

TYPES SN5404, SN54H04, SN54L04, SN54LS04, SN54S04, SN7404, SN74H04, SN74LS04, SN74S04 HEX INVERTERS

REVISED DECEMBER 1983

- Package Options Include Both Plastic and Ceramic Chip Carriers in Addition to Plastic and Ceramic DIPs
- Dependable Texas Instruments Quality and Reliability

description

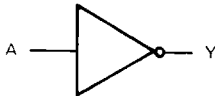
These devices contain six independent inverters.

The SN5404, SN54H04, SN54L04, SN54LS04 and SN54S04 are characterized for operation over the full military temperature range of -55°C to 125°C . The SN7404, SN74H04, 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)

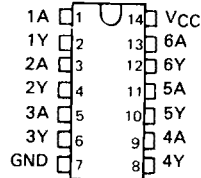


positive logic

$$Y = \bar{A}$$

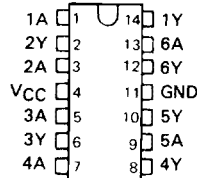
SN5404, SN54H04, SN54L04 ... J PACKAGE
SN54LS04, SN54S04 ... J OR W PACKAGE
SN7404, SN74H04 ... J OR N PACKAGE
SN74LS04, SN74S04 ... D, J OR N PACKAGE

(TOP VIEW)



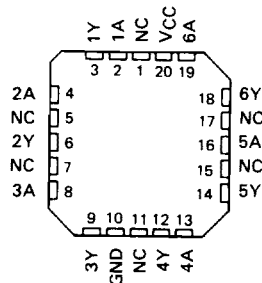
SN5404, SN54H04 ... W PACKAGE

(TOP VIEW)



SN54LS04, SN54S04 ... FK PACKAGE
SN74LS04, SN74S04 ... FN PACKAGE

(TOP VIEW)



NC - No internal connection

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PRODUCTION DATA

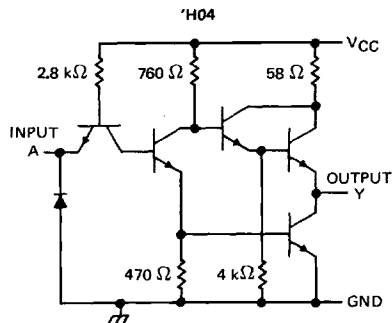
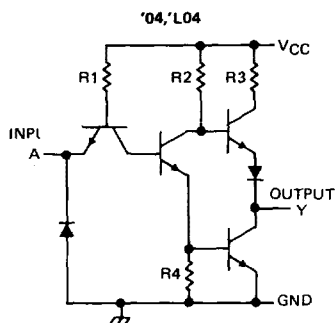
This document contains information current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

TEXAS
INSTRUMENTS

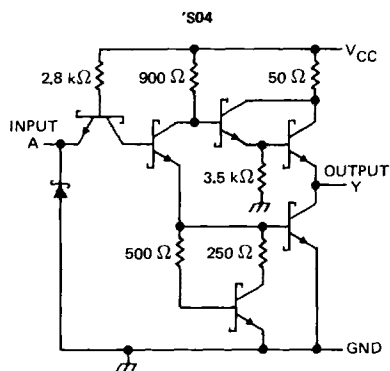
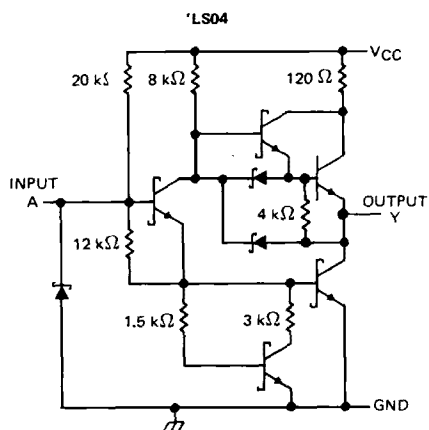
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TYPES SN5404, SN54H04, SN54L04, SN54LS04, SN54S04, SN7404, SN74H04, SN74LS04, SN74S04 HEX INVERTERS

schematics (each gate)



CIRCUIT	R1	R2	R3	R4
'04	4 kΩ	1.6 kΩ	130 Ω	1 kΩ
'L04	40 kΩ	20 kΩ	500 Ω	12 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, 'H04, 'LS04, 'S04	7 V
	'L04	8 V
Input voltage:	'04, 'H04, 'L04, '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.

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TYPES SN5404, SN7404 HEX INVERTERS

recommended operating conditions

	SN5404			SN7404			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			-0.4			-0.4	mA
I_{OL} Low-level output current			16			16	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†	SN5404			SN7404			UNIT
		MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IK}	$V_{CC} = \text{MIN}, I_I = -12 \text{ mA}$			-1.5			-1.5	V
V_{OH}	$V_{CC} = \text{MIN}, V_{IL} = 0.8 \text{ V}, I_{OH} = -0.4 \text{ mA}$	2.4	3.4		2.4	3.4		V
V_{OL}	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, I_{OL} = 16 \text{ mA}$		0.2	0.4		0.2	0.4	V
I_I	$V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$			1			1	mA
I_{IH}	$V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$			40			40	µA
I_{IL}	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$			-1.6			-1.6	mA
$I_{OS} §$	$V_{CC} = \text{MAX}$	-20		-55	-18		-55	mA
I_{CCH}	$V_{CC} = \text{MAX}, V_I = 0 \text{ V}$		6	12		6	12	mA
I_{CCL}	$V_{CC} = \text{MAX}, V_I = 4.5 \text{ V}$		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 $V_{CC} = 5 \text{ V}, T_A = 25^\circ\text{C}$.

