

### Features

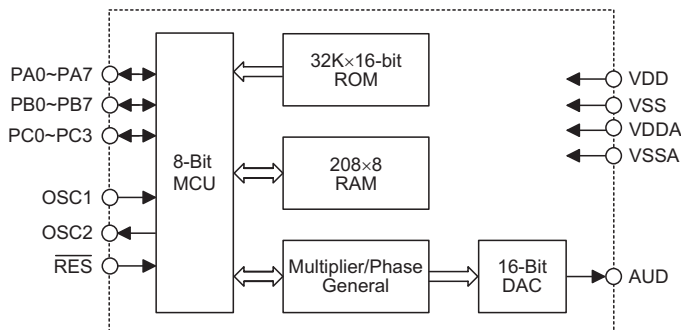
- Operating voltage: 2.4V~5.0V
- Operating frequency: 3.58MHz~12MHz (typ. 8MHz)
- 20 bidirectional I/O lines
- Two 8-bit programmable timer with 8 stage prescaler
- Watchdog Timer
- Built-in 8-bit MCU with 208×8 bits RAM
- Built-in 32K×16-bit ROM for program/data shared
- Mono output
- High D/A converter resolution: 16 bits
- Polyphonic up to 8 notes
- Independent pan and volume mix can be assigned to each sound component
- Sampling rate of 25kHz as 6.4MHz for system frequency
- Eight-level subroutine nesting
- HALT function and wake-up feature to reduce power consumption
- Bit manipulation instructions
- 16-bit table read instructions
- 63 powerful instructions
- All instructions in 1 or 2 machine cycles
- 28-pin SOP, 48-pin SSOP package

### General Description

The HT36A3 is an 8-bit high performance RISC-like microcontroller specifically designed for music applications. It provides an 8-bit MCU and a 8 channel wavetable synthesizer. The program ROM is composed of both program control codes and wavetable voice codes, and can be easily programmed.

The HT36A3 has a built-in 8-bit microprocessor which programs the synthesizer to generate the melody by setting the special register from 20H~2AH. A HALT feature is provided to reduce power consumption.

### Block Diagram



## Pin Assignment

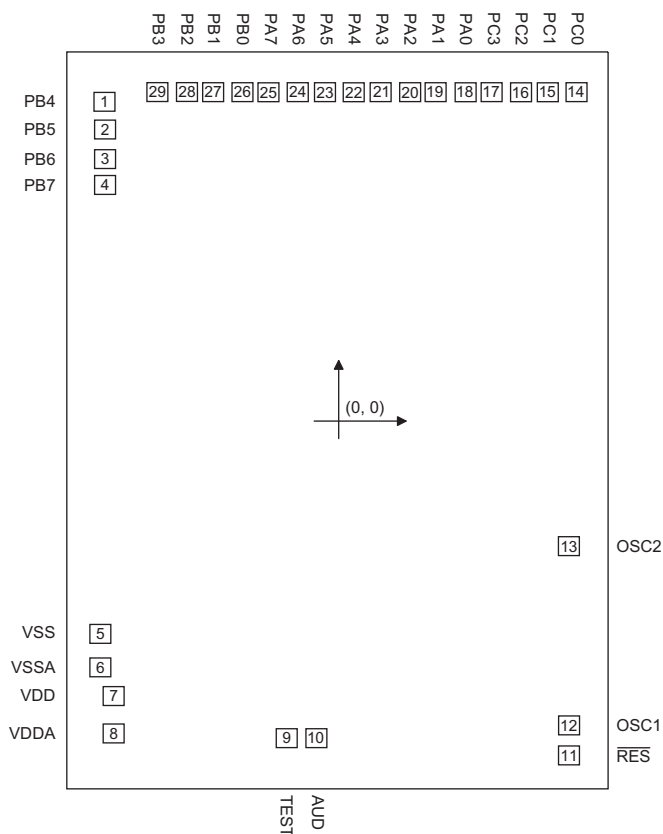
|      |    |    |      |
|------|----|----|------|
| PA4  | 1  | 28 | PA3  |
| PA5  | 2  | 27 | PA2  |
| PA6  | 3  | 26 | PA1  |
| PA7  | 4  | 25 | PA0  |
| NC   | 5  | 24 | NC   |
| NC   | 6  | 23 | NC   |
| NC   | 7  | 22 | OSC2 |
| VSS  | 8  | 21 | NC   |
| VSSA | 9  | 20 | OSC1 |
| VDD  | 10 | 19 | NC   |
| VDDA | 11 | 18 | RES  |
| NC   | 12 | 17 | NC   |
| TEST | 13 | 16 | NC   |
| AUD  | 14 | 15 | NC   |

