

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

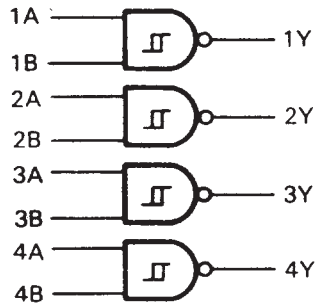
description

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.

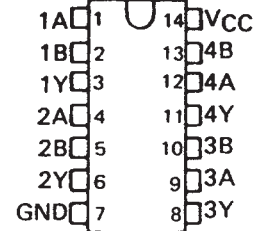
The SN54132, SN54LS132, and SN54S132 are characterized for operation over the full military temperature range of -55°C to 125°C . The SN74132, SN74LS132, and SN74S132 are characterized for operation from 0°C to 70°C .

logic diagram (positive logic)



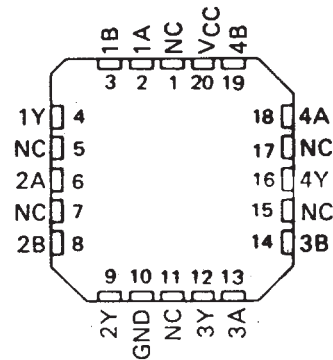
SN54132, SN54LS132, SN54S132 . . . J OR W PACKAGE
SN74132 . . . N PACKAGE
SN74LS132, SN74S132 . . . D OR N PACKAGE

(TOP VIEW)



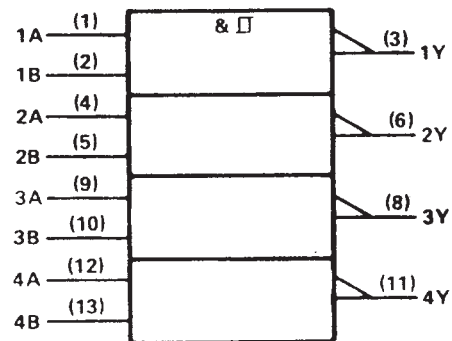
SN54LS132, SN54S132 . . . FK PACKAGE

(TOP VIEW)



