

MC74LVX139

Dual 2-to-4 Decoder/ Demultiplexer

The MC74LVX139 is an advanced high speed CMOS 2-to-4 decoder/demultiplexer fabricated with silicon gate CMOS technology.

When the device is enabled (\bar{E} = low), it can be used for gating or as a data input for demultiplexing operations. When the enable input is held high, all four outputs are fixed high, independent of other inputs.

The inputs tolerate voltages up to 7.0 V, allowing the interface of 5.0 V systems to 3.0 V systems.

Features

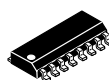
- High Speed: $t_{PD} = 6.0$ ns (Typ) at $V_{CC} = 3.3$ V
- Low Power Dissipation: $I_{CC} = 4$ μ A (Max) at $T_A = 25^\circ$ C
- High Noise Immunity: $V_{NIH} = V_{NIL} = 28\%$ V_{CC}
- Power Down Protection Provided on Inputs
- Balanced Propagation Delays
- Designed for 2 V to 3.6 V Operating Range
- Low Noise: $V_{OLP} = 0.5$ V (Max)
- Pin and Function Compatible with Other Standard Logic Families
- Latchup Performance Exceeds 300 mA
- Chip Complexity: 100 FETs or 25 Equivalent Gates
- ESD Performance:
 - Human Body Model > 2000 V;
 - Machine Model > 200 V
- Pb-Free Packages are Available*



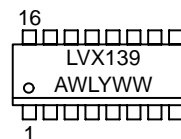
ON Semiconductor®

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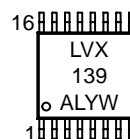
MARKING DIAGRAMS



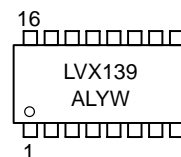
SOIC-16
D SUFFIX
CASE 751B



TSSOP-16
DT SUFFIX
CASE 948F



SOEIAJ-16
M SUFFIX
CASE 966



A = Assembly Location
WL or L = Wafer Lot
Y = Year
WW or W = Work Week

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

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

MC74LVX139



FUNCTION TABLE

| Inputs | | | Outputs | | | |
|--------|----|----|---------|----|----|----|
| E | A1 | A0 | Y0 | Y1 | Y2 | Y3 |
| H | X | X | H | H | H | H |
| L | L | L | L | H | H | H |
| L | L | H | H | L | H | H |
| L | H | L | H | H | L | H |
| L | H | H | H | H | H | L |

