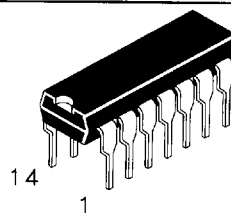


### Hex Inverter

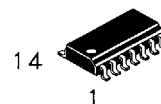
This device contains six independent three-stage inverters, each of which performs the logic INVERT function.

- Output Drive Capability: 10 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 2 to 6 V for HC devices
- Low Input Current: 1  $\mu$ A
- DC, AC parameters guaranteed from -55°C to 125°C

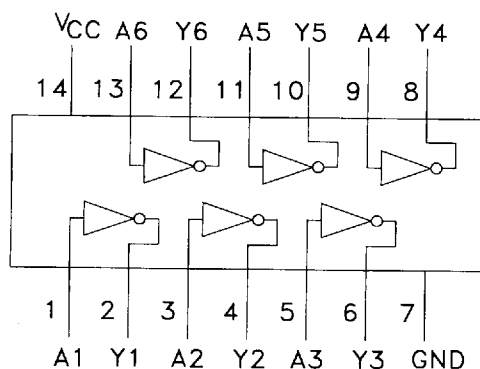
### DV74HC04A DV74HCT04A



N Suffix  
Plastic DIP  
AVG-001Case



D Suffix  
Plastic SOP  
AVG-002 Case



TRUTH TABLE  
 $Y = \bar{A}$

| Inputs | Outputs |
|--------|---------|
| A      | Y       |
| L      | H       |
| H      | L       |

H = High Logic Level  
L = Low Logic Level

### ABSOLUTE MAXIMUM RATINGS

Maximum ratings are those values beyond which damage to the device may occur.

| Symbol    | Parameter                                                  | Value                  | Unit |
|-----------|------------------------------------------------------------|------------------------|------|
| $V_{CC}$  | DC Supply Voltage (Referenced to GND)                      | -0.5 to +7.0           | V    |
| $V_{IN}$  | DC Input Voltage (Referenced to GND)                       | -1.5 to $V_{CC} + 1.5$ | V    |
| $V_{OUT}$ | DC Output Voltage (Referenced to GND)                      | -0.5 to $V_{CC} + 0.5$ | V    |
| $I_{IN}$  | DC Input Current, per Pin                                  | $\pm 20$               | mA   |
| $I_{OUT}$ | DC Output Current, per Pin                                 | $\pm 25$               | mA   |
| $I_{CC}$  | DC Supply Current, $V_{CC}$ and GND Pins                   | $\pm 50$               | mA   |
| $P_D$     | Power Dissipation in Still Air, Plastic DIP<br>SOP Package | 750<br>500             | mW   |
| $T_{STG}$ | Storage Temperature Range                                  | -65 to +150            | °C   |
| $T_L$     | Lead Temperature, 1mm from Case for 10 Seconds             | 260                    | °C   |

### GUARANTEED OPERATING CONDITIONS

| Symbol            | Parameter                                                                                                  | Min         | Max                | Unit |
|-------------------|------------------------------------------------------------------------------------------------------------|-------------|--------------------|------|
| $V_{CC}$          | DC Supply Voltage, HC (HCT), Referenced to GND                                                             | 2.0 (4.5)   | 6.0 (5.5)          | V    |
| $V_{IN}, V_{OUT}$ | DC Input Voltage, Output Voltage, Referenced to GND                                                        | 0           | $V_{CC}$           | V    |
| $T_A$             | Ambient Temperature                                                                                        | -55         | +125               | °C   |
| $t_r, t_f$        | Input Rise and Fall Time: HC: $V_{CC}=2.0V$<br>HCT: $V_{CC}=5.5V$ / HC: $V_{CC}=4.5V$<br>HC: $V_{CC}=6.0V$ | 0<br>0<br>0 | 1000<br>500<br>400 | ns   |

