

# SN54BCT241, SN74BCT241 OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

SCBS005D – OCTOBER 1987 – REVISED APRIL 1994

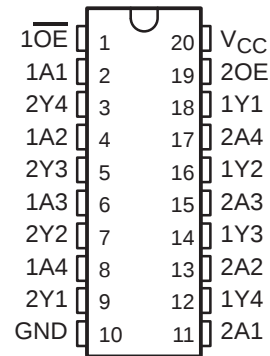
- State-of-the-Art BiCMOS Design Significantly Reduces  $I_{CCZ}$
- ESD Protection Exceeds 2000 V Per MIL-STD-883C, Method 3015
- 3-State Outputs Drive Bus Lines or Buffer Memory Address Registers
- Package Options Include Plastic Small-Outline (DW) and Shrink Small-Outline (DB) Packages, Ceramic Chip Carriers (FK) and Flatpacks (W), and Standard Plastic and Ceramic 300-mil DIPs (J, N)

## description

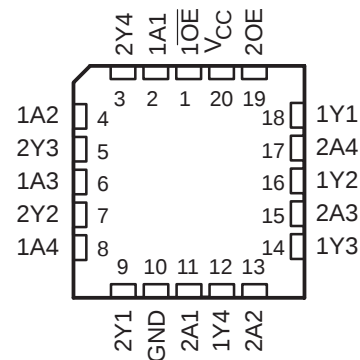
These octal buffers and line drivers are designed specifically to improve both the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters. Taken together with the 'BCT240 and 'BCT244, these devices provide the choice of selected combinations of inverting and noninverting outputs, symmetrical  $\overline{OE}$  (active-low output-enable) inputs, and complementary OE and  $\overline{OE}$  inputs.

The SN54BCT241 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74BCT241 is characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

SN54BCT241 . . . J OR W PACKAGE  
SN74BCT241 . . . DB, DW OR N PACKAGE  
(TOP VIEW)



SN54BCT241 . . . FK PACKAGE  
(TOP VIEW)



FUNCTION TABLES

| INPUTS           |    | OUTPUT |
|------------------|----|--------|
| $\overline{1OE}$ | 1A | 1Y     |
| L                | H  | H      |
| L                | L  | L      |
| H                | X  | Z      |

| INPUTS |    | OUTPUT |
|--------|----|--------|
| 2OE    | 2A | 2Y     |
| H      | H  | H      |
| H      | L  | L      |
| L      | X  | Z      |