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

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	$R_L = 400 \Omega, C_L = 15 \text{ pF}$		12	22	ns
t_{PHL}					8	15	ns

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

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TYPES SN54H04, SN74H04

HEX INVERTERS

recommended operating conditions

	SN54H04			SN74H04			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			- 0.5			- 0.5	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†	MIN	TYP‡	MAX	UNIT
V _{IK}	V _{CC} = MIN, I _I = - 8 mA			- 1.5	V
V _{OH}	V _{CC} = MIN, V _{IL} = 0.8 V, I _{OH} = - 0.5 mA	2.4	3.5		V
V _{OL}	V _{CC} = MIN, V _{IH} = 2 V, I _{OL} = 20 mA		0.2	0.4	V
I _I	V _{CC} = MAX, V _I = 5.5 V			1	mA
I _{IH}	V _{CC} = MAX, V _I = 2.4 V			50	µA
I _{IL}	V _{CC} = MAX, V _I = 0.4 V			- 2	mA
I _{OS} §	V _{CC} = MAX	- 40		- 100	mA
I _{CCH}	V _{CC} = MAX, V _I = 0 V		16	26	mA
I _{CCL}	V _{CC} = MAX, V _I = 4.5 V		40	58	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 V, T_A = 25°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 V, T_A = 25°C (see note 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t _{PLH}	A	Y	R _L = 280 Ω, C _L = 25 pF		6	10	ns
t _{PHL}					6.5	10	ns

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

recommended operating conditions

	SN54L04			UNIT
	MIN	NOM	MAX	
V _{CC} Supply voltage	4.5	5	5.5	V
V _{IH} High-level input voltage	2			V
V _{IL} Low-level input voltage			0.7	V
I _{OH} High-level output current			-0.1	mA
I _{OL} Low-level output current			2	mA
T _A Operating free-air temperature	-55		125	°C

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

PARAMETER	TEST CONDITIONS†	SN54L04			UNIT
		MIN	TYP‡	MAX	
V _{OH}	V _{CC} = MIN, V _{IL} = 0.7 V, I _{OH} = -0.1 mA	2.4	3.3		V
V _{OL}	V _{CC} = MIN, V _{IH} = 2 V, I _{OL} = 2 mA		0.15	0.3	V
I _I	V _{CC} = MAX, V _I = 5.5 V			0.1	mA
I _{IH}	V _{CC} = MAX, V _I = 2.4 V			10	μA
I _{IL}	V _{CC} = MAX, V _I = 0.3 V			-0.18	mA
I _{OS} §	V _{CC} = MAX	-3		-15	mA
I _{CCH}	V _{CC} = MAX, V _I = 0 V		0.66	1.2	mA
I _{CCL}	V _{CC} = MAX, V _I = 4.5 V		1.74	3.06	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 V, T_A = 25°C.

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

switching characteristics, V_{CC} = 5 V, T_A = 25°C (see note 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t _{PLH}	A	Y	R _L = 4 kΩ, C _L = 50 pF		35	60	ns
t _{PHL}					31	60	ns

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

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TYPES SN54LS04, SN74LS04 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} = MIN, I _I = -18 mA		-1.5			-1.5		V
V _{OH}	V _{CC} = MIN, V _{IL} = MAX, I _{OH} = -0.4 mA	2.5	3.4		2.7	3.4		V
V _{OL}	V _{CC} = MIN, V _{IH} = 2 V, I _{OL} = 4 mA		0.25	0.4			0.4	V
	V _{CC} = MIN, V _{IH} = 2 V, I _{OL} = 8 mA					0.25	0.5	
I _I	V _{CC} = MAX, V _I = 7 V			0.1			0.1	mA
I _{IH}	V _{CC} = MAX, V _I = 2.7 V			20			20	µA
I _{IL}	V _{CC} = MAX, V _I = 0.4 V			-0.4			-0.4	mA
I _{OS} §	V _{CC} = MAX	-20		-100	-20		-100	mA
I _{CCH}	V _{CC} = MAX, V _I = 0 V		1.2	2.4		1.2	2.4	mA
I _{CCL}	V _{CC} = MAX, V _I = 4.5 V		3.6	6.6		3.6	6.6	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 V, T_A = 25°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 V, T_A = 25°C (see note 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t _{PLH}	A	Y	R _L = 2 kΩ, C _L = 15 pF		9	15	ns
t _{PHL}					10	15	ns

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

TYPES SN54S04, SN74S04 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_{CCH}	$V_{CC} = \text{MAX}, V_I = 0 \text{ V}$		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 value 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.

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