

# Hex Inverter

## High-Performance Silicon-Gate CMOS

### MC74AC04, MC74ACT04

#### Features

- Outputs Source/Sink 24 mA
- 'ACT04 Has TTL Compatible Inputs
- These are Pb-Free Devices

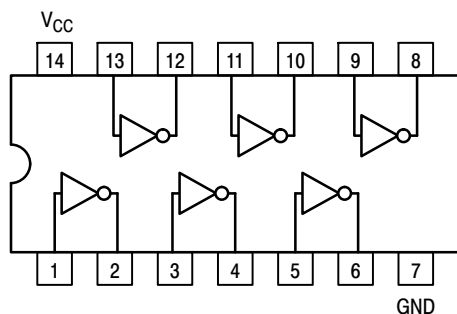
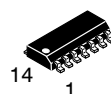
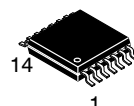
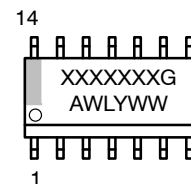


Figure 1. Pinout: 14-Lead Packages Conductors  
(Top View)

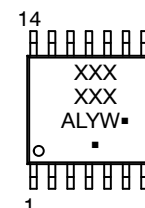
#### MARKING DIAGRAMS



SOIC-14  
D SUFFIX  
CASE 751A



TSSOP-14  
DT SUFFIX  
CASE 948G



XXXX = 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 on page 5 of this data sheet.

# MC74AC04, MC74ACT04

## MAXIMUM RATINGS

| Symbol                | Parameter                                                                           | Value                                          | Unit |
|-----------------------|-------------------------------------------------------------------------------------|------------------------------------------------|------|
| V <sub>CC</sub>       | DC Supply Voltage                                                                   | − 0.5 to +6.5                                  | V    |
| V <sub>I</sub>        | DC Input Voltage                                                                    | − 0.5 ≤ V <sub>I</sub> ≤ V <sub>CC</sub> + 0.5 | V    |
| V <sub>O</sub>        | DC Output Voltage (Note 1)                                                          | − 0.5 ≤ V <sub>O</sub> ≤ V <sub>CC</sub> + 0.5 | V    |
| I <sub>IK</sub>       | DC Input Diode Current                                                              | ± 20                                           | mA   |
| I <sub>OK</sub>       | DC Output Diode Current                                                             | ± 50                                           | mA   |
| I <sub>O</sub>        | DC Output Sink/Source Current                                                       | ± 50                                           | mA   |
| I <sub>CC</sub>       | DC Supply Current per Output Pin                                                    | ± 50                                           | mA   |
| I <sub>GND</sub>      | DC Ground Current per Output Pin                                                    | ± 50                                           | mA   |
| T <sub>STG</sub>      | Storage Temperature Range                                                           | − 65 to + 150                                  | °C   |
| T <sub>L</sub>        | Lead temperature, 1 mm from Case for 10 Seconds                                     | 260                                            | °C   |
| T <sub>J</sub>        | Junction temperature under Bias                                                     | + 150                                          | °C   |
| θ <sub>JA</sub>       | Thermal Resistance (Note 2)<br>SOIC<br>TSSOP                                        | 116<br>150                                     | °C/W |
| P <sub>D</sub>        | Power Dissipation in Still Air at 25°C<br>SOIC<br>TSSOP                             | 1077<br>833                                    | mW   |
| MSL                   | Moisture Sensitivity                                                                | Level 1                                        |      |
| F <sub>R</sub>        | Flammability Rating<br>Oxygen Index: 30% – 35%                                      | UL 94 V-0 @ 0.125 in                           |      |
| V <sub>ESD</sub>      | ESD Withstand Voltage<br>Human Body Model (Note 3)<br>Charged Device Model (Note 4) | > 2000<br>> 1000                               | V    |
| I <sub>Latch-Up</sub> | Latch-Up Performance Above V <sub>CC</sub> and Below GND at 85°C (Note 5)           | ± 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<sub>O</sub> 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 JESD22-C101-A.
5. Tested to EIA/JESD78.

