



# HCF4069UB

## HEX INVERTER

- MEDIUM-SPEED OPERATION  
 $t_{PD} = 30\text{ns}$  (Typ.) at 10V
- STANDARDIZED SYMMETRICAL OUTPUT CHARACTERISTICS
- QUIESCENT CURRENT SPECIFIED UP TO 20V
- 5V, 10V AND 15V PARAMETRIC RATINGS
- INPUT LEAKAGE CURRENT  
 $I_I = 100\text{nA}$  (MAX) AT  $V_{DD} = 18\text{V}$   $T_A = 25^\circ\text{C}$
- 100% TESTED FOR QUIESCENT CURRENT
- MEETS ALL REQUIREMENTS OF JEDEC JESD13B "STANDARD SPECIFICATIONS FOR DESCRIPTION OF B SERIES CMOS DEVICES"



### ORDER CODES

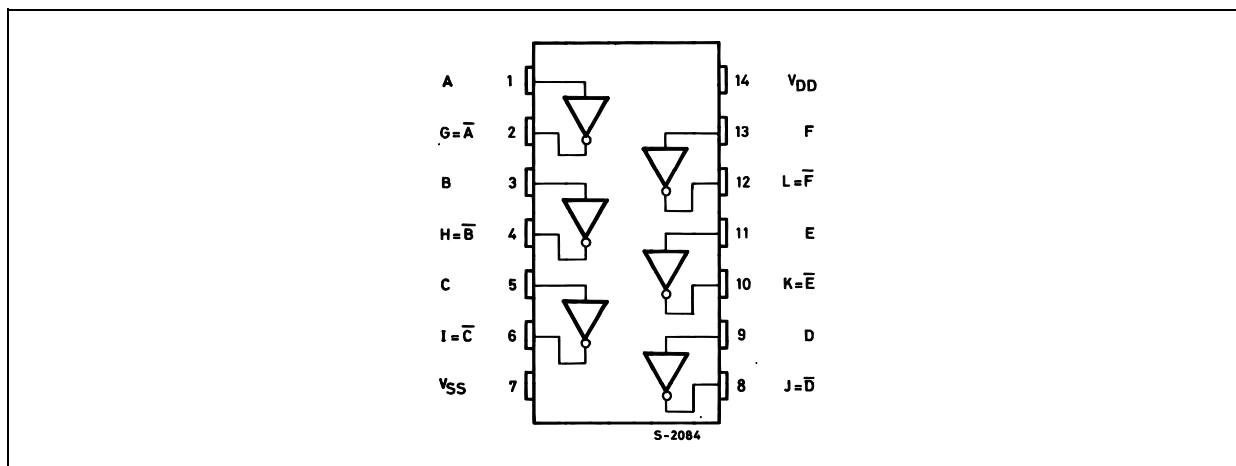
| PACKAGE | TUBE        | T & R          |
|---------|-------------|----------------|
| DIP     | HCF4069UBEY |                |
| SOP     | HCF4069UBM1 | HCF4069UM013TR |

### DESCRIPTION

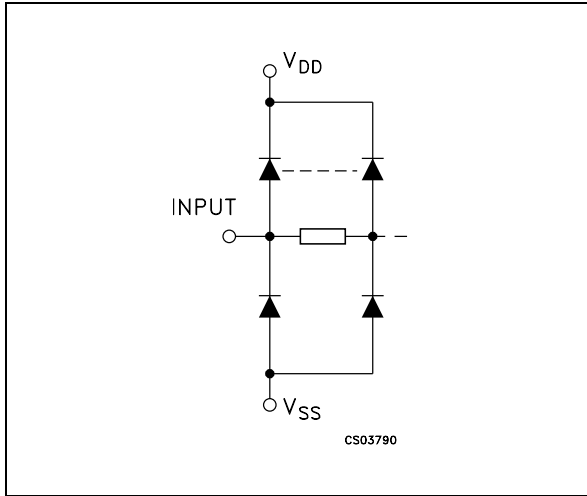
The HCF4069UB is a monolithic integrated circuit fabricated in Metal Oxide Semiconductor technology available in DIP and SOP packages. The HCF4069UB consists of six COS/MOS inverter circuits. This device is intended for all

general purpose inverter applications where the medium power TTL-drive and logic level conversion capabilities of circuits such HCF4049B HEX INVERTER/BUFFERS are not required.

