



# HT12D/HT12F

## 2<sup>12</sup> Series of Decoders

### Features

- Operating voltage: 2.4V~12V
- Low power and high noise immunity CMOS technology
- Low standby current
- Capable of decoding 12 bits of information
- Binary address setting
- Received codes are checked 3 times
- Address/Data number combination
  - HT12D: 8 address bits and 4 data bits
  - HT12F: 12 address bits only
- Built-in oscillator needs only 5% resistor
- Valid transmission indicator
- Easy interface with an RF or an infrared transmission medium
- Minimal external components
- Pair with Holtek's 2<sup>12</sup> series of encoders
- 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 2<sup>12</sup> decoders are a series of CMOS LSIs for remote control system applications. They are paired with Holtek's 2<sup>12</sup> series of encoders (refer to the encoder/decoder cross reference table). For proper operation, a pair of encoder/decoder with the same number of addresses and data format should be chosen.

The decoders receive serial addresses and data from a programmed 2<sup>12</sup> series of encoders that are transmitted by a carrier using an RF or an IR transmission medium. They compare the serial input data three times continu-

ously with their local addresses. If no error or unmatched codes are found, the input data codes are decoded and then transferred to the output pins. The VT pin also goes high to indicate a valid transmission.

The 2<sup>12</sup> series of decoders are capable of decoding informations that consist of N bits of address and 12–N bits of data. Of this series, the HT12D is arranged to provide 8 address bits and 4 data bits, and HT12F is used to decode 12 bits of address information.

### Selection Table

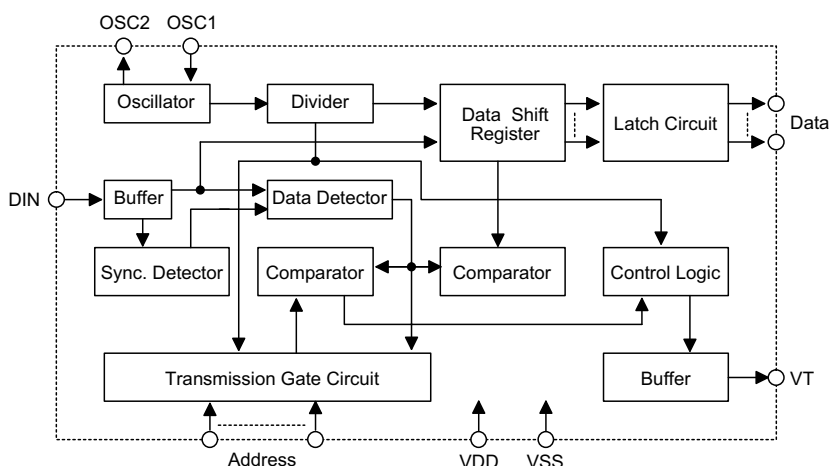
| Function<br>Part No. | Address<br>No. | Data |      | VT | Oscillator    | Trigger         | Package      |
|----------------------|----------------|------|------|----|---------------|-----------------|--------------|
|                      |                | No.  | Type |    |               |                 |              |
| HT12D                | 8              | 4    | L    | √  | RC oscillator | DIN active "Hi" | 18DIP, 20SOP |
| HT12F                | 12             | 0    | —    | √  | RC oscillator | DIN active "Hi" | 18DIP, 20SOP |

Notes: Data type: L stands for latch type data output.

VT can be used as a momentary data output.

