

### **Rochester Electronics Manufactured Components**

Rochester branded components are manufactured using either die/wafers purchased from the original suppliers or Rochester wafers recreated from the original IP. All recreations are done with the approval of the OCM.

Parts are tested using original factory test programs or Rochester developed test solutions to guarantee product meets or exceed the OCM data sheet.

### **Quality Overview**

- ISO-9001
- AS9120 certification
- Qualified Manufacturers List (QML) MIL-PRF-35835
  - Class Q Military
  - Class V Space Level
- Qualified Suppliers List of Distributors (QSLD)
  - Rochester is a critical supplier to DLA and meets all industry and DLA standards.

Rochester Electronics, LLC is committed to supplying products that satisfy customer expectations for quality and are equal to those originally supplied by industry manufacturers.

The original manufacturer's datasheet accompanying this document reflects the performance and specifications of the Rochester manufactured version of this device. Rochester Electronics guarantees the performance of its semiconductor products to the original OEM specifications. 'Typical' values are for reference purposes only. Certain minimum or maximum ratings may be based on product characterization, design, simulation, or sample testing.

# SN54ALS374, SN54AS374, SN74ALS374A, SN74AS374 OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

SDAS167A - APRIL 1982 - REVISED DECEMBER 1984

- D-Type Flip-Flops in a Single Package With 3-State Bus-Driving True Outputs
- Full Parallel Access for Loading
- Buffered Control Inputs
- Package Options Include Plastic Small-Outline (DW) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) 300-mil DIPs

## description

These octal D-type edge-triggered 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.

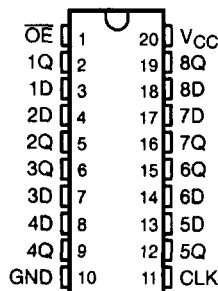
On the positive transition of the clock (CLK) input, the Q outputs are set to the logic levels set up at the data (D) inputs.

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

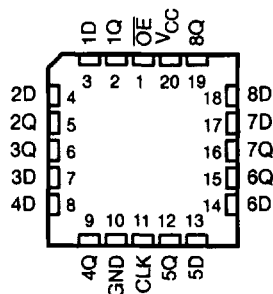
$\overline{OE}$  does not affect internal operations of the flip-flops. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

The SN54ALS374 and SN54AS374 are characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74ALS374A and SN74AS374 are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

SN54ALS374, SN54AS374 ... J PACKAGE  
SN74ALS374A, SN74AS374 ... DW OR N PACKAGE  
(TOP VIEW)



SN54ALS374, SN54AS374 ... FK PACKAGE  
(TOP VIEW)



FUNCTION TABLE  
(each flip-flop)

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

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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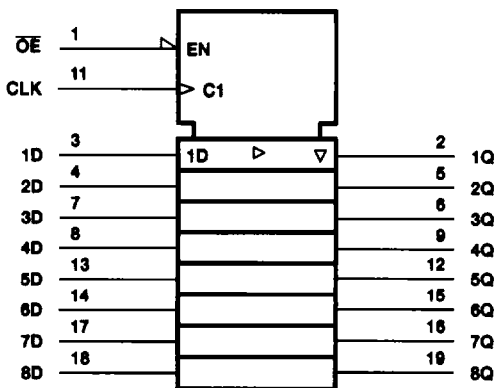
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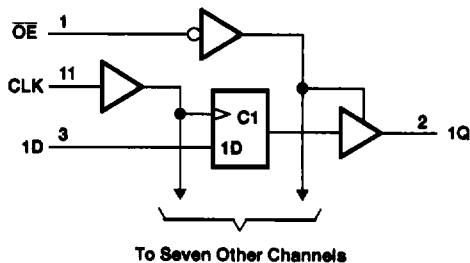
# SN54ALS374, SN54AS374, SN74ALS374A, SN74AS374 OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

