



**DESCRIPTION** — The SN54LS/74LS147 and the SN54LS/74LS148 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.

The SN54LS/74LS748 is a proprietary Motorola part incorporating a built-in deglitcher network which minimizes glitches on the GS output. The glitch occurs on the negative going transition of the EI input when data inputs 0-7 are at logical ones.

The only dc parameter differences between the LS148 and the LS748 are that (1) Pin 10 (input 0) has a fan-in of 2 on the LS748 versus a fan-in of 1 on the LS148; (2) Pins 1, 2, 3, 4, 11, 12 and 13 (inputs 1, 2, 3, 4, 5, 6, 7) have a fan-in of 3 on the LS748 versus a fan-in of 2 on the LS148.

The only ac difference is that  $t_{pHL}$  from EI to EO is changed from 40 to 45 ns.

**SN54LS/74LS147  
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 | X | L | H | H | H | H       | L | L | H |
| X      | X | X | X | L | H | H | H | H | H       | L | H | L |
| X      | X | X | L | H | H | H | H | H | H       | L | H | H |
| 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 |

**SN54LS/74LS148  
SN54LS/74LS748  
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     |
| L      | H | H | H | H | H | H | H | H       | H  | H  | H  | L     |
| L      | X | X | X | X | X | X | L | L       | L  | L  | L  | H     |
| L      | X | X | X | X | X | L | H | L       | L  | H  | L  | H     |
| L      | X | X | X | X | L | H | H | L       | H  | L  | L  | H     |
| L      | X | X | X | L | H | H | H | H       | L  | H  | L  | H     |
| L      | 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     |
| L      | X | L | H | H | H | H | H | H       | H  | H  | L  | L     |
| L      | L | H | H | H | H | H | H | H       | H  | H  | H  | L     |

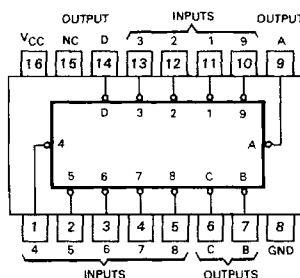
H = high logic level, L = low logic level, X = irrelevant

# **SN54LS/74LS147** **SN54LS/74LS148** **SN54LS/74LS748**

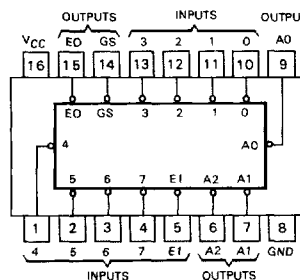
## **10-LINE-TO-4-LINE AND 8-LINE-TO-3-LINE PRIORITY ENCODERS**

**LOW POWER SCHOTTKY**

**SN54LS/74LS147  
(TOP VIEW)**

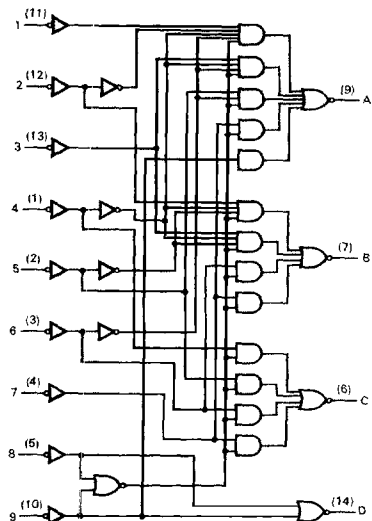


**SN54LS/74LS148  
SN54LS/74LS748  
(TOP VIEW)**

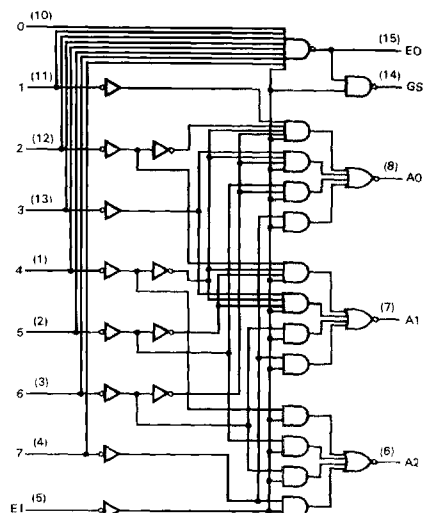


J Suffix — Case 620-08 (Ceramic)  
N Suffix — Case 648-05 (Plastic)

