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# MC74AC86, MC74ACT86

# Quad 2-Input Exclusive-OR Gate

## High−Performance Silicon−Gate CMOS

ON Semiconductor®

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### Features

- Outputs Source/Sink 24 mA
- These are Pb−Free Devices

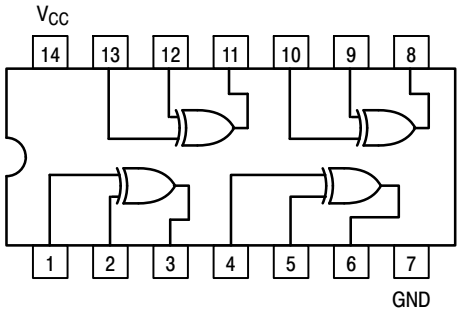
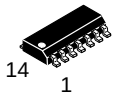
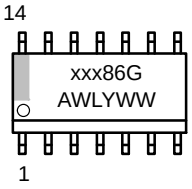


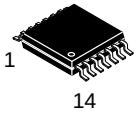

**Figure 1. Pinout: 14−Lead Packages Conductors**
(Top View)

**MARKING DIAGRAMS**

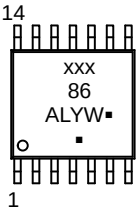



**SOIC−14**
**D SUFFIX**
**CASE 751A**




**TSSOP−14**
**DT SUFFIX**
**CASE 948G**




| | |
|---|---|
| xxx | = AC or ACT |
| A | = Assembly Location |
| WL or L | = Wafer Lot |
| Y | = Year |
| WW or W | = Work Week |
| G or ▪ | = Pb−Free Package |

(Note: Microdot may be in either location)

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

## MAXIMUM RATINGS

| Symbol | Parameter | | Value | Unit |
|---|---|---|---|---|
| $V_{CC}$ | DC Supply Voltage | | −0.5 to +7.0 | V |
| $V_I$ | DC Input Voltage | | $-0.5 \le V_I \le V_{CC} + 0.5$ | V |
| $V_O$ | DC Output Voltage | (Note 1) | $-0.5 \le V_O \le V_{CC} + 0.5$ | V |
| $I_{IK}$ | DC Input Diode Current | | ±20 | mA |
| $I_{OK}$ | DC Output Diode Current | | ±50 | mA |
| $I_O$ | DC Output Sink/Source Current | | ±50 | mA |
| $I_{CC}$ | DC Supply Current per Output Pin | | ±50 | mA |
| $I_{GND}$ | DC Ground Current per Output Pin | | ±50 | mA |
| $T_{STG}$ | Storage Temperature Range | | −65 to +150 | °C |
| $T_L$ | Lead temperature, 1 mm from Case for 10 Seconds | | 260 | °C |
| $T_J$ | Junction temperature under Bias | | +150 | °C |
| $\theta_{JA}$ | Thermal Resistance (Note 2) | SOIC<br>TSSOP | 125<br>170 | °C/W |
| $P_D$ | Power Dissipation in Still Air at 85°C | SOIC<br>TSSOP | 125<br>170 | mW |
| MSL | Moisture Sensitivity | | Level 1 | |
| $F_R$ | Flammability Rating | Oxygen Index: 30% − 35% | UL 94 V−0 @ 0.125 in | |
| $V_{ESD}$ | ESD Withstand Voltage | Human Body Model (Note 3)<br>Machine Model (Note 4)<br>Charged Device Model (Note 5) | > 2000<br>> 200<br>> 1000 | V |
| $I_{Latch-Up}$ | Latch−Up Performance | Above $V_{CC}$ and Below GND at 85°C (Note 6) | ±100 | mA |

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.

1. $I_O$ absolute maximum rating must be observed.
2. The package thermal impedance is calculated in accordance with JESD51−7.
3. Tested to EIA/JESD22−A114−A.
4. Tested to EIA/JESD22−A115−A.
5. Tested to JESD22−C101−A.
6. Tested to EIA/JESD78.

## RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage | ′AC | 2.0 | 5.0 | 6.0 | V |
| | | ′ACT | 4.5 | 5.0 | 5.5 | |
| $V_{in}$, $V_{out}$ | DC Input Voltage, Output Voltage (Ref. to GND) | | 0 | | $V_{CC}$ | V |
| $t_r$, $t_f$ | Input Rise and Fall Time (Note 1)<br>′AC Devices except Schmitt Inputs | $V_{CC}$ @ 3.0 V | − | 150 | − | ns/V |
| | | $V_{CC}$ @ 4.5 V | − | 40 | − | |
| | | $V_{CC}$ @ 5.5 V | − | 25 | − | |
| $t_r$, $t_f$ | Input Rise and Fall Time (Note 2)<br>′ACT Devices except Schmitt Inputs | $V_{CC}$ @ 4.5 V | − | 10 | − | ns/V |
| | | $V_{CC}$ @ 5.5 V | − | 8.0 | − | |
| $T_J$ | Junction Temperature (PDIP) | | − | − | 140 | °C |
| $T_A$ | Operating Ambient Temperature Range | | −40 | 25 | 85 | °C |
| $I_{OH}$ | Output Current − High | | − | − | −24 | mA |
| $I_{OL}$ | Output Current − Low | | − | − | 24 | mA |

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.

1. $V_{in}$ from 30% to 70% $V_{CC}$; see individual Data Sheets for devices that differ from the typical input rise and fall times.
2. $V_{in}$ from 0.8 V to 2.0 V; see individual Data Sheets for devices that differ from the typical input rise and fall times.

## DC CHARACTERISTICS

| Symbol | Parameter | $V_{CC}$ (V) | 74AC $T_A$ = +25°C Typ | 74AC $T_A$ = −40°C to +85°C Guaranteed Limits | | Unit | Conditions |
|---|---|---|---|---|---|---|---|
| $V_{IH}$ | Minimum High Level Input Voltage | 3.0<br>4.5<br>5.5 | 1.5<br>2.25<br>2.75 | 2.1<br>3.15<br>3.85 | 2.1<br>3.15<br>3.85 | V | $V_{OUT}$ = 0.1 V<br>or $V_{CC}$ − 0.1 V |
| $V_{IL}$ | Maximum Low Level Input Voltage | 3.0<br>4.5<br>5.5 | 1.5<br>2.25<br>2.75 | 0.9<br>1.35<br>1.65 | 0.9<br>1.35<br>1.65 | V | $V_{OUT}$ = 0.1 V<br>or $V_{CC}$ − 0.1 V |
| $V_{OH}$ | Minimum High Level Output Voltage | 3.0<br>4.5<br>5.5 | 2.99<br>4.49<br>5.49 | 2.9<br>4.4<br>5.4 | 2.9<br>4.4<br>5.4 | V | $I_{OUT}$ = −50 μA |
| | | 3.0<br>4.5<br>5.5 | −<br>−<br>− | 2.56<br>3.86<br>4.86 | 2.46<br>3.76<br>4.76 | V | *$V_{IN}$ = $V_{IL}$ or $V_{IH}$<br>−12 mA<br>$I_{OH}$ −24 mA<br>−24 mA |
| $V_{OL}$ | Maximum Low Level Output Voltage | 3.0<br>4.5<br>5.5 | 0.002<br>0.001<br>0.001 | 0.1<br>0.1<br>0.1 | 0.1<br>0.1<br>0.1 | V | $I_{OUT}$ = 50 μA |
| | | 3.0<br>4.5<br>5.5 | −<br>−<br>− | 0.36<br>0.36<br>0.36 | 0.44<br>0.44<br>0.44 | V | *$V_{IN}$ = $V_{IL}$ or $V_{IH}$<br>12 mA<br>$I_{OL}$ 24 mA<br>24 mA |
| $I_{IN}$ | Maximum Input Leakage Current | 5.5 | − | ±0.1 | ±1.0 | μA | $V_I$ = $V_{CC}$, GND |
| $I_{OLD}$ | †Minimum Dynamic Output Current | 5.5 | − | − | 75 | mA | $V_{OLD}$ = 1.65 V Max |
| $I_{OHD}$ | | 5.5 | − | − | −75 | mA | $V_{OHD}$ = 3.85 V Min |
| $I_{CC}$ | Maximum Quiescent Supply Current | 5.5 | − | 4.0 | 40 | μA | $V_{IN}$ = $V_{CC}$ or GND |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.
*All outputs loaded; thresholds on input associated with output under test.
†Maximum test duration 2.0 ms, one output loaded at a time.
NOTE: $I_{IN}$ and $I_{CC}$ @ 3.0 V are guaranteed to be less than or equal to the respective limit @ 5.5 V $V_{CC}$.

