

# DATA SHEET

**74F14**

Hex inverter Schmitt trigger

Product specification

1990 Nov 26

IC15 Data Handbook

# Hex inverter Schmitt trigger

# 74F14

## FEATURE

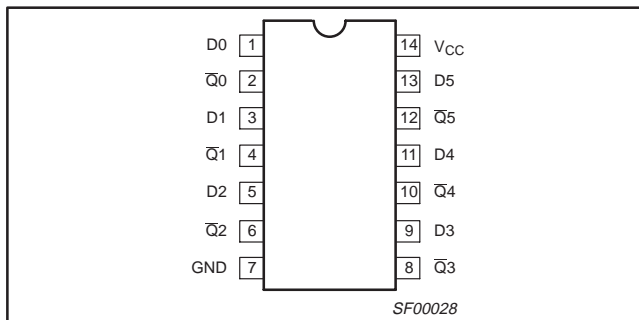
- Industrial temperature range available (−40°C to +85°C)

| TYPE  | TYPICAL PROPAGATION DELAY | TYPICAL SUPPLY CURRENT (TOTAL) |
|-------|---------------------------|--------------------------------|
| 74F14 | 5.0ns                     | 18mA                           |

## DESCRIPTION

The 74F14 contains six logic inverters which accept standard TTL input signals and provide standard TTL output levels. They are capable of transforming slowly changing input signals into sharply defined, jitter free output signals. In addition, they have greater noise margin than conventional inverters. Each circuit contains a Schmitt trigger followed by a Darlington level shifter and a phase splitter driving a TTL totem-pole output. The Schmitt trigger uses positive feedback to effectively speed-up slow input transitions, and provide different input threshold voltages for positive-going and negative-going input threshold (typically 800mV) is determined internally by resistor ratios and is insensitive to temperature and supply voltage variations.

## PIN CONFIGURATION



## ORDERING INFORMATION

| DESCRIPTION        | ORDER CODE   |  | PKG DWG # |
|--------------------|--|--|-----------|
|                    | COMMERCIAL RANGE<br>V <sub>CC</sub> = 5V ±10%, T <sub>amb</sub> = 0°C to +70°C | INDUSTRIAL RANGE<br>V <sub>CC</sub> = 5V ±10%, T <sub>amb</sub> = −40°C to +85°C |           |
| 14-pin plastic DIP | N74F14N  | I74F14N  | SOT27-1   |
| 14-pin plastic SO  | N74F14D  | I74F14D  | SOT108-1  |

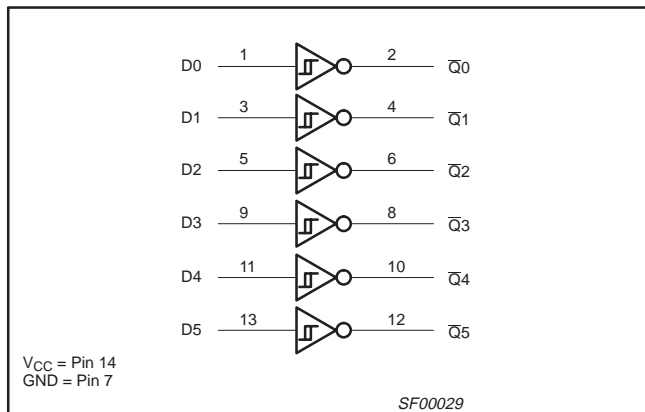
## INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

| PINS           | DESCRIPTION | 74F (U.L.) HIGH/LOW | LOAD VALUE HIGH/LOW |
|----------------|-------------|---------------------|---------------------|
| D <sub>n</sub> | Data inputs | 1.0/1.0             | 20µA/0.6mA          |
| Q <sub>n</sub> | Data output | 50/33               | 1.0mA/20mA          |

### NOTE:

1 One (1.0) FAST unit load is defined as: 20µA in the High state and 0.6mA in the Low state.

## LOGIC DIAGRAM



## FUNCTION TABLE

| INPUTS         | OUTPUT         |
|----------------|----------------|
| D <sub>n</sub> | Q <sub>n</sub> |
| L              | H              |
| H              | L              |

