

# MC74LCX138

## Low-Voltage CMOS 3-to-8 Decoder/Demultiplexer

### With 5 V-Tolerant Inputs

The MC74LCX138 is a high performance, 3-to-8 decoder/demultiplexer 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 MC74LCX138 inputs to be safely driven from 5 V devices. The MC74LCX138 is suitable for memory address decoding and other TTL level bus-oriented applications.

The MC74LCX138 high-speed 3-to-8 decoder/demultiplexer accepts three binary weighted inputs (A0, A1, A2) and, when enabled, provides eight mutually exclusive active-LOW outputs ( $\overline{O0}$ – $\overline{O7}$ ). The LCX138 features three Enable inputs, two active-LOW ( $\overline{E1}$ ,  $\overline{E2}$ ) and one active-HIGH (E3). All outputs will be HIGH unless  $\overline{E1}$  and  $\overline{E2}$  are LOW, and E3 is HIGH. This multiple enabled function allows easy parallel expansion of the device to a 1-of-32 (5 lines to 32 lines) decoder with just four LCX138 devices and one inverter (see Figure 1). The LCX138 can be used as an 8-output demultiplexer by using one of the active-LOW Enable inputs as the data input and the other Enable inputs as strobes. The Enable inputs which are not used must be permanently tied to their appropriate active-HIGH or active-LOW state.

Current drive capability is 24 mA at the outputs.

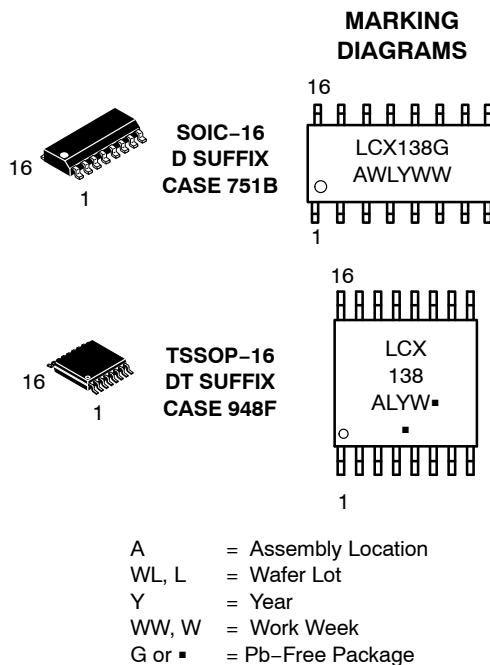
#### Features

- Designed for 2.3 V to 3.6 V  $V_{CC}$  Operation
- 5 V Tolerant Inputs – Interface Capability With 5 V TTL Logic
- LVTTTL Compatible
- LVC MOS Compatible
- 24 mA Balanced Output Sink and Source Capability
- Near Zero Static Supply Current (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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(Note: Microdot may be in either location)

#### ORDERING INFORMATION

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

# MC74LCX138

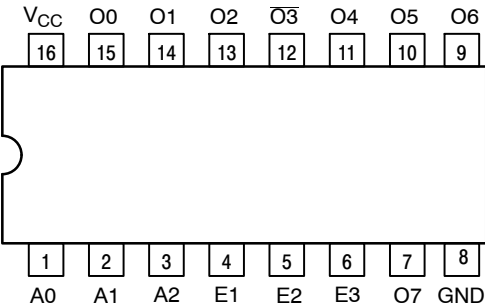


Figure 1. Pinout: 16-Lead (Top View)

