TYPES SN74LS18, SN74LS19, SN74LS24 SCHMITT-TRIGGER POSITIVE-NAND GATES AND INVERTERS WITH TOTEM-POLE OUTPUTS

JANUARY 1981—REVISED DECEMBER 1983

- **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 0.7 V**

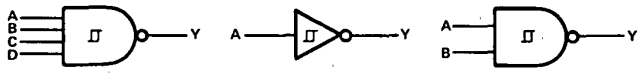
description

Each circuit functions as a NAND gate or inverter, but because of the Schmitt action, it has different input threshold levels for positive (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 900 millivolts.

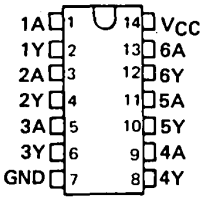
These circuits are temperature-compensated and can be triggered from the slowest of input ramps and still give clean, jitter-free output signals.

logic diagram (each gate or inverter)

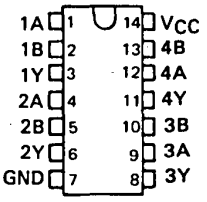
'LS18 'LS19 'LS24



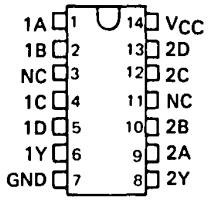
SN74LS19 . . . D, J OR N PACKAGE
(TOP VIEW)



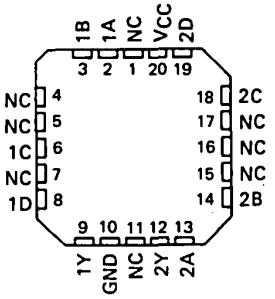
SN74LS24 . . . D, J OR N PACKAGE
(TOP VIEW)



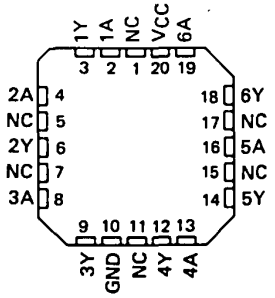
SN74LS18 . . . D, J OR N PACKAGE
(TOP VIEW)



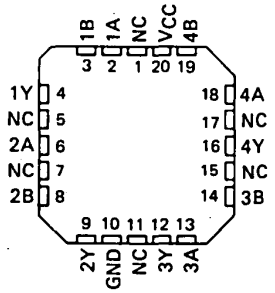
SN74LS18 . . . FN PACKAGE
(TOP VIEW)



SN74LS19 . . . FN PACKAGE
(TOP VIEW)



SN74LS24 . . . FN PACKAGE
(TOP VIEW)



NC - No internal connection

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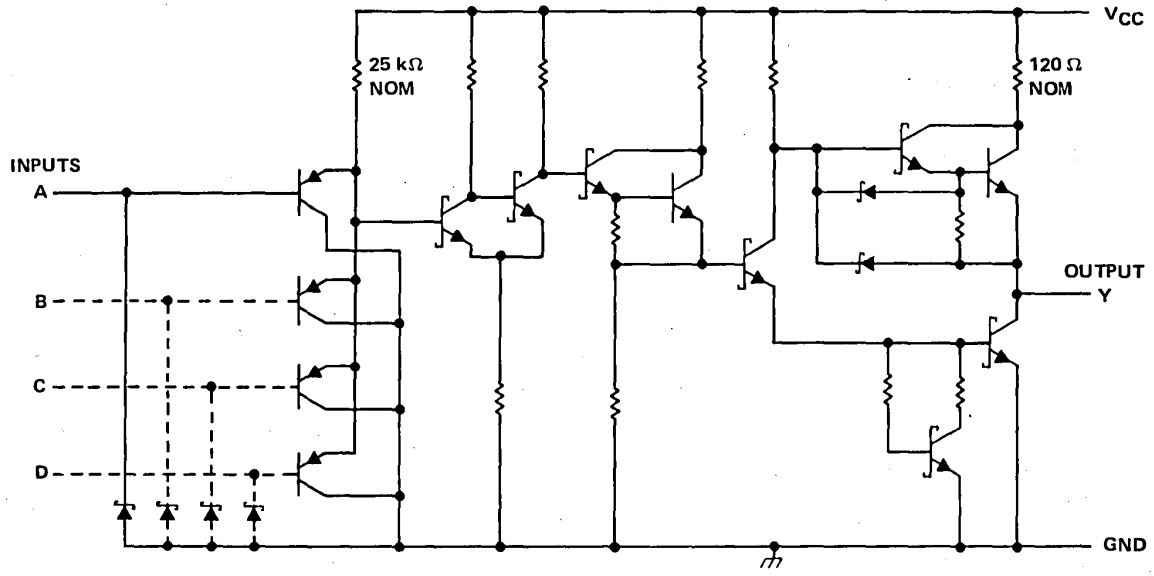
schematic (each gate)



