

SN5433, SN54LS33, SN7433, SN74LS33 QUADRUPLE 2-INPUT POSITIVE-NOR BUFFERS WITH OPEN-COLLECTOR OUTPUTS

SDLS101

DECEMBER 1983—REVISED MARCH 1988

- Package Options Include Plastic "Small Outline" Packages, Ceramic Chip Carriers and Flat Packages, and Plastic and Ceramic DIPs
- Dependable Texas Instruments Quality and Reliability

description

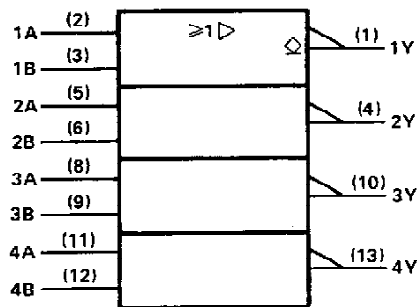
These devices contain four independent 2-input NOR buffer gates with open-collector outputs. Open-collector outputs require resistive pull-up to perform logically but can deliver higher V_{OH} levels and are commonly used in wired-AND applications.

The SN5433 and SN54LS33 are characterized for operation over the full military temperature range of -55°C to 125°C . The SN7433, and SN74LS33 are characterized for operation from 0°C to 70°C .

FUNCTION TABLE (each gate)

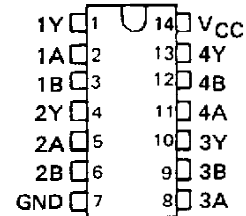
| INPUTS | | OUTPUT |
|--------|---|--------|
| A | B | Y |
| H | X | L |
| X | H | L |
| L | L | H |

logic symbol†

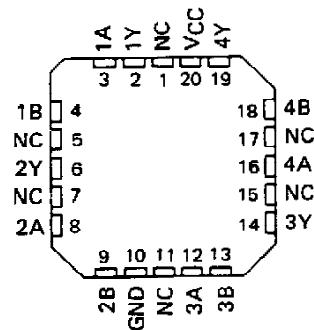


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12. Pin numbers shown are for D, J, N, and W packages.

SN5433, SN54LS33 . . . J OR W PACKAGE
SN7433 . . . N PACKAGE
SN74LS33 . . . D OR N PACKAGE
(TOP VIEW)

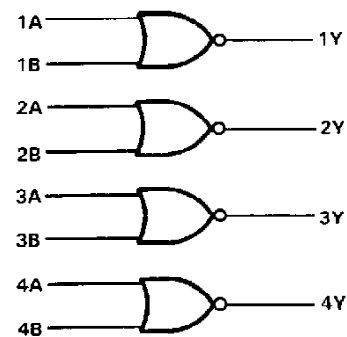


SN54LS33 . . . FK PACKAGE
(TOP VIEW)



NC - No internal connection

logic diagram



positive logic

$$Y = \overline{A + B} \text{ or } Y = \overline{A} \cdot \overline{B}$$

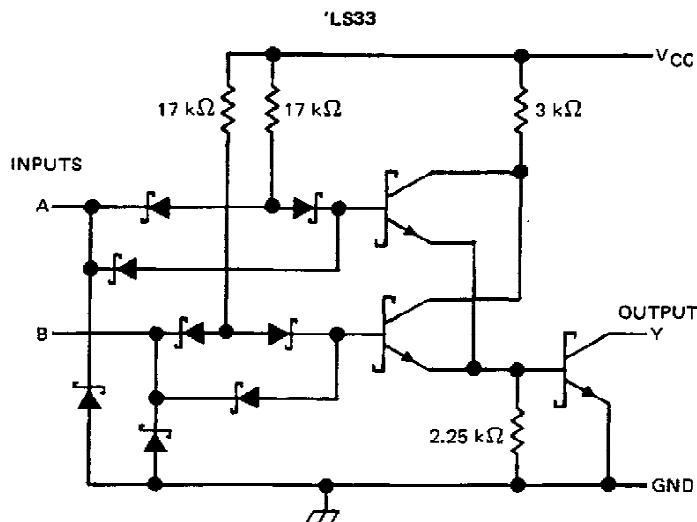
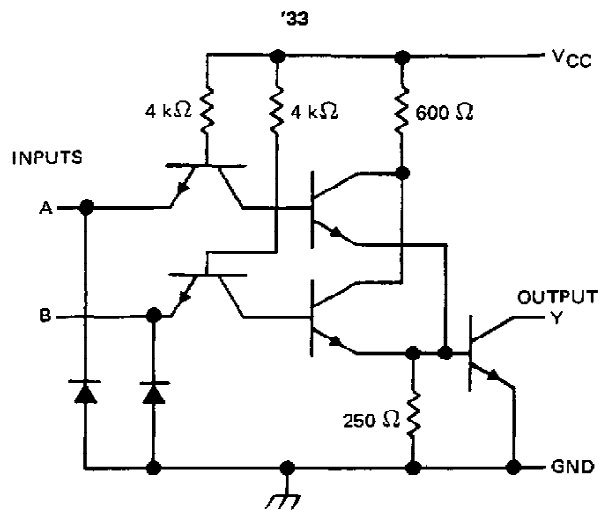
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SN5433, SN54LS33, SN7433, SN74LS33 QUADRUPLE 2-INPUT POSITIVE-NOR BUFFERS WITH OPEN-COLLECTOR OUTPUTS

