

### Features

- Operating voltage: 2.4V~12V
- Low power and high noise immunity CMOS technology
- Low standby current
- Minimum transmission word
  - Four words for  $\overline{TE}$  trigger
  - One word for Data trigger
- Built-in oscillator needs only 5% resistor
- Easy interface with an RF or an infrared transmission medium
- Minimal external components
- Pair with Holtek's 3<sup>12</sup> series of decoders
- 18-pin DIP, 20-pin SOP package

### Applications

- Burglar alarm system
- Smoke and fire alarm system
- Garage door controllers
- Car door controllers
- Car alarm system
- Security system
- Cordless telephones
- Other remote control systems

### General Description

The 3<sup>12</sup> encoders are a series of CMOS LSIs for remote control system applications. They are capable of encoding 12 bits of information which consists of N address bits and 12-N data bits. Each address/data input is externally trinary programmable if bonded out. They are otherwise set floating internally. Various packages of the 3<sup>12</sup> encoders offer flexible combinations of pro-

grammable address/data which meet various applications. The programmable address/data is transmitted together with the header bits via an RF or an infrared transmission medium upon receipt of a trigger signal. A  $\overline{TE}$  (HT6010) or a DATA (HT6012/HT6014) trigger can be selected for application flexibility.

### Selection Table

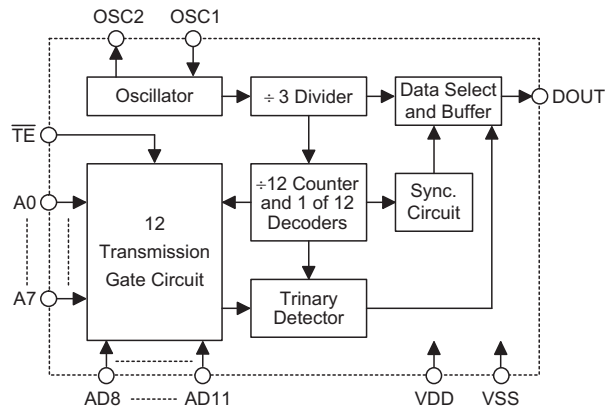
| Function<br>Part No. | Address<br>No. | Address/<br>Data No. | Data<br>No. | Oscillator    | Trigger         | LED<br>Indicator | Package      |
|----------------------|----------------|----------------------|-------------|---------------|-----------------|------------------|--------------|
| HT6010               | 8              | 4                    | 0           | RC oscillator | $\overline{TE}$ | No               | 18DIP, 20SOP |
| HT6012               | 10             | 0                    | 2           | RC oscillator | D10~D11         | Yes              | 18DIP, 20SOP |
| HT6014               | 8              | 0                    | 4           | RC oscillator | D8~D11          | Yes              | 18DIP, 20SOP |

Note: Address/Data represents pins that can be either address or data according to the application requirement.

**Block Diagram**

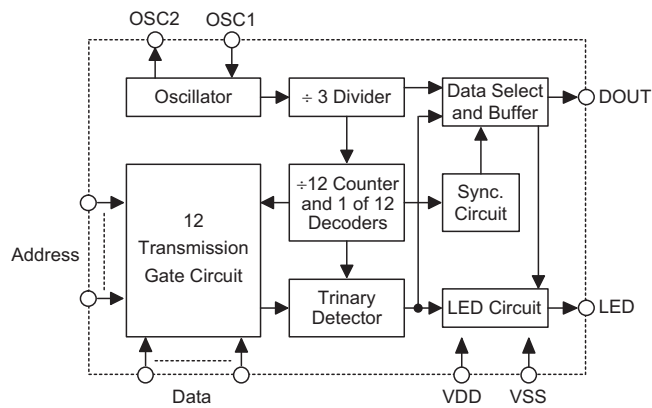
**$\overline{TE}$  Trigger**

HT6010



**DATA Trigger**

HT6012/HT6014

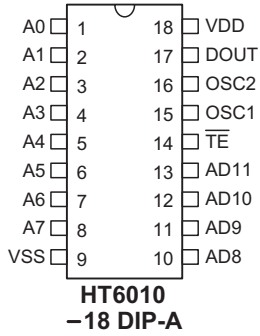


Note: The address/data pins are available in various combinations (refer to the address/data table).

