

SN54ALS874B, SN74ALS874B, SN74ALS876A SN74AS874, SN74AS876 DUAL 4-BIT D-TYPE EDGE-TRIGGERED FLIP-FLOPS

SDAS061C – APRIL 1982 – REVISED JANUARY 1995

- 3-State Buffer-Type Outputs Drive Bus Lines Directly
- Bus-Structured Pinout
- Choice of True or Inverting Logic
 - SN54ALS874B, SN74ALS874B, SN74AS874 Have True Outputs
 - SN74ALS876A, SN74AS876 Have Inverting Outputs
- Asynchronous Clear
- Package Options Include Plastic Small-Outline (DW) Packages, Plastic (FN) and Ceramic (FK) Chip Carriers, and Standard Plastic (NT) and Ceramic (JT) 300-mil DIPs

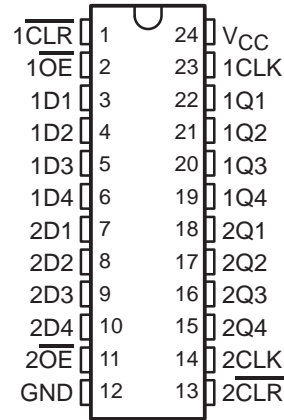
description

These dual 4-bit D-type edge-triggered flip-flops feature 3-state outputs designed specifically as bus drivers. They are particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

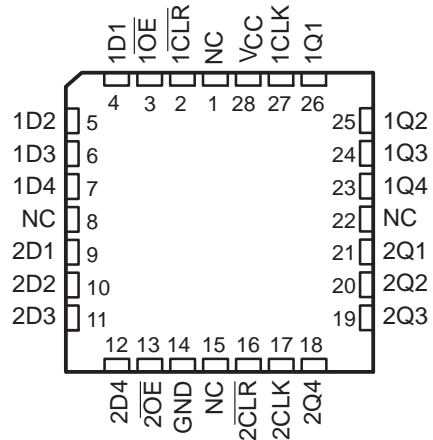
The edge-triggered flip-flops enter data on the low-to-high transition of the clock (CLK) input. The SN54ALS874B, SN74ALS874B, and SN74AS874 have clear ($\overline{\text{CLR}}$) inputs and noninverting Q outputs. The SN74ALS876A and SN74AS876 have preset ($\overline{\text{PRE}}$) inputs and inverting $\overline{\text{Q}}$ outputs; taking $\overline{\text{PRE}}$ low causes the four Q or $\overline{\text{Q}}$ outputs to go low independently of the clock.

The SN54ALS874B is characterized for operation over the full military temperature range of -55°C to 125°C . The SN74ALS874B, SN74ALS876A, SN74AS874, and SN74AS876 devices are characterized for operation from 0°C to 70°C .

SN54ALS874B . . . JT PACKAGE
SN74ALS874B, SN74AS874 . . . DW OR NT PACKAGE
(TOP VIEW)

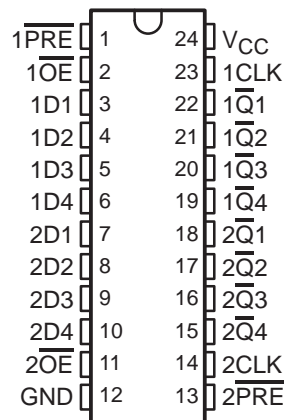


SN54ALS874B . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

SN74ALS876A, SN74AS876 . . . DW OR NT PACKAGE
(TOP VIEW)



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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SN74AS874, SN74AS876
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Function Tables

