

# SN54AHC244, SN74AHC244 OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

SCLS226J – OCTOBER 1995 – REVISED JULY 2003

- Operating Range 2-V to 5.5-V  $V_{CC}$
- Latch-Up Performance Exceeds 250 mA Per JESD 17

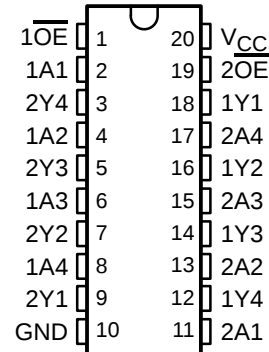
## description/ordering information

These octal buffers/drivers are designed specifically to improve the performance and density of 3-state memory-address drivers, clock drivers, and bus-oriented receivers and transmitters.

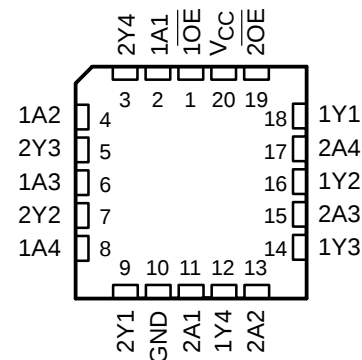
The 'AHC244 devices are organized as two 4-bit buffers/line drivers with separate output-enable ( $\overline{OE}$ ) inputs. When  $\overline{OE}$  is low, the device passes data from the A inputs to the Y outputs. When  $\overline{OE}$  is high, the outputs are in the high-impedance state.

To ensure the high-impedance state during power up or power down,  $\overline{OE}$  should be tied to  $V_{CC}$  through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

SN54AHC244 . . . J OR W PACKAGE  
SN74AHC244 . . . DB, DGV, DW, N, NS, OR PW PACKAGE  
(TOP VIEW)



SN54AHC244 . . . FK PACKAGE  
(TOP VIEW)



## ORDERING INFORMATION

| $T_A$          | PACKAGE <sup>†</sup> |               | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|----------------------|---------------|-----------------------|------------------|
| -40°C to 85°C  | PDIP – N             | Tube          | SN74AHC244N           | SN74AHC244N      |
|                | SOIC – DW            | Tube          | SN74AHC244DW          | AHC244           |
|                |                      | Tape and reel | SN74AHC244DWR         |                  |
|                | SOP – NS             | Tape and reel | SN74AHC244NSR         | AHC244           |
|                | SSOP – DB            | Tape and reel | SN74AHC244DBR         | HA244            |
|                | TSSOP – PW           | Tube          | SN74AHC244PW          | HA244            |
|                |                      | Tape and reel | SN74AHC244PWR         |                  |
|                | TVSOP – DGV          | Tape and reel | SN74AHC244DGV         | HA244            |
| -55°C to 125°C | CDIP – J             | Tube          | SNJ54AHC244J          | SNJ54AHC244J     |
|                | CFP – W              | Tube          | SNJ54AHC244W          | SNJ54AHC244W     |
|                | LCCC – FK            | Tube          | SNJ54AHC244FK         | SNJ54AHC244FK    |

<sup>†</sup> Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).



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.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS  
INSTRUMENTS**

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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

