

SNx4HC14 Hex Inverters with Schmitt-Trigger Inputs

1 Features

- Buffered inputs
- Wide operating voltage range: 2V to 6V
- Wide operating temperature range: -40°C to +85°C
- Supports fanout up to 10 LSTTL loads
- Significant power reduction compared to LSTTL logic ICs

2 Applications

- [Synchronize inverted clock inputs](#)
- [Debounce a switch](#)
- Invert a digital signal

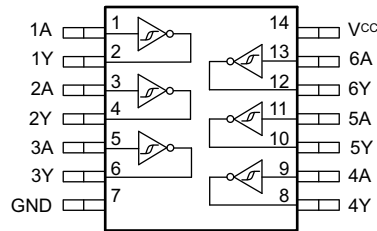
3 Description

This device contains six independent inverters with Schmitt-trigger inputs. Each gate performs the Boolean function $Y = \bar{A}$ in positive logic.

Device Information

| PART NUMBER | PACKAGE ⁽¹⁾ | PACKAGE SIZE ⁽²⁾ | BODY SIZE ⁽³⁾ |
|-------------|------------------------|-----------------------------|--------------------------|
| SN74AHC14 | D (SOIC, 14) | 8.65mm × 6mm | 8.65mm × 3.9mm |
| | DB (SSOP, 14) | 6.2 mm × 7.8mm | 6.2mm × 5.30mm |
| | N (PDIP, 14) | 19.3mm × 9.4mm | 19.3mm × 6.35mm |
| | NS (SOP, 14) | 10.2mm × 7.8mm | 10.3mm × 5.3mm |
| SN54AHC14 | PW (TSSOP, 14) | 5mm × 6.4mm | 5mm × 4.4mm |
| | J (CDIP, 14) | 19.56mm × 7.9mm | 19.56mm × 6.67mm |
| | W (CFP, 14) | 9.21mm × 9mm | 9.21mm × 6.3mm |
| | FK (LCCC, 20) | 8.9mm × 8.9mm | 8.9mm × 8.9mm |

- (1) For more information, see [Section 11](#).
- (2) The package size (length × width) is a nominal value and includes pins, where applicable.
- (3) The body size (length × width) is a nominal value and does not include pins.



Functional pinout



Table of Contents

| | | | |
|--|---|--|----|
| 1 Features | 1 | 7.2 Functional Block Diagram..... | 9 |
| 2 Applications | 1 | 7.3 Feature Description..... | 9 |
| 3 Description | 1 | 7.4 Device Functional Modes..... | 10 |
| 4 Pin Configuration and Functions | 3 | 8 Application and Implementation | 11 |
| 5 Specifications | 4 | 8.1 Application Information..... | 11 |
| 5.1 Absolute Maximum Ratings..... | 4 | 8.2 Typical Application..... | 11 |
| 5.2 ESD Ratings..... | 4 | 8.3 Power Supply Recommendations..... | 13 |
| 5.3 Recommended Operating Conditions..... | 4 | 8.4 Layout..... | 13 |
| 5.4 Thermal Information..... | 4 | 9 Device and Documentation Support | 14 |
| 5.5 Electrical Characteristics - 74..... | 5 | 9.1 Documentation Support..... | 14 |
| 5.6 Electrical Characteristics - 54..... | 5 | 9.2 Support Resources..... | 14 |
| 5.7 Switching Characteristics - 74..... | 6 | 9.3 Trademarks..... | 14 |
| 5.8 Switching Characteristics - 54..... | 7 | 9.4 Electrostatic Discharge Caution..... | 14 |
| 5.9 Operating Characteristics..... | 7 | 9.5 Glossary..... | 14 |
| 5.10 Typical Characteristics..... | 7 | 10 Revision History | 14 |
| 6 Parameter Measurement Information | 8 | 11 Mechanical, Packaging, and Orderable Information | 14 |
| 7 Detailed Description | 9 | | |
| 7.1 Overview..... | 9 | | |

4 Pin Configuration and Functions

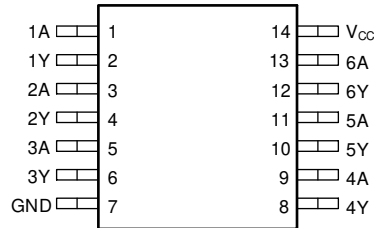


Figure 4-1. D, DB, N, NS, PW, J, or W Package 14-Pin SOIC, SSOP, PDIP, SO, TSSOP, CDIP, or CFP Top View

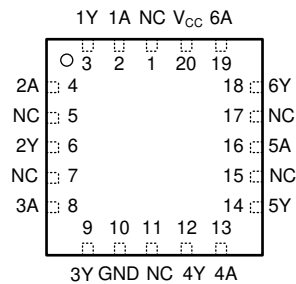


Figure 4-2. FK Package 20-Pin LCCC Top View

Pin Functions

| NAME | PIN | | I/O | DESCRIPTION |
|-----------------|---------------------------|---------------------|--------|--------------------------|
| | D, DB, N, NS, PW, J, or W | FK | | |
| 1A | 1 | 2 | Input | Channel 1, Input A |
| 1Y | 2 | 3 | Output | Channel 1, Output Y |
| 2A | 3 | 4 | Input | Channel 2, Input A |
| 2Y | 4 | 6 | Output | Channel 2, Output Y |
| 3A | 5 | 8 | Input | Channel 3, Input A |
| 3Y | 6 | 9 | Output | Channel 3, Output Y |
| GND | 7 | 10 | — | Ground |
| 4Y | 8 | 12 | Output | Channel 4, Output Y |
| 4A | 9 | 13 | Input | Channel 4, Input A |
| 5Y | 10 | 14 | Output | Channel 5, Output Y |
| 5A | 11 | 16 | Input | Channel 5, Input A |
| 6Y | 12 | 18 | Output | Channel 6, Output Y |
| 6A | 13 | 19 | Input | Channel 6, Input A |
| V _{CC} | 14 | 20 | — | Positive Supply |
| NC | | 1, 5, 7, 11, 15, 17 | — | Not internally connected |

