



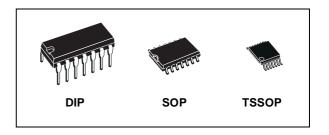
## HEX SCHMITT INVERTER

- HIGH SPEED: t<sub>PD</sub> =12ns (TYP.) at V<sub>CC</sub> = 6V
- LOW POWER DISSIPATION:  $I_{CC} = 1\mu A(MAX.)$  at  $T_A=25^{\circ}C$
- HIGH NOISE IMMUNITY:  $V_H = 1.2 \text{ V (TYP.)}$  AT  $V_{CC} = 6 \text{ V}$
- SYMMETRICAL OUTPUT IMPEDANCE: |I<sub>OH</sub>| = I<sub>OL</sub> = 4mA (MIN)
- BALANCED PROPAGATION DELAYS: t<sub>PLH</sub> ≅ t<sub>PHL</sub>
- WIDE OPERATING VOLTAGE RANGE: V<sub>CC</sub> (OPR) = 2V to 6V
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 14



The M74HC14 is an high speed CMOS HEX SCHMITT INVERTER fabricated with silicon gate  $\mbox{C}^2\mbox{MOS}$  technology. Pin configuration and function are the same as those of the M74HC04 but all inputs have 20%  $\mbox{V}_{\rm CC}$  hysteresis level.

This, together with its schmitt trigger function, allows it to be used on line receivers with slow rise/fall input signals.

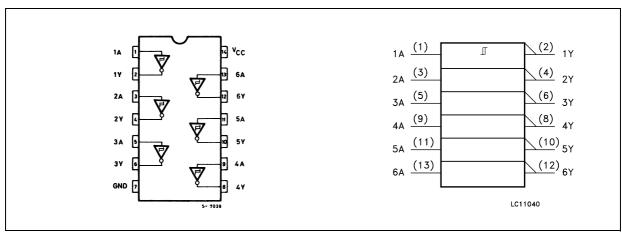


#### **ORDER CODES**

| PACKAGE | TUBE       | T & R         |
|---------|------------|---------------|
| DIP     | M74HC14B1R |               |
| SOP     | M74HC14M1R | M74HC14RM13TR |
| TSSOP   |            | M74HC14TTR    |

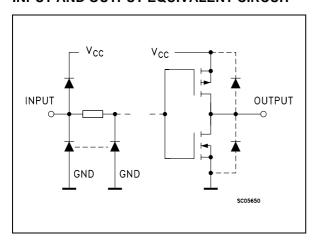
All inputs are equipped with protection circuits against static discharge and transient excess voltage.

#### PIN CONNECTION AND IEC LOGIC SYMBOLS



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### INPUT AND OUTPUT EQUIVALENT CIRCUIT



### **PIN DESCRIPTION**

| PIN No                | SYMBOL          | NAME AND FUNCTION       |
|-----------------------|-----------------|-------------------------|
| 1, 3, 5, 9, 11,<br>13 | 1A to 6A        | Data Inputs             |
| 2, 4, 6, 8, 10,<br>12 | 1Y to 6Y        | Data Outputs            |
| 7                     | GND             | Ground (0V)             |
| 14                    | V <sub>CC</sub> | Positive Supply Voltage |

#### **TRUTH TABLE**

| Α | Y |
|---|---|
| L | Н |
| Н | L |

## **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    |
| Vo                    | 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   |
| Io                    | DC Output Current                    | ± 25                          | mA   |
| $I_{CC}$ or $I_{GND}$ | DC V <sub>CC</sub> or Ground Current | ± 50                          | mA   |
| $P_{D}$               | Power Dissipation                    | 500(*)                        | mW   |
| T <sub>stg</sub>      | Storage Temperature                  | -65 to +150                   | °C   |
| $T_L$                 | Lead Temperature (10 sec)            | 300                           | °C   |

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

(\*) 500mW at 65 °C; derate to 300mW by 10mW/°C from 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>op</sub> | Operating Temperature | -55 to 125           | °C   |

