

Low-Voltage CMOS 16-Bit Buffer

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

MC74LCX16244

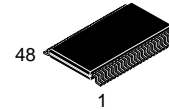
The MC74LCX16244 is a high performance, non-inverting 16-bit buffer operating from a 2.3 to 3.6 V supply. The device is nibble controlled. Each nibble has separate Output Enable inputs which can be tied together for full 16-bit operation. High impedance TTL compatible inputs significantly reduce current loading to input drivers while TTL compatible outputs offer improved switching noise performance. A V_I specification of 5.5 V allows MC74LCX16244 inputs to be safely driven from 5.0 V devices. The MC74LCX16244 is suitable for memory address driving and all TTL level bus oriented transceiver applications.

The 4.5 ns maximum propagation delays support high performance 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.

The MC74LCX16244 contains sixteen non-inverting buffers with 3-state 5.0 V-tolerant outputs. The device is nibble controlled with each nibble functioning identically, but independently. The control pins may be tied together to obtain full 16-bit operation. The 3-state outputs are controlled by an Output Enable ($\overline{OE_n}$) input for each nibble. When $\overline{OE_n}$ is LOW, the outputs are on. When $\overline{OE_n}$ is HIGH, the outputs are in the high impedance state.

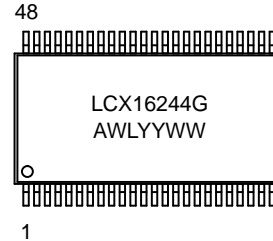
Features

- Designed for 2.3 V to 3.6 V V_{CC} Operation
- 4.5 ns Maximum t_{pd}
- 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
- LVTTTL Compatible
- LVCMOS Compatible
- 24 mA Balanced Output Sink and Source Capability
- Near Zero Static Supply Current in All Three Logic States (20 μ A)
Substantially Reduces System Power Requirements
- Latchup Performance Exceeds 500 mA
- ESD Performance:
 - ◆ Human Body Model >2000 V
 - ◆ Machine Model >200 V
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant



TSSOP-48
DT SUFFIX
CASE 1201

MARKING DIAGRAM



- A = Assembly Location
- WL = Wafer Lot
- YY = Year
- WW = Work Week
- G = Pb-Free Package

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 3 of this data sheet.

NOTE: Some of the devices on this data sheet have been **DISCONTINUED**. Please refer to the table on page 3.

MC74LCX16244

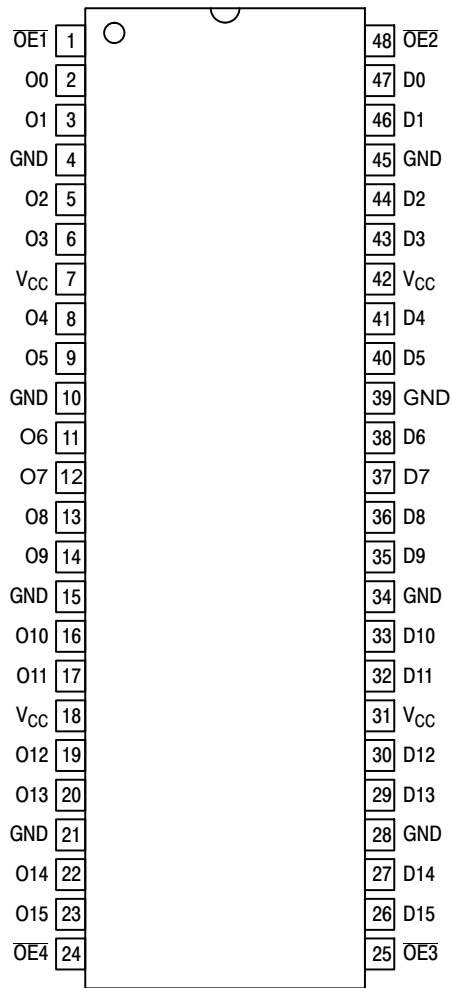


Figure 1. Pinout: 48-Lead (Top View)

Table 1. PIN NAMES

| Pins | Function |
|------------------|----------------------|
| $\overline{OE}n$ | Output Enable Inputs |
| D0–D15 | Inputs |
| O0–O15 | Outputs |