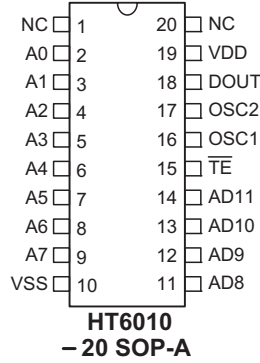
**Pin Assignment**

**$\overline{TE}$  Trigger Type**

**8-Address  
4-Address/Data**

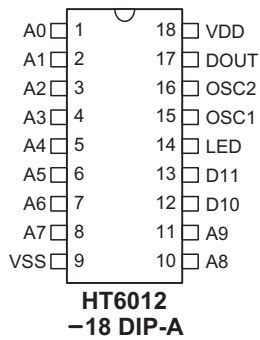


**8-Address  
4-Address/Data**

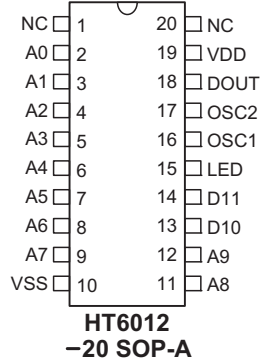


**DATA Trigger Type**

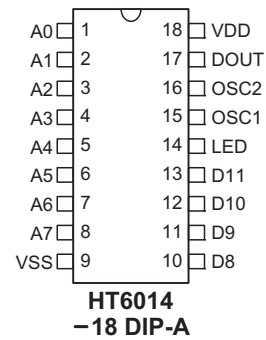
**10-Address  
2-Data**



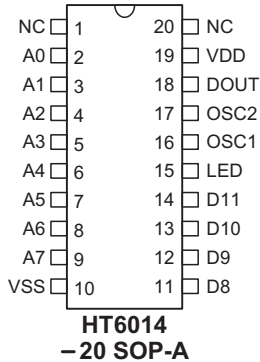
**10-Address  
2-Data**



**8-Address  
4-Data**



**8-Address  
4-Data**

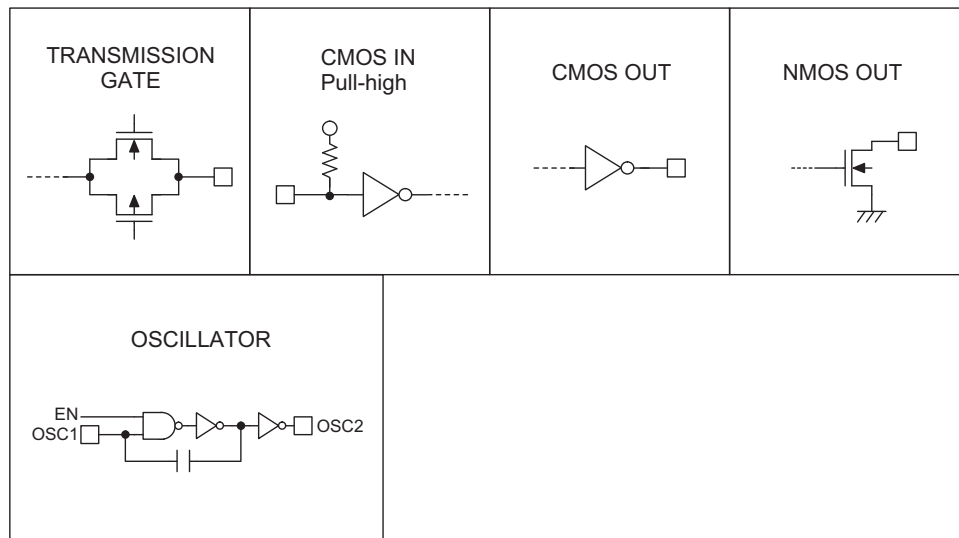


**Pin Description**

| Pin Name        | I/O | Internal Connection  | Description   |
|-----------------|-----|----------------------|---|
| A0~A9           | I   | TRANSMISSION GATE    | Input pins for address A0~A9 setting<br>They can be externally set to VDD or VSS or left open.  |
| AD8~AD11        | I   | TRANSMISSION GATE    | Input pins for address/data (AD8~AD11) setting<br>They can be externally set to VDD or VSS or left open.                                |
| D8~D11          | I   | CMOS IN<br>Pull-high | Input pins for data (D8~D11) setting and transmission enable (active low)<br>They can be externally set to VSS or left open (see Note). |
| DOUT            | O   | CMOS OUT             | Encoder data serial transmission output   |
| LED             | O   | NMOS OUT             | Transmission enable indicator, active low   |
| $\overline{TE}$ | I   | CMOS IN<br>Pull-high | Transmission enable, active low (see Note)  |
| OSC1            | I   | OSCILLATOR           | Oscillator input pin  |
| OSC2            | O   | OSCILLATOR           | Oscillator output pin   |
| VSS             | —   | —                    | Negative power supply, ground   |
| VDD             | —   | —                    | Positive power supply   |

Note: D8~D11 are data input and transmission enable pins of the HT6012/HT6014.

