

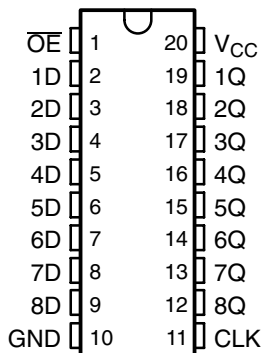
# SN54BCT574, SN74BCT574 OCTAL TRANSPARENT D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS

SCBS074C – SEPTEMBER 1991 – REVISED MARCH 2003

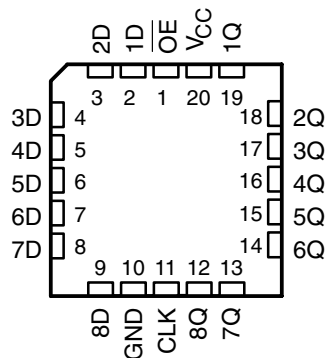
- Operating Voltage Range of 4.5 V to 5.5 V
- State-of-the-Art BiCMOS Design Significantly Reduces  $I_{CCZ}$
- Full Parallel Access for Loading

- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)

SN54BCT574 . . . J OR W PACKAGE  
SN74BCT574 . . . DB, DW, N, OR NS PACKAGE  
(TOP VIEW)



SN54BCT574 . . . FK PACKAGE  
(TOP VIEW)



## description/ordering information

These 8-bit flip-flops feature 3-state outputs designed specifically for driving highly capacitive or relatively low-impedance loads. They are particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

The eight flip-flops of the 'BCT574 devices are edge-triggered D-type flip-flops. On the positive transition of the clock (CLK) input, the Q outputs are set to the logic levels that were set up at the data (D) inputs.

A buffered output-enable ( $\overline{OE}$ ) input can be used to place the eight outputs in either a normal logic state (high or low logic levels) or the high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly. The high-impedance state and increased drive provide the capability to drive bus lines without interface or pullup components.

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.

## ORDERING INFORMATION

| $T_A$          | PACKAGE†  |               | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|-----------|---------------|-----------------------|------------------|
| 0°C to 70°C    | PDIP – N  | Tube          | SN74BCT574N           | BCT574           |
|                | SOIC – DW | Tube          | SN74BCT574DW          |                  |
|                |           | Tape and reel | SN74BCT574DWR         |                  |
|                | SOP – NS  | Tape and reel | SN74BCT574NSR         | BCT574           |
| –55°C to 125°C | SSOP – DB | Tape and reel | SN74BCT574DBR         | BT574            |
|                | CDIP – J  | Tube          | SNJ54BCT574J          | SNJ54BCT574J     |
|                | CFP – W   | Tube          | SNJ54BCT574W          | SNJ54BCT574W     |
|                | LCCC – FK | Tube          | SNJ54BCT574FK         | SNJ54BCT574FK    |

† 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.

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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.

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

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## description/ordering information (continued)

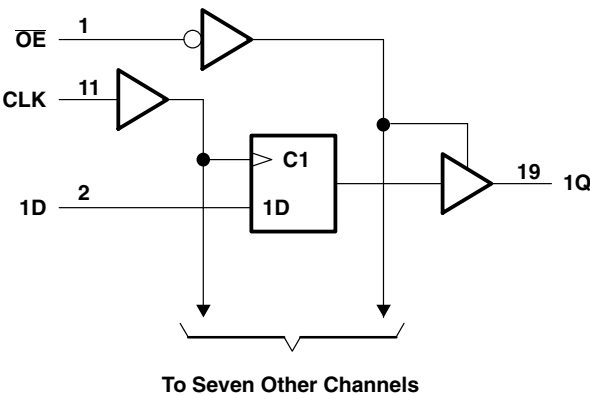
$\overline{OE}$  does not affect internal operations of the flip-flops. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

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, $V_O$                  | –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.

