

# MC74LCX138

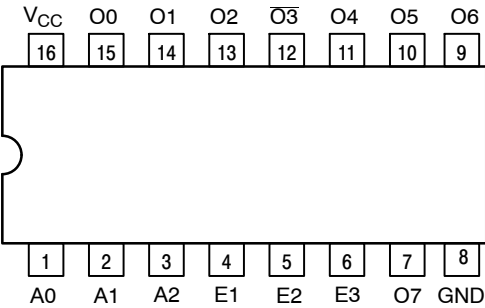


Figure 1. Pinout: 16-Lead (Top View)

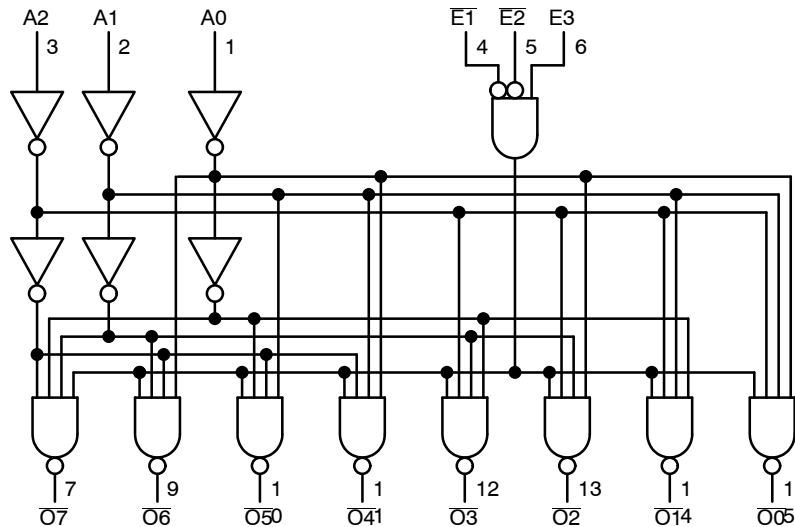


Figure 2. Logic Diagram

## PIN NAMES

| Pins  | Function       |
|-------|----------------|
| A0-A2 | Address Inputs |
| E1-E2 | Enable Inputs  |
| E3    | Enable Input   |
| O0-O7 | Outputs        |

## TRUTH TABLE

| Inputs |    |    |    |    |    | Outputs |    |    |    |    |    |    |    |
|--------|----|----|----|----|----|---------|----|----|----|----|----|----|----|
| E1     | E2 | E3 | A0 | A1 | A2 | O0      | O1 | O2 | O3 | O4 | O5 | O6 | O7 |
| H      | X  | X  | X  | X  | X  | H       | H  | H  | H  | H  | H  | H  | H  |
| X      | H  | X  | X  | X  | X  | H       | H  | H  | H  | H  | H  | H  | H  |
| X      | X  | L  | X  | X  | X  | H       | H  | H  | H  | H  | H  | H  | H  |
| L      | L  | H  | L  | L  | L  | L       | H  | H  | H  | H  | H  | H  | H  |
| L      | L  | H  | H  | L  | L  | H       | L  | H  | H  | H  | H  | H  | H  |
| L      | L  | H  | L  | H  | L  | H       | H  | L  | H  | H  | H  | H  | H  |
| L      | L  | H  | H  | H  | L  | H       | H  | H  | L  | H  | H  | H  | H  |
| L      | L  | H  | L  | L  | H  | H       | H  | H  | H  | L  | H  | H  | H  |
| L      | L  | H  | L  | H  | H  | H       | H  | H  | H  | H  | L  | H  | H  |
| L      | L  | H  | H  | H  | H  | H       | H  | H  | H  | H  | H  | L  | H  |
| L      | L  | H  | H  | H  | H  | H       | H  | H  | H  | H  | H  | H  | L  |

H = High Voltage Level  
L = Low Voltage Level  
X = High or Low Voltage Level and Transitions are Acceptable  
For I<sub>CC</sub> reasons, DO NOT FLOAT Inputs

