



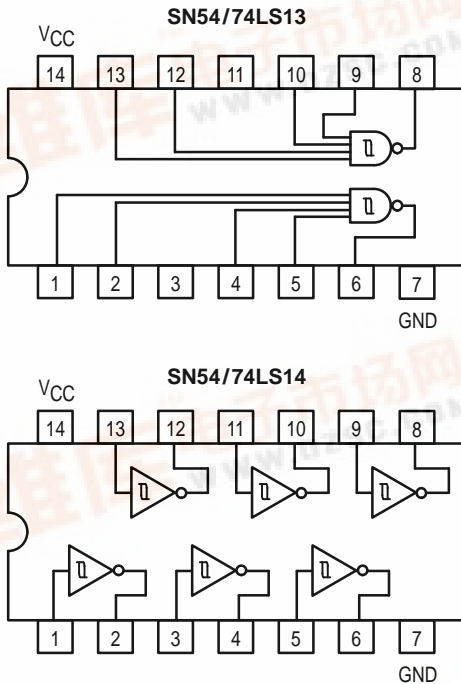
MOTOROLA

SCHMITT TRIGGERS DUAL GATE/HEX INVERTER

The SN54LS/74LS13 and SN54LS/74LS14 contain logic gates/inverters which accept standard TTL input signals and provide standard TTL output levels. They are capable of transforming slowly changing input signals into sharply defined, jitter-free output signals. Additionally, they have greater noise margin than conventional inverters.

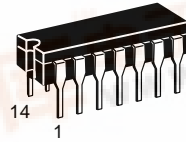
Each circuit contains a Schmitt trigger followed by a Darlington level shifter and a phase splitter driving a TTL totem pole output. The Schmitt trigger uses positive feedback to effectively speed-up slow input transitions, and provide different input threshold voltages for positive and negative-going transitions. This hysteresis between the positive-going and negative-going input thresholds (typically 800 mV) is determined internally by resistor ratios and is essentially insensitive to temperature and supply voltage variations.

LOGIC AND CONNECTION DIAGRAMS

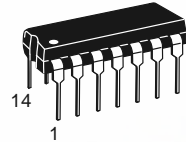


**SN54/74LS13
SN54/74LS14**

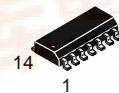
**SCHMITT TRIGGERS
DUAL GATE/HEX INVERTER
LOW POWER SCHOTTKY**



**J SUFFIX
CERAMIC
CASE 632-08**



**N SUFFIX
PLASTIC
CASE 646-06**



**D SUFFIX
SOIC
CASE 751A-02**

ORDERING INFORMATION

SN54LSXXJ Ceramic
SN74LSXXN Plastic
SN74LSXXD SOIC

GUARANTEED OPERATING RANGES

Symbol	Parameter		Min	Typ	Max	Unit
V _{CC}	Supply Voltage	54 74	4.5 4.75	5.0 5.0	5.5 5.25	V
T _A	Operating Ambient Temperature Range	54 74	-55 0	25 25	125 70	°C
I _{OH}	Output Current — High	54, 74			-0.4	mA
I _{OL}	Output Current — Low	54 74			4.0 8.0	mA



SN54/74LS13 • SN54/74LS14

DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE (unless otherwise specified)

Symbol	Parameter	Limits			Unit	Test Conditions
		Min	Typ	Max		
V_{T+}	Positive-Going Threshold Voltage	1.5		2.0	V	$V_{CC} = 5.0\text{ V}$
V_{T-}	Negative-Going Threshold Voltage	0.6		1.1	V	$V_{CC} = 5.0\text{ V}$
$V_{T+} - V_{T-}$	Hysteresis	0.4	0.8		V	$V_{CC} = 5.0\text{ V}$
V_{IK}	Input Clamp Diode Voltage		-0.65	-1.5	V	$V_{CC} = \text{MIN}, I_{IN} = -18\text{ mA}$
V_{OH}	Output HIGH Voltage	54	2.5	3.4	V	$V_{CC} = \text{MIN}, I_{OH} = -400\text{ }\mu\text{A}, V_{IN} = V_{IL}$
		74	2.7	3.4	V	
V_{OL}	Output LOW Voltage	54, 74	0.25	0.4	V	$V_{CC} = \text{MIN}, I_{OL} = 4.0\text{ mA}, V_{IN} = 2.0\text{ V}$
		74	0.35	0.5	V	$V_{CC} = \text{MIN}, I_{OL} = 8.0\text{ mA}, V_{IN} = 2.0\text{ V}$
I_{T+}	Input Current at Positive-Going Threshold		-0.14		mA	$V_{CC} = 5.0\text{ V}, V_{IN} = V_{T+}$
I_{T-}	Input Current at Negative-Going Threshold		-0.18		mA	$V_{CC} = 5.0\text{ V}, V_{IN} = V_{T-}$
I_{IH}	Input HIGH Current		1.0	20	μA	$V_{CC} = \text{MAX}, V_{IN} = 2.7\text{ V}$
				0.1	mA	$V_{CC} = \text{MAX}, V_{IN} = 7.0\text{ V}$
I_{IL}	Input LOW Current			-0.4	mA	$V_{CC} = \text{MAX}, V_{IN} = 0.4\text{ V}$
I_{OS}	Short Circuit Current (Note 1)	-20		-100	mA	$V_{CC} = \text{MAX}, V_{OUT} = 0\text{ V}$
I_{CC}	Power Supply Current					$V_{CC} = \text{MAX}$
	Total, Output HIGH	LS13	2.9	6.0	mA	
		LS14	8.6	16		
	Total, Output LOW	LS13	4.1	7.0	mA	
	LS14	12	21			

Note 1: Not more than one output should be shorted at a time, nor for more than 1 second.

