

# MC74LCX125

## Low-Voltage CMOS Quad Buffer

### With 5 V-Tolerant Inputs and Outputs (3-State, Non-Inverting)

The MC74LCX125 is a high performance, non-inverting quad buffer operating from a 2.3 to 3.6 V supply. High impedance TTL compatible inputs significantly reduce current loading to input drivers while TTL compatible outputs offer improved switching noise performance. A  $V_I$  specification of 5.5 V allows MC74LCX125 inputs to be safely driven from 5.0 V devices. The MC74LCX125 is suitable for memory address driving and all TTL level bus oriented transceiver applications.

Current drive capability is 24 mA at the outputs. The Output Enable ( $\overline{OE_n}$ ) inputs, when HIGH, disable the outputs by placing them in a HIGH Z condition.

#### Features

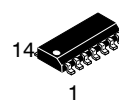
- Designed for 2.3 to 3.6 V  $V_{CC}$  Operation
- 5.0 V Tolerant – Interface Capability With 5.0 V TTL Logic
- Supports Live Insertion and Withdrawal
- $I_{OFF}$  Specification Guarantees High Impedance When  $V_{CC} = 0$  V
- LVTTL Compatible
- LVCMOS Compatible
- 24 mA Balanced Output Sink and Source Capability
- Near Zero Static Supply Current in all Three Logic States (10  $\mu$ A)  
Substantially Reduces System Power Requirements
- Latchup Performance Exceeds 500 mA
- ESD Performance: Human Body Model >2000 V  
Machine Model >200 V
- NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant



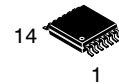
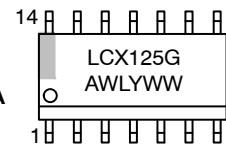
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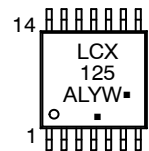
#### MARKING DIAGRAMS



SOIC-14  
D SUFFIX  
CASE 751A



TSSOP-14  
DT SUFFIX  
CASE 948G



A = Assembly Location  
L, WL = Wafer Lot  
Y, YY = Year  
W, WW = 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 4 of this data sheet.

# MC74LCX125

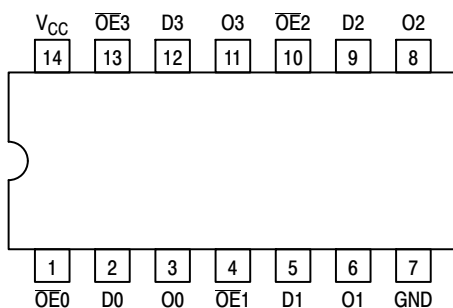


Figure 1. Pinout: 14-Lead (Top View)

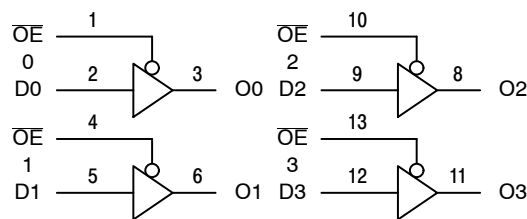


Figure 2. Logic Diagram

## PIN NAMES

| Pins             | Function             |
|------------------|----------------------|
| $\overline{OEn}$ | Output Enable Inputs |
| $Dn$             | Data Inputs          |
| $On$             | 3-State Outputs      |

## TRUTH TABLE

| INPUTS           |      | OUTPUTS |
|------------------|------|---------|
| $\overline{OEn}$ | $Dn$ | $On$    |
| L                | L    | L       |
| L                | H    | H       |
| H                | X    | Z       |

H = High Voltage Level  
 L = Low Voltage Level  
 Z = High Impedance State  
 X = High or Low Voltage Level and Transitions Are Acceptable; for  $I_{CC}$  reasons, DO NOT FLOAT Inputs