## RECOMMENDED OPERATING CONDITIONS

| Symbol                             | Parameter                                                               | Min                     | Typ | Max             | Unit |
|------------------------------------|-------------------------------------------------------------------------|-------------------------|-----|-----------------|------|
| V <sub>CC</sub>                    | Supply Voltage                                                          | 'AC                     | 2.0 | 5.0             | V    |
|                                    |                                                                         | 'ACT                    | 4.5 | 5.0             |      |
| V <sub>in</sub> , V <sub>out</sub> | DC Input Voltage, Output Voltage (Ref. to GND)                          | 0                       | –   | V <sub>CC</sub> | V    |
| t <sub>r</sub> , t <sub>f</sub>    | Input Rise and Fall Time (Note 6)<br>'AC Devices except Schmitt Inputs  | V <sub>CC</sub> @ 3.0 V | –   | 150             | ns/V |
|                                    |                                                                         | V <sub>CC</sub> @ 4.5 V | –   | 40              |      |
|                                    |                                                                         | V <sub>CC</sub> @ 5.5 V | –   | 25              |      |
| t <sub>r</sub> , t <sub>f</sub>    | Input Rise and Fall Time (Note 7)<br>'ACT Devices except Schmitt Inputs | V <sub>CC</sub> @ 4.5 V | –   | 10              | ns/V |
|                                    |                                                                         | V <sub>CC</sub> @ 5.5 V | –   | 8.0             |      |
| T <sub>A</sub>                     | Operating Ambient Temperature Range                                     | –40                     | 25  | 85              | °C   |
| I <sub>OH</sub>                    | Output Current – High                                                   | –                       | –   | –24             | mA   |
| I <sub>OL</sub>                    | 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.

6. V<sub>in</sub> from 30% to 70% V<sub>CC</sub>; see individual Data Sheets for devices that differ from the typical input rise and fall times.
7. V<sub>in</sub> from 0.8 V to 2.0 V; see individual Data Sheets for devices that differ from the typical input rise and fall times.

