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 (121kΩ)
- Interface compliant with ADNS-5020
- 16-pin DIP package

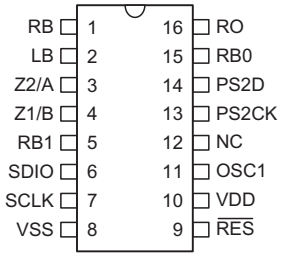
General Description

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
$\overline{RES}$	I	Chip reset input, low active
VDD	—	5V positive power supply
OSCI	I	2MHz RC oscillator for system frequency with external pull-high resistor (121kΩ)
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

Input Voltage ..... V_{SS}–0.3V to V_{SS}+6.0V

Storage Temperature ..... –50°C to 125°C

Operating Temperature ..... –40°C to 85°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 $\overline{RES}$	—	—	0	—	$0.4V_{DD}$	V
V_{IH2}	Input High Voltage for $\overline{RES}$	—	—	$0.9V_{DD}$	—	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

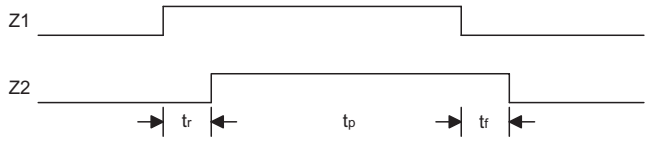
- Mouse mode changes between Standard and Win2K PS/2 mode.
  Sending the commands in the following sequence will set the mouse to Win2K PS/2 mode.

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.

