

# SN74LS19A, SN74LS24A SCHMITT-TRIGGER POSITIVE-NAND GATES AND INVERTERS WITH TOTEM-POLE OUTPUTS

JANUARY 1981 — REVISED MARCH 1988

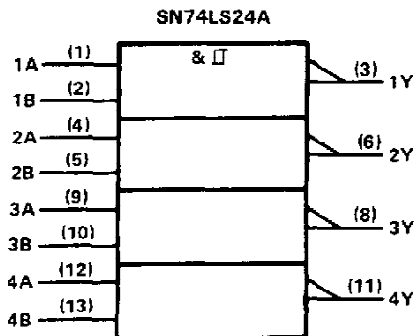
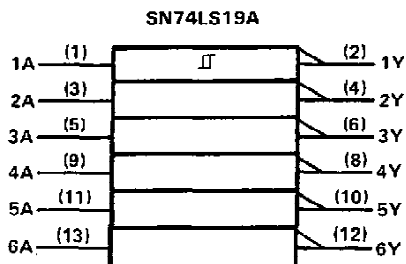
- Functionally and Mechanically Identical to 'LS13, 'LS14, and 'LS132, Respectively
- Improved Line-Receiving Characteristics
- P-N-P Inputs Reduce System Loading
- Excellent Noise Immunity with Typical Hysteresis of 0.8 V

### description

Each circuit functions as a NAND gate or inverter, but because of the Schmitt action, it has different input threshold levels for positive-going ( $V_{T+}$ ) and for negative-going ( $V_{T-}$ ) signals. The hysteresis or backlash, which is the difference between the two threshold levels ( $V_{T+} - V_{T-}$ ), is typically 800 millivolts.

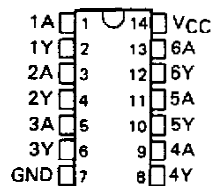
These circuits are temperature-compensated and can be triggered from the slowest of input ramps and still give clean, jitter-free output signals.

### logic symbols †

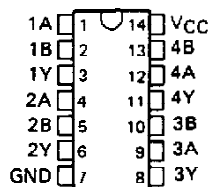


† These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

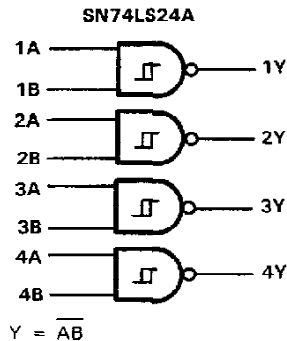
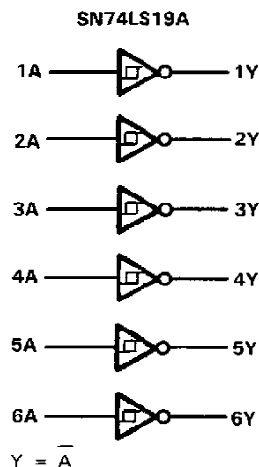
SN74LS19A . . . D, J, OR N PACKAGE  
(TOP VIEW)



SN74LS24A . . . D, J, OR N PACKAGE  
(TOP VIEW)



### logic diagrams (positive logic)



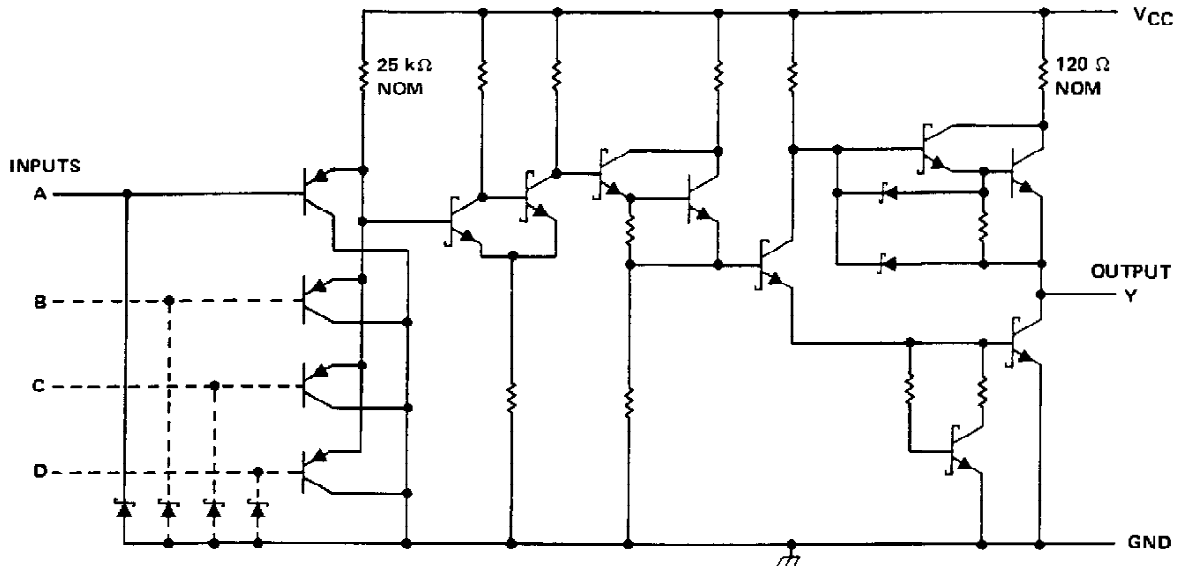
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**SN74LS19A, SN74LS24A**  
**SCHMITT-TRIGGER POSITIVE-NAND GATES**  
**AND INVERTERS WITH TOTEM-POLE OUTPUTS**

schematic (each gate)



