• Dependable Texas Instruments Quality and Reliability

**description/ordering information**

These devices contain six independent inverters.

---

**Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.**
### ORDERING INFORMATION

<table>
<thead>
<tr>
<th>$T_A$</th>
<th>PACKAGE†</th>
<th>ORDERABLE PART NUMBER</th>
<th>TOP-SIDE MARKING</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDIP − N</td>
<td>Tube</td>
<td>SN7404N</td>
<td>SN7404N</td>
</tr>
<tr>
<td></td>
<td>Tube</td>
<td>SN74LS04N</td>
<td>SN74LS04N</td>
</tr>
<tr>
<td></td>
<td>Tube</td>
<td>SN74S04N</td>
<td>SN74S04N</td>
</tr>
<tr>
<td>SOIC − D</td>
<td>Tube</td>
<td>SN7404D</td>
<td>7404</td>
</tr>
<tr>
<td></td>
<td>Tape and reel</td>
<td>SN7404DR</td>
<td>LS04</td>
</tr>
<tr>
<td></td>
<td>Tube</td>
<td>SN74LS04D</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tape and reel</td>
<td>SN74LS04DR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tube</td>
<td>SN74S04D</td>
<td>S04</td>
</tr>
<tr>
<td></td>
<td>Tape and reel</td>
<td>SN74S04DR</td>
<td></td>
</tr>
<tr>
<td>SOP − NS</td>
<td>Tape and reel</td>
<td>SN7404NSR</td>
<td>SN7404</td>
</tr>
<tr>
<td></td>
<td>Tape and reel</td>
<td>SN74LS04NSR</td>
<td>74LS04</td>
</tr>
<tr>
<td></td>
<td>Tape and reel</td>
<td>SN74S04NSR</td>
<td>74S04</td>
</tr>
<tr>
<td>SSOP − DB</td>
<td>Tape and reel</td>
<td>SN74LS04DBR</td>
<td>LS04</td>
</tr>
</tbody>
</table>

| CDIP − J    | Tube      | SN5404J               | SN5404J          |
|             | Tube      | SNJ5404J              | SNJ5404J         |
|             | Tube      | SN54LS04J             | SN54LS04J        |
|             | Tube      | SN54S04J              | SN54S04J         |
|             | Tube      | SNJ54LS04J            | SNJ54S04J        |
|             | Tube      | SNJ54S04J             | SNJ54S04J        |
| CFP − W     | Tube      | SNJ5404W              | SNJ5404W         |
|             | Tube      | SNJ54LS04W            | SNJ54LS04W       |
|             | Tube      | SNJ54S04W             | SNJ54S04W        |
| LCCC − FK   | Tube      | SNJ54LS04FK           | SNJ54LS04FK      |
|             | Tube      | SNJ54S04FK            | SNJ54S04FK       |

†Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

### FUNCTION TABLE

(Each inverter)

<table>
<thead>
<tr>
<th>INPUT A</th>
<th>OUTPUT Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>L</td>
</tr>
<tr>
<td>L</td>
<td>H</td>
</tr>
</tbody>
</table>
logic diagram (positive logic)

Y = \overline{A}
schematics (each gate)

Resistor values shown are nominal.
absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage, \( V_{CC} \) (see Note 1) ................................................................. 7 V
Input voltage, \( V_I \): '04, 'S04 ................................................................. 5.5 V
'LS04 ................................................................. 7 V
Package thermal impedance, \( \theta_{JA} \) (see Note 2): D package .................. 86°C/W
DB package ......................................................... 96°C/W
N package ......................................................... 80°C/W
NS package ......................................................... 76°C/W
Storage temperature range, \( T_{stg} \) ......................................................... −65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. This is stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES:
1. Voltage values are with respect to network ground terminal.
2. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions (see Note 3)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITIONS‡</th>
<th>SN5404</th>
<th></th>
<th>SN7404</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>MIN</td>
<td>NOM</td>
<td>MAX</td>
<td></td>
</tr>
<tr>
<td>( V_{CC} )</td>
<td>Supply voltage</td>
<td>4.5</td>
<td>5</td>
<td>5.5</td>
<td>V</td>
</tr>
<tr>
<td>( V_{IH} )</td>
<td>High-level input voltage</td>
<td>2</td>
<td>2</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>( V_{IL} )</td>
<td>Low-level input voltage</td>
<td>0.8</td>
<td>0.8</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>( I_{OH} )</td>
<td>High-level output current</td>
<td>−0.4</td>
<td>−0.4</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>( I_{OL} )</td>
<td>Low-level output current</td>
<td>16</td>
<td>16</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>( T_A )</td>
<td>Operating free-air temperature</td>
<td>−55</td>
<td>125</td>
<td>0</td>
<td>70 °C</td>
</tr>
</tbody>
</table>

NOTE 3: All unused inputs of the device must be held at \( V_{CC} \) or GND to ensure proper device operation. Refer to the TI application report, Implications of Slow or Floating CMOS Inputs, literature number SCBA004.

