

# SN54BCT2244, SN74BCT2244 OCTAL BUFFERS AND LINE/MOS DRIVERS WITH 3-STATE OUTPUTS

SCBS017D – SEPTEMBER 1988 – REVISED MARCH 2003

- Operating Voltage Range of 4.5 V to 5.5 V
- State-of-the-Art BiCMOS Design Significantly Reduces  $I_{CCZ}$
- Output Ports Have Equivalent 33- $\Omega$  Series Resistors, So No External Resistors Are Required
- 3-State Outputs Drive Bus Lines or Buffer Memory Address Registers

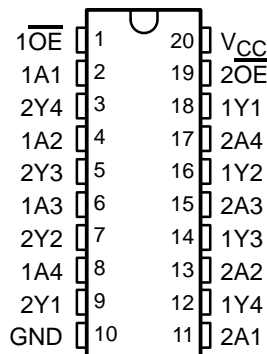
## description/ordering information

The 'BCT2244 devices are designed specifically to improve both the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters. Together with the 'BCT2240 devices and SN74BCT2241, these devices provide the choice of selected combinations of inverting and noninverting outputs, symmetrical active-low output-enable ( $\overline{OE}$ ) inputs, and complementary OE and  $\overline{OE}$  inputs. These devices feature high fan-out and improved fan-in.

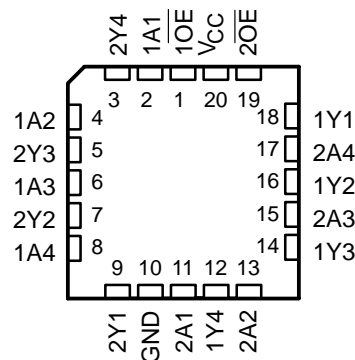
To ensure the high-impedance state during power up or power down,  $\overline{OE}$  should be tied to  $V_{CC}$  through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

The outputs, which are designed to source or sink up to 12 mA, include 33- $\Omega$  series resistors to reduce overshoot and undershoot.

SN54BCT2244 . . . J OR W PACKAGE  
SN74BCT2244 . . . DW, N, OR NS PACKAGE  
(TOP VIEW)



SN54BCT2244 . . . FK PACKAGE  
(TOP VIEW)



## ORDERING INFORMATION

| T <sub>A</sub> | PACKAGE†  |               | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|-----------|---------------|-----------------------|------------------|
|                |           |               |                       |                  |
| 0°C to 70°C    | PDIP – N  | Tube          | SN74BCT2244N          | SN74BCT2244N     |
|                | SOIC – DW | Tube          | SN74BCT2244DW         | BCT2244          |
|                |           | Tape and reel | SN74BCT2244DWR        |                  |
|                | SOP – NS  | Tape and reel | SN74BCT2244NSR        | BCT2244          |
| –55°C to 125°C | CDIP – J  | Tube          | SNJ54BCT2244J         | SNJ54BCT2244J    |
|                | CFP – W   | Tube          | SNJ54BCT2244W         | SNJ54BCT2244W    |
|                | LCCC – FK | Tube          | SNJ54BCT2244FK        | SNJ54BCT2244FK   |

† 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).



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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.

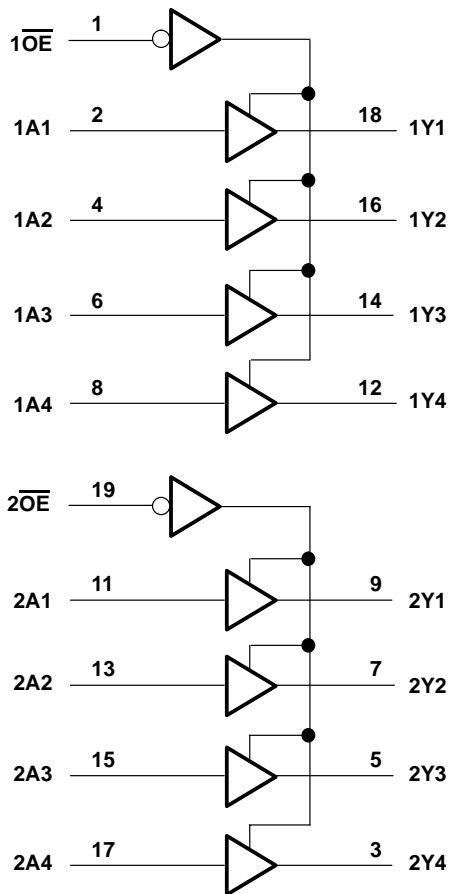
# SN54BCT2244, SN74BCT2244 OCTAL BUFFERS AND LINE/MOS DRIVERS WITH 3-STATE OUTPUTS