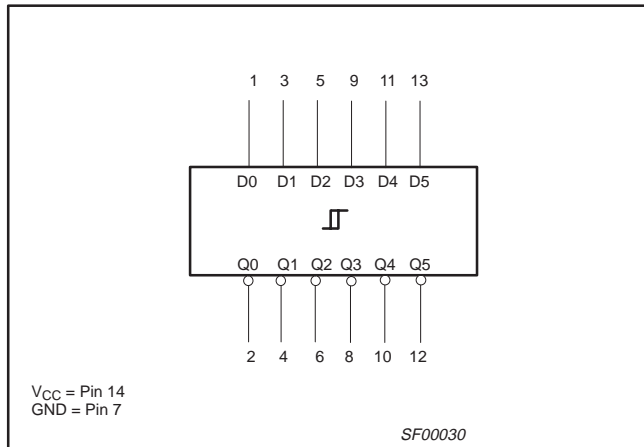
### NOTES:

- H = High voltage level
- L = Low voltage level

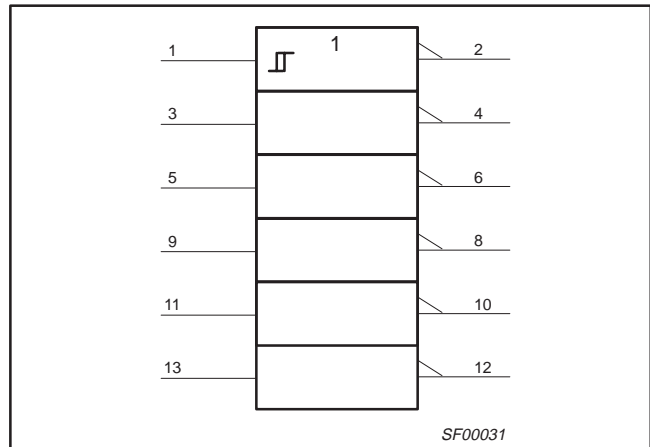
# Hex inverter Schmitt trigger

74F14

## LOGIC SYMBOL



## IEC/IEEE SYMBOL



## ABSOLUTE MAXIMUM RATINGS

(Operation beyond the limits set forth in this table may impair the useful life of the device. Unless otherwise noted these limits are over the operating free-air temperature range.)

| SYMBOL           | PARAMETER                                      | RATING                  | UNIT       |    |
|------------------|--|-------------------------|------------|----|
| V <sub>CC</sub>  | Supply voltage                                 | -0.5 to +7.0            | V          |    |
| V <sub>IN</sub>  | Input voltage                                  | -0.5 to +7.0            | V          |    |
| I <sub>IN</sub>  | Input current                                  | -30 to +5               | mA         |    |
| V <sub>OUT</sub> | Voltage applied to output in high output state | -0.5 to V <sub>CC</sub> | V          |    |
| I <sub>OUT</sub> | Current applied to output in low output state  | 40                      | mA         |    |
| T <sub>amb</sub> | Operating free-air temperature range           | Commercial range        | 0 to +70   | °C |
|                  |  | Industrial range        | -40 to +85 | °C |
| T <sub>stg</sub> | Storage temperature range                      | -65 to +150             | °C         |    |

## RECOMMENDED OPERATING CONDITIONS

| SYMBOL           | PARAMETER                            | LIMITS           |     |     | UNIT |
|------------------|--------------------------------------|------------------|-----|-----|------|
|                  |                                      | MIN              | NOM | MAX |      |
| V <sub>CC</sub>  | Supply voltage                       | 4.5              | 5.0 | 5.5 | V    |
| V <sub>IH</sub>  | High-level input voltage             | 2.0              |     |     | V    |
| V <sub>IL</sub>  | Low-level input voltage              |                  |     | 0.8 | V    |
| I <sub>IK</sub>  | Input clamp current                  |                  |     | -18 | mA   |
| I <sub>OH</sub>  | High-level output current            |                  |     | -1  | mA   |
| I <sub>OL</sub>  | Low-level output current             |                  |     | 20  | mA   |
| T <sub>amb</sub> | Operating free air temperature range | Commercial range | 0   | +70 | °C   |
|                  |                                      | Industrial range | -40 | +85 | °C   |