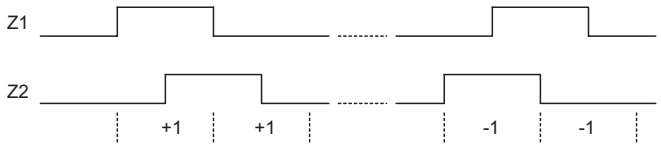
Timing Diagrams

Z-Axis Photo-coupler Cross Width



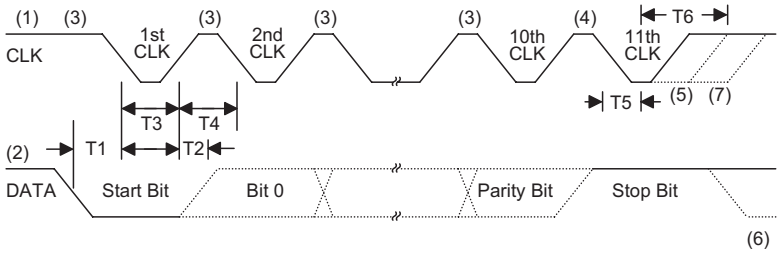
Note: For Z-axis tr, tp, tf > 1ms

Z-Axis Counting



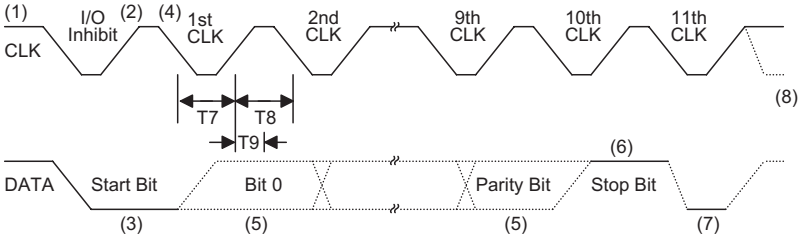
PS/2 Mouse

- Data output



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

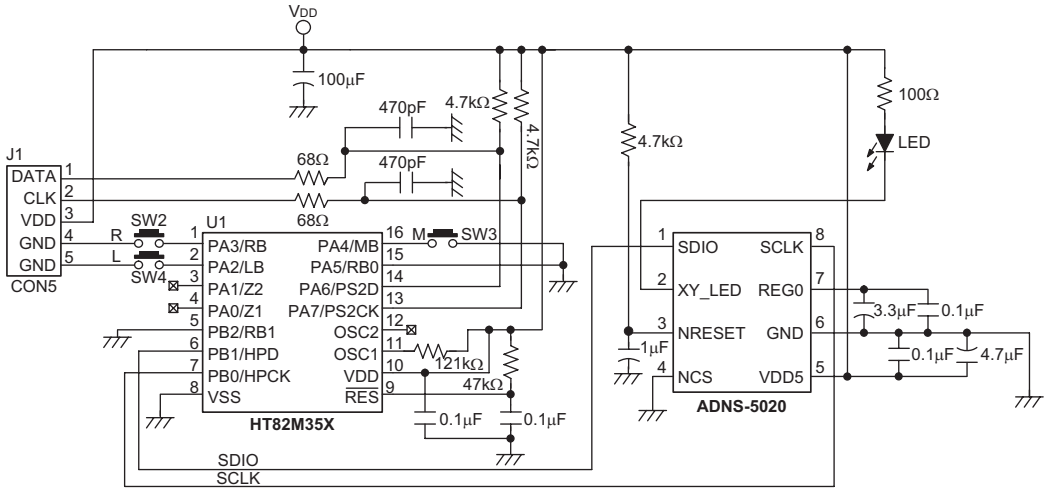
- Data input



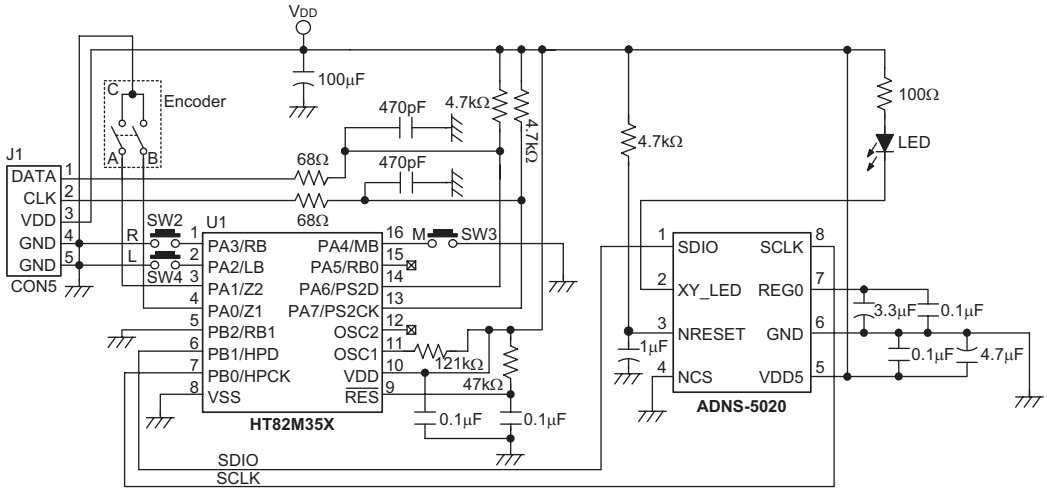
	Timing Parameter	Min./Max.
T7	CLK Duration, low	30/50 μsec
T8	CLK Duration, high	30/50 μsec
T9	Time from low to high CLK transition to time when MOUSE samples DATA line	5/25 μsec