## AC CHARACTERISTICS

| Symbol | Parameter | $V_{CC}$* (V) | 74AC $T_A$ = +25°C, $C_L$ = 50 pF Min | Typ | Max | 74AC $T_A$ = −40°C to +85°C, $C_L$ = 50 pF Min | Max | Unit | Fig. No. |
|---|---|---|---|---|---|---|---|---|---|
| $t_{PLH}$ | Propagation Delay Inputs to Outputs | 3.3<br>5.0 | 2.0<br>1.5 | 6.0<br>4.5 | 11.5<br>8.5 | 1.5<br>1.0 | 12.5<br>9.0 | ns | 3−5 |
| $t_{PHL}$ | Propagation Delay Inputs to Outputs | 3.3<br>5.0 | 2.0<br>1.5 | 6.5<br>4.5 | 11.5<br>8.5 | 1.5<br>1.0 | 12.5<br>9.5 | ns | 3−5 |

*Voltage Range 3.3 V is 3.3 V ±0.3 V
Voltage Range 5.0 V is 5.0 V ±0.5 V.

## DC CHARACTERISTICS

| Symbol | Parameter | $V_{CC}$ (V) | 74ACT $T_A$ = +25°C Typ | 74ACT $T_A$ = −40°C to +85°C Guaranteed Limits | | Unit | Conditions |
|---|---|---|---|---|---|---|---|
| $V_{IH}$ | Minimum High Level Input Voltage | 4.5<br>5.5 | 1.5<br>1.5 | 2.0<br>2.0 | 2.0<br>2.0 | V | $V_{OUT}$ = 0.1 V<br>or $V_{CC}$ − 0.1 V |
| $V_{IL}$ | Maximum Low Level Input Voltage | 4.5<br>5.5 | 1.5<br>1.5 | 0.8<br>0.8 | 0.8<br>0.8 | V | $V_{OUT}$ = 0.1 V<br>or $V_{CC}$ − 0.1 V |
| $V_{OH}$ | Minimum High Level Output Voltage | 4.5<br>5.5 | 4.49<br>5.49 | 4.4<br>5.4 | 4.4<br>5.4 | V | $I_{OUT}$ = −50 μA |
| | | 4.5<br>5.5 | −<br>− | 3.86<br>4.86 | 3.76<br>4.76 | V | *$V_{IN}$ = $V_{IL}$ or $V_{IH}$<br>$I_{OH}$ −24 mA<br>$I_{OH}$ −24 mA |
| $V_{OL}$ | Maximum Low Level Output Voltage | 4.5<br>5.5 | 0.001<br>0.001 | 0.1<br>0.1 | 0.1<br>0.1 | V | $I_{OUT}$ = 50 μA |
| | | 4.5<br>5.5 | −<br>− | 0.36<br>0.36 | 0.44<br>0.44 | V | *$V_{IN}$ = $V_{IL}$ or $V_{IH}$<br>$I_{OL}$ 24 mA<br>$I_{OL}$ 24 mA |
| $I_{IN}$ | Maximum Input Leakage Current | 5.5 | | ±0.1 | ±1.0 | μA | $V_I$ = $V_{CC}$, GND |
| $\Delta I_{CCT}$ | Additional Max. $I_{CC}$/Input | 5.5 | 0.6 | − | 1.5 | mA | $V_I$ = $V_{CC}$ − 2.1 V |
| $I_{OLD}$ | †Minimum Dynamic Output Current | 5.5 | − | − | 75 | mA | $V_{OLD}$ = 1.65 V Max |
| $I_{OHD}$ | | 5.5 | − | − | −75 | mA | $V_{OHD}$ = 3.85 V Min |
| $I_{CC}$ | Maximum Quiescent Supply Current | 5.5 | − | 4.0 | 40 | μA | $V_{IN}$ = $V_{CC}$ or GND |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.
*All outputs loaded; thresholds on input associated with output under test.
†Maximum test duration 2.0 ms, one output loaded at a time.

