

## MM54HCT147/MM74HCT147 10-to-4 Line Priority Encoder

### General Description

This priority encoder utilizes advanced silicon-gate CMOS technology. It has the high noise immunity and low power consumption typical of CMOS circuits, as well as the speeds and output drive similar to LS-TTL.

This priority encoder accepts 9 input request lines 1–9 and outputs 4 line BCD. The priority encoding ensures that only the highest order data line is encoded. The implied decimal zero condition requires no input condition as zero is encoded when all nine data lines are at a high logic level. All data inputs and outputs are active at low logic level.

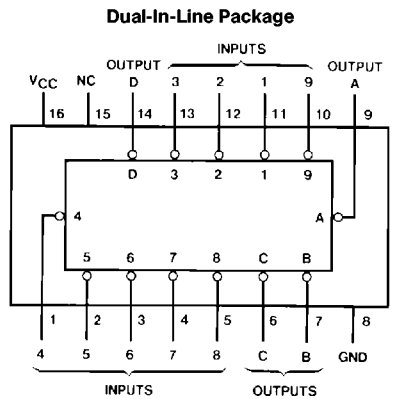
All inputs are protected from damage due to static discharge by internal diode clamps to  $V_{CC}$  and ground.

MM54HCT/MM74HCT devices are intended to interface between TTL and NMOS components and standard CMOS devices. These parts are also plug in replacements for LS-TTL devices and can be used to reduce power consumption in existing designs.

### Features

- Low quiescent power consumption:  
40  $\mu$ W maximum at 25°C
- High speed: 13 ns propagation delay (typical)
- Very low input current:  $10^{-5}$   $\mu$ A typical

### Connection and Logic Diagrams

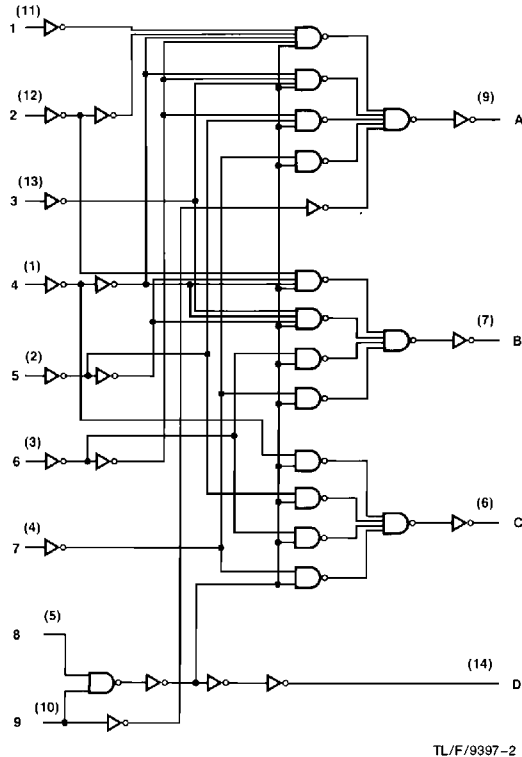


Order Number MM54HCT147 or MM74HCT147

### Truth 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 |

H = High Logic Level, L = Low Logic Level, X = Irrelevant



**Absolute Maximum Ratings** (Notes 1 & 2)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

|                                                  |                          |
|--------------------------------------------------|--------------------------|
| Supply Voltage ( $V_{CC}$ )                      | −0.5V to +7.0V           |
| DC Input Voltage ( $V_{IN}$ )                    | −1.5V to $V_{CC} + 1.5V$ |
| DC Output Voltage ( $V_{OUT}$ )                  | −0.5V to $V_{CC} + 0.5V$ |
| Clamp Diode Current ( $I_{IK}, I_{OK}$ )         | ±20 mA                   |
| DC Output Current, per pin ( $I_{OUT}$ )         | ±35 mA                   |
| DC $V_{CC}$ or GND Current, per pin ( $I_{CC}$ ) | ±75 mA                   |
| Storage Temperature Range ( $T_{STG}$ )          | −65°C to +150°C          |
| Power Dissipation ( $P_D$ )                      |                          |
| (Note 3)                                         | 600 mW                   |
| S.O. Package only                                | 500 mW                   |
| Lead Temperature ( $T_L$ )                       |                          |
| (Soldering 10 seconds)                           | 260°C                    |