Figure 1. Pin Assignment

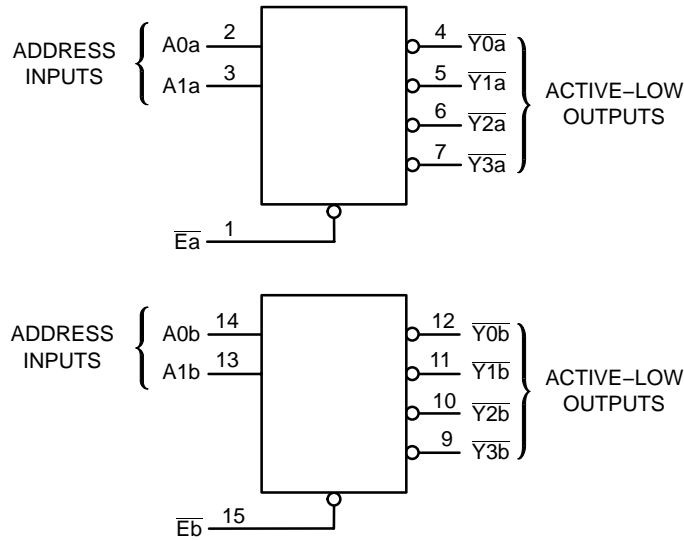


Figure 2. Logic Diagram

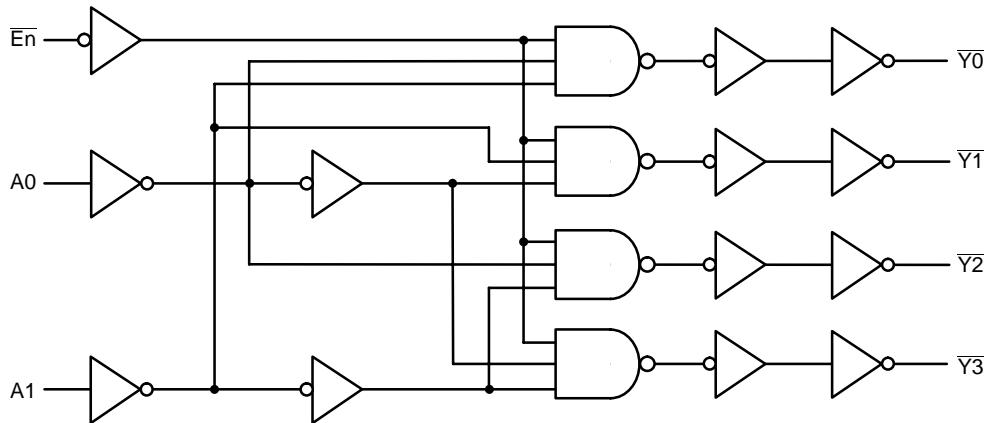


Figure 3. Expanded Logic Diagram
(1/2 of Device)

MC74LVX139

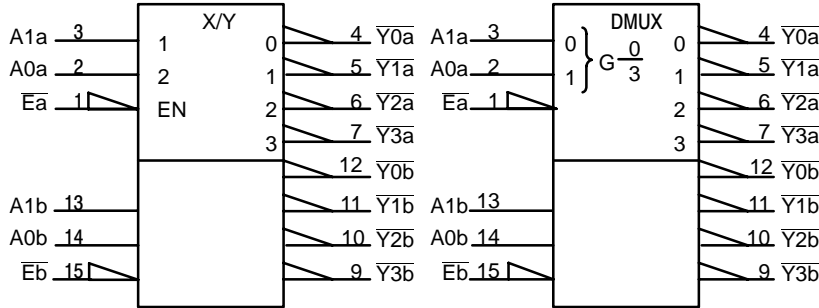


Figure 4. IEC Logic Diagram

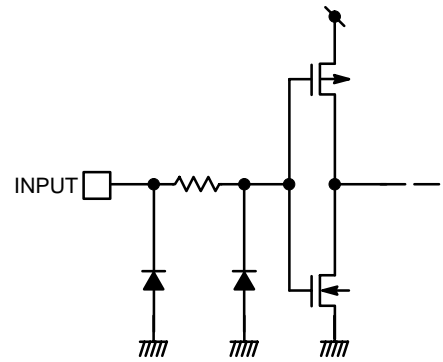


Figure 5. Input Equivalent Circuit

MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit | |
|---------------|------------------------------------------|--------------------------------------------------------------------------------------|------------------------|---------------|
| V_{CC} | Positive DC Supply Voltage | -0.5 to +7.0 | V | |
| V_{IN} | Digital Input Voltage | -0.5 to +7.0 | V | |
| V_{OUT} | DC Output Voltage | -0.5 to $V_{CC} + 0.5$ | V | |
| I_{IK} | Input Diode Current | -20 | mA | |
| I_{OK} | Output Diode Current | ± 20 | mA | |
| I_{OUT} | DC Output Current, per Pin | ± 25 | mA | |
| I_{CC} | DC Supply Current, V_{CC} and GND Pins | ± 75 | mA | |
| P_D | Power Dissipation in Still Air | SOIC Package TSSOP | 200 180 | mW |
| T_{STG} | Storage Temperature Range | -65 to +150 | $^{\circ}C$ | |
| V_{ESD} | ESD Withstand Voltage | Human Body Model (Note 1) Machine Model (Note 2) Charged Device Model (Note 3) | >2000 >200 >2000 | V |
| $I_{LATCHUP}$ | Latchup Performance | Above V_{CC} and Below GND at 125 $^{\circ}C$ (Note 4) | ± 300 | mA |
| θ_{JA} | Thermal Resistance, Junction-to-Ambient | SOIC Package TSSOP | 143 164 | $^{\circ}C/W$ |

