

# SN74LS147 SN74LS148

## 10-Line-to-4-Line and 8-Line-to-3-Line Priority Encoders

The SN74LS147 and the SN74LS148 are Priority Encoders. They provide priority decoding of the inputs to ensure that only the highest order data line is encoded. Both devices have data inputs and outputs which are active at the low logic level.

The LS147 encodes nine data lines to four-line (8-4-2-1) BCD. The implied decimal zero condition does not require an input condition because zero is encoded when all nine data lines are at a high logic level.

The LS148 encodes eight data lines to three-line (4-2-1) binary (octal). By providing cascading circuitry (Enable Input EI and Enable Output EO) octal expansion is allowed without needing external circuitry.

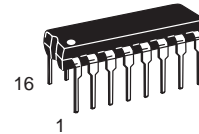
### GUARANTEED OPERATING RANGES

| Symbol   | Parameter                           | Min  | Typ | Max  | Unit |
|----------|-------------------------------------|------|-----|------|------|
| $V_{CC}$ | Supply Voltage                      | 4.75 | 5.0 | 5.25 | V    |
| $T_A$    | Operating Ambient Temperature Range | 0    | 25  | 70   | °C   |
| $I_{OH}$ | Output Current – High               |      |     | -0.4 | mA   |
| $I_{OL}$ | Output Current – Low                |      |     | 8.0  | mA   |

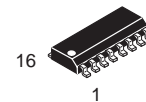


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**LOW  
POWER  
SCHOTTKY**



**PLASTIC  
N SUFFIX  
CASE 648**



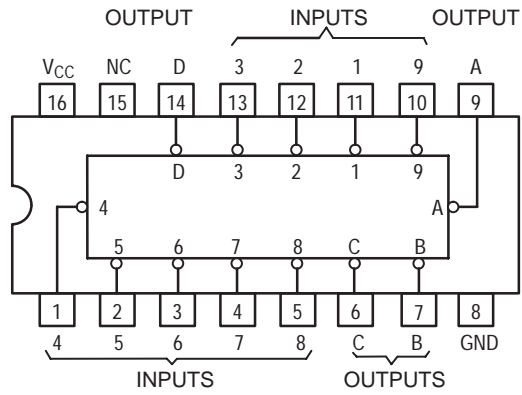
**SOIC  
D SUFFIX  
CASE 751B**

### ORDERING INFORMATION

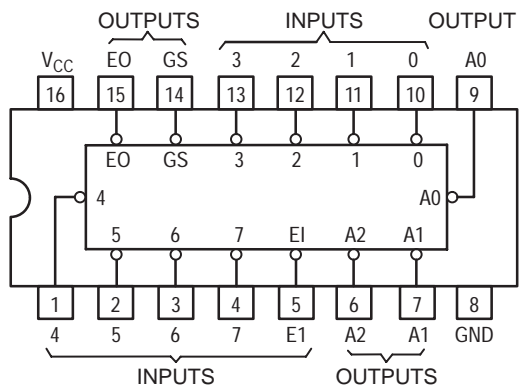
| Device     | Package    | Shipping         |
|------------|------------|------------------|
| SN74LS147N | 16 Pin DIP | 2000 Units/Box   |
| SN74LS147D | 16 Pin     | 2500/Tape & Reel |
| SN74LS148N | 16 Pin DIP | 2000 Units/Box   |
| SN74LS148D | 16 Pin     | 2500/Tape & Reel |