NC-No internal connection

logic symbol†



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

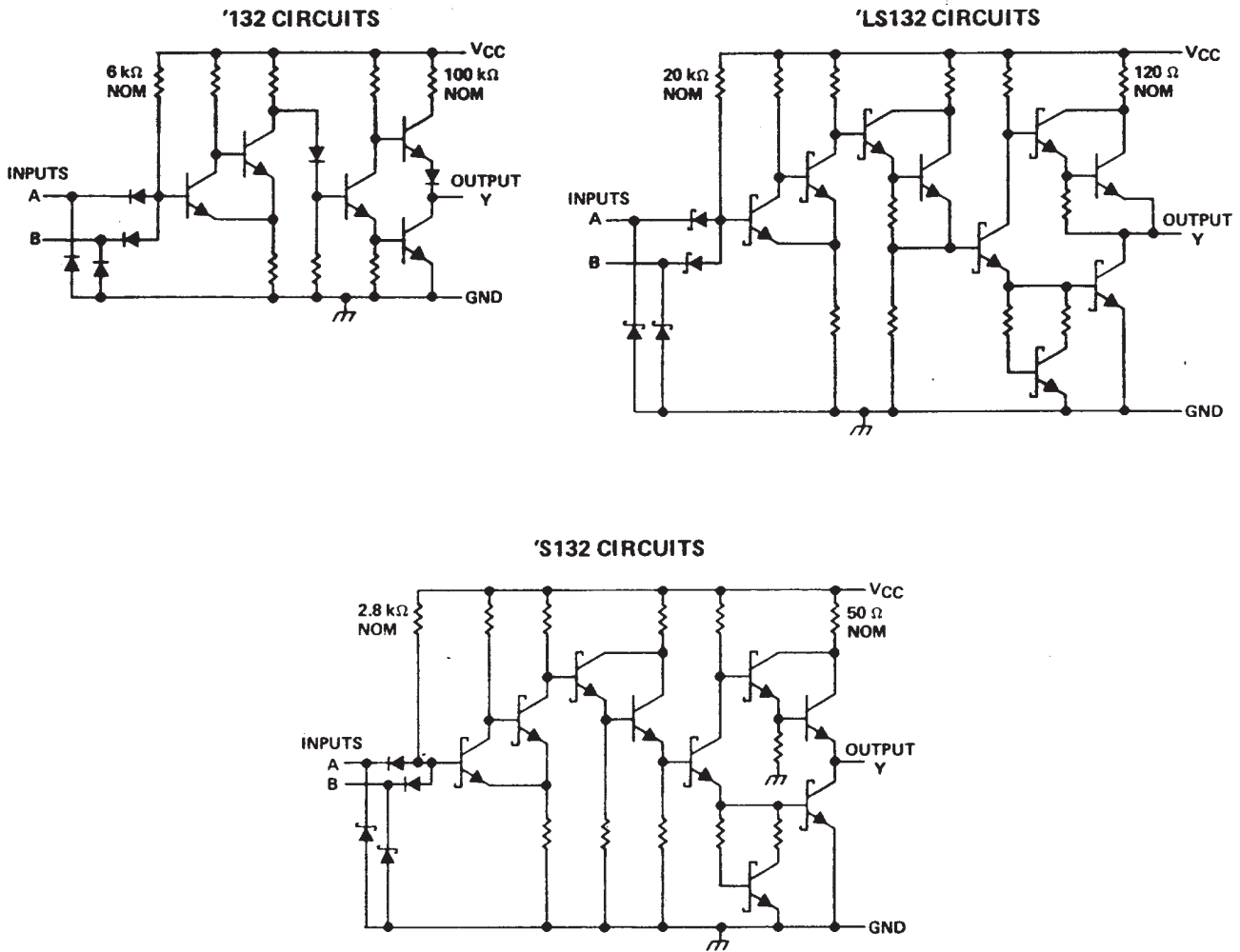
†This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

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

SN54132, SN54LS132, SN54S132,
 SN74132, SN74LS132, SN74S132
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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.



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SN54132, SN74132

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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 |



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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 |



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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.

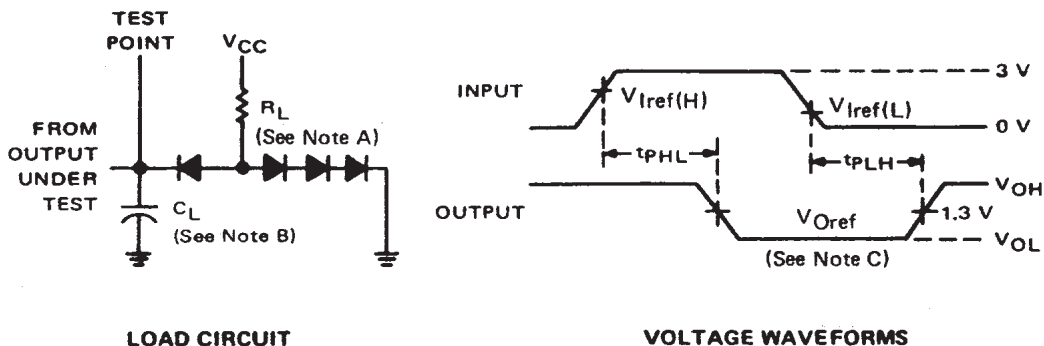
switching characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$ (see figure 1)

| 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 |



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PARAMETER MEASUREMENT INFORMATION



