

# MC74HC139A

## Dual 1-of-4 Decoder/ Demultiplexer

### High-Performance Silicon-Gate CMOS

The MC74HC139A is identical in pinout to the LS139. The device inputs are compatible with standard CMOS outputs; with pull-up resistors, they are compatible with LSTTL outputs.

This device consists of two independent 1-of-4 decoders, each of which decodes a two-bit Address to one-of-four active-low outputs. Active-low Selects are provided to facilitate the demultiplexing and cascading functions. The demultiplexing function is accomplished by using the Address inputs to select the desired device output, and utilizing the Select as a data input.

#### Features

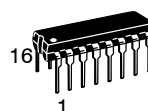
- Output Drive Capability: 10 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS and TTL
- Operating Voltage Range: 2.0 to 6.0 V
- Low Input Current: 1.0  $\mu$ A
- High Noise Immunity Characteristic of CMOS Devices
- In Compliance with the Requirements Defined by JEDEC Standard No. 7 A
- Chip Complexity: 100 FETs or 25 Equivalent Gates
- These Devices are Pb-Free, Halogen Free and are RoHS Compliant



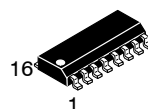
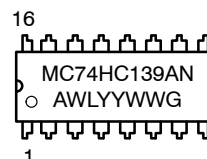
ON Semiconductor®

<http://onsemi.com>

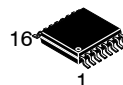
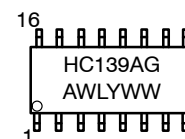
#### MARKING DIAGRAMS



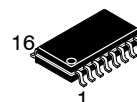
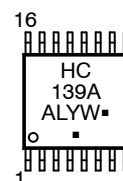
PDIP-16  
N SUFFIX  
CASE 648



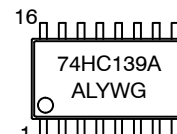
SOIC-16  
D SUFFIX  
CASE 751B



TSSOP-16  
DT SUFFIX  
CASE 948F



SOEIAJ-16  
F SUFFIX  
CASE 966



A = Assembly Location  
L, WL = Wafer Lot  
Y, YY = Year  
W, WW = 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 2 of this data sheet.

# MC74HC139A

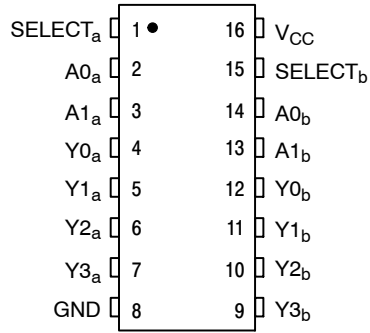


Figure 1. Pin Assignment

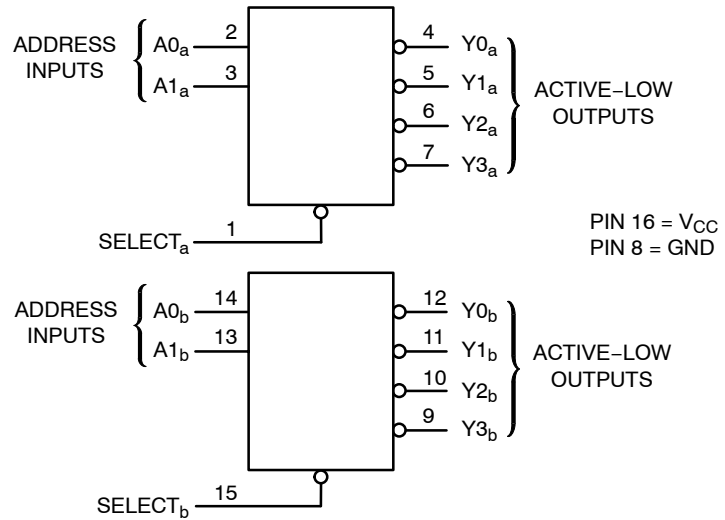


Figure 2. Logic Diagram

## FUNCTION TABLE

| Inputs |    |    | Outputs |    |    |    |
|--------|----|----|---------|----|----|----|
| Select | 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  |

X = don't care

## ORDERING INFORMATION

| Device          | Package                | Shipping <sup>†</sup> |
|-----------------|------------------------|-----------------------|
| MC74HC139ANG    | PDIP-16<br>(Pb-Free)   | 2000 Units / Box      |
| MC74HC139ADG    | SOIC-16<br>(Pb-Free)   | 48 Units / Rail       |
| MC74HC139ADR2G  | SOIC-16<br>(Pb-Free)   | 2500 Units / Reel     |
| MC74HC139ADTR2G | TSSOP-16*              | 2500 Units / Reel     |
| MC74HC139AFELG  | SOEIAJ-16<br>(Pb-Free) | 2000 Units / 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.

