珠海市矽旺半导体有限公司

KA8 Datasheet

V1.0

珠海市矽旺半导体有限公司
2018/2/1

Catalog

Features

- ●Signle power supply
- ●Power range 1.7V -3.2V
- ●Precision optical displacement prediction technology
- ●Very good 2-D motion sensor
- ● Support extremely fast moving speed
- ● Maximum speed of movement 28 Inch/sec CPI
- ● Data transmission is achieved through serial interfaces
- ●Built-in low power timer (LPT),sleep1/sleep2 models
- ● Built-in oscillator
- ●LED current-limiting resistance 68-470 Ohm(Determine by the actual plane),recommend 100 Ohm.
- ● DIP8 package

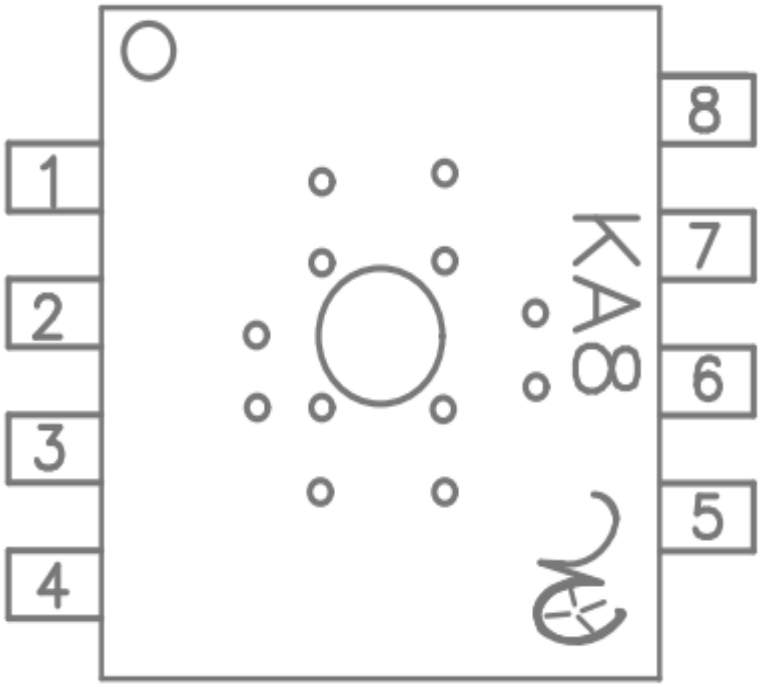
Description

KA8 is a high integration optical mouse sensor, which have minimal external components . It is compatible with Microsoft 3D IntelliMouse, and CPI can be adjusted though fixed CPI register.

Specification:

Power	Working voltage 1.73V ~ 1.94V (VDD and AVDD short) 2.3V ~ 3.2V (VDD)
Optical lens	**1:1**
Speed	2 8 Inch/sec
CPI	**400/ 500/ 600/ 800/ 1000(Default)/ 1200 / 1600 CPI**
Frame rate	3000 FPS
Current	2.2mA @moving (normal) 300uA @hold-on(Sleep1) 60uA @hold-on(Sleep2) 7uA @power-down
Packa ing	StaggerDIP8

Pin Assignment



Pin Description

Number	Name	I/O	Description
1	NC		
2	MOTSWK	OUT	Motion detection active low
3	SDIO	I/O	Serial interface data in/out
4	SCLK	I/O	Serial interface clock
5	LED	OUT	LED driver
6	VSS	GND	Ground
7	VDD	PWR	Power 2.3V-3.2V Or low-power run 1.73V-1.94V(pin7 pin8 short)
8	AVDD	PWR	Analog digital power supply 1.8V

Registers and Operation

The mouse sensor can be programmed through registers, via the serial port, and DSP configuration and motion data can be read from these registers. All registers not listed are reserved, and should never be written by firmware.