# SN54AHC244, SN74AHC244

## OCTAL BUFFERS/DRIVERS

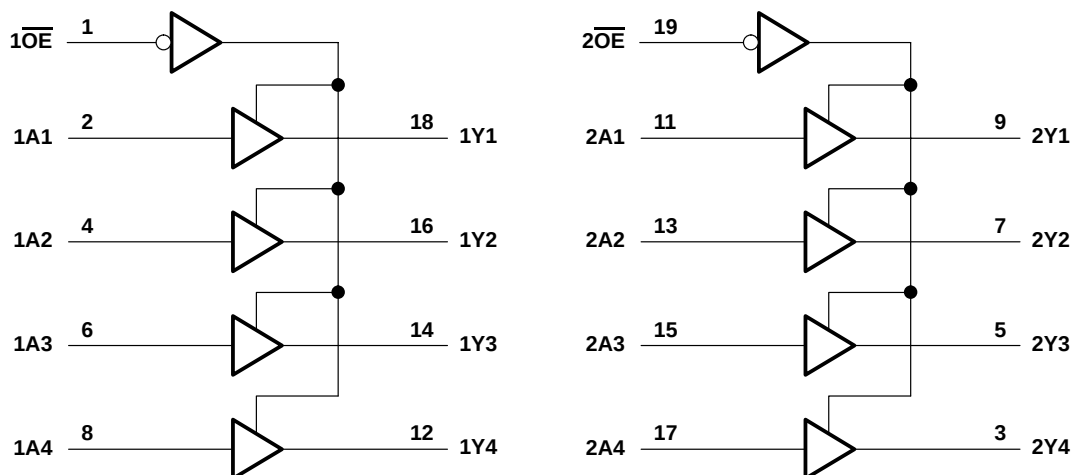
### WITH 3-STATE OUTPUTS

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FUNCTION TABLE  
(each 4-bit buffer/driver)

| INPUTS          |   | OUTPUT<br>Y |
|-----------------|---|-------------|
| $\overline{OE}$ | A |             |
| L               | H | H           |
| L               | L | L           |
| H               | X | Z           |

#### logic diagram (positive logic)



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

|                                                                |                            |
|----------------------------------------------------------------|----------------------------|
| 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):         |                            |
| DB package                                                     | 70°C/W                     |
| DGV package                                                    | 92°C/W                     |
| DW package                                                     | 58°C/W                     |
| N package                                                      | 69°C/W                     |
| NS package                                                     | 60°C/W                     |
| PW package                                                     | 83°C/W                     |
| Storage temperature range, $T_{stg}$                           | –65°C to 150°C             |

<sup>†</sup> 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 51-7.



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# SN54AHC244, SN74AHC244 OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

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## recommended operating conditions (see Note 3)

|                 |                                    |                                 | SN54AHC244 |                 | SN74AHC244 |                 | UNIT |
|-----------------|------------------------------------|---------------------------------|------------|-----------------|------------|-----------------|------|
|                 |                                    |                                 | MIN        | MAX             | MIN        | MAX             |      |
| V <sub>CC</sub> | Supply voltage                     |                                 | 2          | 5.5             | 2          | 5.5             | V    |
| V <sub>IH</sub> | High-level input voltage           | V <sub>CC</sub> = 2 V           | 1.5        |                 | 1.5        |                 | V    |
|                 |                                    | V <sub>CC</sub> = 3 V           | 2.1        |                 | 2.1        |                 |      |
|                 |                                    | V <sub>CC</sub> = 5.5 V         | 3.85       |                 | 3.85       |                 |      |
| V <sub>IL</sub> | Low-level input voltage            | V <sub>CC</sub> = 2 V           |            | 0.5             |            | 0.5             | V    |
|                 |                                    | V <sub>CC</sub> = 3 V           |            | 0.9             |            | 0.9             |      |
|                 |                                    | V <sub>CC</sub> = 5.5 V         |            | 1.65            |            | 1.65            |      |
| V <sub>I</sub>  | Input voltage                      |                                 | 0          | 5.5             | 0          | 5.5             | V    |
| V <sub>O</sub>  | Output voltage                     |                                 | 0          | V <sub>CC</sub> | 0          | V <sub>CC</sub> | V    |
| I <sub>OH</sub> | High-level output current          | V <sub>CC</sub> = 2 V           |            | –50             |            | –50             | μA   |
|                 |                                    | V <sub>CC</sub> = 3.3 V ± 0.3 V |            | –4              |            | –4              | mA   |
|                 |                                    | V <sub>CC</sub> = 5 V ± 0.5 V   |            | –8              |            | –8              |      |
| I <sub>OL</sub> | Low-level output current           | V <sub>CC</sub> = 2 V           |            | 50              |            | 50              | μA   |
|                 |                                    | V <sub>CC</sub> = 3.3 V ± 0.3 V |            | 4               |            | 4               | mA   |
|                 |                                    | V <sub>CC</sub> = 5 V ± 0.5 V   |            | 8               |            | 8               |      |
| Δt/Δv           | Input transition rise or fall rate | V <sub>CC</sub> = 3.3 V ± 0.3 V |            | 100             |            | 100             | ns/V |
|                 |                                    | V <sub>CC</sub> = 5 V ± 0.5 V   |            | 20              |            | 20              |      |
| T <sub>A</sub>  | Operating free-air temperature     |                                 | –55        | 125             | –40        | 85              | °C   |