**HT36A3**  
– 28 SOP-A

|      |    |    |      |
|------|----|----|------|
| PA4  | 1  | 48 | PA3  |
| PA5  | 2  | 47 | PA2  |
| PA6  | 3  | 46 | PA1  |
| PA7  | 4  | 45 | PA0  |
| PB0  | 5  | 44 | PC3  |
| PB1  | 6  | 43 | PC2  |
| PB2  | 7  | 42 | PC1  |
| PB3  | 8  | 41 | PC0  |
| PB4  | 9  | 40 | NC   |
| PB5  | 10 | 39 | NC   |
| PB6  | 11 | 38 | NC   |
| PB7  | 12 | 37 | NC   |
| NC   | 13 | 36 | NC   |
| NC   | 14 | 35 | NC   |
| VSS  | 15 | 34 | OSC2 |
| VSSA | 16 | 33 | OSC1 |
| VDD  | 17 | 32 | NC   |
| VDDA | 18 | 31 | NC   |
| NC   | 19 | 30 | RES  |
| NC   | 20 | 29 | NC   |
| NC   | 21 | 28 | NC   |
| NC   | 22 | 27 | NC   |
| NC   | 23 | 26 | AUD  |
| NC   | 24 | 25 | TEST |

**HT36A3**  
– 48 SSOP-A

## Pad Assignment



Chip size:  $83 \times 111 \text{ (mil)}^2$

\* The IC substrate should be connected to VSS in the PCB layout artwork.

**Pad Coordinates**

| Pad No. | X        | Y         | Pad No. | X        | Y        |
|---------|----------|-----------|---------|----------|----------|
| 1       | -879.100 | 1202.400  | 16      | 693.900  | 1240.150 |
| 2       | -879.100 | 1097.100  | 17      | 583.300  | 1240.150 |
| 3       | -879.100 | 986.500   | 18      | 483.300  | 1240.150 |
| 4       | -879.100 | 886.500   | 19      | 372.700  | 1240.150 |
| 5       | -898.600 | -805.050  | 20      | 272.700  | 1240.150 |
| 6       | -898.600 | -931.910  | 21      | 162.100  | 1240.150 |
| 7       | -847.650 | -1041.910 | 22      | 62.100   | 1240.150 |
| 8       | -847.650 | -1180.350 | 23      | -48.500  | 1240.150 |
| 9       | -193.090 | -1200.600 | 24      | -148.500 | 1240.150 |
| 10      | -81.290  | -1200.600 | 25      | -259.100 | 1240.150 |
| 11      | 875.950  | -1262.274 | 26      | -359.100 | 1240.150 |
| 12      | 875.950  | -1149.626 | 27      | -469.700 | 1240.150 |
| 13      | 875.950  | -471.774  | 28      | -569.700 | 1240.150 |
| 14      | 901.500  | 1240.150  | 29      | -680.300 | 1240.150 |
| 15      | 793.900  | 1240.150  |         |          |          |

