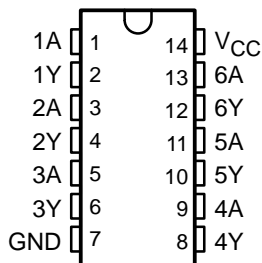


SN54HC04, SN74HC04 HEX INVERTERS

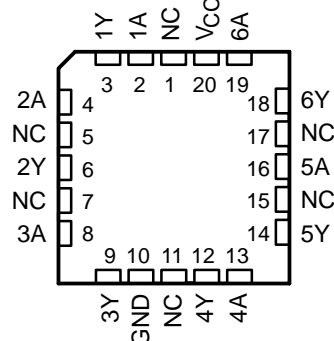
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- Wide Operating Voltage Range of 2 V to 6 V
- Outputs Can Drive Up To 10 LSTTL Loads
- Low Power Consumption, 20- μ A Max I_{CC}
- Typical $t_{pd} = 8$ ns
- ± 4 -mA Output Drive at 5 V
- Low Input Current of 1 μ A Max

SN54HC04 . . . J OR W PACKAGE
SN74HC04 . . . D, N, NS, OR PW PACKAGE
(TOP VIEW)



SN54HC04 . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

description/ordering information

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

ORDERING INFORMATION

T _A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	PDIP – N	Tube of 25	SN74HC04N	SN74HC04N
	SOIC – D	Tube of 50	SN74HC04D	HC04
		Reel of 2500	SN74HC04DR	
		Reel of 250	SN74HC04DT	
	SOP – NS	Reel of 2000	SN74HC04NSR	HC04
	TSSOP – PW	Tube of 90	SN74HC04PW	HC04
Reel of 2000		SN74HC04PWR		
Reel of 250		SN74HC04PWT		
-55°C to 125°C	CDIP – J	Tube of 25	SNJ54HC04J	SNJ54HC04J
	CFP – W	Tube of 150	SNJ54HC04W	SNJ54HC04W
	LCCC – FK	Tube of 55	SNJ54HC04FK	SNJ54HC04FK

† 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



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.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

SN54HC04, SN74HC04 HEX INVERTERS

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logic diagram (positive logic)



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

Supply voltage range, V_{CC}	-0.5 V 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_{OK} ($V_O < 0$ or $V_O > V_{CC}$) (see Note 1)	± 20 mA
Continuous output current, I_O ($V_O = 0$ 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
N package	80°C/W
NS package	76°C/W
PW package	113°C/W
Storage temperature range, T_{stg}	-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.

- 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.

recommended operating conditions (see Note 3)

		SN54HC04			SN74HC04			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage	2	5	6	2	5	6	V
V_{IH}	High-level input voltage	$V_{CC} = 2$ V		1.5	1.5		V	
		$V_{CC} = 4.5$ V		3.15	3.15			
		$V_{CC} = 6$ V		4.2	4.2			
V_{IL}	Low-level input voltage	$V_{CC} = 2$ V			0.5		0.5	V
		$V_{CC} = 4.5$ V			1.35		1.35	
		$V_{CC} = 6$ V			1.8		1.8	
V_I	Input voltage	0		V_{CC}	0		V_{CC}	V
V_O	Output voltage	0		V_{CC}	0		V_{CC}	V
$\Delta t/\Delta v$	Input transition rise/fall time	$V_{CC} = 2$ V			1000		1000	ns
		$V_{CC} = 4.5$ V			500		500	
		$V_{CC} = 6$ V			400		400	
T_A	Operating free-air temperature	-55		125	-40		85	°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.



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

PARAMETER	TEST CONDITIONS		V _{CC}	T _A = 25°C			SN54HC04		SN74HC04		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V _{OH}	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		
		I _{OH} = -4 mA	4.5 V	3.98	4.3		3.7		3.84		
		I _{OH} = -5.2 mA	6 V	5.48	5.8		5.2		5.34		
V _{OL}	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	
		I _{OL} = 4 mA	4.5 V		0.17	0.26		0.4		0.33	
		I _{OL} = 5.2 mA	6 V		0.15	0.26		0.4		0.33	
I _I	V _I = V _{CC} or 0		6 V		±0.1	±100		±1000		±1000	nA
I _{CC}	V _I = V _{CC} or 0, I _O = 0		6 V			2		40		20	μA
C _i			2 V to 6 V		3	10		10		10	pF

switching characteristics over recommended operating free-air temperature range, C_L = 50 pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC}	T _A = 25°C			SN54HC04		SN74HC04		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t _{pd}	A	Y	2 V		45	95		145		120	ns
			4.5 V		9	19		29		24	
			6 V		8	16		25		20	
t _t		Y	2 V		38	75		110		95	ns
			4.5 V		8	15		22		19	
			6 V		6	13		19		16	

