

# SN54132, SN54LS132, SN54S132, SN74132, SN74LS132, SN74S132 QUADRUPLE 2-INPUT POSITIVE-NAND SCHMITT TRIGGERS

SDLS047 - DECEMBER 1983 - REVISED MARCH 1988

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

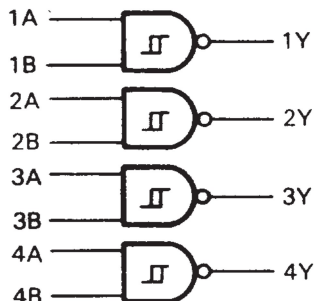
## description

Each circuit functions as a 2-input NAND gate, 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 clear, jitter-free output signals.

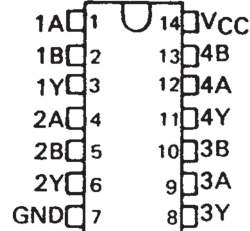
The SN54132, SN54LS132, and SN54S132 are characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74132, SN74LS132, and SN74S132 are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

## logic diagram (positive logic)



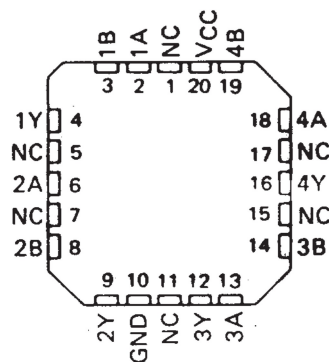
SN54132, SN54LS132, SN54S132 . . . J OR W PACKAGE  
SN74132 . . . N PACKAGE  
SN74LS132, SN74S132 . . . D OR N PACKAGE

(TOP VIEW)



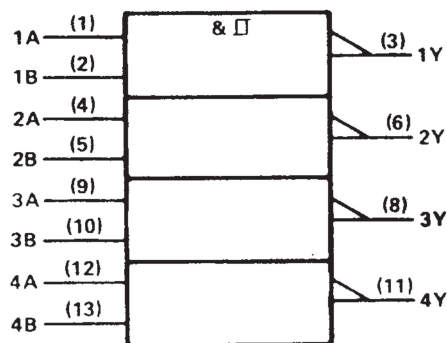
SN54LS132, SN54S132 . . . FK PACKAGE

(TOP VIEW)



