

## Description

The 74AHC86 provides provides four independent 2-input exclusive OR gates with standard push-pull outputs. The device is designed for operation with a power supply range of 2.0V to 5.5V. The inputs are tolerant to 5.5V allowing this device to be used in a mixed voltage environment.

The gates perform the Boolean function:

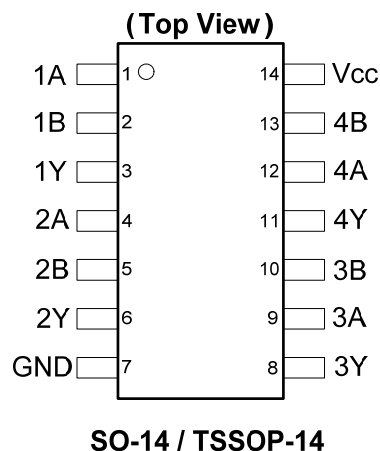
$$Y = A \oplus B \text{ or } Y = \bar{A}B + A\bar{B}$$

## Features

- Wide Supply Voltage Range from 2.0V to 5.5V
- Outputs Sink or Source 8mA at  $V_{CC} = 4.5V$
- CMOS Low Power Consumption
- Schmitt Trigger Action at All Inputs
- Inputs can be driven by 3.3V or 5.5V allowing for voltage translation applications.
- ESD Protection Exceeds JESD 22
  - 200-V Machine Model (A115-A)
  - 2000-V Human Body Model (A114-A)
  - Exceeds 1000-V Charged Device Model (C101C)
- Latch-Up Exceeds 250mA per JESD 78, Class II
- Range of Package Options SO-14 and TSSOP-14
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

Notes: 1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.  
 2. See <http://www.diodes.com> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.  
 3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

## Pin Assignments



## Applications

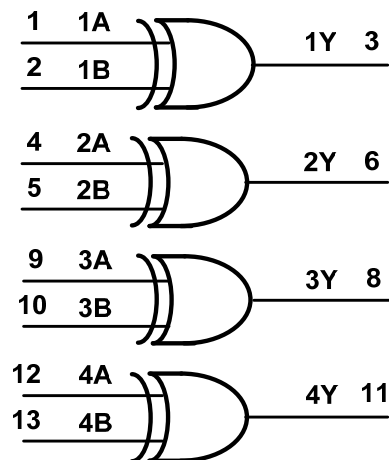
- General Purpose Logic
- Wide array of products such as:
  - PCs, Networking, Notebooks, Netbooks
  - Computer Peripherals, Hard Drives, CD/DVD ROM
  - TV, DVD, DVR, Set Top Box

[Click here for ordering information, located at the end of datasheet](#)

## Pin Descriptions

| Pin Number | Pin Name        | Function       |
|------------|-----------------|----------------|
| 1          | 1A              | Data Input     |
| 2          | 1B              | Data Input     |
| 3          | 1Y              | Data Output    |
| 4          | 2A              | Data Input     |
| 5          | 2B              | Data Input     |
| 6          | 2Y              | Data Output    |
| 7          | GND             | Ground         |
| 8          | 3Y              | Data Output    |
| 9          | 3A              | Data Input     |
| 10         | 3B              | Data Input     |
| 11         | 4Y              | Data Output    |
| 12         | 4A              | Data Input     |
| 13         | 4B              | Data Input     |
| 14         | V <sub>CC</sub> | Supply Voltage |

## Logic Diagram



## Function Table

| Inputs |   | Output |
|--------|---|--------|
| A      | B | Y      |
| L      | L | L      |
| L      | H | H      |
| H      | L | H      |
| H      | H | L      |