$\overline{TE}$  is the transmission enable pin of the HT6010.

**Approximate Internal Connections**

**Absolute Maximum Ratings**

|                      |                               |                             |                                  |
|----------------------|-------------------------------|-----------------------------|----------------------------------|
| Supply Voltage ..... | $V_{SS}-0.3V$ to $V_{SS}+13V$ | Storage Temperature .....   | $-50^{\circ}C$ to $125^{\circ}C$ |
| Input Voltage .....  | $V_{SS}-0.3$ to $V_{DD}+0.3V$ | Operating Temperature ..... | $-20^{\circ}C$ to $75^{\circ}C$  |

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.

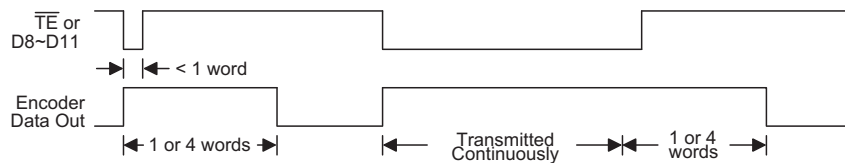
**Electrical Characteristics**

Ta=25°C

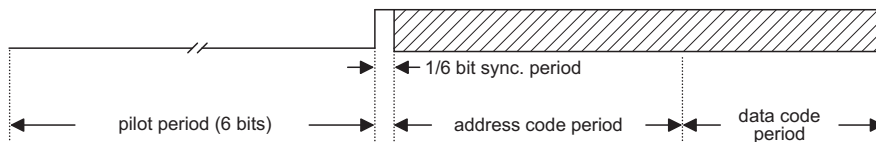
| Symbol            | Parameter                   | Test Conditions |  | Min.               | Typ. | Max.               | Unit |
|-------------------|-----------------------------|-----------------|--|--------------------|------|--------------------|------|
|                   |                             | V <sub>DD</sub> | Conditions                                   |                    |      |                    |      |
| V <sub>DD</sub>   | Operating Voltage           | —               | —  | 2.4                | 5    | 12                 | V    |
| I <sub>STB</sub>  | Standby Current             | 3V              | Oscillator stops                             | —                  | 0.1  | 1                  | μA   |
|                   |                             | 12V             |  | —                  | 2    | 4                  | μA   |
| I <sub>DD</sub>   | Operating Current           | 3V              | No load, f <sub>OSC</sub> =3kHz              | —                  | 250  | 500                | μA   |
|                   |                             | 12V             |  | —                  | 600  | 1200               | μA   |
| I <sub>LED</sub>  | LED Sink Current            | 5V              | V <sub>LED</sub> =0.5V                       | 1.5                | 3    | —                  | mA   |
| I <sub>DOUT</sub> | Output Drive Current        | 5V              | V <sub>OH</sub> =0.9V <sub>DD</sub> (Source) | -0.6               | -1.2 | —                  | mA   |
|                   |                             | 5V              | V <sub>OL</sub> =0.1V <sub>DD</sub> (Sink)   | 0.6                | 1.2  | —                  | mA   |
| V <sub>IH</sub>   | "H" Input Voltage           | —               | —  | 0.8V <sub>DD</sub> | —    | V <sub>DD</sub>    | V    |
| V <sub>IL</sub>   | "L" Input Voltage           | —               | —  | 0                  | —    | 0.2V <sub>DD</sub> | V    |
| f <sub>OSC</sub>  | Oscillator Frequency        | 5V              | R <sub>OSC</sub> =1MΩ                        | —                  | 3    | —                  | kHz  |
| R <sub>TE</sub>   | TE Pull-high Resistance     | 5V              | V <sub>TE</sub> =0V                          | —                  | 1.5  | 3                  | MΩ   |
| R <sub>DATA</sub> | D8~D11 Pull-high Resistance | 5V              | V <sub>DATA</sub> =0V                        | —                  | 1.5  | 3                  | MΩ   |

**Functional Description**
**Operation**

The 3<sup>12</sup> series of encoders begin with a four (HT6010) or a one (HT6012/HT6014) word transmission cycle upon receipt of a transmission enable (TE for the HT6010 or D8~D11 for the HT6012/HT6014, active low). This cycle will repeat itself as long as the transmission enable (TE or D8~D11) is held low. Once the transmission enable returns high the encoder output completes its final cycle and then stops as shown below.

