

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

DECEMBER 1983—REVISED MARCH 1988

- Operation from Very Slow Edges
- Improved Line-Receiving Characteristics
- High Noise Immunity

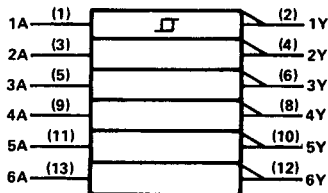
description

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°C to 125°C . The SN7414 and the SN74LS14 are characterized for operation from 0°C to 70°C .

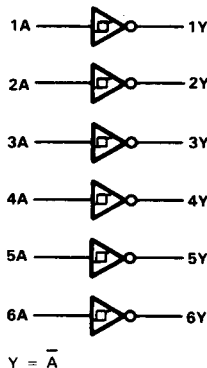
logic symbol†



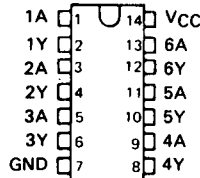
† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

Pin numbers shown are for D, J, N, and W packages.

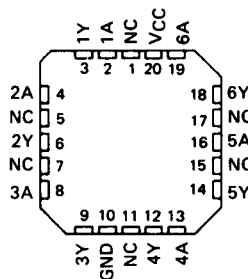
logic diagram (positive logic)



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



SN54LS14 . . . FK PACKAGE
(TOP VIEW)



NC—No internal connection

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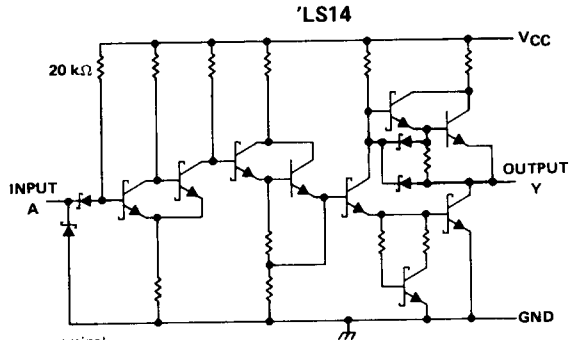
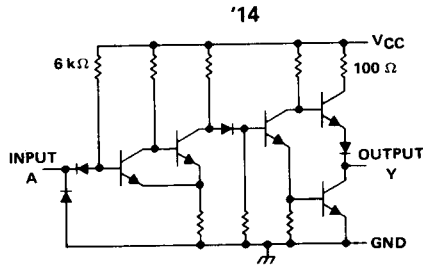
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SN5414, SN54LS14, SN7414, SN74LS14 HEX SCHMITT-TRIGGER INVERTERS

schematics



Resistor values shown are nominal.

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

Supply voltage, V_{CC} (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.

SN5414, SN7414 HEX SCHMITT-TRIGGER INVERTERS

recommended operating conditions

	SN5414			SN7414			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			-0.8			-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†	MIN	TYP‡	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
$I_{OS}§$	$V_{CC} = \text{MAX}$	-18		-55	mA
I_{CCH}	$V_{CC} = \text{MAX}$		22	36	mA
I_{CCL}	$V_{CC} = \text{MAX}$		39	60	mA

† 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.

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

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SN54LS14, SN74LS14 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			$^{\circ}$ 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}	$V_{CC} = \text{MIN}, V_I = 1.9\text{ V}, I_{OL} = 4\text{ mA}$ $I_{OL} = 8\text{ mA}$	0.25		0.4	0.25		0.4	V
					0.35	0.5		V
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			μ A
I_{IL}	$V_{CC} = \text{MAX}, V_{IL} = 0.4\text{ V}$	-0.4			-0.4			mA
$I_{OS}\S$	$V_{CC} = \text{MAX}$	-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, $V_{CC} = 5\text{ V}, T_A = 25^{\circ}\text{C}$

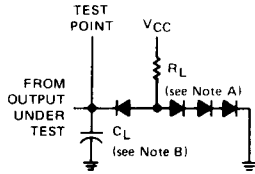
PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	A	Y	$R_L = 2\text{ k}\Omega, C_L = 15\text{ pF}$	15	22		ns
t_{PHL}				15	22		ns