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## **DC SPECIFICATIONS**

|                 |                             | 7               | est Condition                           |      |                       |       | Value |             |      |              |    |
|-----------------|-----------------------------|-----------------|---|------|-----------------------|-------|-------|-------------|------|--------------|----|
| Symbol          | Parameter                   | v <sub>cc</sub> |   | Т    | T <sub>A</sub> = 25°C |       |       | -40 to 85°C |      | -55 to 125°C |    |
|                 |                             | (V)             |   | Min. | Тур.                  | Max.  | Min.  | Max.        | Min. | Max.         |    |
| V <sub>t+</sub> | High Level Input            | 2.0             |   | 1.0  | 1.28                  | 1.5   | 1.0   | 1.5         | 1.0  | 1.5          |    |
|                 | Voltage                     | 4.5             |   | 2.3  | 2.8                   | 3.15  | 2.3   | 3.15        | 2.3  | 3.15         | V  |
|                 |                             | 6.0             |   | 3.0  | 3.7                   | 4.2   | 3.0   | 4.2         | 3.0  | 4.2          |    |
| $V_{t-}$        | Low Level Input             | 2.0             |   | 0.3  | 0.74                  | 0.9   | 0.3   | 0.9         | 0.3  | 0.9          |    |
|                 | Voltage                     | 4.5             |   | 1.13 | 1.8                   | 2.0   | 1.13  | 2.0         | 1.13 | 2.0          | V  |
|                 |                             | 6.0             |   | 1.5  | 2.4                   | 2.6   | 1.5   | 2.6         | 1.5  | 2.6          |    |
| $V_{H}$         | Hysteresis Voltage          | 2.0             |   | 0.3  | 0.54                  | 1.0   | 0.3   | 1.0         | 0.3  | 1.0          |    |
|                 |                             | 4.5             |   | 0.6  | 1.0                   | 1.4   | 0.6   | 1.4         | 0.6  | 1.4          | V  |
|                 |                             | 6.0             |   | 8.0  | 1.3                   | 1.4   | 0.8   | 1.7         | 0.8  | 1.7          |    |
| $V_{OH}$        | High Level Output           | 2.0             | I <sub>O</sub> =-20 μA                  | 1.9  | 2.0                   |       | 1.9   |             | 1.9  |              |    |
|                 | Voltage                     | 4.5             | I <sub>O</sub> =-20 μA                  | 4.4  | 4.5                   |       | 4.4   |             | 4.4  |              |    |
|                 |                             | 6.0             | I <sub>O</sub> =-20 μA                  | 5.9  | 6.0                   |       | 5.9   |             | 5.9  |              | V  |
|                 |                             | 4.5             | I <sub>O</sub> =-4.0mA                  | 4.18 | 4.31                  |       | 4.13  |             | 4.10 |              |    |
|                 |                             | 6.0             | I <sub>O</sub> =-5.2 mA                 | 5.68 | 5.8                   |       | 5.63  |             | 5.60 |              |    |
| V <sub>OL</sub> | Low Level Output            | 2.0             | I <sub>O</sub> =-20 μA                  |      | 0.0                   | 0.1   |       | 0.1         |      | 0.1          |    |
|                 | Voltage                     | 4.5             | I <sub>O</sub> =-20 μA                  |      | 0.0                   | 0.1   |       | 0.1         |      | 0.1          |    |
|                 |                             | 6.0             | I <sub>O</sub> =-20 μA                  |      | 0.0                   | 0.1   |       | 0.1         |      | 0.1          | V  |
|                 |                             | 4.5             | I <sub>O</sub> =-4.0mA                  |      | 0.17                  | 0.26  |       | 0.33        |      | 0.40         |    |
|                 |                             | 6.0             | I <sub>O</sub> =-5.2 mA                 |      | 0.18                  | 0.26  |       | 0.33        |      | 0.40         |    |
| I <sub>I</sub>  | Input Leakage<br>Current    | 6.0             | V <sub>I</sub> = V <sub>CC</sub> or GND |      |                       | ± 0.1 |       | ± 1         |      | ± 1          | μΑ |
| I <sub>CC</sub> | Quiescent Supply<br>Current | 6.0             | $V_I = V_{CC}$ or GND                   |      |                       | 1     |       | 10          |      | 20           | μΑ |

# AC ELECTRICAL CHARACTERISTICS ( $C_L = 50 \text{ pF}$ , Input $t_r = t_f = 6 \text{ns}$ )

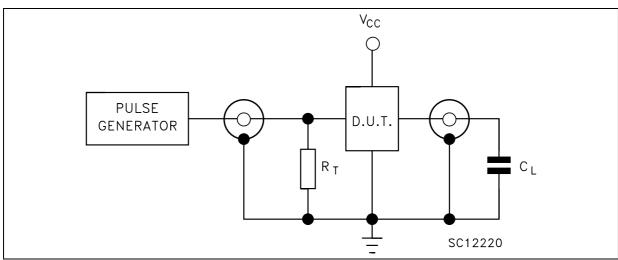
|                                   |                   | 7    | Test Condition |                       | Value |      |      |              |  |      |    |
|-----------------------------------|-------------------|------|----------------|-----------------------|-------|------|------|--------------|--|------|----|
| Symbol Parameter                  | v <sub>cc</sub>   | Vcc  |                | T <sub>A</sub> = 25°C |       |      | 85°C | -55 to 125°C |  | Unit |    |
|                                   | (V)               | Min. | Тур.           | Max.                  | Min.  | Max. | Min. | Max.         |  |      |    |
| t <sub>TLH</sub> t <sub>THL</sub> | Output Transition | 2.0  |                |                       | 30    | 75   |      | 95           |  | 110  |    |
|                                   | Time              | 4.5  |                |                       | 8     | 15   |      | 19           |  | 22   | ns |
|                                   |                   | 6.0  |                |                       | 7     | 13   |      | 16           |  | 19   |    |
| t <sub>PLH</sub> t <sub>PHL</sub> | Propagation Delay | 2.0  |                |                       | 42    | 125  |      | 155          |  | 190  |    |
|                                   | Time              | 4.5  |                |                       | 14    | 25   |      | 31           |  | 38   | ns |
|                                   |                   | 6.0  |                |                       | 12    | 21   |      | 16           |  | 32   |    |

