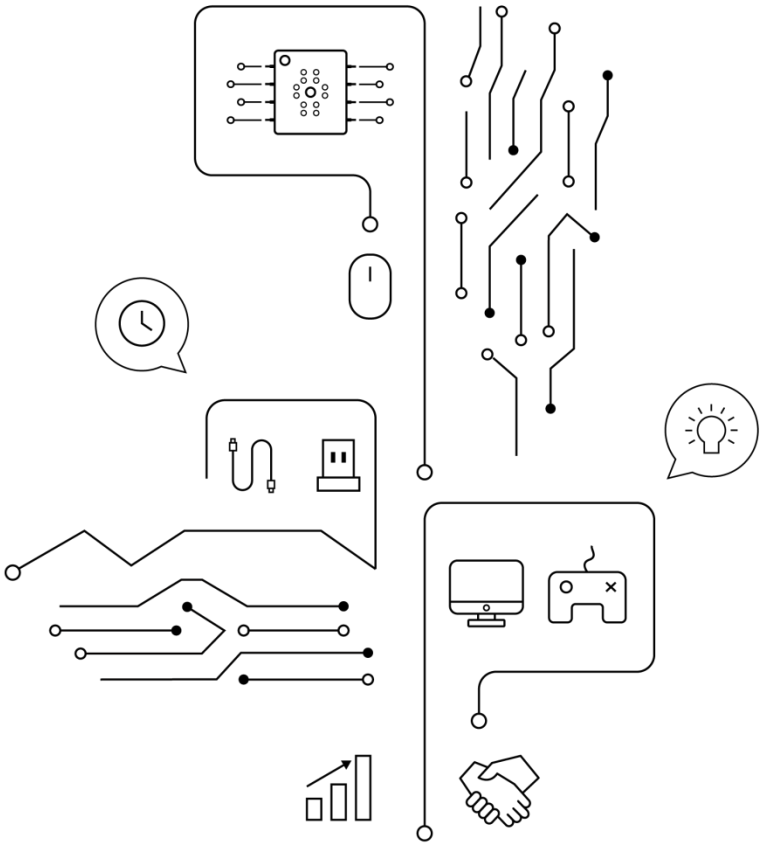
S205 Data Sheet

Low-Power Optical Gaming Sensor



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1. General Description

S205 is a high-performance, low power optical navigation chip with high-precision image displacement detection algorithm and built-in LED driver circuit and OSC circuit. It has configurable work mode which make it suitable for gaming and/or office. In gaming mode, S205 is capable of high-speed motion detection up to the velocity 120 inches/sec and acceleration of 25g. And in office mode, the velocity and acceleration are reduced, but it works with lower power consumption. And the CPI resolution is up to 6400 with good accuracy.

2. Features

- Selectable 2-Wire or 3-Wire SPI serial interface
- In strong light, the current source mode is recommended.
- Programmable rest modes
- Pin1 function (use 2-wire SPI mode):
  (1) Reset function
  (2) PD function
- Supports two working modes：Gaming mode and Office mode

3. Applications

Wireless and low-power mouse (2.4G mouse、Bluetooth mouse), Wired mouse (USB mouse)

4. Parameters

Parameter	Value	
Power Supply Voltage	VDD: 1.8V~2.1V(VDD,VDDA short) VDD: 2.1V~3.6V(VDDA should connect a capacitor to GND)	
Supply Current @VDD=3.3V Not Includes LED Current	Office Mode①	Gaming Mode②
	Run：**0.75mA**	*Run*：**2.2mA**
	Sleep1：**35uA**	*Sleep1*：**110uA**
	Sleep2：**15uA**	*Sleep2*：**28uA**
	Sleep3：**8uA**	*Sleep3*：**8uA**
	PD：**3.8uA**	*PD*：**3.8uA**
Frame rate (fps)	Up to 7200	
Motion data length	8bit(default)/12bit/16bit	
Resolution (cpi)	Up to 6400, with 50cpi step	
Tracking Speed (ips)	120	
Acceleration (g)	25	
Lift detection (mm)	2	

Table 4-1 Parameters

Note:

①Sleep1 frequency is 16ms, Sleep2 frequency is 128ms, Sleep3 frequency is 512ms

②Sleep1 frequency is 4ms, Sleep2 frequency is 32ms, Sleep3 frequency is 512ms

5. Functional Block Diagram

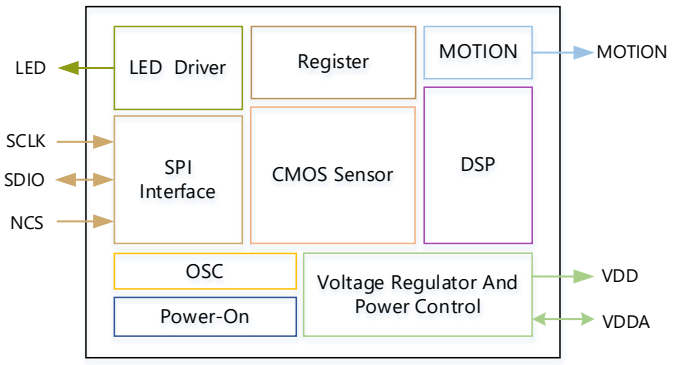
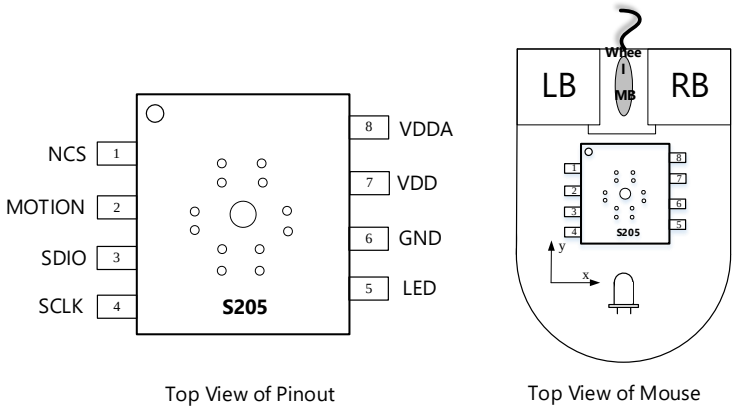


