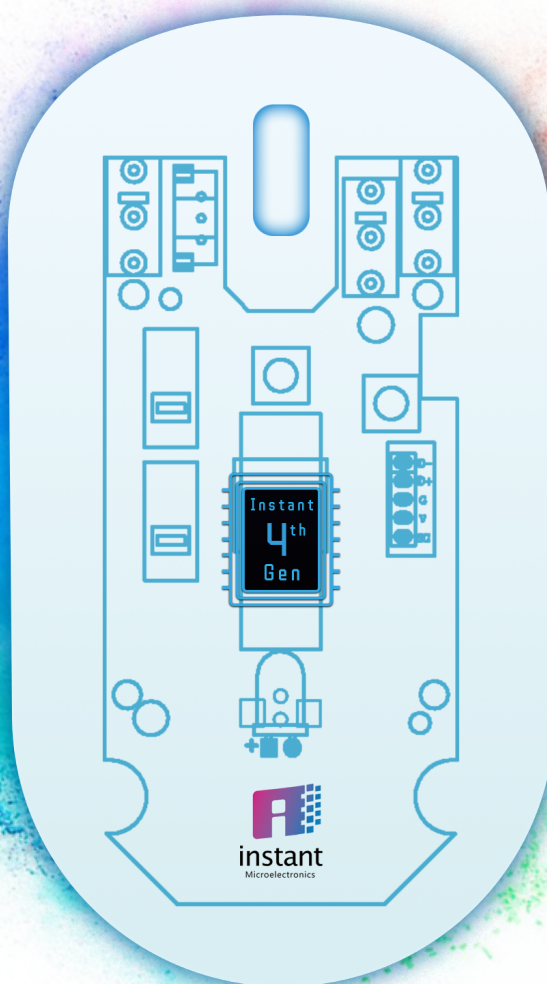


Instant

A824F

Gaming Mouse SOC

DATASHEET



Instant Microelectronics Co., Ltd.

Version: V1.01

Table of contents

1. General Description	1
2. Feature	1
3. Pin Assignment.....	2
4. Pin Description	2
5. Block Diagram.....	3
6. Function Description	3
6.1 Button Array	3
6.2 Customized Functions	3
6.3 USB Report Rate Setting	4
6.4 CPI Setting	4
6.4.1 CPI Switching	4
6.4.2 CPI Indicating	4
6.5 Backlight LED	4
6.5.1 Backlight Mode.....	4
6.5.2 Backlight Control	5
6.6 Configuration And Storage	5
7. Electrical Characteristics	5
7.1 Absolute Maximum Rating	5
7.2 Recommend Operating Conditions	5
7.3 DC Electrical Characteristic (VDD = 5.0V, Temperature = 25°C)	6
7.4 AC Electrical Characteristic (VDD = 5.0V, Temperature = 25 °C)	6
8. Typical Application Circuit	7
9. Package	7
10. Assembly Drawing	8
11. Revision History	9

1. General Description

A824F is a high performance CMOS process optical mouse SOC with full 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 CPI resolution is up to **12800 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 23 values to be selected.

In backlight application, A824F supports 6 kinds of backlight effects, and 16.8M colors of backlight can be configured by users.

A824F 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.
- ◆ Full speed Interface. Selectable USB report rate: 125/250/500/1000 Hz.
- ◆ Support Winxp/Win2003/Win2008/Vista/Win7/Win8/Win10/Linux system, MAC OS, and Android system
- ◆ Up to 6-level resolutions supported; each resolution is selected from 23 available values 200/400/600/800/1000/1200/1400/1600/1800/2000/2400/3200/4000/4800/5600/6400/7200/8000/8800/9600/10400/11200/**12800**.
- ◆ Supports six backlight modes and independent switching button
- ◆ Supports three sets of build-in configuration and independent switching button
- ◆ Supports customizable L/M/R/B4/ B5 buttons and X/Y/Z three axis
- ◆ Supports 32kb storage, support customization of VID, PID and mouse direction
- ◆ Supports soft driver(a given program for A824F).
- ◆ IDIP-14 package and RoHS Compliant

3. Pin Assignment

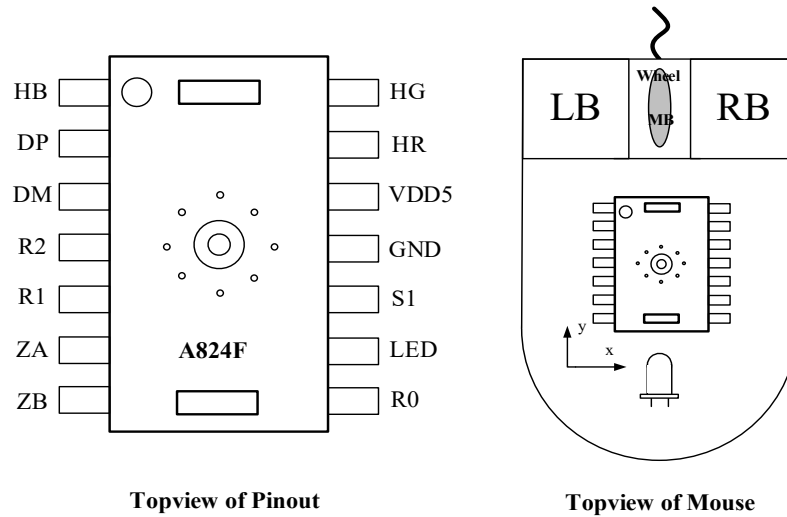


Figure 1. Pinout

4. Pin Description

Pin No.	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	Button array scan in, Single or double CPI select
5	R1	IN	Button array scan in
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