### **CAPACITIVE CHARACTERISTICS**

|                 |  | Test Condition  |                         | Value                 |      |             |      |              |      |      |    |
|-----------------|--|-----------------|-------------------------|-----------------------|------|-------------|------|--------------|------|------|----|
| Symbol          | Parameter                                    | V <sub>CC</sub> |                         | T <sub>A</sub> = 25°C |      | -40 to 85°C |      | -55 to 125°C |      | Unit |    |
|                 | (V)  |                 | Min.                    | Тур.                  | Max. | Min.        | Max. | Min.         | Max. |      |    |
| C <sub>IN</sub> | Input Capacitance                            | 5.0             |                         |                       | 5    | 10          |      | 10           |      | 10   | pF |
| C <sub>PD</sub> | Power Dissipation<br>Capacitance<br>(note 1) | 5.0             | f <sub>IN</sub> = 10MHz |                       | 28   |             |      |              |      |      | pF |

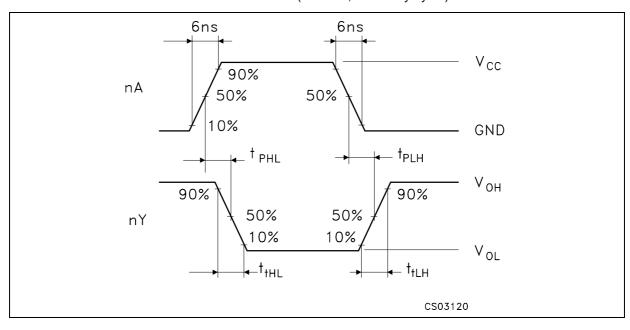
<sup>1)</sup>  $C_{PD}$  is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation.  $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/6$  (per gate)

### **TEST CIRCUIT**



 $C_L$  = 50pF or equivalent (includes jig and probe capacitance)  $R_T$  =  $Z_{OUT}$  of pulse generator (typically  $50\Omega$ )

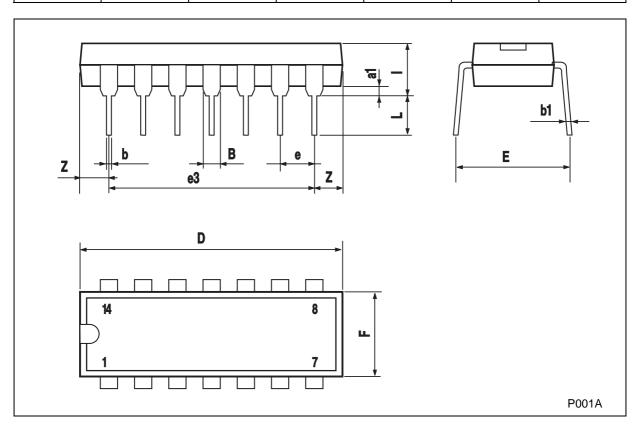
## WAVEFORM: PROPAGATION DELAY TIMES (f=1MHz; 50% duty cycle)



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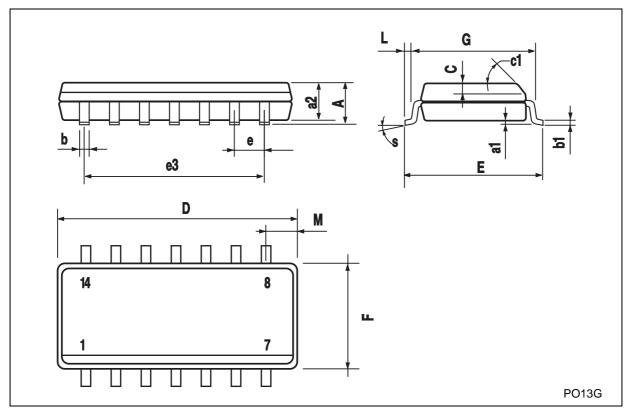
## **Plastic DIP-14 MECHANICAL DATA**