**Pad Description**

| Pad Name     | I/O    | Internal Connection | Function                                                                                                                                                                                                                                                              |
|--------------|--------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PA0~PA7      | I/O    | Pull-High or None   | Bidirectional 8-bit Input/Output port                                                                                                                                                                                                                                 |
| PB0~PB7      | I/O    | Pull-High or None   | Bidirectional 8-bit Input/Output port                                                                                                                                                                                                                                 |
| PC0~PC3      | I/O    | Pull-High or None   | Bidirectional 8-bit Input/Output port                                                                                                                                                                                                                                 |
| VSS          | —      | —                   | Negative power supply, ground                                                                                                                                                                                                                                         |
| VSSA         | —      | —                   | Negative power supply of DAC, ground                                                                                                                                                                                                                                  |
| VDD          | —      | —                   | Digital power supply                                                                                                                                                                                                                                                  |
| VDDA         | —      | —                   | DAC power supply                                                                                                                                                                                                                                                      |
| AUD          | O      | —                   | Audio output                                                                                                                                                                                                                                                          |
| TEST         | —      | —                   | No connection (open)                                                                                                                                                                                                                                                  |
| RES          | I      | —                   | Reset input, active low (no pull-high)                                                                                                                                                                                                                                |
| OSC1<br>OSC2 | I<br>O | —                   | OSC1 and OSC2 are connected to an RC network or a crystal (by mask option) for the internal system clock. In the case of RC operation, OSC2 is the output terminal for 1/8 system clock. The system clock may come from the crystal, the two pins cannot be floating. |

## Absolute Maximum Ratings

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

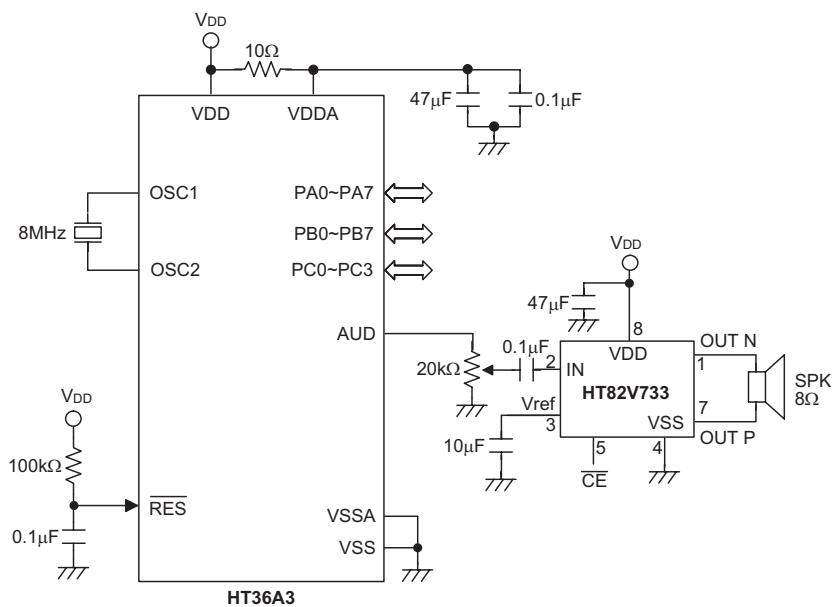
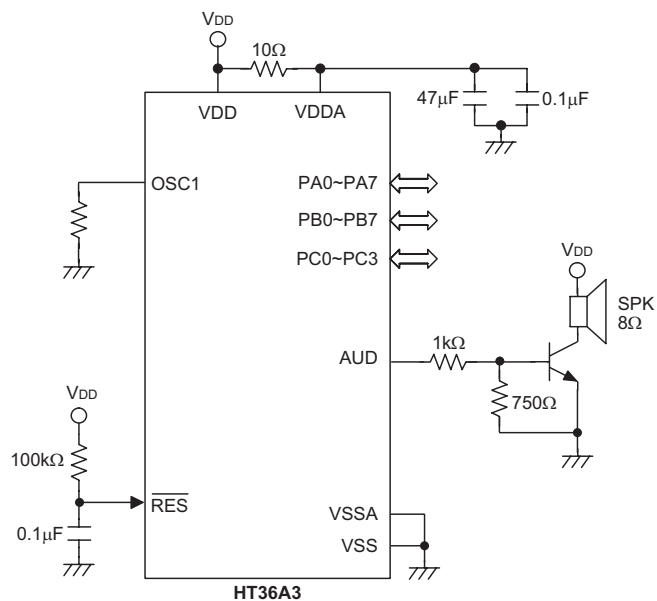
Note: These are stress ratings only. Stresses exceeding the range specified under "Absolute Maximum Ratings" may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions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