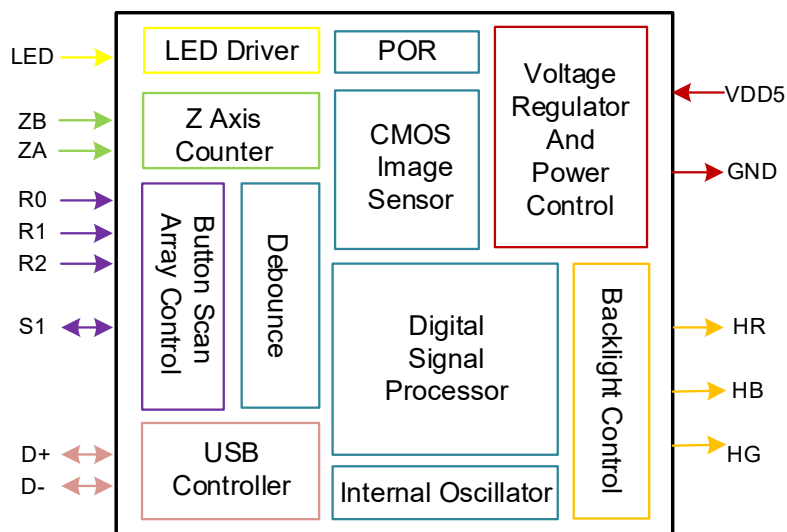


Figure 2. Block Diagram

6. Function Description

6.1 Button Array

The location of the keys in the array:

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

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 USB Report Rate Setting

A824F provides 4 levels of USB report rates: 1000Hz, 500Hz, 250Hz, 125Hz. And user can configure a special button to switch among these report rates. In addition, user can set the desired report rate through a given program.

6.4 CPI Setting

6.4.1 CPI Switching

The number of CPI levels can be set from 1 to 6. And each level can be assigned a resolution from 23 different values (200/400/600/800/1000/1200/1400/1600/1800/2000/2400/3200/4000/4800/5600/6400/7200/8000/8800/9600/10400/11200/12800).

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

6.4.2 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.

A824F supports 16.8M backlight colors for CPI indicating. Users can customize CPI color by using a palette in a given program.

6.5 Backlight LED

6.5.1 Backlight Mode

6.5.1.1 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.

6.5.1.2 Reactive Mode

It is designed in response to button clicks. When the button click behavior is detected, the corresponding backlight effects(only breathing mode supported) is executed for a period of time. If there is no new click action, the backlight is off and no backlight is effective.

Reactive Mode can be used only when users has enabled it through a given program.

6.5.2 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).
- By assigning switch backlight function to a specified button, users can switch up to 6 kinds of backlight effects(include Synchronous mode and reactive mode).

6.6 Configuration And Storage

A824F 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.

A824F supports 4 groups of settings, and users can customize a specific key to switch settings from one group to another (for example: Office settings(Group1) → Game settings I(Group2) → Game settings II (Group3) →Multimedia(Group4)→ Office settings(Group1)).

The backlight LED flashes in corresponding color when configuration settings are switched: **red** for office, **green** for game I, **blue** for game II and **pink** for multimedia.

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
Supply Voltage	VDD	4.5	5.0	5.5	V
Operating Temperature	T _A	0	25	40	°C
System Clock	CLK	-	48	-	MHz

Speed	S	-	-	60	Inch/Sec
Resolution	R	200	1200	12800	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°C)

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 °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. Typical Application Circuit

