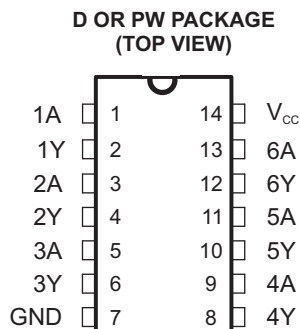


FEATURES

- **Controlled Baseline**
 - One Assembly Site
 - One Test Site
 - One Fabrication Site
- **Extended Temperature Performance of –55°C to 125°C**
- **Enhanced Diminishing Manufacturing Sources (DMS) Support**
- **Enhanced Product-Change Notification**
- **Qualification Pedigree ⁽¹⁾**
- **Operating Range 2-V to 5.5-V V_{CC}**
- **Unbuffered Outputs**
- **Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II**
- **ESD Protection Exceeds JESD 22**
 - 2000-V Human-Body Model (A114-A)
 - 200-V Machine Model (A115-A)
 - 1000-V Charged-Device Model (C101)

(1) Component qualification in accordance with JEDEC and industry standards to ensure reliable operation over an extended temperature range. This includes, but is not limited to, Highly Accelerated Stress Test (HAST) or biased 85/85, temperature cycle, autoclave or unbiased HAST, electromigration, bond intermetallic life, and mold compound life. Such qualification testing should not be viewed as justifying use of this component beyond specified performance and environmental limits.



DESCRIPTION/ORDERING INFORMATION

The 'HC04 devices contain six independent inverters. They perform the Boolean function $Y = \bar{A}$ in positive logic.

ORDERING INFORMATION⁽¹⁾

| T _A | PACKAGE ⁽²⁾ | | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|------------------------|---------------|-----------------------|------------------|
| –55°C to 125°C | TSSOP - PW | Tape and Reel | SN74AHCU04MPWREP | AHCU04M |

- (1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI Web site at www.ti.com.
- (2) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

FUNCTION TABLE (EACH INVERTER)

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

LOGIC DIAGRAM (POSITIVE LOGIC)



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

Absolute Maximum Ratings⁽¹⁾

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

| | | MIN | MAX | UNIT |
|---------------|--|------------------------------------|----------------|------|
| V_{CC} | Supply voltage range | -0.5 | 7 | V |
| V_I | Input voltage range ⁽²⁾ | -0.5 | 7 | V |
| V_O | Output voltage range ⁽²⁾ | -0.5 | $V_{CC} + 0.5$ | V |
| I_{IK} | Input clamp current | $V_I < 0$ | -20 | mA |
| I_{OK} | Output clamp current | $V_O < 0$ or $V_O = 0$ to V_{CC} | ±20 | mA |
| I_O | Continuous output current | $V_O = 0$ to V_{CC} | ±25 | mA |
| | Continuous current through V_{CC} or GND | V_{CC} or GND | ±50 | mA |
| θ_{JA} | Package thermal impedance ⁽³⁾ | D package | 86 | °C/W |
| | | PW package | 113 | |
| T_{stg} | Storage temperature range | -60 | 150 | °C |

(1) Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

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

(3) The package thermal impedance is calculated in accordance with JESD 51-7.

Recommended Operating Conditions⁽¹⁾

| | | MIN | MAX | UNIT |
|----------|--------------------------------|------------------------|----------|------|
| V_{CC} | Supply voltage | 2 | 5.5 | V |
| V_{IH} | High-level input voltage | $V_{CC} = 2$ V | 1.7 | V |
| | | $V_{CC} = 3$ V | 2.4 | |
| | | $V_{CC} = 5.5$ V | 4.4 | |
| V_{IL} | Low-level input voltage | $V_{CC} = 2$ V | 0.3 | V |
| | | $V_{CC} = 3$ V | 0.6 | |
| | | $V_{CC} = 5.5$ V | 1.1 | |
| V_I | Input voltage | 0 | V_{CC} | V |
| V_O | Output voltage | 0 | V_{CC} | V |
| I_{OH} | High-Level output current | $V_{CC} = 2$ V | -50 | μA |
| | | $V_{CC} = 3.3$ V ± 0.3 | -4 | |
| | | $V_{CC} = 5$ V ± 0.5 | -8 | |
| I_{OL} | Low-Level output current | $V_{CC} = 2$ V | 50 | μA |
| | | $V_{CC} = 3.3$ V ± 0.3 | 4 | |
| | | $V_{CC} = 5$ V ± 0.5 | 8 | |
| T_A | Operating free-air temperature | -55 | 125 | °C |