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FUNCTION TABLE  
(each buffer)

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

logic diagram (positive logic)





# SN54BCT2244, SN74BCT2244 OCTAL BUFFERS AND LINE/MOS DRIVERS WITH 3-STATE OUTPUTS

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

| PARAMETER         | TEST CONDITIONS          |                                 | SN54BCT2244 |      |      | SN74BCT2244 |      |      | UNIT |
|-------------------|--------------------------|---------------------------------|-------------|------|------|-------------|------|------|------|
|                   |                          |                                 | MIN         | TYP† | MAX  | MIN         | TYP† | MAX  |      |
| V <sub>IK</sub>   | V <sub>CC</sub> = 4.5 V, | I <sub>I</sub> = -18 mA         | -1.2        |      |      | -1.2        |      |      | V    |
| V <sub>OH</sub>   | V <sub>CC</sub> = 4.5 V  | I <sub>OH</sub> = -1 mA         | 2.4         |      |      | 2.4         |      |      | V    |
|                   |                          | I <sub>OH</sub> = -12 mA        | 2           |      |      | 2           |      |      |      |
| V <sub>OL</sub>   | V <sub>CC</sub> = 4.5 V  | I <sub>OL</sub> = 1 mA          | 0.15        | 0.5  |      | 0.15        | 0.5  | V    |      |
|                   |                          | I <sub>OL</sub> = 12 mA         | 0.35        | 0.8  |      | 0.35        | 0.8  |      |      |
| I <sub>I</sub>    | V <sub>CC</sub> = 5.5 V, | V <sub>I</sub> = 7 V            | 0.1         |      |      | 0.1         |      |      | mA   |
| I <sub>IH</sub>   | V <sub>CC</sub> = 5.5 V, | V <sub>I</sub> = 2.7 V          | 20          |      |      | 20          |      |      | μA   |
| I <sub>IL</sub>   | V <sub>CC</sub> = 5.5 V, | V <sub>I</sub> = 0.5 V          | -1          |      |      | -1          |      |      | mA   |
| I <sub>OZH</sub>  | V <sub>CC</sub> = 5.5 V, | V <sub>O</sub> = 2.7 V          | 50          |      |      | 50          |      |      | μA   |
| I <sub>OZL</sub>  | V <sub>CC</sub> = 5.5 V, | V <sub>O</sub> = 0.5 V          | -50         |      |      | -50         |      |      | μA   |
| I <sub>OS</sub> ‡ | V <sub>CC</sub> = 5.5 V, | V <sub>O</sub> = 0              | -100        |      | -225 | -100        |      | -225 | mA   |
| I <sub>CCH</sub>  | V <sub>CC</sub> = 5.5 V, | Outputs open                    | 23          | 37   |      | 23          | 37   |      | mA   |
| I <sub>CCL</sub>  | V <sub>CC</sub> = 5.5 V, | Outputs open                    | 53          | 77   |      | 53          | 77   |      | mA   |
| I <sub>CCZ</sub>  | V <sub>CC</sub> = 5.5 V, | Outputs open                    | 6.5         | 10   |      | 6.5         | 10   |      | mA   |
| C <sub>i</sub>    | V <sub>CC</sub> = 5 V,   | V <sub>I</sub> = 2.5 V or 0.5 V | 6           |      |      | 6           |      |      | pF   |
| C <sub>o</sub>    | V <sub>CC</sub> = 5 V,   | V <sub>O</sub> = 2.5 V or 0.5 V | 11          |      |      | 11          |      |      | pF   |

† All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

‡ Not more than one output should be tested at a time, and the duration of the test should not exceed one second.

switching characteristics over recommended ranges of supply voltage and operating free-air temperature, C<sub>L</sub> = 50 pF (unless otherwise noted) (see Figure 1)