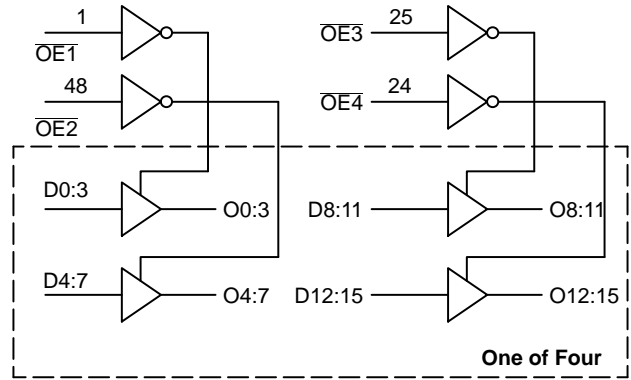


Figure 2. Logic Diagram

TRUTH TABLE

| $\overline{OE}1$ | D0:3 | O0:3 | $\overline{OE}2$ | D4:7 | O4:7 | $\overline{OE}3$ | D8:11 | O8:11 | $\overline{OE}4$ | D12:15 | O12:15 |
|------------------|------|------|------------------|------|------|------------------|-------|-------|------------------|--------|--------|
| L | L | L | L | L | L | L | L | L | L | L | L |
| L | H | H | L | H | H | L | H | H | L | H | H |
| H | X | Z | H | X | Z | H | X | Z | 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.

MC74LCX16244

ORDERING INFORMATION

| Device | Package | Shipping [†] |
|------------------|-----------------------|-----------------------|
| M74LCX16244DTR2G | TSSOP-48 (Pb-Free) | 2500 / Tape & Reel |

DISCONTINUED (Note 1)

| | | |
|-----------------|-----------------------|-----------------|
| MC74LCX16244DTG | TSSOP-48 (Pb-Free) | 39 Units / Rail |
|-----------------|-----------------------|-----------------|

[†]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.

- DISCONTINUED:** This device is not recommended for new design. Please contact your **onsemi** representative for information. The most current information on this device may be available on www.onsemi.com.

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 ≤ V _I ≤ +7.0 | | V |
| V _O | DC Output Voltage | -0.5 ≤ V _O ≤ +7.0 | Output in 3-State | V |
| | | -0.5 ≤ V _O ≤ 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 | ±50 | | mA |
| I _{CC} | DC Supply Current Per Supply Pin | ±100 | | mA |
| I _{GND} | DC Ground Current Per Ground Pin | ±100 | | mA |
| T _{STG} | Storage Temperature Range | -65 to +150 | | °C |
| MSL | Moisture Sensitivity | | Level 1 | |

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.

- I_O absolute maximum rating must be observed.

RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Min | Typ | Max | Units |
|-----------------|--|-----|----------|-----------------|-------|
| V _{CC} | Supply Voltage Operating Data Retention Only | 2.0 | 2.5, 3.3 | 3.6 | V |
| | | 1.5 | 2.5, 3.3 | 3.6 | |
| V _I | Input Voltage | 0 | | 5.5 | V |
| V _O | Output Voltage (HIGH or LOW State) (3-State) | 0 | | V _{CC} | V |
| | | 0 | | 5.5 | |
| I _{OH} | HIGH Level Output Current V _{CC} = 3.0 V – 3.6 V V _{CC} = 2.7 V – 3.0 V V _{CC} = 2.3 V – 2.7 V | | | -24 | mA |
| | | | | -12 | |
| | | | | -8 | |
| I _{OL} | LOW Level Output Current V _{CC} = 3.0 V – 3.6 V V _{CC} = 2.7 V – 3.0 V V _{CC} = 2.3 V – 2.7 V | | | +24 | mA |
| | | | | +12 | |
| | | | | +8 | |
| T _A | Operating Free-Air Temperature | -40 | | +85 | °C |
| Δt/ΔV | Input Transition Rise or Fall Rate, V _{IN} from 0.8 V to 2.0 V, V _{CC} = 3.0 V | 0 | | 10 | ns/V |