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. Tested to EIA/JESD22-A114-A
2. Tested to EIA/JESD22-A115-A
3. Tested to JESD22-C101-A
4. Tested to EIA/JESD78

RECOMMENDED OPERATING CONDITIONS

| Symbol | Characteristics | Min | Max | Unit |
|------------|------------------------------------------------|----------------------------|----------|-------------|
| V_{CC} | DC Supply Voltage | 2.0 | 3.6 | V |
| V_{IN} | DC Input Voltage | 0 | 5.5 | V |
| V_{OUT} | DC Output Voltage | 0 | V_{CC} | V |
| T_A | Operating Temperature Range, all Package Types | -40 | 85 | $^{\circ}C$ |
| t_r, t_f | Input Rise or Fall Time | $V_{CC} = 5.0 V \pm 0.5 V$ | | ns/V |

MC74LVX139

DC CHARACTERISTICS (Voltages Referenced to GND)

| Symbol | Parameter | Condition | V _{CC} (V) | T _A = 25°C | | | -40°C ≤ T _A ≤ 85°C | | Unit |
|-----------------|------------------------------------------------|------------------------------------------|------------------------|-----------------------|-----|----------------------|-------------------------------|----------------------|------|
| | | | | Min | Typ | Max | Min | Max | |
| V _{IH} | Minimum High-Level Input Voltage | | 2.0 | 0.75 V _{CC} | - | - | 0.75 V _{CC} | - | V |
| | | | 3.0 | 0.7 V _{CC} | - | - | 0.7 V _{CC} | - | |
| | | | 3.6 | 0.7 V _{CC} | - | - | 0.7 V _{CC} | - | |
| V _{IL} | Maximum Low-Level Input Voltage | | 2.0 | - | - | 0.25 V _{CC} | - | 0.25 V _{CC} | V |
| | | | 3.0 | - | - | 0.3 V _{CC} | - | 0.3 V _{CC} | |
| | | | 3.6 | - | - | 0.3 V _{CC} | - | 0.3 V _{CC} | |
| V _{OH} | High-Level Output Voltage | I _{OH} = -50 μA | 2.0 | 1.9 | 2.0 | - | 1.9 | - | V |
| | | I _{OH} = -50 μA | 3.0 | 2.9 | 3.0 | - | 2.9 | - | |
| | | I _{OH} = -4 mA | 3.0 | 2.58 | 3.0 | - | 2.48 | - | |
| V _{OL} | Low-Level Output Voltage | I _{OL} = 50 μA | 2.0 | - | 0.0 | 0.1 | - | 0.1 | V |
| | | I _{OH} = 50 μA | 3.0 | - | - | 0.1 | - | 0.1 | |
| | | I _{OH} = 4 mA | 3.0 | - | - | 0.36 | - | 0.44 | |
| I _{IN} | Input Leakage Current | V _{IN} = 5.5 V or GND | 0 to 3.6 | - | - | ±0.1 | - | ±1.0 | μA |
| I _{CC} | Maximum Quiescent Supply Current (per package) | V _{IN} = V _{CC} or GND | 3.6 | 1.0 | 1.0 | 2.0 | - | - | μA |

