

# MC74HC139A

## Dual 1-of-4 Decoder/ Demultiplexer

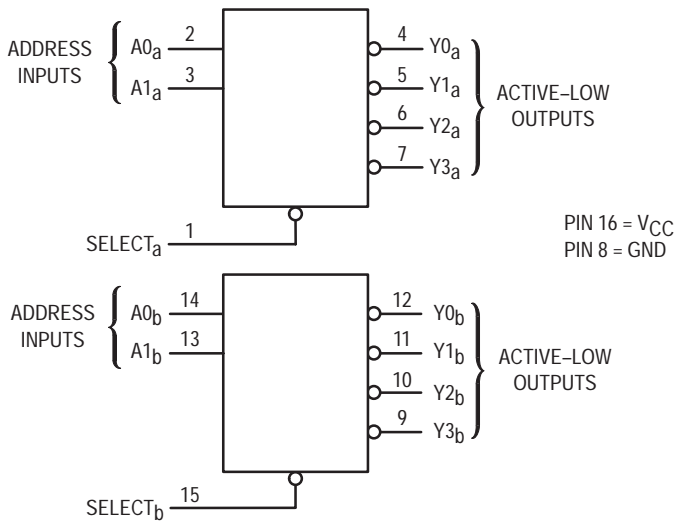
### High-Performance Silicon-Gate CMOS

The MC74HC139A is identical in pinout to the LS139. The device inputs are compatible with standard CMOS outputs; with pullup 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.

- 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. 7A
- Chip Complexity: 100 FETs or 25 Equivalent Gates

#### LOGIC DIAGRAM



#### FUNCTION TABLE

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

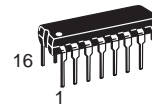
X = don't care



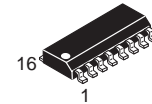
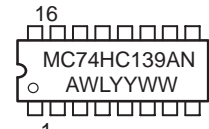
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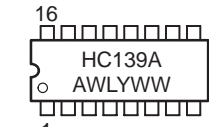
#### MARKING DIAGRAMS



PDIP-16  
N SUFFIX  
CASE 648

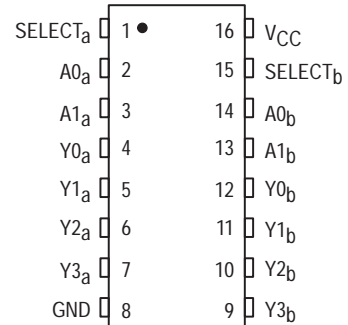


SO-16  
D SUFFIX  
CASE 751B



A = Assembly Location  
WL = Wafer Lot  
YY = Year  
WW = Work Week

#### PIN ASSIGNMENT



#### ORDERING INFORMATION

| Device        | Package | Shipping    |
|---------------|---------|-------------|
| MC74HC139AN   | PDIP-16 | 2000 / Box  |
| MC74HC139AD   | SOIC-16 | 48 / Rail   |
| MC74HC139ADR2 | SOIC-16 | 2500 / Reel |

# 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)  | - 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                                  | ± 50                           | mA   |
| P <sub>D</sub>   | Power Dissipation in Still Air,<br>Plastic DIP†<br>SOIC Package†                 | 750<br>500                     | mW   |
| T <sub>stg</sub> | Storage Temperature  | - 65 to + 150                  | °C   |
| T <sub>L</sub>   | Lead Temperature, 1 mm from Case for 10 Seconds<br>(Plastic DIP or SOIC Package) | 260                            | °C   |

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation, V<sub>in</sub> and V<sub>out</sub> should be constrained to the range GND ≤ (V<sub>in</sub> or V<sub>out</sub>) ≤ V<sub>CC</sub>. Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V<sub>CC</sub>). Unused outputs must be left open.

\*Maximum Ratings are those values beyond which damage to the device may occur.

Functional operation should be restricted to the Recommended Operating Conditions.

†Derating — Plastic DIP: - 10 mW/°C from 65° to 125°C

SOIC Package: - 7 mW/°C from 65° to 125°C

For high frequency or heavy load considerations, see Chapter 2 of the ON Semiconductor High-Speed CMOS Data Book (DL129/D).