\*This package is inherently Pb-Free.

# MC74HC139A

## MAXIMUM RATINGS

| Symbol               | Parameter                                                                                                     | Value                          | Unit |
|----------------------|---------------------------------------------------------------------------------------------------------------|--------------------------------|------|
| V <sub>CC</sub>      | DC Supply Voltage (Referenced to GND)                                                                         | − 0.5 to + 7.0                 | V    |
| V <sub>IN</sub>      | DC Input Voltage (Referenced to GND)                                                                          | − 1.5 to V <sub>CC</sub> + 1.5 | V    |
| V <sub>OUT</sub>     | DC Output Voltage (Referenced to GND) (Note 1)                                                                | − 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> Pin                                                                        | ± 50                           | mA   |
| I <sub>GND</sub>     | DC Ground Current per Ground Pin                                                                              | ± 50                           | 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<br>PDIP<br>SOIC<br>TSSOP                                                                   | 78<br>112<br>148               | °C/W |
| P <sub>D</sub>       | Power Dissipation in Still Air at 85°C<br>PDIP<br>SOIC<br>TSSOP                                               | 750<br>500<br>450              | mW   |
| MSL                  | Moisture Sensitivity                                                                                          | Level 1                        |      |
| F <sub>R</sub>       | Flammability Rating<br>Oxygen Index: 30% – 35%                                                                | UL 94 V-0 @ 0.125 in           |      |
| V <sub>ESD</sub>     | ESD Withstand Voltage<br>Human Body Model (Note 2)<br>Machine Model (Note 3)<br>Charged Device Model (Note 4) | > 2000<br>> 200<br>> 1000      | V    |
| I <sub>LATCHUP</sub> | Latchup Performance<br>Above V <sub>CC</sub> and Below GND at 85°C (Note 5)                                   | ± 300                          | mA   |

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. I<sub>O</sub> absolute maximum rating must be observed.
2. Tested to EIA/JESD22-A114-A.
3. Tested to EIA/JESD22-A115-A.
4. Tested to JESD22-C101-A.
5. Tested to EIA/JESD78.

## RECOMMENDED OPERATING CONDITIONS

| Symbol                             | Parameter                                                                                                               | Min         | Max                | Unit |
|------------------------------------|-------------------------------------------------------------------------------------------------------------------------|-------------|--------------------|------|
| V <sub>CC</sub>                    | DC Supply Voltage (Referenced to GND)                                                                                   | 2.0         | 6.0                | V    |
| V <sub>IN</sub> , V <sub>OUT</sub> | DC Input Voltage, Output Voltage (Referenced to GND)                                                                    | 0           | V <sub>CC</sub>    | V    |
| T <sub>A</sub>                     | Operating Temperature, All Package Types                                                                                | − 55        | + 125              | °C   |
| t <sub>r</sub> , t <sub>f</sub>    | Input Rise and Fall Time<br>(Figure 3)<br>V <sub>CC</sub> = 2.0 V<br>V <sub>CC</sub> = 4.5 V<br>V <sub>CC</sub> = 6.0 V | 0<br>0<br>0 | 1000<br>500<br>400 | ns   |

6. Unused inputs may not be left open. All inputs must be tied to a high-logic voltage level or a low-logic input voltage level.

