

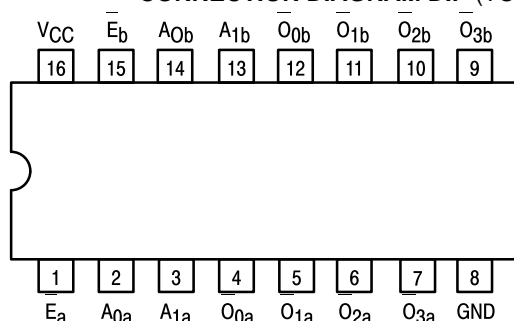


# DUAL 1-OF-4 DECODER/ DEMULTIPLEXER

The LSTTL/MSI SN54/74LS139 is a high speed Dual 1-of-4 Decoder/De-multiplexer. The device has two independent decoders, each accepting two inputs and providing four mutually exclusive active LOW Outputs. Each decoder has an active LOW Enable input which can be used as a data input for a 4-output demultiplexer. Each half of the LS139 can be used as a function generator providing all four minterms of two variables. The LS139 is fabricated with the Schottky barrier diode process for high speed and is completely compatible with all Motorola TTL families.

- Schottky Process for High Speed
- Multifunction Capability
- Two Completely Independent 1-of-4 Decoders
- Active Low Mutually Exclusive Outputs
- Input Clamp Diodes Limit High Speed Termination Effects
- ESD > 3500 Volts

CONNECTION DIAGRAM DIP (TOP VIEW)



NOTE:  
The Flatpak version  
has the same pinouts  
(Connection Diagram) as  
the Dual In-Line Package.

## PIN NAMES

A<sub>0</sub>, A<sub>1</sub> Address Inputs  
E Enable (Active LOW) Input  
O<sub>0</sub>–O<sub>3</sub> Active LOW Outputs (Note b)

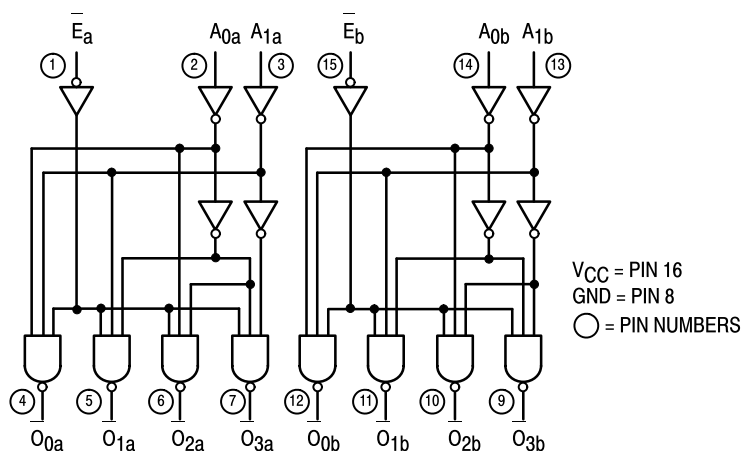
## LOADING (Note a)

| HIGH     | LOW          |
|----------|--------------|
| 0.5 U.L. | 0.25 U.L.    |
| 0.5 U.L. | 0.25 U.L.    |
| 10 U.L.  | 5 (2.5) U.L. |

## NOTES:

- a) 1 TTL Unit Load (U.L.) = 40  $\mu$ A HIGH/1.6 mA LOW.  
b) The Output LOW drive factor is 2.5 U.L. for Military (54) and 5 U.L. for Commercial (74) Temperature Ranges.

