

# SN54ALS136, SN54AS136, SN74ALS136, SN74AS136 QUADRUPLE 2-INPUT EXCLUSIVE-OR GATES WITH OPEN-COLLECTOR OUTPUTS

SDAS162 – MARCH 1984–REVISED OCTOBER 1988

- Package Options include Plastic “Small Outline” Packages, Ceramic Chip Carriers, and Standard Plastic and Ceramic 300-mil DIPs
- Dependable Texas Instruments Quality and Reliability

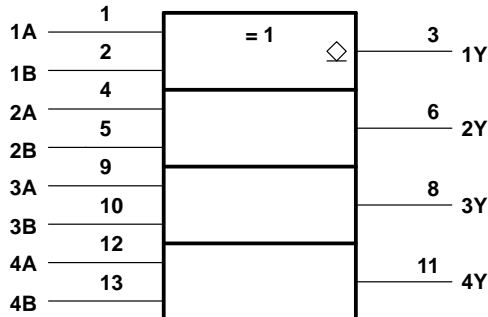
## description

These devices contain four independent Exclusive-OR gates with open-collector outputs. They perform the Boolean functions  $Y = A \oplus B = \overline{A}B + A\overline{B}$  in positive logic.

A common application is a true/complement element. If one of the inputs is low, the other input will be reproduced in true form at the output. If one of the inputs is high, the signal on the other input will be reproduced inverted at the output.

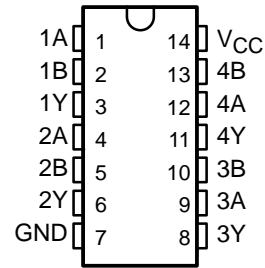
The SN54ALS136 and SN54AS136 are characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74ALS136 and SN74AS136 are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

## logic symbol†

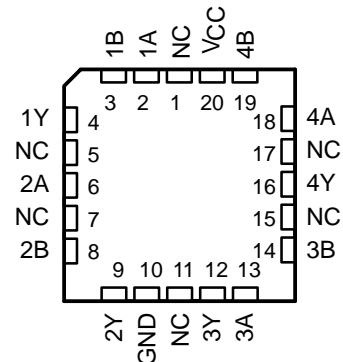


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.  
Pin numbers shown are for D, J, and N packages.

SN54ALS136, SN54AS136 . . . J PACKAGE  
SN74ALS136, SN74AS136 . . . D OR N PACKAGE  
(TOP VIEW)



SN54ALS136, SN54AS136 . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection

FUNCTION TABLE  
(each gate)

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

# SN54ALS136, SN54AS136, SN74ALS136, SN74AS136 QUADRUPLE 2-INPUT EXCLUSIVE-OR GATES WITH OPEN-COLLECTOR OUTPUTS

SDAS162 – MARCH 1984–REVISED OCTOBER 1988

## exclusive-OR logic

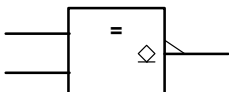
An Exclusive-OR gate has many applications, some of which can be represented better by alternative logic symbols.

### EXCLUSIVE-OR



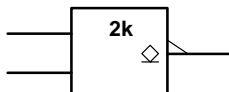
These are five equivalent Exclusive-OR symbols valid for an 'ALS136 gate in positive logic; negation may be shown at any two ports.

### LOGIC IDENTITY ELEMENT



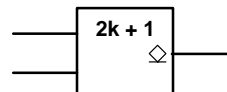
The output is active (low) if all inputs stand at the same logic level (i.e.,  $A=B$ ).

### EVEN-PARITY



The output is active (low) if an even number of inputs (i.e., 0 or 2) are active.

### ODD-PARITY ELEMENT



The output is active (high) if an odd number of inputs (i.e., only 1 of the 2) are active.