5 Specifications

5.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)⁽¹⁾

| | | MIN | MAX | UNIT |
|------------------|---|--|-----|--------|
| V _{CC} | Supply voltage | -0.5 | 7 | V |
| I _{IK} | Input clamp current ⁽²⁾ | V _I < 0 or V _I > V _{CC} | | ±20 mA |
| I _{OK} | Output clamp current ⁽²⁾ | V _O < 0 | | ±20 mA |
| I _O | Continuous output current | V _O = 0 to V _{CC} | | ±25 mA |
| | Continuous current through V _{CC} or GND | | | ±50 mA |
| T _J | Junction temperature ⁽³⁾ | | | 150 °C |
| T _{stg} | Storage temperature | -60 | 150 | °C |

(1) Stresses beyond those listed under *Absolute Maximum Rating* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Condition*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2) The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

(3) Guaranteed by design.

5.2 ESD Ratings

| | | | VALUE | UNIT |
|--------------------|-------------------------|--|-------|------|
| V _(ESD) | Electrostatic discharge | Human-body model (HBM), per ANSI/ESDA/ JEDEC JS-001 ⁽¹⁾ | ±2000 | V |
| | | Charged-device model (CDM), per JEDEC specification JESD22-C101 ⁽²⁾ | ±1500 | |

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

5.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

| | | MIN | NOM | MAX | UNIT |
|-----------------|--------------------------------|----------|-----|-----------------|------|
| V _{CC} | Supply voltage | 2 | 5 | 6 | V |
| V _I | Input voltage | 0 | | V _{CC} | V |
| V _O | Output voltage | 0 | | V _{CC} | V |
| T _A | Operating free-air temperature | SN54HC14 | | 125 | °C |
| | | SN74HC14 | -40 | 85 | |

5.4 Thermal Information

| THERMAL METRIC ⁽¹⁾ | | SN74HC14 | | | | | UNIT |
|-------------------------------|--|----------|-----------|----------|---------|------------|------|
| | | D (SOIC) | DB (SSOP) | N (PDIP) | NS (SO) | PW (TSSOP) | |
| | | 14 PINS | 14 PINS | 14 PINS | 14 PINS | 14 PINS | |
| R _{θJA} | Junction-to-ambient thermal resistance | 133.6 | 114.8 | 60.7 | 122.6 | 151.7 | °C/W |
| R _{θJC(top)} | Junction-to-case (top) thermal resistance | 89 | 64.5 | 47.8 | 81.8 | 79.4 | °C/W |
| R _{θJB} | Junction-to-board thermal resistance | 89.5 | 65.1 | 40.6 | 83.8 | 94.7 | °C/W |
| Ψ _{JT} | Junction-to-top characterization parameter | 45.5 | 23.7 | 26.9 | 45.4 | 25.2 | °C/W |
| Ψ _{JB} | Junction-to-board characterization parameter | 89.1 | 64.4 | 40.5 | 83.4 | 94.1 | °C/W |

| THERMAL METRIC ⁽¹⁾ | | SN74HC14 | | | | | UNIT |
|-------------------------------|--|----------|-----------|----------|---------|------------|------|
| | | D (SOIC) | DB (SSOP) | N (PDIP) | NS (SO) | PW (TSSOP) | |
| | | 14 PINS | 14 PINS | 14 PINS | 14 PINS | 14 PINS | |
| $R_{\theta_{JC(bot)}}$ | Junction-to-case (bottom) thermal resistance | N/A | N/A | N/A | N/A | N/A | °C/W |

(1) For more information about traditional and new thermal metrics, see the [Semiconductor and IC Package Thermal Metrics](#) application report.

5.5 Electrical Characteristics - 74

over operating free-air temperature range; typical values measured at $T_A = 25^\circ\text{C}$ (unless otherwise noted).

| PARAMETER | | TEST CONDITIONS | | V_{CC} | Operating free-air temperature (T_A) | | | | | | UNIT |
|--------------|----------------------------------|----------------------------|----------------------------|----------|--|-------|------|---------------|------|---------|---------------|
| | | | | | 25°C | | | -40°C to 85°C | | | |
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| V_{T+} | Positive switching threshold | | | 2 V | 0.7 | 1.2 | 1.5 | 0.7 | | 1.5 | V |
| | | | | 4.5 V | 1.55 | 2.5 | 3.13 | 1.55 | | 3.13 | |
| | | | | 6 V | 2.1 | 3.3 | 4.2 | 2.1 | | 4.2 | |
| V_{T-} | Negative switching threshold | | | 2 V | 0.3 | 0.6 | 1 | 0.3 | | 1 | V |
| | | | | 4.5 V | 0.9 | 1.6 | 2.45 | 0.9 | | 2.45 | |
| | | | | 6 V | 1.2 | 2 | 3.2 | 1.2 | | 3.2 | |
| ΔV_T | Hysteresis ($V_{T+} - V_{T-}$) | | | 2 V | 0.2 | 0.6 | 1.2 | 0.2 | | 1.2 | V |
| | | | | 4.5 V | 0.4 | 0.9 | 2.1 | 0.4 | | 2.1 | |
| | | | | 6 V | 0.5 | 1.3 | 2.5 | 0.5 | | 2.5 | |
| V_{OH} | High-level output voltage | $V_I = V_{IH}$ or V_{IL} | $I_{OH} = -20 \mu\text{A}$ | 2 V | 1.9 | 1.998 | | 1.9 | | | V |
| | | | | 4.5 V | 4.4 | 4.499 | | 4.4 | | | |
| | | | 6 V | 5.9 | 5.999 | | 5.9 | | | | |
| | | | $I_{OH} = -4 \text{ mA}$ | 4.5 V | 3.98 | 4.3 | | 3.84 | | | |
| | | | $I_{OH} = -5.2 \text{ mA}$ | 6 V | 5.48 | 5.8 | | 5.34 | | | |
| V_{OL} | Low-level output voltage | $V_I = V_{IH}$ or V_{IL} | $I_{OL} = 20 \mu\text{A}$ | 2 V | | 0.002 | 0.1 | | | 0.1 | V |
| | | | | 4.5 V | | 0.001 | 0.1 | | 0.1 | | |
| | | | 6 V | | 0.001 | 0.1 | | 0.1 | | | |
| | | | $I_{OL} = 4 \text{ mA}$ | 4.5 V | | 0.17 | 0.26 | | 0.33 | | |
| | | | $I_{OL} = 5.2 \text{ mA}$ | 6 V | | 0.15 | 0.26 | | 0.33 | | |
| I_I | Input leakage current | $V_I = V_{CC}$ or 0 | | 6 V | | | | ± 0.1 | | ± 1 | μA |
| I_{CC} | Supply current | $V_I = V_{CC}$ or 0 | $I_O = 0$ | 6 V | | | | 2 | | 20 | μA |
| C_i | Input capacitance | | | 5 V | | 3 | 10 | | | 10 | pF |