## Hex inverter Schmitt trigger

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**DC ELECTRICAL CHARACTERISTICS**

(Over recommended operating free-air temperature range unless otherwise noted.)

| SYMBOL       | PARAMETER                                 | TEST CONDITIONS <sup>1</sup>  | LIMITS                |                       |      | UNIT    |    |    |
|--------------|---|---|-----------------------|-----------------------|------|---------|----|----|
|              |   |   | MIN                   | TYP <sup>2</sup>      | MAX  |         |    |    |
| $V_{T+}$     | Positive-going threshold                  | $V_{CC} = 5.0V$   | 1.4                   | 1.7                   | 2.0  | V       |    |    |
| $V_{T-}$     | Negative-going threshold                  | $V_{CC} = 5.0V$   | 0.7                   | 0.9                   | 1.1  | V       |    |    |
| $\Delta V_T$ | Hysteresis ( $V_{T+} - V_{T-}$ )          | $V_{CC} = 5.0V$   | 0.4                   | 0.8                   |      | V       |    |    |
| $V_{OH}$     | High-level output voltage                 | $V_{CC} = \text{MIN}, V_I = V_{T-\text{MIN}},$<br>$I_{OH} = \text{MAX}$ | $\pm 10\%V_{CC}$      | 2.5                   |      | V       |    |    |
|              |   |   | $\pm 5\%V_{CC}$       | 2.7                   | 3.4  | V       |    |    |
| $V_{OL}$     | Low-level output voltage                  | $V_{CC} = \text{MIN}, V_I = V_{T+\text{MAX}},$<br>$I_{OL} = \text{MAX}$ | $\pm 10\%V_{CC}$      |                       | 0.30 | 0.50    | V  |    |
|              |   |   | $\pm 5\%V_{CC}$       |                       | 0.30 | 0.50    | V  |    |
| $V_{IK}$     | Input clamp voltage                       | $V_{CC} = \text{MIN}, I_I = I_{IK}$                                     |                       | -0.73                 | -1.2 | V       |    |    |
| $I_{T+}$     | Input current at positive-going threshold | $V_{CC} = 5.0V, V_I = V_{T+}$   |                       | 0                     |      | $\mu A$ |    |    |
| $I_{T-}$     | Input current at negative-going threshold | $V_{CC} = 5.0V, V_I = V_{T-}$   |                       | -175                  |      | $\mu A$ |    |    |
| $I_I$        | Input current at maximum input voltage    | $V_{CC} = \text{MAX}, V_I = 7.0V$                                       |                       |                       | 100  | $\mu A$ |    |    |
| $I_{IH}$     | High-level input current                  | $V_{CC} = \text{MAX}, V_I = 2.7V$                                       |                       |                       | 20   | $\mu A$ |    |    |
| $I_{IL}$     | Low-level input current                   | $V_{CC} = \text{MAX}, V_I = 0.5V$                                       |                       |                       | -0.6 | mA      |    |    |
| $I_{OS}$     | Short-circuit output current <sup>3</sup> | $V_{CC} = \text{MAX}$   | -60                   |                       | -150 | mA      |    |    |
| $I_{CC}$     | Supply current (total)                    | $I_{CCH}$   | $V_{CC} = \text{MAX}$ | $V_{IN} = \text{GND}$ |      | 13      | 22 | mA |
|              |   | $I_{CCL}$   | $V_{CC} = \text{MAX}$ | $V_{IN} = 4.5V$       |      | 23      | 32 | mA |

**NOTES:**

- For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
- All typical values are at  $V_{CC} = 5V, T_{amb} = 25^\circ C$ .
- Not more than one output should be shorted at a time. For testing  $I_{OS}$ , the use of high-speed test apparatus and/or sample-and-hold techniques are preferable in order to minimize internal heating and more accurately reflect operational values. Otherwise, prolonged shorting of a high output may raise the chip temperature well above normal and thereby cause invalid readings in other parameter tests. In any sequence of parameter tests,  $I_{OS}$  tests should be performed last.