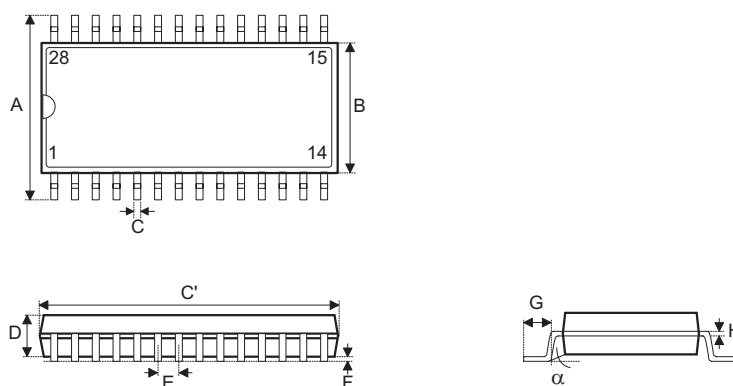
## D.C. Characteristics

 $T_a=25^{\circ}C$ 

| Symbol    | Parameter                        | Test Conditions |                         | Min.        | Typ. | Max.        | Unit    |
|-----------|----------------------------------|-----------------|-------------------------|-------------|------|-------------|---------|
|           |                                  | $V_{DD}$        | Conditions              |             |      |             |         |
| $V_{DD}$  | Operating Voltage                | —               | —                       | 2.2         | 4.5  | 5.5         | V       |
| $I_{DD}$  | Operating Current                | 4.5V            | No load, $f_{OSC}=8MHz$ | —           | 8    | 16          | mA      |
| $I_{STB}$ | Standby Current (WDT Disabled)   | 4.5V            | No load, System HALT    | —           | 1    | 3           | $\mu A$ |
| $I_{OH}$  | I/O Ports Source Current         | 4.5V            | $V_{OH}=4.5V$           | 2           | 3    | —           | mA      |
| $I_{OL}$  | I/O Ports Sink Current           | 4.5V            | $V_{OL}=0.5V$           | 2           | 3    | —           | mA      |
| $V_{IH}$  | Input High Voltage for I/O Ports | 4.5V            | —                       | $0.8V_{DD}$ | —    | $V_{DD}$    | V       |
| $V_{IL}$  | Input Low Voltage for I/O Ports  | 4.5V            | —                       | 0           | —    | $0.2V_{DD}$ | V       |

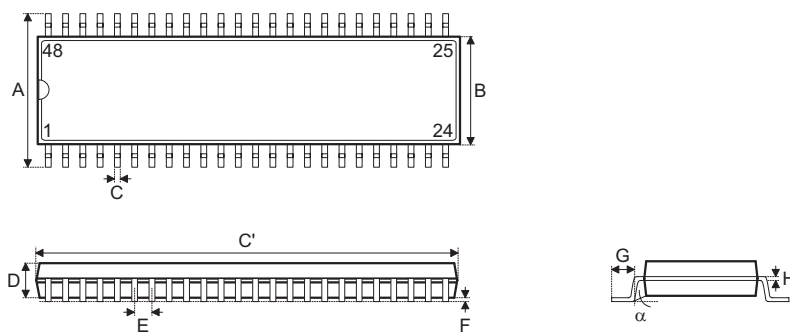
# Application Circuit



**Package Information**
**28-pin SOP (300mil) Outline Dimensions**


| Symbol   | Dimensions in mil |      |      |
|----------|-------------------|------|------|
|          | Min.              | Nom. | Max. |
| A        | 394               | —    | 419  |
| B        | 290               | —    | 300  |
| C        | 14                | —    | 20   |
| C'       | 697               | —    | 713  |
| D        | 92                | —    | 104  |
| E        | —                 | 50   | —    |
| F        | 4                 | —    | —    |
| G        | 32                | —    | 38   |
| H        | 4                 | —    | 12   |
| $\alpha$ | 0°                | —    | 10°  |