# SN74LS147 SN74LS148

**SN74LS147**  
(TOP VIEW)



**SN74LS148**  
(TOP VIEW)



# SN74LS147 SN74LS148

**SN74LS147  
FUNCTION TABLE**

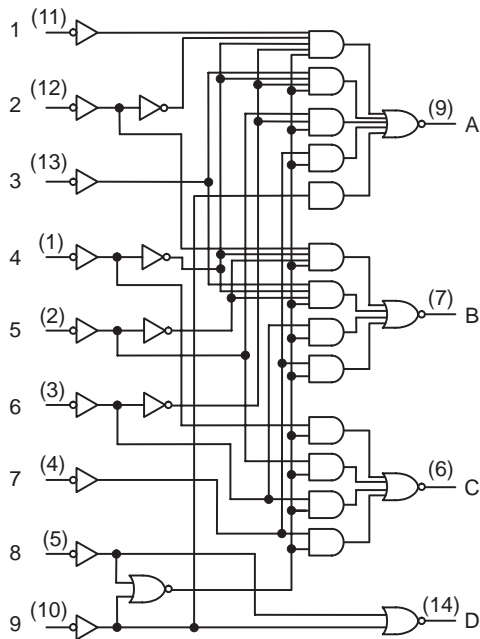
| INPUTS |   |   |   |   |   |   |   |   | OUTPUTS |   |   |   |
|--------|---|---|---|---|---|---|---|---|---------|---|---|---|
| 1      | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D       | C | B | A |
| H      | H | H | H | H | H | H | H | H | H       | H | H | H |
| X      | X | X | X | X | X | X | X | L | L       | H | H | L |
| X      | X | X | X | X | X | X | L | H | L       | H | H | H |
| X      | X | X | X | X | X | L | H | H | H       | L | L | L |
| X      | X | X | X | L | H | H | H | H | H       | L | L | H |
| X      | X | X | L | H | H | H | H | H | H       | L | H | L |
| X      | X | L | H | H | H | H | H | H | H       | H | L | L |
| X      | L | H | H | H | H | H | H | H | H       | H | L | H |
| L      | H | H | H | H | H | H | H | H | H       | H | H | L |

H = HIGH Logic Level, L = LOW Logic Level, X = Irrelevant

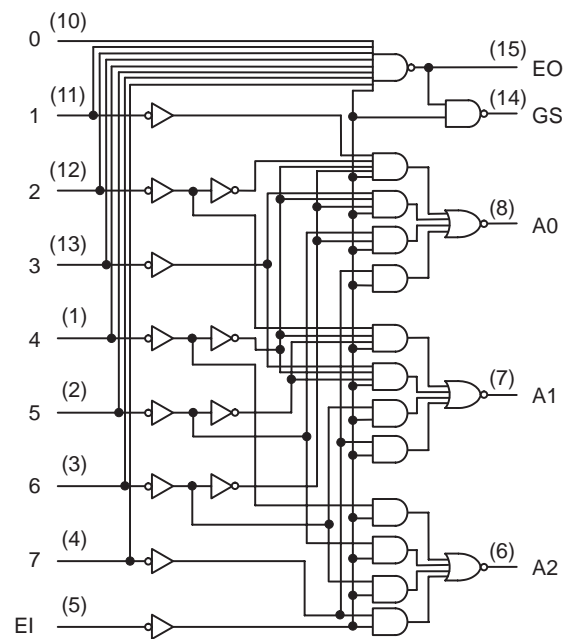
**SN74LS148  
FUNCTION TABLE**

| INPUTS |   |   |   |   |   |   |   | OUTPUTS |    |    |    |    |    |
|--------|---|---|---|---|---|---|---|---------|----|----|----|----|----|
| EI     | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7       | A2 | A1 | A0 | GS | EO |
| H      | X | X | X | X | X | X | X | X       | H  | H  | H  | H  | H  |
| L      | H | H | H | H | H | H | H | H       | H  | H  | H  | H  | L  |
| L      | X | X | X | X | X | X | X | L       | L  | L  | L  | L  | H  |
| L      | X | X | X | X | X | X | L | H       | L  | L  | H  | L  | H  |
| L      | X | X | X | X | L | H | H | H       | L  | H  | L  | L  | H  |
| L      | X | X | X | L | H | H | H | H       | H  | H  | L  | L  | H  |
| L      | X | X | L | H | H | H | H | H       | H  | L  | H  | L  | H  |
| L      | X | L | H | H | H | H | H | H       | H  | H  | L  | L  | H  |
| L      | L | H | H | H | H | H | H | H       | H  | H  | H  | L  | H  |

