

**TYPES SN7404, SN74LS04, SN74S04  
SN5404, SN54LS04, SN54S04**  
**HEX INVERTERS**  
REVISED DECEMBER 1983

- Package Options Include Standard Plastic (N) and Ceramic (J) 300-mil Dual-In-Line Packages, Plastic Small Outline (D) and Ceramic Chip Carrier (FK) Package
- Dependable Texas Instruments Quality and Reliability

**description**

These devices contain six independent inverters.

The SN5404, SN54LS04 and SN54S04 are characterized for Operation over the full military temperature range of -55°C to 125°C. The SN7404, SN74LS04 and SN74S04 are characterized for Operation from 0°C to 70°C.

**FUNCTION TABLE (each inverter)**

INPUTS		OUTPUT	
A		Y	
H		L	
L		H	

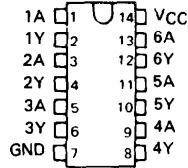
**logic diagram (each inverter)**



**positive logic**

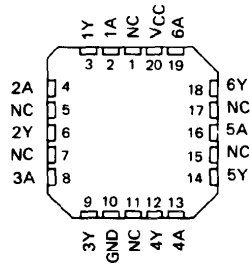
$$Y = \bar{A}$$

SN5404, SN54LS04, SN54S04 ... J PACKAGE  
SN7404 ... N PACKAGE  
SN74LS04, SN74S04 ... D OR N PACKAGE  
(TOP VIEW)



SN54LS04, SN54S04 FK PACKAGE

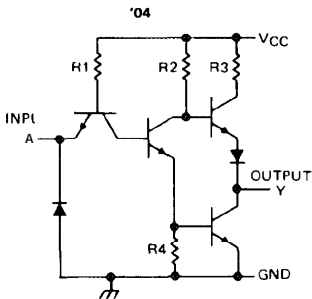
(TOP VIEW)



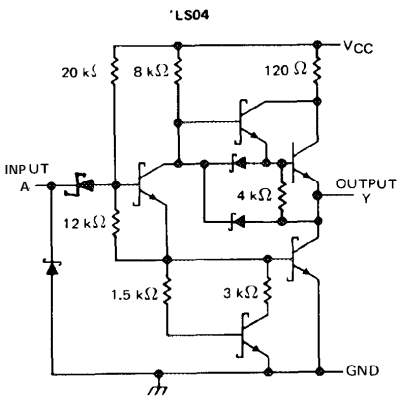
NC No internal connection

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**HEX INVERTERS**

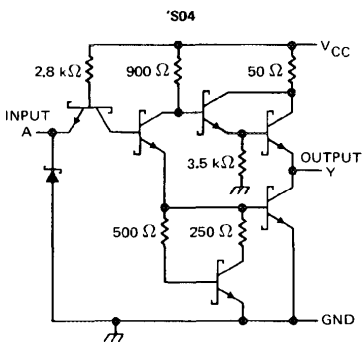
schematics (each gate)



CIRCUIT	R1	R2	R3	R4
'04	4 kΩ	1.6 kΩ	130 Ω	1 kΩ



Resistor values shown are nominal.



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

Supply voltage, $V_{CC}$ (see Note 1): '04, 'LS04, 'S04	7 V
Input voltage: '04, 'S04	5.5 V
'LS04	7 v
Operating free-air temperature range: SN54	- 55 C to 125 C
SN74'	0 c to 70 c
Storage temperature range	-65 C to 150 C

NOTE 1: Voltage values are with respect to network ground terminal.

recommended operating conditions

	SN5404			SN7404			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
V <sub>CC</sub> Supply voltage	4.5	5	5.5	4.75	5	5.25	V
V <sub>IH</sub> High-level input voltage	2			2			V
V <sub>IL</sub> Low-level input voltage			0.8			0.8	V
I <sub>OH</sub> High-level output current			− 0.4			− 0.4	mA
I <sub>OL</sub> Low-level output current			16			16	mA
T <sub>A</sub> Operating free-air temperature	− 55		125	0		70	°C

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

PARAMETER	TEST CONDITIONS†	SN5404			SN7404			UNIT
		MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V <sub>IK</sub>	V <sub>CC</sub> = MIN, I <sub>I</sub> = − 12 mA			− 1.5			− 1.5	V
V <sub>OH</sub>	V <sub>CC</sub> = MIN, V <sub>IL</sub> = 0.8 V, I <sub>OH</sub> = − 0.4 mA	2.4	3.4		2.4	3.4		V
V <sub>OL</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 16 mA	0.2	0.4		0.2	0.4		V
I <sub>I</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 5.5 V			1			1	mA
I <sub>IH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.4 V			40			40	μA
I <sub>IL</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V			− 1.6			− 1.6	mA
I <sub>OS</sub> §	V <sub>CC</sub> = MAX	− 20		− 55	− 18		− 55	mA
I <sub>CCH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0 V	6		12	6		12	mA
I <sub>CCL</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 4.5 V	18		33	18		33	mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

§ Not more than one output should be shorted at a time.

switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C (see note 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t <sub>PLH</sub>	A	Y	R <sub>L</sub> = 400 Ω, C <sub>L</sub> = 15 pF		12	22	ns
t <sub>PHL</sub>					8	15	ns

NOTE 2. See General Information Section for load circuits and voltage waveforms.