schematics (each gate)



Resistor values shown are nominal.

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

| | |
|---|----------------|
| Supply voltage, V_{CC} (see Note 1) | 7 V |
| Input voltage: '33 | 5.5 V |
| 'LS33 | 7 V |
| Off-state output voltage | 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.

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SN5433, SN7433
QUADRUPLE 2-INPUT POSITIVE-NOR BUFFERS WITH OPEN-COLLECTOR OUTPUTS

recommended operating conditions

| | | SN5433 | | | SN7433 | | | UNIT |
|-----------------|--------------------------------|--------|-----|-----|--------|-----|------|------|
| | | MIN | NOM | MAX | MIN | NOM | MAX | |
| V _{CC} | Supply voltage | 4.5 | 5 | 5.5 | 4.75 | 5 | 5.25 | V |
| V _{IH} | High-level input voltage | 2 | | | 2 | | | V |
| V _{IL} | Low-level input voltage | | | | 0.8 | | | V |
| V _{OH} | High-level output voltage | | | | 5.5 | | | V |
| I _{OL} | Low-level output current | | | | 48 | | | 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† | SN5433 | | | SN7433 | | | UNIT |
|------------------|---|--------|------|-----|--------|------|-----|------|
| | | MIN | TYP‡ | MAX | MIN | TYP‡ | MAX | |
| V _{IK} | V _{CC} = MIN, I _I = -12 mA | -1.5 | | | -1.5 | | | V |
| I _{OH} | V _{CC} = MIN, V _{IL} = 0.8 V, V _{OH} = 5.5 V | | | | 0.25 | | | mA |
| | V _{CC} = MIN, V _{IL} = 0.7 V, V _{OH} = 5.5 V | 0.25 | | | | | | |
| V _{OL} | V _{CC} = MIN, V _{IH} = 2 V, I _{OL} = 16 mA | 0.2 | 0.4 | | 0.2 | 0.4 | V | |
| I _I | V _{CC} = MAX, V _I = 5.5 V | 1 | | | 1 | | | mA |
| I _{IH} | V _{CC} = MAX, V _I = 2.4 V | 40 | | | 40 | | | μA |
| I _{IL} | V _{CC} = MAX, V _I = 0.4 V | -1.6 | | | -1.6 | | | mA |
| I _{CCH} | V _{CC} = MAX, V _I = 0 | 3 | 6 | | 3 | 6 | mA | |
| I _{CCL} | V _{CC} = MAX, See Note 2 | 9 | 16.5 | | 9 | 16.5 | 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.

NOTE 2: One input at 4.5 V, all others at 0 V.

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 = 133 kΩ, C _L = 50 pF | 10 | 15 | | ns |
| t _{PHL} | | | | 12 | 18 | | ns |
| t _{PLH} | | | R _L = 133 kΩ, C _L = 150 pF | 15 | 22 | | ns |
| t _{PHL} | | | | 16 | 24 | | ns |

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.



