# MC74LCX16240

# Low-Voltage CMOS 16-Bit Buffer

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

The MC74LCX16240 is a high performance, inverting 16−bit buffer operating from a 2.3 V 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 MC74LCX16240 inputs to be safely driven from 5.0 V devices. The LCX16240 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 ($\overline{OEn}$) inputs, when HIGH, disable the outputs by placing them in a HIGH Z condition.

The MC74LCX16240 contains sixteen 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 ($\overline{OEn}$) input for each nibble. When $\overline{OEn}$ is LOW, the outputs are on. When $\overline{OEn}$ is HIGH, the outputs are in the high impedance state.

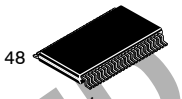
### Features

- 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 μA) 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

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

**ON Semiconductor®**

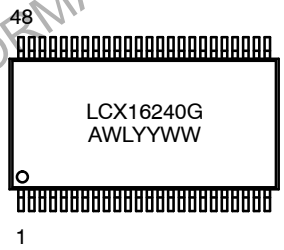
**http://onsemi.com**




**TSSOP−48**
**DT SUFFIX**
**CASE 1201**

DISCONTINUED
THIS DEVICE IS NOT RECOMMENDED FOR NEW DESIGN
PLEASE CONTACT YOUR onsemi
REPRESENTATIVE FOR INFORMATION

**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.

© Semiconductor Components Industries, LLC, 2012

May, 2024 − Rev. 10
Publication Order Number:
MC74LCX16240/D

Downloaded from Arrow.com.

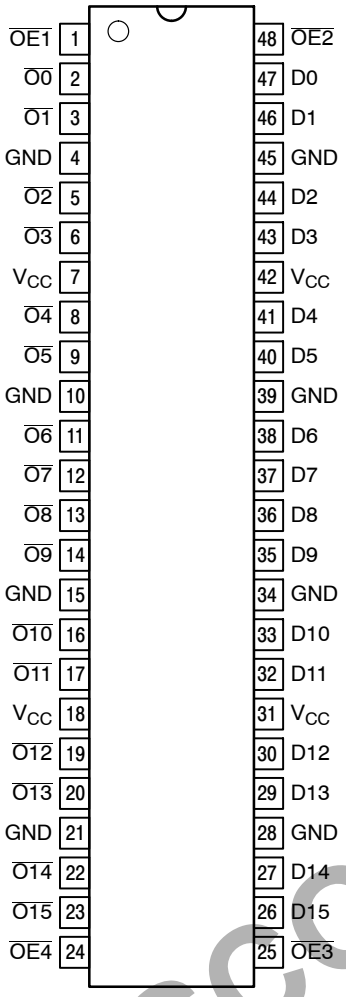



**Figure 1. Pinout: TSSOP−48** (Top View)

**Table 1. PIN NAMES**

| Pins | Function |
|---|---|
| $\overline{OEn}$ | Output Enable Inputs |
| D0−D15 | Inputs |
| $\overline{O0}$−$\overline{O15}$ | Outputs |

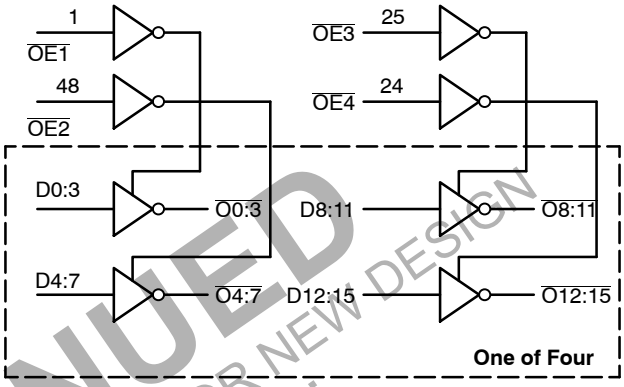



**Figure 2. Logic Diagram**

DISCONTINUED
THIS DEVICE IS NOT RECOMMENDED FOR NEW DESIGN
PLEASE CONTACT YOUR onsemi
REPRESENTATIVE FOR INFORMATION

**TRUTH TABLE**

| OE1 | D0:3 | O0:3 | OE2 | D4:7 | O4:7 | OE3 | D8:11 | O8:11 | OE4 | D12:15 | O12:15 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| L | L | H | L | L | H | L | L | H | L | L | H |
| L | H | L | L | H | L | L | H | L | L | H | L |
| 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



Downloaded from Arrow.com.

