- **Package Options Include Plastic Small-Outline (D) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) 300-mil DIPs**

## description

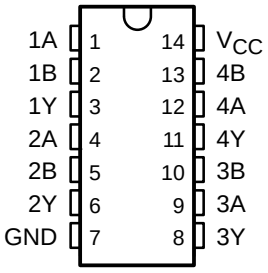
These devices contain four independent 2-input positive-AND gates. They perform the Boolean functions $Y = A \bullet B$ or $Y = \overline{A} + \overline{B}$ in positive logic. The open-collector outputs require pullup resistors to perform correctly. These outputs may be connected to other open-collector outputs to implement active-low wired-OR or active-high wired-AND functions. Open-collector devices are often used to generate higher $V_{OH}$ levels.

The SN54ALS09 is characterized for operation over the full military temperature range of –55°C to 125°C. The SN74ALS09 is characterized for operation from 0°C to 70°C.

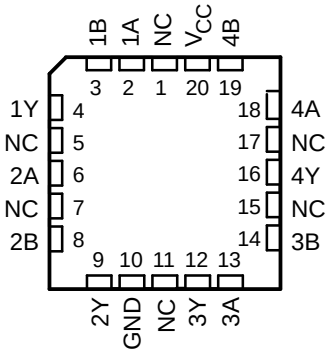
**FUNCTION TABLE**
**(each gate)**

| INPUTS | | OUTPUT |
|---|---|---|
| A | B | Y |
| H | H | H |
| L | X | L |
| X | L | L |

**SN54ALS09 . . . J PACKAGE**
**SN74ALS09 . . . D OR N PACKAGE**
**(TOP VIEW)**

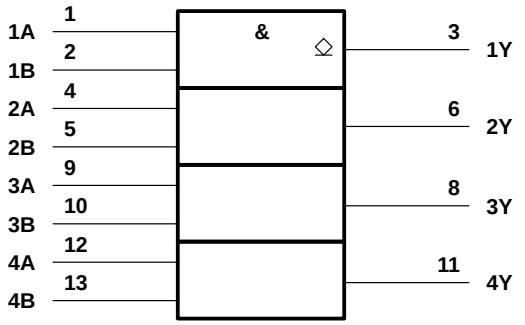



**SN54ALS09 . . . FK PACKAGE**
**(TOP VIEW)**




NC – No internal connection

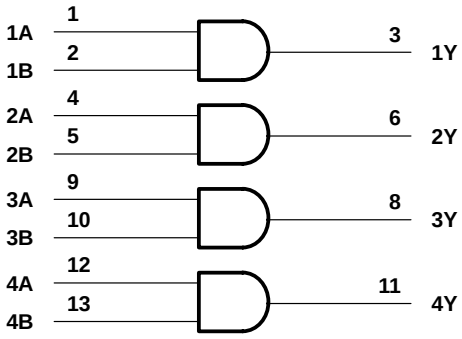
## logic symbol†




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

Pin numbers shown are for the D, J, and N packages.

## logic diagram (positive logic)



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

Supply voltage, $V_{CC}$ . . . . . 7 V
Input voltage, $V_I$ . . . . . 7 V
Off-state output voltage . . . . . 7 V
Operating free-air temperature range, $T_A$: SN54ALS09 . . . . . –55°C to 125°C
SN74ALS09 . . . . . 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

| | | SN54ALS09 | | | SN74ALS09 | | | 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 |
| $V_{OH}$ | High-level output voltage | | | 5.5 | | | 5.5 | V |
| $I_{OL}$ | Low-level output current | | | 4 | | | 8 | mA |
| $T_A$ | Operating free-air temperature | –55 | | 125 | 0 | | 70 | °C |

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

| PARAMETER | TEST CONDITIONS | | SN54ALS09 | | | SN74ALS09 | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | MIN | TYP‡ | MAX | MIN | TYP‡ | MAX | |
| $V_{IK}$ | $V_{CC}$ = 4.5 V, | $I_I$ = –18 mA | | | –1.5 | | | –1.5 | V |
| $V_{OL}$ | $V_{CC}$ = 4.5 V | $I_{OL}$ = 4 mA | | 0.25 | 0.4 | | 0.25 | 0.4 | V |
| | | $I_{OL}$ = 8 mA | | | | | 0.35 | 0.5 | |
| $I_I$ | $V_{CC}$ = 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 | | | –0.1 | | | –0.1 | mA |
| $I_{OH}$ | $V_{CC}$ = 4.5 V, | $V_{OH}$ = 5.5 V | | | 0.1 | | | 0.1 | mA |
| $I_{CCH}$ | $V_{CC}$ = 5.5 V, | $V_I$ = 4.5 V | | 1.35 | 2.4 | | 1.35 | 2.4 | mA |
| $I_{CCL}$ | $V_{CC}$ = 5.5 V, | $V_I$ = 0 | | 2.2 | 4 | | 2.2 | 4 | mA |

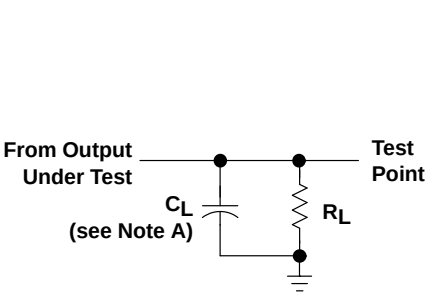
‡ All typical values are at $V_{CC}$ = 5 V, $T_A$ = 25°C.