## MAXIMUM RATINGS

| Symbol    | Parameter                        | Value                             | Condition                             | Units       |
|-----------|----------------------------------|-----------------------------------|---------------------------------------|-------------|
| $V_{CC}$  | DC Supply Voltage                | -0.5 to +7.0                      |                                       | V           |
| $V_I$     | DC Input Voltage                 | $-0.5 \leq V_I \leq +7.0$         |                                       | V           |
| $V_O$     | DC Output Voltage                | $-0.5 \leq V_O \leq +7.0$         | Output in 3-State                     | V           |
|           |                                  | $-0.5 \leq V_O \leq V_{CC} + 0.5$ | Output in HIGH or LOW State. (Note 1) | V           |
| $I_{IK}$  | DC Input Diode Current           | -50                               | $V_I < GND$                           | mA          |
| $I_{OK}$  | DC Output Diode Current          | -50                               | $V_O < GND$                           | mA          |
|           |                                  | +50                               | $V_O > V_{CC}$                        | mA          |
| $I_O$     | DC Output Source/Sink Current    | $\pm 50$                          |                                       | mA          |
| $I_{CC}$  | DC Supply Current Per Supply Pin | $\pm 100$                         |                                       | mA          |
| $I_{GND}$ | DC Ground Current Per Ground Pin | $\pm 100$                         |                                       | mA          |
| $T_{STG}$ | Storage Temperature Range        | -65 to +150                       |                                       | $^{\circ}C$ |
| MSL       | Moisture Sensitivity             |                                   | Level 1                               |             |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

1.  $I_O$  absolute maximum rating must be observed.

# MC74LCX125

## RECOMMENDED OPERATING CONDITIONS

| Symbol              | Parameter   | Min        | Typ                  | Max              | Units |
|---------------------|---|------------|----------------------|------------------|-------|
| $V_{CC}$            | Supply Voltage<br>Operating<br>Data Retention Only  | 2.0<br>1.5 | 2.5, 3.3<br>2.5, 3.3 | 3.6<br>3.6       | V     |
| $V_I$               | Input Voltage   | 0          |                      | 5.5              | V     |
| $V_O$               | Output Voltage<br>HIGH or LOW State<br>3-State  | 0<br>0     |                      | $V_{CC}$<br>5.5  | V     |
| $I_{OH}$            | HIGH Level Output Current<br>$V_{CC} = 3.0\text{ V} - 3.6\text{ V}$<br>$V_{CC} = 2.7\text{ V} - 3.0\text{ V}$<br>$V_{CC} = 2.3\text{ V} - 2.7\text{ V}$ |            |                      | -24<br>-12<br>-8 | mA    |
| $I_{OL}$            | LOW Level Output Current<br>$V_{CC} = 3.0\text{ V} - 3.6\text{ V}$<br>$V_{CC} = 2.7\text{ V} - 3.0\text{ V}$<br>$V_{CC} = 2.3\text{ V} - 2.7\text{ V}$  |            |                      | +24<br>+12<br>+8 | mA    |
| $T_A$               | Operating Free-Air Temperature  | -40        |                      | +85              | °C    |
| $\Delta t/\Delta V$ | Input Transition Rise or Fall Rate, $V_{IN}$ from 0.8 V to 2.0 V,<br>$V_{CC} = 3.0\text{ V}$  | 0          |                      | 10               | ns/V  |

