

# SN54ALS574B, SN54AS574, SN54AS575 SN74ALS574B, SN74ALS575A, SN74AS574, SN74AS575 OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

SDAS165B – JUNE 1982 – REVISED JULY 1995

- 3-State Buffer-Type Noninverting Outputs Drive Bus Lines Directly
- Bus-Structured Pinout
- Buffered Control Inputs
- SN74ALS575A and 'AS575 Have Synchronous Clear
- Package Options Include Plastic Small-Outline (DW) Packages, Ceramic Chip Carriers (FK), Standard Plastic (N, NT) and Ceramic (J, JT) 300-mil DIPs, and Ceramic Flat (W) Packages

## description

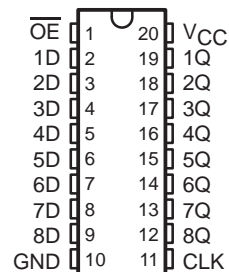
These octal D-type edge-triggered flip-flops feature 3-state outputs designed specifically for bus driving. They are particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

The eight flip-flops enter data on the low-to-high transition of the clock (CLK) input. The SN74ALS575A, SN54AS575, and SN74AS575 may be synchronously cleared by taking the clear ( $\overline{\text{CLR}}$ ) input low.

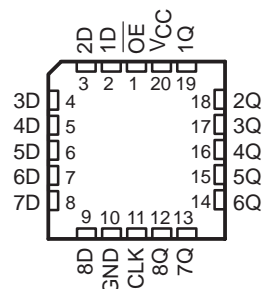
The output-enable ( $\overline{\text{OE}}$ ) input does not affect internal operations of the flip-flops. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

The SN54ALS574B, SN54AS574, and SN54AS575 are characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74ALS574B, SN74ALS575A, SN74AS574, and SN74AS575 are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

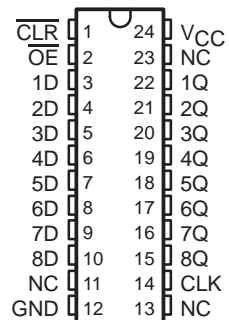
SN54ALS574B, SN54AS574 . . . J OR W PACKAGE  
SN74ALS574B, SN74AS574 . . . DW OR N PACKAGE  
(TOP VIEW)



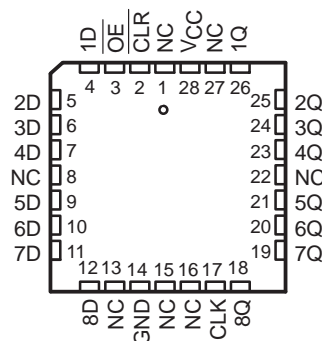
SN54ALS574B, SN54AS574 . . . FK PACKAGE  
(TOP VIEW)



SN54AS575 . . . JT OR W PACKAGE  
SN74ALS575A, SN74AS575 . . . DW OR NT PACKAGE  
(TOP VIEW)



SN54AS575 . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection

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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# SN54ALS574B, SN54AS574, SN54AS575 SN74ALS574B, SN74ALS575A, SN74AS574, SN74AS575 OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

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## Function Tables

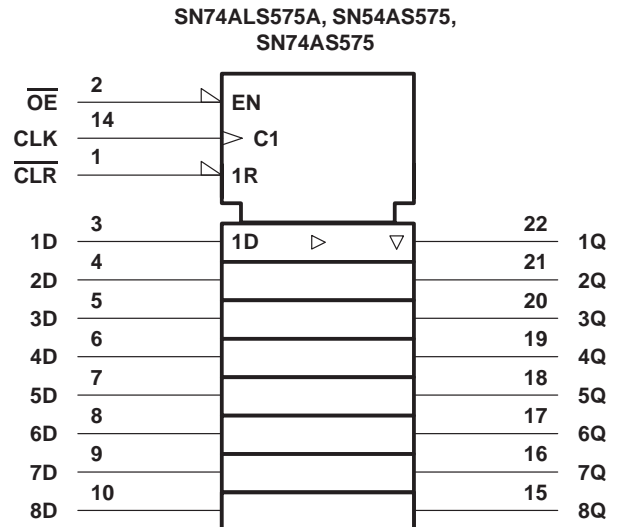
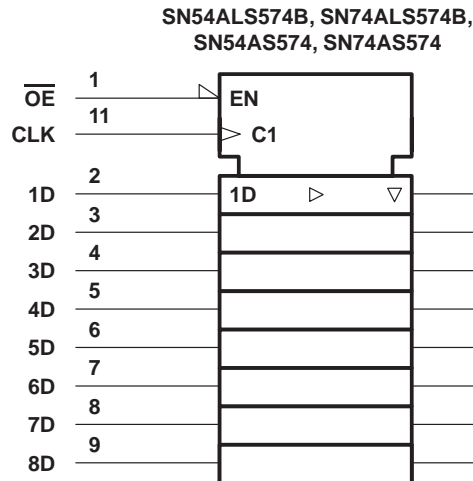
SN54ALS574B, SN74ALS574B, SN54AS574, SN74AS574  
(each flip-flop)