NC-No internal connection

## logic symbol†



positive logic:  $Y = \overline{AB}$  or  $Y = \overline{A} + \overline{B}$

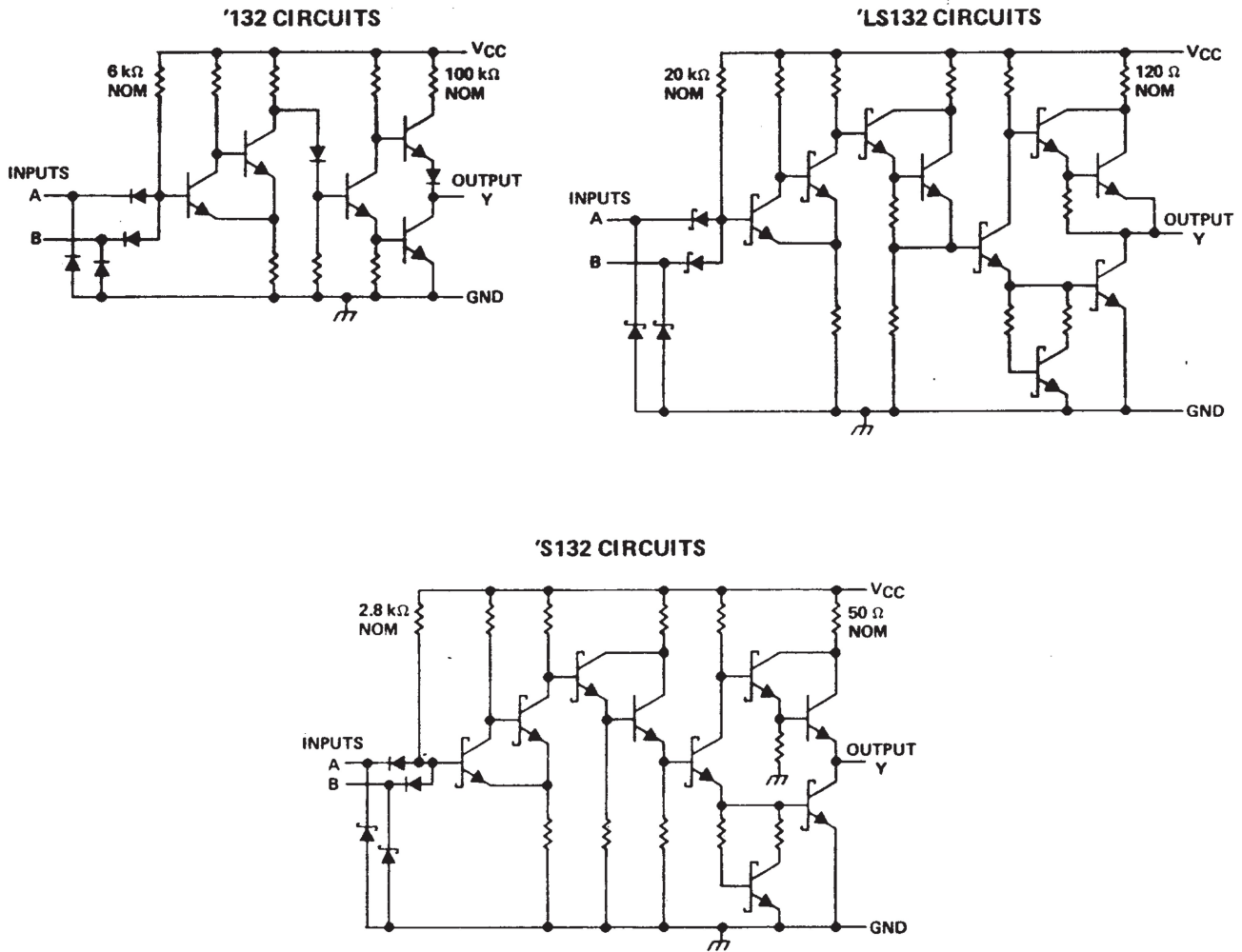
†This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

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

# SN54132, SN54LS132, SN54S132, SN74132, SN74LS132, SN74S132 QUADRUPLE 2-INPUT POSITIVE-NAND SCHMITT TRIGGERS

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## schematics



Resistor values shown are nominal.

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

Supply voltage, $V_{CC}$ (see Note 1).....	7 V
Input voltage: '132, 'S132.....	5.5 V
'LS132.....	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: Voltages values are with respect to network ground terminal.

# SN54132, SN74132

## QUADRUPLE 2-INPUT POSITIVE-NAND SCHMITT TRIGGERS

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### recommended operating conditions

	SN54132			SN74132			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			-0.8			-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†	MIN	TYP‡	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
V <sub>hys</sub> (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>I</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> §	V <sub>CC</sub> = MAX	-18		-55	mA
I <sub>CCH</sub>	V <sub>CC</sub> = MAX		15	24	mA
I <sub>CCL</sub>	V <sub>CC</sub> = MAX		26	40	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.

### switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C (see figure 1)

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



# SN54LS132, SN74LS132 QUADRUPLE 2-INPUT POSITIVE-NAND SCHMITT TRIGGERS

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## recommended operating conditions

	SN54LS132			SN74LS132			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†	SN54LS132			SN74LS132			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
V <sub>hys</sub> (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
		I <sub>OL</sub> = 8 mA				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>I</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	5.9		11	5.9		11	mA
I <sub>CCL</sub>	V <sub>CC</sub> = MAX	8.2		14	8.2		14	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 (see figure 1)

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



# SN54S132, SN74S132

## QUADRUPLE 2-INPUT POSITIVE-NAND SCHMITT TRIGGERS

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### recommended operating conditions