## DC ELECTRICAL CHARACTERISTICS

| Symbol          | Characteristic                    | Condition  | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ |         | Units         |
|-----------------|-----------------------------------|--|---|---------|---------------|
|                 |                                   |  | Min   | Max     |               |
| $V_{IH}$        | HIGH Level Input Voltage (Note 2) | $2.3\text{ V} \leq V_{CC} \leq 2.7\text{ V}$   | 1.7   |         | V             |
|                 |                                   | $2.7\text{ V} \leq V_{CC} \leq 3.6\text{ V}$   | 2.0   |         |               |
| $V_{IL}$        | LOW Level Input Voltage (Note 2)  | $2.3\text{ V} \leq V_{CC} \leq 2.7\text{ V}$   |   | 0.7     | V             |
|                 |                                   | $2.7\text{ V} \leq V_{CC} \leq 3.6\text{ V}$   |   | 0.8     |               |
| $V_{OH}$        | HIGH Level Output Voltage         | $2.3\text{ V} \leq V_{CC} \leq 3.6\text{ V}; I_{OL} = 100\ \mu\text{A}$                              | $V_{CC} - 0.2$                                  |         | V             |
|                 |                                   | $V_{CC} = 2.3\text{ V}; I_{OH} = -8\text{ mA}$   | 1.8   |         |               |
|                 |                                   | $V_{CC} = 2.7\text{ V}; I_{OH} = -12\text{ mA}$  | 2.2   |         |               |
|                 |                                   | $V_{CC} = 3.0\text{ V}; I_{OH} = -18\text{ mA}$  | 2.4   |         |               |
|                 |                                   | $V_{CC} = 3.0\text{ V}; I_{OH} = -24\text{ mA}$  | 2.2   |         |               |
| $V_{OL}$        | LOW Level Output Voltage          | $2.3\text{ V} \leq V_{CC} \leq 3.6\text{ V}; I_{OL} = 100\ \mu\text{A}$                              |   | 0.2     | V             |
|                 |                                   | $V_{CC} = 2.3\text{ V}; I_{OL} = 8\text{ mA}$  |   | 0.6     |               |
|                 |                                   | $V_{CC} = 2.7\text{ V}; I_{OL} = 12\text{ mA}$   |   | 0.4     |               |
|                 |                                   | $V_{CC} = 3.0\text{ V}; I_{OL} = 16\text{ mA}$   |   | 0.4     |               |
|                 |                                   | $V_{CC} = 3.0\text{ V}; I_{OL} = 24\text{ mA}$   |   | 0.55    |               |
| $I_{OZ}$        | 3-State Output Current            | $V_{CC} = 3.6\text{ V}, V_{IN} = V_{IH}\text{ or } V_{IL},$<br>$V_{OUT} = 0\text{ to } 5.5\text{ V}$ |   | $\pm 5$ | $\mu\text{A}$ |
| $I_{OFF}$       | Power Off Leakage Current         | $V_{CC} = 0, V_{IN} = 5.5\text{ V or } V_{OUT} = 5.5\text{ V}$                                       |   | 10      | $\mu\text{A}$ |
| $I_{IN}$        | Input Leakage Current             | $V_{CC} = 3.6\text{ V}, V_{IN} = 5.5\text{ V or GND}$  |   | $\pm 5$ | $\mu\text{A}$ |
| $I_{CC}$        | Quiescent Supply Current          | $V_{CC} = 3.6\text{ V}, V_{IN} = 5.5\text{ V or GND}$  |   | 10      | $\mu\text{A}$ |
| $\Delta I_{CC}$ | Increase in $I_{CC}$ per Input    | $2.3 \leq V_{CC} \leq 3.6\text{ V}; V_{IH} = V_{CC} - 0.6\text{ V}$                                  |   | 500     | $\mu\text{A}$ |

2. These values of  $V_I$  are used to test DC electrical characteristics only.

# MC74LCX125

## AC CHARACTERISTICS ( $t_R = t_F = 2.5 \text{ ns}$ ; $R_L = 500 \Omega$ )

| Symbol                   | Parameter                                      | Waveform | Limits  |            |                          |            |  |            | Units |
|--------------------------|--|----------|---|------------|--------------------------|------------|--|------------|-------|
|                          |  |          | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ |            |                          |            |  |            |       |
|                          |  |          | $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$      |            | $V_{CC} = 2.7 \text{ V}$ |            | $V_{CC} = 2.5 \text{ V} \pm 0.2 \text{ V}$ |            |       |
|                          |  |          | $C_L = 50 \text{ pF}$                           |            | $C_L = 50 \text{ pF}$    |            | $C_L = 30 \text{ pF}$                      |            |       |
|                          |  |          | Min   | Max        | Min                      | Max        | Min  | Max        |       |
| $t_{PLH}$<br>$t_{PHL}$   | Propagation Delay Time<br>Input to Output      | 1        | 1.5<br>1.5                                      | 6.0<br>6.0 | 1.5<br>1.5               | 6.5<br>6.5 | 1.5<br>1.5                                 | 7.2<br>7.2 | ns    |
| $t_{PZH}$<br>$t_{PZL}$   | Output Enable Time to<br>High and Low Level    | 2        | 1.5<br>1.5                                      | 7.0<br>7.0 | 1.5<br>1.5               | 8.0<br>8.0 | 1.5<br>1.5                                 | 9.1<br>9.1 | ns    |
| $t_{PHZ}$<br>$t_{PLZ}$   | Output Disable Time From<br>High and Low Level | 2        | 1.5<br>1.5                                      | 6.0<br>6.0 | 1.5<br>1.5               | 7.0<br>7.0 | 1.5<br>1.5                                 | 7.2<br>7.2 | ns    |
| $t_{OSHL}$<br>$t_{OSLH}$ | Output-to-Output Skew<br>(Note 3)              |          |   | 1.0<br>1.0 |                          |            |  |            | ns    |

3. Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH-to-LOW ( $t_{OSHL}$ ) or LOW-to-HIGH ( $t_{OSLH}$ ); parameter guaranteed by design.

## DYNAMIC SWITCHING CHARACTERISTICS

| Symbol    | Characteristic                         | Condition  | $T_A = +25^\circ\text{C}$ |              |     | Units |
|-----------|--|--|---------------------------|--------------|-----|-------|
|           |  |  | Min                       | Typ          | Max |       |
| $V_{OLP}$ | Dynamic LOW Peak Voltage<br>(Note 4)   | $V_{CC} = 3.3 \text{ V}, C_L = 50 \text{ pF}, V_{IH} = 3.3 \text{ V}, V_{IL} = 0 \text{ V}$<br>$V_{CC} = 2.5 \text{ V}, C_L = 30 \text{ pF}, V_{IH} = 2.5 \text{ V}, V_{IL} = 0 \text{ V}$ |                           | 0.8<br>0.6   |     | V     |
| $V_{OLV}$ | Dynamic LOW Valley Voltage<br>(Note 4) | $V_{CC} = 3.3 \text{ V}, C_L = 50 \text{ pF}, V_{IH} = 3.3 \text{ V}, V_{IL} = 0 \text{ V}$<br>$V_{CC} = 2.5 \text{ V}, C_L = 30 \text{ pF}, V_{IH} = 2.5 \text{ V}, V_{IL} = 0 \text{ V}$ |                           | -0.8<br>-0.6 |     | V     |

4. Number of outputs defined as "n". Measured with "n-1" outputs switching from HIGH-to-LOW or LOW-to-HIGH. The remaining output is measured in the LOW state.

## CAPACITIVE CHARACTERISTICS

| Symbol    | Parameter                     | Condition  | Typical | Units |
|-----------|-------------------------------|--|---------|-------|
| $C_{IN}$  | Input Capacitance             | $V_{CC} = 3.3 \text{ V}, V_I = 0 \text{ V or } V_{CC}$         | 7       | pF    |
| $C_{OUT}$ | Output Capacitance            | $V_{CC} = 3.3 \text{ V}, V_I = 0 \text{ V or } V_{CC}$         | 8       | pF    |
| $C_{PD}$  | Power Dissipation Capacitance | 10 MHz, $V_{CC} = 3.3 \text{ V}, V_I = 0 \text{ V or } V_{CC}$ | 25      | pF    |

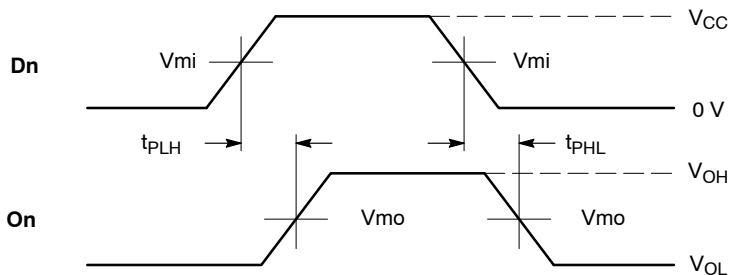
## ORDERING INFORMATION

| Device          | Package                | Shipping <sup>†</sup> |
|-----------------|------------------------|-----------------------|
| MC74LCX125DG    | SOIC-14<br>(Pb-Free)   | 55 Units / Rail       |
| MC74LCX125DR2G  | SOIC-14<br>(Pb-Free)   | 2500 Tape & Reel      |
| MC74LCX125DTG   | TSSOP-14<br>(Pb-Free)  | 96 Units / Rail       |
| MC74LCX125DTR2G | TSSOP-14<br>(Pb-Free)  | 2500 Tape & Reel      |
| NLVLCX125DTR2G  | 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.

