

3/5-Key 3D PS/2 Optical Mouse Controller

Feature

- Operating voltage: 4.0V~5.5V
- Microsoft 3D Intelli mouse and IBM PS/2 mouse compatible
- Microsoft Windows 2000 and 5-button Wheel mouse compatible
- Z-axis can support two kinds of scroller input divided by 2 or 4 (package option)
- Supports 500 or 1000 DPI for ADNS-5020 (package option)
- Serial interface with ADNS-5020
- Auto detect as to which photo sensor is used
- 2MHz RC oscillator for system frequency with external pull-high resistor (140kΩ)
- Interface compliant with ADNS-5020
- 16-pin DIP package

General Description

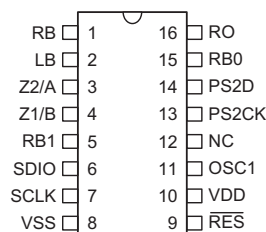
The HT82M35X are designed as 3/5-key 3D PS/2 optical mouse controller. These have serial interface to access the sensor ADNS-5020 or the same compatible

series sensor. Refer to the datasheets for detailed register descriptions of the sensors.

Selection Table

| Part No. | Interface | X/Y-axis Option | Z-axis Option | Package |
|---------------------|--|----------------------------|---------------|---------|
| HT82M35A/HT82M35A-1 | 3/5-key 3D PS/2 optical mouse controller (for Avago ADNS-5020) | Avago Sensor Opto 500 DPI | Divided by 2 | 16 DIP |
| HT82M35B/HT82M35B-1 | | Avago Sensor Opto 1000 DPI | Divided by 2 | |
| HT82M35C/HT82M35C-1 | | Avago Sensor Opto 500 DPI | Divided by 4 | |
| HT82M35D/HT82M35D-1 | | Avago Sensor Opto 1000 DPI | Divided by 4 | |

Pin Assignment



HT82M35A/HT82M35A-1
 HT82M35B/HT82M35B-1
 HT82M35C/HT82M35C-1
 HT82M35D/HT82M35D-1
 – 16 DIP-A

Pin Description

| Pin Name | I/O | Description |
|------------|-----|---|
| RB, RO, LB | I | Right Button: Normal pull-high resistor (30kΩ) Rolling Button: Normal pull-high resistor (30kΩ) Left Button: Normal pull-high resistor (30kΩ) |
| Z2/A, Z1/B | I | "Z" axis input supports three kinds of scroller input Normal pull-high resistor (30kΩ) |
| RB1, RB0 | I | Input ports with 30kΩ pull-high resistor |
| SDIO | I/O | Serial data for Agilent sensor IC SDIO |
| SCLK | O | Serial data for Agilent sensor IC SCLK |
| VSS | — | Negative power supply, ground |
| RES | I | Chip reset input, low active |
| VDD | — | 5V positive power supply |
| OSCI | I | 2MHz RC oscillator for system frequency with external pull-high resistor (140kΩ) |
| NC | — | No connection |
| PS2CK | I/O | PS/2 mouse CLK line |
| PS2D | I/O | PS/2 mouse data line |

Absolute Maximum Ratings

| | | | |
|----------------------|------------------------------------|----------------------------|----------------------------------|
| Supply Voltage | $V_{SS} - 0.3V$ to $V_{SS} + 6.0V$ | Storage Temperature | $-50^{\circ}C$ to $125^{\circ}C$ |
| Input Voltage | $V_{SS} - 0.3V$ to $V_{SS} + 6.0V$ | Operating Temperature..... | $-40^{\circ}C$ to $85^{\circ}C$ |

Note: These are stress ratings only. Stresses exceeding the range specified under "Absolute Maximum Ratings" may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