## Absolute Maximum Ratings (Note 4) (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Symbol           | Description                                                              | Rating       | Unit |
|------------------|--------------------------------------------------------------------------|--------------|------|
| ESD HBM          | Human Body Model ESD Protection                                          | 2            | KV   |
| ESD CDM          | Charged Device Model ESD Protection                                      | 1            | KV   |
| ESD MM           | Machine Model ESD Protection                                             | 200          | V    |
| V <sub>CC</sub>  | Supply Voltage Range                                                     | -0.5 to +7.0 | V    |
| V <sub>I</sub>   | Input Voltage Range                                                      | -0.5 to +7.0 | V    |
| I <sub>IK</sub>  | Input Clamp Current V <sub>I</sub> < -0.5V                               | -20          | mA   |
| I <sub>OK</sub>  | Output Clamp Current V <sub>O</sub> < -0.5V                              | -20          | mA   |
| I <sub>OK</sub>  | Output Clamp Current V <sub>O</sub> > V <sub>CC</sub> +0.5V              | 25           | mA   |
| I <sub>O</sub>   | Continuous Output current -0.5V < V <sub>O</sub> < V <sub>CC</sub> +0.5V | +/- 25       | mA   |
| I <sub>CC</sub>  | Continuous Current Through V <sub>CC</sub>                               | 75           | mA   |
| I <sub>GND</sub> | Continuous Current Through GND                                           | -75          | mA   |
| T <sub>J</sub>   | Operating Junction Temperature                                           | -40 to +150  | °C   |
| T <sub>STG</sub> | Storage Temperature                                                      | -65 to +150  | °C   |
| P <sub>TOT</sub> | Total Power Dissipation                                                  | 500          | mW   |

Note: 4. Stresses beyond the absolute maximum may result in immediate failure or reduced reliability. These are stress values and device operation should be within recommend values.

**Recommended Operating Conditions** (Note 5) (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Symbol          | Parameter                          | Conditions                     | Min | Max             | Unit |
|-----------------|------------------------------------|--------------------------------|-----|-----------------|------|
| V <sub>CC</sub> | Supply Voltage                     |                                | 2.0 | 5.5             | V    |
| V <sub>I</sub>  | Input Voltage                      |                                | 0   | 5.5             | V    |
| V <sub>O</sub>  | Output Voltage                     |                                | 0   | V <sub>CC</sub> | V    |
| Δt/ΔV           | Input Transition Rise or Fall Rate | V <sub>CC</sub> = 3.0V to 3.6V |     | 100             | ns/V |
|                 |                                    | V <sub>CC</sub> = 4.5V to 5.5V |     | 20              |      |
| T <sub>A</sub>  | Operating Free-Air Temperature     |                                | -40 | +125            | °C   |

 Note: 5. Unused inputs should be held at V<sub>CC</sub> or Ground.

**Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Symbol          | Parameter                 | Test Conditions                                              | V <sub>CC</sub> | T <sub>A</sub> = -40°C to +85°C |      | T <sub>A</sub> = -40°C to +125°C |      | Unit |
|-----------------|---------------------------|--------------------------------------------------------------|-----------------|---------------------------------|------|----------------------------------|------|------|
|                 |                           |                                                              |                 | Min                             | Max  | Min                              | Max  |      |
| V <sub>IH</sub> | High-Level Input Voltage  |                                                              | 2.0V            | 1.5                             |      | 1.5                              |      | V    |
|                 |                           |                                                              | 3.0V            | 2.1                             |      | 2.1                              |      |      |
|                 |                           |                                                              | 5.5V            | 3.85                            |      | 3.85                             |      |      |
| V <sub>IL</sub> | Low-Level Input voltage   |                                                              | 2.0V            |                                 | 0.5  |                                  | 0.5  | V    |
|                 |                           |                                                              | 3.0V            |                                 | 0.9  |                                  | 0.9  |      |
|                 |                           |                                                              | 5.5V            |                                 | 1.65 |                                  | 1.65 |      |
| V <sub>OH</sub> | High-Level Output Voltage | I <sub>OH</sub> = -50μA                                      | 2.0V            | 1.9                             |      | 1.9                              |      | V    |
|                 |                           | I <sub>OH</sub> = -50μA                                      | 3.0V            | 2.9                             |      | 2.9                              |      |      |
|                 |                           | I <sub>OH</sub> = -50μA                                      | 4.5V            | 4.4                             |      | 4.4                              |      |      |
|                 |                           | I <sub>OH</sub> = -4mA                                       | 3.0V            | 2.48                            |      | 2.40                             |      |      |
|                 |                           | I <sub>OH</sub> = -8mA                                       | 4.5V            | 3.80                            |      | 3.70                             |      |      |
| V <sub>OL</sub> | Low-Level Output Voltage  | I <sub>OL</sub> = 50μA                                       | 2.0V            |                                 | 0.1  |                                  | 0.1  | V    |
|                 |                           | I <sub>OL</sub> = 50μA                                       | 3.0V            |                                 | 0.1  |                                  | 0.1  |      |
|                 |                           | I <sub>OL</sub> = 50μA                                       | 4.5V            |                                 | 0.1  |                                  | 0.1  |      |
|                 |                           | I <sub>OL</sub> = 4mA                                        | 3.0V            |                                 | 0.44 |                                  | 0.55 |      |
|                 |                           | I <sub>OL</sub> = 8mA                                        | 4.5V            |                                 | 0.44 |                                  | 0.55 |      |
| I <sub>I</sub>  | Input Current             | V <sub>I</sub> = GND to 5.5V                                 | 3.6V            |                                 | ±1   |                                  | ±2   | μA   |
| I <sub>CC</sub> | Supply Current            | V <sub>I</sub> = GND or V <sub>CC</sub> , I <sub>O</sub> = 0 | 3.6V            |                                 | 20   |                                  | 40   | μA   |

