

# 3-to-8 Line Decoder

With 5 V-Tolerant Inputs

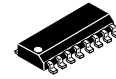
## MC74LVX138

The MC74LVX138 is an advanced high speed CMOS 3-to-8 line decoder. The inputs tolerate voltages up to 5.5 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 100 mA
- ESD Performance:  
Human Body Model > 2000 V
- These Devices are Pb-Free and are RoHS Compliant

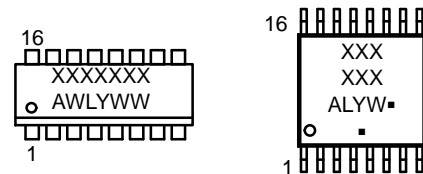


SOIC-16  
D SUFFIX  
CASE 751B



TSSOP-16  
DT SUFFIX  
CASE 948F

### MARKING DIAGRAMS

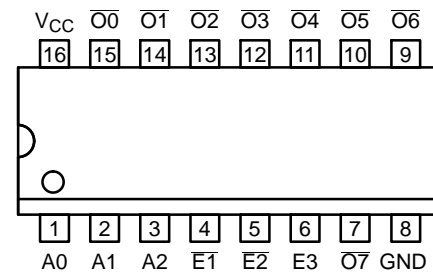


SOIC-16

TSSOP-16

XXXXXX = 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)

### 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

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

# MC74LVX138

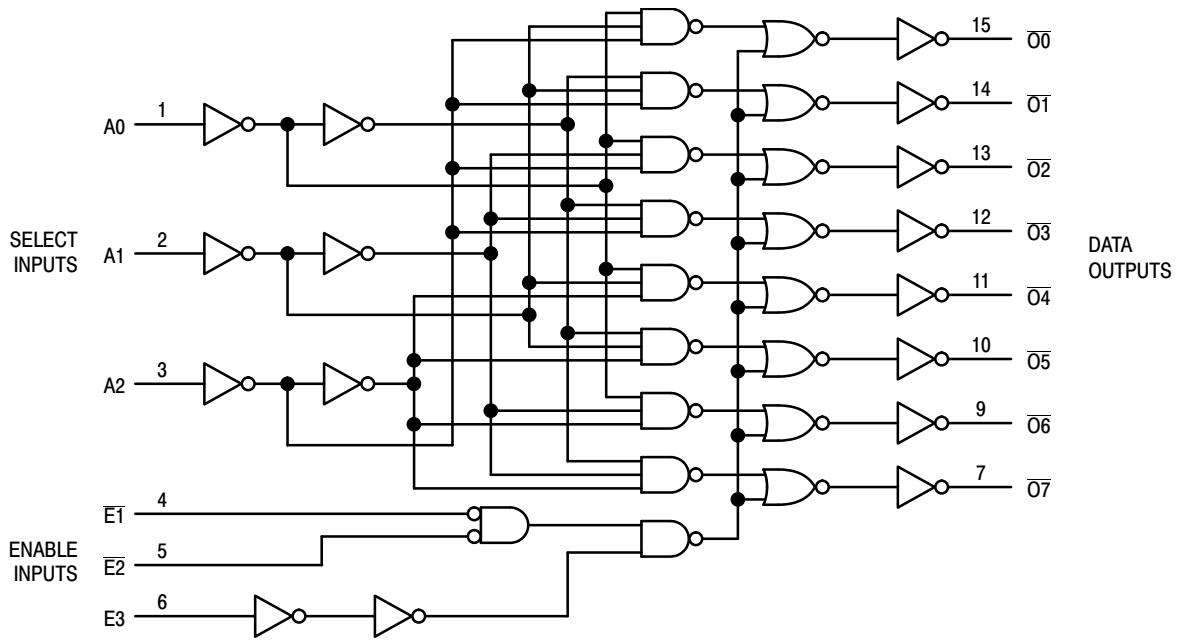


Figure 1. Logic Diagram

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	H	L	H	H	H	H	H	H	L	H	H
L	L	H	H	H	H	H	H	H	H	H	H	L	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