D.C. Characteristics

Ta=25°C

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|------------------|---|-----------------|-------------------------------------|--------------------|------|--------------------|------|
| | | V _{DD} | Conditions | | | | |
| V _{DD} | Operating Voltage | — | f _{SYS} =2MHz | 4.0 | 5.0 | 5.5 | V |
| I _{DD} | Operating Current | 5V | No load, f _{SYS} =2MHz | — | 2.5 | 4 | mA |
| V _{IL1} | Input Low Voltage for RB, LB, RO, Z1, Z2, RB1, RB0, SDIO, PS2CK and PS2D | — | — | 0 | — | 0.3V _{DD} | V |
| V _{IH1} | Input High Voltage for RB, LB, RO, Z1, Z2, RB1, RB0, SDIO, PS2CK and PS2D | — | — | 0.7V _{DD} | — | V _{DD} | V |
| V _{IL2} | Input Low Voltage for RES | — | — | 0 | — | 0.4V _{DD} | V |
| V _{IH2} | Input High Voltage for RES | — | — | 0.9V _{DD} | — | V _{DD} | V |
| I _{OL} | I/O Port Sink Current | 5V | V _{OL} =0.1V _{DD} | 10 | 20 | — | mA |
| I _{OH} | I/O Port Source Current | 5V | V _{OL} =0.9V _{DD} | -2 | -4 | — | mA |
| R _{PH} | Pull-high Resistance for RB, LB, RO, Z1, Z2, RB1, RB0, SDIO, PS2CK and PS2D | 5V | — | 10 | 30 | 50 | kΩ |

A.C. Characteristics

Ta=25°C

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|---------------------|--------------------------------|-----------------|-----------------------|------|------|------|------|
| | | V _{DD} | Conditions | | | | |
| t _{WDTOSC} | Watchdog Oscillator Period | 5V | — | 32 | 65 | 130 | μs |
| t _{WDT1} | Watchdog Time-out Period | 5V | Without WDT prescaler | 8 | 17 | 33 | ms |
| t _{RES} | External Reset Low Pulse Width | — | — | 1 | — | — | μs |

Functional Description

PS/2 Mouse

- PS/2 status byte

Byte 1

bit

7: Reserved

6: 0=Stream Mode, 1=Remote Mode

5: 0=Disabled, 1=Enabled

4: 0=Scaling 1:1, 1=Scaling 2:1

3: 1=Wrap Mode, 0=Stream or Remote
(different from IBM specs.)

2: 1=Left Button Pressed

1: 1=Middle Button Pressed

0: 1=Right Button Pressed

Byte 2

Bit 0~7 current resolution setting

(Bit 0=LSB)

Byte 3

Bit 0~7 current sampling rate (Bit 0=LSB)

- Standard PS/2 data format

Variable rps, 0, 8, 1, bidirectional, synchronous

| Bit No. | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|----------|----|----|----|----|----|----|----|----|
| 1st word | YV | XV | YS | XS | 1 | MB | RO | LB |
| 2nd word | X7 | X6 | X5 | X4 | X3 | X2 | X1 | X0 |
| 3rd word | Y7 | Y6 | Y5 | Y4 | Y3 | Y2 | Y1 | Y0 |

- Data format for 3D PS/2

Variable rps, 0, 8, 1, bidirectional, synchronous

| Bit No. | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|----------|----|----|----|----|----|----|----|----|
| 1st word | YV | XV | YS | XS | 1 | MB | RO | LB |
| 2nd word | X7 | X6 | X5 | X4 | X3 | X2 | X1 | X0 |
| 3rd word | Y7 | Y6 | Y5 | Y4 | Y3 | Y2 | Y1 | Y0 |
| 4th word | Z7 | Z6 | Z5 | Z4 | Z3 | Z2 | Z1 | Z0 |

The x/y data report is 9-bit 2's complement

The z data report is 8-bit 2's complement

- Data format for 5-button Wheel Mouse

| Bit No. | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|----------|----|----|-----|-----|----|----|----|----|
| 1st word | 0 | 0 | YS | XS | 1 | MB | RO | LB |
| 2nd word | X7 | X6 | X5 | X4 | X3 | X2 | X1 | X0 |
| 3rd word | Y7 | Y6 | Y5 | Y4 | Y3 | Y2 | Y1 | Y0 |
| 4th word | 0 | 0 | RB1 | RB0 | Z3 | Z2 | Z1 | Z0 |

X- movement towards the right is positive, moving towards the left is negative

Y- upward movement is positive, moving down is negative

Z- rolling towards the user is positive, else negative

Button status: 1=pressed, 0=released

- Mouse mode changes between Standard and 3D PS/2 mode

Sending the commands in the following sequence will set the mouse to 3D PS/2 mode.