	SN54S132			SN74S132			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			-1			-1	mA
$I_{OL}$ Low-level output current			20			20	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†	SN54S132			SN74S132			UNIT
		MIN	TYP‡	MAX	MIN	TYP‡	MAX	
$V_{T+}$	$V_{CC} = 5\text{ V}$	1.6	1.77	1.9	1.6	1.77	1.9	V
$V_{T-}$	$V_{CC} = 5\text{ V}$	1.1	1.22	1.4	1.1	1.22	1.4	V
$V_{hys}$ ( $V_{T+} - V_{T-}$ )	$V_{CC} = 5\text{ V}$	0.2	0.55		0.2	0.55		V
$V_{IK}$	$V_{CC} = \text{MIN}$ , $I_I = -18\text{ mA}$			-1.2			-1.2	V
$V_{OH}$	$V_{CC} = \text{MIN}$ , $V_I = 1.1\text{ V}$ , $I_{OH} = -1\text{ mA}$	2.5	3.4		2.7	3.4		V
$V_{OL}$	$V_{CC} = \text{MIN}$ , $V_I = 1.9\text{ V}$ , $I_{OL} = 20\text{ mA}$			0.5			0.5	V
$I_{T+}$	$V_{CC} = 5\text{ V}$ , $V_I = V_{T+}$		-0.9			-0.9		mA
$I_{T-}$	$V_{CC} = 5\text{ V}$ , $V_I = V_{T-}$		-1.1			-1.1		mA
$I_I$	$V_{CC} = \text{MAX}$ , $V_I = 5.5\text{ V}$			1			1	mA
$I_{IH}$	$V_{CC} = \text{MAX}$ , $V_I = 2.7\text{ V}$			50			50	μA
$I_{IL}$	$V_{CC} = \text{MAX}$ , $V_{IL} = 0.5\text{ V}$			-2			-2	mA
$I_{OS}§$	$V_{CC} = \text{MAX}$	-40		-100	-40		-100	mA
$I_{CCH}$	$V_{CC} = \text{MAX}$		28	44		28	44	mA
$I_{CCL}$	$V_{CC} = \text{MAX}$		44	68		44	68	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.

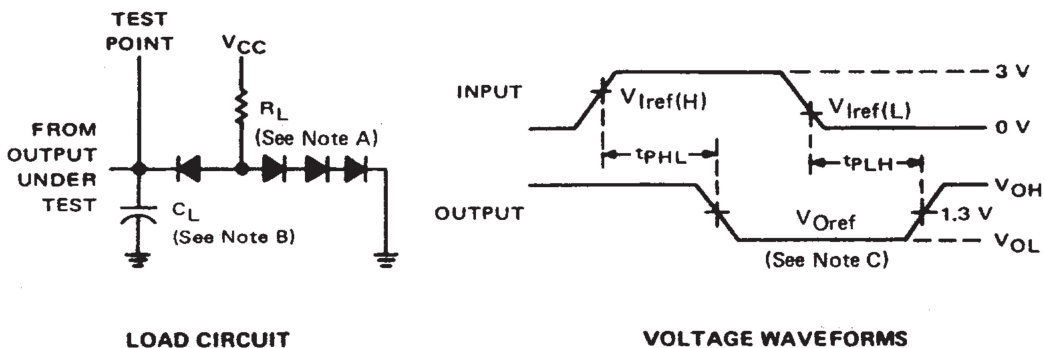
### switching characteristics, $V_{CC} = 5\text{ V}$ , $T_A = 25^\circ\text{C}$ (see figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$	A or B	Y	$R_L = 280\ \Omega$ , $C_L = 15\text{ pF}$		7	10.5	ns
$t_{PHL}$					8.5	13	ns

**SN54132, SN54LS132, SN54S132,  
SN74132, SN74LS132, SN74S132  
QUADRUPLE 2-INPUT POSITIVE-NAND SCHMITT TRIGGERS**

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**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	$t_r$	$t_f$	$V_{Iref(H)}$	$V_{Iref(L)}$	$V_{Oref}$
SN54'/SN74'	50	1 MHz	10 ns	10 ns	1.7 V	0.9 V	1.5 V
SN54LS'/SN74LS'	50	1 MHz	15 ns	6 ns	1.6 V	0.8 V	1.3 V
'S132	50	1 MHz	2.5 ns	2.5 ns	1.8 V	1.2 V	1.5 V