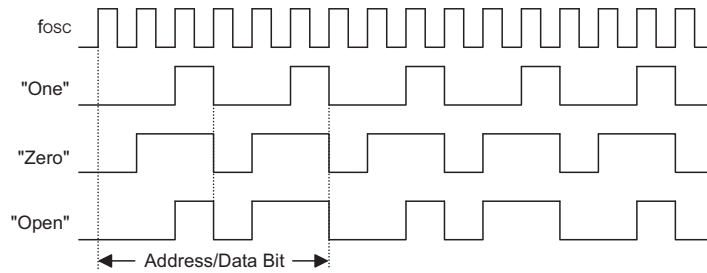

**Transmission Timing**
**Information Word**

An information word is composed of four periods as shown:


**Composition of Information**

**Address/Data Waveform**

Each programmable address/data pin can be externally set to one of the following three logic states:



**Address/Data Bit Waveform**

The "Open" state data input is interpreted as logic high by the decoder since its output has only two states.

**Address/Data Programming (Preset)**

The status of each address/data pin can be individually preset to a logic "high", "low", or "floating". If a transmission enable signal is applied, the encoder scans and transmits the status of the 12 bits of address/data serially in the order A0 to AD11 for the HT6010 and A0 to D11 for the HT6012/HT6014.

If the trigger signal is not applied, the chip only consumes a standby current which is less than  $1\mu\text{A}$  (for  $V_{DD}=5\text{V}$ ).

The address pins are usually preset so as to transmit data codes with their own particular security codes by the DIP switches or PCB wiring, while data is selected using push button or electronic switches.

**Address/Data Sequence**

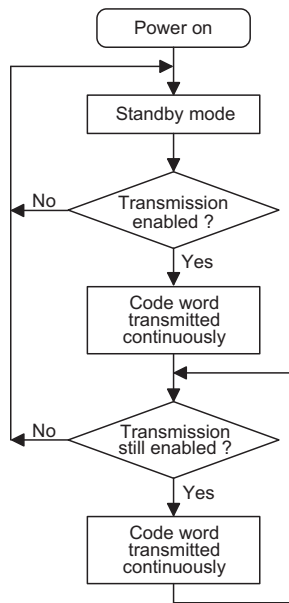
The following table provides the position of the address/data sequence for various models of the 3<sup>12</sup> series encoders.

| Part No. | Address/Data Bits |    |    |    |    |    |    |    |     |     |      |      |
|----------|-------------------|----|----|----|----|----|----|----|-----|-----|------|------|
|          | 0                 | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8   | 9   | 10   | 11   |
| HT6010   | A0                | A1 | A2 | A3 | A4 | A5 | A6 | A7 | AD8 | AD9 | AD10 | AD11 |
| HT6012   | A0                | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8  | A9  | D10  | D11  |
| HT6014   | A0                | A1 | A2 | A3 | A4 | A5 | A6 | A7 | D8  | D9  | D10  | D11  |

**Transmission Enable**

For the  $\overline{\text{TE}}$  trigger type of encoders, transmission is enabled by applying a low signal to the  $\overline{\text{TE}}$  pin. But for the Data trigger type, it is enabled by applying a low signal to one of the data pins D8~D11.