Figure 5-1 Functional Block Diagram

6. Signal Description

6.1 Pin Configuration



Top View of Pinout Top View of Mouse

Figure 6-1 Pin Configuration (Orientation Relationship between Chip and Mouse)

6.2 Pin Description

Pin	Name	Type	Description
1	NCS	IN	3-Wire SPI: NCS (Active low) 2-Wire SPI: Connect to GND
2	MOTION	OUT	Motion detection output (Active low output)
3	SDIO	IN/OUT	Bi-directional I/O for SPI
4	SCLK	IN	Clock input for SPI
5	LED	OUT	LED control
6	GND	GND	Chip ground
7	VDD	PWR	VDD:1.8V~2.1V, VDDA connect to VDD directly
8	VDDA	PWR	VDD:2.1V~3.6V, VDDA connect 4.7uF capacitor to GND

Table 6-1 Pin Description

7. Serial Peripheral Interface(SPI)

S205 supports both 3-wire SPI (NCS、SCLK and SDIO) and 2-wire SPI (SCLK and SDIO) . All the transmission protocols are exactly the same as 3-wired SPI except the NCS pin is ignored in 2-wired SPI mode.

7.1 Transmission Protocol

S205 supports 3-wired SPI. The host controller can use the SPI to write and read registers in the sensor, and to read out the motion information. the SPI adopts half duplex transmission protocol which consists of Write Operation and Read Operation. Both of the two operations consist of two bytes, the first byte contains 1 bit read/write control and 7 bit address, and the second byte is the data.

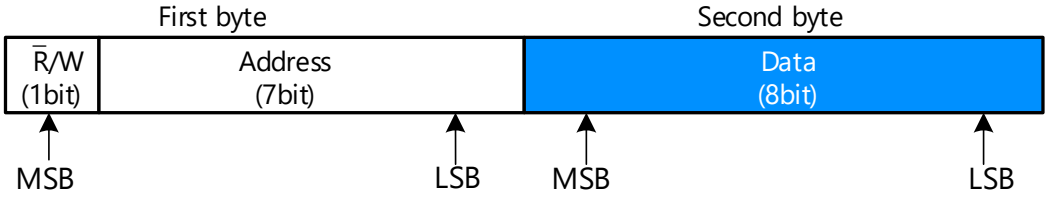


Figure 7-1 Transmission Format of Serial Interface

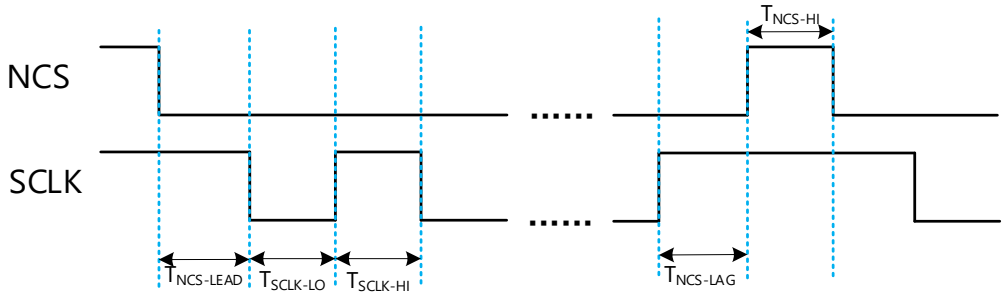


Figure 7-2 Timing of NCS and SCLK

Symbol	Description	Min	Type	Max	Unit
F_{SCLK}	SCLK frequency	-	-	8	MHz
$T_{NCS-LEAD}$	NCS falling edge to the first SCLK falling edge	62.5	-	-	ns
$T_{SCLK-LO}$	SCLK low time	62.5	-	-	ns
$T_{SCLK-HI}$	SCLK high time	62.5	-	-	ns
$T_{NCS-LAG}$	NCS enable lag time	62.5	-	-	ns
T_{NCS-HI}	NCS high time	62.5	-	-	ns

Table 7-1 Timing Description

7.2 Write Operation

A write operation is defined as that the host controller write data to S205 based on the address. It contains two bytes, the first byte contains 1 bit write control (the value is '1') and 7 bit address, and the second byte is the data. SDIO changes on the falling edge of SCLK, and S205 reads SDIO data on the rising edge of SCLK.

