eKM8005

Optical Mouse Controller

Product Specification

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Specification Revision History

Doc. Version	Revision Description	Date
1.0	Initial released version	2007/02/09

1 General Description

The eKM8005 is a high performance CMOS microcontroller device specially designed to control 400 or 800cpi PS/2 optical mouse which supports 3-D 3-Key. It also supports ELAN OM10B optical sensor.

2 Features

- Supports ELAN OM10B optical sensor.

- Two types of resolution (Selected by CPI pin option):

    - 400cpi via CPI pin connect to GND

    - 800cpi via CPI pin NC

- Supports mechanical Z2

- 14-pin DIP/SOP package

3 Application

- PS/2 optical mouse which supports 3 Dimensions with 3 Keys

4 Pin Assignment

CLK	1		14	DATA
Z1	2		13	SDIO
Z2	3		12	SCLK
VDD	4	EKM8005	11	VSS
CPI	5		10	PD
M	6		9	L
VPP	7		8	R
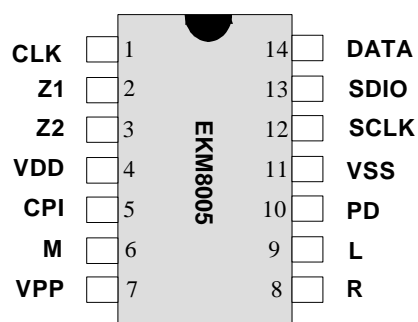
Figure 4-1 14-pin DIP/SOP Pin Assignment

4 Pin Description

Symbol	I/O	Pin	Description
CLK	I/O	1	PS/2 CLK I/O pin
Z1	I	2	Z axis Input 1
Z2	I	3	Z axis Input 2
VDD	P	4	+5V Power Input
CPI	I	5	400/800 CPI Selection pin Floating: 800 CPI Ground: 400 CPI
M	I	6	Middle Key Input
VPP	-	7	This pin connects to VDD
R	I	8	Right Key Input
L	I	9	Left Key Input
PD	I/O	10	Internal pull high to power down sensor Output low to active sensor
VSS	-	11	Ground
SCLK	I/O	12	Serial port clock output
SDIO	I/O	13	Serial port data I/O
DATA	I/O	14	PS/2 Data I/O pin

4 Function Description

4.1 OM10B Serial Interface and Control Register

4.1.1 Synchronous Serial Port

The synchronous serial port is used to set and read parameters in OM10B sensor IC, and can be used to read out the motion information. The eKM8005 always initiates communication.

SCLK: Serial port clock. It is always generated by eKM8005.

SDIO: Serial data line.

PD: Power Down line is used to force re-synchronization between the eKM8005 and the OM10B in case of an error. It can also be used to place the OM10B in low power mode to meet some special case.

4.1.2 Write Operation

Write operations, where data is going from the eKM8005 to OM10B sensor IC, is always initiated by the microcontroller 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 eKM8005 changes SDIO on falling edges of SCLK.

4.1.3 Read Operation

A read operation, which means that data is going from OM10B sensor IC to the eKM8005, is always initiated by the eKM8005 and consists of two bytes. The first byte contains the address, is written by the eKM8005, and has a "0" as its MSB to indicate data direction. The second byte contains the data and is driven by OM10B sensor IC. The transfer is synchronized by SCLK. SDIO is changed on falling edges of SCLK and read on every rising edge of SCLK. The eKM8005 will go to a high Z state after the last address data bit.

During a read operation, SCLK will delay after the last address data bit to ensure that the OM10B sensor IC has at least 100μs to prepare the requested data.

4.1.4 Error Detection and Recovery of OM10B

The eKM8005 will verify the synchronization of the serial port by periodically reading the product ID register of OM10B. Once the eKM8005 and the OM10B get out of sync, then the eKM8005 will output a valid PD pulse to resync.

4.2 Optical Sensor Resolution Selection

Optical Sensor OM10B resolution can be programmed as 400 or 800 cpi (counts per inch).

The eKM8005 has a selection pin, CPI, to select the resolution. The default resolution is 800 cpi. If the selection pin is tied to ground, the eKM8005 will program the OM10B to 400 cpi. To program the resolution, the eKM8005 writes data into the OM10B's configuration register address, 0x0a.

4.3 Registers of OM10B

4.3.1 Product ID

Address: 0x00

Reset Value: 0x03

Usage: The values in this register do not change. This can be used to verify that the serial communications link is OK.

