

# TYPES SN54ALS20A, SN54AS20, SN74ALS20A, SN74AS20 DUAL 4-INPUT POSITIVE-NAND GATES

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

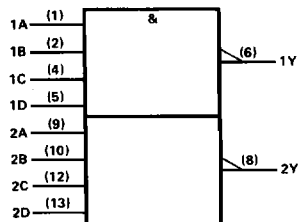
These devices contain two independent 4-input NAND gates. They perform the Boolean functions  $Y = \overline{A \cdot B \cdot C \cdot D}$  or  $Y = \overline{\overline{A} + \overline{B} + \overline{C} + \overline{D}}$  in positive logic.

The SN54ALS20A and SN54AS20 are characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74ALS20A and SN74AS20 are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

FUNCTION TABLE (each gate)

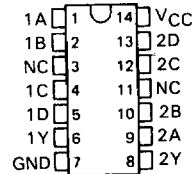
INPUTS				OUTPUT
A	B	C	D	Y
H	H	H	H	L
L	X	X	X	H
X	L	X	X	H
X	X	L	X	H
X	X	X	L	H

## logic symbol

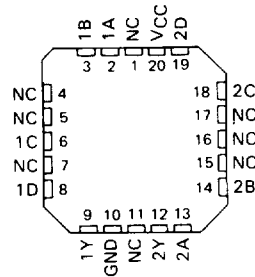


Pin numbers shown are for J and N packages.

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



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



NC—No internal connection

**TYPES SN54ALS20A, SN74ALS20A  
DUAL 4-INPUT POSITIVE-NAND GATES**

**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
$V_{OH}$	$V_{CC} = 4.5 V \text{ to } 5.5 V, I_{OH} = -0.4 mA$	$V_{CC}-2$			$V_{CC}-2$			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	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
$I_{IL}$	$V_{CC} = 5.5 V, V_I = 0.4 V$			-0.1			-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)	$V_{CC} = 4.5 V \text{ to } 5.5 V,$ $C_L = 50 pF,$ $R_L = 500 \Omega,$ $T_A = \text{MIN to MAX}$				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.

2 ALS AND AS CIRCUITS

# TYPES SN54AS20, SN74AS20 DUAL 4-INPUT POSITIVE-NAND GATES

## 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, $T_A = \text{MIN to MAX}$				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.

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ALS AND AS CIRCUITS