

7404, LS04, S04

Inverters

Hex Inverter
Product Specification

Logic Products

TYPE	TYPICAL PROPAGATION DELAY	TYPICAL SUPPLY CURRENT (TOTAL)
7404	10ns	12mA
74LS04	9.5ns	2.4mA
74S04	3ns	22mA

ORDERING CODE

PACKAGES	COMMERCIAL RANGE $V_{CC} = 5V \pm 5\%$; $T_A = 0^\circ C$ to $+70^\circ C$
Plastic DIP	N7404N, N74LS04N, N74S04N
Plastic SO	N74LS04D, N74S04D

FUNCTION TABLE

INPUT	OUTPUT
A	Y
L	H
H	L

H = HIGH voltage level
L = LOW voltage level

NOTE:

For information regarding devices processed to Military Specifications, see the Signetics Military Products Data Manual.

INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

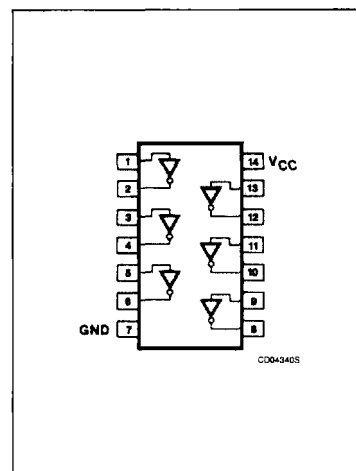
PINS	DESCRIPTION	74	74S	74LS
A	Input	1ul	1Sul	1LSul
Y	Output	10ul	10Sul	10LSul

NOTE:

Where a 74 unit load (ul) is understood to be $40\mu A$ I_{IH} and $-1.6mA$ I_{IL} , a 74S unit load (Sul) is $50\mu A$ I_{IH} and $-2.0mA$ I_{IL} , and 74LS unit load (LSul) is $20\mu A$ I_{IH} and $-0.4mA$ I_{IL} .

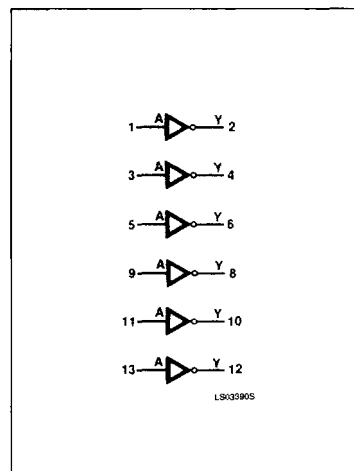
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PIN CONFIGURATION



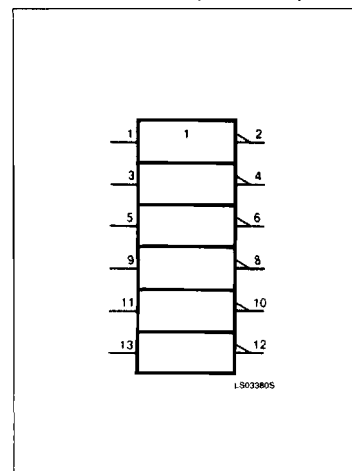
December 4, 1985

LOGIC SYMBOL



5-15

LOGIC SYMBOL (IEEE/IEC)



853-0504 81501

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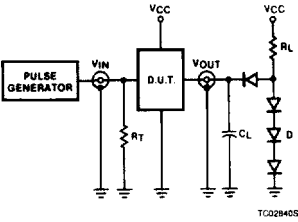
ABSOLUTE MAXIMUM RATINGS (Over operating free-air temperature range unless otherwise noted.)

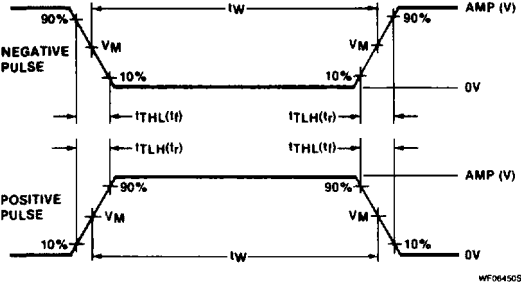
PARAMETER	74	74LS	74S	UNIT
V _{CC} Supply voltage	7.0	7.0	7.0	V
V _{IN} Input voltage	−0.5 to +5.5	−0.5 to +7.0	−0.5 to +5.5	V
I _{IN} Input current	−30 to +5	−30 to +1	−30 to +5	mA
V _{OUT} Voltage applied to output in HIGH output state	−0.5 to +V _{CC}	−0.5 to +V _{CC}	−0.5 to +V _{CC}	V
T _A Operating free-air temperature range	0 to 70			°C

RECOMMENDED OPERATING CONDITIONS

PARAMETER	74			74LS			74S			UNIT
	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	
V _{CC} Supply voltage	4.75	5.0	5.25	4.75	5.0	5.25	4.75	5.0	5.25	V
V _{IH} HIGH-level input voltage	2.0			2.0			2.0			V
V _{IL} LOW-level input voltage			+0.8			+0.8			+0.8	V
I _{IK} Input clamp current			−12			−18			−18	mA
I _{OH} HIGH-level output current			−400			−400			−1000	μA
I _{OL} LOW-level output current			16			8			20	mA
T _A Operating free-air temperature	0		70	0		70	0		70	°C

TEST CIRCUITS AND WAVEFORMS





V_M = 1.3V for 74LS; V_M = 1.5V for all other TTL families.