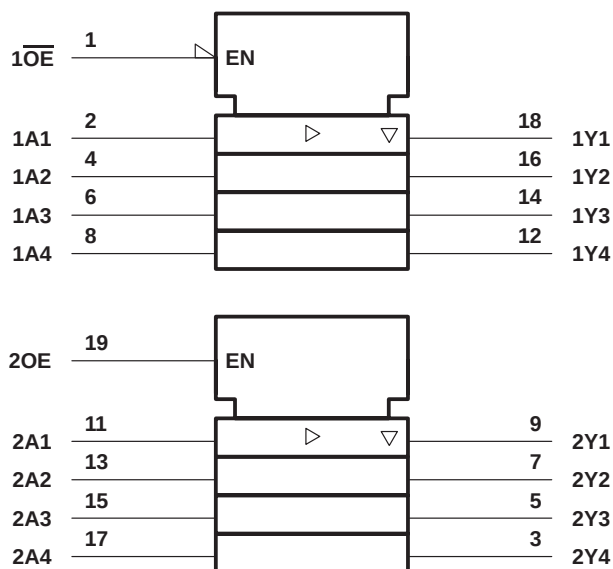
# SN54BCT241, SN74BCT241

## OCTAL BUFFERS/DRIVERS

### WITH 3-STATE OUTPUTS

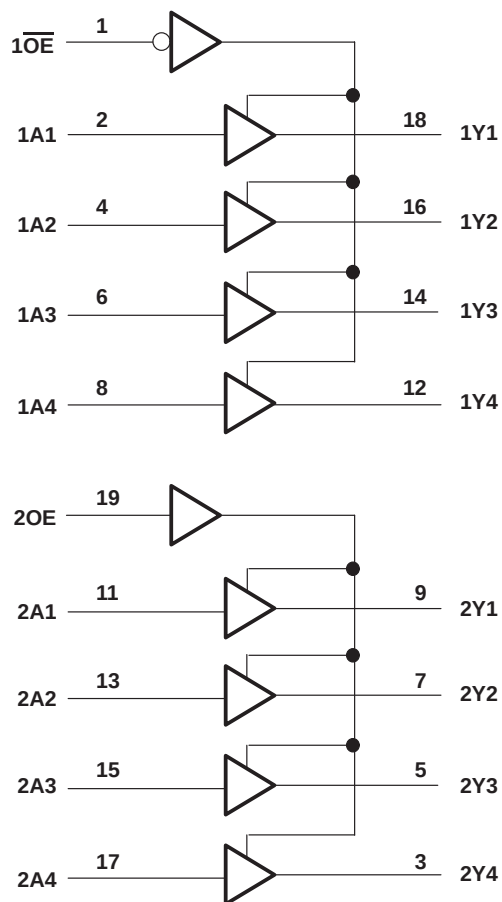
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#### logic symbol†



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

#### logic diagram (positive logic)



#### 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      |
| Voltage range applied to any output in the disabled or power-off state, $V_O$ | – 0.5 V to 5.5 V    |
| Voltage range applied to any output in the high state, $V_O$                  | – 0.5 V to $V_{CC}$ |
| Input clamp current, $I_{IK}$                                                 | – 30 mA             |
| Current into any output in the low state: SN54BCT241                          | 96 mA               |
| SN74BCT241                                                                    | 128 mA              |
| Operating free-air temperature range: SN54BCT241                              | – 55°C to 125°C     |
| SN74BCT241                                                                    | 0°C to 70°C         |
| Storage temperature range                                                     | – 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.

NOTE 1: The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

# SN54BCT241, SN74BCT241 OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

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## recommended operating conditions

|          |                                | SN54BCT241 |     |     | SN74BCT241 |     |     | UNIT |
|----------|--------------------------------|------------|-----|-----|------------|-----|-----|------|
|          |                                | MIN        | NOM | MAX | MIN        | NOM | MAX |      |
| $V_{CC}$ | Supply voltage                 | 4.5        | 5   | 5.5 | 4.5        | 5   | 5.5 | V    |
| $V_{IH}$ | High-level input voltage       | 2          |     |     | 2          |     |     | V    |
| $V_{IL}$ | Low-level input voltage        |            |     | 0.8 |            |     | 0.8 | V    |
| $I_{IK}$ | Input clamp current            |            |     | –18 |            |     | –18 | mA   |
| $I_{OH}$ | High-level output current      |            |     | –12 |            |     | –15 | mA   |
| $I_{OL}$ | Low-level output current       |            |     | 48  |            |     | 64  | mA   |
| $T_A$    | Operating free-air temperature | –55        |     | 125 | 0          |     | 70  | °C   |

