

**TYPES SN7414, SN74LS14**  
**SN5414, SN54LS14**  
**HEX SCHMITT - TRIGGER INVERTERS**  
 REVISED DECEMBER 1983

- Operation from Very Slow Edges
- Improved Line-Receiving Characteristics
- High Noise Immunity
- Package Options Include Standard Plastic (N) and Ceramic (J) 300-mil Dual-In-Line Packages, Plastic Small Outline Packages, Plastic Small Outline (D) and Ceramic Chip Carrier (FK) Package

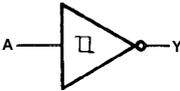
**description**

Each circuit functions as an inverter, but because of the Schmitt action, it has different input threshold levels for positive ( $V_{T+}$ ) and for negative going ( $V_{T-}$ ) signals.

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

The SN5414 and SN54LS14 are characterized for Operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN7414 and the SN74LS14 are characterized for Operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

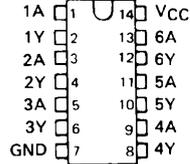
**logic diagram**



**positive logic**

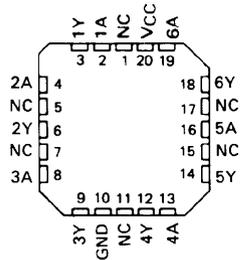
$$Y = \bar{A}$$

**SN5414, SN54LS14...J PACKAGE**  
**SN7414, SN74LS14...D OR N PACKAGE**  
 (TOP VIEW)



**SN54LS14 FK PACKAGE**

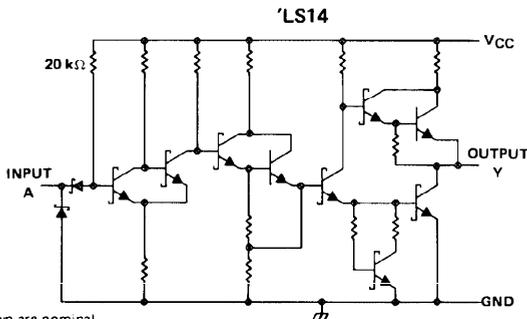
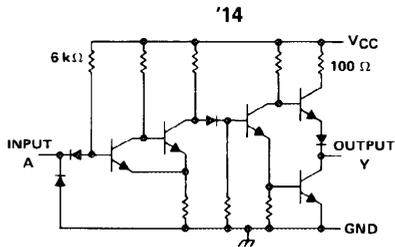
(TOP VIEW)



NC - No internal connection

**TYPES SN7414, SN74LS14, SN5414, SN54LS14**  
**HEX SCHMITT - TRIGGER INVERTERS**

**schematics**



Resistor values shown are nominal.

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

Supply voltage, VCC (see Note 1)	7 v
Input voltage: '14	5.5 v
'LS14	7 V
Operating free-air temperature: SN54'	-55°C to 125°C
SN74'	0°C to 70°C
Storage temperature range	-65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal

**TYPES SN7414, SN5414**  
**HEX SCHMITT • TRIGGER INVERTERS**

**recommended operating conditions**

	SN5414			SN7414			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
V <sub>CC</sub> Supply voltage <sup>a</sup>	4.5	5	5.5	4.75	5	5.25	V
I <sub>OH</sub> High-level output current			-0.8			-0.8	mA
I <sub>OL</sub> Low-level output current			16			16	mA
T <sub>A</sub> Operating free-air temperature	-55		125	0		70	°C

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

PARAMETER	TEST CONDITIONS <sup>†</sup>	MIN	TYP <sup>‡</sup>	MAX	UNIT
V <sub>T+</sub>	V <sub>CC</sub> = 5 V	1.5	1.7	2	V
V <sub>T-</sub>	V <sub>CC</sub> = 5 V	0.6	0.9	1.1	V
Hysteresis (V <sub>T+</sub> - V <sub>T-</sub> )	V <sub>CC</sub> = 5 V	0.4	0.8		V
V <sub>IK</sub>	V <sub>CC</sub> = MIN, I <sub>I</sub> = -12 mA			-1.5	V
V <sub>OH</sub>	V <sub>CC</sub> = MIN, V <sub>I</sub> = 0.6 V, I <sub>OH</sub> = -0.8 mA	2.4	3.4		V
V <sub>OL</sub>	V <sub>CC</sub> = MIN, V <sub>I</sub> = 2 V, I <sub>OL</sub> = 16 mA		0.2	0.4	V
I <sub>T+</sub>	V <sub>CC</sub> = 5 V, V <sub>I</sub> = V <sub>T+</sub>		-0.43		mA
I <sub>T-</sub>	V <sub>CC</sub> = 5 V, V <sub>I</sub> = V <sub>T-</sub>		-0.56		mA
I <sub>I</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 5.5 V			1	mA
I <sub>IH</sub>	V <sub>CC</sub> = MAX, V <sub>IH</sub> = 2.4 V			40	μA
I <sub>IL</sub>	V <sub>CC</sub> = MAX, V <sub>IL</sub> = 0.4 V		-0.8	-1.2	mA
I <sub>OS</sub> <sup>§</sup>	V <sub>CC</sub> = MAX		-18	-55	mA
I <sub>CCH</sub>	V <sub>CC</sub> = MAX		22	36	mA
I <sub>CCL</sub>	V <sub>CC</sub> = MAX		39	60	mA

