

### Features

- Operating voltage: 4.4V~5.25V
- Compatible with Microsoft Windows 2000 and 5-button Wheel Mouse
- Supports 5/7 buttons and Z-axis input
- Z-axis can support only encoder Z/2 scroller input
- Complete Universal Serial Bus specs V2.0 compatibility
- Vista tilt mouse protocol supported
- 3 key or 5 key mode can be selected by circuit
- DPI can be selected high or low by circuit
- Tilt or Non-tilt protocol can be selected by circuit
- Serial Bus Interface Engine (SIE)
- USB transceiver
- Single chip solution especially for USB mouse function
- HALT function and wake-up feature reduce power consumption
- Plug and Play functions
- Minimal external components
- 6MHz crystal oscillator for system clock
- Interface compliant with A2610, A2620, A5020, and P3101
- Pass USB-IF and EMC testing
- 20-pin DIP/SOP package

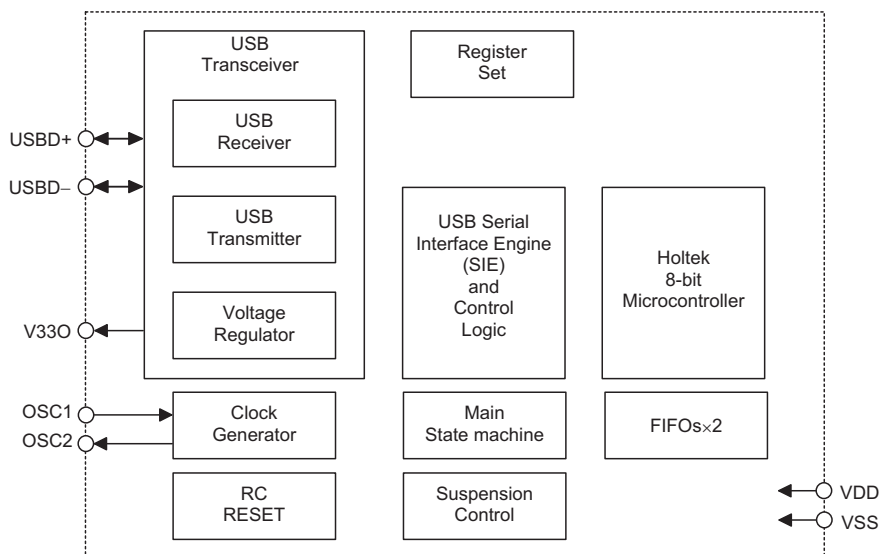
### General Description

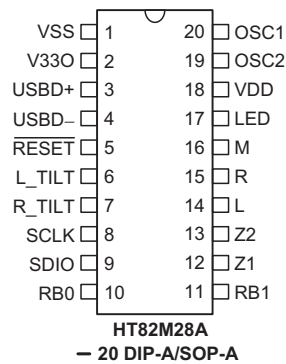
HT82M28A is a Plug and Play 3D USB Mouse controller. The HT82M28A can support the USB Standard Request as well as HID Class Request version 1.1. The Z-axis can support only Z/2 encoder scroller input. It requires minimal external components to implement 3D and Windows Vista 7 key USB mouse. All its features combined

and make up this versatile Holtek 8-bit MCU with an on-chip USB interface logic. The USB is specified by the Universal Serial Bus Specification V2.0.

The USB product ID of 5 key mode is 2083H, and the USB product ID of 3 key mode is 2082H.