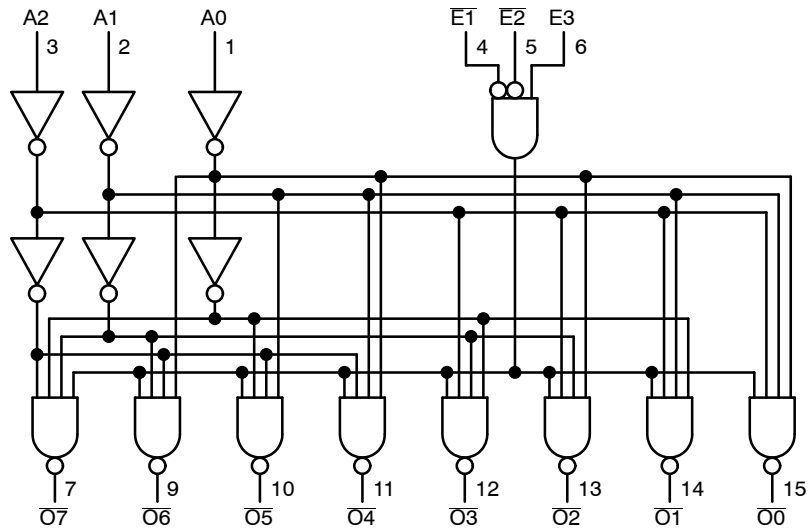


Figure 2. Logic Diagram

## 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

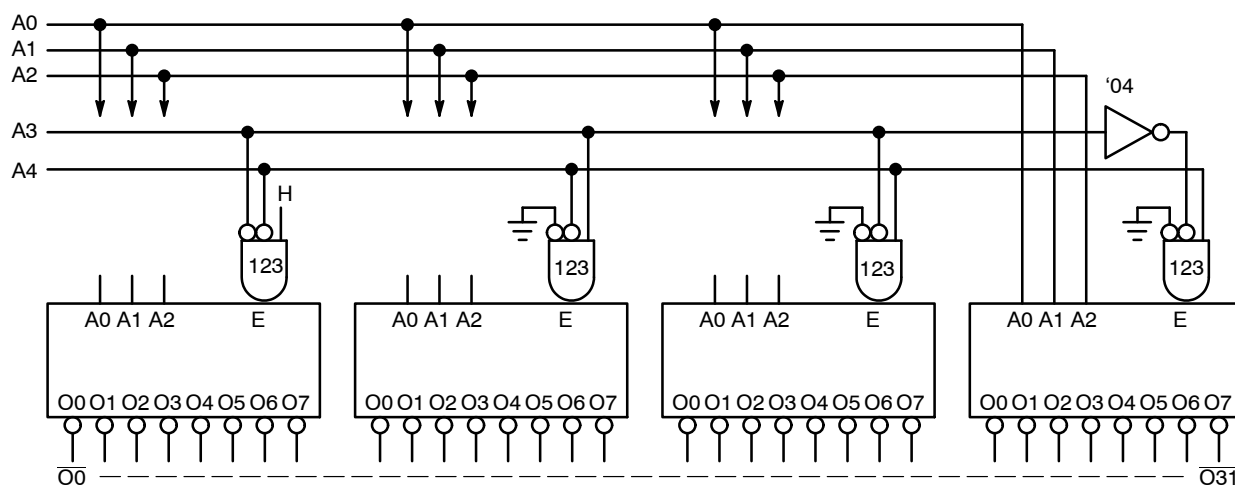


Figure 3. Expansion to 1-of-32 Decoding

### ORDERING INFORMATION

| Device           | Package               | Shipping <sup>†</sup> |
|------------------|-----------------------|-----------------------|
| MC74LCX138DR2G   | SOIC-16<br>(Pb-Free)  | 2500 Tape & Reel      |
| MC74LCX138DTG    | TSSOP-16<br>(Pb-Free) | 96 Units / Rail       |
| MC74LCX138DTR2G  | TSSOP-16<br>(Pb-Free) | 2500 Tape & Reel      |
| NLV74LCX138DR2G* | SOIC-16<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 and PPAP Capable.

