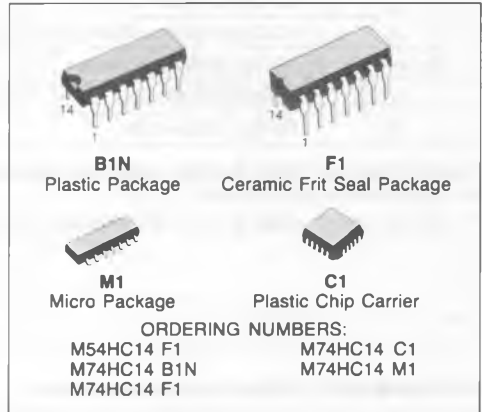


## HEX SCHMITT INVERTER

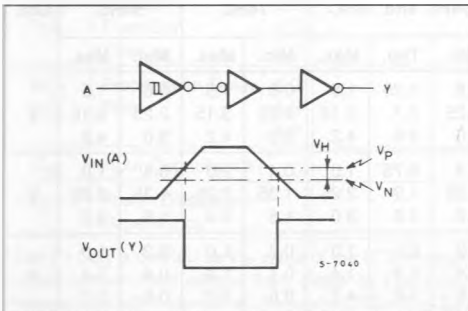
- HIGH SPEED  
 $t_{PD} = 14 \text{ ns (TYP.) at } V_{CC} = 5V$
- LOW POWER DISSIPATION  
 $I_{CC} = 1 \mu\text{A (MAX.) at } T_A = 25^\circ\text{C}$
- HIGH NOISE IMMUNITY  
 $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (MIN.)}$
- OUTPUT DRIVE CAPABILITY  
 10 LSTTL LOADS
- SYMMETRICAL OUTPUT IMPEDANCE  
 $|I_{OH}| = I_{OL} = 4 \text{ mA (MIN.)}$
- BALANCED PROPAGATION DELAYS  
 $t_{PLH} = t_{PHL}$
- WIDE OPERATING VOLTAGE RANGE  
 $V_{CC} \text{ (OPR)} = 2V \text{ to } 6V$
- PIN AND FUNCTION COMPATIBLE  
 WITH 54/74LS14



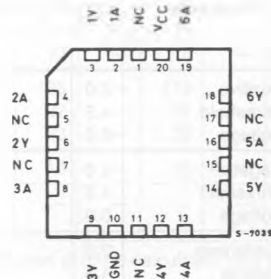
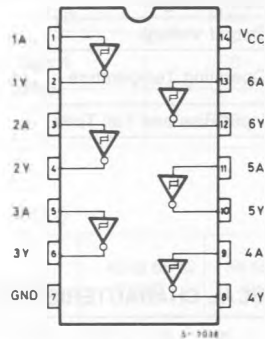
### DESCRIPTION

The M54/74HC14 is a high speed CMOS HEX SCHMITT INVERTER fabricated in silicon gate C<sup>2</sup>MOS technology. It has the same high speed performance of LSTTL combined with true CMOS low power consumption. Pin configuration and function are the same as those of the HC04 but all inputs have 20%  $V_{CC}$  hysteresis level. This together with its schmitt trigger function allows it to be used on line receivers with slow rise/fall input signals. All inputs are equipped with protection circuits against static discharge and transient excess voltage.

### LOGIC DIAGRAM/WAVEFORM



### PIN CONNECTIONS (top view)



NC =  
 No Internal  
 Connection

## ABSOLUTE MAXIMUM RATINGS

| Symbol                              | Parameter                                    | Value                          | Unit |
|-------------------------------------|--|--------------------------------|------|
| V <sub>CC</sub>                     | Supply Voltage                               | - 0.5 to 7                     | V    |
| V <sub>I</sub>                      | DC Input Voltage                             | - 0.5 to V <sub>CC</sub> + 0.5 | V    |
| V <sub>O</sub>                      | DC Output Voltage                            | - 0.5 to V <sub>CC</sub> + 0.5 | V    |
| I <sub>IK</sub>                     | DC Input Diode Current                       | ± 20                           | mA   |
| I <sub>OK</sub>                     | DC Output Diode Current                      | ± 20                           | mA   |
| I <sub>O</sub>                      | DC Output Source Sink Current Per Output Pin | ± 25                           | mA   |
| I <sub>CC</sub> or I <sub>GND</sub> | DC V <sub>CC</sub> or Ground Current         | ± 50                           | mA   |
| P <sub>D</sub>                      | Power Dissipation                            | 500 (*)                        | mW   |
| T <sub>stg</sub>                    | Storage Temperature                          | - 65 to 150                    | °C   |

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied.