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, $V_{CC}$ (see Note 1)	7 V
Input voltage	7 V
Operating free-air temperature range	0°C to 70°C
Storage temperature range	-65°C to 150°C

recommended operating conditions

	MIN	NOM	MAX	UNIT
Supply voltage, $V_{CC}$	4.75	5	5.25	V
High-level output current, $I_{OH}$			-400	$\mu$ A
Low-level output current, $I_{OL}$			8	mA
Operating free-air temperature, $T_A$	0		70	°C

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electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS†	MIN TYP‡ MAX			UNIT	
		MIN	TYP‡	MAX		
$V_{T+}$	$V_{CC} = 5\text{ V}$	1.65	1.9	2.15	V	
$V_{T-}$	$V_{CC} = 5\text{ V}$	0.75	1.0	1.25	V	
Hysteresis ( $V_{T+} - V_{T-}$ )	$V_{CC} = 5\text{ V}$	0.4	0.9		V	
$V_{IK}$	$V_{CC} = \text{MIN.}$ $I_I = -18\text{ mA}$		-1.5		V	
$V_{OH}$	$V_{CC} = \text{MIN.}$ $V_I = V_{T-\text{min}}$ $I_{OH} = -0.4\text{ mA}$	2.7	3.4		V	
$V_{OL}$	$V_{CC} = \text{MIN.}$ $V_I = V_{T+\text{max}}$	$I_{OL} = 4\text{ mA}$	0.25	0.4	V	
		$I_{OL} = 8\text{ mA}$	0.35	0.5		
$I_{T+}$	$V_{CC} = 5\text{ V.}$ $V_I = V_{T+}$		-2	-20	$\mu\text{A}$	
$I_{T-}$	$V_{CC} = 5\text{ V.}$ $V_I = V_{T-}$		-5	-30	$\mu\text{A}$	
$I_I$	$V_{CC} = \text{MAX.}$ $V_I = 7\text{ V}$		0.1		mA	
$I_{IH}$	$V_{CC} = \text{MAX.}$ $V_I = 2.7\text{ V}$			20	$\mu\text{A}$	
$I_{IL}$	$V_{CC} = \text{MAX.}$ $V_I = 0.4\text{ V}$			-50	$\mu\text{A}$	
$I_{OS}^{\S}$	$V_{CC} = \text{MAX.}$ $V_I = V_O = 0\text{ V}$		-20	-100	mA	
$I_{CCH}$	$V_{CC} = \text{MAX.}$ $V_I = 0\text{ V}$	'LS19A		9.9	18	mA
		'LS24A		6.6	12	
$I_{CCL}$	$V_{CC} = \text{MAX.}$ $V_I = 4.5\text{ V}$	'LS19A		17	30	mA
		'LS24A		11	20	

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ 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 the duration of the short-circuit should not exceed one second.

**switching characteristics,  $V_{CC} = 5\text{ V,}$   $T_A = 25^\circ\text{C}$  (see Figure 1)**

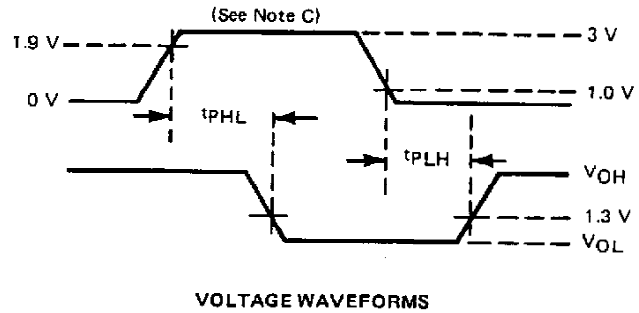
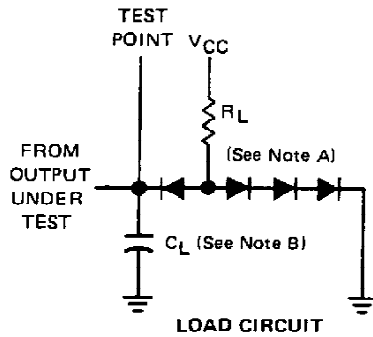
PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	SN74LS19A			SN74LS24A			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
$t_{PLH}$	Any	Y	$R_L = 2\text{ k}\Omega,$ $C_L = 15\text{ pF}$		13	20		13	20	ns
$t_{PHL}$	Any	Y			18	30		25	40	ns

$t_{PLH}$  = Propagation delay time, low-to-high-level output

$t_{PHL}$  = Propagation delay time, high-to-low-level output

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**PARAMETER MEASUREMENT INFORMATION**



- NOTES: A. All diodes are IN3064 or equivalent.  
 B. C<sub>L</sub> includes probe and circuit capacitance.  
 C. The generator characteristics are: PRR = 1 MHz, t<sub>r</sub> = 15 ns, t<sub>p</sub> = 6 ns, Z<sub>o</sub> = 50 Ω.

**FIGURE 1**

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