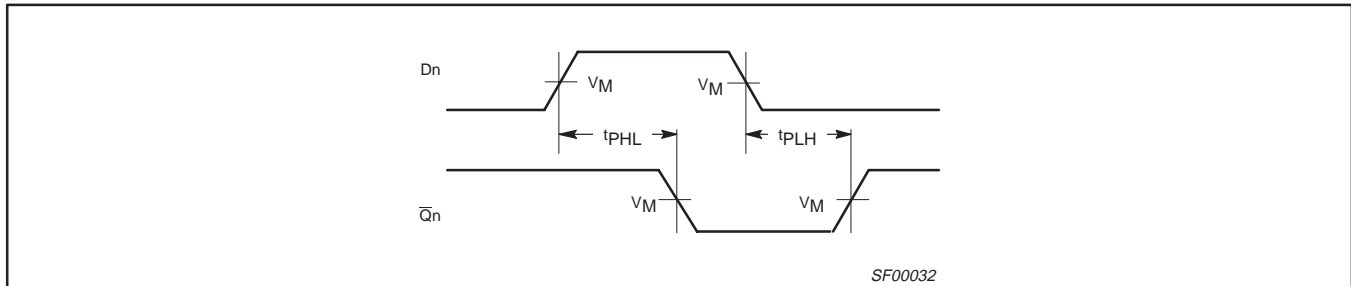
**AC ELECTRICAL CHARACTERISTICS**

| SYMBOL                 | PARAMETER                              | TEST CONDITION | LIMITS   |            |            |   |            |   | UNIT        |     |
|------------------------|--|----------------|--|------------|------------|---|------------|---|-------------|-----|
|                        |  |                | $V_{CC} = +5.0V$<br>$T_{amb} = +25^\circ C$<br>$C_L = 50pF, R_L = 500\Omega$ |            |            | $V_{CC} = +5.0V \pm 10\%$<br>$T_{amb} = 0^\circ C \text{ to } +70^\circ C$<br>$C_L = 50pF, R_L = 500\Omega$ |            | $V_{CC} = +5.0V \pm 10\%$<br>$T_{amb} = -40^\circ C \text{ to } +85^\circ C$<br>$C_L = 50pF, R_L = 500\Omega$ |             |     |
|                        |  |                | MIN  | TYP        | MAX        | MIN   | MAX        | MIN   |             | MAX |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation delay<br>Dn to $\bar{Q}$ n | Waveform 1     | 4.0<br>3.5   | 6.5<br>5.0 | 8.5<br>6.5 | 4.0<br>3.5  | 9.5<br>7.0 | 3.0<br>3.5  | 10.5<br>9.0 | ns  |