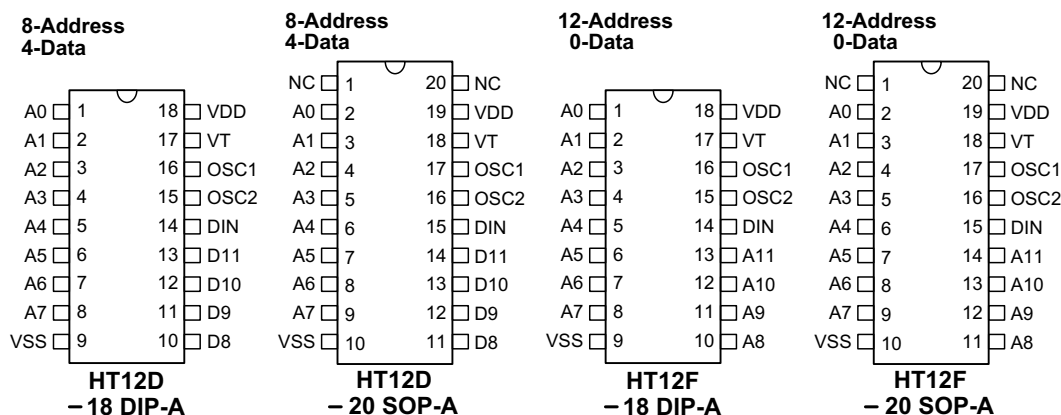


## Block Diagram



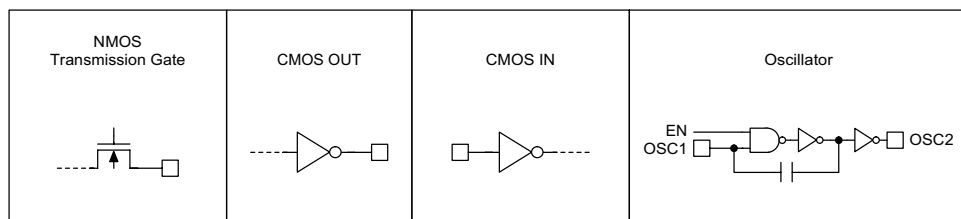
Note: The address/data pins are available in various combinations (see the address/data table).

## Pin Assignment



## Pin Description

| Pin Name       | I/O | Internal Connection    | Description  |
|----------------|-----|------------------------|--|
| A0~A11 (HT12F) | I   | NMOS Transmission Gate | Input pins for address A0~A11 setting<br>These pins can be externally set to VSS or left open. |
| A0~A7 (HT12D)  |     |                        | Input pins for address A0~A7 setting<br>These pins can be externally set to VSS or left open.  |
| D8~D11 (HT12D) | O   | CMOS OUT               | Output data pins, power-on state is low.   |
| DIN            | I   | CMOS IN                | Serial data input pin  |
| VT             | O   | CMOS OUT               | Valid transmission, active high  |
| OSC1           | I   | Oscillator             | Oscillator input pin   |
| OSC2           | O   | Oscillator             | Oscillator output pin  |
| VSS            | —   | —                      | Negative power supply, ground  |
| VDD            | —   | —                      | Positive power supply  |

**Approximate internal connection circuits**

**Absolute Maximum Ratings**

|                      |                               |                             |                |
|----------------------|-------------------------------|-----------------------------|----------------|
| Supply Voltage ..... | -0.3V to 13V                  | Storage Temperature .....   | -50°C to 125°C |
| Input Voltage .....  | $V_{SS}-0.3$ to $V_{DD}+0.3V$ | Operating Temperature ..... | -20°C to 75°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**
 $T_a=25^{\circ}\text{C}$ 

| Symbol    | Parameter                           | Test Conditions |                                  | Min. | Typ. | Max. | Unit          |
|-----------|-------------------------------------|-----------------|----------------------------------|------|------|------|---------------|
|           |                                     | $V_{DD}$        | Conditions                       |      |      |      |               |
| $V_{DD}$  | Operating Voltage                   | —               | —                                | 2.4  | 5    | 12   | V             |
| $I_{STB}$ | Standby Current                     | 5V              | Oscillator stops                 | —    | 0.1  | 1    | $\mu\text{A}$ |
|           |                                     | 12V             |                                  | —    | 2    | 4    | $\mu\text{A}$ |
| $I_{DD}$  | Operating Current                   | 5V              | No load, $f_{OSC}=150\text{kHz}$ | —    | 200  | 400  | $\mu\text{A}$ |
| $I_O$     | Data Output Source Current (D8~D11) | 5V              | $V_{OH}=4.5V$                    | -1   | -1.6 | —    | mA            |
|           | Data Output Sink Current (D8~D11)   | 5V              | $V_{OL}=0.5V$                    | 1    | 1.6  | —    | mA            |
| $I_{VT}$  | VT Output Source Current            | 5V              | $V_{OH}=4.5V$                    | -1   | -1.6 | —    | mA            |
|           | VT Output Sink Current              |                 | $V_{OL}=0.5V$                    | 1    | 1.6  | —    | mA            |
| $V_{IH}$  | "H" Input Voltage                   | 5V              | —                                | 3.5  | —    | 5    | V             |
| $V_{IL}$  | "L" Input Voltage                   | 5V              | —                                | 0    | —    | 1    | V             |
| $f_{OSC}$ | Oscillator Frequency                | 5V              | $R_{OSC}=51\text{k}\Omega$       | —    | 150  | —    | kHz           |

