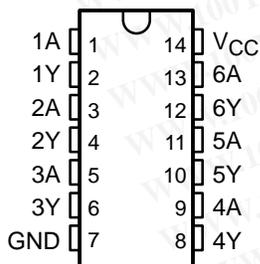
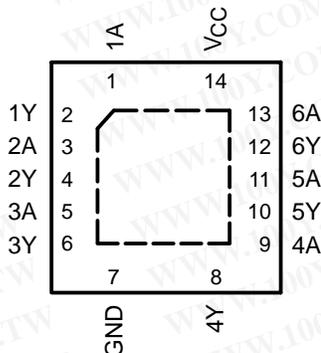


- Operate From 1.65 V to 3.6 V
- Inputs Accept Voltages to 5.5 V
- Max t_{pd} of 4.5 ns at 3.3 V
- Typical V_{OLP} (Output Ground Bounce) <0.8 V at $V_{CC} = 3.3$ V, $T_A = 25^\circ\text{C}$
- Typical V_{OHV} (Output V_{OH} Undershoot) >2 V at $V_{CC} = 3.3$ V, $T_A = 25^\circ\text{C}$
- Latch-Up Performance Exceeds 250 mA Per JESD 17
- ESD Protection Exceeds JESD 22
 - 2000-V Human-Body Model (A114-A)
 - 200-V Machine Model (A115-A)
 - 1000-V Charged-Device Model (C101)

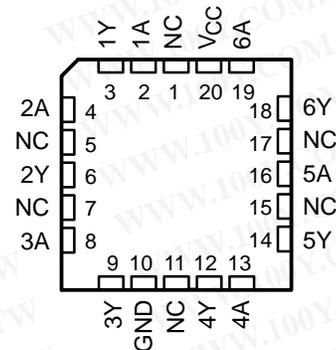
SN54LVC04A . . . J OR W PACKAGE
 SN74LVC04A . . . D, DB, DGV, NS,
 OR PW PACKAGE
 (TOP VIEW)



SN74LVC04A . . . RGY PACKAGE
 (TOP VIEW)



SN54LVC04A . . . FK PACKAGE
 (TOP VIEW)



NC – No internal connection

description/ordering information

The SN54LVC04A hex inverter contains six independent inverters designed for 2.7-V to 3.6-V V_{CC} operation, and the SN74LVC04A hex inverter contains six independent inverters designed for 1.65-V to 3.6-V V_{CC} operation.

The 'LVC04A devices perform the Boolean function $Y = \bar{A}$.

Inputs can be driven from either 3.3-V or 5-V devices. This feature allows the use of these devices as translators in a mixed 3.3-V/5-V system environment.

ORDERING INFORMATION

T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	QFN – RGY	Tape and reel	SN74LVC04ARGYR	LC04A
	SOIC – D	Tube	SN74LVC04AD	LVC04A
		Tape and reel	SN74LVC04ADR	
	SOP – NS	Tape and reel	SN74LVC04ANSR	LVC04A
	SSOP – DB	Tape and reel	SN74LVC04ADBR	LC04A
	TSSOP – PW	Tape and reel	SN74LVC04APWR	LC04A
TVSOP – DGV	Tape and reel	SN74LVC04ADGVR	LC04A	
–55°C to 125°C	CDIP – J	Tube	SNJ54LVC04AJ	SNJ54LVC04AJ
	CFP – W	Tube	SNJ54LVC04AW	SNJ54LVC04AW
	LCCC – FK	Tube	SNJ54LVC04AFK	SNJ54LVC04AFK

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.



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SN54LVC04A, SN74LVC04A HEX INVERTERS

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FUNCTION TABLE
(each inverter)

INPUT A	OUTPUT Y
H	L
L	H

logic diagram, each inverter (positive logic)



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

Supply voltage range, V_{CC}	-0.5 V to 6.5 V
Input voltage range, V_I (see Note 1)	-0.5 V to 6.5 V
Output voltage range, V_O (see Notes 1 and 2)	-0.5 V to $V_{CC} + 0.5$ V
Input clamp current, I_{IK} ($V_I < 0$)	-50 mA
Output clamp current, I_{OK} ($V_O < 0$)	-50 mA
Continuous output current, I_O	± 100 mA
Continuous current through V_{CC} or GND	± 100 mA
Package thermal impedance, θ_{JA} (see Note 3): D package	86°C/W
(see Note 3): DB package	96°C/W
(see Note 3): DGV package	127°C/W
(see Note 3): NS package	76°C/W
(see Note 3): PW package	113°C/W
(see Note 4): RGY package	47°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 negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.
 2. The value of V_{CC} is provided in the recommended operating conditions table.
 3. The package thermal impedance is calculated in accordance with JESD 51-7.
 4. The package thermal impedance is calculated in accordance with JESD 51-5.