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## logic symbol†



## logic diagram (positive logic)



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

## 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, $T_A$ : SN54ALS374 | -55°C to 125°C |
| SN74ALS374A  | 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

|                                       | SN54ALS374 |     |     | SN74ALS374A |     |      | 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           | 0          |     | 30  | 0           |     | 35   | MHz  |
| $t_w$ Pulse duration, CLK high or low | 16.5       |     |     | 14          |     |      | ns   |
| $t_{su}$ Setup time, data before CLK↑ | 10         |     |     | 10          |     |      | ns   |
| $t_h$ Hold time, data after CLK↑      | 4          |     |     | 0           |     |      | ns   |
| $T_A$ Operating free-air temperature  | -55        |     | 125 | 0           |     | 70   | °C   |



# SN54ALS374, SN54AS374, SN74ALS374A, SN74AS374 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                   |                           | SN54ALS374          |      | SN74ALS374A         |      | UNIT |
|------------------|-----------------------------------|---------------------------|---------------------|------|---------------------|------|------|
|                  |                                   |                           | MIN                 | TYP† | MAX                 | MIN  |      |
| V <sub>IK</sub>  | V <sub>CC</sub> = 4.5 V,          | I <sub>I</sub> = -18 mA   | -1.5                |      | -1.5                |      | V    |
| V <sub>OH</sub>  | V <sub>CC</sub> = 4.5 V to 5.5 V, | I <sub>OH</sub> = -0.4 mA | V <sub>CC</sub> - 2 |      | V <sub>CC</sub> - 2 |      | V    |
|                  | V <sub>CC</sub> = 4.5 V           | I <sub>OH</sub> = -1 mA   | 2.4                 | 3.3  |                     |      |      |
| V <sub>OL</sub>  | V <sub>CC</sub> = 4.5 V           | I <sub>OL</sub> = 12 mA   | 0.25                | 0.4  | 0.25                | 0.4  | V    |
|                  |                                   | I <sub>OL</sub> = 24 mA   |                     |      | 0.35                | 0.5  |      |
| I <sub>OZH</sub> | V <sub>CC</sub> = 5.5 V,          | V <sub>O</sub> = 2.7 V    | 20                  |      | 20                  |      | μA   |
| I <sub>OZL</sub> | V <sub>CC</sub> = 5.5 V,          | V <sub>O</sub> = 0.4 V    | -20                 |      | -20                 |      | μA   |
| I <sub>I</sub>   | V <sub>CC</sub> = 5.5 V,          | V <sub>I</sub> = 7 V      | 0.1                 |      | 0.1                 |      | mA   |
| I <sub>IH</sub>  | V <sub>CC</sub> = 5.5 V,          | V <sub>I</sub> = 2.7 V    | 20                  |      | 20                  |      | μA   |
| I <sub>IL</sub>  | V <sub>CC</sub> = 5.5 V,          | V <sub>I</sub> = 0.4 V    | -0.2                |      | -0.2                |      | mA   |
| I <sub>O†</sub>  | V <sub>CC</sub> = 5.5 V,          | V <sub>O</sub> = 2.25 V   | -20                 | -112 | -30                 | -112 | mA   |
| I <sub>CC</sub>  | V <sub>CC</sub> = 5.5 V           | Outputs high              | 11                  | 19   | 11                  | 19   | mA   |
|                  |                                   | Outputs low               | 19                  | 28   | 19                  | 28   |      |
|                  |                                   | Outputs disabled          | 20                  | 31   | 20                  | 31   |      |

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

‡ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I<sub>OS</sub>.

