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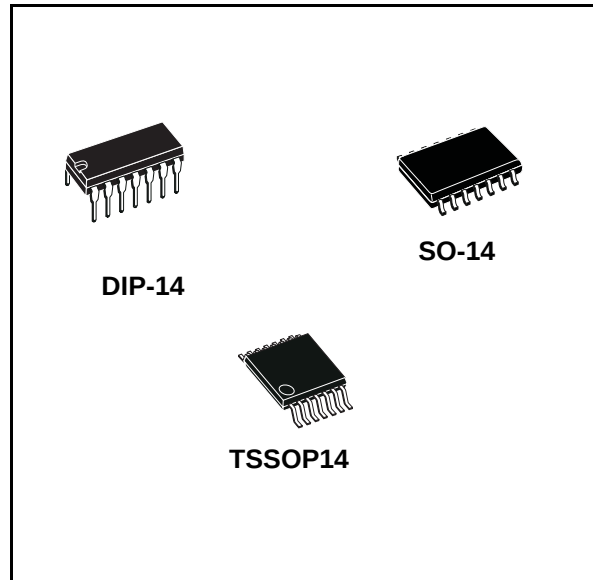
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Jameco Part Number 1996786

## Hex Schmitt inverter

### Features

- High speed:  
 $t_{PD} = 12 \text{ ns (typ.) at } V_{CC} = 6 \text{ V}$
- Low power dissipation:  
 $I_{CC} = 1 \mu\text{A (max.) at } T_A = 25 \text{ }^\circ\text{C}$
- High noise immunity:  
 $V_H = 1.2 \text{ V (typ.) at } V_{CC} = 6 \text{ V}$
- Symmetrical output impedance:  
 $|I_{OH}| = I_{OL} = 4 \text{ mA (min.)}$
- Balanced propagation delays:  
 $t_{PLH} \cong t_{PHL}$
- Wide operating voltage range:  
 $V_{CC} \text{ (opr)} = 2 \text{ to } 6 \text{ V}$
- Pin and function compatible with 74 series 14



### Description

The M74HC14 is a high speed CMOS hex Schmitt inverter fabricated with silicon gate C<sup>2</sup>MOS technology. Pin configuration and functions are the same as those of the M74HC04 but all the inputs have 20%  $V_{CC}$  hysteresis level.

This, together with its Schmitt trigger function, allows the device to be used on line receivers with slow rise/fall input signals.

All inputs are equipped with protection circuits against static discharge and transient excess voltage.

**Table 1. Device summary**

| Order code    | Package | Packaging     |
|---------------|---------|---------------|
| M74HC14B1R    | DIP-14  | Tube          |
| M74HC14RM13TR | SO-14   | Tape and reel |
| M74HC14TTR    | TSSOP14 | Tape and reel |

# 1 Pin connection and IEC logic symbols

Figure 1. Pin connections and IEC logic symbols

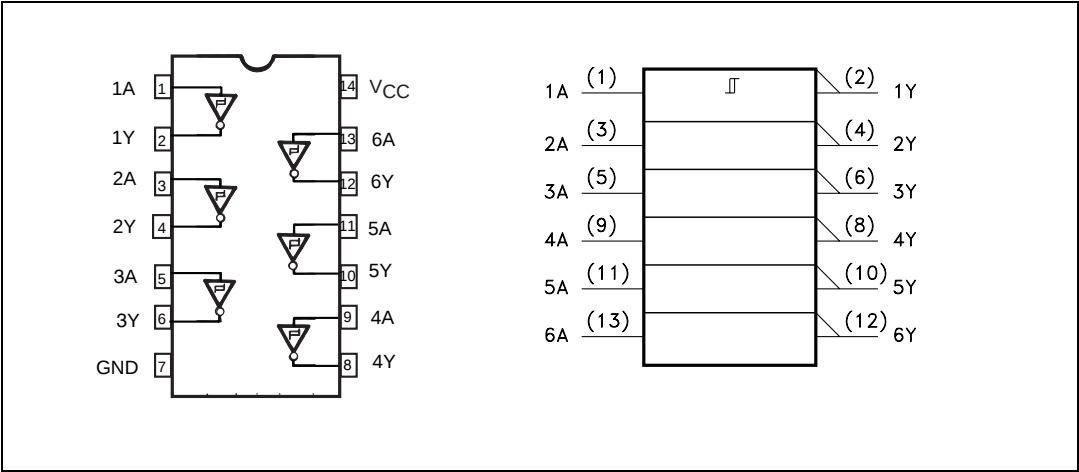


Table 2. Pin description

| Pin number         | Symbol          | Name and function       |
|--------------------|-----------------|-------------------------|
| 1, 3, 5, 9, 11, 13 | 1A to 6A        | Data inputs             |
| 2, 4, 6, 8, 10, 12 | 1Y to 6Y        | Data outputs            |
| 7                  | GND             | Ground (0 V)            |
| 14                 | V <sub>CC</sub> | Positive supply voltage |