### PIN CONNECTION



**INPUT EQUIVALENT CIRCUIT**



**PIN DESCRIPTION**

| PIN No             | SYMBOL           | NAME AND FUNCTION       |
|--------------------|------------------|-------------------------|
| 1, 3, 5, 9, 11, 13 | A, B, C, D, E, F | Data Inputs             |
| 2, 4, 6, 8, 10, 12 | G, H, I, J, K, L | Data Outputs            |
| 7                  | V <sub>SS</sub>  | Negative Supply Voltage |
| 14                 | V <sub>DD</sub>  | Positive Supply Voltage |

**TRUTH TABLE**

| INPUTS           | OUTPUTS          |
|------------------|------------------|
| A, B, C, D, E, F | G, H, I, J, K, L |
| L                | H                |
| H                | L                |

**ABSOLUTE MAXIMUM RATINGS**

| Symbol           | Parameter                               | Value                         | Unit |
|------------------|---|-------------------------------|------|
| V <sub>DD</sub>  | Supply Voltage                          | -0.5 to +22                   | V    |
| V <sub>I</sub>   | DC Input Voltage                        | -0.5 to V <sub>DD</sub> + 0.5 | V    |
| I <sub>I</sub>   | DC Input Current                        | ± 10                          | mA   |
| P <sub>D</sub>   | Power Dissipation per Package           | 200                           | mW   |
|                  | Power Dissipation per Output Transistor | 100                           | mW   |
| T <sub>op</sub>  | Operating Temperature                   | -55 to +125                   | °C   |
| 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. All voltage values are referred to V<sub>SS</sub> pin voltage.

**RECOMMENDED OPERATING CONDITIONS**

| Symbol          | Parameter             | Value                | Unit |
|-----------------|-----------------------|----------------------|------|
| V <sub>DD</sub> | Supply Voltage        | 3 to 20              | V    |
| V <sub>I</sub>  | Input Voltage         | 0 to V <sub>DD</sub> | V    |
| T <sub>op</sub> | Operating Temperature | -55 to 125           | °C   |