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITIONS§</th>
<th>SN5404</th>
<th></th>
<th>SN7404</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>MIN</td>
<td>TYP§</td>
<td>MAX</td>
<td></td>
</tr>
<tr>
<td>( V_{IK} )</td>
<td>( V_{CC} = \text{MIN}, V_I = -12 \text{ mA} )</td>
<td>-1.5</td>
<td>-1.5</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>( V_{OH} )</td>
<td>( V_{CC} = \text{MIN}, V_{IL} = 0.8 \text{ V}, I_{OH} = -0.4 \text{ mA} )</td>
<td>2.4</td>
<td>3.4</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>( V_{OL} )</td>
<td>( V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, I_{OL} = 16 \text{ mA} )</td>
<td>0.2</td>
<td>0.4</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>( I_{I} )</td>
<td>( V_{CC} = \text{MAX}, V_I = 5.5 \text{ V} )</td>
<td>1</td>
<td>1</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>( I_{IH} )</td>
<td>( V_{CC} = \text{MAX}, V_I = 2.4 \text{ V} )</td>
<td>40</td>
<td>40</td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td>( I_{IL} )</td>
<td>( V_{CC} = \text{MAX}, V_I = 0.4 \text{ V} )</td>
<td>-1.6</td>
<td>-1.6</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>( I_{OS} )</td>
<td>( V_{CC} = \text{MAX} )</td>
<td>-20</td>
<td>-55</td>
<td>-18</td>
<td>-55</td>
</tr>
<tr>
<td>( I_{CCH} )</td>
<td>( V_{CC} = \text{MAX}, V_I = 0 \text{ V} )</td>
<td>6</td>
<td>12</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>( I_{CCL} )</td>
<td>( V_{CC} = \text{MAX}, V_I = 4.5 \text{ V} )</td>
<td>18</td>
<td>33</td>
<td>18</td>
<td>33</td>
</tr>
</tbody>
</table>

‡ For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
§ All typical values are at \( V_{CC} = 5 \text{ V}, T_A = 25°C \).
¶ Not more than one output should be shorted at a time.
switching characteristics, \( V_{CC} = 5 \, V, \, T_A = 25\, ^\circ C \) (see Figure 1)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>FROM (INPUT)</th>
<th>TO (OUTPUT)</th>
<th>TEST CONDITIONS</th>
<th>SN5404</th>
<th>SN7404</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>( t_{PLH} )</td>
<td>A</td>
<td>Y</td>
<td>( R_L = 400 , \Omega, , C_L = 15 , pF )</td>
<td>12</td>
<td>22</td>
<td>ns</td>
</tr>
<tr>
<td>( t_{PHL} )</td>
<td>A</td>
<td>Y</td>
<td>( R_L = 400 , \Omega, , C_L = 15 , pF )</td>
<td>8</td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

recommended operating conditions (see Note 3)

<table>
<thead>
<tr>
<th>( V_{CC} ) Supply voltage</th>
<th>SN54LS04</th>
<th>SN74LS04</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min</td>
<td>4.5</td>
<td>4.75</td>
</tr>
<tr>
<td>Nom</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Max</td>
<td>5.5</td>
<td>5.25</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>( V_{IH} ) High-level input voltage</th>
<th>SN54LS04</th>
<th>SN74LS04</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Nom</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>( V_{IL} ) Low-level input voltage</th>
<th>SN54LS04</th>
<th>SN74LS04</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min</td>
<td>0.7</td>
<td>0.8</td>
</tr>
<tr>
<td>Nom</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>( IOH ) High-level output current</th>
<th>SN54LS04</th>
<th>SN74LS04</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min</td>
<td>-0.4</td>
<td>-0.4</td>
</tr>
<tr>
<td>Nom</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>( IOL ) Low-level output current</th>
<th>SN54LS04</th>
<th>SN74LS04</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Nom</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>( T_A ) Operating free-air temperature</th>
<th>SN54LS04</th>
<th>SN74LS04</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min</td>
<td>-55</td>
<td>0</td>
</tr>
<tr>
<td>Nom</td>
<td></td>
<td>70</td>
</tr>
<tr>
<td>Max</td>
<td>125</td>
<td></td>
</tr>
</tbody>
</table>

NOTE 3: All unused inputs of the device must be held at \( V_{CC} \) or GND to ensure proper device operation. Refer to the TI application report, "Implications of Slow or Floating CMOS Inputs," literature number SCBA004.