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SN5414, SN54LS14, SN7414, SN74LS14 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 voltage 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/SN74'	50 Ω	1 MHz	10 ns	10 ns	1.7 V	0.9 V	1.5 V
SN54LS/SN74LS'	50 Ω	1 MHz	15 ns	6 ns	1.6 V	0.8 V	1.3 V

TYPICAL CHARACTERISTICS OF '14 CIRCUITS

POSITIVE-GOING THRESHOLD VOLTAGE
vs
FREE-AIR TEMPERATURE

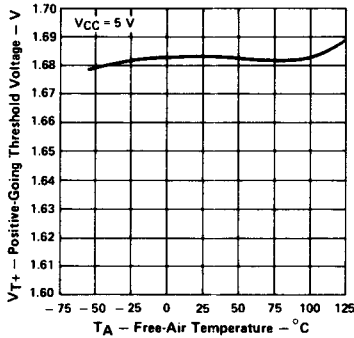


FIGURE 1

NEGATIVE-GOING THRESHOLD VOLTAGE
vs
FREE-AIR TEMPERATURE

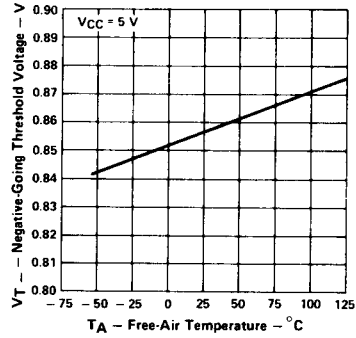


FIGURE 2

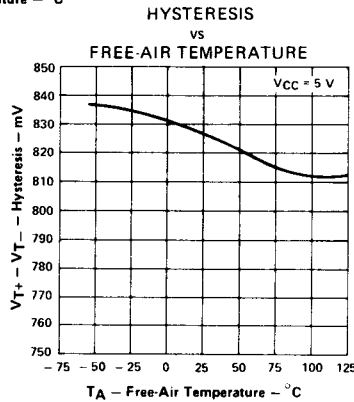


FIGURE 3

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.

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TYPICAL CHARACTERISTICS OF '14 CIRCUITS

