



**THE DATASHEET OF  
MC74LVX138DR2G**



# MC74LVX138

## 3-to-8 Line Decoder

### With 5V-Tolerant Inputs

The MC74LVX138 is an advanced high speed CMOS 3-to-8 line decoder. The inputs tolerate voltages up to 7.0 V, allowing the interface of 5.0 V systems to 3.0 V systems.

When the device is enabled, three Binary Select inputs (A0 – A2) determine which one of the outputs ( $\overline{O0}$  –  $\overline{O7}$ ) will go Low. When enable input E3 is held Low or either  $\overline{E2}$  or  $\overline{E1}$  is held High, decoding function is inhibited and all outputs go high. E3,  $\overline{E2}$ , and  $\overline{E1}$  inputs are provided to ease cascade connection and for use as an address decoder for memory systems.

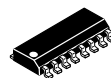
#### Features

- High Speed:  $t_{PD} = 5.5$  ns (Typ) at  $V_{CC} = 3.3$  V
- Low Power Dissipation:  $I_{CC} = 4$   $\mu$ A (Max) at  $T_A = 25$  °C
- Power Down Protection Provided on Inputs
- Balanced Propagation Delays
- Low Noise:  $V_{OLP} = 0.5$  V (Max)
- Pin and Function Compatible with Other Standard Logic Families
- Latchup Performance Exceeds 300 mA
- ESD Performance:
  - Human Body Model > 2000 V;
  - Machine Model > 200 V
- These Devices are Pb-Free and are RoHS Compliant



**ON Semiconductor®**

<http://onsemi.com>

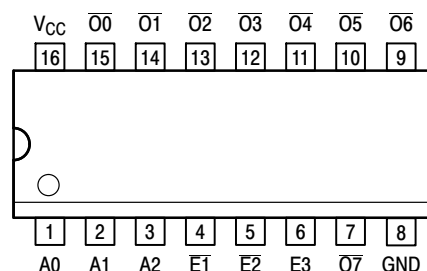


**SOIC-16  
D SUFFIX  
CASE 751B**



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

#### PIN ASSIGNMENT

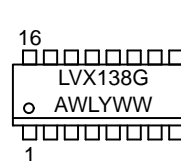


**16-Lead (Top View)**

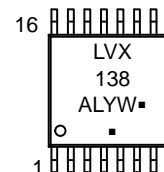
#### PIN NAMES

Pins	Function
A0–A2	Address Inputs
$\overline{E1}$ – $\overline{E2}$	Enable Inputs
E3	Enable Input
$\overline{O0}$ – $\overline{O7}$	Outputs

#### MARKING DIAGRAMS



**SOIC-16**



**TSSOP-16**

LVX138 = Specific Device Code  
 A = Assembly Location  
 WL, L = Wafer Lot  
 Y = Year  
 WW, W = 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 5 of this data sheet.

