



# SN54BCT574, SN74BCT574 OCTAL TRANSPARENT D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS

SCBS074C – SEPTEMBER 1991 – REVISED MARCH 2003

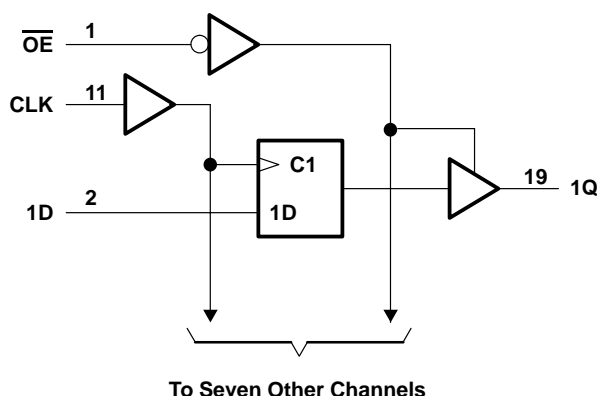
## description/ordering information (continued)

$\overline{OE}$  does not affect internal operations of the flip-flops. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

FUNCTION TABLE  
(each flip-flop)

| INPUTS          |        |   | OUTPUT |
|-----------------|--------|---|--------|
| $\overline{OE}$ | CLK    | D | Q      |
| L               | ↑      | H | H      |
| L               | ↑      | L | L      |
| L               | H or L | X | $Q_0$  |
| H               | X      | 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      |
| 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, $V_{OH}$ .....               | -0.5 V to $V_{CC}$ |
| Input clamp current, $I_{IK}$ ( $V_I < 0$ ) .....                                   | -30 mA             |
| Current into any output in the low state: SN54BCT574 .....                          | 96 mA              |
| SN74BCT574 .....  | 128 mA             |
| Package thermal impedance, $\theta_{JA}$ (see Note 2): DB package .....             | 70°C/W             |
| DW package .....  | 58°C/W             |
| N package .....   | 69°C/W             |
| NS package .....  | 60°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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## recommended operating conditions (see Note 3)

|          |                                | SN54BCT574 |     |     | SN74BCT574 |     |     | 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   |

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

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

| PARAMETER         | TEST CONDITIONS           |  | SN54BCT574 |      | SN74BCT574 |      | UNIT |      |
|-------------------|---------------------------|--|------------|------|------------|------|------|------|
|                   |                           |  | MIN        | TYP† | MAX        | MIN  |      | TYP† |
| $V_{IK}$          | $V_{CC} = 4.5\text{ V}$ , | $I_I = -18\text{ mA}$                  |            |      | -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    |      |
|                   |                           | $I_{OH} = -12\text{ mA}$               | 2          | 3.2  |            |      |      |      |
|                   |                           | $I_{OH} = -15\text{ mA}$               |            |      | 2          | 3.1  |      |      |
| $V_{OL}$          | $V_{CC} = 4.5\text{ V}$   | $I_{OL} = 48\text{ mA}$                |            | 0.38 | 0.55       |      | V    |      |
|                   |                           | $I_{OL} = 64\text{ mA}$                |            |      |            | 0.42 |      | 0.55 |
| $I_I$             | $V_{CC} = 5.5\text{ V}$ , | $V_I = 5.5\text{ V}$                   |            |      | 0.4        |      | 0.4  | mA   |
| $I_{IH}$          | $V_{CC} = 5.5\text{ V}$ , | $V_I = 2.7\text{ V}$                   |            |      | 20         |      | 20   | μA   |
| $I_{IL}$          | $V_{CC} = 5.5\text{ V}$ , | $V_I = 0.5\text{ V}$                   |            |      | -0.6       |      | -0.6 | mA   |
| $I_{OS}^\ddagger$ | $V_{CC} = 5.5\text{ V}$ , | $V_O = 0$                              | -100       |      | -225       | -100 | -225 | mA   |
| $I_{OZH}$         | $V_{CC} = 5.5\text{ V}$ , | $V_O = 2.7\text{ V}$                   |            |      | 50         |      | 50   | μA   |
| $I_{OZL}$         | $V_{CC} = 5.5\text{ V}$ , | $V_O = 0.5\text{ V}$                   |            |      | -50        |      | -50  | μA   |
| $I_{CCL}$         | $V_{CC} = 5.5\text{ V}$ , | Outputs open                           |            | 38.1 | 62         | 38.1 | 62   | mA   |
| $I_{CCH}$         | $V_{CC} = 5.5\text{ V}$ , | Outputs open                           |            | 4.9  | 8          | 4.9  | 8    | mA   |
| $I_{CCZ}$         | $V_{CC} = 5.5\text{ V}$ , | Outputs open                           |            | 4.5  | 8          | 4.9  | 8    | mA   |
| $C_i$             | $V_{CC} = 5\text{ V}$ ,   | $V_I = 2.5\text{ V}$ or $0.5\text{ V}$ |            |      |            | 5.5  |      | pF   |
| $C_o$             | $V_{CC} = 5\text{ V}$ ,   | $V_O = 2.5\text{ V}$ or $0.5\text{ V}$ |            |      |            | 7.5  |      | 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.