| INPUTS          |     |   | OUTPUT |
|-----------------|-----|---|--------|
| $\overline{OE}$ | CLK | D | Q      |
| L               | ↑   | H | H      |
| L               | ↑   | L | L      |
| L               | L   | X | $Q_0$  |
| H               | X   | X | Z      |

SN74ALS575A, SN54AS575, SN74AS575  
(each flip-flop)

| INPUTS          |     |     |   | OUTPUT |
|-----------------|-----|-----|---|--------|
| $\overline{OE}$ | CLR | CLK | D | Q      |
| L               | L   | ↑   | X | L      |
| L               | H   | ↑   | H | H      |
| L               | H   | ↑   | L | L      |
| L               | H   | L   | X | $Q_0$  |
| H               | X   | H   | X | Z      |

## logic symbol†

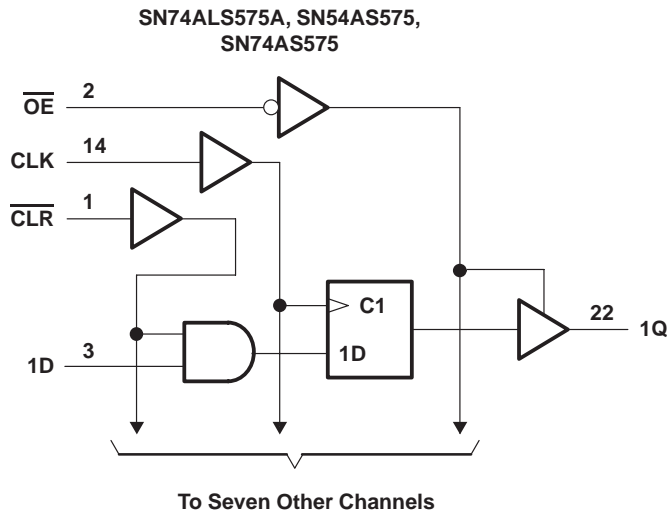
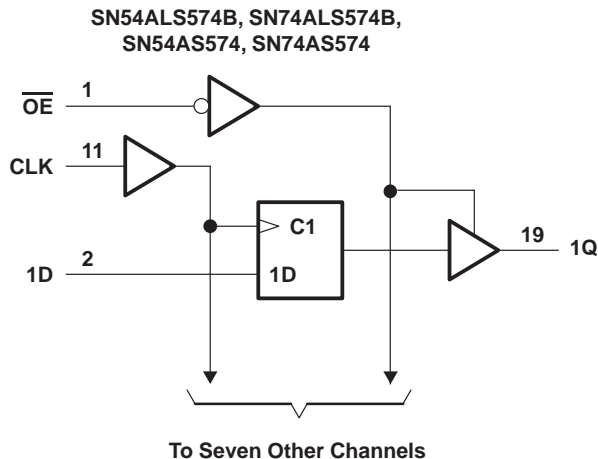


† These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.  
Pin numbers shown are for the DW, J, JT, N, and NT packages.

**SN54ALS574B, SN54AS574, SN54AS575**  
**SN74ALS574B, SN74ALS575A, SN74AS574, SN74AS575**  
**OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS**

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**logic diagrams (positive logic)**



Pin numbers shown are for the DW, J, JT, N, and NT packages.

**absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†**

|   |                |
|---|----------------|
| Supply voltage, $V_{CC}$                                  | 7 V            |
| Input voltage, $V_I$                                      | 7 V            |
| Voltage applied to a disabled 3-state output              | 5.5 V          |
| Operating free-air temperature range, $T_A$ : SN54ALS574B | -55°C to 125°C |
| SN74ALS574B, SN74ALS575A                                  | 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.