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

<sup>‡</sup>All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

<sup>§</sup>Not more than one output should be shorted at a time.

**switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<sup>•</sup> PLH	A	Y	R <sub>L</sub> = 400 Ω, C <sub>L</sub> = 15 pF		15	22	ns
<sup>•</sup> PHL					15	22	ns

# TYPES SN74LS14 SN54LS14

## HEX SCHMITT-TRIGGER INVERTERS

### recommended operating conditions

	SN54LS14			SN74LS14			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
V <sub>CC</sub> Supply voltage	4.5	5	5.5	4.75	5	5.25	V
I <sub>OH</sub> High-level output current			-0.4			-0.4	mA
I <sub>OL</sub> Low-level output current			4			8	mA
T <sub>A</sub> Operating free-air temperature	-55		125	0		70	°C

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

PARAMETER	TEST CONDITIONS†	SN54LS14			SN74LS14			UNIT
		MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V <sub>T+</sub>	V <sub>CC</sub> = 5 V	1.4	1.6	1.9	1.4	1.6	1.9	V
V <sub>T-</sub>	V <sub>CC</sub> = 5 V	0.5	0.8	1	0.5	0.8	1	V
Hysteresis (V <sub>T+</sub> - V <sub>T-</sub> )	V <sub>CC</sub> = 5 V	0.4	0.8		0.4	0.8		V
V <sub>IK</sub>	V <sub>CC</sub> = MIN, I <sub>I</sub> = -18 mA			-1.5			-1.5	V
V <sub>OH</sub>	V <sub>CC</sub> = MIN, V <sub>I</sub> = 0.5 V, I <sub>OH</sub> = -0.4 mA	2.5	3.4		2.7	3.4		V
V <sub>OL</sub>	V <sub>CC</sub> = MIN, V <sub>I</sub> = 1.9 V, I <sub>OL</sub> = 4 mA		0.25	0.4		0.25	0.4	V
						0.35	0.5	
I <sub>T+</sub>	V <sub>CC</sub> = 5 V, V <sub>I</sub> = V <sub>T+</sub>		-0.14			-0.14		mA
I <sub>T-</sub>	V <sub>CC</sub> = 5 V, V <sub>I</sub> = V <sub>T-</sub>		-0.18			-0.18		mA
I <sub>I</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 7 V			0.1			0.1	mA
I <sub>IH</sub>	V <sub>CC</sub> = MAX, V <sub>IH</sub> = 2.7 V			20			20	μA
I <sub>IL</sub>	V <sub>CC</sub> = MAX, V <sub>IL</sub> = 0.4 V			-0.4			-0.4	mA
I <sub>OS</sub> §	V <sub>CC</sub> = MAX	-20		-100	-20		-100	mA
I <sub>CCH</sub>	V <sub>CC</sub> = MAX		8.6	16		8.6	16	mA
I <sub>CCL</sub>	V <sub>CC</sub> = MAX		12	21		12	21	mA

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

‡ All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

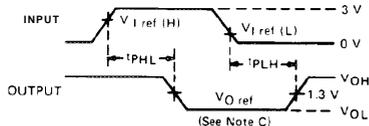
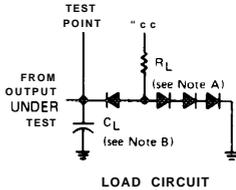
§ Not more than one output should be shorted at a time, and duration of the short-circuit should not exceed one second.

### switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t <sub>PLH</sub>	A	Y	R <sub>L</sub> = 2 kΩ, C <sub>L</sub> = 15 pF		15	22	ns
t <sub>PHL</sub>					15	22	ns

# TYPES SN7414, SN74LS14, SN5414, SN54LS14 HEX SCHMITT-TRIGGER INVERTERS

## PARAMETER MEASUREMENT INFORMATION



NOTES A. All diodes are 1N3064 or equivalent.  
B.  $C_L$  includes probe and jig capacitance.  
C. Generator characteristics and reference voltages are

	Generator Characteristics				Reference Voltages		
	$Z_{out}$	PRR	$t_r$	$t_f$	$V_{I\text{ ref (H)}}$	$V_{I\text{ ref (L)}}$	$V_{O\text{ ref}}$
SN54 <sup>1</sup> /SN74 <sup>1</sup>	50 $\Omega$	1 MHz	10 ns	10 ns	1.7 v	0.9 v	1.5 v
SN54LS <sup>1</sup> /SN74LS <sup>1</sup>	50 $\Omega$	1 MHz	15 ns	6 ns	1.6 v	0.8 v	1.3 v

## TYPICAL CHARACTERISTICS OF '14 CIRCUITS

### POSITIVE-GOING THRESHOLD VOLTAGE

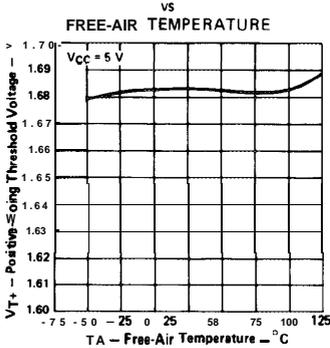


FIGURE 1

### NEGATIVE-GOING THRESHOLD VOLTAGE

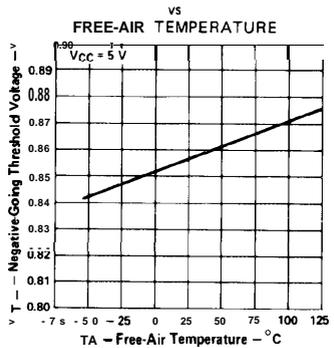


FIGURE 2

### HYSTERESIS

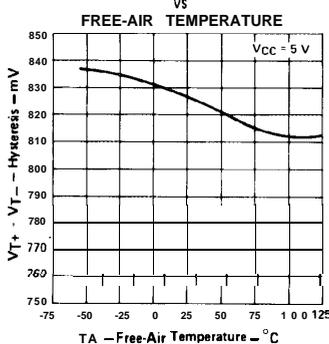
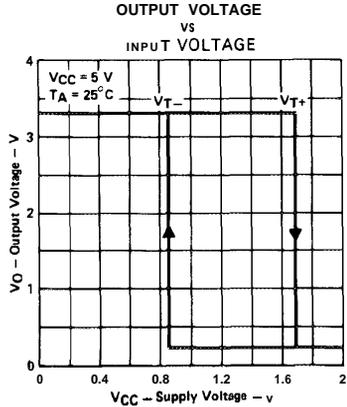
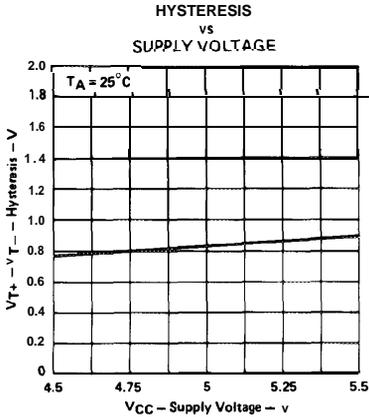
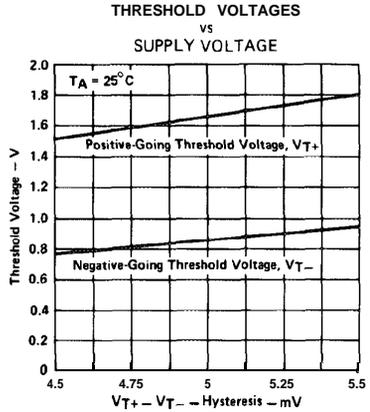
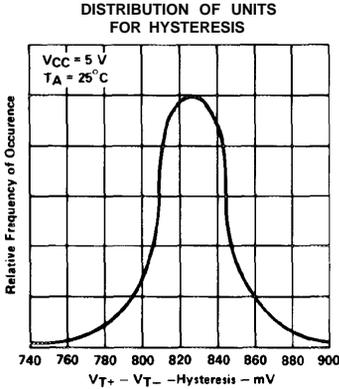


FIGURE 3

Data for temperatures below 0 $^{\circ}\text{C}$  and 70 $^{\circ}\text{C}$  and supply voltages below 4.75V and above 5.25 V are applicable for SN5414 only

**TYPES SN74LS14, SN54LS14  
HEX SCHMITT-TRIGGER INVERTERS**

**TYPICAL CHARACTERISTICS OF '14 CIRCUITS**



Data for temperatures below 0°C and 70°C and supply voltages below 0.75 V and above 5.25 V are applicable for SN5414 only.