**Operating Conditions**

|                                                  | Min | Max      | Units |
|--------------------------------------------------|-----|----------|-------|
| Supply Voltage ( $V_{CC}$ )                      | 2   | 6        | V     |
| DC Input or Output Voltage ( $V_{IN}, V_{OUT}$ ) | 0   | $V_{CC}$ | V     |
| Operating Temp. Range ( $T_A$ )                  |     |          |       |
| MM74HCT                                          | −40 | +85      | °C    |
| MM54HCT                                          | −55 | +125     | °C    |
| Input Rise or Fall Times ( $t_r, t_f$ )          |     | 500      | ns    |

**DC Electrical Characteristics**  $V_{CC} = 5V \pm 10\%$  (unless otherwise specified)

| Symbol          | Parameter                         | Conditions                                                                   | T <sub>A</sub> = 25°C |                       | 74HCT                           | 54HCT                            | Units |
|-----------------|-----------------------------------|------------------------------------------------------------------------------|-----------------------|-----------------------|---------------------------------|----------------------------------|-------|
|                 |                                   |                                                                              |                       |                       | T <sub>A</sub> = −40°C to +85°C | T <sub>A</sub> = −55°C to +125°C |       |
|                 |                                   |                                                                              | Typ                   | Guaranteed Limits     |                                 |                                  |       |
| V <sub>IH</sub> | Minimum High Level Input Voltage  |                                                                              |                       | 2.0                   | 2.0                             | 2.0                              | V     |
| V <sub>IL</sub> | Maximum Low Level Input Voltage   |                                                                              |                       | 0.8                   | 0.8                             | 0.8                              | V     |
| V <sub>OH</sub> | Minimum High Level Output Voltage | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>                         |                       |                       |                                 |                                  |       |
|                 |                                   | I <sub>OUT</sub> = 20 μA                                                     | V <sub>CC</sub>       | V <sub>CC</sub> − 0.1 | V <sub>CC</sub> − 0.1           | V <sub>CC</sub> − 0.1            | V     |
|                 |                                   | I <sub>OUT</sub> = 4.0 mA, V <sub>CC</sub> = 4.5V                            | 4.2                   | 3.98                  | 3.84                            | 3.7                              | V     |
|                 |                                   | I <sub>OUT</sub> = 4.8 mA, V <sub>CC</sub> = 5.5V                            | 5.7                   | 4.98                  | 4.84                            | 4.7                              | V     |
| V <sub>OL</sub> | Maximum Low Level Output Voltage  | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>                         |                       |                       |                                 |                                  |       |
|                 |                                   | I <sub>OUT</sub> = 20 μA                                                     | 0                     | 0.1                   | 0.1                             | 0.1                              | V     |
|                 |                                   | I <sub>OUT</sub> = 4.0 mA, V <sub>CC</sub> = 4.5V                            | 0.2                   | 0.26                  | 0.33                            | 0.4                              | V     |
|                 |                                   | I <sub>OUT</sub> = 4.8 mA, V <sub>CC</sub> = 5.5V                            | 0.2                   | 0.26                  | 0.33                            | 0.4                              | V     |
| I <sub>IN</sub> | Maximum Input Current             | V <sub>IN</sub> = V <sub>CC</sub> or GND, V <sub>IH</sub> or V <sub>IL</sub> |                       | ±0.1                  | ±1.0                            | ±1.0                             | μA    |
| I <sub>CC</sub> | Maximum Quiescent Supply Current  | V <sub>IN</sub> = V <sub>CC</sub> or GND<br>I <sub>OUT</sub> = 0 μA          |                       | 8.0                   | 80                              | 160                              | μA    |
|                 |                                   | V <sub>IN</sub> = 2.4V or 0.5V (Note 4)                                      |                       | 2.0                   | 2.9                             | 3.0                              | mA    |