Registers

Address	Name	R/W	Default	Data Type
0x00	Product ID	R	0x30	Bit field
0x01	Product ID	R	0x54	Bit field
0x02	Motion status	R	-	Bit field
0x03	Delta_X	R	-	Eight bits 2's complement number
0x04	Delta_Y	R	-	Eight bits 2's complement number
0x05	Operation_Mode	R/W	0XB8	Bit field
0x06	Configuration	R/W	0x04	Bit field
0x07	Image_Quality	R	-	Eight bits unsigned integer
0x08	Operation_State	R	-	Bit field
0x09	Write_Protect	R/W	0x00	Bit field
0x0A	Sleep1_Setting	R/W	0x72	Bit field
0x0B	Enter_Time	R/W	0x12	Bit field
0x0C	Sleep2_Setting	R/W	0x92	Bit field
0x0D	Image Threshold	R/W	0x0F	Eight bits unsigned integer
0x0E	Image Recognition	R/W	0xE5	Bit field

Register Descriptions

0x00	Product ID							
Bit	7	6	5	4	3	2	1	0
Field	PID[11:4]							
Usage	The value in this register can't change. It can be used to verify the serial communications link is OK							
0x01	Product ID							
Bit	7	6	5	4	3	2	1	0
Field	PID[11:4]							
Usage	The value in this register can't change. It can be used to verify the serial communications link is OK							
0x02	**Motion_Status**							
Bit	7	6	5	4	3	2	1	0
Field	Motion	Reserved[1:0]		DYOVF	DYOVF	RES[2:0]		
Usage	***Motion_Status*** register allows the user to determine if motion has occurred since the last time it was read. If so, then the user should read ***Delta_X*** and ***Delta_Y***							

<table>
<tr><td></td><td colspan="8">registers to get the accumulated motion. It also tells if the motion buffers have overflowed since the last reading. The current resolution is also shown. Reading this register freezes the Delta_X and Delta_Y register values. Read this register before reading the Delta_X and Delta_Y registers. If Delta_ X and Delta_Y are not read before the motion register is read a second time, the data in Delta_X and Delta_Y will be lost.</td></tr>
<tr><td rowspan="6">Notes</td><td>Field Name</td><td colspan="7">Description</td></tr>
<tr><td>Motion</td><td colspan="7">Motion since last report
0=No motion(Default)
1=Motion occurred, data ready for reading in Delta_X and Delta_Y registers</td></tr>
<tr><td>Reserved[1:0]</td><td colspan="7">Reserved for future use</td></tr>
<tr><td>DYOVF</td><td colspan="7">Motion Delta Y overflow, Y buffer has overflowed since last report,0= No overflow (Default),1= Overflow has occurred</td></tr>
<tr><td>DXOVF</td><td colspan="7">Motion Delta X overflow, X buffer has overflowed since last report,0= No overflow (Default),1== Overflow has occurred</td></tr>
<tr><td>RES[2:0]</td><td colspan="7">Resolution in counts per inch
000=400
001=500
010=600
011=800
100=1000(default)
101=1200
110=1600</td></tr>
<tr><td>0x03</td><td colspan="8">Delta_X</td></tr>
<tr><td>Bit</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Field</td><td>X7</td><td>X6</td><td>X5</td><td>X4</td><td>X3</td><td>X2</td><td>X1</td><td>X</td></tr>
<tr><td>Usage</td><td colspan="8">X movement is counted since last report. Absolute value is determined by resolution. Reading clears the register. Report range –128 ~ +127</td></tr>
<tr><td>0x04</td><td colspan="8">Delta_Y</td></tr>
<tr><td>Bit</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Field</td><td>Y7</td><td>Y6</td><td>Y5</td><td>Y4</td><td>Y3</td><td>Y2</td><td>Y1</td><td>Y0</td></tr>
<tr><td>Usage</td><td colspan="8">Y movement is counted since last report. Absolute value is determined by resolution. Reading clears the register. Report range –128 ~ +127</td></tr>
<tr><td>0x05</td><td colspan="8">Operation_Mode</td></tr>
<tr><td>Bit</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Field</td><td>LEDsht_enh</td><td>0</td><td>1</td><td>Slp_enh</td><td>Slp2_enh</td><td>Slp2mu</td><td>Slp1mu</td><td>Wakeup</td></tr>
<tr><td>Usage</td><td colspan="8">Operation_Mode register allows the user to change the operation of the mouse sensor. Shown below are the bits, their default values, and optional values.
Operation_Mode[4:0]
“0xxxx” = Disable sleep mode
“10xxx” = Enable sleep mode[1]
“11xxx” = Enable sleep mode[2]
“11100” = Force enter sleep2[3]
“1x010” = Force enter sleep1[3] (If Slp2_enh is set, the mouse sensor still enter the sleep2 automatically.)
“1x001” = Force wakeup from sleep mode[3]</td></tr>
</table>

