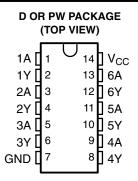
- Qualified for Automotive Applications
- ESD Protection Exceeds 1500 V Per MIL-STD-883, Method 3015; Exceeds 150 V Using Machine Model (C = 200 pF, R = 0)
- EPIC™ (Enhanced-Performance Implanted CMOS) Process
- Operating Range 2-V to 5.5-V V_{CC}



description/ordering information

The SN74AHC04 contains six independent inverters. This device performs the Boolean function $Y = \overline{A}$.

ORDERING INFORMATION[†]

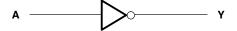
T _A	PACKAGE [‡]		ORDERABLE PART NUMBER	TOP-SIDE MARKING
4000 to 40500	SOIC - D	Tape and reel	SN74AHC04QDRQ1	AHC04Q1
−40°C to 125°C	TSSOP – PW	Tape and reel	SN74AHC04QPWRQ1	AHC04Q1

[†] 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, each inverter (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.

EPIC is a trademark of Texas Instruments.



[‡] 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 _{CC}	–0.5 V to 7 V
Input voltage range, V _I (see Note 1)	–0.5 V to 7 V
Output voltage range, V _O (see Note 1)	0.5 V to V _{CC} + 0.5 V
Input clamp current, $I_{ K }(V_1 < 0)$	–20 mA
Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$)	±20 mA
Continuous output current, $I_O(V_O = 0 \text{ to } V_{CC})$	±25 mA
Continuous current through V _{CC} or GND	±50 mA
Package thermal impedance, θ_{JA} (see Note 2): D package	86°C/W
PW package	113°C/W
Storage temperature range, T _{stq}	–65°C to 150°C

[‡] 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	MAX	UNIT
V_{CC}	Supply voltage		2	5.5	V
		V _{CC} = 2 V	1.5		
V_{IH}	High-level input voltage	V _{CC} = 3 V	2.1		V
		V _{CC} = 5.5 V	3.85		
		V _{CC} = 2 V		0.5	
V_{IL}	Low-level input voltage	V _{CC} = 3 V		0.9	V
		V _{CC} = 5.5 V		1.65	
VI	Input voltage	•	0	5.5	V
Vo	Output voltage		0	V_{CC}	V
		V _{CC} = 2 V		-50	μΑ
I _{OH}	High-level output current	$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$		-4	
		$V_{CC} = 5 V \pm 0.5 V$		-8	mA
		V _{CC} = 2 V		50	μΑ
I_{OL}	Low-level output current	$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$		4	
		$V_{CC} = 5 V \pm 0.5 V$		8	mA
		$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$		100	
Δt/Δv	Input transition rise or fall rate	$V_{CC} = 5 V \pm 0.5 V$		20	ns/V
T _A	Operating free-air temperature	•	-40	125	°C

NOTE 3: 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.



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

^{2.} The package thermal impedance is calculated in accordance with JESD 51-7.

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

242445752	TTOT COMPLTIONS	.,	T _A = 25°C					
PARAMETER	TEST CONDITIONS	V _{cc}	MIN	TYP	MAX	MIN	MAX	UNIT
		2 V	1.9	2		1.9		
	$I_{OH} = -50 \mu A$	3 V	2.9	3		2.9		
V_{OH}		4.5 V	4.4	4.5		4.4		V
	$I_{OH} = -4 \text{ mA}$	3 V	2.58			2.48		
	$I_{OH} = -8 \text{ mA}$	4.5 V	3.94			3.8		
		2 V			0.1		0.1	
	I _{OL} = 50 μA	3 V			0.1		0.1	
V_{OL}		4.5 V			0.1		0.1	V
01	I _{OL} = 4 mA	3 V			0.36		0.5	
	I _{OL} = 8 mA	4.5 V			0.36		0.5	
l _l	V _I = 5.5 V or GND	0 V to 5.5 V			±0.1		±1	μΑ
I _{CC}	$V_I = V_{CC}$ or GND, $I_O = 0$	5.5 V			2		20	μΑ
C _i	V _I = V _{CC} or GND	5 V		2	10			pF

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

24244555	FROM	то	LOAD	T,	_Δ = 25°C	;							
PARAMETER	(INPUT)	(OUTPUT)	CAPACITANCE	MIN	TYP	MAX	MIN	MAX	UNIT				
t _{PLH}		Y	0 45 - 5		5	8.9	1	10.5					
t _{PHL}	A		$C_L = 15 pF$		5	8.9	1	10.5	ns				
t _{PLH}	Δ.	Y	C - 50 pF		7.5	11.4	1	13	no				
t _{PHL}	A		Y	Y	Y	Y	$C_L = 50 \text{ pF}$	C _L = 50 pF		7.5	11.4	1	13

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

DADAMETED	FROM	то	LOAD	T,	_A = 25°C	;					
PARAMETER	(INPUT)	(OUTPUT)	CAPACITANCE	MIN	TYP	MAX	MIN	MAX	UNIT		
t _{PLH}		.,	C _L = 15 pF		3.8	5.5	1	6.5			
t _{PHL}	A	Υ			3.8	5.5	1	6.5	ns		
t _{PLH}	Δ.	V	C		5.3	7.5	1	8.5			
t _{PHL}	A	Y	ť	C _L = 50 pF	$C_L = 50 pF$		5.3	7.5	1	8.5	ns

noise characteristics, $V_{CC} = 5 \text{ V}$, $C_L = 50 \text{ pF}$, $T_A = 25^{\circ}\text{C}$ (see Note 4)

