

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

JANUARY 1981 — REVISED MARCH 1988

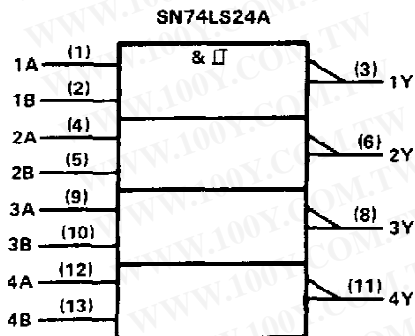
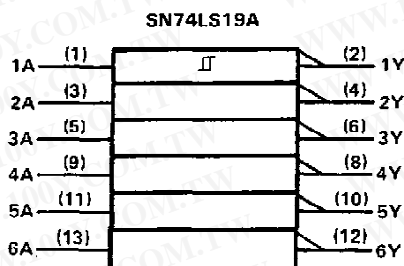
- Functionally and Mechanically Identical to 'LS13, 'LS14, and 'LS132, Respectively
- Improved Line-Receiving Characteristics
- P-N-P Inputs Reduce System Loading
- Excellent Noise Immunity with Typical Hysteresis of 0.8 V

### 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.

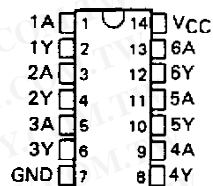
These circuits are temperature-compensated and can be triggered from the slowest of input ramps and still give clean, jitter-free output signals.

### logic symbols †

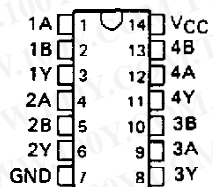


† These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

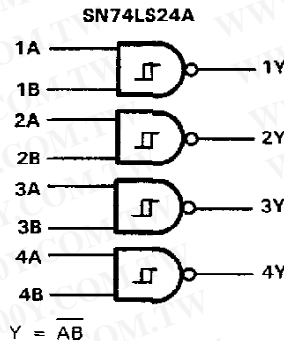
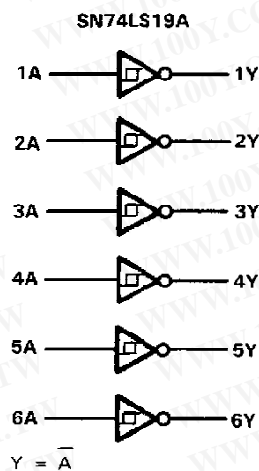
SN74LS19A . . . D, J, OR N PACKAGE  
 (TOP VIEW)



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



### logic diagrams (positive logic)

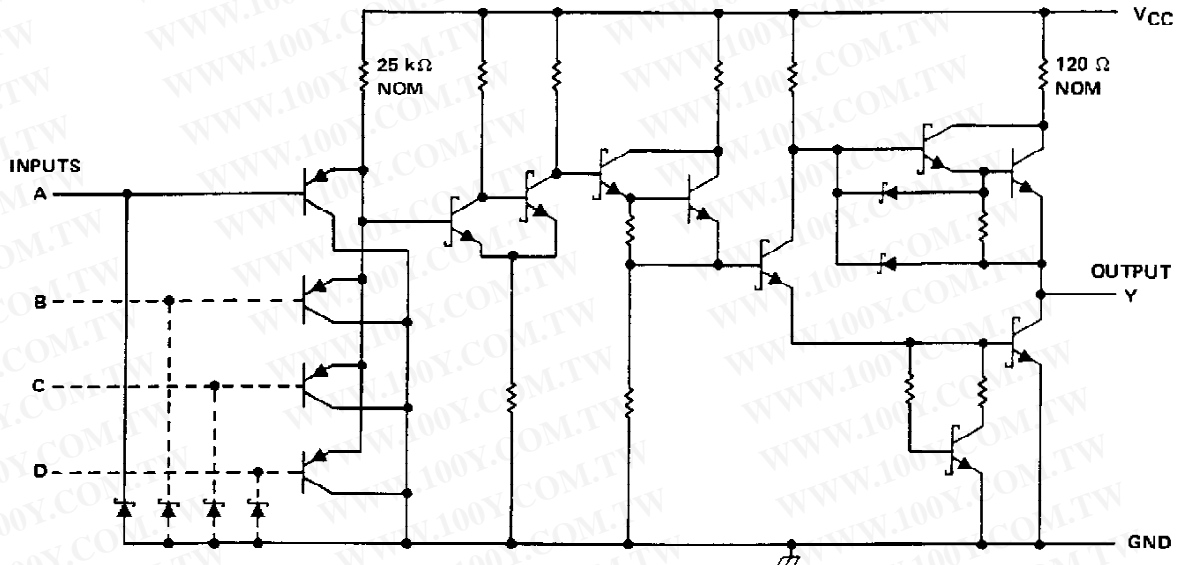


PRODUCTION DATA documents contain information current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