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SN54LVC04A, SN74LVC04A HEX INVERTERS

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recommended operating conditions (see Note 5)

		SN54LVC04A		SN74LVC04A		UNIT
		MIN	MAX	MIN	MAX	
V _{CC}	Supply voltage	Operating		2	3.6	V
		Data retention only		1.5	1.5	
V _{IH}	High-level input voltage	V _{CC} = 1.65 V to 1.95 V		0.65 × V _{CC}		V
		V _{CC} = 2.3 V to 2.7 V		1.7		
		V _{CC} = 2.7 V to 3.6 V		2	2	
V _{IL}	Low-level input voltage	V _{CC} = 1.65 V to 1.95 V		0.35 × V _{CC}		V
		V _{CC} = 2.3 V to 2.7 V		0.7		
		V _{CC} = 2.7 V to 3.6 V		0.8		
V _I	Input voltage	0	5.5	0	5.5	V
V _O	Output voltage	0	V _{CC}	0	V _{CC}	V
I _{OH}	High-level output current	V _{CC} = 1.65 V		-4		mA
		V _{CC} = 2.3 V		-8		
		V _{CC} = 2.7 V		-12		
		V _{CC} = 3 V		-24		
I _{OL}	Low-level output current	V _{CC} = 1.65 V		4		mA
		V _{CC} = 2.3 V		8		
		V _{CC} = 2.7 V		12		
		V _{CC} = 3 V		24		
T _A	Operating free-air temperature	-55	125	-40	85	°C

NOTE 5: 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}	SN54LVC04A			SN74LVC04A			UNIT
			MIN	TYP†	MAX	MIN	TYP†	MAX	
V _{OH}	I _{OH} = -100 μA	1.65 V to 3.6 V				V _{CC} -0.2			V
		2.7 V to 3.6 V	V _{CC} -0.2						
	I _{OH} = -4 mA	1.65 V			1.2				
	I _{OH} = -8 mA	2.3 V			1.7				
	I _{OH} = -12 mA	2.7 V	2.2		2.2				
		3 V	2.4		2.4				
I _{OH} = -24 mA	3 V	2.2		2.2					
V _{OL}	I _{OL} = 100 μA	1.65 V to 3.6 V				0.2			V
		2.7 V to 3.6 V			0.2				
	I _{OL} = 4 mA	1.65 V				0.45			
	I _{OL} = 8 mA	2.3 V				0.7			
	I _{OL} = 12 mA	2.7 V			0.4		0.4		
3 V				0.55		0.55			
I _I	V _I = 5.5 V or GND	3.6 V			±5			±5	μA
I _{CC}	V _I = V _{CC} or GND, I _O = 0	3.6 V			10			10	μA
ΔI _{CC}	One input at V _{CC} - 0.6 V, Other inputs at V _{CC} or GND	2.7 V to 3.6 V			500			500	μA
C _i	V _I = V _{CC} or GND	3.3 V			5			5	pF

† All typical values are at V_{CC} = 3.3 V, T_A = 25°C.

switching characteristics over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54LVC04A				UNIT
			V _{CC} = 2.7 V		V _{CC} = 3.3 V ± 0.3 V		
			MIN	MAX	MIN	MAX	
t _{pd}	A	Y	5.5	0.5	4.5	ns	

switching characteristics over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

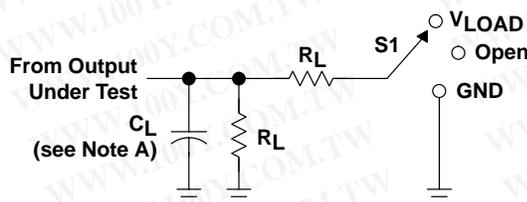
PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN74LVC04A						UNIT	
			V _{CC} = 1.8 V	V _{CC} = 2.5 V ± 0.2 V		V _{CC} = 2.7 V		V _{CC} = 3.3 V ± 0.3 V		
			TYP	MIN	MAX	MIN	MAX	MIN		MAX
t _{pd}	A	Y	13.5	1	7.5	5.5	1	4.5	ns	
t _{sk(o)}								1	ns	

operating characteristics, T_A = 25°C

PARAMETER	TEST CONDITIONS	V _{CC} = 1.8 V	V _{CC} = 2.5 V	V _{CC} = 3.3 V	UNIT	
		TYP	TYP	TYP		
C _{pd}	Power dissipation capacitance per inverter	f = 10 MHz	6	7	8	pF



