

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

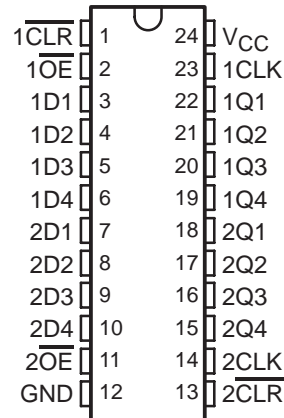
description

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.

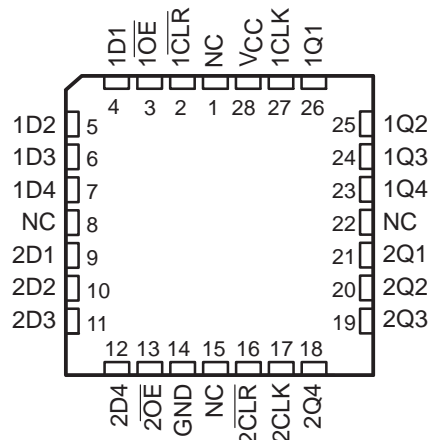
The edge-triggered flip-flops enter data on the low-to-high transition of the clock (CLK) input. The SN54ALS874B, SN74ALS874B, and SN74AS874 have clear ($\overline{\text{CLR}}$) inputs and noninverting Q outputs. The SN74ALS876A and SN74AS876 have preset ($\overline{\text{PRE}}$) inputs and inverting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

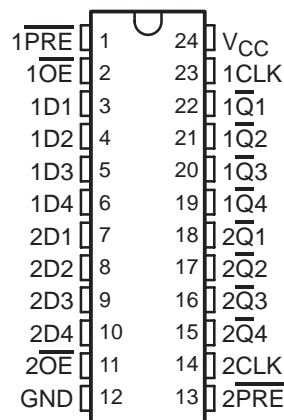


SN54ALS874B . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

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



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Function Tables

SN54ALS874B, SN74ALS874B, SN74AS874
(each flip-flop)

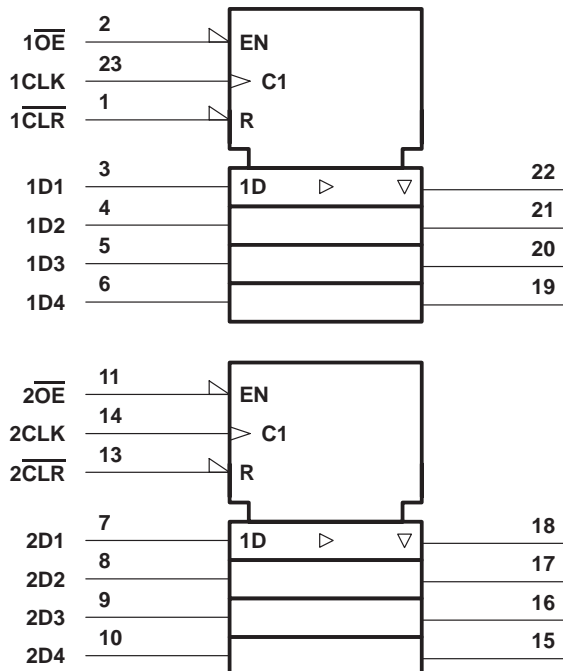
| INPUTS | | | | OUTPUT |
|-----------------|------------------|-----|---|--------|
| \overline{OE} | \overline{CLR} | CLK | D | Q |
| L | L | X | X | L |
| L | H | ↑ | H | H |
| L | H | ↑ | L | L |
| L | H | L | X | Q_0 |
| H | X | X | X | Z |

SN74ALS876A, SN74AS876
(each flip-flop)