## MC74LCX138

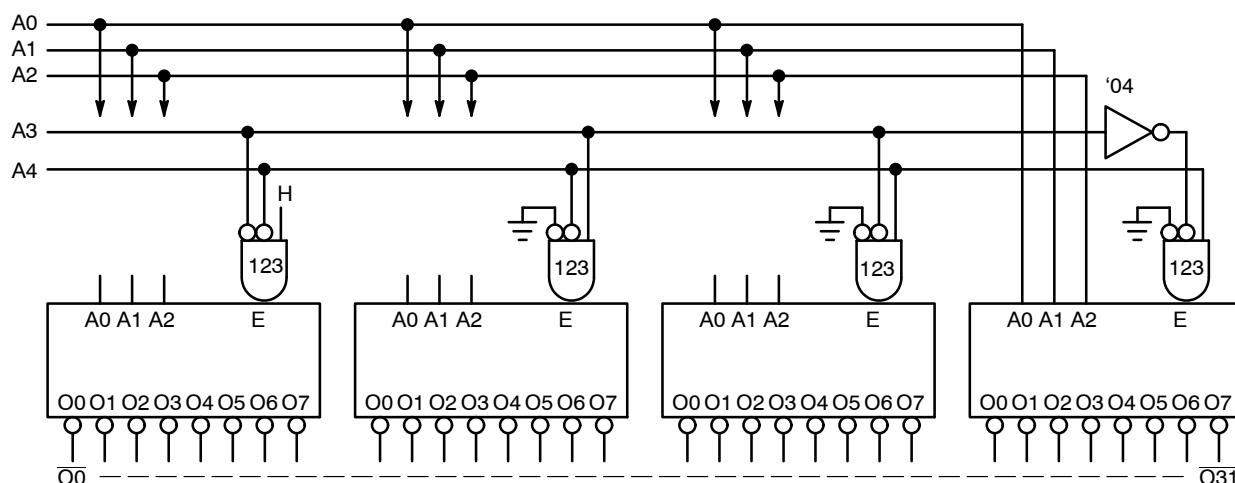


Figure 3. Expansion to 1-of-32 Decoding

### ORDERING INFORMATION

| Device          | Package                | Shipping†        |
|-----------------|------------------------|------------------|
| MC74LCX138DR2   | SOIC-16                | 2500 Tape & Reel |
| MC74LCX138DR2G  | SOIC-16<br>(Pb-Free)   | 2500 Tape & Reel |
| MC74LCX138DT    | TSSOP-16*              | 96 Units / Rail  |
| MC74LCX138DTG   | TSSOP-16*<br>(Pb-Free) | 96 Units / Rail  |
| MC74LCX138DTR2  | TSSOP-16*              | 2500 Tape & Reel |
| MC74LCX138DTR2G | TSSOP-16*<br>(Pb-Free) | 2500 Tape & Reel |
| MC74LCX138MEL   | SOEIAJ-16              | 2000 Tape & Reel |
| MC74LCX138MELG  | SOEIAJ-16<br>(Pb-Free) | 2000 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.

\*This package is inherently Pb-Free.

### 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 ≤ $V_I$ ≤ +7.0           |                                      | V    |
| $V_O$     | DC Output Voltage                | -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   |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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

# MC74LCX138

## RECOMMENDED OPERATING CONDITIONS

| Symbol          | Parameter                                                                                        | Min        | Typ                  | Max              | Unit |
|-----------------|--------------------------------------------------------------------------------------------------|------------|----------------------|------------------|------|
| V <sub>CC</sub> | Supply Voltage                                                                                   | 2.0<br>1.5 | 2.5, 3.3<br>2.5, 3.3 | 3.6<br>3.6       | V    |
| V <sub>I</sub>  | Input Voltage                                                                                    | 0          |                      | 5.5              | V    |
| V <sub>O</sub>  | Output Voltage (HIGH or LOW State) (3-State)                                                     | 0          |                      | V <sub>CC</sub>  | V    |
| I <sub>OH</sub> | HIGH Level Output Current                                                                        |            |                      | -24<br>-12<br>-8 | mA   |
| I <sub>OL</sub> | LOW Level Output Current                                                                         |            |                      | +24<br>+12<br>+8 | mA   |
| T <sub>A</sub>  | Operating Free-Air Temperature                                                                   | -40        |                      | +85              | °C   |
| Δt/ΔV           | Input Transition Rise or Fall Rate, V <sub>IN</sub> from 0.8 V to 2.0 V, V <sub>CC</sub> = 3.0 V | 0          |                      | 10               | ns/V |

