

## 7405, LS05, S05 Inverters

Hex Inverter (Open Collector)  
Product Specification

Logic Products

TYPE	TYPICAL PROPAGATION DELAY	TYPICAL SUPPLY CURRENT (TOTAL)
7405	40ns (t <sub>PLH</sub> ) 8ns (t <sub>PHL</sub> )	12mA
74LS05	17ns (t <sub>PLH</sub> ) 15ns (t <sub>PHL</sub> )	2.4mA
74S05	5ns (t <sub>PLH</sub> ) 4.5ns (t <sub>PHL</sub> )	20mA

### FUNCTION TABLE

INPUT	OUTPUT
A	Y
L	H
H	L

H = HIGH voltage level  
L = LOW voltage level

### ORDERING CODE

PACKAGES	COMMERCIAL RANGE V <sub>CC</sub> = 5V ± 5%; T <sub>A</sub> = 0°C to +70°C
Plastic DIP	N7405N, N74LS05N, N74S05N
Plastic SO	N74LS05D, N74S05D
Ceramic DIP	

#### NOTE:

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

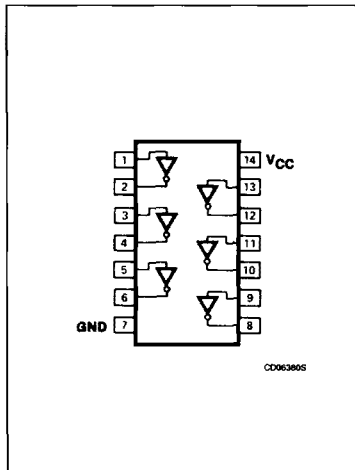
### INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

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

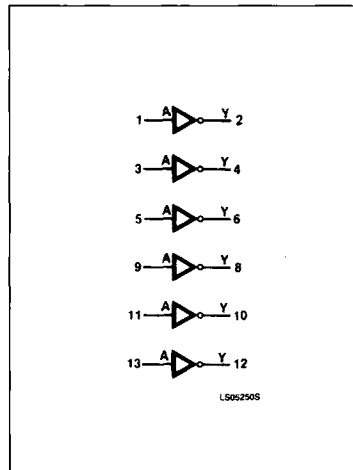
#### NOTE:

Where a 74 unit load (ul) is understood to be 40μA I<sub>IH</sub> and -1.6mA I<sub>IL</sub>, a 74S unit load (Sul) is 50μA I<sub>IH</sub> and -2.0mA I<sub>IL</sub>, and 74LS unit load (LSul) is 20μA I<sub>IH</sub> and -0.4mA I<sub>IL</sub>.

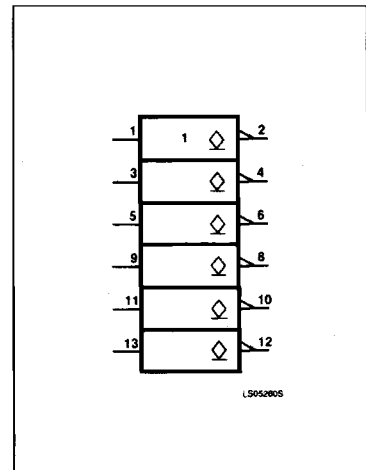
### PIN CONFIGURATION



### LOGIC SYMBOL



### LOGIC SYMBOL (IEEE/IEC)



# Inverters

# 7405, LS05, S05

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

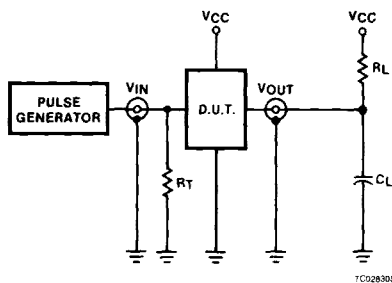
PARAMETER	74	74LS	74S	UNIT
V <sub>CC</sub> Supply voltage	7.0	7.0	7.0	V
V <sub>IN</sub> Input voltage	-0.5 to +5.5	-0.5 to +7.0	-0.5 to +5.5	V
I <sub>IN</sub> Input current	-30 to +5	-30 to +1	-30 to +5	mA
V <sub>OUT</sub> Voltage applied to output in HIGH output state	-0.5 to +V <sub>CC</sub>	-0.5 to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

