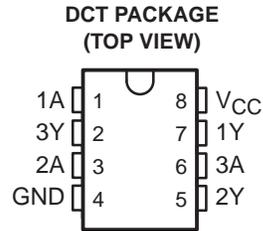


- **EPIC™ (Enhanced-Performance Implanted CMOS) Process**
- **Operating Range 2-V to 5.5-V  $V_{CC}$**
- **Packaged in Plastic Small-Outline Transistor Package**



## description

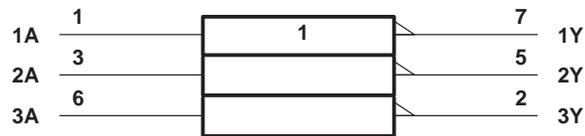
The SN74AHC2G04 contains three independent inverter gates. The device performs the Boolean function  $Y = \bar{A}$ .

The SN74AHC2G04 is characterized for operation from  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .

**FUNCTION TABLE  
(each inverter)**

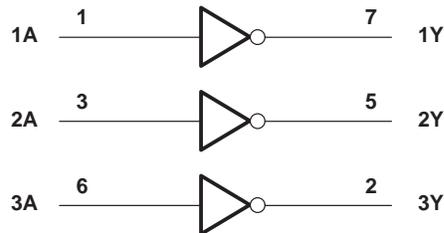
| INPUT<br>A | OUTPUT<br>Y |
|------------|-------------|
| H          | L           |
| L          | H           |

## logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

## logic diagram (positive logic)



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**TEXAS  
INSTRUMENTS**

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# SN74AHC2G04 TRIPLE INVERTER

SCLS433A – SEPTEMBER 1999 – REVISED NOVEMBER 1999

## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

|  |                            |
|--|----------------------------|
| Supply voltage range, $V_{CC}$                                 | -0.5 V to 7 V              |
| Input voltage range, $V_I$ (see Note 1)                        | -0.5 V to 7 V              |
| Output voltage range, $V_O$ (see Note 1)                       | -0.5 V to $V_{CC} + 0.5$ V |
| Input clamp current, $I_{IK}$ ( $V_I < 0$ )                    | -20 mA                     |
| Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{CC}$ ) | ±20 mA                     |
| Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ )     | ±25 mA                     |
| Continuous current through $V_{CC}$ or GND                     | ±50 mA                     |
| Package thermal impedance, $\theta_{JA}$ (see Note 2)          | 296°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. These are 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. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.  
2. The package thermal impedance is calculated in accordance with JESD 51.

## recommended operating conditions

|                     |                                    | MIN                      | MAX      | UNIT |
|---------------------|------------------------------------|--------------------------|----------|------|
| $V_{CC}$            | Supply voltage                     | 2                        | 5.5      | V    |
| $V_{IH}$            | High-level input voltage           | $V_{CC} = 2$ V           | 1.5      | V    |
|                     |                                    | $V_{CC} = 3$ V           | 2.1      |      |
|                     |                                    | $V_{CC} = 5.5$ V         | 3.85     |      |
| $V_{IL}$            | Low-level input voltage            | $V_{CC} = 2$ V           | 0.5      | V    |
|                     |                                    | $V_{CC} = 3$ V           | 0.9      |      |
|                     |                                    | $V_{CC} = 5.5$ V         | 1.65     |      |
| $V_I$               | Input voltage                      | 0                        | 5.5      | V    |
| $V_O$               | Output voltage                     | 0                        | $V_{CC}$ | V    |
| $I_{OH}$            | High-level output current          | $V_{CC} = 2$ V           | -50      | μA   |
|                     |                                    | $V_{CC} = 3.3$ V ± 0.3 V | -4       | mA   |
|                     |                                    | $V_{CC} = 5$ V ± 0.5 V   | -8       |      |
| $I_{OL}$            | Low-level output current           | $V_{CC} = 2$ V           | 50       | μA   |
|                     |                                    | $V_{CC} = 3.3$ V ± 0.3 V | 4        | mA   |
|                     |                                    | $V_{CC} = 5$ V ± 0.5 V   | 8        |      |
| $\Delta t/\Delta v$ | Input transition rise or fall rate | $V_{CC} = 3.3$ V ± 0.3 V | 100      | ns/V |
|                     |                                    | $V_{CC} = 5$ V ± 0.5 V   | 20       |      |
| $T_A$               | Operating free-air temperature     | -40                      | 85       | °C   |