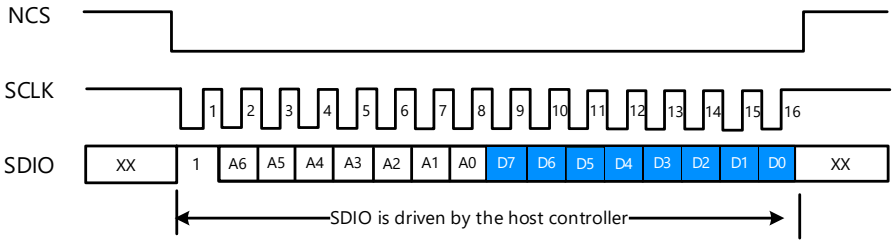


Figure 7-3 Write Operation

7.3 Read Operation

A write operation is defined as that the host controller get data from S205 based on the address. The read operation contains two bytes. In first byte, the MSB is 0, and the next 7 bits are the address. The second byte is the data. SDIO is changed by controller on the falling edges of SCLK for writing address, and then the host controller releases SDIO to high-Z state. After that, S205 output data on the falling edge of SCLK, and the host controller reads data on the rising edge of SCLK.

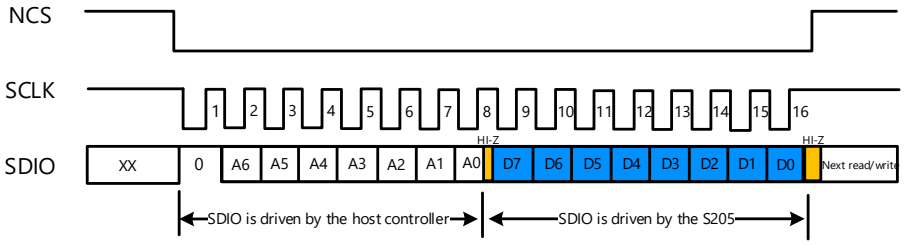


Figure 7-4 Read Operation

7.4 SPI Serial Interface(2-wired)

The 3-wired SPI is the power-on default setting of S205, the host controller has to write SPI Mode (address 0x26) to switch the sensor from 3-wire SPI mode to 2-wire SPI mode after the sensor power-up. During the mode switching, the NCS pin must be low.

2-Wire SPI mode related registers:

Address	Name	Value(Def)	Write	Description
0x09	Write_Protect	0x00	0x5A/0xC3	Disable write protection
0x26	SPI_Mode	0xB4	0x34	Select 2-wire SPI mode, NCS chip-select function is invalid
0x09	Write_Protect	0x00	0x00	Enable write protection

Table 7-2 Switch to 2-wire SPI Mode

7.5 ReSync Serial Interface

In 2-wire mode transmission, the clock and data may be out of synchronization, and the host controller will not be able to correctly access the registers of the sensor. To recover the correct communication of SPI, the host controller must change the SCLK signal from high to low for more than 1 us, and then from low to high more than 3ms. This operation can reset the SPI circuits of S205 and re-synchronize the clock and data.

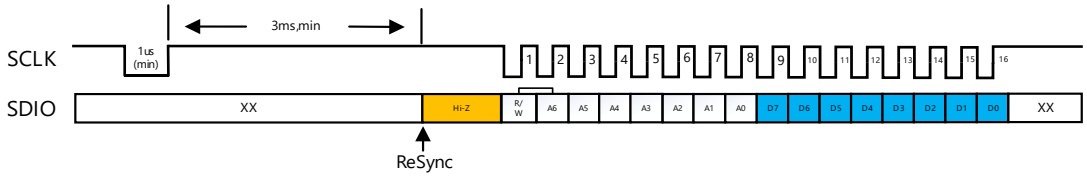


Figure 7-5 Re-synchronization Operation

8. The Function Of Pin1

In addition to the default function (NCS), Pin1 can also be set to the Reset function and the PD function in 2-wire SPI mode by modifying Pin1_Sel bits (bit 5 and 4) in register SPI_Sel (address 0x26).

8.1 Reset Function

Pin1 can be configured as a hardware Reset function to reset the chip. The host controller can set Pin1 to "0" to reset S205. After the reset, all registers will be reloaded or re-initialized to ensure the chip works properly.

8.2 PD Function

The host controller can set Pin1 to "1" to power down the chip. The chip operates at extremely low-power state, just like the effect of using software Power-Down function.

9. MOTION Pin Function

The MOTION pin can be used to monitor the sensor motion. The MOTION pin will output "0"(low) whenever the sensor detects the occurrence of motion, when the host controller reads out all the moving data (motion data is cleared), the MOTION pin outputs "1"(high). If the motion data is not cleared, the MOTION pin will keep a low level.

10.Office/Gaming Mode Selection

S205 has both Office mode and Gaming mode to choose from. During initialization, S205 needs to be configured to one of the two modes as follows.

- Follow the following steps to switch from Gaming mode to **Office mode** :

  (1) Write register 0x06 with value 0x81 //Reset chip
  (2) Delay of 10ms //Delay of 10ms
  (3) Write register 0x09 with value 0xc3
  (4) Write register 0x64 with value 0x80
  (5) Write register 0x65 with value 0x03
  (6) Write register 0x66 with value 0x83
  (7) Write register 0x50 with value 0xe9
  (8) Write register 0x54 with value 0x04
  (9) Write register 0x73 with value 0x53
  (10) Write register 0x75 with value 0x08
  (11) Write register 0x0a with value 0x73 //Slp1_Freq=16ms, Slp1_Etm=256ms
  (12) Write register 0x1a with value 0x30
  (13) Write register 0x0b with value 0x30
  (14) Write register 0x6d with value 0xD0
  (15) Write register 0x6e with value 0xF0
  (16) Write register 0x7c with value 0x70
  (17) Write register 0x7b with value 0x10
  (18) Write register 0x24 with value 0x4f
  (19) Write register 0x25 with value 0x24
  (20) Write register 0x2f with value 0x01
  (21) Write register 0x74 with value 0x20
  (22) Write register 0x77 with value 0x30
  (23) Write register 0x2f with value 0x00
  (24) Write register 0x44 with value 0x09
  (25) Write register 0x43 with value 0xc4
  (26) Write register 0x09 with value 0x00