5.6 Electrical Characteristics - 54

over operating free-air temperature range; typical values measured at $T_A = 25^\circ\text{C}$ (unless otherwise noted).

| PARAMETER | | TEST CONDITIONS | | V_{CC} | Operating free-air temperature (T_A) | | | | | | | | | UNIT |
|-----------|------------------------------|-----------------|--|----------|--|-----|------|---------------|-----|------|----------------|-----|------|------|
| | | | | | 25°C | | | -40°C to 85°C | | | -55°C to 125°C | | | |
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | |
| V_{T+} | Positive switching threshold | | | 2 V | 0.7 | 1.2 | 1.5 | 0.7 | | 1.5 | 0.7 | | 1.5 | V |
| | | | | 4.5 V | 1.55 | 2.5 | 3.13 | 1.55 | | 3.13 | 1.55 | | 3.13 | |
| | | | | 6 V | 2.1 | 3.3 | 4.2 | 2.1 | | 4.2 | 2.1 | | 4.2 | |

over operating free-air temperature range; typical values measured at TA = 25°C (unless otherwise noted).

| PARAMETER | | TEST CONDITIONS | | V _{CC} | Operating free-air temperature (T _A) | | | | | | | | | UNIT | |
|-----------------|---|---|---------------------------|-----------------|--|-------|------|---------------|-----|------|----------------|-----|------|------|------|
| | | | | | 25°C | | | –40°C to 85°C | | | –55°C to 125°C | | | | |
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | | |
| V _{T-} | Negative switching threshold | | | 2 V | 0.3 | 0.6 | 1 | 0.3 | | 1 | 0.3 | | 1 | V | |
| | | | | 4.5 V | 0.9 | 1.6 | 2.45 | 0.9 | | 2.45 | 0.9 | | 2.45 | | |
| | | | | 6 V | 1.2 | 2 | 3.2 | 1.2 | | 3.2 | 1.2 | | 3.2 | | |
| ΔV _T | Hysteresis (V _{T+} - V _{T-}) | | | 2 V | 0.2 | 0.6 | 1.2 | 0.2 | | 1.2 | 0.2 | | 1.2 | V | |
| | | | | 4.5 V | 0.4 | 0.9 | 2.1 | 0.4 | | 2.1 | 0.4 | | 2.1 | | |
| | | | | 6 V | 0.5 | 1.3 | 2.5 | 0.5 | | 2.5 | 0.5 | | 2.5 | | |
| V _{OH} | High-level output voltage | V _I = V _{IH} or V _{IL} | I _{OH} = –20 μA | 2 V | 1.9 | 1.998 | | 1.9 | | | 1.9 | | | V | |
| | | | | 4.5 V | 4.4 | 4.499 | | 4.4 | | | 4.4 | | | | |
| | | | | 6 V | 5.9 | 5.999 | | 5.9 | | | 5.9 | | | | |
| | | | | 4.5 V | 3.98 | 4.3 | | 3.84 | | | 3.7 | | | | |
| | | | I _{OH} = –4 mA | 4.5 V | | | | | | | | | | | |
| | | | I _{OH} = –5.2 mA | 6 V | 5.48 | 5.8 | | 5.34 | | | 5.2 | | | | |
| V _{OL} | Low-level output voltage | V _I = V _{IH} or V _{IL} | I _{OL} = 20 μA | 2 V | | 0.002 | 0.1 | | | 0.1 | | | 0.1 | V | |
| | | | | 4.5 V | | 0.001 | 0.1 | | | 0.1 | | | 0.1 | | |
| | | | | 6 V | | 0.001 | 0.1 | | | 0.1 | | | 0.1 | | |
| | | | | 4.5 V | | | 0.17 | 0.26 | | | 0.33 | | | | 0.33 |
| | | | | 6 V | | | 0.15 | 0.26 | | | 0.33 | | | | 0.33 |
| | | | I _{OL} = 5.2 mA | 6 V | | | | | | | | | | | |
| I _I | Input leakage current | V _I = V _{CC} or 0 | | 6 V | | | ±0.1 | | | ±1 | | ±1 | μA | | |
| I _{CC} | Supply current | V _I = V _{CC} or 0 | I _O = 0 | 6 V | | | 2 | | | 20 | | 40 | μA | | |
| C _i | Input capacitance | | | 2 V to 6 V | | 3 | 10 | | | 10 | | 10 | pF | | |

5.7 Switching Characteristics - 74

over operating free-air temperature range (unless otherwise noted)

| PARAMETER | | FROM | TO | V _{CC} | Operating free-air temperature (T _A) | | | | | | UNIT |
|-----------------|-------------------|------|----|-----------------|--|-----|-----|---------------|-----|-----|------|
| | | | | | 25°C | | | –40°C to 85°C | | | |
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| t _{pd} | Propagation delay | A | Y | 2 V | | 55 | 125 | | | 155 | ns |
| | | | | 4.5 V | | 12 | 25 | | | 31 | |
| | | | | 6 V | | 11 | 21 | | | 26 | |
| t _t | Transition-time | | Y | 2 V | | 38 | 75 | | | 95 | ns |
| | | | | 4.5 V | | 8 | 15 | | | 19 | |
| | | | | 6 V | | 6 | 13 | | | 16 | |