## FUNCTIONAL BLOCK DIAGRAMS



**SN74LS147**



**SN74LS148**

## SN74LS147 SN74LS148

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

| Symbol           | Parameter  | Limits |       |              | Unit | Test Conditions  |
|------------------|--|--------|-------|--------------|------|--|
|                  |  | Min    | Typ   | Max          |      |  |
| V <sub>IH</sub>  | Input HIGH Voltage                                     | 2.0    |       |              | V    | Guaranteed Input HIGH Voltage for All Inputs   |
| V <sub>IL</sub>  | Input LOW Voltage                                      |        |       | 0.8          | V    | Guaranteed Input LOW Voltage for All Inputs  |
| V <sub>IK</sub>  | Input Clamp Diode Voltage                              |        | -0.65 | -1.5         | V    | V <sub>CC</sub> = MIN, I <sub>IN</sub> = -18 mA  |
| V <sub>OH</sub>  | Output HIGH Voltage                                    | 2.7    | 3.5   |              | V    | V <sub>CC</sub> = MIN, I <sub>OH</sub> = MAX, V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> per Truth Table |
| V <sub>OL</sub>  | Output LOW Voltage                                     |        | 0.25  | 0.4          | V    | I <sub>OL</sub> = 4.0 mA   |
|                  |  |        | 0.35  | 0.5          | V    | I <sub>OL</sub> = 8.0 mA   |
| I <sub>IH</sub>  | Input HIGH Current<br>All Others<br>Inputs 1-7 (LS148) |        |       | 20<br>40     | μA   | V <sub>CC</sub> = MAX, V <sub>IN</sub> = 2.7 V   |
|                  | All Others<br>Inputs 1-7 (LS148)                       |        |       | 0.1<br>0.2   | mA   | V <sub>CC</sub> = MAX, V <sub>IN</sub> = 7.0 V   |
| I <sub>IL</sub>  | Input LOW Current<br>All Others<br>Inputs 1-7 (LS148)  |        |       | -0.4<br>-0.8 | mA   | V <sub>CC</sub> = MAX, V <sub>IN</sub> = 0.4 V   |
| I <sub>OS</sub>  | Short Circuit Current (Note 1)                         | -20    |       | -100         | mA   | V <sub>CC</sub> = MAX  |
| I <sub>CCH</sub> | Power Supply Current Output HIGH                       |        |       | 17           | mA   | V <sub>CC</sub> = MAX, All Inputs = 4.5 V  |
| I <sub>CCL</sub> | Output LOW   |        |       | 20           | mA   | V <sub>CC</sub> = MAX, Inputs 7 & E1 = GND<br>All Other Inputs = 4.5 V   |

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

## SN74LS147 SN74LS148

AC CHARACTERISTICS ( $V_{CC} = 5.0\text{ V}$ ,  $T_A = 25^\circ\text{C}$ )

### SN74LS147

| Symbol    | From (Input) | To (Output) | Waveform            | Limits |     |     | Unit | Test Conditions                                      |
|-----------|--------------|-------------|---------------------|--------|-----|-----|------|--|
|           |              |             |                     | Min    | Typ | Max |      |  |
| $t_{PLH}$ | Any          | Any         | In-phase output     |        | 12  | 18  | ns   | $C_L = 15\text{ pF}$ ,<br>$R_L = 2.0\text{ k}\Omega$ |
| $t_{PHL}$ |              |             |                     |        | 12  | 18  |      |  |
| $t_{PLH}$ | Any          | Any         | Out-of-phase output |        | 21  | 33  | ns   |  |
| $t_{PHL}$ |              |             |                     |        | 15  | 23  |      |  |