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: SN74LS' . . . . . 0°C to 70°C
Storage temperature range . . . . . −65°C to 150°C

recommended operating conditions

	SN74LS'			UNIT
	MIN	NOM	MAX	
Supply voltage, V_{CC}	4.75	5	5.25	V
High-level output current, I_{OH}			−400	μA
Low-level output current, I_{OL}			8	mA
Operating free-air temperature, T_A	0		70	°C

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

PARAMETER	TEST CONDITIONS†			SN74LS'			UNIT
				MIN	TYP‡	MAX	
V_{T+}	V_{CC} = 5 V			1.65	1.9	2.15	V
V_{T-}	V_{CC} = 5 V			0.75	1.0	1.25	V
Hysteresis ($V_{T+} - V_{T-}$)	V_{CC} = 5 V			0.4	0.9		V
V_{IK}	V_{CC} = MIN,	I_I = −18 mA				−1.5	V
V_{OH}	V_{CC} = MIN,	$V_I = V_{T-}$ min	I_{OH} = −0.4 mA	2.7	3.4		V
V_{OL}	V_{CC} = MIN,	$V_I = V_{T+}$ max	I_{OL} = 4 mA		0.25	0.4	V
			I_{OL} = 8 mA		0.35	0.5	
I_{T+}	V_{CC} = 5 V,	$V_I = V_{T+}$			−2	−20	μA
I_{T-}	V_{CC} = 5 V,	$V_I = V_{T-}$			−5	−30	μA
I_I	V_{CC} = MAX,	V_I = 7 V				0.1	mA
I_{IH}	V_{CC} = MAX,	V_I = 2.7 V				20	μA
I_{IL}	V_{CC} = MAX,	V_I = 0.4 V				−50	μA
I_{OS}§	V_{CC} = MAX,	$V_I = V_O$ = 0 V		−20		−100	mA
I_{CCH}	V_{CC} = MAX,	V_I = 0 V	'LS18		3.3	6	mA
			'LS19		9.9	18	
			'LS24		6.6	12	
I_{CCL}	V_{CC} = MAX,	V_I = 4.5 V	'LS18		5.7	10	mA
			'LS19		17	30	
			'LS24		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 V, T_A = 25°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 V, T_A = 25°C, see figure 1

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	'LS18			'LS19			'LS24			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
t_{PLH}	Any	Y	R_L = 2 kΩ, C_L = 15 pF		13	20		13	20		13	20	ns
t_{PHL}	Any	Y			37	55		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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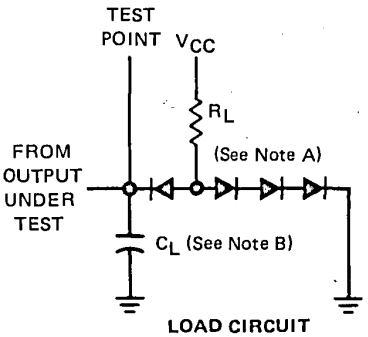
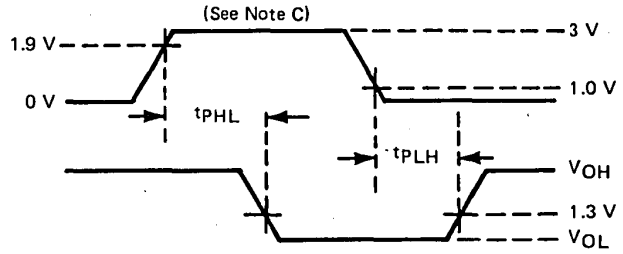
PARAMETER MEASUREMENT INFORMATION



LOAD CIRCUIT



VOLTAGE WAVEFORMS

NOTES: A. All diodes are IN3064 or equivalent.
B. C_L includes probe and circuit capacitance.
C. The generator characteristics are; P_{RR} = 1MHz, t_r = 15 ns, t_p = 6 ns, Z_{out} = 50 Ω.

FIGURE 1