

# SN54ALS21A, SN54AS21, SN74ALS21A, SN74AS21 DUAL 4-INPUT POSITIVE-AND GATES

SDAS085B – APRIL 1982 – REVISED DECEMBER 1994

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

## description

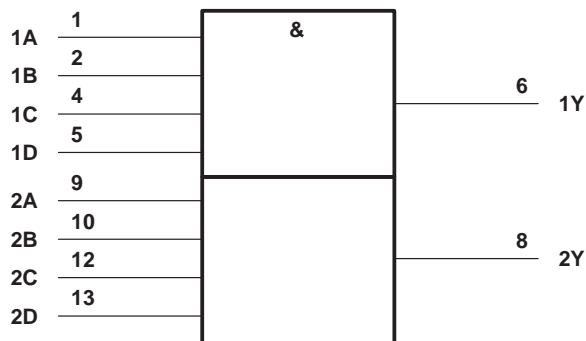
These devices contain two independent 4-input positive-AND gates. They perform the Boolean functions  $Y = A \cdot B \cdot C \cdot D$  or  $Y = \bar{A} + \bar{B} + \bar{C} + \bar{D}$  in positive logic.

The SN54ALS21A and SN54AS21 are characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74ALS21A and SN74AS21 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	H
L	X	X	X	L
X	L	X	X	L
X	X	L	X	L
X	X	X	L	L

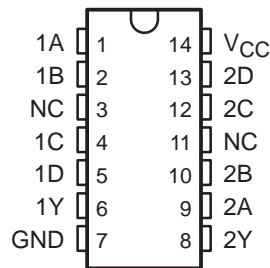
## logic symbol†



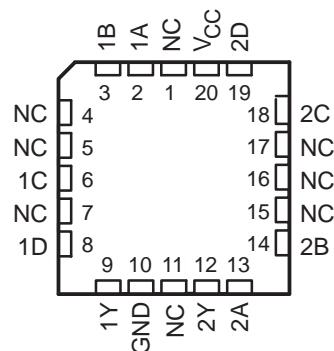
† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

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

SN54ALS21A, SN54AS21 . . . J PACKAGE  
SN74ALS21A, SN74AS21 . . . D OR N PACKAGE  
(TOP VIEW)

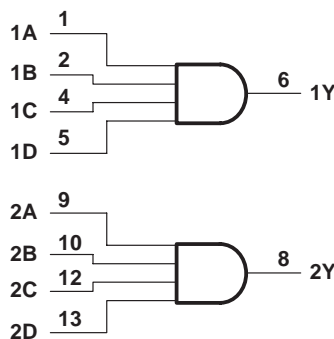


SN54ALS21A, SN54AS21 . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection

## logic diagram (positive logic)



# SN54ALS21A, SN54AS21, SN74ALS21A, SN74AS21 DUAL 4-INPUT POSITIVE-AND GATES

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## 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, $T_A$ : SN54ALS21A	-55°C to 125°C
SN74ALS21A	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

		SN54ALS21A			SN74ALS21A			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		SN54ALS21A			SN74ALS21A			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
		$I_{OL} = 8 mA$				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
$I_{OS}§$	$V_{CC} = 5.5 V$ ,	$V_O = 2.25 V$	-20		-112	-30		-112	mA
$I_{CCH}$	$V_{CC} = 5.5 V$ ,	$V_I = 4.5 V$		0.85	1.4		0.85	1.4	mA
$I_{CCL}$	$V_{CC} = 5.5 V$ ,	$V_I = 0$		1.4	2.3		1.4	2.3	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 Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 4.5 V$ to $5.5 V$ , $C_L = 50 pF$ , $R_L = 500 \Omega$ , $T_A = MIN$ to $MAX$ ¶				UNIT
			SN54ALS21A		SN74ALS21A		
			MIN	MAX	MIN	MAX	
$t_{PLH}$	A, B, C, or D	Y	4	18	4	15	ns
$t_{PHL}$			2	15	2	10	

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



# SN54ALS21A, SN54AS21, SN74ALS21A, SN74AS21 DUAL 4-INPUT POSITIVE-AND GATES

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## 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, $T_A$ : SN54AS21 .....	–55°C to 125°C
SN74AS21 .....	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

		SN54AS21			SN74AS21			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	SN54AS21			SN74AS21			UNIT
		MIN	TYP‡	MAX	MIN	TYP‡	MAX	
$V_{IK}$	$V_{CC} = 4.5\text{ V}$ , $I_I = -18\text{ mA}$			–1.2			–1.2	V
$V_{OH}$	$V_{CC} = 4.5\text{ V to }5.5\text{ V}$ , $I_{OH} = -2\text{ mA}$	$V_{CC} - 2$			$V_{CC} - 2$			V
$V_{OL}$	$V_{CC} = 4.5\text{ V}$ , $I_{OL} = 20\text{ mA}$	0.35		0.5	0.35		0.5	V
$I_I$	$V_{CC} = 5.5\text{ V}$ , $V_I = 7\text{ V}$			0.1			0.1	mA
$I_{IH}$	$V_{CC} = 5.5\text{ V}$ , $V_I = 2.7\text{ V}$			20			20	μA
$I_{IL}$	$V_{CC} = 5.5\text{ V}$ , $V_I = 0.4\text{ V}$			–0.5			–0.5	mA
$I_{O}^{\S}$	$V_{CC} = 5.5\text{ V}$ , $V_O = 2.25\text{ V}$	–30		–112	–30		–112	mA
$I_{CCH}$	$V_{CC} = 5.5\text{ V}$ , $V_I = 4.5\text{ V}$		2.9	4.6		2.9	4.6	mA
$I_{CCL}$	$V_{CC} = 5.5\text{ V}$ , $V_I = 0$		7.4	12		7.4	12	mA