# SN54BCT574, SN74BCT574

## OCTAL TRANSPARENT D-TYPE FLIP-FLOPS

### WITH 3-STATE OUTPUTS

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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† | 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> = −3 mA  | 2.4        | 3.3  |      | 2.4        | 3.3  |      | V    |
|                              |                                                        | I <sub>OH</sub> = −12 mA | 2          | 3.2  |      |            |      |      |      |
|                              |                                                        | I <sub>OH</sub> = −15 mA |            |      |      | 2          | 3.1  |      |      |
| V <sub>OL</sub>              | V <sub>CC</sub> = 4.5 V                                | I <sub>OL</sub> = 48 mA  | 0.38       |      | 0.55 |            |      |      | V    |
|                              |                                                        | I <sub>OL</sub> = 64 mA  |            |      |      | 0.42       | 0.55 |      |      |
| I <sub>I</sub>               | V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 5.5 V        |                          | 0.4        |      |      | 0.4        |      |      | 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        |                          | −0.6       |      |      | −0.6       |      |      | mA   |
| I <sub>OS</sub> <sup>‡</sup> | V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 0            |                          | −100       |      | −225 | −100       |      | −225 | 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>CCL</sub>             | V <sub>CC</sub> = 5.5 V, Outputs open                  |                          | 38.1       | 62   |      | 38.1       | 62   |      | mA   |
| I <sub>CCH</sub>             | V <sub>CC</sub> = 5.5 V, Outputs open                  |                          | 4.9        | 8    |      | 4.9        | 8    |      | mA   |
| I <sub>CCZ</sub>             | V <sub>CC</sub> = 5.5 V, Outputs open                  |                          | 4.5        | 8    |      | 4.9        | 8    |      | mA   |
| C <sub>i</sub>               | V <sub>CC</sub> = 5 V, V <sub>I</sub> = 2.5 V or 0.5 V |                          |            |      |      | 5.5        |      |      | pF   |
| C <sub>o</sub>               | V <sub>CC</sub> = 5 V, V <sub>O</sub> = 2.5 V or 0.5 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        |     | ns   |
|                    |                                 | Low                                                 |     | 6          |     | 6          |     |      |
| $t_h$              | Hold time, data after CLK↑      | High or low                                         |     | 0          |     | 1          |     | ns   |



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# 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<br>(INPUT) | TO<br>(OUTPUT) | $V_{CC} = 5$ V,<br>$T_A = 25^\circ\text{C}$ |     |     | 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  |      |

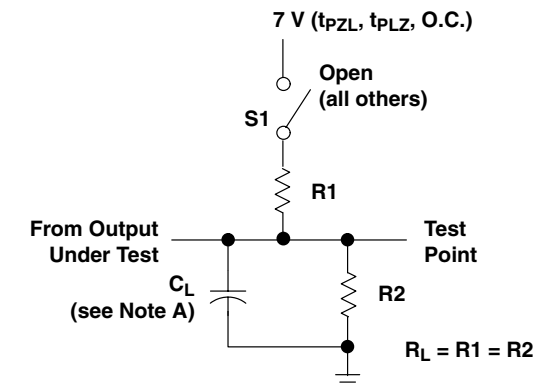


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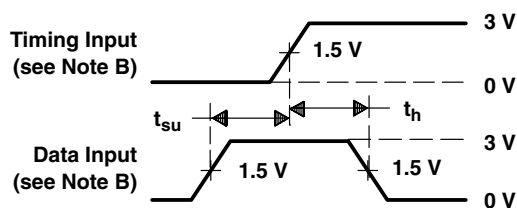
# SN54BCT574, SN74BCT574 OCTAL TRANSPARENT D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS

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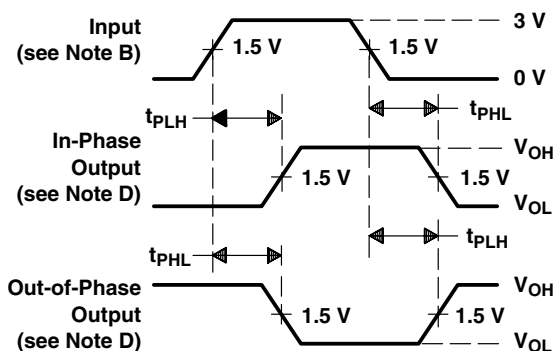
## PARAMETER MEASUREMENT INFORMATION