# MC74HC139A

## DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND)

| Symbol          | Parameter                                      | Test Conditions                                                                                                   | V <sub>CC</sub>   | Guaranteed Limit   |                    |                    | Unit |
|-----------------|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|-------------------|--------------------|--------------------|--------------------|------|
|                 |                                                |                                                                                                                   | V                 | –55°C to 25°C      | ≤85°C              | ≤125°C             |      |
| V <sub>IH</sub> | Minimum High-Level Input Voltage               | V <sub>OUT</sub> = 0.1 V or V <sub>CC</sub> – 0.1 V<br> I <sub>OUT</sub>   ≤ 20 μA                                | 2.0<br>4.5<br>6.0 | 1.5<br>3.15<br>4.2 | 1.5<br>3.15<br>4.2 | 1.5<br>3.15<br>4.2 | V    |
| V <sub>IL</sub> | Maximum Low-Level Input Voltage                | V <sub>OUT</sub> = 0.1 V or V <sub>CC</sub> – 0.1 V<br> I <sub>OUT</sub>   ≤ 20 μA                                | 2.0<br>4.5<br>6.0 | 0.5<br>1.35<br>1.8 | 0.5<br>1.35<br>1.8 | 0.5<br>1.35<br>1.8 | V    |
| V <sub>OH</sub> | Minimum High-Level Output Voltage              | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub><br> I <sub>OUT</sub>   ≤ 20 μA                               | 2.0<br>4.5<br>6.0 | 1.9<br>4.4<br>5.9  | 1.9<br>4.4<br>5.9  | 1.9<br>4.4<br>5.9  | V    |
|                 |                                                | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>OUT</sub>   ≤ 4.0 mA<br> I <sub>OUT</sub>   ≤ 5.2 mA | 4.5<br>6.0        | 3.98<br>5.48       | 3.84<br>5.34       | 3.70<br>5.20       |      |
| V <sub>OL</sub> | Maximum Low-Level Output Voltage               | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub><br> I <sub>OUT</sub>   ≤ 20 μA                               | 2.0<br>4.5<br>6.0 | 0.1<br>0.1<br>0.1  | 0.1<br>0.1<br>0.1  | 0.1<br>0.1<br>0.1  | V    |
|                 |                                                | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>OUT</sub>   ≤ 4.0 mA<br> I <sub>OUT</sub>   ≤ 5.2 mA | 4.5<br>6.0        | 0.26<br>0.26       | 0.33<br>0.33       | 0.40<br>0.40       |      |
| I <sub>IN</sub> | Maximum Input Leakage Current                  | V <sub>IN</sub> = V <sub>CC</sub> or GND                                                                          | 6.0               | ±0.1               | ±1.0               | ±1.0               | μA   |
| I <sub>CC</sub> | Maximum Quiescent Supply Current (per Package) | V <sub>IN</sub> = V <sub>CC</sub> or GND<br>I <sub>OUT</sub> = 0 μA                                               | 6.0               | 4                  | 40                 | 160                | μA   |

## AC ELECTRICAL CHARACTERISTICS (C<sub>L</sub> = 50 pF, Input t<sub>r</sub> = t<sub>f</sub> = 6.0 ns)

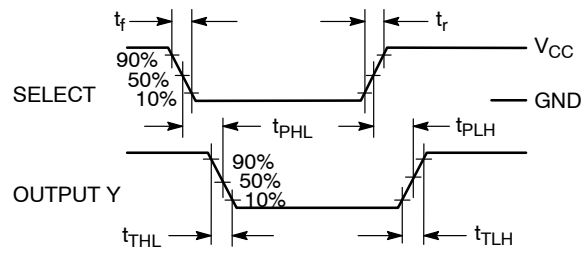
| Symbol                                 | Parameter                                                           | V <sub>CC</sub>   | Guaranteed Limit |                 |                 | Unit |
|----------------------------------------|---------------------------------------------------------------------|-------------------|------------------|-----------------|-----------------|------|
|                                        |                                                                     | V                 | –55°C to 25°C    | ≤85°C           | ≤125°C          |      |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub> | Maximum Propagation Delay, Select to Output Y<br>(Figures 1 and 3)  | 2.0<br>4.5<br>6.0 | 115<br>23<br>20  | 145<br>29<br>25 | 175<br>35<br>30 | ns   |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub> | Maximum Propagation Delay, Input A to Output Y<br>(Figures 2 and 3) | 2.0<br>4.5<br>6.0 | 115<br>23<br>20  | 145<br>29<br>25 | 175<br>35<br>30 | ns   |
| t <sub>TLH</sub> ,<br>t <sub>THL</sub> | Maximum Output Transition Time, Any Output<br>(Figures 1 and 3)     | 2.0<br>4.5<br>6.0 | 75<br>15<br>13   | 95<br>19<br>16  | 110<br>22<br>19 | ns   |
| C <sub>in</sub>                        | Maximum Input Capacitance                                           | –                 | 10               | 10              | 10              | pF   |

7. For propagation delays with loads other than 50 pF, and information on typical parametric values, see the ON Semiconductor High-Speed CMOS Data Book (DL129/D).