5.8 Switching Characteristics - 54

over operating free-air temperature range; typical values measured at $T_A = 25^\circ\text{C}$ (unless otherwise noted).

| PARAMETER | FROM | TO | V_{CC} | Operating free-air temperature (T_A) | | | | | | UNIT | | | |
|-----------|-------------------|----|----------|--|-----|-----|---------------|-----|-----|------|----------------|-----|-----|
| | | | | 25°C | | | -40°C to 85°C | | | | -55°C to 125°C | | |
| | | | | MIN | TYP | MAX | MIN | TYP | MAX | | MIN | TYP | MAX |
| t_{pd} | Propagation delay | A | Y | 2 V | 55 | 125 | | | 155 | | 190 | ns | |
| | | | | 4.5 V | 12 | 25 | | | 31 | | 38 | | |
| | | | | 6 V | 11 | 21 | | | 26 | | 22 | | |
| t_t | Transition-time | | Y | 2 V | 38 | 75 | | | 95 | | 110 | ns | |
| | | | | 4.5 V | 8 | 15 | | | 19 | | 22 | | |
| | | | | 6 V | 6 | 13 | | | 16 | | 19 | | |

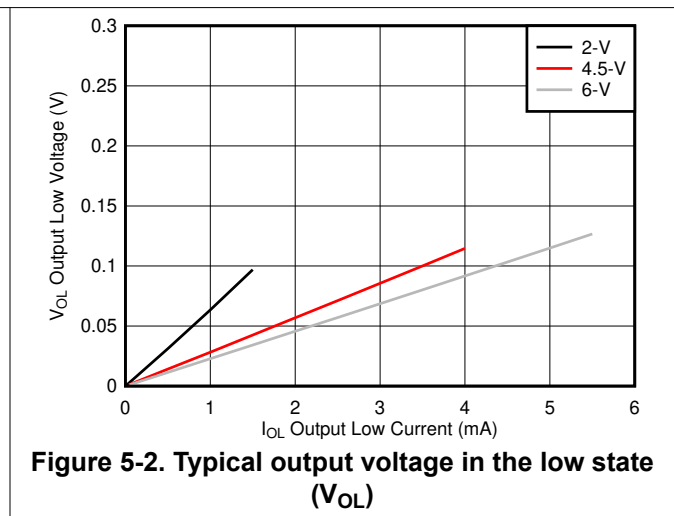
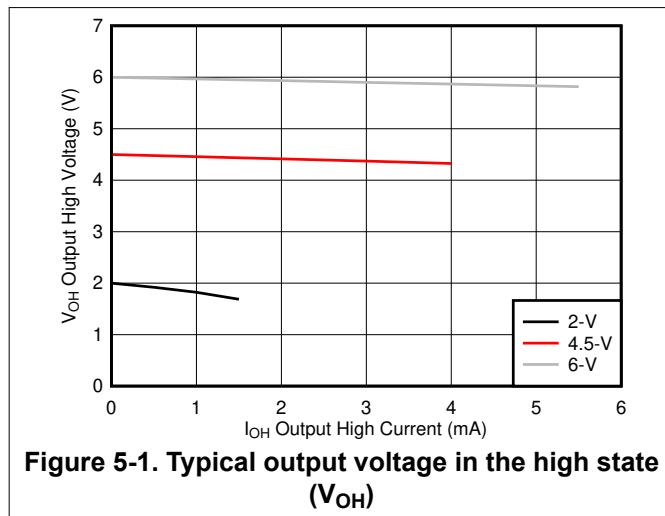
5.9 Operating Characteristics

over operating free-air temperature range; typical values measured at $T_A = 25^\circ\text{C}$ (unless otherwise noted).

| PARAMETER | TEST CONDITIONS | V_{CC} | MIN | TYP | MAX | UNIT |
|-----------|---|------------|-----|-----|-----|------|
| C_{pd} | Power dissipation capacitance per gate No load | 2 V to 6 V | | 20 | | pF |

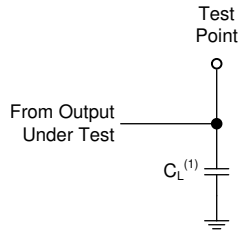
5.10 Typical Characteristics

$T_A = 25^\circ\text{C}$



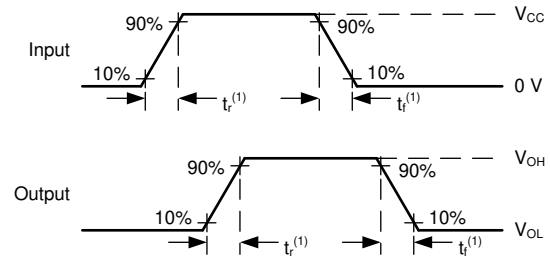
6 Parameter Measurement Information

- Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1 \text{ MHz}$, $Z_O = 50 \Omega$, $t_t < 6 \text{ ns}$.
- The outputs are measured one at a time, with one input transition per measurement.



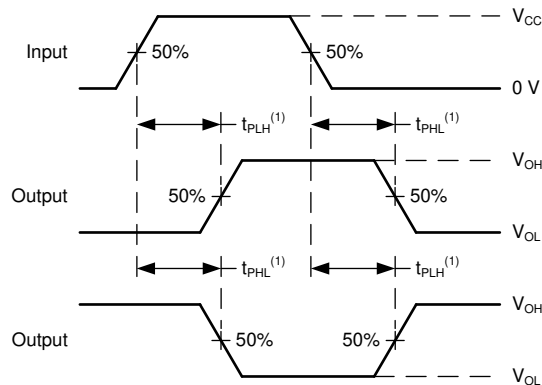
A. $C_L = 50 \text{ pF}$ and includes probe and jig capacitance.