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## AC WAVEFORMS

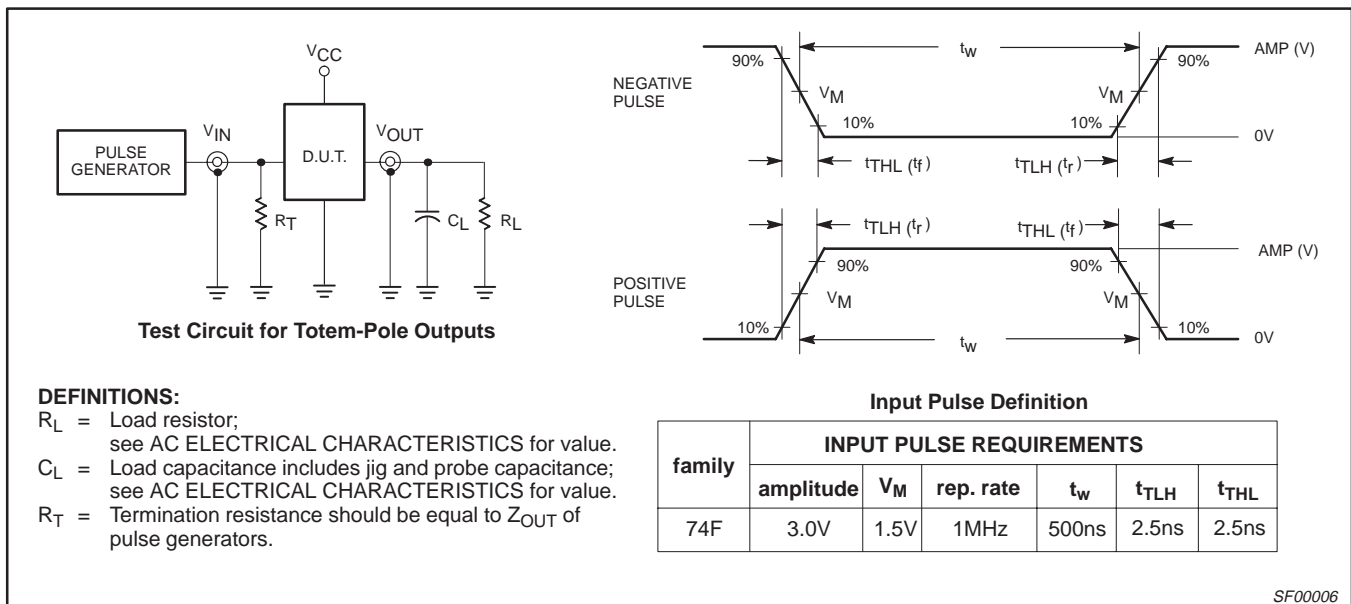


Waveform 1. Propagation delay for inverting outputs

**NOTE:**

For all waveforms, V<sub>M</sub> = 1.5V.