NOTE 3: All unused inputs of the device must be held at V<sub>CC</sub> 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)

| PARAMETER       | TEST CONDITIONS                                                                                      | V <sub>CC</sub> | T <sub>A</sub> = 25°C |     |       | SN54AHC244 |      | SN74AHC244 |      | UNIT |
|-----------------|------------------------------------------------------------------------------------------------------|-----------------|-----------------------|-----|-------|------------|------|------------|------|------|
|                 |                                                                                                      |                 | MIN                   | TYP | MAX   | MIN        | MAX  | MIN        | MAX  |      |
| V <sub>OH</sub> | I <sub>OH</sub> = –50 μA                                                                             | 2 V             | 1.9                   | 2   |       | 1.9        |      | 1.9        |      | V    |
|                 |                                                                                                      | 3 V             | 2.9                   | 3   |       | 2.9        |      | 2.9        |      |      |
|                 |                                                                                                      | 4.5 V           | 4.4                   | 4.5 |       | 4.4        |      | 4.4        |      |      |
|                 | I <sub>OH</sub> = –4 mA                                                                              | 3 V             | 2.58                  |     |       | 2.48       |      | 2.48       |      |      |
|                 | I <sub>OH</sub> = –8 mA                                                                              | 4.5 V           | 3.94                  |     |       | 3.8        |      | 3.8        |      |      |
| V <sub>OL</sub> | I <sub>OL</sub> = 50 μA                                                                              | 2 V             |                       |     | 0.1   |            | 0.1  |            | 0.1  | V    |
|                 |                                                                                                      | 3 V             |                       |     | 0.1   |            | 0.1  |            | 0.1  |      |
|                 |                                                                                                      | 4.5 V           |                       |     | 0.1   |            | 0.1  |            | 0.1  |      |
|                 | I <sub>OL</sub> = 4 mA                                                                               | 3 V             |                       |     | 0.36  |            | 0.5  |            | 0.44 |      |
|                 | I <sub>OL</sub> = 8 mA                                                                               | 4.5 V           |                       |     | 0.36  |            | 0.5  |            | 0.44 |      |
| I <sub>I</sub>  | V <sub>I</sub> = 5.5 V or GND                                                                        | 0 V to 5.5 V    |                       |     | ±0.1  |            | ±1*  |            | ±1   | μA   |
| I <sub>OZ</sub> | V <sub>O</sub> = V <sub>CC</sub> or GND,<br>V <sub>I</sub> (OE) = V <sub>IL</sub> or V <sub>IH</sub> | 5.5 V           |                       |     | ±0.25 |            | ±2.5 |            | ±2.5 | μA   |
| I <sub>CC</sub> | V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0                                          | 5.5 V           |                       |     | 4     |            | 40   |            | 40   | μA   |
| C <sub>i</sub>  | V <sub>I</sub> = V <sub>CC</sub> or GND                                                              | 5 V             |                       | 2   | 10    |            |      |            | 10   | pF   |
| C <sub>O</sub>  | V <sub>O</sub> = V <sub>CC</sub> or GND                                                              | 5 V             |                       | 3.5 |       |            |      |            |      | pF   |

\* On products compliant to MIL-PRF-38535, this parameter is not production tested at V<sub>CC</sub> = 0 V.



# SN54AHC244, SN74AHC244

## OCTAL BUFFERS/DRIVERS

### WITH 3-STATE OUTPUTS

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switching characteristics over recommended operating free-air temperature range,  
 $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$  (unless otherwise noted) (see Figure 1)