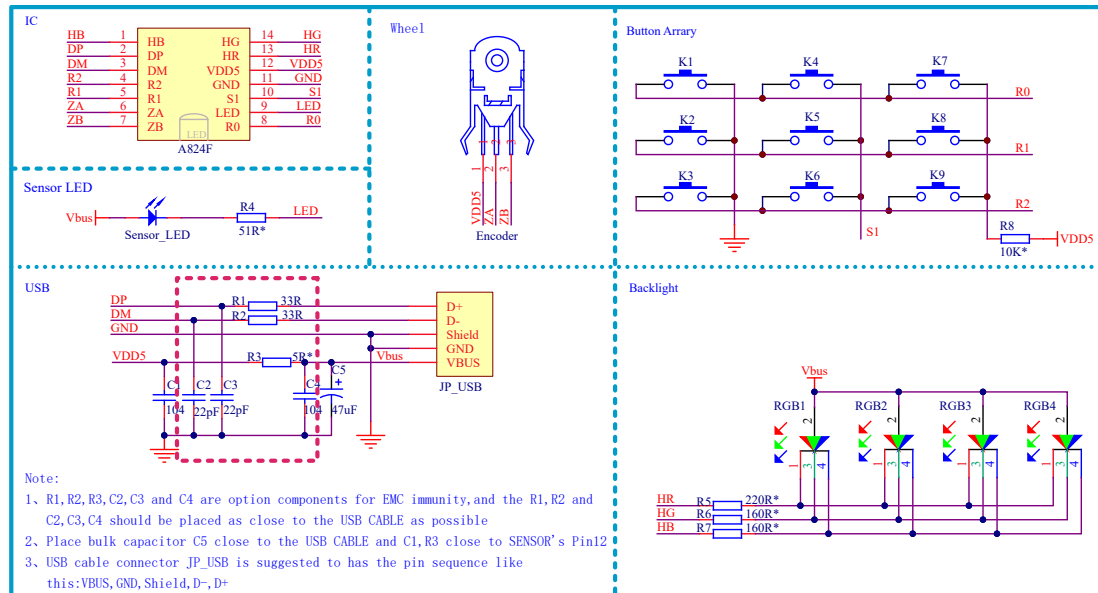
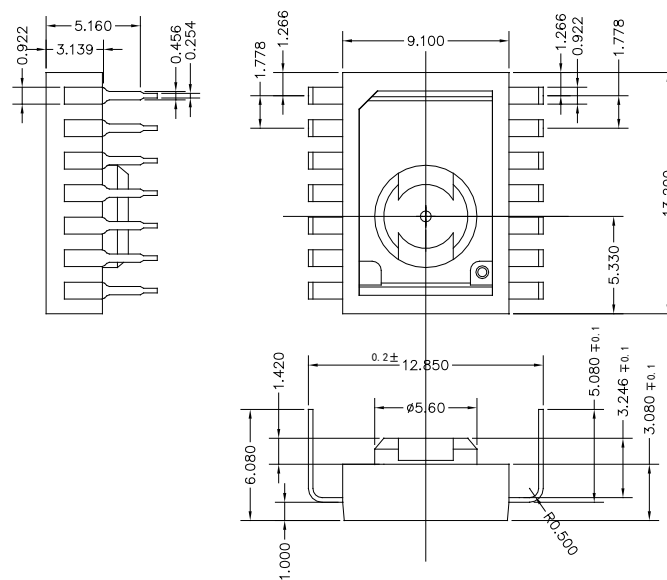


Figure 3. Application Circuit

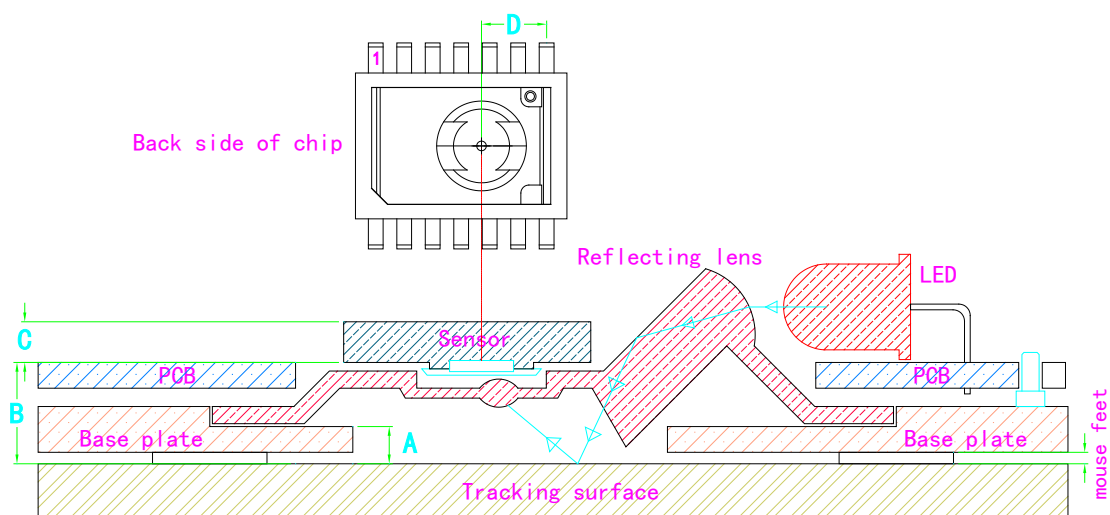
9. Package



Note: Unit: mm

Figure 4. 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	2.980	3.080	3.180	mm
D	Optical center to chip's pin7	-	4.064	-	mm

Figure 5. Assembly drawing of A824F

11. Revision History

Version	Description	Date
A824F_SPEC_EN.V1.00	Create Preliminary Version	2018/09/18
A824F_SPEC_EN.V1.01	Update CPI, up to 12800	2020/12/30