## Functional Description

### Operation

The  $2^{12}$  series of decoders provides various combinations of addresses and data pins in different packages so as to pair with the  $2^{12}$  series of encoders.

The decoders receive data that are transmitted by an encoder and interpret the first N bits of code period as addresses and the last 12-N bits as data, where N is the address code number. A signal on the DIN pin activates the oscillator which in turn decodes the incoming address and data. The decoders will then check the received address three times continuously. If the received address codes all match the contents of the decoder's local address, the 12-N bits of data are decoded to activate the output pins and the VT pin is set high to indicate a valid transmission. This will last unless the address code is incorrect or no signal is received.

The output of the VT pin is high only when the transmission is valid. Otherwise it is always low.

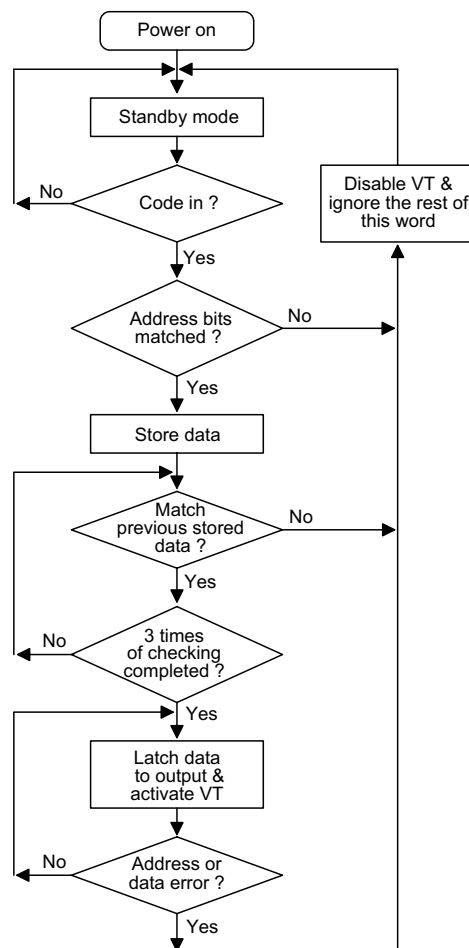
### Output type

Of the  $2^{12}$  series of decoders, the HT12F has no data output pin but its VT pin can be used as a momentary data output. The HT12D, on the other hand, provides 4 latch type data pins whose data remain unchanged until new data are received.

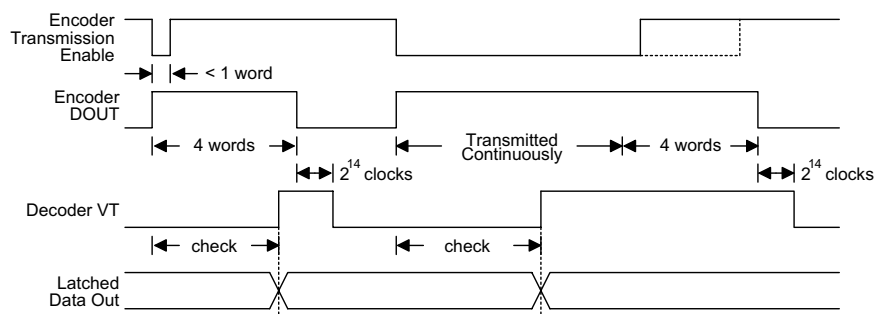
| Part No. | Data Pins | Address Pins | Output Type | Operating Voltage |
|----------|-----------|--------------|-------------|-------------------|
| HT12D    | 4         | 8            | Latch       | 2.4V~12V          |
| HT12F    | 0         | 12           | —           | 2.4V~12V          |

### Flowchart

The oscillator is disabled in the standby state and activated when a logic "high" signal applies to the DIN pin. That is to say, the DIN should be kept low if there is no signal input.