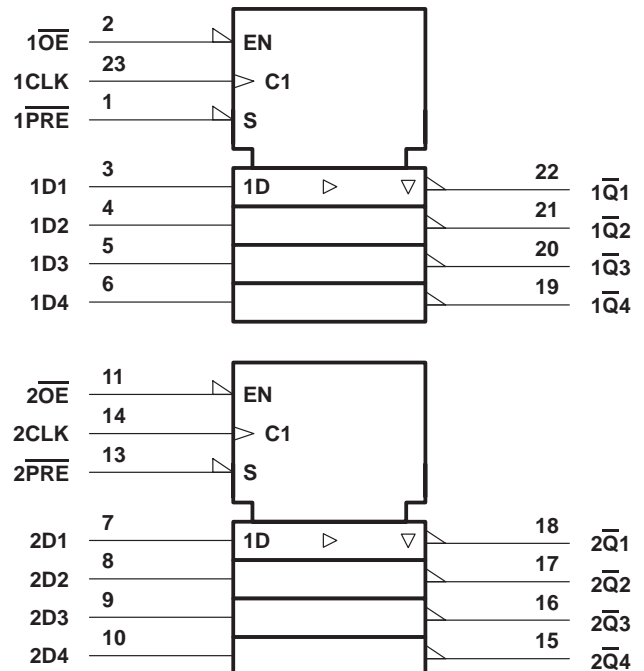
| INPUTS | | | | OUTPUT |
|-----------------|------------------|-----|---|------------------|
| \overline{OE} | \overline{PRE} | CLK | D | \overline{Q} |
| L | L | X | X | L |
| L | H | ↑ | H | L |
| L | H | ↑ | L | H |
| L | H | L | X | $\overline{Q_0}$ |
| H | X | X | X | Z |

logic symbols†

SN54ALS874B, SN74ALS874B, SN74AS874



SN74ALS876A, SN74AS876

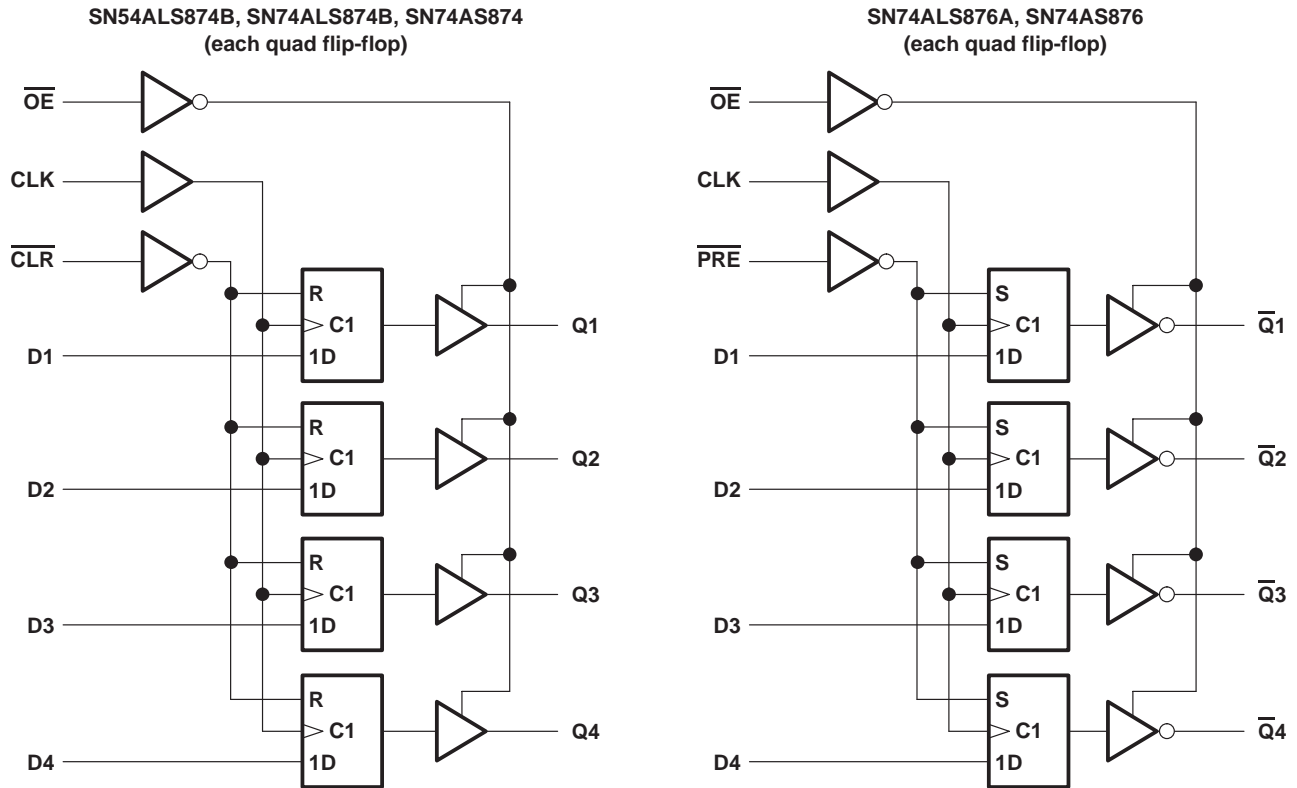


† These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.
Pin numbers shown are for the DW, JT, and NT packages.