FIGURE 1

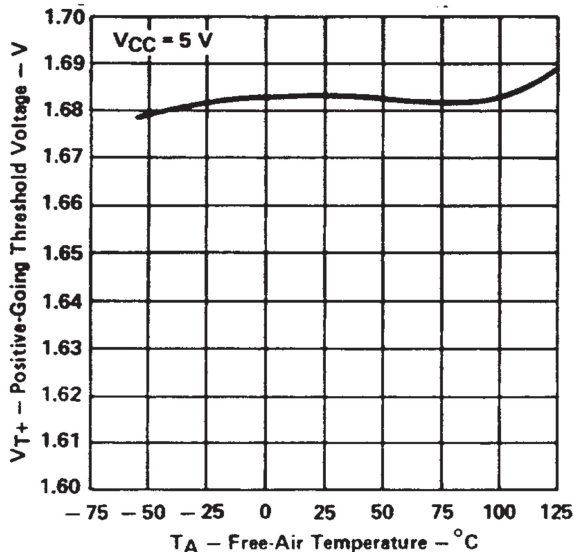
# SN54132, SN74132

## QUADRUPLE 2-INPUT POSITIVE-NAND SCHMITT TRIGGERS

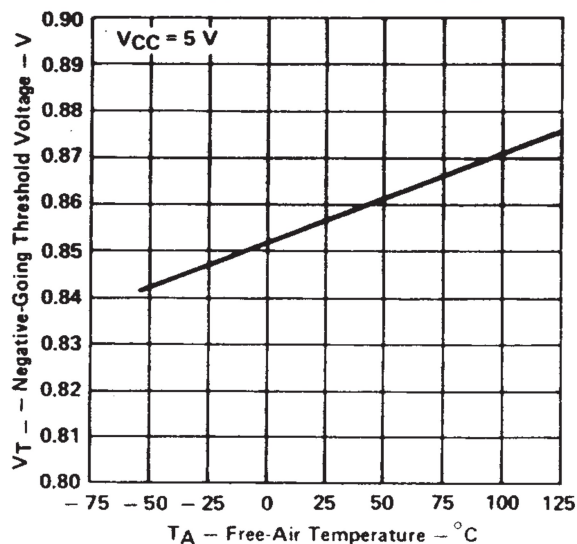
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### TYPICAL CHARACTERISTICS OF '132 CIRCUITS

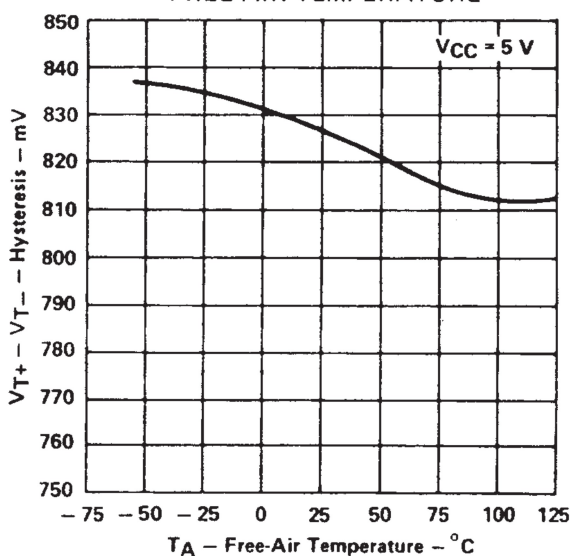
POSITIVE-GOING THRESHOLD VOLTAGE  
vs  
FREE-AIR TEMPERATURE



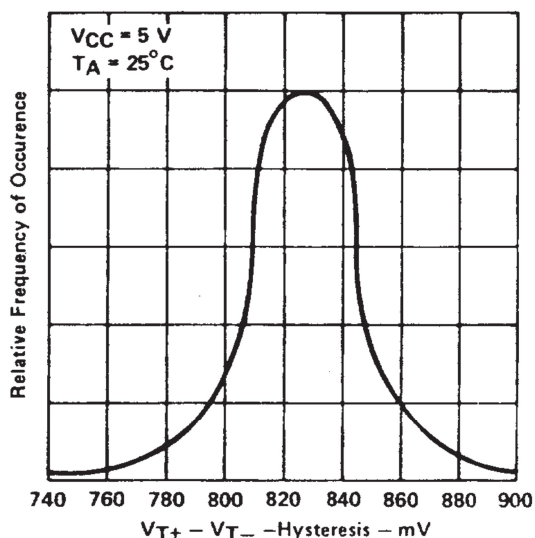
NEGATIVE-GOING THRESHOLD VOLTAGE  
vs  
FREE-AIR TEMPERATURE