## DC ELECTRICAL CHARACTERISTICS

| Symbol           | Characteristic                        | Condition                                                                     | T <sub>A</sub> = -40°C to +85°C |      | Unit |
|------------------|---------------------------------------|-------------------------------------------------------------------------------|---------------------------------|------|------|
|                  |                                       |                                                                               | Min                             | Max  |      |
| V <sub>IH</sub>  | HIGH Level Input Voltage (Note 2)     | 2.3 V ≤ V <sub>CC</sub> ≤ 2.7 V                                               | 1.7                             |      | V    |
|                  |                                       | 2.7 V ≤ V <sub>CC</sub> ≤ 3.6 V                                               | 2.0                             |      |      |
| V <sub>IL</sub>  | LOW Level Input Voltage (Note 2)      | 2.3 V ≤ V <sub>CC</sub> ≤ 2.7 V                                               |                                 | 0.7  | V    |
|                  |                                       | 2.7 V ≤ V <sub>CC</sub> ≤ 3.6 V                                               |                                 | 0.8  |      |
| V <sub>OH</sub>  | HIGH Level Output Voltage             | 2.3 V ≤ V <sub>CC</sub> ≤ 3.6 V; I <sub>OH</sub> = -100 μA                    | V <sub>CC</sub> - 0.2           |      | V    |
|                  |                                       | V <sub>CC</sub> = 2.3 V; I <sub>OH</sub> = -8 mA                              | 1.8                             |      |      |
|                  |                                       | V <sub>CC</sub> = 2.7 V; I <sub>OH</sub> = -12 mA                             | 2.2                             |      |      |
|                  |                                       | V <sub>CC</sub> = 3.0 V; I <sub>OH</sub> = -18 mA                             | 2.4                             |      |      |
|                  |                                       | V <sub>CC</sub> = 3.0 V; I <sub>OH</sub> = -24 mA                             | 2.2                             |      |      |
| V <sub>OL</sub>  | LOW Level Output Voltage              | 2.3 V ≤ V <sub>CC</sub> ≤ 3.6 V; I <sub>OL</sub> = 100 μA                     |                                 | 0.2  | V    |
|                  |                                       | V <sub>CC</sub> = 2.3 V; I <sub>OL</sub> = 8 mA                               |                                 | 0.6  |      |
|                  |                                       | V <sub>CC</sub> = 2.7 V; I <sub>OL</sub> = 12 mA                              |                                 | 0.4  |      |
|                  |                                       | V <sub>CC</sub> = 3.0 V; I <sub>OL</sub> = 16 mA                              |                                 | 0.4  |      |
|                  |                                       | V <sub>CC</sub> = 3.0 V; I <sub>OL</sub> = 24 mA                              |                                 | 0.55 |      |
| I <sub>I</sub>   | Input Leakage Current                 | 2.3 V ≤ V <sub>CC</sub> ≤ 3.6 V; 0 V ≤ V <sub>I</sub> ≤ 5.5 V                 |                                 | ±5   | μA   |
| I <sub>CC</sub>  | Quiescent Supply Current              | 2.3 ≤ V <sub>CC</sub> ≤ 3.6 V; V <sub>I</sub> = GND or V <sub>CC</sub>        |                                 | 10   | μA   |
|                  |                                       | 2.3 ≤ V <sub>CC</sub> ≤ 3.6 V; 3.6 ≤ V <sub>I</sub> or V <sub>O</sub> ≤ 5.5 V |                                 | ±10  |      |
| ΔI <sub>CC</sub> | Increase in I <sub>CC</sub> per Input | 2.3 ≤ V <sub>CC</sub> ≤ 3.6 V; V <sub>IH</sub> = V <sub>CC</sub> - 0.6 V      |                                 | 500  | μA   |

