

Military Logic Products

Hex Inverter

Product Specification

FUNCTION TABLE

INPUT	OUTPUT
A	Y
L	H
H	L

H = High voltage level
L = Low voltage level

ORDERING INFORMATION

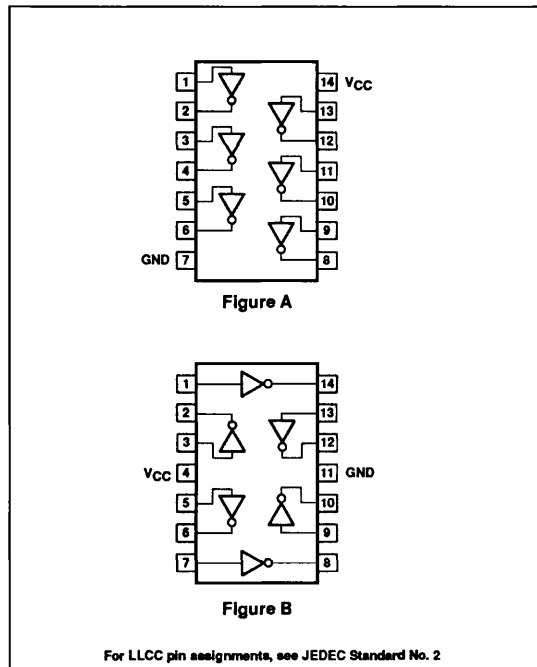
DESCRIPTION	PIN CONFIGURATION	ORDER CODE
Ceramic DIP	Figure A	5404/BCA, 54LS04/BCA, 54S04/BCA
Ceramic Flat Pack	Figure A	54LS04/BDA, 54S04/BDA
	Figure B	5404/BDA
Ceramic LLCC	See JEDEC Standard No. 2	54LS04/B2A, 54S04/B2A

INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

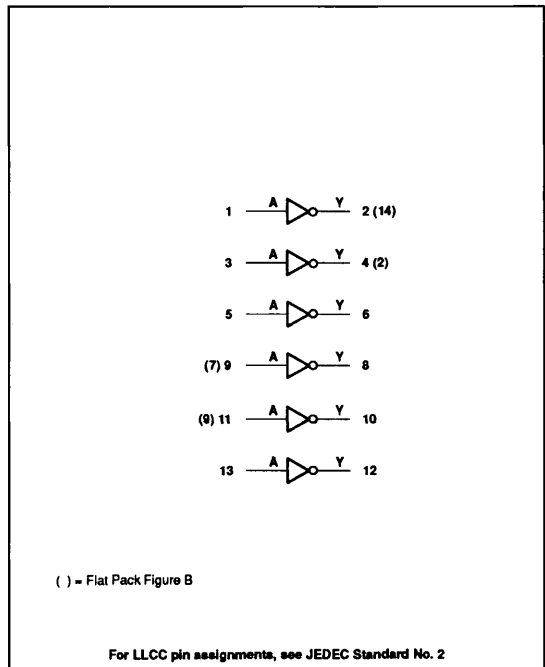
PINS	DESCRIPTION	54	54S	54LS
A	Input	1UL	1SUL	1LSUL
Y	Output	10UL	10SUL	10LSUL

NOTE: Where a 54 Unit Load (UL) is understood to be $40\mu\text{A } I_{IH}$ and $-1.6\text{ mA } I_{IL}$, a 54S Unit Load (SUL) is $50\mu\text{A } I_{IH}$ and $-2.0\text{ mA } I_{IL}$, and a 54LS Unit Load (LSUL) is $20\mu\text{A } I_{IH}$ and $-0.4\text{ mA } I_{IL}$.

PIN CONFIGURATION



LOGIC SYMBOL



Inverters

5404, 54LS04, 54S04

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

SYMBOL	PARAMETER	54	54LS	54S	UNIT
V _{CC}	Supply voltage range	7.0	7.0	7.0	V
V _I	Input voltage range	-0.5 to +5.5	-0.5 to +7.0	-0.5 to +7.0	V
I _I	Input current range	-30 to +5	-30 to +1	-30 to +5	mA
V _O	Voltage applied to output in High output state range	-0.5 to +V _{CC}	-0.5 to +V _{CC}	-0.5 to +V _{CC}	V
T _{STG}	Storage temperature range	-65 to +150			°C

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	54			54LS			54S			UNIT
		Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	
V _{CC}	Supply voltage	4.5	5.0	5.5	4.5	5.0	5.5	4.5	5.0	5.5	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 voltage			-400			-400			-1000	μA
I _{OL}	Low-level output current			16			4			20	mA
T _A	Operating free-air temperature range	-55		+125	-55		+125	-55		+125	°C