### switching characteristics (see Figure 3)

| PARAMETER        | FROM (INPUT) | TO (OUTPUT) | V <sub>CC</sub> = 4.5 V to 5.5 V,<br>C <sub>L</sub> = 80 pF,<br>R <sub>1</sub> = 500 Ω,<br>R <sub>2</sub> = 500 Ω,<br>T <sub>A</sub> = MIN to MAX§ |     |             |     | UNIT |
|------------------|--------------|-------------|--|-----|-------------|-----|------|
|                  |              |             | SN54ALS374   |     | SN74ALS374A |     |      |
|                  |              |             | MIN  | MAX | MIN         | MAX |      |
| f <sub>max</sub> |              |             | 30   |     | 35          | MHz |      |
| t <sub>PLH</sub> | CLK          | Q           | 3  | 14  | 3           | 12  | ns   |
| t <sub>PHL</sub> |              |             | 5  | 17  | 5           | 16  |      |
| t <sub>PZH</sub> | OE           | Q           | 5  | 18  | 3           | 17  | ns   |
| t <sub>PZL</sub> |              |             | 6  | 21  | 5           | 18  |      |
| t <sub>PHZ</sub> | OE           | Q           | 2  | 11  | 1           | 10  | ns   |
| t <sub>PLZ</sub> |              |             | 3  | 19  | 2           | 18  |      |

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



**SN54ALS374, SN54AS374, SN74ALS374A, SN74AS374**  
**OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS**  
**WITH 3-STATE OUTPUTS**

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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, $T_A$ : SN54AS374 ..... | -55°C to 125°C |
| SN74AS374 .....   | 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**

|               |                                | SN54AS374 |     |     | SN74AS374 |     |     | 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      | -12       |     |     | -15       |     |     | mA   |
| $I_{OL}$      | Low-level output current       | 32        |     |     | 48        |     |     | mA   |
| $f_{clock}^*$ | Clock frequency                | 0         |     | 100 | 0         |     | 125 | MHz  |
| $t_w^*$       | Pulse duration                 | CLK high  |     | 5.5 |           | 4   |     | ns   |
|               |                                | CLK low   |     | 3   |           | 3   |     |      |
| $t_{su}^*$    | Setup time, data before CLK↑   | 3         |     |     | 2         |     |     | ns   |
| $t_h^*$       | Hold time, data after CLK↑     | 3         |     |     | 2         |     |     | ns   |
| $T_A$         | 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.



**SN54ALS374, SN54AS374, SN74ALS374A, SN74AS374**  
**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   |   | SN54AS374           |      | SN74AS374           |      | UNIT |
|--------------------------|---|---|---------------------|------|---------------------|------|------|
|                          |   |   | MIN                 | TYP† | MAX                 | MIN  |      |
| 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 to 5.5 V, I <sub>OH</sub> = -2 mA |   | V <sub>CC</sub> - 2 |      | V <sub>CC</sub> - 2 |      | V    |
|                          | V <sub>CC</sub> = 4.5 V                                   | I <sub>OH</sub> = -12 mA                        | 2.4                 | 3.2  | 2.4                 | 3.3  |      |
| I <sub>OH</sub> = -15 mA |   |   |                     |      |                     |      |      |
| V <sub>OL</sub>          | V <sub>CC</sub> = 4.5 V                                   |   | 0.29                |      | 0.5                 |      | V    |
|                          | I <sub>OL</sub> = 32 mA                                   |   |                     |      |                     |      |      |
|                          | I <sub>OL</sub> = 48 mA                                   |   |                     |      | 0.34                |      | 0.5  |
| 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> = 0.4 V           |   | -50                 |      | -50                 |      | μA   |
| I <sub>I</sub>           | V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 7 V             |   | 0.1                 |      | 0.1                 |      | mA   |
| I <sub>IH</sub>          | V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 2.7 V           |   | 20                  |      | 20                  |      | μA   |
| I <sub>IL</sub>          | OE, CLK   | V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 0.4 V | -0.5                |      | -0.5                |      | mA   |
|                          | Data  |   | -3                  |      | -2                  |      |      |
| I <sub>O†</sub>          | V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 2.25 V          |   | -30                 | -112 | -30                 | -112 | mA   |
| I <sub>CC</sub>          | V <sub>CC</sub> = 5.5 V                                   |   | 77                  |      | 77                  |      | mA   |
|                          | Outputs high  |   | 120                 |      | 120                 |      |      |
|                          | Outputs low   |   | 84                  |      | 84                  |      |      |
|                          | Outputs disabled  |   | 84                  |      | 84                  |      | 128  |

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

‡ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I<sub>OS</sub>.