	PARAMETER	MIN	TYP	MAX	UNIT
V _{OL(P)}	Quiet output, maximum dynamic V _{OL}		0.4		V
$V_{OL(V)}$	Quiet output, minimum dynamic V _{OL}		-0.4		V
V _{OH(V)}	Quiet output, minimum dynamic V _{OH}		4.8		V
V _{IH(D)}	High-level dynamic input voltage	3.5			V
$V_{IL(D)}$	Low-level dynamic input voltage			1.5	V

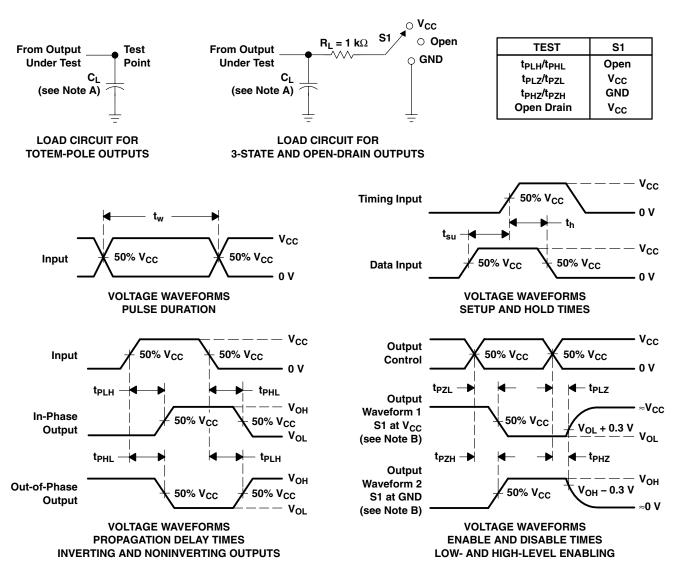
NOTE 4: Characteristics are for surface-mount packages only.



operating characteristics, V_{CC} = 5 V, T_A = 25°C

	PARAMETER		ONDITIONS	TYP	UNIT
С	Power dissipation capacitance	No load,	f = 1 MHz	12	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 input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms



PACKAGE OPTION ADDENDUM

www.ti.com 26-Mar-2010

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	e Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
SN74AHC04QDRG4Q1	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC04QDRQ1	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC04QPWRG4Q1	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC04QPWRQ1	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR

⁽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.

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OTHER QUALIFIED VERSIONS OF SN74AHC04-Q1:

Catalog: SN74AHC04

Enhanced Product: SN74AHC04-EP

• Military: SN54AHC04

NOTE: Qualified Version Definitions:

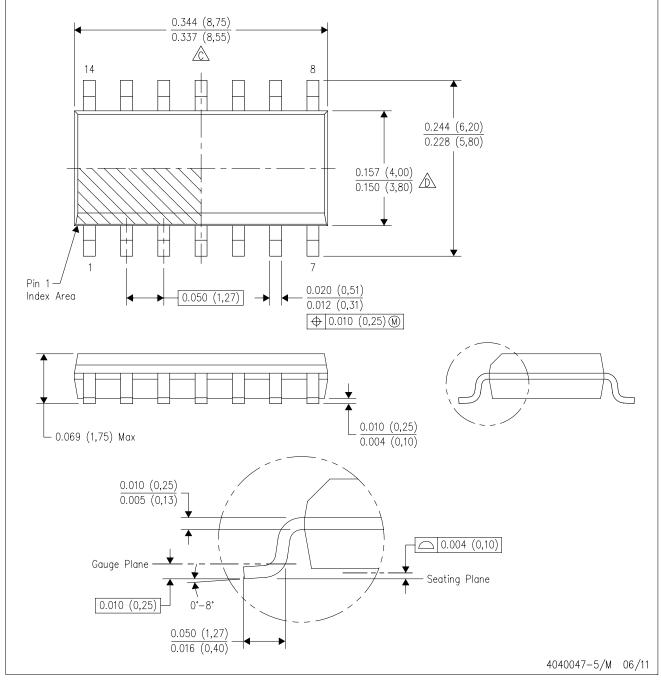
• Catalog - TI's standard catalog product

• Enhanced Product - Supports Defense, Aerospace and Medical Applications

• Military - QML certified for Military and Defense Applications

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



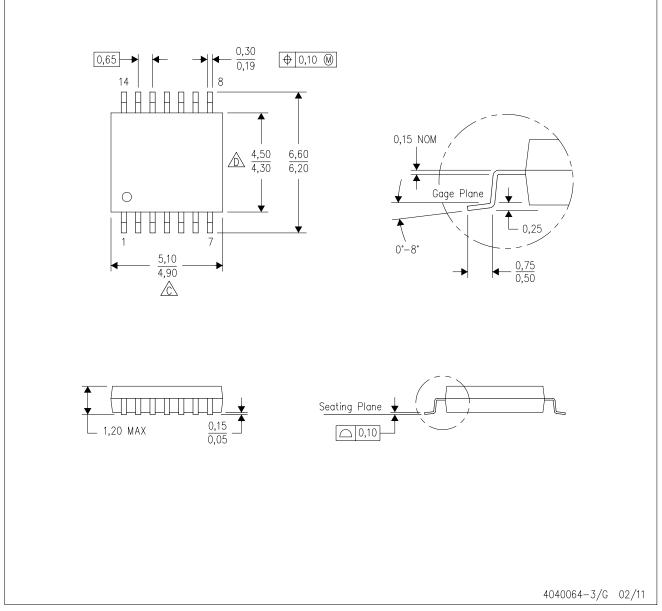
NOTES:

- 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.



PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE



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.
 - Sody 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



NOTES:

- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Publication IPC-7351 is recommended for alternate designs.
- D. 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.
- E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



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