

**TYPES SN741 4, 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 (D) and Ceramic Chip Carrier (FK) Package

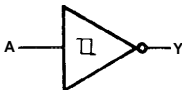
**description**

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  $70^{\circ}\text{C}$ .

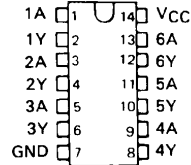
**logic diagram**



**positive logic**

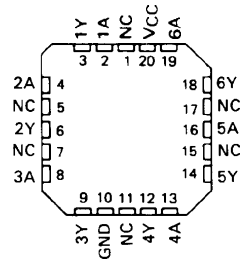
$$Y = \overline{A}$$

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



**SN54LS14 FK PACKAGE**

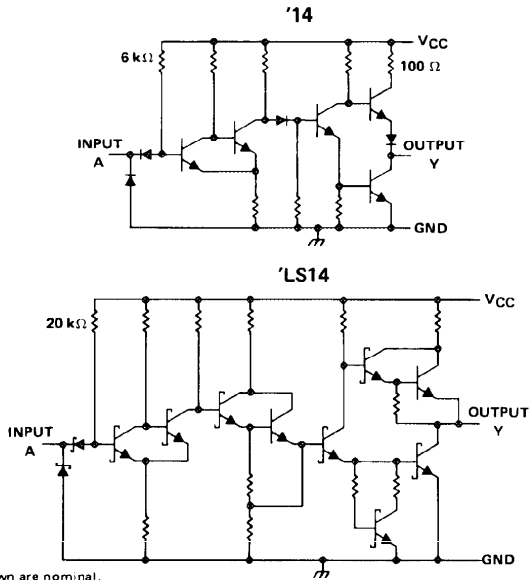
**(TOP VIEW)**



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, V <sub>CC</sub> (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	
$V_{CC}$ Supply voltage <sup>a</sup>	4.5	5	5.5	4.75	5	5.25	V
$I_{OH}$ High-level output current			-0.8			-0.8	mA
$I_{OL}$ Low-level output current			16			16	mA
$T_A$ 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
$V_{T+}$	$V_{CC} = 5\text{ V}$		1.5	1.7	2	V
$V_{T-}$	$V_{CC} = 5\text{ V}$		0.6	0.9	1.1	V
Hysteresis ( $V_{T+} - V_{T-}$ )	$V_{CC} = 5\text{ V}$		0.4	0.8		V
$V_{IK}$	$V_{CC} = \text{MIN}$ , $I_I = -12\text{ mA}$				-1.5	V
$V_{OH}$	$V_{CC} = \text{MIN}$ , $V_I = 0.6\text{ V}$ , $I_{OH} = -0.8\text{ mA}$		2.4	3.4		V
$V_{OL}$	$V_{CC} = \text{MIN}$ , $V_I = 2\text{ V}$ , $I_{OL} = 16\text{ mA}$			0.2	0.4	V
$I_{T+}$	$V_{CC} = 5\text{ V}$ , $V_I = V_{T+}$			-0.43		mA
$I_{T-}$	$V_{CC} = 5\text{ V}$ , $V_I = V_{T-}$			-0.56		mA
$I_I$	$V_{CC} = \text{MAX}$ , $V_I = 5.5\text{ V}$				1	mA
$I_{IH}$	$V_{CC} = \text{MAX}$ , $V_{IH} = 2.4\text{ V}$				40	μA
$I_{IL}$	$V_{CC} = \text{MAX}$ , $V_{IL} = 0.4\text{ V}$			-0.8	-1.2	mA
$I_{OS}^{\S}$	$V_{CC} = \text{MAX}$		-18		-55	mA
$I_{CCH}$	$V_{CC} = \text{MAX}$			22	36	mA
$I_{CCL}$	$V_{CC} = \text{MAX}$			39	60	mA

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

<sup>‡</sup>All typical values are at  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

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

## switching characteristics, $V_{CC} = 5\text{ V}$ , $T_A = 25^\circ\text{C}$

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$	A	Y	$R_L = 400\ \Omega$ , $C_L = 15\text{ pF}$		15	22	ns
$t_{PHL}$					15	22	ns