| PARAMETER          | FROM<br>(INPUT) | TO<br>(OUTPUT) | LOAD<br>CAPACITANCE    | T <sub>A</sub> = 25°C |       |     | SN54AHC244 |     | SN74AHC244 |     | UNIT |
|--------------------|-----------------|----------------|------------------------|-----------------------|-------|-----|------------|-----|------------|-----|------|
|                    |                 |                |                        | MIN                   | TYP   | MAX | MIN        | MAX | MIN        | MAX |      |
| t <sub>PLH</sub>   | A               | Y              | C <sub>L</sub> = 15 pF | 5.8*                  | 8.4*  | 1*  | 10*        | 1   | 10         | ns  |      |
| t <sub>PHL</sub>   |                 |                |                        | 5.8*                  | 8.4*  | 1*  | 10*        | 1   | 10         |     |      |
| t <sub>PZH</sub>   | OE              | Y              | C <sub>L</sub> = 15 pF | 6.6*                  | 10.6* | 1*  | 12.5*      | 1   | 12.5       | ns  |      |
| t <sub>PZL</sub>   |                 |                |                        | 6.6*                  | 10.6* | 1*  | 12.5*      | 1   | 12.5       |     |      |
| t <sub>PHZ</sub>   | OE              | Y              | C <sub>L</sub> = 15 pF | 5*                    | 9.7*  | 1*  | 11*        | 1   | 11         | ns  |      |
| t <sub>PLZ</sub>   |                 |                |                        | 5*                    | 9.7*  | 1*  | 11*        | 1   | 11         |     |      |
| t <sub>PLH</sub>   | A               | Y              | C <sub>L</sub> = 50 pF | 8.3                   | 11.9  | 1   | 13.5       | 1   | 13.5       | ns  |      |
| t <sub>PHL</sub>   |                 |                |                        | 8.3                   | 11.9  | 1   | 13.5       | 1   | 13.5       |     |      |
| t <sub>PZH</sub>   | OE              | Y              | C <sub>L</sub> = 50 pF | 9.1                   | 14.1  | 1   | 16         | 1   | 16         | ns  |      |
| t <sub>PZL</sub>   |                 |                |                        | 9.1                   | 14.1  | 1   | 16         | 1   | 16         |     |      |
| t <sub>PHZ</sub>   | OE              | Y              | C <sub>L</sub> = 50 pF | 10.3                  | 14    | 1   | 16         | 1   | 16         | ns  |      |
| t <sub>PLZ</sub>   |                 |                |                        | 10.3                  | 14    | 1   | 16         | 1   | 16         |     |      |
| t <sub>sk(o)</sub> |                 |                | C <sub>L</sub> = 50 pF | 1.5**                 |       |     |            | 1.5 |            | ns  |      |

\* On products compliant to MIL-PRF-38535, this parameter is not production tested.

\*\* On products compliant to MIL-PRF-38535, this parameter does not apply.

switching characteristics over recommended operating free-air temperature range,  
 $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$  (unless otherwise noted) (see Figure 1)

| PARAMETER          | FROM<br>(INPUT) | TO<br>(OUTPUT) | LOAD<br>CAPACITANCE    | T <sub>A</sub> = 25°C |      |     | SN54AHC244 |     | SN74AHC244 |     | UNIT |
|--------------------|-----------------|----------------|------------------------|-----------------------|------|-----|------------|-----|------------|-----|------|
|                    |                 |                |                        | MIN                   | TYP  | MAX | MIN        | MAX | MIN        | MAX |      |
| t <sub>PLH</sub>   | A               | Y              | C <sub>L</sub> = 15 pF | 3.9*                  | 5.5* | 1*  | 6.5*       | 1   | 6.5        | ns  |      |
| t <sub>PHL</sub>   |                 |                |                        | 3.9*                  | 5.5* | 1*  | 6.5*       | 1   | 6.5        |     |      |
| t <sub>PZH</sub>   | OE              | Y              | C <sub>L</sub> = 15 pF | 4.7*                  | 7.3* | 1*  | 8.5*       | 1   | 8.5        | ns  |      |
| t <sub>PZL</sub>   |                 |                |                        | 4.7*                  | 7.3* | 1*  | 8.5*       | 1   | 8.5        |     |      |
| t <sub>PHZ</sub>   | OE              | Y              | C <sub>L</sub> = 15 pF | 5*                    | 7.2* | 1*  | 8.5*       | 1   | 8.5        | ns  |      |
| t <sub>PLZ</sub>   |                 |                |                        | 5*                    | 7.2* | 1*  | 8.5*       | 1   | 8.5        |     |      |
| t <sub>PLH</sub>   | A               | Y              | C <sub>L</sub> = 50 pF | 5.4                   | 7.5  | 1   | 8.5        | 1   | 8.5        | ns  |      |
| t <sub>PHL</sub>   |                 |                |                        | 5.4                   | 7.5  | 1   | 8.5        | 1   | 8.5        |     |      |
| t <sub>PZH</sub>   | OE              | Y              | C <sub>L</sub> = 50 pF | 6.2                   | 9.3  | 1   | 10.5       | 1   | 10.5       | ns  |      |
| t <sub>PZL</sub>   |                 |                |                        | 6.2                   | 9.3  | 1   | 10.5       | 1   | 10.5       |     |      |
| t <sub>PHZ</sub>   | OE              | Y              | C <sub>L</sub> = 50 pF | 6.7                   | 9.2  | 1   | 10.5       | 1   | 10.5       | ns  |      |
| t <sub>PLZ</sub>   |                 |                |                        | 6.7                   | 9.2  | 1   | 10.5       | 1   | 10.5       |     |      |
| t <sub>sk(o)</sub> |                 |                | C <sub>L</sub> = 50 pF |                       | 1**  |     |            |     | 1          | ns  |      |