HYSTERESIS  
vs  
FREE-AIR TEMPERATURE



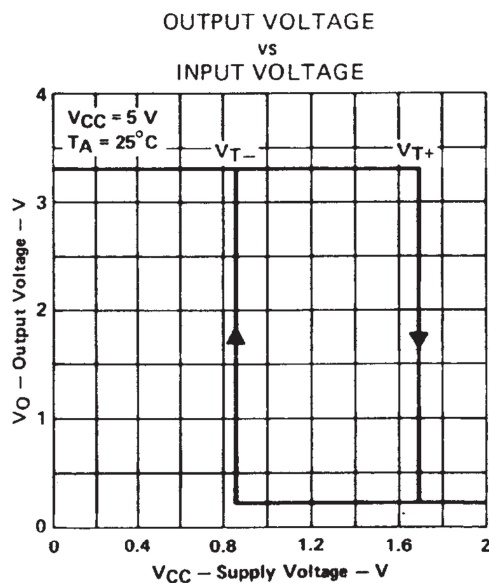
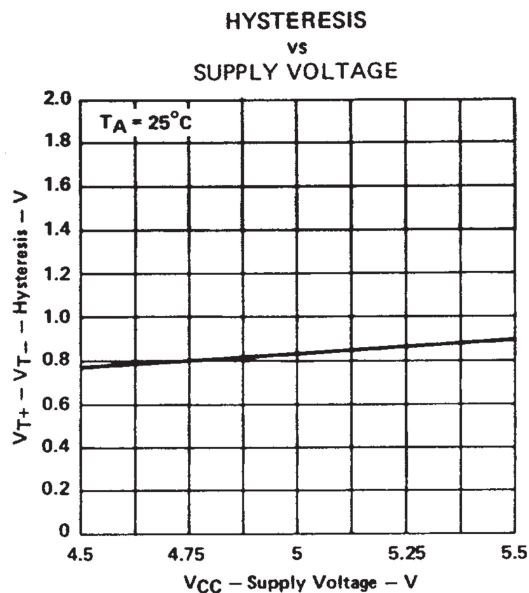
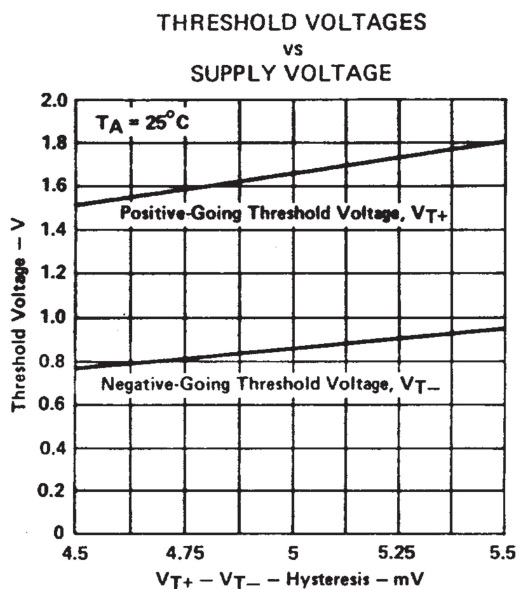
DISTRIBUTION OF UNITS  
FOR HYSTERESIS



# SN54132, SN74132 QUADRUPLE 2-INPUT POSITIVE-NAND SCHMITT TRIGGERS

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## TYPICAL CHARACTERISTICS OF '132 CIRCUITS



† Data for temperatures below 0°C and 70°C and supply below 4.75 V and above 5.25 V are applicable for SN54132 only.