(\*) 500 mW: ≙ 65°C derate to 300 mW by 10 mW/°C: 65°C to 85°C

## RECOMMENDED OPERATING CONDITIONS

| Symbol                          | Parameter   | Value                     | Unit |
|---------------------------------|---|---------------------------|------|
| V <sub>CC</sub>                 | Supply Voltage                                      | 2 to 6                    | V    |
| V <sub>I</sub>                  | Input Voltage                                       | 0 to V <sub>CC</sub>      | V    |
| V <sub>O</sub>                  | Output Voltage                                      | 0 to V <sub>CC</sub>      | V    |
| T <sub>A</sub>                  | Operating Temperature<br>74HC Series<br>54HC Series | - 40 to 85<br>- 55 to 125 | °C   |
| t <sub>r</sub> , t <sub>f</sub> | Input Rise and Fall Time                            | no limits                 |      |

DC ELECTRICAL CHARACTERISTICS (C<sub>L</sub> = 50pF, Input t<sub>r</sub> = t<sub>f</sub> = 6ns)

| Symbol         | Parameter                        | V <sub>CC</sub> | Test Condition | T <sub>A</sub> = 25°C<br>54HC and 74HC |      |      | - 40 to 85°C<br>74HC |      | - 55 to 125°C<br>54HC |      | Unit |
|----------------|----------------------------------|-----------------|----------------|--|------|------|----------------------|------|-----------------------|------|------|
|                |                                  |                 |                | Min.                                   | Typ. | Max. | Min.                 | Max. | Min.                  | Max. |      |
| V <sub>P</sub> | Positive<br>Threshold<br>Voltage | 2.0             |                | 0.8                                    | 1.25 | 1.5  | 0.8                  | 1.5  | 0.8                   | 1.5  | V    |
|                |                                  | 4.5             |                | 2.25                                   | 2.7  | 3.15 | 2.25                 | 3.15 | 2.25                  | 3.15 |      |
|                |                                  | 6.0             |                | 3.0                                    | 3.6  | 4.2  | 3.0                  | 4.2  | 3.0                   | 4.2  |      |
| V <sub>N</sub> | Negative<br>Threshold<br>Voltage | 2.0             |                | 0.4                                    | 0.75 | 1.0  | 0.4                  | 1.0  | 0.4                   | 1.0  | V    |
|                |                                  | 4.5             |                | 1.35                                   | 1.9  | 2.25 | 1.35                 | 2.25 | 1.35                  | 2.25 |      |
|                |                                  | 6.0             |                | 1.8                                    | 2.6  | 3.0  | 1.8                  | 3.0  | 1.8                   | 3.0  |      |
| V <sub>H</sub> | Hysteresis<br>Voltage            | 2.0             |                | 0.2                                    | 0.5  | 1.0  | 0.2                  | 1.0  | 0.2                   | 1.0  | V    |
|                |                                  | 4.5             |                | 0.4                                    | 0.8  | 1.4  | 0.4                  | 1.4  | 0.4                   | 1.4  |      |
|                |                                  | 6.0             |                | 0.6                                    | 1.0  | 1.7  | 0.6                  | 1.7  | 0.6                   | 1.7  |      |

## DC SPECIFICATIONS

| Symbol          | Parameter                 | V <sub>CC</sub>   | Test Condition                           |                | T <sub>A</sub> = 25°C<br>54HC and 74HC   |         |       | - 40 to 85°C<br>74HC |      | - 55 to 125°C<br>54HC |      | Unit |
|-----------------|---------------------------|-------------------|--|----------------|--|---------|-------|----------------------|------|-----------------------|------|------|
|                 |                           |                   |  |                | Min.                                     | Typ.    | Max.  | Min.                 | Max. | Min.                  | Max. |      |
| V <sub>OH</sub> | High Level Output Voltage | 2.0<br>4.5<br>6.0 | V <sub>I</sub>                           | I <sub>O</sub> | 1.9                                      | 2.0     | —     | 1.9                  | —    | 1.9                   | —    | V    |
|                 |                           |                   |  |                | V <sub>IH</sub><br>or<br>V <sub>IL</sub> | - 20 μA | 4.4   | 4.5                  | —    | 4.4                   | —    |      |
|                 |                           |                   | V <sub>IH</sub><br>or<br>V <sub>IL</sub> | - 4.0 mA       | 4.18                                     | 4.31    | —     | 4.13                 | —    | 4.10                  | —    |      |
|                 |                           |                   |  | - 5.2 mA       | 5.68                                     | 5.8     | —     | 5.63                 | —    | 5.60                  | —    |      |
| V <sub>OL</sub> | Low Level Output Voltage  | 2.0<br>4.5<br>6.0 | V <sub>IH</sub><br>or<br>V <sub>IL</sub> | 20 μA          | —  | 0       | 0.1   | —                    | 0.1  | —                     | 0.1  | V    |
|                 |                           |                   |  |                | —  | 0       | 0.1   | —                    | 0.1  | —                     | 0.1  |      |
|                 |                           |                   | V <sub>IH</sub><br>or<br>V <sub>IL</sub> | 4.0 mA         | —  | 0.17    | 0.26  | —                    | 0.33 | —                     | 0.40 |      |
|                 |                           |                   |  | 5.2 mA         | —  | 0.18    | 0.26  | —                    | 0.33 | —                     | 0.40 |      |
| I <sub>I</sub>  | Input Leakage Current     | 6.0               | V <sub>I</sub> = V <sub>CC</sub> or GND  |                | —  | —       | ± 0.1 | —                    | ± 1  | —                     | ± 1  | μA   |
| I <sub>CC</sub> | Quiescent Supply Current  | 6.0               | V <sub>I</sub> = V <sub>CC</sub> or GND  |                | —  | —       | 1     | —                    | 10   | —                     | 20   | μA   |

