

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

JANUARY 1981 — REVISED MARCH 1988

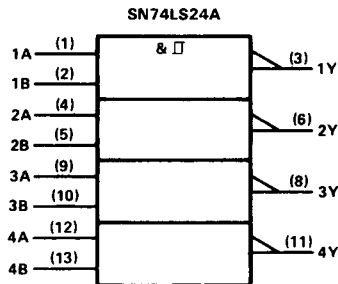
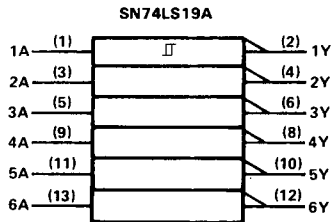
- Functionally and Mechanically Identical to 'LS13, 'LS14, and 'LS132, Respectively
- Improved Line-Receiving Characteristics
- P-N-P Inputs Reduce System Loading
- Excellent Noise Immunity with Typical Hysteresis of 0.8 V

description

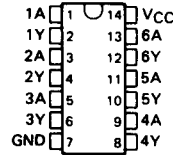
Each circuit functions as a NAND gate or inverter, but because of the Schmitt action, it has different input threshold levels for positive-going (V_{T+}) and for negative-going (V_{T-}) signals. The hysteresis or backlash, which is the difference between the two threshold levels ($V_{T+} - V_{T-}$),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

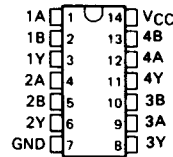
logic symbols†



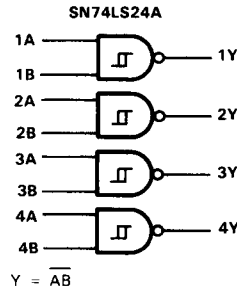
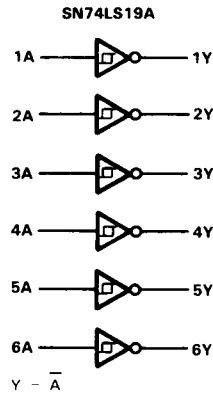
SN74LS19A . . . D, J, OR N PACKAGE
(TOP VIEW)



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



logic diagrams (positive logic)



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

PRODUCTION DATA documents contain information current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

TEXAS
INSTRUMENTS

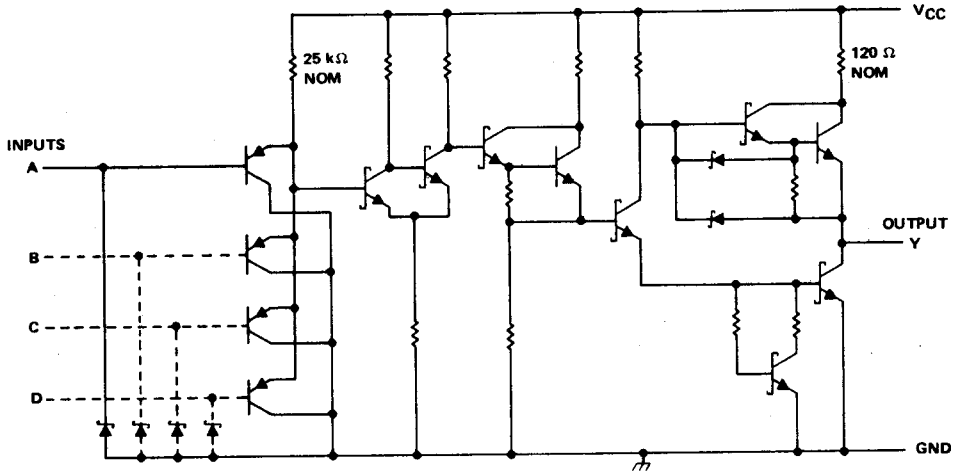
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SCHMITT-TRIGGER POSITIVE-NAND GATES
AND INVERTERS WITH TOTEM-POLE OUTPUTS

schematic (each gate)



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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 | μ 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 |
|-------------------------------------|---|------------------------|------|------|---------------|
| 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 | μA |
| I_{T-} | $V_{CC} = 5\text{ V}$, $V_I = V_{T-}$ | | -5 | -30 | μA |
| 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 | μA |
| I_{IL} | $V_{CC} = \text{MAX.}$, $V_I = 0.4\text{ V}$ | | | -50 | μA |
| 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

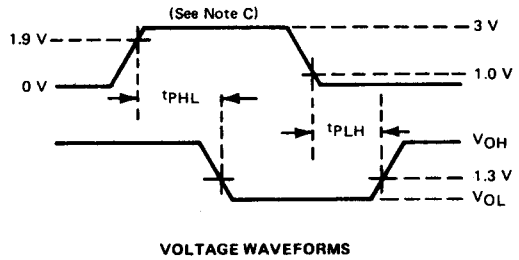
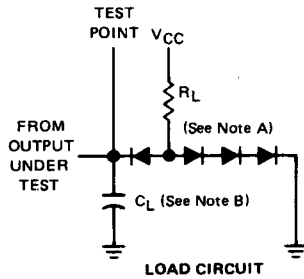
t_{PHL} = Propagation delay time, high-to-low-level output

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PARAMETER MEASUREMENT INFORMATION



- NOTES: A. All diodes are IN3064 or equivalent.
 B. C_L includes probe and circuit capacitance.
 C. The generator characteristics are: PRR = 1 MHz, t_r = 15 ns, t_p = 6 ns, Z_o = 50 Ω .

FIGURE 1

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