**SN54ALS874B, SN74ALS874B, SN74AS874
(each flip-flop)**

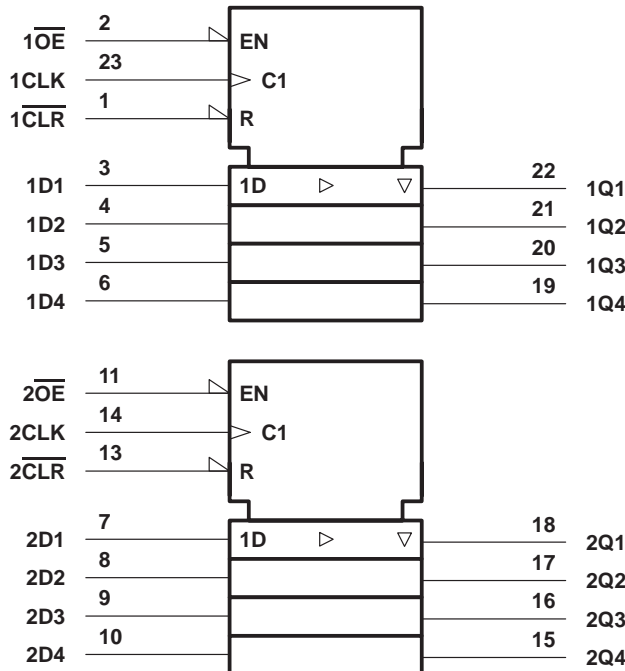
| INPUTS | | | | OUTPUT |
|-----------------|------------------|-----|---|----------------|
| \overline{OE} | \overline{CLR} | CLK | D | Q |
| L | L | X | X | L |
| L | H | ↑ | H | H |
| L | H | ↑ | L | L |
| L | H | L | X | Q ₀ |
| H | X | X | X | Z |

**SN74ALS876A, SN74AS876
(each flip-flop)**

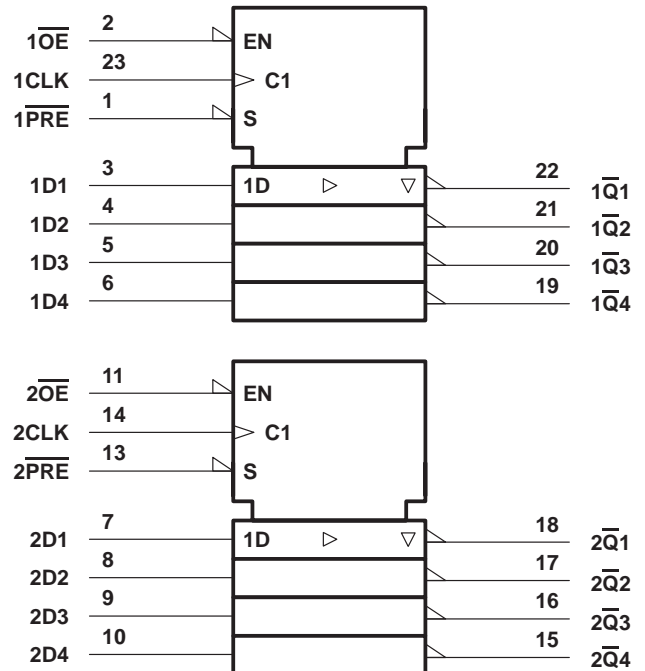
| INPUTS | | | | OUTPUT |
|-----------------|------------------|-----|---|------------------|
| \overline{OE} | \overline{PRE} | CLK | D | \overline{Q} |
| L | L | X | X | L |
| L | H | ↑ | H | L |
| L | H | ↑ | L | H |
| L | H | L | X | \overline{Q}_0 |
| H | X | X | X | Z |