MC74LCX16244

DC ELECTRICAL CHARACTERISTICS

| Symbol | Characteristic | Condition | T _A = -40°C to +85°C | | Units |
|------------------|---------------------------------------|--|---------------------------------|------|-------|
| | | | Min | Max | |
| V _{IH} | HIGH Level Input Voltage (Note 2) | 2.3 V ≤ V _{CC} ≤ 2.7 V | 1.7 | | V |
| | | 2.7 V ≤ V _{CC} ≤ 3.6 V | 2.0 | | |
| V _{IL} | LOW Level Input Voltage (Note 2) | 2.3 V ≤ V _{CC} ≤ 2.7 V | | 0.7 | V |
| | | 2.7 V ≤ V _{CC} ≤ 3.6 V | | 0.8 | |
| V _{OH} | HIGH Level Output Voltage | 2.3 V ≤ V _{CC} ≤ 3.6 V; I _{OL} = 100 μA | V _{CC} - 0.2 | | V |
| | | V _{CC} = 2.3 V; I _{OH} = -8 mA | 1.8 | | |
| | | V _{CC} = 2.7 V; I _{OH} = -12 mA | 2.2 | | |
| | | V _{CC} = 3.0 V; I _{OH} = -18 mA | 2.4 | | |
| | | V _{CC} = 3.0 V; I _{OH} = -24 mA | 2.2 | | |
| V _{OL} | LOW Level Output Voltage | 2.3 V ≤ V _{CC} ≤ 3.6 V; I _{OL} = 100 μA | | 0.2 | V |
| | | V _{CC} = 2.3 V; I _{OL} = 8 mA | | 0.6 | |
| | | V _{CC} = 2.7 V; I _{OL} = 12 mA | | 0.4 | |
| | | V _{CC} = 3.0 V; I _{OL} = 16 mA | | 0.4 | |
| | | V _{CC} = 3.0 V; I _{OL} = 24 mA | | 0.55 | |
| I _{OZ} | 3-State Output Current | V _{CC} = 3.6 V, V _{IN} = V _{IH} or V _{IL} , V _{OUT} = 0 to 5.5 V | | ±5 | μA |
| I _{OFF} | Power Off Leakage Current | V _{CC} = 0, V _{IN} = 5.5 V or V _{OUT} = 5.5 V | | 10 | μA |
| I _{IN} | Input Leakage Current | V _{CC} = 3.6 V, V _{IN} = 5.5 V or GND | | ±5 | μA |
| I _{CC} | Quiescent Supply Current | V _{CC} = 3.6 V, V _{IN} = 5.5 V or GND | | 10 | μA |
| ΔI _{CC} | Increase in I _{CC} per Input | 2.3 ≤ V _{CC} ≤ 3.6 V; V _{IH} = V _{CC} - 0.6 V | | 500 | μA |

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

AC CHARACTERISTICS (t_R = t_F = 2.5 ns; R_L = 500 Ω)

| Symbol | Parameter | Waveform | T _A = -40°C to +85°C | | | | | | Units |
|--|--|----------|---|------------|---|------------|---|------------|-------|
| | | | V _{CC} = 3.3 V ± 0.3 V C _L = 50 pF | | V _{CC} = 2.7 V C _L = 50 pF | | V _{CC} = 2.5 V ± 0.2 V C _L = 30 pF | | |
| | | | Min | Max | Min | Max | Min | Max | |
| t _{PLH} t _{PHL} | Propagation Delay Input to Output | 1 | 1.5 1.5 | 4.5 4.5 | 1.5 1.5 | 5.2 5.2 | 1.5 1.5 | 5.4 5.4 | ns |
| t _{PZH} t _{PZL} | Output Enable Time to High and Low Level | 2 | 1.5 1.5 | 5.5 5.5 | 1.5 1.5 | 6.3 6.3 | 1.5 1.5 | 7.2 7.2 | ns |
| t _{PHZ} t _{PLZ} | Output Disable Time From High and Low Level | 2 | 1.5 1.5 | 5.4 5.4 | 1.5 1.5 | 5.7 5.7 | 1.5 1.5 | 6.5 6.5 | ns |
| t _{OSHL} t _{OSLH} | Output-to-Output Skew (Note 3) | | | 1.0 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.

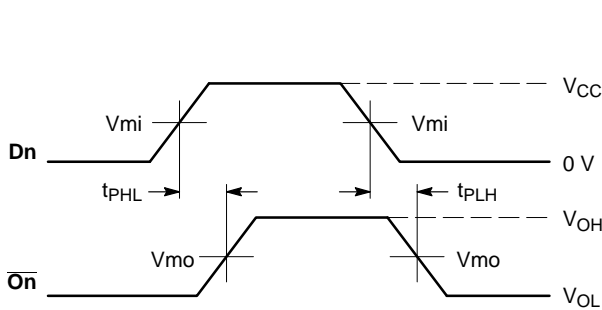
DYNAMIC SWITCHING CHARACTERISTICS

| Symbol | Characteristic | Condition | T _A = +25°C | | | Units |
|------------------|-------------------------------------|--|------------------------|--------------|-----|-------|
| | | | Min | Typ | Max | |
| V _{OLP} | Dynamic LOW Peak Voltage (Note 4) | V _{CC} = 3.3 V, C _L = 50 pF, V _{IH} = 3.3 V, V _{IL} = 0 V V _{CC} = 2.5 V, C _L = 30 pF, V _{IH} = 2.5 V, V _{IL} = 0 V | | 0.8 0.6 | | V |
| V _{OLV} | Dynamic LOW Valley Voltage (Note 4) | V _{CC} = 3.3 V, C _L = 50 pF, V _{IH} = 3.3 V, V _{IL} = 0 V V _{CC} = 2.5 V, C _L = 30 pF, V _{IH} = 2.5 V, V _{IL} = 0 V | | -0.8 -0.6 | | V |