**recommended operating conditions**

|             |                                | SN54ALS574B                   |      |     | SN74ALS574B<br>SN74ALS575A |     |      | 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        |                               |      | 0.7 |                            |     | 0.8  | V    |
| $I_{OH}$    | High-level output current      |                               |      | -1  |                            |     | -2.6 | mA   |
| $I_{OL}$    | Low-level output current       |                               |      | 12  |                            |     | 24   | mA   |
| $f_{clock}$ | Clock frequency                | 'ALS574B                      | 0    | 28  | 0                          |     | 35   | MHz  |
|             |                                | SN74ALS575A                   |      |     | 0                          |     | 30   |      |
| $t_w$       | Pulse duration                 | 'ALS574B, CLK high or low     | 16.5 |     | 14                         |     |      | ns   |
|             |                                | SN74ALS575A, CLK high or low  |      |     | 16.5                       |     |      |      |
| $t_{su}$    | Setup time before CLK↑         | Data                          | 15   |     | 15                         |     |      | ns   |
|             |                                | SN74ALS575A, $\overline{CLR}$ |      |     | 15                         |     |      |      |
| $t_h$       | Hold time after CLK↑           | Data                          | 4    |     | 0                          |     |      | ns   |
|             |                                | SN74ALS575A, $\overline{CLR}$ |      |     | 0                          |     |      |      |
| $T_A$       | Operating free-air temperature | -55                           |      | 125 | 0                          |     | 70   | °C   |



**SN54ALS574B, SN54AS574, SN54AS575**  
**SN74ALS574B, SN74ALS575A, SN74AS574, SN74AS575**  
**OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS**

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

| PARAMETER       | TEST CONDITIONS   |                           | SN54ALS574B      |      |          | SN74ALS574B<br>SN74ALS575A |      |     | 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             |
| $V_{OH}$        | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ , $I_{OH} = -0.4\text{ mA}$ |                           | $V_{CC} - 2$     |      |          | $V_{CC} - 2$               |      |     | V             |
|                 | $V_{CC} = 4.5\text{ V}$   | $I_{OH} = -1\text{ mA}$   | 2.4              | 3.3  |          |                            |      |     |               |
|                 |   | $I_{OH} = -2.6\text{ mA}$ |                  |      |          | 2.4                        | 3.2  |     |               |
| $V_{OL}$        | $V_{CC} = 4.5\text{ V}$   | $I_{OL} = 12\text{ mA}$   | 0.25 0.4         |      | 0.25 0.4 |                            |      |     | V             |
|                 |   | $I_{OL} = 24\text{ mA}$   |                  |      |          | 0.35                       | 0.5  |     |               |
| $I_{OZH}$       | $V_{CC} = 5.5\text{ V}$ ,   | $V_O = 2.7\text{ V}$      | 20               |      |          | 20                         |      |     | $\mu\text{A}$ |
| $I_{OZL}$       | $V_{CC} = 5.5\text{ V}$ ,   | $V_O = 0.4\text{ V}$      | -20              |      |          | -20                        |      |     | $\mu\text{A}$ |
| $I_I$           | $V_{CC} = 5.5\text{ V}$ ,   | $V_I = 7\text{ V}$        | 0.1              |      |          | 0.1                        |      |     | mA            |
| $I_{IH}$        | $V_{CC} = 5.5\text{ V}$ ,   | $V_I = 2.7\text{ V}$      | 20               |      |          | 20                         |      |     | $\mu\text{A}$ |
| $I_{IL}$        | $V_{CC} = 5.5\text{ V}$ ,   | $V_I = 0.4\text{ V}$      | -0.2             |      |          | -0.2                       |      |     | mA            |
| $I_{O\ddagger}$ | $V_{CC} = 5.5\text{ V}$ ,   | $V_O = 2.25\text{ V}$     | -20              | -112 | -30      | -112                       |      |     | mA            |
| $I_{CC}$        | 'ALS574B  | $V_{CC} = 5.5\text{ V}$   | Outputs high     | 11   | 18       | 11                         | 18   | mA  |               |
|                 |   |                           | Outputs low      | 17   | 27       | 17                         | 27   |     |               |
|                 |   |                           | Outputs disabled | 17   | 28       | 17                         | 28   |     |               |
|                 | SN74ALS575A   | $V_{CC} = 5.5\text{ V}$   | Outputs high     | 10   | 17       | 10                         | 17   |     |               |
|                 |   |                           | Outputs low      | 15   | 24       | 15                         | 24   |     |               |
|                 |   |                           | Outputs disabled | 16   | 30       | 16                         | 30   |     |               |

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

‡ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current,  $I_{OS}$ .