**AC Electrical Characteristics**  $V_{CC} = 5V \pm 10\%$ ,  $C_L = 50 \text{ pF}$ ,  $t_r = t_f = 6 \text{ ns}$  (unless otherwise specified)

| Symbol                          | Parameter                              | T <sub>A</sub> = 25°C |                   | 74HCT<br>−40°C to +85°C | 54HCT<br>−55°C to +125°C | Units |
|---------------------------------|----------------------------------------|-----------------------|-------------------|-------------------------|--------------------------|-------|
|                                 |                                        | Typ                   | Guaranteed Limits |                         |                          |       |
| t <sub>PD</sub>                 | Maximum Propagation Delay              |                       | 22                | 28                      | 33                       | ns    |
| t <sub>r</sub> , t <sub>f</sub> | Maximum Output Rise and Fall Time      | 7                     | 11                | 14                      | 17                       | ns    |
| C <sub>PD</sub>                 | Power Dissipation Capacitance (Note 5) | TBD                   |                   |                         |                          | pF    |
| C <sub>IN</sub>                 | Maximum Input Capacitance              | 5                     | 10                | 10                      | 10                       | pF    |

**AC Electrical Characteristics**  $V_{CC} = 5V$ ,  $T_A = 25^\circ\text{C}$ ,  $C_L = 15 \text{ pF}$ ,  $t_r = t_f = 6 \text{ ns}$ 

| Symbol          | Parameter                 | T <sub>A</sub> = 25°C |                   | 74HCT<br>−40°C to +85°C | 54HCT<br>−55°C to +125°C | Units |
|-----------------|---------------------------|-----------------------|-------------------|-------------------------|--------------------------|-------|
|                 |                           | Typ                   | Guaranteed Limits |                         |                          |       |
| t <sub>PD</sub> | Maximum Propagation Delay | 11                    |                   |                         |                          | ns    |

**Note 1:** Absolute Maximum Ratings are those values beyond which damage to the device may occur.

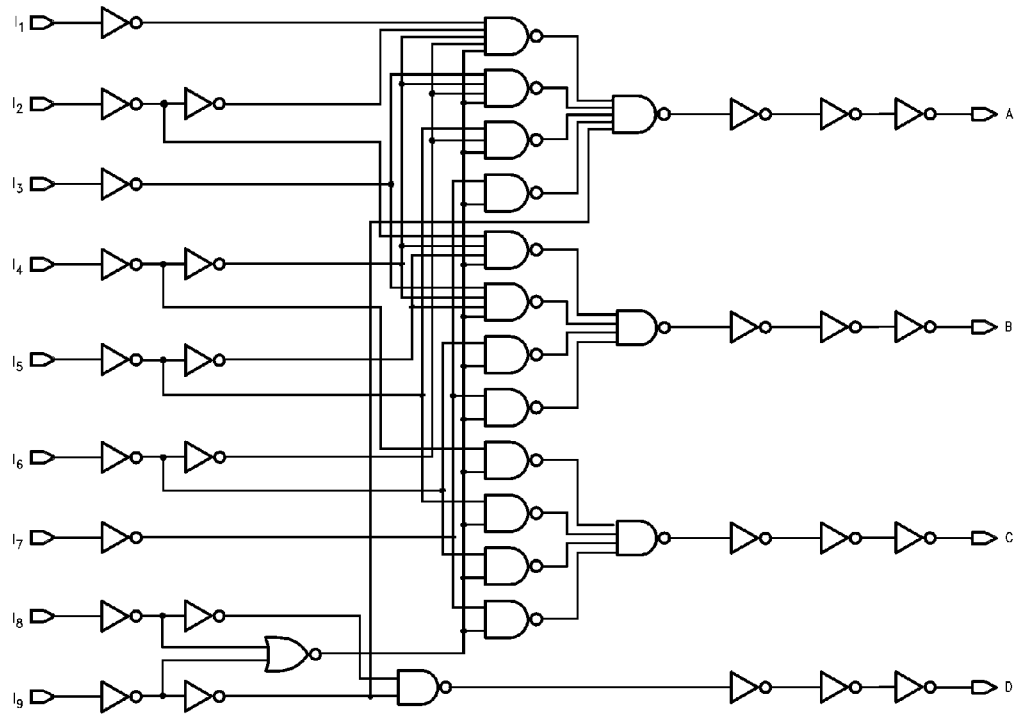
**Note 2:** Unless otherwise specified all voltages are referenced to ground.