## TEST CIRCUIT AND WAVEFORMS

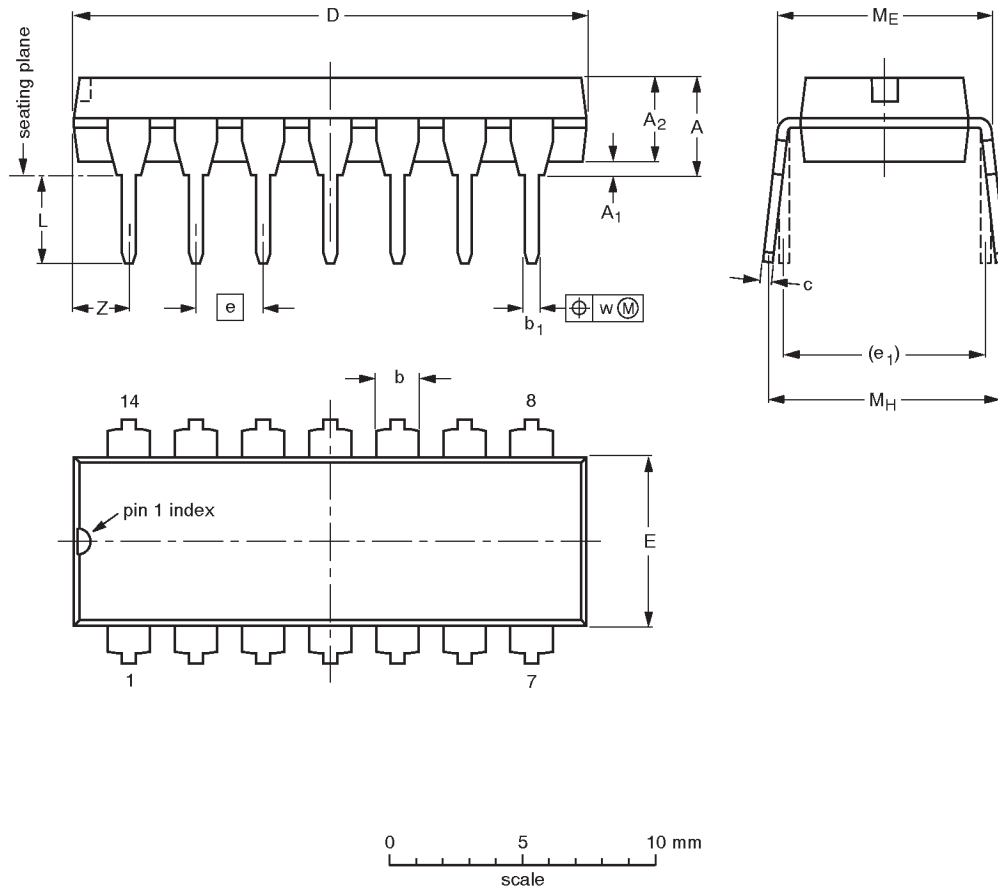


# Hex inverter Schmitt trigger

74F14

DIP14: plastic dual in-line package; 14 leads (300 mil)

SOT27-1



**DIMENSIONS (inch dimensions are derived from the original mm dimensions)**

| UNIT   | A max. | A <sub>1</sub> min. | A <sub>2</sub> max. | b              | b <sub>1</sub> | c              | D <sup>(1)</sup> | E <sup>(1)</sup> | e    | e <sub>1</sub> | L            | M <sub>E</sub> | M <sub>H</sub> | w     | Z <sup>(1)</sup> max. |
|--------|--------|---------------------|---------------------|----------------|----------------|----------------|------------------|------------------|------|----------------|--------------|----------------|----------------|-------|-----------------------|
| mm     | 4.2    | 0.51                | 3.2                 | 1.73<br>1.13   | 0.53<br>0.38   | 0.36<br>0.23   | 19.50<br>18.55   | 6.48<br>6.20     | 2.54 | 7.62           | 3.60<br>3.05 | 8.25<br>7.80   | 10.0<br>8.3    | 0.254 | 2.2                   |
| inches | 0.17   | 0.020               | 0.13                | 0.068<br>0.044 | 0.021<br>0.015 | 0.014<br>0.009 | 0.77<br>0.73     | 0.26<br>0.24     | 0.10 | 0.30           | 0.14<br>0.12 | 0.32<br>0.31   | 0.39<br>0.33   | 0.01  | 0.087                 |