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

| PARAMETER       | TEST CONDITIONS   | V <sub>CC</sub> | T <sub>A</sub> = 25°C |     |      | MIN  | MAX | UNIT |
|-----------------|---|-----------------|-----------------------|-----|------|------|-----|------|
|                 |   |                 | MIN                   | TYP | MAX  |      |     |      |
| V <sub>OH</sub> | I <sub>OH</sub> = -50 μA                                    | 2 V             | 1.9                   | 2   |      | 1.9  | V   |      |
|                 |   | 3 V             | 2.9                   | 3   |      | 2.9  |     |      |
|                 |   | 4.5 V           | 4.4                   | 4.5 |      | 4.4  |     |      |
|                 | I <sub>OH</sub> = -4 mA                                     | 3 V             | 2.58                  |     |      | 2.48 |     |      |
|                 | I <sub>OH</sub> = -8 mA                                     | 4.5 V           | 3.94                  |     |      | 3.8  |     |      |
| V <sub>OL</sub> | I <sub>OL</sub> = 50 μA                                     | 2 V             |                       |     | 0.1  | 0.1  | V   |      |
|                 |   | 3 V             |                       |     | 0.1  | 0.1  |     |      |
|                 |   | 4.5 V           |                       |     | 0.1  | 0.1  |     |      |
|                 | I <sub>OL</sub> = 4 mA                                      | 3 V             |                       |     | 0.36 | 0.44 |     |      |
|                 | I <sub>OL</sub> = 8 mA                                      | 4.5 V           |                       |     | 0.36 | 0.44 |     |      |
| I <sub>I</sub>  | V <sub>I</sub> = V <sub>CC</sub> or GND                     | 5.5 V           |                       |     | ±0.1 | ±1   | μA  |      |
| I <sub>CC</sub> | V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0 | 5.5 V           |                       |     | 1    | 10   | μA  |      |
| C <sub>i</sub>  | V <sub>I</sub> = V <sub>CC</sub> or GND                     | 5 V             |                       |     |      |      | pF  |      |

switching characteristics over recommended operating free-air temperature range, V<sub>CC</sub> = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 1)

| PARAMETER        | FROM (INPUT) | TO (OUTPUT) | LOAD CAPACITANCE       | T <sub>A</sub> = 25°C |     |     | MIN | MAX | UNIT |
|------------------|--------------|-------------|------------------------|-----------------------|-----|-----|-----|-----|------|
|                  |              |             |                        | MIN                   | TYP | MAX |     |     |      |
| t <sub>PLH</sub> | A            | Y           | C <sub>L</sub> = 15 pF |                       |     |     |     |     | ns   |
| t <sub>PHL</sub> |              |             |                        |                       |     |     |     |     |      |
| t <sub>PLH</sub> | A            | Y           | C <sub>L</sub> = 50 pF |                       |     |     |     |     | ns   |
| t <sub>PHL</sub> |              |             |                        |                       |     |     |     |     |      |

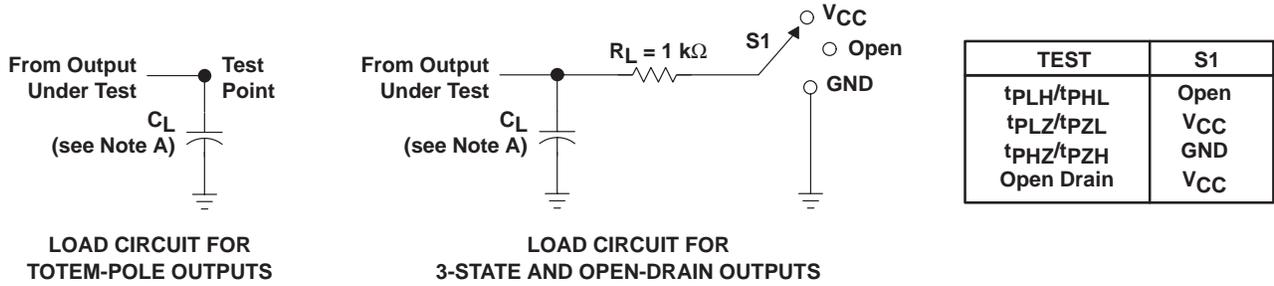
switching characteristics over recommended operating free-air temperature range, V<sub>CC</sub> = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)