Figure 2. Input and output equivalent circuit

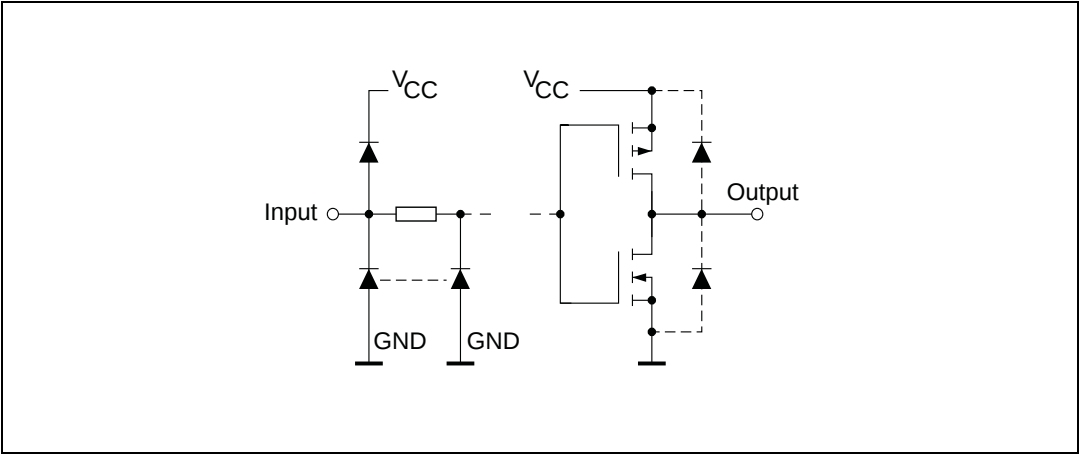


Table 3. Truth table

| A | Y |
|---|---|
| L | H |
| H | L |

## 2 Maximum rating

Stressing the device above the rating listed in the “Absolute maximum ratings” table may cause permanent damage to the device. These are stress ratings only, and operation of the device at these or any other conditions above those indicated in the operating sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. Refer also to the STMicroelectronics SURE Program and other relevant quality documents.

**Table 4. Absolute maximum ratings**

| Symbol                | Parameter                     | Value                  | Unit |
|-----------------------|-------------------------------|------------------------|------|
| $V_{CC}$              | Supply voltage                | -0.5 to +7             | V    |
| $V_I$                 | DC input voltage              | -0.5 to $V_{CC} + 0.5$ | V    |
| $V_O$                 | DC output voltage             | -0.5 to $V_{CC} + 0.5$ | V    |
| $I_{IK}$              | DC input diode current        | $\pm 20$               | mA   |
| $I_{OK}$              | DC output diode current       | $\pm 20$               | mA   |
| $I_O$                 | DC output current             | $\pm 25$               | mA   |
| $I_{CC}$ or $I_{GND}$ | DC $V_{CC}$ or Ground current | $\pm 50$               | mA   |
| $P_D$                 | Power dissipation             | 500 <sup>(1)</sup>     | mW   |
| $T_{stg}$             | Storage temperature           | -65 to +150            | °C   |
| $T_L$                 | Lead temperature (10 sec)     | 300                    | °C   |

1. 500 mW at 65 °C; derate to 300 mW by 10 mW/°C from 65 °C to 85 °C

### 2.1 Recommended operating conditions

**Table 5. Recommended operating conditions**

| Symbol   | Parameter             | Value         | Unit |
|----------|-----------------------|---------------|------|
| $V_{CC}$ | Supply voltage        | 2 to 6        | V    |
| $V_I$    | Input voltage         | 0 to $V_{CC}$ | V    |
| $V_O$    | Output voltage        | 0 to $V_{CC}$ | V    |
| $T_{op}$ | Operating temperature | -55 to 125    | °C   |

