

INVERTERS

54/7405, LS05, S05

Hex Inverter (Open Collector)

TYPE	TYPICAL PROPAGATION DELAY	TYPICAL SUPPLY CURRENT (Total)
7405	40ns (t_{PLH}) 8ns (t_{PHL})	12mA
74LS05	17ns (t_{PLH}) 15ns (t_{PHL})	2.4mA
74S05	5ns (t_{PLH}) 4.5ns (t_{PHL})	20mA

ORDERING CODE

PACKAGES	COMMERCIAL RANGES $V_{CC} = 5V \pm 5\%$; $T_A = 0^\circ C$ to $+70^\circ C$	MILITARY RANGES $V_{CC} = 5V \pm 10\%$; $T_A = -55^\circ C$ to $+125^\circ C$
Plastic DIP	N7405N • N74LS05N N74S05N	
Plastic SO	N74LS05D • N74S05D	
Ceramic DIP		

FUNCTION TABLE

INPUT	OUTPUT
A	Y
L	H
H	L

H = HIGH voltage level
L = LOW voltage level

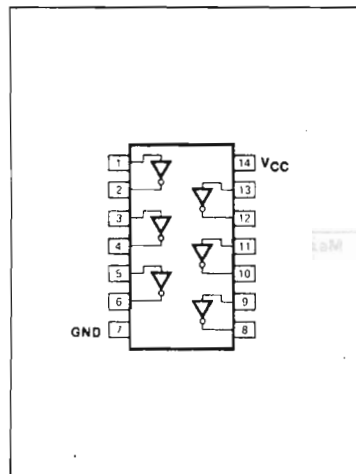
INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

PINS	DESCRIPTION	54/74	54/74S	54/74LS
A	Input	1uI	1Sul	1LSul
Y	Output	10uI	10Sul	10LSul

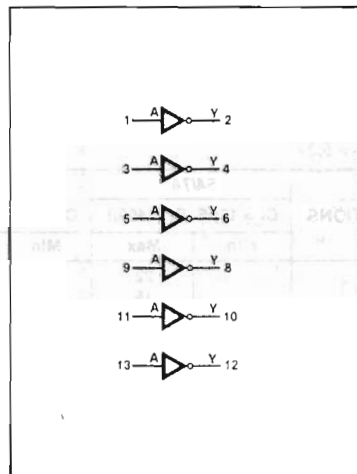
NOTE

Where a 54/74 unit load (uI) is understood to be $40\mu A$ I_{IH} and $-1.6mA$ I_{IL} , a 54/74S unit load (Sul) is $50\mu A$ I_{IH} and $-2.0mA$ I_{IL} , and 54/74LS unit load (LSul) is $20\mu A$ I_{IH} and $-0.4mA$ I_{IL} .

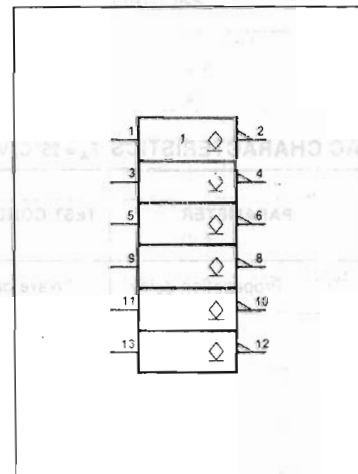
PIN CONFIGURATION



LOGIC SYMBOL



LOGIC SYMBOL (IEEE/IEC)



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

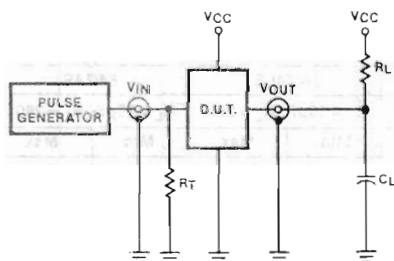
PARAMETER	54	54LS	54S	74	74LS	74S	UNIT
V_{CC} Supply voltage	7.0	7.0	7.0	7.0	7.0	7.0	V
V_{IN} Input voltage	-0.5 to +5.5	-0.5 to +7.0	-0.5 to +5.5	-0.5 to +5.5	-0.5 to +7.0	-0.5 to +5.5	V
I_{IN} Input current	-30 to +5	-30 to +1	-30 to +5	-30 to +5	-30 to +1	-30 to +5	mA
V_{OUT} Voltage applied to output in HIGH output state	-0.5 to + V_{CC}	-0.5 to + V_{CC}	-0.5 to + V_{CC}	-0.5 to + V_{CC}	-0.5 to + V_{CC}	-0.5 to + V_{CC}	V
T_A Operating free-air temperature range	-55 to +125				0 to 70		°C