AC ELECTRICAL CHARACTERISTICS Input t_r = t_f = 3.0 ns

| Symbol | Parameter | Test Conditions | T _A = 25°C | | | -40°C ≤ T _A ≤ 85°C | | Unit | |
|----------------------------------------|----------------------------------------|---------------------------------------------------|-----------------------------------------|------|------|-------------------------------|------|------|----|
| | | | Min | Typ | Max | Min | Max | | |
| t _{PLH} , t _{PHL} | Maximum Propagation Delay, A to Y | V _{CC} = 2.7 V C _L = 15 pF | - | 8.5 | 15.0 | 1.0 | 17.8 | ns | |
| | | C _L = 50 pF | - | 11.0 | 16.5 | 1.0 | 18.0 | | |
| t _{PLH} , t _{PHL} | Maximum Propagation Delay, E to Y | V _{CC} = 3.3 V ± 0.3 V | C _L = 15 pF | - | 6.0 | 10.0 | 1.0 | 12.0 | ns |
| | | | C _L = 50 pF | - | 8.5 | 13.0 | 1.0 | 15.0 | |
| | | V _{CC} = 2.7 V | C _L = 15 pF | - | 8.0 | 13.0 | 1.0 | 15.5 | |
| | | | C _L = 50 pF | - | 10.0 | 16.5 | 1.0 | 18.0 | |
| C _{IN} | Maximum Input Capacitance | | - | 4 | 10 | - | 10 | pF | |
| C _{PD} | Power Dissipation Capacitance (Note 5) | | Typical @ 25°C, V _{CC} = 3.3 V | | | | | pF | |
| | | | 26 | | | | | | |

5. 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} • V_{CC} • f_{in} + I_{CC}/2 (per decoder). C_{PD} is used to determine the no-load dynamic power consumption; P_D = C_{PD} • V_{CC}² • f_{in} + I_{CC} • V_{CC}.

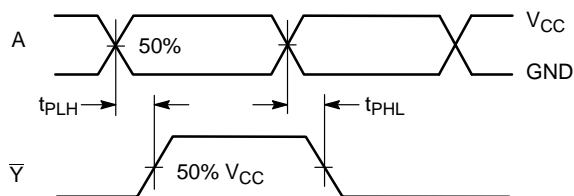


Figure 6. Switching Waveform

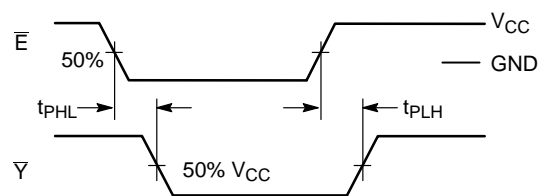
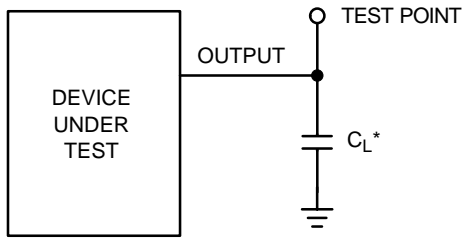


Figure 7. Switching Waveform

MC74LVX139



*Includes all probe and jig capacitance

Figure 8. Test Circuit

ORDERING INFORMATION

| Device | Package | Shipping† |
|----------------|------------------------|------------------|
| MC74LVX139DR2 | SOIC-16 | 2500 Tape & Reel |
| MC74LVX139DR2G | SOIC-16 (Pb-Free) | 2500 Tape & Reel |
| MC74LVX139DTR2 | TSSOP-16* | 2500 Tape & Reel |
| MC74LVX139M | SOEIAJ-16 | 50 Units / Rail |
| MC74LVX139MG | SOEIAJ-16 (Pb-Free) | 50 Units / Rail |
| MC74LVX139MEL | SOEIAJ-16 | 2000 Tape & Reel |
| MC74LVX139MELG | SOEIAJ-16 (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.

EMBOSSED CARRIER DIMENSIONS (See Notes 6 and 7)