### Block Diagram



**Pin Assignment**

**Pin Description**

Pin Name	I/O	Description
VSS	—	Negative power supply, ground
V33O	O	3.3V voltage output
USB D+	I/O	USB data plus, F/W auto-detect USB D+ for USB.
USB D-	I/O	USB data minus, F/W auto-detect USB- for USB.
RESET	I	Chip reset input, low active
SDIO	I/O	Serial data for optical sensor IC SDIO
SCLK	O	Serial data for optical sensor IC SCLK
	I	DPI selection, N/C or GND(connect to a 5.1kΩ pull-down resistor) For A2610, A2620: N/C-800dpi; GND-400dpi For A5020: N/C-1000dpi; GND-500dpi For P3101: N/C-800dpi; GND-1600dpi
RB0, RB1, L, R, M, L_TILT, R_TILT	I	Click button detection. Input ports with 30kΩ pull-high resistor. Input ports with pull-high resistor. These pads can function as Left, Right, Middle, RB0, RB1, L_TILT and R_TILT button input lines.
Z1, Z2	I	Z-axis input supports only Z/2 encoder scroller input.
LED	I/O	Drives LED output
VDD	—	5V positive power supply
OSC2	O	6MHz OSC output
OSC1	I	6MHz OSC input

**Absolute Maximum Ratings**

Supply Voltage .....	$V_{SS}-0.3V$ to $V_{SS}+6V$	Storage Temperature .....	$-50^{\circ}C$ to $125^{\circ}C$
MCU Input Voltage.....	$V_{SS}-0.3V$ to $V_{DD}+0.3V$	Operating Temperature.....	$-25^{\circ}C$ to $70^{\circ}C$
USB Input Voltage .....	$V_{SS}-0.3V$ to $V_{33O}+0.3V$		

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**

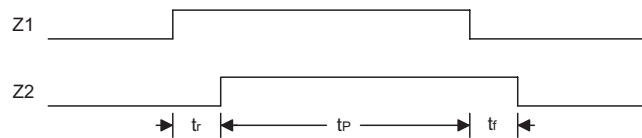
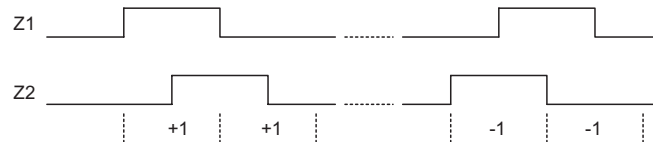
Ta=25°C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V <sub>DD</sub>	Conditions				
V <sub>DD</sub>	Operating Voltage	—	—	4.4	—	5.25	V
I <sub>DD</sub>	Operating Current (Crystal OSC)	5V	No load, f <sub>SYS</sub> =6MHz USB mode	—	10	—	mA
I <sub>SUS</sub>	USB Suspend Mode	5V	No load, system HALT	—	—	250	μA
V <sub>IL1</sub>	Input Low Voltage (Z1, Z2, L, M, R, L_TILT, R_TILT)	5V	—	0	—	1.0	V
V <sub>IH1</sub>	Input High Voltage (Z1, Z2, L, M, R, L_TILT, R_TILT)	5V	—	3.5	—	5	V
V <sub>IL2</sub>	Input Low Voltage ( $\overline{\text{RESET}}$ )	5V	—	0	—	1.5	V
V <sub>IH2</sub>	Input High Voltage ( $\overline{\text{RESET}}$ )	5V	—	3.5	—	5	V
V <sub>POR</sub>	Built-in Power on Reset V <sub>DD</sub> Detection Voltage	5V	—	—	3.7	—	V
I <sub>OL</sub>	Sink Current (LED)	5V	V <sub>OL</sub> =0.8V	—	50	—	mA

**A.C. Characteristics**

Ta=25°C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V <sub>DD</sub>	Conditions				
f <sub>SYS</sub>	System Clock (Crystal OSC)	5V	—	0	6000	—	kHz

 Note:  $t_{\text{SYS}}=1/f_{\text{SYS}}$ 
**Timing Diagram**
**Z-axis Photo-Coupler Crossed Width**

 Note: For Z-axis  $t_r, t_p, t_f > 1\text{ms}$ 
**Z-axis Counting**


### Functional Description

- USB mouse data format for 3D mod

Bit No.	7	6	5	4	3	2	1	0
1st word	0	0	0	0	0	M	R	L
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

- USB mouse data format for 3D with Vista tilt mode

Bit No.	7	6	5	4	3	2	1	0
1st word	0	0	0	0	0	M	R	L
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
5th word	H7	H6	H5	H4	H3	H2	H1	H0

- USB mouse data format for Windows 2000 mode

Bit No.	7	6	5	4	3	2	1	0
1st word	0	0	0	RB1	RB0	M	R	L
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