Command Response From Mouse

| | |
|-----|----------|
| F3h | FAh |
| C8h | FAh |
| F3h | FAh |
| 64h | FAh |
| F3h | FAh |
| 50h | FAh |
| F2h | FAh, 03h |

- Mouse mode changes between Standard and Win2K PS/2 mode.

Sending the commands in the following sequence will set the mouse to Win2K PS/2 mode.

Command Response From Mouse

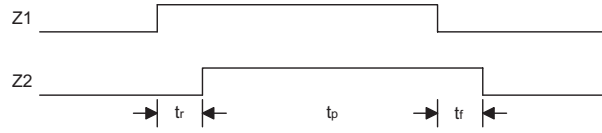
| | |
|-----|----------|
| F3h | FAh |
| C8h | FAh |
| F3h | FAh |
| C8h | FAh |
| F3h | FAh |
| 50h | FAh |
| F2h | FAh, 04h |

- Any time the PC sends a reset "FFh" command to the mouse, it will reset the mouse to Standard PS/2 mode.

- After power-on reset is initiated, the mouse is set to Standard PS/2 mode.

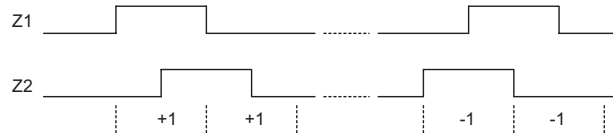
Timing Diagrams

Z-Axis Photo-coupler Cross Width



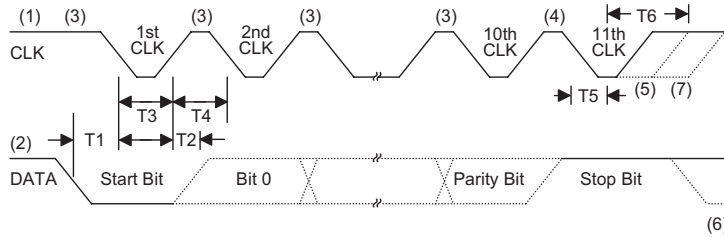
Note: For Z-axis $t_r, t_p, t_f > 1ms$

Z-Axis Counting



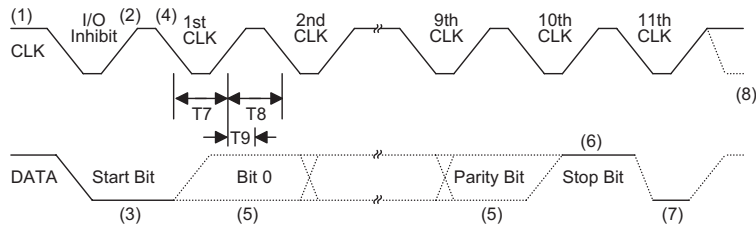
PS/2 Mouse

- Data output



| Timing Parameter | Min./Max. |
|--|------------------|
| T1 DATA transition to the falling edge of CLK | 5/25 μ sec |
| T2 Rising edge of CLK to DATA transition | 5/T4-5 μ sec |
| T3 Inactive CLK Duration | 30/50 μ sec |
| T4 Active CLK Duration | 30/50 μ sec |
| T5 Minimum time to inhibit MOUSE after clock 11 | >0 μ sec |
| T6 Maximum time to inhibit MOUSE after clock 11 to ensure that the MOUSE does not start another transmission | <50 μ sec |