## ORDERING INFORMATION

| Device | Package | Shipping† |
|---|---|---|
| M74LCX16240DTR2G | TSSOP−48<br>(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.

## MAXIMUM RATINGS

| Symbol | Parameter | Value | Condition | Unit |
|---|---|---|---|---|
| $V_{CC}$ | DC Supply Voltage | −0.5 to +7.0 | | V |
| $V_I$ | DC Input Voltage | $-0.5 \le V_I \le +7.0$ | | V |
| $V_O$ | DC Output Voltage | $-0.5 \le V_O \le +7.0$ | Output in 3−State | V |
| | | $-0.5 \le V_O \le V_{CC} + 0.5$ | 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 | |

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.

## RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage | 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 | (HIGH or LOW State)<br>(3−State) | 0<br>0 | | $V_{CC}$<br>5.5 | V |
| $I_{OH}$ | HIGH Level Output Current | $V_{CC}$ = 3.0 V − 3.6 V<br>$V_{CC}$ = 2.7 V − 3.0 V<br>$V_{CC}$ = 2.3 V − 2.7 V | | | −24<br>−12<br>−8 | mA |
| $I_{OL}$ | LOW Level Output Current | $V_{CC}$ = 3.0 V − 3.6 V<br>$V_{CC}$ = 2.7 V − 3.0 V<br>$V_{CC}$ = 2.3 V − 2.7 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, $V_{CC}$ = 3.0 V | | 0 | | 10 | ns/V |

DISCONTINUED
THIS DEVICE IS NOT RECOMMENDED FOR NEW DESIGN
PLEASE CONTACT YOUR onsemi
REPRESENTATIVE FOR INFORMATION



Downloaded from Arrow.com.

## DC ELECTRICAL CHARACTERISTICS

| Symbol | Characteristic | Condition | $T_A$ = −40°C to +85°C | | Unit |
|---|---|---|---|---|---|
| | | | 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 |
| $\Delta I_{CC}$ | 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.

DISCONTINUED
THIS DEVICE IS NOT RECOMMENDED FOR NEW DESIGN
PLEASE CONTACT YOUR onsemi
REPRESENTATIVE FOR INFORMATION

## AC CHARACTERISTICS $t_R$ = $t_F$ = 2.5ns; $R_L$ = 500 Ω

| Symbol | Parameter | Waveform | $T_A$ = −40°C to +85°C | | | | | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | $V_{CC}$ = 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 | |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>Input to Output | 1 | 1.5<br>1.5 | 4.5<br>4.5 | 1.5<br>1.5 | 5.3<br>5.3 | 1.5<br>1.5 | 5.4<br>5.4 | ns |
| $t_{PZH}$<br>$t_{PZL}$ | Output Enable Time to<br>High and Low Level | 2 | 1.5<br>1.5 | 5.4<br>5.4 | 1.5<br>1.5 | 6.0<br>6.0 | 1.5<br>1.5 | 7.0<br>7.0 | ns |
| $t_{PHZ}$<br>$t_{PLZ}$ | Output Disable Time From<br>High and Low Level | 2 | 1.5<br>1.5 | 5.3<br>5.3 | 1.5<br>1.5 | 5.4<br>5.4 | 1.5<br>1.5 | 6.4<br>6.4 | 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.



Downloaded from Arrow.com.

## DYNAMIC SWITCHING CHARACTERISTICS

| Symbol | Characteristic | Condition | $T_A$ = +25°C | | | Unit |
|---|---|---|---|---|---|---|
| | | | 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<br>$V_{CC}$ = 2.5 V, $C_L$ = 30 pF, $V_{IH}$ = 2.5 V, $V_{IL}$ = 0 V | | 0.8<br>0.6 | | V<br>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<br>$V_{CC}$ = 2.5 V, $C_L$ = 30 pF, $V_{IH}$ = 2.5 V, $V_{IL}$ = 0 V | | −0.8<br>−0.6 | | V<br>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.