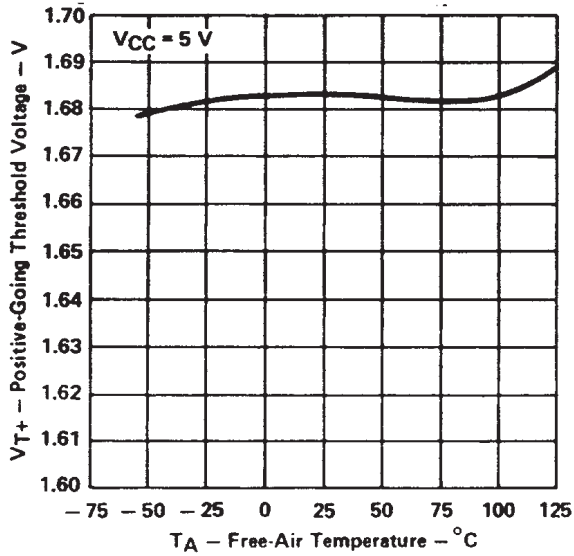
- NOTES: A. All diodes are 1N3064 or equivalent.
 B. C_L includes probe and jig capacitance.
 C. Generator characteristics and reference voltages are:

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

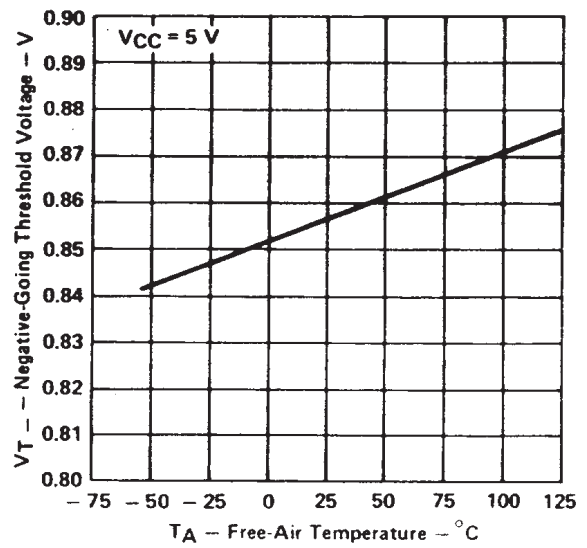
FIGURE 1

TYPICAL CHARACTERISTICS OF '132 CIRCUITS

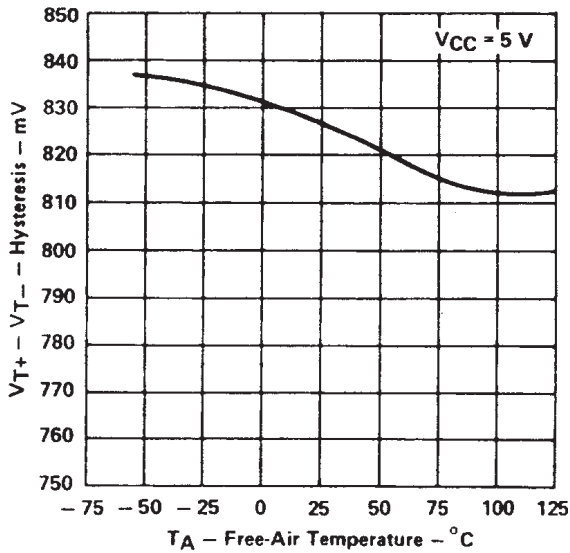
POSITIVE-GOING THRESHOLD VOLTAGE
 vs
 FREE-AIR TEMPERATURE



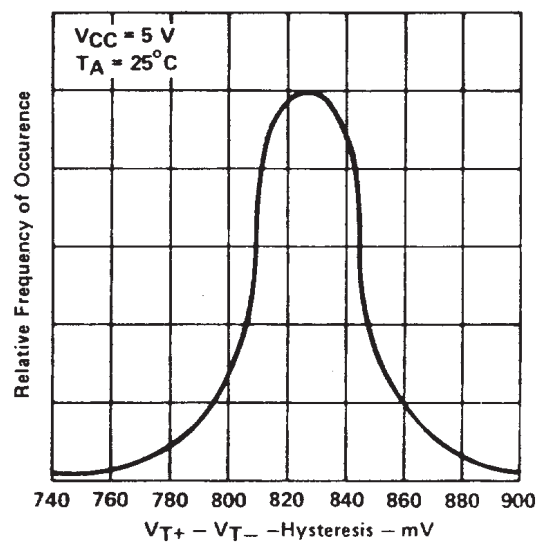
NEGATIVE-GOING THRESHOLD VOLTAGE
 vs
 FREE-AIR TEMPERATURE