# 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

勝特力材料 886-3-5753170  
 勝特力电子(上海) 86-21-34970699  
 勝特力电子(深圳) 86-755-83298787  
[Http://www.100y.com.tw](http://www.100y.com.tw)

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

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

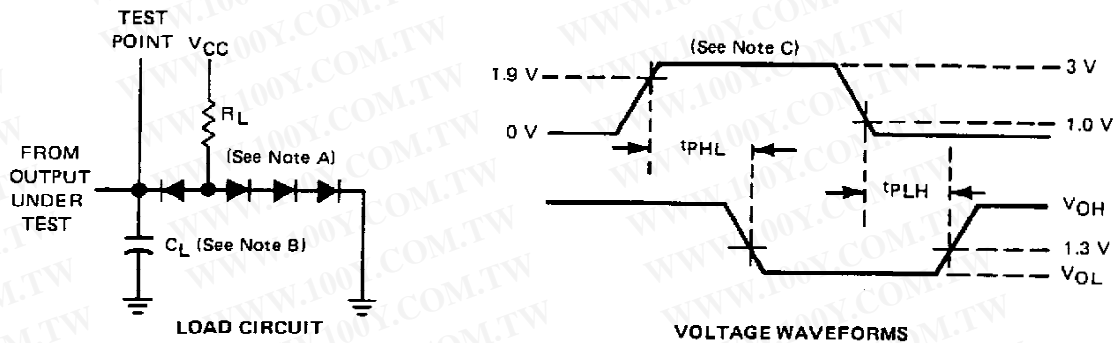
$t_{PLH}$  = Propagation delay time, low-to-high-level output

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

勝特力材料 886-3-5753170  
 勝特力电子(上海) 86-21-34970699  
 勝特力电子(深圳) 86-755-83298787  
[Http://www.100y.com.tw](http://www.100y.com.tw)

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

**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,  $Z_o = 50 \Omega$ .

**FIGURE 1**

勝特力材料 886-3-5753170  
 勝特力电子(上海) 86-21-34970699  
 勝特力电子(深圳) 86-755-83298787  
[Http://www.100y.com.tw](http://www.100y.com.tw)

## IMPORTANT NOTICE

Texas Instruments (TI) reserves the right to make changes to its products or to discontinue any semiconductor product or service without notice, and advises its customers to obtain the latest version of relevant information to verify, before placing orders, that the information being relied on is current.

TI warrants performance of its semiconductor products and related software to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

Certain applications using semiconductor products may involve potential risks of death, personal injury, or severe property or environmental damage ("Critical Applications").

TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, INTENDED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT APPLICATIONS, DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS.

Inclusion of TI products in such applications is understood to be fully at the risk of the customer. Use of TI products in such applications requires the written approval of an appropriate TI officer. Questions concerning potential risk applications should be directed to TI through a local SC sales office.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards should be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein. Nor does TI warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used.

勝特力材料 886-3-5753170  
勝特力电子(上海) 86-21-34970699  
勝特力电子(深圳) 86-755-83298787  
[Http://www.100y.com.tw](http://www.100y.com.tw)

Copyright © 1996, Texas Instruments Incorporated

## IMPORTANT NOTICE

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgement, including those pertaining to warranty, patent infringement, and limitation of liability.

TI warrants performance of its semiconductor products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

CERTAIN APPLICATIONS USING SEMICONDUCTOR PRODUCTS MAY INVOLVE POTENTIAL RISKS OF DEATH, PERSONAL INJURY, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE ("CRITICAL APPLICATIONS"). TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF TI PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE FULLY AT THE CUSTOMER'S RISK.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.

勝特力材料 886-3-5753170  
勝特力电子(上海) 86-21-34970699  
勝特力电子(深圳) 86-755-83298787  
[Http://www.100y.com.tw](http://www.100y.com.tw)

Copyright © 1998, Texas Instruments Incorporated