(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

Electrical Characteristics

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

| PARAMETER | TEST CONDITIONS | V _{CC} | T _A = 25°C | | T _A = –55°C TO 125°C | | UNIT |
|-----------------|---|-----------------|-----------------------|------|---------------------------------|-----|------|
| | | | MIN | MAX | MIN | MAX | |
| V _{OH} | I _{OH} = –50 μA | 2 V | 1.8 | | 1.8 | | V |
| | | 3 V | 2.7 | | 2.7 | | |
| | | 4.5 V | 4 | | 4 | | |
| | I _{OH} = –4 mA | 3 V | 2.58 | | 2.3 | | |
| | I _{OH} = –8 mA | 4.5 V | 3.94 | | 3.5 | | |
| V _{OL} | I _{OL} = 50 μA | 2 V | | 0.1 | | 0.2 | V |
| | | 3 V | | 0.1 | | 0.3 | |
| | | 4.5 V | | 0.1 | | 0.5 | |
| | I _{OL} = 4 mA | 3 V | | 0.26 | | 0.5 | |
| | I _{OL} = 8 mA | 4.5 V | | 0.26 | | 0.5 | |
| I _I | V _I = V _{CC} or GND | 0 V to 5.5 V | | ±0.1 | | ±1 | μA |
| I _{CC} | V _I = V _{CC} or GND, O = 0 | 5.5 V | | 2 | | 20 | μA |
| C _i | V _I = V _{CC} or GND, | 5 V | | 10 | | 10 | pF |

Switching Characteristics

over operating free-air temperature range, V_{CC} = 3.3 ± 0.3 V (unless otherwise noted) (see Figure 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | V _{CC} | T _A = 25°C | | T _A = –55°C TO 125°C | | UNIT |
|------------------|--------------|-------------|------------------------|-----------------------|------|---------------------------------|-----|------|
| | | | | MIN | MAX | MIN | MAX | |
| t _{PLH} | A | Y | C _L = 50 pF | 1 | 10.6 | 1 | 14 | ns |
| t _{PHL} | | | | 1 | 10.6 | 1 | 14 | ns |

Switching Characteristics

over operating free-air temperature range, V_{CC} = 5 ± 0.5 V (unless otherwise noted) (see Figure 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | V _{CC} | T _A = 25°C | | T _A = –55°C TO 125°C | | UNIT |
|------------------|--------------|-------------|------------------------|-----------------------|-----|---------------------------------|-----|------|
| | | | | MIN | MAX | MIN | MAX | |
| t _{PLH} | A | Y | C _L = 50 pF | 1 | 7 | 1 | 11 | ns |
| t _{PHL} | | | | 1 | 7 | 1 | 11 | ns |

Noise Characteristics⁽¹⁾

V_{CC} = 5 V, C_L = 50 pF, T_A = 25°C

| PARAMETER | MIN | TYP | MAX | UNIT |
|--|-----|------|-----|------|
| V _{OL(P)} Quiet output, maximum dynamic V _{OL} | | 0.5 | | V |
| V _{OL(V)} Quiet output, minimum dynamic V _{OL(V)} | | –0.5 | | V |
| V _{OH(V)} Quiet output, minimum dynamic V _{OH} | | 4.3 | | V |
| V _{IH(D)} High-level dynamic input voltage V _{IH(D)} | 4 | | | V |
| V _{IL(D)} Low-level dynamic input voltage V _{IL(D)} | | | 1 | V |