## DC SPECIFICATIONS

| Symbol          | Parameter                 | Test Condition        |                       |                                 |                        | Value                 |               |           |             |         |              | Unit    |         |
|-----------------|---------------------------|-----------------------|-----------------------|---------------------------------|------------------------|-----------------------|---------------|-----------|-------------|---------|--------------|---------|---------|
|                 |                           | V <sub>I</sub><br>(V) | V <sub>O</sub><br>(V) | I <sub>OL</sub>  <br>( $\mu$ A) | V <sub>DD</sub><br>(V) | T <sub>A</sub> = 25°C |               |           | -40 to 85°C |         | -55 to 125°C |         |         |
|                 |                           |                       |                       |                                 |                        | Min.                  | Typ.          | Max.      | Min.        | Max.    | Min.         |         | Max.    |
| I <sub>L</sub>  | Quiescent Current         | 0/5                   |                       |                                 | 5                      |                       | 0.01          | 0.25      |             | 7.5     |              | 7.5     | $\mu$ A |
|                 |                           | 0/10                  |                       |                                 | 10                     |                       | 0.01          | 0.5       |             | 15      |              | 15      |         |
|                 |                           | 0/15                  |                       |                                 | 15                     |                       | 0.01          | 1         |             | 30      |              | 30      |         |
|                 |                           | 0/20                  |                       |                                 | 20                     |                       | 0.02          | 5         |             | 150     |              | 150     |         |
| V <sub>OH</sub> | High Level Output Voltage | 0/5                   |                       | <1                              | 5                      | 4.95                  |               |           | 4.95        |         | 4.95         |         | V       |
|                 |                           | 0/10                  |                       | <1                              | 10                     | 9.95                  |               |           | 9.95        |         | 9.95         |         |         |
|                 |                           | 0/15                  |                       | <1                              | 15                     | 14.95                 |               |           | 14.95       |         | 14.95        |         |         |
| V <sub>OL</sub> | Low Level Output Voltage  | 5/0                   |                       | <1                              | 5                      |                       | 0.05          |           |             | 0.05    |              | 0.05    | V       |
|                 |                           | 10/0                  |                       | <1                              | 10                     |                       | 0.05          |           |             | 0.05    |              | 0.05    |         |
|                 |                           | 15/0                  |                       | <1                              | 15                     |                       | 0.05          |           |             | 0.05    |              | 0.05    |         |
| V <sub>IH</sub> | High Level Input Voltage  |                       | 0.5/4.5               | <1                              | 5                      | 4                     |               |           | 4           |         | 4            |         | V       |
|                 |                           |                       | 1/9                   | <1                              | 10                     | 8                     |               |           | 8           |         | 8            |         |         |
|                 |                           |                       | 1.5/13.5              | <1                              | 15                     | 12.5                  |               |           | 12.5        |         | 12.5         |         |         |
| V <sub>IL</sub> | Low Level Input Voltage   |                       | 4.5/0.5               | <1                              | 5                      |                       |               | 1         |             | 1       |              | 1       | V       |
|                 |                           |                       | 9/1                   | <1                              | 10                     |                       |               | 2         |             | 2       |              | 2       |         |
|                 |                           |                       | 13.5/1.5              | <1                              | 15                     |                       |               | 2.5       |             | 2.5     |              | 2.5     |         |
| I <sub>OH</sub> | Output Drive Current      | 0/5                   | 2.5                   | <1                              | 5                      | -1.36                 | -3.2          |           | -1.15       |         | -1.1         |         | mA      |
|                 |                           | 0/5                   | 4.6                   | <1                              | 5                      | -0.44                 | -1            |           | -0.36       |         | -0.36        |         |         |
|                 |                           | 0/10                  | 9.5                   | <1                              | 10                     | -1.1                  | -2.6          |           | -0.9        |         | -0.9         |         |         |
|                 |                           | 0/15                  | 13.5                  | <1                              | 15                     | -3.0                  | -6.8          |           | -2.4        |         | -2.4         |         |         |
| I <sub>OL</sub> | Output Sink Current       | 0/5                   | 0.4                   | <1                              | 5                      | 0.44                  | 1             |           | 0.36        |         | 0.36         |         | mA      |
|                 |                           | 0/10                  | 0.5                   | <1                              | 10                     | 1.1                   | 2.6           |           | 0.9         |         | 0.9          |         |         |
|                 |                           | 0/15                  | 1.5                   | <1                              | 15                     | 3.0                   | 6.8           |           | 2.4         |         | 2.4          |         |         |
| I <sub>I</sub>  | Input Leakage Current     | 0/18                  | Any Input             |                                 | 18                     |                       | $\pm 10^{-5}$ | $\pm 0.1$ |             | $\pm 1$ |              | $\pm 1$ | $\mu$ A |
| C <sub>I</sub>  | Input Capacitance         |                       | Any Input             |                                 |                        |                       | 5             | 7.5       |             |         |              |         | pF      |

The Noise Margin for both "1" and "0" level is: 1V min. with V<sub>DD</sub>=5V, 2V min. with V<sub>DD</sub>=10V, 2.5V min. with V<sub>DD</sub>=15V

