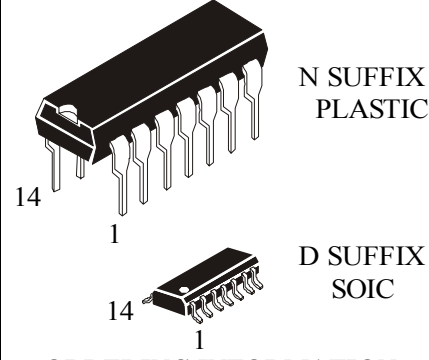


**IN74LV86**

**Quad 2-Input Exclusive OR Gate**

The 74LV86 is a low-voltage Si-gate CMOS device and is pin and function compatible with the 74HC/HCT86. The 74LV86 provides the 2-input EXCLUSIVE-OR function.

- Output voltage levels are compatible with input levels of CMOS, NMOS and TTL ICs
- Supply voltage range: 1.2 to 5.5 V
- Low input current: 1.0 μA; 0.1 μA at T = 25 °C
- Output current: 6 mA at Vcc = 3.0 V; 12 mA at Vcc = 4.5V
- High Noise Immunity Characteristic of CMOS Devices



N SUFFIX PLASTIC

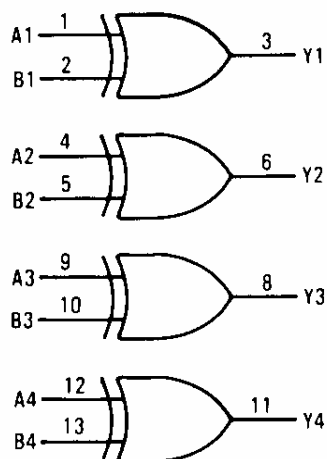
D SUFFIX SOIC

**ORDERING INFORMATION**

IN74LV86N Plastic  
IN74LV86D SOIC

T<sub>A</sub> = -40° to 125° C for all packages

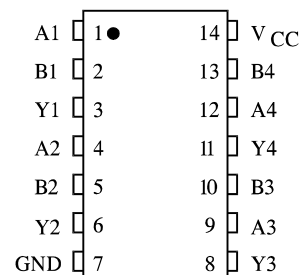
**LOGIC DIAGRAM**



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

PIN 16=V<sub>CC</sub>  
PIN 08 = GND

**PIN ASSIGNMENT**



**FUNCTION TABLE**

| Inputs         |                | Outputs        |
|----------------|----------------|----------------|
| A <sub>n</sub> | B <sub>n</sub> | Y <sub>n</sub> |
| L              | H              | H              |
| L              | L              | L              |
| H              | L              | H              |
| H              | H              | L              |

H= high level  
L = low level

**MAXIMUM RATINGS\***

| Symbol                         | Parameter   | Value        | Unit |
|--------------------------------|---|--------------|------|
| V <sub>CC</sub>                | DC supply voltage   | -0.5 to +5.0 | V    |
| I <sub>IK</sub> * <sup>1</sup> | Input diode current   | ±20          | mA   |
| I <sub>OK</sub> * <sup>2</sup> | Output diode current  | ±50          | mA   |
| I <sub>O</sub> * <sup>3</sup>  | Output source or sink current   | ±25          | mA   |
| I <sub>CC</sub>                | V <sub>CC</sub> current   | ±50          | mA   |
| I <sub>GND</sub>               | GND current   | ±50          | mA   |
| P <sub>D</sub>                 | Power dissipation per package: * <sup>4</sup><br>Plastic DIP<br>SO                          | 750<br>500   | mW   |
| T <sub>stg</sub>               | Storage Temperature   | -65 to +150  | °C   |
| T <sub>L</sub>                 | Lead Temperature, 1.5 mm (Plastic DIP Package), 0.3 mm (SO Package) from Case for 4 Seconds | 260          | °C   |

\*Maximum Ratings are those values beyond which damage to the device may occur. Functional operation should be restricted to the Recommended Operating Conditions.

\*<sup>1</sup> V<sub>I</sub> < -0.5 V or V<sub>I</sub> > V<sub>CC</sub> + 0.5 V.

\*<sup>2</sup> V<sub>O</sub> < -0.5 V or V<sub>O</sub> > V<sub>CC</sub> + 0.5 V.

\*<sup>3</sup> -0.5 V < V<sub>O</sub> < V<sub>CC</sub> + 0.5 V.