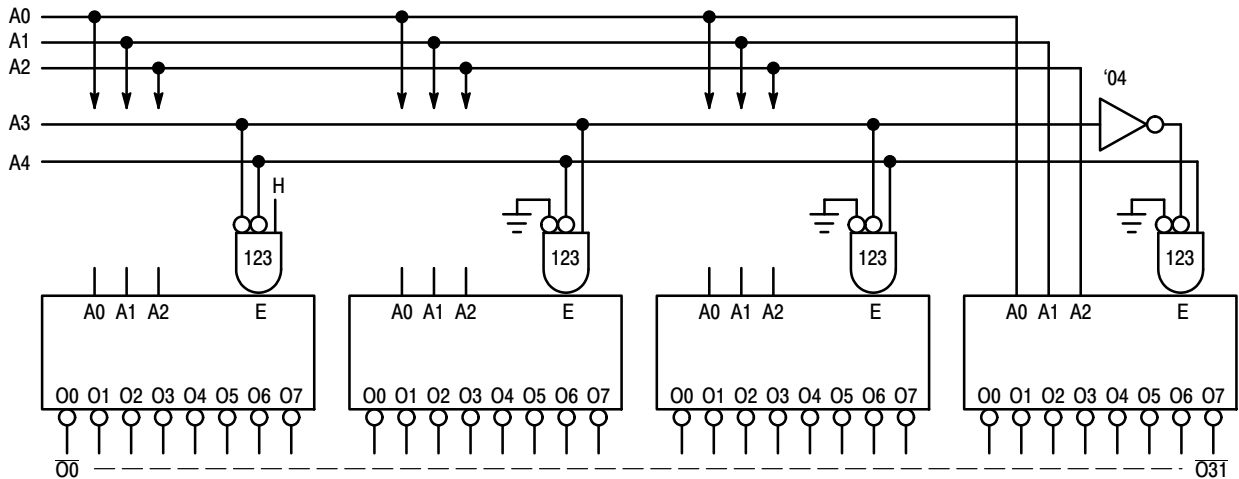


Figure 2. Expansion to 1-of-32 Decoding

# MC74LVX138

## MAXIMUM RATINGS

Symbol	Parameter	Value	Unit	
V <sub>CC</sub>	DC Supply Voltage	-0.5 to +6.5	V	
V <sub>IN</sub>	DC Input Voltage	-0.5 to +6.5	V	
V <sub>OUT</sub>	DC Output Voltage	-0.5 to V <sub>CC</sub> + 0.5	V	
I <sub>IN</sub>	DC Input Current, per Pin	±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	
I <sub>IK</sub>	Input Clamp Current	-20	mA	
I <sub>OK</sub>	Output Clamp Current	±20	mA	
T <sub>STG</sub>	Storage Temperature Range	-65 to +150	°C	
T <sub>L</sub>	Lead Temperature, 1 mm from Case for 10 Seconds	260	°C	
T <sub>J</sub>	Junction Temperature Under Bias	+150	°C	
θ <sub>JA</sub>	Thermal Resistance (Note 1)	SOIC-16 TSSOP-16	126 159	°C/W
P <sub>D</sub>	Power Dissipation in Still Air at 25 °C	SOIC-16 TSSOP-16	995 787	mW
MSL	Moisture Sensitivity	Level 1		
F <sub>R</sub>	Flammability Rating	Oxygen Index: 28 to 34	UL 94 V-0 @ 0.125 in	
V <sub>ESD</sub>	ESD Withstand Voltage (Note 2)	Human Body Model Charged Device Model	2000 N/A	V

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.

1. Measured with minimum pad spacing on an FR4 board, using 76mm-by-114mm, 2-ounce copper trace no air flow per JESD51-7.
2. HBM tested to EIA / JESD22-A114-A. CDM tested to JESD22-C101-A. JEDEC recommends that ESD qualification to EIA/JESD22-A115A (Machine Model) be discontinued.

## 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.

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## 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> = -50 μA	2.0	1.9	2.0	-	1.9	-	V
		I <sub>OH</sub> = -50 μA	3.0	2.9	3.0	-	2.9	-	
		I <sub>OH</sub> = -4 mA	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> = 50 μA	2.0	-	0.0	0.1	-	0.1	V
		I <sub>OL</sub> = 50 μA	3.0	-	0.0	0.1	-	0.1	
		I <sub>OL</sub> = 4 mA	3.0	-	-	0.36	-	0.44	
I <sub>in</sub>	Input Leakage Current	V <sub>in</sub> = 5.5 V 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.