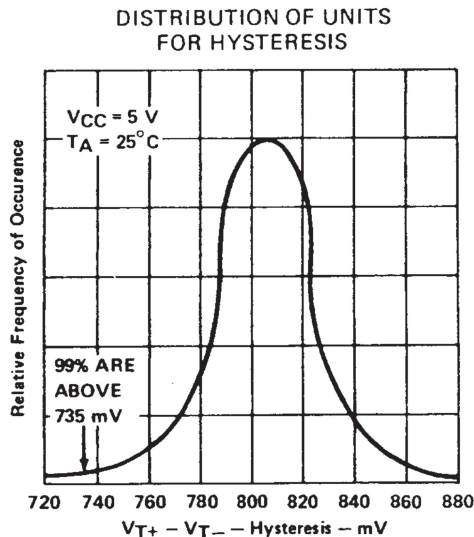
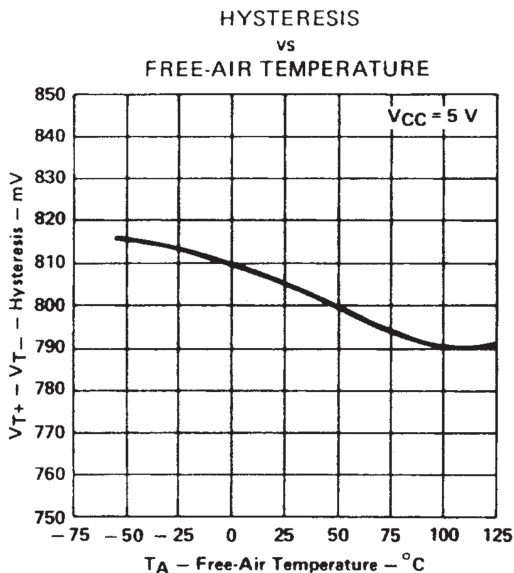
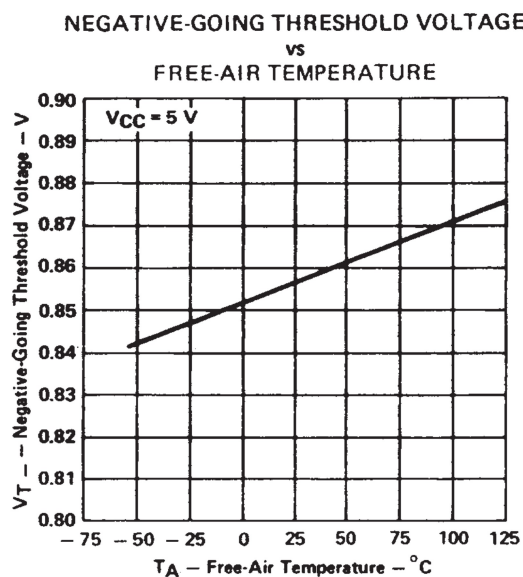
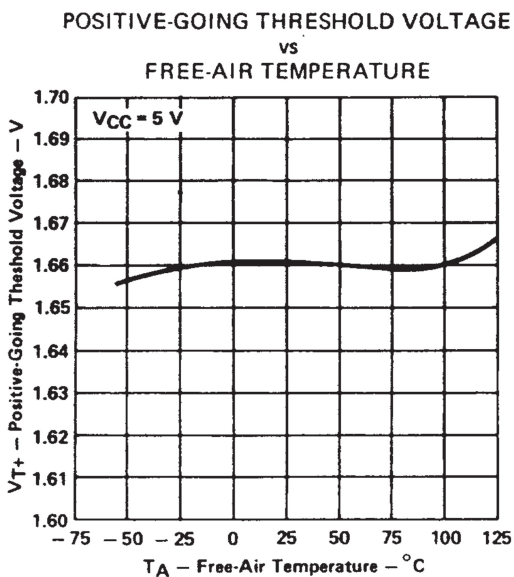


# SN54LS132, SN74LS132

## QUADRUPLE 2-INPUT POSITIVE-NAND SCHMITT TRIGGERS

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### TYPICAL CHARACTERISTICS OF 'LS132 CIRCUITS