### 3 Electrical characteristics

Table 6. DC specifications

| Symbol          | Parameter                 | Test condition         |                                         | Value                 |      |      |             |      |              |      | Unit |
|-----------------|---------------------------|------------------------|-----------------------------------------|-----------------------|------|------|-------------|------|--------------|------|------|
|                 |                           | V <sub>CC</sub><br>(V) |                                         | T <sub>A</sub> = 25°C |      |      | -40 to 85°C |      | -55 to 125°C |      |      |
|                 |                           |                        |                                         | Min                   | Typ  | Max  | Min         | Max  | Min          | Max  |      |
| V <sub>t+</sub> | High level input voltage  | 2.0                    |                                         | 1.0                   | 1.28 | 1.5  | 1.0         | 1.5  | 1.0          | 1.5  | V    |
|                 |                           | 4.5                    |                                         | 2.3                   | 2.8  | 3.15 | 2.3         | 3.15 | 2.3          | 3.15 |      |
|                 |                           | 6.0                    |                                         | 3.0                   | 3.7  | 4.2  | 3.0         | 4.2  | 3.0          | 4.2  |      |
| V <sub>t-</sub> | Low level input voltage   | 2.0                    |                                         | 0.3                   | 0.74 | 0.9  | 0.3         | 0.9  | 0.3          | 0.9  | V    |
|                 |                           | 4.5                    |                                         | 1.13                  | 1.8  | 2.0  | 1.13        | 2.0  | 1.13         | 2.0  |      |
|                 |                           | 6.0                    |                                         | 1.5                   | 2.4  | 2.6  | 1.5         | 2.6  | 1.5          | 2.6  |      |
| V <sub>H</sub>  | Hysteresis voltage        | 2.0                    |                                         | 0.3                   | 0.54 | 1.0  | 0.3         | 1.0  | 0.3          | 1.0  | V    |
|                 |                           | 4.5                    |                                         | 0.6                   | 1.0  | 1.4  | 0.6         | 1.4  | 0.6          | 1.4  |      |
|                 |                           | 6.0                    |                                         | 0.8                   | 1.3  | 1.4  | 0.8         | 1.7  | 0.8          | 1.7  |      |
| V <sub>OH</sub> | High level output voltage | 2.0                    | I <sub>O</sub> = -20 μA                 | 1.9                   | 2.0  |      | 1.9         |      | 1.9          |      | V    |
|                 |                           | 4.5                    | I <sub>O</sub> = -20 μA                 | 4.4                   | 4.5  |      | 4.4         |      | 4.4          |      |      |
|                 |                           | 6.0                    | I <sub>O</sub> = -20 μA                 | 5.9                   | 6.0  |      | 5.9         |      | 5.9          |      |      |
|                 |                           | 4.5                    | I <sub>O</sub> = -4.0 mA                | 4.18                  | 4.31 |      | 4.13        |      | 4.10         |      |      |
|                 |                           | 6.0                    | I <sub>O</sub> = -5.2 mA                | 5.68                  | 5.8  |      | 5.63        |      | 5.60         |      |      |
| V <sub>OL</sub> | Low level output voltage  | 2.0                    | I <sub>O</sub> = -20 μA                 |                       | 0.0  | 0.1  |             | 0.1  |              | 0.1  | V    |
|                 |                           | 4.5                    | I <sub>O</sub> = -20 μA                 |                       | 0.0  | 0.1  |             | 0.1  |              | 0.1  |      |
|                 |                           | 6.0                    | I <sub>O</sub> = -20 μA                 |                       | 0.0  | 0.1  |             | 0.1  |              | 0.1  |      |
|                 |                           | 4.5                    | I <sub>O</sub> = -4.0 mA                |                       | 0.17 | 0.26 |             | 0.33 |              | 0.40 |      |
|                 |                           | 6.0                    | I <sub>O</sub> = -5.2 mA                |                       | 0.18 | 0.26 |             | 0.33 |              | 0.40 |      |
| I <sub>I</sub>  | Input leakage current     | 6.0                    | V <sub>I</sub> = V <sub>CC</sub> or GND |                       |      | ±0.1 |             | ±1   |              | ±1   | μA   |
| I <sub>CC</sub> | Quiescent supply current  | 6.0                    | V <sub>I</sub> = V <sub>CC</sub> or GND |                       |      | 1    |             | 10   |              | 20   | μA   |