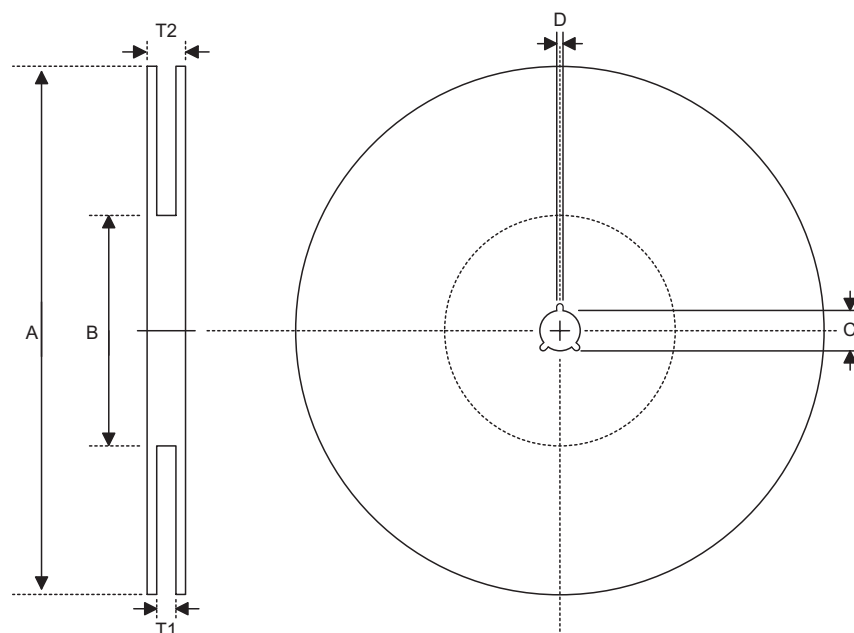
**48-pin SSOP (300mil) Outline Dimensions**



| Symbol   | Dimensions in mil |      |      |
|----------|-------------------|------|------|
|          | Min.              | Nom. | Max. |
| A        | 395               | —    | 420  |
| B        | 291               | —    | 299  |
| C        | 8                 | —    | 12   |
| C'       | 613               | —    | 637  |
| D        | 85                | —    | 99   |
| E        | —                 | 25   | —    |
| F        | 4                 | —    | 10   |
| G        | 25                | —    | 35   |
| H        | 4                 | —    | 12   |
| $\alpha$ | 0°                | —    | 8°   |

## Product Tape and Reel Specifications

### Reel Dimensions

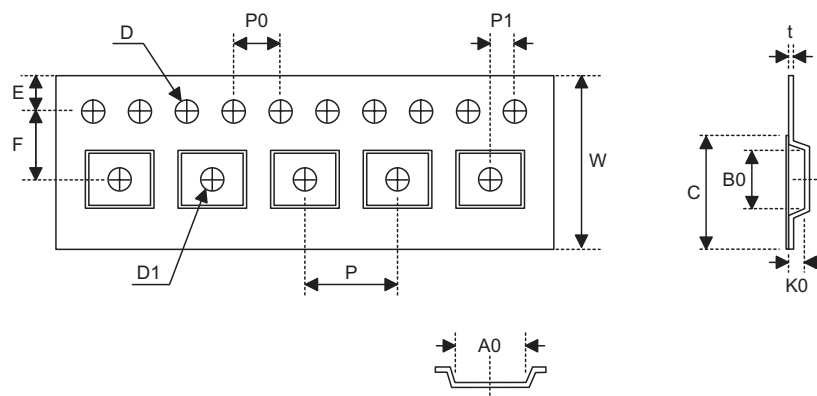


#### SOP 28W (300mil)

| 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<br>-0.2 |
| D      | Key Slit Width        | 2.0±0.5          |
| T1     | Space Between Flange  | 24.8+0.3<br>-0.2 |
| T2     | Reel Thickness        | 30.2±0.2         |