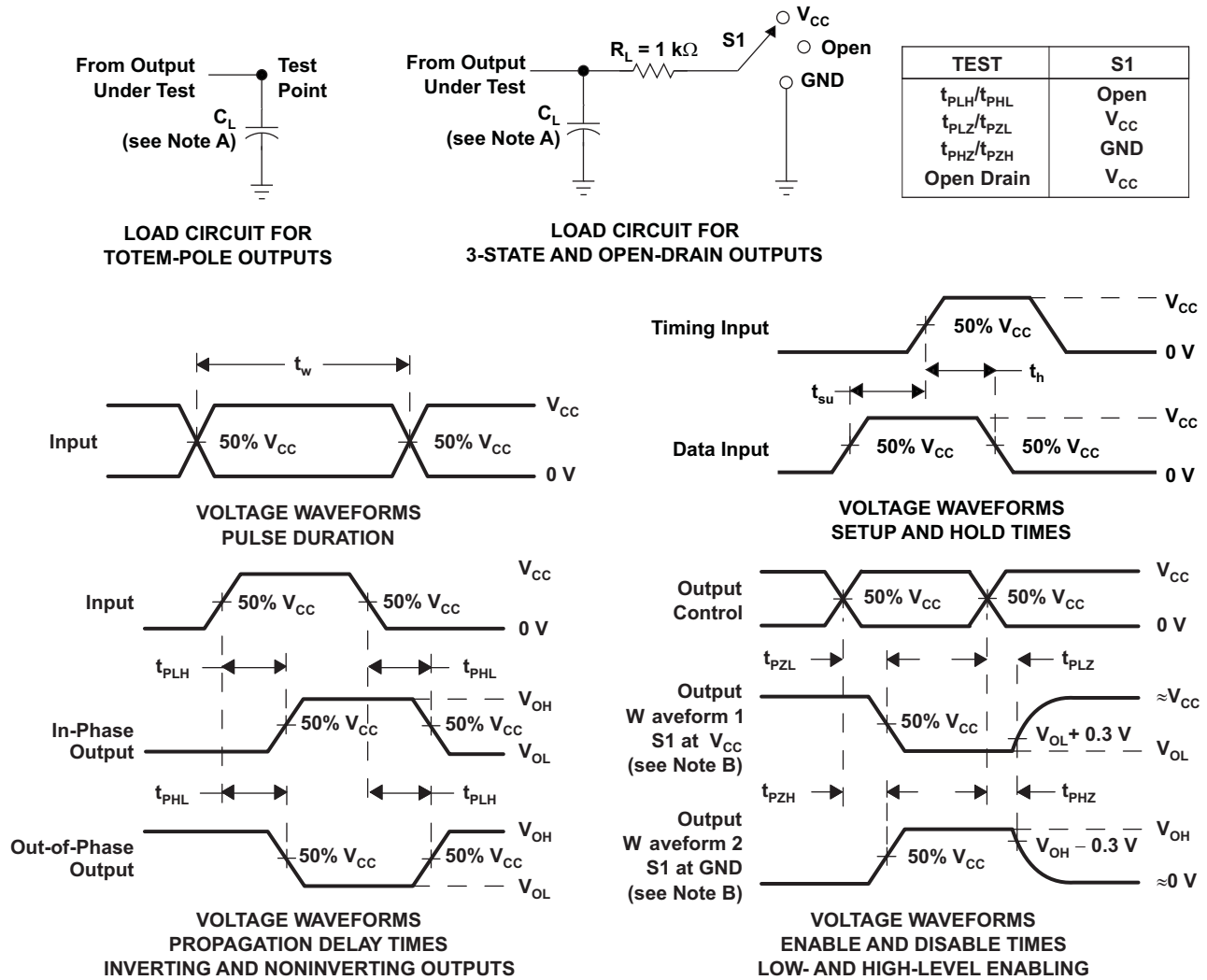
(1) Characteristics are for surface-mount packages only.

Operating Characteristics

T_A = 25°C

| PARAMETER | TEST CONDITIONS | TYP | UNIT |
|---|--------------------|-----|------|
| C _{pd} Power dissipation capacitance | No load, f = 1 MHz | 7.3 | pF |

PARAMETER MEASUREMENT INFORMATION



- NOTES:** A. C_L includes probe and jig capacitance.
 B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
 C. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1$ MHz, $Z_O = 50 \Omega$, $t_r \leq 3$ ns, $t_f \leq 3$ ns.
 D. The outputs are measured one at a time, with one transition per measurement.
 E. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish | MSL Peak Temp (3) | Op Temp (°C) | Top-Side Markings (4) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|-------------------------|------------------|----------------------|--------------|--------------------------|-------------------------|
| SN74AHC04MPWREP | ACTIVE | TSSOP | PW | 14 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -55 to 125 | AHC04M | Samples |
| V62/07619-01XE | ACTIVE | TSSOP | PW | 14 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -55 to 125 | AHC04M | 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) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

(4) Multiple Top-Side Markings will be inside parentheses. Only one Top-Side 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 Top-Side Marking for that device.

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OTHER QUALIFIED VERSIONS OF SN74AHC04-EP :

- Catalog: [SN74AHCU04](#)
- Automotive: [SN74AHCU04-Q1](#)
- Military: [SN54AHCU04](#)

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

TAPE AND REEL INFORMATION
REEL DIMENSIONS

TAPE DIMENSIONS


| | |
|----|---|
| A0 | Dimension designed to accommodate the component width |
| B0 | Dimension designed to accommodate the component length |
| K0 | Dimension designed to accommodate the component thickness |
| W | Overall width of the carrier tape |
| P1 | Pitch between successive cavity centers |

TAPE AND REEL INFORMATION

*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 |
|------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74AHCU04MPWREP | 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) |
|------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74AHCU04MPWREP | TSSOP | PW | 14 | 2000 | 367.0 | 367.0 | 35.0 |

PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE



4040064-3/G 02/11

- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - B. This drawing is subject to change without notice.
 -  Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
 -  Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
 - E. Falls within JEDEC MO-153

PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE



4211284-2/G 08/15

- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Publication IPC-7351 is recommended for alternate designs.
 - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
 - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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