**Table 7. AC electrical characteristics** ( $C_L = 50$  pF, Input  $t_r = t_f = 6$  ns)

| Symbol                            | Parameter              | Test condition         |  | Value                  |     |     |              |     |               | Unit |     |
|-----------------------------------|------------------------|------------------------|--|------------------------|-----|-----|--------------|-----|---------------|------|-----|
|                                   |                        | V <sub>CC</sub><br>(V) |  | T <sub>A</sub> = 25 °C |     |     | -40 to 85 °C |     | -55 to 125 °C |      |     |
|                                   |                        |                        |  | Min                    | Typ | Max | Min          | Max | Min           |      | Max |
| t <sub>TLH</sub> t <sub>THL</sub> | Output transition time | 2.0                    |  |                        | 30  | 75  |              | 95  |               | 110  | ns  |
|                                   |                        | 4.5                    |  |                        | 8   | 15  |              | 19  |               | 22   |     |
|                                   |                        | 6.0                    |  |                        | 7   | 13  |              | 16  |               | 19   |     |
| t <sub>PLH</sub> t <sub>PHL</sub> | Propagation delay time | 2.0                    |  |                        | 42  | 125 |              | 155 |               | 190  | ns  |
|                                   |                        | 4.5                    |  |                        | 14  | 25  |              | 31  |               | 38   |     |
|                                   |                        | 6.0                    |  |                        | 12  | 21  |              | 16  |               | 32   |     |

**Table 8. Capacitive characteristics**

| Symbol          | Parameter                                    | Test condition         |                          | Value                 |     |     |             |     |              | Unit |     |
|-----------------|----------------------------------------------|------------------------|--------------------------|-----------------------|-----|-----|-------------|-----|--------------|------|-----|
|                 |                                              | V <sub>CC</sub><br>(V) |                          | T <sub>A</sub> = 25°C |     |     | -40 to 85°C |     | -55 to 125°C |      |     |
|                 |                                              |                        |                          | Min                   | Typ | Max | Min         | Max | Min          |      | Max |
| C <sub>IN</sub> | Input capacitance                            | 5.0                    |                          |                       | 5   | 10  |             | 10  |              | 10   | pF  |
| C <sub>PD</sub> | Power dissipation capacitance <sup>(1)</sup> | 5.0                    | f <sub>IN</sub> = 10 MHz |                       | 28  |     |             |     |              |      | pF  |

1.  $C_{PD}$  is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to test circuit). Average operating current can be obtained by the following equation:  
 $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/6(\text{per gate})$ .