### MAXIMUM RATINGS

| Symbol           | Parameter                        | Value                                         | Condition                            | Units |
|------------------|----------------------------------|-----------------------------------------------|--------------------------------------|-------|
| V <sub>CC</sub>  | DC Supply Voltage                | -0.5 to +7.0                                  |                                      | V     |
| V <sub>I</sub>   | DC Input Voltage                 | -0.5 ≤ V <sub>I</sub> ≤ +7.0                  |                                      | V     |
| V <sub>O</sub>   | DC Output Voltage                | -0.5 ≤ V <sub>O</sub> ≤ V <sub>CC</sub> + 0.5 | Output in HIGH or LOW State (Note 1) | V     |
| I <sub>IK</sub>  | DC Input Diode Current           | -50                                           | V <sub>I</sub> < GND                 | mA    |
| I <sub>OK</sub>  | DC Output Diode Current          | -50                                           | V <sub>O</sub> < GND                 | mA    |
|                  |                                  | +50                                           | V <sub>O</sub> > V <sub>CC</sub>     | mA    |
| I <sub>O</sub>   | DC Output Source/Sink Current    | ±50                                           |                                      | mA    |
| I <sub>CC</sub>  | DC Supply Current Per Supply Pin | ±100                                          |                                      | mA    |
| I <sub>GND</sub> | DC Ground Current Per Ground Pin | ±100                                          |                                      | mA    |
| T <sub>STG</sub> | Storage Temperature Range        | -65 to +150                                   |                                      | °C    |
| MSL              | Moisture Sensitivity             |                                               | Level 1                              |       |

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<sub>O</sub> absolute maximum rating must be observed.

# MC74LCX138

## RECOMMENDED OPERATING CONDITIONS

| Symbol          | Parameter                                                                                                                          | Min        | Typ                  | Max              | Units |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------|------------|----------------------|------------------|-------|
| V <sub>CC</sub> | Supply Voltage<br>Operating Data Retention Only                                                                                    | 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<br>(HIGH or LOW State) (3-State)                                                                                    | 0          |                      | V <sub>CC</sub>  | V     |
| I <sub>OH</sub> | HIGH Level Output Current<br>V <sub>CC</sub> = 3.0 V – 3.6 V<br>V <sub>CC</sub> = 2.7 V – 3.0 V<br>V <sub>CC</sub> = 2.3 V – 2.7 V |            |                      | –24<br>–12<br>–8 | mA    |
| I <sub>OL</sub> | LOW Level Output Current<br>V <sub>CC</sub> = 3.0 V – 3.6 V<br>V <sub>CC</sub> = 2.7 V – 3.0 V<br>V <sub>CC</sub> = 2.3 V – 2.7 V  |            |                      | +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 |      | Units |
|------------------|---------------------------------------|--------------------------------------------------------------------------|---------------------------------|------|-------|
|                  |                                       |                                                                          | 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>OFF</sub> | Power Off Leakage Current             | V <sub>CC</sub> = 0, V <sub>IN</sub> = 5.5 V or V <sub>OUT</sub> = 5.5 V |                                 | 10   | μA    |
| I <sub>IN</sub>  | Input Leakage Current                 | V <sub>CC</sub> = 3.6 V, V <sub>IN</sub> = 5.5 V or GND                  |                                 | ±5   | μA    |
| I <sub>CC</sub>  | Quiescent Supply Current              | V <sub>CC</sub> = 3.6 V, V <sub>IN</sub> = 5.5 V or GND                  |                                 | 10   | μA    |
| 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)

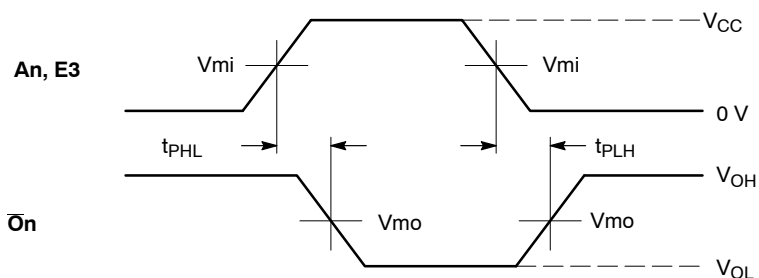
| Symbol                                 | Parameter                                  | Waveform | Limits                          |            |                         |            |                                 |            | Units |
|----------------------------------------|--------------------------------------------|----------|---------------------------------|------------|-------------------------|------------|---------------------------------|------------|-------|
|                                        |                                            |          | 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 $\bar{O}_n$     | 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 $\bar{O}_n$ | 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 $\bar{O}_n$     | 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.