0x06	**Configuration**							
Bit	7	6	5	4	3	2	1	0
Field	Reset	MotSwk	0	0	PD_enh	CPI [2:0]		
Usage	The ***Configuration*** register allows the user to change the configuration of the sensor. Shown below are the bits, their default values, and optional values If ***MotSwk*** bit is clear, the MOTSWK pin is level-sensitive. The pin level remains low when motion has occurred; in other words, ***Delta_X*** and ***Delta_Y*** registers has data. The mouse controller can read ***Motion_Status*** register, ***Delta_X*** register, then ***Delta_Y*** register sequentially. After the mouse controller reads all data, ***Delta_X*** and ***Delta_Y*** are both zero, the pin level will be high (see Section 7). If ***MotSwk*** bit is set, the MOTSWK pin is edge-sensitive. The pin will send a pulse and trigger the mouse controller when motion has occurred during the sleep mode. The mouse controller can read ***Motion_Status*** register, ***Delta_X*** register, then ***Delta_Y*** register sequentially (see Section 7)							

	Field Name	**Field Name**
	Reset	0**= Normal operation mode (Default)** **1**= Full chip rese
	MotSwk	0**= Motion function output (Default)** 1= SWKINT function output
	Bit [5:4]	MUST always be **00**
	PD_enh	0**= Normal operation (Default)** **1**= Power down mode
	CPI[2:0]	Output resolution setting, setting with CPI mode select bit 000=400 001=500 010=600 011=800 100=1000(default) 101=1200 110=1600

0x07	**Image_Quality**							
Bit	7	6	5	4	3	2	1	0
Field								
Usage	Image Quality is a quality level of the sensor in the current frame. Report range 0 ~ 255. The default minimum level for normally working is 10. (please see ***Image_ Threshold*** register)							

0x08	**Operation_State**							
Bit	7	6	5	4	3	2	1	0
Field	Reserved[3:0]				Slp_state	Op_state[2:0]		
Usage	***Operation_State*** register allows the user to read the operation state of the sensor.							

Notes	**Field Name**	**Description**
	Reserved[3:0]	Reserved for future use
	Slp_state	Sleep state (If Op_state[2:0] is 100, the Slp_state bit is effective.) 0 = LPT sleep1 1 = LPT sleep2
	Op_state[2:0]	***000***= Normal state 001= Entry sleep1 processing 010= Entry sleep2 processing

		011= Reserved for future use 100= Sleep mode (see Slp_state bit to get sleep state.)						
0x09	**Write_Protect**							
Bit	7	6	5	4	3	2	1	0
Field	WP[7:0]							
Usage	Write protect for the register 0x0A ~ 0x7F							
Notes	**Field Name**	**Description**						
	WP[7:0]	Write protect enable/disable for the address after 0x09 **0x00 = Enable (Default)**, register 0x0A ~ 0x7F are read only 0x5A = Disable, register 0x0A ~ 0x7F can be read/written						
0x0A	**Sleep1_Setting**							
Bit	7	6	5	4	3	2	1	0
Field	Slp1_freq[3:0]				0	0	1	0
Usage	***Sleep1_Setting*** register allows the user to set frequency time for the sleep1 mode.							
Notes	**Field Name**	**Description**						
	Slp1_freq[3:0]	Setting frequency time for the sleep1 mode A scale is 4ms. Relative to its value 0 ~ 15, the frequency time is 4ms ~ 64ms. Default is 32ms. (slp1_freq[3:0] = 0111)						
	Bit [3:0]	MUST always be **0010**						
0x0B	**Enter_Time**							
Bit	7	6	5	4	3	2	1	0
Field	Slp1_etm[3:0]				Slp2_etm[3:0]			
Usage								
Notes	**Field Name**	**Description**						
	Slp1_etm[3:0]	Setting sleep1 enter time. A scale is 128ms. Relative to its value 0 ~ 15, the frequency time is 128ms-2048ms. Default is 256ms. (slp1_etm[3:0] = 0001)						
	Slp2_etm[3:0]	Setting sleep2 enter time. A scale is 20480ms. Relative to its value 0 ~ 15, the frequency time is 20480ms ~327680ms. Default is 61440ms (about 61 sec). (slp2_etm[3:0] = 0010)						
0x0C	**Sleep2_Setting**							
Bit	7	6	5	4	3	2	1	0
Field	Slp2_freq[3:0]				0	0	1	0
Usage	***Sleep2_Setting*** register allows the user to set frequency time for the sleep2 mode.							
Notes	**Field Name**	**Description**						
	Slp2_freq[3:0]	Setting frequency time for the sleep2 mode A scale is 32ms. Relative to its value 0 ~ 15, the frequency time is 32ms ~ 512ms. Default is 320ms. (slp2_freq[3:0] = 1001)						
	Bit [3:0]	MUST always be **0010**						
0x0D	**Image_ Threshold**							
Bit	7	6	5	4	3	2	1	0
Field	Imgqa_th[7:0]							