2. These values of V<sub>I</sub> are used to test DC electrical characteristics only.

## AC CHARACTERISTICS t<sub>R</sub> = t<sub>F</sub> = 2.5 ns; R<sub>L</sub> = 500 Ω

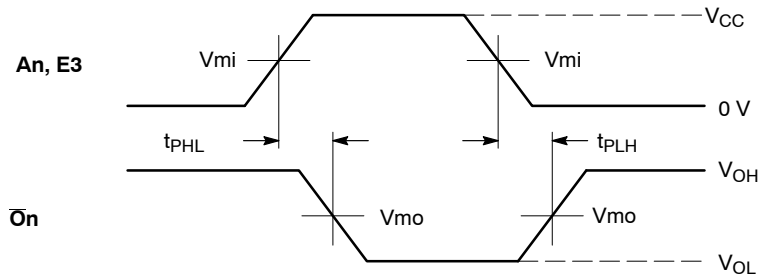
| Symbol                                 | Parameter                         | Waveform | Limits                          |            |                         |            |                                 |            | Unit |
|----------------------------------------|-----------------------------------|----------|---------------------------------|------------|-------------------------|------------|---------------------------------|------------|------|
|                                        |                                   |          | T <sub>A</sub> = -40°C to +85°C |            |                         |            |                                 |            |      |
|                                        |                                   |          | V <sub>CC</sub> = 3.3 V ± 0.3 V |            | V <sub>CC</sub> = 2.7 V |            | V <sub>CC</sub> = 2.5 V ± 0.2 V |            |      |
|                                        |                                   |          | C <sub>L</sub> = 50 pF          |            | C <sub>L</sub> = 50 pF  |            | C <sub>L</sub> = 30 pF          |            |      |
|                                        |                                   |          | Min                             | Max        | Min                     | Max        | Min                             | Max        |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub>   | Propagation Delay<br>An to On     | 1, 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 <sub>PLH</sub><br>t <sub>PHL</sub>   | Propagation Delay<br>E1, E2 to On | 2        | 1.5<br>1.5                      | 6.5<br>6.5 | 1.5<br>1.5              | 7.5<br>7.5 | 1.5<br>1.5                      | 8.4<br>8.4 | ns   |
| t <sub>PLH</sub><br>t <sub>PHL</sub>   | Propagation Delay<br>E3 to On     | 1        | 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 <sub>OSHL</sub><br>t <sub>OSLH</sub> | 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<sub>OSHL</sub>) or LOW-to-HIGH (t<sub>OSLH</sub>); parameter guaranteed by design.

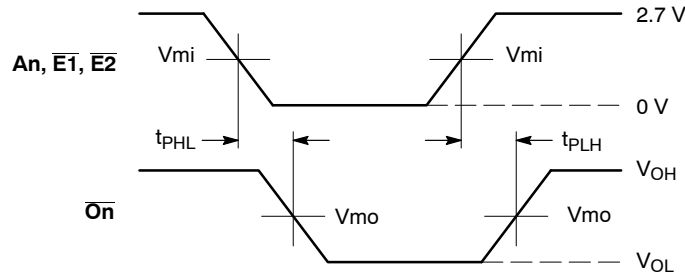
# MC74LCX138

## CAPACITIVE CHARACTERISTICS

| Symbol           | Parameter                     | Condition                                                                | Typical | Unit |
|------------------|-------------------------------|--------------------------------------------------------------------------|---------|------|
| C <sub>IN</sub>  | Input Capacitance             | V <sub>CC</sub> = 3.3 V, V <sub>I</sub> = 0 V or V <sub>CC</sub>         | 7       | pF   |
| C <sub>OUT</sub> | Output Capacitance            | V <sub>CC</sub> = 3.3 V, V <sub>I</sub> = 0 V or V <sub>CC</sub>         | 8       | pF   |
| C <sub>PD</sub>  | Power Dissipation Capacitance | 10 MHz, V <sub>CC</sub> = 3.3 V, V <sub>I</sub> = 0 V or V <sub>CC</sub> | 25      | pF   |