## AC ELECTRICAL CHARACTERISTICS (Input t<sub>r</sub> = t<sub>f</sub> = 3.0 ns)

Symbol	Parameter	Test Conditions	T <sub>A</sub> = 25 °C			T <sub>A</sub> = -40 to 85 °C		Unit
			Min	Typ	Max	Min	Max	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay Input to Output	V <sub>CC</sub> = 2.7 V    C <sub>L</sub> = 15 pF	-	7.1	13.8	1.0	16.5	ns
		V <sub>CC</sub> = 2.7 V    C <sub>L</sub> = 50 pF	-	9.6	17.3	1.0	20.0	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay E3 to $\bar{O}$	V <sub>CC</sub> = 3.3 ± 0.3 V    C <sub>L</sub> = 15 pF	-	5.5	8.8	1.0	10.5	ns
		V <sub>CC</sub> = 3.3 ± 0.3 V    C <sub>L</sub> = 50 pF	-	8.0	12.3	1.0	14.0	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay E3 to $\bar{O}$	V <sub>CC</sub> = 2.7 V    C <sub>L</sub> = 15 pF	-	8.7	16.3	1.0	19.5	ns
		V <sub>CC</sub> = 2.7 V    C <sub>L</sub> = 50 pF	-	11.2	19.8	1.0	23.0	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay E1 or E2 to $\bar{O}$	V <sub>CC</sub> = 3.3 ± 0.3 V    C <sub>L</sub> = 15 pF	-	6.8	10.6	1.0	12.5	ns
		V <sub>CC</sub> = 3.3 ± 0.3 V    C <sub>L</sub> = 50 pF	-	9.3	14.1	1.0	16.0	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay E1 or E2 to $\bar{O}$	V <sub>CC</sub> = 2.7 V    C <sub>L</sub> = 15 pF	-	8.8	16.0	1.0	18.5	ns
		V <sub>CC</sub> = 2.7 V    C <sub>L</sub> = 50 pF	-	11.3	19.5	1.0	22.0	
t <sub>OSSL</sub> , t <sub>OSLH</sub>	Output-to-Output Skew (Note 1)	V <sub>CC</sub> = 2.7 V    C <sub>L</sub> = 50 pF	-	-	2.5	-	2.5	ns
		V <sub>CC</sub> = 3.3 ± 0.3 V    C <sub>L</sub> = 50 pF	-	-	2.5	-	2.5	

- 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>OSSL</sub>) or LOW-to-HIGH (t<sub>OSLH</sub>); parameter guaranteed by design.

## CAPACITIVE CHARACTERISTICS

Symbol	Parameter	T <sub>A</sub> = 25 °C			T <sub>A</sub> = -40 to 85 °C		Unit
		Min	Typ	Max	Min	Max	
C <sub>in</sub>	Input Capacitance	-	4	10	-	10	pF
C <sub>PD</sub>	Power Dissipation Capacitance (Note 2)	-	34	-	-	-	pF

- C<sub>PD</sub> 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<sub>CC(OPR)</sub> = C<sub>PD</sub> • V<sub>CC</sub> • f<sub>in</sub> + I<sub>CC</sub>. C<sub>PD</sub> is used to determine the no-load dynamic power consumption; P<sub>D</sub> = C<sub>PD</sub> • V<sub>CC</sub><sup>2</sup> • f<sub>in</sub> + I<sub>CC</sub> • V<sub>CC</sub>.

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**NOISE CHARACTERISTICS** (Input  $t_r = t_f = 3.0$  ns,  $C_L = 50$  pF,  $V_{CC} = 3.3$  V)

Symbol	Characteristic	$T_A = 25$ °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

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## SWITCHING WAVEFORMS

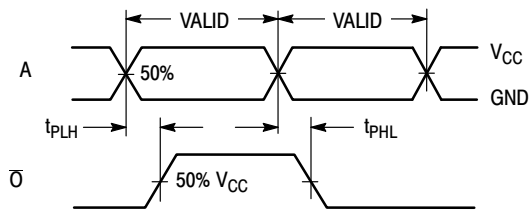


Figure 3. .

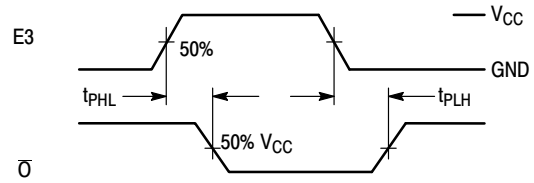


Figure 4. .