## timing requirements over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)

|                    |                                 | $V_{CC} = 5\text{ V}$ ,<br>$T_A = 25^\circ\text{C}$ |     | SN54BCT574 |     | SN74BCT574 |     | UNIT |
|--------------------|---------------------------------|---|-----|------------|-----|------------|-----|------|
|                    |                                 | MIN   | MAX | MIN        | MAX | MIN        | MAX |      |
| $f_{\text{clock}}$ | Clock frequency                 |   | 77  |            | 77  |            | 77  | MHz  |
| $t_w$              | Pulse duration, CLK high or low | 6.5   |     | 6.5        |     | 6.5        |     | ns   |
| $t_{su}$           | Setup time, data before CLK↑    | High  | 4.5 | 4.5        |     | 4.5        |     | ns   |
|                    |                                 | Low   | 6   | 6          |     | 6          |     |      |
| $t_h$              | Hold time, data after CLK↑      |   | 0   | 1          |     | 0          |     | ns   |



**SN54BCT574, SN74BCT574**  
**OCTAL TRANSPARENT D-TYPE FLIP-FLOPS**  
**WITH 3-STATE OUTPUTS**

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switching characteristics over recommended ranges of supply voltage and operating free-air temperature,  $C_L = 50$  pF (unless otherwise noted) (see Figure 1)

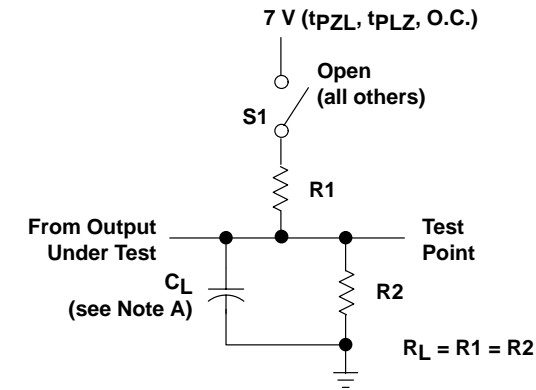
| PARAMETER | FROM (INPUT)    | TO (OUTPUT) | $V_{CC} = 5$ V,<br>$T_A = 25^\circ$ C |     |     | SN54BCT574 |      | SN74BCT574 |      | UNIT |
|-----------|-----------------|-------------|---------------------------------------|-----|-----|------------|------|------------|------|------|
|           |                 |             | MIN                                   | TYP | MAX | MIN        | MAX  | MIN        | MAX  |      |
| $f_{max}$ |                 |             | 77                                    |     |     | 77         |      | 77         |      | MHz  |
| $t_{PLH}$ | CLK             | Q           | 2.2                                   | 6.5 | 8.6 | 2.2        | 11.2 | 2.2        | 10   | ns   |
| $t_{PHL}$ |                 |             | 2.8                                   | 6.1 | 8   | 2.8        | 9.7  | 2.8        | 8.9  |      |
| $t_{PZH}$ | $\overline{OE}$ | Q           | 2.5                                   | 6.4 | 8.1 | 2.5        | 10.9 | 2.5        | 10.4 | ns   |
| $t_{PZL}$ |                 |             | 3.7                                   | 7.3 | 9.2 | 3.7        | 11.3 | 3.7        | 10.9 |      |
| $t_{PHZ}$ | $\overline{OE}$ | Q           | 1                                     | 4.4 | 7.4 | 1          | 8    | 1          | 7.5  | ns   |
| $t_{PLZ}$ |                 |             | 1.3                                   | 4.2 | 5.8 | 1.3        | 7.1  | 1.3        | 6.4  |      |