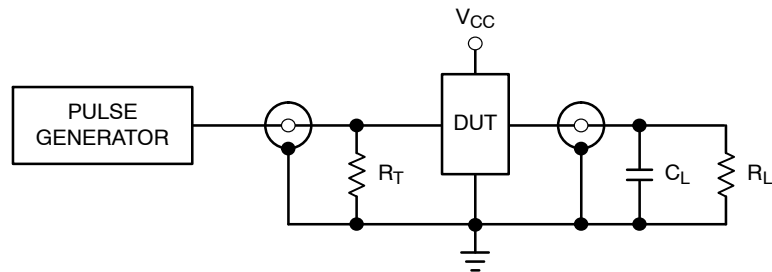
WAVEFORM 1: PROPAGATION DELAYS FOR INVERTING OUTPUTS



WAVEFORM 2: PROPAGATION DELAYS FOR NON-INVERTING OUTPUTS

| Symbol          | V <sub>CC</sub> |       |                    |
|-----------------|-----------------|-------|--------------------|
|                 | 3.3 V ± 0.3 V   | 2.7 V | 2.5 V ± 0.2 V      |
| V <sub>mi</sub> | 1.5 V           | 1.5 V | V <sub>CC</sub> /2 |
| V <sub>mo</sub> | 1.5 V           | 1.5 V | V <sub>CC</sub> /2 |

Figure 4. AC Waveforms



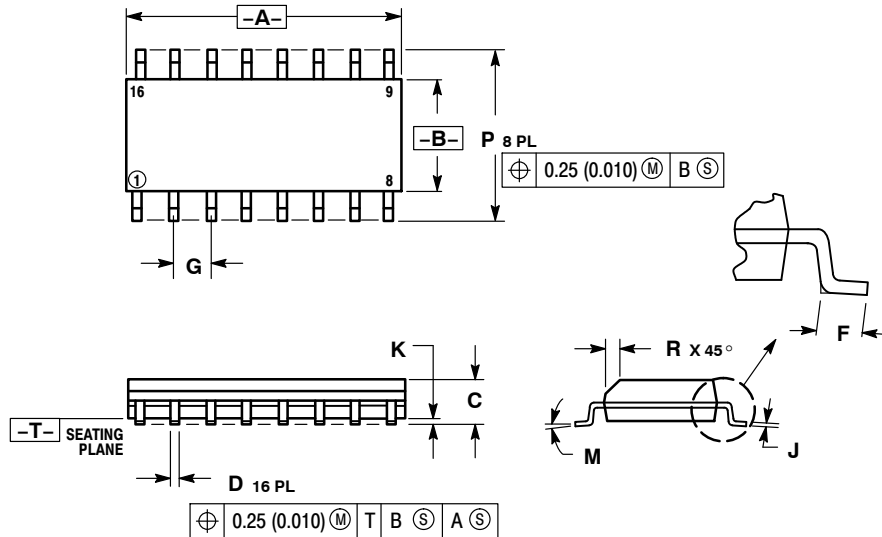
C<sub>L</sub> = 50 pF at V<sub>CC</sub> = 3.3 ± 0.3 V or equivalent (includes jig and probe capacitance)  
C<sub>L</sub> = 30 pF at V<sub>CC</sub> = 2.5 ± 0.2 V or equivalent (includes jig and probe capacitance)  
R<sub>L</sub> = R<sub>1</sub> = 500 Ω or equivalent  
R<sub>T</sub> = Z<sub>OUT</sub> of pulse generator (typically 50 Ω)

