

Hex Inverter

Product Specification

Military Logic Products

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 Jeduc 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

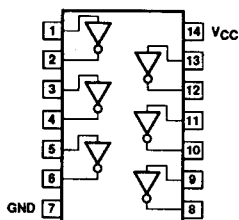


Figure A

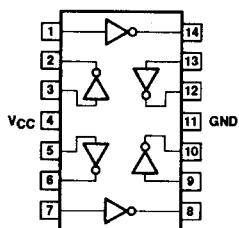
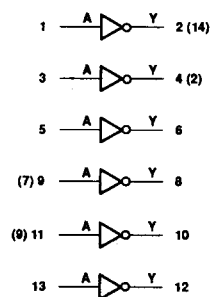


Figure B

For LLCC pin assignments, see JEDEC Standard No. 2

LOGIC SYMBOL



() = Flat Pack Figure B

For LLCC pin assignments, see JEDEC Standard No. 2

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	$V_{CC} = \text{Min}, V_{IL} = \text{Max}, I_{OH} = \text{Max}$	2.4	3.4		2.5	3.4		2.5	3.4		V	
V_{OL}	Low-level output voltage	$V_{CC} = \text{Min}, V_{IH} = \text{Min}, I_{OL} = \text{Max}$		0.2	0.4		0.25	0.4			0.5	V	
V_{IK}	Input clamp voltage	$V_{CC} = \text{Min}, I_I = I_{IK}$			-1.5			-1.5			-1.2	V	
I_{IH2}	Input current at maximum input voltage	$V_{CC} = \text{Max}, V_I = 5.5V$			1.0						1.0	mA	
		$V_I = 7.0V$						0.1				mA	
I_{IH1}	High-level input current	$V_{CC} = \text{Max}, V_I = 2.4V$			40							μA	
		$V_I = 2.7V$						20			50	μA	
I_{IL}	Low-level input current	$V_{CC} = \text{Max}, V_I = 0.4V$			-1.6			-0.4				mA	
		$V_I = 0.5V$									-2.0	mA	
I_{OS}	Short-circuit output current ³	$V_{CC} = \text{Max}$	-20		-55	-20		-100	-40		-110	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

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} t_{PHL}	Propagation delay	Waveform 1		22 15		15 15		4.5 5.0	ns 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} t_{PHL}	Propagation delay	Waveform 1		26 19		20 20		7.0 7.5	ns ns

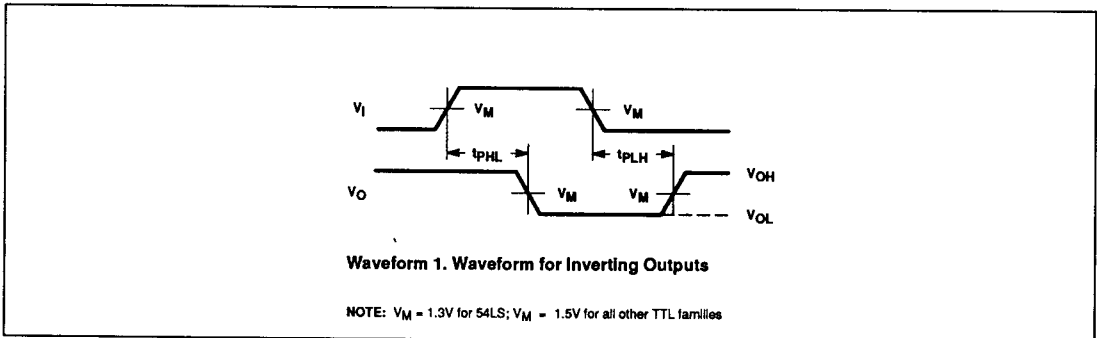
AC ELECTRICAL CHARACTERISTICS $T_A = -55^\circ\text{C}$ and $+125^\circ\text{C}$, $V_{CC} = 5.0\text{V}^4$

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} t_{PHL}	Propagation delay	Waveform 1		34 25		26 26		9.0 9.0	ns ns

NOTES:

1. 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.
2. All typical values are at $V_{CC} = 5\text{V}$, $T_A = 25^\circ\text{C}$.
3. Not more than one output should be shorted at a time, and duration of the short should not exceed one second.
4. These parameters are guaranteed, but not tested.

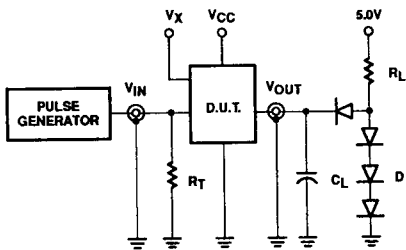
AC WAVEFORM



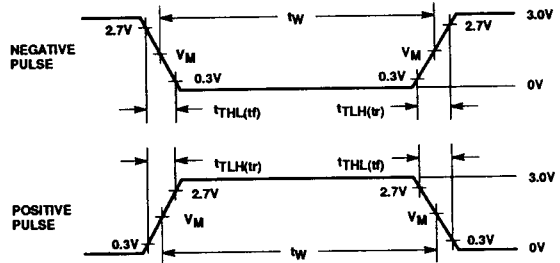
Inverters

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	$\leq 15ns$	$\leq 6ns$
54XXX	400 Ω	1.5V	1MHz	500ns	$\leq 7ns$	$\leq 7ns$
54SXXX	280 Ω	1.5V	1MHz	500ns	$\leq 2.5ns$	$\leq 2.5ns$

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.