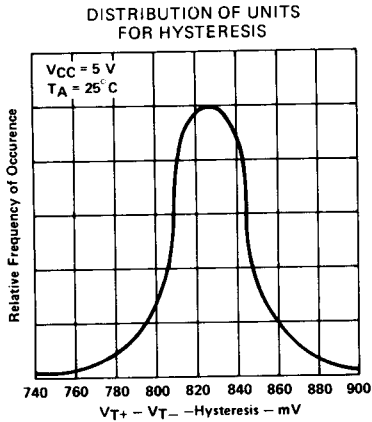


FIGURE 4

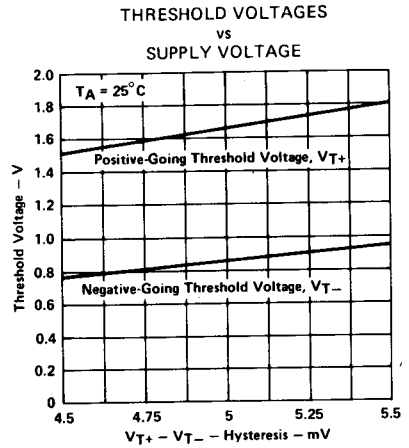


FIGURE 5

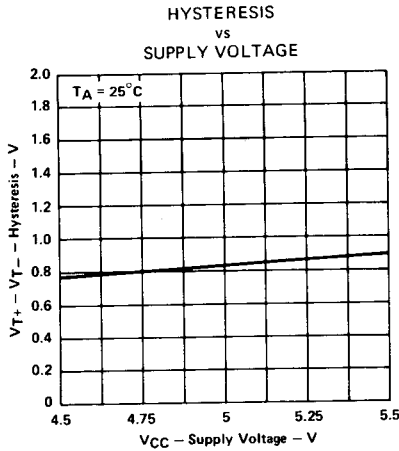


FIGURE 6

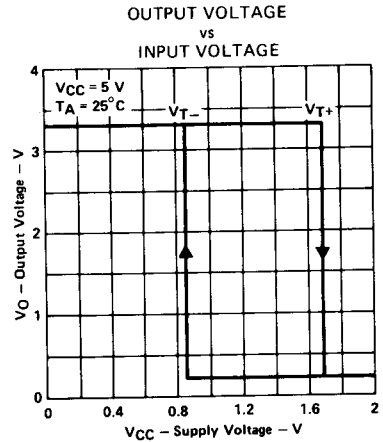


FIGURE 7

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

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TYPICAL CHARACTERISTICS OF 'LS14 CIRCUITS

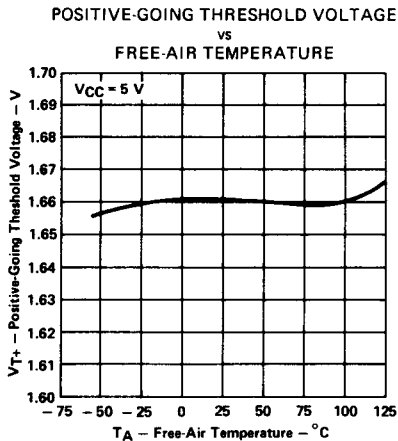


FIGURE 8

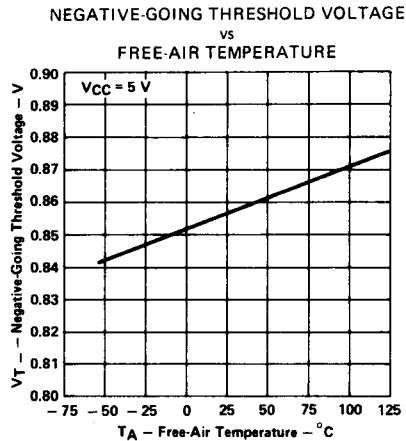


FIGURE 9

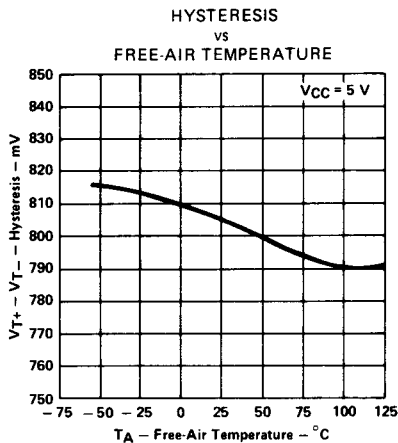


FIGURE 10

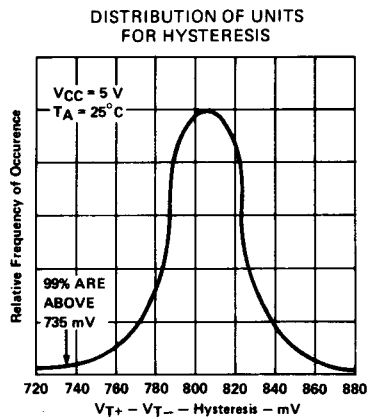


FIGURE 11

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

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TYPICAL CHARACTERISTICS OF 'LS14 CIRCUITS