# MC74LVX138

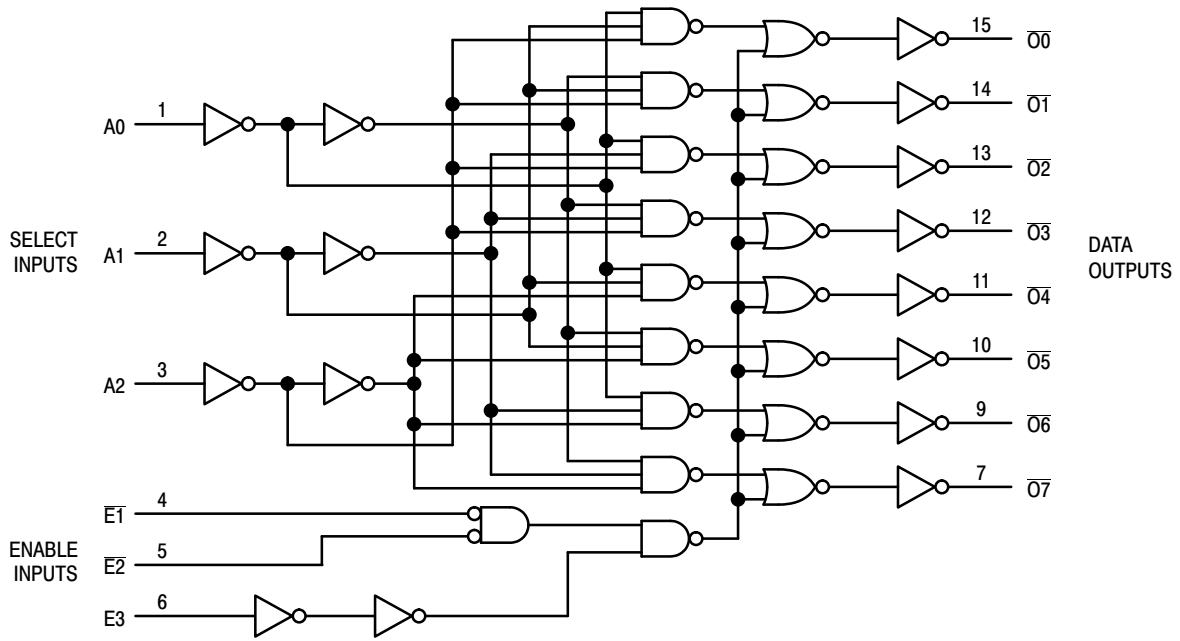


Figure 1. Logic Diagram

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

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

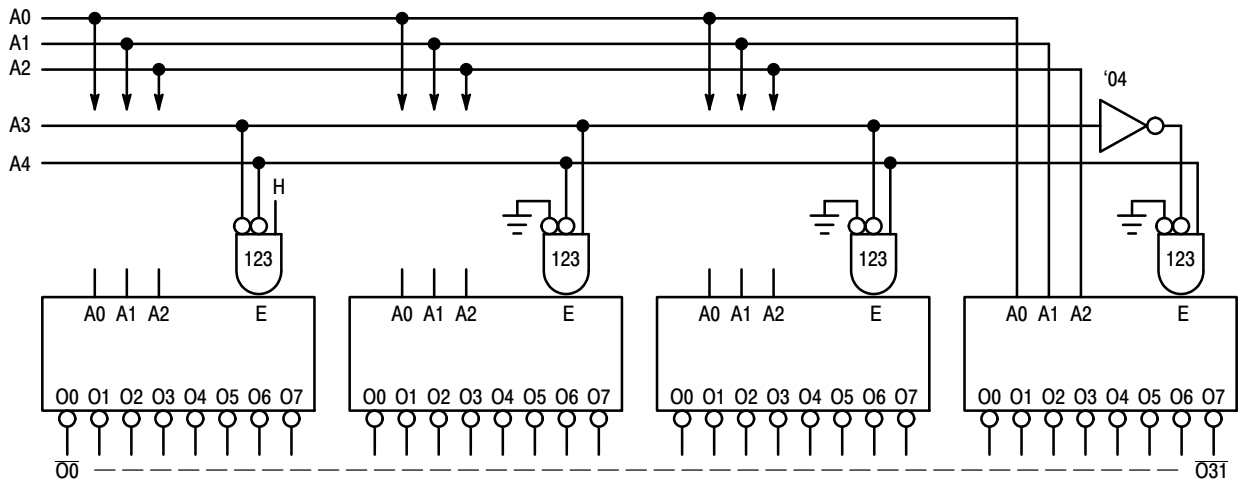


Figure 2. Expansion to 1-of-32 Decoding

# MC74LVX138

## MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	DC Supply Voltage	-0.5 to +7.0	V
V <sub>in</sub>	DC Input Voltage	-0.5 to +7.0	V
V <sub>out</sub>	DC Output Voltage	-0.5 to V <sub>CC</sub> +0.5	V
I <sub>IK</sub>	Input Diode Current	-20	mA
I <sub>OK</sub>	Output Diode Current	±20	mA
I <sub>out</sub>	DC Output Current, per Pin	±25	mA
I <sub>CC</sub>	DC Supply Current, V <sub>CC</sub> and GND Pins	±75	mA
P <sub>D</sub>	Power Dissipation	180	mW
T <sub>stg</sub>	Storage Temperature	-65 to +150	°C

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.

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V <sub>CC</sub>	DC Supply Voltage	2.0	3.6	V
V <sub>in</sub>	DC Input Voltage	0	5.5	V
V <sub>out</sub>	DC Output Voltage	0	V <sub>CC</sub>	V
T <sub>A</sub>	Operating Temperature, All Package Types	-40	+85	°C
Δt/ΔV	Input Rise and Fall Time	0	100	ns/V