- Follow the following steps to switch from Office mode to **Gaming mode** :

  (1) Write register 0x06 with value 0x81 //Reset chip
  (2) Delay of 10ms //Delay of 10ms
  (3) Write register 0x09 with value 0xc3
  (4) Write register 0x64 with value 0x80
  (5) Write register 0x65 with value 0x03
  (6) Write register 0x66 with value 0x83
  (7) Write register 0x50 with value 0xe9
  (8) Write register 0x54 with value 0x04
  (9) Write register 0x73 with value 0xd3

(10) Write register 0x75 with value 0x48
(11) Write register 0x0a with value 0x17 //Slp1_Freq=4ms, Slp1_Etm=512ms
(12) Write register 0x1a with value 0x30
(13) Write register 0x0b with value 0x00
(14) Write register 0x6d with value 0xD0
(15) Write register 0x6e with value 0xF0
(16) Write register 0x7c with value 0x70
(17) Write register 0x7b with value 0x10
(18) Write register 0x24 with value 0x4f
(19) Write register 0x25 with value 0x24
(20) Write register 0x2f with value 0x01
(21) Write register 0x74 with value 0x20
(22) Write register 0x77 with value 0x30
(23) Write register 0x2f with value 0x00
(24) Write register 0x44 with value 0x09
(25) Write register 0x43 with value 0xc4
(26) Write register 0x09 with value 0x00

11.Register

11.1 Register Summary

Address	Name	Description	R/W	Default
0x00	PID1	Product identifier 1 of S205 PID[11:4]	R	0x30
0x01	PID2	Upper 4 bits are PID [3:0], and lower 4 bits are VID [3:0]	R	0x02
0x02	Motion_St	Motion Status	R	-
0x03	DeltaX	DX or lower 8 bits of DX	R	-
0x04	DeltaY	DX or lower 8 bits of DX	R	-
0x05	Op_Mode	Operation mode selection of S205	W/R	0xB8
0x06	Config	Configuration of S205	W/R	0x11
0x09	Write_Protect	To avoid mis-writing registers	W/R	0x00
0x0A	Sleep1_Setting	Frequency setting for Sleep1	W/R	0x77
0x0B	Sleep2_Setting	Frequency setting for Sleep2	W/R	0x10
0x0C	Sleep3_Setting	Frequency setting for Sleep3	W/R	0x70
0x0D	CPI_X	CPI setting for X-axis	W/R	0x1B
0x0E	CPI_Y	CPI setting for Y-axis	W/R	0x1B
0x12	DeltaXY_Hi	Upper 4 bits of DX and DY, in 12 bit data format	R	-
0x13	Img_Qa	Quality of image	R	-
0x17	Frame_Avg	The average value of pixels	R	-
0x19	Mouse_Option	Mouse Options	W/R	0x00
0x20	DeltaX_Hi	Upper 8 bits of DX	R	-
0x21	DeltaY_Hi	Upper 8 bits of DY	R	-
0x22	DxDy_16bit	Enable 16bit data mode	W/R	0x00
0x26	SPI_Mode	3-Wire/2-Wire SPI interface, Pin1 function selection	W/R	0xB4
0x49	PID3	Product identifier 3 of S205	W/R	0xB2
0x5C	LED_Option	Select LED drive mode and set the LED current in constant current source mode	W/R	0xCA

11.2 Register Descriptions

PID1	Address: 0x00

Access: Read **Default Value:** 0x30

Bit	7	6	5	4	3	2	1	0
Field	PID[11:4]							

Usage: This register can be used to check if the communication of the SPI link is valid.

PID2	Address: 0x01

Access: Read **Default Value:** 0x02

Bit	7	6	5	4	3	2	1	0
Field	PID[3:0]				VID[3:0]			

Usage: This register can be used to check if the communication of the SPI link is valid.

Motion_St	Address: 0x02

Access: Read **Default Value:** --

Bit	7	6	5	4	3	2	1	0
Field	Motion	Reserved	Reserved	DYOVF	DXOVF	Reserved[2:0]		

Usage: Be sure to read Motion bit first Before reading out DeltaX and DeltaY registers, DXOVF bit and DYOVF bit show whether if the motion report buffers have overflowed since last read out.

Field Name	Description
Motion	**0: No movement (Default)** 1: Moving, updating DX DY
DYOVF	**0: No overflow (Default)** 1: DY data overflow occurred
DXOVF	**0: No overflow (Default)** 1: DX data overflow occurred

DeltaX	Address: 0x03

Access: Read **Default Value:** --

Bit	7	6	5	4	3	2	1	0
Field	DX[7:0]							

Usage: After reading the Motion_St register, DX movement data will be updated to this register. If the motion data uses 16bit or 12bit mode, then this data is the lower 8 bits of the motion data DX. If 8bit mode is used, then this data is the motion data DX.

DeltaY	Address: 0x04

Access: Read **Default Value:** --

Bit	7	6	5	4	3	2	1	0
Field	DY[7:0]							

Usage: After reading the Motion_St register, DY movement data will be updated to this register. If the motion data uses 16bit or 12bit mode, then this data is the lower 8 bits of the motion data DY. If 8bit mode is used, then this data is the motion data DY.

Op_Mode	Address: 0x05

Access: Write/Read **Default Value:** 0xB8

Bit	7	6	5	4	3	2	1	0
Field	Reserved[2:0]			Slp_Enh	Slp2_Enh	Slp2mu_Enh	Slp1mu_Enh	Wakeup

Usage: This register is used to configure the Sleep function.