Usage	***Image_ Threshold*** register allows the user to set image threshold. The mouse sensor calculates data to Delta_X and Delta_Y registers when image quality (please see Image_Quality register) is larger than image threshold. Image threshold: 0 (High recognition rate) ~ 255 (Low recognition rate). The minimum level for normally working is 10. Default is 00001010.							
0x0E	Image_Recognition							
Bit	7	6	5	4	3	2	1	0
Field	pk_wt[2:0]			0	Imgqa_df[3:0]			
Usage	***Image_Recognition*** register allows the user to set recognition rate.							

Notes	**Field Name**	**Description**
	pk_wt[2:0]	Peak threshold weighting: 0 (Low recognition rate) ~ 7 (High recognition rate). Default is 111.
	Bit 4	0
	Imgqa_df[3:0]	Image qualification threshold difference: 0 (High recognition rate) ~ 15 (Low recognition rate). Default is 1001

Serial Interface

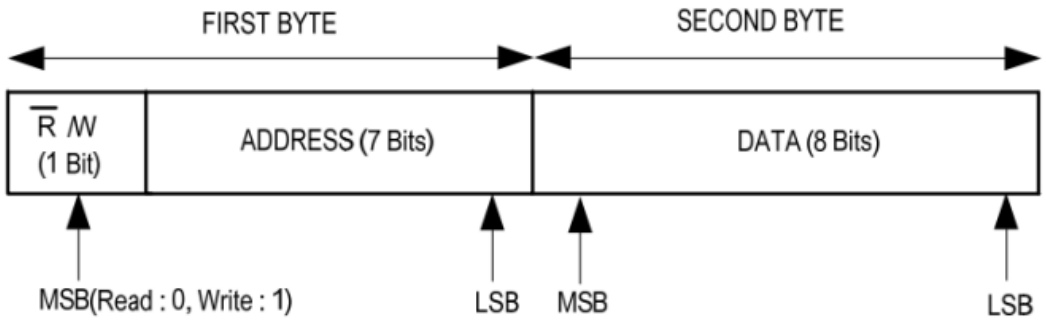
The synchronous serial port is used to set and read parameters in the mouse sensor. **SCLK:** The serial clock line. It is always generated by the mouse controller. **SDIO:** The serial data line is used to write and read data.

Transmission Protocol

The transmission protocol is a two-wire link, half duplex protocol between the micro controller and the mouse sensor. All data changes on SDIO are initiated by the falling edge on SCLK. The mouse controller always initiates communication; the mouse sensor never initiates data transfers. The transmission protocol consists of the two operation modes:

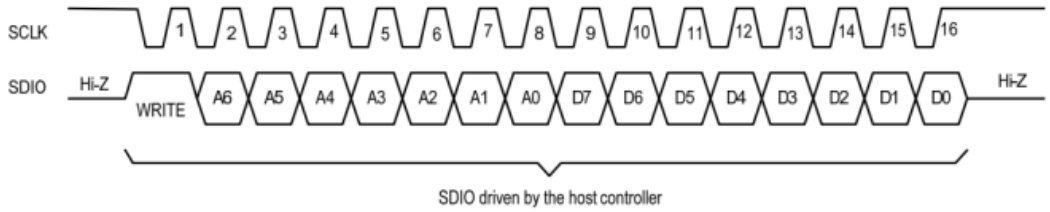
- Write Operation and Read Operation.

Both of the two operation modes consist of two bytes. The first byte contains the address (seven bits) and has a bit 7 as its MSB to indicate data direction. The second byte contains the data.