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

## DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	V <sub>CC</sub> V	T <sub>A</sub> = 25°C			T <sub>A</sub> = -40 to 85°C		Unit
				Min	Typ	Max	Min	Max	
V <sub>IH</sub>	High-Level Input Voltage		2.0	1.5	-	-	1.5	-	V
			3.0	2.0	-	-	2.0	-	
			3.6	2.4	-	-	2.4	-	
V <sub>IL</sub>	Low-Level Input Voltage		2.0	-	-	0.5	-	0.5	V
			3.0	-	-	0.8	-	0.8	
			3.6	-	-	0.8	-	0.8	
V <sub>OH</sub>	High-Level Output Voltage (V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub> )	I <sub>OH</sub> = -50μA I <sub>OH</sub> = -50μA I <sub>OH</sub> = -4mA	2.0	1.9	2.0	-	1.9	-	V
			3.0	2.9	3.0	-	2.9	-	
			3.0	2.58	-	-	2.48	-	
V <sub>OL</sub>	Low-Level Output Voltage (V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub> )	I <sub>OL</sub> = 50μA I <sub>OL</sub> = 50μA I <sub>OL</sub> = 4mA	2.0	-	0.0	0.1	-	0.1	V
			3.0	-	0.0	0.1	-	0.1	
			3.0	-	-	0.36	-	0.44	
I <sub>in</sub>	Input Leakage Current	V <sub>in</sub> = 5.5V or GND	3.6	-	-	±0.1	-	±1.0	μA
I <sub>CC</sub>	Quiescent Supply Current	V <sub>in</sub> = V <sub>CC</sub> or GND	3.6	-	-	4.0	-	40.0	μA

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

# MC74LVX138

## AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 3.0\text{ns}$ )

Symbol	Parameter	Test Conditions	$T_A = 25^\circ\text{C}$			$T_A = -40 \text{ to } 85^\circ\text{C}$		Unit
			Min	Typ	Max	Min	Max	
$t_{PLH}$ , $t_{PHL}$	Propagation Delay Input to Output	$V_{CC} = 2.7\text{V}$ $C_L = 15\text{pF}$	–	7.1	13.8	1.0	16.5	ns
		$C_L = 50\text{pF}$	–	9.6	17.3	1.0	20.0	
		$V_{CC} = 3.3 \pm 0.3\text{V}$ $C_L = 15\text{pF}$	–	5.5	8.8	1.0	10.5	
		$C_L = 50\text{pF}$	–	8.0	12.3	1.0	14.0	
$t_{PLH}$ , $t_{PHL}$	Propagation Delay E3 to $\bar{O}$	$V_{CC} = 2.7\text{V}$ $C_L = 15\text{pF}$	–	8.7	16.3	1.0	19.5	ns
		$C_L = 50\text{pF}$	–	11.2	19.8	1.0	23.0	
		$V_{CC} = 3.3 \pm 0.3\text{V}$ $C_L = 15\text{pF}$	–	6.8	10.6	1.0	12.5	
		$C_L = 50\text{pF}$	–	9.3	14.1	1.0	16.0	
$t_{PLH}$ , $t_{PHL}$	Propagation Delay E1 or E2 to $\bar{O}$	$V_{CC} = 2.7\text{V}$ $C_L = 15\text{pF}$	–	8.8	16.0	1.0	18.5	ns
		$C_L = 50\text{pF}$	–	11.3	19.5	1.0	22.0	
		$V_{CC} = 3.3 \pm 0.3\text{V}$ $C_L = 15\text{pF}$	–	6.9	10.4	1.0	11.5	
		$C_L = 50\text{pF}$	–	9.4	13.9	1.0	15.0	
$t_{OSHL}$ , $t_{OSLH}$	Output-to-Output Skew (Note 1)	$V_{CC} = 2.7\text{V}$ $C_L = 50\text{pF}$	–	–	2.5	–	2.5	ns
		$V_{CC} = 3.3 \pm 0.3\text{V}$ $C_L = 50\text{pF}$	–	–	2.5	–	2.5	

1. 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.

## CAPACITIVE CHARACTERISTICS

Symbol	Parameter	$T_A = 25^\circ\text{C}$			$T_A = -40 \text{ to } 85^\circ\text{C}$		Unit
		Min	Typ	Max	Min	Max	
$C_{in}$	Input Capacitance	–	4	10	–	10	pF
$C_{PD}$	Power Dissipation Capacitance (Note 2)	–	34	–	–	–	pF

2.  $C_{PD}$  is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation:  $I_{CC(OPR)} = C_{PD} \cdot V_{CC} \cdot f_{in} + I_{CC}$ .  $C_{PD}$  is used to determine the no-load dynamic power consumption;  $P_D = C_{PD} \cdot V_{CC}^2 \cdot f_{in} + I_{CC} \cdot V_{CC}$ .