## HC-04A

### DC ELECTRICAL CHARACTERISTICS

| Symbol          | Parameter                                       | Conditions                                                                                       | V <sub>CC</sub><br>V | Guaranteed Limits   |                    |                    | Unit |
|-----------------|-------------------------------------------------|--------------------------------------------------------------------------------------------------|----------------------|---------------------|--------------------|--------------------|------|
|                 |                                                 |                                                                                                  |                      | 25°C<br>to<br>-55°C | ≤85°C              | ≤125°C             |      |
| V <sub>IH</sub> | High Level Input Voltage<br>(Referenced to GND) | V <sub>OUT</sub> = 0.1 V<br> I <sub>OUT</sub>   ≤ 20 μA                                          | 2.0<br>4.5<br>6.0    | 1.5<br>3.15<br>4.2  | 1.5<br>3.15<br>4.2 | 1.5<br>3.15<br>4.2 | V    |
| V <sub>IL</sub> | Low Level Input Voltage                         | V <sub>OUT</sub> = V <sub>CC</sub> - 0.1 V<br> I <sub>OUT</sub>   ≤ 20 μA                        | 2.0<br>4.5<br>6.0    | 0.5<br>1.35<br>1.8  | 0.5<br>1.35<br>1.8 | 0.5<br>1.35<br>1.8 | V    |
| V <sub>OH</sub> | Minimum High Level<br>Output Voltage            | V <sub>IN</sub> = V <sub>IL</sub><br> I <sub>OUT</sub>   < 20 mA                                 | 2.0<br>4.5<br>6.0    | 1.9<br>4.4<br>5.9   | 1.9<br>4.4<br>5.9  | 1.9<br>4.4<br>5.9  | V    |
|                 |                                                 | V <sub>IN</sub> = V <sub>IL</sub> ,  I <sub>OUT</sub>   < 4.0 mA<br> I <sub>OUT</sub>   < 5.2 mA | 4.5<br>6.0           | 3.98<br>5.48        | 3.84<br>5.34       | 3.70<br>5.20       | V    |
| V <sub>OL</sub> | Maximum Low Level Output<br>Voltage             | V <sub>IN</sub> = V <sub>IH</sub><br> I <sub>OUT</sub>   ≤ 20 μA                                 | 2.0<br>4.5<br>6.0    | 0.1<br>0.1<br>0.1   | 0.1<br>0.1<br>0.1  | 0.1<br>0.1<br>0.1  | V    |
|                 |                                                 | V <sub>IN</sub> = V <sub>IH</sub> ,  I <sub>OUT</sub>   < 4.0 mA<br> I <sub>OUT</sub>   < 5.2 mA | 4.5<br>6.0           | 0.26<br>0.26        | 0.33<br>0.33       | 0.40<br>0.40       | V    |
| I <sub>IN</sub> | Maximum Input<br>Leakage Current                | V <sub>IN</sub> = V <sub>CC</sub> or GND                                                         | 6.0                  | ± 0.1               | ± 1.0              | ± 1.0              | μA   |
| I <sub>CC</sub> | Maximum Quiescent<br>Supply Current             | V <sub>IN</sub> = V <sub>CC</sub> or GND<br> I <sub>OUT</sub>   ≤ 0 μA                           | 6.0                  | 1                   | 10                 | 40                 | μA   |

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### SWITCHING CHARACTERISTICS over full operating conditions (C<sub>L</sub>=50 pF, Input t<sub>r</sub>=t<sub>f</sub>=6ns)

| Symbol                                 | Parameter                                      | Vcc<br>V | Guaranteed Limit    |       |        | Unit |
|----------------------------------------|------------------------------------------------|----------|---------------------|-------|--------|------|
|                                        |                                                |          | 25°C<br>to<br>-55°C | ≤85°C | ≤125°C |      |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub> | Propagation Delay Time,<br>Input A To Output Y | 2.0      | 75                  | 95    | 110    | ns   |
|                                        |                                                | 4.5      | 15                  | 19    | 22     |      |
|                                        |                                                | 6.0      | 13                  | 16    | 19     |      |
| t <sub>TLH</sub> ,<br>t <sub>THL</sub> | Output Transition Time<br>Any Output           | 2.0      | 75                  | 95    | 110    | ns   |
|                                        |                                                | 4.5      | 15                  | 19    | 22     |      |
|                                        |                                                | 6.0      | 13                  | 16    | 19     |      |
| C <sub>IN</sub>                        | Maximum Input Capacitance                      | —        | 10                  | 10    | 10     | pF   |

|                 |                                                                                                                                                                                                               |                                       |  |  |    |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|--|--|----|
| C <sub>PD</sub> | Power Dissipation Capacitance (Per Inverter)<br>Used to determine the no-load dynamic power<br>consumption, P <sub>D</sub> = C <sub>PD</sub> V <sub>CC</sub> <sup>2</sup> f + I <sub>CC</sub> V <sub>CC</sub> | Typical @ 25°C, V <sub>CC</sub> = 5 V |  |  | pF |
|                 |                                                                                                                                                                                                               | 20                                    |  |  |    |

## HCT-04A

### DC ELECTRICAL CHARACTERISTICS

| Symbol          | Parameter                                       | Conditions                                                                | V <sub>CC</sub><br>V | Guaranteed Limits   |            |            | Unit |
|-----------------|-------------------------------------------------|---------------------------------------------------------------------------|----------------------|---------------------|------------|------------|------|
|                 |                                                 |                                                                           |                      | 25°C<br>to<br>-55°C | ≤85°C      | ≤125°C     |      |
| V <sub>IH</sub> | High Level Input Voltage<br>(Referenced to GND) | V <sub>OUT</sub> = 0.1 V<br> I <sub>OUT</sub>   ≤ 20 μA                   | 4.5<br>5.5           | 2<br>2              | 2<br>2     | 2<br>2     | V    |
| V <sub>IL</sub> | Low Level Input Voltage                         | V <sub>OUT</sub> = V <sub>CC</sub> - 0.1 V<br> I <sub>OUT</sub>   ≤ 20 μA | 4.5<br>5.5           | 0.8<br>0.8          | 0.8<br>0.8 | 0.8<br>0.8 | V    |