**switching characteristics (see Figure 1)**

| PARAMETER        | FROM<br>(INPUT)        | TO<br>(OUTPUT) | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ ,<br>$C_L = 50\text{ pF}$ ,<br>$R_1 = 500\ \Omega$ ,<br>$R_2 = 500\ \Omega$ ,<br>$T_A = \text{MIN to MAX}\S$ |     |             |     |             |     | UNIT |
|------------------|------------------------|----------------|--|-----|-------------|-----|-------------|-----|------|
|                  |                        |                | SN54ALS574B  |     | SN74ALS574B |     | SN74ALS575A |     |      |
|                  |                        |                | MIN  | MAX | MIN         | MAX | MIN         | MAX |      |
| $f_{\text{max}}$ |                        |                | 28   |     | 35          |     | 30          | MHz |      |
| $t_{\text{PLH}}$ | CLK                    | Q              | 4  | 22  | 3           | 14  | 4           | 14  | ns   |
| $t_{\text{PHL}}$ |                        |                | 4  | 17  | 4           | 14  | 4           | 14  |      |
| $t_{\text{PZH}}$ | $\overline{\text{OE}}$ | Q              | 4  | 21  | 3           | 18  | 4           | 18  | ns   |
| $t_{\text{PZL}}$ |                        |                | 4  | 26  | 4           | 18  | 4           | 18  |      |
| $t_{\text{PHZ}}$ | $\overline{\text{OE}}$ | Q              | 2  | 16  | 1           | 10  | 2           | 10  | ns   |
| $t_{\text{PLZ}}$ |                        |                | 2  | 25  | 2           | 12  | 3           | 13  |      |

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



**SN54ALS574B, SN54AS574, SN54AS575**  
**SN74ALS574B, SN74ALS575A, SN74AS574, SN74AS575**  
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**absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†**

|  |                |
|--|----------------|
| Supply voltage, $V_{CC}$ .....   | 7 V            |
| Input voltage, $V_I$ .....   | 7 V            |
| Voltage applied to a disabled 3-state output .....                       | 5.5 V          |
| Operating free-air temperature range, $T_A$ : SN54AS574, SN54AS575 ..... | –55°C to 125°C |
| SN74AS574, SN74AS575 .....   | 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.

**recommended operating conditions**

|               |                                | SN54AS574<br>SN54AS575               |     |     | SN74AS574<br>SN74AS575 |     |     | 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    |
| $I_{OH}$      | High-level output current      |                                      |     | –12 |                        |     | –15 | mA   |
| $I_{OL}$      | Low-level output current       |                                      |     | 32  |                        |     | 48  | mA   |
| $f_{clock}^*$ | Clock frequency                | 0                                    |     | 100 | 0                      |     | 90  | MHz  |
| $t_w^*$       | Pulse duration                 | CLK high                             |     | 5   | 5.5                    |     | ns  |      |
|               |                                | CLK low                              |     | 4   | 5.5                    |     |     |      |
| $t_{su}^*$    | Setup time before CLK↑         | Data                                 |     | 3   | 5.5                    |     | ns  |      |
|               |                                | 'AS575, $\overline{CLR}$ high or low |     | 6.5 | 6.5                    |     |     |      |
| $t_h^*$       | Hold time after CLK↑           | Data                                 |     | 3   | 3                      |     | ns  |      |
|               |                                | 'AS575, $\overline{CLR}$             |     | 0   | 0                      |     |     |      |
| $T_A$         | Operating free-air temperature | –55                                  |     | 125 | 0                      |     | 70  | °C   |

\* On products compliant to MIL-STD-883, Class B, this parameter is based on characterization data but is not production tested.



**SN54ALS574B, SN54AS574, SN54AS575**  
**SN74ALS574B, SN74ALS575A, SN74AS574, SN74AS575**  
**OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS**