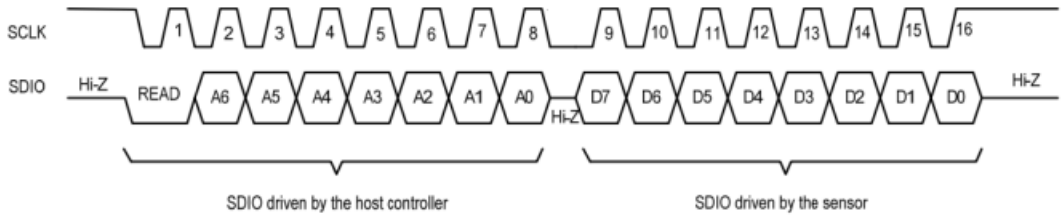
Write Operation

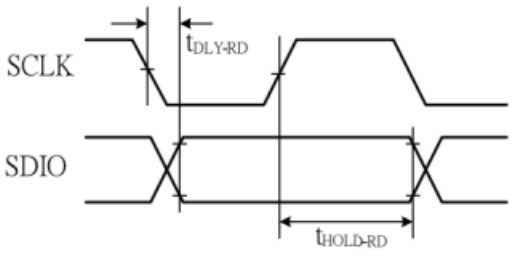
A write operation, which means that data is going from the mouse controller to the mouse sensor, is always initiated by the mouse controller and consists of two bytes. The first byte contains the address (seven bits) and has a "1" as its MSB to indicate data direction. The second byte contains the data. The transfer is synchronized by SCLK. The mouse controller changes SDIO on falling edges of SCLK. The mouse sensor reads SDIO on rising edges of SCLK.



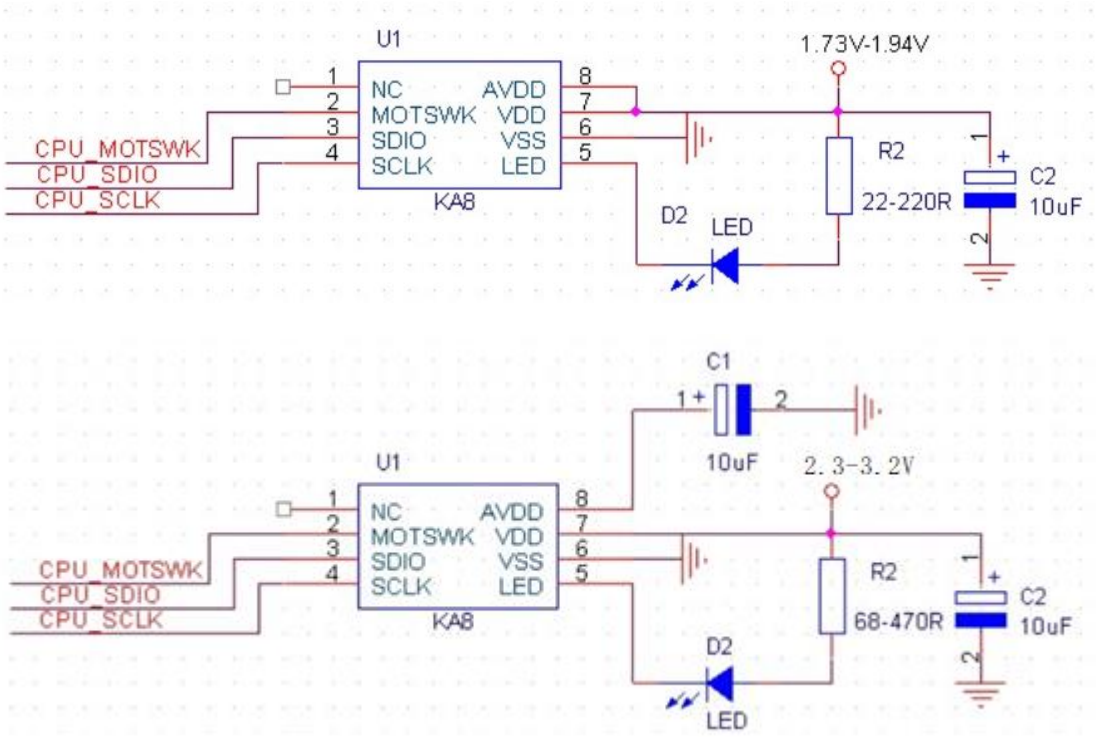
Read Operation

A read operation, which means that data is going from the mouse sensor to the mouse controller, is always initiated by the mouse controller and consists of two bytes. The first byte contains the address, is written by the mouse controller, and has a "0" as its MSB to indicate data direction. The second byte contains the data and is driven by the mouse sensor. The transfer is synchronized by SCLK. SDIO is changed on falling edges of SCLK and read on every rising edge of SCLK. The mouse controller must go to a high Z state after the last address data bit. The mouse sensor will go to the high Z state after the last data bit.





Referencing Application Circuit



Package Information