| DIM  |      | mm.   |      |       | inch  |       |
|------|------|-------|------|-------|-------|-------|
| DIM. | MIN. | TYP   | MAX. | MIN.  | TYP.  | MAX.  |
| a1   | 0.51 |       |      | 0.020 |       |       |
| В    | 1.39 |       | 1.65 | 0.055 |       | 0.065 |
| b    |      | 0.5   |      |       | 0.020 |       |
| b1   |      | 0.25  |      |       | 0.010 |       |
| D    |      |       | 20   |       |       | 0.787 |
| E    |      | 8.5   |      |       | 0.335 |       |
| е    |      | 2.54  |      |       | 0.100 |       |
| e3   |      | 15.24 |      |       | 0.600 |       |
| F    |      |       | 7.1  |       |       | 0.280 |
| I    |      |       | 5.1  |       |       | 0.201 |
| L    |      | 3.3   |      |       | 0.130 |       |
| Z    | 1.27 |       | 2.54 | 0.050 |       | 0.100 |



## **SO-14 MECHANICAL DATA**

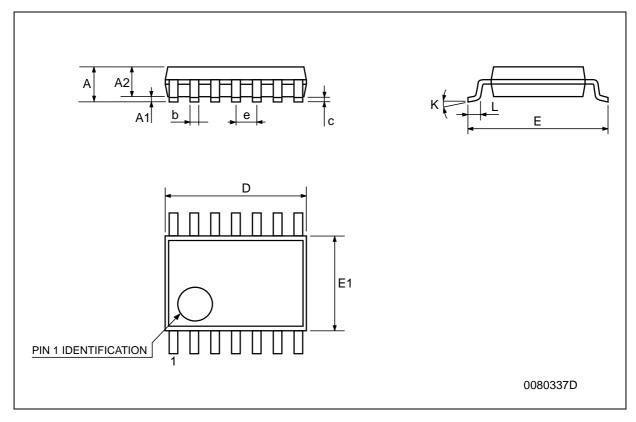
| DIM  |      | mm.      |       |        | inch  |       |  |
|------|------|----------|-------|--------|-------|-------|--|
| DIM. | MIN. | TYP MAX. |       | MIN.   | TYP.  | MAX.  |  |
| Α    |      |          | 1.75  |        |       | 0.068 |  |
| a1   | 0.1  |          | 0.2   | 0.003  |       | 0.007 |  |
| a2   |      |          | 1.65  |        |       | 0.064 |  |
| b    | 0.35 |          | 0.46  | 0.013  |       | 0.018 |  |
| b1   | 0.19 |          | 0.25  | 0.007  |       | 0.010 |  |
| С    |      | 0.5      |       |        | 0.019 |       |  |
| c1   |      |          | 45°   | (typ.) | •     | •     |  |
| D    | 8.55 |          | 8.75  | 0.336  |       | 0.344 |  |
| E    | 5.8  |          | 6.2   | 0.228  |       | 0.244 |  |
| е    |      | 1.27     |       |        | 0.050 |       |  |
| e3   |      | 7.62     |       |        | 0.300 |       |  |
| F    | 3.8  |          | 4.0   | 0.149  |       | 0.157 |  |
| G    | 4.6  |          | 5.3   | 0.181  |       | 0.208 |  |
| L    | 0.5  |          | 1.27  | 0.019  |       | 0.050 |  |
| М    |      |          | 0.68  |        |       | 0.026 |  |
| S    |      | -        | 8° (ı | max.)  |       | 4     |  |



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## **TSSOP14 MECHANICAL DATA**

| DIM.  |      | mm.      |      |       | inch       | ch     |  |  |
|-------|------|----------|------|-------|------------|--------|--|--|
| DIWI. | MIN. | TYP      | MAX. | MIN.  | TYP.       | MAX.   |  |  |
| А     |      |          | 1.2  |       |            | 0.047  |  |  |
| A1    | 0.05 |          | 0.15 | 0.002 | 0.004      | 0.006  |  |  |
| A2    | 0.8  | 1        | 1.05 | 0.031 | 0.039      | 0.041  |  |  |
| b     | 0.19 |          | 0.30 | 0.007 |            | 0.012  |  |  |
| С     | 0.09 |          | 0.20 | 0.004 |            | 0.0089 |  |  |
| D     | 4.9  | 5        | 5.1  | 0.193 | 0.197      | 0.201  |  |  |
| E     | 6.2  | 6.4      | 6.6  | 0.244 | 0.252      | 0.260  |  |  |
| E1    | 4.3  | 4.4      | 4.48 | 0.169 | 0.173      | 0.176  |  |  |
| е     |      | 0.65 BSC |      |       | 0.0256 BSC |        |  |  |
| К     | 0°   |          | 8°   | 0°    |            | 8°     |  |  |
| L     | 0.45 | 0.60     | 0.75 | 0.018 | 0.024      | 0.030  |  |  |



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