logic symbols†

SN54ALS874B, SN74ALS874B, SN74AS874

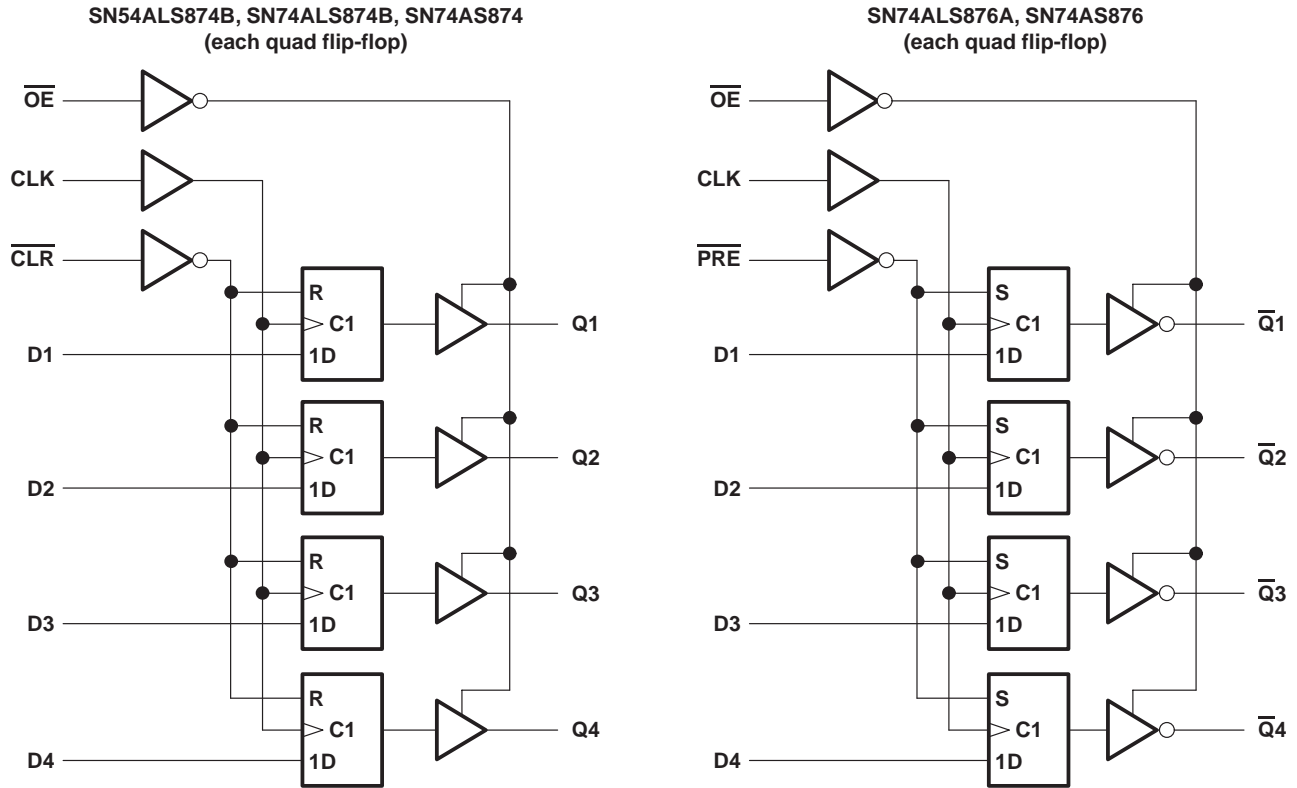


SN74ALS876A, SN74AS876



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

logic diagrams (positive logic)



Pin numbers shown are for the DW, JT, 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 : SN54ALS874B | -55°C to 125°C |
| SN74ALS874B, SN74ALS876A | 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.

**SN54ALS874B, SN74ALS874B, SN74ALS876A
SN74AS874, SN74AS876
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recommended operating conditions

| | | SN54ALS874B | | | SN74ALS874B SN74ALS876A | | | 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 | | 25 | 0 | | 30 | MHz |
| t _w | Pulse duration | PRE or CLR low | | 15 | | 10 | | ns |
| | | CLK high | | 20 | | 16.5 | | |
| | | CLK low | | 20 | | 16.5 | | |
| t _{su} | Setup time before CLK↑ | Data | | 15 | | 15 | | ns |
| | | PRE or CLR inactive | | 15 | | 10 | | |
| t _h | Hold time, data after CLK↑ | 4 | | | 0 | | | ns |
| T _A | Operating free-air temperature | -55 | | 125 | 0 | | 70 | °C |

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

| PARAMETER | | TEST CONDITIONS | | SN54ALS874B | | | SN74ALS874B SN74ALS876A | | | UNIT |
|------------------|-------------|-----------------------------------|---------------------------|---------------------|------|------|----------------------------|------|------|------|
| | | | | MIN | TYP† | MAX | MIN | TYP† | MAX | |
| V _{IK} | | V _{CC} = 4.5 V, | I _I = -18 mA | | | -1.2 | | | -1.2 | V |
| V _{OH} | | V _{CC} = 4.5 V to 5.5 V, | I _{OH} = -0.4 mA | V _{CC} - 2 | | | V _{CC} - 2 | | | V |
| | | V _{CC} = 4.5 V | I _{OH} = -1 mA | 2.4 | 3.3 | | 2.4 | 3.2 | | |
| | | | I _{OH} = -2.6 mA | | | | | | | |
| V _{OL} | | V _{CC} = 4.5 V | I _{OL} = 12 mA | 0.25 | 0.4 | | 0.25 | 0.4 | | V |
| | | | I _{OL} = 24 mA | | | | 0.35 | 0.5 | | |
| I _{OZH} | | V _{CC} = 5.5 V, | V _O = 2.7 V | | | 20 | | | 20 | μA |
| I _{OZL} | | V _{CC} = 5.5 V, | V _O = 0.4 V | | | -20 | | | -20 | μA |
| I _I | | V _{CC} = 5.5 V, | V _I = 7 V | | | 0.1 | | | 0.1 | mA |
| I _{IH} | | V _{CC} = 5.5 V, | V _I = 2.7 V | | | 20 | | | 20 | μA |
| I _{IL} | | V _{CC} = 5.5 V, | V _I = 0.4 V | | | -0.2 | | | -0.2 | mA |
| I _{O‡} | | V _{CC} = 5.5 V, | V _O = 2.25 V | -20 | | -112 | -30 | | -112 | mA |
| I _{CC} | 'ALS874B | V _{CC} = 5.5 V | Outputs high | 14 | 21 | | 14 | 21 | mA | |
| | | | Outputs low | 19 | 30 | | 19 | 30 | | |
| | | | Outputs disabled | 20 | 32 | | 20 | 32 | | |
| | SN74ALS876A | V _{CC} = 5.5 V | Outputs high | | | | 14 | 21 | | |
| | | | Outputs low | | | | 18 | 29 | | |
| | | | Outputs disabled | | | | 20 | 31 | | |