## LOGIC DIAGRAM

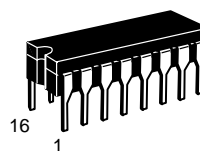


V<sub>CC</sub> = PIN 16  
GND = PIN 8  
○ = PIN NUMBERS

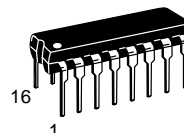
# SN54/74LS139

## DUAL 1-OF-4 DECODER/ DEMULTIPLEXER

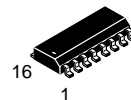
### LOW POWER SCHOTTKY



**J SUFFIX**  
CERAMIC  
CASE 620-09



**N SUFFIX**  
PLASTIC  
CASE 648-08

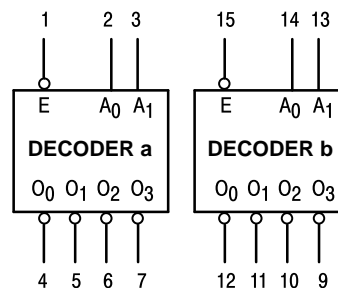


**D SUFFIX**  
SOIC  
CASE 751B-03

## ORDERING INFORMATION

SN54LSXXXJ Ceramic  
SN74LSXXXN Plastic  
SN74LSXXXD SOIC

## LOGIC SYMBOL



V<sub>CC</sub> = PIN 16  
GND = PIN 8

# SN54/74LS139

## FUNCTIONAL DESCRIPTION

The LS139 is a high speed dual 1-of-4 decoder/demultiplexer fabricated with the Schottky barrier diode process. The device has two independent decoders, each of which accept two binary weighted inputs ( $A_0, A_1$ ) and provide four mutually exclusive active LOW outputs ( $O_0-O_3$ ). Each decoder has an active LOW Enable (E). When E is HIGH all outputs are forced HIGH. The enable can be used as the data input for a 4-output

demultiplexer application.

Each half of the LS139 generates all four minterms of two variables. These four minterms are useful in some applications, replacing multiple gate functions as shown in Fig. a, and thereby reducing the number of packages required in a logic network.

| TRUTH TABLE |                |                |                |                |                |                |
|-------------|----------------|----------------|----------------|----------------|----------------|----------------|
| INPUTS      |                |                | OUTPUTS        |                |                |                |
| E           | A <sub>0</sub> | A <sub>1</sub> | O <sub>0</sub> | O <sub>1</sub> | O <sub>2</sub> | O <sub>3</sub> |
| H           | X              | X              | H              | H              | H              | H              |
| L           | L              | L              | L              | H              | H              | H              |
| L           | H              | L              | H              | L              | H              | H              |
| L           | L              | H              | H              | H              | L              | H              |
| L           | H              | H              | H              | H              | H              | L              |

H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Don't Care

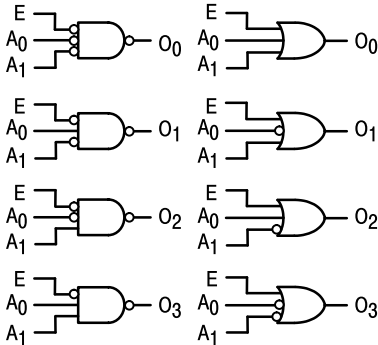


Figure a

## GUARANTEED OPERATING RANGES

| Symbol          | Parameter                           |          | Min         | Typ        | Max         | Unit |
|-----------------|-------------------------------------|----------|-------------|------------|-------------|------|
| V <sub>CC</sub> | Supply Voltage                      | 54<br>74 | 4.5<br>4.75 | 5.0<br>5.0 | 5.5<br>5.25 | V    |
| T <sub>A</sub>  | Operating Ambient Temperature Range | 54<br>74 | -55<br>0    | 25<br>25   | 125<br>70   | °C   |
| I <sub>OH</sub> | Output Current — High               | 54, 74   |             |            | -0.4        | mA   |
| I <sub>OL</sub> | Output Current — Low                | 54<br>74 |             |            | 4.0<br>8.0  | mA   |

# SN54/74LS139

## DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE (unless otherwise specified)

| Symbol   | Parameter                      |        | Limits |       |      | Unit          | Test Conditions   |
|----------|--------------------------------|--------|--------|-------|------|---------------|---|
|          |                                |        | Min    | Typ   | Max  |               |   |
| $V_{IH}$ | Input HIGH Voltage             |        | 2.0    |       |      | V             | Guaranteed Input HIGH Voltage for All Inputs  |
| $V_{IL}$ | Input LOW Voltage              | 54     |        |       | 0.7  | V             | Guaranteed Input LOW Voltage for All Inputs   |
|          |                                | 74     |        |       | 0.8  |               |   |
| $V_{IK}$ | Input Clamp Diode Voltage      |        |        | -0.65 | -1.5 | V             | $V_{CC} = \text{MIN}$ , $I_{IN} = -18 \text{ mA}$   |
| $V_{OH}$ | Output HIGH Voltage            | 54     | 2.5    | 3.5   |      | V             | $V_{CC} = \text{MIN}$ , $I_{OH} = \text{MAX}$ , $V_{IN} = V_{IH}$ or $V_{IL}$ per Truth Table           |
|          |                                | 74     | 2.7    | 3.5   |      | V             |   |
| $V_{OL}$ | Output LOW Voltage             | 54, 74 |        | 0.25  | 0.4  | V             | $I_{OL} = 4.0 \text{ mA}$ $V_{CC} = V_{CC} \text{ MIN}$ , $V_{IN} = V_{IL}$ or $V_{IH}$ per Truth Table |
|          |                                | 74     |        | 0.35  | 0.5  | V             | $I_{OL} = 8.0 \text{ mA}$   |
| $I_{IH}$ | Input HIGH Current             |        |        |       | 20   | $\mu\text{A}$ | $V_{CC} = \text{MAX}$ , $V_{IN} = 2.7 \text{ V}$  |
|          |                                |        |        |       | 0.1  | mA            | $V_{CC} = \text{MAX}$ , $V_{IN} = 7.0 \text{ V}$  |
| $I_{IL}$ | Input LOW Current              |        |        |       | -0.4 | mA            | $V_{CC} = \text{MAX}$ , $V_{IN} = 0.4 \text{ V}$  |
| $I_{OS}$ | Short Circuit Current (Note 1) |        | -20    |       | -100 | mA            | $V_{CC} = \text{MAX}$   |
| $I_{CC}$ | Power Supply Current           |        |        |       | 11   | mA            | $V_{CC} = \text{MAX}$   |