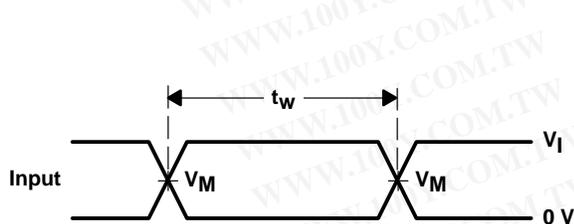
PARAMETER MEASUREMENT INFORMATION



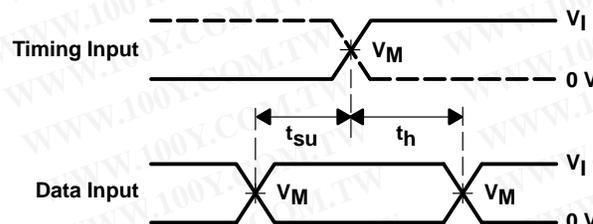
LOAD CIRCUIT

TEST	S1
t _{PLH} /t _{PHL}	Open
t _{PLZ} /t _{PZL}	V _{LOAD}
t _{PHZ} /t _{PZH}	GND

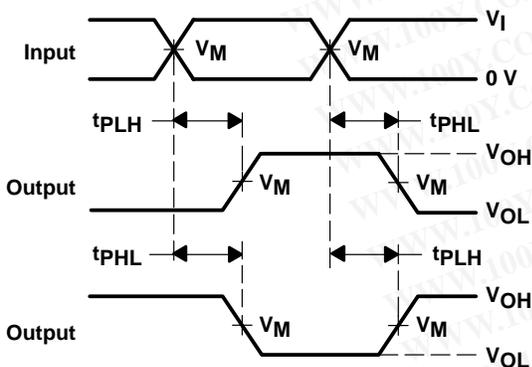
V _{CC}	INPUTS		V _M	V _{LOAD}	C _L	R _L	V _Δ
	V _I	t _r /t _f					
1.8 V ± 0.15 V	V _{CC}	≤ 2 ns	V _{CC} /2	2 × V _{CC}	30 pF	1 kΩ	0.15 V
2.5 V ± 0.2 V	V _{CC}	≤ 2 ns	V _{CC} /2	2 × V _{CC}	30 pF	500 Ω	0.15 V
2.7 V	2.7 V	≤ 2.5 ns	1.5 V	6 V	50 pF	500 Ω	0.3 V
3.3 V ± 0.3 V	2.7 V	≤ 2.5 ns	1.5 V	6 V	50 pF	500 Ω	0.3 V



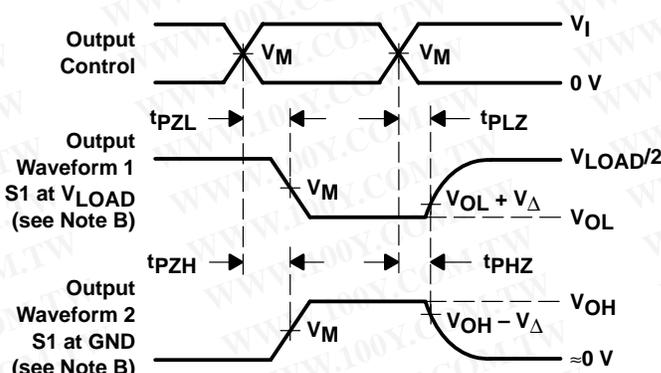
VOLTAGE WAVEFORMS
 PULSE DURATION



VOLTAGE WAVEFORMS
 SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
 PROPAGATION DELAY TIMES
 INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS
 ENABLE AND DISABLE TIMES
 LOW- AND HIGH-LEVEL ENABLING

- 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 ≤ 10 MHz, Z_O = 50 Ω.
 - D. The outputs are measured one at a time with one transition per measurement.
 - E. t_{PLZ} and t_{PHZ} are the same as t_{dis}.
 - F. t_{PZL} and t_{PZH} are the same as t_{en}.
 - G. t_{PLH} and t_{PHL} are the same as t_{pd}.
 - H. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

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