SDLS047

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

DECEMBER 1983 – REVISED MARCH 1988

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

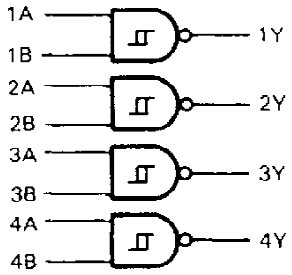
description

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.

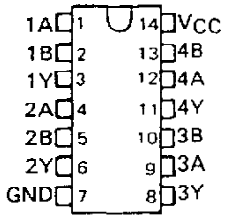
These circuits are temperature-compensated and can be triggered from the slowest of input ramps and still give clear, jitter-free output signals.

The SN54132, SN54LS132, and SN54S132 are characterized for operation over the full military temperature range of −55°C to 125°C. The SN74132, SN74LS132, and SN74S132 are characterized for operation from 0°C to 70°C.

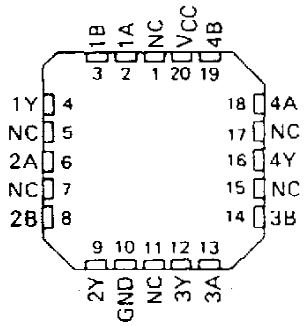
logic diagram (positive logic)



SN54132, SN54LS132, SN54S132 . . . J OR W PACKAGE
SN74132 . . . N PACKAGE
SN74LS132, SN74S132 . . . D OR N PACKAGE
(TOP VIEW)

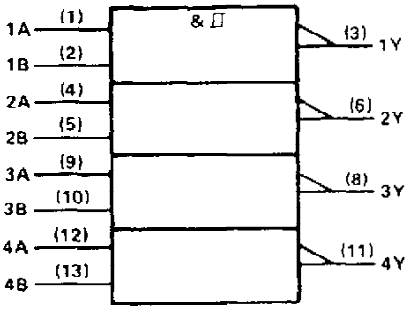


SN54LS132, SN54S132 . . . FK PACKAGE
(TOP VIEW)



NC–No internal connection

logic symbol†



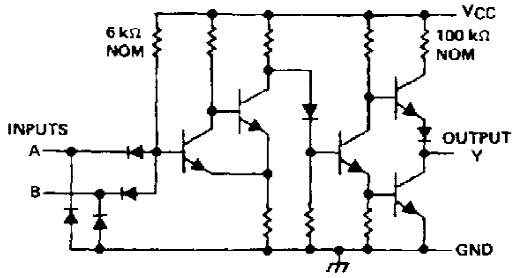
positive logic: $Y = \overline{AB}$ or $Y = \overline{A} + \overline{B}$

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

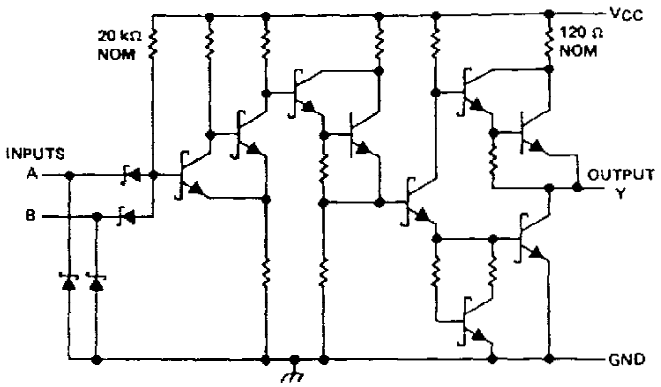
Pin numbers shown are for D, J, N, and W packages.

schematics

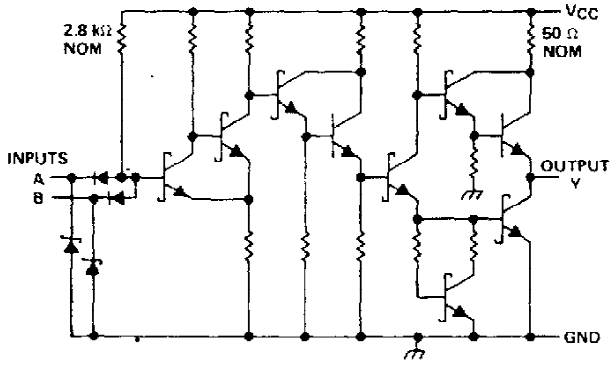
'132 CIRCUITS



'LS132 CIRCUITS



'S132 CIRCUITS



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.