### Decoder timing



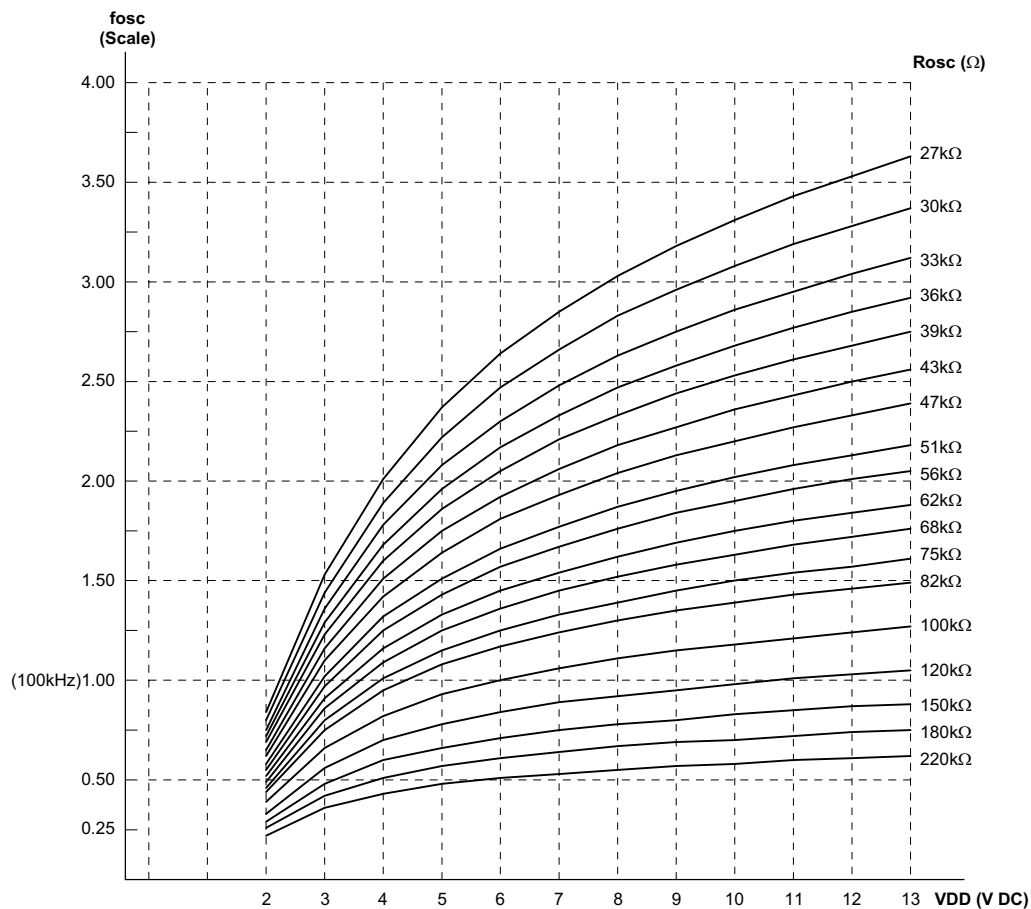
**Encoder/Decoder cross reference table**

| Decoders<br>Part No. | Data Pins | Address Pins | VT | Pair Encoder   | Package |     |         |     |
|----------------------|-----------|--------------|----|----------------|---------|-----|---------|-----|
|                      |           |              |    |                | Encoder |     | Decoder |     |
|                      |           |              |    |                | DIP     | SOP | DIP     | SOP |
| HT12D                | 4         | 8            | √  | HT12A<br>HT12E | 18      | 20  | 18      | 20  |
| HT12F                | 0         | 12           | √  | HT12A<br>HT12E | 18      | 20  | 18      | 20  |

**Address/Data sequence**

The following table provides address/data sequence for various models of the 2<sup>12</sup> series of decoders.