**Note**

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

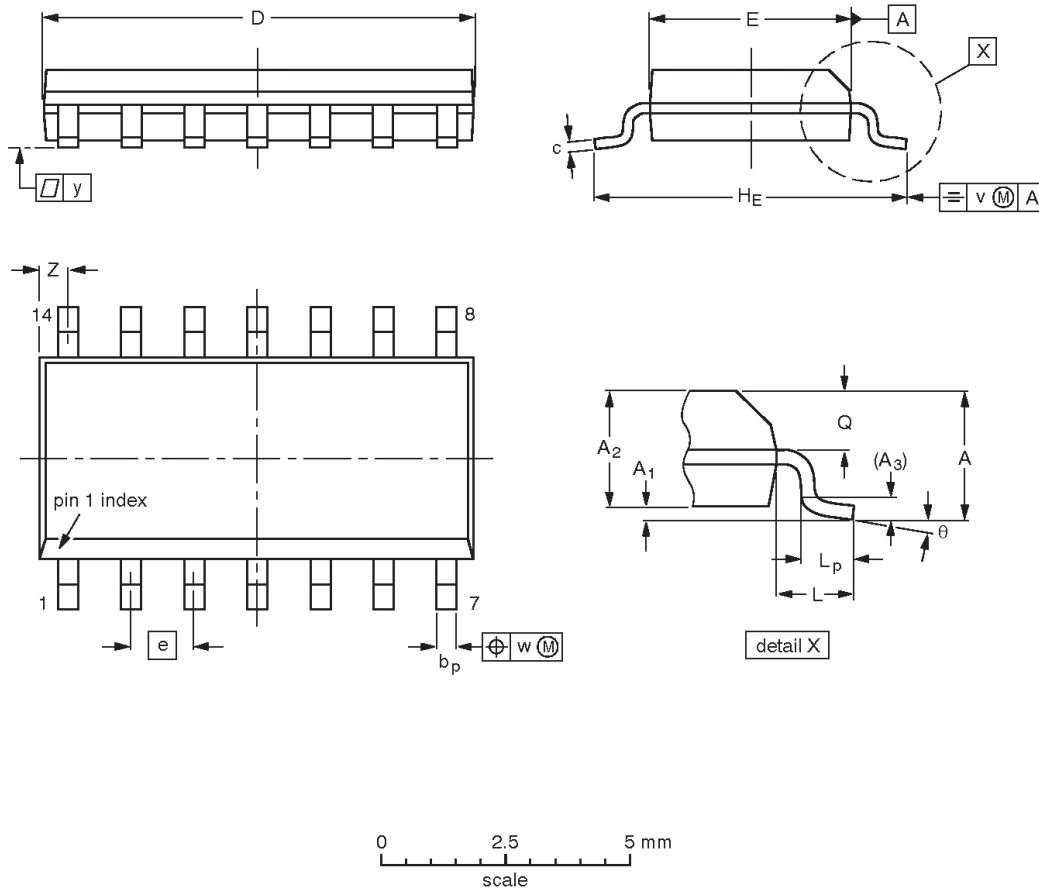
| OUTLINE VERSION | REFERENCES |          |      | EUROPEAN PROJECTION | ISSUE DATE           |
|-----------------|------------|----------|------|---------------------|----------------------|
|                 | IEC        | JEDEC    | EIAJ |                     |                      |
| SOT27-1         | 050G04     | MO-001AA |      |                     | 92-11-17<br>95-03-11 |

# Hex inverter Schmitt trigger

74F14

SO14: plastic small outline package; 14 leads; body width 3.9 mm

SOT108-1



**DIMENSIONS (inch dimensions are derived from the original mm dimensions)**

| UNIT   | A max. | A <sub>1</sub> | A <sub>2</sub> | A <sub>3</sub> | b <sub>p</sub> | c                | D <sup>(1)</sup> | E <sup>(1)</sup> | e     | H <sub>E</sub> | L     | L <sub>p</sub> | Q              | v    | w    | y     | z <sup>(1)</sup> | θ        |
|--------|--------|----------------|----------------|----------------|----------------|------------------|------------------|------------------|-------|----------------|-------|----------------|----------------|------|------|-------|------------------|----------|
| mm     | 1.75   | 0.25<br>0.10   | 1.45<br>1.25   | 0.25           | 0.49<br>0.36   | 0.25<br>0.19     | 8.75<br>8.55     | 4.0<br>3.8       | 1.27  | 6.2<br>5.8     | 1.05  | 1.0<br>0.4     | 0.7<br>0.6     | 0.25 | 0.25 | 0.1   | 0.7<br>0.3       | 8°<br>0° |
| inches | 0.069  | 0.010<br>0.004 | 0.057<br>0.049 | 0.01           | 0.019<br>0.014 | 0.0100<br>0.0075 | 0.35<br>0.34     | 0.16<br>0.15     | 0.050 | 0.244<br>0.228 | 0.041 | 0.039<br>0.016 | 0.028<br>0.024 | 0.01 | 0.01 | 0.004 | 0.028<br>0.012   |          |

**Note**

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES |          |      | EUROPEAN PROJECTION | ISSUE DATE           |
|-----------------|------------|----------|------|---------------------|----------------------|
|                 | IEC        | JEDEC    | EIAJ |                     |                      |
| SOT108-1        | 076E06S    | MS-012AB |      |                     | 95-01-23<br>97-05-22 |

## Hex inverter Schmitt trigger

74F14

## Data sheet status

| Data sheet status         | Product status | Definition [1]   |
|---------------------------|----------------|--|
| Objective specification   | Development    | This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice.  |
| Preliminary specification | Qualification  | This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product. |
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[1] Please consult the most recently issued datasheet before initiating or completing a design.