† All typical values are at V_{CC} = 5 V, T_A = 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_{OS}.



SN54ALS874B, SN74ALS874B, SN74ALS876A
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switching characteristics (see Figure 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | V _{CC} = 4.5 V to 5.5 V, C _L = 50 pF, R ₁ = 500 Ω, R ₂ = 500 Ω, T _A = MIN to MAX† | | | | UNIT |
|------------------|-------------------------|-------------|--|-----|-------------|-----|------|
| | | | SN54ALS874B | | SN74ALS874B | | |
| | | | MIN | MAX | MIN | MAX | |
| f _{max} | | | 25 | | 30 | MHz | |
| t _{PLH} | CLK | Any Q | 4 | 18 | 4 | 14 | ns |
| t _{PHL} | | | 4 | 16 | 4 | 14 | |
| t _{PHL} | $\overline{\text{CLR}}$ | Any Q | 5 | 23 | 5 | 17 | ns |
| t _{PZH} | $\overline{\text{OE}}$ | Any Q | 4 | 24 | 4 | 18 | ns |
| t _{PZL} | | | 4 | 21 | 4 | 18 | |
| t _{PHZ} | $\overline{\text{OE}}$ | Any Q | 2 | 15 | 2 | 10 | ns |
| t _{PLZ} | | | 3 | 22 | 3 | 12 | |

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

switching characteristics (see Figure 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | V _{CC} = 4.5 V to 5.5 V, C _L = 50 pF, R ₁ = 500 Ω, R ₂ = 500 Ω, T _A = MIN to MAX† | | UNIT |
|------------------|-------------------------|---------------------------|--|-----|------|
| | | | SN74ALS876A | | |
| | | | MIN | MAX | |
| f _{max} | | | 30 | | MHz |
| t _{PLH} | CLK | Any $\overline{\text{Q}}$ | 4 | 14 | ns |
| t _{PHL} | | | 4 | 14 | |
| t _{PHL} | $\overline{\text{PRE}}$ | Any $\overline{\text{Q}}$ | 6 | 19 | ns |
| t _{PZH} | $\overline{\text{OE}}$ | Any $\overline{\text{Q}}$ | 4 | 18 | ns |
| t _{PZL} | | | 4 | 18 | |
| t _{PHZ} | $\overline{\text{OE}}$ | Any $\overline{\text{Q}}$ | 2 | 10 | ns |
| t _{PLZ} | | | 3 | 13 | |

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

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

| | |
|---|----------------|
| Supply voltage, V _{CC} | 7 V |
| Input voltage, V _I | 7 V |
| Operating free-air temperature range, T _A : SN74AS874, SN74AS876 | 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.