# SN54ALS136, SN74ALS136

## QUADRUPLE 2-INPUT EXCLUSIVE-OR GATES

### WITH OPEN-COLLECTOR OUTPUTS

SDAS162 – MARCH 1984–REVISED OCTOBER 1988

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

|  |                |
|--|----------------|
| Supply voltage, $V_{CC}$                         | 7 V            |
| Input voltage                                    | 7 V            |
| Off-state output voltage                         | 7 V            |
| Operating free-air temperature range: SN54ALS136 | –55°C to 125°C |
| SN74ALS136                                       | 0°C to 70°C    |
| Storage temperature range                        | –65°C to 150°C |

#### recommended operating conditions

|                                      | SN54ALS136 |     |     | SN74ALS136 |     |     | UNIT |
|--------------------------------------|------------|-----|-----|------------|-----|-----|------|
|                                      | MIN        | NOM | MAX | MIN        | NOM | MAX |      |
| $V_{CC}$ Supply Voltage              | 4.5        | 5   | 5.5 | 4.5        | 5   | 5.5 | 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 current   |            |     | 5.5 |            |     | 5.5 | V    |
| $I_{OL}$ 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                       | SN54ALS136 |      |      | SN74ALS136 |      |      | UNIT |
|-----------|---------------------------------------|------------|------|------|------------|------|------|------|
|           |                                       | MIN        | TYP† | MAX  | MIN        | TYP† | MAX  |      |
| $V_{IK}$  | $V_{CC} = 4.5$ V, $I_I = -18$ mA      |            |      | –1.5 |            |      | –1.5 | V    |
| $I_{OH}$  | $V_{CC} = 4.5$ V, $V_{OH} = 5.5$ V    |            |      | 0.1  |            |      | 0.1  | mA   |
| $V_{OL}$  | $V_{CC} = 4.5$ V, $I_{OL} = 4$ mA     |            | 0.25 | 0.4  |            | 0.25 | 0.4  | V    |
|           | $V_{CC} = 4.5$ V, $I_{OL} = 8$ mA     |            |      |      |            | 0.35 | 0.5  |      |
| $I_I$     | $V_{CC} = 5.5$ V, $V_I = 7$ V         |            |      | 0.1  |            |      | 0.1  | mA   |
| $I_{IH}$  | $V_{CC} = 5.5$ V, $V_I = 2.7$ V       |            |      | 20   |            |      | 20   | μA   |
| $I_{IL}$  | $V_{CC} = 5.5$ V, $V_I = 0.4$ V       |            |      | –0.1 |            |      | –0.1 | mA   |
| $I_{CC}$  | $V_{CC} = 5.5$ V, All inputs at 4.5 V |            | 3.9  | 5.9  |            | 3.9  | 5.9  | mA   |

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

#### switching characteristics (see Note 1)

| PARAMETER        | FROM<br>(INPUT)   | TO<br>(OUTPUT) | V <sub>CC</sub> = 4.5 V to 5.5 V,<br>C <sub>L</sub> = 50 pF,<br>R <sub>L</sub> = 2 kΩ,<br>T <sub>A</sub> = MIN to MAX |     |            |     | UNIT |
|------------------|-------------------|----------------|---|-----|------------|-----|------|
|                  |                   |                | SN54ALS136  |     | SN74ALS136 |     |      |
|                  |                   |                | MIN   | MAX | MIN        | MAX |      |
| t <sub>PLH</sub> | A or B            | Y              | 20  | 55  | 20         | 50  | ns   |
| t <sub>PHL</sub> | (other input low) |                | 3   | 18  | 3          | 15  |      |
| t <sub>PLH</sub> | A or B            | Y              | 20  | 55  | 20         | 50  | ns   |
| t <sub>PHL</sub> | (other input low) |                | 3   | 18  | 3          | 15  |      |

NOTE 1: Load circuit and voltage waveforms are shown in Section 1 of the ALS/AS Logic Data Book, 1986.

# SN54AS136, SN74AS136

## QUADRUPLE 2-INPUT EXCLUSIVE-OR GATES

### WITH OPEN-COLLECTOR OUTPUTS

SDAS162 – MARCH 1984–REVISED OCTOBER 1988

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

|   |                |
|---|----------------|
| Supply voltage, $V_{CC}$                        | 7 V            |
| Input voltage                                   | 7 V            |
| Off-state output voltage                        | 7 V            |
| Operating free-air temperature range: SN54AS136 | –55°C to 125°C |
| SN74AS136                                       | 0°C to 70°C    |
| Storage temperature range                       | 65°C to 150°C  |