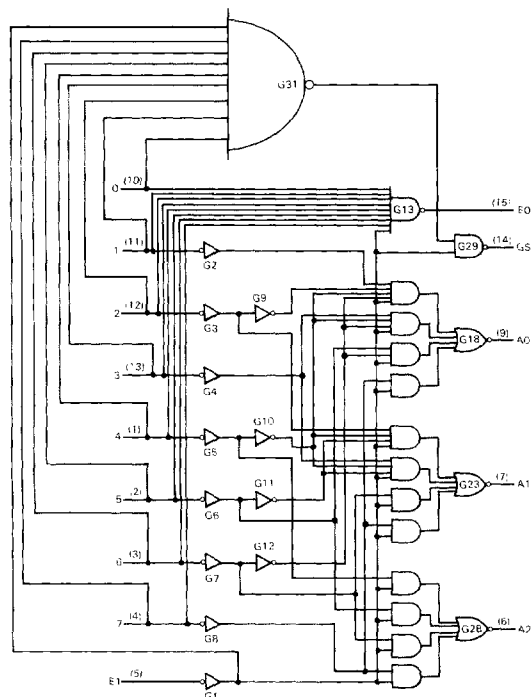
FUNCTIONAL BLOCK DIAGRAMS



SN54LS/74LS147



SN54LS/74LS148



SN54LS/74LS748

**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   |

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

| SYMBOL          | PARAMETER                                                                                       | LIMITS       |              |                              | UNITS | 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                                                                               | 54<br>74     |              | 0.7<br>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                                                                             | 54<br>74     | 2.5<br>2.7   | 3.5<br>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                                                                              | 54, 74<br>74 | 0.25<br>0.35 | 0.4<br>0.5                   | V     | I <sub>OL</sub> = 4.0 mA<br>I <sub>OL</sub> = 8.0 mA<br>V <sub>CC</sub> = V <sub>CC</sub> MIN, V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> per Truth Table |
| I <sub>IH</sub> | Input HIGH Current<br>All Others<br>Input 0 (LS748)<br>Inputs 1-7 (LS148)<br>Inputs 1-7 (LS748) |              |              | 20<br>40<br>40<br>60         | μA    | V <sub>CC</sub> = MAX, V <sub>IN</sub> = 2.7 V                                                                                                                      |
|                 | All Others<br>Input 0 (LS748)<br>Inputs 1-7 (LS148)<br>Inputs 1-7 (LS748)                       |              |              | 0.1<br>0.2<br>0.2<br>0.3     | mA    | V <sub>CC</sub> = MAX, V <sub>IN</sub> = 7.0 V                                                                                                                      |
| I <sub>IL</sub> | Input LOW Current<br>All others<br>Input 0 (LS748)<br>Inputs 1-7 (LS148)<br>Inputs 1-7 (LS748)  |              |              | -0.4<br>-0.8<br>-0.8<br>-1.2 | mA    | V <sub>CC</sub> = MAX, V <sub>IN</sub> = 0.4 V                                                                                                                      |
| I <sub>OS</sub> | Short Circuit Current                                                                           | -20          |              | -100                         | mA    | V <sub>CC</sub> = MAX                                                                                                                                               |
| I <sub>CC</sub> | Power Supply Current                                                                            |              |              | 20                           | mA    | V <sub>CC</sub> = MAX, Inputs 7, EI, GND, Others Open                                                                                                               |
|                 |                                                                                                 |              |              | 17                           | mA    | V <sub>CC</sub> = MAX, All open                                                                                                                                     |

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

**SN54LS/74LS147**

| SYMBOL    | FROM<br>(INPUT) | TO<br>(OUTPUT) | WAVEFORM               | LIMITS |     |     | UNIT | TEST CONDITIONS                                      |
|-----------|-----------------|----------------|------------------------|--------|-----|-----|------|------------------------------------------------------|
|           |                 |                |                        | MIN    | TYP | MAX |      |                                                      |
| $t_{PLH}$ | Any             | Any            | In-phase<br>output     |        | 12  | 18  | ns   | $C_L = 15 \text{ pF}$ ,<br>$R_L = 2 \text{ k}\Omega$ |
| $t_{PHL}$ |                 |                |                        |        | 12  | 18  |      |                                                      |
| $t_{PLH}$ | Any             | Any            | Out-of-phase<br>output |        | 21  | 33  | ns   |                                                      |
| $t_{PHL}$ |                 |                |                        |        | 15  | 23  |      |                                                      |

**SN54LS/74LS148**

**SN54LS/74LS748**

| SYMBOL           | FROM<br>(INPUT) | TO<br>(OUTPUT) | WAVEFORM               | LIMITS |     |     | UNIT | TEST CONDITIONS                                   |
|------------------|-----------------|----------------|------------------------|--------|-----|-----|------|---------------------------------------------------|
|                  |                 |                |                        | MIN    | TYP | MAX |      |                                                   |
| t <sub>PLH</sub> | 1 thru 7        | A0, A1, or A2  | In-phase<br>output     |        | 14  | 18  | ns   | C <sub>L</sub> = 15 pF,<br>R <sub>L</sub> = 2 kΩ, |
| t <sub>PHL</sub> |                 |                |                        |        | 15  | 25  |      |                                                   |
| t <sub>PLH</sub> | 1 thru 7        | A0, A1, or A2  | Out-of-phase<br>output |        | 20  | 36  | ns   |                                                   |
| t <sub>PHL</sub> |                 |                |                        |        | 16  | 29  |      |                                                   |
| t <sub>PLH</sub> | 0 thru 7        | EO             | Out-of-phase<br>output |        | 7.0 | 18  | ns   |                                                   |
| t <sub>PHL</sub> |                 |                |                        |        | 25  | 40  |      |                                                   |
| t <sub>PLH</sub> | 0 thru 7        | GS             | In-phase<br>output     |        | 35  | 55  | ns   |                                                   |
| t <sub>PHL</sub> |                 |                |                        |        | 9.0 | 21  |      |                                                   |
| t <sub>PLH</sub> | EI              | A0, A1, or A2  | In-phase<br>output     |        | 16  | 25  | ns   |                                                   |
| t <sub>PHL</sub> |                 |                |                        |        | 12  | 25  |      |                                                   |
| t <sub>PLH</sub> | EI              | GS             | In-phase<br>output     |        | 12  | 17  | ns   |                                                   |
| t <sub>PHL</sub> |                 |                |                        |        | 14  | 36  |      |                                                   |
| t <sub>PLH</sub> | EI              | EO             | In-phase<br>output     |        | 12  | 21  | ns   |                                                   |
| t <sub>PHL</sub> |                 |                |                        |        | 28  | 40  |      |                                                   |
|                  |                 |                |                        |        | 30  | 45  |      |                                                   |