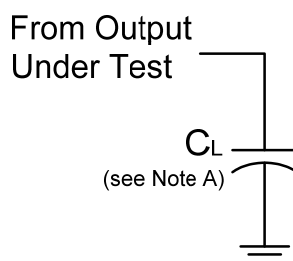
**Operating Characteristics**

| Parameter       |                                        | Test Conditions                           | V <sub>CC</sub> = 2.0V | V <sub>CC</sub> = 3.3V | V <sub>CC</sub> = 5V | Unit |
|-----------------|----------------------------------------|-------------------------------------------|------------------------|------------------------|----------------------|------|
|                 |                                        |                                           | Typ                    | Typ                    | Typ                  |      |
| C <sub>pd</sub> | Power Dissipation Capacitance per Gate | f = 1MHz                                  | 9.7                    | 11.5                   | 15.5                 | pF   |
| C <sub>i</sub>  | Input Capacitance                      | V <sub>I</sub> = V <sub>CC</sub> – or GND | 4.0                    | 4.0                    | 4.0                  | pF   |

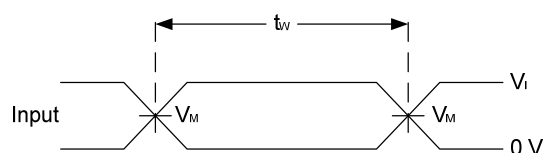
## Switching Characteristics

| Symbol          | Parameter                                          | Test Conditions                   | V <sub>CC</sub> | T <sub>A</sub> = +25°C |     |      | -40°C to +85°C |      | -40°C to +125°C |      | Unit |
|-----------------|----------------------------------------------------|-----------------------------------|-----------------|------------------------|-----|------|----------------|------|-----------------|------|------|
|                 |                                                    |                                   |                 | Min                    | Typ | Max  | Min            | Max  | Min             | Max  |      |
| t <sub>PD</sub> | Propagation Delay A <sub>N</sub> to Y <sub>N</sub> | Figure 1<br>C <sub>L</sub> = 15pF | 3.0V to 3.6V    | 0.5                    | 4.8 | 11.0 | 0.5            | 13.0 | 0.5             | 14.0 | ns   |
|                 |                                                    |                                   | 4.5V to 5.5V    | 0.5                    | 3.4 | 6.8  | 0.5            | 8.0  | 0.5             | 8.5  |      |
|                 |                                                    | Figure 1<br>C <sub>L</sub> = 50pF | 3.0V to 3.6V    | 0.5                    | 6.8 | 14.5 | 0.5            | 16.5 | 0.5             | 18.5 |      |
|                 |                                                    |                                   | 4.5V to 5.5V    | 0.5                    | 4.8 | 8.8  | 0.5            | 10.0 | 0.5             | 11.0 |      |