## NOISE CHARACTERISTICS (Input $t_r = t_f = 3.0\text{ns}$ , $C_L = 50\text{pF}$ , $V_{CC} = 3.3\text{V}$ , Measured in SOIC Package)

Symbol	Characteristic	$T_A = 25^\circ\text{C}$		Unit
		Typ	Max	
$V_{OLP}$	Quiet Output Maximum Dynamic $V_{OL}$	–	0.5	V
$V_{OLV}$	Quiet Output Minimum Dynamic $V_{OL}$	–	–0.5	V
$V_{IHD}$	Minimum High Level Dynamic Input Voltage	–	2.0	V
$V_{ILD}$	Maximum Low Level Dynamic Input Voltage	–	0.8	V

# MC74LVX138

## SWITCHING WAVEFORMS

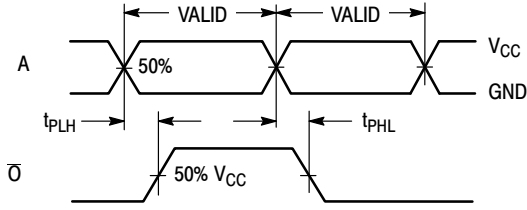


Figure 3. .

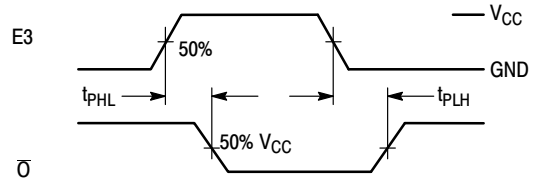


Figure 4. .

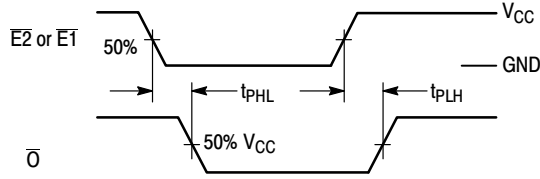
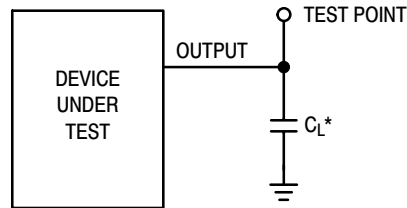


Figure 5.

## TEST CIRCUIT



\*Includes all probe and jig capacitance

Figure 6.

## ORDERING INFORMATION

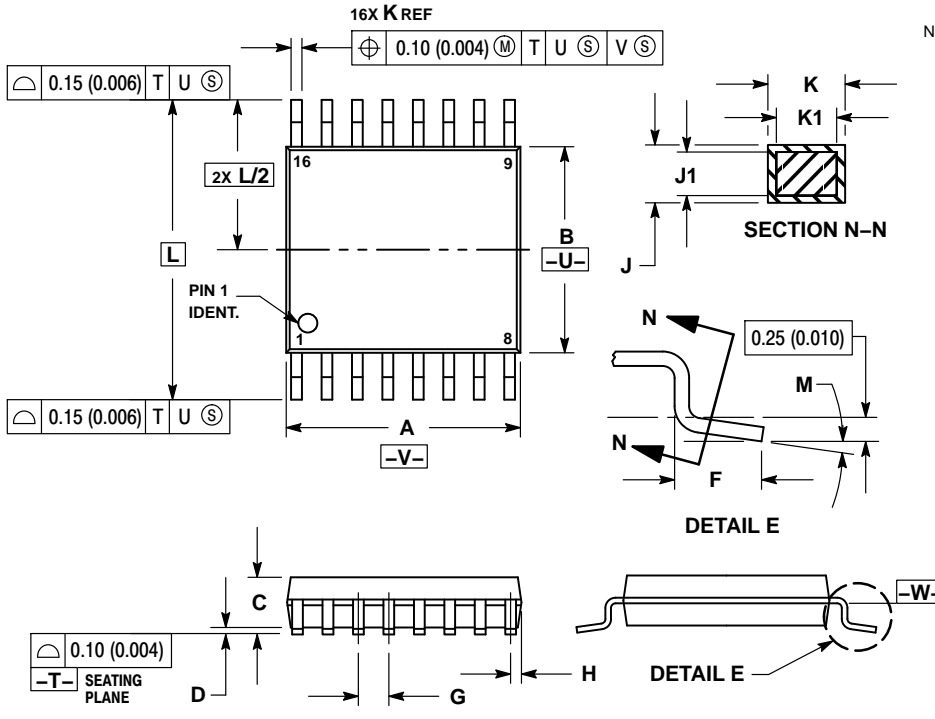
Device	Package	Shipping†
MC74LVX138DR2G	SOIC-16 (Pb-Free)	2500 Tape & Reel
MC74LVX138DTR2G	TSSOP-16 (Pb-Free)	2500 Tape & Reel

†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.