DYNAMIC ELECTRICAL CHARACTERISTICS (T<sub>amb</sub> = 25°C, C<sub>L</sub> = 50pF, R<sub>L</sub> = 200K $\Omega$ , t<sub>r</sub> = t<sub>f</sub> = 20 ns)

| Symbol                            | Parameter              | Test Condition      |  |  | Value (*) |      |      | Unit |
|-----------------------------------|------------------------|---------------------|--|--|-----------|------|------|------|
|                                   |                        | V <sub>DD</sub> (V) |  |  | Min.      | Typ. | Max. |      |
| t <sub>PLH</sub> t <sub>PHL</sub> | Propagation Delay Time | 5                   |  |  |           | 55   | 110  | ns   |
|                                   |                        | 10                  |  |  |           | 30   | 60   |      |
|                                   |                        | 15                  |  |  |           | 25   | 50   |      |
| t <sub>TLH</sub> t <sub>THL</sub> | Output Transition Time | 5                   |  |  |           | 100  | 200  | ns   |
|                                   |                        | 10                  |  |  |           | 50   | 100  |      |
|                                   |                        | 15                  |  |  |           | 40   | 80   |      |

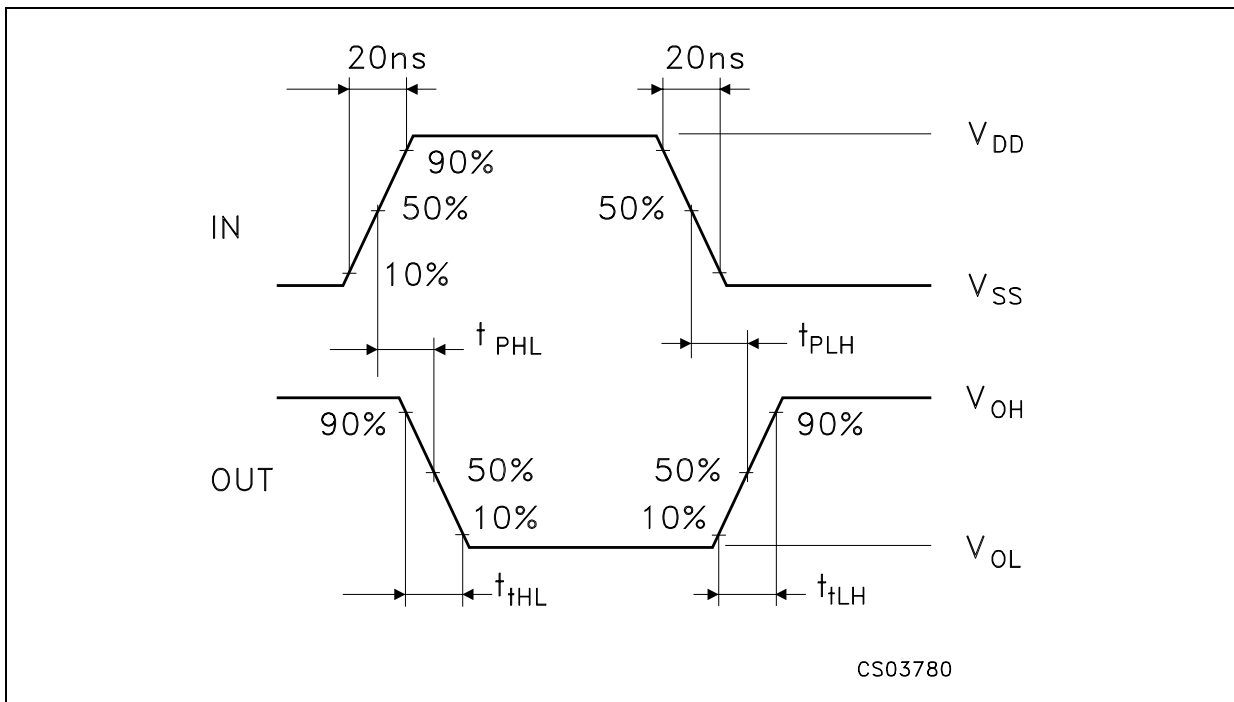
(\*) Typical temperature coefficient for all V<sub>DD</sub> value is 0.3 %/°C.