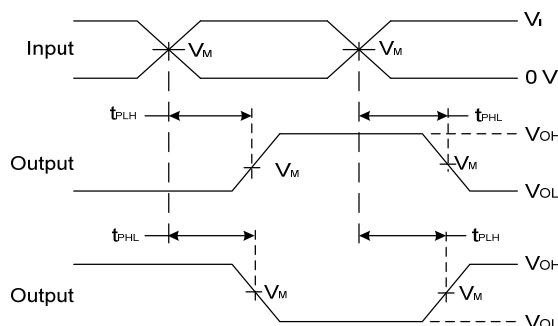
## Parameter Measurement Information



| V <sub>CC</sub> | Inputs          |                                | V <sub>M</sub>     | C <sub>L</sub> |
|-----------------|-----------------|--------------------------------|--------------------|----------------|
|                 | V <sub>I</sub>  | t <sub>r</sub> /t <sub>f</sub> |                    |                |
| 3.3V -3.6V      | V <sub>CC</sub> | 3ns                            | V <sub>CC</sub> /2 | 15pF, 50pF     |
| 4.5V to 5.5V    | V <sub>CC</sub> | 3ns                            | V <sub>CC</sub> /2 | 15pF, 50pF     |



**Voltage Waveform  
Pulse Duration**



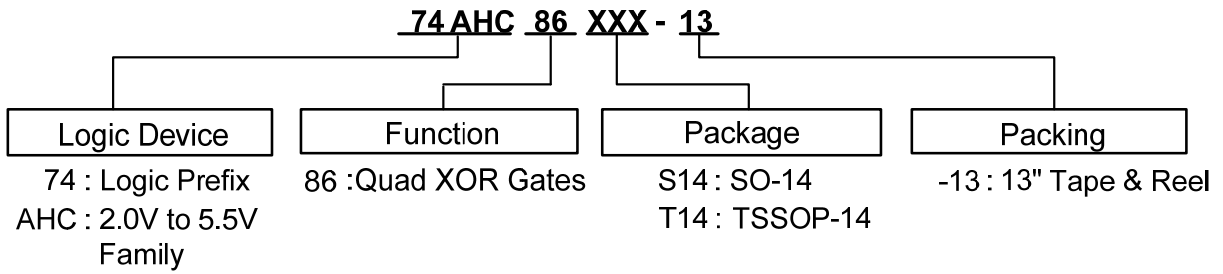
**Voltage Waveform  
Propagation Delay Times  
Inverting and Non Inverting Outputs**

**Figure 1 Load Circuit and Voltage Waveforms**

- Notes:
- A. Includes test lead and test apparatus capacitance.
  - B. All pulses are supplied at pulse repetition rate ≤ 1 MHz.
  - C. Inputs are measured separately one transition per measurement.
  - D. t<sub>PLH</sub> and t<sub>PHL</sub> are the same as t<sub>PD</sub>.

NEW PRODUCT

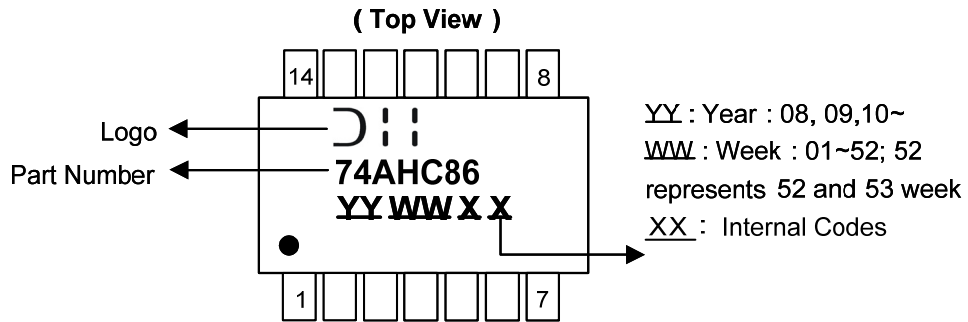
**Ordering Information**



| Device        | Package Code | Packaging | 7" Tape and Reel |                    |
|---------------|--------------|-----------|------------------|--------------------|
|               |              |           | Quantity         | Part Number Suffix |
| 74AHC86S14-13 | S14          | SO-14     | 2500/Tape & Reel | -13                |
| 74AHC86T14-13 | T14          | TSSOP-14  | 2500/Tape & Reel | -13                |

**Marking Information**

(1) SO-14, TSSOP-14

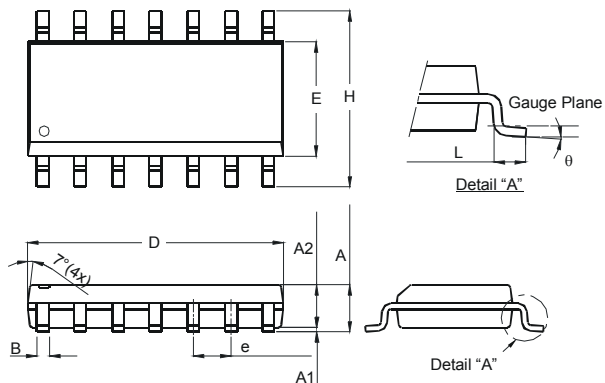


| Part Number | Package  |
|-------------|----------|
| 74AHC86S14  | SO-14    |
| 74AHC86T14  | TSSOP-14 |