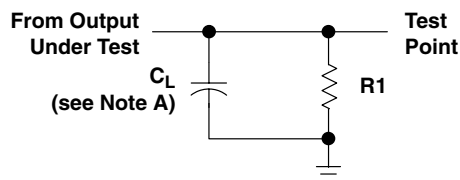
LOAD CIRCUIT FOR  
3-STATE AND OPEN-COLLECTOR OUTPUTS



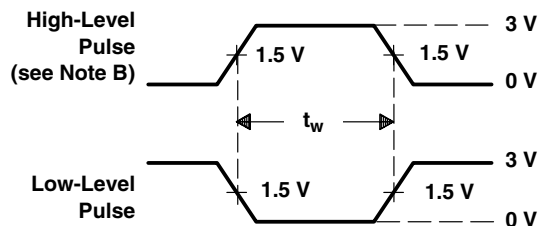
VOLTAGE WAVEFORMS  
SETUP AND HOLD TIMES



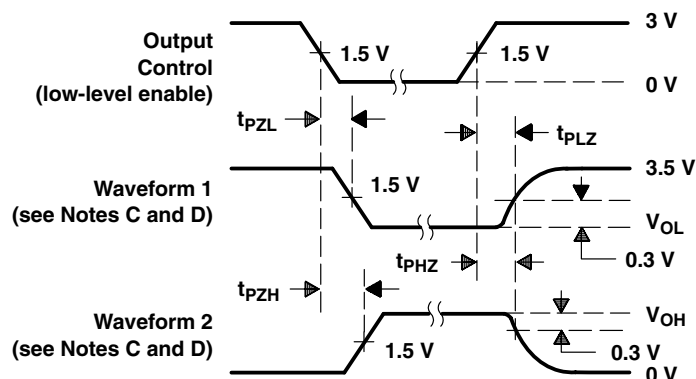
VOLTAGE WAVEFORMS  
PROPAGATION DELAY TIMES (see Note D)



LOAD CIRCUIT FOR  
TOTEM-POLE OUTPUTS



VOLTAGE WAVEFORMS  
PULSE DURATION



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<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)     | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5)             | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|---------------------|--------------------------------------|----------------------|--------------|-------------------------------------|-------------------------|
| 5962-9583601QRA  | ACTIVE        | CDIP         | J                  | 20   | 1              | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 5962-9583601QR<br>A<br>SNJ54BCT574J | <a href="#">Samples</a> |
| SN74BCT574DW     | ACTIVE        | SOIC         | DW                 | 20   | 25             | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | BCT574                              | <a href="#">Samples</a> |
| SN74BCT574N      | ACTIVE        | PDIP         | N                  | 20   | 20             | RoHS &<br>Non-Green | NIPDAU                               | N / A for Pkg Type   | 0 to 70      | SN74BCT574N                         | <a href="#">Samples</a> |
| SNJ54BCT574J     | ACTIVE        | CDIP         | J                  | 20   | 1              | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 5962-9583601QR<br>A<br>SNJ54BCT574J | <a href="#">Samples</a> |

(1) 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.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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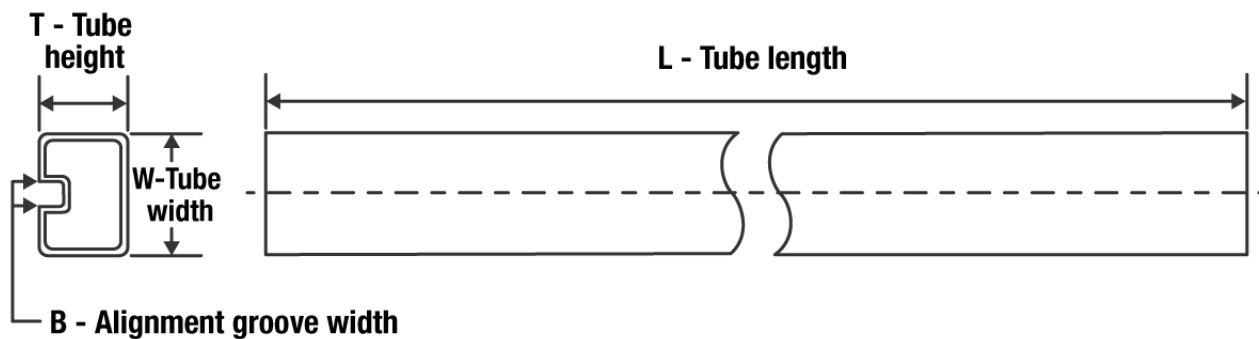
**OTHER QUALIFIED VERSIONS OF SN54BCT574, SN74BCT574 :**