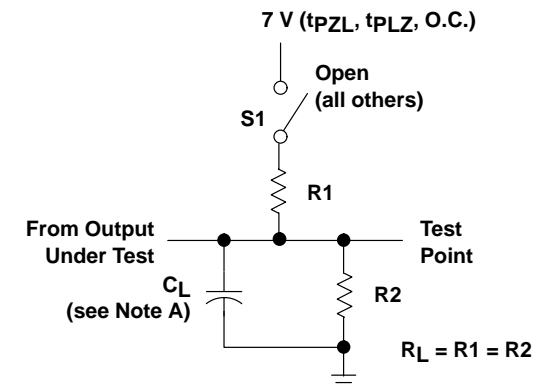
| PARAMETER        | FROM (INPUT)    | TO (OUTPUT) | V <sub>CC</sub> = 5 V,<br>T <sub>A</sub> = 25°C |     |     | SN54BCT2244 |      | SN74BCT2244 |      | UNIT |
|------------------|-----------------|-------------|---|-----|-----|-------------|------|-------------|------|------|
|                  |                 |             | MIN   | TYP | MAX | MIN         | MAX  | MIN         | MAX  |      |
| t <sub>PLH</sub> | A               | Y           | 0.5   | 3   | 4.4 | 0.5         | 5.2  | 0.5         | 4.9  | ns   |
| t <sub>PHL</sub> |                 |             | 1.6   | 4.6 | 6.3 | 1.6         | 7.1  | 1.6         | 6.7  |      |
| t <sub>PZH</sub> | $\overline{OE}$ | Y           | 2.4   | 6.1 | 7.7 | 2.4         | 9.1  | 2.4         | 8.7  | ns   |
| t <sub>PZL</sub> |                 |             | 3.9   | 7.6 | 9.4 | 3.9         | 10.8 | 3.9         | 10.4 |      |
| t <sub>PHZ</sub> | $\overline{OE}$ | Y           | 1.7   | 5.2 | 6.9 | 1.7         | 8.1  | 1.7         | 7.8  | ns   |
| t <sub>PLZ</sub> |                 |             | 2.8   | 6.5 | 8.3 | 2.8         | 10.9 | 2.8         | 9.8  |      |

## PARAMETER MEASUREMENT INFORMATION

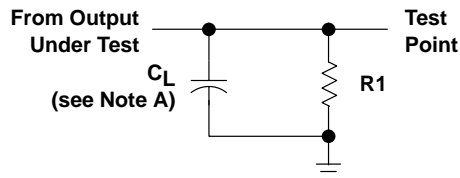


# SN54BCT2244, SN74BCT2244 OCTAL BUFFERS AND LINE/MOS DRIVERS WITH 3-STATE OUTPUTS

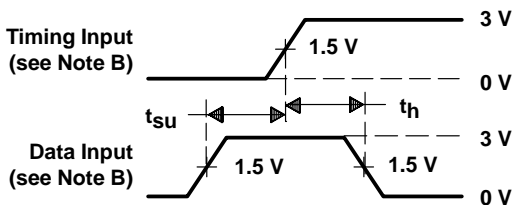
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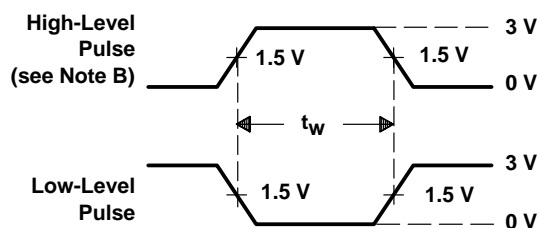
LOAD CIRCUIT FOR  
3-STATE AND OPEN-COLLECTOR OUTPUTS



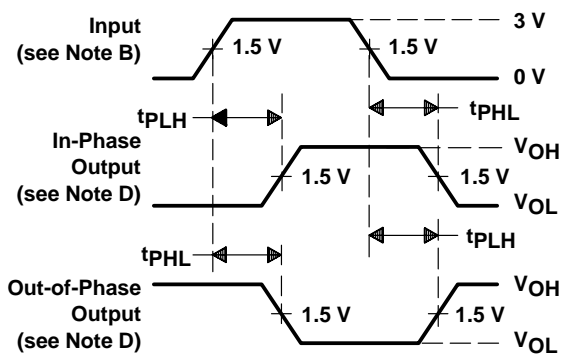
LOAD CIRCUIT FOR  
TOTEM-POLE OUTPUTS



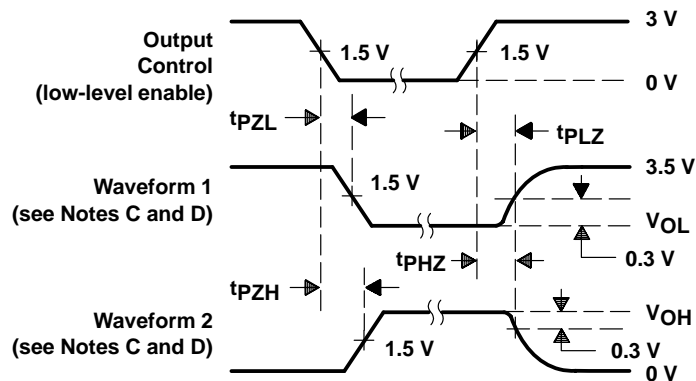
VOLTAGE WAVEFORMS  
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS  
PULSE DURATION