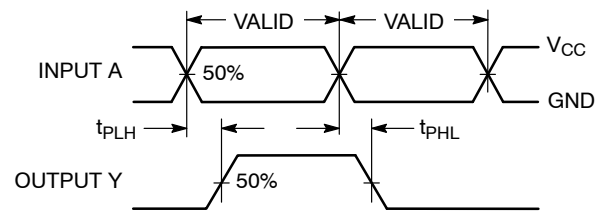
| C <sub>PD</sub> | Power Dissipation Capacitance (Per Decoder) (Note 8) | Typical @ 25°C, V <sub>CC</sub> = 5.0 V | pF |
|-----------------|------------------------------------------------------|-----------------------------------------|----|
|                 |                                                      | 55                                      |    |

8. 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 + I<sub>CC</sub> V<sub>CC</sub>.

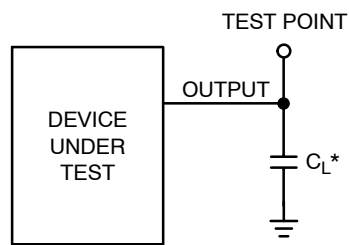
# MC74HC139A



**Figure 3. Switching Waveform**



**Figure 4. Switching Waveform**



\* Includes all probe and jig capacitance

**Figure 5. Test Circuit**

# MC74HC139A

## PIN DESCRIPTIONS

### ADDRESS INPUTS

#### **A0<sub>a</sub>, A1<sub>a</sub>, A0<sub>b</sub>, A1<sub>b</sub> (Pins 2, 3, 14, 13)**

Address inputs. These inputs, when the respective 1-of-4 decoder is enabled, determine which of its four active-low outputs is selected.

### CONTROL INPUTS

#### **Select<sub>a</sub>, Select<sub>b</sub> (Pins 1, 15)**

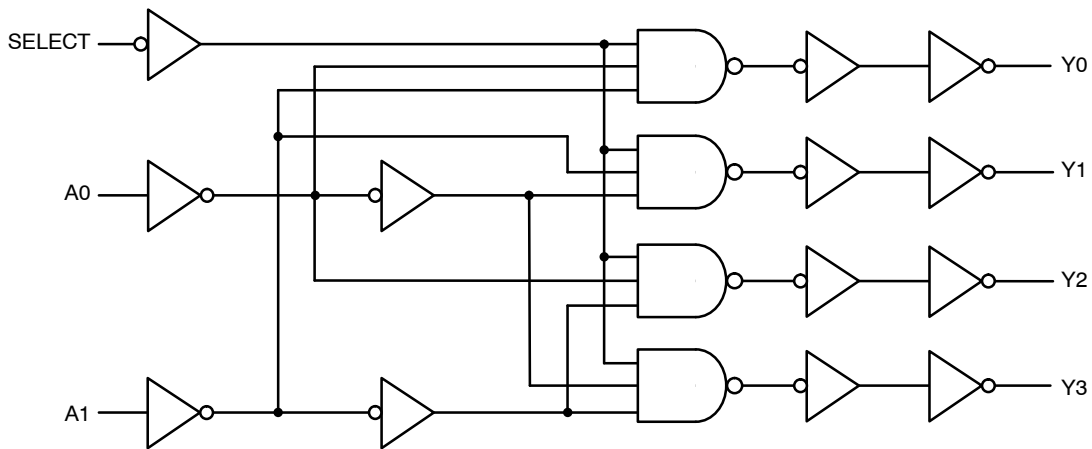
Active-low select inputs. For a low level on this input, the outputs for that particular decoder follow the Address

inputs. A high level on this input forces all outputs to a high level.

### OUTPUTS

#### **Y0<sub>a</sub> – Y3<sub>a</sub>, Y0<sub>b</sub> – Y3<sub>b</sub> (Pins 4 – 7, 12, 11, 10, 9)**

Active-low outputs. These outputs assume a low level when addressed and the appropriate Select input is active. These outputs remain high when not addressed or the appropriate Select input is inactive.

