D2661, APRIL 1982—REVISED DECEMBER 1983

- **Package Options Include Both Plastic and Ceramic Chip Carriers in Addition to Plastic and Ceramic DIPs**
- **Dependable Texas Instruments Quality and Reliability**

## description

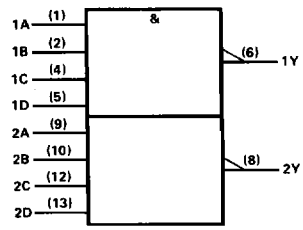
These devices contain two independent 4-input NAND gates. They perform the Boolean functions $Y = \overline{A \cdot B \cdot C \cdot D}$ or $Y = \overline{A} + \overline{B} + \overline{C} + \overline{D}$ in positive logic.

The SN54ALS20A and SN54AS20 are characterized for operation over the full military temperature range of −55°C to 125°C. The SN74ALS20A and SN74AS20 are characterized for operation from 0°C to 70°C.

**FUNCTION TABLE (each gate)**

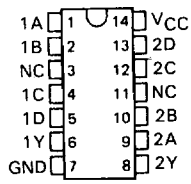
| INPUTS | | | | OUTPUT |
|---|---|---|---|---|
| A | B | C | D | Y |
| H | H | H | H | L |
| L | X | X | X | H |
| X | L | X | X | H |
| X | X | L | X | H |
| X | X | X | L | H |

## logic symbol

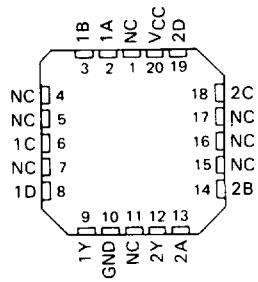



Pin numbers shown are for J and N packages.

**SN54ALS20A, SN54AS20 . . . J PACKAGE**
**SN74ALS20A, SN74AS20 . . . N PACKAGE**
**(TOP VIEW)**




**SN54ALS20A, SN54AS20 . . . FH PACKAGE**
**SN74ALS20A, SN74AS20 . . . FN PACKAGE**
**(TOP VIEW)**




NC—No internal connection

2 ALS AND AS CIRCUITS

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

Supply voltage, $V_{CC}$ . . . . . 7 V
Input voltage . . . . . 7 V
Operating free-air temperature range: SN54ALS20A . . . . . −55 °C to 125 °C
SN74ALS20A . . . . . 0 °C to 70 °C
Storage temperature range . . . . . −65 °C to 150 °C

**recommended operating conditions**

| | | SN54ALS20A | | | SN74ALS20A | | | 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 | | | −0.4 | | | −0.4 | mA |
| $I_{OL}$ | 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 | | SN54ALS20A | | | SN74ALS20A | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | MIN | TYP† | MAX | MIN | TYP† | MAX | |
| $V_{IK}$ | $V_{CC}$ = 4.5 V, | $I_I$ = −18 mA | | | −1.5 | | | −1.5 | V |
| $V_{OH}$ | $V_{CC}$ = 4.5 V to 5.5 V, | $I_{OH}$ = −0.4 mA | $V_{CC}$−2 | | | $V_{CC}$−2 | | | V |
| $V_{OL}$ | $V_{CC}$ = 4.5 V, | $I_{OL}$ = 4 mA | | 0.25 | 0.4 | | 0.25 | 0.4 | V |
| | $V_{CC}$ = 4.5 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 |
| $I_O$‡ | $V_{CC}$ = 5.5 V, | $V_O$ = 2.25 V | −15 | | −70 | −15 | | −70 | mA |
| $I_{CCH}$ | $V_{CC}$ = 5.5 V, | $V_I$ = 0 V | | 0.22 | 0.4 | | 0.22 | 0.4 | mA |
| $I_{CCL}$ | $V_{CC}$ = 5.5 V, | $V_I$ = 4.5 V | | 0.81 | 1.5 | | 0.81 | 1.5 | mA |

† 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, $I_{OS}$.

**switching characteristics (see Note 1)**

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $V_{CC}$ = 4.5 V to 5.5 V, $C_L$ = 50 pF, $R_L$ = 500 Ω, $T_A$ = MIN to MAX | | | | UNIT |
|---|---|---|---|---|---|---|---|
| | | | SN54ALS20A | | SN74ALS20A | | |
| | | | MIN | MAX | MIN | MAX | |
| $t_{PLH}$ | Any | Y | 3 | 13 | 3 | 11 | ns |
| $t_{PHL}$ | Any | Y | 3 | 12 | 3 | 10 | ns |

NOTE 1: For load circuit and voltage waveforms, see page 1-12.




TEXAS INSTRUMENTS
POST OFFICE BOX 225012 • DALLAS, TEXAS 75265

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

Supply voltage, $V_{CC}$ . . . . . 7 V
Input voltage . . . . . 7 V
Operating free-air temperature range: SN54AS20 . . . . . −55°C to 125°C
SN74AS20 . . . . . 0°C to 70°C
Storage temperature range . . . . . −65°C to 150°C

**recommended operating conditions**

| | | SN54AS20 | | | SN74AS20 | | | 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 | | | −2 | | | −2 | mA |
| $I_{OL}$ | Low-level output current | | | 20 | | | 20 | 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 | | SN54AS20 | | | SN74AS20 | | | 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, | $I_{OH}$ = −2 mA | $V_{CC}$−2 | | | $V_{CC}$−2 | | | V |
| $V_{OL}$ | $V_{CC}$ = 4.5 V, | $I_{OL}$ = 20 mA | | 0.35 | 0.5 | | 0.35 | 0.5 | V |
| $I_I$ | $V_{CC}$ = 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 | | | −0.5 | | | −0.5 | mA |
| $I_O$‡ | $V_{CC}$ = 5.5 V, | $V_O$ = 2.25 V | −30 | | −112 | −30 | | −112 | mA |
| $I_{CCH}$ | $V_{CC}$ = 5.5 V, | $V_I$ = 0 V | | 1 | 1.6 | | 1 | 1.6 | mA |
| $I_{CCL}$ | $V_{CC}$ = 5.5 V, | $V_I$ = 4.5 V | | 5.4 | 8.7 | | 5.4 | 8.7 | mA |

†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, $I_{OS}$.

**switching characteristics (see Note 1)**

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $V_{CC}$ = 4.5 V to 5.5 V, $C_L$ = 50 pF, $R_L$ = 500 Ω, $T_A$ = MIN to MAX | | | | UNIT |
|---|---|---|---|---|---|---|---|
| | | | SN54AS20 | | SN74AS20 | | |
| | | | MIN | MAX | MIN | MAX | |
| $t_{PLH}$ | Any | Y | 1 | 5.5 | 1 | 5 | ns |
| $t_{PHL}$ | Any | Y | 1 | 5 | 1 | 4.5 | ns |

NOTE 1: For load circuit and voltage waveforms, see page 1-12.