4.3.2 Motion

Address: 0x02

Reset Value: 0x00

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
MOT	Reserved	0	OVFY	OVFX	Reserved	Reserved	RES

Usage: Register 0x02 allows the user to determine if motion has occurred since the last time it was read. If so, then the eKM8005 should Read Registers 0x03 and 0x04 to get the accumulated motion. It also tells if the motion buffers have overflowed since the last reading. The current resolution is also shown.

Field Name	Description
MOT	Motion since last report or PD **0** = No Motion **1** = Motion occurred, data ready for reading in Delta_X and Delta_Y registers.
Reserved	Reserved for future
OVFY	Motion overflow Y, Delta_Y buffer has overflowed since the last report. **0** = No overflow **1** = Overflow has occurred
OVFX	Motion overflow X, Delta_X buffer has overflowed since the last report. **0** = No overflow **1** = Overflow has occurred
RES	Resolution in counts per inch **0** = 400 **1** = 800

4.3.3 Delta_X

Address: 0x03

Reset Value: 0x00

Usage : X movement is counted since the last report. Absolute value is determined by resolution. Reading clears the register.

4.3.4 Delta_Y

Address: 0x04

Reset Value: 0x00

Usage: Y movement is counted since the last report. Absolute value is determined by resolution. Reading clears the register.

4.3.5 Configuration_Bits

Address: 0x0a

Reset Value: 0x00

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
RESET	Reserved	Reserved	RES	Reserved	Reserved	Reserved	Sleep

Usage : Register 0x0a allows the user to change the configuration of the sensor. Shown below are the bits, their default values, and optional values.

Field Name	Description
RESET	Power up defaults (bit always reads 0) **0** = No effect **1** = Reset registers and bits to power up default settings
RES	Resolution in counts per inch **0** = 400 **1** = 800
Sleep	Sleep Mode **0** = Normal, enter sleep mode after one second of no movement (1500 frames/s) **1** = always awake

4.4 PS/2 Mouse Commands Description

Hex Code	Command	eKM8005 Echo Code
FF	Reset	FA,AA,00
FE	Resend	XX, (XX,XX)
F6	Set Default	FA
F5	Disable	FA
F4	Enable	FA
F3,XX	Set Sampling Rate	FA,FA
F2	Read Device Type	FA,00
F0	Set Remote Mode	FA
EE	Set Wrap Mode	FA
EC	Reset Wrap Mode	FA
EB	Read Data	FA,XX,XX,XX
EA	Set Stream Mode	FA
E9	Status Request	FA,XX,XX,XX
E8,XX	Set Resolution	FA,FA
E7	Set Auto-speed	FA
E6	Reset Auto-speed	FA

4.5 Microsoft PS/2 Scrolling Mouse

- ■ Entering Procedure: Except in WRAP mode, while the eKM8005 receives the following consecutive commands

  - ● F3 C8 ---- set sampling rate 200 Hz

  - ● F3 64 ---- set sampling rate 100 Hz

  - ● F3 50 ---- set sampling rate 80 Hz

  - ● F3 3C ---- set sampling rate 60 Hz

  - ● F3 28 ---- set sampling rate 40 Hz

  - ● F3 14 ---- set sampling rate 20 Hz

  - ● F3 0A ---- set sampling rate 10 Hz

■ Operating for 3-D 3-Key:

● a. All of the commands in legacy mode will still be valid.

● b. The ID code of read device type command (F2) will change from "00" to "03".

● c. Data report will be four bytes format:

Byte	Bit	Description
1	0	Left button status; 1 = pressed
	1	Right button status; 1 = pressed
	2	Middle button status; 1 = pressed
	3	Reserve
	4	X data sign; 1 = negative
	5	Y data sign; 1 = negative
	6	X data overflow; 1 = overflow
	7	Y data overflow; 1 = overflow
2	0-7	X data (D0-D7)
3	0-7	Y data (D0-D7)
4	0-7	Z data (D0-D7) limit value is ± 7.