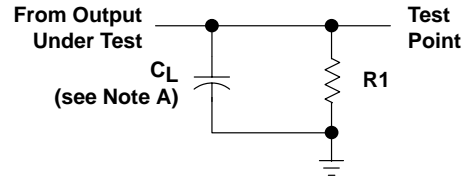
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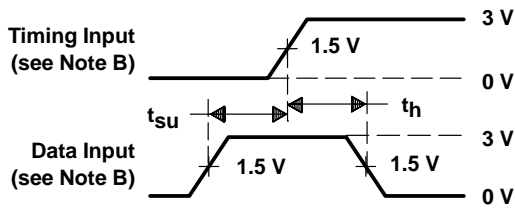
## PARAMETER MEASUREMENT INFORMATION



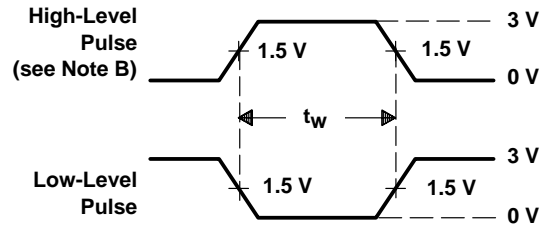
**LOAD CIRCUIT FOR  
3-STATE AND OPEN-COLLECTOR OUTPUTS**



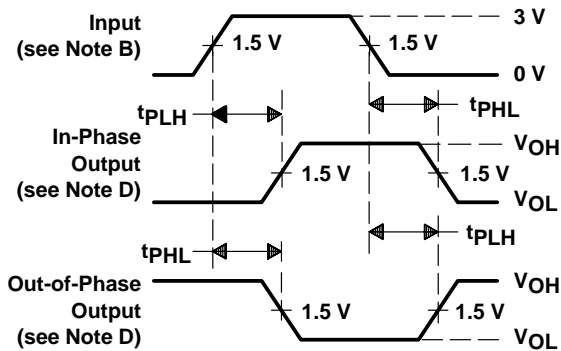
**LOAD CIRCUIT FOR  
TOTEM-POLE OUTPUTS**



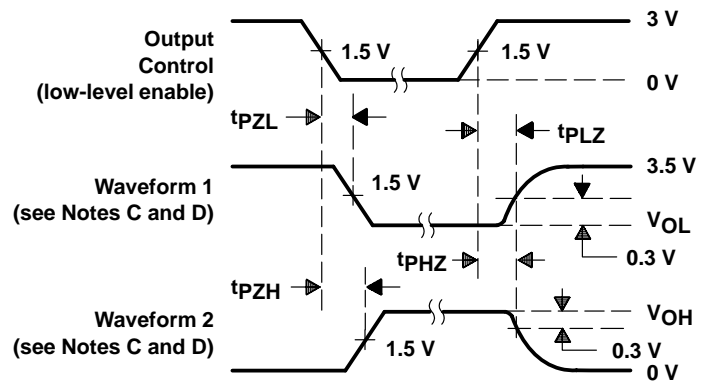
**VOLTAGE WAVEFORMS  
SETUP AND HOLD TIMES**