# MC74AC04, MC74ACT04

## DC CHARACTERISTICS

| Symbol           | Parameter                            | V <sub>CC</sub><br>(V) | 74AC                   |                   | 74AC                                  | Unit | Conditions                                                                                          |
|------------------|--------------------------------------|------------------------|------------------------|-------------------|---------------------------------------|------|-----------------------------------------------------------------------------------------------------|
|                  |                                      |                        | T <sub>A</sub> = +25°C |                   | T <sub>A</sub> =<br>–40°C to<br>+85°C |      |                                                                                                     |
|                  |                                      |                        | Typ                    | Guaranteed Limits |                                       |      |                                                                                                     |
| V <sub>IH</sub>  | Minimum High Level<br>Input Voltage  | 3.0                    | 1.5                    | 2.1               | 2.1                                   | V    | V <sub>OUT</sub> = 0.1 V<br>or V <sub>CC</sub> – 0.1 V                                              |
|                  |                                      | 4.5                    | 2.25                   | 3.15              | 3.15                                  |      |                                                                                                     |
|                  |                                      | 5.5                    | 2.75                   | 3.85              | 3.85                                  |      |                                                                                                     |
| V <sub>IL</sub>  | Maximum Low Level<br>Input Voltage   | 3.0                    | 1.5                    | 0.9               | 0.9                                   | V    | V <sub>OUT</sub> = 0.1 V<br>or V <sub>CC</sub> – 0.1 V                                              |
|                  |                                      | 4.5                    | 2.25                   | 1.35              | 1.35                                  |      |                                                                                                     |
|                  |                                      | 5.5                    | 2.75                   | 1.65              | 1.65                                  |      |                                                                                                     |
| V <sub>OH</sub>  | Minimum High Level<br>Output Voltage | 3.0                    | 2.99                   | 2.9               | 2.9                                   | V    | I <sub>OUT</sub> = –50 μA                                                                           |
|                  |                                      | 4.5                    | 4.49                   | 4.4               | 4.4                                   |      |                                                                                                     |
|                  |                                      | 5.5                    | 5.49                   | 5.4               | 5.4                                   |      |                                                                                                     |
|                  |                                      | 3.0                    | –                      | 2.56              | 2.46                                  | V    | *V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>–12 mA<br>I <sub>OH</sub> –24 mA<br>–24 mA |
|                  |                                      | 4.5                    | –                      | 3.86              | 3.76                                  |      |                                                                                                     |
|                  |                                      | 5.5                    | –                      | 4.86              | 4.76                                  |      |                                                                                                     |
| V <sub>OL</sub>  | Maximum Low Level<br>Output Voltage  | 3.0                    | 0.002                  | 0.1               | 0.1                                   | V    | I <sub>OUT</sub> = 50 μA                                                                            |
|                  |                                      | 4.5                    | 0.001                  | 0.1               | 0.1                                   |      |                                                                                                     |
|                  |                                      | 5.5                    | 0.001                  | 0.1               | 0.1                                   |      |                                                                                                     |
|                  |                                      | 3.0                    | –                      | 0.36              | 0.44                                  | V    | *V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>12 mA<br>I <sub>OL</sub> 24 mA<br>24 mA    |
|                  |                                      | 4.5                    | –                      | 0.36              | 0.44                                  |      |                                                                                                     |
|                  |                                      | 5.5                    | –                      | 0.36              | 0.44                                  |      |                                                                                                     |
| I <sub>IN</sub>  | Maximum Input<br>Leakage Current     | 5.5                    | –                      | ±0.1              | ±1.0                                  | μA   | V <sub>I</sub> = V <sub>CC</sub> , GND                                                              |
| I <sub>OLD</sub> | †Minimum Dynamic<br>Output Current   | 5.5                    | –                      | –                 | 75                                    | mA   | V <sub>OLD</sub> = 1.65 V Max                                                                       |
| I <sub>OHD</sub> |                                      | 5.5                    | –                      | –                 | –75                                   | mA   | V <sub>OHD</sub> = 3.85 V Min                                                                       |
| I <sub>CC</sub>  | Maximum Quiescent<br>Supply Current  | 5.5                    | –                      | 4.0               | 40                                    | μA   | V <sub>IN</sub> = V <sub>CC</sub> 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<sub>IN</sub> and I<sub>CC</sub> @ 3.0 V are guaranteed to be less than or equal to the respective limit @ 5.5 V V<sub>CC</sub>.

## AC CHARACTERISTICS

| Symbol           | Parameter         | V <sub>CC</sub> *<br>(V) | 74AC                                             |            |            | 74AC                                                         |            | Unit |
|------------------|-------------------|--------------------------|--------------------------------------------------|------------|------------|--------------------------------------------------------------|------------|------|
|                  |                   |                          | T <sub>A</sub> = +25°C<br>C <sub>L</sub> = 50 pF |            |            | T <sub>A</sub> = -40°C<br>to +85°C<br>C <sub>L</sub> = 50 pF |            |      |
|                  |                   |                          | Min                                              | Typ        | Max        | Min                                                          | Max        |      |
| t <sub>PLH</sub> | Propagation Delay | 3.3<br>5.0               | 1.5<br>1.5                                       | 4.5<br>4.0 | 9.0<br>7.0 | 1.0<br>1.0                                                   | 10<br>7.5  | ns   |
| t <sub>PHL</sub> | Propagation Delay | 3.3<br>5.0               | 1.5<br>1.5                                       | 4.5<br>3.5 | 8.5<br>6.5 | 1.0<br>1.0                                                   | 9.5<br>7.0 | ns   |

\*Voltage Range 3.3 V is 3.3 V ±0.3 V.

Voltage Range 5.0 V is 5.0 V ±0.5 V.