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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 | | | | | |
| | | | I _{OH} = -2.6 mA | | | | | 2.4 | 3.2 | | |
| V _{OL} | | V _{CC} = 4.5 V | I _{OL} = 12 mA | | 0.25 | 0.4 | | 0.25 | 0.4 | | |
| | | | 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.



SN54ALS874B, SN74ALS874B, SN74ALS876A
SN74AS874, SN74AS876
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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 | MAX | MIN | |
| V_{IK} | | $V_{CC} = 4.5$ V, | $I_I = -18$ mA | | | | -1.2 | V |
| V_{OH} | | $V_{CC} = 4.5$ V to 5.5 V, | $I_{OH} = -2$ mA | $V_{CC} - 2$ | | | | V |
| | | $V_{CC} = 4.5$ V, | $I_{OH} = -15$ mA | 2.4 | 3.3 | | | |
| V_{OL} | | $V_{CC} = 4.5$ V, | $I_{OL} = 48$ mA | 0.35 | 0.5 | | | V |
| I_{OZH} | | $V_{CC} = 5.5$ V, | $V_O = 2.7$ V | | | | 50 | μ A |
| I_{OZL} | | $V_{CC} = 5.5$ V, | $V_O = 0.4$ V | | | | -50 | μ A |
| I_I | | $V_{CC} = 5.5$ V, | $V_I = 7$ V | | | | 0.1 | mA |
| I_{IH} | | $V_{CC} = 5.5$ V, | $V_I = 2.7$ V | | | | 20 | μ A |
| I_{IL} | D | $V_{CC} = 5.5$ V, | $V_I = 0.4$ V | | | | -2 | mA |
| | All others | | | | | | -0.5 | |
| $I_{O\ddagger}$ | | $V_{CC} = 5.5$ V, | $V_O = 2.25$ V | -30 | | | -112 | mA |
| I_{CC} | SN74AS874 | $V_{CC} = 5.5$ 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 $V_{CC} = 5$ V, $T_A = 25^{\circ}$ 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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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



PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|------------------|--------------------------------------|----------------------|--------------|-----------------------------|-------------------------|
| 8401001LA | ACTIVE | CDIP | JT | 24 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 8401001LA SNJ54ALS874BJT | Samples |
| SN54ALS874BJT | ACTIVE | CDIP | JT | 24 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | SN54ALS874BJT | Samples |
| SN74ALS874BDW | ACTIVE | SOIC | DW | 24 | 25 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | ALS874B | Samples |
| SN74ALS874BDWR | ACTIVE | SOIC | DW | 24 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | ALS874B | Samples |
| SN74ALS874BDWRE4 | ACTIVE | SOIC | DW | 24 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | ALS874B | Samples |
| SN74AS874DW | ACTIVE | SOIC | DW | 24 | 25 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | AS874 | Samples |
| SNJ54ALS874BJT | ACTIVE | CDIP | JT | 24 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 8401001LA SNJ54ALS874BJT | Samples |

(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 SN54ALS874B, SN74ALS874B :

- Catalog : [SN74ALS874B](#)
- Military : [SN54ALS874B](#)

NOTE: Qualified Version Definitions:

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

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 |
|----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74ALS874BDWR | SOIC | DW | 24 | 2000 | 330.0 | 24.4 | 10.75 | 15.7 | 2.7 | 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) |
|----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74ALS874BDWR | SOIC | DW | 24 | 2000 | 350.0 | 350.0 | 43.0 |

JT (R-GDIP-T**)

CERAMIC DUAL-IN-LINE

24 LEADS 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 ceramic lid using glass frit.
 D. Index point is provided on cap for terminal identification.
 E. Falls within MIL STD 1835 GDIP3-T24, GDIP4-T28, and JEDEC MO-058 AA, MO-058 AB

DW (R-PDSO-G24)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.
 - 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 AD.

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