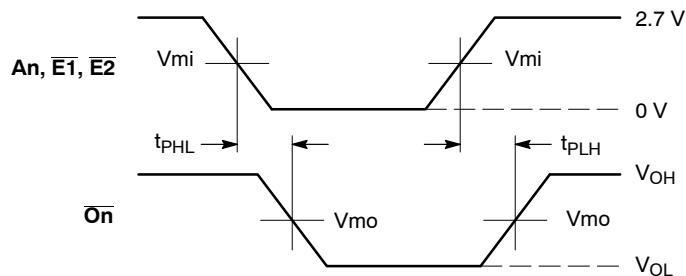
# MC74LCX138

## CAPACITIVE CHARACTERISTICS

| Symbol    | Parameter                     | Condition                                                          | Typical | 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    |



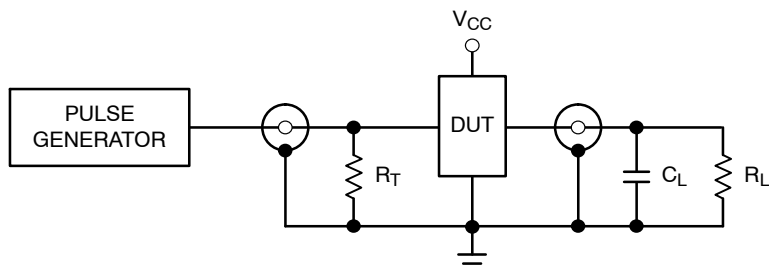
WAVEFORM 1: PROPAGATION DELAYS FOR INVERTING OUTPUTS



WAVEFORM 2: PROPAGATION DELAYS FOR NON-INVERTING OUTPUTS

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

Figure 4. AC Waveforms



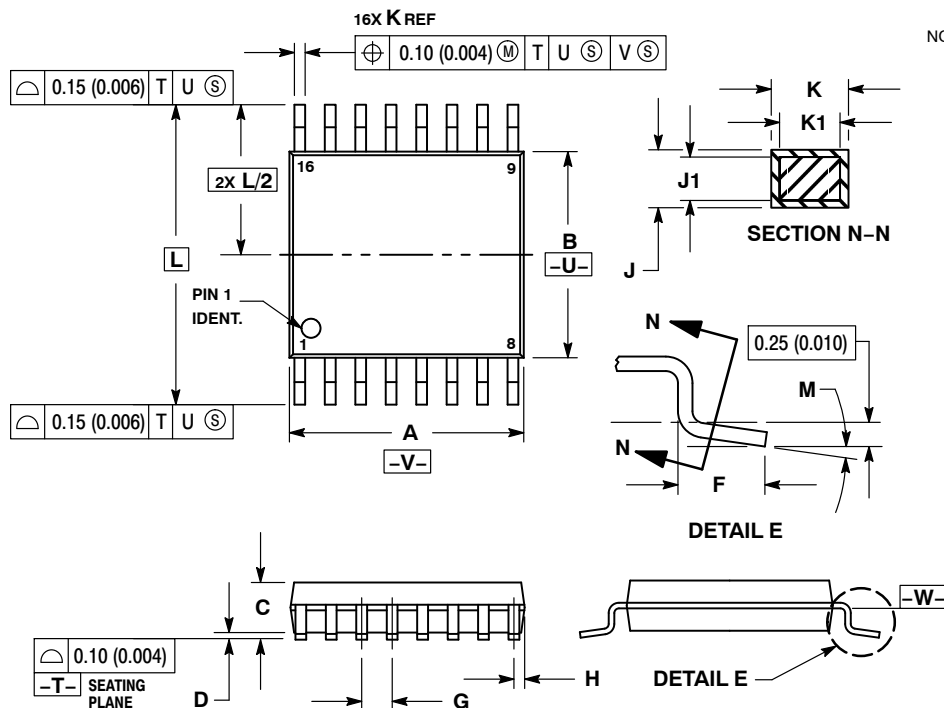
$C_L = 50 \text{ pF}$  at  $V_{CC} = 3.3 \pm 0.3 \text{ V}$  or equivalent (includes jig and probe capacitance)  
 $C_L = 30 \text{ pF}$  at  $V_{CC} = 2.5 \pm 0.2 \text{ V}$  or equivalent (includes jig and probe capacitance)  
 $R_L = R_1 = 500 \Omega$  or equivalent  
 $R_T = Z_{OUT}$  of pulse generator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