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

| PARAMETER         |             | TEST CONDITIONS                                                | SN54BCT241 |      |      | SN74BCT241 |      |      | UNIT |
|-------------------|-------------|----------------------------------------------------------------|------------|------|------|------------|------|------|------|
|                   |             |                                                                | MIN        | TYP† | MAX  | MIN        | TYP† | MAX  |      |
| $V_{IK}$          |             | $V_{CC} = 4.5\text{ V}$ , $I_I = -18\text{ mA}$                |            |      | –1.2 |            |      | –1.2 | V    |
| $V_{OH}$          |             | $V_{CC} = 4.5\text{ V}$ , $I_{OH} = -3\text{ mA}$              | 2.4        | 3.3  |      | 2.4        | 3.3  |      | V    |
|                   |             | $V_{CC} = 4.5\text{ V}$ , $I_{OH} = -12\text{ mA}$             | 2          | 3.2  |      |            |      |      |      |
|                   |             | $V_{CC} = 4.5\text{ V}$ , $I_{OH} = -15\text{ mA}$             |            |      |      | 2          | 3.1  |      |      |
| $V_{OL}$          |             | $V_{CC} = 4.5\text{ V}$ , $I_{OL} = 48\text{ mA}$              |            | 0.38 | 0.55 |            |      |      | V    |
|                   |             | $V_{CC} = 4.5\text{ V}$ , $I_{OL} = 64\text{ mA}$              |            |      |      |            | 0.42 | 0.55 |      |
| $I_I$             |             | $V_{CC} = 5.5\text{ V}$ , $V_I = 7\text{ V}$                   |            |      | 0.1  |            |      | 0.1  | mA   |
| $I_{IH}$          |             | $V_{CC} = 5.5\text{ V}$ , $V_I = 2.7\text{ V}$                 |            |      | 20   |            |      | 20   | μA   |
| $I_{IL}$          | 10E or 20E  | $V_{CC} = 5.5\text{ V}$ , $V_I = 0.5\text{ V}$                 |            |      | –1   |            |      | –1   | mA   |
|                   | Any A input |                                                                |            |      | –1.6 |            |      | –1.6 |      |
| $I_{OZH}$         |             | $V_{CC} = 5.5\text{ V}$ , $V_O = 2.7\text{ V}$                 |            |      | 50   |            |      | 50   | μA   |
| $I_{OZL}$         |             | $V_{CC} = 5.5\text{ V}$ , $V_O = 0.5\text{ V}$                 |            |      | –50  |            |      | –50  | μA   |
| $I_{OS}^\ddagger$ |             | $V_{CC} = 5.5\text{ V}$ , $V_O = 0$                            | –100       |      | –225 | –100       |      | –225 | mA   |
| $I_{CCH}$         |             | $V_{CC} = 5.5\text{ V}$ , Outputs open                         |            | 23   | 43   |            | 23   | 43   | mA   |
| $I_{CCL}$         |             | $V_{CC} = 5.5\text{ V}$ , Outputs open                         |            | 53   | 85   |            | 53   | 85   | mA   |
| $I_{CCZ}$         |             | $V_{CC} = 5.5\text{ V}$ , Outputs open                         |            | 4    | 10   |            | 4    | 10   | mA   |
| $C_i$             |             | $V_{CC} = 5\text{ V}$ , $V_I = 2.5\text{ V}$ or $0.5\text{ V}$ |            | 6    |      |            | 6    |      | pF   |
| $C_o$             |             | $V_{CC} = 5\text{ V}$ , $V_O = 2.5\text{ V}$ or $0.5\text{ V}$ |            | 11   |      |            | 11   |      | pF   |

† All typical values are at  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

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



# SN54BCT241, SN74BCT241

## OCTAL BUFFERS/DRIVERS

### WITH 3-STATE OUTPUTS

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#### switching characteristics (see Note 2)

| PARAMETER        | FROM<br>(INPUT) | TO<br>(OUTPUT) | V <sub>CC</sub> = 5 V,<br>C <sub>L</sub> = 50 pF,<br>R1 = 500 Ω,<br>R2 = 500 Ω,<br>T <sub>A</sub> = 25°C |     |     | V <sub>CC</sub> = 4.5 V to 5.5 V,<br>C <sub>L</sub> = 50 pF,<br>R1 = 500 Ω,<br>R2 = 500 Ω,<br>T <sub>A</sub> = MIN to MAX† |     |            |     | UNIT |
|------------------|-----------------|----------------|----------------------------------------------------------------------------------------------------------|-----|-----|----------------------------------------------------------------------------------------------------------------------------|-----|------------|-----|------|
|                  |                 |                | 'BCT241                                                                                                  |     |     | SN54BCT241                                                                                                                 |     | SN74BCT241 |     |      |
|                  |                 |                | MIN                                                                                                      | TYP | MAX | MIN                                                                                                                        | MAX | MIN        | MAX |      |
| t <sub>PLH</sub> | A               | Y              | 0.5                                                                                                      | 2.5 | 4.5 | 0.5                                                                                                                        | 5.2 | 0.5        | 4.9 | ns   |
| t <sub>PHL</sub> |                 |                | 1                                                                                                        | 3   | 5.4 | 1                                                                                                                          | 6.3 | 1          | 5.9 |      |
| t <sub>PZH</sub> | OE or OE        | Y              | 1                                                                                                        | 5.7 | 7.8 | 1                                                                                                                          | 9.1 | 1          | 8.7 | ns   |
| t <sub>PZL</sub> |                 |                | 1                                                                                                        | 5.2 | 8.6 | 1                                                                                                                          | 10  | 1          | 9.4 |      |
| t <sub>PHZ</sub> | OE or OE        | Y              | 1                                                                                                        | 5.8 | 6.8 | 1                                                                                                                          | 8.4 | 1          | 8.1 | ns   |
| t <sub>PLZ</sub> |                 |                | 1                                                                                                        | 7   | 8.1 | 1                                                                                                                          | 11  | 1          | 9.9 |      |

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.