# TYPES SN74LS04, SN54LS04

## HEX INVERTERS

### recommended operating conditions

	SN54LS04			SN74LS04			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
$V_{CC}$ Supply voltage	4.5	5	5.5	4.75	5	5.25	V
$V_{IH}$ High-level input voltage	2			2			V
$V_{IL}$ Low-level input voltage			0.7			0.8	V
$I_{OH}$ High-level output current			-0.4			-0.4	mA
$I_{OL}$ Low-level output current			4			8	mA
$T_A$ Operating free-air temperature	-55		125	0		70	°C

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

PARAMETER	TEST CONDITIONS †	SN54LS04			SN74LS04			UNIT
		MIN	TYP ‡	MAX	MIN	TYP ‡	MAX	
$V_{IK}$	$V_{CC} = \text{MIN.}$ , $I_I = -18 \text{ mA}$			1.5			-1.5	V
$V_{OH}$	$V_{CC} = \text{MIN.}$ , $V_{IL} = \text{MAX.}$ , $I_{OH} = -0.4 \text{ mA}$	2.5	3.4		2.7	3.4		V
$V_{OL}$	$V_{CC} = \text{MIN.}$ , $V_{IH} = 2 \text{ V.}$ , $I_{OL} = 4 \text{ mA}$	0.25	0.4			0.4		V
	$V_{CC} = \text{MIN.}$ , $V_{IH} = 2 \text{ V.}$ , $I_{OL} = 8 \text{ mA}$				0.25	0.5		
$I_I$	$V_{CC} = \text{MAX.}$ , $V_I = 7 \text{ V}$		0.1			0.1		mA
$I_{IH}$	$V_{CC} = \text{MAX.}$ , $V_I = 2.7 \text{ V}$		20			20		µA
$I_{IL}$	$V_{CC} = \text{MAX.}$ , $V_I = 0.4 \text{ V}$		-0.4			-0.4		mA
$I_{OS} §$	$V_{CC} = \text{MAX.}$	-20		-100	-20		-100	mA
$I_{CCH}$	$V_{CC} = \text{MAX.}$ , $V_I = 0 \text{ V}$	1.2	2.4		1.2	2.4		mA
$I_{CCL}$	$V_{CC} = \text{MAX.}$ , $V_I = 4.5 \text{ V}$	3.6	6.6		36	66		mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

§ No more than one output should be shorted at a time, and the duration of the short circuit should not exceed one second.

### switching characteristics, $V_{CC} = 5 \text{ V}$ , $T_A = 25^\circ\text{C}$ (see note 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$	A	Y	$R_L = 2 \text{ k}\Omega$ , $C_L = 15 \text{ pF}$		9	15	ns
$t_{PHL}$					10	15	ns

NOTE 2: See General Information Section for load circuits and voltage waveforms.

# TYPES SN74S04, SN54S04

## HEX INVERTERS

### recommended operating conditions

	SN54S04			SN74S04			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
$V_{CC}$ Supply voltage	4.5	5	5.5	4.75	5	5.25	V
$V_{IH}$ High-level input voltage	2			2			V
$V_{IL}$ Low-level input voltage			0.8			0.8	V
$I_{OH}$ High-level output current			-1			-1	mA
$I_{OL}$ Low-level output current			20			20	mA
$T_A$ Operating free-air temperature	-55	125		0	70		°C

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

PARAMETER	TEST CONDITIONS †	SN54S04			SN74S04			UNIT
		MIN	TYP ‡	MAX	MIN	TYP ‡	MAX	
$V_{IK}$	$V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$			-1.2			-1.2	V
$V_{OH}$	$V_{CC} = \text{MIN}, V_{IL} = 0.8 \text{ V}, I_{OH} = -1 \text{ mA}$	2.5	3.4		2.7	3.4		V
$V_{OL}$	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, I_{OL} = 20 \text{ mA}$			0.5			0.5	V
$I_I$	$V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$			1			1	mA
$I_{IH}$	$V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$			50			50	µA
$I_{IL}$	$V_{CC} = \text{MAX}, V_I = 0.5 \text{ V}$			-2			-2	mA
$I_{OS} §$	$V_{CC} = \text{MAX}$	-40		-100	-40		-100	mA
$I_{OCH}$	$V_{CC} = \text{MAX}, V_I = 0 \text{ V}$		15	24		15	24	mA
$I_{CCL}$	$V_{CC} = \text{MAX}, V_I = 4.5 \text{ V}$		30	54		30	54	mA

† For conditions shown as MIN or MAX, use the appropriate values specified under recommended operating conditions.

‡ All typical values are at  $V_{CC} = 5 \text{ V}, T_A = 25^\circ\text{C}$ .

§ Not more than one output should be shorted at a time, and the duration of the short circuit should not exceed one second.

### switching characteristics, $V_{CC} = 5 \text{ V}, T_A = 25^\circ\text{C}$ (see note 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$	A	Y	$R_L = 280 \Omega, C_L = 15 \text{ pF}$		3	4.5	ns
$t_{PHL}$					3	5	ns
$t_{PLH}$			$R_L = 280 \Omega, C_L = 50 \text{ pF}$		4.5		ns
$t_{PHL}$					5		ns

NOTE 2. See General Information Section for load circuits and voltage waveforms.