\* On products compliant to MIL-PRF-38535, this parameter is not production tested.

\*\* On products compliant to MIL-PRF-38535, this parameter does not apply.



# SN54AHC244, SN74AHC244 OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

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noise characteristics,  $V_{CC} = 5\text{ V}$ ,  $C_L = 50\text{ pF}$ ,  $T_A = 25^\circ\text{C}$  (see Note 4)

| PARAMETER                                          | SN74AHC244 |      |     | UNIT |
|----------------------------------------------------|------------|------|-----|------|
|                                                    | MIN        | TYP  | MAX |      |
| $V_{OL(P)}$ Quiet output, maximum dynamic $V_{OL}$ |            | 0.5  |     | V    |
| $V_{OL(V)}$ Quiet output, minimum dynamic $V_{OL}$ |            | -0.2 |     | V    |
| $V_{OH(V)}$ Quiet output, minimum dynamic $V_{OH}$ |            | 4.8  |     | V    |
| $V_{IH(D)}$ High-level dynamic input voltage       |            | 3.5  |     | V    |
| $V_{IL(D)}$ Low-level dynamic input voltage        |            |      | 1.5 | V    |

NOTE 4: Characteristics are for surface-mount packages only.

operating characteristics,  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$

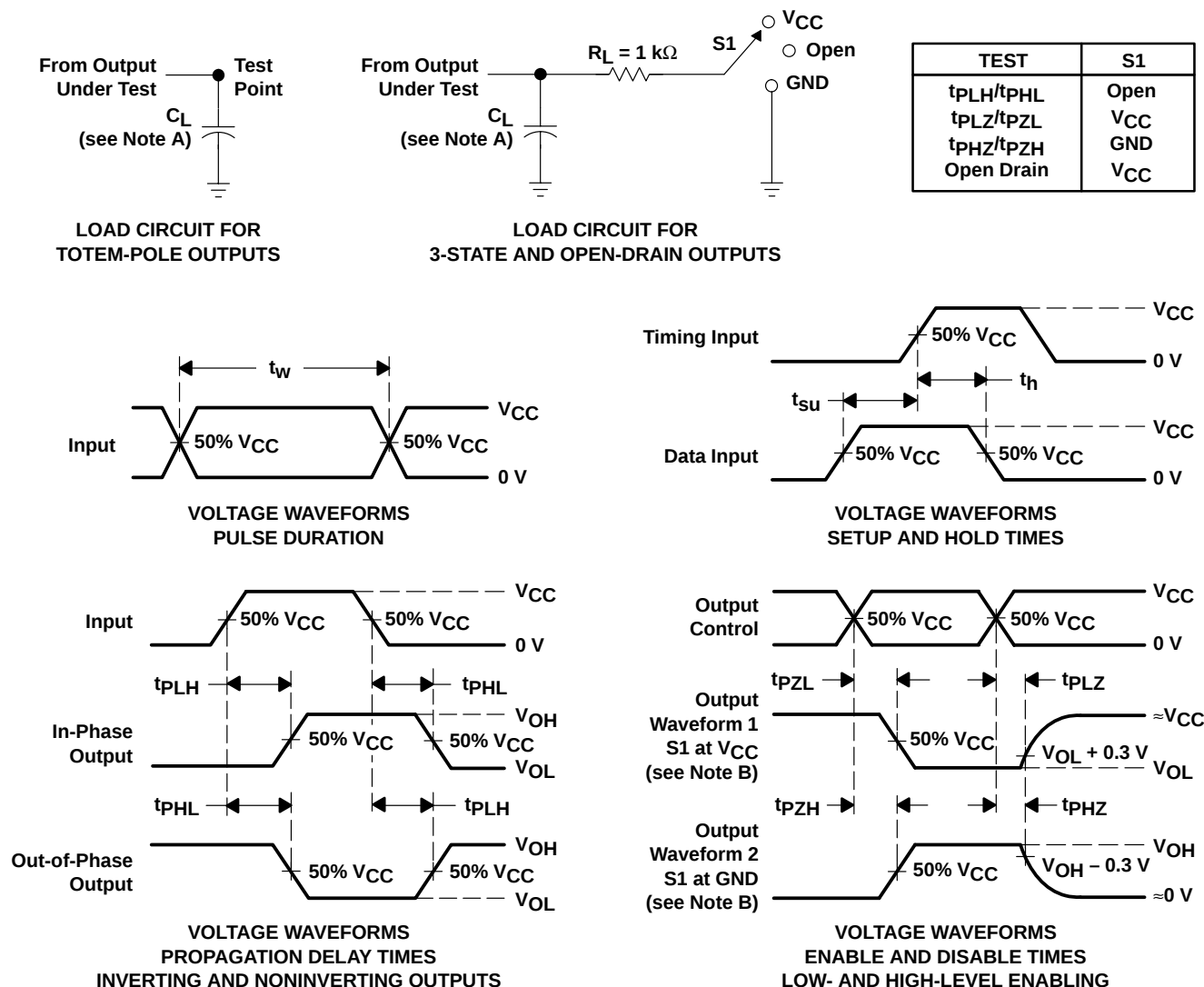
| PARAMETER                              | TEST CONDITIONS             | TYP | UNIT |
|----------------------------------------|-----------------------------|-----|------|
| $C_{pd}$ Power dissipation capacitance | No load, $f = 1\text{ MHz}$ | 8.6 | pF   |