**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> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| 5962-9074301M2A  | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | POST-PLATE       | N / A for Pkg Type           |
| 5962-9074301MRA  | ACTIVE                | CDIP         | J               | 20   | 1           | TBD                     | A42 SNPB         | N / A for Pkg Type           |
| 5962-9074301MSA  | ACTIVE                | CFP          | W               | 20   | 1           | TBD                     | Call TI          | N / A for Pkg Type           |
| SN74BCT241DBLE   | OBSOLETE              | SSOP         | DB              | 20   |             | TBD                     | Call TI          | Call TI                      |
| SN74BCT241DBR    | OBSOLETE              | SSOP         | DB              | 20   |             | TBD                     | Call TI          | Call TI                      |
| SN74BCT241DW     | ACTIVE                | SOIC         | DW              | 20   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74BCT241DWE4   | ACTIVE                | SOIC         | DW              | 20   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74BCT241DWG4   | ACTIVE                | SOIC         | DW              | 20   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74BCT241DWR    | ACTIVE                | SOIC         | DW              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74BCT241DWRE4  | ACTIVE                | SOIC         | DW              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74BCT241DWRG4  | ACTIVE                | SOIC         | DW              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74BCT241N      | ACTIVE                | PDIP         | N               | 20   | 20          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| SN74BCT241NE4    | ACTIVE                | PDIP         | N               | 20   | 20          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| SN74BCT241NSR    | ACTIVE                | SO           | NS              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74BCT241NSRE4  | ACTIVE                | SO           | NS              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74BCT241NSRG4  | ACTIVE                | SO           | NS              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SNJ54BCT241FK    | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | POST-PLATE       | N / A for Pkg Type           |
| SNJ54BCT241J     | ACTIVE                | CDIP         | J               | 20   | 1           | TBD                     | A42 SNPB         | N / A for Pkg Type           |
| SNJ54BCT241W     | 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)

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<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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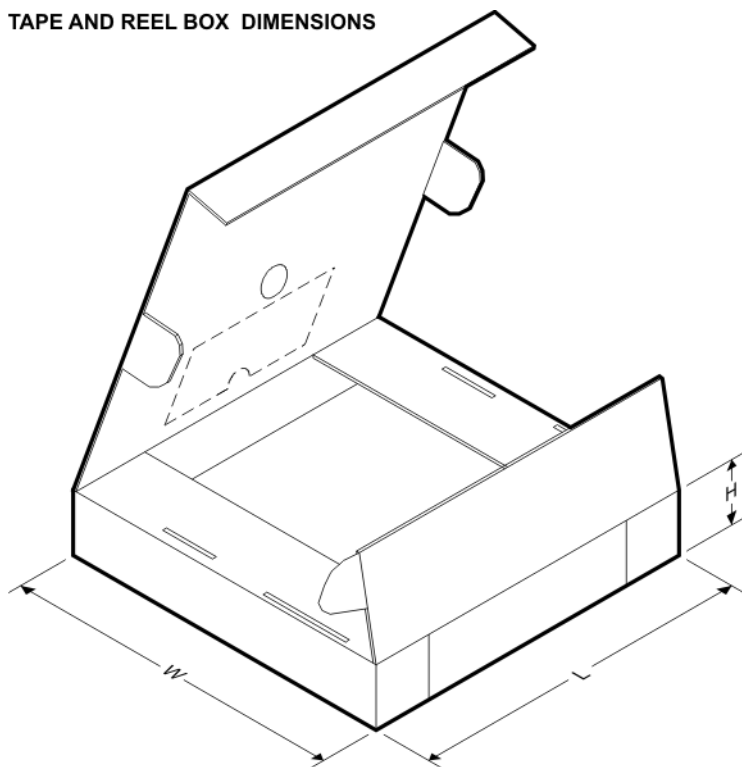
**TAPE AND REEL INFORMATION**



\*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 |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74BCT241DWR | SOIC         | DW              | 20   | 2000 | 330.0              | 24.4               | 10.8    | 13.0    | 2.7     | 12.0    | 24.0   | Q1            |
| SN74BCT241NSR | SO           | NS              | 20   | 2000 | 330.0              | 24.4               | 8.2     | 13.0    | 2.5     | 12.0    | 24.0   | Q1            |