Application Circuits

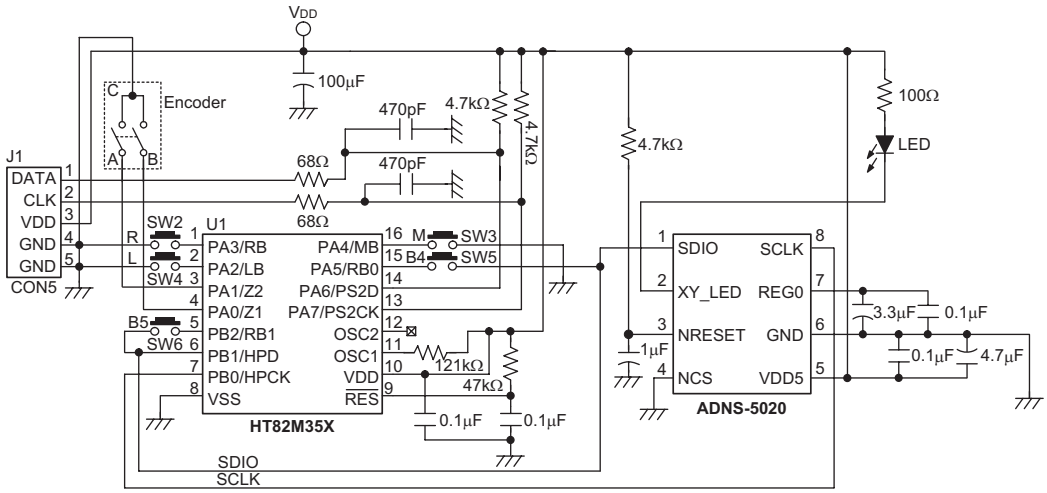
2D PS/2 Optical Mouse for ADNS-5020



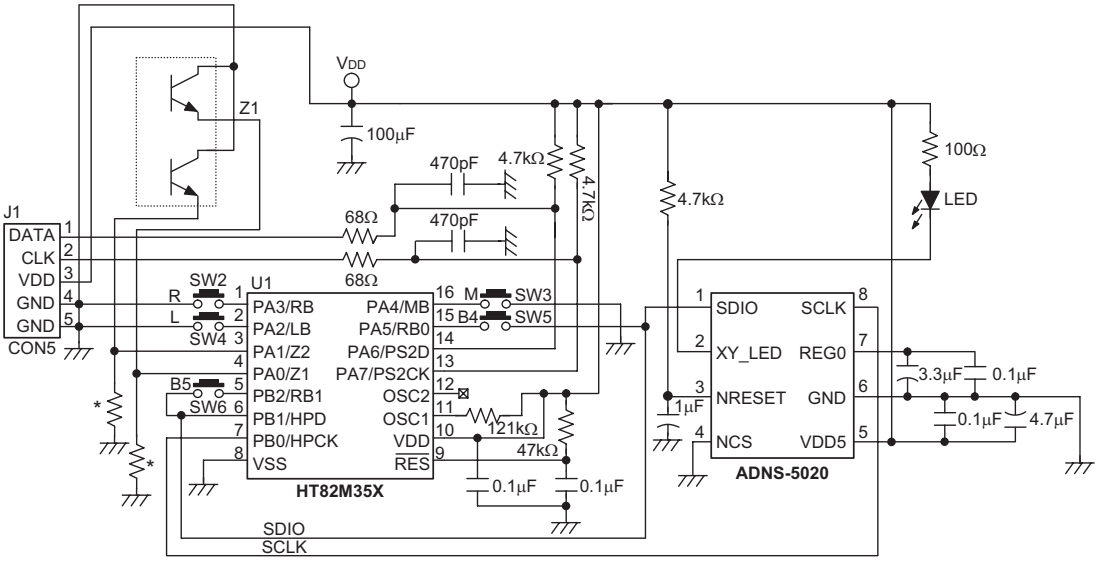
3D PS/2 Optical Mouse for ADNS-5020



Win2K PS/2 Optical Mouse for ADNS-5020



HT82M35X Z-Axis Optomechanical (This Application Circuit is for Reference Only)



Note: * For resistor value selection, refer to high or low input level of Z1 and Z2 in the D.C. Characteristics table. The recommended value is 6kΩ.

Package Information

16-pin DIP (300mil) Outline Dimensions

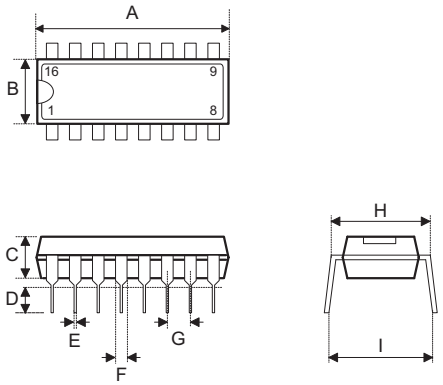


Fig1. Full Lead Packages

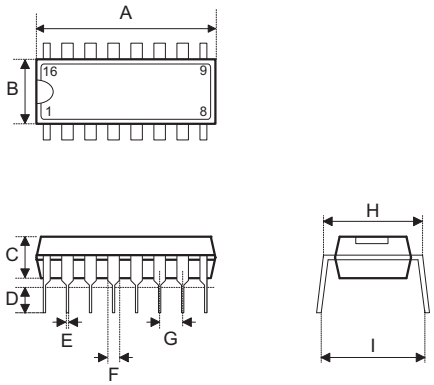


Fig2. 1/2 Lead Packages

• MS-001d (see fig1)

Symbol	Dimensions in mil		
	Min.	Nom.	Max.
A	780	—	880
B	240	—	280
C	115	—	195
D	115	—	150
E	14	—	22
F	45	—	70
G	—	100	—
H	300	—	325
I	—	—	430

• MS-001d (see fig2)

Symbol	Dimensions in mil		
	Min.	Nom.	Max.
A	735	—	775
B	240	—	280
C	115	—	195
D	115	—	150
E	14	—	22
F	45	—	70
G	—	100	—
H	300	—	325
I	—	—	430

- MO-095a (see fig2)

Symbol	Dimensions in mil		
	Min.	Nom.	Max.
A	745	—	785
B	275	—	295
C	120	—	150
D	110	—	150
E	14	—	22
F	45	—	60
G	—	100	—
H	300	—	325
I	—	—	430

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