# SN54AHC244, SN74AHC244 OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

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## PARAMETER MEASUREMENT INFORMATION



- NOTES:
- $C_L$  includes probe and jig capacitance.
  - 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.
  - All input pulses are supplied by generators having the following characteristics:  $PRR \leq 1\text{ MHz}$ ,  $Z_O = 50\text{ }\Omega$ ,  $t_r \leq 3\text{ ns}$ ,  $t_f \leq 3\text{ ns}$ .
  - The outputs are measured one at a time with one input transition per measurement.
  - All parameters and waveforms are not applicable to all devices.

**Figure 1. Load Circuit and Voltage Waveforms**

**PACKAGING INFORMATION**

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup>               |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|--------------------------------------------|
| 5962-9678201Q2A  | ACTIVE                | LCCC         | FK              | 20   | 1           | None                    | Call TI          | Level-NC-NC-NC                             |
| 5962-9678201QRA  | ACTIVE                | CDIP         | J               | 20   | 1           | None                    | Call TI          | Level-NC-NC-NC                             |
| 5962-9678201QSA  | ACTIVE                | CFP          | W               | 20   | 1           | None                    | Call TI          | Level-NC-NC-NC                             |
| 5962-9678201SA   | ACTIVE                | CFP          | W               | 20   |             | None                    | Call TI          | Call TI                                    |
| 5962-9678201VRA  | ACTIVE                | CDIP         | J               | 20   | 1           | None                    | Call TI          | Level-NC-NC-NC                             |
| 5962-9678201VSA  | ACTIVE                | CFP          | W               | 20   | 1           | None                    | Call TI          | Level-NC-NC-NC                             |
| SN74AHC244DBLE   | OBSOLETE              | SSOP         | DB              | 20   |             | None                    | Call TI          | Call TI                                    |
| SN74AHC244DBR    | ACTIVE                | SSOP         | DB              | 20   | 2000        | Pb-Free (RoHS)          | CU NIPDAU        | Level-2-260C-1 YEAR/<br>Level-1-235C-UNLIM |
| SN74AHC244DGVR   | ACTIVE                | TVSOP        | DGV             | 20   | 2000        | Pb-Free (RoHS)          | CU NIPDAU        | Level-1-250C-UNLIM                         |
| SN74AHC244DW     | ACTIVE                | SOIC         | DW              | 20   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | Level-2-250C-1 YEAR/<br>Level-1-235C-UNLIM |
| SN74AHC244DWR    | ACTIVE                | SOIC         | DW              | 20   | 2000        | Pb-Free (RoHS)          | CU NIPDAU        | Level-2-250C-1 YEAR/<br>Level-1-235C-UNLIM |
| SN74AHC244N      | ACTIVE                | PDIP         | N               | 20   | 20          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC                             |
| SN74AHC244NSR    | ACTIVE                | SO           | NS              | 20   | 2000        | Pb-Free (RoHS)          | CU NIPDAU        | Level-2-260C-1 YEAR/<br>Level-1-235C-UNLIM |
| SN74AHC244PW     | ACTIVE                | TSSOP        | PW              | 20   | 70          | Pb-Free (RoHS)          | CU NIPDAU        | Level-1-250C-UNLIM                         |
| SN74AHC244PWLE   | OBSOLETE              | TSSOP        | PW              | 20   |             | None                    | Call TI          | Call TI                                    |
| SN74AHC244PWR    | ACTIVE                | TSSOP        | PW              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM                         |
| SNJ54AHC244FK    | ACTIVE                | LCCC         | FK              | 20   | 1           | None                    | Call TI          | Level-NC-NC-NC                             |
| SNJ54AHC244J     | ACTIVE                | CDIP         | J               | 20   | 1           | None                    | Call TI          | Level-NC-NC-NC                             |
| SNJ54AHC244W     | ACTIVE                | CFP          | W               | 20   | 1           | None                    | Call TI          | Level-NC-NC-NC                             |

