

# Quad 2-Input Exclusive OR Gate

## MM74HC86

The MM74HC86 exclusive OR gate utilizes advanced silicon-gate CMOS technology to achieve operating speeds similar to equivalent LS-TTL gates, while maintaining the low power consumption and high noise immunity characteristic of standard CMOS integrated circuits. These gates are fully buffered and have a fanout of 10 LS-TTL loads. The 74HC logic family is functionally as well as pin-out compatible with the standard 74LS logic family. All inputs are protected from damage due to static discharge by internal diode clamps to V<sub>CC</sub> and ground.

### Features

- Typical Propagation Delay: 12 ns
- Wide Operating Voltage Range: 2 V – 6 V
- Low Input Current: 1 μA Maximum
- Low Quiescent Current: 40 μA Maximum (74 Series)
- Output Drive Capability: 10 LS-TTL Loads
- These Devices are Pb-Free, Halide Free and are RoHS Compliant

### Connection Diagram

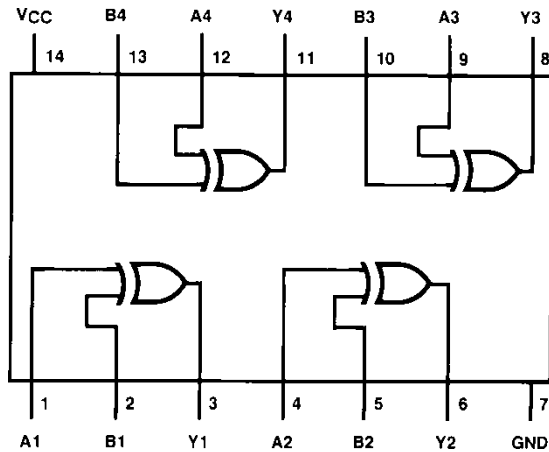


Figure 1. Pin Assignments (Top View)

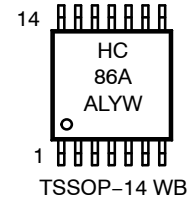
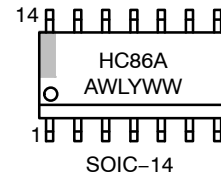
### TRUTH TABLE

| Inputs |   | Outputs   |
|--------|---|-----------|
| A      | B | Y (Note1) |
| L      | L | L         |
| L      | H | H         |
| H      | L | H         |
| H      | H | L         |

1.  $Y = A \oplus B = \overline{A}B + A\overline{B}$



### MARKING DIAGRAM



HC86A = Specific Device Code  
A = Assembly Location  
WL, L = Wafer Lot  
Y = Year  
WW, W = Work Week

### ORDERING INFORMATION

See detailed ordering and shipping information on page 4 of this data sheet.

# MM74HC86

## MAXIMUM RATINGS (Note 3)

| Symbol           | Parameter                                | Min  | Max            | Unit |
|------------------|--|------|----------------|------|
| $V_{CC}$         | Supply Voltage                           | -0.5 | 7.0            | V    |
| $V_{IN}$         | DC Input Voltage                         | -0.5 | $V_{CC} + 0.5$ | V    |
| $V_{OUT}$        | DC Output Voltage                        | -0.5 | $V_{CC} + 0.5$ | V    |
| $I_{IK}, I_{OK}$ | Clamp Diode Current                      | ±20  |                | mA   |
| $I_{OUT}$        | DC Output Current, per Pin               | ±25  |                | mA   |
| $I_{CC}$         | DC $V_{CC}$ or GND Current, per Pin      | ±50  |                | mA   |
| $T_{STG}$        | Storage Temperature Range                | -65  | +150           | °C   |
| $T_L$            | Lead Temperature (Soldering, 10 Seconds) | -    | 260            | °C   |
| $P_D$            | Power Dissipation (Note 3), (Note 2)     | -    | 600            | mW   |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