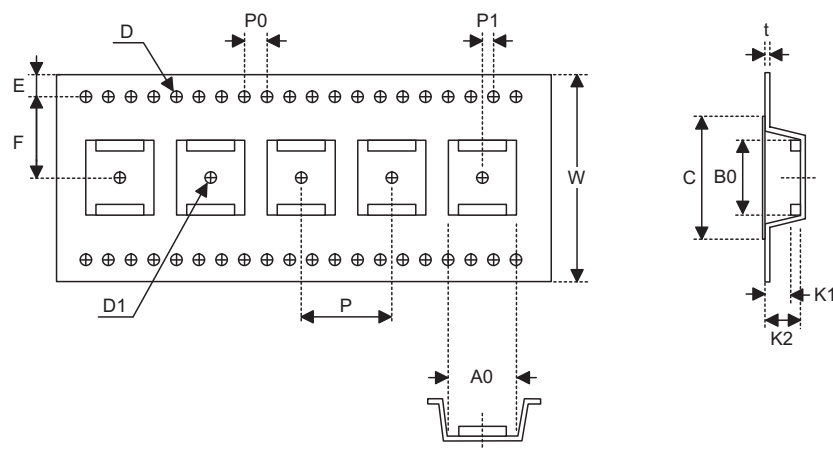
#### SSOP 48W

| Symbol | Description           | Dimensions in mm |
|--------|-----------------------|------------------|
| A      | Reel Outer Diameter   | 330±1.0          |
| B      | Reel Inner Diameter   | 100±0.1          |
| C      | Spindle Hole Diameter | 13.0+0.5<br>-0.2 |
| D      | Key Slit Width        | 2.0±0.5          |
| T1     | Space Between Flange  | 32.2+0.3<br>-0.2 |
| T2     | Reel Thickness        | 38.2±0.2         |

**Carrier Tape Dimensions**


SOP 28W (300mil)

| Symbol | Description                              | Dimensions in mm |
|--------|------------------------------------------|------------------|
| W      | Carrier Tape Width                       | 24.0±0.3         |
| 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                            | 10.85±0.1        |
| B0     | Cavity Width                             | 18.34±0.1        |
| K0     | Cavity Depth                             | 2.97±0.1         |
| t      | Carrier Tape Thickness                   | 0.35±0.01        |
| C      | Cover Tape Width                         | 21.3             |



SSOP 48W

| Symbol | Description                              | Dimensions in mm |
|--------|------------------------------------------|------------------|
| W      | Carrier Tape Width                       | 32.0±0.3         |
| P      | Cavity Pitch                             | 16.0±0.1         |
| E      | Perforation Position                     | 1.75±0.1         |
| F      | Cavity to Perforation (Width Direction)  | 14.2±0.1         |
| D      | Perforation Diameter                     | 2.0 Min.         |
| 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                            | 12.0±0.1         |
| B0     | Cavity Width                             | 16.20±0.1        |
| K1     | Cavity Depth                             | 2.4±0.1          |
| K2     | Cavity Depth                             | 3.2±0.1          |
| t      | Carrier Tape Thickness                   | 0.35±0.05        |
| C      | Cover Tape Width                         | 25.5             |

**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: 021-6485-5560  
Fax: 021-6485-0313  
<http://www.holtek.com.cn>

**Holtek Semiconductor Inc. (Shenzhen Sales Office)**

43F, SEG Plaza, Shen Nan Zhong Road, Shenzhen, China 518031  
Tel: 0755-8346-5589  
Fax: 0755-8346-5590  
ISDN: 0755-8346-5591

**Holtek Semiconductor Inc. (Beijing Sales Office)**

Suite 1721, Jinyu Tower, A129 West Xuan Wu Men Street, Xicheng District, Beijing, China 100031  
Tel: 010-6641-0030, 6641-7751, 6641-7752  
Fax: 010-6641-0125

**Holmate Semiconductor, Inc. (North America Sales Office)**

46712 Fremont Blvd., Fremont, CA 94538  
Tel: 510-252-9880  
Fax: 510-252-9885  
<http://www.holmate.com>

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