| Tape Size | B ₁ Max | D | D ₁ | E | F | K | P | P ₀ | P ₂ | R | T | W |
|-----------|---------------------|-------------------------------------|---------------------------|---------------------------------------|----------------------------------------|----------------------------|--------------------------------------------------------------------------------------------------------------------------|--------------------------------------|--------------------------------------|------------------|-------------------|---------------------------------------|
| 8 mm | 4.35 mm (0.179") | 1.5 mm + 0.1 -0.0 (0.059") | 1.0 mm Min (0.179") | 1.75 mm ±0.1 (0.069 ±0.004") | 3.5 mm ±0.5 (1.38 ±0.002") | 2.4 mm Max (0.094") | 4.0 mm ±0.10 (0.157 ±0.004") | 4.0 mm ±0.1 (0.157 ±0.004") | 2.0 mm ±0.1 (0.079 ±0.004") | 25 mm (0.98") | 0.6 mm (0.024) | 8.3 mm (0.327) |
| 12 mm | 8.2 mm (0.323") | +0.004 -0.0 | 1.5 mm Min (0.060) | | 5.5 mm ±0.5 (0.217 ±0.002") | 6.4 mm Max (0.252") | 4.0 mm ±0.10 (0.157 ±0.004") 8.0 mm ±0.10 (0.315 ±0.004") | | | 30 mm (1.18") | | 12.0 mm ±0.3 (0.470 ±0.012") |
| 16 mm | 12.1 mm (0.476") | | | | 7.5 mm ±0.10 (0.295 ±0.004") | 7.9 mm Max (0.311") | 4.0 mm ±0.10 (0.157 ±0.004") 8.0 mm ±0.10 (0.315 ±0.004") 12.0 mm ±0.10 (0.472 ±0.004") | | | | | 16.3 mm (0.642) |
| 24 mm | 20.1 mm (0.791") | | | | 11.5 mm ±0.10 (0.453 ±0.004") | 11.9 mm Max (0.468") | 16.0 mm ±0.10 (0.63 ±0.004") | | | | | 24.3 mm (0.957) |

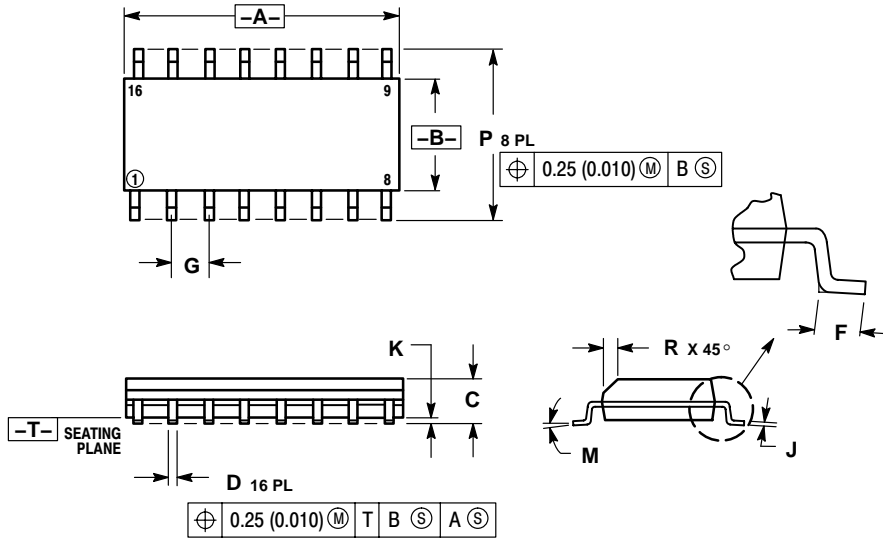
6. Metric Dimensions Govern-English are in parentheses for reference only.

7. A₀, B₀, and K₀ are determined by component size. The clearance between the components and the cavity must be within 0.05 mm min to 0.50 mm max. The component cannot rotate more than 10° within the determined cavity