VOLTAGE WAVEFORMS  
PROPAGATION DELAY TIMES (see Note D)



VOLTAGE WAVEFORMS  
ENABLE AND DISABLE TIMES, 3-STATE OUTPUTS

- NOTES:
- $C_L$  includes probe and jig capacitance.
  - All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10$  MHz,  $t_r = t_f \leq 2.5$  ns, duty cycle = 50%.
  - 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.
  - The outputs are measured one at a time with one transition per measurement.
  - When measuring propagation delay times of 3-state outputs, switch S1 is open.
  - 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> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| 5962-9074101M2A  | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | POST-PLATE       | N / A for Pkg Type           |
| 5962-9074101MRA  | ACTIVE                | CDIP         | J               | 20   | 1           | TBD                     | A42 SNPB         | N / A for Pkg Type           |
| 5962-9074101MSA  | ACTIVE                | CFP          | W               | 20   | 1           | TBD                     | Call TI          | N / A for Pkg Type           |
| SN74BCT2244DW    | ACTIVE                | SOIC         | DW              | 20   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74BCT2244DWE4  | ACTIVE                | SOIC         | DW              | 20   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74BCT2244DWG4  | ACTIVE                | SOIC         | DW              | 20   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74BCT2244DWR   | ACTIVE                | SOIC         | DW              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74BCT2244DWRE4 | ACTIVE                | SOIC         | DW              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74BCT2244DWRG4 | ACTIVE                | SOIC         | DW              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74BCT2244N     | ACTIVE                | PDIP         | N               | 20   | 20          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| SN74BCT2244NE4   | ACTIVE                | PDIP         | N               | 20   | 20          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| SN74BCT2244NSR   | ACTIVE                | SO           | NS              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74BCT2244NSRE4 | ACTIVE                | SO           | NS              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74BCT2244NSRG4 | ACTIVE                | SO           | NS              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SNJ54BCT2244FK   | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | POST-PLATE       | N / A for Pkg Type           |
| SNJ54BCT2244J    | ACTIVE                | CDIP         | J               | 20   | 1           | TBD                     | A42 SNPB         | N / A for Pkg Type           |
| SNJ54BCT2244W    | ACTIVE                | CFP          | W               | 20   | 1           | TBD                     | Call TI          | N / A for Pkg Type           |

<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 - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**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.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<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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**TAPE AND REEL INFORMATION**



**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**



\*All dimensions are nominal

| Device         | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74BCT2244DWR | SOIC         | DW              | 20   | 2000 | 330.0              | 24.4               | 10.8    | 13.0    | 2.7     | 12.0    | 24.0   | Q1            |
| SN74BCT2244NSR | SO           | NS              | 20   | 2000 | 330.0              | 24.4               | 8.2     | 13.0    | 2.5     | 12.0    | 24.0   | Q1            |



**TAPE AND REEL BOX DIMENSIONS**



\*All dimensions are nominal

| Device         | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74BCT2244DWR | SOIC         | DW              | 20   | 2000 | 346.0       | 346.0      | 41.0        |
| SN74BCT2244NSR | SO           | NS              | 20   | 2000 | 346.0       | 346.0      | 41.0        |

FK (S-CQCC-N\*\*)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



- 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

# MECHANICAL DATA

NS (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.

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

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



| DIM \ PINS ** | 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:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package is hermetically sealed with a ceramic lid using glass frit.
  - Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
  - 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

DW (R-PDSO-G20)

PLASTIC SMALL-OUTLINE PACKAGE



- 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-013 variation AC.

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

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- 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.

4040049/E 12/2002

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|                             |  |
|-----------------------------|--|
| Amplifiers                  | <a href="http://amplifier.ti.com">amplifier.ti.com</a>             |
| Data Converters             | <a href="http://dataconverter.ti.com">dataconverter.ti.com</a>     |
| DSP                         | <a href="http://dsp.ti.com">dsp.ti.com</a>                         |
| Clocks and Timers           | <a href="http://www.ti.com/clocks">www.ti.com/clocks</a>           |
| Interface                   | <a href="http://interface.ti.com">interface.ti.com</a>             |
| Logic                       | <a href="http://logic.ti.com">logic.ti.com</a>                     |
| Power Mgmt                  | <a href="http://power.ti.com">power.ti.com</a>                     |
| Microcontrollers            | <a href="http://microcontroller.ti.com">microcontroller.ti.com</a> |
| RFID                        | <a href="http://www.ti-rfid.com">www.ti-rfid.com</a>               |
| RF/IF and ZigBee® Solutions | <a href="http://www.ti.com/lprf">www.ti.com/lprf</a>               |

### Applications

|                    |  |
|--------------------|--|
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