\*<sup>4</sup> Derating - Plastic DIP: - 12 mW/°C from 70° to 125°C  
SO Package: - 8 mW/°C from 70° to 125°C

**RECOMMENDED OPERATING CONDITIONS**

| Symbol                          | Parameter                                | Min | Max             | Unit |
|---------------------------------|--|-----|-----------------|------|
| V <sub>CC</sub>                 | DC Supply Voltage                        | 1.2 | 5.5             | V    |
| V <sub>I</sub>                  | DC Input Voltage                         | 0   | V <sub>CC</sub> | V    |
| V <sub>O</sub>                  | DC Output Voltage                        | 0   | V <sub>CC</sub> | V    |
| T <sub>A</sub>                  | Operating Temperature, All Package Types | -40 | +125            | °C   |
| t <sub>r</sub> , t <sub>f</sub> | Input Rise and Fall Time (Figure 1)      |     |                 | ns/V |
|                                 | 1.0 B ≤ V <sub>CC</sub> < 2.0 B          | 0   | 500             |      |
|                                 | 2.0 B ≤ V <sub>CC</sub> < 2.7 B          | 0   | 200             |      |
|                                 | 2.7 B ≤ V <sub>CC</sub> < 3.6 B          | 0   | 100             |      |
|                                 | 3.6 B ≤ V <sub>CC</sub> ≤ 5.5 B          | 0   | 50              |      |

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation, V<sub>IN</sub> and V<sub>OUT</sub> should be constrained to the range GND ≤ (V<sub>IN</sub> or V<sub>OUT</sub>) ≤ V<sub>CC</sub>.

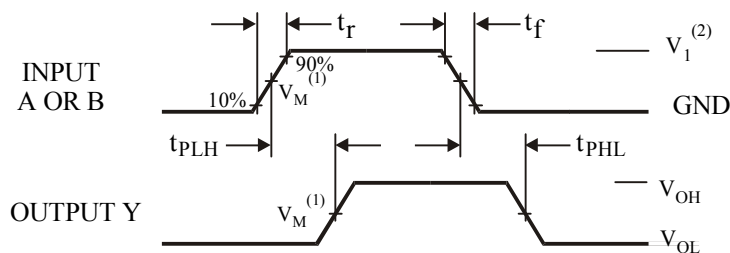
Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V<sub>CC</sub>). Unused outputs must be left open.