Figure 3. Test circuit

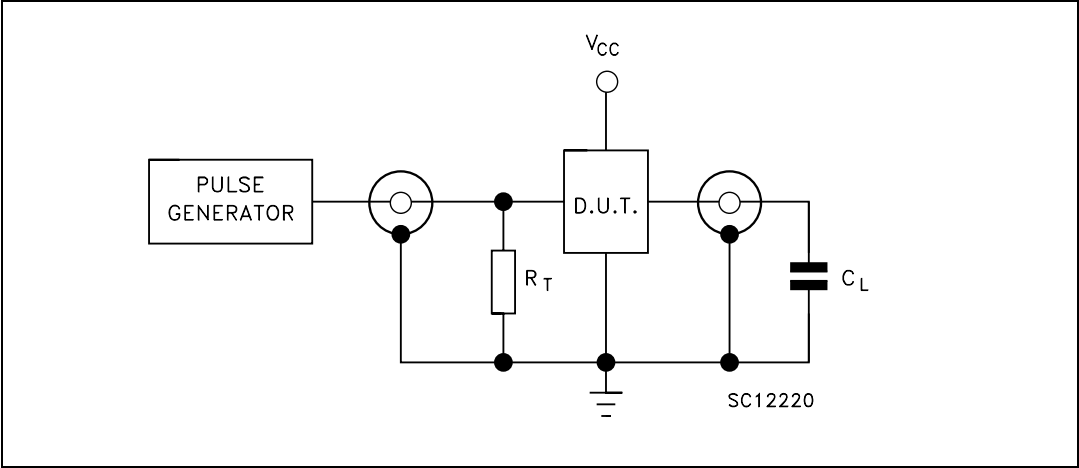
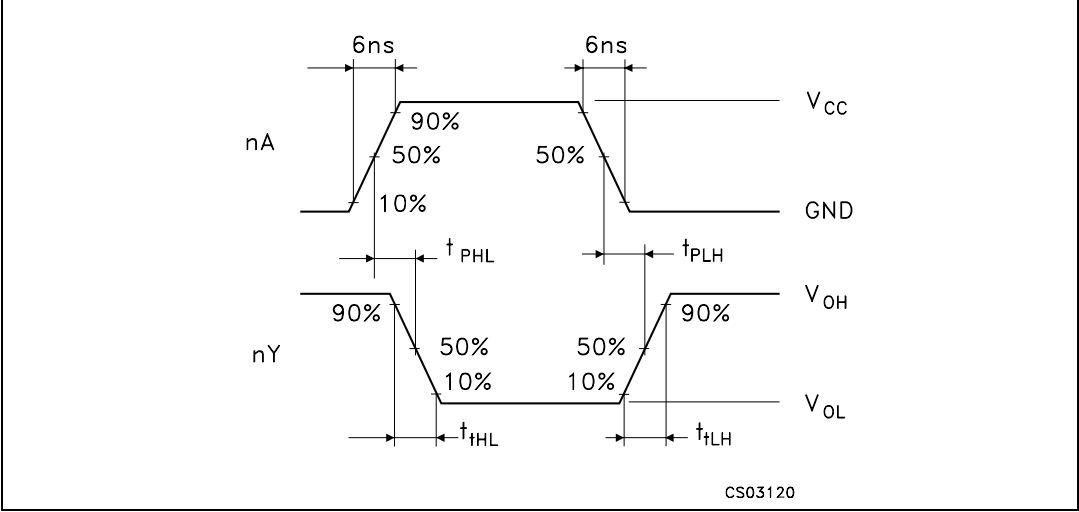
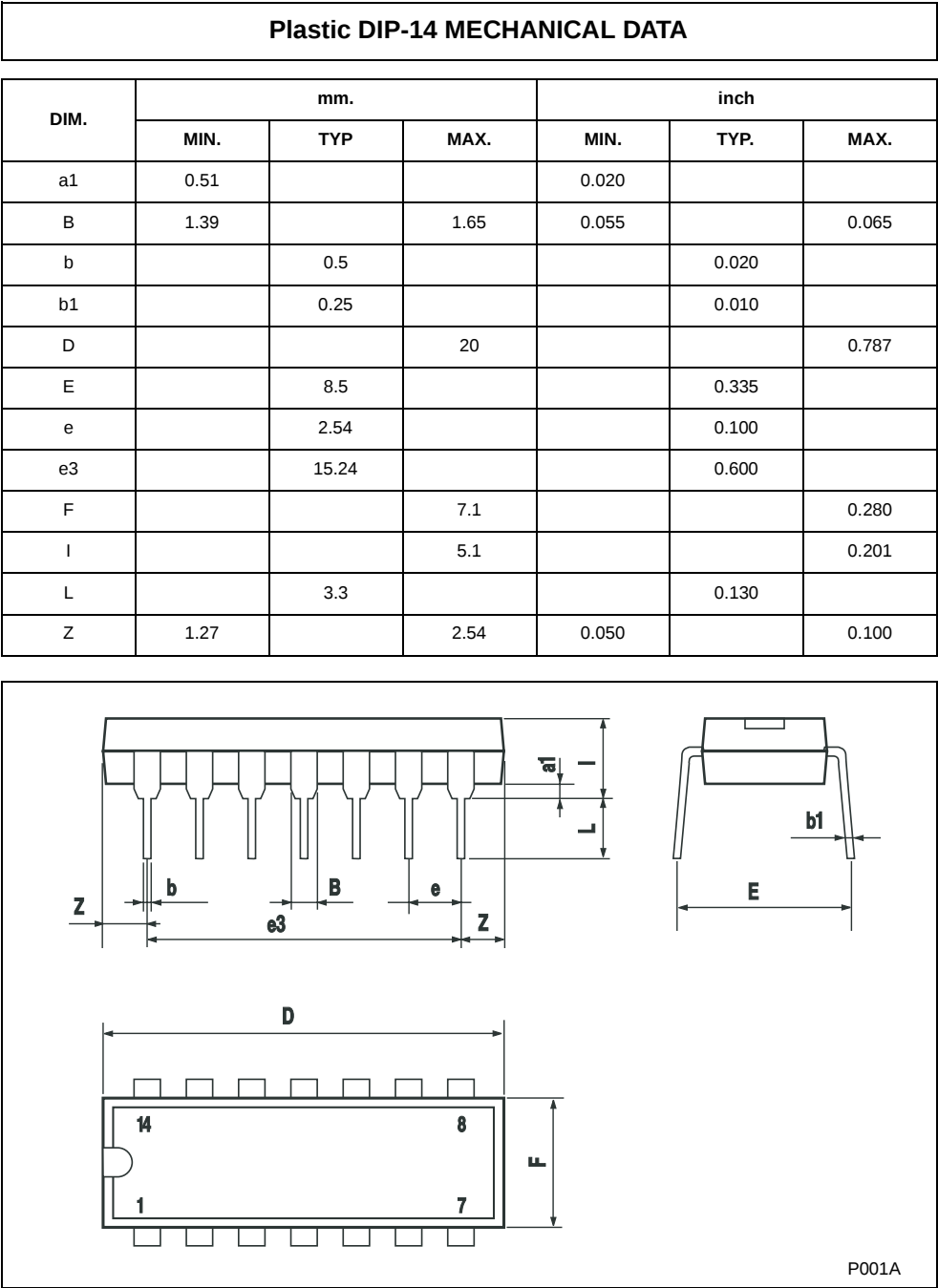