2. Power dissipation temperature derating – plastic “N” package: -12 mW/°C from 65°C to 85°C.

3. S.O. package only 500 mW.

## RECOMMENDED OPERATING CONDITIONS

| Symbol            | Parameter                   | Conditions              | Min | Max      | Unit |
|-------------------|-----------------------------|-------------------------|-----|----------|------|
| $V_{CC}$          | Supply Voltage              |                         | 2   | 6        | V    |
| $V_{IN}, V_{OUT}$ | DC Input or Output Voltage  |                         | 0   | $V_{CC}$ | V    |
| $T_A$             | Operating Temperature Range |                         | -55 | +125     | °C   |
| $t_r, t_f$        | Input Rise or Fall Times    | $V_{CC} = 2.0\text{ V}$ | -   | 1000     | ns   |
|                   |                             | $V_{CC} = 4.5\text{ V}$ | -   | 500      |      |
|                   |                             | $V_{CC} = 6.0\text{ V}$ | -   | 400      |      |

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

# MM74HC86

## DC CHARACTERISTICS (Note 4)

| Symbol          | Parameter                         | Conditions   | V <sub>CC</sub> (V) | T <sub>A</sub> = 25°C |                   |      | T <sub>A</sub> = -40°C | T <sub>A</sub> = -55°C | Unit |
|-----------------|-----------------------------------|--|---------------------|-----------------------|-------------------|------|------------------------|------------------------|------|
|                 |                                   |  |                     | Typ                   | Guaranteed Limits |      | to 85°C                | to 125°C               |      |
|                 |                                   |  |                     |                       |                   |      |                        |                        |      |
| V <sub>IH</sub> | Minimum HIGH Level Input Voltage  |  | 2.0                 | -                     | 1.5               | 1.5  | 1.5                    | V                      |      |
|                 |                                   |  | 4.5                 | -                     | 3.15              | 3.15 | 3.15                   |                        |      |
|                 |                                   |  | 6.0                 | -                     | 4.2               | 4.2  | 4.2                    |                        |      |
| V <sub>IL</sub> | Maximum LOW Level Input Voltage   |  | 2.0                 | -                     | 0.5               | 0.5  | 0.5                    | V                      |      |
|                 |                                   |  | 4.5                 | -                     | 1.35              | 1.35 | 1.35                   |                        |      |
|                 |                                   |  | 6.0                 | -                     | 1.8               | 1.8  | 1.8                    |                        |      |
| V <sub>OH</sub> | Minimum HIGH Level Output Voltage | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,<br> I <sub>OUT</sub>   ≤ 20 μA  | 2.0                 | 2.0                   | 1.9               | 1.9  | 1.9                    | V                      |      |
|                 |                                   |  | 4.5                 | 4.5                   | 4.4               | 4.4  | 4.4                    |                        |      |
|                 |                                   |  | 6.0                 | 6.0                   | 5.9               | 5.9  | 5.9                    |                        |      |
|                 |                                   | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,<br> I <sub>OUT</sub>   ≤ 4.0 mA | 4.5                 | 4.2                   | 3.98              | 3.84 | 3.70                   |                        |      |
|                 |                                   | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,<br> I <sub>OUT</sub>   ≤ 5.2 mA | 6.0                 | 5.7                   | 5.48              | 5.34 | 5.20                   |                        |      |
| V <sub>OL</sub> | Maximum LOW Level Output Voltage  | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,<br> I <sub>OUT</sub>   ≤ 20 μA  | 2.0                 | 0                     | 0.1               | 0.1  | 0.1                    | V                      |      |
|                 |                                   |  | 4.5                 | 0                     | 0.1               | 0.1  | 0.1                    |                        |      |
|                 |                                   |  | 6.0                 | 0                     | 0.1               | 0.1  | 0.1                    |                        |      |
|                 |                                   | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,<br> I <sub>OUT</sub>   ≤ 4.0 mA | 4.5                 | 0.2                   | 0.26              | 0.33 | 0.4                    |                        |      |
|                 |                                   | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,<br> I <sub>OUT</sub>   ≤ 5.2 mA | 6.0                 | 0.2                   | 0.26              | 0.33 | 0.4                    |                        |      |
| I <sub>IN</sub> | Maximum Input Current             | V <sub>IN</sub> = V <sub>CC</sub> or GND   | 6.0                 | -                     | ±0.1              | ±1.0 | ±1.0                   | μA                     |      |
| I <sub>CC</sub> | Maximum Quiescent Supply Current  | V <sub>IN</sub> = V <sub>CC</sub> or GND,<br>I <sub>OUT</sub> = 0 mA                   | 6.0                 | -                     | 2.0               | 20   | 40                     | μA                     |      |