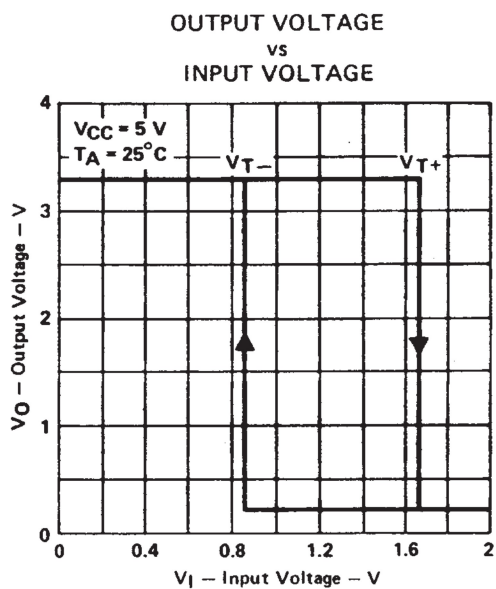
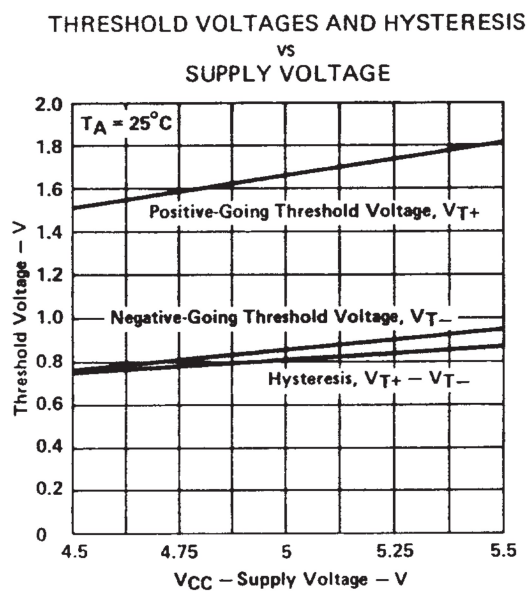


Data for temperatures below 0°C and above 70°C and supply voltages below 4.75 V and above 5.25 V are applicable for SN54LS132 only.

# SN54LS132, SN74LS132 QUADRUPLE 2-INPUT POSITIVE-NAND SCHMITT TRIGGERS

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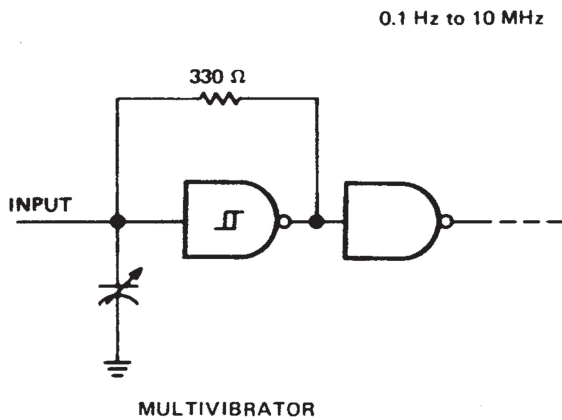
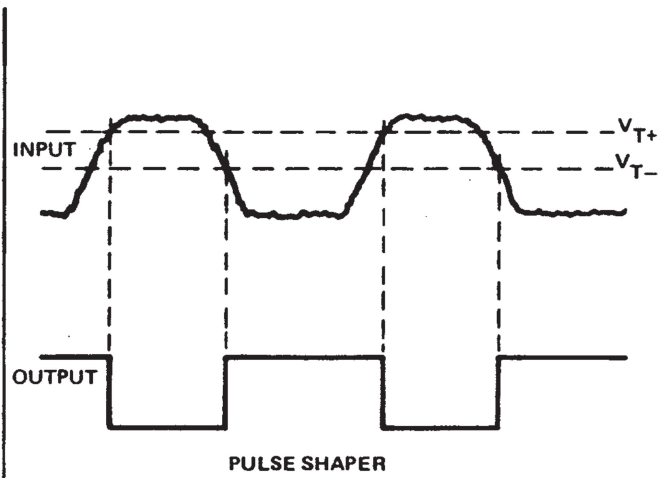
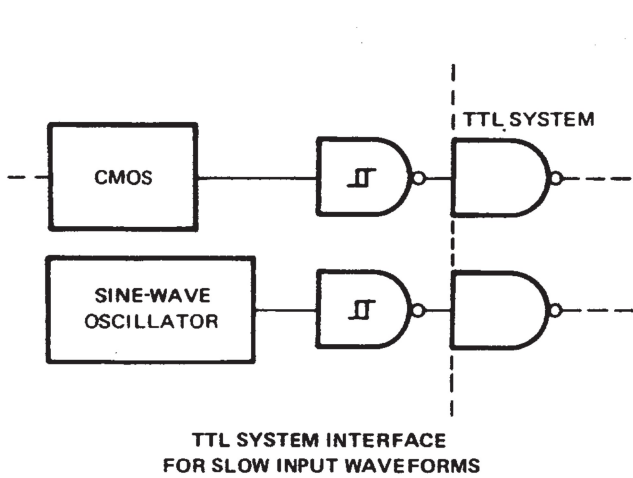
## TYPICAL CHARACTERISTICS OF 'LS132 CIRCUITS