Figure 4. Waveform: propagation delay times ( $f = 1\text{ MHz}$ ; 50% duty cycle)

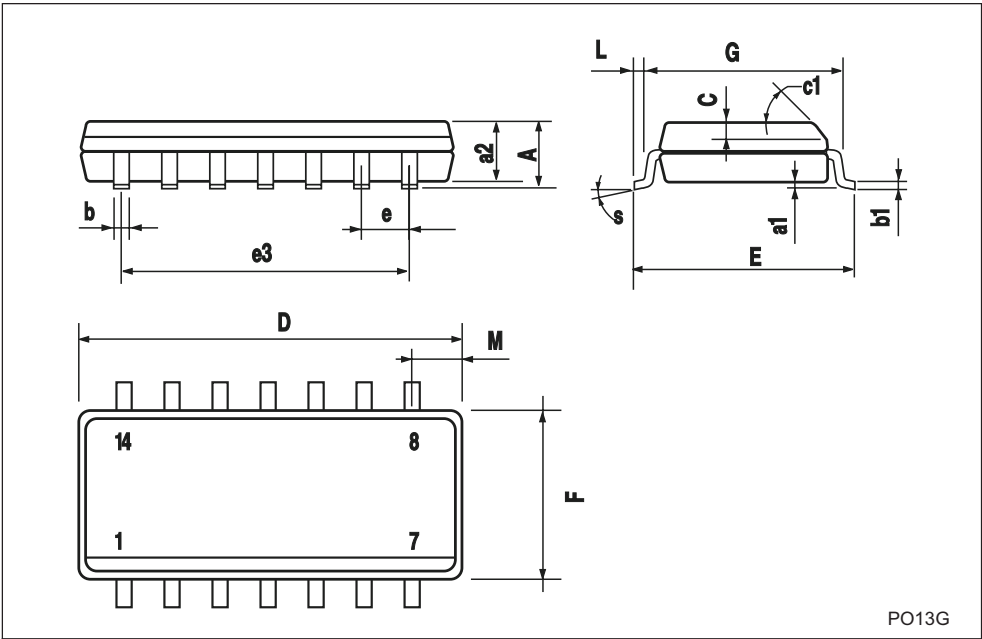


## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com).



| SO-14 MECHANICAL DATA |            |      |      |       |       |       |
|-----------------------|------------|------|------|-------|-------|-------|
| DIM.                  | mm.        |      |      | inch  |       |       |
|                       | MIN.       | TYP. | MAX. | MIN.  | TYP.  | MAX.  |
| A                     |            |      | 1.75 |       |       | 0.068 |
| a1                    | 0.1        |      | 0.2  | 0.003 |       | 0.007 |
| a2                    |            |      | 1.65 |       |       | 0.064 |
| b                     | 0.35       |      | 0.46 | 0.013 |       | 0.018 |
| b1                    | 0.19       |      | 0.25 | 0.007 |       | 0.010 |
| C                     |            | 0.5  |      |       | 0.019 |       |
| c1                    | 45° (typ.) |      |      |       |       |       |
| D                     | 8.55       |      | 8.75 | 0.336 |       | 0.344 |
| E                     | 5.8        |      | 6.2  | 0.228 |       | 0.244 |
| e                     |            | 1.27 |      |       | 0.050 |       |
| e3                    |            | 7.62 |      |       | 0.300 |       |
| F                     | 3.8        |      | 4.0  | 0.149 |       | 0.157 |
| G                     | 4.6        |      | 5.3  | 0.181 |       | 0.208 |
| L                     | 0.5        |      | 1.27 | 0.019 |       | 0.050 |
| M                     |            |      | 0.68 |       |       | 0.026 |
| S                     | 8° (max.)  |      |      |       |       |       |