4. For a power supply of 5 V ±10% the worst-case output voltages (V<sub>OH</sub>, and V<sub>OL</sub>) occur for HC at 4.5 V. Thus the 4.5 V values should be used when designing with this supply. Worst-case V<sub>IH</sub> and V<sub>IL</sub> occur at V<sub>CC</sub> = 5.5 V and 4.5 V, respectively. (The V<sub>IH</sub> values at 5 V and 5.5 V are 3.5 V and 3.85 V, respectively.) The worst-case leakage current (I<sub>IN</sub>, I<sub>CC</sub>, and I<sub>OZ</sub>) occurs for CMOS at the higher voltage, so the 6.0 V values should be used.

## AC CHARACTERISTICS (C<sub>L</sub> = 50 pF, t<sub>r</sub> = t<sub>f</sub> = 6 ns (unless otherwise specified))

| Symbol                              | Parameter   | Conditions  | V <sub>CC</sub> (V) | T <sub>A</sub> = 25°C |                   |     | T <sub>A</sub> = -40°C | T <sub>A</sub> = -55°C | Unit |
|-------------------------------------|---|---|---------------------|-----------------------|-------------------|-----|------------------------|------------------------|------|
|                                     |   |   |                     | Typ                   | Guaranteed Limits |     | to 85°C                | to 125°C               |      |
|                                     |   |   |                     |                       |                   |     |                        |                        |      |
| t <sub>PHL</sub> , t <sub>PLH</sub> | Maximum Propagation Delay                         | C <sub>L</sub> = 15 pF,<br>t <sub>r</sub> = t <sub>f</sub> = 6 ns | 5.0                 | 12                    | -                 | 20  | -                      | ns                     |      |
| t <sub>PHL</sub> , t <sub>PLH</sub> | Maximum Propagation Delay                         | C <sub>L</sub> = 50 pF,<br>t <sub>r</sub> = t <sub>f</sub> = 6 ns | 2.0                 | 60                    | 120               | 151 | 179                    | ns                     |      |
|                                     |   |   | 4.5                 | 12                    | 24                | 30  | 36                     |                        |      |
|                                     |   |   | 6.0                 | 10                    | 20                | 26  | 30                     |                        |      |
| t <sub>TLH</sub> , t <sub>THL</sub> | Maximum Output Rise and Fall Time                 |   | 2.0                 | 30                    | 75                | 95  | 110                    | ns                     |      |
|                                     |   |   | 4.5                 | 8                     | 15                | 19  | 22                     |                        |      |
|                                     |   |   | 6.0                 | 7                     | 13                | 16  | 19                     |                        |      |
| C <sub>PD</sub>                     | Power Dissipation Capacitance (per Gate) (Note 5) |   |                     | 25                    | -                 | -   | -                      | pF                     |      |
| C <sub>IN</sub>                     | Maximum Input Capacitance                         |   |                     | 5                     | 10                | 10  | 10                     | pF                     |      |

5. C<sub>PD</sub> determines the no-load dynamic power consumption, P<sub>D</sub> = C<sub>PD</sub> V<sub>CC</sub><sup>2</sup> f + I<sub>CC</sub> V<sub>CC</sub>, and the no load dynamic current consumption, I<sub>S</sub> = C<sub>PD</sub> V<sub>CC</sub> f + I<sub>CC</sub>.