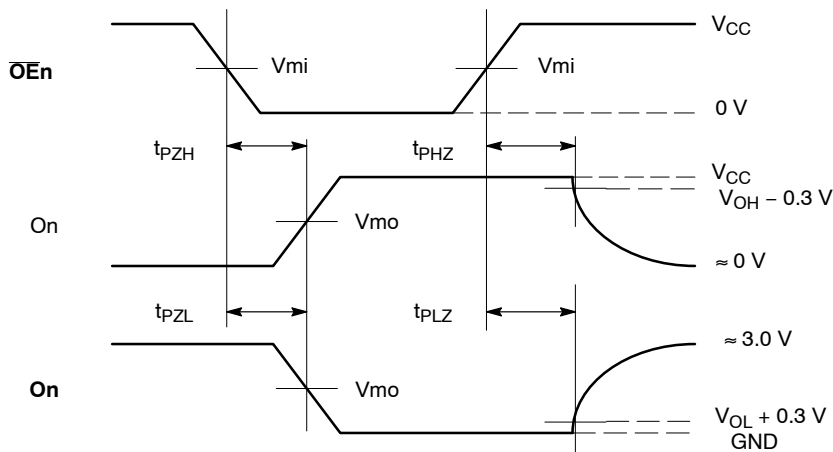
\*NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified.

# MC74LCX125



**WAVEFORM 1 - PROPAGATION DELAYS**

$t_R = t_F = 2.5 \text{ ns}$ , 10% to 90%;  $f = 1 \text{ MHz}$ ;  $t_W = 500 \text{ ns}$

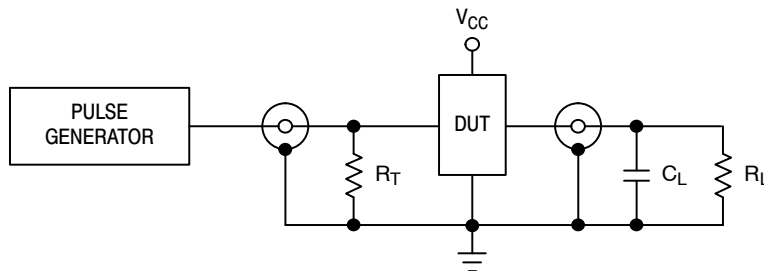


**WAVEFORM 2 - OUTPUT ENABLE AND DISABLE TIMES**

$t_R = t_F = 2.5 \text{ ns}$ , 10% to 90%;  $f = 1 \text{ MHz}$ ;  $t_W = 500 \text{ ns}$

| Symbol | $V_{CC}$                          |                 |                                   |
|--------|-----------------------------------|-----------------|-----------------------------------|
|        | $3.3 \text{ V} \pm 0.3 \text{ V}$ | $2.7 \text{ V}$ | $2.5 \text{ V} \pm 0.2 \text{ V}$ |
| Vmi    | 1.5 V                             | 1.5 V           | $V_{CC}/2$                        |
| Vmo    | 1.5 V                             | 1.5 V           | $V_{CC}/2$                        |

**Figure 3. AC Waveforms**



$C_L = 50 \text{ pF}$  at  $V_{CC} = 3.3 \pm 0.3 \text{ V}$  or equivalent (includes jig and probe capacitance)  
 $C_L = 30 \text{ pF}$  at  $V_{CC} = 2.5 \pm 0.2 \text{ V}$  or equivalent (includes jig and probe capacitance)  
 $R_L = R_1 = 500 \Omega$  or equivalent  
 $R_T = Z_{OUT}$  of pulse generator (typically  $50 \Omega$ )

**Figure 4. Test Circuit**

# 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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