

SN54136, SN54LS136, SN74136, SN74LS136
QUADRUPLE 2-INPUT EXCLUSIVE-OR GATES
WITH OPEN-COLLECTOR OUTPUTS

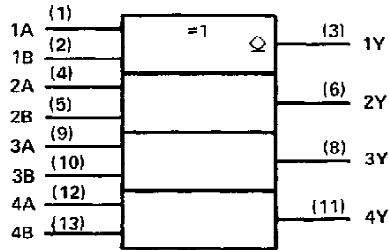
DECEMBER 1972 - REVISED MARCH 1988

FUNCTION TABLE

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

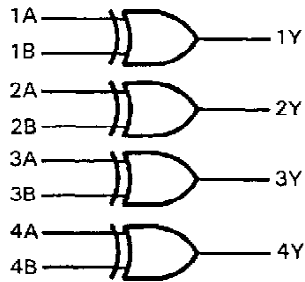
H = high level, L = low level

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.

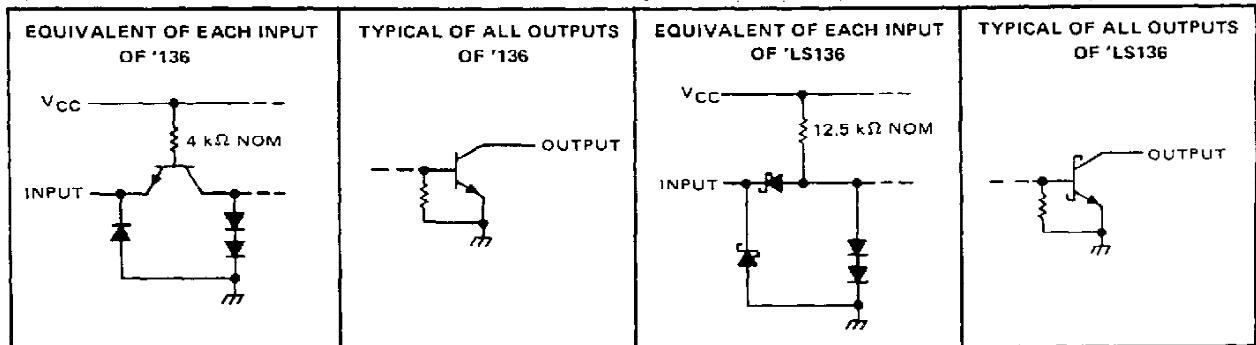
logic diagram (each gate)



positive logic

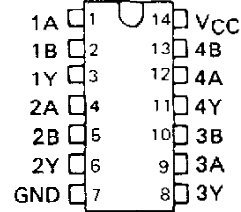
$$Y = A \oplus B = \bar{A} \cdot B + A \cdot \bar{B}$$

schematics of inputs and outputs

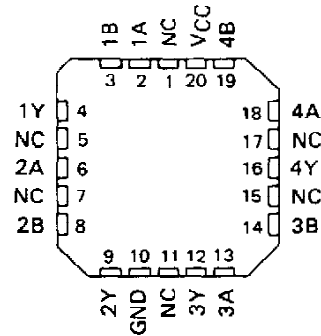


Resistor values shown are nominal.

SN54136, SN54LS136 ... J OR W PACKAGE
 SN74136 ... N PACKAGE
 SN74LS136 ... D OR N PACKAGE
 (TOP VIEW)



SN54LS136 ... FK PACKAGE
 (TOP VIEW)



NC - No internal connection

PRODUCTION DATA documents contain information current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



SN54136, SN74136 QUADRUPLE 2-INPUT EXCLUSIVE-OR GATES WITH OPEN-COLLECTOR OUTPUTS

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

| | |
|---|----------------|
| Supply voltage, V_{CC} (see Note 1) | 7 V |
| Input voltage | 5.5 V |
| Operating free-air temperature range: SN54136 | -55°C to 125°C |
| SN74136 | 0°C to 70°C |
| Storage temperature range | -65°C to 150°C |

NOTE 1: Voltage values are with respect to network ground terminal.

recommended operating conditions

| | SN54136 | | | SN74136 | | | UNIT |
|---------------------------------------|---------|-----|-----|---------|-----|------|------|
| | MIN | NOM | MAX | MIN | NOM | MAX | |
| Supply voltage, V_{CC} | 4.5 | 5 | 5.5 | 4.75 | 5 | 5.25 | V |
| High-level input voltage, V_{IH} | 2 | | | 2 | | | V |
| Low-level input voltage, V_{IL} | | | 0.8 | | | 0.8 | V |
| High-level output voltage, V_{OH} | | | 5.5 | | | 5.5 | V |
| Low-level output current, I_{OL} | | | 16 | | | 16 | mA |
| Operating free-air temperature, T_A | -55 | | 125 | 0 | | 70 | °C |