Field Name					Description
Slp_Enh	Slp2_Enh	Slp2mu_Enh	Slp1mu_Enh	Wakeup	
0	x	x	x	x	Turn off Sleep function
1	0	x	x	x	Open Sleep1 and close Sleep2
1	1	x	x	x	**Open Sleep1, Open Sleep2 (Default)**
1	1	1	0	0	Force to enter Sleep2
1	x	0	1	0	Force to enter Sleep1
1	x	0	0	1	Wake up from Sleep

Field Name	Description
Slp_Enh	0:Disable **1:Enable (Default)**
Slp2_Enh	0:Disable **1:Enable (Default)**
Slp2mu_Enh	Set 1 to enter Sleep2 and then it will automatically reset to 0
Slp1mu_Enh	Set 1 to enter Sleep1 and then it will automatically reset to 0
Wakeup	Set 1 to Wakeup and then it will automatically reset to 0

Config	Address: 0x06

Access: Write/Read **Default Value:** 0x11

Bit	7	6	5	4	3	2	1	0
Field	Rst	Reserved	Slp3_Enh	Reserved	PD_Enh	Reserved[2:0]		

Usage: This register is used to reset or power down the chip, or set Sleep3 Enable function.

Field Name	Description
Rst	**0:Working (Default)** 1:Reset all settings of the chip
Slp3_Enh	**0:Disable (Default)** 1:Enable
PD_Enh	**0:Working (Default)** 1:Power Down

Write_Protect	Address: 0x09

Access: Write/Read **Default Value:** 0x00

Bit	7	6	5	4	3	2	1	0
Field	WP[7:0]							

Usage: This register is used to avoid mis-writing the registers after address 0x09.

Field Name	Description
WP[7:0]	**0x00: Enable write protection, registers after address 0x09 are read only (Default)** 0x5A: Disabled write protection, registers which addresses are 0x0A~0x19/0x26 /0x5C can be read and written 0xC3: Disable write protection, registers after address 0x09 can be read and written

Sleep1_Setting	Address: 0x0A

Access: Write/Read **Default Value:** 0x77

Bit	7	6	5	4	3	2	1	0
Field	Slp1_Freq[3:0]				Slp1_Etm[3:0]			

Usage: This register is used to set the frequency of Sleep1 and the time to enter Sleep1.

Field Name	Description
Slp1_Freq[3:0]	The sampling frequency time of Sleep1 is 2ms~32ms, and the default value is Slp1_Freq [3:0]=7 (16ms) The calculation formula：2* (Slp1_Freq[3:0]+1) ms
Slp1_Etm [3:0]	The time to enter Sleep1 is 64ms~1024ms, and the default value is Slp1_Etm [3:0]=7 (512ms) The calculation formula：64* (Slp1_Etm [3:0]+1) ms

Sleep2_Setting	Address: 0x0B

Access: Write/Read **Default Value:** 0x10

Bit	7	6	5	4	3	2	1	0
Field	Slp2_Freq[3:0]				Slp2_Etm[3:0]			

Usage: This register is used to set the frequency of Sleep2 and the time to enter Sleep2.

Field Name	Description
Slp2_Freq[3:0]	The sampling frequency time of Sleep2 is 32ms~512ms. Default Slp2_freq [3:0]=1 (64ms) The calculation formula：32* (Slp2_freq[3:0]+1) ms
Slp2_Etm[3:0]	The time to enter Sleep2 is 20.48sec~327.68 sec. Default Slp2_Etm[3:0]=0 (20.48 sec) The calculation formula：20.48* (Slp2_Etm[3:0]+1) sec

Sleep3_Setting	Address: 0x0C

Access: Write/Read **Default Value:** 0x70

Bit	7	6	5	4	3	2	1	0
Field	Slp3_Freq[3:0]				Slp3_Etm[3:0]			

Usage: This register is used to set the frequency of Sleep3 and the time to enter Sleep3.

Field Name	Description
Slp3_Freq[3:0]	The sampling frequency time of Sleep3 is 64ms~1024ms. Default Slp3_Freq [3:0] =7 (512ms) The calculation formula：64* (Slp3_Freq[3:0]+1) ms
Slp3_Etm[3:0]	The time to enter Sleep3 is 20.48sec~327.68 sec. Default Slp3_Etm[3:0]=0 (20.48 sec) The calculation formula：20.48* (Slp3_Etm[3:0]+1) sec

CPI_X	Address: 0x0D

Access: Write/Read **Default Value**: 0x1B

Bit	7	6	5	4	3	2	1	0
Field	CPI_X[7:0]							

Usage: This register is used to set the CPI resolution of the X-axis, with a default value of 0x1B (CPI=1350), CPI=50*CPI_X, Range 1~128 (CPI=50~6400).

CPI_Y	Address: 0x0E

Access: Write/Read **Default Value:** 0x1B

Bit	7	6	5	4	3	2	1	0
Field	CPI_Y[7:0]							

Usage: This register is used to set the CPI resolution of the Y-axis, with a default value of 0x1B (CPI=1350), CPI=50*CPI_Y, Range 1~128 (CPI=50~6400).

DeltaXY_Hi	Address: 0x12

Access: Read **Default:** --

Bit	7	6	5	4	3	2	1	0
Field	DX[11:8]				DY[11:8]			

Usage: In 12 bit mode, the upper 4 bits of DX [11:0] and DY [11:0].

