DM5406/DM7406 Hex Inverting Buffers with High Voltage Open-Collector Outputs

# DM5406/DM7406 Hex Inverting Buffers with High Voltage Open-Collector Outputs

## **General Description**

This device contains six independent buffers each of which performs the logic INVERT function. The open-collector outputs require external pull-up resistors for proper logical operation.

# **Pull-Up Resistor Equations**

$$R_{MAX} = \frac{V_{O} \text{ (Min)} - V_{OH}}{N_{1} (I_{OH}) + N_{2} (I_{IH})}$$

$$R_{MIN} = \frac{V_{O} (Max) - V_{OL}}{I_{OL} - N_{3} (I_{IL})}$$

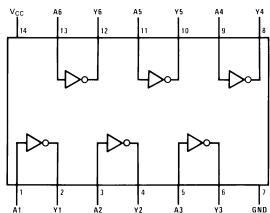
Where:  $N_1$  ( $I_{OH}$ ) = total maximum output high current for all outputs tied to pull-up resistor

 $N_2 \; (I_{IH}) = total \; maximum \; input high current for all inputs tied to pull-up resistor$ 

 $N_3 \ (I_{IL}) = total \ maximum \ input low current for all inputs tied to pull-up resistor$ 

### **Connection Diagram**

#### **Dual-In-Line Package**



TL/F/6496-1

Order Number DM5406J, DM5406W, DM7406M or DM7406N See NS Package Number J14A, M14A, N14A or W14B

#### **Function Table**

$$\begin{array}{c|c} \mathbf{Y} = \overline{\mathbf{A}} \\ \hline \mathbf{Input} & \mathbf{Output} \\ \mathbf{A} & \mathbf{Y} \\ \mathbf{L} & \mathbf{H} \\ \end{array}$$

H = High Logic Level
L = Low Logic Level

#### **Absolute Maximum Ratings (Note)**

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

Supply Voltage 7V
Input Voltage 5.5V
Output Voltage 30V

Operating Free Air Temperature Range

 DM54
 -55°C to +125°C

 DM74
 0°C to +70°C

 Storage Temperature Range
 -65°C to +150°C

Note: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the "Electrical Characteristics" table are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

## **Recommended Operating Conditions**

| Symbol          | Parameter                      | DM5406 |     | DM7406 |      |     | Units |     |
|-----------------|--------------------------------|--------|-----|--------|------|-----|-------|-----|
|                 |                                | Min    | Nom | Max    | Min  | Nom | Max   | 013 |
| V <sub>CC</sub> | Supply Voltage                 | 4.5    | 5   | 5.5    | 4.75 | 5   | 5.25  | V   |
| V <sub>IH</sub> | High Level Input Voltage       | 2      |     |        | 2    |     |       | V   |
| $V_{IL}$        | Low Level Input Voltage        |        |     | 0.8    |      |     | 0.8   | V   |
| V <sub>OH</sub> | High Level Output Voltage      |        |     | 30     |      |     | 30    | V   |
| l <sub>OL</sub> | Low Level Output Current       |        |     | 30     |      |     | 40    | mA  |
| T <sub>A</sub>  | Free Air Operating Temperature | -55    |     | 125    | 0    |     | 70    | °C  |

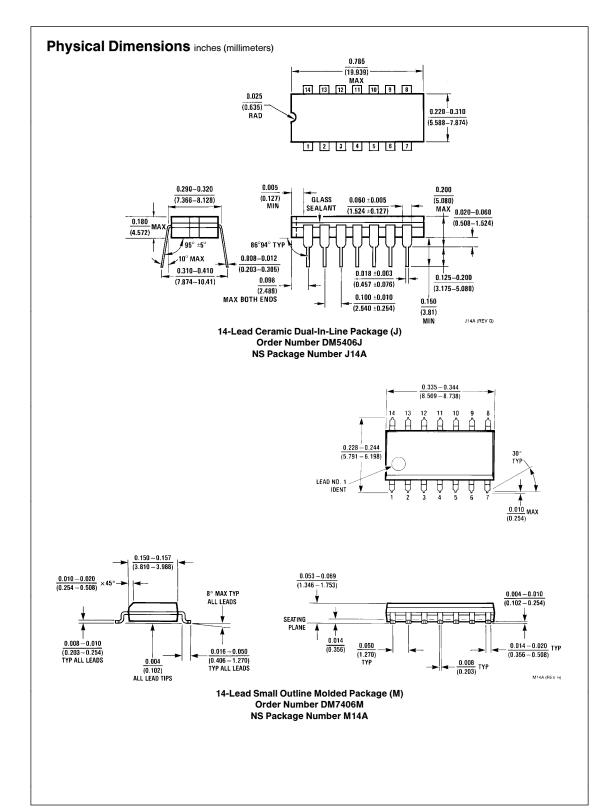
# Electrical Characteristics over recommended operating free air temperature range (unless otherwise noted)