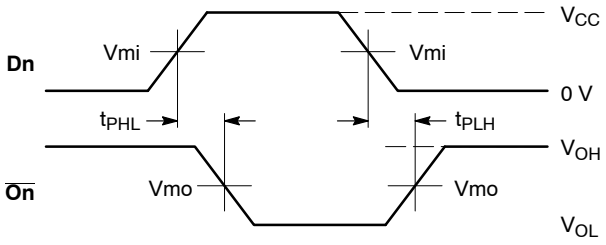
## CAPACITIVE CHARACTERISTICS

| Symbol | Parameter | Condition | Typical | Unit |
|---|---|---|---|---|
| $C_{IN}$ | 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 |

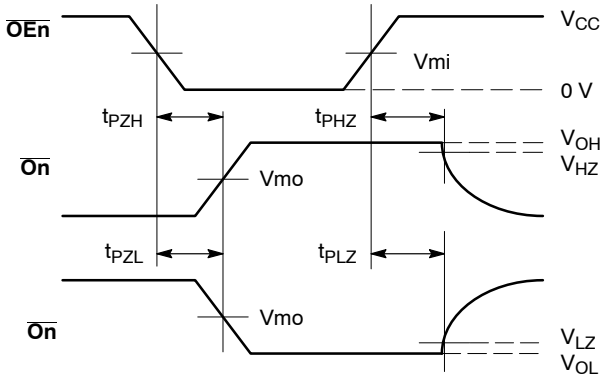
DISCONTINUED
THIS DEVICE IS NOT RECOMMENDED FOR NEW DESIGN
PLEASE CONTACT YOUR onsemi
REPRESENTATIVE FOR INFORMATION



Downloaded from Arrow.com.




**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**

DISCONTINUED
THIS DEVICE IS NOT RECOMMENDED FOR NEW DESIGN
PLEASE CONTACT YOUR onsemi
REPRESENTATIVE FOR INFORMATION

**Table 2. AC WAVEFORMS**

| Symbol | $V_{CC}$ | | |
|---|---|---|---|
| | **3.3 V ± 0.3 V** | **2.7 V** | **2.5 V ± 0.2 V** |
| Vmi | 1.5 V | 1.5 V | $V_{CC}$ / 2 |
| Vmo | 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 | $V_{OH}$ – 015 V |

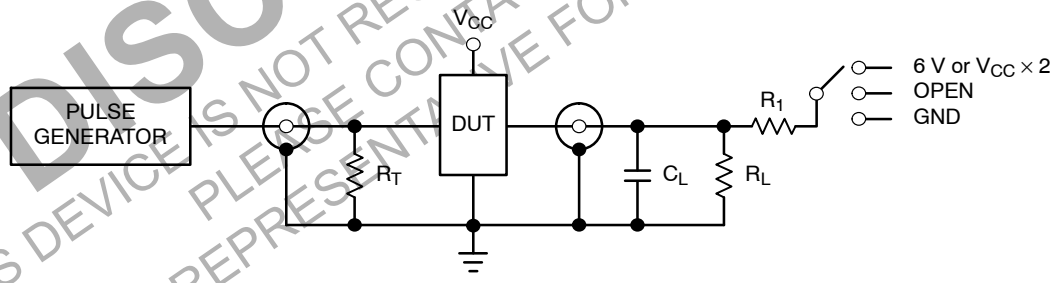



**Figure 4. Test Circuit**

**Table 3. TEST CIRCUIT**

| TEST | SWITCH |
|---|---|
| $t_{PLH}$, $t_{PHL}$ | Open |
| $t_{PZL}$, $t_{PLZ}$ | 6 V at $V_{CC}$ = 3.3 ±0.3 V<br>6 V at $V_{CC}$ = 2.5 ±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 ±0.3 V or equivalent (includes jig and probe capacitance)
$C_L$ = 30 pF at $V_{CC}$ = 2.5 ±0.2 V or equivalent (includes jig and probe capacitance)
$R_L = R_1$ = 500 Ω or equivalent
$R_T = Z_{OUT}$ of pulse generator (typically 50 Ω)