HYSTERESIS
 vs
 FREE-AIR TEMPERATURE



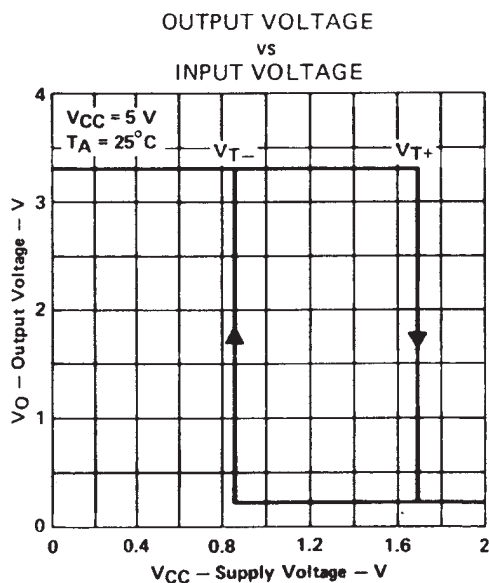
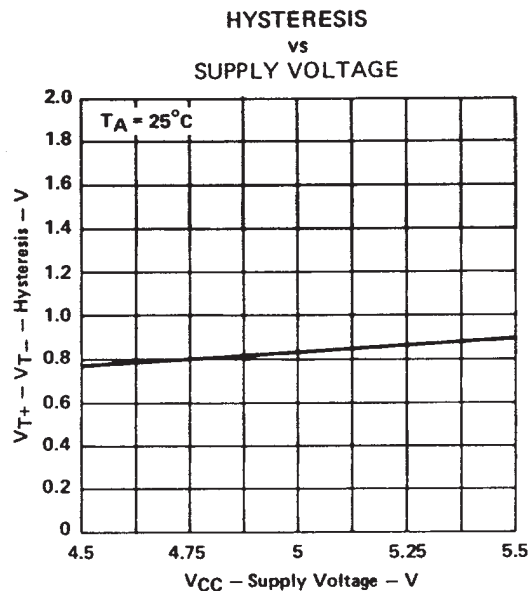
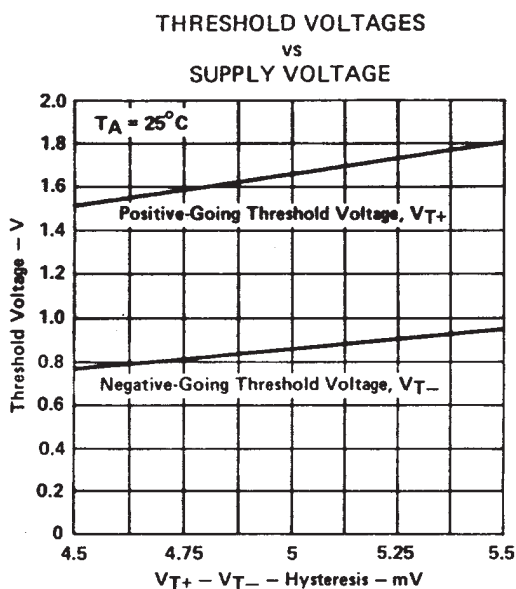
DISTRIBUTION OF UNITS
 FOR HYSTERESIS



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TYPICAL CHARACTERISTICS OF '132 CIRCUITS