■ Exiting Microsoft scrolling mode:

There are two ways to exit:

● a. Power off

● b. Reset command (FF)

5   Absolute Maximum Rating

Symbol	Min	Max	Unit
Temperature under bias	0	70	^{o}C
Storage temperature	-65	150	^{o}C
Input voltage	-0.5	6.0	V
Output voltage	-0.5	6.0	V

6   Application Circuit
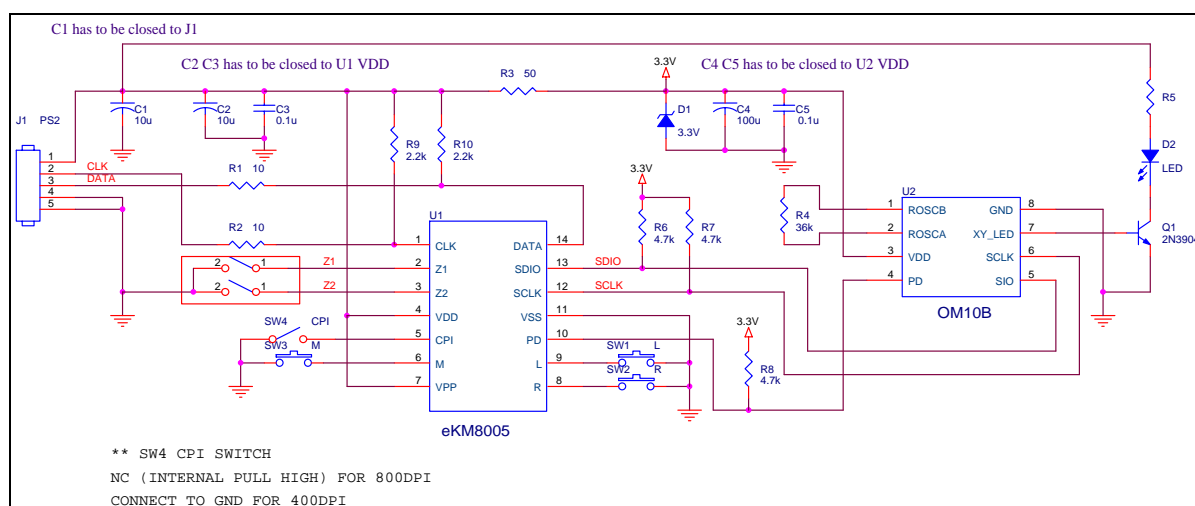
Fig. 6-1 3-D 3-Key with Mechanical Z/2

7   Pad Diagram

Chip Size: 1170 * 1990 UM
(2)Pad Configuration

	3	2	1	14	13	12	

4 | VDD | P6_6_ | P6_7_ | P5_0_ | P5_1_ | P5_2_ | P5_3_ | GND | 11

(0,0)
+

5 | P6_5_ | | P6_0_ | 10

	P6_4_		P6_3_	P6_2_	P6_1_	
	6		7	8	9	
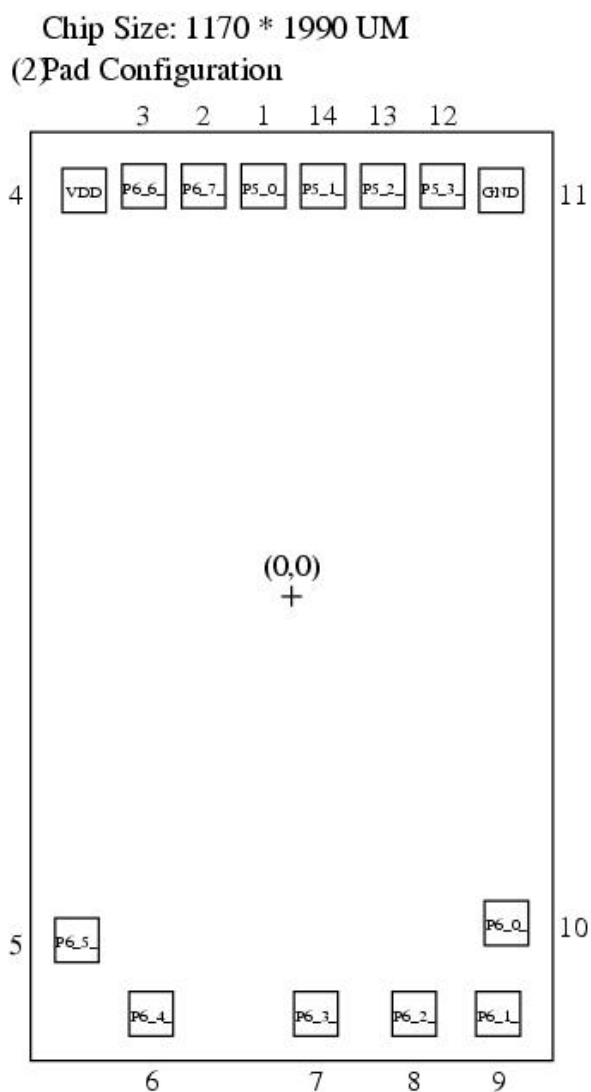
8   Pad Coordinate