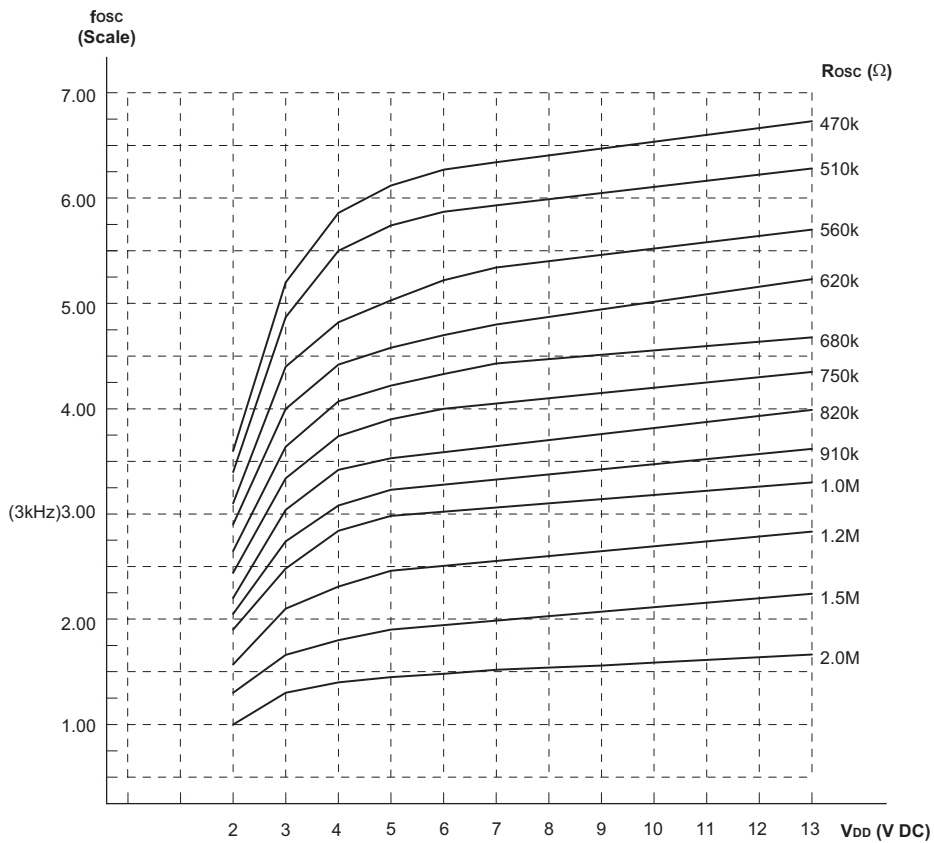
Flowchart



Note: D8~D11 are transmission enable of the HT6012/HT6014.

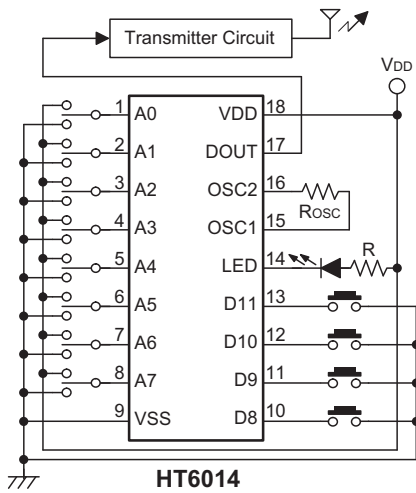
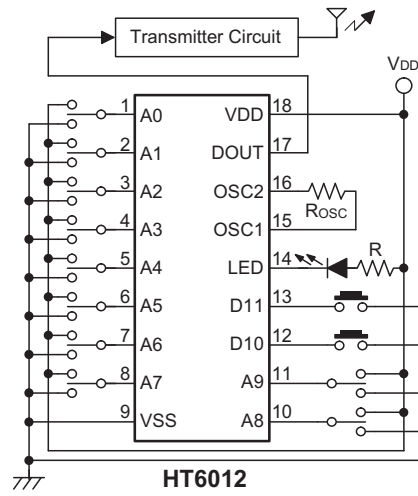
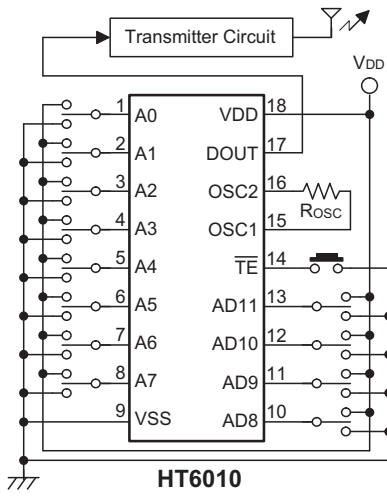
$\overline{TE}$  is the transmission enable of the HT6010.