# MC74LVX138

## PACKAGE DIMENSIONS

TSSOP-16  
CASE 948F  
ISSUE B

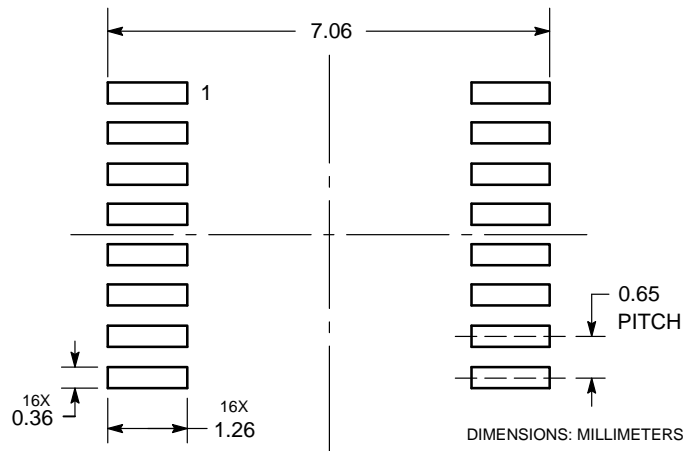


**NOTES:**

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\*

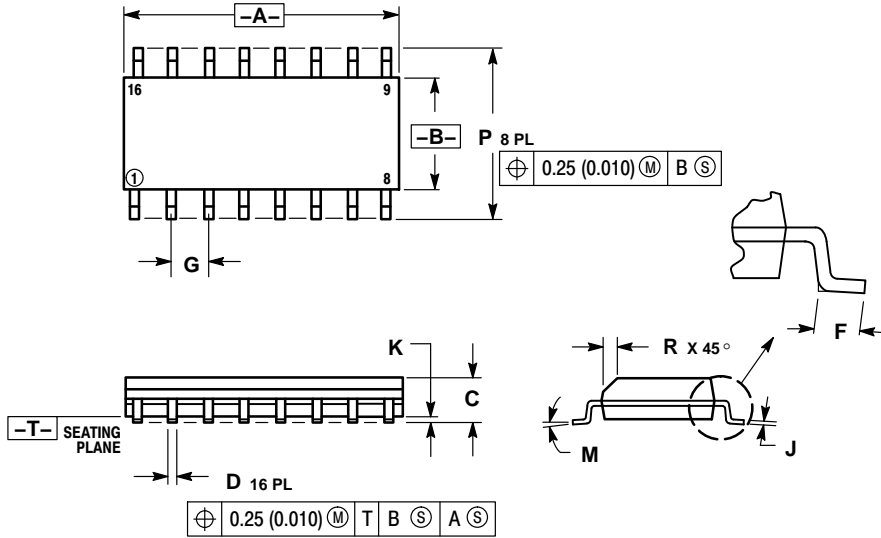


\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

# MC74LVX138

## PACKAGE DIMENSIONS

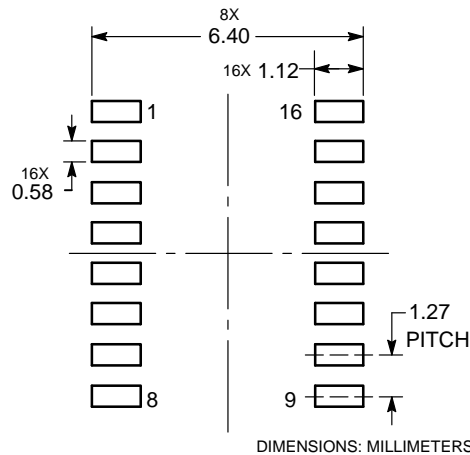
SOIC-16  
CASE 751B-05  
ISSUE K



### 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.

### 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.

ON Semiconductor and the are registered trademarks of Semiconductor Components Industries, LLC (SCILLC) or its subsidiaries in the United States and/or other countries. SCILLC owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of SCILLC's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). 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: 81-3-5817-1050

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

## Looking for pricing, stock, or lifecycle information?

Click below to explore more details on WIN SOURCE:

 [View MC74LVX138DR2G on WIN SOURCE](#)

 [ON Semiconductor](#) Information

## Optimize Your Supply Chain with WIN SOURCE Solutions

-  Global Sourcing Solution
-  Obsolete Management
-  Cost Control Management
-  Shortage Management
-  Alternative Solution
-  Excess Inventory Management