Figure 6-1. Load Circuit



A. t_t is the greater of t_r and t_f .

Figure 6-2. Voltage Waveforms Transition Times



A. The maximum between t_{PLH} and t_{PHL} is used for t_{pd} .

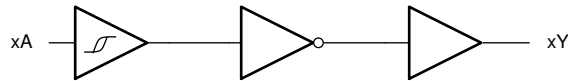
Figure 6-3. Voltage Waveforms Propagation Delays

7 Detailed Description

7.1 Overview

This device contains six independent inverters with Schmitt-trigger inputs. Each gate performs the Boolean function $Y = \bar{A}$ in positive logic.

7.2 Functional Block Diagram



7.3 Feature Description

7.3.1 Balanced CMOS Push-Pull Outputs

A balanced output allows the device to sink and source similar currents. The drive capability of this device may create fast edges into light loads so routing and load conditions should be considered to prevent ringing. Additionally, the outputs of this device are capable of driving larger currents than the device can sustain without being damaged. It is important for the output power of the device to be limited to avoid damage due to over-current. The electrical and thermal limits defined in the [Absolute Maximum Ratings](#) must be followed at all times.

The SN74HC14 can drive a load with a total capacitance less than or equal to the maximum load listed in the [Switching Characteristics - 74](#) connected to a high-impedance CMOS input while still meeting all of the datasheet specifications. Larger capacitive loads can be applied, however it is not recommended to exceed the provided load value. If larger capacitive loads are required, it is recommended to add a series resistor between the output and the capacitor to limit output current to the values given in the [Absolute Maximum Ratings](#).

7.3.2 CMOS Schmitt-Trigger Inputs

Standard CMOS inputs are high impedance and are typically modeled as a resistor from the input to ground in parallel with the input capacitance given in the [Electrical Characteristics - 74](#). The worst case resistance is calculated with the maximum input voltage, given in the [Absolute Maximum Ratings](#), and the maximum input leakage current, given in the [Electrical Characteristics - 74](#), using ohm's law ($R = V \div I$).

The Schmitt-trigger input architecture provides hysteresis as defined by ΔV_T in the [Electrical Characteristics - 74](#), which makes this device extremely tolerant to slow or noisy inputs. While the inputs can be driven much slower than standard CMOS inputs, it is still recommended to properly terminate unused inputs. Driving the inputs slowly will also increase dynamic current consumption of the device. For additional information regarding Schmitt-trigger inputs, please see [Understanding Schmitt Triggers](#).

7.3.3 Clamp Diode Structure

The inputs and outputs to this device have both positive and negative clamping diodes as depicted in [Figure 7-1](#).

CAUTION

Voltages beyond the values specified in the [Absolute Maximum Ratings](#) table can cause damage to the device. The recommended input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.

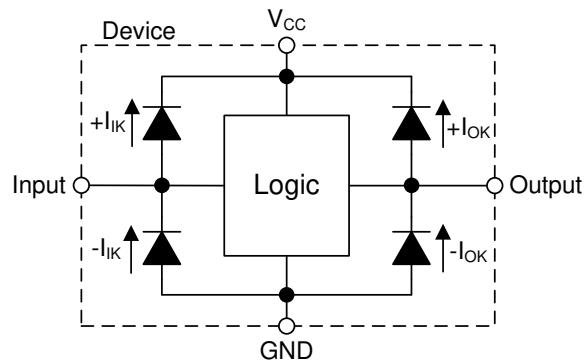


Figure 7-1. Electrical Placement of Clamping Diodes for Each Input and Output

7.4 Device Functional Modes

Table 7-1. Function Table

| INPUT | OUTPUT |
|-------|--------|
| A | Y |
| L | H |
| H | L |

8 Application and Implementation

Note

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

8.1 Application Information

This device can be used to add an additional stage to a counter with an external flip-flop. Because counters use a negative edge trigger, the flip-flop's clock input must be inverted to provide this function. This function only requires one of the six available inverters in the device, so the remaining channels can be used for other applications needing an inverted signal or improved signal integrity. Unused inputs must be terminated at V_{CC} or GND. Unused outputs can be left floating.

8.2 Typical Application

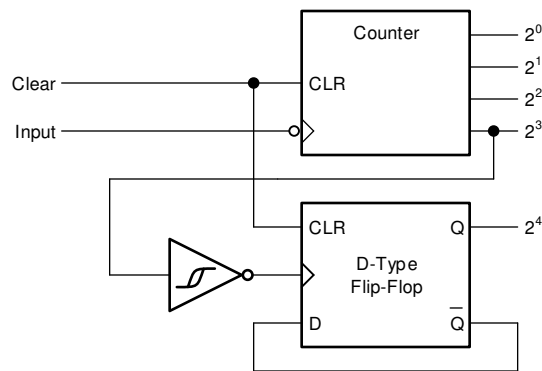


Figure 8-1. Typical application schematic

8.2.1 Design Requirements

8.2.1.1 Power Considerations

Ensure the desired supply voltage is within the range specified in the [Recommended Operating Conditions](#). The supply voltage sets the device's electrical characteristics as described in the [Electrical Characteristics - 74](#).

The supply must be capable of sourcing current equal to the total current to be sourced by all outputs of the SN74HC14 plus the maximum supply current, I_{CC} , listed in the [Electrical Characteristics - 74](#). The logic device can only source or sink as much current as it is provided at the supply and ground pins, respectively. Be sure not to exceed the maximum total current through GND or V_{CC} listed in the [Absolute Maximum Ratings](#).

Total power consumption can be calculated using the information provided in [CMOS Power Consumption and \$C_{pd}\$ Calculation](#).

Thermal increase can be calculated using the information provided in [Thermal Characteristics of Standard Linear and Logic \(SLL\) Packages and Devices](#).

CAUTION

The maximum junction temperature, $T_{J(max)}$ listed in the [Absolute Maximum Ratings](#), is an *additional limitation* to prevent damage to the device. Do not violate any values listed in the [Absolute Maximum Ratings](#). These limits are provided to prevent damage to the device.