recommended operating conditions

	SN54132			SN74132			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 V			1.5	1.7	2	V
V_{T-}	V_{CC} = 5 V			0.6	0.9	1.1	V
V_{hys} ($V_{T+} - V_{T-}$)	V_{CC} = 5 V			0.4	0.8		V
V_{IK}	V_{CC} = MIN,	I_I = −12 mA				−1.5	V
V_{OH}	V_{CC} = MIN,	V_I = 0.6 V,	I_{OH} = −0.8 mA	2.4	3.4		V
V_{OL}	V_{CC} = MIN,	V_I = 2 V,	I_{OL} = 16 mA		0.2	0.4	V
I_{T+}	V_{CC} = 5 V,	V_I = V_{T+}			−0.43		mA
I_{T-}	V_{CC} = 5 V,	V_I = V_{T-}			−0.56		mA
I_I	V_{CC} = MAX,	V_I = 5.5 V				1	mA
I_{IH}	V_{CC} = MAX,	V_I = 2.4 V				40	μA
I_{IL}	V_{CC} = MAX,	V_{IL} = 0.4 V			−0.8	−1.2	mA
I_{OS}§	V_{CC} = MAX			−18		−55	mA
I_{CCH}	V_{CC} = MAX				15	24	mA
I_{CCL}	V_{CC} = 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_{CC} = 5 V, T_A = 25°C.
§ Not more than one output should be shorted at a time.

switching characteristics, V_{CC} = 5 V, T_A = 25°C (see figure 1)

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

recommended operating conditions

	SN54LS132			SN74LS132			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†		SN54LS132			SN74LS132			UNIT
			MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{T+}	V_{CC} = 5 V		1.4	1.6	1.9	1.4	1.6	1.9	V
V_{T-}	V_{CC} = 5 V		0.5	0.8	1	0.5	0.8	1	V
V_{hys} ($V_{T+} - V_{T-}$)	V_{CC} = 5 V		0.4	0.8		0.4	0.8		V
V_{IK}	V_{CC} = MIN, I_I = −18 mA				−1.5			−1.5	V
V_{OH}	V_{CC} = MIN, V_I = 0.5 V,	I_{OH} = −0.4 mA	2.5	3.4		2.7	3.4		V
V_{OL}	V_{CC} = MIN, V_I = 1.9 V	I_{OL} = 4 mA		0.25	0.4		0.25	0.4	V
		I_{OL} = 8 mA					0.35	0.5	
I_{T+}	V_{CC} = 5 V, V_I = V_{T+}			−0.14			−0.14		mA
I_{T-}	V_{CC} = 5 V, V_I = V_{T-}			−0.18			−0.18		mA
I_I	V_{CC} = MAX, V_I = 7 V				0.1			0.1	mA
I_{IH}	V_{CC} = MAX, V_I = 2.7 V				20			20	μA
I_{IL}	V_{CC} = MAX, V_{IL} = 0.4 V				−0.4			−0.4	mA
I_{OS} §	V_{CC} = MAX		−20		−100	−20		−100	mA
I_{CCH}	V_{CC} = MAX			5.9	11		5.9	11	mA
I_{CCL}	V_{CC} = 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_{CC} = 5 V, T_A = 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_{CC} = 5 V, T_A = 25°C (see figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	Any	Y	R_L = 2 kΩ, C_L = 15 pF		15	22	ns
t_{PHL}					15	22	ns

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)

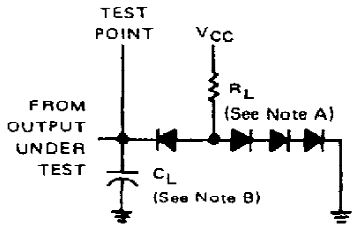
PARAMETER	TEST CONDITIONS†	SN54S132			SN74S132			UNIT
		MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{T+}	V_{CC} = 5 V	1.6	1.77	1.9	1.6	1.77	1.9	V
V_{T-}	V_{CC} = 5 V	1.1	1.22	1.4	1.1	1.22	1.4	V
V_{hys} ($V_{T+} - V_{T-}$)	V_{CC} = 5 V	0.2	0.55		0.2	0.55		V
V_{IK}	V_{CC} = MIN, I_I = −18 mA			−1.2			−1.2	V
V_{OH}	V_{CC} = MIN, V_I = 1.1 V, I_{OH} = −1 mA	2.5	3.4		2.7	3.4		V
V_{OL}	V_{CC} = MIN, V_I = 1.9 V, I_{OL} = 20 mA			0.5			0.5	V
I_{T+}	V_{CC} = 5 V, V_I = V_{T+}		−0.9			−0.9		mA
I_{T-}	V_{CC} = 5 V, V_I = V_{T-}		−1.1			−1.1		mA
I_I	V_{CC} = MAX, V_I = 5.5 V			1			1	mA
I_{IH}	V_{CC} = MAX, V_I = 2.7 V			50			50	μA
I_{IL}	V_{CC} = MAX, V_{IL} = 0.5 V			−2			−2	mA
I_{OS}§	V_{CC} = MAX	−40		−100	−40		−100	mA
I_{CCH}	V_{CC} = MAX		28	44		28	44	mA
I_{CCL}	V_{CC} = 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 V, T_A = 25°C.
§ Not more than one output should be shorted at a time, and duration of the short-circuit should not exceed one second.