# MM74HC86

## ORDERING INFORMATION

| Part Number  | Package  | Shipping†          |
|--------------|--|--------------------|
| MM74HC86M    | SOIC-14, Case 751A-03<br>(Pb-Free, Halide Free)  | 55 Units / Tube    |
| MM74HC86MTC  | TSSOP-14, Case 948G-01<br>(Pb-Free, Halide Free) | 96 Units / Tube    |
| MM74HC86MX   | SOIC-14, Case 751EF<br>(Pb-Free, Halide Free)    | 2500 / Tape & Reel |
| MM74HC86MTCX | TSSOP-14, Case 948G-01<br>(Pb-Free, Halide Free) | 2500 / Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



SCALE 1:1

SOIC-14 NB  
CASE 751A-03  
ISSUE L

DATE 03 FEB 2016



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF AT MAXIMUM MATERIAL CONDITION.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSIONS.
5. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 1.35        | 1.75 | 0.054     | 0.068 |
| A1  | 0.10        | 0.25 | 0.004     | 0.010 |
| A3  | 0.19        | 0.25 | 0.008     | 0.010 |
| b   | 0.35        | 0.49 | 0.014     | 0.019 |
| D   | 8.55        | 8.75 | 0.337     | 0.344 |
| E   | 3.80        | 4.00 | 0.150     | 0.157 |
| e   | 1.27 BSC    |      | 0.050 BSC |       |
| H   | 5.80        | 6.20 | 0.228     | 0.244 |
| h   | 0.25        | 0.50 | 0.010     | 0.019 |
| L   | 0.40        | 1.25 | 0.016     | 0.049 |
| M   | 0°          | 7°   | 0°        | 7°    |

SOLDERING FOOTPRINT\*



DIMENSIONS: MILLIMETERS

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

GENERIC MARKING DIAGRAM\*



- XXXXXX = Specific Device Code
- A = Assembly Location
- WL = Wafer Lot
- Y = Year
- WW = Work Week
- G = Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

STYLES ON PAGE 2

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**SOIC-14**  
**CASE 751A-03**  
**ISSUE L**

DATE 03 FEB 2016

STYLE 1:  
 PIN 1. COMMON CATHODE  
 2. ANODE/CATHODE  
 3. ANODE/CATHODE  
 4. NO CONNECTION  
 5. ANODE/CATHODE  
 6. NO CONNECTION  
 7. ANODE/CATHODE  
 8. ANODE/CATHODE  
 9. ANODE/CATHODE  
 10. NO CONNECTION  
 11. ANODE/CATHODE  
 12. ANODE/CATHODE  
 13. NO CONNECTION  
 14. COMMON ANODE

STYLE 2:  
 CANCELLED

STYLE 3:  
 PIN 1. NO CONNECTION  
 2. ANODE  
 3. ANODE  
 4. NO CONNECTION  
 5. ANODE  
 6. NO CONNECTION  
 7. ANODE  
 8. ANODE  
 9. ANODE  
 10. NO CONNECTION  
 11. ANODE  
 12. ANODE  
 13. NO CONNECTION  
 14. COMMON CATHODE

STYLE 4:  
 PIN 1. NO CONNECTION  
 2. CATHODE  
 3. CATHODE  
 4. NO CONNECTION  
 5. CATHODE  
 6. NO CONNECTION  
 7. CATHODE  
 8. CATHODE  
 9. CATHODE  
 10. NO CONNECTION  
 11. CATHODE  
 12. CATHODE  
 13. NO CONNECTION  
 14. COMMON ANODE

STYLE 5:  
 PIN 1. COMMON CATHODE  
 2. ANODE/CATHODE  
 3. ANODE/CATHODE  
 4. ANODE/CATHODE  
 5. ANODE/CATHODE  
 6. NO CONNECTION  
 7. COMMON ANODE  
 8. COMMON CATHODE  
 9. ANODE/CATHODE  
 10. ANODE/CATHODE  
 11. ANODE/CATHODE  
 12. ANODE/CATHODE  
 13. NO CONNECTION  
 14. COMMON ANODE

STYLE 6:  
 PIN 1. CATHODE  
 2. CATHODE  
 3. CATHODE  
 4. CATHODE  
 5. CATHODE  
 6. CATHODE  
 7. CATHODE  
 8. ANODE  
 9. ANODE  
 10. ANODE  
 11. ANODE  
 12. ANODE  
 13. ANODE  
 14. ANODE

STYLE 7:  
 PIN 1. ANODE/CATHODE  
 2. COMMON ANODE  
 3. COMMON CATHODE  
 4. ANODE/CATHODE  
 5. ANODE/CATHODE  
 6. ANODE/CATHODE  
 7. ANODE/CATHODE  
 8. ANODE/CATHODE  
 9. ANODE/CATHODE  
 10. ANODE/CATHODE  
 11. COMMON CATHODE  
 12. COMMON ANODE  
 13. ANODE/CATHODE  
 14. ANODE/CATHODE