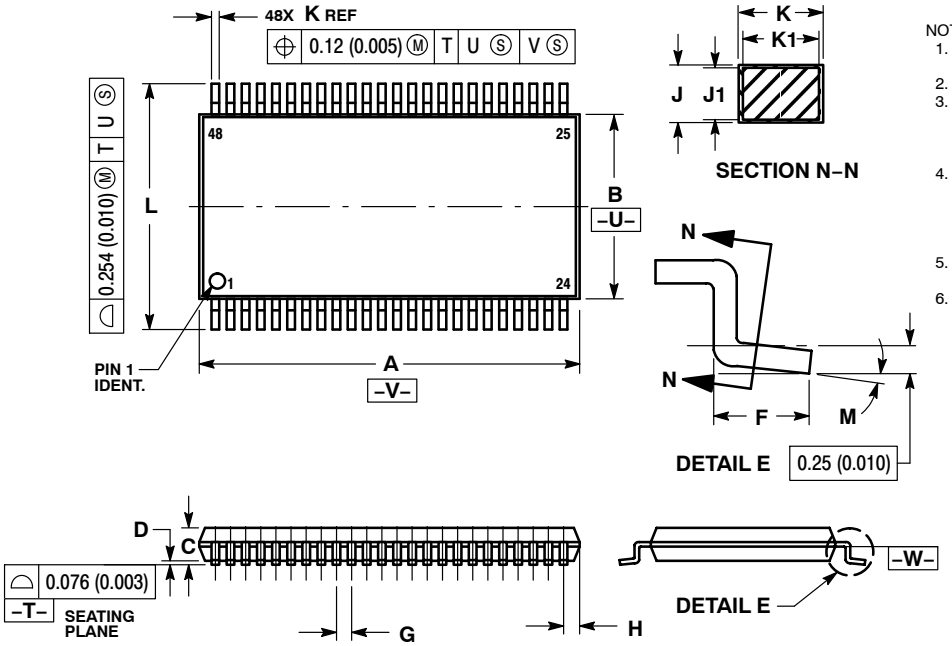


Downloaded from Arrow.com.

1
**SCALE 1:1**

**TSSOP−48**
CASE 1201
ISSUE B

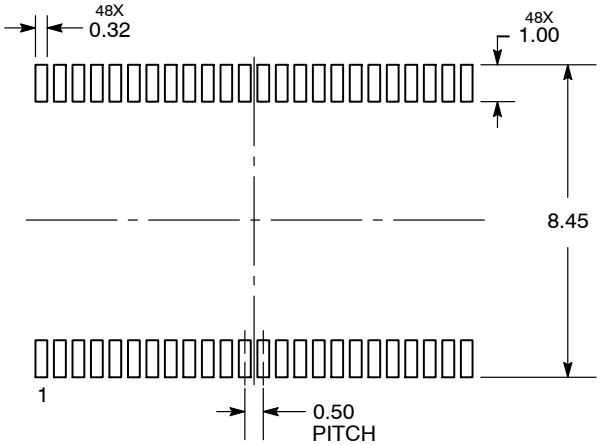
DATE 06 JUL 2010




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−.

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | 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.

| | | |
|---|---|---|
| **DOCUMENT NUMBER:** | **98ASH70297A** | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red. |
| **DESCRIPTION:** | **TSSOP−48** | **PAGE 1 OF 1** |

**onsemi** and onsemi are trademarks of Semiconductor Components Industries, LLC dba **onsemi** or its subsidiaries in the United States and/or other countries. **onsemi** reserves the right to make changes without further notice to any products herein. **onsemi** makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. **onsemi** does not convey any license under its patent rights nor the rights of others.



Downloaded from Arrow.com.

**onsemi**, ONSEMI , and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent−Marking.pdf. **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as−is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## ADDITIONAL INFORMATION

**TECHNICAL PUBLICATIONS**:
**Technical Library:** www.onsemi.com/design/resources/technical−documentation
**onsemi Website:** www.onsemi.com

**ONLINE SUPPORT**: www.onsemi.com/support
**For additional information, please contact your local Sales Representative at** www.onsemi.com/support/sales

◊

Downloaded from Arrow.com.