8.2.1.2 Input Considerations

Input signals must cross $V_{L}(min)$ to be considered a logic LOW, and $V_{T+}(max)$ to be considered a logic HIGH. Do not exceed the maximum input voltage range found in the [Absolute Maximum Ratings](#).

Unused inputs must be terminated to either V_{CC} or ground. These can be directly terminated if the input is completely unused, or they can be connected with a pull-up or pull-down resistor if the input is to be used sometimes, but not always. A pull-up resistor is used for a default state of HIGH, and a pull-down resistor is used for a default state of LOW. The resistor size is limited by drive current of the controller, leakage current into the SN74HC14, as specified in the [Electrical Characteristics - 74](#), and the desired input transition rate. A 10-k Ω resistor value is often used due to these factors.

The SN74HC14 has no input signal transition rate requirements because it has Schmitt-trigger inputs.

Another benefit to having Schmitt-trigger inputs is the ability to reject noise. Noise with a large enough amplitude can still cause issues. To know how much noise is too much, please refer to the $\Delta V_T(min)$ in the [Electrical Characteristics - 74](#). This hysteresis value will provide the peak-to-peak limit.

Unlike what happens with standard CMOS inputs, Schmitt-trigger inputs can be held at any valid value without causing huge increases in power consumption. The typical additional current caused by holding an input at a value other than V_{CC} or ground is plotted in the [Typical Characteristics](#).

Refer to the [Feature Description](#) for additional information regarding the inputs for this device.

8.2.1.3 Output Considerations

The positive supply voltage is used to produce the output HIGH voltage. Drawing current from the output will decrease the output voltage as specified by the V_{OH} specification in the [Electrical Characteristics - 74](#). Similarly, the ground voltage is used to produce the output LOW voltage. Sinking current into the output will increase the output voltage as specified by the V_{OL} specification in the [Electrical Characteristics 74](#).

Unused outputs can be left floating. Do not connect outputs directly to V_{CC} or ground.

Refer to [Feature Description](#) for additional information regarding the outputs for this device.

8.2.2 Detailed Design Procedure

1. Add a decoupling capacitor from V_{CC} to GND. The capacitor needs to be placed physically close to the device and electrically close to both the V_{CC} and GND pins. An example layout is shown in the [Layout](#).
2. Ensure the capacitive load at the output is ≤ 70 pF. This is not a hard limit, however it will ensure optimal performance. This can be accomplished by providing short, appropriately sized traces from the SN74HC14 to the receiving device.
3. Ensure the resistive load at the output is larger than $(V_{CC} / I_O(max)) \Omega$. This will ensure that the maximum output current from the [Absolute Maximum Ratings](#) is not violated. Most CMOS inputs have a resistive load measured in megaohms; much larger than the minimum calculated above.
4. Thermal issues are rarely a concern for logic gates, however the power consumption and thermal increase can be calculated using the steps provided in the application report, [CMOS Power Consumption and Cpd Calculation](#)

8.2.3 Application Curves

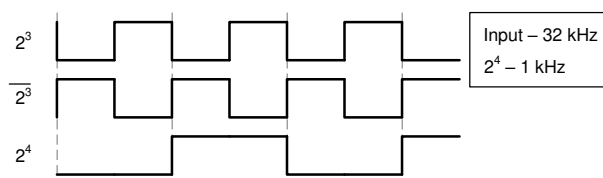


Figure 8-2. Typical application timing diagram

8.3 Power Supply Recommendations

The power supply can be any voltage between the minimum and maximum supply voltage rating located in the *Recommended Operating Conditions*. Each V_{CC} terminal should have a bypass capacitor to prevent power disturbance. A 0.1- μF capacitor is recommended for this device. It is acceptable to parallel multiple bypass caps to reject different frequencies of noise. The 0.1- μF and 1- μF capacitors are commonly used in parallel. The bypass capacitor should be installed as close to the power terminal as possible for best results, as shown in *Figure 8-3*.

8.4 Layout

8.4.1 Layout Guidelines

When using multiple-input and multiple-channel logic devices inputs must not ever be left floating. In many cases, functions or parts of functions of digital logic devices are unused; for example, when only two inputs of a triple-input AND gate are used. Such unused input pins must not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. All unused inputs of digital logic devices must be connected to a logic high or logic low voltage, as defined by the input voltage specifications, to prevent them from floating. The logic level that must be applied to any particular unused input depends on the function of the device. Generally, the inputs are tied to GND or V_{CC} , whichever makes more sense for the logic function or is more convenient.

8.4.2 Layout Example

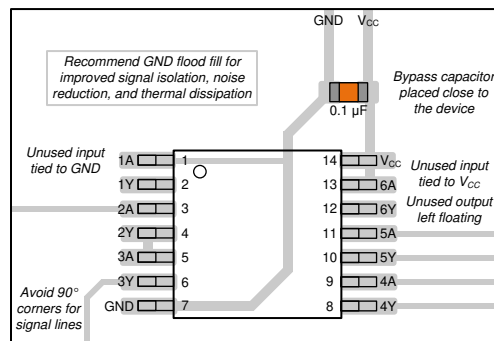


Figure 8-3. Example layout for the SN74HC14

9 Device and Documentation Support

9.1 Documentation Support

9.1.1 Related Documentation

For related documentation see the following:

- [HCMOS Design Considerations](#)
- [CMOS Power Consumption and CPD Calculation](#)
- [Designing with Logic](#)

9.2 Support Resources

[TI E2E™ support forums](#) are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's [Terms of Use](#).

9.3 Trademarks

TI E2E™ is a trademark of Texas Instruments.

All trademarks are the property of their respective owners.