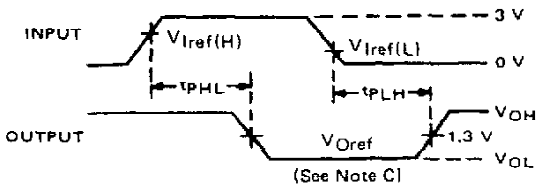
switching characteristics, V_{CC} = 5 V, T_A = 25°C (see figure 1)

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

PARAMETER MEASUREMENT INFORMATION



LOAD CIRCUIT



VOLTAGE WAVEFORMS

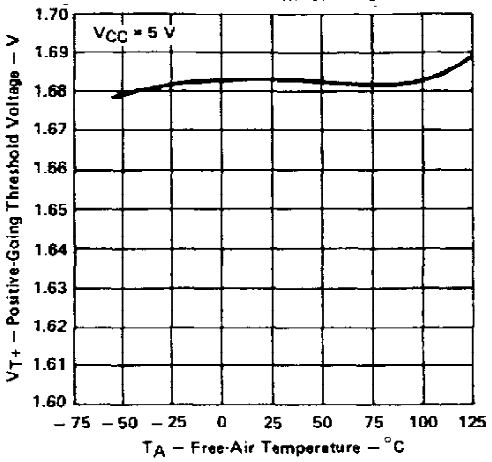
NOTES: A. All diodes are 1N3064 or equivalent.
B. C_L includes probe and jig capacitance.
C. Generator characteristics and reference voltages are:

	Generator Characteristics				Reference Voltages		
	Z_{out}	PRR	t_r	t_f	$V_{I\ ref(H)}$	$V_{I\ ref(L)}$	$V_{O\ ref}$
SN54'/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

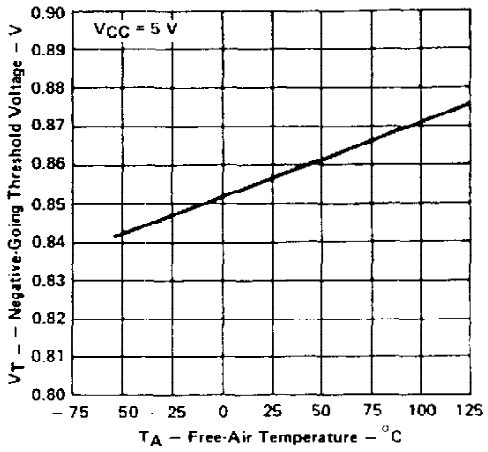
FIGURE 1

TYPICAL CHARACTERISTICS OF '132 CIRCUITS

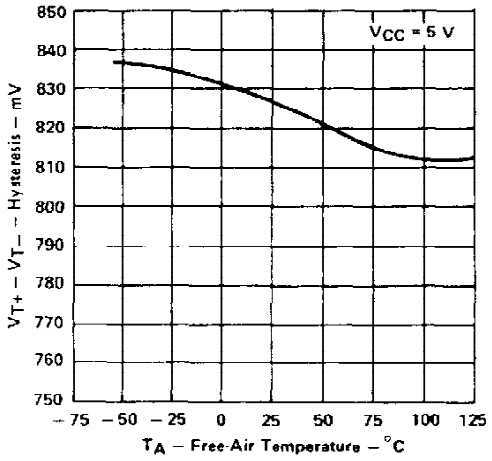
POSITIVE-GOING THRESHOLD VOLTAGE
vs
FREE-AIR TEMPERATURE