- Catalog: [SN74BCT574](#)
- Military: [SN54BCT574](#)

**NOTE:** Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

## TUBE



\*All dimensions are nominal

| Device       | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|--------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| SN74BCT574DW | DW           | SOIC         | 20   | 25  | 507    | 12.83  | 5080   | 6.6    |
| SN74BCT574N  | N            | PDIP         | 20   | 20  | 506    | 13.97  | 11230  | 4.32   |

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.

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

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



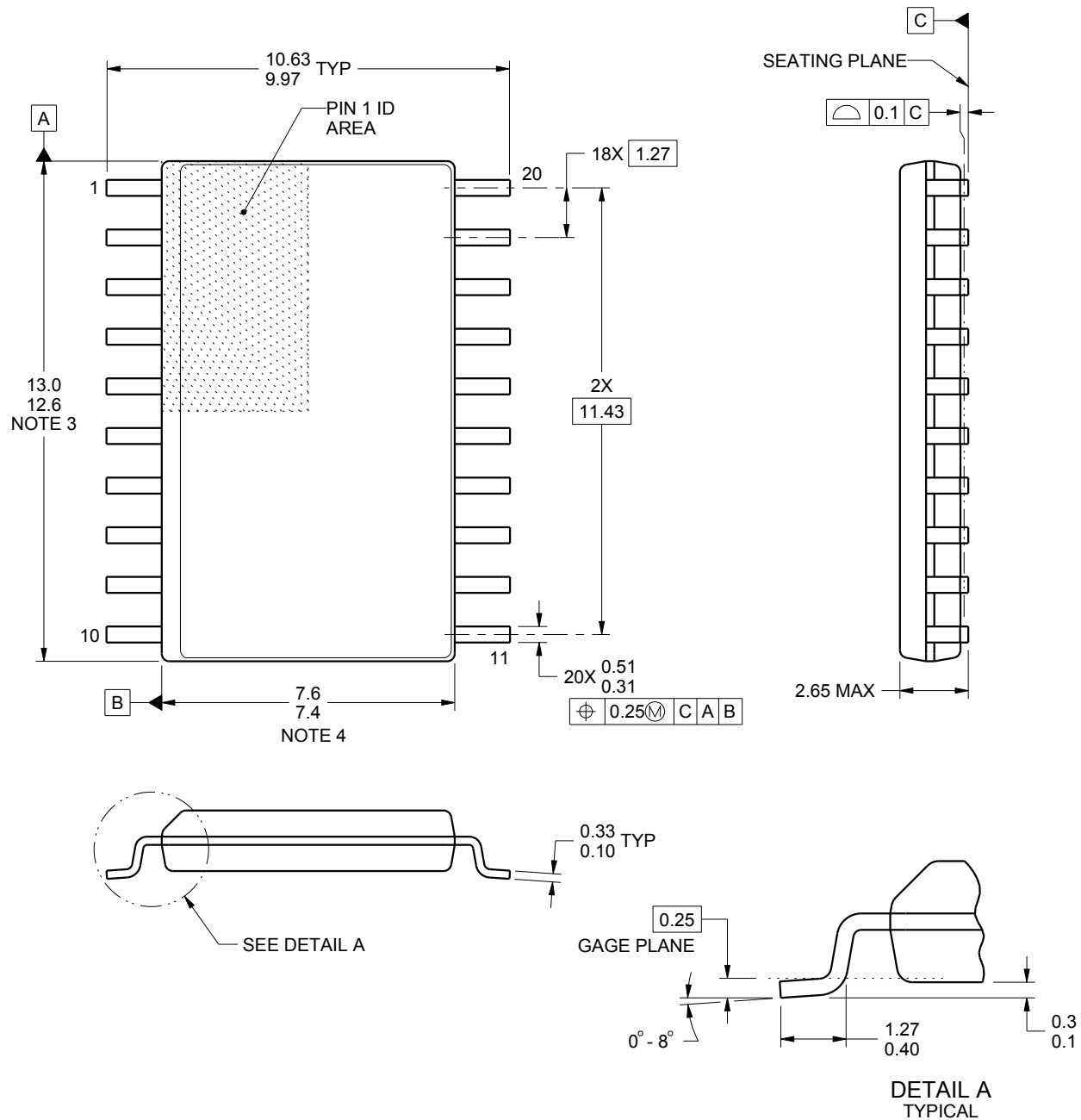
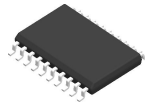
| PINS **<br>DIM      | 14               | 16               | 18               | 20               |
|---------------------|------------------|------------------|------------------|------------------|
| A MAX               | 0.775<br>(19,69) | 0.775<br>(19,69) | 0.920<br>(23,37) | 1.060<br>(26,92) |
| 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.