### RECOMMENDED OPERATING CONDITIONS

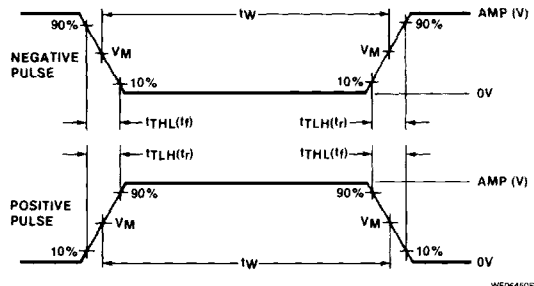
PARAMETER	74			74LS			74S			UNIT
	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	
V <sub>CC</sub> Supply voltage	4.75	5.0	5.25	4.75	5.0	5.25	4.75	5.0	5.25	V
V <sub>IH</sub> HIGH-level input voltage	2.0			2.0			2.0			V
V <sub>IL</sub> LOW-level input voltage			+0.8			+0.8			+0.8	V
I <sub>IK</sub> Input clamp current			-12			-18			-18	mA
V <sub>OH</sub> HIGH-level output voltage			5.5			5.5			5.5	V
I <sub>OL</sub> LOW-level output current			16			8			20	mA
T <sub>A</sub> Operating free-air temperature	0		70	0		70	0		70	°C

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### TEST CIRCUITS AND WAVEFORMS



Test Circuit For 74 Open Collector Outputs



V<sub>M</sub> = 1.3V for 74LS; V<sub>M</sub> = 1.5V for all other TTL families.

Input Pulse Definition

#### DEFINITIONS

R<sub>L</sub> = Load resistor to V<sub>CC</sub>; see AC CHARACTERISTICS for value.

C<sub>L</sub> = Load capacitance includes jig and probe capacitance; see AC CHARACTERISTICS for value.

R<sub>T</sub> = Termination resistance should be equal to Z<sub>OUT</sub> of Pulse Generators.

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

t<sub>TLH</sub>, t<sub>THL</sub> Values should be less than or equal to the table entries.

FAMILY	INPUT PULSE REQUIREMENTS				
	Amplitude	Rep. Rate	Pulse Width	t <sub>TLH</sub>	t <sub>THL</sub>
74	3.0V	1MHz	500ns	7ns	7ns
74LS	3.0V	1MHz	500ns	15ns	6ns
74S	3.0V	1MHz	500ns	2.5ns	2.5ns

## Inverters

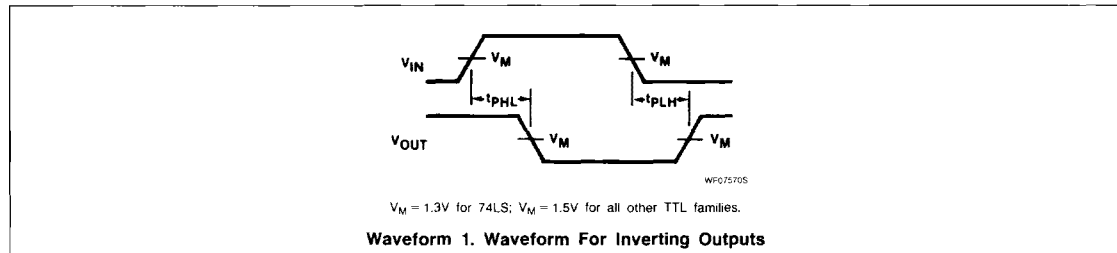
## 7405, LS05, S05

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

PARAMETER	TEST CONDITIONS <sup>1</sup>	7405			74LS05			74S05			UNIT	
		Min	Typ <sup>2</sup>	Max	Min	Typ <sup>2</sup>	Max	Min	Typ <sup>2</sup>	Max		
$I_{OH}$	HIGH-level output current $V_{CC} = \text{MIN}, V_{IL} = \text{MAX}, V_{OH} = 5.5\text{V}$			250			100			250	$\mu\text{A}$	
$V_{OL}$	LOW-level output voltage $V_{CC} = \text{MIN}, V_{IH} = \text{MIN}$	$I_{OL} = \text{MAX}$		0.2	0.4		0.35	0.5		0.5	V	
		$I_O = 4\text{mA}$ (74LS)					0.25	0.4				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					1.0	$\text{mA}$	
		$V_I = 7.0\text{V}$					0.1				$\text{mA}$	
$I_{IH}$	HIGH-level input current $V_{CC} = \text{MAX}$	$V_I = 2.4\text{V}$			40						$\mu\text{A}$	
		$V_I = 2.7\text{V}$					20		50		$\mu\text{A}$	
$I_{IL}$	LOW-level input current $V_{CC} = \text{MAX}$	$V_I = 0.4\text{V}$			-1.6		-0.4				$\text{mA}$	
		$V_I = 0.5\text{V}$							-2.0		$\text{mA}$	
$I_{CC}$	Supply current (total) $V_{CC} = \text{MAX}$	$I_{CCH}$ Outputs HIGH		6	12		1.2	2.4		9	19.8	$\text{mA}$
		$I_{CCL}$ Outputs LOW		18	33		3.6	6.6		30	54	$\text{mA}$

**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 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 For 7405 only, $R_L = 4\text{k}\Omega$ for $t_{PLH}$ Waveform 1		55 15		32 28		7.5 7.0	ns