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER | TEST CONDITIONS [†] | SN54136 | | | SN74136 | | | UNIT | |
|-----------|--|---------|------------------|------|---------|------------------|------|---------------|----|
| | | MIN | TYP [‡] | MAX | MIN | TYP [‡] | MAX | | |
| V_{IK} | $V_{CC} = \text{MIN}$, $I_I = -8 \text{ mA}$ | | | -1.5 | | | -1.5 | V | |
| I_{OH} | $V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = 0.8 \text{ V}$, $V_{OH} = 5.5 \text{ V}$ | | | | | | 0.25 | mA | |
| | $V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = 0.7 \text{ V}$, $V_{OH} = 5.5 \text{ V}$ | | | 0.25 | | | | | |
| V_{OL} | $V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = 0.8 \text{ V}$, $I_{OL} = 16 \text{ mA}$ | | | 0.2 | 0.4 | | 0.2 | 0.4 | V |
| I_I | $V_{CC} = \text{MAX}$, $V_I = 5.5 \text{ V}$ | | | 1 | | | 1 | mA | |
| I_{IH} | $V_{CC} = \text{MAX}$, $V_I = 2.4 \text{ V}$ | | | 40 | | | 40 | μA | |
| I_{IL} | $V_{CC} = \text{MAX}$, $V_I = 0.4 \text{ V}$ | | | -1.6 | | | -1.6 | mA | |
| I_{CC} | $V_{CC} = \text{MAX}$, See Note 2 | | | 30 | 43 | | 30 | 50 | 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: I_{CC} is measured with one input of each gate at 4.5 V, the other inputs grounded, and the outputs open.

switching characteristics, $V_{CC} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$

| PARAMETER [¶] | FROM (INPUT) | TEST CONDITIONS | | MIN | TYP | MAX | UNIT | |
|------------------------|--------------|------------------|---|-----|-----|-----|------|----|
| | | Other input low | Other input high | | | | | |
| t_{PLH} | A or B | Other input low | $C_L = 15 \text{ pF}$, $R_L = 400 \Omega$, See Note 3 | | | 12 | 18 | ns |
| t_{PHL} | | | | | | 39 | 50 | |
| t_{PLH} | A or B | Other input high | See Note 3 | | | 14 | 22 | ns |
| t_{PHL} | | | | | | 42 | 55 | |

[¶] t_{PLH} propagation delay time, low-to-high-level output

t_{PHL} propagation delay time, high-to-low-level output

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



SN54LS136, SN74LS136

QUADRUPLE 2-INPUT EXCLUSIVE-OR GATES

WITH OPEN-COLLECTOR OUTPUTS

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

| | |
|---|----------------|
| Supply voltage, V_{CC} (see Note 1) | 7 V |
| Input voltage | 7 V |
| Operating free-air temperature range: SN54LS136 | -55°C to 125°C |
| SN74LS136 | 0°C to 70°C |
| Storage temperature range | -65°C to 150°C |

NOTE 1: Voltage values are with respect to network ground terminal.

recommended operating conditions

| | SN54LS136 | | | SN74LS136 | | | UNIT |
|---------------------------------------|-----------|-----|-----|-----------|-----|------|------|
| | MIN | NOM | MAX | MIN | NOM | MAX | |
| Supply voltage, V_{CC} | 4.5 | 5 | 5.5 | 4.75 | 5 | 5.25 | V |
| High-level output voltage, V_{OH} | 5.5 | | | 5.5 | | | V |
| Low-level output current, I_{OL} | 4 | | | 8 | | | mA |
| Operating free-air temperature, T_A | -55 | 125 | | 0 | 70 | | °C |

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER | TEST CONDITIONS† | SN54LS136 | | SN74LS136 | | UNIT | |
|--|--|-------------------------|------|-----------|------|---------------|------|
| | | MIN | TYP‡ | MAX | MIN | | TYP‡ |
| V_{IH} High-level input voltage | | 2 | | 2 | | V | |
| V_{IL} Low-level input voltage | | 0.7 | | 0.8 | | V | |
| V_{IK} Input clamp voltage | $V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$ | -1.5 | | -1.5 | | V | |
| I_{OH} High-level output current | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}, V_{OH} = 5.5 \text{ V}$ | 100 | | 100 | | μA | |
| V_{OL} Low-level output voltage | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}$ | $I_{OL} = 4 \text{ mA}$ | 0.25 | 0.4 | 0.25 | 0.4 | V |
| | | $I_{OL} = 8 \text{ mA}$ | | | 0.35 | 0.5 | |
| I_I Input current at maximum input voltage | $V_{CC} = \text{MAX}, V_I = 7 \text{ V}$ | 0.2 | | 0.2 | | mA | |
| I_{IH} High-level input current | $V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$ | 40 | | 40 | | μA | |
| I_{IL} Low-level input current | $V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$ | -0.8 | | -0.8 | | mA | |
| I_{CC} Supply current | $V_{CC} = \text{MAX}, \text{ See Note 2}$ | 6.1 | 10 | 6.1 | 10 | mA | |

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

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

NOTE 2: I_{CC} is measured with one input of each gate at 4.5 V, the other inputs grounded, and the outputs open.

switching characteristics, $V_{CC} = 5 \text{ V}, T_A = 25^\circ\text{C}$

| PARAMETER‡ | FROM (INPUT) | TEST CONDITIONS | | MIN | TYP | MAX | UNIT |
|------------|--------------|------------------|---|-----|-----|-----|------|
| | | | | | | | |
| t_{PLH} | A or B | Other input low | $C_L = 15 \text{ pF}, R_L = 2 \text{ k}\Omega,$ (See Note 3) | 18 | 30 | ns | |
| t_{PHL} | | | | 18 | 30 | | |
| t_{PLH} | A or B | Other input high | (See Note 3) | 18 | 30 | ns | |
| t_{PHL} | | | | 18 | 30 | | |

† t_{PLH} propagation delay time, low-to-high-level output

‡ t_{PHL} propagation delay time, high-to-low-level output

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



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