Figure 5. Test Circuit

# MC74LCX138

## PACKAGE DIMENSIONS

SOIC-16  
D SUFFIX  
CASE 751B-05  
ISSUE K

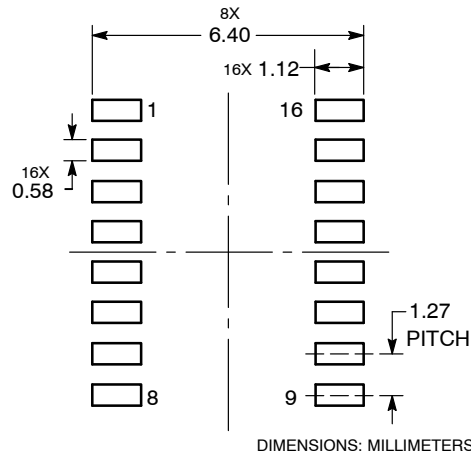


### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

|     | MILLIMETERS |       | INCHES    |       |
|-----|-------------|-------|-----------|-------|
| DIM | MIN         | MAX   | MIN       | MAX   |
| A   | 9.80        | 10.00 | 0.386     | 0.393 |
| B   | 3.80        | 4.00  | 0.150     | 0.157 |
| C   | 1.35        | 1.75  | 0.054     | 0.068 |
| D   | 0.35        | 0.49  | 0.014     | 0.019 |
| F   | 0.40        | 1.25  | 0.016     | 0.049 |
| G   | 1.27 BSC    |       | 0.050 BSC |       |
| J   | 0.19        | 0.25  | 0.008     | 0.009 |
| K   | 0.10        | 0.25  | 0.004     | 0.009 |
| M   | 0°          | 7°    | 0°        | 7°    |
| P   | 5.80        | 6.20  | 0.229     | 0.244 |
| R   | 0.25        | 0.50  | 0.010     | 0.019 |