4220724/A 05/2016

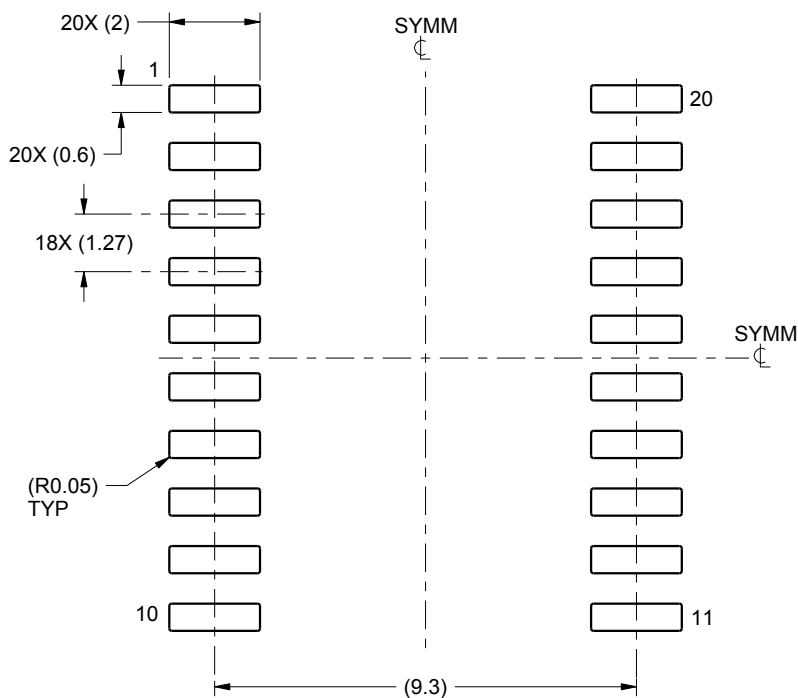
## NOTES:

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.43 mm per side.
5. Reference JEDEC registration MS-013.

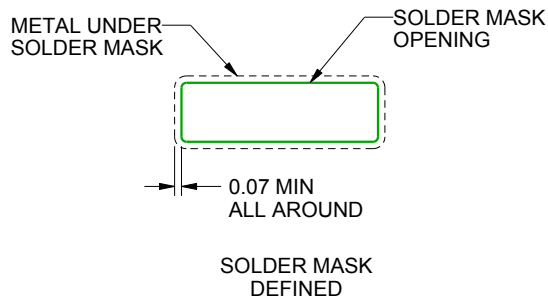
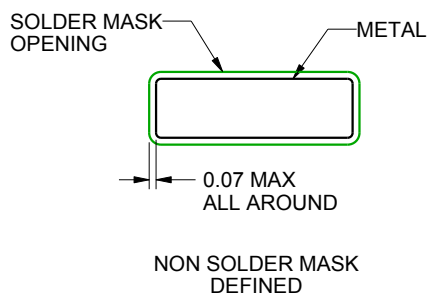
**DW0020A**

### SOIC - 2.65 mm max height

SOIC



LAND PATTERN EXAMPLE  
SCALE:6X



## SOLDER MASK DETAILS

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NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.  
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

## EXAMPLE STENCIL DESIGN

DW0020A

SOIC - 2.65 mm max height

SOIC



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:6X

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NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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