## AC CHARACTERISTICS

| Symbol | Parameter | $V_{CC}$* (V) | 74ACT $T_A$ = +25°C, $C_L$ = 50 pF Min | Typ | Max | 74ACT $T_A$ = −40°C to +85°C, $C_L$ = 50 pF Min | Max | Unit | Fig. No. |
|---|---|---|---|---|---|---|---|---|---|
| $t_{PLH}$ | Propagation Delay | 5.0 | 1.5 | 8.5 | 9.5 | 1.0 | 10.0 | ns | 3−5 |
| $t_{PHL}$ | Propagation Delay | 5.0 | 1.5 | 7.0 | 9.5 | 1.0 | 10.5 | ns | 3−5 |

*Voltage Range 5.0 V is 5.0 V ±0.5 V.

## CAPACITANCE

| Symbol | Parameter | Value Typ | Unit | Test Conditions |
|---|---|---|---|---|
| $C_{IN}$ | Input Capacitance | 4.5 | pF | $V_{CC}$ = 5.0 V |
| $C_{PD}$ | Power Dissipation Capacitance | 35 | pF | $V_{CC}$ = 5.0 V |

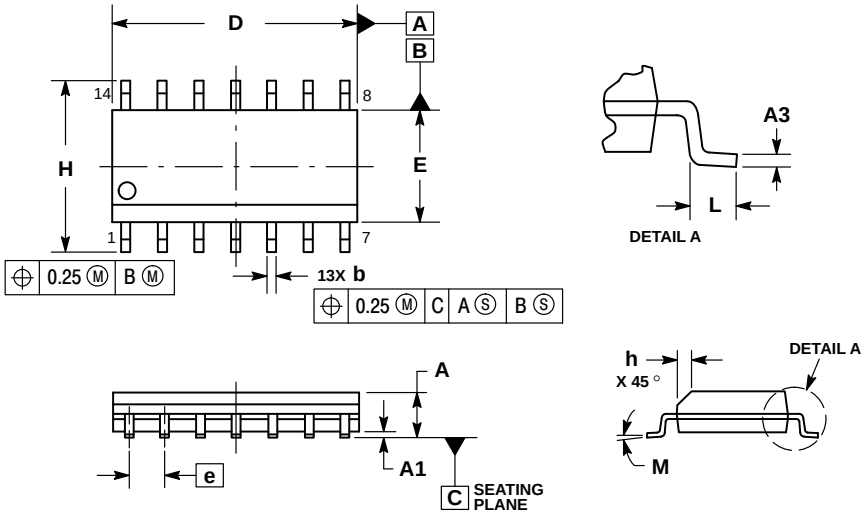
## ORDERING INFORMATION

| Device | Package | Shipping† |
|---|---|---|
| MC74AC86DG | SOIC−14 (Pb−Free) | 55 Units / Rail |
| MC74AC86DR2G | | 2500 / Tape & Reel |
| MC74AC86DTR2G | TSSOP−14 (Pb−Free) | 2500 / Tape & Reel |
| MC74ACT86DG | SOIC−14 (Pb−Free) | 55 Units / Rail |
| MC74ACT86DR2G | | 2500 / Tape & Reel |
| MC74ACT86DTR2G | TSSOP−14 (Pb−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.

