

## 7438, LS38, S38 Buffers

Quad Two-Input NAND Buffers (Open Collectors)  
*Product Specification*

Logic Products

TYPE	TYPICAL PROPAGATION DELAY	TYPICAL SUPPLY CURRENT (TOTAL)
7438	13ns	28mA
74LS38	19ns	3.5mA
74S38	6.5ns	33mA

### ORDERING CODE

PACKAGES	COMMERCIAL RANGE $V_{CC} = 5V \pm 5\%$ ; $T_A = 0^\circ C$ to $+70^\circ C$
Plastic DIP	N7438N, N74LS38N, N74S38N
Plastic SO	N74S38D, N74LS38D

### FUNCTION TABLE

INPUTS		OUTPUT
A	B	Y
L	L	H
L	H	H
H	L	H
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.

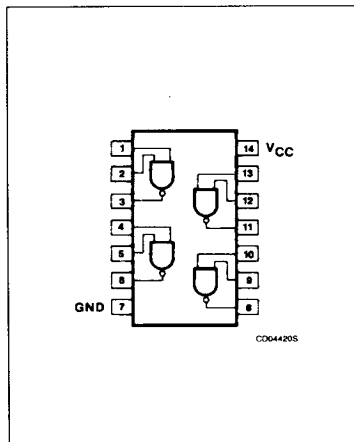
### INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

PINS	DESCRIPTION	74	74S	74LS
A, B	Inputs	1uI	2Sul	1LSul
Y	Output	30uI	30Sul	30LSul

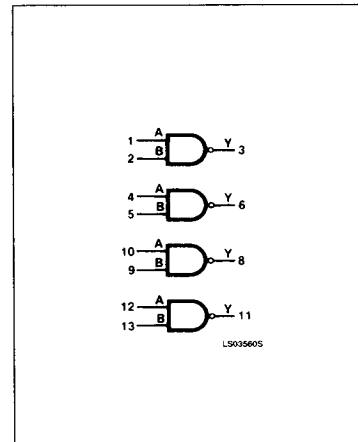
### NOTE:

Where a 74 unit load (uI) 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  $-0.4mA I_{IL}$ .

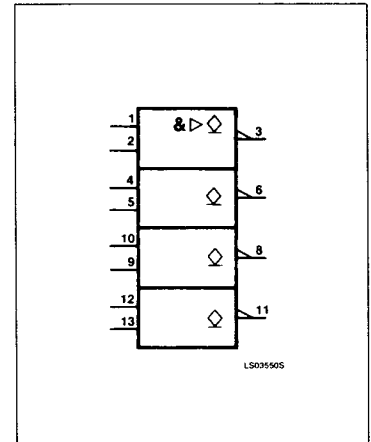
### PIN CONFIGURATION



### LOGIC SYMBOL



### LOGIC SYMBOL (IEEE/IEC)



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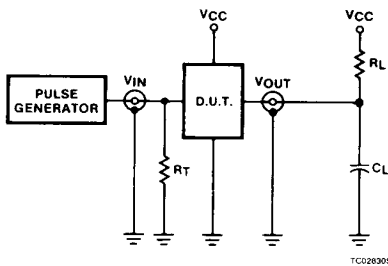
## ABSOLUTE MAXIMUM RATINGS (Over operating free-air temperature range unless otherwise noted.)

PARAMETER	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 current			5.5			5.5			5.5	V
I <sub>OL</sub> LOW-level output current			48			24			60	mA
T <sub>A</sub> Operating free-air temperature	0		70	0		70	0		70	°C

## TEST CIRCUITS AND WAVEFORMS



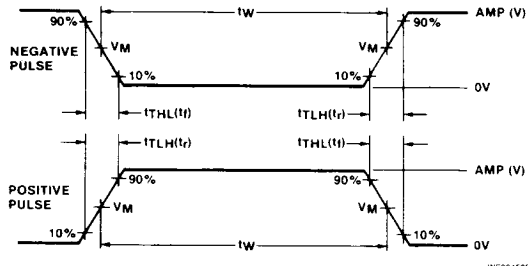
Test Circuit For 74 Open Collector Outputs

### 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.

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



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

### Input Pulse Definition

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

**Buffers**

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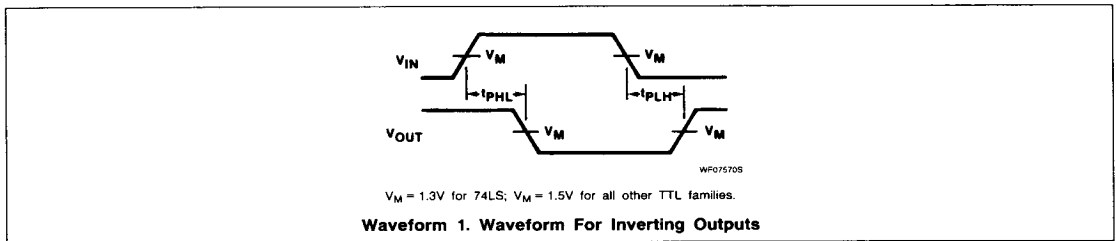
**DC ELECTRICAL CHARACTERISTICS** (Over recommended operating free-air temperature range unless otherwise noted.)

PARAMETER	TEST CONDITIONS <sup>1</sup>	7438			74LS38			74S38			UNIT	
		Min	Typ <sup>2</sup>	Max	Min	Typ <sup>2</sup>	Max	Min	Typ <sup>2</sup>	Max		
$I_{OH}$	HIGH-level output voltage $V_{CC} = \text{MIN}, V_{IL} = \text{MAX}, V_{OH} = 5.5\text{V}$			250			250			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	
		$I_{OL} = 12\text{mA} (74\text{LS})$					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		100	$\mu\text{A}$	
$I_{IL}$	LOW-level input current $V_{CC} = \text{MAX}$	$V_I = 0.4\text{V}$				-1.6		-0.4			$\text{mA}$	
		$V_I = 0.5\text{V}$								-4.0	$\text{mA}$	
$I_{CC}$	Supply current (total) $V_{CC} = \text{MAX}$	$I_{CCH}$ Outputs HIGH			5	8.5	0.9	2		20	36	$\text{mA}$
		$I_{CCL}$ Outputs LOW			34	54		6	12		46	80

**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
		$C_L = 45\text{pF}, R_L = 133\Omega$		$C_L = 45\text{pF}, R_L = 667\Omega$		$C_L = 50\text{pF}, R_L = 93\Omega$		
		Min	Max	Min	Max	Min	Max	
$t_{PLH}$ $t_{PHL}$	Propagation delay Waveform 1		22 18		32 28		10 10	ns