| Symbol          | Parameter                         | Conditions                                                             | V <sub>CC</sub><br>V | Guaranteed Limits |            |            | Unit |
|-----------------|-----------------------------------|------------------------------------------------------------------------|----------------------|-------------------|------------|------------|------|
|                 |                                   |                                                                        |                      | 25°C to -55°C     | ≤85°C      | ≤125°C     |      |
| V <sub>OH</sub> | Minimum High Level Output Voltage | V <sub>IN</sub> = V <sub>IL</sub><br> I <sub>OUT</sub>   ≤ 20 μA       | 4.5<br>5.5           | 4.4<br>5.4        | 4.4<br>5.4 | 4.4<br>5.4 | V    |
|                 |                                   | V <sub>IN</sub> = V <sub>IL</sub>  I <sub>OUT</sub>   ≤ 4.0 mA         | 4.5                  | 3.98              | 3.84       | 3.70       | V    |
| V <sub>OL</sub> | Maximum Low Level Output Voltage  | V <sub>IN</sub> = V <sub>IH</sub><br> I <sub>OUT</sub>   ≤ 20 μA       | 4.5<br>5.5           | 0.1<br>0.1        | 0.1<br>0.1 | 0.1<br>0.1 | V    |
|                 |                                   | V <sub>IN</sub> = V <sub>IH</sub>  I <sub>OUT</sub>   ≤ 4.0 mA         | 4.5                  | 0.26              | 0.33       | 0.40       | V    |
| I <sub>IN</sub> | Maximum Input Leakage Current     | V <sub>IN</sub> = V <sub>CC</sub> or GND                               | 5.5                  | ± 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 | 5.5                  | 1                 | 10         | 40         | μA   |

| Δ I <sub>CC</sub> | Additional Quiescent Supply Current | V <sub>IN</sub> =2.4 V, Any One Input<br>V <sub>IN</sub> =V <sub>CC</sub> or GND, Other Inputs<br>I <sub>OUT</sub> =0μA | 5.5 | ≥-55°C | 25°C to 125°C | mA |
|-------------------|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------|-----|--------|---------------|----|
|                   |                                     |                                                                                                                         |     | 2.9    | 2.4           |    |

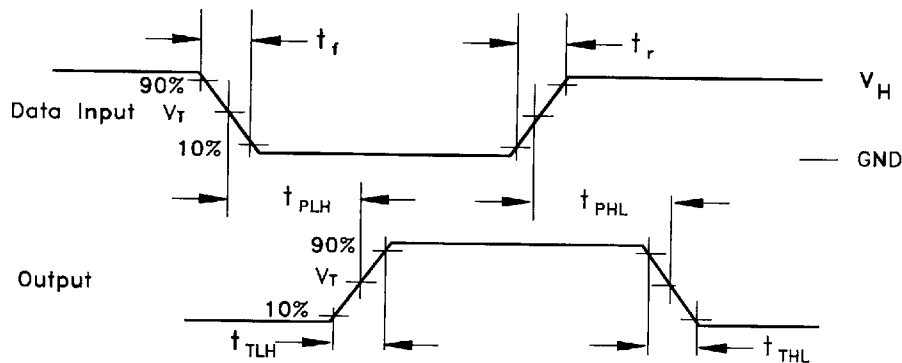
Total Supply Current = I<sub>CC</sub>+ΣΔI<sub>CC</sub>

**SWITCHING CHARACTERISTICS** over full operating conditions (C<sub>L</sub>=50 pF, Input t<sub>r</sub>=t<sub>f</sub>=6ns)

| Symbol                                 | Parameter                                      | Guaranteed Limit |       |        | Unit |
|----------------------------------------|------------------------------------------------|------------------|-------|--------|------|
|                                        |                                                | 25°C to -55°C    | ≤85°C | ≤125°C |      |
| t <sub>PLH</sub>                       | Propagation Delay Time,<br>Input A To Output Y | 15               | 19    | 22     | ns   |
| t <sub>PHL</sub>                       |                                                | 17               | 21    | 26     |      |
| t <sub>TLH</sub> ,<br>t <sub>THL</sub> | Output Transition Time<br>Any Output           | 15               | 19    | 22     | ns   |
| C <sub>IN</sub>                        | Maximum Input Capacitance                      | 10               | 10    | 10     | pF   |

|     |                                                                                                                                                                                                   |                                       |    |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|----|
| CPD | Power Dissipation Capacitance (Per Inverter)<br>Used to determine the no-load dynamic power consumption,<br>P <sub>D</sub> = CPD V <sub>CC</sub> <sup>2</sup> f + I <sub>CC</sub> V <sub>CC</sub> | Typical @ 25°C, V <sub>CC</sub> = 5 V | pF |
|     |                                                                                                                                                                                                   | 22                                    |    |

## SWITCHING WAVEFORMS



Input and Output threshold voltage,  $V_T=50\% V_{CC}$  for HC; 1.3V for HCT  
 $V_H=V_{CC}$  for HC, 3V for HCT

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