**VOLTAGE WAVEFORMS  
PULSE DURATION**



**VOLTAGE WAVEFORMS  
PROPAGATION DELAY TIMES (see Note D)**



**VOLTAGE WAVEFORMS  
ENABLE AND DISABLE TIMES, 3-STATE OUTPUTS**

- NOTES:
- A.  $C_L$  includes probe and jig capacitance.
  - B. 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%.
  - C. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
  - D. The outputs are measured one at a time with one transition per measurement.
  - E. When measuring propagation delay times of 3-state outputs, switch S1 is open.
  - F. 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> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| 5962-9583601Q2A  | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | POST-PLATE       | N / A for Pkg Type           |
| 5962-9583601QRA  | ACTIVE                | CDIP         | J               | 20   | 1           | TBD                     | A42              | N / A for Pkg Type           |
| 5962-9583601QSA  | ACTIVE                | CFP          | W               | 20   | 1           | TBD                     | Call TI          | N / A for Pkg Type           |
| SN74BCT574DBRE4  | ACTIVE                | SSOP         | DB              | 20   |             | TBD                     | Call TI          | Call TI                      |
| SN74BCT574DBRG4  | ACTIVE                | SSOP         | DB              | 20   |             | TBD                     | Call TI          | Call TI                      |
| SN74BCT574DW     | ACTIVE                | SOIC         | DW              | 20   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74BCT574DWE4   | ACTIVE                | SOIC         | DW              | 20   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74BCT574DWG4   | ACTIVE                | SOIC         | DW              | 20   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74BCT574DWR    | ACTIVE                | SOIC         | DW              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74BCT574DWRE4  | ACTIVE                | SOIC         | DW              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74BCT574DWRG4  | ACTIVE                | SOIC         | DW              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74BCT574N      | ACTIVE                | PDIP         | N               | 20   | 20          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| SN74BCT574NE4    | ACTIVE                | PDIP         | N               | 20   | 20          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| SN74BCT574NSR    | ACTIVE                | SO           | NS              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74BCT574NSRE4  | ACTIVE                | SO           | NS              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74BCT574NSRG4  | ACTIVE                | SO           | NS              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SNJ54BCT574FK    | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | POST-PLATE       | N / A for Pkg Type           |
| SNJ54BCT574J     | ACTIVE                | CDIP         | J               | 20   | 1           | TBD                     | A42              | N / A for Pkg Type           |
| SNJ54BCT574W     | 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 |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74BCT574DWR | SOIC         | DW              | 20   | 2000 | 330.0              | 24.4               | 10.8    | 13.0    | 2.7     | 12.0    | 24.0   | Q1            |
| SN74BCT574NSR | SO           | NS              | 20   | 2000 | 330.0              | 24.4               | 8.2     | 13.0    | 2.5     | 12.0    | 24.0   | Q1            |