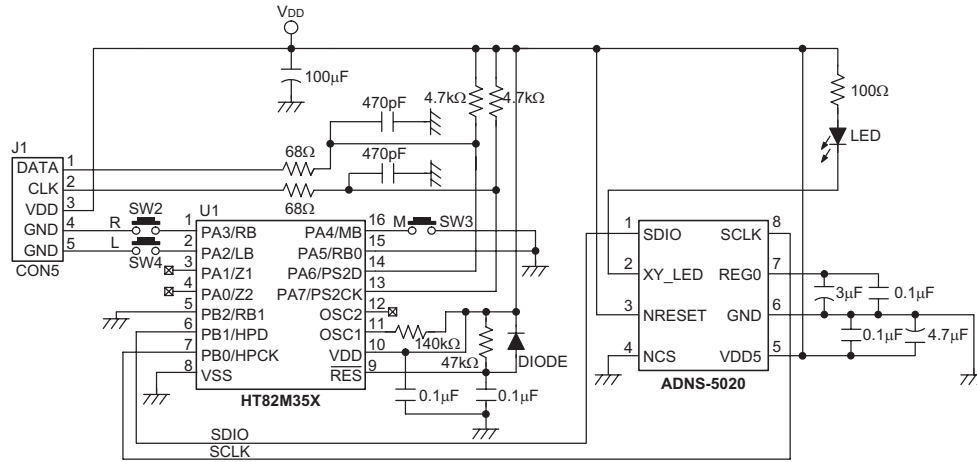
- Data input



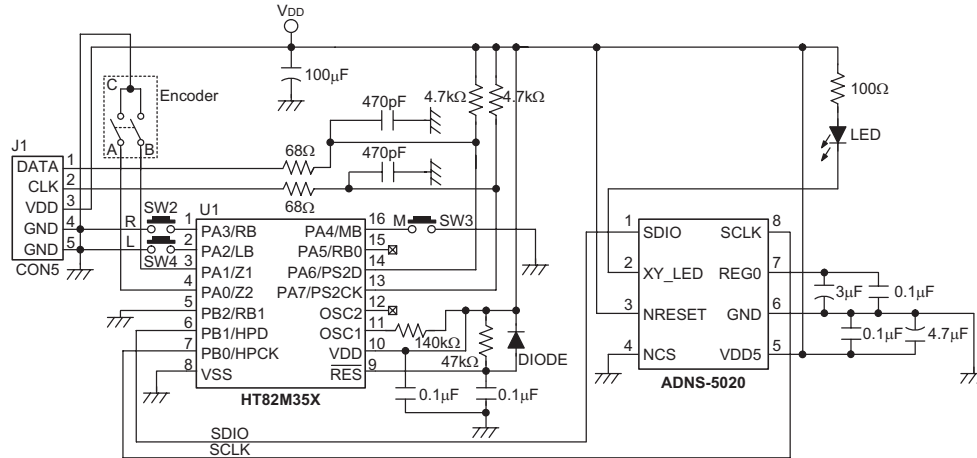
| Timing Parameter | Min./Max. |
|--|-----------------|
| T7 CLK Duration, low | 30/50 μ sec |
| T8 CLK Duration, high | 30/50 μ sec |
| T9 Time from low to high CLK transition to time when MOUSE samples DATA line | 5/25 μ sec |