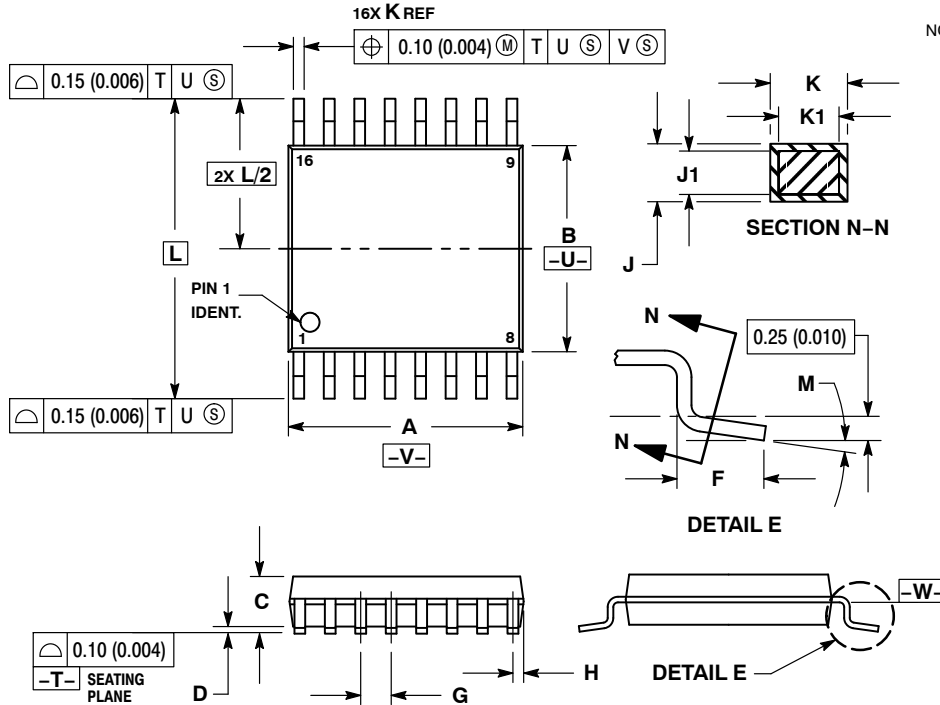
## SOLDERING FOOTPRINT



# MC74LCX138

## PACKAGE DIMENSIONS

TSSOP-16  
DT SUFFIX  
CASE 948F-01  
ISSUE B

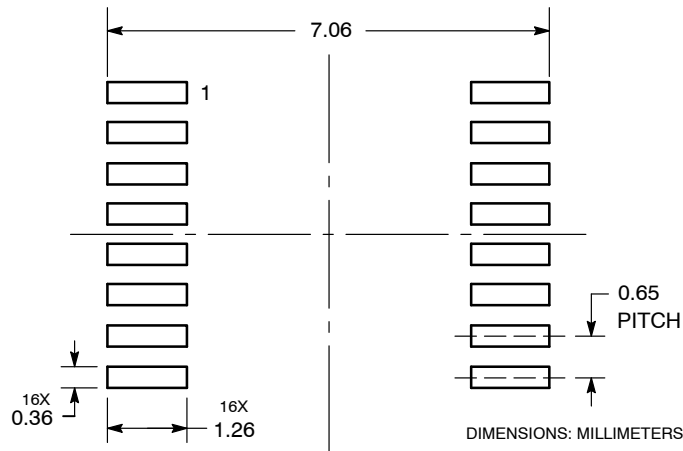


### NOTES:

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-

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | 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   | 0.18        | 0.28 | 0.007     | 0.011 |
| 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°    |

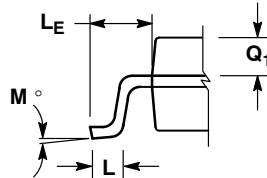
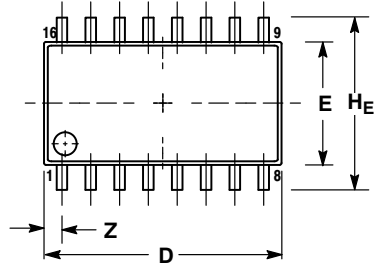
### SOLDERING FOOTPRINT



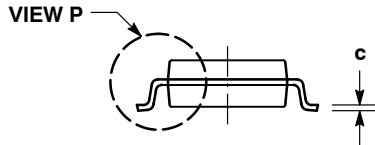
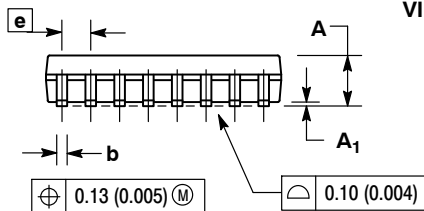
# MC74LCX138

## PACKAGE DIMENSIONS

SOEIAJ-16  
M SUFFIX  
CASE 966-01  
ISSUE A



DETAIL P



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS AND ARE MEASURED AT THE PARTING LINE. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
5. THE LEAD WIDTH DIMENSION (b) DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE LEAD WIDTH DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSIONS AND ADJACENT LEAD TO BE 0.46 (0.018).

| DIM            | MILLIMETERS |       | INCHES    |       |
|----------------|-------------|-------|-----------|-------|
|                | MIN         | MAX   | MIN       | MAX   |
| A              | ---         | 2.05  | ---       | 0.081 |
| A <sub>1</sub> | 0.05        | 0.20  | 0.002     | 0.008 |
| b              | 0.35        | 0.50  | 0.014     | 0.020 |
| c              | 0.10        | 0.20  | 0.007     | 0.011 |
| D              | 9.90        | 10.50 | 0.390     | 0.413 |
| E              | 5.10        | 5.45  | 0.201     | 0.215 |
| e              | 1.27 BSC    |       | 0.050 BSC |       |
| H <sub>E</sub> | 7.40        | 8.20  | 0.291     | 0.323 |
| L              | 0.50        | 0.85  | 0.020     | 0.033 |
| L <sub>E</sub> | 1.10        | 1.50  | 0.043     | 0.059 |
| M              | 0 °         | 10 °  | 0 °       | 10 °  |
| Q <sub>1</sub> | 0.70        | 0.90  | 0.028     | 0.035 |
| Z              | ---         | 0.78  | ---       | 0.031 |

ON Semiconductor and  are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC 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. "Typical" parameters which may be provided in SCILLC 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. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC 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 SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

### PUBLICATION ORDERING INFORMATION

#### LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor  
P.O. Box 5163, Denver, Colorado 80217 USA  
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
Email: [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

N. American Technical Support: 800-282-9855 Toll Free  
USA/Canada  
Europe, Middle East and Africa Technical Support:  
Phone: 421 33 790 2910  
Japan Customer Focus Center  
Phone: 81-3-5773-3850

ON Semiconductor Website: [www.onsemi.com](http://www.onsemi.com)

Order Literature: <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative

MC74LCX138/D