TEST CIRCUIT



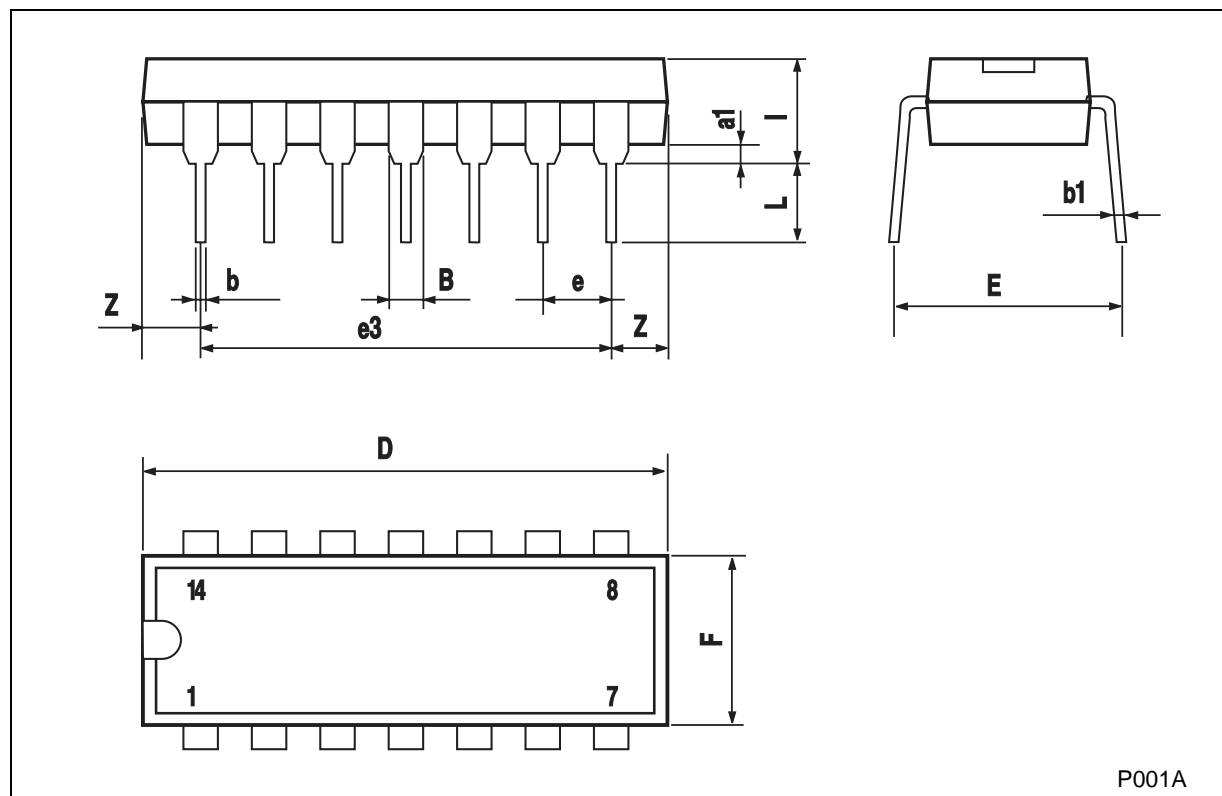
$C_L = 50\text{pF}$  or equivalent (includes jig and probe capacitance)  
 $R_L = 200\text{K}\Omega$   
 $R_T = Z_{\text{OUT}}$  of pulse generator (typically  $50\Omega$ )

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



|                                       |  |  |  |  |  |  |
|---------------------------------------|--|--|--|--|--|--|
| <b>Plastic DIP-14 MECHANICAL DATA</b> |  |  |  |  |  |  |
|---------------------------------------|--|--|--|--|--|--|

| DIM. | mm.  |       |      | inch  |       |       |
|------|------|-------|------|-------|-------|-------|
|      | MIN. | TYP   | MAX. | MIN.  | TYP.  | MAX.  |
| a1   | 0.51 |       |      | 0.020 |       |       |
| B    | 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 |       |
| e    |      | 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  |       |       |
|------|------------|------|------|-------|-------|-------|
|      | MIN.       | TYP. | MAX. | MIN.  | TYP.  | MAX.  |
| A    |            |      | 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 |
| C    |            | 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 |
| e    |            | 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 |
| M    |            |      | 0.68 |       |       | 0.026 |
| S    | 8° (max.)  |      |      |       |       |       |



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