## 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 1)               | 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>1000<br>500<br>400 | ns   |

## DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND)

| Symbol          | Parameter                                      | Test Conditions   | V <sub>CC</sub><br>V | Guaranteed Limit |        |         | Unit |
|-----------------|--|---|----------------------|------------------|--------|---------|------|
|                 |  |   |                      | - 55 to<br>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                  | 1.5              | 1.5    | 1.5     | V    |
|                 |  |   | 4.5                  | 3.15             | 3.15   | 3.15    |      |
|                 |  |   | 6.0                  | 4.2              | 4.2    | 4.2     |      |
| 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                  | 0.5              | 0.5    | 0.5     | V    |
|                 |  |   | 4.5                  | 1.35             | 1.35   | 1.35    |      |
|                 |  |   | 6.0                  | 1.8              | 1.8    | 1.8     |      |
| 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                  | 1.9              | 1.9    | 1.9     | V    |
|                 |  |   | 4.5                  | 4.4              | 4.4    | 4.4     |      |
|                 |  | 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                  | 3.98             | 3.84   | 3.70    |      |
|                 |  |   | 6.0                  | 5.48             | 5.34   | 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                  | 0.1              | 0.1    | 0.1     | V    |
|                 |  |   | 4.5                  | 0.1              | 0.1    | 0.1     |      |
|                 |  | 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                  | 0.26             | 0.33   | 0.40    |      |
|                 |  |   | 6.0                  | 0.26             | 0.33   | 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   |

NOTE: Information on typical parametric values can be found in Chapter 2 of the ON Semiconductor High-Speed CMOS Data Book (DL129/D).

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## AC ELECTRICAL CHARACTERISTICS ( $C_L = 50 \text{ pF}$ , Input $t_r = t_f = 6.0 \text{ ns}$ )

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

NOTE: For propagation delays with loads other than 50 pF, and information on typical parametric values, see Chapter 2 of the ON Semiconductor High-Speed CMOS Data Book (DL129/D).

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

\* Used to determine the no-load dynamic power consumption:  $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$ . For load considerations, see Chapter 2 of the ON Semiconductor High-Speed CMOS Data Book (DL129/D).

## SWITCHING WAVEFORMS

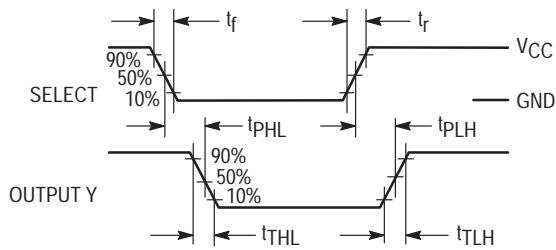


Figure 1.

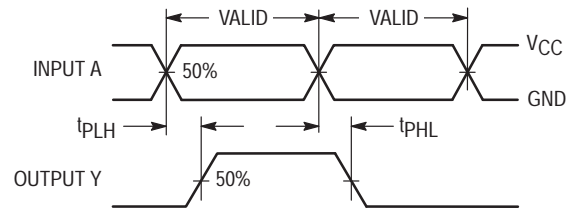
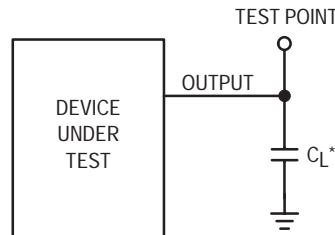


Figure 2.