Field Name	Description
DX[11:8]	The upper 4 bits of DX in 12 bit format
DY[11:8]	The upper 4 bits of DY in 12 bit format

Img_Qa	Address: 0x13

Access: Read **Default:** --

Bit	7	6	5	4	3	2	1	0
Field	Img_Qa[7:0]							

Usage: This register is used to represent the quality of the current image. The larger the value, the better the image quality, with a range of 0-255.

Frame_Avg	Address: 0x17

Access: Read **Default:** --

Bit	7	6	5	4	3	2	1	0
Field	FA[7:0]							

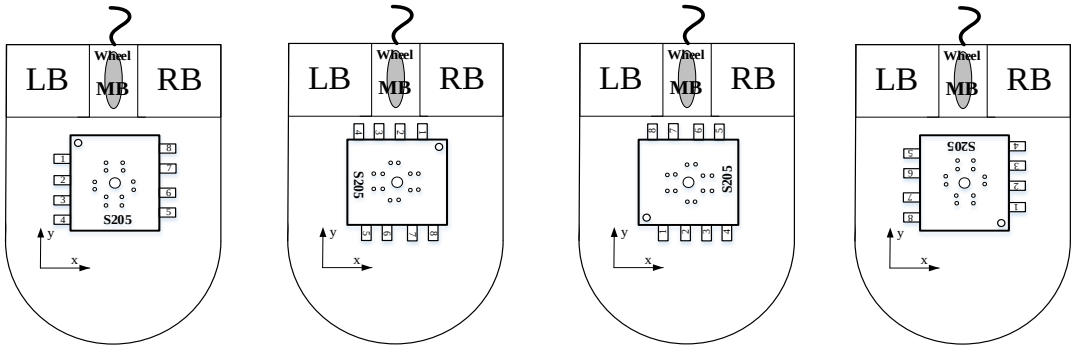
Usage: This register is used to represent the average pixel value of a frame, ranging from 0 to 255.

Mouse_Option	Address: 0x19

Access: Write/Read **Default:** 0x00

Bit	7	6	5	4	3	2	1	0
Field	Reserved[1:0]		Movxy_Sw	Movy_Inv	Movx_Inv	XY12bit_Enh	Reserved	

Usage: This register can be used to select the direction of X/Y and determine the motion data length (8bit/12bit) for Delta_X/Delta_Y.



0x19[5:3] = 0(def) **0x19[5:3] = 6** **0x19[5:3] = 5** **0x19[5:3] = 3**

Field Name	Description
Movxy_Sw	Swap XY direction, default value is 0
Movy_Inv	Reverse the direction of Y, default value is 0
Movx_Inv	Reverse the direction of X, default value is 0
XY12bit_Enh	**0: Enable 8bit mode(Default)** 1: Enable 12bit mode

DeltaX_Hi	Address: 0x20

Access: Read **Default:** --

Bit	7	6	5	4	3	2	1	0
Field	DX[15:8]							

Usage: The upper 8 bits of DX can only be read when 16bit mode data length is enabled (XY16bit_Enh=1 in register 0x22). When using high CPI, it is recommended to enable 16bit mode. DX [15] is the sign bit.

DeltaY_Hi	Address: 0x21

Access: Read **Default:** --

Bit	7	6	5	4	3	2	1	0
Field	DY[15:8]							

Usage: The upper 8 bits of DY can only be read when 16bit mode is enabled. When using high CPI, it is recommended to enable 16bit mode. DY [15] is the sign bit.

DxDy_16bit	Address: 0x22

Access: Write/Read **Default:** 0x00

Bit	7	6	5	4	3	2	1	0
Field	Reserved[6:0]							XY16bit_Enh

Usage: This register determines the length of motion data for Delta_X/Delta_Y (8bit/12bit /16bit).

Field Name	Description
XY16bit_Enh	Choose a motion data length of 8bit/12bit/16bit **0: 8bit / 12bit mode(Default)** 1: Enable 16bit mode

Note:

1、it is recommended to use the 16 bit mode to determine DX&DY data in order to prevent overflow caused by excessively large values.

2、The 8bit/12bit mode is disabled when the 16 bit mode is enabled.

SPI_Mode	Address: 0x26

Access: Write/Read **Default: 0xB4**

Bit	7	6	5	4	3	2	1	0
Field	SPI_Sel	Reserved	Pin1_Sel[1:0]		Reserved[3:0]			

Usage: This register is used to select the 2-Wire or 3-Wire SPI interface mode, or to select the function of Pin1 pin during 2-Wire SPI.

Field Name	Description
SPI_Sel	0: Using 2-Wire SPI mode **1: Using 3-Wire SPI mode (Default)**
Pin1_Sel[1:0]	0: Hardware reset function 2: Hardware PD function **3: No Function (Default)**

PID3	Address: 0x49							
Access: Read				**Default Value:** 0xB2				
Bit	7	6	5	4	3	2	1	0
Field	PID3[7:0]							

Usage: This register can be used to verify whether the chip is S205.

LED_Option	Address: 0x5C							
Access: Write/Read				**Default:** 0xCA				
Bit	7	6	5	4	3	2	1	0
Field	Reserved[1:0]		LED_Mode[1:0]		LED_SRC[3:0]			

Usage: Select LED driver mode：Switch mode or Current source mode, and select LED driver under the Current source.

Field Name	Description
LED_Mode[1:0]	**0: Enable switch mode(Default)** 1: Enable current source mode
LED_SRC [3:0]	Set the LED driver current in current source mode (The default value is 13) LED driver current is LED_SRC[3:0]*1.3mA

11.3 Sensor Registers Initialization Sequence

- 3-wired SPI
  No sensor settings are required.