TYPICAL CHARACTERISTICS OF 'LS14 CIRCUITS

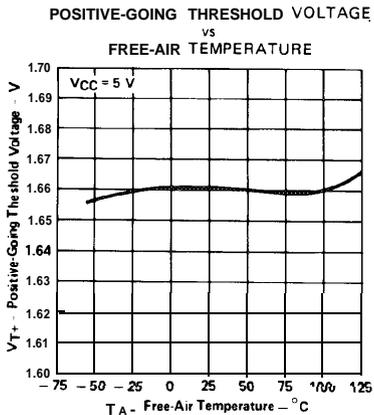


FIGURE 8

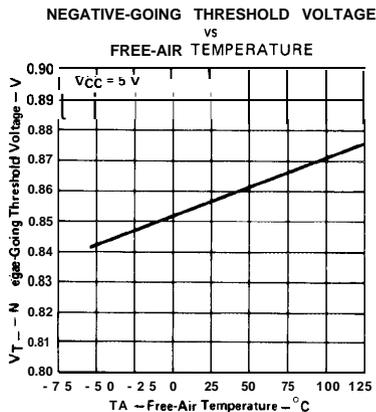


FIGURE 9

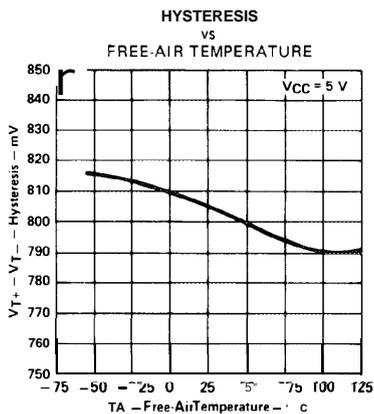


FIGURE 10

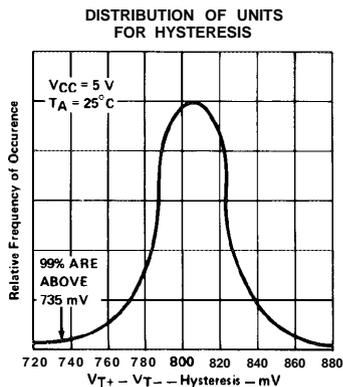


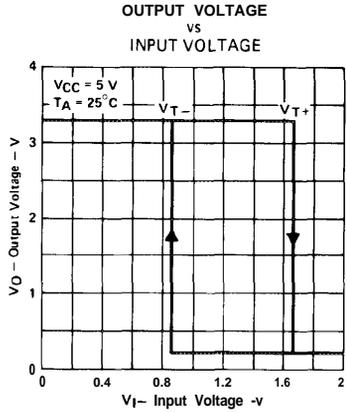
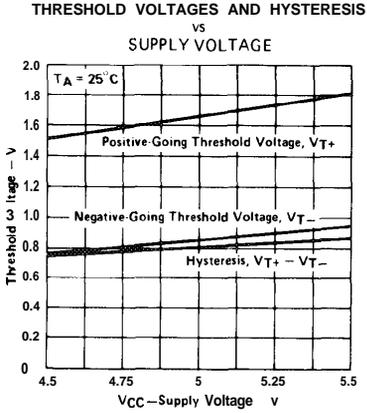
FIGURE 11

Data for temperatures below 0 °C and above 70 °C and supply voltages

4.75 V and above 5.25 V are applicable for SN54LS14 only.

**TYPES SN74LS14, SN54LS14**  
**HEX SCHMITT-TRIGGER INVERTERS**

**TYPICAL CHARACTERISTICS OF 'LS14 CIRCUITS**



Data for temperatures below 0°C and above 70°C and supply voltages below 4.75 V and above 5.25 V are applicable for SN54LS14 only

TYPICAL APPLICATION DATA

