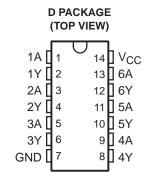
- Qualified for Automotive Applications
- ESD Protection Exceeds 2000 V Per MIL-STD-883, Method 3015; Exceeds 200 V Using Machine Model (C = 200 pF, R = 0)
- Operating Voltage Range of 4.5 V to 5.5 V
- Outputs Can Drive Up To 10 LSTTL Loads
- Low Power Consumption, 20-μA Max I<sub>CC</sub>
- Typical t<sub>pd</sub> = 13 ns

#### description/ordering information

This device contains six independent inverters. It performs the Boolean function  $Y = \overline{A}$  in positive logic.

- ±4-mA Output Drive at 5 V
- Low Input Current of 1 μA Max
- Inputs Are TTL-Voltage Compatible



## ORDERING INFORMATION†

TA	PACKAGE <sup>‡</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	SOIC - D	Reel of 2500	SN74HCT04IDRQ1	HCT04IQ1

<sup>†</sup> 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 http://www.ti.com.

## FUNCTION TABLE (each inverter)

INPUT A	OUTPUT Y
Н	L
L	Н

#### 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.



<sup>‡</sup> Package drawings, thermal data, and symbolization are available at http://www.ti.com/packaging.

### absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage range, V <sub>CC</sub>	−0.5 \	/ to 7 V
Input clamp current, $I_{IK}$ ( $V_I < 0$ or $V_I > V_{CC}$ ) (see Note 1)	±	±20 mA
Output clamp current, I <sub>OK</sub> (V <sub>O</sub> < 0 or V <sub>O</sub> > V <sub>CC</sub> ) (see Note 1)	±	±20 mA
Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ )	±	±25 mA
Continuous current through V <sub>CC</sub> or GND	±	±50 mA
Package thermal impedance, $\theta_{JA}$ (see Note 2)	8	36°C/W
Storage temperature range, T <sub>stq</sub>	-65°C to	150°C

<sup>†</sup> 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.

### recommended operating conditions (see Note 3)

		MIN	NOM	MAX	UNIT
VCC	Supply voltage	4.5	5	5.5	V
VIH	High-level input voltage $V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	2			V
$V_{IL}$	Low-level input voltage $V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$			0.8	V
٧ <sub>I</sub>	Input voltage	0		VCC	V
VO	Output voltage	0		VCC	V
Δt/Δν	Input transition rise/fall time			500	ns
TA	Operating free-air temperature	-40		85	°C

NOTE 3: All unused inputs of the device must be held at V<sub>CC</sub> 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 recommended operating free-air temperature range (unless otherwise noted)

DADAMETED	TEST COMPITIO	NC.		T <sub>A</sub> = 25°C			BAAV	LINUT	
PARAMETER	TEST CONDITIO	NS	VCC	MIN	TYP	MAX	MIN	MAX	UNIT
V	$V_I = V_{IH}$ or $V_{IL}$	I <sub>OH</sub> = -20 μA	451/	4.4	4.499		4.4		V
VOH		$I_{OH} = -4 \text{ mA}$	4.5 V	3.98	4.3		3.84		
V	I <sub>OL</sub> = 20 μA			0.001	0.1		0.1	V	
VOL	VI = VIH or VIL	$I_{OL} = 4 \text{ mA}$	4.5 V		0.17	0.26		0.33	V
lį	$V_I = V_{CC}$ or 0		5.5 V		±0.1	±100		±1000	nA
ICC	$V_I = V_{CC}$ or 0,	IO = 0	5.5 V			2		20	μΑ
Δl <sub>CC</sub> ‡	One input at 0.5 V or 2.4 V, Other inputs at 0 or V <sub>CC</sub>		5.5 V		1.4	2.4		2.9	mA
C <sub>i</sub>			4.5 V to 5.5 V	·	3	10	·	10	pF

<sup>‡</sup> This is the increase in supply current for each input that is at one of the specified TTL voltage levels, rather than 0 V or VCC.



NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

<sup>2.</sup> The package thermal impedance is calculated in accordance with JESD 51-7.

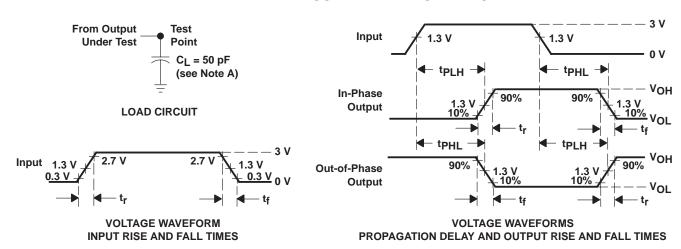
# switching characteristics over recommended operating free-air temperature range, $C_L = 50 \text{ pF}$ (unless otherwise noted) (see Figure 1)

DADAMETED	FROM	то	TO TA	T <sub>A</sub> = 25°C		MAY			
PARAMETER	(INPUT)	(OUTPUT)	VCC	MIN	TYP	MAX	MIN	MAX	UNIT
	Δ.	V	4.5 V		14	20		25	
<sup>t</sup> pd	А	Y	5.5 V 13 18	18 2	23	ns			
					9	15		19	no
τt		ī	5.5 V		8	14		17	ns

## operating characteristics, T<sub>A</sub> = 25°C

	PARAMETER	TEST CONDITIONS	TYP	UNIT
C <sub>pd</sub>	Power dissipation capacitance per inverter	No load	20	pF

#### PARAMETER MEASUREMENT INFORMATION



- NOTES: A. C<sub>L</sub> includes probe and test-fixture capacitance.
  - B. Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics: PRR  $\leq$  1 MHz,  $Z_O = 50 \ \Omega$ ,  $t_f = 6 \ ns$ ,  $t_f = 6 \ ns$ .
  - C. The outputs are measured one at a time with one input transition per measurement.
  - D. tpLH and tpHL are the same as tpd.

Figure 1. Load Circuit and Voltage Waveforms

#### PACKAGE OPTION ADDENDUM

www.ti.com 15-Jul-2009

#### **PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins Pa	ackage Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
SN74HCT04IDRQ1	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

<sup>(1)</sup> 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.

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#### OTHER QUALIFIED VERSIONS OF SN74HCT04-Q1:

- Catalog: SN74HCT04
- Enhanced Product: SN74HCT04-EP
- Military: SN54HCT04

#### NOTE: Qualified Version Definitions:

- Catalog TI's standard catalog product
- Enhanced Product Supports Defense, Aerospace and Medical Applications
- Military QML certified for Military and Defense Applications

## D (R-PDSO-G14)

#### PLASTIC SMALL OUTLINE



NOTES:

- A. All linear dimensions are in inches (millimeters).
- 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 0.006 (0,15) each side.
- Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
- E. Reference JEDEC MS-012 variation AB.



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