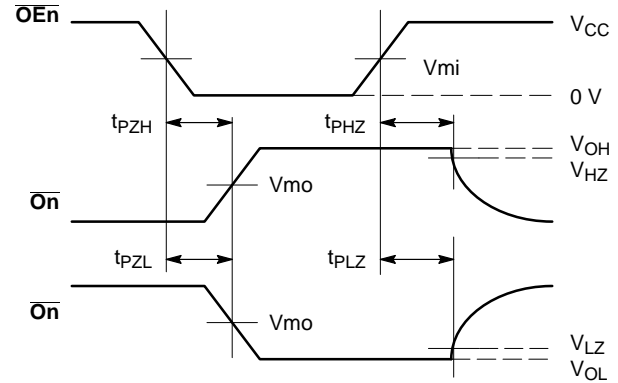
4. Number of outputs defined as “n”. Measured with “n-1” outputs switching from HIGH-to-LOW or LOW-to-HIGH. The remaining output is measured in the LOW state.

CAPACITIVE CHARACTERISTICS

| Symbol | Parameter | Condition | Typical | Units |
|------------------|-------------------------------|--|---------|-------|
| C _{IN} | Input Capacitance | V _{CC} = 3.3 V, V _I = 0 V or V _{CC} | 7 | pF |
| C _{OUT} | Output Capacitance | V _{CC} = 3.3 V, V _I = 0 V or V _{CC} | 8 | pF |
| C _{PD} | Power Dissipation Capacitance | 10 MHz, V _{CC} = 3.3 V, V _I = 0 V or V _{CC} | 20 | pF |



WAVEFORM 1 – PROPAGATION DELAYS
 $t_R = t_F = 2.5$ ns, 10% to 90%; $f = 1$ MHz; $t_W = 500$ ns



WAVEFORM 2 – OUTPUT ENABLE AND DISABLE TIMES
 $t_R = t_F = 2.5$ ns, 10% to 90%; $f = 1$ MHz; $t_W = 500$ ns

Figure 3. AC Waveforms

Table 2. AC WAVEFORMS

| Symbol | V _{CC} | | |
|-----------------|-------------------------|-------------------------|--------------------------|
| | 3.3 V ± 0.3 V | 2.7 V | 2.5 V ± 0.2 V |
| V _{mi} | 1.5 V | 1.5 V | V _{CC} / 2 |
| V _{mo} | 1.5 V | 1.5 V | V _{CC} / 2 |
| V _{HZ} | V _{OL} + 0.3 V | V _{OL} + 0.3 V | V _{OL} + 0.15 V |
| V _{LZ} | V _{OH} - 0.3 V | V _{OH} - 0.3 V | V _{OH} - 0.15 V |

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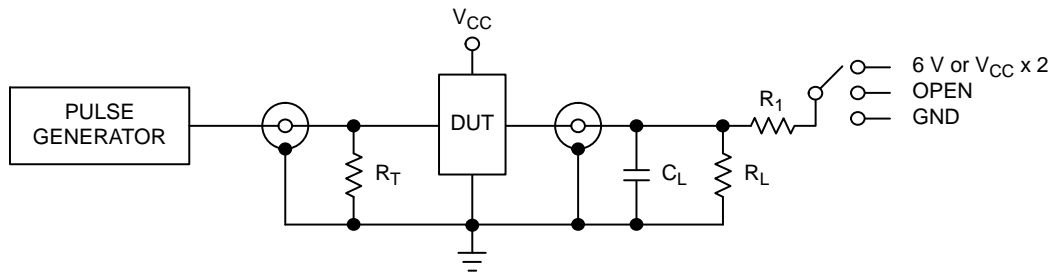


Figure 4. Test Circuit

Table 3. TEST CIRCUIT

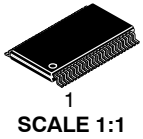
| Test | Switch |
|--|--|
| t_{PLH} , t_{PHL} | Open |
| t_{PZL} , t_{PLZ} | 6 V at $V_{CC} = 3.3 \pm 0.3$ V 6 V at $V_{CC} = 2.5 \pm 0.2$ V |
| Open Collector/Drain t_{PLH} and t_{PHL} | 6 V |
| t_{PZH} , t_{PHZ} | GND |