RECOMMENDED OPERATING CONDITIONS

PARAMETER		54/74			54/74LS			54/74S			UNIT
		Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	
V_{CC} Supply voltage	Mil	4.5	5.0	5.5	4.5	5.0	5.5	4.5	5.0	5.5	V
	Com'l	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	Mil			+0.8			+0.7			+0.8	V
	Com'l			+0.8			+0.8			+0.8	V
I_{IK} Input clamp current				-12			-18			-18	mA
V_{OH} HIGH-level output voltage				5.5			5.5			5.5	V
I_{OL} LOW-level output current	Mil			16			4			20	mA
	Com'l			16			8			20	mA
T_A Operating free-air temperature	Mil	-55		+125	-55		+125	-55		+125	°C
	Com'l	0		70	0		70	0		70	°C

TEST CIRCUITS AND WAVEFORMS

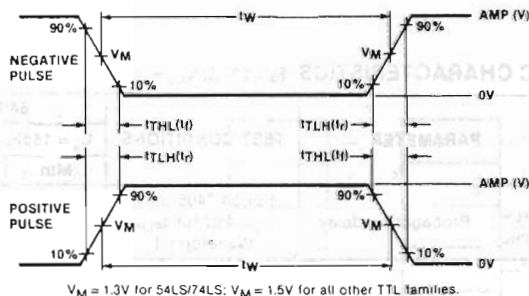
TEST CIRCUIT FOR 54/74 OPEN COLLECTOR OUTPUTS



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

INPUT PULSE DEFINITIONS



FAMILY	INPUT PULSE REQUIREMENTS				
	Amplitude	Rep. Rate	Pulse Width	t_{TLH}	t_{THL}
54/74	3.0V	1MHz	500ns	7ns	7ns
54LS/74LS	3.0V	1MHz	500ns	15ns	6ns
54S/74S	3.0V	1MHz	500ns	2.5ns	2.5ns

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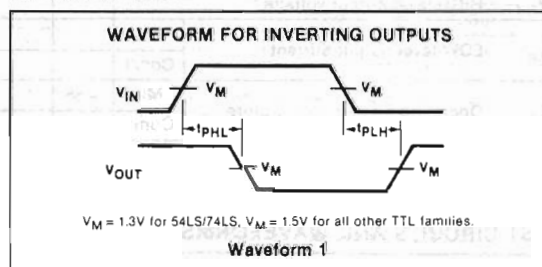
DC ELECTRICAL CHARACTERISTICS (Over recommended operating free-air temperature range unless otherwise noted.)

PARAMETER	TEST CONDITIONS ¹	54/7405			54/74LS05			54/74S05			UNIT
		Min	Typ ²	Max	Min	Typ ²	Max	Min	Typ ²	Max	
I_{OH} HIGH-level output current	$V_{CC} = \text{MIN}, V_{IL} = \text{MAX}, V_{OH} = 5.5\text{V}$			250			100			250	μA
V_{OL} LOW-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = \text{MIN}$	$I_{OL} = \text{MAX}$			$I_{OL} = \text{MAX}$			$I_{OL} = \text{MAX}$			
		Mil		0.2	0.4		0.25	0.4		0.2	V
		Com'I		0.2	0.4		0.35	0.5		0.2	V
V_{OL} LOW-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = \text{MIN}$	$I_{OL} = 4\text{mA}$			$I_{OL} = 4\text{mA}$			$I_{OL} = 4\text{mA}$			V
		74LS			74LS			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	$V_{CC} = \text{MAX}$	$V_I = 5.5\text{V}$		1.0	$V_I = 5.5\text{V}$			$V_I = 5.5\text{V}$		1.0	mA
		$V_I = 7.0\text{V}$			$V_I = 7.0\text{V}$		0.1	$V_I = 7.0\text{V}$			mA
I_{IH} HIGH-level input current	$V_{CC} = \text{MAX}$	$V_I = 2.4\text{V}$		40	$V_I = 2.4\text{V}$			$V_I = 2.4\text{V}$			μA
		$V_I = 2.7\text{V}$			$V_I = 2.7\text{V}$		20	$V_I = 2.7\text{V}$		50	μA
I_{IL} LOW-level input current	$V_{CC} = \text{MAX}$	$V_I = 0.4\text{V}$		-1.6	$V_I = 0.4\text{V}$		-0.4	$V_I = 0.4\text{V}$			mA
		$V_I = 0.5\text{V}$			$V_I = 0.5\text{V}$			$V_I = 0.5\text{V}$		-2.0	mA
I_{CC} Supply Current (total)	$V_{CC} = \text{MAX}$	I_{CCH} Outputs HIGH		6	I_{CCH} Outputs HIGH		1.2	I_{CCH} Outputs HIGH		9	mA
		I_{CCL} Outputs LOW		18	I_{CCL} Outputs LOW		3.6	I_{CCL} Outputs LOW		30	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 $V_{CC} = 5\text{V}$, $T_A = 25^\circ\text{C}$.

AC WAVEFORM

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

PARAMETER	TEST CONDITIONS	54/74		54/74LS		54/74S		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	For 54/7405 only, $R_L = 4\text{k}\Omega$ for t_{PLH} Waveform 1		55 15		32 28		7.5 7.0	ns