**Package Outline Dimensions** (All dimensions in mm.)

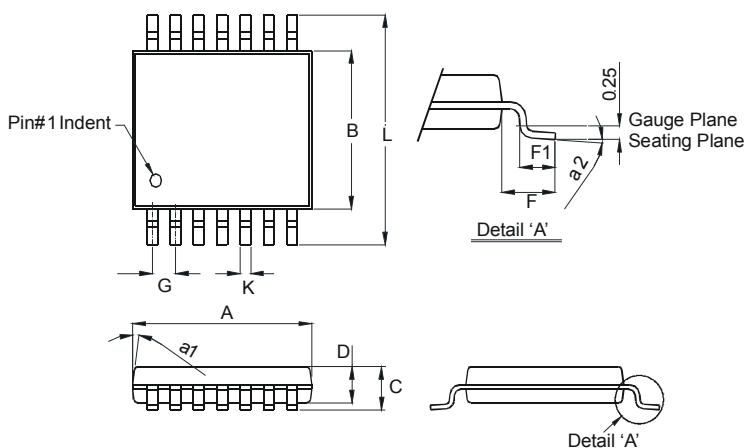
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.

**Package Type: SO-14**



| SO-14                       |          |      |
|-----------------------------|----------|------|
| Dim                         | Min      | Max  |
| A                           | 1.47     | 1.73 |
| A1                          | 0.10     | 0.25 |
| A2                          | 1.45 Typ |      |
| B                           | 0.33     | 0.51 |
| D                           | 8.53     | 8.74 |
| E                           | 3.80     | 3.99 |
| e                           | 1.27 Typ |      |
| H                           | 5.80     | 6.20 |
| L                           | 0.38     | 1.27 |
| θ                           | 0°       | 8°   |
| <b>All Dimensions in mm</b> |          |      |

**Package Type: TSSOP-14**

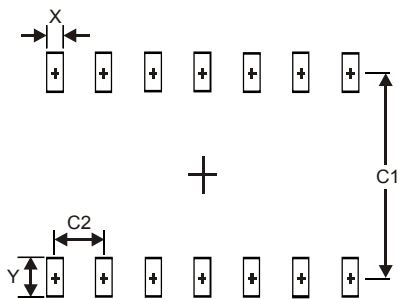


| TSSOP-14                    |          |      |
|-----------------------------|----------|------|
| Dim                         | Min      | Max  |
| a1                          | 7° (4X)  |      |
| a2                          | 0°       | 8°   |
| A                           | 4.9      | 5.10 |
| B                           | 4.30     | 4.50 |
| C                           | —        | 1.2  |
| D                           | 0.8      | 1.05 |
| F                           | 1.00 Typ |      |
| F1                          | 0.45     | 0.75 |
| G                           | 0.65 Typ |      |
| K                           | 0.19     | 0.30 |
| L                           | 6.40 Typ |      |
| <b>All Dimensions in mm</b> |          |      |

## Suggested Pad Layout

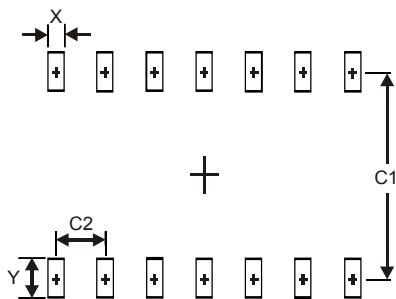
Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.

### Package Type: SO-14



| Dimension s | Value (in mm) |
|-------------|---------------|
| X           | 0.60          |
| Y           | 1.50          |
| C1          | 5.4           |
| C2          | 1.27          |

### Package Type: TSSOP-14



| Dimension s | Value (in mm) |
|-------------|---------------|
| X           | 0.45          |
| Y           | 1.45          |
| C1          | 5.9           |
| C2          | 0.65          |

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