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

| PARAMETER       | TEST CONDITIONS   |  | SN54AS574<br>SN54AS575 |      | SN74AS574<br>SN74AS575 |               | UNIT |      |
|-----------------|---|--|------------------------|------|------------------------|---------------|------|------|
|                 |   |  | MIN                    | TYP† | MAX                    | MIN           |      | TYP† |
| $V_{IK}$        | $V_{CC} = 4.5\text{ V}$ , $I_I = -18\text{ mA}$                   |  | -1.2                   |      | -1.2                   |               | V    |      |
| $V_{OH}$        | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ , $I_{OH} = -2\text{ mA}$ |  | $V_{CC} - 2$           |      | $V_{CC} - 2$           |               | V    |      |
|                 | $V_{CC} = 4.5\text{ V}$   | $I_{OH} = -12\text{ mA}$                       | 2.4                    | 3.2  |                        |               |      |      |
|                 |   | $I_{OH} = -15\text{ mA}$                       |                        |      | 2.4                    | 3.3           |      |      |
| $V_{OL}$        | $V_{CC} = 4.5\text{ V}$   | $I_{OL} = 32\text{ mA}$                        | 0.29                   | 0.5  |                        |               | V    |      |
|                 |   | $I_{OL} = 48\text{ mA}$                        |                        |      | 0.34                   | 0.5           |      |      |
| $I_{OZH}$       | $V_{CC} = 5.5\text{ V}$ , $V_O = 2.7\text{ V}$                    | 50   |                        | 50   |                        | $\mu\text{A}$ |      |      |
| $I_{OZL}$       | $V_{CC} = 5.5\text{ V}$ , $V_O = 0.4\text{ V}$                    | -50  |                        | -50  |                        | $\mu\text{A}$ |      |      |
| $I_I$           | $V_{CC} = 5.5\text{ V}$ , $V_I = 7\text{ V}$                      | 0.1  |                        | 0.1  |                        | mA            |      |      |
| $I_{IH}$        | $V_{CC} = 5.5\text{ V}$ , $V_I = 2.7\text{ V}$                    | 20   |                        | 20   |                        | $\mu\text{A}$ |      |      |
| $I_{IL}$        | $\overline{OE}$ , CLK, $\overline{CLR}$                           | $V_{CC} = 5.5\text{ V}$ , $V_I = 0.4\text{ V}$ | -0.5                   |      | -0.5                   |               | mA   |      |
|                 | D   |  | -3                     |      | -2                     |               |      |      |
| $I_{O\ddagger}$ | $V_{CC} = 5.5\text{ V}$ , $V_O = 2.25\text{ V}$                   | -30  | -112                   | -30  | -112                   | mA            |      |      |
| $I_{CC}$        | 'AS574  | $V_{CC} = 5.5\text{ V}$                        | Outputs high           | 73   | 116                    | 73            | 116  | mA   |
|                 |   |  | Outputs low            | 85   | 134                    | 85            | 134  |      |
|                 |   |  | Outputs disabled       | 84   | 134                    | 84            | 134  |      |
|                 | 'AS575  | $V_{CC} = 5.5\text{ V}$                        | Outputs high           | 78   | 126                    | 78            | 126  |      |
|                 |   |  | Outputs low            | 89   | 142                    | 89            | 142  |      |
|                 |   |  | Outputs disabled       | 88   | 142                    | 88            | 142  |      |

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

‡ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current,  $I_{OS}$ .

**switching characteristics (see Figure 1)**

| PARAMETER          | FROM<br>(INPUT) | TO<br>(OUTPUT) | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ ,<br>$C_L = 50\text{ pF}$ ,<br>$R_1 = 500\ \Omega$ ,<br>$R_2 = 500\ \Omega$ ,<br>$T_A = \text{MIN to MAX}\S$ |     |                        |     | UNIT |
|--------------------|-----------------|----------------|--|-----|------------------------|-----|------|
|                    |                 |                | SN54AS574<br>SN54AS575   |     | SN74AS574<br>SN74AS575 |     |      |
|                    |                 |                | MIN  | MAX | MIN                    | MAX |      |
| $f_{\text{max}}^*$ |                 |                | 100  |     | 90                     | MHz |      |
| $t_{PLH}$          | CLK             | Any Q          | 3  | 11  | 3                      | 8   | ns   |
| $t_{PHL}$          |                 |                | 4  | 11  | 4                      | 9   |      |
| $t_{PZH}$          | $\overline{OE}$ | Any Q          | 2  | 7   | 2                      | 6   | ns   |
| $t_{PZL}$          |                 |                | 3  | 11  | 3                      | 10  |      |
| $t_{PHZ}$          | $\overline{OE}$ | Any Q          | 2  | 7   | 2                      | 6   | ns   |
| $t_{PLZ}$          |                 |                | 2  | 7   | 2                      | 6   |      |

\* On products compliant to MIL-STD-883, Class B, this parameter is based on characterization data but is not production tested.