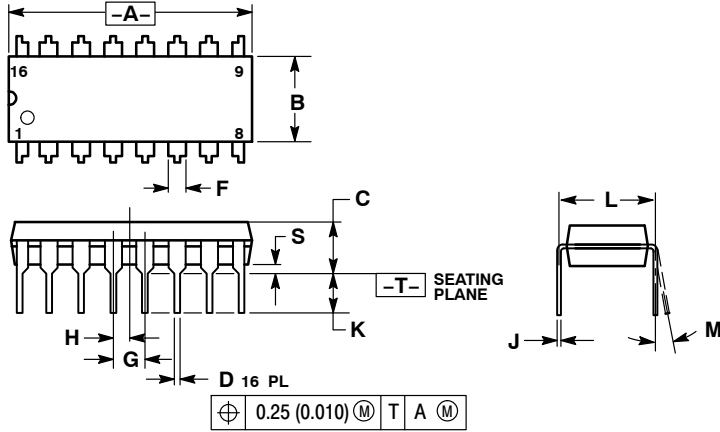


**Figure 6. Expanded Logic Diagram**  
(1/2 of Device)

# MC74HC139A

## PACKAGE DIMENSIONS

PDIP-16  
CASE 648-08  
ISSUE T



### NOTES:

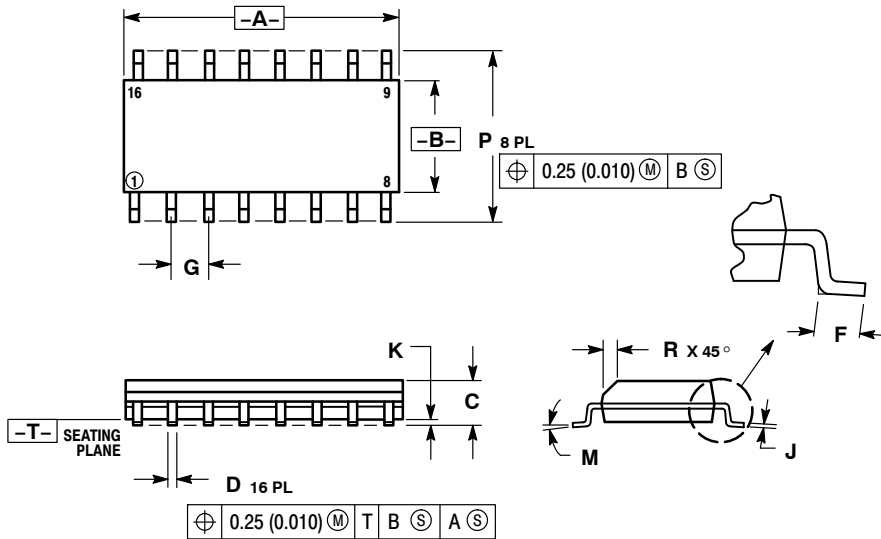
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN       | MAX   | MIN         | MAX   |
| A   | 0.740     | 0.770 | 18.80       | 19.55 |
| B   | 0.250     | 0.270 | 6.35        | 6.85  |
| C   | 0.145     | 0.175 | 3.69        | 4.44  |
| D   | 0.015     | 0.021 | 0.39        | 0.53  |
| F   | 0.040     | 0.70  | 1.02        | 1.77  |
| G   | 0.100 BSC |       | 2.54 BSC    |       |
| H   | 0.050 BSC |       | 1.27 BSC    |       |
| J   | 0.008     | 0.015 | 0.21        | 0.38  |
| K   | 0.110     | 0.130 | 2.80        | 3.30  |
| L   | 0.295     | 0.305 | 7.50        | 7.74  |
| M   | 0° 10°    |       | 0° 10°      |       |
| S   | 0.020     | 0.040 | 0.51        | 1.01  |

# MC74HC139A

## PACKAGE DIMENSIONS

SOIC-16  
CASE 751B-05  
ISSUE K

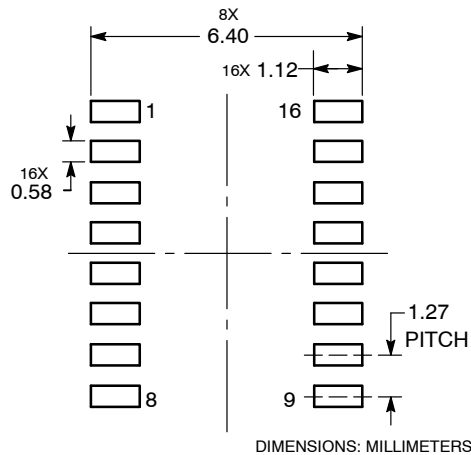


### NOTES:

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.