THRESHOLD VOLTAGES AND HYSTERESIS
vs
SUPPLY VOLTAGE

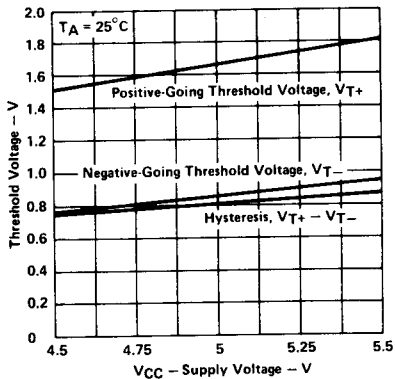


FIGURE 12

OUTPUT VOLTAGE
vs
INPUT VOLTAGE

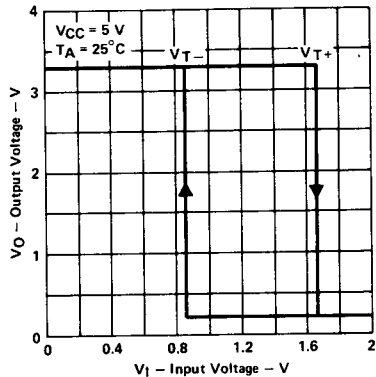


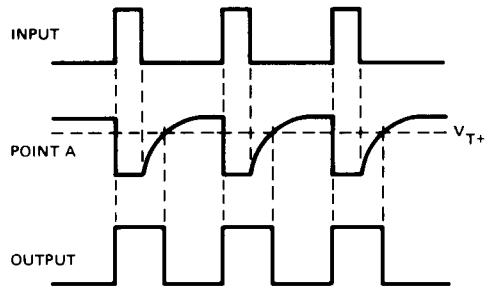
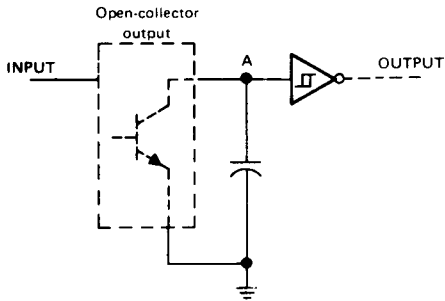
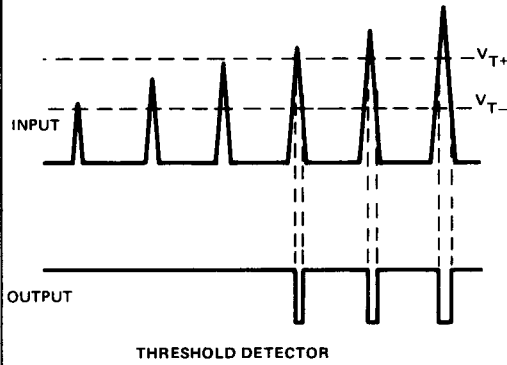
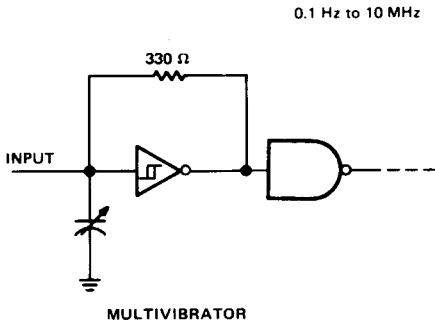
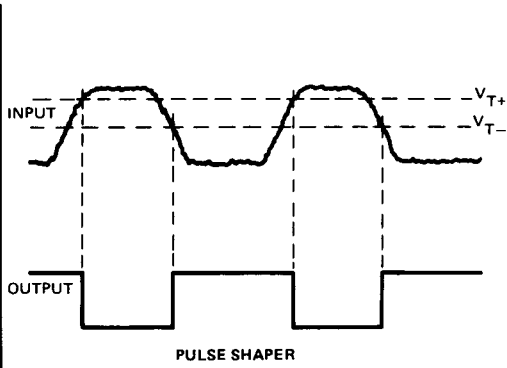
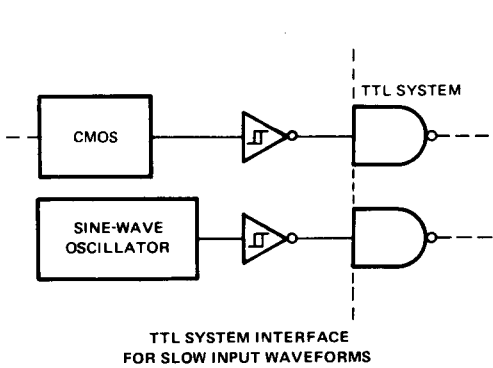
FIGURE 13

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.

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TYPICAL APPLICATION DATA



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