- USB mouse data format for Windows 2000 with Vista tilt mode

Bit No.	7	6	5	4	3	2	1	0
1st word	0	0	0	RB1	RB0	M	R	L
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
5th word	H7	H6	H5	H4	H3	H2	H1	H0

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

Y- upward movement is negative, moving down is positive

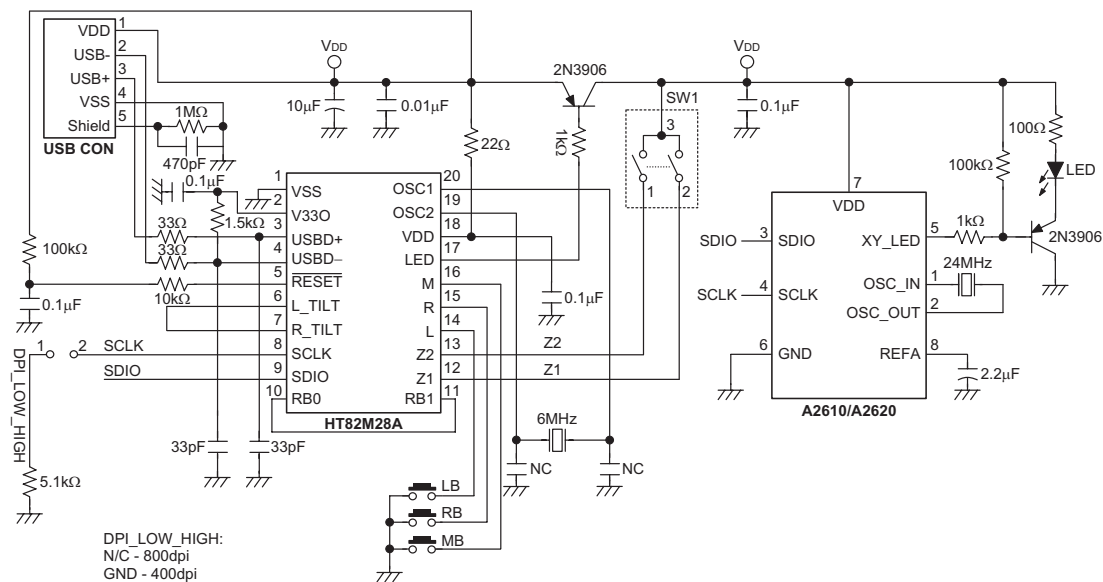
Z- rolling towards the user is negative, otherwise positive