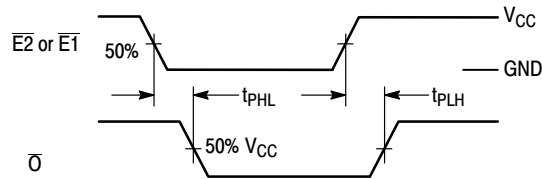
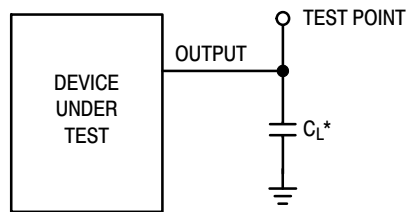


Figure 5.

## TEST CIRCUIT



\*Includes all probe and jig capacitance

Figure 6.

## ORDERING INFORMATION

Device	Marking	Package	Shipping <sup>†</sup>
MC74LVX138DR2G	LVX138G	SOIC-16 (Pb-Free)	2500 Tape & Reel
MC74LVX138DTR2G	LVX 138	TSSOP-16 (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.

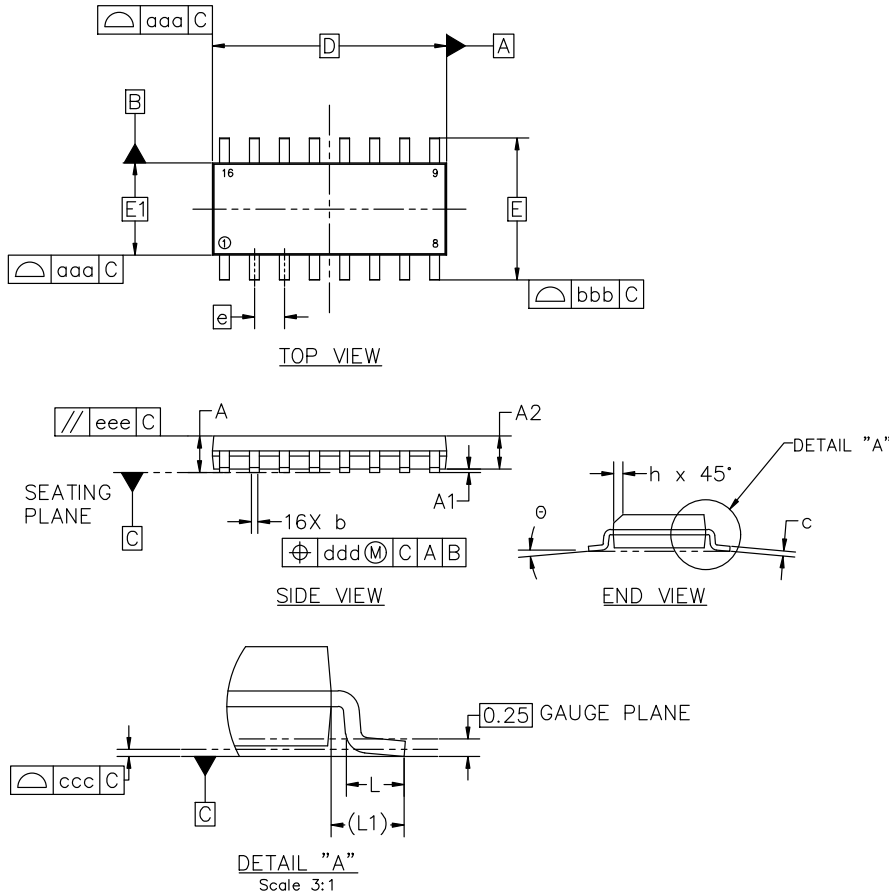


**SOIC-16 9.90x3.90x1.37 1.27P**  
**CASE 751B**  
**ISSUE M**

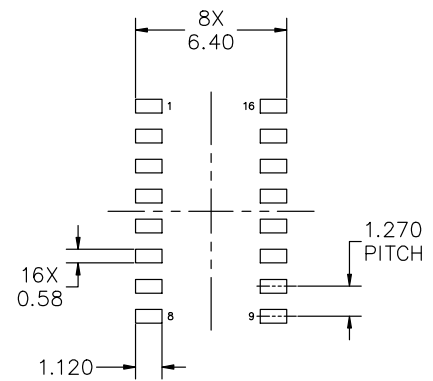
DATE 18 OCT 2024

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. DIMENSION IN MILLIMETERS. ANGLE IN DEGREES.
3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15mm PER SIDE.
5. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127mm TOTAL IN EXCESS OF THE b DIMENSION AT MAXIMUM MATERIAL CONDITION.