#### recommended operating conditions

|                                      | SN54AS136 |     |     | SN74ALS136 |     |     | UNIT |
|--------------------------------------|-----------|-----|-----|------------|-----|-----|------|
|                                      | MIN       | NOM | MAX | MIN        | NOM | MAX |      |
| $V_{CC}$ Supply Voltage              | 4.5       | 5   | 5.5 | 4.5        | 5   | 5.5 | V    |
| $V_{IH}$ High-level input Voltage    | 2         |     |     | 2          |     |     | V    |
| $V_{IL}$ Low-level input voltage     |           |     | 0.8 |            |     | 0.8 | V    |
| $V_{OH}$ High-level output current   |           |     | 5.5 |            |     | 5.5 | V    |
| $I_{OL}$ 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                                  | SN54AS136 |      |      | SN74AS136 |      |      | UNIT |
|-----------|--|-----------|------|------|-----------|------|------|------|
|           |  | MIN       | TYP† | MAX  | MIN       | TYP† | MAX  |      |
| $V_{IK}$  | $V_{CC} = 4.5$ V, $I_I = -18$ mA                 |           |      | –1.5 |           |      | –1.5 | V    |
| $I_{OH}$  | $V_{CC} = 4.5$ V, $V_{OH} = 5.5$ V               |           |      | 2    |           |      | 0.1  | mA   |
| $V_{OL}$  | $V_{CC} = 4.5$ V, $I_{OL} = 4$ mA                |           | 0.35 | 0.5  |           | 0.25 | 0.4  | V    |
| $I_I$     | $V_{CC} = 5.5$ V, $V_I = 7$ V                    |           |      | 0.1  |           |      | 0.1  | mA   |
| $I_{IH}$  | $V_{CC} = 5.5$ V, $V_I = 2.7$ V                  |           |      | 20   |           |      | 20   | μA   |
| $I_{IL}$  | $V_{CC} = 5.5$ V, $V_I = 0.4$ V                  |           |      | –0.5 |           |      | –0.5 | mA   |
| $I_{CC}$  | $V_{CC} = 5.5$ V, $V_{IA} = 4.5$ V, $V_{IB} = 0$ |           | 14   | 20   |           | 14   | 20   | mA   |
| $I_{CCL}$ | $V_{CC} = 5.5$ V, $V_{IA} = 4.5$ V               |           | 22   | 31   |           | 22   | 31   | mA   |

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

#### switching characteristics (see Note 1)

| PARAMETER        | FROM<br>(INPUT)   | TO<br>(OUTPUT) | V <sub>CC</sub> = 4.5 V to 5.5 V,<br>C <sub>L</sub> = 50 pF,<br>R <sub>L</sub> = 2 kΩ,<br>T <sub>A</sub> = MIN to MAX |      |            |      | UNIT |
|------------------|-------------------|----------------|---|------|------------|------|------|
|                  |                   |                | SN54AS136   |      | SN74ALS136 |      |      |
|                  |                   |                | MIN   | MAX  | MIN        | MAX  |      |
| t <sub>PLH</sub> | A or B            | Y              | 6.3   | 14.8 | 6.3        | 12.5 | ns   |
| t <sub>PHL</sub> | (other input low) |                | 3.3   | 7.9  | 3.3        | 7.1  |      |
| t <sub>PLH</sub> | A or B            | Y              | 6.3   | 12.4 | 6.3        | 11.4 | ns   |
| t <sub>PHL</sub> | (other input low) |                | 3.3   | 14.1 | 3.3        | 10.7 |      |

NOTE 1: Load circuit and voltage waveforms are shown in Section 1 of the ALS/AS Logic Data Book, 1986.

## **IMPORTANT NOTICE**

Texas Instruments (TI) reserves the right to make changes to its products or to discontinue any semiconductor product or service without notice, and advises its customers to obtain the latest version of relevant information to verify, before placing orders, that the information being relied on is current.

TI warrants performance of its semiconductor products and related software to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

Certain applications using semiconductor products may involve potential risks of death, personal injury, or severe property or environmental damage ("Critical Applications").

**TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, INTENDED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT APPLICATIONS, DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS.**

Inclusion of TI products in such applications is understood to be fully at the risk of the customer. Use of TI products in such applications requires the written approval of an appropriate TI officer. Questions concerning potential risk applications should be directed to TI through a local SC sales office.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards should be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein. Nor does TI warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used.