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITIONS†</th>
<th>SN54LS04</th>
<th>SN74LS04</th>
<th>UNI T</th>
</tr>
</thead>
<tbody>
<tr>
<td>( V_{IK} ) ( V_{CC} = \text{MIN} ), ( I_I = -18 , mA )</td>
<td>Min</td>
<td>2.5</td>
<td>4.75</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>TYP†</td>
<td>3.4</td>
<td>4.75</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>MAX</td>
<td>4.4</td>
<td>5.25</td>
<td>V</td>
</tr>
<tr>
<td>( V_{OH} ) ( V_{CC} = \text{MIN} ), ( V_{IL} = \text{MAX} ), ( I_{OH} = -0.4 , mA )</td>
<td>Min</td>
<td>0.25</td>
<td>0.25</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>TYP†</td>
<td>0.4</td>
<td>0.4</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>MAX</td>
<td>0.4</td>
<td>0.4</td>
<td>V</td>
</tr>
<tr>
<td>( V_{OL} ) ( V_{CC} = \text{MIN} ), ( V_{IH} = 2 , V ), ( I_{OL} = 4 , mA )</td>
<td>Min</td>
<td>0.01</td>
<td>0.01</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td>TYP†</td>
<td>0.1</td>
<td>0.1</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td>MAX</td>
<td>0.1</td>
<td>0.1</td>
<td>mA</td>
</tr>
<tr>
<td>( I_I ) ( V_{CC} = \text{MAX} ), ( V_{I} = 7 , V )</td>
<td>Min</td>
<td>0.20</td>
<td>0.20</td>
<td>( \mu )A</td>
</tr>
<tr>
<td></td>
<td>TYP†</td>
<td>0.4</td>
<td>0.4</td>
<td>( \mu )A</td>
</tr>
<tr>
<td></td>
<td>MAX</td>
<td>0.4</td>
<td>0.4</td>
<td>( \mu )A</td>
</tr>
<tr>
<td>( I_{IH} ) ( V_{CC} = \text{MAX} ), ( V_{I} = 2.7 , V )</td>
<td>Min</td>
<td>-0.4</td>
<td>-0.4</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td>TYP†</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td>MAX</td>
<td>-0.4</td>
<td>-0.4</td>
<td>mA</td>
</tr>
<tr>
<td>( I_{OL} ) ( V_{CC} = \text{MAX} ), ( V_{I} = 0 , V )</td>
<td>Min</td>
<td>1.2</td>
<td>1.2</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td>TYP†</td>
<td>2.4</td>
<td>2.4</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td>MAX</td>
<td>3.6</td>
<td>3.6</td>
<td>mA</td>
</tr>
<tr>
<td>( I_{OS} ) ( V_{CC} = \text{MAX} )</td>
<td>Min</td>
<td>-20</td>
<td>-20</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td>TYP†</td>
<td>-100</td>
<td>-100</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td>MAX</td>
<td>-20</td>
<td>-100</td>
<td>mA</td>
</tr>
<tr>
<td>( I_{CCH} ) ( V_{CC} = \text{MAX} ), ( V_{I} = 0 , V )</td>
<td>Min</td>
<td>2.4</td>
<td>2.4</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td>TYP†</td>
<td>1.2</td>
<td>1.2</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td>MAX</td>
<td>3.6</td>
<td>3.6</td>
<td>mA</td>
</tr>
<tr>
<td>( I_{CCL} ) ( V_{CC} = \text{MAX} ), ( V_{I} = 4.5 , V )</td>
<td>Min</td>
<td>9</td>
<td>9</td>
<td>nS</td>
</tr>
<tr>
<td></td>
<td>TYP†</td>
<td>15</td>
<td>15</td>
<td>nS</td>
</tr>
<tr>
<td></td>
<td>MAX</td>
<td>15</td>
<td>15</td>
<td>nS</td>
</tr>
</tbody>
</table>

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡ All typical values are at \( V_{CC} = 5 \, V, \, T_A = 25\, ^\circ C \).
§ Not more than one output should be shorted at a time, and the duration of the short-circuit should not exceed one second.

