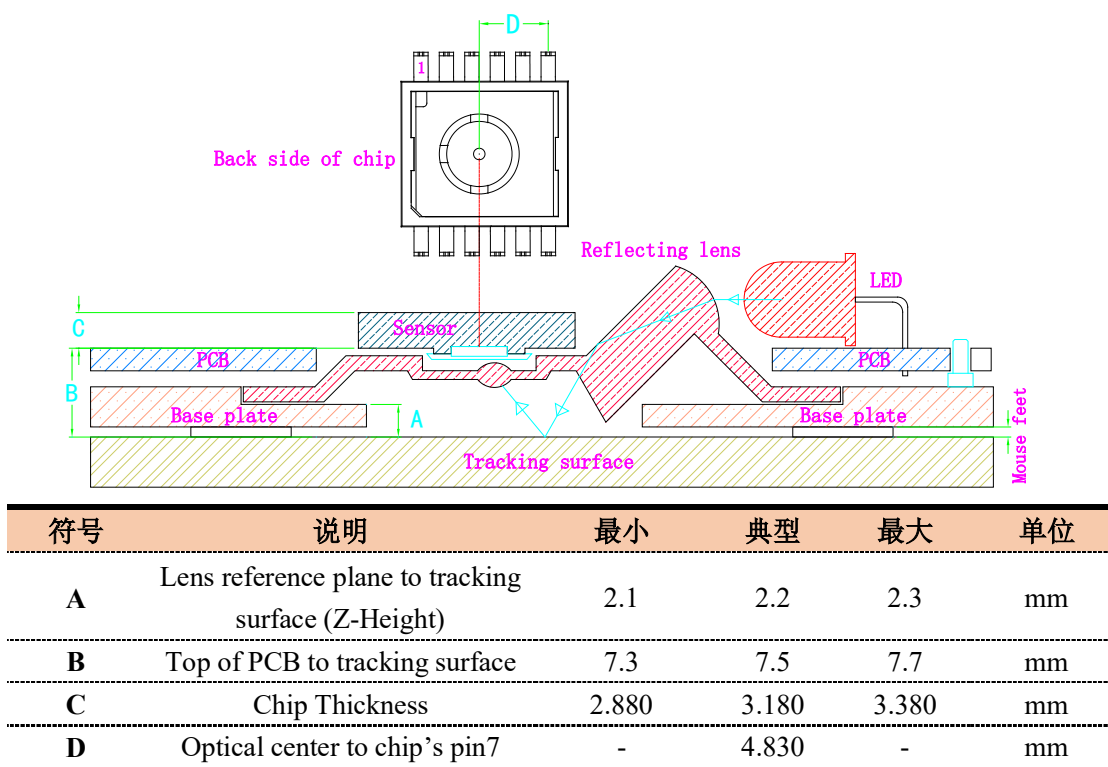Figure 5. Package Outline Drawing

10. Assembly Drawing

符号	说明	最小	典型	最大	单位
A	Lens reference plane to tracking surface (Z-Height)	2.1	2.2	2.3	mm
B	Top of PCB to tracking surface	7.3	7.5	7.7	mm
C	Chip Thickness	2.880	3.180	3.380	mm
D	Optical center to chip's pin7	-	4.830	-	mm

Figure 6. Assembly drawing of A725F

11. Revision History

Version	Description	Date
A725F_SPEC_EN.V1.00	Create Preliminary Version	2018/10/18