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - May not be currently available - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**None:** Not yet available Lead (Pb-Free).

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean "Pb-Free" and in addition, uses package materials that do not contain halogens, including bromine (Br) or antimony (Sb) above 0.1% of total product weight.

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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J (R-GDIP-T\*\*)

14 LEADS SHOWN

# CERAMIC DUAL IN-LINE PACKAGE



| PINS **<br>DIM | 14                     | 16                     | 18                     | 20                     |
|----------------|------------------------|------------------------|------------------------|------------------------|
| A              | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC |
| B MAX          | 0.785<br>(19,94)       | .840<br>(21,34)        | 0.960<br>(24,38)       | 1.060<br>(26,92)       |
| B MIN          | —                      | —                      | —                      | —                      |
| C MAX          | 0.300<br>(7,62)        | 0.300<br>(7,62)        | 0.310<br>(7,87)        | 0.300<br>(7,62)        |
| C MIN          | 0.245<br>(6,22)        | 0.245<br>(6,22)        | 0.220<br>(5,59)        | 0.245<br>(6,22)        |



4040083/F 03/03

- 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.

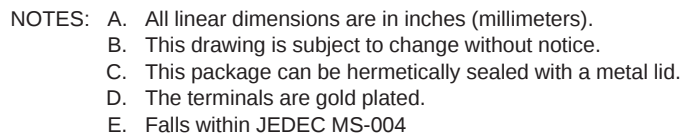
W (R-GDFP-F20)

CERAMIC DUAL FLATPACK



- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a ceramic lid using glass frit.
  - Index point is provided on cap for terminal identification only.
  - Falls within Mil-Std 1835 GDFP2-F20

## 28 TERMINAL SHOWN



N (R-PDIP-T\*\*)

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



| PINS **<br>DIM      | 14               | 16               | 18               | 20               |
|---------------------|------------------|------------------|------------------|------------------|
| A MAX               | 0.775<br>(19,69) | 0.775<br>(19,69) | 0.920<br>(23,37) | 1.060<br>(26,92) |
| A MIN               | 0.745<br>(18,92) | 0.745<br>(18,92) | 0.850<br>(21,59) | 0.940<br>(23,88) |
| MS-001<br>VARIATION | AA               | BB               | AC               | AD               |



4040049/E 12/2002

NOTES:

- A. All linear dimensions are in inches (millimeters).  
B. This drawing is subject to change without notice.
-  Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).  
 The 20 pin end lead shoulder width is a vendor option, either half or full width.