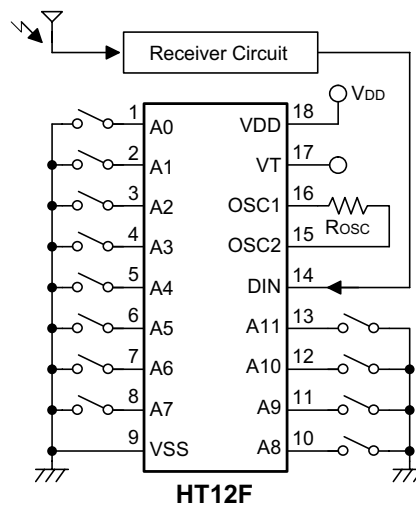
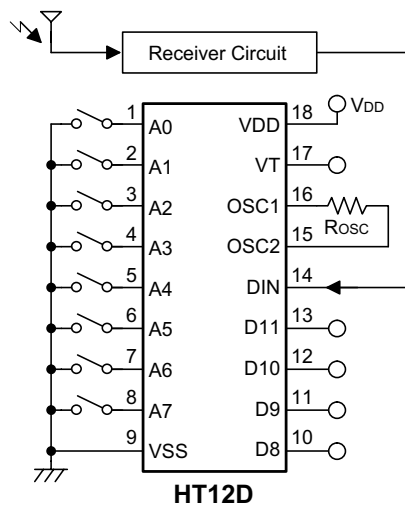
| Part No. | Address/Data Bits |    |    |    |    |    |    |    |    |    |     |     |
|----------|-------------------|----|----|----|----|----|----|----|----|----|-----|-----|
|          | 0                 | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10  | 11  |
| HT12D    | A0                | A1 | A2 | A3 | A4 | A5 | A6 | A7 | D8 | D9 | D10 | D11 |
| HT12F    | A0                | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 |

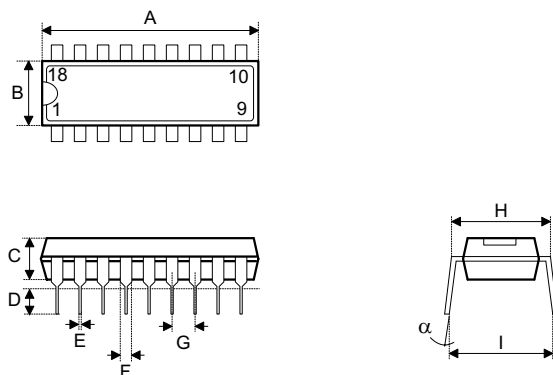
**Oscillator frequency vs supply voltage**


Note: The recommended oscillator frequency is  $f_{OSCD}$  (decoder)  $\cong 50 f_{OSCE}$  (HT12E encoder)

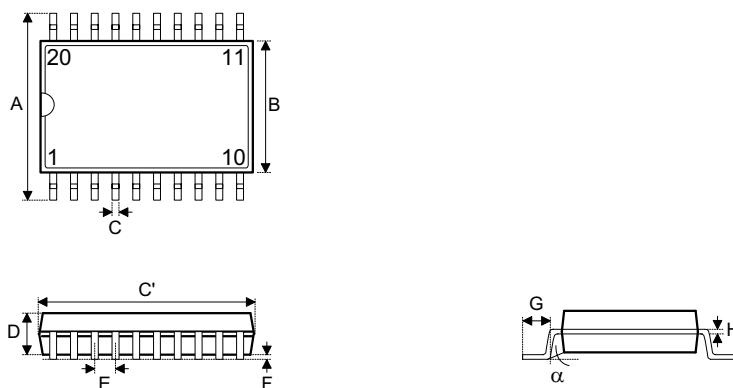
$$\cong \frac{1}{3} f_{OSCE} \text{ (HT12A encoder).}$$