| PARAMETER        | FROM (INPUT) | TO (OUTPUT) | LOAD CAPACITANCE       | T <sub>A</sub> = 25°C |     |     | MIN | MAX | UNIT |
|------------------|--------------|-------------|------------------------|-----------------------|-----|-----|-----|-----|------|
|                  |              |             |                        | MIN                   | TYP | MAX |     |     |      |
| t <sub>PLH</sub> | A            | Y           | C <sub>L</sub> = 15 pF |                       |     |     |     |     | ns   |
| t <sub>PHL</sub> |              |             |                        |                       |     |     |     |     |      |
| t <sub>PLH</sub> | A            | Y           | C <sub>L</sub> = 50 pF |                       |     |     |     |     | ns   |
| t <sub>PHL</sub> |              |             |                        |                       |     |     |     |     |      |

operating characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C

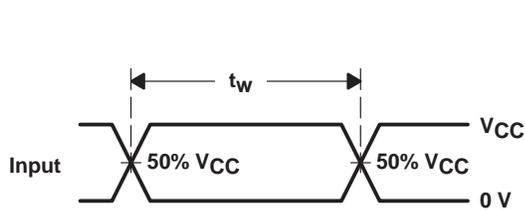
| PARAMETER                                     | TEST CONDITIONS    | TYP | UNIT |
|---|--------------------|-----|------|
| C <sub>pd</sub> Power dissipation capacitance | No load, f = 1 MHz |     | pF   |

PARAMETER MEASUREMENT INFORMATION

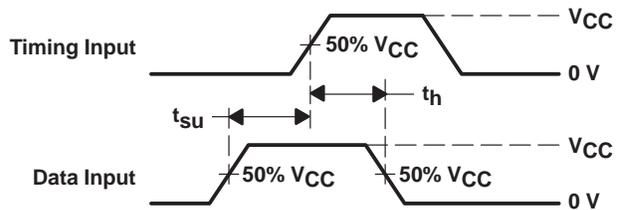


LOAD CIRCUIT FOR TOTEM-POLE OUTPUTS

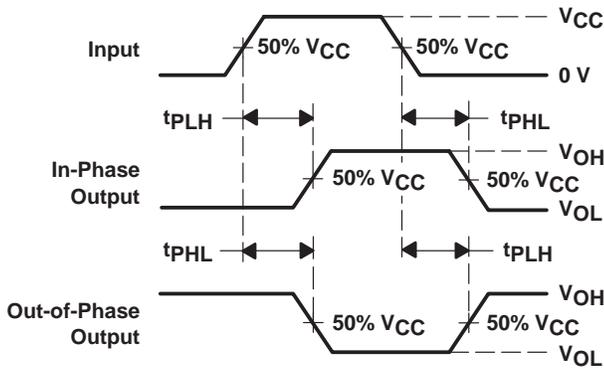
LOAD CIRCUIT FOR 3-STATE AND OPEN-DRAIN OUTPUTS



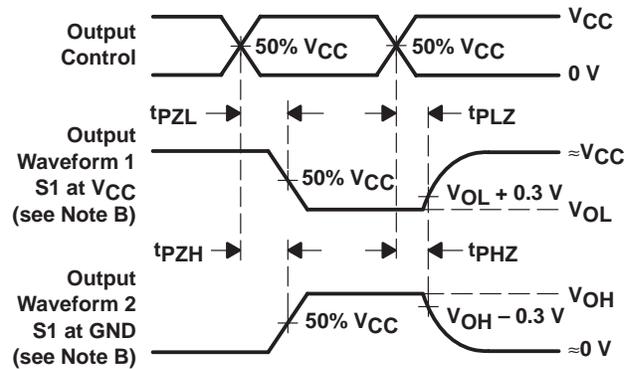
VOLTAGE WAVEFORMS PULSE DURATION



VOLTAGE WAVEFORMS SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS PROPAGATION DELAY TIMES INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS ENABLE AND DISABLE TIMES LOW- AND HIGH-LEVEL ENABLING

- NOTES: A.  $C_L$  includes probe and jig capacitance.  
 B. 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.  
 C. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 1$  MHz,  $Z_O = 50 \Omega$ ,  $t_r \leq 3$  ns,  $t_f \leq 3$  ns.  
 D. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

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