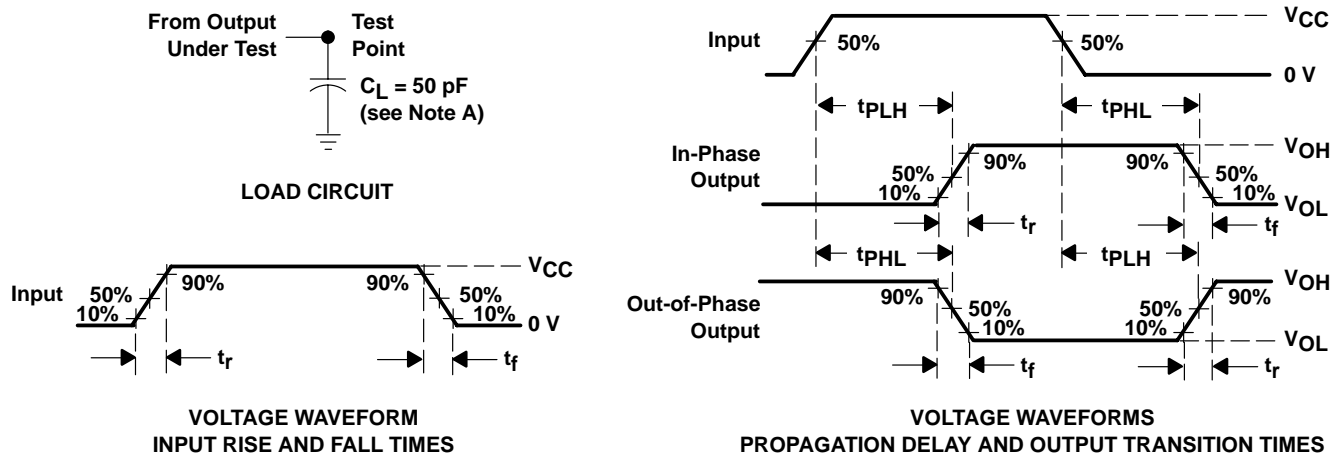
operating characteristics, T_A = 25°C

PARAMETER	TEST CONDITIONS	TYP	UNIT
C _{pd} Power dissipation capacitance per inverter	No load	20	pF

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PARAMETER MEASUREMENT INFORMATION



- NOTES:
- A. C_L 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, $Z_O = 50 \Omega$, $t_r = 6$ ns, $t_f = 6$ ns.
 - C. The outputs are measured one at a time with one input transition per measurement.
 - D. t_{PLH} and t_{PHL} are the same as t_{pd} .

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⁾
5962-8409801VCA	ACTIVE	CDIP	J	14	1	TBD	Call TI	Level-NC-NC-NC
5962-8409801VDA	ACTIVE	CFP	W	14	1	TBD	Call TI	Level-NC-NC-NC
84098012A	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Level-NC-NC-NC
8409801CA	ACTIVE	CDIP	J	14	1	TBD	Call TI	Level-NC-NC-NC
8409801DA	ACTIVE	CFP	W	14	1	TBD	Call TI	Level-NC-NC-NC
JM38510/65701B2A	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Level-NC-NC-NC
JM38510/65701BCA	ACTIVE	CDIP	J	14	1	TBD	Call TI	Level-NC-NC-NC
JM38510/65701BDA	ACTIVE	CFP	W	14	1	TBD	Call TI	Level-NC-NC-NC
SN54HC04J	ACTIVE	CDIP	J	14	1	TBD	Call TI	Level-NC-NC-NC
SN74HC04D	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC04DBR	ACTIVE	SSOP	DB	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC04DBRE4	ACTIVE	SSOP	DB	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC04DE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC04DR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC04DRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC04DRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC04DT	ACTIVE	SOIC	D	14	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC04DTE4	ACTIVE	SOIC	D	14	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC04N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74HC04N3	OBSOLETE	PDIP	N	14		TBD	Call TI	Call TI
SN74HC04NE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74HC04NSR	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC04NSRG4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC04PW	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC04PWG4	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC04PWLE	OBSOLETE	TSSOP	PW	14		TBD	Call TI	Call TI
SN74HC04PWR	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC04PWRG4	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC04PWT	ACTIVE	TSSOP	PW	14	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
SN74HC04PWTG4	ACTIVE	TSSOP	PW	14	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SNJ54HC04FK	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Level-NC-NC-NC
SNJ54HC04J	ACTIVE	CDIP	J	14	1	TBD	Call TI	Level-NC-NC-NC
SNJ54HC04W	ACTIVE	CFP	W	14	1	TBD	Call TI	Level-NC-NC-NC
SNV54HC04J	ACTIVE	CDIP	J	14		TBD	Call TI	Call TI
SNV54HC04W	ACTIVE	CFP	W	14		TBD	Call TI	Call TI

⁽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) 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.

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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