**Application Circuits**



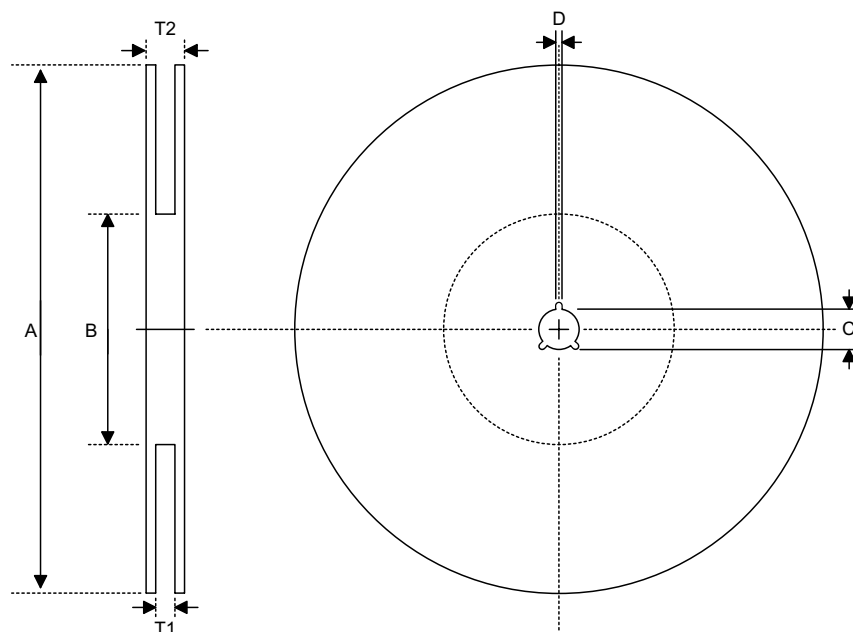
**Package Information**
**18-pin DIP (300mil) outline dimensions**


| Symbol   | Dimensions in mil |      |      |
|----------|-------------------|------|------|
|          | Min.              | Nom. | Max. |
| A        | 895               | —    | 915  |
| 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**


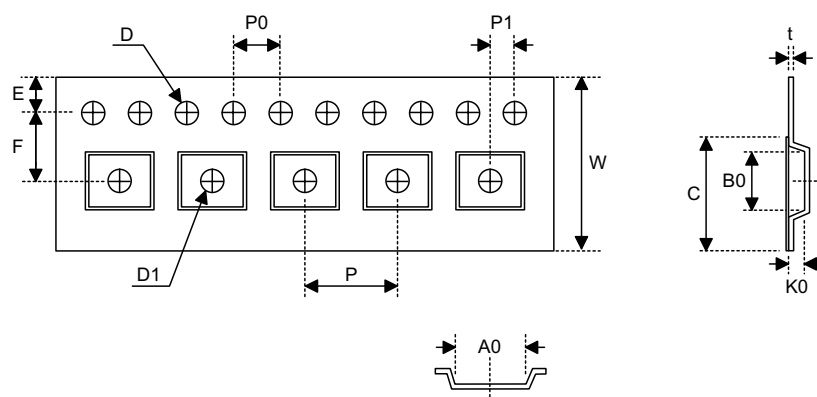
| Symbol   | Dimensions in mil |      |      |
|----------|-------------------|------|------|
|          | Min.              | Nom. | Max. |
| A        | 394               | —    | 419  |
| B        | 290               | —    | 300  |
| C        | 14                | —    | 20   |
| C'       | 490               | —    | 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   | $330 \pm 1.0$          |
| B      | Reel Inner Diameter   | $62 \pm 1.5$           |
| C      | Spindle Hole Diameter | $13.0 + 0.5$<br>$-0.2$ |
| D      | Key Slit Width        | $2.0 \pm 0.5$          |
| T1     | Space Between Flange  | $24.8 + 0.3$<br>$-0.2$ |
| T2     | Reel Thickness        | $30.2 \pm 0.2$         |

**Carrier tape dimensions**

**SOP 20W**

| Symbol | Description                              | Dimensions in mm |
|--------|--|------------------|
| W      | Carrier Tape Width                       | 24.0+0.3<br>-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             |

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