Note 1: Not more than one output should be shorted at a time, nor for more than 1 second.

## AC CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ )

| Symbol    | Parameter                           | Levels of Delay | Limits |     |     | Unit | Test Conditions                                   |
|-----------|-------------------------------------|-----------------|--------|-----|-----|------|---|
|           |                                     |                 | Min    | Typ | Max |      |   |
| $t_{PLH}$ | Propagation Delay Address to Output | 2               |        | 13  | 20  | ns   | $V_{CC} = 5.0 \text{ V}$<br>$C_L = 15 \text{ pF}$ |
| $t_{PHL}$ | Propagation Delay Address to Output | 2               |        | 22  | 33  | ns   |   |
| $t_{PLH}$ | Propagation Delay Address to Output | 3               |        | 18  | 29  | ns   |   |
| $t_{PHL}$ | Propagation Delay Address to Output | 3               |        | 25  | 38  | ns   |   |
| $t_{PLH}$ | Propagation Delay Enable to Output  | 2               |        | 16  | 24  | ns   |   |
| $t_{PHL}$ | Propagation Delay Enable to Output  | 2               |        | 21  | 32  | ns   |   |

## AC WAVEFORMS

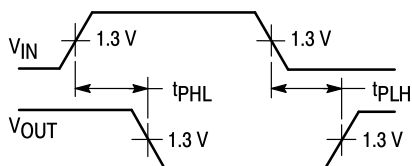


Figure 1

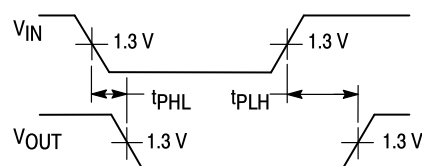
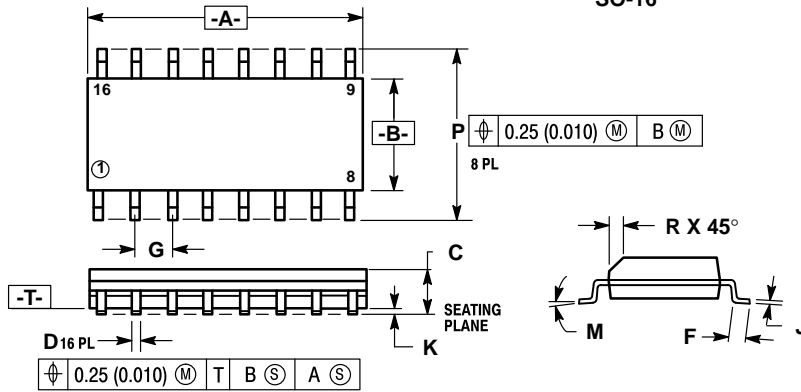