STYLE 8:  
 PIN 1. COMMON CATHODE  
 2. ANODE/CATHODE  
 3. ANODE/CATHODE  
 4. NO CONNECTION  
 5. ANODE/CATHODE  
 6. ANODE/CATHODE  
 7. COMMON ANODE  
 8. COMMON ANODE  
 9. ANODE/CATHODE  
 10. ANODE/CATHODE  
 11. NO CONNECTION  
 12. ANODE/CATHODE  
 13. ANODE/CATHODE  
 14. COMMON CATHODE

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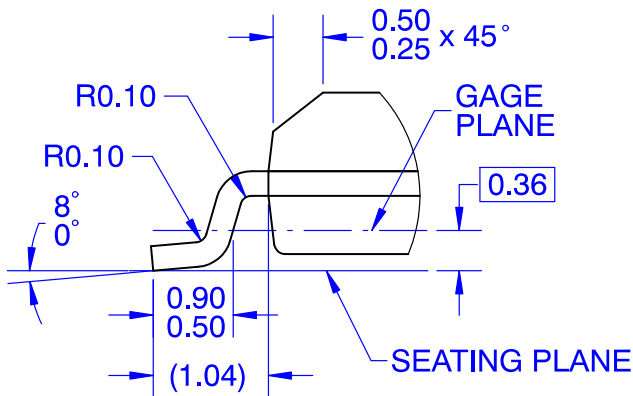
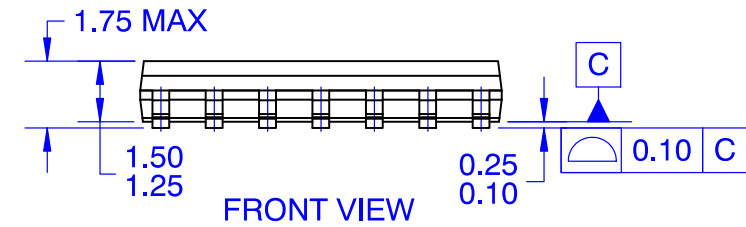
**MECHANICAL CASE OUTLINE**  
**PACKAGE DIMENSIONS**

ON Semiconductor®



**SOIC14**  
**CASE 751EF**  
**ISSUE O**

DATE 30 SEP 2016



**DETAIL A**  
**SCALE 16 : 1**

**NOTES:**

- A. CONFORMS TO JEDEC MS-012, VARIATION AB, ISSUE C
- B. ALL DIMENSIONS ARE IN MILLIMETERS
- C. DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS
- D. LAND PATTERN STANDARD: SOIC127P600X145-14M
- E. CONFORMS TO ASME Y14.5M, 2009

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# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



**TSSOP-14 WB**  
CASE 948G  
ISSUE C

DATE 17 FEB 2016

SCALE 2:1



**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 4.90        | 5.10 | 0.193     | 0.200 |
| B   | 4.30        | 4.50 | 0.169     | 0.177 |
| C   | ---         | 1.20 | ---       | 0.047 |
| D   | 0.05        | 0.15 | 0.002     | 0.006 |
| F   | 0.50        | 0.75 | 0.020     | 0.030 |
| G   | 0.65 BSC    |      | 0.026 BSC |       |
| H   | 0.50        | 0.60 | 0.020     | 0.024 |
| J   | 0.09        | 0.20 | 0.004     | 0.008 |
| J1  | 0.09        | 0.16 | 0.004     | 0.006 |
| K   | 0.19        | 0.30 | 0.007     | 0.012 |
| K1  | 0.19        | 0.25 | 0.007     | 0.010 |
| L   | 6.40 BSC    |      | 0.252 BSC |       |
| M   | 0°          | 8°   | 0°        | 8°    |

**GENERIC MARKING DIAGRAM\***



- A = Assembly Location
- L = Wafer Lot
- Y = Year
- W = Work Week
- = Pb-Free Package

(Note: Microdot may be in either location)

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

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