## PACKAGE DIMENSIONS

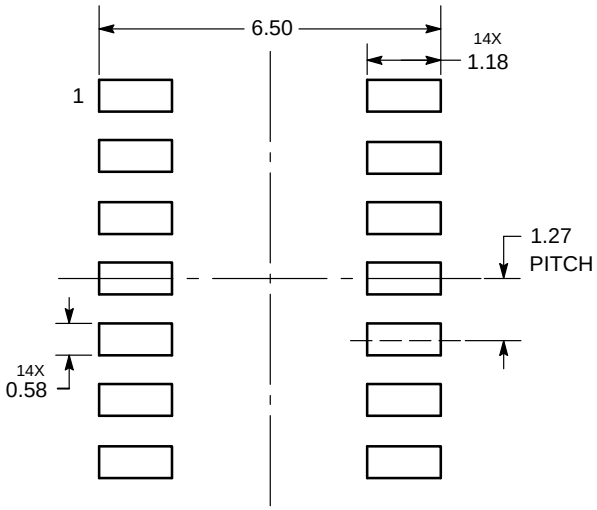
**SOIC−14 NB**
CASE 751A−03
ISSUE K




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.

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | 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*

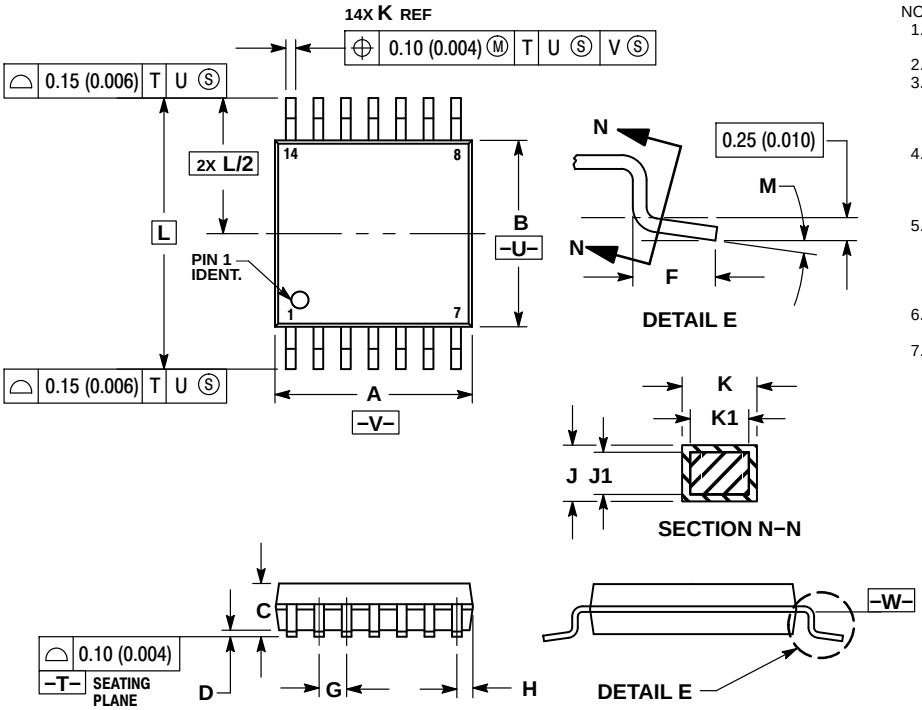



DIMENSIONS: MILLIMETERS

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

## PACKAGE DIMENSIONS

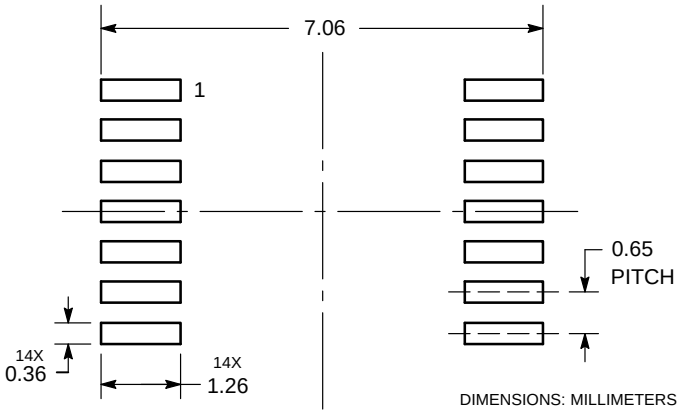
**TSSOP−14**
CASE 948G
ISSUE B




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−.

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | 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 ° |

### 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.

## PUBLICATION ORDERING INFORMATION

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**Fax**: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
**Email**: orderlit@onsemi.com

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**Europe, Middle East and Africa Technical Support:**
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**MC74AC86/D**