## TAPE AND REEL BOX DIMENSIONS



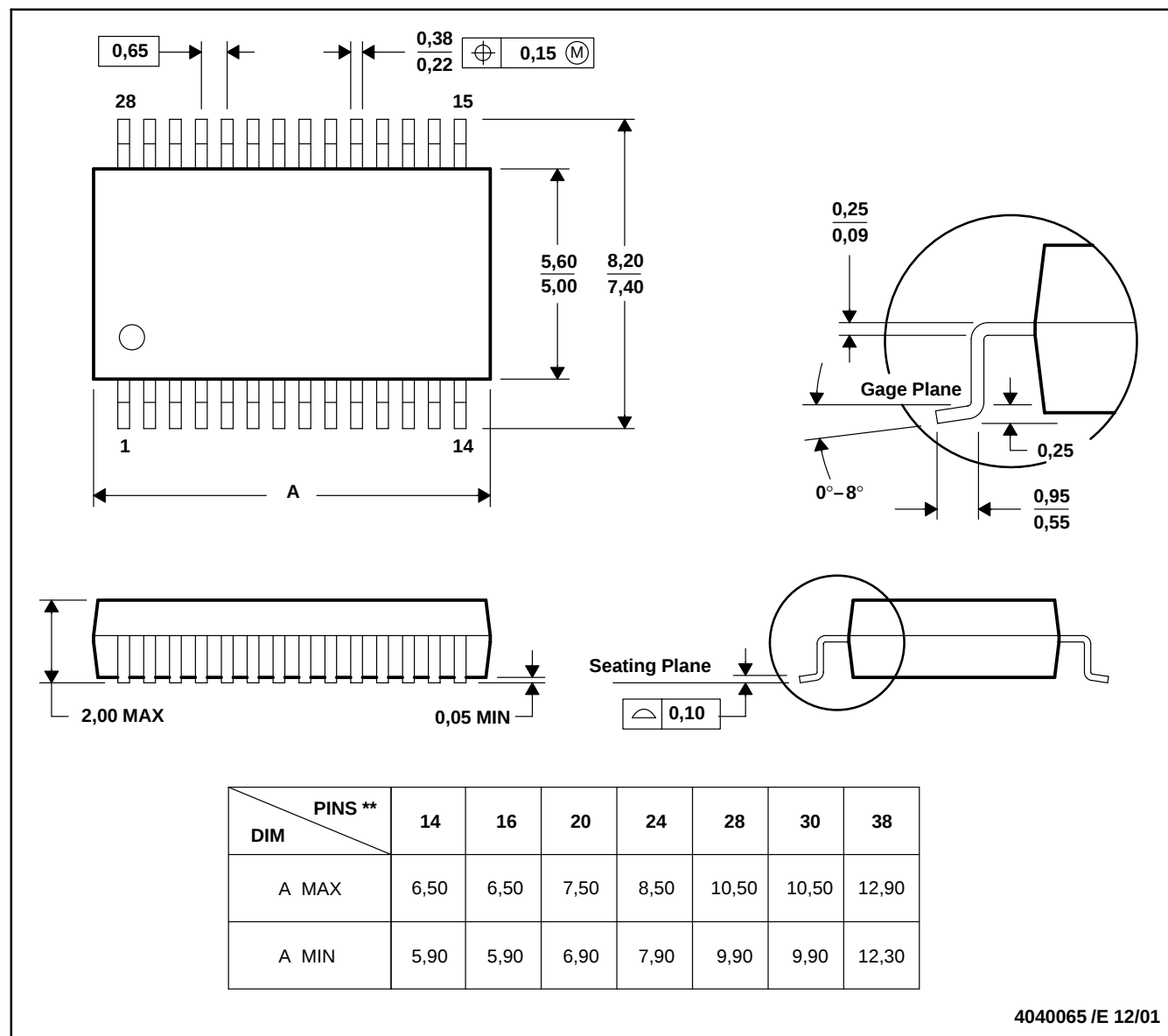
\*All dimensions are nominal

| Device        | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|---------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74BCT241DWR | SOIC         | DW              | 20   | 2000 | 346.0       | 346.0      | 41.0        |
| SN74BCT241NSR | SO           | NS              | 20   | 2000 | 346.0       | 346.0      | 41.0        |

## 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

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

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a metal lid.
  - The terminals are gold plated.
  - Falls within JEDEC MS-004

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.