H-scrolling towards left is negative, otherwise positive

Button status: 1=pressed, 0=released

### Application Circuits

#### 3Key non-tilt with A2610/A2620

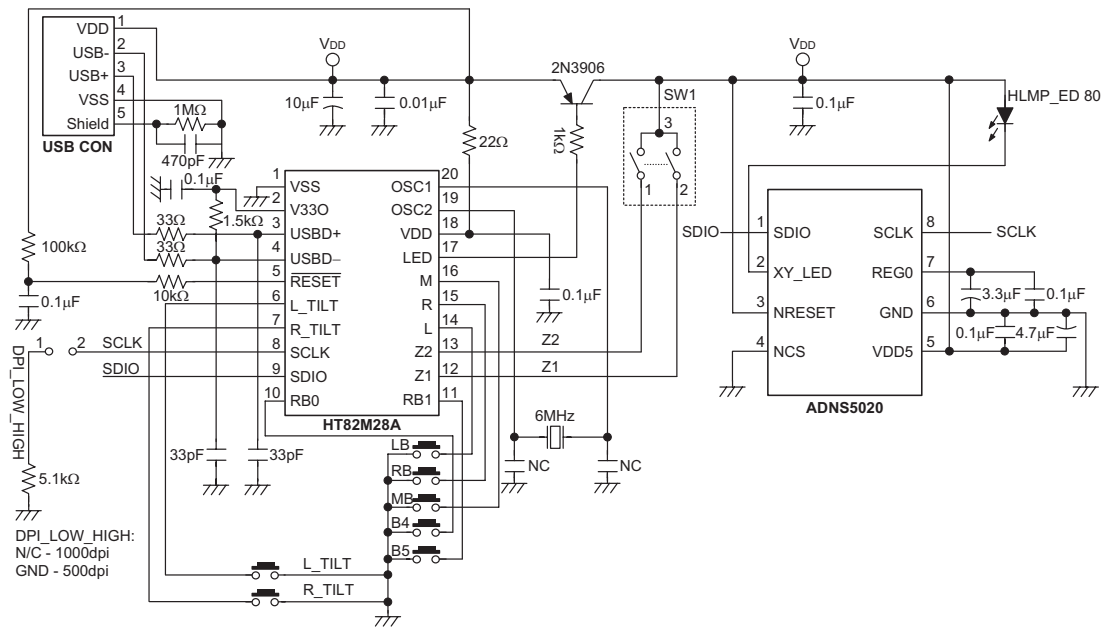




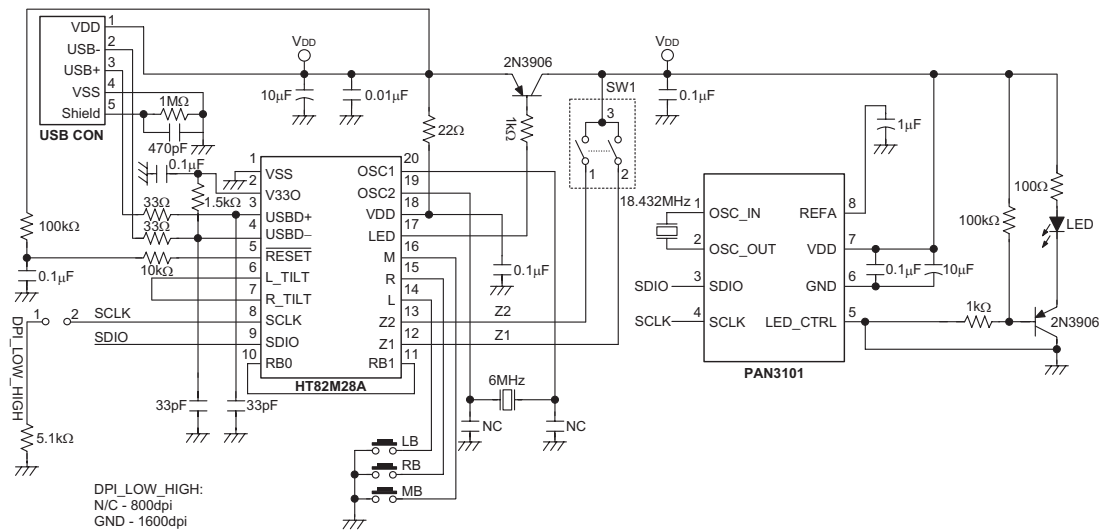




**5Key tilt with A5020**



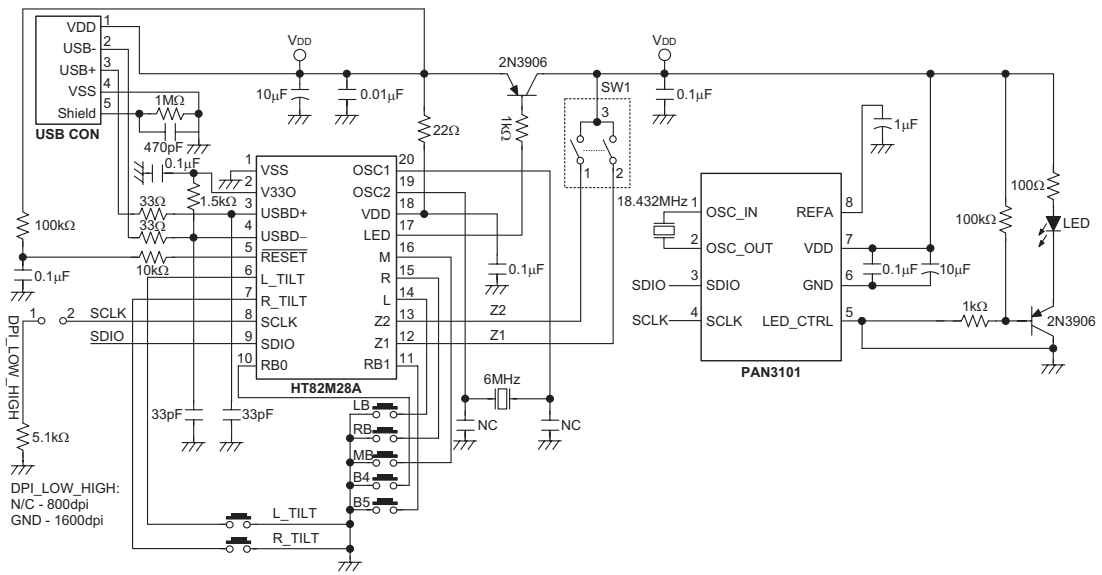