switching characteristics, \( V_{CC} = 5 \, V, \, T_A = 25\, ^\circ C \) (see Figure 2)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>FROM (INPUT)</th>
<th>TO (OUTPUT)</th>
<th>TEST CONDITIONS</th>
<th>SN54LS04</th>
<th>SN74LS04</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>( t_{PLH} )</td>
<td>A</td>
<td>Y</td>
<td>( R_L = 2 , k\Omega, , C_L = 15 , pF )</td>
<td>9</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>( t_{PHL} )</td>
<td>A</td>
<td>Y</td>
<td>( R_L = 2 , k\Omega, , C_L = 15 , pF )</td>
<td>10</td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>
### recommended operating conditions (see Note 3)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SN54S04</th>
<th>SN74S04</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCC</td>
<td>MIN</td>
<td>NOM</td>
<td>MAX</td>
</tr>
<tr>
<td></td>
<td>4.5</td>
<td>5</td>
<td>5.5</td>
</tr>
<tr>
<td>VIH</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>VIL</td>
<td></td>
<td>0.8</td>
<td></td>
</tr>
<tr>
<td>IOH</td>
<td></td>
<td>8-1</td>
<td></td>
</tr>
<tr>
<td>IOL</td>
<td></td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>TA</td>
<td></td>
<td>-55</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE 3:** All unused inputs of the device must be held at VCC or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

### electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITIONS†</th>
<th>SN54S04</th>
<th>SN74S04</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MIN</td>
<td>NOM</td>
<td>MAX</td>
<td>MIN</td>
</tr>
<tr>
<td>VIH</td>
<td>VCC = MIN,</td>
<td>-1.2</td>
<td>-1.2</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>II = -18 mA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VOH</td>
<td>VCC = MIN,</td>
<td>2.5</td>
<td>3.4</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>VIL = 0.8 V,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IOH = -1 mA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VOL</td>
<td>VCC = MIN,</td>
<td>0.5</td>
<td>0.5</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>VIH = 2 V,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IOL = 20 mA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IL</td>
<td>VCC = MAX,</td>
<td>1</td>
<td>1</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td>VI = 5.5 V</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IIL</td>
<td>VCC = MAX,</td>
<td>50</td>
<td>50</td>
<td>µA</td>
</tr>
<tr>
<td></td>
<td>VI = 0.5 V</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>IOS§</td>
<td>VCC = MAX</td>
<td>-40</td>
<td>-100</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td>VI = 0 V</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICCH</td>
<td>VCC = MAX,</td>
<td>15</td>
<td>24</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td>VI = 0 V</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICCL</td>
<td>VCC = MAX,</td>
<td>15</td>
<td>24</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td>VI = 4.5 V</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡ All typical values are at VCC = 5 V, TA = 25°C.
§ Not more than one output should be shorted at a time, and the duration of the short-circuit should not exceed one second.

### switching characteristics, VCC = 5 V, TA = 25°C (see Figure 1)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>FROM (INPUT)</th>
<th>TO (OUTPUT)</th>
<th>TEST CONDITIONS</th>
<th>SN54S04</th>
<th>SN74S04</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>tPLH</td>
<td>A</td>
<td>Y</td>
<td>RL = 280 Ω, CL = 15 pF</td>
<td>3</td>
<td>4.5</td>
<td>ns</td>
</tr>
<tr>
<td>tPLH</td>
<td>A</td>
<td>Y</td>
<td>RL = 280 Ω, CL = 50 pF</td>
<td>4.5</td>
<td>5</td>
<td>ns</td>
</tr>
</tbody>
</table>

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265
PARAMETER MEASUREMENT INFORMATION
SERIES 54/74 AND 54S/74S DEVICES

LOAD CIRCUIT
FOR 2-STATE TOTEM-POLE OUTPUTS

LOAD CIRCUIT
FOR OPEN-Collector OUTPUTS

LOAD CIRCUIT
FOR 3-STATE OUTPUTS

VOLTAGE WAVEFORMS
PULSE DURATIONS

VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES

VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES

VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES, 3-STATE OUTPUTS

NOTES:
A. $C_L$ includes probe and jig capacitance.
B. All diodes are 1N3064 or equivalent.
C. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control.
   Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
D. S1 and S2 are closed for $t_{PLH}$, $t_{PHL}$, $t_{PHZ}$, and $t_{PLZ}$; S1 is open and S2 is closed for $t_{PZH}$; S1 is closed and S2 is open for $t_{PZL}$.
E. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1 \text{ MHz}$, $Z_O \approx 50 \Omega$; $t_r$ and $t_f \leq 7 \text{ ns}$ for Series 54/74 devices and $t_r$ and $t_f \leq 2.5 \text{ ns}$ for Series 54S/74S devices.
F. The outputs are measured one at a time, with one input transition per measurement.