# MC74AC04, MC74ACT04

## DC CHARACTERISTICS

| Symbol            | Parameter                              | V <sub>CC</sub><br>(V) | 74ACT                  |                   | 74ACT                                 |    | Unit                                                                                      | Conditions |
|-------------------|----------------------------------------|------------------------|------------------------|-------------------|---------------------------------------|----|-------------------------------------------------------------------------------------------|------------|
|                   |                                        |                        | T <sub>A</sub> = +25°C |                   | T <sub>A</sub> =<br>–40°C to<br>+85°C |    |                                                                                           |            |
|                   |                                        |                        | Typ                    | Guaranteed Limits |                                       |    |                                                                                           |            |
| V <sub>IH</sub>   | 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 <sub>OUT</sub> = 0.1 V<br>or V <sub>CC</sub> – 0.1 V                                    |            |
| V <sub>IL</sub>   | 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 <sub>OUT</sub> = 0.1 V<br>or V <sub>CC</sub> – 0.1 V                                    |            |
| V <sub>OH</sub>   | 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 <sub>OUT</sub> = –50 μA                                                                 |            |
|                   |                                        | 4.5<br>5.5             | –<br>–                 | 3.86<br>4.86      | 3.76<br>4.76                          | V  | *V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>–24 mA<br>I <sub>OH</sub> –24 mA |            |
| V <sub>OL</sub>   | 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 <sub>OUT</sub> = 50 μA                                                                  |            |
|                   |                                        | 4.5<br>5.5             | –<br>–                 | 0.36<br>0.36      | 0.44<br>0.44                          | V  | *V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>24 mA<br>I <sub>OL</sub> 24 mA   |            |
| I <sub>IN</sub>   | Maximum Input Leakage Current          | 5.5                    | –                      | ±0.1              | ±1.0                                  | μA | V <sub>I</sub> = V <sub>CC</sub> , GND                                                    |            |
| ΔI <sub>CCT</sub> | Additional Max. I <sub>CC</sub> /Input | 5.5                    | 0.6                    | –                 | 1.5                                   | mA | V <sub>I</sub> = V <sub>CC</sub> – 2.1 V                                                  |            |
| I <sub>OLD</sub>  | †Minimum Dynamic Output Current        | 5.5                    | –                      | –                 | 75                                    | mA | V <sub>OLD</sub> = 1.65 V Max                                                             |            |
| I <sub>OHD</sub>  |                                        | 5.5                    | –                      | –                 | –75                                   | mA | V <sub>OHD</sub> = 3.85 V Min                                                             |            |
| I <sub>CC</sub>   | Maximum Quiescent Supply Current       | 5.5                    | –                      | 4.0               | 40                                    | μA | V <sub>IN</sub> = V <sub>CC</sub> 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 <sub>CC</sub> *<br>(V) | 74ACT                                            |     |     | 74ACT                                                        |     | Unit |
|------------------|-------------------|--------------------------|--------------------------------------------------|-----|-----|--------------------------------------------------------------|-----|------|
|                  |                   |                          | T <sub>A</sub> = +25°C<br>C <sub>L</sub> = 50 pF |     |     | T <sub>A</sub> = -40°C<br>to +85°C<br>C <sub>L</sub> = 50 pF |     |      |
|                  |                   |                          | Min                                              | Typ | Max | Min                                                          | Max |      |
| t <sub>PLH</sub> | Propagation Delay | 5.0                      | 1.5                                              |     | 8.5 | 1.0                                                          | 9.0 | ns   |
| t <sub>PHL</sub> | Propagation Delay | 5.0                      | 1.5                                              |     | 8.0 | 1.0                                                          | 8.5 | ns   |

\*Voltage Range 5.0 V is 5.0 V ±0.5 V.