### switching characteristics (see Figure 1)

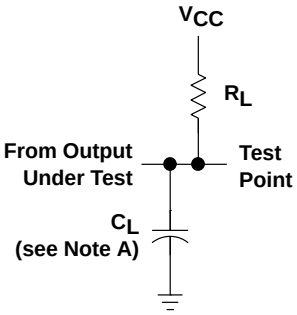
| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $V_{CC}$ = 4.5 V to 5.5 V, $C_L$ = 50 pF, $R_L$ = 2 kΩ, $T_A$ = MIN to MAX§ | | | | UNIT |
|---|---|---|---|---|---|---|---|
| | | | SN54ALS09 | | SN74ALS09 | | |
| | | | MIN | MAX | MIN | MAX | |
| $t_{PLH}$ | A or B | Y | 20 | 69 | 23 | 54 | ns |
| $t_{PHL}$ | | | 5 | 23 | 5 | 15 | |

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

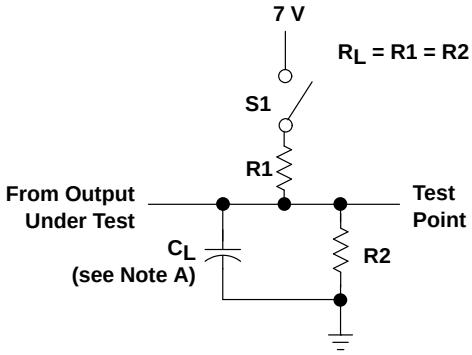
## PARAMETER MEASUREMENT INFORMATION
## SERIES 54ALS/74ALS AND 54AS/74AS DEVICES



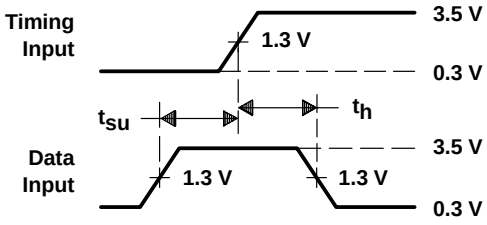

LOAD CIRCUIT FOR
BI-STATE
TOTEM-POLE OUTPUTS



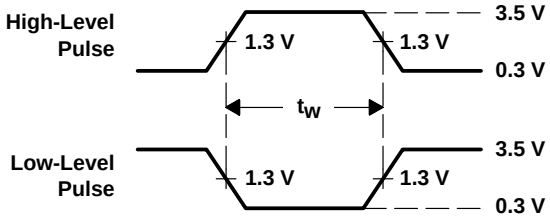

LOAD CIRCUIT
FOR OPEN-COLLECTOR OUTPUTS



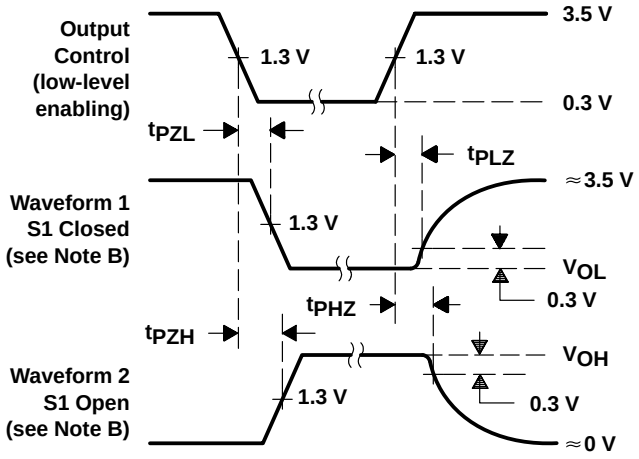

LOAD CIRCUIT
FOR 3-STATE OUTPUTS



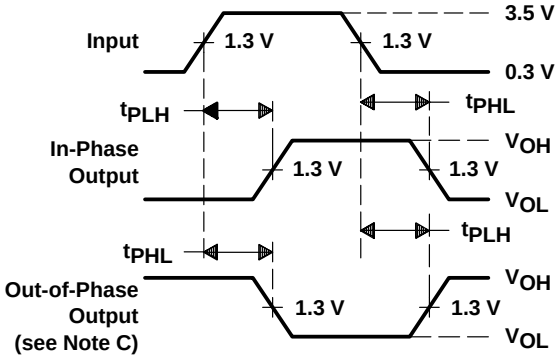

VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES




VOLTAGE WAVEFORMS
PULSE DURATIONS




VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES, 3-STATE OUTPUTS




VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES

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 ≤ 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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