**DC ELECTRICAL CHARACTERISTICS** (Voltages Referenced to GND)

| Symbol           | Parameter                                     | Test conditions   | V <sub>CC</sub><br>V   | Guaranteed Limit |      |      |      |       |      | Unit |   |
|------------------|---|---|--|------------------|------|------|------|-------|------|------|---|
|                  |   |   |  | -40°C to 25°C    |      | 85°C |      | 125°C |      |      |   |
|                  |   |   |  | min              | max  | min  | max  | min   | max  |      |   |
| V <sub>IH</sub>  | HIGH level input voltage                      |   | 1.2  | 0.9              | -    | 0.9  | -    | 0.9   | -    | V    |   |
|                  |   |   | 2.0  | 1.4              | -    | 1.4  | -    | 1.4   | -    |      |   |
|                  |   |   | 2.7  | 2.0              | -    | 2.0  | -    | 2.0   | -    |      |   |
|                  |   |   | 3.0  | 2.0              | -    | 2.0  | -    | 2.0   | -    |      |   |
|                  |   |   | 3.6  | 2.0              | -    | 2.0  | -    | 2.0   | -    |      |   |
|                  |   |   | 4.5  | 3.15             | -    | 3.15 | -    | 3.15  | -    |      |   |
|                  |   |   | 5.5  | 3.85             | -    | 3.85 | -    | 3.85  | -    |      |   |
| V <sub>IL</sub>  | LOW level input voltage                       |   | 1.2  | -                | 0.3  | -    | 0.3  | -     | 0.3  | V    |   |
|                  |   |   | 2.0  | -                | 0.6  | -    | 0.6  | -     | 0.6  |      |   |
|                  |   |   | 2.7  | -                | 0.8  | -    | 0.8  | -     | 0.8  |      |   |
|                  |   |   | 3.0  | -                | 0.8  | -    | 0.8  | -     | 0.8  |      |   |
|                  |   |   | 3.6  | -                | 0.8  | -    | 0.8  | -     | 0.8  |      |   |
|                  |   |   | 4.5  | -                | 1.35 | -    | 1.35 | -     | 1.35 |      |   |
|                  |   |   | 5.5  | -                | 1.65 | -    | 1.65 | -     | 1.65 |      |   |
| V <sub>OH</sub>  | HIGH level output voltage                     | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>I <sub>O</sub> = -100 μA | 1.2  | 1.05             | -    | 1.0  | -    | 1.0   | -    | V    |   |
|                  |   |   | 2.0  | 1.85             | -    | 1.8  | -    | 1.8   | -    |      |   |
|                  |   |   | 2.7  | 2.55             | -    | 2.5  | -    | 2.5   | -    |      |   |
|                  |   |   | 3.0  | 2.85             | -    | 2.8  | -    | 2.8   | -    |      |   |
|                  |   |   | 3.6  | 3.45             | -    | 3.4  | -    | 3.4   | -    |      |   |
|                  |   |   | 4.5  | 4.35             | -    | 4.3  | -    | 4.3   | -    |      |   |
|                  |   |   | 5.5  | 5.35             | -    | 5.3  | -    | 5.3   | -    |      |   |
|                  |   |   | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>I <sub>O</sub> = -6 mA  | 3.0              | 2.48 | -    | 2.34 | -     | 2.20 | -    | V |
|                  |   |   | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>I <sub>O</sub> = -12 mA | 4.5              | 3.70 | -    | 3.60 | -     | 3.50 | -    | V |
| V <sub>OL</sub>  | LOW level output voltage                      | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>I <sub>O</sub> = 100 μA  | 1.2  | -                | 0.15 | -    | 0.2  | -     | 0.2  | V    |   |
|                  |   |   | 2.0  | -                | 0.15 | -    | 0.2  | -     | 0.2  |      |   |
|                  |   |   | 2.7  | -                | 0.15 | -    | 0.2  | -     | 0.2  |      |   |
|                  |   |   | 3.0  | -                | 0.15 | -    | 0.2  | -     | 0.2  |      |   |
|                  |   |   | 3.6  | -                | 0.15 | -    | 0.2  | -     | 0.2  |      |   |
|                  |   |   | 4.5  | -                | 0.15 | -    | 0.2  | -     | 0.2  |      |   |
|                  |   |   | 5.5  | -                | 0.15 | -    | 0.2  | -     | 0.2  |      |   |
|                  |   |   | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>I <sub>O</sub> = 6 mA   | 3.0              | -    | 0.33 | -    | 0.40  | -    | 0.50 | V |
|                  |   |   | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>I <sub>O</sub> = 12 mA  | 4.5              | -    | 0.40 | -    | 0.55  | -    | 0.65 | V |
| I <sub>I</sub>   | Input current                                 | V <sub>I</sub> = V <sub>CC</sub> or 0 V   | 5.5  | -                | ±0.1 | -    | ±1.0 | -     | ±1.0 | μA   |   |
| I <sub>CC</sub>  | Supply current                                | V <sub>I</sub> = V <sub>CC</sub> or 0 V<br>I <sub>O</sub> = 0 μA                | 5.5  | -                | 4.0  | -    | 20   | -     | 40   | μA   |   |
| I <sub>CC1</sub> | Additional quiescent supply current per input | V <sub>I</sub> = V <sub>CC</sub> - 0.6 V  | 2.7  | -                | 0.2  | -    | 0.5  | -     | 0.85 | mA   |   |
|                  |   |   | 3.6  | -                | 0.2  | -    | 0.5  | -     | 0.85 |      |   |

**AC ELECTRICAL CHARACTERISTICS** ( $C_L=50$  pF,  $R_L = 1$  k $\Omega$ ,  $t_r=t_f=2.5$  ns)

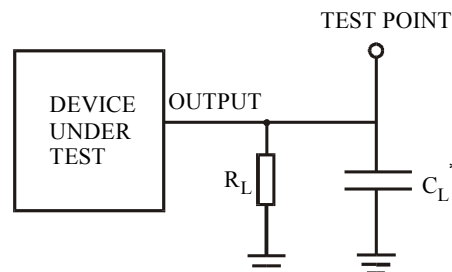
| Symbol                              | Parameter  | Test conditions  | V <sub>CC</sub><br>V | Guaranteed Limit |     |      |     |       |     | Unit |
|-------------------------------------|--|--|----------------------|------------------|-----|------|-----|-------|-----|------|
|                                     |  |  |                      | -40°C to 25°C    |     | 85°C |     | 125°C |     |      |
|                                     |  |  |                      | min              | max | min  | max | min   | max |      |
| t <sub>PHL</sub> , t <sub>PLH</sub> | Propagation delay ,<br>A <sub>n</sub> , B <sub>n</sub> , to Y <sub>n</sub> | V <sub>I</sub> = 0 V or V <sub>CC</sub><br>Figure 1, 2           | 1.2                  | -                | 140 | -    | 150 | -     | 180 | ns   |
|                                     |  |  | 2.0                  | -                | 24  | -    | 32  | -     | 41  |      |
|                                     |  |  | 2.7                  | -                | 19  | -    | 24  | -     | 30  |      |
|                                     |  |  | 3.0                  | -                | 15  | -    | 19  | -     | 24  |      |
|                                     |  |  | 4.5                  | -                | 13  | -    | 16  | -     | 20  |      |
| C <sub>I</sub>                      | Input capacitance  | T <sub>A</sub> = 25°C  | 5.0                  | -                | 7.0 | -    | -   | -     | -   | pF   |
| C <sub>PD</sub>                     | Power dissipation capacitance (per gate)                                   | V <sub>I</sub> = 0 V or V <sub>CC</sub><br>T <sub>A</sub> = 25°C | 5.5                  | -                | 60  | -    | -   | -     | -   | pF   |