SN54LS33, SN74LS33

QUADRUPLE 2-INPUT POSITIVE-NOR BUFFERS WITH OPEN-COLLECTOR OUTPUTS

recommended operating conditions

| | SN54LS33 | | | SN74LS33 | | | UNIT |
|--------------------------------------|----------|-----|-----|----------|-----|------|------|
| | MIN | NOM | MAX | MIN | NOM | MAX | |
| V_{CC} Supply voltage | 4.5 | 5 | 5.5 | 4.75 | 5 | 5.25 | V |
| V_{IH} High-level input voltage | 2 | | | 2 | | | V |
| V_{IL} Low-level input voltage | | | 0.7 | | | 0.8 | V |
| V_{OH} High-level output voltage | | | 5.5 | | | 5.5 | V |
| I_{OL} Low-level output current | | | 12 | | | 24 | 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 † | SN54LS33 | | | SN74LS33 | | | UNIT |
|-----------|---|----------|-------|------|----------|-------|------|------|
| | | MIN | TYP ‡ | MAX | MIN | TYP ‡ | MAX | |
| V_{IK} | $V_{CC} = \text{MIN}$, $I_I = -18 \text{ mA}$ | | -1.5 | | | -1.5 | | V |
| I_{OH} | $V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = \text{MAX}$, $V_{OH} = 5.5 \text{ V}$ | | | 0.25 | | | 0.25 | mA |
| V_{OL} | $V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = \text{MAX}$, $I_{OL} = 12 \text{ mA}$ | | 0.25 | 0.4 | | 0.25 | 0.4 | V |
| | $V_{CC} = \text{MIN}$, $V_{IL} = \text{MAX}$, $I_{OL} = 24 \text{ mA}$ | | | | | 0.35 | 0.5 | |
| I_I | $V_{CC} = \text{MAX}$, $V_I = 7 \text{ V}$ | | | 0.1 | | | 0.1 | mA |
| I_{IH} | $V_{CC} = \text{MAX}$, $V_I = 2.7 \text{ V}$ | | | 20 | | | 20 | μA |
| I_{IL} | $V_{CC} = \text{MAX}$, $V_I = 0.4 \text{ V}$ | | | -0.4 | | | -0.4 | mA |
| I_{CCH} | $V_{CC} = \text{MAX}$, $V_I = 0$ | | 1.8 | 3.6 | | 1.8 | 3.6 | mA |
| I_{CCL} | $V_{CC} = \text{MAX}$, See Note 2 | | 6.9 | 13.8 | | 6.9 | 13.8 | mA |

†For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

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

NOTE 2: One input at 4.5 V, all others at 0 V.

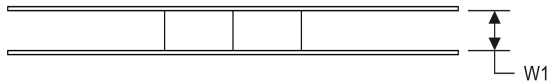
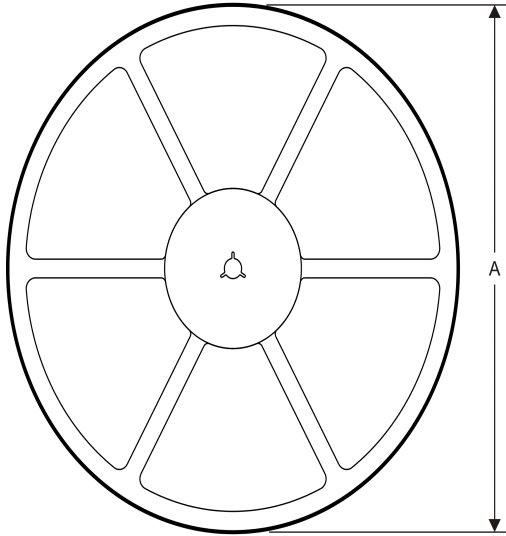
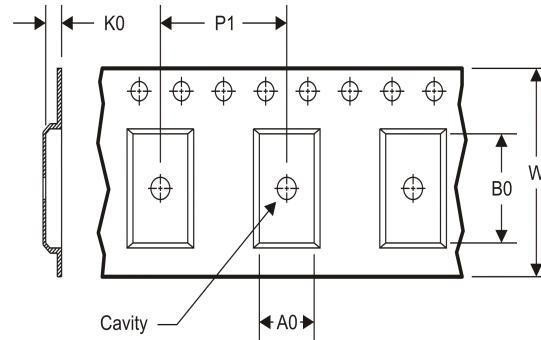
switching characteristics, $V_{CC} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$ (see note 3)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|-----------|--------------|-------------|--|-----|-----|-----|------|
| t_{PLH} | A or B | Y | $R_L = 667 \Omega$, $C_L = 45 \text{ pF}$ | | 20 | 32 | ns |
| t_{PHL} | | | | | 18 | 28 | |

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.

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TAPE AND REEL INFORMATION
REEL DIMENSIONS

TAPE DIMENSIONS


| | |
|----|---|
| A0 | Dimension designed to accommodate the component width |
| B0 | Dimension designed to accommodate the component length |
| K0 | Dimension designed to accommodate the component thickness |
| W | Overall width of the carrier tape |
| P1 | Pitch between successive cavity centers |

TAPE AND REEL INFORMATION

*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|-------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74LS33DR | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |
| SN74LS33NSR | SO | NS | 14 | 2000 | 330.0 | 16.4 | 8.2 | 10.5 | 2.5 | 12.0 | 16.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|-------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74LS33DR | SOIC | D | 14 | 2500 | 367.0 | 367.0 | 38.0 |
| SN74LS33NSR | SO | NS | 14 | 2000 | 367.0 | 367.0 | 38.0 |

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