Pin No.	Pad Name	Coordinate	
		X	Y
1	P5_0_	-58.0	834.6
2	P6_7	-180.3	834.6
3	P6_6	-302.7	834.6
4	VDD	-425.0	825.7
5	P6_5	-440.0	-700.0
6	P6_4	-287.8	-850.0
7	P6_3	49.8	-850.0
8	P6_2	250.9	-850.0
9	P6_1	422.9	-850.0
10	P6_0	440.0	-665.4
11	GND	429.1	825.7
12	P5_3	309.1	834.6
13	P5_2	186.7	834.6
14	P5_1	64.4	834.6

Chip Size: 1170×1990 μM

9 Package

■ **PDIP-14L 300 mil Package Outline Dimension (Unit: mm)**
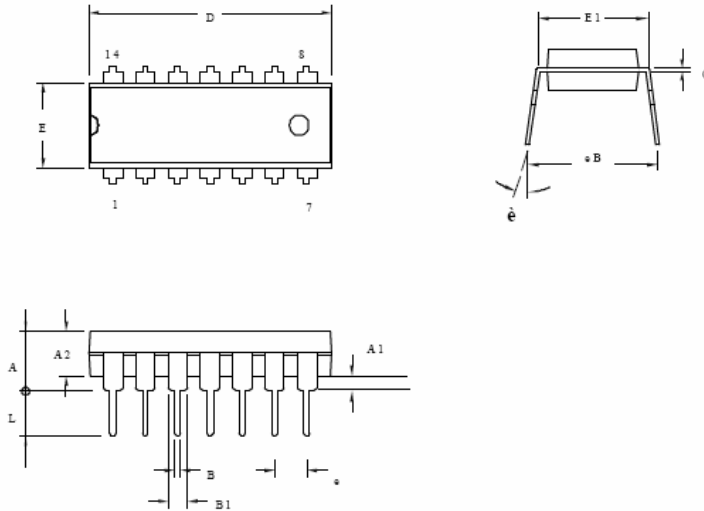
Symbol	Min	Normal	Max
A			4.318
A1	0.381		
A2	3.175	3.302	3.429
c	0.203	0.254	0.356
D	18.796	19.050	19.304
E	6.174	6.401	6.628
E1	7.366	7.696	8.025
eB	8.409	9.017	9.625
B	0.356	0.457	0.559
B1	1.143	1.524	1.778
L	3.048	3.302	3.556
e	2.540(TYP)		
θ	0		15

■ **SOP-14L 150 mil Package Outline Dimension (Unit: mm)**
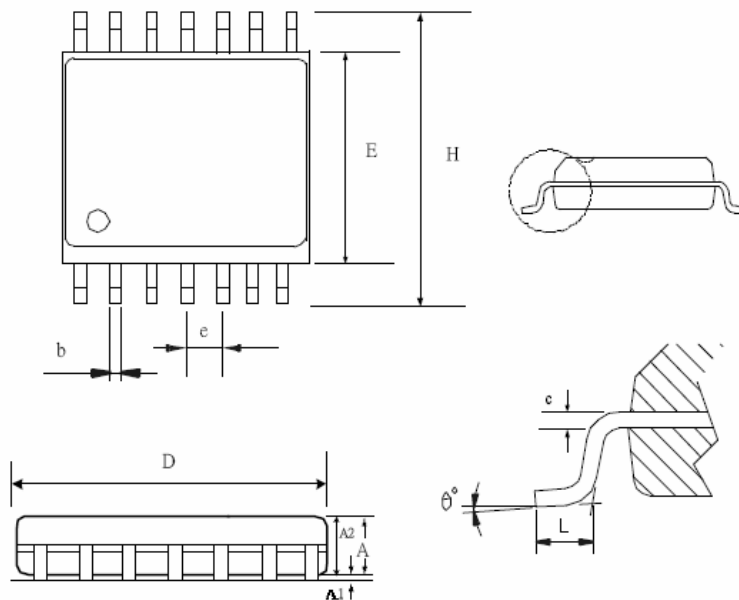
Symbol	Min	Normal	Max
A	1.350		1.750
A1	0.100		0.250
b	0.330		0.510
c	0.190		0.250
E	3.800		4.000
H	5.800		6.200
D	8.550		8.750
L	0.600		1.270
e	1.27(TYP)		
θ	0		8