$C_L = 50$ pF at $V_{CC} = 3.3 \pm 0.3$ V or equivalent (includes jig and probe capacitance)

$C_L = 30$ pF at $V_{CC} = 2.5 \pm 0.2$ V or equivalent (includes jig and probe capacitance)

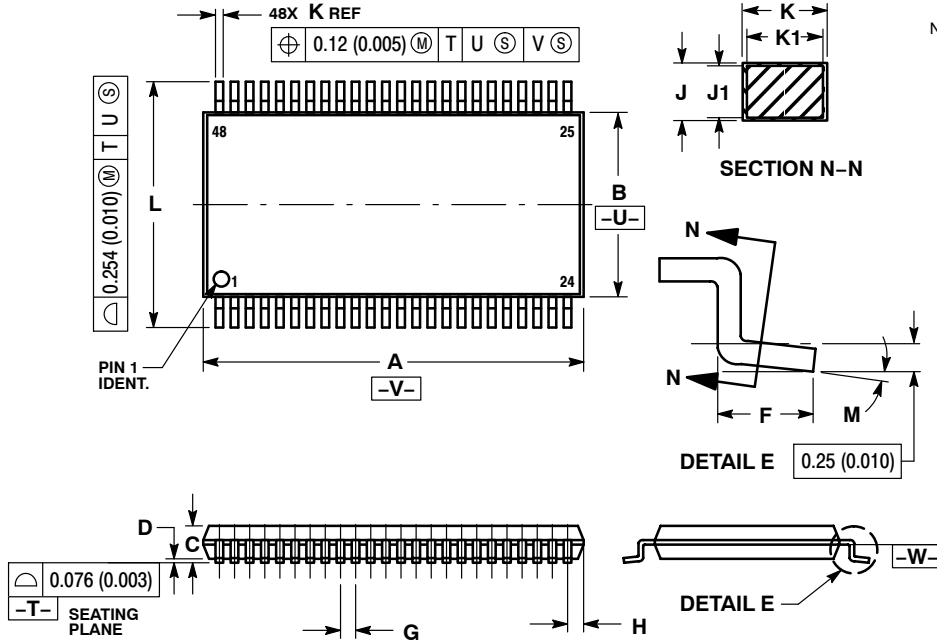
$R_L = R_1 = 500 \Omega$ or equivalent

$R_T = Z_{OUT}$ of pulse generator (typically 50 Ω)



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ISSUE B

DATE 06 JUL 2010

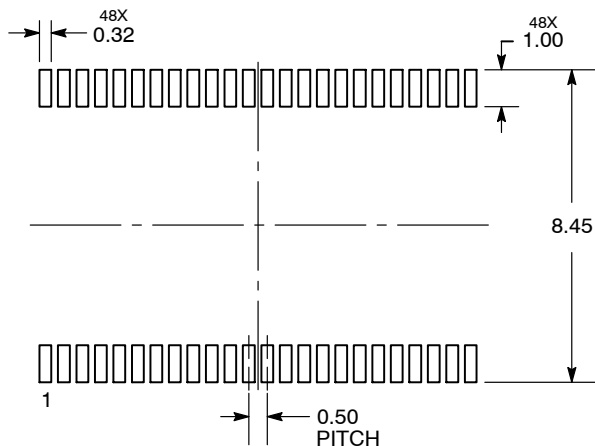


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. 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.
5. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
6. DIMENSIONS A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|-------|------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 12.40 | 12.60 | 0.488 | 0.496 |
| B | 6.00 | 6.20 | 0.236 | 0.244 |
| C | --- | 1.10 | --- | 0.043 |
| D | 0.05 | 0.15 | 0.002 | 0.006 |
| F | 0.50 | 0.75 | 0.020 | 0.030 |
| G | 0.50 BSC | | 0.0197 BSC | |
| H | 0.37 | --- | 0.015 | --- |
| J | 0.09 | 0.20 | 0.004 | 0.008 |
| J1 | 0.09 | 0.16 | 0.004 | 0.006 |
| K | 0.17 | 0.27 | 0.007 | 0.011 |
| K1 | 0.17 | 0.23 | 0.007 | 0.009 |
| L | 7.95 | 8.25 | 0.313 | 0.325 |
| M | 0° | 8° | 0° | 8° |

RECOMMENDED
SOLDERING FOOTPRINT*



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*



- XXXXX = Specific Device Code
- A = Assembly Location
- WL = Wafer Lot
- YY = 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.

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