**3Key non-tilt with P3101**





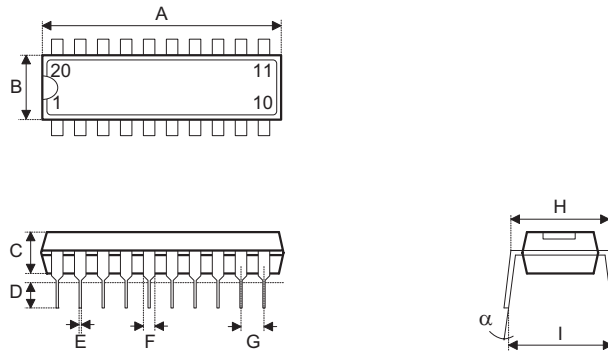


5Key tilt with P3101



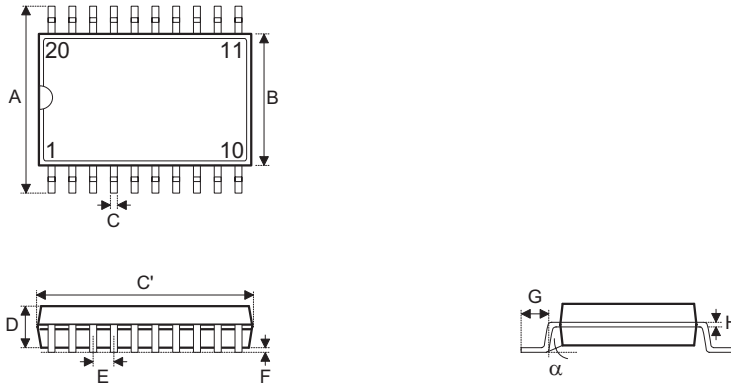
**Package Information**

**20-pin DIP (300mil) Outline Dimensions**



Symbol	Dimensions in mil		
	Min.	Nom.	Max.
A	1020	—	1045
B	240	—	260
C	125	—	135
D	125	—	145
E	16	—	20
F	50	—	70
G	—	100	—
H	295	—	315
I	335	—	375
$\alpha$	0°	—	15°