Figure 1. Load Circuits and Voltage Waveforms
PARAMETER MEASUREMENT INFORMATION
SERIES 54LS/74LS DEVICES

LOAD CIRCUIT
FOR 2-STATE TOTEM-POLE OUTPUTS

LOAD CIRCUIT
FOR OPEN-COLLECTOR OUTPUTS

LOAD CIRCUIT
FOR 3-STATE OUTPUTS

VOLTAGE WAVEFORMS
PULSE DURATIONS

VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES

VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES, 3-STATE OUTPUTS

NOTES:
A. $C_L$ includes probe and jig capacitance.
B. All diodes are 1N3064 or equivalent.
C. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control.
Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
D. S1 and S2 are closed for $t_{PLH}$, $t_{PZH}$, $t_{PZL}$; S1 is open and S2 is closed for $t_{PHZ}$; S1 is closed and S2 is open for $t_{PZL}$.
E. Phase relationships between inputs and outputs have been chosen arbitrarily for these examples.
F. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1 \text{ MHz}$, $Z_O = 50 \Omega$, $t_f \leq 1.5 \text{ ns}$, $\tau_f \leq 2.6 \text{ ns}$.
G. The outputs are measured one at a time, with one input transition per measurement.

Figure 2. Load Circuits and Voltage Waveforms
CERAMIC DUAL IN-LINE PACKAGE

NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package is hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.
NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only.
E. Falls within MIL STD 1835 GDFP1-F14 and JEDEC MO-092AB
**FK (S-CQCC-N**)**

**LEADLESS CERAMIC CHIP CARRIER**

28 TERMINAL SHOWN

---

#### MECHANICAL DATA

**NO. OF TERMINALS**

<table>
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<th>TERMINALS</th>
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</thead>
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<td>MIN</td>
</tr>
<tr>
<td>20</td>
<td>0.342 (8.69)</td>
</tr>
<tr>
<td>28</td>
<td>0.442 (11.23)</td>
</tr>
<tr>
<td>44</td>
<td>0.640 (16.26)</td>
</tr>
<tr>
<td>52</td>
<td>0.739 (18.78)</td>
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<tr>
<td>68</td>
<td>0.938 (23.83)</td>
</tr>
<tr>
<td>84</td>
<td>1.141 (28.99)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIN</td>
</tr>
<tr>
<td>0.307 (7.80)</td>
</tr>
<tr>
<td>0.406 (10.31)</td>
</tr>
<tr>
<td>0.495 (12.58)</td>
</tr>
<tr>
<td>0.850 (21.6)</td>
</tr>
<tr>
<td>1.047 (26.6)</td>
</tr>
</tbody>
</table>

#### NOTES:

A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. The terminals are gold plated.
E. Falls within JEDEC MS-004
N (R-PDIP-T**)  
PLASTIC DUAL-IN-LINE PACKAGE  

16 PINS SHOWN

<table>
<thead>
<tr>
<th>PINS **</th>
<th>14</th>
<th>16</th>
<th>18</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIM A MAX</td>
<td>0.775 (19.69)</td>
<td>0.775 (19.69)</td>
<td>0.920 (23.37)</td>
<td>1.060 (26.92)</td>
</tr>
<tr>
<td>DIM A MIN</td>
<td>0.745 (18.92)</td>
<td>0.745 (18.92)</td>
<td>0.850 (21.59)</td>
<td>0.940 (23.88)</td>
</tr>
</tbody>
</table>

MS-100 VARIATION  
AA  
BB  
AC  
AD

NOTES:  
A. All linear dimensions are in inches (millimeters).  
B. This drawing is subject to change without notice.  
C. Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).  
D. The 20 pin end lead shoulder width is a vendor option, either half or full width.
D (R-PDSO-G**)  
PLASTIC SMALL-OUTLINE PACKAGE  
8 PINS SHOWN

Notes:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0.006 (0.15).
D. Falls within JEDEC MS-012
# MECHANICAL DATA

**PLASTIC SMALL-OUTLINE PACKAGE**

14-PINS SHOWN

<table>
<thead>
<tr>
<th>DIM</th>
<th>14</th>
<th>16</th>
<th>20</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>A MAX</td>
<td>10.50</td>
<td>10.50</td>
<td>12.90</td>
<td>15.30</td>
</tr>
<tr>
<td>A MIN</td>
<td>9.90</td>
<td>9.90</td>
<td>12.30</td>
<td>14.70</td>
</tr>
</tbody>
</table>

**NOTES:**

A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0.15.
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<td>Automotive</td>
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<td>Broadband</td>
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<td>Interface</td>
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