Oscillator Frequency vs. Supply Voltage

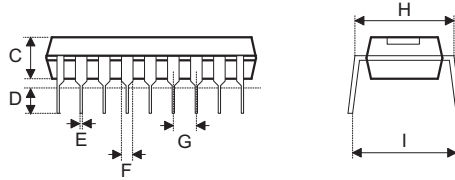
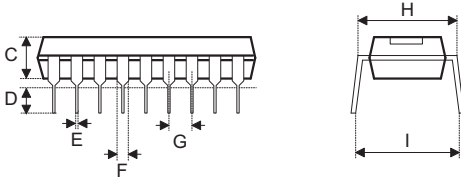
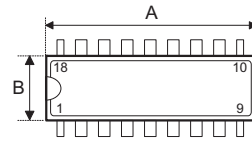
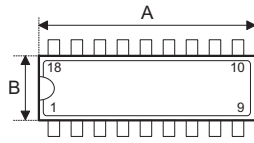


The recommended oscillator frequency is  $f_{OSC D} \text{ (decoder)} \cong 33 f_{OSCE} \text{ (encoder)}$

**Application Circuits**





**Package Information**
**18-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      | 880               | —    | 920  |
| B      | 240               | —    | 280  |
| C      | 115               | —    | 195  |
| D      | 115               | —    | 150  |
| E      | 14                | —    | 22   |
| F      | 45                | —    | 70   |
| G      | —                 | 100  | —    |
| H      | 300               | —    | 325  |
| I      | —                 | —    | 430  |

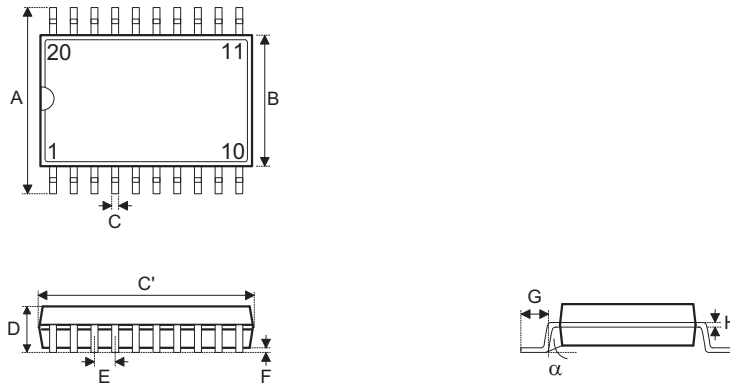
- MS-001d (see fig2)

| Symbol | Dimensions in mil |      |      |
|--------|-------------------|------|------|
|        | Min.              | Nom. | Max. |
| A      | 845               | —    | 880  |
| 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      | 845               | —    | 885  |
| B      | 275               | —    | 295  |
| C      | 120               | —    | 150  |
| D      | 110               | —    | 150  |
| E      | 14                | —    | 22   |
| F      | 45                | —    | 60   |
| G      | —                 | 100  | —    |
| H      | 300               | —    | 325  |
| I      | —                 | —    | 430  |