# TYPES SN74LS14 SN54LS14

## HEX SCHMITT-TRIGGER INVERTERS

### recommended operating conditions

	SN54LS14			SN74LS14			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
$V_{CC}$ Supply voltage	4.5	5	5.5	4.75	5	5.25	V
$I_{OH}$ High-level output current			-0.4			-0.4	mA
$I_{OL}$ Low-level output current			4			8	mA
$T_A$ 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	
$V_{T+}$	$V_{CC} = 5\text{ V}$	1.4	1.6	1.9	1.4	1.6	1.9	V
$V_{T-}$	$V_{CC} = 5\text{ V}$	0.5	0.8	1	0.5	0.8	1	V
Hysteresis ( $V_{T+} - V_{T-}$ )	$V_{CC} = 5\text{ V}$	0.4	0.8		0.4	0.8		V
$V_{IK}$	$V_{CC} = \text{MIN}, I_I = -18\text{ mA}$			-1.5			-1.5	V
$V_{OH}$	$V_{CC} = \text{MIN}, V_I = 0.5\text{ V}, I_{OH} = -0.4\text{ mA}$	2.5	3.4		2.7	3.4		V
$V_{OL}$	$V_{CC} = \text{MIN}, V_I = 1.9\text{ V}$	$I_{OL} = 4\text{ mA}$		0.25	0.4	0.25		0.4
		$I_{OL} = 8\text{ mA}$				0.35		0.5
$I_{T+}$	$V_{CC} = 5\text{ V}, V_I = V_{T+}$	-0.14			-0.14			mA
$I_{T-}$	$V_{CC} = 5\text{ V}, V_I = V_{T-}$	-0.18			-0.18			mA
$I_I$	$V_{CC} = \text{MAX}, V_I = 7\text{ V}$	0.1			0.1			mA
$I_{IH}$	$V_{CC} = \text{MAX}, V_{IH} = 2.7\text{ V}$	20			20			µA
$I_{IL}$	$V_{CC} = \text{MAX}, V_{IL} = 0.4\text{ V}$	-0.4			-0.4			mA
$I_{OS}§$	$V_{CC} = \text{MAX}$	-20		-100	-20		-100	mA
$I_{CCH}$	$V_{CC} = \text{MAX}$	8.6		16	8.6		16	mA
$I_{CCL}$	$V_{CC} = \text{MAX}$	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  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

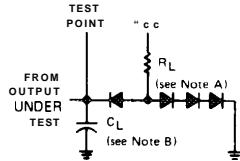
§ Not more than one output should be shorted at a time, and duration of the short-circuit should not exceed one second.

### switching characteristics, $V_{CC} = 5\text{ V}$ , $T_A = 25^\circ\text{C}$

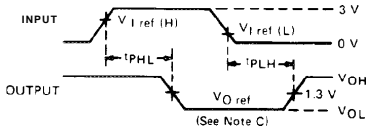
PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
PLH	A	Y	$R_L = 2\text{ k}\Omega$ , $C_L = 15\text{ pF}$		15	22	ns
PHL					15	22	ns

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

## PARAMETER MEASUREMENT INFORMATION



LOAD CIRCUIT



VOLTAGE WAVEFORMS

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	$t_r$	$t_f$	$V_{I\ ref(H)}$	$V_{I\ ref(L)}$	$V_{O\ ref}$
SN54 <sup>+</sup> /SN74 <sup>+</sup>	50 $\Omega$	1 MHz	10 ns	10 ns	1.7 V	0.9 V	1.5 V
SN54LS <sup>+</sup> /SN74LS <sup>+</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

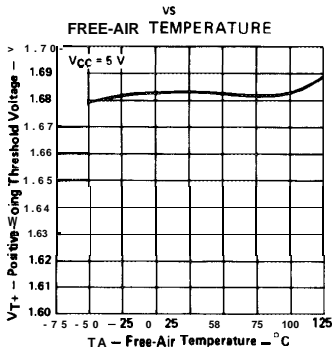


FIGURE 1

### NEGATIVE-GOING THRESHOLD VOLTAGE

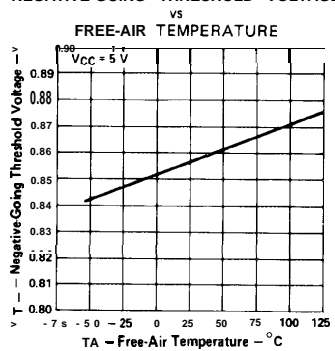


FIGURE 2

### HYSTERESIS

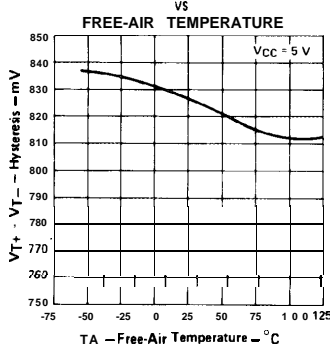
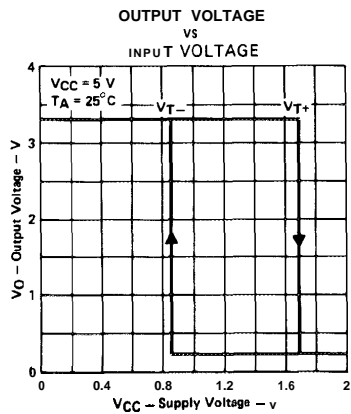
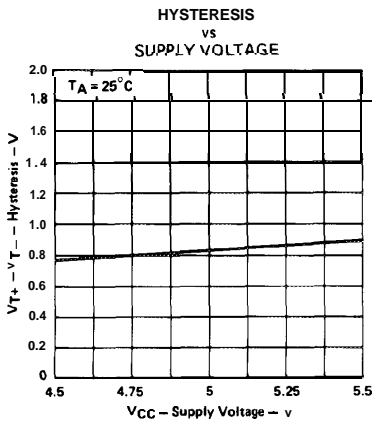
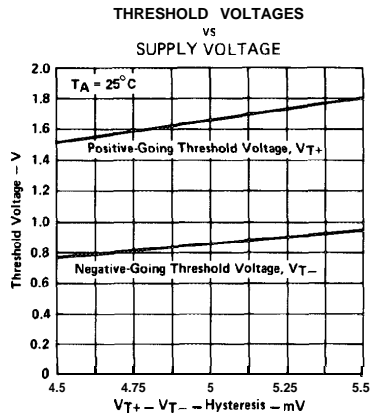
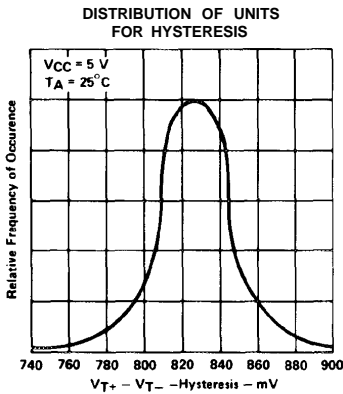