9.4 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

9.5 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

10 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

| Changes from Revision K (June 2021) to Revision L (July 2024) | Page |
|--|------|
| • Added package sizes to <i>Device Information</i> table..... | 1 |
| • Updated thermal values for N package from $\Psi_{JB} = 40.3$ to 40.5, all values in °C/W | 4 |

| Changes from Revision J (October 2016) to Revision K (June 2021) | Page |
|--|------|
| • Updated the numbering format for tables, figures and cross-references throughout the document..... | 1 |
| • Updated to new data sheet standards..... | 1 |
| • Updated package sizing for DB package in <i>Device Information</i> table..... | 1 |
| • Increased D (86 to 133.6), DB (96 to 114.8), NS (76 to 122.6), and PW (113 to 151.7); decreased N (80 to 60.7) °C/W..... | 4 |

11 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|------------------|--------------------------------------|----------------------|--------------|------------------------------------|-------------------------|
| 5962-8409101VCA | ACTIVE | CDIP | J | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962-8409101VCA A SNV54HC14J | Samples |
| 5962-8409101VDA | ACTIVE | CFP | W | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962-8409101VDA A SNV54HC14W | Samples |
| 84091012A | ACTIVE | LCCC | FK | 20 | 55 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 84091012A SNJ54HC 14FK | Samples |
| 8409101CA | ACTIVE | CDIP | J | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 8409101CA SNJ54HC14J | Samples |
| 8409101DA | ACTIVE | CFP | W | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 8409101DA SNJ54HC14W | Samples |
| JM38510/65702BCA | ACTIVE | CDIP | J | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 65702BCA | Samples |
| JM38510/65702BDA | ACTIVE | CFP | W | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 65702BDA | Samples |
| M38510/65702BCA | ACTIVE | CDIP | J | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 65702BCA | Samples |
| M38510/65702BDA | ACTIVE | CFP | W | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 65702BDA | Samples |
| SN54HC14J | ACTIVE | CDIP | J | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | SN54HC14J | Samples |
| SN74HC14D | OBSOLETE | SOIC | D | 14 | | TBD | Call TI | Call TI | -40 to 85 | HC14 | |
| SN74HC14DBR | ACTIVE | SSOP | DB | 14 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | HC14 | Samples |
| SN74HC14DR | ACTIVE | SOIC | D | 14 | 2500 | RoHS & Green | NIPDAU SN | Level-1-260C-UNLIM | -40 to 85 | HC14 | Samples |
| SN74HC14DRG3 | ACTIVE | SOIC | D | 14 | 2500 | RoHS & Green | SN | Level-1-260C-UNLIM | -40 to 85 | HC14 | Samples |
| SN74HC14DRG4 | ACTIVE | SOIC | D | 14 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | HC14 | Samples |
| SN74HC14DT | OBSOLETE | SOIC | D | 14 | | TBD | Call TI | Call TI | -40 to 85 | HC14 | |
| SN74HC14N | ACTIVE | PDIP | N | 14 | 25 | RoHS & Green | NIPDAU | N / A for Pkg Type | -40 to 85 | SN74HC14N | Samples |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|---------------------|--------------------------------------|----------------------|--------------|------------------------------|-------------------------|
| SN74HC14NE4 | ACTIVE | PDIP | N | 14 | 25 | RoHS & Green | NIPDAU | N / A for Pkg Type | -40 to 85 | SN74HC14N | Samples |
| SN74HC14NSR | ACTIVE | SOP | NS | 14 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | HC14 | Samples |
| SN74HC14NSRE4 | ACTIVE | SOP | NS | 14 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | HC14 | Samples |
| SN74HC14PW | OBSOLETE | TSSOP | PW | 14 | | TBD | Call TI | Call TI | -40 to 85 | HC14 | |
| SN74HC14PWR | ACTIVE | TSSOP | PW | 14 | 2000 | RoHS & Green | NIPDAU SN | Level-1-260C-UNLIM | -40 to 85 | HC14 | Samples |
| SN74HC14PWRG4 | ACTIVE | TSSOP | PW | 14 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | HC14 | Samples |
| SN74HC14PWT | OBSOLETE | TSSOP | PW | 14 | | TBD | Call TI | Call TI | -40 to 85 | HC14 | |
| SNJ54HC14FK | ACTIVE | LCCC | FK | 20 | 55 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 84091012A SNJ54HC 14FK | Samples |
| SNJ54HC14J | ACTIVE | CDIP | J | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 8409101CA SNJ54HC14J | Samples |
| SNJ54HC14W | ACTIVE | CFP | W | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 8409101DA SNJ54HC14W | Samples |

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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OTHER QUALIFIED VERSIONS OF SN54HC14, SN54HC14-SP, SN74HC14 :

- Catalog : [SN74HC14](#), [SN54HC14](#)

- Automotive : [SN74HC14-Q1](#), [SN74HC14-Q1](#)

- Military : [SN54HC14](#)

- Space : [SN54HC14-SP](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

- Military - QML certified for Military and Defense Applications

- Space - Radiation tolerant, ceramic packaging and qualified for use in Space-based application