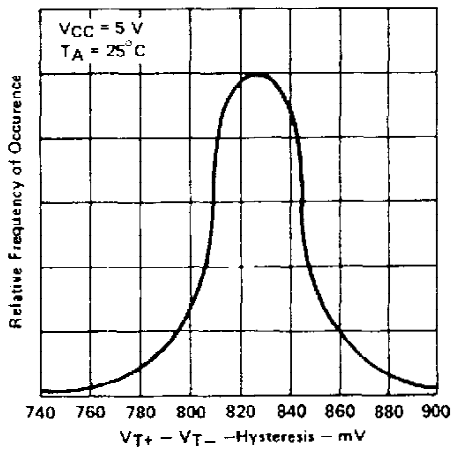
NEGATIVE-GOING THRESHOLD VOLTAGE
vs
FREE-AIR TEMPERATURE



HYSTERESIS
vs
FREE-AIR TEMPERATURE



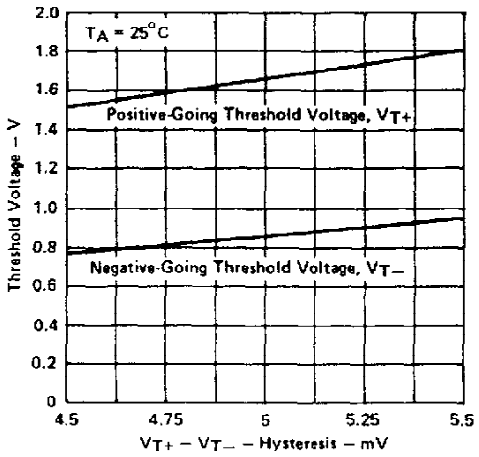
DISTRIBUTION OF UNITS
FOR HYSTERESIS



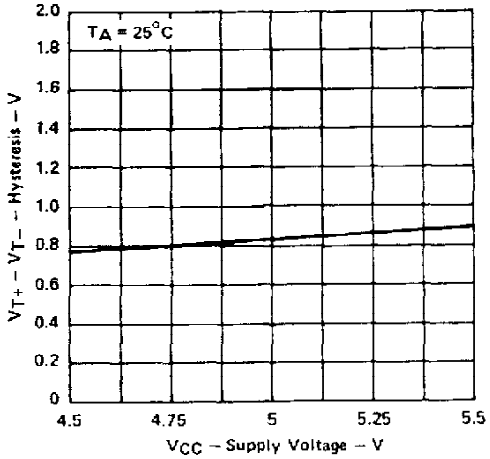
† Data for temperatures below 0°C and 70°C and supply below 4.75 V and above 5.25 V are applicable for SN54132 only.

TYPICAL CHARACTERISTICS OF '132 CIRCUITS

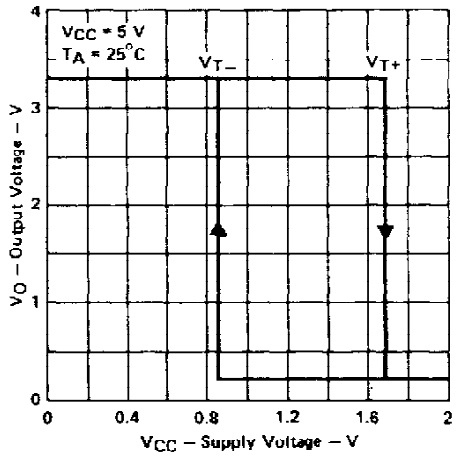
THRESHOLD VOLTAGES
vs
SUPPLY VOLTAGE



HYSTERESIS
vs
SUPPLY VOLTAGE



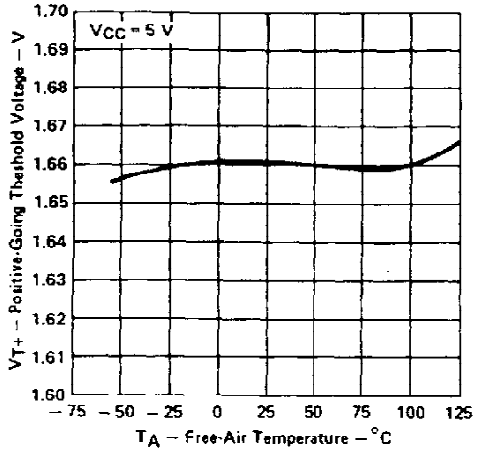
OUTPUT VOLTAGE
vs
INPUT VOLTAGE



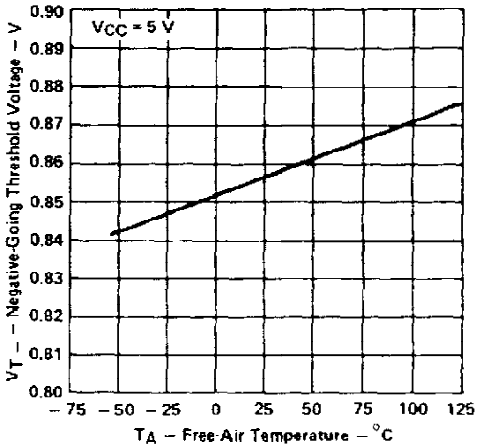
† Data for temperatures below 0°C and 70°C and supply below 4.75 V and above 5.25 V are applicable for SN54132 only.