AC ELECTRICAL CHARACTERISTICS (V<sub>CC</sub> = 5V, T<sub>A</sub> = 25°C, C<sub>L</sub> = 15pF, Input t<sub>r</sub> = t<sub>f</sub> = 6ns)

| Symbol                               | Parameter              | 54HC and 74HC |      |      | Unit |
|--------------------------------------|------------------------|---------------|------|------|------|
|                                      |                        | Min.          | Typ. | Max. |      |
| t <sub>TLH</sub><br>t <sub>THL</sub> | Output Transition Time |               | 4    | 8    | ns   |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay Time |               | 14   | 22   | ns   |

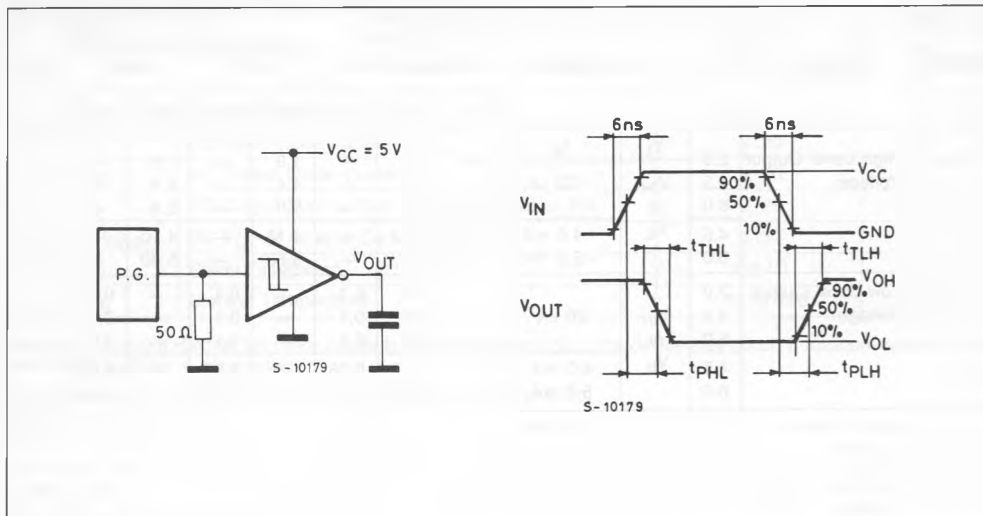
AC ELECTRICAL CHARACTERISTICS (C<sub>L</sub> = 50pF, Input t<sub>r</sub> = t<sub>f</sub> = 6ns)

| Symbol                               | Parameter                     | V <sub>CC</sub> | Test Condition |  | T <sub>A</sub> = 25°C<br>54HC and 74HC |      |      | - 40 to 85°C<br>74HC |      | - 55 to 125°C<br>54HC |      | Unit |
|--------------------------------------|-------------------------------|-----------------|----------------|--|--|------|------|----------------------|------|-----------------------|------|------|
|                                      |                               |                 |                |  | Min.                                   | Typ. | Max. | Min.                 | Max. | Min.                  | Max. |      |
| t <sub>TLH</sub><br>t <sub>THL</sub> | Output Transition Time        | 2.0             |                |  | —                                      | 30   | 75   | —                    | 95   | —                     | 110  | ns   |
| t <sub>PLH</sub><br>t <sub>PHL</sub> |                               | 4.5             |                |  | —                                      | 8    | 15   | —                    | 19   | —                     | 22   |      |
|                                      |                               | 6.0             |                |  | —                                      | 7    | 13   | —                    | 16   | —                     | 19   |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay Time        | 2.0             |                |  | —                                      | 68   | 135  | —                    | 170  | —                     | 205  | ns   |
| t <sub>PLH</sub><br>t <sub>PHL</sub> |                               | 4.5             |                |  | —                                      | 17   | 27   | —                    | 34   | —                     | 41   |      |
|                                      |                               | 6.0             |                |  | —                                      | 14   | 23   | —                    | 29   | —                     | 35   |      |
| C <sub>IN</sub>                      | Input Capacitance             |                 |                |  | —                                      | 5    | 10   | —                    | 10   | —                     | 10   | pF   |
| C <sub>PD</sub> (*)                  | Power Dissipation Capacitance |                 |                |  | —                                      | 31   | —    | —                    | —    | —                     | —    | pF   |

Note (\*) C<sub>PD</sub> is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit)

Average operating current is: I<sub>CC(opr)</sub> = CPD • V<sub>CC</sub> • f<sub>IN</sub> + I<sub>CC</sub>

SWITCHING CHARACTERISTICS TEST CIRCUIT



TEST CIRCUIT I<sub>CC</sub> (Opr.)