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## Features

- Industrial temperature range available (-40°C to +85°C)

## Applications

- [AN202\\_1: Testing and specifying FAST logic](#) (date 01-Jun-87)
- [AN2021\\_1: Thermal considerations for FAST logic products](#) (date 13-Mar-95)
- [AN203\\_2: Test Fixtures for High Speed Logic](#) (date 02-Apr-98)
- [AN216\\_2: Arbitration in shared resource systems](#) (date 18-Jul-88)

## Datasheet

| Type number | Title                        | Publication release date | Datasheet status      | Page count | File size (kB) | Datasheet                |
|-------------|------------------------------|--------------------------|-----------------------|------------|----------------|--------------------------|
| 74F14       | Hex inverter Schmitt trigger | 11/26/1990               | Product specification | 8          | 80             | <a href="#">Download</a> |

## Blockdiagram(s)

[Block diagram of N74F14N](#)

## ▣ Parametrics

| Type number | Package                         | Description                  | Propagation Delay(ns) | Voltage   | No. of Pins | Power Dissipation Considerations | Logic Switching Levels | Output Drive Capability |
|-------------|---------------------------------|------------------------------|-----------------------|-----------|-------------|----------------------------------|------------------------|-------------------------|
| I74F14D     | <a href="#">SOT108-1</a> (SO14) | Hex Inverter Schmitt-Trigger | 6~10                  | 5 Volts + | 14          | None                             | TTL                    | Low                     |
| I74F14N     | <a href="#">SOT27-1</a> (DIP14) | Hex Inverter Schmitt-Trigger | 6~10                  | 5 Volts + | 14          | None                             | TTL                    | Low                     |
| N74F14D     | <a href="#">SOT108-1</a> (SO14) | Hex Inverter Schmitt-Trigger | 6~10                  | 5 Volts + | 14          | None                             | TTL                    | Low                     |
| N74F14N     | <a href="#">SOT27-1</a> (DIP14) | Hex Inverter Schmitt-Trigger | 6~10                  | 5 Volts + | 14          | None                             | TTL                    | Low                     |

## ▣ Products, packages, availability and ordering

| <u>Type number</u> | <u>North American type number</u> | <u>Ordering code (12NC)</u> | <u>Marking/Packing</u><br><a href="#">Discretes packing info</a> | <u>Package</u>                  | <u>Device status</u> | <u>Buy online</u>                                   |
|--------------------|-----------------------------------|-----------------------------|--|---------------------------------|----------------------|---|
| I74F14D            | I74F14D                           | 9350 331 10602              | Standard Marking * Tube (Signetics)                              | <a href="#">SOT108-1</a> (SO14) | Full production      | <a href="#">order this</a> <input type="checkbox"/> |
|                    | I74F14 D                          | 9350 331 10623              | Standard Marking * Reel Pack, SMD, 13" (Signetics)               | <a href="#">SOT108-1</a> (SO14) | Full production      | <a href="#">order this</a> <input type="checkbox"/> |
| I74F14N            | I74F14N                           | 9350 331 20602              | Standard Marking * Tube (Signetics)                              | <a href="#">SOT27-1</a> (DIP14) | Full production      | <a href="#">order this</a> <input type="checkbox"/> |
| N74F14D            | N74F14D                           | 9337 393 70602              | Standard Marking * Tube (Signetics)                              | <a href="#">SOT108-1</a> (SO14) | Full production      | <a href="#">order this</a> <input type="checkbox"/> |
|                    | N74F14D-T                         | 9337 393 70623              | Standard Marking * Reel Pack, SMD, 13" (Signetics)               | <a href="#">SOT108-1</a> (SO14) | Full production      | <a href="#">order this</a> <input type="checkbox"/> |
| N74F14N            | N74F14N                           | 9337 066 90602              | Standard Marking * Tube (Signetics)                              | <a href="#">SOT27-1</a> (DIP14) | Full production      | <a href="#">order this</a> <input type="checkbox"/> |

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