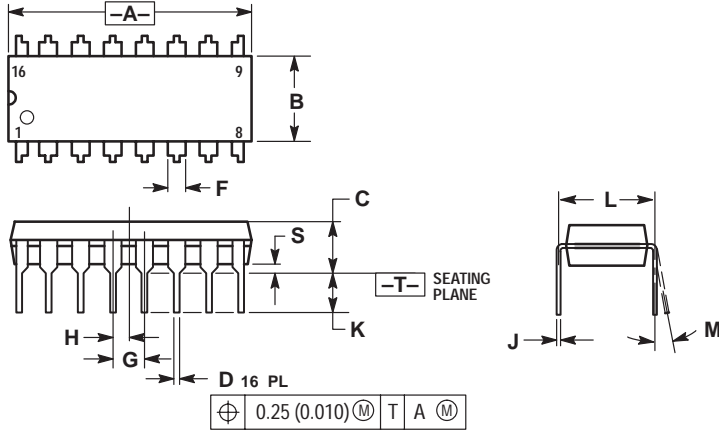
### SN74LS148

| Symbol    | From (Input) | To (Output)   | Waveform            | Limits |     |     | Unit | Test Conditions                                      |
|-----------|--------------|---------------|---------------------|--------|-----|-----|------|--|
|           |              |               |                     | Min    | Typ | Max |      |  |
| $t_{PLH}$ | 1 thru 7     | A0, A1, or A2 | In-phase output     |        | 14  | 18  | ns   | $C_L = 15\text{ pF}$ ,<br>$R_L = 2.0\text{ k}\Omega$ |
| $t_{PHL}$ |              |               |                     |        | 15  | 25  |      |  |
| $t_{PLH}$ | 1 thru 7     | A0, A1, or A2 | Out-of-phase output |        | 20  | 36  | ns   |  |
| $t_{PHL}$ |              |               |                     |        | 16  | 29  |      |  |
| $t_{PLH}$ | 0 thru 7     | EO            | Out-of-phase output |        | 7.0 | 18  | ns   |  |
| $t_{PHL}$ |              |               |                     |        | 25  | 40  |      |  |
| $t_{PLH}$ | 0 thru 7     | GS            | In-phase output     |        | 35  | 55  | ns   |  |
| $t_{PHL}$ |              |               |                     |        | 9.0 | 21  |      |  |
| $t_{PLH}$ | EI           | A0, A1, or A2 | In-phase output     |        | 16  | 25  | ns   |  |
| $t_{PHL}$ |              |               |                     |        | 12  | 25  |      |  |
| $t_{PLH}$ | EI           | GS            | In-phase output     |        | 12  | 17  | ns   |  |
| $t_{PHL}$ |              |               |                     |        | 14  | 36  |      |  |
| $t_{PLH}$ | EI           | EO            | In-phase output     |        | 12  | 21  | ns   |  |
| $t_{PHL}$ |              |               |                     |        | 28  | 40  |      |  |
|           |              |               |                     |        | 30  | 45  |      | (LS148)  |

# SN74LS147 SN74LS148

## PACKAGE DIMENSIONS

**N SUFFIX**  
**PLASTIC PACKAGE**  
**CASE 648-08**  
**ISSUE R**



**NOTES:**

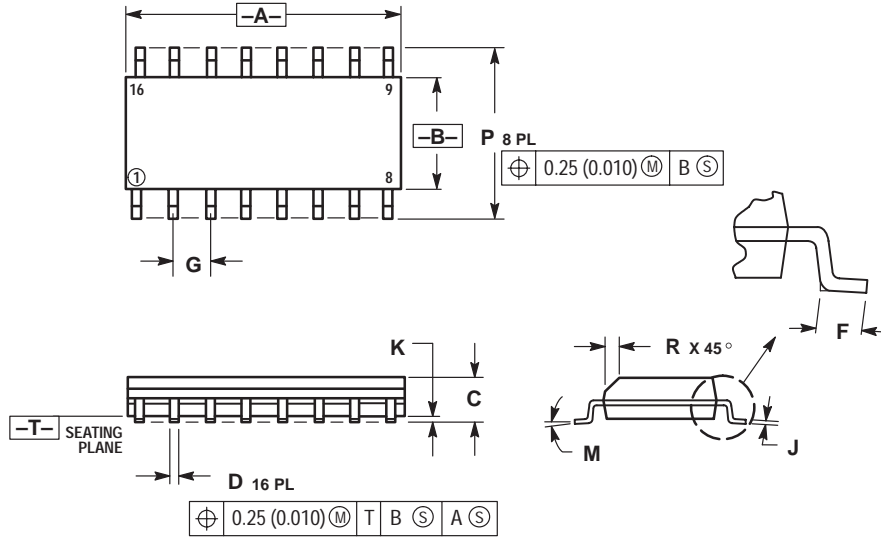
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

| 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     | 0.70  | 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  |

# SN74LS147 SN74LS148

## PACKAGE DIMENSIONS


### D SUFFIX PLASTIC SOIC PACKAGE 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°       |       | 0° 7°     |       |
| P   | 5.80        | 6.20  | 0.229     | 0.244 |
| R   | 0.25        | 0.50  | 0.010     | 0.019 |

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