| Symbol           | Parameter                            | Conditions                                     | Min | Typ<br>(Note 1) | Max  | Units |
|------------------|--------------------------------------|--|-----|-----------------|------|-------|
| VI               | Input Clamp Voltage                  | $V_{CC} = Min, I_I = -12 \text{ mA}$           |     |                 | -1.5 | V     |
| I <sub>CEX</sub> | High Level Output<br>Current         | $V_{CC} = Min, V_O = 30V$<br>$V_{IL} = Max$    |     |                 | 250  | μΑ    |
| V <sub>OL</sub>  | Low Level Output<br>Voltage          | $V_{CC} = Min, I_{OL} = Max$ $V_{IH} = Min$    |     |                 | 0.7  | V     |
|                  |                                      | I <sub>OL</sub> = 16 mA, V <sub>CC</sub> = Min |     |                 | 0.4  |       |
| I <sub>I</sub>   | Input Current @ Max<br>Input Voltage | $V_{CC} = Max, V_I = 5.5V$                     |     |                 | 1    | mA    |
| I <sub>IH</sub>  | High Level Input Current             | $V_{CC} = Max, V_I = 2.4V$                     |     |                 | 40   | μΑ    |
| I <sub>IL</sub>  | Low Level Input Current              | $V_{CC} = Max, V_I = 0.4V$                     |     |                 | -1.6 | mA    |
| I <sub>CCH</sub> | Supply Current with<br>Outputs High  | V <sub>CC</sub> = Max                          |     | 30              | 48   | mA    |
| I <sub>CCL</sub> | Supply Current with<br>Outputs Low   | V <sub>CC</sub> = Max                          |     | 27              | 51   | mA    |

# $\textbf{Switching Characteristics} \text{ at V}_{CC} = 5 \text{V and T}_{A} = 25 ^{\circ}\text{C (See Section 1 for Test Waveforms and Output Load)}$

| Symbol           | Parameter  | Conditions                      | Min | Max | Units |
|------------------|--|---------------------------------|-----|-----|-------|
| t <sub>PLH</sub> | Propagation Delay Time<br>Low to High Level Output | $C_L = 15 pF$ $R_L = 110\Omega$ |     | 15  | ns    |
| t <sub>PHL</sub> | Propagation Delay Time<br>High to Low Level Output |                                 |     | 23  | ns    |

Note 1: All typicals are at  $V_{CC}=5V$ ,  $T_A=25^{\circ}C$ .



# Physical Dimensions inches (millimeters) (Continued) 14 13 12 11 10 9 8 14 13 12 INDEX AREA 0.250±0.010 (6.350±0.254) 1 2 3 4 5 6 7 0.092 (2.337) DIA 0.030 MAX (0.762) DEPTH OPTION 02 $\frac{0.135 \pm 0.005}{(3.429 \pm 0.127)}$ 0.300 - 0.320 (7.620 - 8.128 0.060 (1.524) TYP

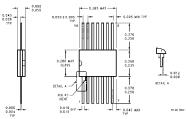
0.050 ± 0.010 (1.270 - 0.254) TYP

14-Lead Molded Dual-In-Line Package (N) Order Number DM7406N NS Package Number N14A

0.075 ±0.015 (1.905 ±0.381)

0.325 + 0.040 - 0.015 (8.255 + 1.016) - 0.381)

0.100 ± 0.010 (2.540 ± 0.254)



14-Lead Ceramic Flat Package (W) Order Number DM5406W NS Package Number W14B

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 $\frac{0.125 - 0.150}{(3.175 - 3.810)}$ 

 $\frac{0.014 - 0.023}{(0.356 - 0.584)}$  TYP

2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.



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