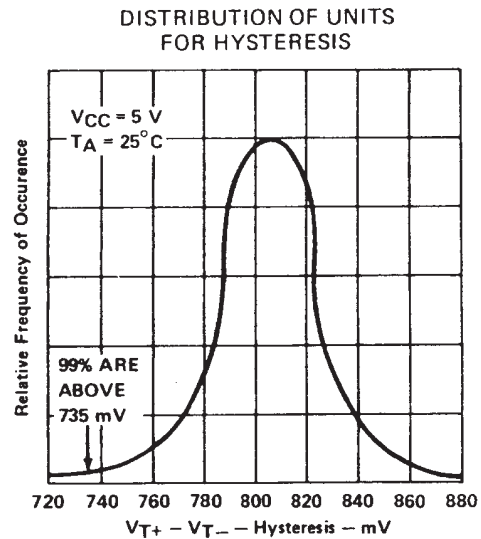
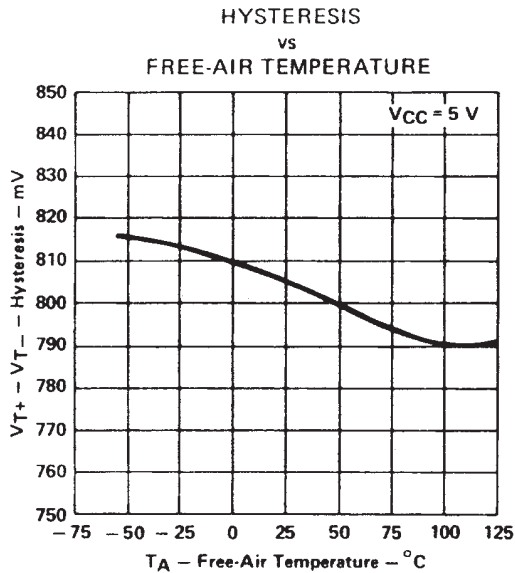
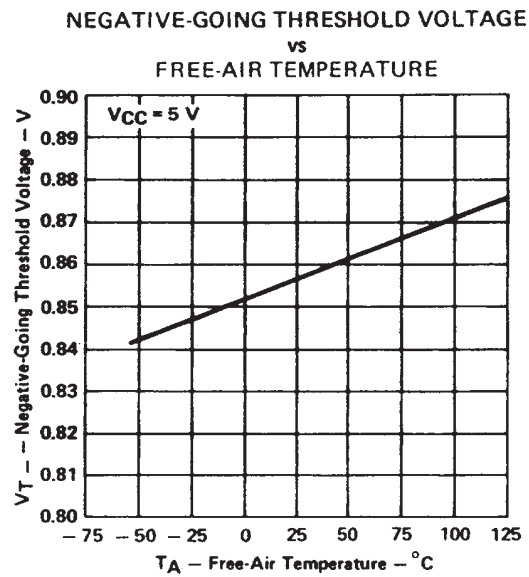
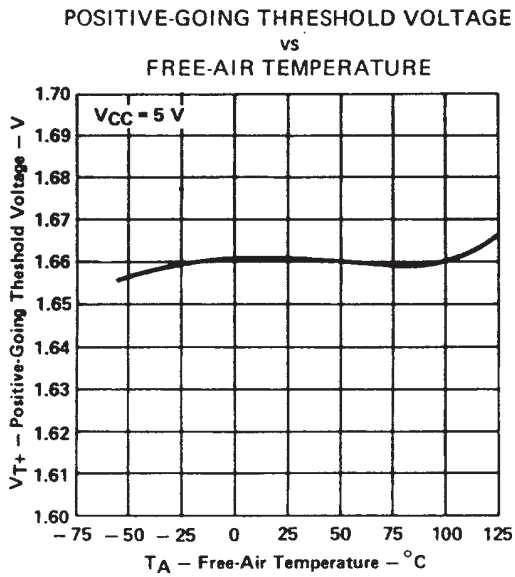
† Data for temperatures below 0°C and 70°C and supply below 4.75 V and above 5.25 V are applicable for SN54132 only.