**switching characteristics (see Figure 3)**

| PARAMETER          | FROM (INPUT) | TO (OUTPUT) | V <sub>CC</sub> = 4.5 V to 5.5 V,<br>C <sub>L</sub> = 50 pF,<br>R <sub>1</sub> = 500 Ω,<br>R <sub>2</sub> = 500 Ω,<br>T <sub>A</sub> = MIN to MAX§ |      |           |     | UNIT |
|--------------------|--------------|-------------|--|------|-----------|-----|------|
|                    |              |             | SN54AS374  |      | SN74AS374 |     |      |
|                    |              |             | MIN  | MAX  | MIN       | MAX |      |
| t <sub>max</sub> * |              |             | 100  |      | 125       | MHz |      |
| t <sub>PLH</sub>   | CLK          | Q           | 3  | 11   | 3         | 8   | ns   |
| t <sub>PHL</sub>   |              |             | 4  | 11.5 | 4         | 9   |      |
| t <sub>PZH</sub>   | OE           | Q           | 2  | 7    | 2         | 6   | ns   |
| t <sub>PZL</sub>   |              |             | 3  | 11   | 3         | 10  |      |
| t <sub>PHZ</sub>   | OE           | Q           | 2  | 10   | 2         | 6   | ns   |
| t <sub>PLZ</sub>   |              |             | 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.

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



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**WITH 3-STATE OUTPUTS**

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**APPLICATION INFORMATION**

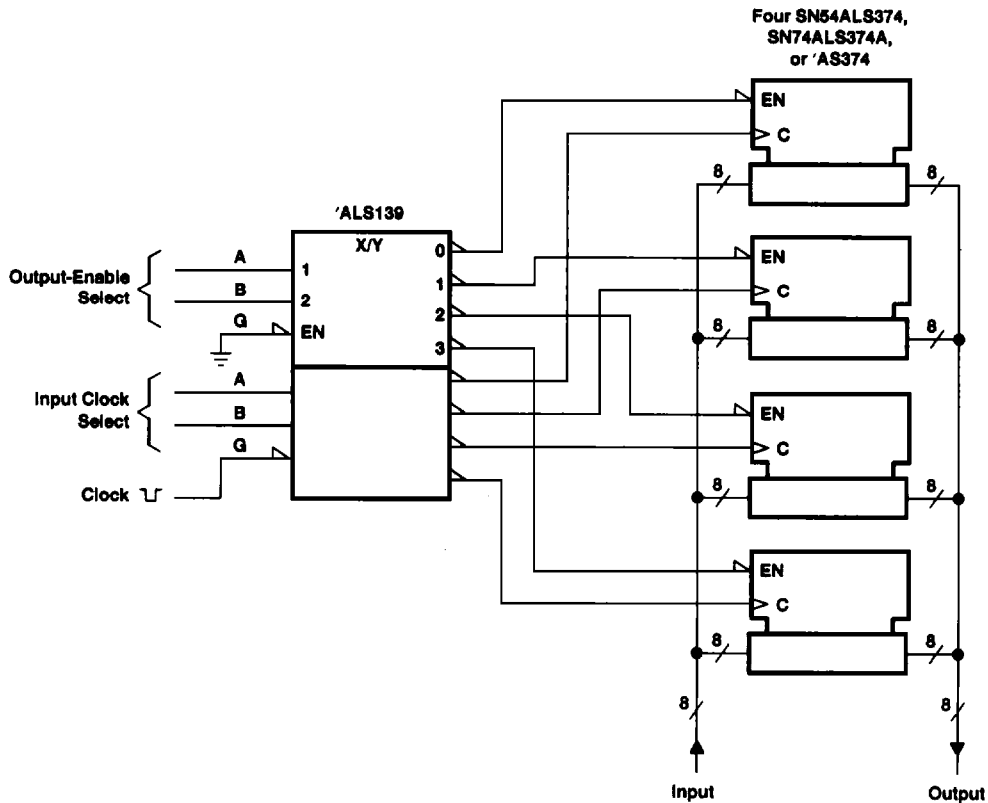


Figure 1. Expandable 4-Word by 8-Bit General File Register

SN54ALS374, SN54AS374, SN74ALS374A, SN74AS374  
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 WITH 3-STATE OUTPUTS