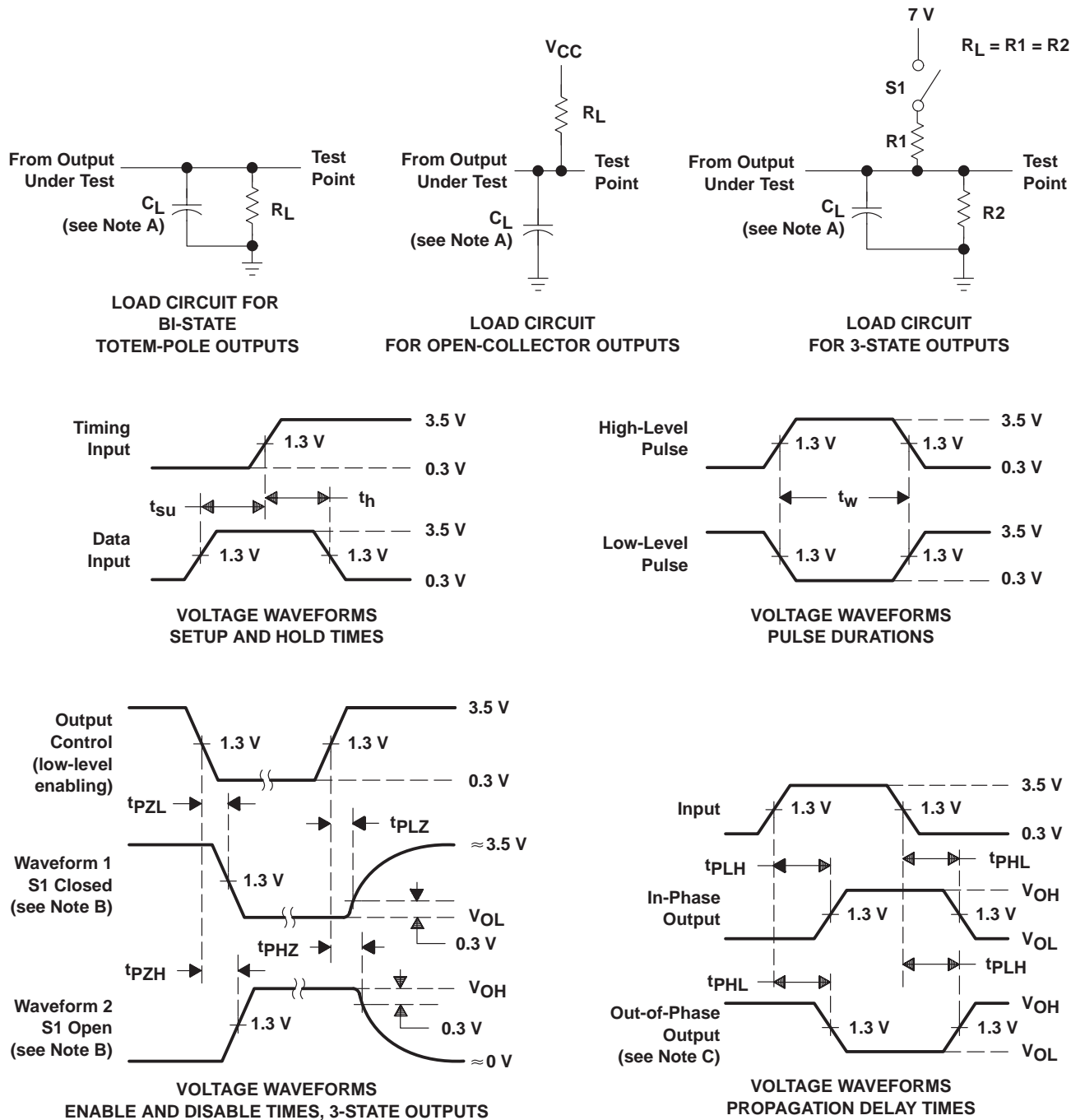
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 OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

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**PARAMETER MEASUREMENT INFORMATION  
 SERIES 54ALS/74ALS AND 54AS/74AS DEVICES**



- NOTES: A.  $C_L$  includes probe and jig capacitance.  
 B. 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.  
 C. When measuring propagation delay items of 3-state outputs, switch S1 is open.  
 D. All input pulses have the following characteristics:  $PRR \leq 1$  MHz,  $t_r = t_f = 2$  ns, duty cycle = 50%.  
 E. The outputs are measured one at a time with one transition per measurement.

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

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