**TAPE AND REEL BOX DIMENSIONS**

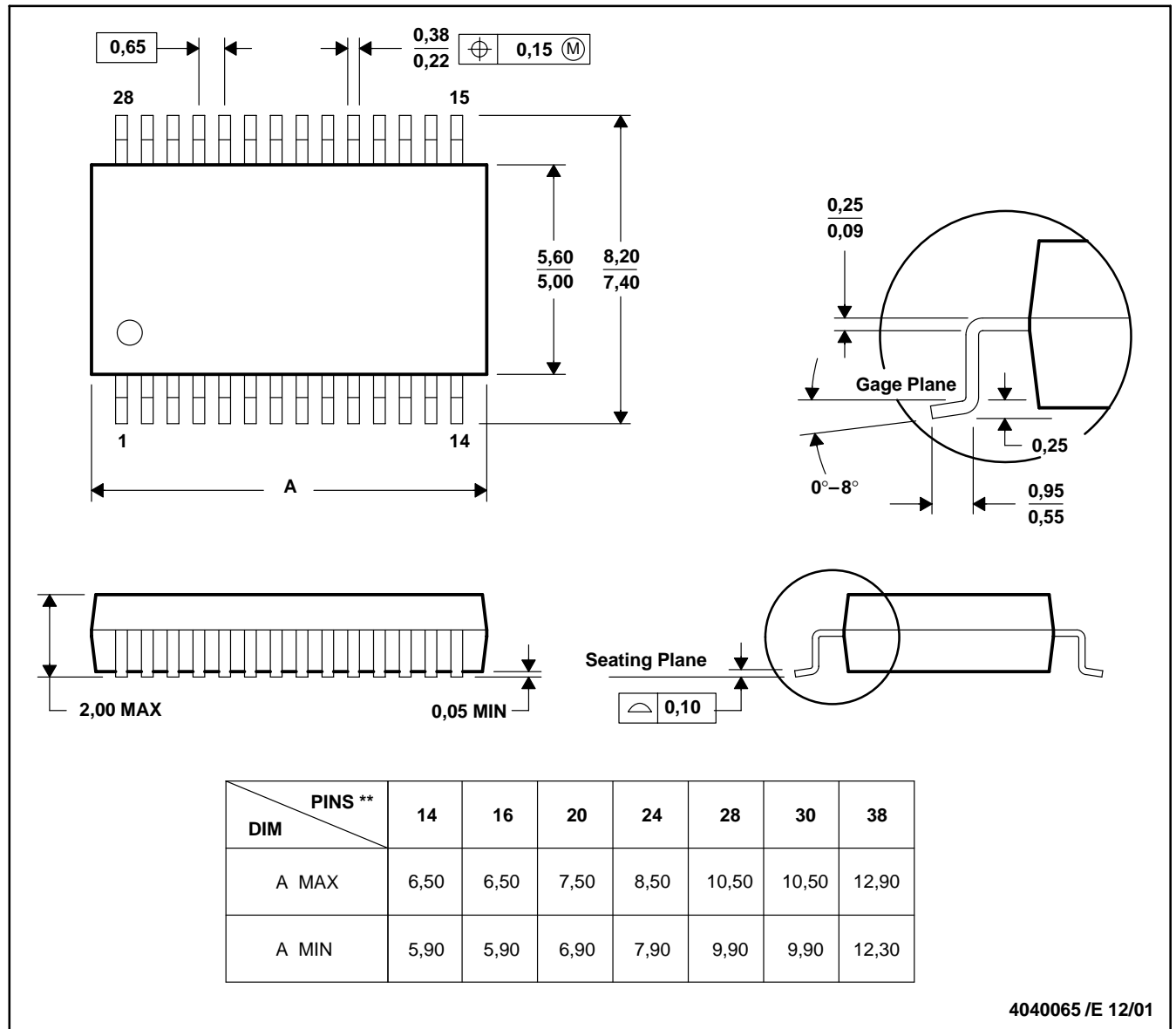

\*All dimensions are nominal

| Device        | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|---------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74BCT574DWR | SOIC         | DW              | 20   | 2000 | 346.0       | 346.0      | 41.0        |
| SN74BCT574NSR | 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:
- 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

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.