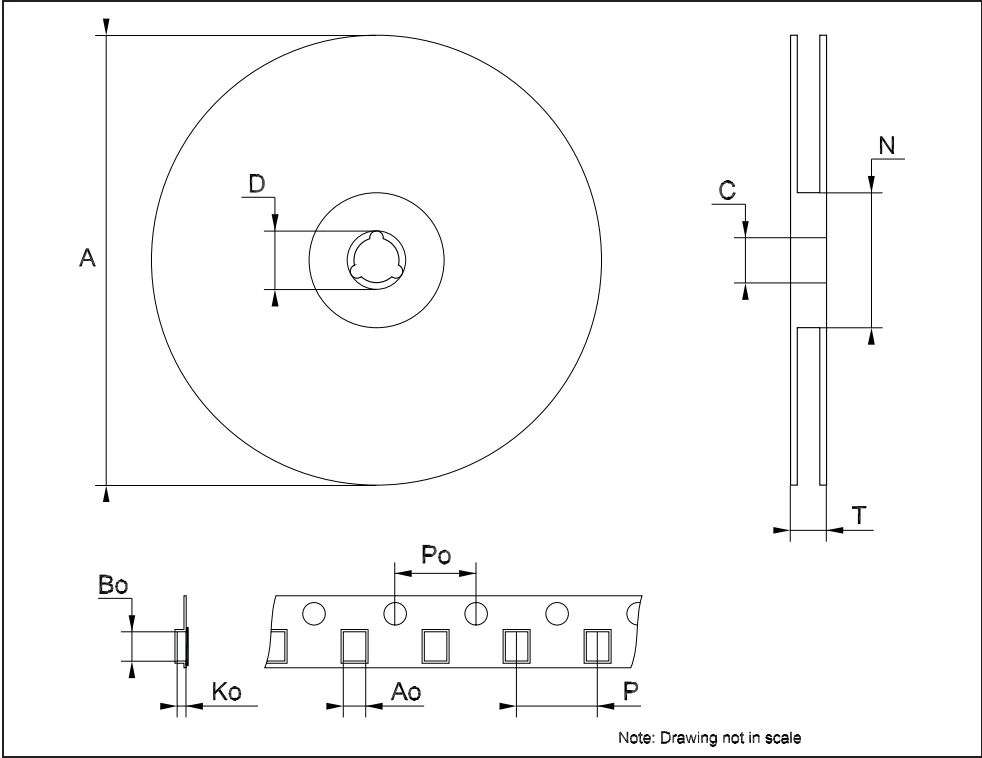
| TSSOP14 MECHANICAL DATA |      |          |      |       |            |        |
|-------------------------|------|----------|------|-------|------------|--------|
| DIM.                    | mm.  |          |      | inch  |            |        |
|                         | MIN. | TYP      | MAX. | MIN.  | TYP.       | MAX.   |
| A                       |      |          | 1.2  |       |            | 0.047  |
| A1                      | 0.05 |          | 0.15 | 0.002 | 0.004      | 0.006  |
| A2                      | 0.8  | 1        | 1.05 | 0.031 | 0.039      | 0.041  |
| b                       | 0.19 |          | 0.30 | 0.007 |            | 0.012  |
| c                       | 0.09 |          | 0.20 | 0.004 |            | 0.0089 |
| D                       | 4.9  | 5        | 5.1  | 0.193 | 0.197      | 0.201  |
| E                       | 6.2  | 6.4      | 6.6  | 0.244 | 0.252      | 0.260  |
| E1                      | 4.3  | 4.4      | 4.48 | 0.169 | 0.173      | 0.176  |
| e                       |      | 0.65 BSC |      |       | 0.0256 BSC |        |
| K                       | 0°   |          | 8°   | 0°    |            | 8°     |
| L                       | 0.45 | 0.60     | 0.75 | 0.018 | 0.024      | 0.030  |