TYPICAL CHARACTERISTICS OF 'LS132 CIRCUITS

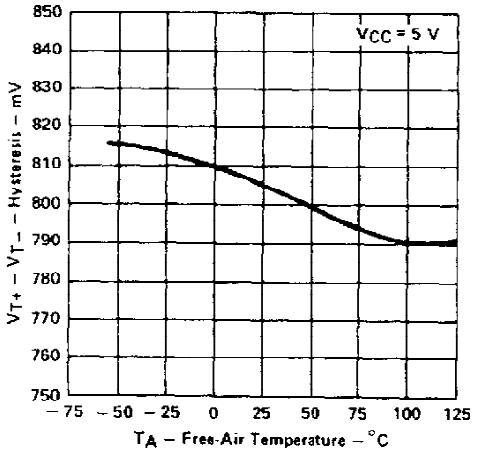
POSITIVE-GOING THRESHOLD VOLTAGE
vs
FREE-AIR TEMPERATURE



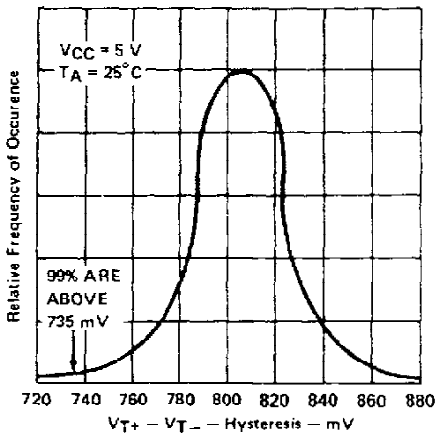
NEGATIVE-GOING THRESHOLD VOLTAGE
vs
FREE-AIR TEMPERATURE



HYSTERESIS
vs
FREE-AIR TEMPERATURE



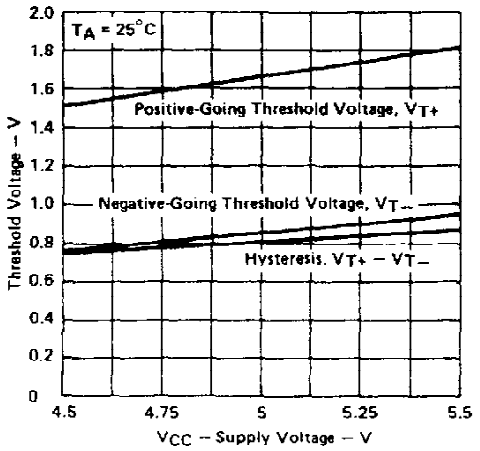
DISTRIBUTION OF UNITS
FOR HYSTERESIS



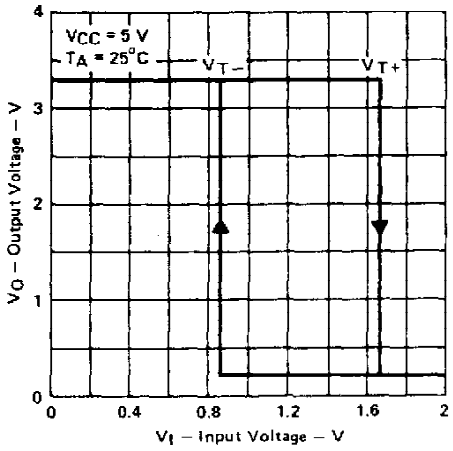
† Data for temperatures below 0°C and above 70°C and supply voltages below 4.75 V and above 5.25 V are applicable for SN54LS132 only.