## CAPACITANCE

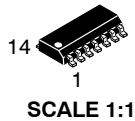
| Symbol          | Parameter                     | Value<br>Typ | Unit | Test Conditions         |
|-----------------|-------------------------------|--------------|------|-------------------------|
| C <sub>IN</sub> | Input Capacitance             | 4.5          | pF   | V <sub>CC</sub> = 5.0 V |
| C <sub>PD</sub> | Power Dissipation Capacitance | 30           | pF   | V <sub>CC</sub> = 5.0 V |

## MC74AC04, MC74ACT04

### DEVICE ORDERING INFORMATION

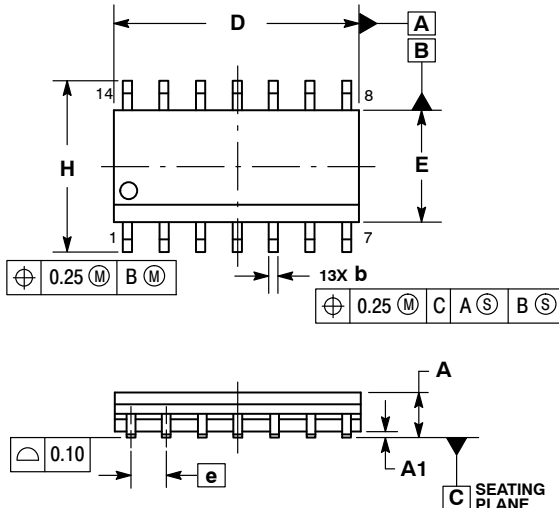
| Device         | Marking   | Package               | Shipping <sup>†</sup> |
|----------------|-----------|-----------------------|-----------------------|
| MC74AC04DG     | AC04G     | SOIC-14<br>(Pb-Free)  | 55 Units / Rail       |
| MC74AC04DR2G   | AC04G     | SOIC-14<br>(Pb-Free)  | 2500 / Tape & Reel    |
| MC74ACT04DR2G  | ACT04G    | SOIC-14<br>(Pb-Free)  | 2500 / Tape & Reel    |
| MC74AC04DTR2G  | AC<br>04  | TSSOP-14<br>(Pb-Free) | 2500 / Tape & Reel    |
| MC74ACT04DTR2G | ACT<br>04 | TSSOP-14<br>(Pb-Free) | 2500 / Tape & Reel    |

<sup>†</sup>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.



SOIC-14 NB  
CASE 751A-03  
ISSUE L

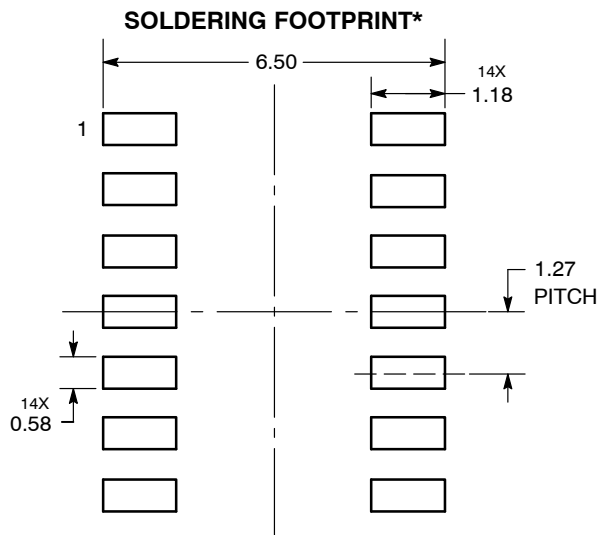
DATE 03 FEB 2016



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.

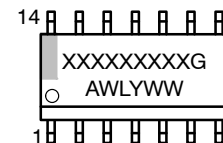
| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 1.35        | 1.75 | 0.054     | 0.068 |
| A1  | 0.10        | 0.25 | 0.004     | 0.010 |
| A3  | 0.19        | 0.25 | 0.008     | 0.010 |
| b   | 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°    |



DIMENSIONS: MILLIMETERS

\*For additional information on our Pb-Free strategy and soldering details, please download the **onsemi** 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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| DESCRIPTION:     | SOIC-14 NB  | PAGE 1 OF 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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