Application Circuits

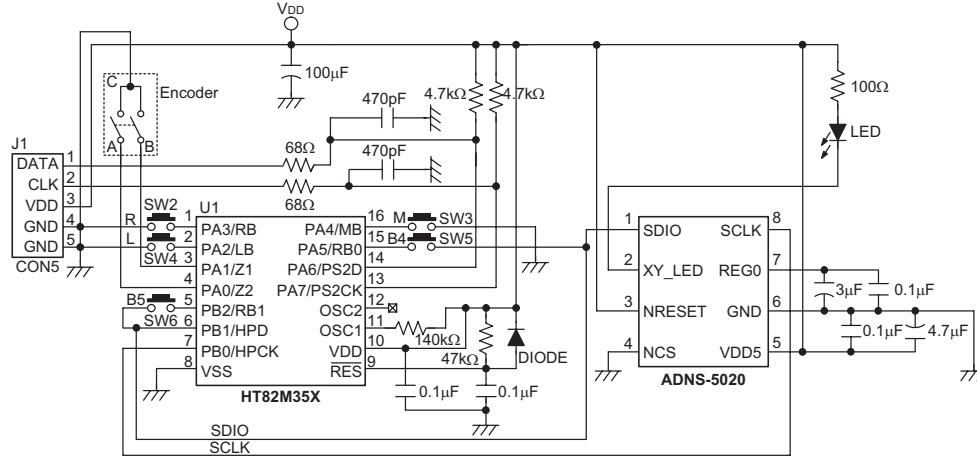
2D PS/2 Optical Mouse for ADNS-5020



3D PS/2 Optical Mouse for ADNS-5020

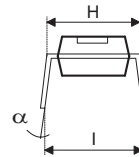
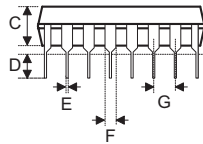
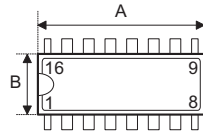


Win2K PS/2 Optical Mouse for ADNS-5020



Package Information

16-pin DIP (300mil) Outline Dimensions



| Symbol | Dimensions in mil | | |
|----------|-------------------|------|------|
| | Min. | Nom. | Max. |
| A | 745 | — | 775 |
| B | 240 | — | 260 |
| C | 125 | — | 135 |
| D | 125 | — | 145 |
| E | 16 | — | 20 |
| F | 50 | — | 70 |
| G | — | 100 | — |
| H | 295 | — | 315 |
| I | 335 | — | 375 |
| α | 0° | — | 15° |

Holtek Semiconductor Inc. (Headquarters)

No.3, Creation Rd. II, Science Park, Hsinchu, Taiwan
Tel: 886-3-563-1999
Fax: 886-3-563-1189
<http://www.holtek.com.tw>

Holtek Semiconductor Inc. (Taipei Sales Office)

4F-2, No. 3-2, YuanQu St., Nankang Software Park, Taipei 115, Taiwan
Tel: 886-2-2655-7070
Fax: 886-2-2655-7373
Fax: 886-2-2655-7383 (International sales hotline)

Holtek Semiconductor Inc. (Shanghai Sales Office)

7th Floor, Building 2, No.889, Yi Shan Rd., Shanghai, China 200233
Tel: 86-21-6485-5560
Fax: 86-21-6485-0313
<http://www.holtek.com.cn>

Holtek Semiconductor Inc. (Shenzhen Sales Office)

5/F, Unit A, Productivity Building, Cross of Science M 3rd Road and Gaoxin M 2nd Road, Science Park, Nanshan District, Shenzhen, China 518057
Tel: 86-755-8616-9908, 86-755-8616-9308
Fax: 86-755-8616-9722

Holtek Semiconductor Inc. (Beijing Sales Office)

Suite 1721, Jinyu Tower, A129 West Xuan Wu Men Street, Xicheng District, Beijing, China 100031
Tel: 86-10-6641-0030, 86-10-6641-7751, 86-10-6641-7752
Fax: 86-10-6641-0125

Holtek Semiconductor Inc. (Chengdu Sales Office)

709, Building 3, Champagne Plaza, No.97 Dongda Street, Chengdu, Sichuan, China 610016
Tel: 86-28-6653-6590
Fax: 86-28-6653-6591

Holtek Semiconductor (USA), Inc. (North America Sales Office)

46729 Fremont Blvd., Fremont, CA 94538
Tel: 1-510-252-9880
Fax: 1-510-252-9885
<http://www.holtek.com>

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