Figure 2

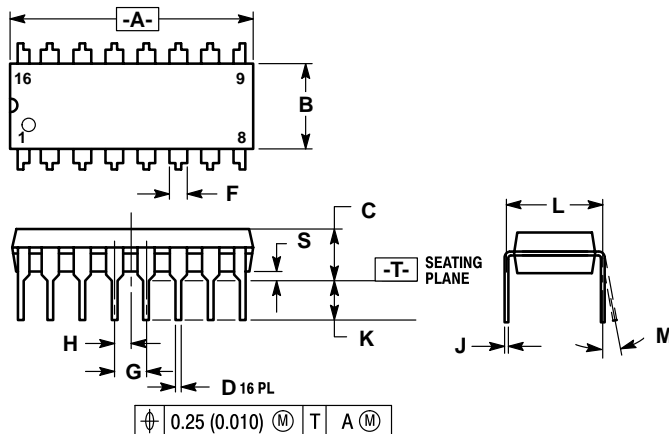
**Case 751B-03 D Suffix**  
**16-Pin Plastic**  
**SO-16**



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
  4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
  5. 751B-01 IS OBSOLETE, NEW STANDARD 751B-03.

| 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 |

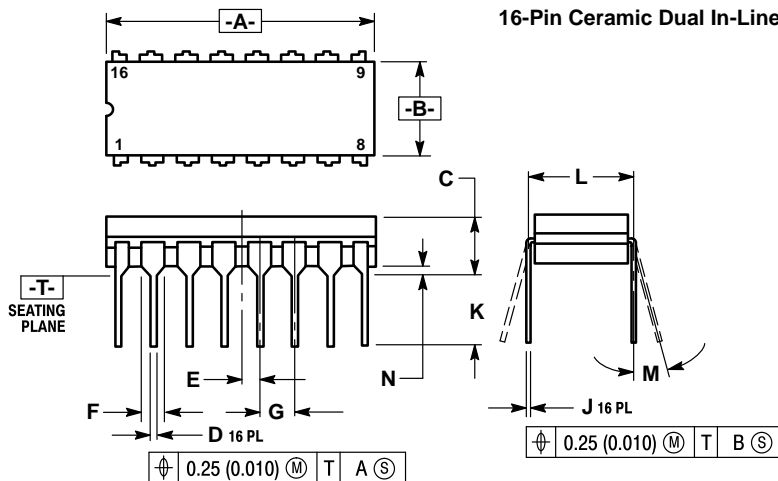
**Case 648-08 N Suffix**  
**16-Pin Plastic**



- 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.
  6. 648-01 THRU -07 OBSOLETE, NEW STANDARD 648-08.


| DIM | MILLIMETERS |       | INCHES    |       |
|-----|-------------|-------|-----------|-------|
|     | MIN         | MAX   | MIN       | MAX   |
| A   | 18.80       | 19.55 | 0.740     | 0.770 |
| B   | 6.35        | 6.85  | 0.250     | 0.270 |
| C   | 3.69        | 4.44  | 0.145     | 0.175 |
| D   | 0.39        | 0.53  | 0.015     | 0.021 |
| F   | 1.02        | 1.77  | 0.040     | 0.070 |
| G   | 2.54 BSC    |       | 0.100 BSC |       |
| H   | 1.27 BSC    |       | 0.050 BSC |       |
| J   | 0.21        | 0.38  | 0.008     | 0.015 |
| K   | 2.80        | 3.30  | 0.110     | 0.130 |
| L   | 7.50        | 7.74  | 0.295     | 0.305 |
| M   | 0°          | 10°   | 0°        | 10°   |
| S   | 0.51        | 1.01  | 0.020     | 0.040 |

**Case 620-09 J Suffix**  
**16-Pin Ceramic Dual In-Line**



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
  4. DIM F MAY NARROW TO 0.76 (0.030) WHERE THE LEAD ENTERS THE CERAMIC BODY.
  5. 620-01 THRU -08 OBSOLETE, NEW STANDARD 620-09.

| DIM | MILLIMETERS |       | INCHES    |       |
|-----|-------------|-------|-----------|-------|
|     | MIN         | MAX   | MIN       | MAX   |
| A   | 19.05       | 19.55 | 0.750     | 0.770 |
| B   | 6.10        | 7.36  | 0.240     | 0.290 |
| C   | —           | 4.19  | —         | 0.165 |
| D   | 0.39        | 0.53  | 0.015     | 0.021 |
| E   | 1.27 BSC    |       | 0.050 BSC |       |
| F   | 1.40        | 1.77  | 0.055     | 0.070 |
| G   | 2.54 BSC    |       | 0.100 BSC |       |
| J   | 0.23        | 0.27  | 0.009     | 0.011 |
| K   | —           | 5.08  | —         | 0.200 |
| L   | 7.62 BSC    |       | 0.300 BSC |       |
| M   | 0°          | 15°   | 0°        | 15°   |
| N   | 0.39        | 0.88  | 0.015     | 0.035 |

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