**Note 3:** Power Dissipation temperature derating — plastic "N" package: −12 mW/°C from 65°C to 85°C; ceramic "J" package: −12 mW/°C from 100°C to 125°C.

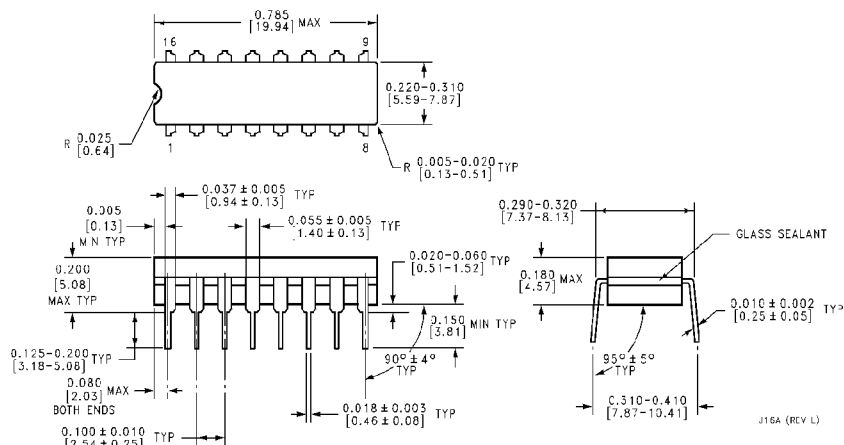
**Note 4:** Measured per input, other inputs held at  $V_{CC}$  or GND.

**Note 5:**  $C_{PD}$  determines the no load dynamic power consumption, and the no load dynamic current consumption.

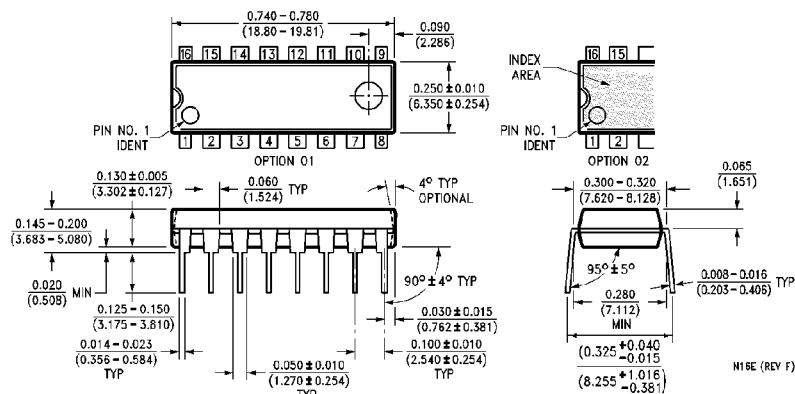
# Schematic Diagram



TL/F/9397-3

**Physical Dimensions** inches (millimeters)

**Ceramic Dual-In-Line Package (J)**  
**Order Number MM54HCT147J or MM74HCT147J**  
**NS Package Number J16A**



**Molded Dual-In-Line Package (N)**  
**Order Number MM74HC147N**  
**NS Package Number N16E**

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