# 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.

W (R-GDFP-F20)

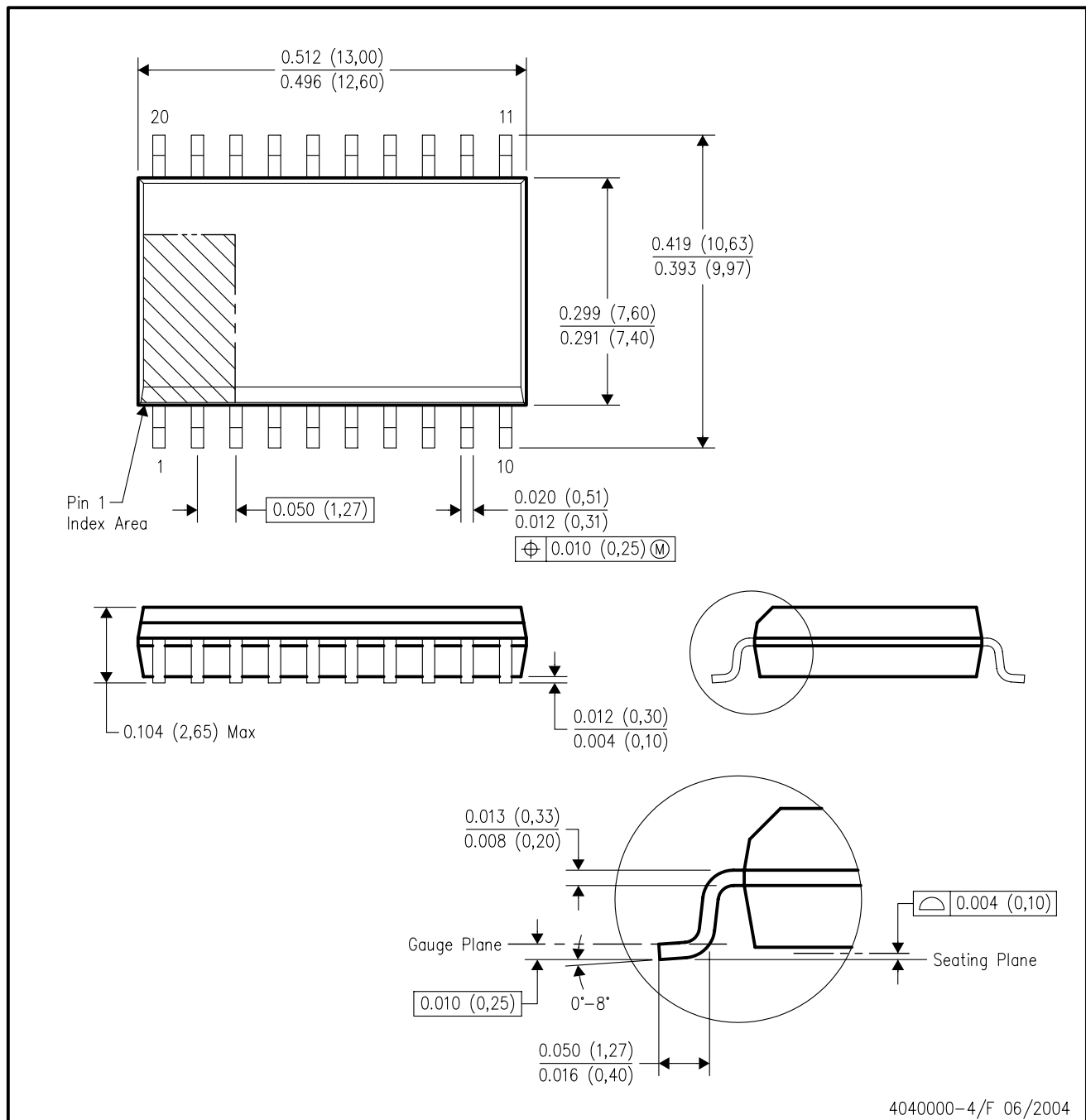
CERAMIC DUAL FLATPACK



- 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:
- 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.

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

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



| PINS **             | 14               | 16               | 18               | 20               |
|---------------------|------------------|------------------|------------------|------------------|
| DIM                 |                  |                  |                  |                  |
| 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.

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Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

### Products

|                             |                                                                    |
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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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| Digital Control    | <a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a> |
| Medical            | <a href="http://www.ti.com/medical">www.ti.com/medical</a>               |
| Military           | <a href="http://www.ti.com/military">www.ti.com/military</a>             |
| Optical Networking | <a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a> |
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