SN54LS132, SN74LS132

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TYPICAL CHARACTERISTICS OF 'LS132 CIRCUITS

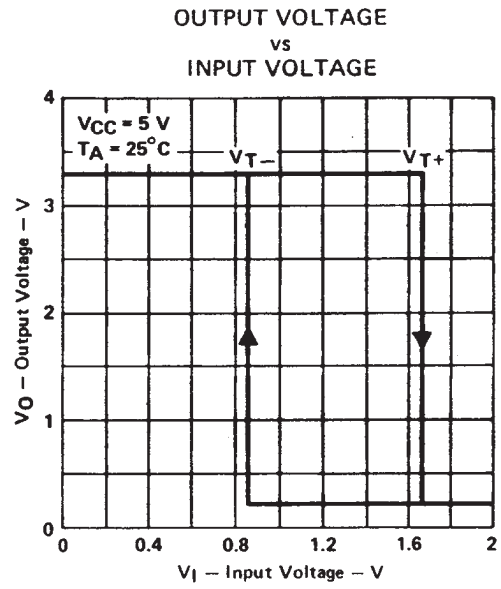
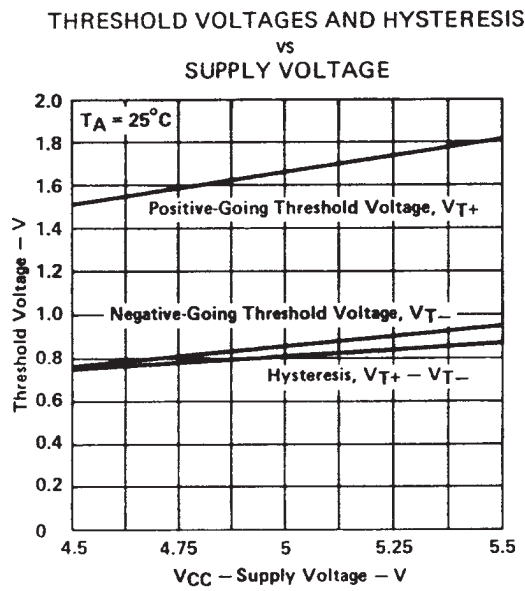


Data for temperatures below 0°C and above 70°C and supply voltages below 4.75 V and above 5.25 V are applicable for SN54LS132 only.