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SN74AS874, SN74AS876
DUAL 4-BIT D-TYPE EDGE-TRIGGERED FLIP-FLOPS**

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recommended operating conditions

| | | SN74AS874 | | | SN74AS876 | | | 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 | | | -15 | | | -15 | mA |
| I_{OL} | Low-level output current | | | 48 | | | 48 | mA |
| f_{clock} | Clock frequency | 0 | | 125 | 0 | | 80 | MHz |
| t_w | Pulse duration | \overline{PRE} or \overline{CLR} low | | 2 | | 4.5 | | ns |
| | | CLK high | | 3 | | 6.2 | | |
| | | CLK low | | 4 | | 6.2 | | |
| t_{su} | Setup time before CLK \uparrow | Data | | 2 | | 4.5 | | ns |
| | | \overline{PRE} or \overline{CLR} inactive | | 4 | | 5 | | |
| t_h | Hold time, data after CLK \uparrow | 1 | | | 2 | | | ns |
| T_A | Operating free-air temperature | 0 | | 70 | 0 | | 70 | $^{\circ}$ C |

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

| PARAMETER | | TEST CONDITIONS | | SN74AS874 SN74AS876 | | UNIT |
|-----------------|------------|---|--------------------------|------------------------|---------------|---------|
| | | | | MIN | TYP \dagger | |
| V_{IK} | | $V_{CC} = 4.5\text{ V}$, | $I_I = -18\text{ mA}$ | | -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 |
| | | $V_{CC} = 4.5\text{ V}$, | $I_{OH} = -15\text{ mA}$ | 2.4 | 3.3 | |
| V_{OL} | | $V_{CC} = 4.5\text{ V}$, | $I_{OL} = 48\text{ mA}$ | 0.35 | 0.5 | V |
| I_{OZH} | | $V_{CC} = 5.5\text{ V}$, | $V_O = 2.7\text{ V}$ | | 50 | μ A |
| I_{OZL} | | $V_{CC} = 5.5\text{ V}$, | $V_O = 0.4\text{ V}$ | | -50 | μ A |
| I_I | | $V_{CC} = 5.5\text{ V}$, | $V_I = 7\text{ V}$ | | 0.1 | mA |
| I_{IH} | | $V_{CC} = 5.5\text{ V}$, | $V_I = 2.7\text{ V}$ | | 20 | μ A |
| I_{IL} | D | $V_{CC} = 5.5\text{ V}$, | $V_I = 0.4\text{ V}$ | | -2 | mA |
| | All others | | | | -0.5 | |
| $I_{O\ddagger}$ | | $V_{CC} = 5.5\text{ V}$, | $V_O = 2.25\text{ V}$ | -30 | -112 | mA |
| I_{CC} | SN74AS874 | $V_{CC} = 5.5\text{ V}$ | Outputs high | 82 | 133 | mA |
| | | | Outputs low | 92 | 149 | |
| | | | Outputs disabled | 100 | 160 | |
| | SN74AS876 | | Outputs high | 88 | 142 | |
| | | | Outputs low | 94 | 150 | |
| | | | Outputs disabled | 100 | 160 | |

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

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

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SN74AS874, SN74AS876
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switching characteristics (see Figure 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | V _{CC} = 4.5 V to 5.5 V, C _L = 50 pF, R ₁ = 500 Ω, R ₂ = 500 Ω, T _A = MIN to MAX† | | UNIT |
|------------------|-------------------------|----------------|--|------|------|
| | | | SN74AS874 | | |
| | | | MIN | MAX | |
| f _{max} | | | 125 | | MHz |
| t _{PLH} | CLK | Any Q | 3 | 8.5 | ns |
| t _{PHL} | | | 4 | 10.5 | |
| t _{PHL} | $\overline{\text{CLR}}$ | Any Q | 4 | 9.5 | ns |
| t _{PZH} | $\overline{\text{OE}}$ | Any Q | 2 | 7 | ns |
| t _{PZL} | | | 3 | 10.5 | |
| t _{PHZ} | $\overline{\text{OE}}$ | Any Q | 2 | 6 | ns |
| t _{PLZ} | | | 2 | 7.5 | |

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

switching characteristics (see Figure 1)