## MECHANICAL DATA

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

**PLASTIC SMALL-OUTLINE PACKAGE**

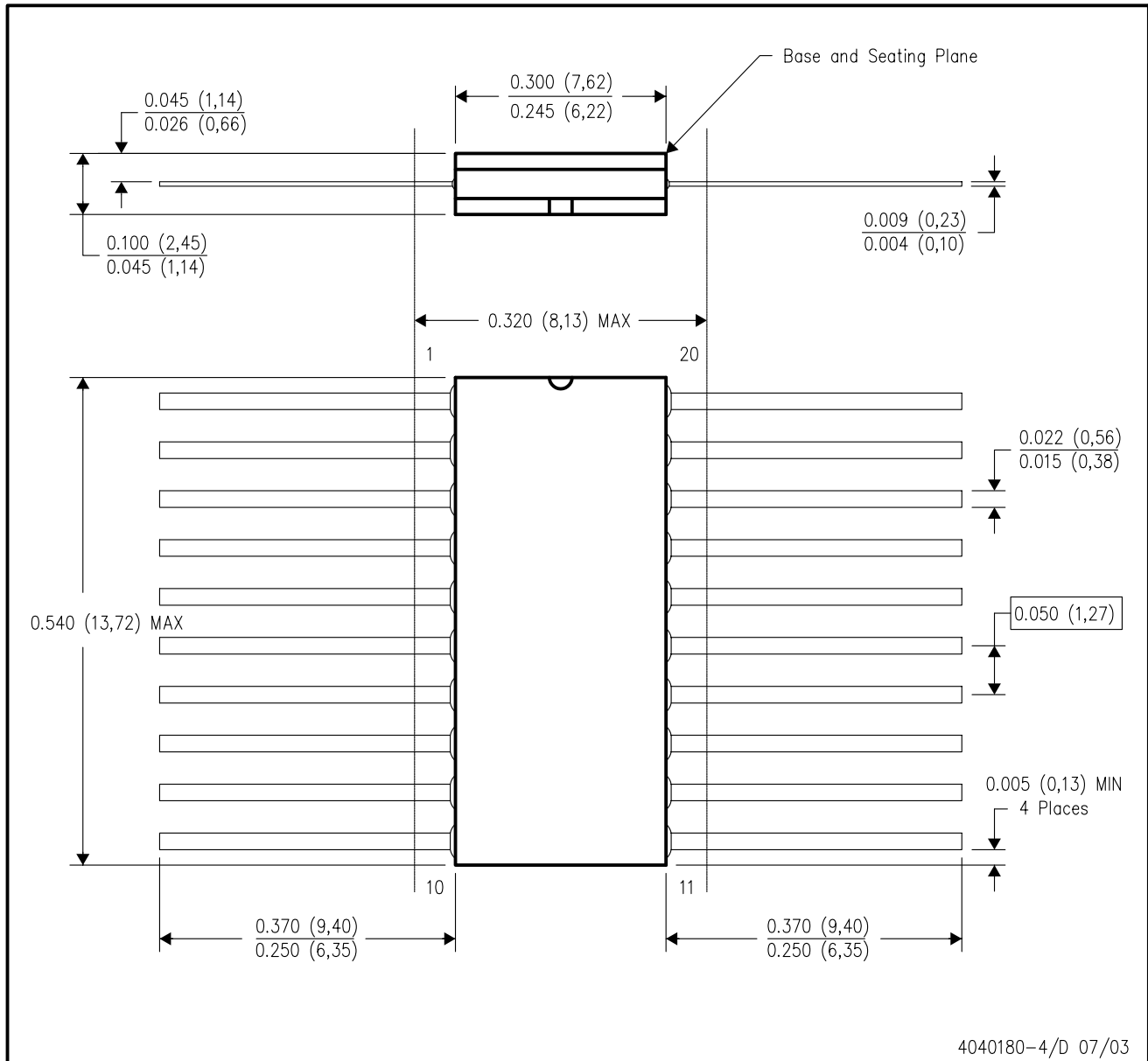
**14-PINS SHOWN**



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

DW (R-PDSO-G20)

PLASTIC SMALL-OUTLINE PACKAGE



4040000-4/F 06/2004

- 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.
  - $\triangle C$  Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - $\triangle D$  The 20 pin end lead shoulder width is a vendor option, either half or full width.

4040049/E 12/2002

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| DLP® Products               | <a href="http://www.dlp.com">www.dlp.com</a>                       |
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