MILLIMETERS			
DIM	MIN	NOM	MAX
A	1.35	1.55	1.75
A1	0.10	0.18	0.25
A2	1.25	1.37	1.50
b	0.35	0.42	0.49
c	0.19	0.22	0.25
D	9.90 BSC		
E	6.00 BSC		
E1	3.90 BSC		
e	1.27 BSC		
h	0.25	---	0.50
L	0.40	0.83	1.25
L1	1.05 REF		
θ	0°	---	7°
TOLERANCE OF FORM AND POSITION			
aaa	0.10		
bbb	0.20		
ccc	0.10		
ddd	0.25		
eee	0.10		



RECOMMENDED MOUNTING FOOTPRINT

\*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE onsemi SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERM/D

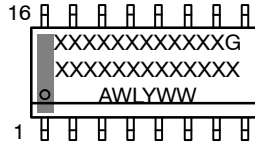
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<b>DESCRIPTION:</b>	<b>SOIC-16 9.90X3.90X1.37 1.27P</b>	<b>PAGE 1 OF 2</b>

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**SOIC-16 9.90x3.90x1.37 1.27P**  
**CASE 751B**  
**ISSUE M**

DATE 18 OCT 2024

**GENERIC  
MARKING DIAGRAM\***



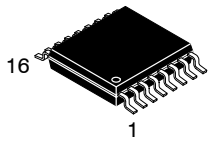
XXXXX = Specific Device Code  
A = Assembly Location  
WL = Wafer Lot  
Y = Year  
WW = Work Week  
G = Pb-Free Package

\*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.

<p><b>STYLE 1:</b></p> <p>PIN 1. COLLECTOR  2. BASE  3. EMITTER  4. NO CONNECTION  5. EMITTER  6. BASE  7. COLLECTOR  8. COLLECTOR  9. BASE  10. EMITTER  11. NO CONNECTION  12. EMITTER  13. BASE  14. COLLECTOR  15. EMITTER  16. COLLECTOR</p>	<p><b>STYLE 2:</b></p> <p>PIN 1. CATHODE  2. ANODE  3. NO CONNECTION  4. CATHODE  5. CATHODE  6. NO CONNECTION  7. ANODE  8. CATHODE  9. CATHODE  10. ANODE  11. NO CONNECTION  12. CATHODE  13. CATHODE  14. NO CONNECTION  15. ANODE  16. CATHODE</p>	<p><b>STYLE 3:</b></p> <p>PIN 1. COLLECTOR, DYE #1  2. BASE, #1  3. EMITTER, #1  4. COLLECTOR, #1  5. COLLECTOR, #2  6. BASE, #2  7. EMITTER, #2  8. COLLECTOR, #2  9. COLLECTOR, #3  10. BASE, #3  11. EMITTER, #3  12. COLLECTOR, #3  13. COLLECTOR, #4  14. BASE, #4  15. EMITTER, #4  16. COLLECTOR, #4</p>	<p><b>STYLE 4:</b></p> <p>PIN 1. COLLECTOR, DYE #1  2. COLLECTOR, #1  3. COLLECTOR, #2  4. COLLECTOR, #2  5. COLLECTOR, #3  6. COLLECTOR, #3  7. COLLECTOR, #4  8. COLLECTOR, #4  9. BASE, #4  10. EMITTER, #4  11. BASE, #3  12. EMITTER, #3  13. BASE, #2  14. EMITTER, #2  15. BASE, #1  16. EMITTER, #1</p>
<p><b>STYLE 5:</b></p> <p>PIN 1. DRAIN, DYE #1  2. DRAIN, #1  3. DRAIN, #2  4. DRAIN, #2  5. DRAIN, #3  6. DRAIN, #3  7. DRAIN, #4  8. DRAIN, #4  9. GATE, #4  10. SOURCE, #4  11. GATE, #3  12. SOURCE, #3  13. GATE, #2  14. SOURCE, #2  15. GATE, #1  16. SOURCE, #1</p>	<p><b>STYLE 6:</b></p> <p>PIN 1. CATHODE  2. CATHODE  3. CATHODE  4. CATHODE  5. CATHODE  6. CATHODE  7. CATHODE  8. CATHODE  9. ANODE  10. ANODE  11. ANODE  12. ANODE  13. ANODE  14. ANODE  15. ANODE  16. ANODE</p>	<p><b>STYLE 7:</b></p> <p>PIN 1. SOURCE N-CH  2. COMMON DRAIN (OUTPUT)  3. COMMON DRAIN (OUTPUT)  4. GATE P-CH  5. COMMON DRAIN (OUTPUT)  6. COMMON DRAIN (OUTPUT)  7. COMMON DRAIN (OUTPUT)  8. SOURCE P-CH  9. SOURCE P-CH  10. COMMON DRAIN (OUTPUT)  11. COMMON DRAIN (OUTPUT)  12. COMMON DRAIN (OUTPUT)  13. GATE N-CH  14. COMMON DRAIN (OUTPUT)  15. COMMON DRAIN (OUTPUT)  16. SOURCE N-CH</p>	