MC74LVX139

PACKAGE DIMENSIONS

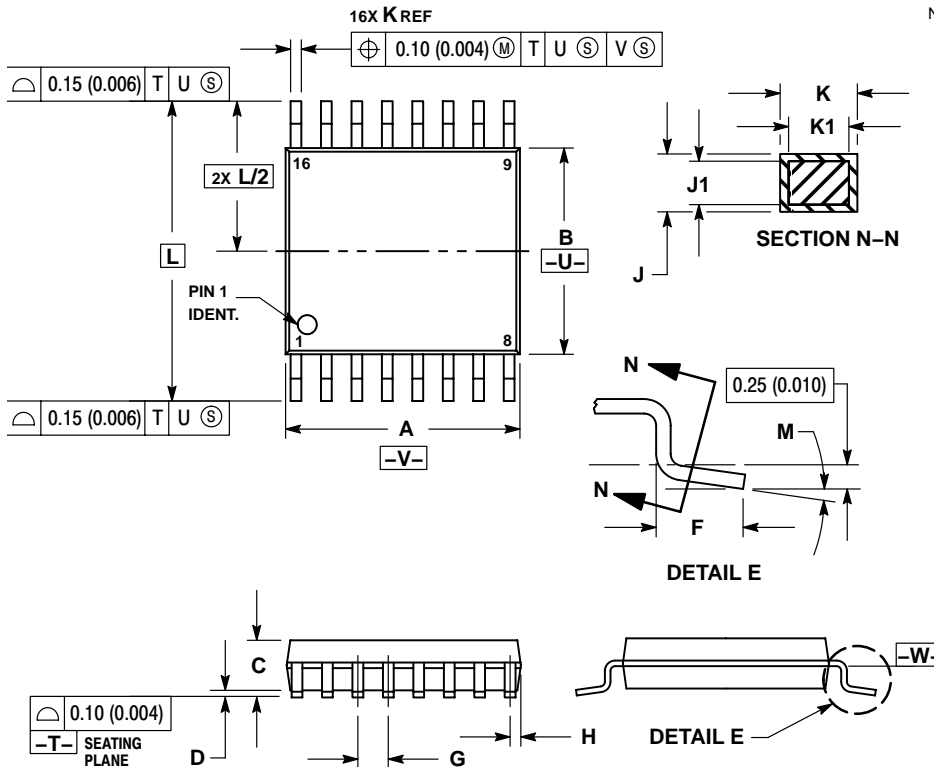
SOIC-16
D SUFFIX
CASE 751B-05
ISSUE J



- NOTES:
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 - CONTROLLING DIMENSION: MILLIMETER.
 - DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
 - MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
 - 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 |

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

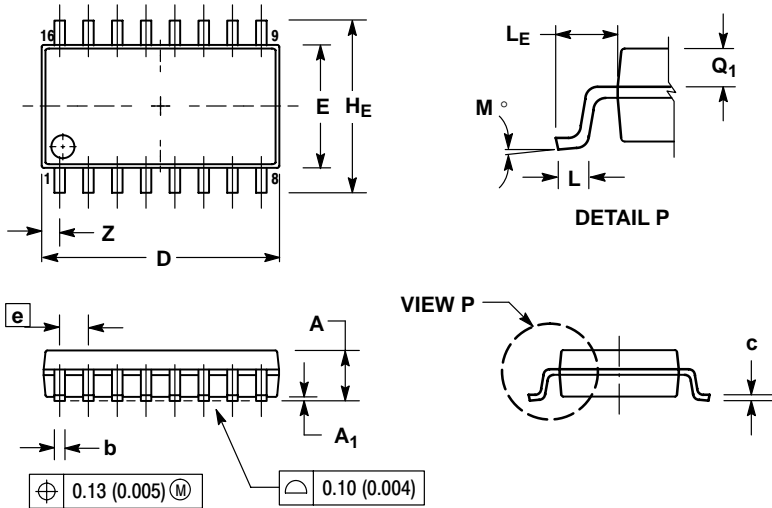


- NOTES:
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 - CONTROLLING DIMENSION: MILLIMETER.
 - DIMENSION A DOES NOT INCLUDE MOLD FLASH. PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
 - DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
 - 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.
 - TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
 - 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° |

MC74LVX139

SOEIAJ-16
M SUFFIX
CASE 966-01
ISSUE O



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 ₁ | 0.05 | 0.20 | 0.002 | 0.008 |
| b | 0.35 | 0.50 | 0.014 | 0.020 |
| c | 0.18 | 0.27 | 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 | |
| HE | 7.40 | 8.20 | 0.291 | 0.323 |
| L | 0.50 | 0.85 | 0.020 | 0.033 |
| LE | 1.10 | 1.50 | 0.043 | 0.059 |
| M | 0° - 10° | | 0° - 10° | |
| Q ₁ | 0.70 | 0.90 | 0.028 | 0.035 |
| Z | --- | 0.78 | --- | 0.031 |

MC74LVX139

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