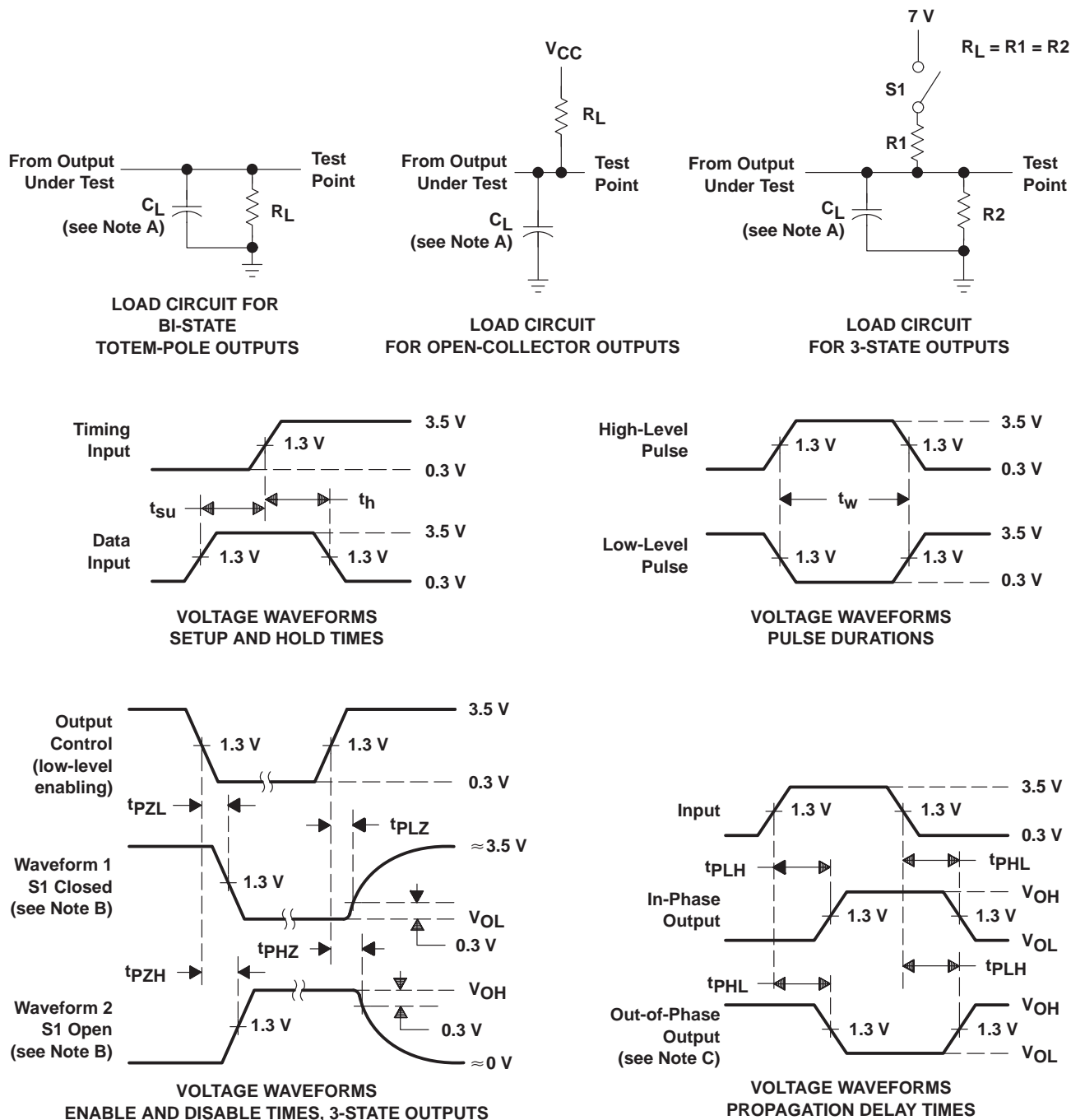
| PARAMETER | FROM (INPUT) | TO (OUTPUT) | V _{CC} = 4.5 V to 5.5 V, C _L = 50 pF, R ₁ = 500 Ω, R ₂ = 500 Ω, T _A = MIN to MAX† | | UNIT |
|------------------|-------------------------|---------------------------|--|------|------|
| | | | SN74AS876 | | |
| | | | MIN | MAX | |
| f _{max} | | | 80 | | MHz |
| t _{PLH} | CLK | Any $\overline{\text{Q}}$ | 3 | 8.5 | ns |
| t _{PHL} | | | 4 | 10.5 | |
| t _{PHL} | $\overline{\text{PRE}}$ | Any $\overline{\text{Q}}$ | 4 | 9.5 | ns |
| t _{PZH} | $\overline{\text{OE}}$ | Any $\overline{\text{Q}}$ | 2 | 7 | ns |
| t _{PZL} | | | 3 | 11 | |
| t _{PHZ} | $\overline{\text{OE}}$ | Any $\overline{\text{Q}}$ | 2 | 7 | ns |
| t _{PLZ} | | | 2 | 7 | |

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

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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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