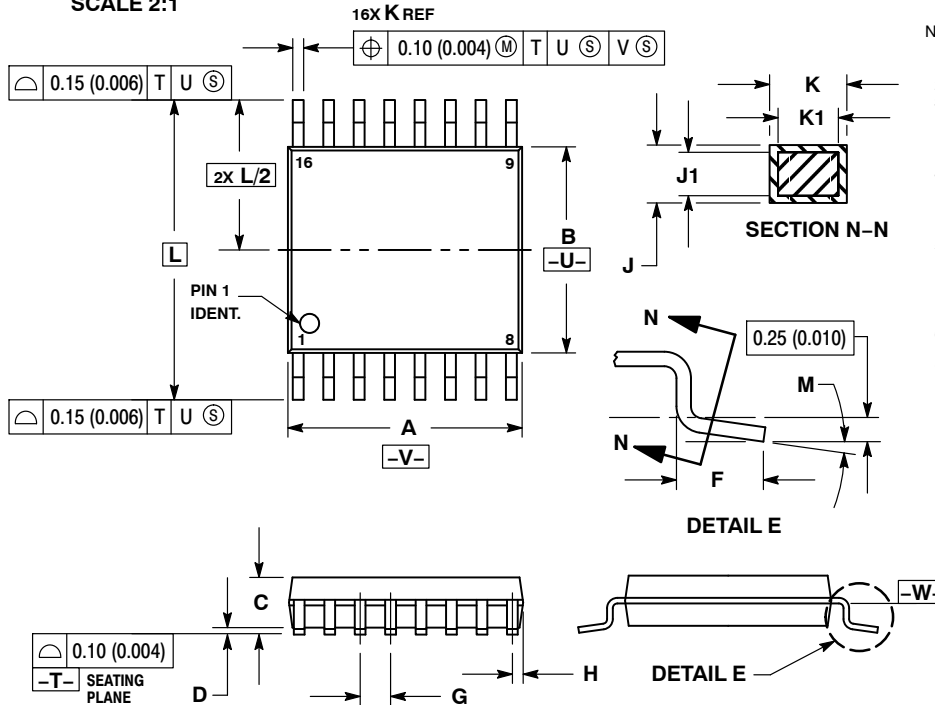
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<b>DESCRIPTION:</b>	<b>SOIC-16 9.90X3.90X1.37 1.27P</b>	<b>PAGE 2 OF 2</b>

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TSSOP-16 WB  
CASE 948F  
ISSUE B

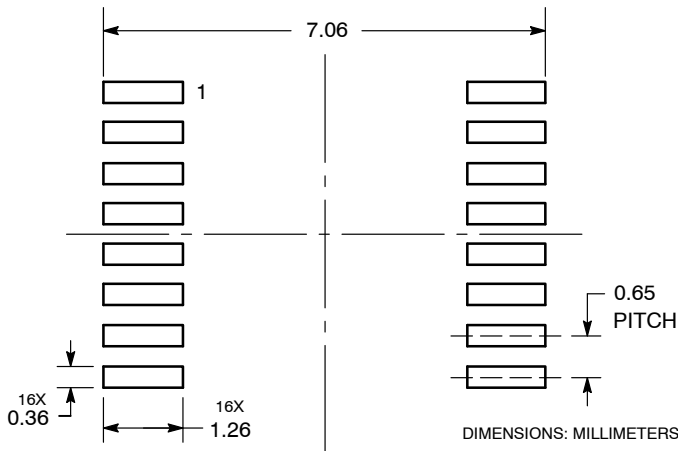
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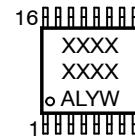
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
  4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. 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°

RECOMMENDED  
SOLDERING FOOTPRINT\*



GENERIC  
MARKING DIAGRAM\*



- XXXX = Specific Device Code
- A = Assembly Location
- L = Wafer Lot
- Y = Year
- W = Work Week
- G or ■ = 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.

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

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