FIGURE 3

Data for temperatures below 0°C and 70°C and supply voltages below 4.75V and above 5.25 V are applicable for SN5414 only

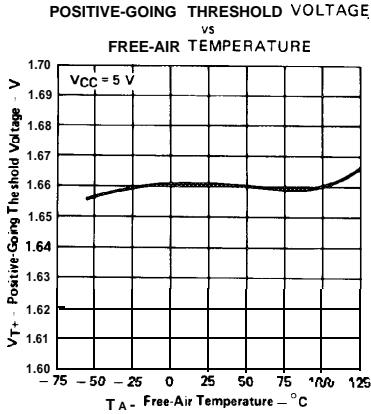
TYPES SN74LS14, SN54LS14  
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TYPICAL CHARACTERISTICS OF '14 CIRCUITS

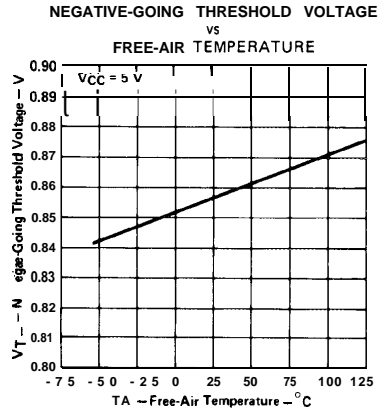


Data for temperatures below  $0^\circ\text{C}$  and  $70^\circ\text{C}$  and supply voltages below  $0.75\text{ V}$  and above  $5.25\text{ V}$  are applicable for SN5414 only.

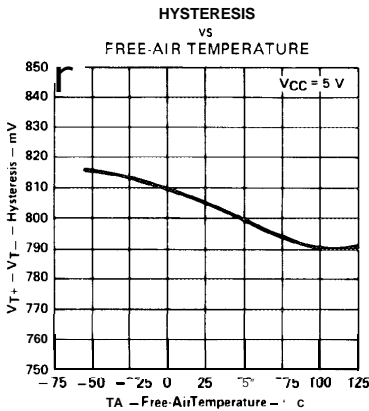
**TYPICAL CHARACTERISTICS OF 'LS14 CIRCUITS**



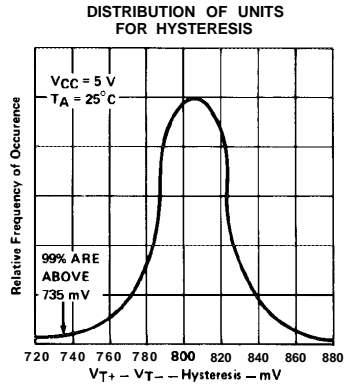
**FIGURE 8**



**FIGURE 9**



**FIGURE 10**



**FIGURE 11**

Data for temperatures below  $0^{\circ}\text{C}$  and above  $70^{\circ}\text{C}$  and supply voltages

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

TYPES SN74LS14, SN54LS14  
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TYPICAL CHARACTERISTICS OF 'LS14 CIRCUITS

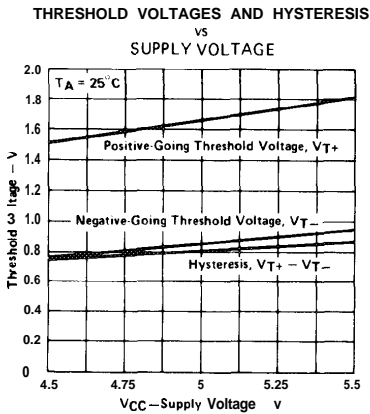


FIGURE 12

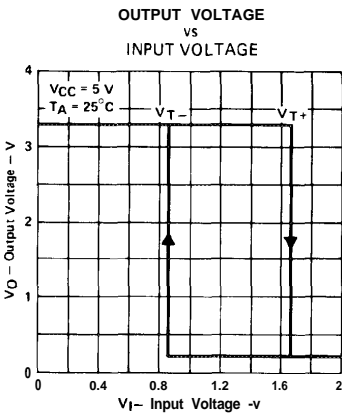


FIGURE 13

Data for temperatures below  $0^\circ\text{C}$  and above  $70^\circ\text{C}$  and supply voltages below 4.75 V and above 5.25 V are applicable for SN54LS14 only



TYPICAL APPLICATION DATA