- 2-wired SPI
  Write register 0x09 with value 0xc3
  Write register 0x26 with value 0x34
  Write register 0x09 with value 0x00

- Low Voltage (1.8V-2.1V) Segment
  Write register 0x09 with value 0xc3
  Write register 0x46 with value 0x01
  Write register 0x58 with value 0x60
  Write register 0x09 with value 0x00

- High Voltage (2.1V-3.6V) Segment
  No sensor settings are required.

12.Electrical Characteristic

12.1 Absolute Maximum Rating

Parameter	Symbol	Min	Max	Unit	Notes
Supply Voltage	V_{DD}	-0.3	3.9	V	
	V_{DDA}	-0.2	2.3		
Operating Temperature	T_O	-15	55	°C	
Storage Temperature	T_S	-40	85	°C	
Lead Solder Temperature	T_{SOLDER}	-	260	°C	
Input Voltage	V_{in}	-0.3	VDD/VDDA	V	All I/O pins
ESD	V_{ESD}	-	2	KV	All pins, human body model

12.2 Recommend Operation Conditions

Parameter		Symbol	Min	Typical	Max	Unit	Notes
Supply Voltage		V_{DD}	2.1	2.7	3.6	V	VDDA should connect a capacitor to GND
			1.8	1.9	2.1		VDD,VDDA short
Operating Temperature		T_O	0	-	40	°C	
Supply Noise		Vnpp	-	-	100	mV	Peak to Peak 10K~80MHz
Distance from the Bottom of Lens to the Working Surface		Z	2.1	2.2	2.3	mm	
SCLK Clock		Fsclk	-	-	8	MHz	
Resolution		R	50	-	6400	CPI	
Office Mode	Frame Rate	Fr_1	-	-	2000	FPS	
	Speed	S_1	0	-	30	IPS	
	Acceleration	A_1	0	-	10	g	
Gaming Mode	Frame Rate	Fr_2	-	-	7200	FPS	
	Speed	S_2	0	-	120	IPS	
	Acceleration	A_2	0	-	25	g	

12.3 DC Parameter

Parameter		Symbol	Min	Typical	Max	Unit	Notes
Office Mode Current	Run	I_{Run-1}	-	0.75	-	mA	The average current is calculated as: The weight of 10 ips is 85%, The weight of 20 ips is 15%,
	Sleep1	I_{Slp1-1}	-	35	-	uA	Sleep1 frequency is 16ms
	Sleep2	I_{Slp2-1}	-	15	-	uA	Sleep2 frequency is 128ms
	Sleep3	I_{Slp3-1}	-	8	-	uA	Sleep3 frequency is 512ms
Gaming Mode Current	Run	I_{Run-2}	-	2.2	-	mA	The average current is calculated as: The weight of 20 ips is 85%, The weight of 40 ips is 15%,
	Sleep1	I_{Slp1-2}	-	110	-	uA	Sleep1 frequency is 4ms
	Sleep2	I_{Slp2-2}	-	28	-	uA	Sleep2 frequency is 32ms
	Sleep3	I_{Slp3-2}	-	8	-	uA	Sleep3 frequency is 512ms
Power Down current		I_{PD}	-	3.8	-	uA	-
LED pin Sink Current	Switch mode	I_{LED-1}	-	-	60	mA	-
	Current source mode	I_{LED-2}	1.3	-	19.5	mA	Please refer to Register Description for details

Note: Test conditions VDD=3.3V (not includes LED), temperature=25 °C.

13.Typical application circuit (nRF24LE1+S205)

13.1 Typical application circuits in high voltage range (2.1~3.6V)

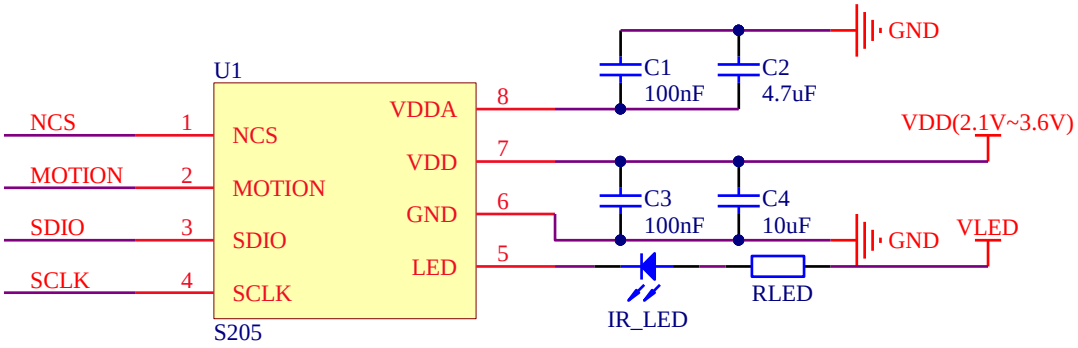


Figure 13-1 Typical Application Circuit (2.1~3.6V)

Note:

(1) C1 should be as close as possible to the VDDA pin, and C3 should be as close as possible to the VDD pin.

(2) Table show the recommended value of RLED and VLED.