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

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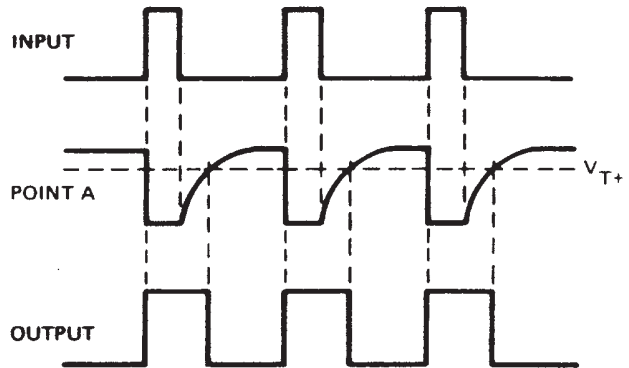
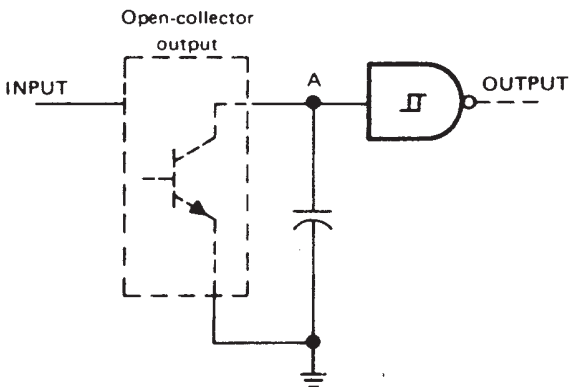
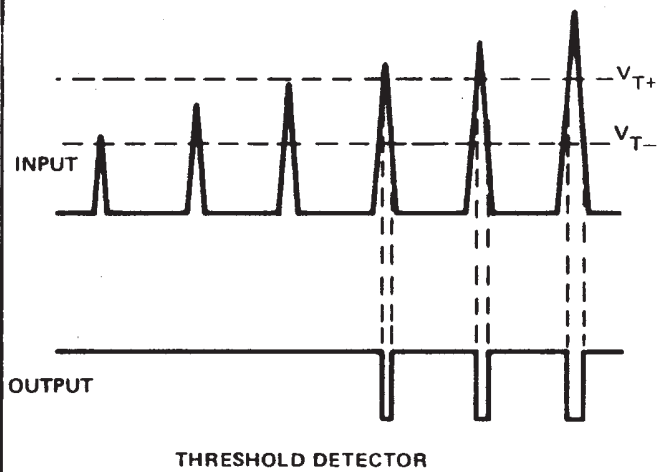
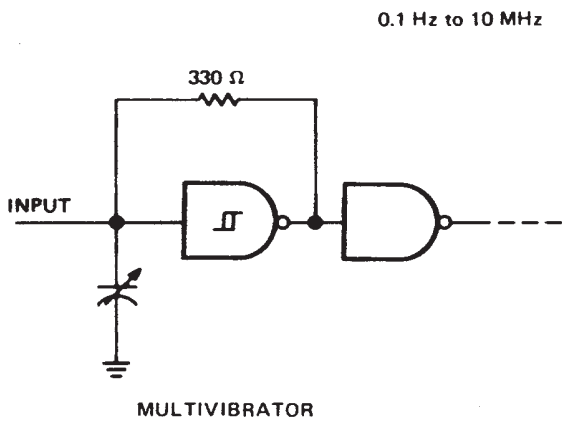
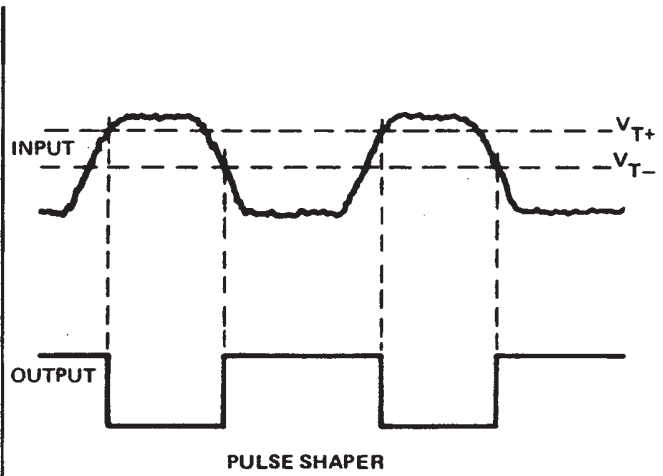
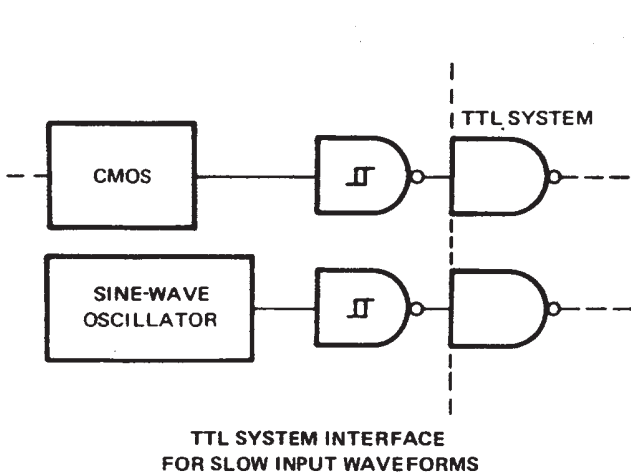
TYPICAL CHARACTERISTICS OF 'LS132 CIRCUITS



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

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 SN74132, SN74LS132, SN74S132
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TYPICAL APPLICATION DATA



PULSE STRETCHER

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