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

SYMBOL	PARAMETER	TEST CONDITIONS ¹	5400			54LS00			54S00			UNIT	
			Min	Typ ²	Max	Min	Typ ²	Max	Min	Typ ²	Max		
V _{OH}	High-level output voltage	V _{CC} = Min, V _{IL} = Max, I _{OH} = Max	2.4	3.4		2.5	3.4		2.5	3.4		V	
V _{OL}	Low-level output voltage	V _{CC} = Min, V _{IH} = Min, I _{OL} = Max		0.2	0.4		0.25	0.4			0.5	V	
V _{IK}	Input clamp voltage	V _{CC} = Min, I _I = I _{IK}			-1.5			-1.5			-1.2	V	
I _{IH2}	Input current at maximum input voltage	V _{CC} = Max, V _I = 5.5V			1.0						1.0	mA	
		V _I = 7.0V						0.1				mA	
I _{IH1}	High-level input current	V _{CC} = Max, V _I = 2.4V			40							μA	
		V _I = 2.7V						20			50	μA	
I _{IL}	Low-level input current	V _{CC} = Max, V _I = 0.4V			-1.6			-0.4				mA	
		V _I = 0.5V									-2.0	mA	
I _{OS}	Short-circuit output current ³	V _{CC} = Max	-20		-55	-20		-100	-40		-110	mA	
I _{CC}	Supply current (total)	V _{CC} = Max	I _{CC} H Outputs High		6	12		1.2	2.4		15	24	mA
			I _{CC} L Outputs Low		18	33		3.6	6.6		30	54	mA

Inverters

5404, 54LS04, 54S04

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

SYMBOL	PARAMETER	TEST CONDITIONS	54 ⁴		54LS		54S		UNIT
			$C_L = 15\text{pF}$		$C_L = 15\text{pF}$		$C_L = 15\text{pF}$		
			Min	Max	Min	Max	Min	Max	
t_{PLH}	Propagation delay	Waveform 1		22		15		4.5	ns
t_{PHL}			15		15		5.0	ns	

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

SYMBOL	PARAMETER	TEST CONDITIONS	54		54LS ⁴		54S ⁴		UNIT
			$C_L = 50\text{pF}$		$C_L = 50\text{pF}$		$C_L = 50\text{pF}$		
			Min	Max	Min	Max	Min	Max	
t_{PLH}	Propagation delay	Waveform 1		26		20		7.0	ns
t_{PHL}			19		20		7.5	ns	

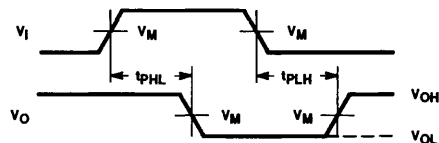
AC ELECTRICAL CHARACTERISTICS $T_A = -55^\circ\text{C}$ and $+125^\circ\text{C}$, $V_{CC} = 5.0\text{V}$ ⁴

SYMBOL	PARAMETER	TEST CONDITIONS	54		54LS		54S		UNIT
			$C_L = 15\text{pF}$		$C_L = 15\text{pF}$		$C_L = 15\text{pF}$		
			Min	Max	Min	Max	Min	Max	
t_{PLH}	Propagation delay	Waveform 1		34		26		9.0	ns
t_{PHL}			25		26		9.0	ns	

NOTES:

- For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type and function table operating mode.
- 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 duration of the short should not exceed one second.
- These parameters are guaranteed, but not tested.

AC WAVEFORM



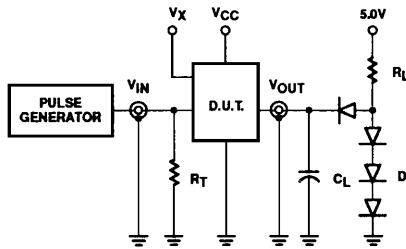
Waveform 1. Waveform for Inverting Outputs

NOTE: $V_M = 1.3\text{V}$ for 54LS; $V_M = 1.5\text{V}$ for all other TTL families

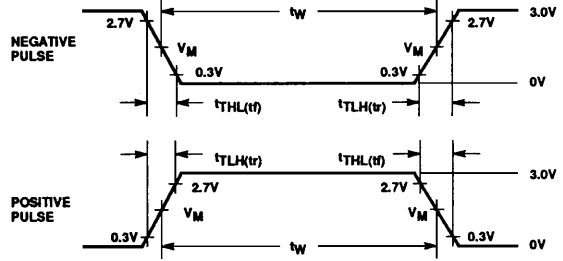
Inverters

5404, 54LS04, 54S04

TEST CIRCUIT AND WAVEFORM



Test Circuit for 54 Totem-Pole Outputs



Input Pulse Definition

FAMILY	INPUT PULSE CHARACTERISTICS					
	R_L	V_M	Rep. Rate	T_w	T_{TLH}	T_{THL}
54LSXXX	2.0k Ω	1.3V	1MHz	500ns	≤ 15 ns	≤ 6 ns
54XXX	400 Ω	1.5V	1MHz	500ns	≤ 7 ns	≤ 7 ns
54SXXX	280 Ω	1.5V	1MHz	500ns	≤ 2.5 ns	≤ 2.5 ns

DEFINITIONS:

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.

V_X = Unclocked pins must be held at $\leq 0.8V$, $\geq 2.7V$ or open per Function Table.