\*Includes all probe and jig capacitance

Figure 3. 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

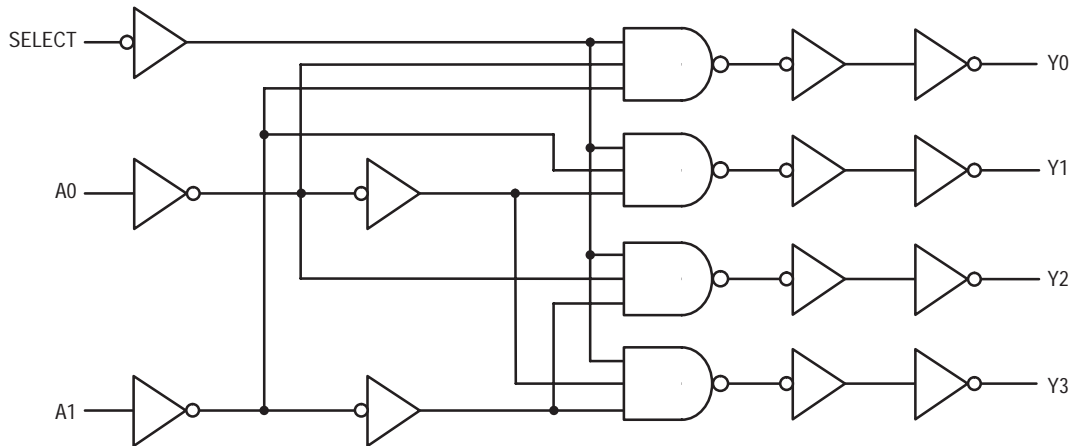
inputs. A high level on this input forces all outputs to a high level.

### 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.

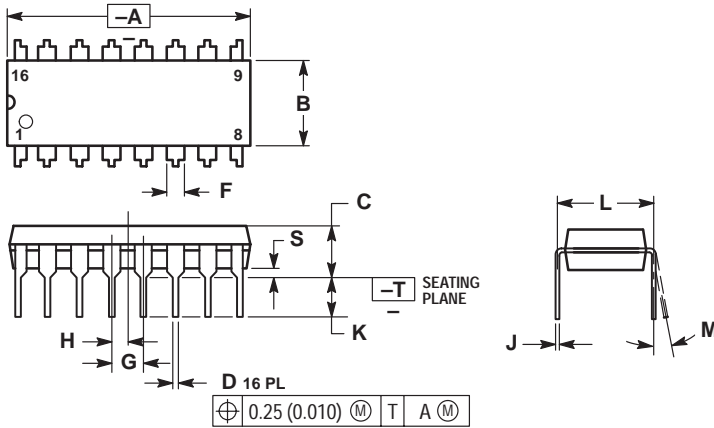
## EXPANDED LOGIC DIAGRAM (1/2 OF DEVICE)



# MC74HC139A

## PACKAGE DIMENSIONS

PDIP-16  
N SUFFIX  
CASE 648-08  
ISSUE R

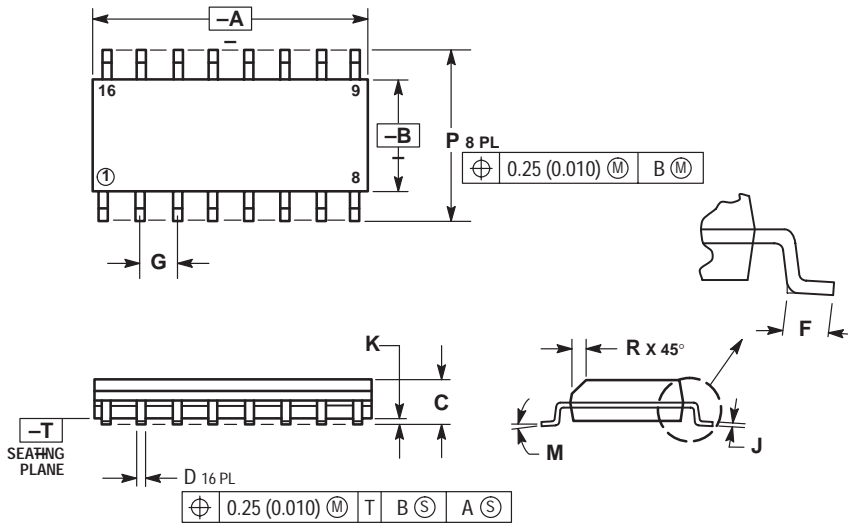


NOTES:

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     | 0.070 | 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°         |       |
| S   | 0.020     | 0.040 | 0.51        | 1.01  |

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



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°        |       |
| P   | 5.80        | 6.20  | 0.229     | 0.244 |
| R   | 0.25        | 0.50  | 0.010     | 0.019 |

## Notes

## Notes

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