| 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 |

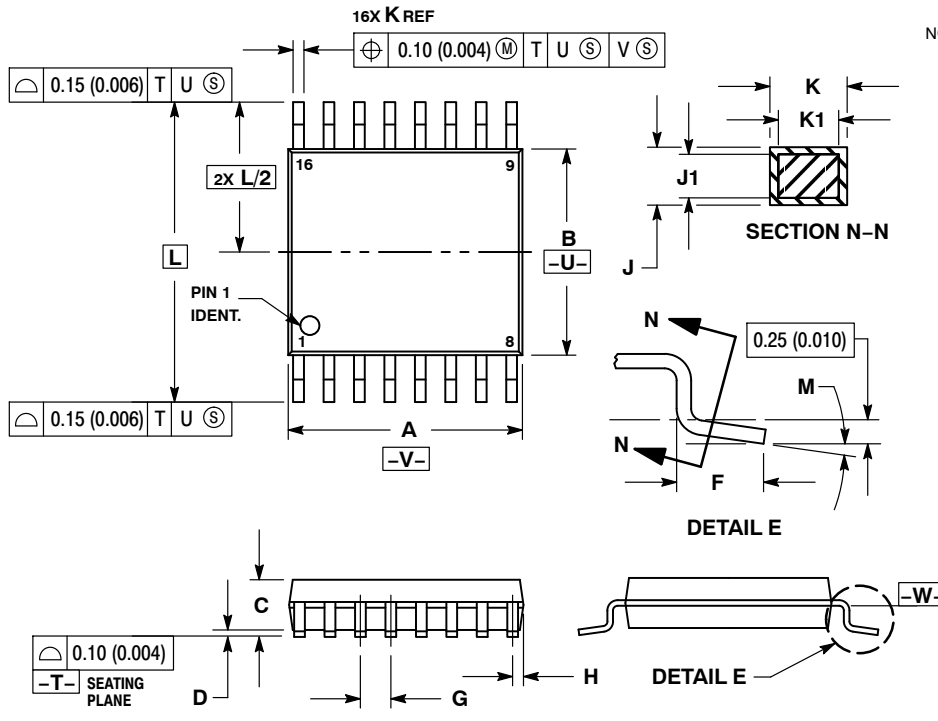
## SOLDERING FOOTPRINT



# MC74HC139A

## PACKAGE DIMENSIONS

TSSOP-16  
CASE 948F-01  
ISSUE B

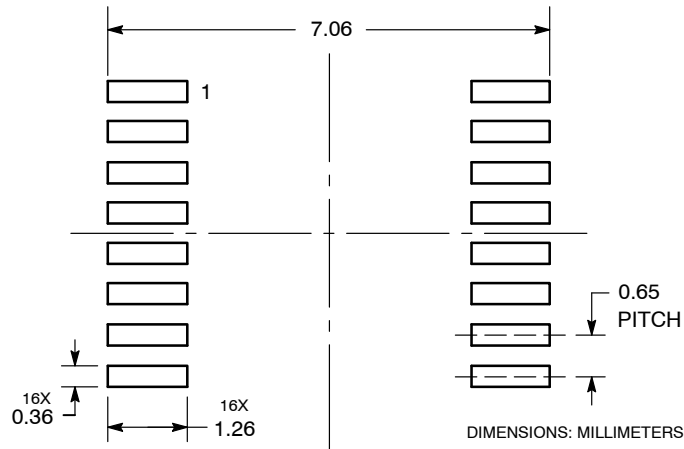


### NOTES:

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°    |

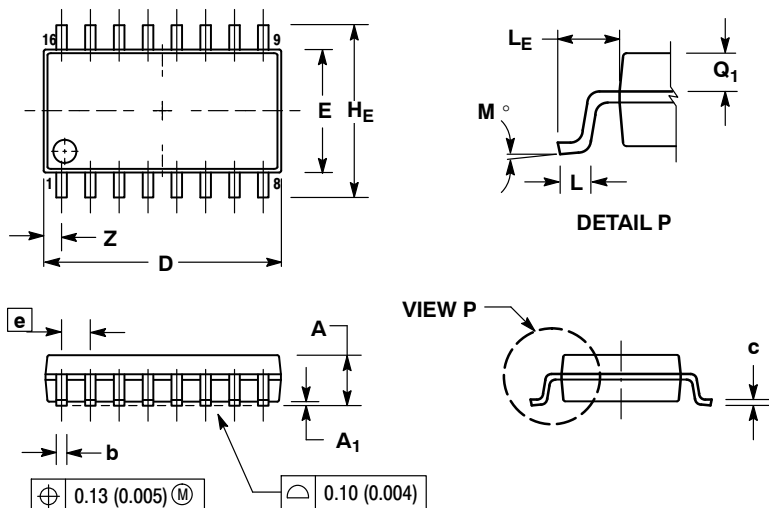
## SOLDERING FOOTPRINT



# MC74HC139A

## PACKAGE DIMENSIONS

SOEIAJ-16  
CASE 966-01  
ISSUE A



### 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