VLED(V)	Recommended RLED(Ω)
3.3	51

Table 13-1 Recommended RLED

13.2 Typical application circuits in low voltage range (1.8-2.1V)

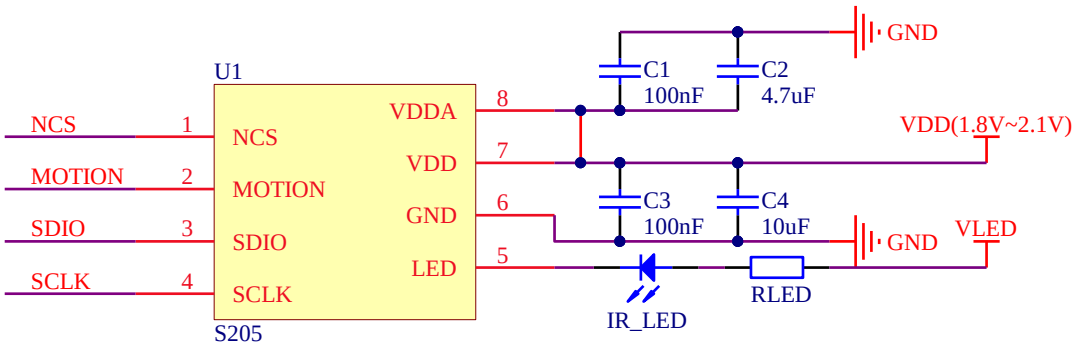


Figure 13-2 Typical Application Circuit (1.8~2.1V)

Note:

(1) C1 should be as close as possible to the VDDA pin, and C3 should be as close as possible to the VDD pin.

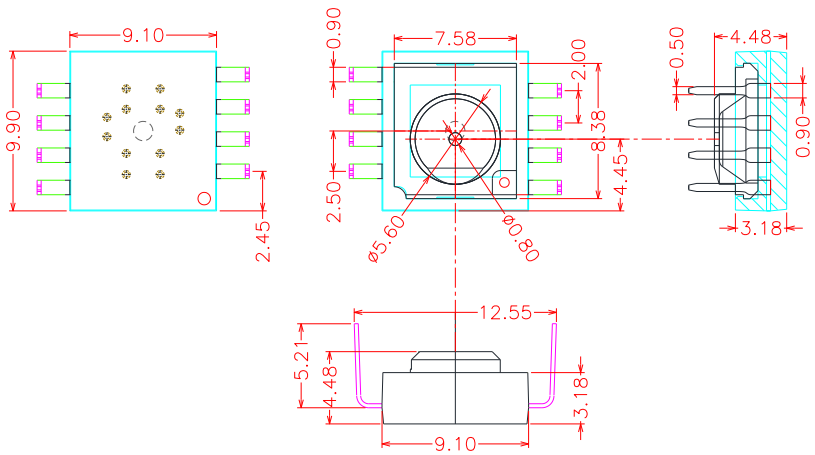
(2) It is recommended to use infrared LED in low voltage applications.

(3) Table show the recommended value of RLED and VLED.

VLED(V)	Recommended RLED(Ω)
1.9	10

Table 13-2 Recommended RLED

14.Package



Unit：mm

Figure 14-1 Package

15.Assembly Drawing

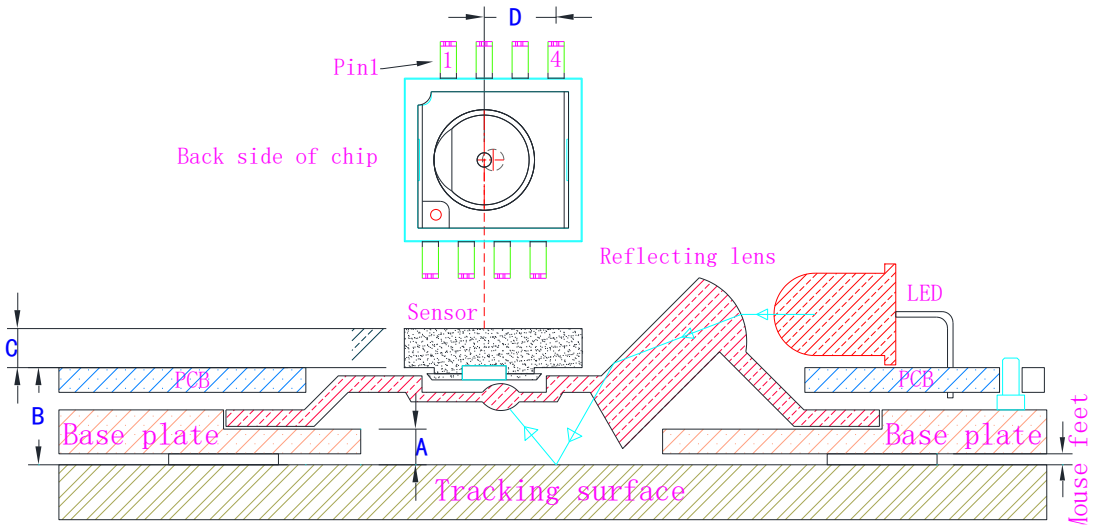


Figure 15-1 2D Assembly Drawing

Symbol	Description	Min	Typical	Max	Unit
A	Distance from the bottom of the lens to the desktop (Z-Height)	2.1	2.2	2.3	mm
B	The distance from the top of the PCB to the desktop	7.1	7.2	7.3	mm
C	The packaging thickness of the sensor	2.98	3.18	3.38	mm
D	The distance from the center of the light hole to pin4	-	4.0	-	mm

16.Revision History

Versions	Date	Reviser	Description
S205_Spec_EN_V1.00	2024/6/5	Kevin	Create Preliminary Version
S205_Spec_EN_V1.01	2024/9/5	Kevin	Update office mode and gaming mode Initialization setting
S205_Spec_EN_V1.02	2024/9/12	Kevin	Modify office mode and gaming mode description