TAPE AND REEL INFORMATION

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74HC14DBR | SSOP | DB | 14 | 2000 | 330.0 | 16.4 | 8.35 | 6.6 | 2.4 | 12.0 | 16.0 | Q1 |
| SN74HC14DR | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |
| SN74HC14DRG3 | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.6 | 9.3 | 2.1 | 8.0 | 16.0 | Q1 |
| SN74HC14DRG4 | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |
| SN74HC14NSR | SOP | NS | 14 | 2000 | 330.0 | 16.4 | 8.45 | 10.55 | 2.5 | 12.0 | 16.2 | Q1 |
| SN74HC14NSR | SOP | NS | 14 | 2000 | 330.0 | 16.4 | 8.45 | 10.55 | 2.5 | 12.0 | 16.2 | Q1 |
| SN74HC14PWR | TSSOP | PW | 14 | 2000 | 330.0 | 12.4 | 6.9 | 5.3 | 1.6 | 8.0 | 12.0 | Q1 |
| SN74HC14PWR | TSSOP | PW | 14 | 2000 | 330.0 | 12.4 | 6.9 | 5.6 | 1.6 | 8.0 | 12.0 | Q1 |
| SN74HC14PWRG4 | TSSOP | PW | 14 | 2000 | 330.0 | 12.4 | 6.9 | 5.6 | 1.6 | 8.0 | 12.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74HC14DBR | SSOP | DB | 14 | 2000 | 356.0 | 356.0 | 35.0 |
| SN74HC14DR | SOIC | D | 14 | 2500 | 367.0 | 367.0 | 38.0 |
| SN74HC14DRG3 | SOIC | D | 14 | 2500 | 366.0 | 364.0 | 50.0 |
| SN74HC14DRG4 | SOIC | D | 14 | 2500 | 356.0 | 356.0 | 35.0 |
| SN74HC14NSR | SOP | NS | 14 | 2000 | 356.0 | 356.0 | 35.0 |
| SN74HC14NSR | SOP | NS | 14 | 2000 | 367.0 | 367.0 | 38.0 |
| SN74HC14PWR | TSSOP | PW | 14 | 2000 | 367.0 | 367.0 | 35.0 |
| SN74HC14PWR | TSSOP | PW | 14 | 2000 | 356.0 | 356.0 | 35.0 |
| SN74HC14PWRG4 | TSSOP | PW | 14 | 2000 | 356.0 | 356.0 | 35.0 |

TUBE


*All dimensions are nominal

| Device | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|------------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| 5962-8409101VDA | W | CFP | 14 | 25 | 506.98 | 26.16 | 6220 | NA |
| 84091012A | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| 8409101DA | W | CFP | 14 | 25 | 506.98 | 26.16 | 6220 | NA |
| JM38510/65702BDA | W | CFP | 14 | 25 | 506.98 | 26.16 | 6220 | NA |
| M38510/65702BDA | W | CFP | 14 | 25 | 506.98 | 26.16 | 6220 | NA |
| SN74HC14N | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |
| SN74HC14N | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |
| SN74HC14NE4 | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |
| SN74HC14NE4 | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |
| SNJ54HC14FK | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| SNJ54HC14W | W | CFP | 14 | 25 | 506.98 | 26.16 | 6220 | NA |

D0014A



PACKAGE OUTLINE

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



4220718/A 09/2016

NOTES:

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.43 mm, per side.
5. Reference JEDEC registration MS-012, variation AB.

EXAMPLE BOARD LAYOUT

D0014A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



LAND PATTERN EXAMPLE
SCALE:8X



SOLDER MASK DETAILS

4220718/A 09/2016

NOTES: (continued)

- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

D0014A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:8X

4220718/A 09/2016

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

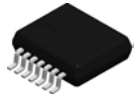
W (R-GDFP-F14)

CERAMIC DUAL FLATPACK



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. This package can be hermetically sealed with a ceramic lid using glass frit.
 - D. Index point is provided on cap for terminal identification only.
 - E. Falls within MIL STD 1835 GDFP1-F14

DB0014A



PACKAGE OUTLINE

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. Reference JEDEC registration MO-150.

EXAMPLE BOARD LAYOUT

DB0014A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



4220762/A 05/2024

NOTES: (continued)

- 5. Publication IPC-7351 may have alternate designs.
- 6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DB0014A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4220762/A 05/2024

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

GENERIC PACKAGE VIEW

FK 20

LCCC - 2.03 mm max height

8.89 x 8.89, 1.27 mm pitch

LEADLESS CERAMIC CHIP CARRIER

This image is a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.



4229370VA\

J 14

GENERIC PACKAGE VIEW
CDIP - 5.08 mm max height
CERAMIC DUAL IN LINE PACKAGE



Images above are just a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

4040083-5/G

J0014A



PACKAGE OUTLINE

CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE



4214771/A 05/2017

NOTES:

1. All controlling linear dimensions are in inches. Dimensions in brackets are in millimeters. Any dimension in brackets or parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This package is hermetically sealed with a ceramic lid using glass frit.
4. Index point is provided on cap for terminal identification only and on press ceramic glass frit seal only.
5. Falls within MIL-STD-1835 and GDIP1-T14.

EXAMPLE BOARD LAYOUT

J0014A

CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE



LAND PATTERN EXAMPLE
NON-SOLDER MASK DEFINED
SCALE: 5X



4214771/A 05/2017

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 - The 20 pin end lead shoulder width is a vendor option, either half or full width.

PW0014A



PACKAGE OUTLINE
TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



4220202/B 12/2023

NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.

EXAMPLE BOARD LAYOUT

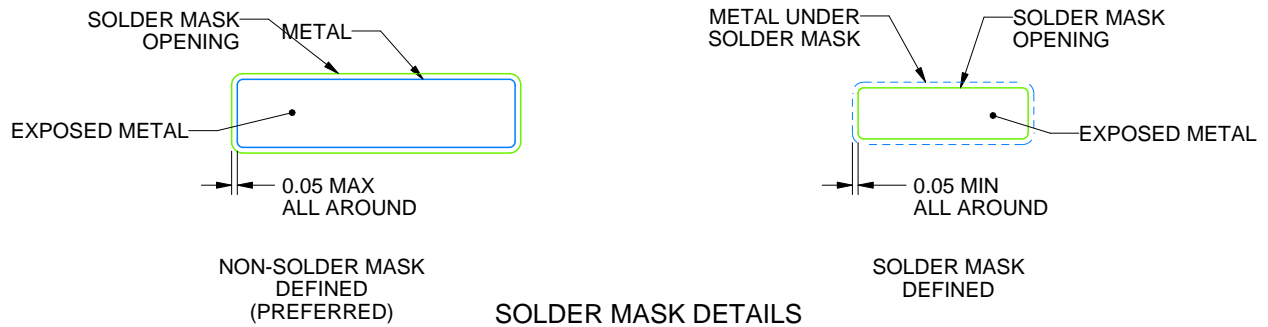
PW0014A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



4220202/B 12/2023

NOTES: (continued)

- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

PW0014A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4220202/B 12/2023

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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