**Figure 1. Switching Waveforms**

**Note:**

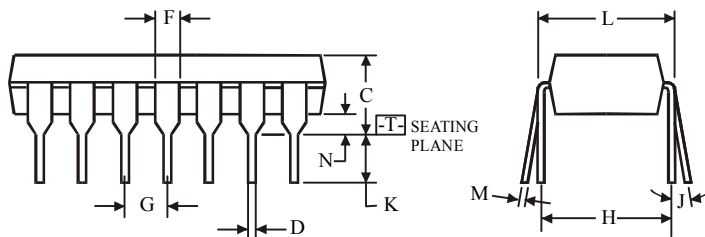
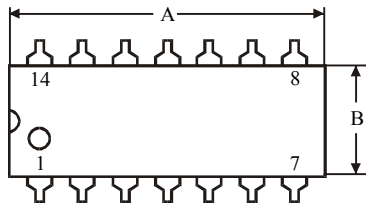
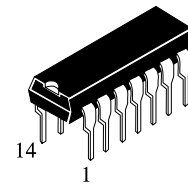
- (1) V<sub>M</sub> = 1.5 V at V<sub>CC</sub> = 2.7 V  
 V<sub>M</sub> = 0.5 · V<sub>CC</sub> at V<sub>CC</sub> = 1.2 V, 2.0 V, 3.0 V, 4.5 V
- (2) V<sub>I</sub> = V<sub>CC</sub> at V<sub>CC</sub> = 1.2 V, 2.0 V, 2.7 V, 4.5 V  
 V<sub>I</sub> = 2.7 V at V<sub>CC</sub> = 3.0 V



\* Includes all probe and jig capacitance

**Figure 4. Test Circuit**

**N SUFFIX PLASTIC DIP  
(MS - 001AA)**



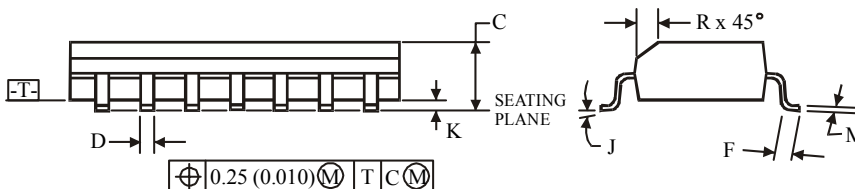
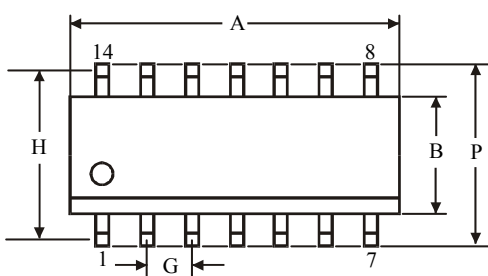
$$\oplus 0.25 (0.010) \text{ (M) } T$$

**NOTES:**

- Dimensions "A", "B" do not include mold flash or protrusions.  
Maximum mold flash or protrusions 0.25 mm (0.010) per side.

| Symbol | Dimension, mm |       |
|--------|---------------|-------|
|        | MIN           | MAX   |
| A      | 18.67         | 19.69 |
| B      | 6.1           | 7.11  |
| C      |               | 5.33  |
| D      | 0.36          | 0.56  |
| F      | 1.14          | 1.78  |
| G      | 2.54          |       |
| H      | 7.62          |       |
| J      | 0°            | 10°   |
| K      | 2.92          | 3.81  |
| L      | 7.62          | 8.26  |
| M      | 0.2           | 0.36  |
| N      | 0.38          |       |

**D SUFFIX SOIC  
(MS - 012AB)**



$$\oplus 0.25 (0.010) \text{ (M) } T \text{ C (M)}$$

**NOTES:**

- Dimensions A and B do not include mold flash or protrusion.
- Maximum mold flash or protrusion 0.15 mm (0.006) per side for A; for B - 0.25 mm (0.010) per side.

| Symbol | Dimension, mm |      |
|--------|---------------|------|
|        | MIN           | MAX  |
| A      | 8.55          | 8.75 |
| B      | 3.8           | 4    |
| C      | 1.35          | 1.75 |
| D      | 0.33          | 0.51 |
| F      | 0.4           | 1.27 |
| G      | 1.27          |      |
| H      | 5.27          |      |
| J      | 0°            | 8°   |
| K      | 0.1           | 0.25 |
| M      | 0.19          | 0.25 |
| P      | 5.8           | 6.2  |
| R      | 0.25          | 0.5  |