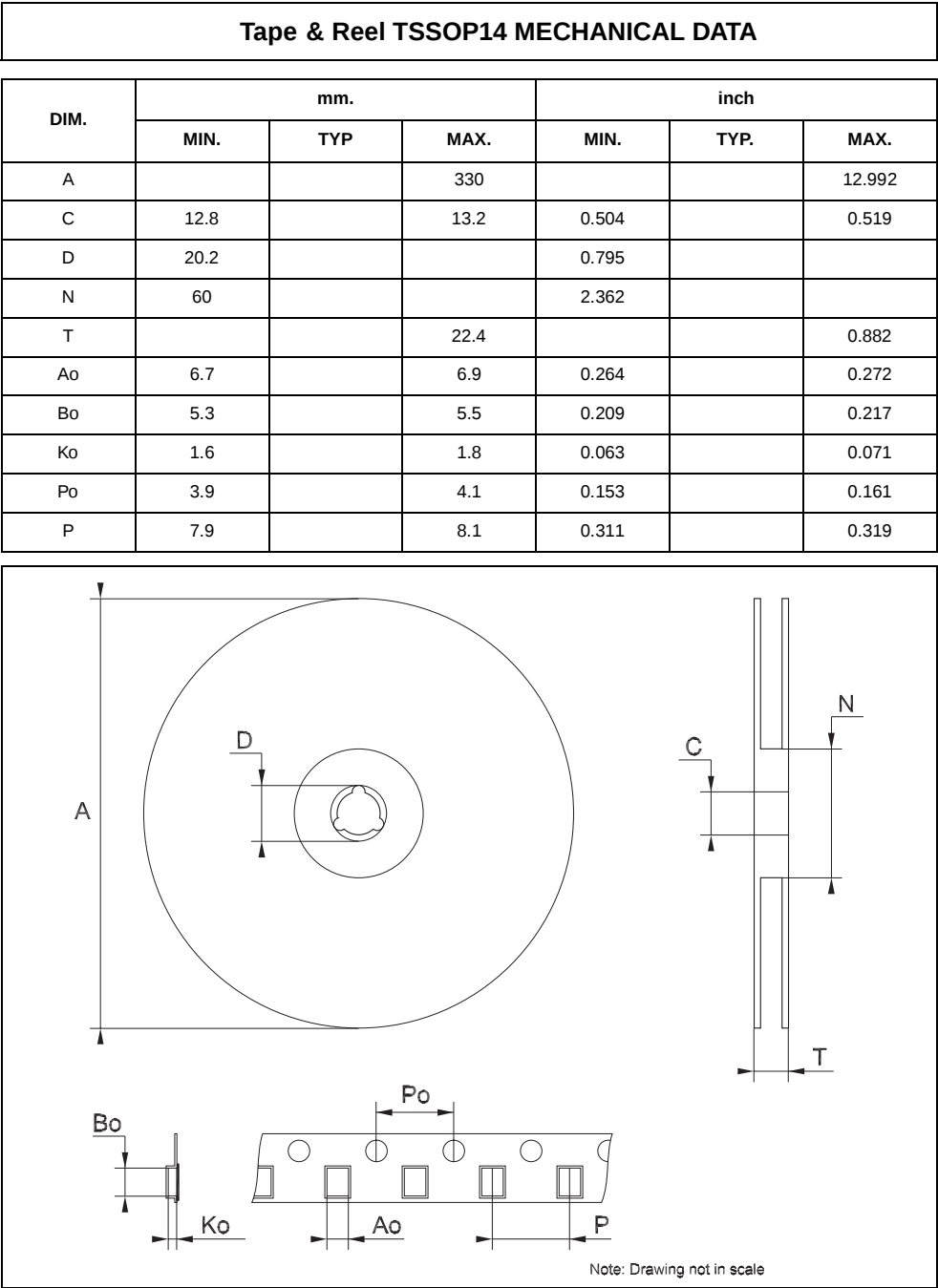
The diagram illustrates the mechanical specifications of the TSSOP14 package. It includes three views: a top view showing dimensions A, A1, A2, b, e, c, D, and E1; a side view showing dimensions K, L, and E; and a pin 1 identification view showing the package footprint and pin 1 location. The package is a 14-pin small outline package with a maximum height of 1.2 mm (0.047 inch) and a maximum width of 6.6 mm (0.260 inch). The pin pitch is 0.65 mm (0.0256 inch). The package is shown with a maximum lead angle of 8°.

0080337D

Tape & Reel SO-14 MECHANICAL DATA

| DIM. | mm.  |     |      | inch  |      |        |
|------|------|-----|------|-------|------|--------|
|      | MIN. | TYP | MAX. | MIN.  | TYP. | MAX.   |
| A    |      |     | 330  |       |      | 12.992 |
| C    | 12.8 |     | 13.2 | 0.504 |      | 0.519  |
| D    | 20.2 |     |      | 0.795 |      |        |
| N    | 60   |     |      | 2.362 |      |        |
| T    |      |     | 22.4 |       |      | 0.882  |
| Ao   | 6.4  |     | 6.6  | 0.252 |      | 0.260  |
| Bo   | 9    |     | 9.2  | 0.354 |      | 0.362  |
| Ko   | 2.1  |     | 2.3  | 0.082 |      | 0.090  |
| Po   | 3.9  |     | 4.1  | 0.153 |      | 0.161  |
| P    | 7.9  |     | 8.1  | 0.311 |      | 0.319  |





## 5 Revision history

**Table 9. Document revision history**

| Date        | Revision | Changes                                                                                                                                                        |
|-------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 01-Jul-2001 | 1        | Initial release.                                                                                                                                               |
| 23-May-2008 | 2        | Document converted and restructured to new template.<br>Removed: M74HC14M1R order code.<br>Added: tape and reel specifications for SO-14 and TSSOP14 packages. |

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