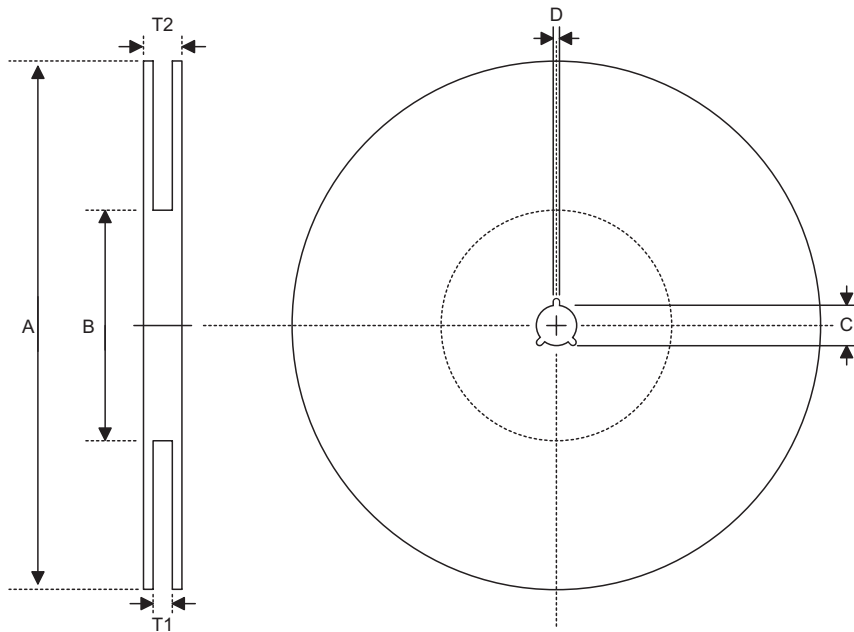
20-pin SOP (300mil) Outline Dimensions



Symbol	Dimensions in mil		
	Min.	Nom.	Max.
A	394	—	419
B	290	—	300
C	14	—	20
C'	490	—	510
D	92	—	104
E	—	50	—
F	4	—	—
G	32	—	38
H	4	—	12
$\alpha$	0°	—	10°

**Product Tape and Reel Specifications**

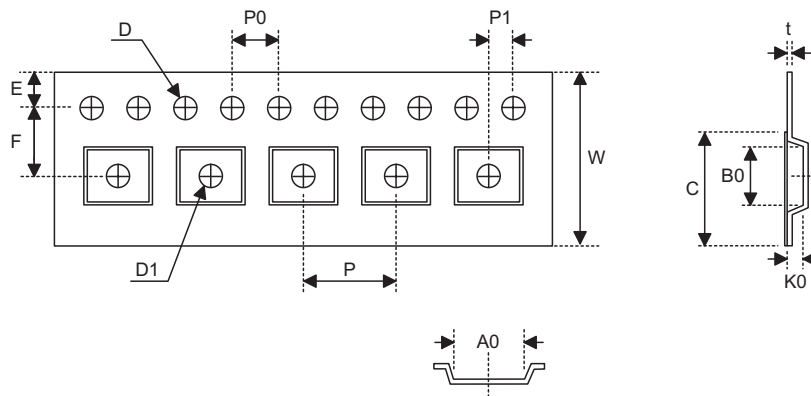
**Reel Dimensions**



SOP 20W

Symbol	Description	Dimensions in mm
A	Reel Outer Diameter	330±1.0
B	Reel Inner Diameter	62±1.5
C	Spindle Hole Diameter	13.0+0.5 -0.2
D	Key Slit Width	2.0±0.5
T1	Space Between Flange	24.8+0.3 -0.2
T2	Reel Thickness	30.2±0.2

Carrier Tape Dimensions



SOP 20W

Symbol	Description	Dimensions in mm
W	Carrier Tape Width	24.0+0.3 -0.1
P	Cavity Pitch	12.0±0.1
E	Perforation Position	1.75±0.1
F	Cavity to Perforation (Width Direction)	11.5±0.1
D	Perforation Diameter	1.5+0.1
D1	Cavity Hole Diameter	1.5+0.25
P0	Perforation Pitch	4.0±0.1
P1	Cavity to Perforation (Length Direction)	2.0±0.1
A0	Cavity Length	10.8±0.1
B0	Cavity Width	13.3±0.1
K0	Cavity Depth	3.2±0.1
t	Carrier Tape Thickness	0.3±0.05
C	Cover Tape Width	21.3

**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>

Copyright © 2007 by HOLTEK SEMICONDUCTOR INC.

The information appearing in this Data Sheet is believed to be accurate at the time of publication. However, Holtek assumes no responsibility arising from the use of the specifications described. The applications mentioned herein are used solely for the purpose of illustration and Holtek makes no warranty or representation that such applications will be suitable without further modification, nor recommends the use of its products for application that may present a risk to human life due to malfunction or otherwise. Holtek's products are not authorized for use as critical components in life support devices or systems. Holtek reserves the right to alter its products without prior notification. For the most up-to-date information, please visit our web site at <http://www.holtek.com.tw>.