AC CHARACTERISTICS ($T_A = 25^\circ\text{C}$)

Symbol	Parameter	Max		Unit	Test Conditions
		LS13	LS14		
t_{PLH}	Propagation Delay, Input to Output	22	22	ns	$V_{CC} = 5.0\text{ V}$ $C_L = 15\text{ pF}$
t_{PHL}	Propagation Delay, Input to Output	27	22	ns	

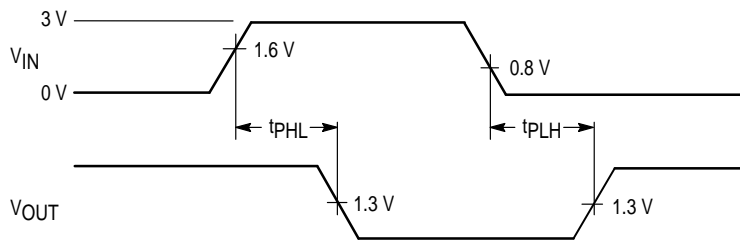


Figure 1. AC Waveforms

SN54/74LS13 • SN54/74LS14

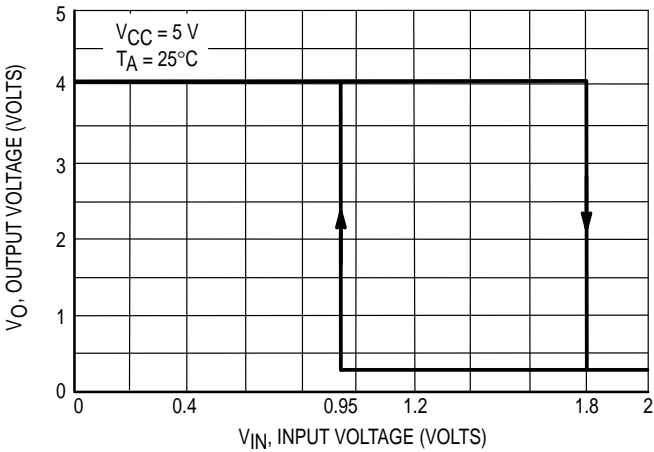


Figure 2. V_{IN} versus V_{OUT} Transfer Function

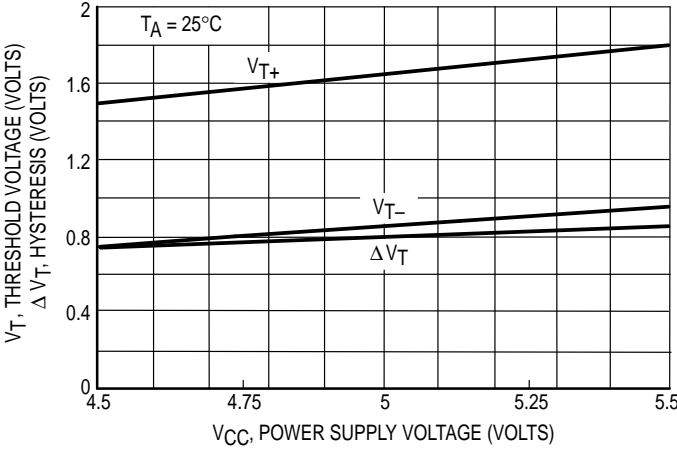


Figure 3. Threshold Voltage and Hysteresis versus Power Supply Voltage

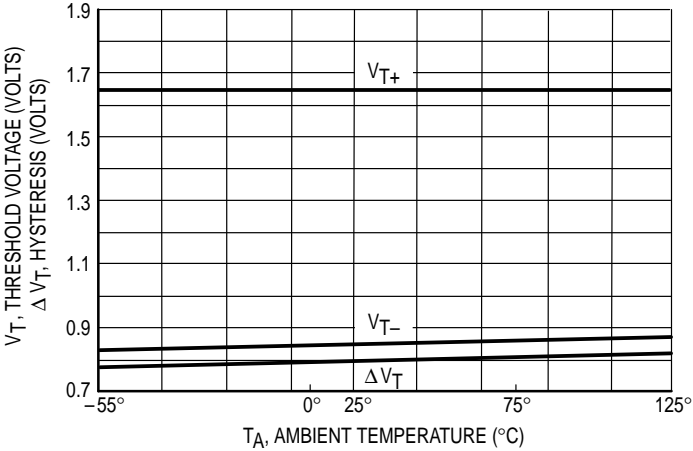


Figure 4. Threshold Voltage Hysteresis versus Temperature