TYPICAL CHARACTERISTICS OF 'LS132 CIRCUITS

THRESHOLD VOLTAGES AND HYSTERESIS
vs
SUPPLY VOLTAGE

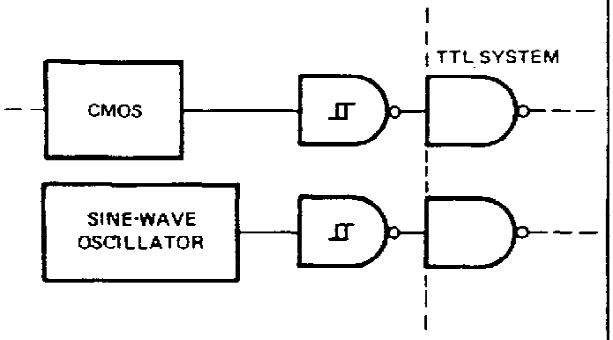


OUTPUT VOLTAGE
vs
INPUT VOLTAGE

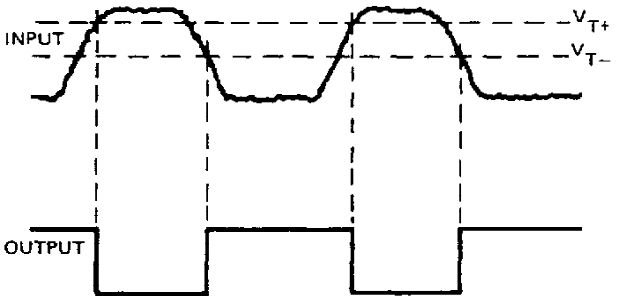


† Data for temperatures below 0°C and above 70°C and supply voltages below 4.75 V and above 5.25 V are applicable for SN54LS132 only.

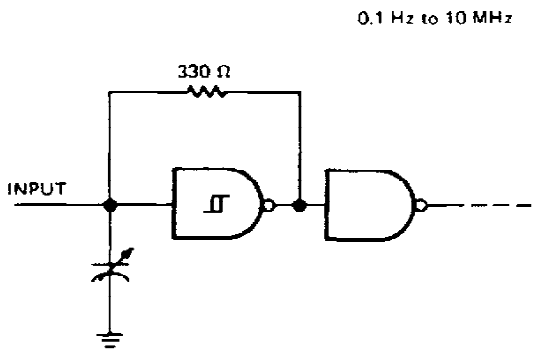
TYPICAL APPLICATION DATA



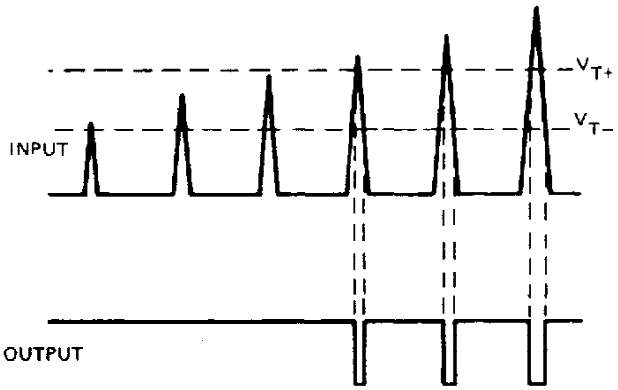
TTL SYSTEM INTERFACE
FOR SLOW INPUT WAVEFORMS



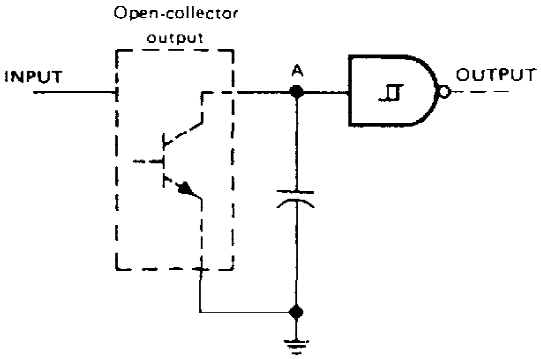
PULSE SHAPER

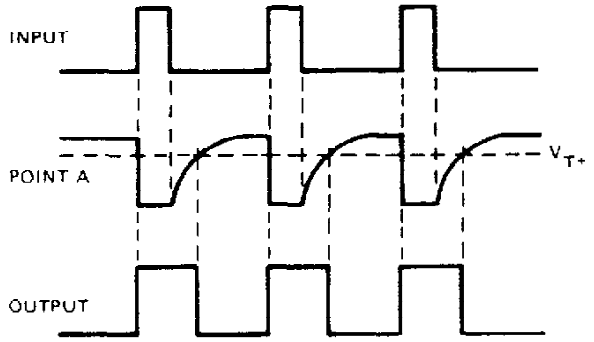


MULTIVIBRATOR



THRESHOLD DETECTOR





PULSE STRETCHER

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