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

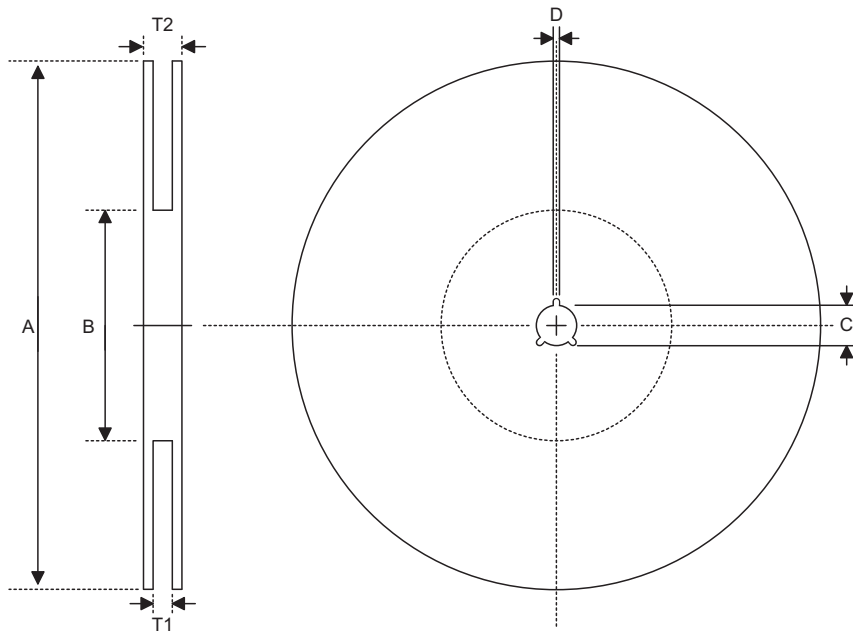


• MS-013

| Symbol   | Dimensions in mil |      |      |
|----------|-------------------|------|------|
|          | Min.              | Nom. | Max. |
| A        | 393               | —    | 419  |
| B        | 256               | —    | 300  |
| C        | 12                | —    | 20   |
| C'       | 496               | —    | 512  |
| D        | —                 | —    | 104  |
| E        | —                 | 50   | —    |
| F        | 4                 | —    | 12   |
| G        | 16                | —    | 50   |
| H        | 8                 | —    | 13   |
| $\alpha$ | 0°                | —    | 8°   |

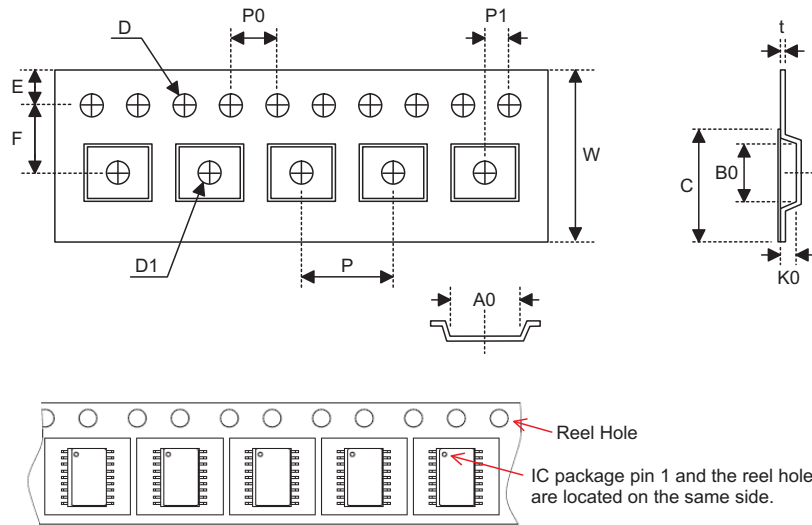
**Product Tape and Reel Specifications**

**Reel Dimensions**



SOP 20W

| Symbol | Description           | Dimensions in mm          |
|--------|-----------------------|---------------------------|
| A      | Reel Outer Diameter   | 330.0±1.0                 |
| B      | Reel Inner Diameter   | 100.0±1.5                 |
| C      | Spindle Hole Diameter | 13.0 <sup>+0.5/-0.2</sup> |
| D      | Key Slit Width        | 2.0±0.5                   |
| T1     | Space Between Flange  | 24.8 <sup>+0.3/-0.2</sup> |
| T2     | Reel Thickness        | 30.2±0.2                  |

**Carrier Tape Dimensions**

**SOP 20W**

| Symbol | Description                              | Dimensions in mm            |
|--------|--|-----------------------------|
| W      | Carrier Tape Width                       | 24.0 <sup>+0.3/-0.1</sup>   |
| P      | Cavity Pitch                             | 12.0±0.1                    |
| E      | Perforation Position                     | 1.75±0.10                   |
| F      | Cavity to Perforation (Width Direction)  | 11.5±0.1                    |
| D      | Perforation Diameter                     | 1.5 <sup>+0.1/-0.0</sup>    |
| D1     | Cavity Hole Diameter                     | 1.50 <sup>+0.25/-0.00</sup> |
| 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                   | 0.30±0.05                   |
| C      | Cover Tape Width                         | 21.3±0.1                    |

**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)**

G Room, 3 Floor, No.1 Building, No.2016 Yi-Shan Road, Minhang District, Shanghai, China 201103  
Tel: 86-21-5422-4590  
Fax: 86-21-5422-4705  
<http://www.holtek.com.cn>

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

5F, Unit A, Productivity Building, Gaoxin M 2nd, Middle Zone Of High-Tech Industrial Park, 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, USA  
Tel: 1-510-252-9880  
Fax: 1-510-252-9885  
<http://www.holtek.com>

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