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APPLICATION INFORMATION

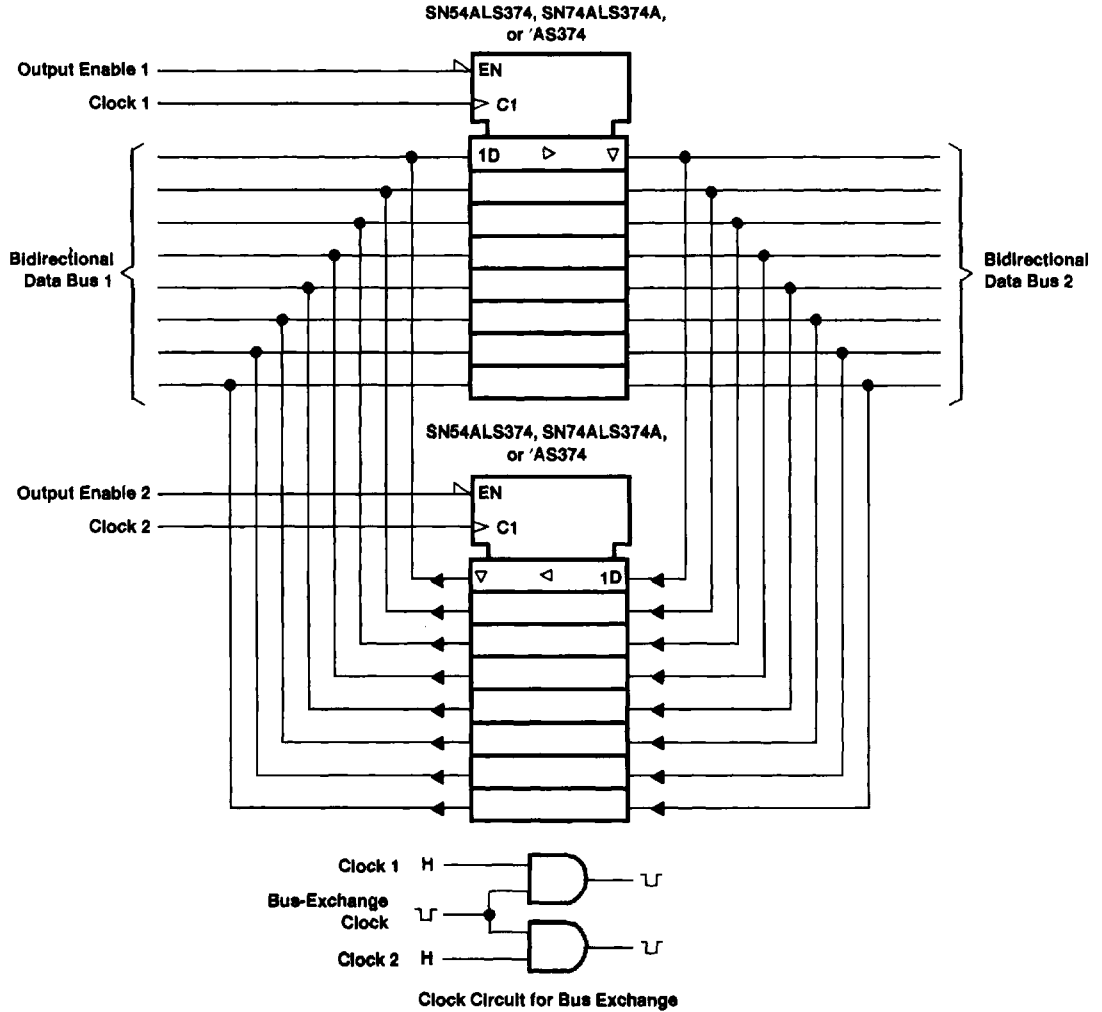


Figure 2. Bidirectional Bus Driver



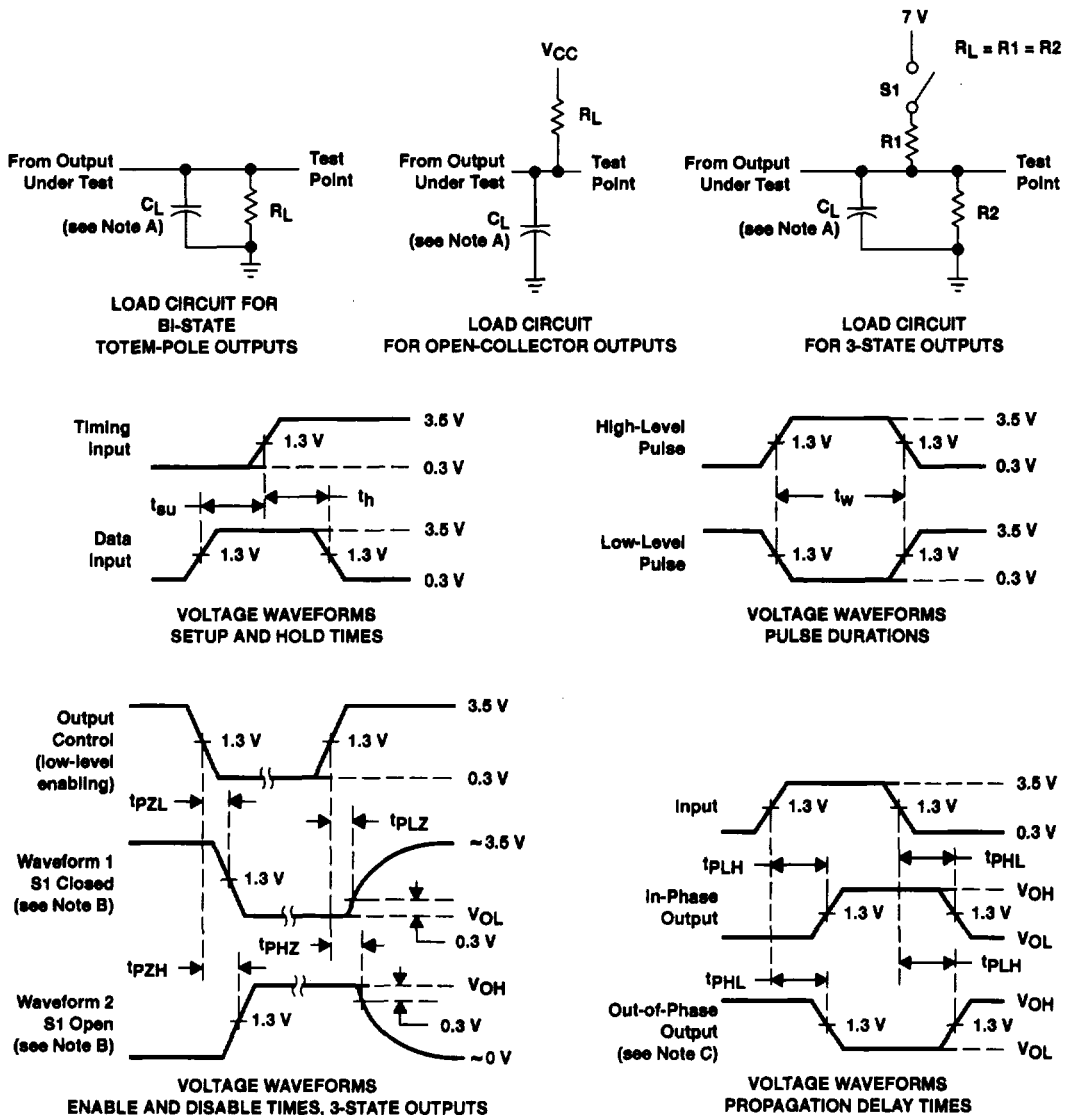
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**PARAMETER MEASUREMENT INFORMATION**  
**SERIES 54ALS/74ALS AND 54AS/74AS DEVICES**



- 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 3. Load Circuits and Voltage Waveforms**



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