## DGV (R-PDSO-G\*\*)

## PLASTIC SMALL-OUTLINE

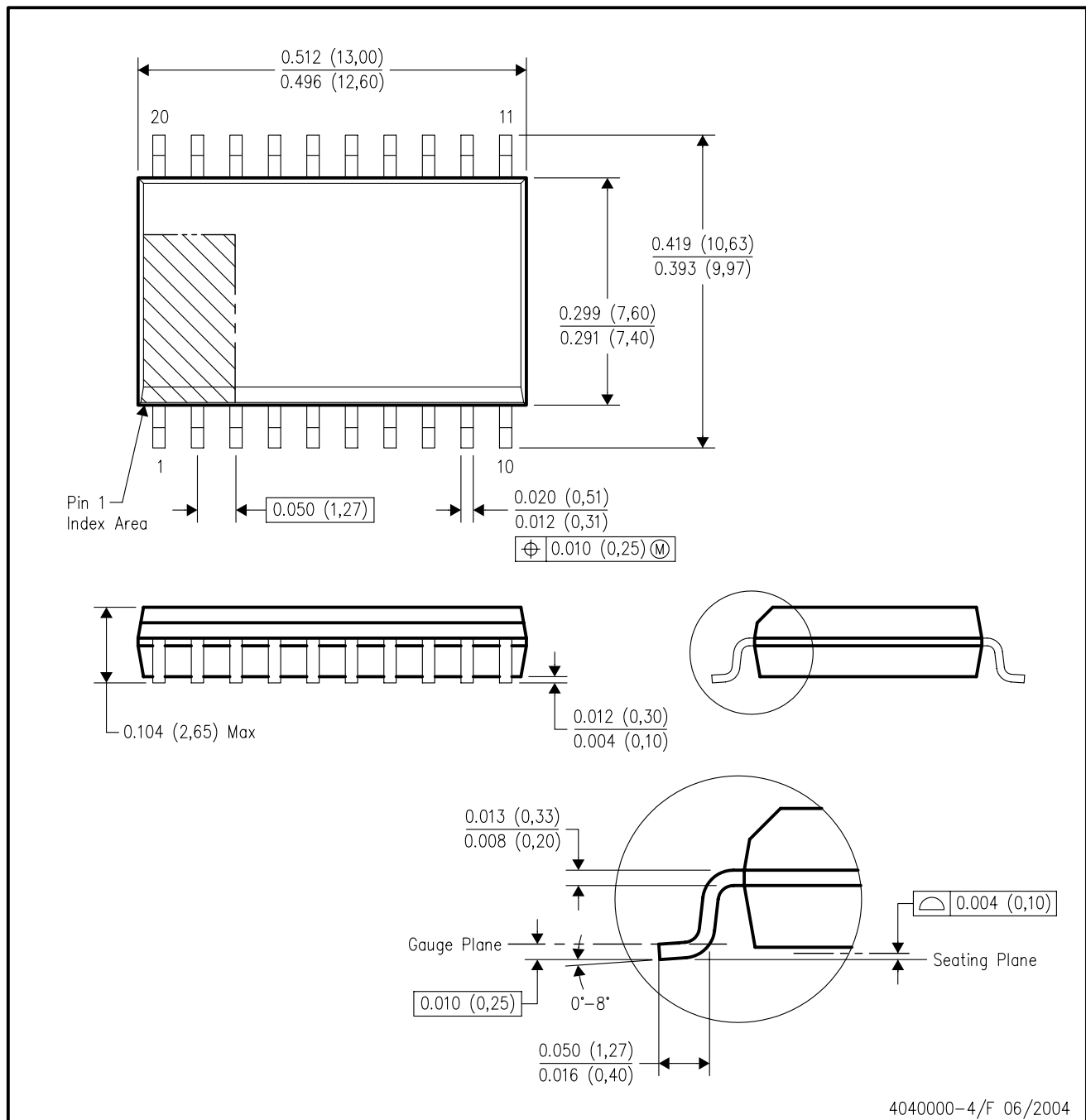
24 PINS SHOWN



- 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 per side.  
 D. Falls within JEDEC: 24/48 Pins – MO-153  
 14/16/20/56 Pins – MO-194

DW (R-PDSO-G20)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - Falls within JEDEC MS-013 variation AC.

# MECHANICAL DATA

NS (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



| DIM \ PINS ** | 14    | 16    | 20    | 24    |
|---------------|-------|-------|-------|-------|
| A MAX         | 10,50 | 10,50 | 12,90 | 15,30 |
| A MIN         | 9,90  | 9,90  | 12,30 | 14,70 |

4040062/C 03/03

- 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.

## DB (R-PDSO-G\*\*)

## PLASTIC SMALL-OUTLINE

28 PINS SHOWN



- 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.  
 D. Falls within JEDEC MO-150

## PW (R-PDSO-G\*\*)

## PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



- 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.  
 D. Falls within JEDEC MO-153

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