Figure 5. Test Circuit

# MC74LCX138

## PACKAGE DIMENSIONS

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

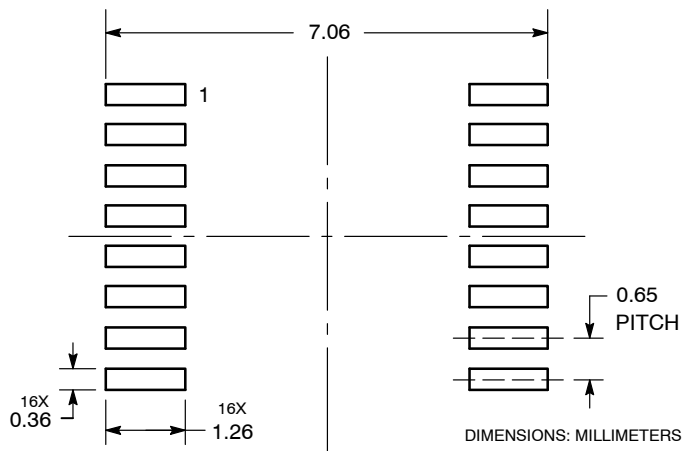


### NOTES:

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\*

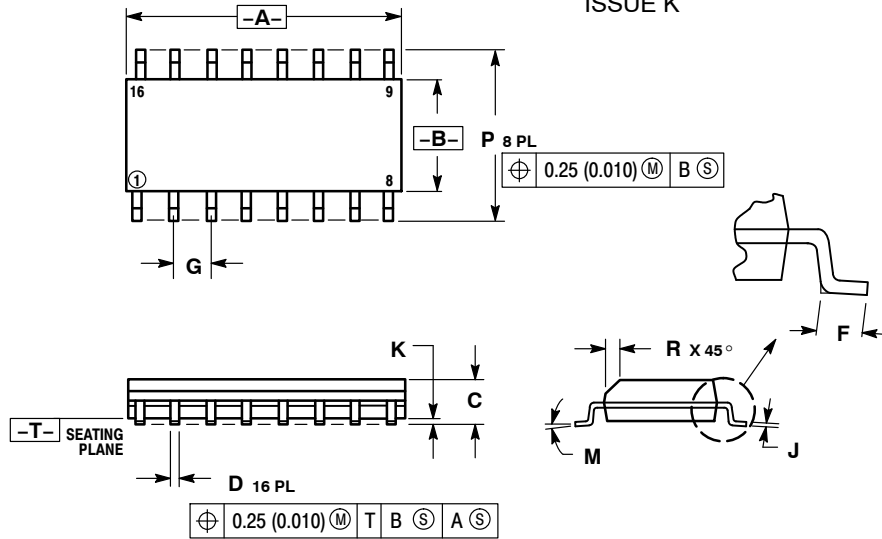


\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

# MC74LCX138

## PACKAGE DIMENSIONS

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

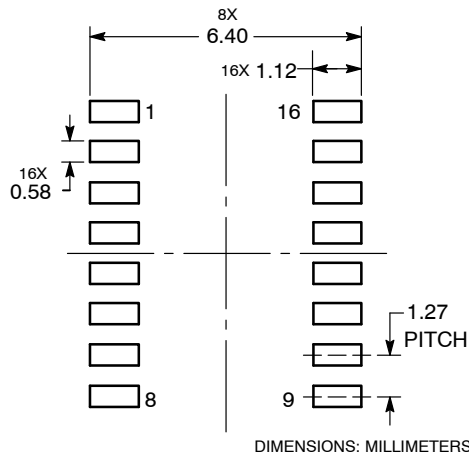


### NOTES:

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.

| DIM | MILLIMETERS |       | INCHES    |       |
|-----|-------------|-------|-----------|-------|
|     | 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\*



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

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## Данный компонент на территории Российской Федерации

**Вы можете приобрести в компании MosChip.**

Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

<http://moschip.ru/get-element>

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

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