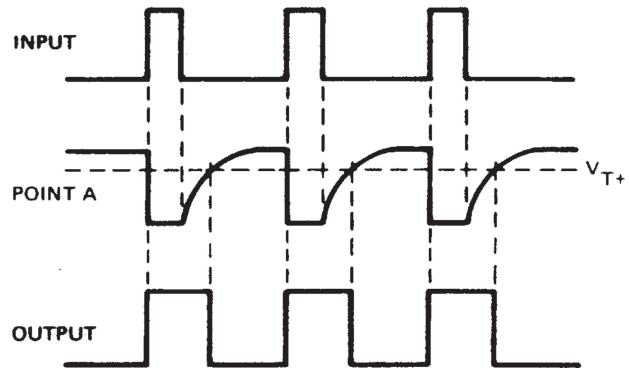
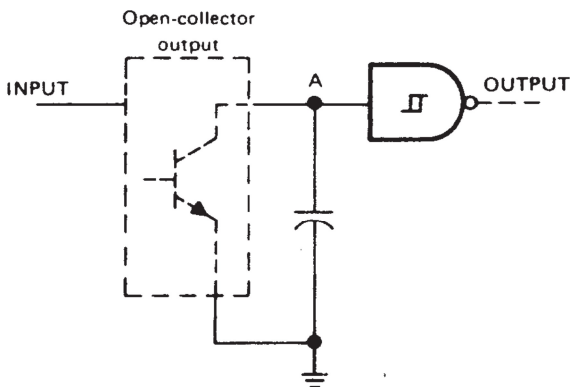
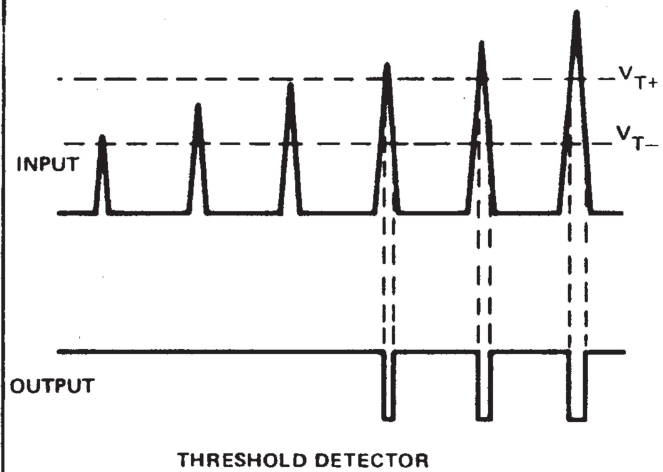
† Data for temperatures below  $0^\circ\text{C}$  and above  $70^\circ\text{C}$  and supply voltages below 4.75 V and above 5.25 V are applicable for SN54LS132 only.

SN54132, SN54LS132, SN54S132,  
SN74132, SN74LS132, SN74S132  
**QUADRUPLE 2-INPUT POSITIVE-NAND SCHMITT TRIGGERS**  
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TYPICAL APPLICATION DATA



0.1 Hz to 10 MHz



PULSE STRETCHER