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

§ 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 Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 4.5\text{ V to }5.5\text{ V}$ , $C_L = 50\text{ pF}$ , $R_L = 500\ \Omega$ , $T_A = \text{MIN to MAX}^{\parallel}$				UNIT
			SN54AS21		SN74AS21		
			MIN	MAX	MIN	MAX	
$t_{PLH}$	A, B, C, or D	Y	1	6.5	1	6	ns
$t_{PHL}$			1	6.5	1	6	

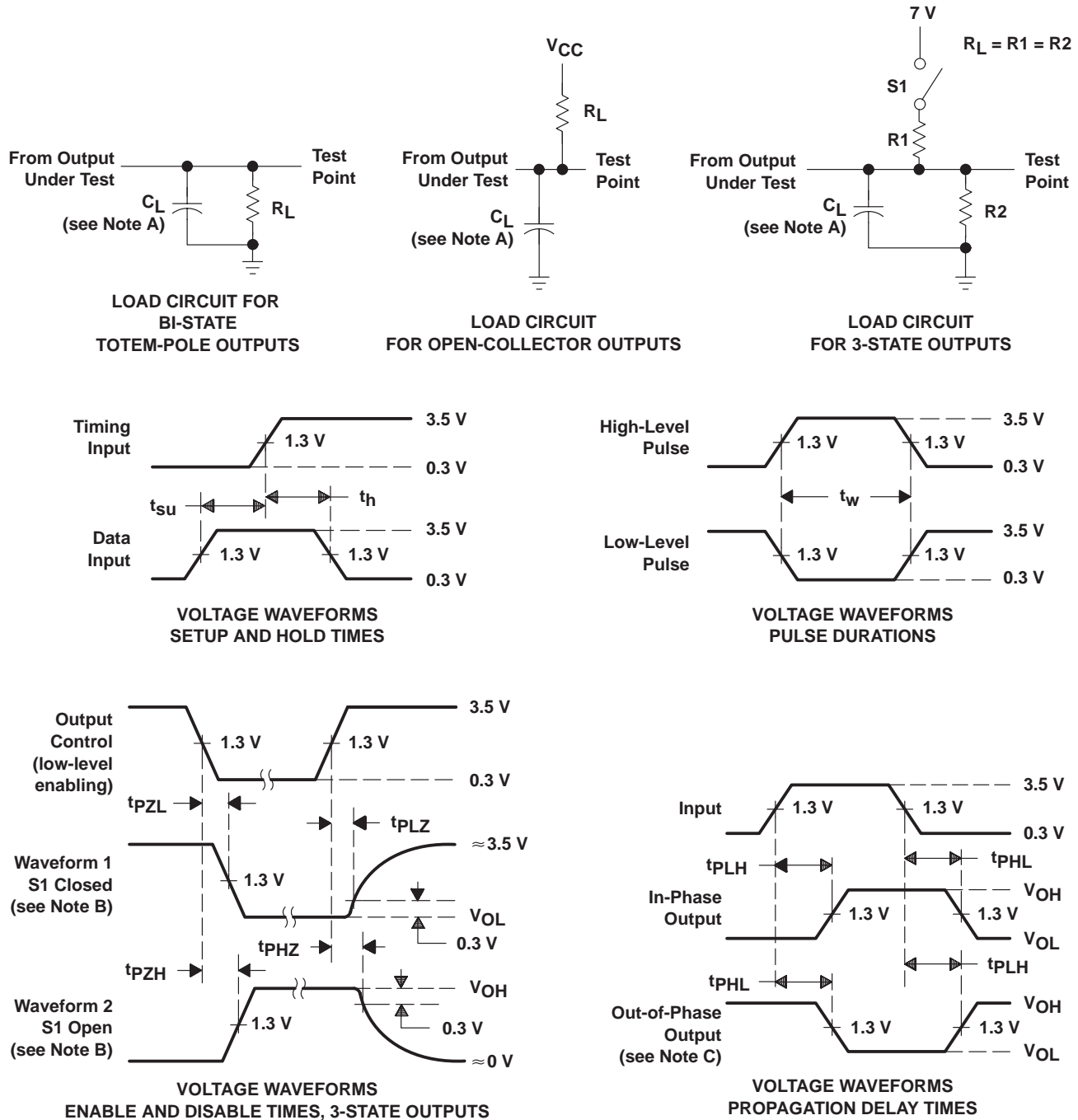
<sup>¶</sup> For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.



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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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