Test Circuit For 74 Totem-Pole Outputs

DEFINITIONS

R_L = Load resistor to V_{CC}; see AC CHARACTERISTICS for value.

C_L = Load capacitance includes jig and probe capacitance; see AC CHARACTERISTICS for value.

R_T = Termination resistance should be equal to Z_{OUT} of Pulse Generators.

D = Diodes are 1N916, 1N3064, or equivalent.

t_{TLH}, t_{THL} Values should be less than or equal to the table entries.

Input Pulse Definition

FAMILY	INPUT PULSE REQUIREMENTS				
	Amplitude	Rep. Rate	Pulse Width	t _{TLH}	t _{THL}
74	3.0V	1MHz	500ns	7ns	7ns
74LS	3.0V	1MHz	500ns	15ns	6ns
74S	3.0V	1MHz	500ns	2.5ns	2.5ns

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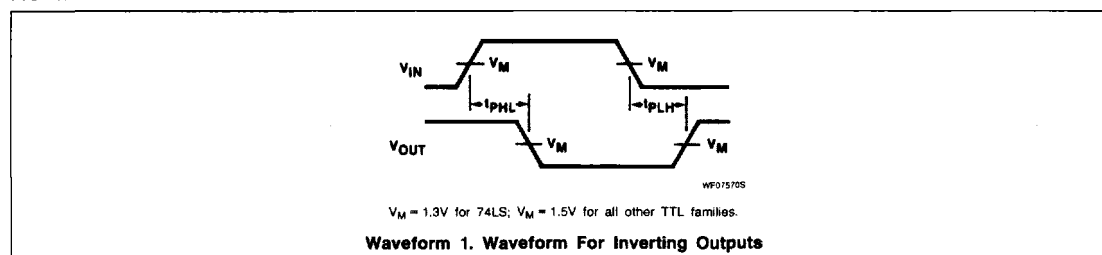
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DC ELECTRICAL CHARACTERISTICS (Over recommended operating free-air temperature range unless otherwise noted.)

PARAMETER	TEST CONDITIONS ¹	7404			74LS04			74S04			UNIT
		Min	Typ ²	Max	Min	Typ ²	Max	Min	Typ ²	Max	
V_{OH} HIGH-level output voltage	$V_{CC} = \text{MIN}$, $V_{IL} = \text{MAX}$, $I_{OH} = \text{MAX}$	2.4	3.4		2.7	3.4		2.7	3.4		V
V_{OL} LOW-level output voltage	$V_{CC} = \text{MIN}$, $V_{IH} = \text{MIN}$	$I_{OL} = \text{MAX}$									V
		$I_{OL} = 4\text{mA (74LS)}$									V
V_{IK} Input clamp voltage	$V_{CC} = \text{MIN}$, $I_I = I_{IK}$			-1.5			-1.5			-1.2	V
I_I Input current at maximum input voltage	$V_{CC} = \text{MAX}$	$V_I = 5.5\text{V}$									mA
		$V_I = 7.0\text{V}$						0.1			mA
I_{IH} HIGH-level input current	$V_{CC} = \text{MAX}$	$V_I = 2.4\text{V}$									μA
		$V_I = 2.7\text{V}$						20			μA
I_{IL} LOW-level input current	$V_{CC} = \text{MAX}$	$V_I = 0.4\text{V}$						-0.4			mA
		$V_I = 0.5\text{V}$						-2.0			mA
I_{OS} Short-circuit output current ³	$V_{CC} = \text{MAX}$	-18		-55	-20		-100	-40		-100	mA
I_{CC} Supply current (total)	$V_{CC} = \text{MAX}$	I_{CCH} Outputs HIGH	6	12		1.2	2.4		15	24	mA
		I_{CCL} Outputs LOW	18	33		3.6	6.6		30	54	mA

NOTES:

- For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
- All typical values are at $V_{CC} = 5\text{V}$, $T_A = 25^\circ\text{C}$.
- I_{OS} is tested with $V_{OUT} = +0.5\text{V}$ and $V_{CC} = V_{CC} \text{ MAX} + 0.5\text{V}$. Not more than one output should be shorted at a time and duration of the short circuit should not exceed one second.

AC WAVEFORM**AC ELECTRICAL CHARACTERISTICS** $T_A = 25^\circ\text{C}$, $V_{CC} = 5.0\text{V}$

PARAMETER	TEST CONDITIONS	74		74LS		74S		UNIT
		$C_L = 15\text{pF}, R_L = 400\Omega$		$C_L = 15\text{pF}, R_L = 2\text{k}\Omega$		$C_L = 15\text{pF}, R_L = 280\Omega$		
		Min	Max	Min	Max	Min	Max	
t_{PLH} t_{PHL} Propagation delay	Waveform 1		22 15		15 15		4.5 5.0	ns